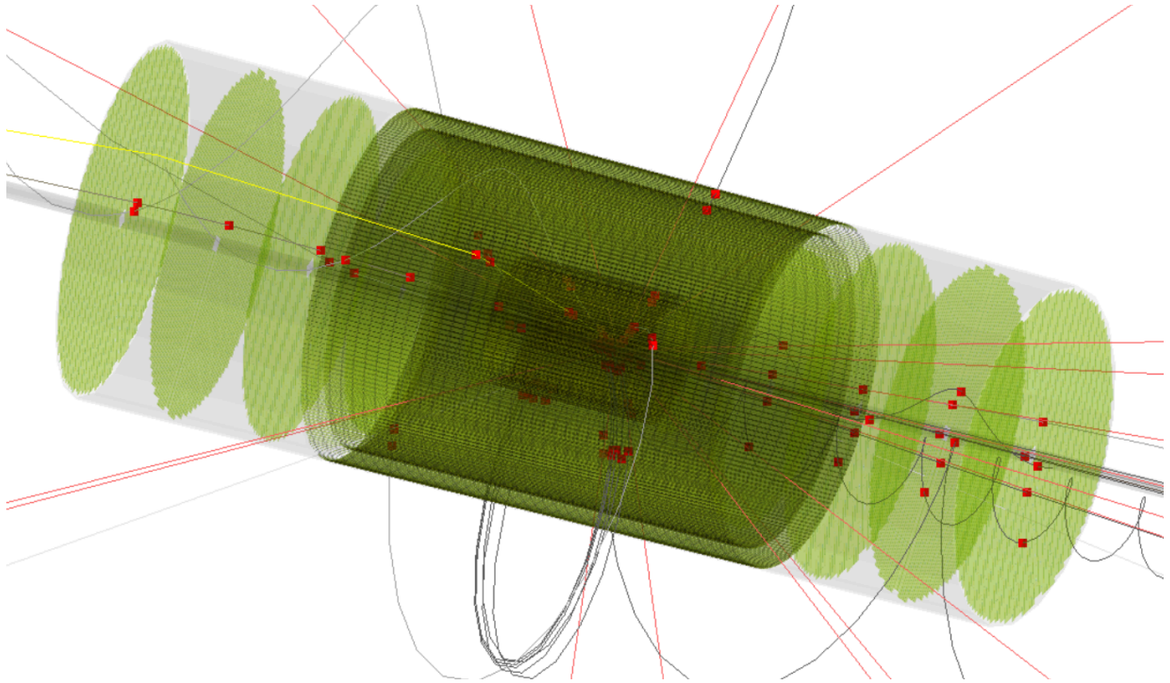
All-Si Tracker studies in Fun4All (Update)



Rey Cruz-Torres

Outline

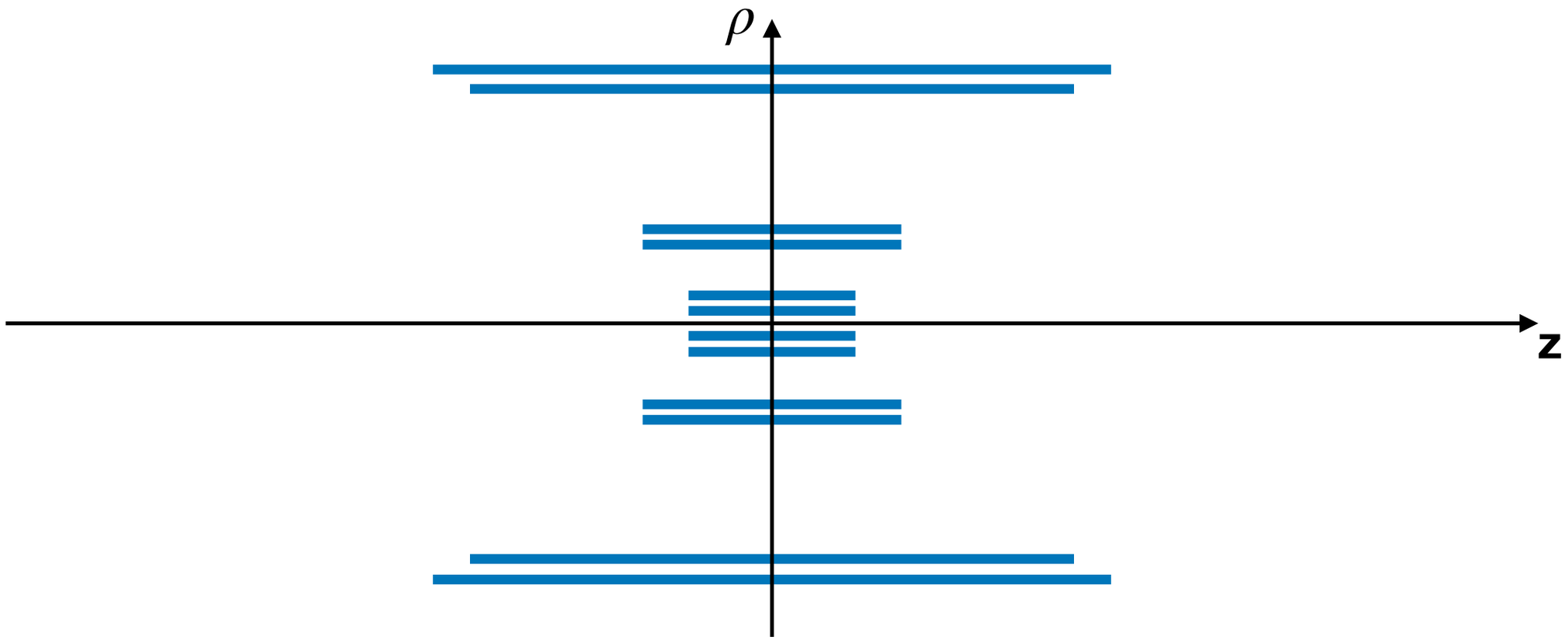
1. Detailed Material Scan
2. B-field comparison

