

The NOvA Test Beam Experiment

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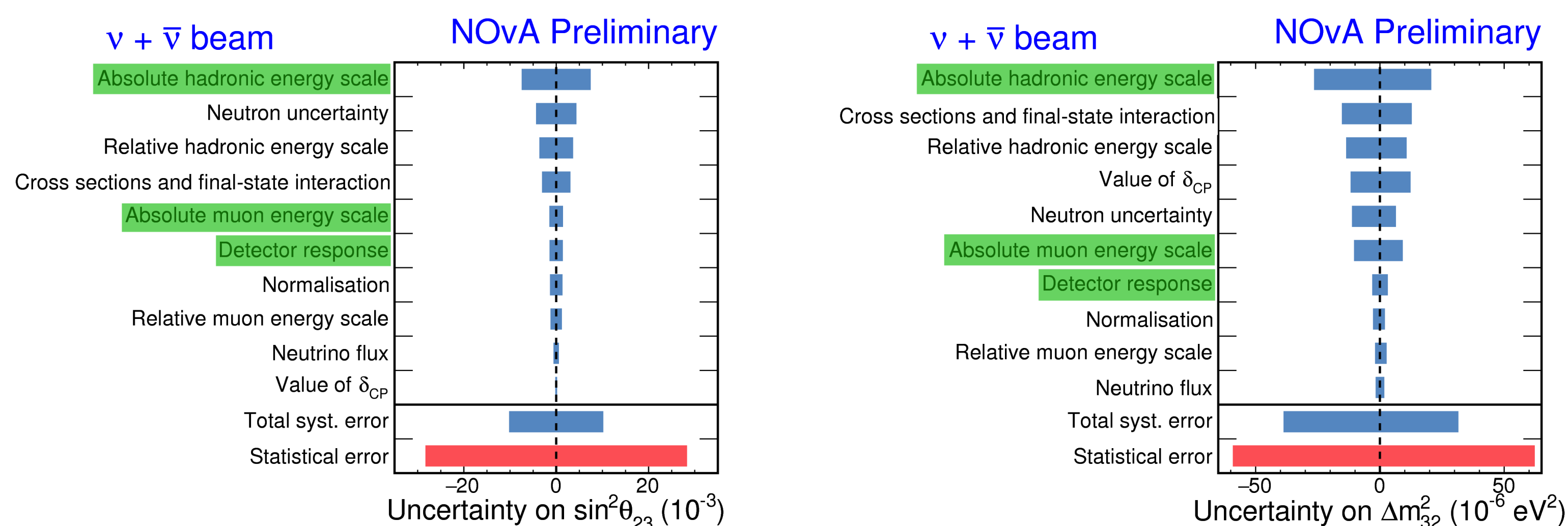
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Motivation of NOvA Test Beam

