CEBAF: Status and Plans

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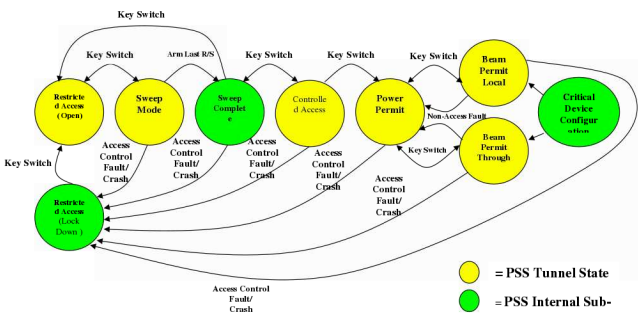
Outline

Safety

Three near misses in 2014

- **No one got injured or were exposed to prompt radiation**, but several *defense in depth* barriers were violated.
- Personnel gained access to a controlled area improperly.

  Staff, contractors, users involved.
- Each event was unique in the manner of how the barriers were violated.



PSS Logic - State Diagram

Corrective Actions

- When possible identify an engineering solution

  PSS logic will be updated so that doors lock automatically, previously the Safety System Officer had to manually lock the door.

Performance Evaluation

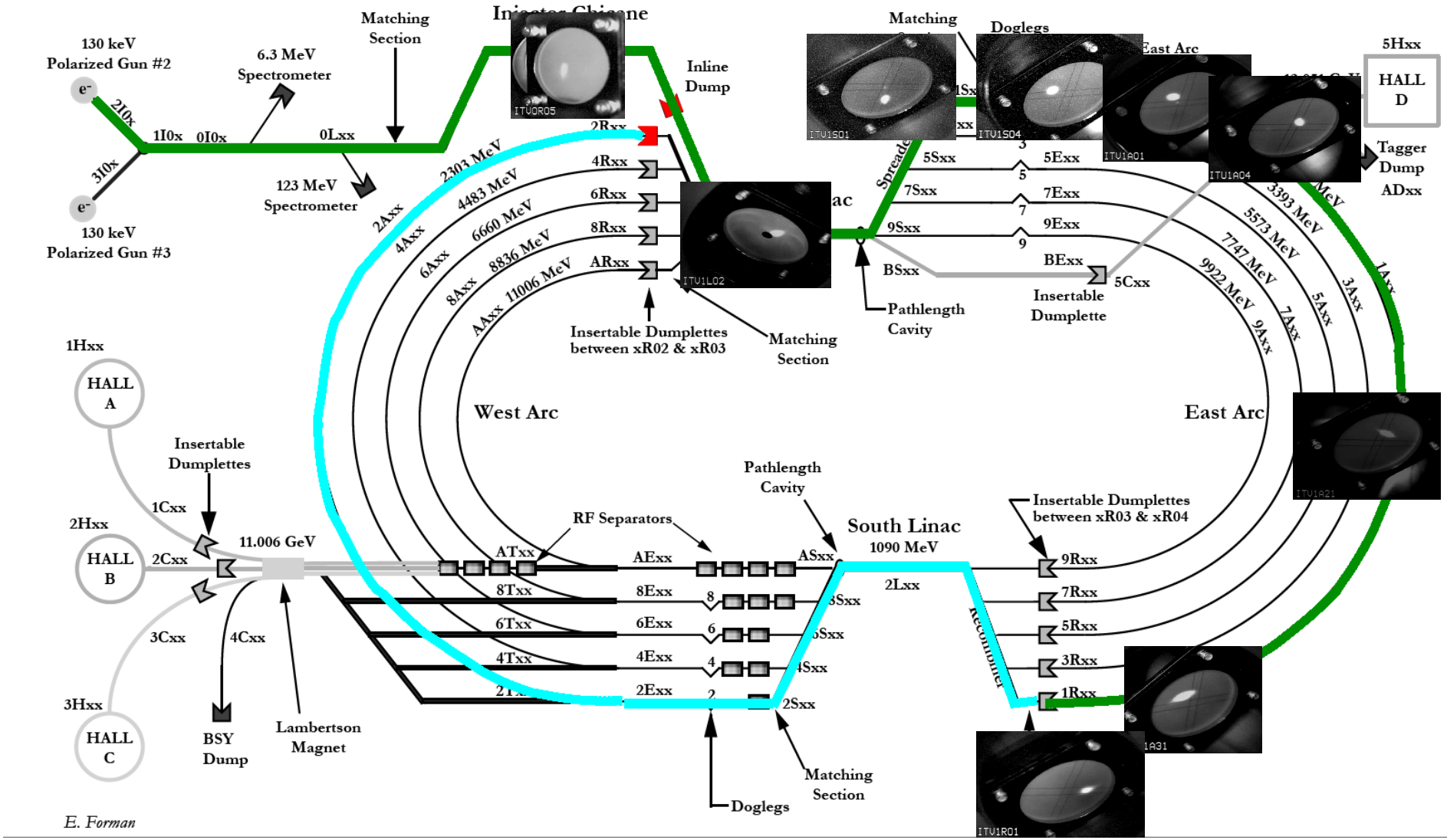
Category		Letter Grade	Numerical Score	Overall Grade
2.0	Construction and Operations of User Research Facilities and Equipment			B+
	2.3 Operations of Facilities	A+	4.2	

