

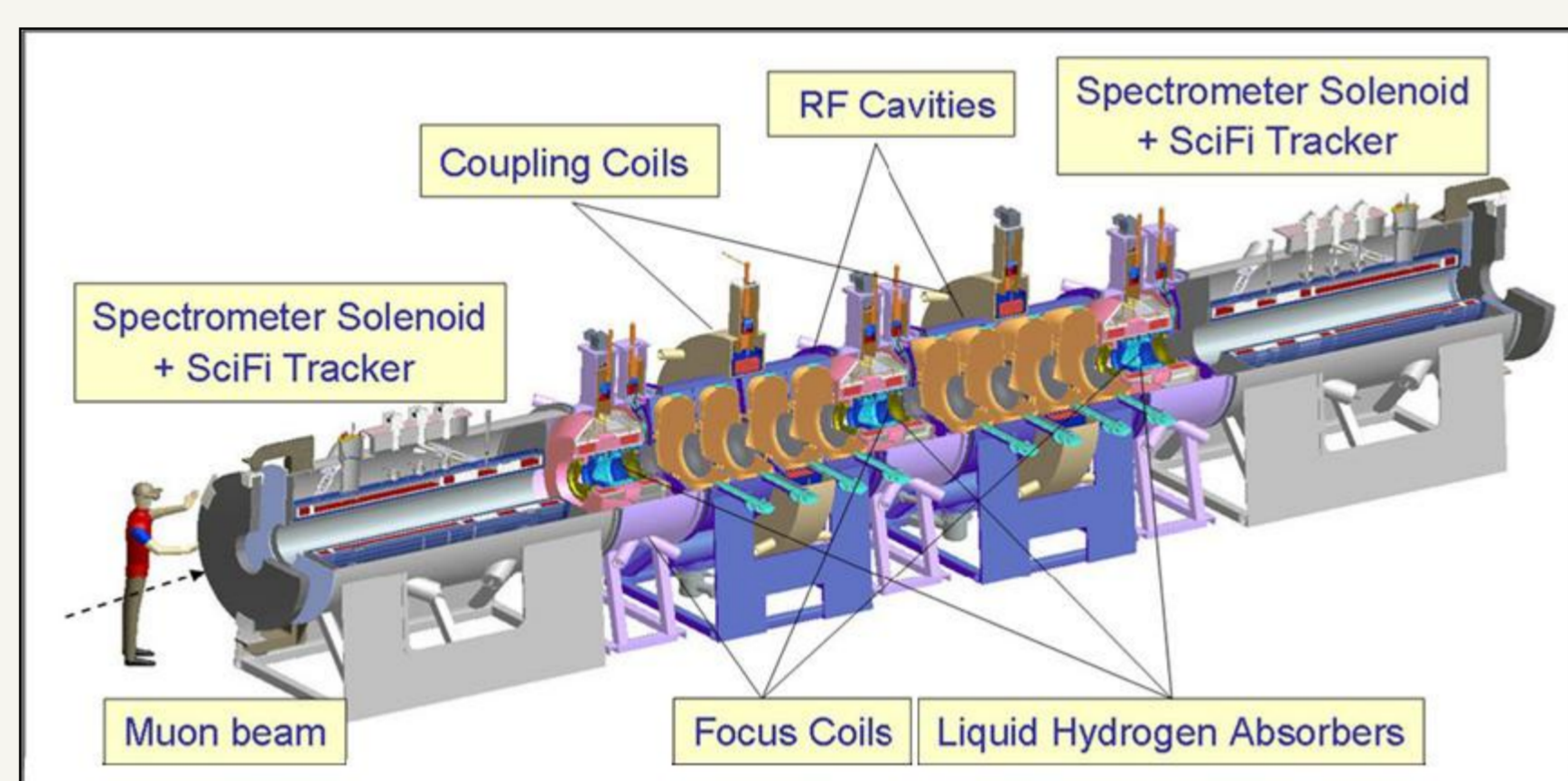
Ionization Cooling in MICE Step IV

The international Muon Ionization Cooling Experiment (MICE)

