

# HEX Cost Book Report for Final Design Review



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<b>WBS: 7.05</b>		<b>HEX</b>						
<b>WBS Manager:</b>		<b>Andrew Broadbent</b>						
<b>Dictionary:</b>								
ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05	HEX	81,864	\$25,666,593	\$30,000,000	\$2,333,730	\$32,333,730	\$2,596,358	\$32,596,357

**WBS: 7.05.01**      **HEX Management**  
**WBS Manager:** Andrew Broadbent  
**Dictionary:** Performance of management and support activities, including labor, materials, travel, and fixed costs associated with management and support functions, consisting of;  
•Beamline Lead Scientist and Scientist  
•Project / Construction management, including Liaison Engineers,  
•Administrative support,  
•ES&H,  
•QA,  
•Configuration management,  
•Business operations,  
•Project controls, and  
•Document control.  
**Note:** the procurement professional labor is typically included in the BNL material burden and is not be included in this WBS.  
This WBS also includes all project level meetings and reviews, (whether sponsor or DOE mandated, or not), BAT meetings, and IRR hosting and associated organizational costs including travel).  
CAD workstation software, Cobra and Primavera P6 licenses (apportioned).

**Deliverables:**  
Review of procurement, design, and installation documents to ensure all work is planned and done in accordance with BNL requirements. Oversight of installation activities by BNL or contract vendors. NEPA evaluation, Hazard Analysis, checking and archiving of vendor end item documentation, vault drawings, Operations documentation (ie configuration control checklists, procedures/work instructions, etc). Installation and testing documentation. Creation of project/design review reports, Project plans and IRR preparation

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.01	HEX Management	23,076	\$3,978,020	\$5,000,000	\$0	\$5,000,000	\$40,172	\$5,040,172

**Activity Details**

**Activity Name:** HEX10005      **CAM:** Zhong  
**Activity Description:** Actuals thru Sep-18  
**WBS Code:** 7.05.01      **Estimate Year:**  
**PC Rep:**      **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
ACTNL-HEX3	Actuals Non Labor	AC	0.0	\$0.00	\$20,883.00
ACTL-HEX3	Actuals Labor	AC	0.0	\$711,763.00	\$711,763.00
		<b>Total</b>	<b>0</b>	<b>\$711,763</b>	<b>\$732,646</b>

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**Activity Details**

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**Activity Name:** HEX10006**CAM:** Zhong**Activity Description:** Actuals Oct-18 thru Jan-19**WBS Code:** 7.05.01**Estimate Year:****PC Rep:****Estimator:****Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
ACTL-HEX3 Actuals Labor	AC	0.0	\$245,180.00	\$245,180.00
ACTNL-HEX3 Actuals Non Labor	AC	0.0	\$0.00	\$4,956.00
<b>Total</b>	<b>0</b>	<b>\$245,180</b>	<b>\$250,136</b>	

**Activity Details**

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**Activity Name:** HEX10050**CAM:** Zhong**Activity Description:** HEX - Project Scientist FY19**WBS Code:** 7.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NS1_HEX3 Scientist	LOE	1,183.0	\$155,150.45	\$198,411.97
<b>Total</b>	<b>1,183</b>	<b>\$155,150</b>	<b>\$198,412</b>	

**Activity Details**

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**Activity Name:** HEX10060**CAM:** Zhong**Activity Description:** HEX - Project Management and Support FY19**WBS Code:** 7.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO7_HEX3 Project Engineer	LOE	81.0	\$8,227.98	\$10,522.24
MO7_HEX3 Project Engineer	LOE	134.0	\$13,611.72	\$17,407.16
NA1_HEX3 Manager	LOE	946.0	\$159,060.44	\$203,412.21
NA2_HEX3 Administrative	LOE	134.0	\$8,728.76	\$11,162.65
NA4_HEX3 ES&H Professional	LOE	403.0	\$46,590.83	\$59,582.03
NA5_HEX3 QA Professional	LOE	134.0	\$13,919.92	\$17,801.29
NB1_HEX3 Project Controls	LOE	946.0	\$117,304.00	\$150,012.57
NB2_HEX3 Business Ops	LOE	134.0	\$8,728.76	\$11,162.65
<b>Total</b>	<b>2,912</b>	<b>\$376,172</b>	<b>\$481,063</b>	

**Activity Details**

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**Activity Name:** HEX10080**CAM:** Zhong**Activity Description:** HEX - Project Scientist FY20**WBS Code:** 7.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NS1_HEX3 Scientist	LOE	3,520.0	\$461,648.00	\$608,083.21

**Total 3,520 \$461,648 \$608,083**

**Activity Details**

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**Activity Name:** HEX10090 **CAM:** Zhong  
**Activity Description:** HEX - Second Project Scientist Part FY19  
**WBS Code:** 7.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NB2_HEX3 Business Ops	LOE	201.0	\$13,093.14	\$17,246.30
NB1_HEX3 Project Controls	LOE	1,004.0	\$124,496.00	\$162,871.79
NA5_HEX3 QA Professional	LOE	201.0	\$20,879.88	\$27,503.00
NA4_HEX3 ES&H Professional	LOE	602.0	\$69,597.22	\$91,673.53
NA2_HEX3 Administrative	LOE	201.0	\$13,093.14	\$17,246.30
NA1_HEX3 Manager	LOE	1,408.0	\$236,741.12	\$311,835.64
MO7_HEX3 Project Engineer	LOE	241.0	\$24,480.78	\$32,246.11
MO7_HEX3 Project Engineer	LOE	201.0	\$20,417.58	\$26,894.06
<b>Total</b>			<b>4,059 \$522,799</b>	<b>\$687,517</b>

**Activity Details**

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**Activity Name:** HEX10110 **CAM:** Zhong  
**Activity Description:** HEX - BAT Meeting No. 3  
**WBS Code:** 7.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NTR_HEX3 Travel Cost	LOE	0.0	\$2,000.00	\$2,812.74
<b>Total</b>			<b>0 \$2,000</b>	<b>\$2,813</b>

**Activity Details**

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**Activity Name:** HEX10120 **CAM:** Zhong  
**Activity Description:** HEX - BAT Meeting No. 4  
**WBS Code:** 7.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NTR_HEX3 Travel Cost	LOE	0.0	\$2,000.00	\$2,812.74
<b>Total</b>			<b>0 \$2,000</b>	<b>\$2,813</b>

**Activity Details**

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**Activity Name:** HEX10130 **CAM:** Zhong  
**Activity Description:** HEX - Project Scientist FY21  
**WBS Code:** 7.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>

NS1_HEX3 Scientist	LOE	3,520.0	\$461,648.00	\$626,325.71
<b>Total</b>		<b>3,520</b>	<b>\$461,648</b>	<b>\$626,326</b>

**Activity Details**

**Activity Name:** HEX10140 **CAM:** Zhong

**Activity Description:** HEX - Project Management and Support FY21

**WBS Code:** 7.05.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO7_HEX3	Project Engineer	LOE	300.0	\$30,474.00	\$41,344.60
MO7_HEX3	Project Engineer	LOE	240.0	\$24,379.20	\$33,075.68
NA1_HEX3	Manager	LOE	1,408.0	\$236,741.12	\$321,190.71
NA2_HEX3	Administrative	LOE	200.0	\$13,028.00	\$17,675.31
NA4_HEX3	ES&H Professional	LOE	600.0	\$69,366.00	\$94,110.03
NA5_HEX3	QA Professional	LOE	300.0	\$31,164.00	\$42,280.73
NB1_HEX3	Project Controls	LOE	1,000.0	\$124,000.00	\$165,954.02
NB2_HEX3	Business Ops	LOE	200.0	\$13,028.00	\$17,675.31
<b>Total</b>			<b>4,248</b>	<b>\$542,180</b>	<b>\$733,306</b>

**Activity Details**

**Activity Name:** HEX10150 **CAM:** Zhong

**Activity Description:** HEX - Project Scientist FY22

**WBS Code:** 7.05.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX3	Scientist	LOE	882.0	\$115,674.30	\$161,645.41
<b>Total</b>			<b>882</b>	<b>\$115,674</b>	<b>\$161,645</b>

**Activity Details**

**Activity Name:** HEX10160 **CAM:** Zhong

**Activity Description:** HEX - Project Management and Support FY22

**WBS Code:** 7.05.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NB2_HEX3	Business Ops	LOE	48.0	\$3,126.72	\$4,369.34
NB1_HEX3	Project Controls	LOE	240.0	\$29,760.00	\$40,745.03
NA5_HEX3	QA Professional	LOE	72.0	\$7,479.36	\$10,451.80
NA4_HEX3	ES&H Professional	LOE	144.0	\$16,647.84	\$23,264.00
NA2_HEX3	Administrative	LOE	48.0	\$3,126.72	\$4,369.34
MO7_HEX3	Project Engineer	LOE	72.0	\$7,313.76	\$10,220.38
MO7_HEX3	Project Engineer	LOE	62.0	\$6,297.96	\$8,800.89
NA1_HEX3	Manager	LOE	336.0	\$56,495.04	\$78,947.22
<b>Total</b>			<b>1,022</b>	<b>\$130,247</b>	<b>\$181,168</b>

**Activity Details**

**Activity Name:** HEX10180 **CAM:** Zhong  
**Activity Description:** HEX - IRR Review Final  
**WBS Code:** 7.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_HEX3	Material (Purchase <\$25k)	LOE	0.0	\$5,000.00	\$5,989.54
		<b>Total</b>	<b>0</b>	<b>\$5,000</b>	<b>\$5,990</b>

**Activity Details**

**Activity Name:** HEX10190 **CAM:** Zhong  
**Activity Description:** HEX - Schedule and Cost Contingency  
**WBS Code:** 7.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NB1_HEX3	Project Controls	LOE	143.9	\$17,839.26	\$24,424.10
NA1_HEX3	Manager	LOE	560.0	\$94,158.40	\$131,578.69
		<b>Total</b>	<b>704</b>	<b>\$111,998</b>	<b>\$156,003</b>

**Activity Details**

**Activity Name:** HEX17700 **CAM:** Zhong  
**Activity Description:** HEX - Second Project Scientist Part FY19  
**WBS Code:** 7.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NS1_HEX3	Scientist	LOE	1,026.0	\$134,559.90	\$172,080.04
		<b>Total</b>	<b>1,026</b>	<b>\$134,560</b>	<b>\$172,080</b>

**WBS: 7.05.02**      **HEX Design**  
**WBS Manager:** Zhong Zhong  
**Dictionary:**

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.02	HEX Design	507	\$453,337	\$466,341	\$39,165	\$505,506	\$566	\$466,907

**WBS: 7.05.02.01**      **HEX Conceptual Design**  
**WBS Manager:** Zhong Zhong  
**Dictionary:** 7.5.02.01 Conceptual Integrated Design

Conceptual integrated design and analysis of the beamline optical system, including appropriate simulations, necessary to deliver the sought photon beam parameters. Conceptual design and analysis of the endstation, including appropriate simulations, necessary to deliver its sought capabilities.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.02.01	HEX Conceptual Design	0	\$14,782	\$14,782	\$0	\$14,782	\$0	\$14,782

**Activity Details**

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**Activity Name:** HEX11000

**CAM:** Zhong

**Activity Description:** Conceptual Design actuals

**WBS Code:** 7.05.02.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
ACTL-HEX3	Actuals Labor	AC	0.0	\$14,782.00	\$14,782.00
<b>Total</b>			<b>0</b>	<b>\$14,782</b>	<b>\$14,782</b>

**WBS: 7.05.02.02**      **HEX Preliminary Design**

**WBS Manager:** Zhong Zhong

**Dictionary:** Preliminary integrated design and analysis of the beamline optical system, including appropriate simulations and radiological ray tracing, necessary to deliver the sought photon beam parameters. Preliminary design and analysis of the end-station, including appropriate simulations and radiological ray tracing if needed, necessary to deliver its sought capabilities.

Completion of this activity allows commencement of procurement activity for the long lead time items (hutches, optics, etc.).

The basic conceptual design of all three branches of the beamline is to be included.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.02.02	HEX Preliminary Design	0	\$125,180	\$125,180	\$0	\$125,180	\$0	\$125,180

**Activity Details**

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**Activity Name:** HEX11019

**CAM:** Zhong

**Activity Description:** Preliminary Design Actuals

**WBS Code:** 7.05.02.02

**Estimate Year:**

**PC Rep:**

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
ACTL-HEX3	Actuals Labor	AC	0.0	\$125,180.00	\$125,180.00
<b>Total</b>			<b>0</b>	<b>\$125,180</b>	<b>\$125,180</b>

**WBS: 7.05.02.03**      **HEX Final Design**

**WBS Manager:** Zhong Zhong

**Dictionary:** Final design and analysis of the integrated beamline optical system and the integrated end station(s), including appropriate simulations and x-ray ray tracing necessary to deliver the sought photon beam parameters.

Safety write-up with a detailed listing and discussion of the hazards present in the full beamline project as part of the FDR report.

X-ray radiation shielding calculations for all enclosures and transport pipe (these may have to be re-run as the final designs of the enclosures and transport pipe are completed).

Completion of this activity allows all remaining procurement activities to commence.

**Deliverable:** completion and satisfactory review of the final design report by a team of experts.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.02.03	HEX Final Design	507	\$313,375	\$326,379	\$39,165	\$365,544	\$566	\$326,945

**Activity Details**

**Activity Name:** HEX11050 **CAM:** Zhong  
**Activity Description:** HEX - Radiation Shielding Calculations Remaining Work  
**WBS Code:** 7.05.02.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NS1_HEX3	Scientist	AC	18.0	\$2,360.70	\$3,018.95
<b>Total</b>			<b>18</b>	<b>\$2,361</b>	<b>\$3,019</b>

**Activity Details**

**Activity Name:** HEX11060 **CAM:** Zhong  
**Activity Description:** HEX - Final Design Remaining Work  
**WBS Code:** 7.05.02.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO1_HEX3	Mechanical Engineer	LOE	244.5	\$24,837.53	\$31,763.12
NO2_HEX3	Mechanical Designer	LOE	244.5	\$19,438.70	\$24,858.91
<b>Total</b>			<b>489</b>	<b>\$44,276</b>	<b>\$56,622</b>

**Activity Details**

**Activity Name:** HEX11080 **CAM:** Zhong  
**Activity Description:** Final Design Actuals Thru Jan-19  
**WBS Code:** 7.05.02.03 **Estimate Year:**  
**PC Rep:** **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
ACTL-HEX3	Actuals Labor	AC	0.0	\$266,738.00	\$266,738.00
<b>Total</b>			<b>0</b>	<b>\$266,738</b>	<b>\$266,738</b>

**WBS: 7.05.03** **HEX Beamline Construction**

**WBS Manager:** Zhong Zhong

**Dictionary:**

<b>ID</b>	<b>Name</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	<b>TD Risk Assessment</b>	<b>Total Cost + RA</b>	<b>Bu Estimate Uncertainty</b>	<b>Total Cost + EU</b>
7.05.03	HEX Beamline Construction	9,765	\$5,815,553	\$6,607,223	\$520,218	\$7,127,442	\$836,359	\$7,443,582



**Activity Details**

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**Activity Name:** HEX12130 **CAM:** Zhong  
**Activity Description:** PDS Procurement and Fabrication  
**WBS Code:** 7.05.03.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

**Supporting Documentation:**  
 FMBO Beamline Optics Cost

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$2,000,000.00	\$2,237,825.38
NLP_Fixed_HE	Large Procurment (>\$2M) X3 (Fixed Rate)	VQ	0.0	\$1,080,907.00	\$1,105,767.86
<b>Total</b>			<b>0</b>	<b>\$3,080,907</b>	<b>\$3,343,593</b>

**WBS: 7.05.03.02**      **HEX Photon Delivery System Installation and Test**

**WBS Manager:** Zhong Zhong

**Dictionary:** The on-site assembly, installation, and testing of photon delivery sub-systems and integrated system. This also includes the following;  
 •EEI of all electrical equipment.  
 •Inspection of vacuum and cryogenic equipment by staff from the Safety Engineering Group.  
 •Filing of as-built drawings and preparation for the IRR.  
 •Personal Protective Equipment, including safety shoes and safety glasses, for Project team members.  
 •Component survey and associated reporting for safety critical components and other components, as required.  
**Deliverable:** completed assembly, installation and testing (without beam) of the photon delivery system. This also requires substantial completion of controls work (7.05.06.01).

