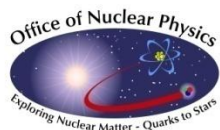


RF System LSD Work

William Merz

LSD Re-Baseline Review
Jefferson Lab
November 16, 2012



Thomas Jefferson National Accelerator Facility

November 16, 2012

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Outline

What I will talk about –

- 12 GEV RF power system installation and commissioning
- R100 installation
- 6 GEV RF system recovery
- 6 GEV RF maintenance

What I won't talk about –

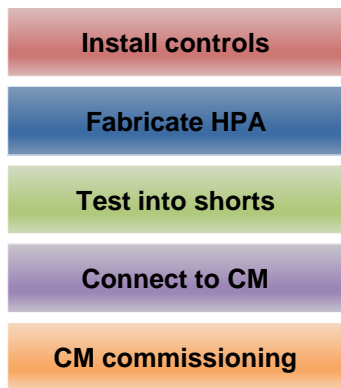
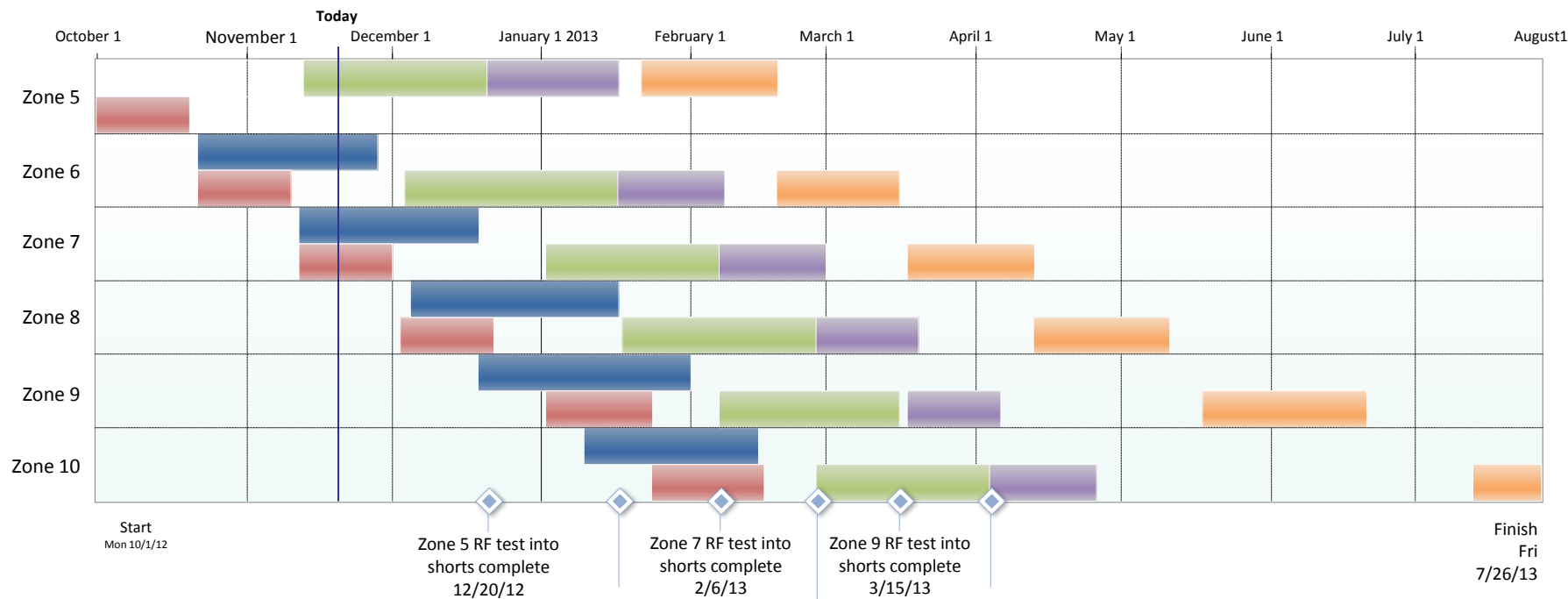
- C100 installation and commissioning
- RF Separator work plans
- New C50 module
- Helium processing
- Gradient recovery