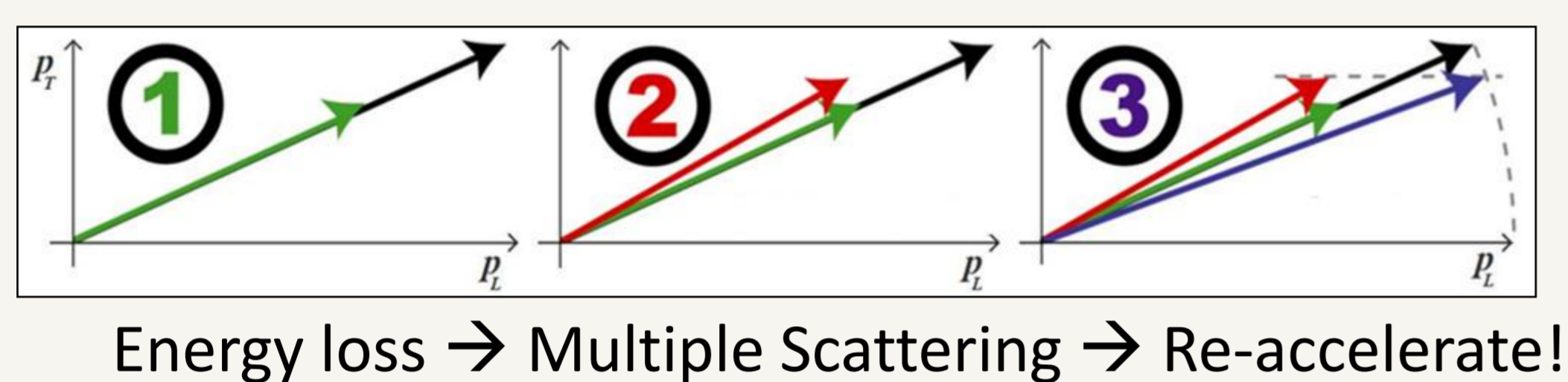
The MICE Experiment

MICE is the **first experimental test of ionization cooling**, under construction at the Rutherford Appleton Laboratory (UK).

Three, 35cm, liquid hydrogen absorbers reduce the total momentum loss by 11 MeV/c each – providing **cooling**. Cooling describes the reduction of beam size in phase space, known as **beam emittance**.

