

Material Budget Effects in the MVD

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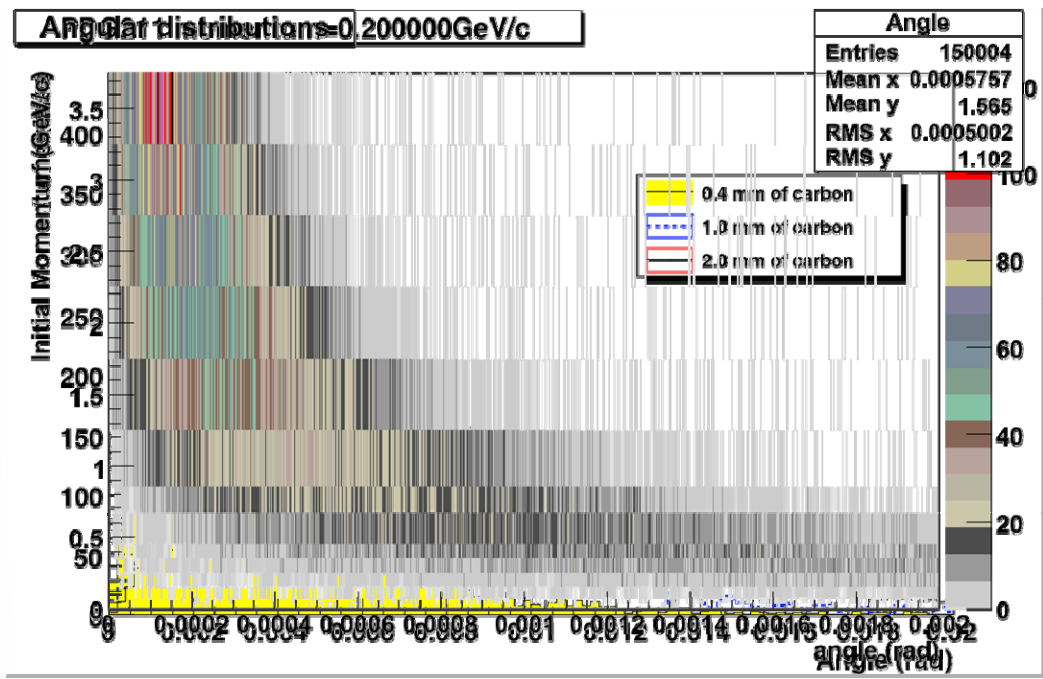


Summary

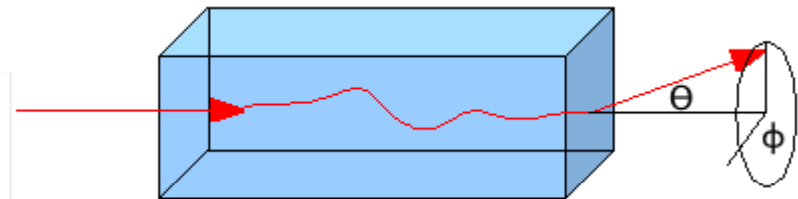
- Studies about multiple scattering
- Effects of material budget:
 1. in the barrel-part of the MVD
 2. in the forward-part of the MVD
- Simulations with the detailed MVD geometry

Preliminary Studies

Particle crossing a single volume:



e⁻ in 0.4 mm of carbon



Input Parameters

Ptc

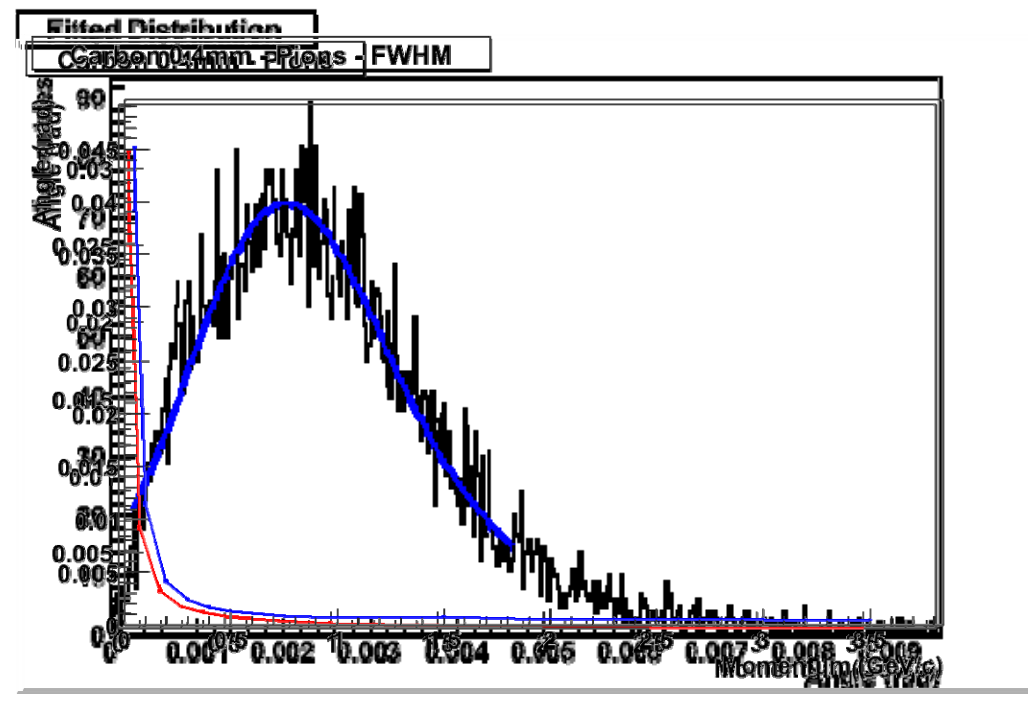
Initial Momentum

Material

Thickness

Preliminary Studies (II)

