

Neutrino cross section measurements and momentum reconstruction with the FASERν detector

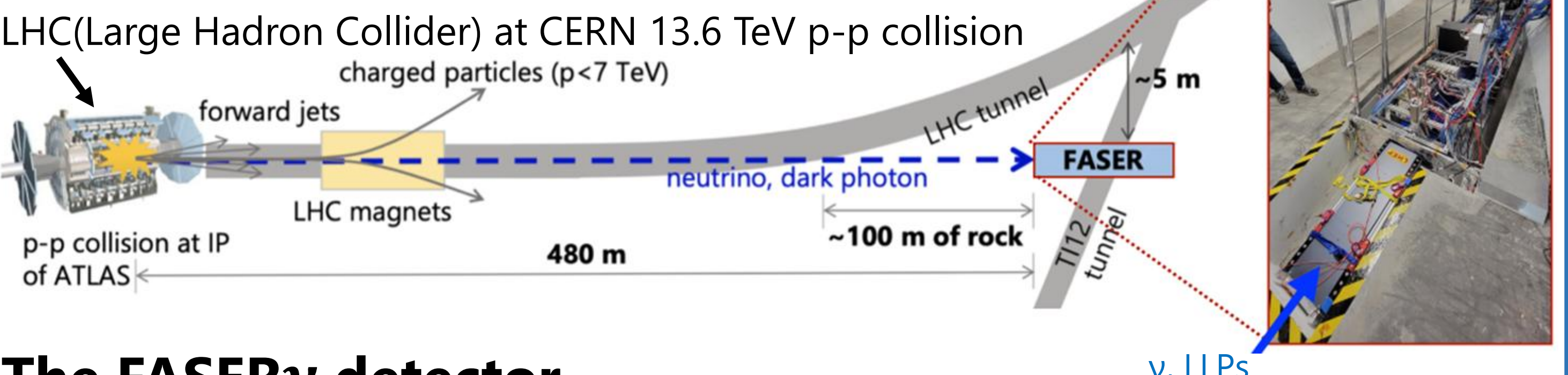
Haruhi Fujimori (haruhi.fujimori@cern.ch, Chiba University) on behalf of the FASER Collaboration

25th of June 2026, XXXII International Conference on Neutrino Physics and Astrophysics, University of California, Irvine, U.S.A.

