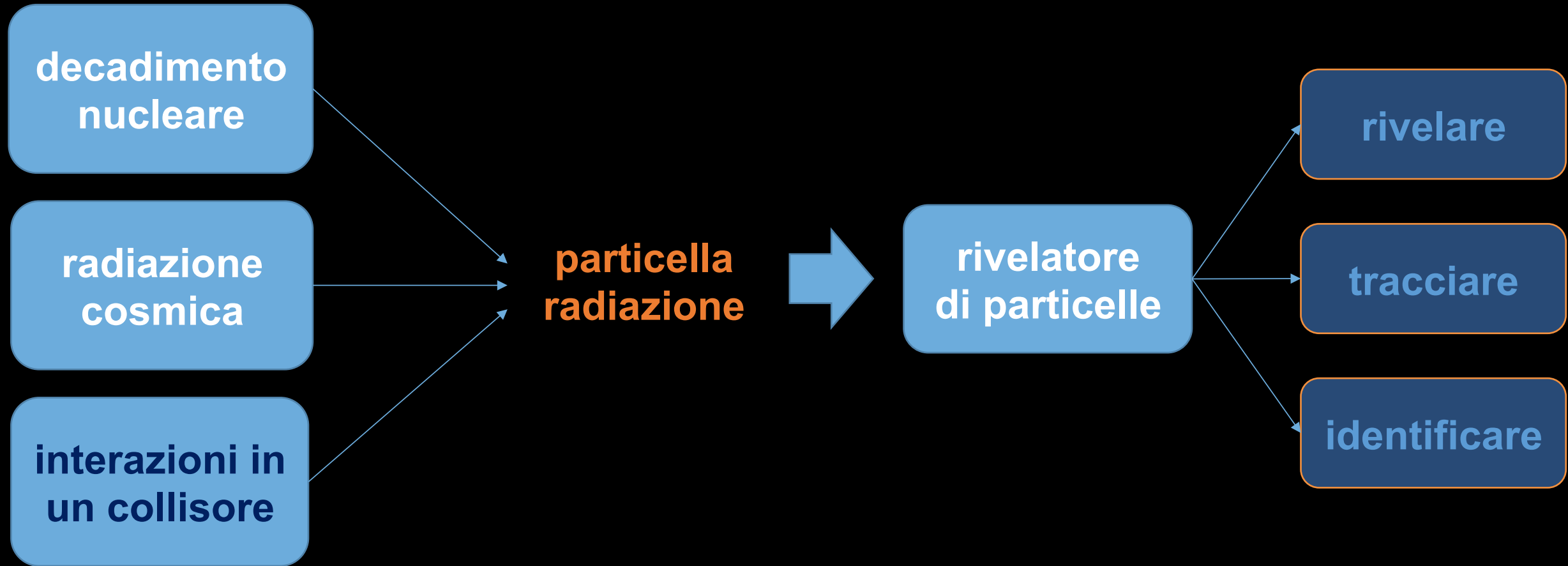


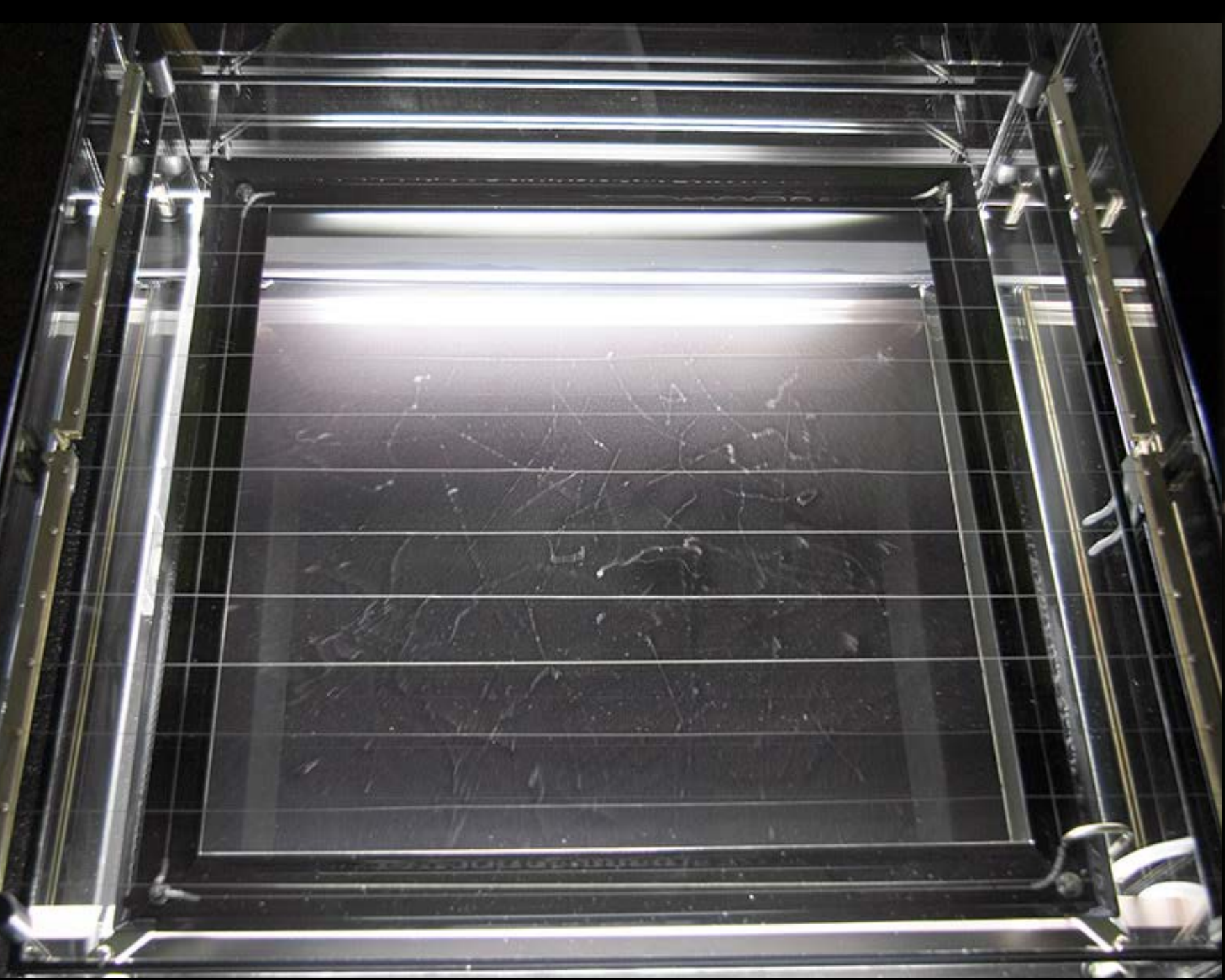
Rivelatori di Particelle

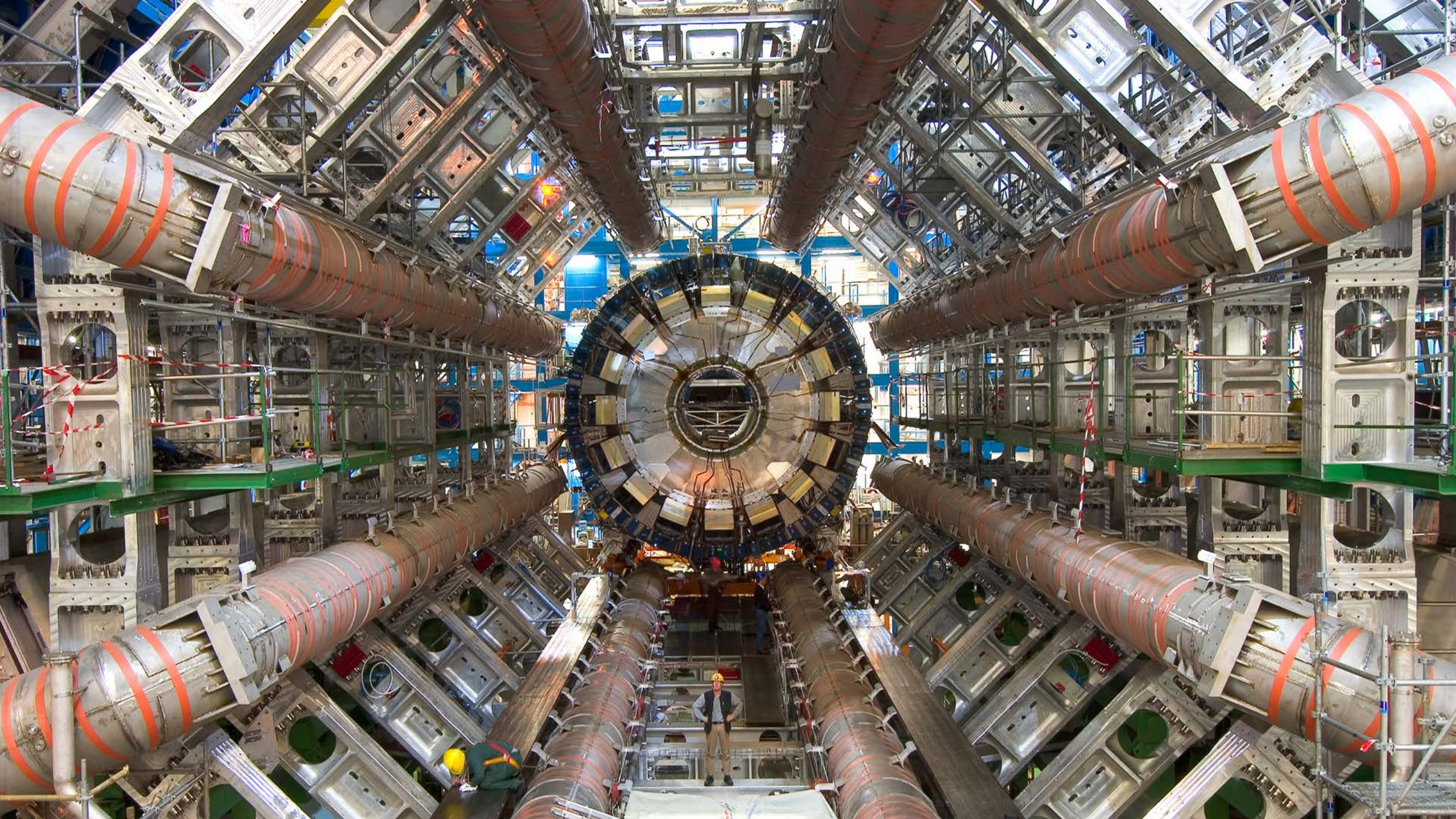
Danilo Domenici

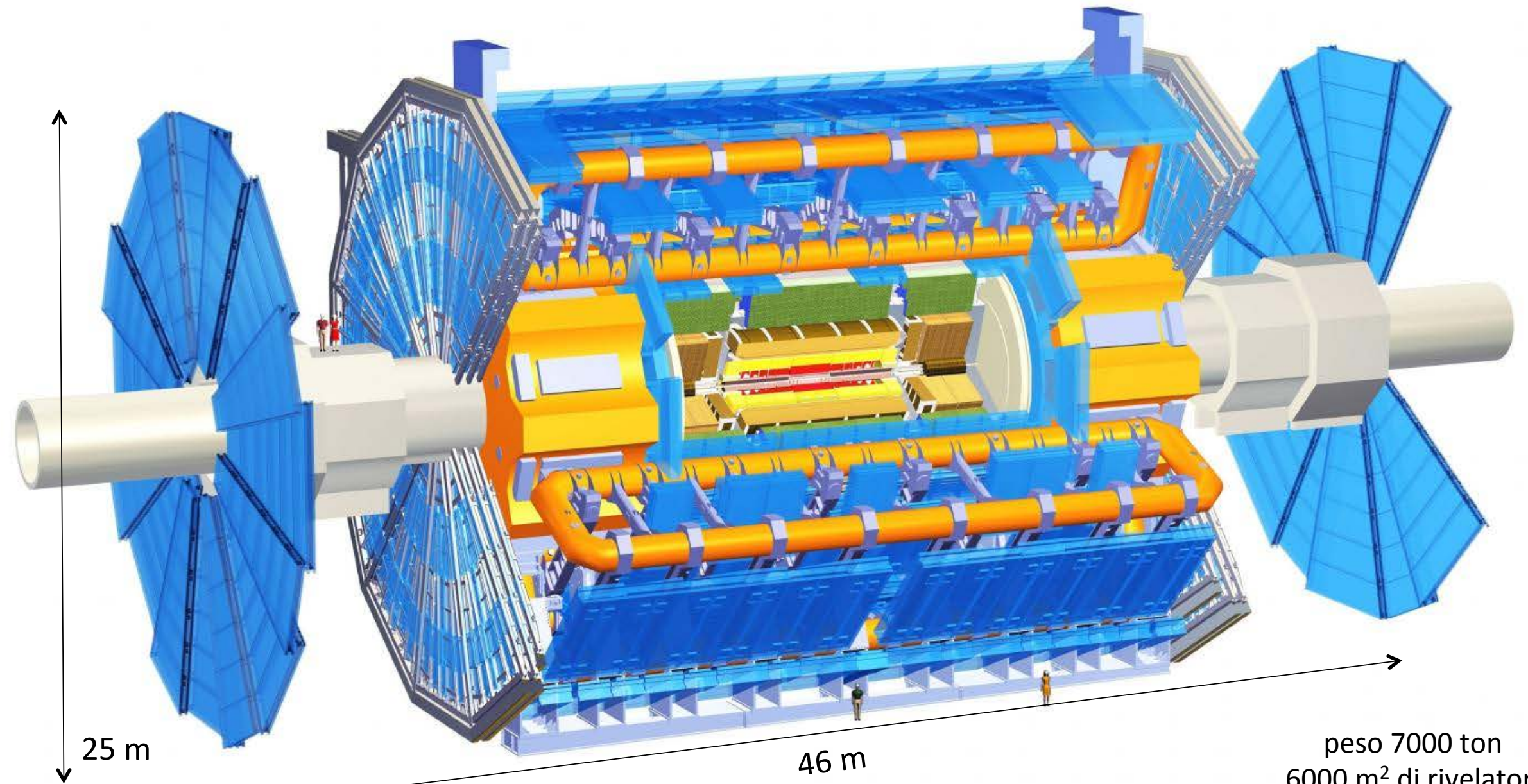
mappa concettuale