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.03.02	HEX Photon Delivery System Installation and Test	9,285	\$857,599	\$1,146,190	\$137,543	\$1,283,733	\$286,548	\$1,432,738

**Activity Details**

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**Activity Name:** HEX12340 **CAM:** Zhong  
**Activity Description:** HEX - Engineering and Installation Oversight  
**WBS Code:** 7.05.03.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX3	Mechanical Engineer	PJ	3,864.7	\$392,572.87	\$521,131.94
<b>Total</b>			<b>3,865</b>	<b>\$392,573</b>	<b>\$521,132</b>

**Activity Details**

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**Activity Name:** HEX12350 **CAM:** Zhong  
**Activity Description:** HEX - Beamline Technician Effort  
**WBS Code:** 7.05.03.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX3	Mechanical Technician	PJ	2,988.0	\$229,060.08	\$308,448.90

**Total 2,988 \$229,060 \$308,449**

**Activity Details**

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**Activity Name:** HEX12360 **CAM:** Zhong

**Activity Description:** Special White Beam Shutters Installation and Testing

**WBS Code:** 7.05.03.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO3_HEX3	Mechanical Technician	PJ	20.0	\$1,533.20	\$2,025.59
NO1_HEX3	Mechanical Engineer	PJ	40.0	\$4,063.20	\$5,368.11
<b>Total</b>			<b>60</b>	<b>\$5,596</b>	<b>\$7,394</b>

**Activity Details**

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**Activity Name:** HEX12370 **CAM:** Zhong

**Activity Description:** HEX - Photon Delivery System Installation and Test Labor

**WBS Code:** 7.05.03.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTU_HEX3	Building Trades Unassigned	PJ	90.0	\$10,367.10	\$13,853.26
BTUC_HEX3	Building Trades Carpenter - Unassigned	PJ	126.0	\$14,513.94	\$19,394.57
BTUR_HEX3	Building Trades Riggers - Unassigned	PJ	252.0	\$29,027.88	\$38,789.13
MO1_HEX3	ME - Survey Engineer	PJ	180.0	\$18,284.40	\$24,757.12
MO2_HEX3	ME - Survey Technician	PJ	360.0	\$27,914.40	\$37,796.16
MO5_HEX3	ME - Vacuum Engineer	PJ	262.0	\$26,613.96	\$36,035.36
MO6_HEX3	ME - Vacuum Technician	PJ	314.4	\$24,101.90	\$32,634.03
<b>Total</b>			<b>1,584</b>	<b>\$150,824</b>	<b>\$203,260</b>

**Activity Details**

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**Activity Name:** HEX12380 **CAM:** Zhong

**Activity Description:** Additional Rigger Hours

**WBS Code:** 7.05.03.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTAR_HEX3	Building Trades Riggers - Assigned	PJ	748.0	\$72,859.76	\$97,360.43
<b>Total</b>			<b>748</b>	<b>\$72,860</b>	<b>\$97,360</b>

**Activity Details**

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**Activity Name:** HEX12390 **CAM:** Zhong  
**Activity Description:** HEX - EEI Labor for Electrical Inspection  
**WBS Code:** 7.05.03.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3 Electrical Engineer	PJ	40.0	\$4,186.40	\$5,668.39
<b>Total</b>			<b>40</b>	<b>\$4,186</b>

**Activity Details**

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**Activity Name:** HEX12400 **CAM:** Zhong  
**Activity Description:** HEX - PPE Costs (Safety shoes, Glasses etc.)  
**WBS Code:** 7.05.03.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_HEX3 Material (Purchase <\$25k)	PJ	0.0	\$2,500.00	\$2,927.44
<b>Total</b>			<b>0</b>	<b>\$2,500</b>

**WBS: 7.05.03.03**      **HEX End Station Procurement and Fabrication**

**WBS Manager:** Zhong Zhong

**Dictionary:** Final detailed instrument design, specification, procurement, and fabrication of end-station sub-systems and integrated system. These include sample housings, environments, visualization, and support and manipulation systems, detection systems, optical systems within the sample vessel and beam diagnostic/visualization and conditioning/definition/deflection components just before the sample (e.g. on the same support as the sample or contiguous with it) or between the sample and detector (e.g. crystal/grating/mirror-based analyzer or spectrometer system) including their housings, supports, and manipulation systems, vacuum system, and cooling/heating and temperature stabilization systems associated with end-station components. This will include relevant design reviews and Factory Acceptance Testing, with associated travel costs, where applicable.

**Deliverable:** End-station equipment, delivered to NSLS-II site.

<b>ID</b>	<b>Name</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	<b>TD Risk Assessment</b>	<b>Total Cost + RA</b>	<b>Bu Estimate Uncertainty</b>	<b>Total Cost + EU</b>
7.05.03.03	HEX End Station Procurement and Fabrication	0	\$1,609,150	\$1,800,498	\$162,045	\$1,962,543	\$180,050	\$1,980,548

**Activity Details**

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**Activity Name:** HEX12445 **CAM:** Zhong  
**Activity Description:** Procure KB-Mirror  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NEQ_Fixed_HE Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$400,000.00	\$447,565.08
<b>Total</b>			<b>0</b>	<b>\$400,000</b>

### Activity Details

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**Activity Name:** HEX12450 **CAM:** Zhong  
**Activity Description:** Procure Beam conditioning table, Imaging and EDXD detector table and ADXD detector table  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

**Supporting Documentation:**

[QE111 ADC Code](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$307,000.00	\$343,506.20
<b>Total</b>			<b>0</b>	<b>\$307,000</b>	<b>\$343,506</b>

#### Activity Details

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**Activity Name:** HEX12470 **CAM:** Zhong  
**Activity Description:** Procure Lead scatter shield (wall)  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$12,600.00	\$14,098.30
<b>Total</b>			<b>0</b>	<b>\$12,600</b>	<b>\$14,098</b>

#### Activity Details

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**Activity Name:** HEX12500 **CAM:** Zhong  
**Activity Description:** Procure Sample table and stages. EDXD 2-theta arm and two slits  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

**Supporting Documentation:**

[Sample Tower Huber Quote](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$273,321.00	\$305,822.34
<b>Total</b>			<b>0</b>	<b>\$273,321</b>	<b>\$305,822</b>

#### Activity Details

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**Activity Name:** HEX12510 **CAM:** Zhong  
**Activity Description:** Procure Small misc parts for E/S (optics hardware, sample holders, etc)  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$25,000.00	\$27,972.82
<b>Total</b>			<b>0</b>	<b>\$25,000</b>	<b>\$27,973</b>

### Activity Details

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**Activity Name:** HEX12520 **CAM:** Zhong  
**Activity Description:** Procure Imaging Detectors (X-Ray Converter, Lens attachment, Camera)  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

**Supporting Documentation:**

[Imaging Detectors Hamamatsu Quote](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$310,000.00	\$346,862.93
<b>Total</b>			<b>0</b>	<b>\$310,000</b>	<b>\$346,863</b>

#### Activity Details

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**Activity Name:** HEX12530 **CAM:** Zhong  
**Activity Description:** Procure ADXD Flat Panel detector, Frame Grabber  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

**Supporting Documentation:**

[Varex dedector Quote](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$112,007.00	\$125,326.05
<b>Total</b>			<b>0</b>	<b>\$112,007</b>	<b>\$125,326</b>

#### Activity Details

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**Activity Name:** HEX12590 **CAM:** Zhong  
**Activity Description:** Procure EDXD Ge single element detector (eg Canberra)  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

**Supporting Documentation:**

[Canberra Quote](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$36,000.00	\$40,280.86
<b>Total</b>			<b>0</b>	<b>\$36,000</b>	<b>\$40,281</b>

#### Activity Details

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**Activity Name:** HEX12610 **CAM:** Zhong  
**Activity Description:** Procure EDXD Ge multi element detector (Siddons design)  
**WBS Code:** 7.05.03.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	VQ	0.0	\$100,000.00	\$111,891.27



**WBS: 7.05.04**      **HEX Beamlines Infrastructure****WBS Manager:** Chris Stebbins**Dictionary:**

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.04	HEX Beamlines Infrastructure	11,905	\$3,505,065	\$4,159,316	\$331,119	\$4,490,435	\$383,050	\$4,542,366

**WBS: 7.05.04.01**      **HEX Hutches****WBS Manager:** Andrew Broadbent**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, and testing of the required radiological enclosures, including the necessary hoist, air handling equipment, fans, labyrinths, doors, windows, and lights.

Scope includes A, C, D, E, F hutches. B-hutch descope prior to contract placement for budget reasons in Jan 2019.

Design, specification, procurement, fabrication, assembly, installation, and testing of required environmental cabins (not radiological enclosures) including the necessary ventilation, doors, windows, wiring, and lights. This also includes filing of as-built drawings and preparation for the IRR.

**Deliverable:** completed hutches, installed, ready to start utilities installation and fully inspected with the exception of testing with x-ray beam.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.04.01	HEX Hutches	244	\$1,833,859	\$2,056,807	\$82,272	\$2,139,080	\$3,805	\$2,060,613

**Activity Details****Activity Name:** HEX13090**CAM:** Stebbins**Activity Description:** HEX - Hutch Design Reviews and Contractor Document Filing**WBS Code:** 7.05.04.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX3	Mechanical Engineer	LOE	144.0	\$14,627.52	\$18,942.03
<b>Total</b>			<b>144</b>	<b>\$14,628</b>	<b>\$18,942</b>

**Activity Details****Activity Name:** HEX13110**CAM:** Stebbins**Activity Description:** HEX - HU Beam Commissioning**WBS Code:** 7.05.04.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX3	Scientist	PJ	24.0	\$3,147.60	\$4,398.51
<b>Total</b>			<b>24</b>	<b>\$3,148</b>	<b>\$4,399</b>

**Activity Details****Activity Name:** HEX13150**CAM:** Stebbins**Activity Description:** HEX - Hutch Milestone Payment for PDR**WBS Code:** 7.05.04.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
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NEQ\_Fixed\_HE Capital Equipment (Fixed X3 Rate) AC 0.0 \$269,300.00 \$301,323.19

**Total 0 \$269,300 \$301,323**

**Activity Details**

**Activity Name:** HEX13170 **CAM:** Stebbins

**Activity Description:** HEX - Hutch Milestone Payment for FDR

**WBS Code:** 7.05.04.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE Capital Equipment (Fixed X3 Rate)	AC	0.0	\$269,300.00	\$301,323.19

**Total 0 \$269,300 \$301,323**

**Activity Details**

**Activity Name:** HEX13180 **CAM:** Stebbins

**Activity Description:** HEX - Hutch Manufacturing Lead Time

**WBS Code:** 7.05.04.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX3 Mechanical Engineer	PJ	28.0	\$2,844.24	\$3,683.63

**Total 28 \$2,844 \$3,684**

**Activity Details**

**Activity Name:** HEX13190 **CAM:** Stebbins

**Activity Description:** HEX - Hutch A Completion of Installation

**WBS Code:** 7.05.04.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX3 Mechanical Engineer	PJ	12.0	\$1,218.96	\$1,564.88

**Total 12 \$1,219 \$1,565**

**Activity Details**

**Activity Name:** HEX13200 **CAM:** Stebbins

**Activity Description:** HEX - Hutch Acceptance Testing and training Complete - Final Payment

**WBS Code:** 7.05.04.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE Capital Equipment (Fixed X3 Rate)	AC	0.0	\$249,076.00	\$278,694.30

**Total 0 \$249,076 \$278,694**

### Activity Details

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**Activity Name:** HEX13210

**CAM:** Stebbins

**Activity Description:** HEX - Hutch Milestone Payment for Mfg Prog Plan

**WBS Code:** 7.05.04.01

**Estimate Year:**

**PC Rep:**

**Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	AC	0.0	\$18,000.00	\$20,140.43
<b>Total</b>			<b>0</b>	<b>\$18,000</b>	<b>\$20,140</b>

#### Activity Details

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**Activity Name:** HEX13260

**CAM:** Stebbins

**Activity Description:** Hutch A Acceptance Payment

**WBS Code:** 7.05.04.01

**Estimate Year:**

**PC Rep:**

**Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	AC	0.0	\$359,067.00	\$401,764.62
<b>Total</b>			<b>0</b>	<b>\$359,067</b>	<b>\$401,765</b>

#### Activity Details

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**Activity Name:** HEX17720

**CAM:** Stebbins

**Activity Description:** HEX - Hutch E Completion of Installation

**WBS Code:** 7.05.04.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX3	Mechanical Engineer	PJ	12.0	\$1,218.96	\$1,605.62
<b>Total</b>			<b>12</b>	<b>\$1,219</b>	<b>\$1,606</b>

#### Activity Details

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**Activity Name:** HEX17730

**CAM:** Stebbins

**Activity Description:** HEX - Hutch D Completion of Installation

**WBS Code:** 7.05.04.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX3	Mechanical Engineer	PJ	12.0	\$1,218.96	\$1,605.62
<b>Total</b>			<b>12</b>	<b>\$1,219</b>	<b>\$1,606</b>

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**Activity Details**

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**Activity Name:** HEX17740 **CAM:** Stebbins  
**Activity Description:** HEX - Hutch C Completion of Installation  
**WBS Code:** 7.05.04.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO1_HEX3	Mechanical Engineer	PJ	12.0	\$1,218.96	\$1,605.62
		<b>Total</b>	<b>12</b>	<b>\$1,219</b>	<b>\$1,606</b>

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**Activity Details**

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**Activity Name:** HEX17750 **CAM:** Stebbins  
**Activity Description:** Hutch E Acceptance Payment  
**WBS Code:** 7.05.04.01 **Estimate Year:**  
**PC Rep:** **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	AC	0.0	\$136,262.00	\$152,465.28
		<b>Total</b>	<b>0</b>	<b>\$136,262</b>	<b>\$152,465</b>

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**Activity Details**

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**Activity Name:** HEX17760 **CAM:** Stebbins  
**Activity Description:** Hutch D Acceptance Payment  
**WBS Code:** 7.05.04.01 **Estimate Year:**  
**PC Rep:** **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	AC	0.0	\$179,533.00	\$200,881.75
		<b>Total</b>	<b>0</b>	<b>\$179,533</b>	<b>\$200,882</b>

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**Activity Details**

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**Activity Name:** HEX17780 **CAM:** Stebbins  
**Activity Description:** Hutch C Acceptance Payment  
**WBS Code:** 7.05.04.01 **Estimate Year:**  
**PC Rep:** **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	AC	0.0	\$179,533.00	\$200,881.75
		<b>Total</b>	<b>0</b>	<b>\$179,533</b>	<b>\$200,882</b>

**Activity Details**

**Activity Name:** HEX17790 **CAM:** Stebbins  
**Activity Description:** Hutch F Acceptance Payment  
**WBS Code:** 7.05.04.01 **Estimate Year:**  
**PC Rep:** **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	AC	0.0	\$136,262.00	\$152,465.28
<b>Total</b>			<b>0</b>	<b>\$136,262</b>	<b>\$152,465</b>

**Activity Details**

**Activity Name:** HEX17920 **CAM:** Stebbins  
**Activity Description:** HEX - Amendments to Hutch Contract  
**WBS Code:** 7.05.04.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X3 Rate)	AC	0.0	\$12,031.00	\$13,461.64
<b>Total</b>			<b>0</b>	<b>\$12,031</b>	<b>\$13,462</b>