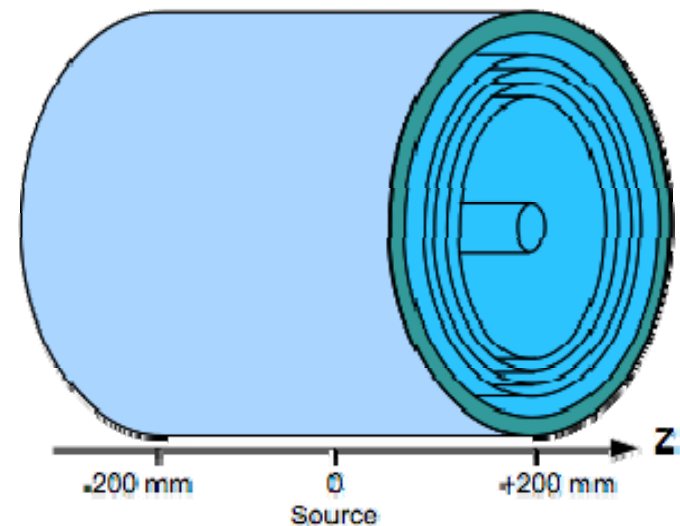
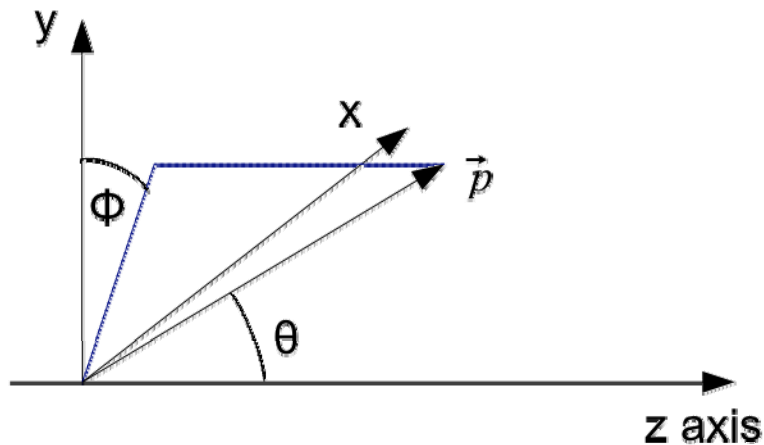
Fit with a Landau - Vavilov distribution



μ^+ of 400 MeV/c crossing 1 mm of carbon

MVD - Barrel

- Different material budget setups (only air \rightarrow full material)
- Particles: π^+ , μ^- , p , e^-
- Scans on momenta: 50 MeV/c \rightarrow 3.5 GeV/c
- Simulations with different ϑ values: 90° , 60° and 45°



MVD - Barrel

Different setups

“Only Air”

The full MVD volume is filled with air.

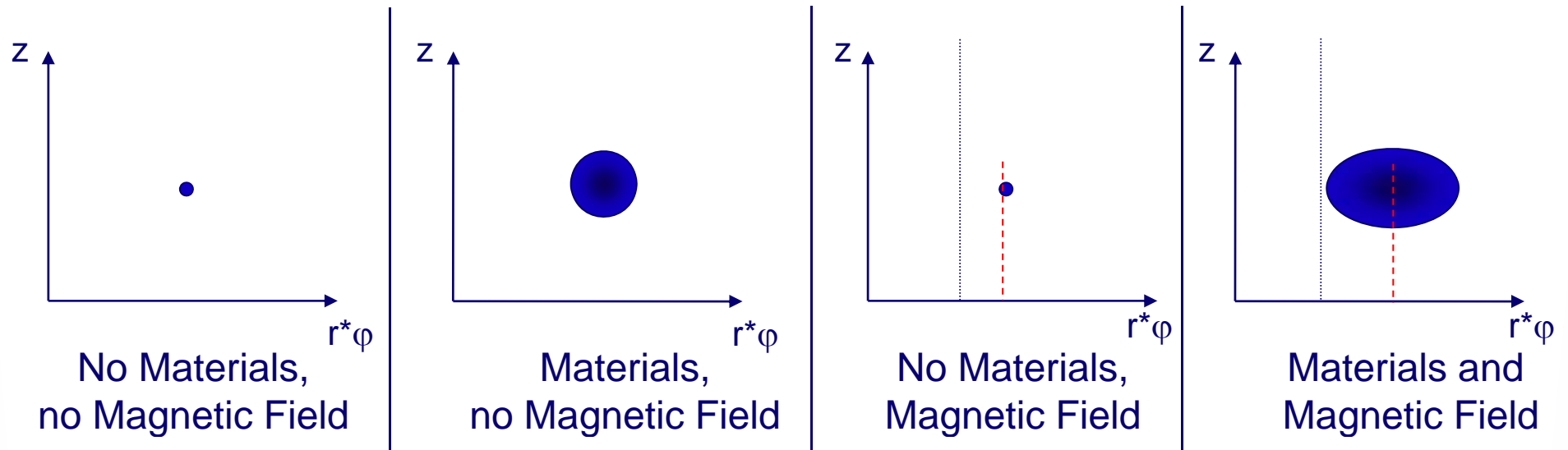
One silicon cylindrical detector placed on the outer surface of the volume ($r=150$ mm)

“Full Material”

4 coaxial layers with full smeared material budget:

- ◆ Silicon (sensor+FFE)
- ◆ Cooling (H_2O +pipes)
- ◆ Cables
- ◆ Glue

MVD Barrel - Analysis

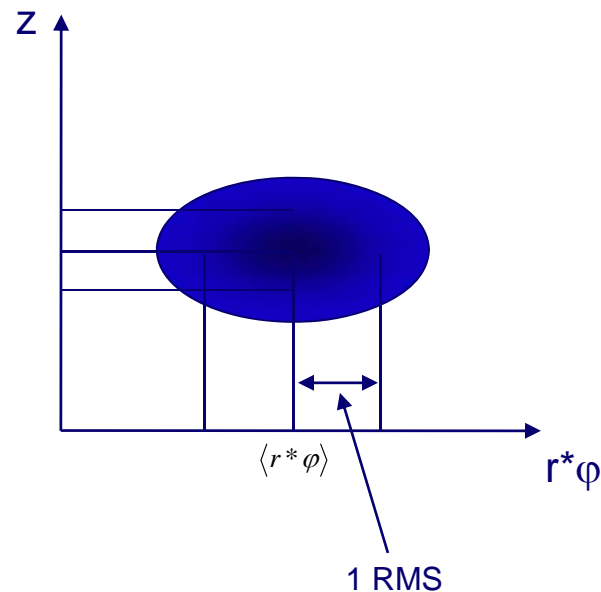


“Only air” setup \rightarrow Ideal reference

“Full Material” \rightarrow Worst possible scenario

Comparison between the two setups

MVD Barrel - Analysis (II)

