The MINERvA Test Beam Study

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(http://minerva.fnal.gov.)

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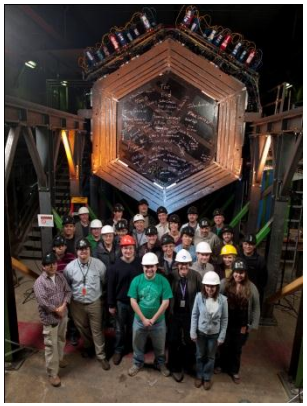
1. Introduction

MINERvA collaboration (http://minerva.fnal.gov) is a high statistics neutrino scattering experiment based at Fermilab. (http://www.fnal.gov).
It is a Main INjector ExpeRiment of ν-A interactions.

It is constituted by 100 physicists from 22 institutions in 7 countries -USA, Russia, Mexico, Chile, Peru, Brazil, Greece-.



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Its mains goals are the following:

1. Study ν-A interactions, with A like C, Pb, Fe, H20, He and neutrino energy from 1 GeV to 20 GeV.

2. Study ν-A exclusive final states, and also do inclusive cross section measurements.

3. Study ν-A interaction form factors and structure functions.

4. Study nuclear effects in neutrino scattering.

2. MINERvA Experiment

MINERvA experiment is completely setup and taking data.

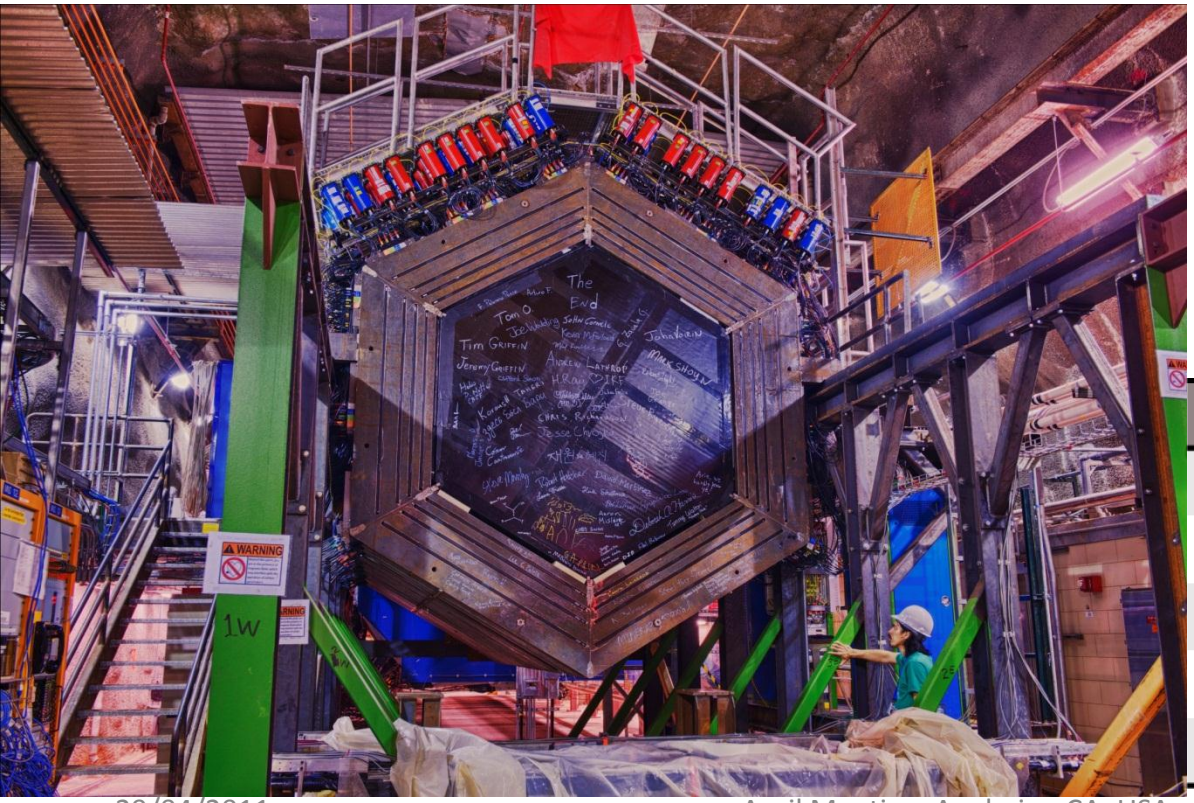
It is in the NuMI Beam line, upstream of MINOS near detector, 105 meter underground.

