

APS-U Update



Dean R. Haeffner

Associate Project Manager
Argonne National Laboratory

APS All-Hands Meeting
September 28, 2016

DOE CD-3B & ICR Reviews

DOE CD-3B & ICR Reviews

- DOE CD-3B Review July 26-28, 2016
- DOE Independent Cost Review (ICR) July 25 & 26, 2016
- CD-3B Review Purpose
 1. Status review of the Project as a whole
 2. Permission to pursue a plan for Long-lead Procurements (LLPs)
Approximately \$90M of Project scope
For purchase in FY17, FY18, and FY19
Criteria:
 - Items on or near the critical path
 - Reduce installation schedule risk
 - Reduce risk related to vendor management and the overall supply chain
 - Reduction of technical risk
- ICR Purpose
 - Independently verify costs for CD-3B items



DOE CD-3B Review of the Advanced Photon Source Upgrade Project
July 26-28, 2016

DOE Review Key Recommendations

- Complete the RF option study because it impacts accelerator performance, conditioning time, costs, reliability before FY17 procurement of the bunch lengthening cavity and cryomodule
- Continue to aggressively look for other vendors who can build a reliable pulser. If none are available, formalize R&D programs with other laboratories with the appropriate experience to develop a high voltage, narrow width pulser.
- Complete the road mapping process and for each beamline project complete the functional requirements documents, preliminary beamline design (new, upgraded & enhanced), and non-generalized cost & resource loaded schedules prior to CD-2
- Complete the hiring of the ESH and QA Managers within the next three months
- Work with BES and OPA to resolve and document the process to be used for EVMS reporting of the LLPs
- The project should revisit the reference plan with respect to both the risks and the tight funding profile to ensure that there is adequate contingency before awarding each LLP contract.
- The FPD, Program Office and Office of Science, should determine the optimum monitoring, oversight and reporting requirements for APS-U LLP and any policy or guidance surrounding long-lead procurements prior to APS-U CD-3B.
- Proceed to CD-3B

Review Summaries

From the DOE/OPA Review Executive Summary:

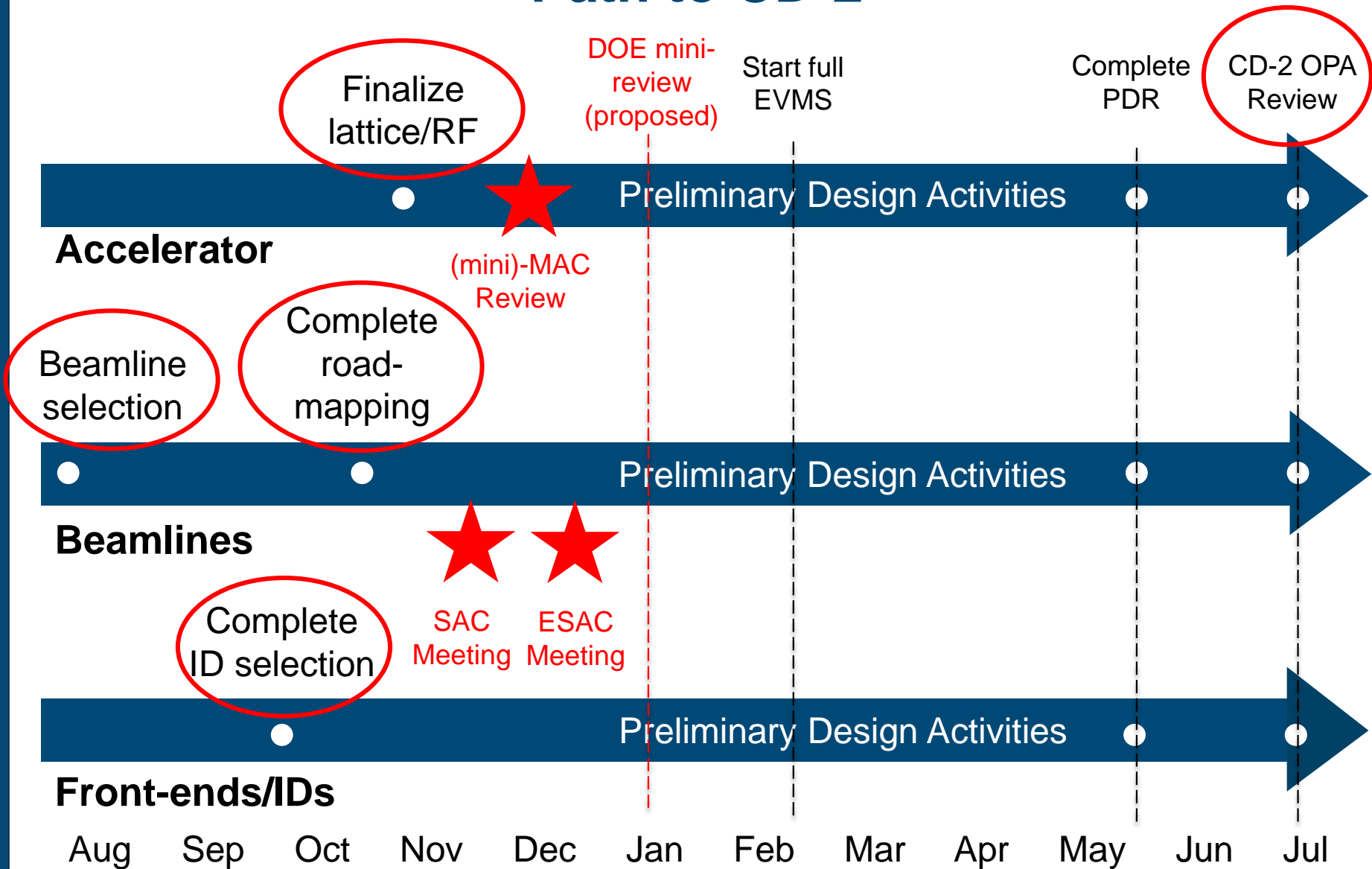
“The Committee concluded that the project is making good progress and with the exception of a few items on the LLP list, the project is generally ready for CD-3b. The Committee assessed that the project proceed with the CD-3b approval after implementation of the recommendations.”

