

WBS: 7.05 HEX

WBS Manager:

Dictionary:

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05	HEX	99,890	\$25,773,808	\$31,216,997	\$4,454,276	\$35,671,274	\$3,990,488	\$35,207,485

WBS: 7.05.01 HEX Management

WBS Manager: Zhong Zhong

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 and Primavera P6 licenses (apportioned).

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	32,771	\$4,083,114	\$5,523,711	\$0	\$5,523,711	\$58,468	\$5,582,178

Activity Details

Activity Name: HEX25080

CAM: Zhong

Activity Description: HEX - Project Management and Support FY18

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.01

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO7_HEX2	Project Engineer	LOE	39.8	\$3,775.95	\$4,650.80
MO7_HEX2	Project Engineer	LOE	99.6	\$9,439.87	\$11,627.01
NA1_HEX2	Manager	LOE	996.0	\$163,282.49	\$201,113.73
NA2_HEX2	Administrative	LOE	199.2	\$12,915.06	\$15,907.37
NA4_HEX2	ES&H Professional	LOE	597.6	\$62,398.40	\$76,855.61
NA5_HEX2	QA Professional	LOE	99.6	\$9,887.79	\$12,178.71
NB1_HEX2	Project Controls	LOE	796.8	\$100,715.52	\$118,589.81
NB2_HEX2	Business Ops	LOE	199.2	\$12,915.06	\$15,907.37
Total			3,028	\$375,330	\$456,830

Activity Details

Activity Name: HEX25090

CAM: Zhong

Activity Description: HEX - Project Management and Support FY19

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.01

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO7_HEX2	Project Engineer	LOE	120.0	\$11,373.33	\$14,996.26
MO7_HEX2	Project Engineer	LOE	200.0	\$18,955.56	\$24,993.77

NA1_HEX2 Manager	LOE	1,200.0	\$196,725.89	\$259,392.11
NA2_HEX2 Administrative	LOE	200.0	\$12,966.92	\$17,097.48
NA4_HEX2 ES&H Professional	LOE	600.0	\$62,649.00	\$82,605.58
NA5_HEX2 QA Professional	LOE	200.0	\$19,855.00	\$26,179.73
NB1_HEX2 Project Controls	LOE	800.0	\$101,120.00	\$132,296.78
NB2_HEX2 Business Ops	LOE	200.0	\$12,966.92	\$17,097.48
Total		3,520	\$436,613	\$574,659

Activity Details

Activity Name: HEX25100

CAM: Zhong

Activity Description: HEX - Project Management and Support FY20

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.01

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO7_HEX2	Project Engineer	LOE	241.0	\$22,837.65	\$31,045.98
MO7_HEX2	Project Engineer	LOE	200.8	\$19,031.38	\$25,871.65
NA1_HEX2	Manager	LOE	1,204.8	\$197,512.79	\$268,503.01
NA2_HEX2	Administrative	LOE	200.8	\$13,018.79	\$17,698.02
NA4_HEX2	ES&H Professional	LOE	602.4	\$62,899.60	\$85,507.02
NA5_HEX2	QA Professional	LOE	200.8	\$19,934.42	\$27,099.27
NB1_HEX2	Project Controls	LOE	803.2	\$101,524.48	\$135,880.97
NB2_HEX2	Business Ops	LOE	200.8	\$13,018.79	\$17,698.02
Total			3,655	\$449,778	\$609,304

Activity Details

Activity Name: HEX25110

CAM: Zhong

Activity Description: HEX - Project Management and Support FY21

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.01

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO7_HEX2	Project Engineer	LOE	300.0	\$28,433.33	\$39,851.11
MO7_HEX2	Project Engineer	LOE	240.0	\$22,746.67	\$31,880.88
NA1_HEX2	Manager	LOE	1,200.0	\$196,725.89	\$275,723.70
NA2_HEX2	Administrative	LOE	200.0	\$12,966.92	\$18,173.96
NA4_HEX2	ES&H Professional	LOE	600.0	\$62,649.00	\$87,806.51
NA5_HEX2	QA Professional	LOE	300.0	\$29,782.50	\$41,742.05
NB1_HEX2	Project Controls	LOE	800.0	\$101,120.00	\$138,452.42
NB2_HEX2	Business Ops	LOE	200.0	\$12,966.92	\$18,173.96
Total			3,840	\$467,391	\$651,805

Activity Details

Activity Name: HEX251221 **CAM:** Zhong
Activity Description: HEX - Project Management and Support FY22
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO7_HEX2	Project Engineer	LOE	238.8	\$22,632.93	\$32,704.84
MO7_HEX2	Project Engineer	LOE	207.0	\$19,615.21	\$28,344.20
NA1_HEX2	Manager	LOE	955.2	\$156,593.81	\$226,279.82
NA2_HEX2	Administrative	LOE	159.2	\$10,321.67	\$14,914.93
NA4_HEX2	ES&H Professional	LOE	477.6	\$49,868.60	\$72,060.70
NA5_HEX2	QA Professional	LOE	238.8	\$23,706.87	\$34,256.70
NB1_HEX2	Project Controls	LOE	636.8	\$80,491.52	\$112,742.91
NB2_HEX2	Business Ops	LOE	159.2	\$10,321.67	\$14,914.93
Total			3,073	\$373,552	\$536,219

Activity Details

Activity Name: HEX13400 **CAM:** Zhong
Activity Description: HEX - IRR Review Final
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	PJ	0.0	\$5,000.00	\$6,127.75
Total			0	\$5,000	\$6,128

Activity Details

Activity Name: HEX11710 **CAM:** Zhong
Activity Description: HEX - Project Scientist FY18
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2	Scientist	LOE	1,760.0	\$221,399.62	\$272,696.14
Total			1,760	\$221,400	\$272,696

Activity Details

Activity Name: HEX11720 **CAM:** Zhong
Activity Description: HEX - Project Scientist FY19
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2 Scientist	LOE	3,520.0	\$442,799.24	\$583,851.14
Total		3,520	\$442,799	\$583,851

Activity Details

Activity Name: HEX11730 **CAM:** Zhong
Activity Description: HEX - Project Scientist FY20
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2 Scientist	LOE	3,520.0	\$442,799.24	\$601,950.52
Total		3,520	\$442,799	\$601,951

Activity Details

Activity Name: HEX11740 **CAM:** Zhong
Activity Description: HEX - Project Scientist FY21
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2 Scientist	LOE	3,520.0	\$442,799.24	\$620,610.99
Total		3,520	\$442,799	\$620,611

Activity Details

Activity Name: HEX251211 **CAM:** Zhong
Activity Description: HEX - Project Scientist FY22
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2 Scientist	LOE	3,184.0	\$400,532.04	\$578,773.35
Total		3,184	\$400,532	\$578,773

Activity Details

Activity Name: HEX251231 **CAM:** Zhong
Activity Description: HEX - Project Scientist additional for Part FY18
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2 Scientist	LOE	152.0	\$19,120.88	\$23,551.03
Total		152	\$19,121	\$23,551

Activity Details

Activity Name: HEX13000 **CAM:** Zhong
Activity Description: HEX - BAT Meeting No. 3
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NTR_HEX2 Travel Cost	PJ	0.0	\$2,000.00	\$2,342.14
Total		0	\$2,000	\$2,342

Activity Details

Activity Name: HEX10500 **CAM:** Zhong
Activity Description: HEX - BAT Meeting No. 1
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NTR_HEX2 Travel Cost	PJ	0.0	\$2,000.00	\$2,648.14
Total		0	\$2,000	\$2,648

Activity Details

Activity Name: HEX12800 **CAM:** Zhong
Activity Description: HEX - BAT Meeting No. 2
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NTR_HEX2 Travel Cost	PJ	0.0	\$2,000.00	\$2,342.14
Total		0	\$2,000	\$2,342

WBS: 7.05.02 HEX Design**WBS Manager:****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	4,844	\$430,335	\$546,394	\$63,284	\$609,678	\$11,049	\$557,443

WBS: 7.05.02.01 HEX Conceptual Design**WBS Manager:** Zhong Zhong

Dictionary: 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	163	\$15,449	\$19,028	\$0	\$19,028	\$0	\$19,028

Activity Details**Activity Name:** HEX13820**CAM:** Zhong**Activity Description:** HEX - Conceptual Design (actuals)**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.02.01**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	AC	155.0	\$14,690.56	\$18,094.24
Total			155	\$14,691	\$18,094

Activity Details**Activity Name:** HEX13830**CAM:** Zhong**Activity Description:** HEX - CDR (actuals)**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.02.01**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	AC	8.0	\$758.22	\$933.90
Total			8	\$758	\$934

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.).

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	921	\$85,500	\$105,651	\$12,678	\$118,329	\$287	\$105,938

Activity Details

Activity Name: HEX13840 **CAM:** Zhong
Activity Description: HEX - Preliminary Design (actuals)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.02.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE	Material (Purchase X2 <\$25k) (Fixed Rate)	AC	0.0	\$3,700.70	\$4,899.99
NO1_HEX2	Mechanical Engineer	AC	438.0	\$41,512.67	\$51,130.82
NO2_HEX2	Mechanical Designer	AC	195.0	\$14,952.00	\$18,416.26
NS1_HEX2	Scientist	AC	16.0	\$2,016.50	\$2,483.70
Total			649	\$62,182	\$76,931

Activity Details

Activity Name: HEX251311 **CAM:** Zhong
Activity Description: HEX - Preliminary Design
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.02.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	LOE	136.0	\$12,889.78	\$15,876.24
NO2_HEX2	Mechanical Designer	LOE	136.0	\$10,428.06	\$12,844.16
Total			272	\$23,318	\$28,720

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

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	3,760	\$329,387	\$421,714	\$50,606	\$472,320	\$10,762	\$432,476

Activity Details

Activity Name: HEX13850 **CAM:** Zhong
Activity Description: HEX - Final Design
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.02.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	LOE	1,792.0	\$169,841.78	\$218,043.61
NO2_HEX2	Mechanical Designer	LOE	1,792.0	\$137,405.04	\$176,401.19
Total			3,584	\$307,247	\$394,445

Activity Details

Activity Name: HEX13860 **CAM:** Zhong
Activity Description: HEX - Radiation Shielding Calculations
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.02.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2	Scientist	PJ	176.0	\$22,139.96	\$27,269.61
Total			176	\$22,140	\$27,270

WBS: 7.05.03 **HEX Beamline Construction**

WBS Manager:
Dictionary:

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.03	HEX Beamline Construction	13,546	\$6,266,951	\$7,333,429	\$706,039	\$8,039,468	\$867,886	\$8,201,315

WBS: 7.05.03.01 **HEX Photon Delivery System Procurement and Fabrication**

WBS Manager: Zhong Zhong

Dictionary: Final detailed component level design, specification, procurement, and fabrication, of photon delivery sub-systems. These include the beamline optical systems upstream of the end-station (including their housings, supports, and manipulation systems), apertures and beam definition and conditioning systems, beam diagnostic/visualization systems, beam transport system, vacuum system*, cooling/heating and temperature stabilization systems associated with individual photon delivery system components, and shielding systems (exclusive of radiological enclosures) that include collimators, masks, shields (eg for secondary Bremsstrahlung), shutters, and beam stops.

This will include relevant beamline component design reviews and Factory Acceptance Testing, with associated travel costs, where applicable.