12 GEV RF Installation Status



Location	HPA							LLRF					Tunnel			Status
	Klystron	Pedestal	Card Cage	LCW	Wave Guide	Cathode PS	Wiring	FCC	HPA Controls	Stepper Chassis	Piezo Tuner	Interlock Chassis	Wave Guide	Cable	Cryo Module	
SL24	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SL25	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SL23	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SL22	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SL26	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓	✓	-	✓	-	-
NL22	-	✓	✓	✓	50%	✓	75%	✓	✓	✓	✓	✓	-	✓	✓	-
NL23	-	✓	✓	✓	50%	✓	-	-	-	-	-	-	-	✓	-	-
NL24	-	✓	✓	✓	50%	✓	-	-	-	-	-	-	-	✓	✓	-
NL25	-	✓	✓	✓	35%	✓	-	-	-	-	-	-	-	✓	-	-
NL26	-	✓	75%	✓	-	✓	-	-	-	-	-	-	-	✓	-	-
	Klystron	Pedestal	Card Cage	LCW	Wave Guide	Cathode PS	Wiring	FCC	HPA Controls	Stepper Chassis	Piezo Tuner	Interlock Chassis	Wave Guide	Cable	Cryo Module	Commissioned

12 GEV RF Plan- FY12 Installation & Testing



The Other RF Work

Completing the 12 GEV Machine

- The upgrade requires a solid base to build upon
- Several System upgrades and part of the recovery process is “off the project” but necessary

Additional RF system work

- Injector RF upgrades – R100 Cavity and RF System
 - New RF Controls
 - New Klystron
 - Upgraded Cathode Power Supply
- “Old” RF System Recovery
 - Re-characterize the 6 GEV RF cavities following temperature cycle to room temperature (E_{max} and Q, etc.)
 - Helium Process low gradient cavities
 - Thorough PM, re-hab and check out of RF power systems

A schedule supporting this work is developed and consistent with meeting the 12 GeV schedule

R100 Work – Project Charter

Objectives	Redesign 0L04 to allow for a full energy injector intended to help achieve 12Gev using a newer LLRF system and Hybrid CPS/HPA
Deliverables	<ul style="list-style-type: none"> • Replace C25 Cryomodule with a higher gradient Cryomodule (R100). • Design a new interface chassis to be placed between the 12Gev HPA chassis and the hybrid CPS/HPA system. • Replace the entire RF control system with the newer 12GeV hardware. • Replace old Vacuum system with the newer 12GeV system. This includes all new HV cabling to meet today's new standards. • Commission and re-certify 0L04. <p>Provide a system to allow full-energy injector for 12 GeV era (123.5 MeV) with digital LLRF and RF power for up to 200μA.</p>
Constraints	The R100 has already been installed and aligned. This system needs to be completed by Nov 2013 for 1 pass beam.
Assumptions	Use of R100 Cryomodule and that it is ready by Nov 13 th ; Engineering and Operations support available for installation and commissioning phase. Also that the 8KW Klystrons are ordered and delivered on time. Also that the new hybrid CPS/HPA system will fit into the existing cabinet.
Special JLab Commitments	None that I can think about.
Budget	The budget is \$535K for this project but if you include the 49% GSA that increases the total to \$983K.

