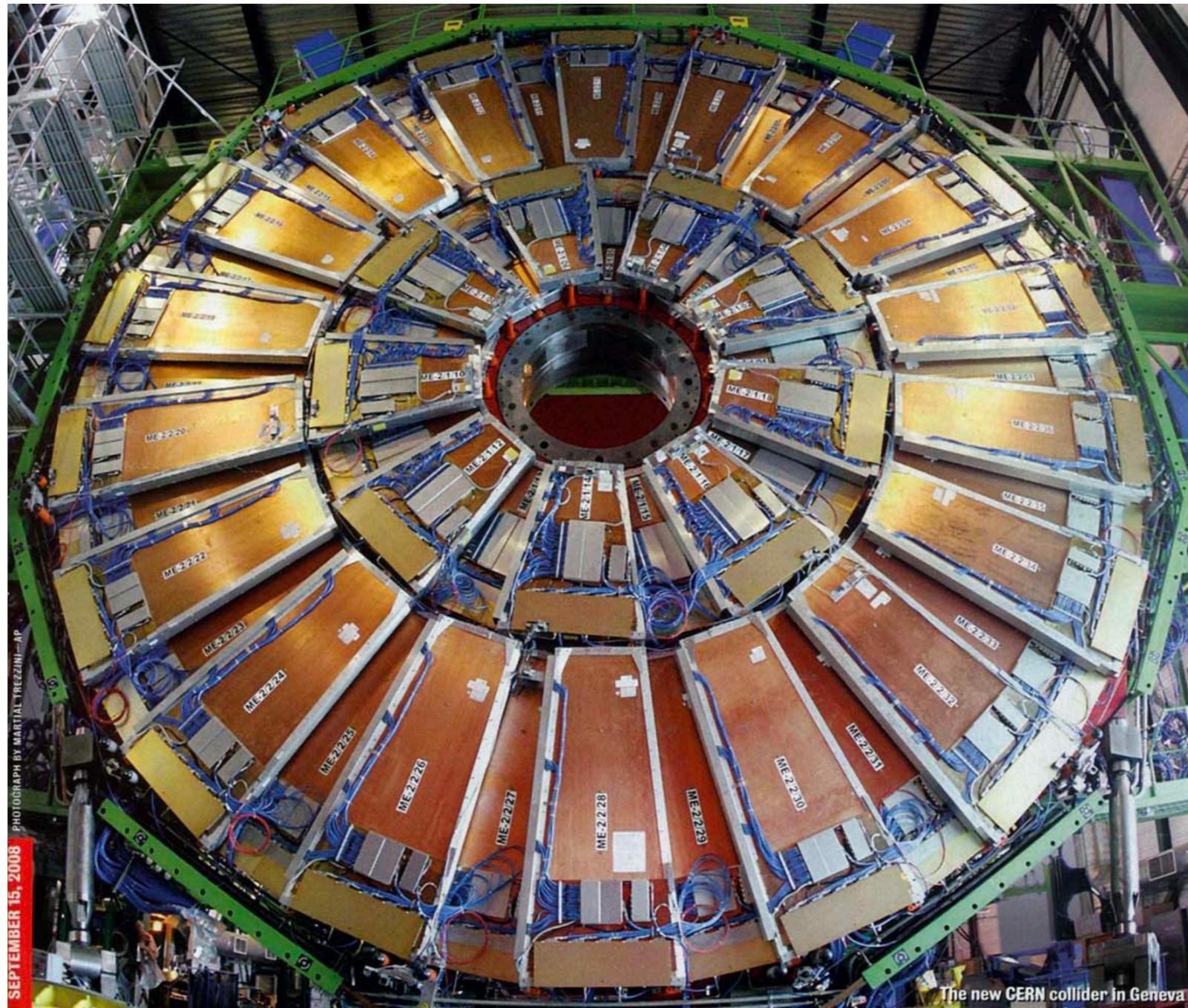
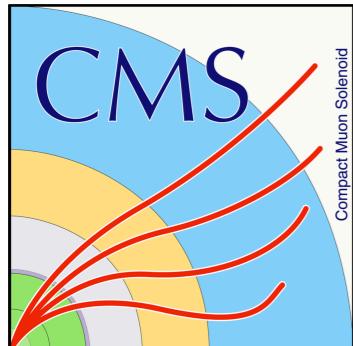