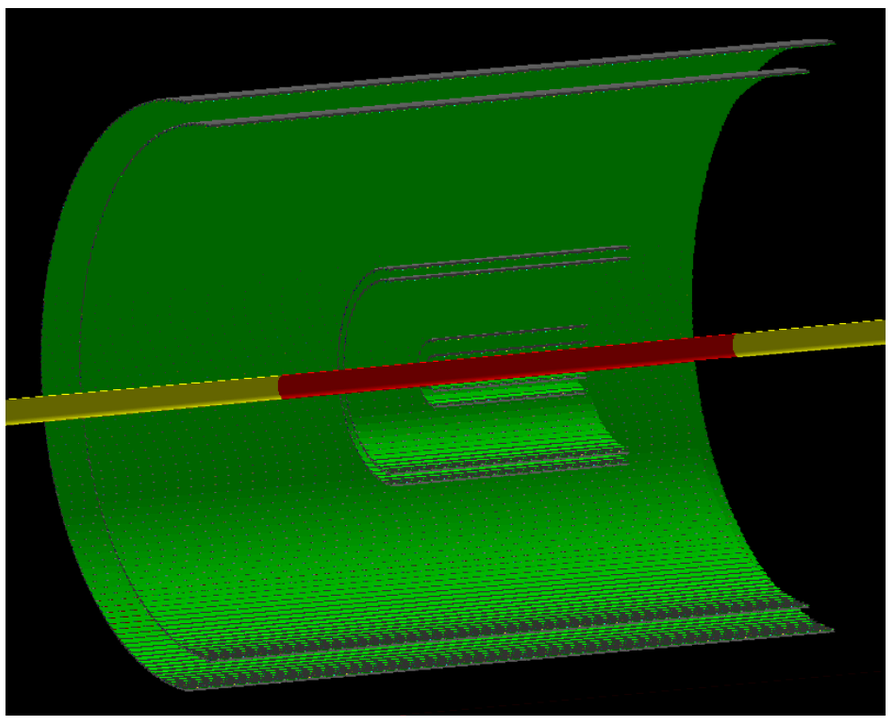
Outline

1. Detailed Material Scan

2. B-field comparison

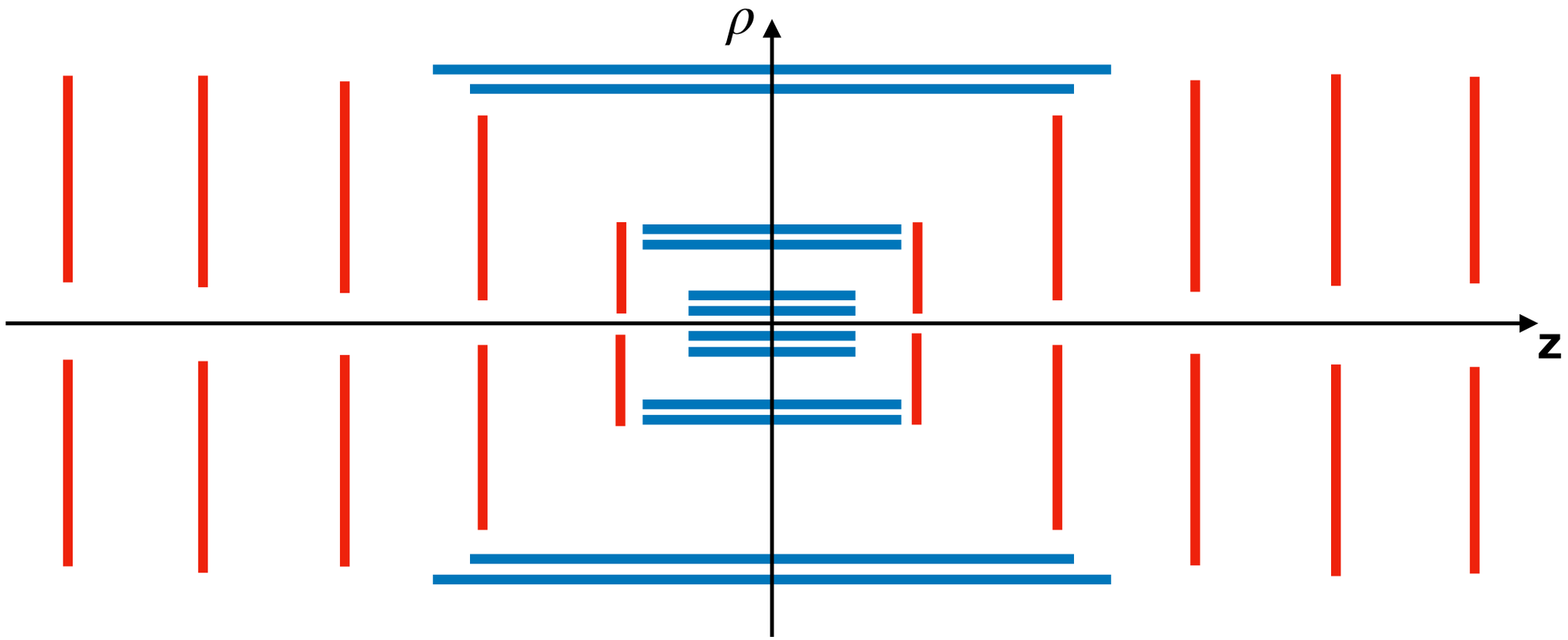
All-Silicon Tracker Geometry

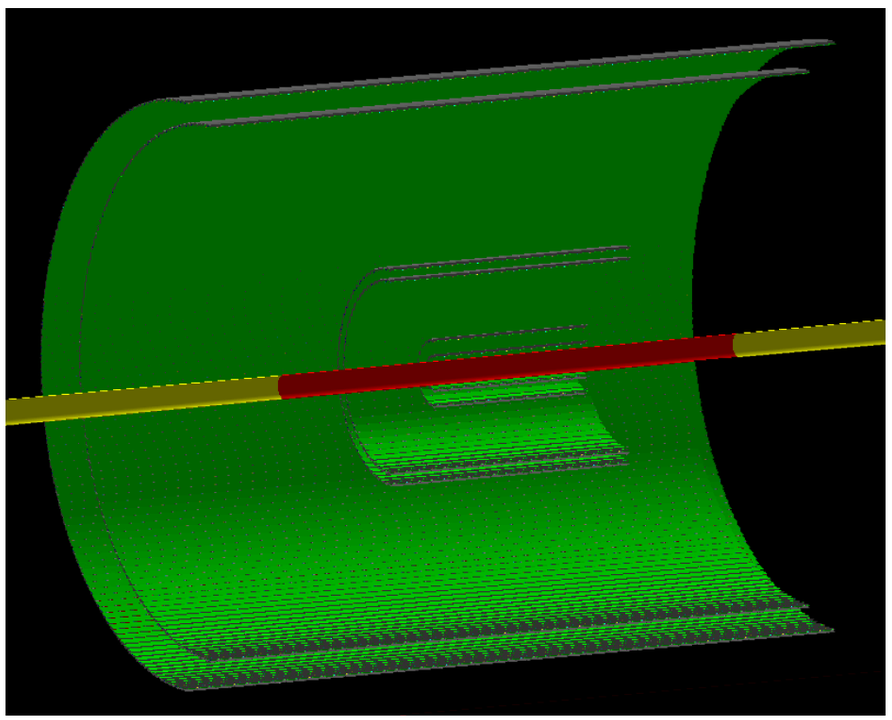




Barrel

All-Silicon Tracker Geometry

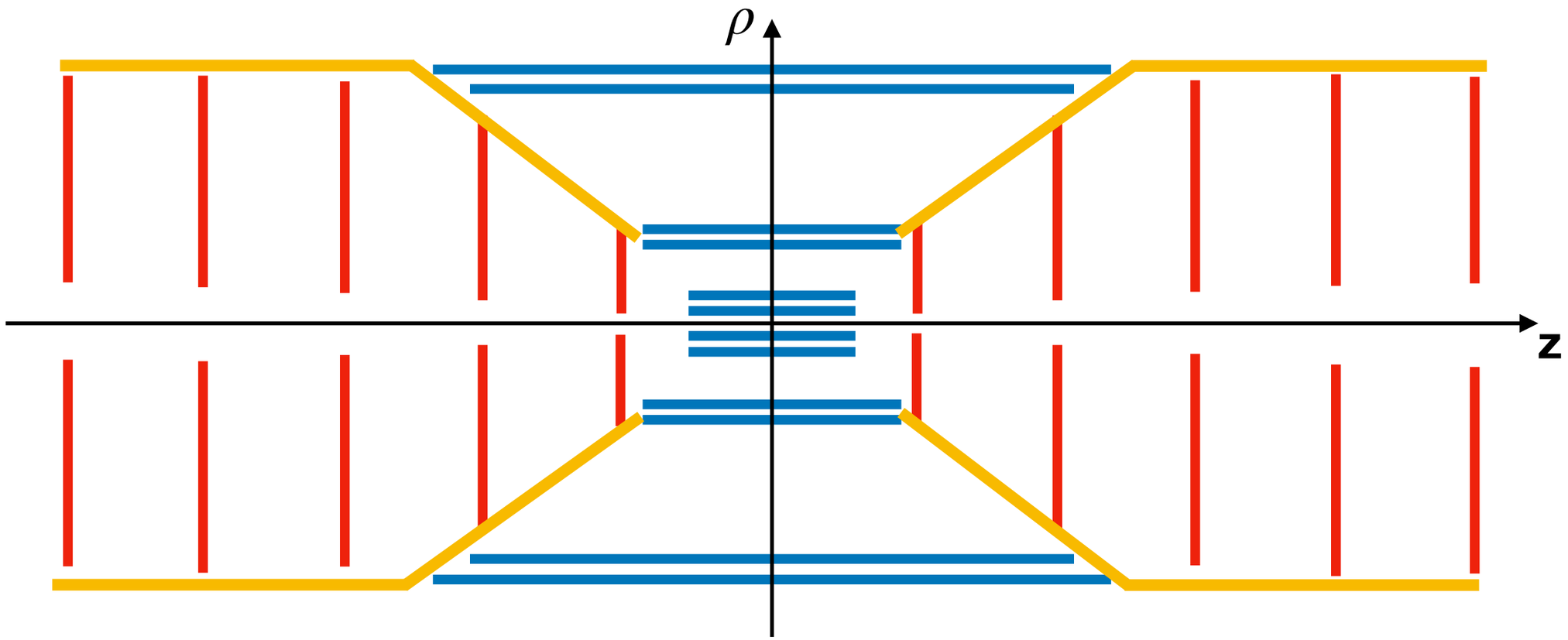


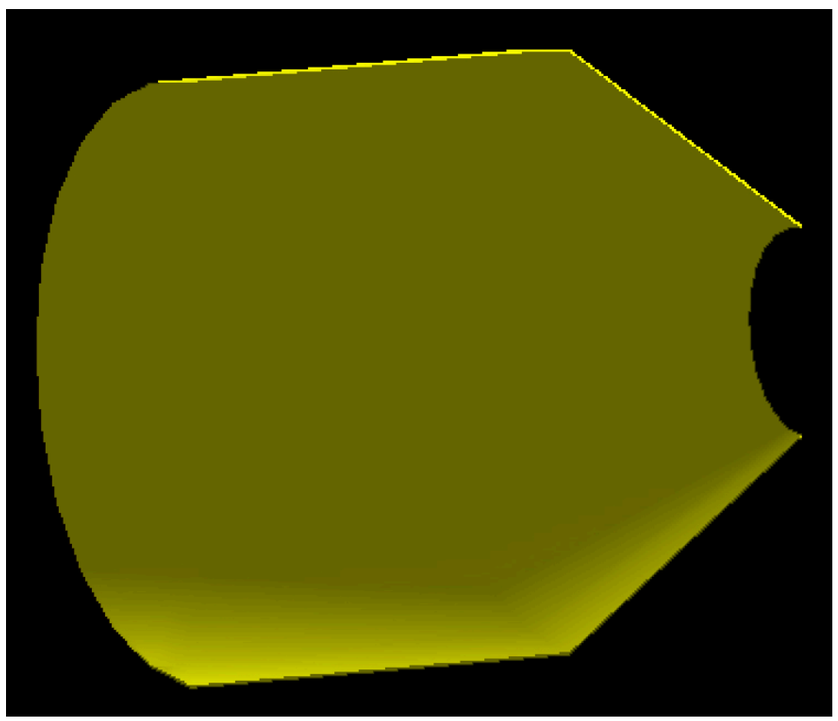


Barrel

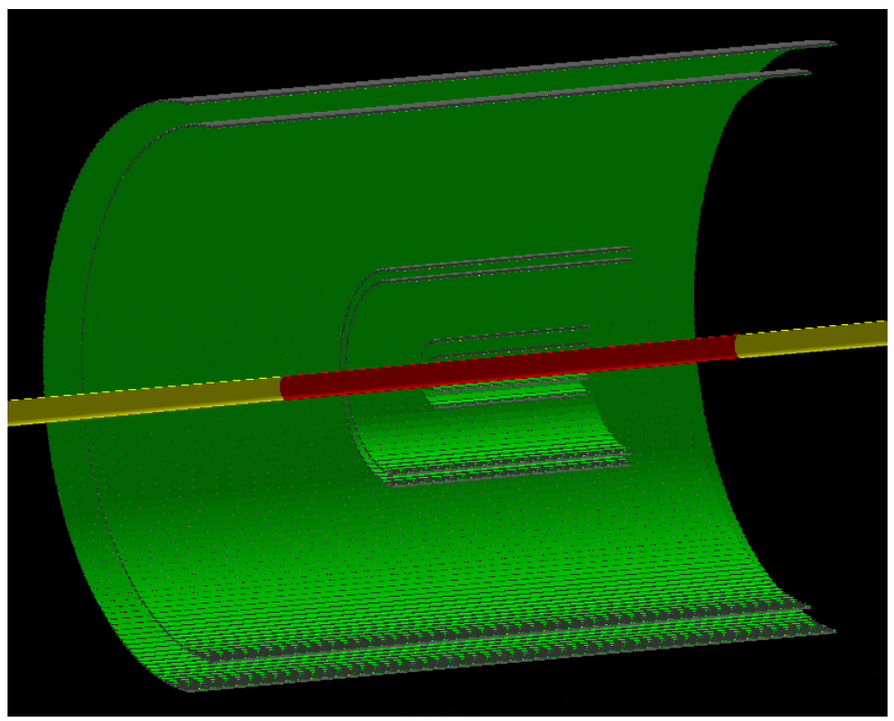
5F+5B Disks

All-Silicon Tracker Geometry





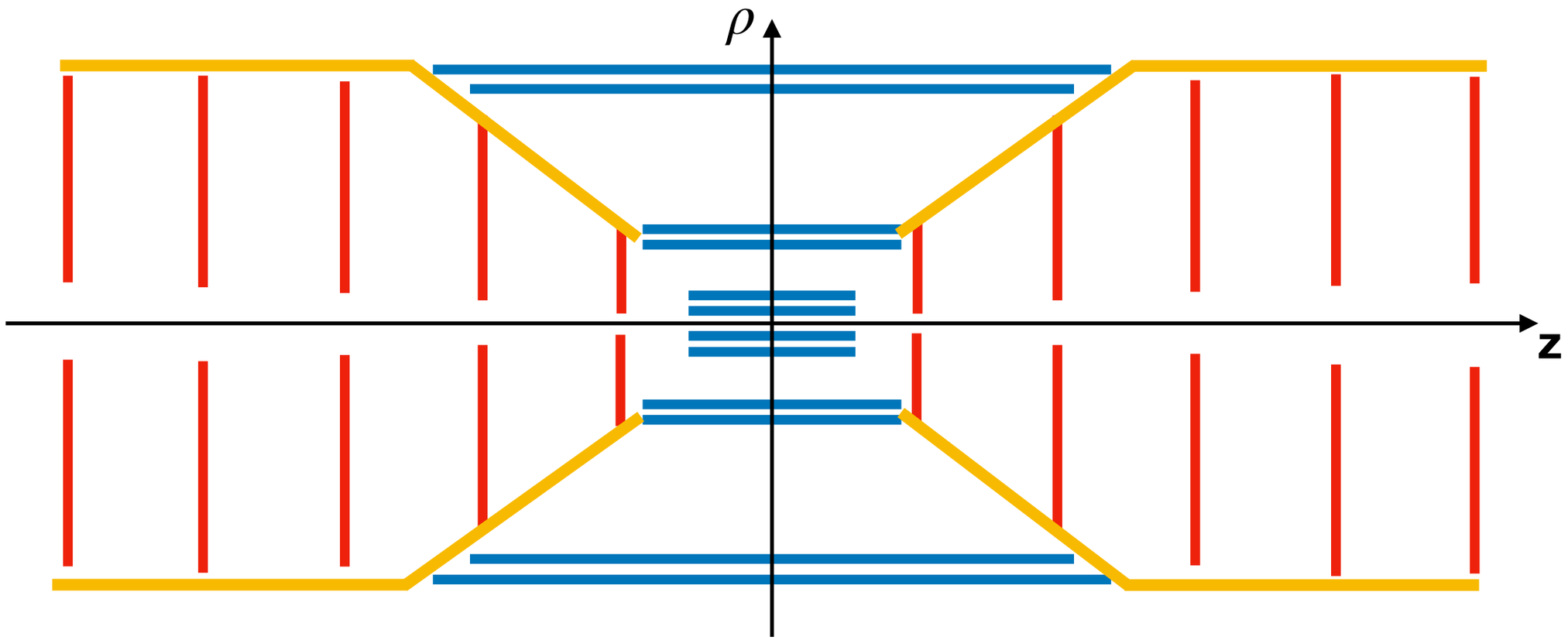
