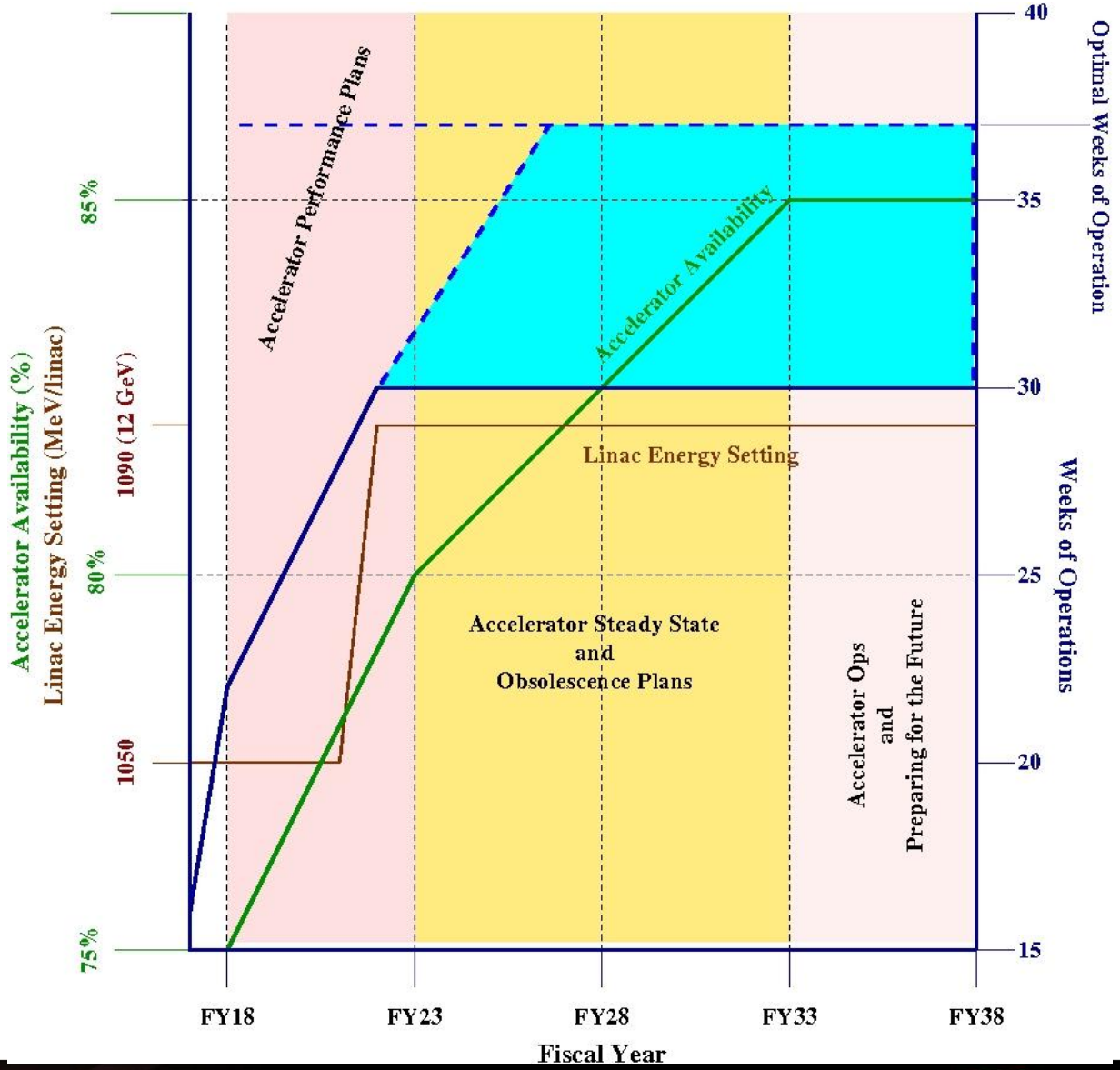
The CEBAF Performance Plan

- Establishing reliable CEBAF performance at 12 GeV
- SRF/RF/Cryo Focus

High level view

- 20 year scope
- 5 year ramp up
  - Availability
  - Energy Reach
  - Weeks of Operation
- Stuff
  - Critical Spares
  - C75s
  - Obsolescence
- Staff
  - Support optimal weeks
  - Support maximum hall multiplicity



