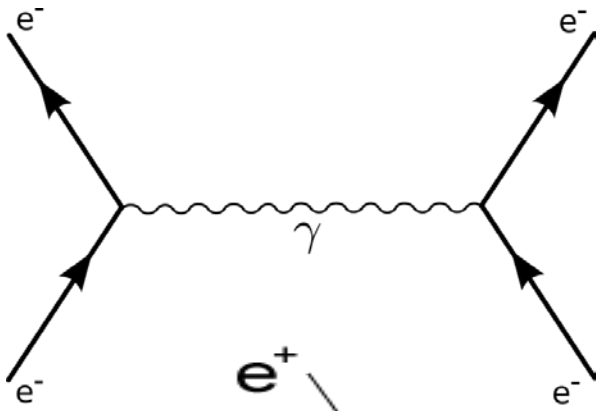
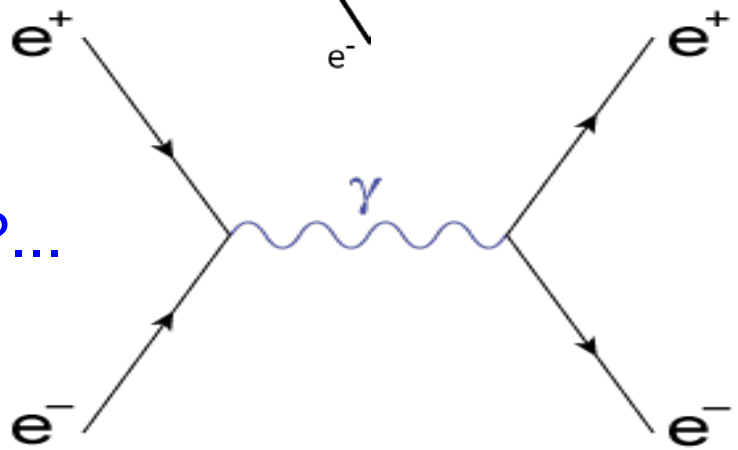
An Introduction to Particle Physics

