Inner and Forward Tracking Upgrade

Towards a CD0

Gerrit van Nieuwenhuizen

TUP workshop

BNL, 28 February 2006

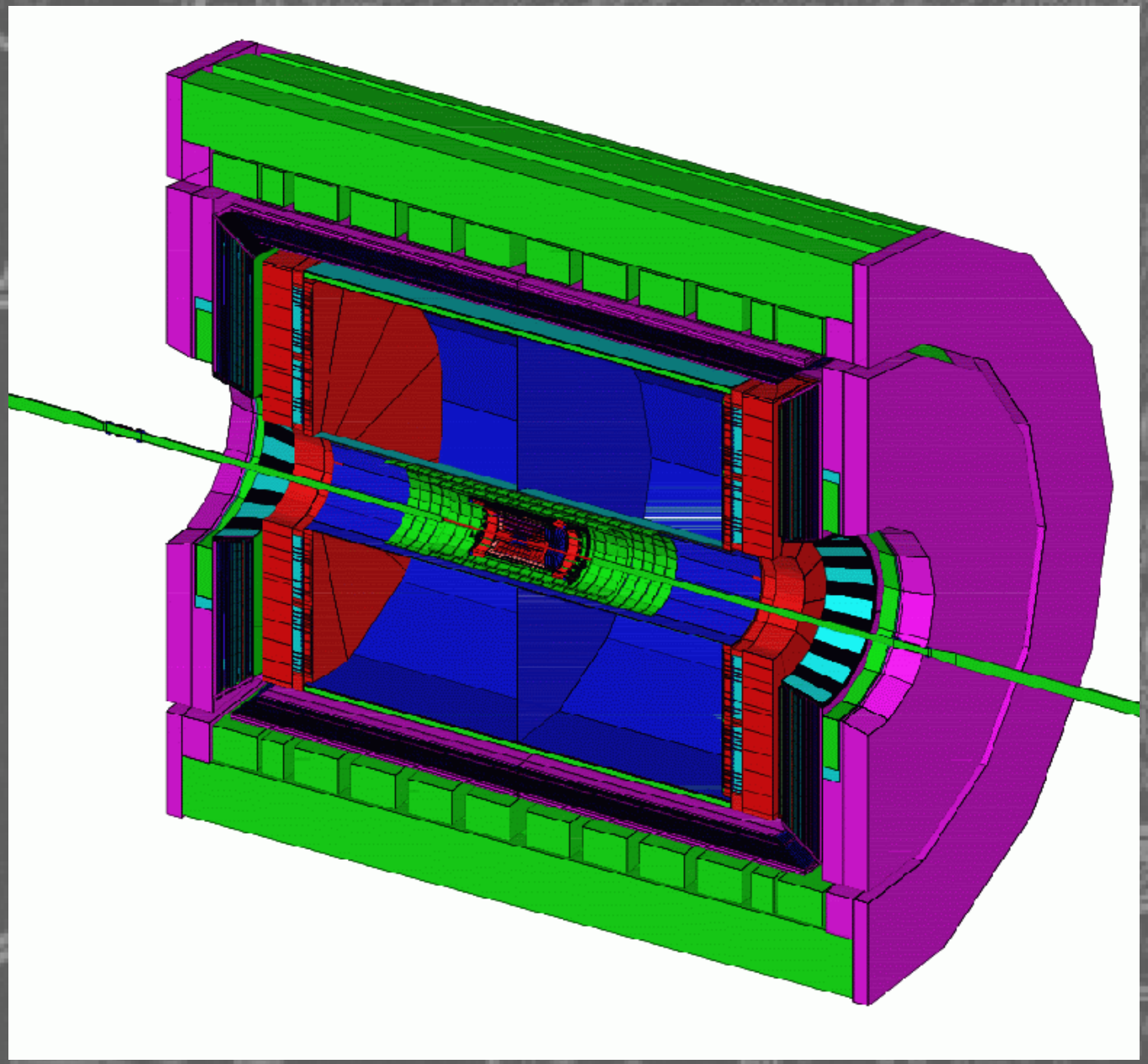
IST physics

Jim told most of this already

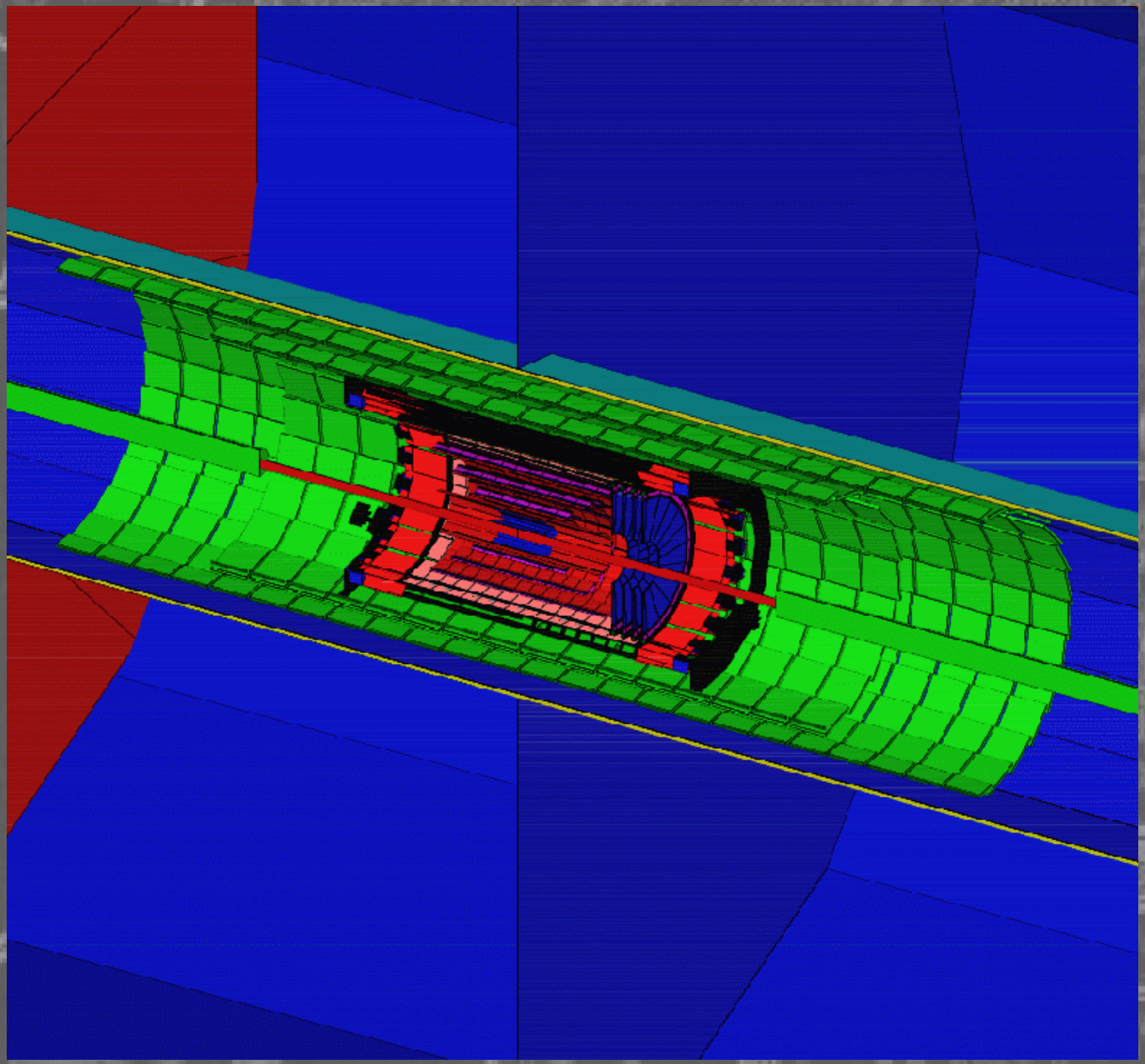
(c,b) R_AA as function of centrality
(c,b) Flow as function of centrality
Reference/Baseline systems (p+p, d+A, light A+A),
lower energies

Fast detector (no problems with overlapping events)
Able to work at low multiplicities
Good pointing resolution to hook up to HFT
Reasonable DCA resolution to do (c,b)

