



MICE demonstration of ionisation cooling

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Outline

- Overview
 - CM40 Reference Lattice
 - New Lattice
- Results
- Alternative lattices



Outline

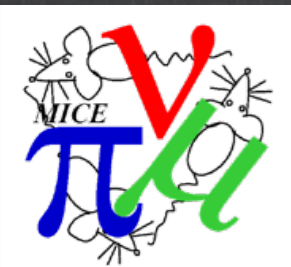
Overview

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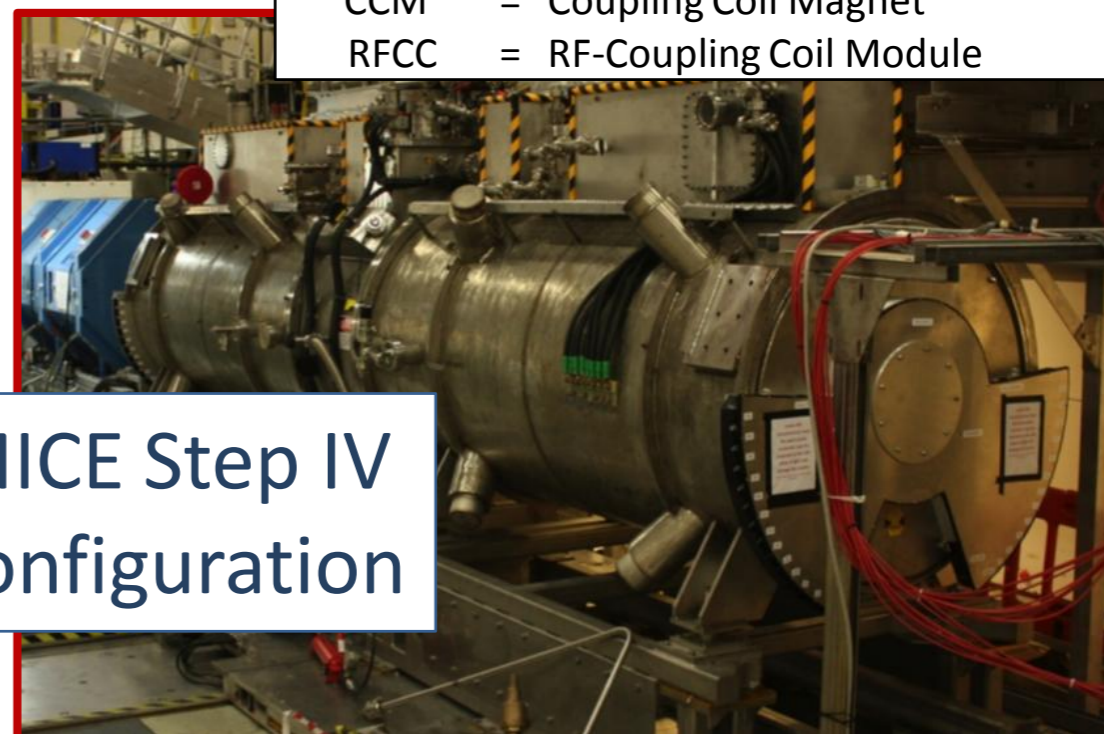
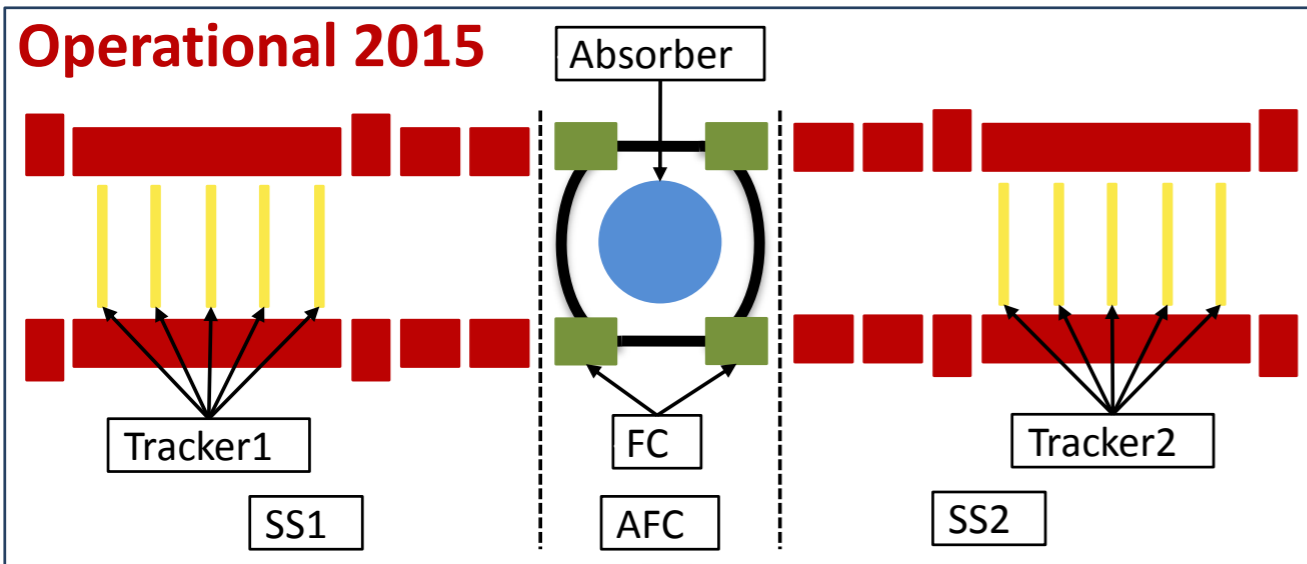


MICE Steps IV & V

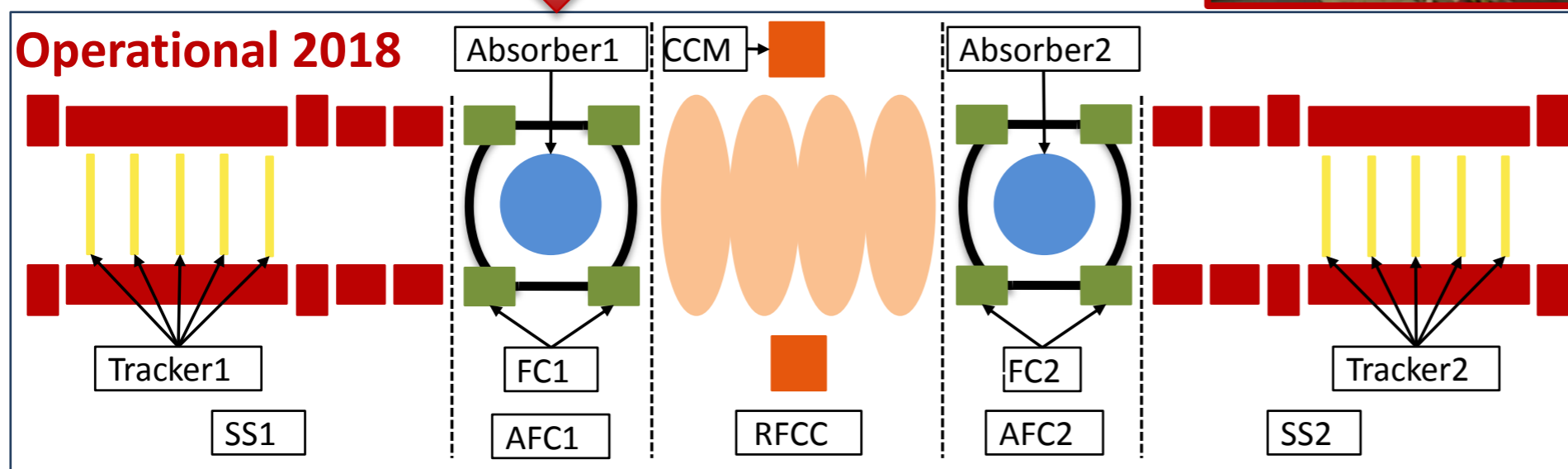
Plan endorsed by MICE
Project Board in April 2014