I - Some theoretical views…

... very basic (?)…

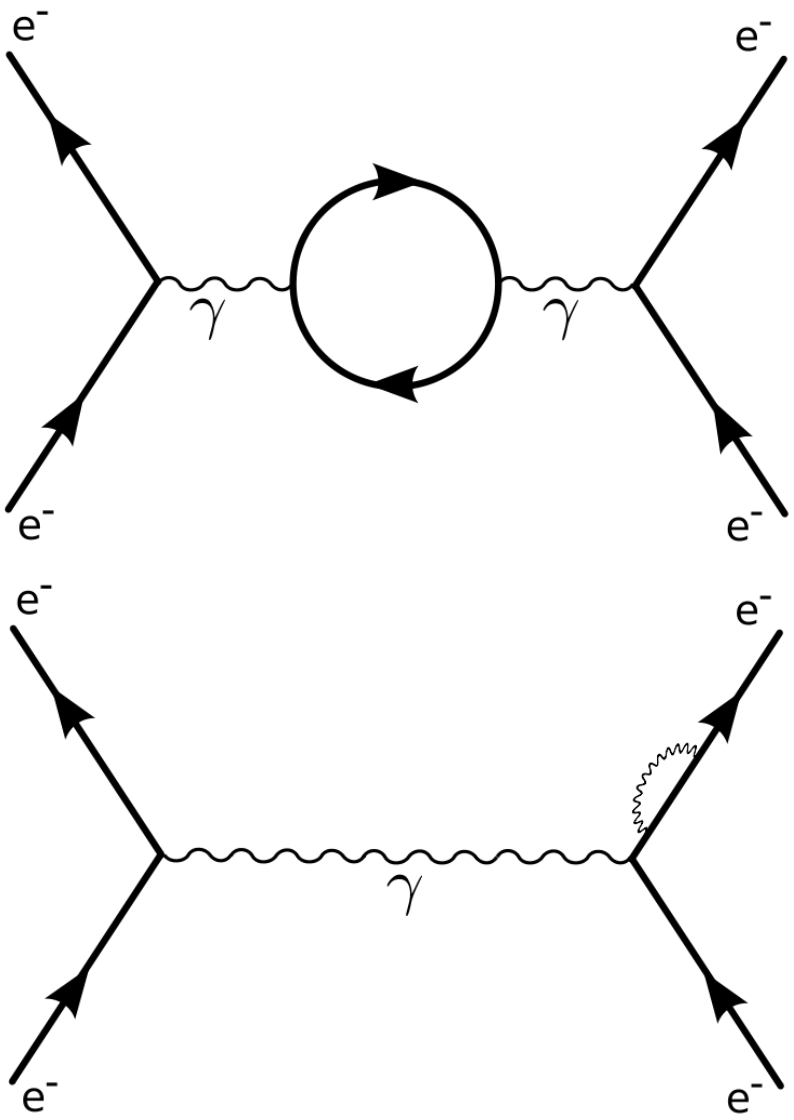


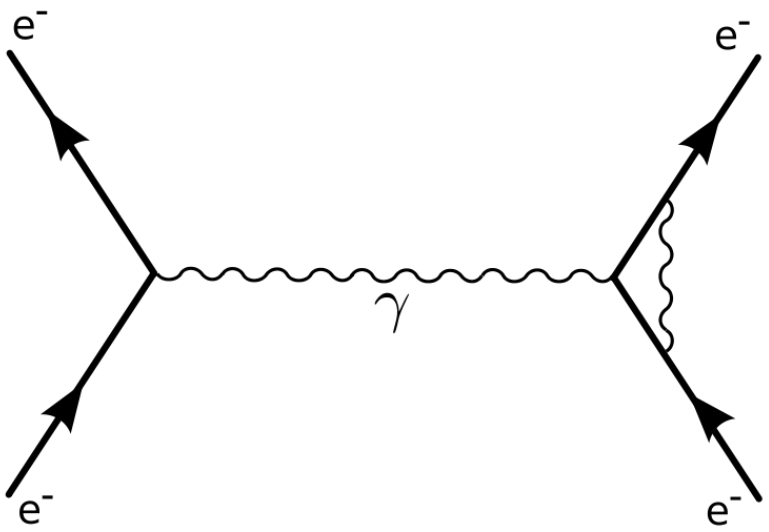
... is there a link?...



Some theoretical views (cont'd)

