The forward detectors of CMS Experiment at LHC

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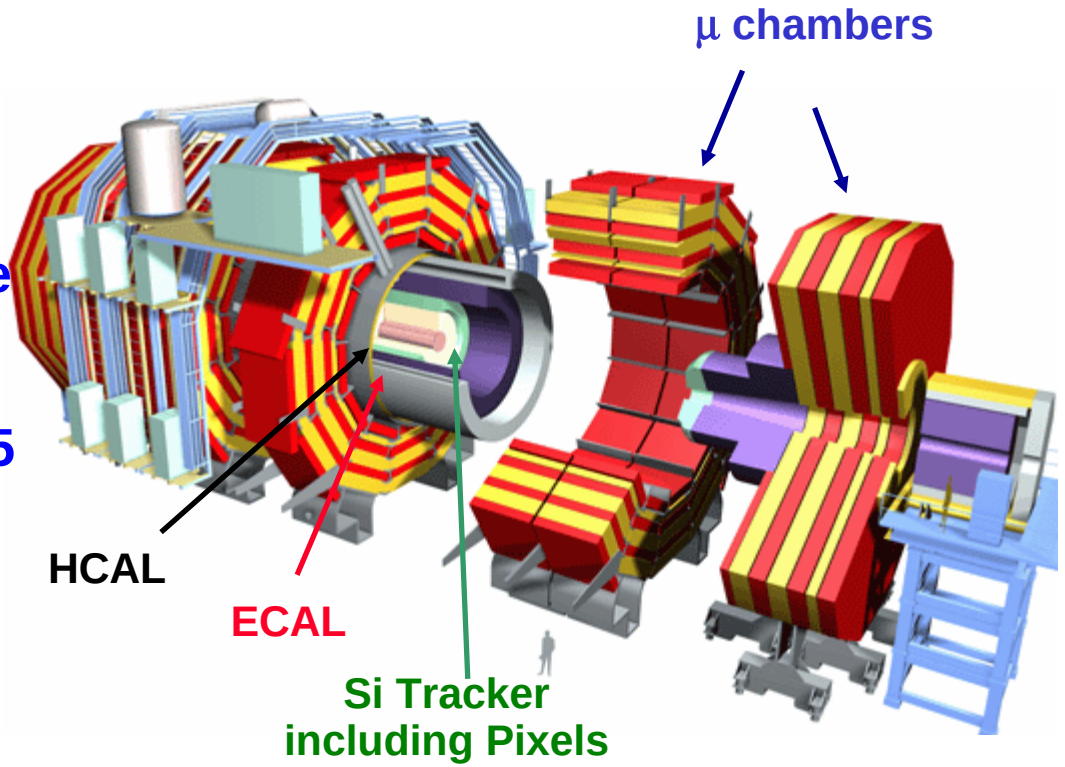
A collection of graphs and drawings from talks of
A. Panagiotou, K. Eggert, A De Roeck and others

CMS as a Detector for Heavy Ion Physics

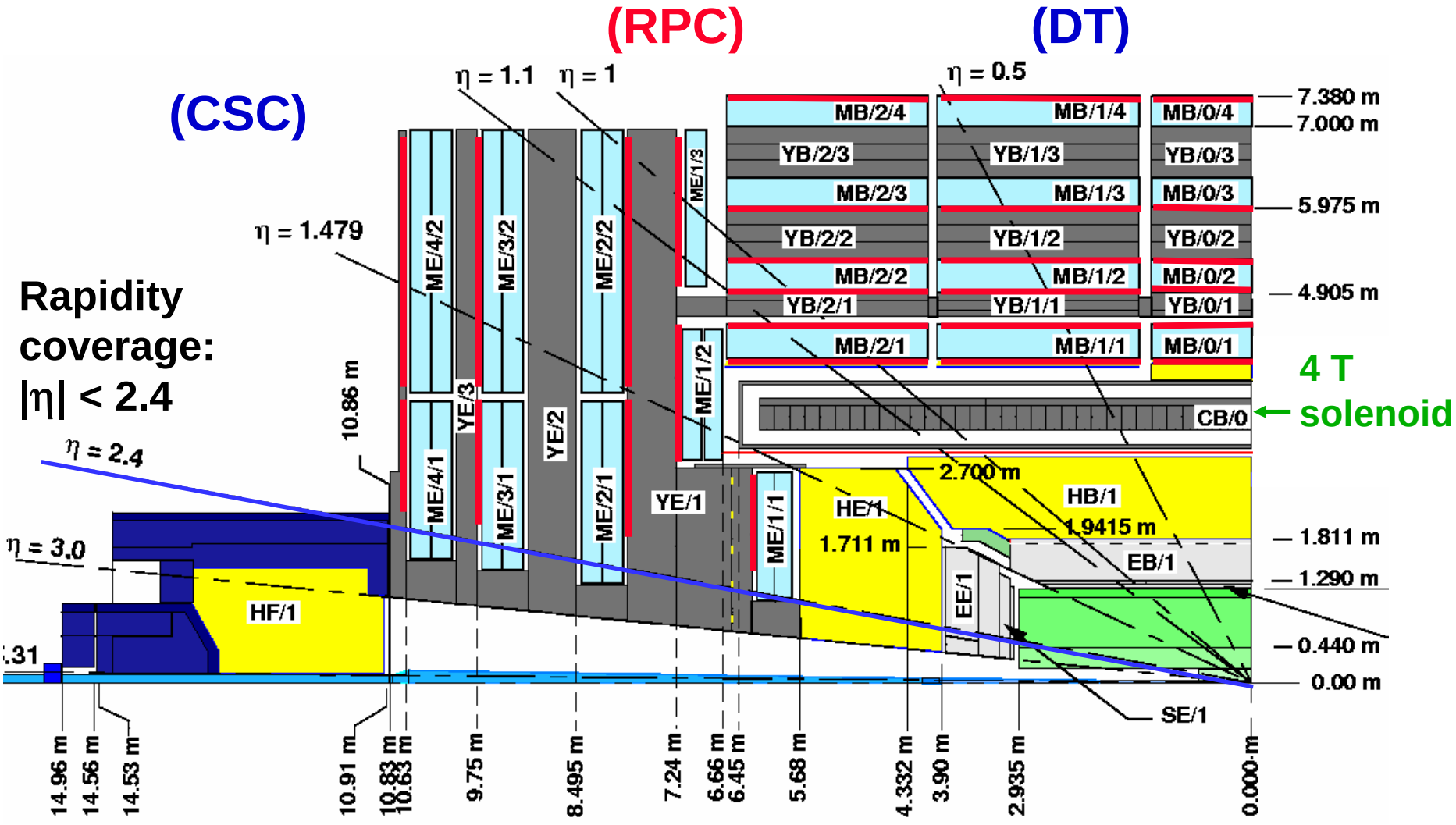
- **Fine Grained High Resolution Calorimeter**
  - Hermetic coverage up to $|\eta|<5$
  - ($|\eta|<7$ proposed using CASTOR)
  - Zero Degree Calorimeter (proposed)
- **Tracking μ from Z^0, J/ψ, Υ**
  - Wide rapidity range $|\eta|<2.4$
  - σ_m ~50 MeV at Υ
- **Silicon Tracker**
  - Good efficiency and low fake rate for $p_T>1$ GeV
  - Excellent momentum resolution $\Delta p/p \sim 1\%$ for $p_T<25$ GeV and higher

