Advanced Photon Source Upgrade Update

George Srajer

APS Users Monthly Meeting
October 31, 2012

U.S. DEPARTMENT OF ENERGY | Office of Science

Outline

- Recent Major Review
  - October 16-18: Independent Cost Estimate/Independent Cost Review
- Preparation for the Upcoming Major Review
  - December 4-6: DOE CD-2 Baseline Review
  - Preliminary Design Report Milestones
  - Practice Talks

Independent Cost Estimate/Cost Review

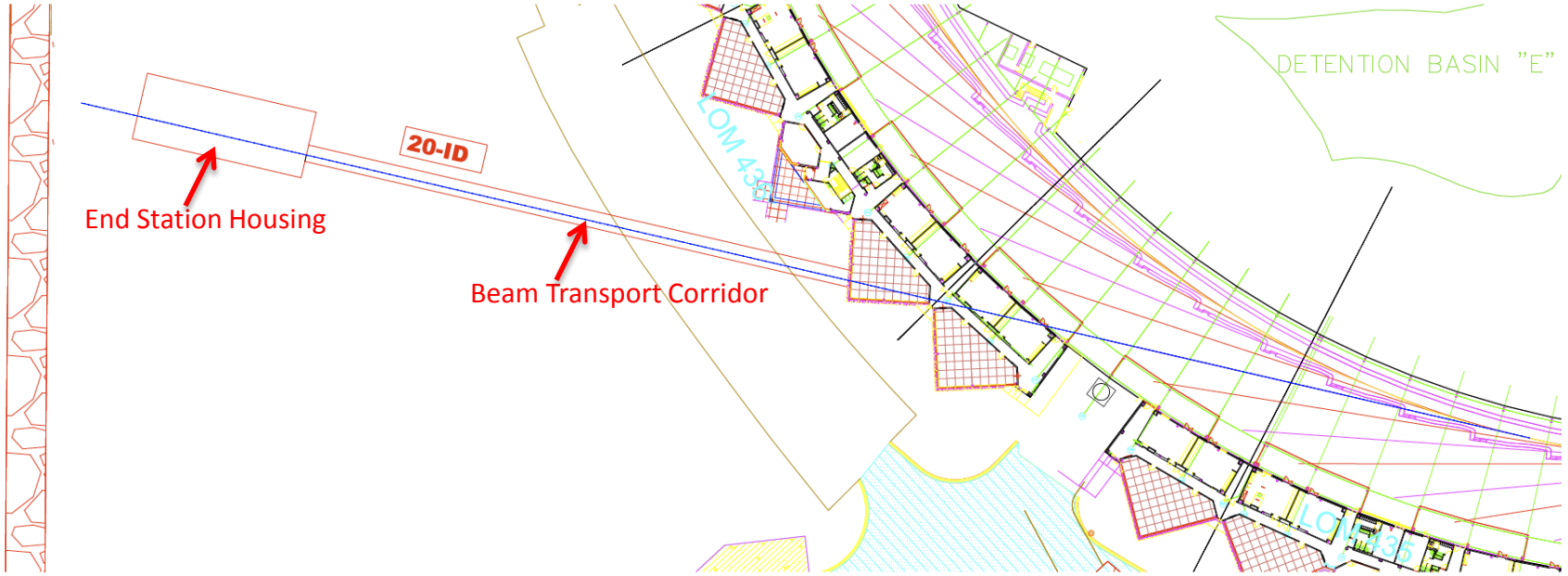
- Date: October 16-18
- Part I: Independent Cost Estimate (ICE)
  - Conventional Facilities
  - Enclosures
  - Control Rooms
- Part II: Independent Cost Review (ICR)
  - ~ 50% of Project Scope
  - ~ 70% of Project Schedule
- Draft Report on November 13

ICE Review Team

- RICK BLAISDELL, DOE APM, ICE Team Lead
- Scott Dam, MENG, MBA, P.E. - Legin Group Consultant
- Larry Harrod – US Cost
- Ian Sullivan, PMP – MPR
- William S. Turner, BS, MS, PG - Legin Group Consultant
- Mark Cunnigham – US Cost
- John White – DOE

Physical Infrastructure - Wide-Field Imaging Beamline (WBS U1.05.03.01)

- A 250-m-long beamline with two end stations in an external building.
- Provide a new (~ 4800 sq. ft.) hi-bay structure to house the end stations for the new beamline and a 100-m-long beam transport utility corridor.
- Preliminary design was completed. Consulting firms helped with HVAC, Geotechnical, Architectural, and Cost estimation services.

