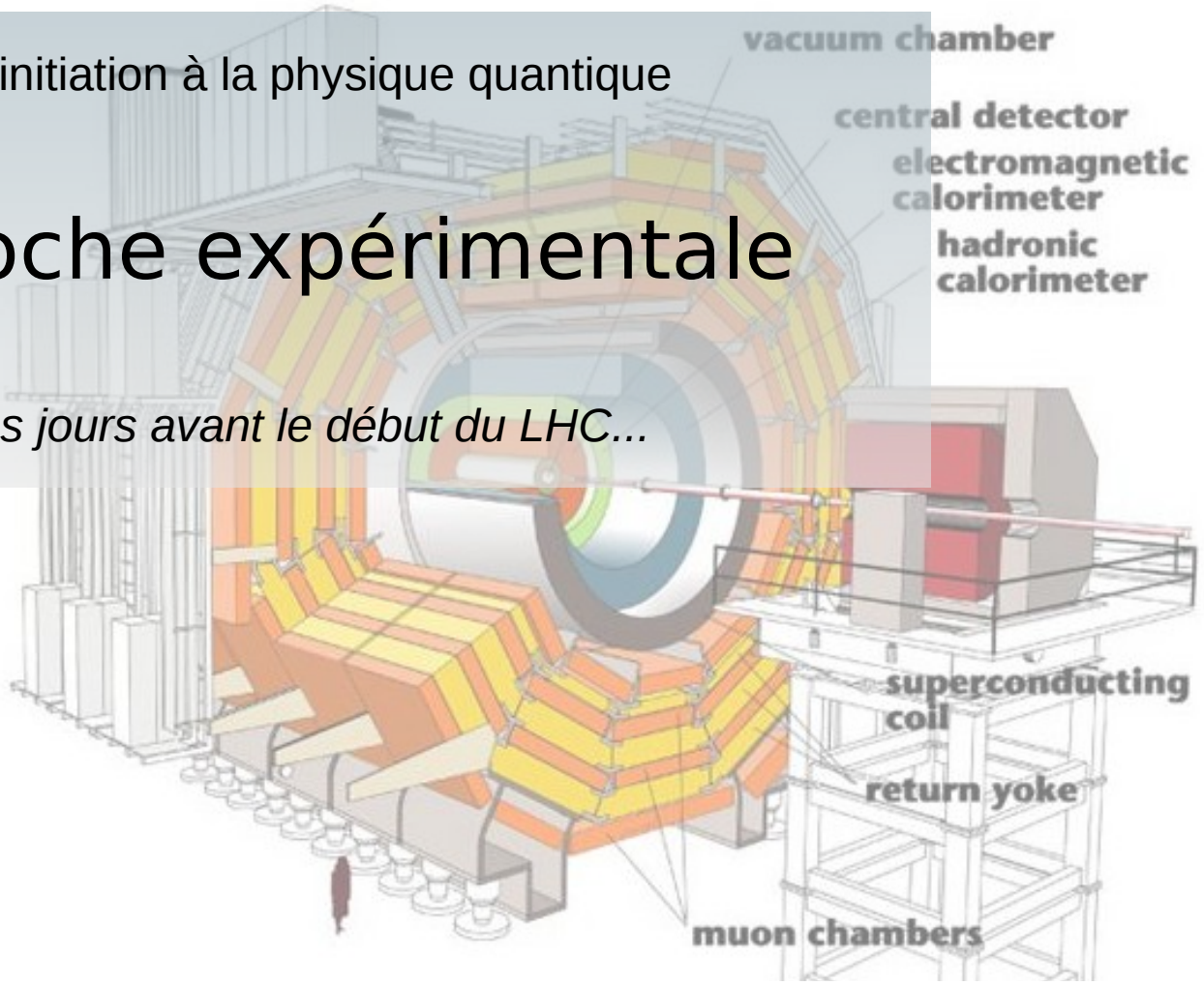
Cours d'initiation à la physique quantique

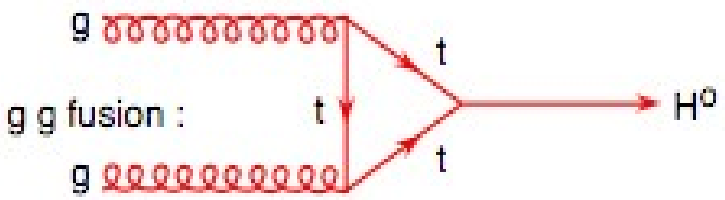
Approche expérimentale

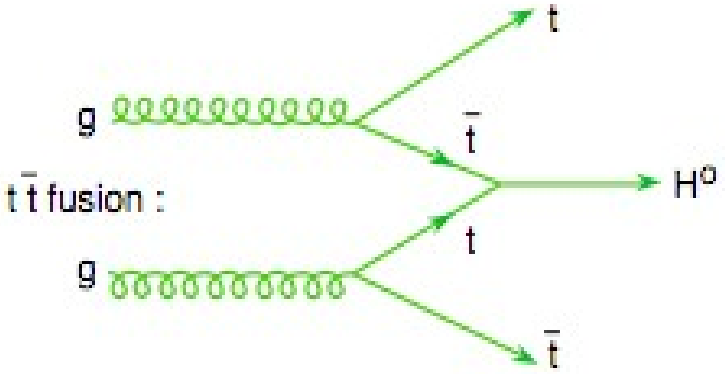
Quelques jours avant le début du LHC...



Recherche du boson de Higgs

1) Production

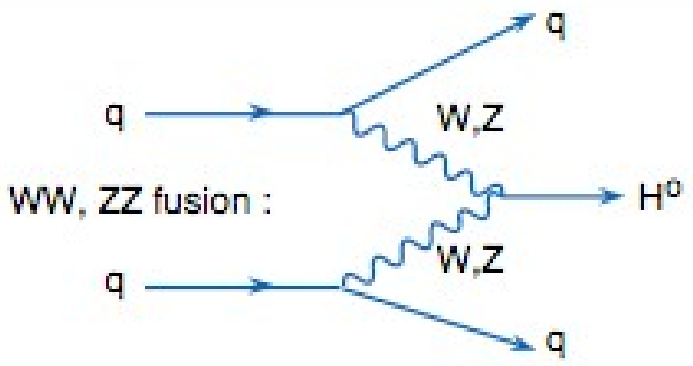




Fusion gluon gluon

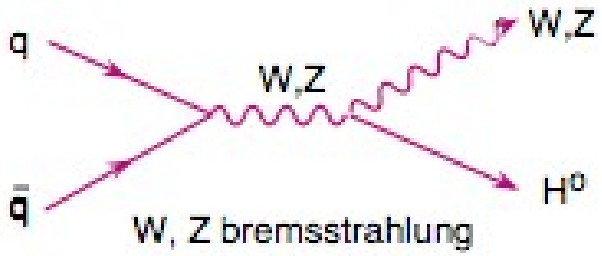
Recherche du boson de Higgs

1) Production



Vector Boson Fusion

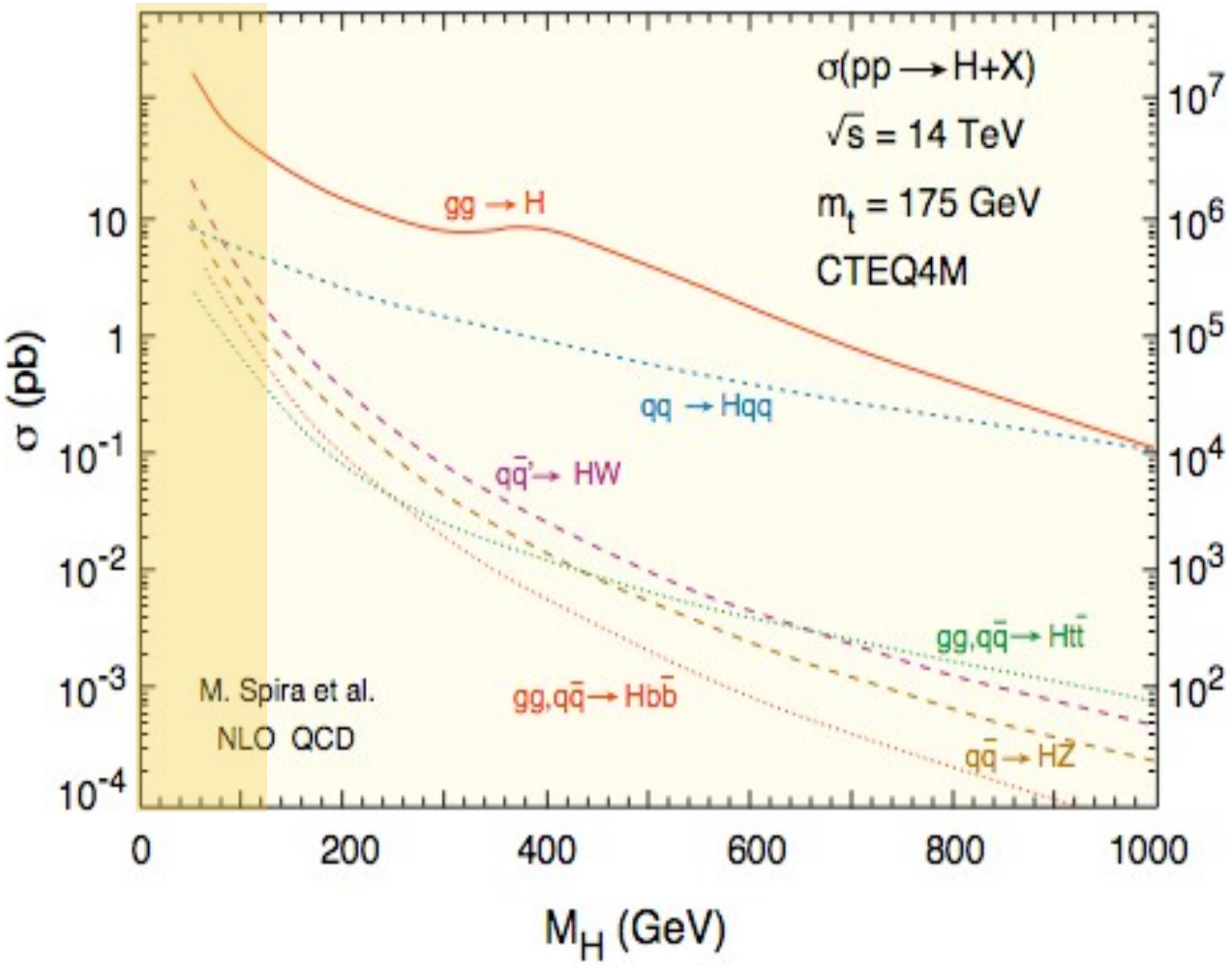
2 jets vers l'avant !
W/Z : pas d'échange de couleur



