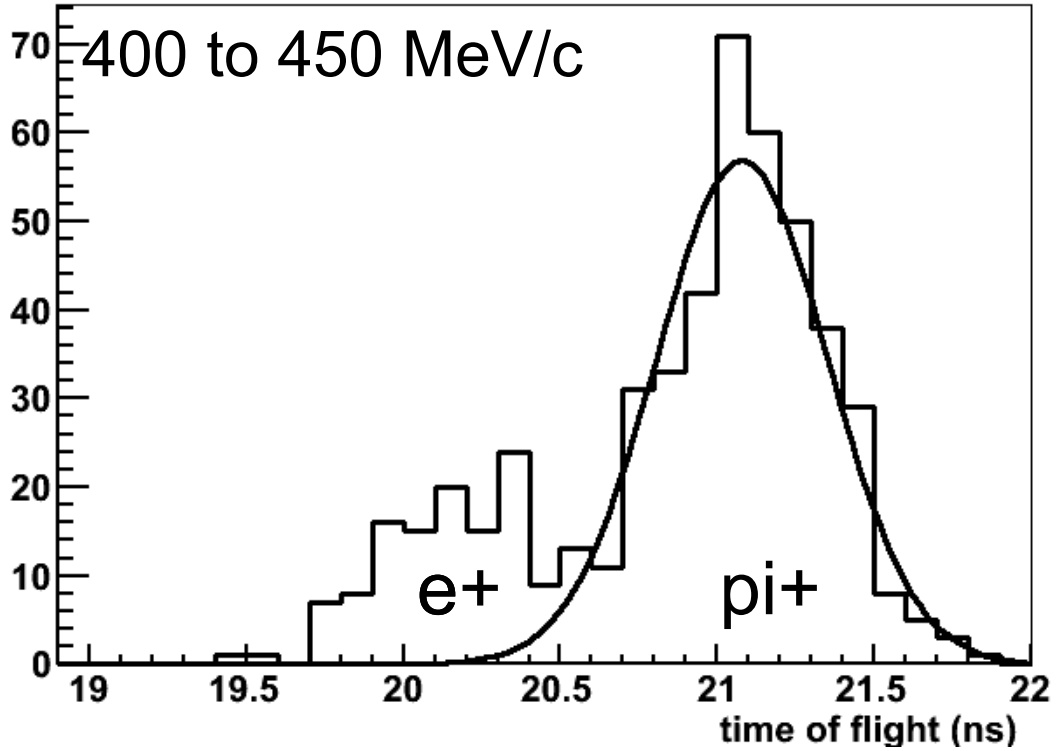
electron:pion ratio and possible LArIAT momentum spectra extracted from MINERvA/T977 beam data