For calibration of the MINERvA detector, there is a smaller test beam detector that was put in the Fermilab Test Beam Facility.

The test beam detector was set up and took data in the summer of 2010. The data analysis is in progress.

2.1 MINERvA Detector

It is a fully compact detector that uses the NuMi line of FERMILAB, to study the neutrino (antineutrino) nucleus interactions.

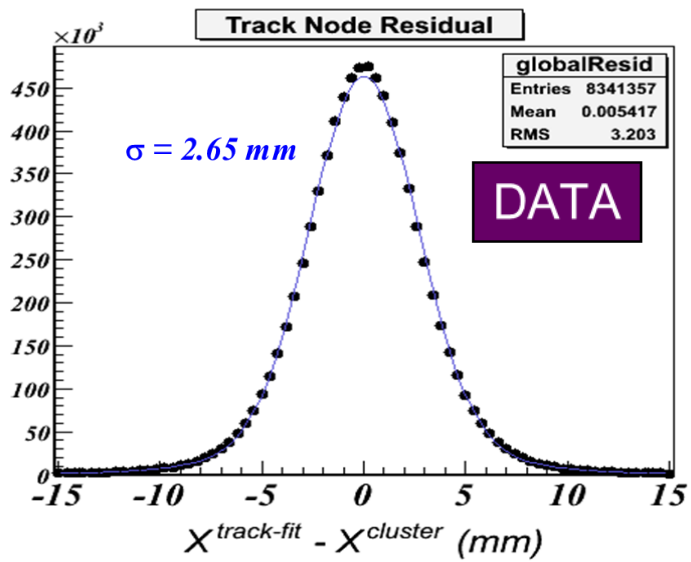


It is directly located upstream of MINOS near detector.

Nuclear Target	Fid .Vol.
CH (tracker)	6.43t
He	0.25t
C	0.17t
Fe	0.97t
Pb	0.98t

The data acquisition is for neutrino (antineutrino) on each of the five targets with neutrino (antineutrino) energies ranging from 1 GeV to 20 GeV.

Time resolution is 4 ns. Spatial one is in figure, 2.65 mm.



It has recorded, as of April 2011, about $1.3X10^{20}$ POT, for neutrino data, and $1.3X10^{20}$POT, for antineutrino data, where the peak of neutrino energy distribution is about 3 GeV.