From the DOE Independent Cost Review:

“The ICR Team Concluded:

- The APS-U project team produced an accurate, well-documented, and credible cost estimate of \$89.5M for the proposed Long Lead Procurement items.*
- The cost estimating process was comprehensive with effective guidance and management support.*
- The LLP estimate assumptions were reasonable and consistently applied by the CAMs.”*

Path to CD-2



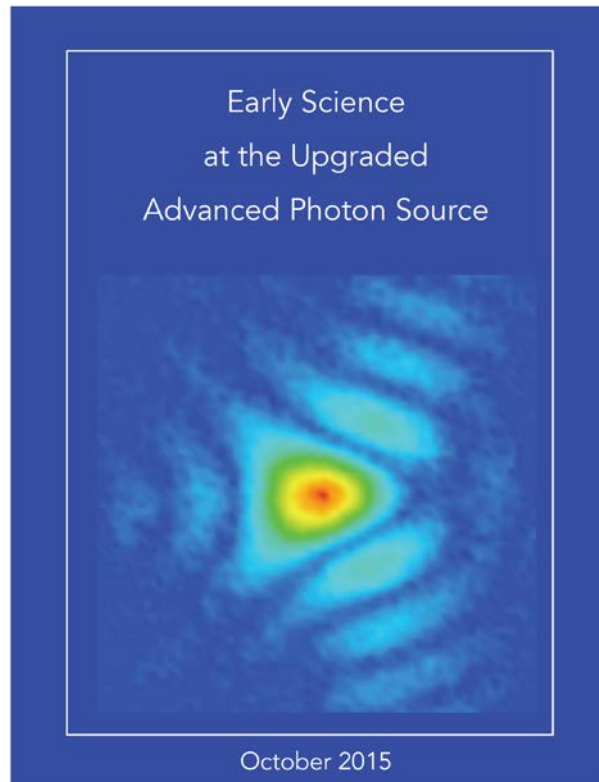
APS-U Beamline Selection

APS-U Beamline Selection

Many workshops, etc. over the last decade

Early science workshops in May 2015

> 200 participants



Guide that underlies beamline development plans



Beamline Selection Process

- **Call** for White Papers for possible beamlines for inclusion in the APS-U Project
 - 10 pages maximum (10/30/15)
 - 36 Submitted (1/25/16)
- **Review** of White Papers
 - APS-U Beamline Review Committee
 - Followed by APS/APS-U Management Review/Feedback
 - Discussion with APS Scientific Advisory Committee (SAC) (3/10/16)
- **Call** for Full APS-U Beamline Proposals from the approved White Papers
 - 30 pages maximum (3/22/16)
 - 14 proposals requested (6/6/16)
- **Review** of Full APS-U Beamline Proposals
 - APS-U Beamline Review Committee
 - APS/APS-U Management Prioritization/Selection
 - Presentation of Prioritization/Selection to the APS SAC for comment (7/11/16)
- **Finalization** of the Prioritization/Selection by APS/APS-U Management
 - Results announced 7/20/16
- **Roadmap** – siting of beamline scope at the APS
- Selected Proposals developed to DOE Preliminary Design level

