

# The Tracker Systems for the Muon Cooling Experiment (MICE)

Christopher Heidt for the MICE Collaboration  
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## The Muon Ionization Cooling Experiment

### Overview:

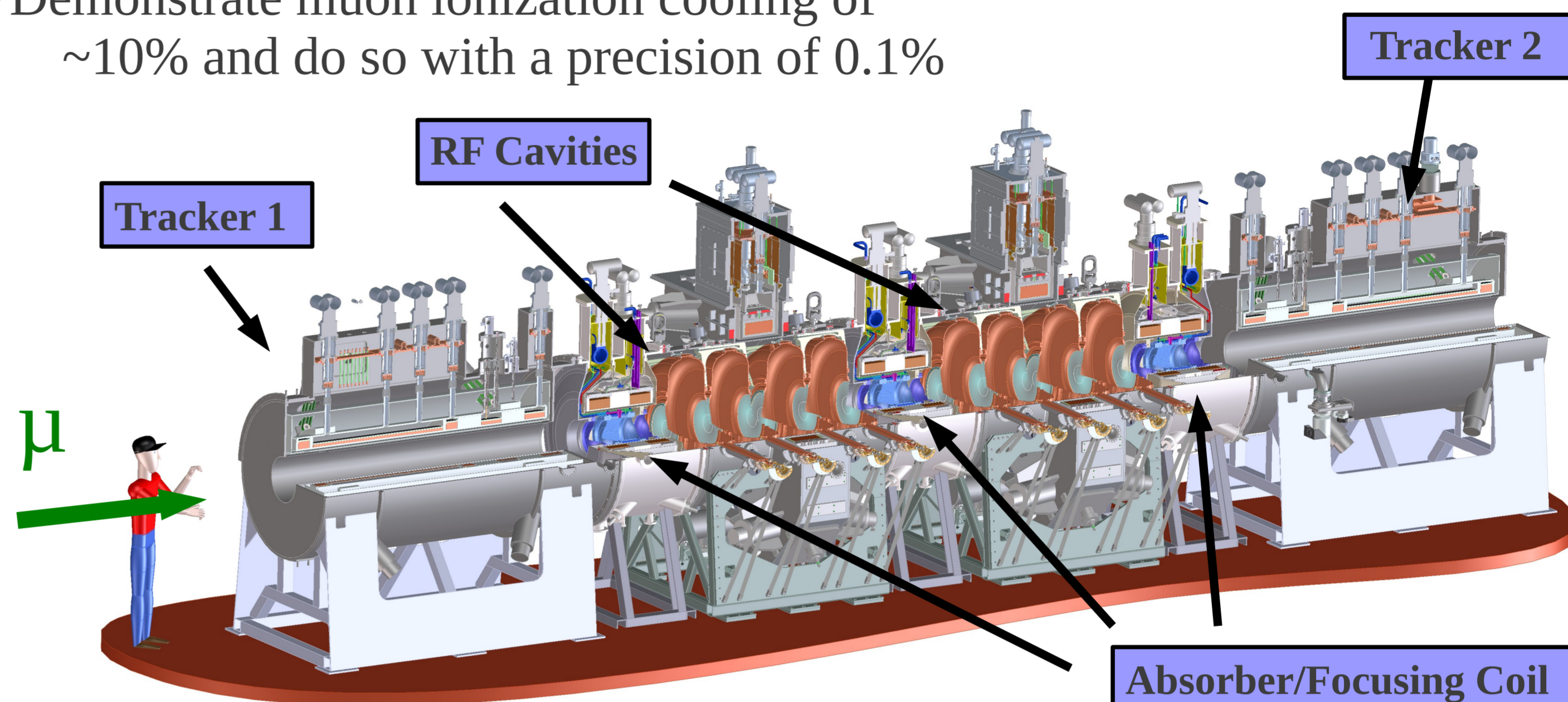
- A single lattice cooling cell of a proposed Muon Collider / Neutrino Factory
- Muon beam of 140 – 240 MeV/c
- Located at the Rutherford Appleton Lab



