



SPECTROSCOPY UPDATE: MOVING 20-ID TO 25-ID

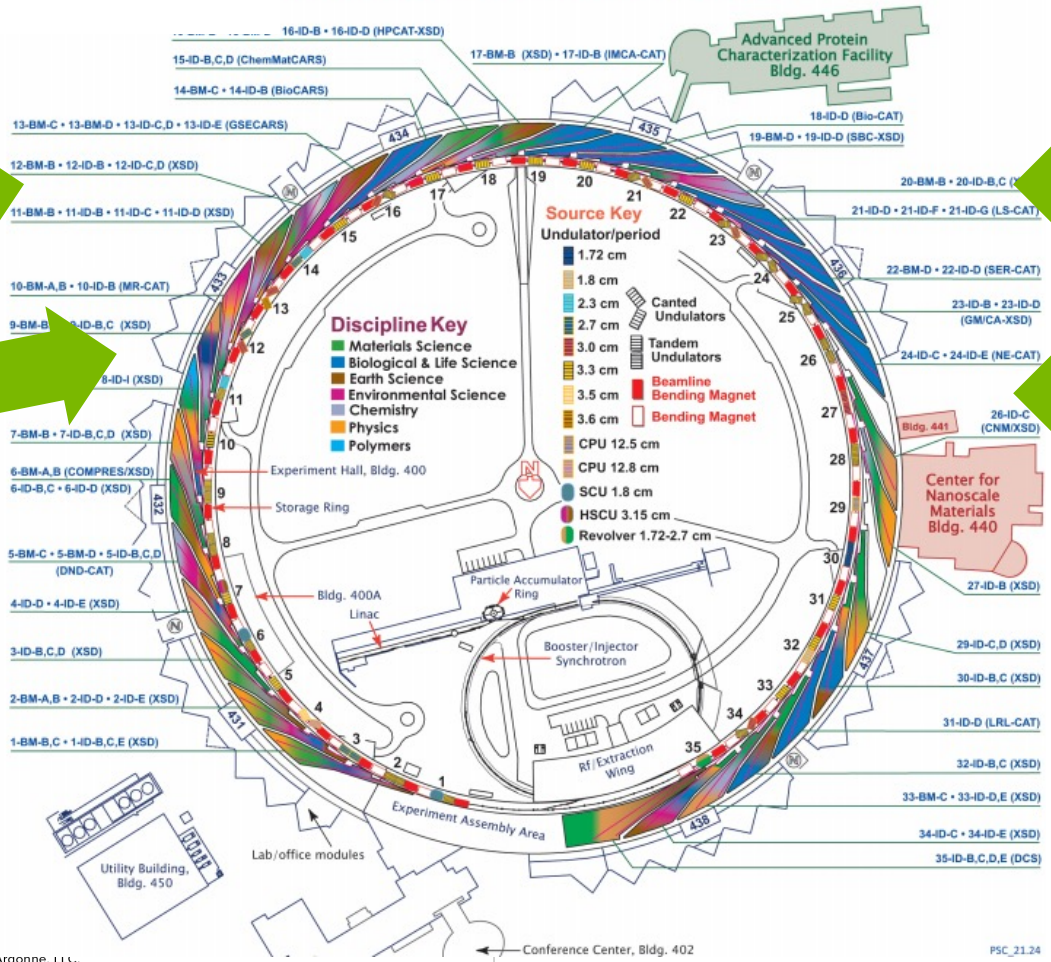
- Spectroscopy Group Beamlines and Science
- High-level design of S-25
- Moving from 20-ID to 25-ID
- Commissioning 25-ID

11-ID-D

9BM

20-ID and BM

Empty 25-ID



SPECTROSCOPY GROUP

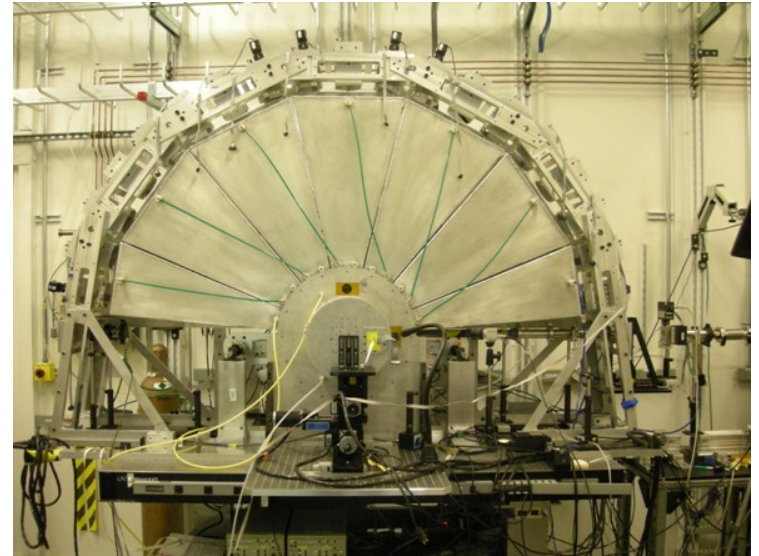
Operates three beamlines at the APS

- 9-BM-B,C beamline is a quick-scanning XAFS capable of extended XAFS measurements in a few seconds.
 - Optimized for low-energy measurements including P and S K-edges
 - Full *in-situ* and *operando* catalyst studies
- 20-BM-B beamline is primarily dedicated to XAFS.
 - Flexible capabilities for confocal imaging and micro-spectroscopy.

