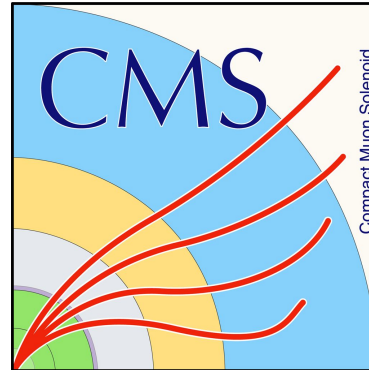
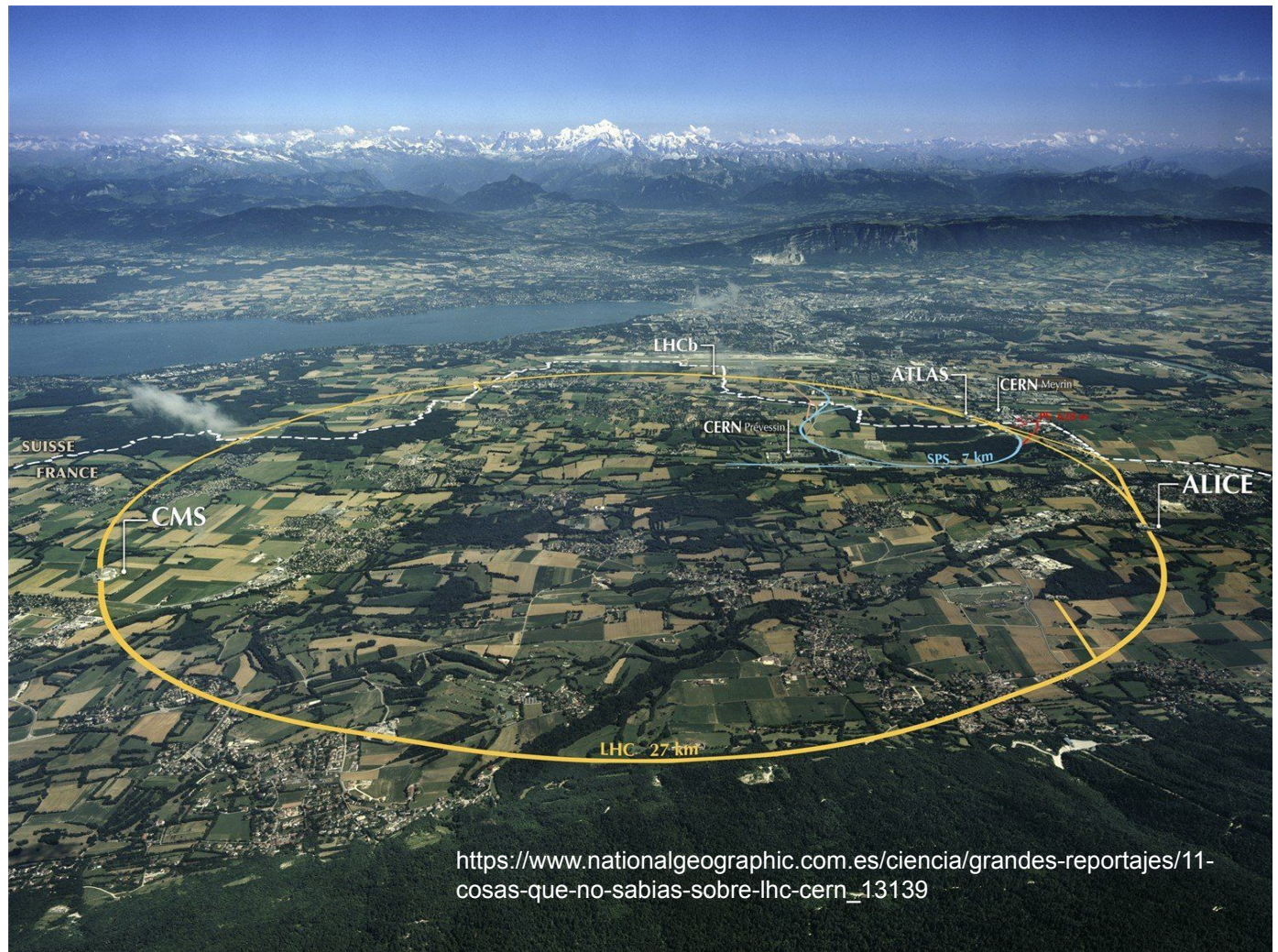


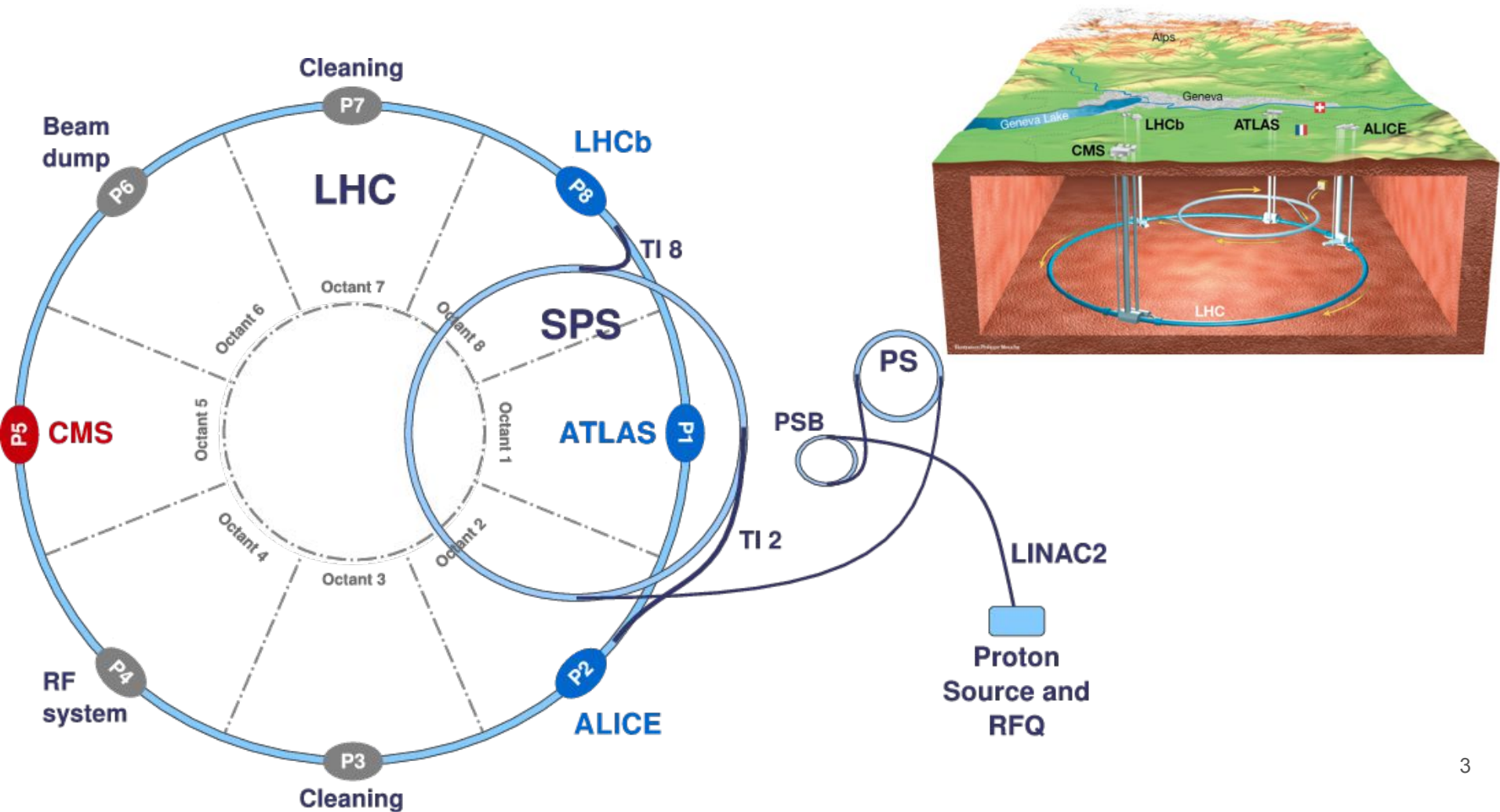
Exotics searches status at the CMS Experiment

José David Ruiz-Alvarez
on behalf of the CMS Collaboration

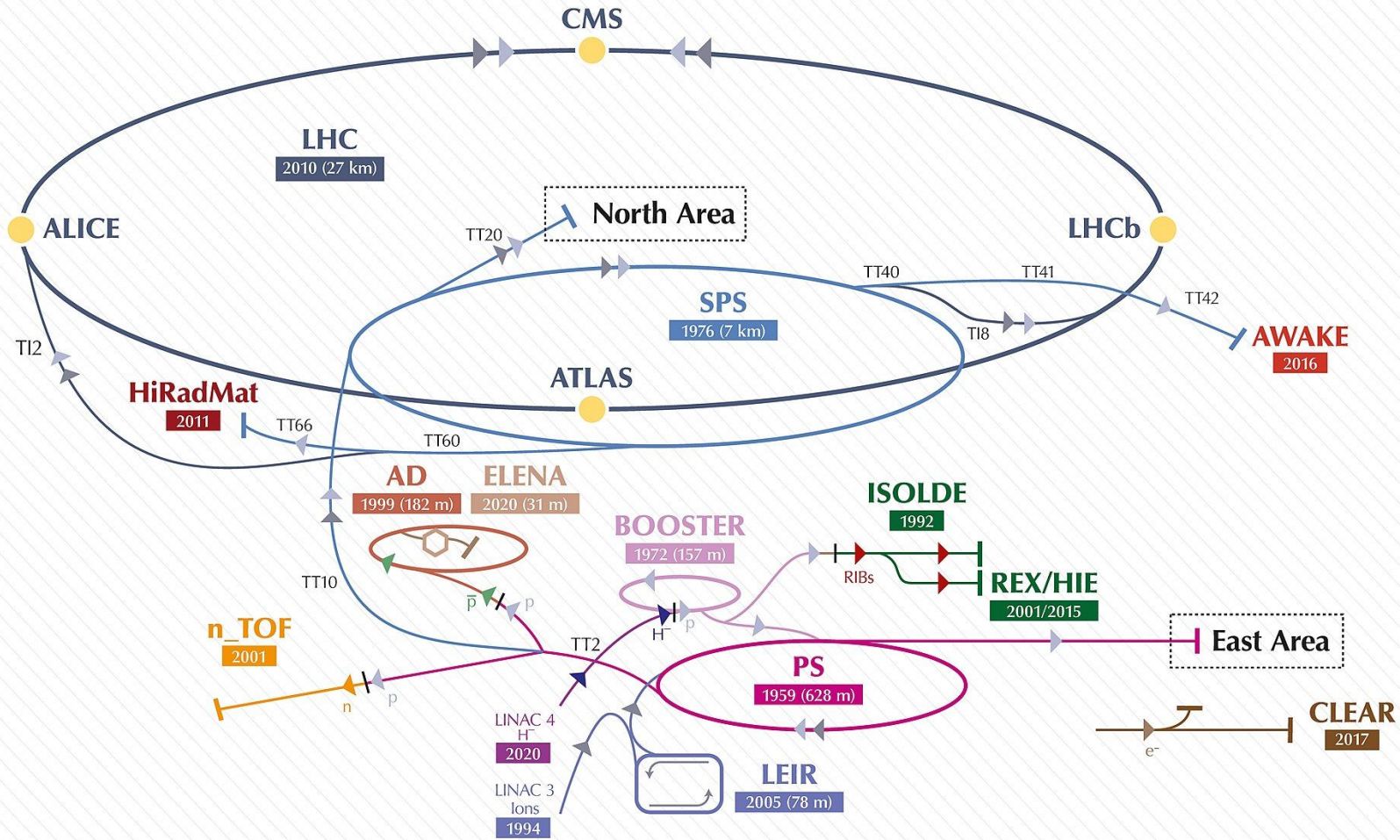


The LHC

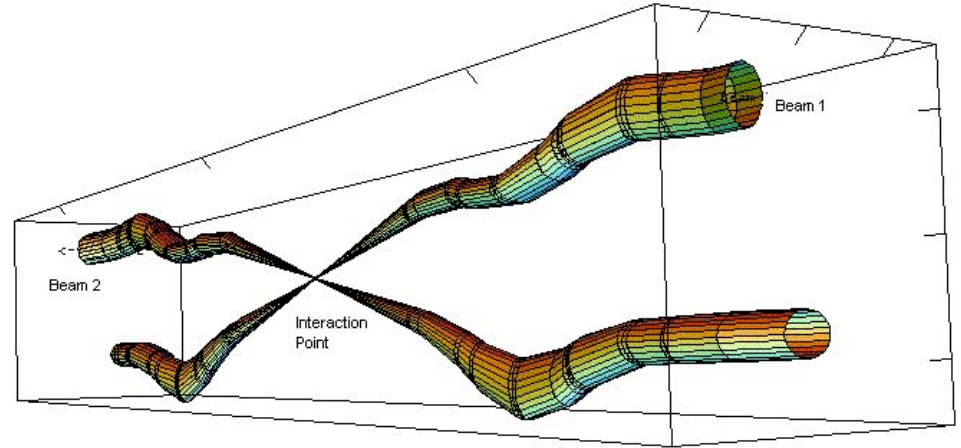
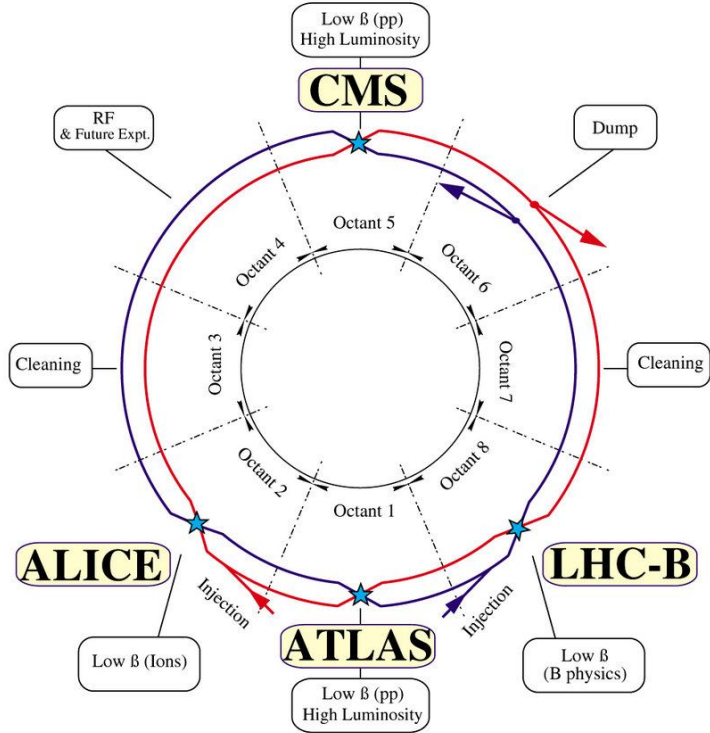




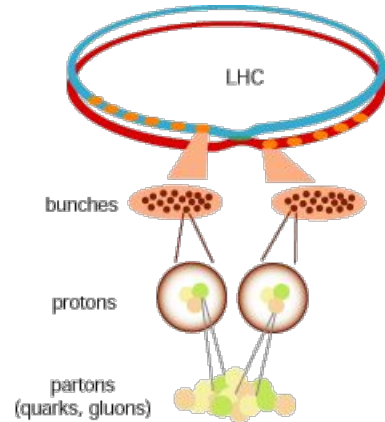




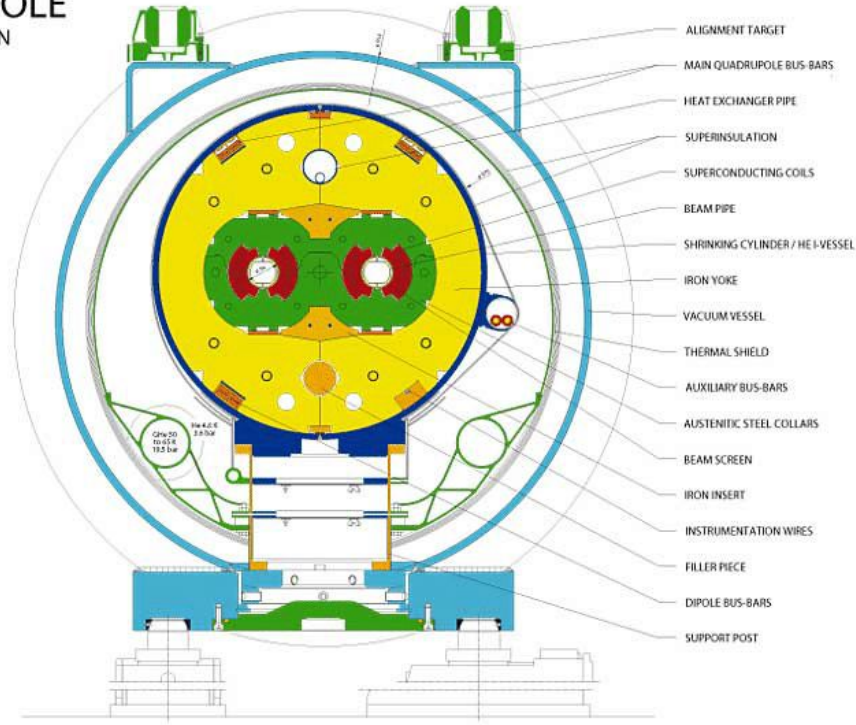
LHC LAYOUT



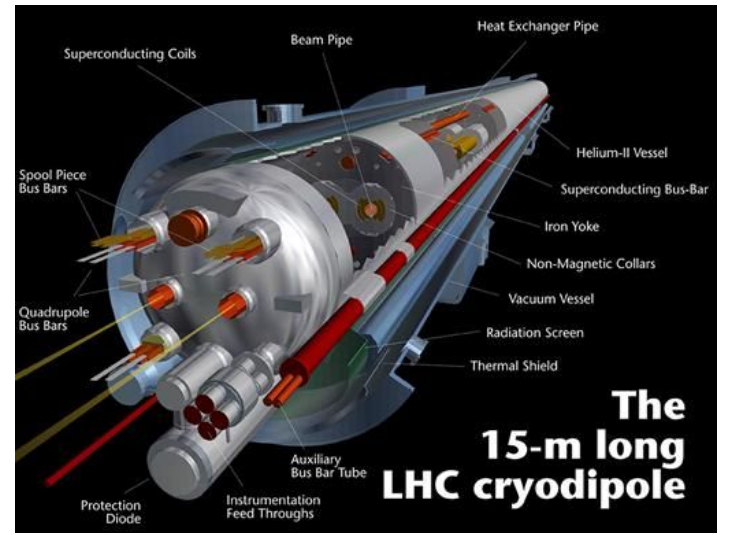
Relative beam sizes around IP1 (Atlas) in collision



