



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Update on PXIE front end status

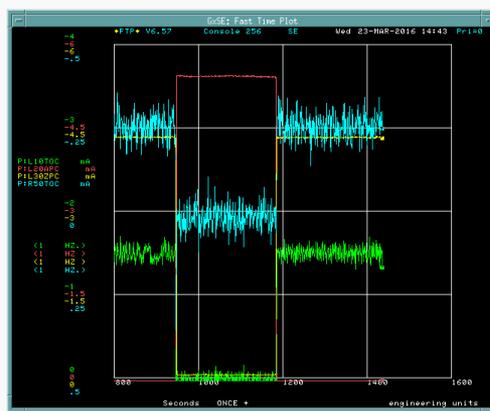
A. Shemyakin

PIP-II technical meeting

29 March 2016

Happy moment

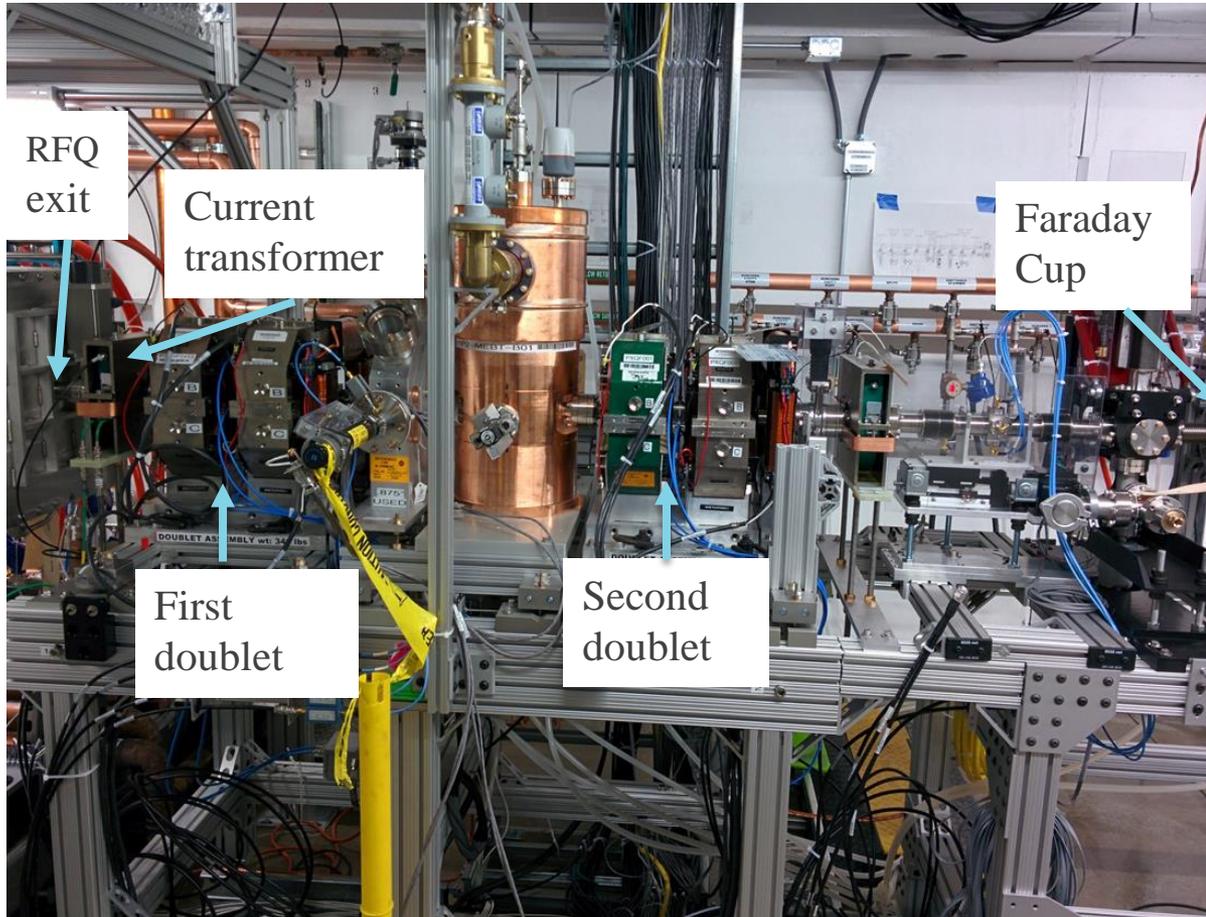
- We received permission to run the beam through RFQ on March 23, and saw an accelerated beam within an hour



