Fermilab

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# PIP FY14 Q4 PMG

W. Pellico

PIP PMG

2 Oct 2014

# PIP FY14 Q4 PMG – year end wrap-up

- Outline
  - FY14 Q4 activities
    - PIP quarterly milestones
    - Linac
    - Booster
    - Project Controls
  - FY14 Summary
  - FY15 Outline

- PIP FY14 Q4 Milestones

| Task | RLS Date | Completion Date | Notes |
|---|---|---|---|
| Klystron CDR | Q3 | Q4 7/10 | Vendor time/delay to meet requirements |
| Approval of 53 cell modulator | FY15 Q1 | Q4 8/1 | Available funds to move ahead |
| L1 Substation Install | Q4 | Q4 9/24 | Task will be closed |
| Linac Vacuum Complete | Q4 | Q4 9/18 | Task will be closed |
| Linac LCW | Q4 | FY15 – Not Set | T&M overrun – go FP |
| Anode Supplies | Q4 | FY15 – Not Set | Vendor delays |
| 1st Bias Supply Install | Q3 | Q4 7/30 | 9 more for completion |
| Notcher Complete | Q4 | FY15 Q1 | Use entire shutdown |
| Booster BPM Spec. | Q3 | FY15 Q1 | Late start - Labor |
| Dampers Spec. | Q2 | FY15 Q1 | Late start - Labor |

# PIP: 200 MHz RF Power Systems (WBS 1.1.1) Linac High Level

- Klystron Effort Continued
  - A CDR with our vendor CPI was completed
  - Work has shifted from design to drafting of the klystron
  - Schedule outline provided
  - Risk update provided
  - Action items reviewed
- Continuing dialogue on hardware specifics
- Fermi discussion on testing
- Fermi effort on circulator – vendor issues

| Action | Date |
|---|---|
| Preliminary Design Review | 4/2/2014 |
| Critical Design Review | 7/11/2014 |
| Seal in Drawings Complete | 10/6/2014 |
| Final Assy. Drawings Complete | 12/17/2014 |
| Seal in Assembly Complete | 6/17/2015 |
| Final Dress Complete | 7/15/2015 |
| Testing Complete | 8/26/2015 |
| Customer Source Inspection | 8/27/2015 |
| Package and Ship | 9/8/2015 |

# PIP – Linac WBS 1.1.1

## Linac Modulator

- AD/EE work/design/testing continues
- Enclosure design completed – vendor nearing completion of unit
- Gate driver circuit board design/layout done
- Short circuit testing continues
- Starting design of charging supply
- Feed-forward control system work underway