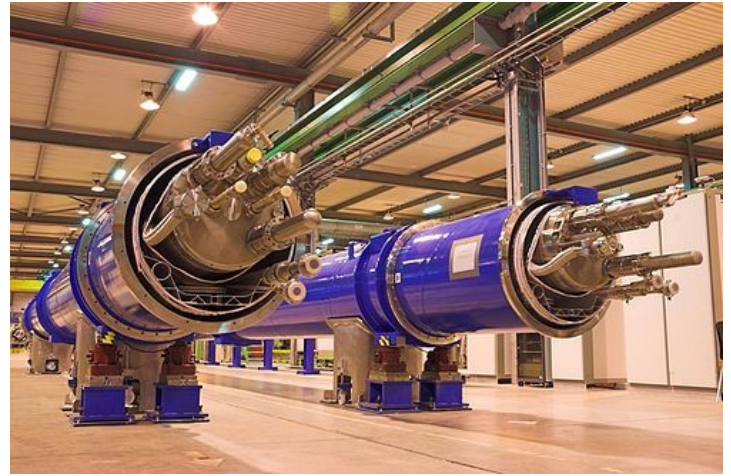
LHC DIPOLE CROSS SECTION



CERN AC/DI/MM — 2001/06

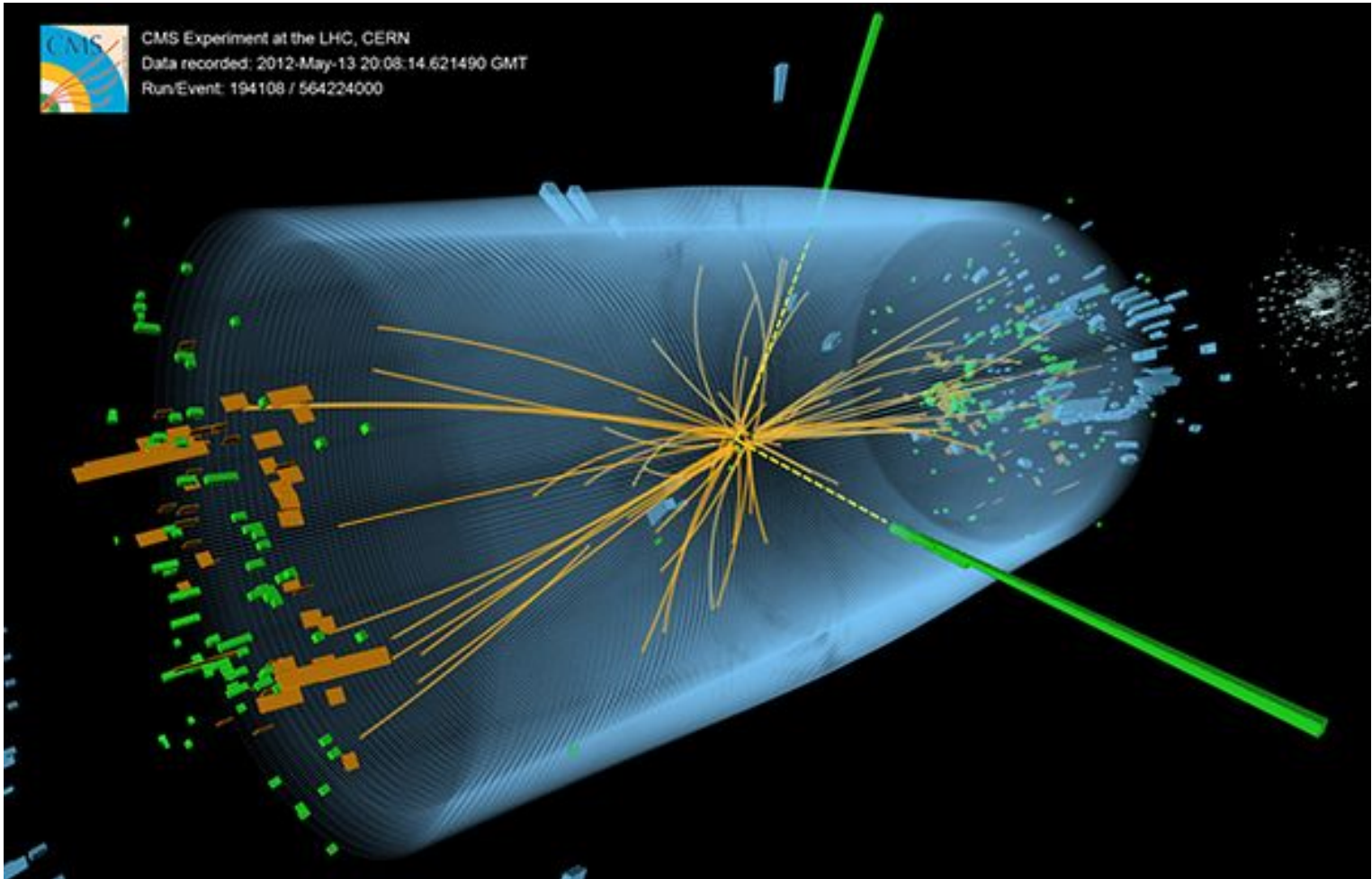


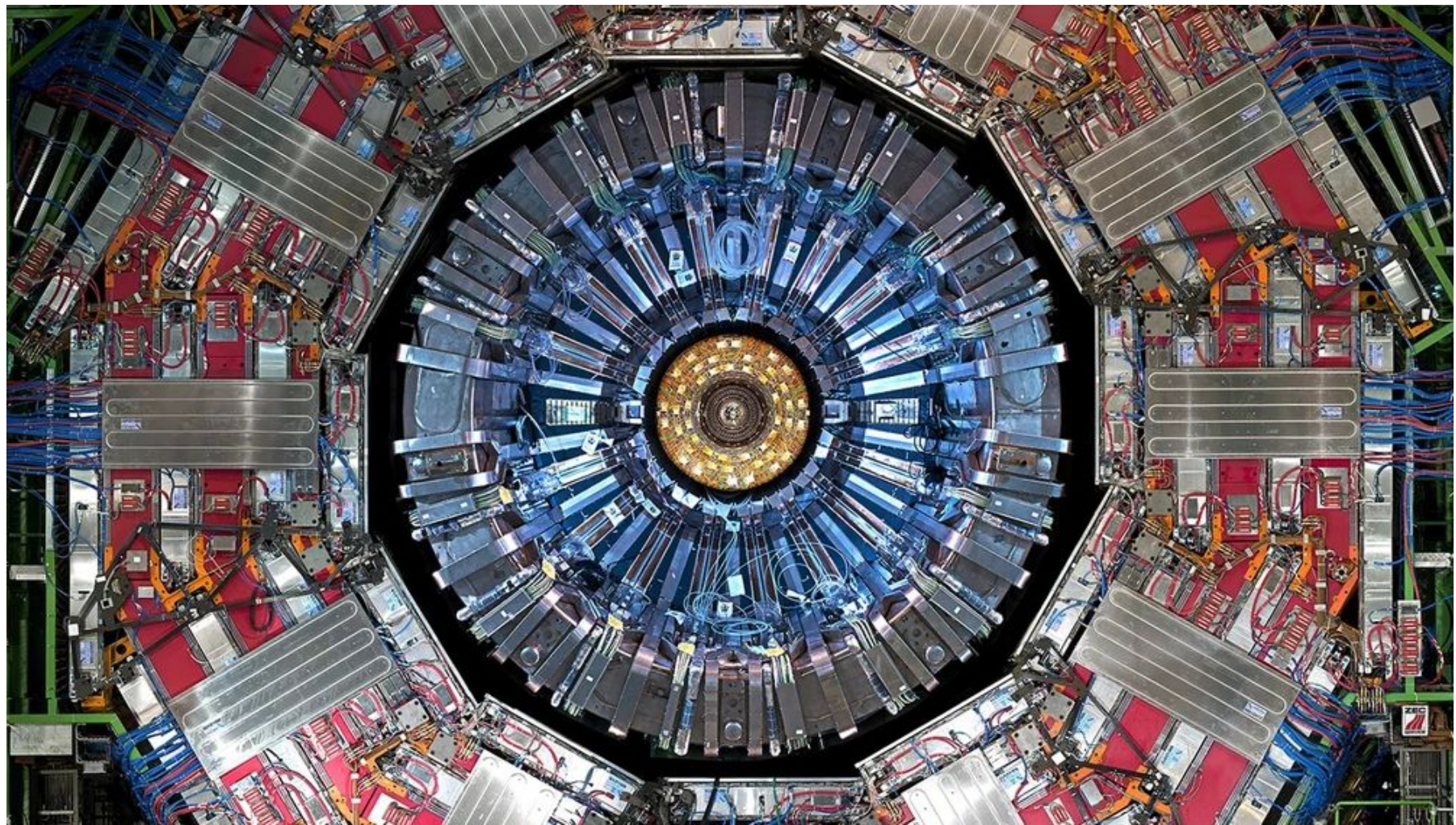
Dipolos





CMS Experiment at the LHC, CERN
Data recorded: 2012-May-13 20:08:14.621490 GMT
Run/Event: 194108 / 564224000





CMS Experiment

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 ($100 \times 150 \mu\text{m}$) $\sim 1\text{m}^2 \sim 66\text{M}$ channels
Microstrips ($80 \times 180 \mu\text{m}$) $\sim 200\text{m}^2 \sim 9.6\text{M}$ 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

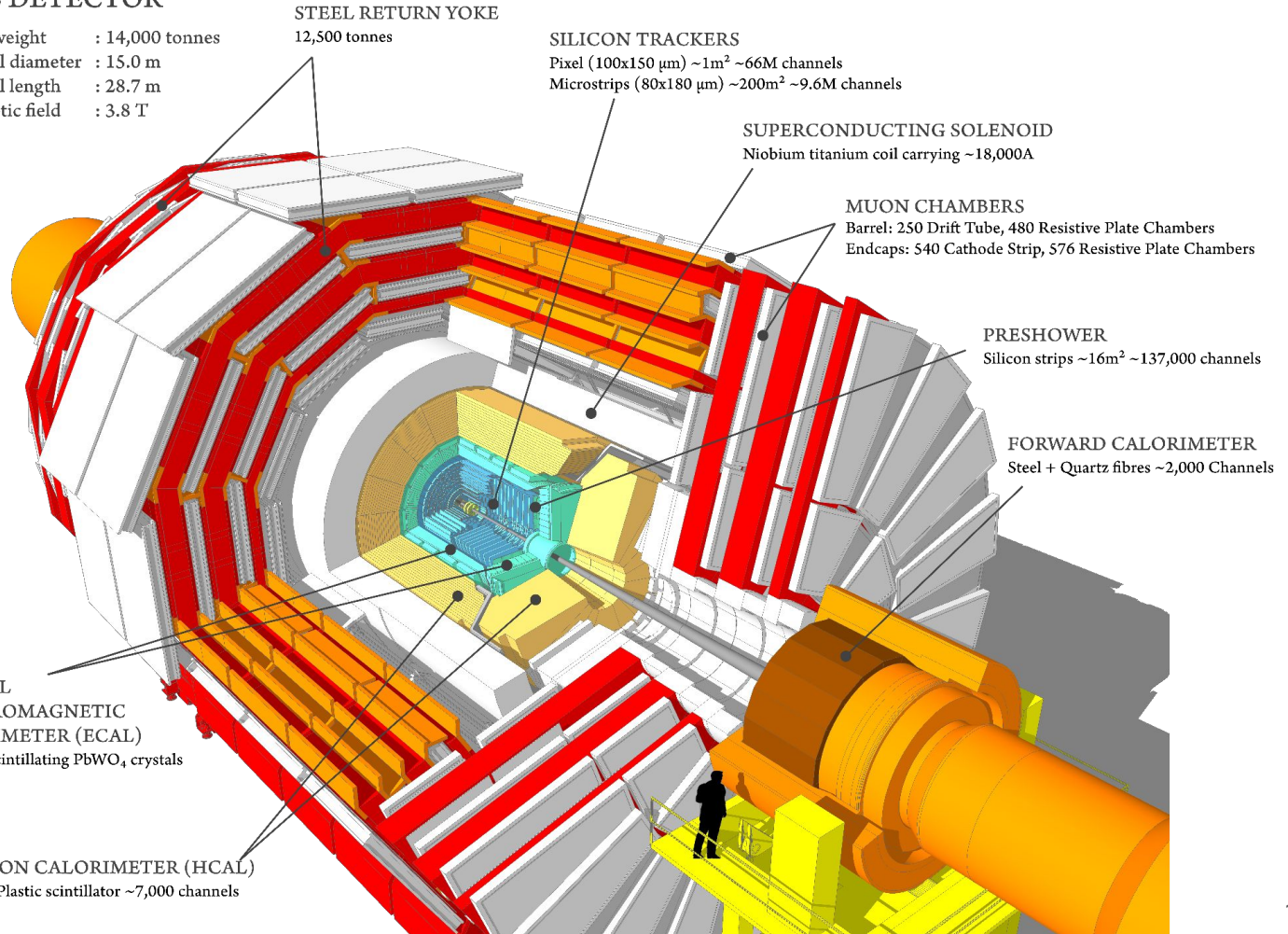
Steel + Quartz fibres $\sim 2,000$ Channels

CRYSTAL
ELECTROMAGNETIC
CALORIMETER (ECAL)

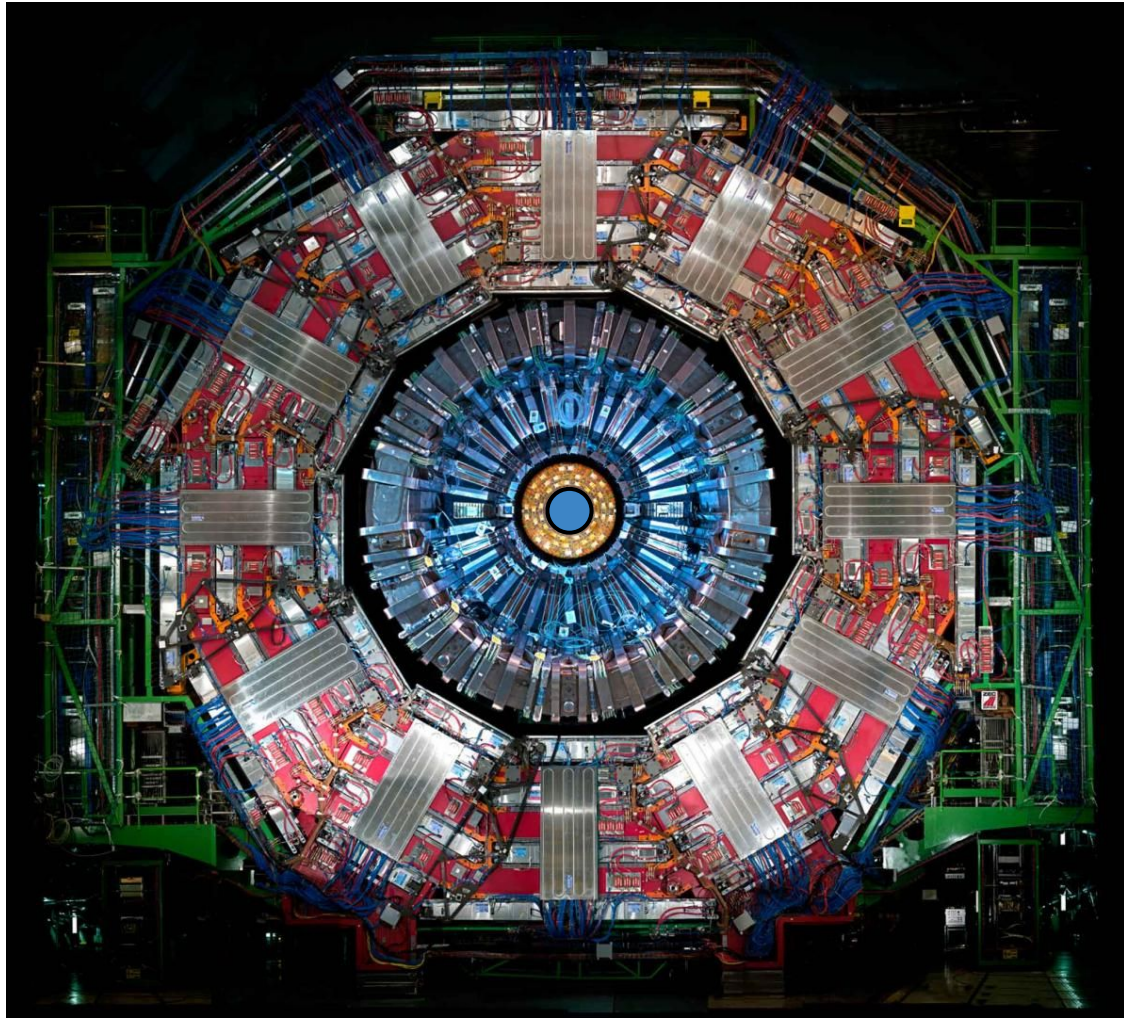
$\sim 76,000$ scintillating PbWO_4 crystals

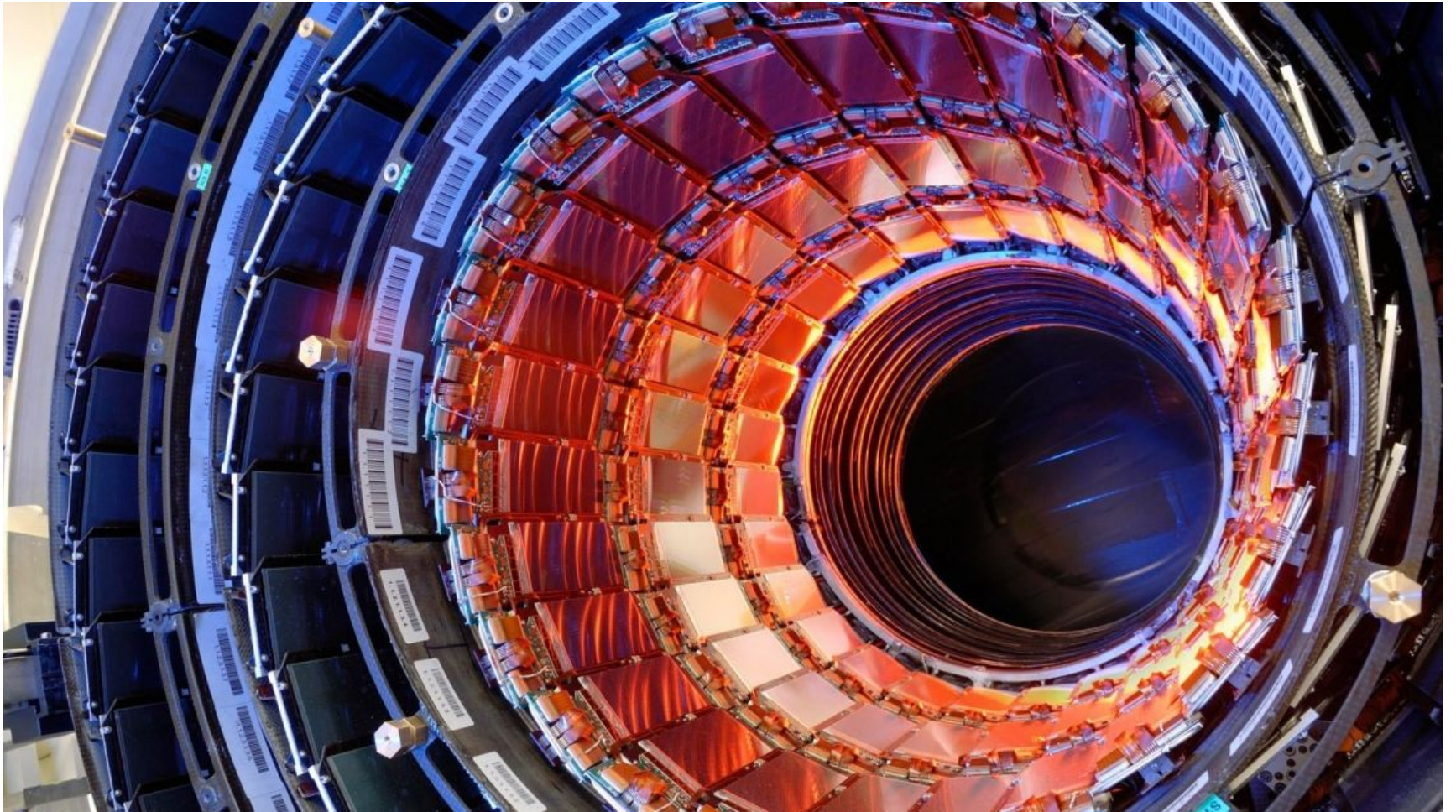
HADRON CALORIMETER (HCAL)

