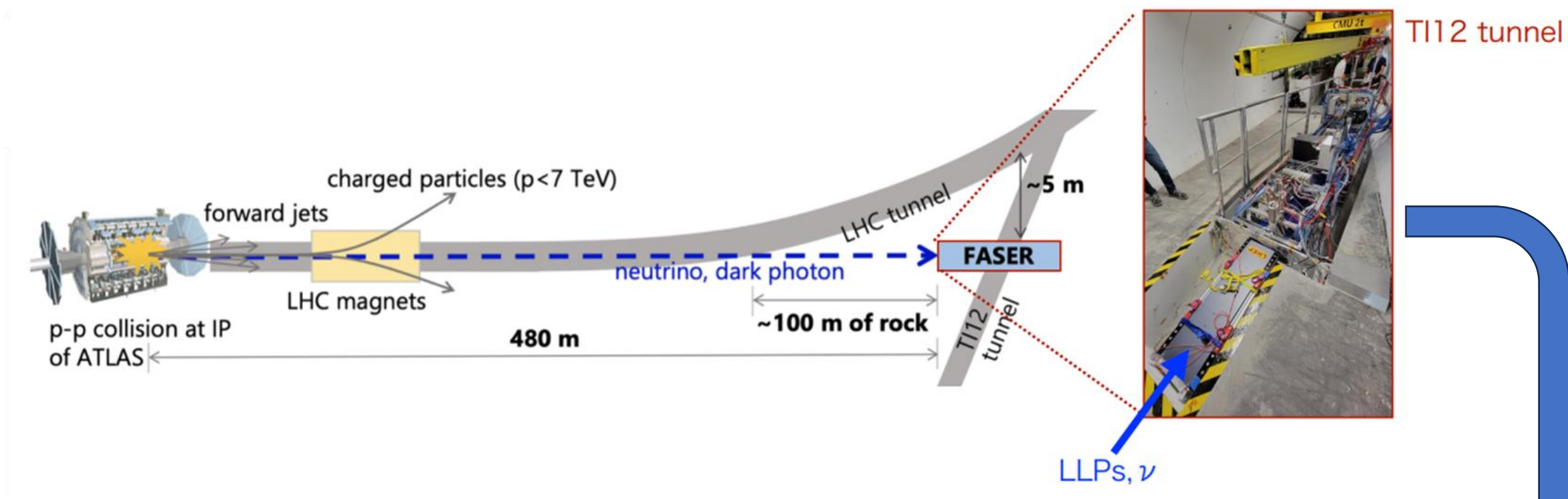


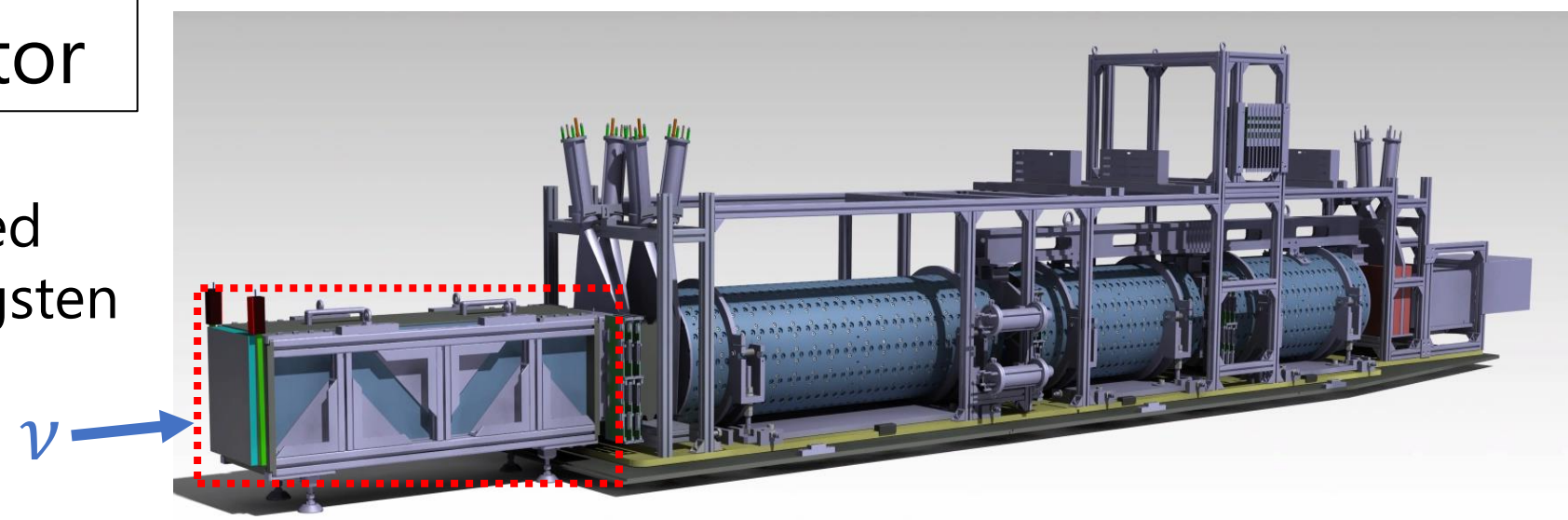
1. Motivations of FASER ν



- Neutrino measurement in the unexplored TeV region
- LHC(Large Hadron Collider) at