Le détecteur ATLAS présentation du TP

Frédéric Déliot

masterclass, 2 avril 2015

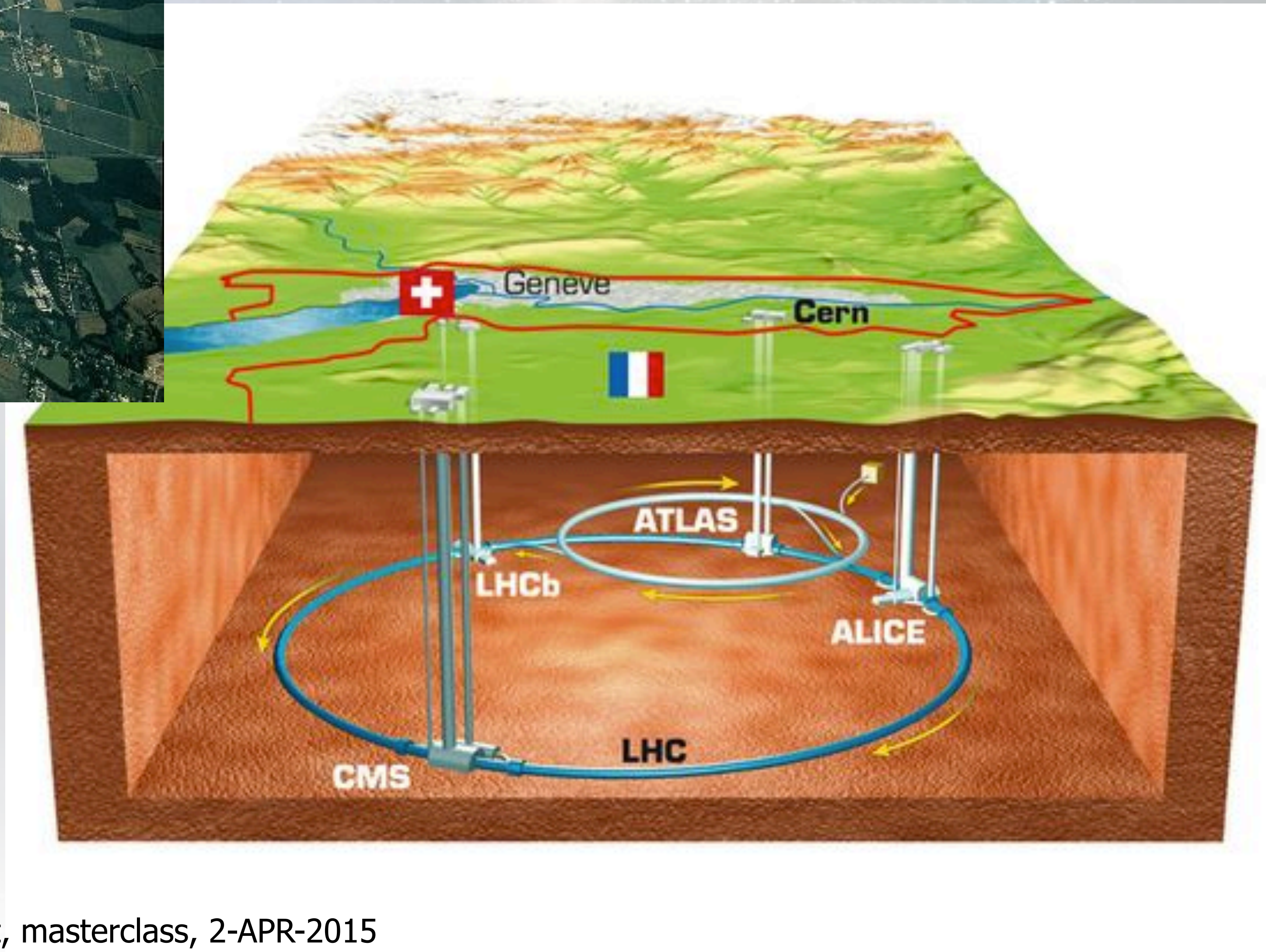
largement inspiré des transparents de Laurent Chevalier

INTERNATIONAL MASTERCLASSES
hands on particle physics

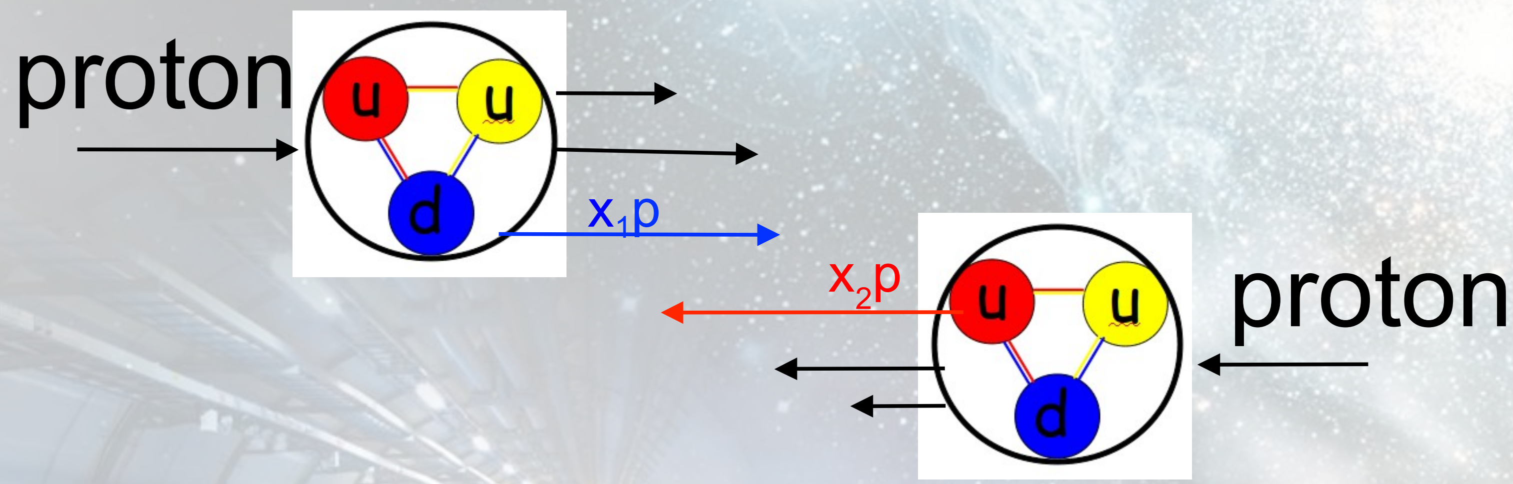
International Particle Physics Outreach Group

CEA - Saclay

ATLAS au CERN

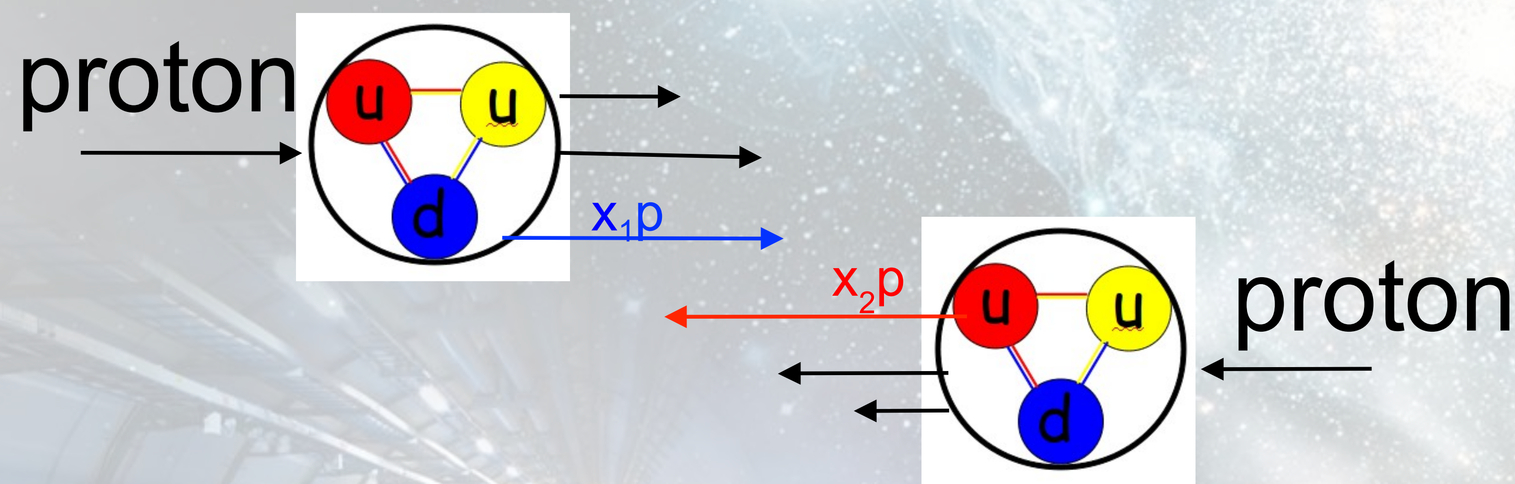


Collisions au LHC

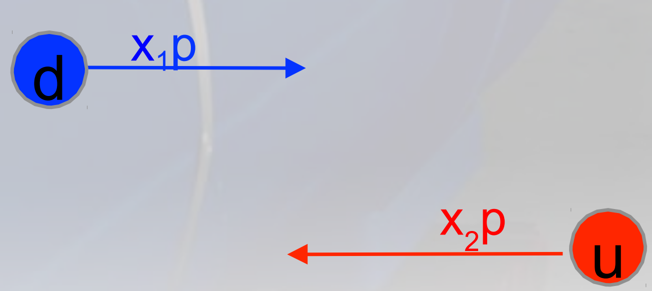


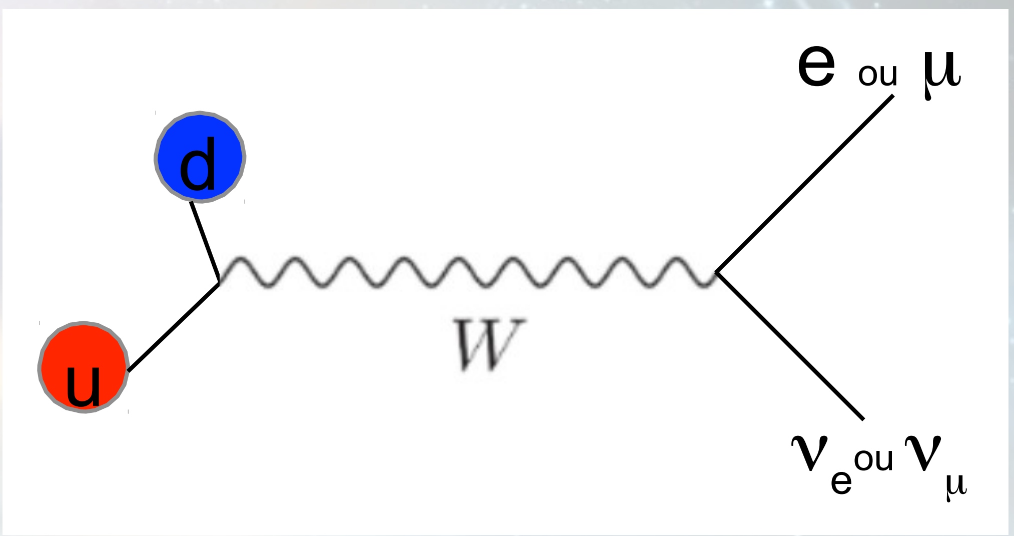
matière (proton) $\longrightarrow$ $E=mc^2$ énergie $\longrightarrow$ matière (boson W)

