

PSC All-Hands Meeting: APS-U Update

Bob Hettel

April 15, 2020

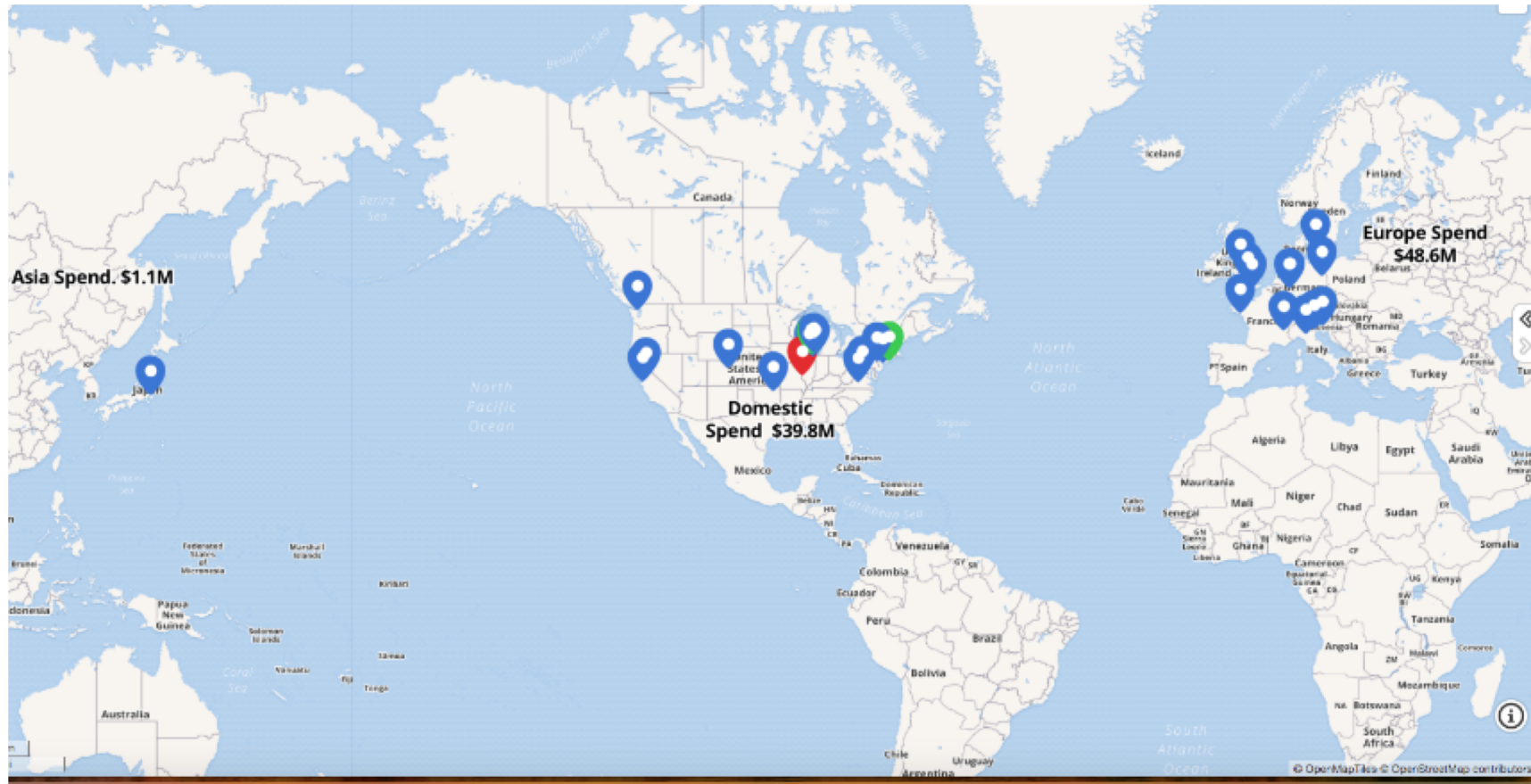


Overall Project Status

- Adequate funding available for the project
 - \$170M (vs \$150M baselined) FY20 funding, \$119M received to date, \$178M available to spend
 - \$150/159.8M (vs \$159.8M baselined) FY21 funding proposed
- Schedule a concern at the moment as project as >\$20M schedule variance
- Several critical paths to manage to ensure project success
 - Accelerator vacuum chambers, module assembly and testing, and into removal and installation.
 - SCU R&D and production, the into removal and installation.
 - 4-ID & 28-ID design, procurement, assembly, installation and overall beamline commissioning
- Contracts awarded for many major items
 - All accelerator magnets, supports and vacuum chambers
 - ID vacuum chambers, monokeepers, magnets, absorbers and poles
 - All canted front-end components
 - BPM processors, etc.....

APS-U Procurements

- Upgrade is ~2/3rd industrial procurements
- Vendor oversight will be key in coming years

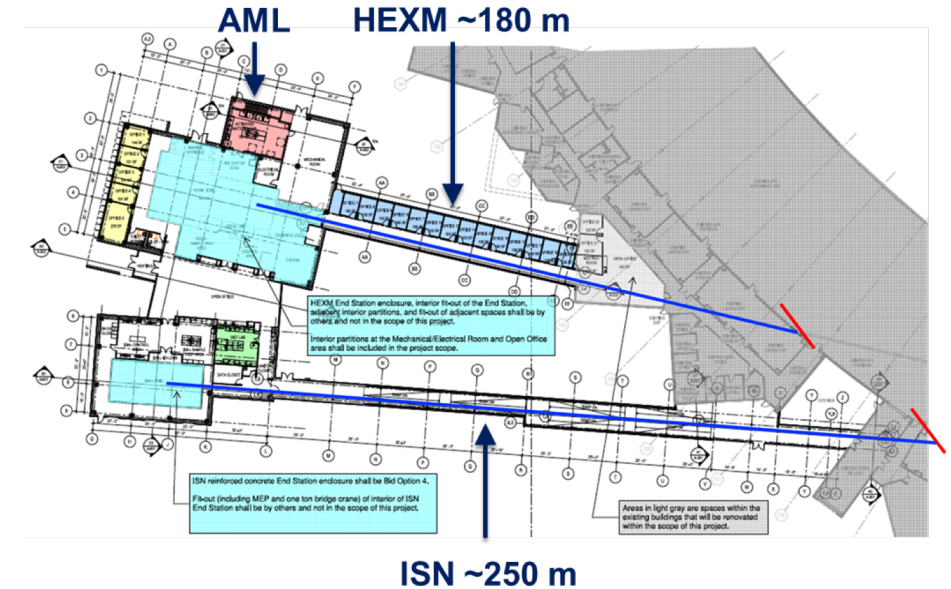


Some issues in progress

- A complete radiation protection plan for injecting with beamlines open
- The choice of vertical vs. horizontal injection into the ring
- Beam test of the small-gap injection stripline kickers
- Maximizing robust performance of the injector for high charge operation
- Detailed design of beam size diagnostic ports
- Gap analysis in preparation for ARR
- ...

