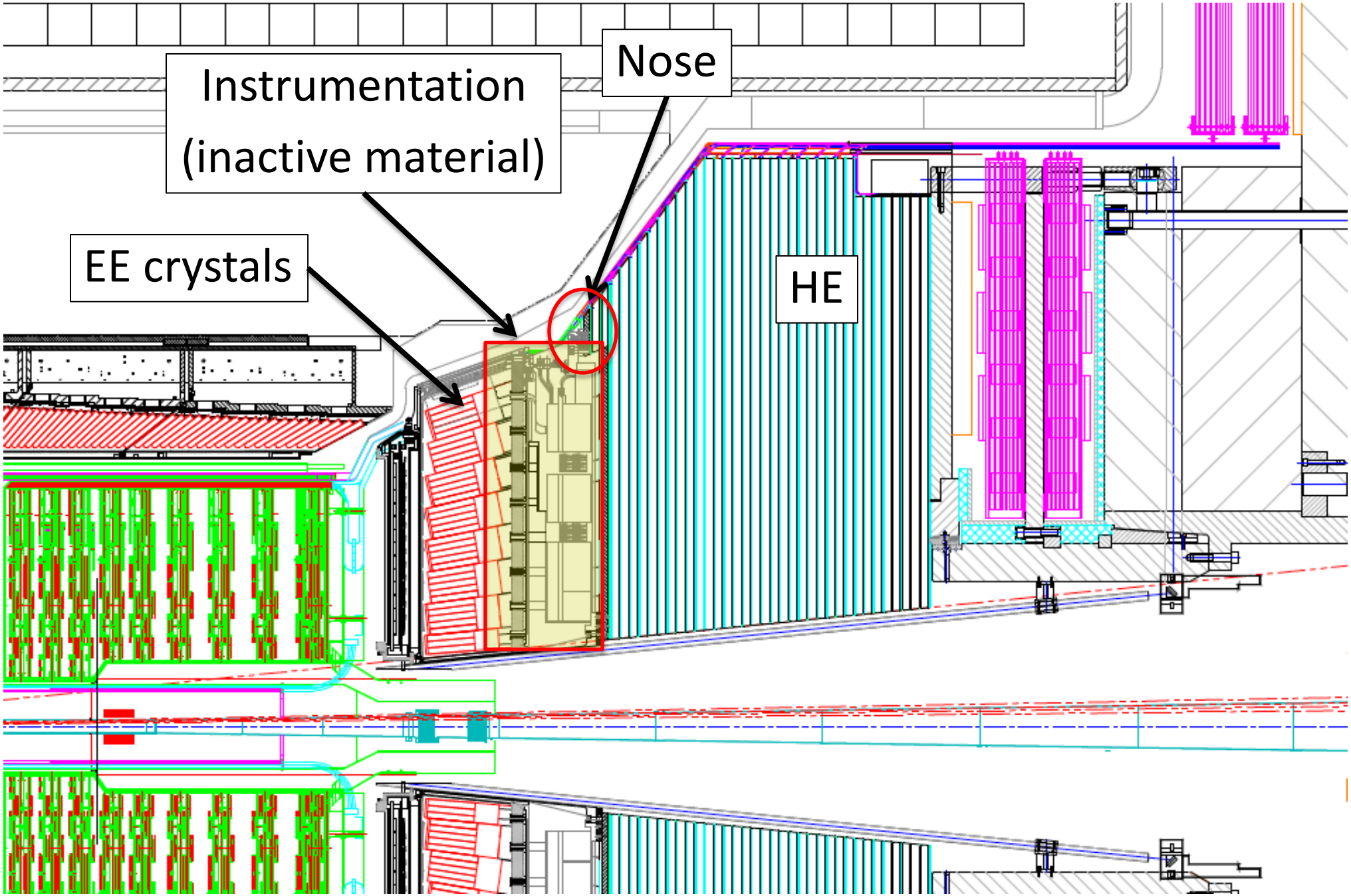
Phase 2
Geometry Summary

Present Configuration



Geometry Options in CMSSW

We have agreed to a reference geometry which is being implemented in CMSSW

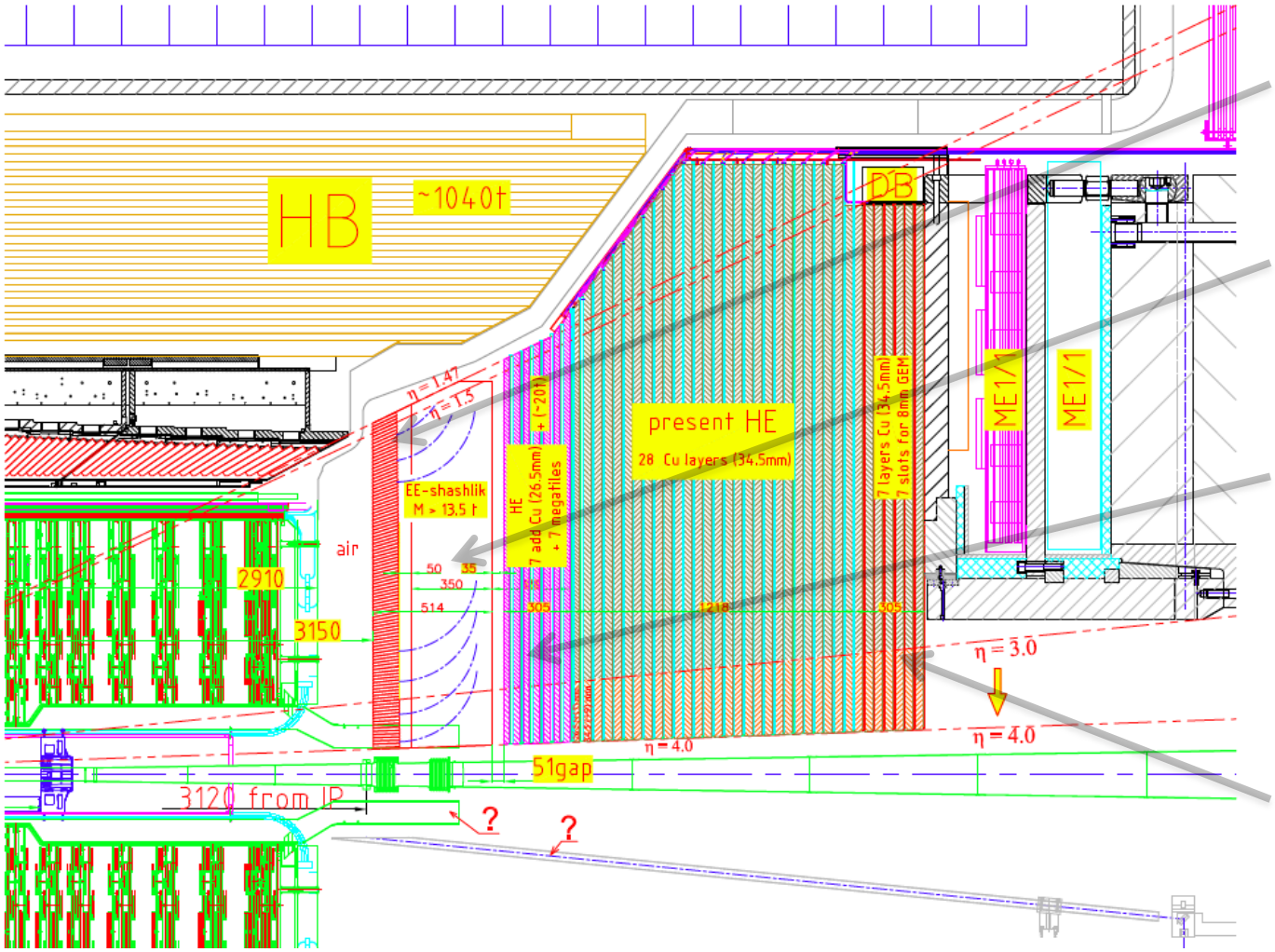
Being implemented in a flexible way…

Final geometry may change based on new information

Need a stable configuration for reconstruction code development

Lets stick to what we agreed on…

Reference Configuration
(EE Shashlik + HE Rebuild)



More compact EE, with increased eta-phi segmentation

Need 40cm gap between EE and HE

Add layers to the front of HE, remove layers from back of HE, increased eta-phi segmentation

Space available at the back of HE for muon detector (ME0)