* The ion pumps, gauges, valves to be included with the beamline components procurement (s), HOWEVER, the pump and gauge controllers and vacuum cables / connectors will be procured directly by NSLS-II.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.03.01	HEX Photon Delivery System Procurement and Fabrication	0	\$3,337,809	\$3,739,494	\$336,554	\$4,076,048	\$407,864	\$4,147,358

Activity Details

Activity Name: HEX14100 **CAM:** Zhong
Activity Description: 1 Laue mono
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:

[Laue Mono](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE X2	Capital Equipment (Fixed Rate)	HC	0.0	\$819,607.00	\$917,632.00

Assumptions: Based on XPD DLM cost w/o R&D costs (\$707k). Added 5 yrs inflation at 3%.

Total	0	\$819,607	\$917,632
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Activity Details

Activity Name: HEX14200 **CAM:** Zhong
Activity Description: Non-optics components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:
[QE02A Airline Hyd Brems Support](#)

Supporting Documentation:
[QE02B Lead Sheets Supply](#)

Supporting Documentation:
[QE03 VAT Valves](#)

Supporting Documentation:
[QE04 Windows and Filters](#)

Supporting Documentation:
[QE05 Diagnostics WB slits and Vert stages](#)

Supporting Documentation:
[QE09 WB Shielded Transport pipe](#)

Supporting Documentation:
[QE13 Beam Diagnostics Module](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$1,921,300.00	\$2,151,087.48

Assumptions: Refer to Components budget for detailed line items.
Some estimates are based on SST Front End estimates/actuals
Allowance for pumps and gauges not included with transport pipe.
Ion chamber with local electronics estimate based on experience.

Total 0 \$1,921,300 \$2,151,087

Activity Details

Activity Name: HEX14210 **CAM:** Zhong
Activity Description: 2 Special White Beam Shutters
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	HC	0.0	\$340,000.00	\$380,664.00

Assumptions: Front End SST Estimate - Front End Safety Shutter and Photon Shutter combined cost. Identical assembly, aperture adequate

Total 0 \$340,000 \$380,664

Activity Details

Activity Name: HEX14420 **CAM:** Zhong
Activity Description: Procure Vacuum Pump and Gauge Controllers and Cables (12 Vac sections)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:

[Vacuum components summary](#)

Supporting Documentation:

[Roughing turbo cart](#)

Supporting Documentation:

[Fixed turbo station](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE	Material (Purchase X2 <\$25k) (Fixed Rate)	VQ	0.0	\$211,902.00	\$237,118.34
Total			0	\$211,902	\$237,118

Activity Details

Activity Name: HEX14220 **CAM:** Zhong
Activity Description: HEX - PDR, Status and FAT visits to Vendors
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NTR_HEX2	Travel Cost	PJ	0.0	\$45,000.00	\$52,991.84
Total			0	\$45,000	\$52,992

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.

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	13,066	\$1,114,637	\$1,551,154	\$186,139	\$1,737,293	\$98,096	\$1,649,250

Activity Details

Activity Name: HEX14440 **CAM:** Zhong
Activity Description: Additional Rigger Hours
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAR_HEX2	Building Trades Riggers - Assigned	LOE	748.0	\$72,862.68	\$99,743.47
Total			748	\$72,863	\$99,743

Activity Details

Activity Name: HEX14190 **CAM:** Zhong
Activity Description: HEX - Photon Delivery System Installation and Test Labor
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTU_HEX2	Building Trades Unassigned	PJ	90.0	\$10,214.10	\$13,982.33
BTUC_HEX2	Building Trades Carpenter - Unassigned	PJ	126.0	\$14,299.74	\$19,575.26
BTUR_HEX2	Building Trades Riggers - Unassigned	PJ	252.0	\$28,599.48	\$39,150.51
MO1_HEX2	ME - Survey Engineer	PJ	180.0	\$17,060.00	\$23,904.47
MO2_HEX2	ME - Survey Technician	PJ	360.0	\$25,928.42	\$36,330.89
MO5_HEX2	ME - Vacuum Engineer	PJ	405.0	\$38,385.00	\$53,785.05
MO6_HEX2	ME - Vacuum Technician	PJ	900.0	\$65,612.82	\$91,936.65
Total			2,313	\$200,100	\$278,665

Activity Details

Activity Name: HEX25380 **CAM:** Zhong
Activity Description: HEX - PPE Costs (Safety shoes, Glasses etc.)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	PJ	0.0	\$2,500.00	\$2,995.00
Total			0	\$2,500	\$2,995

Activity Details

Activity Name: HEX14130 **CAM:** Zhong
Activity Description: Special White Beam Shutters Installation and Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	PJ	40.0	\$3,791.11	\$5,281.53
NO3_HEX2	Mechanical Technician	PJ	20.0	\$1,458.06	\$1,982.12
Total			60	\$5,249	\$7,264

Activity Details

Activity Name: HEX251531 **CAM:** Zhong
Activity Description: HEX - Engineering and Installation Oversight
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2 Mechanical Engineer	LOE	4,979.2	\$471,917.52	\$655,709.05
Total		4,979	\$471,918	\$655,709

Activity Details

Activity Name: HEX14110 **CAM:** Zhong
Activity Description: Non-optics components Installation and Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX2 Mechanical Technician	LOE	720.0	\$52,490.25	\$73,568.39
Total		720	\$52,490	\$73,568

Activity Details

Activity Name: HEX14140 **CAM:** Zhong
Activity Description: Laue mono Installation and Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX2 Mechanical Technician	PJ	540.0	\$39,367.69	\$55,176.29
Total		540	\$39,368	\$55,176

Activity Details

Activity Name: HEX14230 **CAM:** Zhong
Activity Description: HEX - Beamline Technician Effort
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX2 Mechanical Technician	LOE	3,705.6	\$270,149.84	\$378,033.39
Total		3,706	\$270,150	\$378,033

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.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.03.03	HEX End Station Procurement and Fabrication	0	\$1,779,512	\$1,992,342	\$179,311	\$2,171,652	\$349,317	\$2,341,658

Activity Details

Activity Name: HEX251331

CAM: Zhong

Activity Description: Procure Micro-focusing optics (KB-mirror)

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.03.03

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	PJ	0.0	\$400,000.00	\$447,840.00
Total			0	\$400,000	\$447,840

Activity Details

Activity Name: HEX251341

CAM: Zhong

Activity Description: Procure EDXRD Sample Stage

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.03.03

Estimator:

PC Rep: Gutta

Cost Summary

Supporting Documentation:

[QE17A Huber](#)

Supporting Documentation:

[QE17B sample stack](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$48,000.00	\$53,740.80
Total			0	\$48,000	\$53,741

Activity Details

Activity Name: HEX251351 **CAM:** Zhong
Activity Description: Procure EDXRD Sample table
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary**Supporting Documentation:**[QE11 IDT](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$65,000.00	\$72,774.00
Total			0	\$65,000	\$72,774

Activity Details

Activity Name: HEX251381 **CAM:** Zhong
Activity Description: Procure EDXRD Detector, single element Ge detector (eg Canberra)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	PJ	0.0	\$140,000.00	\$156,744.00
Total			0	\$140,000	\$156,744

Activity Details

Activity Name: HEX251391 **CAM:** Zhong
Activity Description: Procure EDXRD Detector, multielement Ge R&D project Pete Siddons
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	EE	0.0	\$100,000.00	\$111,960.00
Total			0	\$100,000	\$111,960

Activity Details

Activity Name: HEX251401 **CAM:** Zhong
Activity Description: Procure Lead Wall, 1" Thick, Sliding on floor rails (costed below)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$12,600.00	\$14,106.96

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	EE	0.0	\$93,000.00	\$104,122.80
Total			0	\$93,000	\$104,123

Activity Details

Activity Name: HEX251471 **CAM:** Zhong
Activity Description: Procure ADXRD detector
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	PJ	0.0	\$100,000.00	\$111,960.00
Total			0	\$100,000	\$111,960

Activity Details

Activity Name: HEX251361 **CAM:** Zhong
Activity Description: Procure EDXRD Detector Table (Stable)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:
[QE11 IDT](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$75,000.00	\$83,970.00
Total			0	\$75,000	\$83,970

Activity Details

Activity Name: HEX251371 **CAM:** Zhong
Activity Description: Procure 2 Theta Cradle (Slit on each end)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:
[QE16 2Theta](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$47,912.00	\$53,642.28
Total			0	\$47,912	\$53,642

Activity Details

Activity Name: HEX251501 **CAM:** Zhong
Activity Description: Procure Beam Stop
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	PJ	0.0	\$25,000.00	\$27,990.00
Total			0	\$25,000	\$27,990

Activity Details

Activity Name: HEX251421 **CAM:** Zhong
Activity Description: Procure Imaging Sample Table
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary**Supporting Documentation:**[QE11 IDT](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$65,000.00	\$72,774.00
Total			0	\$65,000	\$72,774

Activity Details

Activity Name: HEX251431 **CAM:** Zhong
Activity Description: Procure Imaging Detector Table
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary**Supporting Documentation:**[QE11 IDT](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$75,000.00	\$83,970.00
Total			0	\$75,000	\$83,970

Activity Details

Activity Name: HEX251481 **CAM:** Zhong
Activity Description: Procure Detector translation stage (move between EDXRD, ADXRD and imaging)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.03.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
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NEQ_Fixed_HE Capital Equipment (Fixed X2 Rate) EE 0.0 \$75,000.00 \$83,970.00

Total 0 \$75,000 \$83,970

Activity Details

Activity Name: HEX251491 **CAM:** Zhong

Activity Description: Procure Imaging Detectors

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.03.03 **Estimator:**

PC Rep: Gutta

Cost Summary

Supporting Documentation:

[QE12 Hamamatsu and Wah-Keat](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$260,000.00	\$291,096.00
Total			0	\$260,000	\$291,096

WBS: 7.05.03.04 HEX End Station Installation and Test

WBS Manager: Zhong Zhong

Dictionary: On-site assembly, installation, and testing of end-station sub-systems and integrated system. EEI of all electrical equipment. Inspection of vacuum and cryogenic equipment by staff from the Safety Engineering Group. This also includes filing of as-built drawings and preparation for the IRR.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + Bu Estimate RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.03.04	HEX End Station Installation and Test	480	\$34,994	\$50,439	\$4,035	\$54,474	\$12,610	\$63,049

Activity Details

Activity Name: HEX14170 **CAM:** Zhong

Activity Description: G Endstation & Detector Installation and Testing Placeholder

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.03.04 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO3_HEX2	Mechanical Technician	PJ	480.0	\$34,993.50	\$50,439.31
Total			480	\$34,994	\$50,439

WBS: 7.05.04 HEX Beamlines Infrastructure

WBS Manager:

Dictionary:

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + Bu Estimate RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.04	HEX Beamlines Infrastructure	12,871	\$3,703,154	\$4,458,497	\$611,257	\$5,069,753	\$505,627	\$4,964,123

WBS: 7.05.04.01

HEX Hutches

WBS Manager: Chris Stebbins

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. 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.