Legend:

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



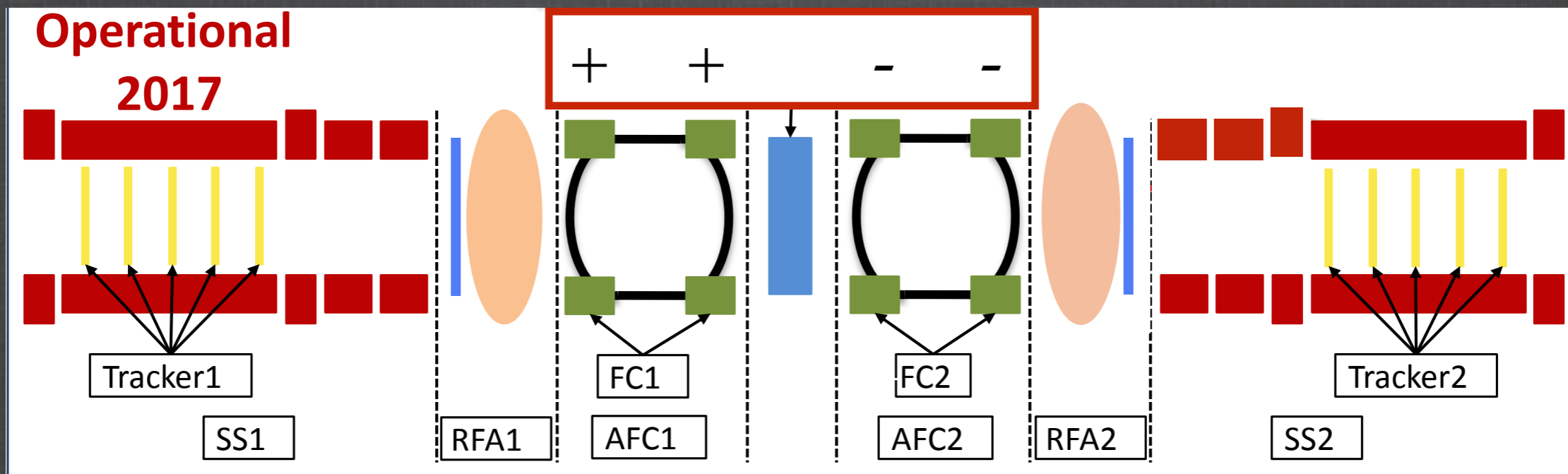
MICE Step IV
Configuration

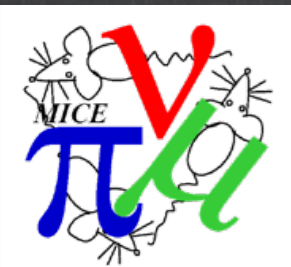


MICE Step V
Configuration



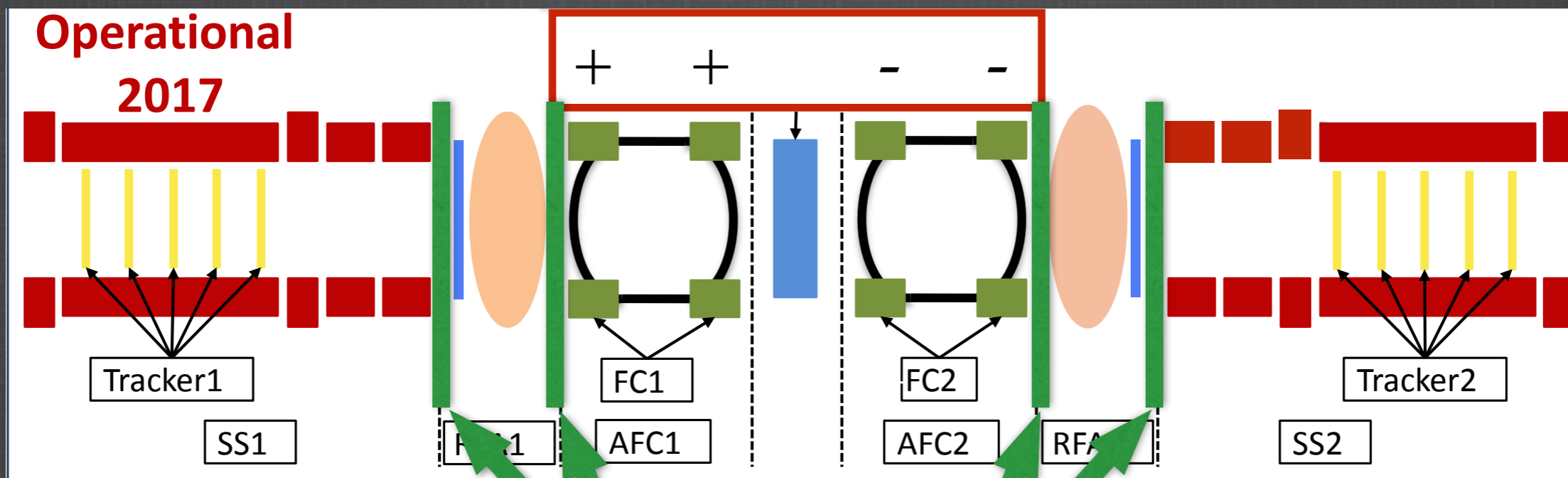
CM40 Reference Lattice





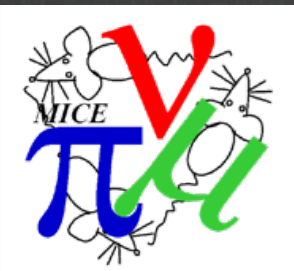
New Lattice

Concern about damaging sealing face preventing pump down



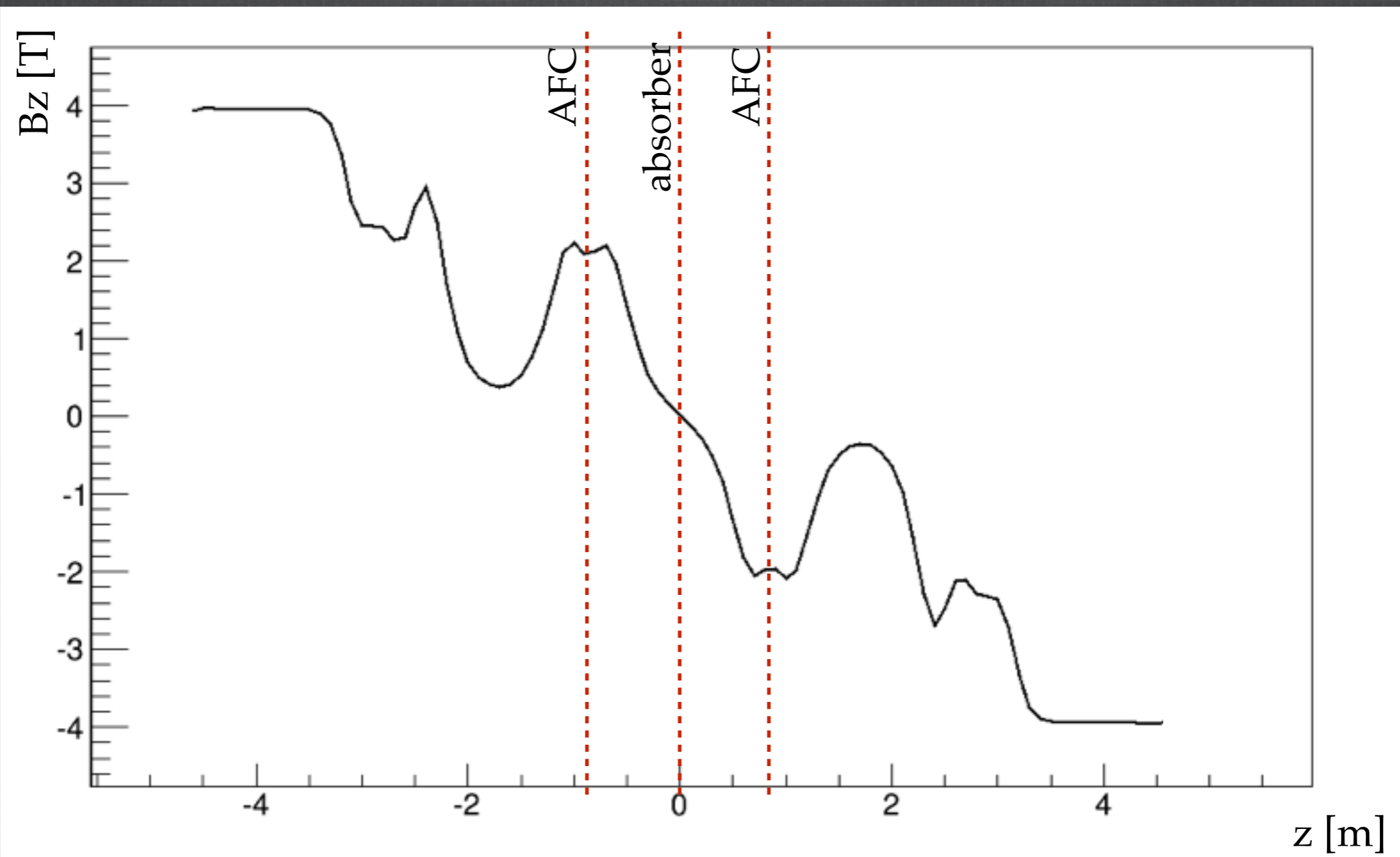
Bellows

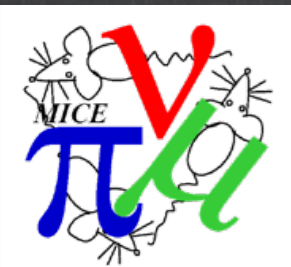
Lattice 194 mm longer



New Lattice

Magnetic field





Coil currents (6 mm, 200 MeV)

Coil	Reference lattice	Nominal values (step V)
Upstream E2	+253.00	255.46
Upstream C	+274.00	288.27
Upstream E1	+234.00	239.37
Upstream M2	+203.13	290.69
Upstream M1	+240.61	274.34