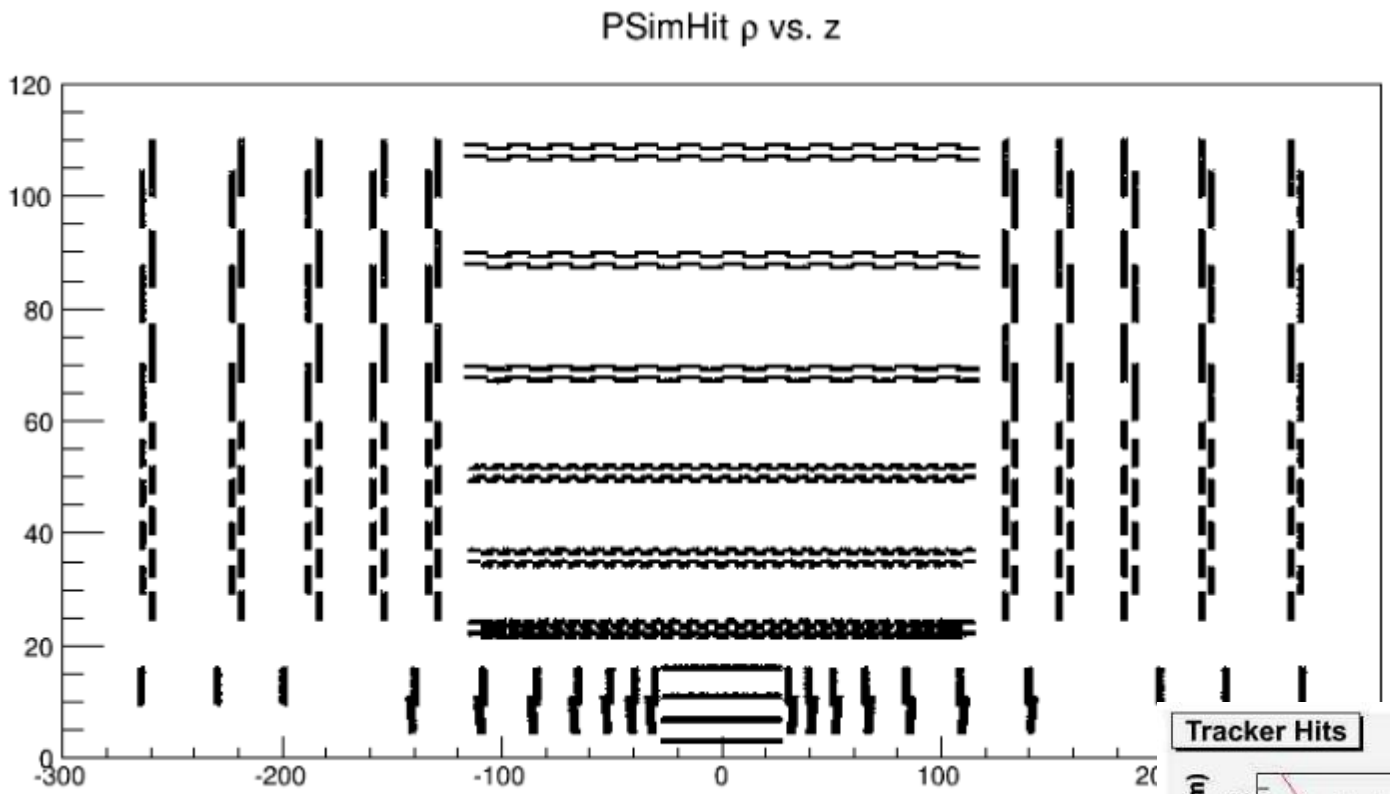
Specify geometry for two configs:

Calo-Eta3 (η < 3) and Calo-Eta4 (η < 4)

Extended track coverage: BE5D + Pixel10D

Calorimeter based Time of Arrival

BE5D + Pixel10D (Extended Pixel)

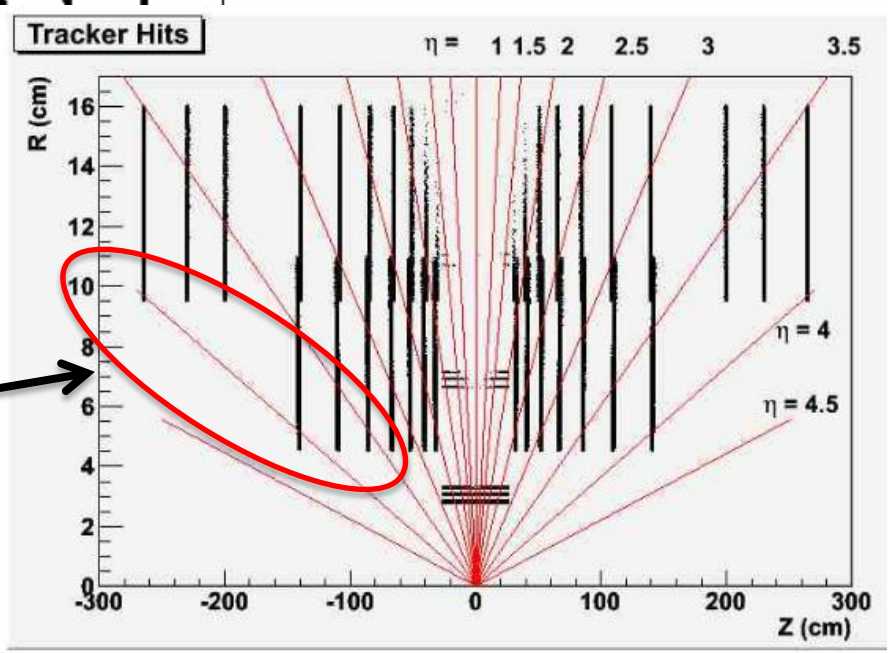


Phase 1 pixel

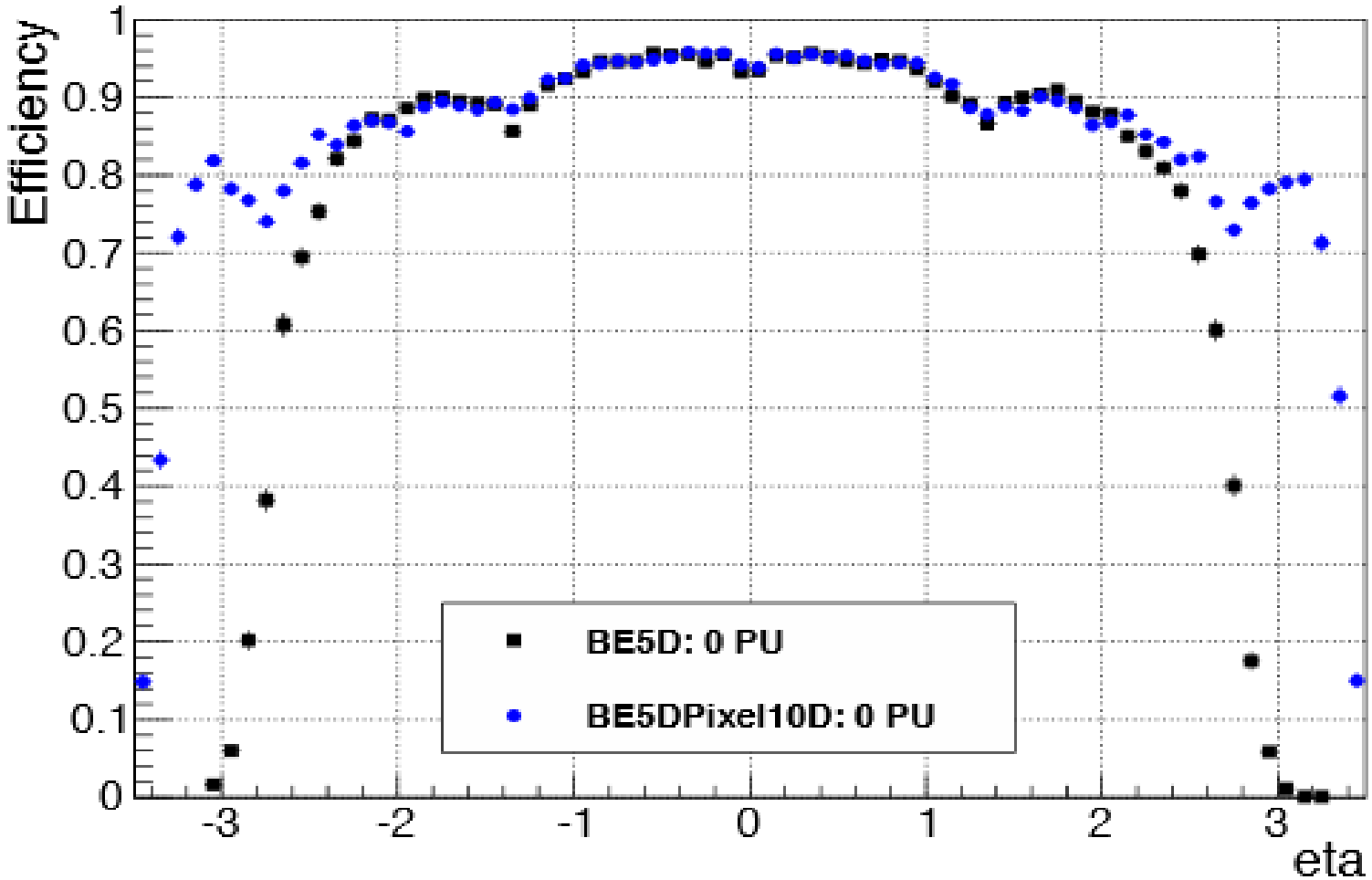
BE5D

Pixel10D
(Extended pixel)

