MEBT status update

A. Shemyakin

January 21, 2014

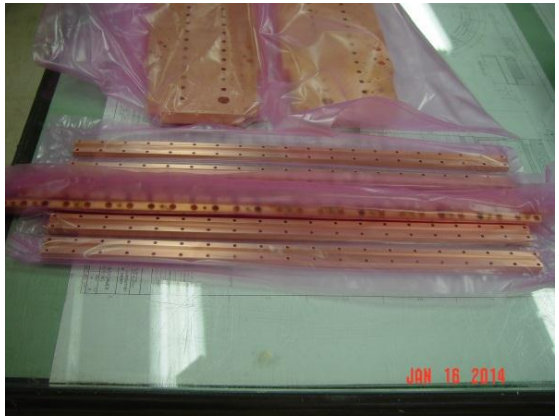
MEBT

Slow valve, toroid	Scrapers, RF	Emittance monitor, laser wire, scraper, wire scanner	Kicker	RF, wire scanner, Fast Faraday Cup	Kicker	Absorber	Different. pumping, scrapers, wire scanner	Scrapers, RF, slow valve, extinction monitor	Fast valve, DCCT, toroid, laser wire, wire scanner	Slow valve

- Speed of MEBT development is slower than in FY13
  - On one hand, reduced manpower allocation
  - Also, interference with other jobs, holidays, vacations etc.
- No new lines of development. Continue to work with
  - Kicker (50 and 200 Ohm)
  - Absorber
  - Bunching cavity
  - Quadrupoles/correctors (BARC, India)
  - Diagnostics

50 Ohm kicker (1)

Ground plate



Cooling tube base plate etc.

- Parts are cleaned.
- Will be assembled (in air): ~end of Feb.
- RF measurement: 2nd week of March.
- Power test: March (?)

Clamps and support stands

Cooling water feedthrough

Slide from Ding Sun

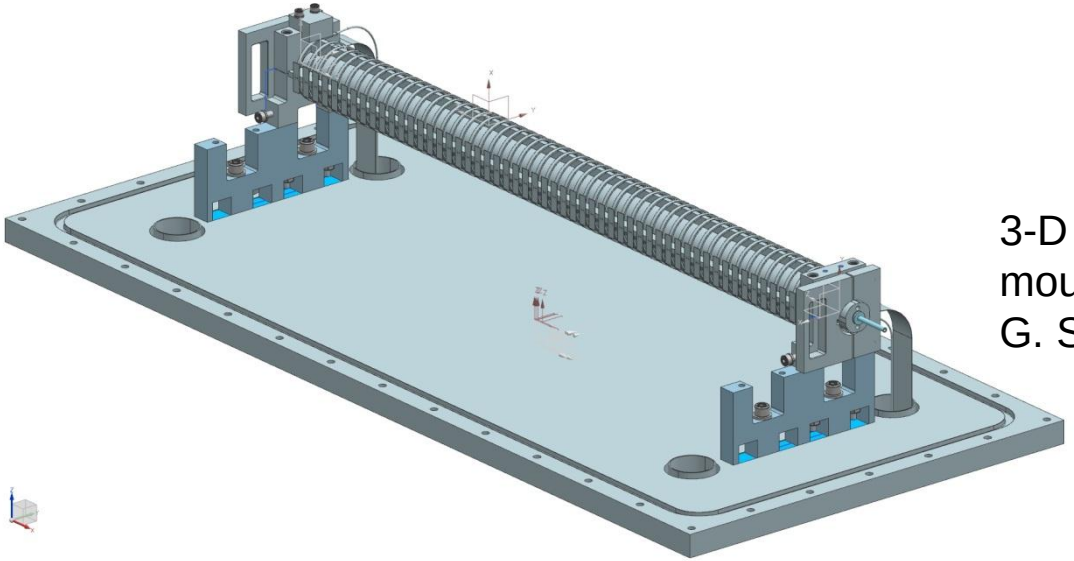
50 Ohm kicker (2)

- Other Work to Be Done
  - All electrodes to be machined.
  - RF power feedthrough extension.
  - Flanges to be welded.
  - Parts with many holes will be ultrasonic cleaned
  - Water tube to be bent and brazed.
  - Final assembly.