Fully functional at highest expected multiplicities
Detailed studies at ~3000-5000 and cross-checks at 7000-8000

- **DAQ and Trigger**
  - High rate capability for AA, pA, pp
  - High Level Trigger capable of full reconstruction of most HI events in real time

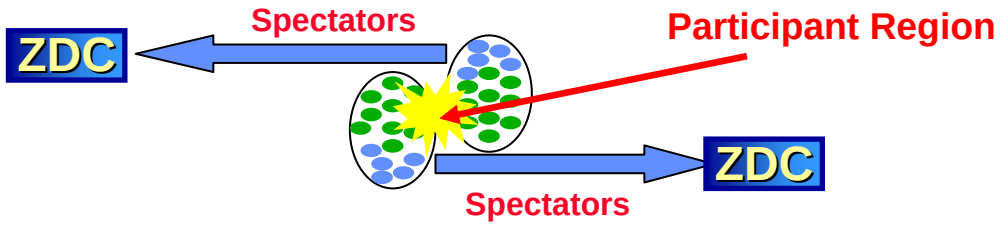


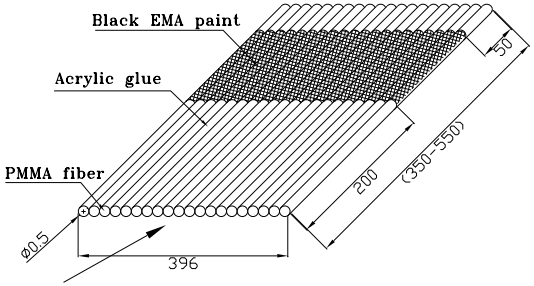
Quarter Cross-Sectional View



Muon momentum measurement uses return field of iron yoke

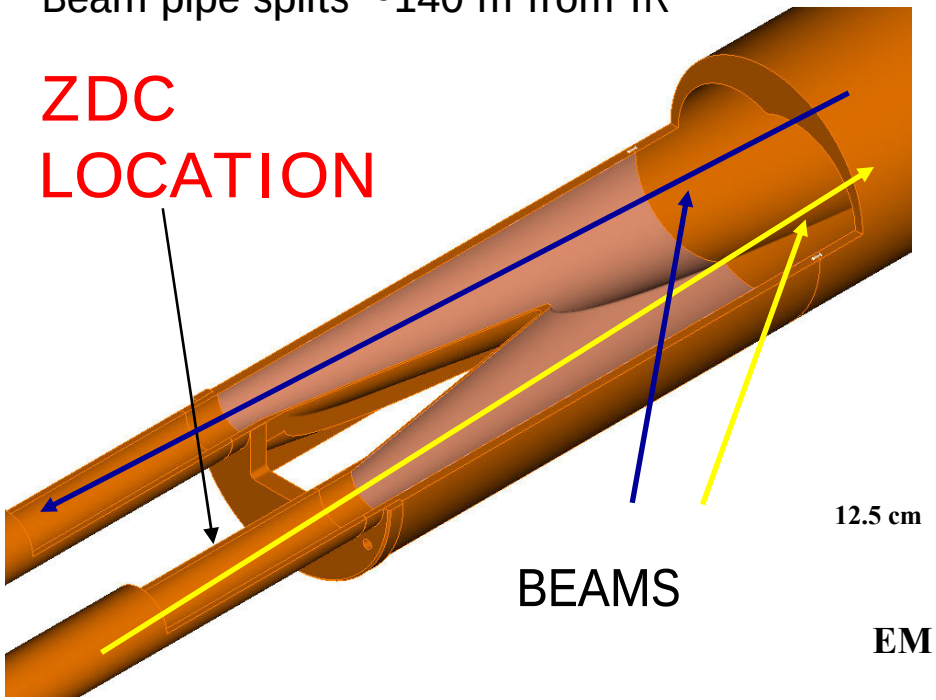
Zero Degree Calorimetry for CMS

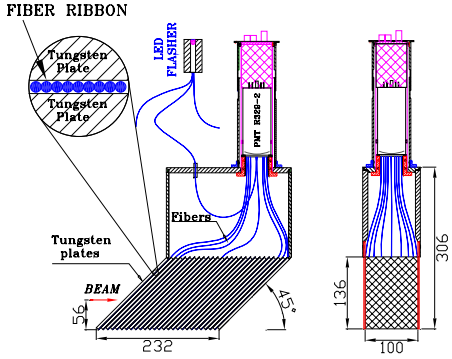


