HEX Beamline Project Management.

Final Design Review

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Partner Beamlines Portfolio Manager
1-April-2019

Firstly: Welcome to Michael Drakopoulos

Michael joined us on 11th March 2019 from Diamond Light Source (UK synchrotron), where he was responsible for the design, construction and operation of the JEEP beamline including line management of beamline staff and supporting users.

The Joint Engineering, Environmental, and Processing beamline is a world-class high energy x-ray beamline for imaging, diffraction and scattering, which operates at energies of 53-150 keV and is devoted to applied science / engineering applications.

Michael will be the Lead Beamline Scientist for the HEX beamline. He will work with Zhong who has done all of the design of the optics and End Stations.

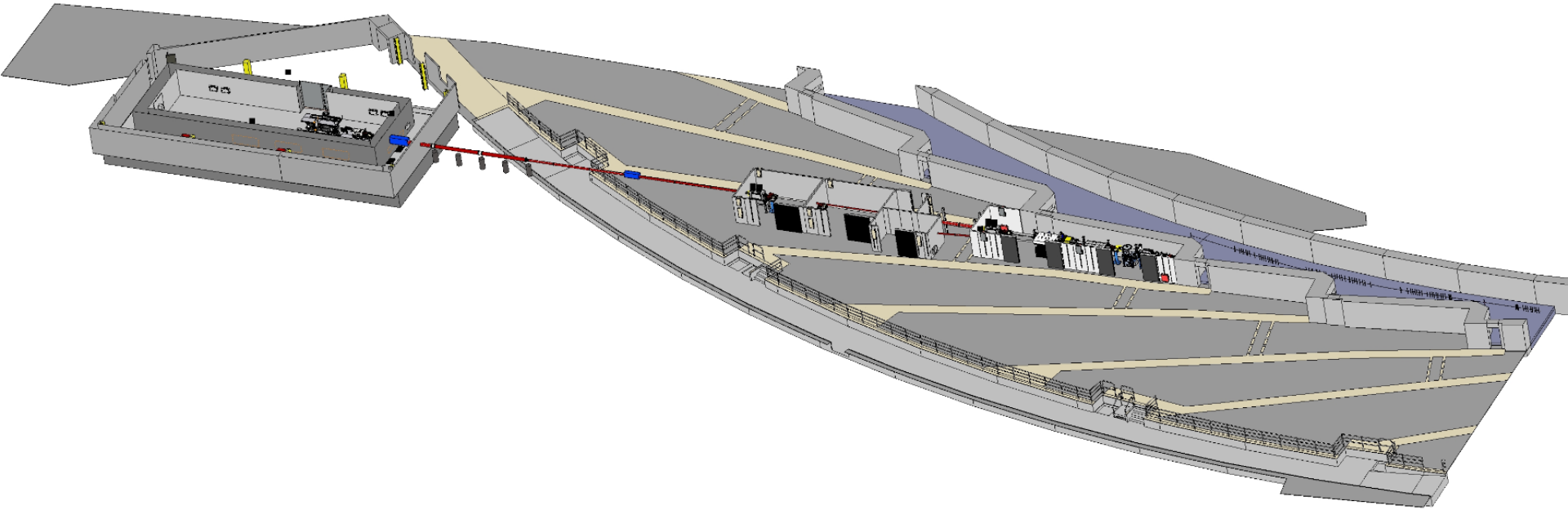
Scope of Talk

- Scope
- Management
- Schedule
- Costs
- Risks
- Previous Review Recommendations
- Transition to Operations
- Specific WBS areas: Management, Design, Photon Delivery System and End Station, Hutches.
- Progress with the Hutch Contract.
- Conclusion

Project Scope

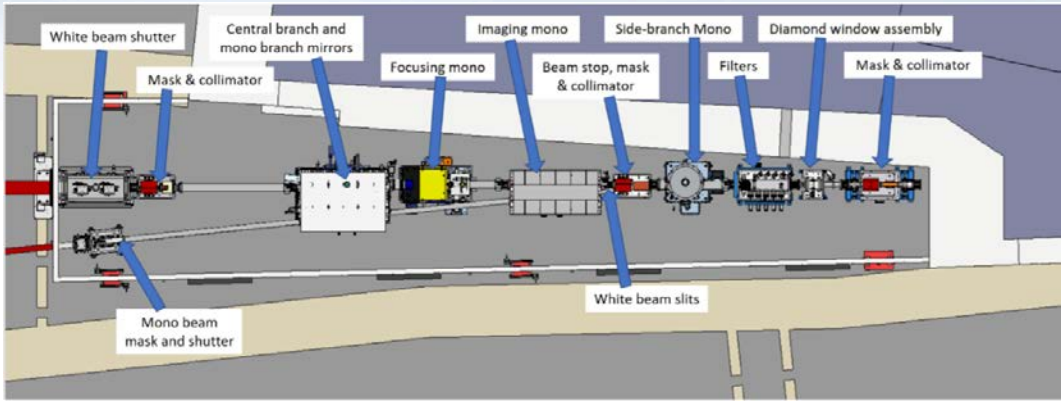
Complete beamline primarily funded by NYSERDA ($25M) and NSLS-II ($5M for Management and Oversight).

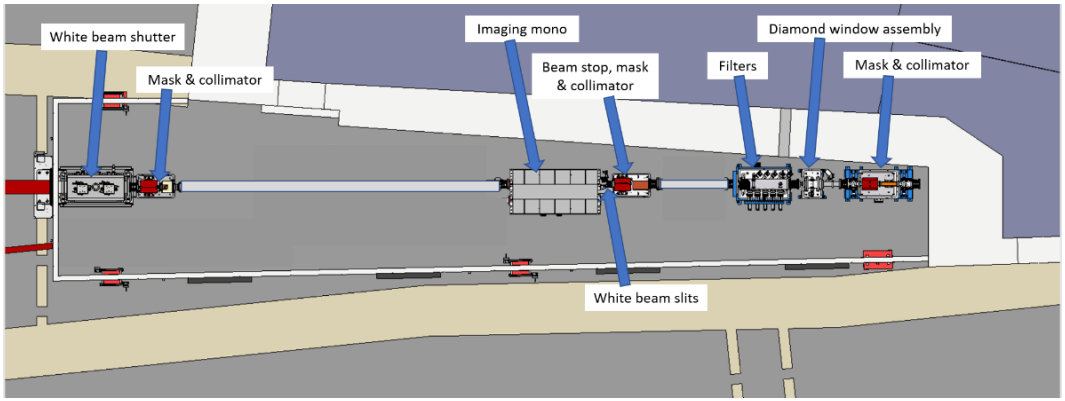
Completion in ~4½ years, funding constraints now lifted (was 5 years, with constrained funding).



Project Scope

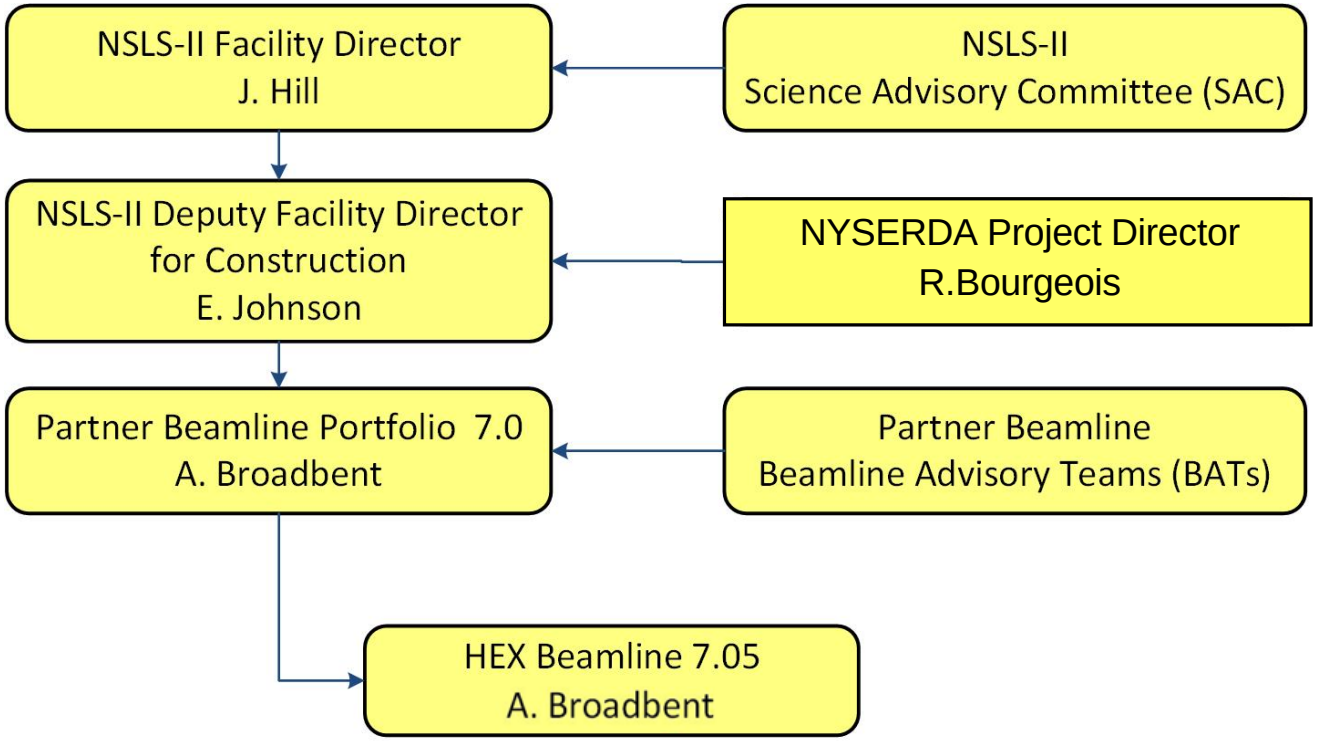
HEX was initially costed without constraint for the planned three-branch mature scope design (~$40M).