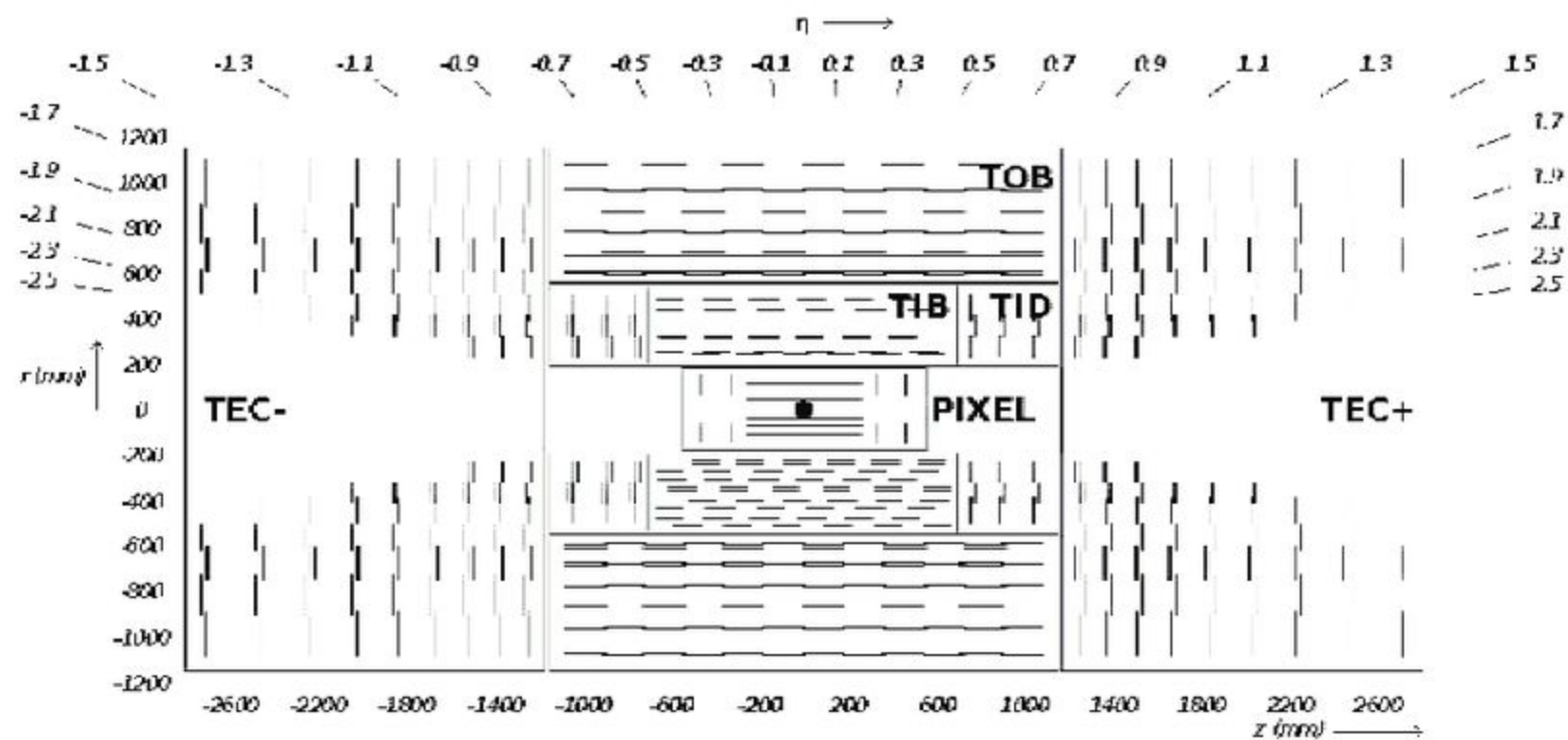
Brass + Plastic scintillator $\sim 7,000$ channels