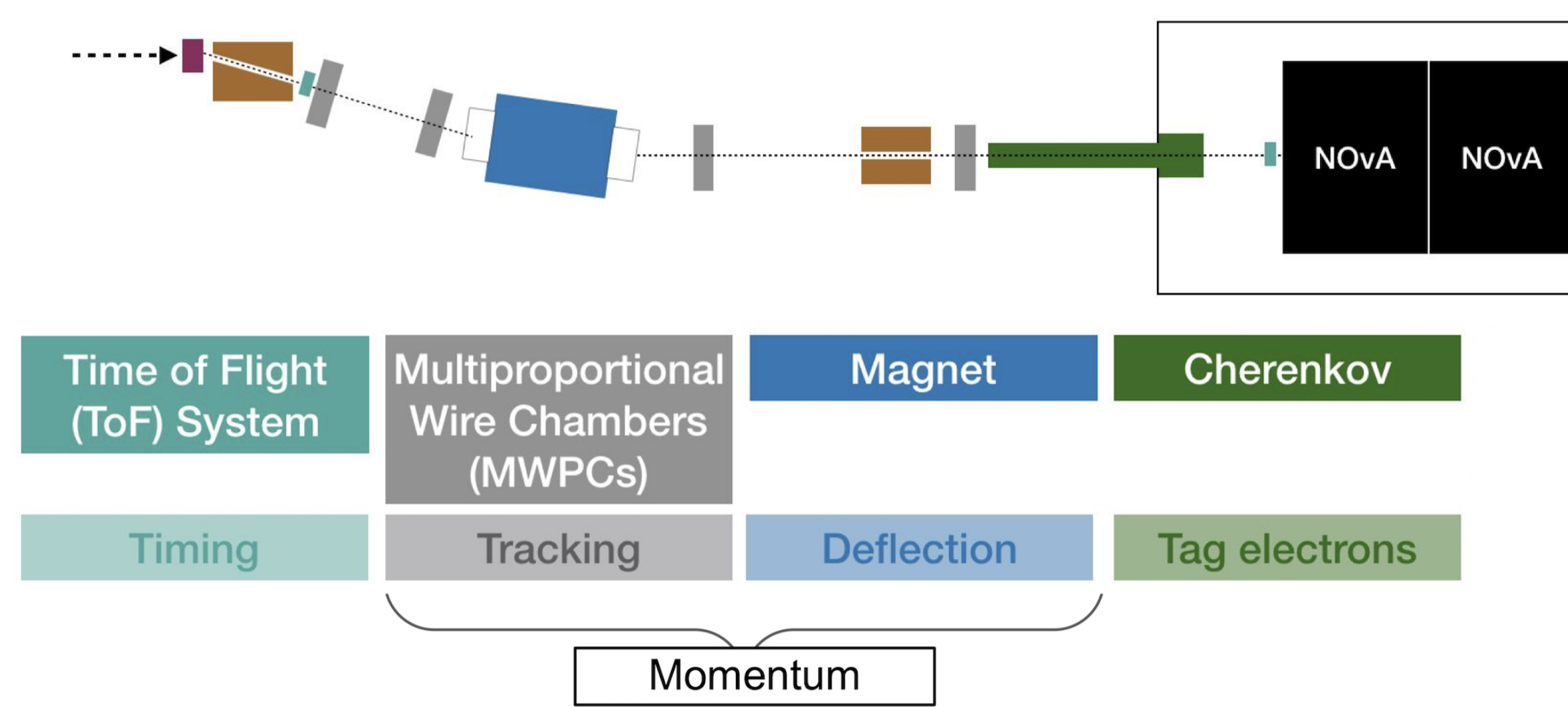
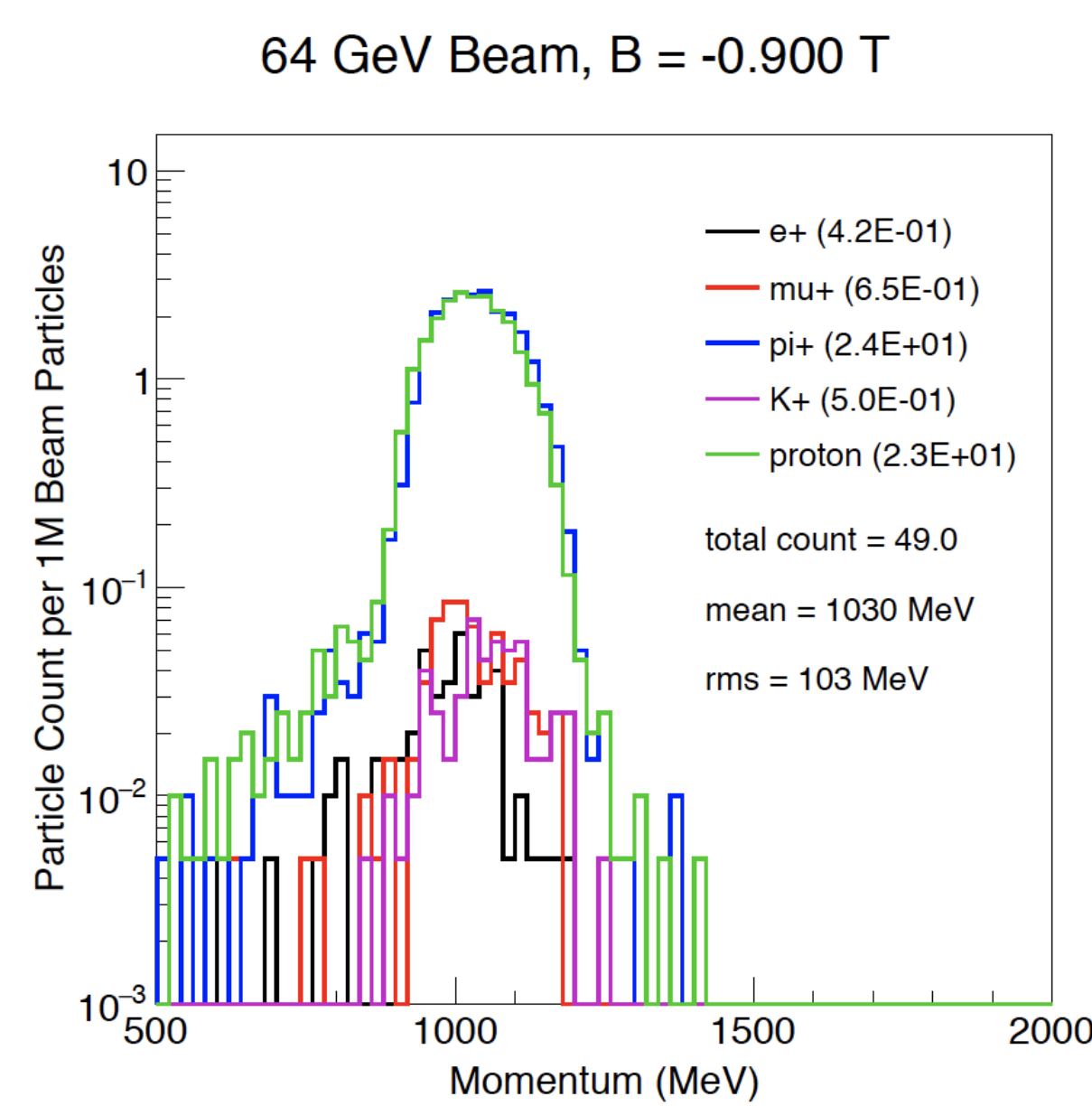
- NOvA is an off-axis long-baseline accelerator neutrino oscillation experiment.
- Main physics goals: measurements of $\nu_\mu(\bar{\nu}_\mu)$ disappearance and $\nu_e(\bar{\nu}_e)$ appearance, precision measurement of θ_{23} , probing neutrino mass ordering and the CP violating phase δ_{CP} .
- The NOvA Test Beam will assist NOvA in reaching these goals by studying the limiting factors of current analyses.



