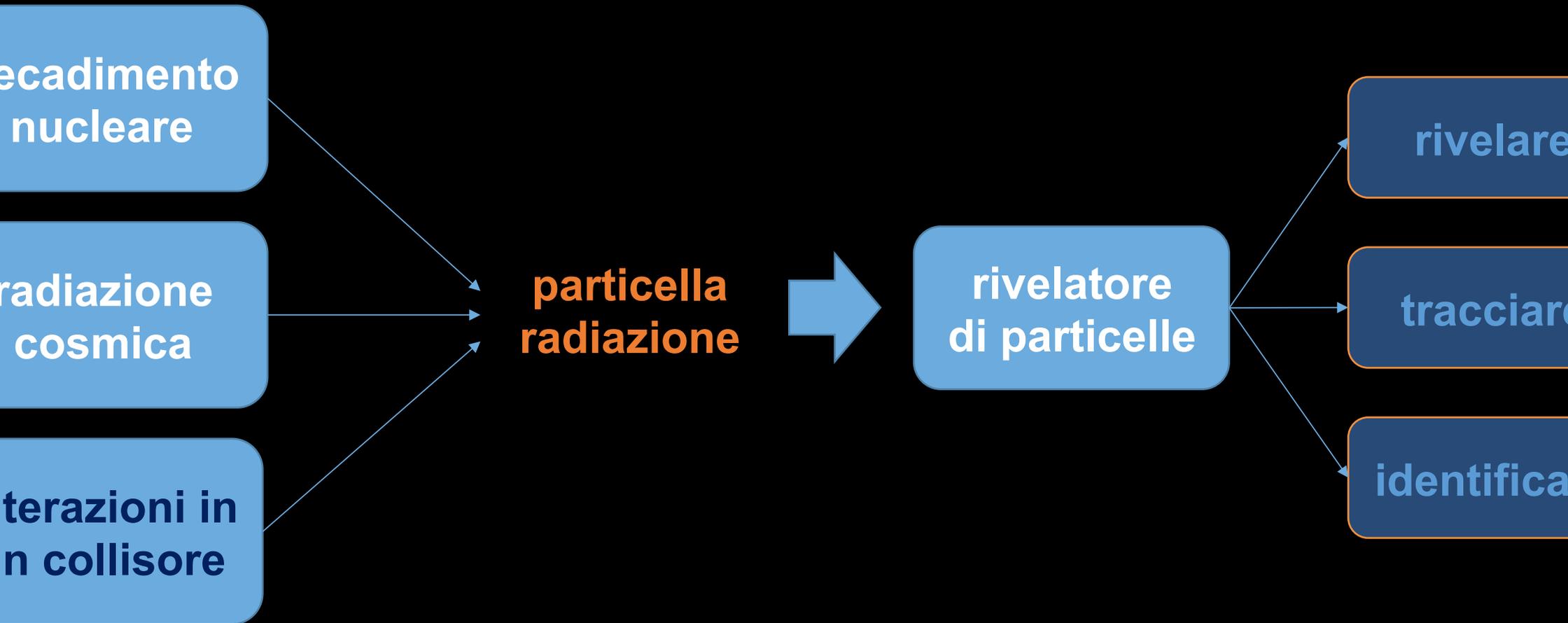


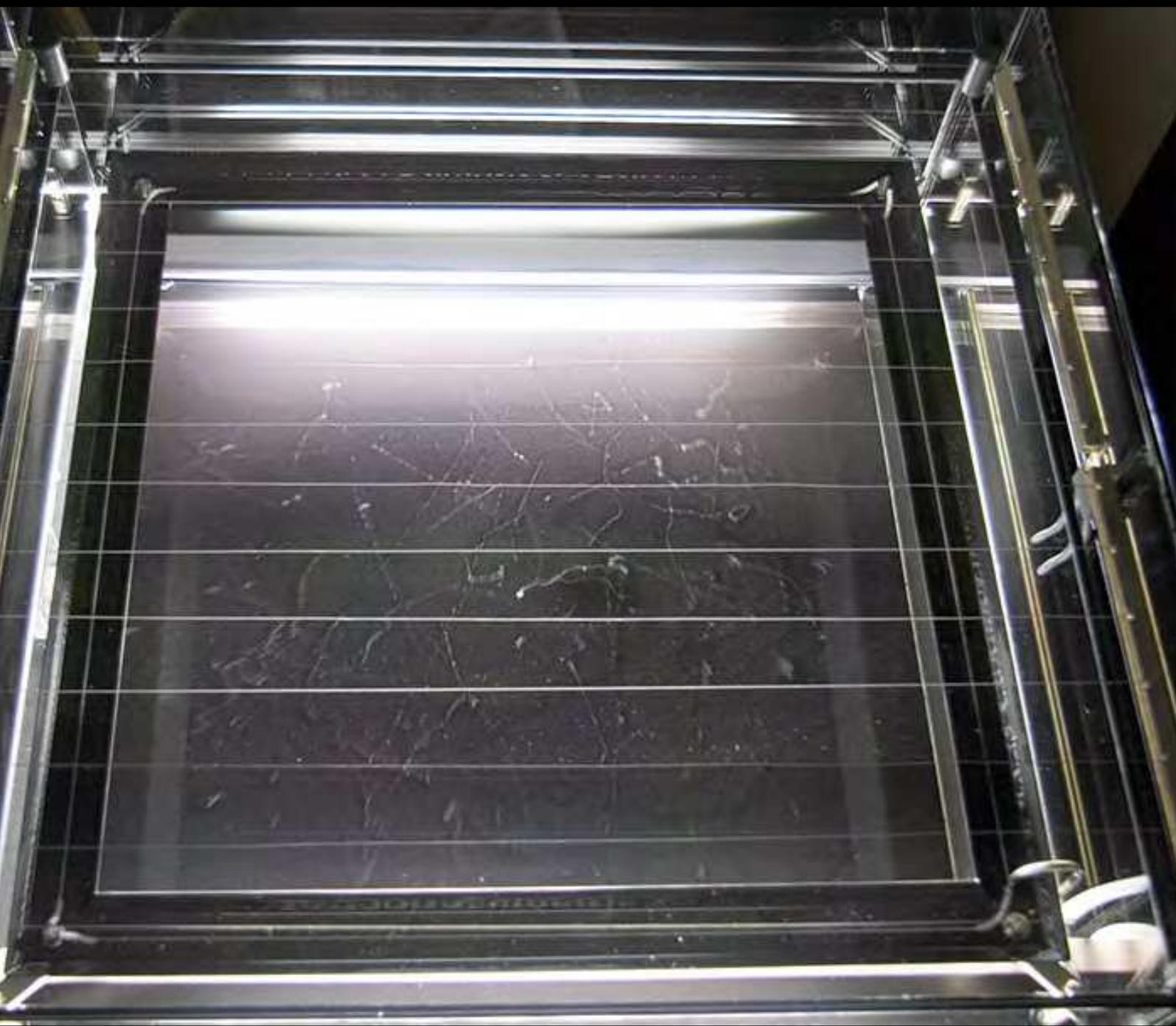
Rivelatori di Particelle

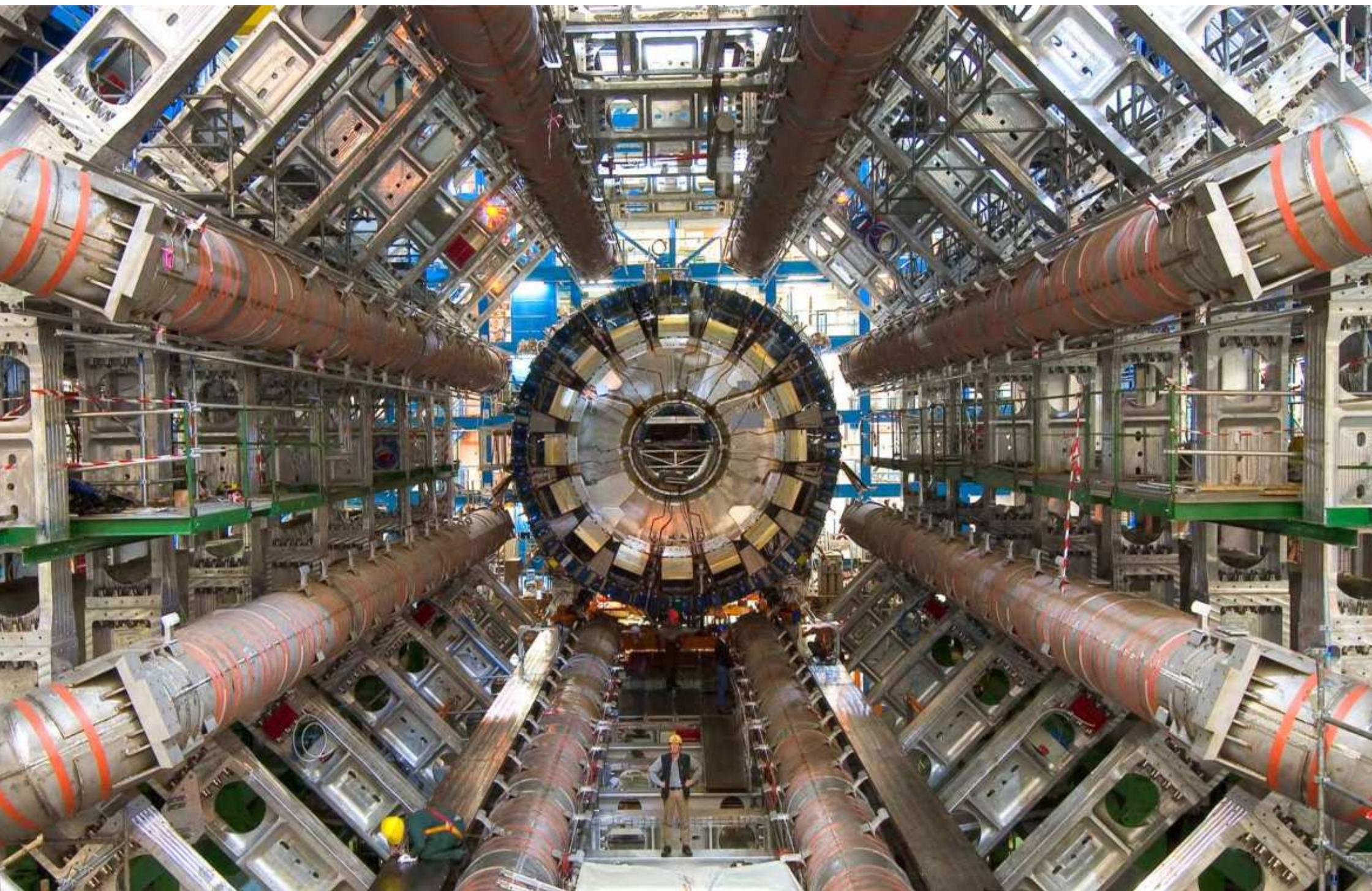
Danilo Domenici

mappa concettuale

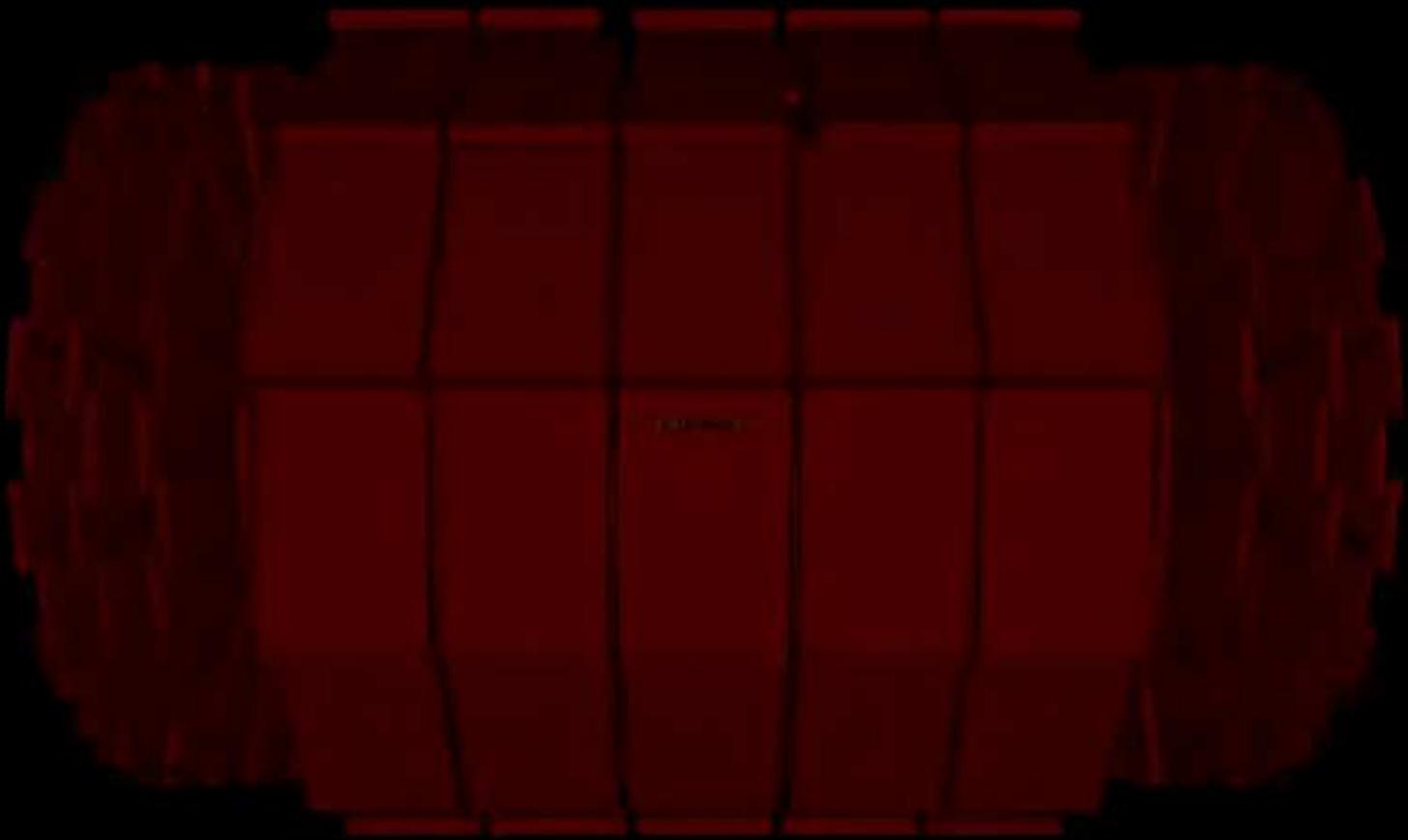




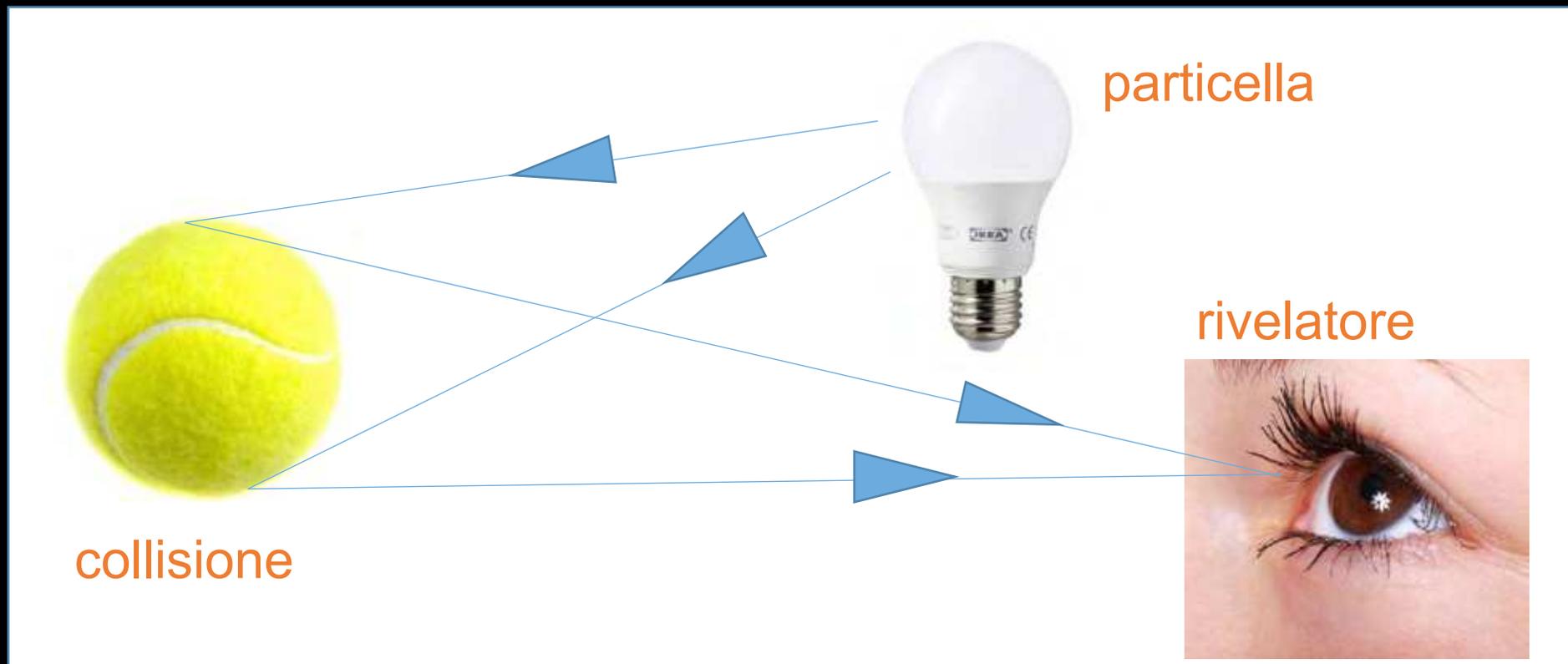




CMS Experiment at the LHC, CERN
Tue 2010-Mar-30 13:23:00 CET