Long Beamline Building

- New construction + modifications to LOM's
 - 20k – 22.6k SF facility connecting to LOMs 435-436
 - Demolition and site improvements (parking, landscaping)
 - Will house two new beamline end stations (HEXM & ISN)
- Special Requirements:
 - Vibration (VC-E or better) for ISN
 - Strict temperature and acoustical control requirements
 - Activated Materials Laboratory (off APS-U project)
 - 1,700 SF facility to support examination of radioactive materials at APS
 - Inventories less than Hazcat 3; ALARA engineered controls w/ HEPA filtered exhaust.
- Environmental Safety & Health:
 - Sustainability: High Performance Sustainable Buildings (HPSB)
 - Design shall support safe laboratory operations and ALARA
- Construction contract scheduled to be awarded this Summer



Off-Site Space

- 108,000 SF warehouse with office space
- Special requirements:
 - New HVAC system
 - High speed WiFi
 - Badged entry and video surveillance
 - Electrical distribution
 - Updated fire protection system
 - Forklift charging stations
 - PA system
- Storage area with specialized pallet racking system
- Assembly and testing areas
 - Clean rooms and cranes
 - Burn-in room
 - Nitrogen gas distribution and compressed air
- Contract award anticipated in May 2020



APS-U Ongoing Work in Min-Safe Conditions

- Completion of designs, including reviews, and assembly and processing of Procurement Packages
- Receipt of production magnets
- Receipt of production power supplies
- Testing of PAR RF12 amplifier
- On- and off-site space prep
 - Drawings for 400A being finalized, tours of the space being organized to help plan the work
 - Pre-bid meeting for off-site build-out and tours completed, bids due back in a few weeks, reqs in progress for security system and networking (equipment can be stored as soon as security system installed)
- Support for the above activities (receiving, rigging, accounts payable...)
- Hiring

The above activities involve items here or in transit; payments to vendors and contractors; and prep of areas (largely through contractors) for spaces we will need in the future.

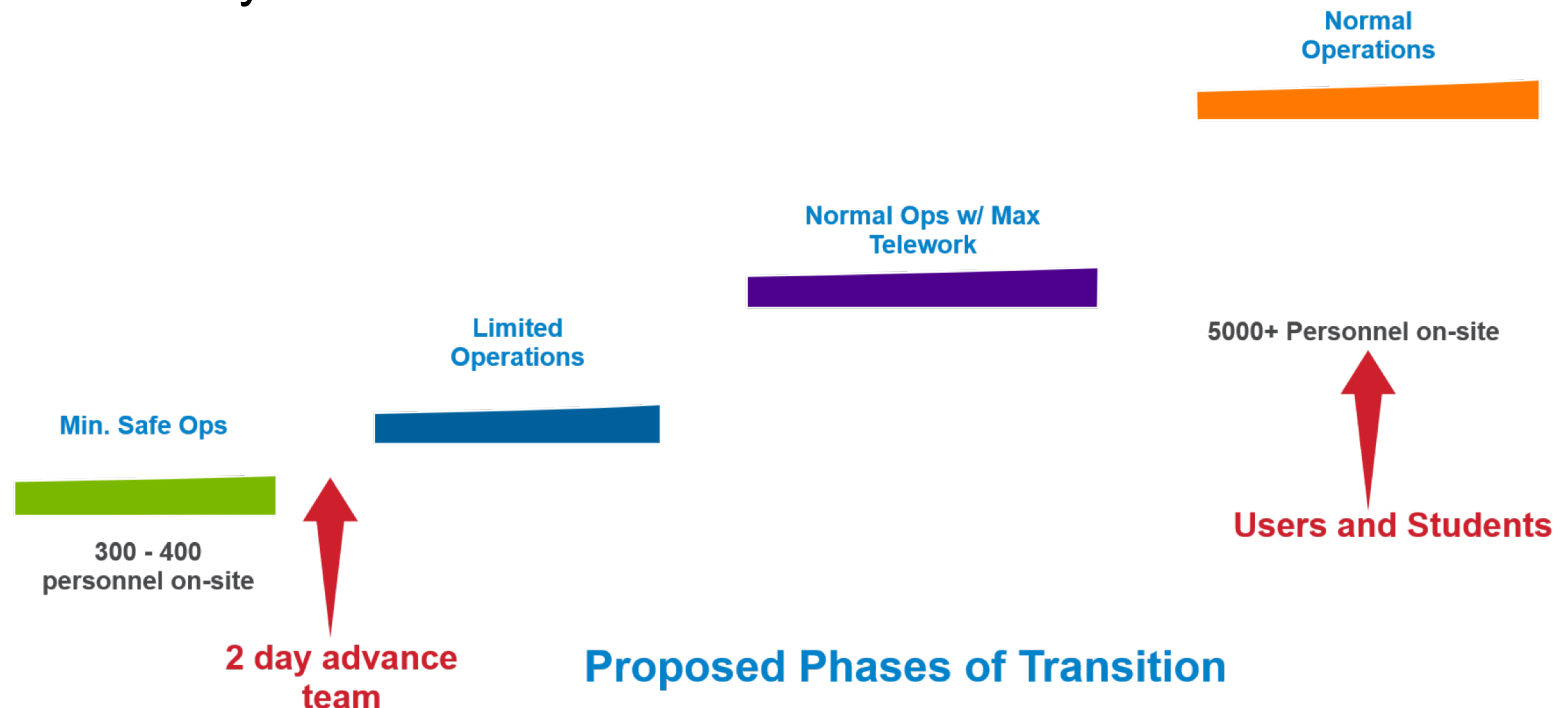
All on site work must be done on a reviewed and approved work plan. The work must then be authorized before it can proceed.

