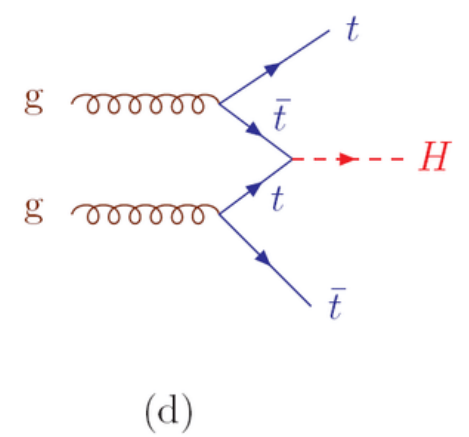
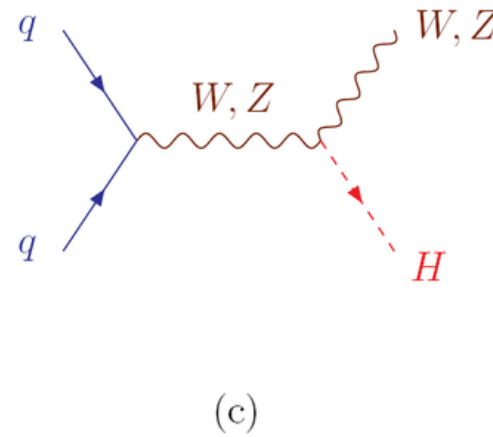
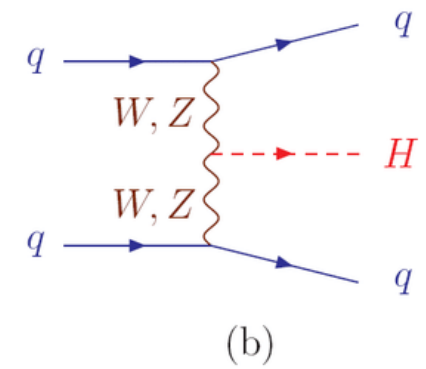
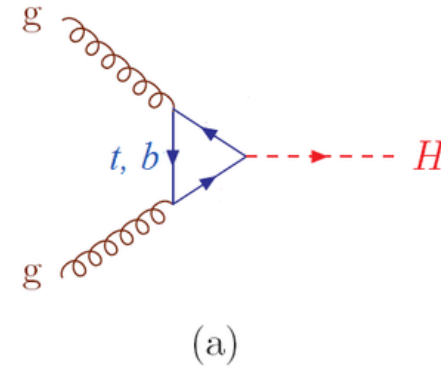
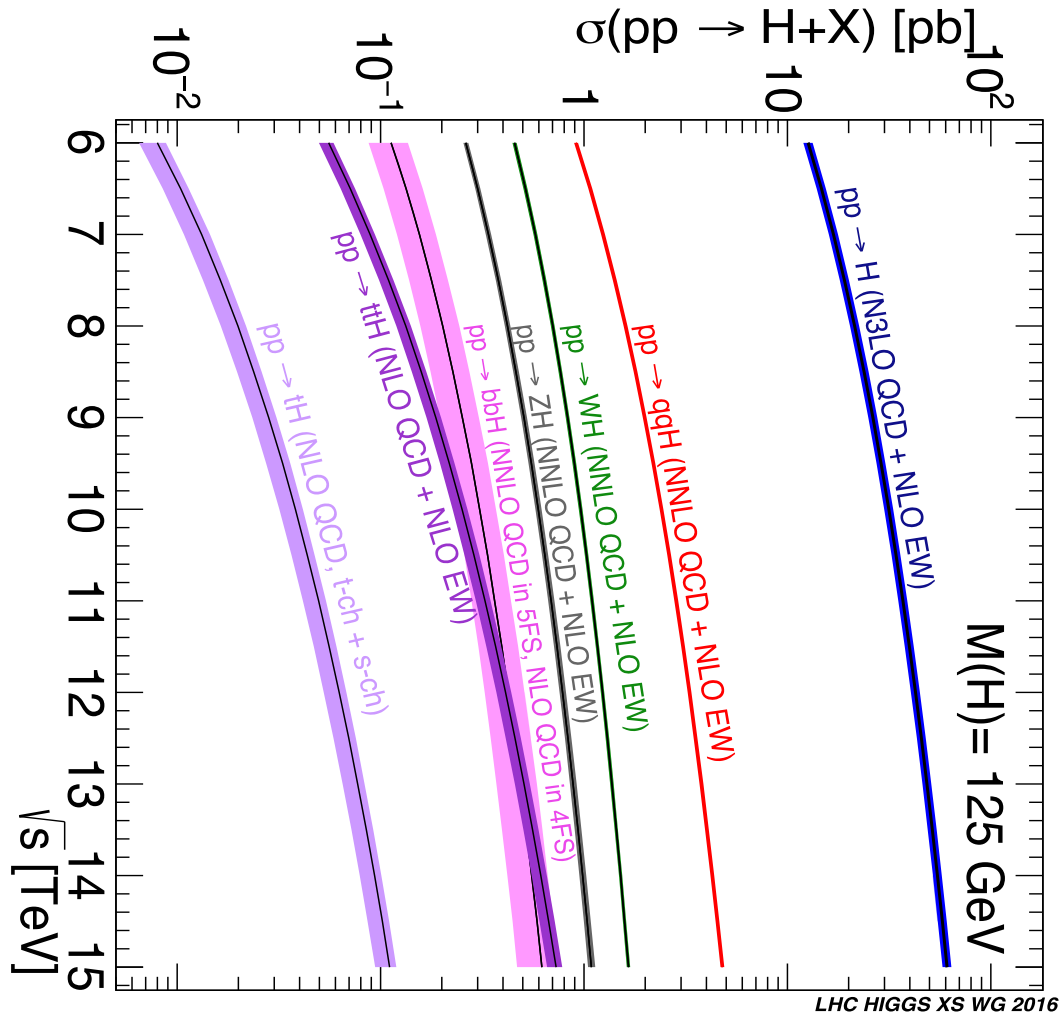


Redécouverte du boson H dans le canal $H \rightarrow ZZ^{(*)} \rightarrow l^+ l^- l'^+ l'^-$

