Plan for MEBT measurements in FY16

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MEBT stages

- The MEBT is proposed to be installed in several steps, determined mainly by arrival of magnets from BARC
  - MEBT \(-x, x=1, 2, 3\) in this report corresponds to intermediate configurations with different number of magnets
  - Each configuration may have several variations of different diagnostics placement, which are referred as MEBT \(x\)-\(y\)

MEBT-1: 2 doublets, 1 buncher

MEBT-2: +4 triplets, 1 buncher

MEBT-3: +3 triplets, 1 buncher
Assumptions for the plan

• Can start RFQ beam in pulse mode in Jan 2016
  – RFQ is RF-commissioned
  – MEBT 1-1 is ready to roll in
• No bad discoveries with beam and components
• Stop beam run in July 2016 for installation of MEBT-2
  – 4 triplets are supplied by BARC and one is re-measured in TD
  – One more bunching cavity is ready for installation
  – Kickers and additional diagnostics are ready
• In the case of further delays with RFQ, sacrifice the quantity of beam measurements for assembling MEBT-2 as soon as possible
Overall schedule

• Jan –Mar 2016 – 20 µs beam in MEBT-1-1
  – Main goal: characterize the beam from RFQ
  – Commission all systems
• Apr- May-2016 – high-power beam in MEBT-1-2
  – Main goal: 10 kW (CW or long – pulse)
  – Test the absorber prototype with H-
• Jun-Jul 2016- emittance scanner measurements in MEBT 1-3
  – Main goal: transverse phase space reconstruction
  – Prepare to analyze effect of LEBT bend installation
• Jul-Sep 2016- shutdown to install MEBT-2
  – Install the LEBT bend at the same time
• Depending on progress on each stage, the list of elements in the following stages may be slightly adjusted
MEBT 1-1

• Jan 2016 – installation, Jan-Mar – MEBT 1-1 run
• Goals (beam – related)
  – Measure RFQ transmission and H- energy
  – Measure of transverse and longitudinal properties of a pulsed beam
  – Commission MPS
  – Characterize bunching cavity

• In parallel, a lot of instrumentation, LLRF and other efforts
• All beam line elements are fabricated
• Need RFQ and bunching cavity phase-locked by mid-Jan
List of MEBT 1-1 beam measurements

- Beam current and losses (toroids, scrapers, Faraday Cup from LEBT)
- Machine Protection System (ring pickup etc.)
- Beam trajectory (BPMs)
- Energy (Time-of-Flight monitor, BPMs)
- Bunching cavity characterization (Fast Faraday Cup, ToF)
- Transverse optics (BPMs, scrapers, donut, quad scans)
- Longitudinal optics (FFC)
- Transverse tails (scrapers)
- RFQ/LEBT tuning
- Need ring pickup, BPM, FFC electronics and software
- Possibility to test diagnostics (Wire Scanner, Diamond)
MEBT 1-2

- Mar 2016 – installation, Apr- May-2016 – MEBT-1-2 run
- Goal: test RFQ and MEBT in the high-power (CW) mode
  - Demonstrate 10 kW (average)
  - Test the absorber prototype with H-
- Measurements
  - CW beam scraping, MPS
  - beam tuning to fill the dump aperture
  - Irradiate the absorber prototype with ~ 5 kW H-
- Need to fabricate connections
- Need RF amplifiers in CW
MEBT 1-3

• May 2016 – installation, Jun-Jul-2016 – MEBT-1-3 run
• Goal: transverse phase space reconstruction
• Measurements
  – Commission the MEBT Allison scanner
  – Measure phase space and Twiss parameters
  – Optimize LEBT/RFQ
• The Allison scanner needs to be designed, fabricated, and assembled
MEBT 2-1

- Jul-Sep 2016- installation of MEBT 2-1 and LEBT bend
  - First two MEBT sections stay unchanged
    - Keep emittance scanner in the same position to understand possible changes due to the LEBT bend
  - Add:
    - 4 triplets with BPMs, 1 bunching cavity, 2 kicker prototypes, +BPM
    - Assembly with Wire scanner and Laser wire with electron collection
  - Design just started

![Diagram of MEBT 2-1 with labeled components such as Scrapers + WS, Kicker 50 Ohm, Kicker 200 Ohm, BPM, Toroid, and Dump.](image-url)
MEBT-2 goals (FY17)

- Characterize transverse and longitudinal optics of the longer beam line, start experiments with laser wire and WCM
- Main goal: test and characterize kickers
  - First, separately, looking at the trajectory with BPMs
    - 50 Ohm powered by two 81.25 MHz CW amplifiers
    - 200 Ohm: two prototype 500V switches
  - Then, synch them and try to remove every other bunch
Possible scenario beyond FY16

- **Oct – Dec 2016 – MEBT-2 run**
  - In the middle of the run, move the emittance scanner downstream and install Wall Current Monitor (MEBT 2-2)
  - Toward the end, install prototype absorber to try bunch-by-bunch separation (MEBT 2-3)
- **Jan – Feb 2017 – install MEBT-3 (full length with prototypes)**
- **Mar – Apr 2017 – MEBT-3 run**
  - Characterize full beam line
  - First test of differential pumping
- **May - Nov 2017 – shutdown to install cryo, HWR, 10-MeV HEBT, and clean the MEBT downstream sections**
- **Jan 2018 – beam through HWR**