**WBS: 7.05.04.02**      **HEX Utilities - Mechanical**  
**WBS Manager:** Chris Stebbins  
**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, and testing of beamline mechanical utilities including  
 •structural utility support pylons and L-brackets,  
 •equipment racks (including heat exchangers, shelves, cable entry brushes and seals and temperature control hardware),  
 •DI water system (with appropriate flow/temperature instrumentation and automated isolation valves),  
 •process chilled water system,  
 •gaseous nitrogen and compressed air systems,  
 •exhaust system, and  
 •liquid nitrogen distribution systems (including all drops, interfaces, emergency shutoff system, and any phase separator etc).  
 This also includes filing of as-built drawings, safety reviews and oversight, and preparation for the IRR.  
**Deliverable:** completed mechanical utilities, installed, ready to commence beamline equipment installation and fully inspected with the exception of testing with installed components.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.04.02	HEX Utilities - Mechanical	2,493	\$555,798	\$669,777	\$107,164	\$776,941	\$103,266	\$773,043

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**Activity Details**

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**Activity Name:** HEX14000 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Design - Gather Requirements  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary****Supporting Documentation:**[Mech Util WBS Estimate](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX3	ME - Utility Engineer	EE	40.0	\$4,063.20	\$5,196.17
MO4_HEX3	ME - Utility Technician	EE	10.0	\$766.60	\$980.36
NO2_HEX3	Mechanical Designer	EE	40.0	\$3,180.00	\$4,066.70
<b>Total</b>			<b>90</b>	<b>\$8,010</b>	<b>\$10,243</b>

**Activity Details**

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**Activity Name:** HEX14010 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Design - Develop Preliminary Drawings  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO2_HEX3	Mechanical Designer	EE	100.0	\$7,950.00	\$10,166.75
MO4_HEX3	ME - Utility Technician	EE	5.0	\$383.30	\$490.18
MO3_HEX3	ME - Utility Engineer	EE	40.0	\$4,063.20	\$5,196.17
<b>Total</b>			<b>145</b>	<b>\$12,397</b>	<b>\$15,853</b>

**Activity Details**

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**Activity Name:** HEX14020 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Design - Finalize Drawings  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX3	ME - Utility Engineer	EE	100.0	\$10,158.00	\$12,990.42
NO2_HEX3	Mechanical Designer	EE	200.0	\$15,900.00	\$20,333.49
<b>Total</b>			<b>300</b>	<b>\$26,058</b>	<b>\$33,324</b>

**Activity Details**

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**Activity Name:** HEX14030 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Procure - Utilities Materials  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_Fixed_HE	Material (Purchase X3 >\$25k<\$2M) (Fixed Rate)	HC	0.0	\$148,800.00	\$166,494.21

**Total 0      \$148,800      \$166,494**

**Activity Details**

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**Activity Name:** HEX14040 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Procure - 4 Pylons and 25 L-brackets  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_HEX3	Material (Purchase <\$25k)	HC	0.0	\$20,000.00	\$22,892.95
		<b>Total</b>	<b>0</b>	<b>\$20,000</b>	<b>\$22,893</b>

**Activity Details**

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**Activity Name:** HEX14050 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Procure - Equipment racks and Hardware  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NSM_HEX3	Material (Purchase >\$25k<\$2M)	HC	0.0	\$50,000.00	\$57,232.38
		<b>Total</b>	<b>0</b>	<b>\$50,000</b>	<b>\$57,232</b>

**Activity Details**

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**Activity Name:** HEX14060 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Procure - Procure & Receive Piping and Hardware  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO4_HEX3	ME - Utility Technician	EE	80.0	\$6,132.80	\$8,078.13
MO3_HEX3	ME - Utility Engineer	EE	30.0	\$3,047.40	\$4,014.04
		<b>Total</b>	<b>110</b>	<b>\$9,180</b>	<b>\$12,092</b>

**Activity Details**

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**Activity Name:** HEX14080 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Installation - Labor (Pylons install, Misc)  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTAC_HEX3	Building Trades Carpenter - Assigned	EE	20.0	\$1,948.20	\$2,548.73
BTU_HEX3	Building Trades Unassigned	EE	80.0	\$9,215.20	\$12,055.78
		<b>Total</b>	<b>100</b>	<b>\$11,163</b>	<b>\$14,605</b>

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**Activity Details**

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**Activity Name:** HEX14090 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Installation - Experimental Floor Compressed Air Labor  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTAP_HEX3	Building Trades Plumber - Assigned	EE	280.0	\$27,274.80	\$35,682.23
		<b>Total</b>	<b>280</b>	<b>\$27,275</b>	<b>\$35,682</b>

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**Activity Details**

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**Activity Name:** HEX14100 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Installation - Experimental Floor Water and GN2 Labor  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO3_HEX3	ME - Utility Engineer	EE	70.0	\$7,110.60	\$9,366.09
MO4_HEX3	ME - Utility Technician	EE	582.0	\$44,616.12	\$58,768.40
		<b>Total</b>	<b>652</b>	<b>\$51,727</b>	<b>\$68,134</b>

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**Activity Details**

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**Activity Name:** HEX14110 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Design - Complete  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO3_HEX3	ME - Utility Engineer	EE	40.0	\$4,063.20	\$5,352.05
NO2_HEX3	Mechanical Designer	EE	20.0	\$1,590.00	\$2,094.35
		<b>Total</b>	<b>60</b>	<b>\$5,653</b>	<b>\$7,446</b>

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**Activity Details**

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**Activity Name:** HEX14120 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Procure - LN2 Distribution Piping  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NSM_HEX3	Material (Purchase >\$25k<\$2M)	HC	0.0	\$103,200.00	\$118,290.66
		<b>Total</b>	<b>0</b>	<b>\$103,200</b>	<b>\$118,291</b>

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**Activity Details**

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**Activity Name:** HEX14130 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Installation - Satellite Building Compressed Air Labor  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTAP_HEX3	Building Trades Plumber - Assigned	EE	70.0	\$6,818.70	\$8,920.56
		<b>Total</b>	<b>70</b>	<b>\$6,819</b>	<b>\$8,921</b>

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**Activity Details**

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**Activity Name:** HEX14140 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Installation - Satellite Building Water and GN2 Labor  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO3_HEX3	ME - Utility Engineer	EE	18.0	\$1,828.44	\$2,408.42
MO4_HEX3	ME - Utility Technician	EE	145.0	\$11,115.70	\$14,641.61
		<b>Total</b>	<b>163</b>	<b>\$12,944</b>	<b>\$17,050</b>

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**Activity Details**

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**Activity Name:** HEX14160 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Installation - Exhaust system from SB Hutch to Main Facility  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_HEX3	Material (Purchase <\$25k)	HC	0.0	\$15,000.00	\$17,564.62
		<b>Total</b>	<b>0</b>	<b>\$15,000</b>	<b>\$17,565</b>

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**Activity Details**

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**Activity Name:** HEX14180 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - IRR Preparations  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO2_HEX3	Mechanical Designer	EE	20.0	\$1,590.00	\$2,157.18
MO4_HEX3	ME - Utility Technician	EE	244.0	\$18,705.04	\$25,377.45
MO3_HEX3	ME - Utility Engineer	EE	115.0	\$11,681.70	\$15,848.76
BTAP_HEX3	Building Trades Plumber - Assigned	EE	112.0	\$10,909.92	\$14,601.17
		<b>Total</b>	<b>491</b>	<b>\$42,887</b>	<b>\$57,985</b>

**Activity Details**

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**Activity Name:** HEX17680 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Procure - Emergency Shower Materials  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NSM_HEX3	Material (Purchase >\$25k<\$2M)	HC	0.0	\$1,000.00	\$1,144.65
<b>Total</b>			<b>0</b>	<b>\$1,000</b>	<b>\$1,145</b>

**Activity Details**

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**Activity Name:** HEX17690 **CAM:** Stebbins  
**Activity Description:** HEX Mech Utilities - Installation - Eyewash  
**WBS Code:** 7.05.04.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTUP_HEX3	Building Trades Plumber - Unassigned	EE	32.0	\$3,686.08	\$4,822.31
<b>Total</b>			<b>32</b>	<b>\$3,686</b>	<b>\$4,822</b>

**WBS: 7.05.04.03**      **HEX Utilities - Electrical**

**WBS Manager:** Chris Stebbins

**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, and testing of beamline electrical utilities (110V, 208V) including;  
 •cable trays, conduits, utility power cables, power outlets, boxes and circuit breaker panels,  
 •provisioning of power to equipment racks,  
 •installation of all conduit and boxes for the Oxygen Deficiency Hazard (ODH) system  
 •UPS system for the beamline  
 •hutch smoke detectors  
 •Installation of the beamline SAF monitors and conduit.  
 This also includes filing of as-built drawings and preparation for the IRR.  
 Deliverable: completed electrical utilities, installed, ready to commence beamline equipment installation and fully inspected with the exception of testing with installed components.

<b>ID</b>	<b>Name</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	<b>TD Risk Assessment</b>	<b>Total Cost + RA</b>	<b>Bu Estimate Uncertainty</b>	<b>Total Cost + EU</b>
7.05.04.03	HEX Utilities - Electrical	2,696	\$329,435	\$420,906	\$67,345	\$488,251	\$84,181	\$505,087

**Activity Details**

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**Activity Name:** HEX14200 **CAM:** Stebbins  
**Activity Description:** HEX - Elec Utilities - Design - Gather Requirements  
**WBS Code:** 7.05.04.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

**Supporting Documentation:**  
[Elec Util WBS Backup](#)

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	20.0	\$2,093.20	\$2,676.86
<b>Total</b>			<b>20</b>	<b>\$2,093</b>	<b>\$2,677</b>

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**Activity Details**

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**Activity Name:** HEX14210**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Design - Develop Preliminary Drawings**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	20.0	\$2,093.20	\$2,676.86
NE2_HEX3	Electrical Designer	EE	20.0	\$1,681.20	\$2,149.98
<b>Total</b>			<b>40</b>	<b>\$3,774</b>	<b>\$4,827</b>

**Activity Details**

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**Activity Name:** HEX14220**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Design - Finalize Drawings**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE2_HEX3	Electrical Designer	EE	20.0	\$1,681.20	\$2,149.98
NE1_HEX3	Electrical Engineer	EE	20.0	\$2,093.20	\$2,676.86
<b>Total</b>			<b>40</b>	<b>\$3,774</b>	<b>\$4,827</b>

**Activity Details**

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**Activity Name:** HEX14230**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Procure ODH for 2 Hutches**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NSM_HEX3	Material (Purchase >\$25k<\$2M)	EE	0.0	\$16,800.00	\$19,230.08
<b>Total</b>			<b>0</b>	<b>\$16,800</b>	<b>\$19,230</b>

**Activity Details**

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**Activity Name:** HEX14240**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Procure - Materials**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_HEX3	Material (Purchase <\$25k)	EE	0.0	\$50,000.00	\$57,232.38
<b>Total</b>			<b>0</b>	<b>\$50,000</b>	<b>\$57,232</b>

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**Activity Details**

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**Activity Name:** HEX14260**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Installation - ODH**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	40.0	\$2,877.20	\$3,789.85
BTAE_HEX3	Building Trades Electrician - Assigned	EE	120.0	\$11,689.20	\$15,292.39
<b>Total</b>			<b>160</b>	<b>\$14,566</b>	<b>\$19,082</b>

**Activity Details**

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**Activity Name:** HEX14270**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Installation - Experimental Floor Labor**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTAE_HEX3	Building Trades Electrician - Assigned	EE	1,152.0	\$112,216.32	\$146,806.91
NE1_HEX3	Electrical Engineer	EE	144.0	\$15,071.04	\$19,851.59
<b>Total</b>			<b>1,296</b>	<b>\$127,287</b>	<b>\$166,658</b>

**Activity Details**

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**Activity Name:** HEX14280**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Installation - Satellite Building Labor**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	100.0	\$10,466.00	\$13,785.83
BTAE_HEX3	Building Trades Electrician - Assigned	EE	800.0	\$77,928.00	\$101,949.24
<b>Total</b>			<b>900</b>	<b>\$88,394</b>	<b>\$115,735</b>

**Activity Details**

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**Activity Name:** HEX14290**CAM:** Stebbins**Activity Description:** HEX - Elec Utilities - Design - Complete**WBS Code:** 7.05.04.03**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	20.0	\$2,093.20	\$2,823.34
NE2_HEX3	Electrical Designer	EE	40.0	\$3,362.40	\$4,535.25
<b>Total</b>			<b>60</b>	<b>\$5,456</b>	<b>\$7,359</b>

**Activity Details**

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**Activity Name:** HEX14310

**CAM:** Stebbins

**Activity Description:** HEX - Elec Utilities - IRR Preparations

**WBS Code:** 7.05.04.03

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE2_HEX3	Electrical Designer	EE	40.0	\$3,362.40	\$4,561.83
NE1_HEX3	Electrical Engineer	EE	40.0	\$4,186.40	\$5,679.76
BTAE_HEX3	Building Trades Electrician - Assigned	EE	100.0	\$9,741.00	\$13,036.76
<b>Total</b>			<b>180</b>	<b>\$17,290</b>	<b>\$23,278</b>

**WBS: 7.05.04.04**

**HEX EPS**

**WBS Manager:** Chris Stebbins

**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, and testing of Equipment Protection System (EPS) including PLC, wiring, and custom sensors, and water leak detection system and integration of the rack smoke alarms. This scope includes the PLC software and cables/connectors to interface to the various water flow sensors, temperature sensors and the vacuum pump and gauge controllers used in the beamline (particularly in the white/pink beam sections). This also includes filing of as-built drawings and preparation for the IRR.

**Deliverable:** completed Equipment Protection System, installed, connected to beamline equipment and fully tested and documented.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.04.04	HEX EPS	1,068	\$155,100	\$194,123	\$31,060	\$225,183	\$38,825	\$232,948

**Activity Details**

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**Activity Name:** HEX14400

**CAM:** Stebbins

**Activity Description:** HEX EPS - Gather Requirements

**WBS Code:** 7.05.04.04

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

**Supporting Documentation:**

[EPS WBS Backup](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3	Controls Engineer	EE	40.0	\$4,186.40	\$5,514.33
<b>Total</b>			<b>40</b>	<b>\$4,186</b>	<b>\$5,514</b>

**Activity Details**

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**Activity Name:** HEX14410

**CAM:** Stebbins

**Activity Description:** HEX EPS - Design system input / outputs

**WBS Code:** 7.05.04.04

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3	Controls Engineer	EE	40.0	\$4,186.40	\$5,514.33
<b>Total</b>			<b>40</b>	<b>\$4,186</b>	<b>\$5,514</b>

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**Activity Details**

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**Activity Name:** HEX14420 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Design PLC code  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	80.0	\$8,372.80	\$11,028.66
		<b>Total</b>	<b>80</b>	<b>\$8,373</b>	<b>\$11,029</b>

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**Activity Details**

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**Activity Name:** HEX14430 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Design Input output computer (IOC)  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	80.0	\$8,372.80	\$11,028.66
		<b>Total</b>	<b>80</b>	<b>\$8,373</b>	<b>\$11,029</b>

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**Activity Details**

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**Activity Name:** HEX14440 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Design CS Studio screens  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	112.0	\$11,721.92	\$15,440.12
		<b>Total</b>	<b>112</b>	<b>\$11,722</b>	<b>\$15,440</b>

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**Activity Details**

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**Activity Name:** HEX14450 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Purchase system components  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_Fixed_HE	Material (Purchase	EE	0.0	\$63,000.00	\$70,491.50
X3	<\$25k) (Fixed Rate)				
		<b>Total</b>	<b>0</b>	<b>\$63,000</b>	<b>\$70,491</b>

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**Activity Details**

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**Activity Name:** HEX14460 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Build I/O enclosures  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	140.0	\$10,070.20	\$13,662.41
<b>Total</b>			<b>140</b>	<b>\$10,070</b>	<b>\$13,662</b>

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**Activity Details**

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**Activity Name:** HEX14470 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Install I/O enclosures and chassis  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	20.0	\$1,438.60	\$1,951.77
<b>Total</b>			<b>20</b>	<b>\$1,439</b>	<b>\$1,952</b>

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**Activity Details**

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**Activity Name:** HEX14480 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Pull required cables  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	112.0	\$8,056.16	\$10,929.93
<b>Total</b>			<b>112</b>	<b>\$8,056</b>	<b>\$10,930</b>

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**Activity Details**

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**Activity Name:** HEX14490 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Terminate cables  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	304.0	\$21,866.72	\$29,666.95
<b>Total</b>			<b>304</b>	<b>\$21,867</b>	<b>\$29,667</b>

**Activity Details**

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**Activity Name:** HEX14500 **CAM:** Stebbins  
**Activity Description:** HEX EPS - Test system  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	80.0	\$8,372.80	\$11,359.52
<b>Total</b>			<b>80</b>	<b>\$8,373</b>	<b>\$11,360</b>

**Activity Details**

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**Activity Name:** HEX14520 **CAM:** Stebbins  
**Activity Description:** HEX EPS - IRR Preparations  
**WBS Code:** 7.05.04.04 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	20.0	\$2,093.20	\$2,891.00
NE2_HEX3	Electrical Designer	EE	40.0	\$3,362.40	\$4,643.94
<b>Total</b>			<b>60</b>	<b>\$5,456</b>	<b>\$7,535</b>

**WBS: 7.05.04.05**      **HEX PPS**  
**WBS Manager:** Chris Stebbins  
**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, and testing of Personnel Protection System (PPS) including PLC, wiring, switches, locks, special interlocked personnel protective safeguards such as gates and light screens, and Human Machine Interface (HMI) panel. Also includes the in-house fabricated mounting plates for door switches, locks etc. This also includes filing of as-built drawings and preparation for the IRR.  
**Deliverable:** completed Personnel Protection System, installed, connected to equipment (door/labyrinth switches/locks, water flow and vacuum sensors (as applicable), shutters etc. To be fully certified and documented.