Collisions au LHC

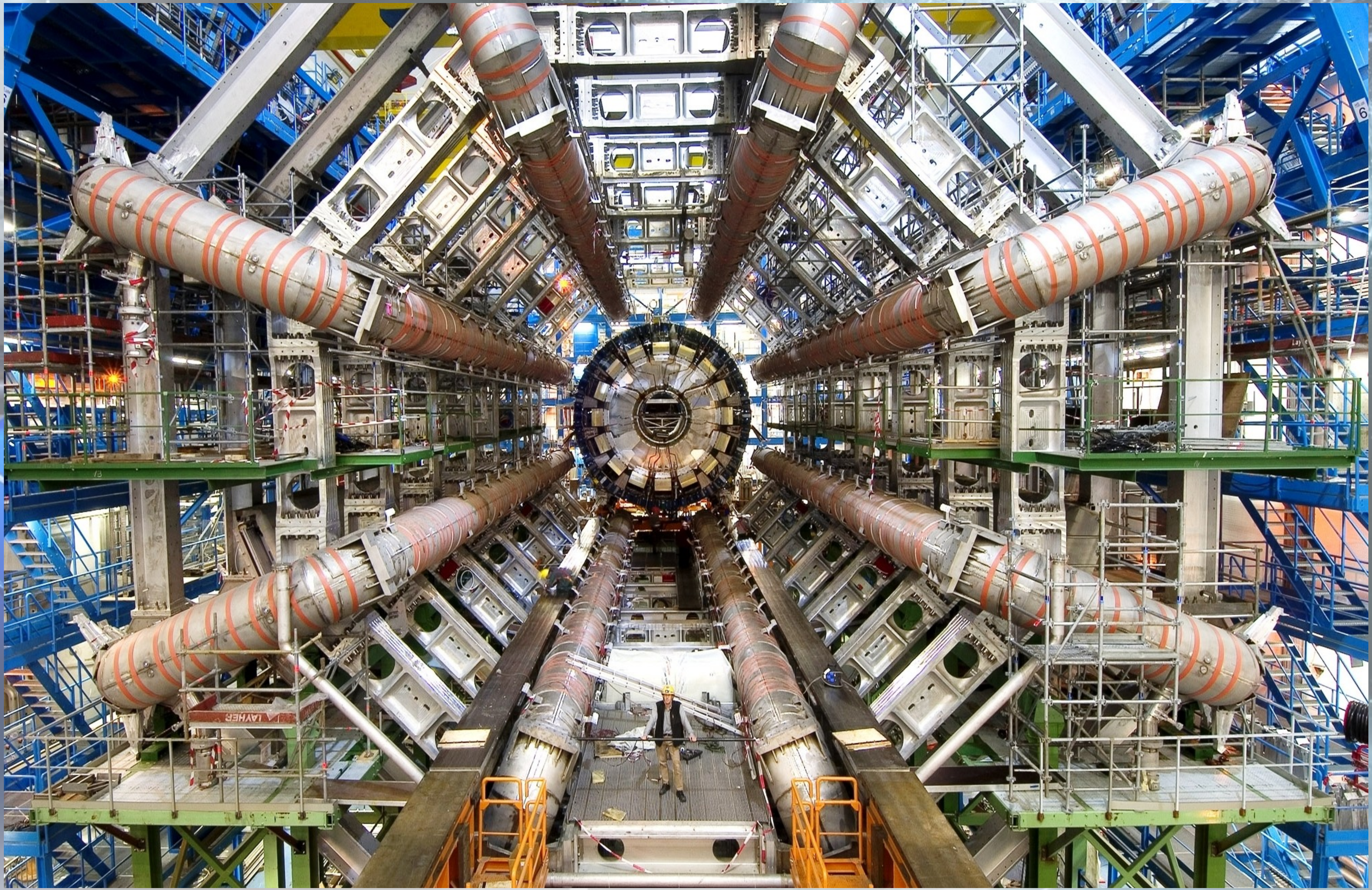


matière (proton) ⟶ $E=mc^2$ énergie ⟶ matière (boson W)