CERN 13.6 TeV proton-proton collision

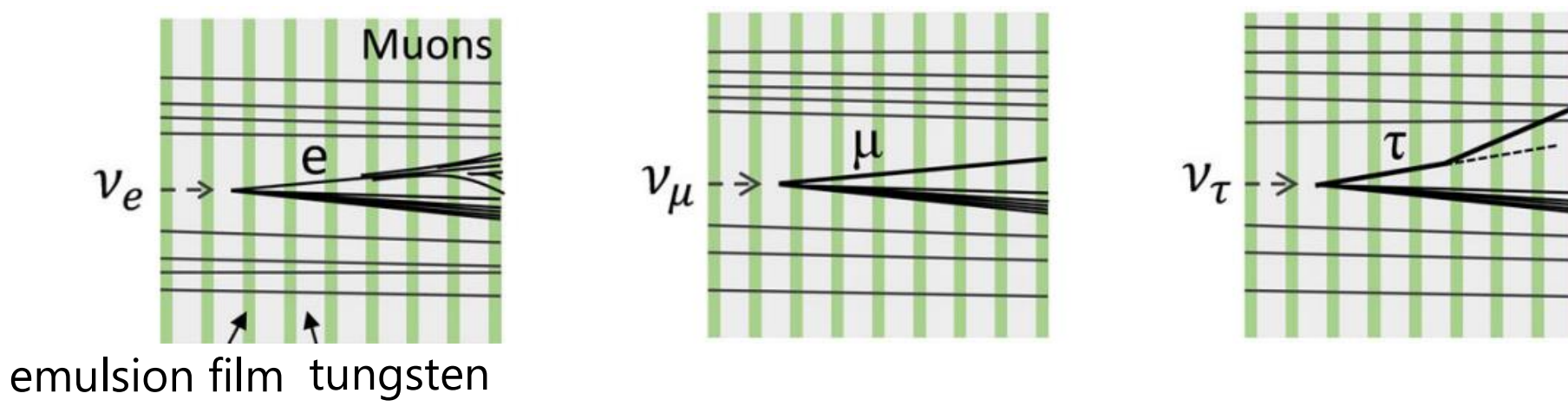
The FASER ν detector

Consists of 730 layers of emulsion films interleaved with 1.09-mm-thick tungsten plates.

