

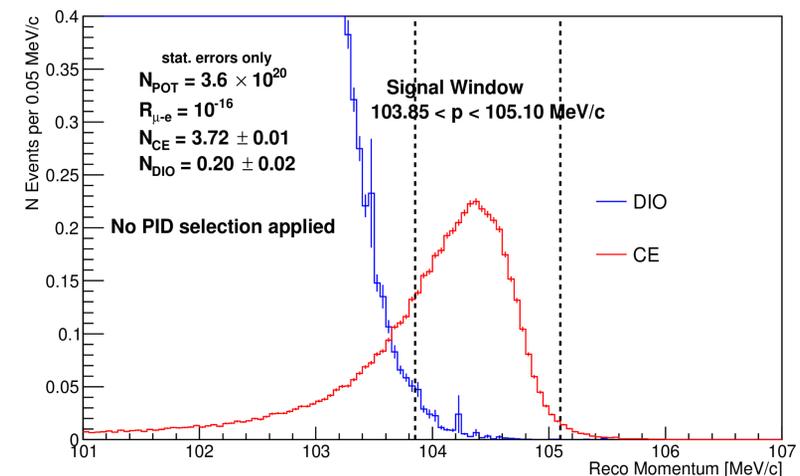
## Overview

The Mu2e experiment will search for the charge lepton flavor violating process of neutrinoless muon to electron conversion in the field of a nucleus with a single event sensitivity of  $2.4 \times 10^{-17}$ .

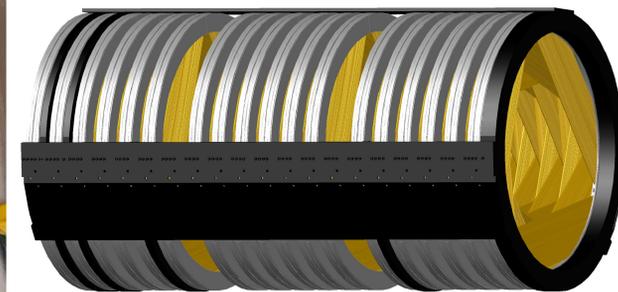
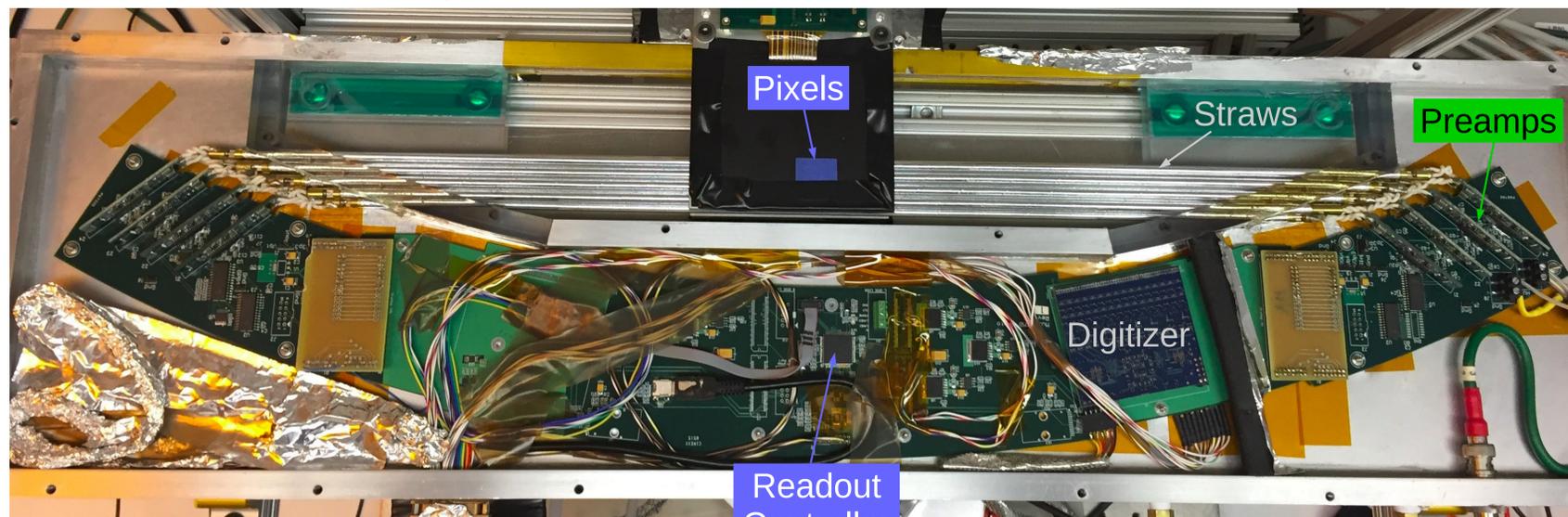
Muon to electron conversion produces a monoenergetic 105 MeV electron. A high resolution (RMS < 200 keV/c) tracker is required to separate conversion electrons from the lower energy electrons produced by muons decaying in orbit.

