Demonstration of Ionization Cooling- the Final Step ($3\pi/2$)

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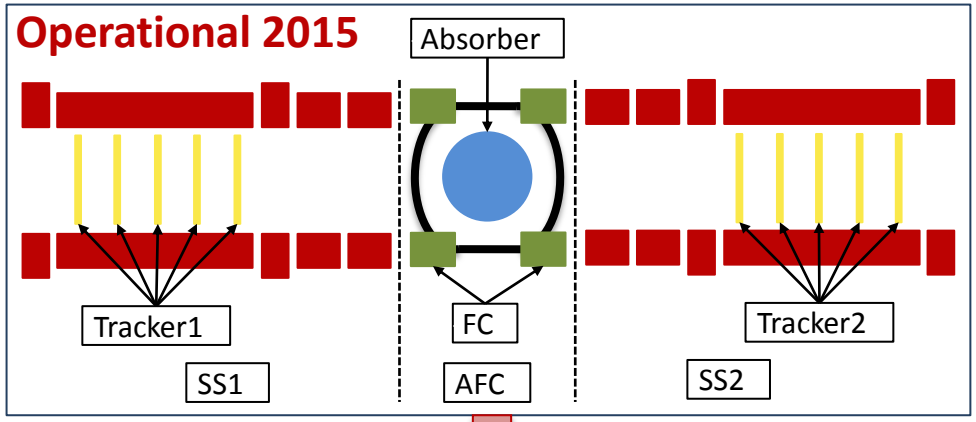
28/10/2014, CM40, Rome

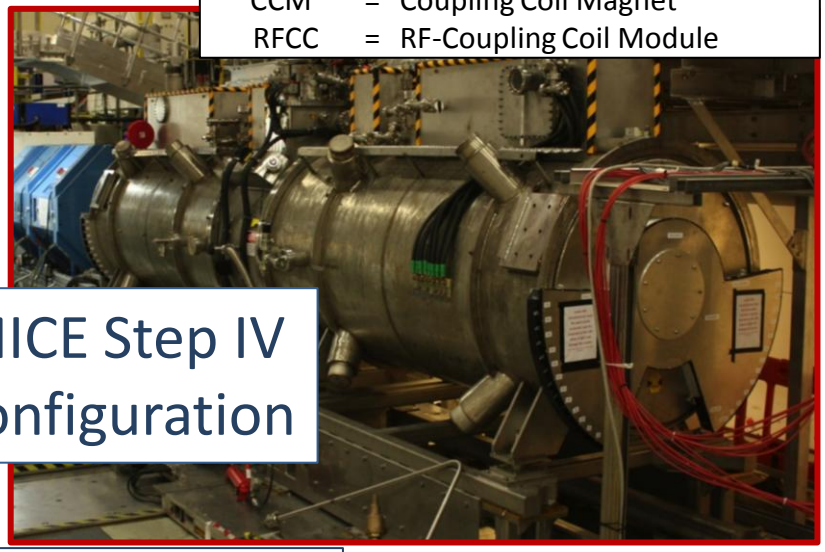
MICE Steps IV & V

Plan endorsed by MICE Project Board in April 2014

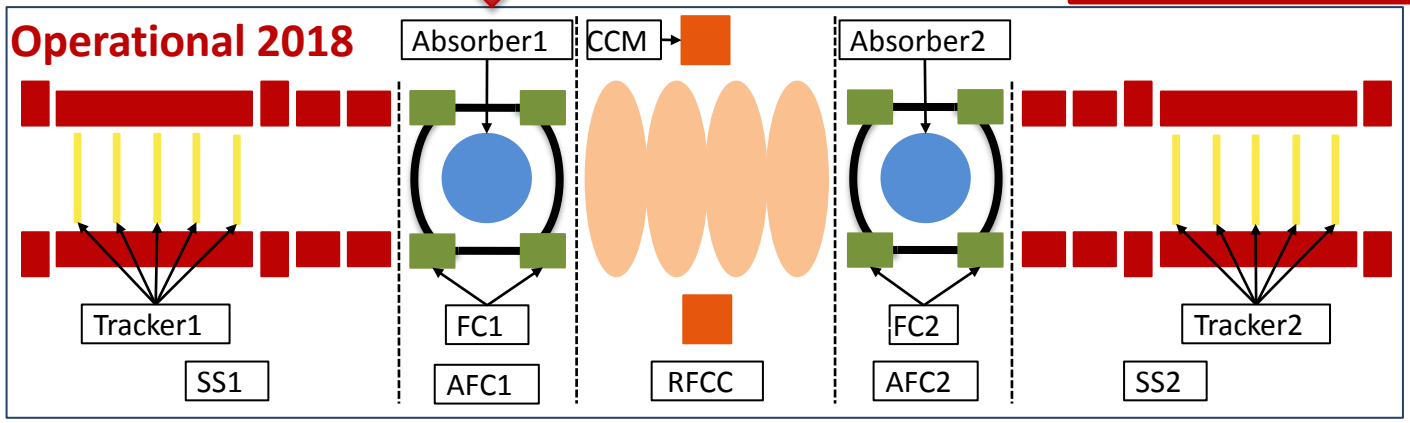
Legend:

SS	=	Spectrometer Solenoid
FC	=	Focus Coil
AFC	=	Absorber-Focus Coil Module
CCM	=	Coupling Coil Magnet
RFCC	=	RF-Coupling Coil Module