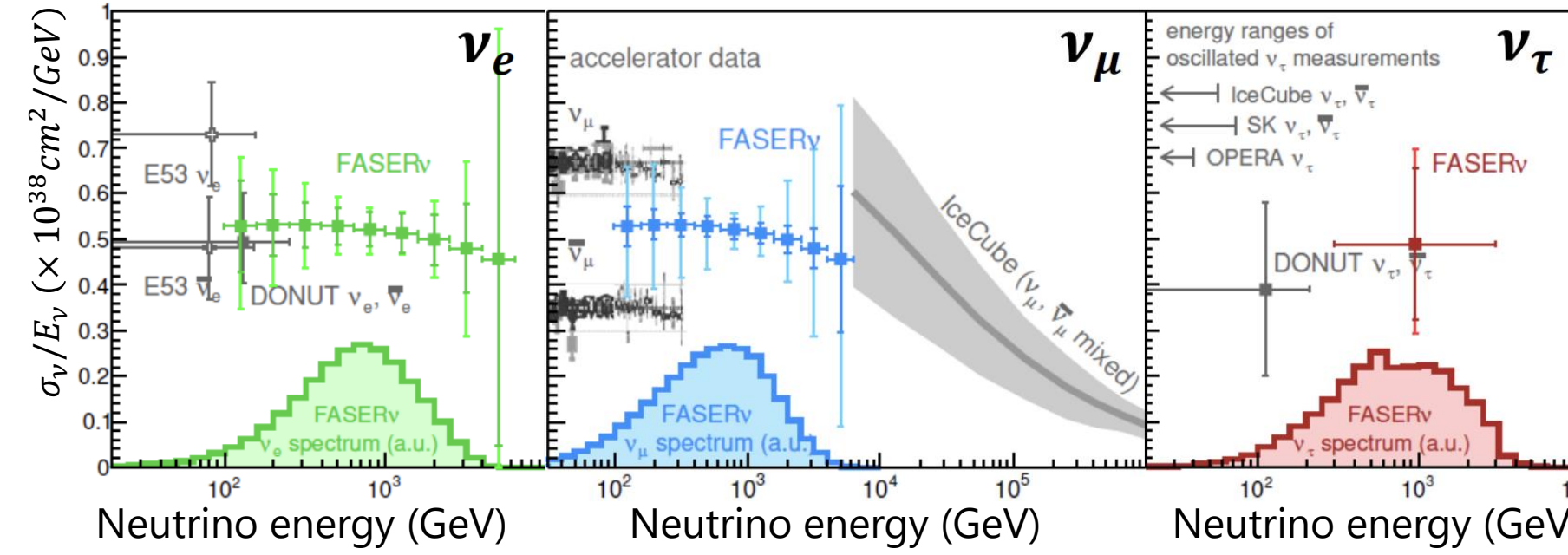


2. Purposes of momentum measurement

Momentum measurement of charged particle in a TeV range from neutrino interaction

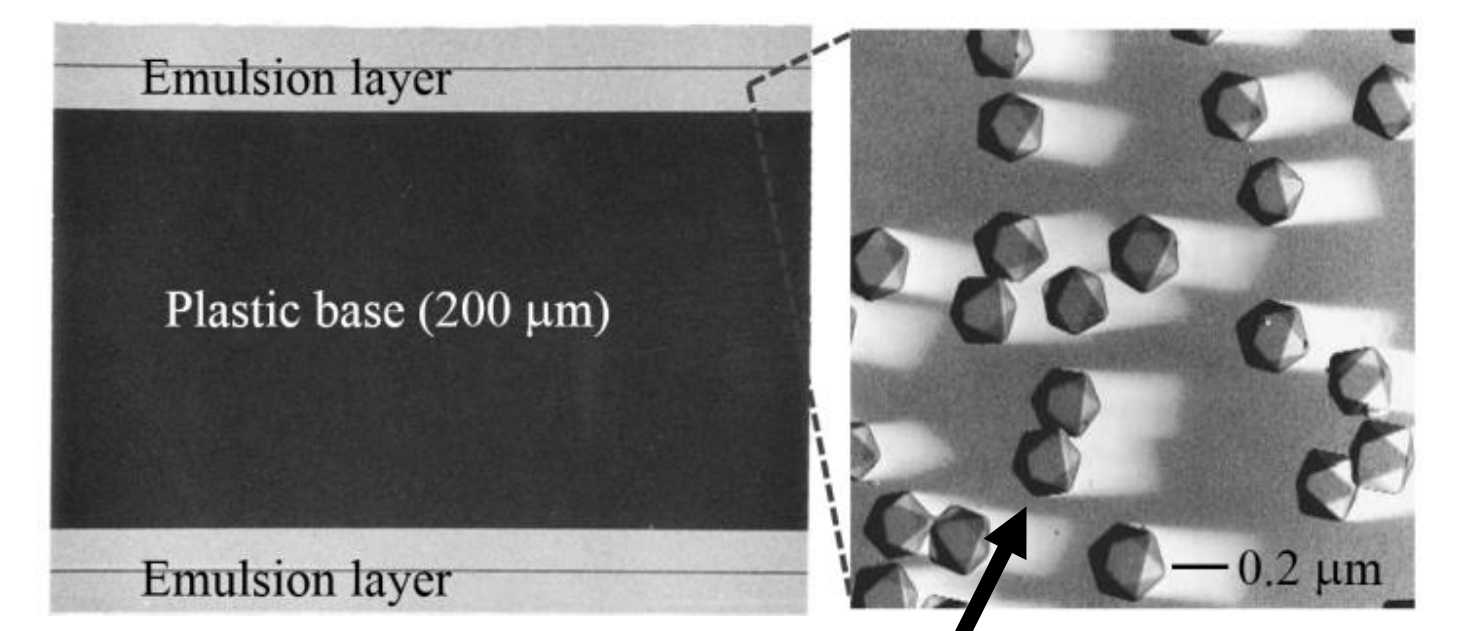


- Improve neutrino identification
- Reconstruct the neutrino energy using particle momenta for cross section measurements