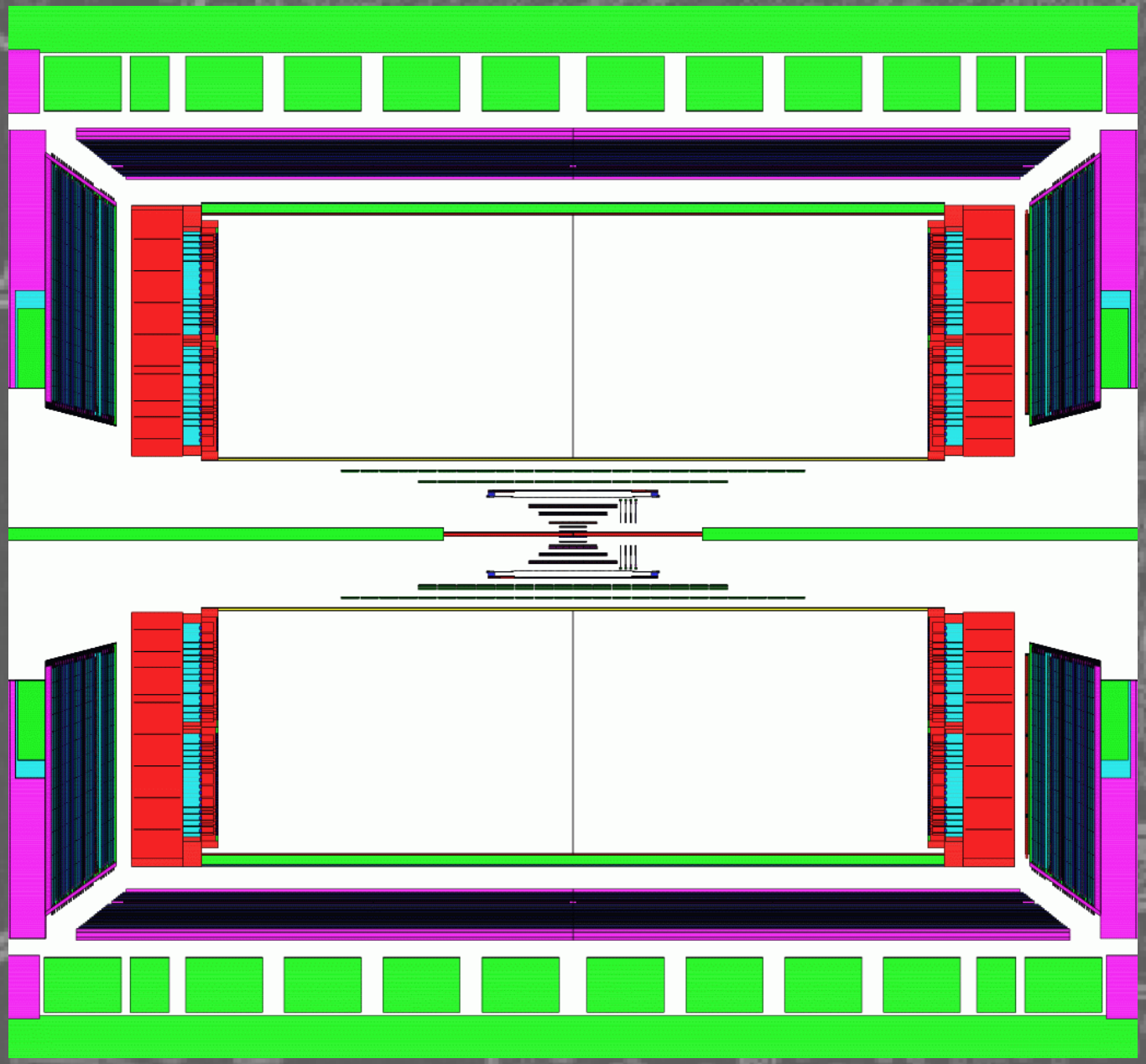
Tracking Upgrade in STAR



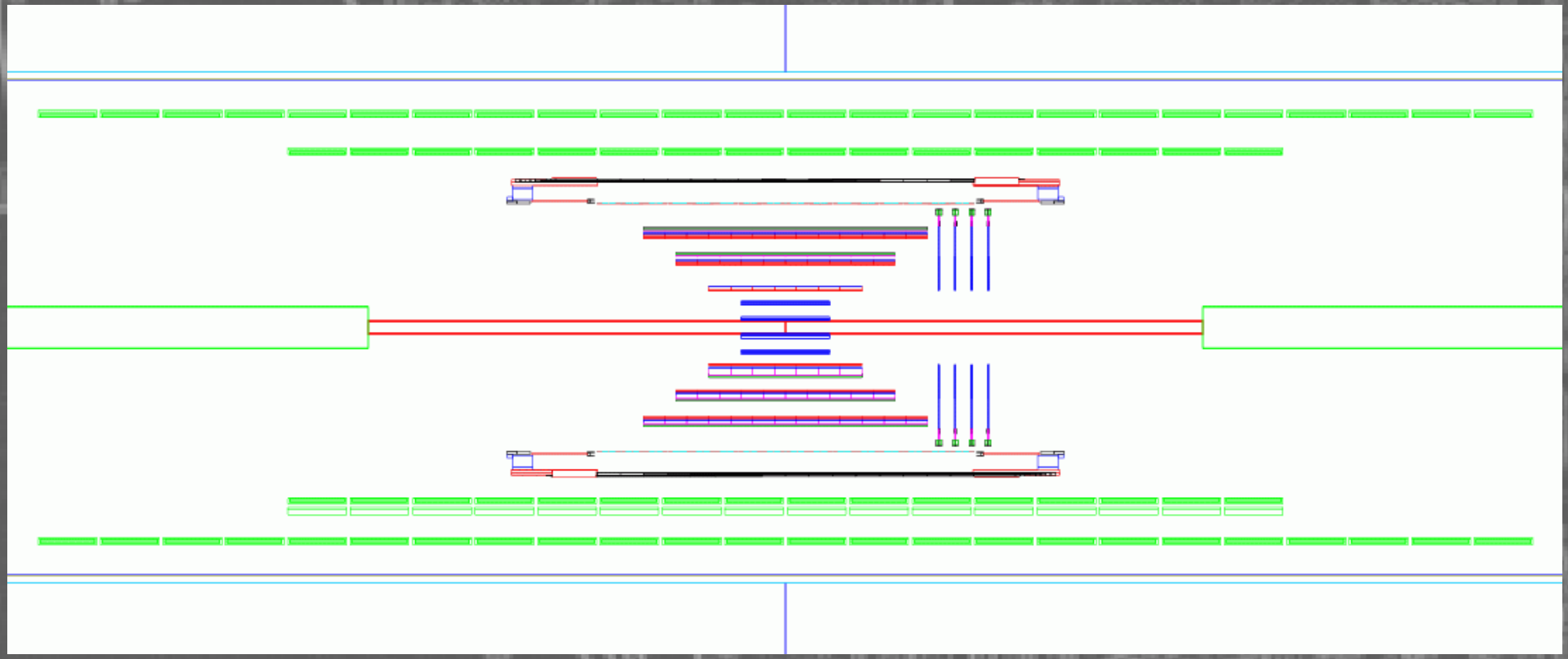
Tracking Upgrade inside TPC



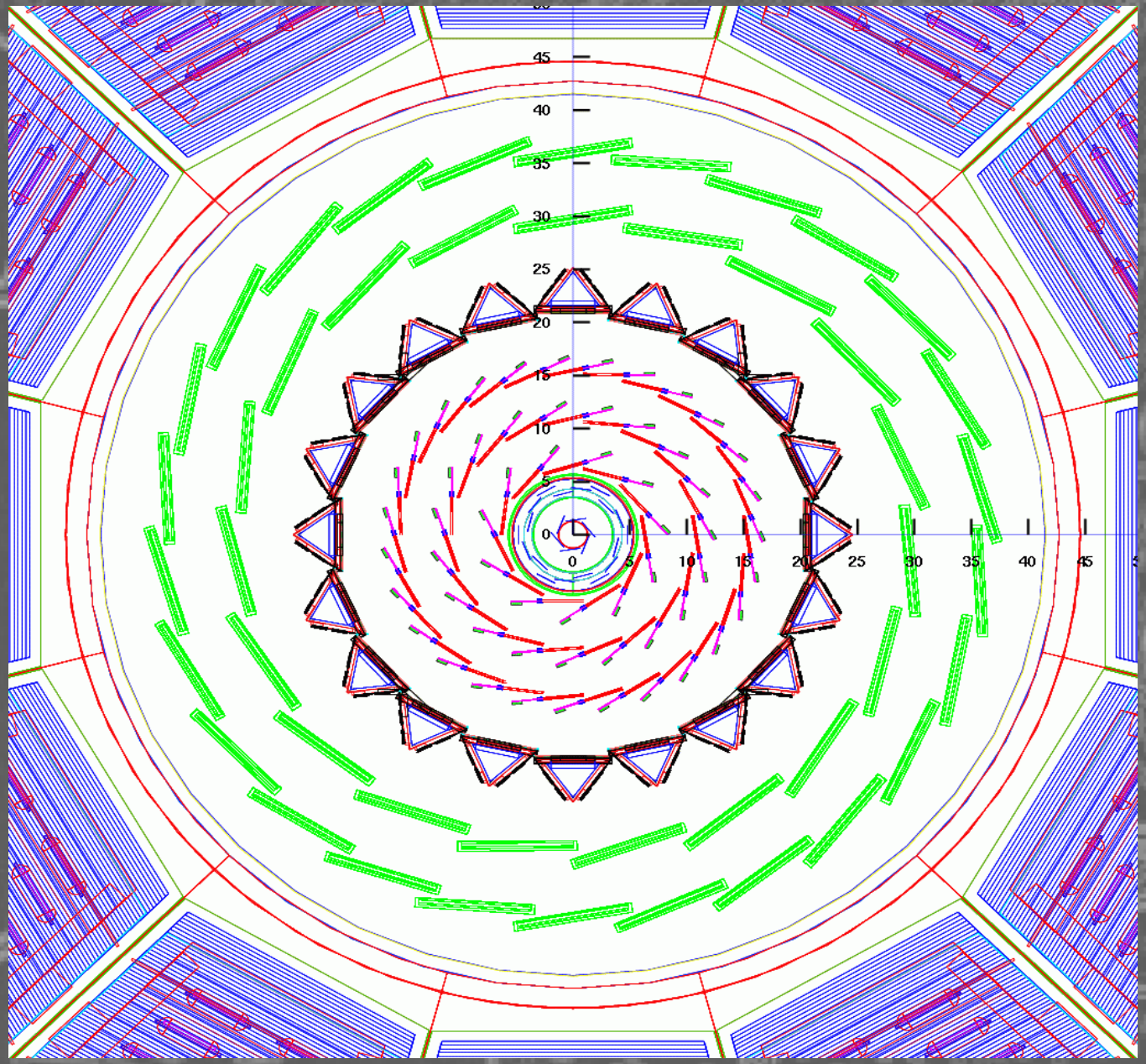
Tracking Upgrade in STAR



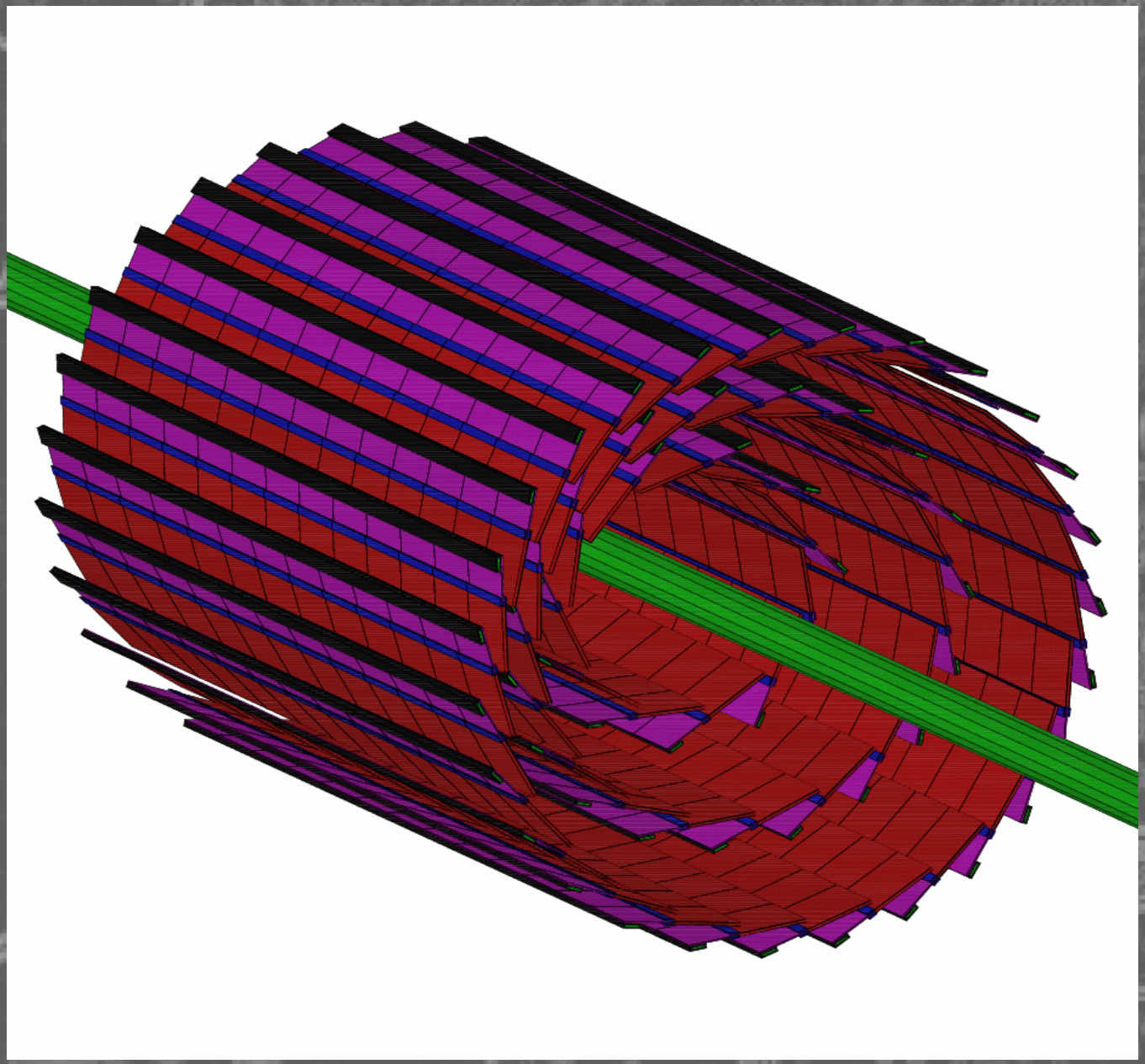