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	530	\$1,965,507	\$2,211,472	\$221,147	\$2,432,620	\$227,001	\$2,438,474

Activity Details

Activity Name: HEX14800

CAM: Stebbins

Activity Description: HEX - Hutch A Place Order - Payment (1A)

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.04.01

Estimator:

PC Rep: Gutta

Cost Summary

Supporting Documentation:

QE41 Hutches

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$90,787.50	\$101,645.69
Total			0	\$90,788	\$101,646

Activity Details

Activity Name: HEX14820

CAM: Stebbins

Activity Description: HEX - Hutch A FDR - Milestone Payment (2A)

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.04.01

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$90,787.50	\$101,645.69
Total			0	\$90,788	\$101,646

Activity Details

Activity Name: HEX14840

CAM: Stebbins

Activity Description: HEX - Hutch A FAT - Milestone Payment (3A)

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.04.01

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$90,787.50	\$101,645.69
Total			0	\$90,788	\$101,646

Activity Details

Activity Name: HEX24830 **CAM:** Stebbins
Activity Description: HEX - Hutches BCDE FDR - Milestone Payment (2BCDE)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$291,287.25	\$326,125.21
Total	0	\$291,287	\$326,125	

Activity Details

Activity Name: HEX24840 **CAM:** Stebbins
Activity Description: HEX - Hutches BCDE FAT - Milestone Payment (3BCDE)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$291,287.25	\$326,125.21
Total	0	\$291,287	\$326,125	

Activity Details

Activity Name: HEX24850 **CAM:** Stebbins
Activity Description: HEX - Hutches BCDE Acceptance Final Payment (4BCDE)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$291,287.25	\$326,125.21
Total	0	\$291,287	\$326,125	

Activity Details

Activity Name: HEX25120 **CAM:** Stebbins
Activity Description: HEX - Hutches FG Place Order - Payment (1B)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary**Supporting Documentation:**[QE41 Hutches](#)

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$96,557.75	\$108,106.06

Total 0 \$96,558 \$108,106

Activity Details

Activity Name: HEX25140 **CAM:** Stebbins

Activity Description: HEX - Hutches FG FDR - Milestone Payment (2B)

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.04.01 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$96,557.75	\$108,106.06

Total 0 \$96,558 \$108,106

Activity Details

Activity Name: HEX25160 **CAM:** Stebbins

Activity Description: HEX - Hutches FG FAT - Milestone Payment (3B)

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.04.01 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$96,557.75	\$108,106.06

Total 0 \$96,558 \$108,106

Activity Details

Activity Name: HEX25190 **CAM:** Stebbins

Activity Description: HEX - Hutches FG Acceptance Final Payment (4B)

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.04.01 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$96,557.75	\$108,106.06

Total 0 \$96,558 \$108,106

Activity Details

Activity Name: HEX14910 **CAM:** Stebbins

Activity Description: HEX - Hutch A Acceptance - Final Payment (4A)

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.04.01 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$90,787.50	\$101,645.69

Total 0 \$90,788 \$101,646

Activity Details

Activity Name: HEX24820 **CAM:** Stebbins
Activity Description: HEX - Hutches BCDE Place Order - Payment (1BCDE)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:

[QE41 Hutches](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$291,287.25	\$326,125.21
Total			0	\$291,287	\$326,125

Activity Details

Activity Name: HEX14500 **CAM:** Stebbins
Activity Description: HEX - Hutches Procurement Documentation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	PJ	48.0	\$4,549.33	\$5,603.38
Total			48	\$4,549	\$5,603

Activity Details

Activity Name: HEX14600 **CAM:** Stebbins
Activity Description: HEX - Hutch Design Reviews and Contractor Document Filing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	LOE	144.0	\$13,648.00	\$18,086.72
Total			144	\$13,648	\$18,087

Activity Details

Activity Name: HEX14870 **CAM:** Stebbins
Activity Description: HEX - Hutch A Delivery and Installation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	PJ	28.0	\$2,653.78	\$3,538.90

Total 28 \$2,654 \$3,539

Activity Details

Activity Name: HEX14880 **CAM:** Stebbins
Activity Description: HEX - Hutch A Acceptance Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2 Mechanical Engineer	PJ	12.0	\$1,137.33	\$1,546.11
Total		12	\$1,137	\$1,546

Activity Details

Activity Name: HEX14700 **CAM:** Stebbins
Activity Description: HEX - Hutches BCDE Delivery and Installation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2 Mechanical Engineer	PJ	130.0	\$12,321.11	\$16,430.61
Total		130	\$12,321	\$16,431

Activity Details

Activity Name: HEX25170 **CAM:** Stebbins
Activity Description: HEX - Hutches FG Delivery and Installation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2 Mechanical Engineer	PJ	64.0	\$6,065.78	\$8,088.92
Total		64	\$6,066	\$8,089

Activity Details

Activity Name: HEX25180 **CAM:** Stebbins
Activity Description: HEX - Hutches FG Acceptance Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2 Mechanical Engineer	PJ	26.0	\$2,464.22	\$3,349.92
Total		26	\$2,464	\$3,350

Activity Details

Activity Name: HEX14900 **CAM:** Stebbins
Activity Description: HEX - Hutches BCDE Acceptance Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	PJ	54.0	\$5,118.00	\$6,957.52
Total			54	\$5,118	\$6,958

Activity Details

Activity Name: HEX15000 **CAM:** Stebbins
Activity Description: HEX - HU Beam Commissioning
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2	Scientist	PJ	24.0	\$3,019.09	\$4,362.61
Total			24	\$3,019	\$4,363

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.

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	2,461	\$564,617	\$696,816	\$111,491	\$808,306	\$83,618	\$780,434

Activity Details

Activity Name: HEX15720 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Installation - Labor (Pylons install, Misc)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAC_HEX2	Building Trades Carpenter - Assigned	HC	20.0	\$1,948.20	\$2,607.48
BTU_HEX2	Building Trades Unassigned	HC	80.0	\$9,079.20	\$12,151.66

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	40.0	\$3,791.11	\$4,669.48
MO4_HEX2	ME - Utility Technician	HC	10.0	\$729.03	\$897.94
NO2_HEX2	Mechanical Designer	HC	40.0	\$3,067.08	\$3,777.69
Total			90	\$7,587	\$9,345

Activity Details

Activity Name: HEX15200 **CAM:** Stebbins

Activity Description: HEX Mech Utilities - Design - Develop Preliminary Drawings

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.04.02 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	40.0	\$3,791.11	\$4,669.48
MO4_HEX2	ME - Utility Technician	HC	5.0	\$364.52	\$448.97
NO2_HEX2	Mechanical Designer	HC	100.0	\$7,667.69	\$9,444.24
Total			145	\$11,823	\$14,563

Activity Details

Activity Name: HEX15400 **CAM:** Stebbins

Activity Description: HEX Mech Utilities - Design - Finalize Drawings

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.04.02 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	100.0	\$9,477.78	\$11,673.70
NO2_HEX2	Mechanical Designer	HC	200.0	\$15,335.38	\$18,888.47
Total			300	\$24,813	\$30,562

Activity Details

Activity Name: HEX15700 **CAM:** Stebbins

Activity Description: HEX Mech Utilities - Installation - Experimental Floor Water and GN2 Labor

Complexity: Level 3 **Estimate Year:**

WBS Code: 7.05.04.02 **Estimator:**

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	70.0	\$6,634.44	\$9,019.00
MO4_HEX2	ME - Utility Technician	HC	582.0	\$42,429.62	\$57,679.71
Total			652	\$49,064	\$66,699

Activity Details

Activity Name: HEX15410 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Procure - Procure & Receive Piping and Hardware
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	30.0	\$2,843.33	\$3,865.29
MO4_HEX2	ME - Utility Technician	HC	80.0	\$5,832.25	\$7,928.48
Total			110	\$8,676	\$11,794

Activity Details

Activity Name: HEX15730 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Design - Complete
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	40.0	\$3,791.11	\$5,153.72
NO2_HEX2	Mechanical Designer	HC	20.0	\$1,533.54	\$2,084.72
Total			60	\$5,325	\$7,238

Activity Details

Activity Name: HEX251261 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Installation - Satellite Building Water and GN2 Labor
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	18.0	\$1,706.00	\$2,319.17
MO4_HEX2	ME - Utility Technician	HC	145.0	\$10,570.95	\$14,370.37
Total			163	\$12,277	\$16,690

Activity Details

Activity Name: HEX15600 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Procure - 4 Pylons and 25 L-brackets
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	HC	0.0	\$20,000.00	\$23,421.40

Total 0 \$20,000 \$23,421

Activity Details

Activity Name: HEX15760 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Installation - Exhaust system from SB Hutch to Main Facility
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	HC	0.0	\$15,000.00	\$17,970.00
Total			0	\$15,000	\$17,970

Activity Details

Activity Name: HEX15500 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Procure - Utilities Materials
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_HEX2	Material (Purchase >\$25k<\$2M)	HC	0.0	\$148,800.00	\$174,255.22
Total			0	\$148,800	\$174,255

Activity Details

Activity Name: HEX15420 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Procure - Equipment racks and Hardware
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_HEX2	Material (Purchase >\$25k<\$2M)	HC	0.0	\$50,000.00	\$58,553.50
Total			0	\$50,000	\$58,554

Activity Details

Activity Name: HEX15430 **CAM:** Stebbins
Activity Description: HEX Mech Utilities - Procure - LN2 Distribution Piping
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_HEX2	Material (Purchase >\$25k<\$2M)	HC	0.0	\$108,200.00	\$126,709.77

Total 900 \$87,706 \$117,592
Activity Details

Activity Name: HEX17330 **CAM:** Stebbins
Activity Description: HEX - Elec Utilities - IRR Preparations
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAE_HEX2	Building Trades Electrician - Assigned	HC	100.0	\$9,741.00	\$13,644.03
NE1_HEX2	Electrical Engineer	HC	40.0	\$3,911.20	\$5,651.73
NE2_HEX2	Electrical Designer	HC	40.0	\$3,225.50	\$4,660.88
Total			180	\$16,878	\$23,957

Activity Details

Activity Name: HEX251281 **CAM:** Stebbins
Activity Description: HEX - Elec Utilities - Installation - ODH
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAE_HEX2	Building Trades Electrician - Assigned	HC	120.0	\$11,689.20	\$15,644.89
NE3_HEX2	Electrical Technician	HC	40.0	\$2,886.62	\$3,924.12
Total			160	\$14,576	\$19,569

Activity Details

Activity Name: HEX16900 **CAM:** Stebbins
Activity Description: HEX - Elec Utilities - Design - Gather Requirements
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	20.0	\$1,955.60	\$2,408.70
Total			20	\$1,956	\$2,409

Activity Details

Activity Name: HEX17000 **CAM:** Stebbins
Activity Description: HEX - Elec Utilities - Design - Develop Preliminary Drawings
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
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NE1_HEX2 Electrical Engineer	HC	20.0	\$1,955.60	\$2,408.70
NE2_HEX2 Electrical Designer	HC	20.0	\$1,612.75	\$1,986.41
Total		40	\$3,568	\$4,395

Activity Details

Activity Name: HEX17200 **CAM:** Stebbins
Activity Description: HEX - Elec Utilities - Design - Finalize Drawings
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2 Electrical Engineer	HC	20.0	\$1,955.60	\$2,408.70
NE2_HEX2 Electrical Designer	HC	20.0	\$1,612.75	\$1,986.41
Total		40	\$3,568	\$4,395

Activity Details

Activity Name: HEX17320 **CAM:** Stebbins
Activity Description: HEX - Elec Utilities - Design - Complete
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2 Electrical Engineer	HC	20.0	\$1,955.60	\$2,666.72
NE2_HEX2 Electrical Designer	HC	40.0	\$3,225.50	\$4,398.40
Total		60	\$5,181	\$7,065

Activity Details

Activity Name: HEX17100 **CAM:** Stebbins
Activity Description: HEX - Elec Utilities - Procure - Materials
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2 Material (Purchase <\$25k)	HC	0.0	\$50,000.00	\$58,553.50
Total		0	\$50,000	\$58,554

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.