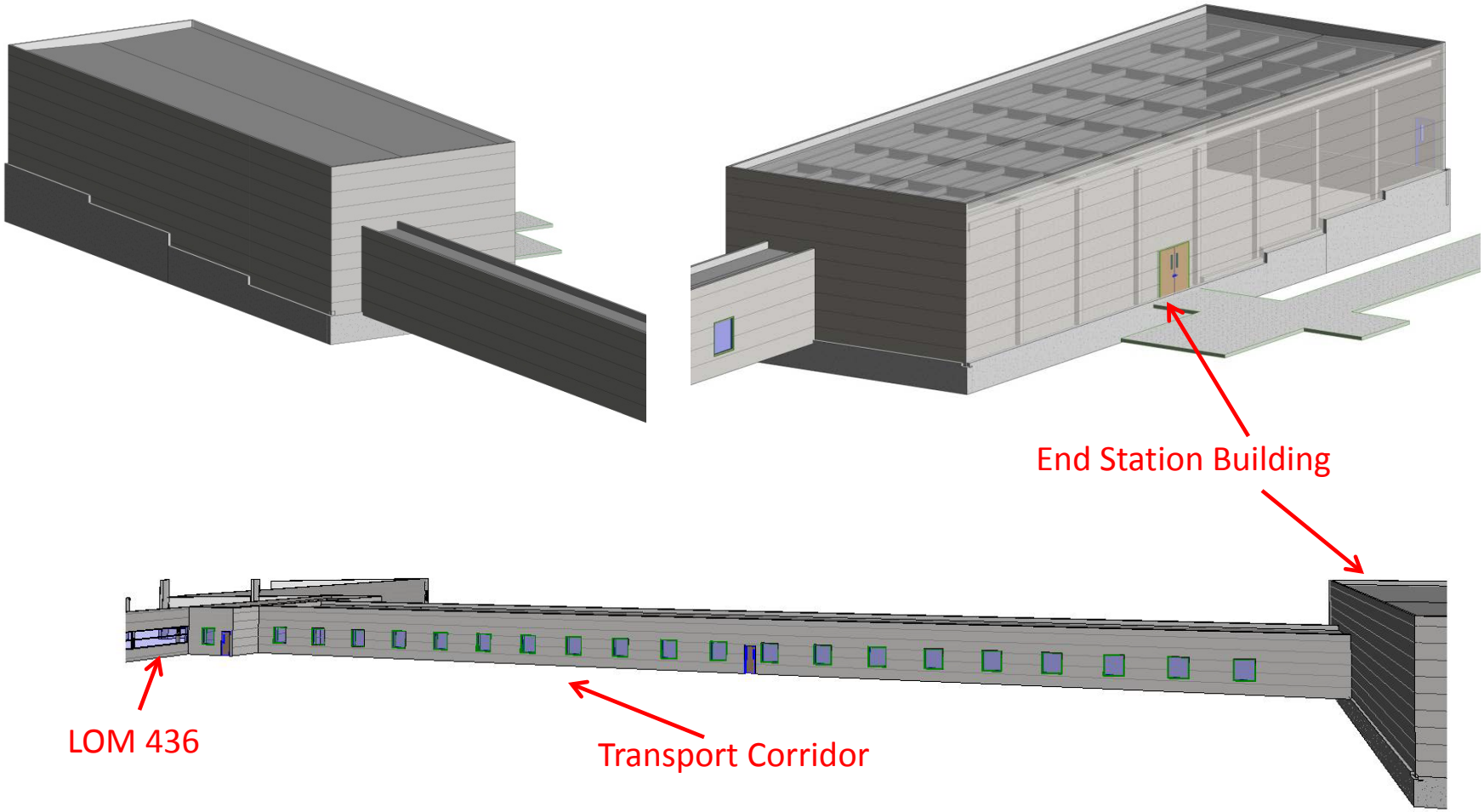


Wide Field Imaging: Overview of Scope Of Work

There are several distinct components to the Conventional Facilities aspects of this APS-U Project:

- Work inside the Experiment Hall Building
- Modification to the Lab Office Module (LOM 436 Building)
- Site Work (Parking, Roadways, Drainage)
- Beam Transport/ Utility Corridor
- End Station Building
- Engineering Design by APS-SO and Outside Consultants

Wide Field Imaging: Isometric Views



Scope – Technical Components

10/10/2012 WBS	APS-U Target WBS Elements for Detailed Review Description		RSL Estimate	Reviewer
U1-1.01	**Project Management & Planning**		**$31,233,107**	
U1-1.01.01.01	Project Management and Administration	$	9,294,631.36	Scott/Ian
U1-1.01.01.03	Project Controls/EV Support	$	8,775,563.48	Scott/Ian
U1-1.01.01.06	Systems Integration & Management	$	4,168,391.12	Scott/Ian
U1-1.02	**Research and Development**		**$14,373,455**	
U1-1.02.01.03	Short Pulse X-Ray (SPX) R&D	$	11,760,004	Bill
U1-1.03	**Accelerator Systems**		**$71,376,627**	
U1-1.03.02.02	Beam Stability	$	7,539,538	Scott
U1-1.03.03.10	Mechanical Systems Infrastructure	$	9,688,388	Scott
U1-1.03.03.12	Cavity & Cryomodule JLAB	$	6,944,112	Scott
U1-1.03.04.04	Revolver Undulator	$	5,822,804.00	Bill
U1-1.04	**Experiment Facilities – Beamlines**		**$115,488,872**	
U1-1.04.02.03	Short Pulse X ray Imaging & Microscope	$	9,107,079	Bill
U1-1.04.02.05	Wide Field Imaging	$	12,216,129	Bill
U1-1.04.02.07	In situ Nanoprobe	$	13,256,860	Bill
U1-1.04.02.10	High Energy X-Ray Diffraction	$	9,002,193.00	Bill
U1-1.04.02.11	X-Ray Interface Science	$	14,064,773	Bill
U1-1.04.02.13	Advanced Spectroscopy & LERIX	$	8,358,995	Bill
U1-1.05	**Infrastructure & Enabling**		**$30,871,794**	
U1-1.05.02.02	Front End for High Heat Load In Line Undulators	$	4,189,702	Bill
U1-1.05.02.03	Front End for Canted Undulators (CUFE)	$	3,955,164.00	Bill
	Total of Selected WBS Elements	**$**	**138,144,326.00**	
	Percentage of Total		52.5%	
	Grand Project Estimate	**$**	**263,343,853.00**	
	Note: Ian will support WBS element reviews as available			

Scope: U1.03.04.04 - Revolver Undulator

- The scope of this WBS area is to construct, tune, install, and make functional five (5) complete revolver undulator systems.