Selected Beamline Proposals

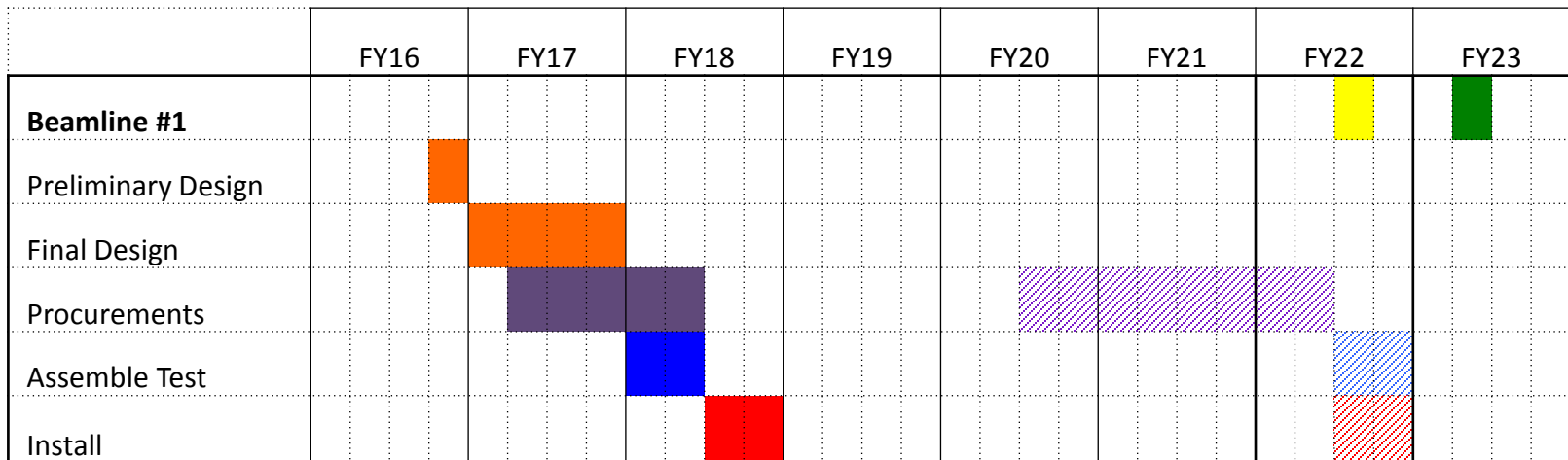
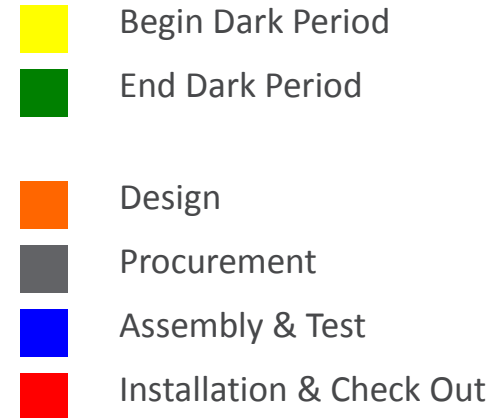
Name	Title	Technique
CHEX	Coherent High-Energy X-ray Sector for In Situ Science	<i>In situ</i> , surface high-energy coherent scattering
Polar	Polarization modulation spectroscopy	Magnetic spectroscopy
HEXM	A High-Energy X-ray Microscope	High-energy microscopies & CDI
SAXPCS	Development of a Small-Angle X-ray Photon Correlation Spectroscopy Beamline for Studying Dynamics in Soft Matter	Small-angle XPCS
WAXPCS	Wide-Angle X-Ray Photon Correlation Spectroscopy and Time-Resolved Coherent X-Ray Scattering Beamline	Wide-angle XPCS
Ptycho	PtychoProbe	Ultimate resolution, forward scattering ptychography/spectromicroscopy
InSitu	In Situ Nanoprobe Beamline	<i>In situ</i> , forward scattering ptychography/spectromicroscopy Long working distances
CSSI	Coherent Surface Scattering Imaging Beamline for Unraveling Mesoscopic Spatial-Temporal Correlations	Coherent GISAXS, XPCS
Atomic/3DMicroNano	3D Micro & Nano Diffraction Atomic – A beamline for extremely high resolution coherent imaging of atomistic structures	Diffraction microscopy & CDI Bragg CDI Upgrade of current 34-ID