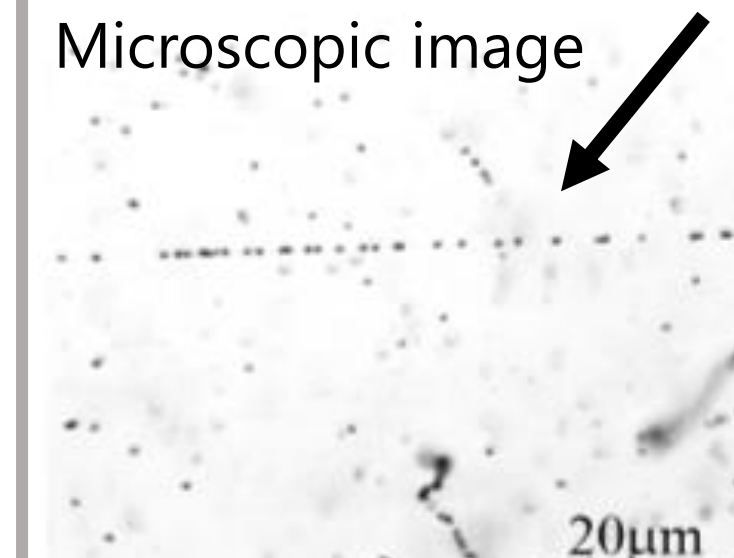
Emulsion film

A photographic film, ultra-sensitive to charged particles.