Tracking Upgrade inside TPC



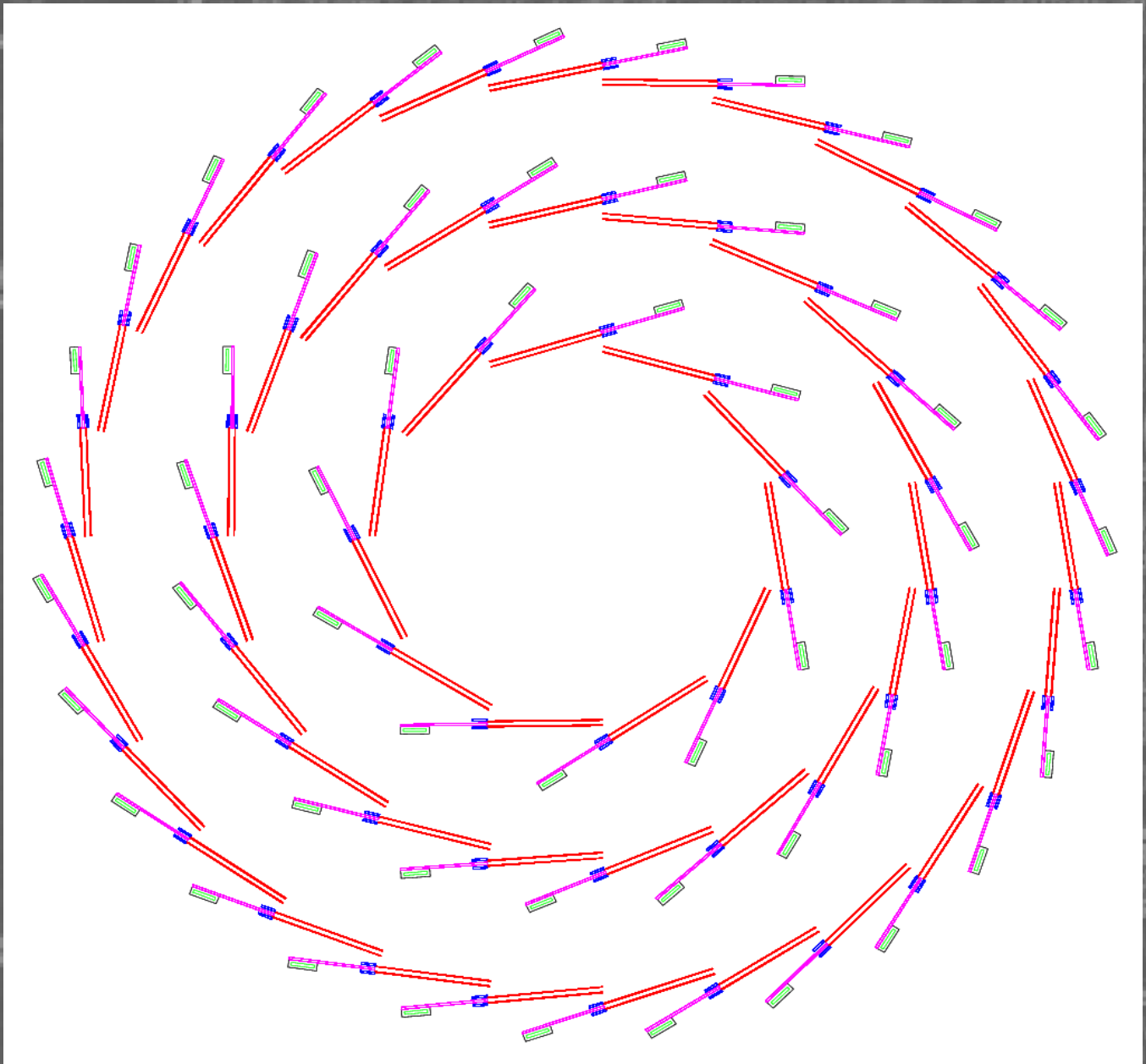
Tracking Upgrade inside TPC



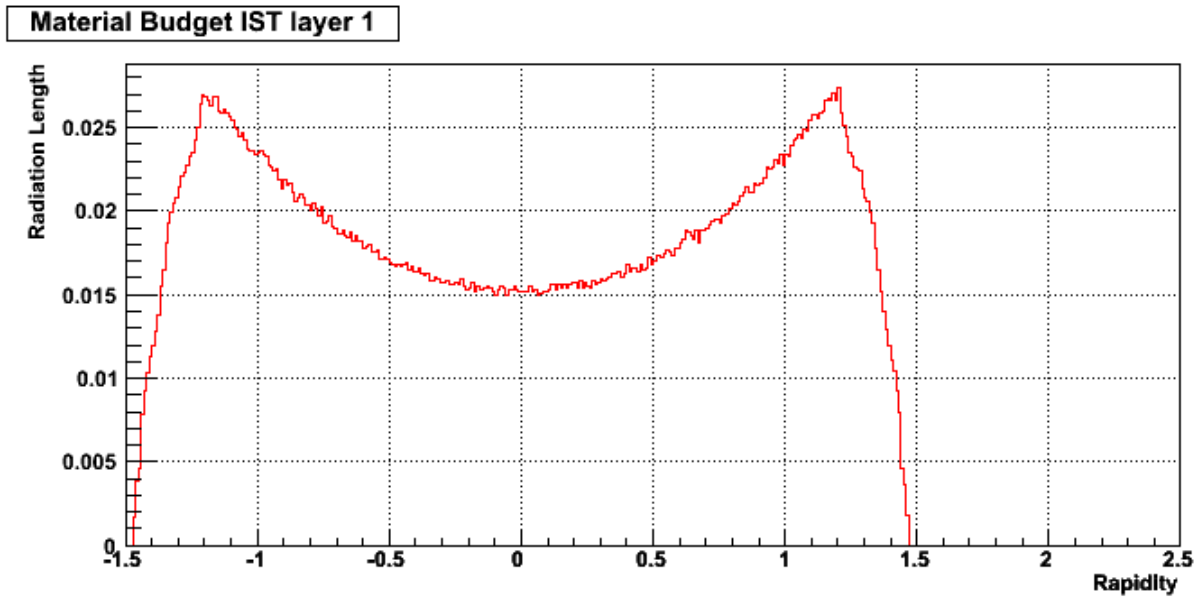
Inner STAR Tracker (IST)

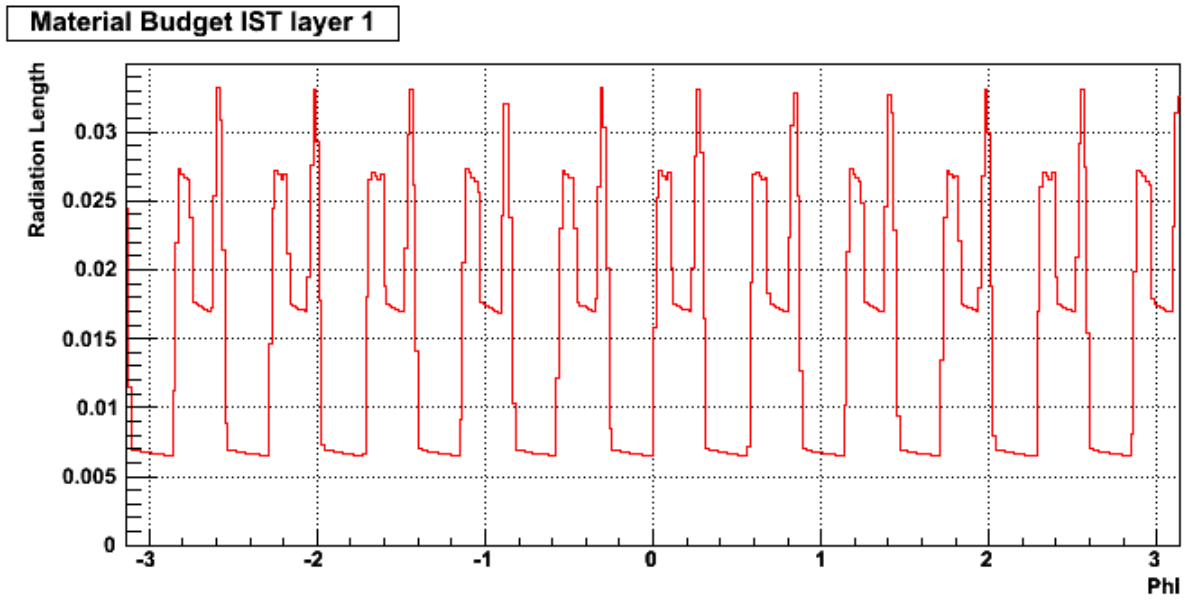


Inner STAR Tracker (IST)