Dominant systematic errors of the measurement of $\sin^2 \theta_{23}$ and Δm_{32}^2 . Highlighted in green are those that NOvA Test Beam will be able to improve.

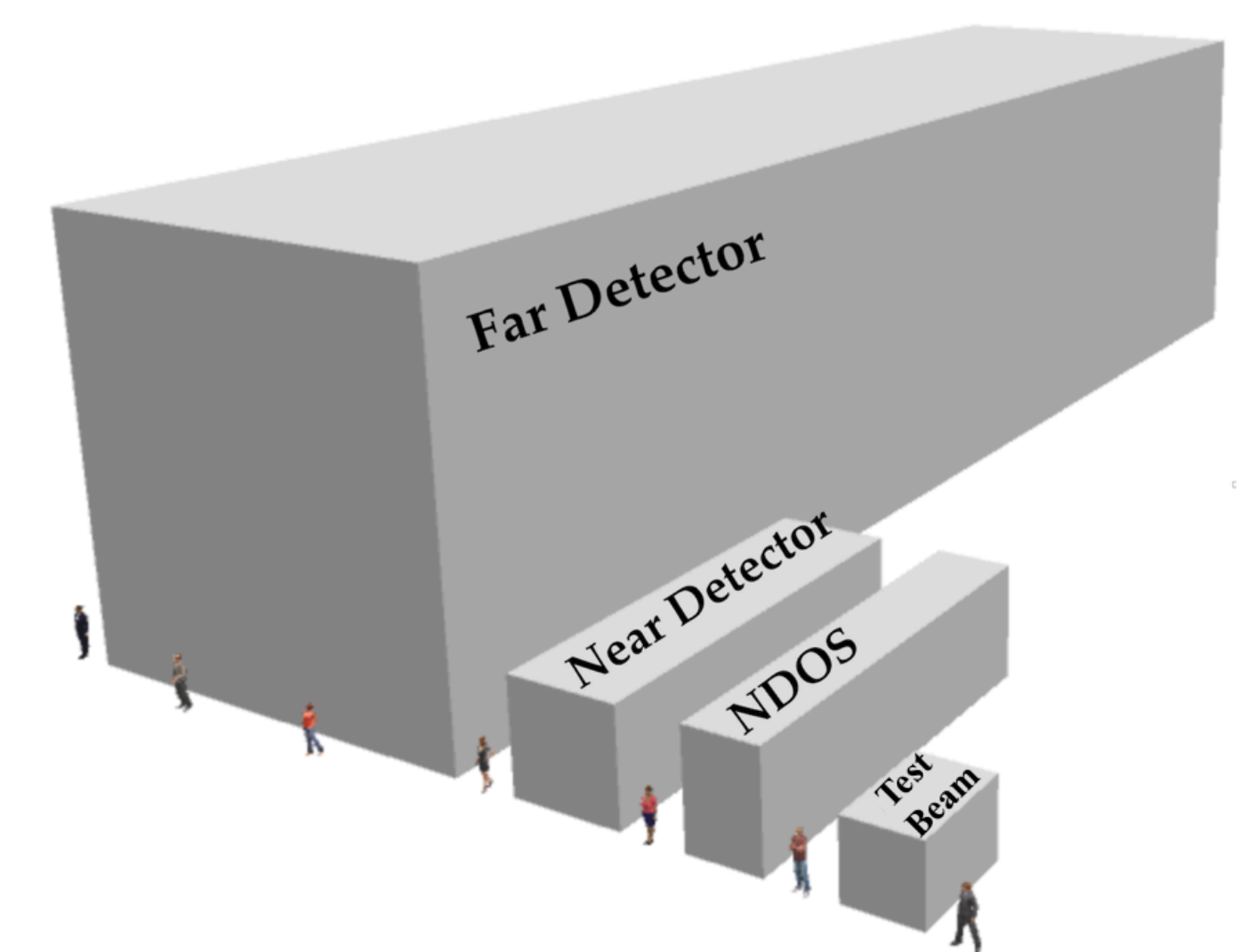
MC7 Beamline

- Located in the MC7b enclosure at the FTBF.
- Secondary beam of 64 GeV/c protons hits a copper target: produces tertiary beam composed primarily of p , π and a small contribution from e , μ and K .
- Beamline components (right): 2 scintillator paddles for time-of-flight measurements, 4 wire chambers for momentum measurements and a Cherenkov counter to tag electrons.
- Equipped with two collimators and a dipole magnet, which guides particles within a momentum range from 0.3 to 2 GeV/c. Momenta and counts of particles entering the detector after traversing all beamline components (left).



