Update on PXIE front end status

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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.
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.

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 µs, 10 Hz
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 µs beam pulse
  – ~30 µs (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, 2\textsuperscript{nd} 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
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
**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