Al Support Structure

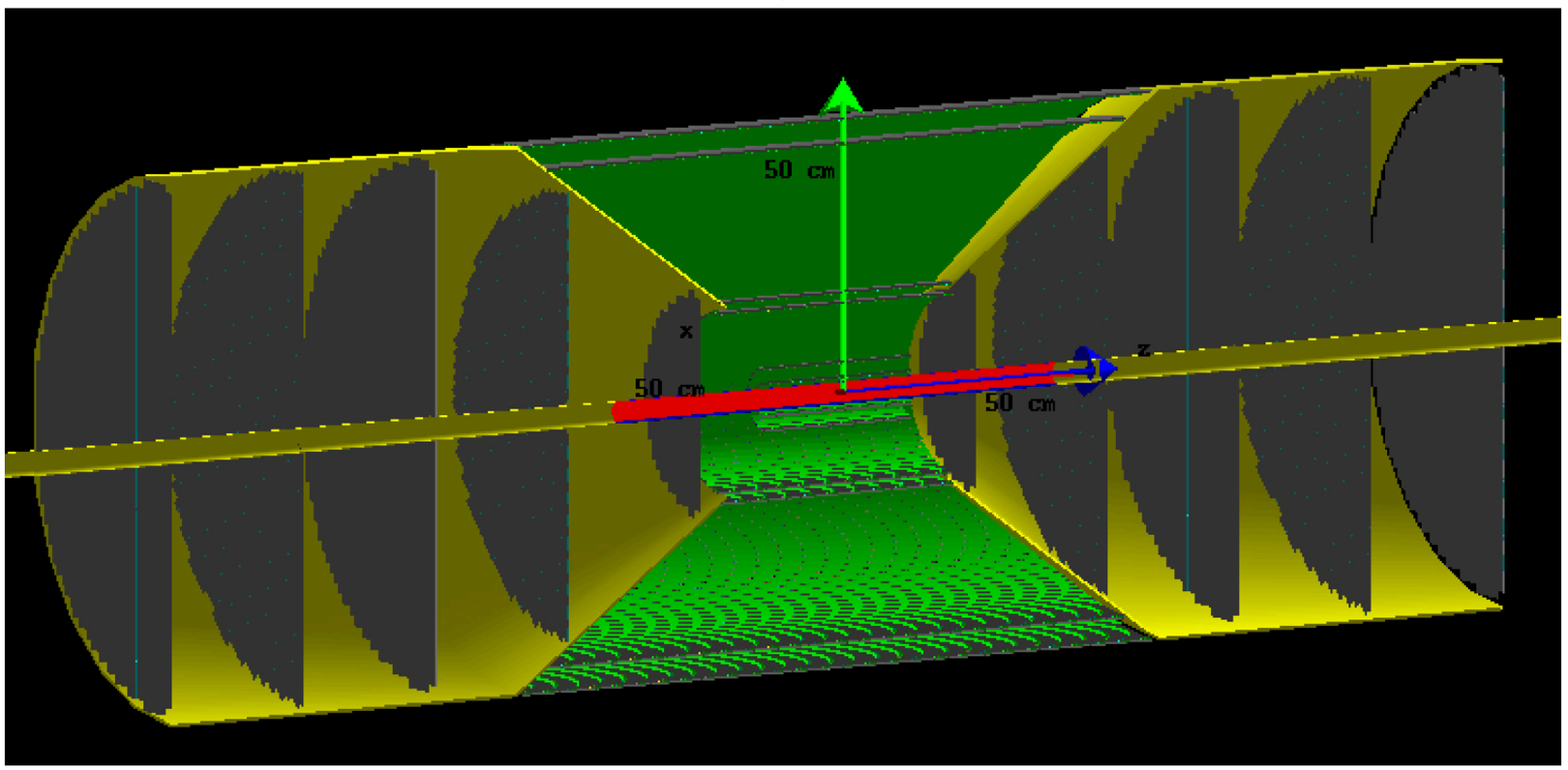


Barrel

5F+5B Disks

All-Silicon Tracker Geometry

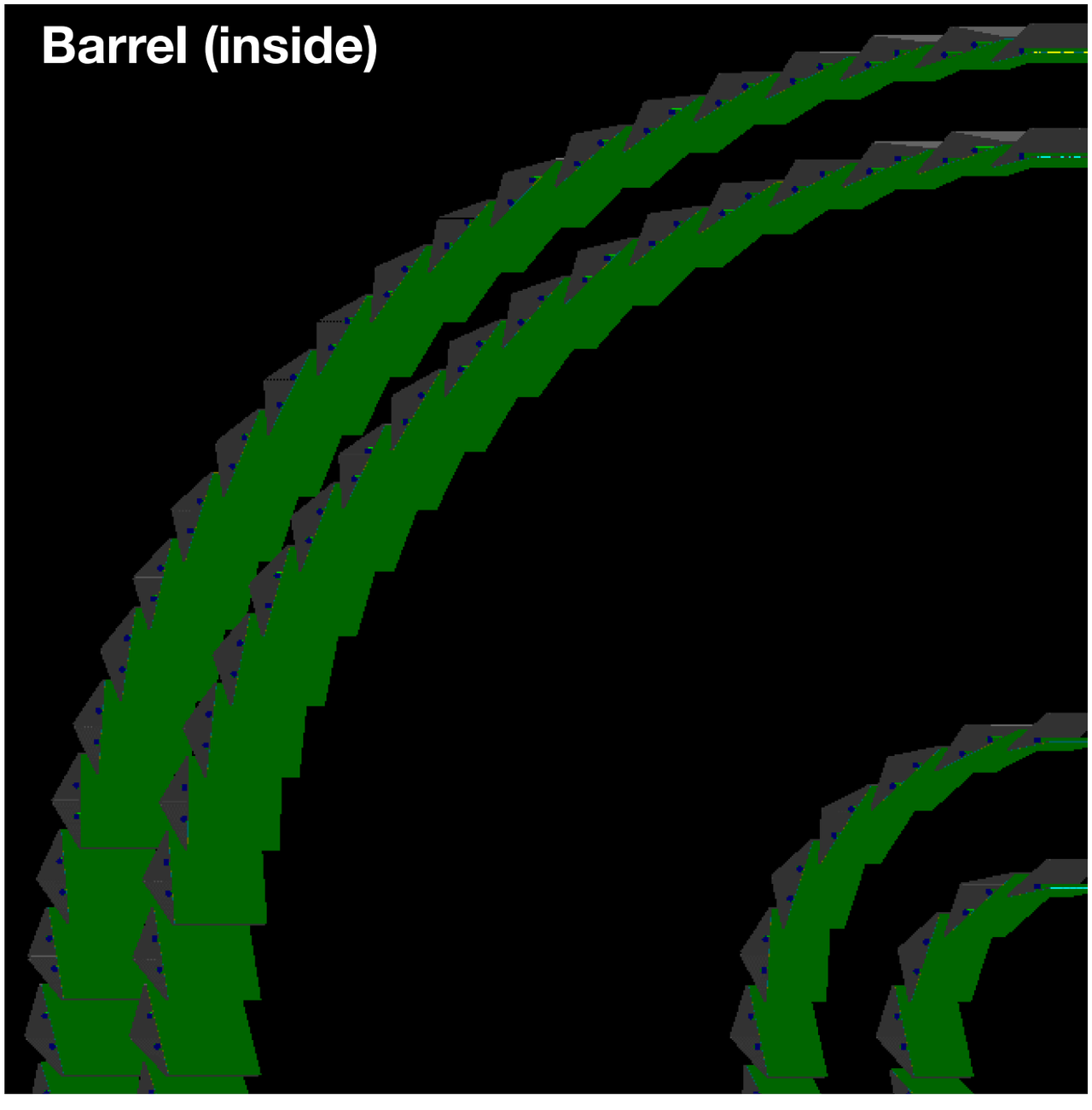


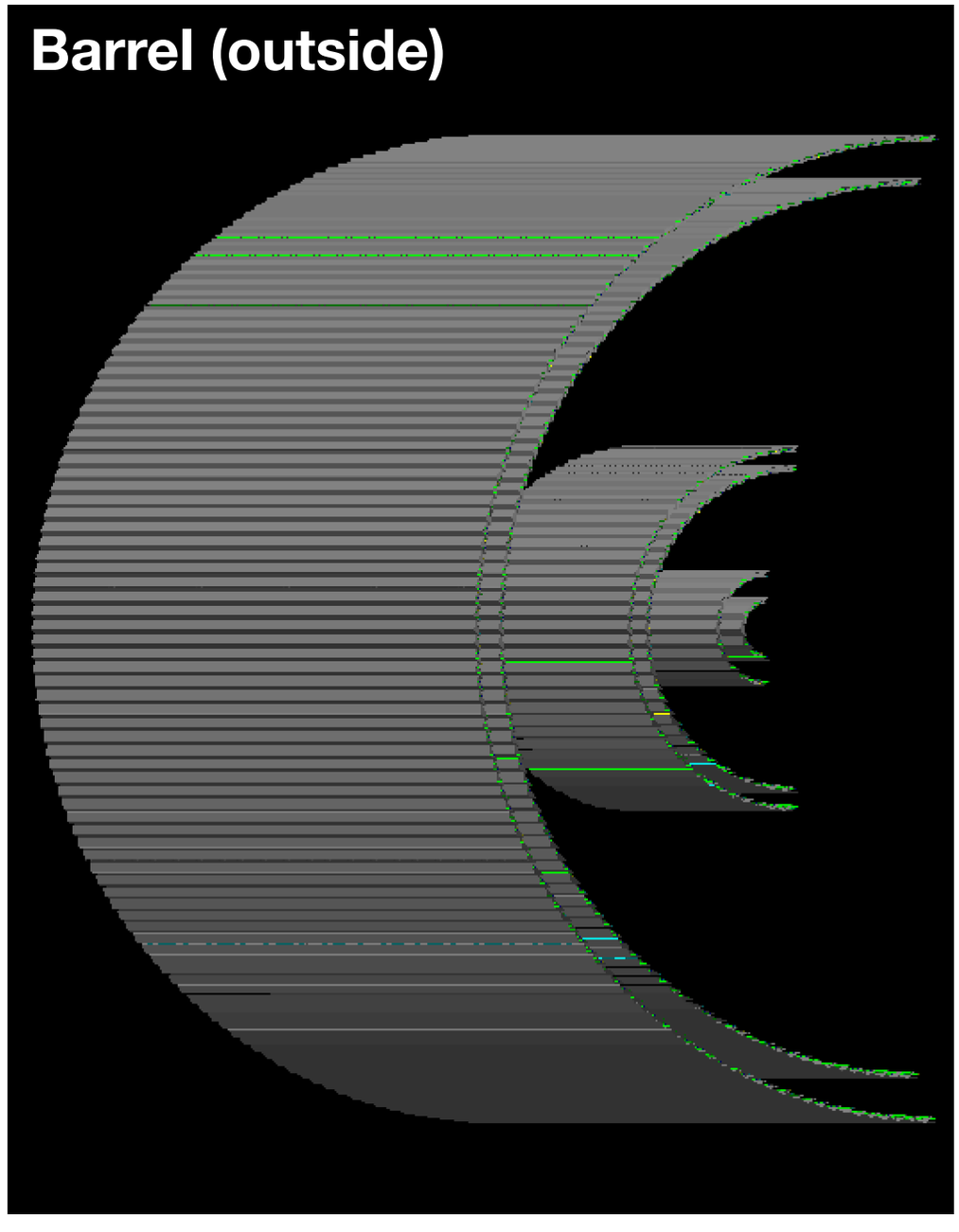


Geometry implemented by Ernst and Yue Shi in EICroot and loaded into Fun4All

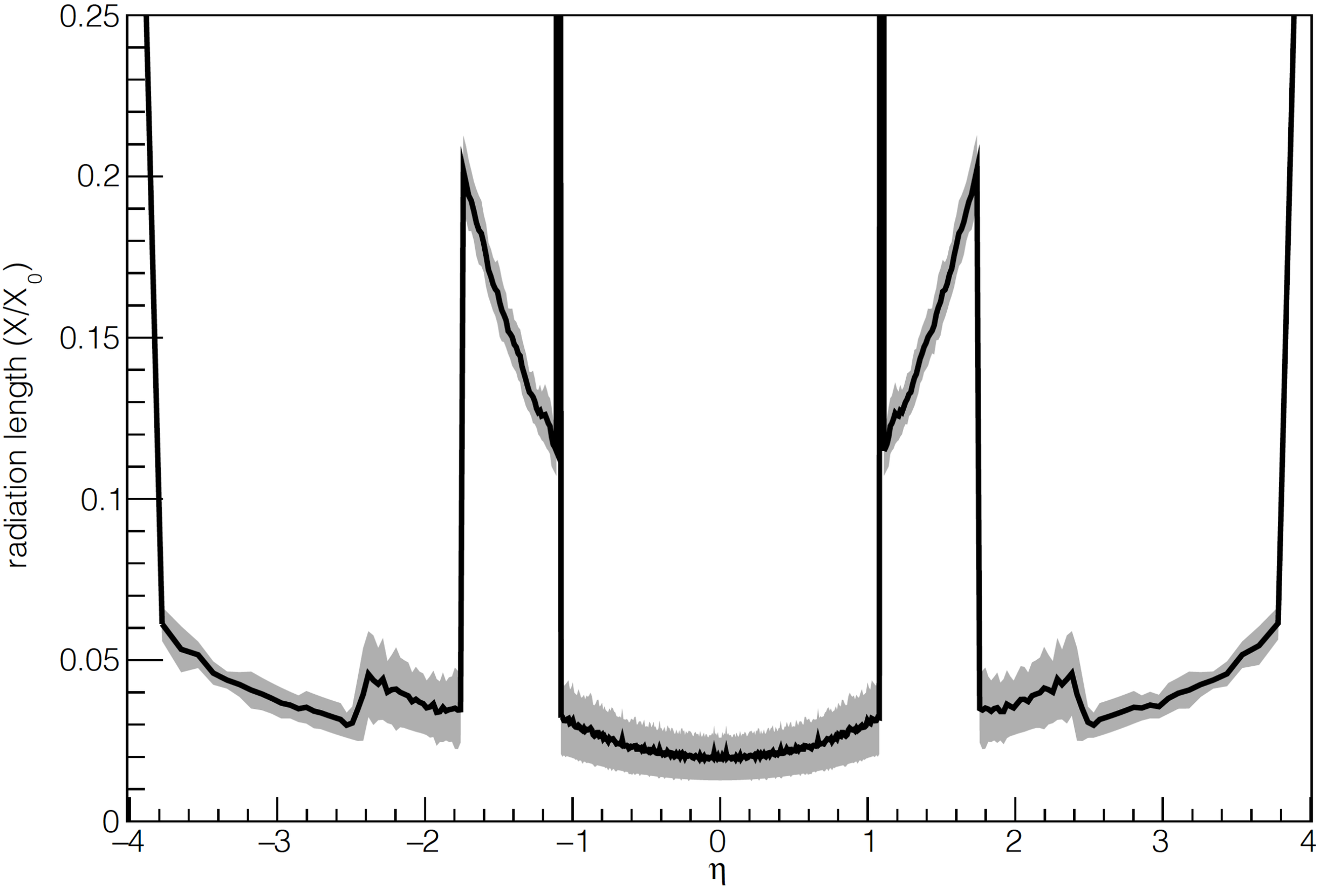
Material Scan

- Detector is not “smooth” in ϕ
- For a given η, did scan in ϕ
- error bar corresponds to max and min X/X_0

