Accelerator Operations

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U.S. DEPARTMENT OF ENERGY | Office of Science

JSA

Last Year's Goals and Performance

Deliver beam to three halls for nuclear physics program safely and reliably	✓	Delivered beam to ACBD with 76% reliability vs 77% promised.
Execute CEBAF Performance Plan	✓	SFR delivered two C75CM and one C100. Reliability scope had to be reduced due to funding.
Improve CEBAF reliability: reduce unscheduled downtime and frequency of trips	✓	Noticeable improvement in critical systems. See next slide.
Improve CEBAF multi-hall performance with a high beam intensity	✓	Improvements demonstrated. Need more work.
Prepare for upcoming experiments to meet users' requirements	✓	Work in progress. Work with SMEs. Support beam studies.
Enhance CEBAF capabilities through AIPs	✓	Progress with LLRF and BPM.
Maintain strong operations team capable of meeting operational challenges	✓	Operator team reaches full strength.

Reliability Comparison FY24 to FY23

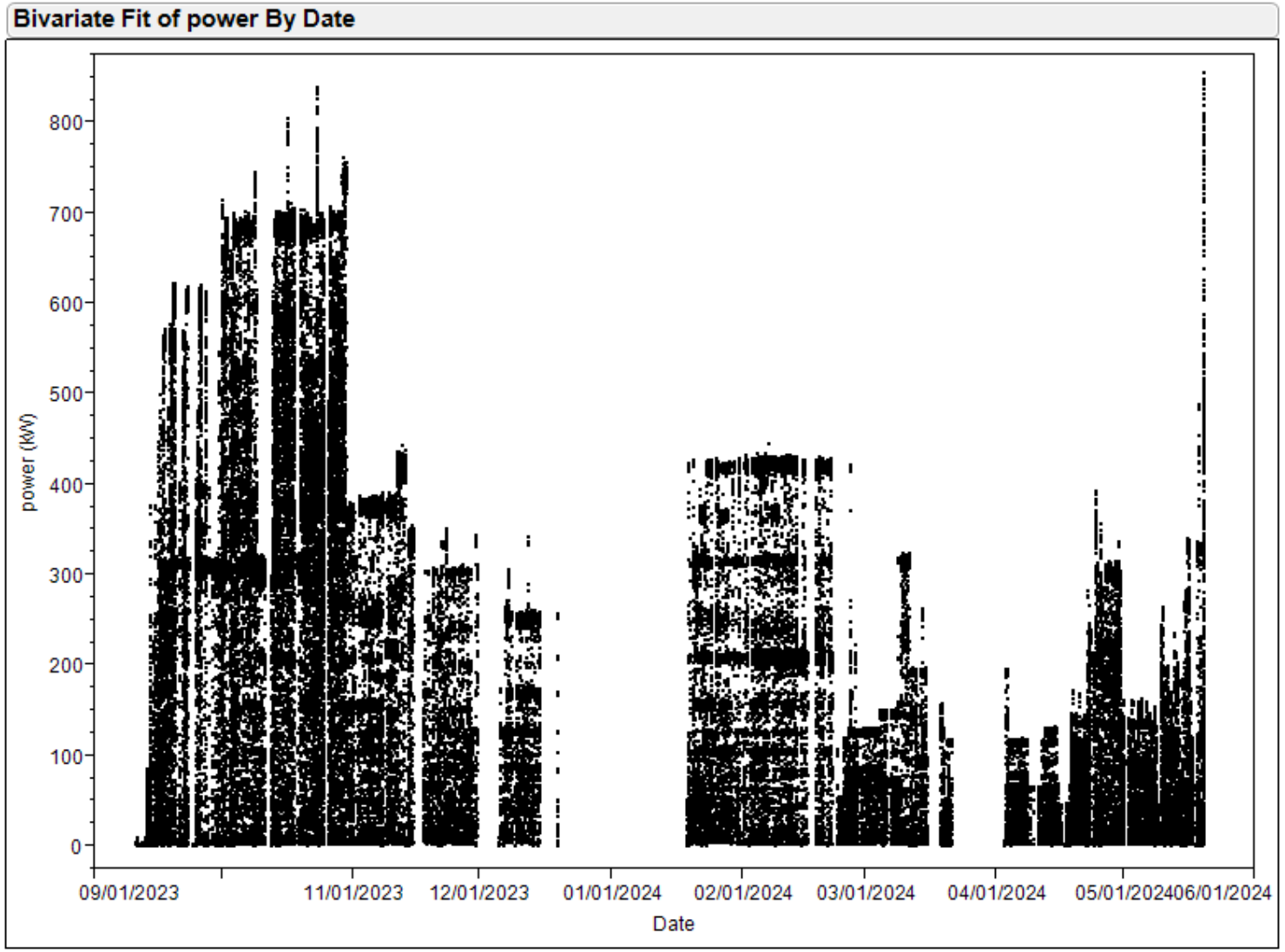
- Significant improvement in RF, Beam Transport, and Magnet reliability
  - Improvement due to focus on maintenance, beam tuning, and their optimization
  - CMs added to CEBAF as part of CPP increased energy margin
  - Lower beam intensity last run and three Halls
- Incident with the Gun Laser negatively affected reliability

