Monitoring Update

1. Objectives of Monitoring System
2. Possible Changes to Beamline
3. Hadron Monitoring System
    - MC predictions
    - Detector Choice
4. Muon Monitoring System
    - MC predictions
    - Detector Choice
5. Focus of next 6 days

Deborah Harris
Fermilab
June 9, 2000
Week in the Woods

Objectives for Beamline Monitoring

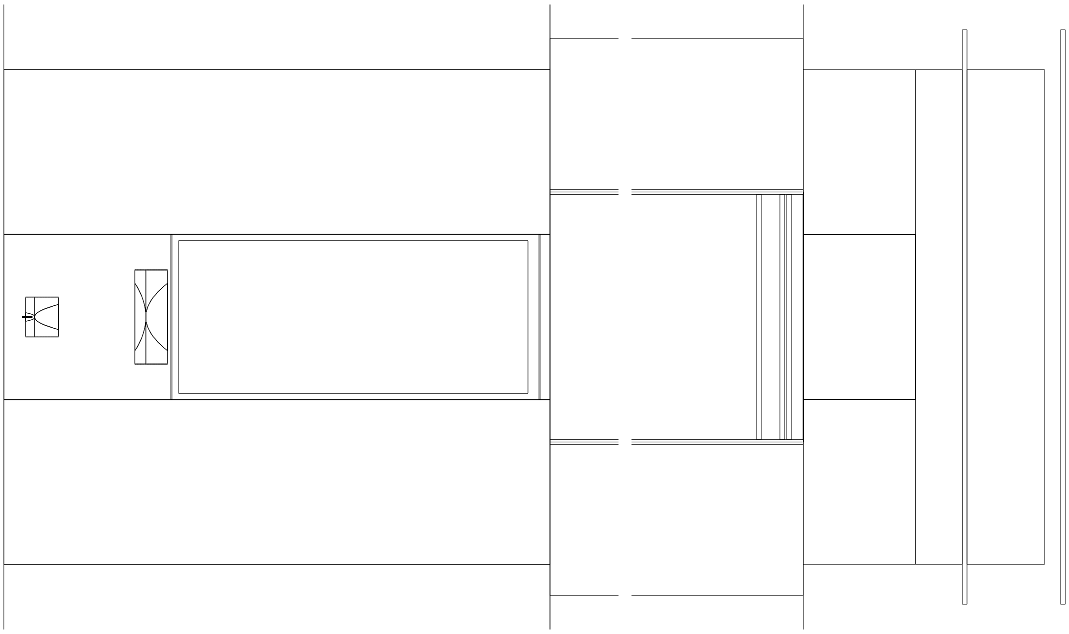
1. Beginning of Run
   - measure initial beamline performance
   - measure optimal running conditions
   - cross-check of alignment
2. During the Run
   - primary monitor of horns and target
   - corroborating monitor for primary proton beam (and target)
   - able to detect catastrophic failure
   - able to detect slow drifts from nominal
   - redundancy a goal to isolate problem

These objectives can be met by monitoring both secondary particles (hadrons) and muons

Beamline Variables

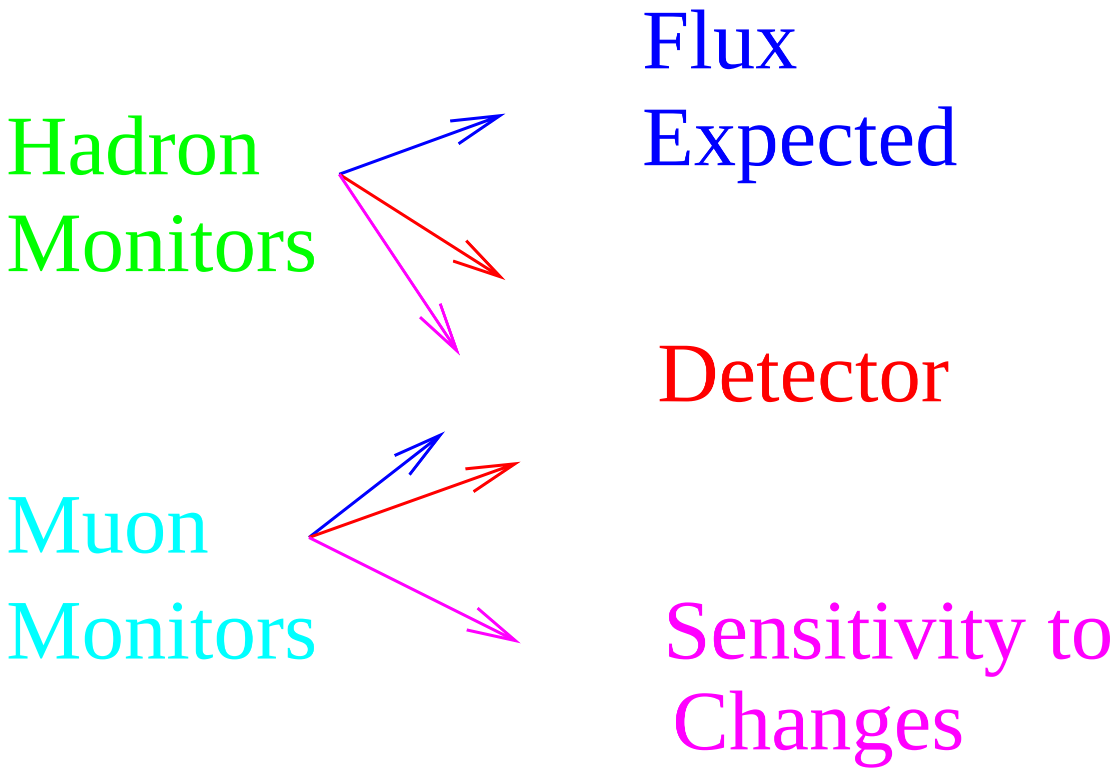
1. Single Turn Extraction
2. Low Energy (cf Medium Energy) Beam
   - Ensemble of relevant secondaries have lower momentum
3. Beam Plug in Low Energy beam
   - more secondaries produced after first horn
4. Hadronic Hose
   - additional focussing of secondaries
   - Downstream detectors monitor hose
   - upstream detectors still monitor horns
   - special spills without pulsing hose (1/5 min or so)