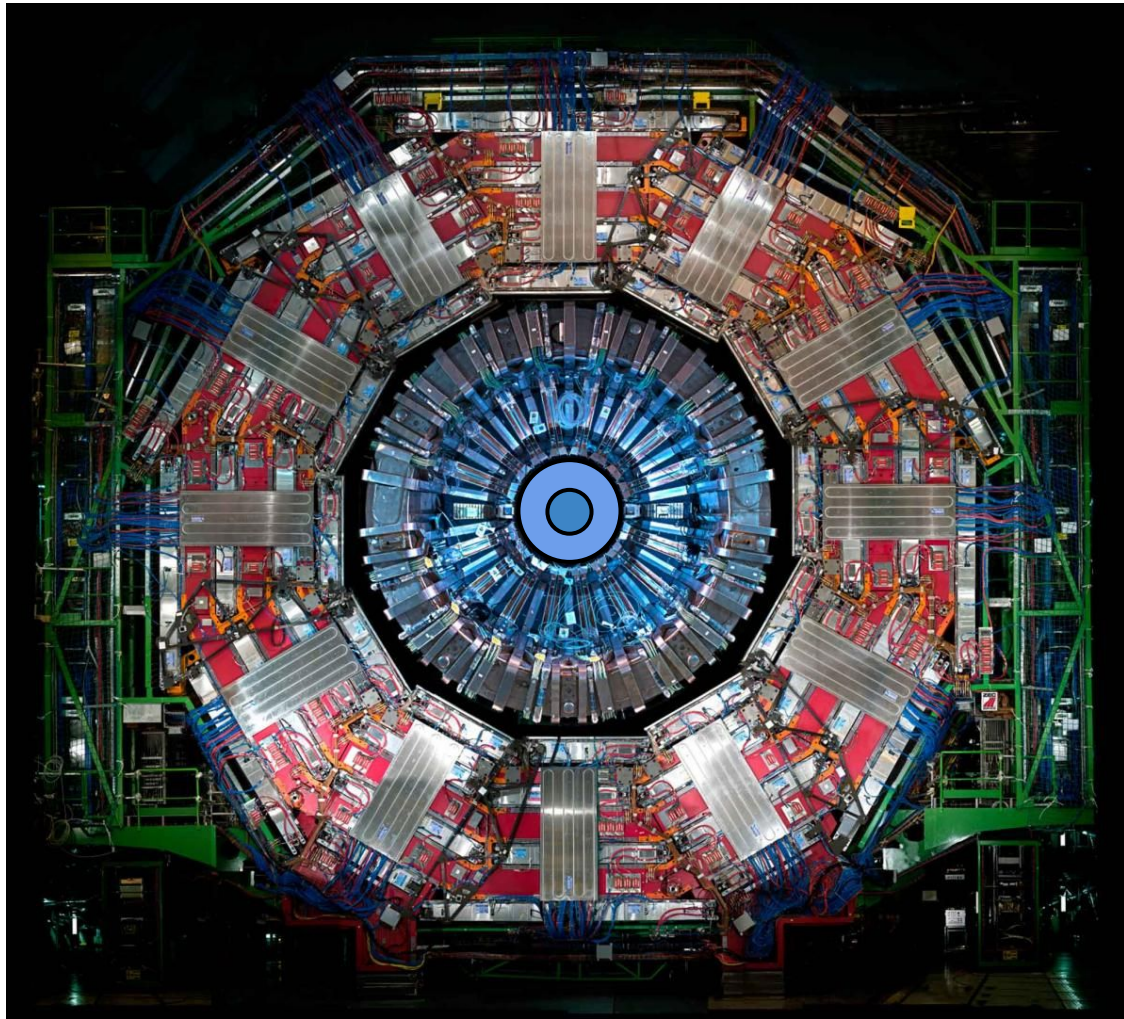
Tracker

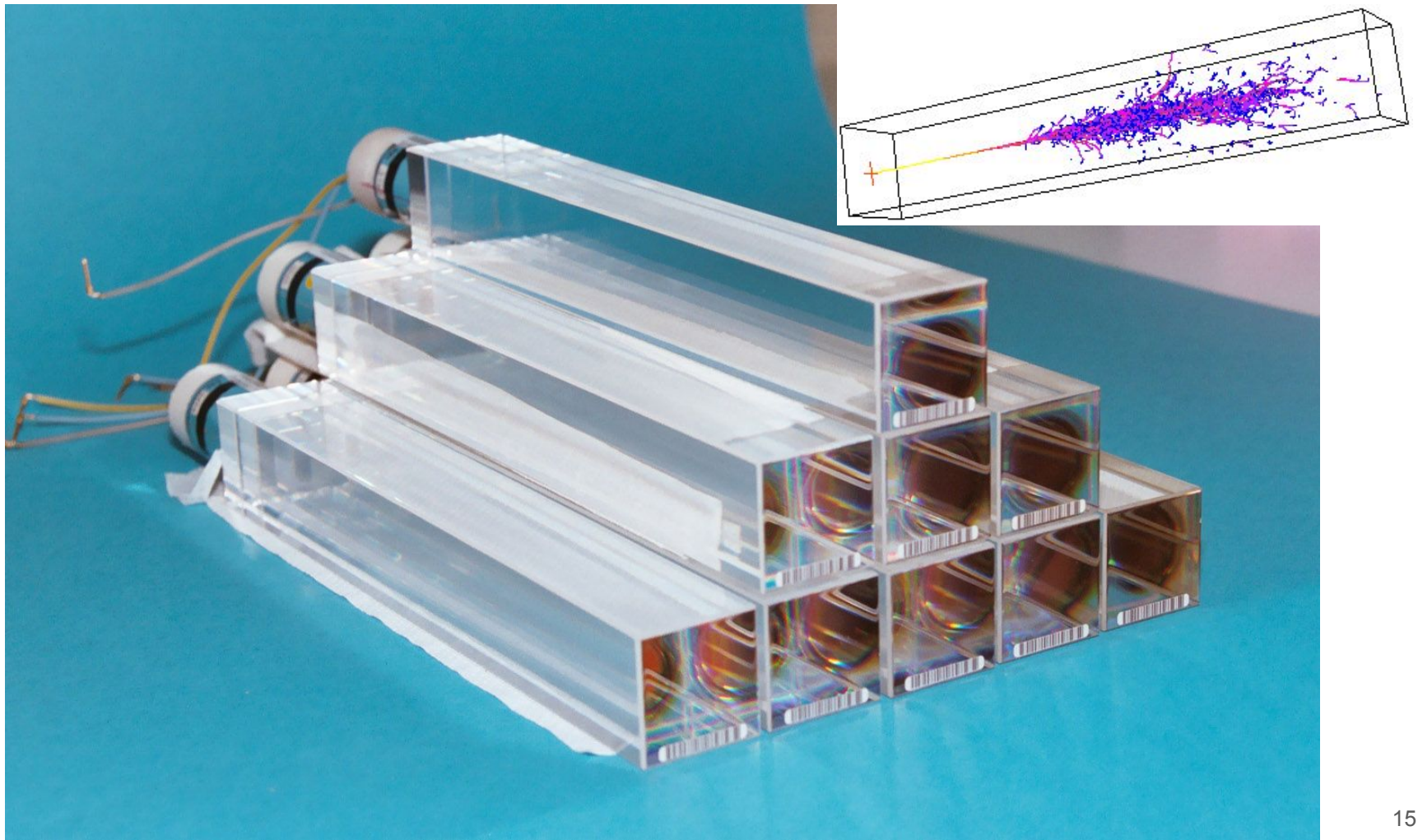




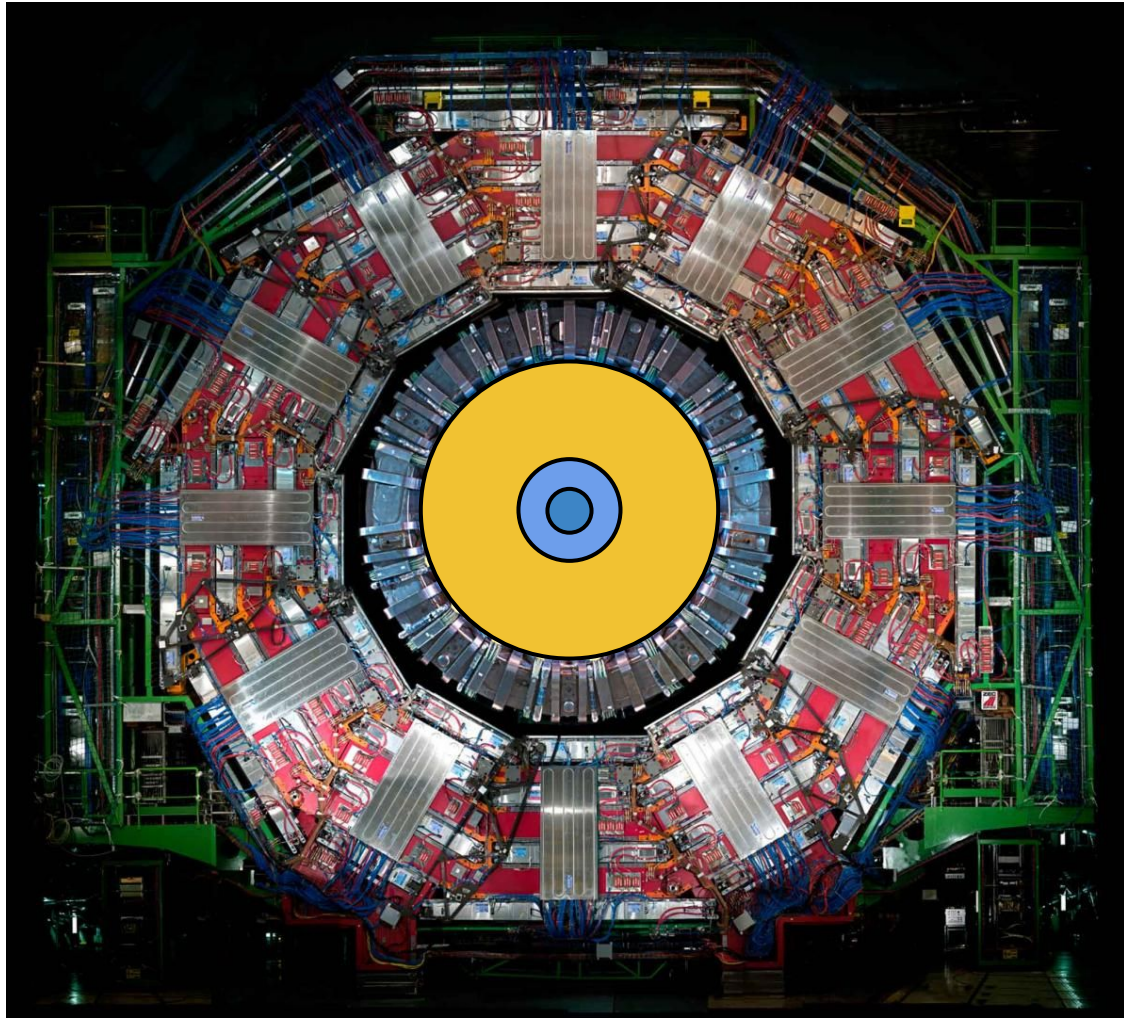


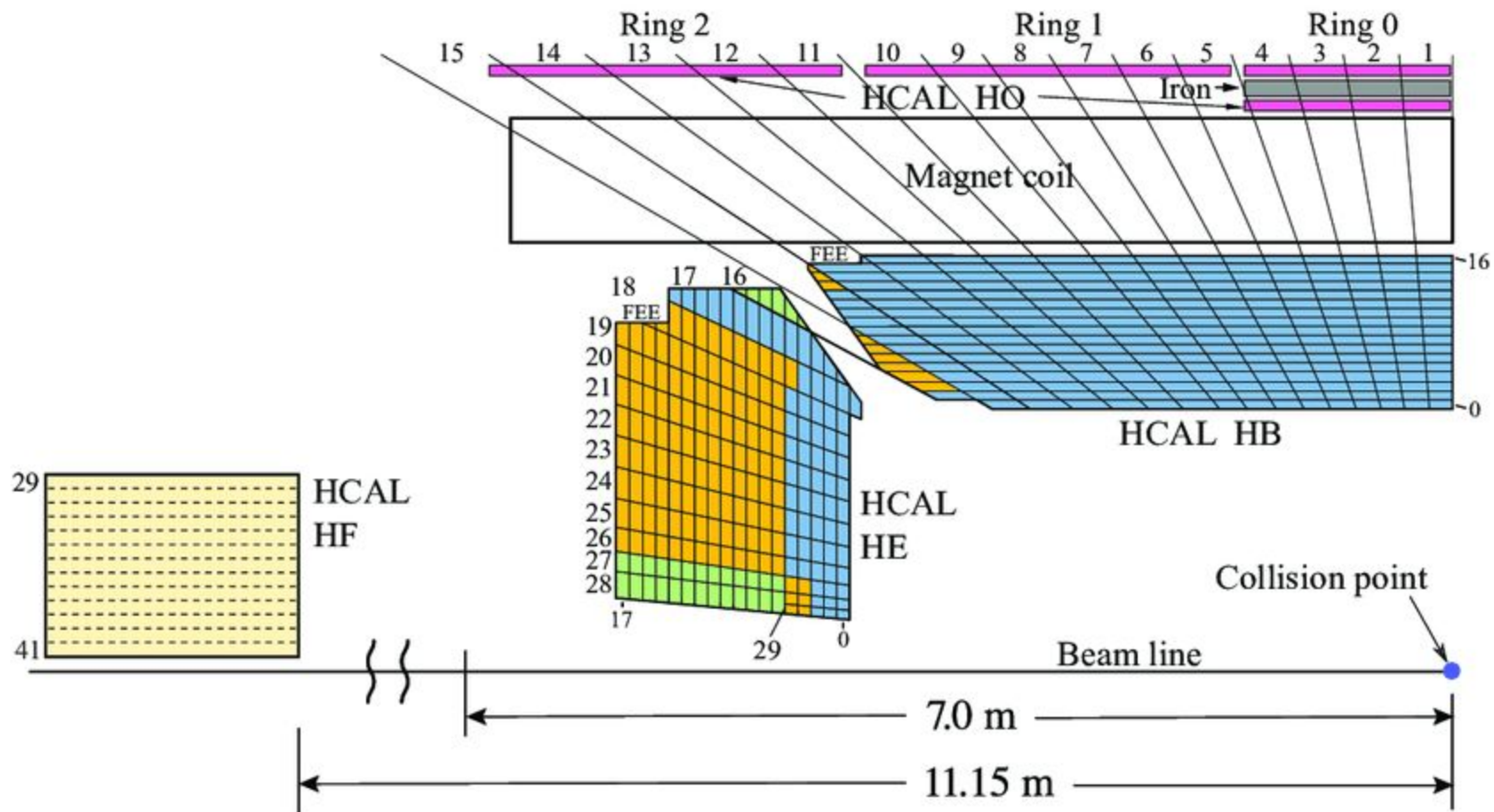
ECAL



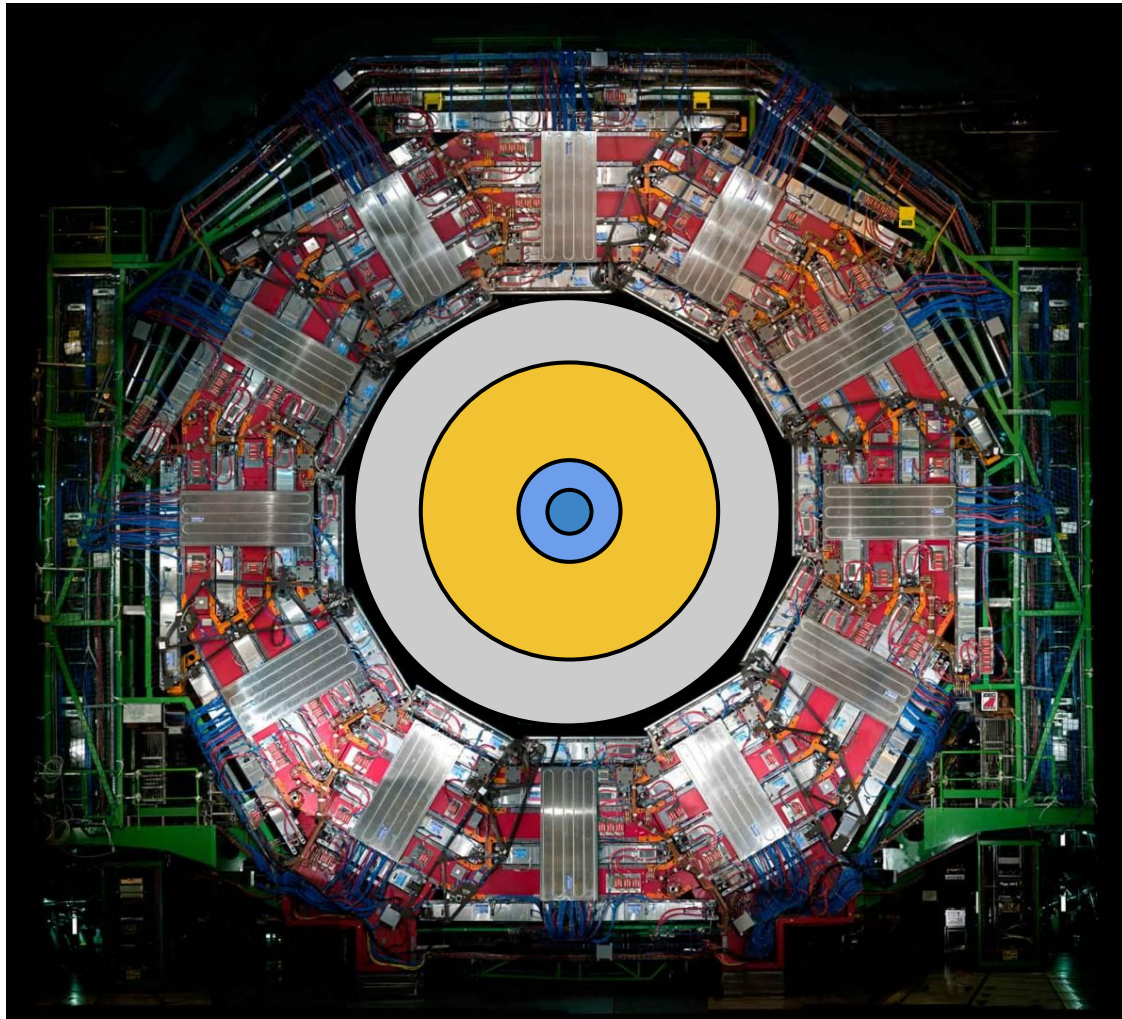


HCAL

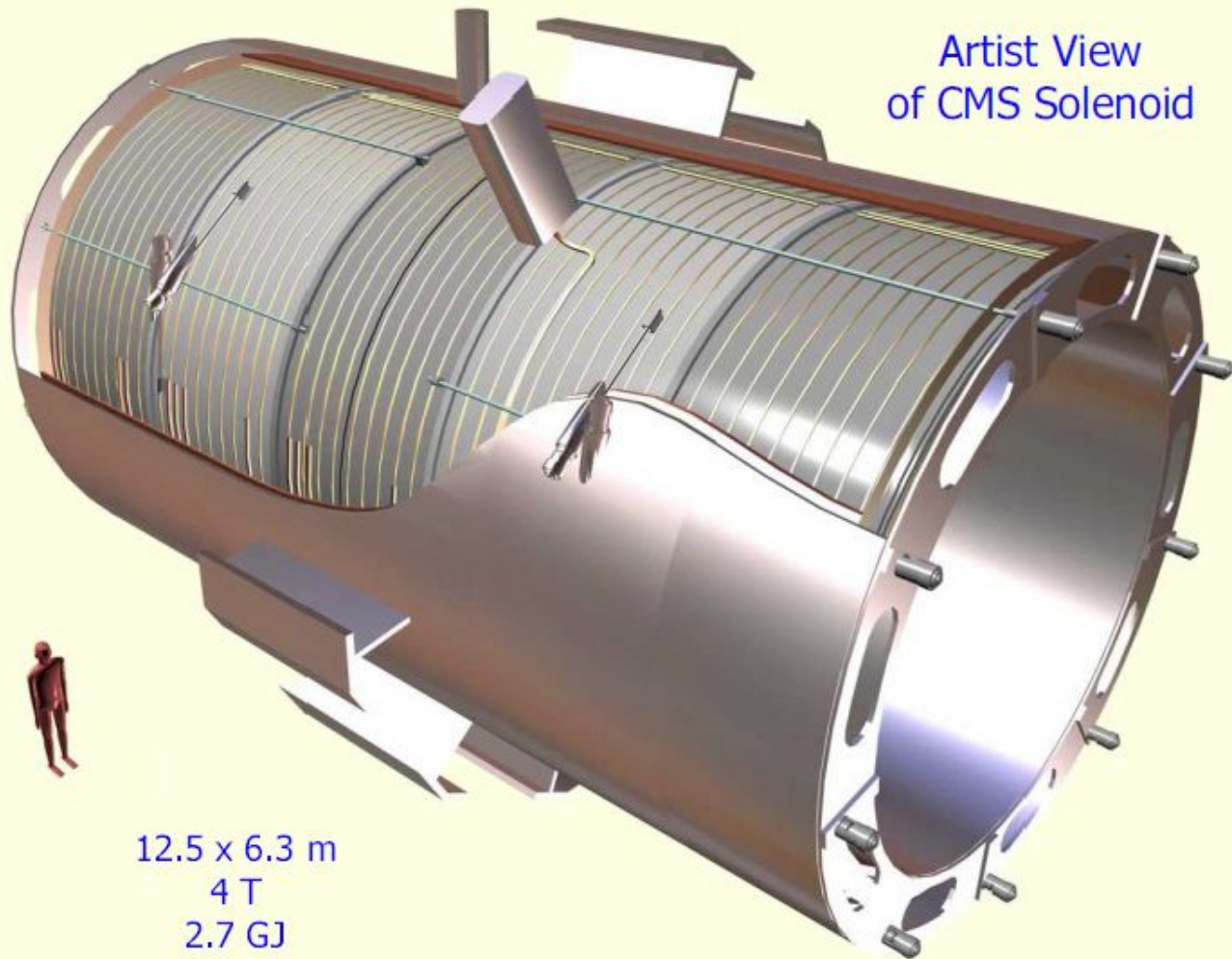




Solenoid

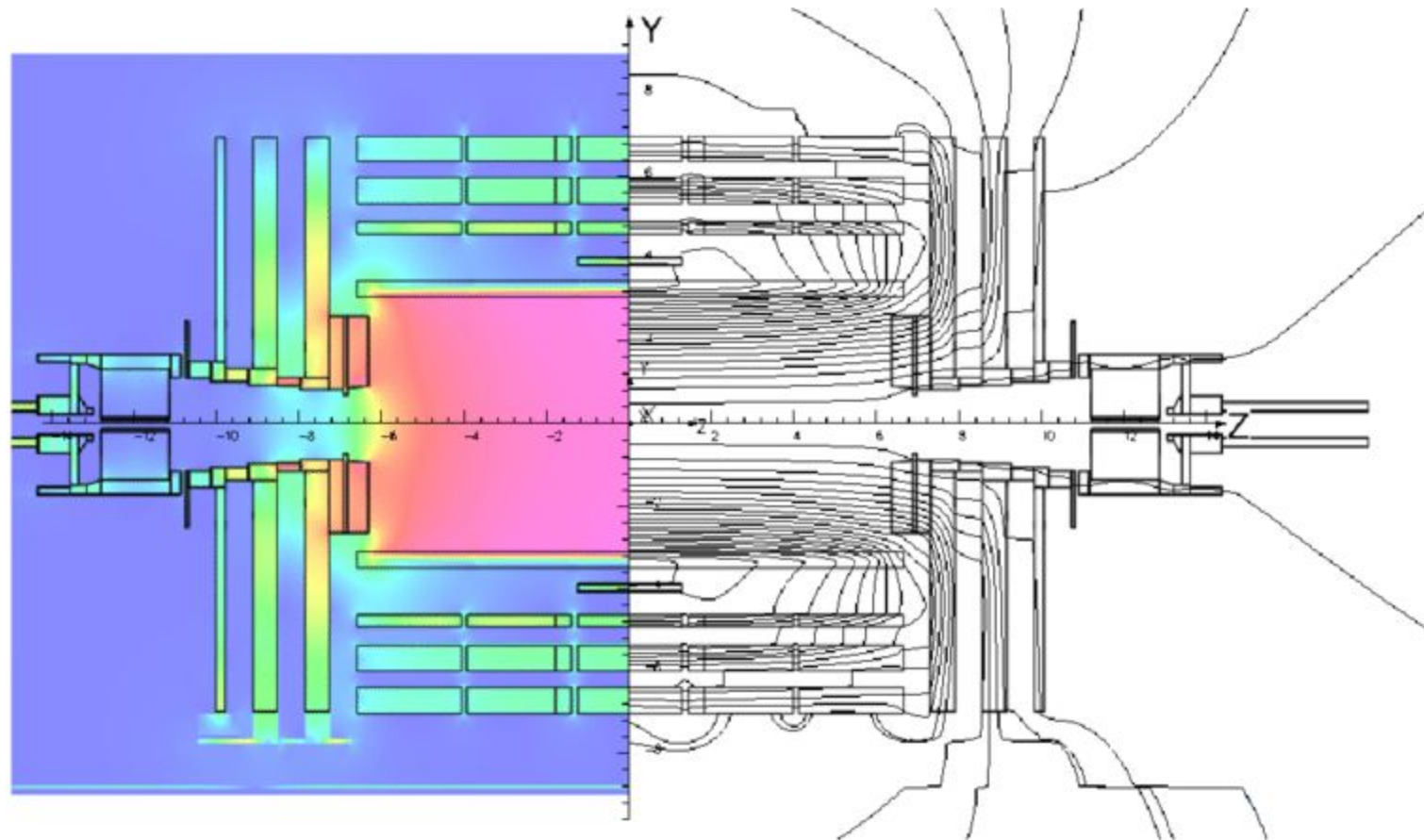
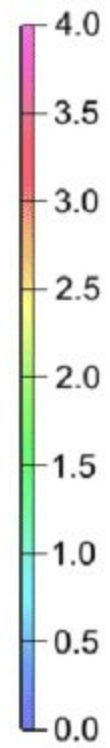


Artist View
of CMS Solenoid

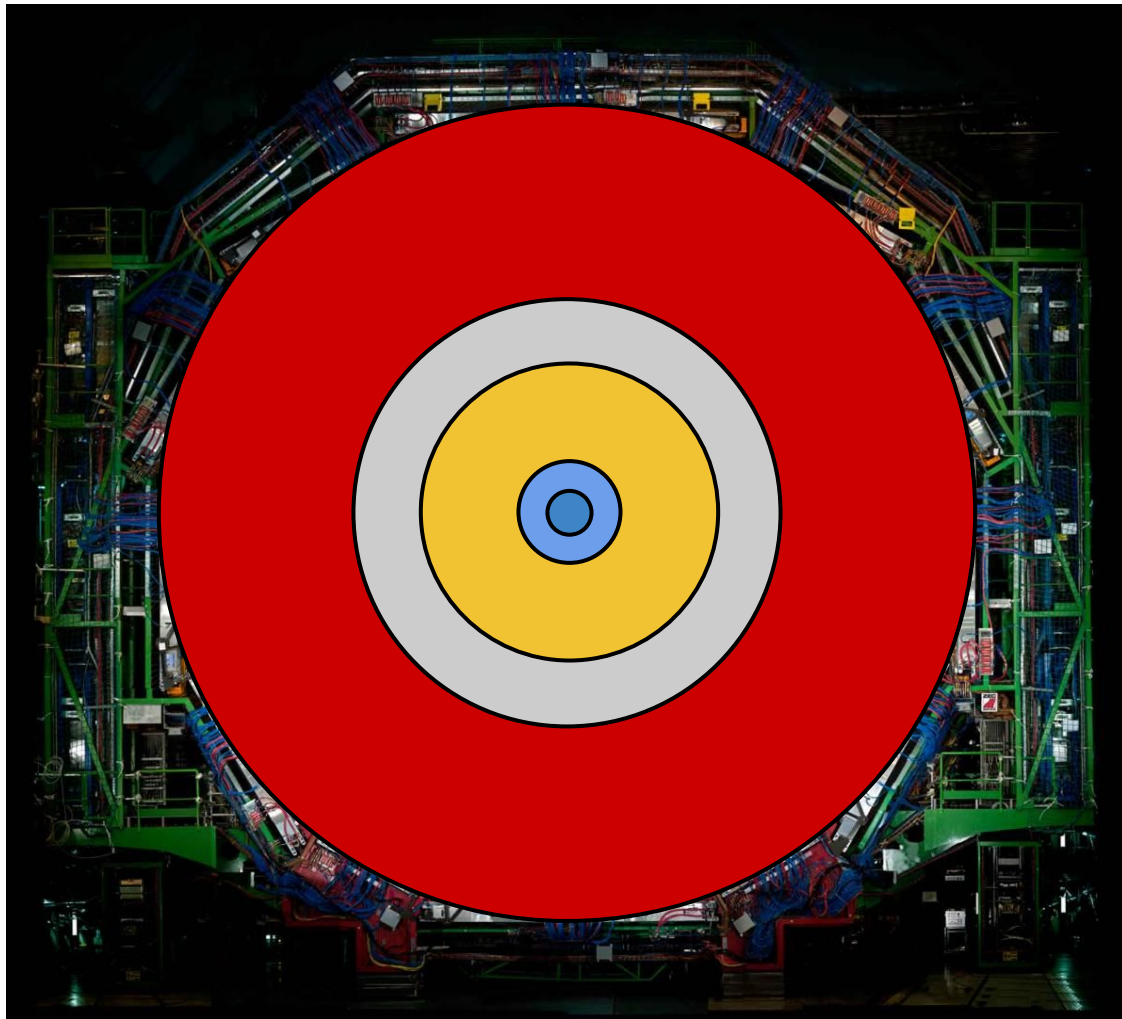


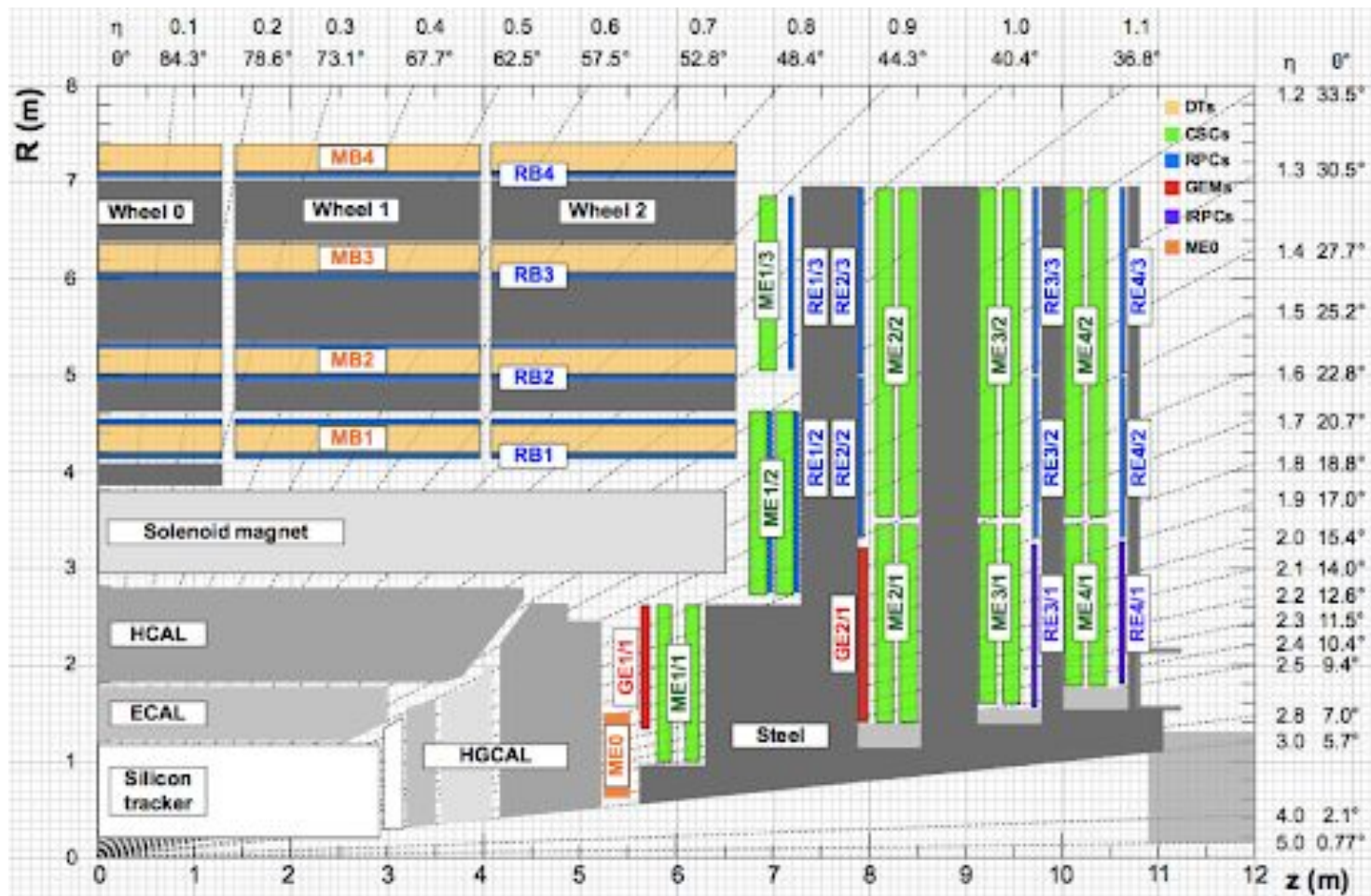
12.5 x 6.3 m
4 T
2.7 GJ

$|B|$ [T]