Run 132440 Event 4285681
COM Energy 7.00TeV

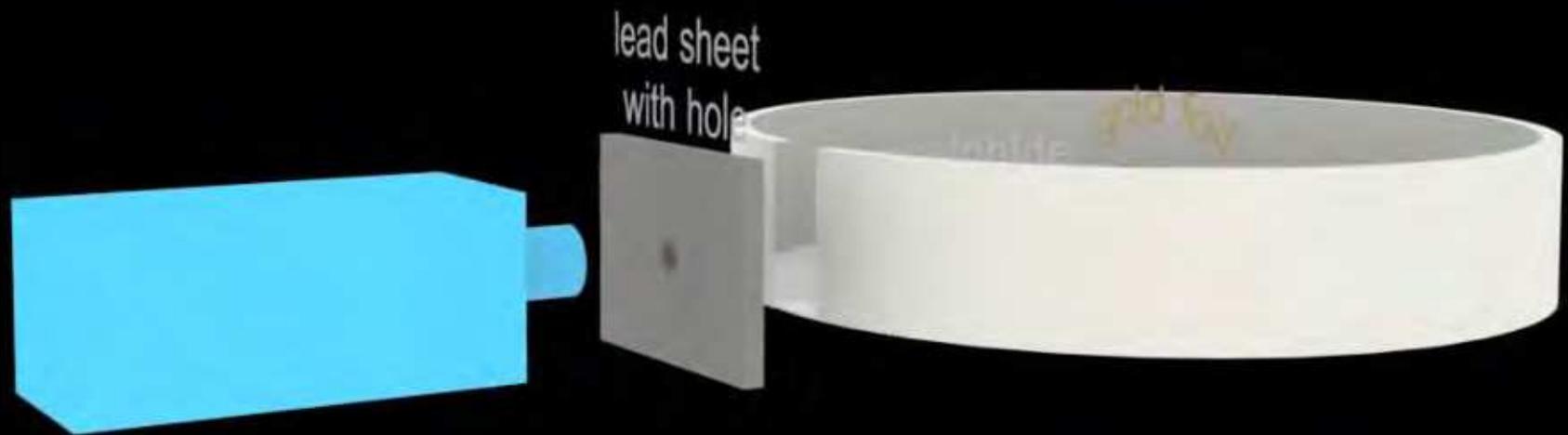


perché facciamo collidere le particelle?

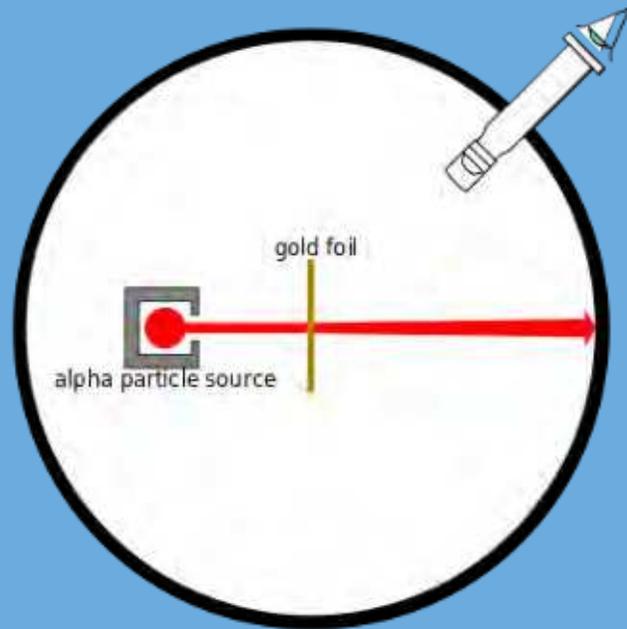
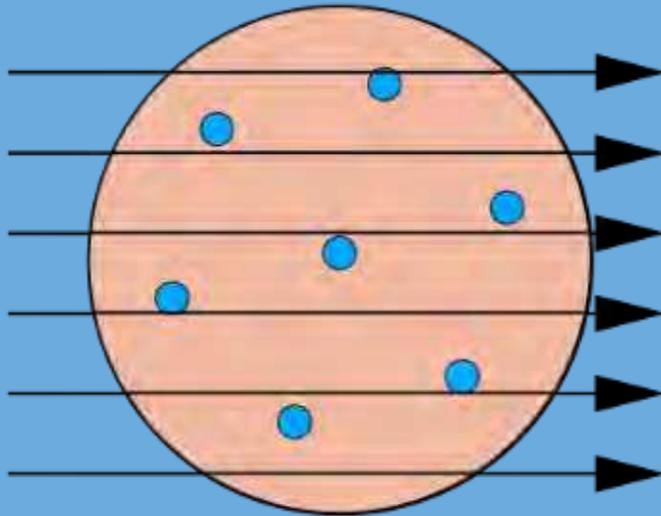


per capire come è fatta la materia

esperimento di rutherford



THOMSON MODEL



perché le facciamo collidere
a energia sempre più alta?