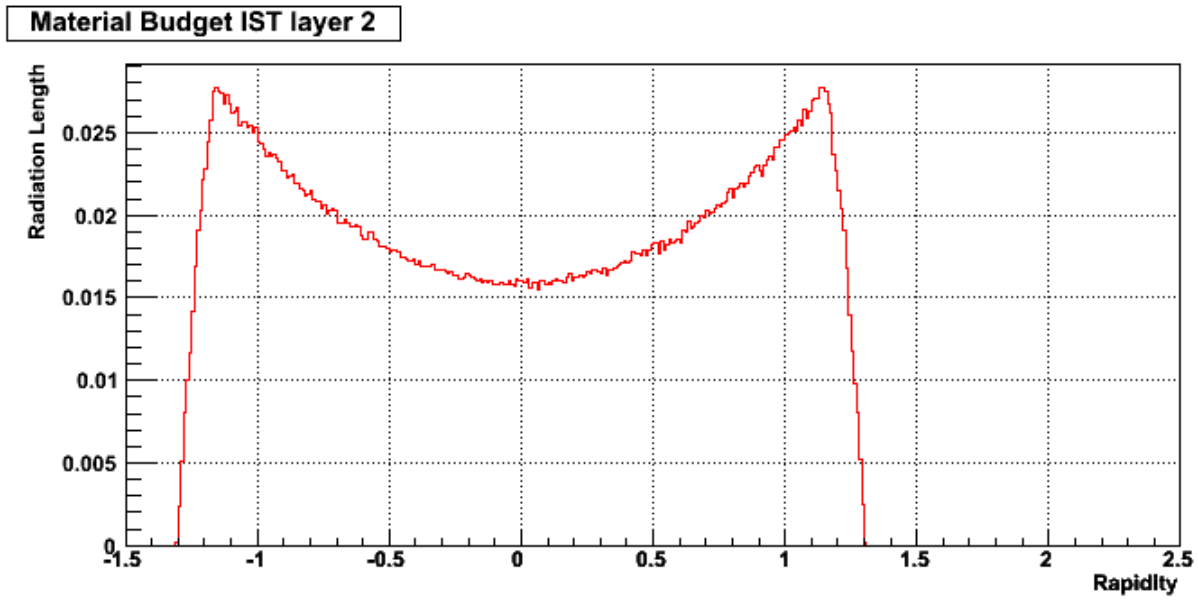


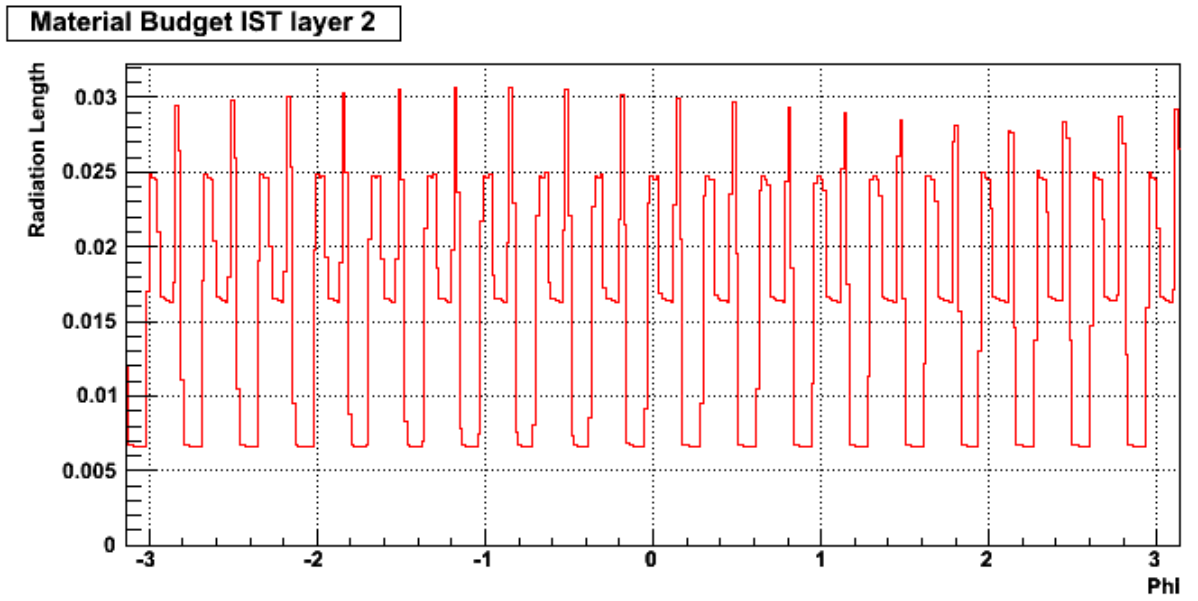
Material Budget IST Layer 1



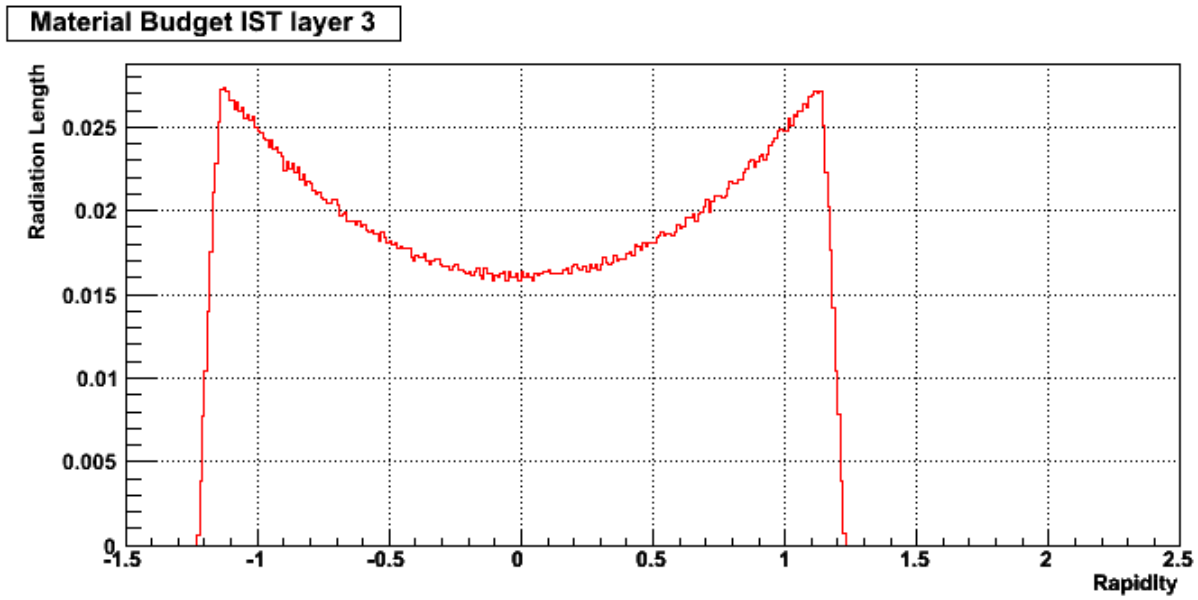


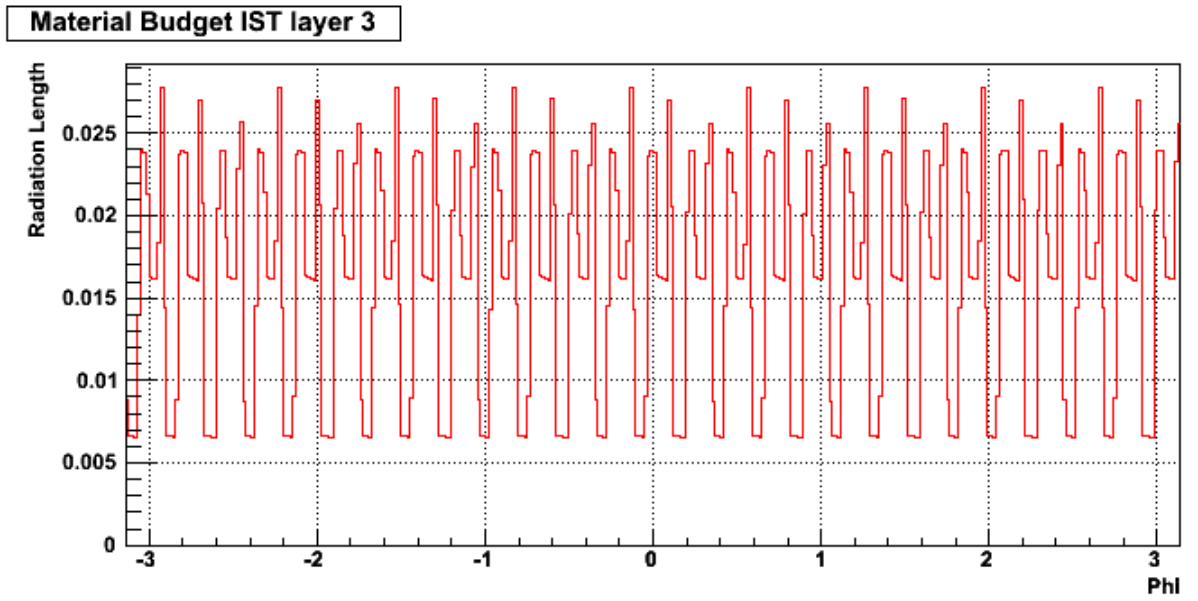
Material Budget IST Layer 2



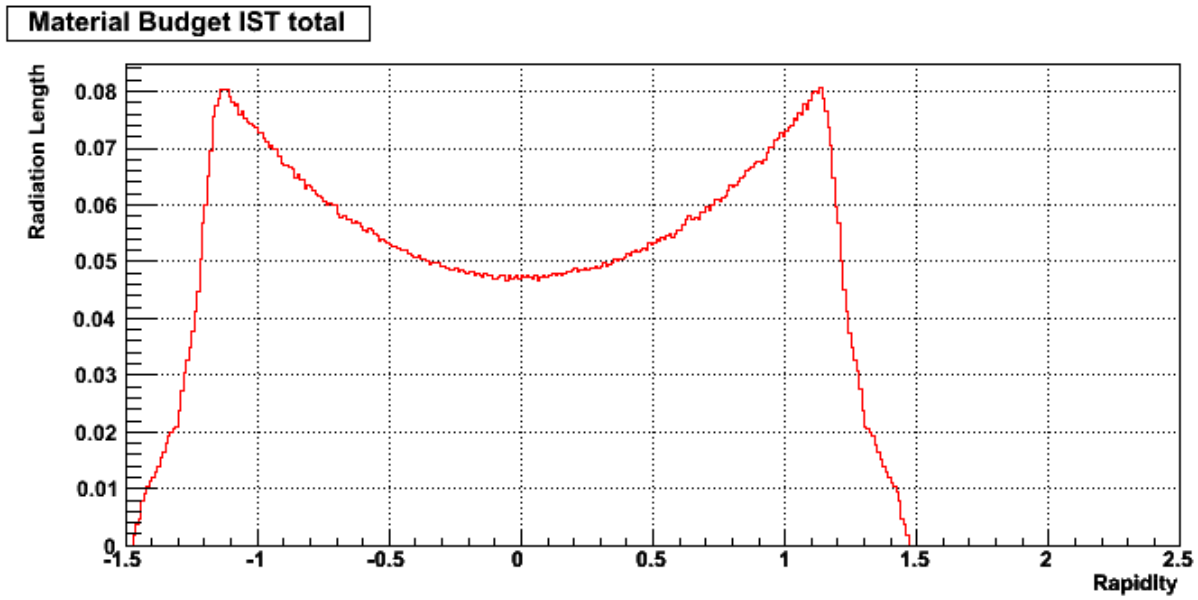


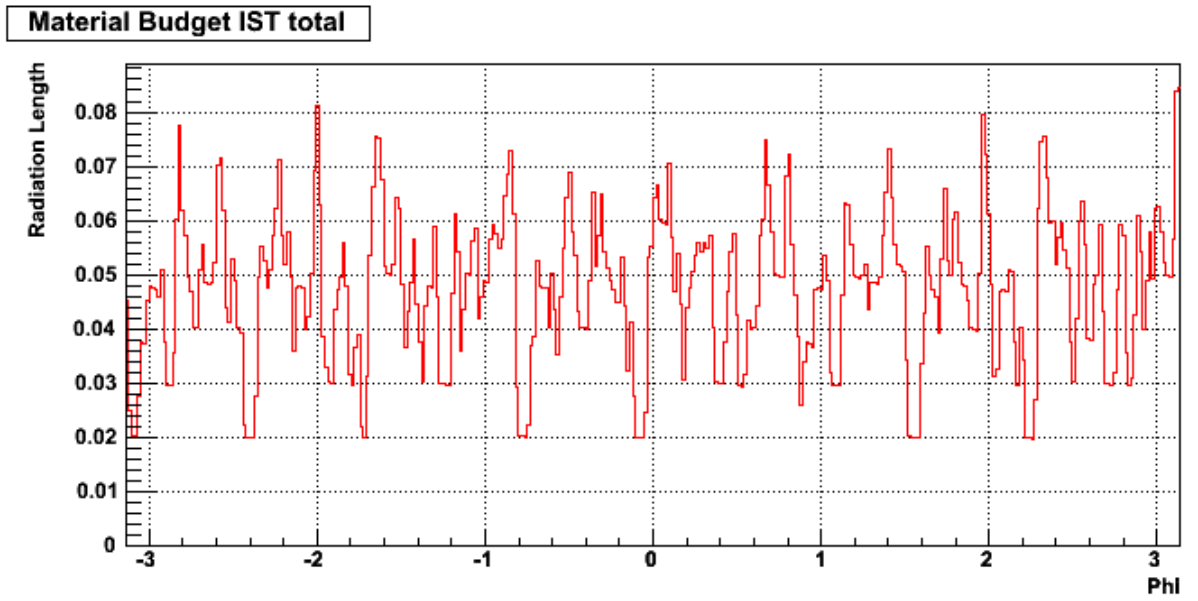
Material Budget IST Layer 3



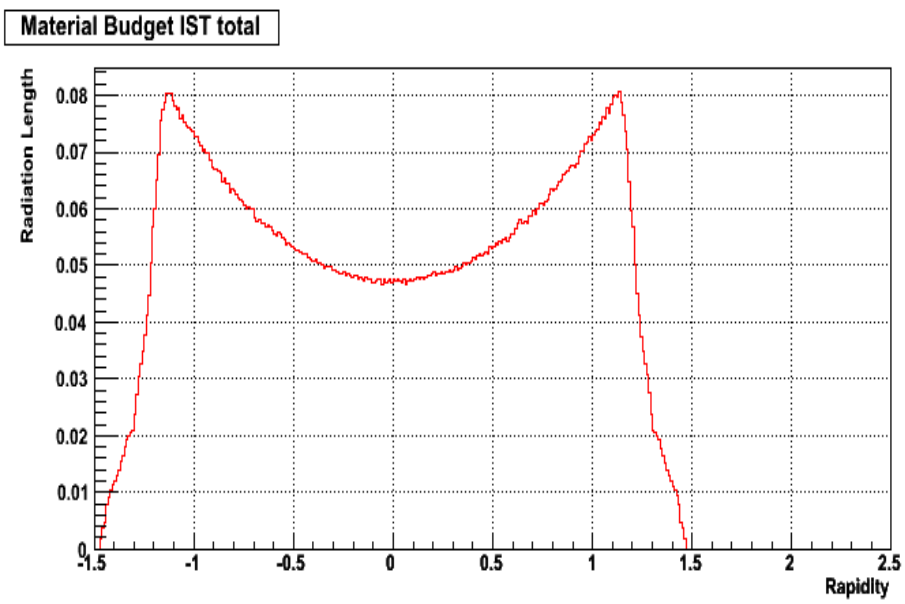


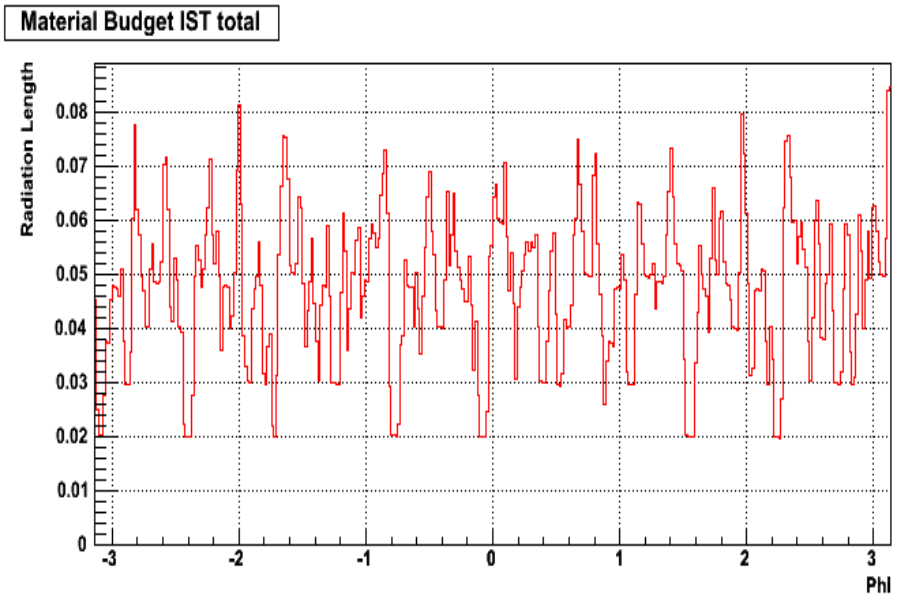
Total Material Budget IST

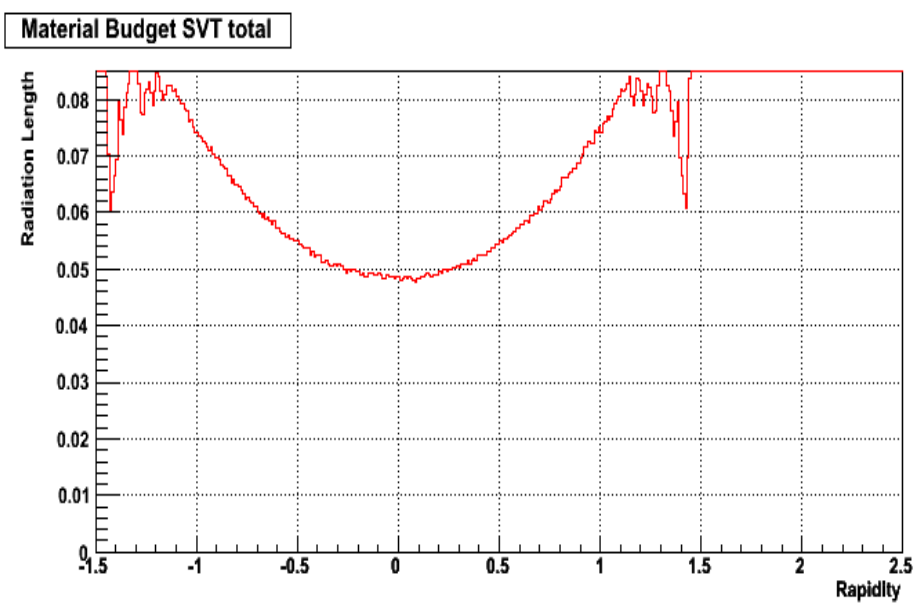


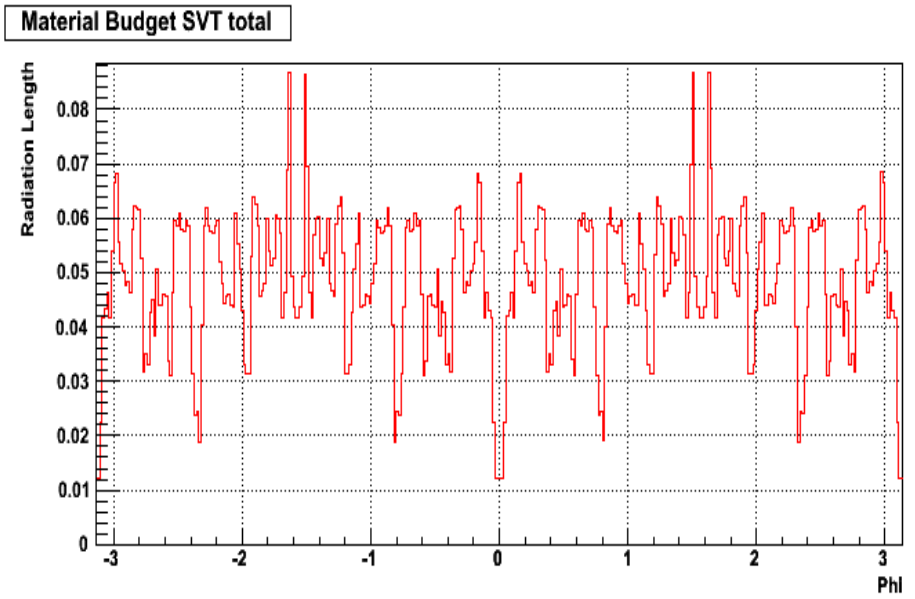


Material Budget IST and SVT

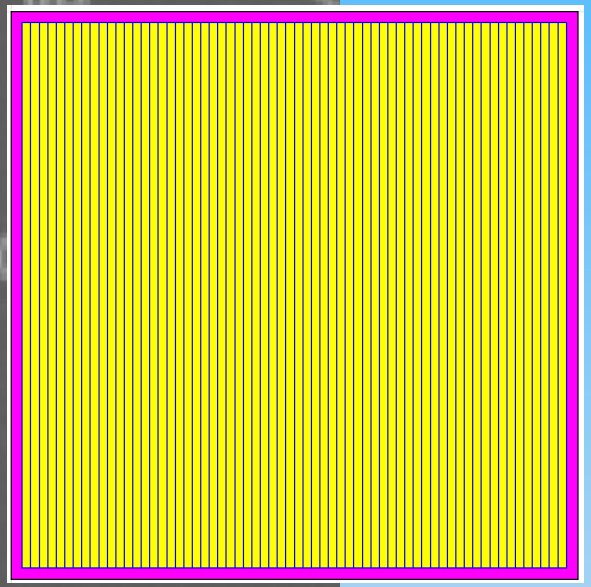


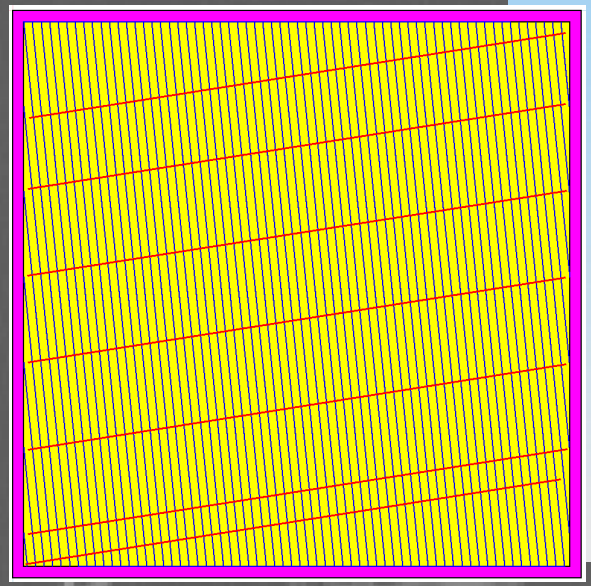


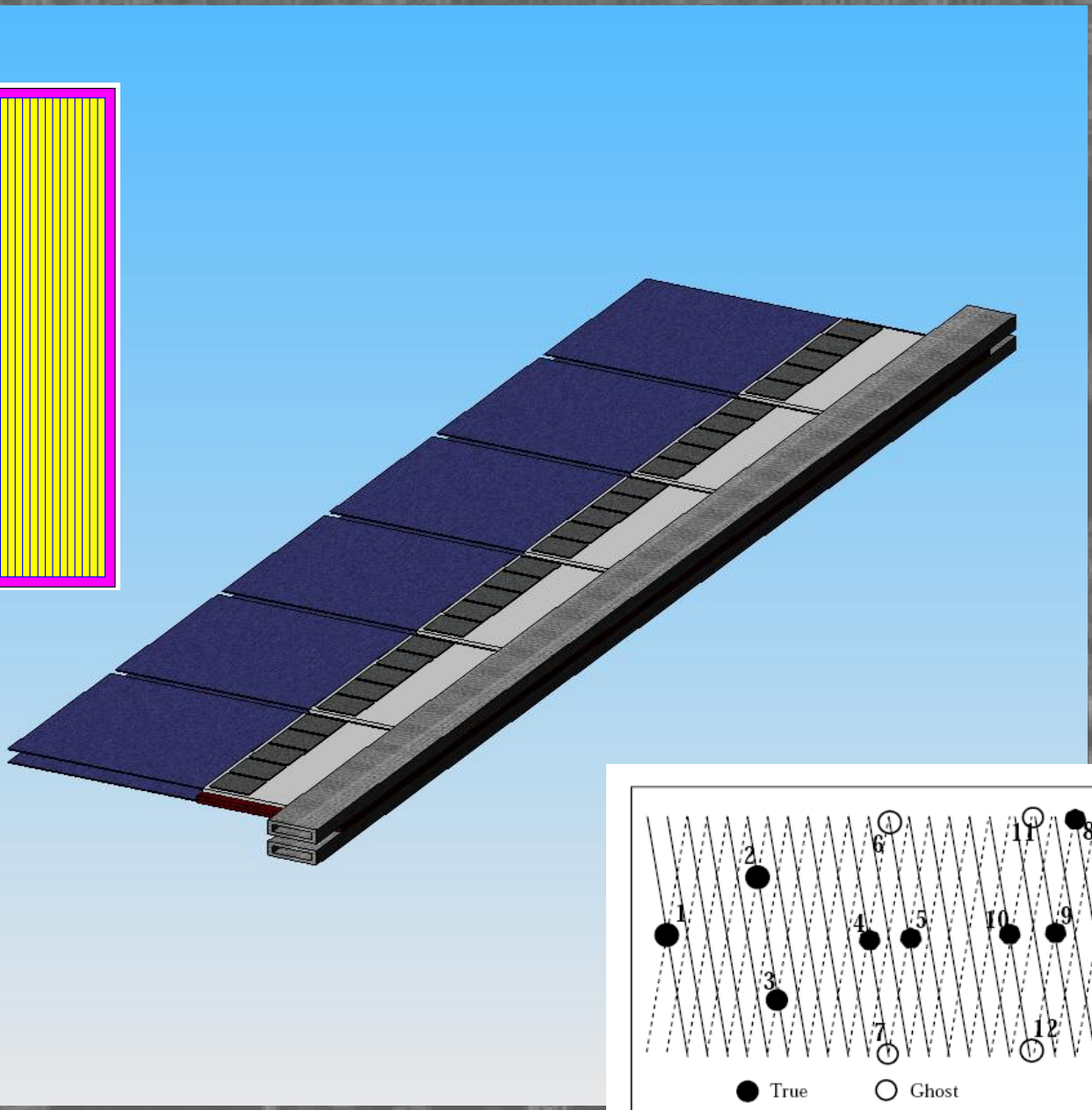


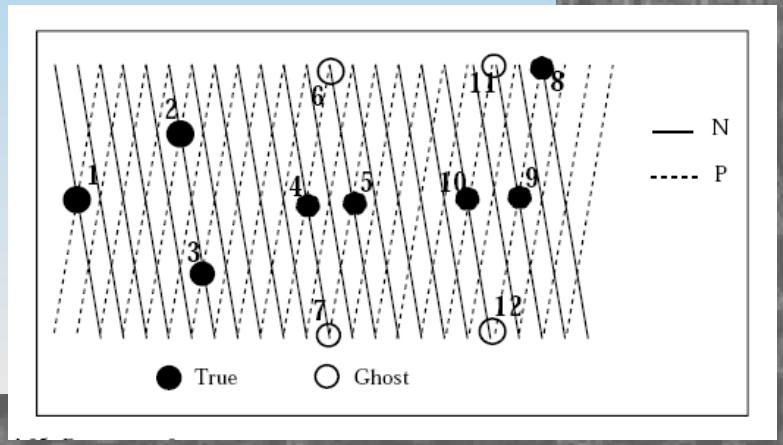


IST Ladder

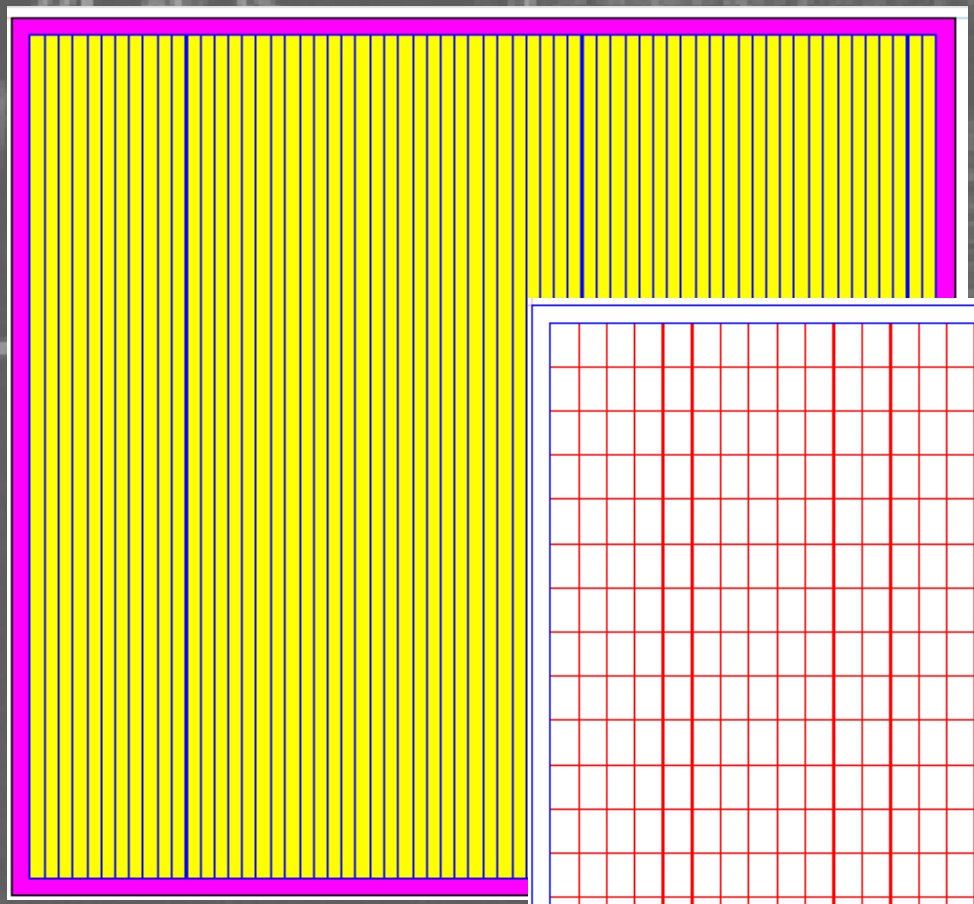




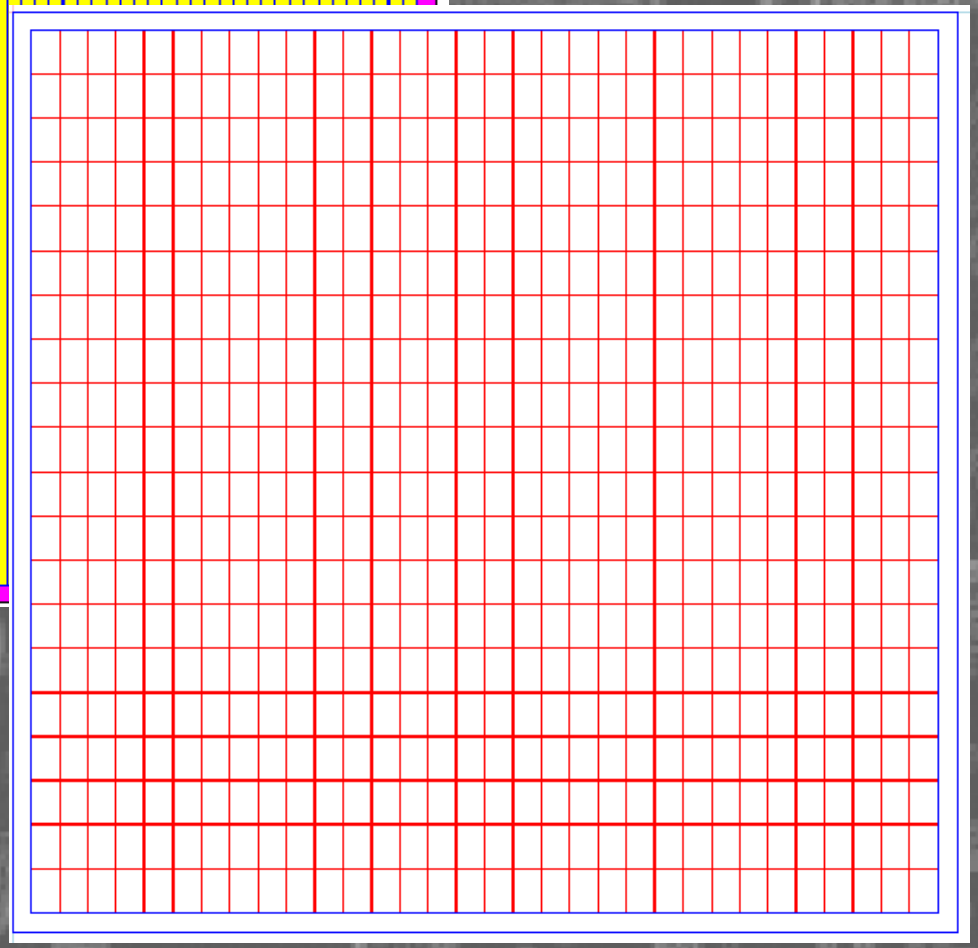