Emulsion layer: Silver bromide crystals dispersed in gelatin

Charged particles are recorded as silver grains

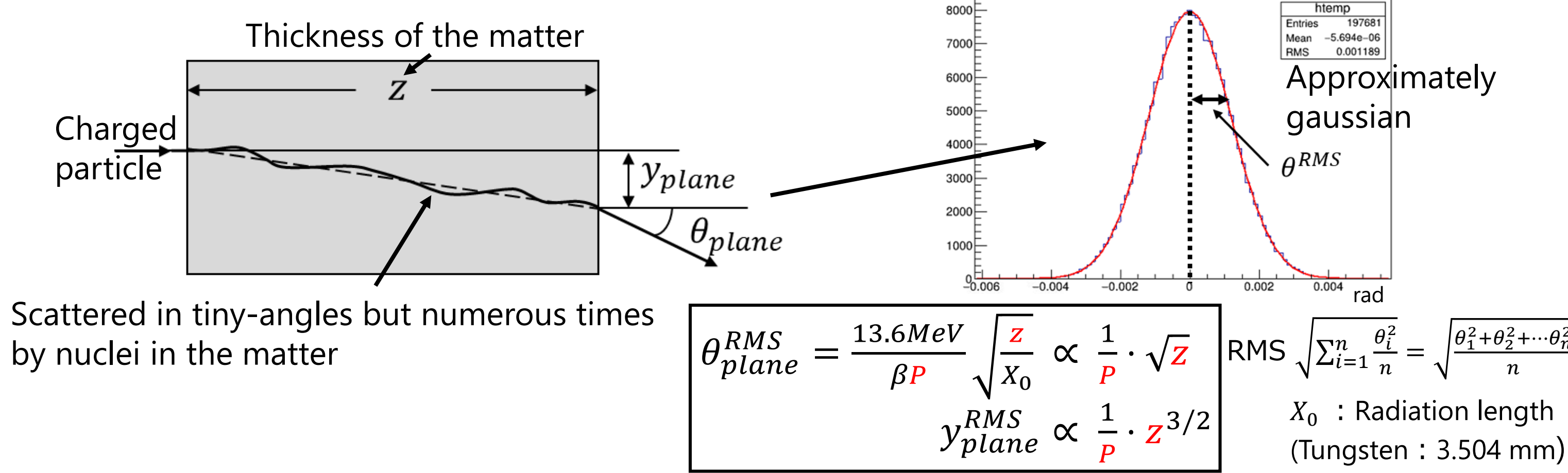


3D Track Detector with sub-micron positional accuracy

3. Method

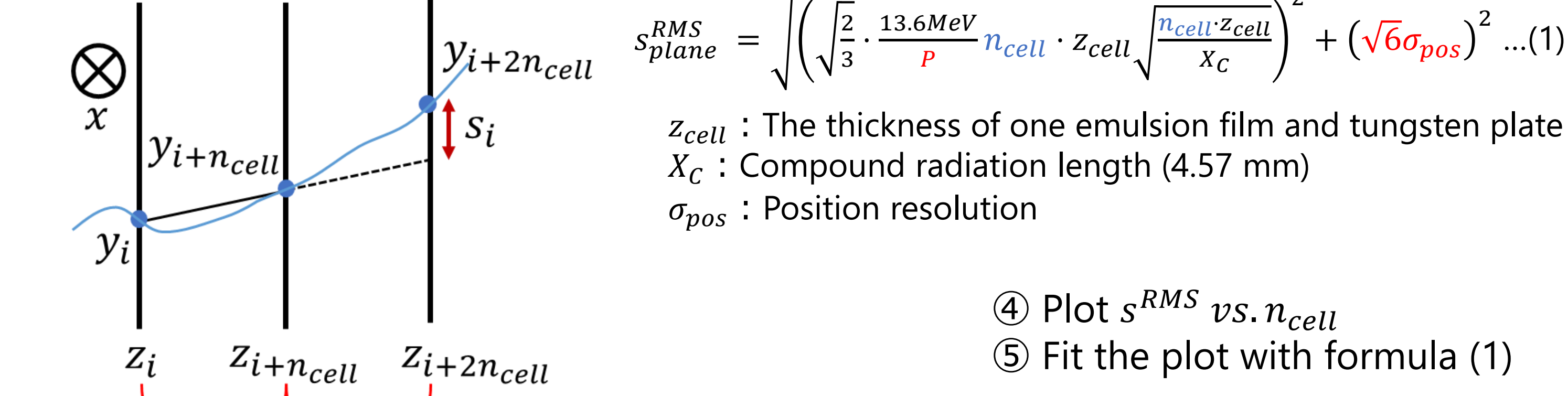
Multiple Coulomb scattering

The difference of angles before and after the material

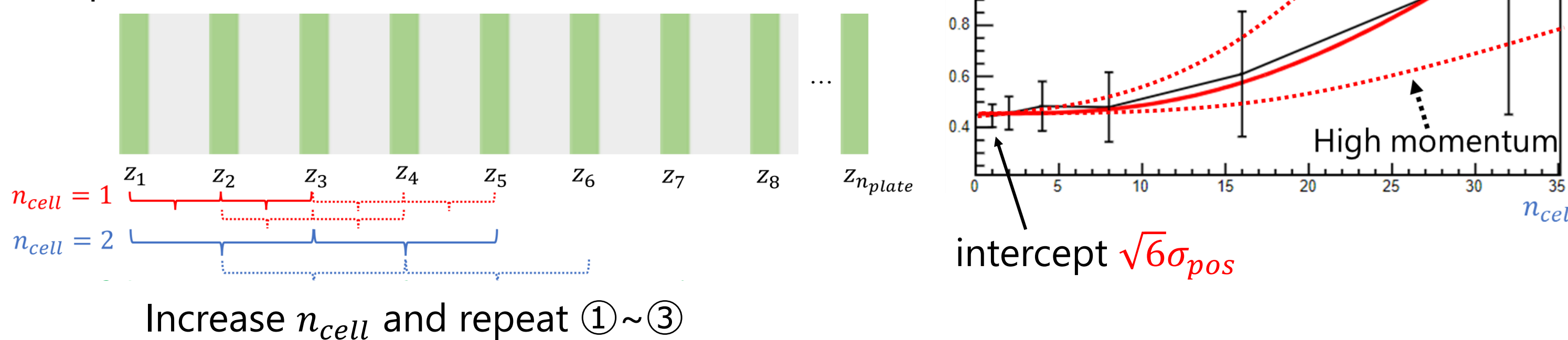