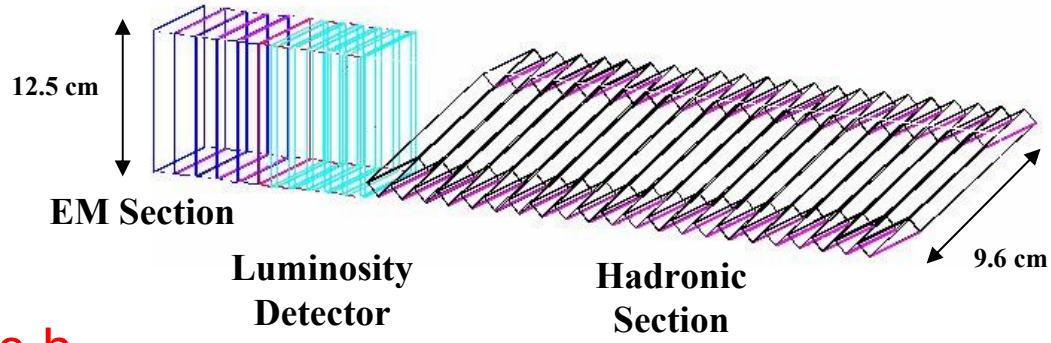


Beam pipe splits ~140 m from IR

ZDC LOCATION

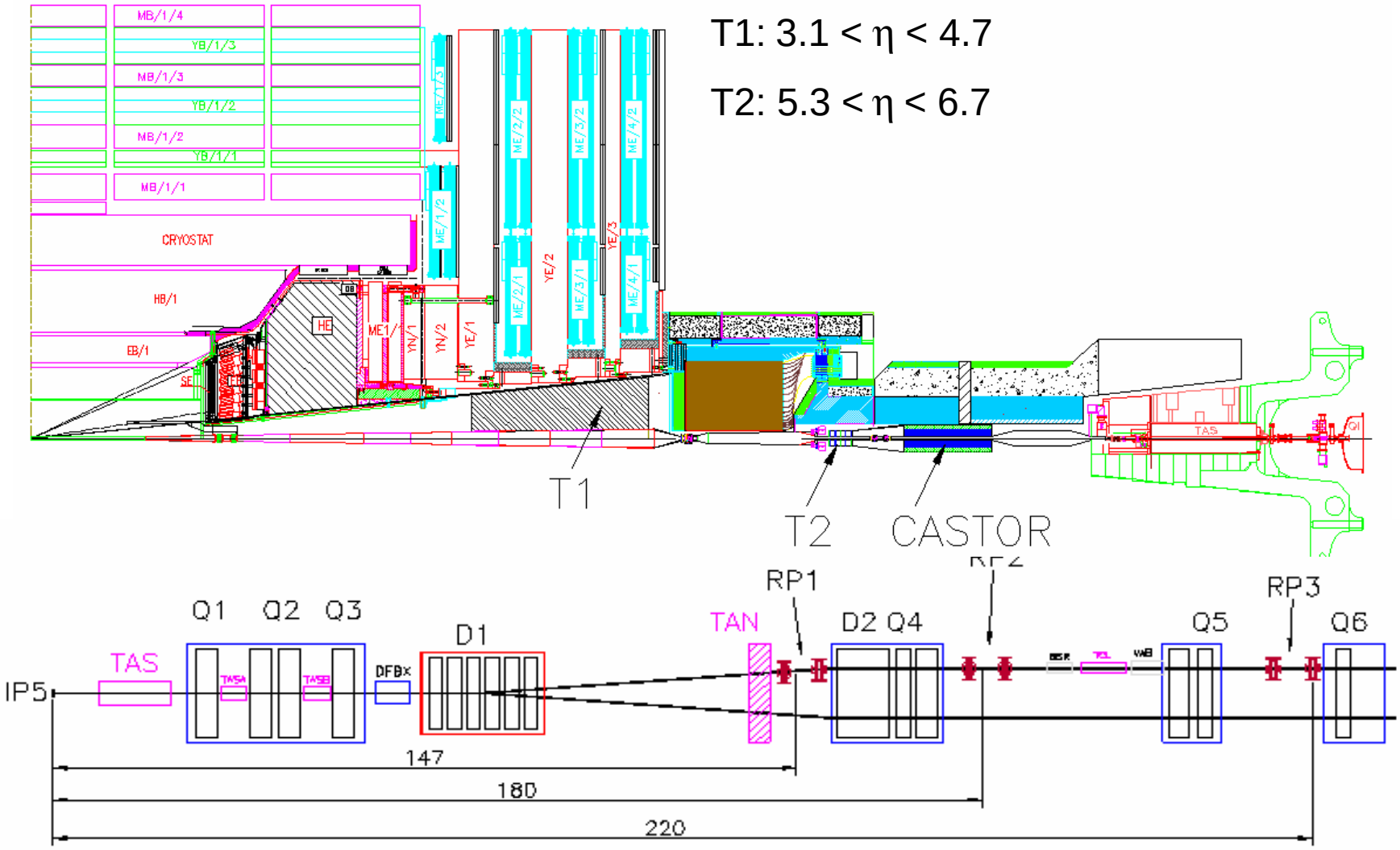




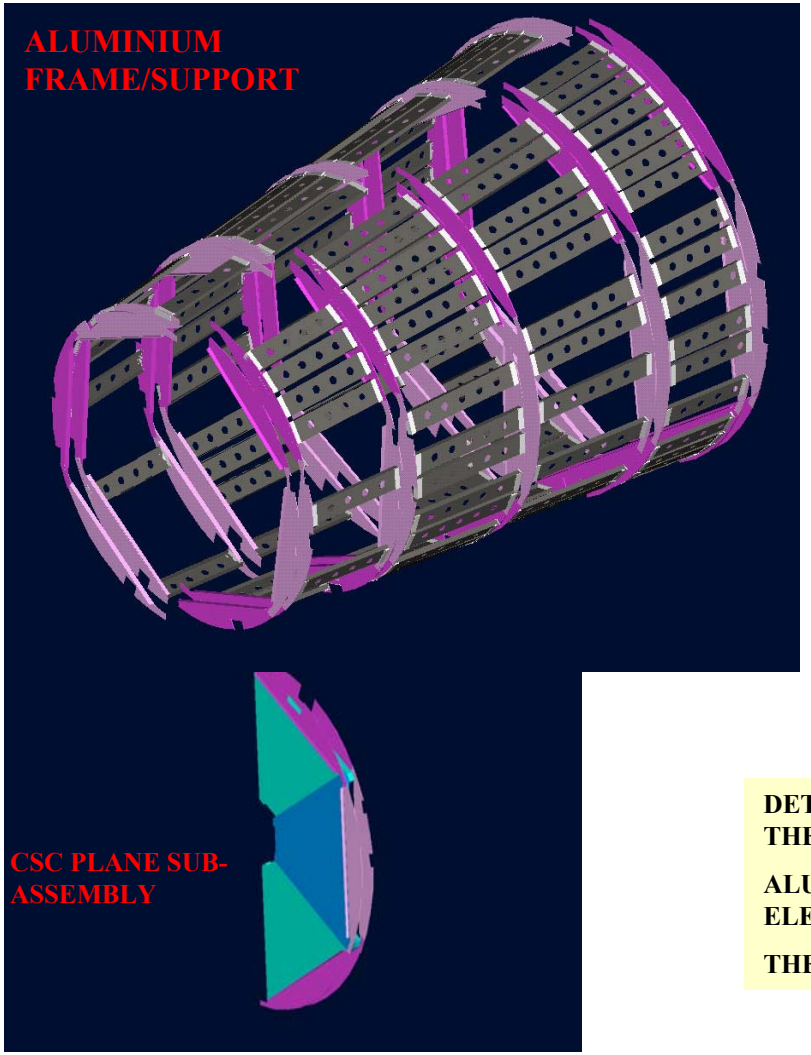


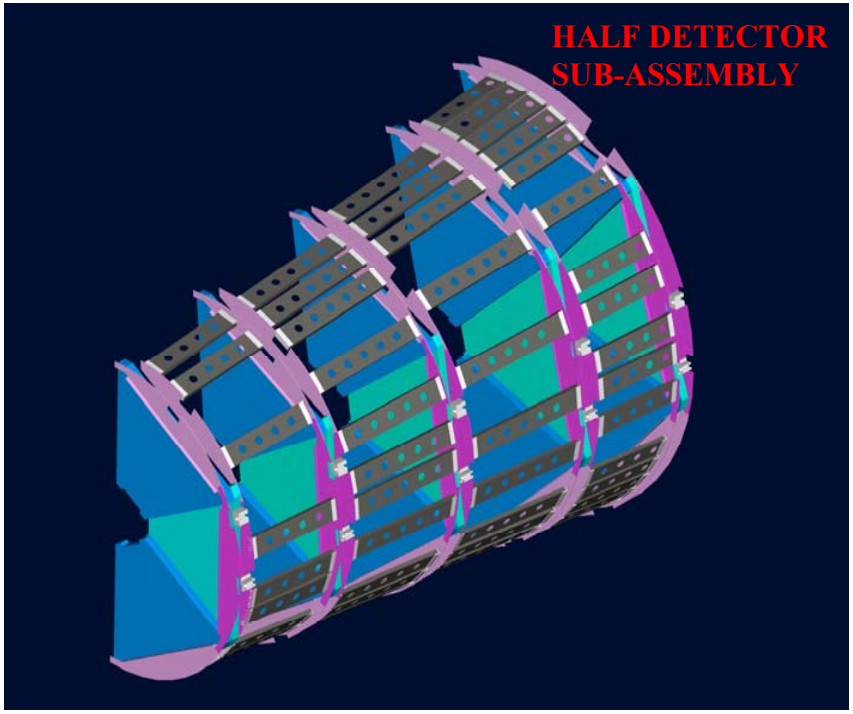
ZDC improves resolution at large b

ZDC integration with TAN


T1: 3.1 < η < 4.7
T2: 5.3 < η < 6.7
MB/1/4
YB/1/3
MB/1/3
YB/1/2
MB/1/2
YB/1/1
MB/1/1
CRYOSTAT
HB/1
EB/1
HE
ME1/
YN/1
YN/2
YE/1
ME/1/3
ME/1/2
ME/2/2
ME/2/1
YE/2
ME/3/2
ME/3/1
YE/3
ME/4/2
ME/4/1
T1
T2
CASTOR
Q1
Q2
Q3
D1
TAS
IP5
DFBX
TAN
RP1
D2 Q4
Q5
RP3
Q6
147
180
220