MICE Step IV Configuration

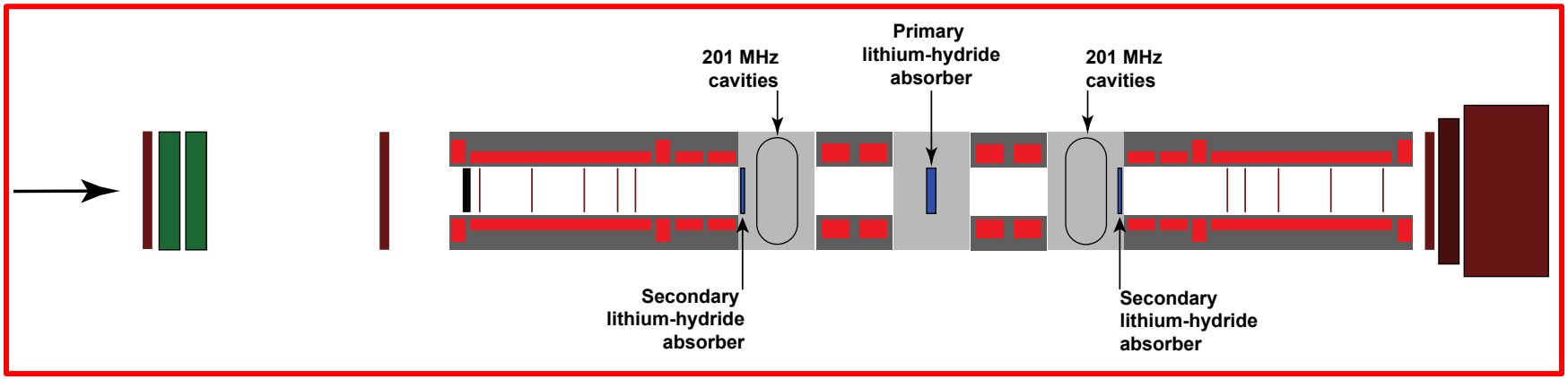


MICE Step V Configuration

Unfortunately CC and RFCC are no longer on our plan (the DOE decision)
Please, ask the US collaborators for details.

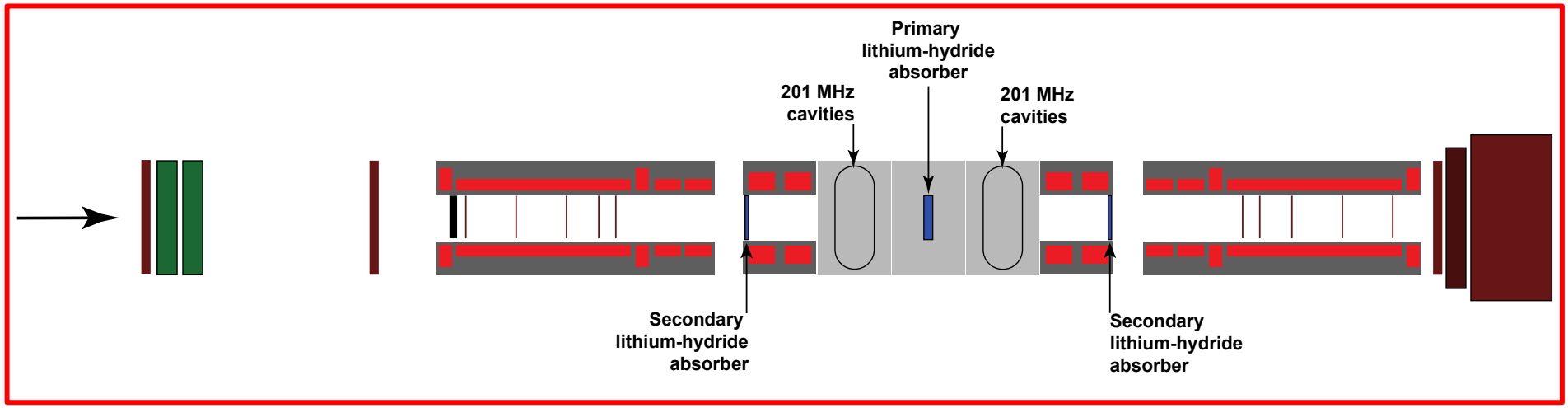
Reference design (see J-B. Lagrange's talk, addressing the performance)

- Current length between the FC centres (1.524m) This is still a free parameter!



Alternative design (see, C. Rogers talk)