Beamline 1 for R&D

- Need
 - Currently, no APS ID beamline is available for significant APS-U R&D
 - Optics & detector test beamline (1-BM) useful, but does not have ID capabilities for coherence or heat loads
- Solution
 - Use of one of the open APS ID ports for a temporary R&D beamline
 - 25-ID or 28-ID
 - Post Beamline Selection/Roadmap process for final choice
 - Phase I – Build enclosures, infrastructure appropriate for eventual scientific program
 - Goal is to award enclosure(s) contract in 1Q CY17
 - Designed so that FOE and other basic infrastructure would be useful for R&D program
 - Turn over to scientific program prior to the start of the storage-ring shutdown for Phase II (completion of beamline)

Beamline 1 for R&D (continued)

- Available for R&D for at least 1.5, possibly 2+ years
- Used for
 - Optics testing
 - BPM testing, calibration
 - Heat-load component testing
 - Undulator testing
- Reduces installation time/risks



Phase I

Phase II

Beamline Enhancements

- Improvements to all beamlines not involved in the Beamline Selection process
 - Minor upgrades that are essential in order to be able to utilize beam from the APS-U
 - “Do no harm”
 - Upgrades that are desirable to be able to make the most out of the APS-U
 - “Bang for the buck”
 - Do as much as the budget will allow
- Meetings between APS-U staff and beamline staff for every beamline
 - Data gathering
 - 36 meetings in all
- Top down budget developed for CD-3B review
- Working on detailed scope to be completed by CD-2

APS-U Beamlines: Next Steps

- Roadmap
 - Assign locations to selected beamlines
 - Locate two long beamlines
 - Discuss with stakeholders
 - Present to SAC/ESAC for feedback
- Select early beamlines
 - Likely on 25-ID and 28-ID
 - Beamline 1 (R&D beamline)
 - Beamline 2 (early build beamline)
- Beamline Enhancements
 - Develop evaluation process
 - Define scope
 - Select/execute LLP items

Other APS-U Highlights

Prototype APS-U injection Stripline Kicker - Fast (< 20 ns) High-voltage (± 15 kV) Installed in APS Booster Beam Dump Transport Line



View from downstream



View from upstream



Attenuator loads located
under dipole magnet

Meets high-level
DOE milestone



Cable strain-relief detail



Attaching LOTO signage

Designed, fabricated by ANL-
PHY : Z. Conway, A.
Barcikowski, J. Rohrer.

Installed by AES-MOM: T.
Clute et al.,

Powered by ASD-PS (Ju
Wang et al.), AES-CTL (T.
Fors, F. Lenkszus)

Physics design by ASD-AOP,
ASD-DIA (C.Y. Yao, X. Sun)

Managed by PSC / APS-U, J.
Carwardine

And many others

From G. Decker

ID & Front End Status

- A preliminary Insertion Device selection for all beamlines completed September 18, 2016
 - Meets DOE Milestone
- Every beamline was given a choice to select a one-for-one replacement for IDs to baseline the project
- Towards this process
 - Provided CATs and all XSD group leaders (in BOX) with extensive data on brightness, flux through an aperture and power for various periods
 - In XSD group leaders meeting, requested the group leader to pick a one-for-one replacement for IDs to baseline the project
 - Met with CAT's and walked them through the process to pick a one-for-one replacement of IDs
- Informed everyone that the information will be shared with the APS/APSU Management, SAC, and ESAC

- From M. Ramanathan

Moving Towards CD-2

- Goal is to reach the Preliminary Design Level of Maturity across the entire project (>50%)
 - Projection at CD-3B review was 60% by July 2017
- Clarifying design deliverables expected at each design phase
- Focus on requirements, engineering specifications, interfaces
 - FReDs, ESDs, ICDs
- Closeout review recommendations
- EVMS implementation
 - Internal at first
 - Show 3 months prior to CD-2 review