T1 – DETECTOR: LAYOUT



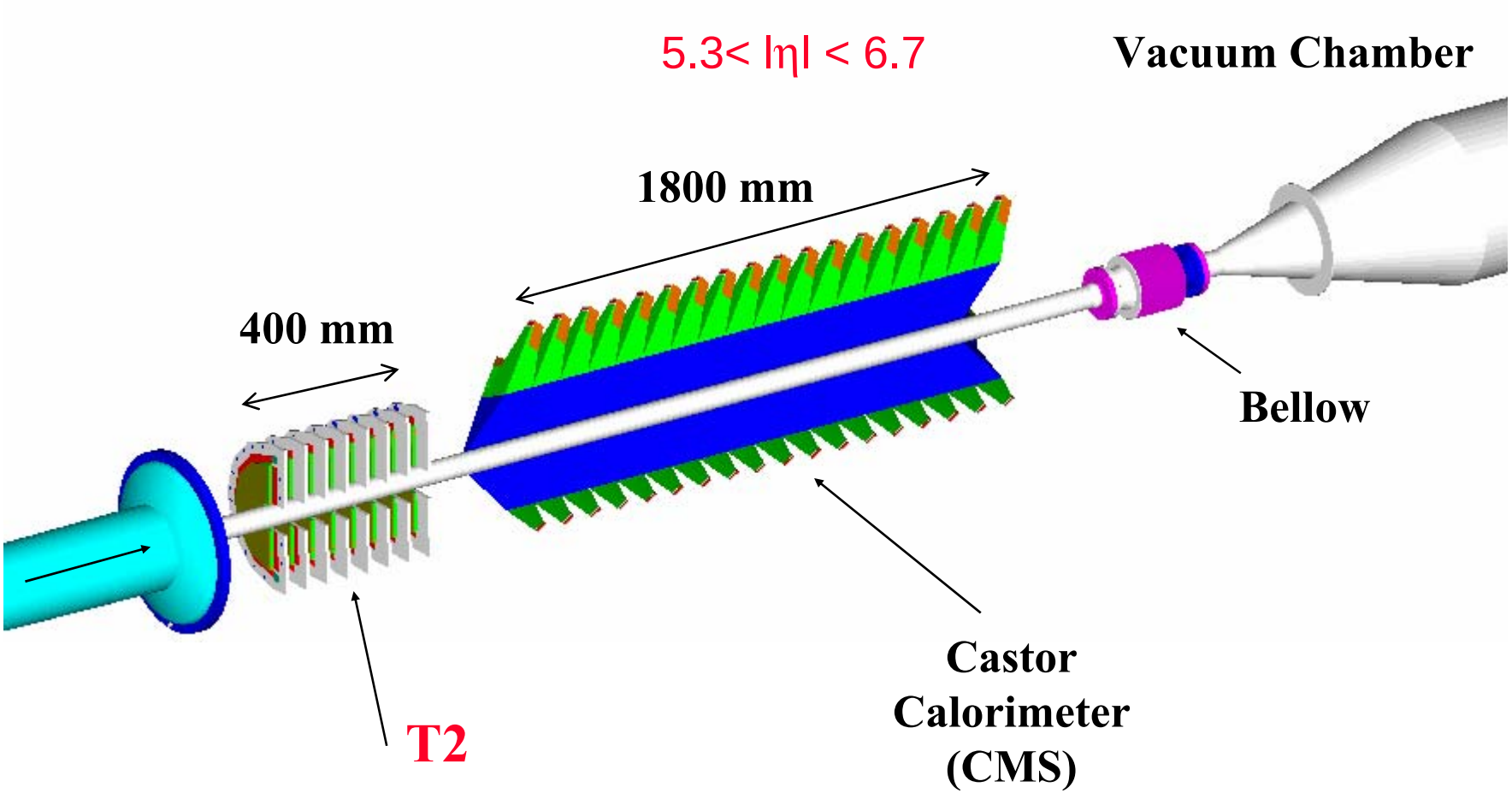


DETECTOR IN TWO HALVES, TO ALLOW INSTALLATION WHEN THE VACUUM CHAMBER IS ALREADY IN PLACE

ALUMINIUM FRAME FOR EACH CSCs PLANE (SUPPORTS ELECTRONICS, SERVICES AND LINK TO THE RAILS)