Upstream AFC1	+77.86	245.65
Downstream AFC1	+77.86	245.65
Upstream AFC2	-72.94	245.65
Downstream AFC2	-72.94	245.65
Downstream M1	-218.39	274.34
Downstream M2	-187.68	290.69
Downstream E1	-234.00	239.37
Downstream C	-274.00	288.27
Downstream E2	-253.00	255.46



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Initial beam

- Pure muon beam, $\sim 10\,000$ particles
- Position: before first plane upstream tracker (after diffuser)
- Gaussian distribution
- Normalised rms longitudinal emittance = 20 mm
- Normalised rms transverse emittance = 6 mm

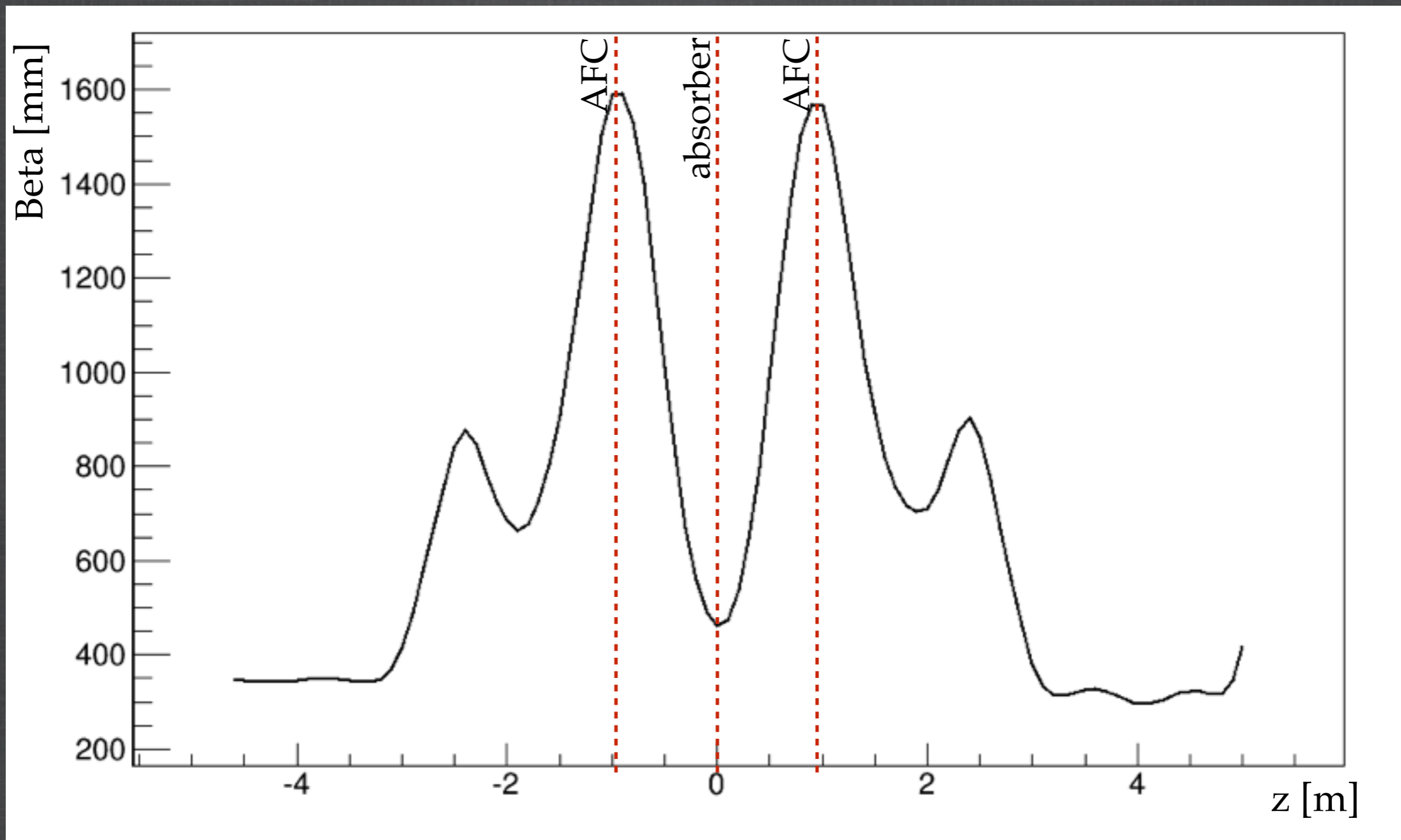
Cuts

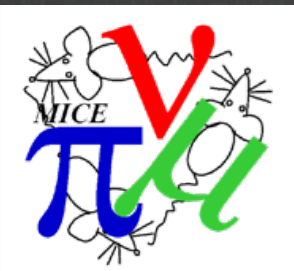
- PID cut
- Transmission cut
- Radial cut $r < 200$ mm, at first and last plane.