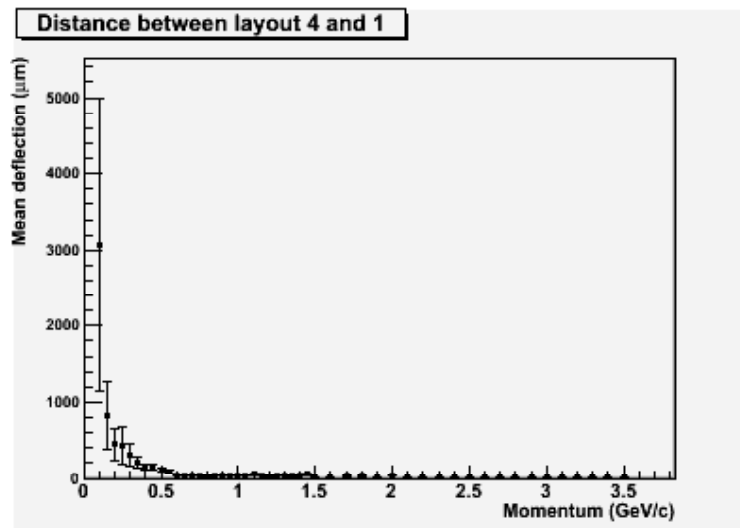


I determined the center of gravity of the distributions from different material budgets.

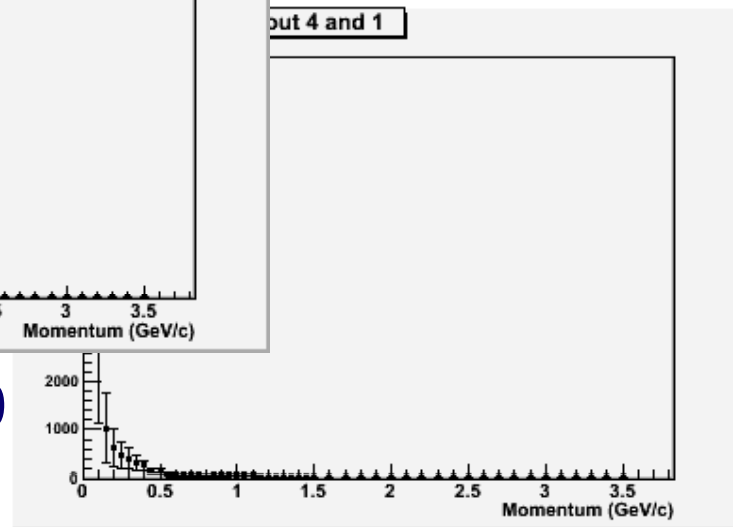
The distance between the two points is due to the energy loss (\rightarrow decreasing of the bending radius).

The width of the distribution is due to multiple scattering deflections.