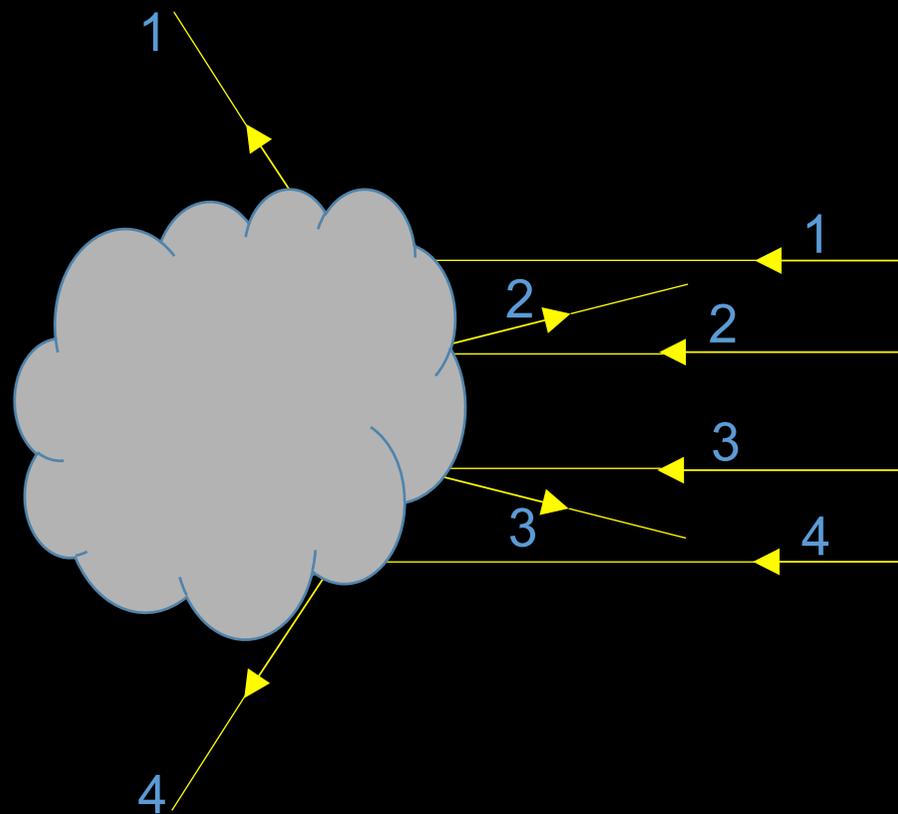
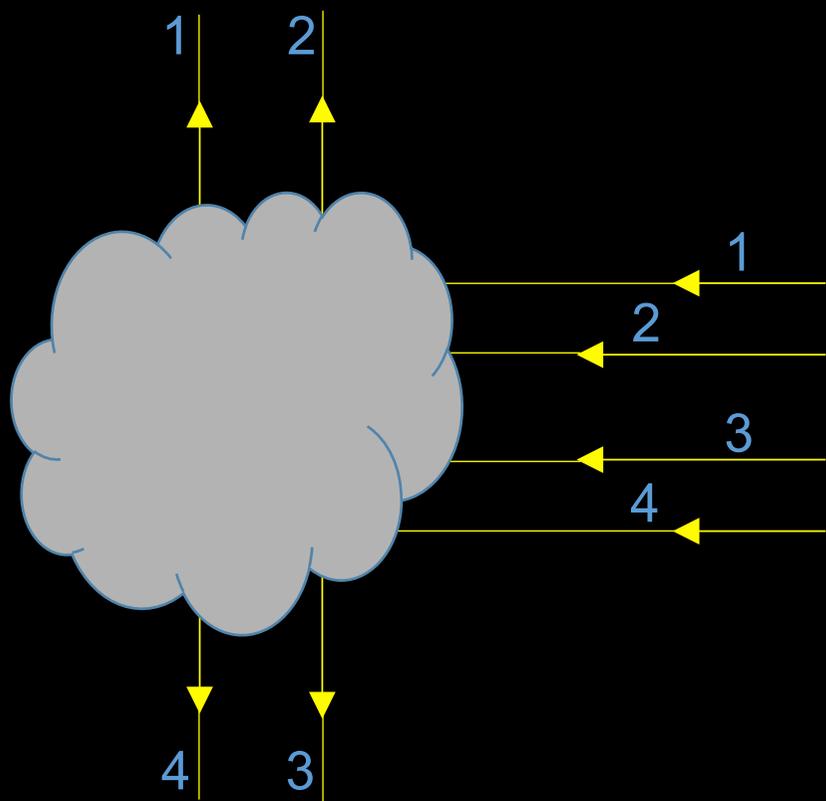


diminuisce la lunghezza
che posso studiare



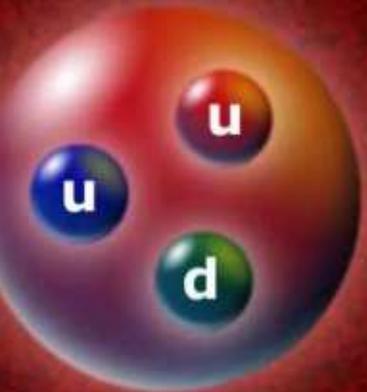
aumenta la nuova materia
che posso creare

come vediamo l'invisibile



| | | | | |
|---------------------------------|-------------------------------|--------------------------------------------|------------------------------------------|---------------------------------------|
| u quark up | c quark charm | \bar{u} quark anti-up | \bar{c} quark anti-charm | \bar{t} quark anti-top |
| d quark down | s quark strange | \bar{d} quark anti-down | \bar{s} quark anti-strange | \bar{b} quark anti-bottom |
| e^- elettrone | μ^- muone | e^+ anti-elettrone (positrone) | μ^+ anti-muone | τ^+ anti-tau |
| ν_e neutrino elettronico | ν_μ neutrino muonico | $\bar{\nu}_e$ anti-neutrino elettronico | $\bar{\nu}_\mu$ anti-neutrino muonico | $\bar{\nu}_\tau$ anti-neutrino tau |

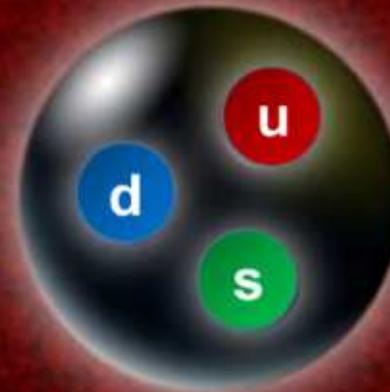
Barioni - 3 quark



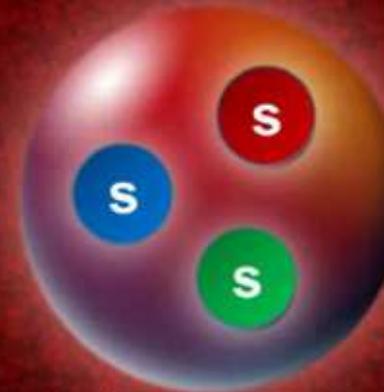
proton



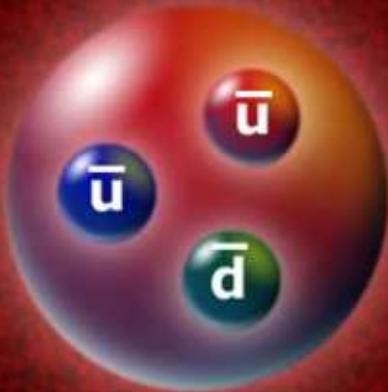
neutron



lambda



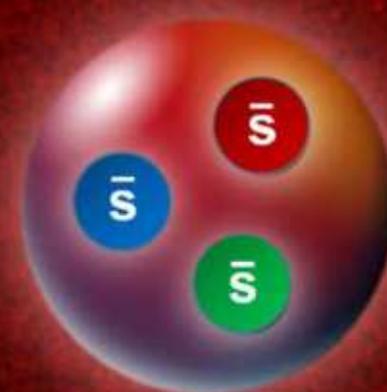
sigma



antiproton



antineutron



antistigma

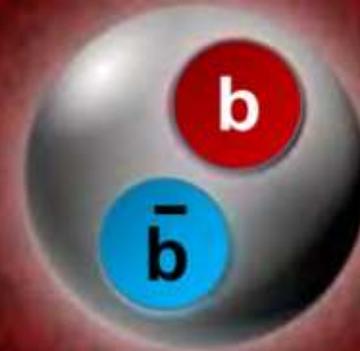
Mesoni - 1 quark 1 antiquark



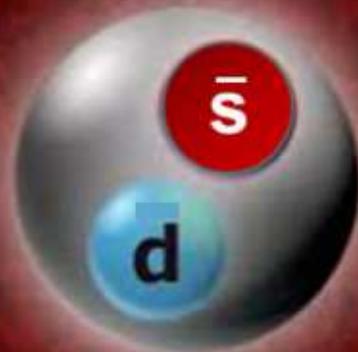
pion



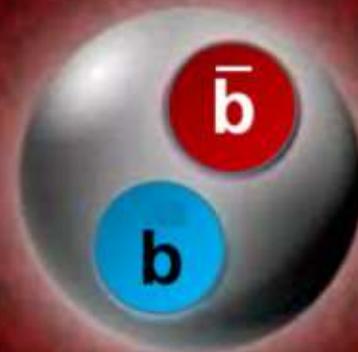
kaon



upsilon



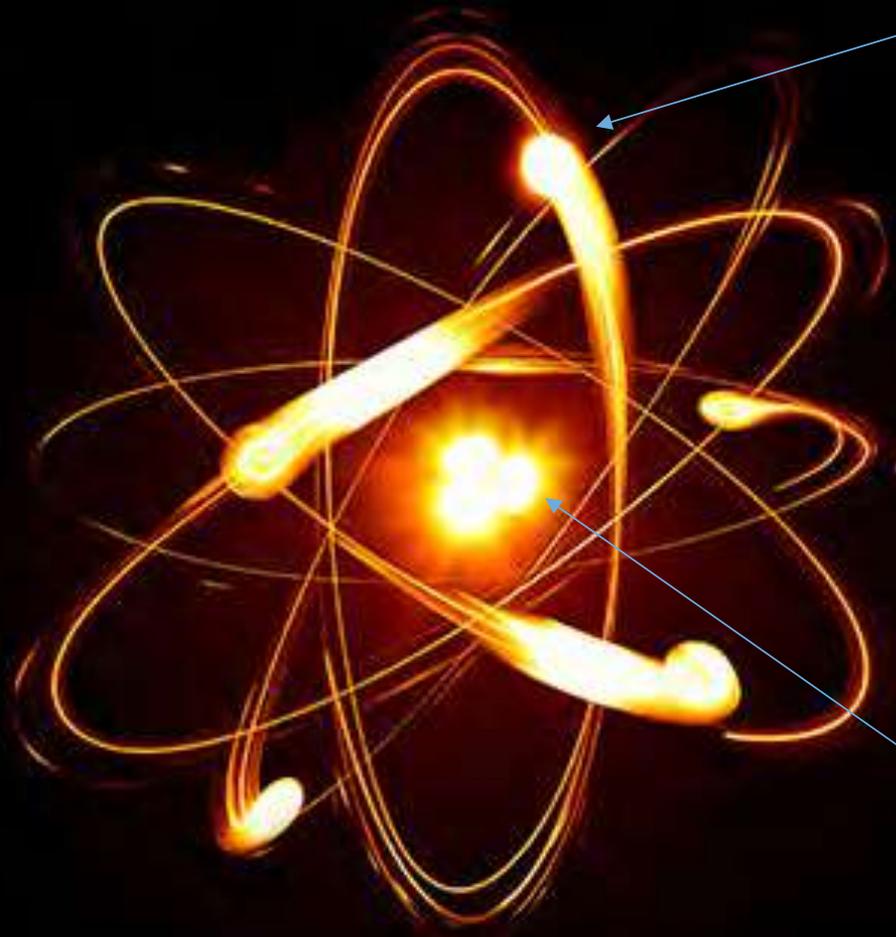
antikaon



upsilon

interazione radiazione-materia

tipi diversi
di particelle
possono interagire
con gli elettroni
o con il nucleo



elettroni
carica elettrica negativa

nucleo
carica elettrica positiva
carica forte

interazione radiazione-materia

particelle direttamente rivelabili

e

elettrone

p

protone

n

neutrone

γ

fotone

particelle stabili

μ

muone

π

pione

K

kaone

particelle con vita media $> 10^{-10}$ s

tutte le particelle con vita media $< 10^{-10}$ s
si identificano attraverso i loro prodotti di decadimento



interazione radiazione-materia

particelle e antiparticelle direttamente rivelabili

e^-

elettrone

e^+

elettrone

p

protone

\bar{p}

protone

n

neutrone

\bar{n}

neutrone

γ

fotone

μ^-

muone

μ^+

muone

π^-

pione

π^+

pione

K^-

kaone

K_S

kaone

K^+

kaone

K_L

kaone

interazione radiazione-materia

urti con gli elettroni – forza elettromagnetica



urti con il nucleo – forza forte



produzione di coppie e^+e^-



apparato di rivelazione ermetico



Rivelatore di Vertice o Tracciatore Interno
rivela le particelle cariche
e ne misura la quantità di moto