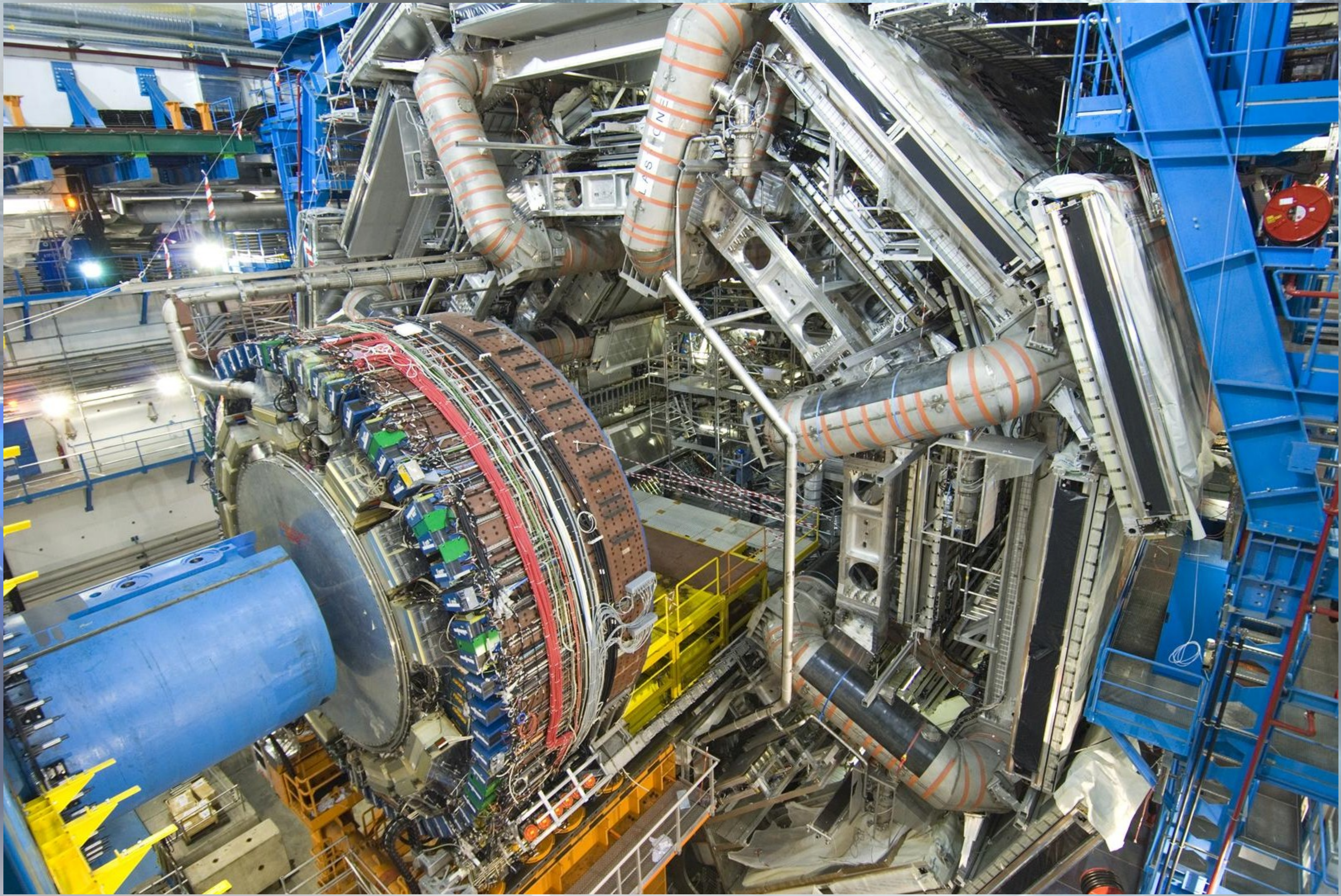




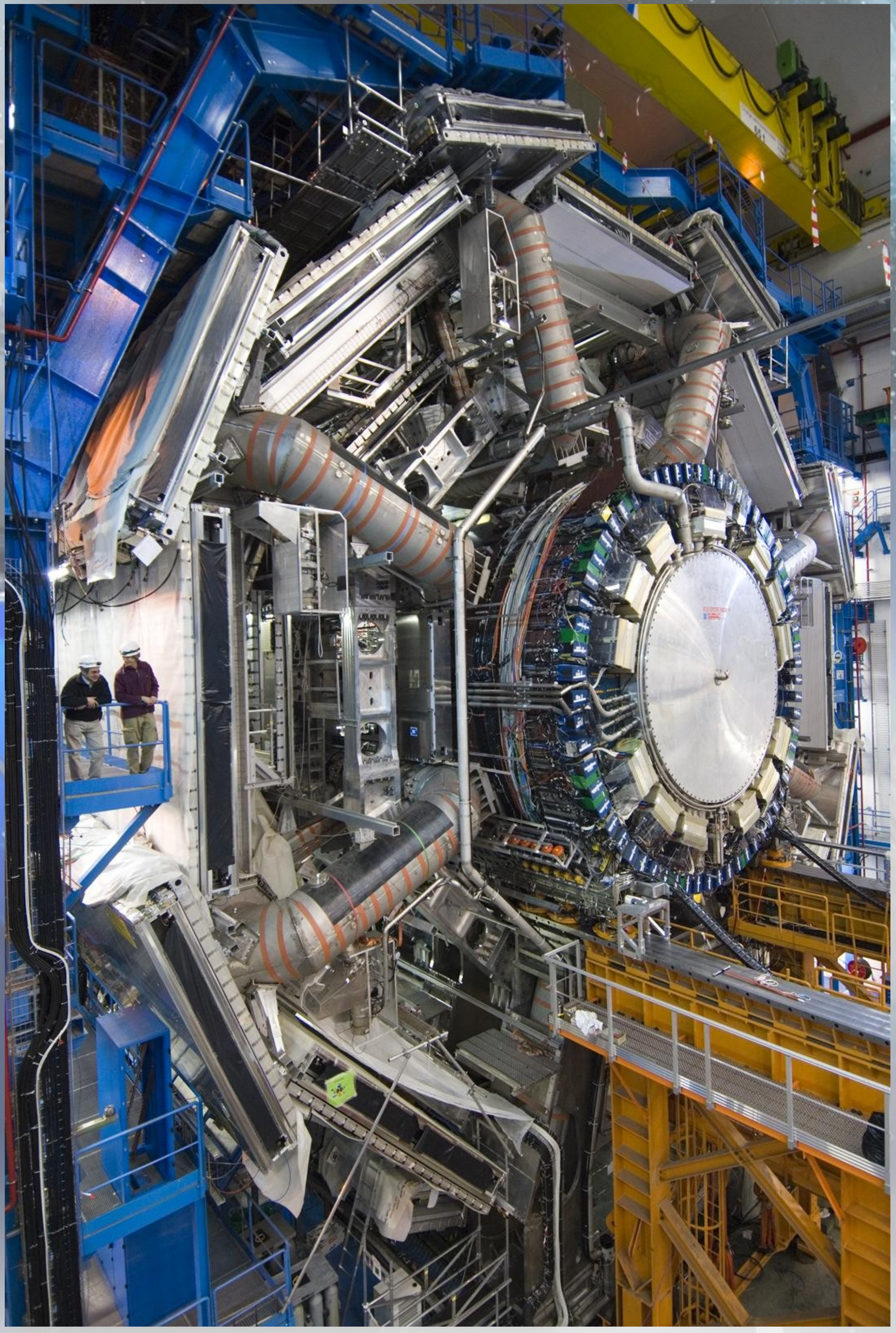
Le détecteur ATLAS

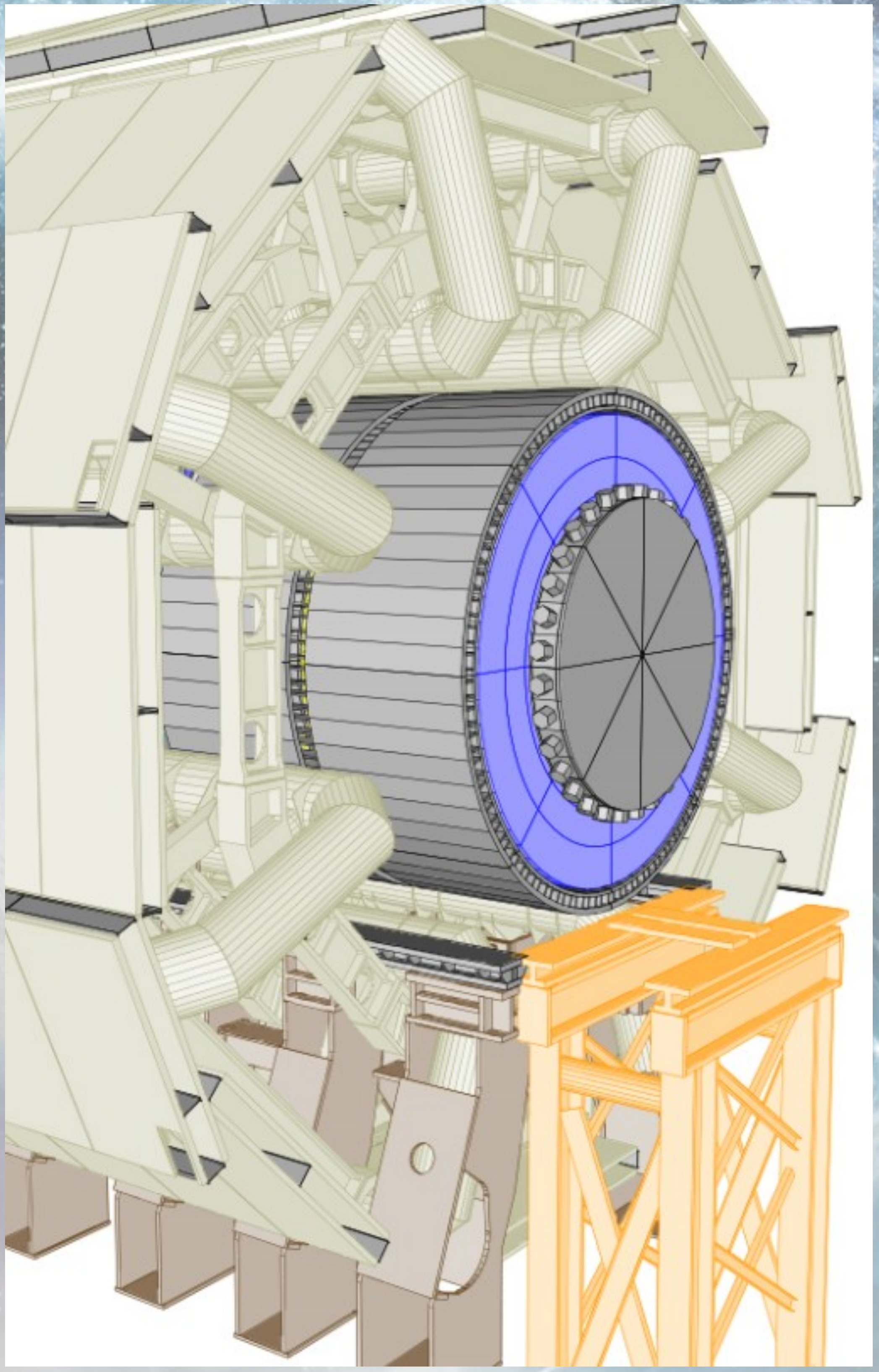


Le détecteur ATLAS



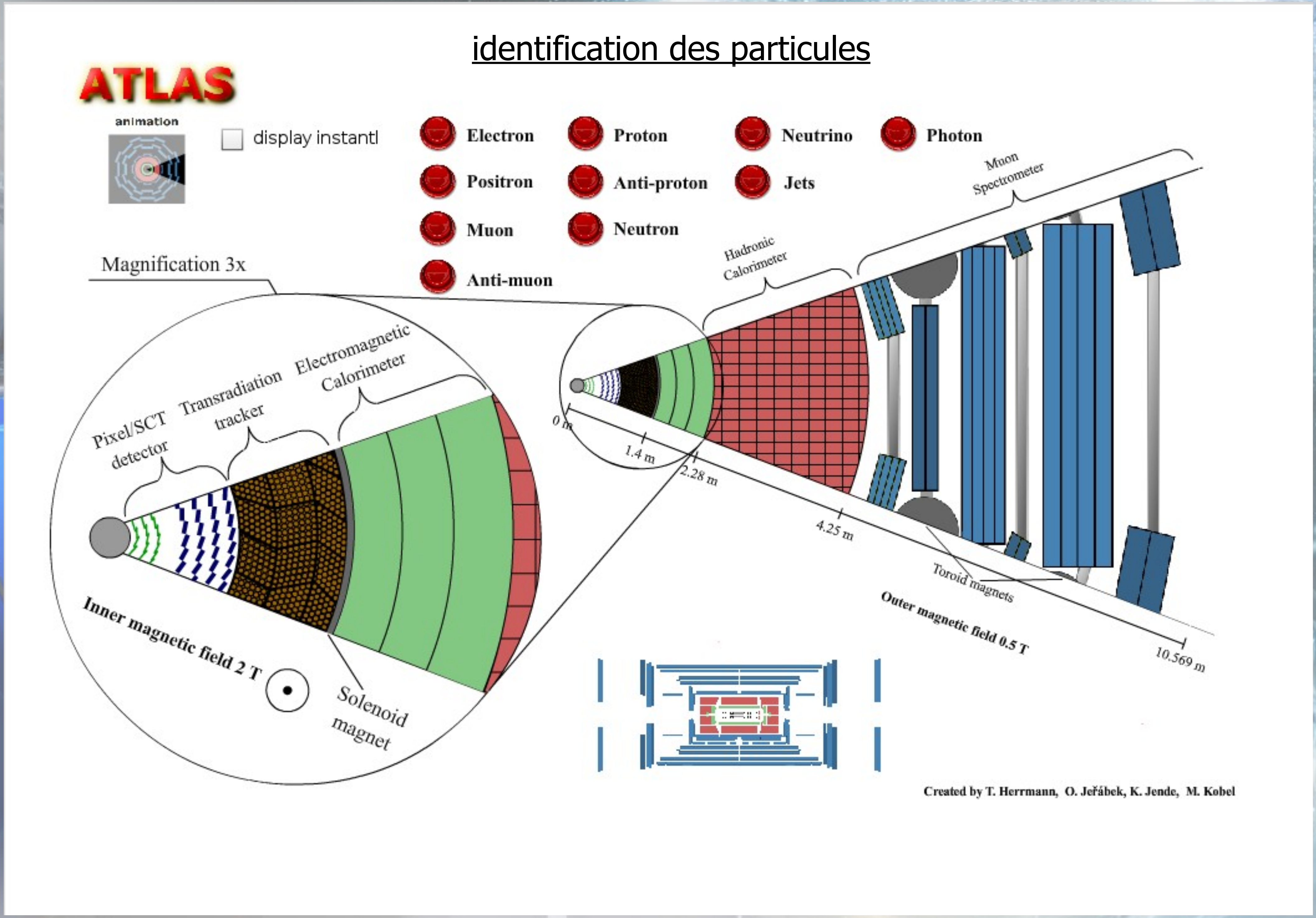
Simulation



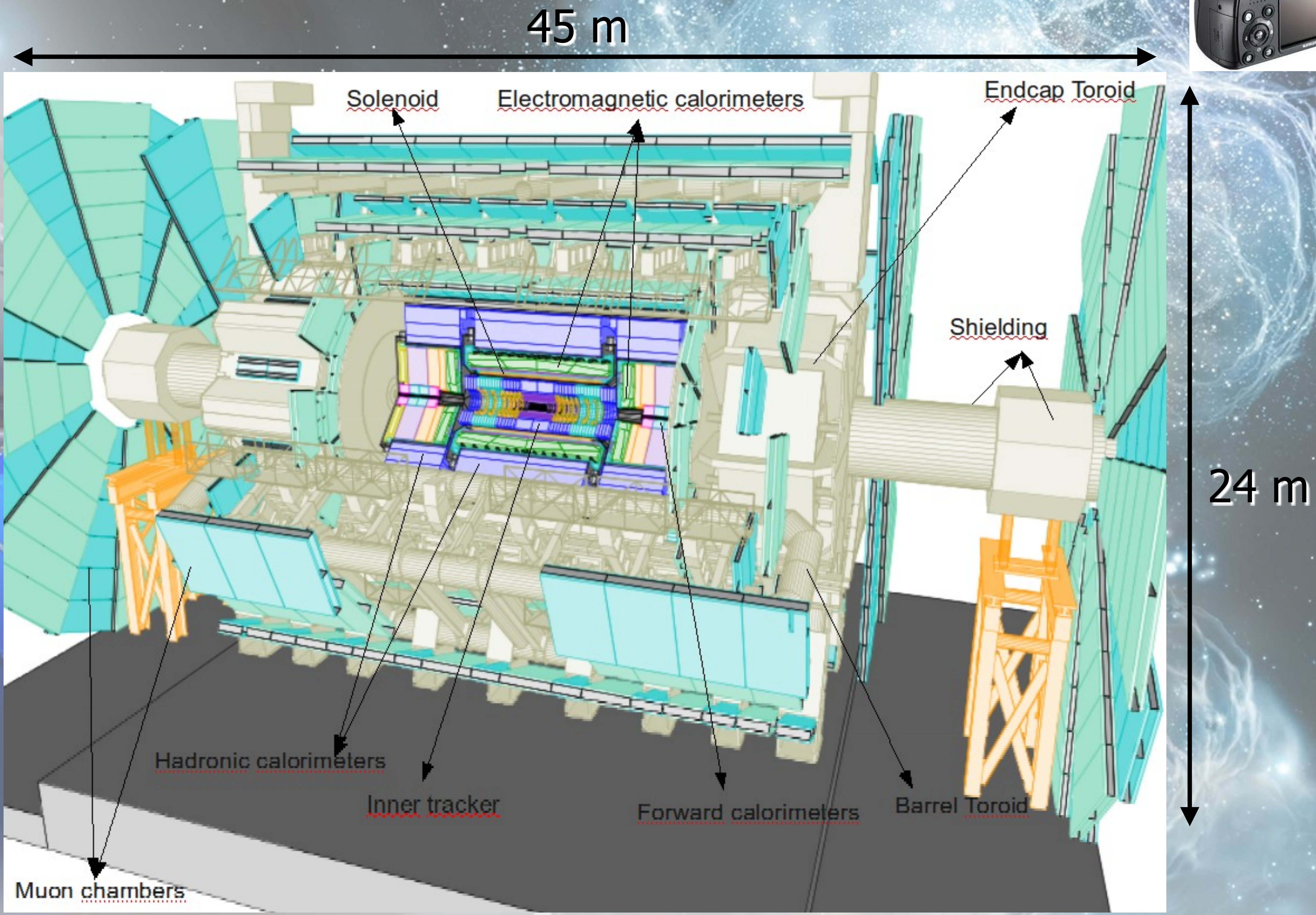


Principe d'un détecteur

Différents sous systèmes



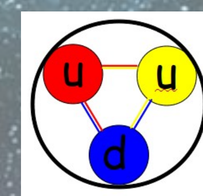
ATLAS: ~ 90 000 000 pixels



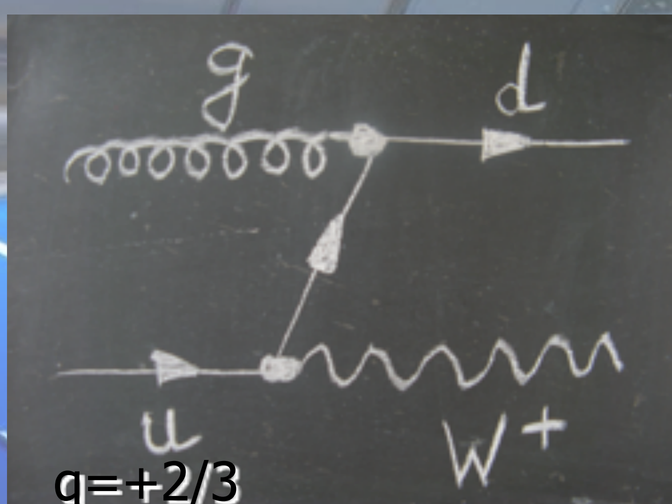
But du TP

identifier et compter les événements avec un boson W^+, W^- ou 2 W's

1) test de la structure du proton:



signal



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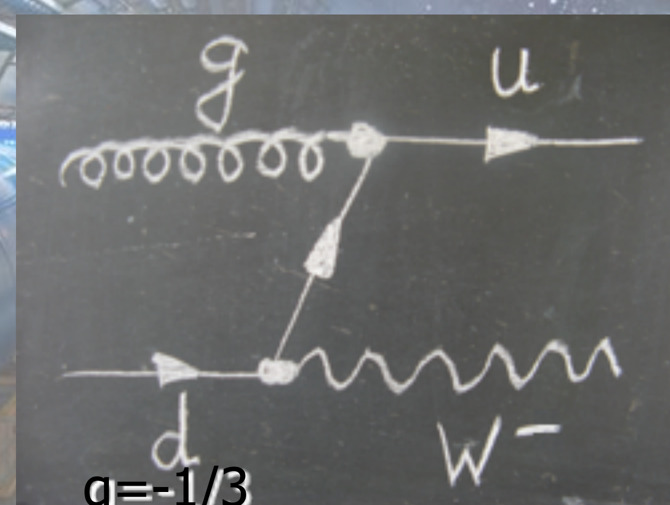
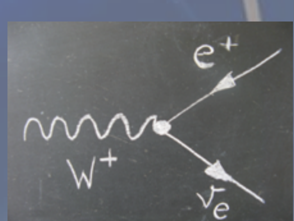
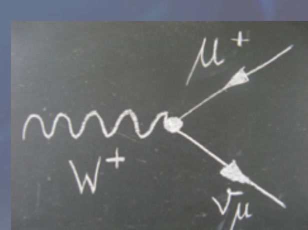
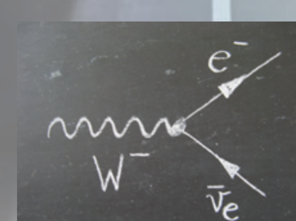
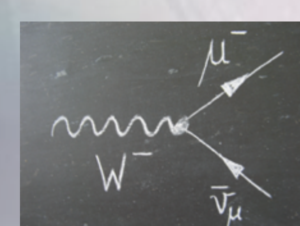