Productions associées WH ou ZH

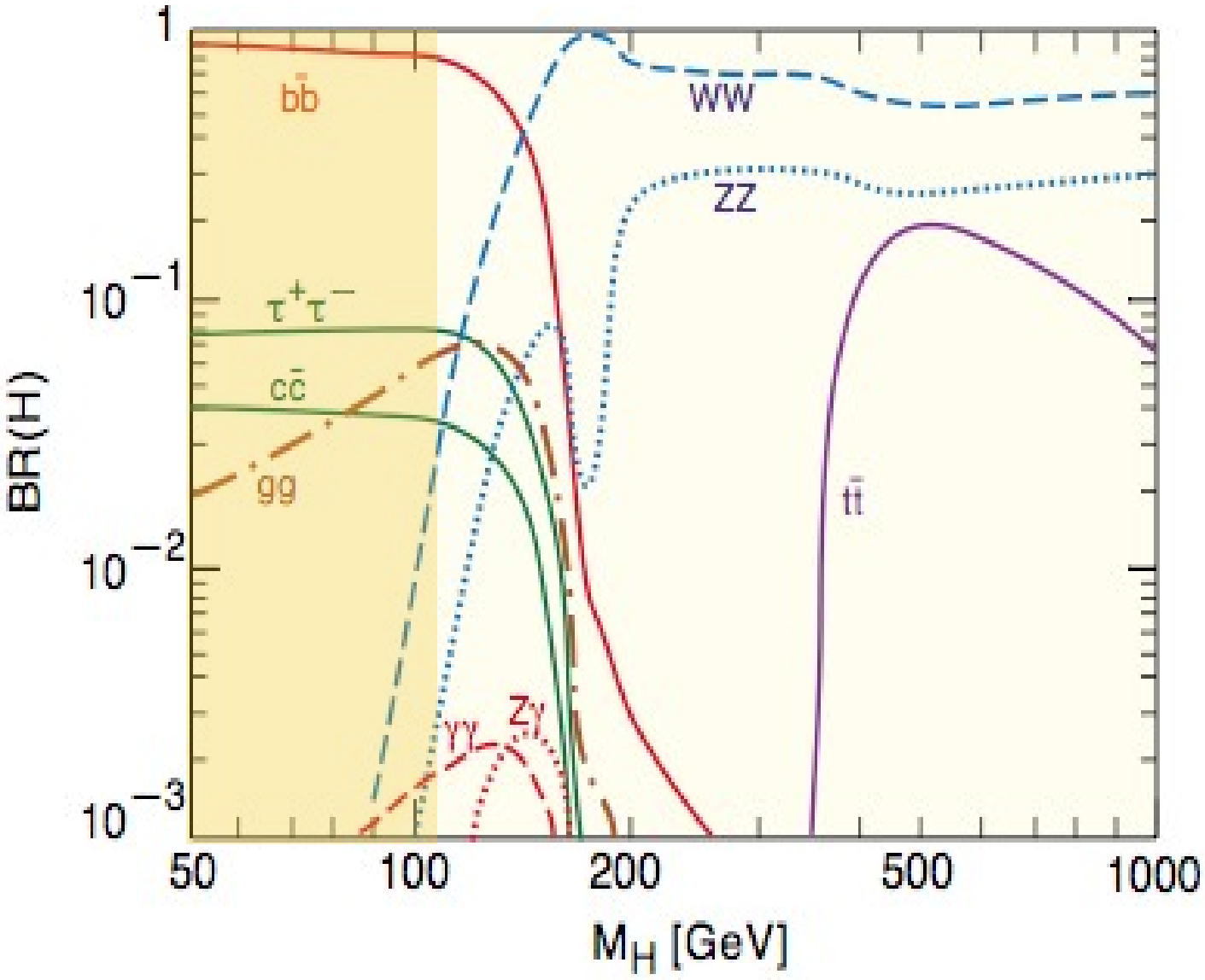
Recherche du boson de Higgs

1) Production

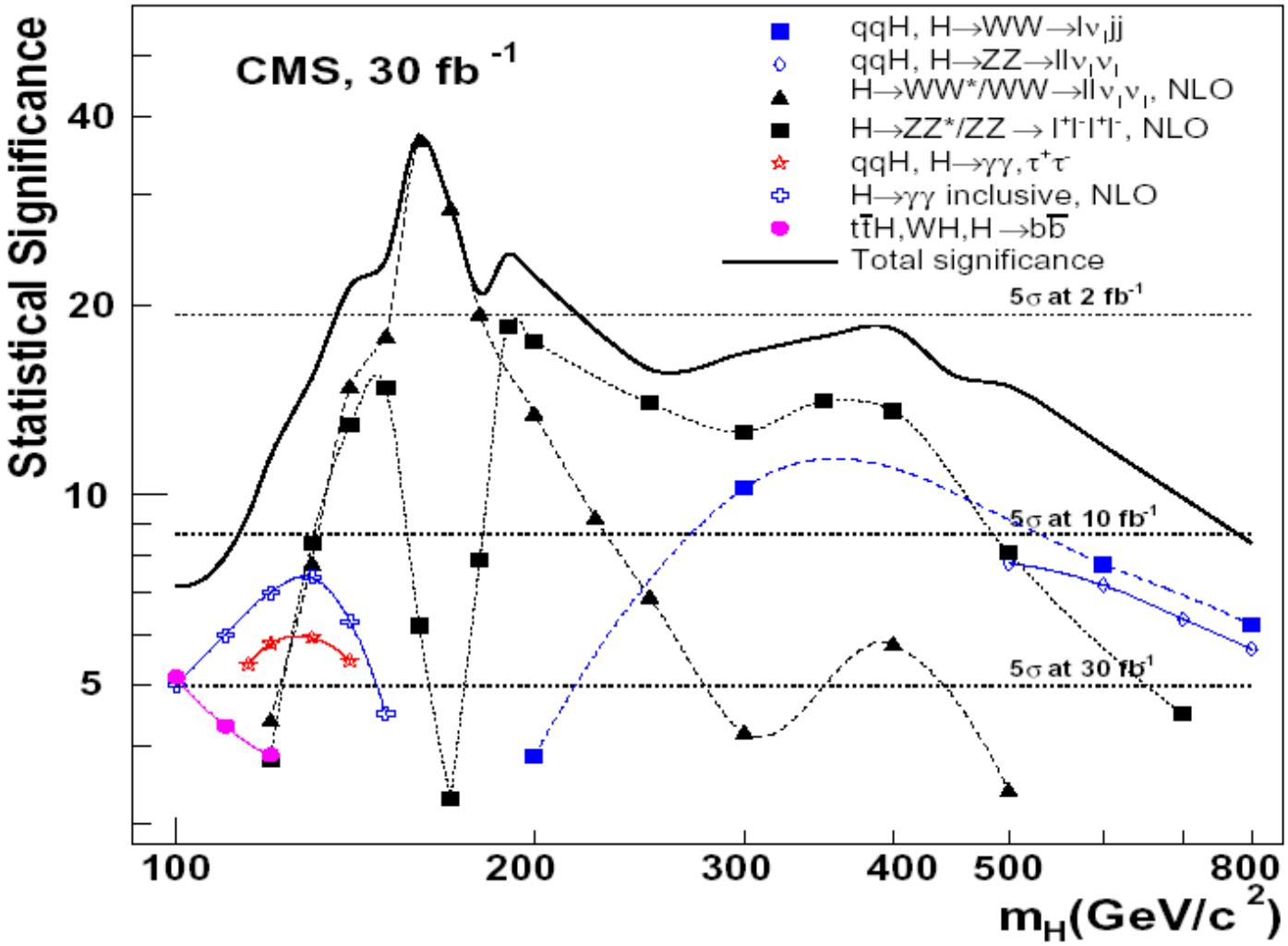


Recherche du boson de Higgs

2) Désintégration

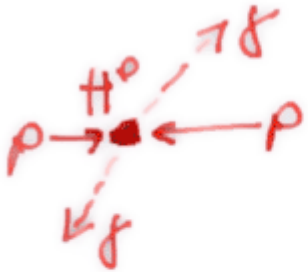


Recherche au LHC

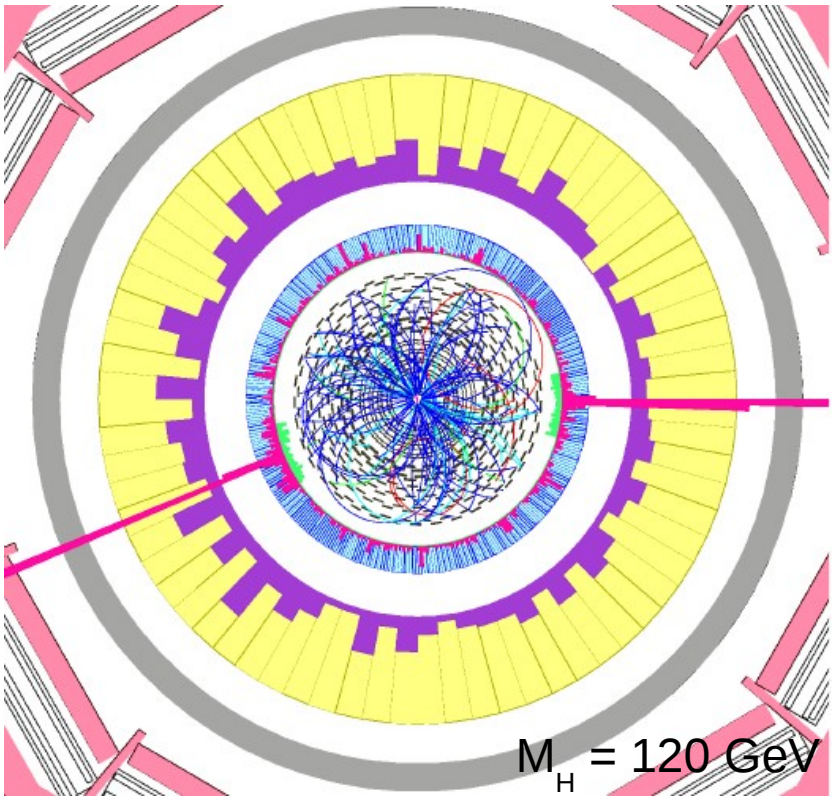


$H \to \gamma\gamma$

- 115 GeV < M_H < 150 GeV
- Deux photons “isolés” de grand p_T

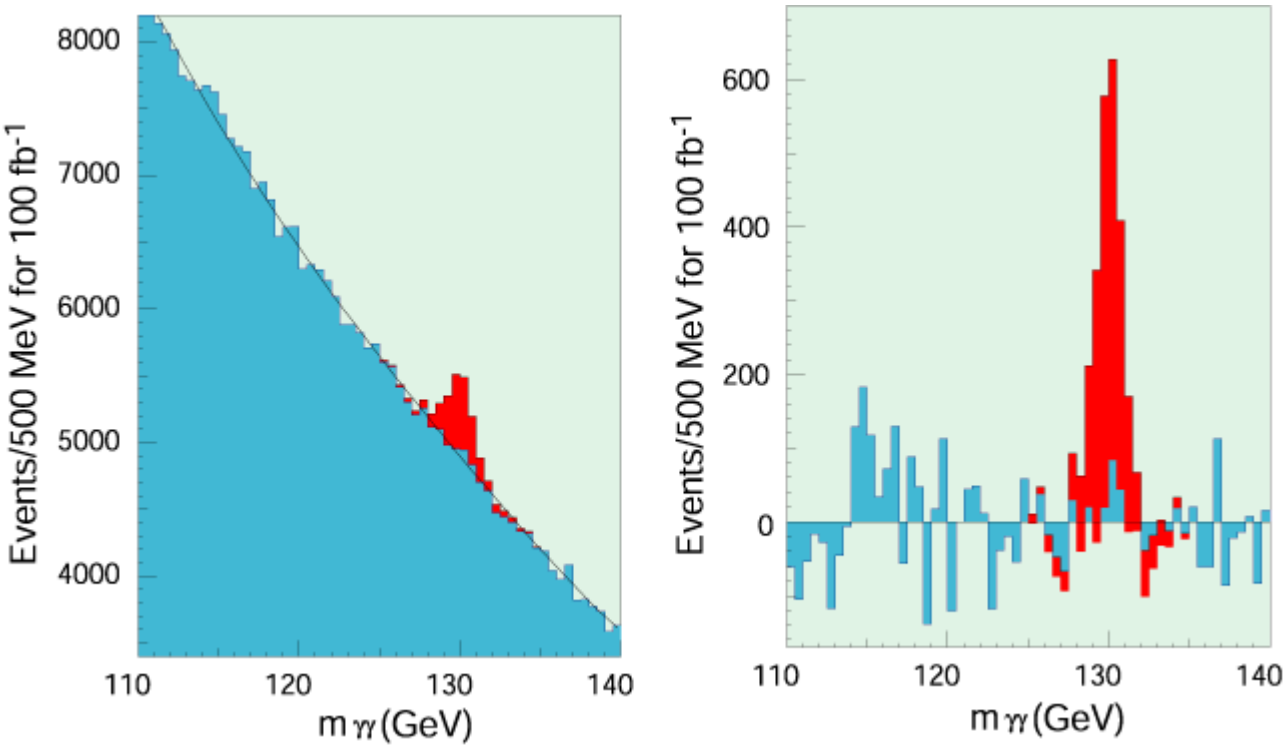