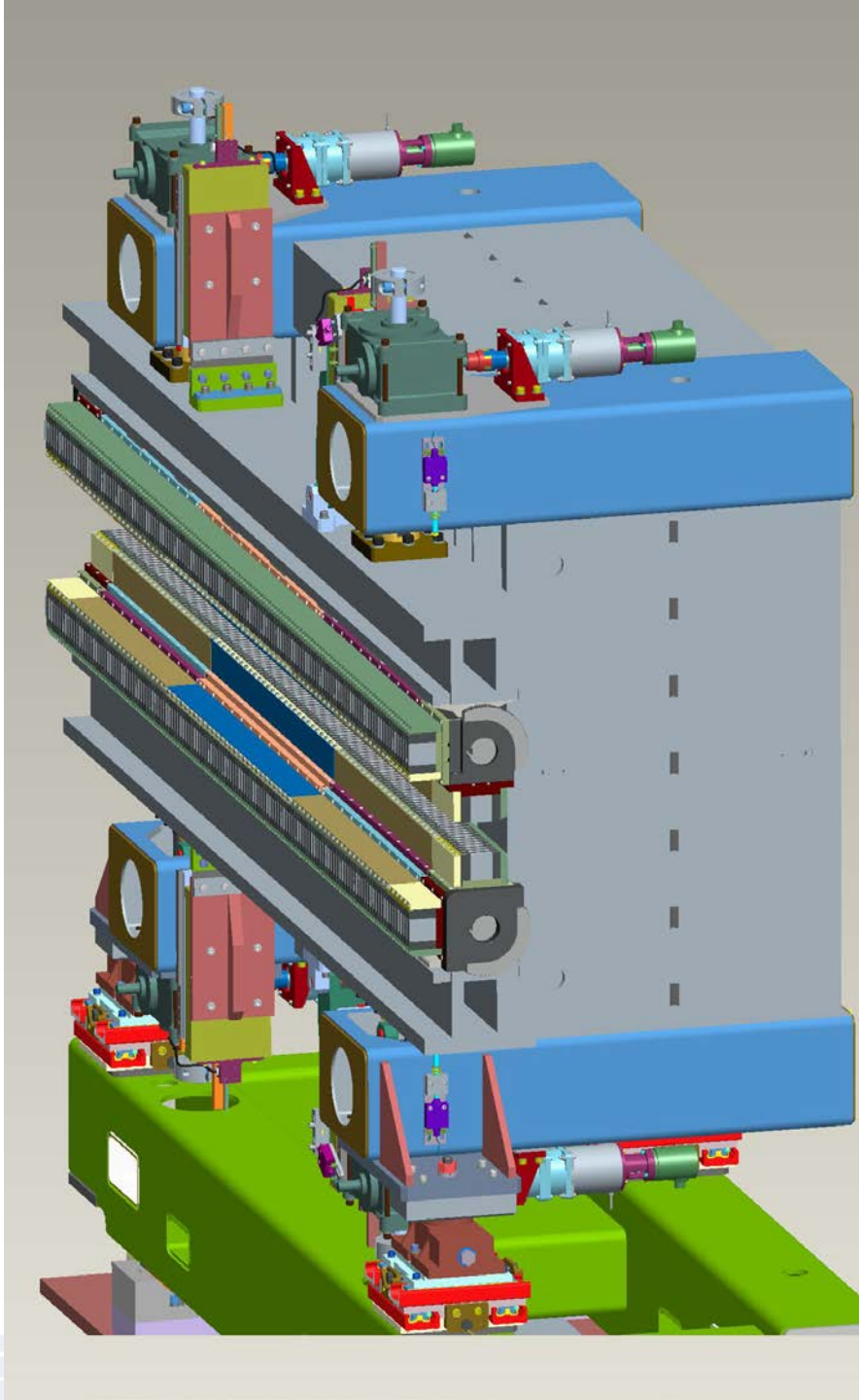
- U1.03.04.04.01 Magnetic Structures
- U1.03.04.04.02 Revolver Supports
- U1.03.04.04.03 Controls & Cabling
- U1.03.04.04.04 Integration & Installation - Revolver Undulators

- Ongoing design and prototyping of the revolver undulator are not APS Upgrade Project activities;

- APS Upgrade will adopt the successful design after review.