ISIS and the MICE hall at RAL. The lab is located in Oxfordshire, UK

### Goal:

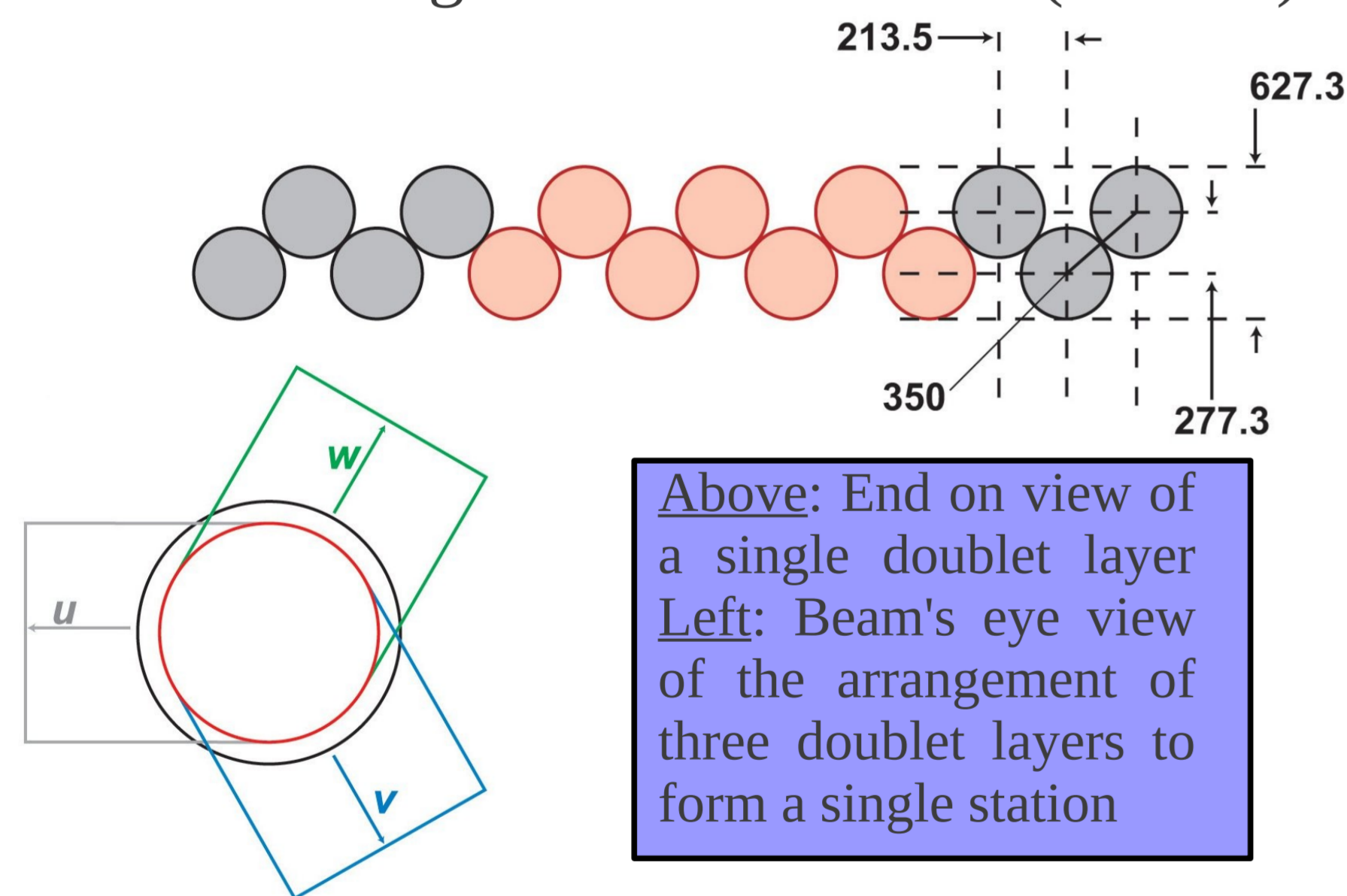
- Demonstrate muon ionization cooling of ~10% and do so with a precision of 0.1%



## Tracker Design

### Scintillating Fiber Planes

- Doublet layers offset by a half fiber width
- Position resolution of 470 $\mu$ m
- Fibers grouped in gangs of 7 for readout
- Data read out via clear light guides to Visible Light Photon Counters (VLPCs)