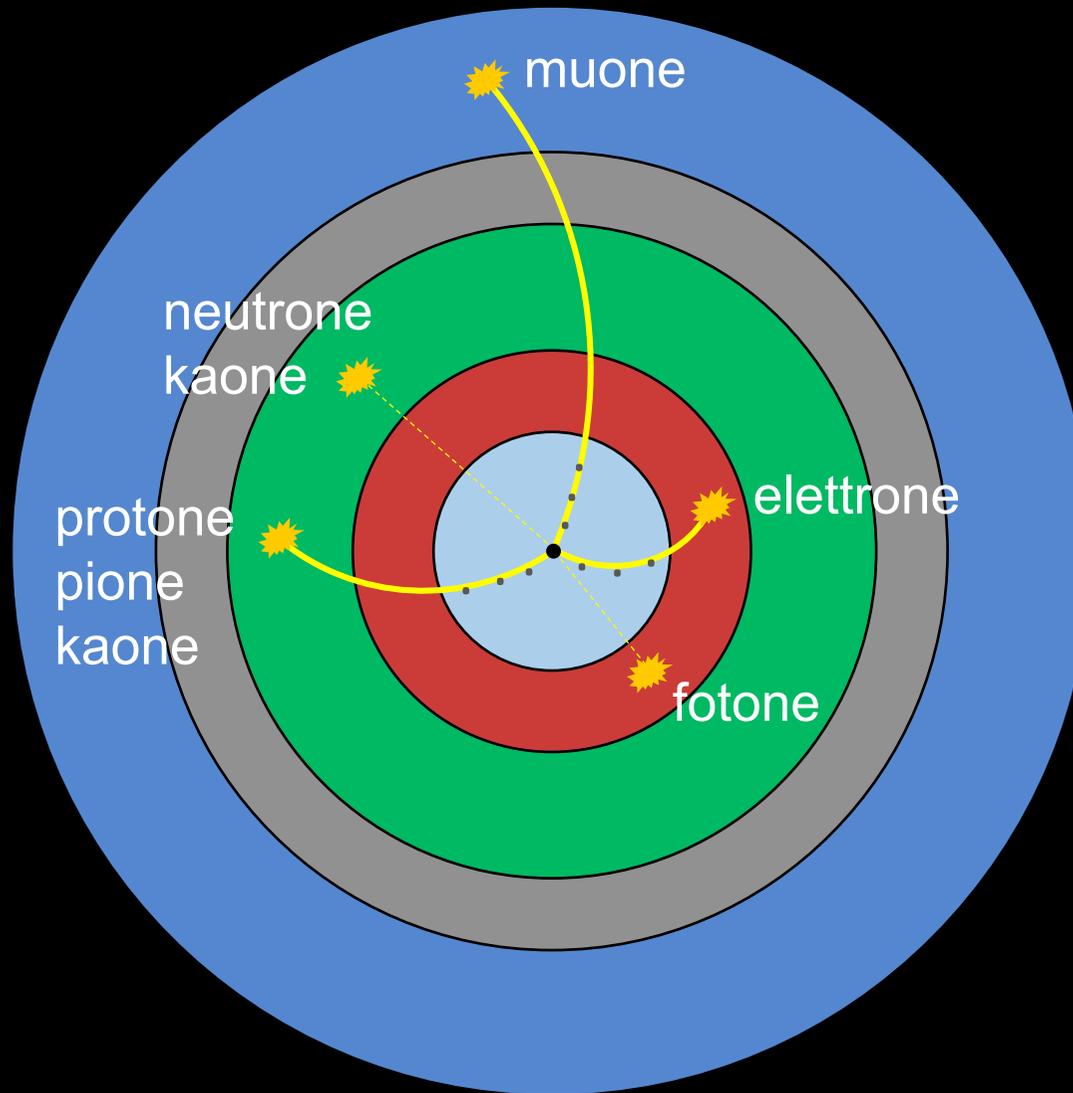
Calorimetro Elettromagnetico
rivela elettroni e fotoni
e ne misura l'energia

Calorimetro Adronico
rivela protoni, neutroni, pioni, kaoni
e ne misura l'energia

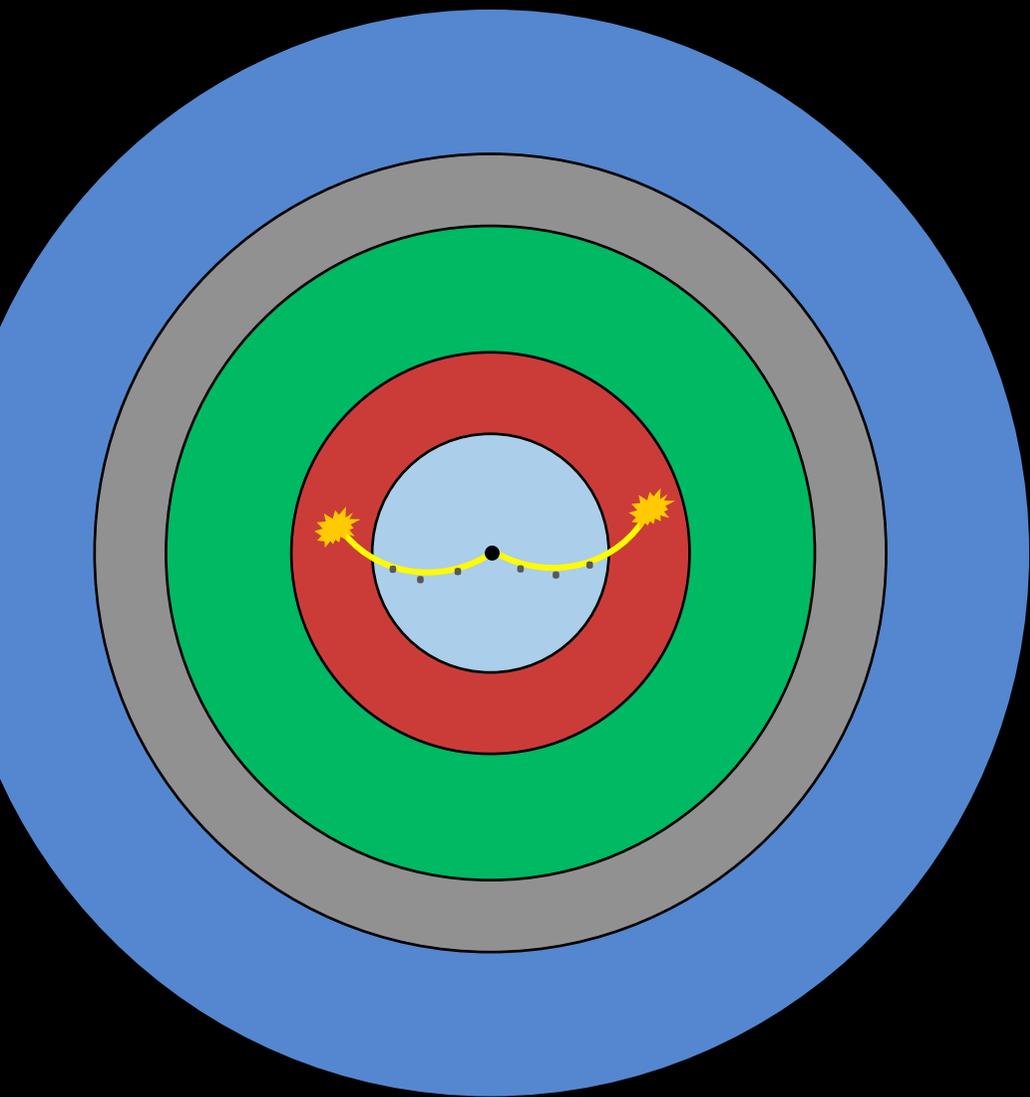
Magnete
curva le particelle cariche
e ne permette la misura della quantità di moto