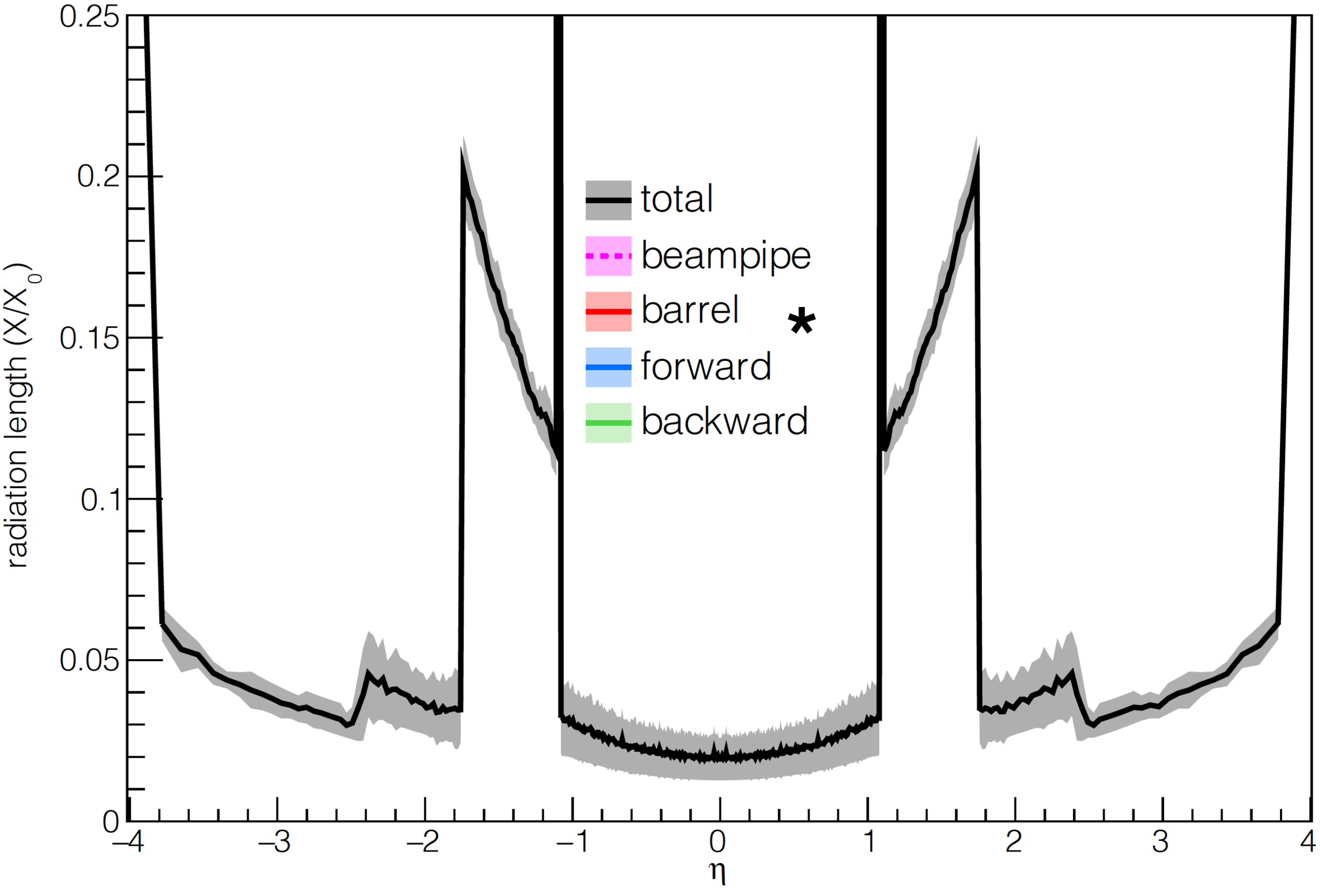




Material Scan

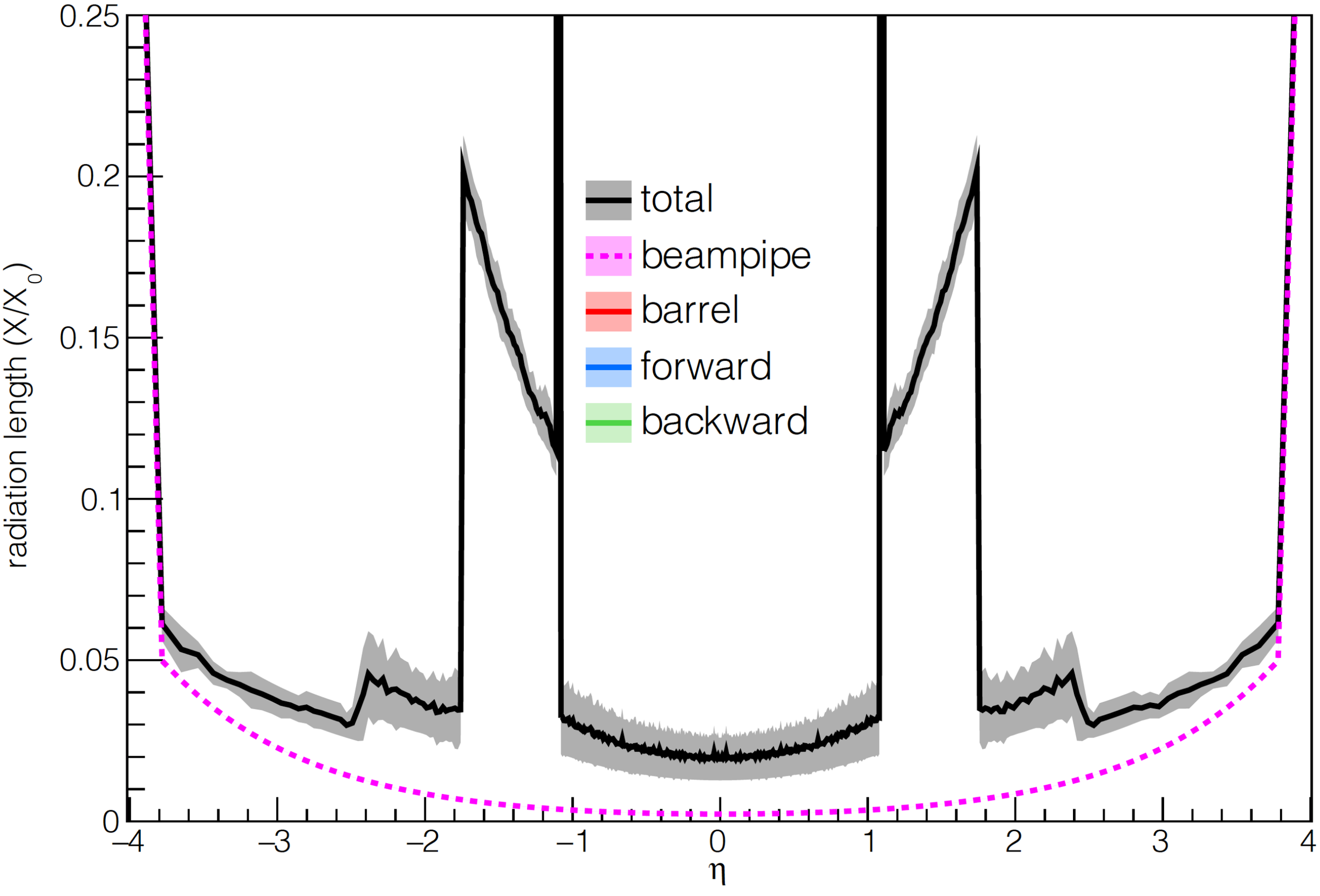


Material Scan

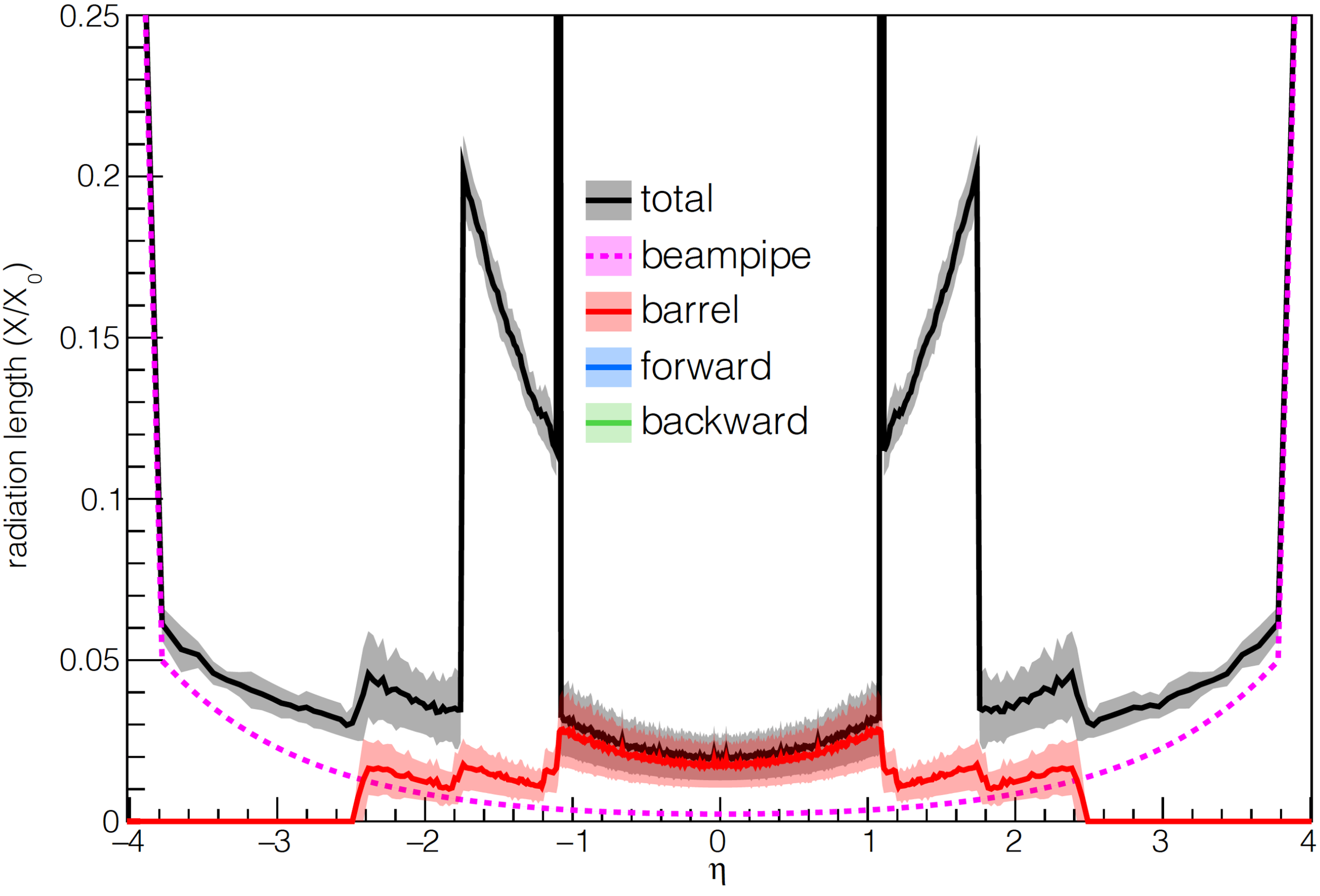


*** These are labels from the geometry file**

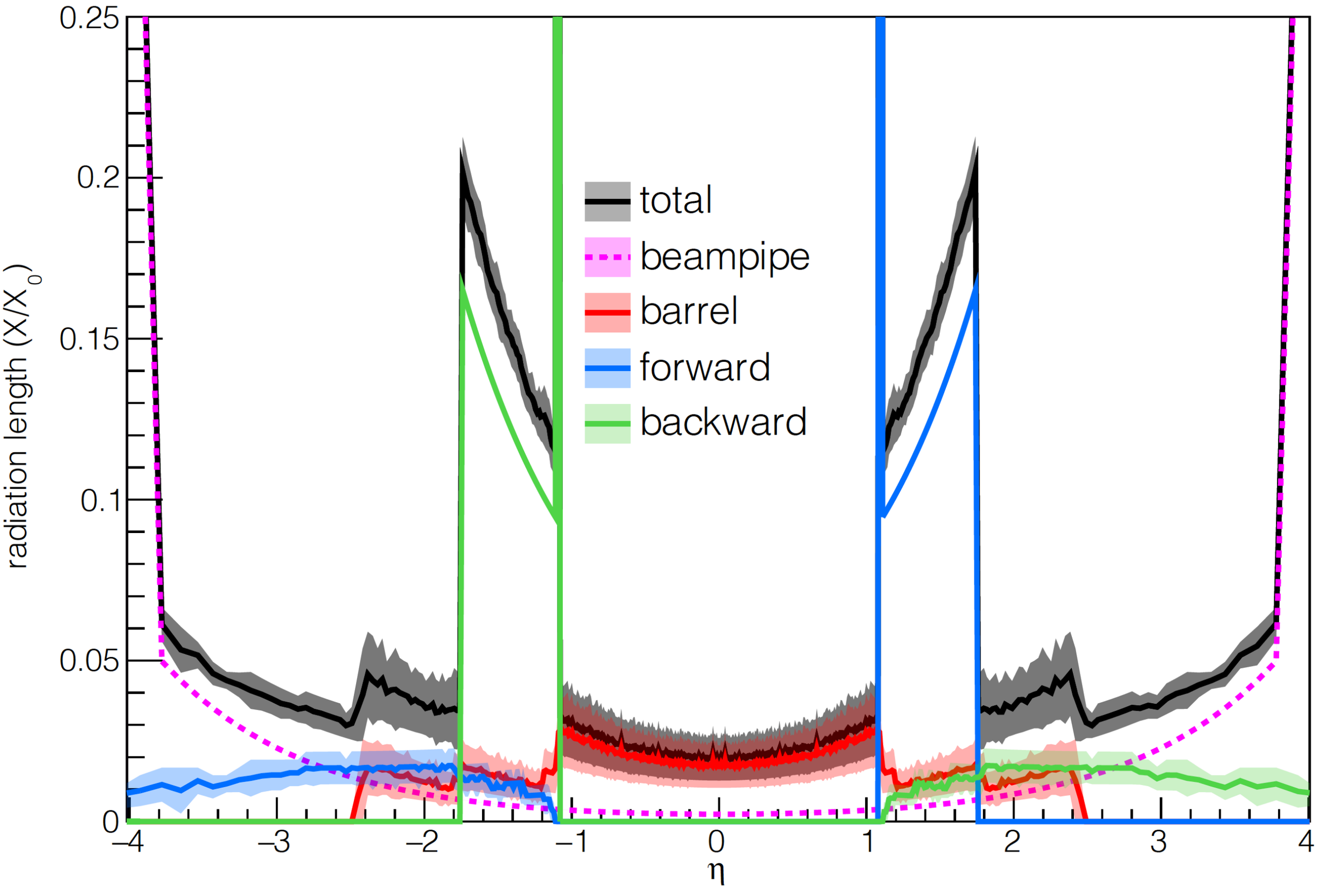
Material Scan



Material Scan



Material Scan

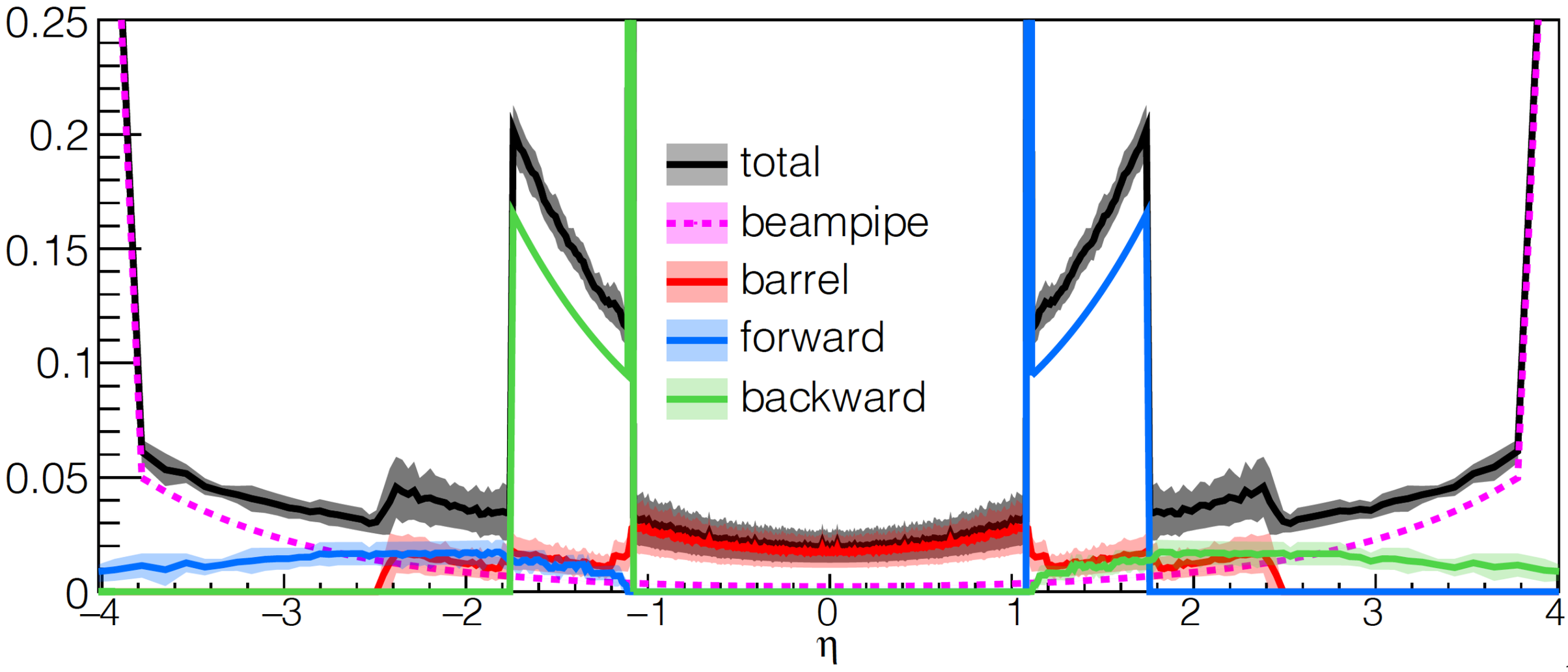


Questions

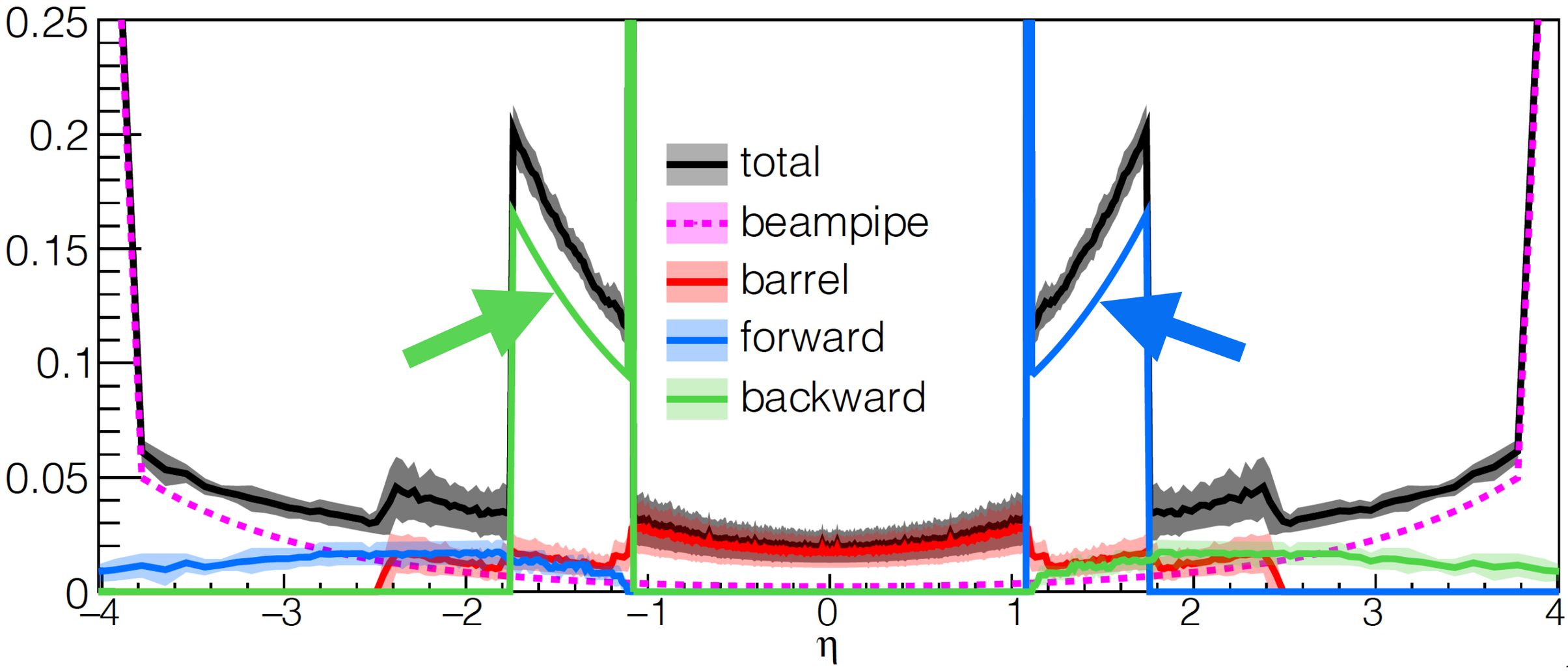
1. What are the ears right above the spikes at $\eta = \pm 1.1$?

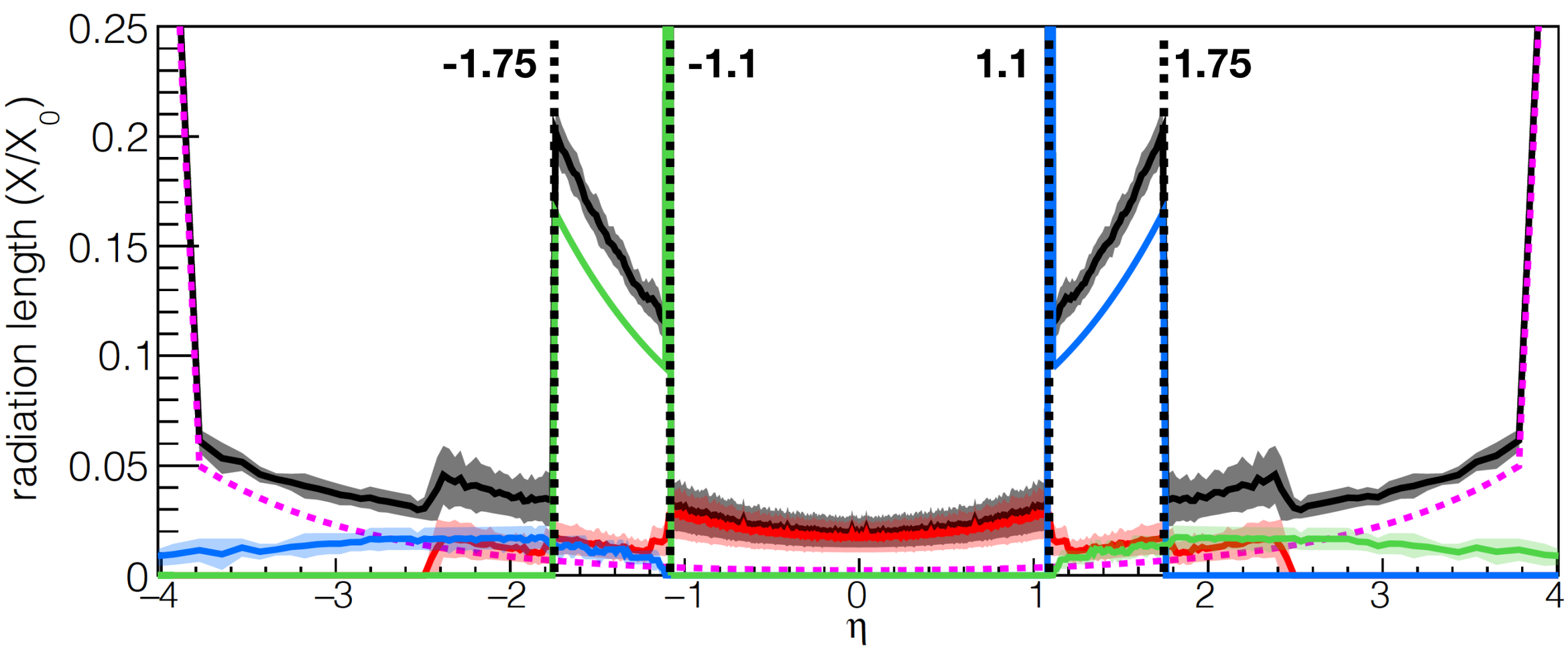
2. Does the barrel coverage make sense?