New Lattice

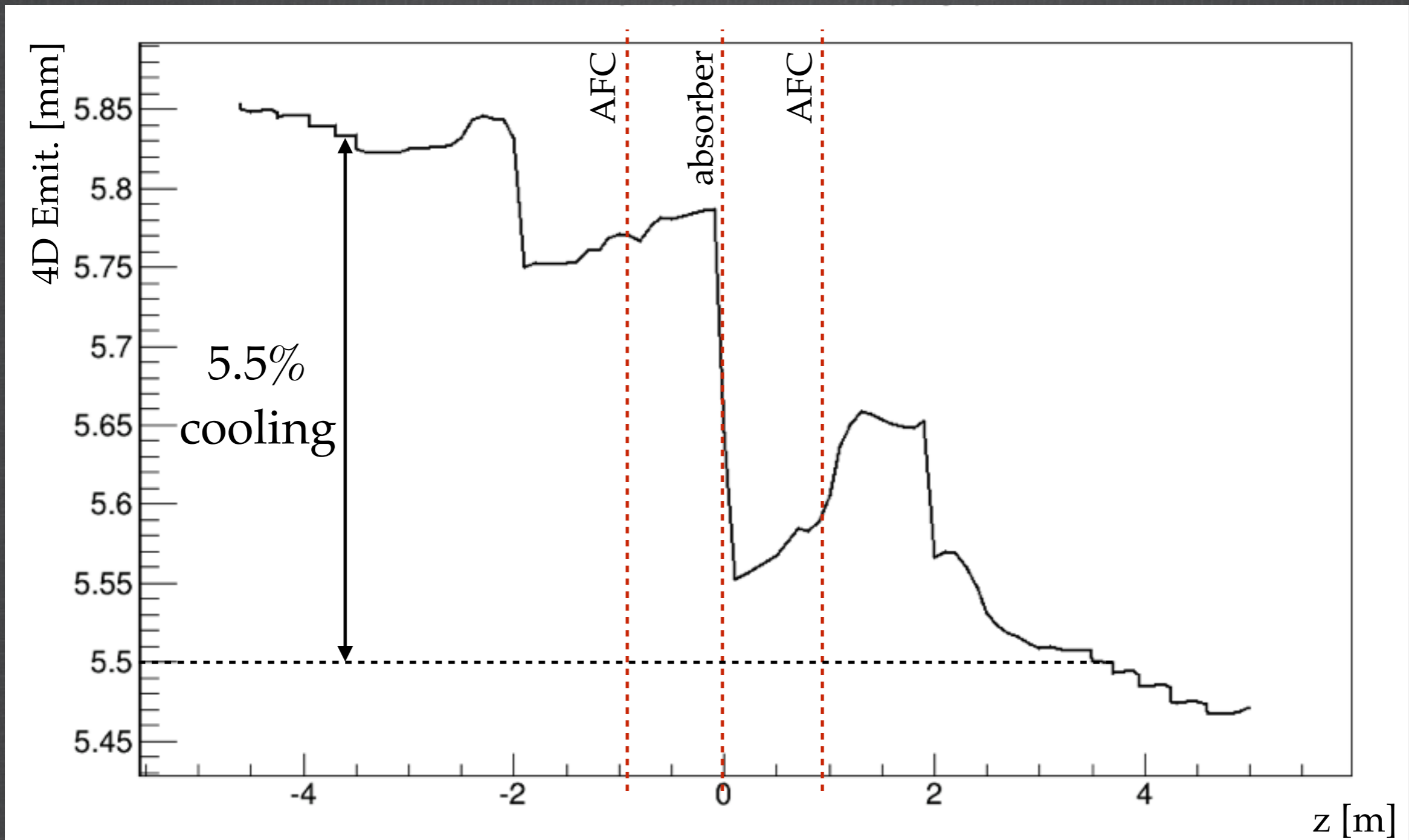
Transverse beta

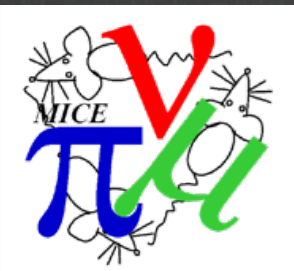




New Lattice

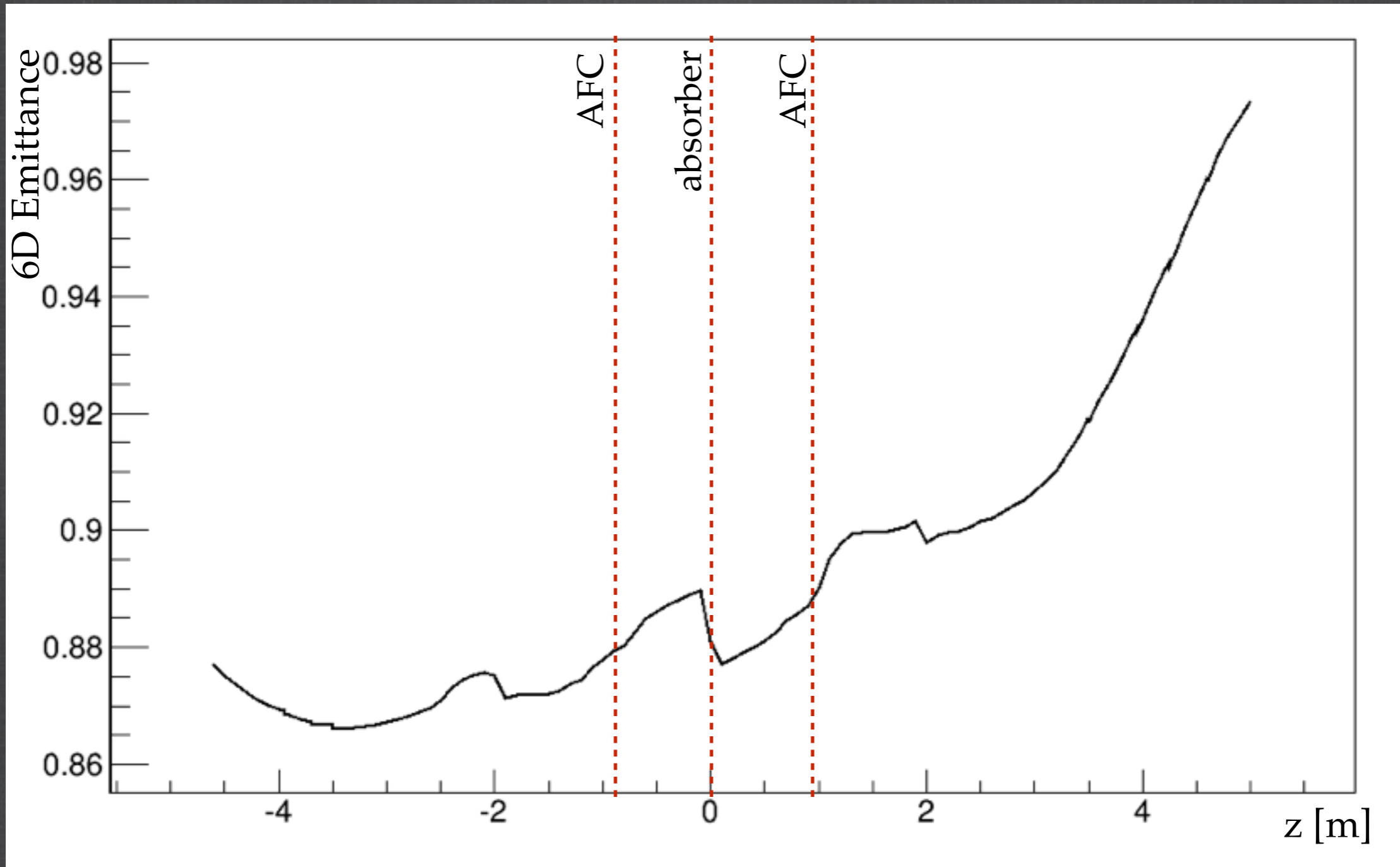
4D emittance





New Lattice

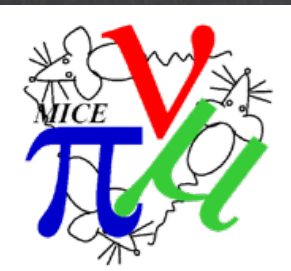
6D emittance





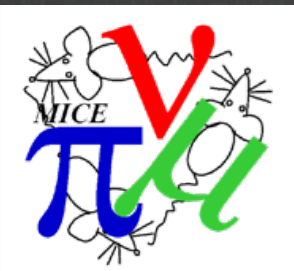