20-ID PROGRAMS

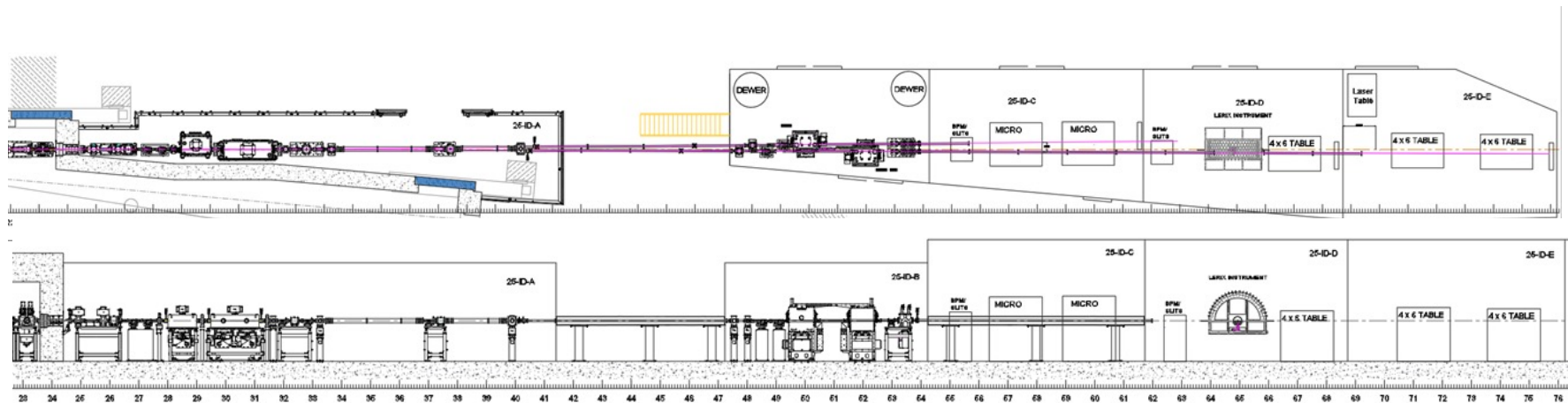
Two experimental stations: B and C

- 20-ID-B has dedicated facilities for micro-XAFS and an x-ray Raman spectrometer (LERIX).
- 20-ID-C provides multiple options for high-resolution fluorescence spectroscopy and x-ray emission spectroscopy.



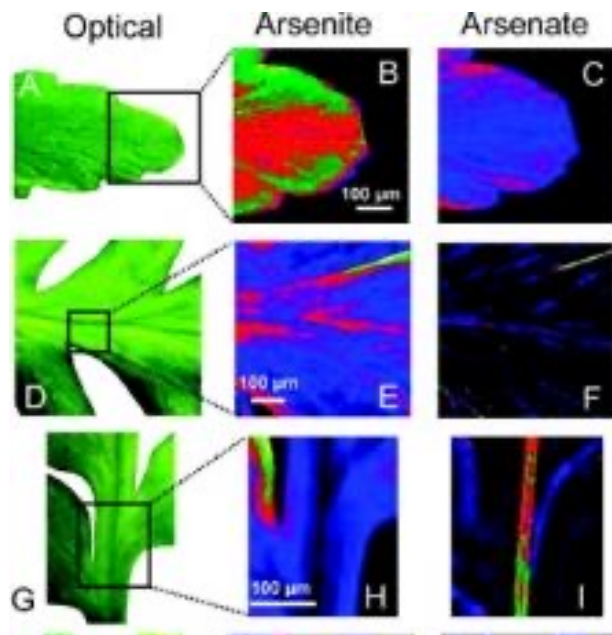
NEW BEAMLINE ON GREENFIELD SPACE

- Beamline has a canted front end and both branches run independently.
- Beamline provides major upgrades to current programs at 20-ID.