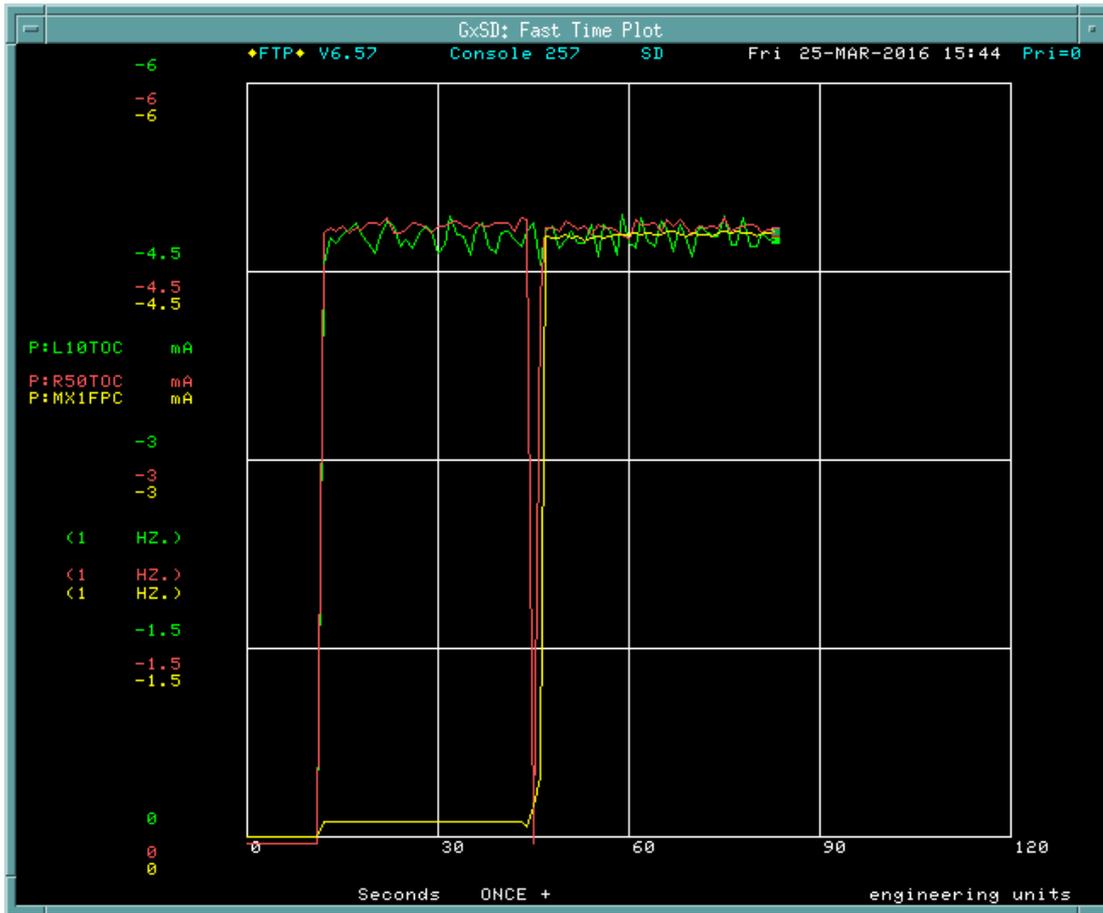
**Congratulations to the entire team!
Thanks to everybody who
contributed to PXIE!**

Beam from RFQ

- We received permission to run the beam through RFQ on March 23, and saw an accelerated beam within an hour



Transport through the MEBT-1.1 line



The MEBT magnets were turned on at $T=45$ sec.

Green – beam current at the entrance of RFQ.

Red - beam current at the exit of RFQ.

Yellow – beam current in the Faraday Cup.

Vertical axis – beam current, 1.5 mA/div.

Horizontal axis – time, 30 sec/div.