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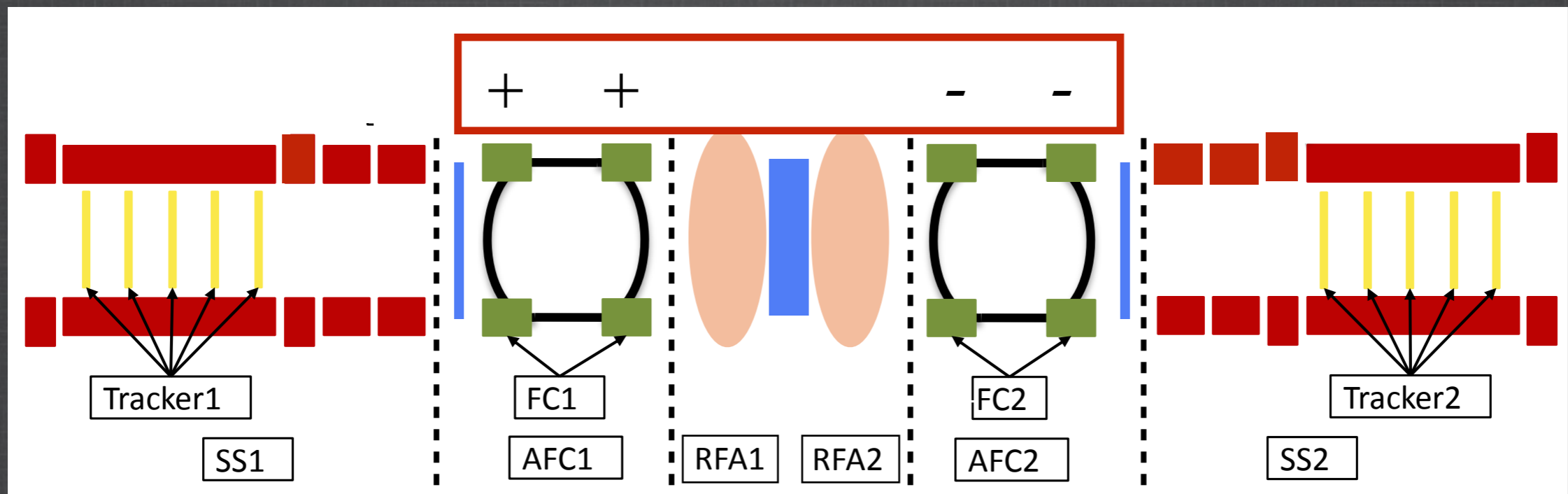


Secondary absorbers in the SS

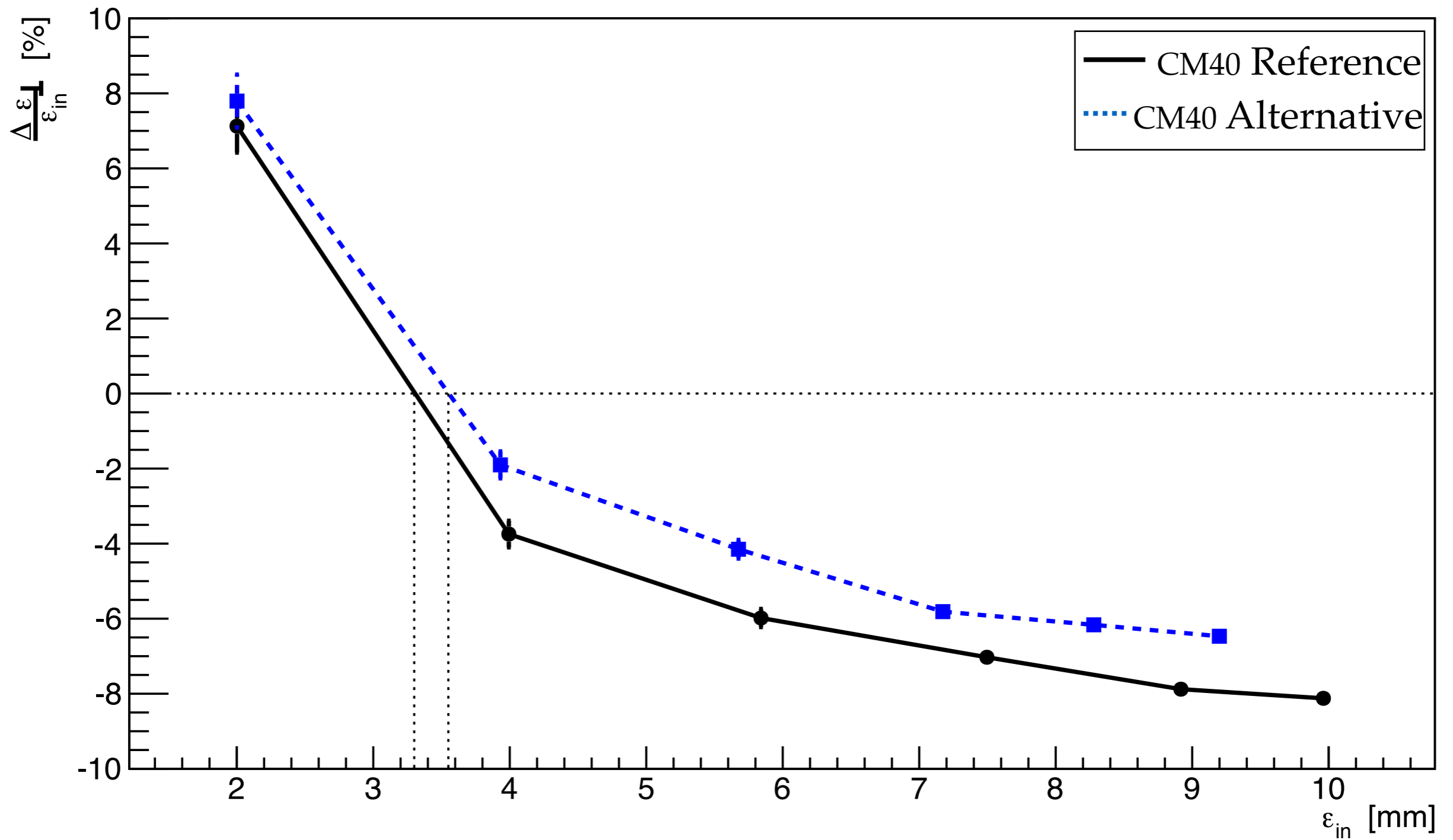
- Better performances (6.5% cooling at 6 mm, 200MeV).
- Beta constant for any momentum at secondary absorbers.
- BUT impossible to remove the secondary absorbers.