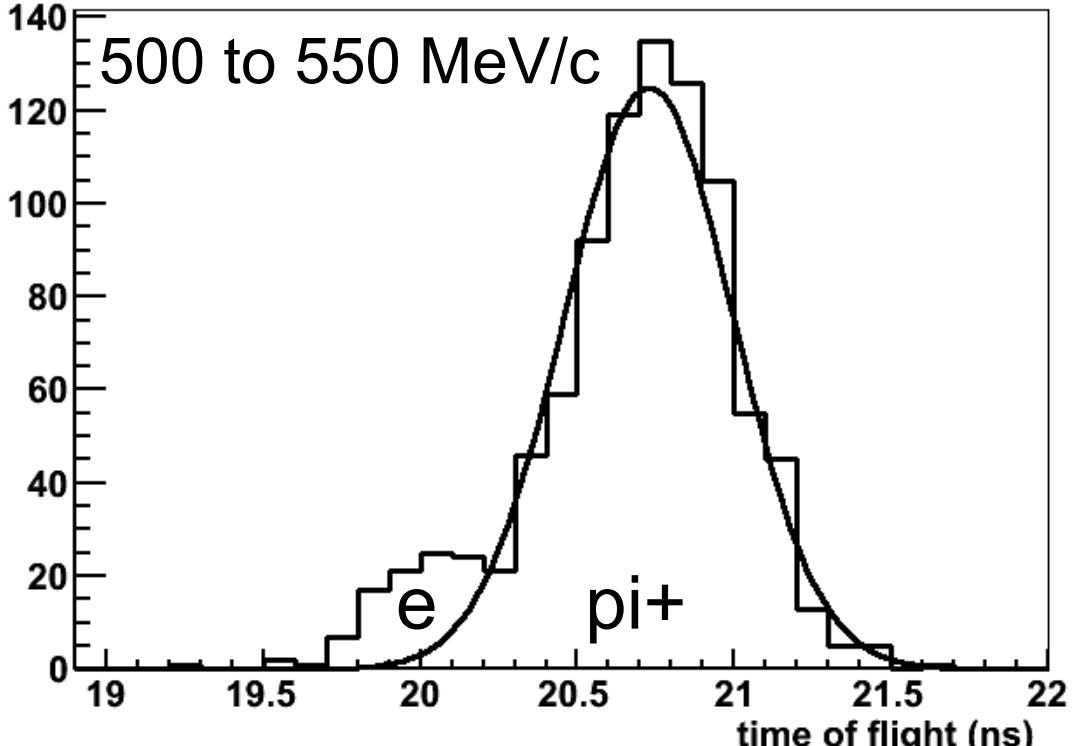
The data I show is from the positive polarity runs
That we took with the 20ECAL20HCAL configuration
over the course of a week.