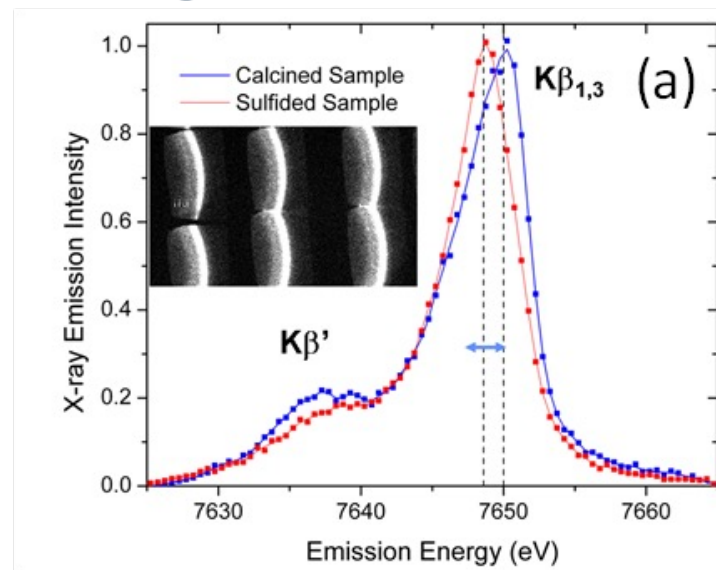
MICROPROBE BRANCH (OUTBOARD)

XRF mapping and micro-spectroscopy:
Chemical mapping with rapid variable focus
0.5 to 10 microns.



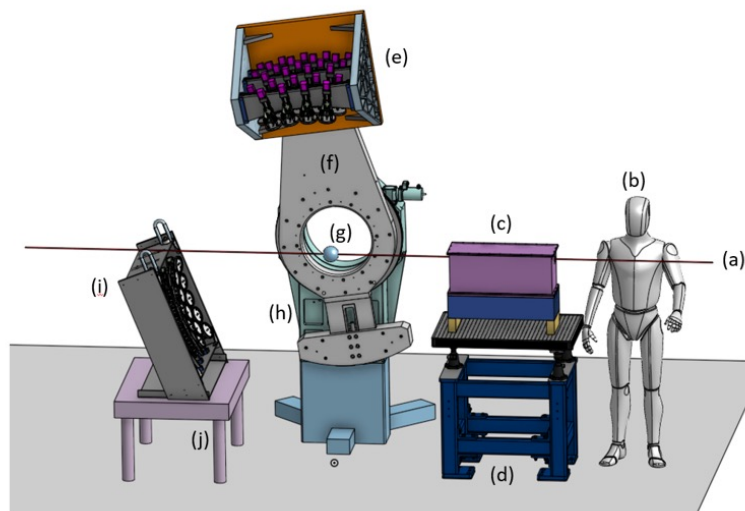
X-ray emission spectroscopy for spin-state,
valence, ligand measurements.

Co emission from catalyst
using miniXS – 30 sec



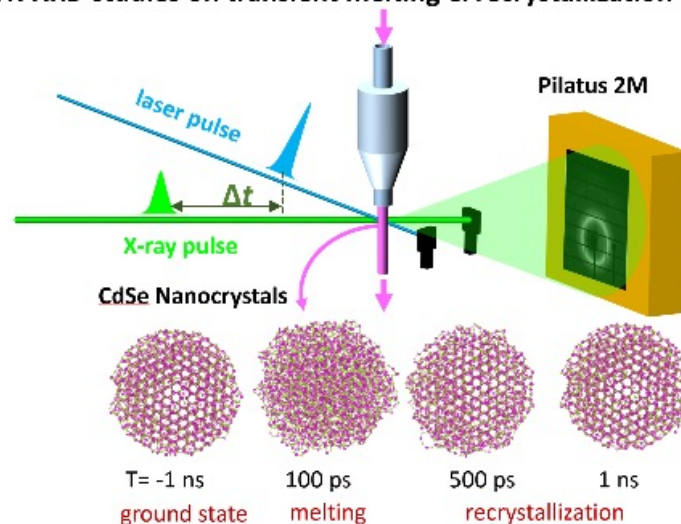
LERIX AND TRXS BRANCH (INBOARD)

New APS-U LERIX spectrometer: Probing soft x-ray transitions with hard x-rays.



Time Resolved X-ray Science (from 11-ID-D): Multiple timescale electronic and structural dynamics underlying material properties.