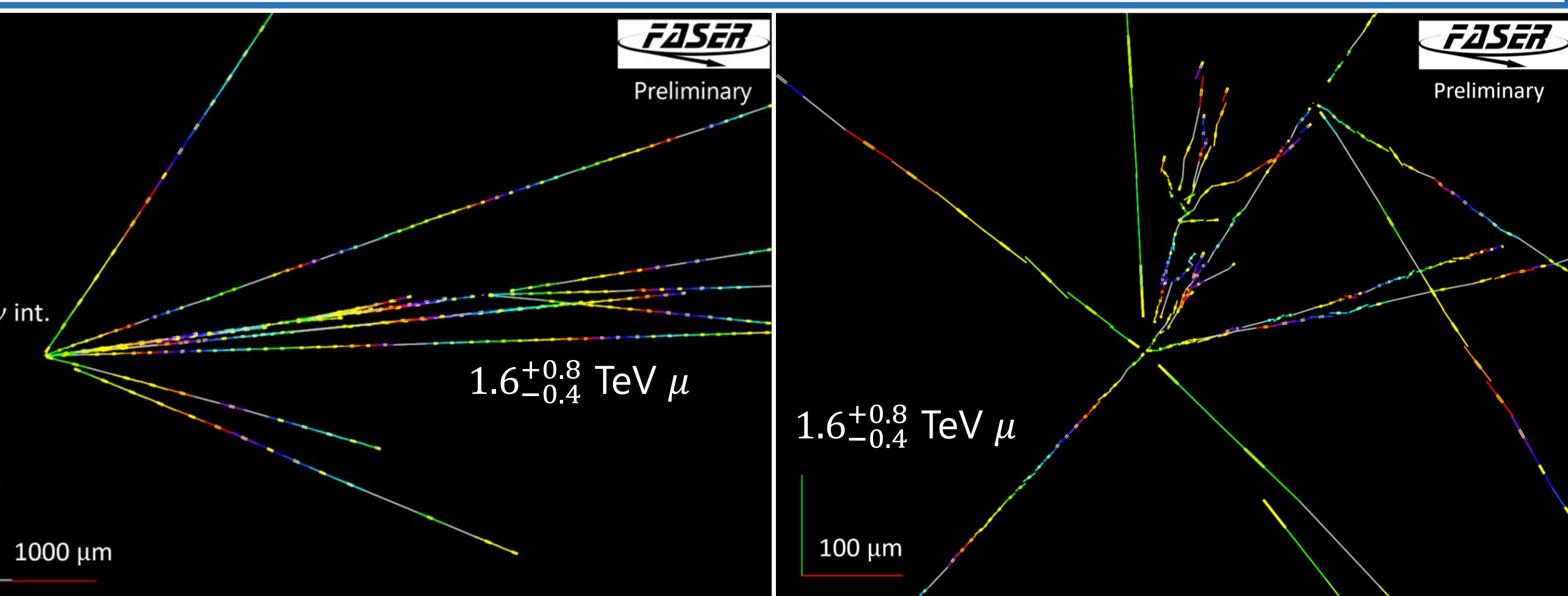
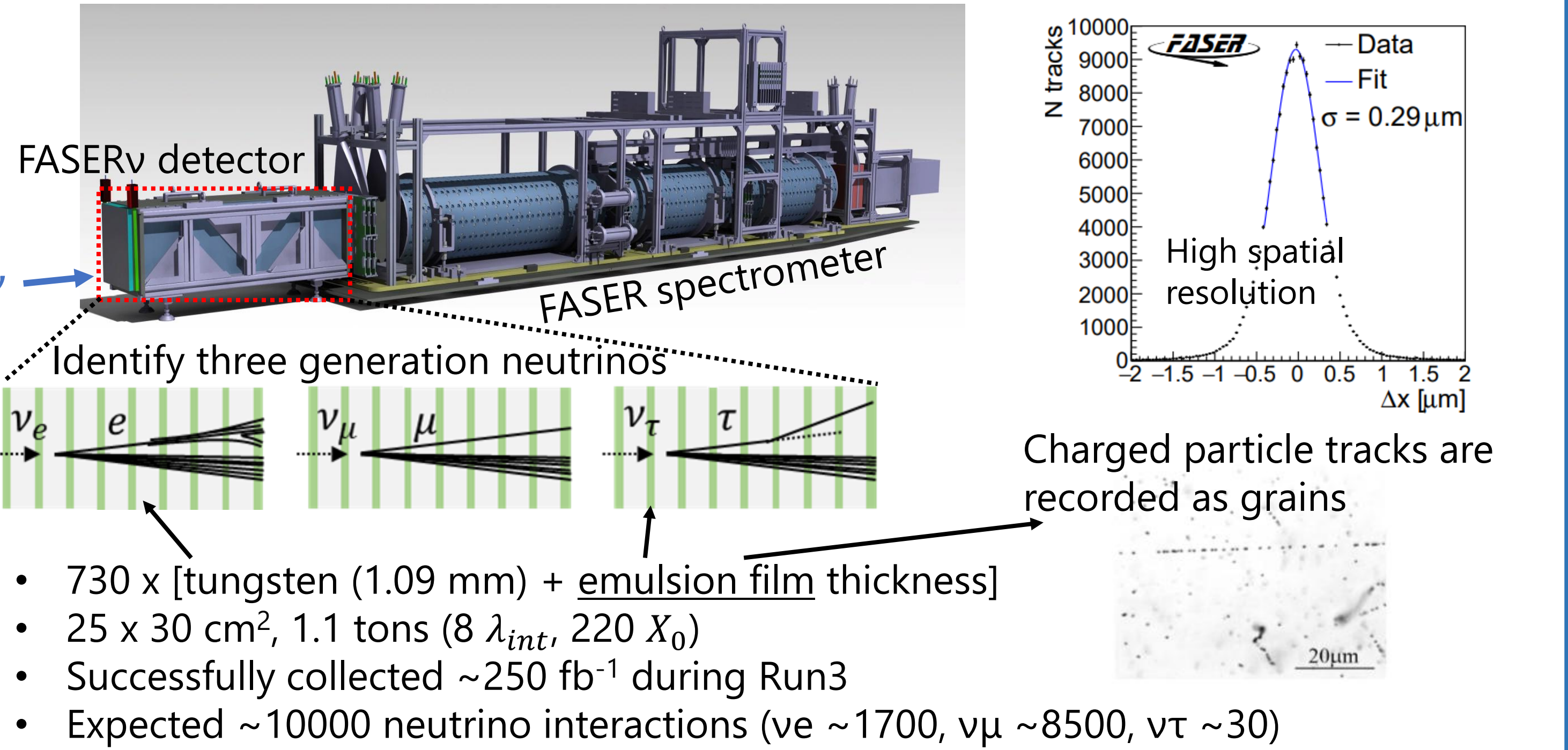