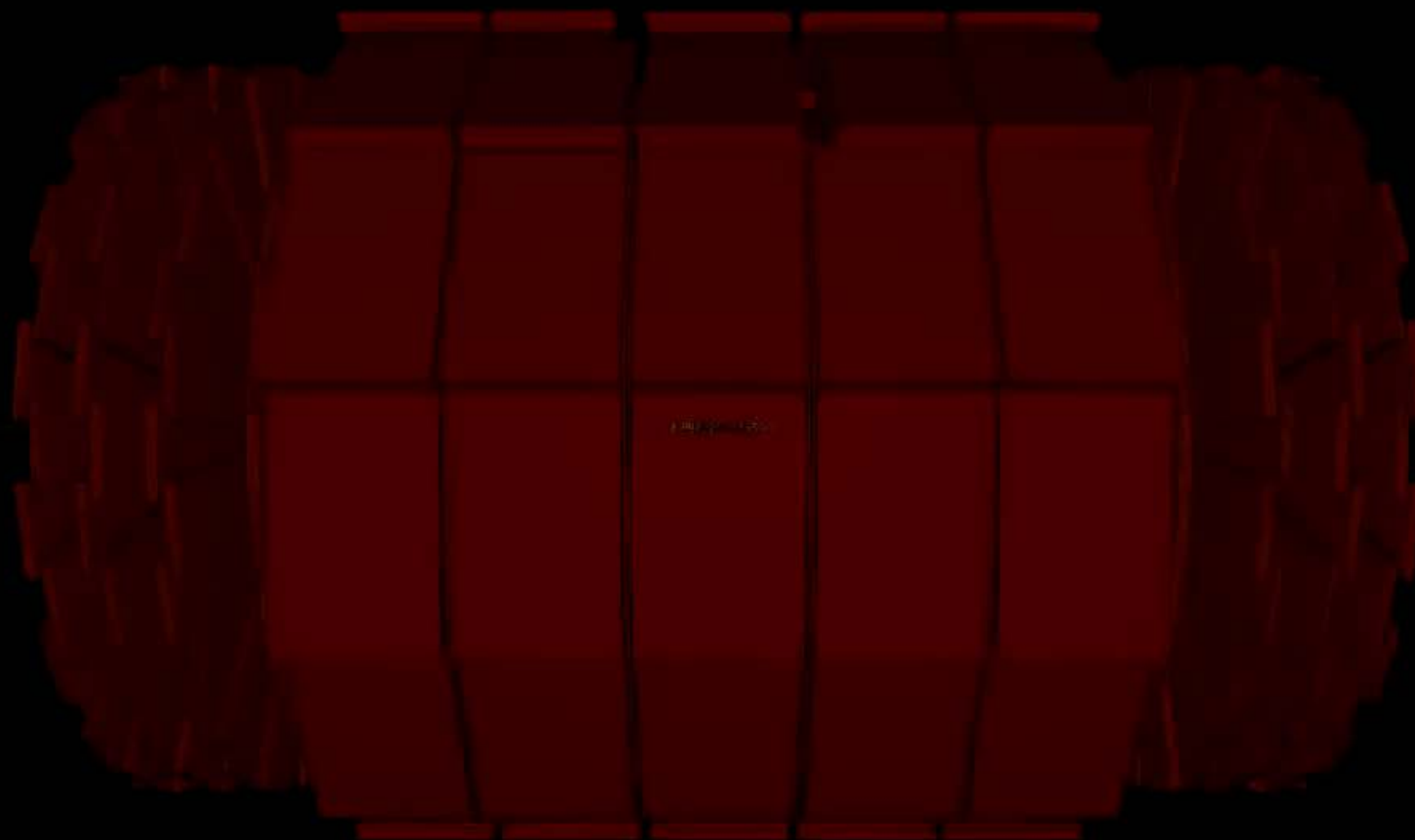




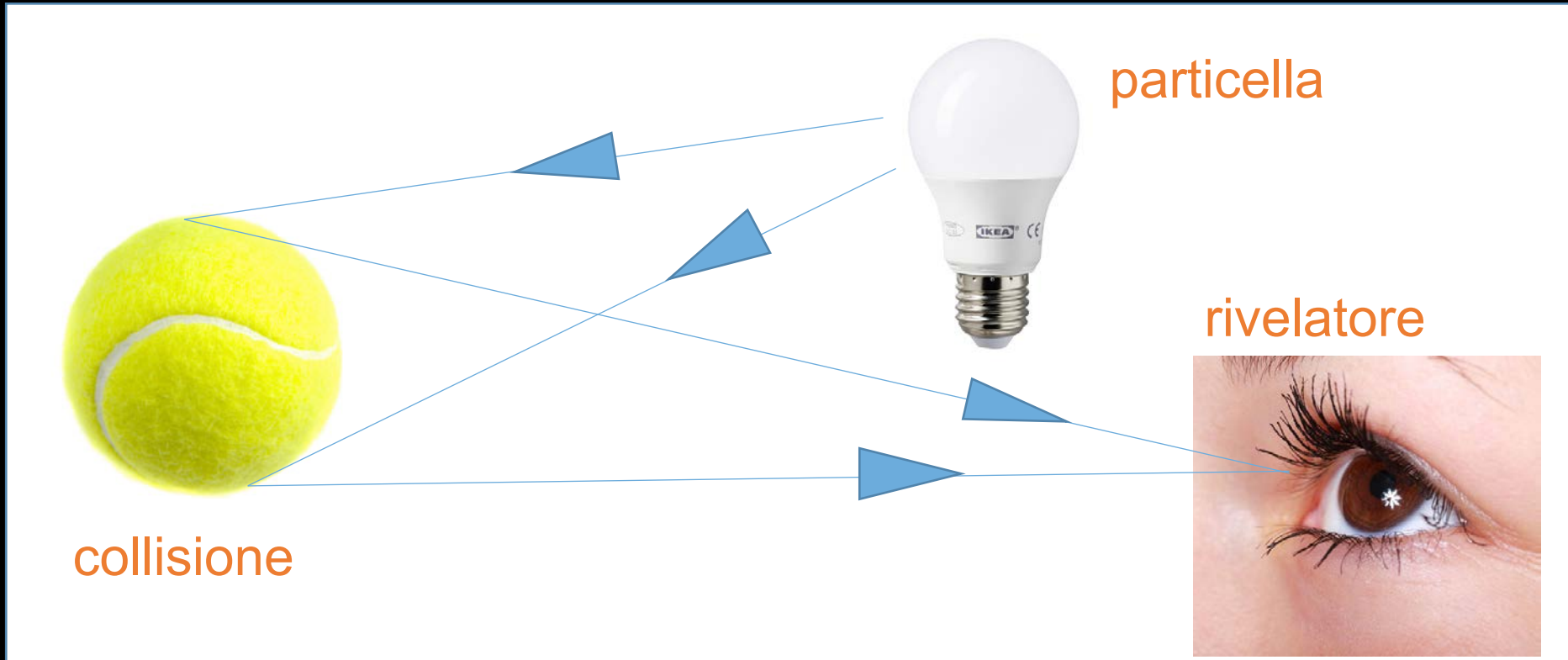
25 m

46 m

peso 7000 ton
6000 m² di rivelatori
3000 ricercatori
38 paesi del mondo

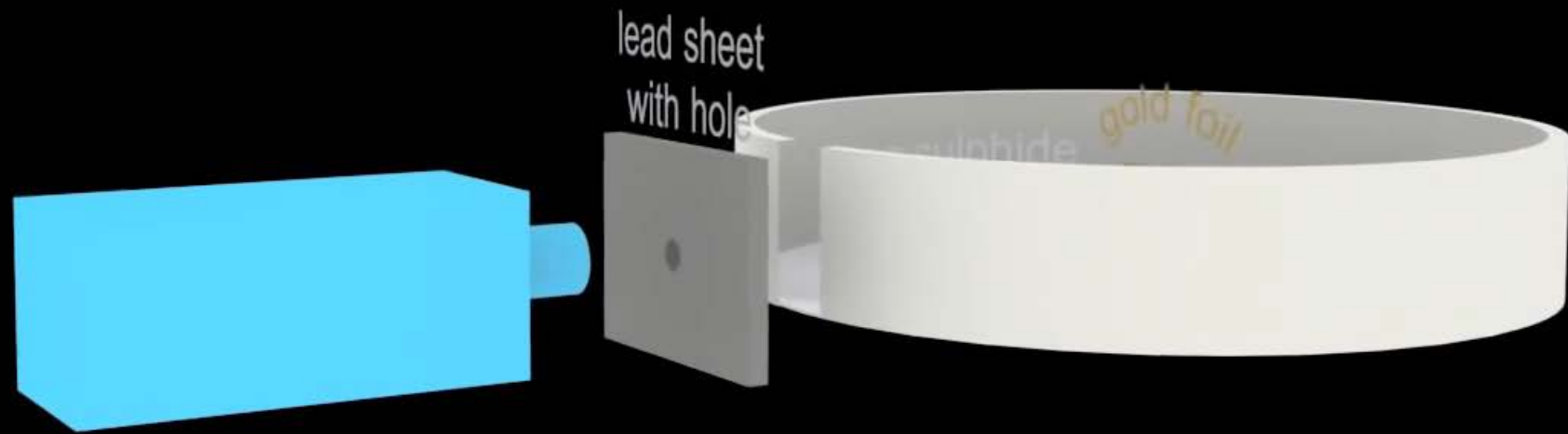


perché facciamo collidere le particelle?