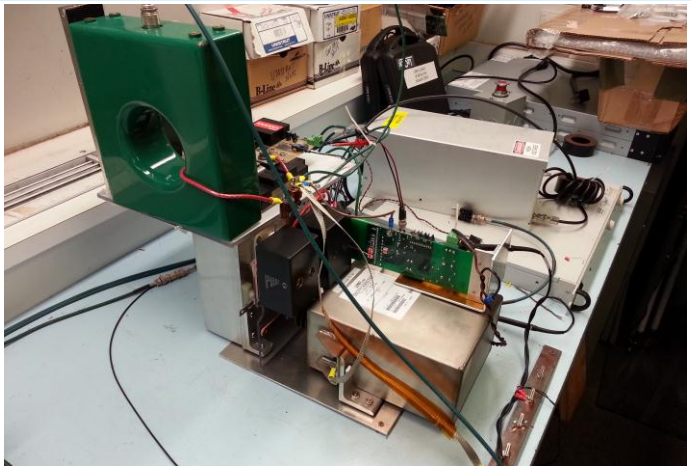
Available funding

- Decision to proceed with

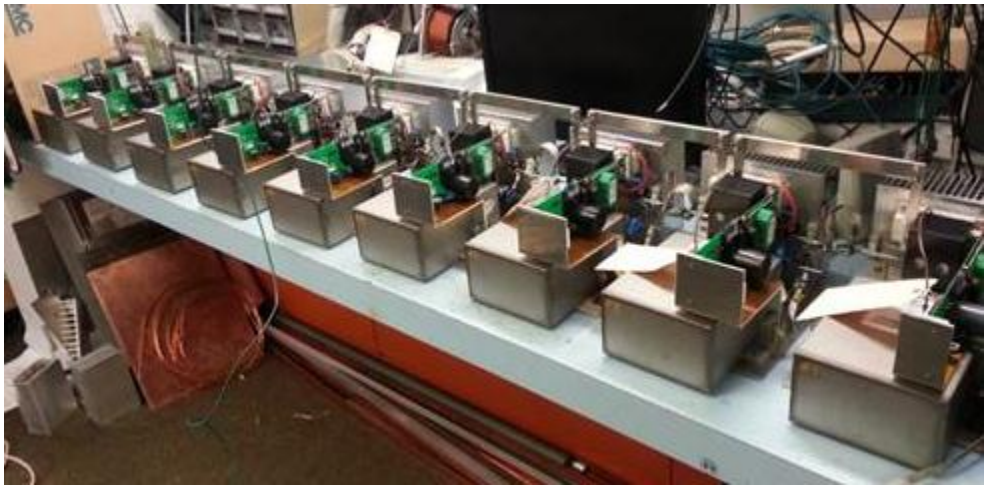
53 cell design

(FY15 Q1 milestone – done)

- Most parts ordered
- Some have already arrived



Overcurrent testing continues



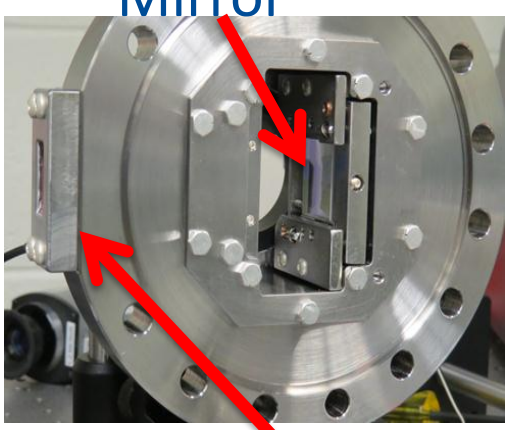
9 cell timing tests completed

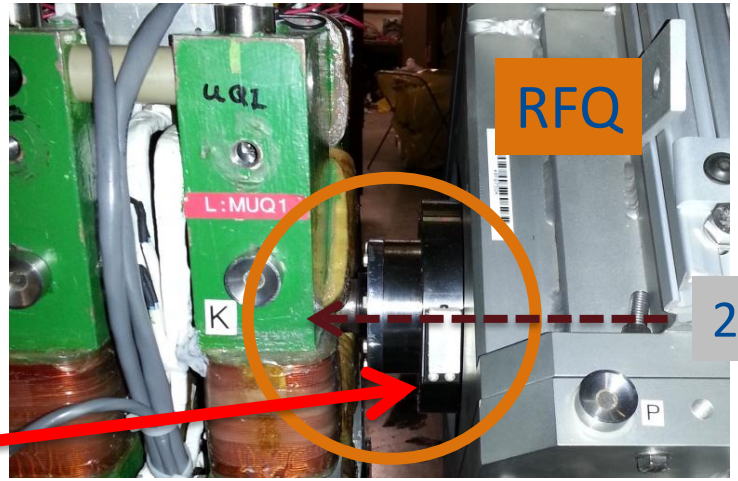
# PIP Accelerator Physics (WBS 1.1.2) Linac Laser Notcher

## Linac Notch Creation

- System install review
- Complete the construction of the Vacuum Optical Cavity
- Installation of the cavity on the RFQ
- Construction of the test laser system

- PIP Linac Notcher Mechanical Design Review
- PIP Linac Notcher Mechanical Design Review
- Final report from the Committee members
- PIP Linac, Laser Notch and TRACEWIN
- PiP Linac Notcher Overview & Plans



# PIP – Linac Utilities (WBS 1.1.5)

## Power Distribution

- L1 transformer installed

  (Level 3 milestone )

  - Tested & powered

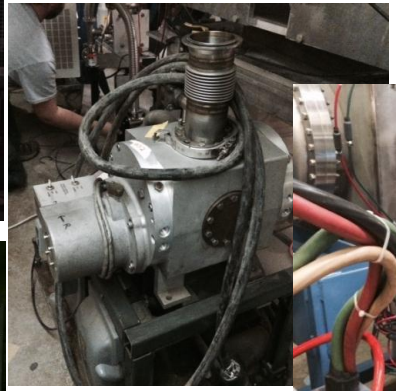
## LCW distribution

- Dual temp. system
  - DP-18 generated
  - NTP done
  - Work started (gallery)
- CUB chiller backup pump
  - T&M overran budget
  - Task put on hold
  - Splitting up work/schedule
  - Delays in issuing NTP
    - BSSD late approval
    - FESS waiting on other job