Minimal length of the Cooling Cell (From FC centre to FC centre)- 2.18 m

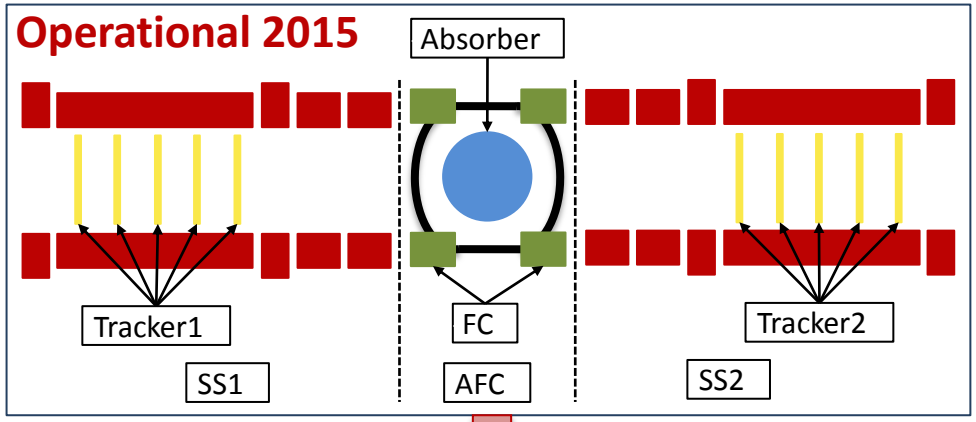


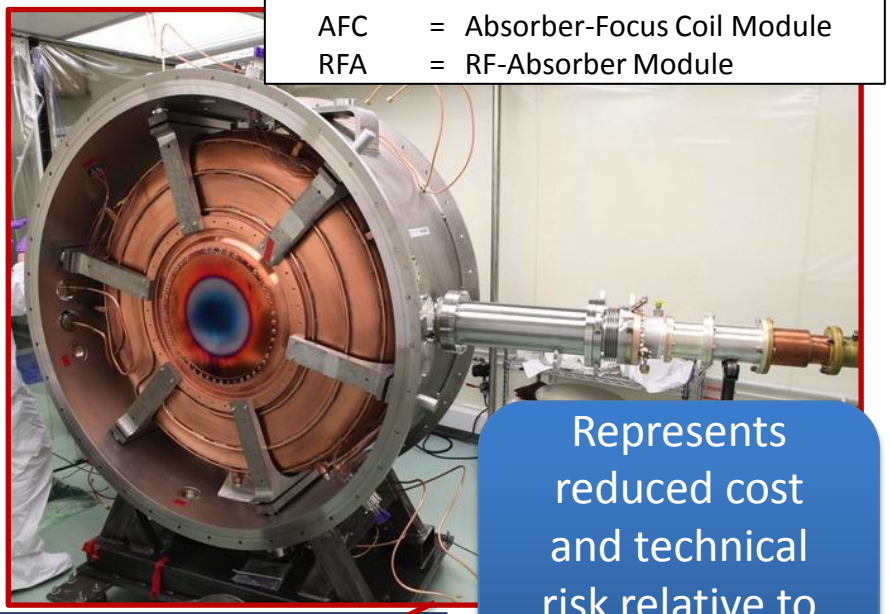
New MICE Reference Design I

Plan developed in response to P5 recommendations

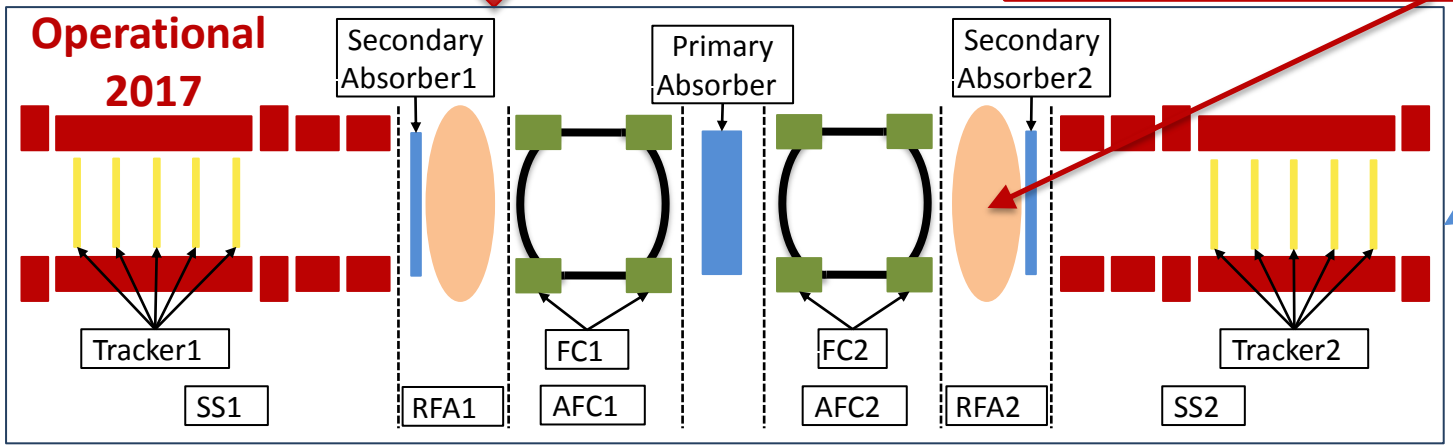
Legend:

SS	=	Spectrometer Solenoid
FC	=	Focus Coil
AFC	=	Absorber-Focus Coil Module
RFA	=	RF-Absorber Module





Represents reduced cost and technical risk relative to MICE Step V

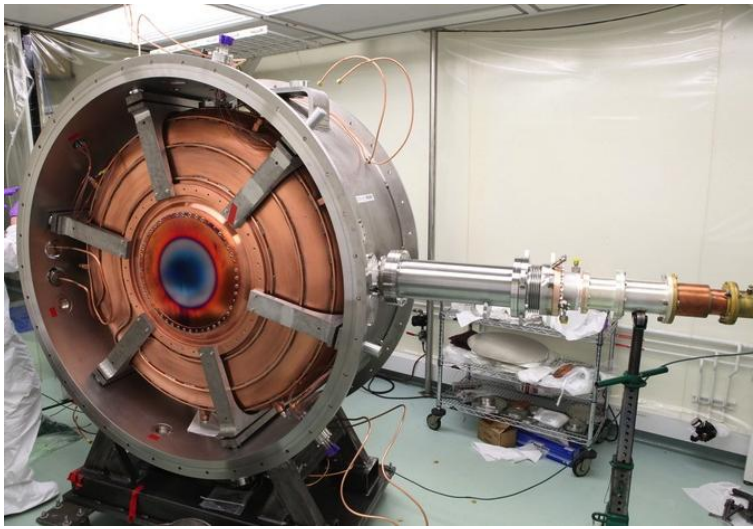


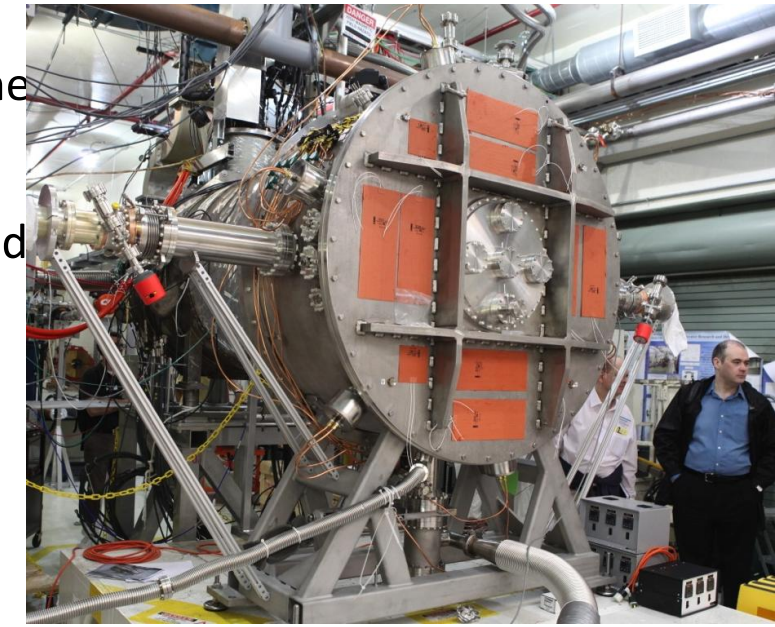
NEW

Expedited MICE Final Configuration

New MICE Reference Design II

- Principal differences since review
  - Spectrometer solenoids and Focus Coils need to be separated to properly match the optics
  - US construction greatly simplified by building two single-cavity vessels
    - Essentially just replicate the Single Cavity Test System presently in MTA
    - Allow for outboard “thin” absorbers to shield trackers
    - Incorporate all *lessons learned* from MTA
  - Single primary LiH absorber in center of channe (minimize UK LH_2 support requirements)
  - Two RF systems, each capable of 2MW@201MHz ⇨ 12MV/m with no losses and no overhead allowance
    - Deployment of additional 2 RF stations could allow 16MV/m operation
- These choices help limit cost, schedule duration, and project risk