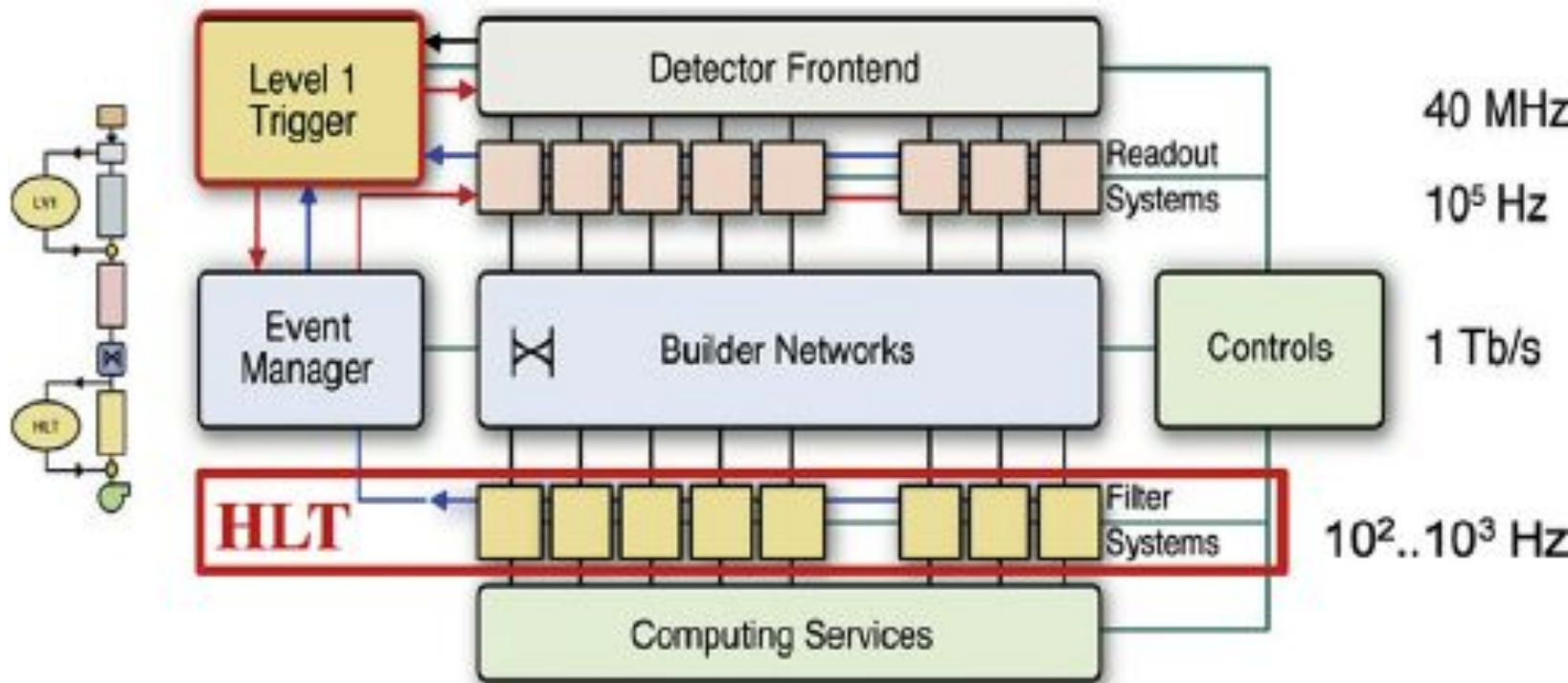


Muon
chambers

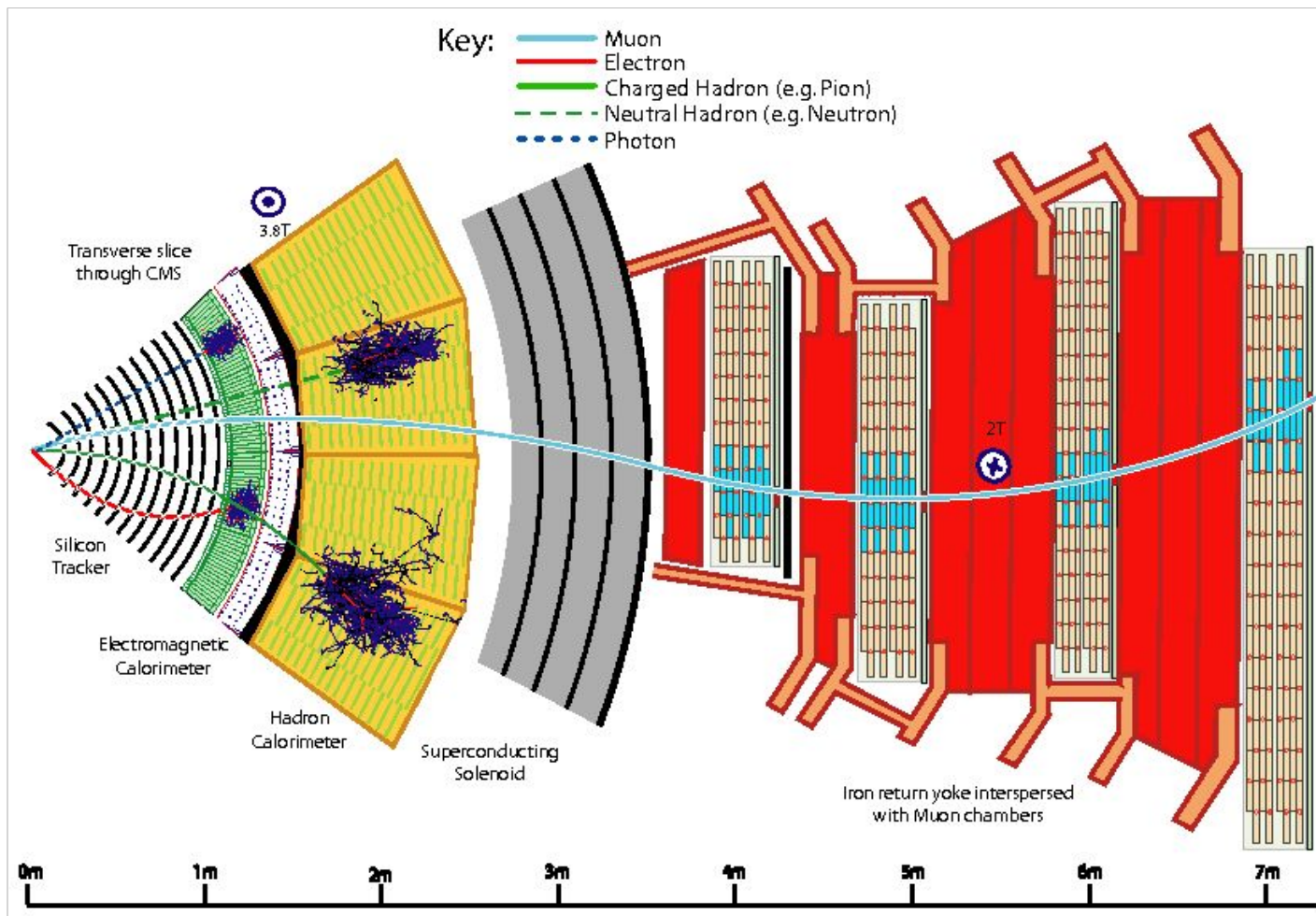




Triggering

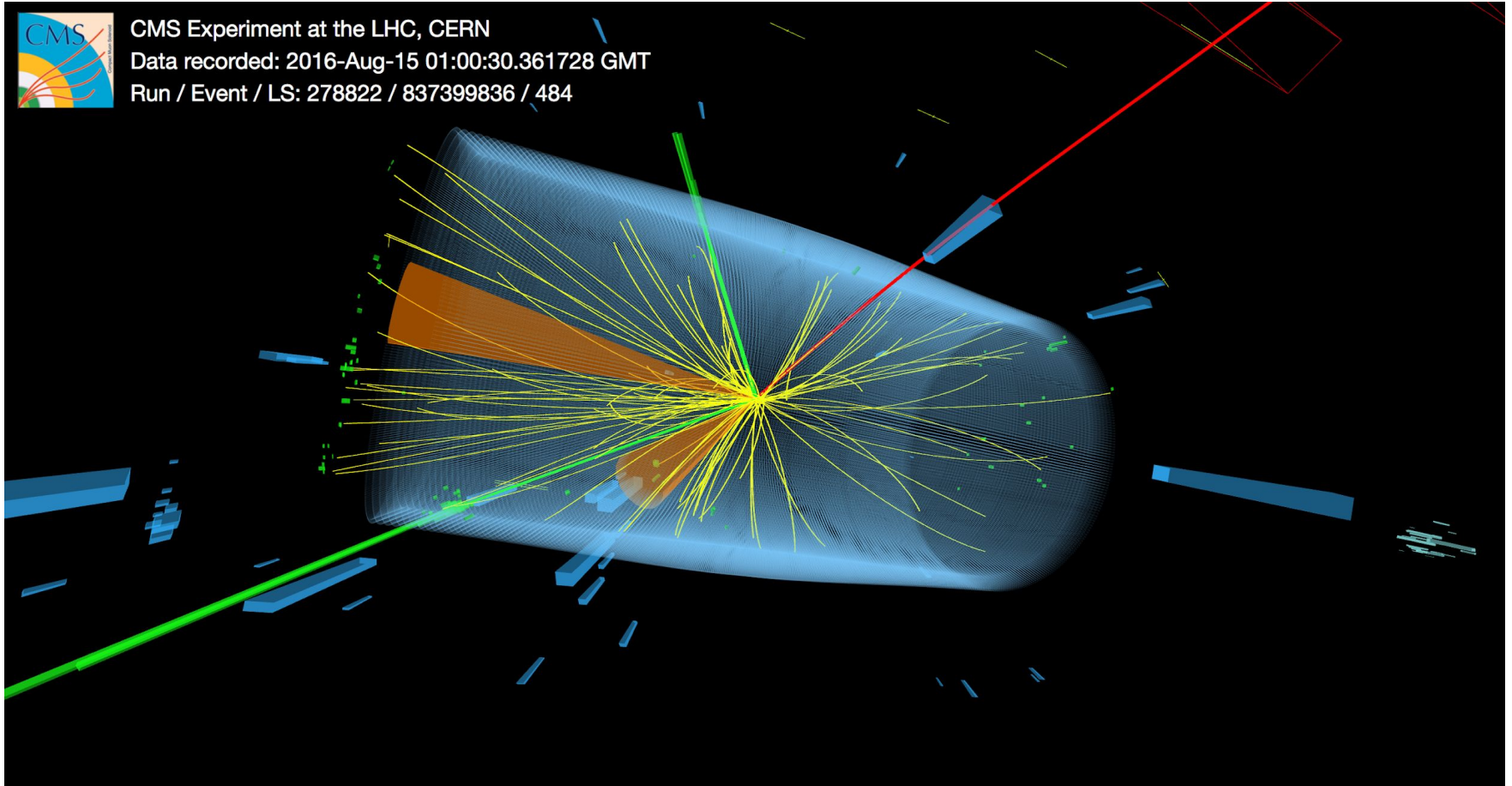


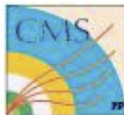
Object reconstruction



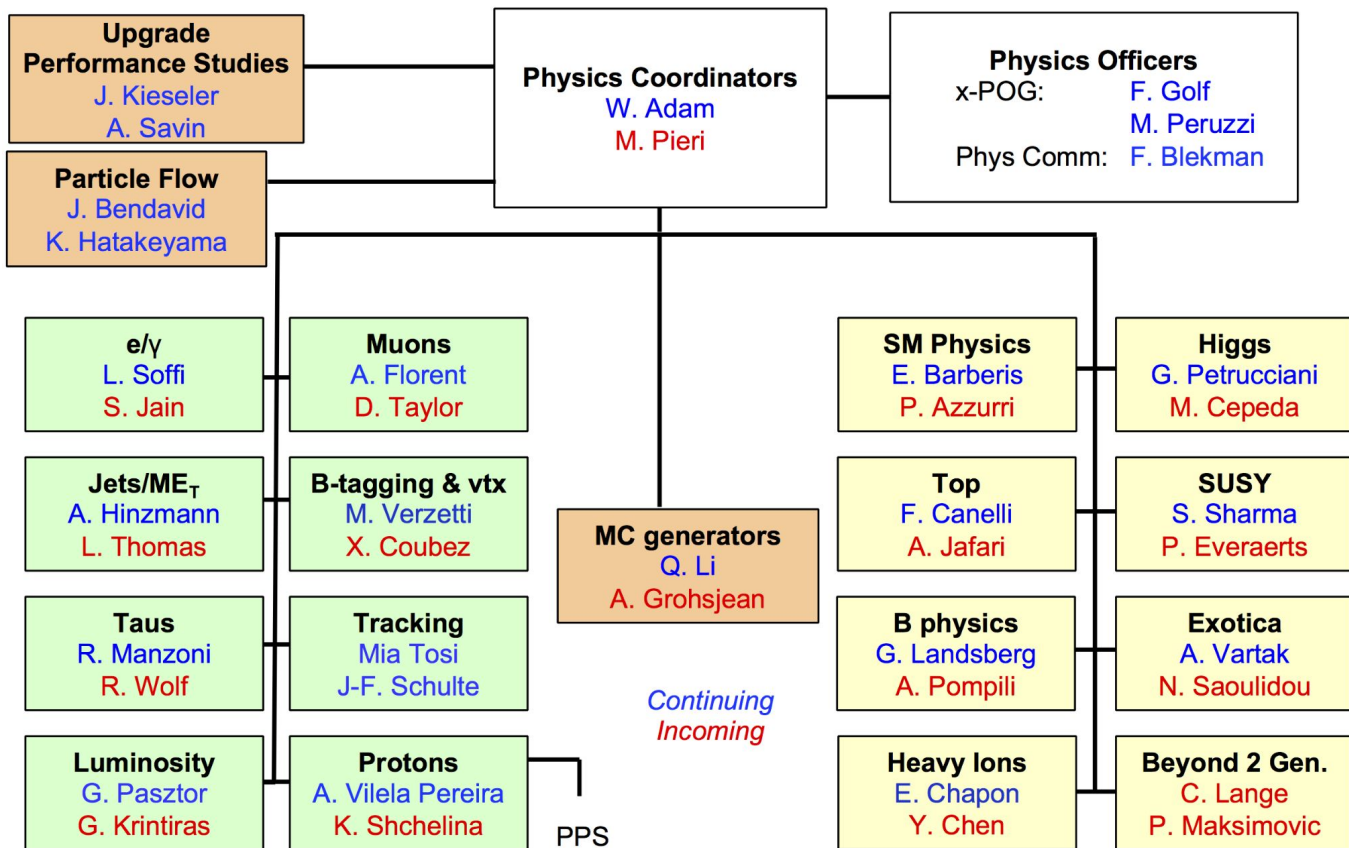


CMS Experiment at the LHC, CERN
Data recorded: 2016-Aug-15 01:00:30.361728 GMT
Run / Event / LS: 278822 / 837399836 / 484





CMS physics organization (2019-2020)



Dark sector searches with the CMS experiment

arXiv:2405.13778

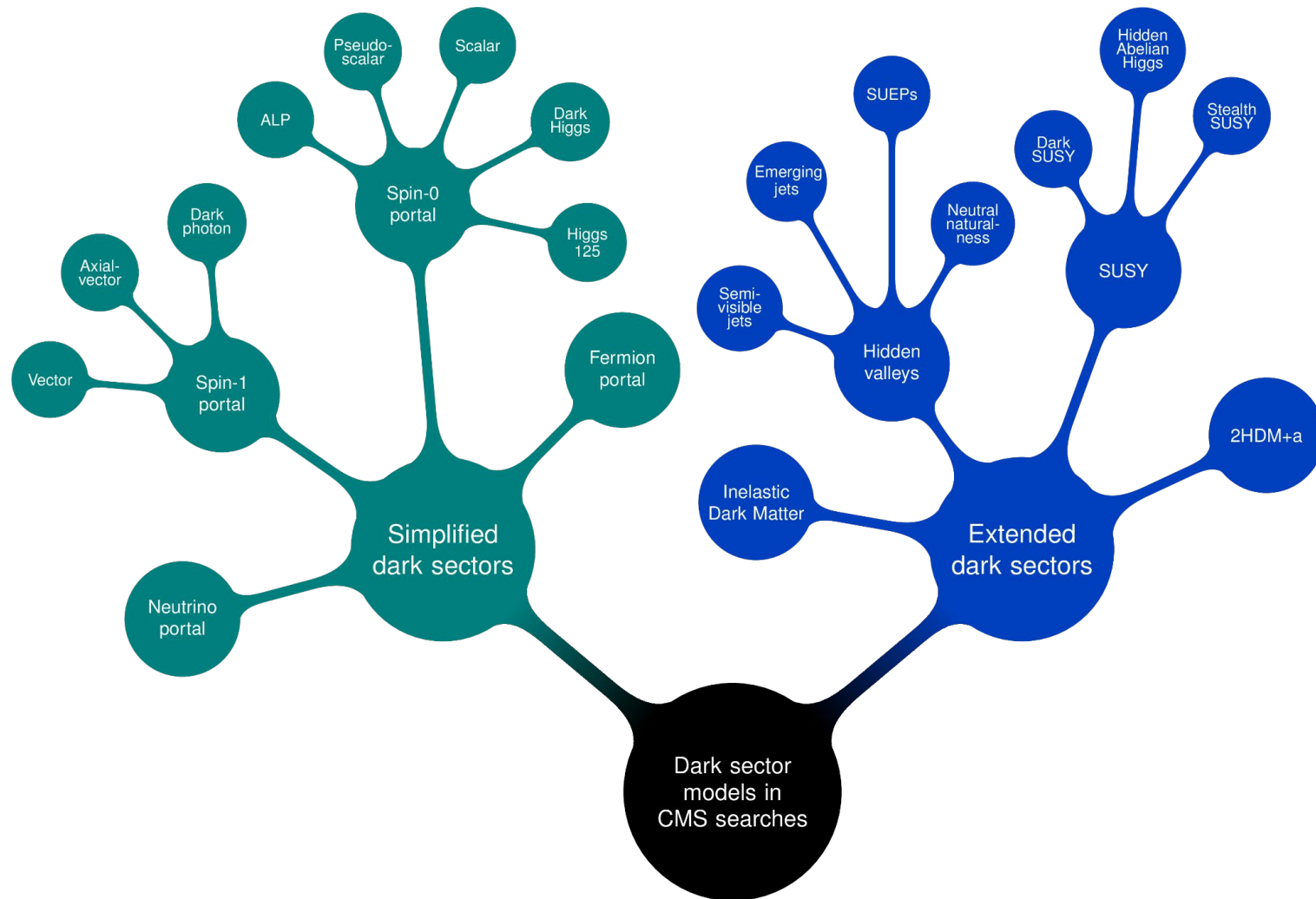
Review of searches for
vector-like quarks,
vector-like leptons, and
heavy neutral leptons

arXiv:2405.17605

Enriching the physics
program of the CMS
experiment via data
scouting and data parking

arXiv:2405.16134

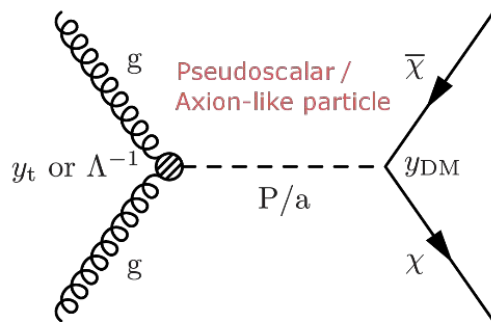
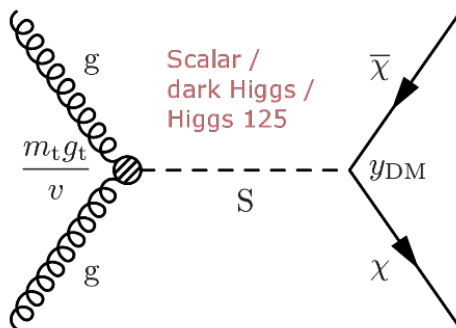
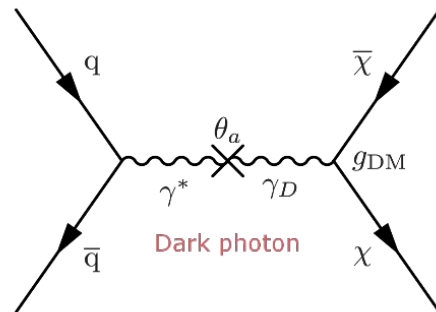
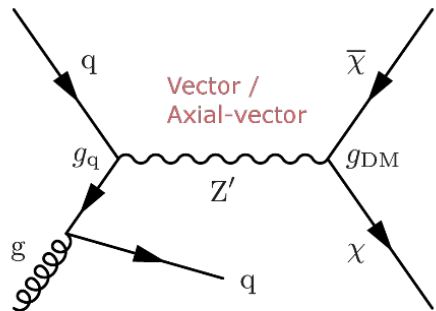
Dark sectors



Simplified dark sectors

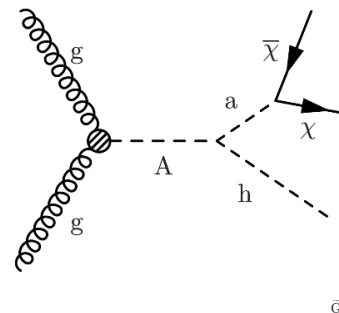
Spin-0 portal

Spin-1 portal

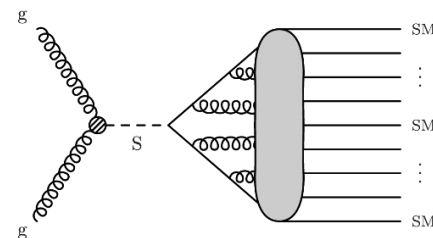
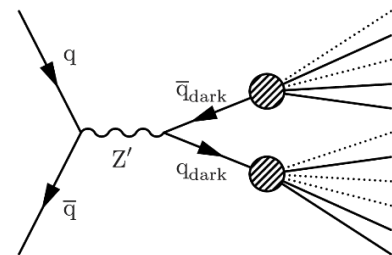


Extended dark sectors

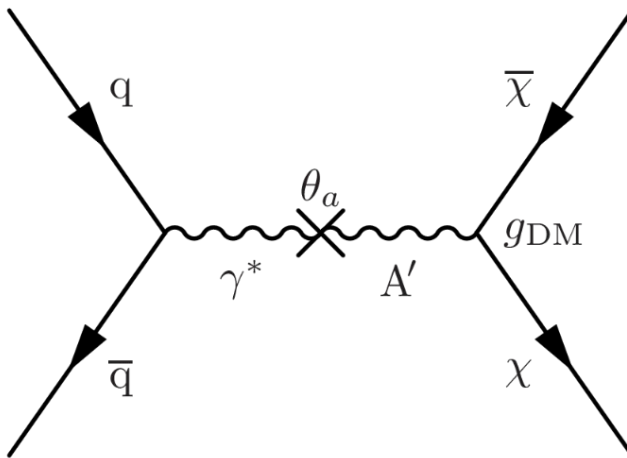
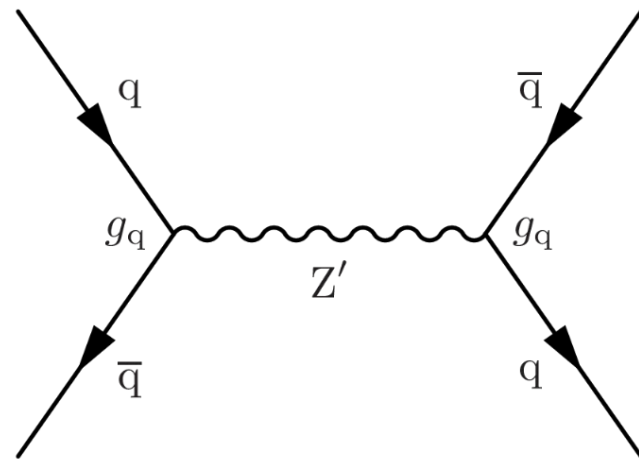
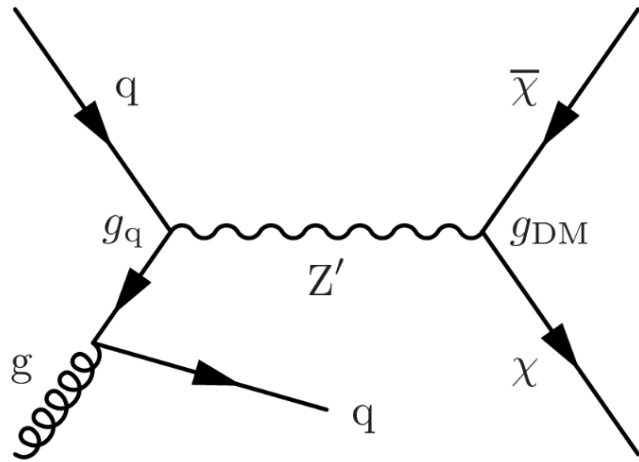
2HDM+a