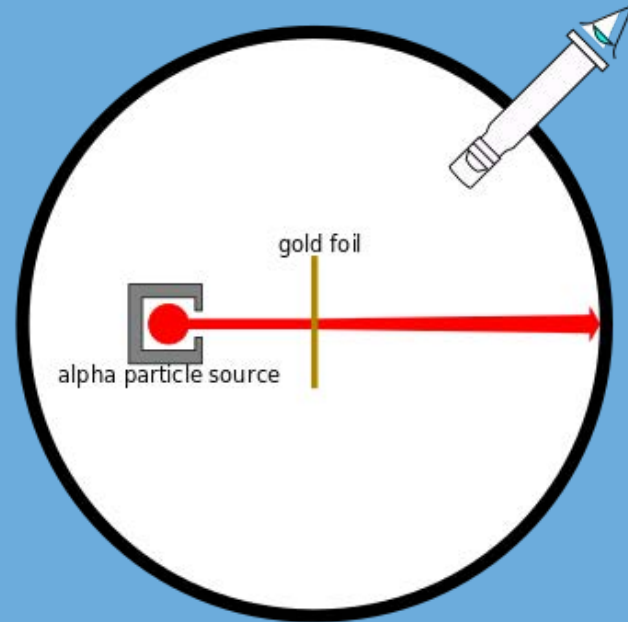
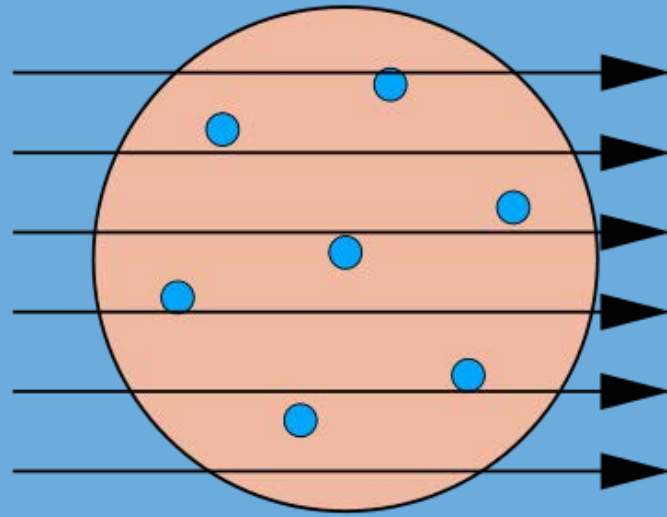


per capire come è fatta la materia

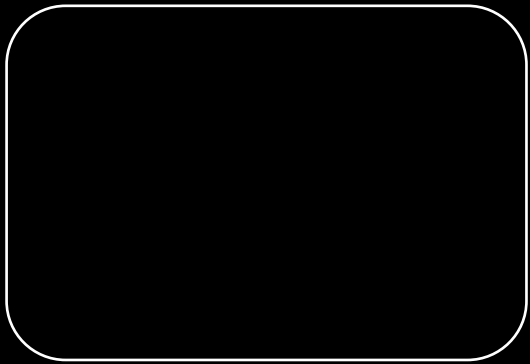
esperimento di rutherford



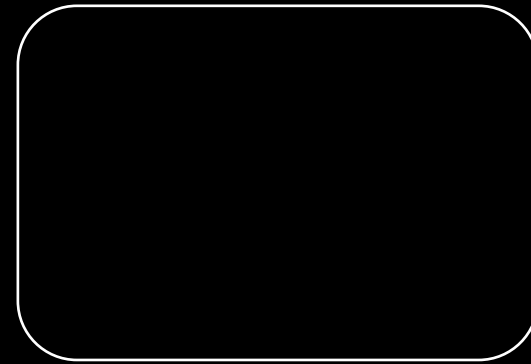
THOMSON MODEL



perché le facciamo collidere
a energia sempre più alta?

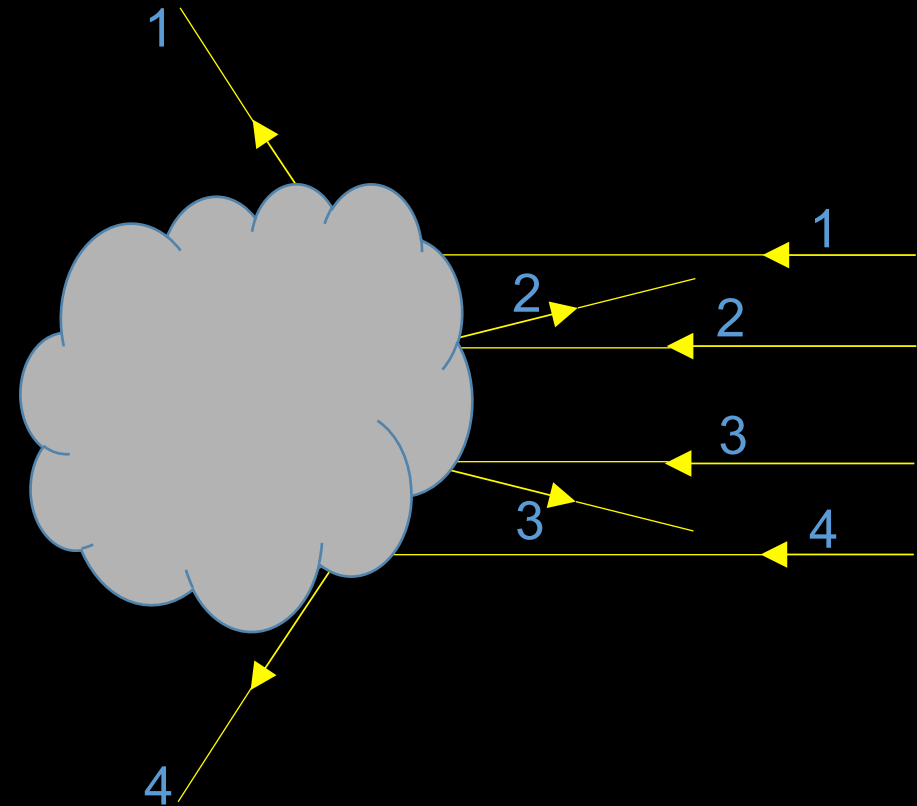
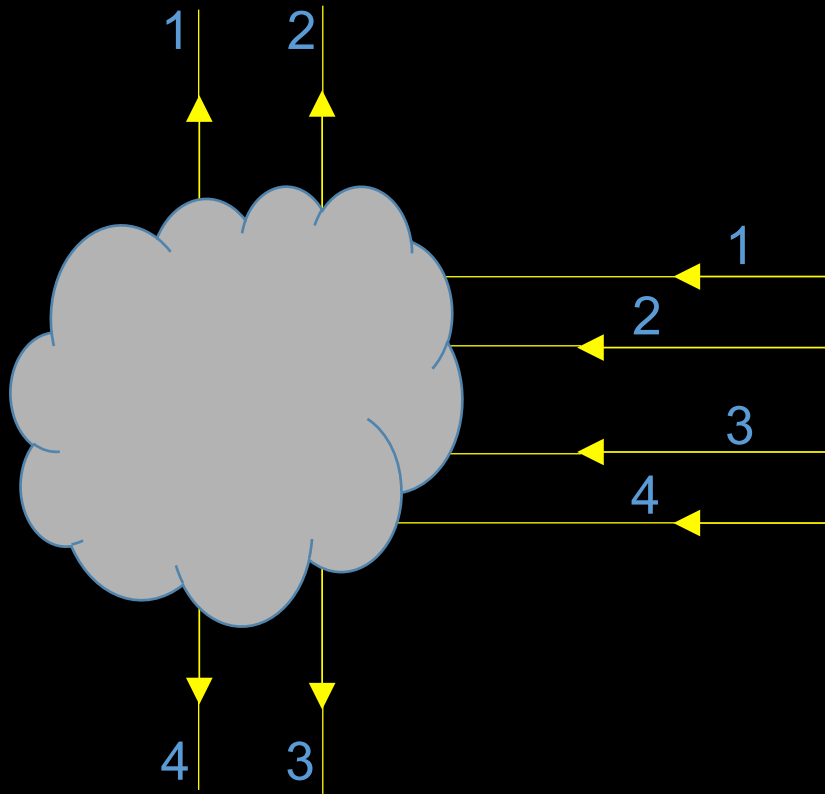