Proposed Monitor Locations

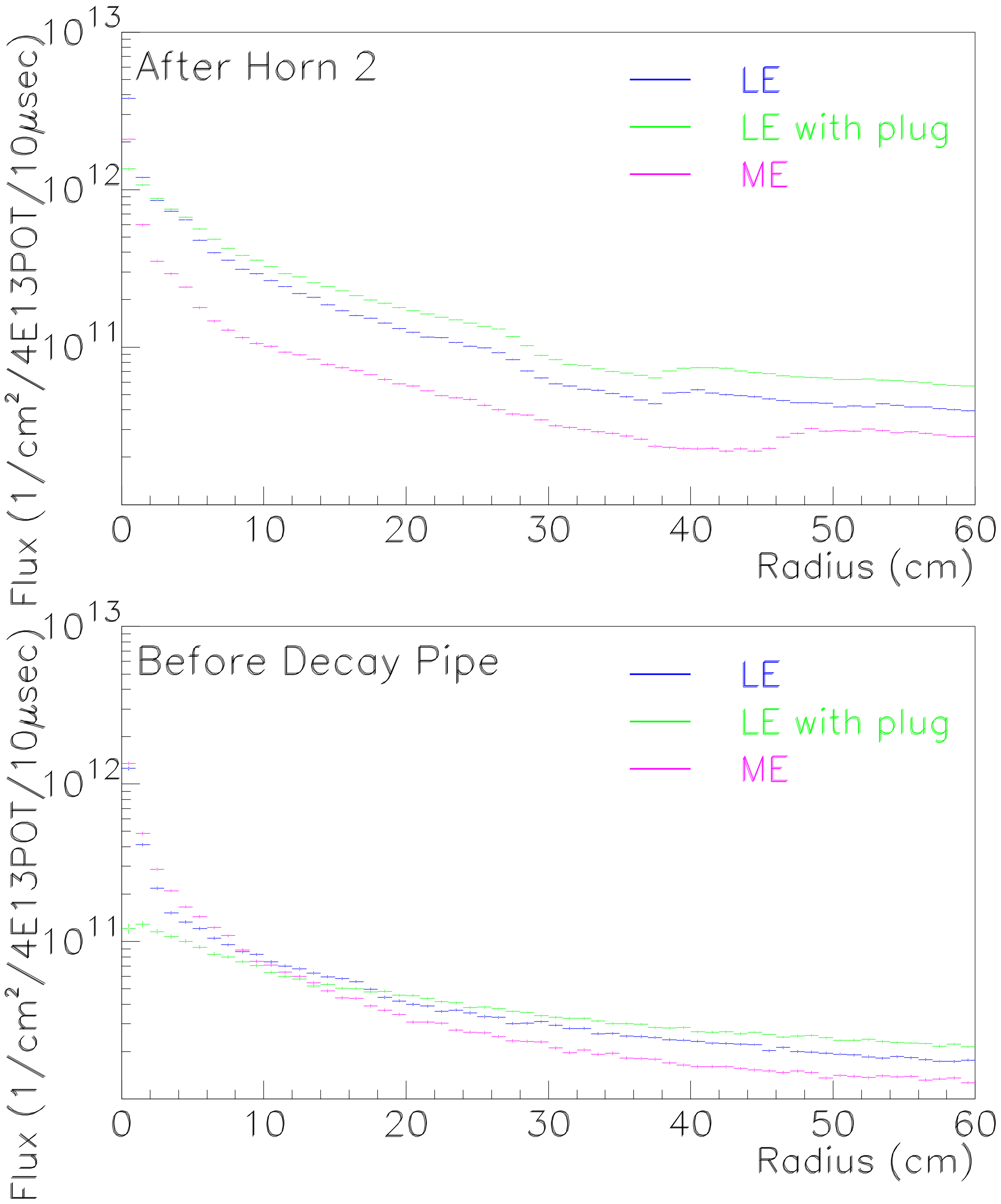


- Upstream Hadron Monitor
  Highest fraction of focused hadrons, hottest location, low detector mass needed
- Downstream Hadron Monitor
  long lever arm, but information diluted
- Muon Monitors
  purest particle composition, most directly related to neutrino beam

