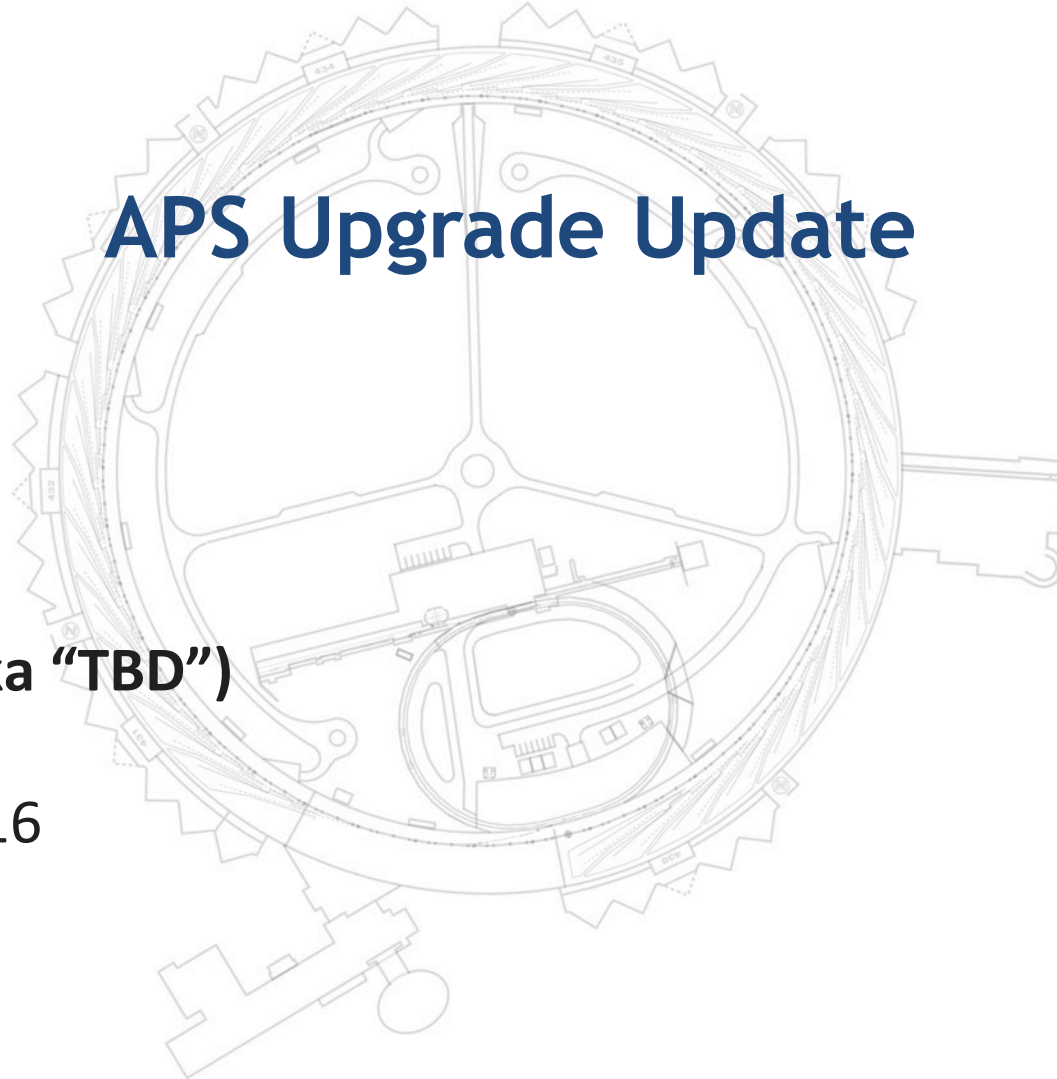


APS Upgrade Update

Jim Kerby (aka "TBD")

March 10, 2016

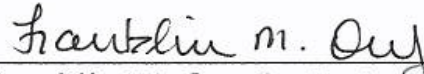


News: APS Upgrade Project CD-1 Refresh Approval

Advanced Photon Source Upgrade
At Argonne National Laboratory
CD-1 Refresh ESAAB – Equivalent Review

Approval:

Based on the information presented above and at this review, Critical Decision-1 Refresh, Approve Revised Cost Range is approved and authorized to proceed with the preliminary design and planning, establishing the performance baselines for the Advanced Photon Source Upgrade project.