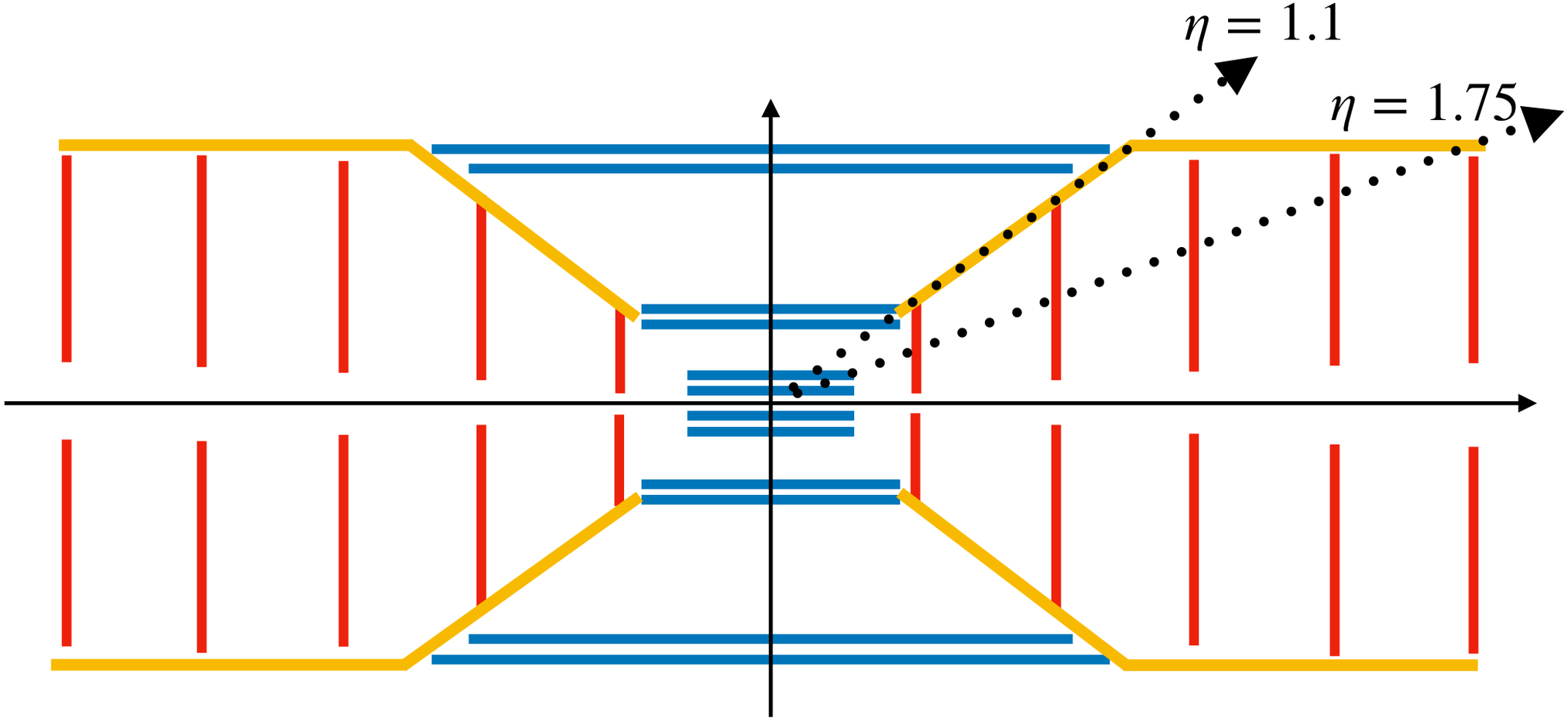
3. Why is there material in the forward region of the backward-labeled detector part?



1. What are the ears right above the spikes at $\eta = \pm 1.1$?




-1.75
-1.1
1.1
1.75
radiation length (X/X0)
0.25
0.2
0.15
0.1
0.05
0
–4
–3
–2
–1
0
1
2
3
4
η