IST sensors

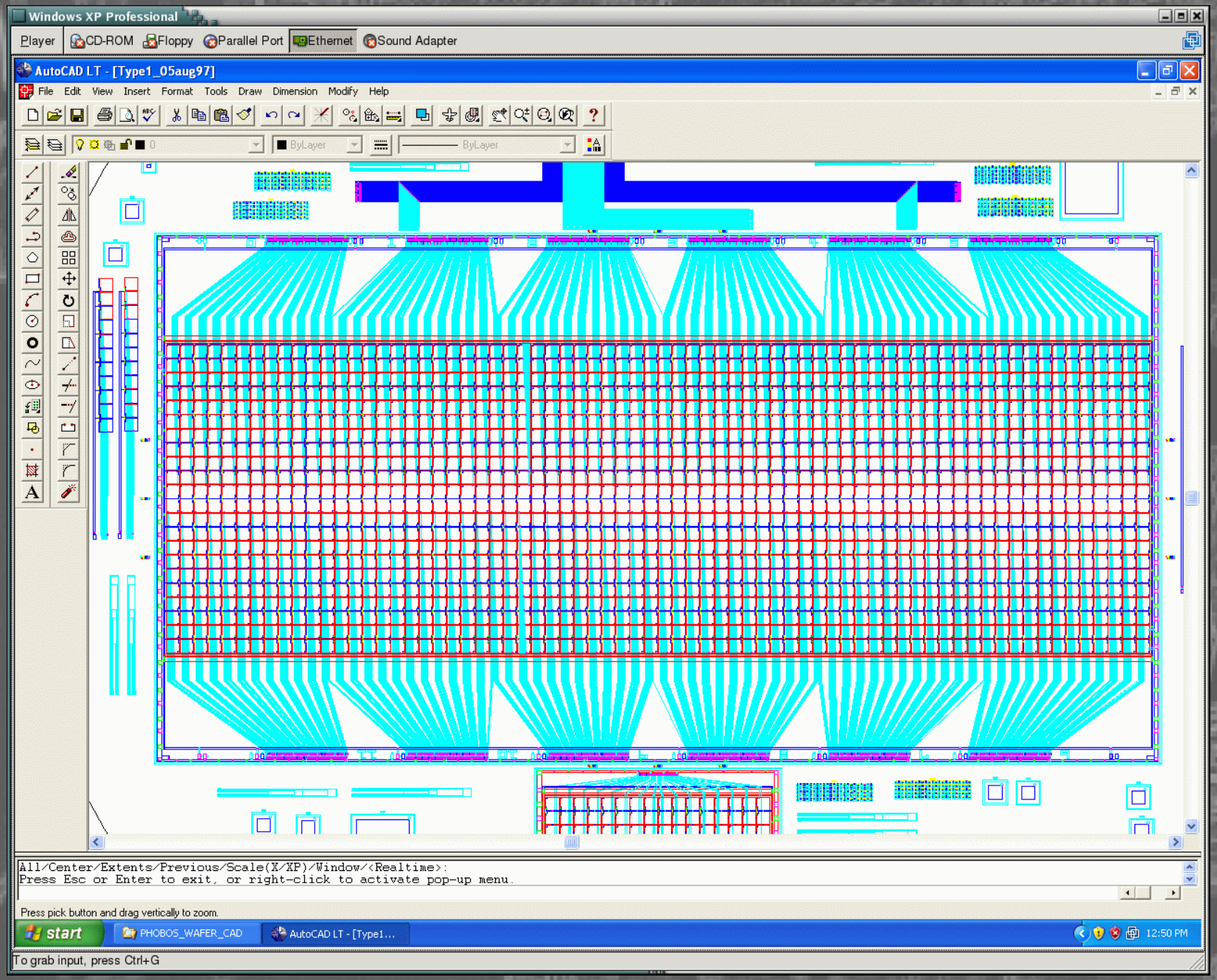


4 cm X 4 cm
640 strips
60 um pitch

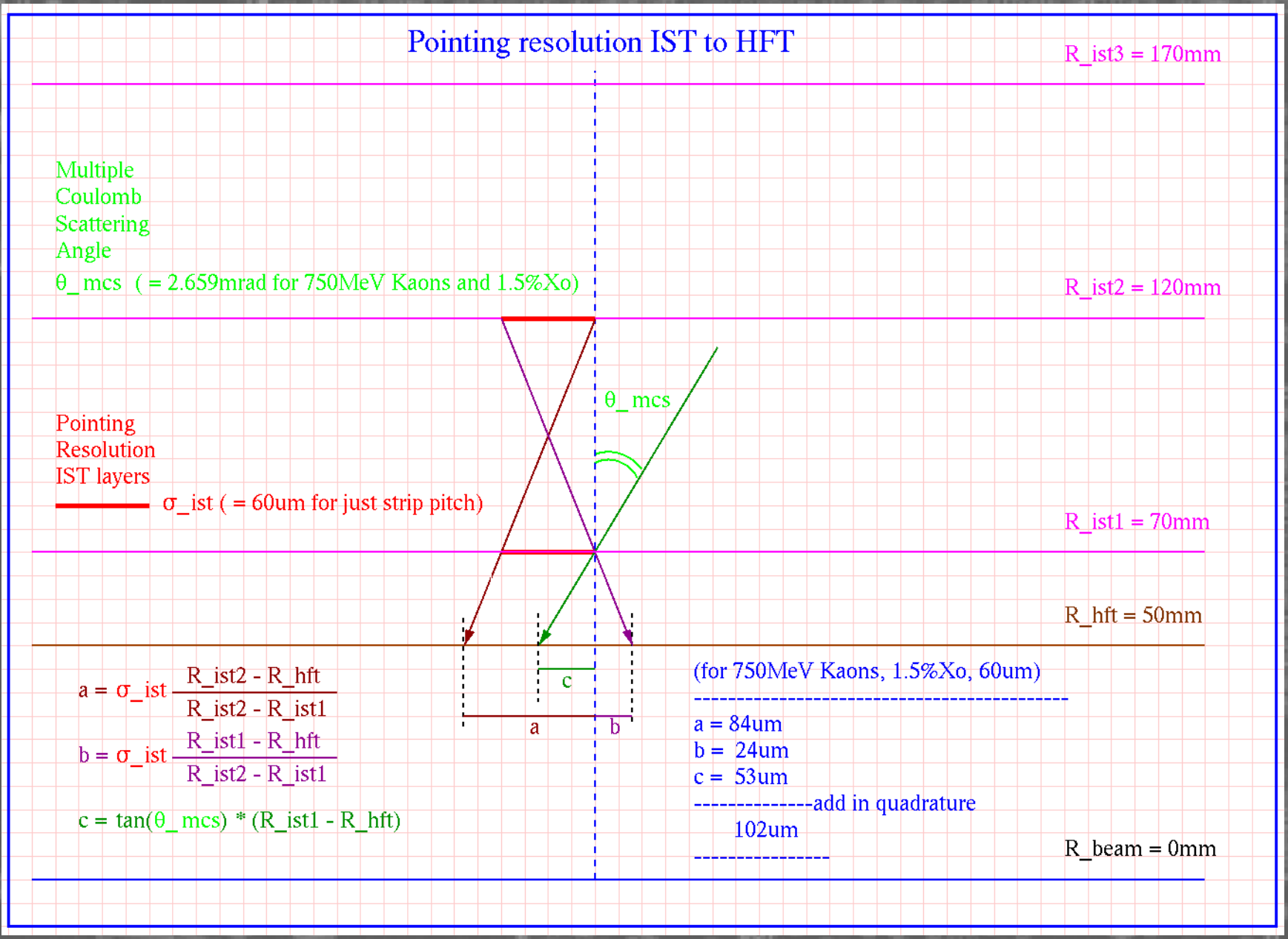


4 cm X 4 cm
30 X 21 pads
1.3 mm x 1.8 mm

PHOBOS Silicon Pad Sensors



Pointing Resolution



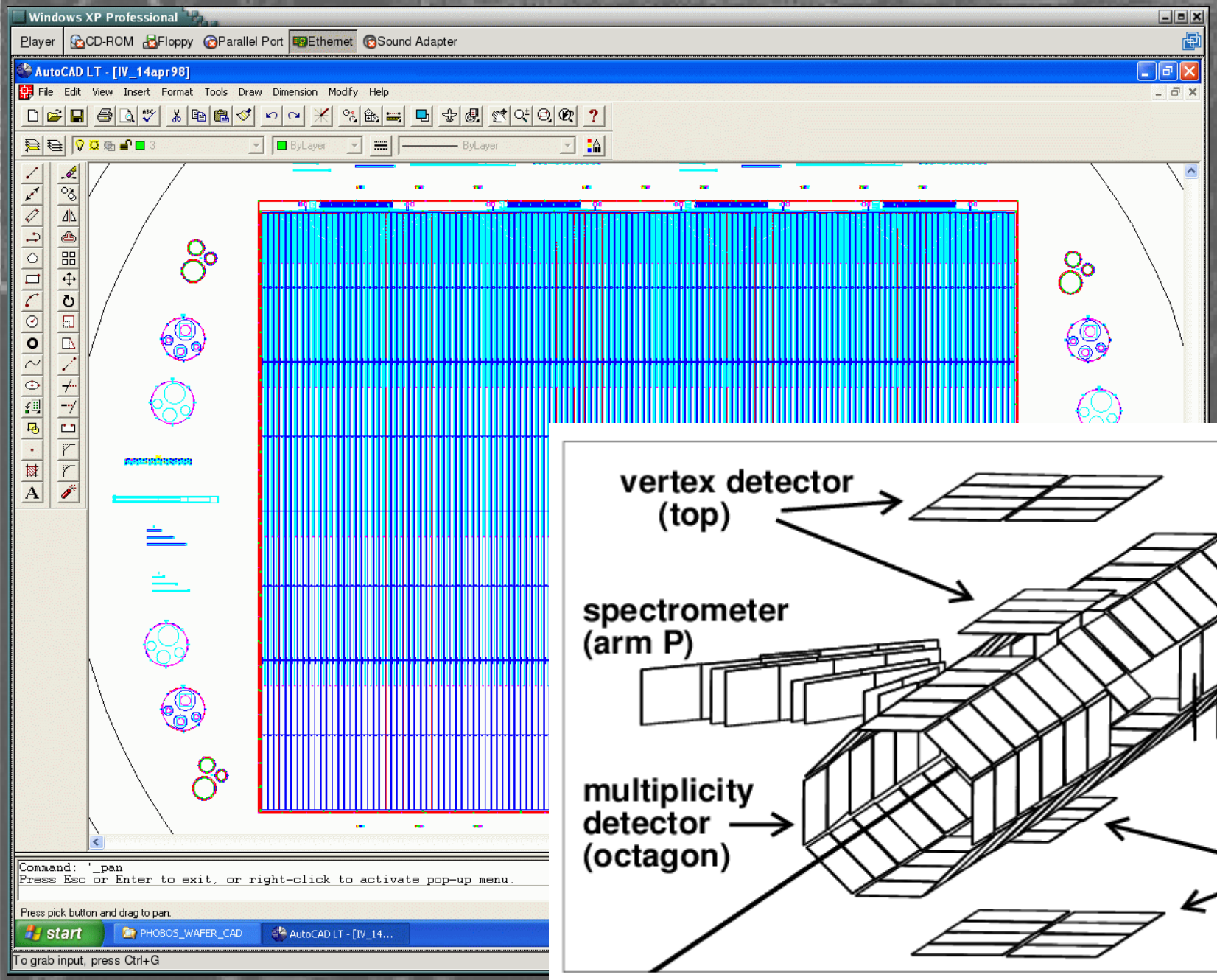
DCA Resolution

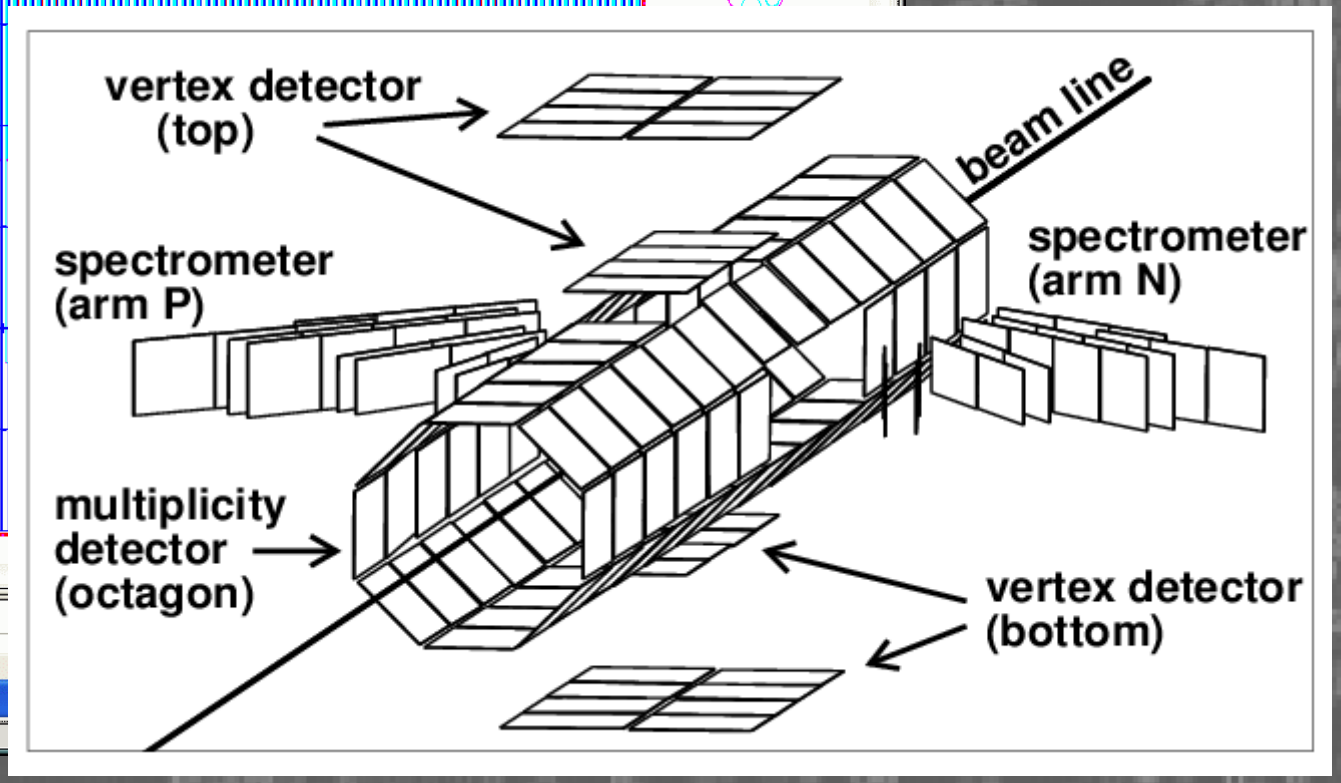
```
root [0] .x Pointing1.C
-----------------------------------------------------
theta = 90.002657
beta  = 0.835121
MCS angle = 0.002659
---------------HFT-----------------------------------
PosZ     Res at HFT = 87.361319
PosPhiZ Res at HFT = 1456.021978
MCS      Res at HFT = 53.186802
Total    Z pointing resolution at HFT = 102.278229
Total Phi pointing resolution at HFT = 1456.993042
---------------DCA-----------------------------------
PosZ     Res     DCA = 166.709328
PosPhiZ Res     DCA = 2778.488798
MCS      Res     DCA = 186.153813
Total    Z pointing resolution     DCA = 249.890457
Total Phi pointing resolution     DCA = 2784.717773
-----------------------------------------------------
```

```
[0] .x Pointing1.C
-----------------------------------------------------
 = 90.002657
 = 0.835121
ngle = 0.002659
----------HFT----------------------------------------
   Res at HFT = 43.680659
Res at HFT = 1456.021978
Res at HFT = 53.186802
 pointing resolution at HFT = 68.824677
 pointing resolution at HFT = 1456.993042
------DCA----------------------------------------
Res     DCA = 83.354664
Res     DCA = 2778.488798
Res     DCA = 186.153813
 pointing resolution     DCA = 203.963821
 pointing resolution     DCA = 2784.717773
-----------------------------------------------------
```