Franklin M. Orr, Jr., Project Management Executive
Under Secretary for Science and Energy

2/4/16
Date

Thanks for all your hard work that led to this success!

FY17 President's Budget Request

FY 2016 Enacted	FY 2017 Request	Explanation of Changes FY 2017 vs FY 2016
	also includes funds for planning and initial disposition of unused equipment at the Lujan Center.	
Nanoscale Science Research Centers \$118,763,000 Funding supports operations at the NSRCs at near optimal levels. Program emphasis continues to cultivate and expand the user base from universities, national laboratories, and industry. Planning efforts continue to advance the cutting-edge nanostructure characterization capabilities, with an emphasis on coupling multi-probes of photon, neutron, and electron, and planning for future electron scattering needs that could address scientific roadblocks toward observing ultrafast chemical and physical phenomena at ultra-small size scales in different sample environments.	\$122,272,000 The Request includes funding for optimal operations of the five Nanoscale Science Research Centers to fully support research, including clean energy research. Funding will be used to exploit synergies between the NSRCs and major co-located x-ray, neutron, computation and fabrication facilities including developing new beamlines. These efforts build tools and capabilities to address challenges in characterizing ultrafast chemical and physical nanoscale phenomena in real environments. Joint activities involving all NSRCs such as workshops will be continued.	+\$3,509,000 The funding increase will support optimal operations and instrument repairs, and replacement. Some NSRCs will begin developing joint capabilities with their co-located facilities.
Other Project Costs \$0 No funds are requested for Other Project Costs.	\$0 No funds are requested for Other Project Costs.	\$0 No funds are requested.
Major Items of Equipment \$35,500,000 The Advanced Photon Source-Upgrade (APS-U) project continues with planning and facility design, magnet prototyping, and research and development related to implementation of the multi-bend achromat lattice during FY 2016. The NSLS-II Experimental Tools (NEXT) project continues with the design, procurements, construction/fabrication, installation, testing and commissioning of equipment during FY 2016.	\$20,000,000 APS-U will continue activity associated with R&D, engineering design, equipment prototyping and equipment fabrication in preparation for long lead procurements in FY 2017. No funds are requested for NEXT in FY 2017. NEXT will continue with the remaining design, procurements, construction/fabrication, installation, testing and commissioning of equipment during FY 2017. The project will complete by the end of FY 2017.	-\$15,500,000 The FY 2017 Request for APS-U is flat compared to the FY 2016 Enacted level. FY 2016 is the last year of funding for NEXT per the project plan.

- Impact of flat funding in FY17 is an approximately one-year delay in project completion and ~\$30M increase in TPC (for shifted funding profile)

BESAC Prioritization

- 2016 Omnibus Appropriations:
 - “...BESAC is directed to update its assessment of the proposed upgrades to x-ray scattering facilities...and to the Spallation Neutron Source using the same criteria that were used in prior studies...”
 - “The assessment shall include a prioritization of the next three to five projects and be submitted to the Committees on Appropriations of both Houses of Congress not later than 1800 days after the enactment of this act.”
- Charge letter from Cherry Murray (Director of DOE/SC) to BESAC
- “Three categories of facilities are to be considered in the prioritization:
 - Free electron laser based x-ray light sources
 1. SLAC LCLS-II High Energy Upgrade (LCLS-II-HE) (i.e. additional cryomodules in existing tunnel)
 - Ring-based x-ray light sources
 1. ANL Advanced Photon Source Upgrade (APS-U)
 2. LBNL Advanced Light Source Upgrade (ALS-U)
 - Spallation based neutron scattering sources
 1. ORNL Spallation Neutron Source Proton Power Upgrade (SNS-PPU)
 2. ORNL Spallation Neutron Source Second Target Station (SNS-STs)
- We are in very good shape going into this prioritization exercise
- We are confident in our story, but remain vigilant
- The first round of presentations (BESAC Feb 11-12) went very well

What to make of all this?