Category	FY23 Downtime, h (/%)	FY24 Downtime (h/%)	Progress (in relative terms)
RF	300 (7%)	222 (4%)	-37% ↓
Beam Transport	244 (6%)	156 (3%)	-45% ↓
Magnets/DC	229 (5%)	72 (1%)	-73% ↓
Gun	2 (0%)	353 (7%)	+16717% ↑
Scheduled hours	**4307**	**5027**	

Technical Improvements: Increasing Beam Power

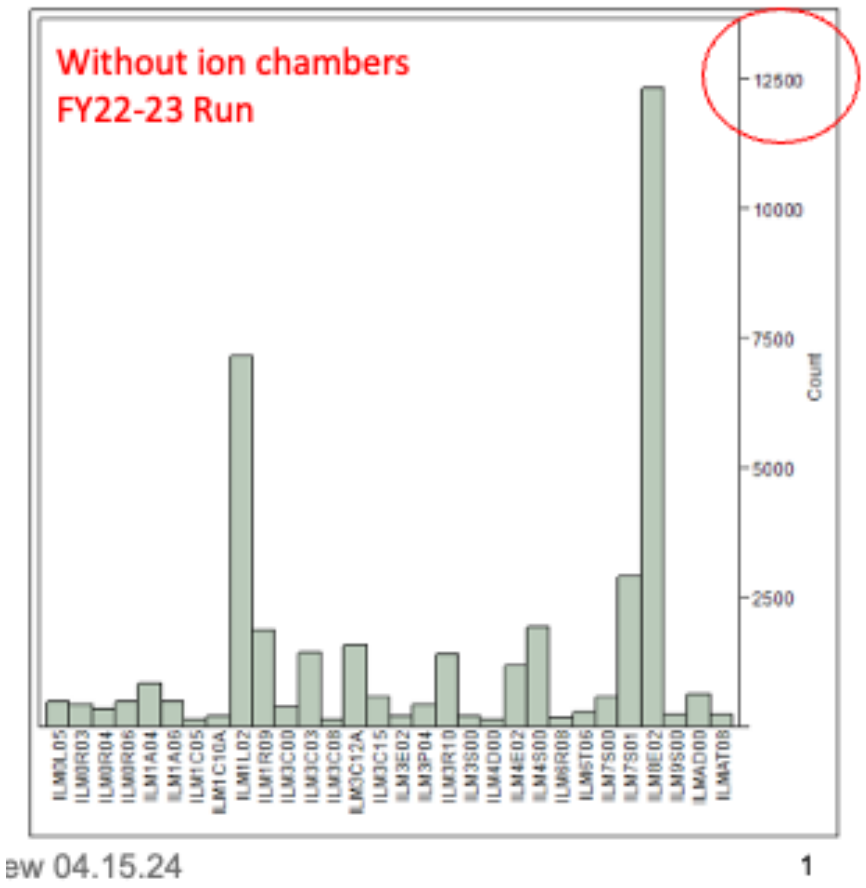
Increased beam power from 800 to 900 kW by the end of the run