## Vacuum

(Level 3 milestone )

- New 400 Mev turbos
- Isolation valves
- Instrumentation
  - Cables
  - Controls

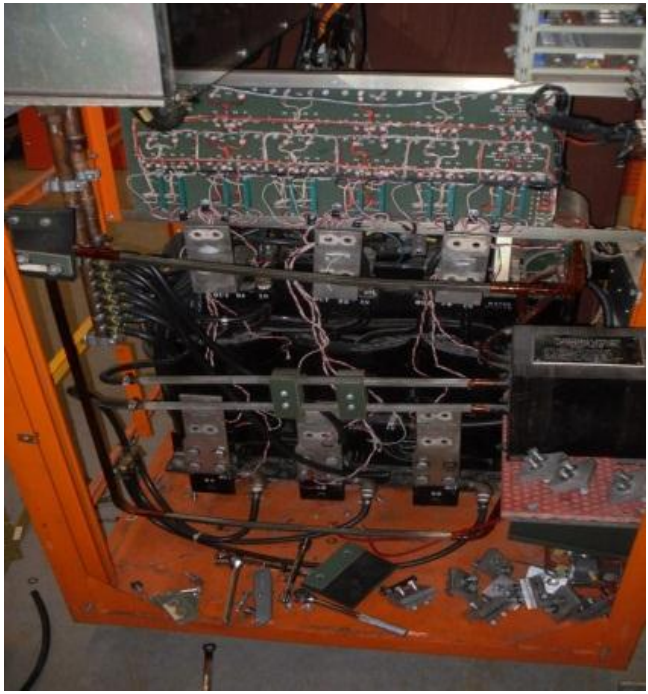


# PIP – Booster Anode Supplies (WBS 1.2.1.1)

- We had hope to replace both Anodes this shutdown
- Problem with delivery of the enclosures (some long lead items)
- EE support has been putting together sub-assemblies
- Looks like
  - May get Anodes built by end of the shutdown
  - Probably not be able to test within shutdown period
    - Testing will go beyond shutdown
    - Look for window of opportunity to install during the next year
      - Can do both with a week long shutdown
- Reliable running at 15 Hz

# PIP – Booster Bias Supplies (WBS 1.2.1.2)

- Replacing transformers for 15 Hz operation
  - Also requires re-plumbing and re-wiring
- Since July PMG, have gone from 2.5 to 3.75 (out of 10 bias supplies for West Gallery) done
  - One during testing proved problematic
- First upgraded bias supply installed in operation & ran last 6 weeks of running
  - This effort is not as far along as projected, largely due to labor.
  - Should not impact initial 15 Hz testing