Coordinate method to measure scattering

① Calculate position difference s_i



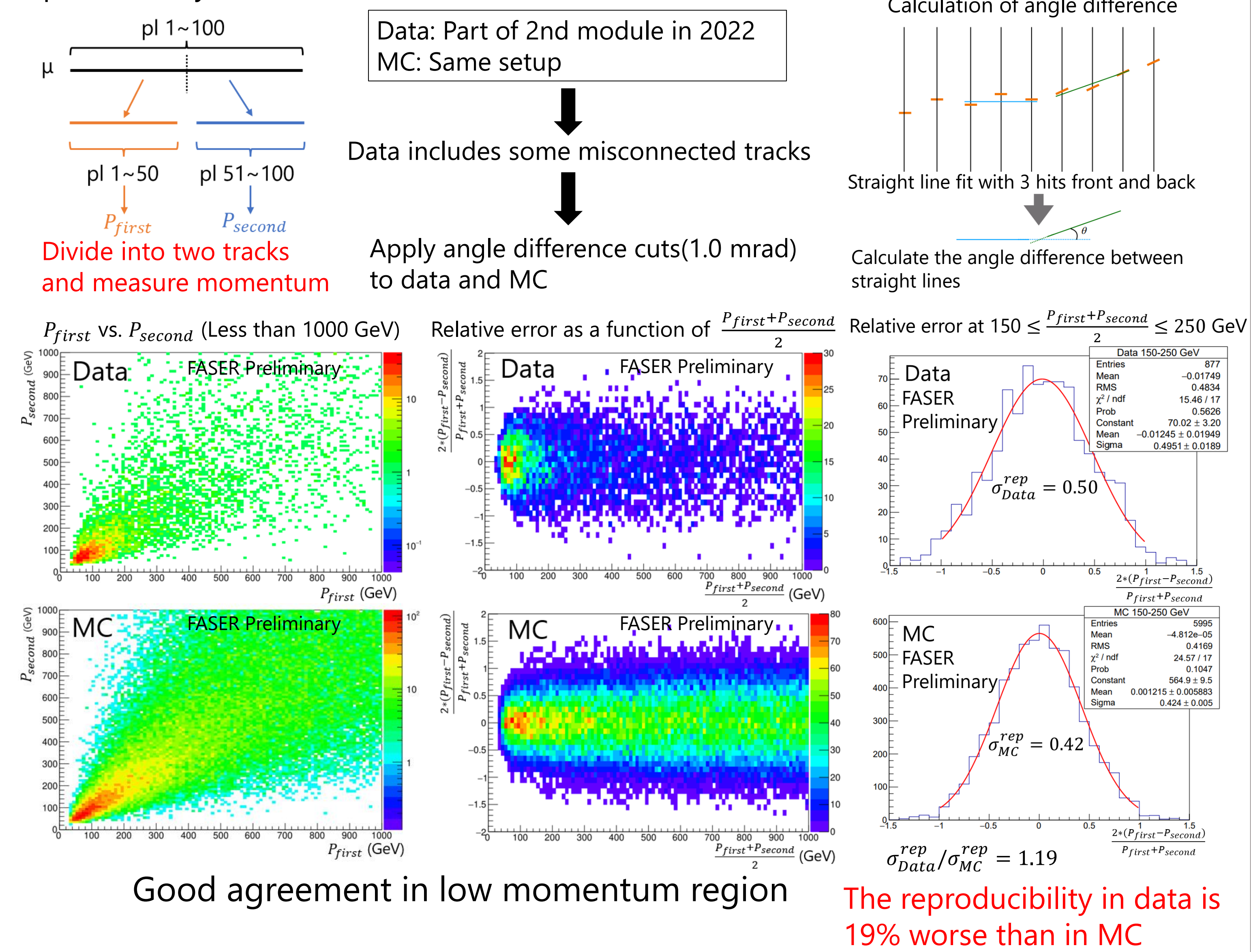
② Shift 1 segment and calculate s_i
③ Calculate s^{RMS} and attach error considering independent stats



5. Reproducibility of momentum measurement

Current FASER ν analysis applies 200 GeV momentum cut for removing background events.