Scaling data rates is hard, because several aspects
of the intensity, trigger, and LAr readout conditions
will be different, possibly very different.

But relative rates for species and momenta spectra
are the useful things I wanted to present.

Rik Gran, December 2012





Positron content

Positive polarity beam electrons and pions separated by TOF.

TOF resolution 200ps

Selection is after aggressive, high purity hardware rigger and clean WC reco.

Eliminates cases where multiple particles were hitting WC's and bad reco p fits

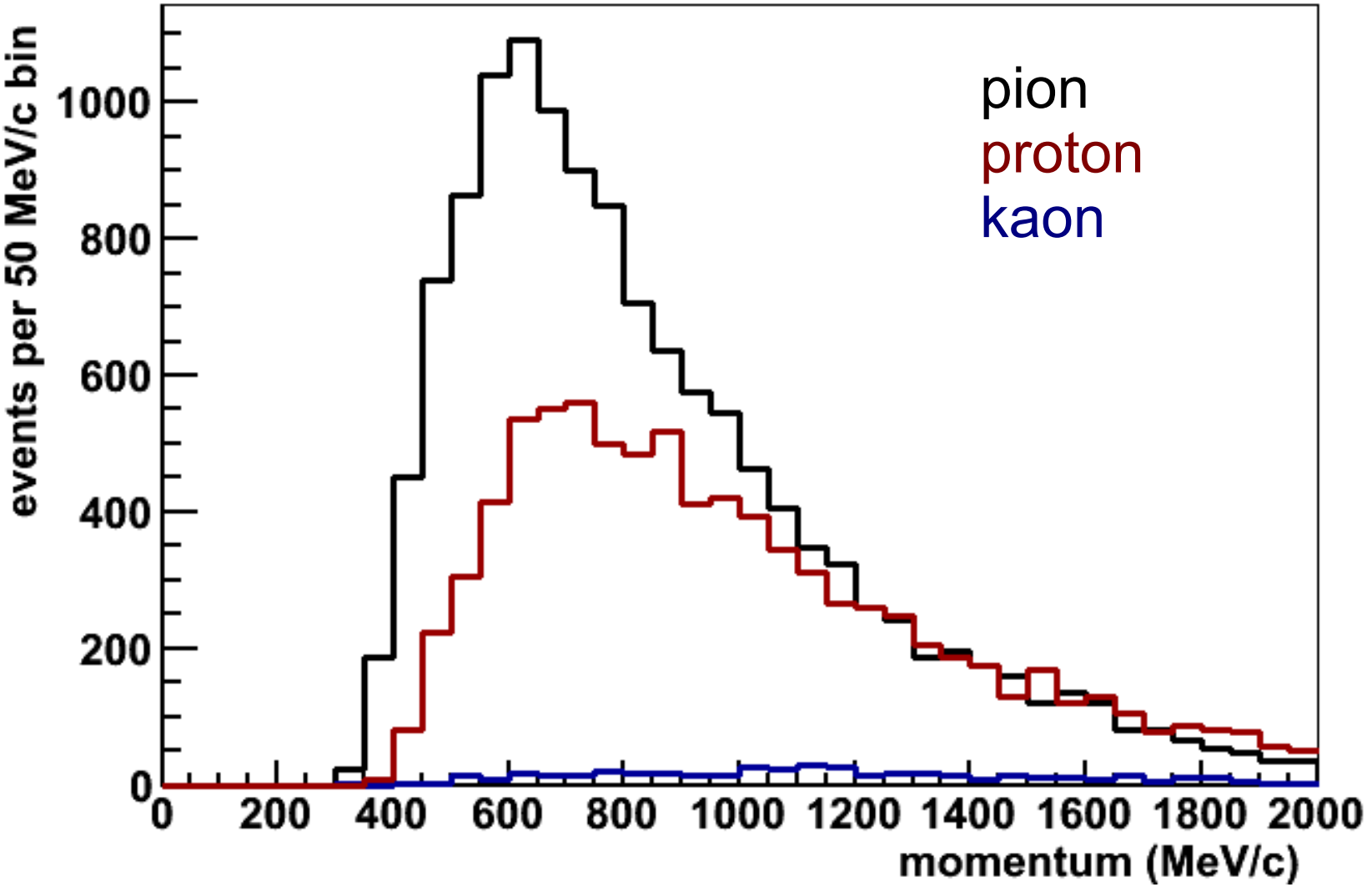
Summary of electron:pion ratio

Momentum range	e:pi
< 400 MeV/c	0.53
400 to 450 MeV/c	0.29
450 to 500 MeV/c	0.14
500 to 550 MeV/c	0.09
550 to 600 MeV/c	0.08

The absolute rate of electrons in these 50 MeV/c bins is falling from about 110 to 50 in this data set.

Above 600, our TOF resolution is not good enough to know. But we had a simulation that seemed to confirm that the electromagnetic content of the triggers continued to decrease as we went up in energy.
The simulation included the trigger-like requirement
One and only one particle traverses the beam instrumentation.