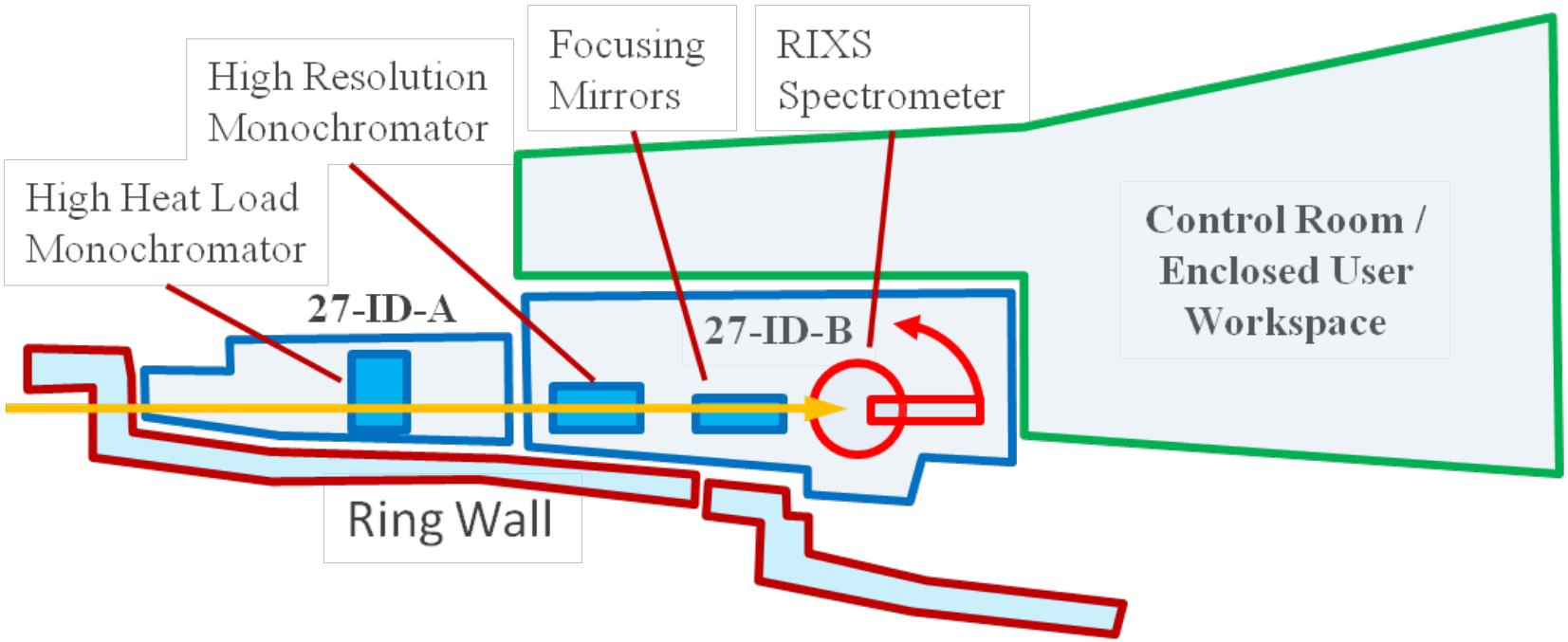
Scope: Revolver Undulator

- A revolver undulator is two undulators in one.
- Revolvers allow the user to remotely select either of two different magnetic structures available in the device.
- Each structure is optimized for a specific requirement or in order to cover a given spectral range with higher average brightness than would be possible with a single device.