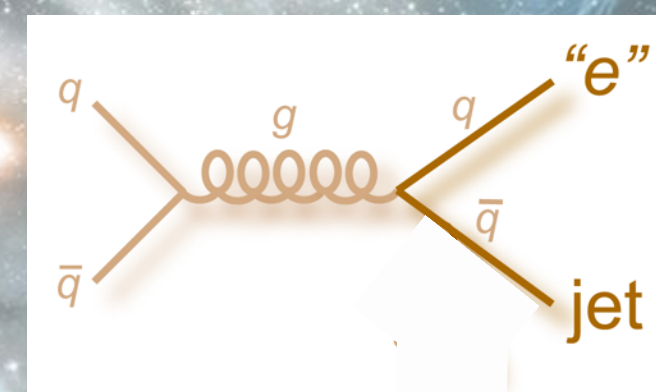


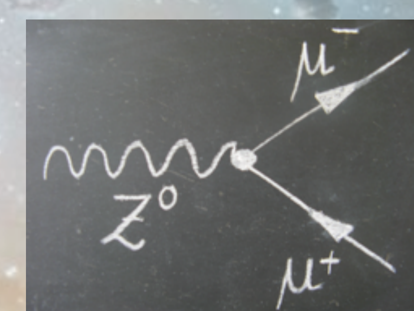






bruit de fond



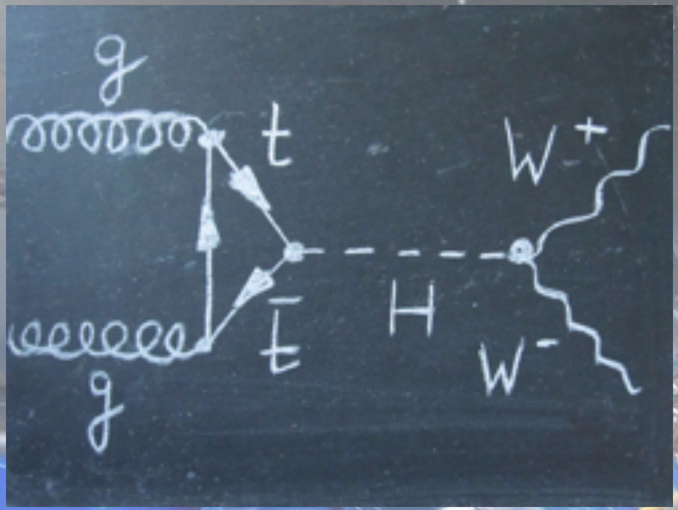


But du TP (2)

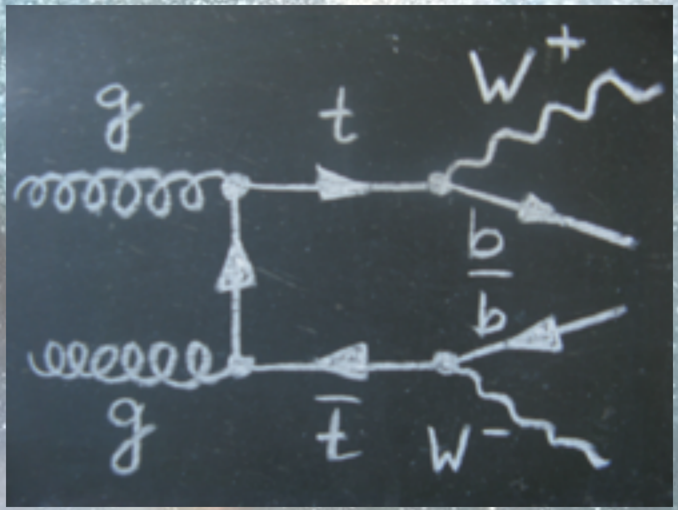
identifier et compter les événements avec un boson W^+, W^- ou 2 W's

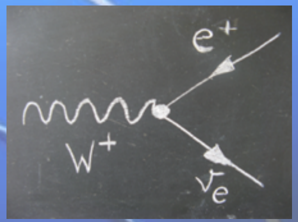
2) recherche du boson de Higgs:

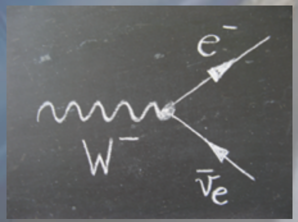
signal

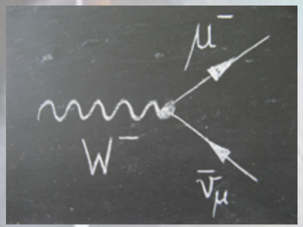


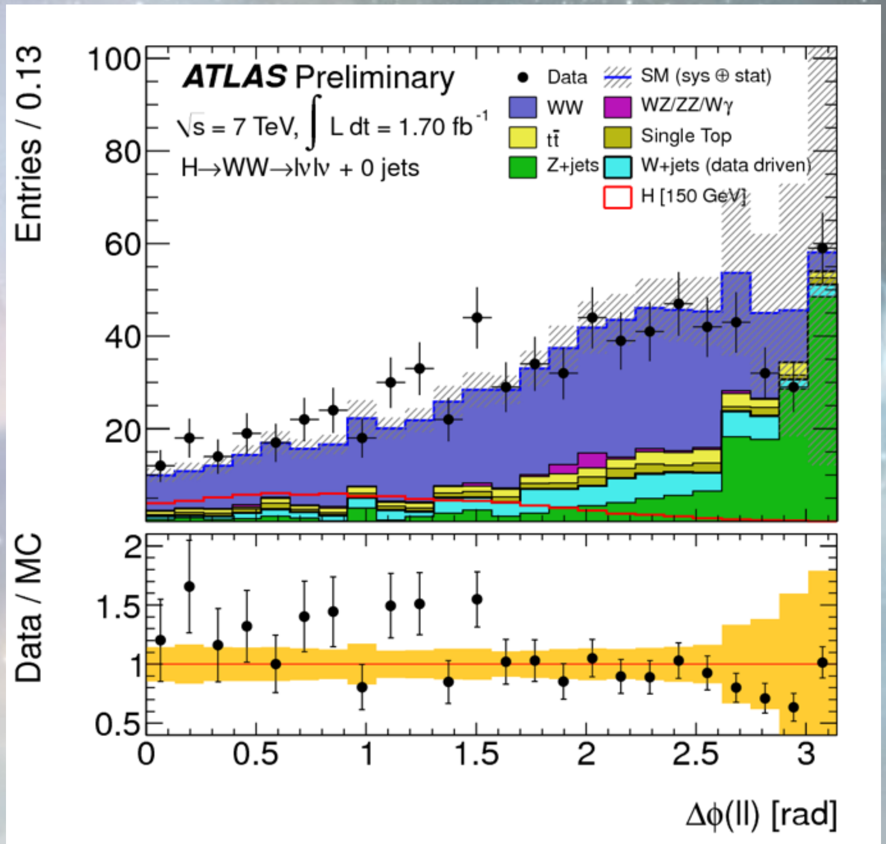
bruit de fond





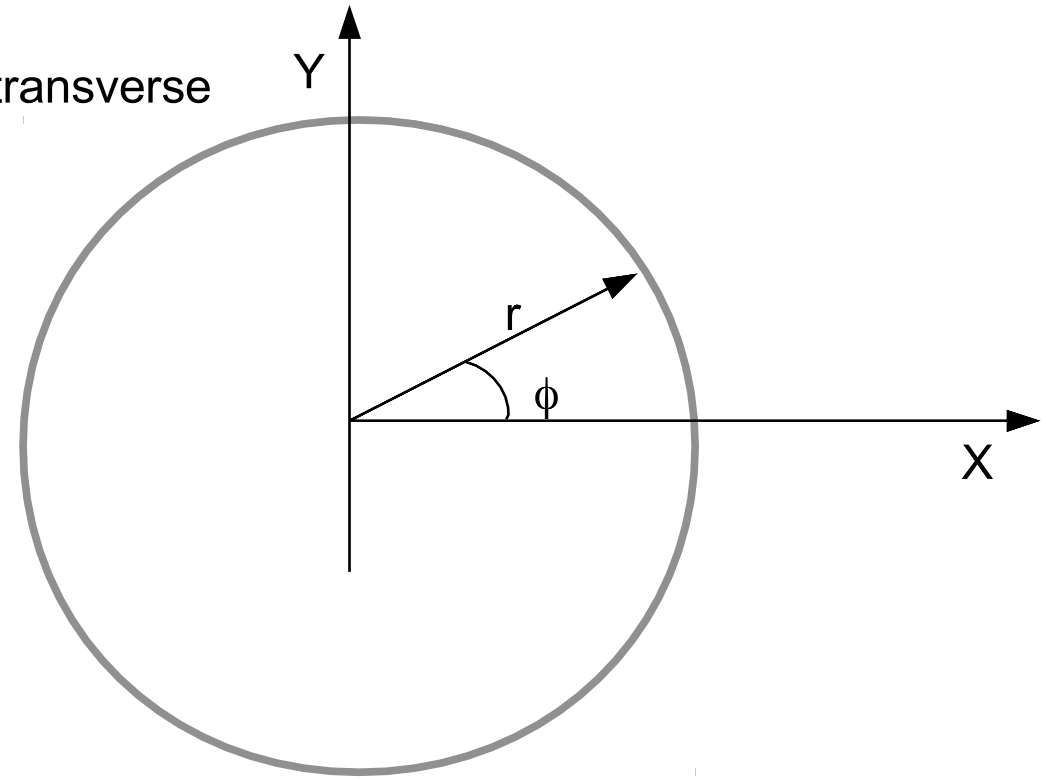


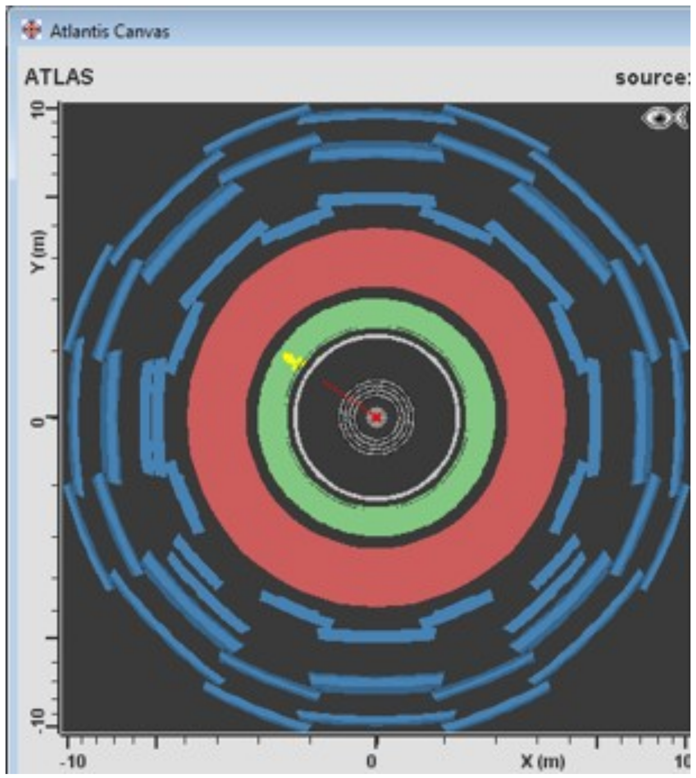




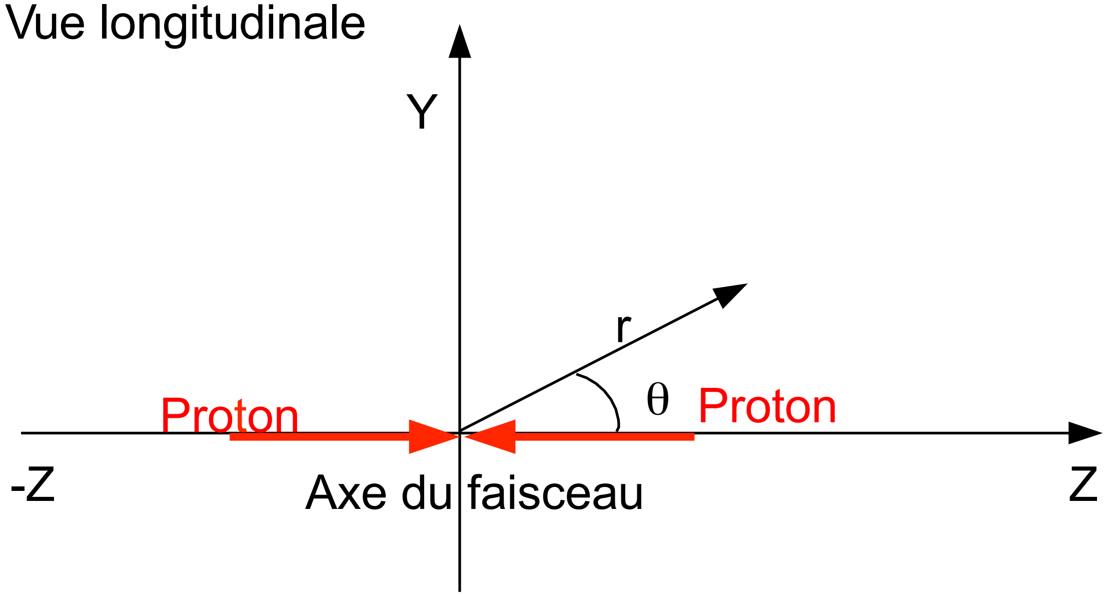
Visualisation

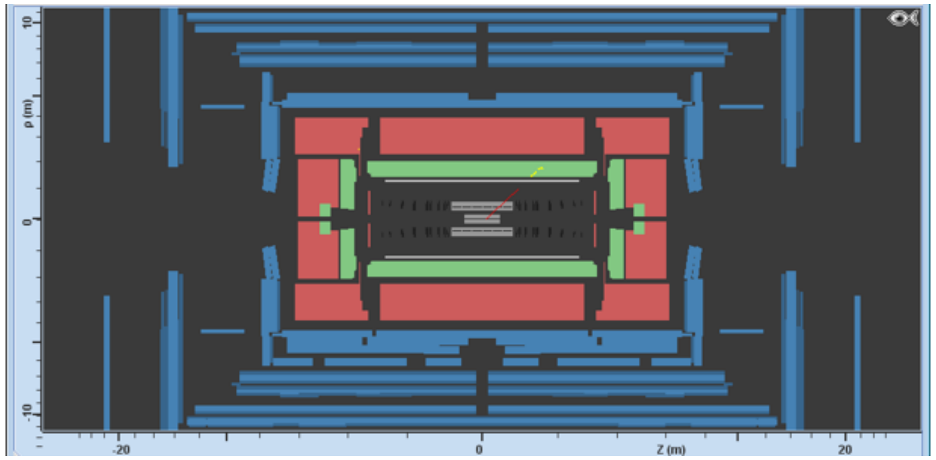
Vue transverse



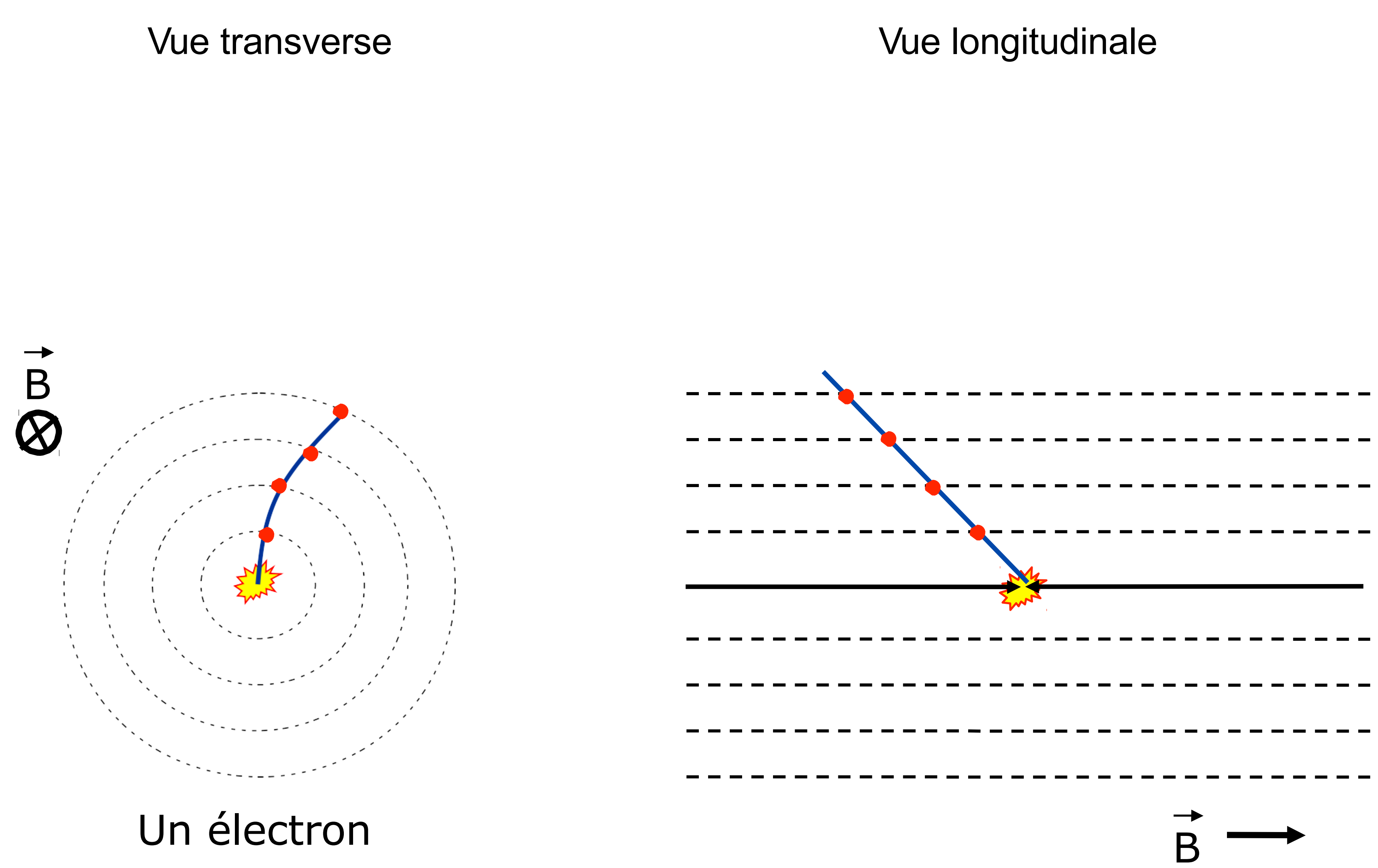


Vue longitudinale

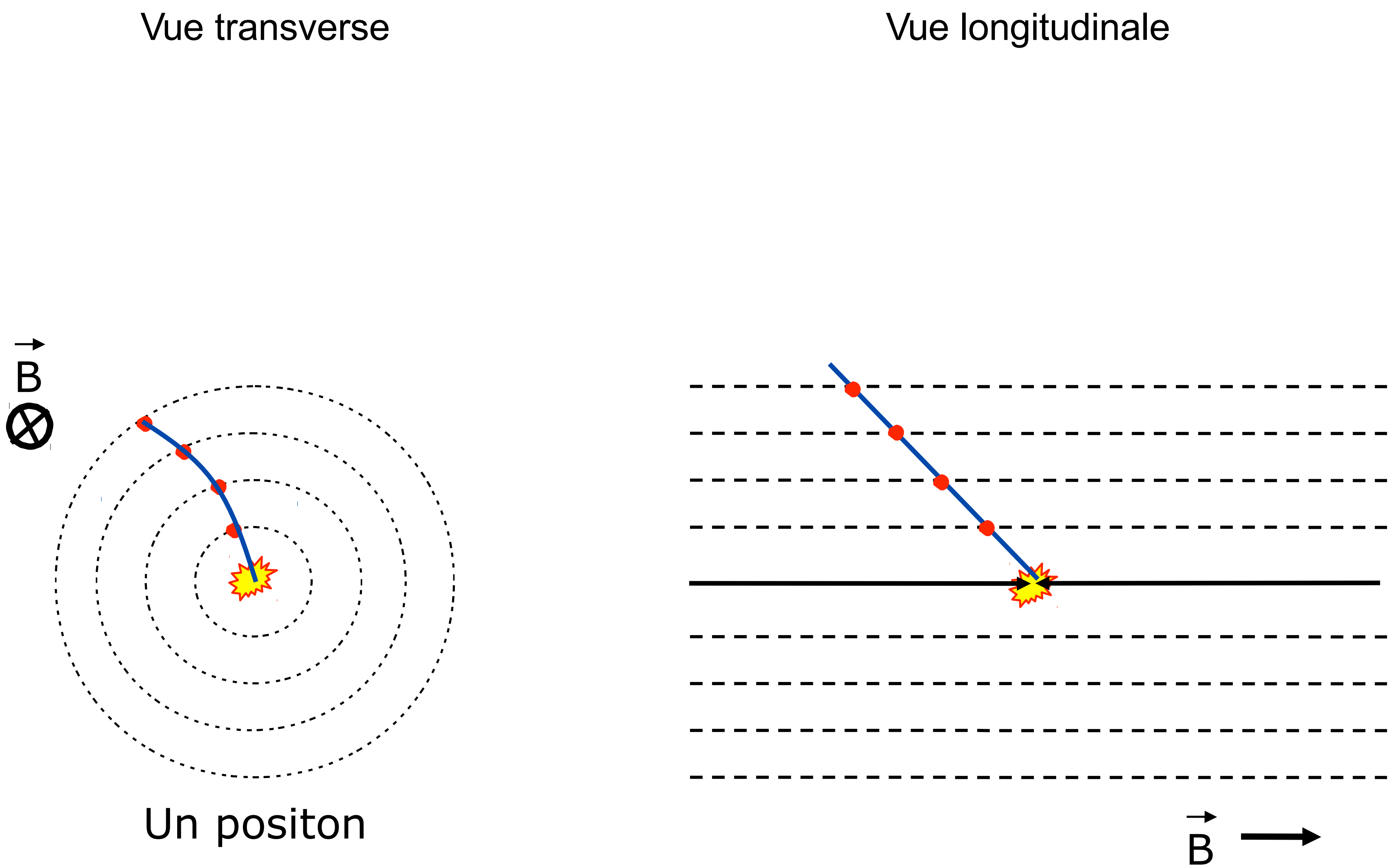




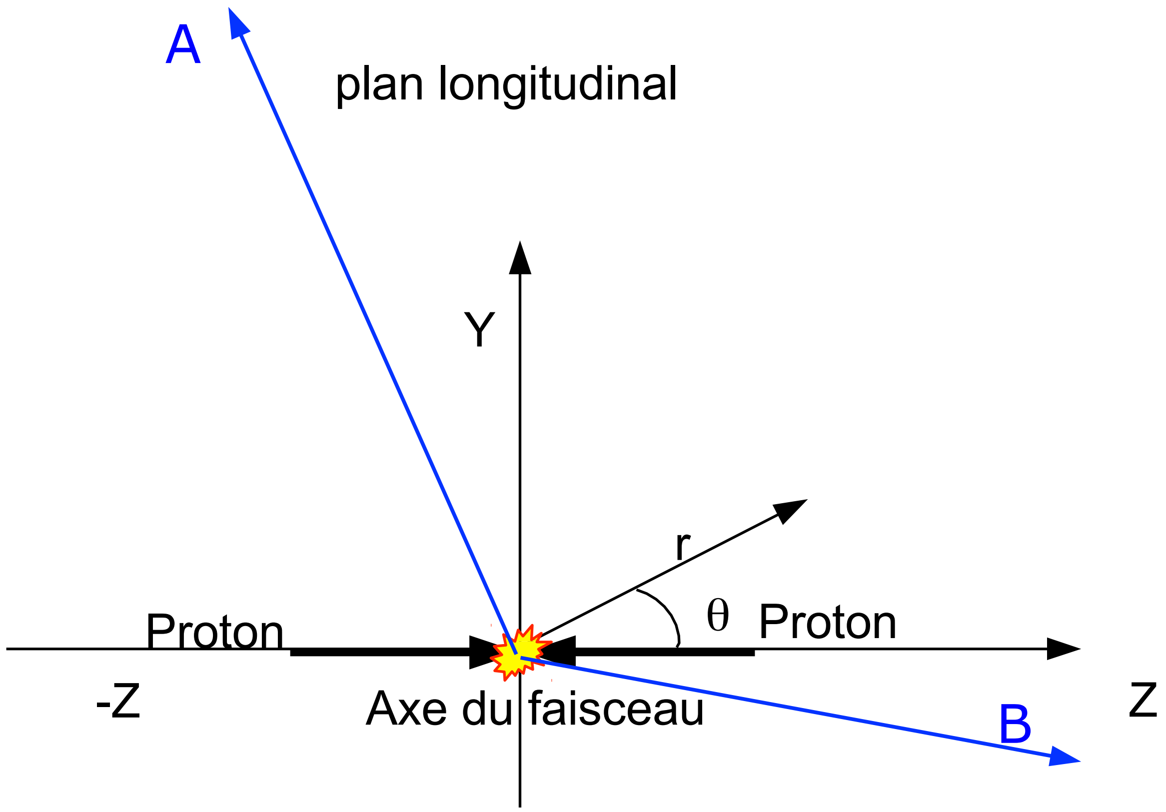
Visualisation

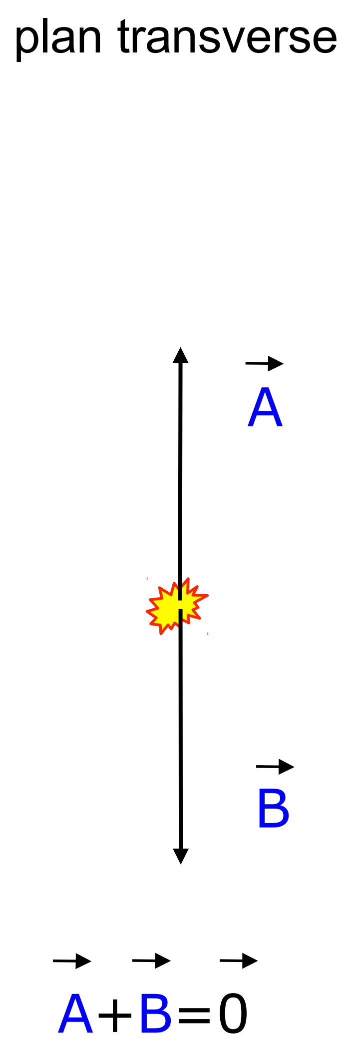


Visualisation



Conservation de la quantité de mouvement