1. FASER experiment

Neutrino measurement in the unexplored TeV region and search for long-lived particles

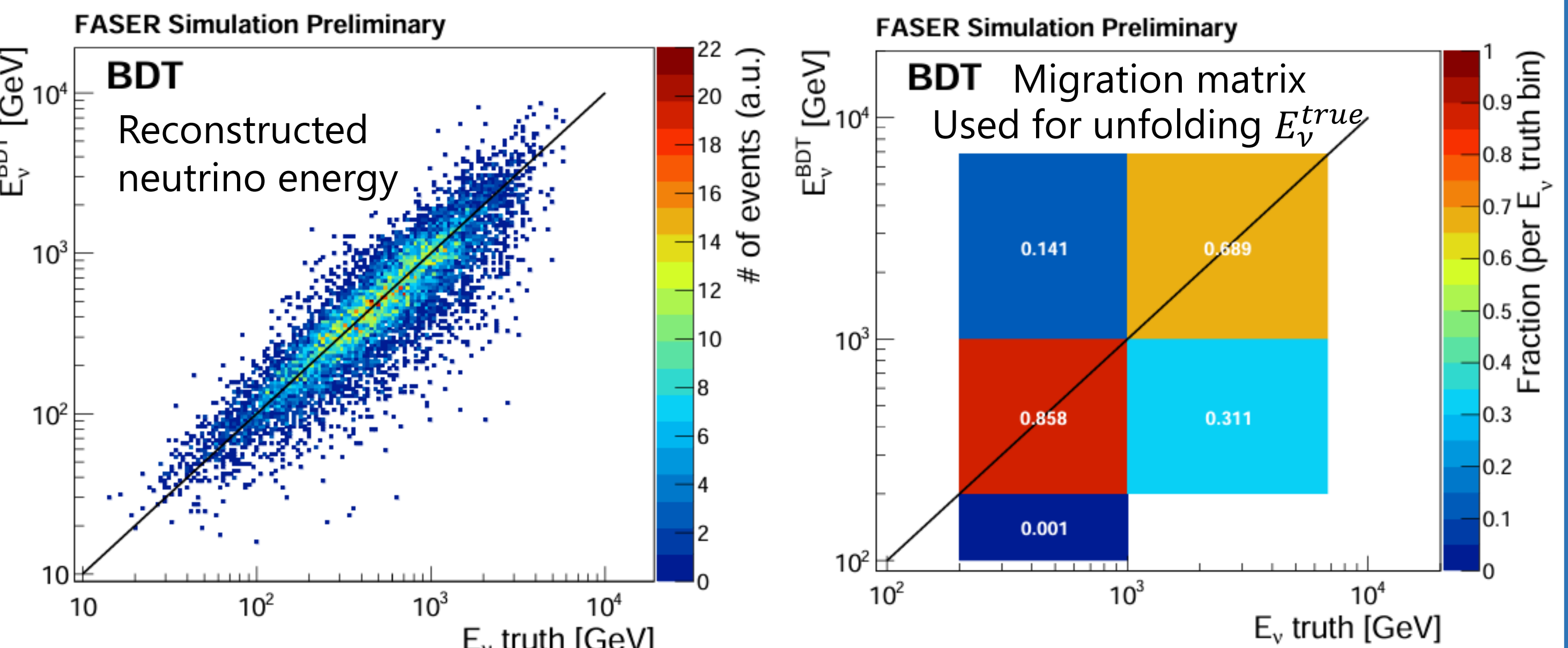


The FASERν detector



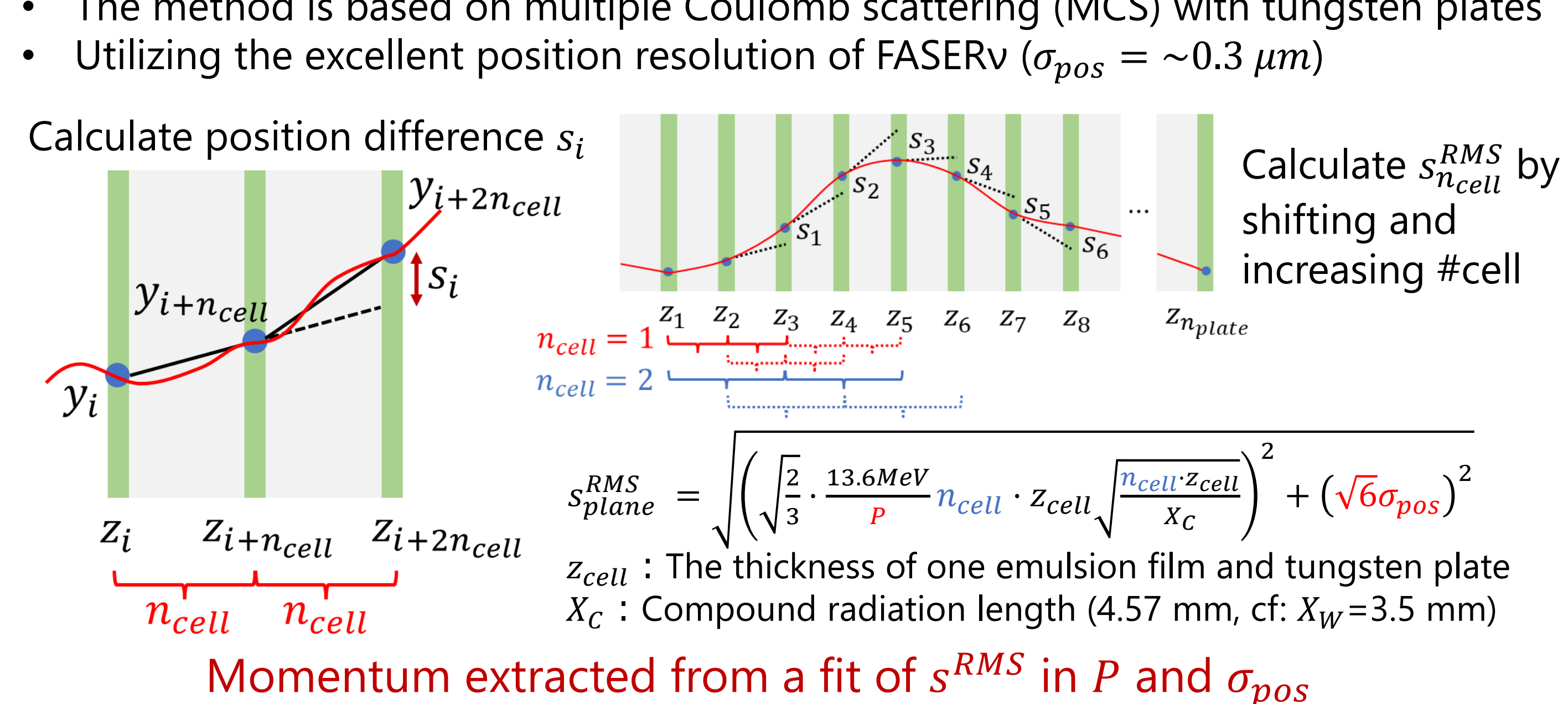
4. Muon neutrino energy reconstruction

- Multivariate regression using Gradient Boosted Decision Trees
- Input variables:** P_μ , $\sum P^{\text{charged hadrons}}$ and $1/\tan\theta_\mu$
- Training sample: FASER GENIE simulation, $1/E\nu^2$ flux distribution up to 15 TeV
- Less than 10% offset and resolution 30-40% (200 GeV – 3 TeV)



