

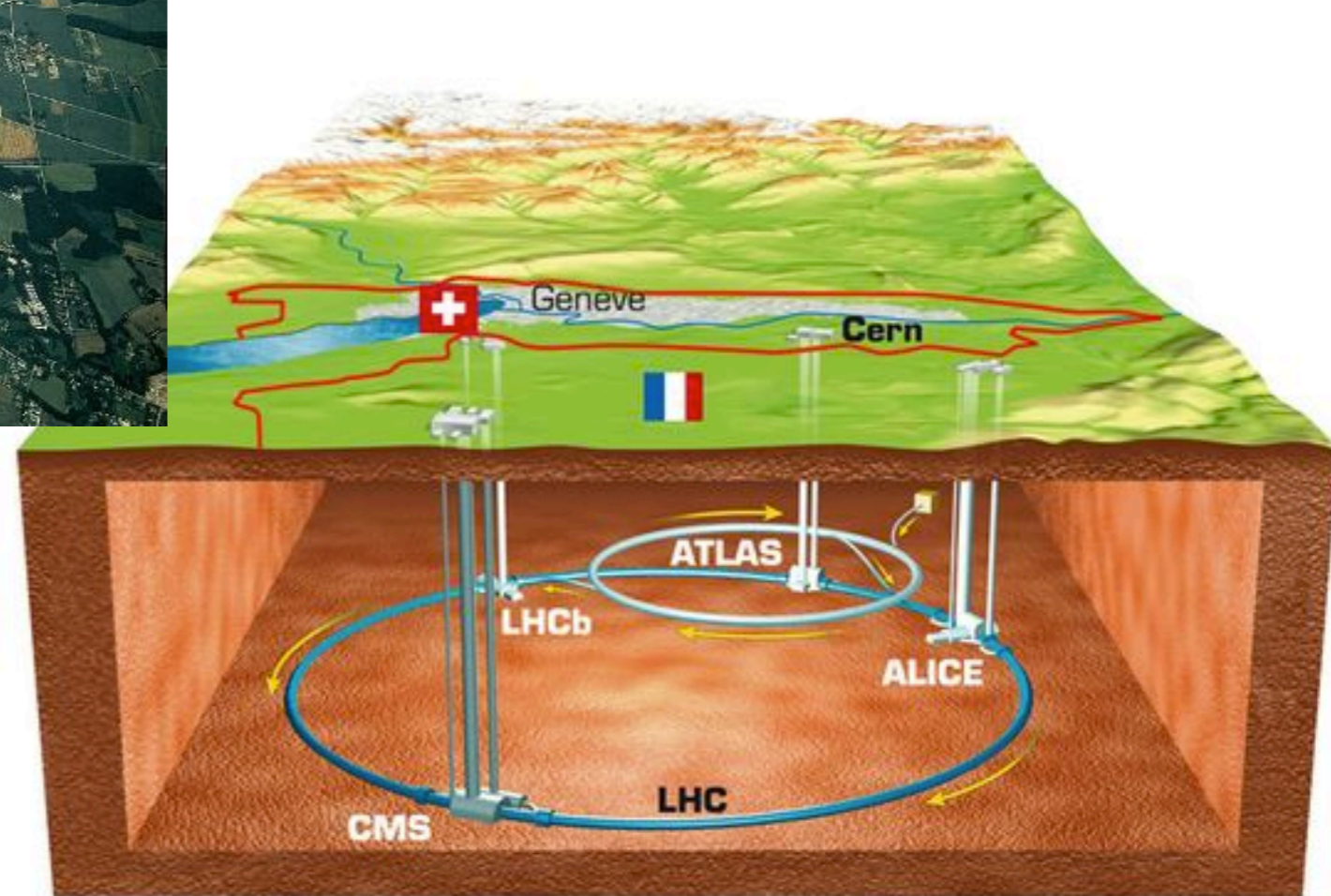
# Le détecteur ATLAS présentation du TP

**Frédéric Déliot**

masterclass, 30 mars 2015

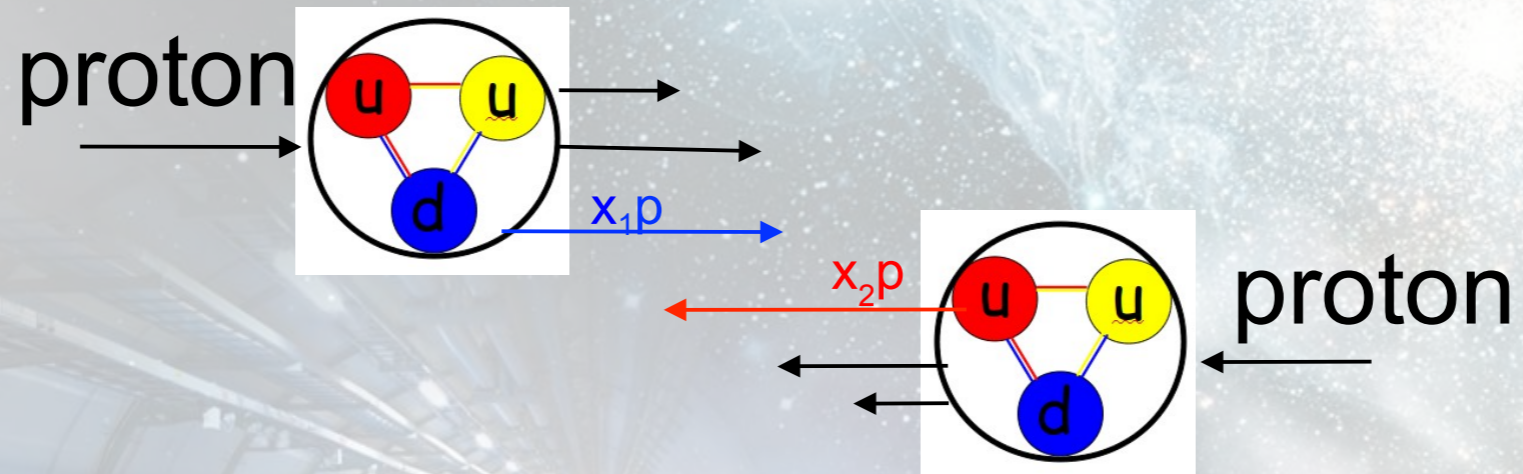


# ATLAS au CERN





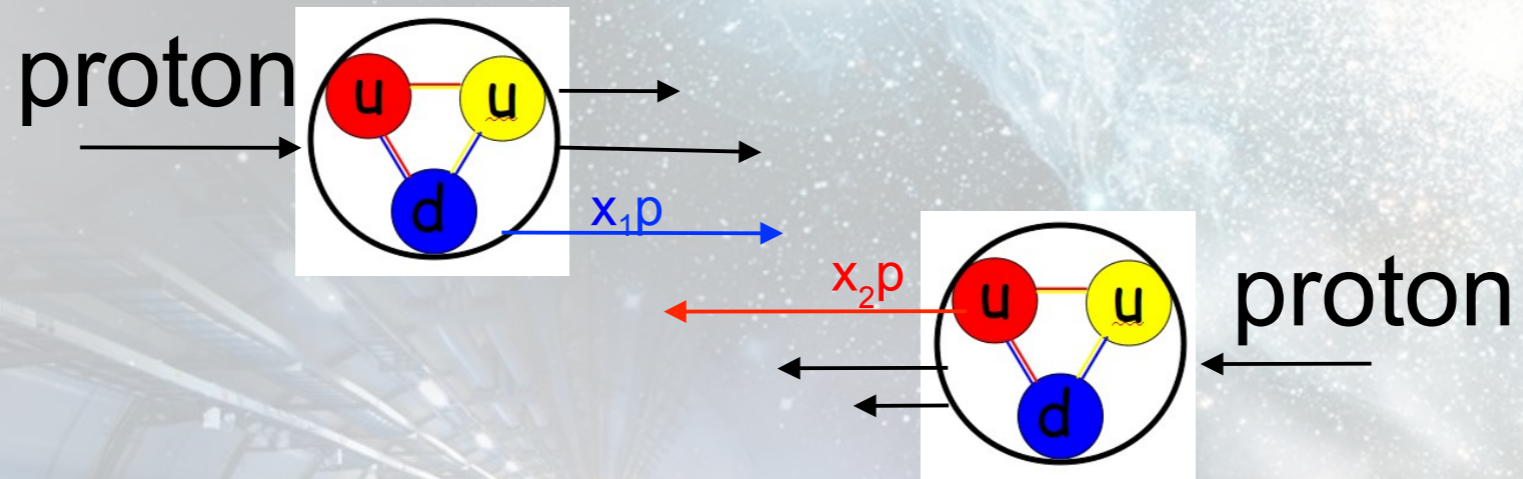
# Collisions au LHC



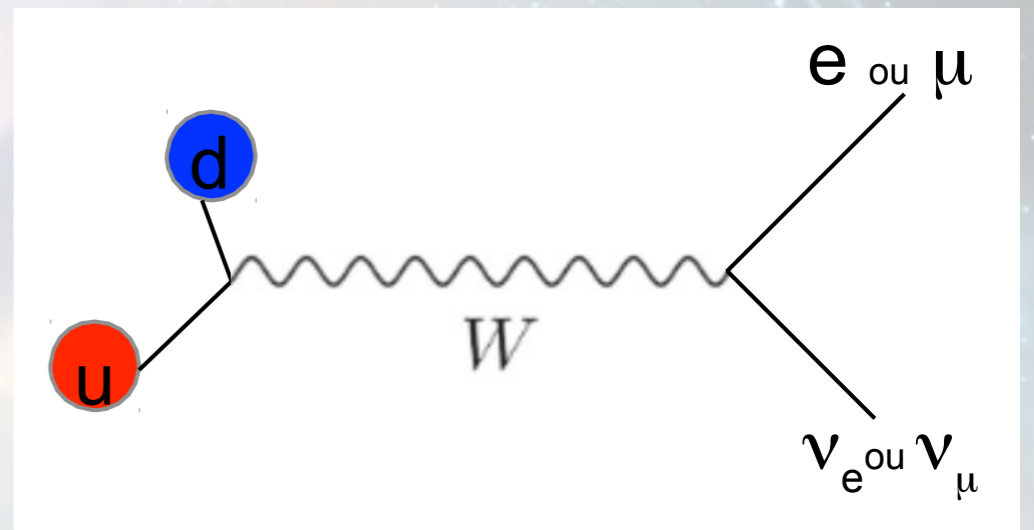
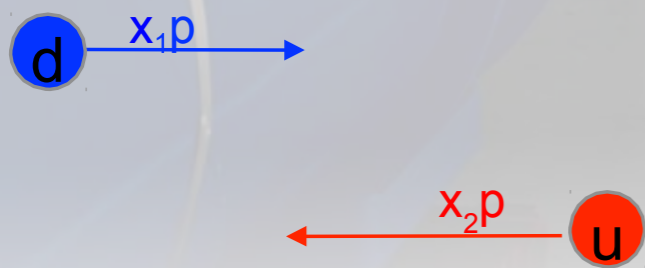
matière (proton)  $\longrightarrow$   $E=mc^2$  énergie  $\longrightarrow$  matière (boson W)



# Collisions au LHC

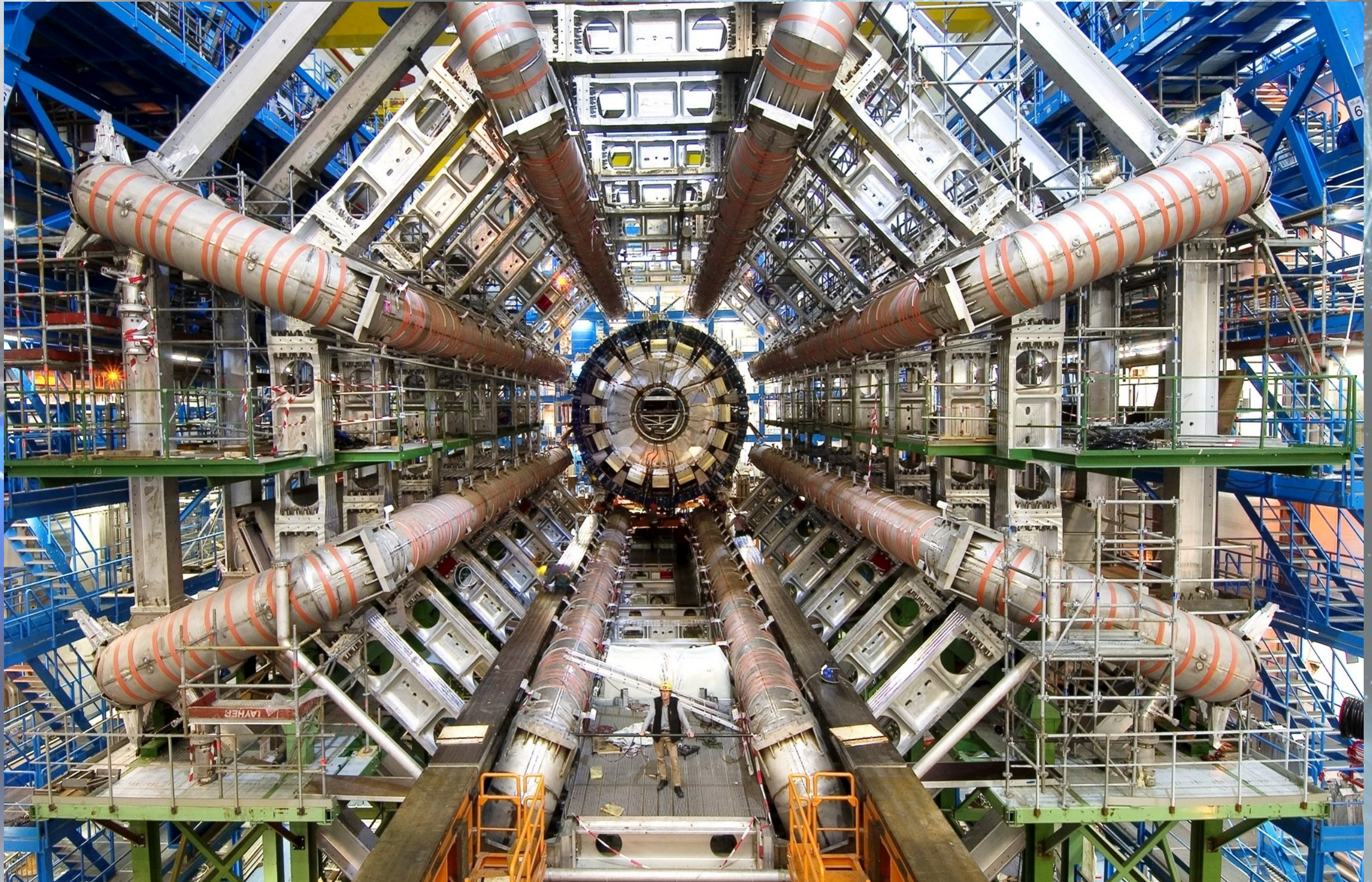


matière (proton)  $\longrightarrow$   $E=mc^2$  énergie  $\longrightarrow$  matière (boson W)