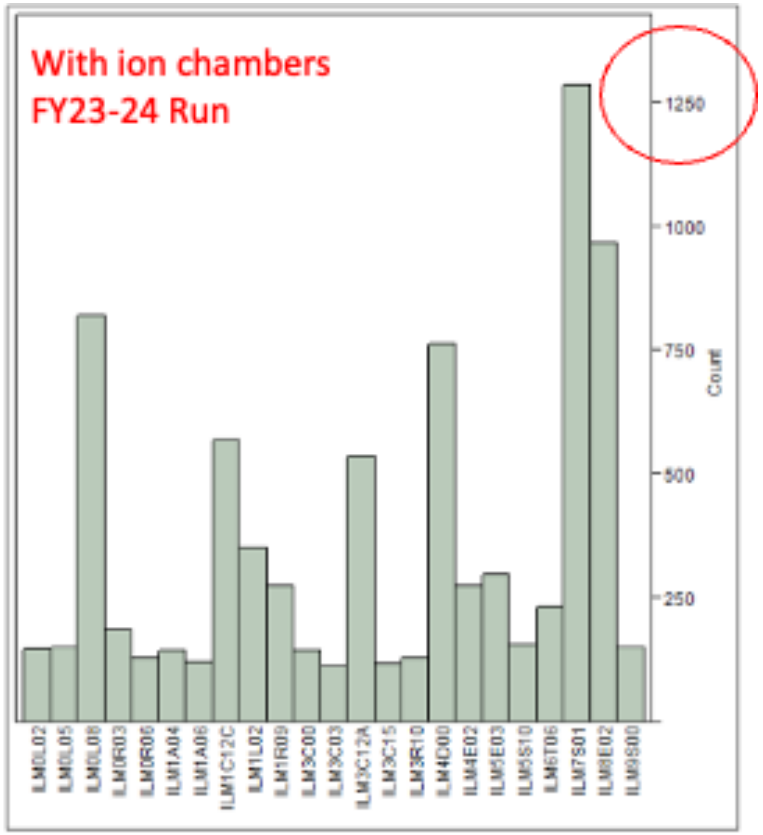
- CPP added Cryomodules
- Plasma processing in South Linac
- RF/LLRF
- 13 kW Klystrons
- Q_L adjustment



Technical Improvements: Reducing Beam Losses

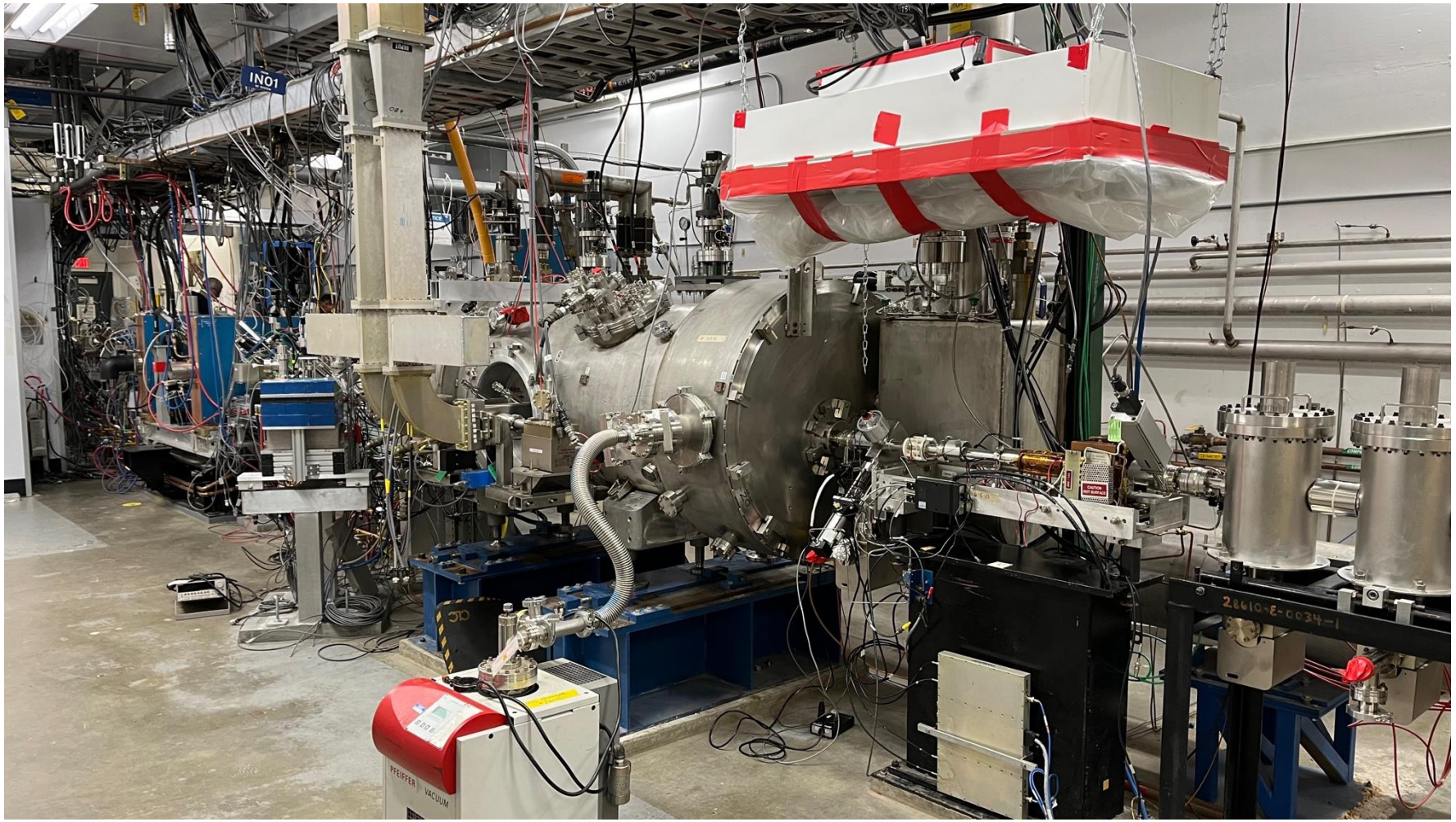
Installation of 4 additional ion chambers helped to reduce losses in some locations by an order of magnitude.