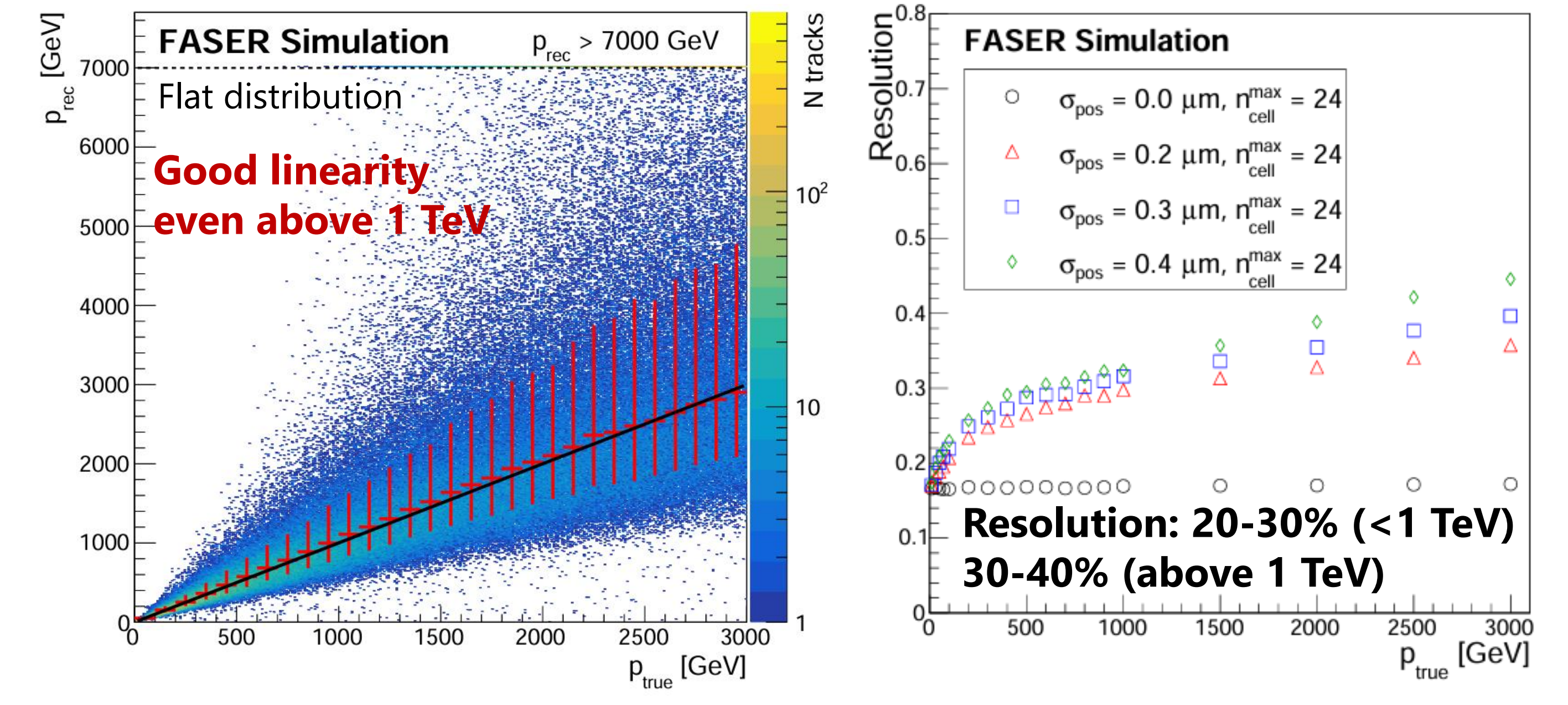
2. Momentum reconstruction

- Momentum reconstruction of charged particles in the TeV range is critical for kinematical analysis in the FASERν detector**
- The method is based on multiple Coulomb scattering (MCS) with tungsten plates
- Utilizing the excellent position resolution of FASERν ($\sigma_{pos} = \sim 0.3 \mu\text{m}$)