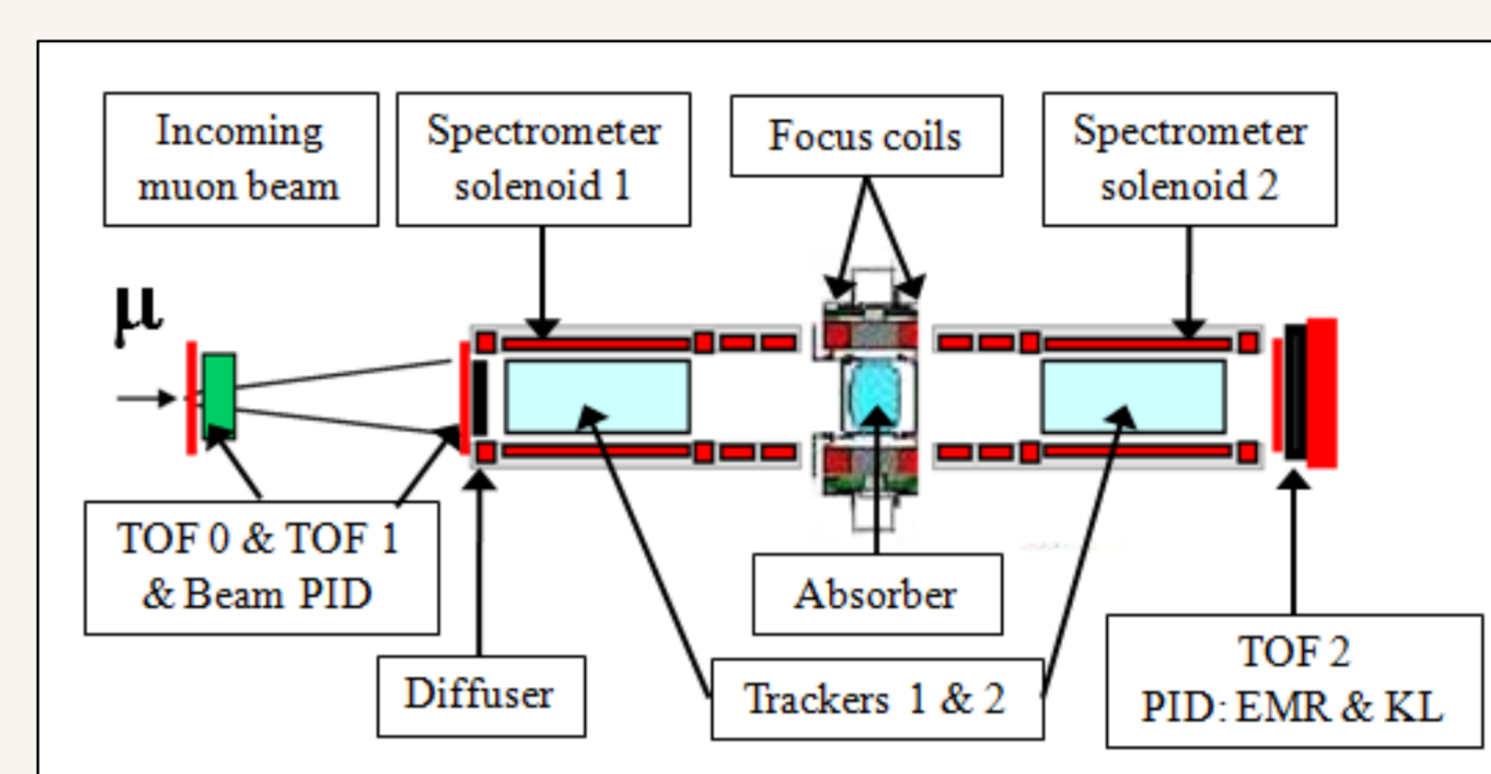


Re-accelerate using **201 MHz RF cavities** at high gradients.

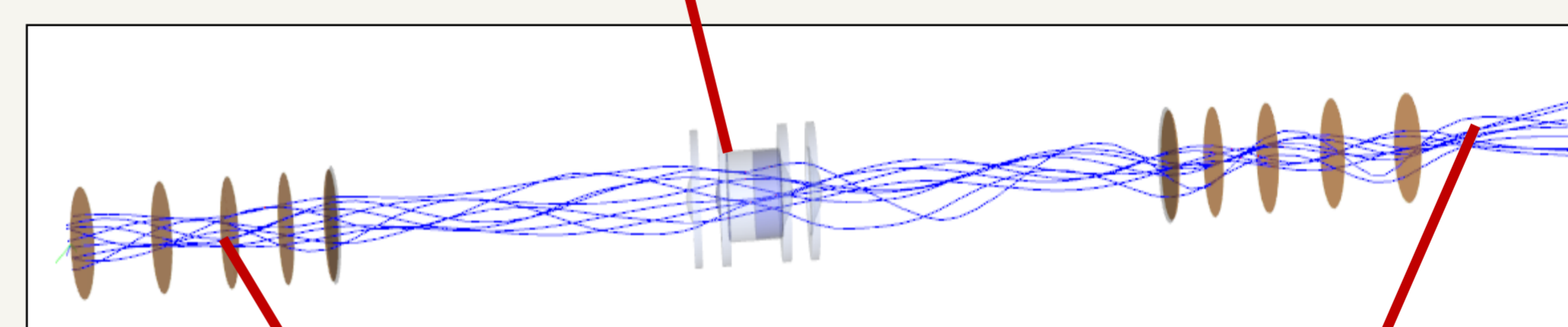


Step IV

Step IV of MICE due to start in 2012, in which the first ionization cooling measurements will be made. Step IV uses an absorber focus coil (AFC) module to house liquid hydrogen (LH₂) or solid absorbers, and is placed between two trackers.