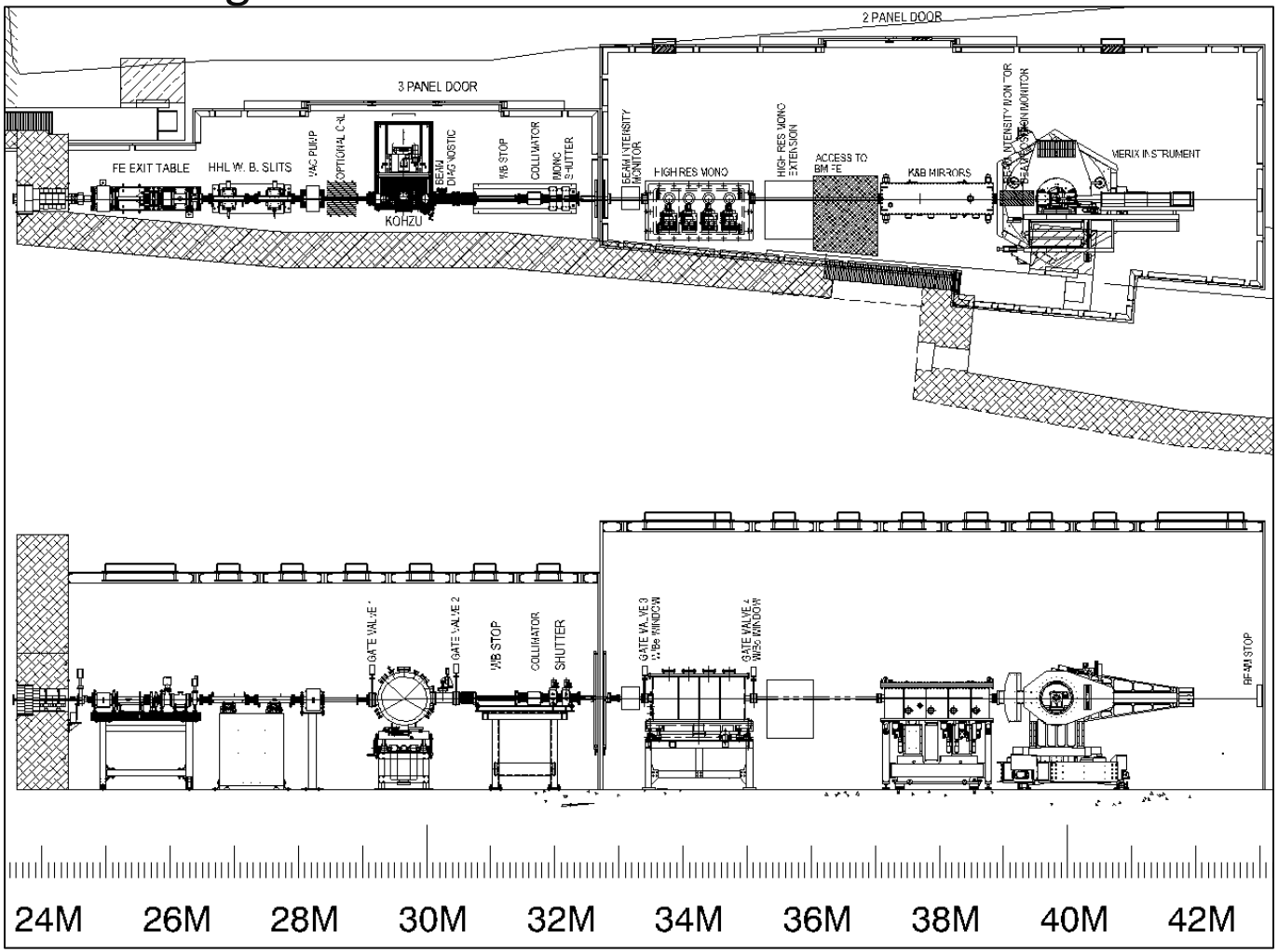
Experimental Facilities Design

- RIXS as an example: Conceptual design as of CD-1



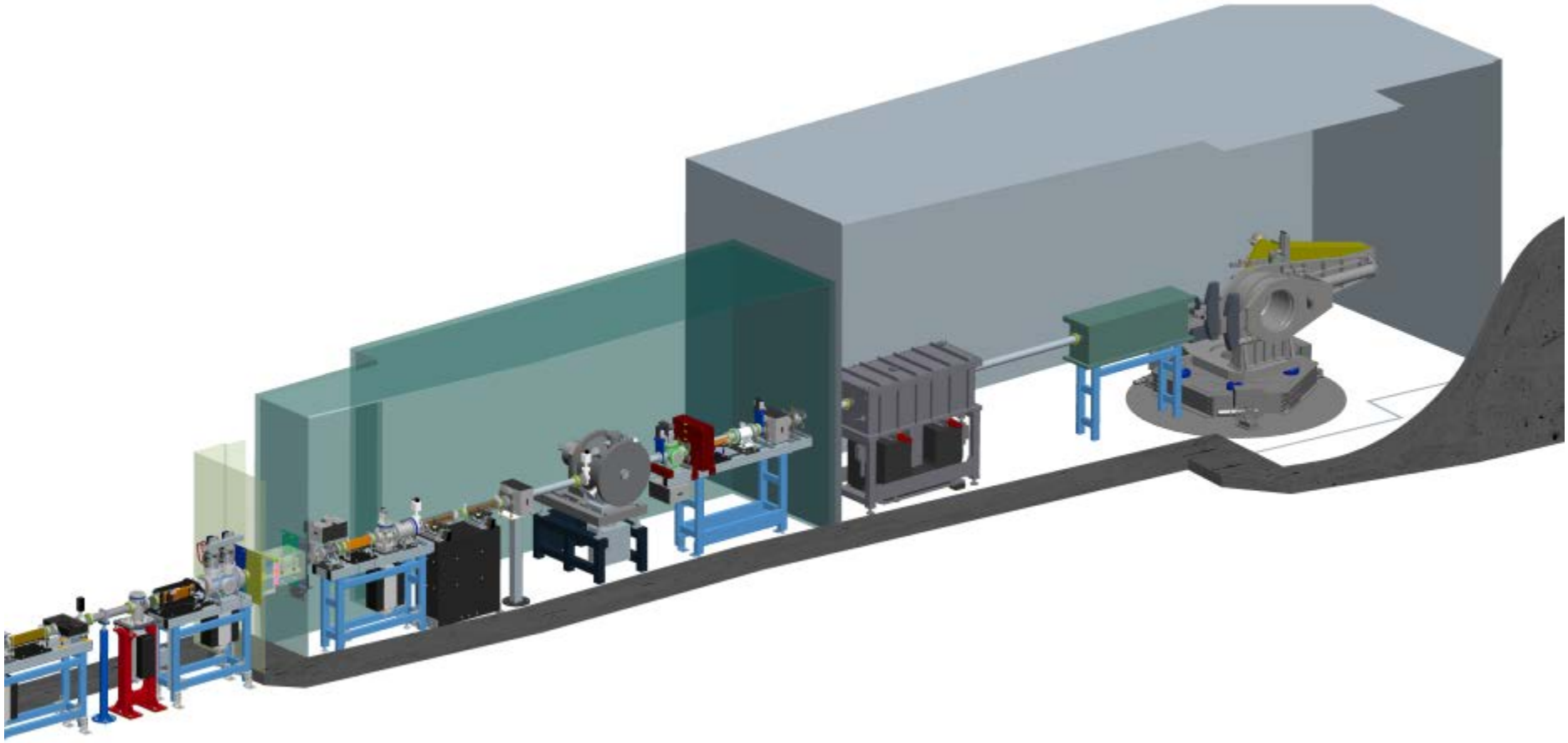
Experimental Facilities Design

- RIXS as an example: Detailed beamline design, preliminary component design

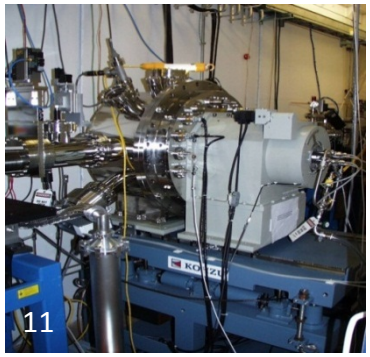


Experimental Facilities Design

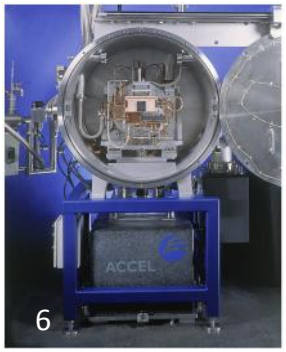
- RIXS as an example: Putting it all together.