Rivelatore di Muoni
rivela i muoni

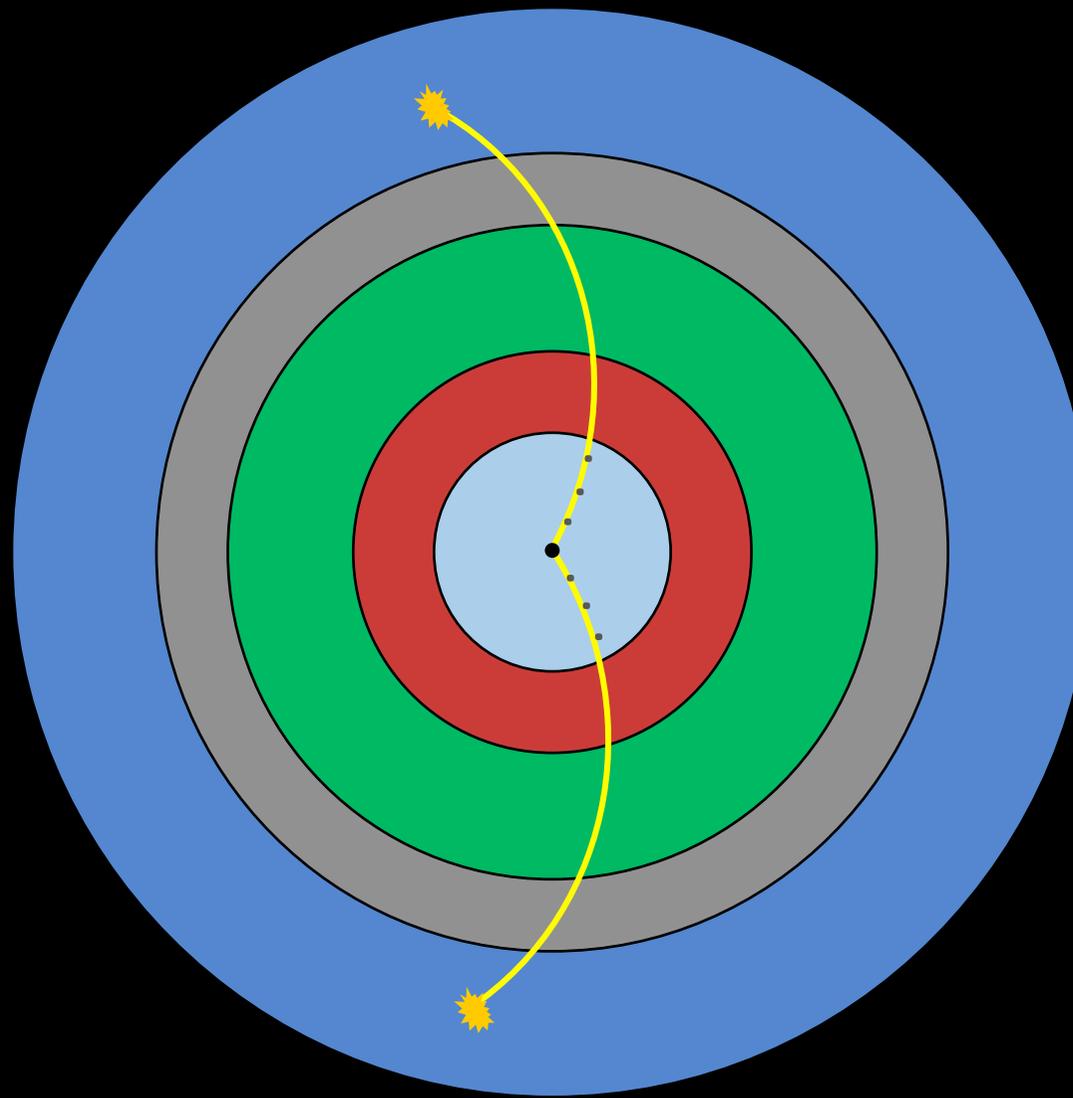
identificazione delle particelle



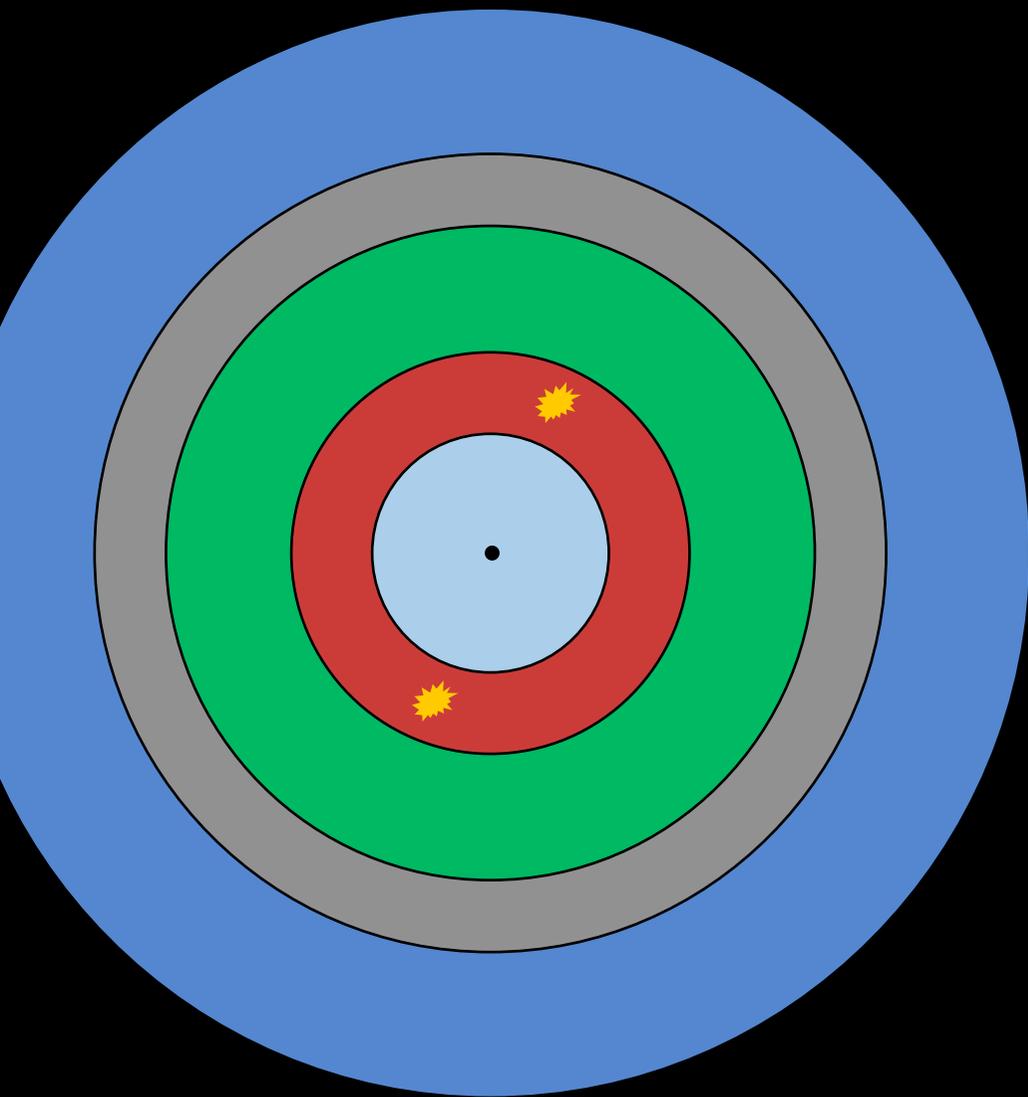
$$e^+ e^- \rightarrow e^+ e^-$$



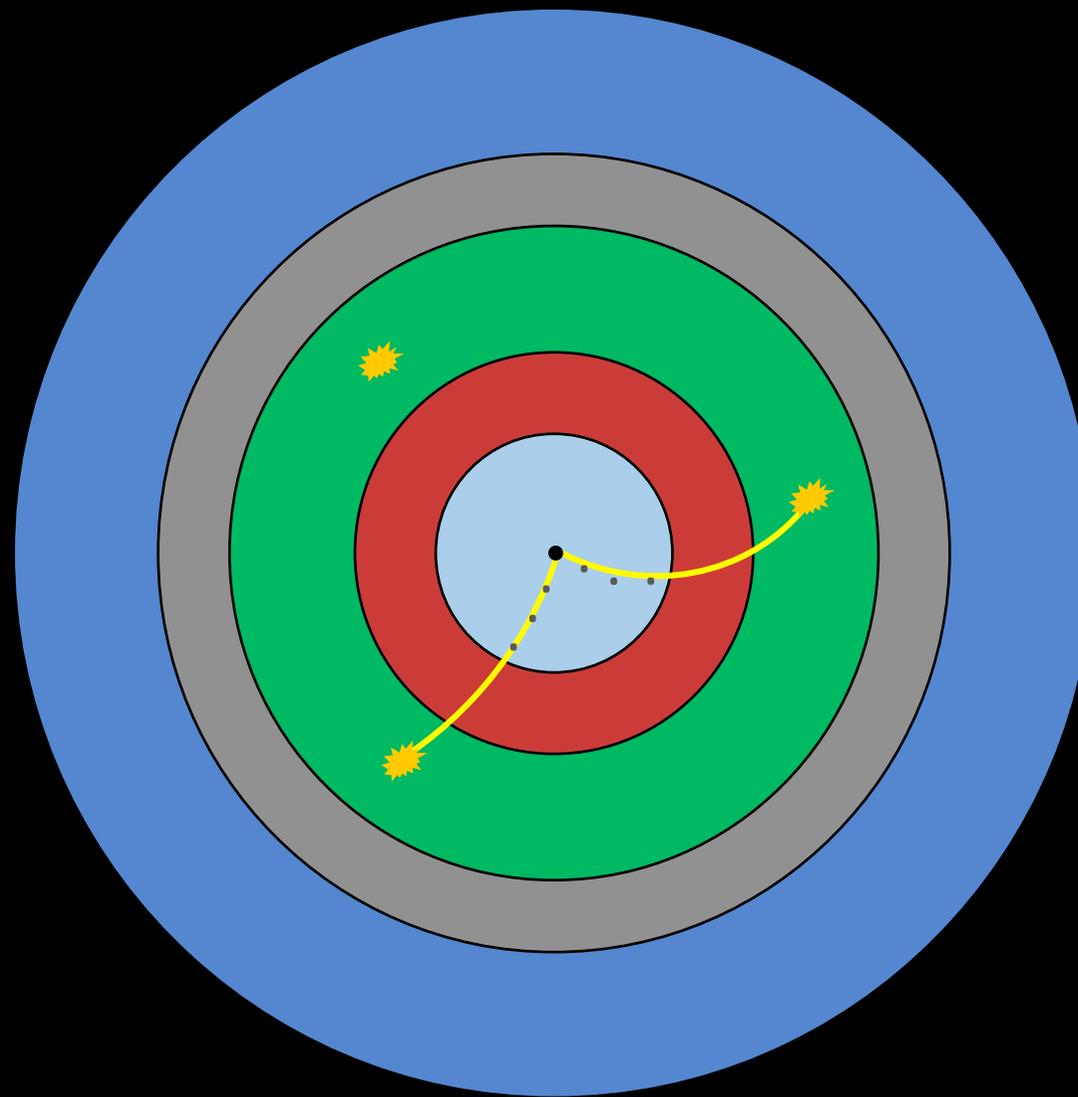
$$e^+ e^- \rightarrow \mu^+ \mu^-$$