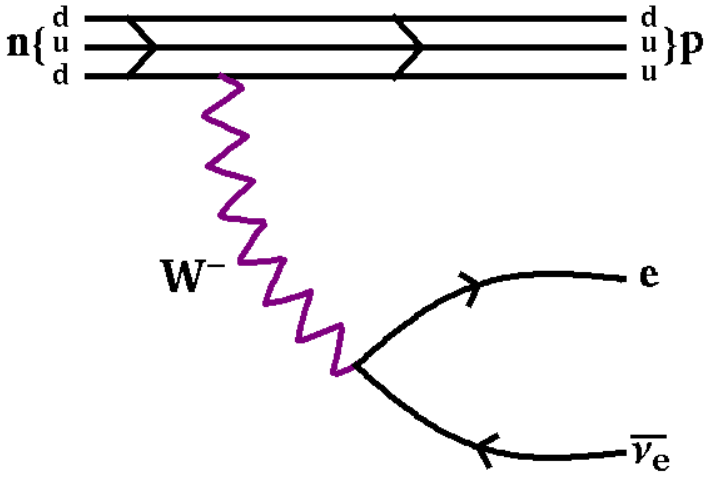
... not so evident (2nd order)…



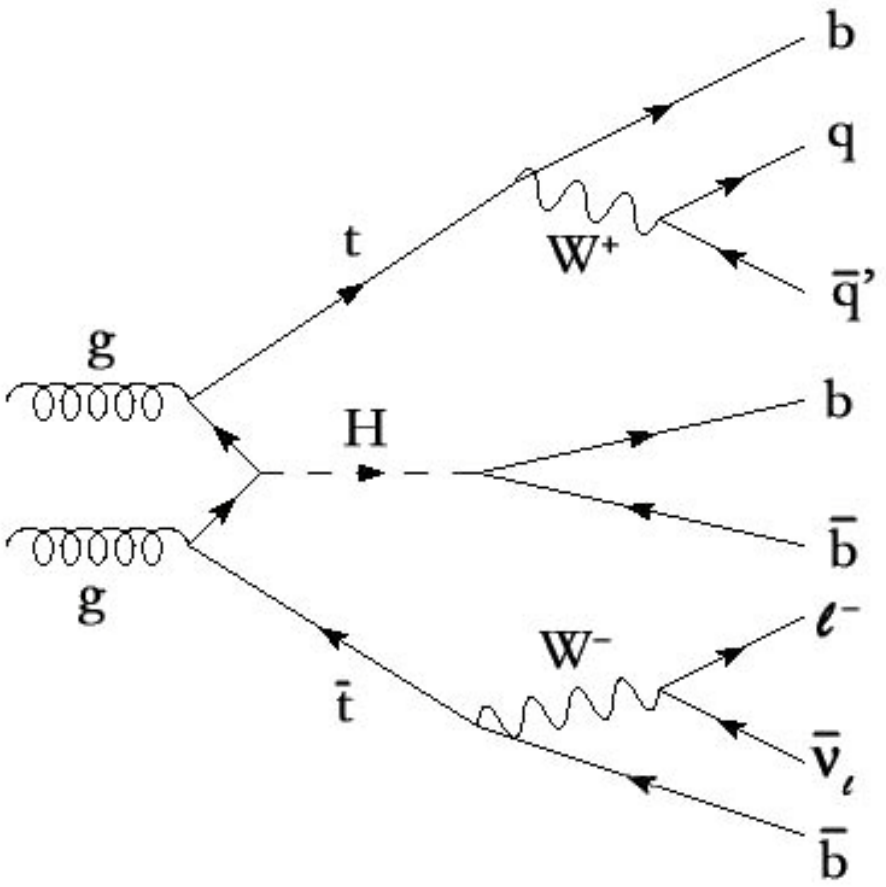


Some theoretical views (cont'd)

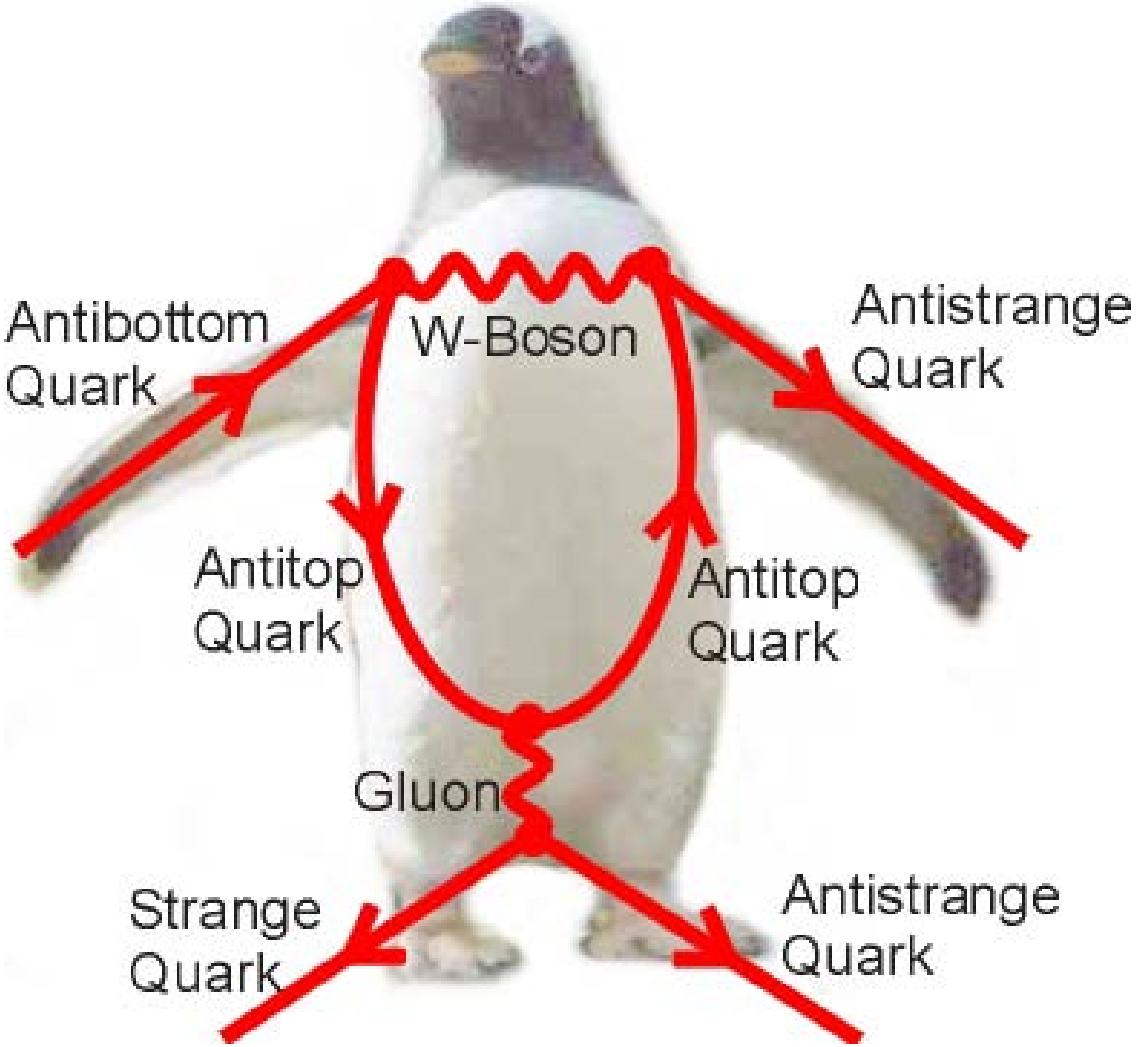
... not evident at all (weak interactions)…