Objective Evaluation:

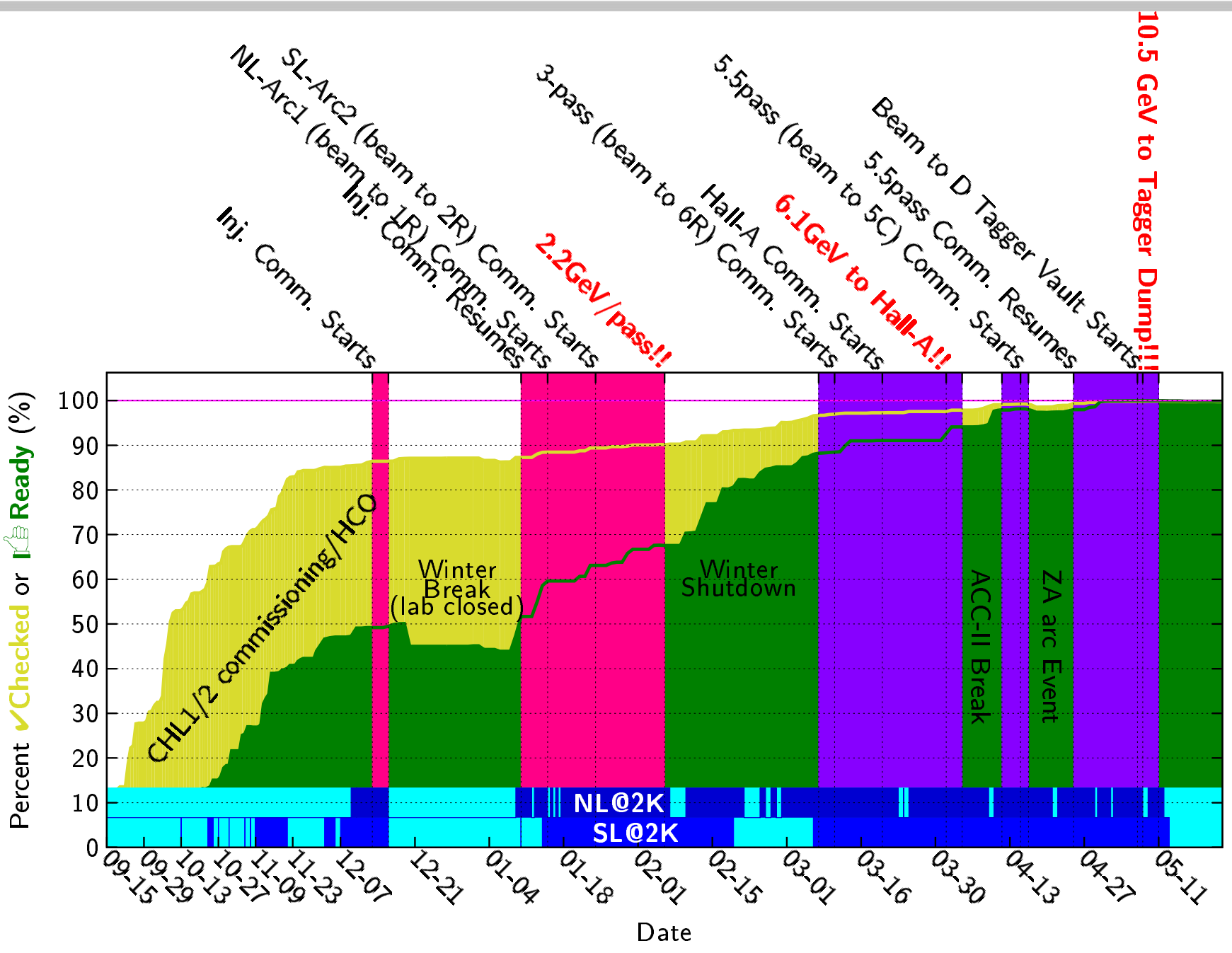
The CEBAF facility did not operate in 2014 for physics as it was being commissioned to demonstrate CD4a performance parameters. The lab successfully confirmed through an independent accelerator readiness review that their commissioning effort could be performed safely and efficiently. With this successful achievement, the lab was then able to effectively and efficiently accomplish early the critical decision (CD)-4A key performance parameters for the accelerator and civil scope of work. Overall, these accomplishments resulted in the CD-4A being approved 5 months ahead the milestone completion date.