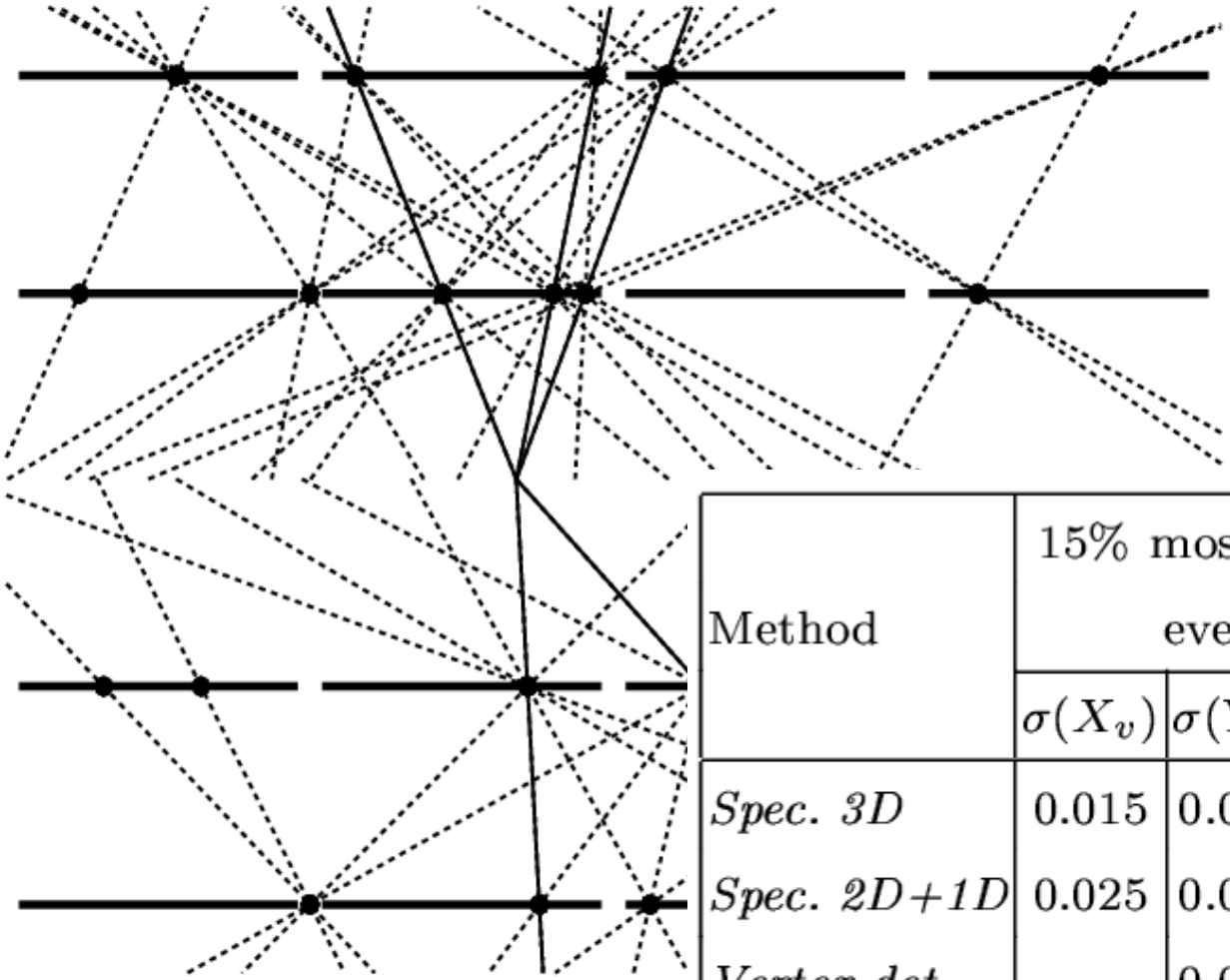
particle	daughters	cτ (μm)	Mass (GeV)
D^0	$K^-\pi^+$ (3.8%)	123	1.8646
$D^\pm$	$K^-\pi^+\pi^+$ (9.2%)	312	1.8694
D_s	$K^+K^-\pi^+$ (4.4%) $\pi^+\pi^+\pi^-$ (1.0%)	147	1.9683
Λ_c	$p\,K^-\pi^+$ (5.0%)	59.9	2.2849
B^0		460	5.2794
$B^\pm$		501	5.2790

PHOBOS Vertex Sensors

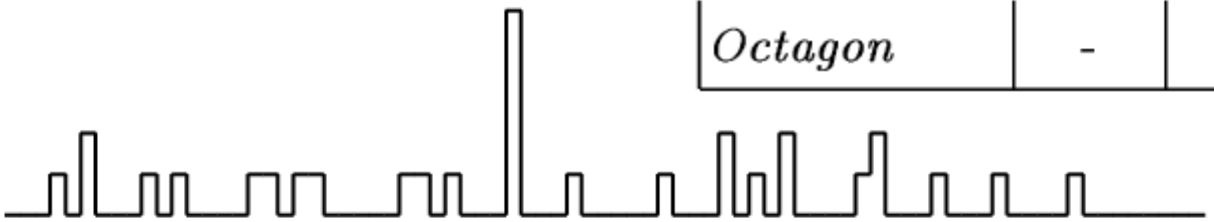




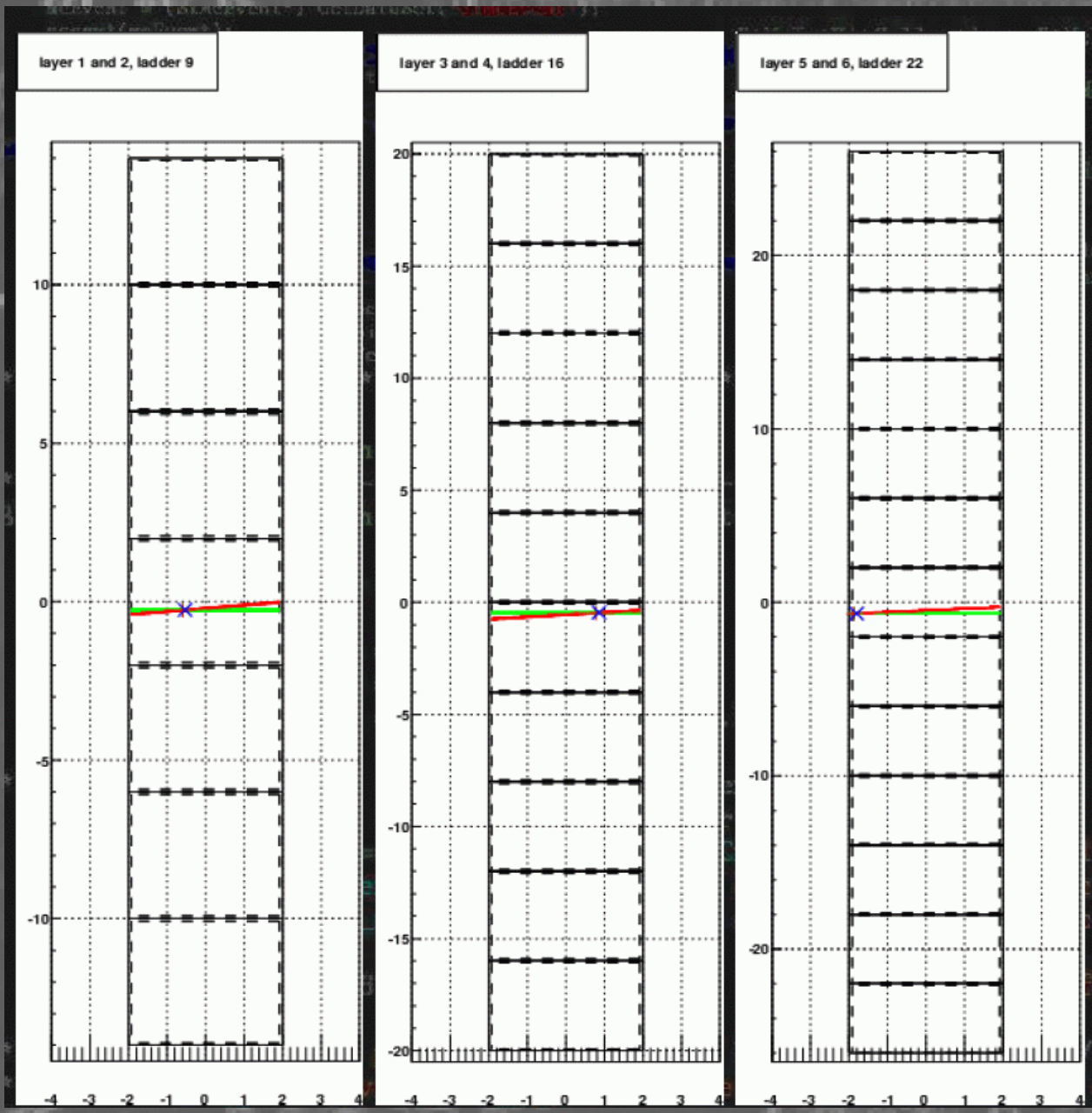
PHOBOS Vertexing



Method	15% most central events			30% most peripheral events			
	$\sigma(X_v)$	$\sigma(Y_v)$	$\sigma(Z_v)$	$\sigma(X_v)$	$\sigma(Y_v)$	$\sigma(Z_v)$	eff.
Spec. 3D	0.015	0.022	0.020	0.350	0.100	0.300	4%
Spec. 2D+1D	0.025	0.022	0.030	0.150	0.150	0.250	7%
Vertex det.	-	0.015	0.006	-	0.030	0.023	28%
Octagon	-	-	0.500	-	-	1.100	85%



