

PAMM/Outage Recovery

This pVS age is a reference for system dependencies and prioritized recovery from utility outages, PAMMs, and other disasters

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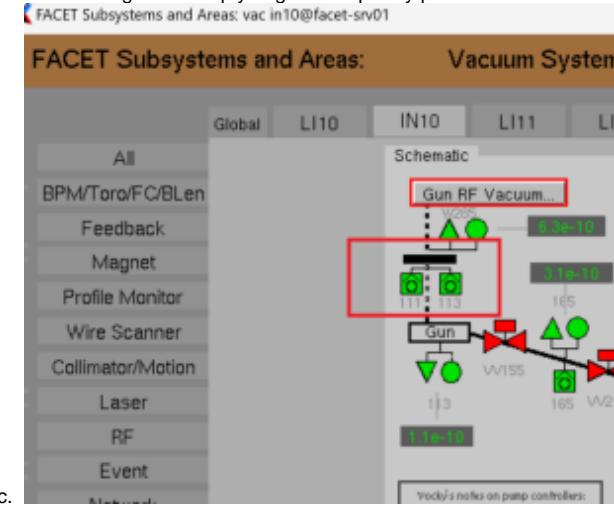
Recovering from an extensive site power outage

Things to keep in mind:

- Depending on the nature of the outage only partial restoration may be possible particularly if we are limited to run on the site backup 60kV line
- Programmatic priority and resource availability should be factored into recovery planning
- Establish contact with the FACET Area Managers, Physicists, and Laser Leads to help assess impact on critical systems and infrastructure

Critical Systems to examine first when notified of outage:

1. Verify the Safety Systems have functioned as expected and safely secured the beam hazard
 - a. May need PPS group to power cycle S10 Injector or Linac Global PLCs in order to prepare areas for access
 - b. Possible for Linac Middle Waring Audio settings to get lost during a power outage
 - c. RPFO will likely need to perform a survey before access can occur in FACET Accelerator areas
2. The Injector Gun vacuum is critical for operations and the cathode would catastrophically degrade with loss of vacuum
 - a. If power outage will be extended greater than 8 hours, we will need to procure temporary power to keep the vacuum pumps going for the FACET Gun.
 - b. Area manager can help you get a temporary power source for the 2 critical gun vacuum pumps: 111 & 113.



Prioritized recovery of systems once power restored:

1. Restore Vacuum to critical RF stations:
 - a. 10-2, 10-3, 10-4, 10-5, 11-1, 11-2, & 20-4B
2. Restoring the Control System:
 - a. Begin Recovery of the SLC/VAX control system
 - b. Begin Recovery of the EPICS control system
 - c. Begin Recovery of the Archiver Application
 - d. Will also need controls personnel in field locations for restoring/power cycling controls hardware for both the SCP and EPICS control system
3. Restoring Sector 10 RF Hut Water System:
 - a. Recovery of Sect 10 RF Hut Water is critical since many things depend on it including:
 - i. Master Amplifier timing source
 - ii. MP00 for SCP Beam Code Broadcast, which depends on Master Amp being up and transmitting 119MHz signal
 - iii. EVG Timing
 - iv. Timing and RF necessary for S10 & S20 Laser Operations
 - v. Timing for many other running programs including LCLS
4. Since Lasers have a long(day-ish recovery) its critical to restart them sooner rather than later to prepare for beam operations
 - a. Recovery of the Sector 10 Laser Room LCW and HVAC
 - b. Recovery of the Sector 20 Laser Room LCW and HVAC
 - c. Laser Motors can lose home and will likely need to be rehomed by laser experts and or controls folks

- d. There may also be a need to consult with timing experts to re-lock the laser

5. Restoring Vacuum Pumps

- a. Should survey vacuum levels and dispatch MFD Vacuum to restore failed vacuum pumps
 - i. Priority areas for the vacuum restoration are the S10 Injector, and S20 X-Tcav
 - ii. PEM can be first line to troubleshoot failed Klystron Station Gauges that are off

6. Restoration of remaining LCW Systems

a. Recover LCW for Sectors 10-20

- i. Recovering Water for Sector 10 Injector stations should be done first
- ii. Sector 20 MCS is also important since it will feed the DPS pumps, and Facet Dump BCS Flow Switches.
- iii. Recover LCW(ACS, WCS,KCS) for sectors 10-20.
- iv. Note we may need to leave ACS, WCS,KCS heaters off if we are power restricted on the 60kV line
- v. Schedule Tunnel Walk Through After LCW gets restored to search for water leaks

7. Things with smaller power draw to consider powering up after LCW restored if allotted power available on 60kV line

a. Modulator/Klystron Related

- i. Modulator Control Power
- ii. Klystron Filaments
- iii. Klystron Focus Supplies
- iv. Sector SubBoosters
- v. SBST 19 May have **additional RF chassis** that will need to be reset after a power outage. Contact AMRF if the SBST Glassman is up, but there is no RF out for this unit.

b. Linac Magnets

8. Other Items to recover while waiting for full site power to restore:

a. BCS

- i. Recover S10 SBTC Chassis
 - 1. Will require no BCS faults and Beam Permit On to clear
 - 2. Permits for ACCEL and STBY need to be manually turned ON after power cycle
 - 3. If chassis will not come up, and no BCS faults are present, then contact BCS group
- ii. Make sure S20 PIC HV is ON.
- iii. Need S20 MCS on in order to clear BCS flow faults on FACET Dump Flow Switches

b. MPS

- i. Scan the Java MPS CUD to see if there are any faults that will not clear or are masked by TD-11 or other upstream mitigators installed

c. Contact Accelerator Operations to get schedule for searching any FACET accelerator areas if applicable

d. Timing system.