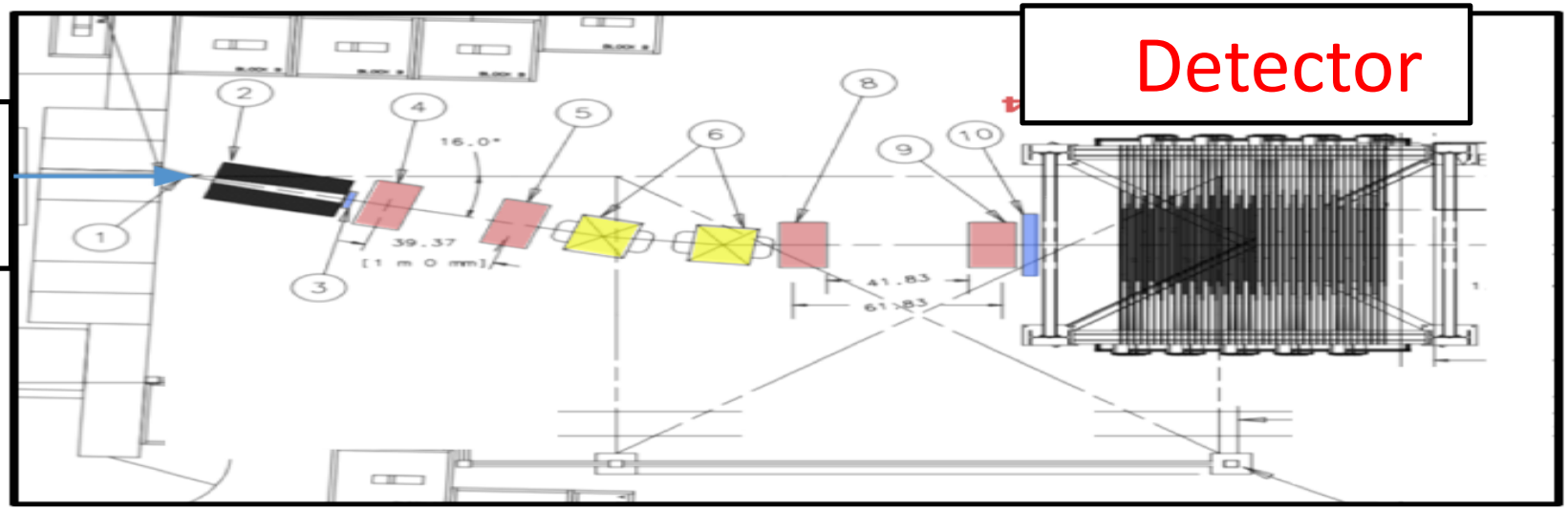
This low energy data is very useful for finding various signatures such as QE or single pion production.

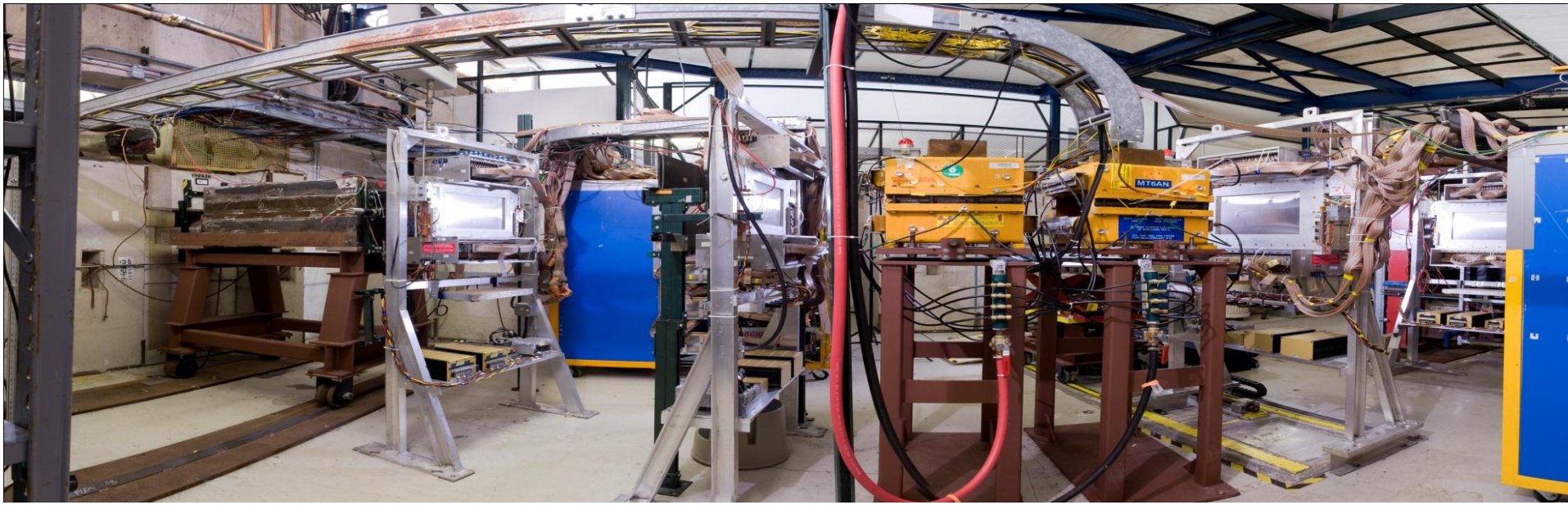
DIS is really going to be a feature of the medium energy data that we take after the NOvA Shutdown.