5 mA, 20 μ s, 10 Hz

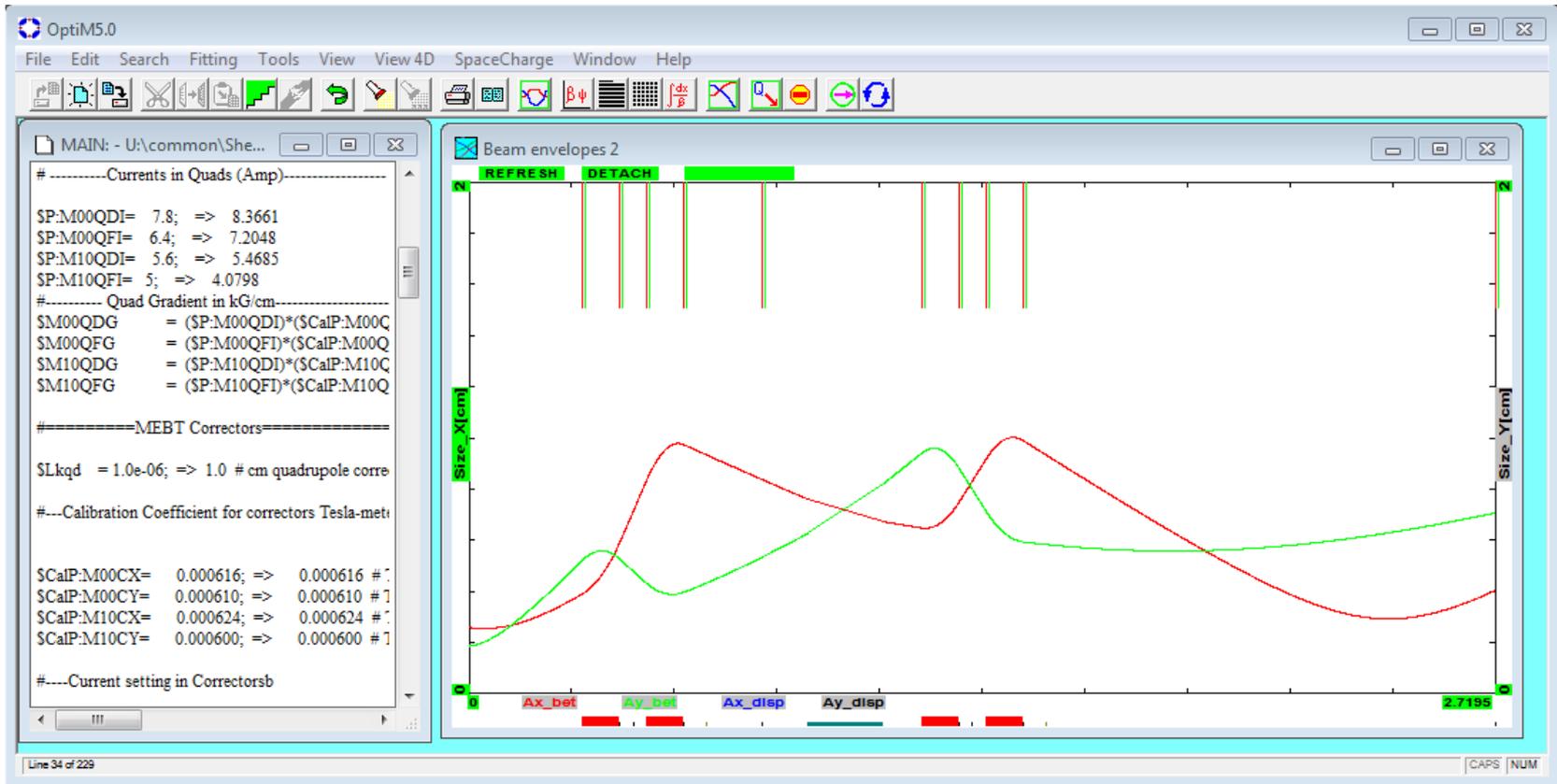
With quadrupoles and dipole correctors tuned, most of the beam goes into the Faraday Cup at the end of the beam line at the nominal current of 5 mA. Max beam current: 8 mA, >90% transmission to Faraday Cup.

Most of things work as expected

- LEBT
 - The beam went through without significant tuning
- RFQ
 - RFQ works reliably in the pulsed mode at nominal vane voltage
 - Amplifiers work (in the pulsed mode) without big problems
 - LLRF system keeps the RF pulse flat, compensating the beam loading (see details later)
- MEBT
 - Magnets are operational
 - 1st toroid and Faraday Cup read believable information
- MPS
 - Operational with the LEBT inputs

Magnet settings are reasonable

- Beam goes into the Faraday Cup at settings compatible with simulations



– OptiM file prepared by Arun Saini

Mode of operation

- Current < 10 mA, 10 Hz, 20 μ s beam pulse
 - ~ 30 μ s (flat top) RF pulse to further decrease chances of generating an accelerated CW beam
 - Will try up to 0.1 ms when MPS is operational with Ring Pickup
- The cave is kept closed until Safety will verify that there is no high radiation at up to 0.1 ms beam pulse
- Shifts 8-12:30, 12:30-5
- Coming Wed March 30 is the access day (no beam)

Looking ahead

- Need all diagnostics operational to begin beam studies
 - Ring pickup for MPS; BPMs, 2nd toroid, ToF (see details in the next slides)
 - Need to install Fast Faraday Cup (in ~ 2 weeks)
- All 4 scraper plates are shorted
 - May use relying on changes in the Faraday Cup current
 - Will look for the reason on coming Wed
- Noise at the MPS input signals is being addressed
- Bunching cavity needs to be connected and commissioned