<b>ID</b>	<b>Name</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	<b>TD Risk Assessment</b>	<b>Total Cost + Bu Estimate RA</b>	<b>Total Cost + Uncertainty EU</b>	
7.05.04.05	HEX PPS	5,356	\$590,661	\$769,841	\$38,492	\$808,333	\$141,008	\$910,848

**Activity Details**

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**Activity Name:** HEX14600 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Advance Material Purchase (actuals)  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Supporting Documentation:**  
[PPS WBS Backup](#)

<b>Cost Summary</b>					
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
ACTNL-HEX3	Actuals Non Labor	AC	0.0	\$0.00	\$9,550.00
<b>Total</b>			<b>0</b>	<b>\$0</b>	<b>\$9,550</b>

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**Activity Details**

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**Activity Name:** HEX14610**CAM:** Stebbins**Activity Description:** HEX PPS - Define Requirements**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	4.0	\$418.64	\$535.37
NE1_HEX3	Electrical Engineer	EE	8.0	\$837.28	\$1,070.74
NE3_HEX3	Electrical Technician	EE	8.0	\$575.44	\$735.89
<b>Total</b>			<b>20</b>	<b>\$1,831</b>	<b>\$2,342</b>

**Activity Details**

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**Activity Name:** HEX14620**CAM:** Stebbins**Activity Description:** HEX PPS - Create Electrical Schematics & Logic Diagram**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	200.0	\$20,932.00	\$26,768.59
NE2_HEX3	Electrical Designer	EE	200.0	\$16,812.00	\$21,499.79
<b>Total</b>			<b>400</b>	<b>\$37,744</b>	<b>\$48,268</b>

**Activity Details**

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**Activity Name:** HEX14630**CAM:** Stebbins**Activity Description:** HEX PPS - Procurement and Inspection of components**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	40.0	\$4,186.40	\$5,353.72
NE3_HEX3	Electrical Technician	EE	80.0	\$5,754.40	\$7,358.93
<b>Total</b>			<b>120</b>	<b>\$9,941</b>	<b>\$12,713</b>

**Activity Details**

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**Activity Name:** HEX14640**CAM:** Stebbins**Activity Description:** HEX PPS - Software Development**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	360.0	\$37,677.60	\$49,628.97
<b>Total</b>			<b>360</b>	<b>\$37,678</b>	<b>\$49,629</b>

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**Activity Details**

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**Activity Name:** HEX14650**CAM:** Stebbins**Activity Description:** HEX PPS - Installation of Conduit Experimental Floor**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTAE_HEX3	Building Trades Electrician - Assigned	EE	700.0	\$68,187.00	\$89,205.59
NE1_HEX3	Electrical Engineer	EE	60.0	\$6,279.60	\$8,271.50
NE3_HEX3	Electrical Technician	EE	60.0	\$4,315.80	\$5,684.78
<b>Total</b>			<b>820</b>	<b>\$78,782</b>	<b>\$103,162</b>

**Activity Details**

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**Activity Name:** HEX14660**CAM:** Stebbins**Activity Description:** HEX PPS - Install & Wire Subpanels**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	340.0	\$24,456.20	\$32,213.73
NE1_HEX3	Electrical Engineer	EE	48.0	\$5,023.68	\$6,617.20
NE2_HEX3	Electrical Designer	EE	88.0	\$7,397.28	\$9,743.70
<b>Total</b>			<b>476</b>	<b>\$36,877</b>	<b>\$48,575</b>

**Activity Details**

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**Activity Name:** HEX14670**CAM:** Stebbins**Activity Description:** HEX PPS - Receipt of PPS Materials**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NSM_Fixed_HE	Material (Purchase X3 >\$25k<\$2M) (Fixed Rate)	HC	0.0	\$123,450.00	\$138,129.77
<b>Total</b>			<b>0</b>	<b>\$123,450</b>	<b>\$138,130</b>

**Activity Details**

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**Activity Name:** HEX14680**CAM:** Stebbins**Activity Description:** HEX PPS - Installation of Conduit Satellite Building**WBS Code:** 7.05.04.05**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	20.0	\$2,093.20	\$2,757.17
NE3_HEX3	Electrical Technician	EE	20.0	\$1,438.60	\$1,894.93
BTAE_HEX3	Building Trades Electrician - Assigned	EE	200.0	\$19,482.00	\$25,487.31

**Total 240      \$23,014      \$30,139**

**Activity Details**

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**Activity Name:** HEX14690 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Pull Cables  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	40.0	\$4,186.40	\$5,657.70
NE2_HEX3	Electrical Designer	EE	80.0	\$6,724.80	\$9,088.22
NE3_HEX3	Electrical Technician	EE	120.0	\$8,631.60	\$11,665.16
		<b>Total</b>	<b>240</b>	<b>\$19,543</b>	<b>\$26,411</b>

**Activity Details**

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**Activity Name:** HEX14700 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Assemble subpanels  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	468.0	\$33,663.24	\$45,671.49
NE2_HEX3	Electrical Designer	EE	152.0	\$12,777.12	\$17,334.94
NE1_HEX3	Electrical Engineer	EE	72.0	\$7,535.52	\$10,223.57
		<b>Total</b>	<b>692</b>	<b>\$53,976</b>	<b>\$73,230</b>

**Activity Details**

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**Activity Name:** HEX14710 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Installation of Hutch PPS Components  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE3_HEX3	Electrical Technician	EE	208.0	\$14,961.44	\$20,298.44
		<b>Total</b>	<b>208</b>	<b>\$14,961</b>	<b>\$20,298</b>

**Activity Details**

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**Activity Name:** HEX14720 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Wire hutch PPS components  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE2_HEX3	Electrical Designer	EE	120.0	\$10,087.20	\$13,685.48
NE3_HEX3	Electrical Technician	EE	440.0	\$31,649.20	\$42,939.01
NE1_HEX3	Electrical Engineer	EE	80.0	\$8,372.80	\$11,359.52

**Total 640      \$50,109      \$67,984**

**Activity Details**

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**Activity Name:** HEX14730 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Integration (Power, EPS, HMI, Water)  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>						
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	
NE1_HEX3	Electrical Engineer	EE	200.0	\$20,932.00	\$28,398.80	
NE3_HEX3	Electrical Technician	EE	240.0	\$17,263.20	\$23,421.28	
<b>Total</b>				<b>440</b>	<b>\$38,195</b>	<b>\$51,820</b>

**Activity Details**

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**Activity Name:** HEX14740 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Integrated Testing  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>						
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	
NE3_HEX3	Electrical Technician	EE	100.0	\$7,193.00	\$9,758.87	
NE1_HEX3	Electrical Engineer	EE	280.0	\$29,304.80	\$39,758.32	
<b>Total</b>				<b>380</b>	<b>\$36,498</b>	<b>\$49,517</b>

**Activity Details**

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**Activity Name:** HEX14750 **CAM:** Stebbins  
**Activity Description:** HEX PPS - Certification by ESH & Complete Documentation  
**WBS Code:** 7.05.04.05 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>						
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	
NE1_HEX3	Electrical Engineer	EE	80.0	\$8,372.80	\$11,359.52	
NE2_HEX3	Electrical Designer	EE	200.0	\$16,812.00	\$22,809.13	
NE3_HEX3	Electrical Technician	EE	40.0	\$2,877.20	\$3,903.55	
<b>Total</b>				<b>320</b>	<b>\$28,062</b>	<b>\$38,072</b>

**WBS: 7.05.04.06      HEX Beamline Furniture and Office Equipment**

**WBS Manager:** Chris Stebbins

**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, and testing of furniture for the beamline control station including partitions and their power and communications wiring.

Desktop computers, screens and printers.

This also includes the SAF monitors (hardware only). This also includes filing of as-built drawings and preparation for the IRR.

**Deliverable:** completed Control Station and furniture installation.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.04.06	HEX Beamline Furniture and Office Equipment	48	\$40,211	\$47,862	\$4,786	\$52,648	\$11,965	\$59,827

**Activity Details**

**Activity Name:** HEX14800 **CAM:** Stebbins  
**Activity Description:** HEX - Procure Furniture for satellite building  
**WBS Code:** 7.05.04.06 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

**Supporting Documentation:**  
[BL Furniture WBS Backup](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX3	Material (Purchase <\$25k)	PJ	0.0	\$15,502.00	\$18,125.24
<b>Total</b>			<b>0</b>	<b>\$15,502</b>	<b>\$18,125</b>

**Activity Details**

**Activity Name:** HEX14810 **CAM:** Stebbins  
**Activity Description:** HEX - Procure office equipments (Printer, Computer etc.)  
**WBS Code:** 7.05.04.06 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX3	Material (Purchase <\$25k)	PJ	0.0	\$20,000.00	\$23,419.49
<b>Total</b>			<b>0</b>	<b>\$20,000</b>	<b>\$23,419</b>

**Activity Details**

**Activity Name:** HEX14820 **CAM:** Stebbins  
**Activity Description:** Install Furniture and Office Eqpts  
**WBS Code:** 7.05.04.06 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX3	Mechanical Engineer	PJ	8.0	\$812.64	\$1,102.52
BTAC_HEX3	Building Trades Carpenter - Assigned	PJ	40.0	\$3,896.40	\$5,214.70
<b>Total</b>			<b>48</b>	<b>\$4,709</b>	<b>\$6,317</b>

**WBS: 7.05.05**      **HEX Accelerator Infrastructure**

**WBS Manager:** Greg Fries

**Dictionary:**

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.05	HEX Accelerator Infrastructure	25,849	\$5,754,342	\$6,884,795	\$944,472	\$7,829,268	\$1,107,002	\$7,991,797

WBS: 7.05.05.01      HEX Front End

WBS Manager: Greg Fries

Dictionary: Design (including simulations and radiological ray tracing), specification, procurement, fabrication, assembly, installation, and testing of front end sub-systems and integrated system. These include the front end chambers, vacuum system, supports, apertures, slits, collimators, masks, stops (if applicable), shields, shutters, and diagnostics including flags and beam position monitors (if required). The necessary utilities, protection systems, and controls for the front end are included (eg slits, BPMs). This also includes filing of as-built drawings and IRR preparation.

Deliverable: completed Front End, installed, functionally tested with controls, documented and ready for testing with x-rays (FE shutter closed).

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.05.01	HEX Front End	9,191	\$2,165,225	\$2,560,146	\$256,015	\$2,816,160	\$350,507	\$2,910,653

**Activity Details**

Activity Name: HEX15030

CAM: Fries

Activity Description: HEX FE - Detail Components & Final Design

WBS Code: 7.05.05.01

Estimate Year:

PC Rep: Gutta

Estimator:

**Cost Summary**

**Supporting Documentation:**

[FE WBS Backup](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX3	ME - Vacuum Engineer	EE	5.0	\$507.90	\$649.52
NO1_HEX3	Mechanical Engineer	EE	18.0	\$1,828.44	\$2,338.27
NO2_HEX3	Mechanical Designer	EE	26.0	\$2,067.00	\$2,643.35
NO6_HEX3	ME - D&I Engineer	EE	5.0	\$507.90	\$649.52
<b>Total</b>			<b>54</b>	<b>\$4,911</b>	<b>\$6,281</b>

**Activity Details**

Activity Name: HEX15040

CAM: Fries

Activity Description: HEX FE - Slit and stage design, prototyping and test

WBS Code: 7.05.05.01

Estimate Year:

PC Rep: Gutta

Estimator:

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX3	Mechanical Technician	EE	48.0	\$3,679.68	\$4,705.71
NO1_HEX3	Mechanical Engineer	EE	120.0	\$12,189.60	\$15,588.50
NO2_HEX3	Mechanical Designer	EE	104.0	\$8,268.00	\$10,573.42
NO6_HEX3	ME - D&I Engineer	EE	32.0	\$3,250.56	\$4,156.93
TE2_HEX3	EL - D&I Technician	EE	24.0	\$1,726.32	\$2,207.68
NE4_HEX3	Controls Engineer	EE	32.0	\$3,349.12	\$4,282.97
<b>Total</b>			<b>360</b>	<b>\$32,463</b>	<b>\$41,515</b>

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**Activity Details**

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**Activity Name:** HEX15050**CAM:** Fries**Activity Description:** HEX FE - Dipole chamber & vacuum design**WBS Code:** 7.05.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO5_HEX3	ME - Vacuum Engineer	EE	126.0	\$12,799.08	\$16,367.92
SE5_HEX3	EL - Vacuum Engineer	EE	42.0	\$4,395.72	\$5,621.40
NO2_HEX3	Mechanical Designer	EE	84.0	\$6,678.00	\$8,540.07
NO1_HEX3	Mechanical Engineer	EE	28.0	\$2,844.24	\$3,637.32
<b>Total</b>			<b>280</b>	<b>\$26,717</b>	<b>\$34,167</b>

**Activity Details**

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**Activity Name:** HEX15070**CAM:** Fries**Activity Description:** HEX FE - Electrical & Controls Design**WBS Code:** 7.05.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
TE1_HEX3	EL - D&I Engineer	EE	80.0	\$8,372.80	\$10,707.44
NE4_HEX3	Controls Engineer	EE	80.0	\$8,372.80	\$10,707.44
NE3_HEX3	Electrical Technician	EE	60.0	\$4,315.80	\$5,519.20
NE1_HEX3	Electrical Engineer	EE	80.0	\$8,372.80	\$10,707.44
NE2_HEX3	Electrical Designer	EE	40.0	\$3,362.40	\$4,299.96
<b>Total</b>			<b>340</b>	<b>\$32,797</b>	<b>\$41,941</b>

**Activity Details**

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**Activity Name:** HEX15090**CAM:** Fries**Activity Description:** HEX FE - Procurement of Basic Components**WBS Code:** 7.05.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE1_HEX3	Electrical Engineer	EE	19.0	\$1,988.54	\$2,543.02
NE3_HEX3	Electrical Technician	EE	19.0	\$1,366.67	\$1,747.75
NE4_HEX3	Controls Engineer	EE	19.0	\$1,988.54	\$2,543.02
MO5_HEX3	ME - Vacuum Engineer	EE	74.0	\$7,516.92	\$9,612.91
MO3_HEX3	ME - Utility Engineer	EE	19.0	\$1,930.02	\$2,468.18
TE1_HEX3	EL - D&I Engineer	EE	19.0	\$1,988.54	\$2,543.02
SE5_HEX3	EL - Vacuum Engineer	EE	37.0	\$3,872.42	\$4,952.19
NO1_HEX3	Mechanical Engineer	EE	167.0	\$16,963.86	\$21,693.99
NO3_HEX3	Mechanical Technician	EE	37.0	\$2,836.42	\$3,627.32
NO6_HEX3	ME - D&I Engineer	EE	19.0	\$1,930.02	\$2,468.18
<b>Total</b>			<b>429</b>	<b>\$42,382</b>	<b>\$54,200</b>