→The uncertainty of the measurement around 200 GeV have been checked comparing the reproducibility between data and MC

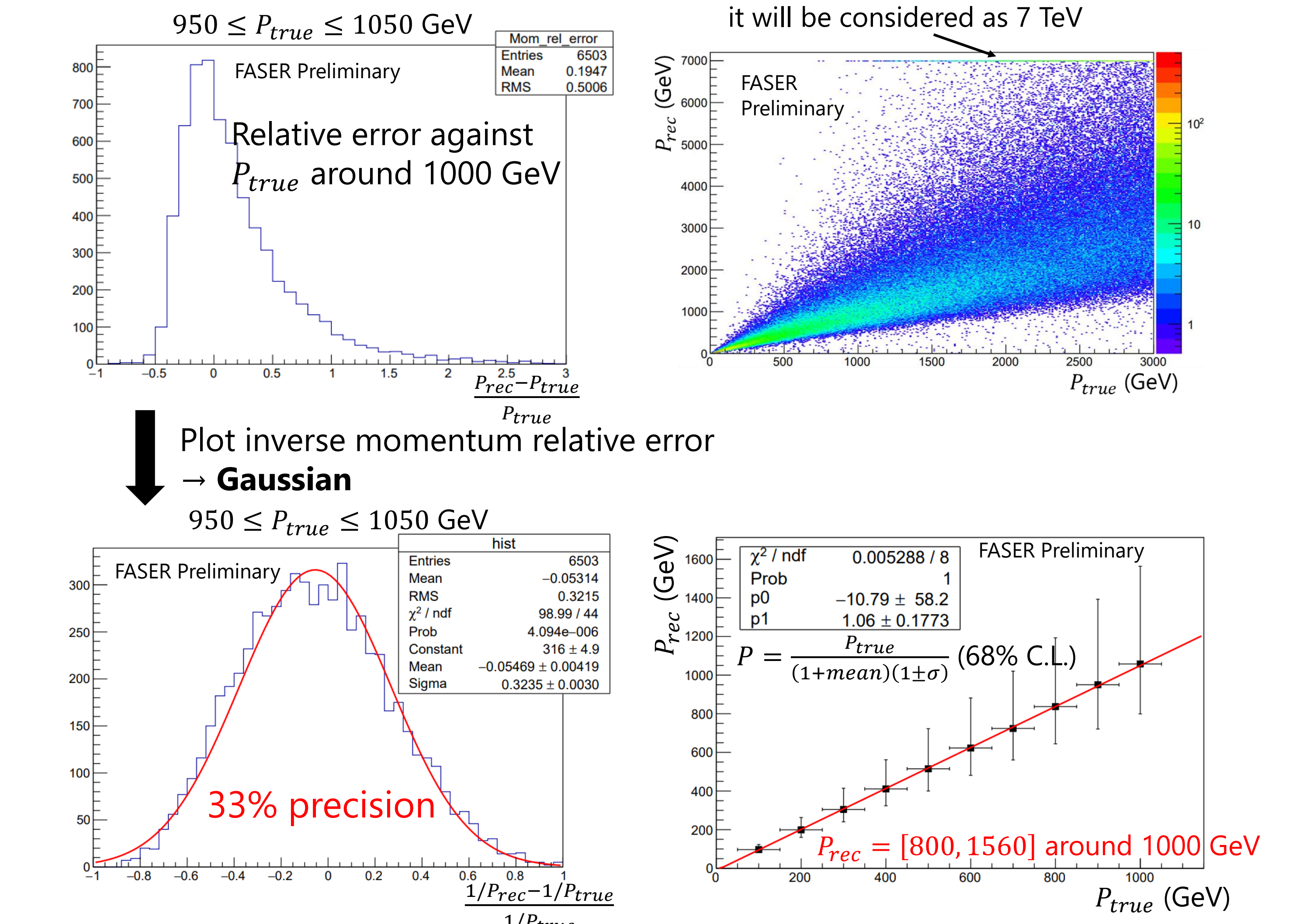


4. Evaluation using MC simulations

Setup

Flat momentum distribution of muons from 1 GeV to 3000 GeV. Momentum measurement using 100 tungsten plates and emulsion films.