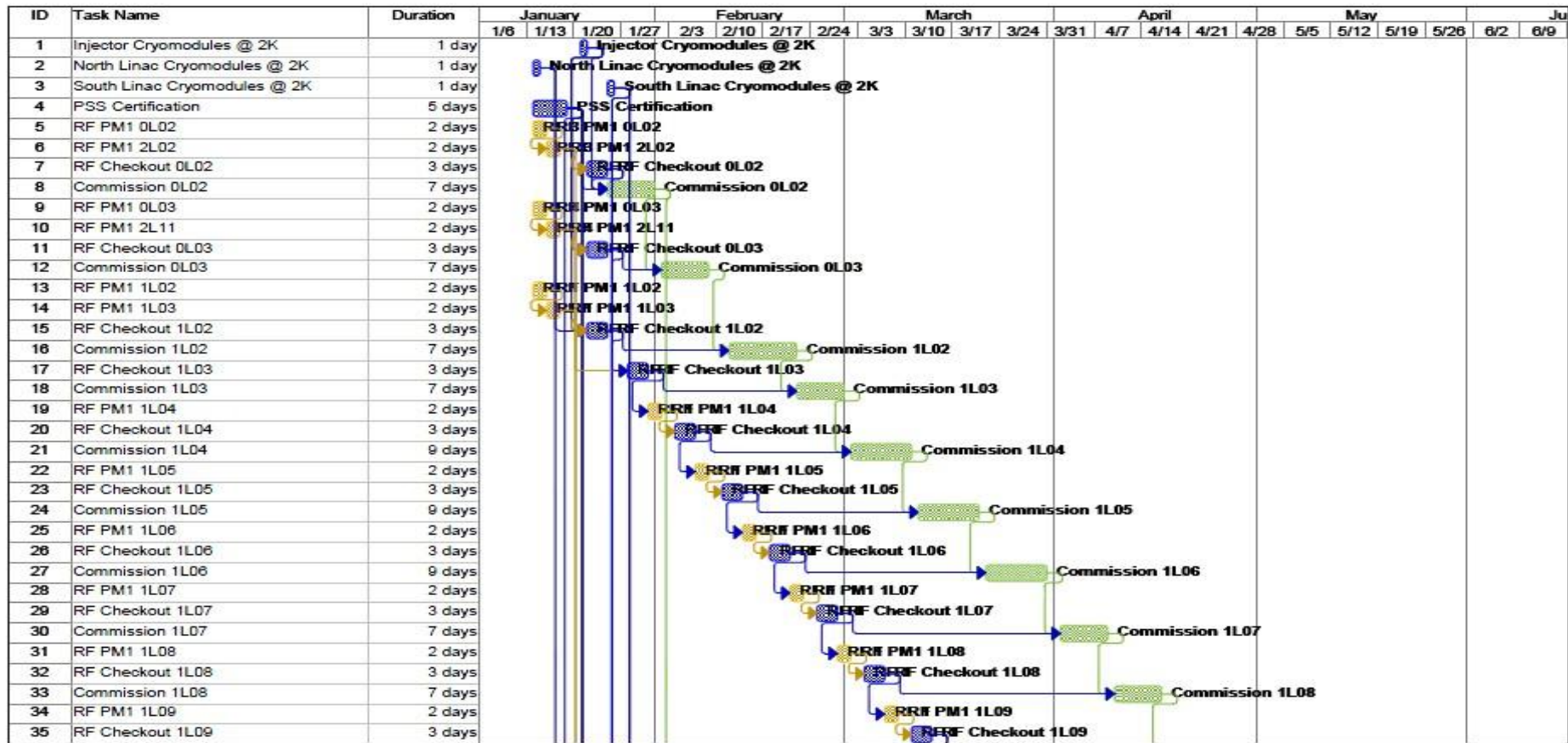
Labor: 46 m-w total – 4 m-w EE, 42 m-w Coordinator, ED and ET