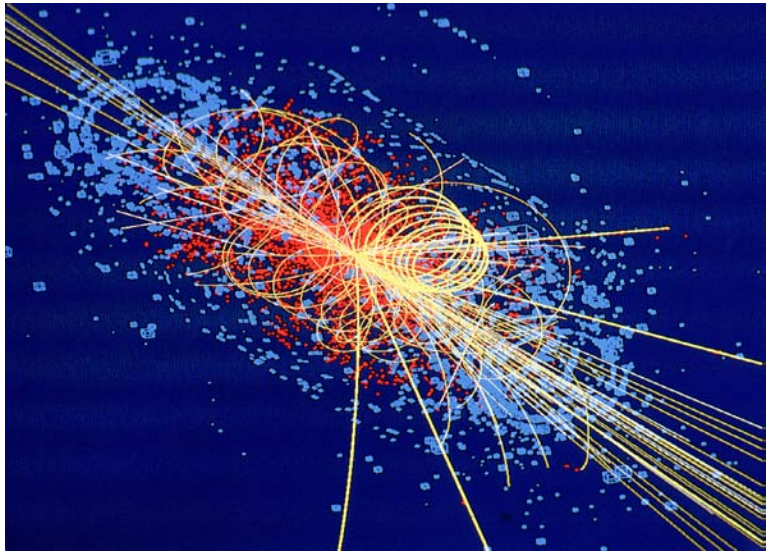
... frankly hostile (QCD inside)…



... and exotic…

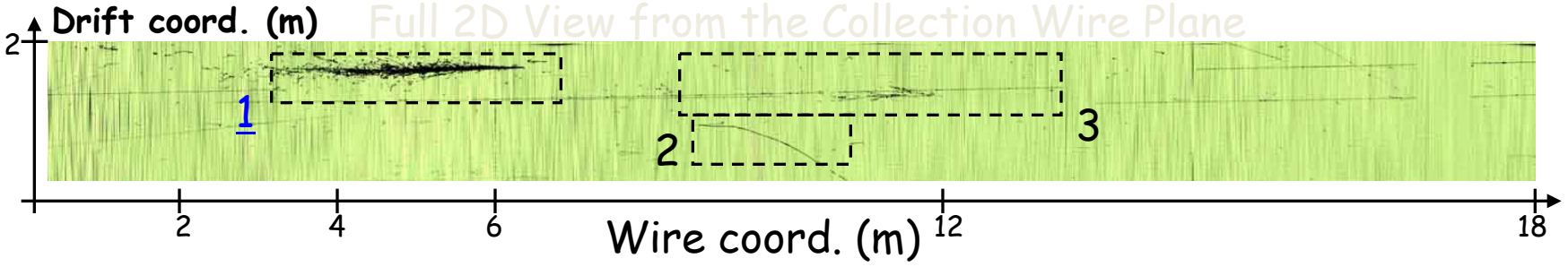

Antibottom Quark
W-Boson
Antistrange Quark
Antitop Quark
Antitop Quark
Gluon
Strange Quark
Antistrange Quark