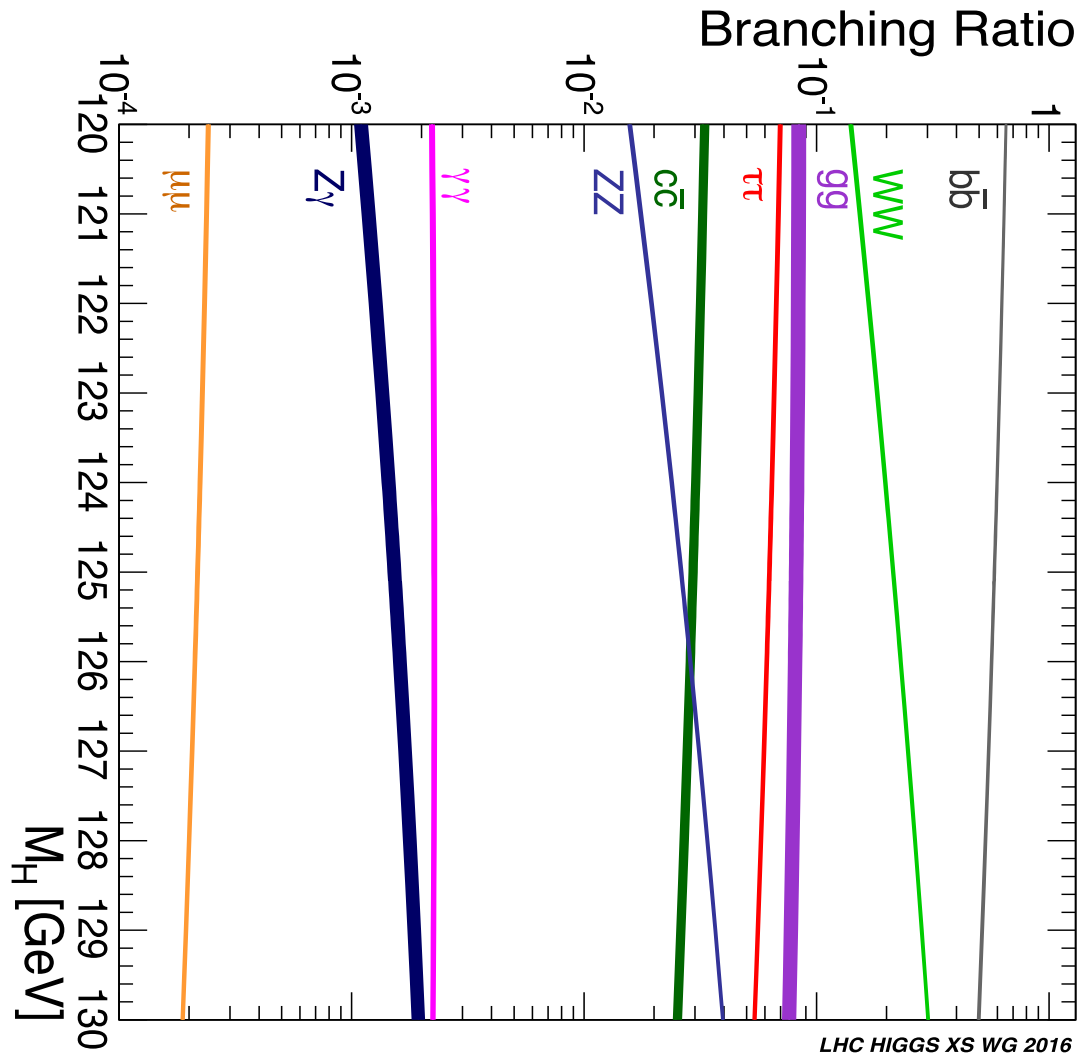
stage BA3

18 février 2025

Production du boson H du modèle standard au LHC



Modes de désintégration du boson H du modèle standard



$$m_H = 125 \text{ GeV:}$$

$$BR(H \rightarrow ZZ^{(*)} \rightarrow l^+ l^- l'^+ l'^-); (l, l' = e, \mu) = 1.25 \times 10^{-4}$$

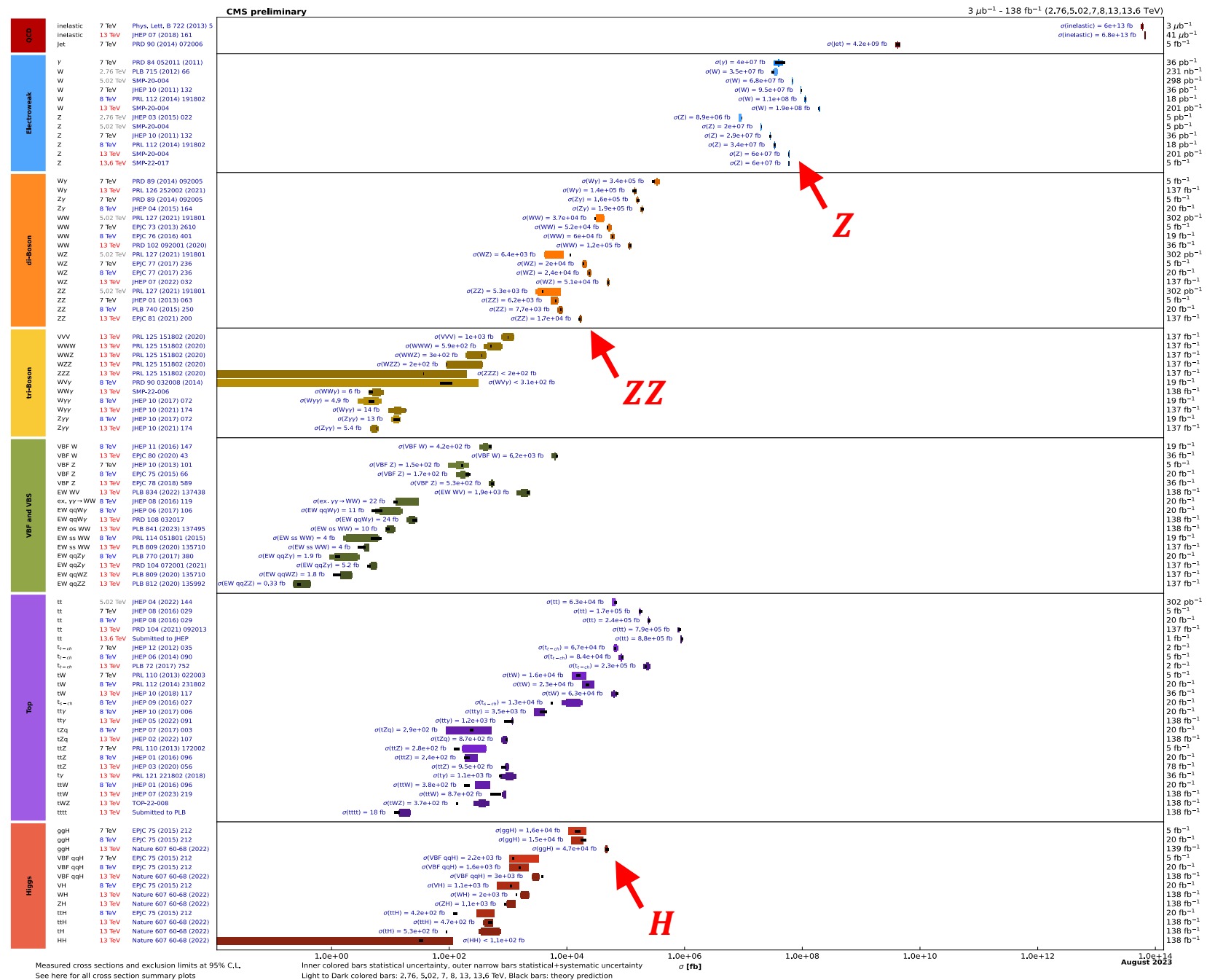
$$BR(Z \rightarrow l^+ l^-) = 3.37\%$$

Nombre d'événements attendus pour $\int \mathcal{L} dt = 140 \text{ fb}^{-1}$?