THE TRUSS/RAIL SYSTEM IS INTEGRAL PART OF DETECTOR

T2 Telescope

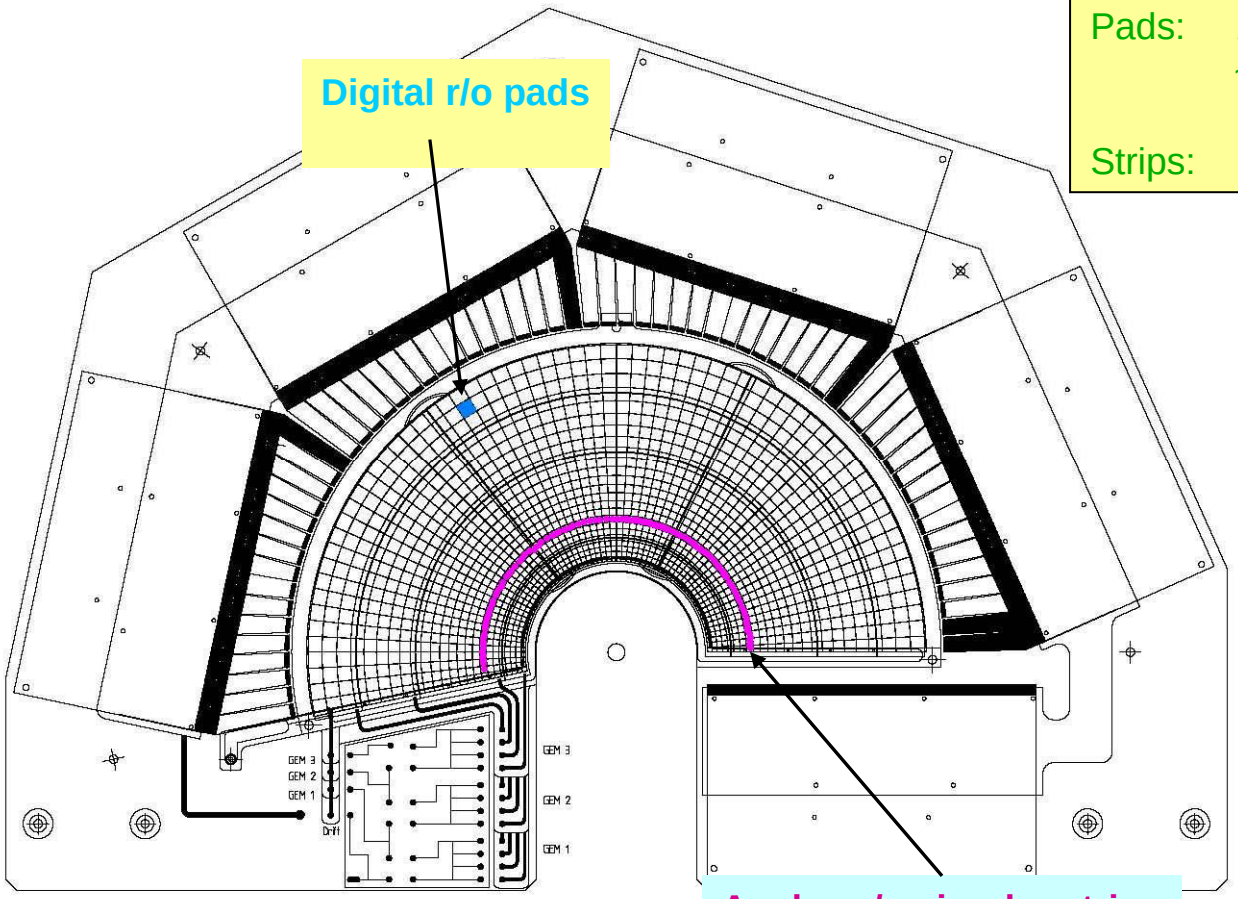


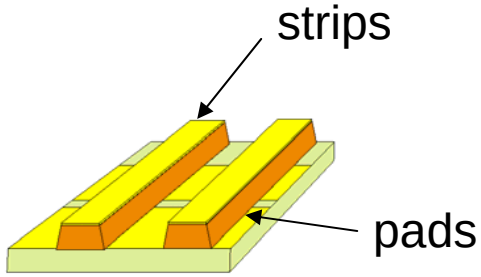
GEM Telescope: 8 planes
13500 mm from IP

T2: telescope

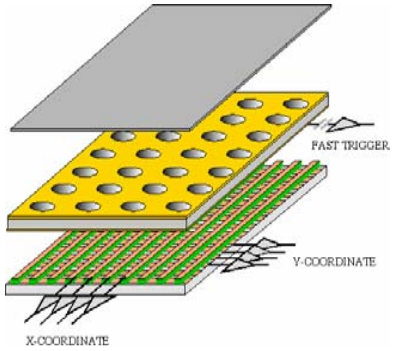
8 triple-GEM planes, to cope with high particle fluxes
5.3<|η|<6.6