TR-XRD studies on transient melting & recrystallization of QDs

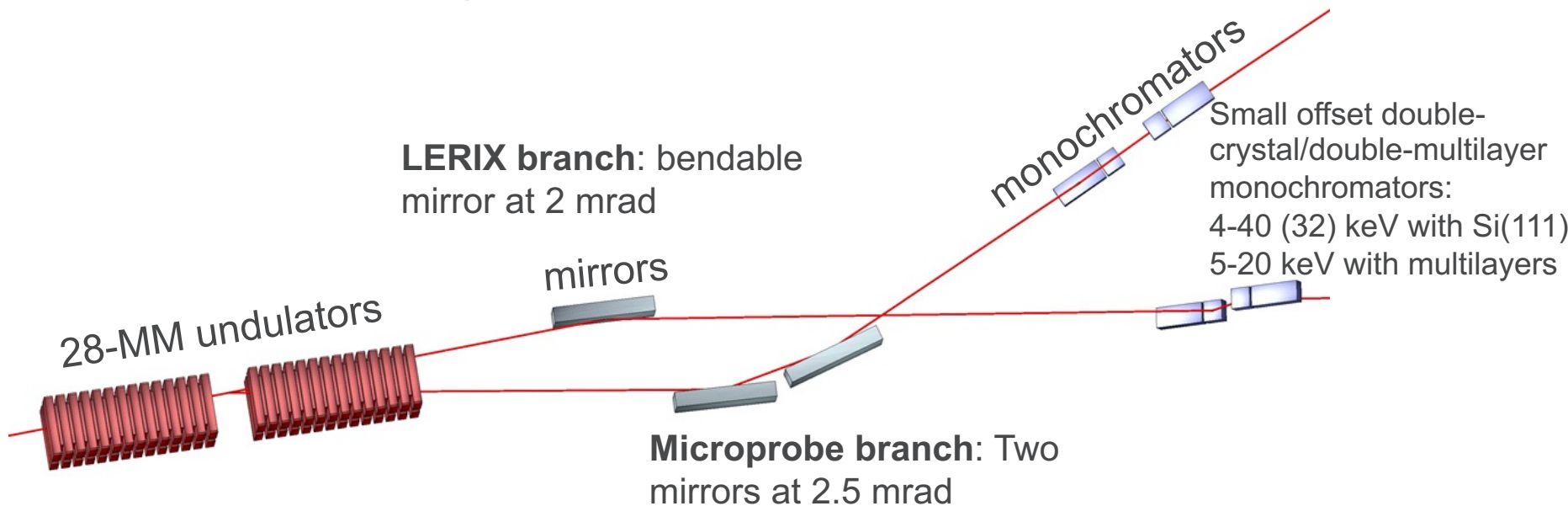


OVERALL DESIGN GOALS

- Microprobe (outboard) branch:
 - 4-32 keV (all elements K or L edges heavier than K)
 - Microprobe with zoom capability (0.5 – 10 μm)
 - Multilayer mono option for non-resonant applications
 - ~30-cm separation from inboard branch
- LERIX (inboard) branch
 - 4-40 keV (covers a few applications above 32 keV)
 - Possibility for better than Si (111) resolution
 - Multilayer mono options for non-resonant applications
 - Space for multiple end stations for both LERIX and TRXS

BASIC OPTICAL LAYOUT

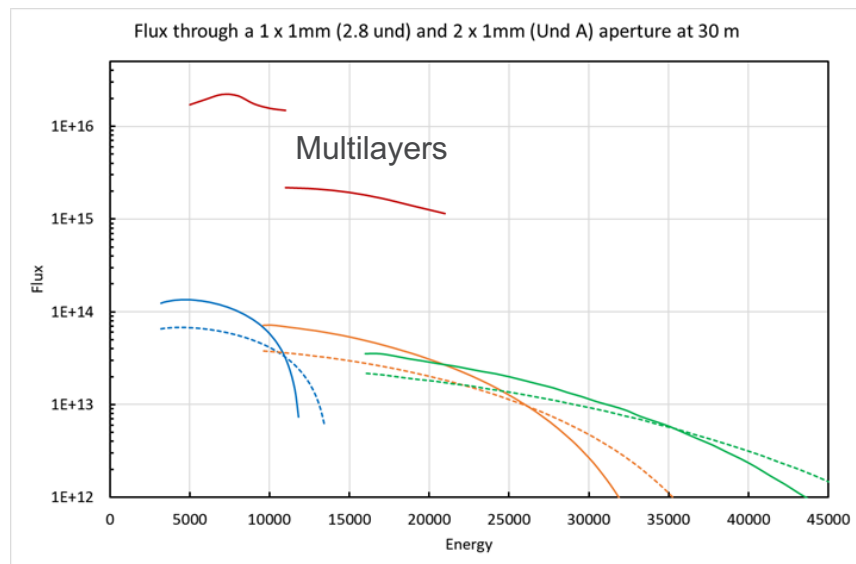
Horizontal deflecting mirrors to separate two beamlines