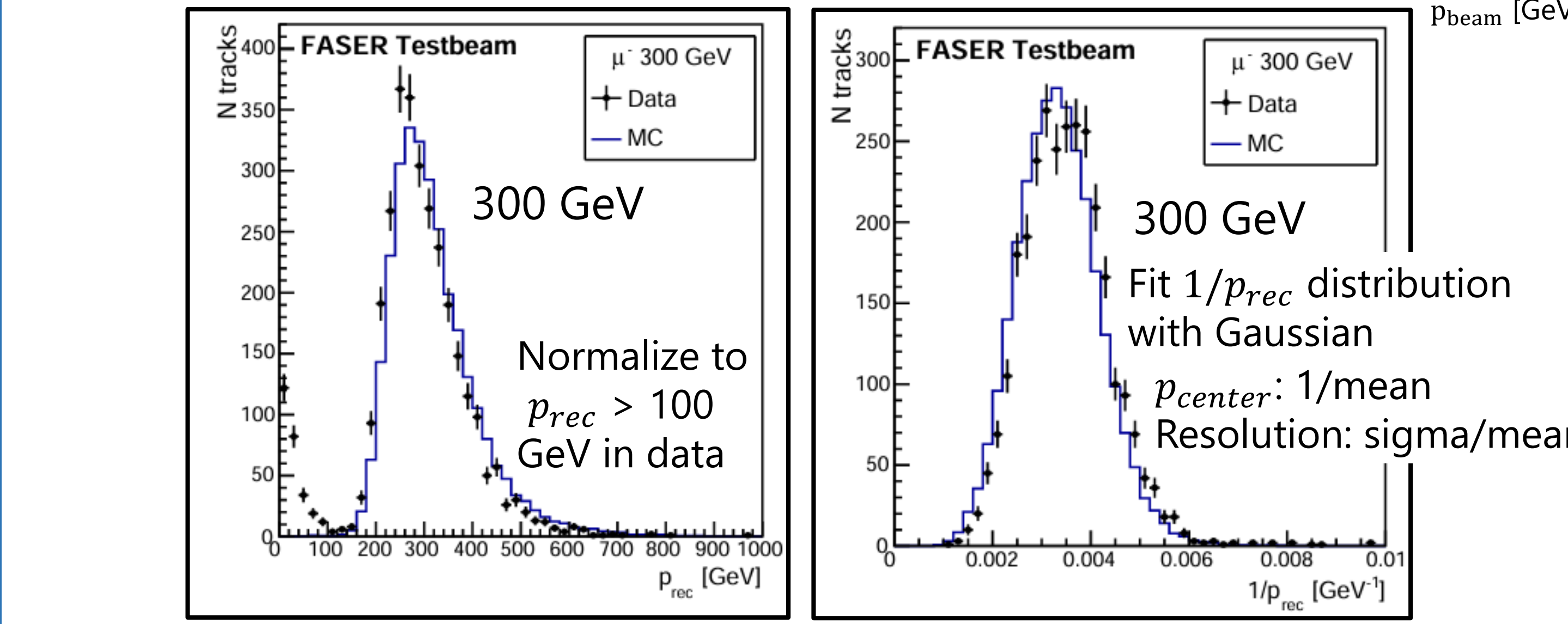
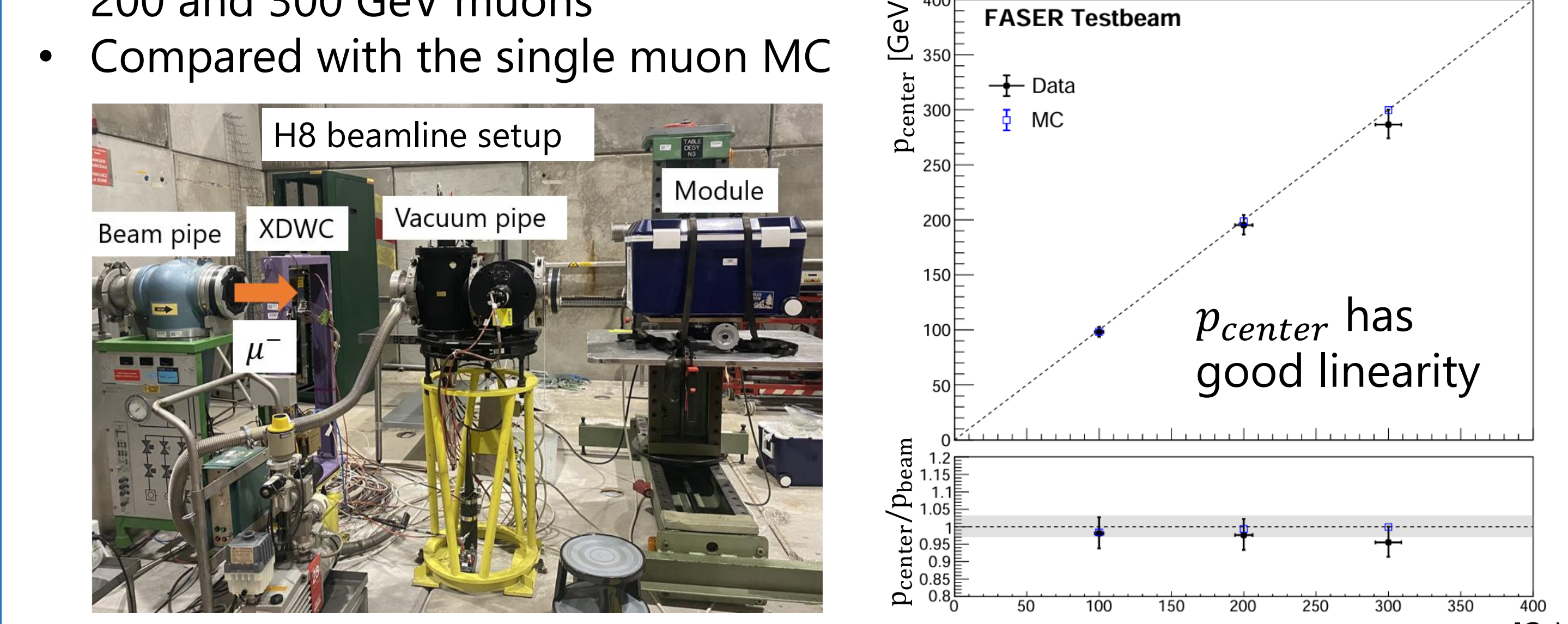
Performance evaluation using MC simulations

- Momentum measurement using 100 tungsten plates and emulsion films
- Muons simulated with Geant4 (apply position smearing to match data)



3. Validation with test beam data

- The test beam performed at the H8 beamline at the SPS in July 2024
- Momentum measurement with 100-layer detector, irradiated with 100, 200 and 300 GeV muons
- Compared with the single muon MC