$p\,p \to H^0 \hookrightarrow \gamma\gamma$



$H \to \gamma\gamma$

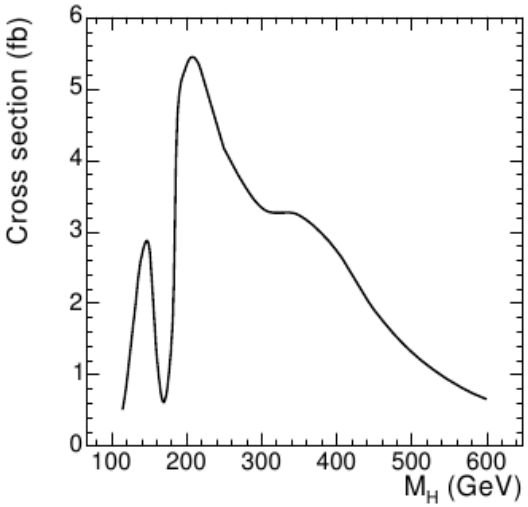
- BR ~ 0.002 (dominé par $H \to b\bar{b}$)
- Pic étroit sur un gros bruit de fond

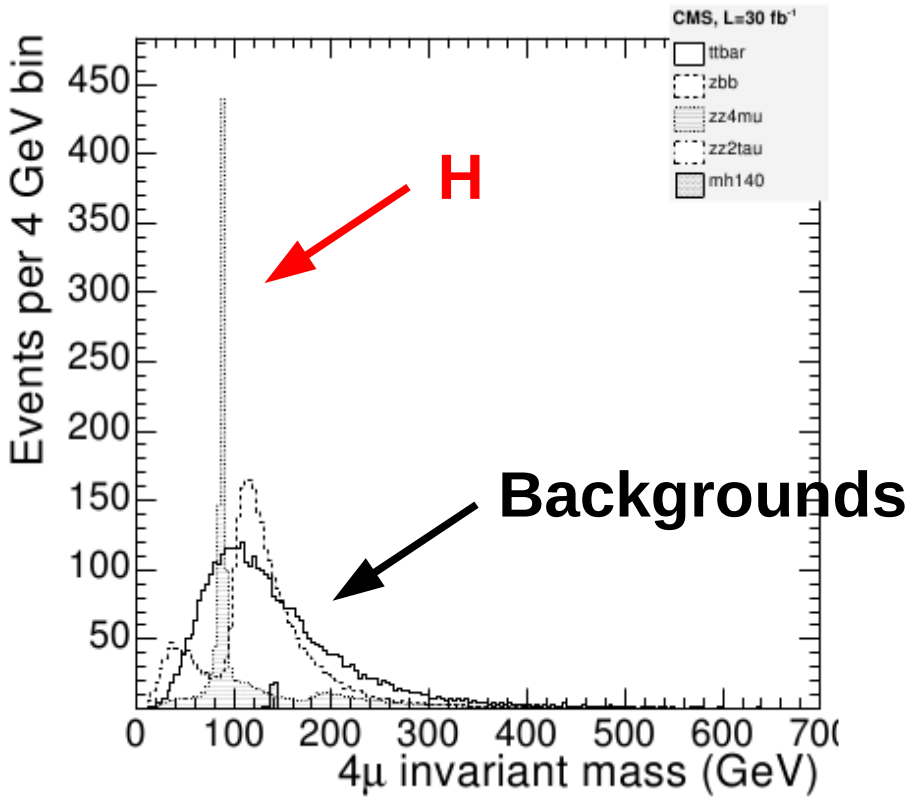


Masse invariante des deux photons

$H \rightarrow ZZ \rightarrow 4\,\mu$

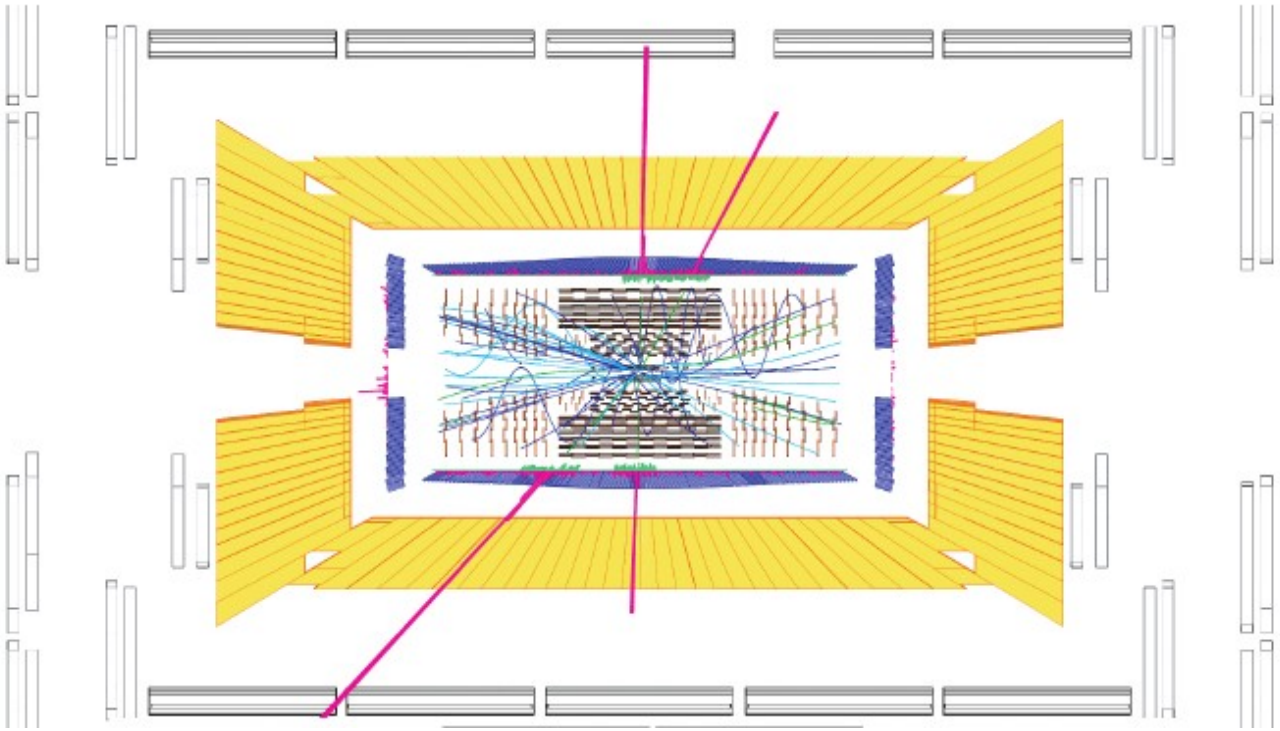
Golden channel ! $115\,\text{GeV} \longrightarrow 600\,\text{GeV}$