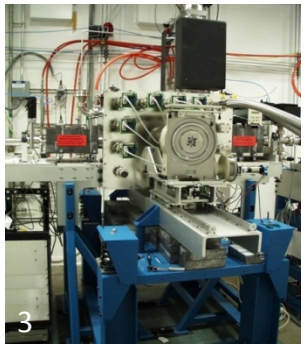
Monochromator Designs Currently in Use



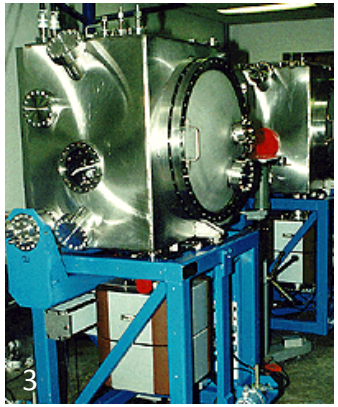
Kohzu Design



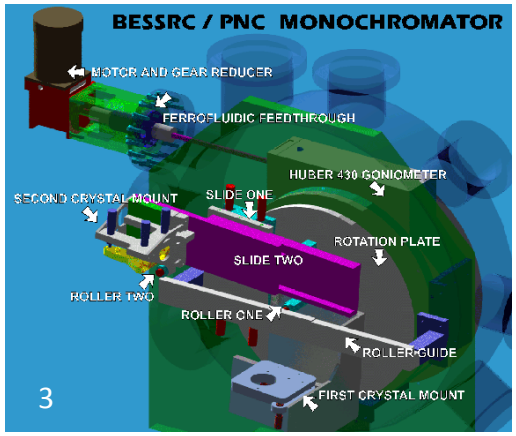
Accel Design



Rosenbaum Design

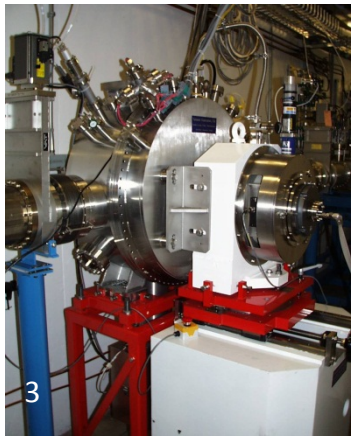


PSL / U Wisconsin



BESSRC Design

FMB Oxford



VG/Daresbury

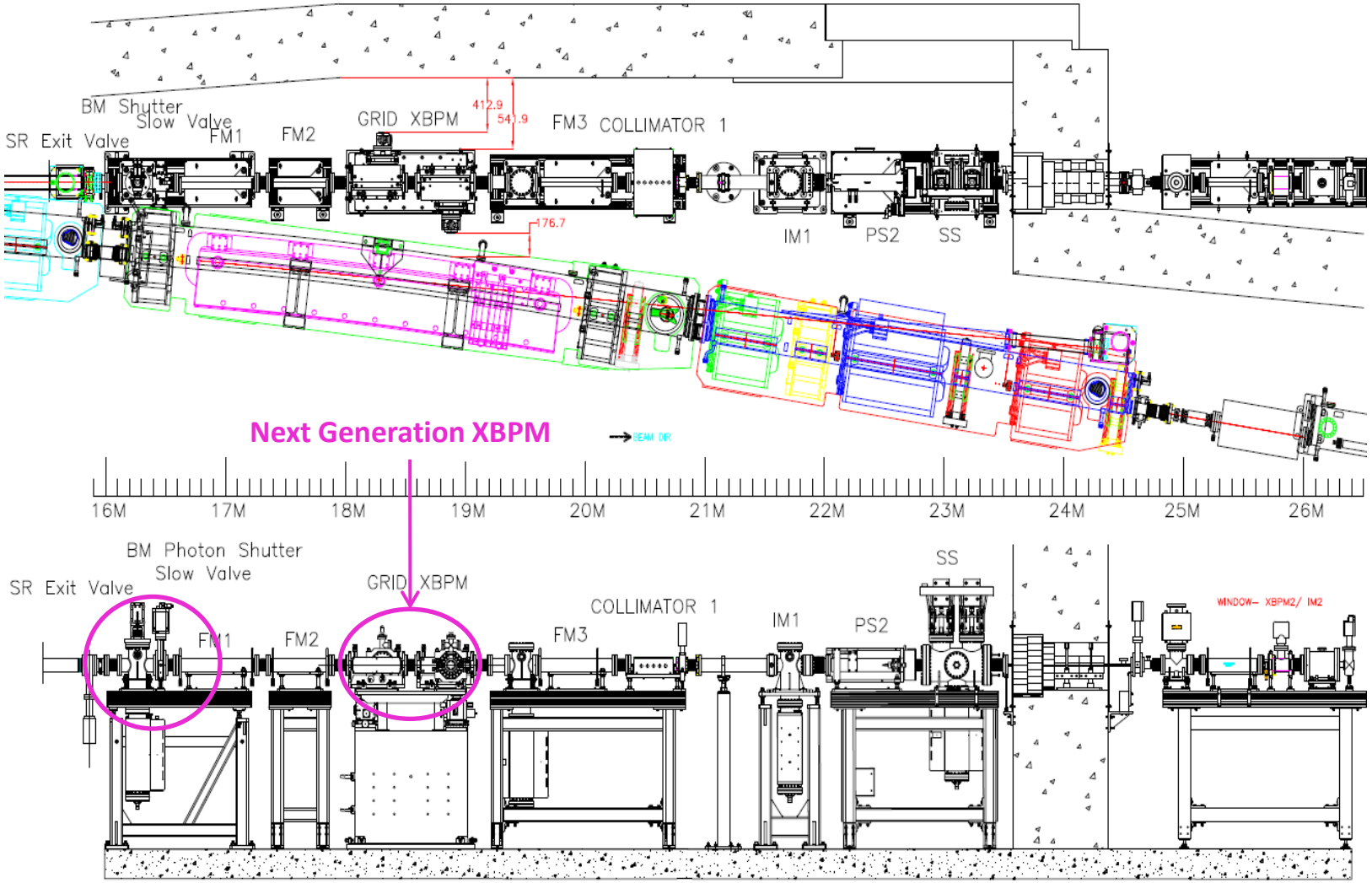
Others:
- CARS design
- IDT design
- JJ X-ray design
- Specialized APS designs
- UIUC design