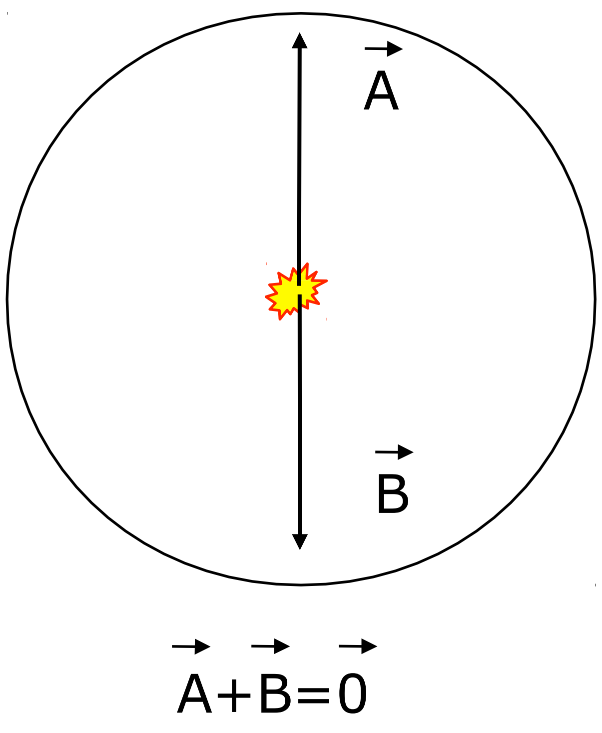


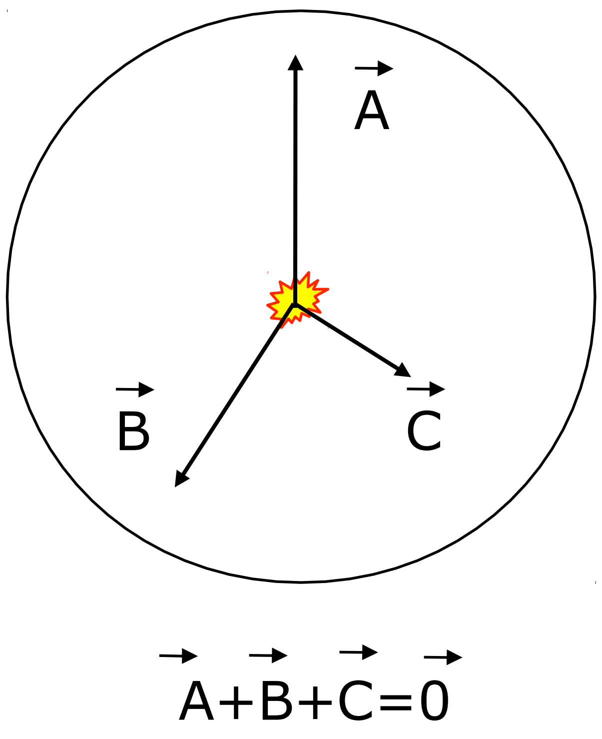


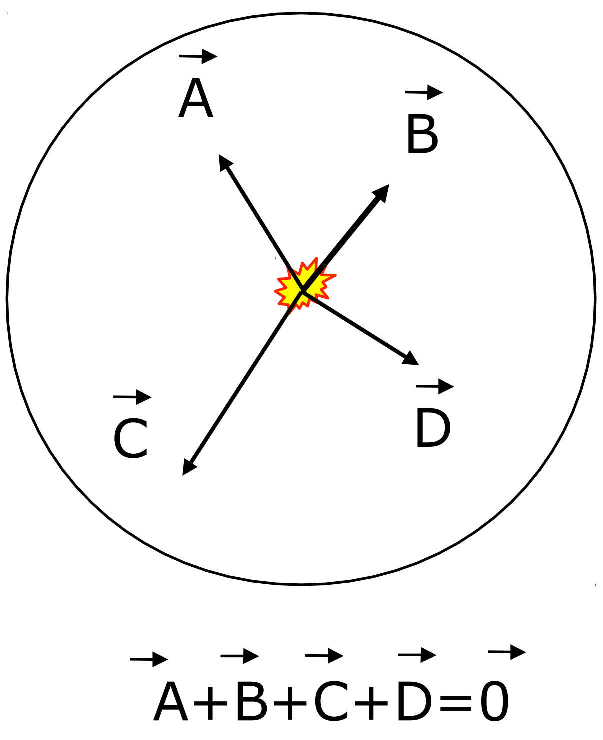
Quantité de mouvement (p=mv) = impulsion

Conservation de l'impulsion dans le plan transverse au faisceau

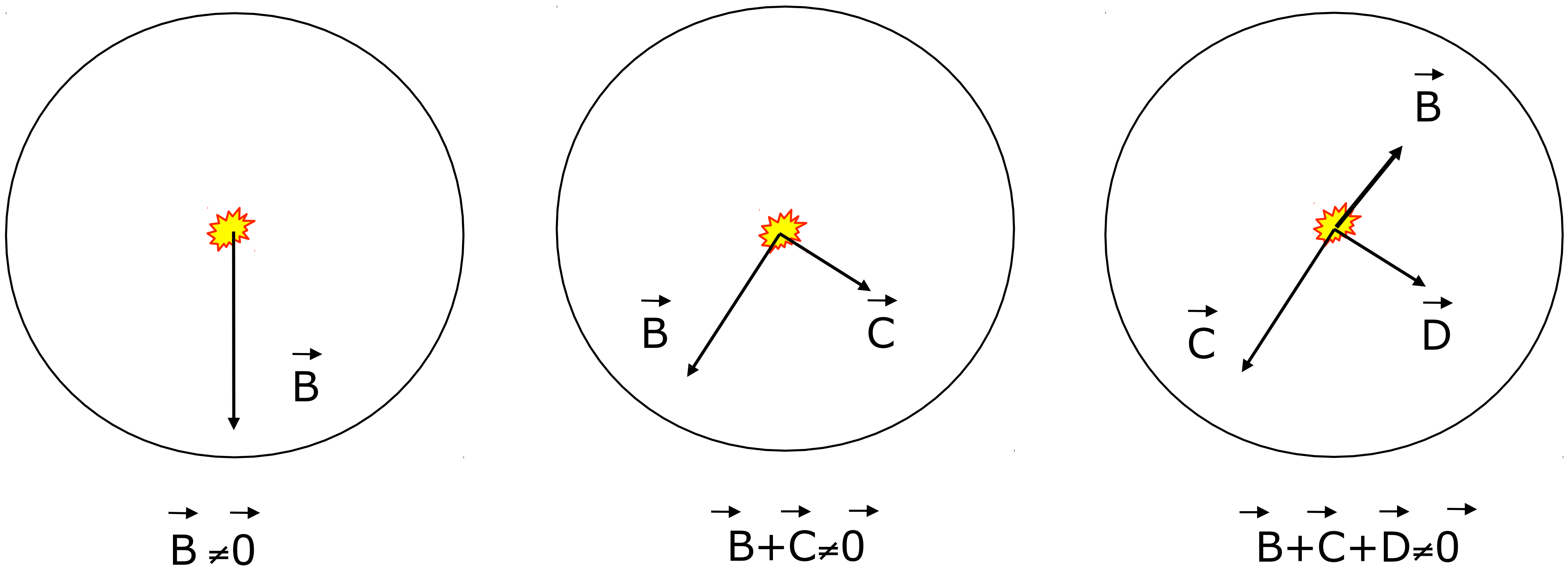
Conservation de la quantité de mouvement







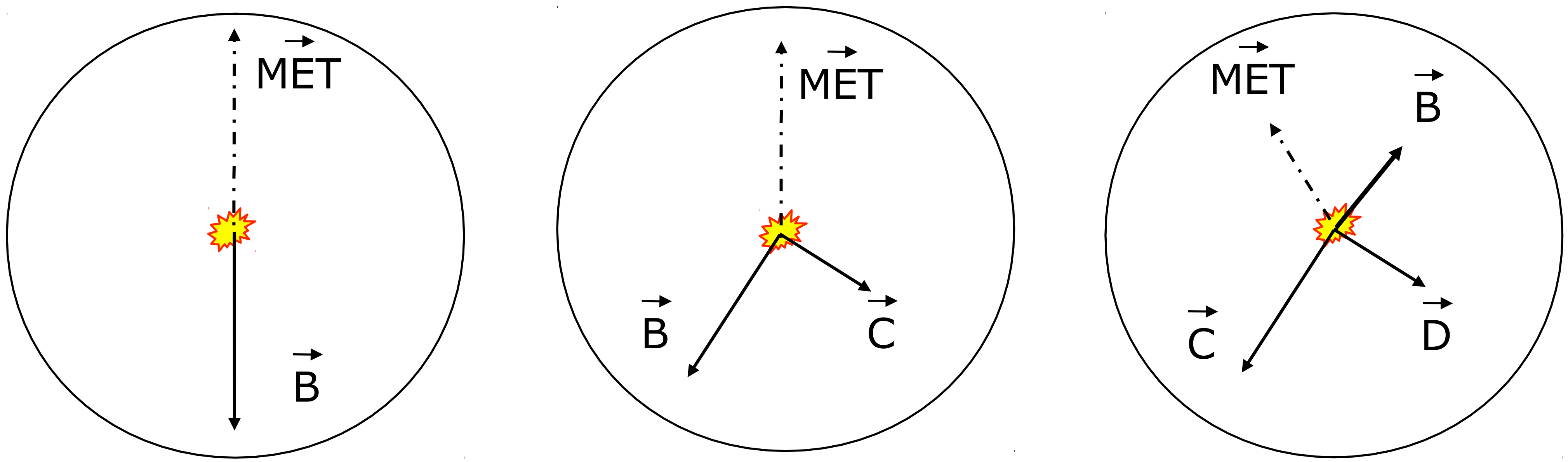
Energie manquante (MET)



Le neutrino ne laisse pas de trace dans le détecteur interne (neutre) et ne dépose pas d'énergie dans le calorimètre (interagit très faiblement).

Si la particule A est un neutrino, l'impulsion dans le plan transverse semble ne plus être conservée.