- We have come a huge distance over the last year to lead the pack of projects vying for priority as next in line.
- We been awarded CD-1 in recognition of our design, plan and ability to deliver this project.
- We have strong community engagement and support
- We have strong support within DOE/SC

- We intend to cement our leadership position through the BESAC prioritization process

- On the other hand, budgets are very tight, and there are macro-level political priorities in play



The Plan: Strategy and Timeline for CD-3b/2/3

- Strategy w.r.t. flat FY17 funding
 - Continue progressing on R&D to reduce/retire as much risk as possible
 - Further advance basis of estimate
 - Keep pushing design toward (and past) preliminary design stage
 - Initiate advanced/long-lead procurements
- We need to be aggressive in continuing to move APS-U forward
- In light of all this, we are focusing our attention in the near-term on positioning the Project for CD-3b approval at the next DOE/OPA Review
 - Procurement authority allows us to
 - get started with magnet vendors, reduce risk to the project while maintaining momentum
 - Begin “beamline 1” serving as test-bed for coherence R&D, reducing risk
 - Project completion is set by CD-3 (and 3b) schedule, less-so by CD-2
- Therefore, we have decided to decouple CD-3b from CD-2
 - Delayed CD-2 is consistent with FY17 funding request; allows more mature design
 - Allows bringing beamline designs to 40-60% design maturity prior to CD-2
 - Allows further R&D which reduces uncertainty in project scope, cost
- Tentative date for a “CD-3b Readiness Review” is July 26-28, 2016

What does it mean to be ready for CD-3b, and how does this whole thing work?

- At the CD-3b Review, we will describe several components that have reached the final design level of maturity, and a number which are at the preliminary design level of maturity
- Upon CD-3b approval (early FY17) we would initiate the procurement process for those components at final design
- As the other components/systems reach final design maturity later in FY17 or FY18, with available funding, we would seek concurrence from the FPD and program office to initiate those procurements
 - In other words, not everything on our CD-3b advance procurement list has to be ready to go at the time of the CD-3b review
- At the CD-3b Review we want to have completed the Final Design Reviews for
 - Quadrupole doublet magnets
 - High head load front-ends
- We will also present a plan for final design completion for the other items on the advanced procurement list

Beamline Review Committee Feb. 8-9, 2016

- Beamline Review Committee assessed 36 white papers according to provided criteria:
 - Scientific/Technological Importance of Program
 - The use of APS-U characteristics and potential for this beamline to be world-leading or world-class
 - Feasibility of design and required R&D activities to mitigate risks
 - Strength of team and expected productivity
- Committee provided very valuable advice
 - Recommended a set to move forward to full proposals
 - Advised on approaches for common proposals
 - Paid attention to breadth of full APS beamline suite ca. 2022
 - Paid particular attention to Early Science opportunities and capabilities
- Next Steps:
 - Present package of selected whitepapers to SAC for advice
 - Request Full Proposals based on outcome



Beamline planning timeline

Date(s)	Activity
10/30/15	Call: White Papers
1/25/16	Deadline: White Paper
1/29/15 – 2/15/16	Review by APS-U Beamline Committee
2/16/16 – 2/26/16	APS Management Evaluation
3/15/16*	Call: Full Proposals
6/1/16*	Deadline: Full Proposals
6/2/16 – 6/12/16*	Review by Beamline Cmte and APS Management
6/13/16*	Prioritization/Selection to SAC/ESAC
7/1/16*	Announcement of Selection

← SAC Meeting

* tentative

* tentative



APS-U Risk Workshop Summary Feb. 9-10

- Purpose: “The risk management workshop will focus on verifying the comprehensiveness of the risk identification, quantitative risk assessments of new and existing risks and mitigation strategies with associated residual risk assessments.”
- Structure:
 - Facilitator: Keith Molenaar (U. Colorado)
 - Focus on four key areas: Accelerator Systems, Beamlines/ Front-ends/IDs, Installation and Integration, Project Management
- Outcome:
 - External participants were excellent
 - Examples of splitting risks into ‘development’ and ‘production’ to make more actionable
 - Working through quantification exercises
 - Typically 3-5 new or re-worked risks in each area (exception... installation, which had fewer...in good shape!)
 - Increased understanding across APS-U of how risks fit into Project culture
 - Team excited to go implement what they had learned