Pads:	54(φ) x 22(η) = 1536 pads Δη x Δφ = 0.06 x 0.018π ~2x2 mm² – ~7x7 mm²
Strips:	256 (width: 80 μm,pitch: 400 μm)





Technology used in COMPASS

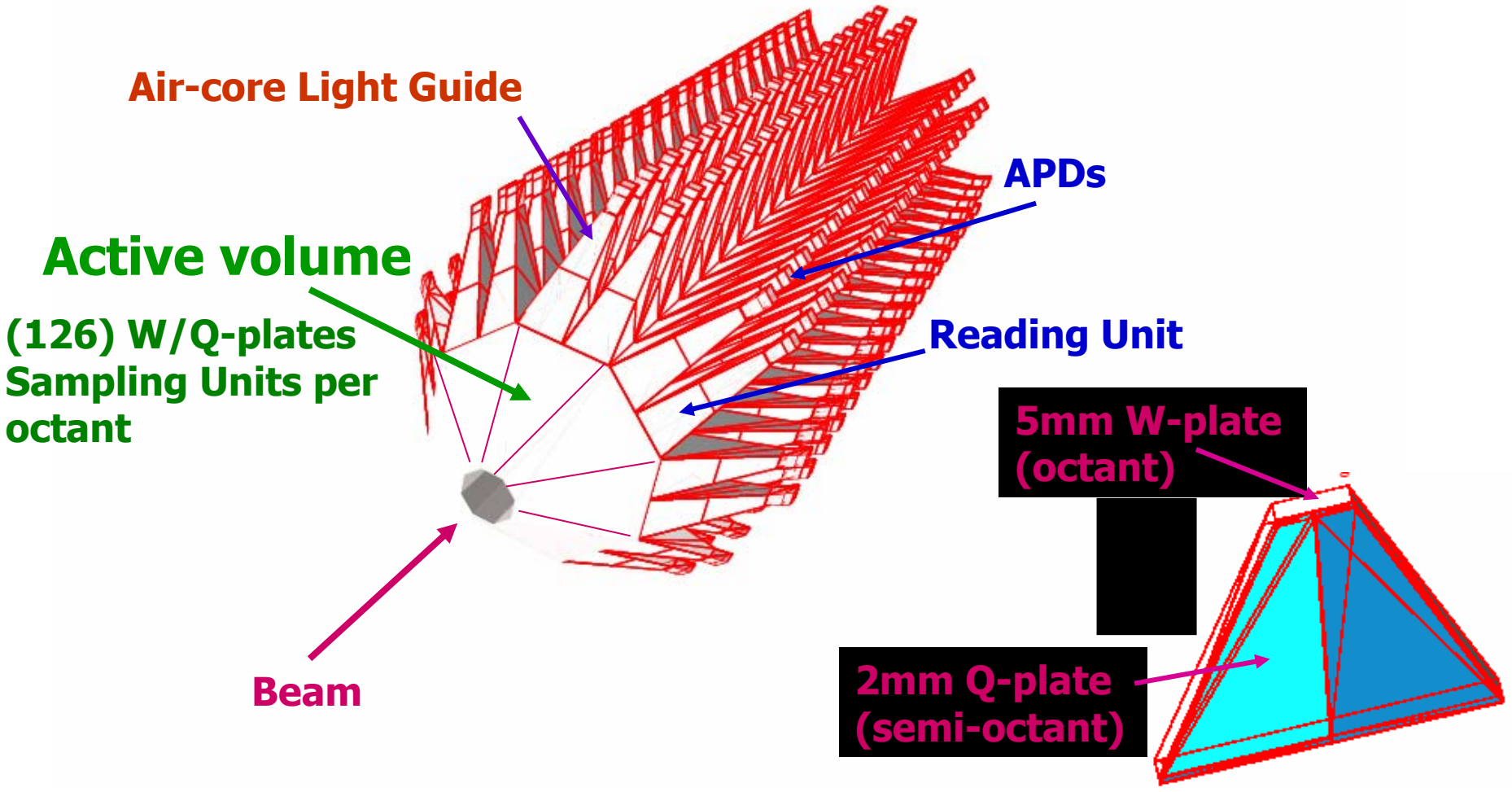


CASTOR SPECIFICATIONS

H
CASTOR
A
L

Sampling Unit ~ 0.078 λ_I ~ 2 X_o
Reading Unit=7SU ~ 0.544 λ_I ~14 X_o
(16) Sectors in φ (22.5°)
Channels (RUs)=16 x 18=288