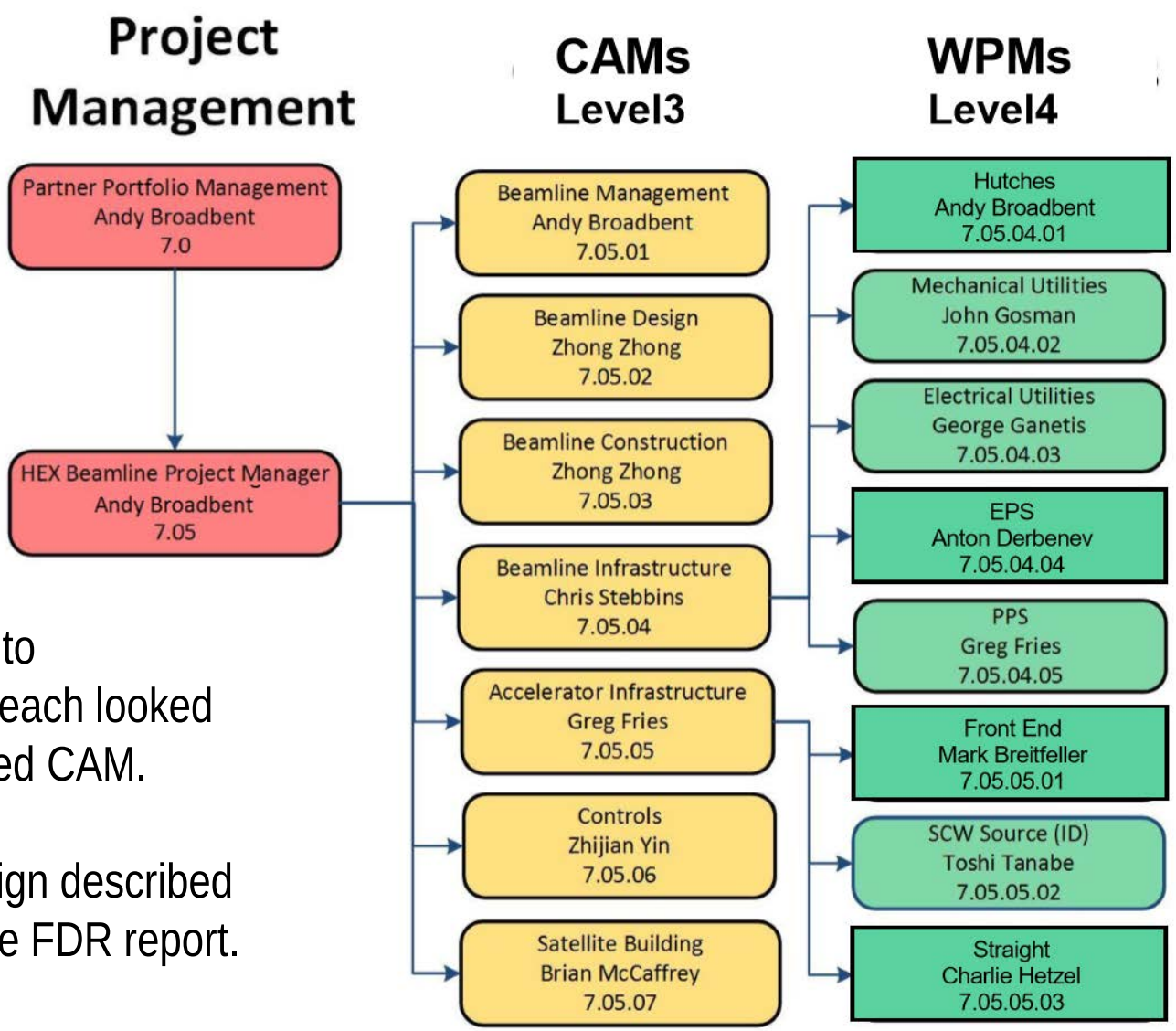


After discussion, the project scope was agreed to include a single branch beamline, with satellite building, science ready end station, optics for the single branch, with affordances for the side branches, and all necessary accelerator additions and modifications, including the superconducting wiggler ($30M).

HEX Beamline Construction Oversight



HEX Beamline Project Organization



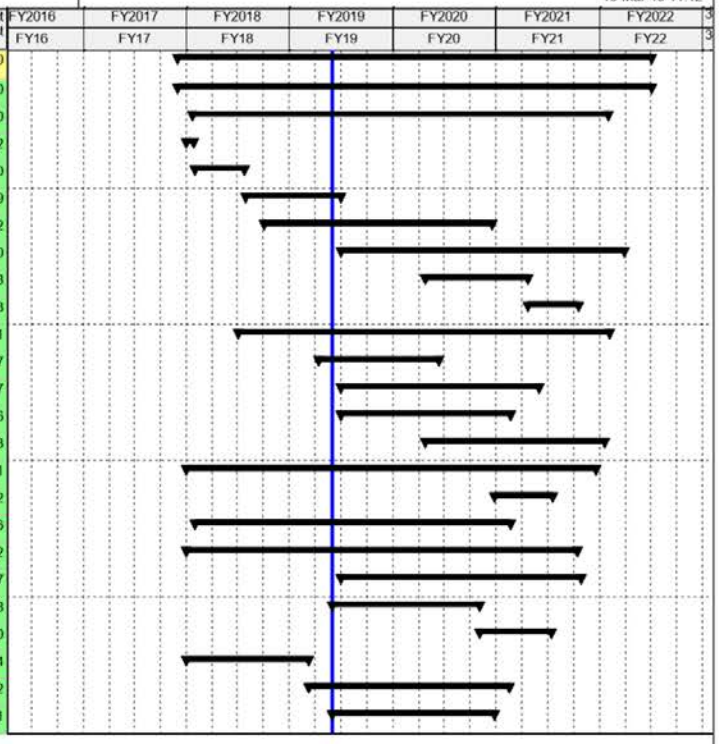
- Scope is broken up into manageable chunks, each looked after by an experienced CAM.
- Current technical design described in detail by WBS in the FDR report.

Schedule

- Schedule has been refined over many iterations since the CDR.
- This is now a technically limited schedule since the funding constraint was removed.