diminuisce la lunghezza
che posso studiare



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

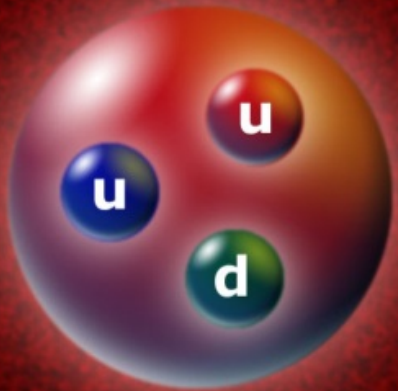
 $\bar{\nu}_\mu$

anti-neutrino
muonico

 $\bar{\nu}_\tau$

anti-neutrino
tau

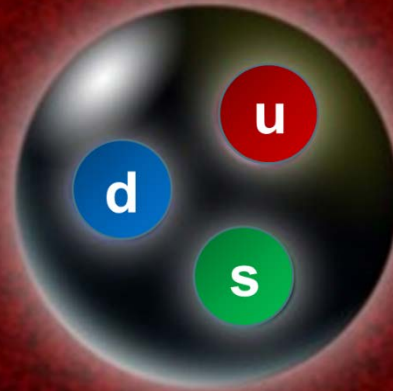
Barioni - 3 quark



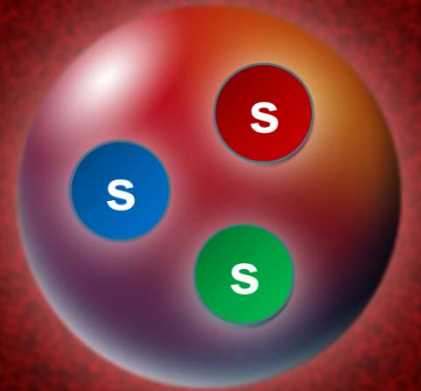
proton



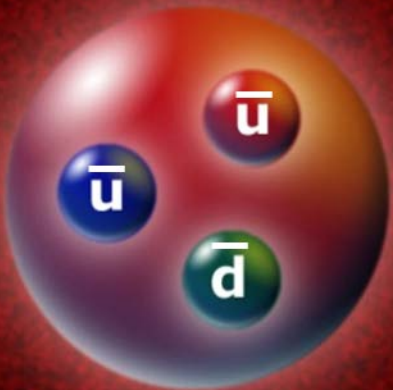
neutron



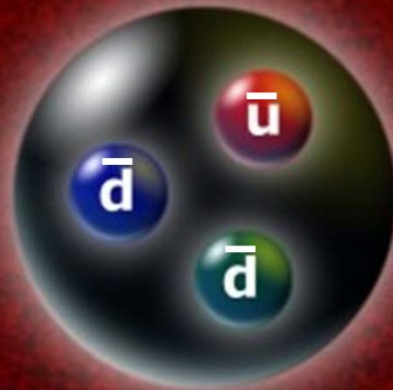
lambda



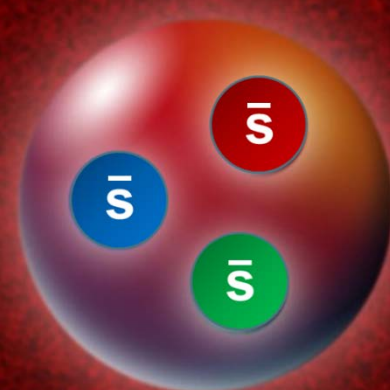
sigma



antiproton



antineutron



antisigma

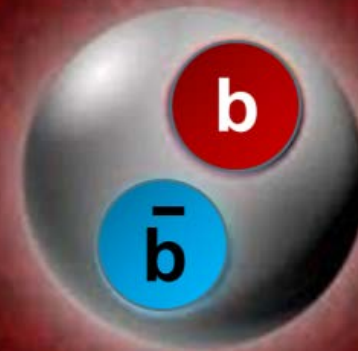
Mesoni - 1 quark 1 antiquark



pion



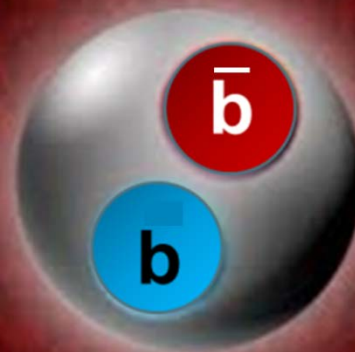
kaon



upsilon



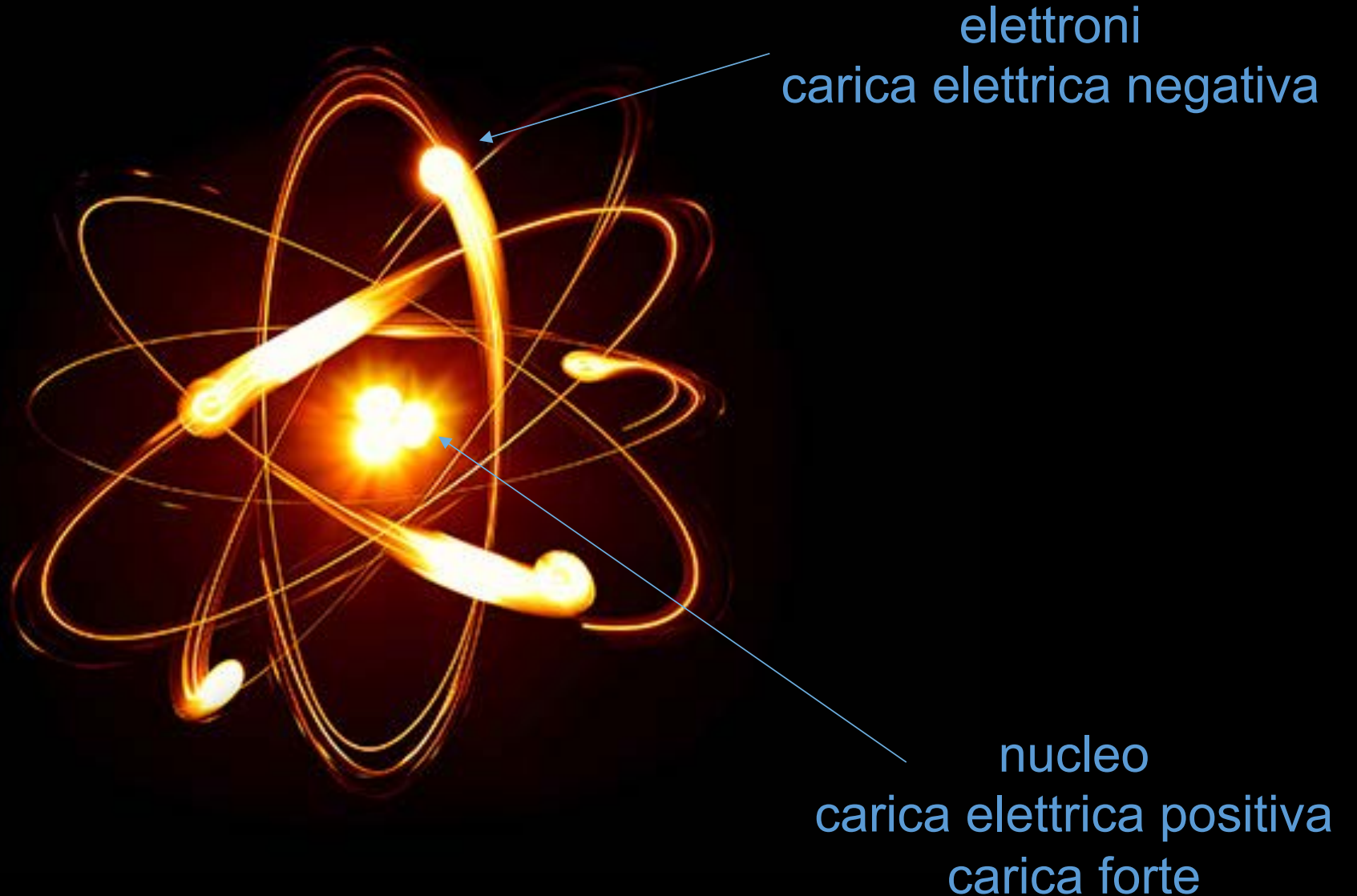
antikaon



upsilon

interazione radiazione-materia

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



interazione radiazione-materia

particelle direttamente rivelabili

e

elettrone

p

protone

n

neutrone

γ

fotone

particelle stabili

μ

muone

π

pione

K

kaone

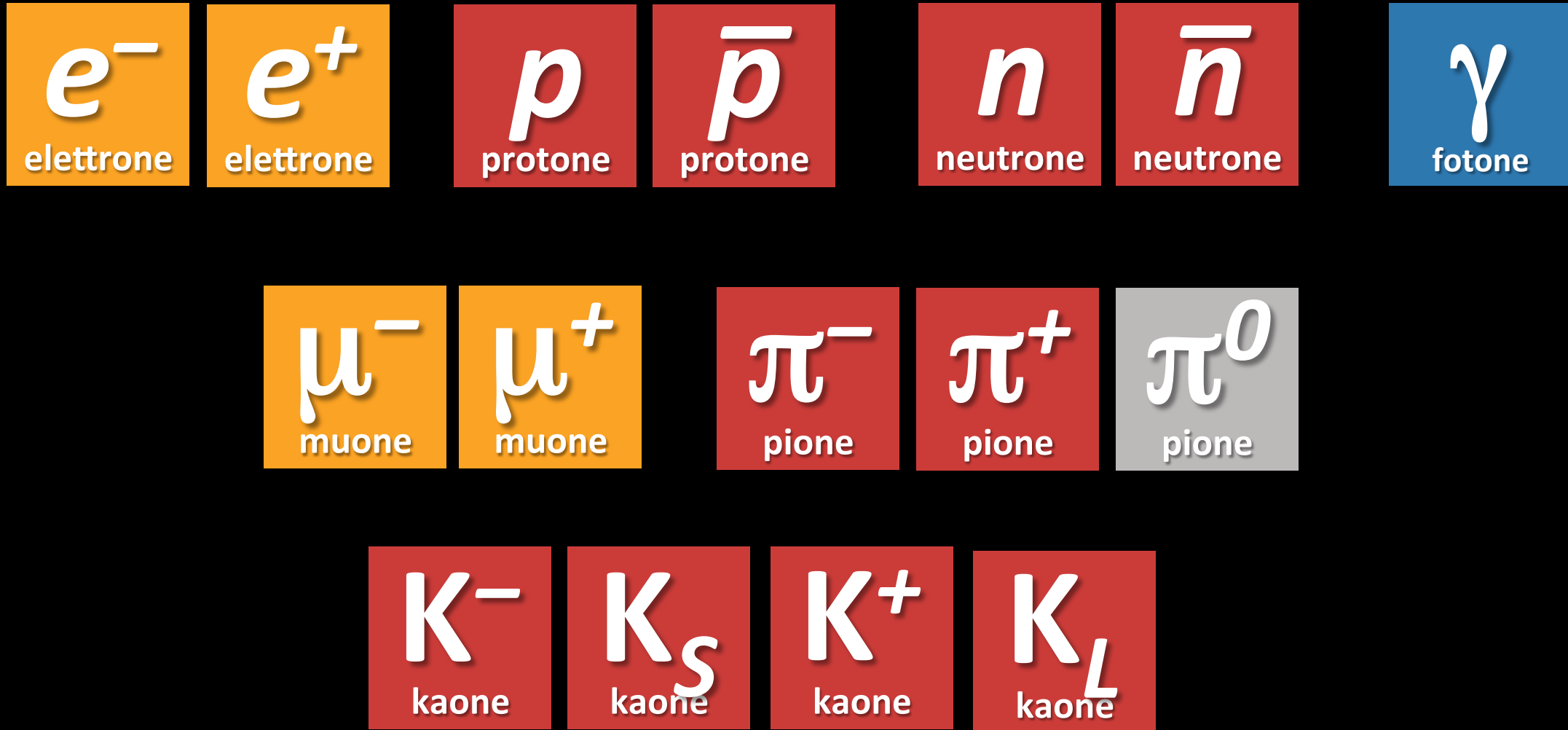
particelle con vita media $> 10^{-10}$ s