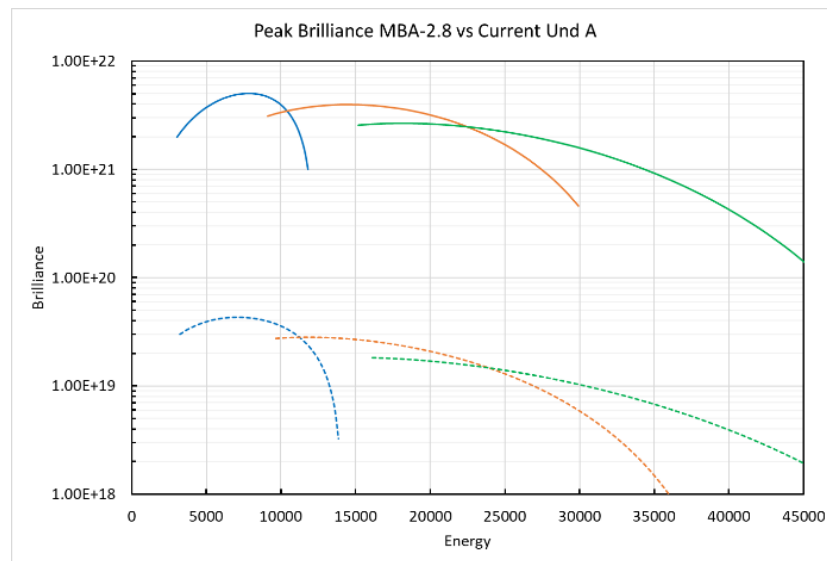
28-MM UNDULATOR FOR BOTH BRANCH LINES

- Provides full coverage of our energy ranges
- Initial operation with Undulator A (dashed lines)

Flux



Brilliance

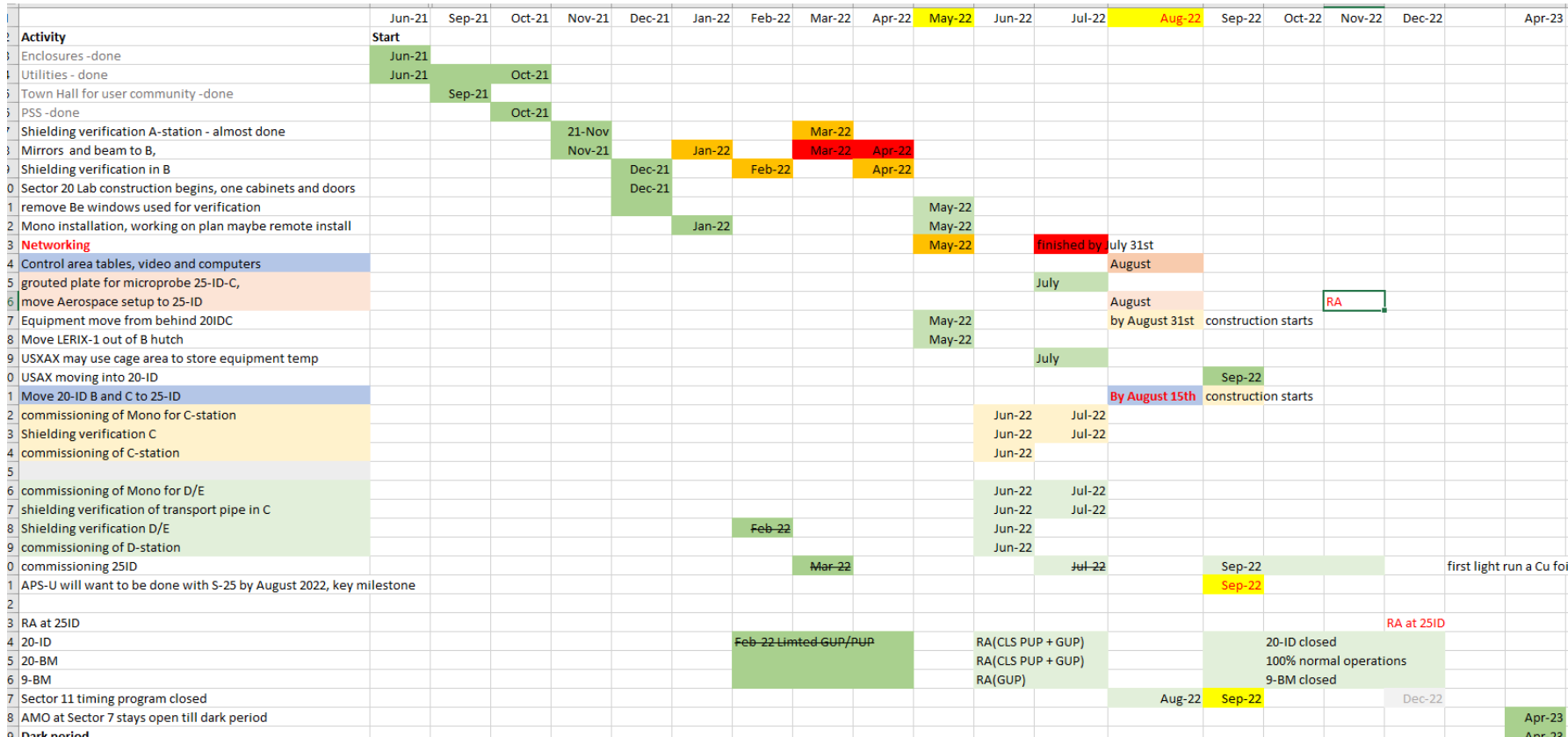


PROJECT TEAM MEMBERS

Sector 25

- Conception design: Steve Heald
- Project management: Robert Winarski
- Engineering: Jonathan Knopp
- Procurement: Tim Graber
- Controls: Dale Brewé
- Optical design and specifications: Xianbo Shi
- Optical fabrication: Elina Kasman and Ray Coley