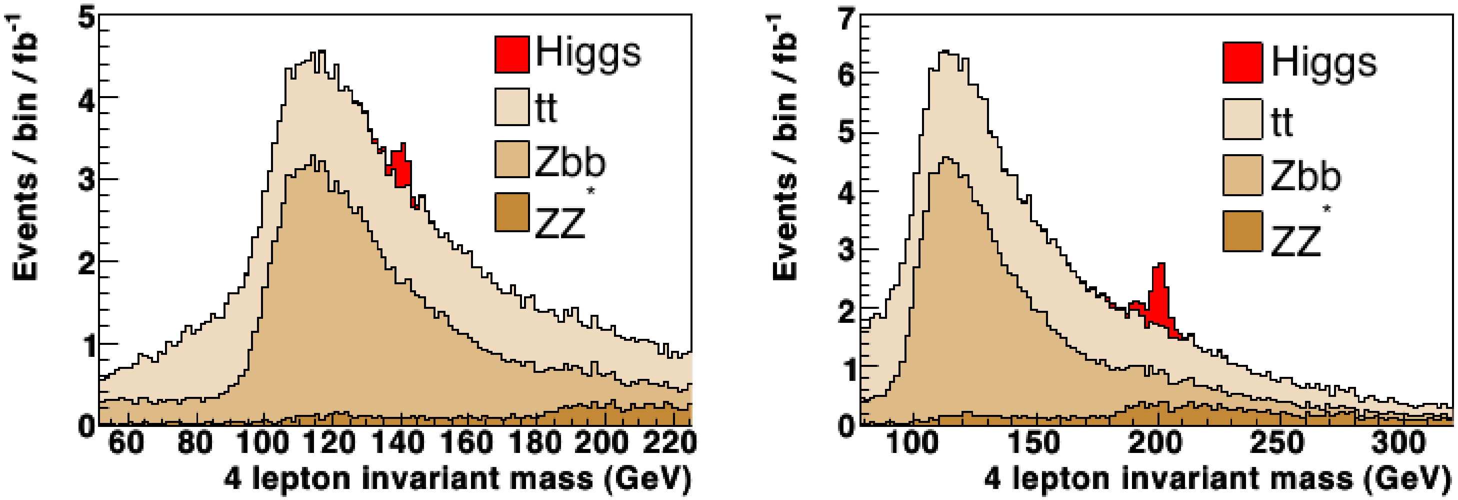
$H \rightarrow ZZ \rightarrow 4e$

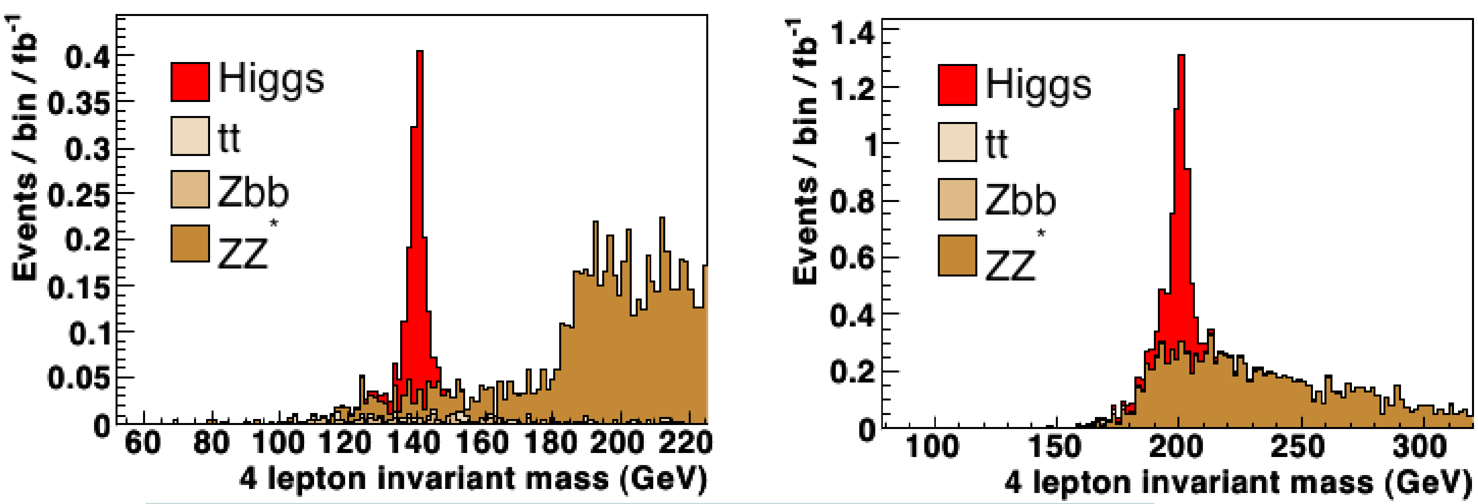
$H \rightarrow ZZ^{*} \rightarrow e^{+}e^{-}e^{+}e^{-}$ (M_H=150 GeV)



$H \to ZZ \to 2\mu 2e$

Avant analyse





Après analyse

Autres

Au-delà du Modèle Standard

$Z' \to \mu\,\mu$ Boson de jauge neutre lourd

$\gamma\,\gamma \to m\,\bar{m}$ Monopoles magnétiques

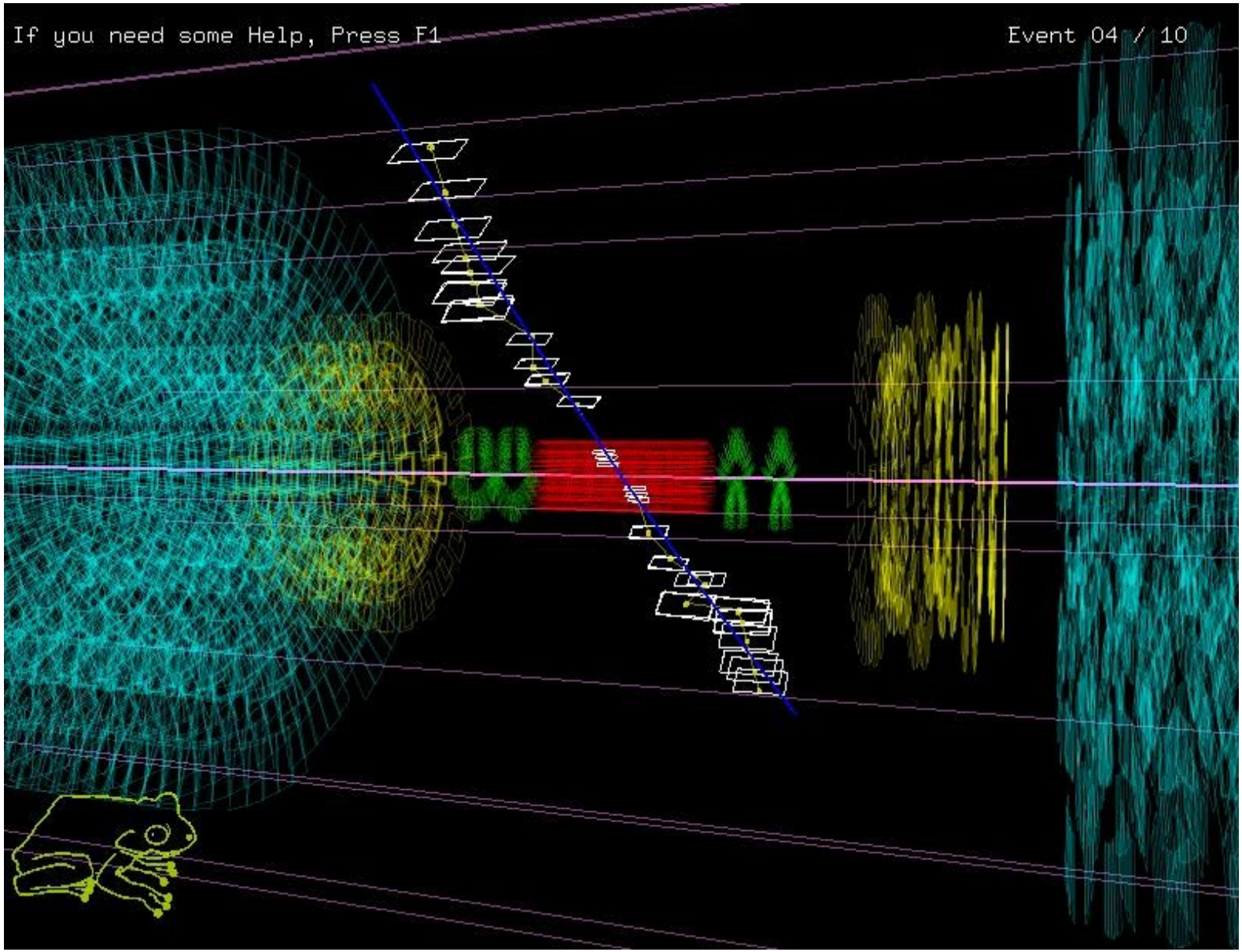
Particules supersymétriques

. . .