Tracking efficiency at very high eta depends on the number of layers



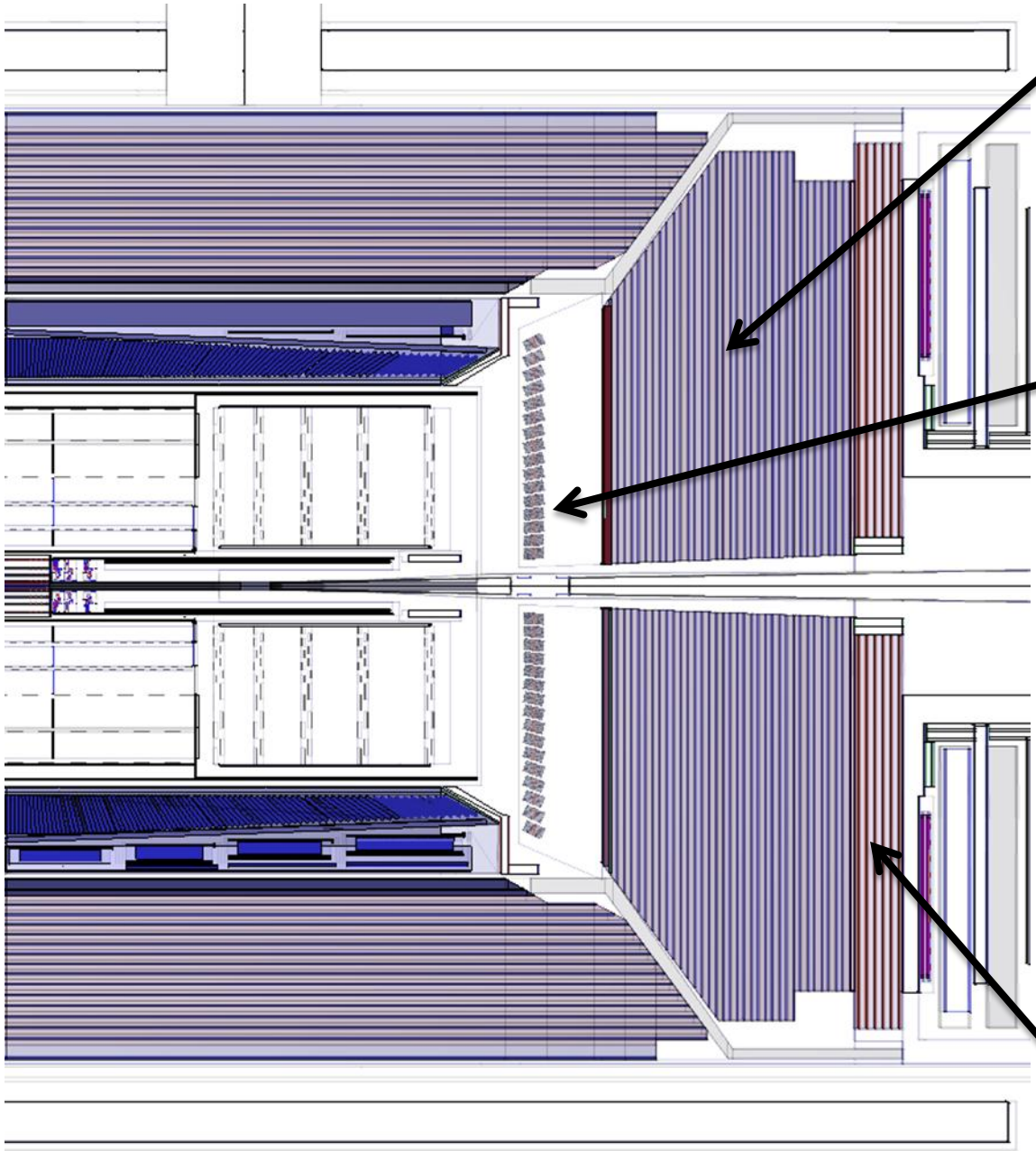
Tracking Efficiency BE5DPixel10D



This is the tracking efficiency for 0 PU out of the box

There is some hope that efficiencies can be improved for the high eta region…

EE Shashlik + HE Rebuild + ME0 in CMSSW



HE rebuild is included in CMSSW

Can produce RecHits!!!!

EE shashlik geometry in CMSSW

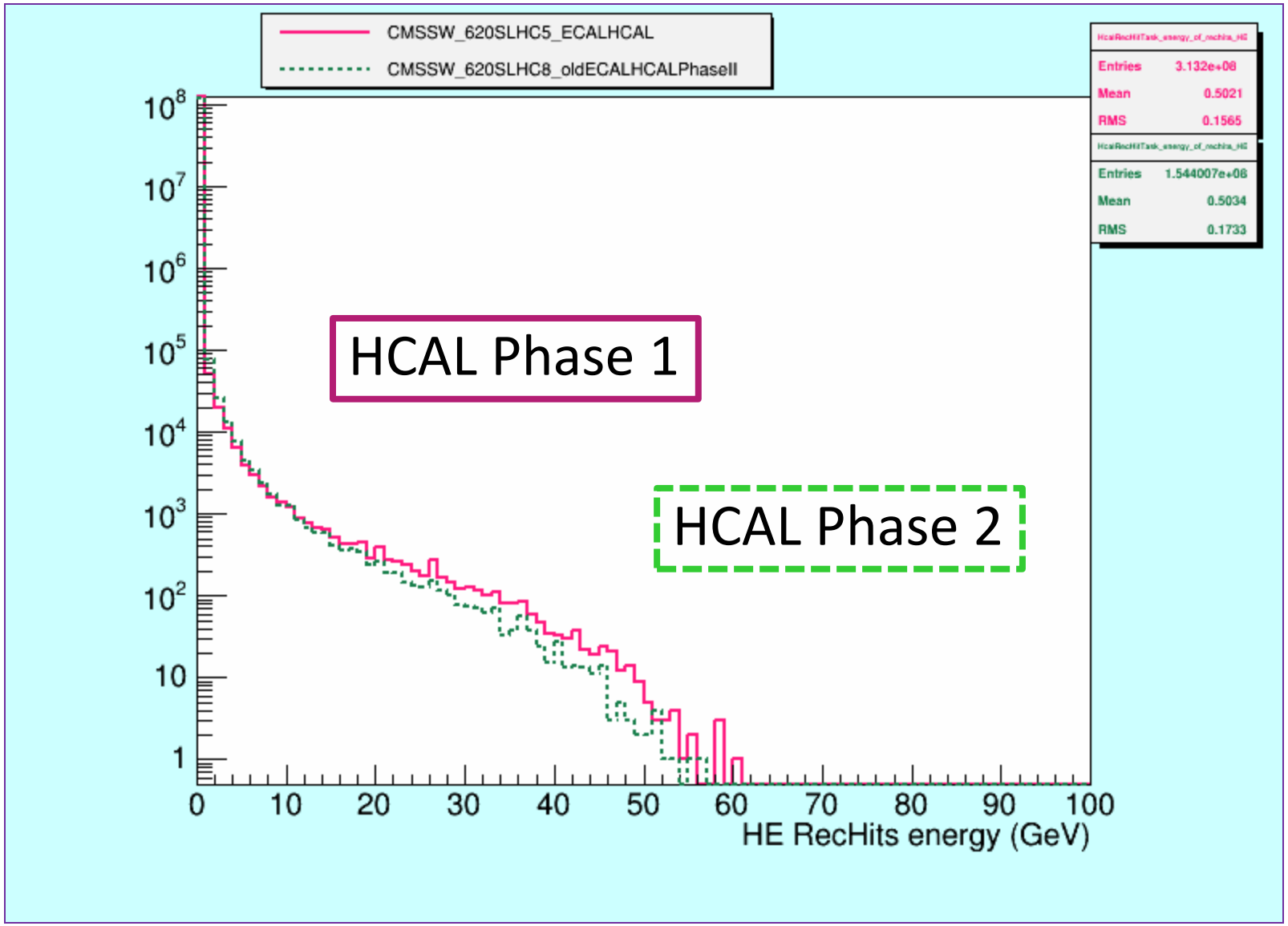
No SimHits yet…

Pointing and gaps between super modules need to be worked out…

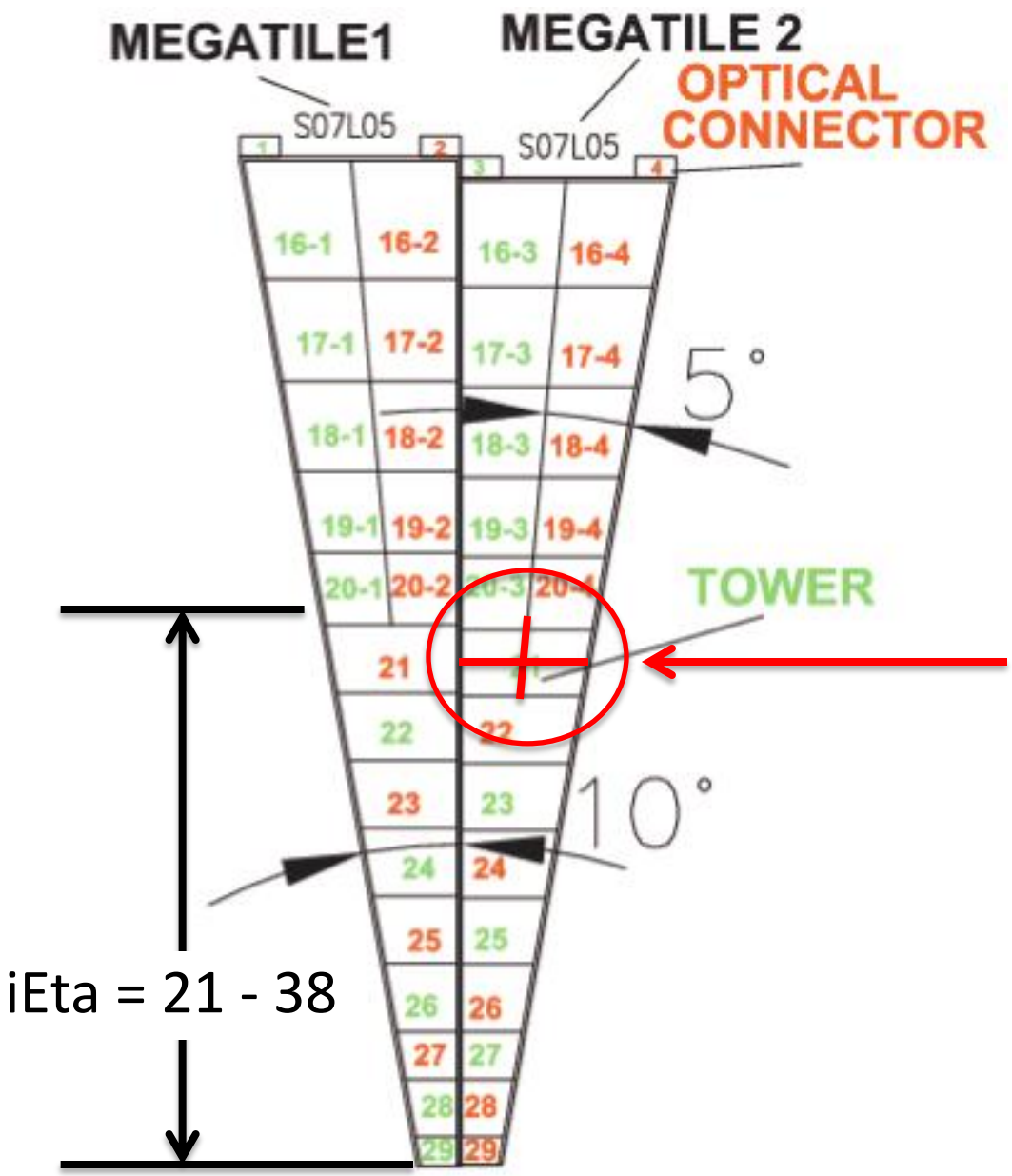
Both eta < 3 and eta < 4 options are available…

ME0 (full length) pilot geometry available…

HE RecHits!