Overview of CMS cross section results

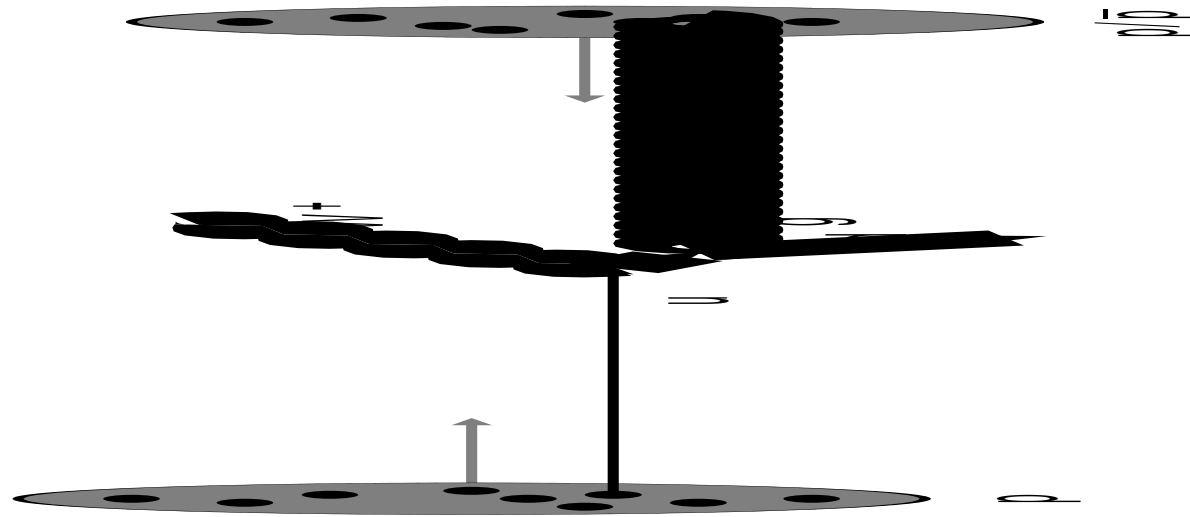
Bruits de fond

- ZZ
- $Z + jets$



Effets dus à la QCD

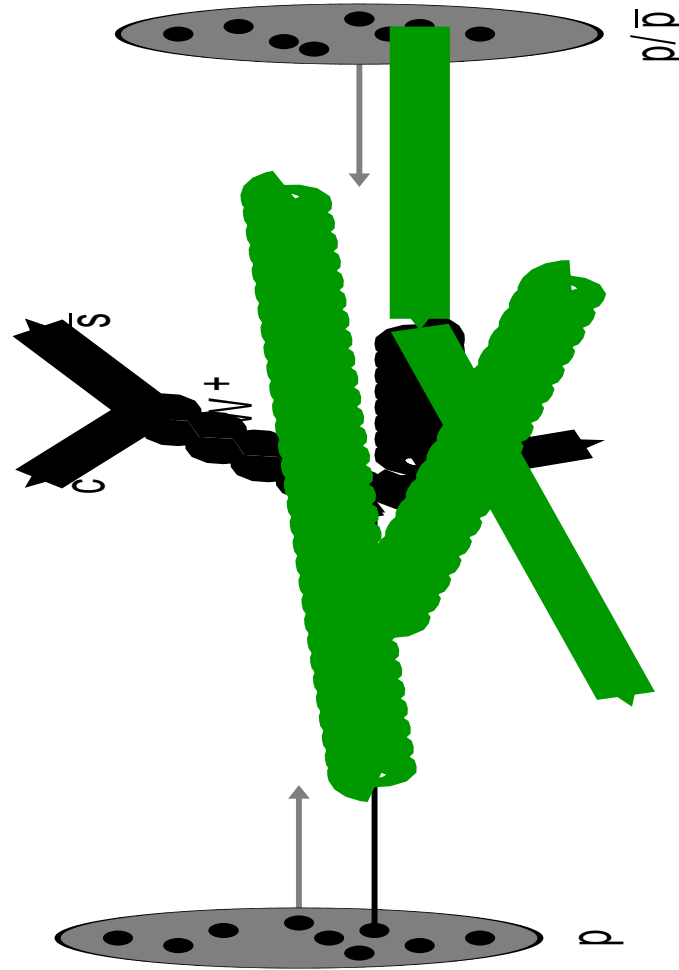
Processus partonique



Sjostrand, T., *Monte Carlo Generators for the LHC*,
Academic Training Lectures, CERN, 2005

Effets dus à la QCD

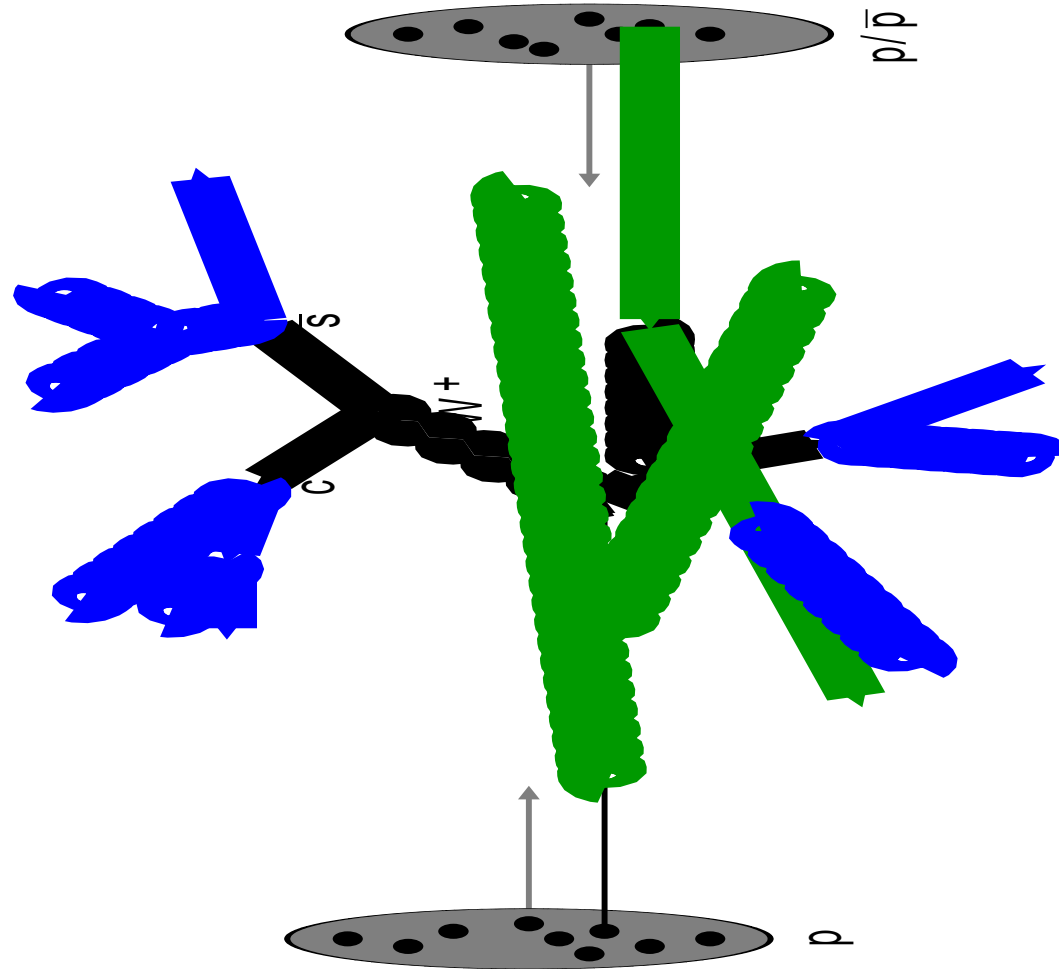
Radiations de gluons et quarks dans l'état initial