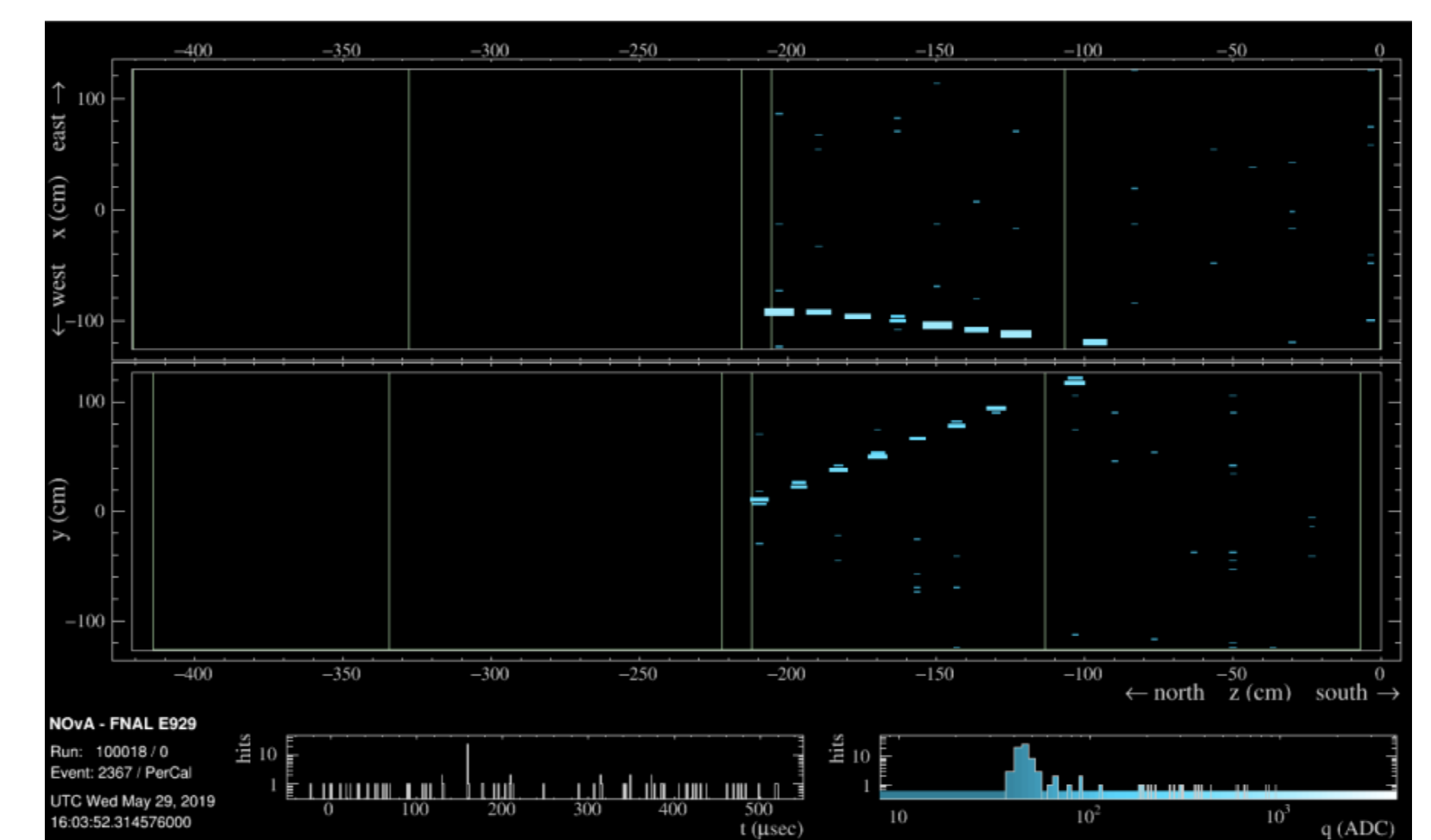
NOvA Test Beam Detector

- Similar design to NOvA's Near and Far detectors, but smaller in size: 63 planes of plastic extrusion modules filled with liquid scintillator.
- Size was chosen based on containment study determining the range of different particles at different momenta.
- Utilizes both FD and ND front-end boards to study electronic response differences between them. So far, 32 out of 63 planes have been filled with liquid scintillator and hooked up to front-end electronics.



Detector commissioning

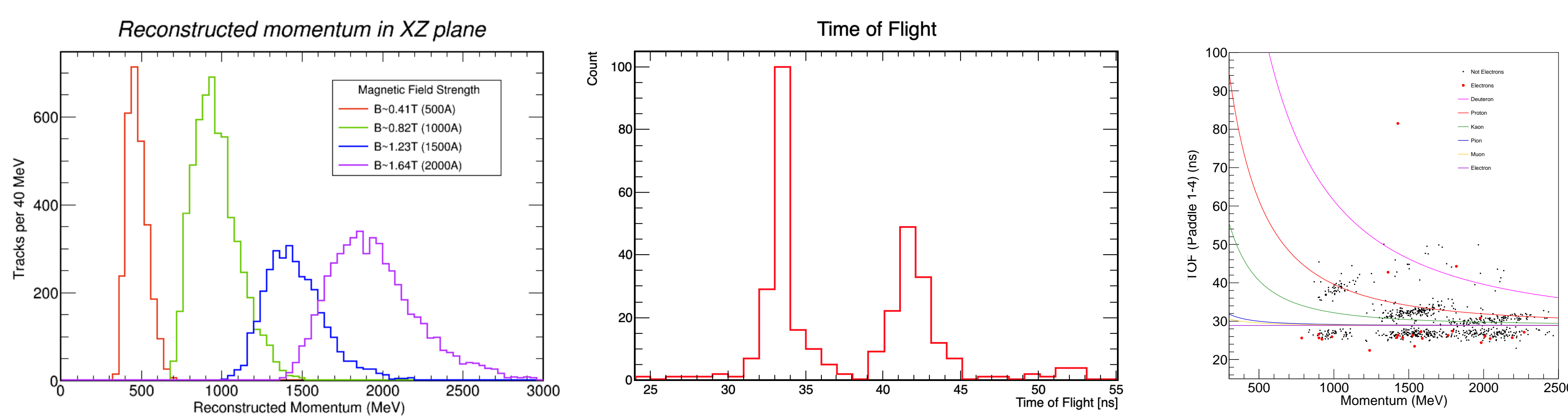
- Commissioning runs in progress, cosmic and beam data taking.
- Currently focusing on synchronizing with beamline components.



Display of a cosmic ray event.

Beamline Commissioning

A set of reconstruction algorithms is in place. Tracks of beam particles are reconstructed from MWPC, allowing momentum measurement (left). Together with Time-of-Flight (middle) and electron selection from the Cherenkov counter, the PID of beam particles can be performed (right).



Status and plans

- Beamline detectors' instrumentation and installation has been finalized. Timing calibration is in progress.
- Remaining 31 planes of the second block will be filled during the 2019 shutdown.
- Status of all beamline components and detector can be monitored and controlled via Synoptic system.
- Reconstruction are developed, tested and used in beamline commissioning to study momentum, TOF and PID.

This document was prepared by [NOvA Collaboration] using the resources of the Fermi National Accelerator Laboratory (Fermilab), a U.S. Department of Energy, Office of Science, HEP User Facility. Fermilab is managed by Fermi Research Alliance, LLC (FRA), acting under Contract No. DE-AC02-07CH11359.

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