Summary of other species vs. momentum



MINERvA/T977 positive polarity beam

Events pass beamline reconstruction, no detector selection

Hard to see, K+ is 10 to 15 per bin from 500 to 1600 MeV/c

Note on kaons

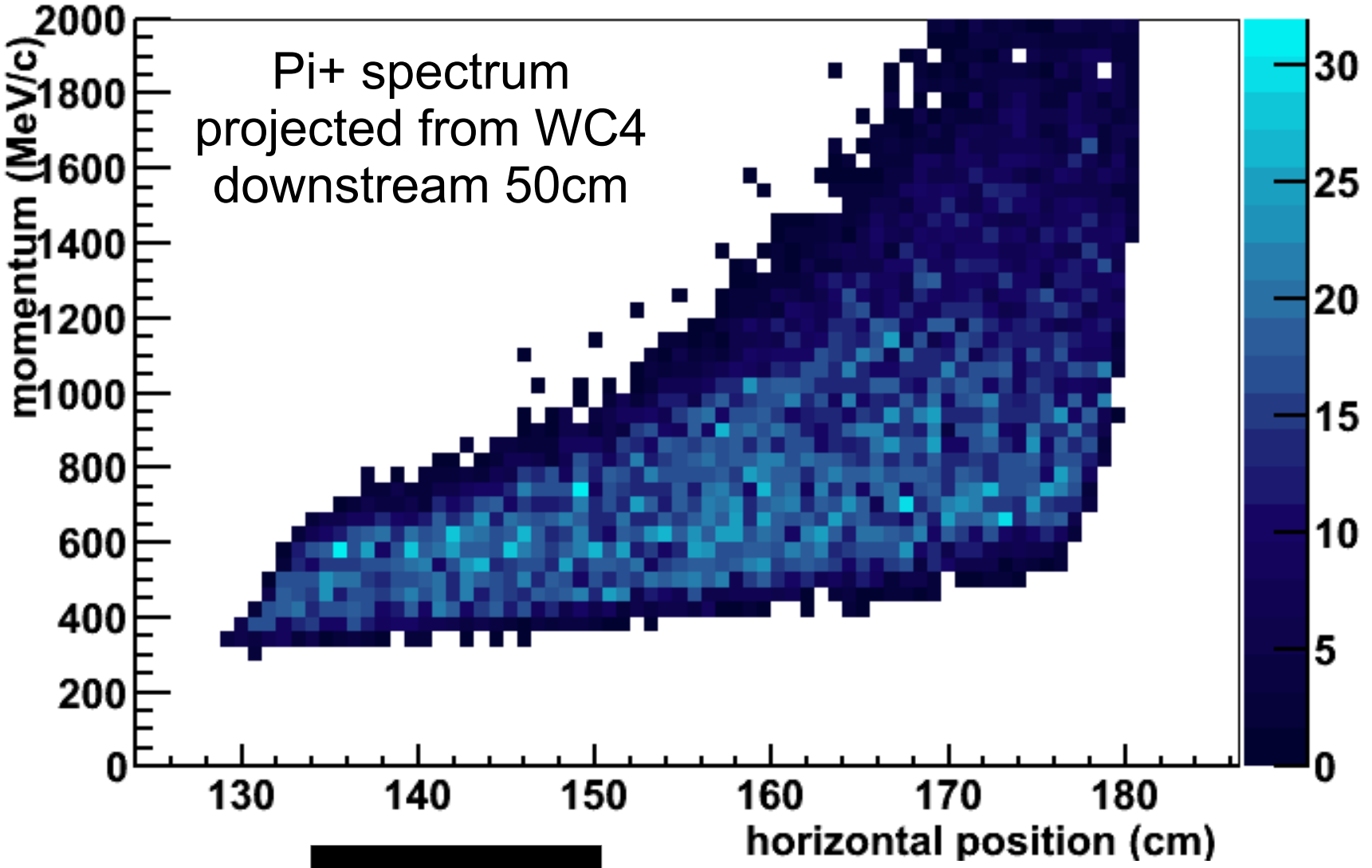
A large fraction of the kaon triggers were not useful
Because they decayed before entering the detector.

Compared to pions, they travel slower,
(our detector was ~100 cm behind WC4)
and anyway have half as long a mean lifetime.

About half the kaon triggers don't appear in the detector
as an interesting kaon event. Muon or decay stuff only.

(Compare to about 10% of pion triggers)