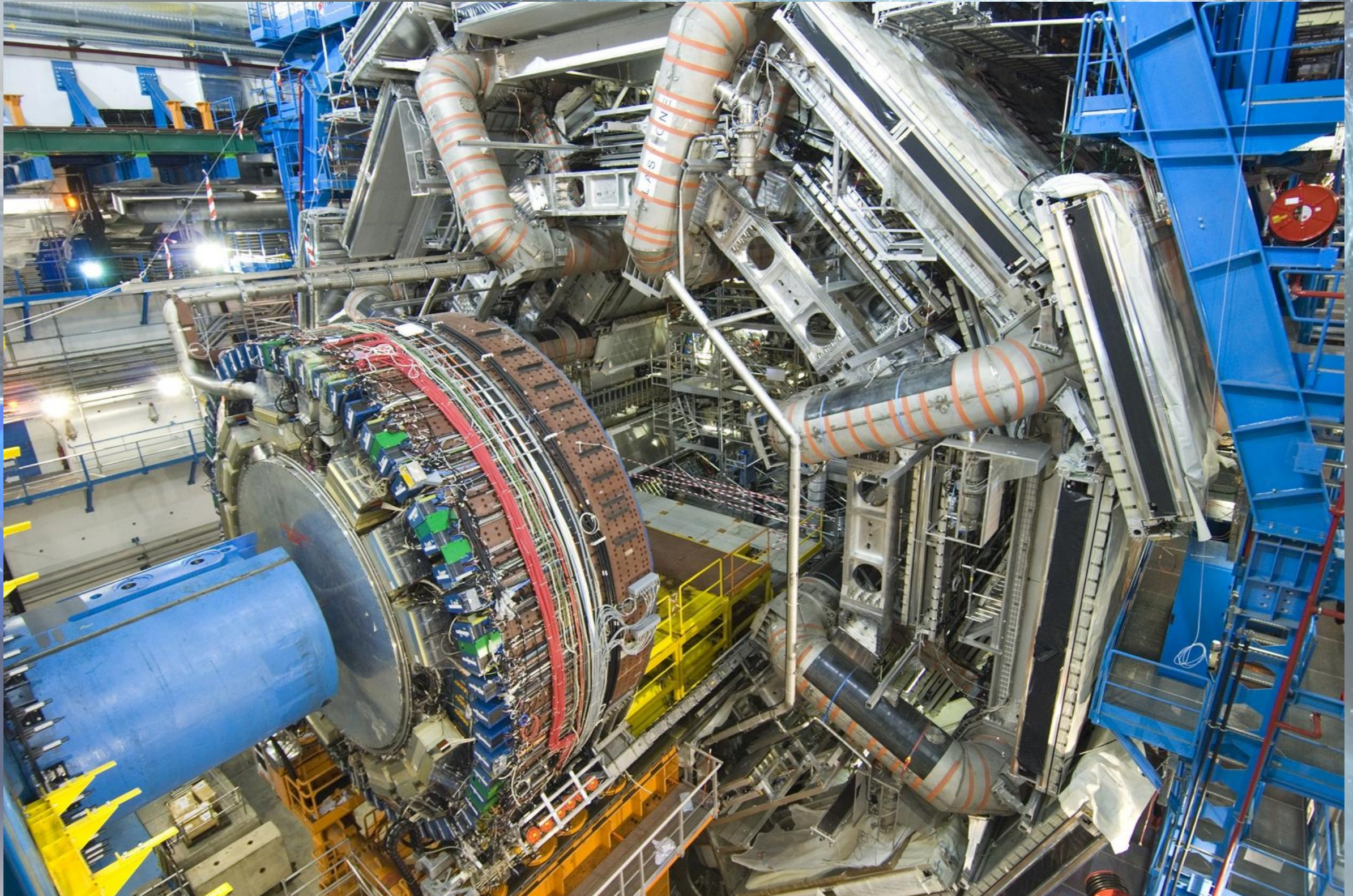


# Le détecteur ATLAS



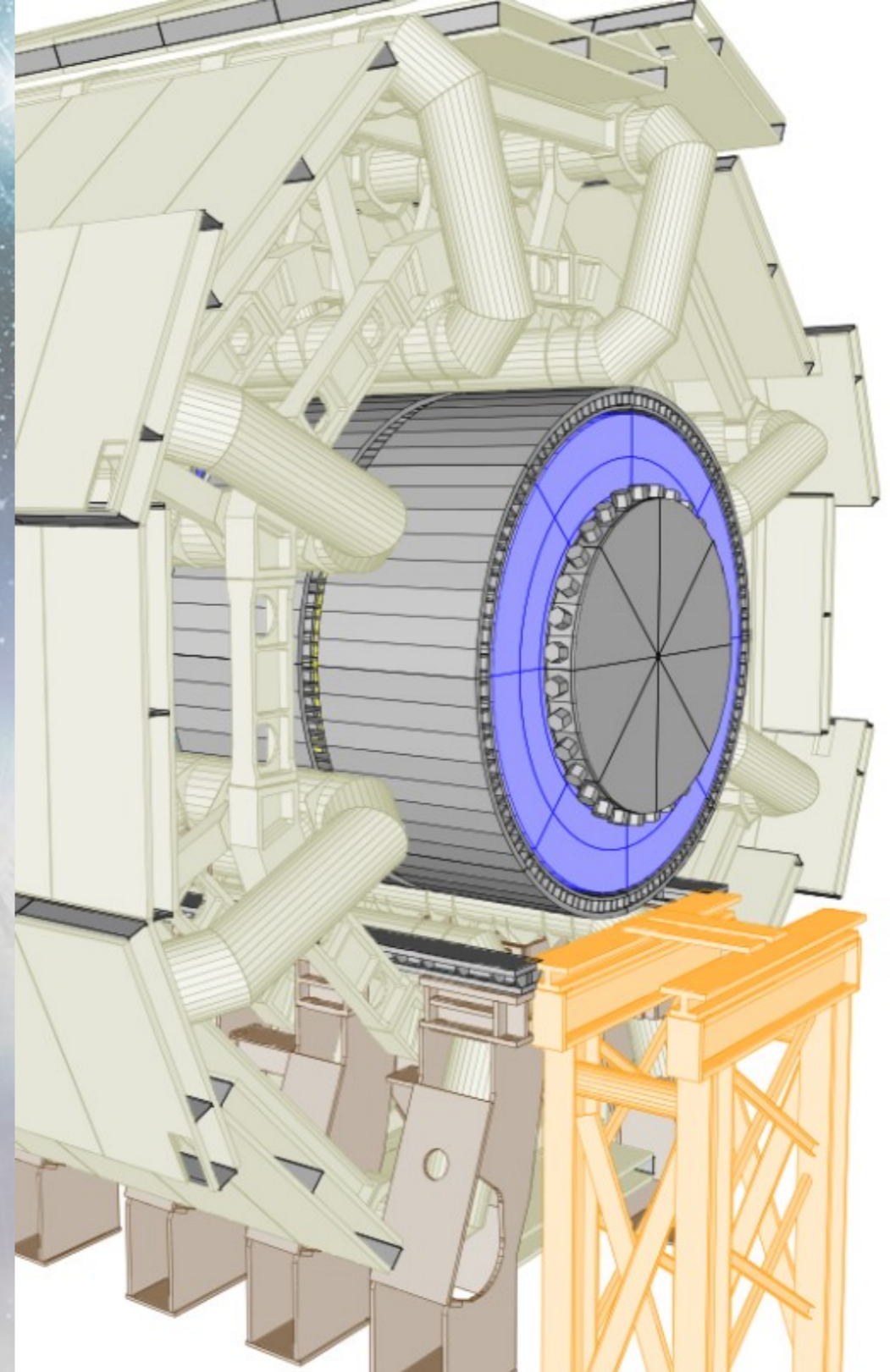
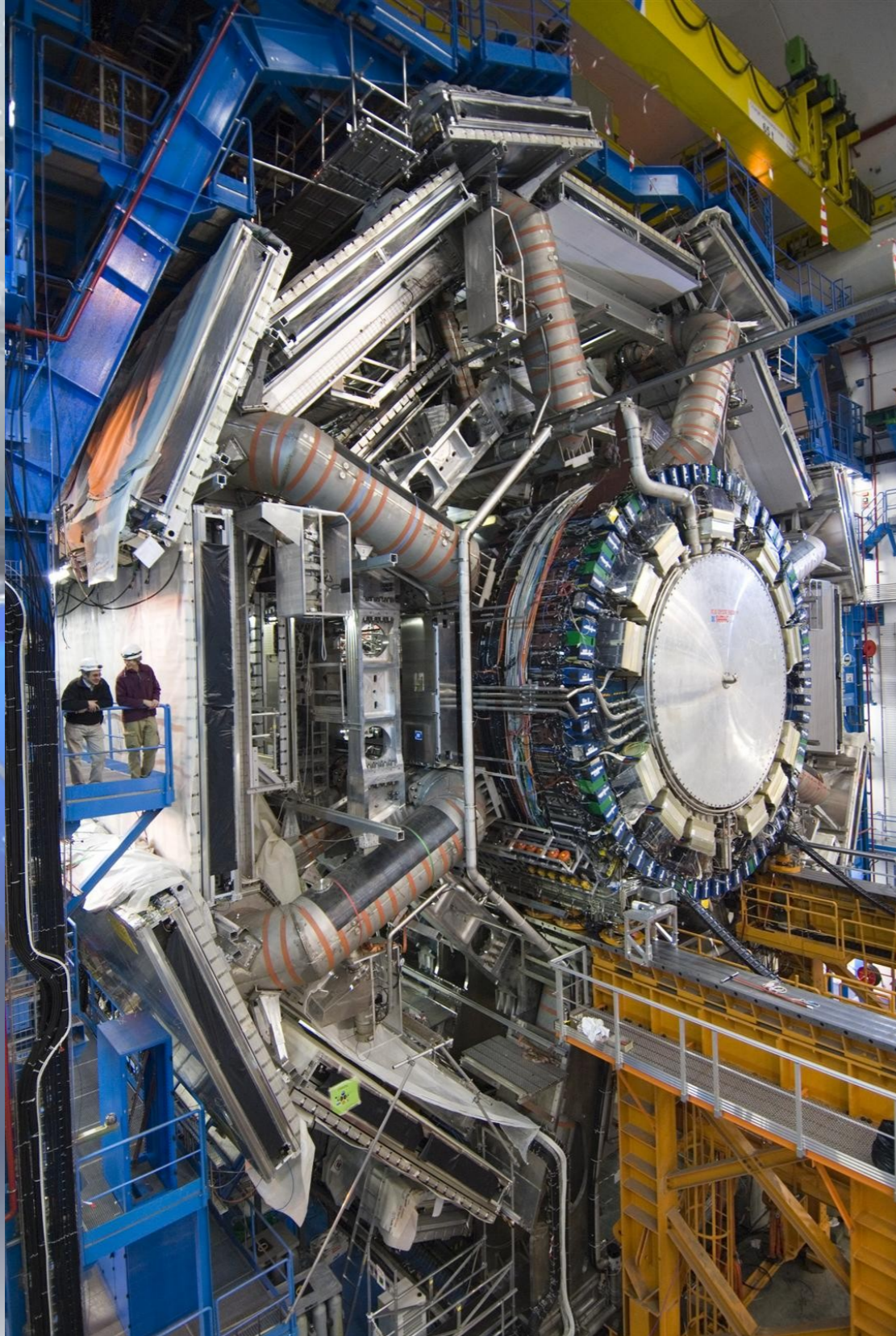