Initial-state radiation: spacelike parton showers

Effets dus à la QCD

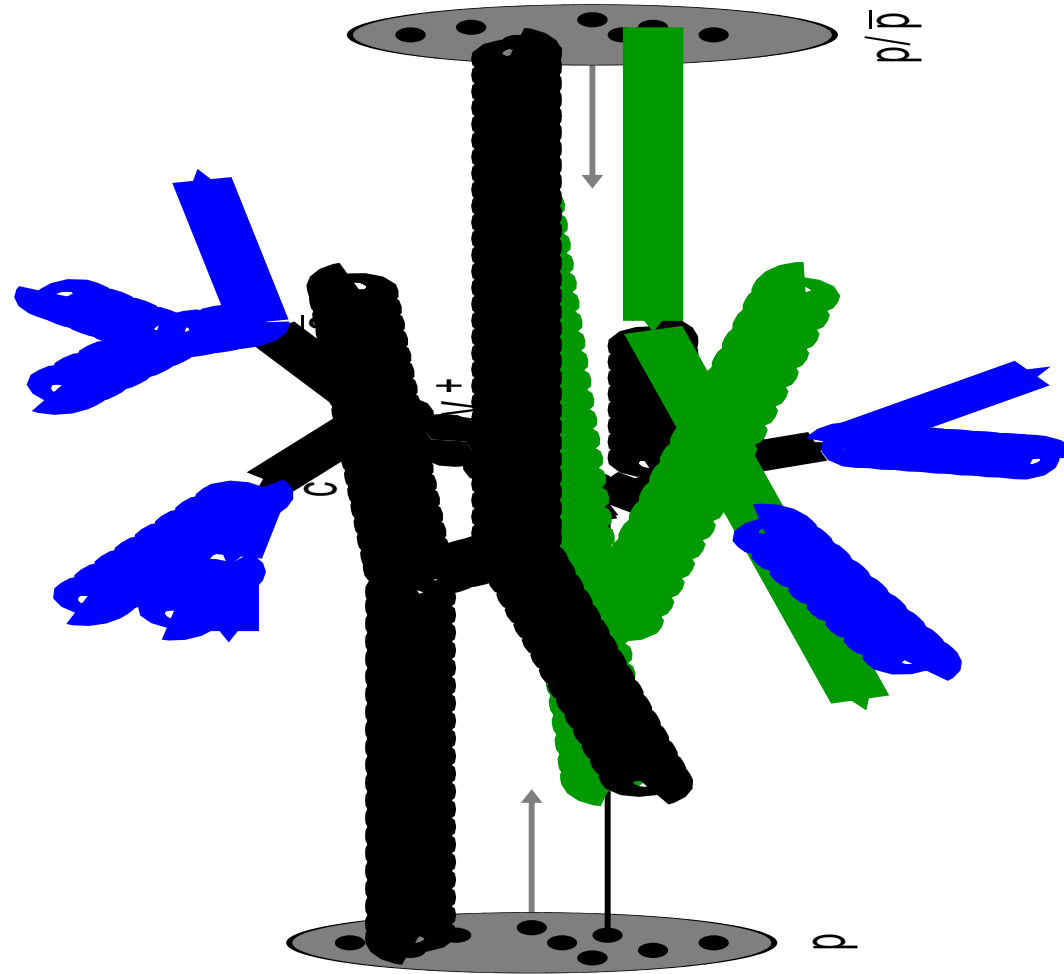
Radiations dans l'état final



Final-state radiation: timelike parton showers

Effets dus à la QCD

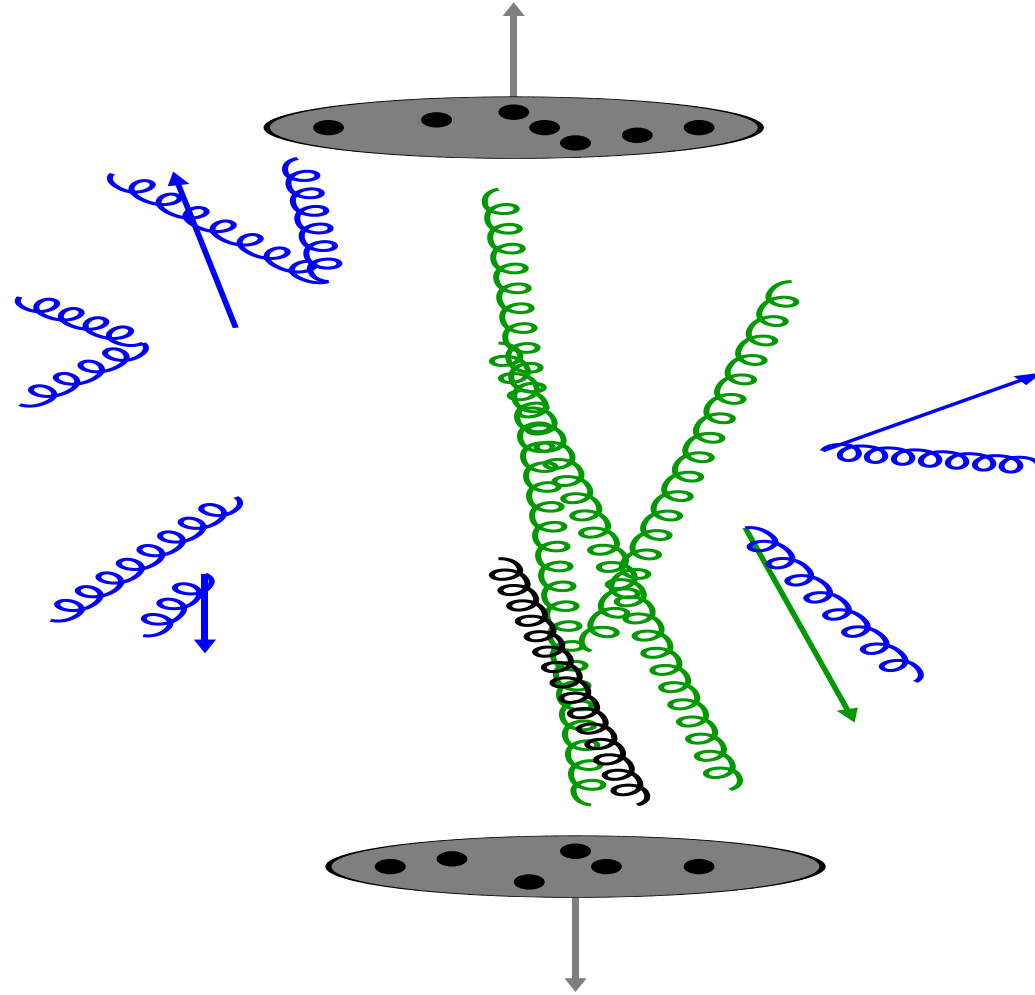
Interactions partoniques multiples



Multiple parton-parton interactions ...

Effets dus à la QCD

Restes des faisceaux; partons dans l'état final



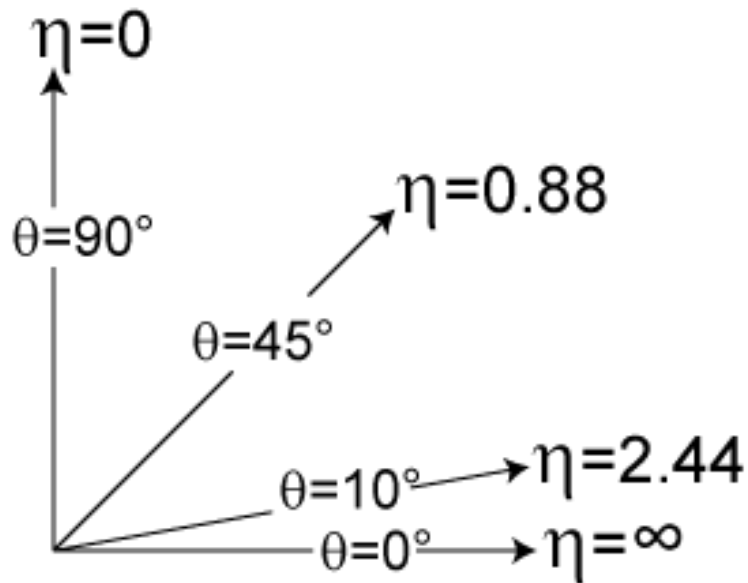
Beam remnants and other outgoing partons