η = 1.1
η = 1.75

Aluminum Support Structure Contribution

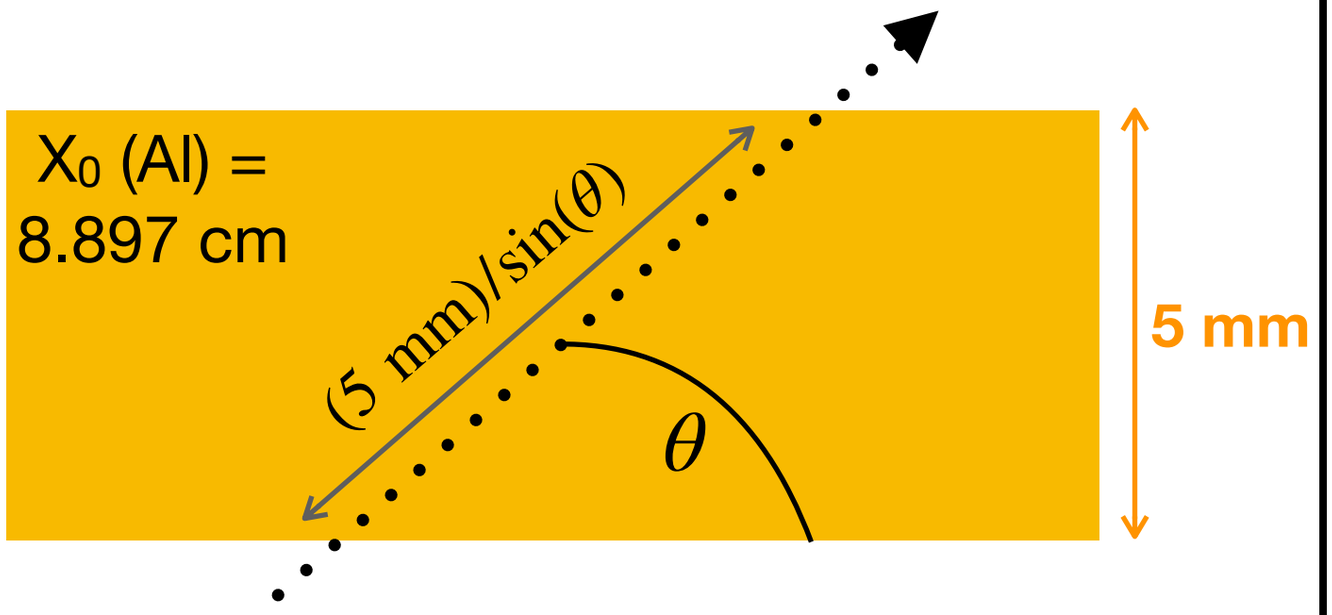
Back-of-the-envelope calculation

$@\ \eta = 1.1$

$X/X_0 = 0.094$

$@\ \eta = 1.75$

$X/X_0 = 0.167$

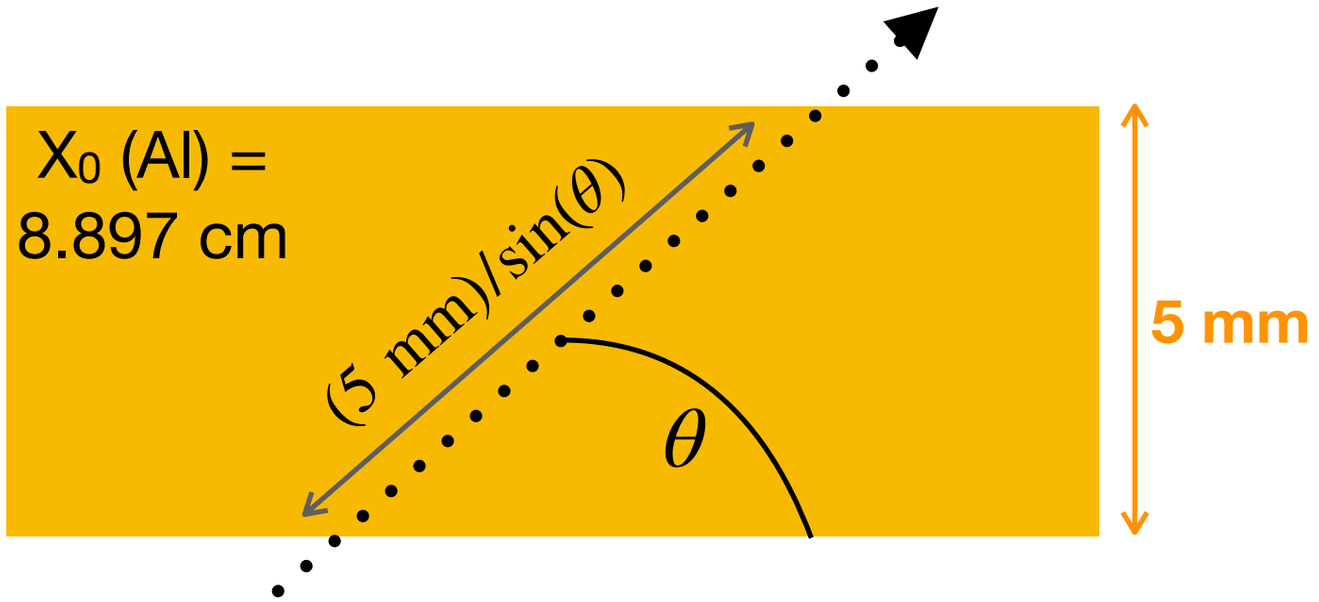


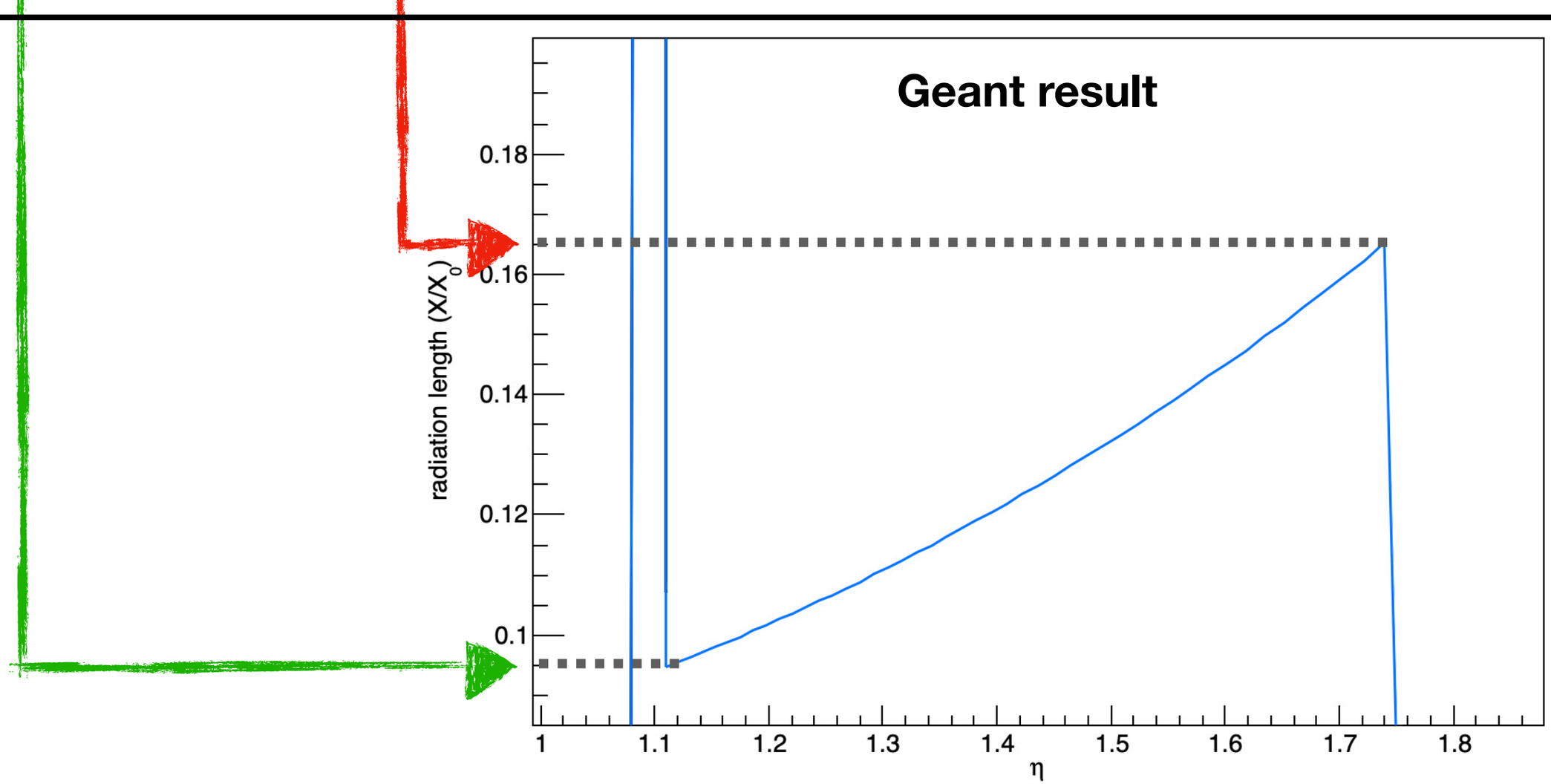
Aluminum Support Structure Contribution

Back-of-the-envelope calculation

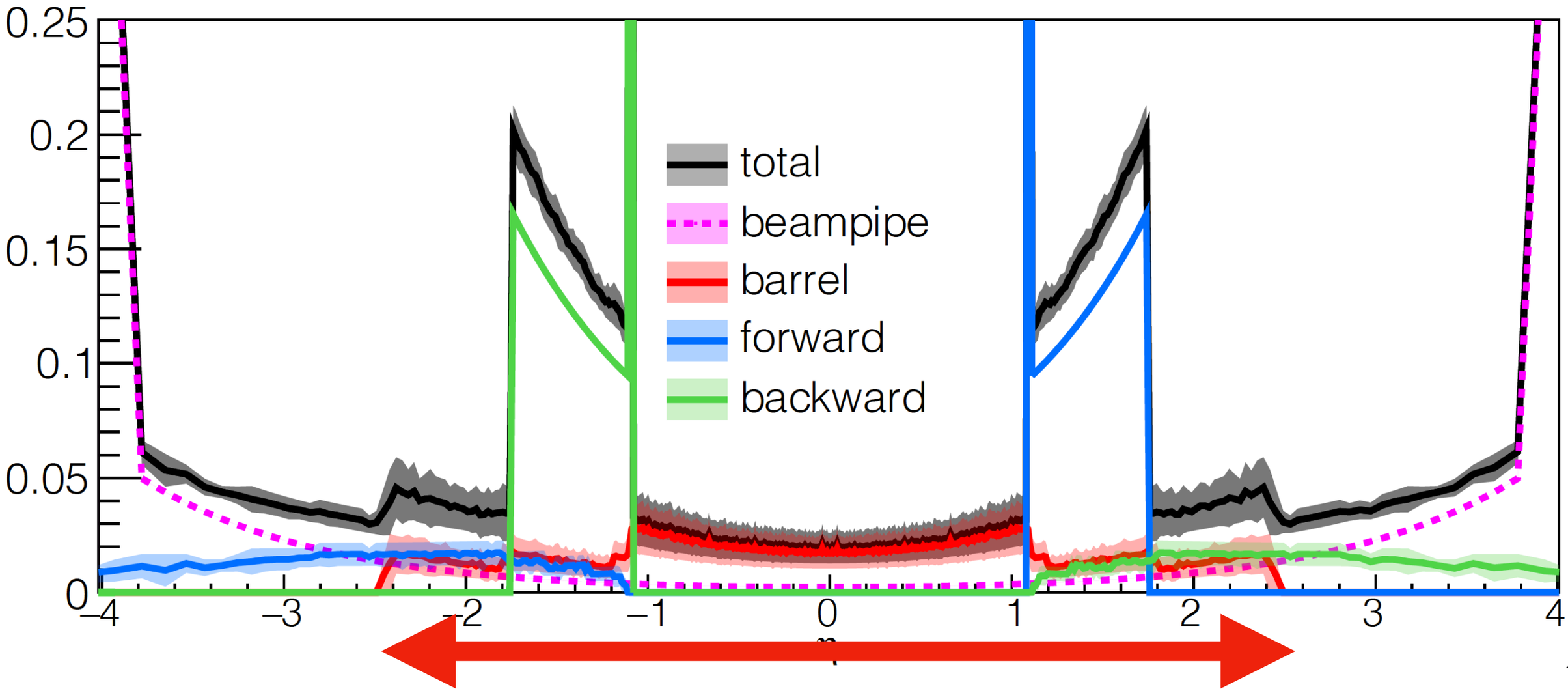
$@\ \eta = 1.1$ $@\ \eta = 1.75$

$X/X_0 = 0.094$ $X/X_0 = 0.167$

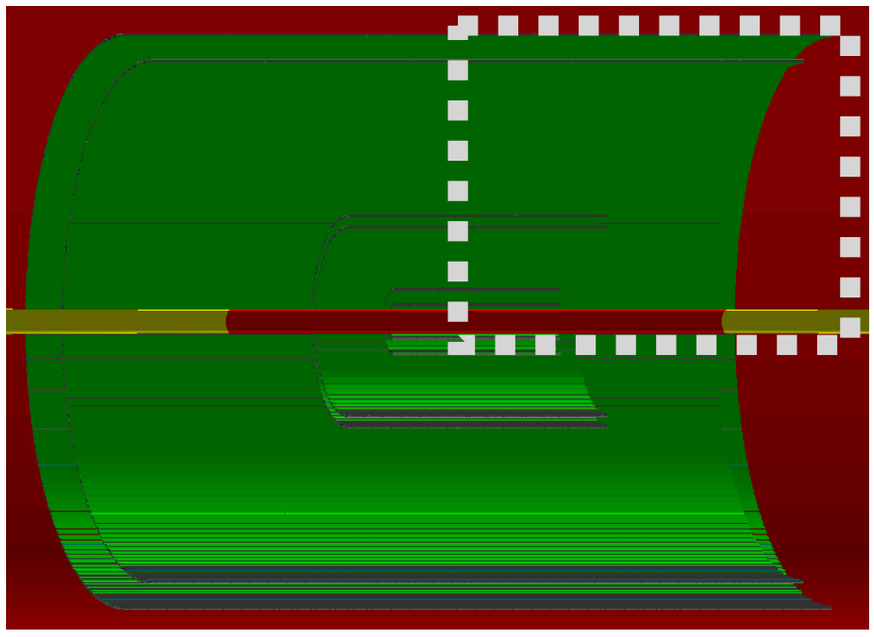


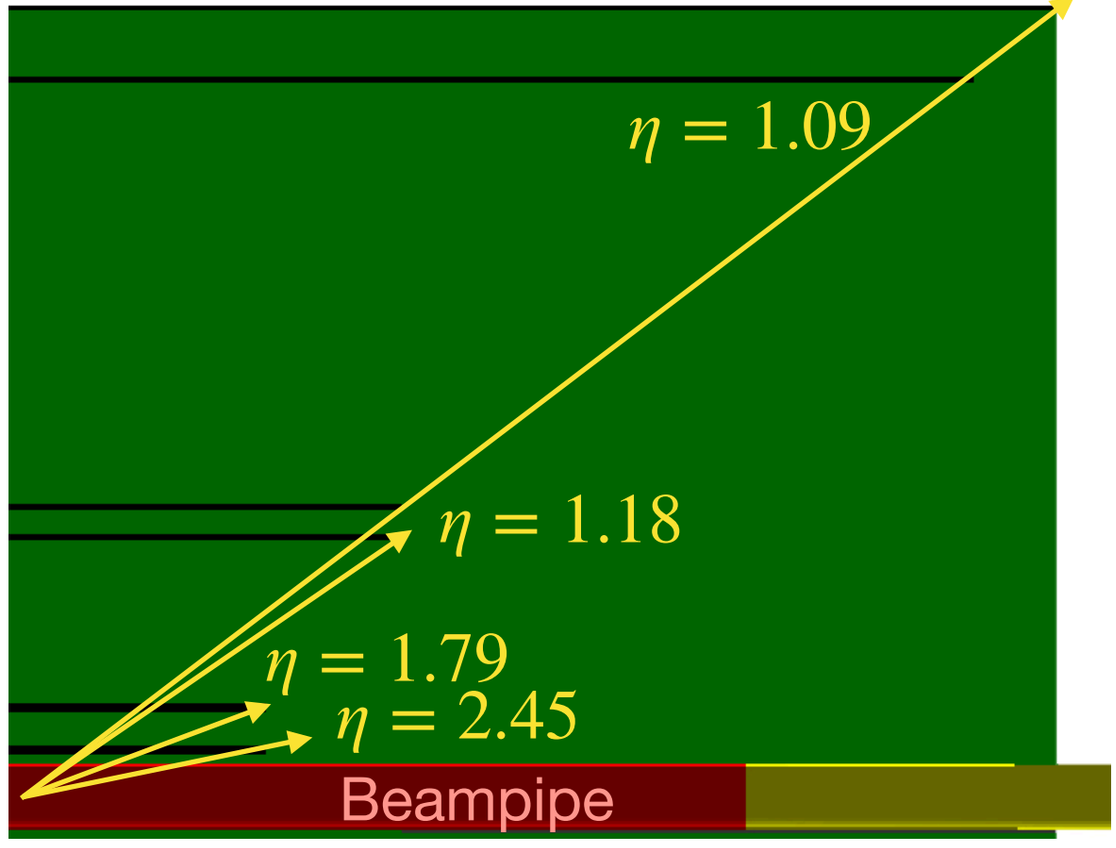


2. Does the barrel coverage make sense?

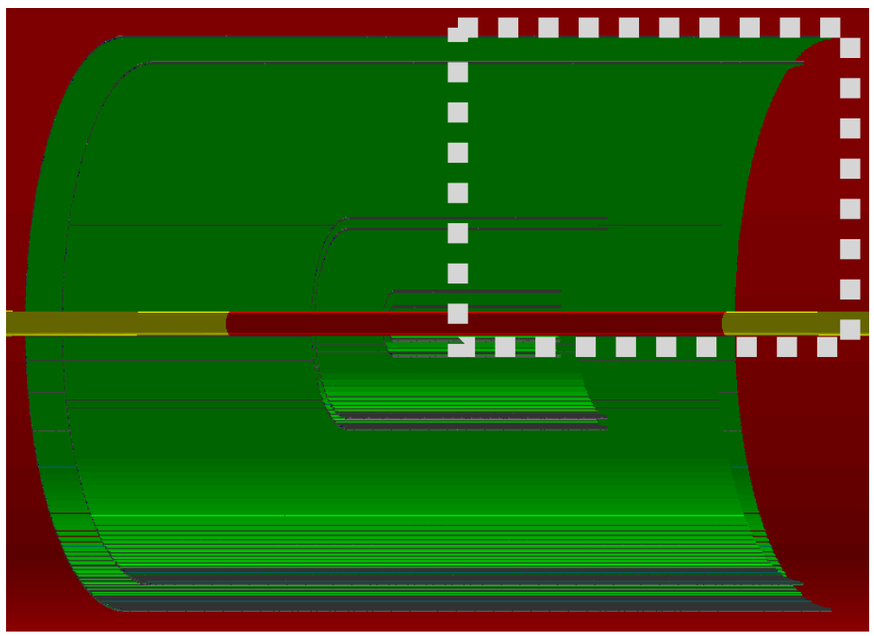


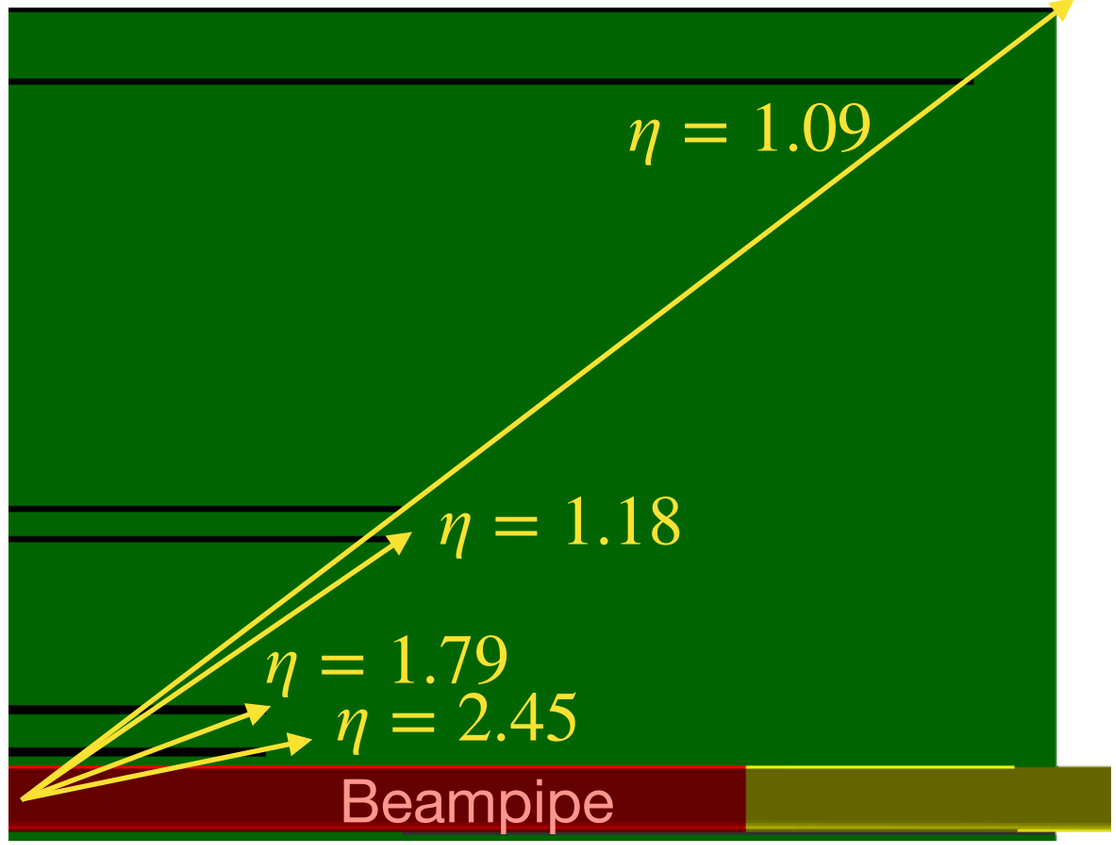
Barrel Scan





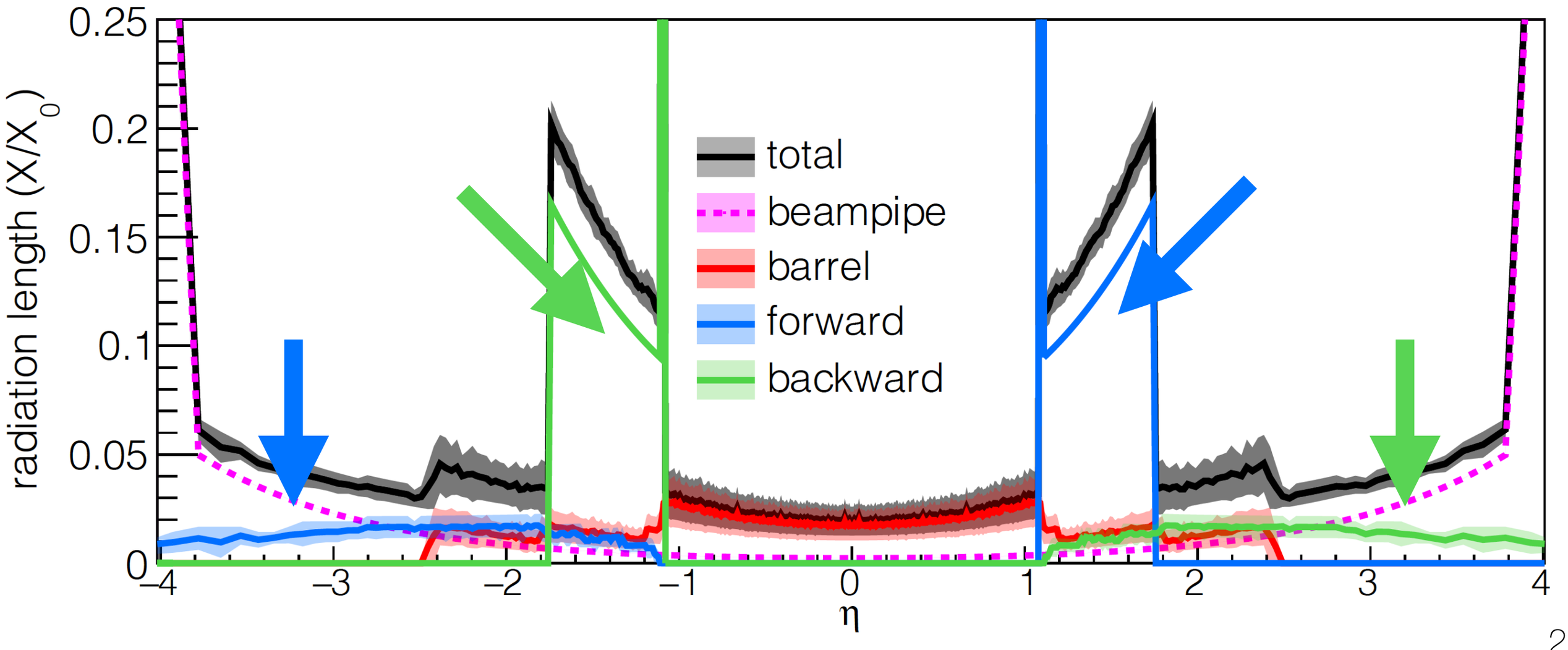
Barrel Scan

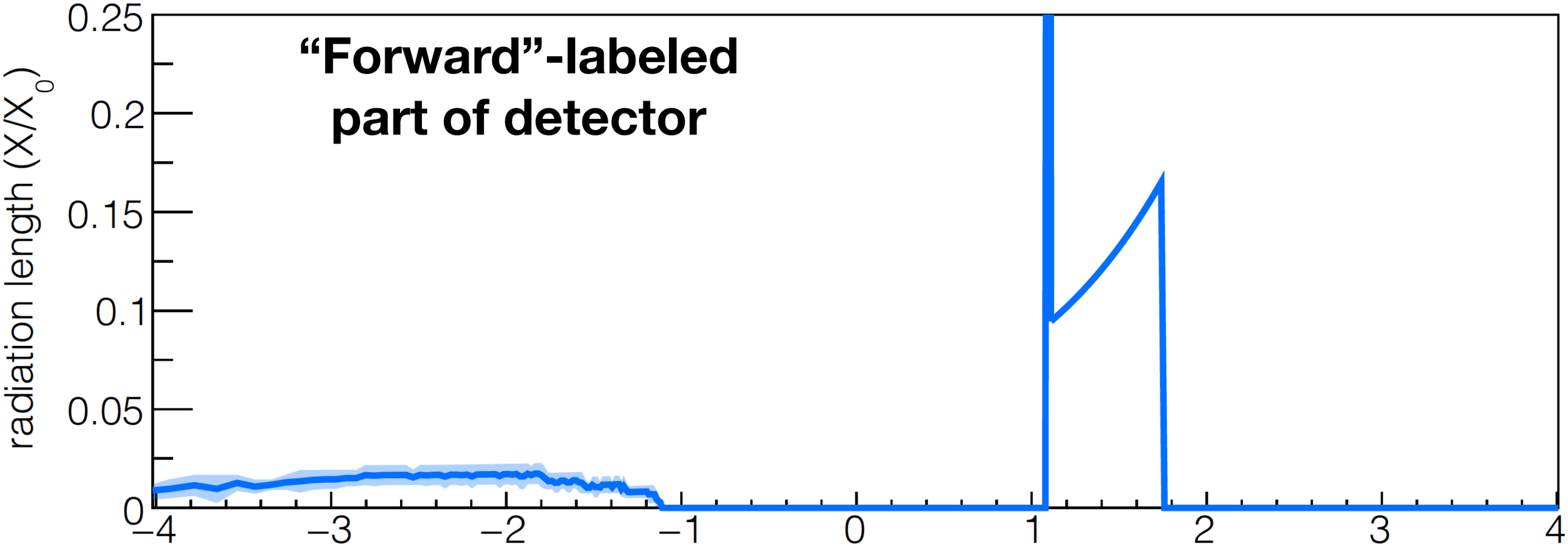



η = 1.09
η = 1.18
η = 1.79
η = 2.45
Beampipe

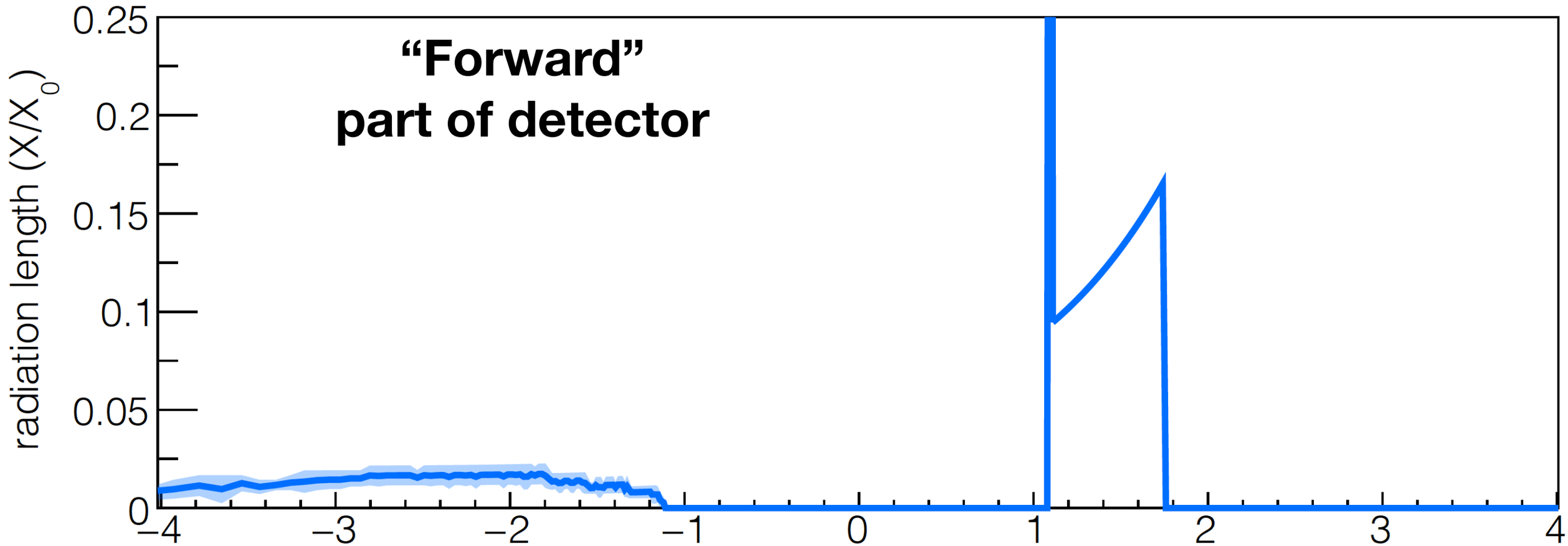
-1.09