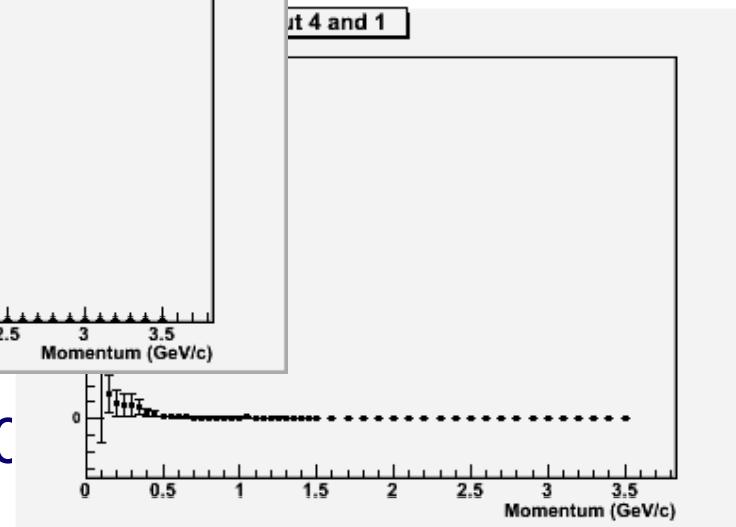
MVD Barrel - Results π^+



π^+ $\vartheta=90^\circ$



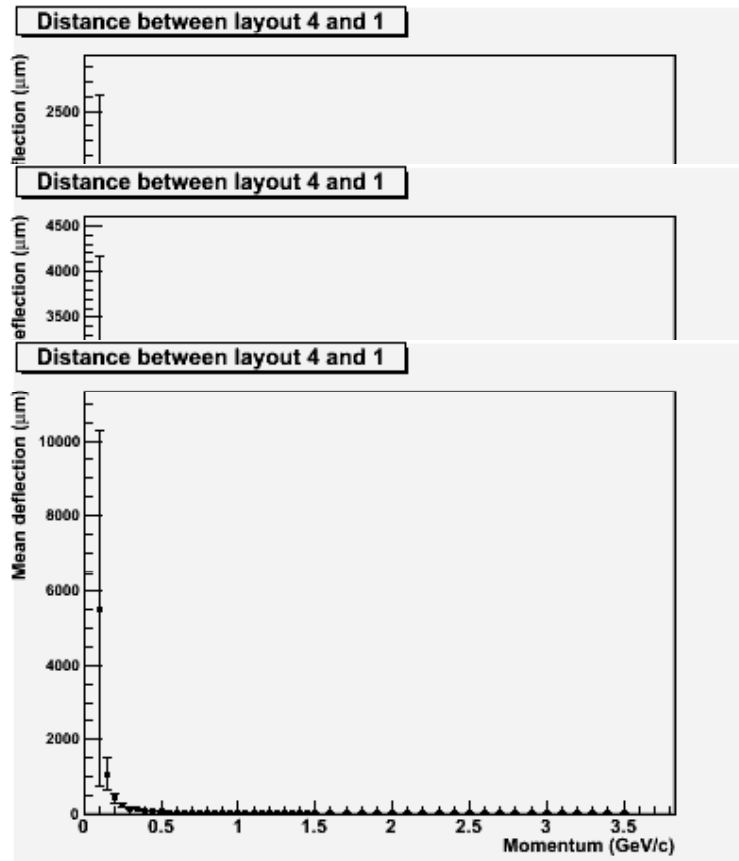
π^+ $\vartheta=60^\circ$



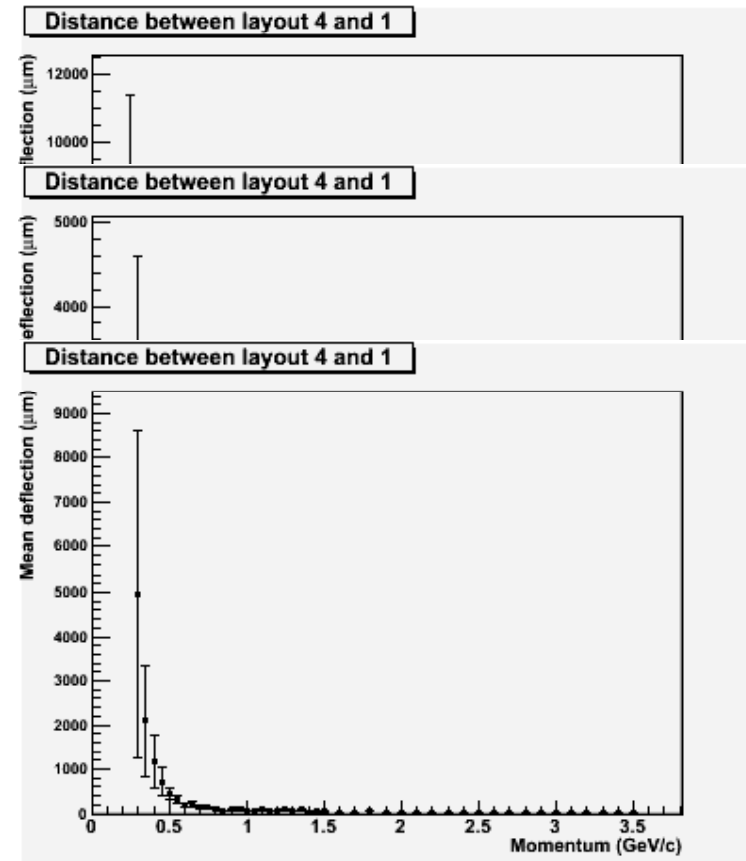
π^+ $\vartheta=45^\circ$

MVD Barrel - Results μ^- and p

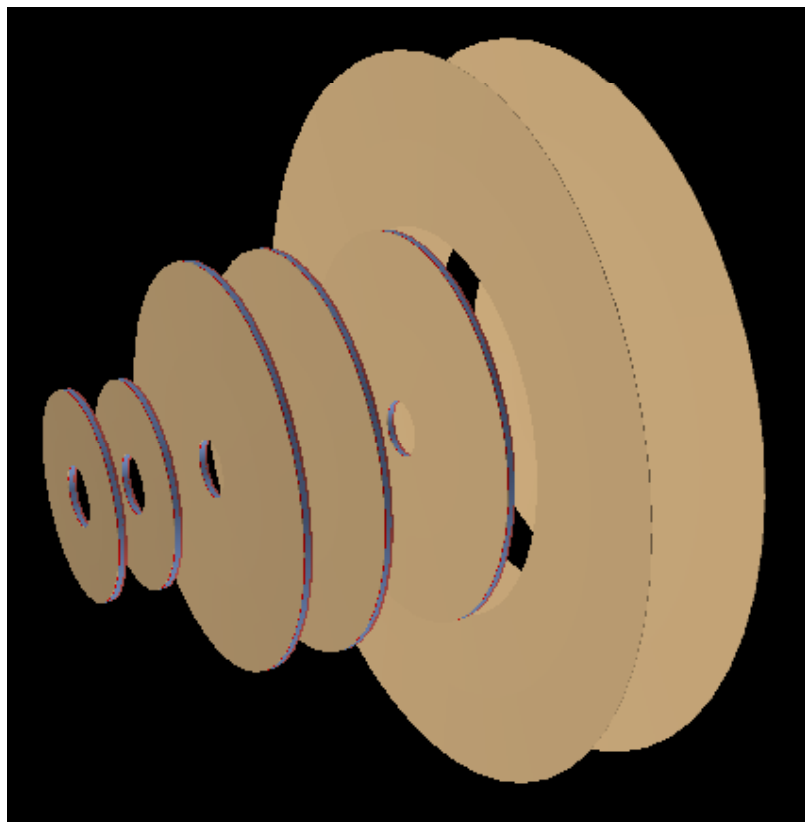
μ^-



p



MVD - Forward Disks



Material Budget

Silicon: Sensor + FFE

Water: Cooling

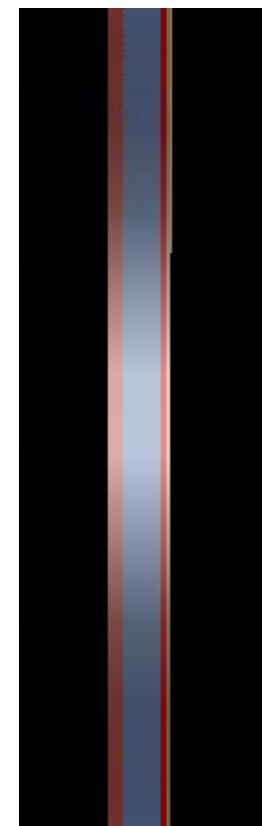
Carbon: Support

PIXELS

Sensor	200 μm
F.F.E.	300 μm
Water	2 mm
Carbon	1 mm

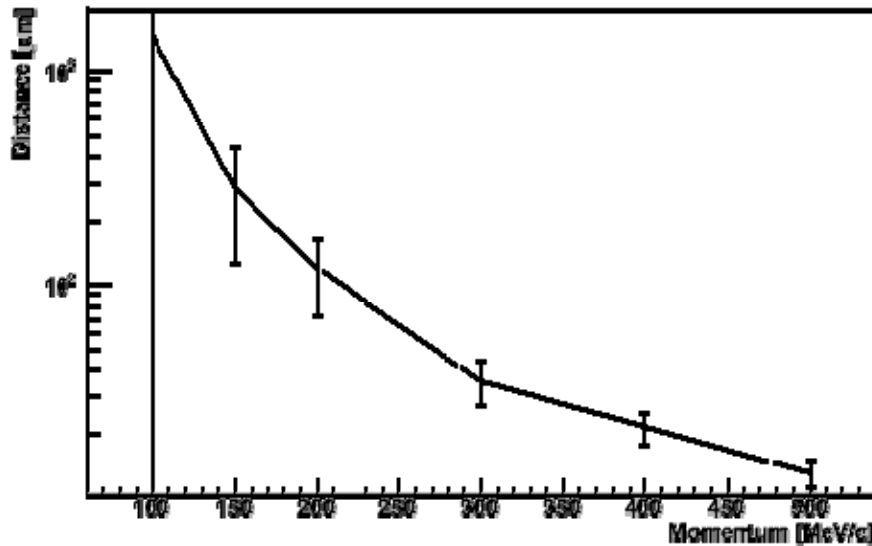