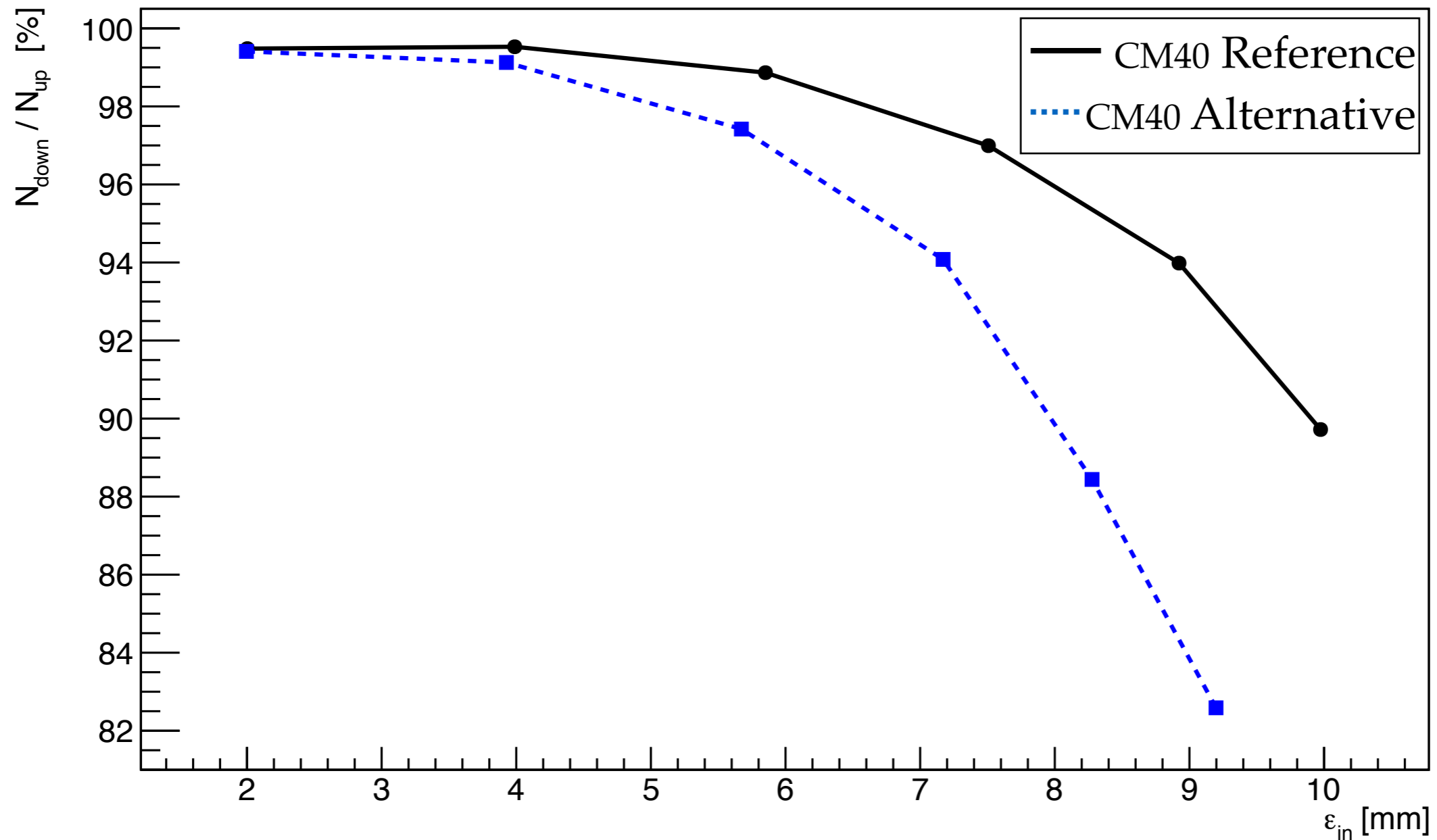
CM40 Alternative Lattice

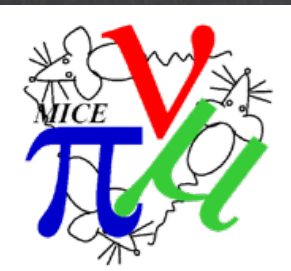


4D emittance



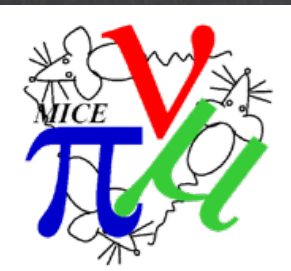
Transmission





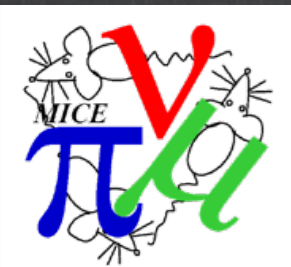
Summary

- Lattice has been modified to allow easy removal of cavity module.
- It decreases slightly the cooling performance of the channel
 - 5.5% 4D cooling in the new lattice,
 - 6% in the CM40 lattice,
 - 5.7% with only bellows between SS and cavity
- Stable lattice, with a good working point

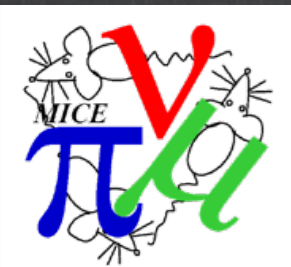


Future plans

- Optimisation of the distance FC \leftrightarrow FC (current lattice not far from optimum).
- Study of different emittances in the new lattice.
- Paper on the way.