Technical Improvements: New Injector

New injector was commissioned in FY24.
Significant improvements of the gun and transport solenoids this SAM.



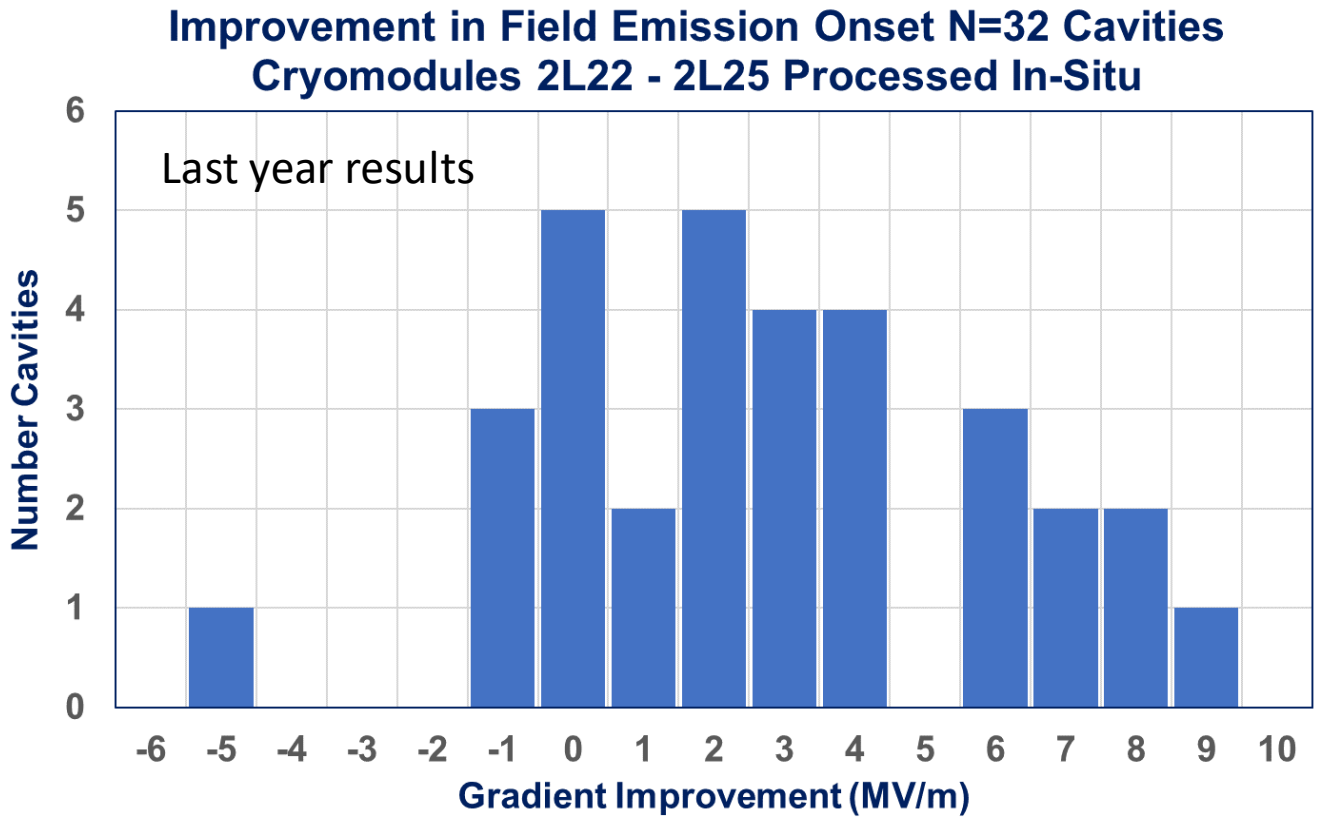
Technical Improvements: CPP Energy Reach Work