EM = 2 RU (~ 28 X_o)
H = 18 RU (~ 10 λ_I)



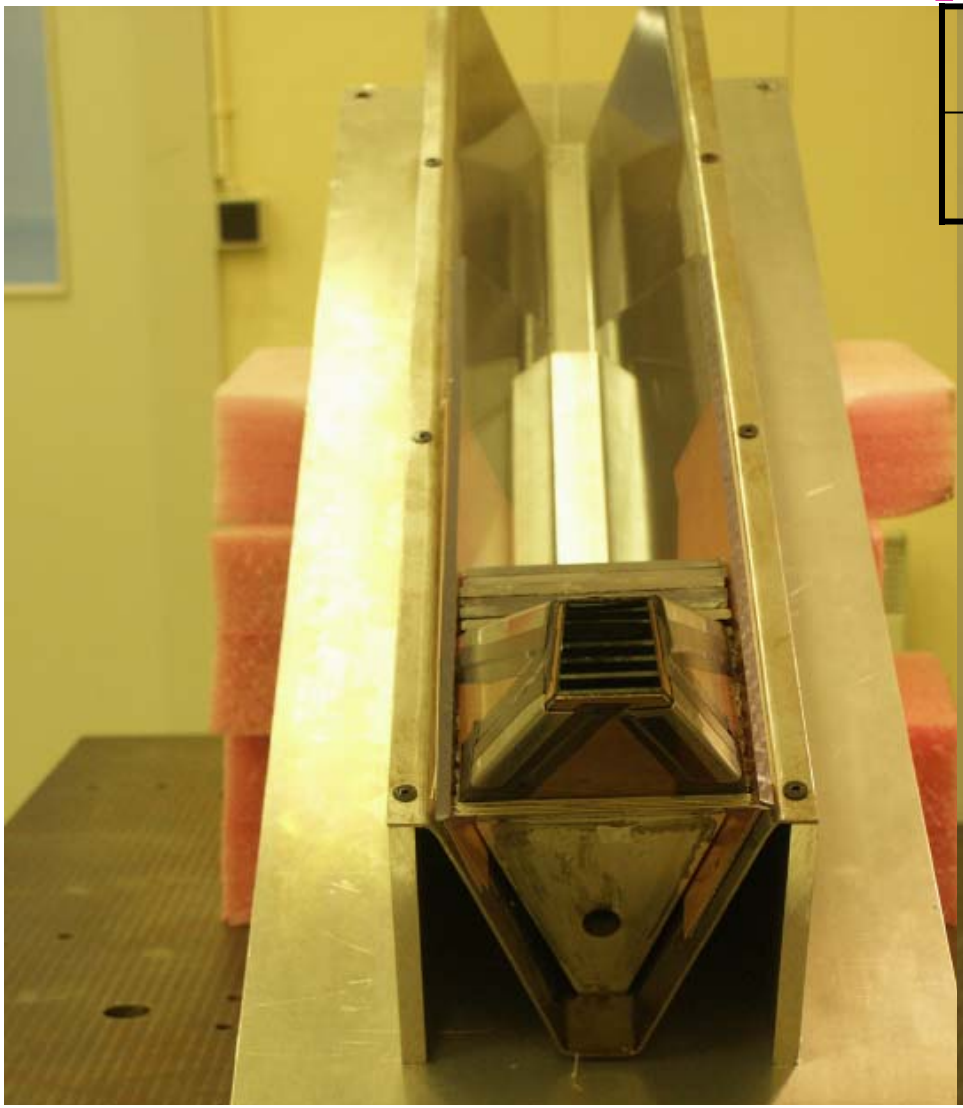
CASTOR PROTOTYPE II

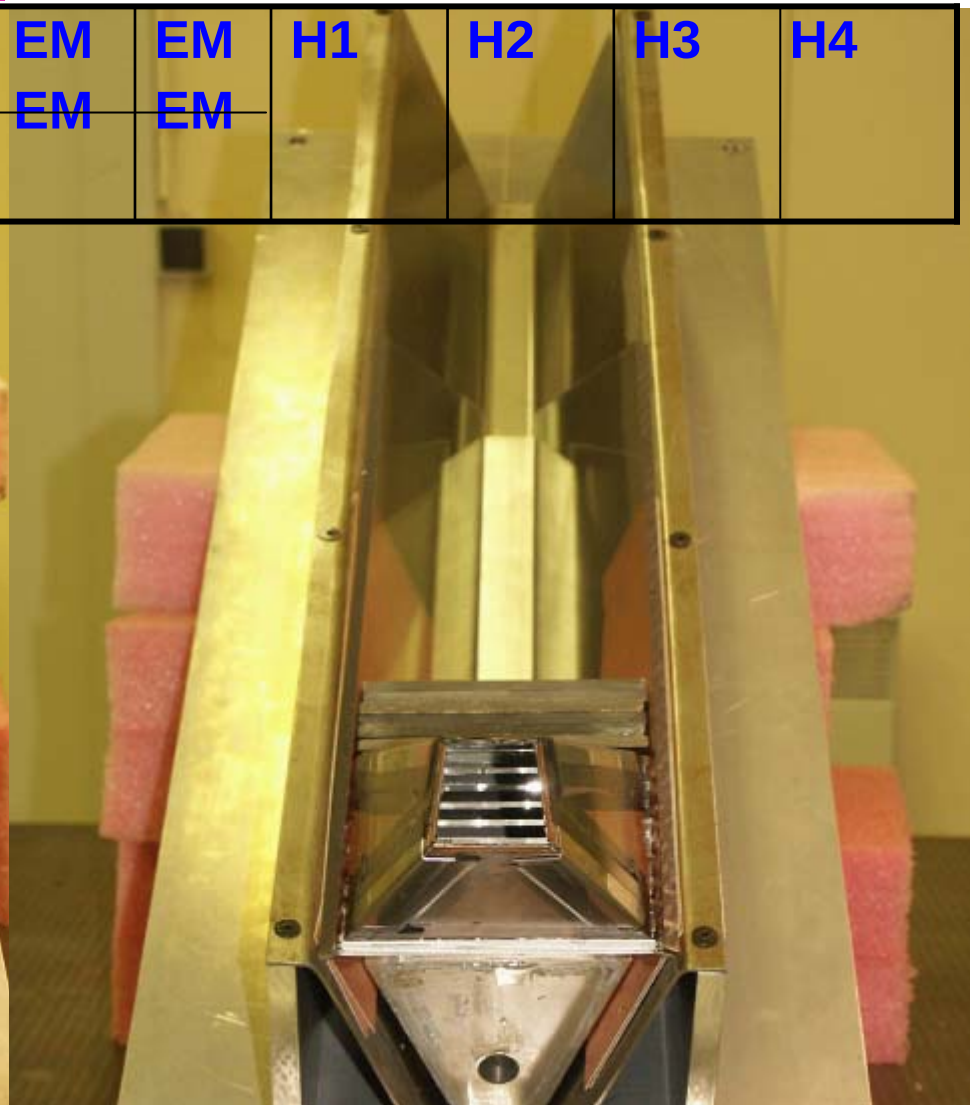
H
CASTOR
A
L

EM = 2EMRU = 27 X_o

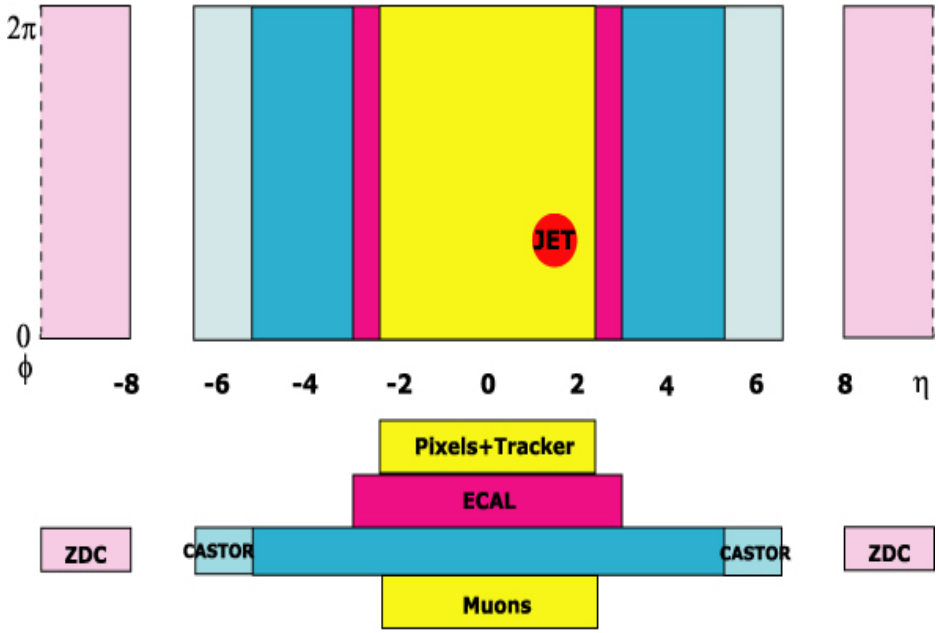
H=2EMRU+4HRU=4.3 λ_I

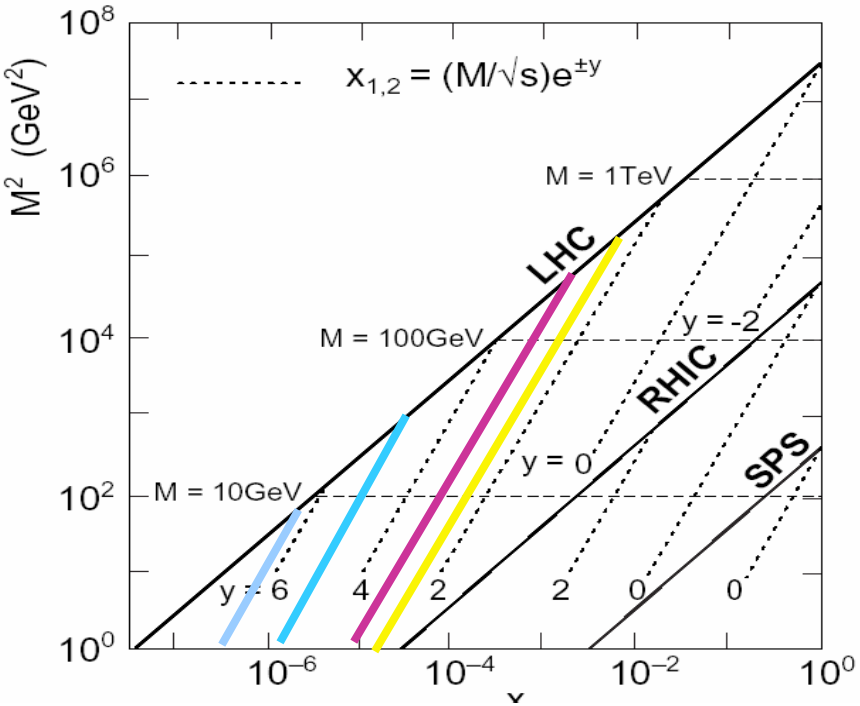
EM	EM	H1	H2	H3	H4
EM	EM				





Detector Coverage





Forward Region:

- Multiplicity and hermetic coverage to $|\eta|<7$
- Zero Degree Energy
- Physics:
  - Centrality
  - Limiting Fragmentation
  - Peripheral and ultra-peripheral collisions
  - Low-x, Color-Glass Condensate
  - DCC, Centauros, Strangelets

Conclusions

- **Forward detectors are being designed for CMS**
  - **CASTOR**
  - **ZDC**
- **Inclusion of TOTEM detectors in the heavy ion runs will significantly enhance forward capabilities**

WHEN CMS STARTS TAKING DATA WITH HEAVY IONS
THIS IS THE FIRST RESULT THAT WE WILL OBTAIN