COVID-19 – Project Risks

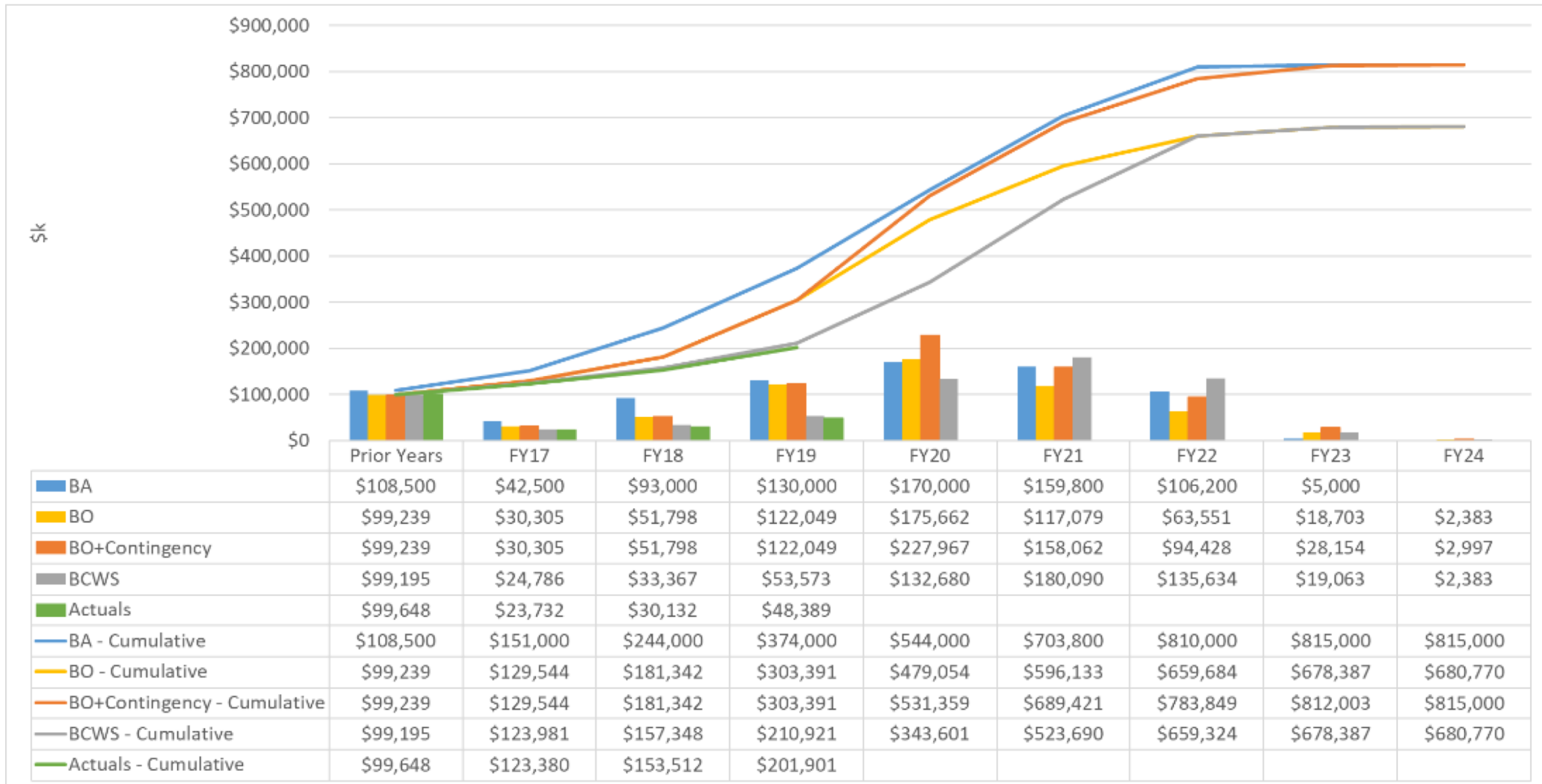
- Vendor shutdowns – High – directly delay deliverables to Argonne not just by the time of the shutdown but restart times as well. We are staying open to accept product and pay the vendors.
- Vendor Illness – High – should a critical person at a vendor become ill, we will have to react to this.
- Vendor shipments – Medium – as borders between countries or states close to shipments, we are incurring delays.
- Staff – Medium – Keeping our staff healthy is critical. We are limiting to an extreme personnel on site.
- Hiring – Medium – we have been ramping up and are working through the challenges of hiring new staff into ANL in this environment. Interviewing remotely (OK), and the onboarding process has been worked out.
- Safety – Medium – making sure our Work Plans are appropriate and ensure distance, shielding and exposure time. All Work Plans being reviewed consistent with laboratory guidance (April 3 memo).

Looking Forward

- Initial scenarios are being formed...e.g. 3-month and 6-month slowdowns. The inputs we are getting are very fresh, the situation dynamic. Overall the initial analysis suggests this is a use of schedule contingency and possibly contained within cost contingency. We are in close communication with BES and the lab.
- These are extremely dynamic times...we are trying to develop best possible methods to react in a timely manner to reality as it arises.