R100 Work - Schedule

<p>Schedule</p>	<p>Already installed the R100 Cryomodule Alignment of the R100 is completed. Dec 12⁷ – Have the Klystrons on order. Dec 12⁷ – Have the long lead 12GeV Vacuum equipment ordered. Dec 12⁷ – Have the network equipment purchased. Dec 12⁷ – Locate all of the components that have been purchased to make the CPS/HPA hybrid system. Feb 13⁷ – Make sure we don't need any changes to the PSS system Feb 13⁷ – Have a design in place for the interface chassis to go between the HPA chassis and the CPS/HPA. Feb 13⁷ – Have new cabling identified and on order Feb 13⁷ – Have a CAD design for the CPS/HPA and start on its modification. Mar 13⁷ – Install waveguide Mar 13⁷ – Order up all of the 12GeV chassis. Mar 13⁷ – Build the interface chassis. May 13⁷ – Install the LLRF chassis and cabling. June 13⁷ – Test the system into shorts. July 13⁷ – Start commissioning. Oct 13⁷ – Replace the 5KW Klystrons with the newer 8KW units.</p>
<p>Controls/Reporting</p>	<p>The requirements will be reviewed by the head of the operations department. Monthly status reports will be provided to the controls group leader and head of the operations department.</p>

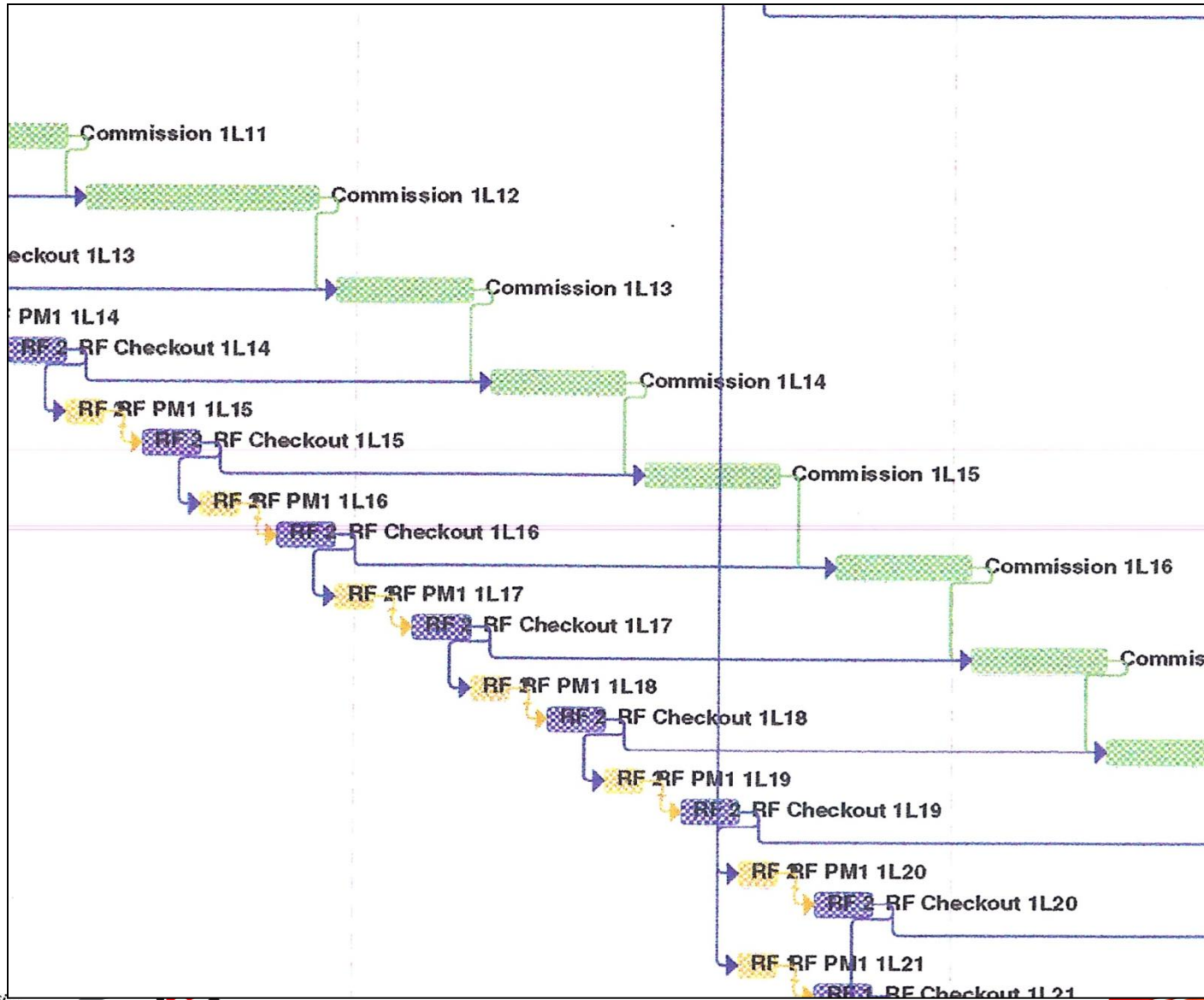
Recovery Schedule



Project: RF Support Activities CY13 Date: Wed 11/14/12	Task		External Milestone		Manual Summary Rollup	
	Split		Inactive Task		Manual Summary	
	Milestone		Inactive Milestone		Start-only	
	Summary		Inactive Summary		Finish-only	
	Project Summary		Manual Task		Progress	
	External Tasks		Duration-only		Deadline	



RF Recovery Schedule: Expanded View



Recovery Notes

PSS Functional Certification

- Mid January for most zones, gets HV turned on

RF PM1: Initial Checks

- Perform basic electronic checks
- Inspect and service as required
- Generally should take about 2 days per zone but likely to vary

RF Checkout

- Recover and tune RF system so it will operate up to cavity limitations or max system capability
- When complete, ready to perform SRF re-commission measurements
- Allocated 3 days for optimization per zone

Work Plan

- A team of 2 people in each Linac
- Working on two zones in each Linac in parallel