Upcoming Meetings and Events

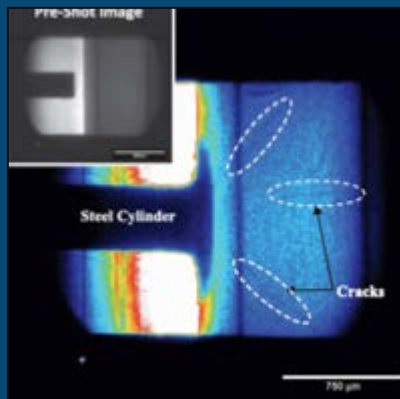
- Upcoming Reviews and APS-U Events
 - PMAC: October 4-5, 2016
 - SAC: Nov. 9-10, 2016
 - ESAC: December 1-2, 2016
 - MAC: November/December
 - APS-U Forum 2nd & 4th Thursday of every month (10 am in A1100)
 - Oct. 13 – TBD
 - Oct. 27 – Michael Borland on APS-U Lattice Status/Choices
- Other
 - 5-way DOE light sources meeting, SLAC, Oct. 5, 2016
 - NAPAC16, Chicago, Oct. 9-14
 - MS&T16 – Symposium on Applications of Low Emittance Synchrotron X-ray Sources to Mesoscale Materials Studies, Salt Lake City, Oct. 25 & 26, 2016

Conclusion: APS-U – The Future Looks Very Bright

High Energy

Penetrating bulk materials and operating systems

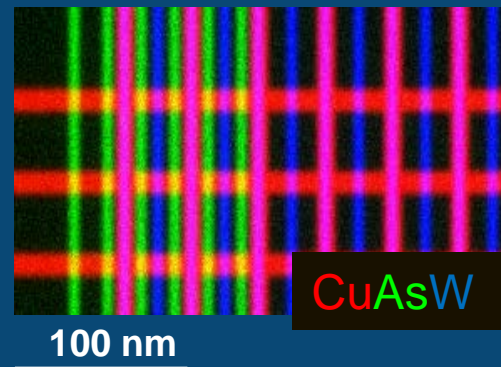
- World's brightest source of hard x-rays
- 3D mapping deep inside samples
- X-ray cinematography in previously inaccessible regimes



Brightness

Providing macroscopic fields of view with nm-scale resolution

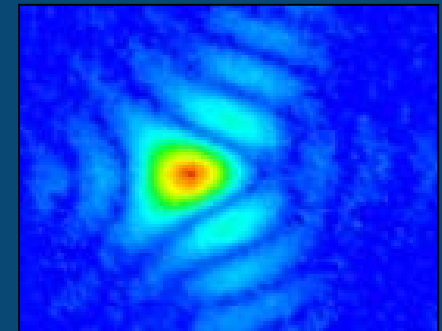
- Multi-scale imaging connecting nanometer features across macroscopic dimensions
- Fast sampling with chemical, magnetic, electronic sensitivity



Coherence

Enabling highest spatial resolution even in non-periodic materials

- Extends lens-less imaging to hard x-ray domain, with resolution down to <1 nm, localizing atoms
- Increases phase contrast for fast full-field imaging
- Correlation methods improve by 10,000x-1,000,000x



Beamline Source Scope

Device	At CD1	Preliminary Selection	Comments
HPM Planar	39	40	Nominal 2.8cm period. (Special 1.35cm)
HPM Revolver	8 + (2)	10 + (1)	2 out of 3 heads populated.
SCU	3 + (2)	8 + (2)	2 devices of 1.8m each in one cryostat - 2 locations 2 devices of 1.2m with canting magnets - 2 locations 2 devices – either in canted location or co-linear with HPM
APPLE	4	0	
HGVPU		0	Only CNM maybe be able to use!!
EMVPU	1 + (1)	(1) + (1)	Reuse both IEX and CPU
Variable Polarization SCU (SCAPE)		2	2 devices in one cryostat for polarization switching studies for hard x-rays

Nominal length of PM devices are 2.4m (2.1 m in canted configurations) and SCU are 1.8m (1.2-1.5 m in canted configurations)

Device count in () is existing and may need minor modifications

Beamline requesting for use of full straight section of undulators (2 x 2.4 m long) will be provided with phase tuning

from M. Ramanathan