U1.05.02 Front Ends Scope Details

- APS has a total of 35 ID beam ports, 12 of them require no change due to the existing front ends that can operate at least 150 mA
- One front end (35-ID) is assigned to Dynamic Compression Sector (DCS) funded by National Nuclear Security Administration (NNSA) and is not in APS Upgrade scope
- Rest of the 22 front ends require either an upgrade or new front end

Quantity	Type of Front Ends	Description	Locations
7	FEv1.2R	FEv1.2 Retrofit	5-ID, 10-ID, 15-ID, 17-ID, 18-ID, 19-ID, 33-ID
7	HHL	New HHLFE with next generation XBPMs	3-ID, 4-ID, 7-ID, 8-ID, 11-ID, 14-ID 27-ID (unoccupied)
6	CU	New CUFE with next generation XBPMs	2-ID, 9-ID, 20-ID, 32-ID 25-ID (unoccupied) and 28-ID (unoccupied)
1	LSSCU	Long straight section CU for SCUs	1-ID
1	SPXCU	CUFE for SPX (large vertical aperture)	6-ID

U1.05.02.02 High Heat Load Front End with Next Generation X-ray Beam Position Monitor



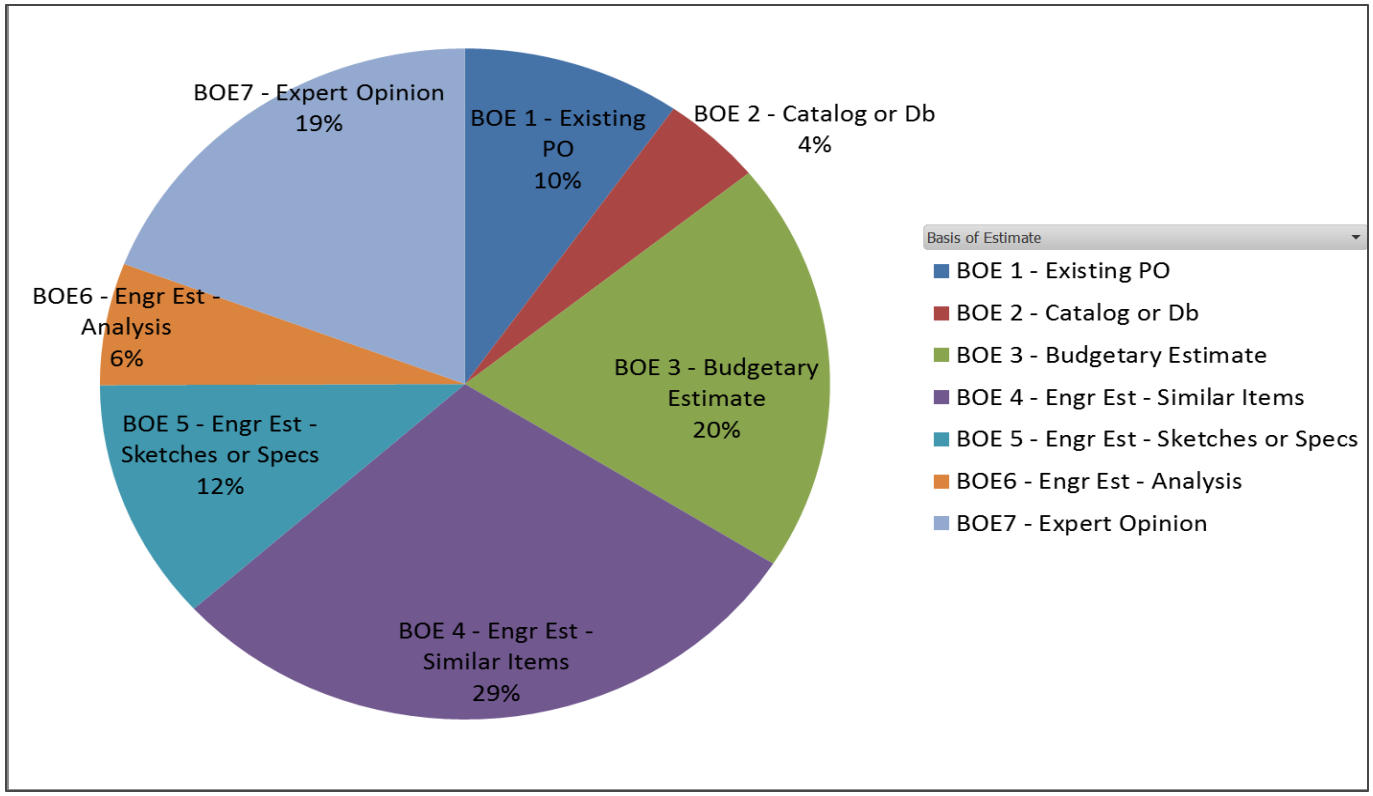
Project Scope and WBS

WBS		Labor (k$)	Non-Labor (k$)	Total Estimated Cost (k$)
U1	**APS Upgrade Project**			**391,000**
1.01	PROJECT MANAGEMENT	16,728	17,448	34,176
1.02	RESEARCH & DEVELOPMENT	8,213	7,245	15,458
1.03	ACCELERATOR SYSTEMS	30,187	40,601	70,789
1.04	EXPERIMENTAL FACILITIES	26,693	91,523	118,217
1.05	INFRASTRUCTURE AND ENABLING TECHNOLOGIES	8,976	20,089	29,065
	Sub-total (incl Indirect)	**90,798**	**176,907**	**267,704**
	Escalation	10,135	19,774	29,910
	Sub-total (incl Escalation & Indirect)	**100,933**	**196,681**	**297,614**
	Contingency	31671	61715	93,386

- Available Contingency → 31.4% of TPC

Cost Development - BOE Contingency

- The Project has been actively pursuing R&D, refining scope, and getting better quotes since CD-1 to make the estimate more concrete



Project Change Requests: Samples

- APS-PEND07-U1 "SCU1 and 2" (reduction estimated $1.75M)

  - Status= In progress.