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



interazione radiazione-materia

urti con gli elettroni – forza elettromagnetica



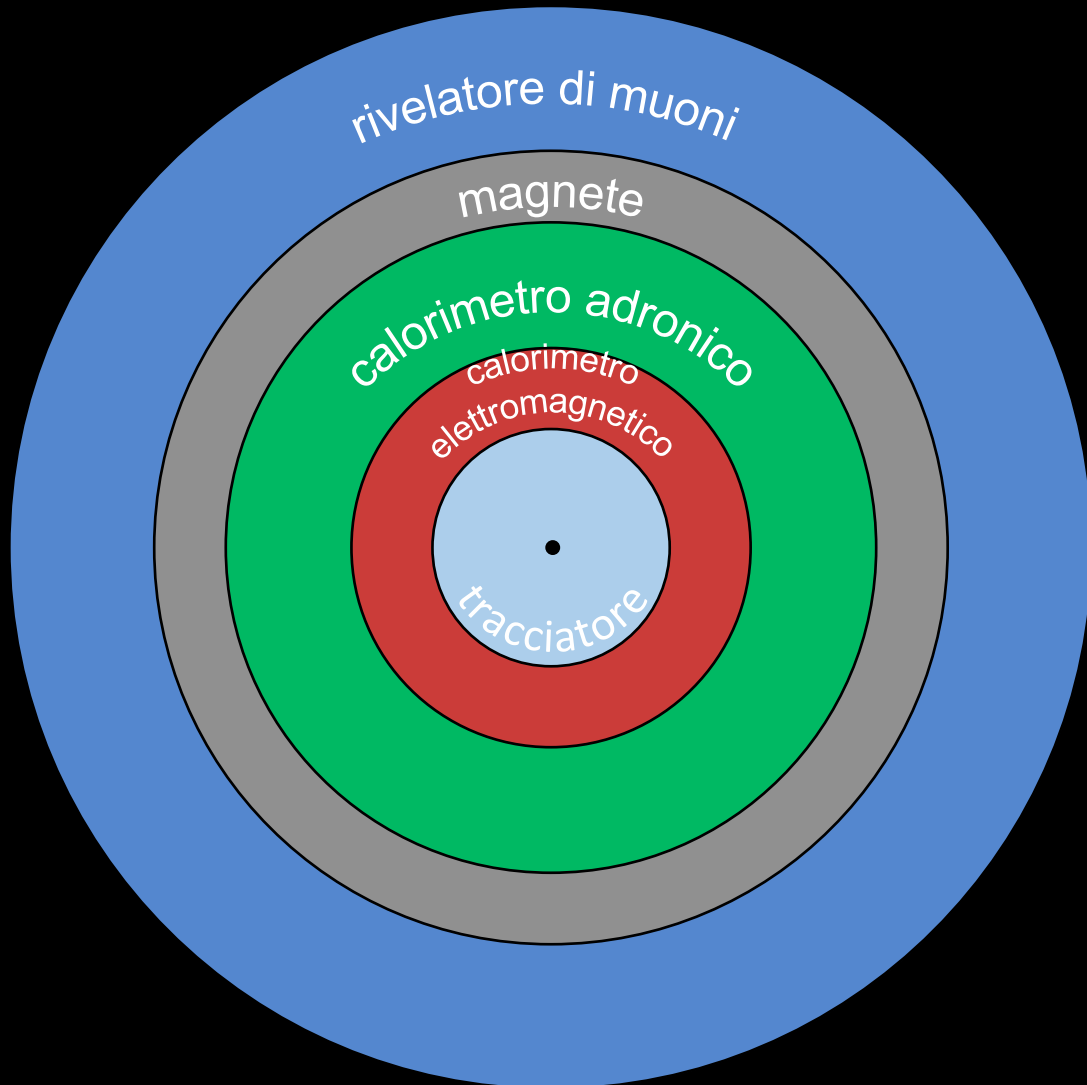
urti con il nucleo – forza forte



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

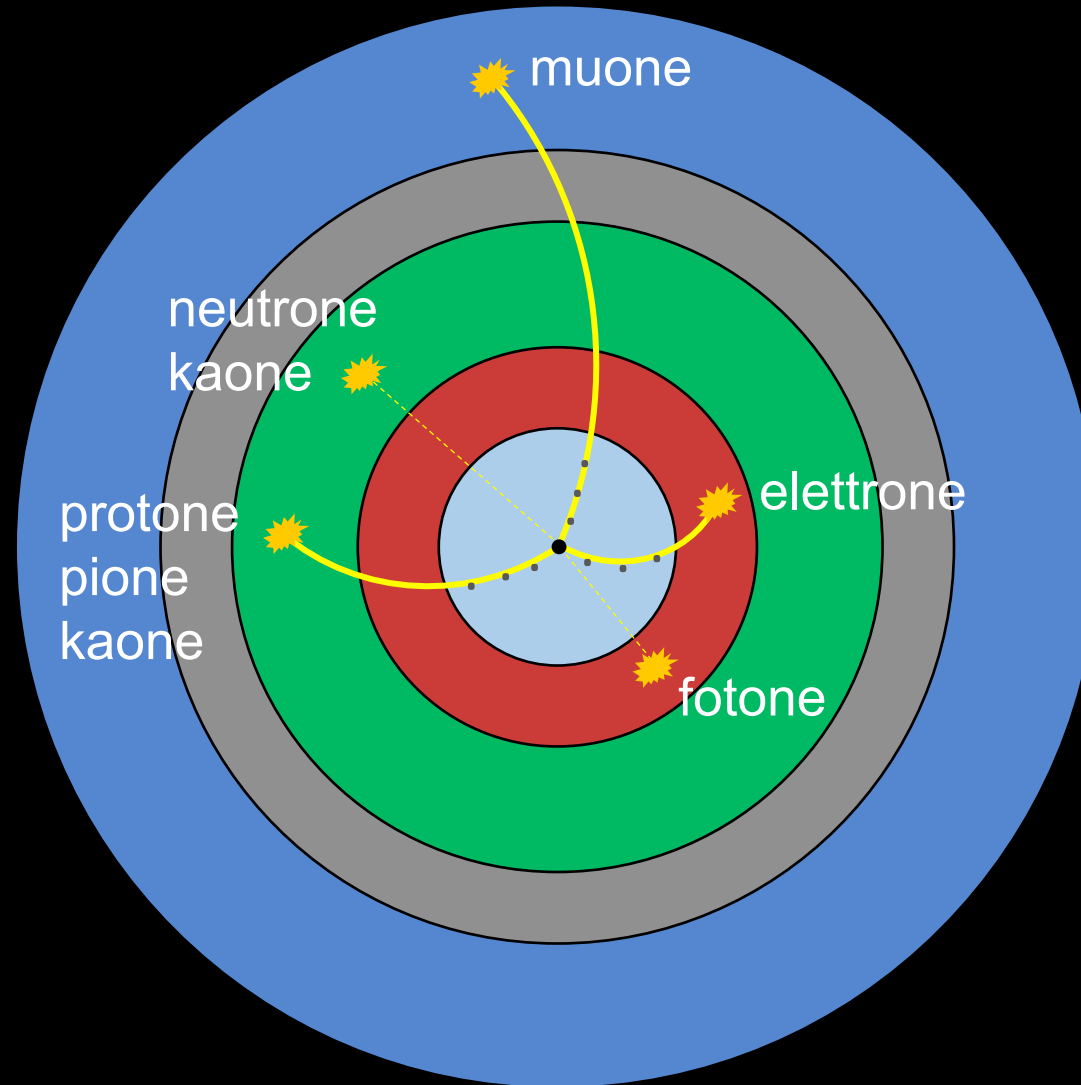
Calorimetro Elettromagnetico
rivela elettroni e fotoni
e ne misura l'energia

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

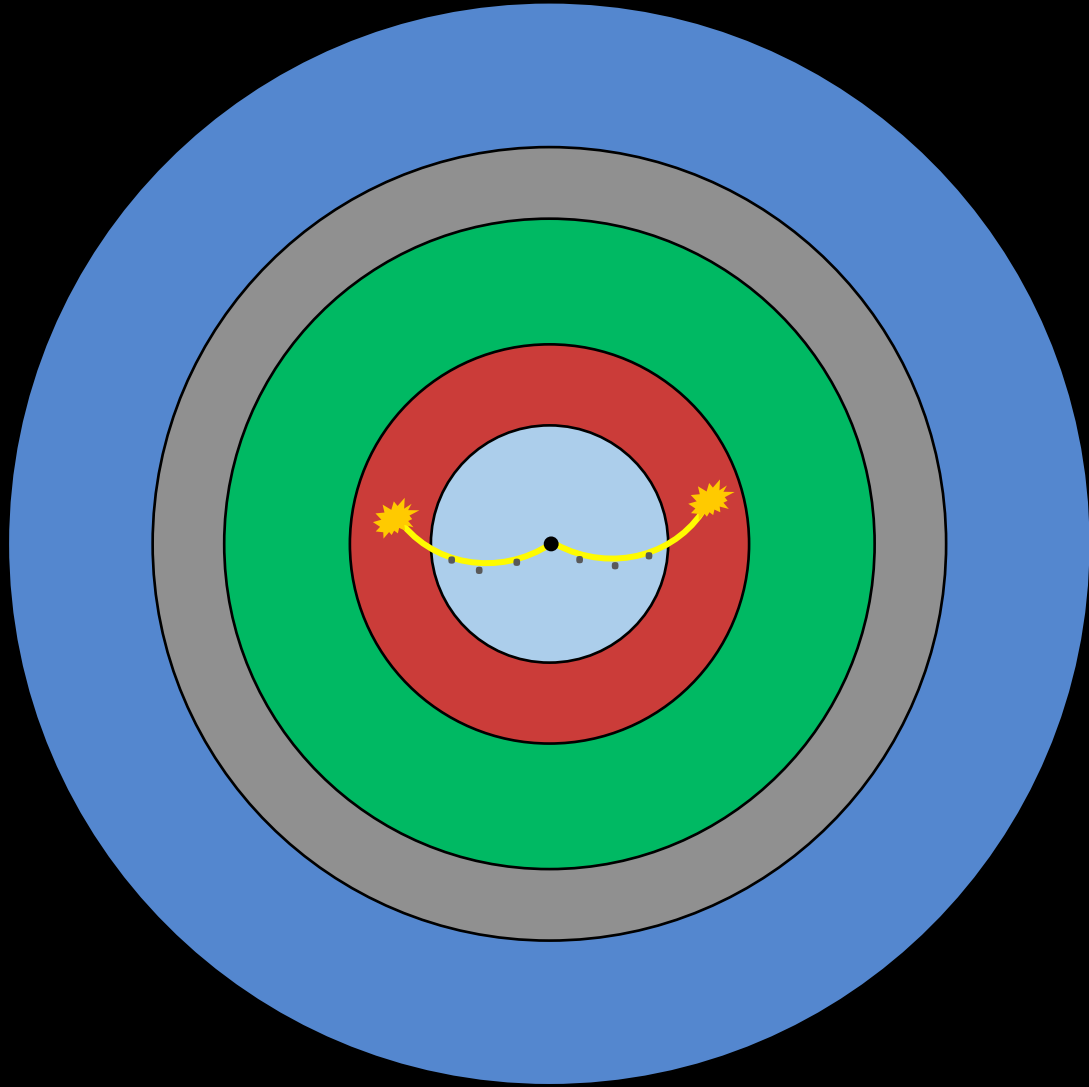
Magnete
curva le particelle cariche
e ne permette la misura della quantità di moto