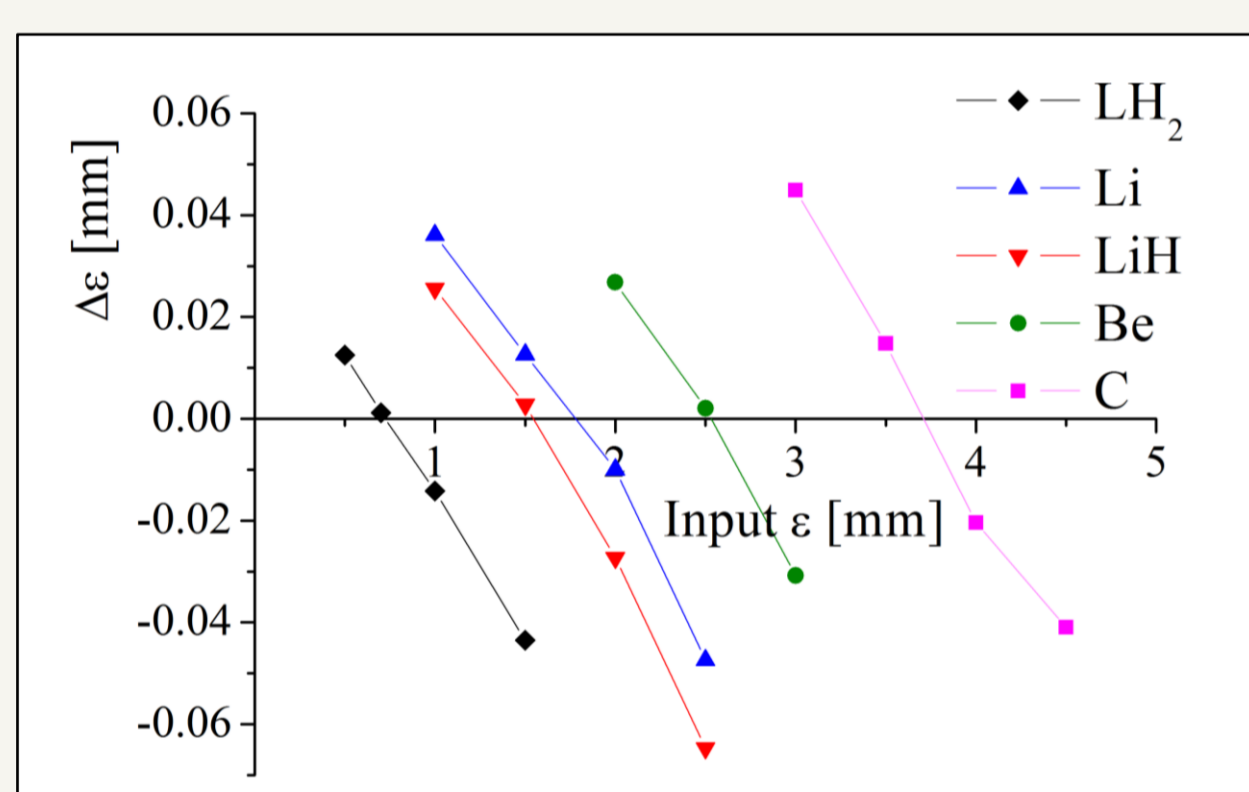


Absorber Focus Coil 35 cm LH₂ Absorber body

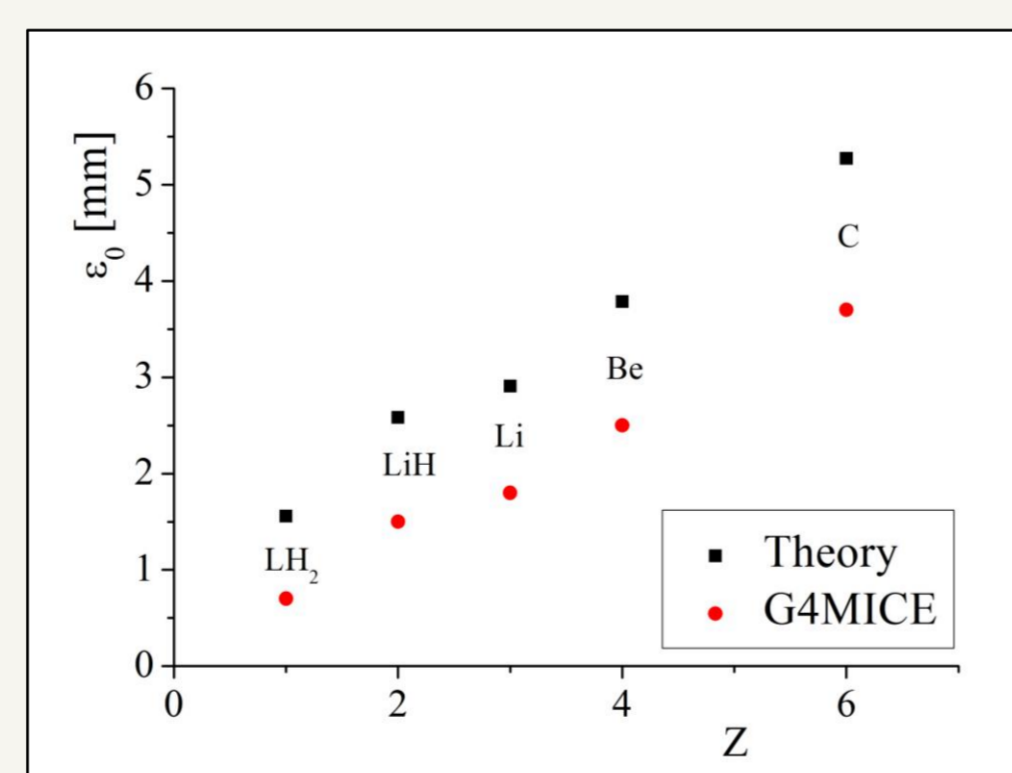


Scintillating fibre planes of the tracker Helical muon tracks through the MICE magnetic field

Ionization Cooling

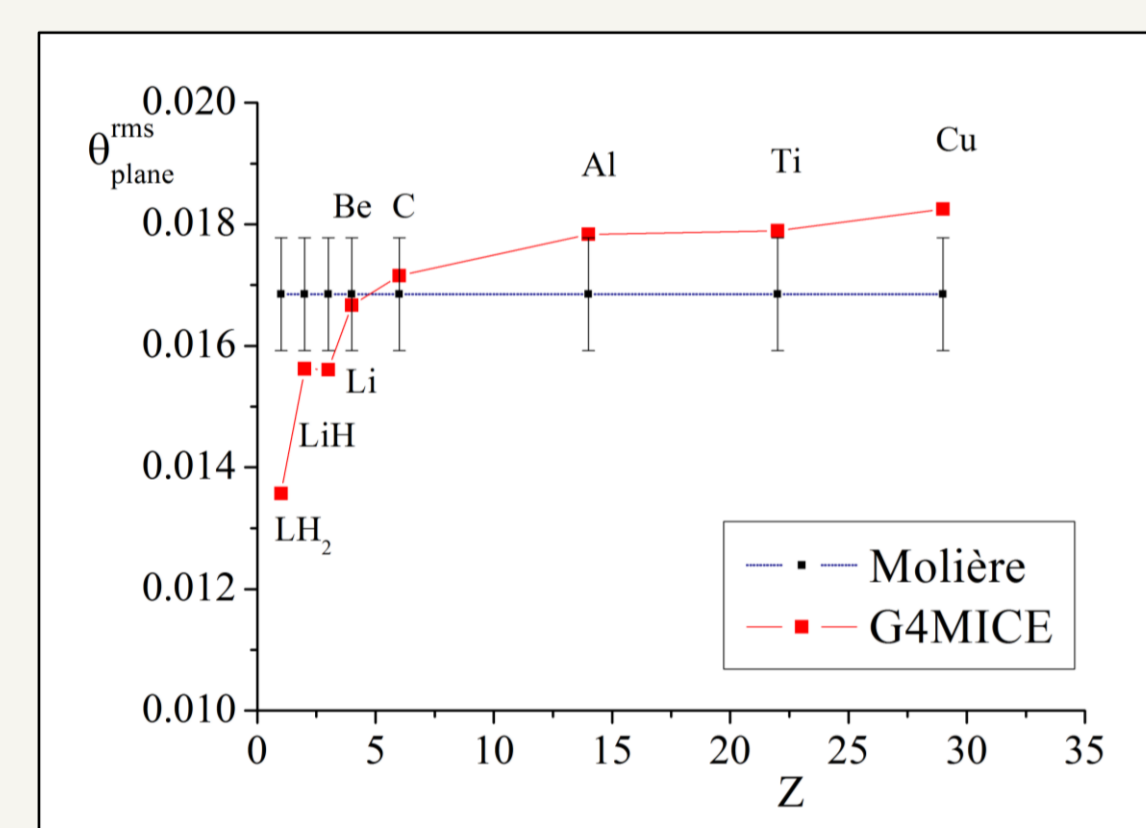


Can **study cooling** in various materials in G4MICE software, based on GEANT4 → **measure the equilibrium emittance**.



Measured value in G4MICE **disagrees with predictions** in absorber materials of Z<6.

Can also look at the scattering angle θ_{plane}^{rms} of pencil beams through materials.