Beam transport to date: circa 2014-01-22

Slide 3 from last years presentation



Spring 2014: March to Hall-D



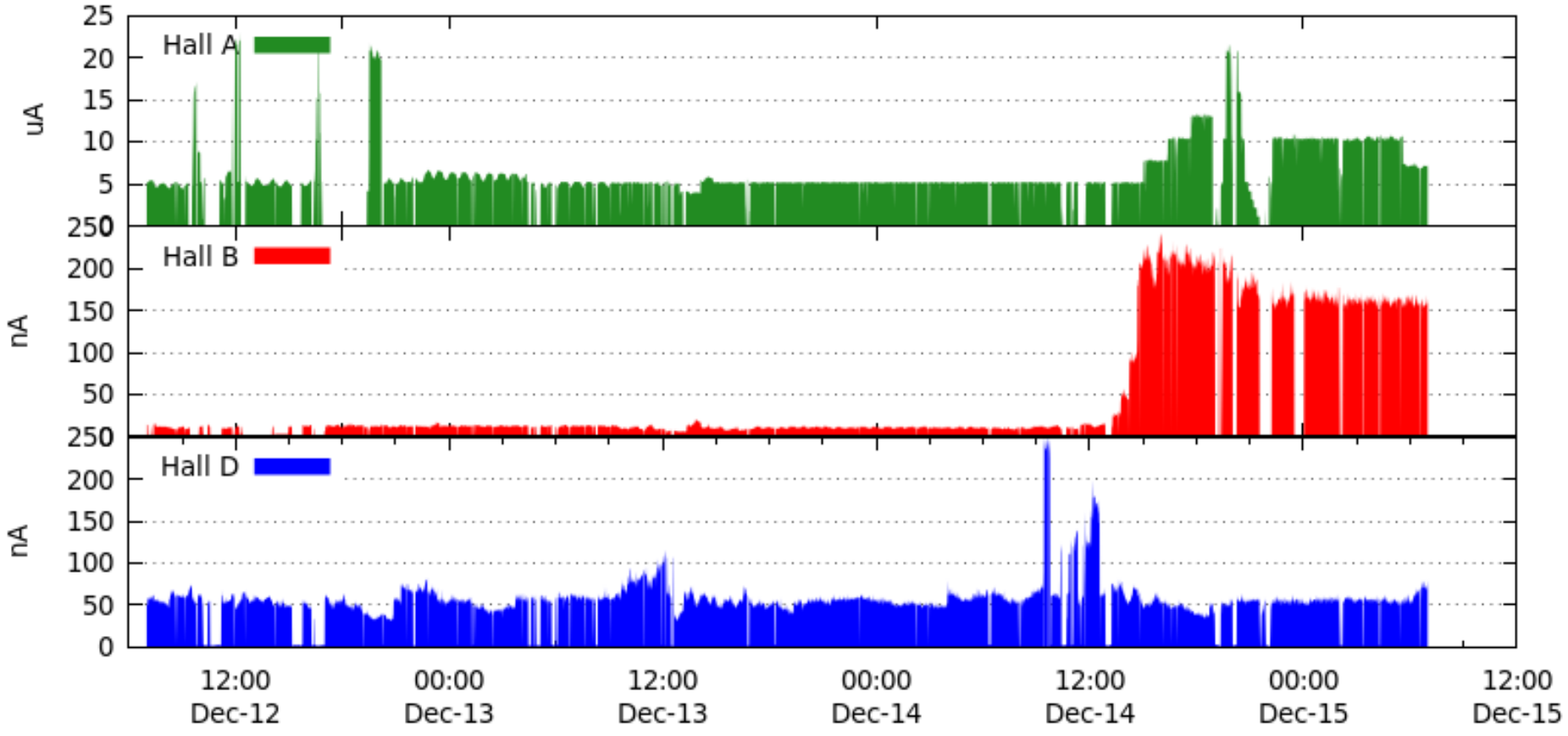
Fall 2014: Beam Operations

- Original plan: 13.4 weeks from Sept 19th $\rightarrow$ Mon Dec. 22nd
  - Actual Execution: 10.8 weeks from Oct 8th $\rightarrow$ Mon Dec. 22nd
  - Delayed start due to cryogenic issues.
- 5.5pass Energy 10GeV, required for Project key performance parameters. Desired by operations for the manageable trip rate.
- Commissioning activities included:
  - Finish commissioning the Hall-D transport: deliver CW beam to tagger vault without scraping.
  - Support Hall-D/glue-$\mathcal{X}$ commissioning activities
  - Commission RF separators and deliver CW beam to A (4^{th}pass) and B(1^{nd}pass) via RF separation.
  - Beam optics measurements, ε, dl, $\frac{dp}{d}$ evolution.

Run Objectives

- ✔ Project goal: demonstrate Hall-D CD4B KPP
- ✔ Operations goal: Deliver CW beam to experimental user
- ✔ Operations goal: Demonstrate 2-Hall Capability, CW beam