HEX Partner Beamline Rate Update — IPD - Summary Schedule — 19-Mar-19 11:12

Activity ID	At Completion Duration	Start	Finish	BL Project Start	BL Project Finish	BL Project Total Cost
Total	1145	31-Aug-17 A	04-Apr-22	31-Aug-17	04-Apr-22	$30,000,000
HEX Management	1145	31-Aug-17 A	04-Apr-22	31-Aug-17	04-Apr-22	$5,000,000
NYSERDA Milestones	1006	25-Oct-17 A	02-Nov-21	25-Oct-17	02-Nov-21	$0
HEX Conceptual Design	17	02-Oct-17 A	25-Oct-17 A	02-Oct-17	25-Oct-17	$14,782
HEX Preliminary Design	120	01-Nov-17 A	27-Apr-18 A	01-Nov-17	27-Apr-18	$125,180
HEX Final Design	230	01-May-18 A	02-Apr-19	01-May-18	02-Apr-19	$326,379
HEX Photon Delivery System Procurement and Fabrication	555	02-Jul-18 A	17-Sep-20	02-Jul-18	17-Sep-20	$3,610,612
HEX Photon Delivery System Installation and Test	687	03-Apr-19	30-Dec-21	03-Apr-19	30-Dec-21	$1,146,190
HEX End Station Procurement and Fabrication	251	22-Jan-20	21-Jan-21	22-Jan-20	21-Jan-21	$1,800,498
HEX End Station Installation and Test	125	22-Jan-21	20-Jul-21	22-Jan-21	20-Jul-21	$49,923
HEX Hutches	902	02-Apr-18 A	04-Nov-21	02-Apr-18	04-Nov-21	$23,341
Hutches Procurement	290	11-Jan-19 A	10-Mar-20	11-Jan-19	10-Mar-20	$2,033,467
HEX Mechanical Utilities	478	03-Apr-19	02-Mar-21	03-Apr-19	02-Mar-21	$669,777
HEX Electrical Utilities	413	03-Apr-19	23-Nov-20	03-Apr-19	23-Nov-20	$420,906
HEX EPS	439	22-Jan-20	19-Oct-21	22-Jan-20	19-Oct-21	$194,123
HEX PPS	991	02-Oct-17 A	17-Sep-21	02-Oct-17	17-Sep-21	$769,841
HEX Beamline Furniture and Office Equipment	140	25-Sep-20	20-Apr-21	25-Sep-20	20-Apr-21	$47,862
HEX Front End	764	01-Nov-17 A	20-Nov-20	01-Nov-17	20-Nov-20	$2,560,146
HEX Source	947	02-Oct-17 A	16-Jul-21	02-Oct-17	16-Jul-21	$3,623,462
HEX Straight	584	03-Apr-19	30-Jul-21	03-Apr-19	30-Jul-21	$701,187
HEX Basic System Controls	360	01-Mar-19	04-Aug-20	01-Mar-19	04-Aug-20	$1,034,068
HEX Instrument Applications	173	05-Aug-20	15-Apr-21	05-Aug-20	15-Apr-21	$291,720
HEX Conventional Facilities Design and Bid Preparation	294	02-Oct-17 A	07-Dec-18 A	02-Oct-17	07-Dec-18	$332,774
HEX Conventional Facilities Construction	486	10-Dec-18 A	16-Nov-20	10-Dec-18	16-Nov-20	$4,375,742
HEX Conventional Facilities Commissioning	396	01-Mar-19	24-Sep-20	01-Mar-19	24-Sep-20	$848,021



Major Milestones

Milestone	Contract Date	Actual or Projected Date
Project Start		Sept-17
Conceptual Design Review	Nov-17	Oct-17
Preliminary Design Review (go / no-go 1)	Apr-18	Apr-18
SCW Procure or Make Decision (go / no-go 2)	Aug-18	Aug-18
Front End Design Review	Oct-18	Sept-18
Hutches Place Order	Mar-19	Jan-19
Final Design Review (go / no-go 3)	May-19	Apr-19
Satellite building contract placed	Jul-19	Dec-18
Optical Components Ordered	Sept-19	Jul-19
All Hutches Acceptance Testing Complete	Apr-20	Feb-20
Satellite Building Beneficial Occupancy	Jul-20	Jul-20
End Station Components Ordered	Sept-20	Jan-20
Beamline Utilities Complete	N/A	Feb-21
Optical Components Installed	Sep-21	Mar-21
SCW Installation Complete	Apr-22	May-21
IRR	Jun-22	Nov-21
Project Complete	July-22	Dec-21
Schedule Contingency		Mar-22

4½ -year Project

Cost Summary

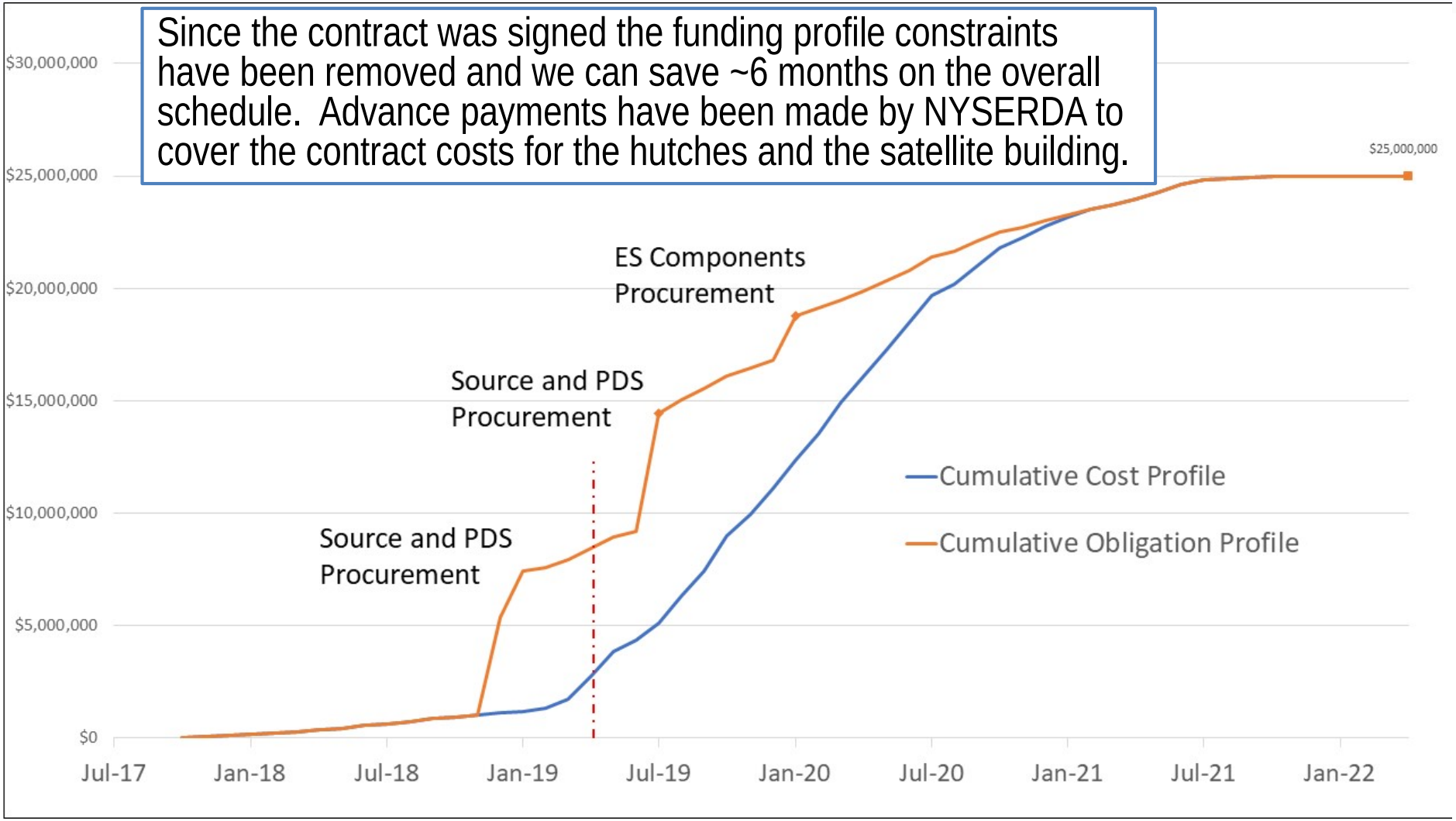
WBS	Description	M&S [$]	Labor [$]	Total [$]
7.05.01	NSLS-II activities funded by NSLSII	$19k	$4,981k	$5,000k
7.05.02 – 7.05.07	NSLS-II activities funded by NYSERDA	$16,351k	$8,649k	$25,000k
Total Project Cost [$]		$16,370k	$13,630k	$30,000k

We have a very detailed cost and schedule plan (using Primavera P6).
Actual costs and progress of all tasks are monitored to track cost and schedule variances.
These variances are reported monthly to the BNL Project Oversight Board.

See the P6 poster printout, or the copy on the review website.

Cost and Obligation Profiles

Since the contract was signed the funding profile constraints have been removed and we can save ~6 months on the overall schedule. Advance payments have been made by NYSERDA to cover the contract costs for the hutches and the satellite building.