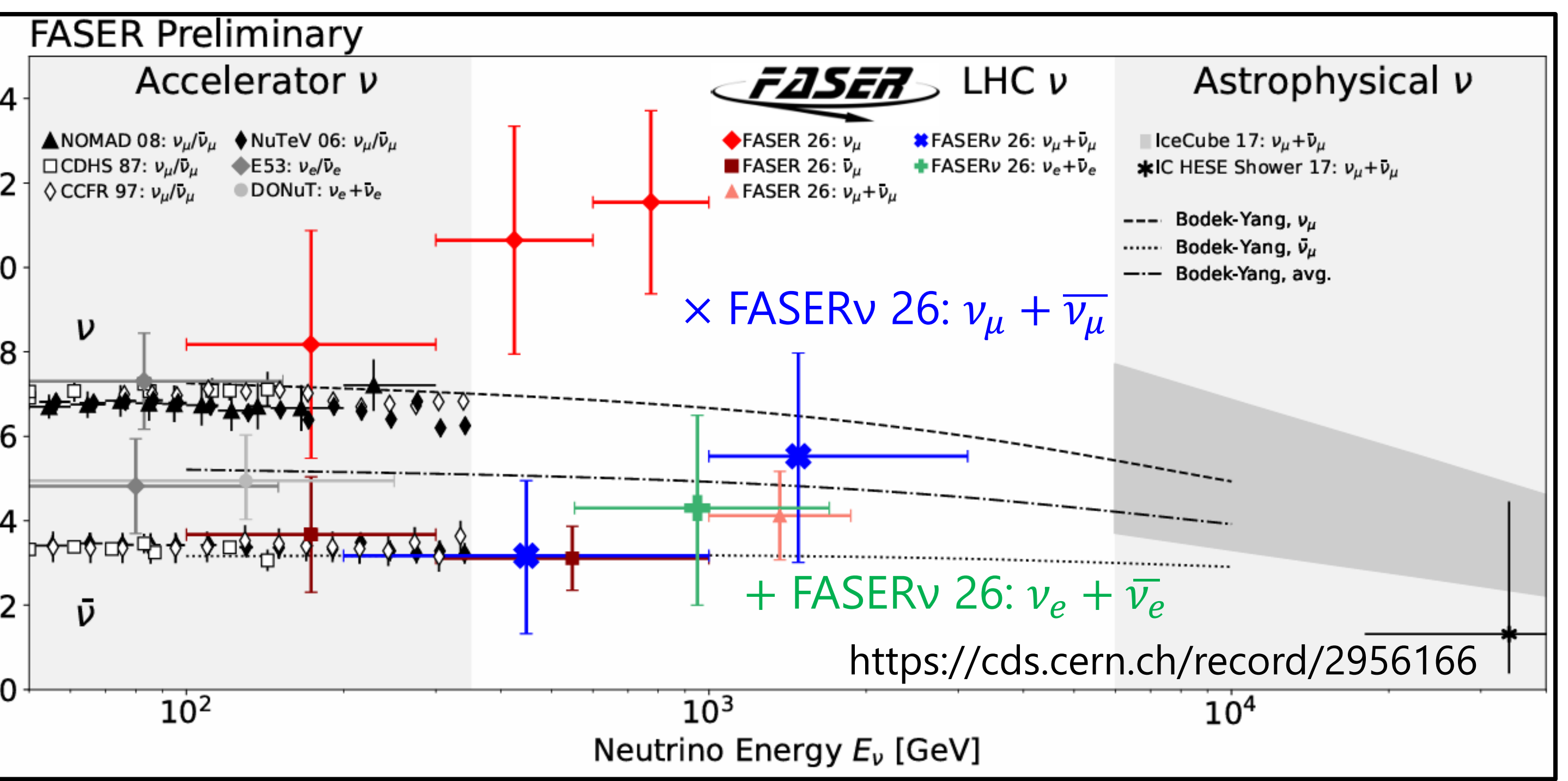