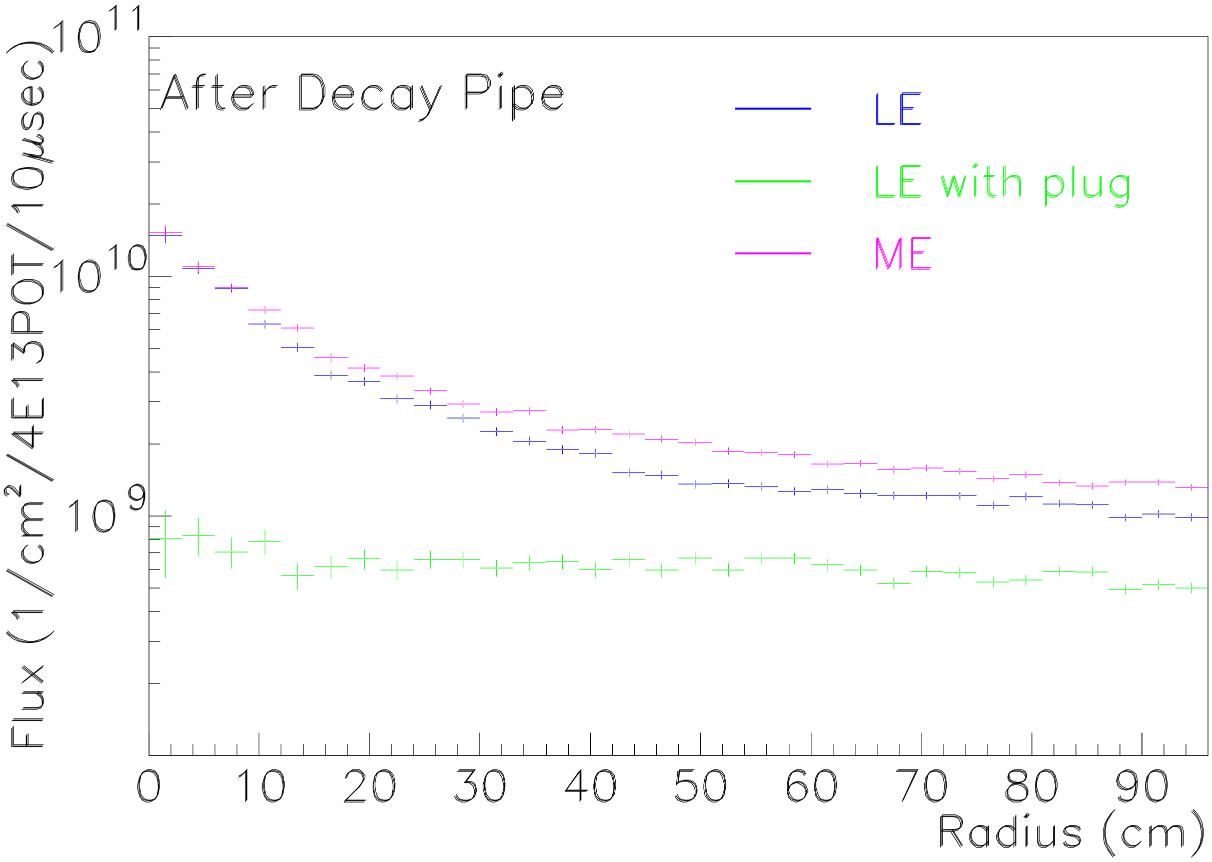
Remainder of Talk



Flux vs Radius for Upstream Hadron Monitors



Flux vs Radius for Downstream Hadron Monitor

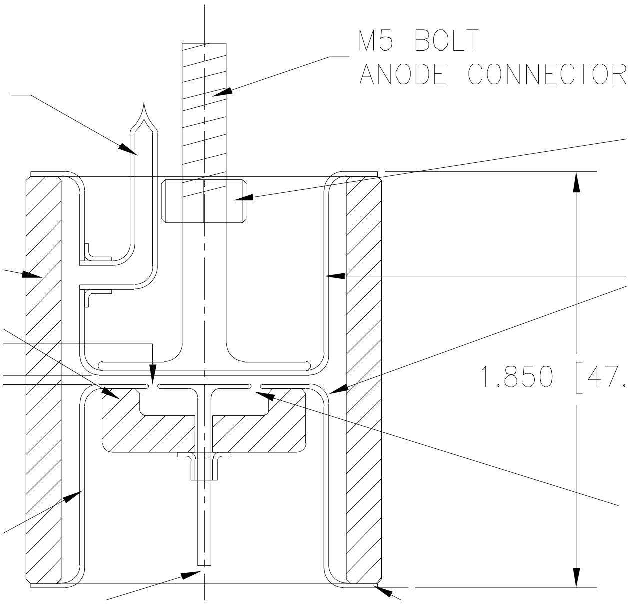


Status of the Hadron Monitoring System

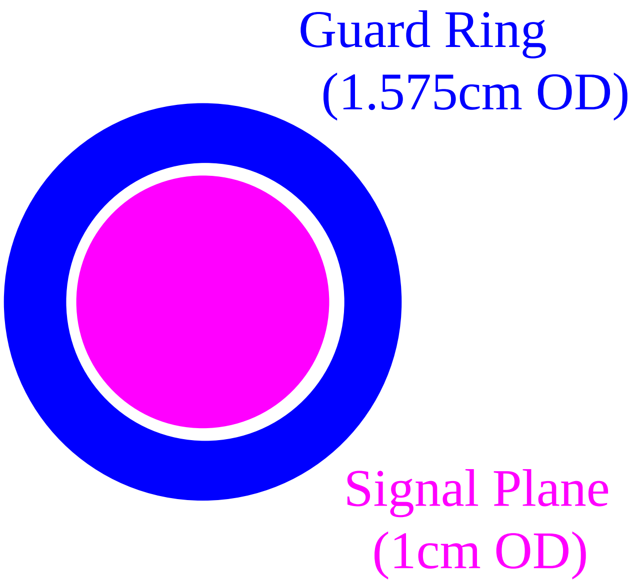
M. Velasko, S. Eichblatt, D. Schoo, G. Tassotto

- Technology: Small Ionization Counter
  - ceramic tube containing He (atm)
  - 1cm diameter signal region 1mm HV-signal plane separation
  - developed with Richardson Electronics (LaFox, IL)

Seen From the Side:



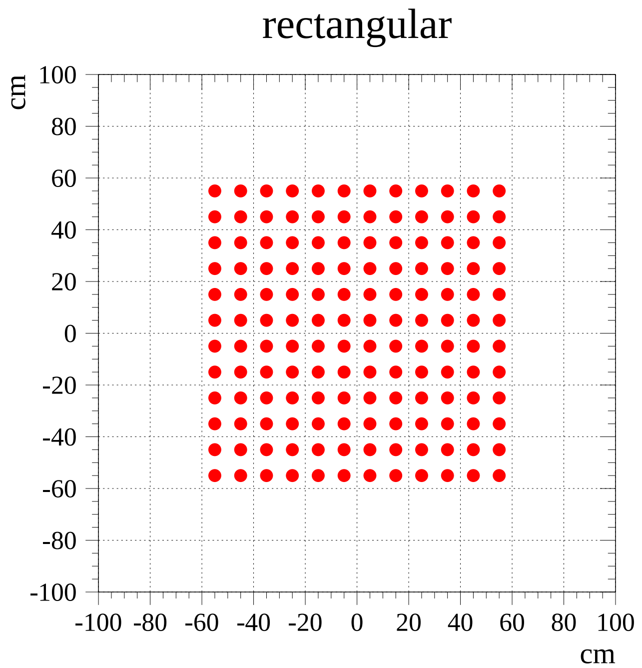
Seen from Above:

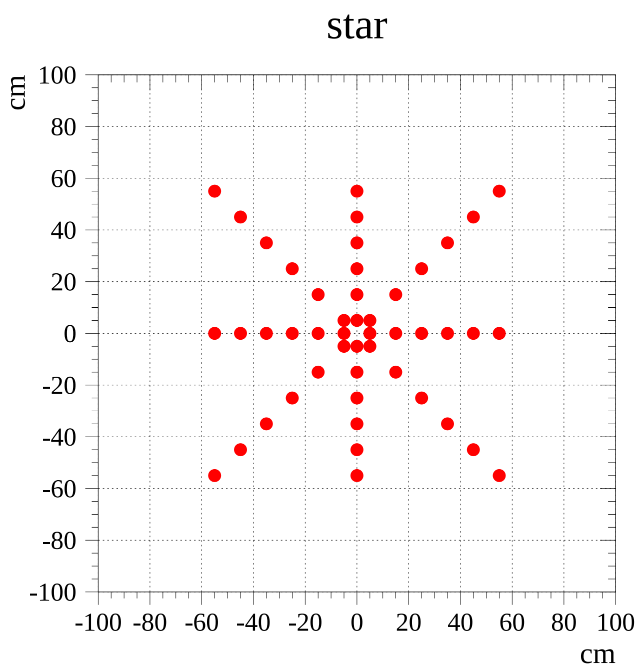


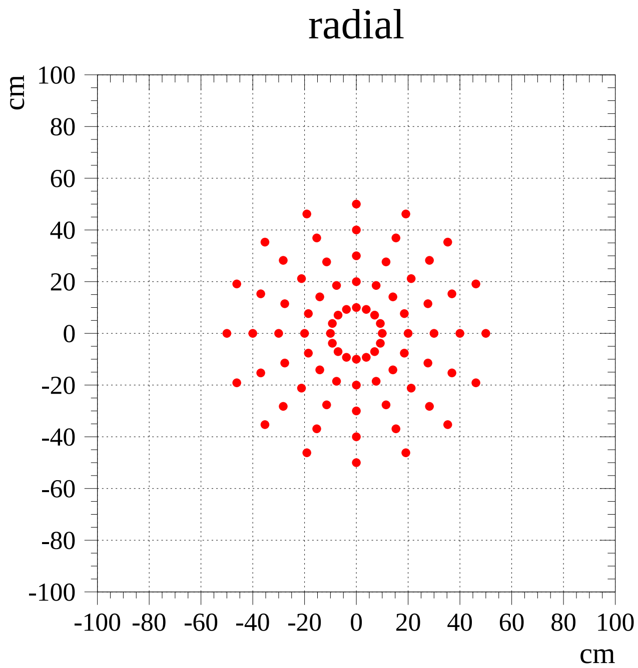
Hadron Monitoring System II

- Can take the instantaneous STE rates before and after decay pipe
- Electrode field simulations done to study distortions
- Power Supply developed, readout electronics being developed
- Radiation hardness tests of small prototype in Booster abort soon!
- Full size prototype tests to come next...
- Can also be used to calibrate muon monitors (and cross-calibrate themselves)