1.09
6 barrel layer
-1.18
1.18
-2.45
-1.79
1.79
2.45
3 barrel layer
2 barrel layer
1 barrel layer
radiation length (X/X0)
0.04
0.03
0.02
0.01
0
−2
−1
0
1
2
η

3. Why is there material in the forward region of the backward-labeled detector part?





Why do we see material both in the forward and backward regions for the forward-label part of the detector?


“Forward”
part of detector
radiation length (X/X0)
0.25
0.2
0.15
0.1
0.05
0
−4
−3
−2
−1
0
1
2
3
4
η

Outline

1. Detailed Material Scan

2. B-field comparison

Uniform vs. Map B-Fields

Uniform

Map

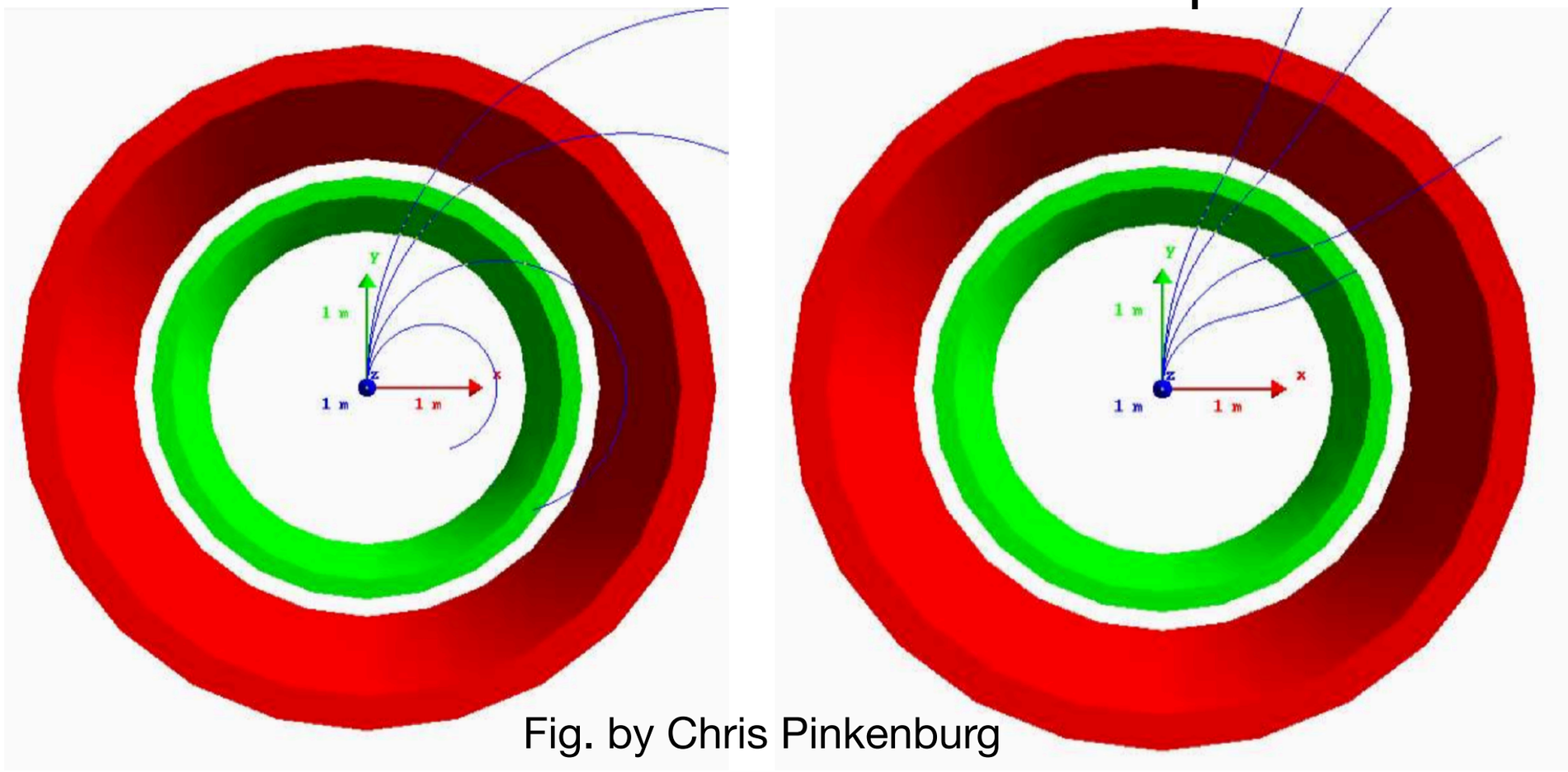


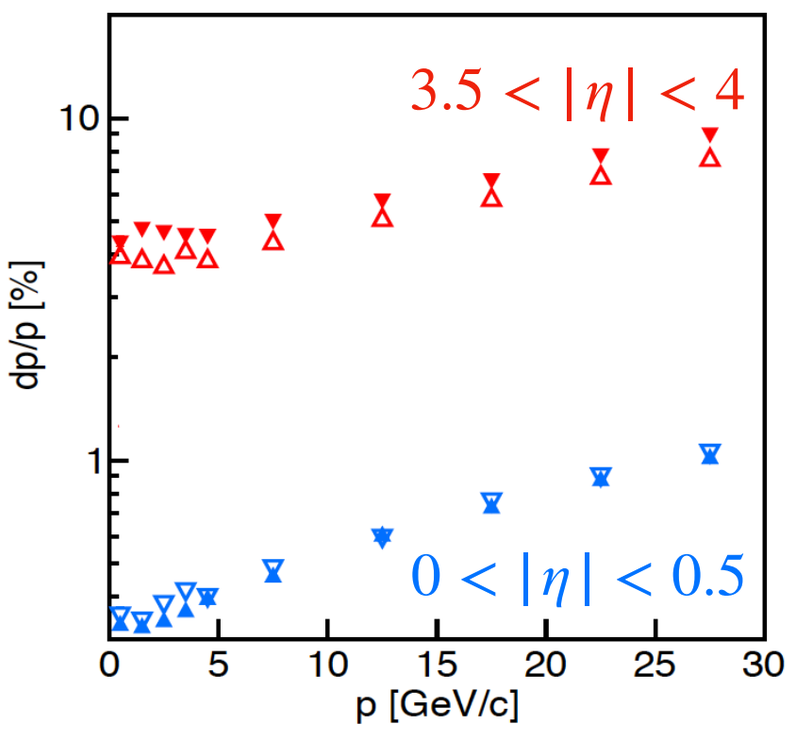
Fig. by Chris Pinkenburg

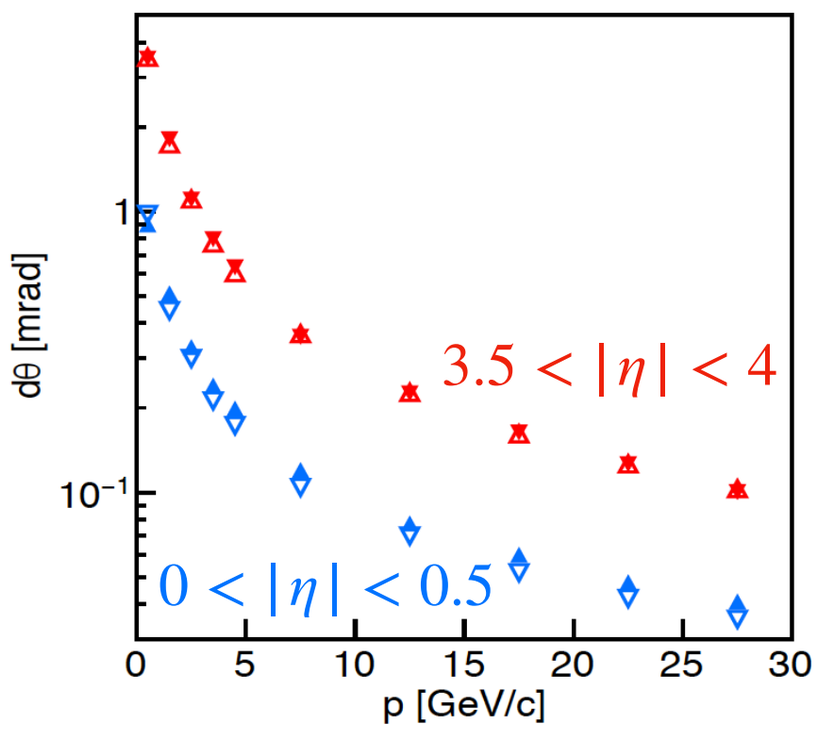
Uniform 3.0 T vs. Beast Map

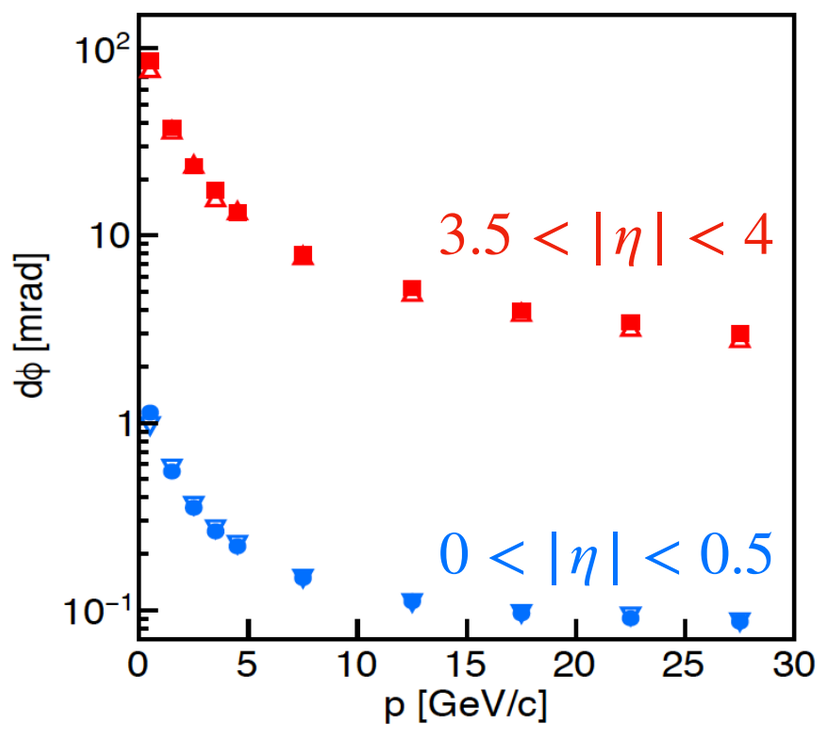
Uniform 1.5 T vs. sPHENIX Map

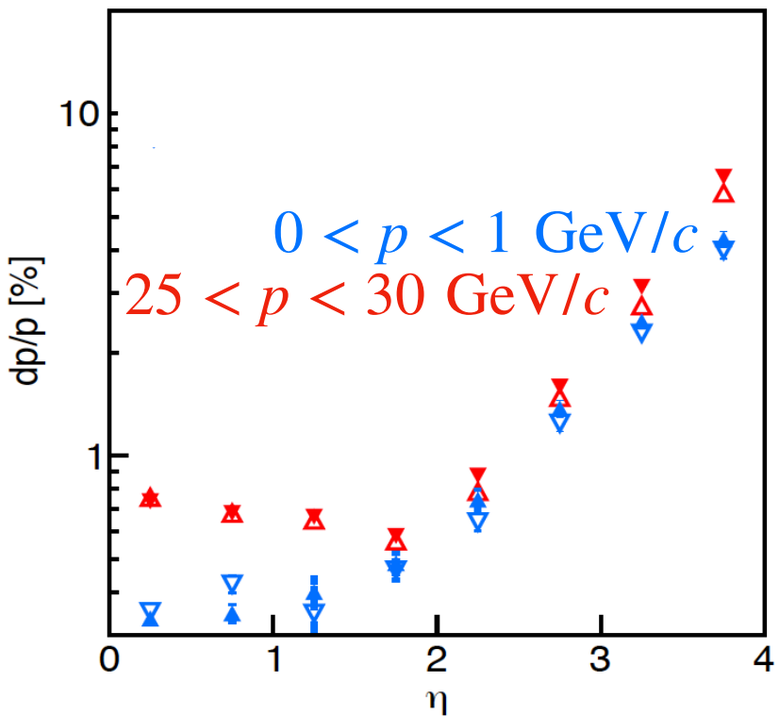
3.0 T Field comparison (π^-, at vertex)