TRACKING/PREPARATION ACTIVITIES



CLOSING 20-ID AND BEGINNING OF 25-ID



July 29, 2022

AUGUST THE BIG MOVE: TEAM EFFORT

Day	Tasks completed	Monday	Tuesday	Wednesday	Thursday	Friday	
Monday	Install shelves Get carts ready	Riggers move tables to S-25: moved 3 tables, grouted plate table was stuck took down motor put one bike to take LERIX table took pictures	Monday	run motor cables	Monday	signal cables for 300mm table organize bnc cables	
Tuesday	Move equipment Work on Gas Move motor Move some cables open labrinth	Tuesday	Replaced gas panel Took long CAT6 Mark coordinates put up a cable holder organized step put one more bike	Tuesday	set up air lines install 2nd motor rack	Tuesday	set up Aerospace signal chains organize gas line tube bin signal cables for mp table
Wednesday	Pull out all the Work on Gas Bring another Start organizing Mark floor at	Wednesday	Move grouted table clean tape and Move Aerospace	Wednesday	clean out more from unpack SR570s continue air-lines	Wednesday	install last two phytron drivers hook up gas lines for D station both tables test motors in C station, slits, kb mirrors test sr570 control order 3 more moxa's for controlling SR570s -CJS order another gas line tube bin -MP
Thursday	day off	Thursday	experimental equipment photo shoot discussed gas lines	Thursday	BNC patch pannels in holder for BNC Move Be window down	Thursday	testing motors in C hutch optical stack, IO: IW CJS mounting monitors in the hutch -Mark moving filter control to S-25 -skd measure Cat6 cables for satellite phytron drivers, 42 ft 8x6 -Mark install remaining MaxVs in VME crate -Mark, SDK
Friday	Prepare table Move 300mm Unmount and Take more up Move tools and Finish install Installed web Start installation organize unist	Friday	take down motor Put lerix table a Put up motor rack Unpack and ins Move control table install Cat6 cables discuss controls	Friday	Move 300mm KB mirror setup Moxa for SR570 setup 4 signals for ion finalize air-filter with remove gas bottles at try moving a motor w holders for plastic bins in both 25-ID-C and D	Friday	upgrade desks to 8ft sections from 8-ID install transition boards Test limits using hall-affect -CJS (turn lead screw possible) Mike/SDK review motors cables we need verse what we ordered found cables for filter control