Evaluate momentum resolution

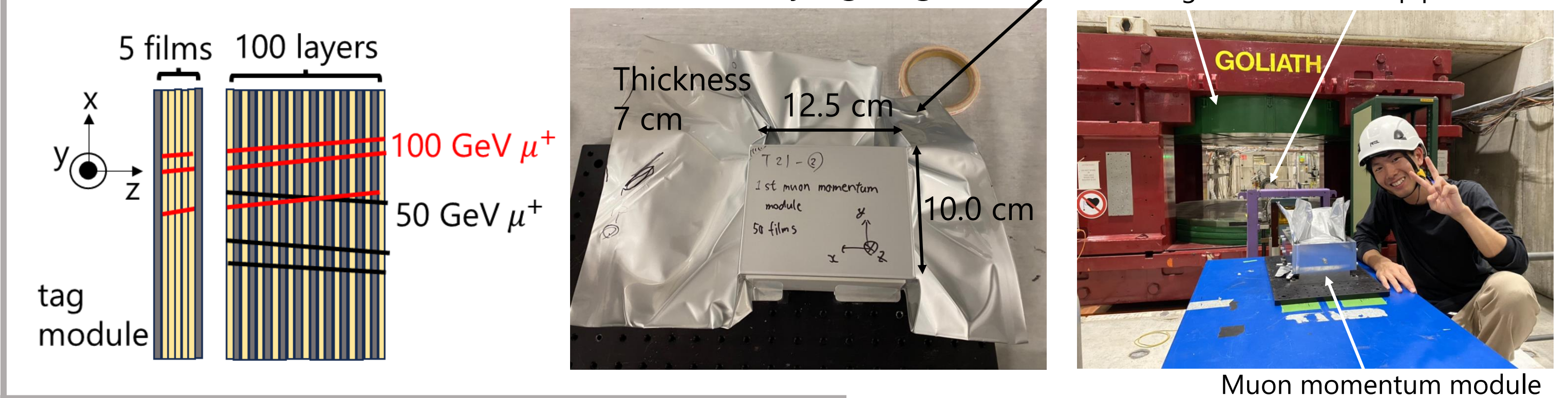


6. Test beam experiment at SPS

Test beam experiment had conducted at SPS in CERN this August. Two types of modules, muon momentum module and muon spectrometer.

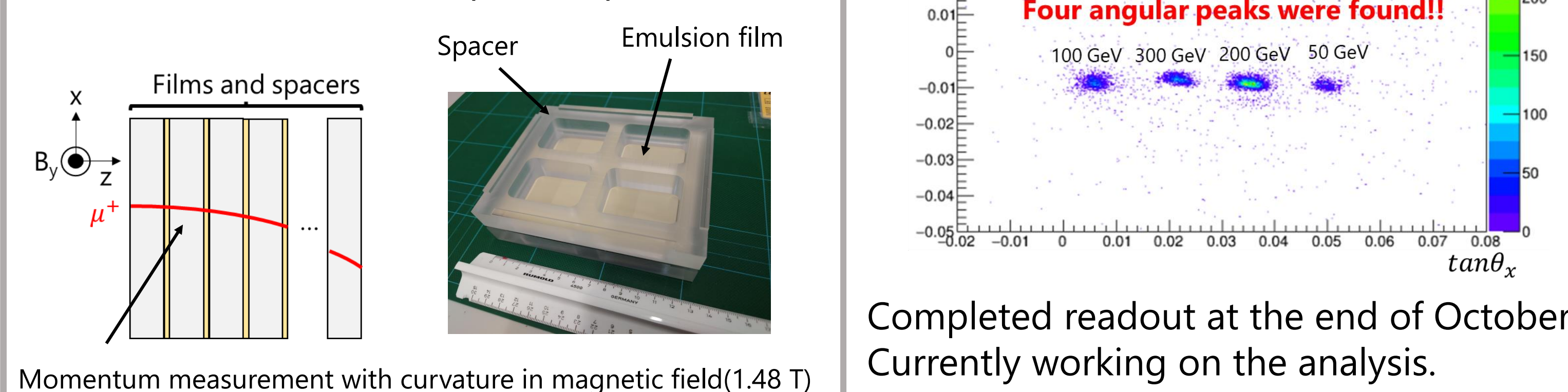
Muon momentum module

To validate the momentum measurement method. 1 pack consists of 50 tungsten plates and emulsion films (12.5 kg). Irradiated 50, 100, 200, 300 GeV muons at varying angles.



Muon spectrometer

To estimate the uncertainty of muon beam. 22 emulsion films and 23 plastic spacers.



7. Summary

On Simulation, momentum around 1000 GeV can be measured 33% precision at inverse momentum distribution ($P_{rec} = [800, 1560]$ GeV at 68% C.L.) To validate momentum measurement methods in data, test beam experiment has conducted this summer at SPS and analysis is currently in progress.