CMSSW_620SLHC5_ECALHCAL
CMSSW_620SLHC8_oldECALHCALPhaseII
Entries 3.132e+08
Mean 0.5021
RMS 0.1565
Entries 1.544007e+08
Mean 0.5034
RMS 0.1733
HCAL Phase 1
HCAL Phase 2
HE RecHits energy (GeV)

HE Segmentation in CMSSW



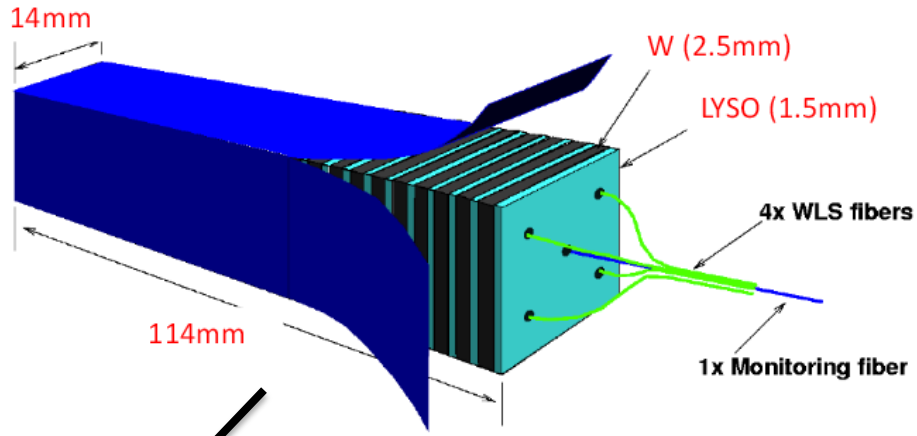
We have in HE ieta's *up to 38* (instead of former 29)

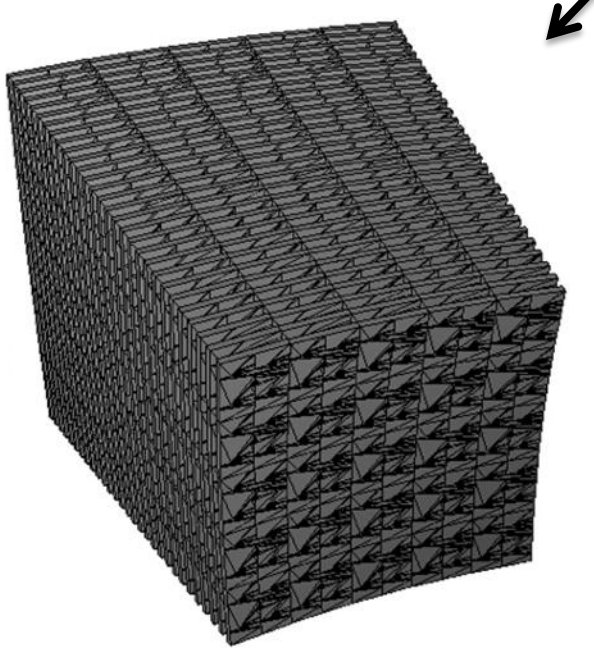
iphi = 1,2...71,72 (nPhi=72) for *all* HE ieta rings

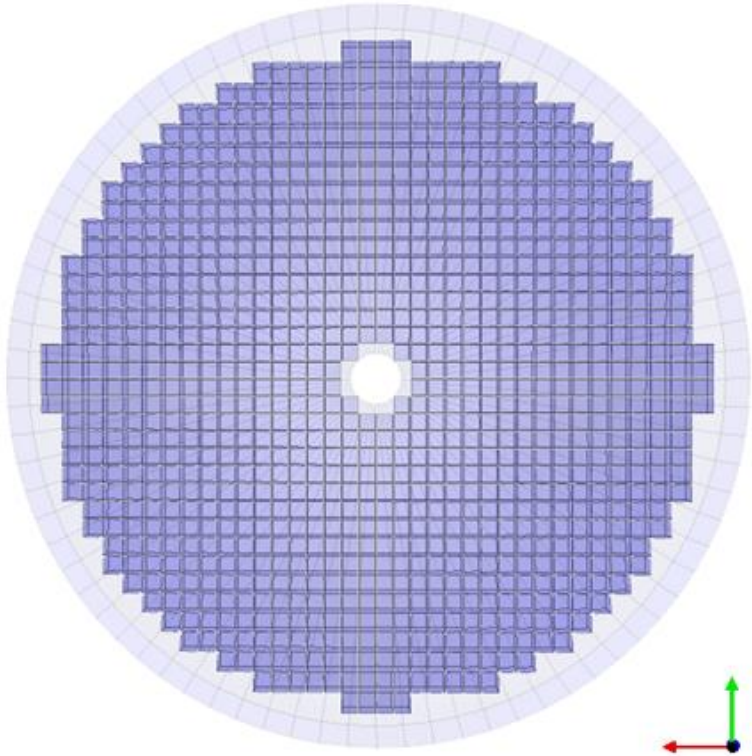
Increase eta and phi segmentation for towers 21 – 29 by 2x

(LHC geometry has nPhi=72 only up until ieta=20, then for ieta=21-29 Nphi=36)

EE Shashlik Segmentation

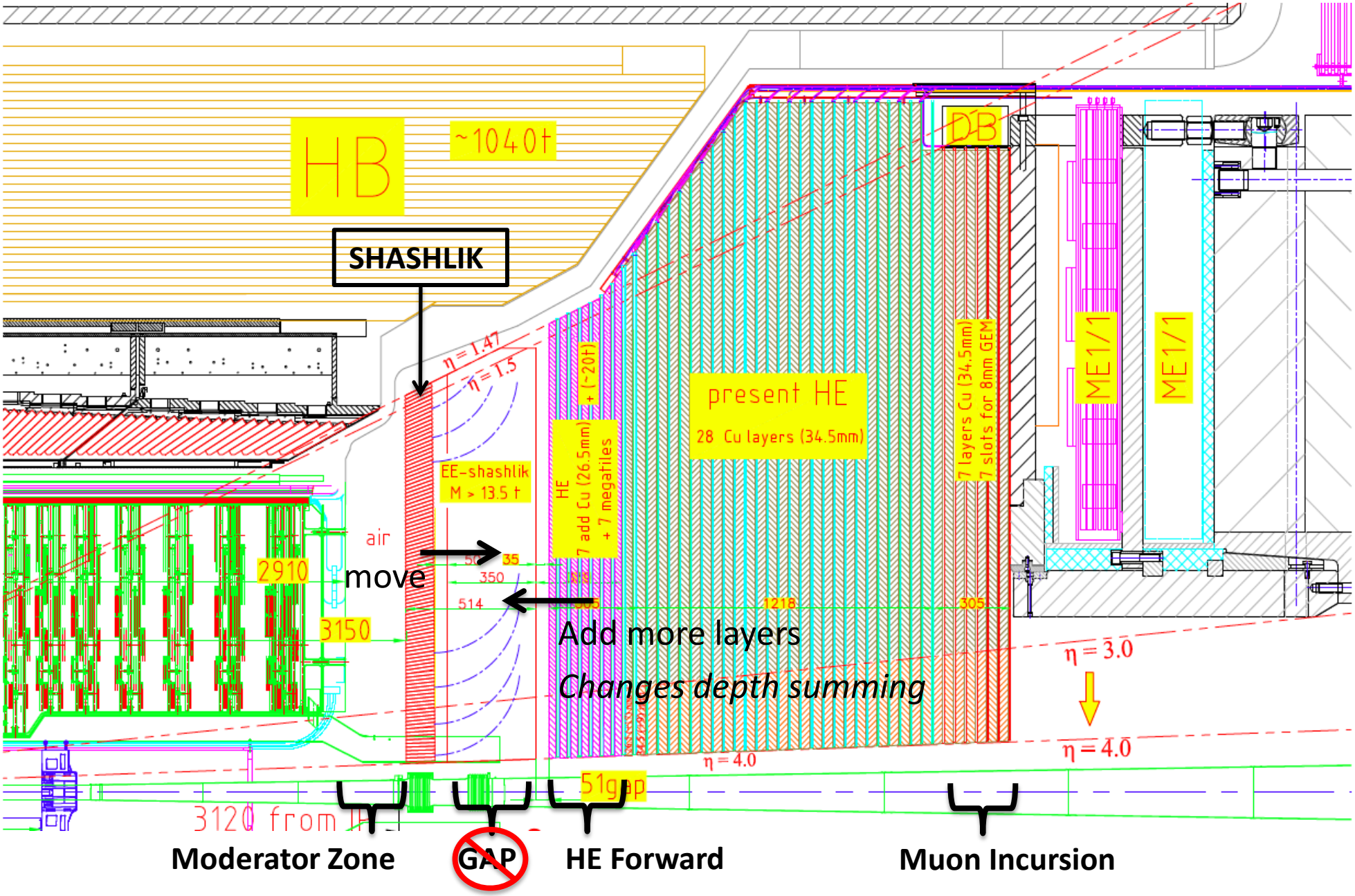






Gaps and pointing to be worked out…

Reducing the Gap



HE Segmentation Proposal

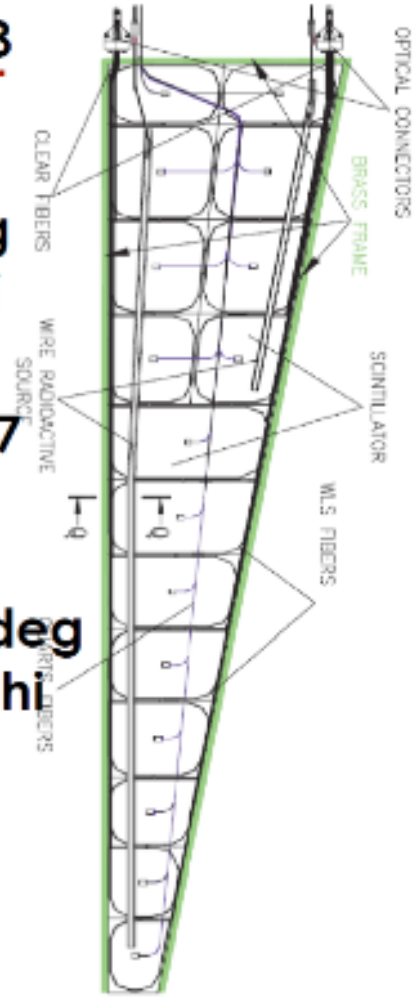
$\eta = 1.3$

5 deg in phi

$\eta = 1.7$

10 deg in phi

$\eta = 3$



present

Eta	Phi1/3	Eta	Phi2/4	
16	5°	16	5°	1.305
17	5°	17	5°	1.392
18	5°	18	5°	1.479
19	5°	19	5°	1.566
20	5°	20	5°	1.653