TEAMWORK



Mike Pape



Chengjun Sun



Debora Motta Meira



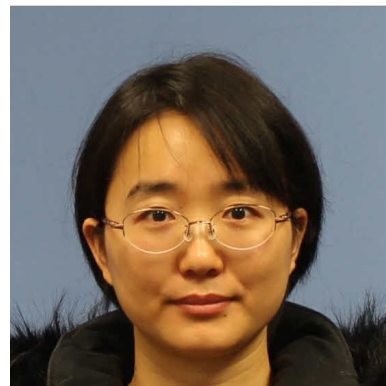
Mark Wolfman



Inhui Hwang



Aleks Solovyev



Yanna Chen



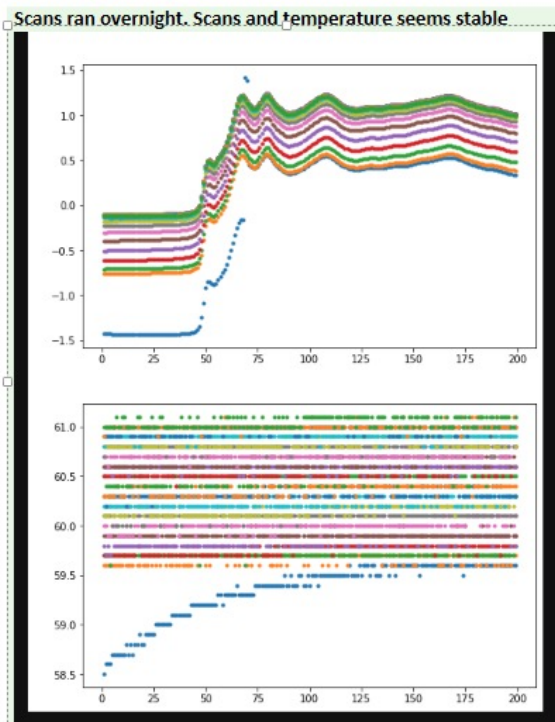
George Sterbinsky

S-25 COMMISSIONING

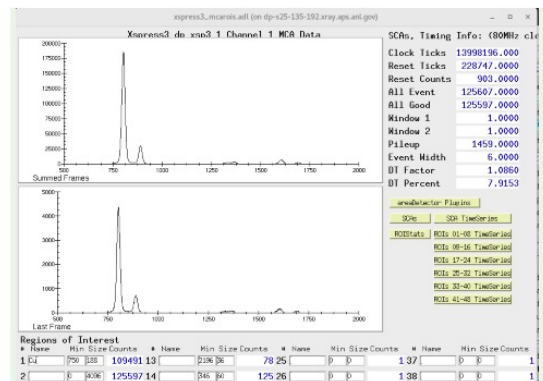
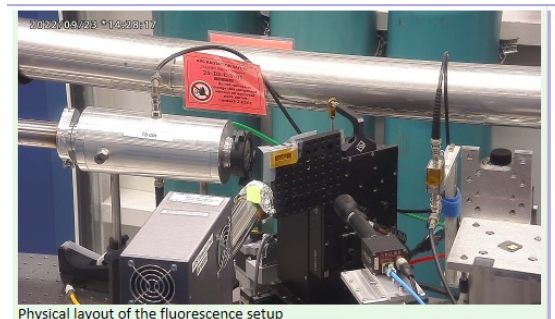
- Test monos' motor temperature for consecutive scans
- Alignment of beams: front-end slits, mirror, masks, monos to end-station
 - Get central cone of ID: 'Crazy Steering Saves the Day'
 - Move beam pipes
- Align WB slits to mirrors, installation of encoders
- Implemented and initial testing of XAS-type energy scan
- Improve mirror vacuum: bake and high power
- Calibrate mono gaps for Si(111) and MTLs; establish motions for switching
- Verify energy range of MTLs; gap and height
- Activate and test mono internal feedback
- Verify energy calibration of monos over full range and repeated scans
- Establish protocol for mirror vertical translations for Pt, Si, and Rh and focusing

COMMISSIONING TESTS

MONO MOTOR TEMP



VORTEX DETECTOR



COMMISSIONING 'CRAZY STEERING'

9/24/2022 – 10/3/2022: 'CRAZY STEERING'

- With help from Kurt Goetze and Shawn (MCR) this morning, we moved the S25ID XBPM down and steered the beam up. Skipping all details, we have steered the beam up by +90 μ rad and got the beam centered on the GRID-XBPM located at its nominal position. The undulator beam should be centered on the Exit Mask now, as accurate as Survey/Alignment has put it.
 - Si(111) Flux 10^{13}
 - 100x more flux with ML
- Next mono gap value



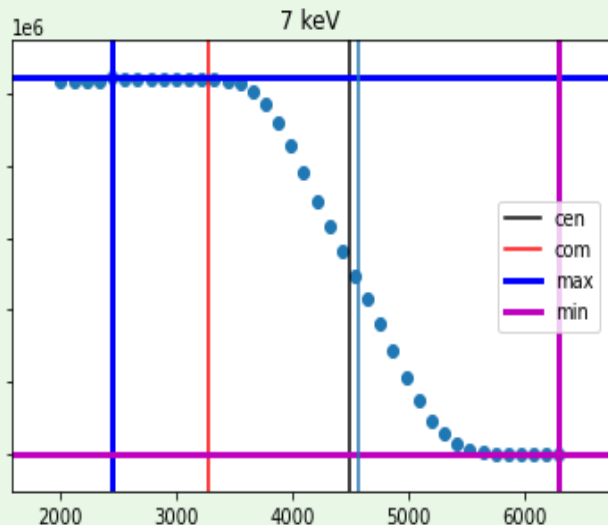
GAP DETERMINATION

$$\text{Height} = 2 * \text{gap} * \cos(\theta)$$

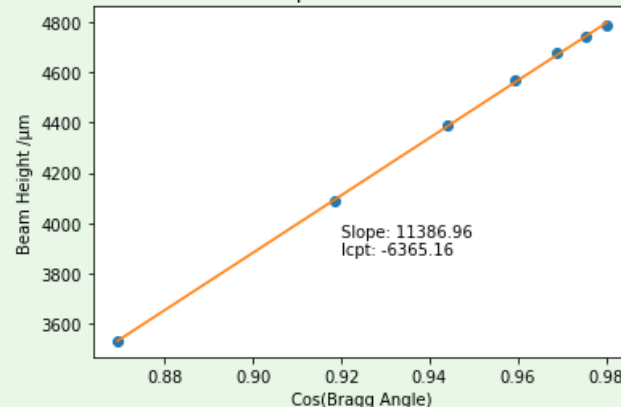
MANY KNIFE-EDGE SCANS

SLOPE IS EQUAL TO 2*GAP

Knife edge scan



Mono Gap Calibration (25-ID-C)



- Survey gap adjusted by ~500 microns for MicroProbe Branch
- Working on LERIX Branch