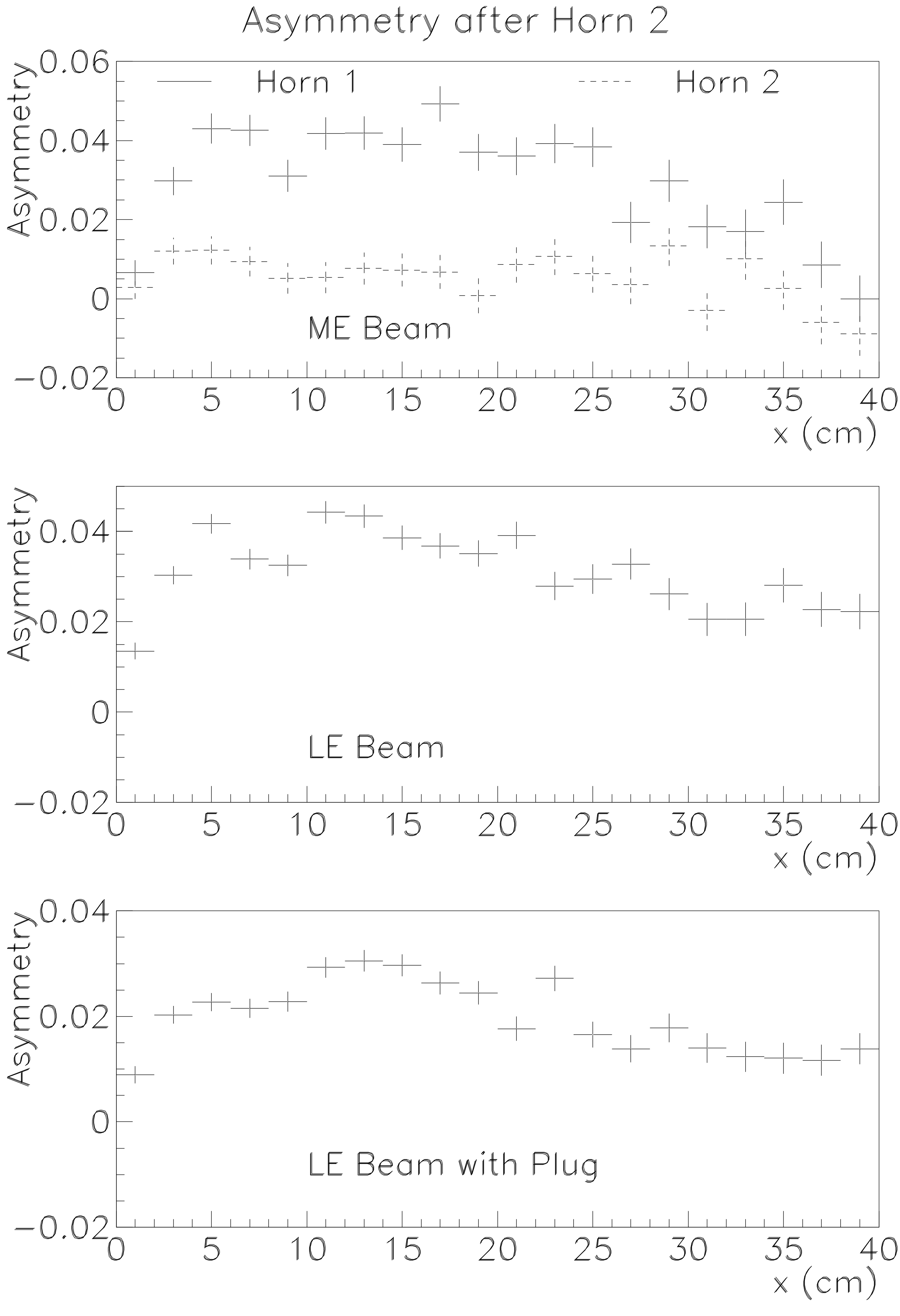
Geometry Considerations for SIC arrays

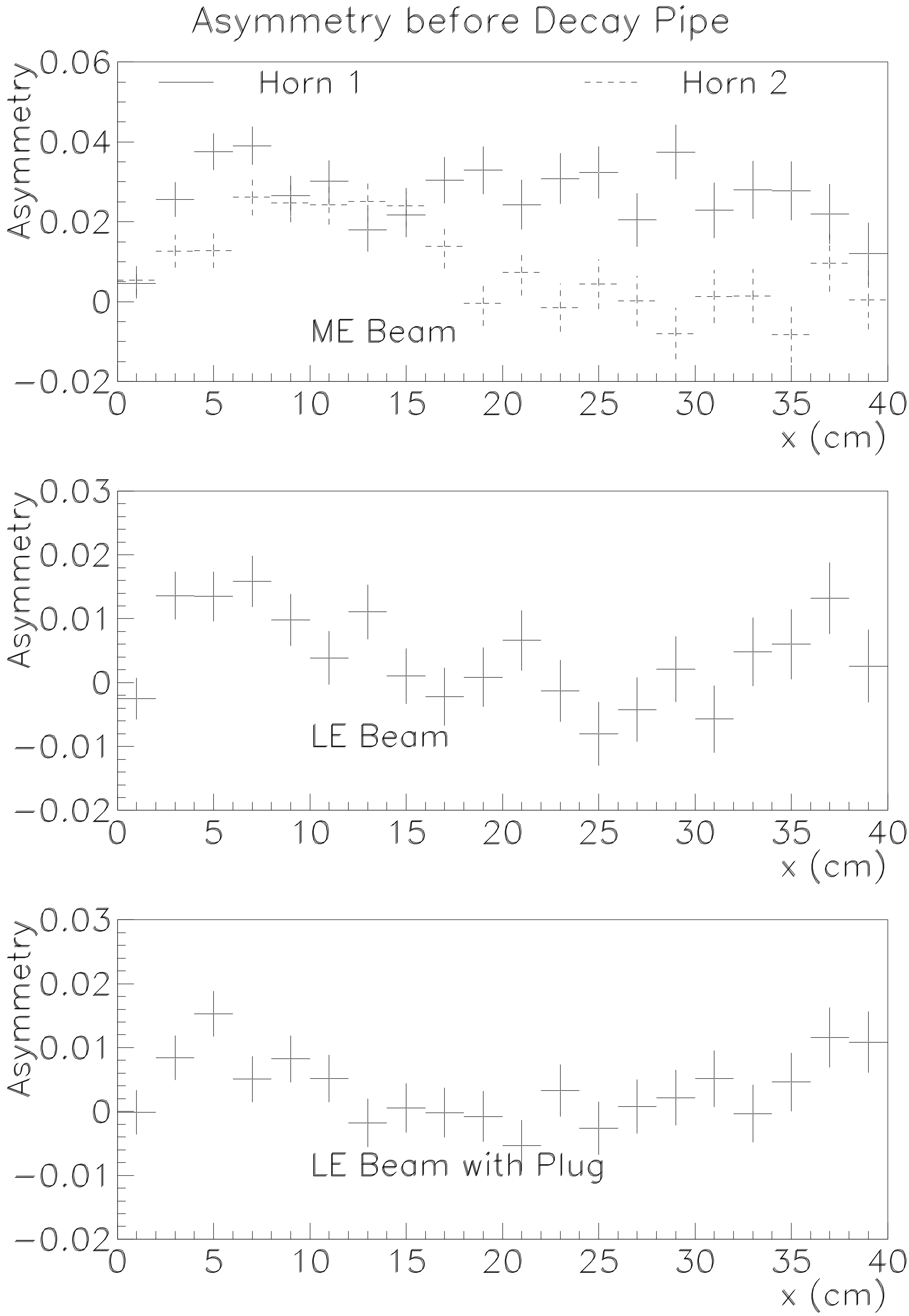


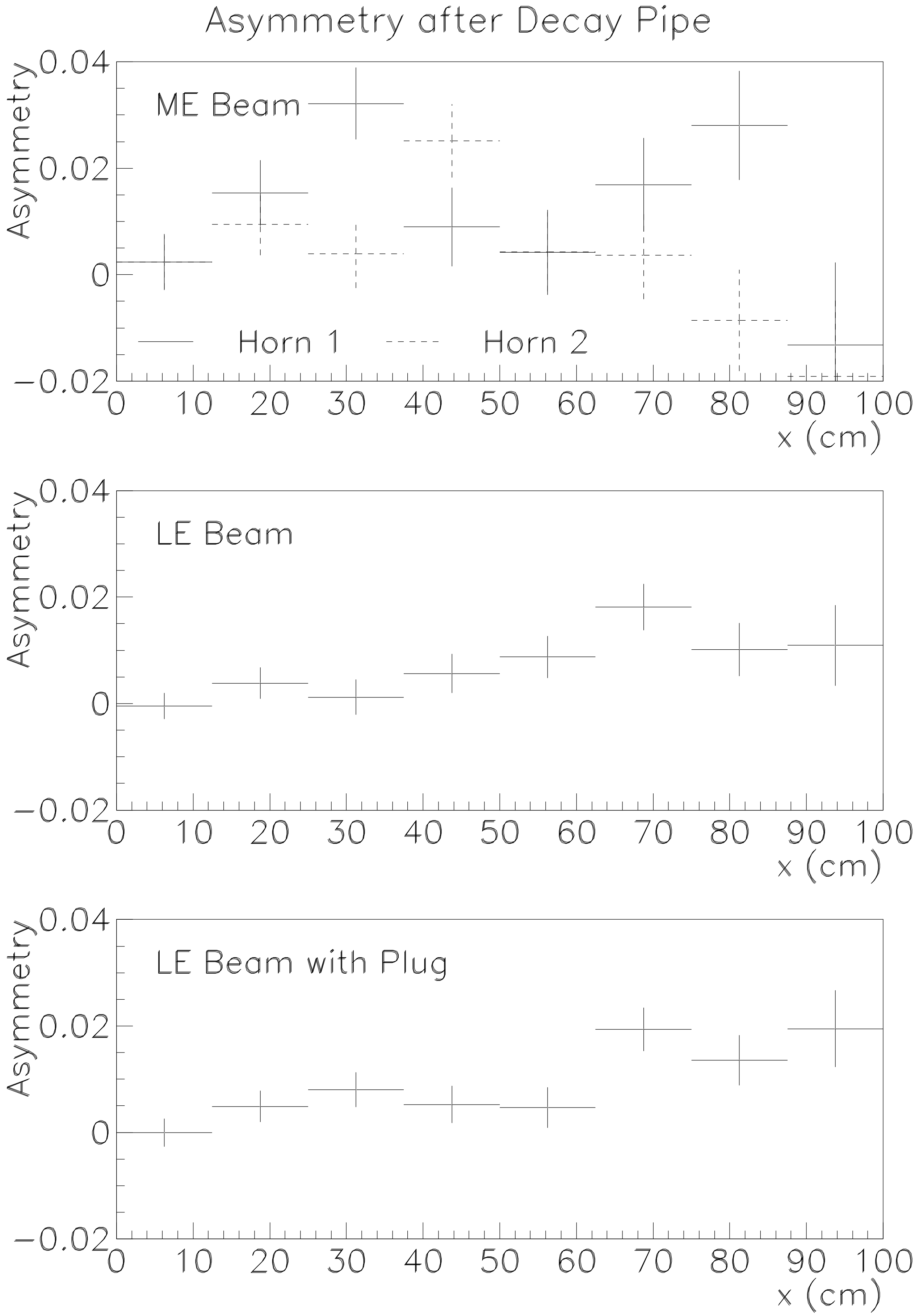




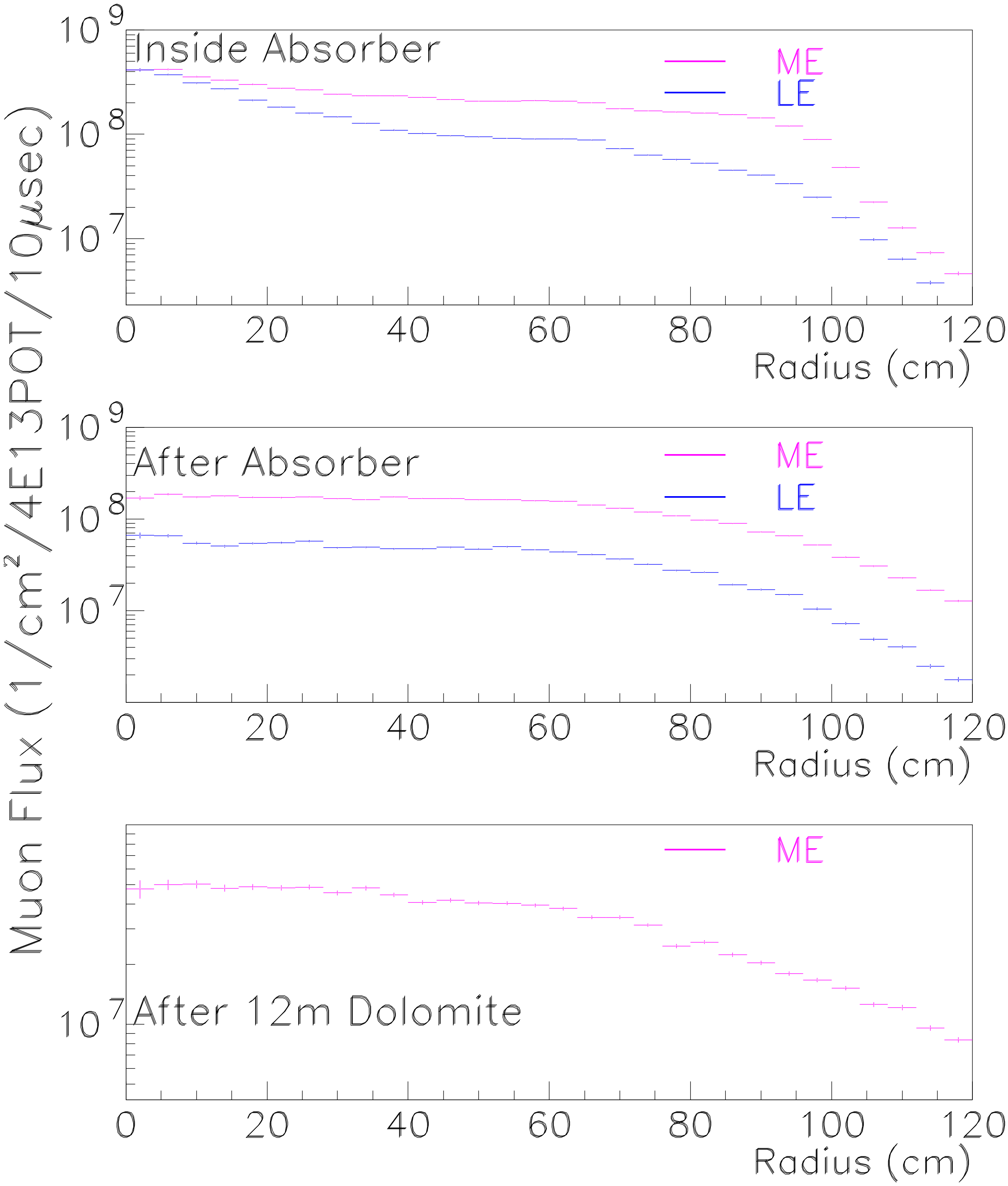
- Different geometries being considered
- Frame considerations begun


Asymmetry after Horn 2
Horn 1
Horn 2
Asymmetry
0.06
0.04
0.02
0
−0.02
0
5
10
15
20
25
30
35
40
x (cm)
ME Beam
LE Beam
LE Beam with Plug


Asymmetry before Decay Pipe
Asymmetry
Horn 1
Horn 2
ME Beam
x (cm)
LE Beam
LE Beam with Plug
0.06
0.04
0.02
0
−0.02
0.03
0.01
−0.01
0
5
10
15
20
25
30
35
40


Asymmetry after Decay Pipe
ME Beam
Horn 1
Horn 2
LE Beam
LE Beam with Plug
Asymmetry
x (cm)
0.04
0.02
0
−0.02
0
10
20
30
40
50
60
70
80
90
100