# Le détecteur ATLAS





# Simulation





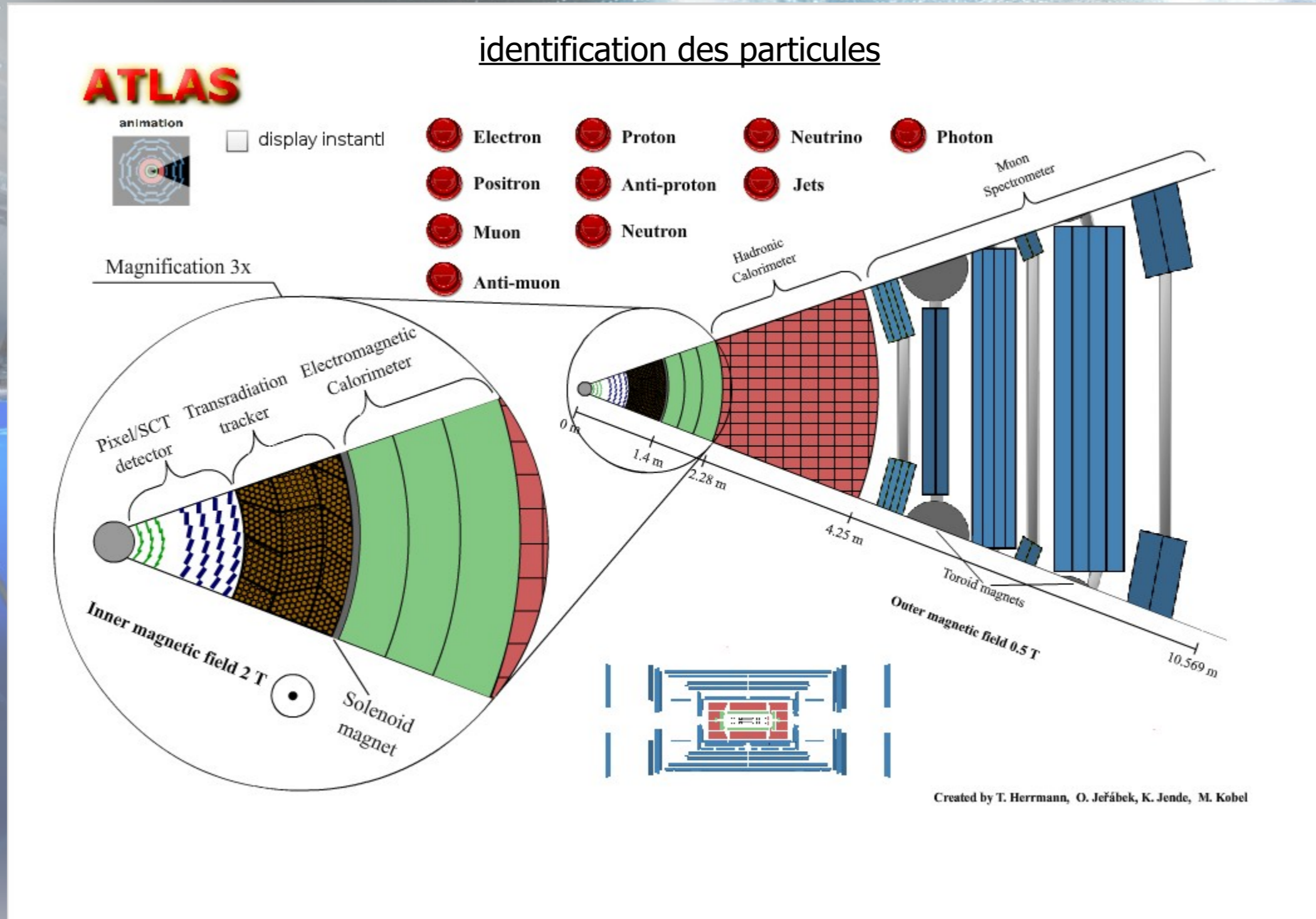
# Principe d'un détecteur



collision proton-proton dans ATLAS



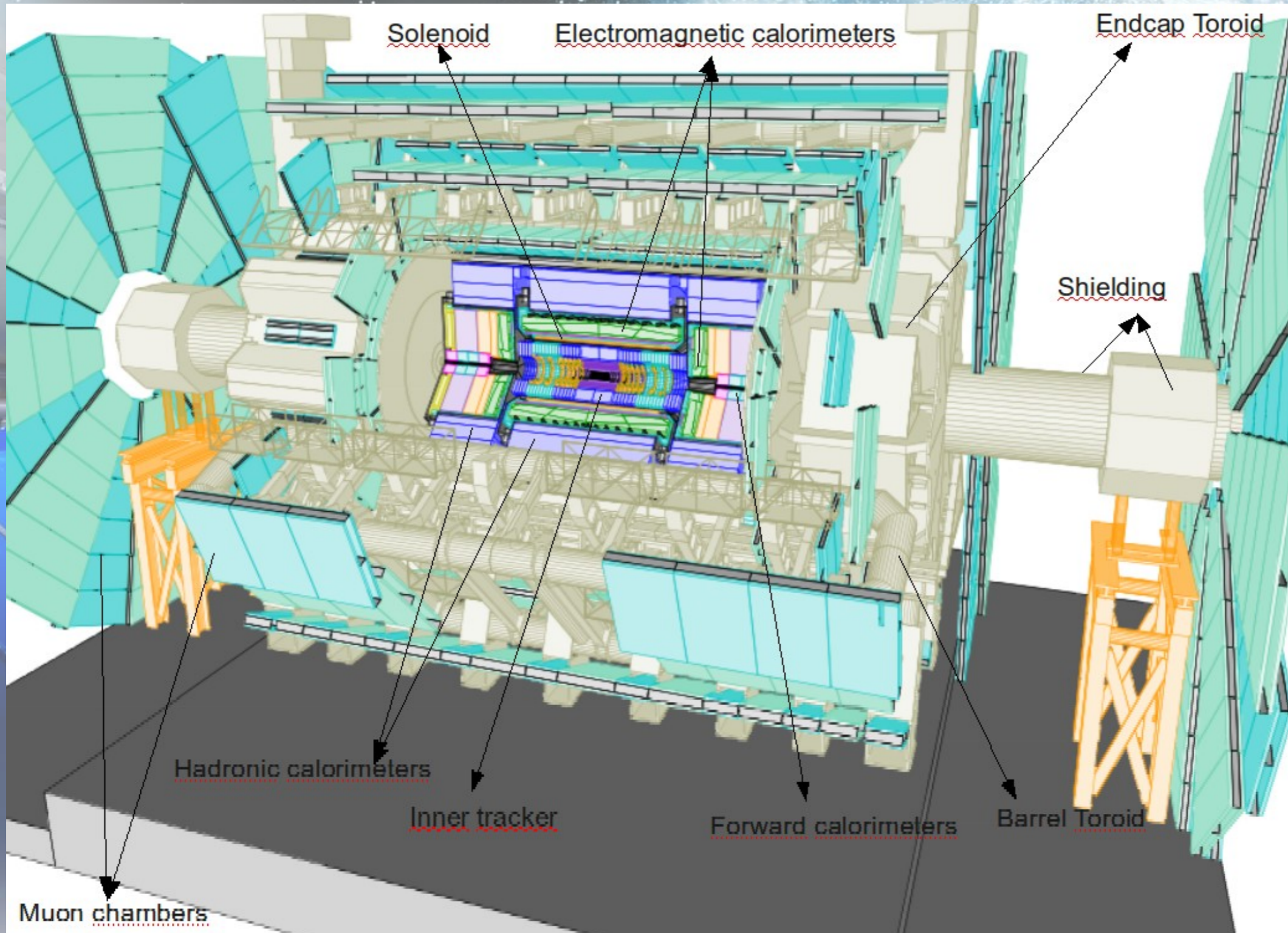
# Différents sous systèmes





# ATLAS: $\sim 90\,000\,000$ pixels

45 m



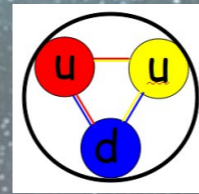
24 m



# But du TP

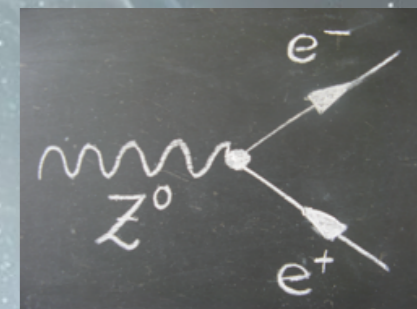
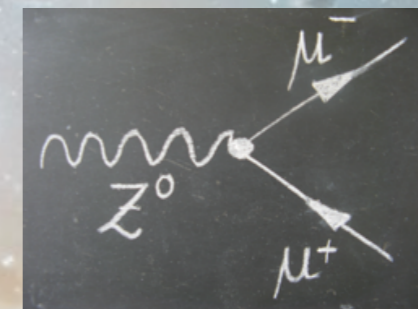
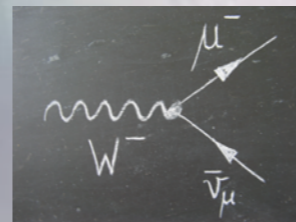
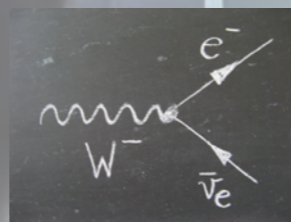
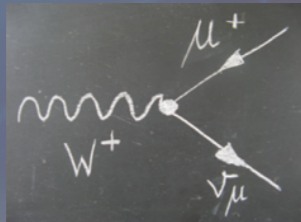
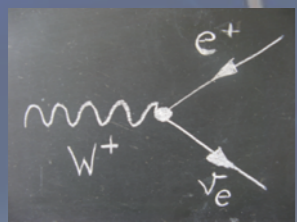
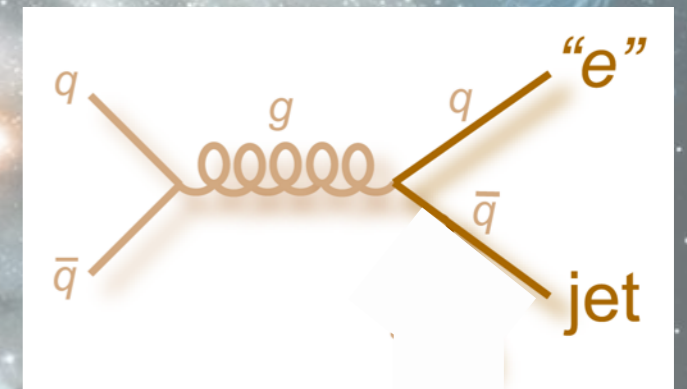
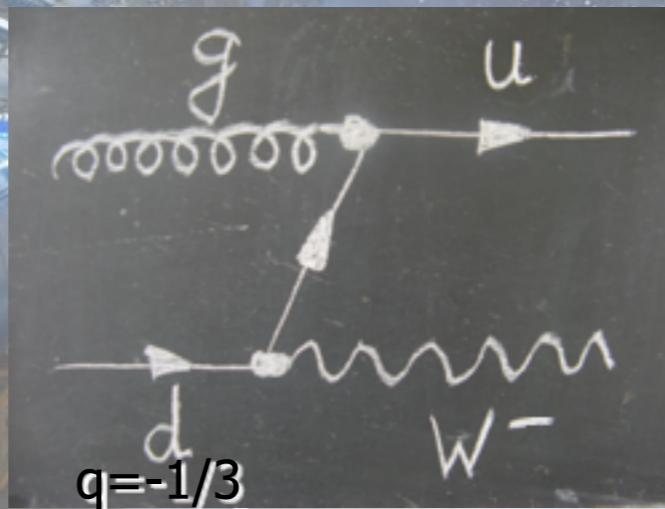
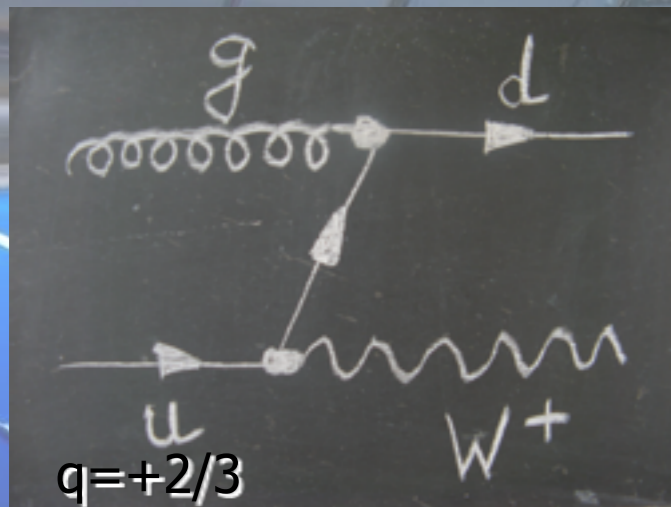
identifier et compter les événements avec un boson  $W^+$ ,  $W^-$  ou 2  $W$ 's