See J. Chvojka's talk for more details.

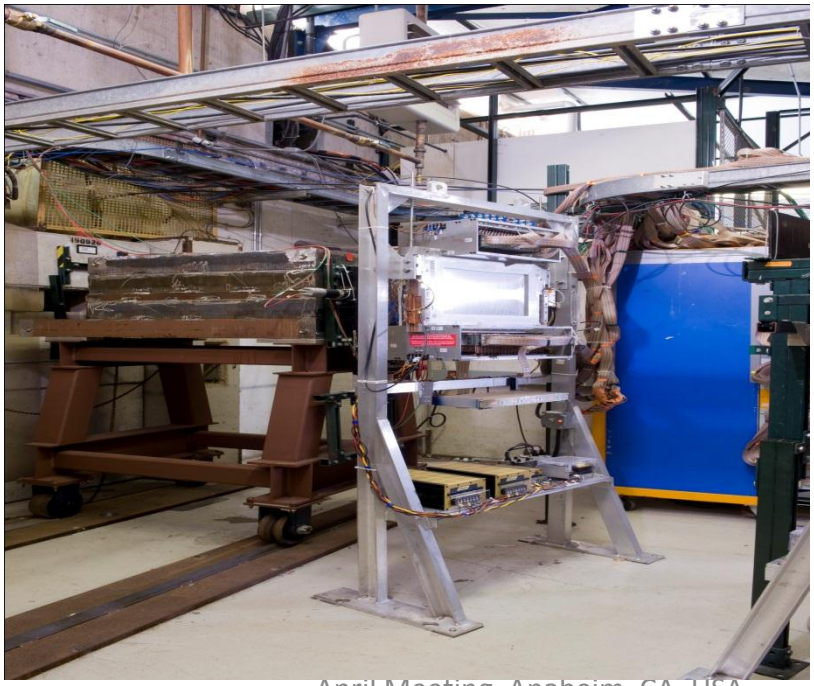
2.2 Test Beam Beamline

Beam
at
16 GeV



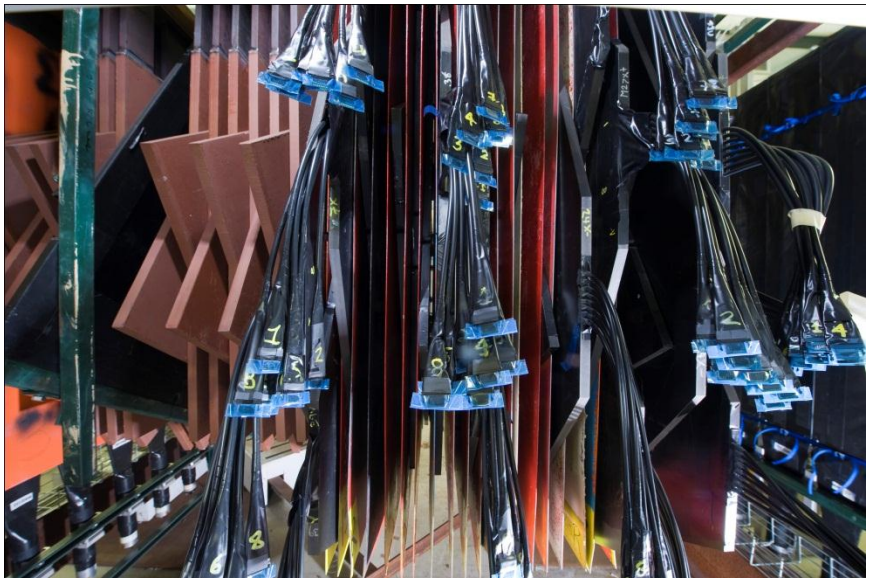


Its main goal is to run with π+ at different energies, at different fluxes, and hit the Cu target to obtain a tertiary beam of electrons, positrons, protons, pions, kaons, etc. and study how these particles interact with the detector material to determine the energy scale for these particles in the MINERvA detector.