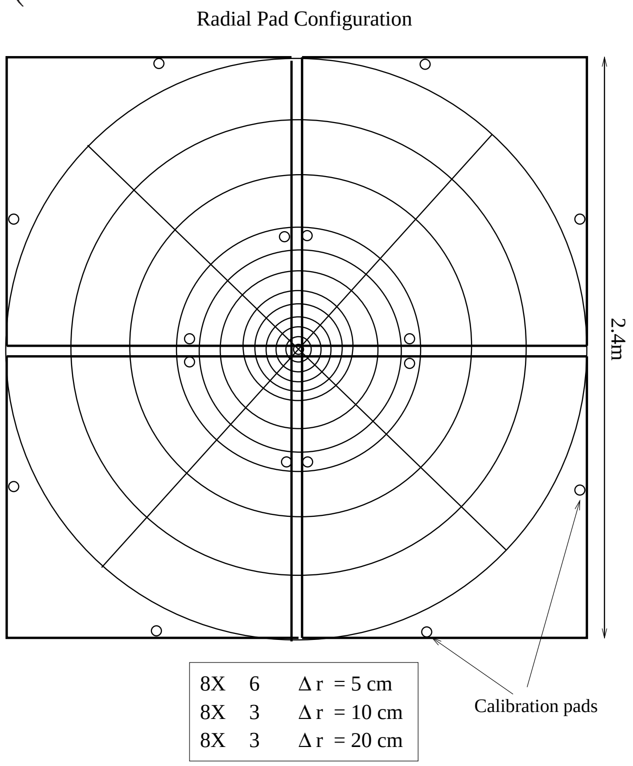
Flux vs Radius for Muon Monitors



Status of Muon Monitoring System

D.Naples, G.Tzanakos, D.Northacker

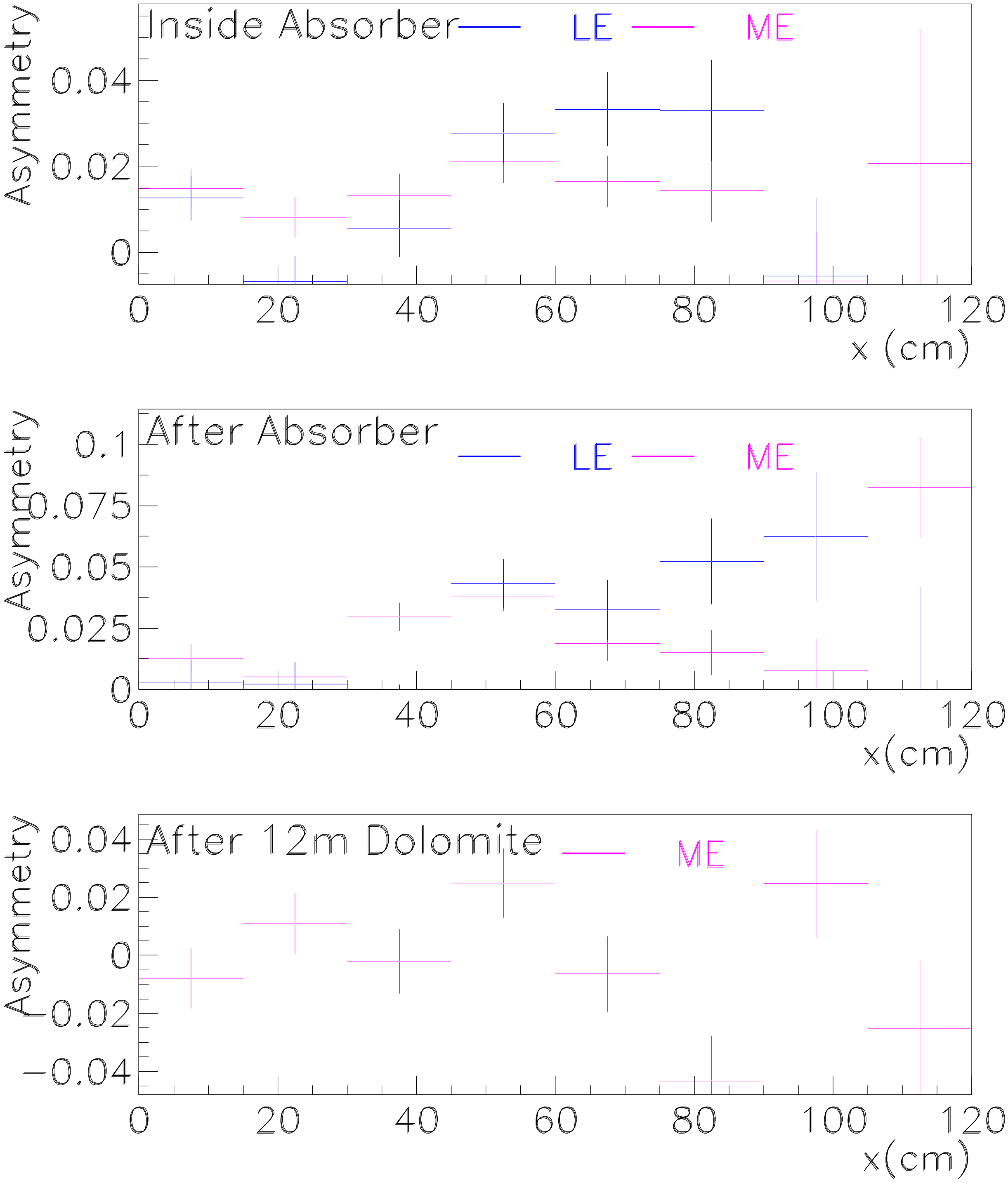
- Muons can be monitored in STE using basic gas ionization chamber
- Small prototype successfully tested in MTest ($2.5GHz/cm^2$)
- Array of four 1/4 panels ($120 \times 120cm^2$) at each location with radial pad geometry (similar to BNL ν beam)



Status of Muon Monitoring System (II)

- Testing stability of SWIC electronics
- Need test beam facility to understand full scale 1/4 panel and radial pad design

Asymmetries for Muon Monitors



Sensitivity to Horn Movement

Asymmetry defined as (Right-Left)/(Right+Left)

Asymmetry from 2mm Horn 1 Shift:

Monitor Location	LE	Rad (cm)	ME	Rad (cm)
After Horn 2	4%	2-20	4%	5-25
Before Decay Pipe	1.5%	2-7	3%	5-25
After Decay Pipe	2%	40-80	2%	0-80
In Absorber	3%	50-100	1%	0-100
After Absorber	5%	50-100	2%	30-100
After 12m Dolomite			1%	30-100

- Compare with Plug in LE Beam: lose 40% of upstream asymmetry
- ME beam has Horn1/Horn2 discrimination
- 5% current decrease gives 10(15)% loss in intensity in (after) absorber

Monitoring Summary

- Basic ionization chamber usable for muon monitoring in STE, advanced design work continuing
- candidate hadron monitoring technology being developed, beam tests soon
- Monte Carlo indicates need for detectors with sensitivty at 1% level to detect changes from nominal

Plans for Monitoring Group at Ely

Topics Under Discussion

- Test Beam Needs
- Calibration Plans
  - What are the calibrators?
  - Initial Gain
  - Time-Dependent Gains
  - How do we achieve 1% uncertainty in response?

Parallel Sessions:

1. Saturday, June 10: 15:45 - 18:00
2. Tuesday, June 13: 9:00 - 10:45
   (note new time)