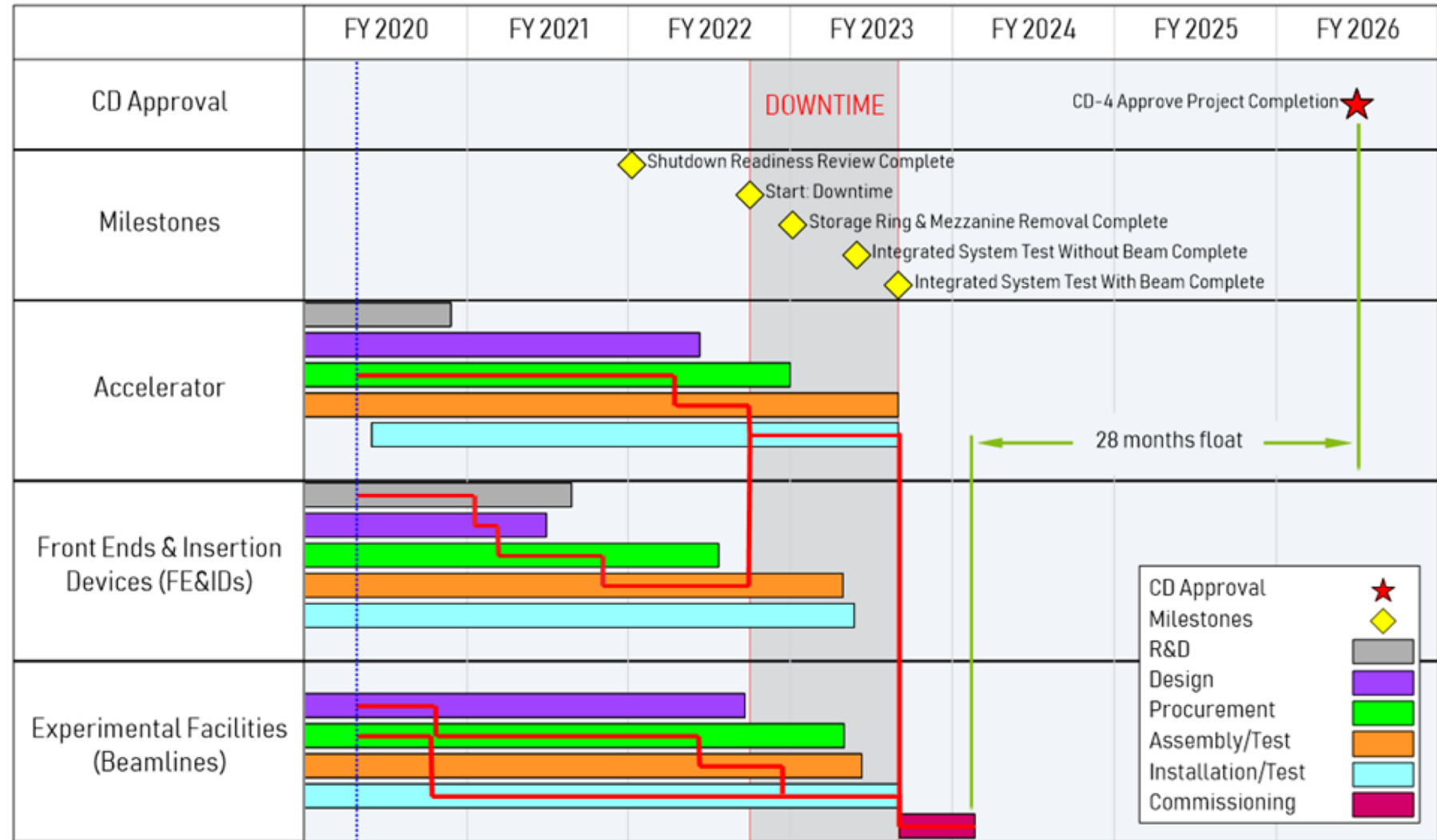
Integrated Project Profiles



- Adequate funding available throughout the project

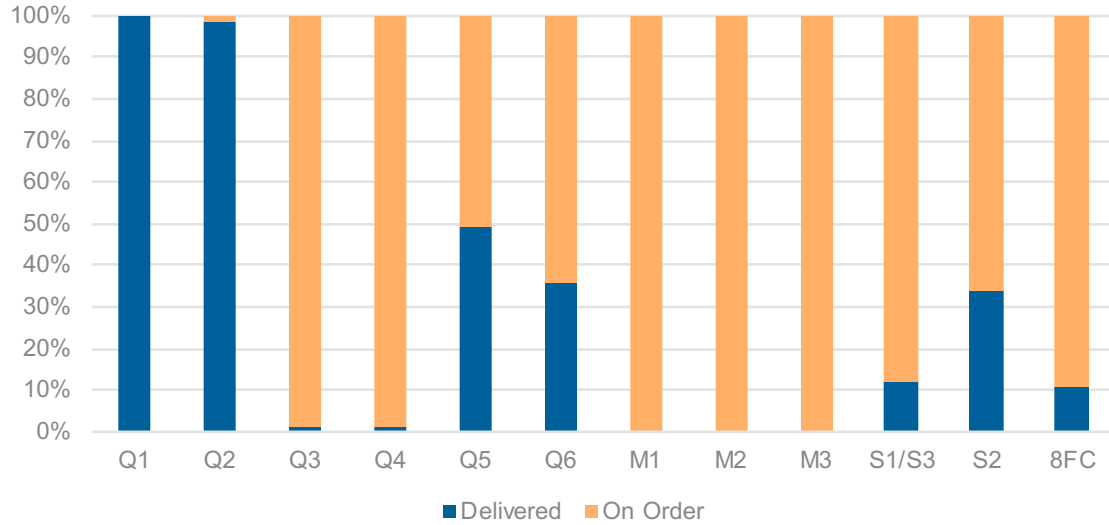
Schedule Update

- Critical path runs through
 - Accelerator vacuum chambers, module assembly and testing, and into removal and installation.
 - SCU R&D and production, the into removal and installation.
 - 4-ID & 28-ID design, procurement, assembly, installation and overall beamline commissioning