Cinématique: $\vec{p} = (p_T, \eta, \varphi)$

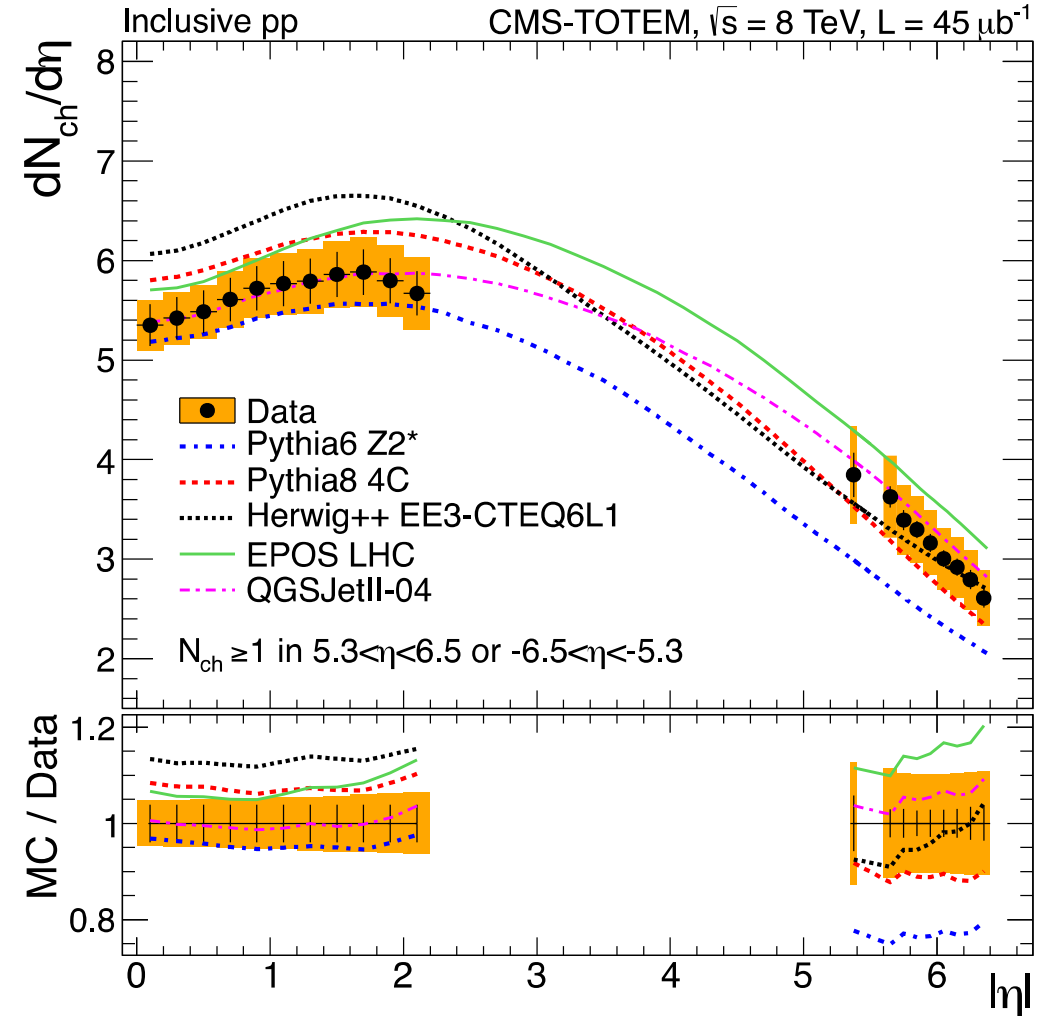
$$\eta \equiv -\ln \left[\tan \left(\frac{\theta}{2} \right) \right] = \frac{1}{2} \ln \left(\frac{|\mathbf{p}| + p_L}{|\mathbf{p}| - p_L} \right) = \operatorname{arctanh} \left(\frac{p_L}{|\mathbf{p}|} \right)$$

$$y \equiv \frac{1}{2} \ln \left(\frac{E + p_L}{E - p_L} \right)$$

- Δy est indépendante du boost du système partonique dans la direction des faisceaux
- $dN/d\eta$ est approx. constant