1) test de la structure du proton:



signal

bruit de fond



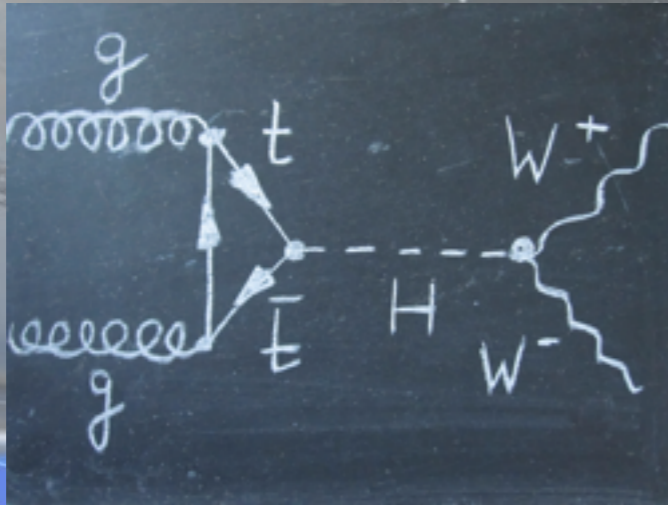


# But du TP (2)

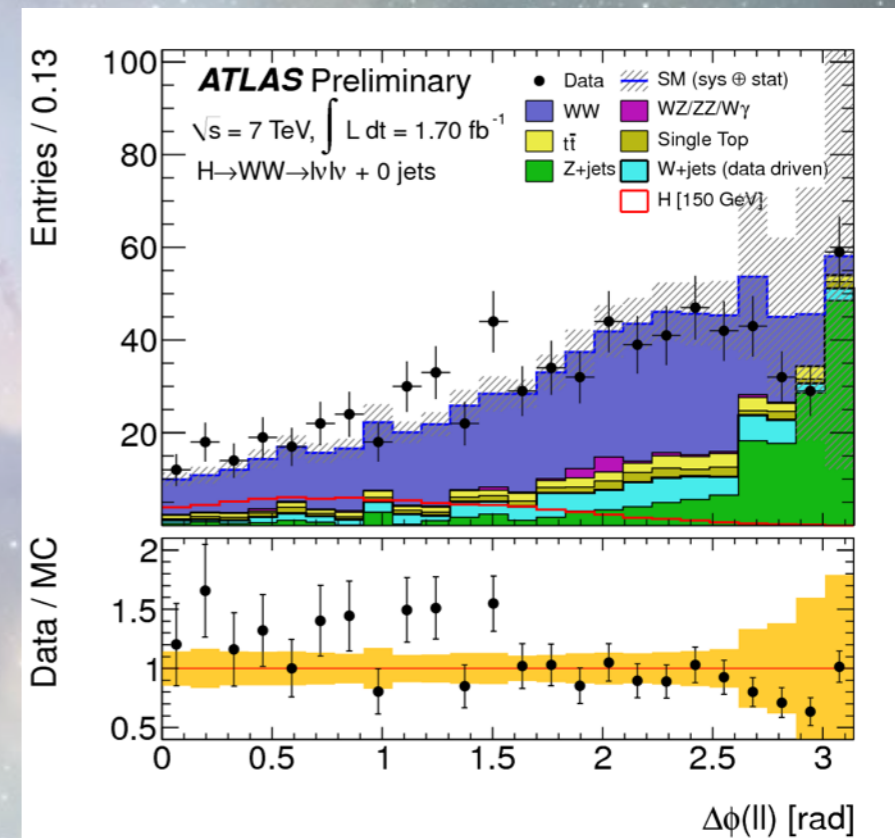
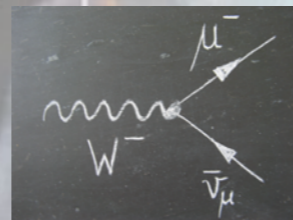
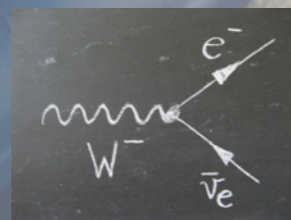
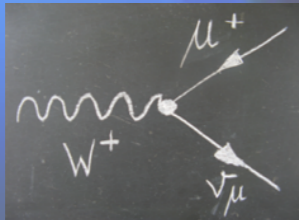
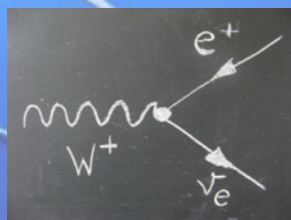
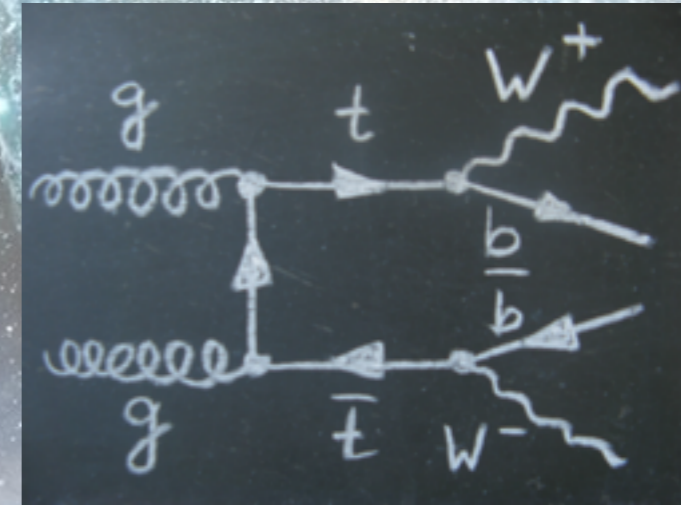
identifier et compter les événements avec un boson  $W^+$ ,  $W^-$  ou 2  $W$ 's

2) recherche du boson de Higgs:

signal

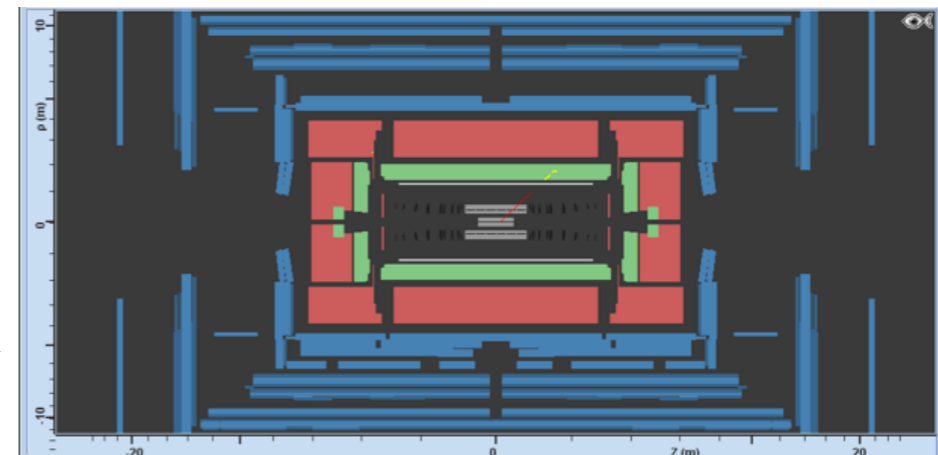
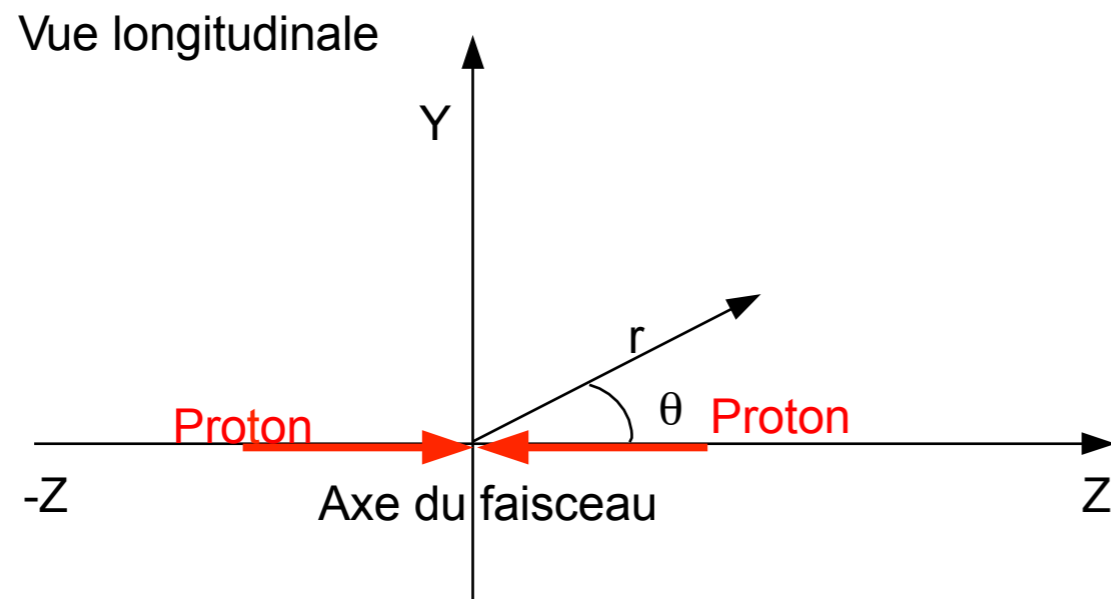
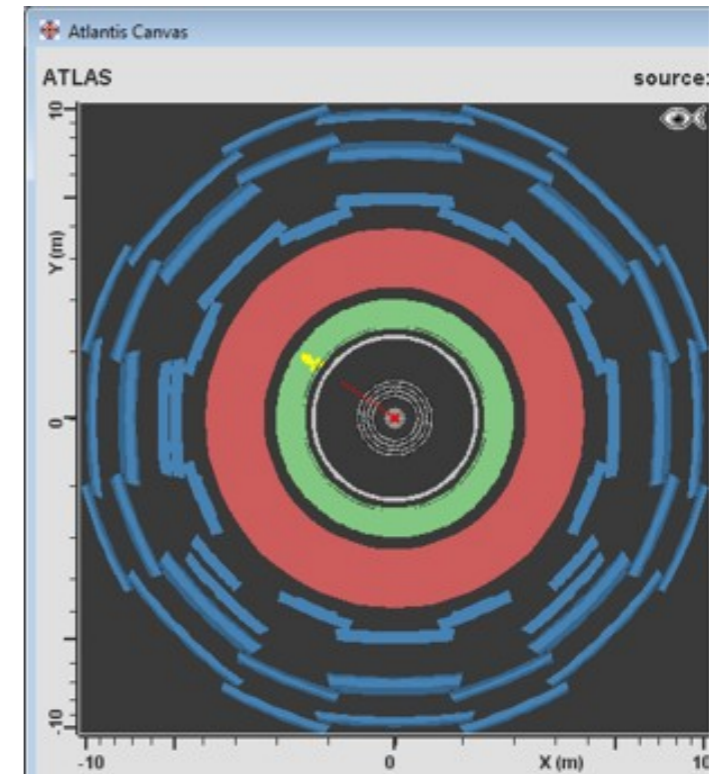
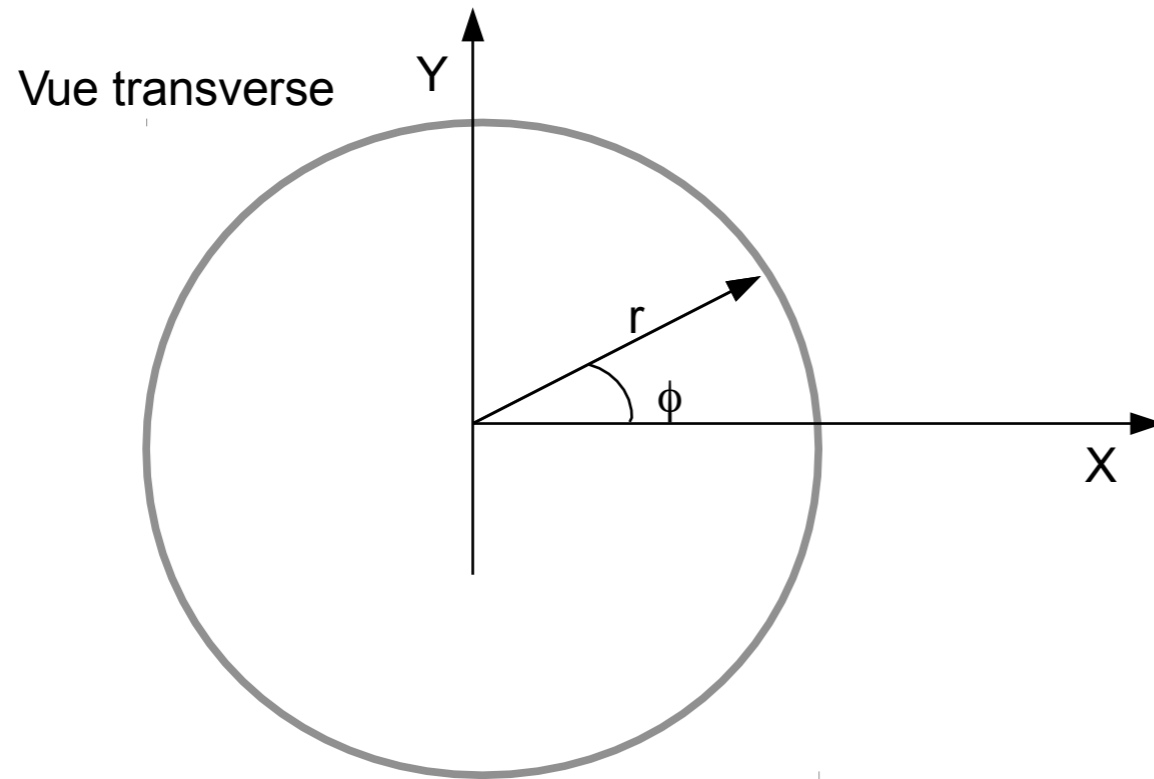