II - Some experimental views



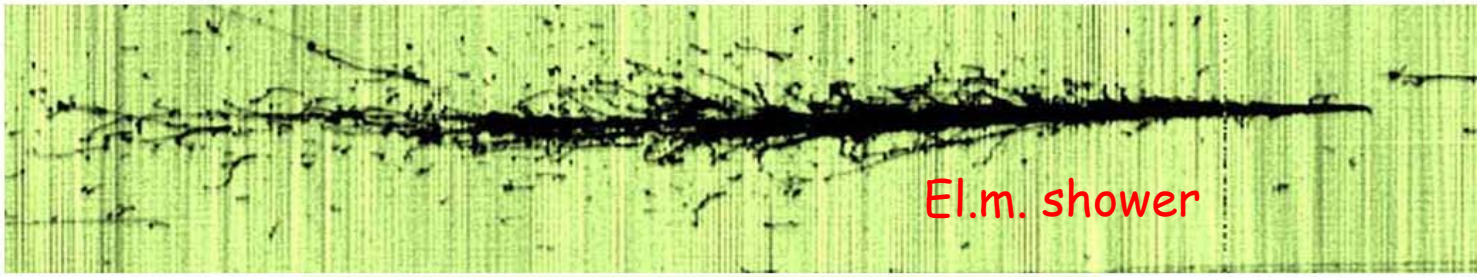
... simulated event

... real events…



Zoom details

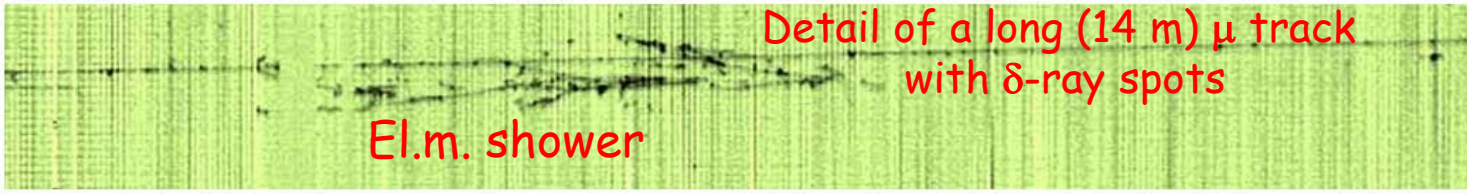
1



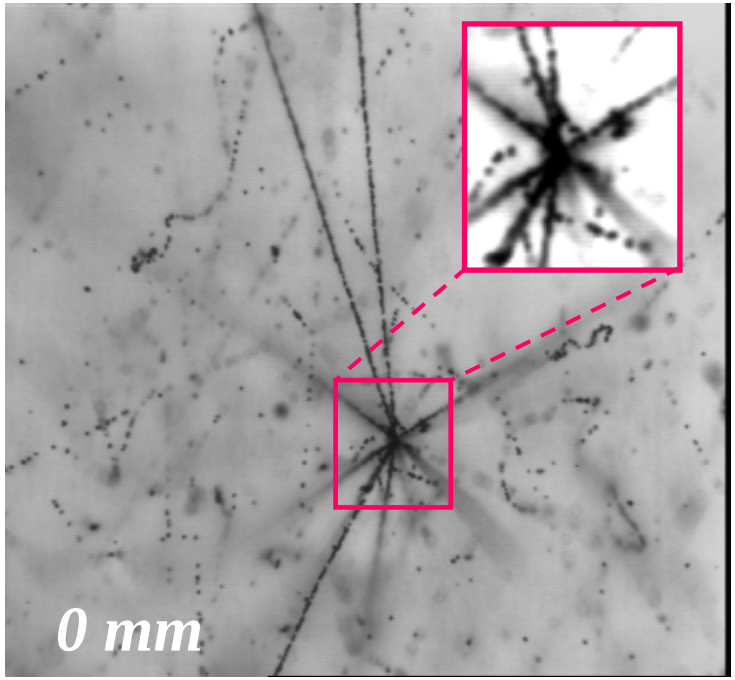
2

$\mu \rightarrow e + \nu_\mu + \nu_e$

3

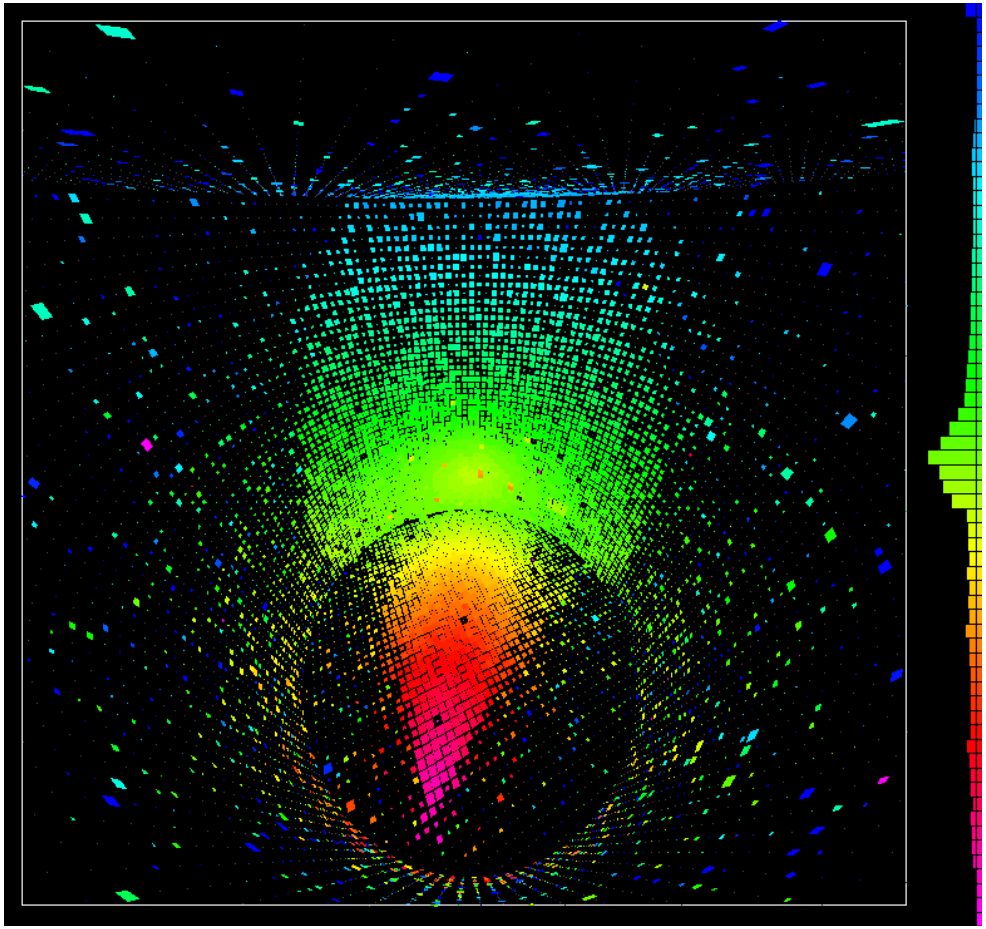


... real events but different techniques…

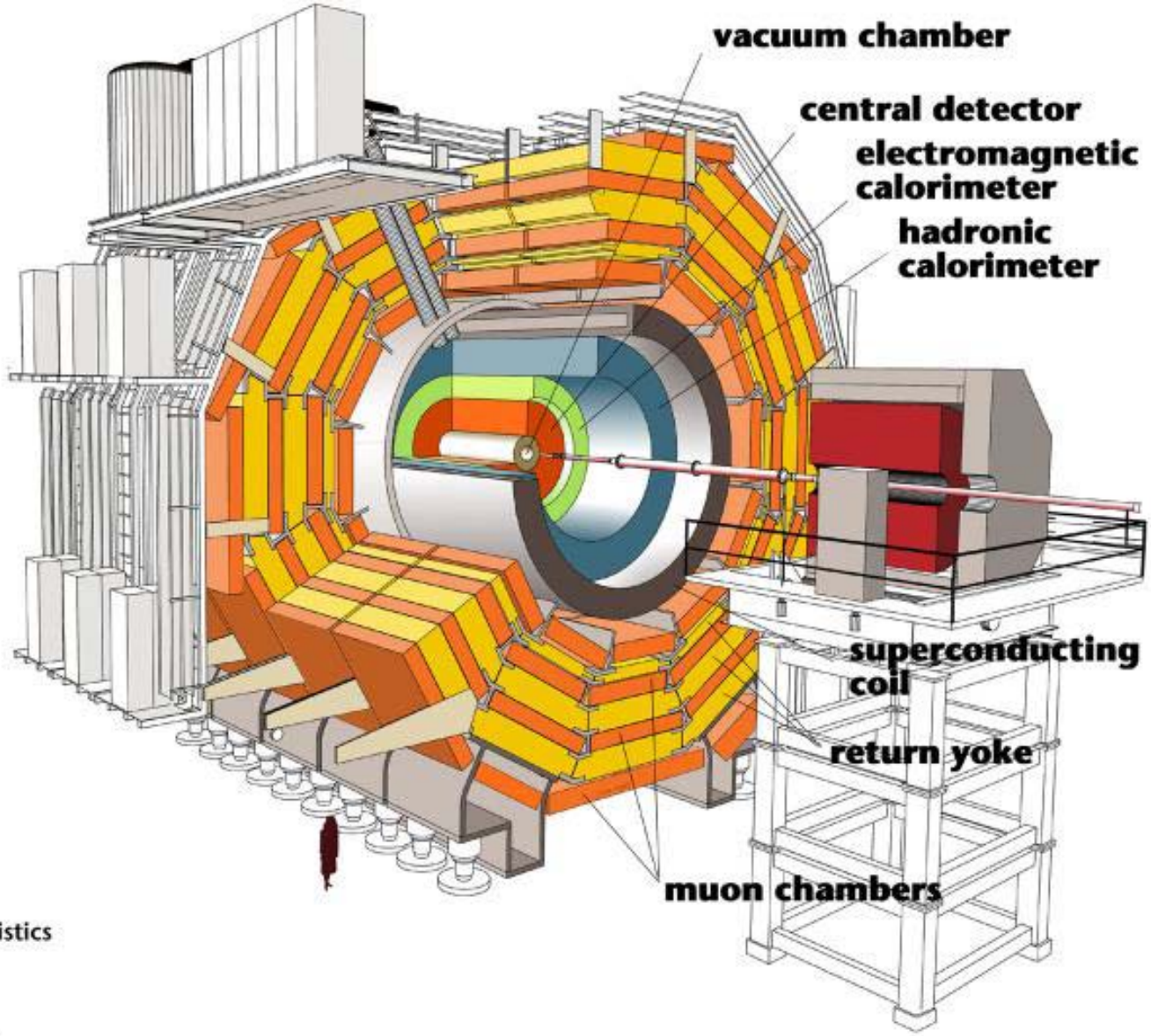


Vertex seen in
nuclear emulsions

Cerenkov light ring