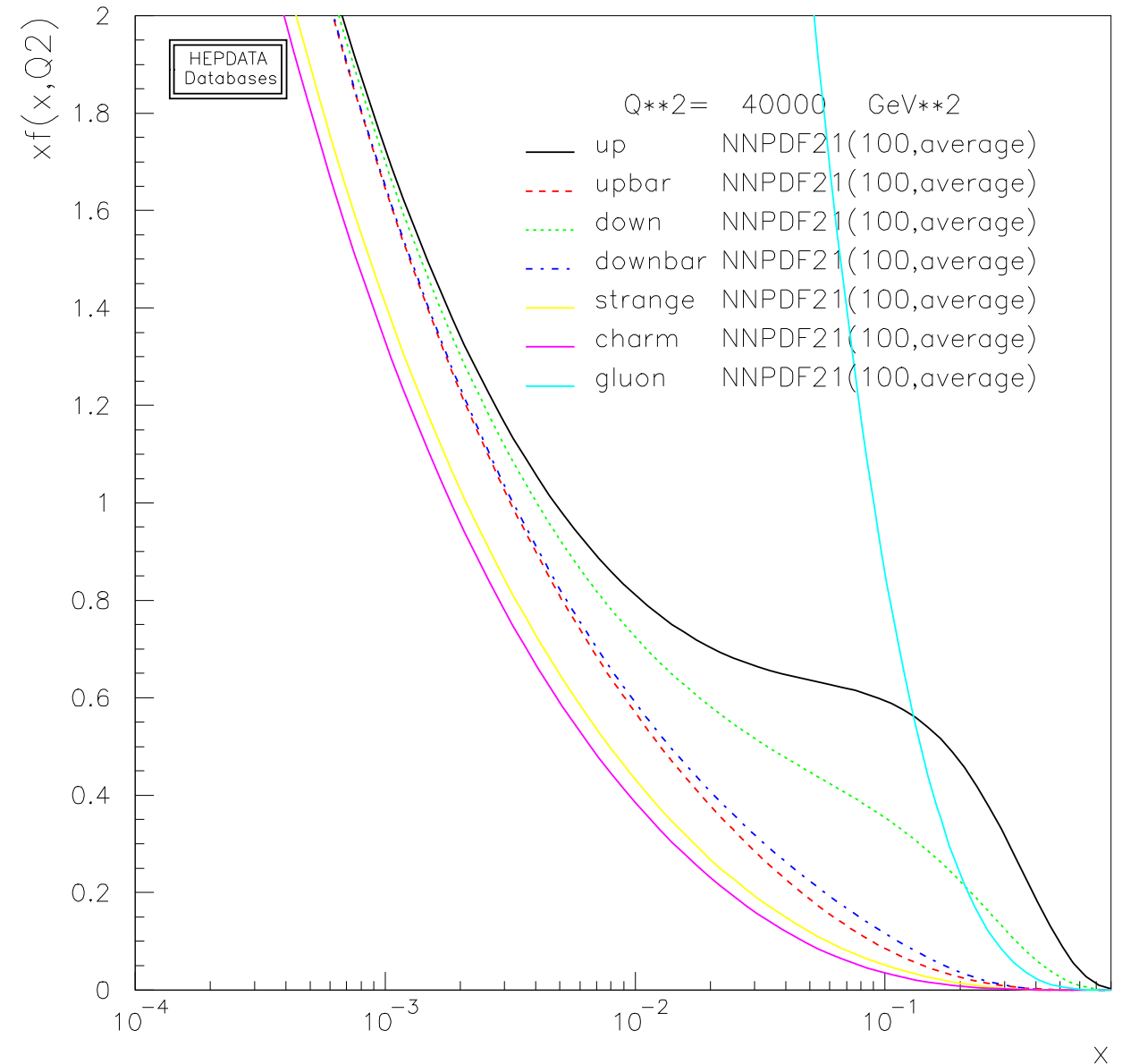


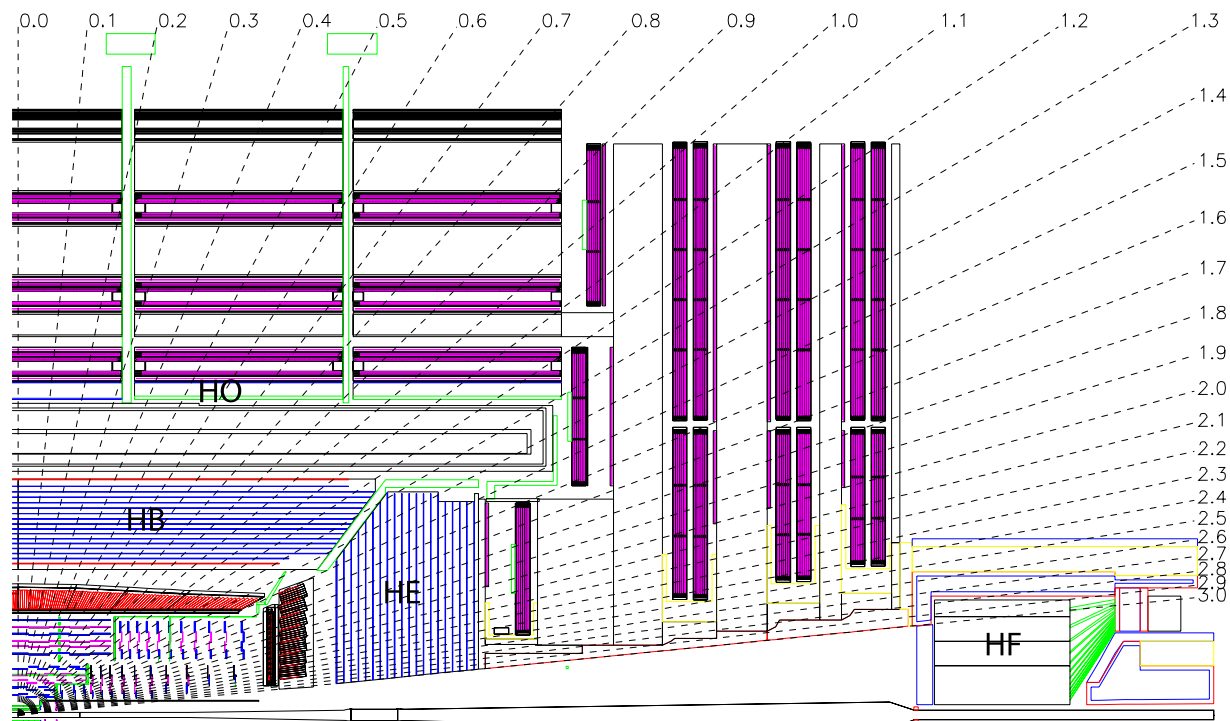
arxiv:1405.0722



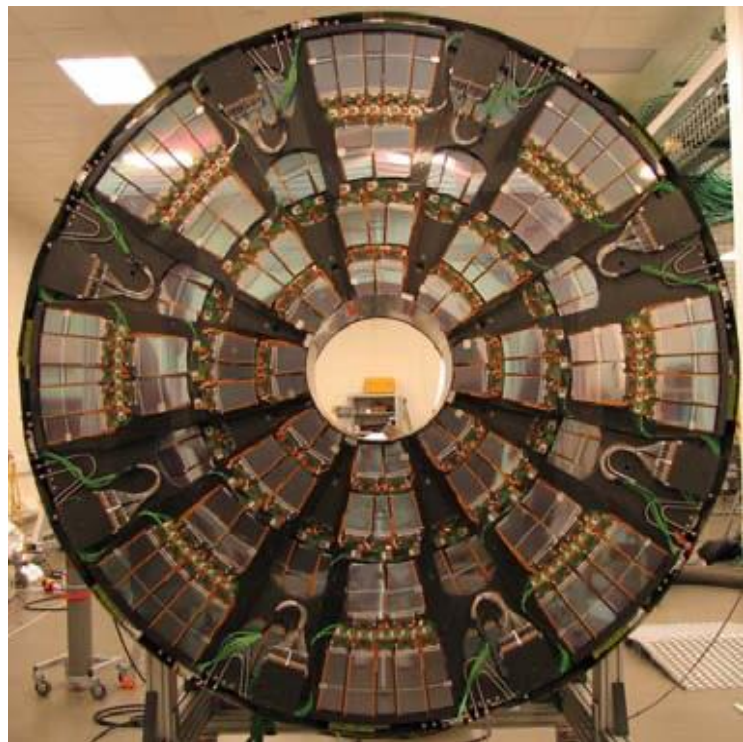
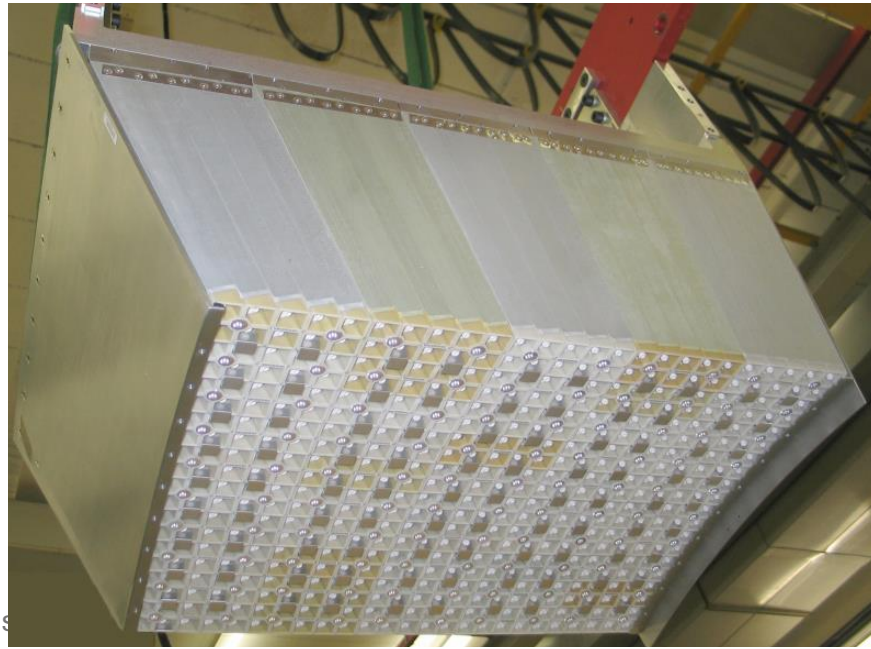
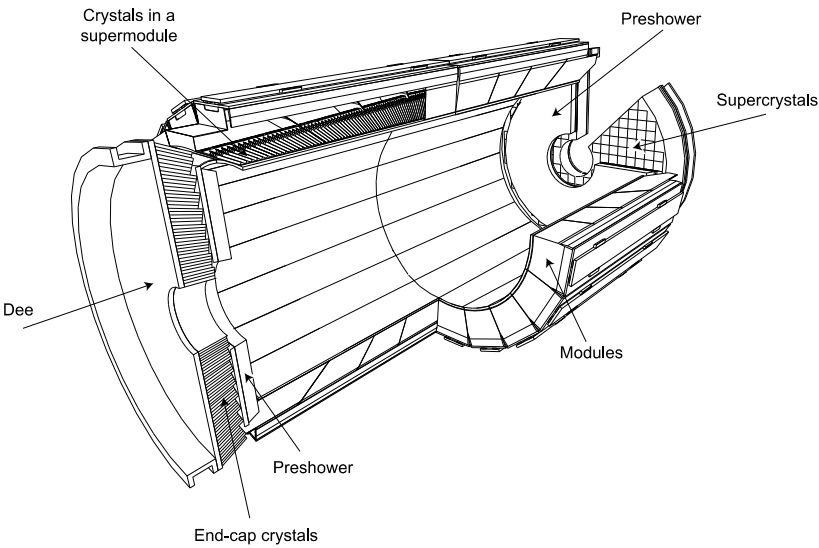
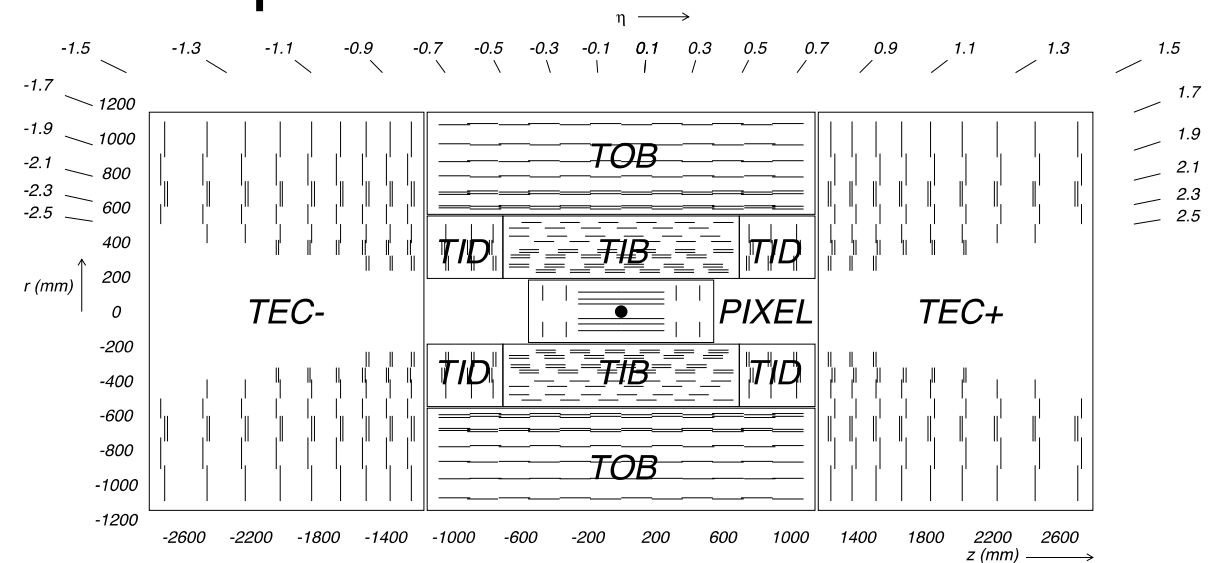
Cinématique: densités de partons