- Upgraded two C20 CMs to C75 CMs (2L05 and 1L09)
  - Each add approximately 40 MeV gain
- Installed refurbished 1L22 CM
  - Added approximately 30-35 MeV gain

- Injector 0L03 (C20 CM) He processing to meet injector energy requirements

Technical Improvements: Plasma Processing (PP)

- Last year results
  - Field emission free operation was improved by 59.1 MeV (24%).
  - An average improvement of 2.7 MV/m.
  - 5 cavities were field emission free after processing.
- Four NL CM and one SL CM. were PP
- This year PP showed mixed results. Some cryomodules demonstrated gains comparable to last years. However, others showed decrease in field emission on-set.
- We believe PP works but suspect contamination.
- No PP until we understand what happened.
- We will have to drive North Linac cryomodules harder to get required energy.



Technical Improvements: Other

- Near term improvements
  - Fast BPM acquisition system in the machine to better understand and mitigate energy and orbits oscillations (HyperNuclear, MOLLER)
    - Band-Aid before NextGen BPM AIP Upgrade
  - Fast feedback
  - Energy spread control for HyperNuclear
    - MOMOD
    - Synchrotron Light Interferometer for precise energy spread measurement

- Long term future Upgrades
  - Degrader for to test transport of large emittance e+ beam
  - Test of permanent magnets for 22 GeV Upgrade

Impact of Safety and Compliance Related Issues

- Delayed start of CEBAF due to safety pauses twice
- Reduced moral and loss of expertise, including critical
- Reliability improvement initiatives and work on upgrades had to be postponed until resources are available
- We expect that ePAS and High Hazard High Consequence work policy will increase response time and affect the machine reliability
  - Working with the ES&H to understand and mitigate impact
  - We are likely to incur at least 5% reduction in reliability

Budget Perspective

- Last year CPP Reliability budget was significantly reduced – no obsolescence and reliability upgrades
- Funding issues and late release of procurements did not allow us to start the North Linac CM lifetime improvement initiatives.
- Slow AIP development (LLRF, BPM, Timing System, Beam Loss Monitors)
- This year CR
  - Effectively reduced by inflation
  - Late availability of money (start-stop)
- DOE communicated to plan CPP assuming no increase in budget
  - Budget increase is required for additional vacuum work and addressing reliability issues
  - Not having Degradation addressed will cause us to continue spending effort on CM refurbishment

Next Run

- Next run: March 7 – Sep 2
- Halls: ABCD
- Energy: 1060 MeV/linac
- Beam power: 900 kW
- Polarization: ABCD
- Reliability goal 80%

- RF and SRF are on critical path for start of beam recovery in CEBAF
- Injector beam work is on going
- 1L09 work completed: 2/26
- Beam recovery begins: 2/21
- Physics begins: 3/7

Run Risks

- Technical requirements are challenging: higher energy, beam power, and reliability.
- Staffing in support groups
- ePAS and HHHC impact on uptime
- Technical and schedule impact of safety pause, new rules (safety, procurement, etc.), and delays still are not completely understood
- Budget
- Run continues late into the summer