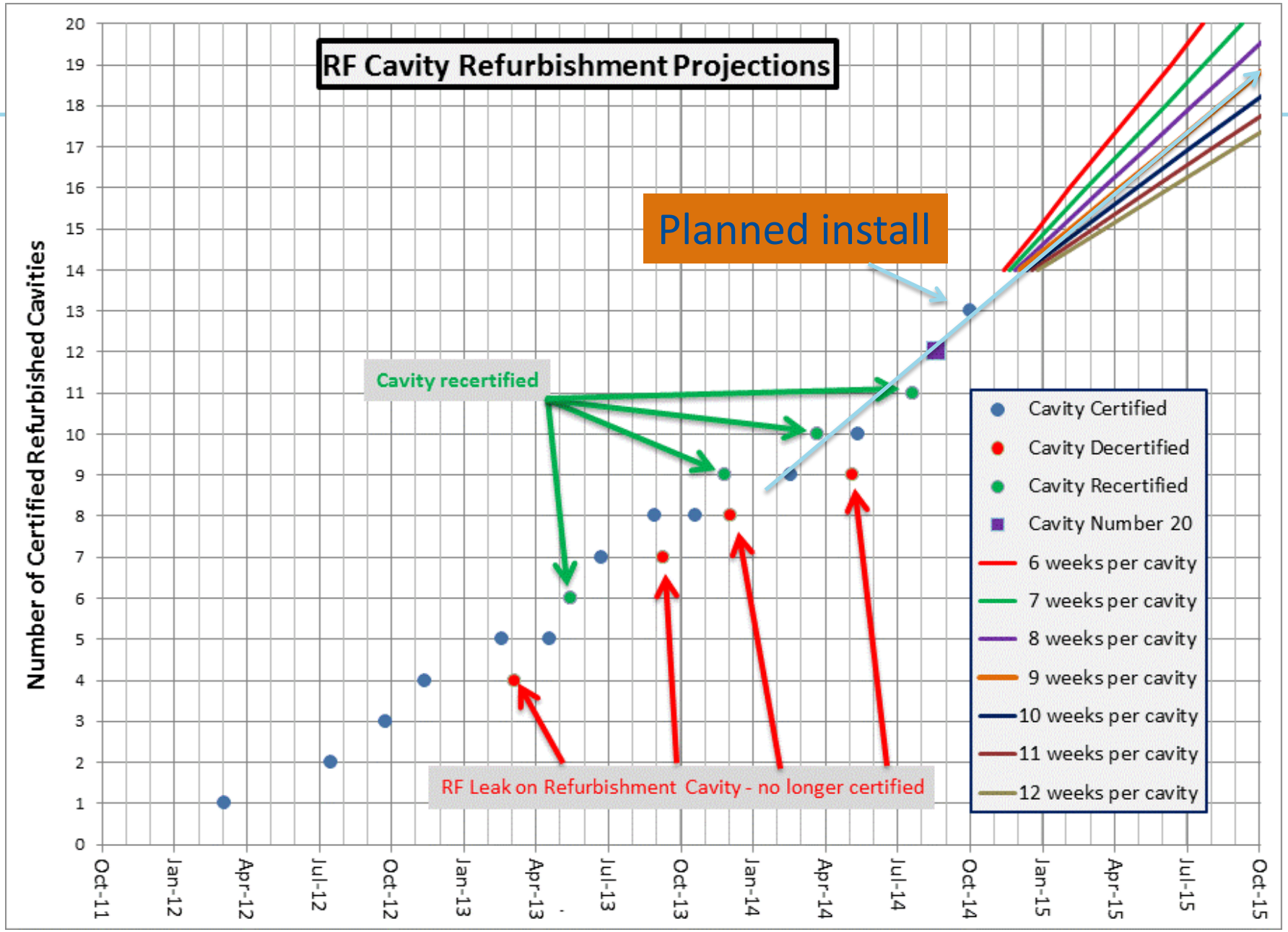
# PIP – Booster Cavity & Tuner Refurbishment (WBS 1.2.1.5)

- No new “finds” – started to run some refurbished cavities at 15 Hz – will continue after shutdown with more 15 Hz testing

- Cones for tuners is limiting issue
  - TD is used to do some re-work; AD team does majority
  - New cones had problems with vendor quality

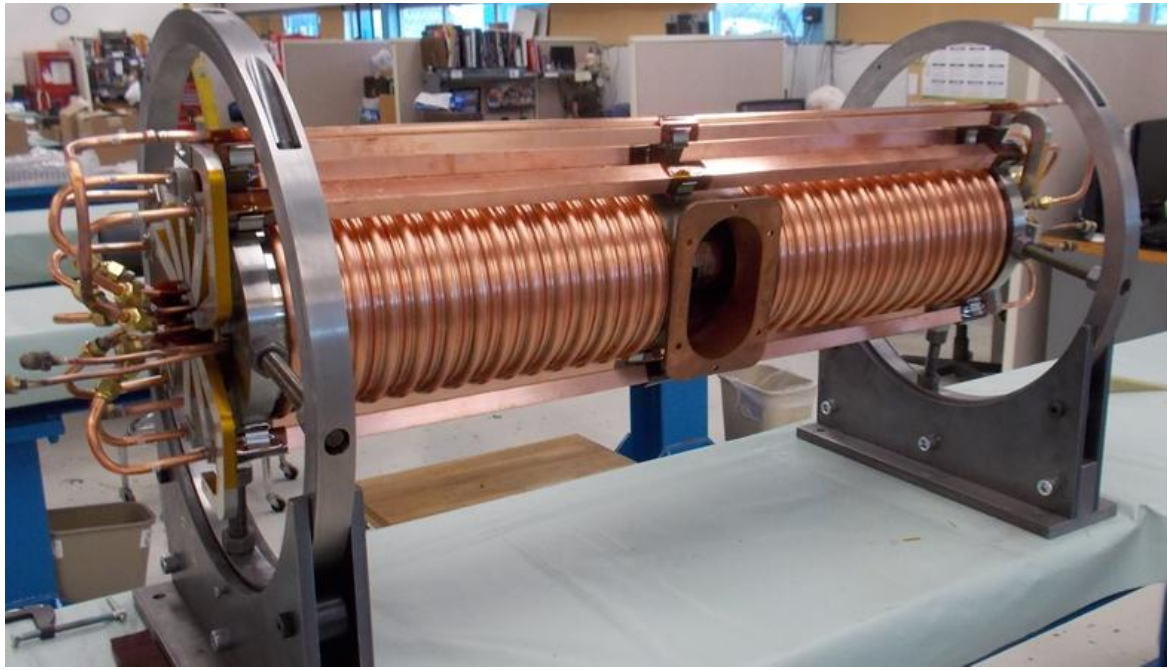
- Labor
  - One contract tech left
  - MSD re-assigned a contract tech to work on refurbishment
    - Takes several months to train