Horizontal beam profile 50cm down from WC4



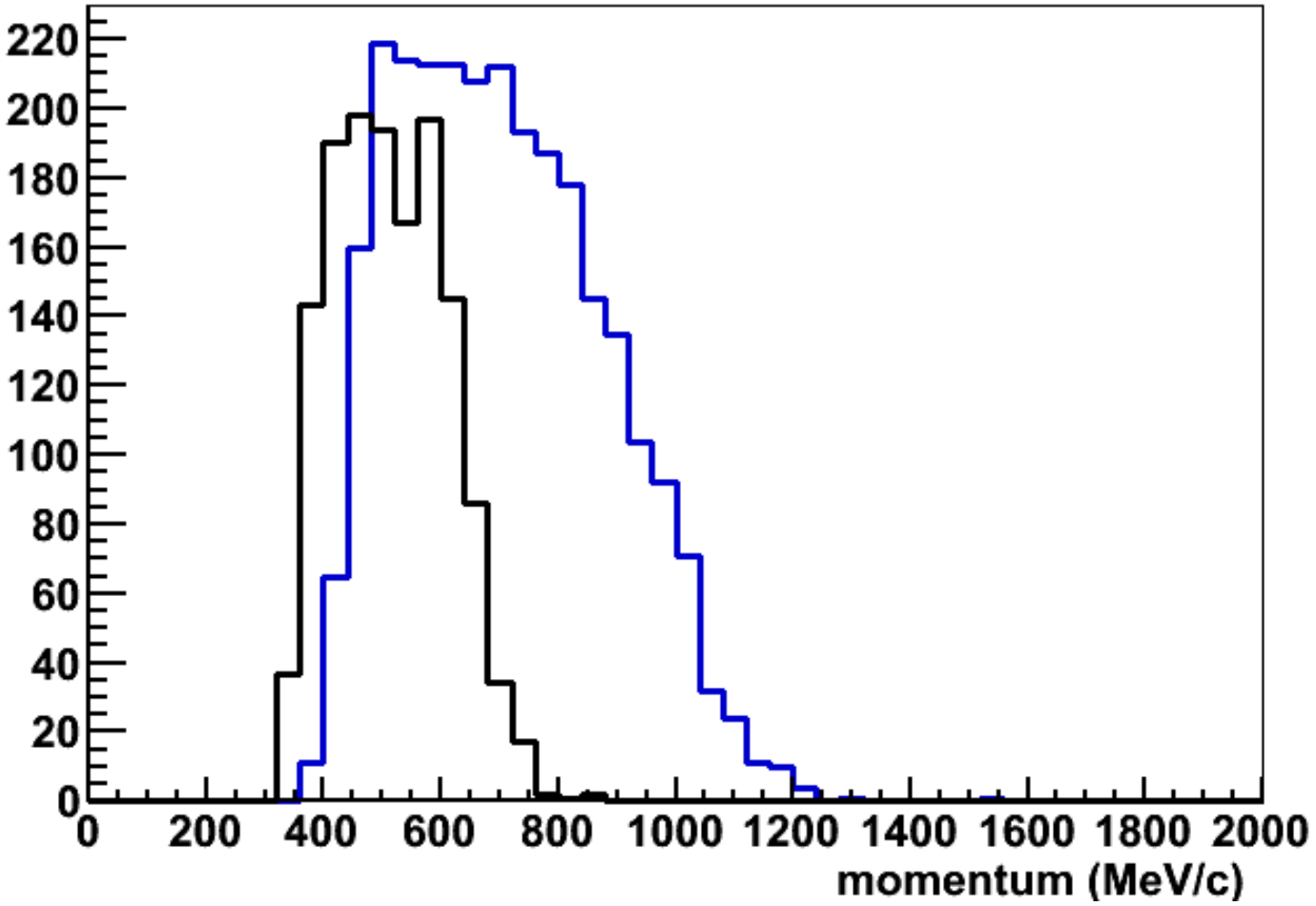
6 inch diameter aperture

center at 138 cm

center at 155 cm

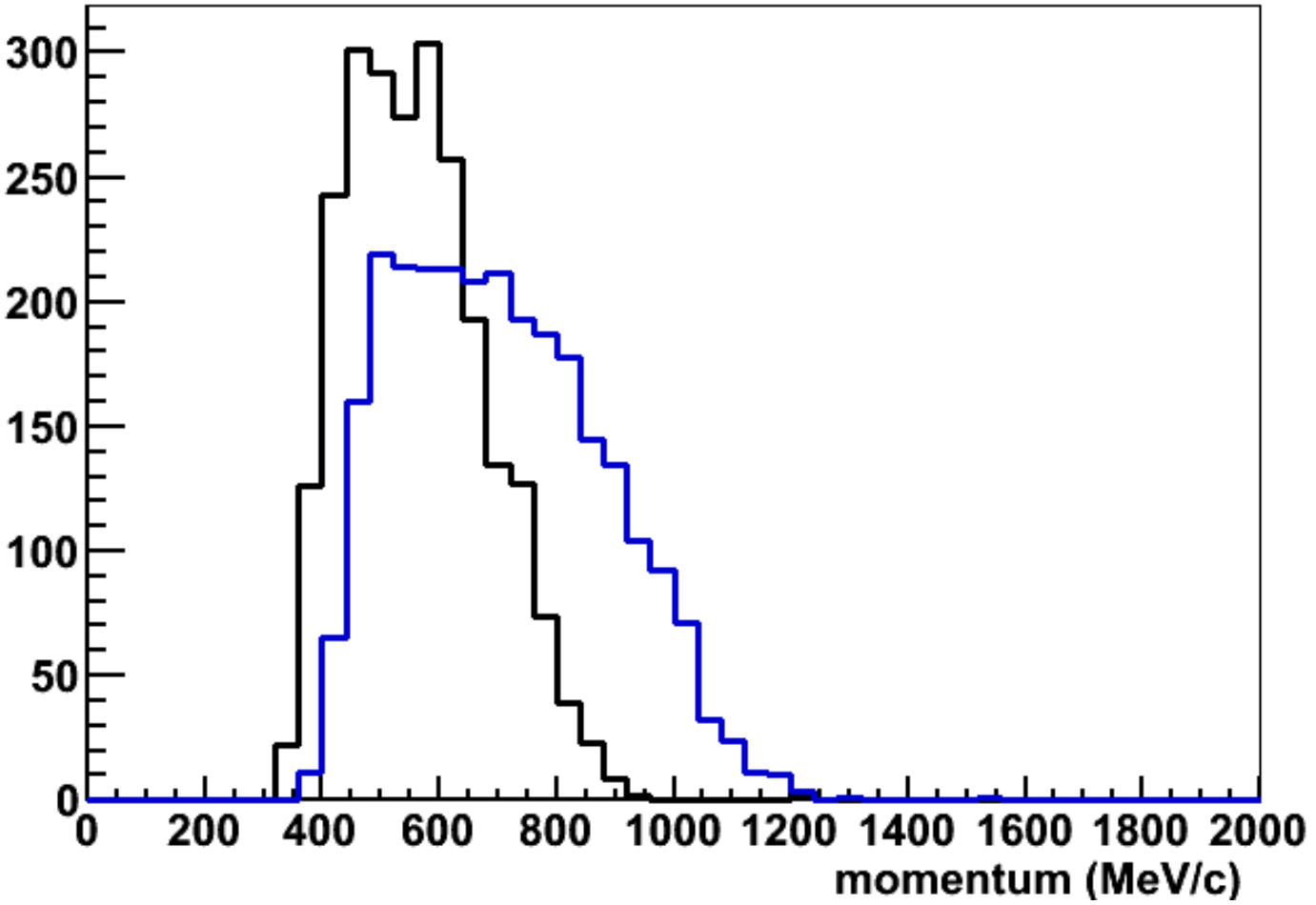
Imagine placing Argoneut detector at these two locations

Pion momentum profiles at 138 cm and 155 cm



Blue is measured and projected to 155 cm
Black is measured and projected to 138 cm
Though really we want to change magnet field, not move the detector (next slide)...

Pion momentum profiles at 155 cm, two B fields



Blue is measured and projected to 155 cm.
Black is same projection, but simple geometrical scaling that corresponds to dropping Pt kick from 115 to 80 MeV/c
Protons are similar. Our data doesn't allow me to go lower.

Comment after today's talk

If we want to get a beam containing 300 MeV/c to 500 MeV/c Pions, we maybe want to put Argoneut around the 135 cm position AND turn down the magnet current.

(but check the simulation, how many 300 MeV/c pions are Produced and survive to that point?)

BUT the problem is we don't get any 1000 MeV/c anything at that position, even at the full 100 Amp magnet current.

If we want both high momentum and low momentum,
Then we need to put the detector at 155 or 160cm
And turn the magnet down even more when we want
To grab the 300 MeV/c pions.
Turn it up again to get the stuff at 1000 MeV/c.

Or engineer that we can put the detector in two locations.

One other comment after today's talk

I talked about the location of an Argoneut sized detector.

The size and location of WC2 also affects
The momentum selection.

For MINERvA, we used a large chamber
and accepted basically the entire magnet aperture
about 20 cm wide.