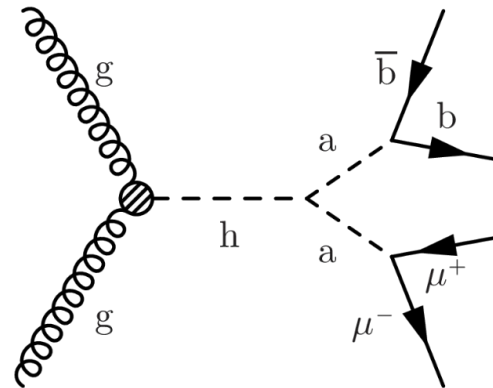
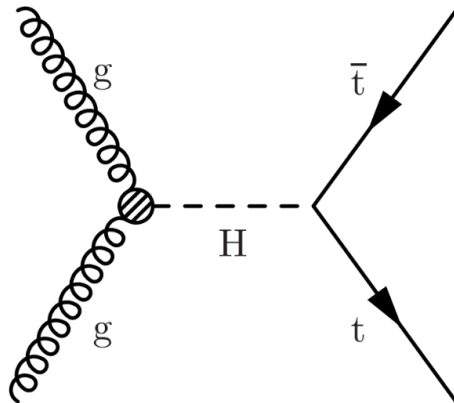
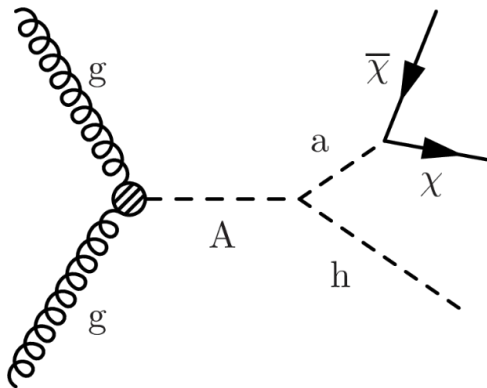
Hidden valleys



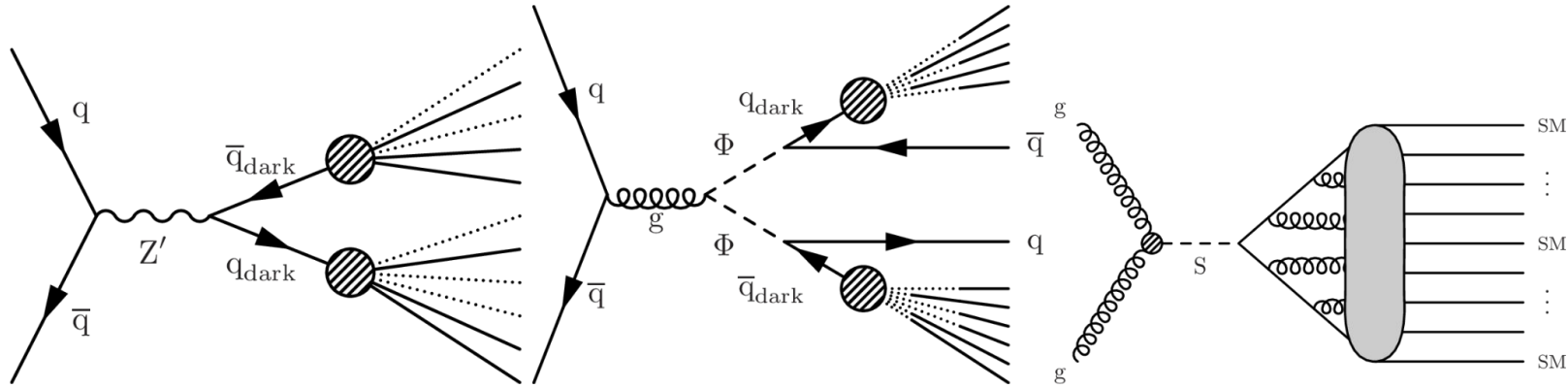
Simplified spin 1



Simplified spin 0

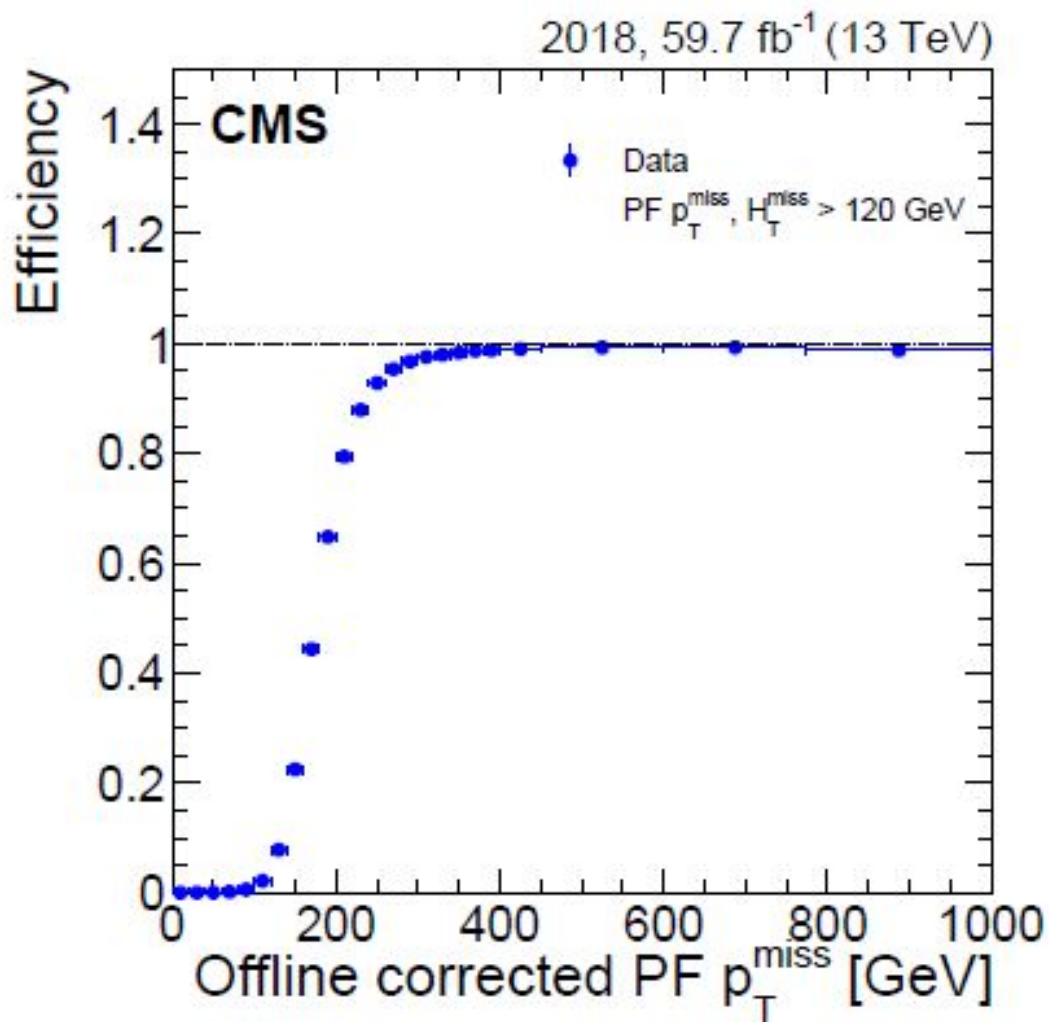


Hidden valleys



Rich dark sector only accessible at high energies.

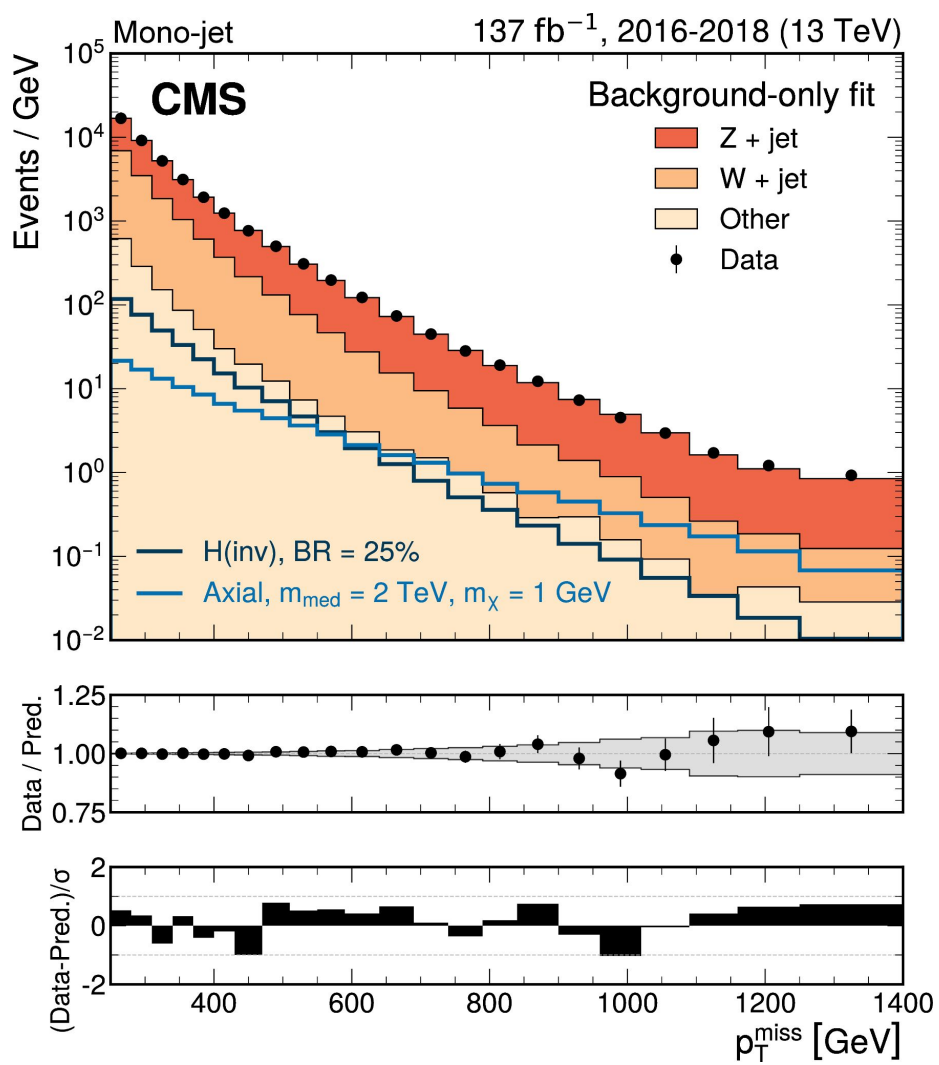
Triggers



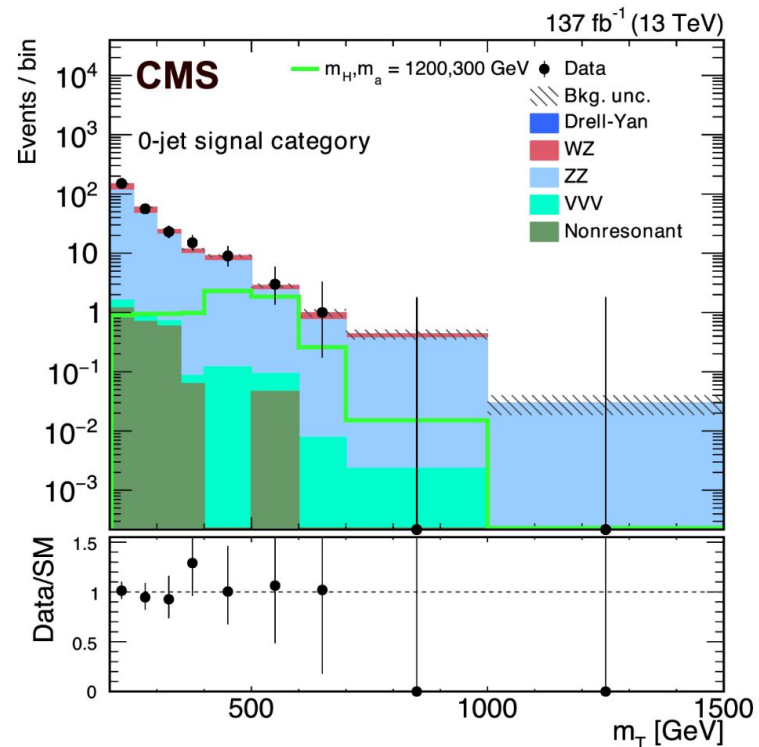
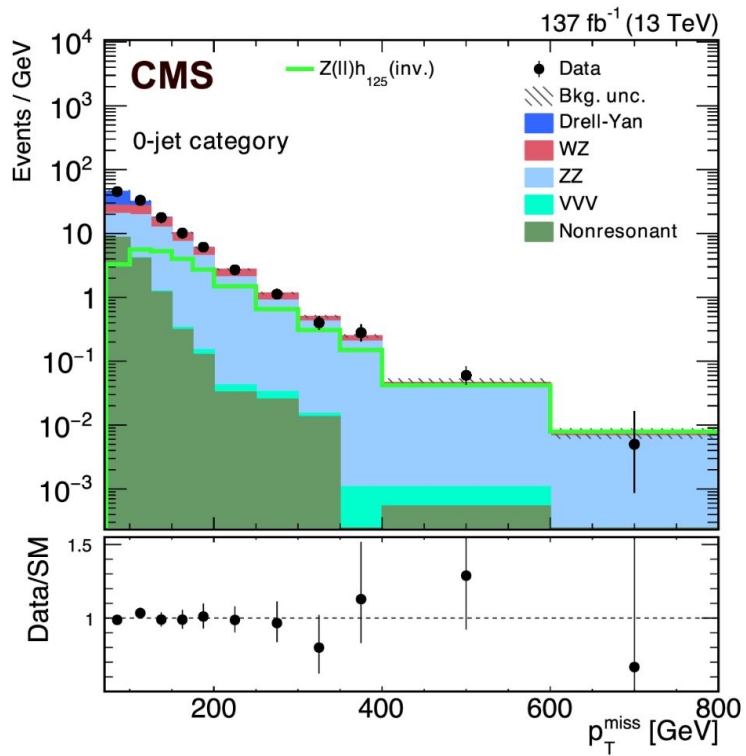
Triggers

		Single-object triggers						
		e	μ	τ (iso.)	γ	Jet	p_T^{miss}	H_T
		32 (iso.)	24 (iso.)	180	110 (iso., barrel)	500 (AK4)	120	1050
		115	50		200	400, $m_{\text{trim}} > 30$ (AK8)		330 + 4 jets, 3 b tags
		Di-object triggers						
		e	μ	τ (iso.)	γ	Jet	p_T^{miss}	H_T
e		23, 12 (iso.) 25, 25	23, 12 (iso.) 27, 37	24 (iso.), 30		30 (iso.), 35 50, 165		28 (iso.), 150
μ		23, 12 (iso.) 27, 37	17, 8 (iso.), $m_{\mu\mu} > 3.8$ 37, 27	20 (iso.), 27	17, 30			
τ (iso.)		180		35, 35			50 (1-prong), 100	
γ					30, 18 (iso.) 70, 70			
p_T^{miss}								100, 500