Thank you for your attention

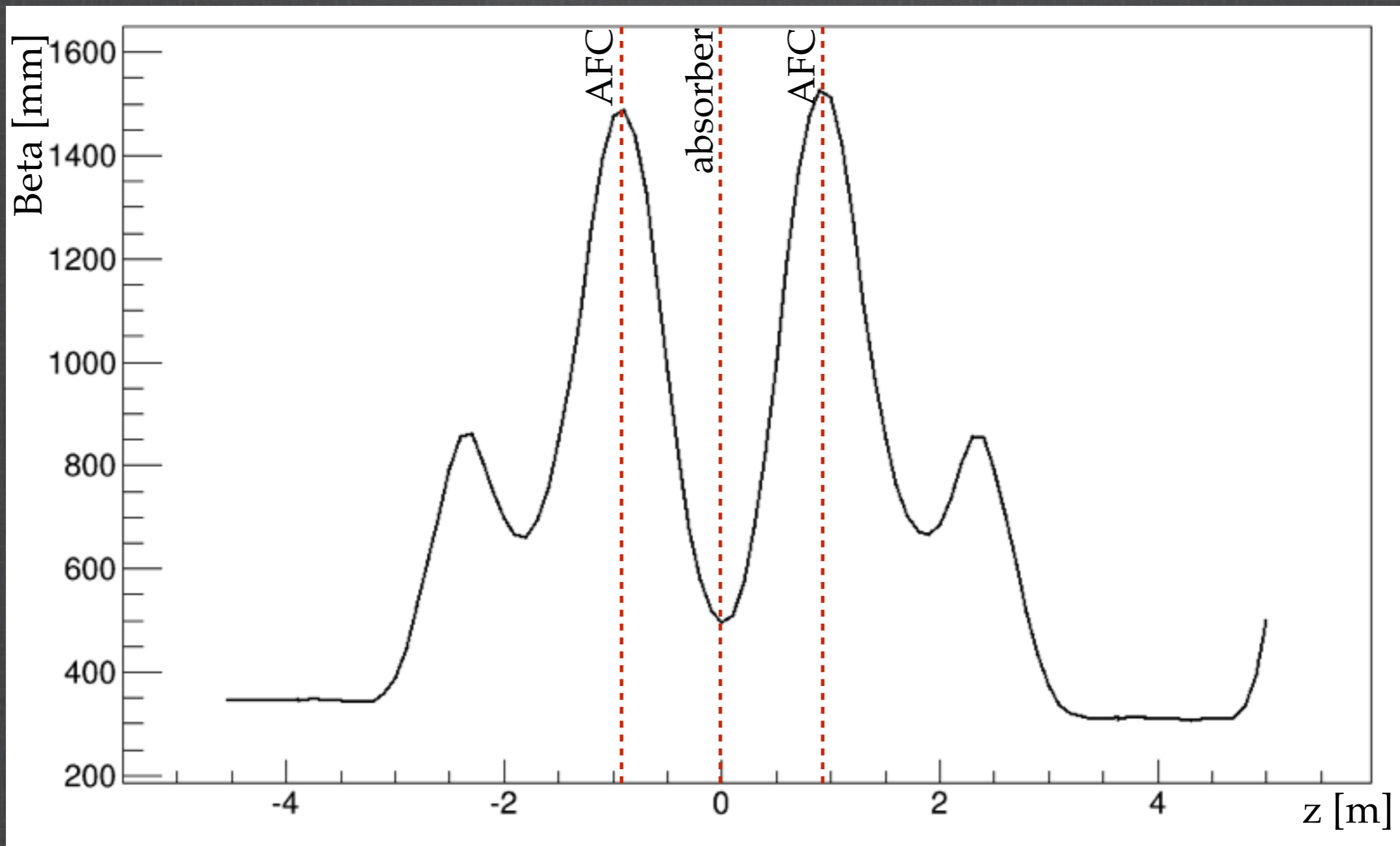


Back-up slides



CM40 Reference Lattice

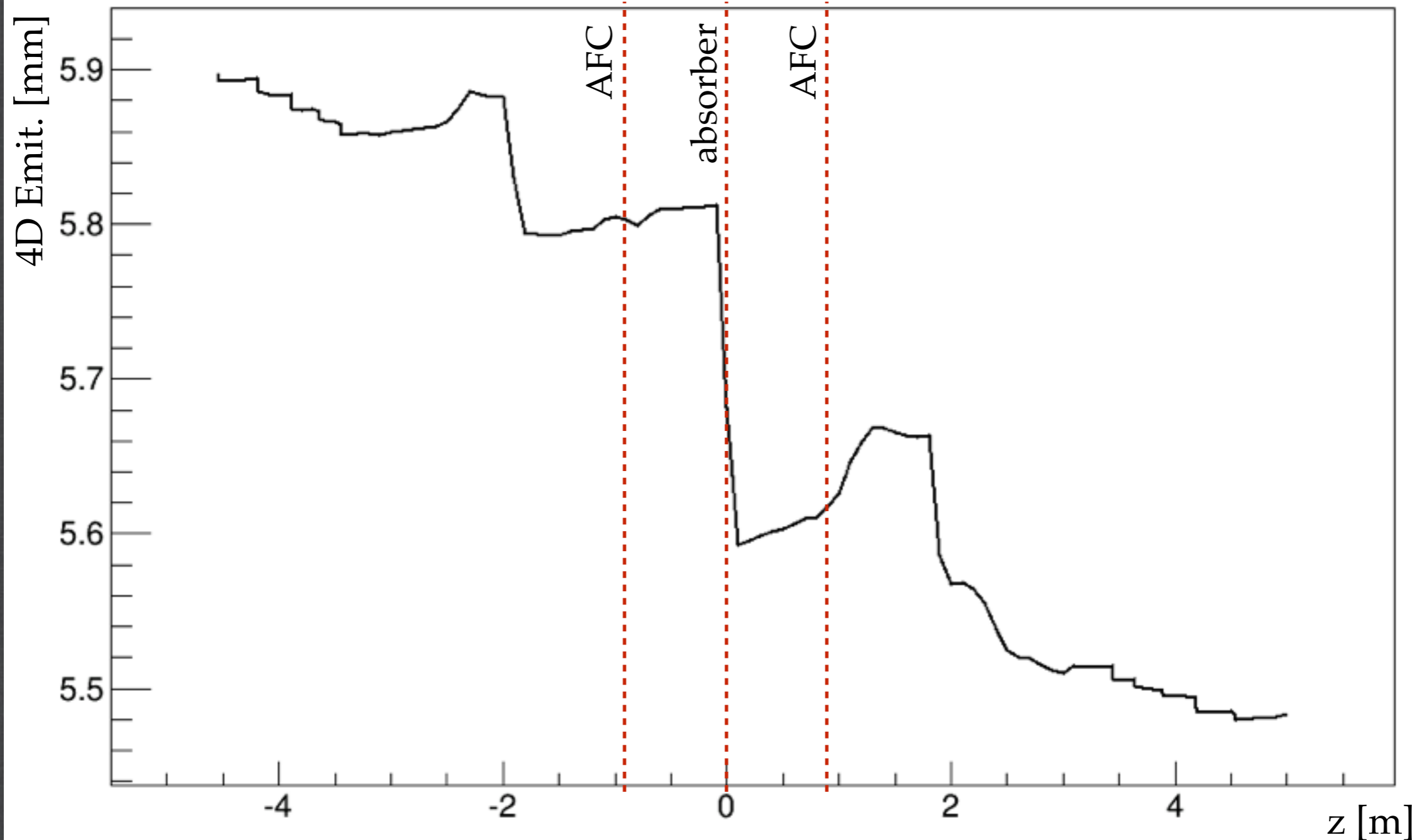
Transverse beta





CM40 Reference Lattice

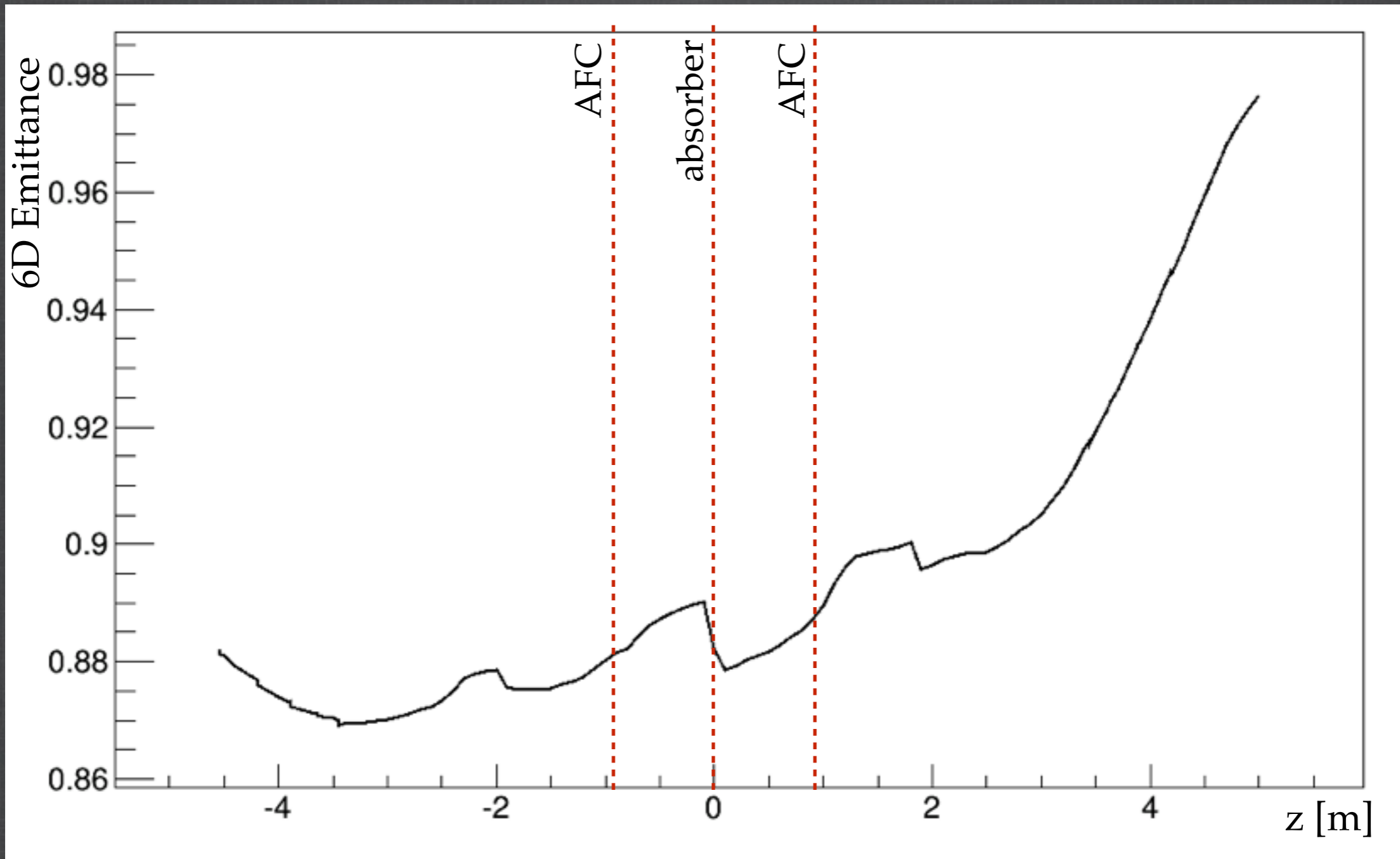
4D emittance

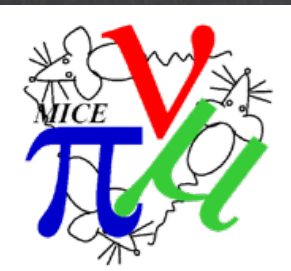