Typical energies and fluxes are as follows:
16 GeV pion+, 346 spills with intensity of 300 000 POT per spill.

As of July, 2010 it was collected data as follows:
~107 000 events to analyze, running for 2 months.



3. MINERvA Test Beam Study

The studies are in progress.

The first step in the analysis is to determine the momentum of particles.
using the time of flight system.

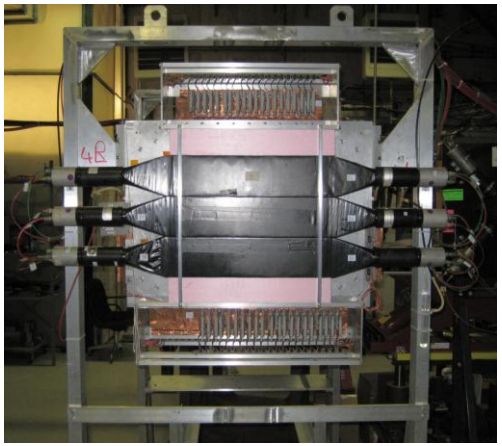
The second one is to determine the time of flight of the particles, and get the particle identification.

And the third one is to measure the detector response to those kinds of particles.

With the magnets on, the selected events, in one week, are as follows:

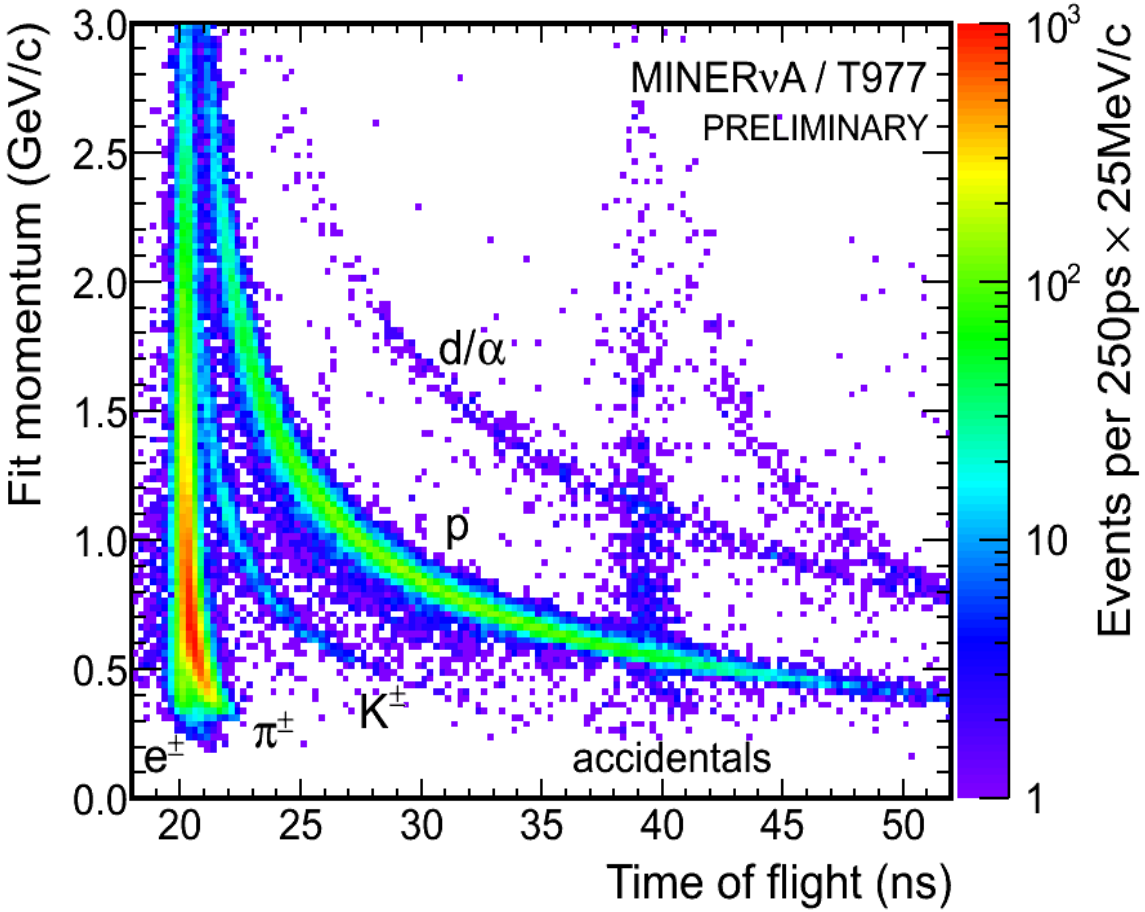
From June 9-21, 2010, 9 000 negative charged particles and from June 21-27, 2010, 10 000 positive charged particles.