Eta	Phi1/4	
21	10°	1.740
22	10°	1.830
23	10°	1.930
24	10°	2.043
25	10°	2.172
26	10°	2.322
27	10°	2.500
28	10°	2.650
29	10°	2.868
		3.000

HE-rebuild

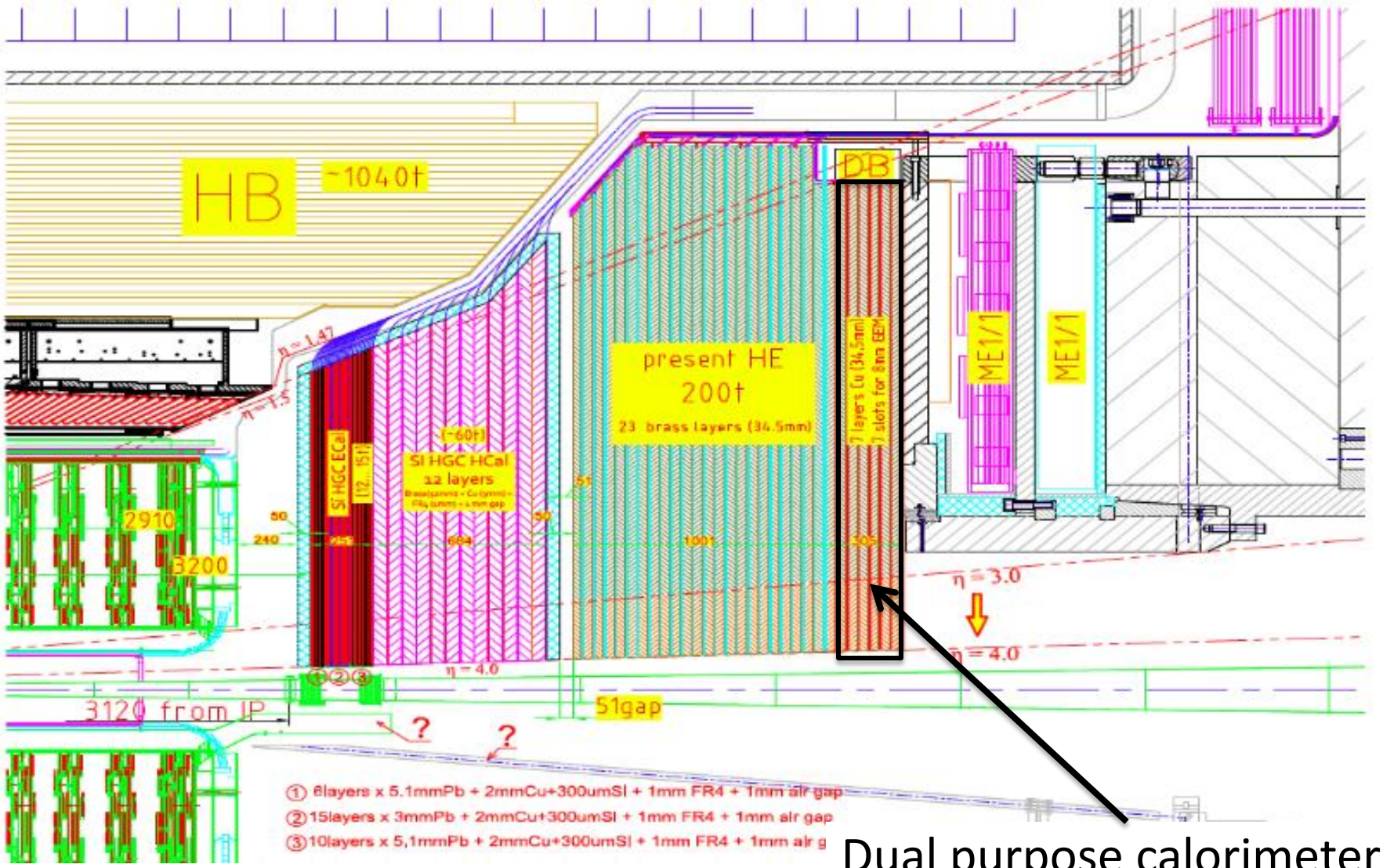
Tower	Phi1/3	Tower	Phi2/4	Eta	D_Eta
16	5°	16	5°	1.305	0.087
17	5°	17	5°	1.392	0.087
18	5°	18	5°	1.479	0.087
19	5°	19	5°	1.566	0.087
20	5°	20	5°	1.653	0.087
21	5°	21	5°	1.740	0.087
22	5°	22	5°	1.827	0.087
23	5°	23	5°	1.914	0.087
24	5°	24	5°	2.001	0.087
25	5°	25	5°	2.088	0.087
26	5°	26	5°	2.175	0.087
27	5°	27	5°	2.262	0.087
28	5°	28	5°	2.349	0.087
29	5°	29	5°	2.436	0.087
30	5°	30	5°	2.523	0.087
31	5°	31	5°	2.610	0.087

Eta	Phi1/4		
32	10°	2.697	0.175
33	10°	2.872	0.128
		3.000	

Changes in transverse segmentation of HE-rebuild, relative to present HE:
a) extend 5deg segmentation in phi to eta= 2.7 (presently stops at eta=1.7)
b) extend Delta_eta = 0.087 segmentation to eta =2.7 (presently stops at eta=1.7)