The CMS Detector

(Compact Muon Solenoid)



Jake Rosenzweig

2021-07-01

Outline of the beauty herself: CMS

- Pixel Detector
- Strip Detector
- ECAL
 - ▶ Electromagnetic Calorimeter
- HCAL
 - ▶ Hadronic Calorimeter
- Solenoid
- Muon System
 - ▶ Drift Tubes (DT) in the barrel
 - ▶ Cathode Strip Chambers (CSC) in the endcaps
 - ▶ Resistive Plate Chambers (RPC)



CMS Anatomy: Tracker System

CMS DETECTOR

Total weight : 14,000 tonnes
Overall diameter : 15.0 m
Overall length : 28.7 m
Magnetic field : 3.8 T

STEEL RETURN YOKE

12,500 tonnes

SILICON TRACKERS

Pixel ($100 \times 150 \mu\text{m}^2$) $\sim 1.9 \text{ m}^2 \sim 124\text{M}$ channels
Microstrips ($80-180 \mu\text{m}$) $\sim 200 \text{ m}^2 \sim 9.6\text{M}$ channels

SUPERCONDUCTING SOLENOID

Niobium titanium coil carrying $\sim 18,000 \text{ A}$

MUON CHAMBERS

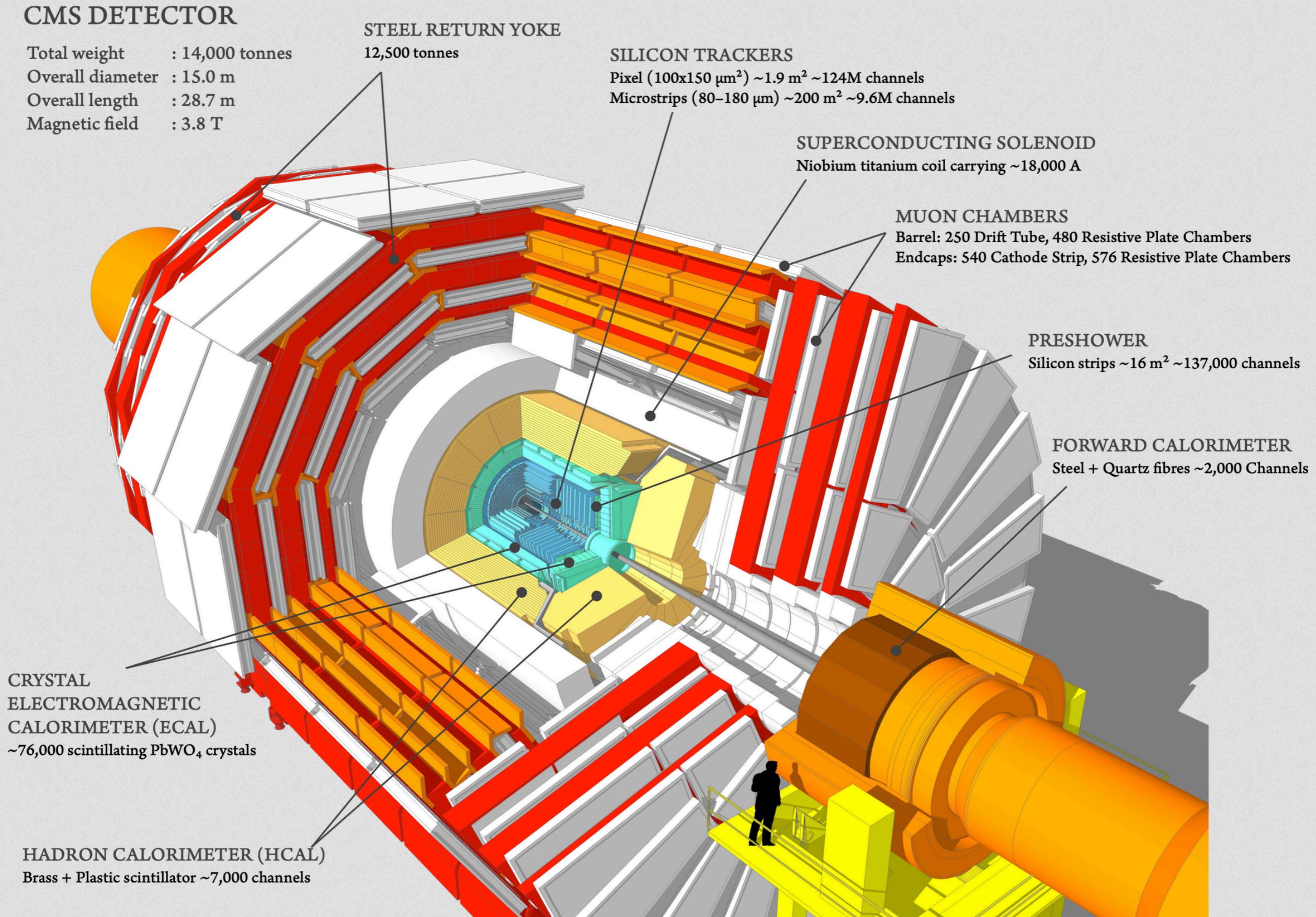
Barrel: 250 Drift Tube, 480 Resistive Plate Chambers
Endcaps: 540 Cathode Strip, 576 Resistive Plate Chambers