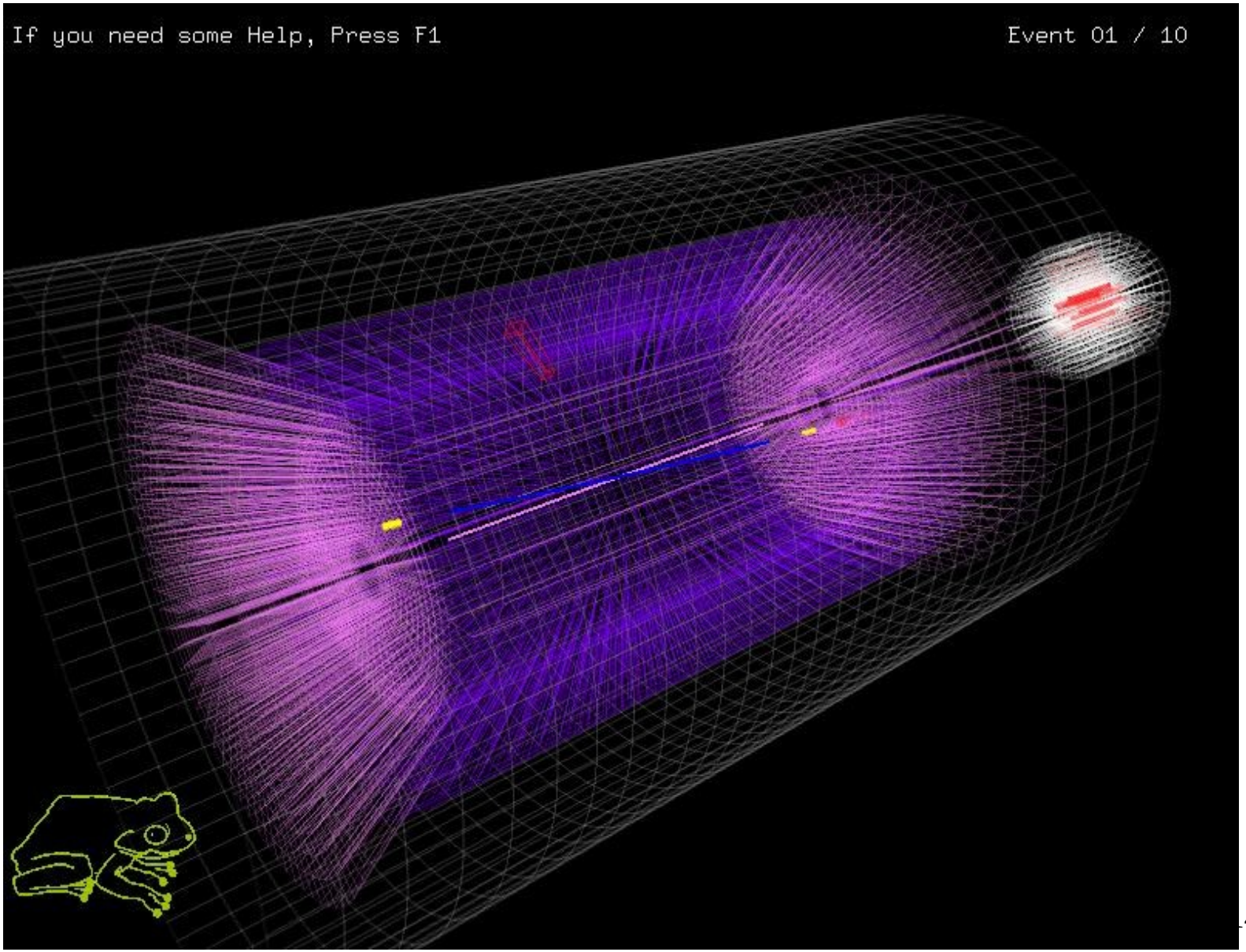
Dans le Modèle Standard

Physique du top, théorie électrofaible, ...