To achieve such a high resolution, Mu2e will use a low-mass straw tracker operating in a vacuum consisting of 20,763 straws grouped into 18 stations, each of 12 panels.

A fully functional, 8-straw prototype was built to test that the tracker design will meet the resolution requirements using cosmic rays, radioactive sources and proton beams.



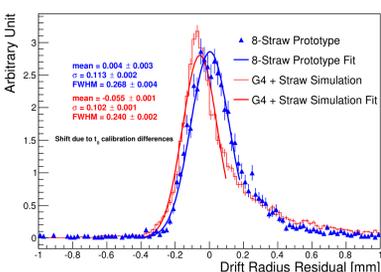
Reconstructed momentum of conversion electrons (CEs) and decay-in-orbit (DIO) electrons from simulation. Full background overlays have been used and no PID selection has been applied.



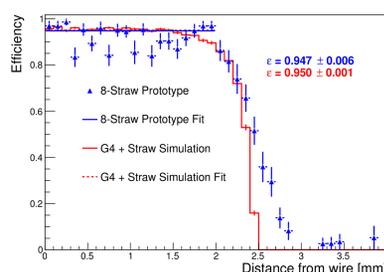
CAD drawing of the Mu2e tracker

## Cosmic Rays

The straw hit efficiency and transverse resolution were measured using two ATLAS pixel modules<sup>1</sup> to record cosmic muons. The results meet specifications and are consistent with tuned simulations.



Transverse hit resolution for simulation (red) and prototype data (blue).

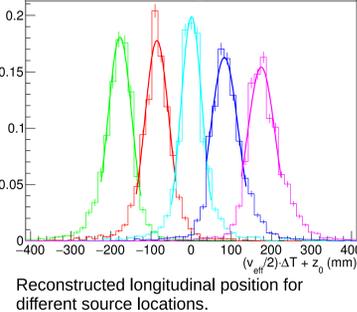
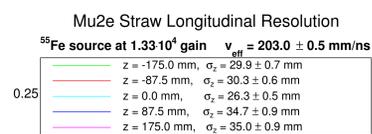


Straw hit efficiency as a function of the distance from the wire for simulation (red) and prototype data (blue).

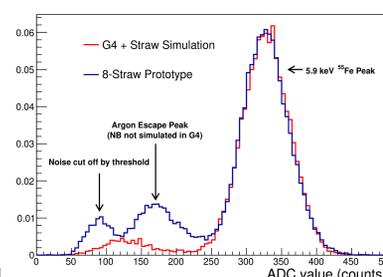
<sup>1</sup>We thank the LBNL ATLAS group for their technical support and the pixel modules they provided for these measurements.

## Sources

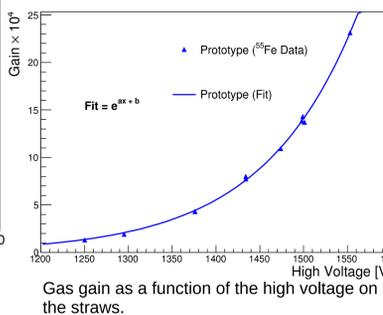
An <sup>55</sup>Fe source was used to measure the gas gain as well as the longitudinal resolution.



Reconstructed longitudinal position for different source locations.

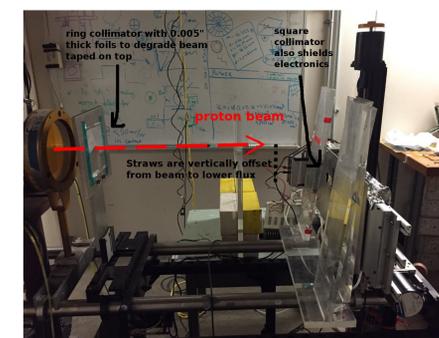


ADC value of the pedestal subtracted pulse height for simulation (red) and prototype data (blue).



Gas gain as a function of the high voltage on the straws.

## Beam



A 20 MeV proton beam from the 88" cyclotron at LBNL was used to test the prototype for cross-talk and SEUs.

Proton induced cross-talk was found to be small, corresponding to <1% deadtime for Mu2e straws.



The Altera Cyclone-V had >1 Hz configuration SEUs. Mu2e will use the rad-hard Microsemi SmartFusion2 instead.