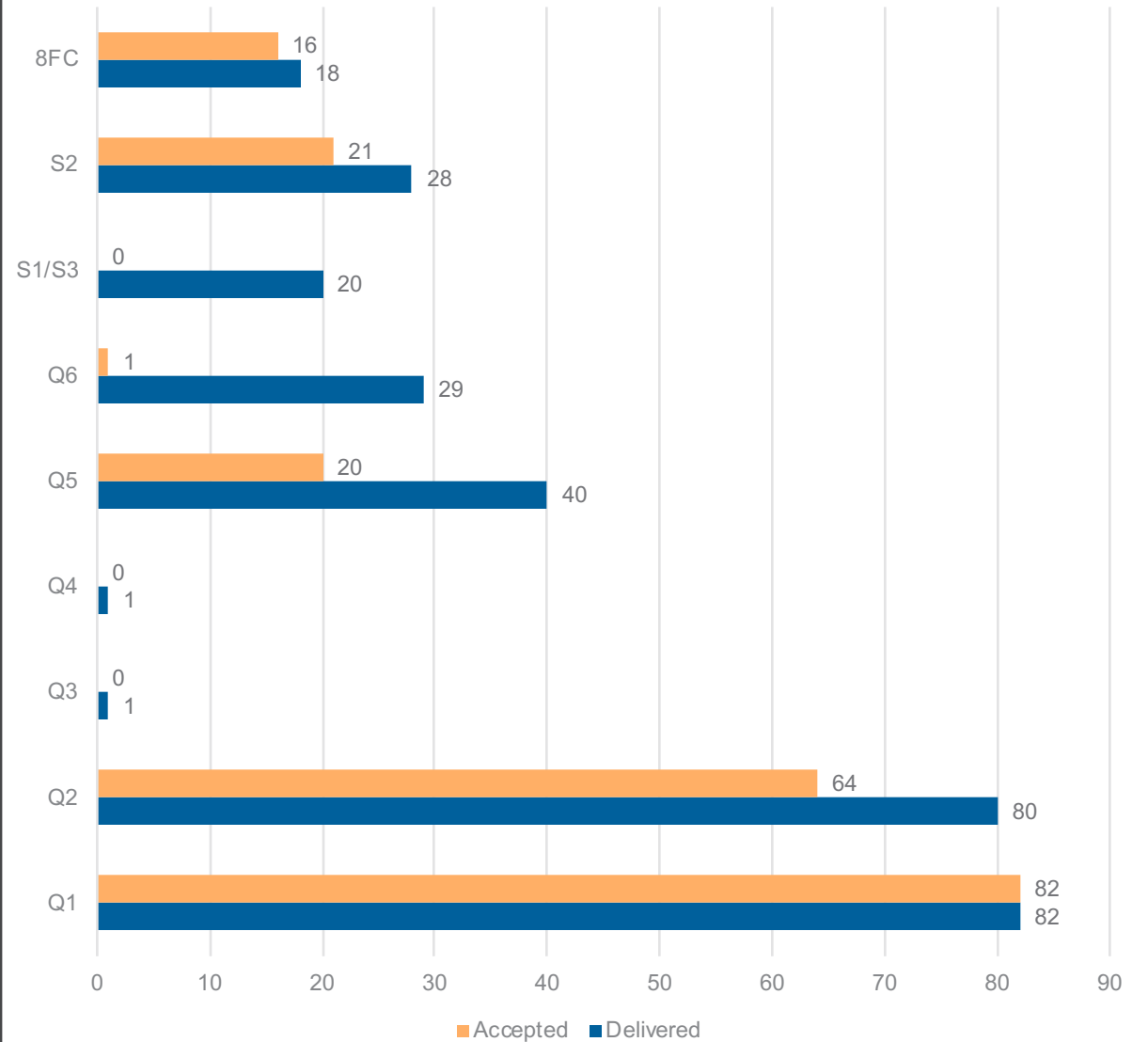


Magnet Progress

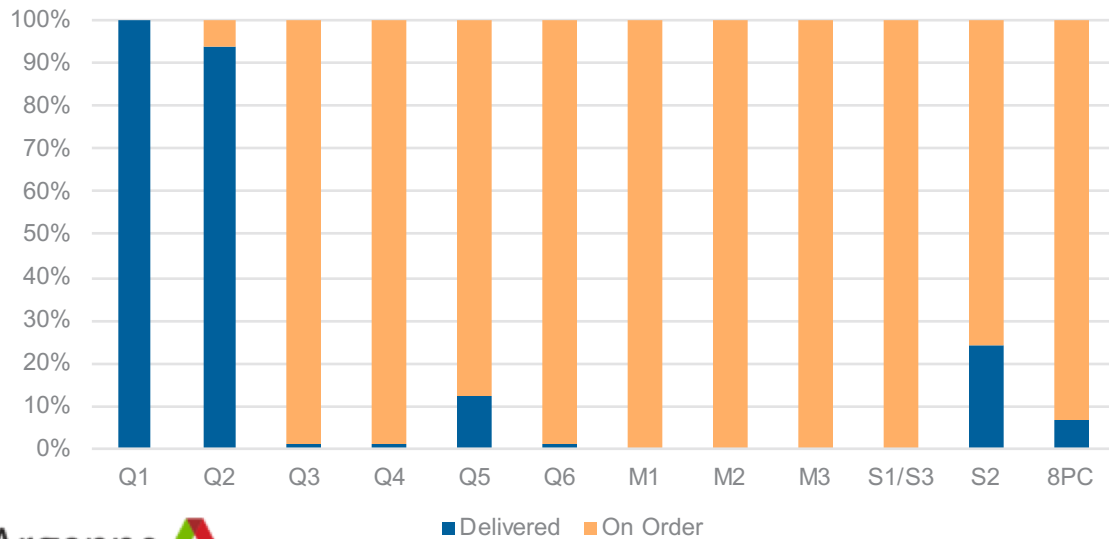
Magnet Delivery Progress (Current)



Acceptance Inspection Progress (Current)

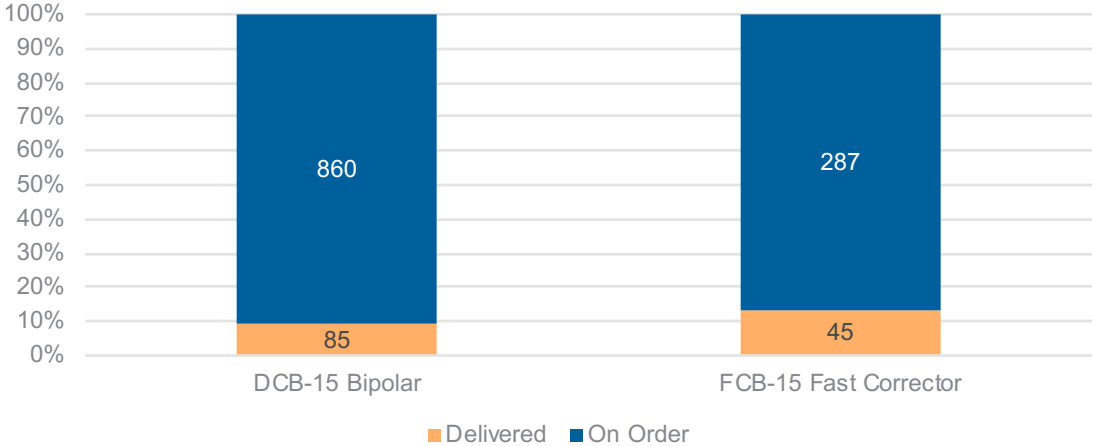


Magnet Delivery Progress (February)

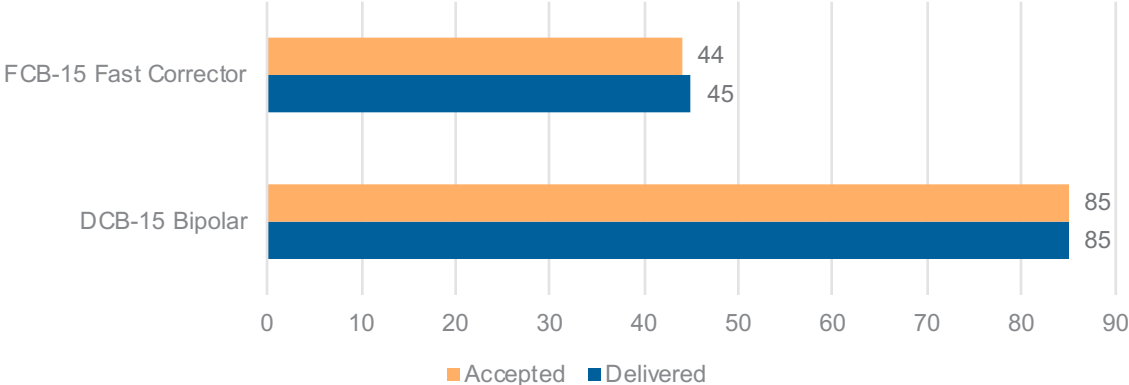


Power Supply Progress

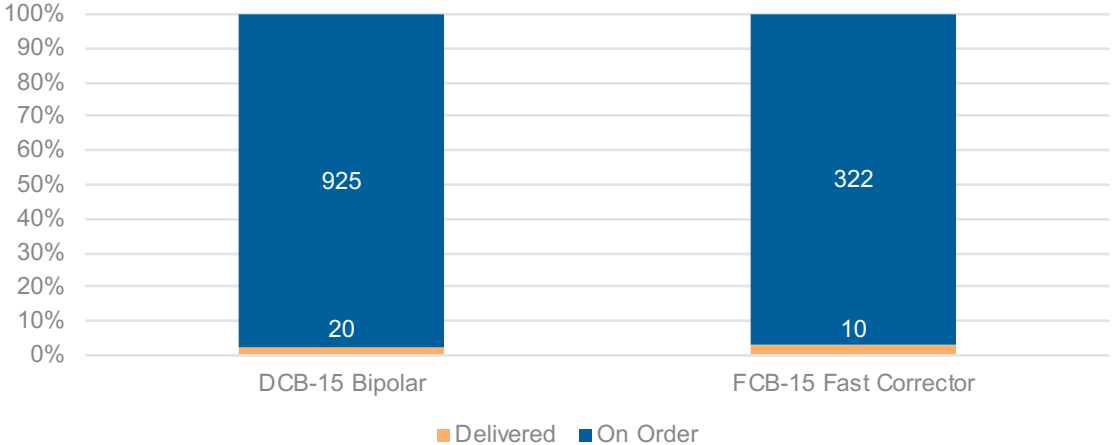
Delivery Progress (Current)