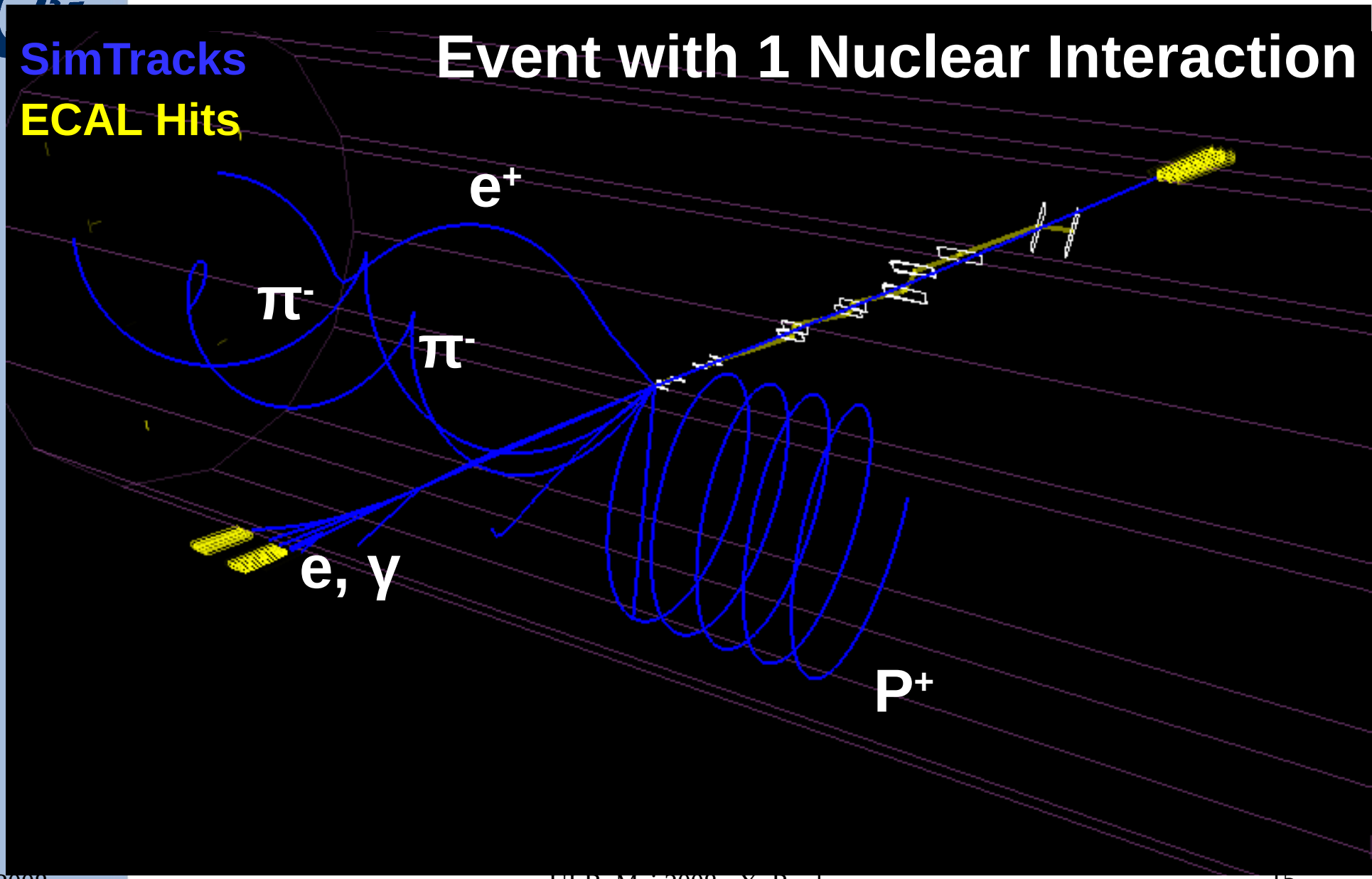
L'intérieur du tracker



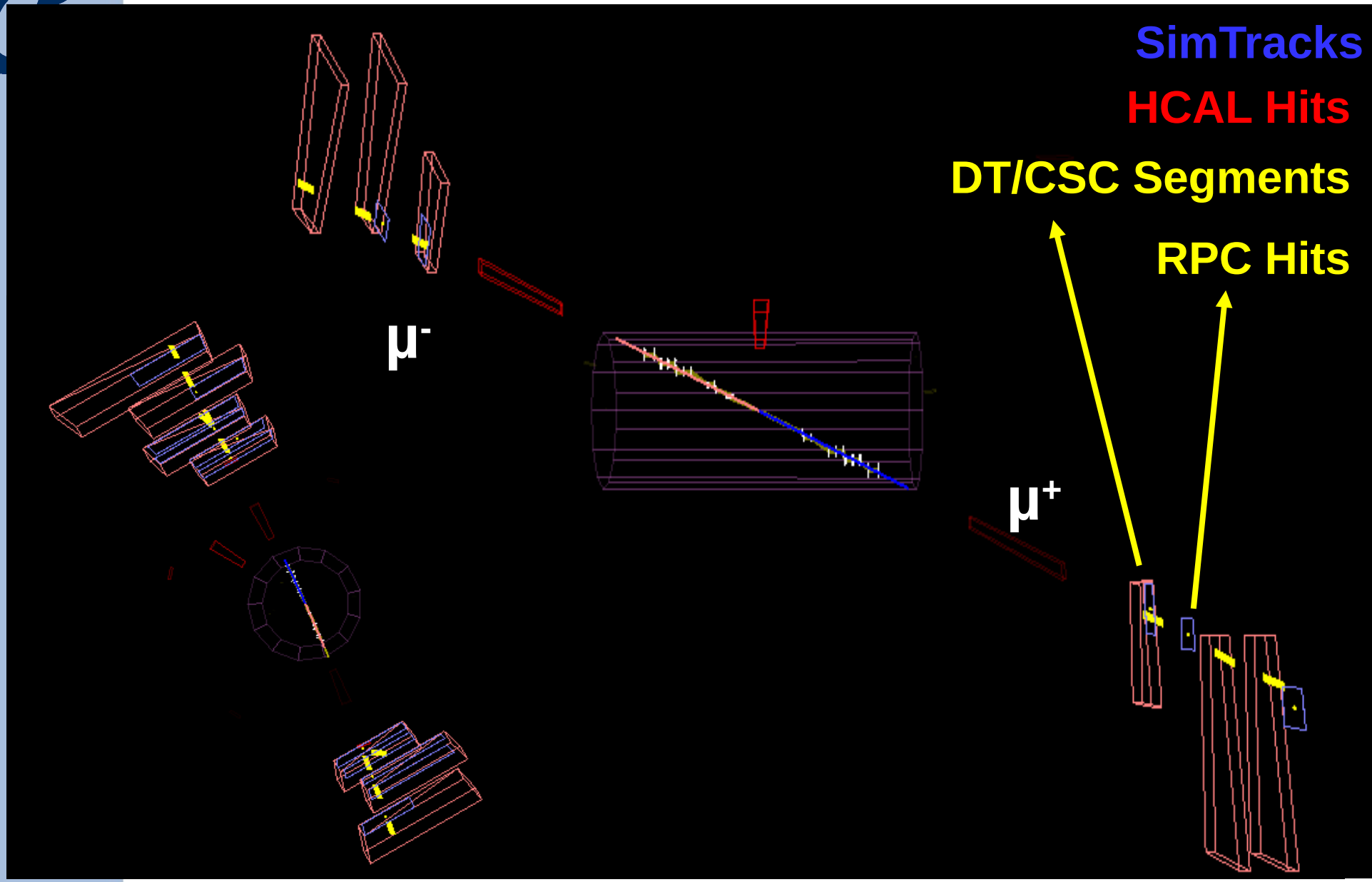
L'intérieur du calorimètre



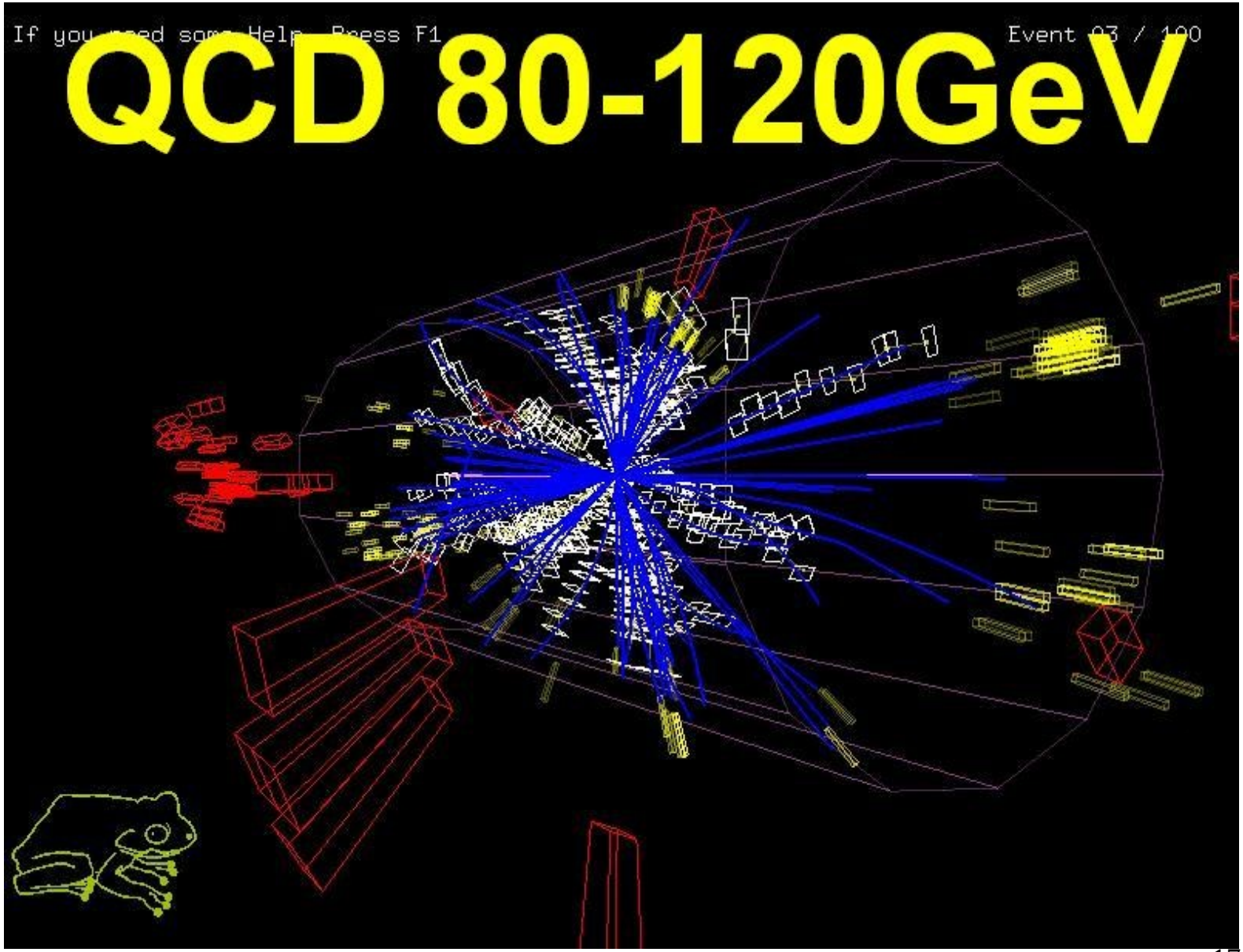
Une interaction nucléaire...



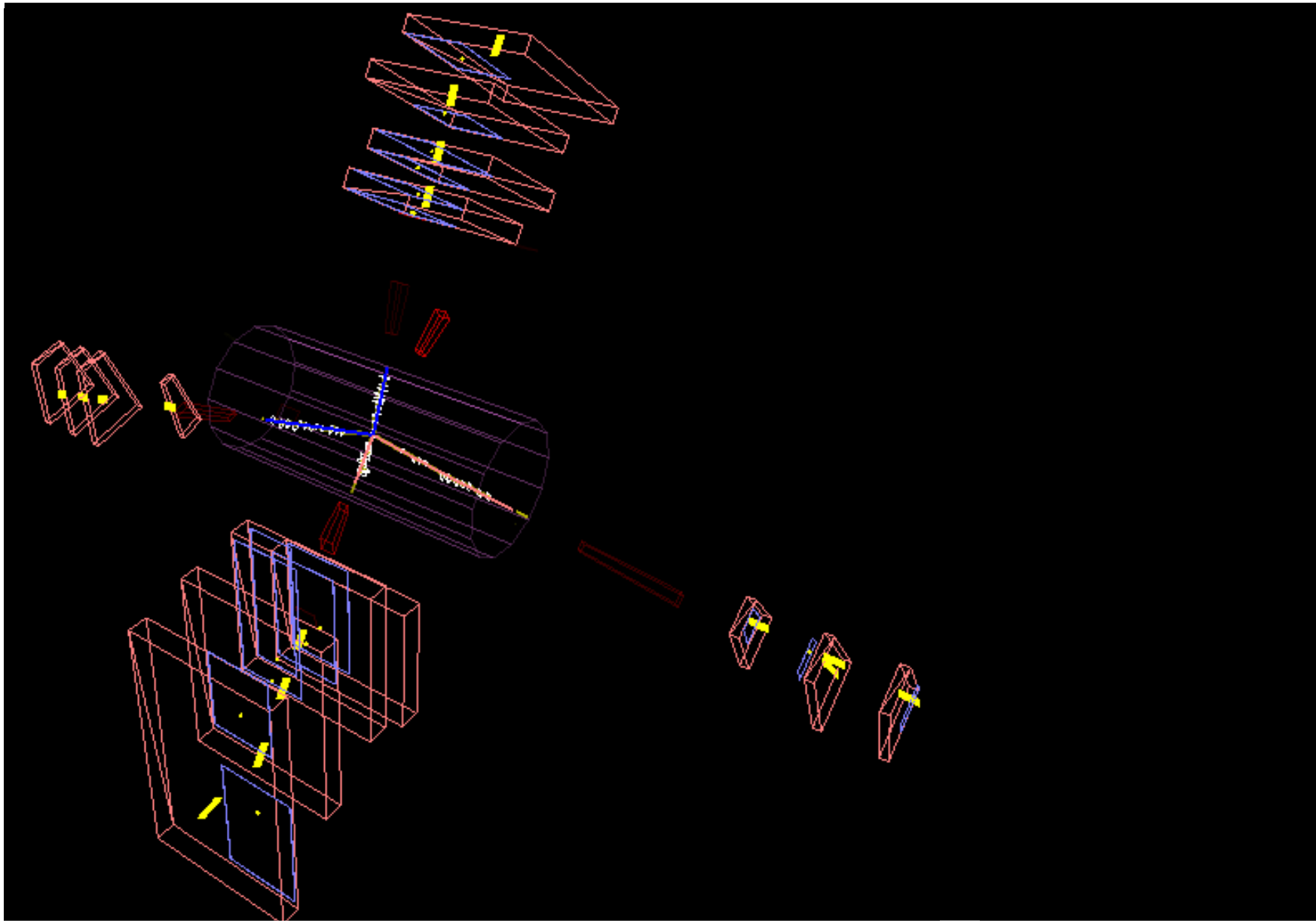
Deux muons !



Des jets...