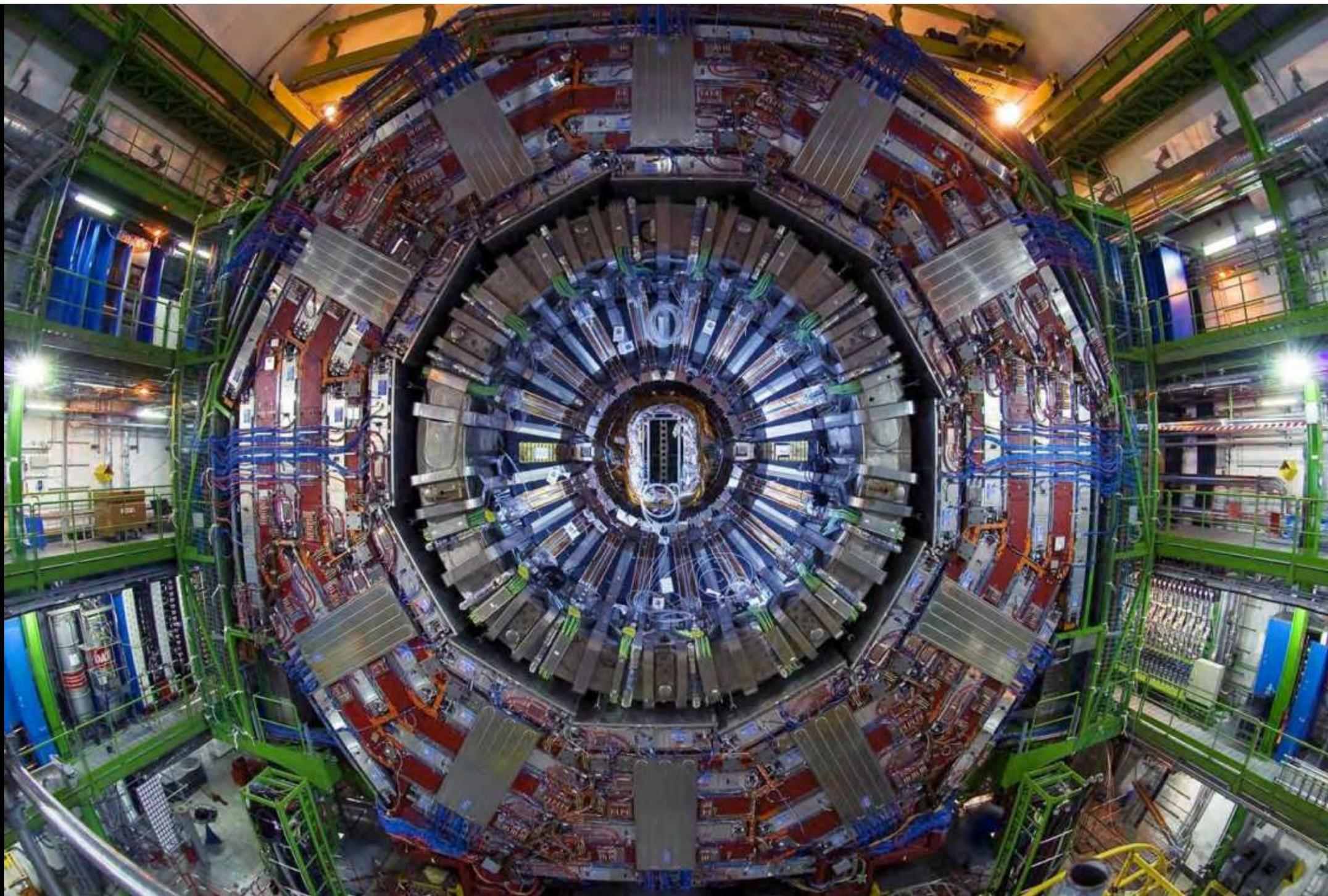


$$e^+ e^- \rightarrow \gamma \gamma$$

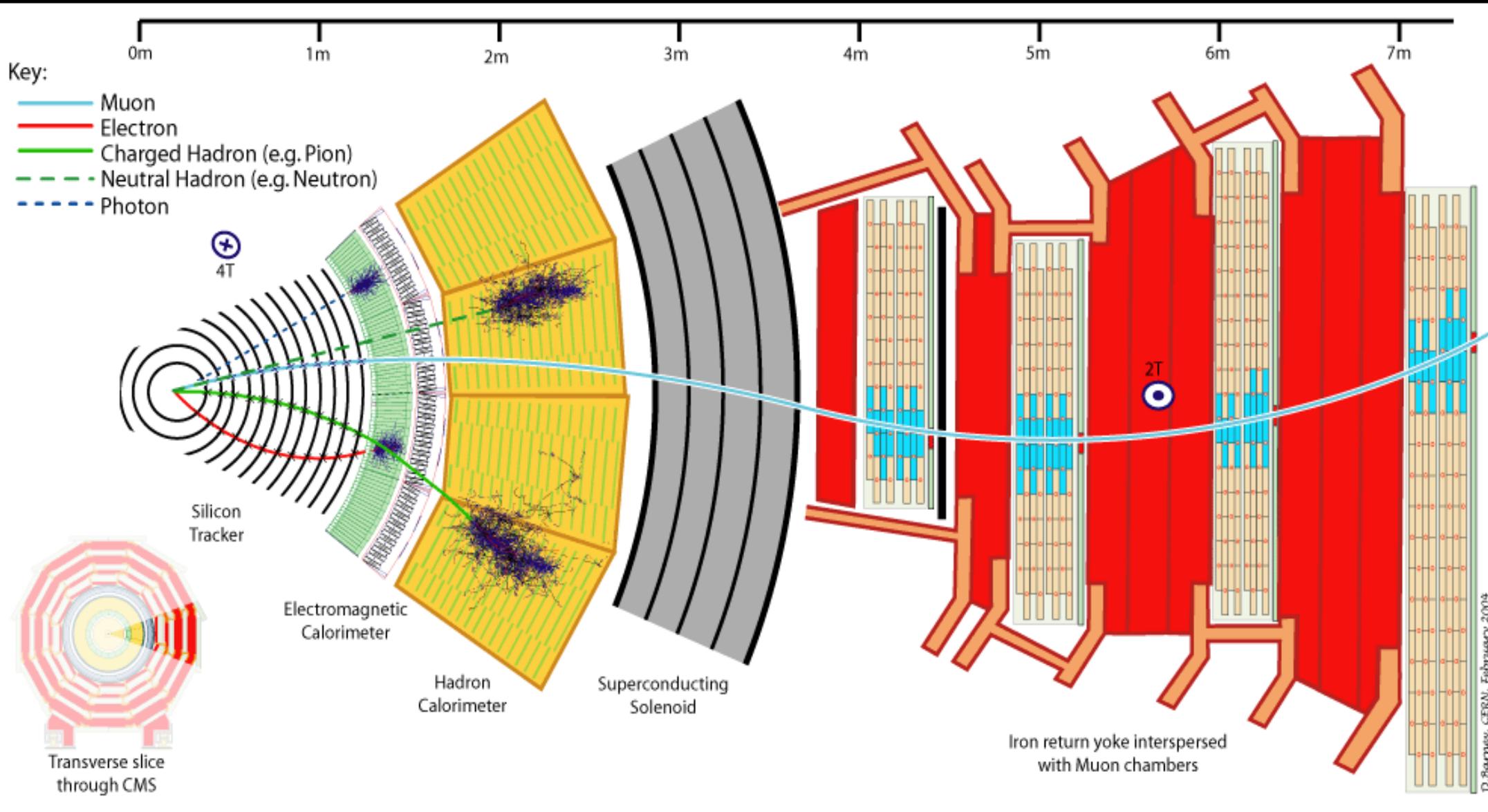


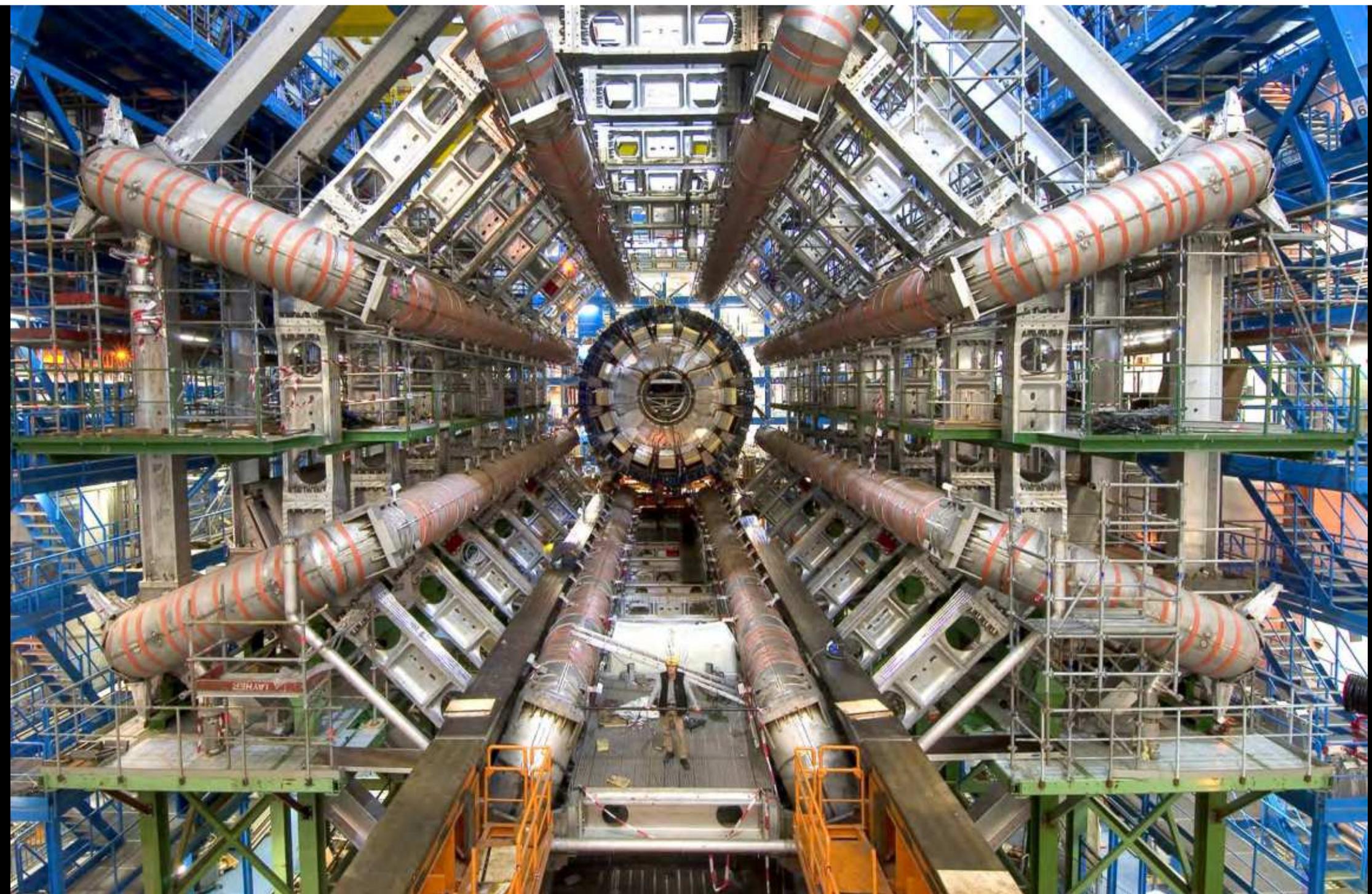
$$e^+ e^- \rightarrow \pi^+ \bar{p} n$$



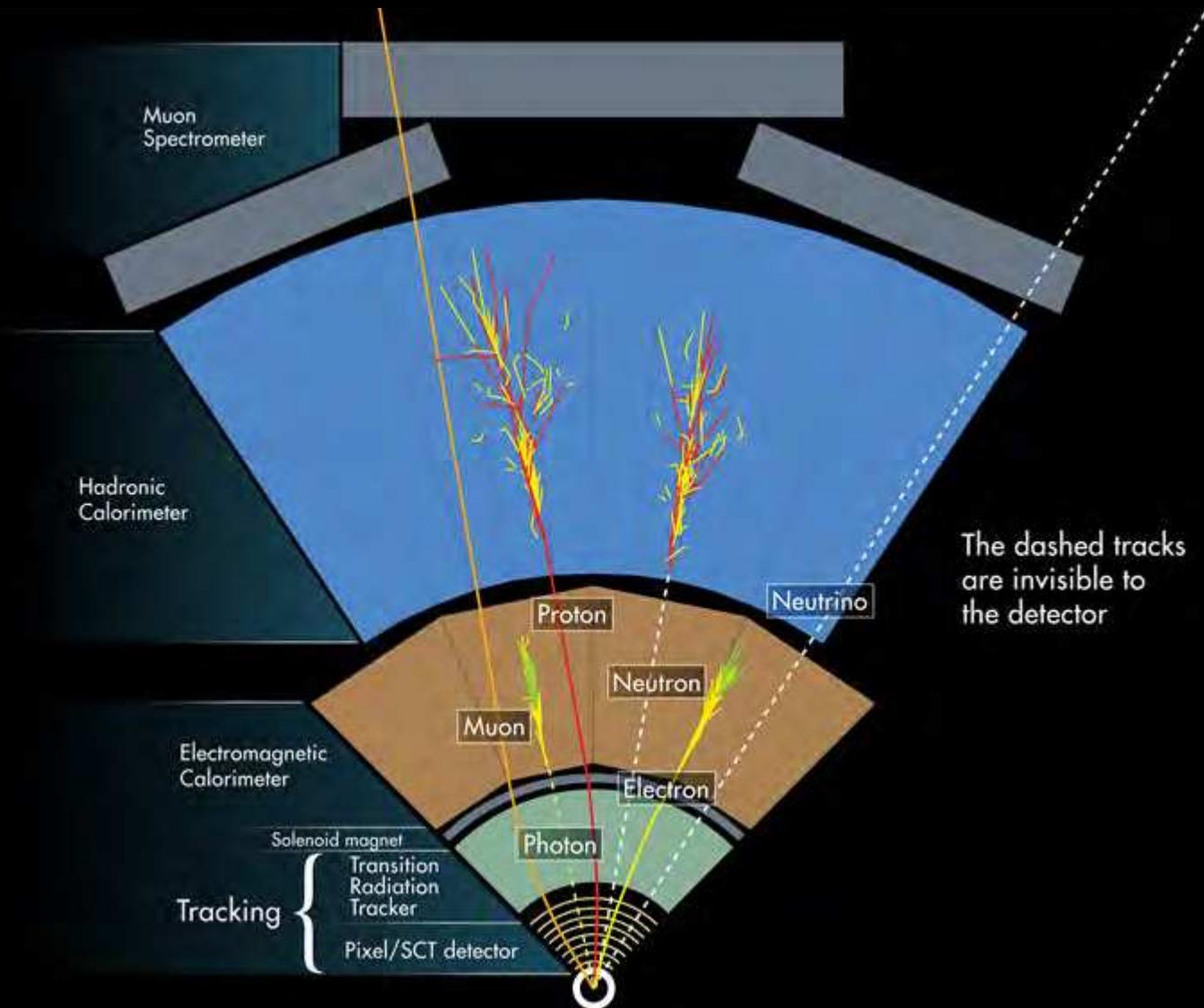