- ✔ Operations goal: Demonstrate 3-Hall Capability, CW beam, a Spring 2015 objective achieved Fall 2014.

Sustained beam delivery to 3-users!



Tunnel Temperature

It's hot, but not too hot!

Outline

1. CEBAF Status: 2014 Year in Review

2. CEBAF Plans
   - Spring 2015 Run Parameters and Plans
   - Summer 2015 Shutdown and Gradient Maintenance
   - CEBAF Schedule
   - 12GeV Initial Year Beam Parameters

3. Summary

Spring 2015 Run

- Plan: 11.4 weeks from Fri. Feb. 13^{th} $\rightarrow$ Mon May. 4^{th}
- 5.5pass Energy 10.5GeV.
- Support Physics in A & B, continued detector commissioning in Hall-D

Commissioning activities include:

- Commission 750MHz horizontal 5-pass separators

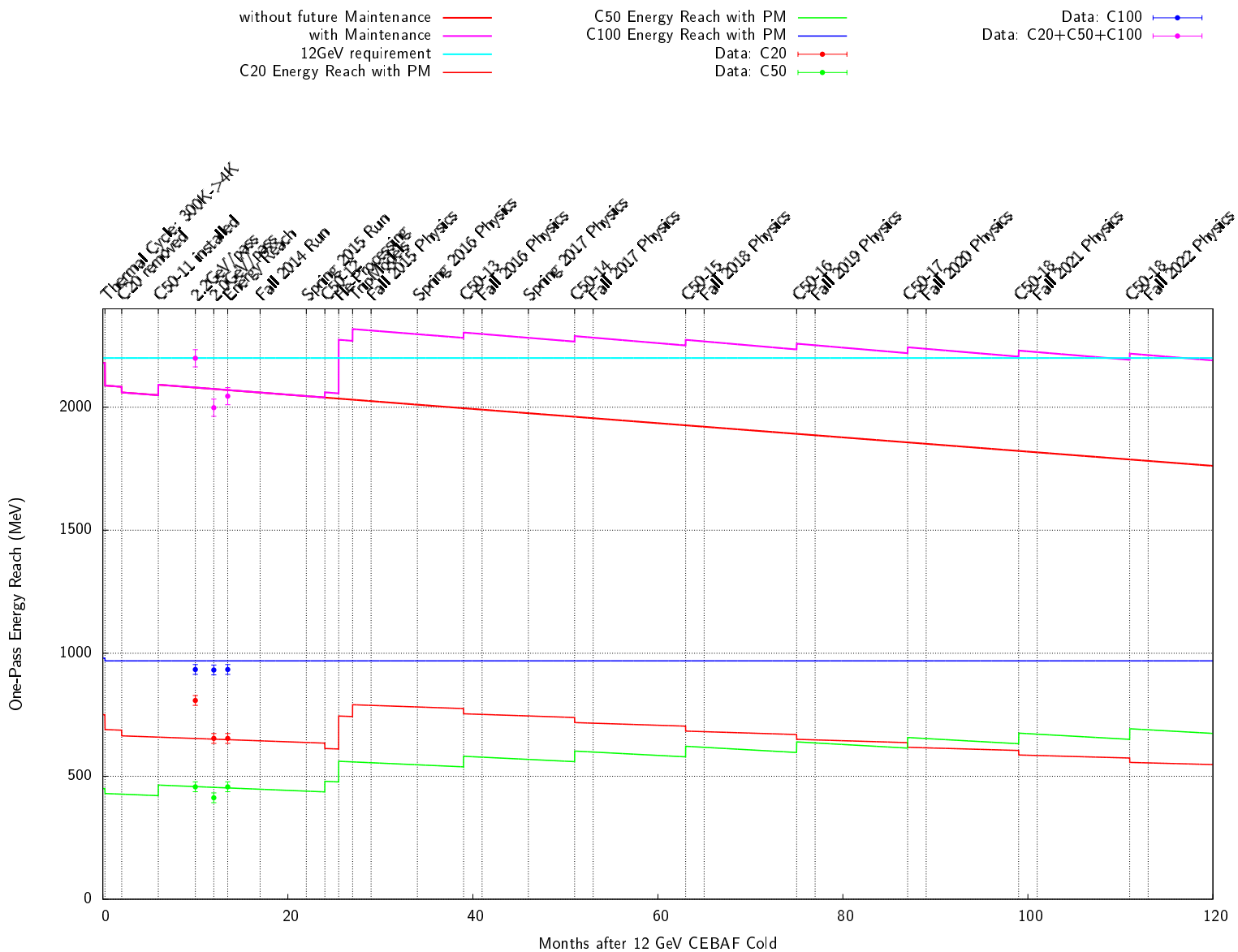
  Required for $(A|B|C)_{5-pass}$ **&** D operations
  Two out four cavities assembled and ready for installation. Remaining two cavities being assembled. On track for the Feb. 13th beam operations.
  Laser modifications in progress and on-track for run start.
- Beam optics measurements, ε, dl, $\frac{dp}{d}$ evolution.