Some results are as follows:



4. Analysis Status

Resume



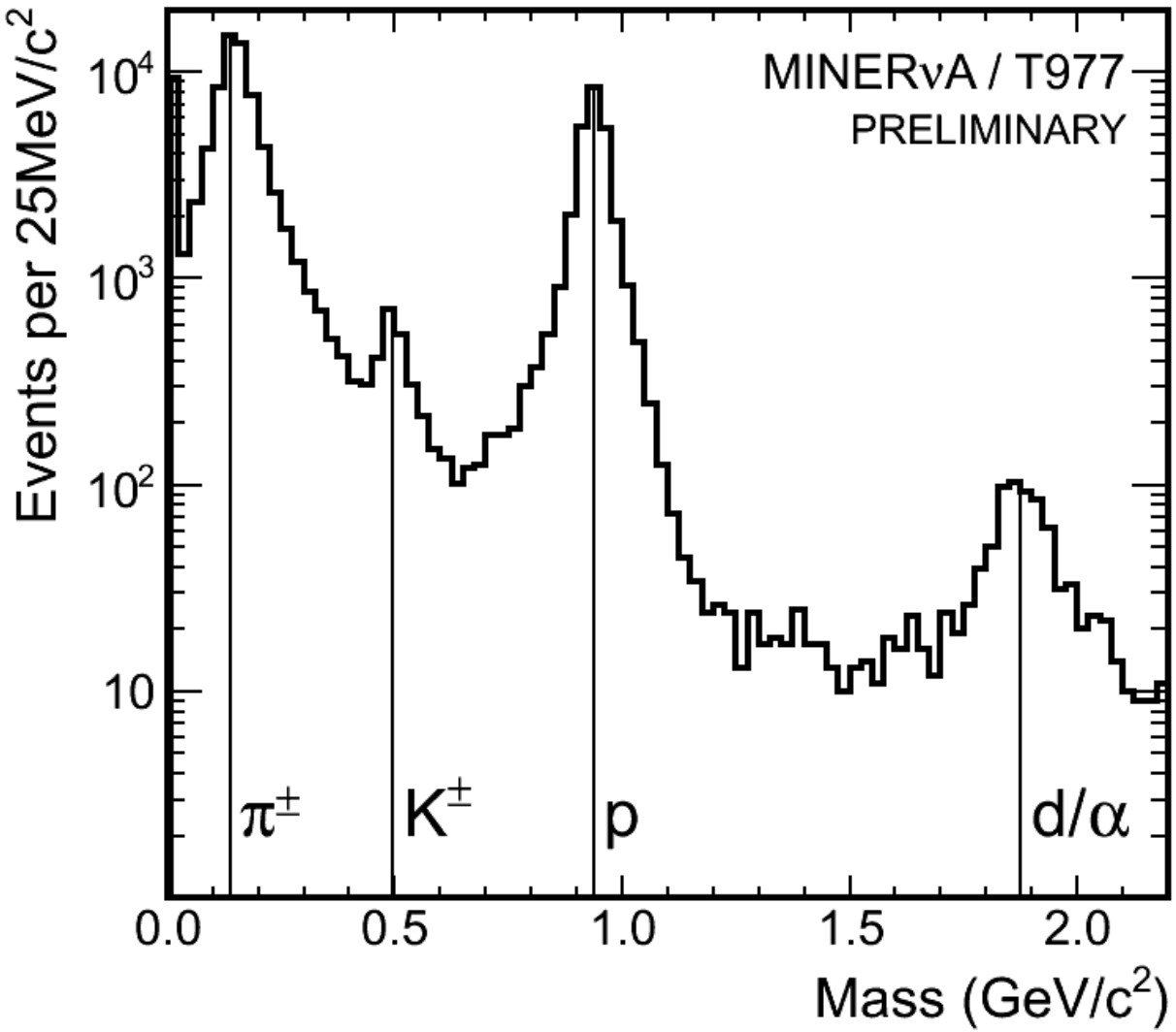
20E-20H (calorimeter)
negative particles: 8930