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	1,100	\$154,504	\$205,553	\$32,888	\$238,441	\$24,666	\$230,219

Activity Details

Activity Name: HEX18710

CAM: Stebbins

Activity Description: HEX EPS - IRR Preparations

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.04.04

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE2_HEX2	Electrical Designer	HC	40.0	\$3,225.50	\$4,660.88
NE4_HEX2	Controls Engineer	HC	20.0	\$1,955.60	\$2,825.86
Total			60	\$5,181	\$7,487

Activity Details

Activity Name: HEX18300

CAM: Stebbins

Activity Description: HEX EPS - Build I/O enclosures

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.04.04

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX2	Electrical Technician	HC	140.0	\$10,103.15	\$14,599.17
Total			140	\$10,103	\$14,599

Activity Details

Activity Name: HEX18400

CAM: Stebbins

Activity Description: HEX EPS - Install I/O enclosures and chassis

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.04.04

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX2	Electrical Technician	HC	20.0	\$1,443.31	\$2,085.60
Total			20	\$1,443	\$2,086

Activity Details

Activity Name: HEX18500 **CAM:** Stebbins
Activity Description: HEX EPS - Pull required cables
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX2 Electrical Technician	HC	120.0	\$8,659.85	\$12,513.57
		Total	120	\$8,660

Activity Details

Activity Name: HEX18600 **CAM:** Stebbins
Activity Description: HEX EPS - Terminate cables
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX2 Electrical Technician	HC	320.0	\$23,092.92	\$33,369.53
		Total	320	\$23,093

Activity Details

Activity Name: HEX17700 **CAM:** Stebbins
Activity Description: HEX EPS - Gather Requirements
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2 Controls Engineer	HC	40.0	\$3,911.20	\$5,316.97
		Total	40	\$3,911

Activity Details

Activity Name: HEX17800 **CAM:** Stebbins
Activity Description: HEX EPS - Design system input / outputs
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2 Controls Engineer	HC	40.0	\$3,911.20	\$5,316.97
		Total	40	\$3,911

Activity Details

Activity Name: HEX17900 **CAM:** Stebbins
Activity Description: HEX EPS - Design PLC code
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	HC	80.0	\$7,822.40	\$10,633.93
Total			80	\$7,822	\$10,634

Activity Details

Activity Name: HEX18000 **CAM:** Stebbins
Activity Description: HEX EPS - Design Input output computer (IOC)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	HC	80.0	\$7,822.40	\$10,633.93
Total			80	\$7,822	\$10,634

Activity Details

Activity Name: HEX18100 **CAM:** Stebbins
Activity Description: HEX EPS - Design CS Studio screens
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	HC	120.0	\$11,733.60	\$15,950.90
Total			120	\$11,734	\$15,951

Activity Details

Activity Name: HEX18700 **CAM:** Stebbins
Activity Description: HEX EPS - Test system
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	HC	80.0	\$7,822.40	\$11,303.46
Total			80	\$7,822	\$11,303

Activity Details

Activity Name: HEX18200 **CAM:** Stebbins
Activity Description: HEX EPS - Purchase system components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.04 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_HEX2	Material (Purchase >\$25k<\$2M)	HC	0.0	\$63,000.00	\$76,341.83
Total			0	\$63,000	\$76,342

WBS: 7.05.04.05 **HEX PPS**

WBS Manager: Greg Fries

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

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.04.05	HEX PPS	5,924	\$653,212	\$868,291	\$173,658	\$1,041,949	\$104,195	\$972,485

Activity Details

Activity Name: HEX19400 **CAM:** Stebbins
Activity Description: HEX PPS - Installation of Conduit Experimental Floor
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAE_HEX2	Building Trades Electrician - Assigned	HC	800.0	\$77,928.00	\$104,299.30
NE1_HEX2	Electrical Engineer	HC	60.0	\$5,866.80	\$7,975.45
NE3_HEX2	Electrical Technician	HC	60.0	\$4,329.92	\$5,886.19
Total			920	\$88,125	\$118,161

Activity Details

Activity Name: HEX25070 **CAM:** Stebbins
Activity Description: HEX PPS - Installation of Conduit Satellite Building
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAE_HEX2	Building Trades Electrician - Assigned	HC	300.0	\$29,223.00	\$39,607.01
NE1_HEX2	Electrical Engineer	HC	20.0	\$1,955.60	\$2,703.81
NE3_HEX2	Electrical Technician	HC	20.0	\$1,443.31	\$1,995.52
Total			340	\$32,622	\$44,306

Activity Details

Activity Name: HEX18900 **CAM:** Stebbins
Activity Description: HEX PPS - Define Requirements
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	4.0	\$391.12	\$515.71
NE1_HEX2	Electrical Engineer	HC	8.0	\$782.24	\$1,031.42
NE3_HEX2	Electrical Technician	HC	8.0	\$577.32	\$761.23
Total			20	\$1,751	\$2,308

Activity Details

Activity Name: HEX19000 **CAM:** Stebbins
Activity Description: HEX PPS - Create Electrical Schematics & Logic Diagram
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	200.0	\$19,556.00	\$25,785.48
NE2_HEX2	Electrical Designer	HC	200.0	\$16,127.50	\$21,264.85
Total			400	\$35,684	\$47,050

Activity Details

Activity Name: HEX19300 **CAM:** Stebbins
Activity Description: HEX PPS - Software Development
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	360.0	\$35,200.80	\$47,852.70
Total			360	\$35,201	\$47,853

Activity Details

Activity Name: HEX19500 **CAM:** Stebbins
Activity Description: HEX PPS - Install & Wire Subpanels
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	48.0	\$4,693.44	\$6,380.36
NE2_HEX2	Electrical Designer	HC	88.0	\$7,096.10	\$9,646.59

NE3_HEX2 Electrical Technician	HC	340.0	\$24,536.23	\$33,355.06
Total		476	\$36,326	\$49,382

Activity Details

Activity Name: HEX19700 **CAM:** Stebbins
Activity Description: HEX PPS - Pull Cables
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	40.0	\$3,911.20	\$5,481.79
NE2_HEX2	Electrical Designer	HC	80.0	\$6,451.00	\$9,041.48
NE3_HEX2	Electrical Technician	HC	120.0	\$8,659.85	\$12,137.32
Total			240	\$19,022	\$26,661

Activity Details

Activity Name: HEX19800 **CAM:** Stebbins
Activity Description: HEX PPS - Integration (Power, EPS, HMI, Water)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	240.0	\$23,467.20	\$32,890.76
NE3_HEX2	Electrical Technician	HC	240.0	\$17,319.69	\$24,274.64
Total			480	\$40,787	\$57,165

Activity Details

Activity Name: HEX19900 **CAM:** Stebbins
Activity Description: HEX PPS - Integrated Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	320.0	\$31,289.60	\$43,854.34
NE3_HEX2	Electrical Technician	HC	100.0	\$7,216.54	\$10,114.43
Total			420	\$38,506	\$53,969

Activity Details

Activity Name: HEX20000 **CAM:** Stebbins
Activity Description: HEX PPS - Certification by ESH & Complete Documentation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	80.0	\$7,822.40	\$11,167.51
NE2_HEX2	Electrical Designer	HC	200.0	\$16,127.50	\$23,024.13
NE3_HEX2	Electrical Technician	HC	40.0	\$2,886.62	\$4,121.02
Total			320	\$26,837	\$38,313

Activity Details

Activity Name: HEX19510 **CAM:** Stebbins
Activity Description: HEX PPS - Assemble subpanels
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	80.0	\$7,822.40	\$10,963.59
NE2_HEX2	Electrical Designer	HC	168.0	\$13,547.10	\$18,987.11
NE3_HEX2	Electrical Technician	HC	500.0	\$36,082.69	\$50,572.16
Total			748	\$57,452	\$80,523

Activity Details

Activity Name: HEX19610 **CAM:** Stebbins
Activity Description: HEX PPS - Wire hutch PPS components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	80.0	\$7,822.40	\$10,963.59
NE2_HEX2	Electrical Designer	HC	120.0	\$9,676.50	\$13,562.22
NE3_HEX2	Electrical Technician	HC	560.0	\$40,412.61	\$56,640.82
Total			760	\$57,912	\$81,167

Activity Details

Activity Name: HEX19110 **CAM:** Stebbins
Activity Description: HEX PPS - Procurement and Inspection of components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	HC	40.0	\$3,911.20	\$5,316.97
NE3_HEX2	Electrical Technician	HC	80.0	\$5,773.23	\$7,848.25
Total			120	\$9,684	\$13,165

Activity Details

Activity Name: HEX19600 **CAM:** Stebbins
Activity Description: HEX PPS - Installation of Hutch PPS Components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX2	Electrical Technician	HC	320.0	\$23,092.92	\$32,366.18
Total			320	\$23,093	\$32,366

Activity Details

Activity Name: HEX251251 **CAM:** Stebbins
Activity Description: HEX PPS - Advance Material Purchase (actuals)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_Fixed_HE	Material (Purchase X2 <\$25k) (Fixed Rate)	HC	0.0	\$34.92	\$46.24
NSM_HEX2	Material (Purchase >\$25k<\$2M)	HC	0.0	\$8,176.63	\$9,563.39
Total			0	\$8,212	\$9,610

Activity Details

Activity Name: HEX19200 **CAM:** Stebbins
Activity Description: HEX PPS - Receipt of PPS Materials
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.04.05 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_HEX2	Material (Purchase >\$25k<\$2M)	HC	0.0	\$142,000.00	\$166,291.94
Total			0	\$142,000	\$166,292

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

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	160	\$55,586	\$69,098	\$6,910	\$76,008	\$17,275	\$86,373

Activity Details**Activity Name:** HEX14280**CAM:** Stebbins**Activity Description:** Install Furniture and Office Eqpts**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.04.06**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAC_HEX2	Building Trades Carpenter - Assigned	PJ	40.0	\$3,896.40	\$5,334.91
BTAE_HEX2	Building Trades Electrician - Assigned	PJ	120.0	\$11,689.20	\$16,004.73
Total			160	\$15,586	\$21,340

Activity Details**Activity Name:** HEX14260**CAM:** Stebbins**Activity Description:** HEX - Procure Furniture for satellite building**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.04.06**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	PJ	0.0	\$20,000.00	\$23,798.42
Total			0	\$20,000	\$23,798

Activity Details**Activity Name:** HEX14270**CAM:** Stebbins**Activity Description:** HEX - Procure office equipments (Printer, Computer etc.)**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.04.06**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	PJ	0.0	\$20,000.00	\$23,960.00
Total			0	\$20,000	\$23,960

WBS: 7.05.05 HEX Accelerator Infrastructure

WBS Manager:

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	23,236	\$5,152,780	\$6,355,673	\$2,191,831	\$8,547,504	\$1,200,955	\$7,556,628

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.