Costs Profile by L3 WBS

L3 WBS	Description	FY18	FY19	FY20	FY21	FY22	Budgeted Cost
7.05.01	HEX Management	$732,646	$1,101,691	$1,301,226	$1,359,633	$504,805	$5,000,000
7.05.02	HEX Design	$290,357	$175,984				$466,341
7.05.03	HEX Construction		$765,111	$4,561,619	$1,227,372	$53,123	$6,607,224
7.05.04	HEX Beamline Infrastructure	$9,550	$910,455	$2,607,037	$623,353	$8,920	$4,159,317
7.05.05	HEX Accelerator Infrastructure	$361,964	$2,220,391	$2,706,240	$1,596,197		$6,884,791
7.05.06	HEX Controls		$346,935	$753,668	$225,187		$1,325,790
7.05.07	HEX Conventional Facilities	$280,884	$1,981,619	$3,294,030			$5,556,537
Grand Total		$1,675,401	$7,502,186	$15,223,820	$5,031,742	$566,848	$30,000,000

No cost contingency; this is not normal for DOE projects, but common elsewhere.

Contingency is being managed through tailoring scope (see HEX16, Contingency Analysis Report).

Costs

We will continue to monitor and refine the costs as the project progresses, currently:

- Satellite building and hutches (fixed price) contracts are placed, within budget, although the B-hutch was descoped in order to achieve this (this is for a side station that can be added later, not part of the project scope, more later in this talk).
- Superconducting wiggler: we will not be able to procure this from Russia (sanctions), cost estimates assume we will procure this from a less experienced vendor, perhaps with BNL supplying some sub-systems. Bids for this are due in late April.
- Front end: possible cost savings being pursued via a build-to-print contract.
- Beamline and End-Station components – we have commercial budget quotes for components and sub-systems based on the final design (more in Zhong's talk).
- Utilities and protection systems cost estimates based on detailed requirements (Utilities Interface Control Drawings, see website), and a lot of experience.
- Controls and software estimates again based on significant experience.

Labor Resources

From P6 we create a list of required staff, by work group and job category (this is posted on the review website).

This is added to all staffing requirements from other projects and compared to available staffing levels.

We use this for recruitment planning.

At present no recruitment is needed, this will be reviewed as the project progresses, especially where a long term need arises (e.g. beamline technician, or controls engineer).

Resource ID	Resource Name	Sum of FY19	Sum of FY20	Sum of FY21	Sum of FY22
BTAC_HEX3	Building Trades Carpenter - Assigned	0.00	0.01	0.02	0.00
BTAE_HEX3	Building Trades Electrician - Assigned	0.01	1.72	0.20	0.00
BTAP_HEX3	Building Trades Plumber - Assigned	0.00	0.20	0.06	0.00
BTAR_HEX3	Building Trades Riggers - Assigned	0.05	0.07	0.43	0.00
BTU_HEX3	Building Trades Unassigned	0.00	0.09	0.12	0.00
BTUC_HEX3	Building Trades Carpenter - Unassigned	0.00	0.01	0.07	0.00
BTUP_HEX3	Building Trades Plumber - Unassigned	0.00	0.02	0.00	0.00
BTUR_HEX3	Building Trades Riggers - Unassigned	0.00	0.01	0.13	0.00
MO1_HEX3	ME - Survey Engineer	0.09	0.11	0.18	0.00
MO2_HEX3	ME - Survey Technician	0.15	0.17	0.39	0.00
MO3_HEX3	ME - Utility Engineer	0.17	0.20	0.25	0.00
MO4_HEX3	ME - Utility Technician	0.01	0.48	0.33	0.00
MO5_HEX3	ME - Vacuum Engineer	0.40	0.29	0.31	0.00
MO6_HEX3	ME - Vacuum Technician	0.18	0.47	0.74	0.00
MO7_HEX3	Project Engineer	0.11	0.25	0.31	0.08
MPO_ADM_HEX3	MPO Administrative	0.00	0.01	0.00	0.00
MPO_ARC_HEX3	MPO Architect	0.09	0.14	0.00	0.00
MPO_CAM_HEX3	MPO CAM	0.02	0.03	0.00	0.00
MPO_EEP_HEX3	MPO Project Electrical Engineer	0.01	0.02	0.00	0.00
MPO_EI_HEX3	MPO Electrical Inspector	0.03	0.04	0.00	0.00
MPO_MEP_HEX3	MPO Project Mechanical Engineer	0.03	0.06	0.00	0.00
MPO_MGR_HEX3	MPO Manager	0.00	0.01	0.00	0.00
MPO_MI_HEX3	MPO Mechanical Inspector	0.05	0.09	0.00	0.00
MPO_OTH_HEX3	MPO Other Professional	0.00	0.18	0.00	0.00
MPO_SAF_HEX3	MPO Safety Engineer	0.06	0.11	0.00	0.00
MPO_SE_HEX3	MPO Structural Engineer	0.21	0.35	0.00	0.00
MPO_SI_HEX3	MPO Structural Inspector	0.26	0.43	0.00	0.00
NA1_HEX3	Manager	0.48	0.80	0.80	0.51
NA2_HEX3	Administrative	0.07	0.11	0.11	0.03
NA4_HEX3	ES&H Professional	0.20	0.34	0.34	0.08
NA5_HEX3	QA Professional	0.07	0.11	0.17	0.04
NA7_HEX3	IT Professional (Software)	0.02	0.52	1.00	0.00
NB1_HEX3	Project Controls	0.48	0.57	0.57	0.22
NB2_HEX3	Business Ops	0.07	0.11	0.11	0.03
NE1_HEX3	Electrical Engineer	0.56	1.14	0.91	0.00
NE2_HEX3	Electrical Designer	0.28	0.35	0.54	0.01
NE3_HEX3	Electrical Technician	0.21	1.19	1.48	0.00
NE4_HEX3	Controls Engineer	0.52	2.02	0.20	0.01
NO1_HEX3	Mechanical Engineer	1.09	1.19	0.98	0.07
NO2_HEX3	Mechanical Designer	0.62	0.13	0.26	0.00
NO3_HEX3	Mechanical Technician	0.44	1.05	1.23	0.20
NO6_HEX3	ME - D&I Engineer	0.23	0.06	0.05	0.00
NO8_HEX3	ME - Insertion Device Engineer	0.11	0.13	0.35	0.00
NO9_HEX3	ME - Insertion Device Technician	0.11	0.19	0.60	0.00
NS1_HEX3	Scientist	1.18	2.00	2.00	0.51
NS2_HEX3	Assistant/Associate Scientist	0.34	0.23	0.24	0.00
SE5_HEX3	EL - Vacuum Engineer	0.15	0.12	0.11	0.00
TE1_HEX3	EL - D&I Engineer	0.20	0.10	0.12	0.00
TE2_HEX3	EL - D&I Technician	0.15	0.13	0.19	0.00
TE4_HEX3	EL - Insertion Device Engineer	0.21	0.21	0.32	0.00
Grand Total		**9.72**	**18.36**	**16.23**	**1.79**

Risk Register

The risk register is available on the review website.

67 risks identified, with a total value of $7.84M.

25 risks retired, mitigated or avoided, reducing the total risk value by $1.99M. Total now $5.85M.

42 risks remain, with a total value of $5.85M. Average probability 5%, giving an **Expected Monetary Value (EMV) of $430k**.

The most significant risks include the SCW and the Satellite building. The situation regarding the SCW should become clearer when the bids are evaluated (mid-May).

Risk and Contingency Analysis

No contingency funds for the project, only scope contingency
Three methods used to determine scope contingency value (see Contingency Analysis Report).

- Risk Register - $430k (see also "Risk Register" Ref Doc HEX22).
- Risk assessment at WBS level – $2.33M (see "Risk Assessment" Ref Doc HEX21).
- Estimate uncertainty – $2.60M

Weighted scope contingency required – $1.1M….
Therefore need to identify savings or scope contingency items in excess of this value:

We hope to save money on the Front Ends and SCW through possible build-to-print contract and cost savings once the SCW bids are evaluated.

Item	WBS	Value	Decision date	Mitigation or consequence
End station fit-out	7.05.03.03	$1,61M	Jan-2020	Use existing equipment from NSLS
Controls (DAMA) descoping	7.05.06.02	$100k	Aug-2020	Less software functionality
Total		$1.7M		

Recommendations from Previous Reviews

	POB Review	BAT Meeting	CDR	PDR
Closed	27	14	8	15
Ongoing	2	8	-	14
Open	-	2	-	1
Total	**29**	**24**	**8**	**30**

70% closed

Open items include: crane for end station, and visits to other facilities for Zhong.

Ongoing items include: a number relating to the End Station / Detectors / Software which will be addressed in the near future, plus some relating to community development.