Rivelatore di Muoni
rivela i muoni

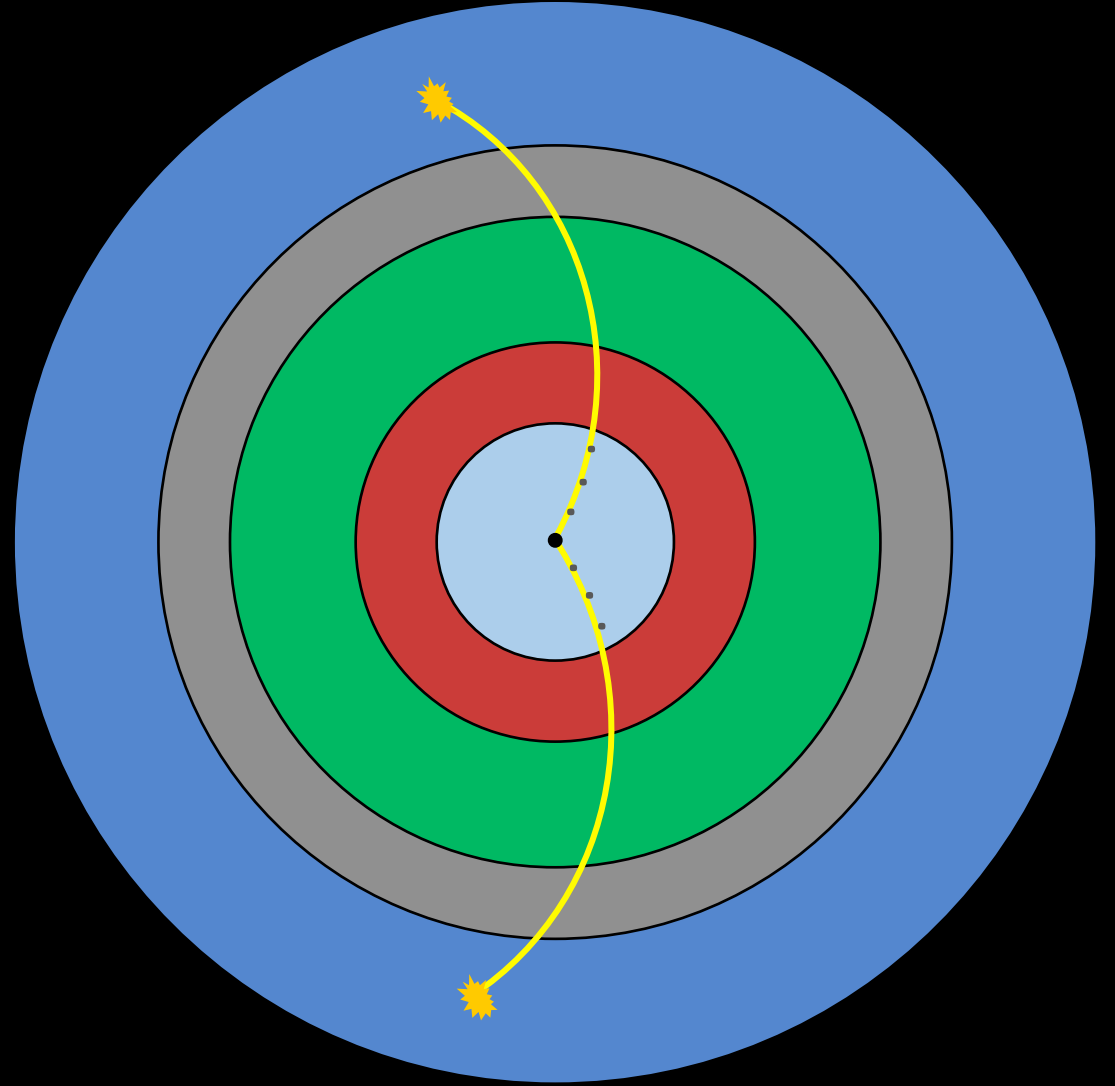
identificazione delle particelle



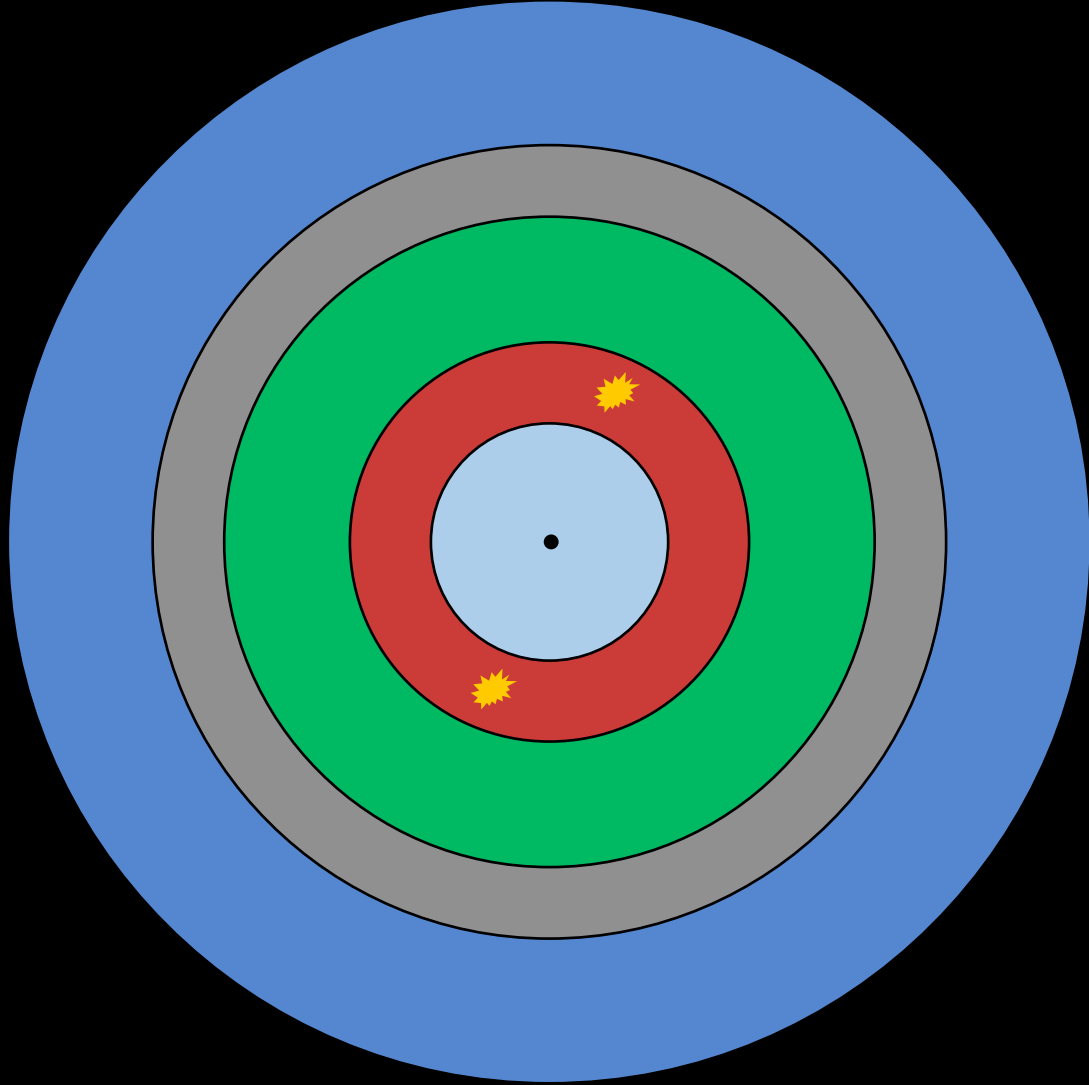
$$e^+ e^- \rightarrow e^+ e^-$$



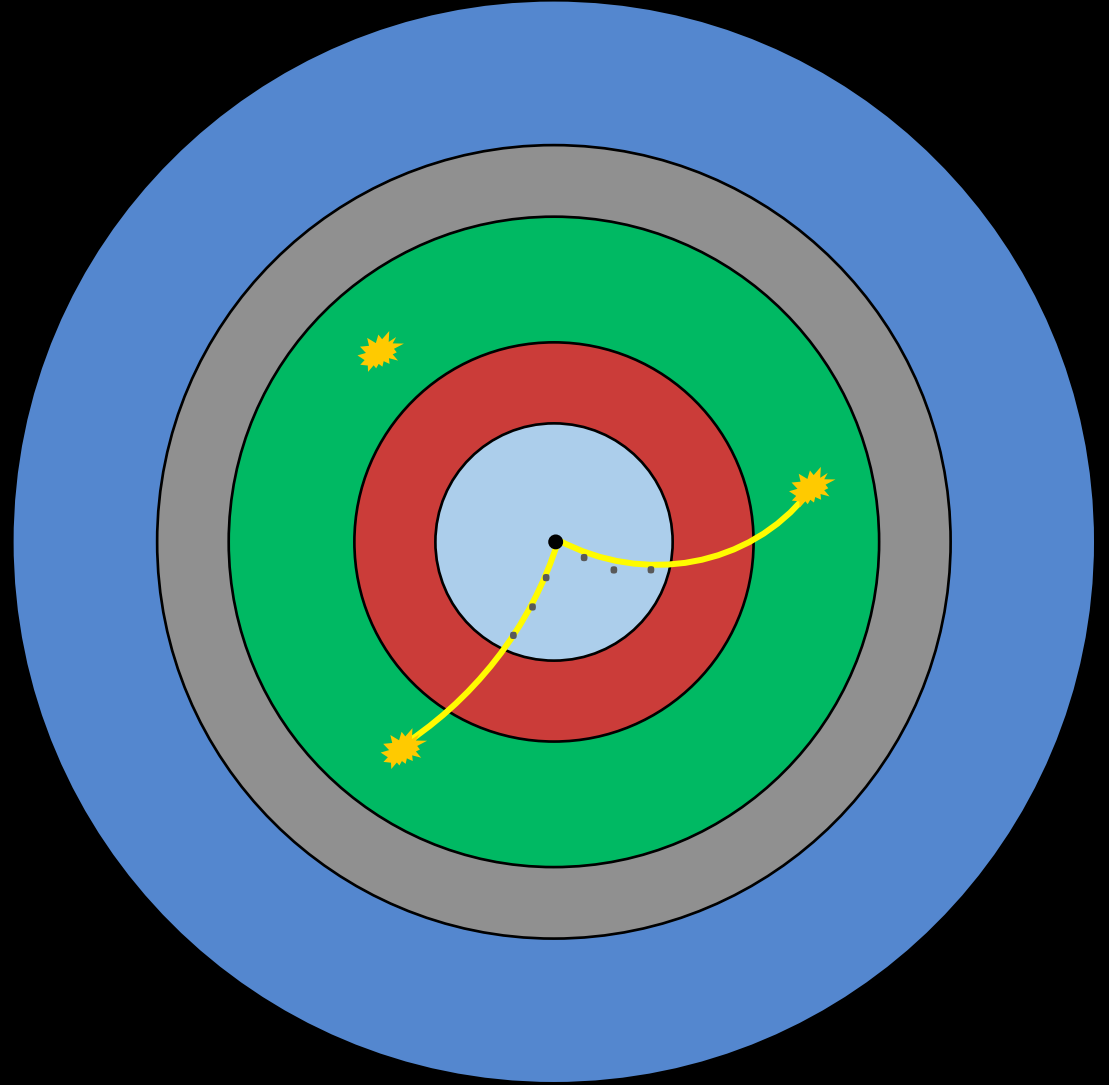
$$e^+ e^- \rightarrow \mu^+ \mu^-$$



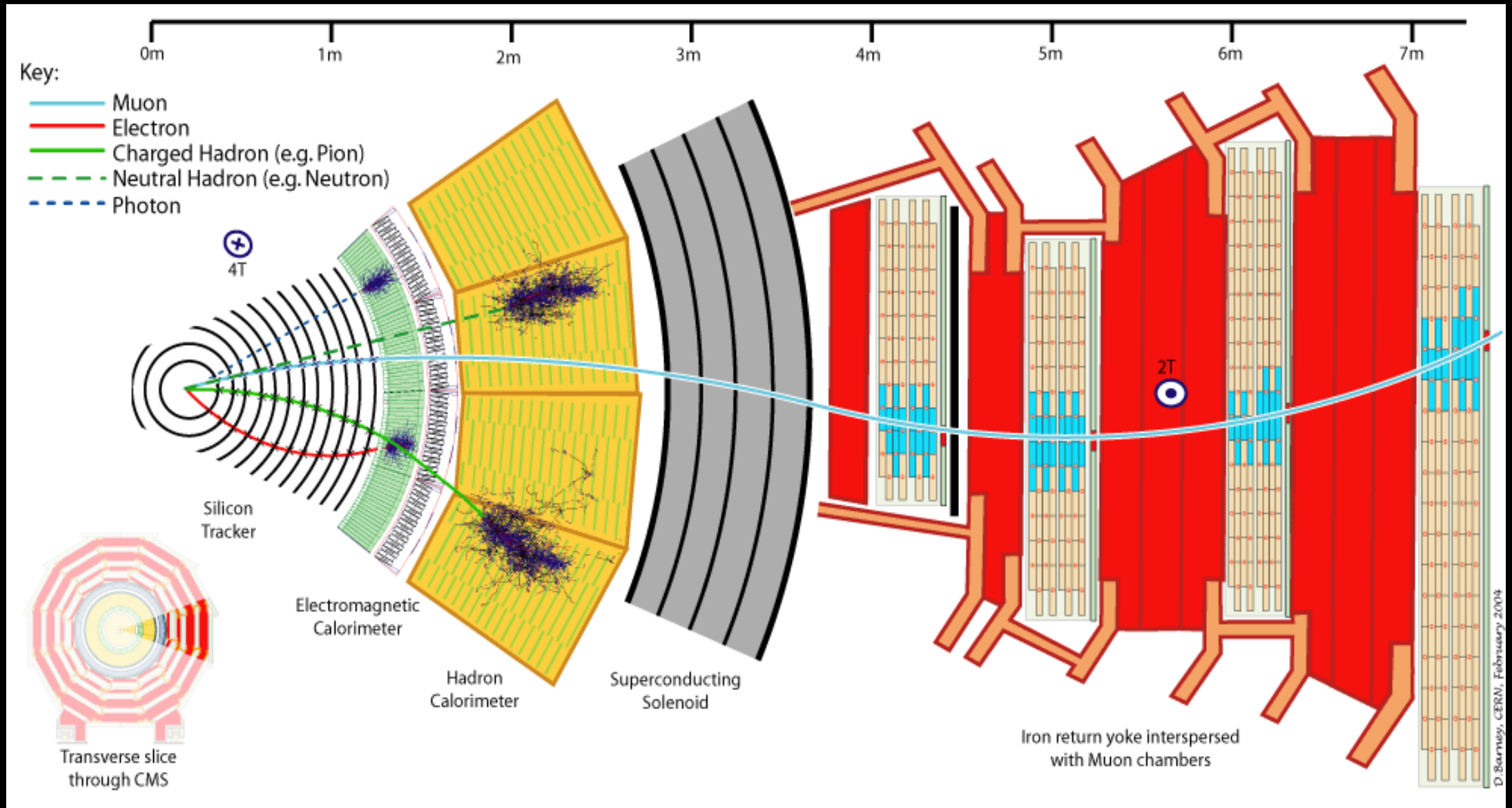
$$e^+ e^- \rightarrow \gamma \gamma$$



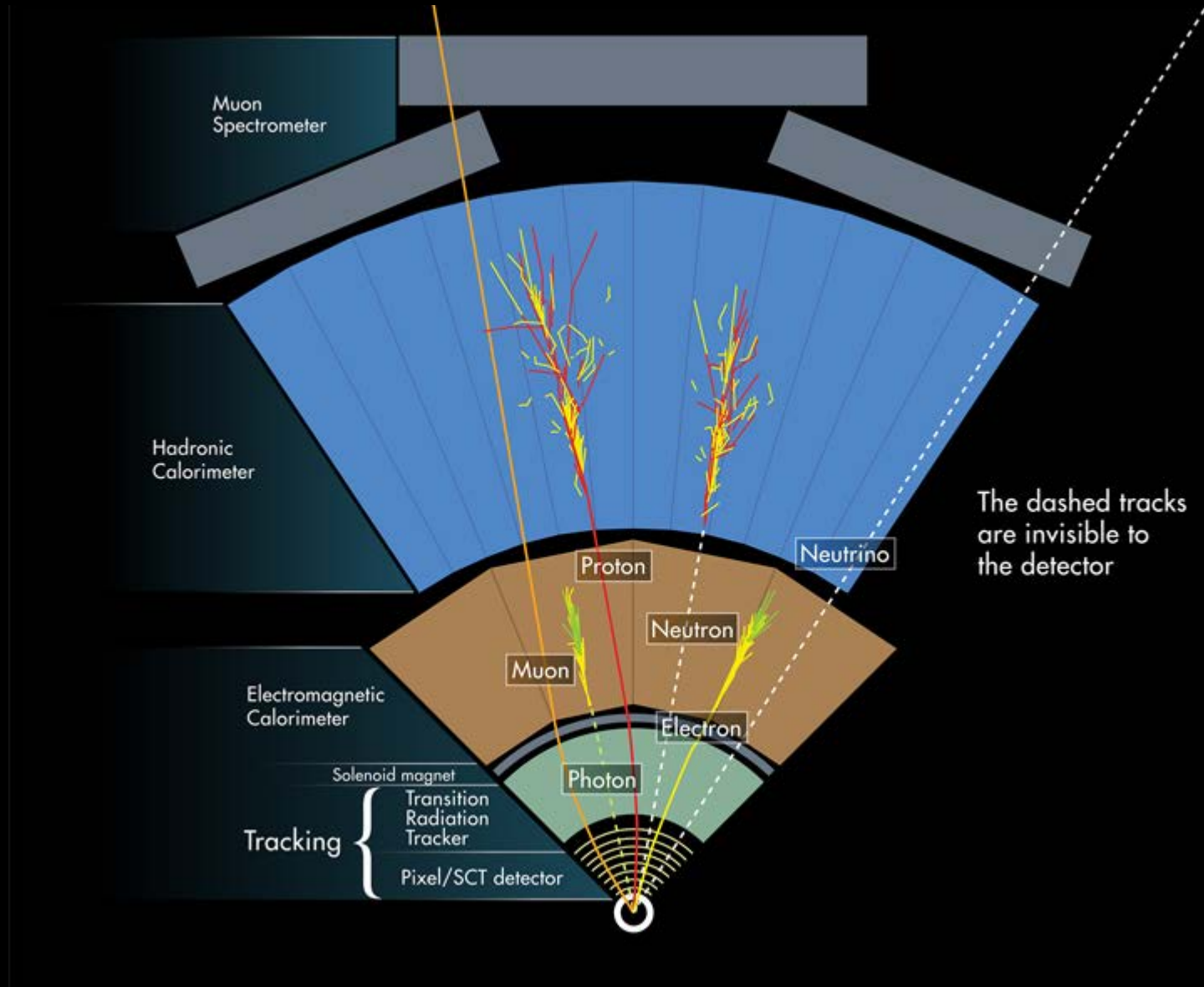