CM40 Reference Lattice

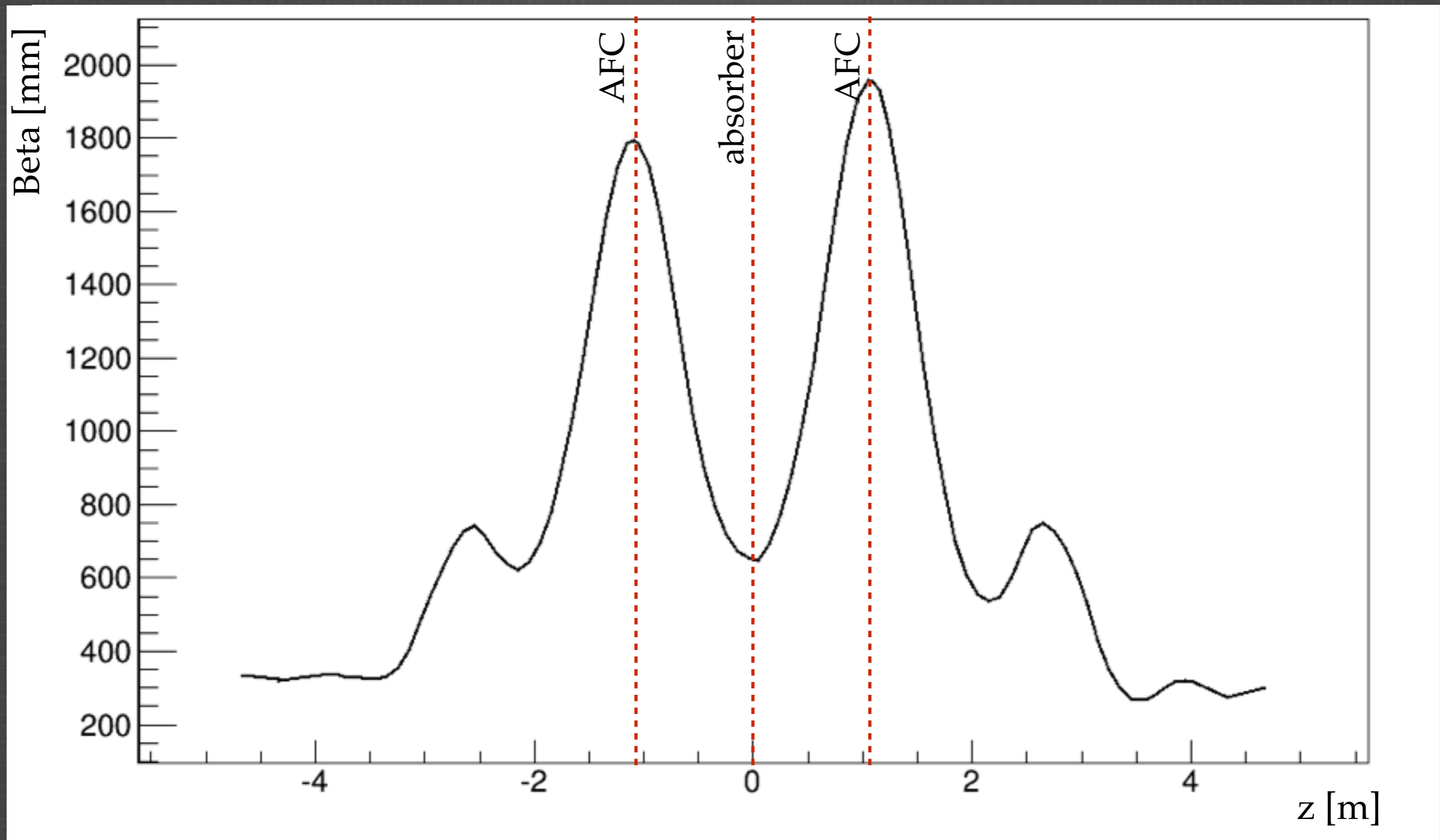
6D emittance

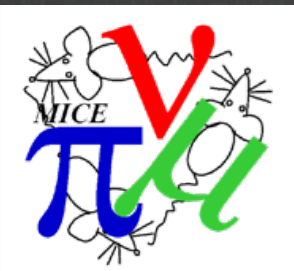




CM40 Alternative Lattice

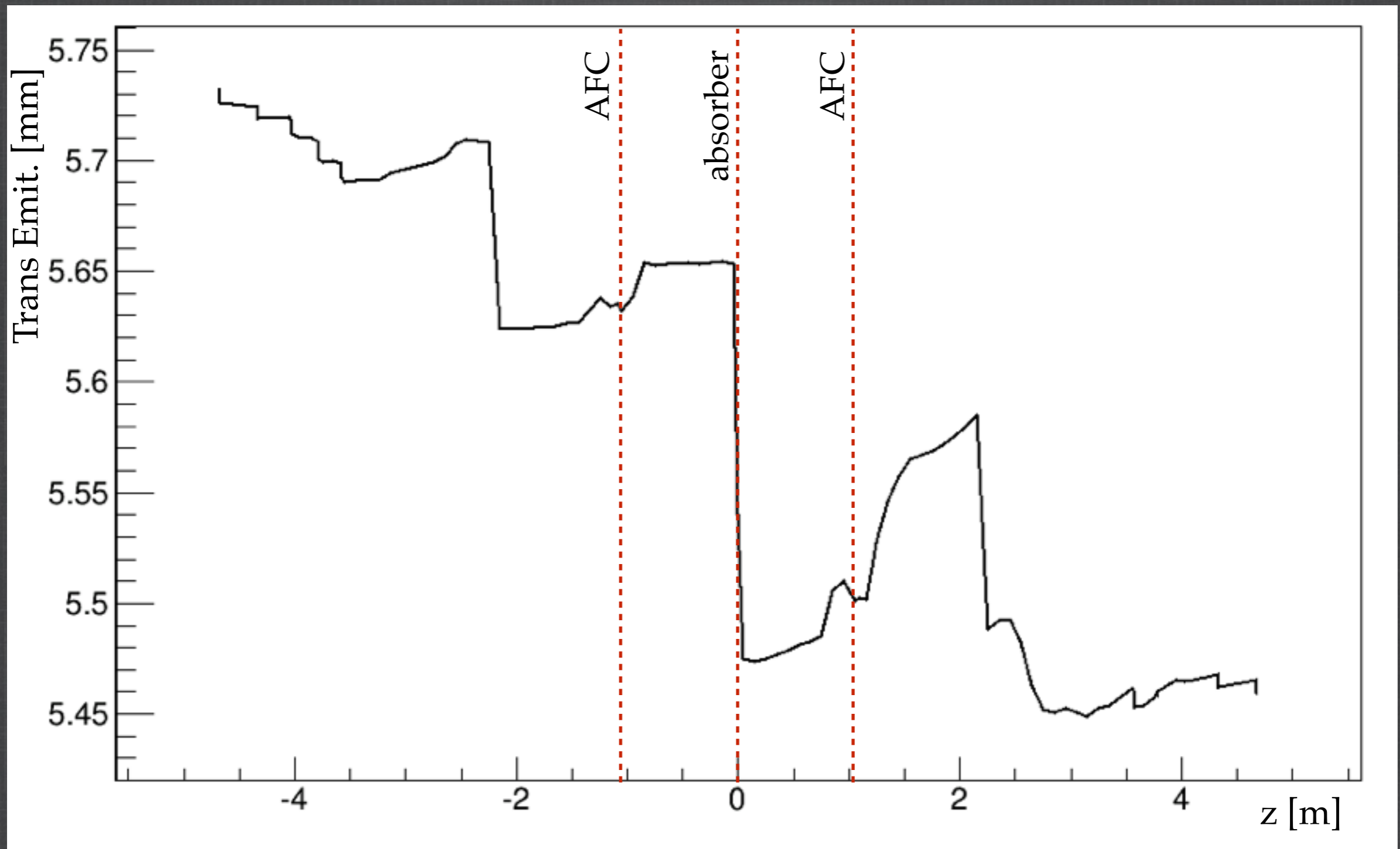
Transverse beta





CM40 Alternative Lattice

4D emittance





CM40 Alternative Lattice

6D emittance