STRIPS

Sensor	200 μm
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MVD - FWD - Results

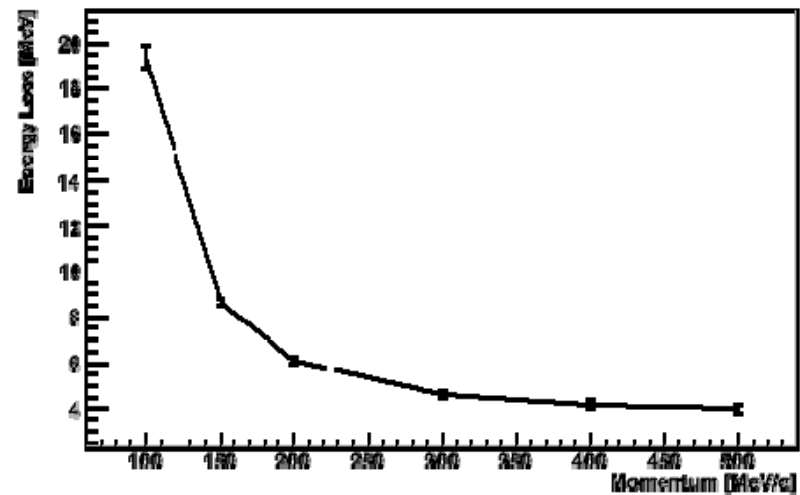
Material Effects



Scattering effects become really important with momenta below 200 MeV/c

π^+ shot with $\vartheta = 30^\circ$
From the Interaction Point

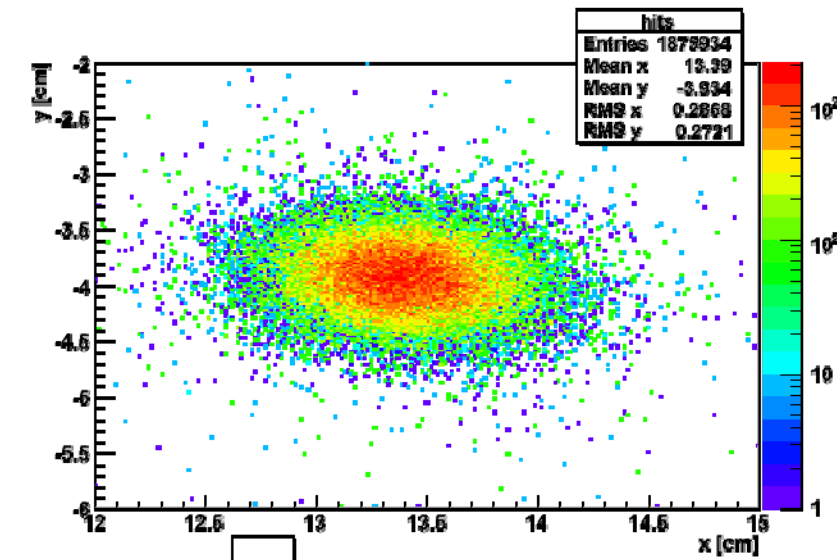
Energy Loss



MVD - FWD - Results (II)

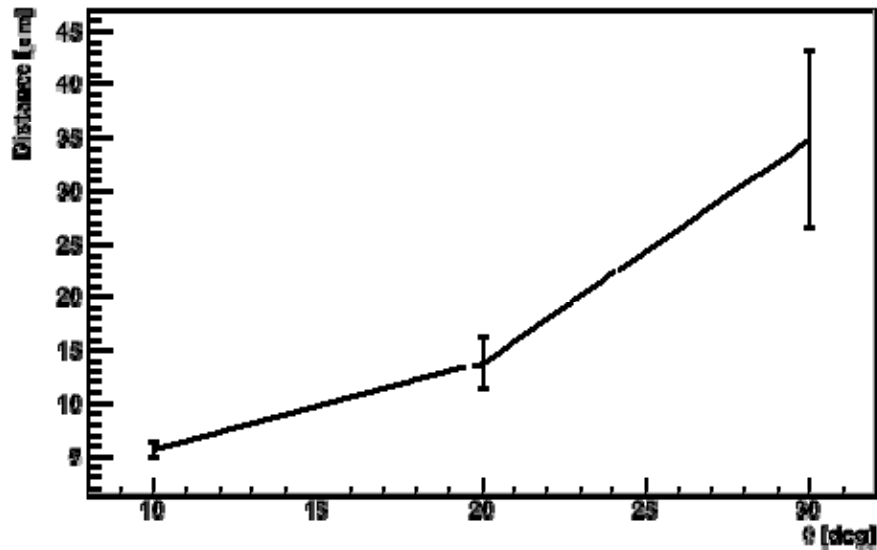
<u>Momentum [MeV/c]</u>	<u>Distance [μm]</u>	<u>Radius distr. [μm]</u>
100	1462	1538
150	288	793
200	120	552
300	36	347
400	22	256
500	13	200