$$e^+ e^- \rightarrow \pi^+ \bar{p} n$$

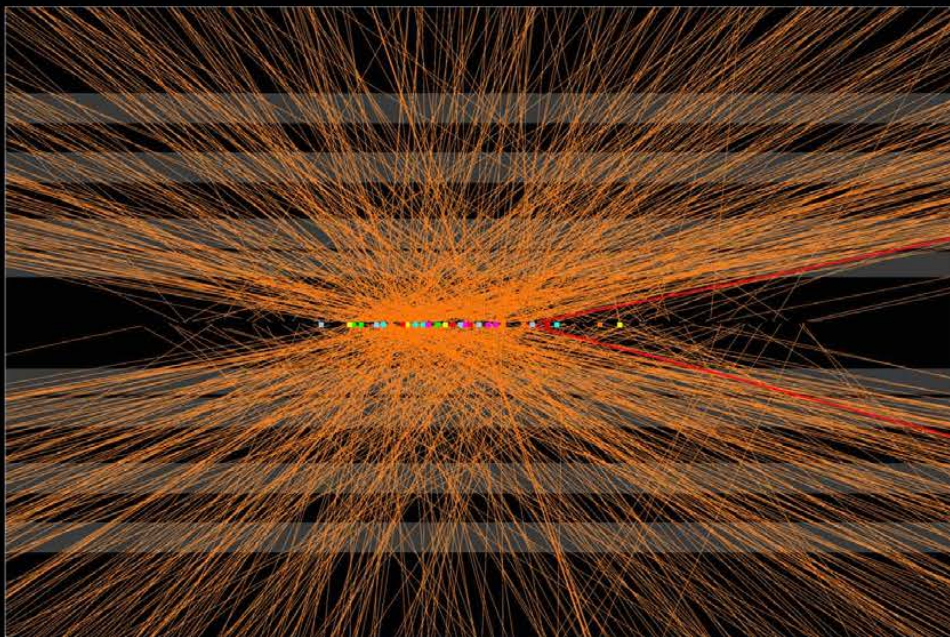


il rivelatore cms a lhc



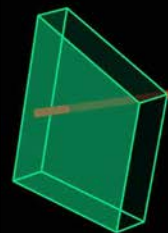
il rivelatore atlas a lhc



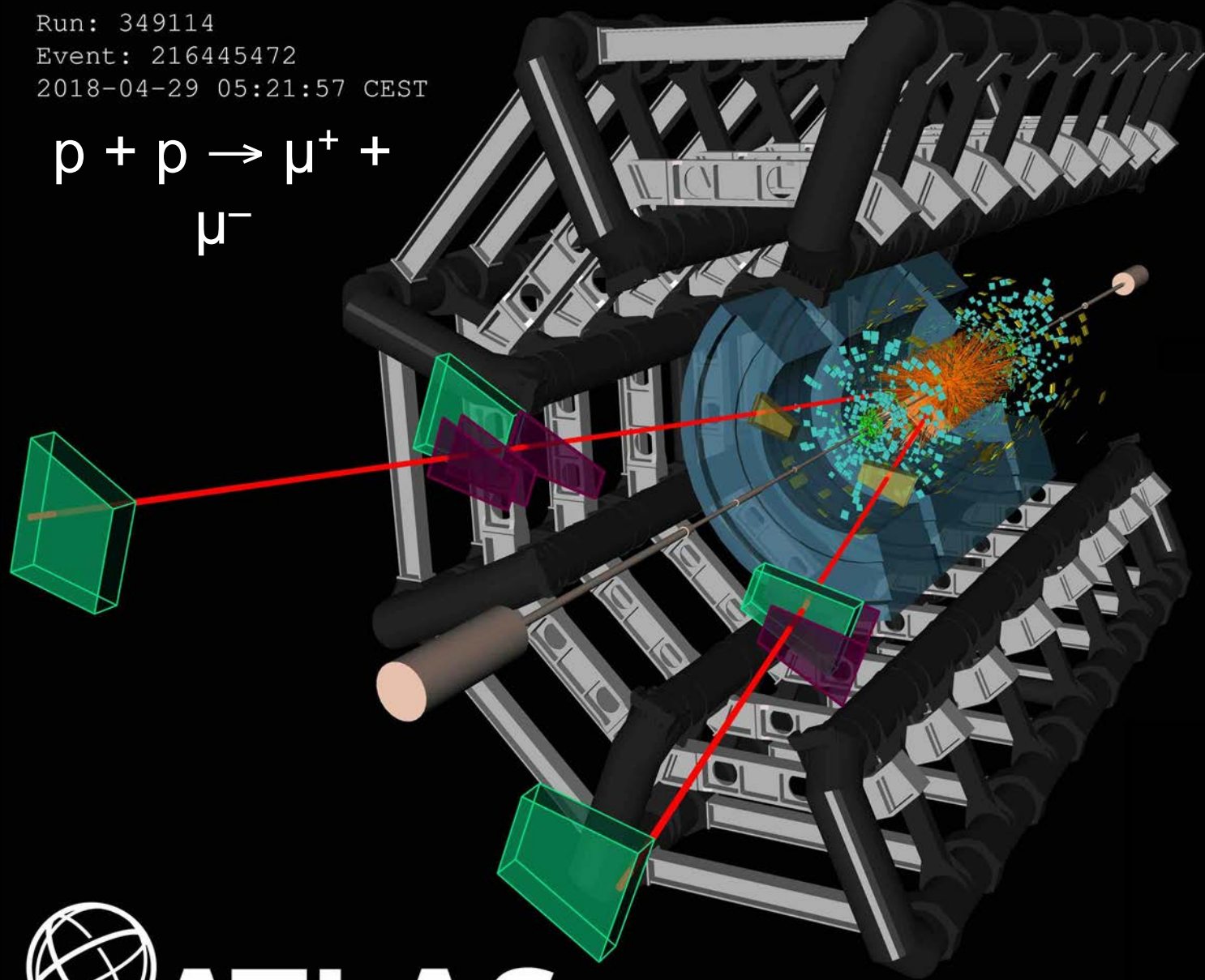


Run: 349114
Event: 216445472
2018-04-29 05:21:57 CEST

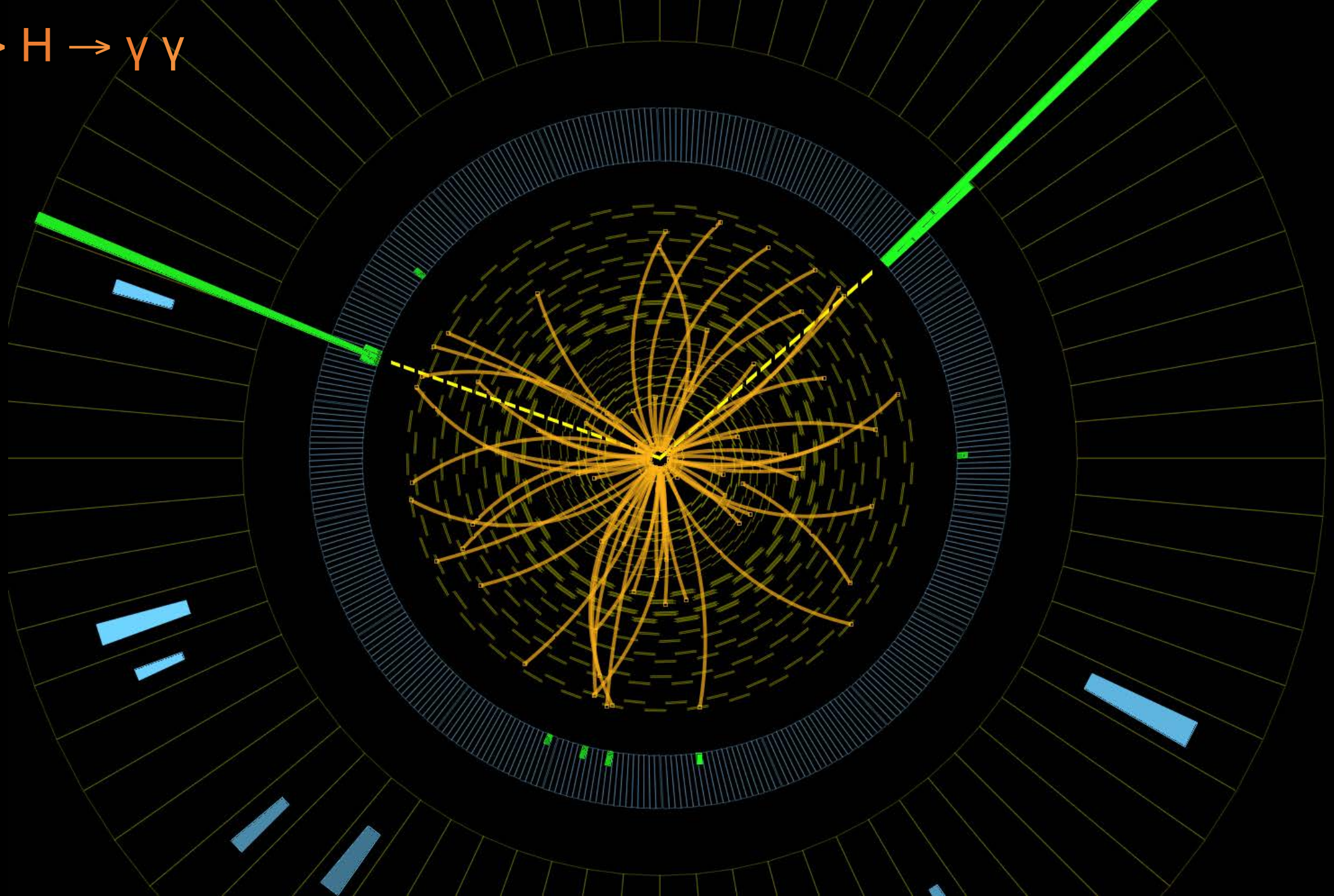
$$p + p \rightarrow \mu^+ + \mu^-$$



ATLAS
EXPERIMENT



$pp \rightarrow H \rightarrow \gamma \gamma$