PRESHOWER

Silicon strips $\sim 16 \text{ m}^2 \sim 137,000$ channels

FORWARD CALORIMETER

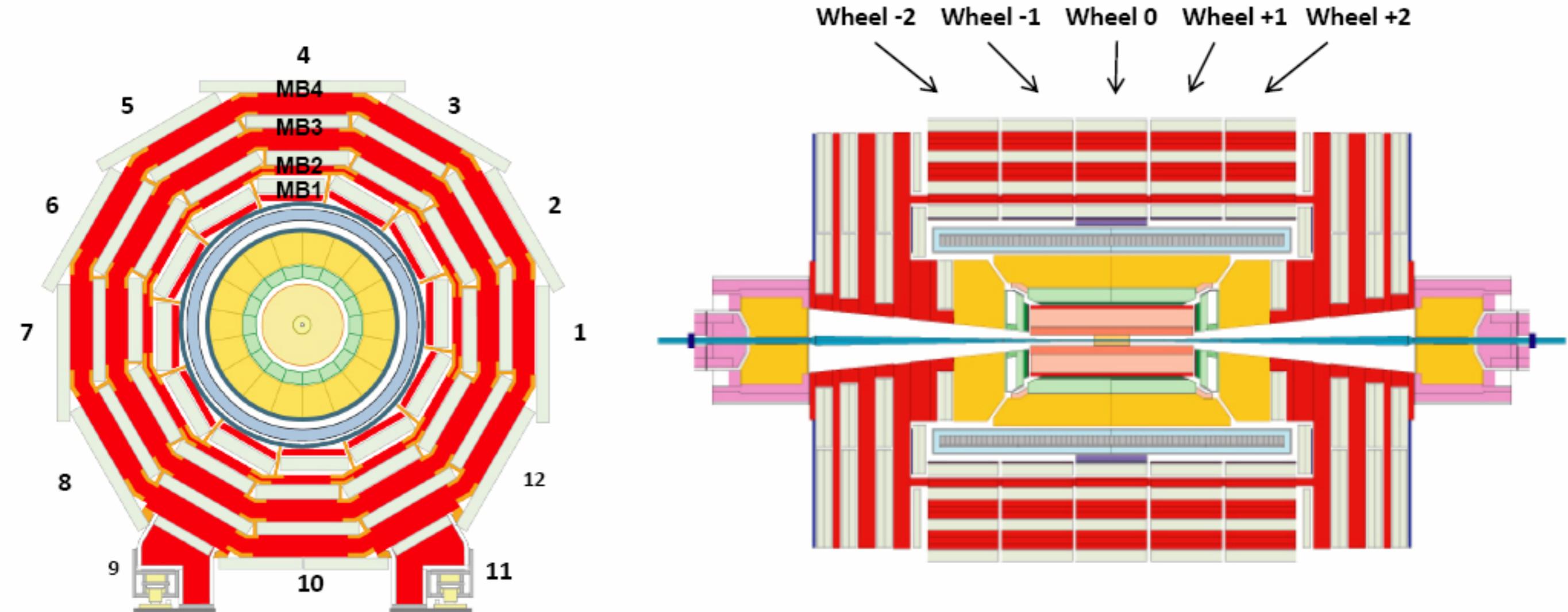
Steel + Quartz fibres $\sim 2,000$ Channels