- At 9 weeks/cavity; reach **17** certified mid June 2015


RF Cavity Refurbishment Projections
Planned install
Cavity recertified
RF Leak on Refurbishment Cavity - no longer certified
Number of Certified Refurbished Cavities
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Cavity Certified
Cavity Decertified
Cavity Recertified
Cavity Number 20
6 weeks per cavity
7 weeks per cavity
8 weeks per cavity
9 weeks per cavity
10 weeks per cavity
11 weeks per cavity
12 weeks per cavity

# PIP – Booster New Tuners (WBS 1.2.1.6)

- New tuner has been in service for 6 weeks of running



- Placed requisition for ferrites
  - Appeared to be held up since both mu ferrites totaled >$100K
  - Vendor adjusted price and now both orders are <$100K
  - Vendor got order last week but has not set delivery date
    - Generally, vendor has stated ~6 weeks for processing

# PIP – Booster New Cavities (WBS 1.2.1.7)

- Splitting into three thrusts:
  - Additional 3 RF Stations (total of 22)
    - Need 2 cavities/tuners
      - Rework existing cavities with new tuners
    - Need 3 power systems
      - Repeat previous Solid State work
  - Harmonic Cavity System (Perpendicular Bias)
    - Initial design plan is for injection and transition
    - Modelling progress and hope to start building in FY15
  - Replacement RF system compatible with PIP II (PIP III?)
    - Smaller tuning range with 800 MeV injection energy
    - 20 Hz capable

# PIP – Booster Cavity 1013 (WBS 1.2.1.8)

- Tested successfully
- Installed late August
- Ran for the last 2 weeks before the shutdown

This was an original cavity - rejected due to mechanical issues. Redone with spare components and machining. This will allow for 20 stations to operational upon completion of refurbishment.

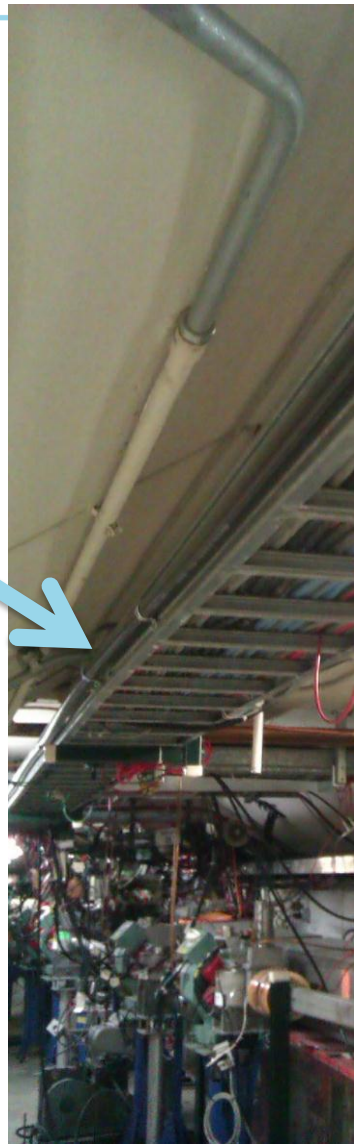
# PIP – Booster Notcher (WBS 1.2.2.3)

- Operationally, ran 2 short kickers with new PS
- TD is finishing the last of the short kickers
- Will move completely to short kicker system and power supply during shutdown