- Major problems will be bypassed in order to move to the next zone to stay ahead of the SRF team if necessary
- Major PM effort (PM2) deferred until after SRF recovery and more resources are available following the completion of 12 GEV commissioning
- Proposed schedule supports SRF plan, completion in May 2013

RF Work - Details

RF PM's Part 1	RF Checkout	RF PM's Part 2
Low Level RF System:		
Replace defective Conformable Cables, Buffer cables, etc.	Isolate RF Control Module problems in machine	
Isolate & resolve Interface Chassis to Cryomodule cabling/connection problem	Isolate Arc, IR Waveguide Vacuum Interlock problems in machine	
Verify proper operation of the LLRF Power Supply Air Flow Sensor	Verify proper LO/IF levels at each RFCM	
Measure RF Module Power Supply DC output voltages and AC ripple	Verify proper Driveline Heaters/Controllers operation	
Measure Interface Chassis Power Supply DC output voltages and AC ripple		
Measure MOPS DC voltages, AC ripple & verify proper cryomodule heater outputs		
High Power RF System:		
<u>CPS:</u>		
Replace defective/cracked 50 Ohm Resistors (cathode resistors)	Verify proper HV operation	Perform physical PMs
Verify proper interlock operation		Replace/repair HV wiring with corroded connectors
Verify proper metering operation		Replace corroded hardware
		Realign & stabilize HV transformer bobbins to prevent HV arc failures
<u>HPA:</u>		
Replace defective waveguide air hoses	Isolate and resolve 2 1/2 watt amp & p/s problems	Perform physical PMs
Adjust waveguide air pressure system for proper operation	Isolate and resolve klystron filament operational problems	Replace defective Klystron Connection Board cabling/hardware
Replace defective LCW hoses	Isolate and resolve klystron mod anode operational problems	Upgrade waveguide air pressure interlock
Verify operation of the LCW flowmeter and adjust, as necessary	Isolate and resolve klystron operational problems	Replace suspect LCW hoses
Measure 2 1/2 Watt Amp Power Supplies DC output voltages and AC ripple		Run klystron Miram curves and adjust fillament voltages for proper klystron operation
Remove & replace defective fiber optic cables		Remove & replace defective waveguide circulator loads

Back-Up Slides