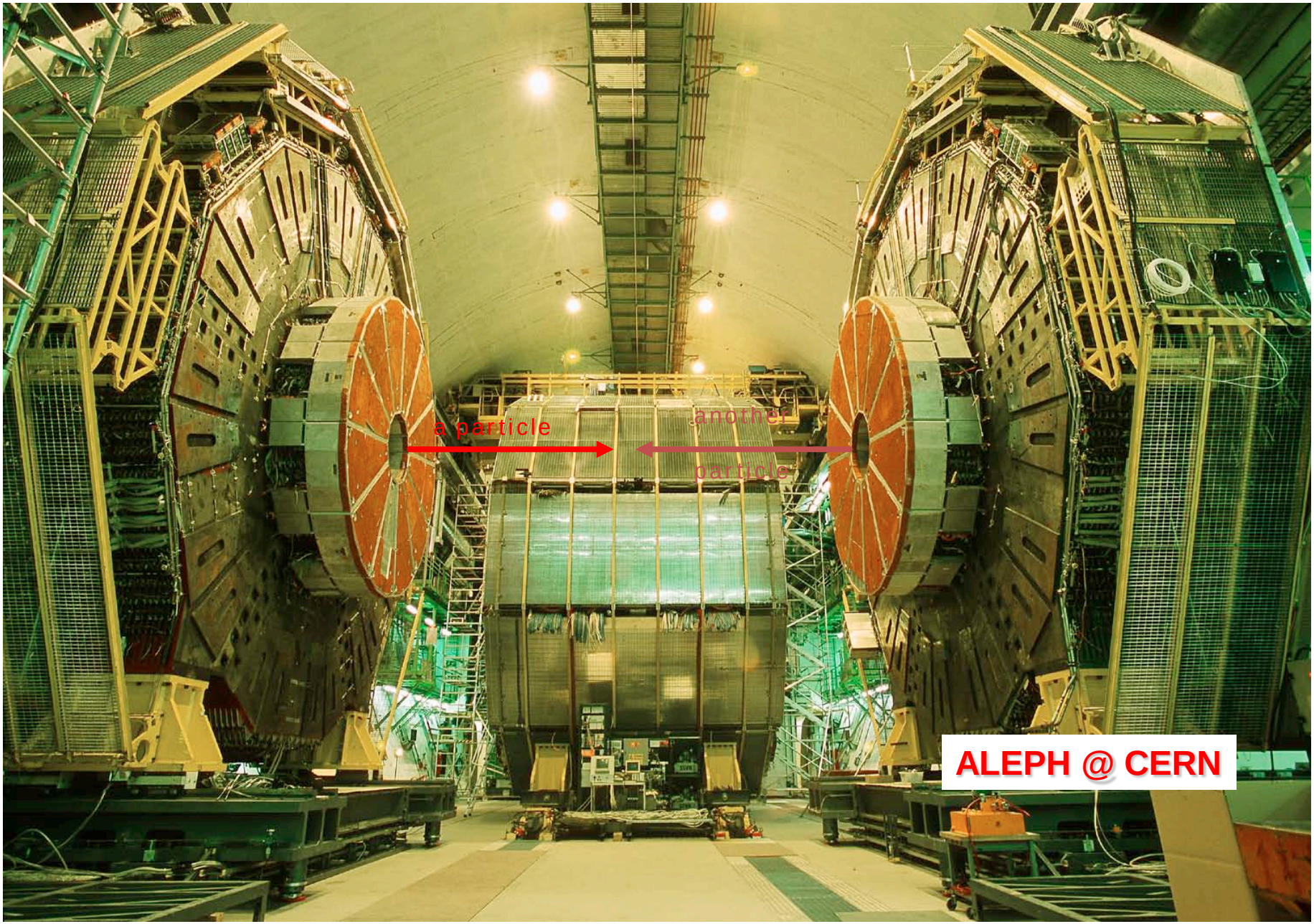
II bis - Some experimental challenges

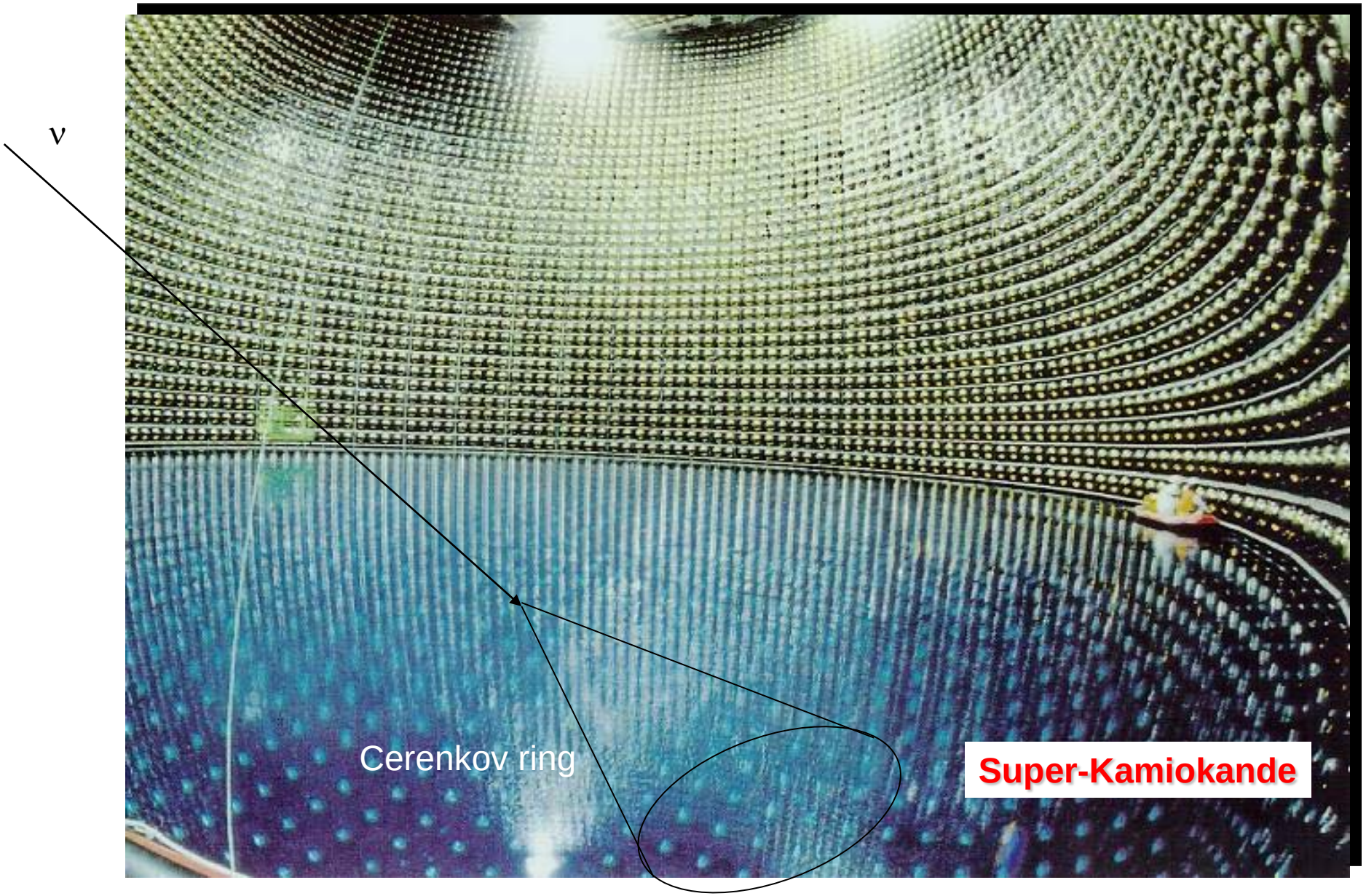


Detector characteristics

Width: 22m
Diameter: 15m
Weight: 14'500t

II bis - Some experimental challenges


a particle
another particle
ALEPH @ CERN


ν
Cerenkov ring
Super-Kamiokande

Outline/Plan

1/ Particle phenomenology :
quarks & leptons;
Strong, electro-weak interactions;
Some actual problems :
Higgs boson search,
matter-antimatter asymmetry,
grand unification theories…

2/ Experimental facts :
Particle-matter interactions;
Some detection techniques;
Particles production.

3/ The free theory :
Particles spin description;
Propagation equations, propagators;
Lagrangian description.

4/ Interacting theory :
Feynman diagrams;
Cross sections;
Basics of QED.

1/ Phénoménologie des particules et de leurs interactions :
quarks & leptons;
interactions électro-faible & forte;
quelques problèmes actuels :
recherche du boson de Higgs,
brisure matière-antimatière,
théories de grande unification…

2/ Aspects expérimentaux :
interaction particules-matière;
quelques techniques de détection;
production de particules: les grands accélérateurs.

3/ La théorie libre :
description spinorielle des particules;
équations de propagation, propagateurs;
formulation Lagrangienne de la théorie.

4/ La théorie en interaction :
diagrammes de Feynman;
sections efficaces;
Les bases de QED.