- Replacing BPM and vacuum chamber at Long 12 with better aperture
  - Activated more than expected at point where kicked excursion is largest before hitting absorber
- Adding additional “sleeve” to absorber to reduce downstream leakage of showers

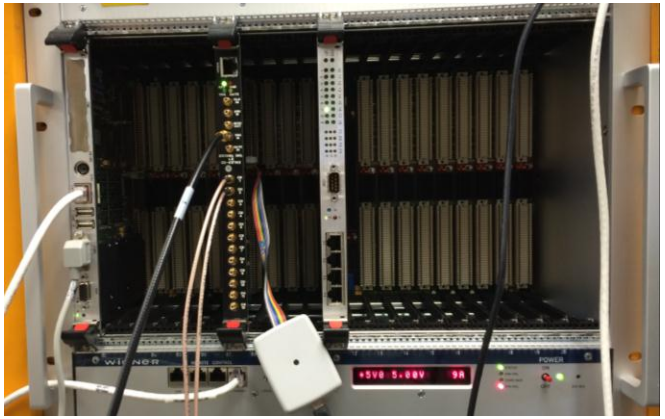
# PIP – Booster Radiation Shielding (WBS 1.2.2.6)

- TLM system is being installed by (non-PIP) in Booster
- Agreement of Booster, PIP, ES&H assessment group, interlock group and TLM developers on installation
- 8 detectors (each covering 3 Booster periods)
  - No single detector covers more than 1 expected "lossy" region
    - Injection, extraction, collimators, notcher
- Will want to run series of beam tests in Nov-Dec to characterize system
- ES&H assessment group is working on possible dosages through the shielding versus penetrations



# PIP – Booster Instrumentation (WBS 1.2.2.3)

- BPM Late start awaited personnel availability
  - The Booster BPM front end test-stand is running a Linux/RTAI kernel and the AD/Control's department ACSYS software (this is the Linux equivalent of MOOC)
  - Being that this is the first time we're running Linux in a VME crate some effort was required to build and test the VME drivers for Linux
  - This week we began testing the VME interface to the 250MHz digitizer with Alexi's help
  - Begun work on the BPM control and readout software. Our first goal is to provide raw measurements to ACNET



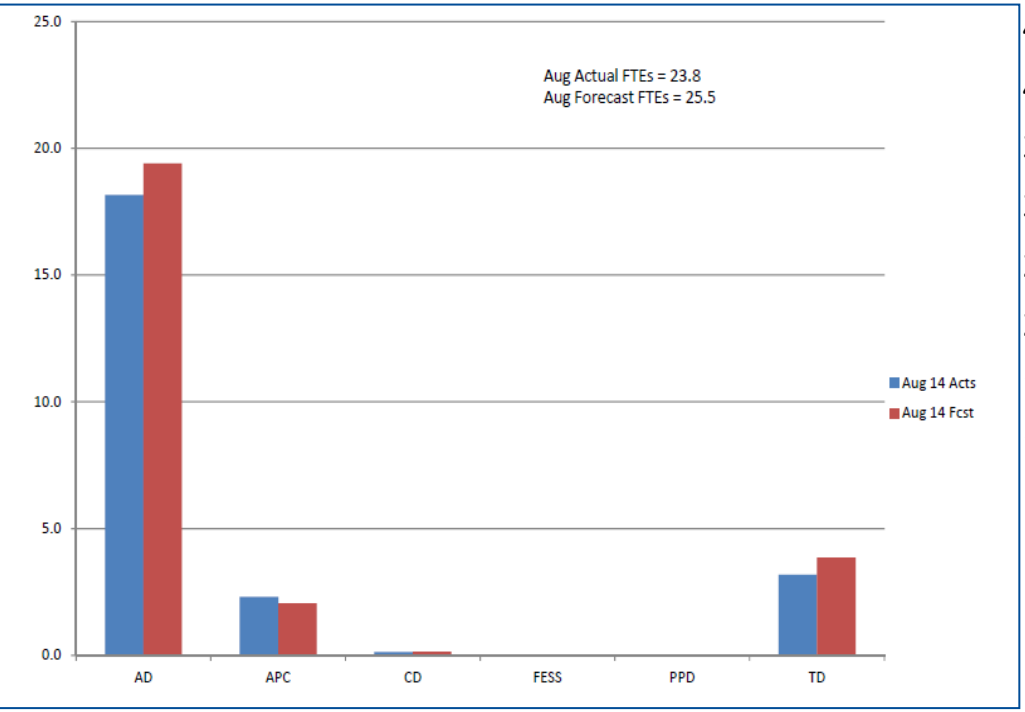
- Dampers Availability of personnel to work on setting system up
  - Several problems encountered with initial frontend
    - Lock issues
    - Card debugging
  - Transfer measurements
  - Phase control work – to match present system
  - Compared old and new system amplitudes and rates of CB instabilities