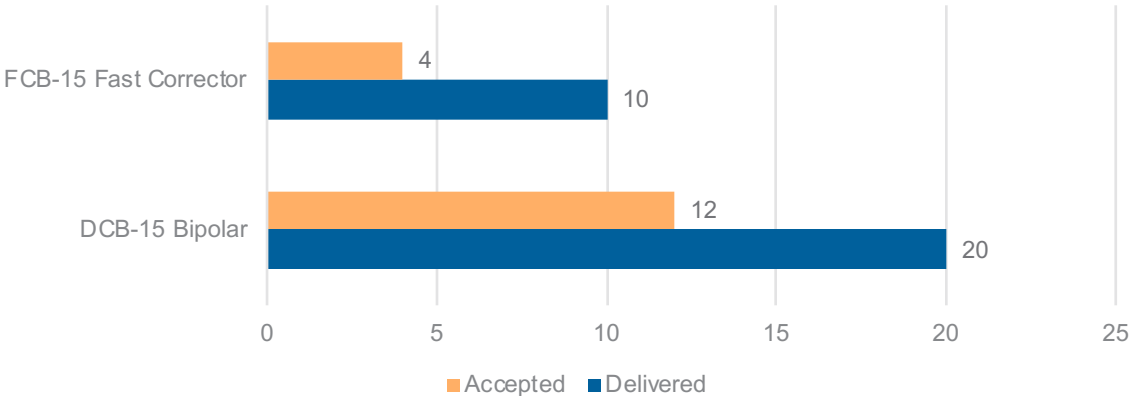
Acceptance Inspection Progress (Current)



Delivery Progress (February)

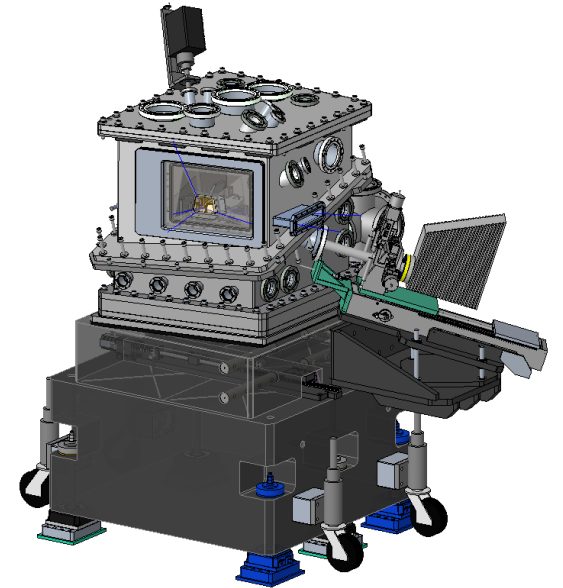


Acceptance Inspection Progress (February)

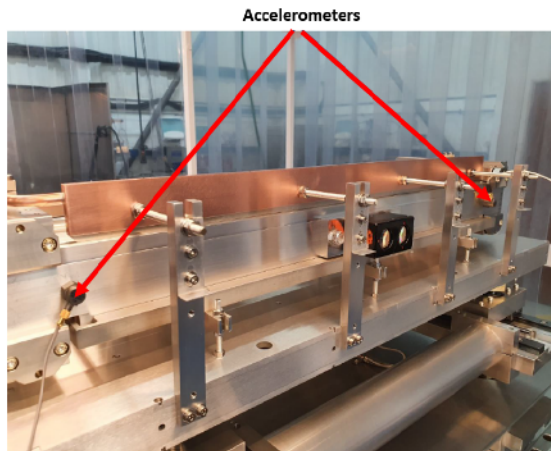


Technical Progress – Experimental Systems

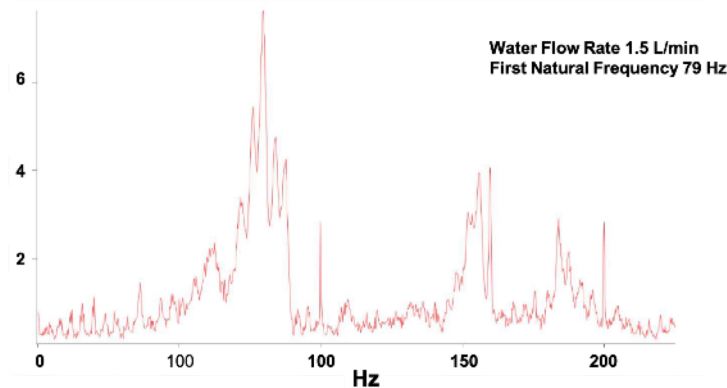
- CNM beamline (26-ID) nanoprobe instrument is being replaced with a new instrument. Planning to incorporate a robot for the diffraction detector setup pending testing of the robot in an existing beamline at APS
- Thermal analysis was performed for several beamlines to calculate the absorbed power density for critical elements under worst-case scenarios.
- ASL (25-ID) mirror system is undergoing FAT in FMB oxford. Motion testing, water testing, and alignment for all systems was completed. Vibration testing for the Inboard Reflecting Mirror System (IRM) was completed. Delivery in May 2020.



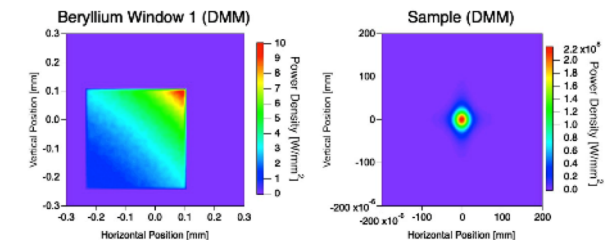
The nanoprobe instrument design for the CNM beamline (26-ID).



Vibration measurement of the 25-ID mirror as part of FAT at FMB Oxford



Measured transfer function between the pitch angle of the IRM and floor is shown with a nominal water flow rate of 1.5 L/min.



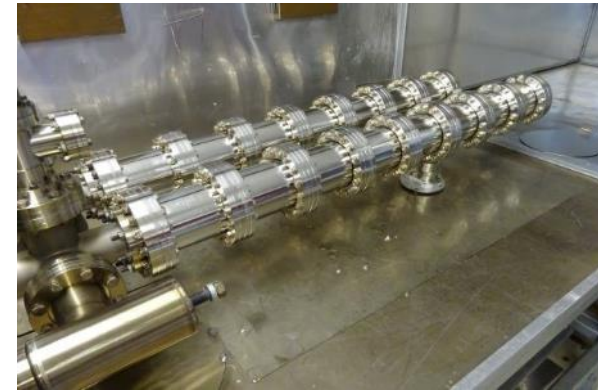
Power density calculation for the ISN beamline: focused beam power distribution on the beryllium window and sample.