Run Objectives

- Operations goal: Demonstrate $(A|B|C)_{5-pass}$ **&** D capability.
- ✔ Operations goal: Demonstrate 3-Hall Capability, CW beam, a Spring 2015 objective achieved Fall 2014.

Summer 2015 Shutdown: Gradient Maintenance

JLAB-TN-14-024



SRF/RF Performance targets

As presented at the 2014-06-03 Users Meeting

Trips: Any SRF/RF related downtime $\leq$ 5min in duration

Dates	**Max.** 5.5pass Energy	Trip Downtime Goal (% - min/hr)
Fall2014	11 GeV	<20% <12
Spring2015	11 GeV	<17% <10
Fall2015	12 GeV	<20% <12
Spring2016	12 GeV	<17% <10
Fall2016	12 GeV	<13% <8
Spring2017	12 GeV	<12% <7
Fall2017	12 GeV	<10% <6
Spring2018	12 GeV	<10% <6
Out-years	12 GeV	<5% <3

Non-trip downtime

Dates	Max. 5.5pass Energy	Long duration Downtime Goal (%)
Fall2014-Spring2015	11 GeV	<5%
Fall2016-Spring2017	12 GeV	<4%
Fall2017-Spring2018	12 GeV	<3%

CEBAF Schedule: FY16

Cost of Living Scenario 2015 BB: Extremely raw information

Fall 2015: 7 weeks

- First attempt to deliver 12GeV beam to Hall-D
- Priority will be CEBAF (SRF/RF)
- Participation from Hall-D and Hall-A strongly desired.

Spring 2016: 9 weeks

- No planned CEBAF commissioning activities
- $E_{5.5pass} = 12$ GeV
- All Physics except for restoration, beam studies, tuning and downtime.
- To be scheduled by NPES.
- Run terminates, March 31^{st}, a month before the power bill read.

CEBAF Schedule: Nominal Schedule

Cost of Living Scenario 2015 BB: Extremely raw information

Fall 20??: 13 weeks

- Run starts sometime after Labor Day (post-power bill read).
- Thanksgiving CEBAF in hot stand-by, no beam operations.
- Run terminates a day or so before the start of the Winter Break.

Spring 20??: 16 weeks

- Short Winter Down period for PSS certification (at least two weeks in duration).
- Run starts 3^{rd} week in Jan.
- Run ends first Monday in May (pre-power bill read).