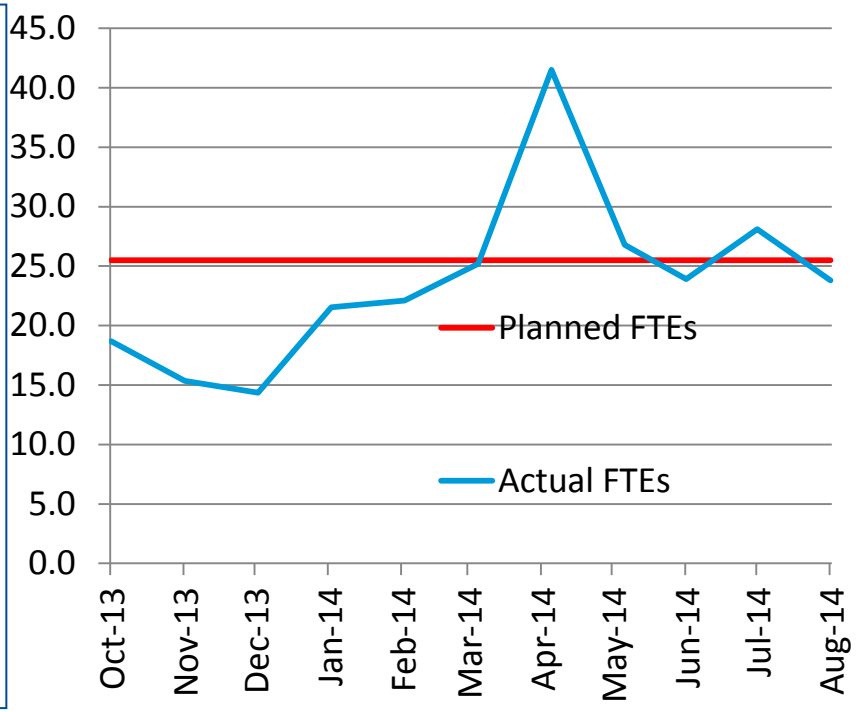
# PIP – Booster Utilities (WBS 1.2.2.5)

- Transformers
  - First replaced last Saturday
  - Second scheduled for replacement on Oct 11 (?)

- Vacuum
  - Cabling and associated rack work is on-going
  - Tunnel work awaits personnel availability & will be fill-in work this shutdown

# PIP End of Year Budget and Labor Summary




| FY14 PIP OBL BUDGET K$ ** | OBL BUDGET | YTD OBL | RIP | BUDGET BAL |
|---|---|---|---|---|
| **M&S** | 7,652.0 | 6,105.6 | 88.2 | 1,458.2 |
| **Labor** | 5,778.5 | *5,060.3* | | 718.2 |
| **FY14 Sums** | 13,430.5 | 11,165.9 | 88.2 | 2,176.4 |