COMMISSIONING

ENERGY SCAN IN EPICS

25idd: - Energy Scan

Energy Setup | Scan Setup

	Rel. Energy (eV)	Abs. Energy (eV)	Wavenumber (1/Ang)	Step Size (eV)	Step Size (1/Ang)	Integration Time (s)	Steps
Base		7000.000000					
Region 1	-30.000000	6970.000000		10.000000		1.000000	27
Region 2	-30.000000	6970.000000		1.000000		1.000000	60
Region 3	30.000000	7030.000000	2.80239	0.100000		1.000000	52

Integration Time Weighting: 1.250000

E to k factor: 3.820

Total steps: 139

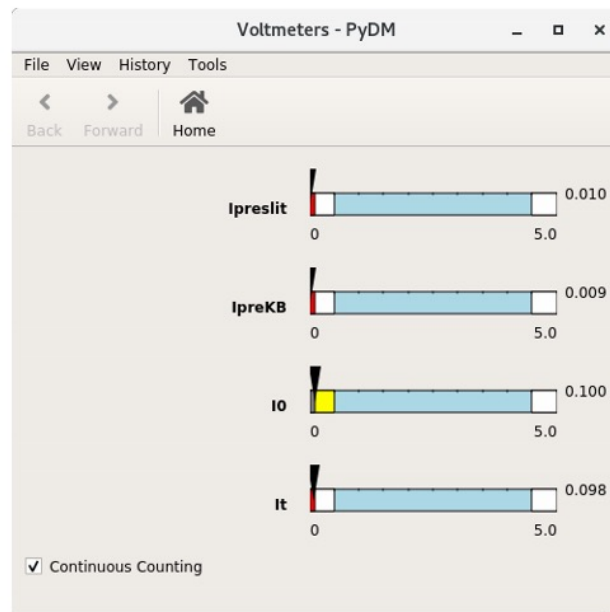
Buttons: Changed, Load, Done, Start Scan, Done, Go, Pause, Stop

Calcs | Array Calcs | Mono Tracking: 0.000000 | Mono Energy (eV): 8000.000000

Scan | Sequences | Stepping (eV): 0.000000 | off | ID Stepping | ID Energy (keV): 8.160

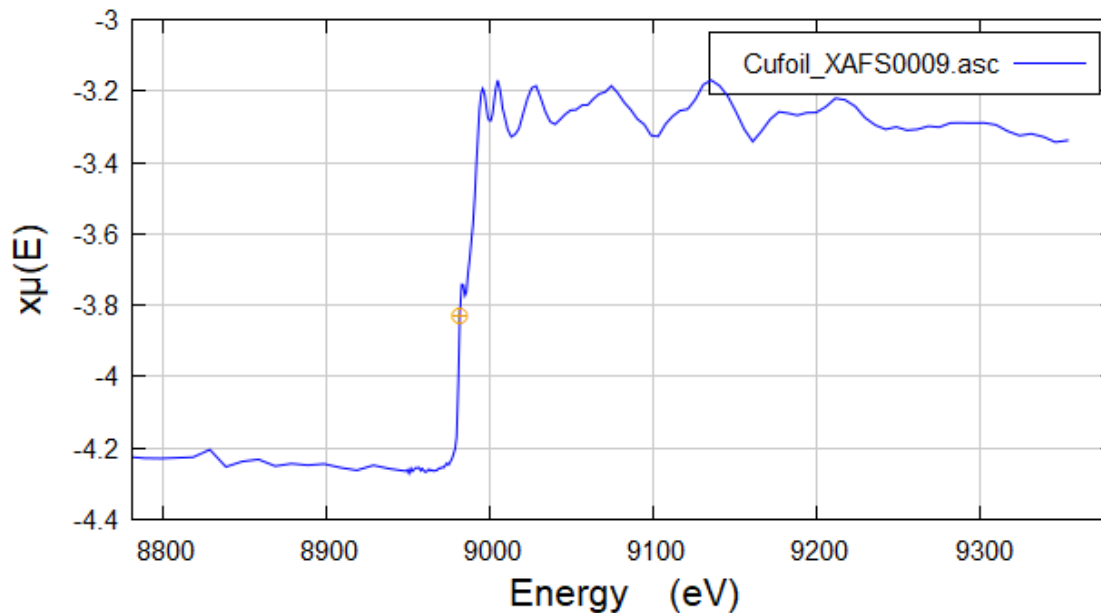
EASY TO READ VOLTMETER

To start voltmeters window (just upstream tables for now):
start_voltmeters_25idd
start_voltmeters_25idd



COPPER EXAFS SCAN

Cufoil_XAFS0009.asc in energy



UPCOMING MILESTONES

- First PUP experiments at end of November (Aerospace)
- SPC Group and TRR Group member trainings in Nov/December
- SPC RA proposal system is open for Spectroscopy Group for 22-3
 - First experiments on the books include:
 - XES with Si(111) and ML before and after the upgrade
 - XAS of dilute systems

QUESTIONS? AND FEEDBACK