bruit de fond





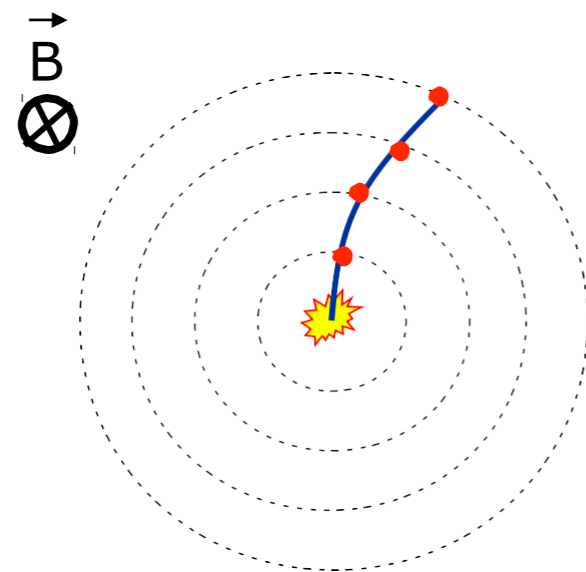
# Visualisation





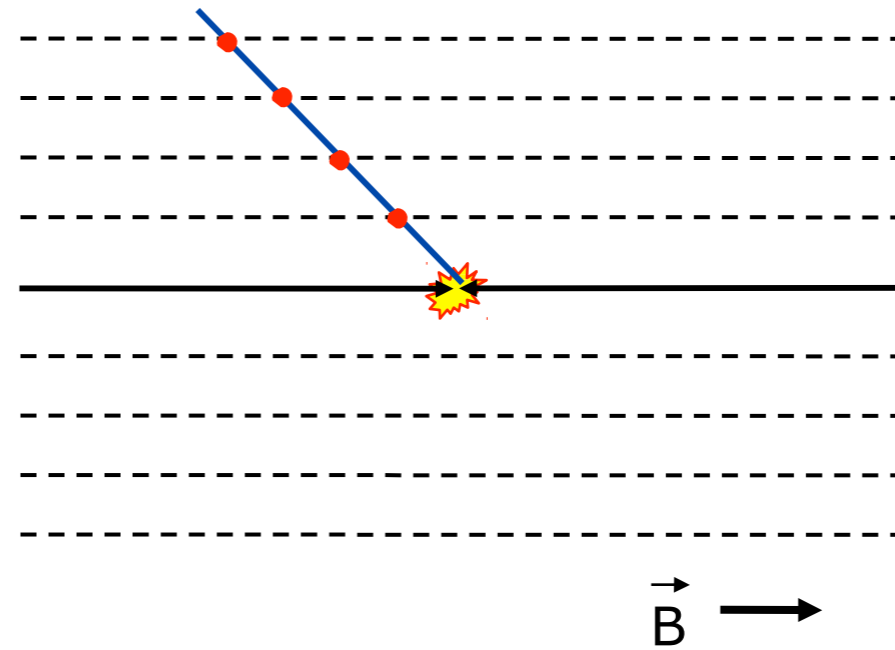
# Visualisation

Vue transverse



Un électron

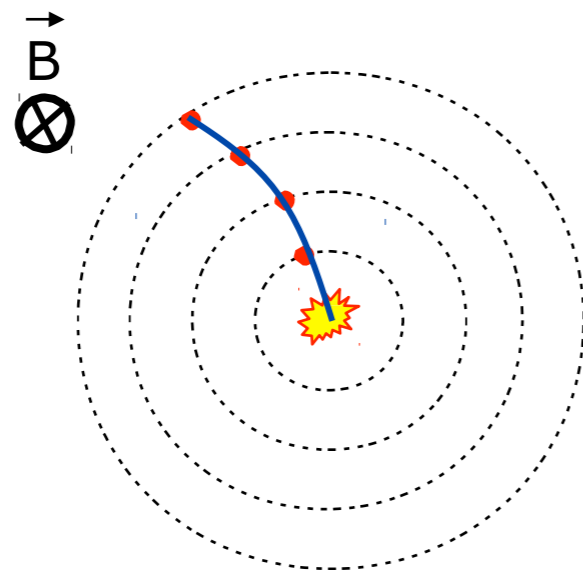
Vue longitudinale





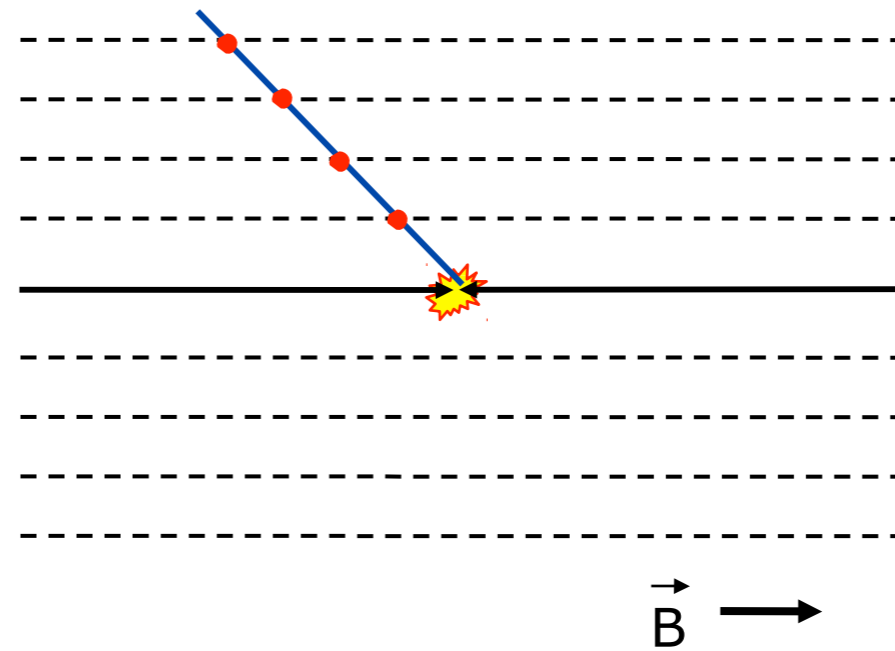
# Visualisation

Vue transverse



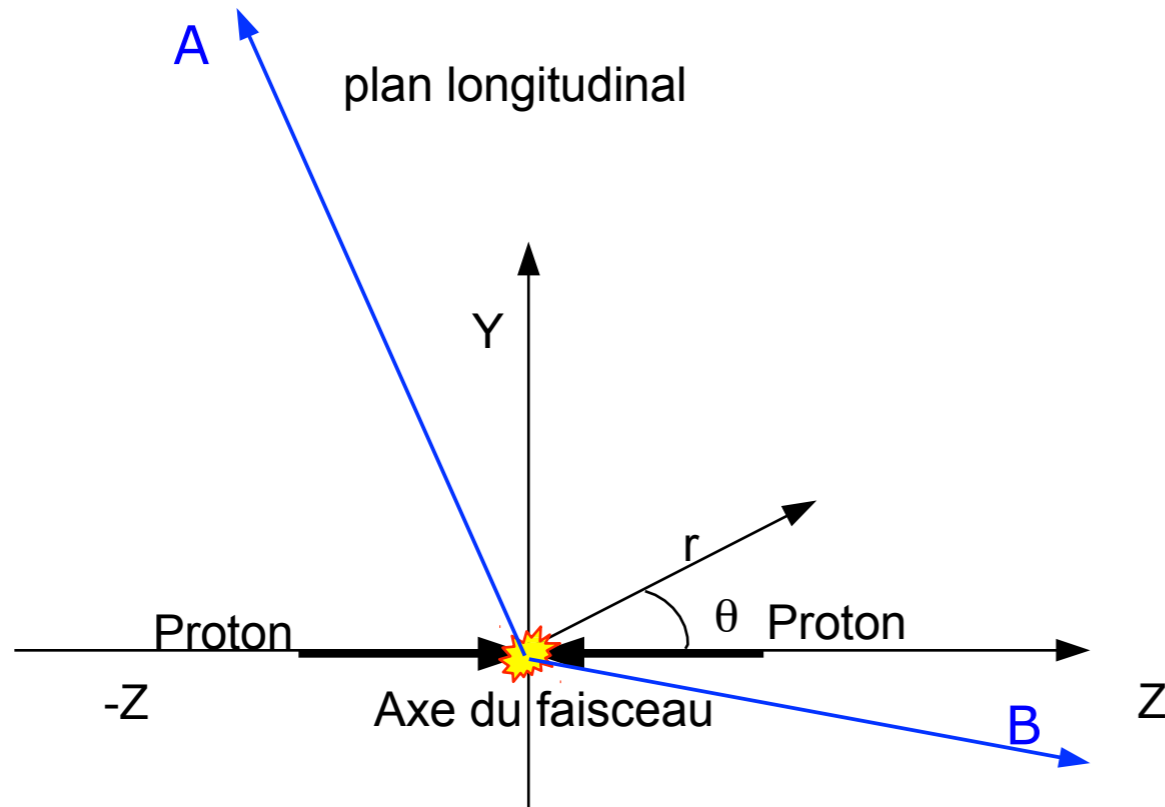
Un positon

Vue longitudinale



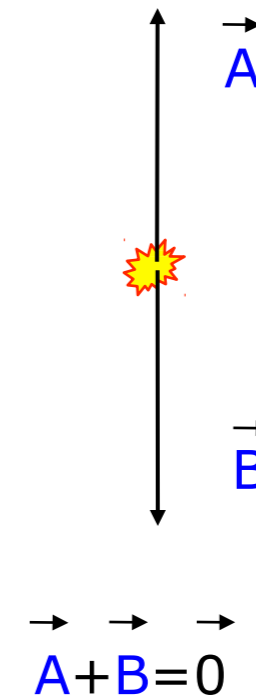


# Conservation de la quantité de mouvement



Quantité de mouvement ( $p=mv$ ) = **impulsion**

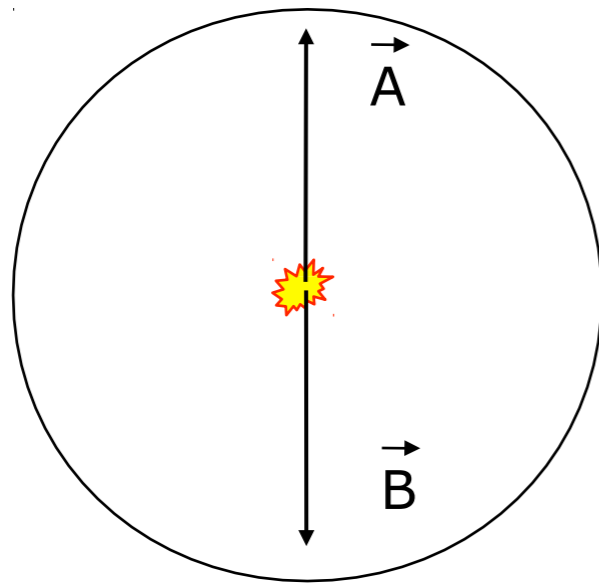
plan transverse



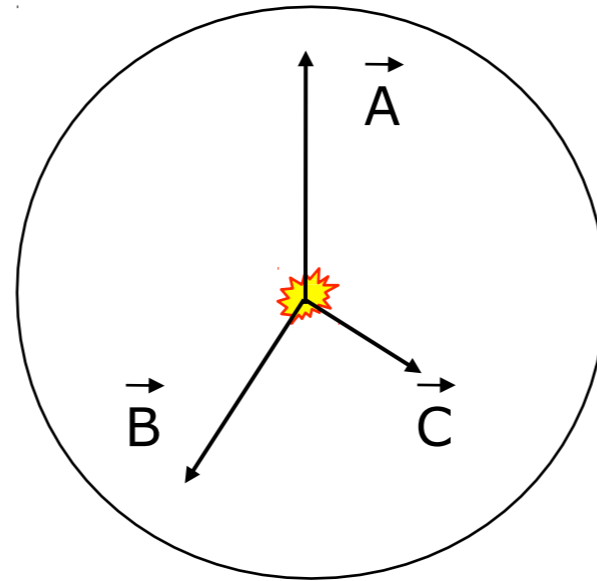
**Conservation de l'impulsion dans le plan transverse au faisceau**