20E-20H (calorimeter)
positive particles: 10153

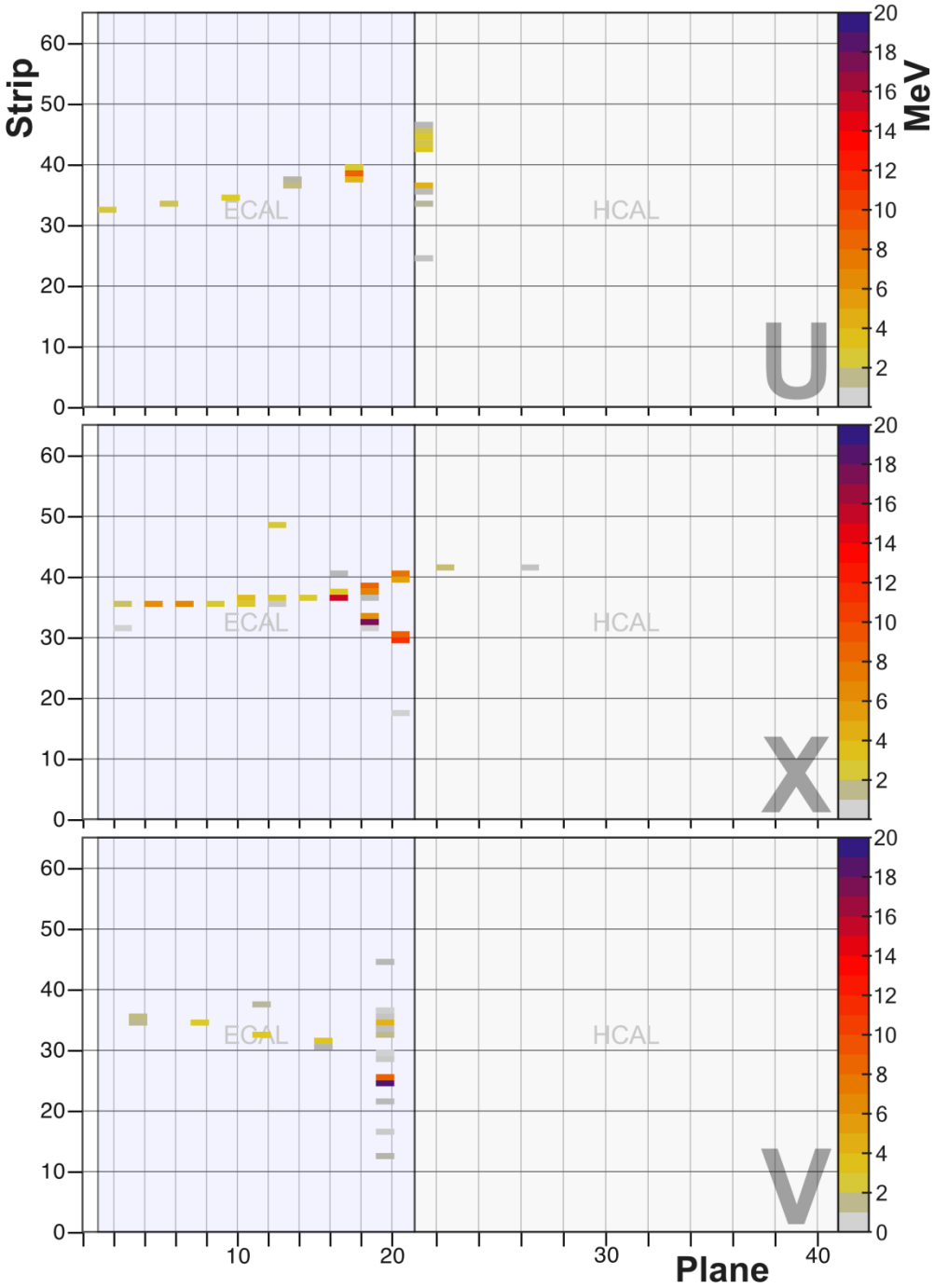
20T-20E (tracker)
positive particles: 15734