Performance Plan Development

1. Define Performance Parameters
   a. Reliability
   b. Energy
   c. Multiplicity
   d. Weeks of Operations
2. Perform Gap analysis
   a. Establish areas that do not meet Performance Parameters
3. Plan Development
   a. Make a plan that will close the identified gaps
4. Make the case to Lab Leadership

Performance Goals, Gaps, Plans

What	Unit	Goal	Gap	Plan
Reliability	%	> 80	5-10%	Critical spares
Optimal Weeks	weeks-per-year	37	Yes	Operations and Technical support Staffing
Beam Tuning Hours	h/week	< 8	Yes	Operations Staffing
Peak Hall Multiplicity	Number of halls	4	Yes	Operations Staffing
12 GeV Program Expected Duration	years	20	Yes	Obsolescence Plan
Performance Plans Duration	years	5		
Obsolescence Plans Duration	years	10		
Linac Design Energy	MeV	1090	~40 and growing	8 C75s
Required Linac Energy Margin at start of FY	MeV	> 110		
Overall FSD Trip rate	trips/h	< 15		
Overall FSD Trip Downtime	min/h	5		
RF Trip rate	trips/h	< 10		
Beam Loss Trip rate	trips/h	< 5		

Critical Spares Top Priority

1. **Spring 2014**: ZA magnet coil and vacuum failure; **3 week interruption** to replace damaged coil and repair the vacuum chamber. This failure consumed the existing spare coil; **the next failure will take much longer** for repair and recovery.
2. **Spring 2015**: Cold compressor 4 failure in 2 K cold-box, SC1; No spare at JLab, consumed the SNS cold compressor spare. **Program change required:** half design energy after 5 week down.
3. **Fall 2016**: Arc7 box supply failure, no spare, **program change required:** to single hall operation until supply repaired.
4. **Fall 2016**: 5th pass separator vacuum leak, **program change required**, could not support 5th pass beam to Hall-A simultaneously with 5.5 pass beam to Hall-D.
5. **Spring 2017**: Cold compressor 5 failure in 2 K cold-box, SC1; on-going root cause investigation, might be repairable. **Scheduled program terminated.**

Critical Spares List

1. Cryogenics
   a. New 2K cold-box, $10M over 3 years
   b. New ESR, $10M over 3 years
   c. Sundry stuff, $3M over 3 years
2. CEBAF Critical Spares
   a. $1.3M over 2 years
   b. Box power supplies
   c. Magnet coils and vacuum chambers
   d. Klystrons 20 per year (most will be consumed by the C75s).
   e. Sundry RF stuff
      i. RF separator power supply
      ii. Master Oscillator
      iii. RF separator solid state amplifier
      iv. Chopper amplifier

12 GeV by FY22 Plan

	FY	Proposed Maximum Linac Energy Setting for FY	Linac Margin	Refurbished cryomodules completed in FY
Date		(MeV/Linac)	(MeV/linac)	
2016-10-01	FY17	1050	55	C50-13
2017-10-01	FY18	1050	50	C75-1
2018-10-01	FY19	1050	56	C75-2
2019-10-01	FY20	1050	62	C75-3, C75-4
2020-10-01	FY21	1050	90	C75-5, C75-6
2021-10-01	**FY22**	**1090**	**78**	C75-7, C75-8
2022-10-01	**FY23**	**1090**	**106**	C75-9
2023-10-01	**FY24**	**1090**	**112**	-
2024-10-01	**FY25**	**1090**	**95**	C75-10

SRF/RF Obsolescence

List are still be fleshed out, here is my vision

1. LLRF Analog to digital upgrade for all zones.
   a. 2/year over 15 years
   b. Should we be thinking about incorporating features in the digital LLRF to decrease the recovery time from a C20/C50 trip?
2. Warm region cleaning and new vacuum pumps
   a. 2/year over 15 years
   b. Include changing out the end-cap O-rings?
3. Continue C20 **Upgrade** (C75) at a rate that exceeds the annual loss.
   a. 1 C75 every 1.3 years?
   b. Evaluate the loss annually

Open Issues

- C100s in 20 years? What should be planned? What is our expectation?
- 499MHz separator cavities? Were they designed for a 40 year operational life?
- Injector RF
  - Hopefully capture is removed in a few years
  - Spare ¼ Cryomodule?
- Digital LLRF improvements to reduce C20/C50 trip times.