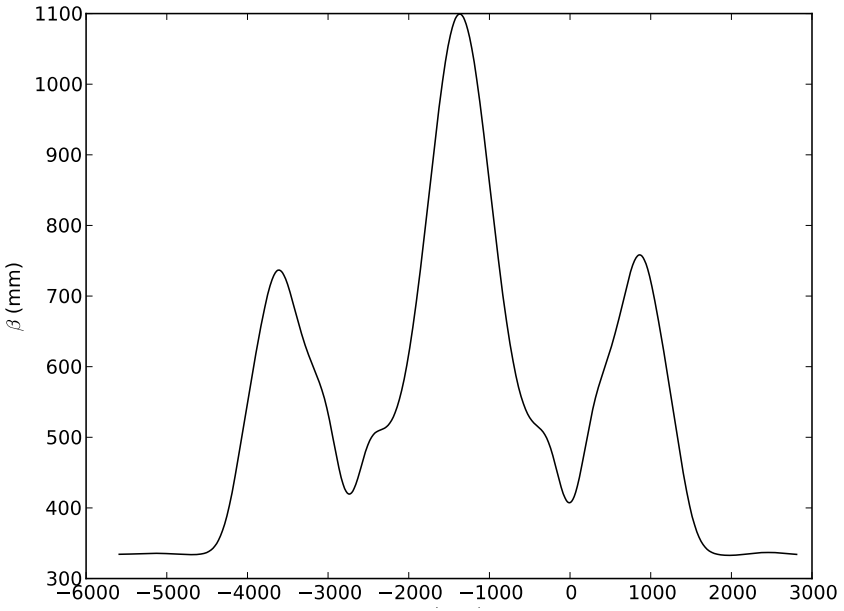




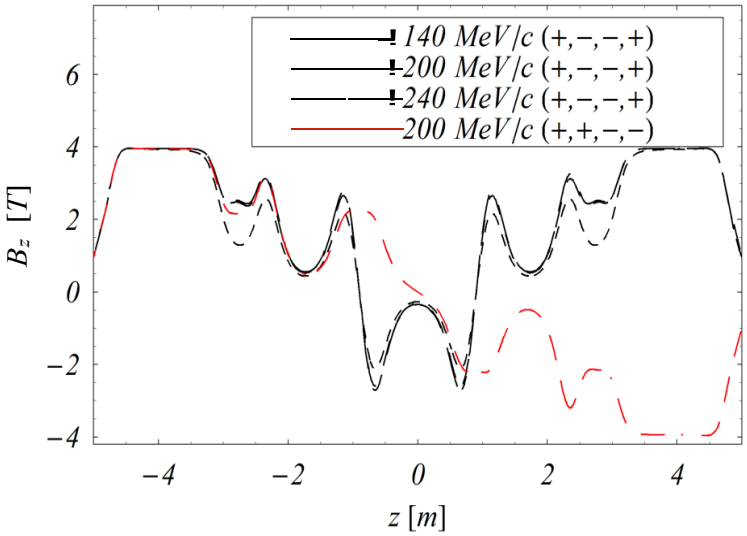
New MICE Reference Design III

- Optics Development
  - Major issue is that absorbers inside FCs don't work

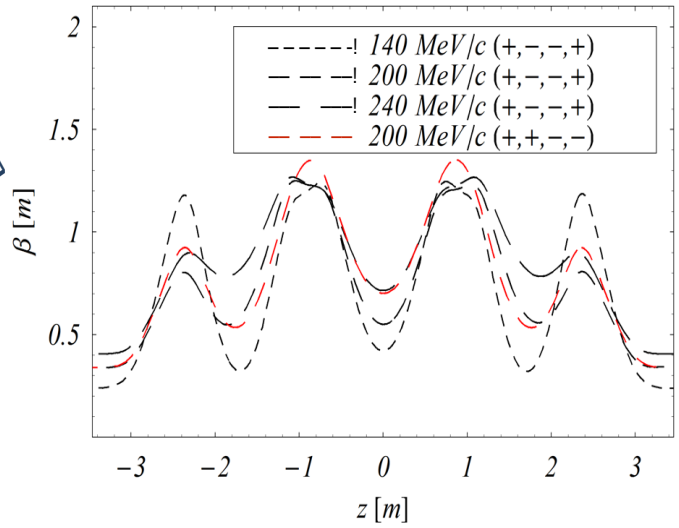
Step V ⇨



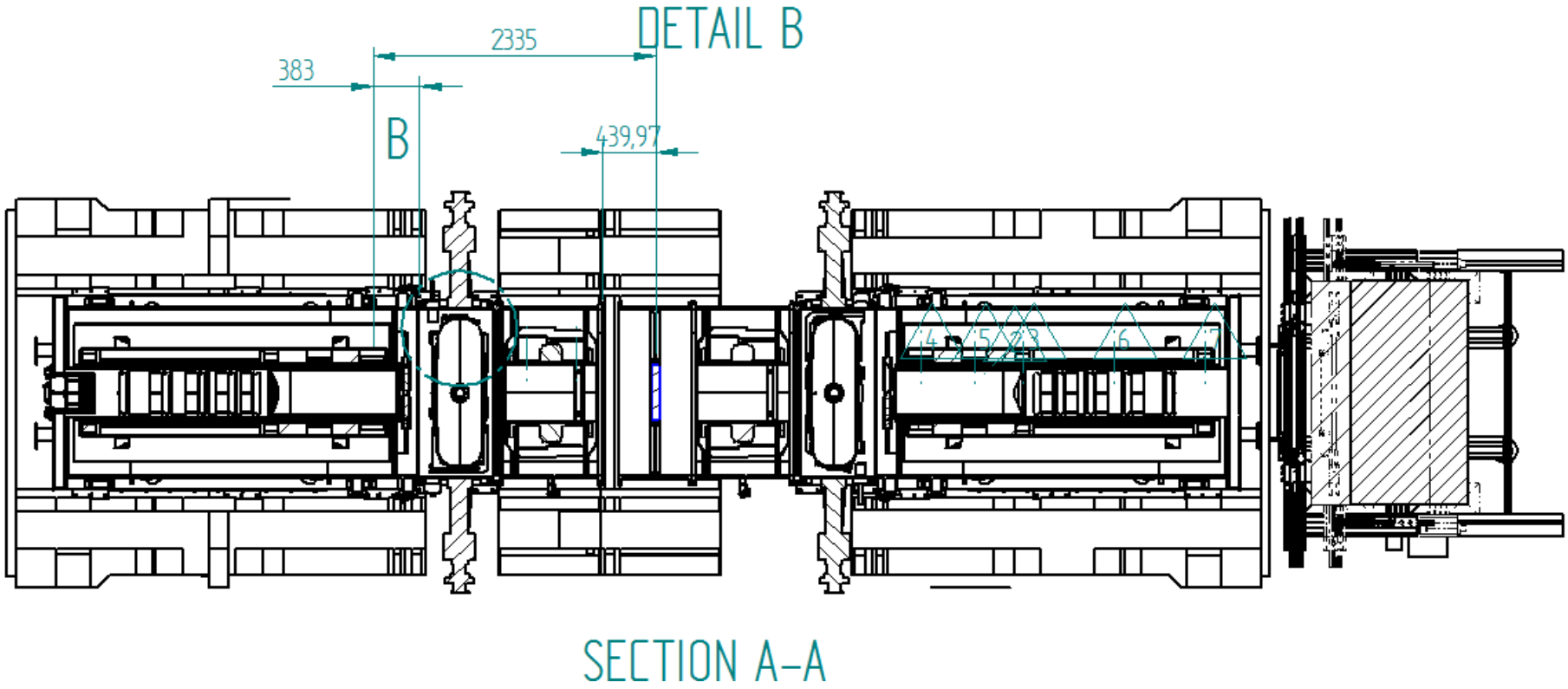
All coil currents within magnet specifications