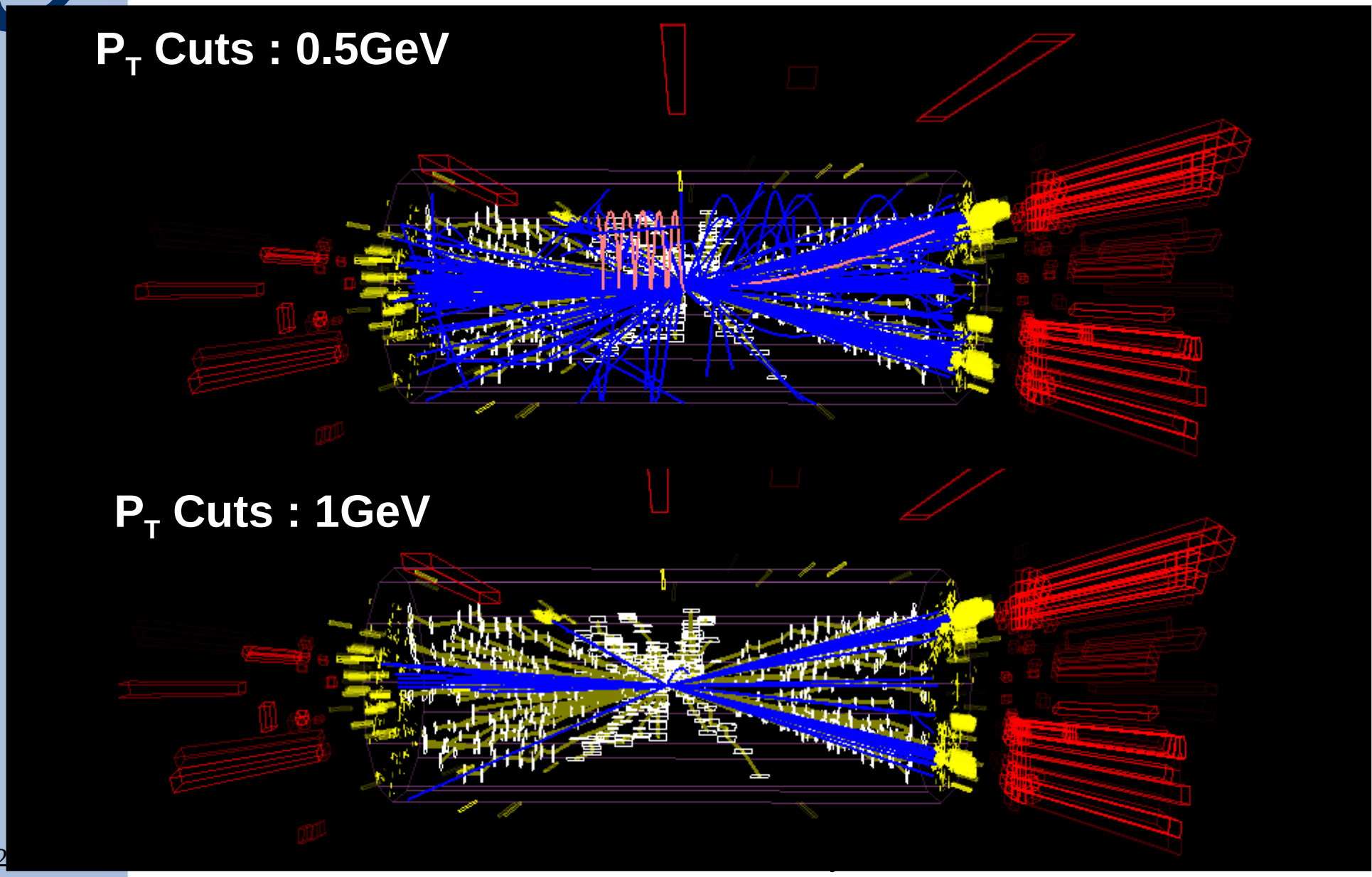


Voici le Higgs !