Strip Simulator



Afterburner to simulate silicon strip response

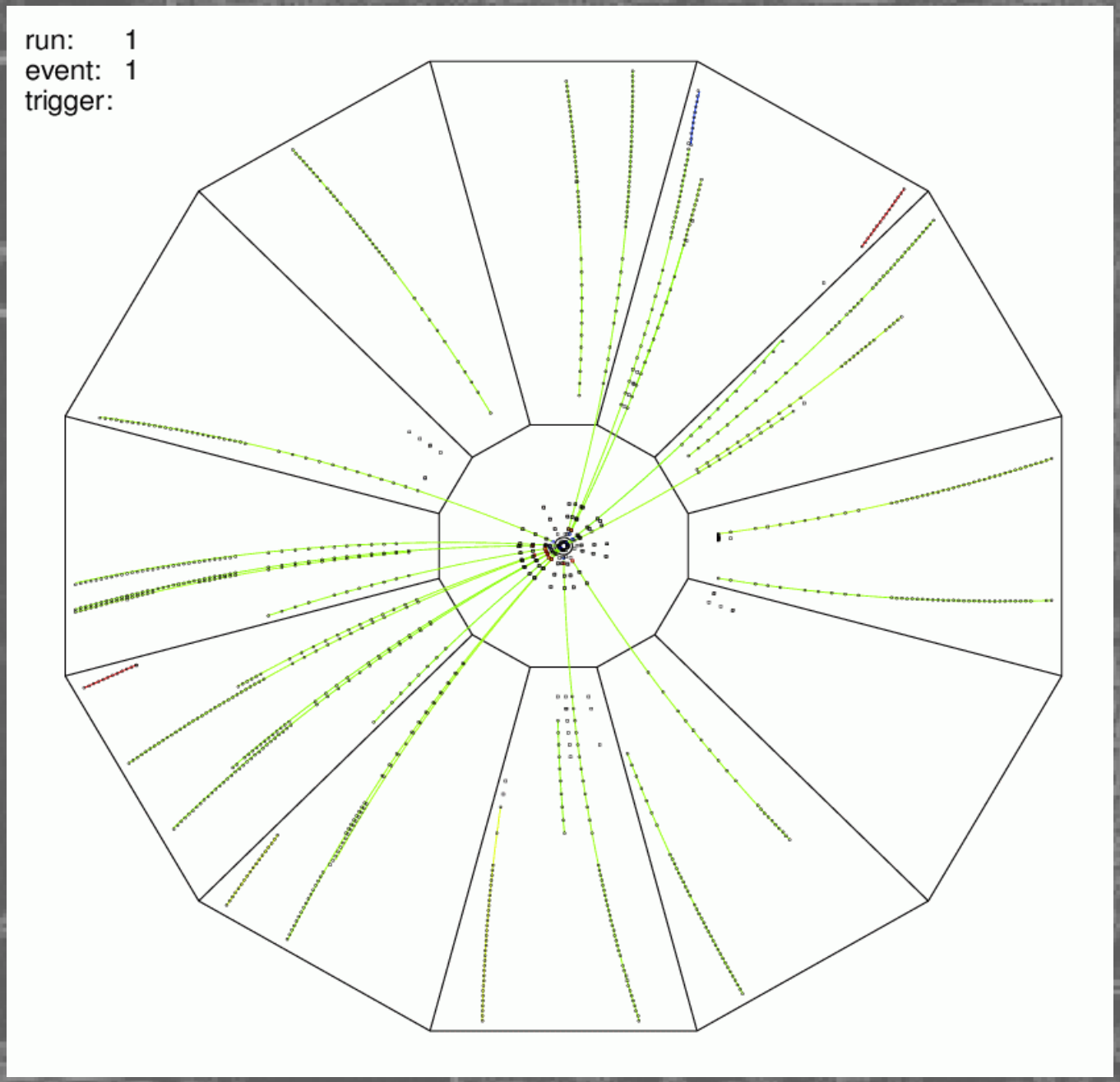
Internal strip geometry implemented

Finds hits, reconstructs hits from hit strips

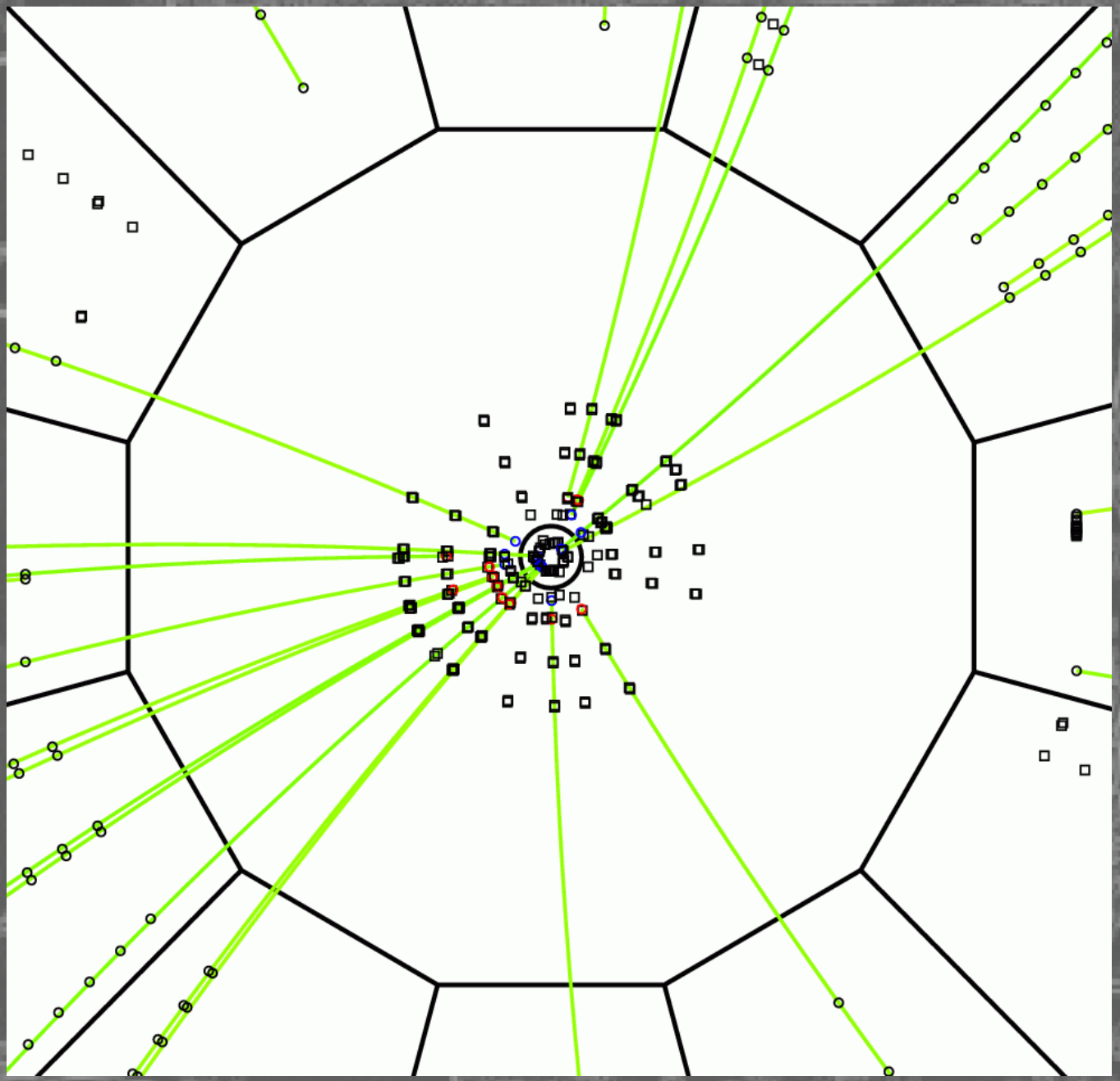
Proper strip clustering is being worked on

New pad geometry easy to implement

ITTF is coming online



ITTF needs tuning



CD0 Status

Contents

1 Executive Summary **3**

2 Physics motivation **4**
- 2.1 Relativistic Heavy-Ion program 4
  - 2.1.1 Characterizing the medium 5
  - 2.1.2 Transverse momentum spectra 6
  - 2.1.3 Flow 7
  - 2.1.4 Hadron Chemistry 7
- 2.2 Spin physics program 7
  - 2.2.1 The RHIC Spin program 7
  - 2.2.2 Heavy flavor physics 9
  - 2.2.3 W physics 12

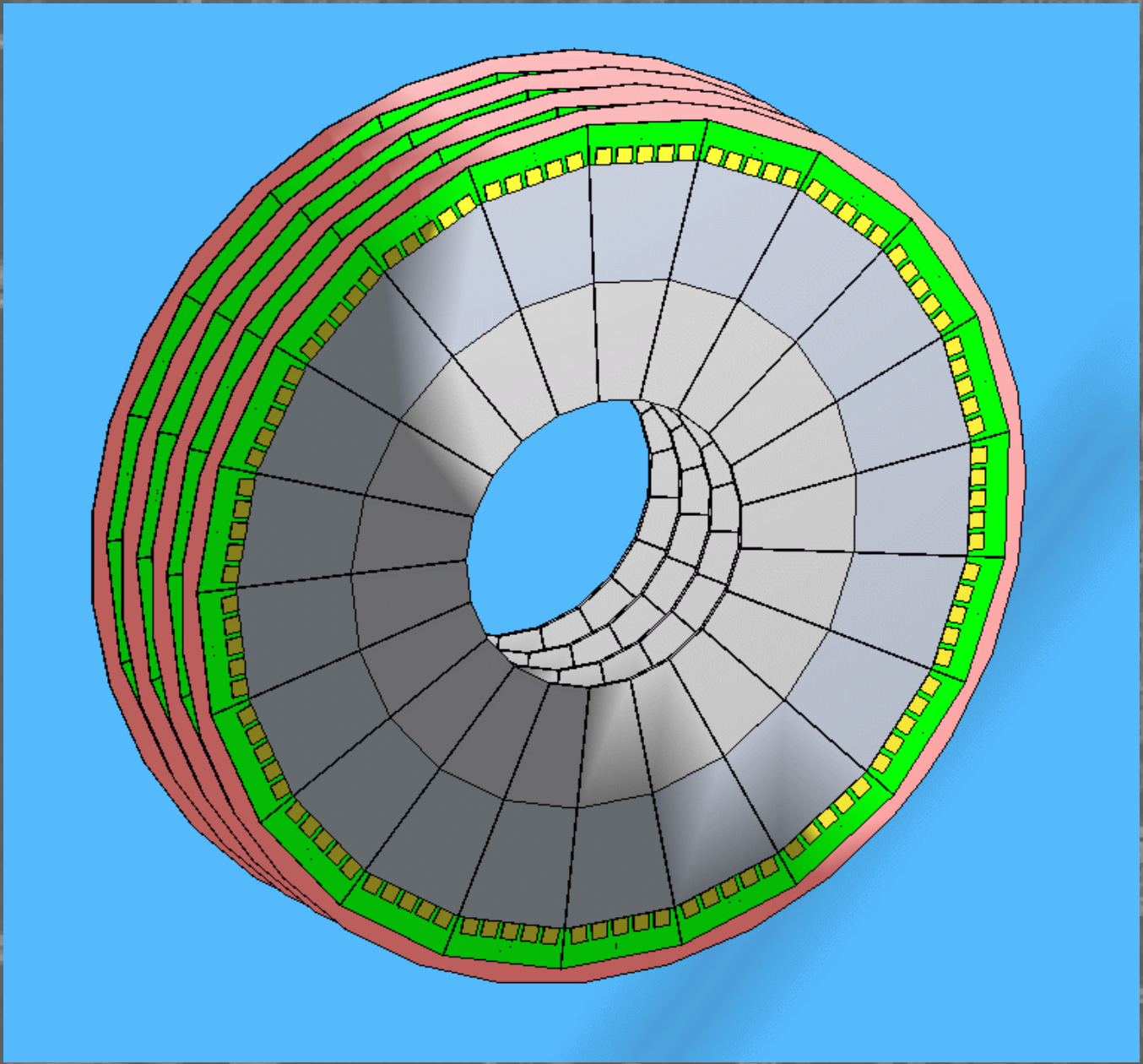
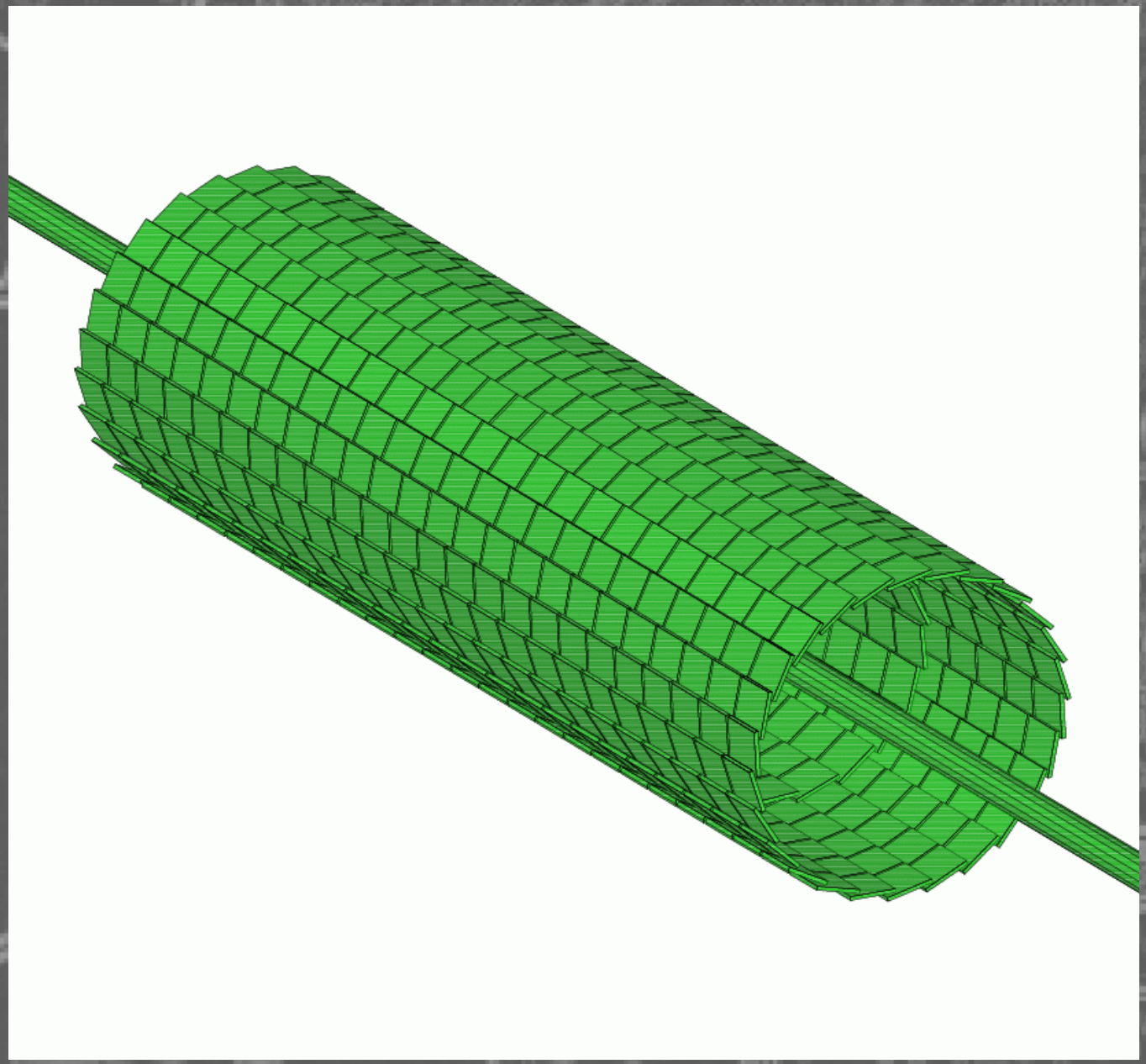
3 Conceptual layout of the STAR Integrated Tracker **25**
- 3.1 Overview 25
- 3.2 Inner Silicon Tracker (IST) 25
- 3.3 Forward Silicon Tracker (FST) 29
- 3.4 Forward GEM Tracker (FGT) 29

4 Technical realization and R&D requirements **42**
- 4.1 Overview 42
- 4.2 Inner-Silicon and Forward-Silicon Tracker 42
- 4.3 Forward GEM Tracker 49
- 4.4 Readout electronics 51

5 Cost estimate **61**
- 5.1 Inner Silicon Tracker (IST) 61
- 5.2 Forward Silicon Tracker (FST) 63
- 5.3 Forward GEM Tracker (FGT) 64
- 5.4 Funding profile 65

6 Summary **68**

Forward STAR Tracker (FST)



Inner GEM Tracker (IGT)