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	13,951	\$2,233,469	\$2,864,020	\$687,365	\$3,551,385	\$644,053	\$3,508,073

Activity Details

Activity Name: HEX21100

CAM: Fries

Activity Description: HEX FE - Installation Prep & Cabling Pulling

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.05.01

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAE_HEX2	Building Trades Electrician - Assigned	PJ	48.0	\$4,675.68	\$6,401.89
BTU_HEX2	Building Trades Unassigned	PJ	24.0	\$2,723.76	\$3,729.34
MO1_HEX2	ME - Survey Engineer	PJ	40.0	\$3,791.11	\$5,313.48
MO2_HEX2	ME - Survey Technician	PJ	60.0	\$4,321.40	\$6,056.72
MO6_HEX2	ME - Vacuum Technician	PJ	60.0	\$4,374.19	\$6,130.70
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,328.37
NE1_HEX2	Electrical Engineer	PJ	60.0	\$5,866.80	\$8,222.69
NE2_HEX2	Electrical Designer	PJ	80.0	\$6,451.00	\$9,041.48
NE3_HEX2	Electrical Technician	PJ	120.0	\$8,659.85	\$12,137.32
NO1_HEX2	Mechanical Engineer	PJ	80.0	\$7,582.22	\$10,626.96
NO3_HEX2	Mechanical Technician	PJ	60.0	\$4,374.19	\$6,130.70
SE5_HEX2	EL - Vacuum Engineer	PJ	60.0	\$5,866.80	\$8,222.69
TE1_HEX2	EL - D&I Engineer	PJ	60.0	\$5,866.80	\$8,222.69
TE2_HEX2	EL - D&I Technician	PJ	80.0	\$5,773.23	\$8,091.55
Total			842	\$71,275	\$99,657

Activity Details

Activity Name: HEX21110 **CAM:** Fries
Activity Description: HEX FE - Replacement of dipole chamber
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAE_HEX2	Building Trades Electrician - Assigned	PJ	24.0	\$2,337.84	\$3,200.95
MO1_HEX2	ME - Survey Engineer	PJ	20.0	\$1,895.56	\$2,656.74
MO2_HEX2	ME - Survey Technician	PJ	40.0	\$2,880.94	\$4,037.81
MO5_HEX2	ME - Vacuum Engineer	PJ	40.0	\$3,791.11	\$5,313.48
MO6_HEX2	ME - Vacuum Technician	PJ	140.0	\$10,206.44	\$14,304.96
NE3_HEX2	Electrical Technician	PJ	20.0	\$1,443.31	\$2,022.89
NO1_HEX2	Mechanical Engineer	PJ	40.0	\$3,791.11	\$5,313.48
NO3_HEX2	Mechanical Technician	PJ	80.0	\$5,832.25	\$8,174.27
Total			404	\$32,179	\$45,025

Activity Details

Activity Name: HEX21300 **CAM:** Fries
Activity Description: HEX FE - Build Stand Assemblies
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAR_HEX2	Building Trades Riggers - Assigned	PJ	60.0	\$5,844.60	\$8,002.36
MO1_HEX2	ME - Survey Engineer	PJ	60.0	\$5,686.67	\$7,970.22
MO2_HEX2	ME - Survey Technician	PJ	80.0	\$5,761.87	\$8,075.62
MO5_HEX2	ME - Vacuum Engineer	PJ	120.0	\$11,373.33	\$15,940.44
MO6_HEX2	ME - Vacuum Technician	PJ	120.0	\$8,748.38	\$12,261.40
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,328.37
NE1_HEX2	Electrical Engineer	PJ	40.0	\$3,911.20	\$5,481.79
NO1_HEX2	Mechanical Engineer	PJ	240.0	\$22,746.67	\$31,880.88
NO3_HEX2	Mechanical Technician	PJ	360.0	\$26,245.13	\$36,784.20
NO6_HEX2	ME - D&I Engineer	PJ	40.0	\$3,791.11	\$5,313.48
TE1_HEX2	EL - D&I Engineer	PJ	40.0	\$3,911.20	\$5,481.79
TE2_HEX2	EL - D&I Technician	PJ	120.0	\$8,659.85	\$12,137.32
Total			1,290	\$107,628	\$150,658

Activity Details

Activity Name: HEX21400 **CAM:** Fries
Activity Description: HEX FE - Build Ratchet Wall Collimator
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAR_HEX2	Building Trades Riggers - Assigned	PJ	40.0	\$3,896.40	\$5,334.91
MO1_HEX2	ME - Survey Engineer	PJ	40.0	\$3,791.11	\$5,313.48
MO2_HEX2	ME - Survey Technician	PJ	60.0	\$4,321.40	\$6,056.72
MO5_HEX2	ME - Vacuum Engineer	PJ	20.0	\$1,895.56	\$2,656.74
MO6_HEX2	ME - Vacuum Technician	PJ	40.0	\$2,916.13	\$4,087.13
NO1_HEX2	Mechanical Engineer	PJ	60.0	\$5,686.67	\$7,970.22
NO3_HEX2	Mechanical Technician	PJ	160.0	\$11,664.50	\$16,348.53
Total			420	\$34,172	\$47,768

Activity Details

Activity Name: HEX21500 **CAM:** Fries
Activity Description: HEX FE - Stand Assembly Installation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAR_HEX2	Building Trades Riggers - Assigned	PJ	24.0	\$2,337.84	\$3,200.95
BTU_HEX2	Building Trades Unassigned	PJ	48.0	\$5,447.52	\$7,458.69
MO1_HEX2	ME - Survey Engineer	PJ	60.0	\$5,686.67	\$7,970.22
MO2_HEX2	ME - Survey Technician	PJ	60.0	\$4,321.40	\$6,056.72
MO6_HEX2	ME - Vacuum Technician	PJ	40.0	\$2,916.13	\$4,087.13
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,328.37
NO1_HEX2	Mechanical Engineer	PJ	80.0	\$7,582.22	\$10,626.96
NO3_HEX2	Mechanical Technician	PJ	160.0	\$11,664.50	\$16,348.53
NO6_HEX2	ME - D&I Engineer	PJ	60.0	\$5,686.67	\$7,970.22
Total			542	\$46,591	\$65,048

Activity Details

Activity Name: HEX22000 **CAM:** Fries
Activity Description: HEX FE - RWC & Safety Shutter Installation and Tie - In to SR
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAR_HEX2	Building Trades Riggers - Assigned	PJ	30.0	\$2,922.30	\$4,070.20

MO1_HEX2 ME - Survey Engineer	PJ	20.0	\$1,895.56	\$2,718.51
MO2_HEX2 ME - Survey Technician	PJ	40.0	\$2,880.94	\$4,131.69
MO5_HEX2 ME - Vacuum Engineer	PJ	80.0	\$7,582.22	\$10,874.04
MO6_HEX2 ME - Vacuum Technician	PJ	120.0	\$8,748.38	\$12,546.48
MO7_HEX2 Project Engineer	PJ	10.0	\$947.78	\$1,359.25
NO1_HEX2 Mechanical Engineer	PJ	80.0	\$7,582.22	\$10,874.04
NO3_HEX2 Mechanical Technician	PJ	240.0	\$17,496.75	\$25,092.95
Total	620	\$50,056	\$71,667	

Activity Details

Activity Name: HEX21200 **CAM:** Fries
Activity Description: HEX FE - Build Component Subassemblies
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO1_HEX2	ME - Survey Engineer	PJ	80.0	\$7,582.22	\$10,626.96
MO2_HEX2	ME - Survey Technician	PJ	160.0	\$11,523.74	\$16,151.25
MO5_HEX2	ME - Vacuum Engineer	PJ	80.0	\$7,582.22	\$10,626.96
MO6_HEX2	ME - Vacuum Technician	PJ	120.0	\$8,748.38	\$12,261.40
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,328.37
NO1_HEX2	Mechanical Engineer	PJ	120.0	\$11,373.33	\$15,940.44
NO2_HEX2	Mechanical Designer	PJ	40.0	\$3,067.08	\$4,298.70
NO3_HEX2	Mechanical Technician	PJ	320.0	\$23,329.00	\$32,697.06
NO6_HEX2	ME - D&I Engineer	PJ	40.0	\$3,791.11	\$5,313.48
TE1_HEX2	EL - D&I Engineer	PJ	20.0	\$1,955.60	\$2,740.90
TE2_HEX2	EL - D&I Technician	PJ	180.0	\$12,989.77	\$18,205.98
Total	1,170	\$92,890	\$130,192		

Activity Details

Activity Name: HEX22100 **CAM:** Fries
Activity Description: HEX FE - Bakeout & Final Survey
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO1_HEX2	ME - Survey Engineer	PJ	30.0	\$2,843.33	\$4,108.65
MO2_HEX2	ME - Survey Technician	PJ	60.0	\$4,321.40	\$6,244.48
MO5_HEX2	ME - Vacuum Engineer	PJ	40.0	\$3,791.11	\$5,478.20
MO6_HEX2	ME - Vacuum Technician	PJ	160.0	\$11,664.50	\$16,855.34
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,369.55
NO1_HEX2	Mechanical Engineer	PJ	20.0	\$1,895.56	\$2,739.10
NO3_HEX2	Mechanical Technician	PJ	40.0	\$2,916.13	\$4,213.83
Total	360	\$28,380	\$41,009		

Activity Details

Activity Name: HEX22200 **CAM:** Fries
Activity Description: HEX FE - Integrated Testing and Complete Documentation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	PJ	40.0	\$3,791.11	\$5,478.20
MO6_HEX2	ME - Vacuum Technician	PJ	60.0	\$4,374.19	\$6,320.75
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,369.55
NE1_HEX2	Electrical Engineer	PJ	120.0	\$11,733.60	\$16,955.19
NE2_HEX2	Electrical Designer	PJ	80.0	\$6,451.00	\$9,321.77
NE3_HEX2	Electrical Technician	PJ	80.0	\$5,773.23	\$8,342.38
NE4_HEX2	Controls Engineer	PJ	160.0	\$15,644.80	\$22,606.91
NO1_HEX2	Mechanical Engineer	PJ	80.0	\$7,582.22	\$10,956.40
NO2_HEX2	Mechanical Designer	PJ	80.0	\$6,134.15	\$8,863.92
NO3_HEX2	Mechanical Technician	PJ	40.0	\$2,916.13	\$4,213.83
SE5_HEX2	EL - Vacuum Engineer	PJ	80.0	\$7,822.40	\$11,303.46
TE1_HEX2	EL - D&I Engineer	PJ	120.0	\$11,733.60	\$16,955.19
TE2_HEX2	EL - D&I Technician	PJ	60.0	\$4,329.92	\$6,256.79
Total			1,010	\$89,234	\$128,944

Activity Details

Activity Name: HEX20500 **CAM:** Fries
Activity Description: HEX FE - Procurement of Basic Components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	HC	20.0	\$1,895.56	\$2,656.74
MO5_HEX2	ME - Vacuum Engineer	HC	120.0	\$11,373.33	\$15,940.44
MO7_HEX2	Project Engineer	HC	10.0	\$947.78	\$1,328.37
NE1_HEX2	Electrical Engineer	HC	20.0	\$1,955.60	\$2,740.90
NE3_HEX2	Electrical Technician	HC	20.0	\$1,443.31	\$2,022.89
NE4_HEX2	Controls Engineer	HC	20.0	\$1,955.60	\$2,740.90
NO1_HEX2	Mechanical Engineer	HC	240.0	\$22,746.67	\$31,880.88
NO3_HEX2	Mechanical Technician	HC	40.0	\$2,916.13	\$4,087.13
NO6_HEX2	ME - D&I Engineer	HC	20.0	\$1,895.56	\$2,656.74
SE5_HEX2	EL - Vacuum Engineer	HC	40.0	\$3,911.20	\$5,481.79
TE1_HEX2	EL - D&I Engineer	HC	20.0	\$1,955.60	\$2,740.90
Total			570	\$52,996	\$74,278

Activity Details

Activity Name: HEX20800 **CAM:** Fries
Activity Description: HEX FE - Procurement of Beamline Specific Components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	PJ	20.0	\$1,895.56	\$2,656.74
MO5_HEX2	ME - Vacuum Engineer	PJ	120.0	\$11,373.33	\$15,940.44
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,328.37
NE1_HEX2	Electrical Engineer	PJ	60.0	\$5,866.80	\$8,222.69
NE3_HEX2	Electrical Technician	PJ	40.0	\$2,886.62	\$4,045.77
NO1_HEX2	Mechanical Engineer	PJ	320.0	\$30,328.89	\$42,507.85
NO2_HEX2	Mechanical Designer	PJ	80.0	\$6,134.15	\$8,597.40
NO3_HEX2	Mechanical Technician	PJ	80.0	\$5,832.25	\$8,174.27
NO6_HEX2	ME - D&I Engineer	PJ	120.0	\$11,373.33	\$15,940.44
SE5_HEX2	EL - Vacuum Engineer	PJ	80.0	\$7,822.40	\$10,963.59
TE1_HEX2	EL - D&I Engineer	PJ	80.0	\$7,822.40	\$10,963.59
Total			1,010	\$92,284	\$129,341