CRYSTAL
ELECTROMAGNETIC
CALORIMETER (ECAL)
 $\sim 76,000$ scintillating PbWO₄ crystals

HADRON CALORIMETER (HCAL)
Brass + Plastic scintillator $\sim 7,000$ channels

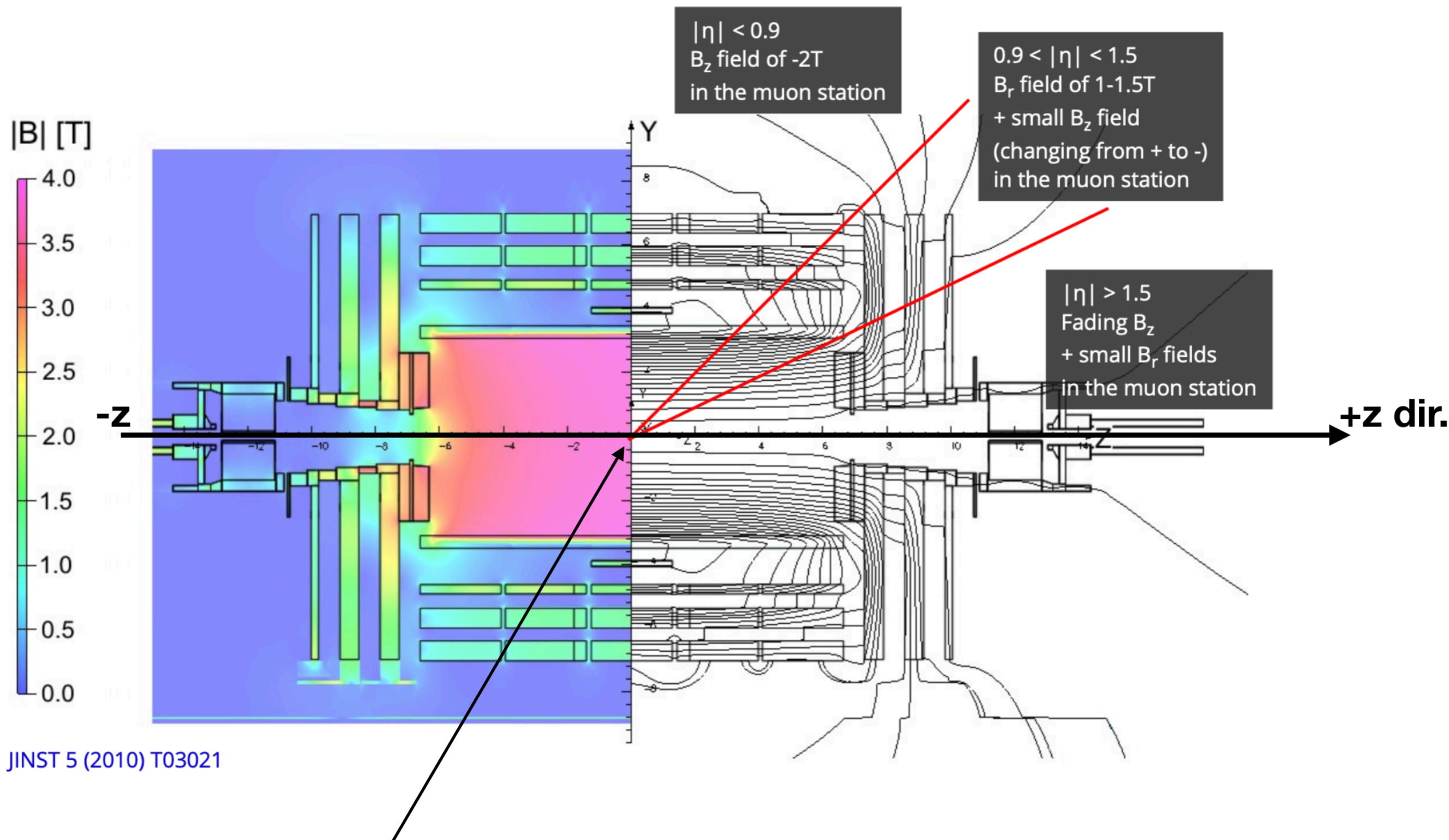
Different Perspectives of CMS:



*Let's see what CMS looks like
when you separate the wheels...*

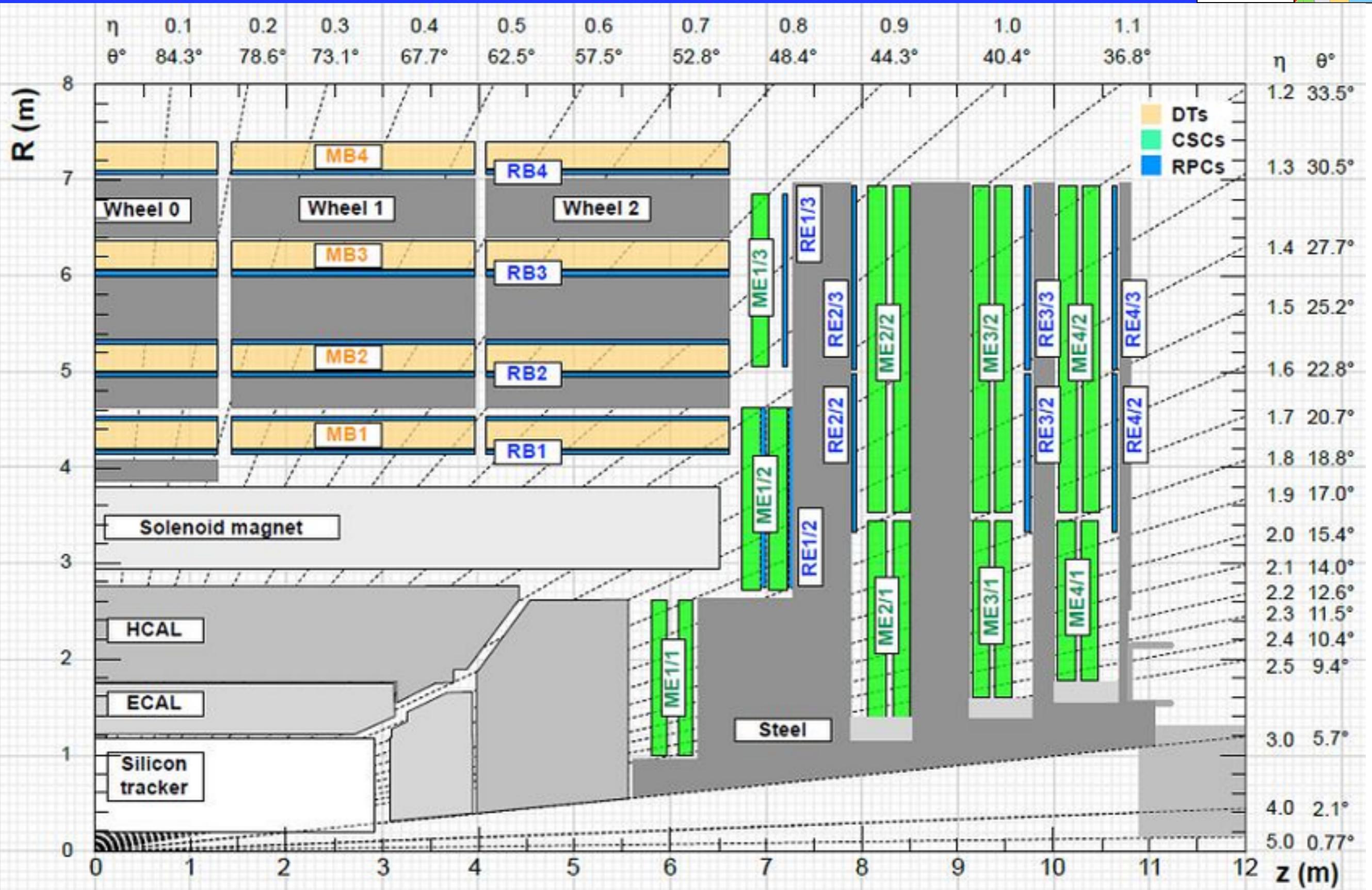
Jake's First Visit (Jan 2019):

Compact Muon Solenoid:

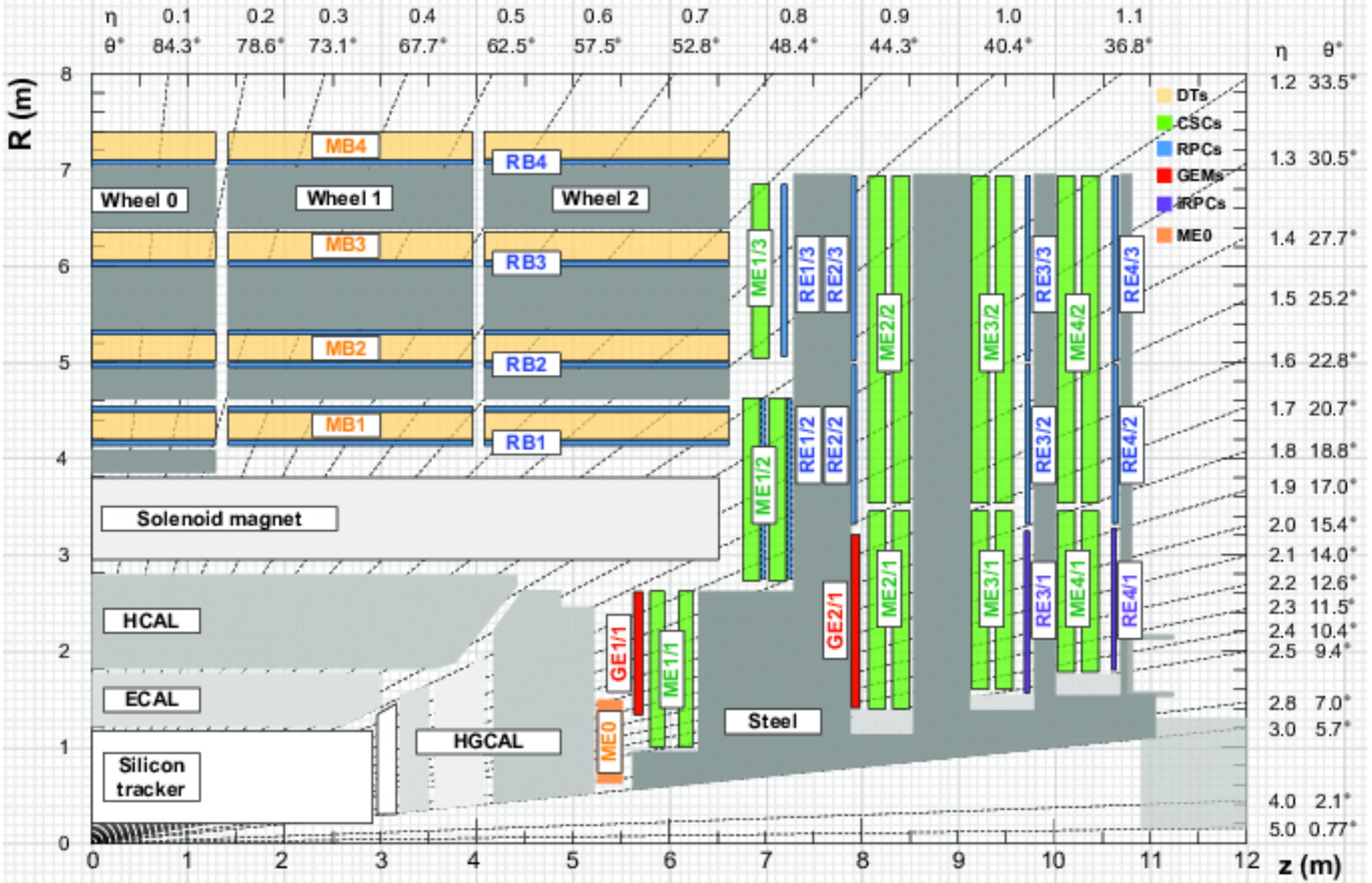


Enormous ***uniform*** magnetic field
near the pp collision point (0,0)

Pseudorapidity (η) is the new θ :



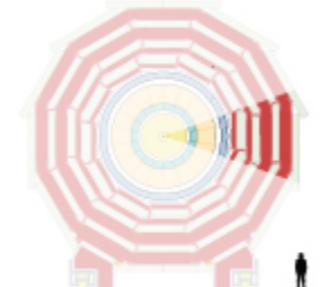
Run 3 Upgrade: Can you spot the differences?