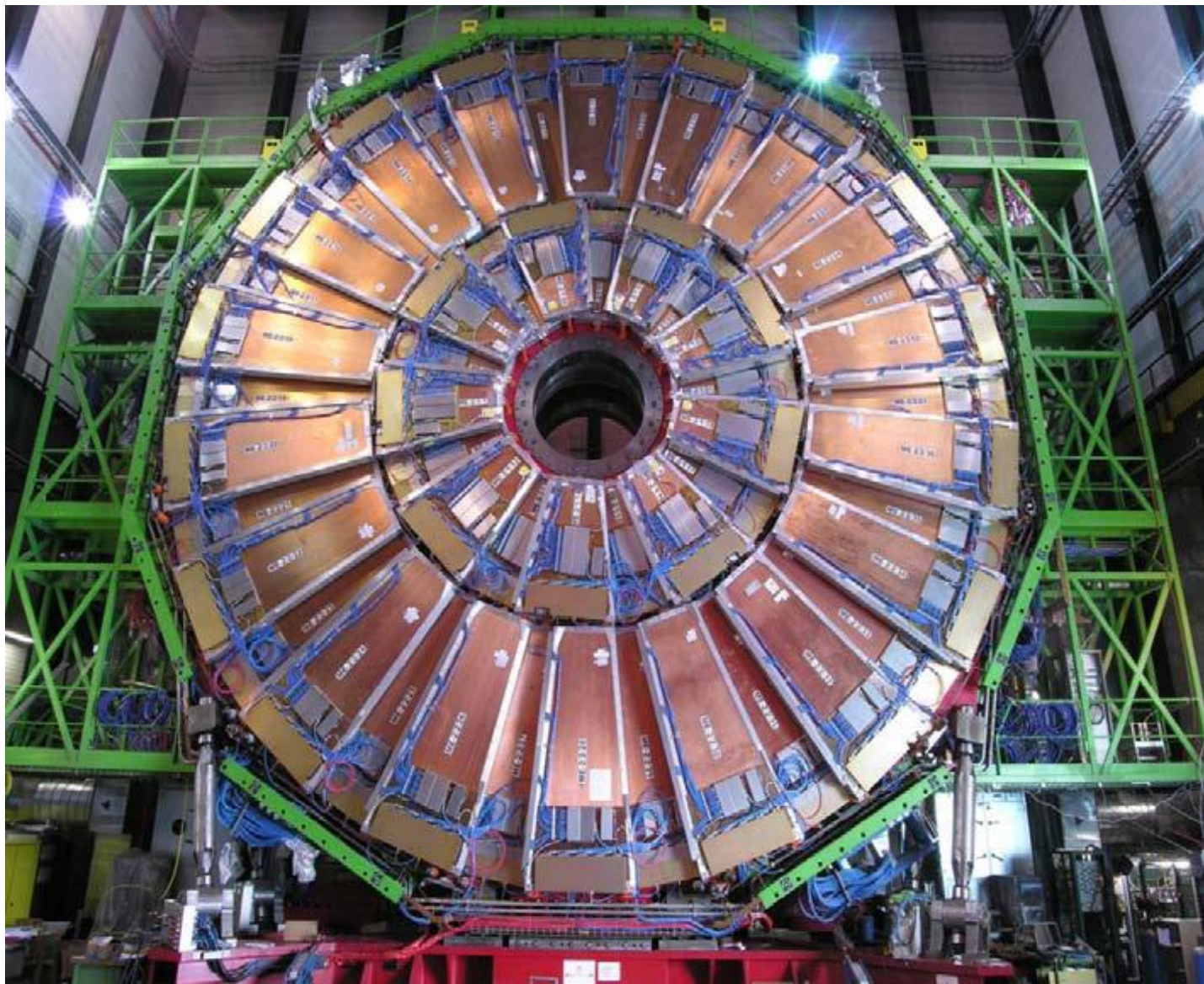
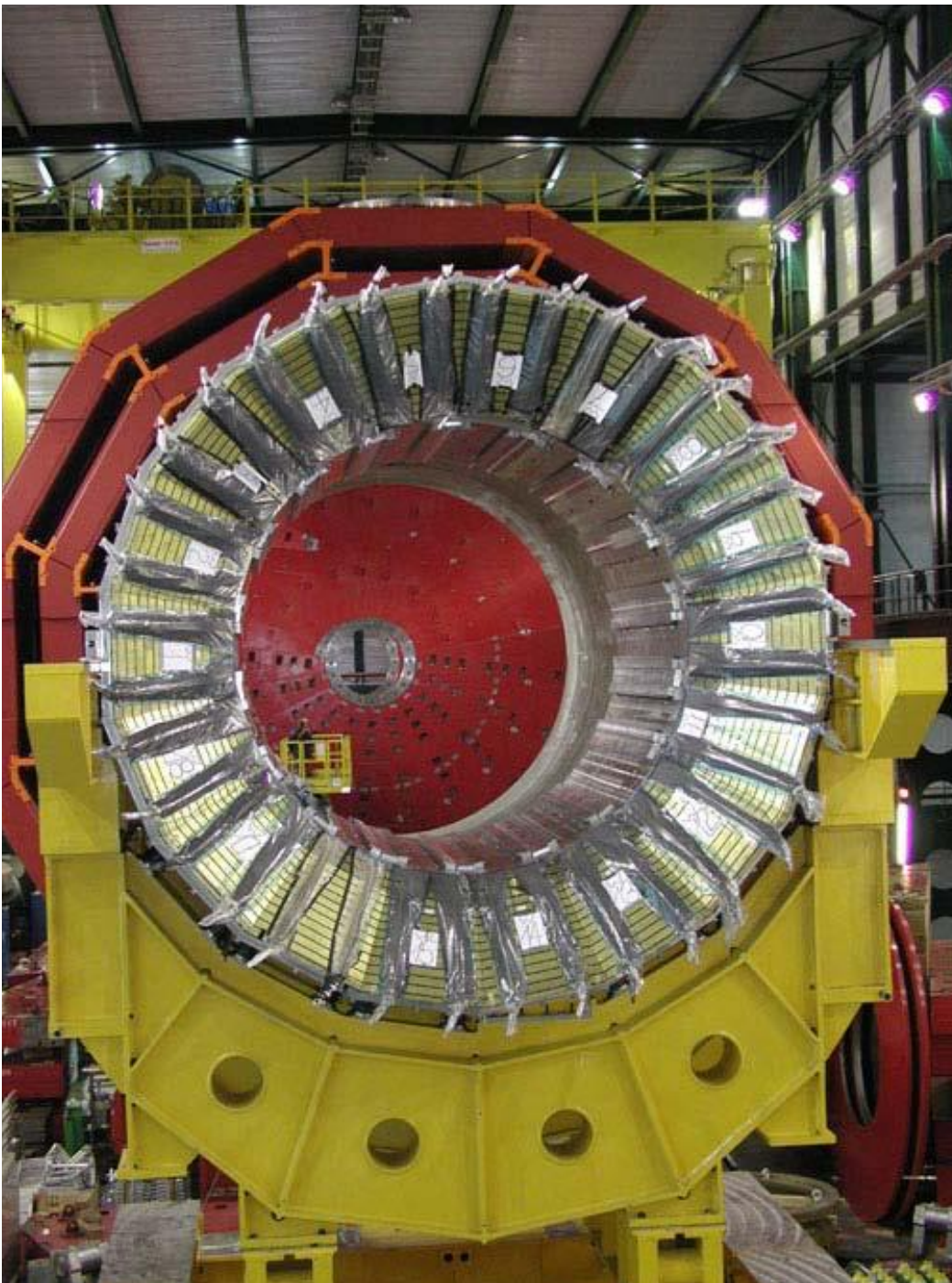
- $m_{ZZ} = \sqrt{s x_1 x_2}$ où $\sqrt{s} = 13 TeV$
- $p_z \cong p_{proton} \cdot (x_2 - x_1)$ où $p_{proton} = 6.5 TeV$