π^+ of 300 MeV/c
with $\vartheta = 30^\circ$



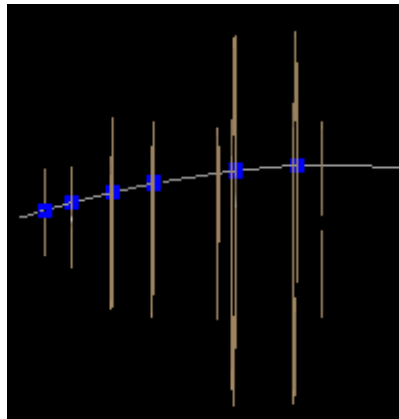
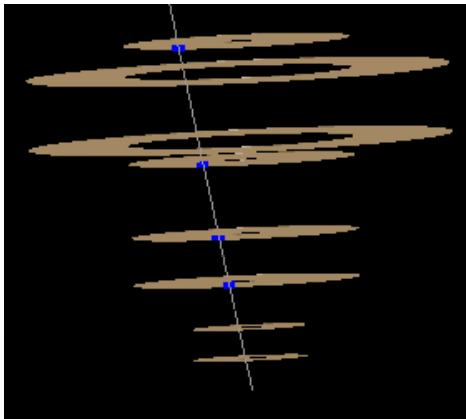
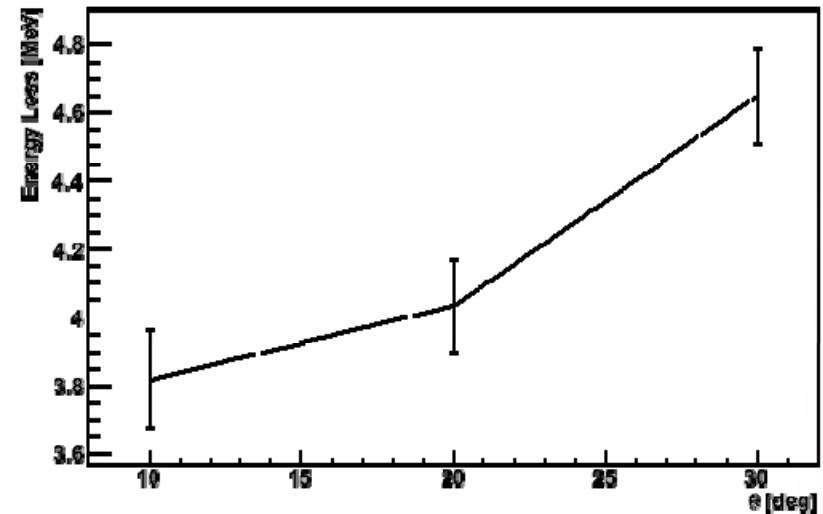
MVD - FWD - Results (II)