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**Activity Details**

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**Activity Name:** HEX15100 **CAM:** Fries  
**Activity Description:** HEX FE - Procurement of Beamline Specific Components  
**WBS Code:** 7.05.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO6_HEX3 ME - D&I Engineer	EE	80.0	\$8,126.40	\$10,462.48
NO3_HEX3 Mechanical Technician	EE	80.0	\$6,132.80	\$7,895.78
NO1_HEX3 Mechanical Engineer	EE	260.0	\$26,410.80	\$34,003.06
NO2_HEX3 Mechanical Designer	EE	80.0	\$6,360.00	\$8,188.30
SE5_HEX3 EL - Vacuum Engineer	EE	80.0	\$8,372.80	\$10,779.71
TE1_HEX3 EL - D&I Engineer	EE	80.0	\$8,372.80	\$10,779.71
MO3_HEX3 ME - Utility Engineer	EE	20.0	\$2,031.60	\$2,615.62
MO5_HEX3 ME - Vacuum Engineer	EE	80.0	\$8,126.40	\$10,462.48
NE1_HEX3 Electrical Engineer	EE	60.0	\$6,279.60	\$8,084.78
NE3_HEX3 Electrical Technician	EE	40.0	\$2,877.20	\$3,704.30
<b>Total</b>		<b>860</b>	<b>\$83,090</b>	<b>\$106,976</b>

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**Activity Details**

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**Activity Name:** HEX15110 **CAM:** Fries  
**Activity Description:** HEX FE - Receipt of Front End Components  
**WBS Code:** 7.05.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NSM_Fixed_HE Material (Purchase X3 >\$25k<\$2M) (Fixed Rate)	HC	0.0	\$665,000.00	\$744,076.94
<b>Total</b>		<b>0</b>	<b>\$665,000</b>	<b>\$744,077</b>

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**Activity Details**

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**Activity Name:** HEX15120 **CAM:** Fries  
**Activity Description:** HEX FE - Receipt of Slit Assemblies  
**WBS Code:** 7.05.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NSM_Fixed_HE Material (Purchase X3 >\$25k<\$2M) (Fixed Rate)	HC	0.0	\$350,000.00	\$391,619.44
<b>Total</b>		<b>0</b>	<b>\$350,000</b>	<b>\$391,619</b>

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**Activity Details**

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**Activity Name:** HEX15130 **CAM:** Fries  
**Activity Description:** HEX FE - Build Ratchet Wall Collimator  
**WBS Code:** 7.05.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX3	Mechanical Technician	EE	120.0	\$9,199.20	\$11,764.27
NO1_HEX3	Mechanical Engineer	EE	60.0	\$6,094.80	\$7,794.25
MO6_HEX3	ME - Vacuum Technician	EE	40.0	\$3,066.40	\$3,921.42
MO2_HEX3	ME - Survey Technician	EE	60.0	\$4,652.40	\$5,949.66
MO5_HEX3	ME - Vacuum Engineer	EE	20.0	\$2,031.60	\$2,598.08
BTAR_HEX3	Building Trades Riggers - Assigned	EE	40.0	\$3,896.40	\$4,982.86
MO1_HEX3	ME - Survey Engineer	EE	40.0	\$4,063.20	\$5,196.17
<b>Total</b>			<b>380</b>	<b>\$33,004</b>	<b>\$42,207</b>

**Activity Details**

**Activity Name:** HEX15140

**CAM:** Fries

**Activity Description:** HEX FE - Installation Prep & Cabling Pulling

**WBS Code:** 7.05.05.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO1_HEX3	ME - Survey Engineer	EE	40.0	\$4,063.20	\$5,320.87
BTU_HEX3	Building Trades Unassigned	EE	24.0	\$2,764.56	\$3,600.47
BTAE_HEX3	Building Trades Electrician - Assigned	EE	48.0	\$4,675.68	\$6,089.45
MO2_HEX3	ME - Survey Technician	EE	60.0	\$4,652.40	\$6,092.45
NE2_HEX3	Electrical Designer	EE	80.0	\$6,724.80	\$8,806.31
NE3_HEX3	Electrical Technician	EE	80.0	\$5,754.40	\$7,535.55
NE1_HEX3	Electrical Engineer	EE	60.0	\$6,279.60	\$8,223.31
MO6_HEX3	ME - Vacuum Technician	EE	60.0	\$4,599.60	\$6,023.30
NO1_HEX3	Mechanical Engineer	EE	80.0	\$8,126.40	\$10,641.75
NO3_HEX3	Mechanical Technician	EE	60.0	\$4,599.60	\$6,023.30
TE2_HEX3	EL - D&I Technician	EE	80.0	\$5,754.40	\$7,535.55
SE5_HEX3	EL - Vacuum Engineer	EE	60.0	\$6,279.60	\$8,223.31
TE1_HEX3	EL - D&I Engineer	EE	60.0	\$6,279.60	\$8,223.31
<b>Total</b>			<b>792</b>	<b>\$70,554</b>	<b>\$92,339</b>

**Activity Details**

**Activity Name:** HEX15150

**CAM:** Fries

**Activity Description:** HEX FE - Build Component Subassemblies

**WBS Code:** 7.05.05.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
TE2_HEX3	EL - D&I Technician	EE	120.0	\$8,631.60	\$11,038.40
TE1_HEX3	EL - D&I Engineer	EE	20.0	\$2,093.20	\$2,676.86
NO3_HEX3	Mechanical Technician	EE	260.0	\$19,931.60	\$25,489.25
NO6_HEX3	ME - D&I Engineer	EE	20.0	\$2,031.60	\$2,598.08
NO1_HEX3	Mechanical Engineer	EE	120.0	\$12,189.60	\$15,588.50
NO2_HEX3	Mechanical Designer	EE	40.0	\$3,180.00	\$4,066.70
MO5_HEX3	ME - Vacuum Engineer	EE	80.0	\$8,126.40	\$10,392.33
MO6_HEX3	ME - Vacuum Technician	EE	120.0	\$9,199.20	\$11,764.27

MO1_HEX3 ME - Survey Engineer	EE	60.0	\$6,094.80	\$7,794.25
MO2_HEX3 ME - Survey Technician	EE	120.0	\$9,304.80	\$11,899.31
<b>Total</b>		<b>960</b>	<b>\$80,783</b>	<b>\$103,308</b>

**Activity Details**

**Activity Name:** HEX15160

**CAM:** Fries

**Activity Description:** HEX FE - Replacement of dipole chamber

**WBS Code:** 7.05.05.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO5_HEX3	ME - Vacuum Engineer	EE	40.0	\$4,063.20	\$5,352.05
BTAE_HEX3	Building Trades Electrician - Assigned	EE	24.0	\$2,337.84	\$3,058.48
MO1_HEX3	ME - Survey Engineer	EE	20.0	\$2,031.60	\$2,676.03
MO2_HEX3	ME - Survey Technician	EE	40.0	\$3,101.60	\$4,085.43
MO6_HEX3	ME - Vacuum Technician	EE	180.0	\$13,798.80	\$18,175.79
NE3_HEX3	Electrical Technician	EE	20.0	\$1,438.60	\$1,894.93
NO1_HEX3	Mechanical Engineer	EE	40.0	\$4,063.20	\$5,352.05
NO3_HEX3	Mechanical Technician	EE	80.0	\$6,132.80	\$8,078.13
<b>Total</b>			<b>444</b>	<b>\$36,968</b>	<b>\$48,673</b>

**Activity Details**

**Activity Name:** HEX15170

**CAM:** Fries

**Activity Description:** HEX FE - Build Stand Assemblies

**WBS Code:** 7.05.05.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO3_HEX3	Mechanical Technician	EE	280.0	\$21,464.80	\$27,600.93
NO6_HEX3	ME - D&I Engineer	EE	40.0	\$4,063.20	\$5,224.75
NO1_HEX3	Mechanical Engineer	EE	180.0	\$18,284.40	\$23,511.35
TE2_HEX3	EL - D&I Technician	EE	80.0	\$5,754.40	\$7,399.41
TE1_HEX3	EL - D&I Engineer	EE	40.0	\$4,186.40	\$5,383.16
MO6_HEX3	ME - Vacuum Technician	EE	120.0	\$9,199.20	\$11,828.97
NE1_HEX3	Electrical Engineer	EE	40.0	\$4,186.40	\$5,383.16
MO5_HEX3	ME - Vacuum Engineer	EE	120.0	\$12,189.60	\$15,674.24
BTAR_HEX3	Building Trades Riggers - Assigned	EE	60.0	\$5,844.60	\$7,505.80
MO2_HEX3	ME - Survey Technician	EE	80.0	\$6,203.20	\$7,976.51
MO1_HEX3	ME - Survey Engineer	EE	60.0	\$6,094.80	\$7,837.12
<b>Total</b>			<b>1,100</b>	<b>\$97,471</b>	<b>\$125,325</b>

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**Activity Details**

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**Activity Name:** HEX15180**CAM:** Fries**Activity Description:** HEX FE - Stand Assembly Installation**WBS Code:** 7.05.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO2_HEX3	ME - Survey Technician	EE	60.0	\$4,652.40	\$6,128.15
MO1_HEX3	ME - Survey Engineer	EE	60.0	\$6,094.80	\$8,028.08
BTAR_HEX3	Building Trades Riggers - Assigned	EE	24.0	\$2,337.84	\$3,058.48
BTU_HEX3	Building Trades Unassigned	EE	48.0	\$5,529.12	\$7,233.47
MO6_HEX3	ME - Vacuum Technician	EE	40.0	\$3,066.40	\$4,039.07
NO1_HEX3	Mechanical Engineer	EE	80.0	\$8,126.40	\$10,704.10
NO6_HEX3	ME - D&I Engineer	EE	60.0	\$6,094.80	\$8,028.08
NO3_HEX3	Mechanical Technician	EE	160.0	\$12,265.60	\$16,156.26
<b>Total</b>			<b>532</b>	<b>\$48,167</b>	<b>\$63,376</b>

**Activity Details**

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**Activity Name:** HEX15190**CAM:** Fries**Activity Description:** HEX FE - Connections, Terminations & Electronics Installation**WBS Code:** 7.05.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO3_HEX3	Mechanical Technician	EE	120.0	\$9,199.20	\$12,117.20
NO1_HEX3	Mechanical Engineer	EE	20.0	\$2,031.60	\$2,676.03
TE2_HEX3	EL - D&I Technician	EE	120.0	\$8,631.60	\$11,369.55
TE1_HEX3	EL - D&I Engineer	EE	40.0	\$4,186.40	\$5,514.33
SE5_HEX3	EL - Vacuum Engineer	EE	60.0	\$6,279.60	\$8,271.50
MO6_HEX3	ME - Vacuum Technician	EE	80.0	\$6,132.80	\$8,078.13
NE1_HEX3	Electrical Engineer	EE	160.0	\$16,745.60	\$22,057.32
NE3_HEX3	Electrical Technician	EE	160.0	\$11,508.80	\$15,159.40
NE4_HEX3	Controls Engineer	EE	80.0	\$8,372.80	\$11,028.66
MO3_HEX3	ME - Utility Engineer	EE	40.0	\$4,063.20	\$5,352.05
MO4_HEX3	ME - Utility Technician	EE	40.0	\$3,066.40	\$4,039.07
MO5_HEX3	ME - Vacuum Engineer	EE	20.0	\$2,031.60	\$2,676.03
<b>Total</b>			<b>940</b>	<b>\$82,250</b>	<b>\$108,339</b>

**Activity Details**

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**Activity Name:** HEX15200**CAM:** Fries**Activity Description:** HEX FE - RWC & Safety Shutter Installation and Tie - In to SR**WBS Code:** 7.05.05.01**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MO5_HEX3	ME - Vacuum Engineer	EE	80.0	\$8,126.40	\$10,704.10

MO1_HEX3	ME - Survey Engineer	EE	20.0	\$2,031.60	\$2,676.03
BTAR_HEX3	Building Trades Riggers - Assigned	EE	30.0	\$2,922.30	\$3,823.10
MO2_HEX3	ME - Survey Technician	EE	40.0	\$3,101.60	\$4,085.43
MO6_HEX3	ME - Vacuum Technician	EE	120.0	\$9,199.20	\$12,117.20
NO1_HEX3	Mechanical Engineer	EE	80.0	\$8,126.40	\$10,704.10
NO3_HEX3	Mechanical Technician	EE	160.0	\$12,265.60	\$16,156.26
<b>Total</b>			<b>530</b>	<b>\$45,773</b>	<b>\$60,266</b>

**Activity Details**

**Activity Name:** HEX15210

**CAM:** Fries

**Activity Description:** HEX FE - Bakeout & Final Survey

**WBS Code:** 7.05.05.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX3	Mechanical Technician	EE	40.0	\$3,066.40	\$4,039.07
NO1_HEX3	Mechanical Engineer	EE	20.0	\$2,031.60	\$2,676.03
MO6_HEX3	ME - Vacuum Technician	EE	120.0	\$9,199.20	\$12,117.20
MO2_HEX3	ME - Survey Technician	EE	60.0	\$4,652.40	\$6,128.15
MO1_HEX3	ME - Survey Engineer	EE	30.0	\$3,047.40	\$4,014.04
MO5_HEX3	ME - Vacuum Engineer	EE	40.0	\$4,063.20	\$5,352.05
<b>Total</b>			<b>310</b>	<b>\$26,060</b>	<b>\$34,327</b>

**Activity Details**

**Activity Name:** HEX15230

**CAM:** Fries

**Activity Description:** HEX FE - Integrated Testing and Complete Documentation

**WBS Code:** 7.05.05.01

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX3	ME - Utility Engineer	EE	40.0	\$4,063.20	\$5,432.33
MO6_HEX3	ME - Vacuum Technician	EE	60.0	\$4,599.60	\$6,149.48
NE1_HEX3	Electrical Engineer	EE	80.0	\$8,372.80	\$11,194.09
NE4_HEX3	Controls Engineer	EE	120.0	\$12,559.20	\$16,791.14
NO1_HEX3	Mechanical Engineer	EE	80.0	\$8,126.40	\$10,864.66
NE3_HEX3	Electrical Technician	EE	80.0	\$5,754.40	\$7,693.40
NE2_HEX3	Electrical Designer	EE	80.0	\$6,724.80	\$8,990.78
NO2_HEX3	Mechanical Designer	EE	80.0	\$6,360.00	\$8,503.06
NO3_HEX3	Mechanical Technician	EE	40.0	\$3,066.40	\$4,099.65
SE5_HEX3	EL - Vacuum Engineer	EE	80.0	\$8,372.80	\$11,194.09
TE1_HEX3	EL - D&I Engineer	EE	80.0	\$8,372.80	\$11,194.09
TE2_HEX3	EL - D&I Technician	EE	60.0	\$4,315.80	\$5,770.05
<b>Total</b>			<b>880</b>	<b>\$80,688</b>	<b>\$107,877</b>

**Activity Details**

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**Activity Name:** HEX15259 **CAM:** Fries  
**Activity Description:** HEX FE - Actuals thru Jan-19  
**WBS Code:** 7.05.05.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
ACTL-HEX3	Actuals Labor	AC	0.0	\$326,147.08	\$326,147.08
ACTNL-HEX3	Actuals Non Labor	AC	0.0	\$0.00	\$27,186.22
<b>Total</b>			<b>0</b>	<b>\$326,147</b>	<b>\$353,333</b>