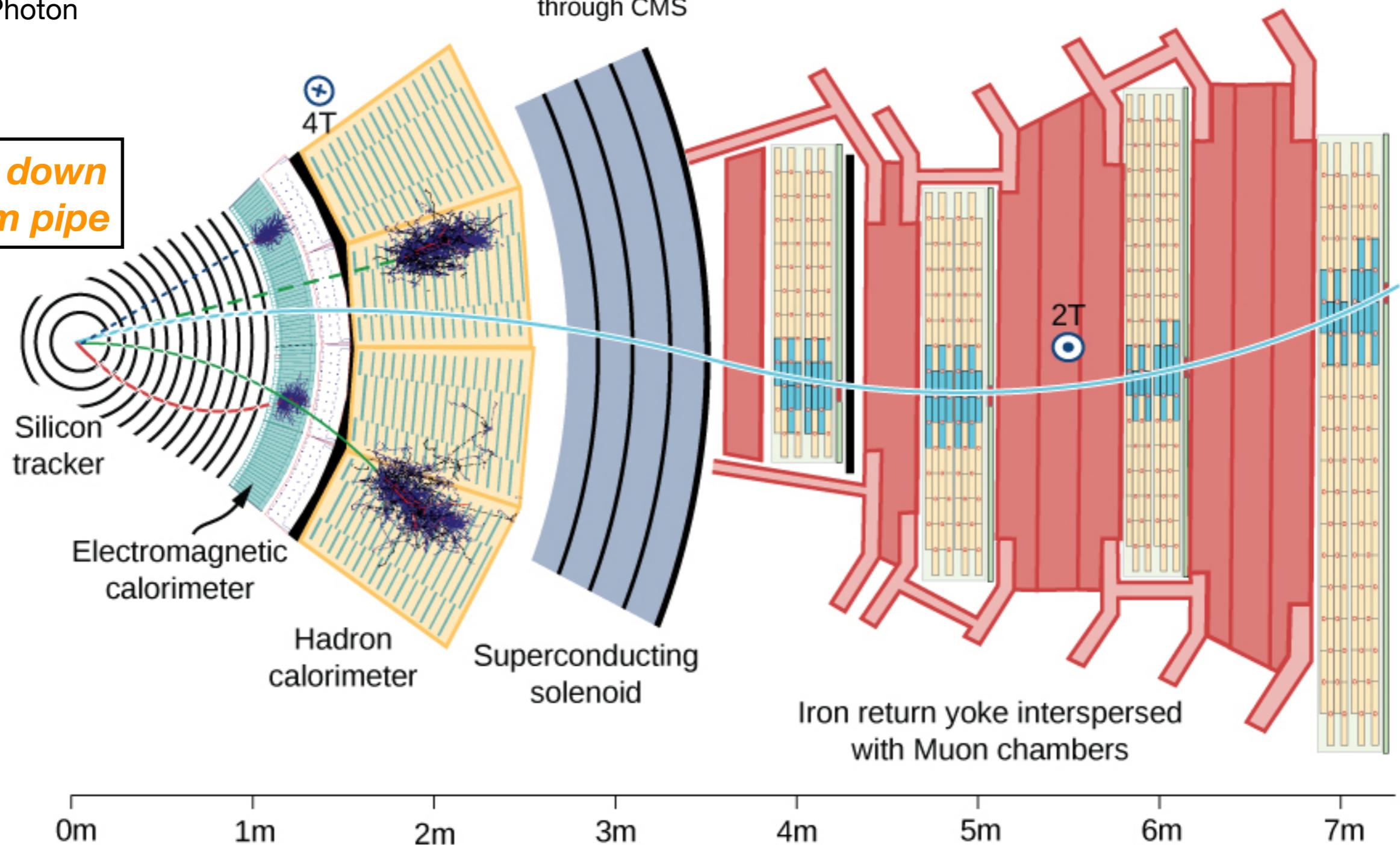
CMS is a Particle Filter:

Key:

- Muon
- Positron
- Charged Hadron (e.g. Pion)
- Neutral Hadron (e.g. Neutron)
- Photon



Transverse slice
through CMS



Questions!