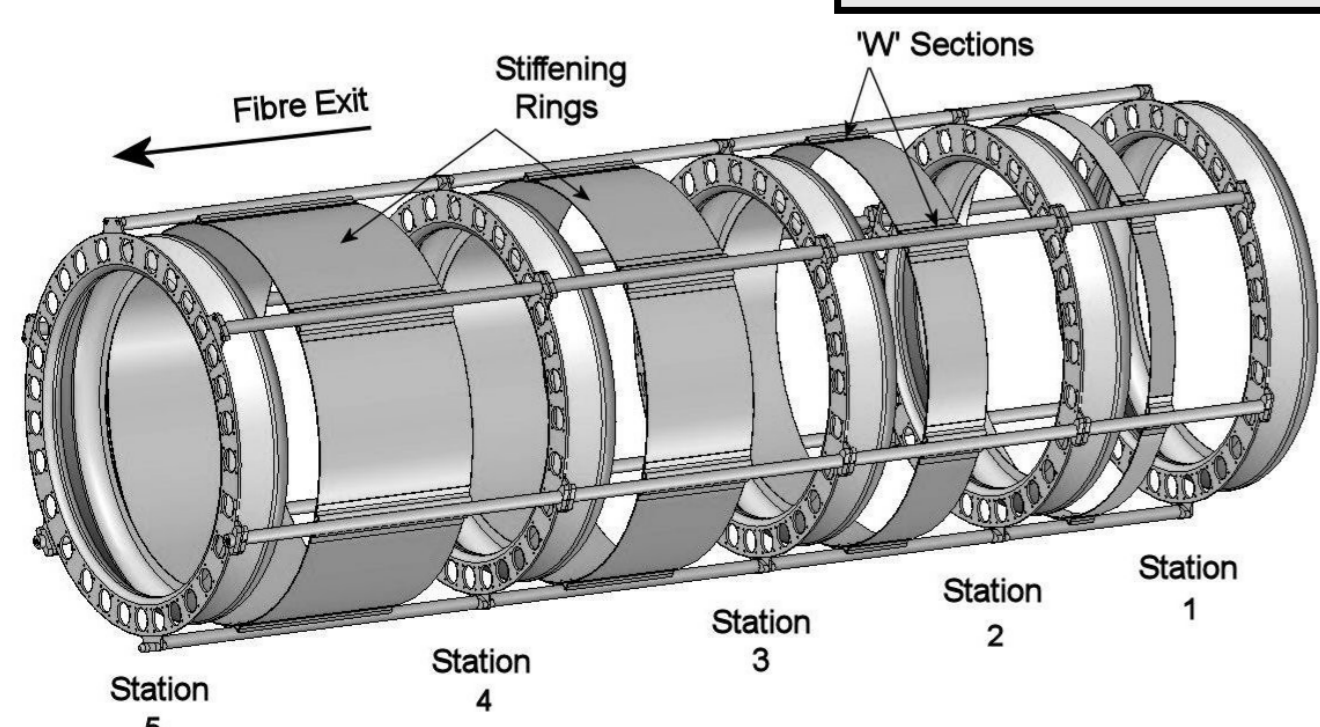
### Tracker Stations

- 3 Scintillating Fiber Planes  $u$ ,  $v$ ,  $w$
- Each plane at 120°

### Station Layout

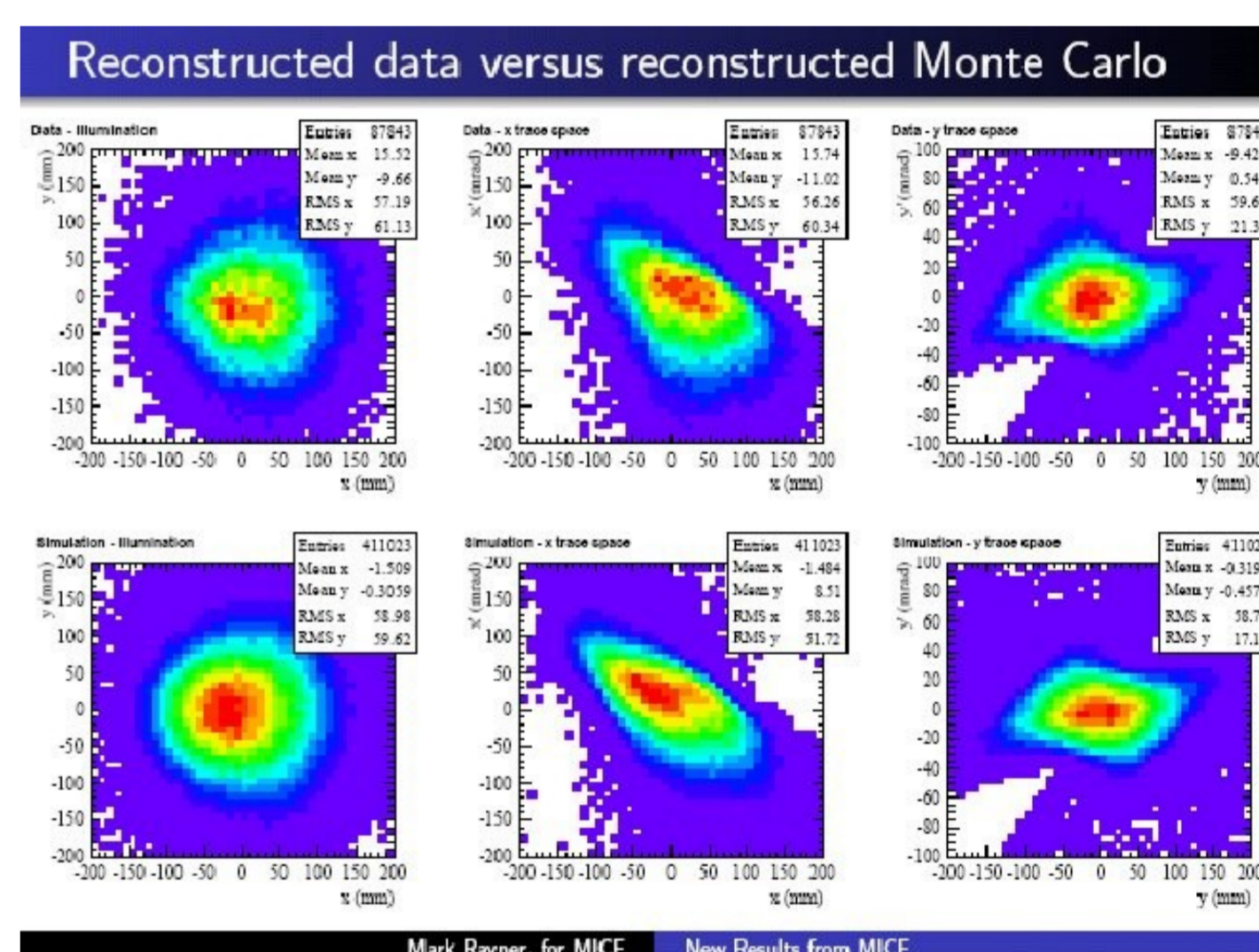
- 5 stations per tracker
- Track residual of 650 $\mu$ m

Station Separation	
Stations 1-2	20cm
Stations 2-3	25cm
Stations 3-4	30cm
Stations 4-5	35cm



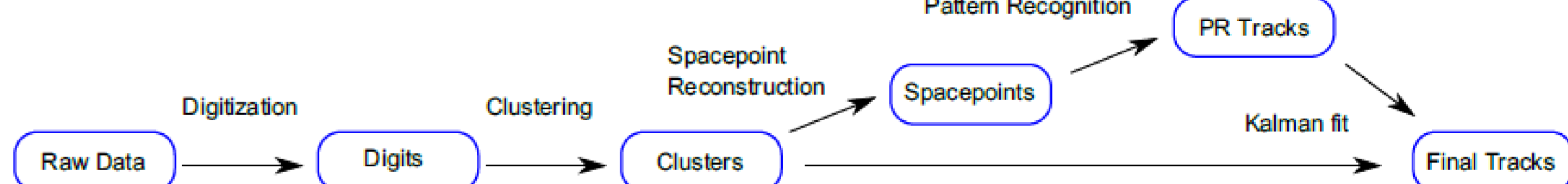
## Measuring Emittance

- Emittance is derived from an ensemble of single particle measurements
- Trackers placed directly upstream and downstream of MICE cooling channel
- 4T fields in both trackers allow  $p_x$  and  $p_y$  measurements
- VLPC output digitized, grouped into clusters to create spacepoints
- Pattern Recognition using least square fitting and Kalman fitting



Above: Early MICE emittance measurements from time-of-flight data and expected expected results from simulation

### Software Track Reconstruction



## Cosmic Test

- Cosmic tests ran from 2008 – 2009 and from 2011 – early 2012
- 30 Gb of data collected between two runs

Right: cosmic track reconstruction  
Bottom Right: number of station hits per incoming particle  
Bottom Middle: total hits recorded in all stations of a single tracker  
Bottom Left: number of photoelectrons per hit