**WBS: 7.05.05.02** **HEX Source**  
**WBS Manager:** Greg Fries  
**Dictionary:** Design (including simulations and radiological ray tracing), specification, procurement, fabrication, assembly, installation, and testing of radiation source and associated hardware. This is a Superconducting Wiggler (SCW) required for high energy x-rays. All magnetic measurements for the device are included. The necessary device control hardware and software for the source with protection system(s) and rack mounting electrical panel, plus any trim coils and power supplies required for field correction shall be included. This also includes filing of as-built drawings and preparation for the IRR.  
**Deliverable:** completed Superconducting Wiggler System, tested and characterized in the ID test lab, installed in the storage ring, connected to the control system, run to field and fully tested and documented.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + Bu Estimate RA	Total Cost + Uncertainty EU
7.05.05.02	HEX Source	12,528	\$3,028,945	\$3,623,462	\$688,458	\$4,311,920	\$632,818

**Activity Details**

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**Activity Name:** HEX15399 **CAM:** Zhong  
**Activity Description:** Source actuals thru Jan-19  
**WBS Code:** 7.05.05.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
ACTL-HEX3	Actuals Labor	AC	0.0	\$81,596.00	\$81,596.00
<b>Total</b>			<b>0</b>	<b>\$81,596</b>	<b>\$81,596</b>

**Activity Details**

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**Activity Name:** HEX17370 **CAM:** Fries  
**Activity Description:** HEX SCW - Modeling and Beam Tracking Remaining Work  
**WBS Code:** 7.05.05.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO2_HEX3	Mechanical Designer	PJ	20.0	\$1,590.00	\$2,033.35
NO8_HEX3	ME - Insertion Device Engineer	PJ	20.0	\$2,031.60	\$2,598.08
NS2_HEX3	Assistant/Associate Scientist	PJ	20.0	\$1,845.20	\$2,359.71
NS2_HEX3	Assistant/Associate Scientist	PJ	50.0	\$4,613.00	\$5,899.27



NS2_HEX3	Assistant/Associate Scientist	AC	8.0	\$738.08	\$943.88
NO8_HEX3	ME - Insertion Device Engineer	AC	8.0	\$812.64	\$1,039.23
MO5_HEX3	ME - Vacuum Engineer	AC	4.0	\$406.32	\$519.62
NE1_HEX3	Electrical Engineer	AC	8.0	\$837.28	\$1,070.74
<b>Total</b>			<b>28</b>	<b>\$2,794</b>	<b>\$3,573</b>

**Activity Details**

**Activity Name:** HEX17430

**CAM:** Fries

**Activity Description:** Evaluate Proposals

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX3	Electrical Engineer	PJ	40.0	\$4,186.40	\$5,353.72
MO5_HEX3	ME - Vacuum Engineer	PJ	20.0	\$2,031.60	\$2,598.08
NO1_HEX3	Mechanical Engineer	PJ	20.0	\$2,031.60	\$2,598.08
NS2_HEX3	Assistant/Associate Scientist	PJ	40.0	\$3,690.40	\$4,719.42
<b>Total</b>			<b>120</b>	<b>\$11,940</b>	<b>\$15,269</b>

**Activity Details**

**Activity Name:** HEX17450

**CAM:** Fries

**Activity Description:** Control System Development & Procurement

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
TE4_HEX3	EL - Insertion Device Engineer	PJ	60.0	\$6,279.60	\$8,129.96
NE1_HEX3	Electrical Engineer	PJ	120.0	\$12,559.20	\$16,259.91
NE2_HEX3	Electrical Designer	PJ	40.0	\$3,362.40	\$4,353.17
NE3_HEX3	Electrical Technician	PJ	60.0	\$4,315.80	\$5,587.50
NE4_HEX3	Controls Engineer	PJ	120.0	\$12,559.20	\$16,259.91
<b>Total</b>			<b>400</b>	<b>\$39,076</b>	<b>\$50,590</b>

**Activity Details**

**Activity Name:** HEX17460

**CAM:** Fries

**Activity Description:** Cryo Infrastructure Development & Procurement

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE2_HEX3	Electrical Designer	PJ	40.0	\$3,362.40	\$4,353.17
NE3_HEX3	Electrical Technician	PJ	80.0	\$5,754.40	\$7,450.00
NE1_HEX3	Electrical Engineer	PJ	120.0	\$12,559.20	\$16,259.91
MO3_HEX3	ME - Utility Engineer	PJ	120.0	\$12,189.60	\$15,781.41
NO1_HEX3	Mechanical Engineer	PJ	40.0	\$4,063.20	\$5,260.47

NO2_HEX3 Mechanical Designer	PJ	40.0	\$3,180.00	\$4,117.02
<b>Total</b>		<b>440</b>	<b>\$41,109</b>	<b>\$53,222</b>

**Activity Details**

**Activity Name:** HEX17470 **CAM:** Fries

**Activity Description:** Power Supply Development & Procurement

**WBS Code:** 7.05.05.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX3	Electrical Engineer	PJ	360.0	\$37,677.60	\$49,062.82
NE2_HEX3	Electrical Designer	PJ	240.0	\$20,174.40	\$26,270.59
NE3_HEX3	Electrical Technician	PJ	120.0	\$8,631.60	\$11,239.85
<b>Total</b>		<b>720</b>	<b>\$66,484</b>	<b>\$86,573</b>	

**Activity Details**

**Activity Name:** HEX17480 **CAM:** Fries

**Activity Description:** Quench Detection Development & Procurement

**WBS Code:** 7.05.05.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX3	Electrical Technician	PJ	80.0	\$5,754.40	\$7,493.23
NE2_HEX3	Electrical Designer	PJ	80.0	\$6,724.80	\$8,756.86
NE1_HEX3	Electrical Engineer	PJ	180.0	\$18,838.80	\$24,531.41
NS2_HEX3	Assistant/Associate Scientist	PJ	60.0	\$5,535.60	\$7,208.32
<b>Total</b>		<b>400</b>	<b>\$36,854</b>	<b>\$47,990</b>	

**Activity Details**

**Activity Name:** HEX17490 **CAM:** Fries

**Activity Description:** BNL Technical Labor to Support Procurement

**WBS Code:** 7.05.05.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO8_HEX3	ME - Insertion Device Engineer	PJ	180.0	\$18,284.40	\$24,186.05
NO2_HEX3	Mechanical Designer	PJ	180.0	\$14,310.00	\$18,928.83
NE2_HEX3	Electrical Designer	PJ	180.0	\$15,130.80	\$20,014.56
TE4_HEX3	EL - Insertion Device Engineer	PJ	60.0	\$6,279.60	\$8,306.46
NS2_HEX3	Assistant/Associate Scientist	PJ	360.0	\$33,213.60	\$43,933.94
MO5_HEX3	ME - Vacuum Engineer	PJ	180.0	\$18,284.40	\$24,186.05
NE1_HEX3	Electrical Engineer	PJ	360.0	\$37,677.60	\$49,838.79
MO3_HEX3	ME - Utility Engineer	PJ	120.0	\$12,189.60	\$16,124.03
NE4_HEX3	Controls Engineer	PJ	60.0	\$6,279.60	\$8,306.46
<b>Total</b>		<b>1,680</b>	<b>\$161,650</b>	<b>\$213,825</b>	

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**Activity Details**

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**Activity Name:** HEX17500**CAM:** Fries**Activity Description:** Inspection, Testing, & Magnetic Measurement**WBS Code:** 7.05.05.02**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	PJ	120.0	\$12,559.20	\$16,964.84
NE1_HEX3	Electrical Engineer	PJ	160.0	\$16,745.60	\$22,619.78
MO5_HEX3	ME - Vacuum Engineer	PJ	60.0	\$6,094.80	\$8,232.79
MO2_HEX3	ME - Survey Technician	PJ	40.0	\$3,101.60	\$4,189.61
MO6_HEX3	ME - Vacuum Technician	PJ	60.0	\$4,599.60	\$6,213.09
MO7_HEX3	Project Engineer	PJ	10.0	\$1,015.80	\$1,372.13
BTAR_HEX3	Building Trades Riggers - Assigned	PJ	24.0	\$2,337.84	\$3,118.27
MO1_HEX3	ME - Survey Engineer	PJ	20.0	\$2,031.60	\$2,744.26
TE4_HEX3	EL - Insertion Device Engineer	PJ	500.0	\$52,330.00	\$70,686.82
NO8_HEX3	ME - Insertion Device Engineer	PJ	100.0	\$10,158.00	\$13,721.32
NS2_HEX3	Assistant/Associate Scientist	PJ	200.0	\$18,452.00	\$24,924.77
NO9_HEX3	ME - Insertion Device Technician	PJ	450.0	\$34,497.00	\$46,598.19
<b>Total</b>			<b>1,744</b>	<b>\$163,923</b>	<b>\$221,386</b>

**Activity Details**

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**Activity Name:** HEX17510**CAM:** Fries**Activity Description:** Bulk Shielding Mods & Supplemental Shielding**WBS Code:** 7.05.05.02**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NO2_HEX3	Mechanical Designer	PJ	80.0	\$6,360.00	\$8,628.72
NO3_HEX3	Mechanical Technician	PJ	120.0	\$9,199.20	\$12,480.71
NO1_HEX3	Mechanical Engineer	PJ	180.0	\$18,284.40	\$24,806.76
BTU_HEX3	Building Trades Unassigned	PJ	48.0	\$5,529.12	\$7,399.84
<b>Total</b>			<b>428</b>	<b>\$39,373</b>	<b>\$53,316</b>

**Activity Details**

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**Activity Name:** HEX17520**CAM:** Fries**Activity Description:** SCW Installation Prep & Cable Pulling**WBS Code:** 7.05.05.02**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
BTU_HEX3	Building Trades Unassigned	PJ	80.0	\$9,215.20	\$12,333.06
MO1_HEX3	ME - Survey Engineer	PJ	20.0	\$2,031.60	\$2,756.31

BTAE_HEX3	Building Trades Electrician - Assigned	PJ	260.0	\$25,326.60	\$33,895.57
MO3_HEX3	ME - Utility Engineer	PJ	40.0	\$4,063.20	\$5,512.61
MO4_HEX3	ME - Utility Technician	PJ	80.0	\$6,132.80	\$8,320.47
NE1_HEX3	Electrical Engineer	PJ	100.0	\$10,466.00	\$14,199.40
MO6_HEX3	ME - Vacuum Technician	PJ	120.0	\$9,199.20	\$12,480.71
MO2_HEX3	ME - Survey Technician	PJ	40.0	\$3,101.60	\$4,207.99
MO5_HEX3	ME - Vacuum Engineer	PJ	20.0	\$2,031.60	\$2,756.31
NE3_HEX3	Electrical Technician	PJ	120.0	\$8,631.60	\$11,710.64
NO8_HEX3	ME - Insertion Device Engineer	PJ	40.0	\$4,063.20	\$5,512.61
NO9_HEX3	ME - Insertion Device Technician	PJ	80.0	\$6,132.80	\$8,320.47
<b>Total</b>			<b>1,000</b>	<b>\$90,395</b>	<b>\$122,006</b>

**Activity Details**

**Activity Name:** HEX17530

**CAM:** Fries

**Activity Description:** Cryo installation

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO9_HEX3	ME - Insertion Device Technician	PJ	80.0	\$6,132.80	\$8,320.47
NO8_HEX3	ME - Insertion Device Engineer	PJ	40.0	\$4,063.20	\$5,512.61
NO2_HEX3	Mechanical Designer	PJ	80.0	\$6,360.00	\$8,628.72
NE3_HEX3	Electrical Technician	PJ	80.0	\$5,754.40	\$7,807.09
NE1_HEX3	Electrical Engineer	PJ	80.0	\$8,372.80	\$11,359.52
MO4_HEX3	ME - Utility Technician	PJ	180.0	\$13,798.80	\$18,721.07
MO3_HEX3	ME - Utility Engineer	PJ	120.0	\$12,189.60	\$16,537.84
<b>Total</b>			<b>660</b>	<b>\$56,672</b>	<b>\$76,887</b>

**Activity Details**

**Activity Name:** HEX17540

**CAM:** Fries

**Activity Description:** SCW Installation

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX3	ME - Utility Engineer	PJ	40.0	\$4,063.20	\$5,512.61
MO4_HEX3	ME - Utility Technician	PJ	80.0	\$6,132.80	\$8,320.47
MO5_HEX3	ME - Vacuum Engineer	PJ	20.0	\$2,031.60	\$2,756.31
BTAR_HEX3	Building Trades Riggers - Assigned	PJ	48.0	\$4,675.68	\$6,257.64
MO1_HEX3	ME - Survey Engineer	PJ	40.0	\$4,063.20	\$5,512.61
NE1_HEX3	Electrical Engineer	PJ	80.0	\$8,372.80	\$11,359.52
MO2_HEX3	ME - Survey Technician	PJ	80.0	\$6,203.20	\$8,415.99
MO6_HEX3	ME - Vacuum Technician	PJ	120.0	\$9,199.20	\$12,480.71
NE4_HEX3	Controls Engineer	PJ	40.0	\$4,186.40	\$5,679.76
NE2_HEX3	Electrical Designer	PJ	40.0	\$3,362.40	\$4,561.83

NE3_HEX3	Electrical Technician	PJ	160.0	\$11,508.80	\$15,614.19
NO2_HEX3	Mechanical Designer	PJ	40.0	\$3,180.00	\$4,314.36
NO8_HEX3	ME - Insertion Device Engineer	PJ	160.0	\$16,252.80	\$22,050.45
NO3_HEX3	Mechanical Technician	PJ	40.0	\$3,066.40	\$4,160.24
NO9_HEX3	ME - Insertion Device Technician	PJ	350.0	\$26,831.00	\$36,402.07
TE4_HEX3	EL - Insertion Device Engineer	PJ	40.0	\$4,186.40	\$5,679.76
SE5_HEX3	EL - Vacuum Engineer	PJ	60.0	\$6,279.60	\$8,519.64
<b>Total</b>			<b>1,438</b>	<b>\$123,595</b>	<b>\$167,598</b>

**Activity Details**

**Activity Name:** HEX17550

**CAM:** Fries

**Activity Description:** Integrated Testing and Complete Documentation

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
SE5_HEX3	EL - Vacuum Engineer	PJ	40.0	\$4,186.40	\$5,679.76
TE4_HEX3	EL - Insertion Device Engineer	PJ	40.0	\$4,186.40	\$5,679.76
NO9_HEX3	ME - Insertion Device Technician	PJ	120.0	\$9,199.20	\$12,480.71
NO8_HEX3	ME - Insertion Device Engineer	PJ	120.0	\$12,189.60	\$16,537.84
NO2_HEX3	Mechanical Designer	PJ	80.0	\$6,360.00	\$8,628.72
NE2_HEX3	Electrical Designer	PJ	120.0	\$10,087.20	\$13,685.48
NE4_HEX3	Controls Engineer	PJ	40.0	\$4,186.40	\$5,679.76
NE1_HEX3	Electrical Engineer	PJ	120.0	\$12,559.20	\$17,039.28
MO3_HEX3	ME - Utility Engineer	PJ	40.0	\$4,063.20	\$5,512.61
<b>Total</b>			<b>720</b>	<b>\$67,018</b>	<b>\$90,924</b>

**Activity Details**

**Activity Name:** HEX17560

**CAM:** Fries

**Activity Description:** IRR Prep

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX3	ME - Utility Engineer	PJ	40.0	\$4,063.20	\$5,512.61
MO5_HEX3	ME - Vacuum Engineer	PJ	40.0	\$4,063.20	\$5,512.61
NE1_HEX3	Electrical Engineer	PJ	40.0	\$4,186.40	\$5,679.76
NE2_HEX3	Electrical Designer	PJ	80.0	\$6,724.80	\$9,123.65
NO2_HEX3	Mechanical Designer	PJ	80.0	\$6,360.00	\$8,628.72
NO8_HEX3	ME - Insertion Device Engineer	PJ	80.0	\$8,126.40	\$11,025.23
NO9_HEX3	ME - Insertion Device Technician	PJ	40.0	\$3,066.40	\$4,160.24
NS2_HEX3	Assistant/Associate Scientist	PJ	20.0	\$1,845.20	\$2,503.41
<b>Total</b>			<b>420</b>	<b>\$38,436</b>	<b>\$52,146</b>