Slide from Ding Sun

200 Ohm kicker (1)

- The nearest goal is to manufacture one helix in its final configuration
  - To test the manufacturing procedure
  - To perform RF measurements of the helix
    - The design is sensitive to permittivity of the support ceramics and is based on a specific choice (AlN, machinable)
- 3D model of the helix and tooling is complete
  - Production drawings are in works

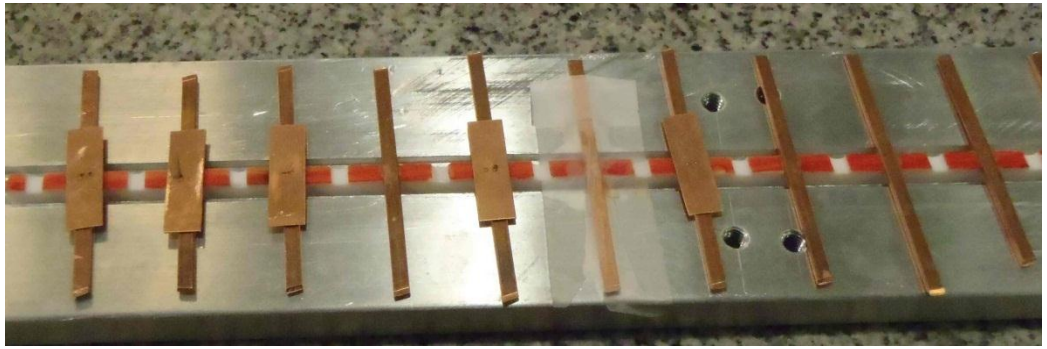


3-D model of the 200 Ohm helix mounted at a test plate. A. Chen, G. Saewert, P. Jones

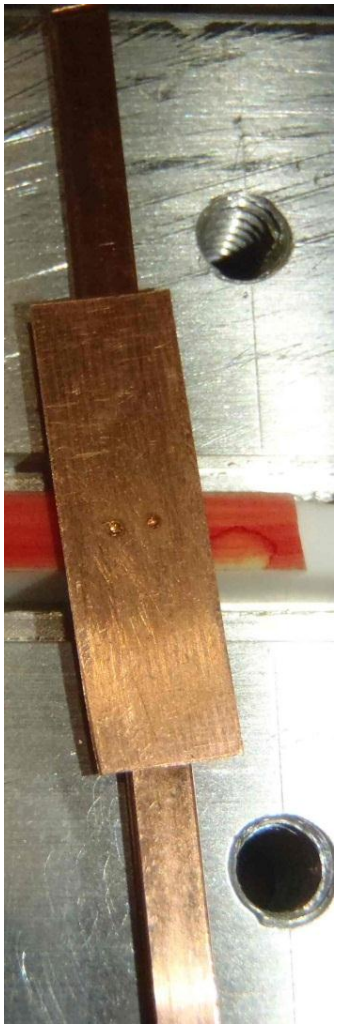
200 Ohm kicker (2)

- Helix ALN ceramic supports have been manufactured

- Procedure of laser welding of electrodes was successfully tested with the copper wire glued to a ceramic by a vacuum-compatible epoxy