- i. Make sure FFTB_EXT bit is set correctly (run 30 Hz to dump macro in SCP if not).
- ii. Verify event codes are properly defined (e.g., FACET TS5 10 Hz should *always* have 10 Hz, if not check masks against [a reference](#)).
- iii. Check that faulty EDEFs (12-15, 19, and 20) are not open. These don't work and cause GUIs to fail if they unknowingly reserve them.

9. No Power Restriction Full Recovery Items

a. VVSs 5-9

b. Sector 10-20 Linac Modulators

c. Control System Checkout of High Level Applications:

- i. Emittance/Optics GUI
- ii. LEM GUI
- iii. Profile Monitor GUI
- iv. BSA GUI
- v. Correlation Plot GUI
- vi. S20 Optics GUI
- vii. Sextupole GUI

Recovering from a PAMM

Things to consider:

1. Scan the PAMM jobs list in CATER to see what jobs could impact beam recovery such as:

- a. Check the PAMM schedule to determine a likely recovery start time(VVS ON). Typically this is approximately 30 minutes after the last area is searched inhibiting hazard turn on for Linac Middle
- b. Will there be any Modulator or RF work on critical stations(10-2,10-3,10-4,10-5,11-1,11-2, 20-4B) that will require processing or supervised turn on from PEM/AMRF?
 - i. If you will need shop support for recovering the RF systems, be sure to schedule that as far in advance as possible
- c. Scan the list for jobs that will impact currently used hardware and assess whether or not this work will inhibit function upon completion of the PAMM. Especially work on the following systems:
 - i. Klystrons/Modulators & Subboosters: Will any supervised run-up, processing or re-phasing be necessary after the work?
 - ii. Profile Monitors: Perform as much checkout as can be done post work and prior to turn on.
 - iii. Magnets: Check to see that magnets turn on and trim or standardize as necessary to ensure they are back to nominal operation
 - iv. Wire Scanners/PMTs: Perform as much checkout as can be done post work and prior to turn on.
 - v. Facilities Work like LCW/Heaters & HVAC. Check that systems worked on are back at desired temperature and stabilized
 - 1. Often times when water systems go down water interlocks can fault on equipment fed by that system. This can require local resets by equipment owners, and should be scheduled in order to save time on recovery
 - vi. Vacuum Work: After work is complete it is good to check that levels are coming back to nominal, and all pumps and gauges are on and functioning as expected
- d. Check the list for software work being performed and assess the impact of that work:
 - i. For work being done on HLA's like Score, BPM GUI, or Matlab GUIs; check that the apps launch and function as expected after work is complete
 - ii. Also keep in mind some software jobs can impact multiple applications even if only one has changed. In general its not a bad idea to check that all the following applications still run coming out of the PAMM:
 - 1. Emittance/Optics GUI

2. LEM GUI
3. Profile Monitor GUI
4. BSA GUI
5. Correlation Plot GUI
6. S20 Optics GUI
7. Sextupole GUI

2. Will there be any laser work that would cause injector retuning?

- a. If invasive laser work will be performed a plan should be made to schedule the necessary injector studies/measurements to restore the injector to the nominal operating condition

3. Check for any timing system issues:

- a. Check the Event Global EPICS panel to see if we have rate as expected:
 - i. If global rate is not present check to see we are getting rate from the MPG using the SCP
 - ii. If MPG rate is zero check that MP00 Micro is up
 - iii. Check that Master Beam Control Bits are set to allow rate, and that the Beam Permit is on. Note if there are issues with the master beam control we will need Ops assistance to make any changes to the Master Beam Control Box (CyBox)
- b. Timing issues can cause BCS faults, so also check to see we have the triggers necessary to clear the BCS faults

4. Check for any PPS or other Site/Area Safety Issues:

- a. PPS/Safety issues can often delay recovery especially when discovered mid PAMM. Its important to track them and work the area manager to see that the proper WPC(CATER, RSWCFs) are moving forward to expedite the resolution of the issue so that they do not inhibit recovery

5. Check for any BCS faults:

- a. Recover S10 SBTC Chassis
 - i. Will require no BCS faults and Beam Permit On to clear
 - ii. If chassis will not come up, and no BCS faults are present, then contact BCS group
- b. Need S20 MCS on in order to clear BCS flow faults on FACET Dump Flow Switches
- c. Check the sector 19/20 PICs LIONs are not faulted

6. Check for any MPS faults

- a. Scan the Java MPS CUD to see if there are any faults that will not clear or are masked by TD-11 or other upstream mitigation devices inserted.
- b. There is a fault that sometimes shows up called "Bypass Recovery". This is a helper MPS fault to remind us to re-bypass any faults that we had bypassed previously. If it cannot be cleared with the Bypass Recovery button on MPS Global, we can bypass it until controls group members can fix it.

7. Scan LCLS Home for Red/Purple/White/Yellow Status:

- a. Check all areas and subsystems. Even if there is a known alarming box, still good to verify anyways to be sure nothing new has popped up there

Recovering Schottky timing after laser work or timing shifts.

Often when recovering from a PAMM, extended outage, or any significant drive laser work there will be a shift in the laser timing relative to the RF timing in the rest of the linac. To avoid having to make changes to the phases and timing of downstream devices it is often easier to adjust the Target Time for the drive laser instead.

If on recovery the Schottky phase is found to change from the normal operational setpoint (waveguide phase at 0 deg) then it is suggested to follow this flow chart for [Recovering Laser Timing](#). Properly accounting for source timing changes should minimize work required to recover.