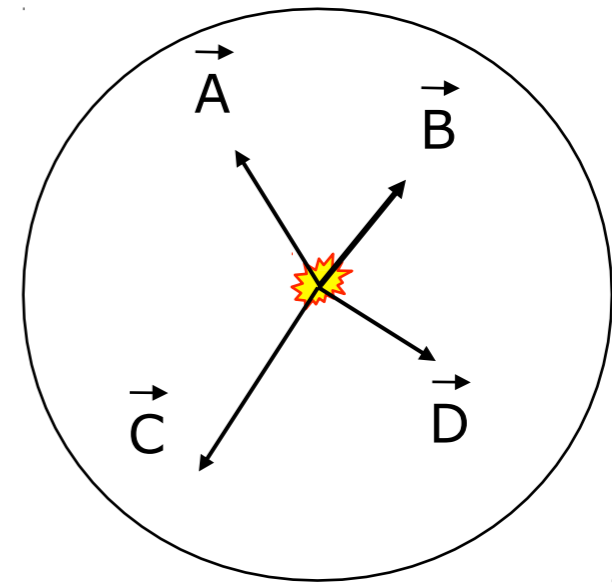
# Conservation de la quantité de mouvement



$$\vec{A} + \vec{B} = 0$$



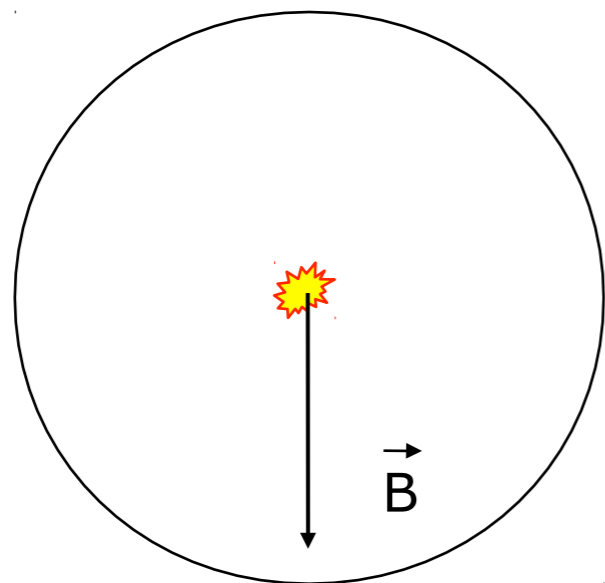
$$\vec{A} + \vec{B} + \vec{C} = 0$$



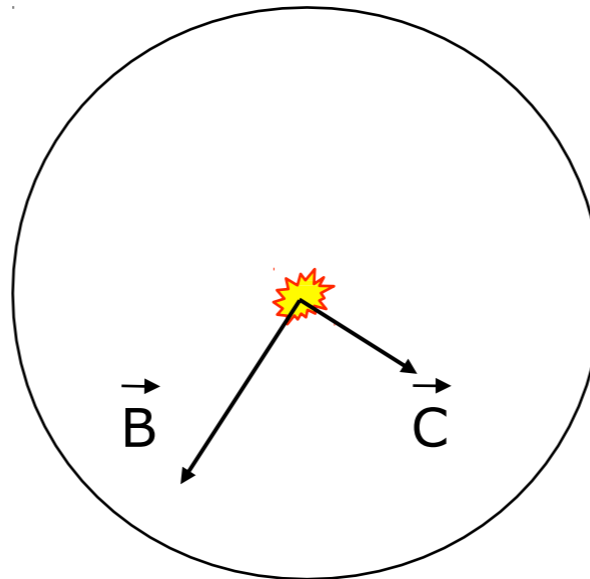
$$\vec{A} + \vec{B} + \vec{C} + \vec{D} = 0$$



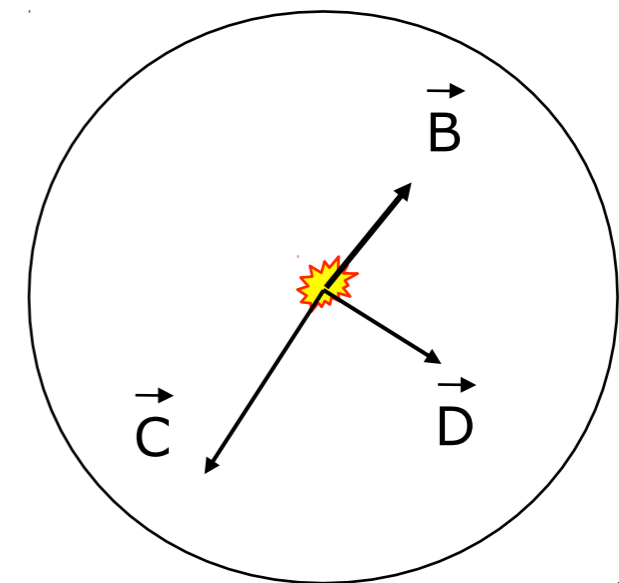
# Energie manquante (MET)



$$\vec{B} \neq 0$$



$$\vec{B} + \vec{C} \neq 0$$



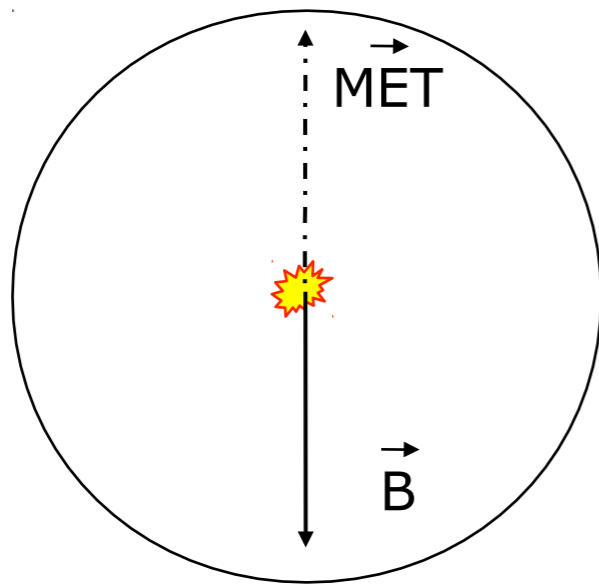
$$\vec{B} + \vec{C} + \vec{D} \neq 0$$

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

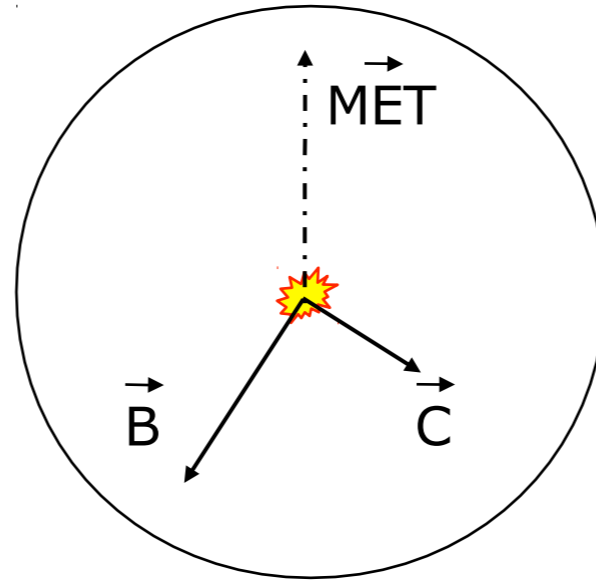
Si la particule A est un neutrino, l'impulsion dans le plan transverse semble ne plus être conservée.



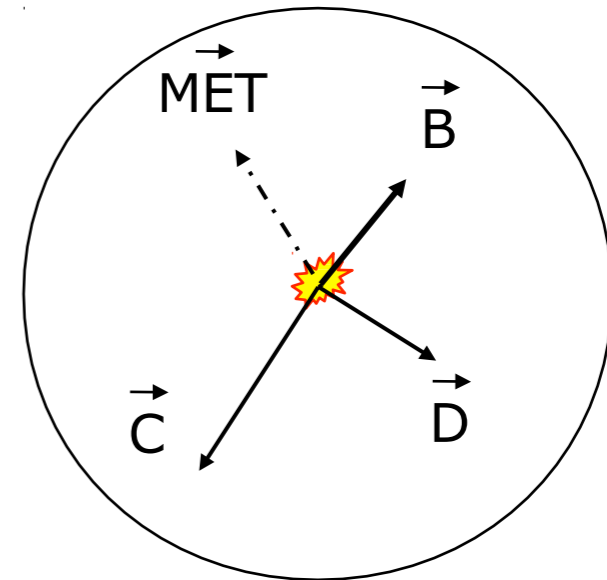
# Energie manquante (MET)



$$\vec{B} = -\vec{MET}$$



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

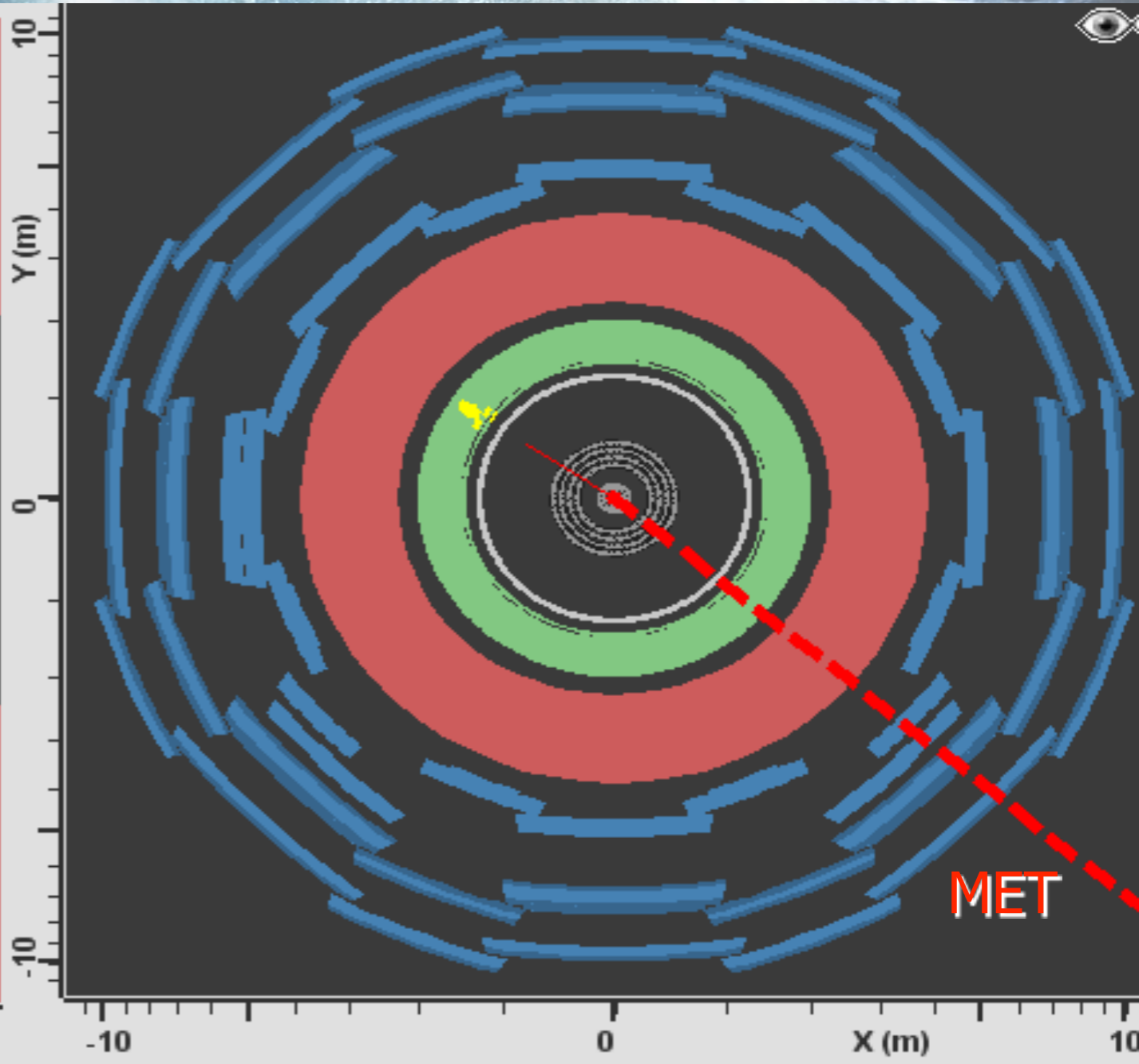
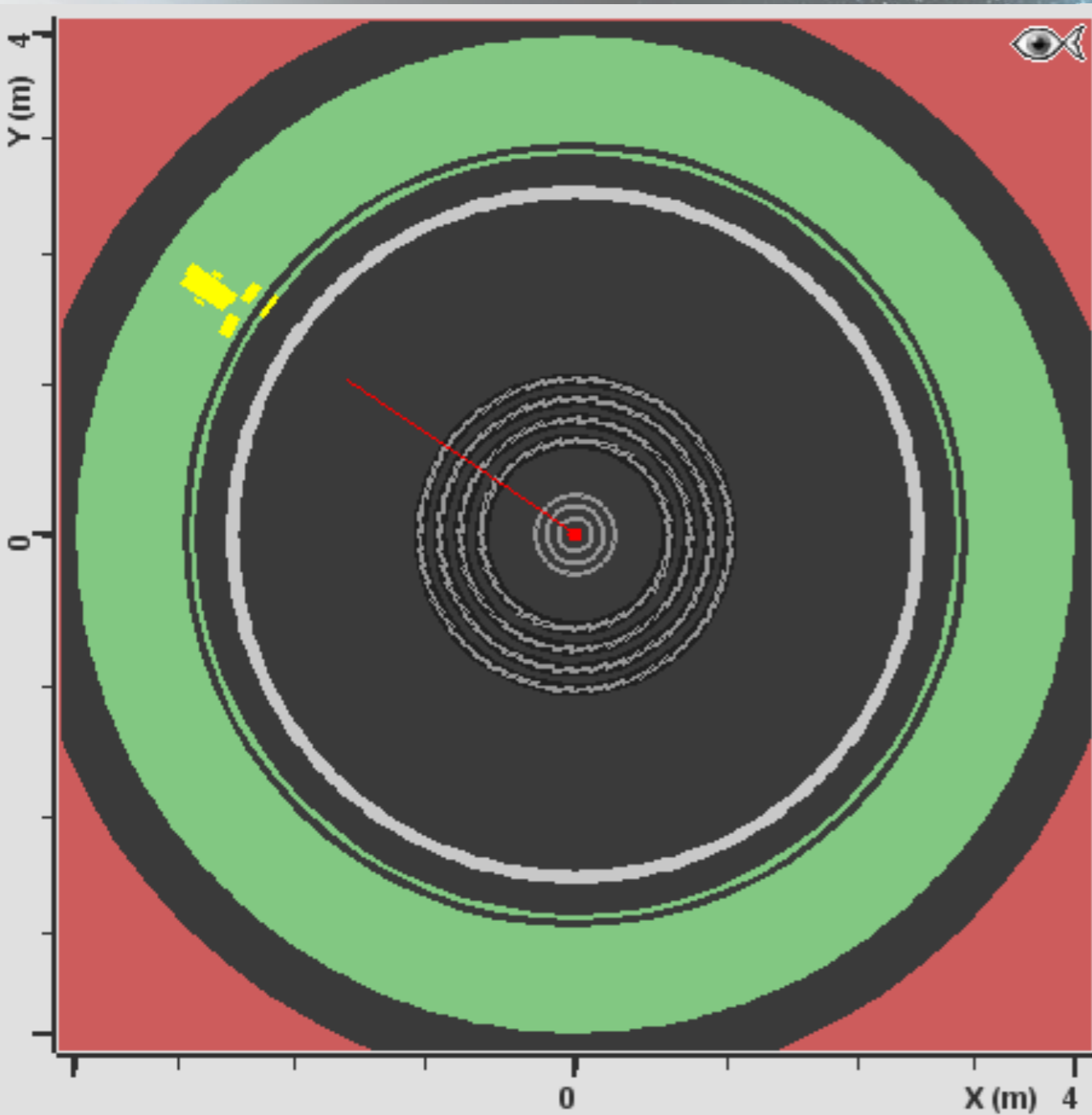