A. Chen



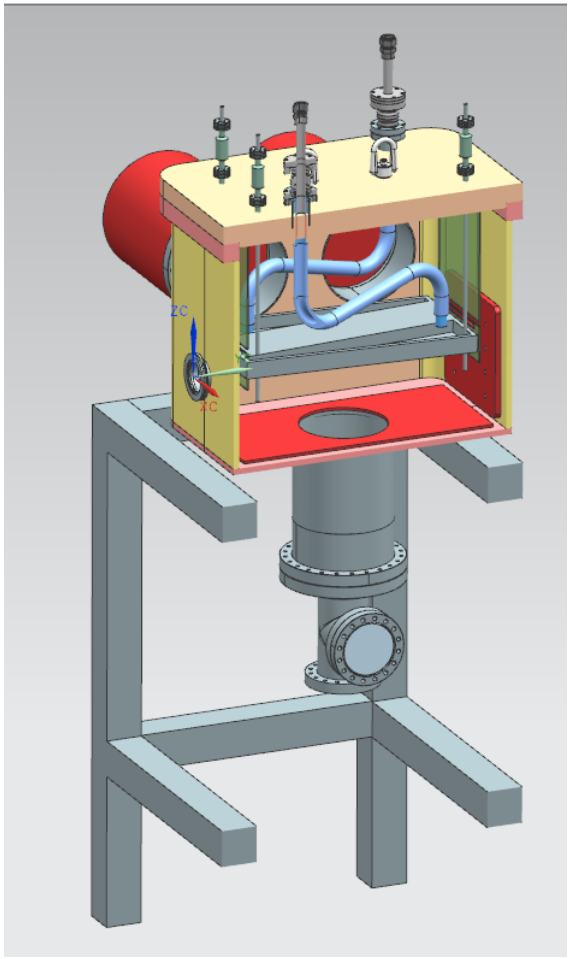
200 Ohm kicker driver

- No significant progress with the 200 Ohm kicker driver in recent months
  - Greg worked with LEBT
    - Spark protection, ion source modulator, kicker driver

- The plan for Greg is to return to the driver development in a month
  - The nearest goal is to fully characterize 300 V version of the driver

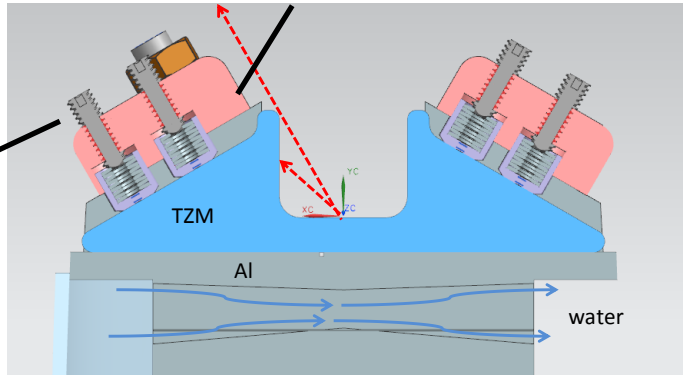
Absorber: concept

- The absorber concept has been modified to take into account the result of measuring of Prototype-I (C. Baffes)
  - The absorbing surface is composed from separate TZM fins
  - Thermal contact to the aluminum cooling strongback through graphite
  - A better confinement of secondary particles



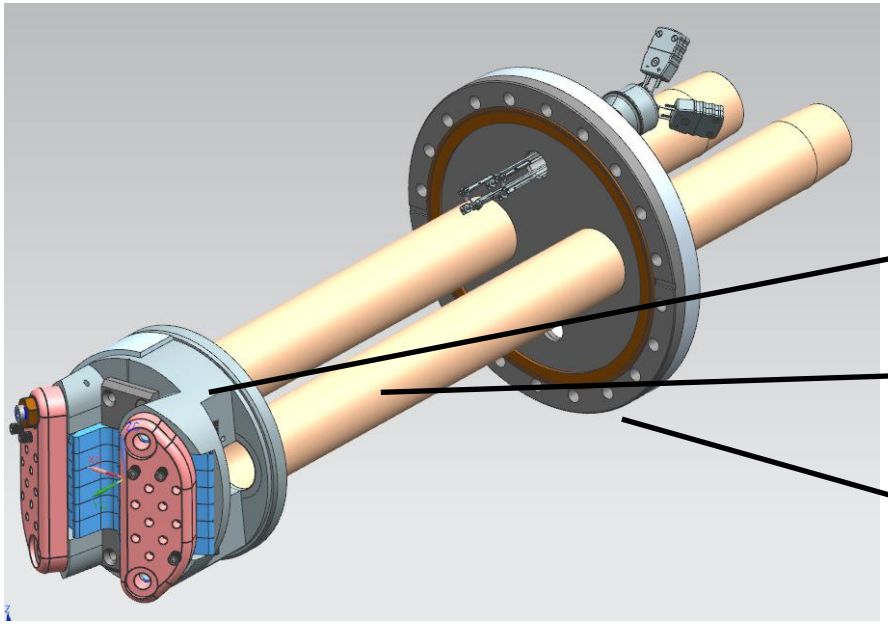
Structure mostly shielded from reflected energy by TZM