Summer Down 20??: 15 weeks

- PSS Certifications (required to perform two PSS certifications/year)
- Maintain CEBAF at 2K on one CHL

  SRF/RF maintenance/improvements
  CHL maintenance

12GeV Initial Year Beam (@12GeV) Parameters

Hall	Emittance (nm-rad)	Energy Spread σ (%)	Spot Size σ (μm)	Halo
A	$\varepsilon_x < 10$ $\varepsilon_y < 5$	<0.05 (12 GeV) <0.003 (2-4 GeV)	$\sigma_x < 400$ $\sigma_y < 200$ ($\sigma_y < 100$) (2-4 GeV)	$< 1 \times 10^{-4\dagger}$
B	$\varepsilon_x < 10$ $\varepsilon_y < 10$	<0.1	$\sigma_x < 400$ $\sigma_y < 400$	$< 2 \times 10^{-4\dagger}$
C	$\varepsilon_x < 10$ $\varepsilon_y < 10$	<0.05	$\sigma_x < 500$ $\sigma_y < 500$	$< 2 \times 10^{-4\dagger}$
D	$\varepsilon_x < 50$ $\varepsilon_y < 10$	<0.5	At Radiator: $\sigma_x < 1550$, $\sigma_y < 550$ At Collimator $\sigma_x < 540$, $\sigma_y < 520$	$< 1\%^{\ddagger}$

† Ratio of the integrated non-Gaussian tail to Gaussian core.

‡ Ratio of Halo background event rate to physics event rate.

(GlueX-doc-775-v4, GlueX-doc-646-v5)

Outline

Opportunities for Improvement

- Ability to meet schedule. Delays cost users beamtime. Cryogenic issue will be somewhat mitigated by steady state 2K operation.
- Reducing *tune-time*. Operations/CASA still learning the subtleties of this machine and the new hardware. Likely to be additional opportunities with CEBAF at 12GeV setting.
- Vacuum loads in the Spreaders/Recombiners. Vacuum load is significantly larger at 10GeV (last run) than 6GeV CEBAF. Concerns for the 12GeV operations. Push to have vacuum pumps at near 100% by end of Summer 2015 down.
  - This issue contributed to the struggles establishing CW beam to Hall-A on 4^{th} pass this Fall.
- Energy Reach with headroom: Gradient maintenance plan in place. Need to execute it.
  - C100 2L25 cryomodule offline for essentially all of Fall2014 operations. Choice of energy (10GeV) allowed the run to continue without changing energy. Resulting trip rate at 10GeV was at about 10trips/h.

The Last Slide

- Achieved 12GeV Project CD4A key performance parameters — both beam parameters and equipment-specific — five months ahead of schedule.
- Delivered beam quality at 10GeV meets, by a robust margin, the *initial years* user requirements (ε, dp/p, polarization, ...).
  - Beam data collected and in the process of being analyzed.
  - Anxiously anticipating Fall2015, first beam with $E_{5.5pass} = 12$GeV.
- Transported beam through **every** available section of CEBAF.
  - Hall C line, expected to be ready in Spring 2016.
- Delivered *initial years* beam quality to **three** experimental halls simultaneously.

End here!

Beam Requirements for Out-Year Operations

Hall	Emittance (nm-rad)	Energy Spread σ (%)	Spot Size σ (μm)	Halo
A	$\varepsilon_x < 10$ $\varepsilon_y < 5$	<0.05 (12 GeV) <0.003 (2-4 GeV)	$\sigma_x < 400$ $\sigma_y < 200$ ($\sigma_y < 100$) (2-4 GeV)	$< 1 \times 10^{-4\dagger}$
B	$\varepsilon_x < 10$ $\varepsilon_y < 10$	<0.1	$\sigma_x < 400$ $\sigma_y < 400$	$< 1 \times 10^{-4\dagger}$
C	$\varepsilon_x < 10$ $\varepsilon_y < 5$	<0.05 <0.03 (6 GeV)	$\sigma_x < 400$ $\sigma_y < 200$	$< 1 \times 10^{-4\dagger}$
D	$\varepsilon_x < 10$ $\varepsilon_y < 5$	<0.5	At Radiator: $\sigma_x < 1550$, $\sigma_y < 550$ At Collimator $\sigma_x < 540$, $\sigma_y < 520$	$< 1\%^{\ddagger}$

† Ratio of the integrated non-Gaussian tail to Gaussian core.

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