External participants;

- *Erik Johnson (BNL)*
- *Ron Ray (FNAL)*
- *Pedro Tavares (MAX-IV)*
- *Toshi Tanabe (BNL)*
- *Steven Hulbert (BNL)*
- *Gregory Fries (BNL)*
- *David Augustine (FNAL)*



Beam Physics/Lattice Preliminary Design Review: Feb 24-25, 2016

Four lattice alternatives under consideration

- **67-pm nominal** – this is the lattice described in the CDR
- **90-pm** – accommodates off-axis injection; lower risk from point of view of injection
- **67-pm with high-beta insertion** – accommodates off-axis injection
- **41-pm reverse-bend lattice** – higher performance lattice

Committee

- Bob Hettel (SLAC), chair
- Christoph Steier (LBNL),
- Yunhai Cai (SLAC)
- Timur Shaftan (BNL)
- Simon Leeman (MAX-IV)
- Ricardo Bartolini (DIAMOND)
- Laurent Nadolski (SOLEIL)

In addition, we are evaluating a lower-frequency main RF system which would benefit lifetime and single-bunch current limit, which is an important consideration for the 48-bunch timing mode



Outcome and Strategy following Beam Physics Review

Outcome:

- Committee agreed with our assessment that we should focus on on-axis injection options, and no longer continue to pursue off-axis accumulation
- 67-pm lattice is ready to go
- They encouraged further work to achieve even higher performance, with a number of technical suggestions to pursue
- From the point of view of accelerator performance, they were enthusiastic about a lower-frequency ring RF system. But there is a cost, and some risks that that would bring...

Our Plan:

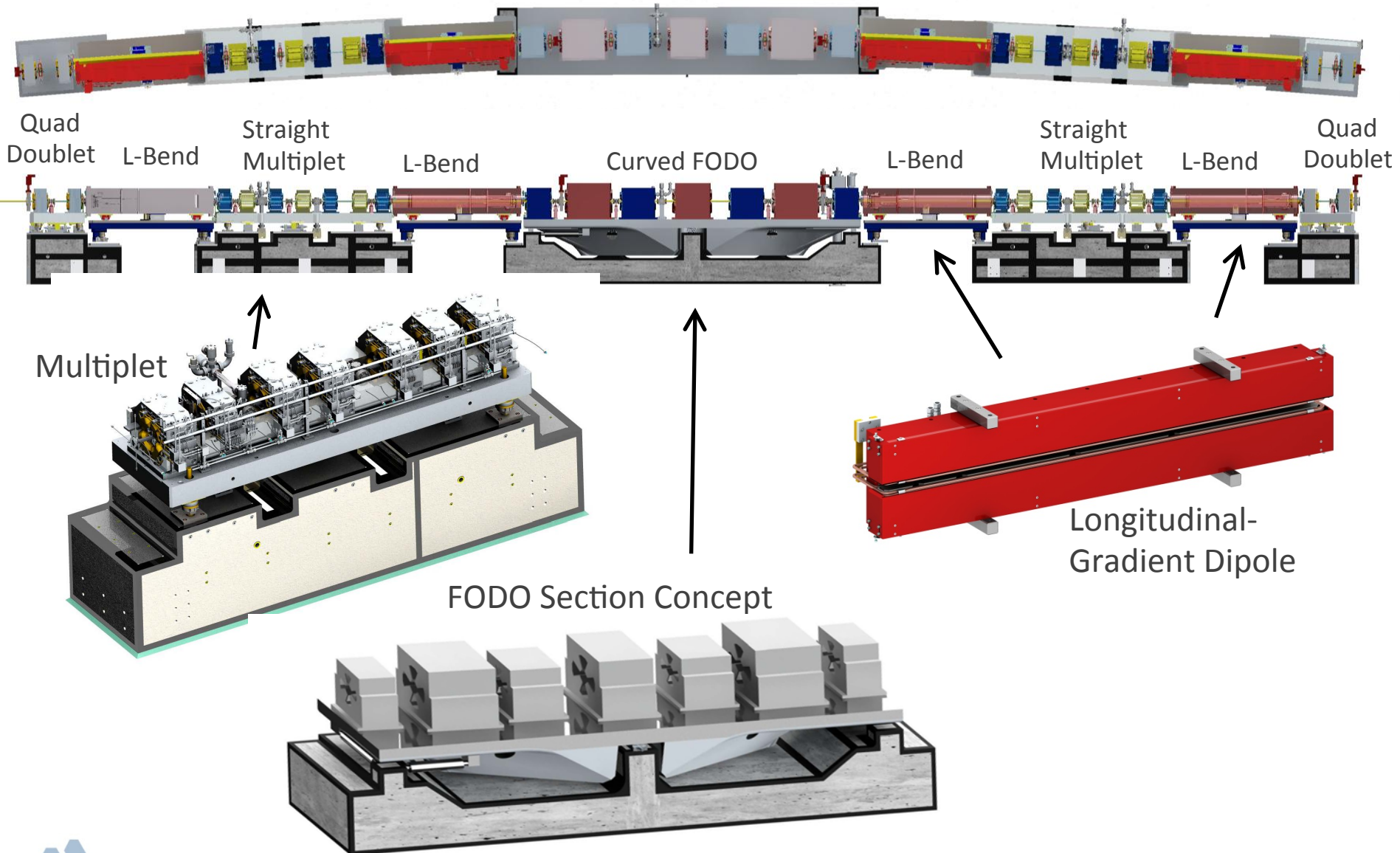
- Incorporate a set of selected changes to the 67-pm lattice and use as basis for design
 - Adjust circumference to maintain ID source locations
 - Other lattice adjustments to improve performance
- Continue to pursue/improve viability of a higher performing lattice (41-pm lattice), and evaluate some aspects of implementation
 - Should be emphasized that this lattice is very similar to the 67-pm lattice, but with smaller emittance and higher brightness.
- Lock down Q1/Q2 design to bring to final design