** Thru Sep 2014

# PIP FY15 Initial Upload (some small differences – will be corrected)

## Adjustments are being planned: Code structure, Some task plans and Labor needs

| CHOOSE OHAP ROLE | OHAP Category (will fill) | AD | APC | FESS | PPD | CD | TD | | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| FTEs | | | | | | | | | | |
| TOTAL FTE | | 18.99 | 2.20 | 0.01 | 0.00 | 0.00 | 3.05 | 0.00 | 0.00 | 24.25 |
| | | | | | | | | | | |
| LABOR COST (will calculate) | | | | | | | | | | |
| TOTAL LABOR COST | | $1,923.6 | $357.4 | $1.2 | $0.0 | $0.0 | $275.9 | $0.0 | $0.0 | $2,558.1 |
| *LABOR OH RATE* | | *97.37%* | *97.37%* | *54.19%* | *73.47%* | *70.00%* | *87.34%* | *0.00%* | *0.00%* | |
| LABOR OH | | $1,873.0 | $348.0 | $0.7 | $0.0 | $0.0 | $240.9 | $0.0 | $0.0 | $2,462.6 |
| M&S (enter) | | | | | | | | | | |
| Standard | | $1,848.5 | | | | | | | | $1,848.5 |
| Pass-Through | | | | | | | | | | $0.0 |
| Exempt - $ of POs > $500K | | $2,126.1 | | | | | | | | $2,126.1 |
| *Exempt - # OF PO > $500K* | | *2* | | | | | | | | *2* |
| TOTAL M&S | | $3,974.6 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $3,974.6 |
| | | | | | | | | | | |
| M&S OVERHEAD RATES | | | | | | | | | | |
| *M&S Standard* | | *21.28%* | | | | | | | | |
| *M&S Pass-Through* | | *3.00%* | | | | | | | | |
| *Exempt - M&S on first $500k* | | *$106.4* | | | | | | | | |
| | | | | | | | | | | |
| TOTAL M&S OH | | $606.2 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $606.2 |
| | | | | | | | | | | |
| BUDGET SUMMARY | | | | | | | | | | |
| SWF | | $1,923.6 | $357.4 | $1.2 | $0.0 | $0.0 | $275.9 | $0.0 | $0.0 | $2,558.1 |
| SWF OH | | $1,873.0 | $348.0 | $0.7 | $0.0 | $0.0 | $240.9 | $0.0 | $0.0 | $2,462.6 |
| M&S | | $3,974.6 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $3,974.6 |
| M&S OH | | $606.2 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $606.2 |
| TOTAL BUDGET SUMMARY | | $8,377.3 | $705.4 | $1.9 | $0.0 | $0.0 | $516.8 | $0.0 | $0.0 | $9,601.4 |
| | | | | | | | | | | 12,000.0 |
| | | | | | | | | Over (Under) Guidance | | (2,398.6) |

# PIP to PIP II Adjustments

Fermilab

**Sergei Nagaitsev**
Accelerator Division
MS 306

630.840.4397
nsergei@fnal.gov

September 30, 2014

Bill Pellico
Project Manager
Proton Improvement Plan
pellico@fnal.gov

Dear Bill,

I would like to update the objectives and goals for the Proton Improvement Plan (PIP) in light of progress to this point and the lab's strategy. Even though PIP is well underway, some adjustments to the project are needed to align with the upcoming PIP-II project. This letter supplants the initial guidance delivered by Stuart Henderson on Dec. 7, 2010, at the Proton Source Workshop and documented in Beams-doc-3739.

The overarching goal of PIP should now be to develop and implement a plan to meet the targets for Proton Source throughput, while maintaining good availability and acceptable residual activation. Specifically, when executed, PIP should enable Linac/Booster operation capable of delivering 2.3E17 protons per hour at 15 Hz while maintaining Proton Source availability at 85 % and maintaining residual activation at acceptable levels.

These plans should anticipate a useful operating life of the Linac through 2023, and the Booster through 2030. In addition, the plan should anticipate a transition to the new PIP-II linac in 2023, with which the Booster will be expected to deliver 4.7E17 protons per hour at 20 Hz. The remaining deliverables within PIP should be mindful of the PIP-II and possible subsequent upgrades.

Sincerely,

SNag 11291

Sergei Nagaitsev
Chief Accelerator Officer
Fermi National Accelerator Laboratory

CC: Nigel Lockyer, Joe Lykken, Tim Meyer, Hasan Padamsee, Greg Bock, Steve Geer, Gina Rameika, Mike Lindren, Rob Roser, Vladimir Shiltsev, Paul Czarapata, Bob Zwaska, Steve Holmes

Modifications to PIP objectives that reflect present laboratory planning. This letter from Sergei will be added to PIP docs and reflected in PIP planning.

# PIP-II impacts *The Original PIP*

- Anticipating a PIP-II Linac in 2023
  - Linac needs to operate until 2023
  - Booster needs to operate until at least 2030, and be able to accept the PIP-II beam in 2023
- Meetings and studies underway to adjust the PIP plan for PIP-II
  - Some changes made immediately, expect plan to fully settle mid-2015
- Implications:
  - Klystron implementation on hold until need is demonstrated
    - Prototype will be completed and tested to spec
  - Booster cavity strategy evolving
    - Any full replacement to be compatible with PIP-II and later upgrades
    - Requirements to be settled upon in the near future
  - Booster modifications to allow 800 MeV injection
  - Booster 20 Hz operations will be studied
  - Booster infrastructure