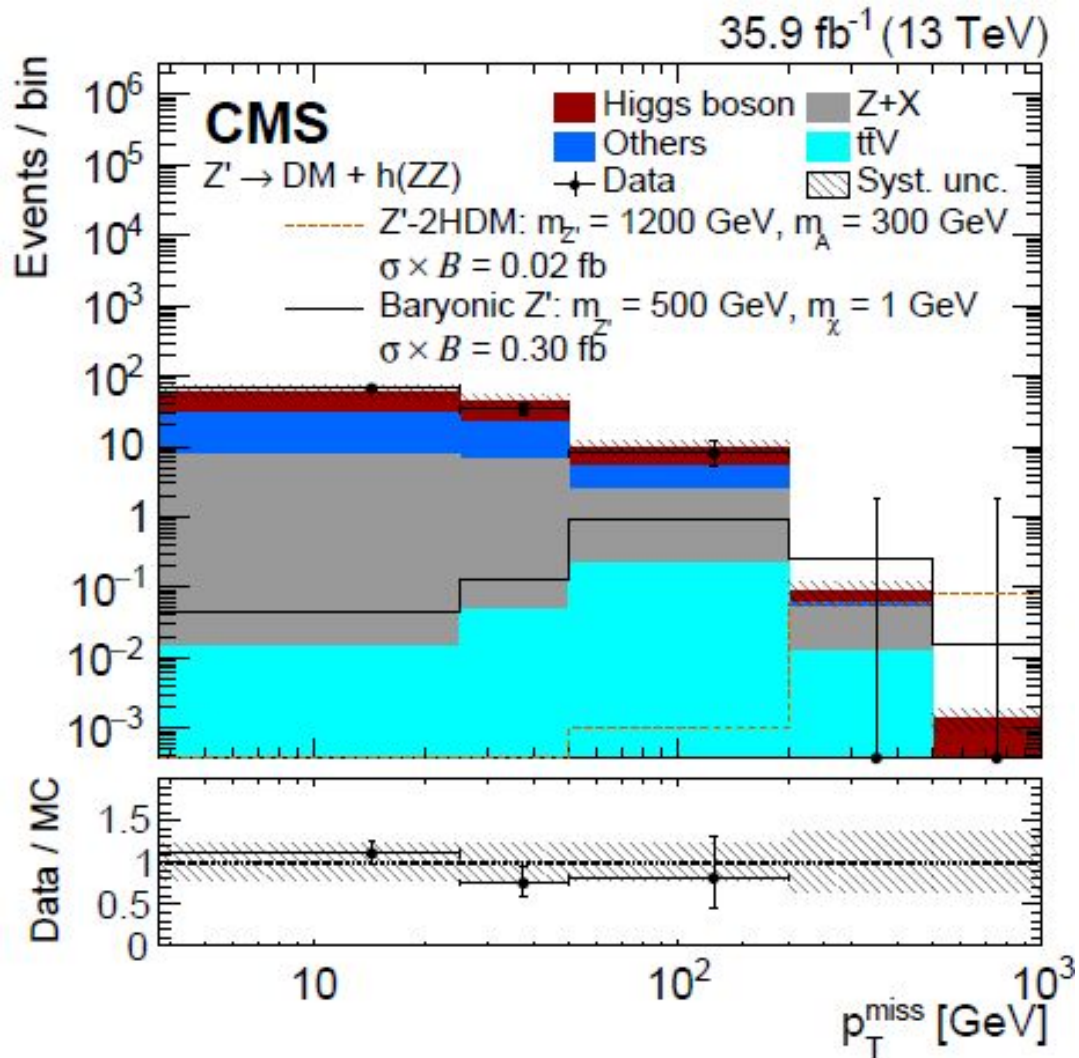
Monojet



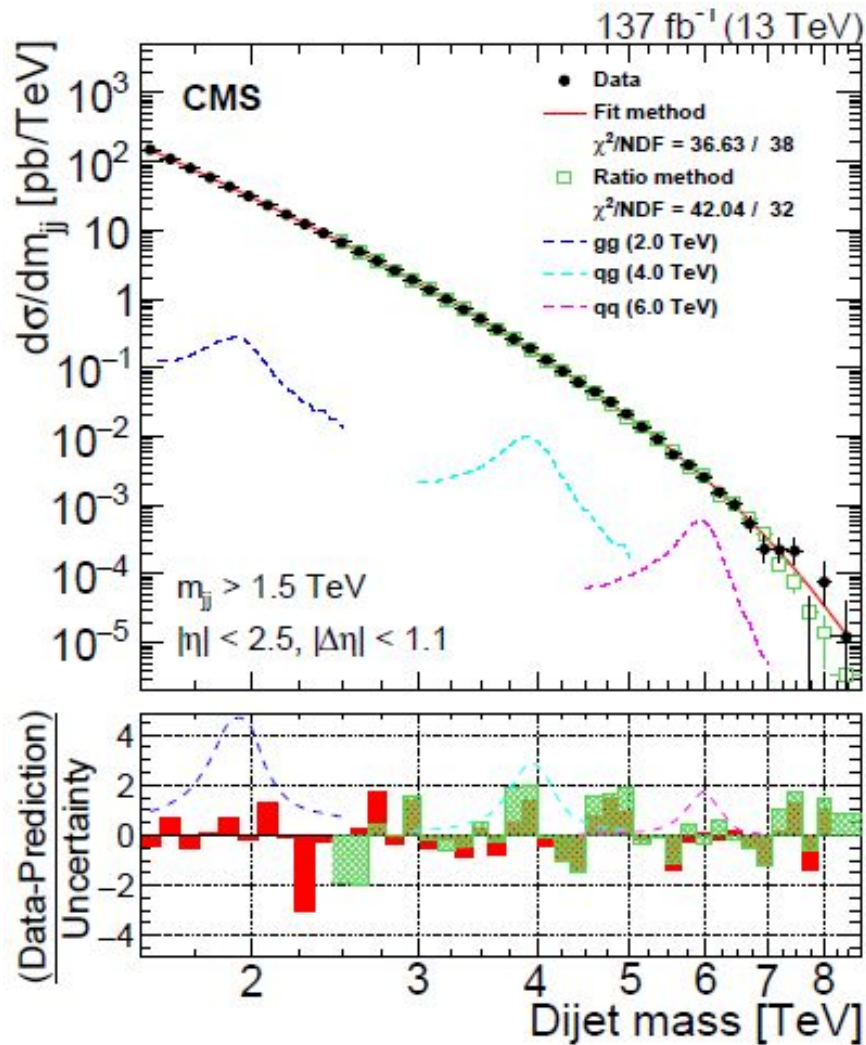
Mono-Z



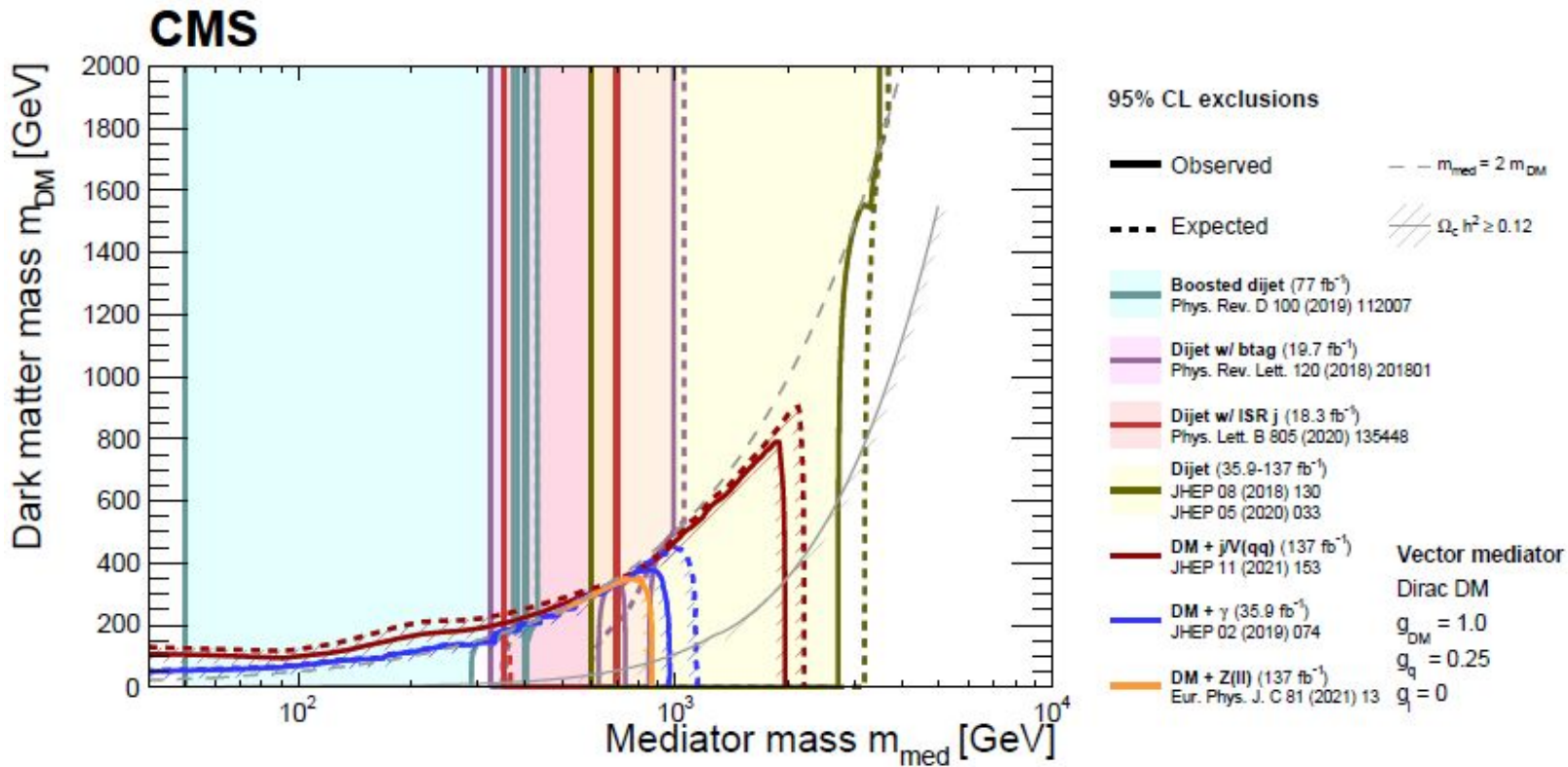
Mono-H



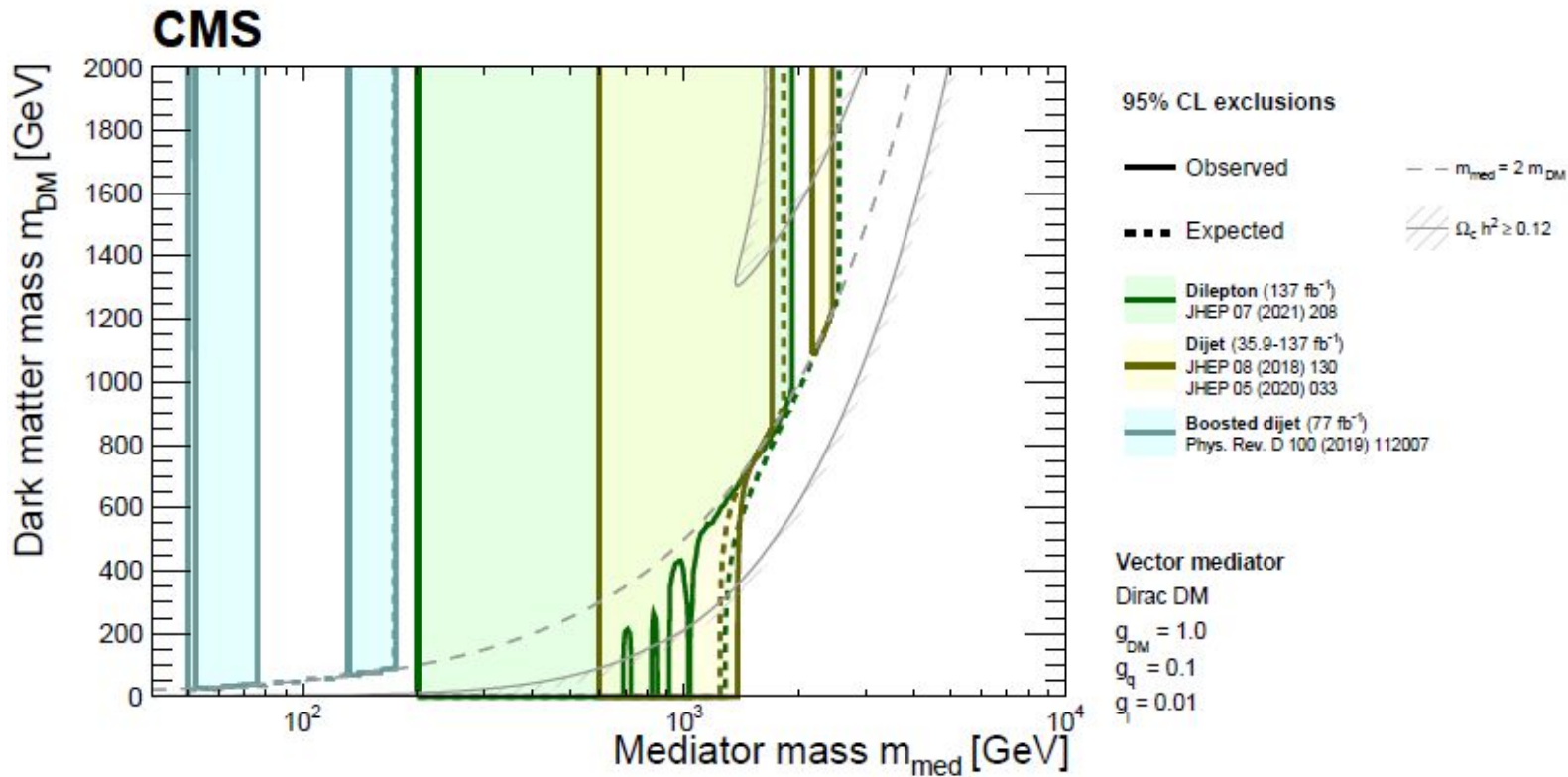
Dijets

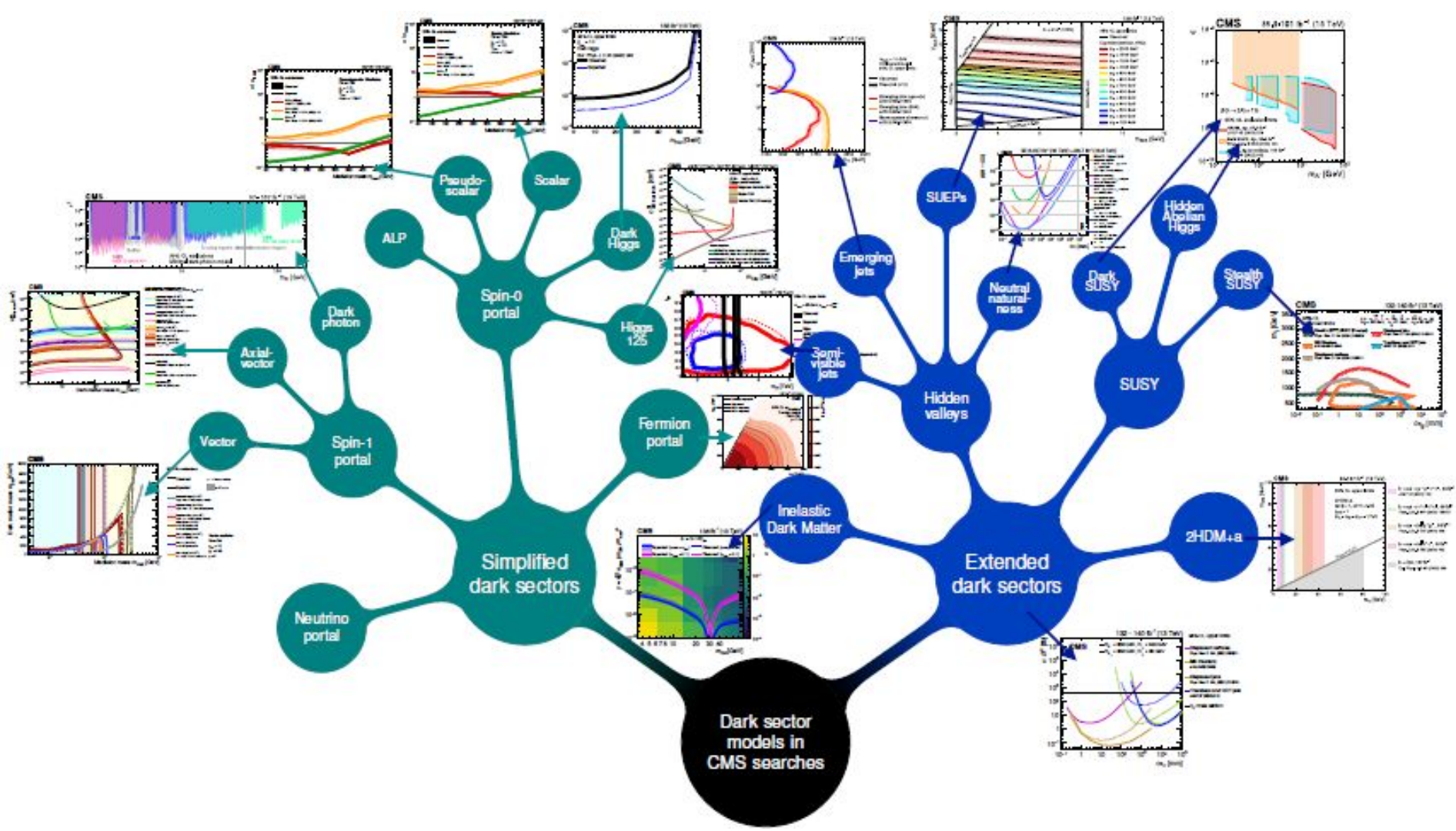


Limits

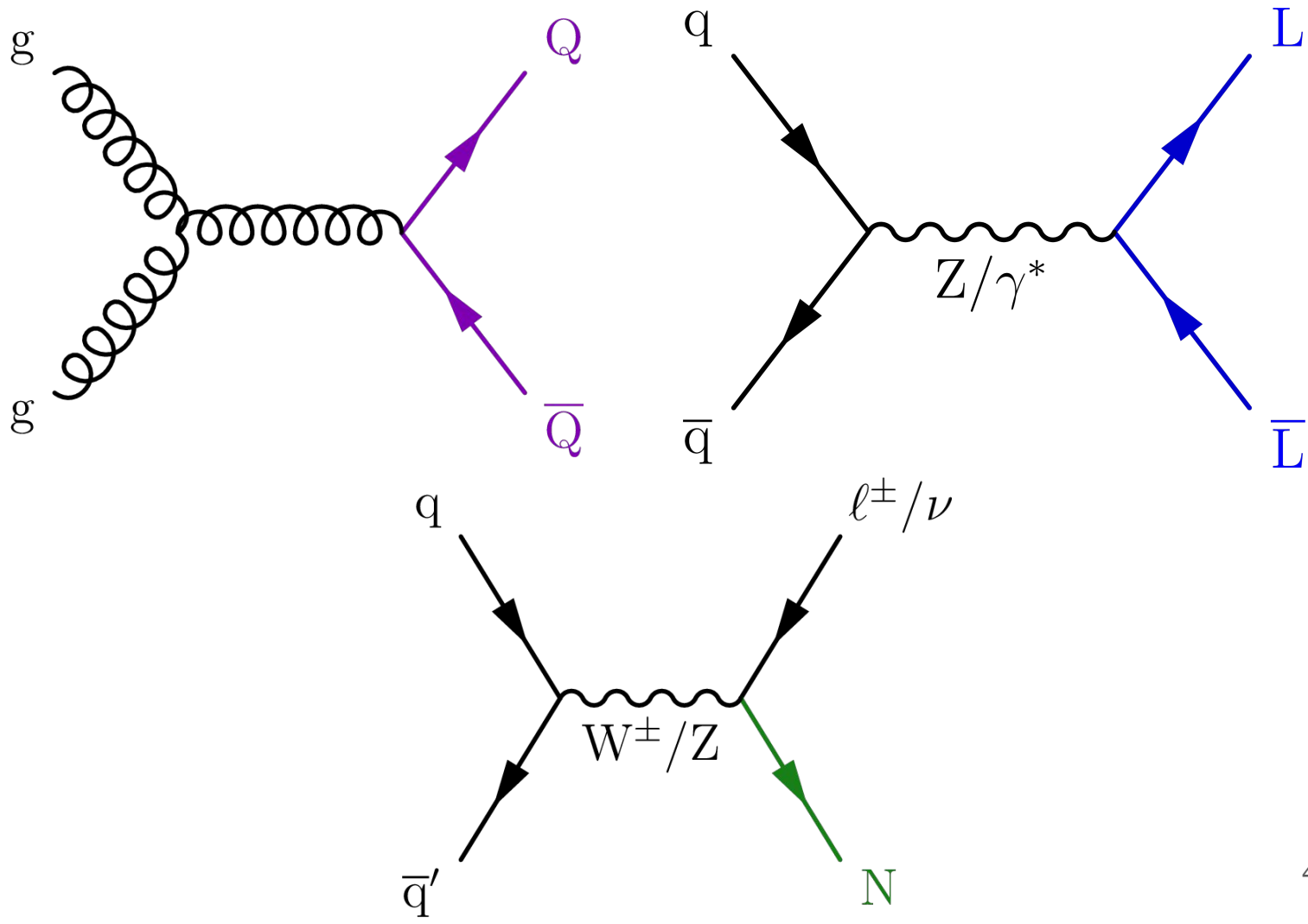


Limits





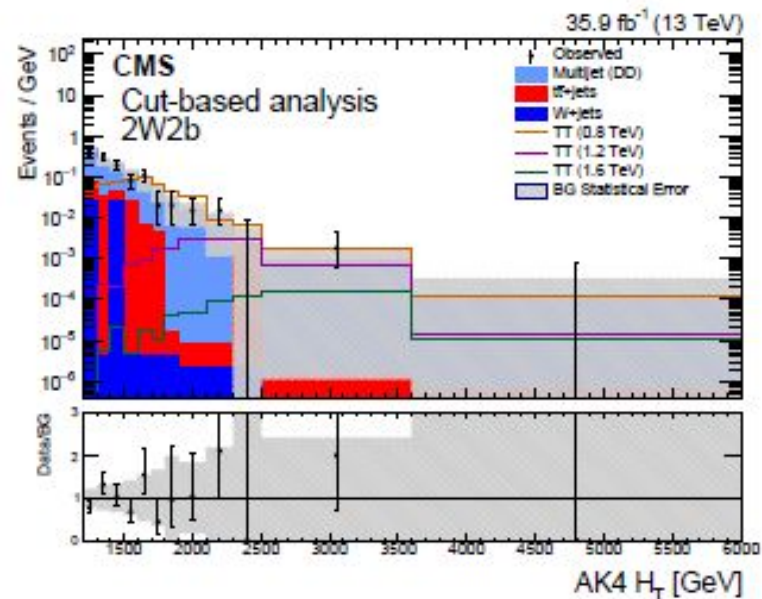
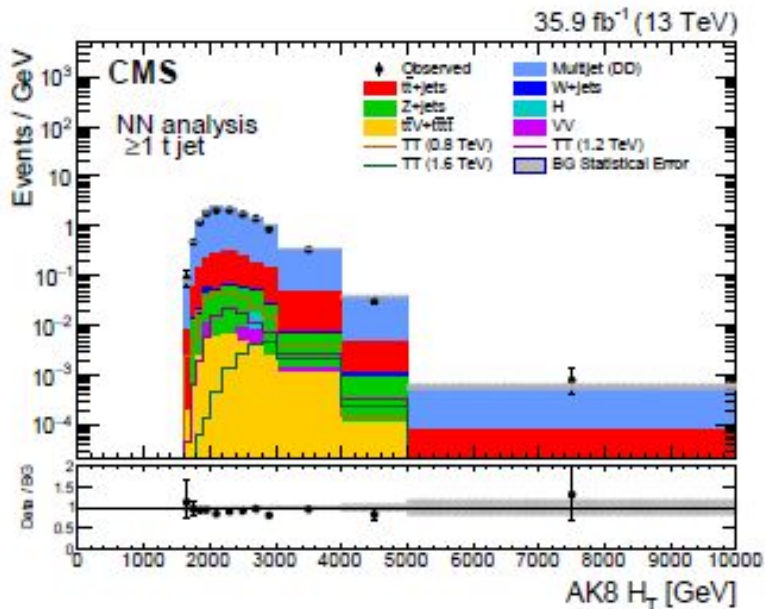
Vector-like