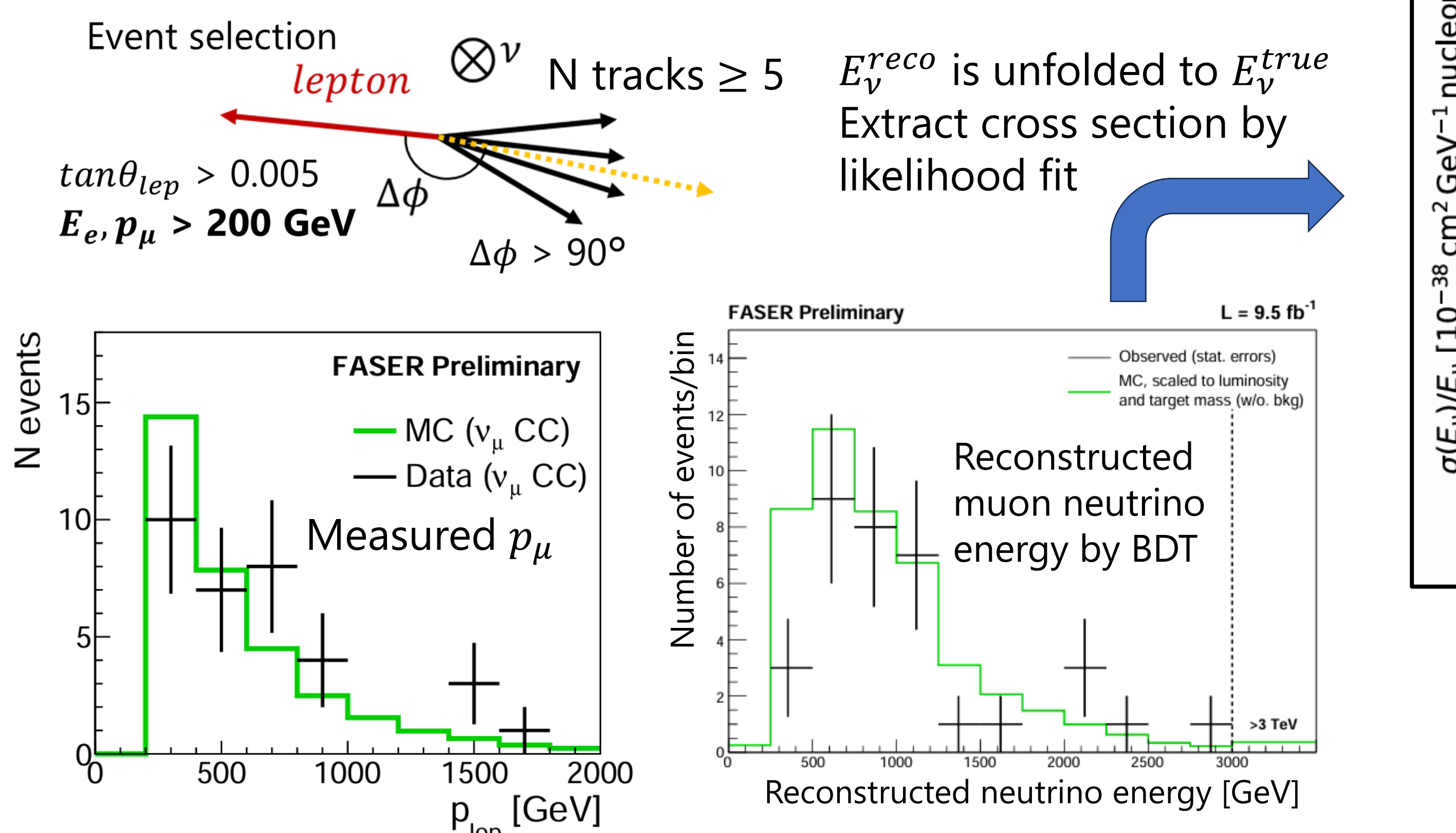