Compliant preloading with disk springs



Absorber: prototype-II

- The modified concept will be verified by manufacturing a second prototype and testing it with an electron beam
  - Likely to be used as an absorber at the first stages of MEBT
- 3-D model is finalize; production drawings are under preparation

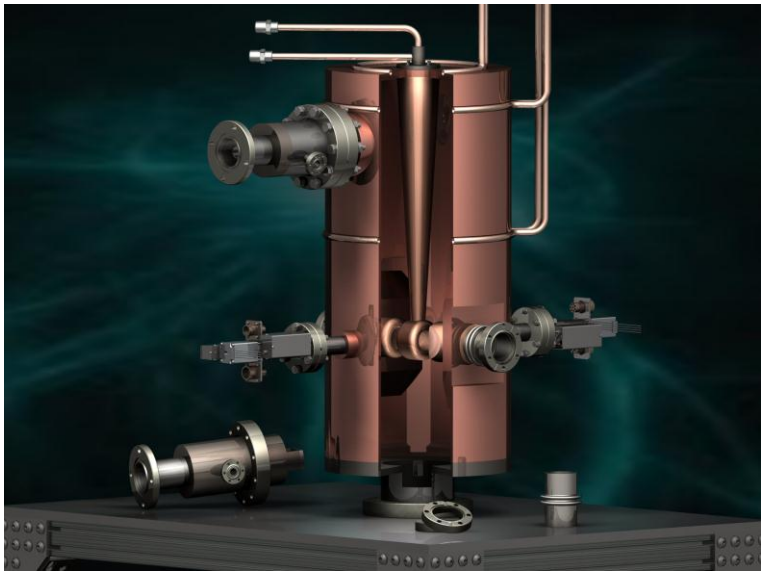


- 6 PXIE-like TZM fins
  - Graphite thermal contact
  - Individually preloaded
- Aluminum cooling strongback
  - Transverse cooling channels
- Aluminum plumbing to air
  - No in-vacuum material transitions
- ATLAS Aluminum/SS flange interfaces to test bench