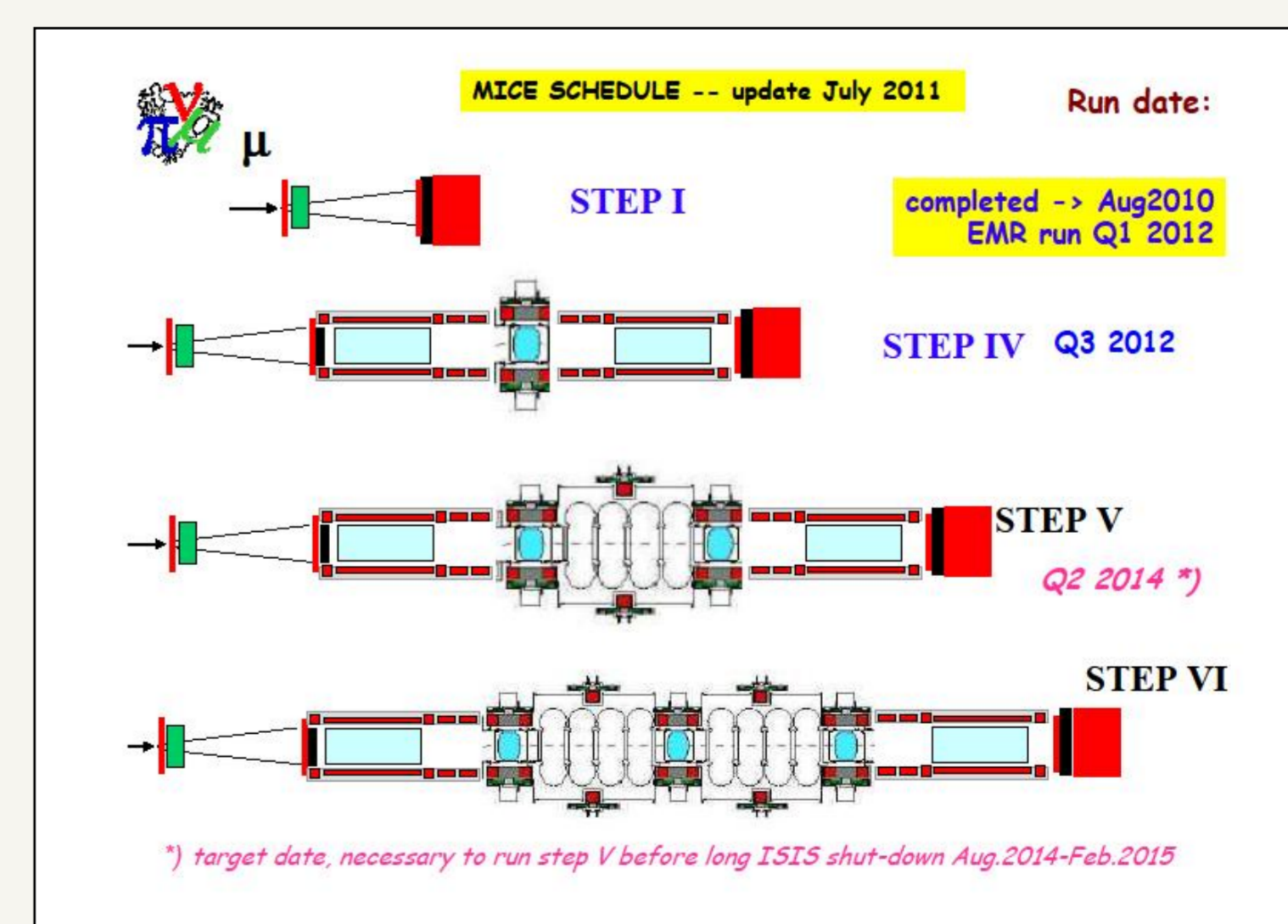
→ significantly less scattering at low Z in G4MICE compared with theory.

Outlook

MICE is a critical milestone on the way to building a Neutrino Factory. Step IV provides the first test of ionization cooling, and will run in 2012.

Step IV also provides an excellent opportunity to measure the equilibrium emittance of various absorber materials, and verify the discrepancy between GEANT4 and the standard theory.

Step V will see the introduction of the first set of RF cavities, followed by the complete MICE channel in Step VI.



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