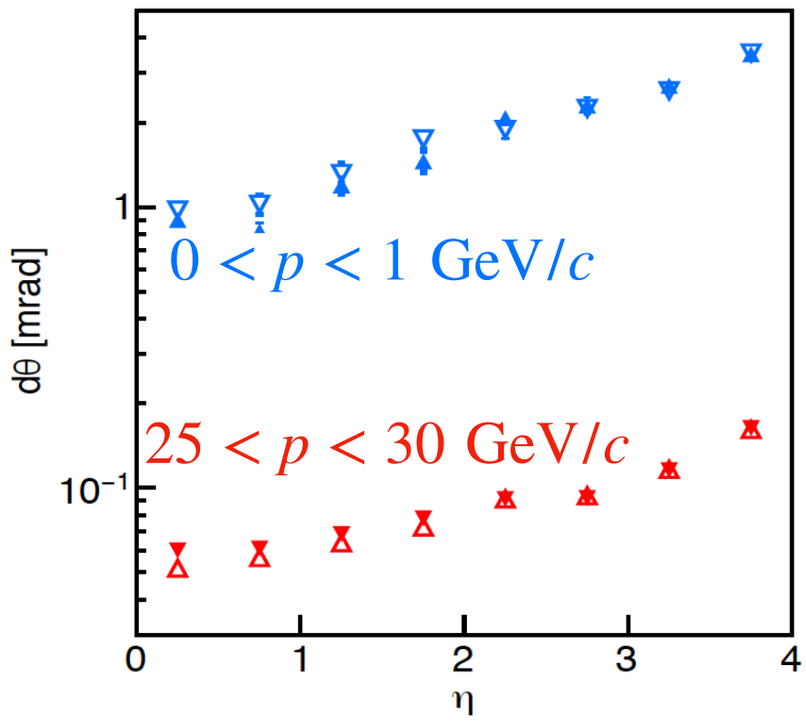
Map **Ideal**

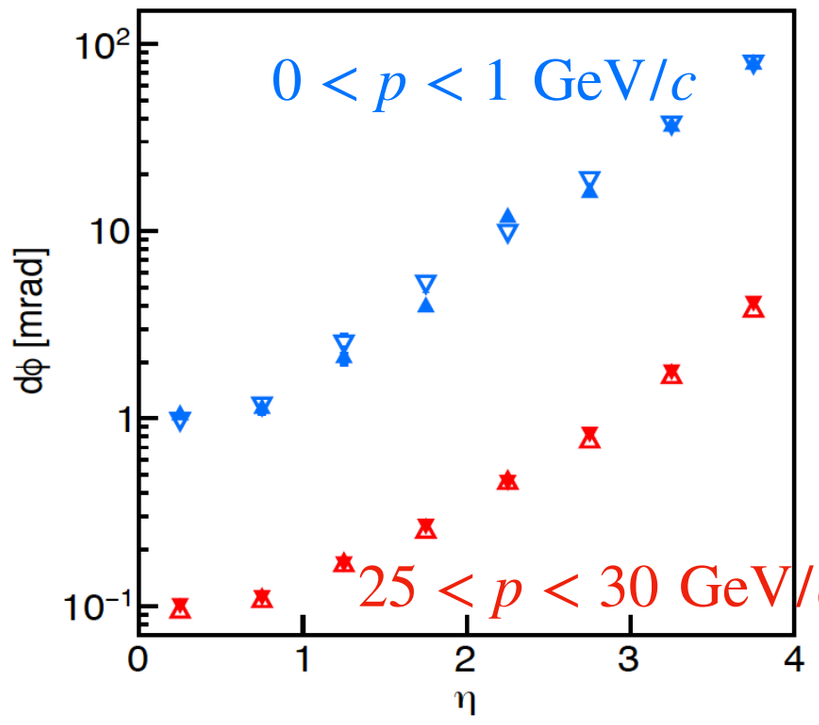












Plots by Winston DeGraw

Uniform vs. Map B-Fields

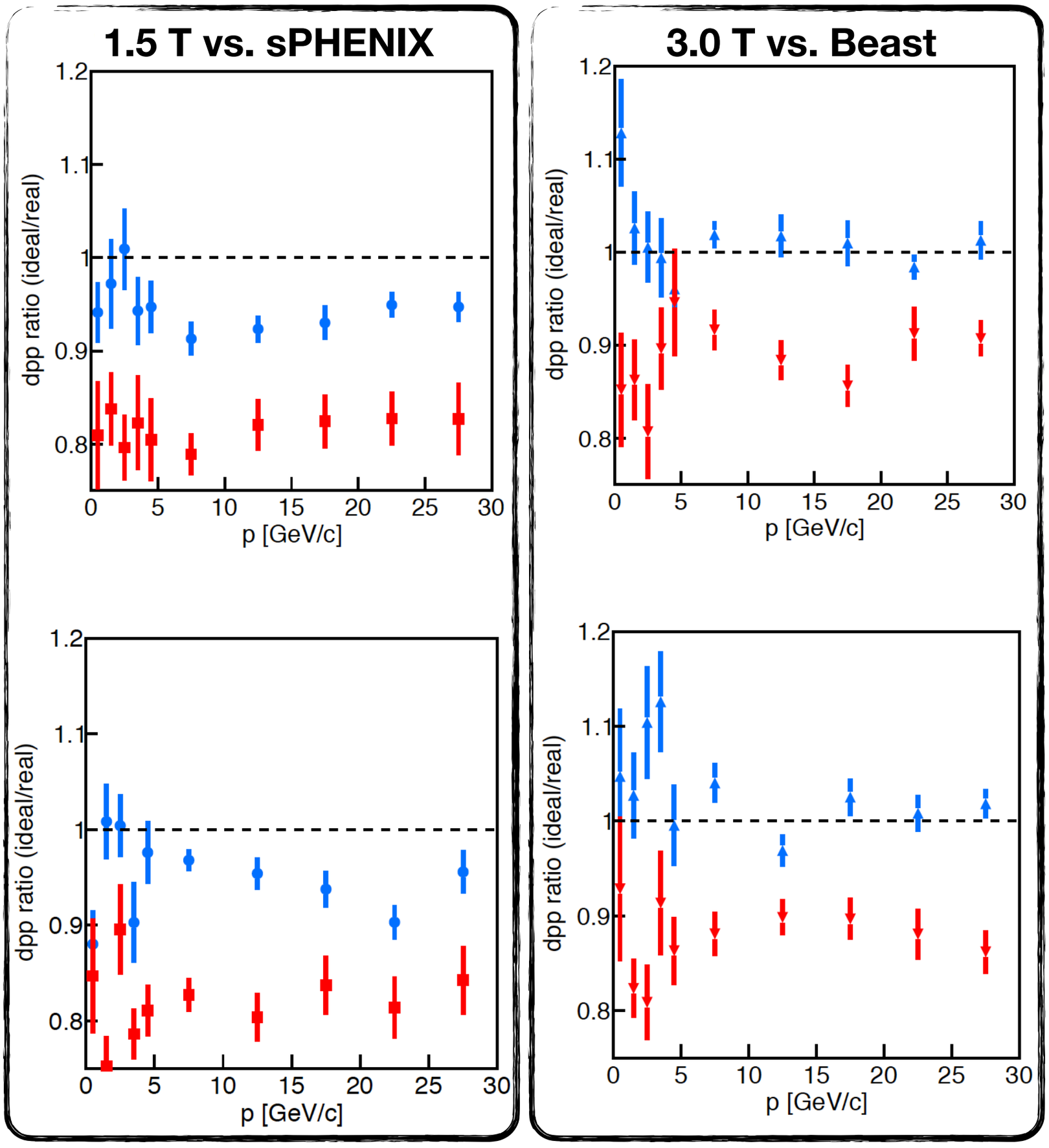
Plots by Winston DeGraw

e^-

$0 < |\eta| < 0.5$

$3.5 < |\eta| < 4$

π^-



Uniform vs. Map B-Fields

Plots by Winston DeGraw

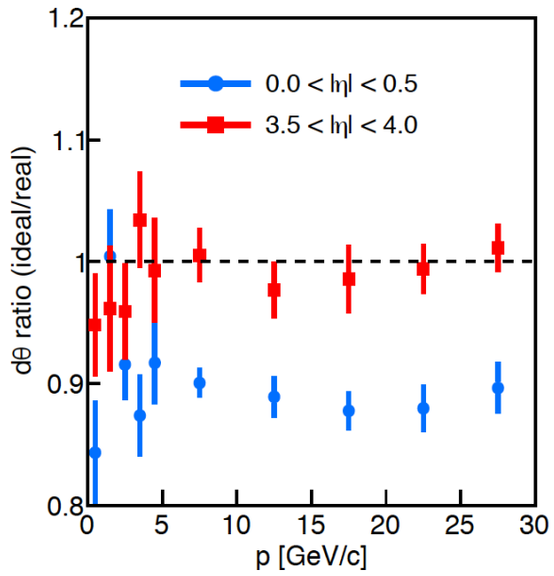
$0 < |\eta| < 0.5$

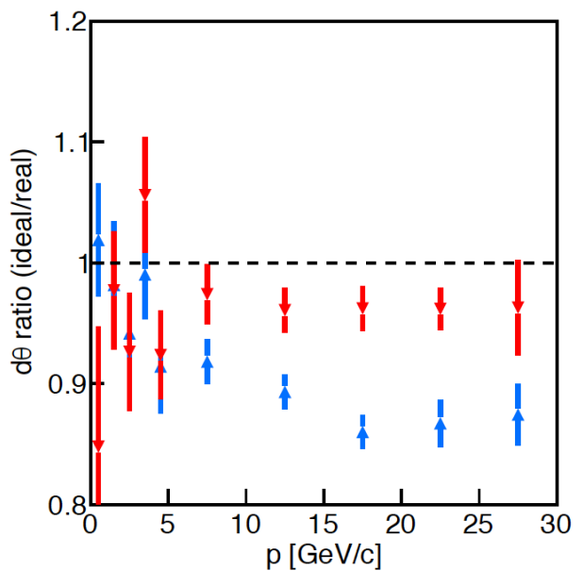
$3.5 < |\eta| < 4$

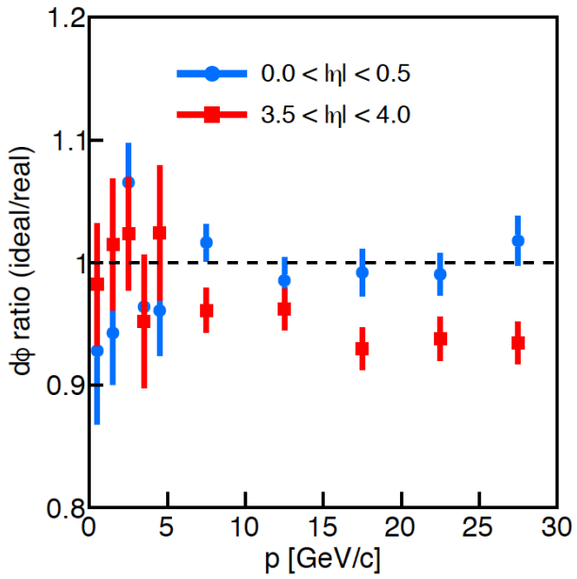
$d\theta$ $d\phi$

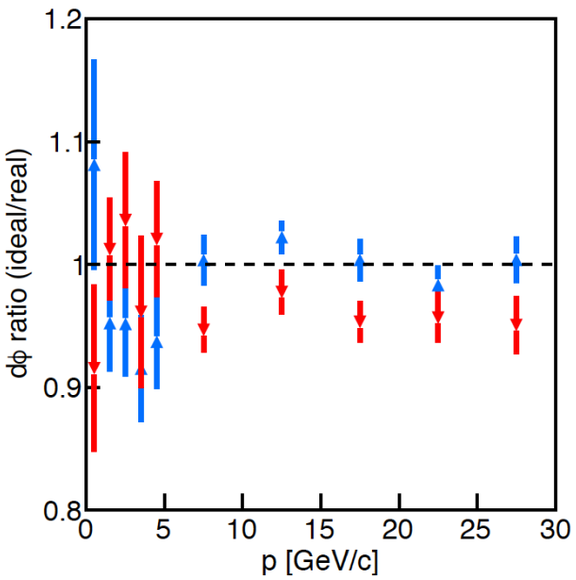
1.5 T vs. sPHENIX **3.0 T vs. Beast** **1.5 T vs. sPHENIX** **3.0 T vs. Beast**

e^-

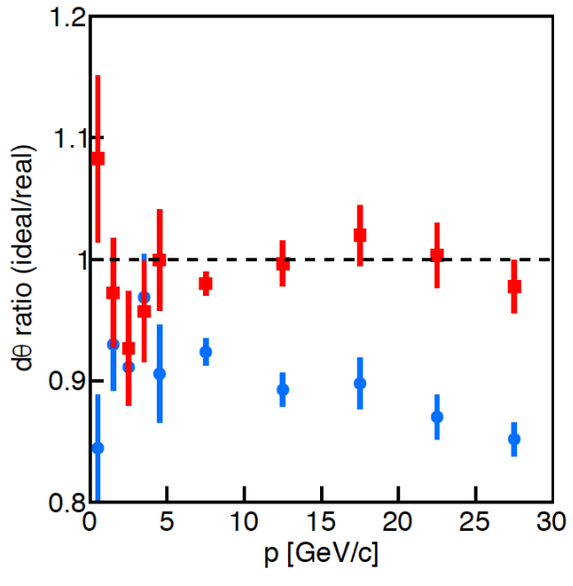


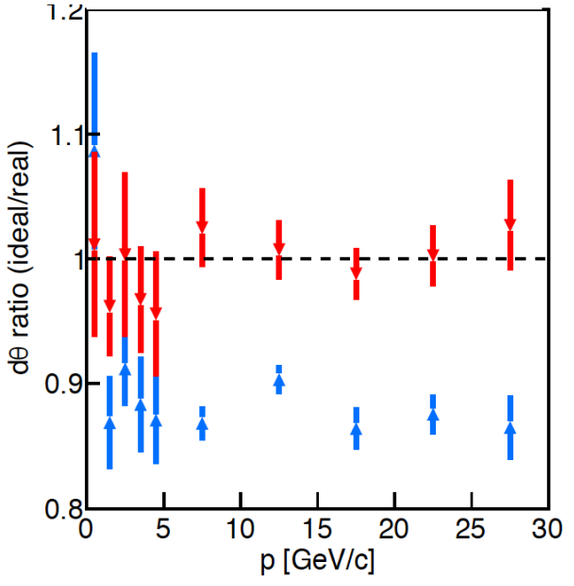


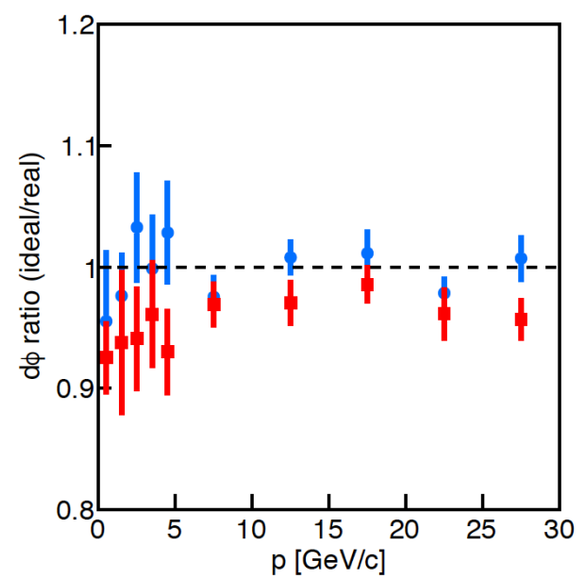


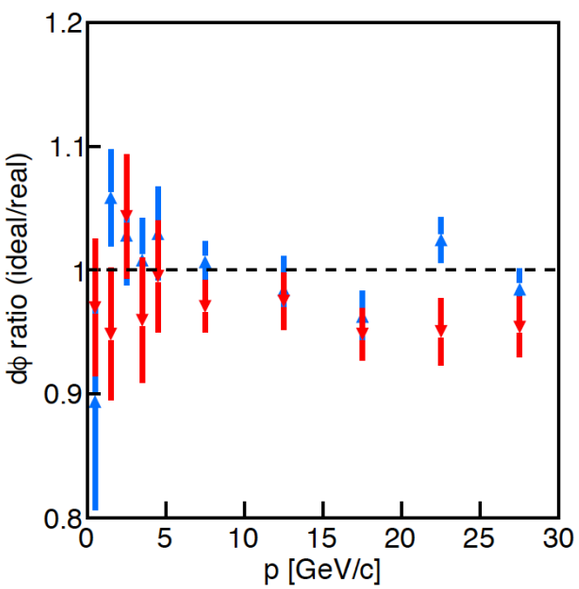


π^-









Summary and Conclusions

- Detailed geometry study
  - Understand features of the X/X_0 plots
  - Understand features of the TGeo file
- Compared uniform to realistic B fields

* Next steps: study jet performance of the detector