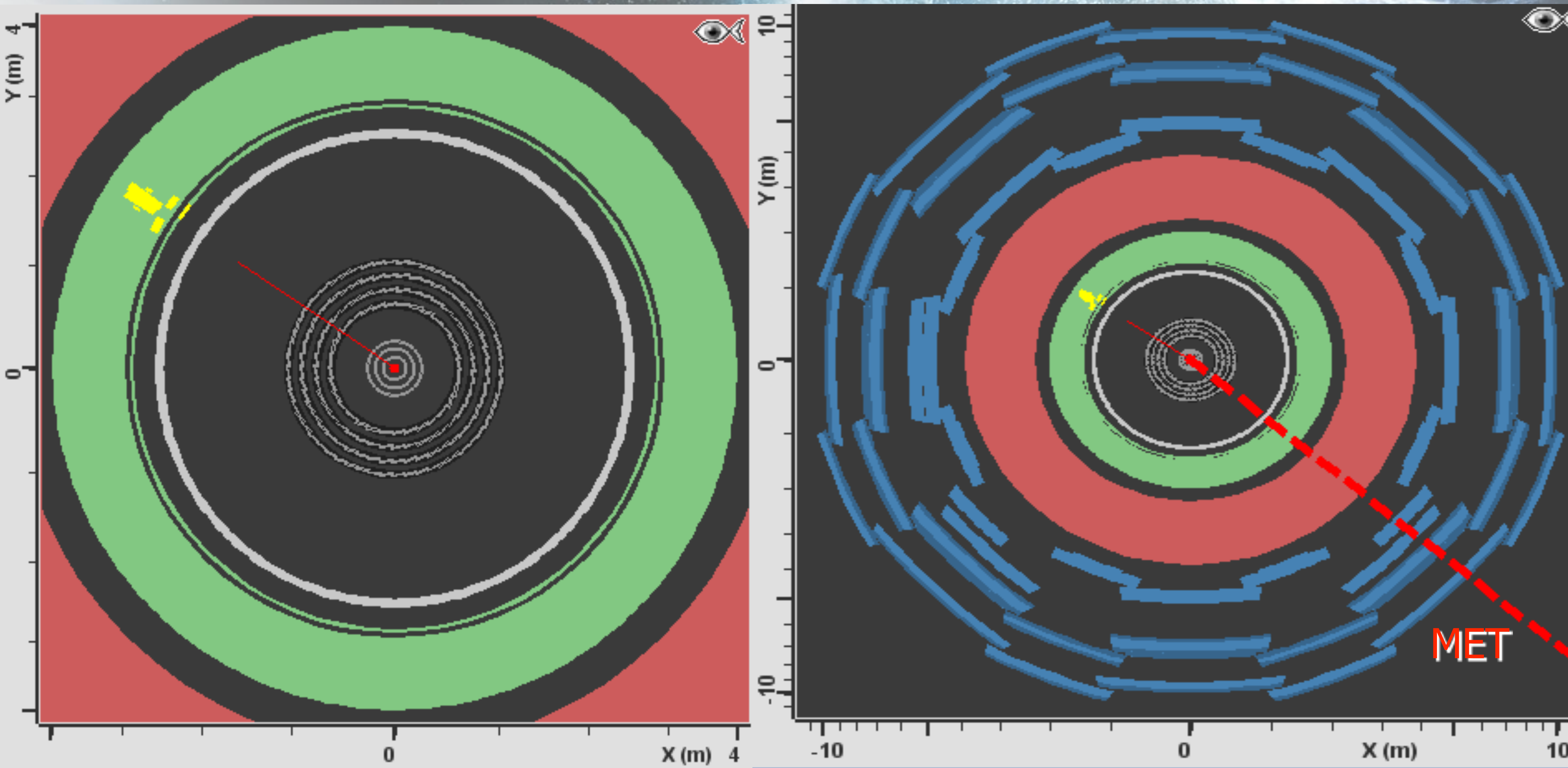
Energie manquante (MET)



$\vec{B}=-\vec{MET}$ $\quad$ $\vec{B}+\vec{C}=-\vec{MET}$ $\quad$ $\vec{B}+\vec{C}+\vec{D}=-\vec{MET}$

$|\overrightarrow{MET}| \neq 0$ $\Rightarrow$ Presence d'un neutrino

Energie manquante (MET)



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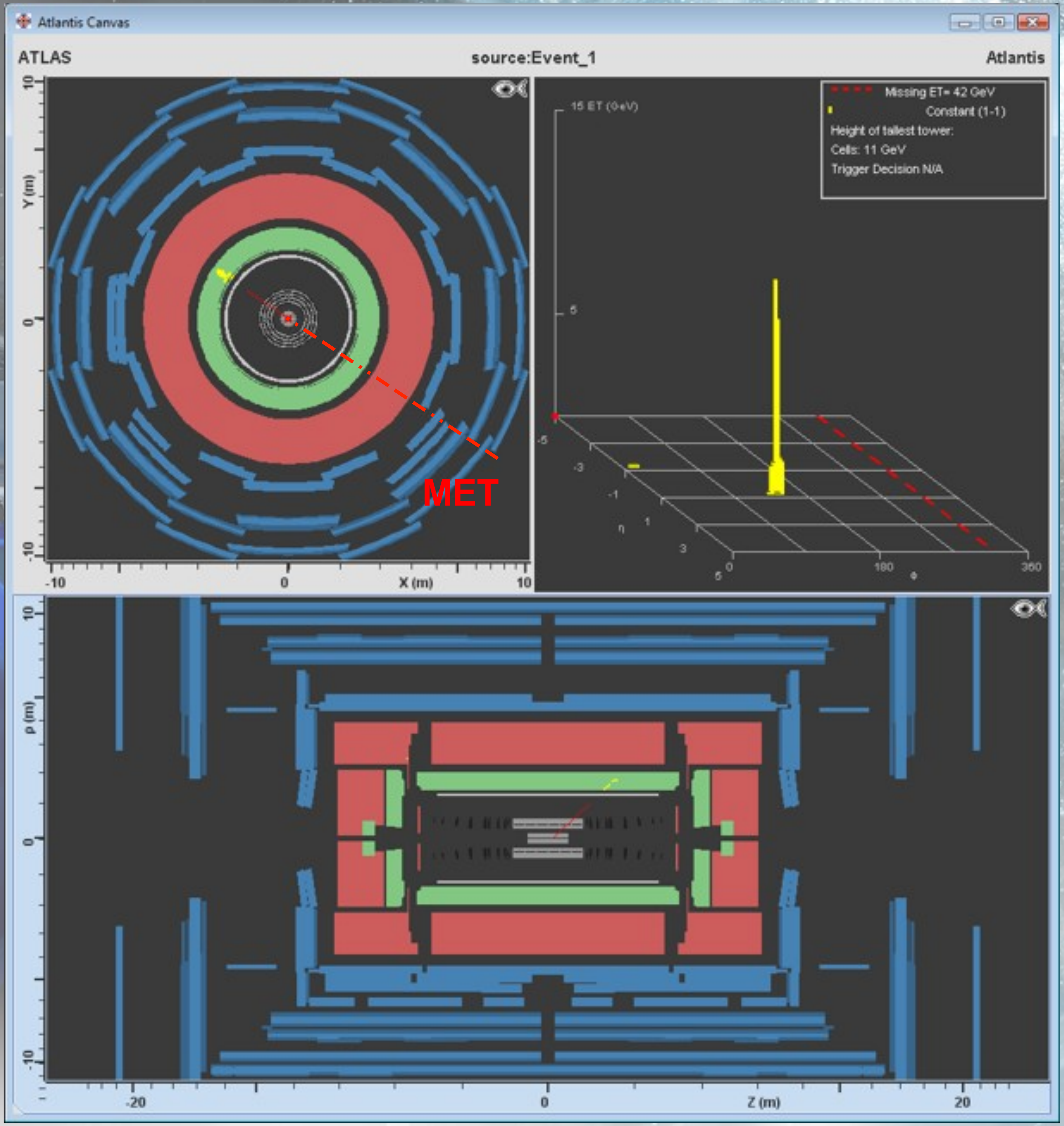
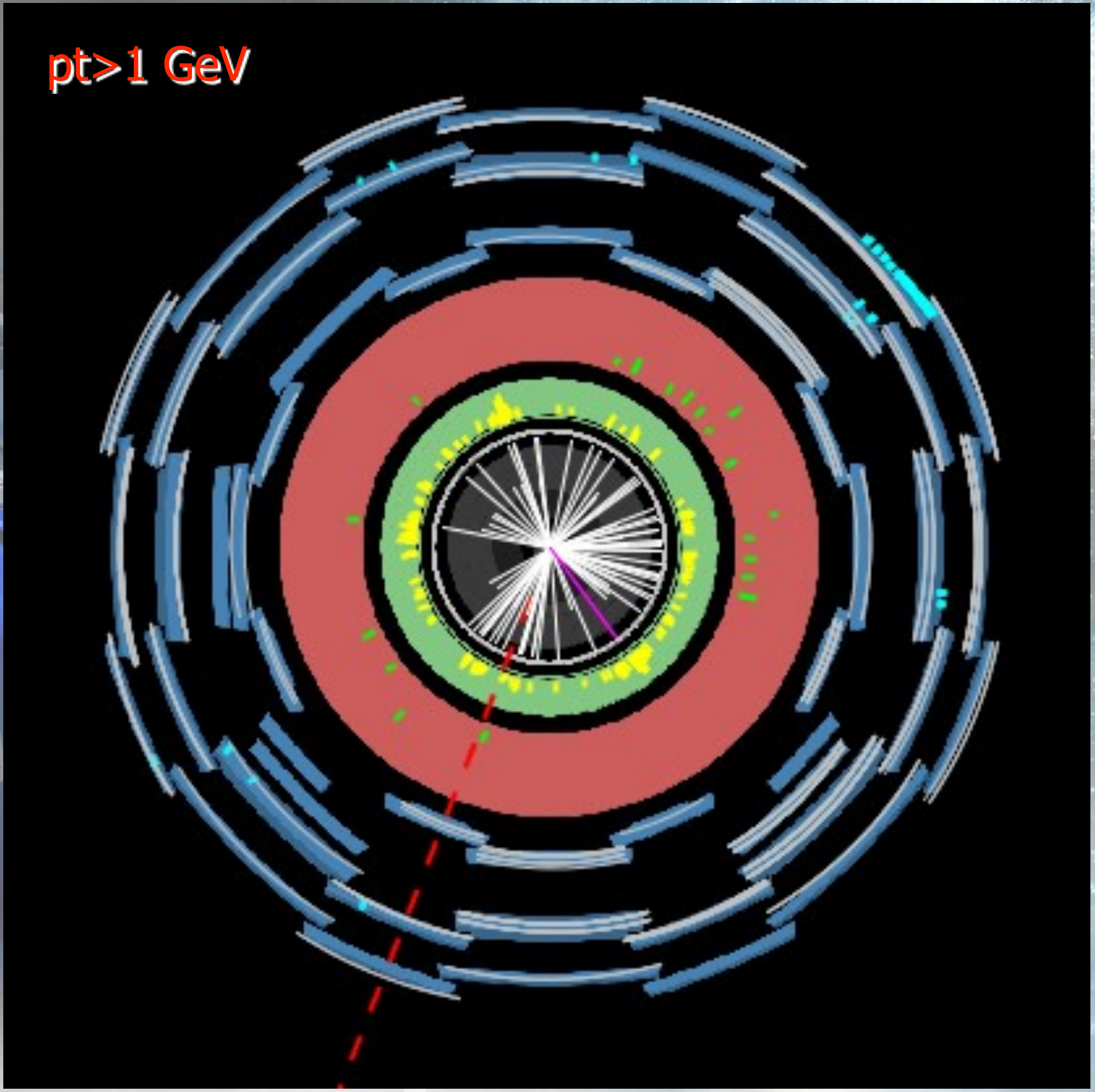


Isolation dans le détecteur interne



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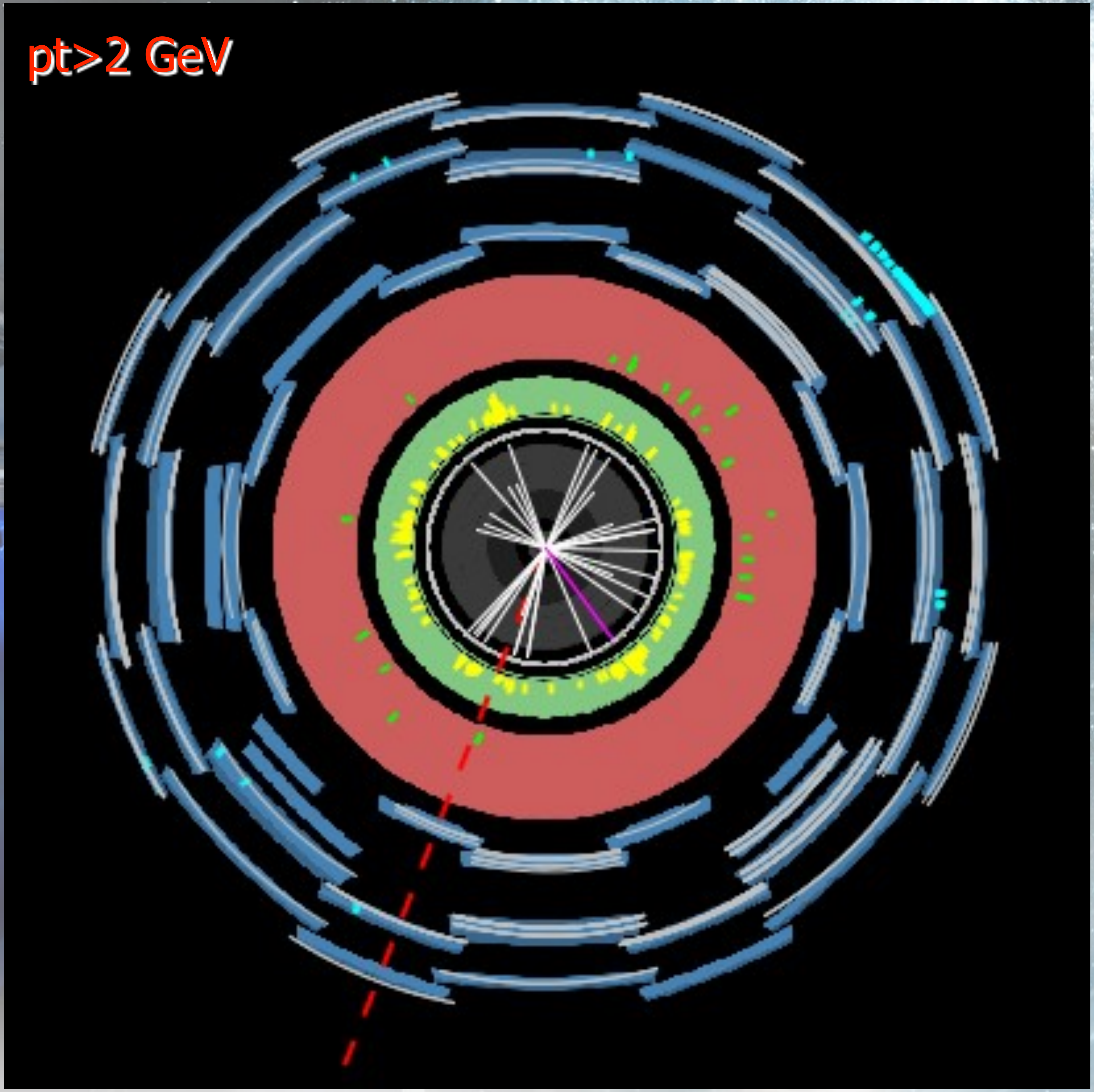