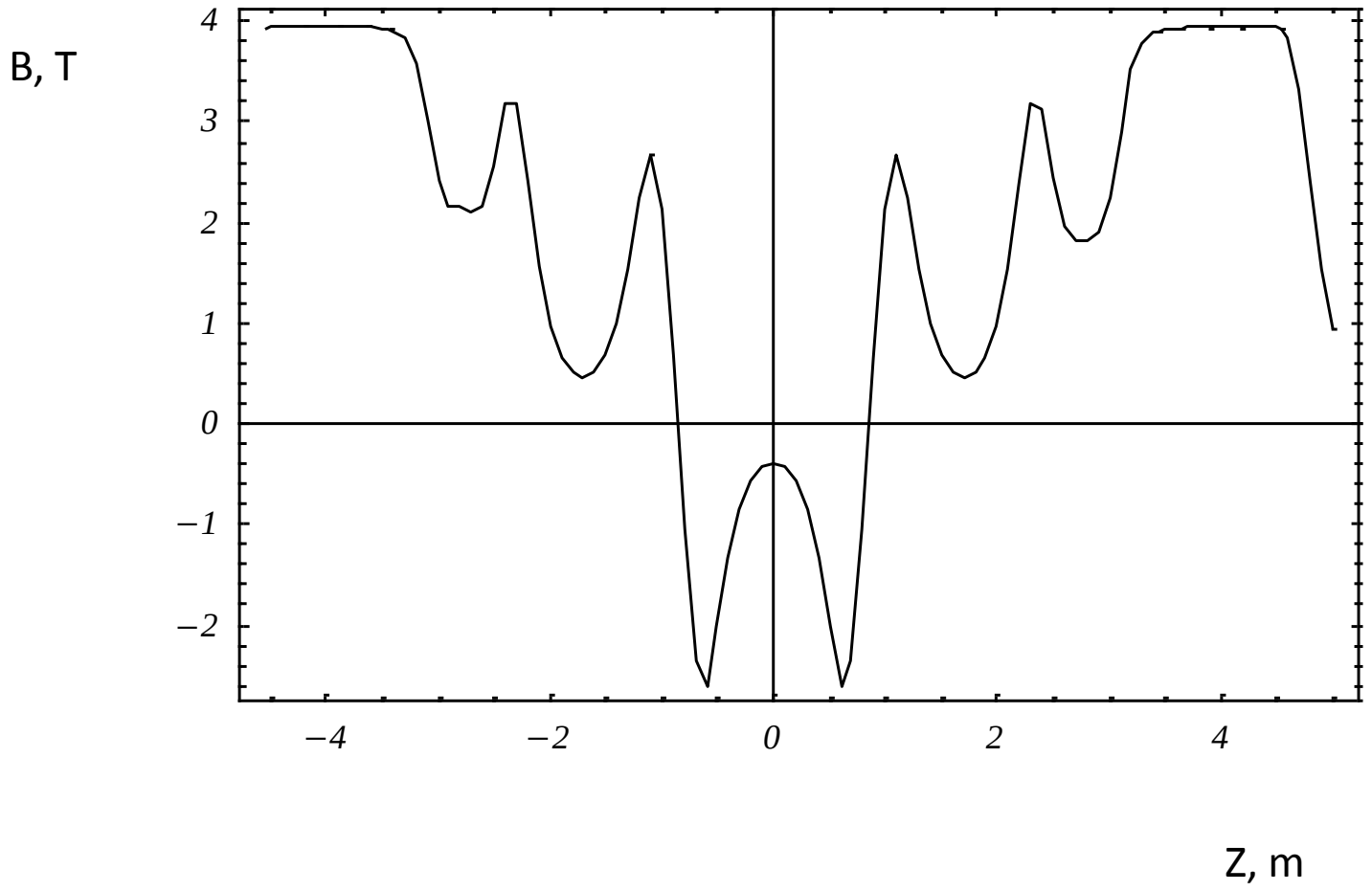
⇦ Step 3π/2 ⇨



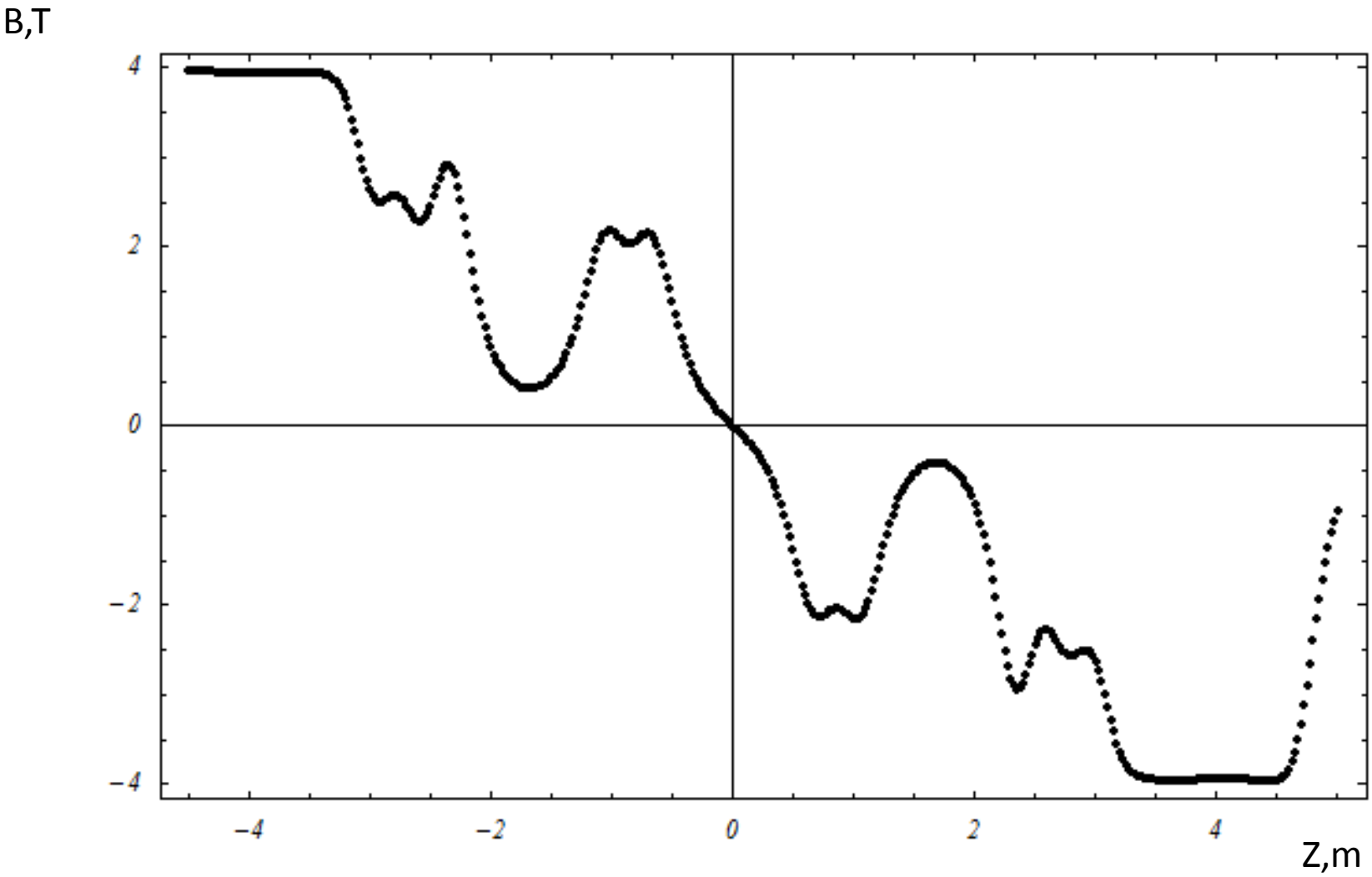
Progress on Engineering



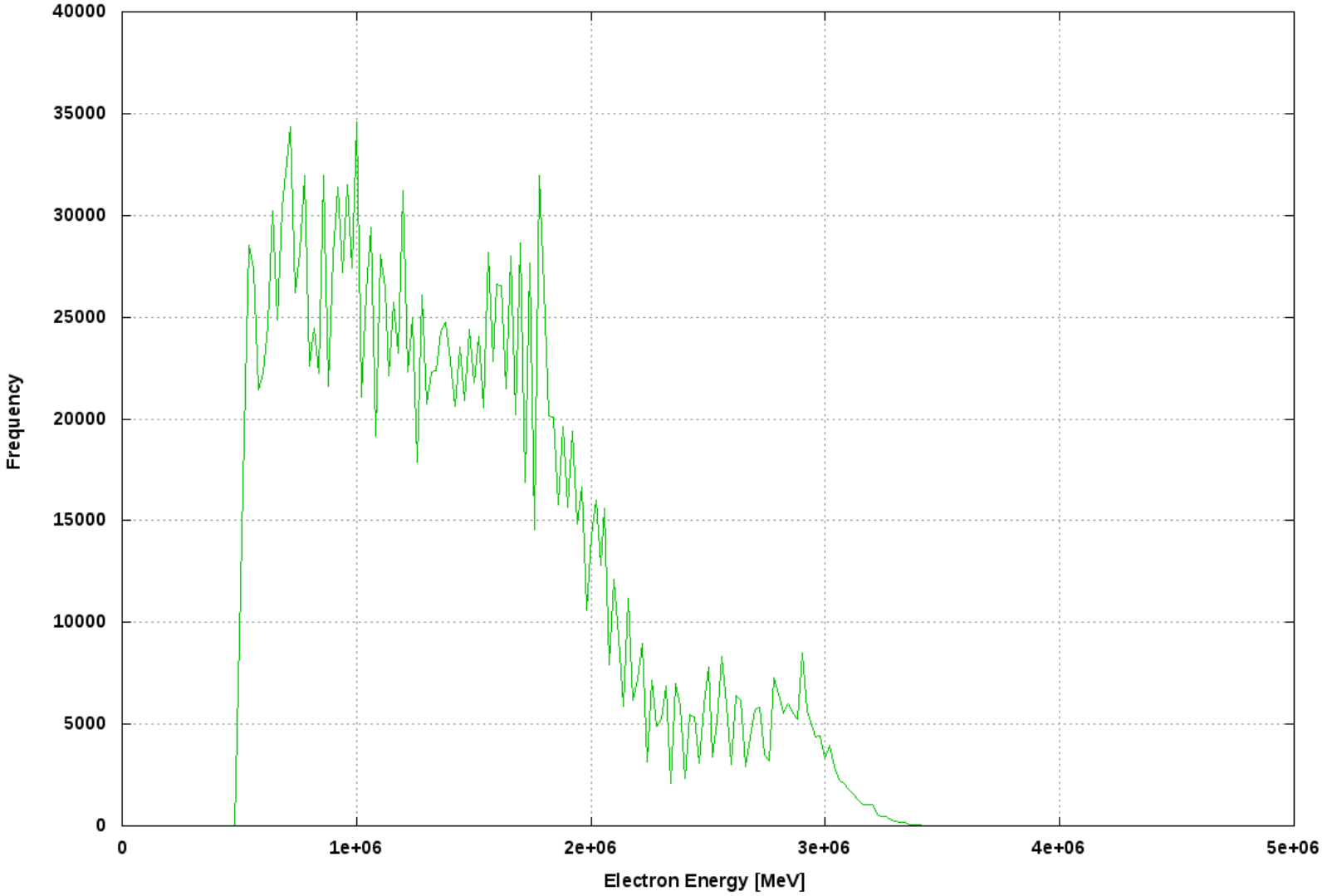
Reference: +--+ Lattice



Reference: ++-- Lattice

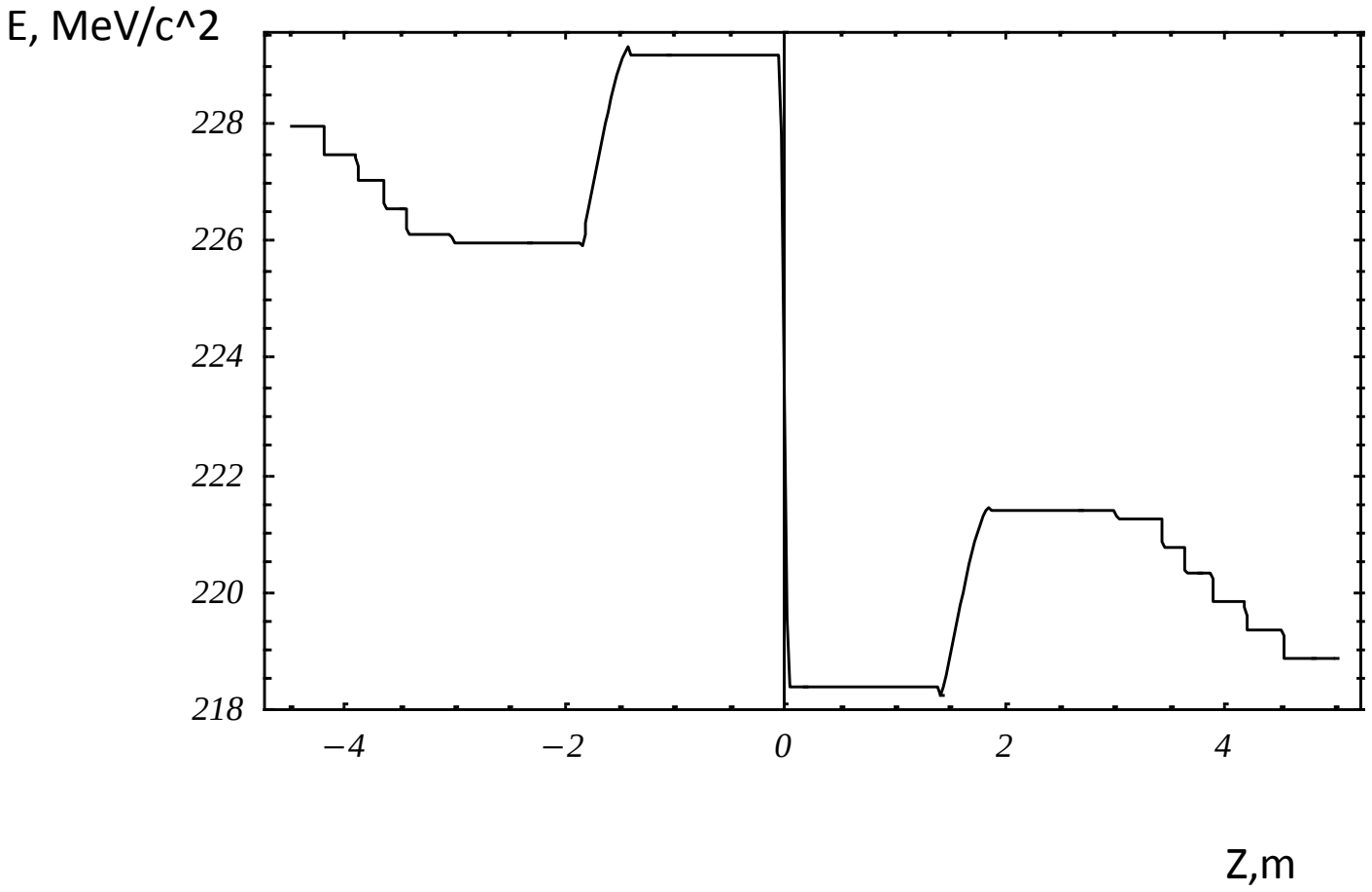


Dark current electrons emitted from the single RF cavity (10.3 MV/m)- FES