Instrumentation status (from Niral Patel) -1

Diagnostics online:

- MEBT Toroid 1
 - MEBT Toroid 1 was calibrated last Tuesday
 - To first order, toroids are operational within few percent
 - Additional analysis/work needed to get to 1% level accuracy
- Faraday cup/donut
 - Faraday cup and donut were calibrated and operational last Tuesday
 - Calibration will be verified on Wed 3/30

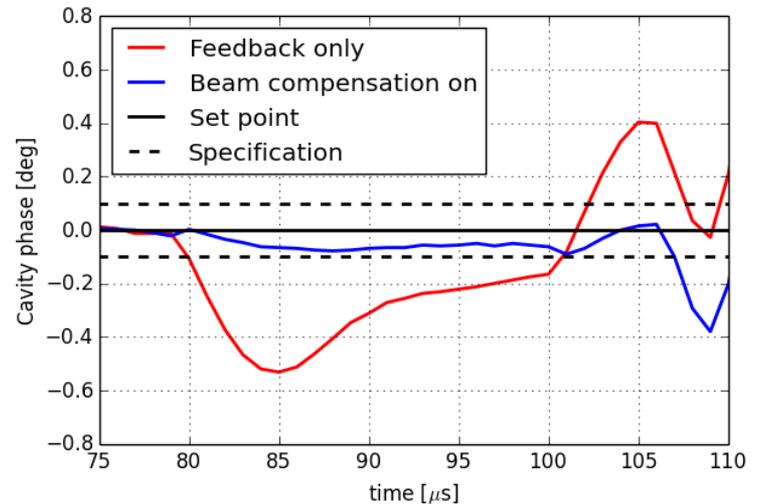
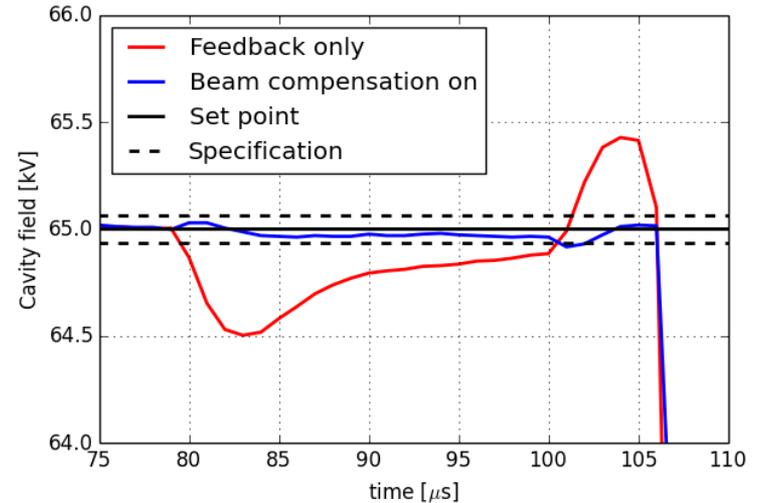
Instrumentation status (from Niral Patel) -2

Diagnostics offline:

- Ring pickup
 - Getting ring pickup calibrated and ready for use is a priority, and currently being looked at
 - Electronics has been installed; aiming towards being operational this week
- MEBT scrapers
 - Electronics have been installed; waiting for shorts repair
- BPM
 - BPM electronics presently being worked on for both hardware and software
 - May be a few weeks to get the system operational; will review if it makes sense to put in a temporary solution until then

LLRF Status (from Jonathan Edelen)

- Feedback has been commissioned
- With feed-forward beam compensation, the LLRF system achieves the regulation requirements for a short beam pulse
- Adaptive beam compensation is in the process of being commissioned
- Firmware changes have been implemented
- Unresolved items
 - Include integral gain in frequency tracking loop
 - Commission the bunching cavity system
 - Auto-download of calibrations (Working with controls)
- Right: Demonstration of feed-forward beam loading compensation for a 20 microsecond beam pulse at 5mA



Plans

- Fully commission all systems
 - Diagnostics; MPS; install FFC; repair scrapers
- Understand the beam with MEBT-1.1 as much as we can
 - Characterize cavity, check optics, beam profiles with scrapers
- Switch to CW as soon as RFQ amplifier spare parts are available (~June)
 - Need to install the 16 kW beam dump (“SNS/HINS”)
- Install the Allison scanner when ready (~ June)
- Prepare for ~2 months shutdown to install MEBT-2 (~ Sep)
 - Need 4 triplets from India, 1 more buncher
 - 200 Ohm kicker needs to be assembled and tested