Material Effects

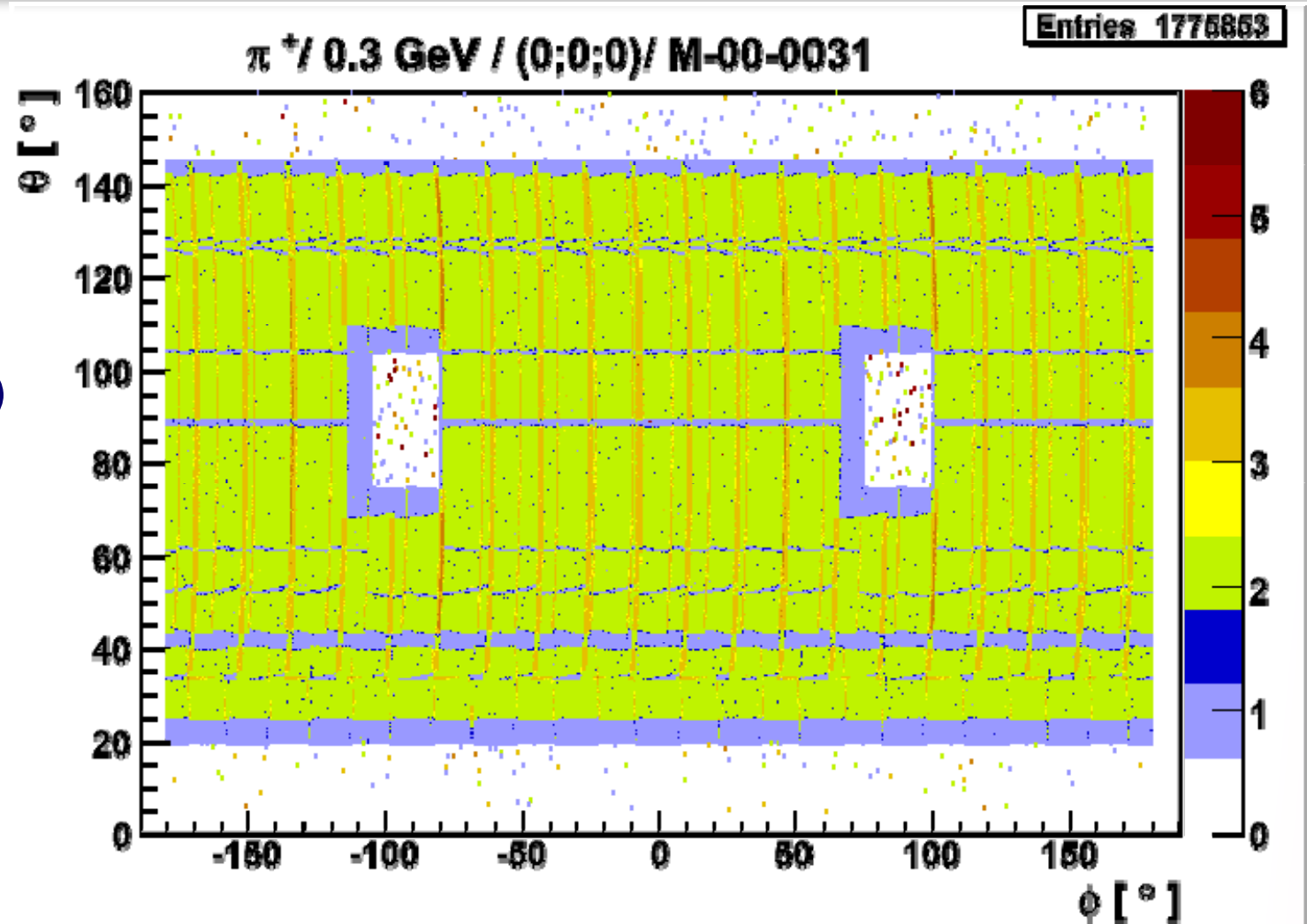


π^+ of 300 MeV/c shot with different ϑ from the IP

Energy Loss



MVD 2.0 Coverage Tests



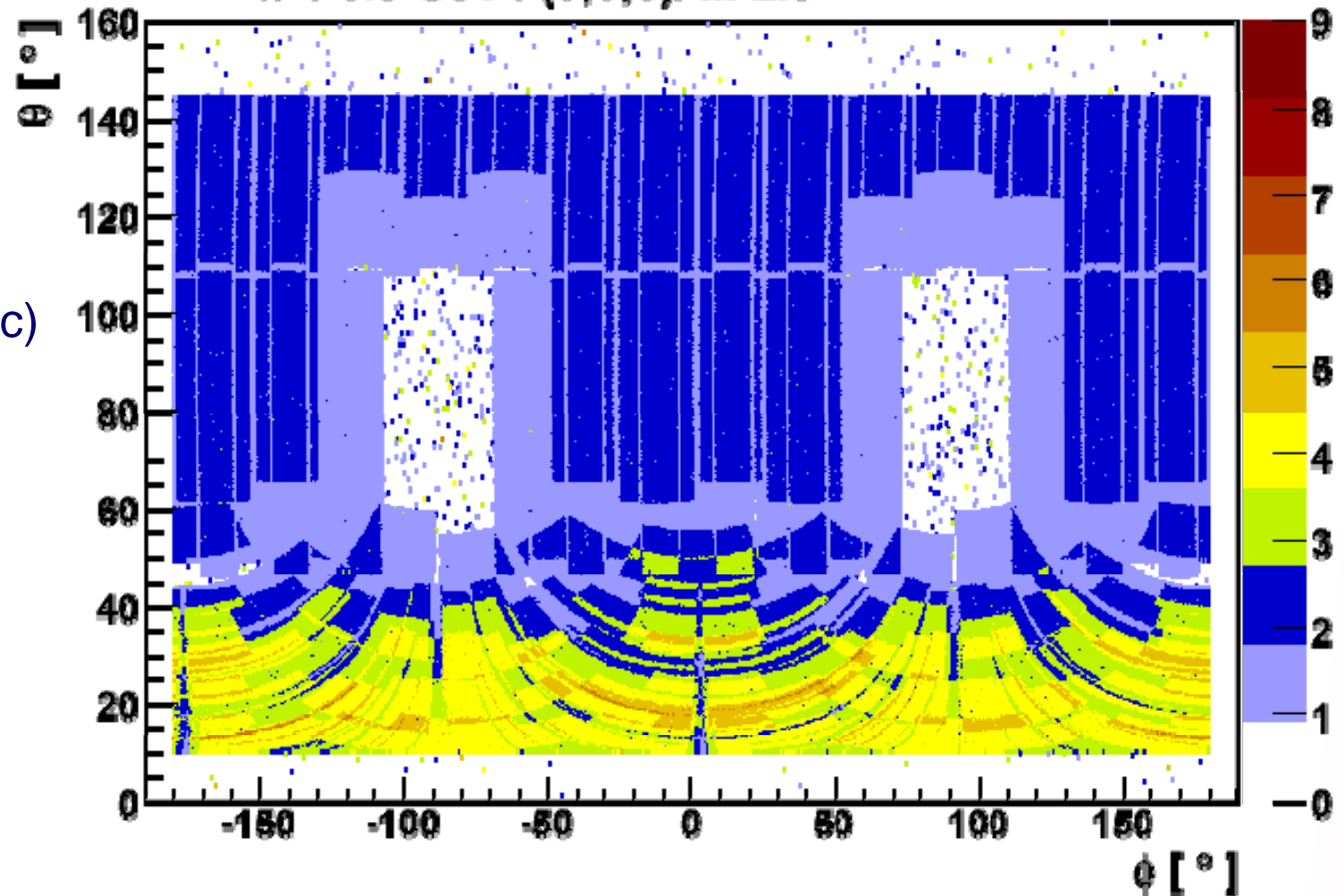
2M of π^+
($p = 500$ MeV/c)