Transition to Operations

Activity	Date	Involves	Funding
IRR preparation	Nov-2021	CAMs	Project
IRR	Dec-2021	CAMs	Project
IRR closeout	Dec-2021	CAMs, as needed	Project
First light	Jan 2022	BL Staff	Project
Monochromatic photons on sample	Feb 2022	BL Staff	Project
End of Project	Feb 2022		
Technical commissioning	Mar-Jun 2022	BL Staff	NSLS-II Ops
Science Commissioning	Jul-Oct 2022	Selected Users	NSLS-II Ops
User Operations	Nov 2022	General Users + NYSERDA Users	NSLS-II Ops

Management WBS 7.05.01

Performance of management and support activities, including labor, materials, travel, and fixed costs associated with management and support functions, consisting of;

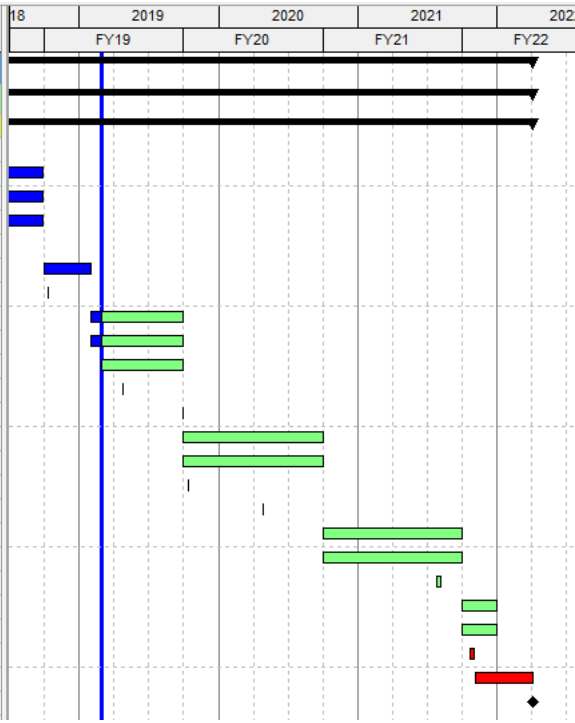
- Beamline Lead Scientist and Scientist
- Project / Construction management, including Liaison Engineers,
- Administrative support,
- ES&H,
- QA,
- Configuration management,
- Business operations,
- Project controls, and
- Document control.

WBS	WBS Name	Resource Type	Budgeted Cost
7.05.01	**HEX Management**	Labor	$4,005,603
		Nonlabor	$994,398
Grand Total			**$5,000,001**

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

Management WBS 7.05.01

Activity ID	Activity Name	Original Duration	Activity % Complete	Start	Finish	Budgeted Labor Units	Budgeted Nonlabor Units	Budgeted Total Cost
HEX Partner Beamline Rate Update		1145		31-Aug-17 A	04-Apr-22	23076	991782	$5,000,000
HEX Beamline		1145		31-Aug-17 A	04-Apr-22	23076	991782	$5,000,000
HEX Management		1145		31-Aug-17 A	04-Apr-22	23076	991782	$5,000,000
HEX10000	HEX - Project Start	0	100%	31-Aug-17 A		0	0	$0
HEX10005	Actuals thru Sep-18	249	100%	02-Oct-17 A	28-Sep-18 A	0	732646	$732,646
HEX10010	HEX - Project Scientist FY18	249	100%	02-Oct-17 A	28-Sep-18 A	0	0	$0
HEX10020	HEX - Project Management and Support FY18	249	100%	02-Oct-17 A	28-Sep-18 A	0	0	$0
HEX10030	HEX - BAT Meeting No. 1	1	100%	24-Oct-17 A	24-Oct-17 A	0	0	$0
HEX10006	Actuals Oct-18 thru Jan-19	82	100%	01-Oct-18 A	31-Jan-19 A	0	250136	$250,136
HEX17340	HEX - BAT Meeting No. 2	1	100%	11-Oct-18 A	11-Oct-18 A	0	0	$0
HEX10050	HEX - Project Scientist FY19	168	11.31%	01-Feb-19 A	30-Sep-19	1183	0	$198,412
HEX10060	HEX - Project Management and Support FY19	168	11.31%	01-Feb-19 A	30-Sep-19	2912	0	$481,063
HEX17700	HEX - Second Project Scientist Part FY19	149	0%	01-Mar-19*	30-Sep-19	1026	0	$172,080
HEX10070	HEX - Status Review 1	1	0%	24-Apr-19	24-Apr-19	0	0	$0
HEX10100	HEX - Status Review 2	1	0%	01-Oct-19	01-Oct-19	0	0	$0
HEX10080	HEX - Project Scientist FY20	251	0%	01-Oct-19	30-Sep-20	3520	0	$608,083
HEX10090	HEX - Second Project Scientist Part FY19	251	0%	01-Oct-19	30-Sep-20	4059	0	$687,517
HEX10110	HEX - BAT Meeting No. 3	1	0%	15-Oct-19	15-Oct-19	0	2000	$2,813
HEX10120	HEX - BAT Meeting No. 4	1	0%	28-Apr-20	28-Apr-20	0	2000	$2,813
HEX10130	HEX - Project Scientist FY21	250	0%	01-Oct-20	30-Sep-21	3520	0	$626,326
HEX10140	HEX - Project Management and Support FY21	250	0%	01-Oct-20	30-Sep-21	4248	0	$733,306
HEX10170	HEX - IRR Review for FE, Hutches, ID	10	0%	26-Jul-21	06-Aug-21	0	0	$0
HEX10150	HEX - Project Scientist FY22	60	0%	01-Oct-21	30-Dec-21	882	0	$161,645
HEX10160	HEX - Project Management and Support FY22	60	0%	01-Oct-21	30-Dec-21	1022	0	$181,168
HEX10180	HEX - IRR Review Final	10	0%	20-Oct-21	02-Nov-21	0	5000	$5,990
HEX10190	HEX - Schedule and Cost Contingency	100	0%	05-Nov-21	04-Apr-22	704	0	$156,003
HEX10200	HEX - Project Complete	0	0%		04-Apr-22*	0	0	$0



Design WBS 7.05.02

7.5.02.03 Final Integrated Design (example – PDR, CDR are similar).
Final design and analysis of the integrated beamline optical system and the integrated end station(s), including appropriate simulations and x-ray ray tracing necessary to deliver the sought photon beam parameters. Safety write-up with a detailed listing and discussion of the hazards present in the full beamline project as part of the FDR report. X-ray radiation shielding calculations for all enclosures and transport pipe (these may have to be re-run as the final designs of the enclosures and transport pipe are completed. Completion of this activity allows all remaining procurement activities to commence.
Deliverable: completion and satisfactory review of the final design report by a team of experts.

WBS	WBS Name	Resource Type	Budgeted Cost
7.05.02.01	**HEX Conceptual Design**	Nonlabor	$14,782
7.05.02.02	**HEX Preliminary Design**	Labor	$0
		Nonlabor	$125,180
7.05.02.03	**HEX Final Design**	Labor	$59,641
		Nonlabor	$266,738
Grand Total			**$466,341**

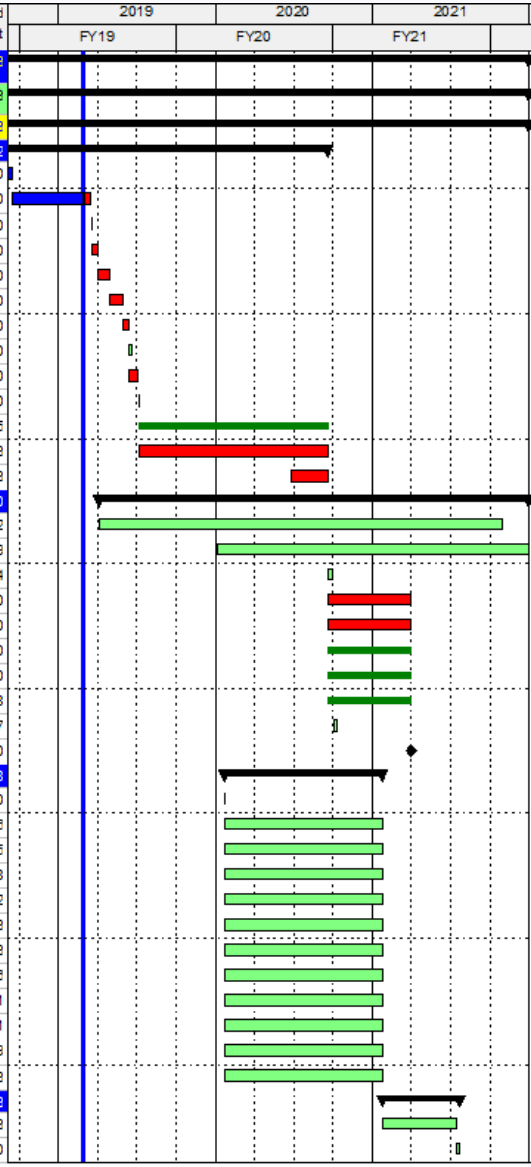
Photon Delivery System and End Station WBS 7.05.03

WBS	WBS Name	Resource Type	Budgeted Cost
7.05.03.01	**HEX Photon Delivery System Procurement and Fabrication**	Nonlabor	$3,610,611
7.05.03.02	**HEX Photon Delivery System Installation and Test**	Labor	$1,143,262
		Nonlabor	$2,927
7.05.03.03	**HEX End Station Procurement and Fabrication**	Nonlabor	$1,800,497
7.05.03.04	**HEX End Station Installation and Test**	Labor	$49,923
Grand Total			**$6,607,220**

7.5.03.01 Photon Delivery System Final Detailed Specification, Procurement, Detailed Design and Fabrication (example). 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.
Deliverable: complete photon delivery system, delivered to NSLS-II site.