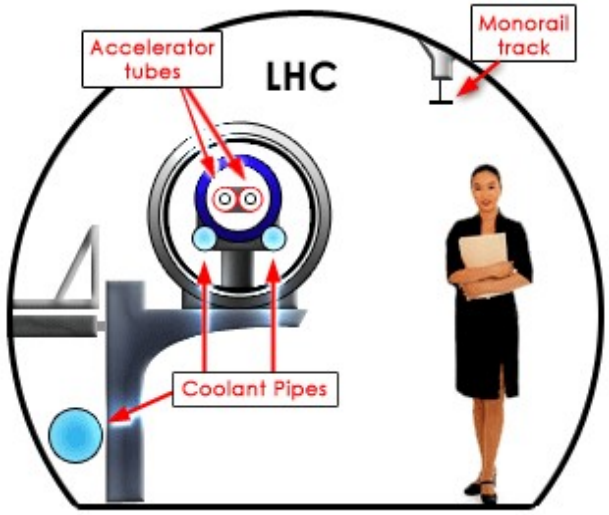


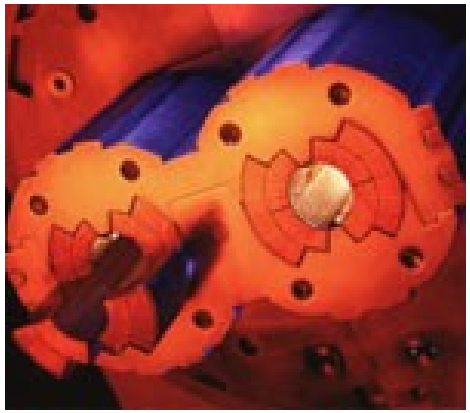
Z'(700GeV) -> Jet Jet

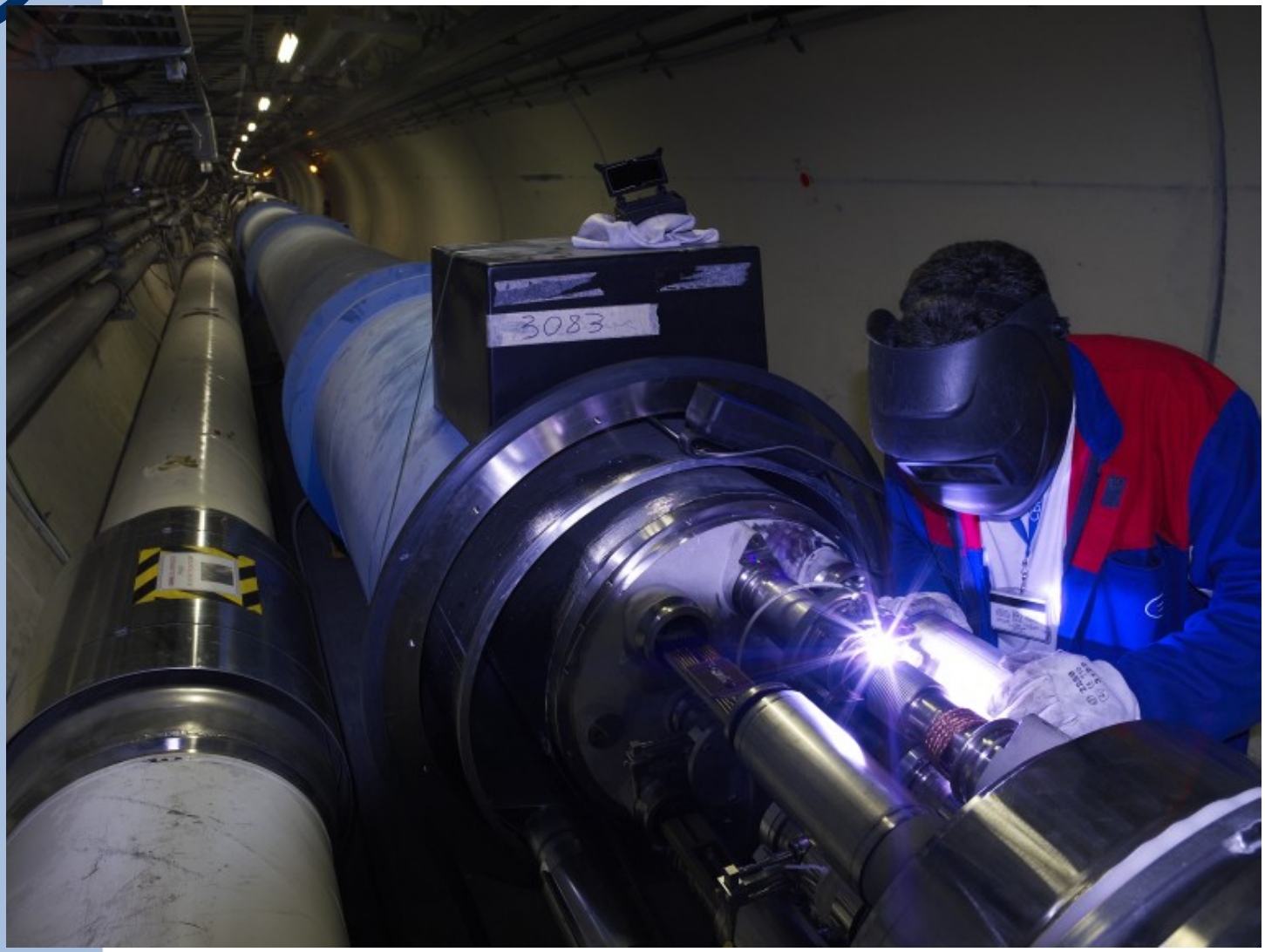
FROG, L. Quertenmont, V. Roberfroid

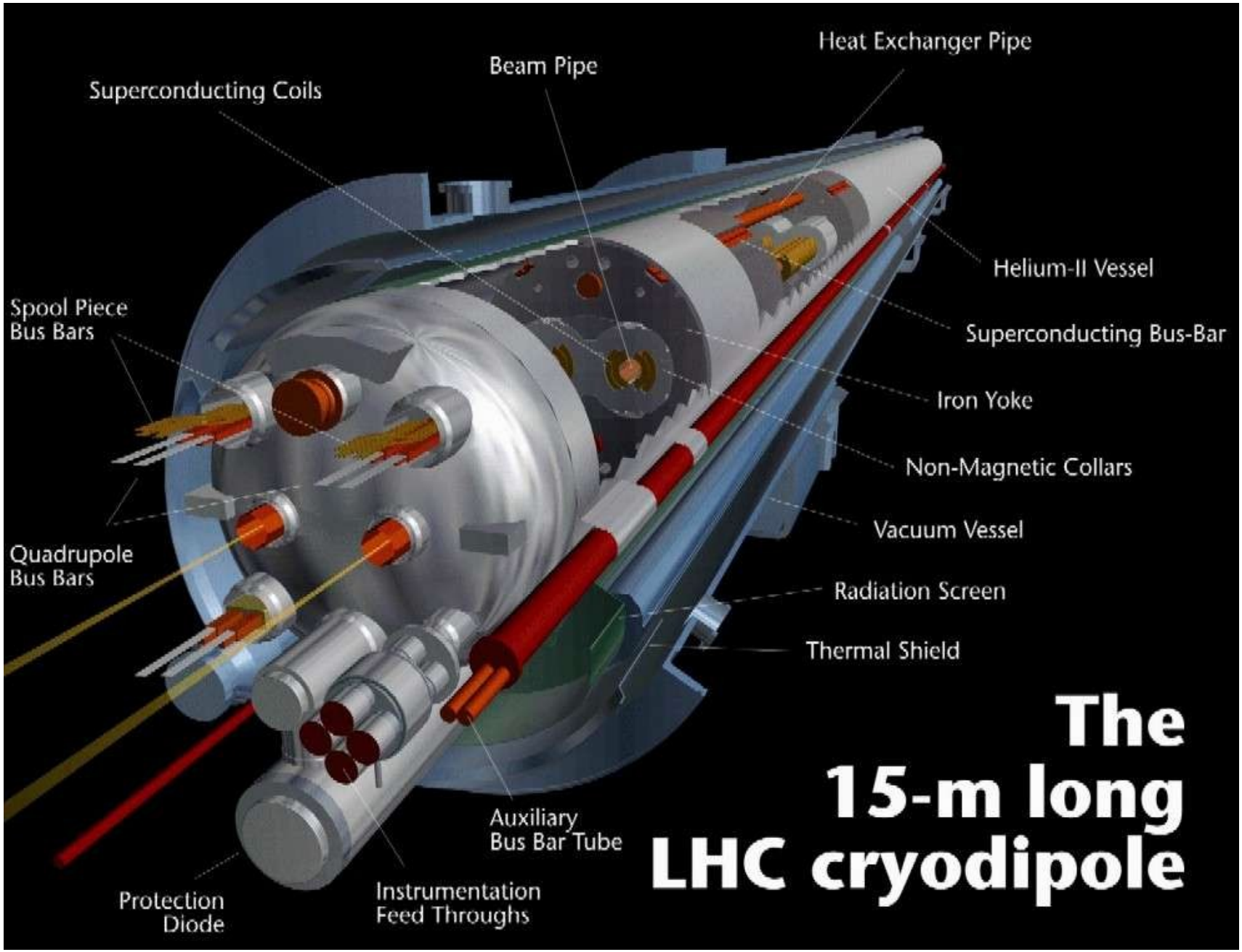


Le LHC


Accelerator tubes
LHC
Monorail track
Coolant Pipes




3083


Heat Exchanger Pipe
Beam Pipe
Superconducting Coils
Helium-II Vessel
Spool Piece
Bus Bars
Superconducting Bus-Bar
Iron Yoke
Non-Magnetic Collars
Vacuum Vessel
Quadrupole
Bus Bars
Radiation Screen
Thermal Shield
The
15-m long
LHC cryodipole
Auxiliary
Bus Bar Tube
Protection
Diode
Instrumentation
Feed Throughs


KEK • Fermilab
HCLQX
JPG

Quelle énergie ?

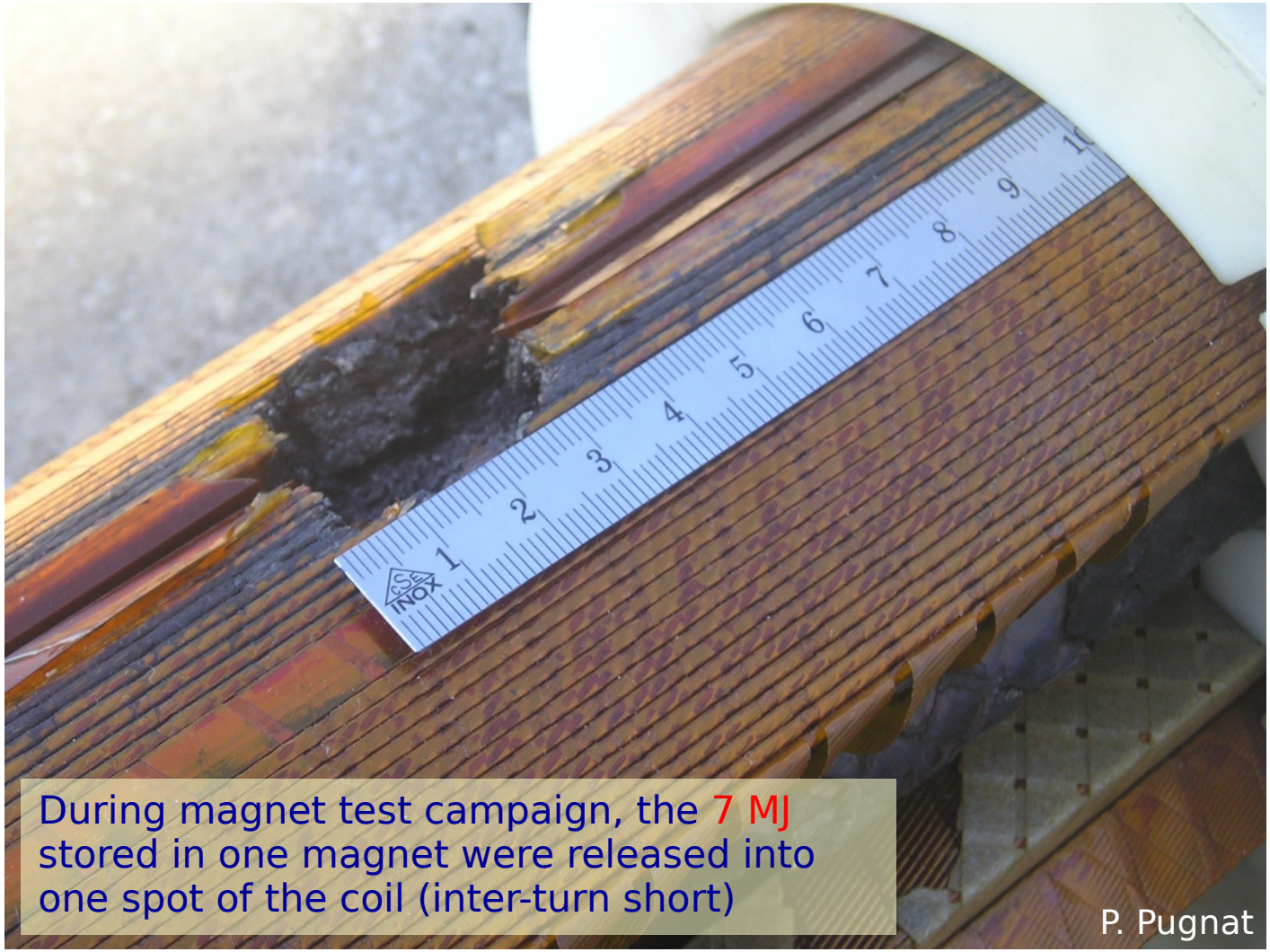
- 14 TeV
- 11 GJ dans les dipôles

  = un porte-avion à 55 km/h

  = 3 tonnes de TNT

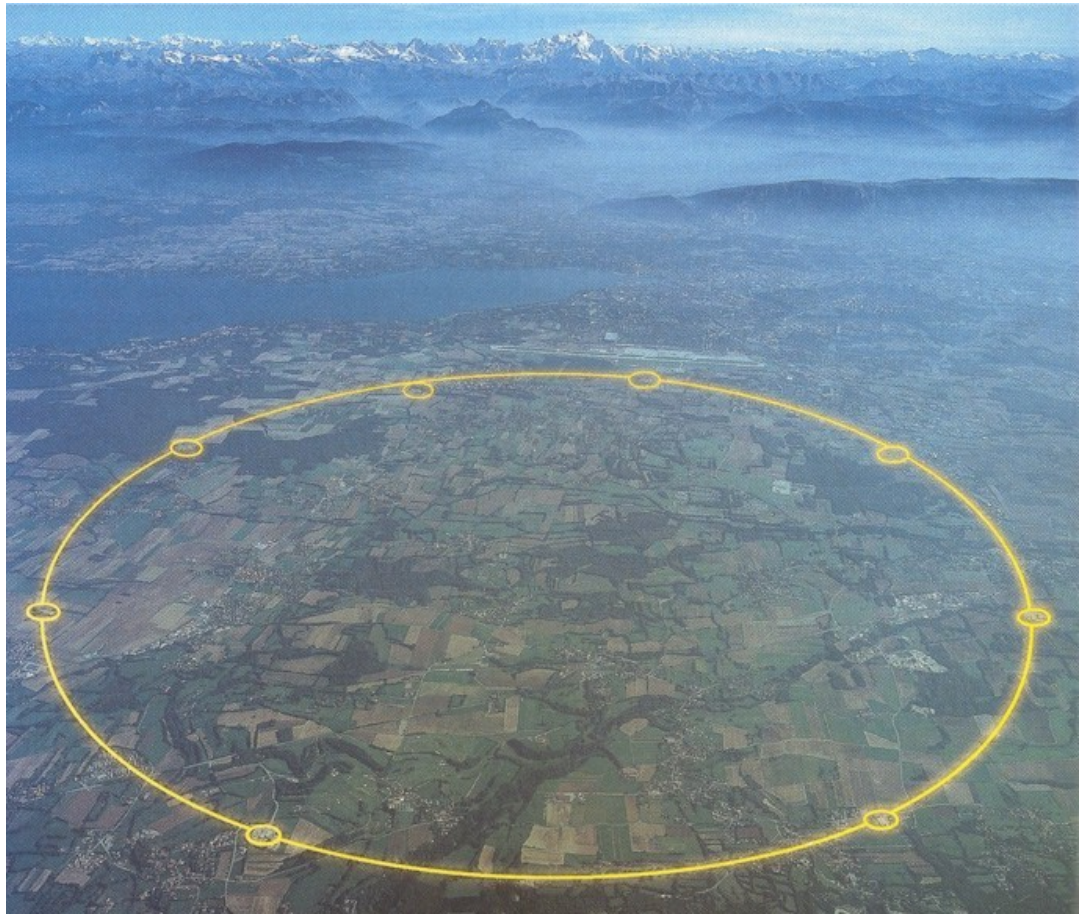
  = 370 kg de chocolat noir
- 362 MJ dans les faisceaux

  = ce qu'il faut pour faire fondre 500 kg de Cu


During magnet test campaign, the 7 MJ stored in one magnet were released into one spot of the coil (inter-turn short)
P. Pugnat

“C'était le bon temps...”

- LHC
- ISS
- ITER
- VLT
- ICE³
- GRID
- VIRGO
- ...



“~~C'était~~ le bon temps...”

- LHC
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“c'est le bon temps !”

Pour faire de la physique...