Activity Details

Activity Name: HEX21900 **CAM:** Fries
Activity Description: HEX FE - Connections, Terminations & Electronics Installation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO3_HEX2	ME - Utility Engineer	PJ	40.0	\$3,791.11	\$5,313.48
MO4_HEX2	ME - Utility Technician	PJ	40.0	\$2,916.13	\$4,087.13
MO5_HEX2	ME - Vacuum Engineer	PJ	20.0	\$1,895.56	\$2,656.74
MO6_HEX2	ME - Vacuum Technician	PJ	80.0	\$5,832.25	\$8,174.27
MO7_HEX2	Project Engineer	PJ	10.0	\$947.78	\$1,328.37
NE1_HEX2	Electrical Engineer	PJ	200.0	\$19,556.00	\$27,408.96
NE3_HEX2	Electrical Technician	PJ	200.0	\$14,433.08	\$20,228.86
NE4_HEX2	Controls Engineer	PJ	80.0	\$7,822.40	\$10,963.59
NO1_HEX2	Mechanical Engineer	PJ	20.0	\$1,895.56	\$2,656.74
NO3_HEX2	Mechanical Technician	PJ	180.0	\$13,122.56	\$18,392.10
SE5_HEX2	EL - Vacuum Engineer	PJ	60.0	\$5,866.80	\$8,222.69
TE1_HEX2	EL - D&I Engineer	PJ	40.0	\$3,911.20	\$5,481.79
TE2_HEX2	EL - D&I Technician	PJ	120.0	\$8,659.85	\$12,137.32
Total			1,090	\$90,650	\$127,052

Activity Details

Activity Name: HEX20200 **CAM:** Fries
Activity Description: HEX FE - Layout & Basic Component Design
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2 ME - Vacuum Engineer	PJ	72.0	\$6,824.00	\$8,405.07
MO7_HEX2 Project Engineer	PJ	6.0	\$568.67	\$700.42
NO1_HEX2 Mechanical Engineer	PJ	108.0	\$10,236.00	\$12,607.60
NO2_HEX2 Mechanical Designer	PJ	144.0	\$11,041.48	\$13,599.70
Total		330	\$28,670	\$35,313

Activity Details

Activity Name: HEX20300 **CAM:** Fries
Activity Description: HEX FE - Ray Tracing & Radiation Analysis
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2 ME - Vacuum Engineer	PJ	78.0	\$7,392.67	\$9,105.49
MO7_HEX2 Project Engineer	PJ	6.5	\$616.06	\$758.79
NO1_HEX2 Mechanical Engineer	PJ	117.0	\$11,089.00	\$13,658.23
NO2_HEX2 Mechanical Designer	PJ	156.0	\$11,961.60	\$14,733.01
NS2_HEX2 Assistant/Associate Scientist	PJ	26.0	\$2,333.19	\$2,873.78
Total		384	\$33,393	\$41,129

Activity Details

Activity Name: HEX20400 **CAM:** Fries
Activity Description: HEX FE - Detail Components & Final Design
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2 ME - Vacuum Engineer	PJ	120.0	\$11,373.33	\$14,218.36
MO7_HEX2 Project Engineer	PJ	10.0	\$947.78	\$1,184.86
NO1_HEX2 Mechanical Engineer	PJ	400.0	\$37,911.11	\$47,394.52
NO2_HEX2 Mechanical Designer	PJ	560.0	\$42,939.08	\$53,680.22
NO6_HEX2 ME - D&I Engineer	PJ	120.0	\$11,373.33	\$14,218.36
Total		1,210	\$104,545	\$130,696

Activity Details

Activity Name: HEX251321 **CAM:** Fries
Activity Description: HEX FE - Layout & Basic Comp Design, Ray Trace and Rad Anlysis (actuals)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2 ME - Vacuum Engineer	PJ	124.0	\$11,752.44	\$14,475.39
NO1_HEX2 Mechanical Engineer	PJ	256.7	\$24,328.51	\$29,965.23
NO2_HEX2 Mechanical Designer	PJ	149.0	\$11,424.86	\$14,071.91
Total		530	\$47,506	\$58,513

Activity Details

Activity Name: HEX20410 **CAM:** Fries
Activity Description: HEX FE - Dipole chamber & vacuum design
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2 ME - Vacuum Engineer	PJ	240.0	\$22,746.67	\$28,576.65
NO1_HEX2 Mechanical Engineer	PJ	40.0	\$3,791.11	\$4,762.78
NO2_HEX2 Mechanical Designer	PJ	180.0	\$13,801.85	\$17,339.27
SE5_HEX2 EL - Vacuum Engineer	PJ	60.0	\$5,866.80	\$7,370.46
Total		520	\$46,206	\$58,049

Activity Details

Activity Name: HEX20700 **CAM:** Fries
Activity Description: HEX FE - Electrical & Controls Design
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO7_HEX2 Project Engineer	PJ	10.0	\$947.78	\$1,249.69
NE1_HEX2 Electrical Engineer	PJ	80.0	\$7,822.40	\$10,314.19
NE2_HEX2 Electrical Designer	PJ	40.0	\$3,225.50	\$4,252.97
NE3_HEX2 Electrical Technician	PJ	60.0	\$4,329.92	\$5,709.20
NE4_HEX2 Controls Engineer	PJ	160.0	\$15,644.80	\$20,628.39
TE1_HEX2 EL - D&I Engineer	PJ	80.0	\$7,822.40	\$10,314.19
Total		430	\$39,793	\$52,469

Activity Details

Activity Name: HEX21610 **CAM:** Fries
Activity Description: HEX FE - Slit and stage design, prototyping and test
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	PJ	160.0	\$15,644.80	\$19,558.32
NO1_HEX2	Mechanical Engineer	PJ	380.0	\$36,015.56	\$45,024.79
NO2_HEX2	Mechanical Designer	PJ	320.0	\$24,536.61	\$30,674.41
NO3_HEX2	Mechanical Technician	PJ	180.0	\$13,122.56	\$16,405.15
NO6_HEX2	ME - D&I Engineer	PJ	120.0	\$11,373.33	\$14,218.36
TE2_HEX2	EL - D&I Technician	PJ	60.0	\$4,329.92	\$5,413.05
Total			1,220	\$105,023	\$131,294

Activity Details

Activity Name: HEX20600 **CAM:** Fries
Activity Description: HEX FE - Receipt of Standard Front End Assemblies
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_HEX2	Material (Purchase >\$25k<\$2M)	EE	0.0	\$590,000.00	\$706,820.00
Total			0	\$590,000	\$706,820

Activity Details

Activity Name: HEX20900 **CAM:** Fries
Activity Description: HEX FE - Receipt of Slit Assemblies
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NSM_HEX2	Material (Purchase >\$25k<\$2M)	EE	0.0	\$450,000.00	\$539,100.00
Total			0	\$450,000	\$539,100

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.

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.05.02	HEX Source	5,155	\$2,379,430	\$2,784,395	\$1,447,885	\$4,232,280	\$386,077	\$3,170,472

Activity Details

Activity Name: HEX24100

CAM: Fries

Activity Description: HEX SCW - Insertion Device Installation

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.05.02

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAE_HEX2	Building Trades Electrician - Assigned	PJ	260.0	\$25,326.60	\$35,474.48
BTAR_HEX2	Building Trades Riggers - Assigned	PJ	48.0	\$4,675.68	\$6,549.13
BTU_HEX2	Building Trades Unassigned	PJ	80.0	\$9,079.20	\$12,717.06
MO1_HEX2	ME - Survey Engineer	PJ	40.0	\$3,791.11	\$5,478.20
MO2_HEX2	ME - Survey Technician	PJ	80.0	\$5,761.87	\$8,325.97
MO3_HEX2	ME - Utility Engineer	PJ	20.0	\$1,895.56	\$2,739.10
MO4_HEX2	ME - Utility Technician	PJ	40.0	\$2,916.13	\$4,213.83
MO5_HEX2	ME - Vacuum Engineer	PJ	40.0	\$3,791.11	\$5,478.20
MO6_HEX2	ME - Vacuum Technician	PJ	40.0	\$2,916.13	\$4,213.83
NE1_HEX2	Electrical Engineer	PJ	140.0	\$13,689.20	\$19,781.05
NE2_HEX2	Electrical Designer	PJ	20.0	\$1,612.75	\$2,330.44
NE3_HEX2	Electrical Technician	PJ	200.0	\$14,433.08	\$20,855.96
NE4_HEX2	Controls Engineer	PJ	40.0	\$3,911.20	\$5,651.73
NO2_HEX2	Mechanical Designer	PJ	40.0	\$3,067.08	\$4,431.96
NO3_HEX2	Mechanical Technician	PJ	40.0	\$2,916.13	\$4,213.83
NO8_HEX2	ME - Insertion Device Engineer	PJ	160.0	\$15,164.44	\$21,912.79
NO9_HEX2	ME - Insertion Device Technician	PJ	350.0	\$25,516.10	\$36,871.05
SE5_HEX2	EL - Vacuum Engineer	PJ	20.0	\$1,955.60	\$2,825.86
TE4_HEX2	EL - Insertion Device Engineer	PJ	40.0	\$3,911.20	\$5,651.73
Total			1,698	\$146,330	\$209,716

Activity Details

Activity Name: HEX23600 **CAM:** Fries
Activity Description: HEX SCW - Inspection, Testing & Magnetic Measurement
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
BTAR_HEX2	Building Trades Riggers - Assigned	PJ	24.0	\$2,337.84	\$3,224.73
MO1_HEX2	ME - Survey Engineer	PJ	20.0	\$1,895.56	\$2,683.35
MO2_HEX2	ME - Survey Technician	PJ	40.0	\$2,880.94	\$4,078.25
MO5_HEX2	ME - Vacuum Engineer	PJ	20.0	\$1,895.56	\$2,683.35
MO6_HEX2	ME - Vacuum Technician	PJ	40.0	\$2,916.13	\$4,128.07
NE1_HEX2	Electrical Engineer	PJ	80.0	\$7,822.40	\$11,073.39
NE4_HEX2	Controls Engineer	PJ	350.0	\$34,223.00	\$48,446.08
NO8_HEX2	ME - Insertion Device Engineer	PJ	100.0	\$9,477.78	\$13,416.74
NO9_HEX2	ME - Insertion Device Technician	PJ	450.0	\$32,806.41	\$46,440.75
NS2_HEX2	Assistant/Associate Scientist	PJ	200.0	\$17,947.65	\$25,406.69
TE4_HEX2	EL - Insertion Device Engineer	PJ	500.0	\$48,890.00	\$69,208.69
Total			1,824	\$163,093	\$230,790

Activity Details

Activity Name: HEX251291 **CAM:** Fries
Activity Description: HEX SCW - Spec and SOW Development
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2	ME - Vacuum Engineer	PJ	20.0	\$1,895.56	\$2,334.74
NE1_HEX2	Electrical Engineer	PJ	120.0	\$11,733.60	\$14,452.18
NE2_HEX2	Electrical Designer	PJ	20.0	\$1,612.75	\$1,986.41
NO8_HEX2	ME - Insertion Device Engineer	PJ	40.0	\$3,791.11	\$4,669.48
NS2_HEX2	Assistant/Associate Scientist	PJ	200.0	\$17,947.65	\$22,105.97
NS2_HEX2	Assistant/Associate Scientist	PJ	20.0	\$1,794.76	\$2,210.60
TE1_HEX2	EL - D&I Engineer	PJ	20.0	\$1,955.60	\$2,408.70
Total			440	\$40,731	\$50,168