Photon Delivery System and End Station WBS 7.05.03

Activity ID	Activity Name	Original Duration	Activity % Complete	Start	Finish	Budgeted Labor Units	Budgeted Nonlabor Units	Budgeted Total Cost
HEX Partner Beamline Rate Update		874		02-Jul-18 A	30-Dec-21	9765	4923657	$6,607,223
HEX Beamline		874		02-Jul-18 A	30-Dec-21	9765	4923657	$6,607,223
HEX Beamline Construction		874		02-Jul-18 A	30-Dec-21	9765	4923657	$6,607,223
HEX Photon Delivery System Procurement and Fabrication		555		02-Jul-18 A	17-Sep-20	0	3312007	$3,610,612
HEX12000	Photon Delivery System Delay Due to Funding Profile - 6M	52	100%	02-Jul-18 A	13-Sep-18 A	0	0	$0
HEX12040	Prepare Procurement Documentation	123	50%	14-Sep-18 A	15-Mar-19	0	0	$0
HEX12050	Accept Req at PPM	1	0%	18-Mar-19	18-Mar-19	0	0	$0
HEX12060	Prepare and submit RFP	10	0%	19-Mar-19	01-Apr-19	0	0	$0
HEX12070	Receive Proposals	20	0%	02-Apr-19	29-Apr-19	0	0	$0
HEX12080	Evaluate Proposals	20	0%	30-Apr-19	28-May-19	0	0	$0
HEX12090	Negotiate with Offerors	10	0%	29-May-19	11-Jun-19	0	0	$0
HEX12010	HEX - Review Scope and Budget Prior to Mono and Non Optic	5	0%	12-Jun-19	18-Jun-19	0	0	$0
HEX12100	Prepare &Approve Contract Package	17	0%	12-Jun-19	05-Jul-19	0	0	$0
HEX12110	Contract Award	1	0%	08-Jul-19	08-Jul-19	0	0	$0
HEX12020	HEX - PDR, Status and FAT visits to Vendors	301	0%	09-Jul-19	17-Sep-20	0	30000	$42,005
HEX12130	PDS Procurement and Fabrication	301	0%	09-Jul-19	17-Sep-20	0	3080907	$3,343,593
HEX12030	Procure Vacuum Pump and Gauge Controllers and Cables (12	60	0%	24-Jun-20	17-Sep-20	0	201100	$225,013
HEX Photon Delivery System Installation and Test		687		03-Apr-19	30-Dec-21	9285	2500	$1,146,190
HEX12340	HEX - Engineering and Installation Oversight	647	0%	03-Apr-19	29-Oct-21	3865	0	$521,132
HEX12350	HEX - Beamline Technician Effort	500	0%	02-Jan-20	30-Dec-21	2988	0	$308,449
HEX12360	Special White Beam Shutters Installation and Testing	10	0%	18-Sep-20	01-Oct-20	60	0	$7,394
HEX12410	Non-optics components Installation and Testing	131	0%	18-Sep-20	31-Mar-21	0	0	$0
HEX12420	Laue mono Installation and Testing	131	0%	18-Sep-20	31-Mar-21	0	0	$0
HEX12370	HEX - Photon Delivery System Installation and Test Labor	131	0%	18-Sep-20	31-Mar-21	1584	0	$203,260
HEX12380	Additional Rigger Hours	131	0%	18-Sep-20	31-Mar-21	748	0	$97,360
HEX12390	HEX - EEI Labor for Electrical Inspection	131	0%	18-Sep-20	31-Mar-21	40	0	$5,668
HEX12400	HEX - PPE Costs (Safety shoes, Glasses etc)	5	0%	02-Oct-20	08-Oct-20	0	2500	$2,927
HEX12430	HEX - All Beamline components testing complete	0	0%		31-Mar-21	0	0	$0
HEX End Station Procurement and Fabrication		251		22-Jan-20	21-Jan-21	0	1609150	$1,800,498
HEX12440	Order End Station Components	1	0%	22-Jan-20	22-Jan-20	0	0	$0
HEX12450	Procure Beam conditioning table, Imaging and EDXD detector	250	0%	23-Jan-20	21-Jan-21	0	307000	$343,506
HEX12445	Procure KB-Mirror	250	0%	23-Jan-20	21-Jan-21	0	400000	$447,565
HEX12470	Procure Lead scatter shield (wall)	250	0%	23-Jan-20	21-Jan-21	0	12600	$14,098
HEX12500	Procure Sample table and stages. EDXD 2-theta arm and two s	250	0%	23-Jan-20	21-Jan-21	0	273321	$305,822
HEX12510	Procure Small misc parts for E/S (optics hardware, sample holc	250	0%	23-Jan-20	21-Jan-21	0	25000	$27,973
HEX12520	Procure Imaging Detectors (X-Ray Converter, Lens attachment,	250	0%	23-Jan-20	21-Jan-21	0	310000	$346,863
HEX12530	Procure ADXD Flat Panel detector, Frame Grabber	250	0%	23-Jan-20	21-Jan-21	0	112007	$125,326
HEX12590	Procure EDXD Ge single element detector (eg Canberra)	250	0%	23-Jan-20	21-Jan-21	0	36000	$40,281
HEX12610	Procure EDXD Ge multi element detector (Siddons design)	250	0%	23-Jan-20	21-Jan-21	0	100000	$111,891
HEX12620	Procure Beam Stop	250	0%	23-Jan-20	21-Jan-21	0	10000	$11,189
HEX17910	Procure MCA for EDXD Detector	250	0%	23-Jan-20	21-Jan-21	0	23222	$25,983
HEX End Station Installation and Test		125		22-Jan-21	20-Jul-21	480	0	$49,923
HEX12630	G Endstation & Detector Installation and Testing Placeholder	120	0%	22-Jan-21	13-Jul-21	480	0	$49,923
HEX12640	HEX - All End Station Installation & Testing Complete	5	0%	14-Jul-21	20-Jul-21	0	0	$0



Hutches WBS 7.05.04.01

Design, specification, procurement, fabrication, assembly, installation, and testing of the required radiological enclosures, including the necessary hoist, air handling equipment, fans, labyrinths, doors, windows, and lights. Scope includes A, C, D, E, F hutches.
B-hutch descoped prior to contract placement for budget reasons in Jan 2019.

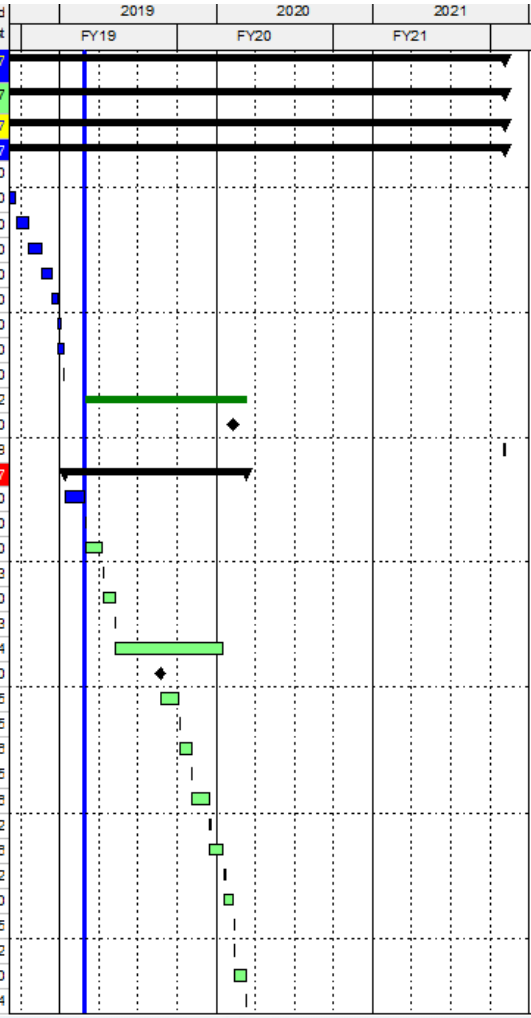
This also includes filing of as-built drawings and preparation for the IRR.