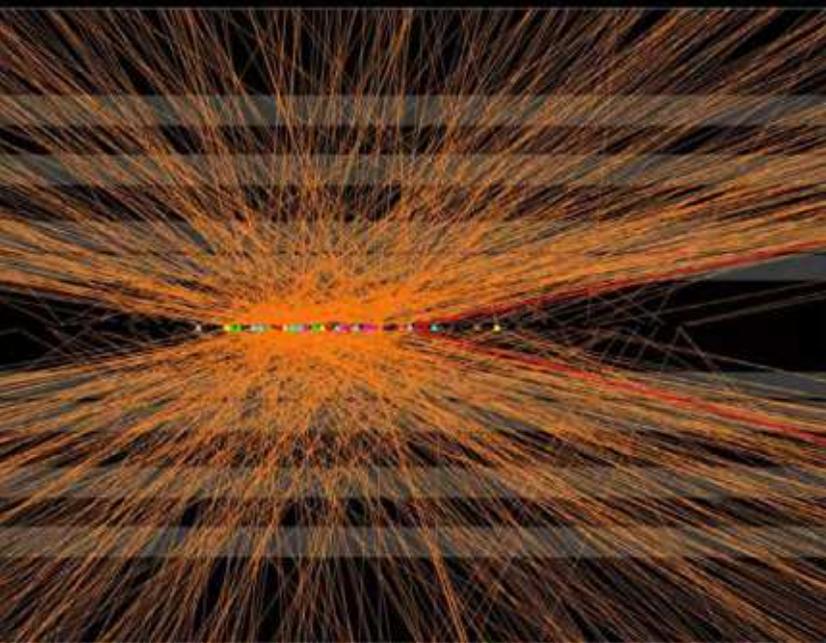
il rivelatore cms a lhc





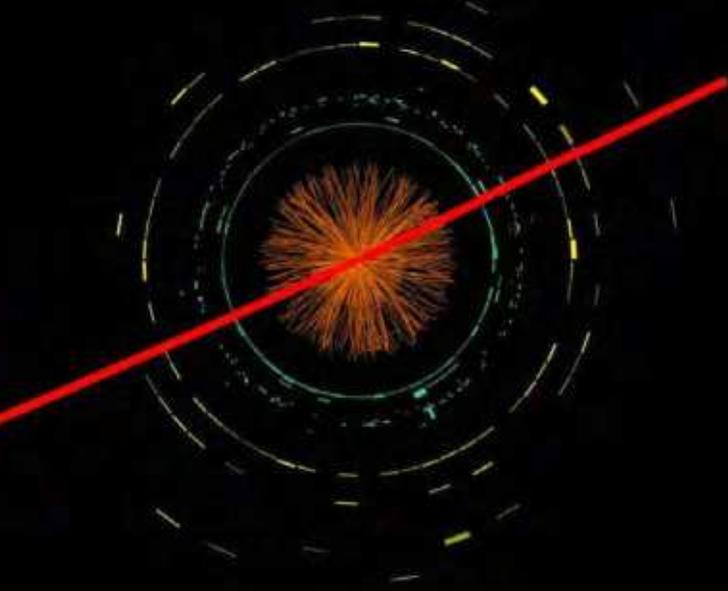
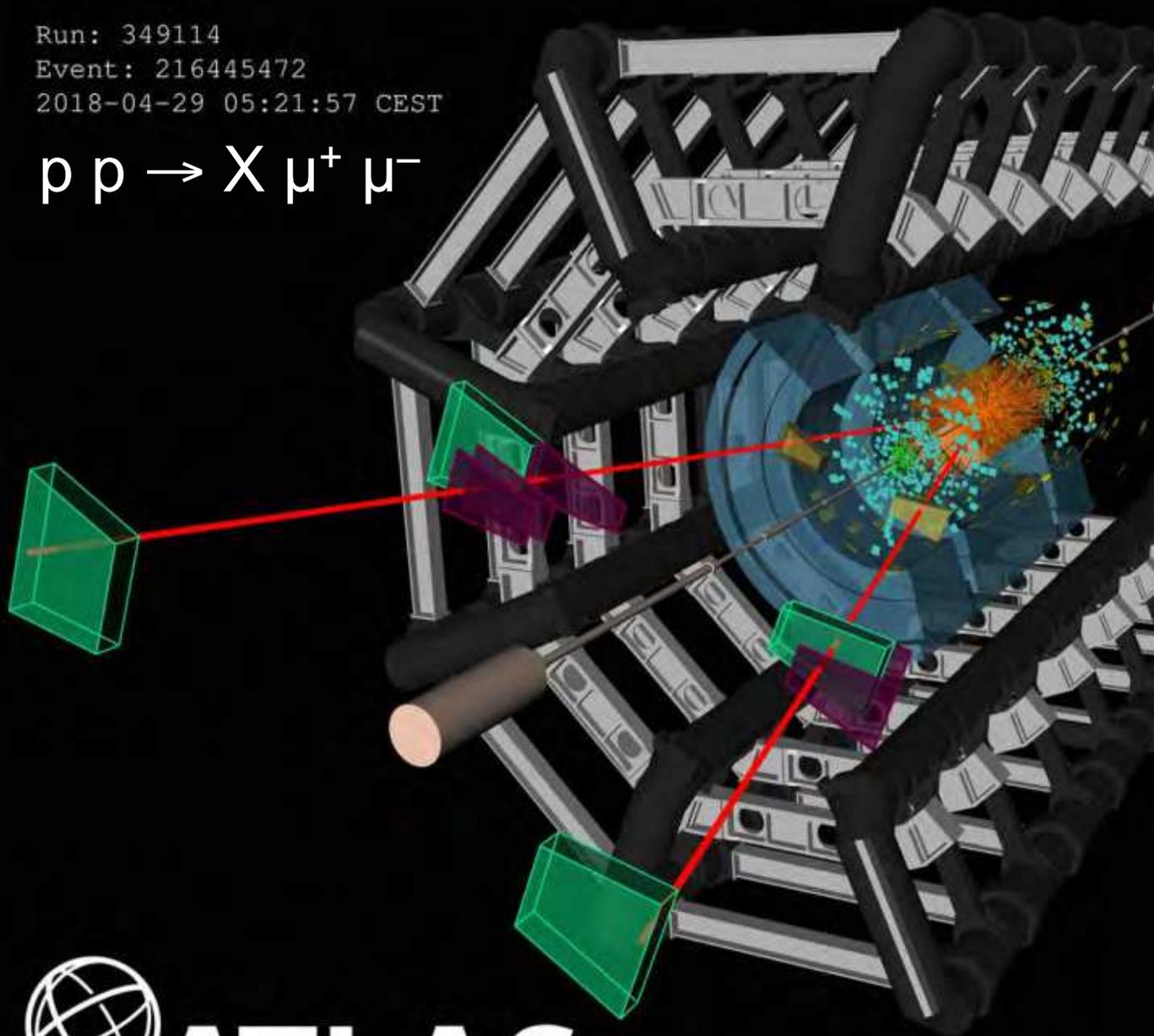
il rivelatore atlas a lhc





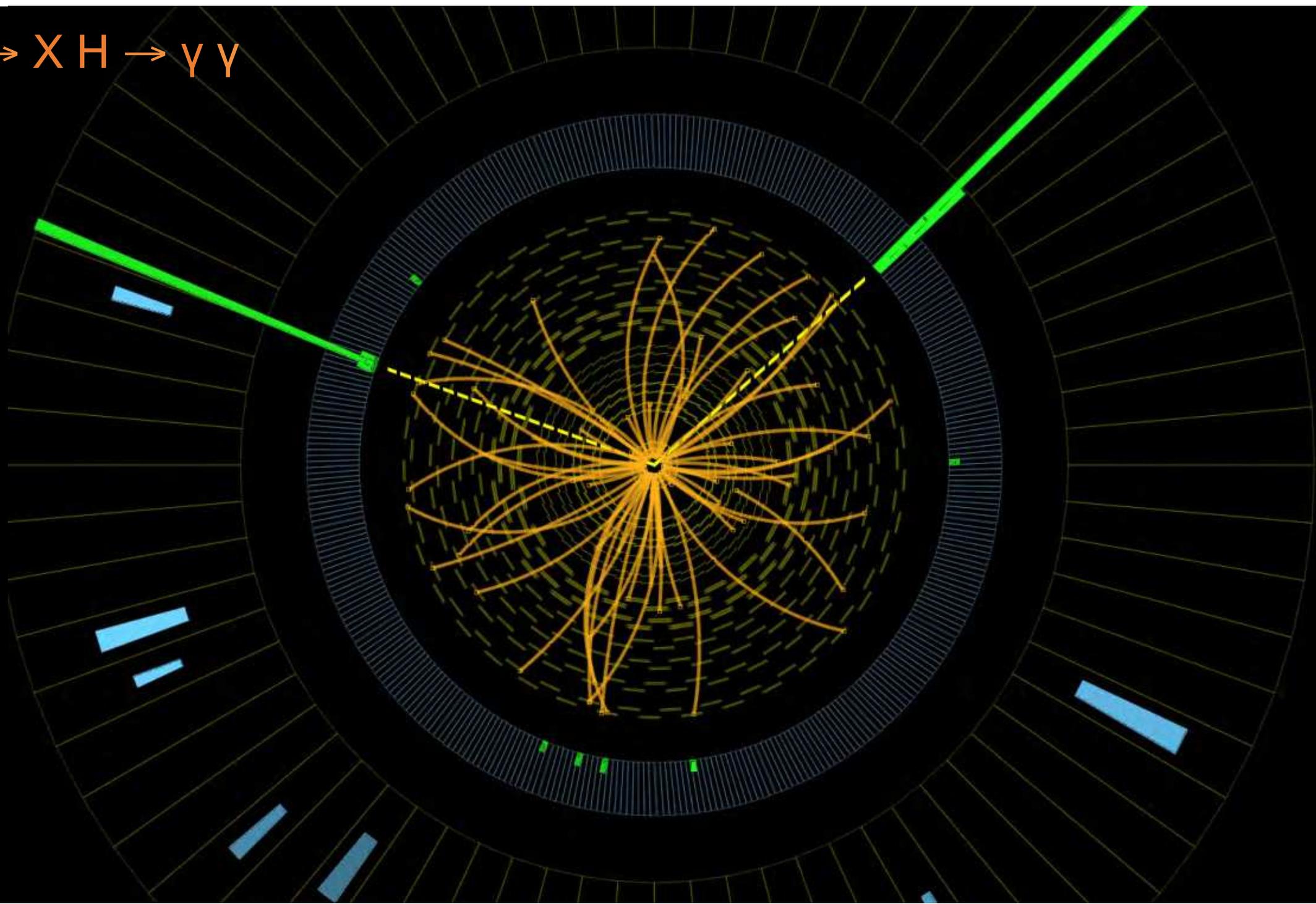
Run: 349114
Event: 216445472
2018-04-29 05:21:57 CEST