C. Baffes

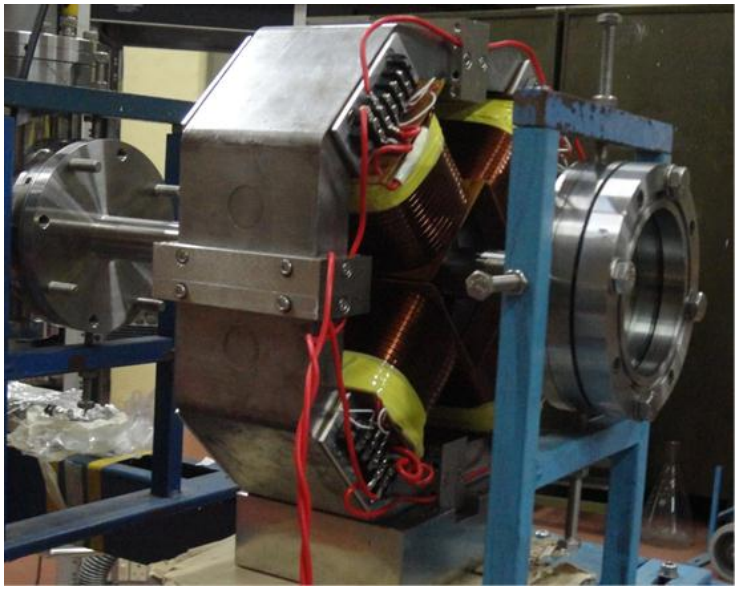
Bunching cavity

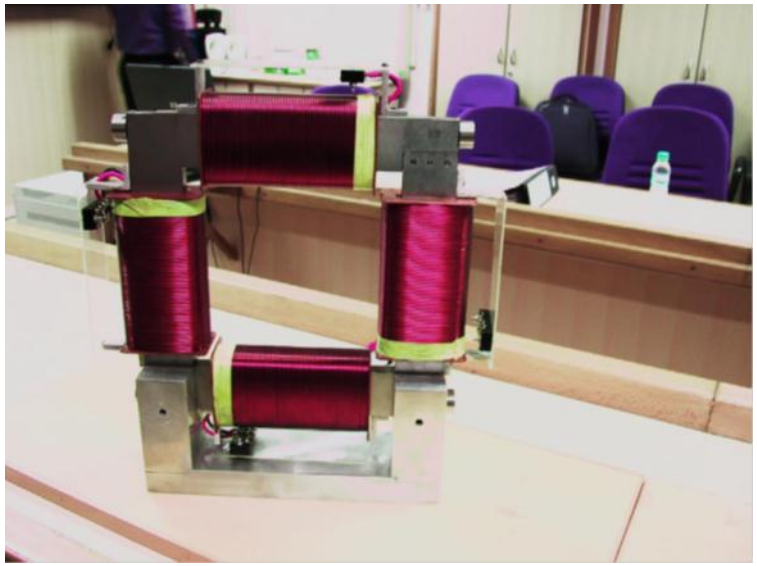
- The first bid, closed in Sep 2013, was unsuccessful
- The cavity design was updated with changed tolerances and including an RF measurement before final brazing, and was put for second bidding
- The proposals are at Fermilab, and a decision is expected by the next week



Quadrupoles

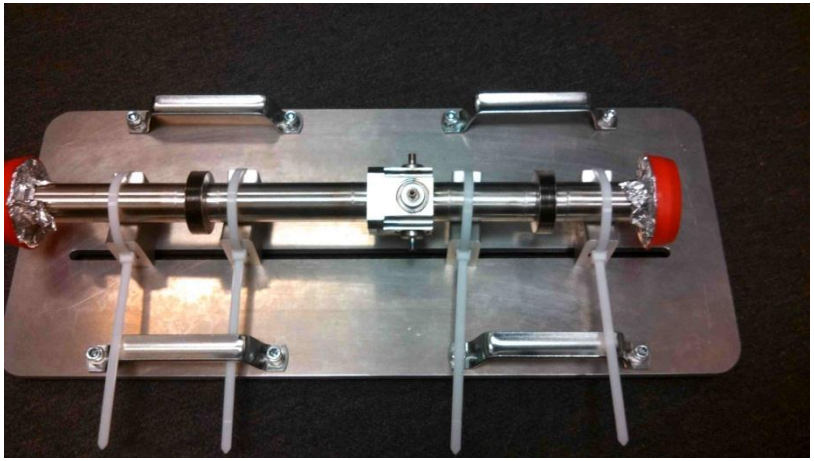
- The MEBT quadrupoles and dipole correctors have been designed and prototyped at BARC, India
  - Prototypes of the F-quad and correctors were successfully manufactured, measured, and tested at a 2.5 MeV proton beam line
  - Orders for prototypes of complete doublet and triplet are planned to be placed in Jan 2014
  - The work is on schedule to deliver first quadrupoles and dipole correctors by the time when we need them for the RFQ beam characterization





Diagnostics: BPMs

- Specifications for BPM were signed in Oct 2013
  - Average positions and phases to be measured with electronics identical to one developed for FRIB
    - Electronics for several BPMs can be done in several weeks
  - Measurements for bunch-by-bunch selection with a fast scope
- Buttons are chosen to be identical to FRIB's
  - A requisition for 16 buttons has been placed
- A prototype triplet vacuum chamber has been manufactured (M. Alvarez)
  - Includes a BPM mockup (the final body but no buttons)
  - Compatible with BARC design of the triplet



Diagnostics: toroid

- We plan to have identical toroids on entrance and exit of RFQ to compare the current readings and estimate the beam loss in RFQ
  - Need to agree within 1% even the beam is bunched after RFQ and un-bunched in LEBT
- Choice: Pearson 7655 Toroid (Aisha Ibrahim, Vic Scarpine)
  - Modelling of the toroid response has started

- *Sensitivity: 0.1 Volts per Amp +/- 1%*
- *Droop rate: ~ 7% per millisecond*
- Low Freq 3 dB point: ~ 10 Hz
- High Freq 3 dB point: ~ 4 MHz