- APS-PEND09-U1 "R&D Zone Plates" (increase estimate $2-2.5M)

  - Status = In progress.

Integrated Beamline Installation Schedule

ACTIVITY ID	ACRONYM	LOCA-TION
U1.04.02.02 Short Pulse X-ray Scattering and Spectroscopy	SPXSS	7
U1.04.02.03 Short Pulse X-ray Imaging and Microscopy	SPXIM	6
U1.04.02.04 High Flux Pump-Probe	HFPP (na)	14
U1.04.02.05a Wide Field Imaging (interior)	WFIi	20
U1.04.02.05b Wide Field Imaging (exterior) independent	WFIe (use WFIi)	20
U1.04.02.07 In-situ Nanoprobe	ISN	32
U1.04.02.08 Resonant Inelastic X-ray Scattering	RIXS	27
U1.04.02.09 Magnetic Spectroscopy–Hard	MS-H	4
U1.04.02.10 High Energy X-ray Diffraction	HEXD	1
U1.04.02.11 X-ray Interface Science	XIS (incl LSS))	28
U1.04.02.12 Sub-micron 3D Diffraction	S3DD	34
U1.04.02.13 Advanced Spectroscopy and LERIX	ASL	25
U1.04.02.16 Magnetic Spectroscopy–Soft	MS-S	2
U1.04.02.17 Magnetic Diffraction	MD	2
U1.04.02.18 Fuel Spray Dynamics	FSD	?
U1.04.02.19 Bragg Coherent Diffractive Imaging	BCDI	9
U1.04.02.20 Fluorescence Microscopy	mFluor	9

DOE CD-2 Draft Agenda - Day 1 (December 4)

Department of Energy/Office of Science (CD-2) Review of the Advanced Photon Source Upgrade (APS-U) Project
December 4-6, 2012

DRAFT AGENDA

Tuesday, December 4, 2012—APS Conference (402), Gallery on Lower Level

8:00 am	DOE Full Committee Executive Session	Lehman/Lutha
8:45 am	ANL Welcome	Isaacs
8:55 am	The Advanced Photon Source—Present and Future	Stephenson
9:15 am	The APS Upgrade Project	Srajer
10:00 am	ES&H	Barkalow
10:15 am	Break	
10:30 am	APS-U Project Management	Kerby
11:15 am	APS-U Integration	Barkalow
12:00 pm	Lunch	
1:00 pm	Tour	
2:30 pm	Accelerator Systems	White
3:15 pm	Infrastructure and Enabling Technologies	Ramanathan
4:00 pm	Experimental Facilities	Haeffner
4:45 pm	Summary	Srajer
5:00 pm	DOE Full Committee Executive Session	
6:30 pm	Adjourn	

DOE CD-2 Draft Agenda - Day 2 (December 5)

		Breakout Session - SC 1 IDs, LSS, Diagnostics
8:00 AM	4:00	Detail Talks
12:00 PM	1:00	Lunch
1:00 PM	2:00	Detail Talks
3:00 PM	2:00	Executive Session
5:00 PM		end
		Breakout Session - SC 2 Accelerator Physics, SPX System
8:00 AM	4:00	Detail Talks
12:00 PM	1:00	Lunch
1:00 PM	2:00	Detail Talks
3:00 PM	2:00	Executive Session
5:00 PM		end
		Breakout Session - SC 3 Ultrafast & Spectroscopy Beamlines
8:00 AM	4:00	Detail Talks
12:00 PM	1:00	Lunch
1:00 PM	2:00	Detail Talks
3:00 PM	2:00	Executive Session
5:00 PM		end

		Breakout Session - SC 4 Diffraction Beamlines
8:00 AM	4:00	Detail Talks
12:00 PM	1:00	Lunch
1:00 PM	2:00	Detail Talks
3:00 PM	2:00	Executive Session
5:00 PM		end
		Breakout Session - SC 5 Imaging Beamlines
8:00 AM	4:00	Detail Talks
12:00 PM	1:00	Lunch
1:00 PM	2:00	Detail Talks
3:00 PM	2:00	Executive Session
5:00 PM		end
		Breakout Session - SC 6 Management
8:00 AM	4:00	Detail Talks
12:00 PM	1:00	Lunch
1:00 PM	2:00	Detail Talks
3:00 PM	2:00	Executive Session
5:00 PM		end

DOE CD-2 Draft Agenda - Day 3 (December 6)

		Thursday December 6
		402/Lower Gallery
8:00 AM	1:00	Followup Questions
9:00 AM	4:00	Writing / Dry Run
1:00 PM	1:00	Committee Working Lunch
2:00 PM	1:00	Closeout
3:00 PM		END

Time Table to Complete Preliminary Design Report

- *October 5: All edits on Beamline sections complete for review*
- *October 12: All edits complete for all chapters including responses to Director's Review and scope clarifications*
- October 15: November 2 – APS Management review of full PDR
- November 2-10: Incorporate edits from APS Management team
- November 10-20: Final document assembly
- November 20: All documents (final version) including the PDR posted for the CD-2 Review

Time Table for Practice Talks

- Hard deadline for all talks: November 27 (one week before CD-2)
- Templates will be provided: October 31
- Financials available: November 5
- November 5 - 16: Practice talks/Dry runs
- Last corrections: November 26
- Important: please practice your talks prior to November 5-16
  - Maximize efficiency and minimize frustration

- DOE CD-2 Review: December 4-6 ⟹ Most important review to date!
- **APS has to perform well: there are other, competing BES projects!!**