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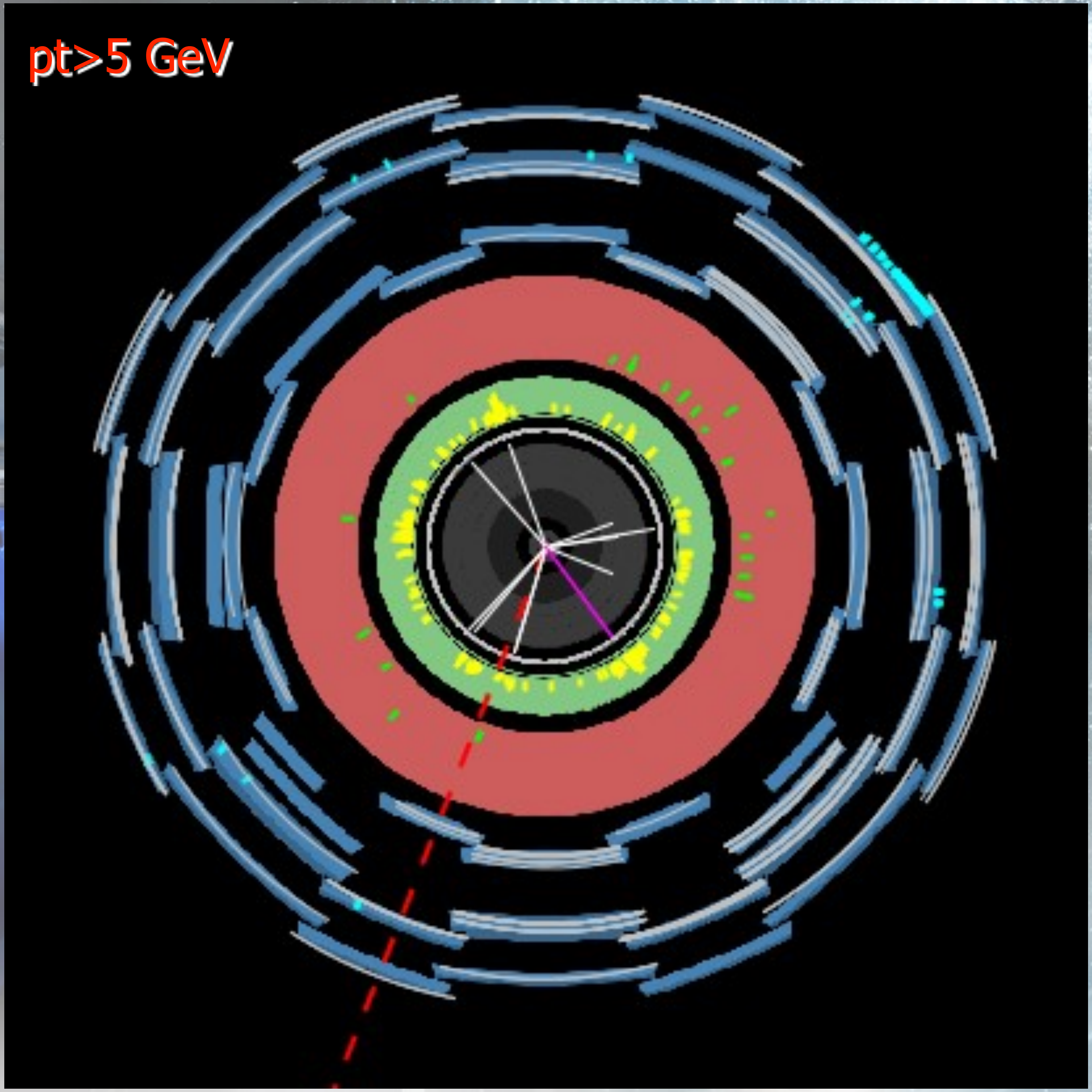

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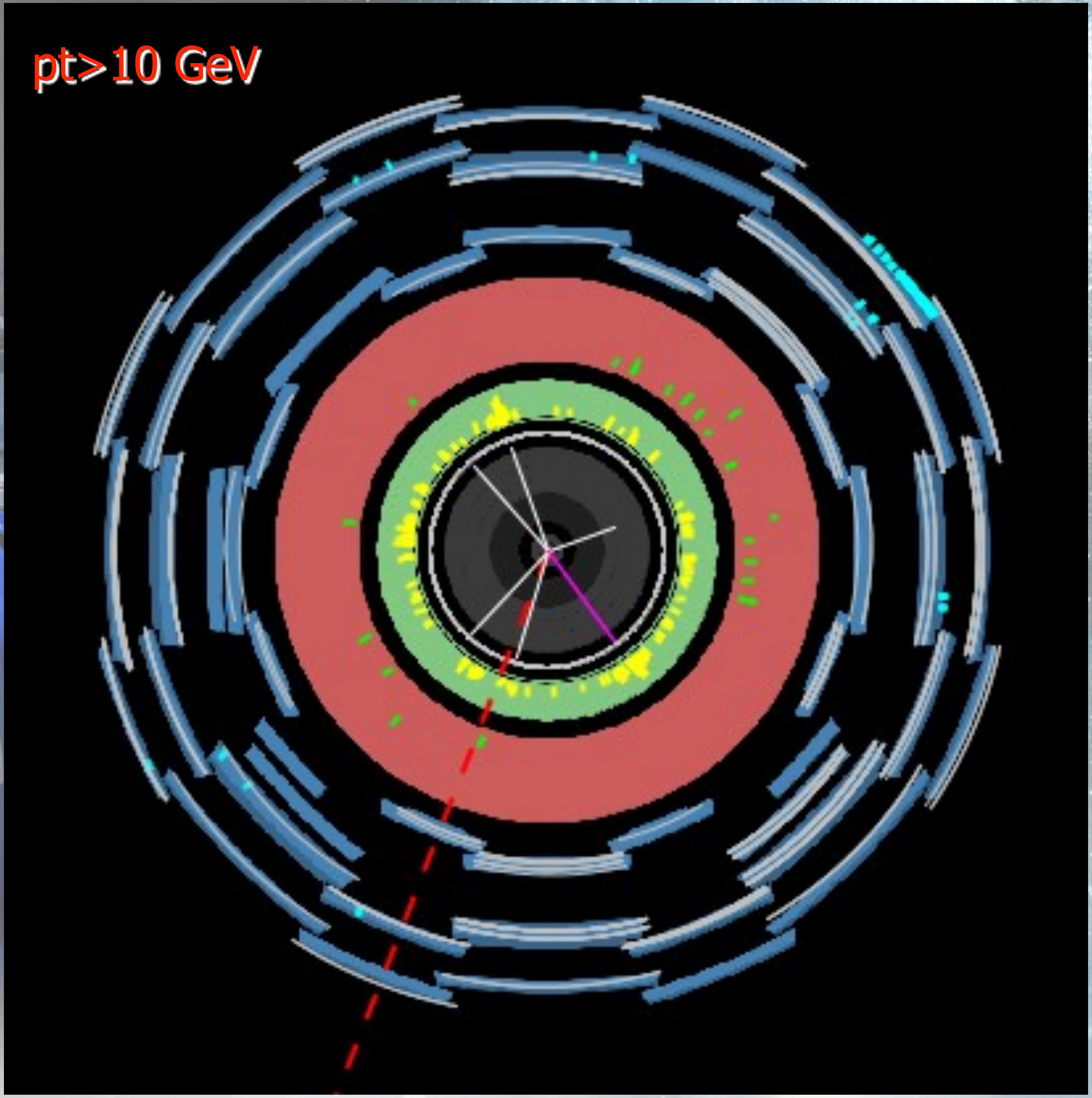

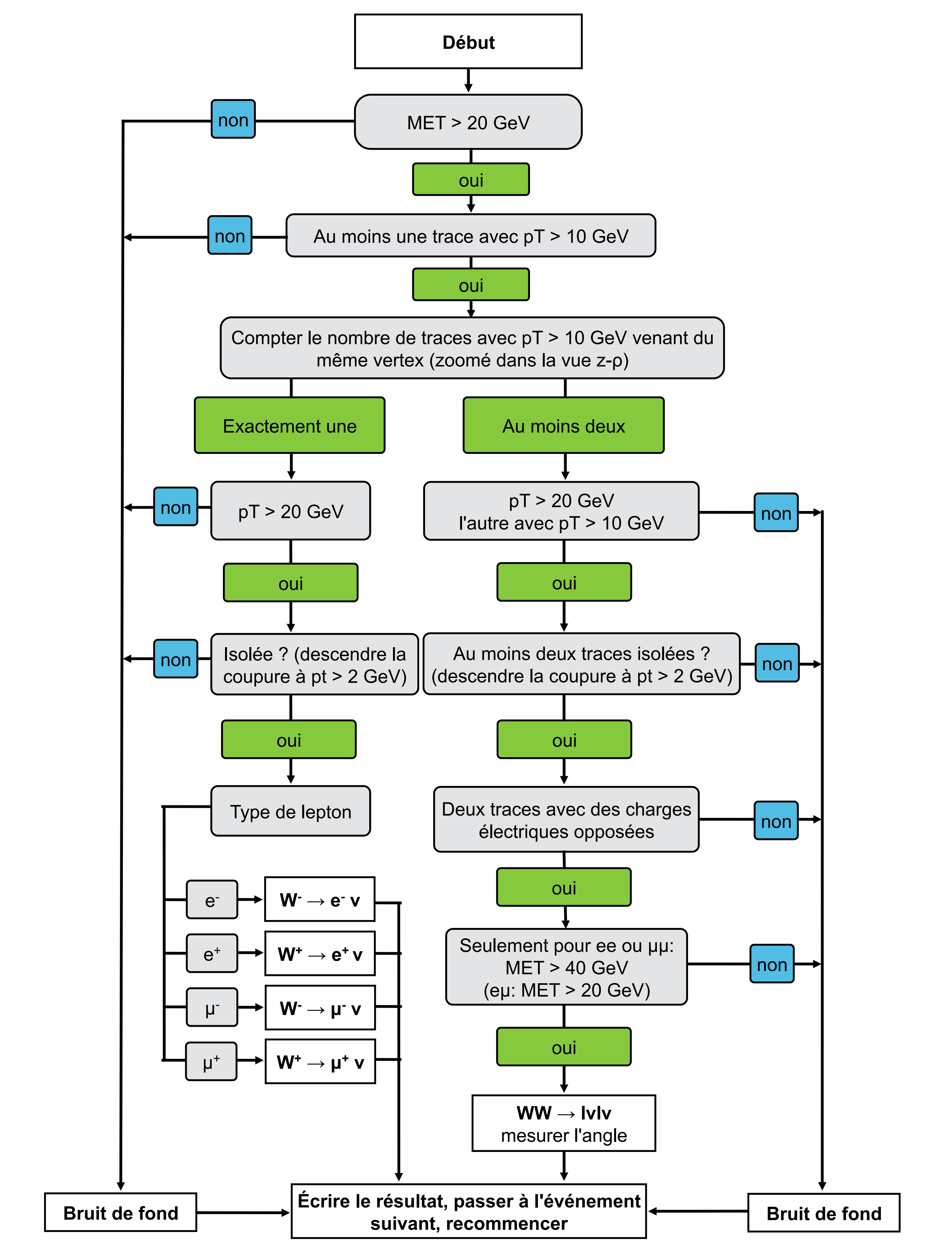

Entrainement

exercice 2