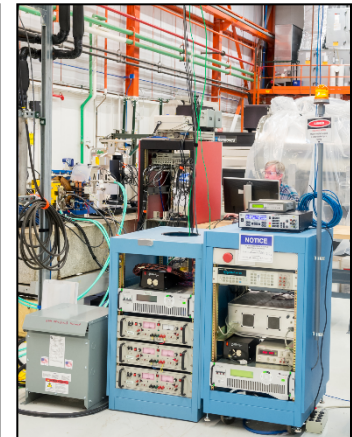
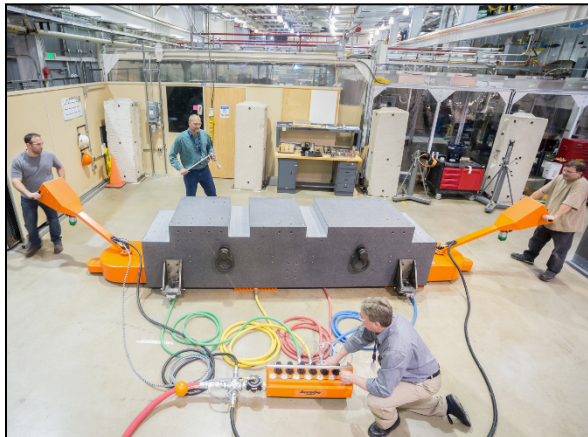
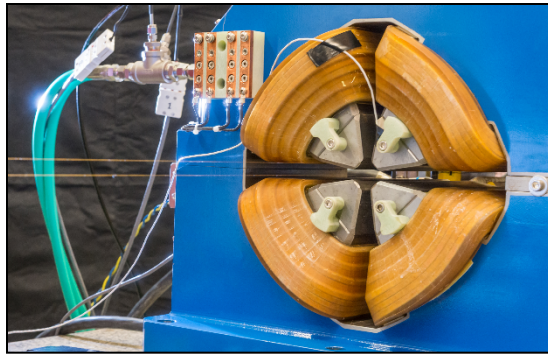
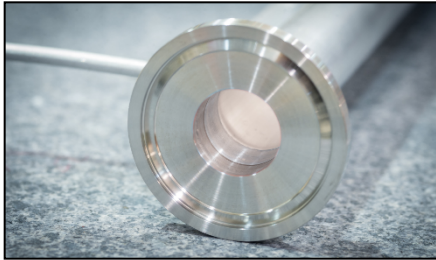
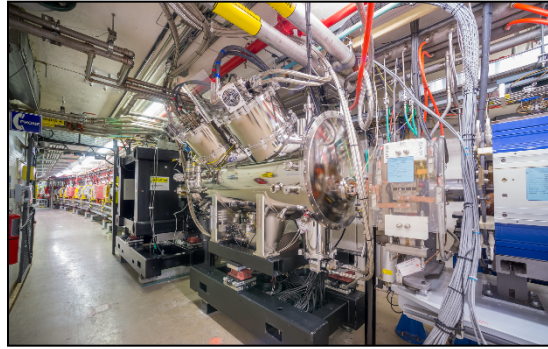
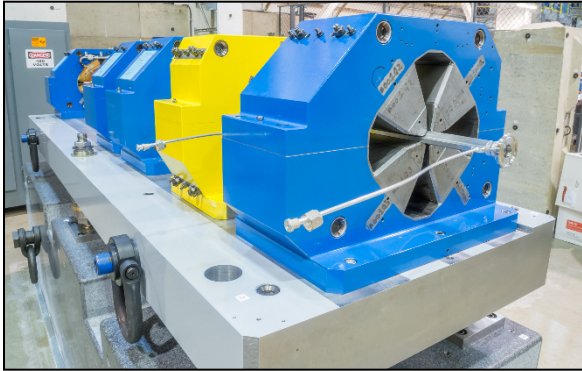
Strategy following Beam Physics/Lattice PDR