**Activity Details**

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**Activity Name:** HEX17580

**CAM:** Fries

**Activity Description:** Power Supply Procurement

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_Fixed_HE	Material (Purchase	PJ	0.0	\$75,000.00	\$83,918.45
X3	<\$25k) (Fixed Rate)				
<b>Total</b>			<b>0</b>	<b>\$75,000</b>	<b>\$83,918</b>

**Activity Details**

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**Activity Name:** HEX17590

**CAM:** Fries

**Activity Description:** Controls Procurement

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_Fixed_HE	Material (Purchase	PJ	0.0	\$25,000.00	\$27,972.82
X3	<\$25k) (Fixed Rate)				
<b>Total</b>			<b>0</b>	<b>\$25,000</b>	<b>\$27,973</b>

**Activity Details**

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**Activity Name:** HEX17600

**CAM:** Fries

**Activity Description:** Quench Detection Procurement

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_Fixed_HE	Material (Purchase	PJ	0.0	\$50,000.00	\$55,945.63
X3	<\$25k) (Fixed Rate)				
<b>Total</b>			<b>0</b>	<b>\$50,000</b>	<b>\$55,946</b>

**Activity Details**

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**Activity Name:** HEX17610

**CAM:** Fries

**Activity Description:** Travel to Vendors

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_Fixed_HE	Material (Purchase	PJ	0.0	\$60,000.00	\$67,134.76
X3	<\$25k) (Fixed Rate)				
<b>Total</b>			<b>0</b>	<b>\$60,000</b>	<b>\$67,135</b>

**Activity Details**

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**Activity Name:** HEX17620 **CAM:** Fries  
**Activity Description:** Consultant  
**WBS Code:** 7.05.05.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE	Material (Purchase	PJ	0.0	\$35,000.00	\$39,161.94
X3	<\$25k) (Fixed Rate)				
<b>Total</b>			<b>0</b>	<b>\$35,000</b>	<b>\$39,162</b>

**Activity Details**

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**Activity Name:** HEX17630 **CAM:** Fries  
**Activity Description:** Control System Assembly & Testing  
**WBS Code:** 7.05.05.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3	Controls Engineer	PJ	120.0	\$12,559.20	\$16,542.99
NE3_HEX3	Electrical Technician	PJ	80.0	\$5,754.40	\$7,579.70
NE1_HEX3	Electrical Engineer	PJ	120.0	\$12,559.20	\$16,542.99
NO9_HEX3	ME - Insertion Device	PJ	60.0	\$4,599.60	\$6,058.60
TE4_HEX3	EL - Insertion Device	PJ	40.0	\$4,186.40	\$5,514.33
	Engineer				
<b>Total</b>			<b>420</b>	<b>\$39,659</b>	<b>\$52,239</b>

**Activity Details**

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**Activity Name:** HEX17640 **CAM:** Fries  
**Activity Description:** Power Supply Assembly & Testing  
**WBS Code:** 7.05.05.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO9_HEX3	ME - Insertion Device	PJ	40.0	\$3,066.40	\$4,043.10
	Technician				
NE2_HEX3	Electrical Designer	PJ	60.0	\$5,043.60	\$6,650.08
NE1_HEX3	Electrical Engineer	PJ	120.0	\$12,559.20	\$16,559.53
NE3_HEX3	Electrical Technician	PJ	180.0	\$12,947.40	\$17,071.38
NE4_HEX3	Controls Engineer	PJ	80.0	\$8,372.80	\$11,039.69
<b>Total</b>			<b>480</b>	<b>\$41,989</b>	<b>\$55,364</b>

**Activity Details**

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**Activity Name:** HEX17650 **CAM:** Fries  
**Activity Description:** Quench Detection Assembly & Testing  
**WBS Code:** 7.05.05.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX3	Electrical Technician	PJ	120.0	\$8,631.60	\$11,380.92
NE1_HEX3	Electrical Engineer	PJ	80.0	\$8,372.80	\$11,039.69
NO8_HEX3	ME - Insertion Device Engineer	PJ	40.0	\$4,063.20	\$5,357.40
NO9_HEX3	ME - Insertion Device Technician	PJ	40.0	\$3,066.40	\$4,043.10
TE4_HEX3	EL - Insertion Device Engineer	PJ	40.0	\$4,186.40	\$5,519.84
<b>Total</b>			<b>320</b>	<b>\$28,320</b>	<b>\$37,341</b>

**Activity Details**

**Activity Name:** HEX17660

**CAM:** Fries

**Activity Description:** Installation Infrastructure

**WBS Code:** 7.05.05.02

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE X3	Material (Purchase <\$25k) (Fixed Rate)	PJ	0.0	\$50,000.00	\$55,945.63
<b>Total</b>			<b>0</b>	<b>\$50,000</b>	<b>\$55,946</b>

**WBS: 7.05.05.03**

**HEX Straight**

**WBS Manager:** Greg Fries

**Dictionary:** Design (including simulations and radiological ray tracing), specification, procurement, fabrication, assembly, installation, and testing of accelerator straight section sub-systems and integrated system. These include;

- the straight section chamber(s),
- vacuum system,
- supports,
- masks and shields,
- diagnostics including beam position monitors,
- necessary utilities (including utility provisions to local interface points for the Insertion Device itself),
- protection systems, and controls for the straight section
- additional modifications to the SR to accommodate the large ID fan which may impact the dipole chamber and/or magnet yokes. Filing of as-built drawings and preparation for the IRR.

**Deliverable:** completed straight section, installed with the SCW, connected to ancillary equipment and fully tested and documented.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.05.03	HEX Straight	4,130	\$560,172	\$701,187	\$0	\$701,187	\$123,678	\$824,865

**Activity Details**

**Activity Name:** HEX15800

**CAM:** Fries

**Activity Description:** HEX ID Straight - ID Lattice Simulations & Control System Upgrading

**WBS Code:** 7.05.05.03

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX3	Electrical Engineer	EE	50.0	\$5,233.00	\$6,692.15
NE4_HEX3	Controls Engineer	EE	200.0	\$20,932.00	\$26,768.59
NO8_HEX3	ME - Insertion Device Engineer	EE	30.0	\$3,047.40	\$3,897.12
NO6_HEX3	ME - D&I Engineer	EE	20.0	\$2,031.60	\$2,598.08

NO9_HEX3	ME - Insertion Device Technician	EE	80.0	\$6,132.80	\$7,842.85
NS2_HEX3	Assistant/Associate Scientist	EE	90.0	\$8,303.40	\$10,618.69
TE4_HEX3	EL - Insertion Device Engineer	EE	200.0	\$20,932.00	\$26,768.59
<b>Total</b>			<b>670</b>	<b>\$66,612</b>	<b>\$85,186</b>

**Activity Details**

**Activity Name:** HEX15810

**CAM:** Fries

**Activity Description:** HEX ID Straight - Vacuum Chamber Design

**WBS Code:** 7.05.05.03

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS2_HEX3	Assistant/Associate Scientist	EE	40.0	\$3,690.40	\$4,719.42
SE5_HEX3	EL - Vacuum Engineer	EE	100.0	\$10,466.00	\$13,384.30
NO6_HEX3	ME - D&I Engineer	EE	80.0	\$8,126.40	\$10,392.33
NO8_HEX3	ME - Insertion Device Engineer	EE	20.0	\$2,031.60	\$2,598.08
NO2_HEX3	Mechanical Designer	EE	160.0	\$12,720.00	\$16,266.79
MO5_HEX3	ME - Vacuum Engineer	EE	160.0	\$16,252.80	\$20,784.66
<b>Total</b>			<b>560</b>	<b>\$53,287</b>	<b>\$68,146</b>

**Activity Details**

**Activity Name:** HEX15820

**CAM:** Fries

**Activity Description:** HEX ID Straight - RF BPM Design & Procurement

**WBS Code:** 7.05.05.03

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO2_HEX3	Mechanical Designer	EE	100.0	\$7,950.00	\$10,202.33
NO6_HEX3	ME - D&I Engineer	EE	150.0	\$15,237.00	\$19,553.82
TE2_HEX3	EL - D&I Technician	EE	50.0	\$3,596.50	\$4,615.43
TE1_HEX3	EL - D&I Engineer	EE	150.0	\$15,699.00	\$20,146.71
<b>Total</b>			<b>450</b>	<b>\$42,483</b>	<b>\$54,518</b>

**Activity Details**

**Activity Name:** HEX15830

**CAM:** Fries

**Activity Description:** HEX ID Straight - Vacuum Chamber Procurement & Testing

**WBS Code:** 7.05.05.03

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
TE4_HEX3	EL - Insertion Device Engineer	EE	40.0	\$4,186.40	\$5,477.39
SE5_HEX3	EL - Vacuum Engineer	EE	50.0	\$5,233.00	\$6,846.74
NS2_HEX3	Assistant/Associate Scientist	EE	40.0	\$3,690.40	\$4,828.43
MO5_HEX3	ME - Vacuum Engineer	EE	200.0	\$20,316.00	\$26,580.99

MO6_HEX3 ME - Vacuum Technician	EE	200.0	\$15,332.00	\$20,060.04
<b>Total</b>		<b>530</b>	<b>\$48,758</b>	<b>\$63,794</b>

**Activity Details**

**Activity Name:** HEX15840 **CAM:** Fries  
**Activity Description:** HEX ID Straight - Procurement Receipt of RF BPMs, Supports, Cable, Conns  
**WBS Code:** 7.05.05.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE	Material (Purchase X3 <\$25k) (Fixed Rate)	HC	0.0	\$85,000.00	\$95,107.58
<b>Total</b>		<b>0</b>	<b>\$85,000</b>	<b>\$95,108</b>	

**Activity Details**

**Activity Name:** HEX15850 **CAM:** Fries  
**Activity Description:** HEX ID Straight - Procurement Receipt of Vacuum Chambers & Components  
**WBS Code:** 7.05.05.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE	Material (Purchase X3 <\$25k) (Fixed Rate)	HC	0.0	\$100,000.00	\$111,891.27
<b>Total</b>		<b>0</b>	<b>\$100,000</b>	<b>\$111,891</b>	

**Activity Details**

**Activity Name:** HEX15860 **CAM:** Fries  
**Activity Description:** HEX ID Straight - Vacuum Chamber Installation & Bake  
**WBS Code:** 7.05.05.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO6_HEX3	ME - Vacuum Technician	EE	680.0	\$52,128.80	\$70,724.03
NE1_HEX3	Electrical Engineer	EE	20.0	\$2,093.20	\$2,839.88
MO5_HEX3	ME - Vacuum Engineer	EE	80.0	\$8,126.40	\$11,025.23
MO1_HEX3	ME - Survey Engineer	EE	50.0	\$5,079.00	\$6,890.77
MO2_HEX3	ME - Survey Technician	EE	140.0	\$10,855.60	\$14,727.98
SE5_HEX3	EL - Vacuum Engineer	EE	50.0	\$5,233.00	\$7,099.70
NO6_HEX3	ME - D&I Engineer	EE	40.0	\$4,063.20	\$5,512.61
NS2_HEX3	Assistant/Associate Scientist	EE	80.0	\$7,380.80	\$10,013.66
NO8_HEX3	ME - Insertion Device Engineer	EE	20.0	\$2,031.60	\$2,756.31
TE1_HEX3	EL - D&I Engineer	EE	20.0	\$2,093.20	\$2,839.88
TE4_HEX3	EL - Insertion Device Engineer	EE	40.0	\$4,186.40	\$5,679.76
<b>Total</b>		<b>1,220</b>	<b>\$103,271</b>	<b>\$140,110</b>	

### Activity Details

**Activity Name:** HEX15870

**CAM:** Fries

**Activity Description:** HEX ID Straight - RF BPM Testing & Install

**WBS Code:** 7.05.05.03

**Estimate Year:**

**PC Rep:** Gutta

**Estimator:**

#### Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
TE2_HEX3	EL - D&I Technician	EE	300.0	\$21,579.00	\$29,276.60
TE1_HEX3	EL - D&I Engineer	EE	150.0	\$15,699.00	\$21,299.10
NO8_HEX3	ME - Insertion Device Engineer	EE	20.0	\$2,031.60	\$2,756.31
NO6_HEX3	ME - D&I Engineer	EE	50.0	\$5,079.00	\$6,890.77
MO2_HEX3	ME - Survey Technician	EE	60.0	\$4,652.40	\$6,311.99
MO1_HEX3	ME - Survey Engineer	EE	20.0	\$2,031.60	\$2,756.31
MO5_HEX3	ME - Vacuum Engineer	EE	40.0	\$4,063.20	\$5,512.61
NE1_HEX3	Electrical Engineer	EE	40.0	\$4,186.40	\$5,679.76
NE3_HEX3	Electrical Technician	EE	20.0	\$1,438.60	\$1,951.77
<b>Total</b>			<b>700</b>	<b>\$60,761</b>	<b>\$82,435</b>

**WBS: 7.05.06**      **HEX Controls**

**WBS Manager:** Zhijan Yin

**Dictionary:**

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.06	HEX Controls	6,850	\$1,062,267	\$1,325,788	\$212,126	\$1,537,914	\$220,728	\$1,546,516

**WBS: 7.05.06.01**      **HEX Basic System Controls**

**WBS Manager:** Zhijan Yin

**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, configuration, and testing of photon delivery system and endstation control systems, including specifically:

- Fiber optic networks for beamline network and machine timing;
- Ethernet copper cabling for beamline networks
- Machine timing hardware (VME crate and EVR timing cards);
- Network switches, patch panels and associated Ethernet cables;
- EPICS IOC and Archiver computers;
- Motor controllers and associated connectors and cables, (for motors, encoders, piezos, network, etc) with connectors including population of the equipment racks;
- Serial to Ethernet hubs;
- EPICS PV Gateway installation and/or configuration as required for accelerator controls system access, including Accelerator, Front End, Insertion Devices control.
- Code management (Mercurical, Github, etc) of software and configuration data
- Filing of as-built drawings and preparation for the IRR.

These include operator consoles for control (to the engineering screen level), and an IOC database and software for controlling all Ethernet-based motors, serial devices, and non-safety PLCs.

**Note:** The controls for the Straight, Source and Front End are included within the relevant WBSs for this equipment.

Instrument applications (high level software) is included below.