P_{beam}	P_{center}		Resolution	
	Data [GeV]	MC [GeV]	Data [%]	MC [%]
100 GeV	98.1 ^{+4.6} _{-4.3}	98.4 ^{+4.6} _{-4.3}	20.7 ± 0.6	20.7 ± 0.1
200 GeV	195.2 ^{+9.3} _{-8.5}	198.7 ^{+0.2} _{-0.2}	22.7 ± 0.6	22.6 ± 0.1
300 GeV	288.6 ^{+13.5} _{-12.4}	299.7 ^{+0.4} _{-0.3}	23.2 ± 0.4	24.2 ± 0.1

Test beam data and MC show good agreement arXiv:2602.17575

5. Neutrino cross section measurements

- Dataset: 2nd 2022 module 9.5 fb⁻¹, analyzed target mass = 681.1 kg
- 33 ν_μ and 7 ν_e observed** while 40 ν_μ and 7.7 ν_e expect



E_{ν_μ}	10-200 [GeV]	200-1000 [GeV]	>1000 [GeV]
n_{true}^{exp}	0.00 ^{+0.00} _{-0.00}	22.3 ^{+8.4} _{-5.4}	17.9 ^{+7.0} _{-4.7}
n_{reco}^{exp}	0.02 ^{+0.00} _{-0.00}	25.8 ^{+9.0} _{-6.1}	15.5 ^{+5.8} _{-4.0}
N_{obs}^{reco}	0	19	14