- We are in the preliminary design phase
- Incorporate a set of selected changes to the 67-pm lattice and use as basis for design
 - Adjust circumference to maintain ID source locations
 - Other lattice adjustments to improve performance
 - Evaluate space requests
- Continue to pursue/improve viability of a higher performing lattice (41-pm lattice), and evaluate some aspects of implementation
 - Evaluating collective effects and limitations
 - Evaluating some aspects of vacuum system implementation
- Lock down Q1/Q2 design to bring to final design

Configuration of Accelerator Arcs



APS-U R&D, prototyping are progressing at a strong pace



Addressing Technical Challenges independent of final implementation

Recent and Upcoming Events

■ Recent Events

- PMRC (Jan 25)
- ESAAB (Feb 4)
- APS-U Beamline Review Committee Meeting (Feb 8-9)
- APS-U Risk Workshop (Feb 9-10)
- Topical Workshop on Instabilities, Impedance and Collective Effects (TWIICE), Feb 8-10, UK
- BESAC Meeting (Feb 11-12)
- APS Upgrade Beam Physics and Lattice Preliminary Design Review (Feb 24-25)
- DLSR, DESY Hamburg (Mar 9-11, DESY)
- APS SAC Meeting (Mar 9-10)

■ Upcoming Events

- Technical System Reviews (Mar-May)
- IPAC16, Busan, Korea, May 8-13
- DOE OPA Review July 26-28



Upcoming Optics Presentations of Interest

- **Luca Peverini and James McVea, Thales/Sesso**
 - Staying ~ 1.5 days
 - Arrive Monday March 14 morning and leave Tuesday March 15 afternoon
 - Talk **Monday, March 14 at 2:00 pm 401-A1100**
- **Akihiko Ueda, JTEC**
 - Staying approx. 3 days
 - Arrives Monday March 28 departs Wed. March 30
 - Talk **Tuesday, March 29 at 2 pm 401-A1100**
- **Ray Barrett, ESRF**
 - Staying one 1 week
 - Monday April 4- Friday April 8th
 - Talk **Monday, April 4th at 2:00 pm 401-A1100**
- **Tom Tonnessen, Insync**
 - Staying ~1 day
 - Arrives Wed. April 6th morning, departs 5:00 pm same day
 - Talk **Wednesday, April 6 at 1:30 pm 401-A1100**



Questions?