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

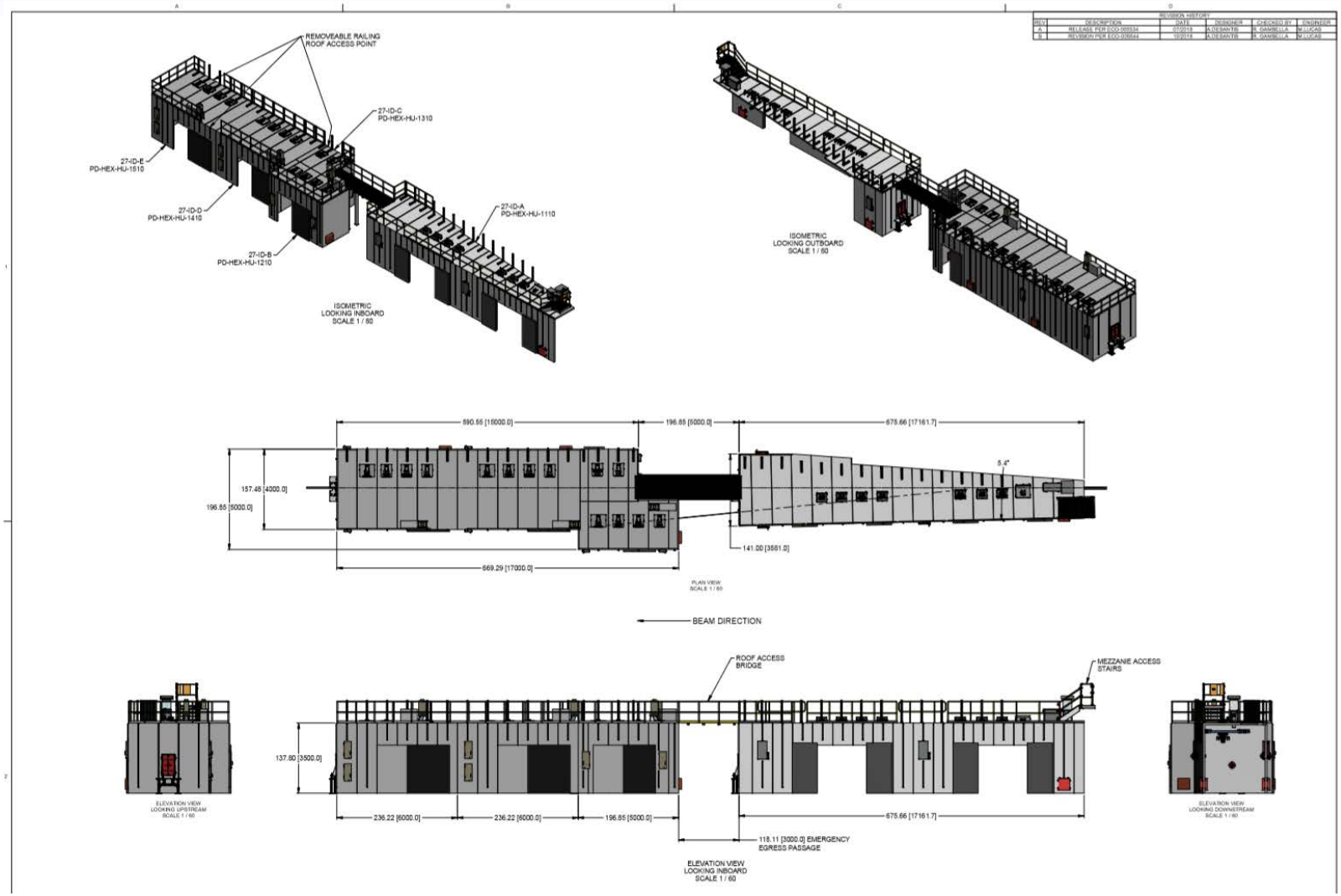
WBS	WBS Name	Resource Type	Budgeted Cost
7.05.04.01	**HEX Hutches**	Labor	$23,341
7.05.04.01.01	**Hutches Procurement**	Labor	$10,067
		Nonlabor	$2,023,401
Grand Total			**$2,056,809**

Hutches WBS 7.05.04.01

Activity ID	Activity Name	Original Duration	Activity % Complete	Start	Finish	Budgeted Labor Units	Budgeted Nonlabor Units	Budgeted Total Cost
HEX Partner Beamline Rate Update		902		02-Apr-18A	04-Nov-21	244	1808364	$2,056,807
HEX Beamline		902		02-Apr-18A	04-Nov-21	244	1808364	$2,056,807
HEX Beamline Infrastructure		902		02-Apr-18A	04-Nov-21	244	1808364	$2,056,807
HEX Hutches		902		02-Apr-18A	04-Nov-21	244	1808364	$2,056,807
HEX13000	HEX - Hutches Procurement Documentation	83	100%	02-Apr-18A	27-Jul-18 A	0	0	$0
HEX13010	HEX - PPM Accepts & pins Req	11	100%	04-Sep-18 A	18-Sep-18 A	0	0	$0
HEX13020	HEX - Prepare and Submit RFP	21	100%	19-Sep-18 A	18-Oct-18 A	0	0	$0
HEX13030	HEX - Receive Proposal	20	100%	19-Oct-18A	19-Nov-18 A	0	0	$0
HEX13040	HEX - Evaluate Proposals	15	100%	19-Nov-18 A	11-Dec-18 A	0	0	$0
HEX13050	HEX - Negotiate with Offerors	10	100%	12-Dec-18 A	26-Dec-18 A	0	0	$0
HEX13060	HEX - Review Scope and Budget Prior to Hutches Contract	5	100%	27-Dec-18 A	03-Jan-19 A	0	0	$0
HEX13070	HEX - Prepare & Approve Contract package	9	100%	27-Dec-18 A	09-Jan-19 A	0	0	$0
HEX13080	HEX - Contract Award	1	100%	10-Jan-19A	10-Jan-19 A	0	0	$0
HEX13090	HEX - Hutch Design Reviews and Contractor Document Filing	257	0%	01-Mar-19	10-Mar-20	144	0	$18,942
HEX13100	HEX - All Hutches Acceptance Testing Complete	0	0%		07-Feb-20	0	0	$0
HEX13110	HEX - HU Beam Commissioning	2	0%	03-Nov-21	04-Nov-21	24	0	$4,399
Hutches Procurement		290		11-Jan-19A	10-Mar-20	76	1808364	$2,033,467
HEX13120	HEX - Hutch Manufacturing Program Plan	33	100%	11-Jan-19A	28-Feb-19 A	0	0	$0
HEX13210	HEX - Hutch Milestone Payment for Mfg Prog Plan	1	0%	01-Mar-19	01-Mar-19	0	18000	$20,140
HEX13140	HEX - Hutch Preliminary Design Review	27	0%	01-Mar-19	08-Apr-19	0	0	$0
HEX13150	HEX - Hutch Milestone Payment for PDR	1	0%	09-Apr-19	09-Apr-19	0	269300	$301,323
HEX13160	HEX - Hutch Final Design Review	21	0%	10-Apr-19	08-May-19	0	0	$0
HEX13170	HEX - Hutch Milestone Payment for FDR	1	0%	09-May-19	09-May-19	0	269300	$301,323
HEX13180	HEX - Hutch Manufacturing Lead Time	172	0%	10-May-19	17-Jan-20	28	0	$3,684
HEX13250	Hutch Delivery Start Milestone	0	0%	22-Aug-19		0	0	$0
HEX13190	HEX - Hutch A Completion of Installation	31	0%	22-Aug-19	04-Oct-19	12	0	$1,565
HEX13260	HutchA Acceptance Payment	1	0%	07-Oct-19	07-Oct-19	0	359067	$401,765
HEX17720	HEX - Hutch E Completion of Installation	19	0%	07-Oct-19	01-Nov-19	12	0	$1,606
HEX17750	Hutch E Acceptance Payment	1	0%	04-Nov-19	04-Nov-19	0	136262	$152,465
HEX17730	HEX - Hutch D Completion of Installation	27	0%	04-Nov-19	13-Dec-19	12	0	$1,606
HEX17760	Hutch D Acceptance Payment	1	0%	16-Dec-19	16-Dec-19	0	179533	$200,882
HEX17740	HEX - Hutch C Completion of Installation	23	0%	16-Dec-19	17-Jan-20	12	0	$1,606
HEX17780	Hutch C Acceptance Payment	1	0%	21-Jan-20	21-Jan-20	0	179533	$200,882
HEX13220	HEX - Hutch Instalation of Lead Parts for F hutch	14	0%	21-Jan-20	07-Feb-20	0	0	$0
HEX17790	Hutch F Acceptance Payment	1	0%	10-Feb-20	10-Feb-20	0	136262	$152,465
HEX17920	HEX - Amendments to Hutch Contract	1	0%	10-Feb-20	10-Feb-20	0	12031	$13,462
HEX13240	HEX Hutch Training and Documentation	19	0%	11-Feb-20	09-Mar-20	0	0	$0
HEX13200	HEX - Hutch Acceptance Testing and training Complete - Final	1	0%	10-Mar-20	10-Mar-20	0	249076	$278,694