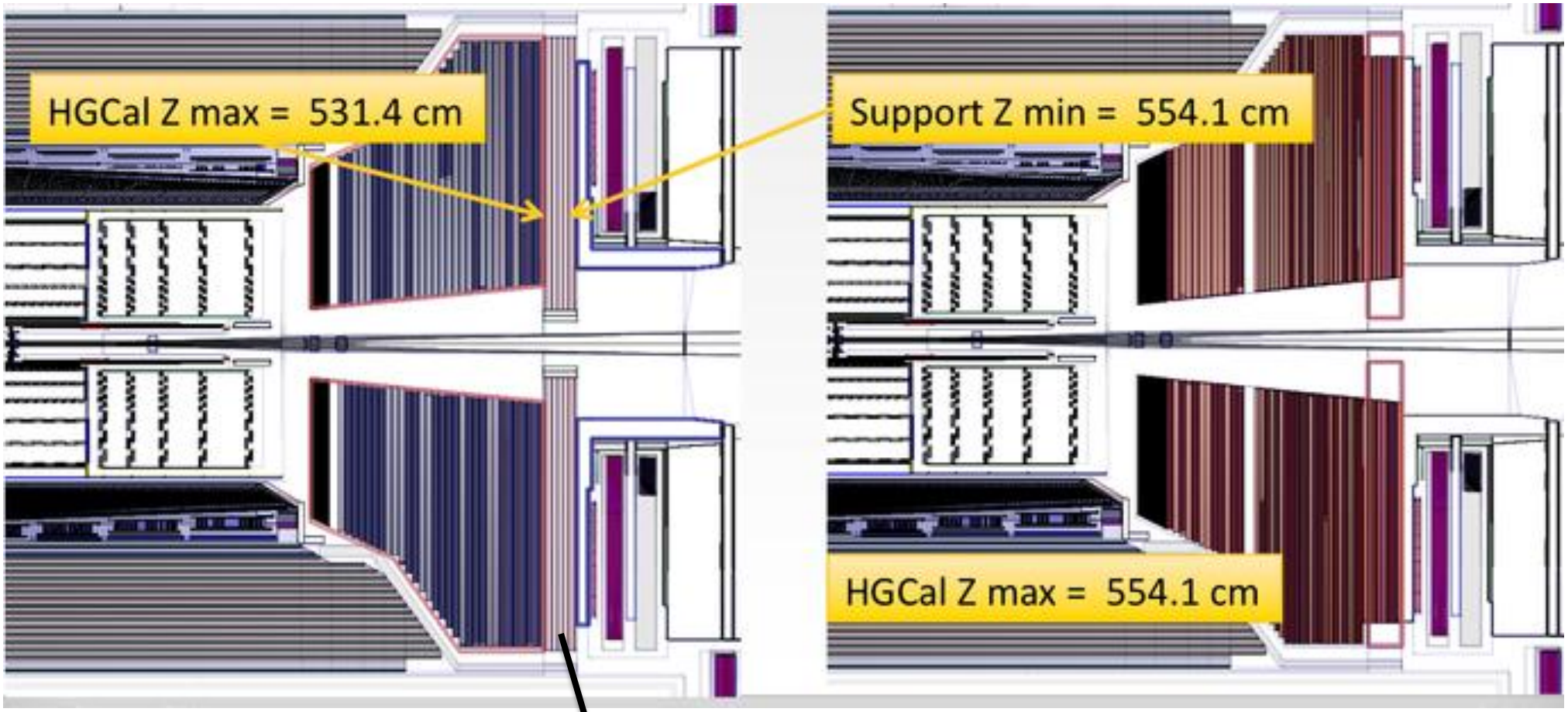
Conceptual Design of HGCal in CMSSW

M. Mannelli R. Rusack, CMS week 11 December 2013



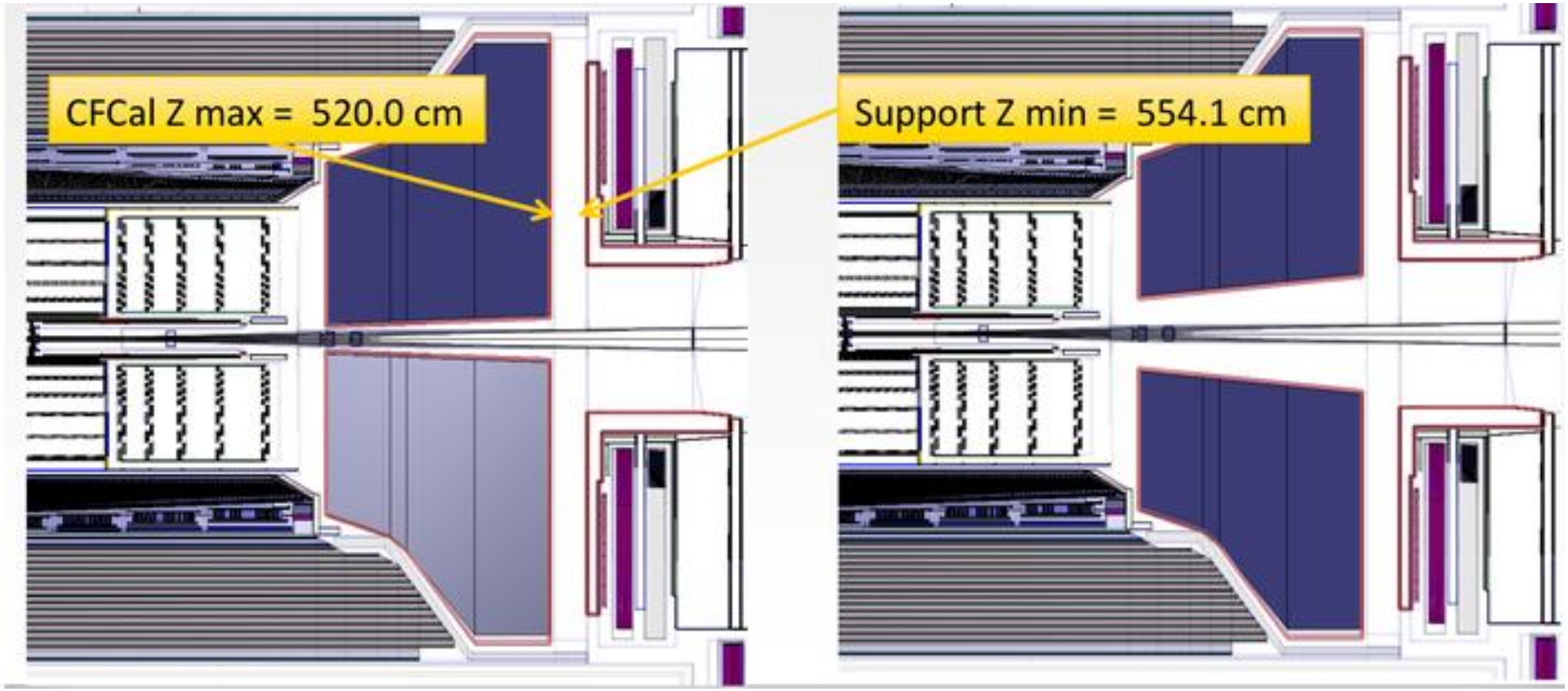
Dual purpose calorimeter + muon or ME0?

HGCal Old vs New in CMSSW



ME0 pilot muon station

CFCal in CMSSW



Two geometry configurations (|η| < 3, |η| < 4)

Space available behind the endcap for muon detectors…

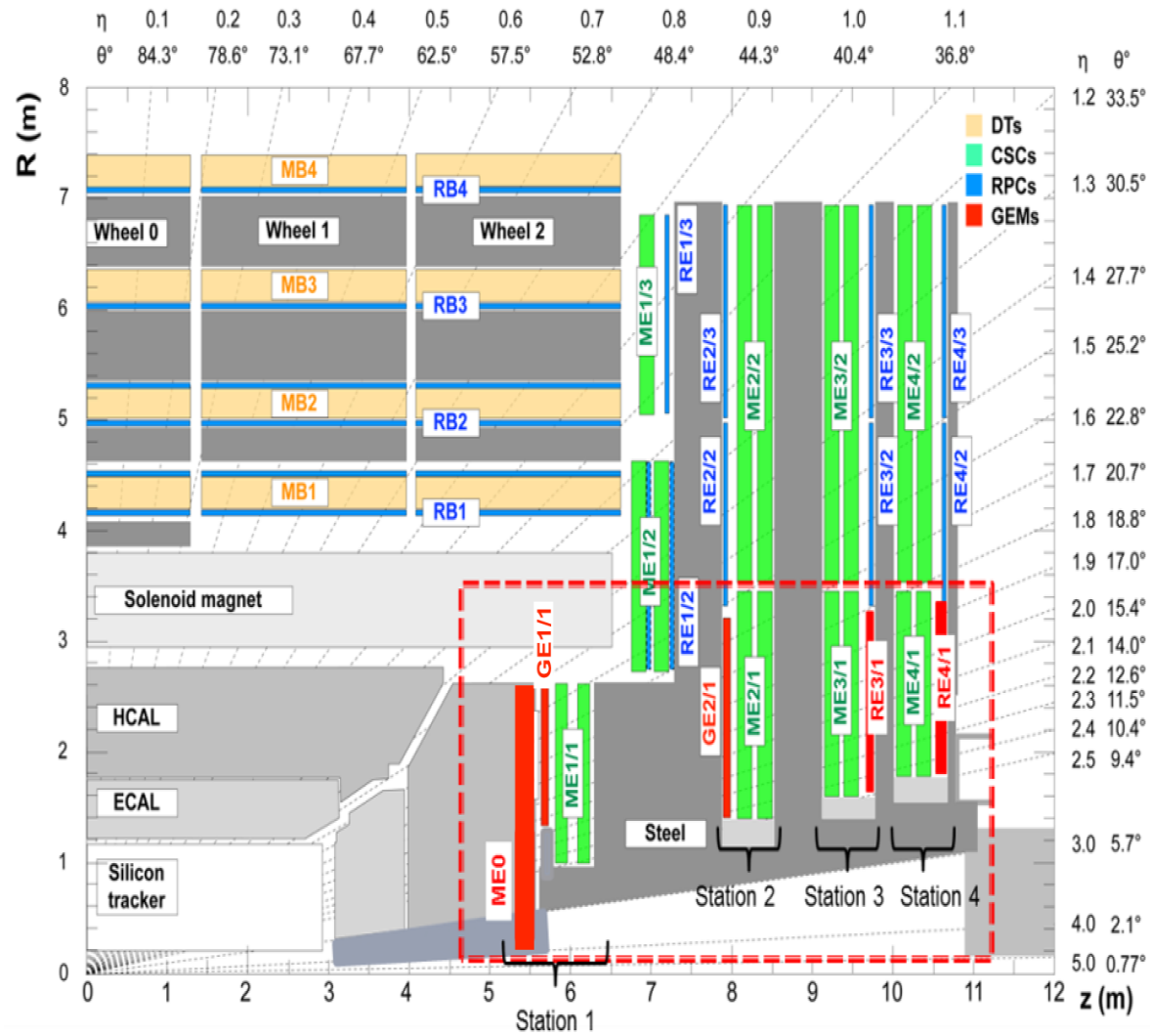
Muon Simulation Goals

Goals:

- Quantify physics gains for each proposed element and groups of elements
- Determine optimal detector parameters