Technical Progress – Front Ends

- The first batch of wall collimators and first collimator for the CUFE which was awarded to MDC was receipted this month. (top right)
- The GRID XBPM support system based on APS recent design of a beamline instrument which using air bearing for motion undergoing FAT. (lower right corner)
- First batch of table for canted undulator front end received at ANL. (lower left corner)
- The vacuum chambers and spool pieces for all the canted undulator front ends undergoing FAT. (lower middle two)



CUFE first collimator assembly



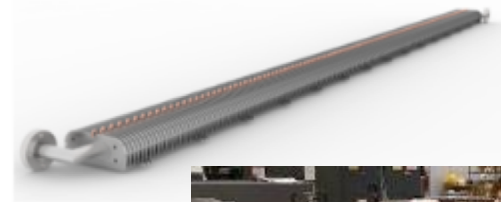
CU front end tables (left), CU front end spool pieces undergoing FAT (middle two) and the granite base for the CU GRID XBPM support system undergoing FAT (right).

Insertion Devices

Superconducting Undulator



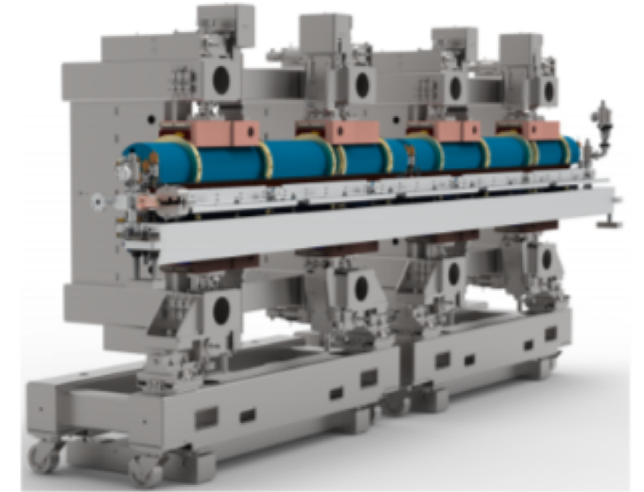
Planar HPMU and monokeeper



SCU Cryostat delivered to ANL

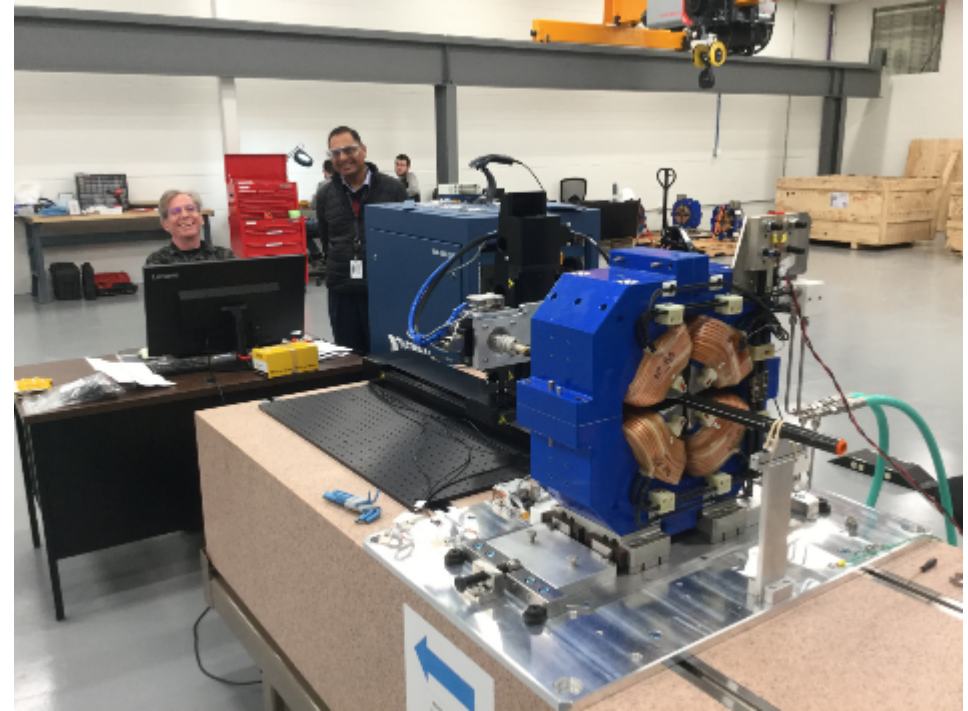


Copper thermal shield assembly



Revolver ID

Magnets and Measurement



Animesh Jain, Chuck Doose

Magnets undergoing incoming inspection in magnet measurement lab.

299 magnets delivered, 204 accepted (over 50 showed up just last week) of 1321 total.