Only Strips

MVD 2.0 Coverage Tests

Entries 1782410

π^+ / 0.5 GeV / (0;0;0) / M-2.0



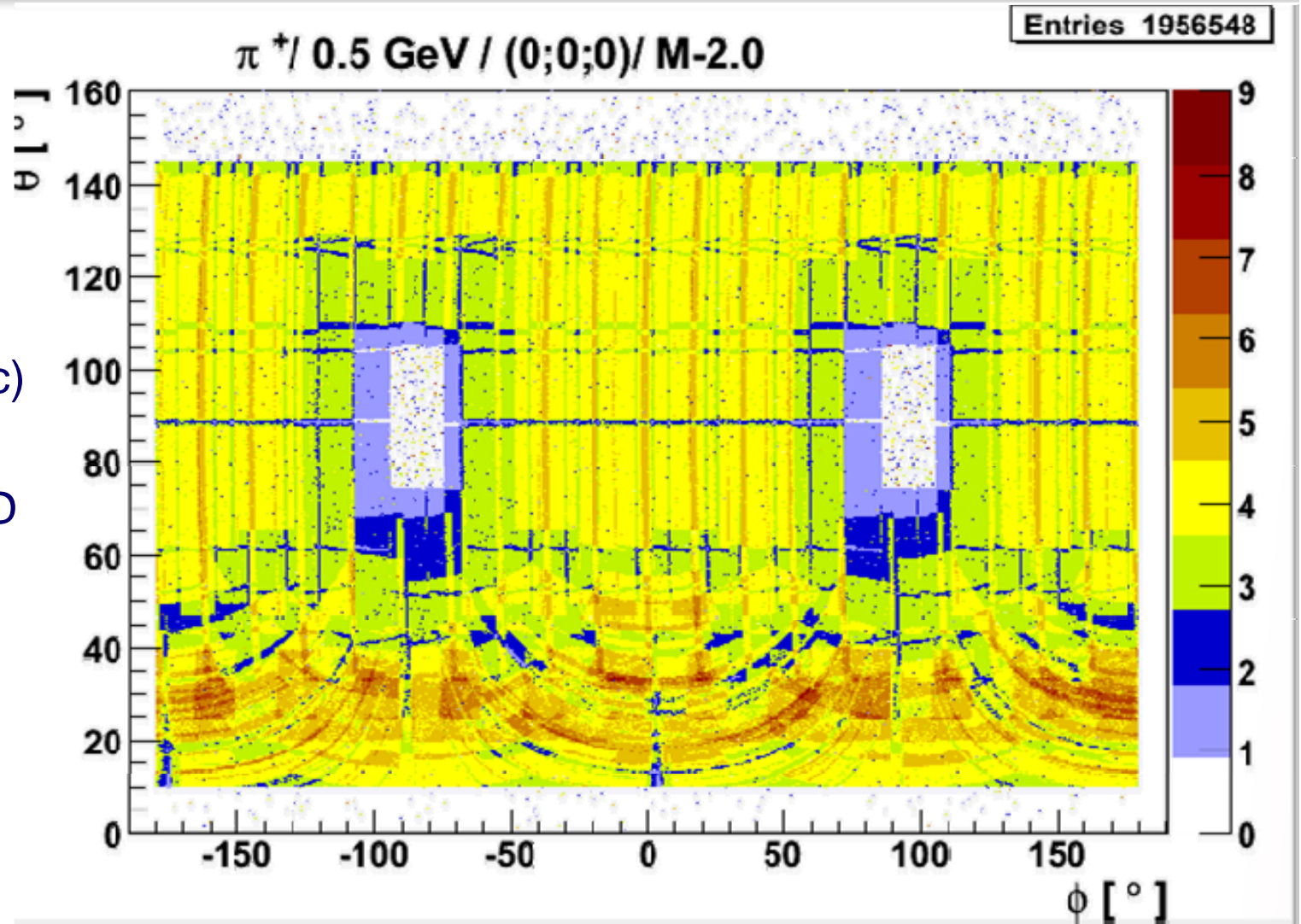
2M of π^+
($p = 500$ MeV/c)

Only Pixels

MVD 2.0 Coverage Tests

2M of π^+
($p = 500 \text{ MeV}/c$)

Complete MVD

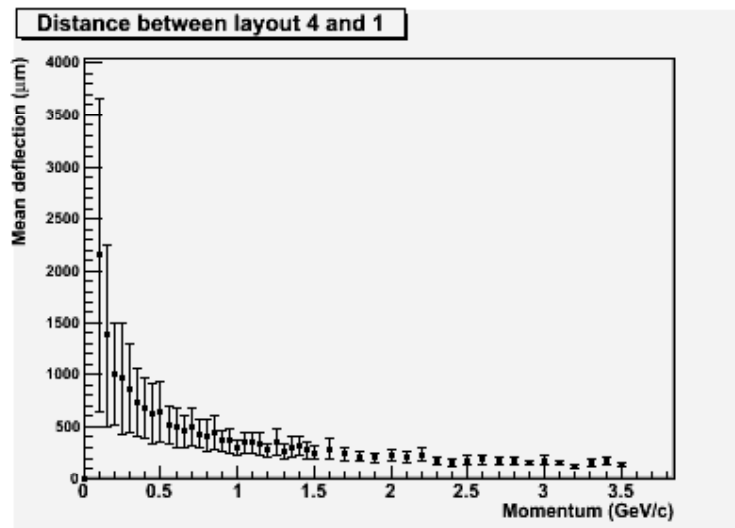




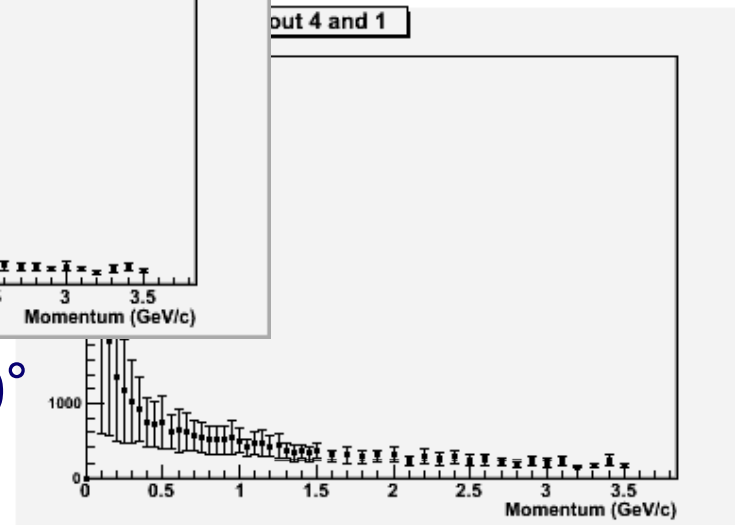
THANKS FOR YOUR ATTENTION



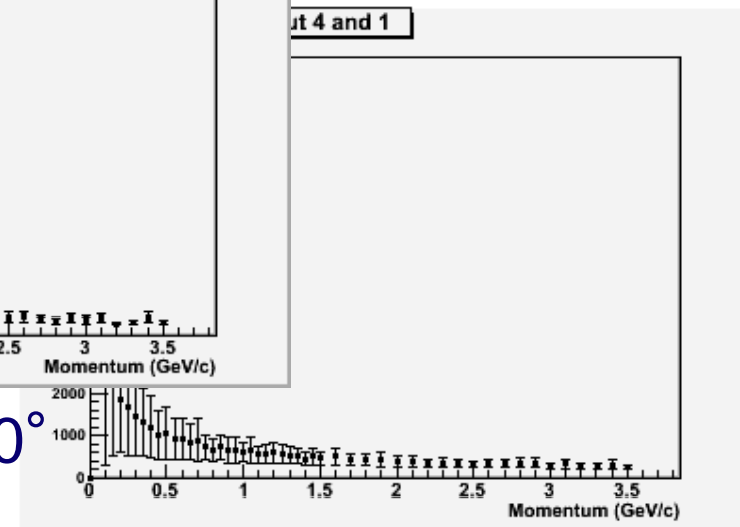
MVD Barrel - Results e^-



e^- $\vartheta=90^\circ$



e^- $\vartheta=60^\circ$



e^- $\vartheta=45^\circ$