$$\vec{B} + \vec{C} + \vec{D} = -\vec{MET}$$

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

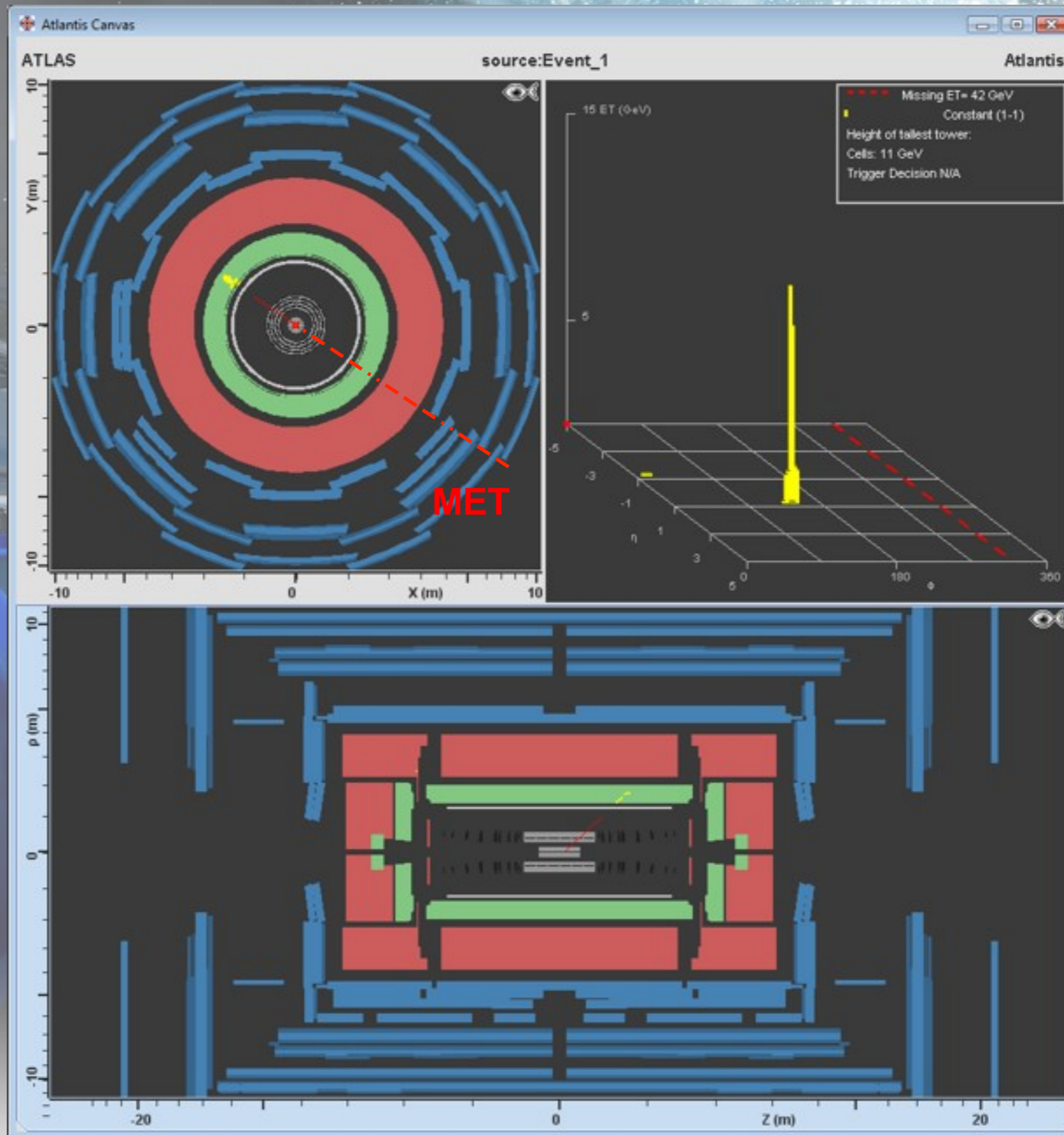


# Energie manquante (MET)





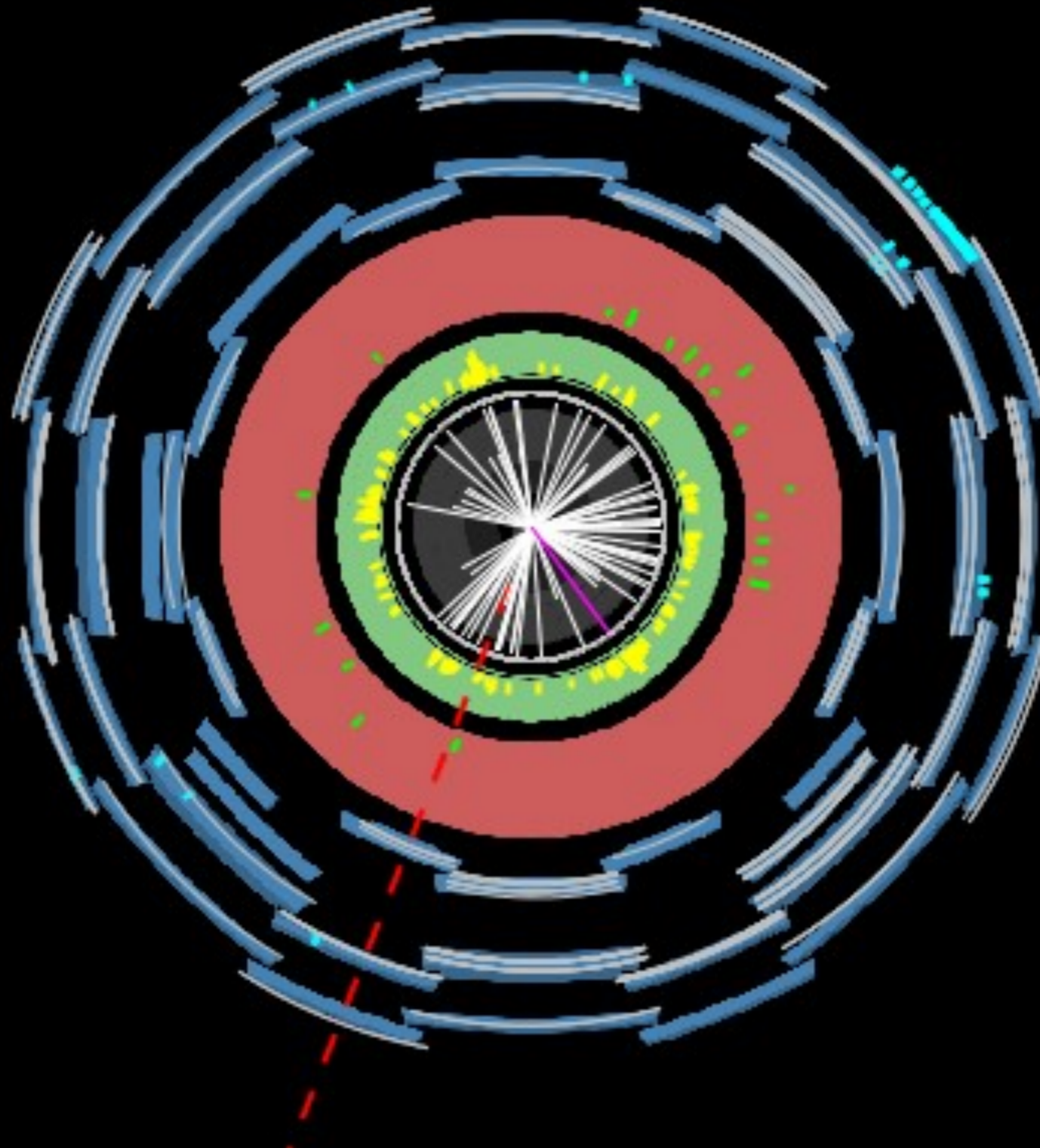
# Energie manquante (MET)