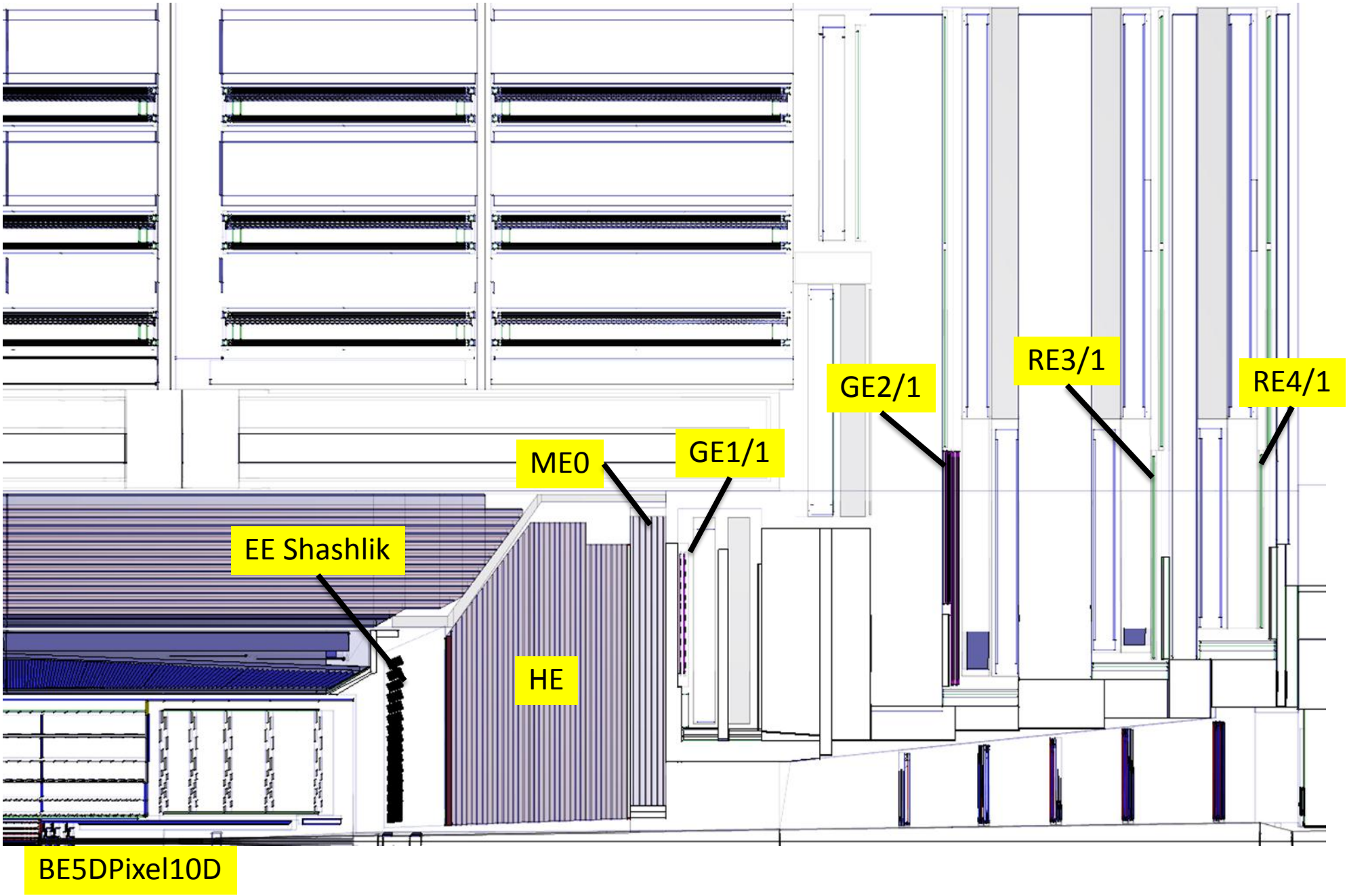
Strategy:

- Implement "maximum scenario" configuration
  - Even if unrealistic: it is easy to drop unnecessary hits, much harder to add something that is not there
- Optimize parameters for performance
- Evaluate and compare baseline scenarios



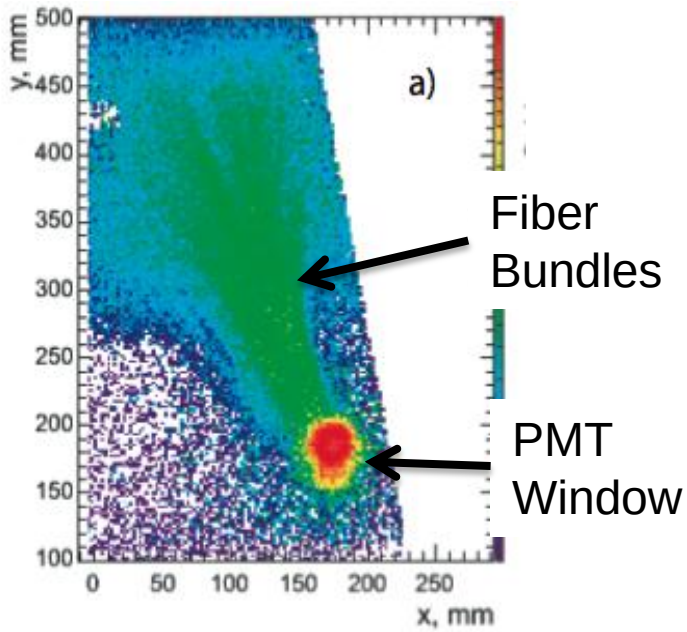
- Example: we likely can't even have a "long" ME-0 due to space limitations, but we can use it as a yard stick in optimizing the baseline