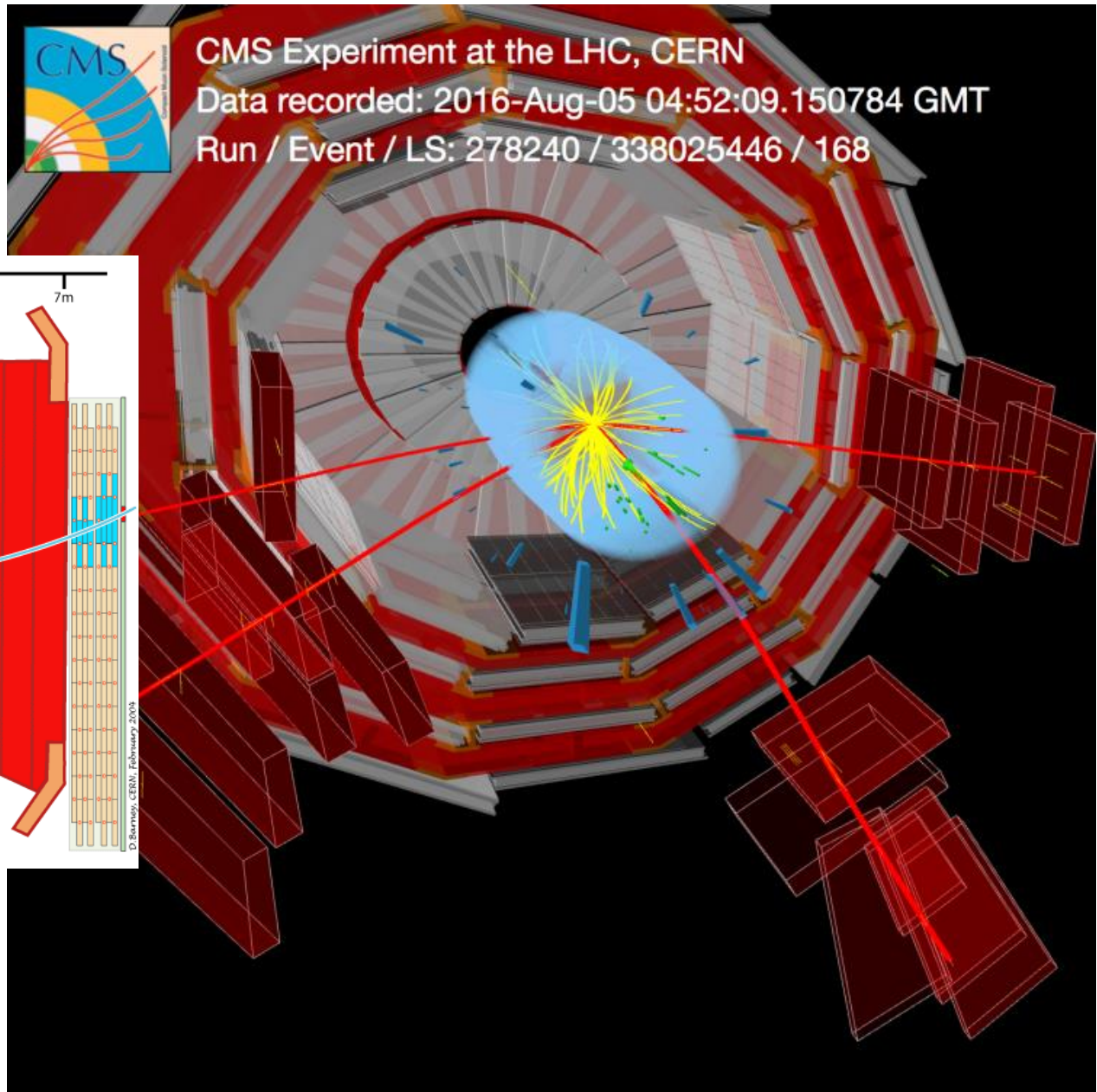
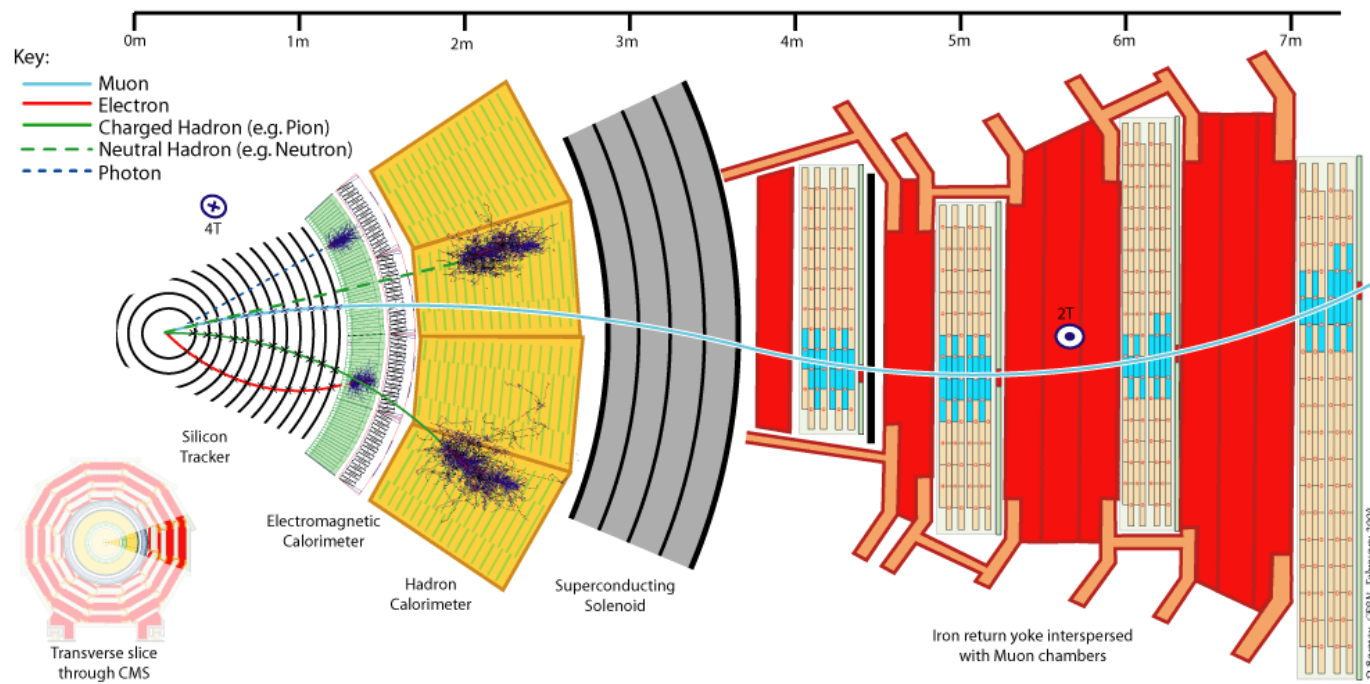




L'expérience CMS







Mesure des muons et des électrons