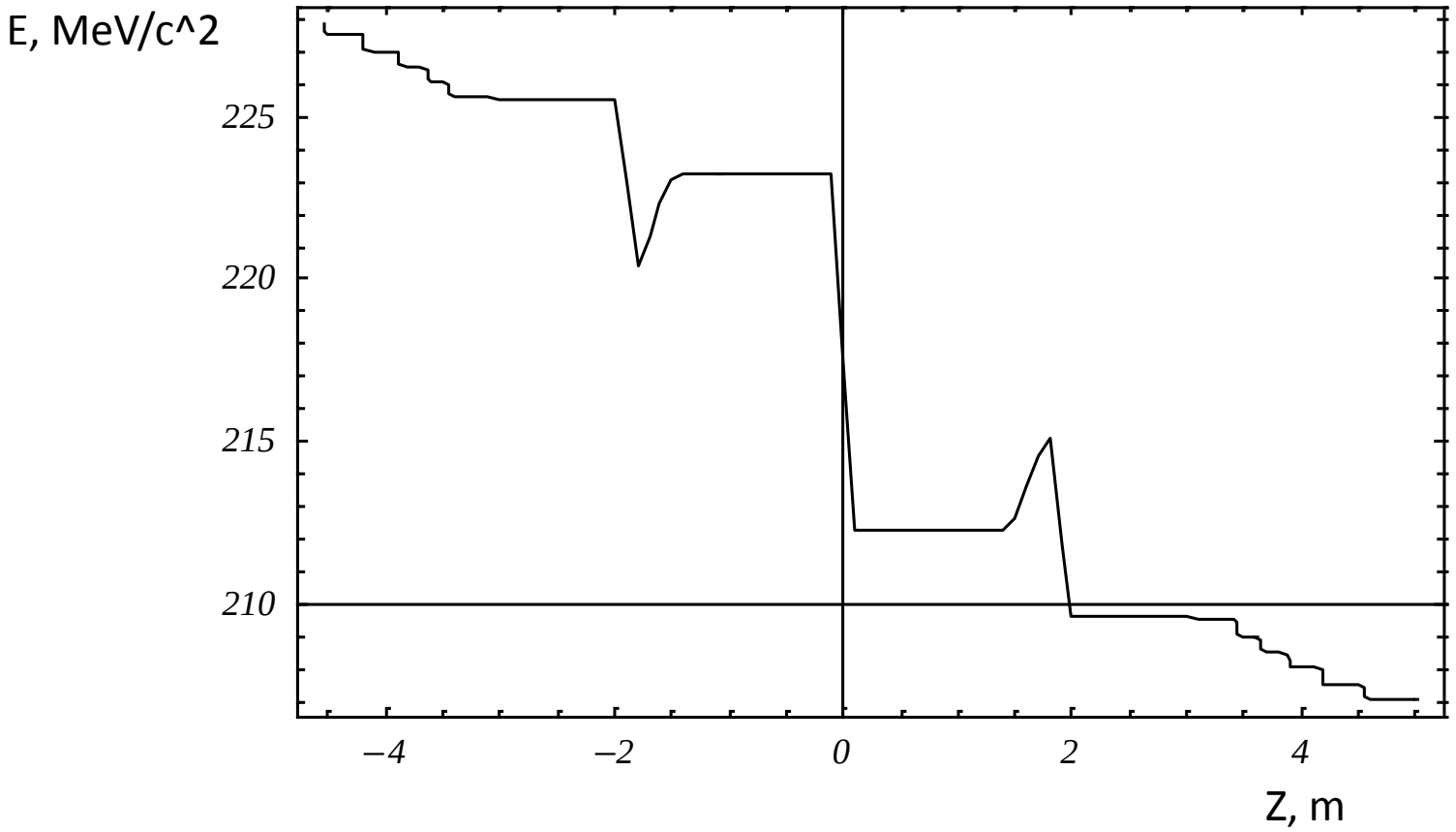


Secondary absorber of 32.5 mm will stop these electrons!

Energy loss with the main absorber only



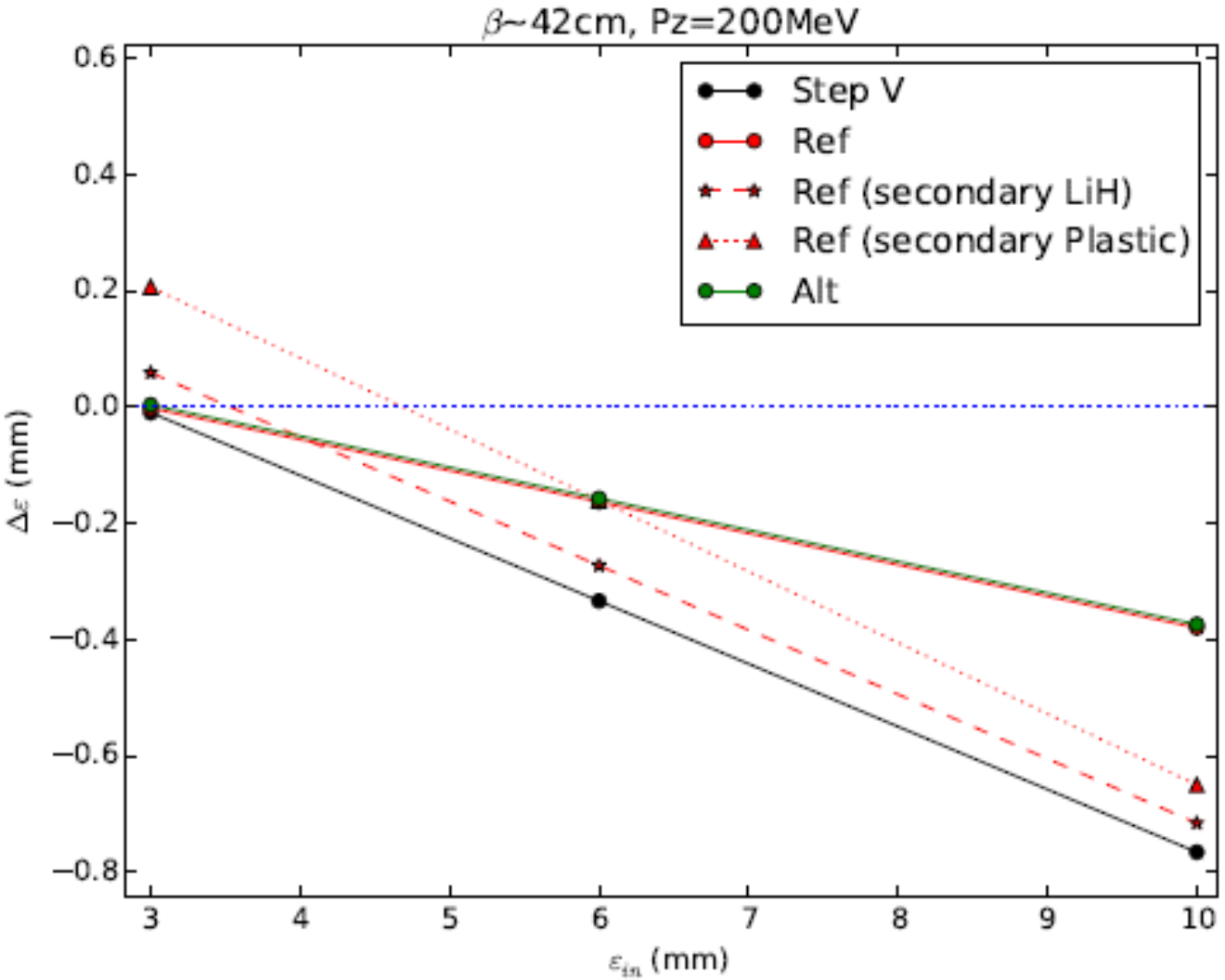
Energy loss including the secondary absorbers



Rematching is needed!

Secondary absorbers are 32.5 mm long LiH disks.

Effect of plastic for Secondary Absorbers



Questions to be addressed by November

- What is the minimal length between FCs with acceptable forces)? Can we get better optics?

  The forces are smaller, than in Step IV, so we are going to play with this distance more.
- What is the minimal length between SS and FC? Can we get better optics? We understand it now!
- What is the length for the secondary absorbers?
  We assume 32.5 mm LiH disks- sufficient to stop DC electrons from the cavity
- What is their cooling effect? See J-B. Lagrange's talk.
- Can we use plastic? Yes!
- What is the performance of ++-- lattice? See J-B. Lagrange's talk.
- Can we observe cooling in 6D? What if not?

  See J-B. Lagrange's talk.