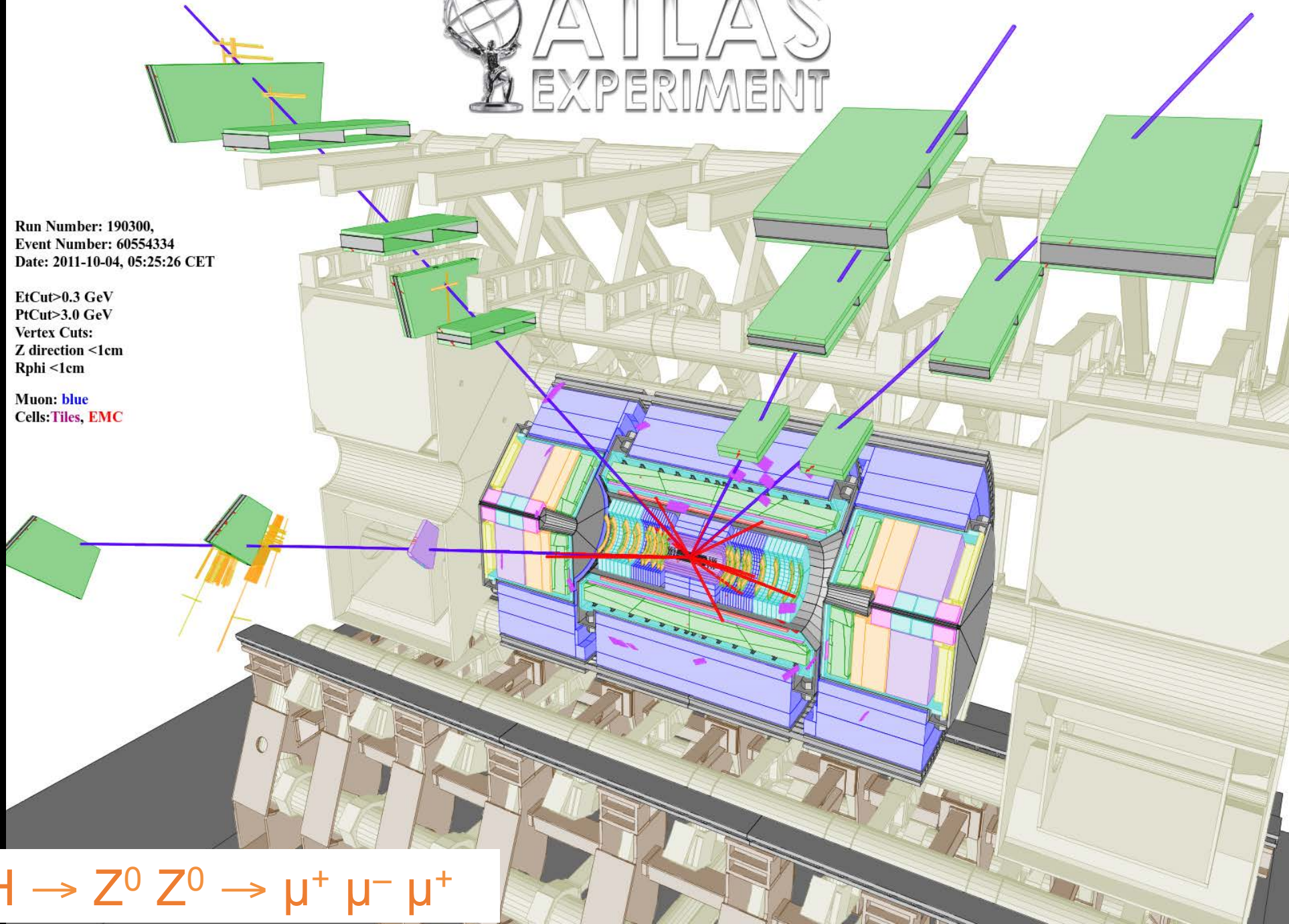


ATLAS EXPERIMENT

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

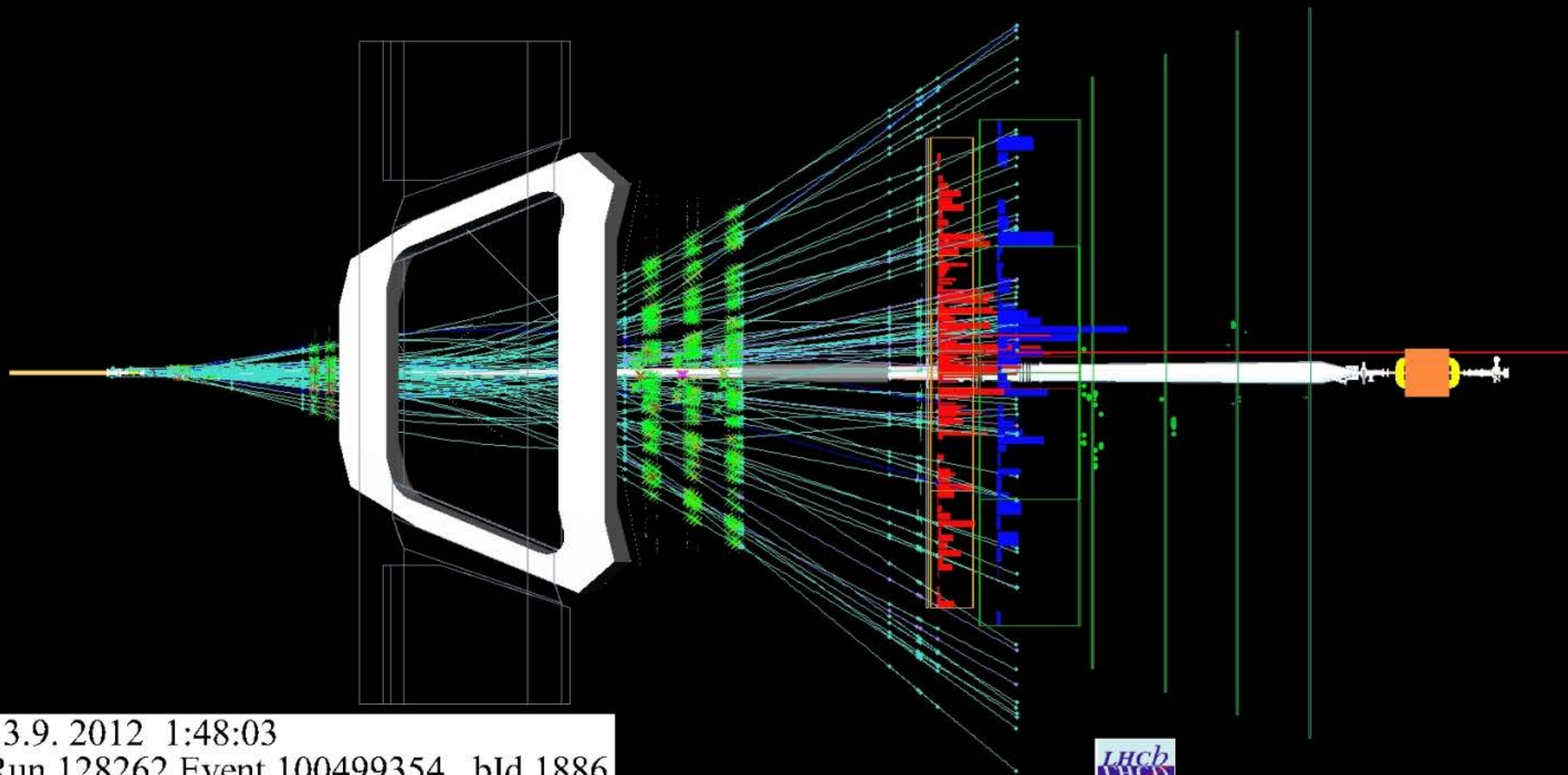
EtCut>0.3 GeV
PtCut>3.0 GeV
Vertex Cuts:
Z direction <1cm
Rphi <1cm

Muon: blue
Cells: Tiles, EMC



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

LHCb Event Display



13.9. 2012 1:48:03
Run 128262 Event 100499354 bId 1886