Activity Details

Activity Name: HEX23020 **CAM:** Fries
Activity Description: HEX SCW - Procurement Documentation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA1_HEX2	Manager	PJ	150.0	\$24,590.74	\$31,897.18
NO1_HEX2	Mechanical Engineer	PJ	150.0	\$14,216.67	\$18,440.75
NO3_HEX2	Mechanical Technician	PJ	150.0	\$10,935.47	\$14,184.64
Total			450	\$49,743	\$64,523

Activity Details

Activity Name: HEX23000 **CAM:** Fries
Activity Description: HEX SCW - Control System
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	PJ	40.0	\$3,911.20	\$5,157.10
Total			40	\$3,911	\$5,157

Activity Details

Activity Name: HEX22320 **CAM:** Fries
Activity Description: HEX SCW - Procurement (Assumes bought)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:

[QE53 SCW](#)

Supporting Documentation:

[QE54 SCW](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_Fixed_HE	Capital Equipment (Fixed X2 Rate)	VQ	0.0	\$1,800,000.00	\$2,015,280.00
Total			0	\$1,800,000	\$2,015,280

Activity Details

Activity Name: HEX23010 **CAM:** Fries
Activity Description: HEX SCW - Controls Procurement
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NEQ_HEX2	Capital Equipment	PJ	0.0	\$100,000.00	\$114,535.00
Total			0	\$100,000	\$114,535

Activity Details

Activity Name: HEX22305 **CAM:** Fries
Activity Description: HEX SCW - Preliminary design work and analysis (actuals)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO1_HEX2	Mechanical Engineer	AC	6.0	\$568.67	\$700.42
NO8_HEX2	ME - Insertion Device Engineer	AC	8.0	\$758.22	\$933.90
NS1_HEX2	Scientist	AC	189.0	\$23,775.30	\$29,283.85
Total			203	\$25,102	\$30,918

Activity Details

Activity Name: HEX251301 **CAM:** Fries
Activity Description: HEX SCW - Modeling and Beam Tracking
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO2_HEX2	Mechanical Designer	PJ	40.0	\$3,067.08	\$3,777.69
NO8_HEX2	ME - Insertion Device Engineer	PJ	40.0	\$3,791.11	\$4,669.48
NS2_HEX2	Assistant/Associate Scientist	PJ	100.0	\$8,973.82	\$11,052.99
NS2_HEX2	Assistant/Associate Scientist	PJ	40.0	\$3,589.53	\$4,421.19
Total			220	\$19,422	\$23,921

Activity Details

Activity Name: HEX22700 **CAM:** Fries
Activity Description: HEX SCW - SRP analysis
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO8_HEX2	ME - Insertion Device Engineer	PJ	40.0	\$3,791.11	\$4,998.75
NS2_HEX2	Assistant/Associate Scientist	PJ	40.0	\$3,589.53	\$4,732.96
Total			80	\$7,381	\$9,732

Activity Details

Activity Name: HEX22310 **CAM:** Fries
Activity Description: HEX SCW - Detailed Lattice Studies
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS1_HEX2	Scientist	PJ	160.0	\$20,127.24	\$24,921.67
Total			160	\$20,127	\$24,922

Activity Details

Activity Name: HEX22600 **CAM:** Fries
Activity Description: HEX SCW - Beam Tracking
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NS2_HEX2	Assistant/Associate Scientist	PJ	40.0	\$3,589.53	\$4,732.96
Total			40	\$3,590	\$4,733

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.

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	\$539,881	\$707,258	\$56,581	\$763,839	\$170,825	\$878,083

Activity Details

Activity Name: HEX24200 **CAM:** Fries
Activity Description: HEX ID Straight - Vacuum Chamber Installation & Bake
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO1_HEX2	ME - Survey Engineer	PJ	50.0	\$4,738.89	\$6,641.85
MO2_HEX2	ME - Survey Technician	PJ	140.0	\$10,083.27	\$14,132.34
MO5_HEX2	ME - Vacuum Engineer	PJ	80.0	\$7,582.22	\$10,626.96
MO6_HEX2	ME - Vacuum Technician	PJ	680.0	\$49,574.13	\$69,481.26
NE1_HEX2	Electrical Engineer	PJ	20.0	\$1,955.60	\$2,740.90

NO6_HEX2	ME - D&I Engineer	PJ	40.0	\$3,791.11	\$5,313.48
NO8_HEX2	ME - Insertion Device Engineer	PJ	20.0	\$1,895.56	\$2,656.74
NS2_HEX2	Assistant/Associate Scientist	PJ	80.0	\$7,179.06	\$10,061.90
SE5_HEX2	EL - Vacuum Engineer	PJ	50.0	\$4,889.00	\$6,852.24
TE1_HEX2	EL - D&I Engineer	PJ	20.0	\$1,955.60	\$2,740.90
TE4_HEX2	EL - Insertion Device Engineer	PJ	40.0	\$3,911.20	\$5,481.79
Total			1,220	\$97,556	\$136,730

Activity Details

Activity Name: HEX24300

CAM: Fries

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

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.05.03

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO1_HEX2	ME - Survey Engineer	PJ	20.0	\$1,895.56	\$2,739.10
MO2_HEX2	ME - Survey Technician	PJ	60.0	\$4,321.40	\$6,244.48
MO5_HEX2	ME - Vacuum Engineer	PJ	40.0	\$3,791.11	\$5,478.20
NE1_HEX2	Electrical Engineer	PJ	40.0	\$3,911.20	\$5,651.73
NE3_HEX2	Electrical Technician	PJ	20.0	\$1,443.31	\$2,085.60
NO6_HEX2	ME - D&I Engineer	PJ	50.0	\$4,738.89	\$6,847.75
NO8_HEX2	ME - Insertion Device Engineer	PJ	20.0	\$1,895.56	\$2,739.10
TE1_HEX2	EL - D&I Engineer	PJ	150.0	\$14,667.00	\$21,193.98
TE2_HEX2	EL - D&I Technician	PJ	300.0	\$21,649.61	\$31,283.94
Total			700	\$58,314	\$84,264

Activity Details

Activity Name: HEX23300

CAM: Fries

Activity Description: HEX ID Straight - Vacuum Chamber Design

Complexity: Level 3

Estimate Year:

WBS Code: 7.05.05.03

Estimator:

PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2	ME - Vacuum Engineer	PJ	160.0	\$15,164.44	\$19,995.02
NO2_HEX2	Mechanical Designer	PJ	160.0	\$12,268.31	\$16,176.33
NO6_HEX2	ME - D&I Engineer	PJ	80.0	\$7,582.22	\$9,997.51
NO8_HEX2	ME - Insertion Device Engineer	PJ	20.0	\$1,895.56	\$2,499.38
NS2_HEX2	Assistant/Associate Scientist	PJ	40.0	\$3,589.53	\$4,732.96
SE5_HEX2	EL - Vacuum Engineer	PJ	100.0	\$9,778.00	\$12,892.74
Total			560	\$50,278	\$66,294

Activity Details

Activity Name: HEX23700 **CAM:** Fries
Activity Description: HEX ID Straight - Vacuum Chamber Procurement & Testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MO5_HEX2	ME - Vacuum Engineer	PJ	200.0	\$18,955.56	\$26,180.28
MO6_HEX2	ME - Vacuum Technician	PJ	200.0	\$14,580.63	\$20,137.89
NS2_HEX2	Assistant/Associate Scientist	PJ	40.0	\$3,589.53	\$4,957.64
SE5_HEX2	EL - Vacuum Engineer	PJ	50.0	\$4,889.00	\$6,752.39
TE4_HEX2	EL - Insertion Device Engineer	PJ	40.0	\$3,911.20	\$5,401.92
Total			530	\$45,926	\$63,430

Activity Details

Activity Name: HEX23200 **CAM:** Fries
Activity Description: HEX ID Straight - ID Lattice Simulations & Control System Upgrading
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE1_HEX2	Electrical Engineer	PJ	50.0	\$4,889.00	\$6,446.37
NE4_HEX2	Controls Engineer	PJ	200.0	\$19,556.00	\$25,785.48
NO6_HEX2	ME - D&I Engineer	PJ	20.0	\$1,895.56	\$2,499.38
NO8_HEX2	ME - Insertion Device Engineer	PJ	30.0	\$2,843.33	\$3,749.07
NO9_HEX2	ME - Insertion Device Technician	PJ	80.0	\$5,832.25	\$7,690.09
NS2_HEX2	Assistant/Associate Scientist	PJ	90.0	\$8,076.44	\$10,649.16
TE4_HEX2	EL - Insertion Device Engineer	PJ	200.0	\$19,556.00	\$25,785.48
Total			670	\$62,649	\$82,605

Activity Details

Activity Name: HEX24400 **CAM:** Fries
Activity Description: HEX ID Straight - Procurement Receipt of Vacuum Chambers & Components
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	EE	0.0	\$100,000.00	\$119,800.00
Total			0	\$100,000	\$119,800

Activity Details

Activity Name: HEX23800 **CAM:** Fries
Activity Description: HEX ID Straight - Procurement Receipt of RF BPMs, Supports, Cable, Conns
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2	Material (Purchase <\$25k)	PJ	0.0	\$85,000.00	\$99,540.95
Total			0	\$85,000	\$99,541

Activity Details

Activity Name: HEX23400 **CAM:** Fries
Activity Description: HEX ID Straight - RF BPM Design & Procurement
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.05.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NO2_HEX2	Mechanical Designer	PJ	100.0	\$7,667.69	\$10,423.62
NO6_HEX2	ME - D&I Engineer	PJ	150.0	\$14,216.67	\$19,326.43
TE1_HEX2	EL - D&I Engineer	PJ	150.0	\$14,667.00	\$19,938.63
TE2_HEX2	EL - D&I Technician	PJ	50.0	\$3,608.27	\$4,905.16
Total			450	\$40,160	\$54,594

WBS: 7.05.06

HEX Controls

WBS Manager:

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	7,300	\$1,048,631	\$1,389,982	\$228,342	\$1,618,324	\$277,996	\$1,667,978

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, 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

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.06.01	HEX Basic System Controls	4,940	\$841,666	\$1,092,744	\$174,839	\$1,267,583	\$218,549	\$1,311,293

Activity Details**Activity Name:** HEX24550**CAM:** Yin**Activity Description:** HEX Controls - Design**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.06.01**Estimator:****PC Rep:** Gutta**Cost Summary****Supporting Documentation:**[QE60 Controls estimate. Applies to all activities](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA7_HEX2	IT Professional (Software)	EE	40.0	\$3,489.18	\$4,743.26
NE4_HEX2	Controls Engineer	EE	336.0	\$32,854.08	\$44,662.52
NE4_HEX2	Controls Engineer	EE	160.0	\$15,644.80	\$21,267.87
Total			536	\$51,988	\$70,674

Activity Details**Activity Name:** HEX24570**CAM:** Yin**Activity Description:** HEX Controls - Diagnostic Control**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.06.01**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA7_HEX2	IT Professional (Software)	EE	32.0	\$2,791.34	\$3,912.24
NE3_HEX2	Electrical Technician	EE	32.0	\$2,309.29	\$3,236.62
NE4_HEX2	Controls Engineer	EE	272.0	\$26,596.16	\$37,276.19
Total			336	\$31,697	\$44,425