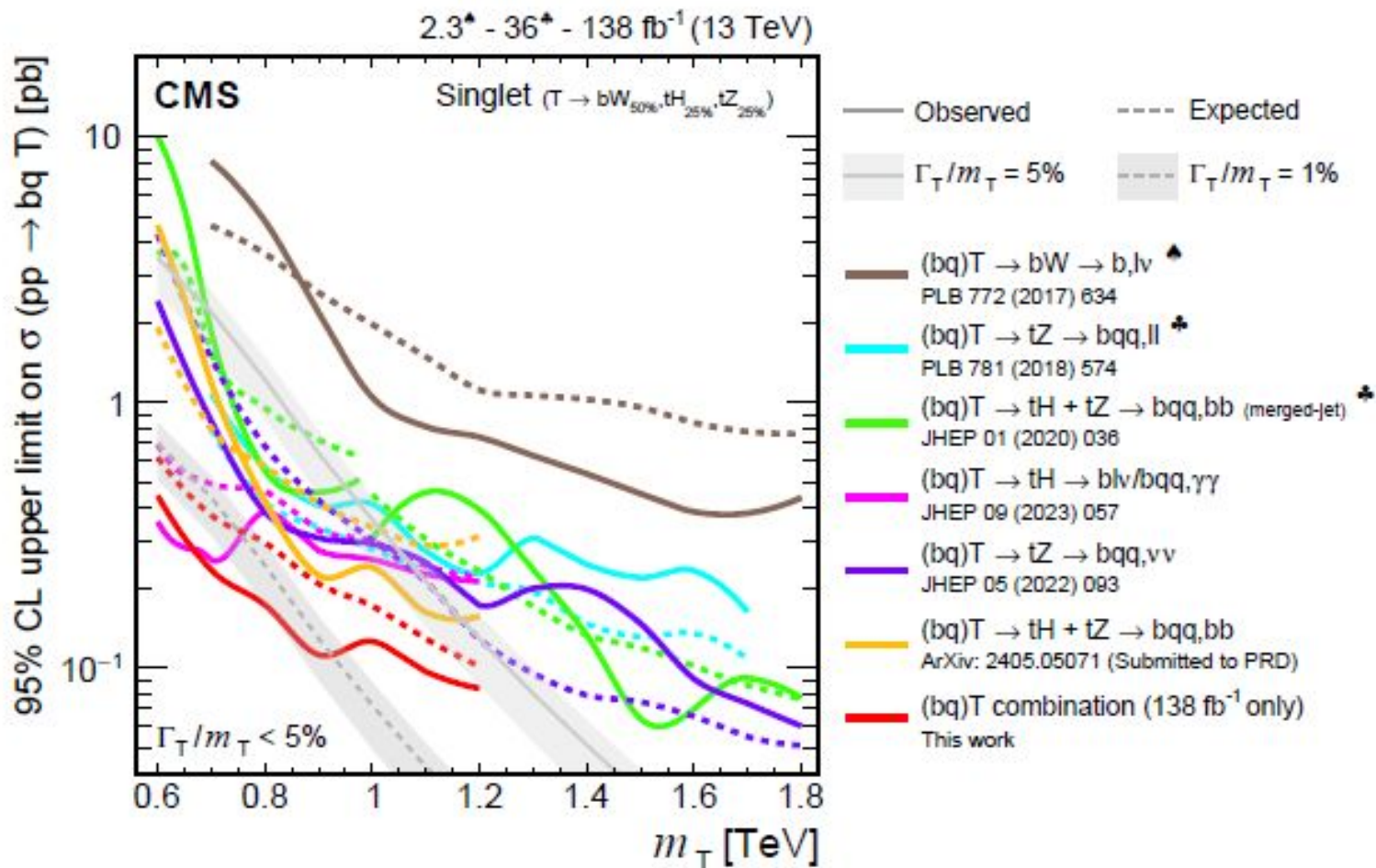
Pair production

Production mode	Decay mode	Channel
$T\bar{T}$	bW, tH, tZ	0l, 1l, OS 2l, SS 2l, 3l
$B\bar{B}$	tW, bH, bZ	0l, 1l, OS 2l, SS 2l, 3l
$X_{5/3}\bar{X}_{5/3}$	tW	1l, SS 2l
$Y_{4/3}\bar{Y}_{4/3}$	bW	1l
T	tZ	bqq $\ell\ell$, bqq bb, bqq $\nu\nu$
	tH	bqq $\gamma\gamma$, bqq bb
	bW	b $\ell\nu$
B	bH	b bb
	tW	bqq $\ell\nu$, b $\ell\nu$ qq, bqq qq
$X_{5/3}$	tW	bqq $\ell\nu$, b $\ell\nu$ qq, bqq qq
$Y_{4/3}$	bW	b $\ell\nu$
$Z' \rightarrow T\bar{T}$	bW	0l
	tH, tZ	1l
$W' \rightarrow T_b$	tH, tZ	0l
$W' \rightarrow B_t$	bH, bZ	0l

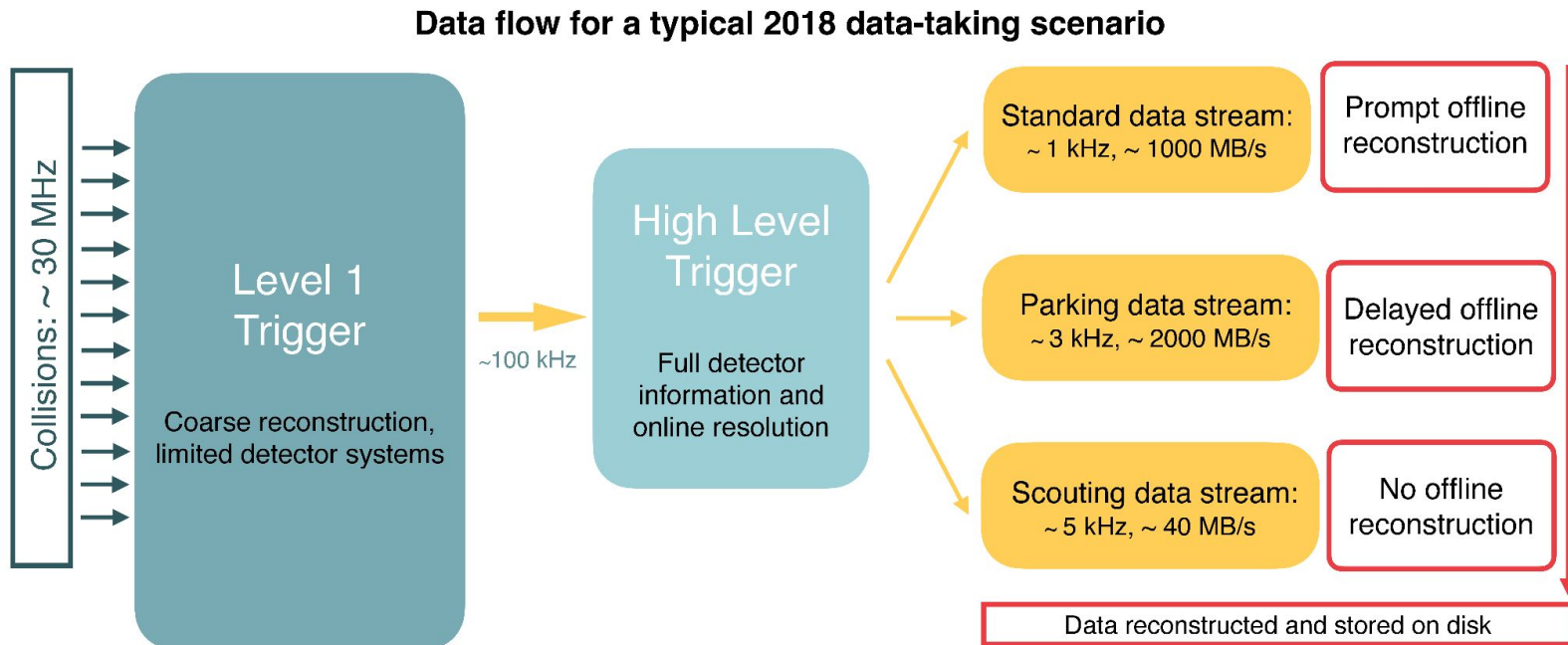
Pair production



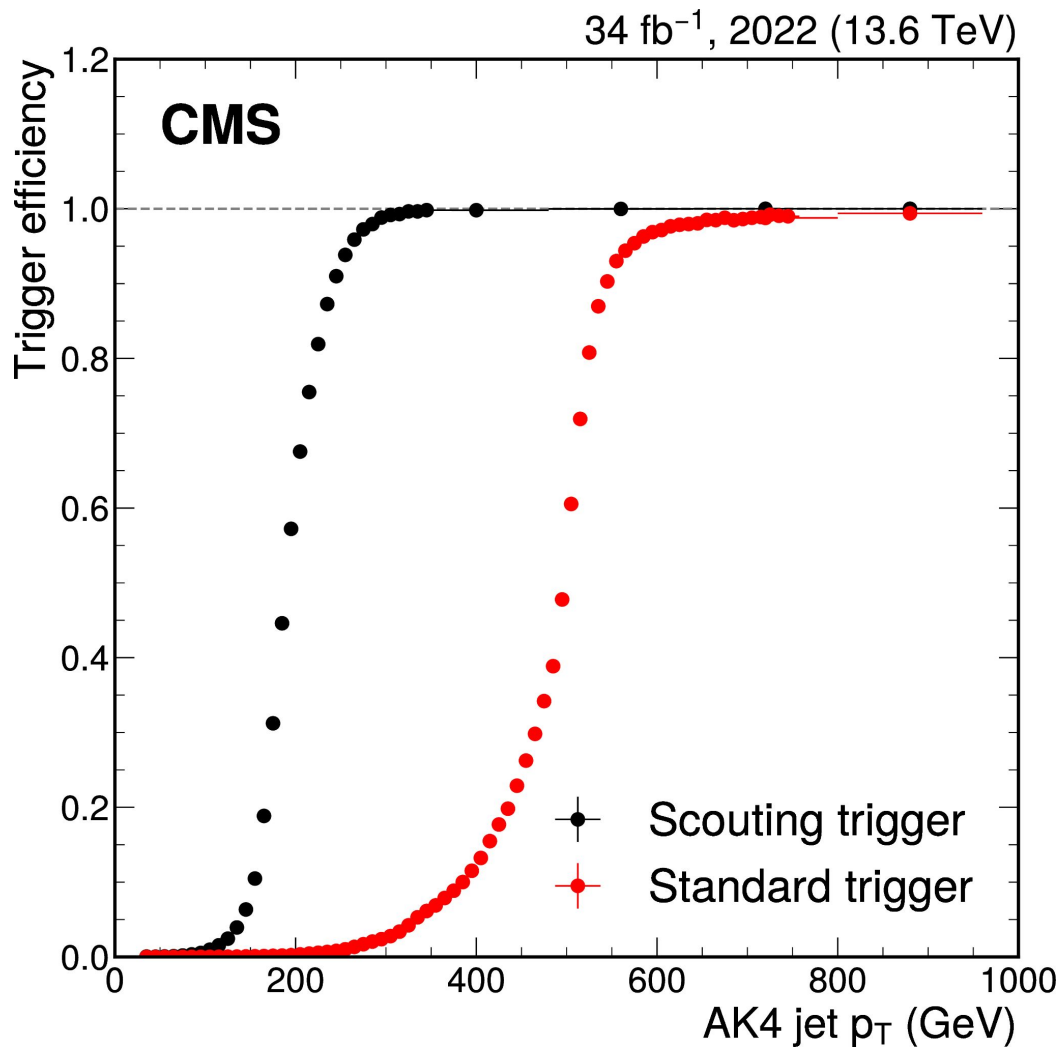
Limits



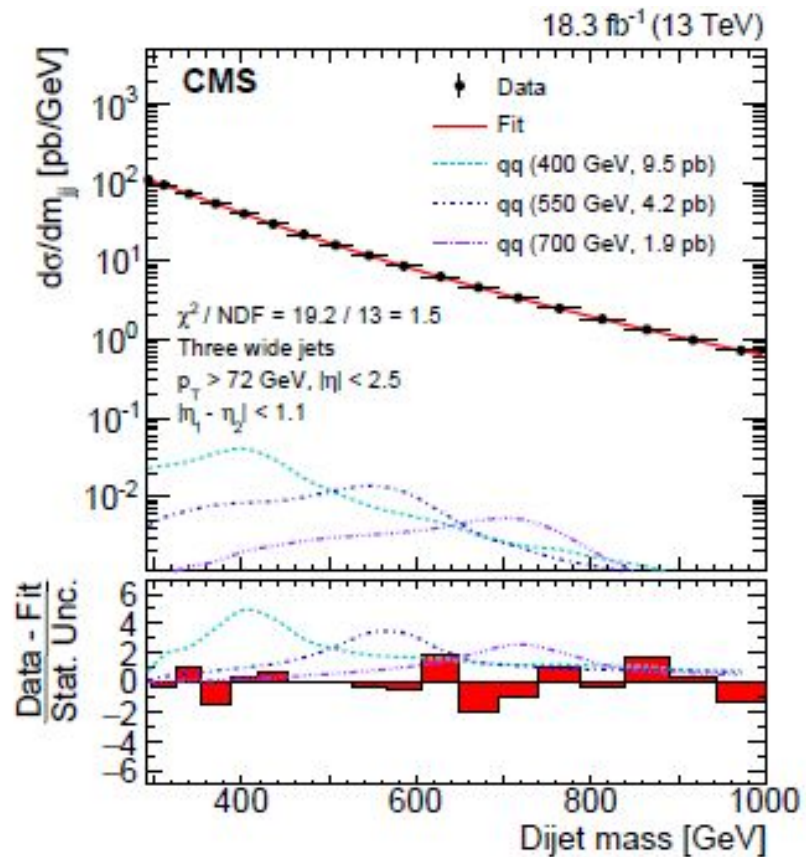
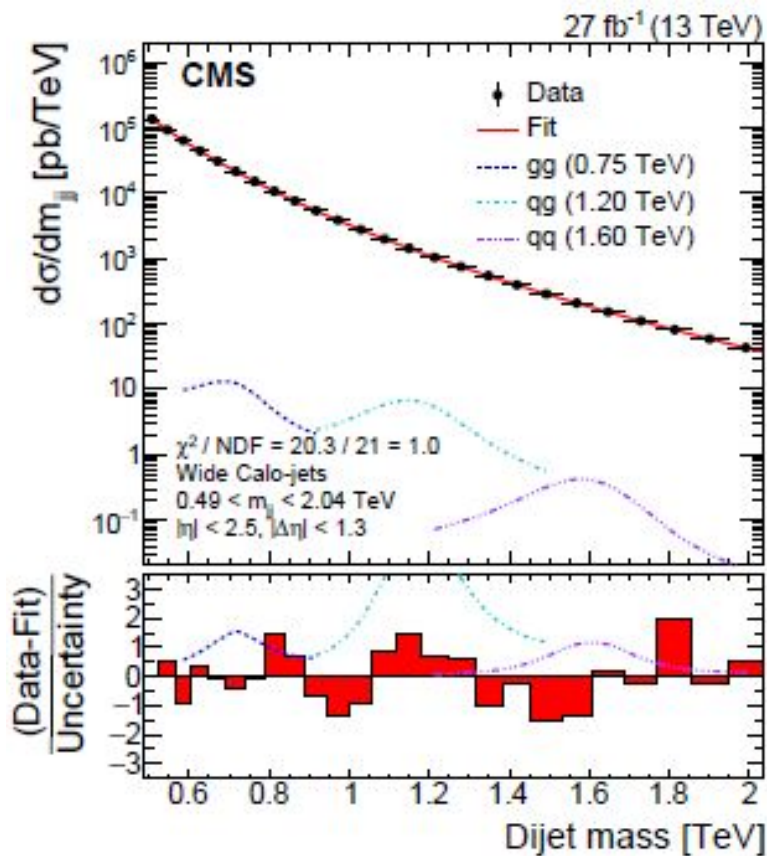
Scouting and parking



Triggering



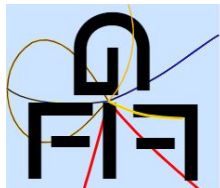
Dijet



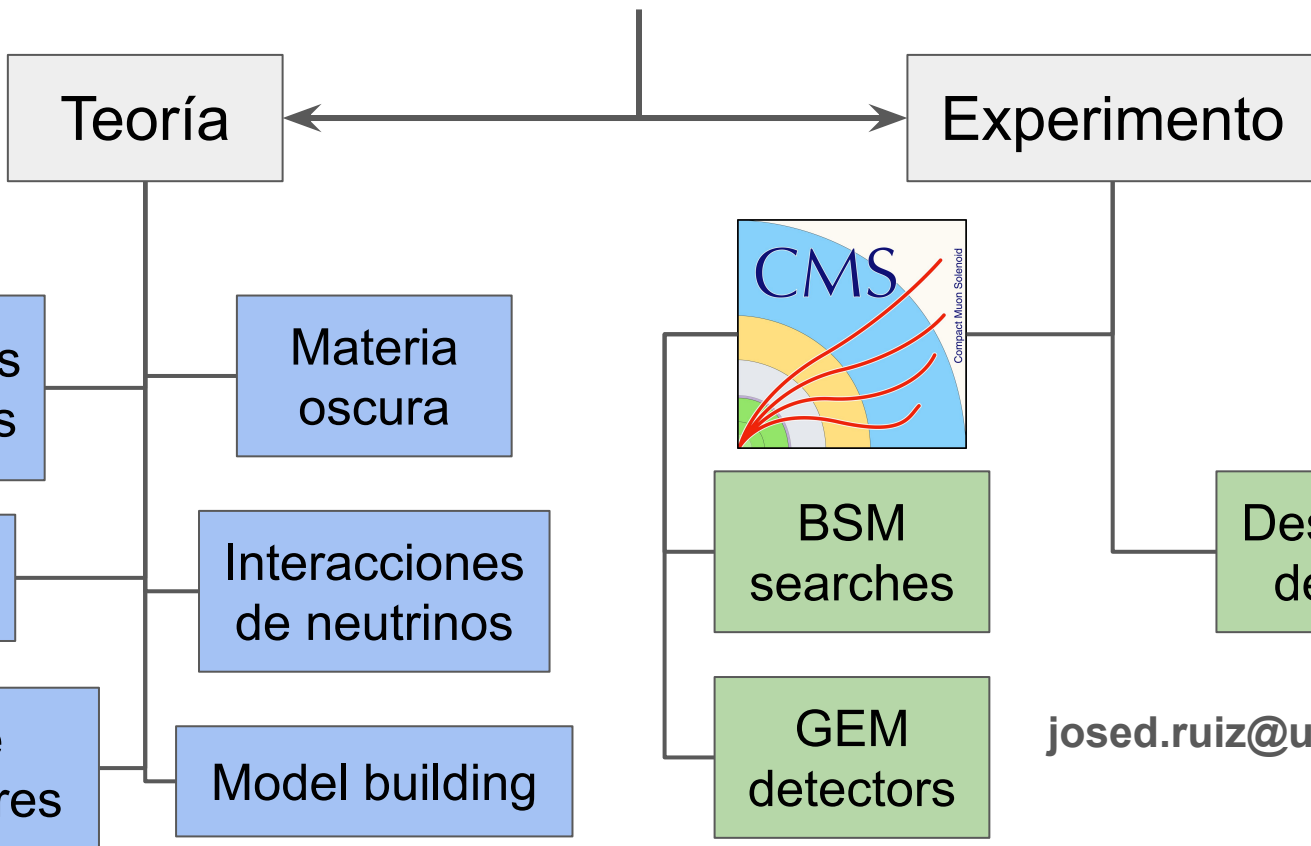
In conclusion

- CMS has a wide and exciting Exotica physics program.
- We have turned a lot of stones without any serious hint of new physics.
- We have pursued a very complete and creative new physics program.
- We still have rocks to turn, and new physics to discover (!).





GRUPO DE FENOMENOLOGÍA DE INTERACCIONES FUNDAMENTALES



josed.ruiz@udea.edu.co

¡Muchas gracias!



EL CAMINO DE LOS INVISIBLES



José David Ruiz-Álvarez

Profesor Asociado Universidad de Antioquia
Miembro CMS - Centro Europeo de Investigación Nuclear

JUEVES 5 DE DICIEMBRE 2024

7:00 P. M

**15•37- RESTAURANTE BAR
CL 20 #40-63, PASTO, NARIÑO**

Organiza:



Apoya:

