

APS OPERATIONS UPDATE



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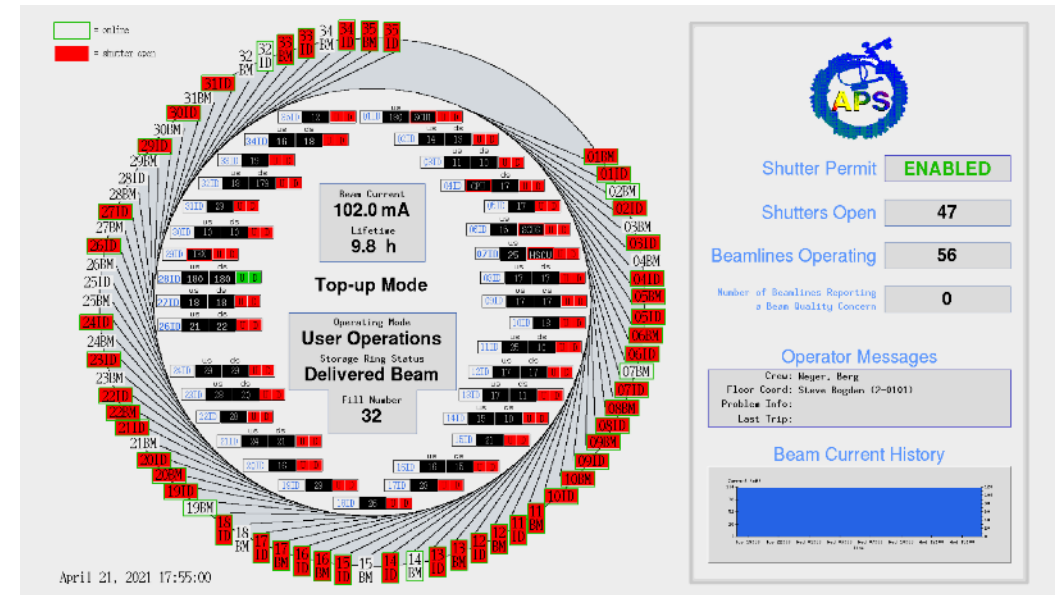
Photon Sciences Directorate

PSC All Hands Meeting

April 28, 2021

APS OPERATIONS UPDATE

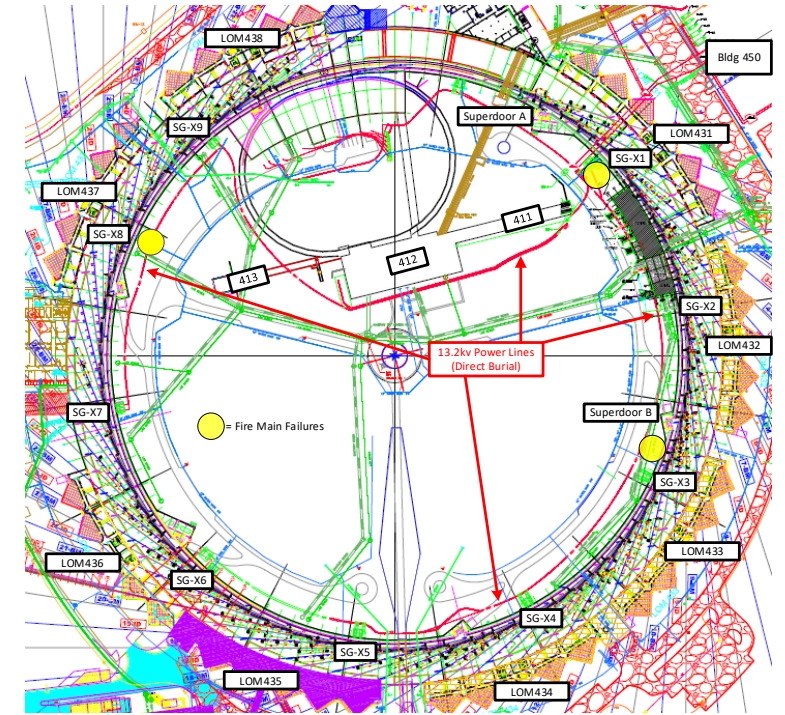
- Chronology (brief):
 - As the COVID-19 pandemic has evolved, the APS has responded with the actions below:
 - March 21, 2020: Illinois stay-at-home order; APS to Minimum Safe
 - Late May: APS expands to non-COVID experiments, only remote access permitted (no onsite users).
 - June 1-10: APS short shutdown for annual validations and calibrations
 - June 15: APS moved to Limited Operations with Argonne site.
 - Aug 14 to Sept 14: APS shutdown period to align with NSLS-II run
 - Oct 1: Start of APS 2020-3 user run; limited onsite Argonne employee users permitted
 - Dec 17 – Jan 26 2021: APS shutdown, 2021-1 user run started Jan 26
 - Apr 22 – Jun 2 2021: APS shutdown, 2021-2 user run starts Jun 2
- Accelerator, Beamline and Facility current status:
 - The APS accelerator complex provided stored beam for users at high reliability (>97.74% for 2021-1 run). ComEd 138kV site supply transients (3 separate in late January, mid February) were responsible for ~0.55% availability loss in the 2021-1 run.
 - Beamlines are enabled for COVID, proprietary pharma and non-COVID research. Majority of experiments are mail-in/remote access with limited in-situ experiments that are within established staffing and sample risk thresholds.
 - The APS regularly has ~280 staff onsite at any given time, in direct support of APS-U and APS Operations mission essential work.



APS Operations dashboard on Apr 21, 2021 (last day of 2021-1 user run)

APS 13.2KV POWER SHUTDOWN (APR 30 – MAY 4)

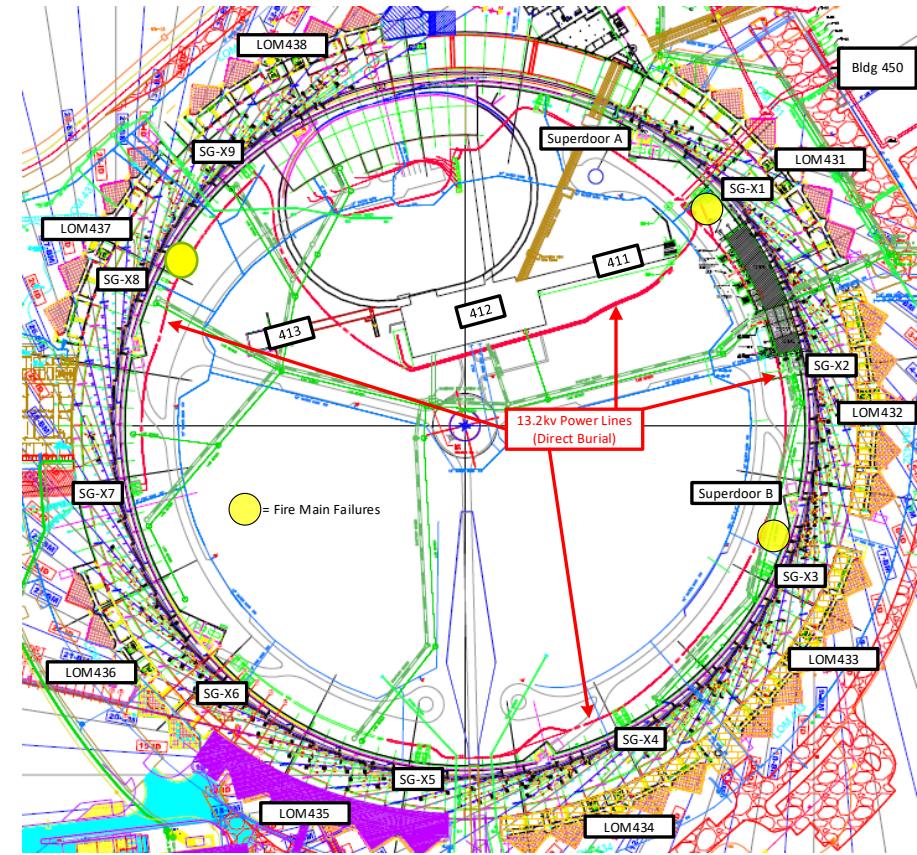
- **Extensive medium voltage (13.2 kV) power shutdown to portions of the APS Storage Ring and Experiment Hall**
 - *Initiating Event:* Unanticipated failure of three (3) domestic water mains that supply the APS Storage Ring and Experiment Hall fire suppression system.
 - *Response:* Failed domestic water mains have redundant water supply by design, which was enabled immediately following leak isolation.
 - Significant APS Storage Ring and Experiment Hall power shutdowns are required to repair three (3) failed fire water lines in the Storage Ring infield by Super Door A, B & E.
 - Planning began in mid-March to repair ruptured domestic mains concurrently during the Apr/May scheduled APS maintenance shutdown, specifically from Apr 30 to May 8.
- Site emergency power will be available, but limited. Impact to accelerator, beamline and facility technical systems as well as work environment e.g., lighting, HVAC, network services, emergency power availability for critical components are being actively mitigated.
- *Root Cause and Extent of Condition:* Piping corrosion and embrittlement over the service life (~26 years) of the steel piping, exacerbated by rapid spring thaw. NDE examinations of additional infield water lines will be ongoing after repair period to characterize remaining lines. Repaired lines will be non-metallic (HDPE, 50-year life) and routed away from buried power lines and transformer sets.



Domestic Water Fire Main failures on APS infield (yellow circles)

APS POWER SHUTDOWNS

- Major power shutdowns are required to repair three (3) failed fire water lines in the Storage Ring infield by Superdoor A, B & E in proximity to buried 13.2 kV power supply lines.
- Repairs at the failures will happen concurrently
- Repairs are estimated to take about 5 days or less, by schedule (1 week with contingency exercised).



Above: Failure Locations on APS infield indicated by yellow circles

Far Left: Super Door A

Middle: Super Door B

Left: Super Door E

APS POWER SHUTDOWNS

Computer/Network Systems that will be affected by Power Outage

GENERAL

- Distributed Antenna System (DAS) in LOMs and Experiment Hall – no cell phone coverage
- ICR – No file backups or restores will be available for "home" file systems

BEAMLINES

- XSD and CAT computers
- XSD and CAT network switches
- XSD file backups and restores
- XSD terminal servers for IOCs
- IOCs
- Beamline cameras

ACCELERATOR

- Tier 3 Network for Linac/PAR/Booster/Storage Ring
- IOCs
- Terminal servers
- Building 400A network and computers
- Distributed computers

Computer/Network Systems NOT affected by Power Outage

GENERAL

- Buildings 401 / 402 network and wireless
- APS Datacenter (Room D1109)
- EAA / MM1 network and wireless
- Bldg 420 (RF) network and wireless
- APS and XSD web services
- Oracle applications hosted on beams
- Access to Argonne computing resources
- Access to CELS computing resources
- Office365 email

BEAMLINES

- LOM networks and wireless (unless switches overheat without cooling)
- Orthros On-Demand HPC (note general maintenance performed on May 12-13)
- Beamline computing resources xfm1 (S34, S32), monas (RAVEN), pchip (RAVEN)
- Beamline core networking (new switches being installed starting on April 30; no outage due to high avail. configuration)
- CAT core networking

ACCELERATOR

- Tier 1 / Tier 2 Network
- Bldg 420 RF Tier 2 network
- Main Control Room
- Accelerator servers and storage
- Accelerator web server

APS POWER SHUTDOWNS

Other Systems/Locations that will be affected by Power Outage

GENERAL

- Building 400, 411, 412, 413 HVAC
- ICR HVAC (not on e-power)
- Lighting
- Bathroom faucets on automatic sensors
- Shipping may suspend deliveries and pickups to APS for power shutdown duration

BEAMLINES

- Beamline equipment not on e-power
- LN2 fill stations
- ODH monitors (open hatches with wall monitors since LN2 available)
- LOM work spaces (lighting, HVAC)
- Refrigerators
- All fume hoods (no wet lab work)
- LOM laboratory lighting

ACCELERATOR

- Power Supply control power
- Building 400A
- Technical water systems
- Diagnostics equipment
- Superconducting undulators

Other Systems/Locations NOT affected by Power Outage

GENERAL

- Buildings 401 / 402
- Bldg 446 (APCF) and Bldg 440 (CNM)
- Bldg 420 (RF)
- Main Control Room
- Early Assembly Area (EAA) and MM1
- Chilled water
- Compressed air
- Vacuum (unless generators fail)
- ACIS/PSS/FEEPS (unless generators fail)

BEAMLINES

- Liquid Nitrogen Distribution System main IOC, PLCs and interconnect PLCs (however, no EPICS screens)
- LOM network (but no cooling available)
- LOM doors and ProxCard readers

ACCELERATOR

- EAA
- RF
- PS Control power S36-S01
- Vacuum S36-S01
- ACIS - RF

APS POWER SHUTDOWNS

Preparation and Mitigation (sample list)

- Reduce scope / schedule uncertainty: Borescoping of failed lines for early characterization; significant excavation and prep work during run period; line locating and verification for future directional boring
- Mitigations prepared: Generator redundancy in event of failure, schedule contingency for repair scope(s), contact tree in the event of a significant issue during power shutdown
- Estimate accelerator system impact: Indexed impact to technical and conventional (HVAC, compressed air, LNDS) systems; contingencies identified including prepping spares, if needed
- Estimate beamline impact: Detailed inventory of critical beamline power needs; estimated total generator load addition (sufficient); all non-critical, automatic starting/re-starting equipment should be disabled prior to power shutdown
- Expedited infrastructure upgrades: Emergency outlet addition; tie-in SCUs and critical equipment
- WSH preparation: Battery-powered task lighting for shutdown work, heat stress monitoring, portable ODH monitors, LOM lab and gas cabinet preparation,
- Ex-APS impacts considered: CNM (440) and APCF (446) notified, both not impacted by power shutdown
- Global pre-job brief with all shutdown personnel in keeping with past shutdowns