**Deliverable:** completed beamline control system, installed, connected to beamline equipment and fully tested (with all motions demonstrated and CSS screens operational) and documented.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
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7.05.06.01 HEX Basic System Controls 4,490 \$845,810 \$1,034,068 \$165,451 \$1,199,519 \$162,384 \$1,196,452

**Activity Details**

**Activity Name:** HEX16000 **CAM:** Yin

**Activity Description:** HEX Controls - Design

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

**Supporting Documentation:**

[QE140-Controls WBS Backup](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3	Controls Engineer	EE	160.0	\$16,745.60	\$21,414.87
NE4_HEX3	Controls Engineer	EE	350.0	\$36,631.00	\$46,845.04
NA7_HEX3	IT Professional (Software)	EE	40.0	\$3,668.00	\$4,690.77
<b>Total</b>			<b>550</b>	<b>\$57,045</b>	<b>\$72,951</b>

**Activity Details**

**Activity Name:** HEX16010 **CAM:** Yin

**Activity Description:** HEX Controls - Procure Basic Control M&S

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE	Material (Purchase X3 <\$25k) (Fixed Rate)	VQ	0.0	\$314,880.00	\$352,323.23
<b>Total</b>			<b>0</b>	<b>\$314,880</b>	<b>\$352,323</b>

**Activity Details**

**Activity Name:** HEX16020 **CAM:** Yin

**Activity Description:** HEX Controls - Motion Control

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3	Controls Engineer	EE	690.0	\$72,215.40	\$95,122.20
NE3_HEX3	Electrical Technician	EE	33.0	\$2,373.69	\$3,126.63
<b>Total</b>			<b>723</b>	<b>\$74,589</b>	<b>\$98,249</b>

**Activity Details**

**Activity Name:** HEX16030 **CAM:** Yin

**Activity Description:** HEX Controls - Diagnostic Control

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX3	Electrical Technician	EE	32.0	\$2,301.76	\$3,031.88
NE4_HEX3	Controls Engineer	EE	256.0	\$26,792.96	\$35,291.71

NA7_HEX3 IT Professional (Software)	EE	32.0	\$2,934.40	\$3,865.19
<b>Total</b>		<b>320</b>	<b>\$32,029</b>	<b>\$42,189</b>

**Activity Details**

**Activity Name:** HEX16040 **CAM:** Yin

**Activity Description:** HEX Controls - Vacuum Control IOC and testing

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3 Controls Engineer	EE	80.0	\$8,372.80	\$11,028.66
NE4_HEX3 Controls Engineer	EE	40.0	\$4,186.40	\$5,514.33
<b>Total</b>		<b>120</b>	<b>\$12,559</b>	<b>\$16,543</b>

**Activity Details**

**Activity Name:** HEX16050 **CAM:** Yin

**Activity Description:** HEX Controls - Timing IOC and testing

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3 Controls Engineer	EE	80.0	\$8,372.80	\$11,028.66
<b>Total</b>		<b>80</b>	<b>\$8,373</b>	<b>\$11,029</b>

**Activity Details**

**Activity Name:** HEX16060 **CAM:** Yin

**Activity Description:** HEX Controls - CSS development

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX3 Controls Engineer	EE	320.0	\$33,491.20	\$44,114.64
<b>Total</b>		<b>320</b>	<b>\$33,491</b>	<b>\$44,115</b>

**Activity Details**

**Activity Name:** HEX16070 **CAM:** Yin

**Activity Description:** HEX Controls - Installation

**WBS Code:** 7.05.06.01 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX3 Electrical Technician	EE	280.0	\$20,140.40	\$26,528.96
NE3_HEX3 Electrical Technician	EE	437.0	\$31,433.41	\$41,404.12
NA7_HEX3 IT Professional (Software)	EE	360.0	\$33,012.00	\$43,483.44
<b>Total</b>		<b>1,077</b>	<b>\$84,586</b>	<b>\$111,417</b>

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**Activity Details**

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**Activity Name:** HEX16080 **CAM:** Yin  
**Activity Description:** HEX Controls - Interface with accelerator control (gateway)  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	20.0	\$2,093.20	\$2,757.17
		<b>Total</b>	<b>20</b>	<b>\$2,093</b>	<b>\$2,757</b>

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**Activity Details**

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**Activity Name:** HEX16090 **CAM:** Yin  
**Activity Description:** HEX Controls - Integrated testing and IRR prep  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	160.0	\$16,745.60	\$22,057.32
		<b>Total</b>	<b>160</b>	<b>\$16,746</b>	<b>\$22,057</b>

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**Activity Details**

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**Activity Name:** HEX16100 **CAM:** Yin  
**Activity Description:** HEX Controls - Detector Integration  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	320.0	\$33,491.20	\$44,114.64
		<b>Total</b>	<b>320</b>	<b>\$33,491</b>	<b>\$44,115</b>

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**Activity Details**

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**Activity Name:** HEX16110 **CAM:** Yin  
**Activity Description:** HEX Controls - End station instrumentation  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	640.0	\$66,982.40	\$88,229.28
		<b>Total</b>	<b>640</b>	<b>\$66,982</b>	<b>\$88,229</b>

**Activity Details**

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**Activity Name:** HEX16120 **CAM:** Yin  
**Activity Description:** HEX Controls - Other endstation control tasks  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NE4_HEX3	Controls Engineer	EE	160.0	\$16,745.60	\$22,057.32
		<b>Total</b>	<b>160</b>	<b>\$16,746</b>	<b>\$22,057</b>

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**Activity Details**

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**Activity Name:** HEX16130 **CAM:** Yin  
**Activity Description:** HEX Controls - FAT Travel  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NTR_HEX3	Travel Cost	EE	0.0	\$10,000.00	\$14,063.68
		<b>Total</b>	<b>0</b>	<b>\$10,000</b>	<b>\$14,064</b>

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**Activity Details**

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**Activity Name:** HEX17890 **CAM:** Yin  
**Activity Description:** HEX Controls - Procure DAQ Server  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_Fixed_HE	Material (Purchase X3 <\$25k) (Fixed Rate)	VQ	0.0	\$36,000.00	\$40,280.86
		<b>Total</b>	<b>0</b>	<b>\$36,000</b>	<b>\$40,281</b>

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**Activity Details**

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**Activity Name:** HEX17900 **CAM:** Yin  
**Activity Description:** HEX Controls - Procure CUDA/GPU Unit  
**WBS Code:** 7.05.06.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

		<b>Cost Summary</b>			
<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NMA_Fixed_HE	Material (Purchase X3 <\$25k) (Fixed Rate)	VQ	0.0	\$46,200.00	\$51,693.77
		<b>Total</b>	<b>0</b>	<b>\$46,200</b>	<b>\$51,694</b>

**WBS: 7.05.06.02**      **HEX Instrument Applications**

**WBS Manager:** Zhijan Yin

**Dictionary:** Design, specification, procurement, fabrication, assembly, installation, and testing of photon delivery system and endstation instrument control applications, including specifically;

- experimental control workstations
- data processing and storage hardware and software
- experimental control software
- data acquisition equipment and software for detectors
- filing of as-built drawings and preparation for the IRR

**Deliverable:** completed instrument applications, installed with the necessary hardware ready to perform initial experiments, fully tested and documented.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.06.02	HEX Instrument Applications	2,360	\$216,457	\$291,720	\$46,675	\$338,395	\$58,344	\$350,064

**Activity Details**

**Activity Name:** HEX16150      **CAM:** Yin

**Activity Description:** HEX IA - Data Aq - Development (Core Functionality)

**WBS Code:** 7.05.06.02      **Estimate Year:**

**PC Rep:** Gutta      **Estimator:**

**Cost Summary**

**Supporting Documentation:**

[QE140-Controls WBS Backup](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA7_HEX3	IT Professional (Software)	EE	240.0	\$22,008.00	\$29,660.28
<b>Total</b>			<b>240</b>	<b>\$22,008</b>	<b>\$29,660</b>

**Activity Details**

**Activity Name:** HEX17800      **CAM:** Yin

**Activity Description:** HEX IA - Data Aq - Integration with EPICS (Detectors)

**WBS Code:** 7.05.06.02      **Estimate Year:**

**PC Rep:** Gutta      **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA7_HEX3	IT Professional (Software)	EE	480.0	\$44,016.00	\$59,320.57
<b>Total</b>			<b>480</b>	<b>\$44,016</b>	<b>\$59,321</b>

**Activity Details**

**Activity Name:** HEX17810      **CAM:** Yin

**Activity Description:** HEX IA - Data Aq - Integration with EPICS (Motion)

**WBS Code:** 7.05.06.02      **Estimate Year:**

**PC Rep:** Gutta      **Estimator:**

**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA7_HEX3	IT Professional (Software)	EE	40.0	\$3,668.00	\$4,943.38
<b>Total</b>			<b>40</b>	<b>\$3,668</b>	<b>\$4,943</b>

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**Activity Details**

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**Activity Name:** HEX17820 **CAM:** Yin

**Activity Description:** HEX IA - Data Aq - Development (Experiment Plans)

**WBS Code:** 7.05.06.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NA7_HEX3 IT Professional (Software)	EE	590.0	\$54,103.00	\$72,914.86
<b>Total</b>		<b>590</b>	<b>\$54,103</b>	<b>\$72,915</b>

**Activity Details**

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**Activity Name:** HEX17830 **CAM:** Yin

**Activity Description:** HEX IA - Graphical Elements Development (Plotting/UI)

**WBS Code:** 7.05.06.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NA7_HEX3 IT Professional (Software)	EE	590.0	\$54,103.00	\$72,914.86
<b>Total</b>		<b>590</b>	<b>\$54,103</b>	<b>\$72,915</b>

**Activity Details**

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**Activity Name:** HEX17840 **CAM:** Yin

**Activity Description:** HEX IA - Data Aq - Installation

**WBS Code:** 7.05.06.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NA7_HEX3 IT Professional (Software)	EE	20.0	\$1,834.00	\$2,471.69
<b>Total</b>		<b>20</b>	<b>\$1,834</b>	<b>\$2,472</b>

**Activity Details**

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**Activity Name:** HEX17850 **CAM:** Yin

**Activity Description:** HEX IA - Data Management Infra Config

**WBS Code:** 7.05.06.02 **Estimate Year:**

**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NA7_HEX3 IT Professional (Software)	EE	160.0	\$14,672.00	\$19,773.52
<b>Total</b>		<b>160</b>	<b>\$14,672</b>	<b>\$19,774</b>

**Activity Details**

**Activity Name:** HEX17860 **CAM:** Yin  
**Activity Description:** HEX IA - Data Management Infra Benchmarking & Testing  
**WBS Code:** 7.05.06.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NA7_HEX3 IT Professional (Software)	EE	160.0	\$14,672.00	\$19,773.52
<b>Total</b>		<b>160</b>	<b>\$14,672</b>	<b>\$19,774</b>

**Activity Name:** HEX17870 **CAM:** Yin  
**Activity Description:** HEX IA - Data Analysis Software Config & Deployment  
**WBS Code:** 7.05.06.02 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
NS2_HEX3 Assistant/Associate Scientist	EE	80.0	\$7,380.80	\$9,947.14
<b>Total</b>		<b>80</b>	<b>\$7,381</b>	<b>\$9,947</b>

**WBS: 7.05.07** **HEX Conventional Facilities**

**WBS Manager:** Brian McCaffrey

**Dictionary:**

<b>ID</b>	<b>Name</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	<b>TD Risk Assessment</b>	<b>Total Cost + Bu Estimate RA</b>	<b>Uncertainty</b>	<b>Total Cost + EU</b>
7.05.07	HEX Conventional Facilities	3,912	\$5,098,009	\$5,556,536	\$286,629	\$5,843,165	\$8,480	\$5,565,016

**WBS: 7.05.07.01** **HEX Conventional Facilities Design and Bid Prep**

**WBS Manager:** Brian McCaffrey

**Dictionary:** Design (by architect) and completion of all required design work prior to the bid document being released. Costs will include BNL staff labor and may also include design consultants and/or engagement of an external consulting architect. This also includes filing of as-built drawings and preparation for the IRR.

**Deliverable:** completed construction bid package ready to be posted on FedBizOpps.

<b>ID</b>	<b>Name</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>	<b>TD Risk Assessment</b>	<b>Total Cost + Bu Estimate RA</b>	<b>Uncertainty</b>	<b>Total Cost + EU</b>
7.05.07.01	HEX Conventional Facilities Design and Bid Prep	0	\$332,774	\$332,774	\$0	\$332,774	\$0	\$332,774

**Activity Details**

**Activity Name:** HEX16999 **CAM:** Zhong  
**Activity Description:** Satellite Building Actuals thru Feb-19  
**WBS Code:** 7.05.07.01 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

<b>Cost Summary</b>				
<b>Resource Id Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
ACTL-HEX3 Actuals Labor	AC	0.0	\$332,773.75	\$332,773.75
<b>Total</b>		<b>0</b>	<b>\$332,774</b>	<b>\$332,774</b>

**WBS: 7.05.07.02**      **HEX Conventional Facilities Construction****WBS Manager:** Brian McCaffrey**Dictionary:** Construction contract as awarded to a contractor, or construction work performed by BNL staff.**Deliverable:** completed conventional facilities contract with beneficial occupancy granted and punch-list work closed out or negotiated. Building and systems fully checked and documented.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.07.02	HEX Conventional Facilities Construction	0	\$4,089,850	\$4,375,742	\$218,787	\$4,594,529	\$0	\$4,375,742

**Activity Details****Activity Name:** HEX17190**CAM:** McCaffrey**Activity Description:** HEX Satellite Building Construction Contract**WBS Code:** 7.05.07.02**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
CHV_Fixed_HE	Construction HV (Fixed X3 Rate)	AC	0.0	\$2,000,000.00	\$2,237,825.38
NLP_Fixed_HE	Large Procurment (>\$2M) X3 (Fixed Rate)	AC	0.0	\$1,945,000.00	\$1,989,735.00
<b>Total</b>			<b>0</b>	<b>\$3,945,000</b>	<b>\$4,227,560</b>

**Activity Details****Activity Name:** HEX17250**CAM:** McCaffrey**Activity Description:** HEX Satellite Building Construction - Contingency**WBS Code:** 7.05.07.02**Estimate Year:****PC Rep:** Gutta**Estimator:****Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurment (>\$2M) X3 (Fixed Rate)	AC	0.0	\$144,850.00	\$148,181.55
<b>Total</b>			<b>0</b>	<b>\$144,850</b>	<b>\$148,182</b>

**WBS: 7.05.07.03**      **HEX Conventional Facilities Commissioning****WBS Manager:** Brian McCaffrey**Dictionary:** Costs include safety and engineering supervision of the contractor and all beneficial occupancy testing, as well as any punch-list completion costs (that are not borne by the Contractor).**Deliverable:** completed conventional facilities contract with beneficial occupancy granted and punch-list work closed out. Building and systems fully checked and documented.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.07.03	HEX Conventional Facilities Commissioning	3,912	\$675,385	\$848,021	\$67,842	\$915,862	\$8,480	\$856,501

**Activity Details**

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**Activity Name:** HEX17280 **CAM:** McCaffrey  
**Activity Description:** HEX Satellite Building Contract Oversight  
**WBS Code:** 7.05.07.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
CLV_Fixed_HEX3	Construction LV (Fixed Rate)	LOE	0.0	\$98,082.80	\$109,746.09
MPO_ADM_HEX3	MPO Administrative	LOE	16.0	\$2,361.28	\$3,019.69
MPO_ARC_HEX3	MPO Architect	LOE	400.0	\$59,032.00	\$75,492.24
MPO_CAM_HEX3	MPO CAM	LOE	80.0	\$11,806.40	\$15,098.45
MPO_EEP_HEX3	MPO Project Electrical Engineer	LOE	60.0	\$8,854.80	\$11,323.84
MPO_EI_HEX3	MPO Electrical Inspector	LOE	120.0	\$17,709.60	\$22,647.67
MPO_MEP_HEX3	MPO Project Mechanical Engineer	LOE	160.0	\$23,612.80	\$30,196.90
MPO_MGR_HEX3	MPO Manager	LOE	16.0	\$2,361.28	\$3,019.69
MPO_MI_HEX3	MPO Mechanical Inspector	LOE	240.0	\$35,419.20	\$45,295.35
MPO_OTH_HEX3	MPO Other Professional	LOE	4.0	\$590.32	\$754.92
MPO_SAF_HEX3	MPO Safety Engineer	LOE	300.0	\$44,274.00	\$56,619.18
MPO_SE_HEX3	MPO Structural Engineer	LOE	1,000.0	\$147,580.00	\$188,730.61
MPO_SI_HEX3	MPO Structural Inspector	LOE	1,200.0	\$177,096.00	\$226,476.73
<b>Total</b>			<b>3,596</b>	<b>\$628,780</b>	<b>\$788,421</b>

**Activity Details**

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**Activity Name:** HEX17310 **CAM:** McCaffrey  
**Activity Description:** HEX Satellite Building Contract Oversight Contingency 8%  
**WBS Code:** 7.05.07.03 **Estimate Year:**  
**PC Rep:** Gutta **Estimator:**

**Cost Summary**

<b>Resource Id</b>	<b>Description</b>	<b>Cost Basis</b>	<b>Hours</b>	<b>Direct</b>	<b>Total Cost (Dir+Bur+Esc)</b>
MPO_OTH_HEX3	MPO Other Professional	LOE	315.8	\$46,604.29	\$59,599.24
<b>Total</b>			<b>316</b>	<b>\$46,604</b>	<b>\$59,599</b>