Activity Details

Activity Name: HEX24620 **CAM:** Yin
Activity Description: HEX Controls - Installation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA7_HEX2 IT Professional (Software)	EE	360.0	\$31,402.62	\$44,012.74
NE3_HEX2 Electrical Technician	EE	280.0	\$20,206.31	\$28,320.41
NE3_HEX2 Electrical Technician	EE	632.0	\$45,608.52	\$63,923.21
Total		1,272	\$97,217	\$136,256

Activity Details

Activity Name: HEX24560 **CAM:** Yin
Activity Description: HEX Controls - Motion Control
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE3_HEX2 Electrical Technician	EE	48.0	\$3,463.94	\$4,854.93
NE4_HEX2 Controls Engineer	EE	928.0	\$90,739.84	\$127,177.59
Total		976	\$94,204	\$132,033

Activity Details

Activity Name: HEX24580 **CAM:** Yin
Activity Description: HEX Controls - Vacuum Control IOC and testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2 Controls Engineer	EE	80.0	\$7,822.40	\$10,963.59
NE4_HEX2 Controls Engineer	EE	40.0	\$3,911.20	\$5,481.79
Total		120	\$11,734	\$16,445

Activity Details

Activity Name: HEX24590 **CAM:** Yin
Activity Description: HEX Controls - Timing IOC and testing
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2 Controls Engineer	EE	80.0	\$7,822.40	\$10,963.59

Total 80 \$7,822 \$10,964

Activity Details

Activity Name: HEX24610 **CAM:** Yin
Activity Description: HEX Controls - CSS development
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	EE	320.0	\$31,289.60	\$43,854.34
Total			320	\$31,290	\$43,854

Activity Details

Activity Name: HEX24660 **CAM:** Yin
Activity Description: HEX Controls - Interface with accelerator control (gateway)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	EE	20.0	\$1,955.60	\$2,740.90
Total			20	\$1,956	\$2,741

Activity Details

Activity Name: HEX24670 **CAM:** Yin
Activity Description: HEX Controls - Integrated testing and IRR prep
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	EE	160.0	\$15,644.80	\$21,927.17
Total			160	\$15,645	\$21,927

Activity Details

Activity Name: HEX24680 **CAM:** Yin
Activity Description: HEX Controls - Detector Integration
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2	Controls Engineer	EE	320.0	\$31,289.60	\$43,854.34
Total			320	\$31,290	\$43,854

Activity Details

Activity Name: HEX24690 **CAM:** Yin
Activity Description: HEX Controls - End station instrumentation
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2 Controls Engineer	EE	640.0	\$62,579.20	\$87,708.68
Total		640	\$62,579	\$87,709

Activity Details

Activity Name: HEX24790 **CAM:** Yin
Activity Description: HEX Controls - Other endstation control tasks
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NE4_HEX2 Controls Engineer	EE	160.0	\$15,644.80	\$21,927.17
Total		160	\$15,645	\$21,927

Activity Details

Activity Name: HEX24810 **CAM:** Yin
Activity Description: HEX Controls - Procure Items
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NMA_HEX2 Material (Purchase <\$25k)	EE	0.0	\$378,600.00	\$447,955.17
Total		0	\$378,600	\$447,955

Activity Details

Activity Name: HEX24860 **CAM:** Yin
Activity Description: HEX Controls - FAT Travel
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.06.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NTR_HEX2 Travel Cost	EE	0.0	\$10,000.00	\$11,980.00
Total		0	\$10,000	\$11,980

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

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	\$206,965	\$297,238	\$53,503	\$350,740	\$59,448	\$356,685

Activity Details**Activity Name:** HEX24870**CAM:** Yin**Activity Description:** HEX Instrument Applications - DAMA Effort**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.06.02**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NA7_HEX2	IT Professional (Software)	EE	1,920.0	\$167,480.62	\$240,530.65
NS2_HEX2	Assistant/Associate Scientist	EE	440.0	\$39,484.83	\$56,706.92
Total			2,360	\$206,965	\$297,238

WBS: 7.05.07 **HEX Conventional Facilities****WBS Manager:****Dictionary:**

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.07	HEX Conventional Facilities	5,322	\$5,088,841	\$5,609,312	\$653,524	\$6,262,836	\$1,068,508	\$6,677,820

WBS: 7.05.07.01 **HEX Conventional Facilities Design****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

ID	Name	Hours	Direct	Total Cost (Dir+Bur+Esc)	TD Risk Assessment	Total Cost + RA	Bu Estimate Uncertainty	Total Cost + EU
7.05.07.01	HEX Conventional Facilities Design	1,054	\$306,865	\$360,136	\$57,622	\$417,758	\$18,672	\$378,809

Activity Details**Activity Name:** HEX252051**CAM:** McCaffrey**Activity Description:** HEX Satellite Building Final Design Phase**Complexity:** Level 3**Estimate Year:****WBS Code:** 7.05.07.01**Estimator:****PC Rep:** Gutta**Cost Summary**

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MPO_ARC_HE X2	MPO Architect	EE	86.0	\$12,721.98	\$14,979.79
MPO_CAM_HE X2	MPO CAM	EE	74.0	\$10,946.82	\$12,889.58

MPO_EEP_HEX	MPO Project Electrical 2 Engineer	EE	57.0	\$8,432.01	\$9,928.46
MPO_EES_HEX	MPO Senior Electrical 2 Engineer	EE	28.0	\$4,142.04	\$4,877.14
MPO_MEP_HE	MPO Project Mechanical X2 Engineer	EE	78.0	\$11,538.54	\$13,586.32
MPO_MES_HE	MPO Senior Mechanical X2 Engineer	EE	31.0	\$4,585.83	\$5,399.69
MPO_MGR_HE	MPO Manager X2	EE	14.0	\$2,071.02	\$2,438.57
MPO_OTH_HE	MPO Other Professional X2	EE	9.0	\$1,331.37	\$1,567.65
MPO_SE_HEX2	MPO Structural Engineer	EE	109.0	\$16,124.37	\$18,986.01
Total			486	\$71,894	\$84,653

Activity Details

Activity Name: HEX24600 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Initial Design Phase (actuals)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MPO_CAM_HE	MPO CAM X2	AC	418.1	\$61,849.53	\$72,826.15
Total			418	\$61,850	\$72,826

Activity Details

Activity Name: HEX24630 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Final Design Phase (actuals)
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MPO_CAM_HE	MPO CAM X2	AC	99.8	\$14,758.09	\$17,377.25
Total			100	\$14,758	\$17,377

Activity Details

Activity Name: HEX24650 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Design Contingency 5%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MPO_CAM_HE	MPO CAM X2	EE	50.0	\$7,396.50	\$8,709.18
Total			50	\$7,397	\$8,709

Activity Details

Activity Name: HEX252031 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Drafting Support Payment 1
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MPO_CON_HE X2	MPO Consultants	AC	0.0	\$62,543.00	\$73,150.04
Total			0	\$62,543	\$73,150

Activity Details

Activity Name: HEX252041 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Drafting Support Payment 2
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.01 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MPO_CON_HE X2	MPO Consultants	AC	0.0	\$88,424.00	\$103,420.35
Total			0	\$88,424	\$103,420

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

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	\$4,112,611	\$4,399,201	\$527,904	\$4,927,105	\$879,840	\$5,279,041

Activity Details

Activity Name: HEX24700 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - Trades
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Supporting Documentation:

[Satellite Building Quote](#)

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
CHV_Fixed_HE X2	Construction HV (Fixed Rate)	EE	0.0	\$2,000,000.00	\$2,238,000.00
NLP_Fixed_HE X2	Large Procurment (>\$2M) (Fixed Rate)	EE	0.0	\$653,864.00	\$668,902.87
Total			0	\$2,653,864	\$2,906,903

Activity Details

Activity Name: HEX24700_1 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - Design contingency 13%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurement (>\$2M)	EE	0.0	\$331,730.00	\$339,359.79
	X2 (Fixed Rate)				
Total			0	\$331,730	\$339,360

Activity Details

Activity Name: HEX24700_2 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - Cost contingency 8%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurement (>\$2M)	EE	0.0	\$204,142.00	\$208,837.27
	X2 (Fixed Rate)				
Total			0	\$204,142	\$208,837

Activity Details

Activity Name: HEX24700_3 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - Gen Conditions 10%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurement (>\$2M)	EE	0.0	\$255,177.00	\$261,046.07
	X2 (Fixed Rate)				
Total			0	\$255,177	\$261,046

Activity Details

Activity Name: HEX24700_4 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - Insurance 2%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurement (>\$2M)	EE	0.0	\$51,035.00	\$52,208.81
	X2 (Fixed Rate)				
Total			0	\$51,035	\$52,209

Activity Details

Activity Name: HEX24700_5 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - OH Fee 15%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurment (>\$2M) X2 (Fixed Rate)	EE	0.0	\$509,078.00	\$520,786.79
Total			0	\$509,078	\$520,787

Activity Details

Activity Name: HEX24700_6 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - Escalation 2%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurment (>\$2M) X2 (Fixed Rate)	EE	0.0	\$67,877.00	\$69,438.17
Total			0	\$67,877	\$69,438

Activity Details

Activity Name: HEX24700_7 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Construction - Pmt and Perf Bond 1%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.02 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
NLP_Fixed_HE	Large Procurment (>\$2M) X2 (Fixed Rate)	EE	0.0	\$39,708.00	\$40,621.28
Total			0	\$39,708	\$40,621

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).

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	4,268	\$669,365	\$849,975	\$67,998	\$917,973	\$169,995	\$1,019,970

Activity Details

Activity Name: HEX25545 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Contract Oversight
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
CLV_Fixed_HEX2	Construction LV (Fixed Rate)	EE	0.0	\$38,000.00	\$42,522.00
MPO_ADM_HEX2	MPO Administrative	EE	8.0	\$1,183.44	\$1,513.50
MPO_ARC_HEX2	MPO Architect	EE	440.0	\$65,089.20	\$83,242.58
MPO_CAM_HEX2	MPO CAM	EE	800.0	\$118,344.00	\$151,350.14
MPO_EEP_HEX2	MPO Project Electrical Engineer	EE	40.0	\$5,917.20	\$7,567.51
MPO_EI_HEX2	MPO Electrical Inspector	EE	400.0	\$59,172.00	\$75,675.07
MPO_MEP_HEX2	MPO Project Mechanical Engineer	EE	40.0	\$5,917.20	\$7,567.51
MPO_MGR_HEX2	MPO Manager	EE	40.0	\$5,917.20	\$7,567.51
MPO_MI_HEX2	MPO Mechanical Inspector	EE	120.0	\$17,751.60	\$22,702.52
MPO_OTH_HEX2	MPO Other Professional	EE	24.0	\$3,550.32	\$4,540.50
MPO_SAF_HEX2	MPO Safety Engineer	EE	280.0	\$41,420.40	\$52,972.55
MPO_SE_HEX2	MPO Structural Engineer	EE	160.0	\$23,668.80	\$30,270.03
MPO_SI_HEX2	MPO Structural Inspector	EE	1,600.0	\$236,688.00	\$302,700.29
Total			3,952	\$622,619	\$790,192

Activity Details

Activity Name: HEX251521 **CAM:** McCaffrey
Activity Description: HEX Satellite Building Contract Oversight Contingency 8%
Complexity: Level 3 **Estimate Year:**
WBS Code: 7.05.07.03 **Estimator:**
PC Rep: Gutta

Cost Summary

Resource Id	Description	Cost Basis	Hours	Direct	Total Cost (Dir+Bur+Esc)
MPO_OTH_HEX2	MPO Other Professional	EE	316.0	\$46,745.88	\$59,783.31
Total			316	\$46,746	\$59,783