Accelerator Components



First article unipolar power supplies from CAEN, Italy



ITech BPM processors



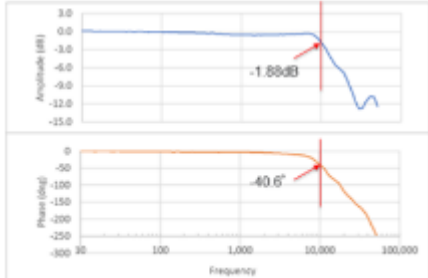
ID vacuum chambers extrusions



Fast corrector and power supply



Frequency response with 8-pole magnet, small signal (1%) with 7.5A DC bias

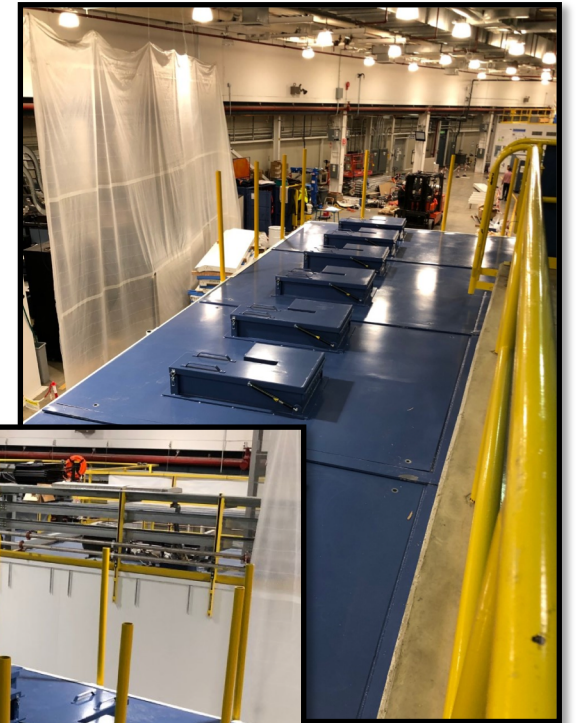


SC bunch lengthening cavity and cryo-vessel



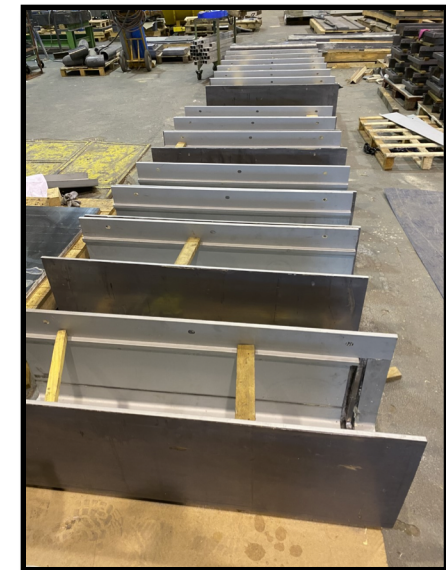
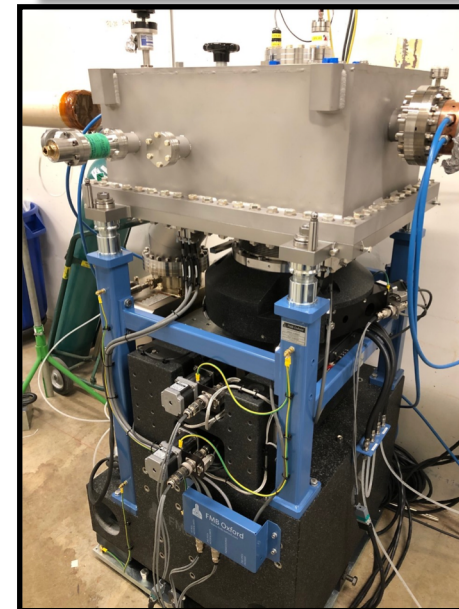
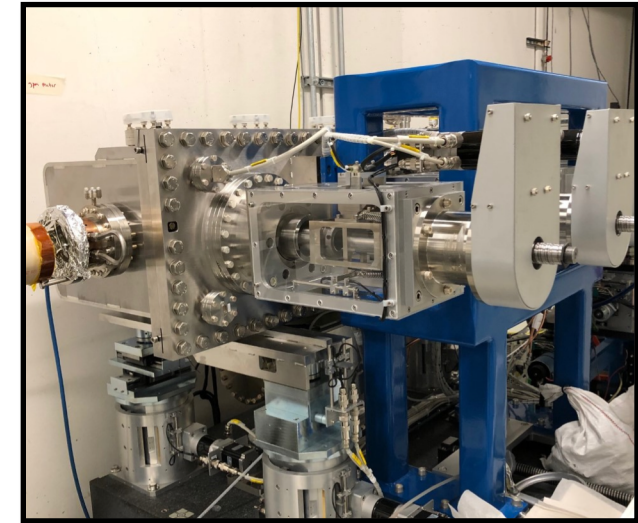
Experimental Station Construction Status at 25-ID

- 25-ID-A station assembly nearly complete
- Station installation will continue with the B, C, D, and E stations
- Utility installation will begin after enclosures are completed
- Beamline components being delivered and staged for installation
- Beamline optics being delivered in the next few months



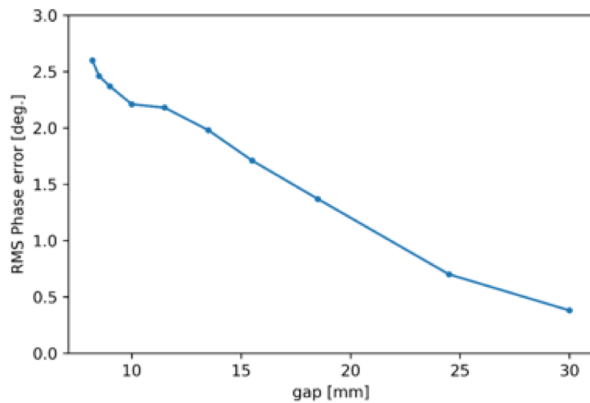
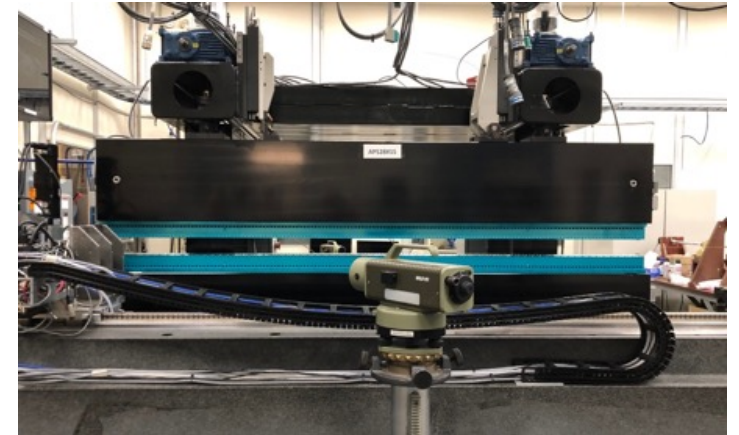
Experimental Station Construction Status at 28-ID

- Shielding validation underway
- Utilities installed
- Beamline optics installation in progress
- Shielded transport delivered and will be installed soon
- Preparing end stations for optics testing

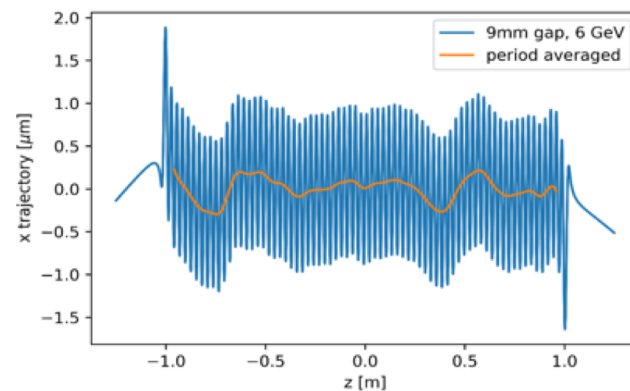


APS-U First Article Undulator (2.8 cm) Assembled and Tuned

- New monokeeper mechanical design promises less shimming
- APS-U will build dozens of new undulators and refurbish many of the current IDs.
- The first article for 2.8 cm has been assembled and characterized. Tuning of trajectory achieved using “side shims.” Multipole correction done using a few surface shims.



RMS phase error vs gap: within the requirement of 3 degrees.



Beam trajectory along the undulator: better than $\pm 0.5 \mu\text{m}$