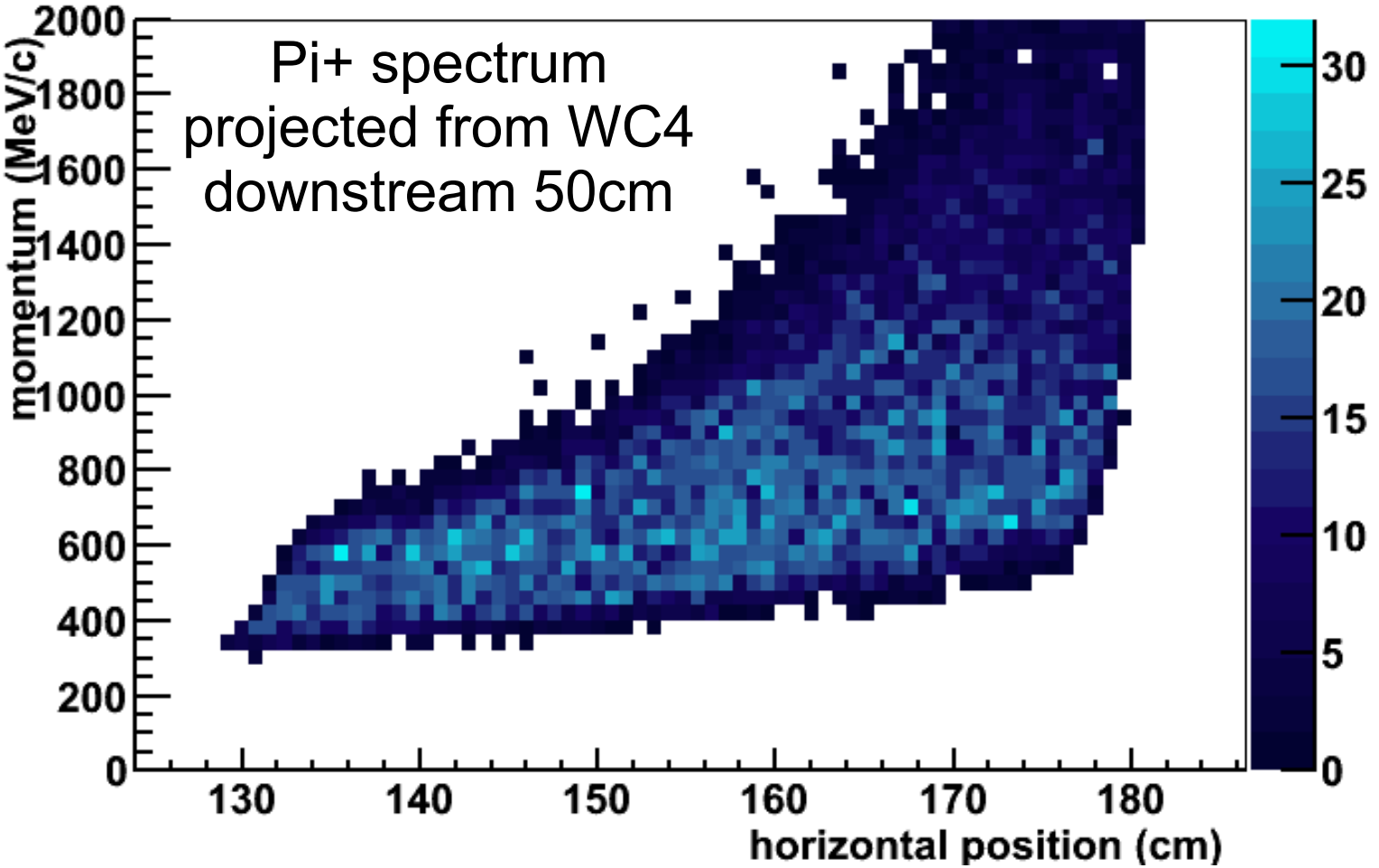
But the Fenker chamber has (?) a 6” window so ~ 15 cm.

Putting it in the middle of the magnet aperture
will miss particles both with
the lowest momenta (further outside)
and the highest momenta (further inside).

Momentum resolution ~2% total; worse at low p

Better from multiple scattering

Worse from Multiple Scattering ~1.5% pion ~3% proton



Better from wire pitch

Worse from wire pitch ~1%

Plus ~uniform 1% in quadrature, probably from non-uniform B-field

No one source dominates for whole sample,

Take them in quadrature, typical ~2% resolution is pretty good.