# Isolation dans le détecteur interne

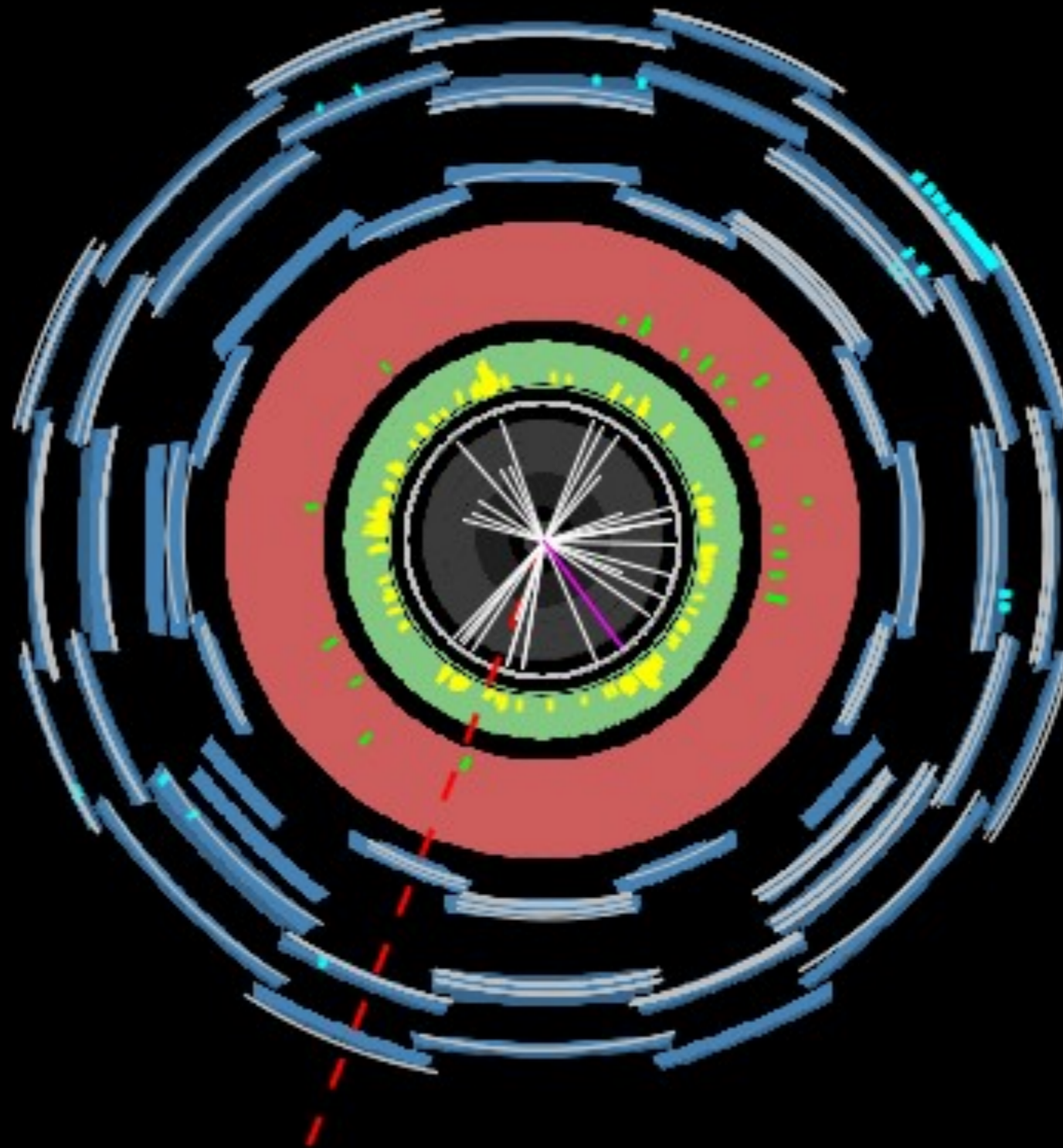
$pt > 1 \text{ GeV}$





# Isolation dans le détecteur interne

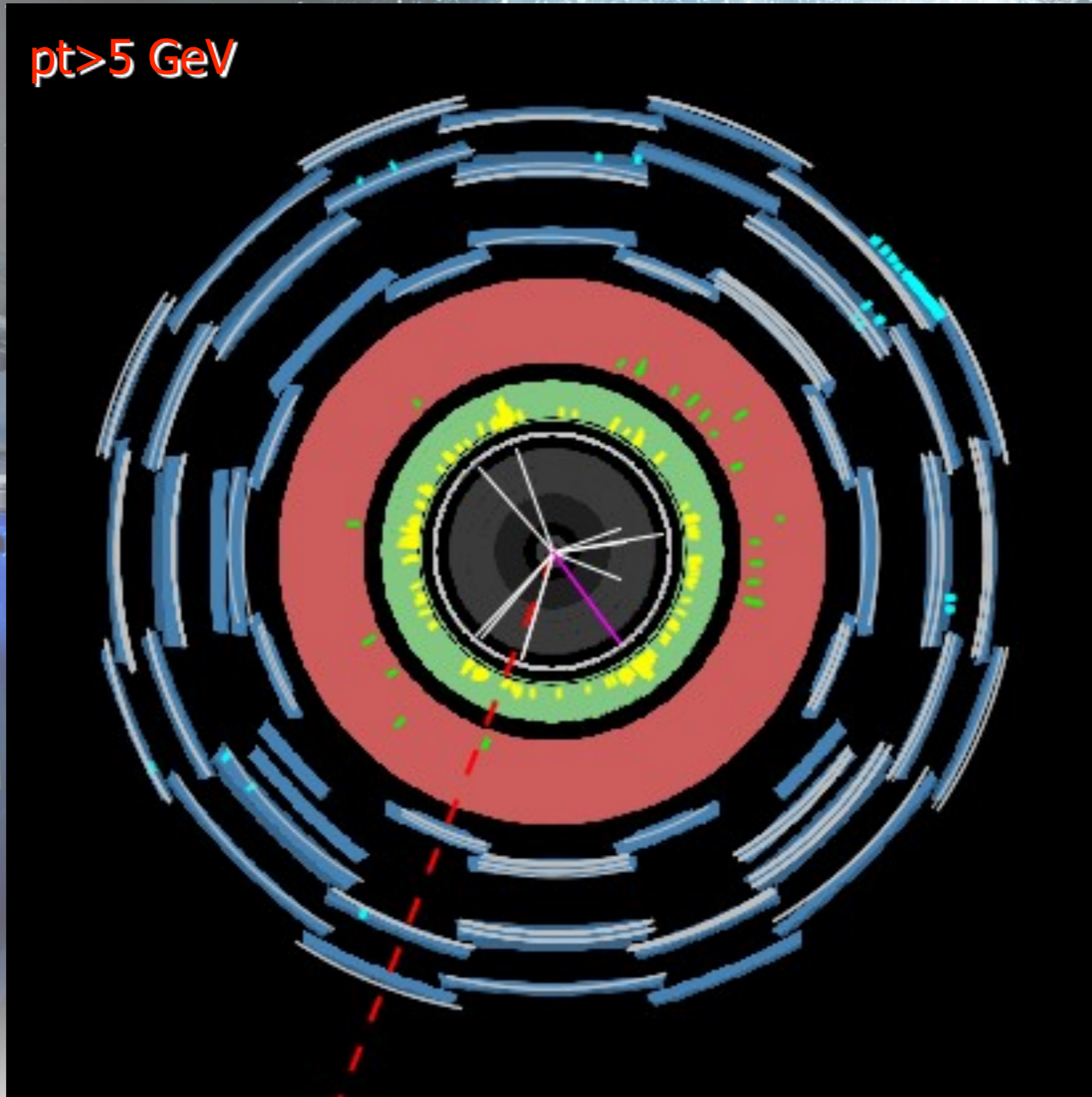
$pt > 2 \text{ GeV}$





# Isolation dans le détecteur interne

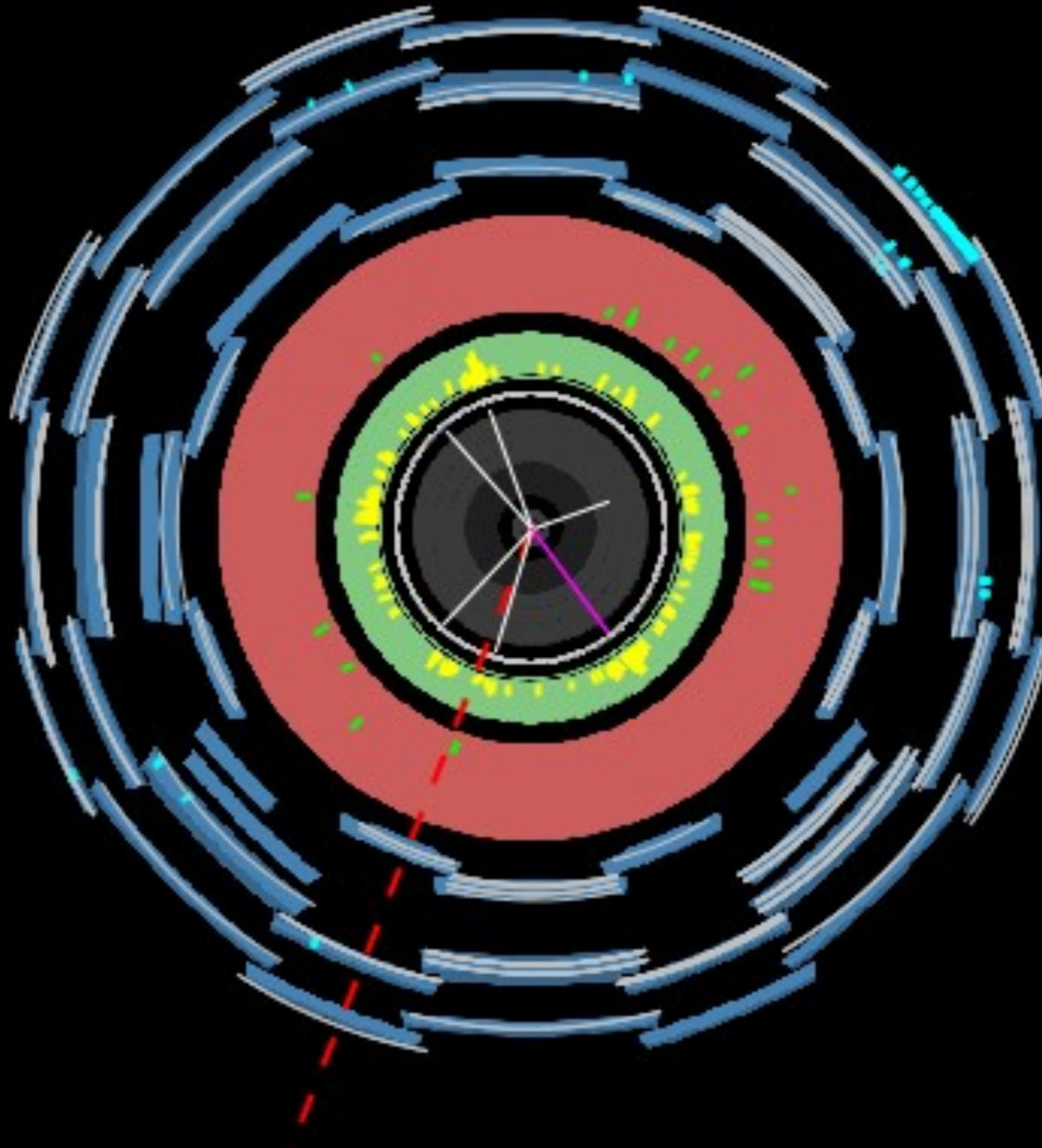
$pt > 5 \text{ GeV}$



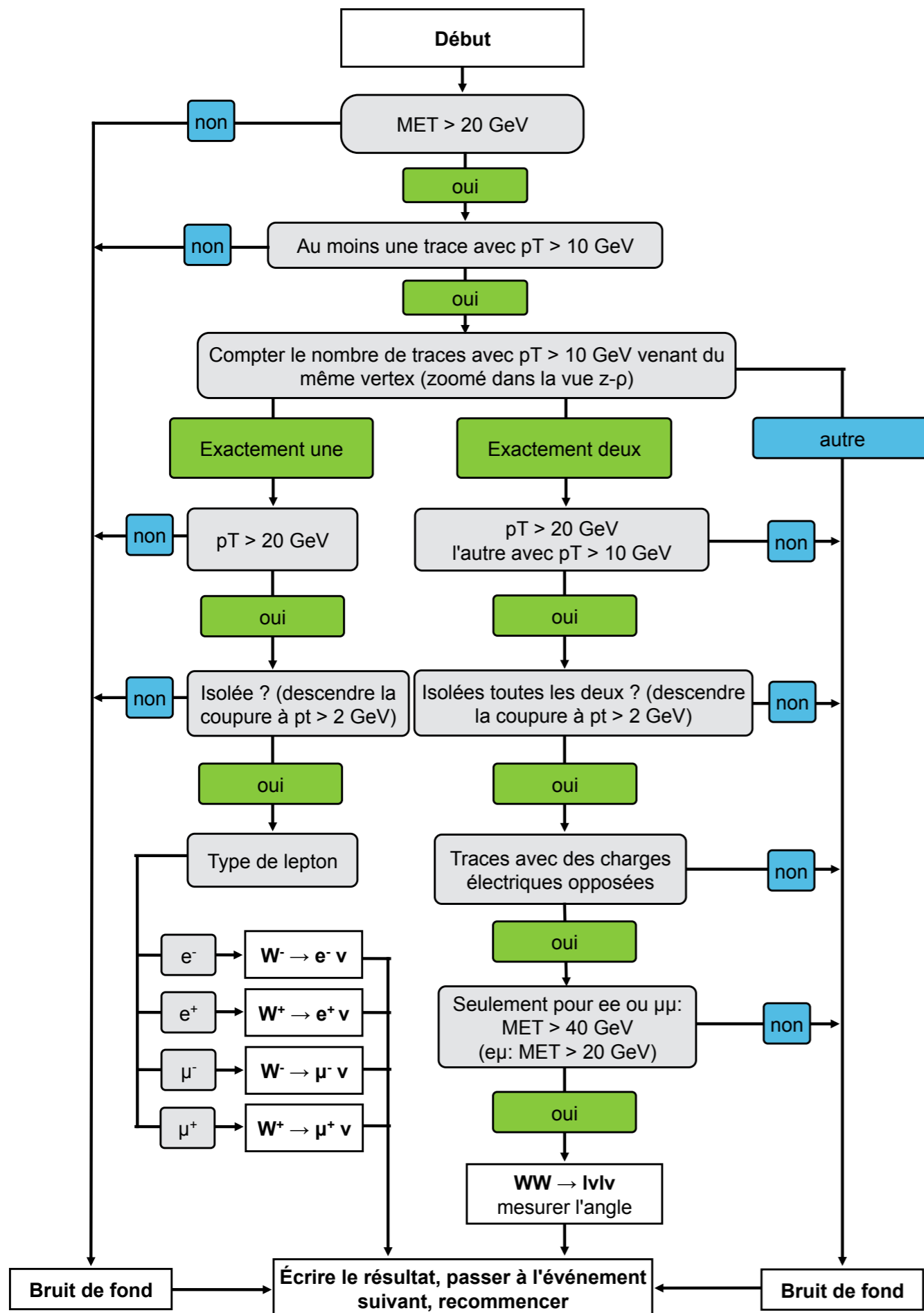


# Isolation dans le détecteur interne

$pt > 10 \text{ GeV}$







# Entrainement

exercice 2