$$p p \rightarrow X \mu^+ \mu^-$$



 **ATLAS**
EXPERIMENT

$D \rightarrow X H \rightarrow \gamma \gamma$

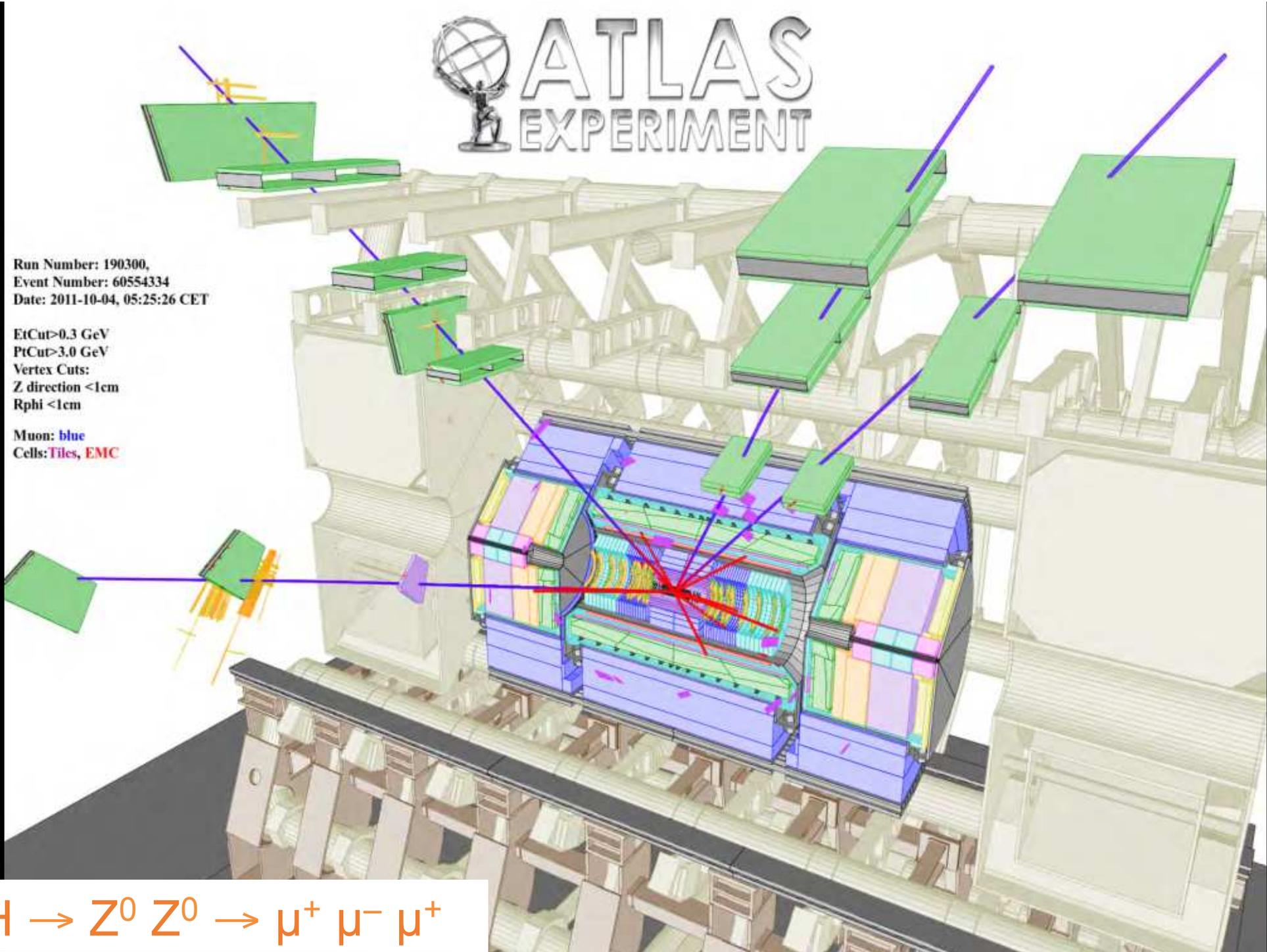


ATLAS EXPERIMENT

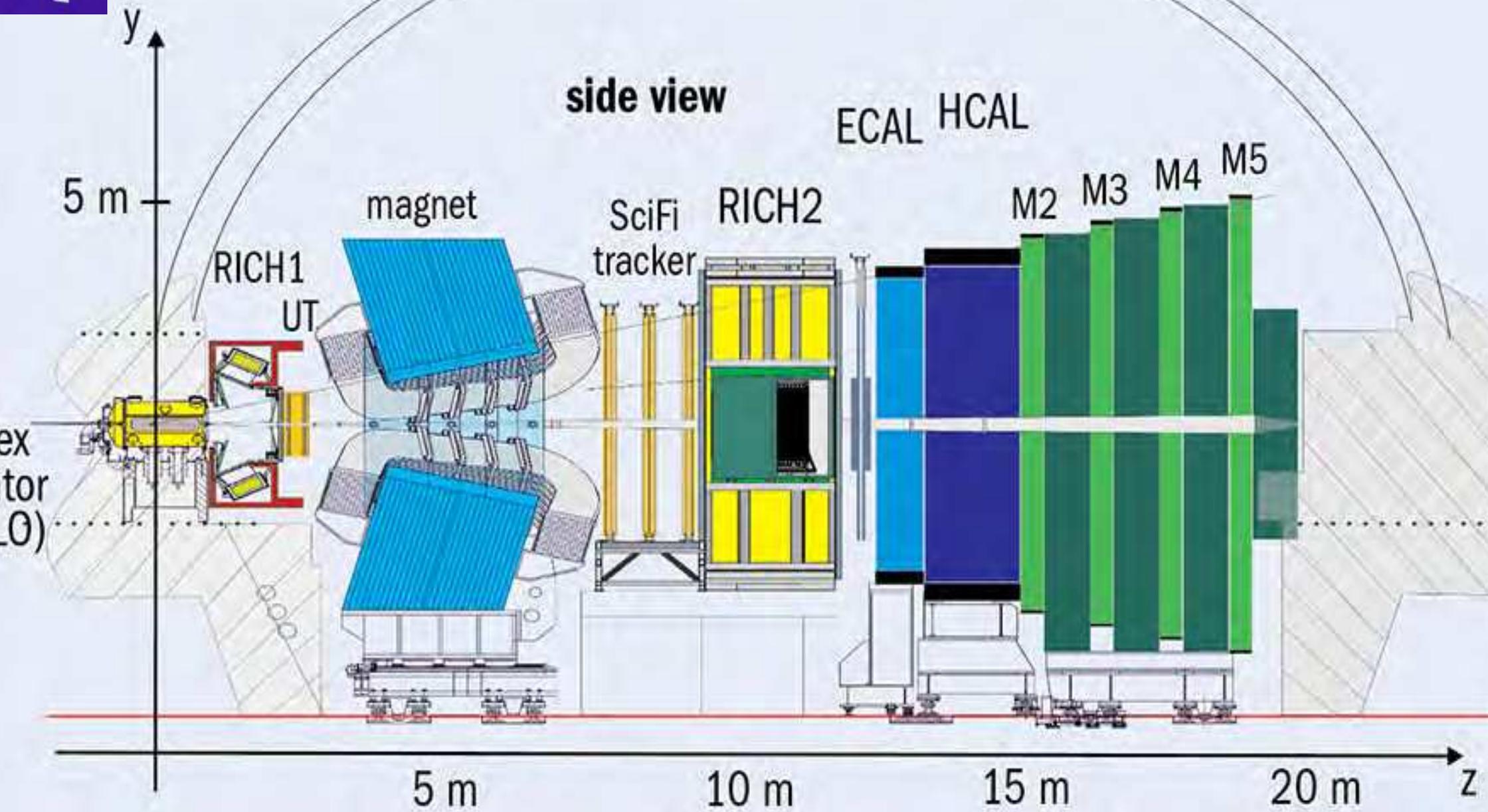
Run Number: 190300,
Event Number: 60554334
Date: 2011-10-04, 05:25:26 CET

EtCut > 0.3 GeV
PtCut > 3.0 GeV
Vertex Cuts:
Z direction < 1cm
Rphi < 1cm

Muon: blue
Cells: Tiles, EMC



→ $H \rightarrow Z^0 Z^0 \rightarrow \mu^+ \mu^- \mu^+$

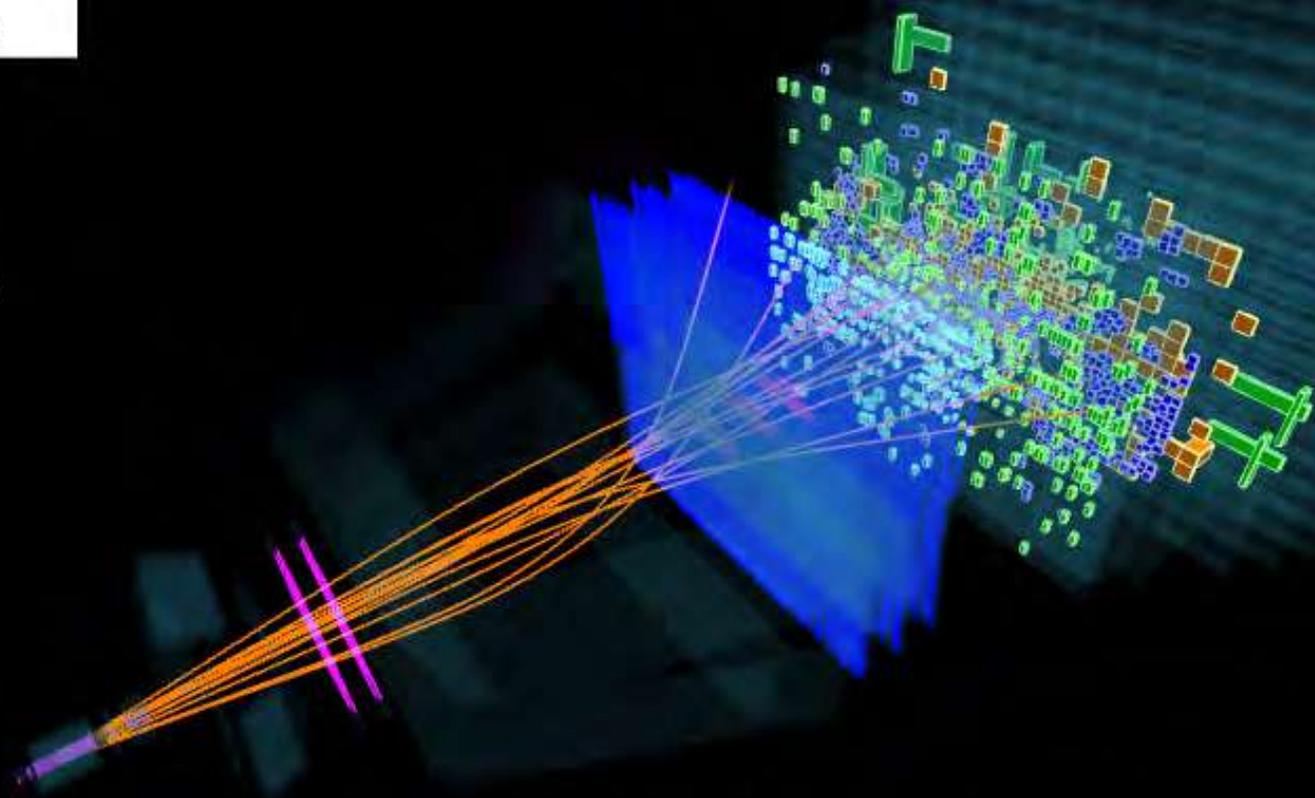


LHCb
ГЧП

event 2598326

run 168486

Wed, 25 Nov 2015 12:51:53



il rivelatore padme a Inf