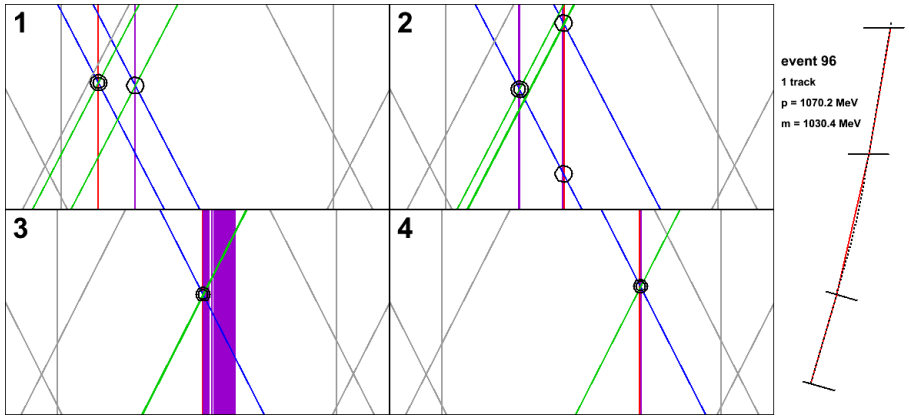
20T-20E (tracker)
negative particles: 1581

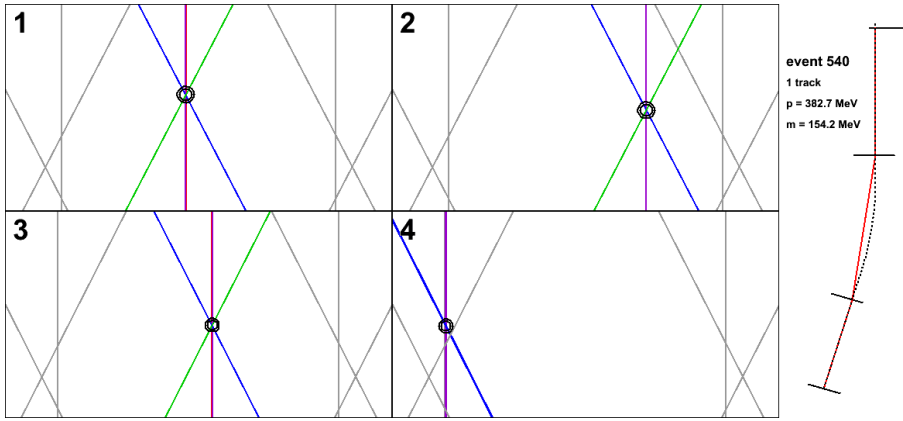
Mass of Particles



Pion signals







5. Conclusions

We took event statistics in various configurations, and we are analyzing the data.

The Test Beam line goal in momentum resolution is less than 2%.

So far we have identified particles that enter the Test Beam detector.