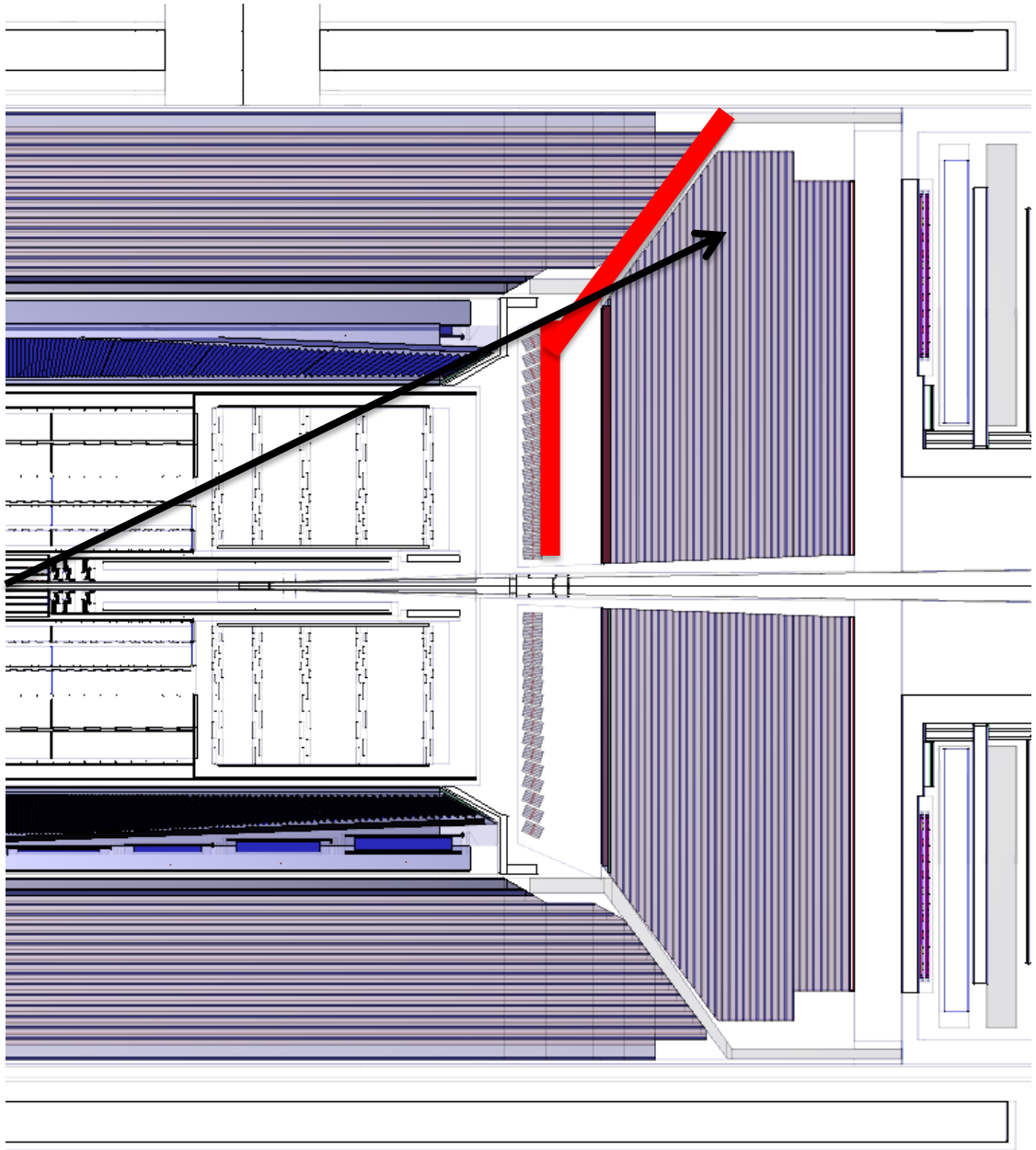
Muon Stations in CMSSW



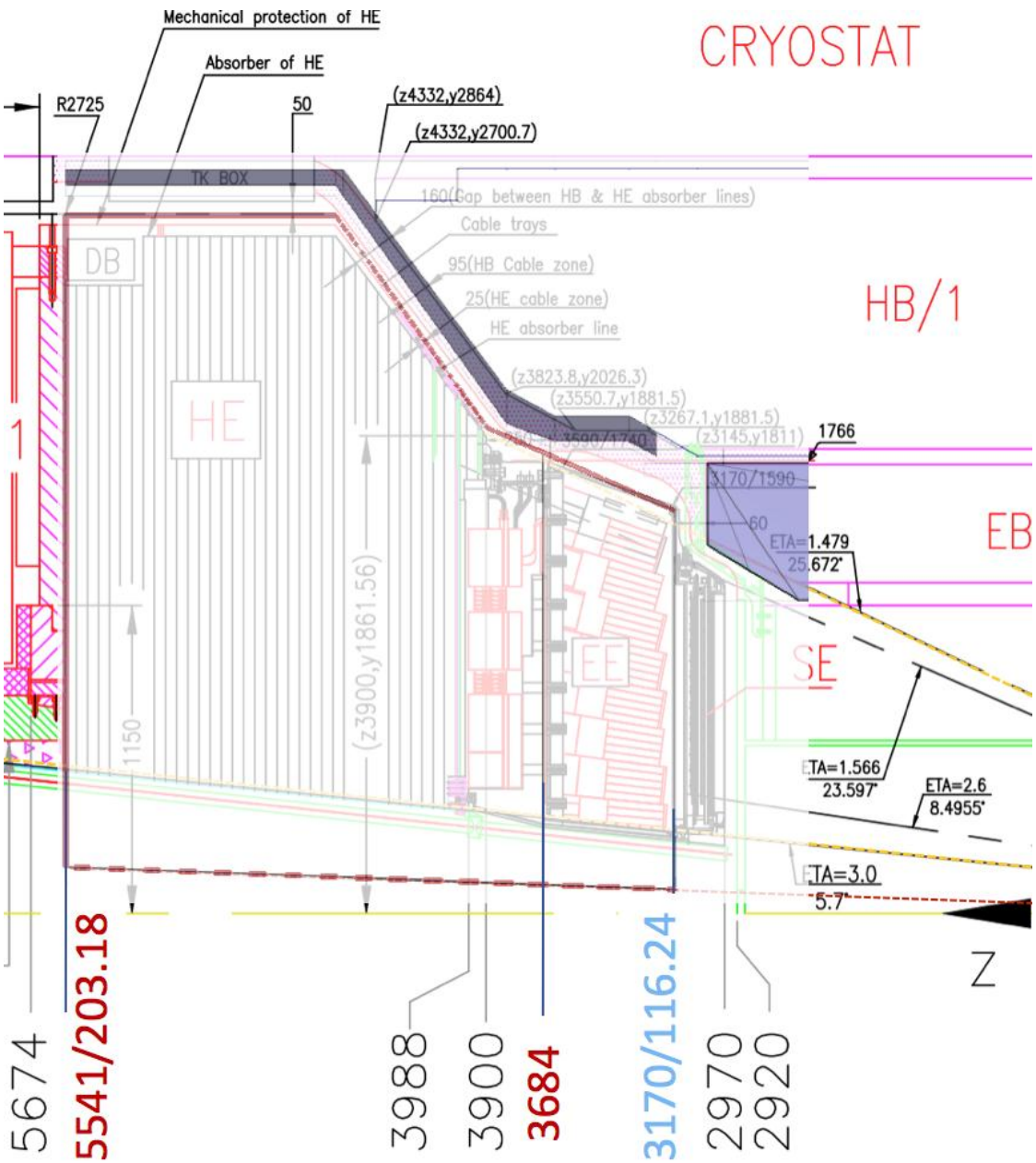
HF PMT Window Hits

Eur.Phys.J. C53, 139-166 (2008)





EndCap Volume

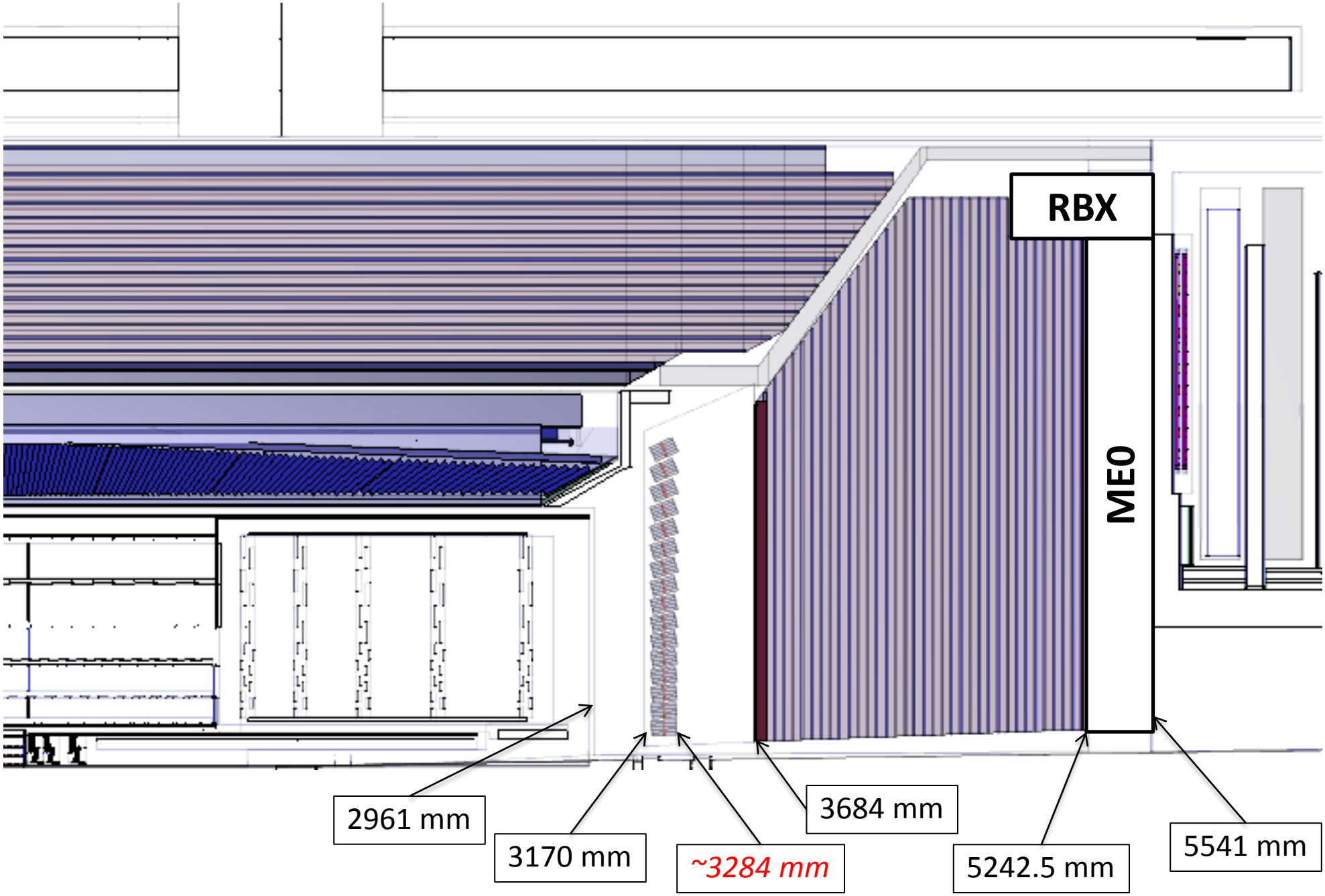
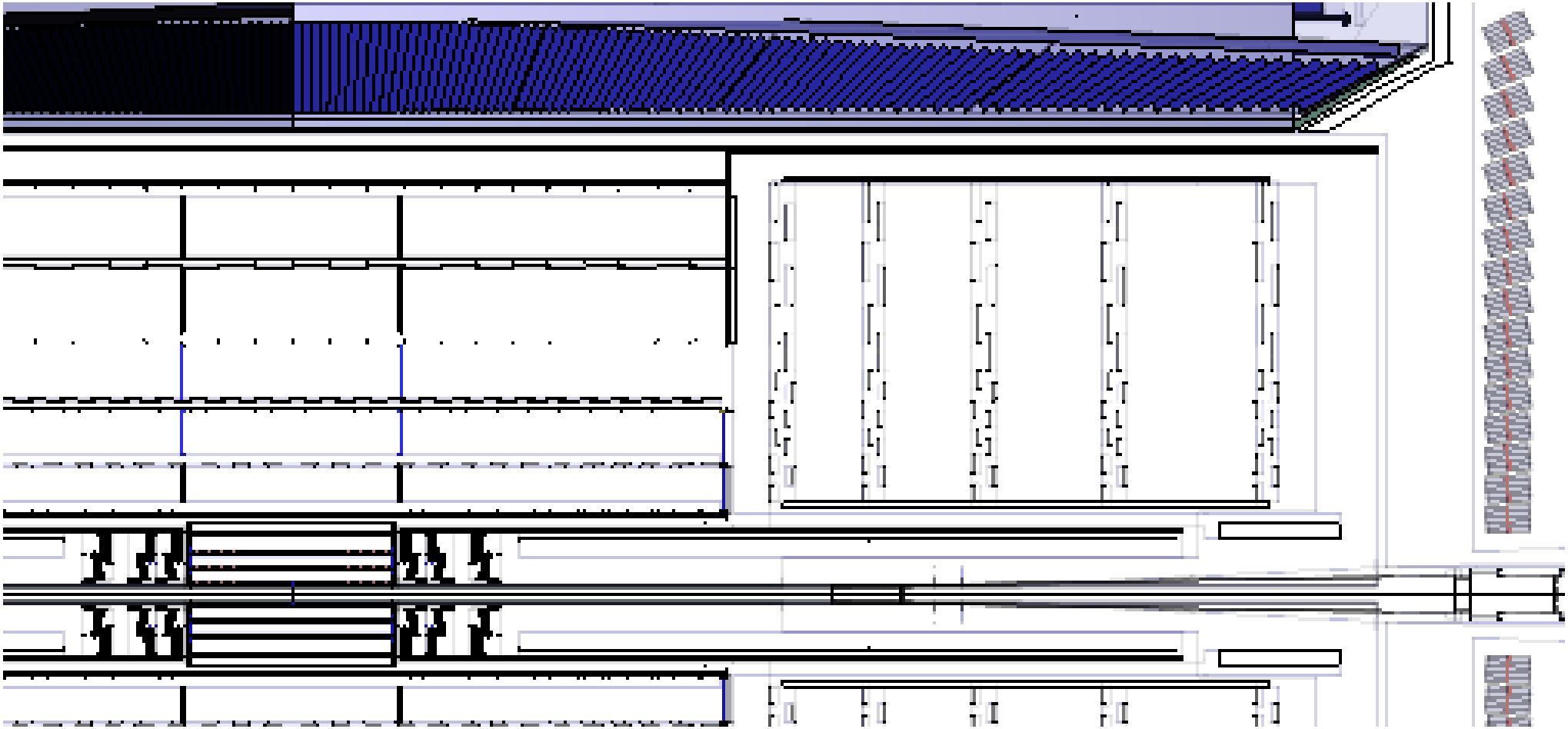


Preshower:	2961 mm
EE Front:	3170 mm
EE Back:	3284 mm
EE service:	*3584 mm*
HE Front:	3684 mm
HE back:	5242.5 mm
Front of ME0:	5241 mm
Back of ME0:	5541 mm

ME0 is 300 mm wide

Small overlap with HE

EndCap Volume



Tracker Detail