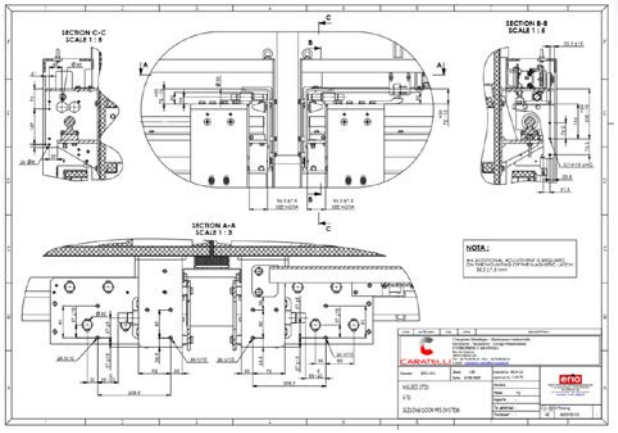


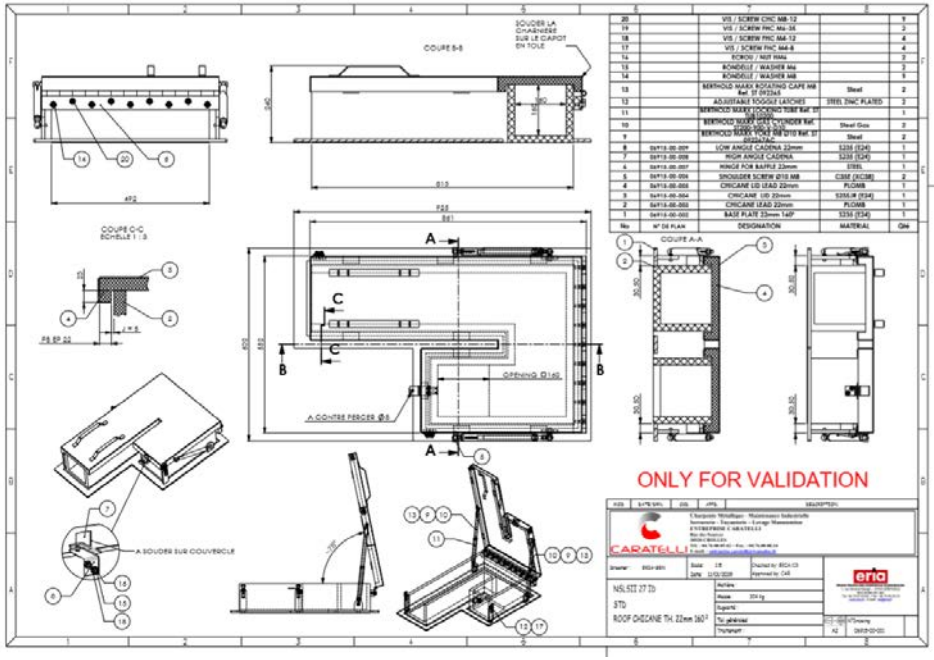
Hutches Procurement Drawing

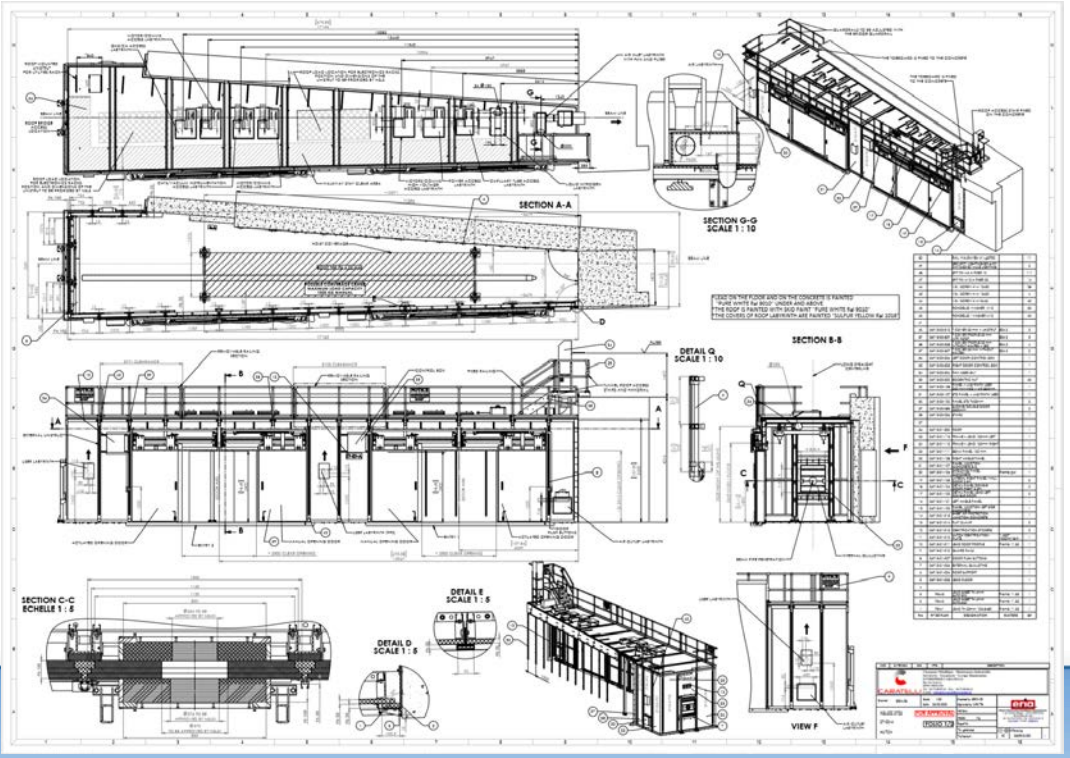


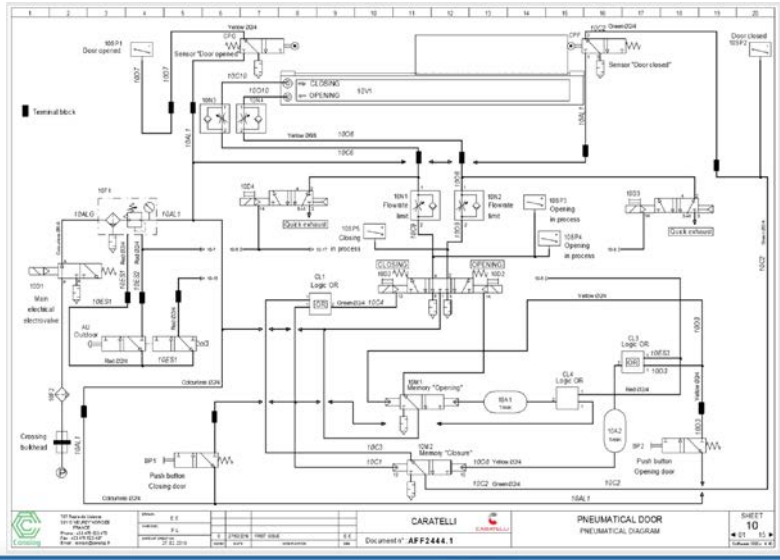
Hutch Design Development

Contract PDR 11-April









Summary

Scope is well understood, and is feasible within the budget, although the lack of cost contingency is a concern; we cannot allow costs to grow, and the project requires careful management of costs.

Designs have progressed well, and we are at least as advanced as any previous beamline project at NSLS-II for the FDR. This is well documented in the Final Design Report.

We are appropriately positioned, after the review closeout, to continue with procurements.

We anticipate making design adjustments and improvements, in-house, or in conjunction with vendors, for the remainder of the construction project.

An experienced project team is in place ready to commence construction.