

LHCb @ UB

ANIOL LOBO SALVIA

CROSS-COLLSEOLA PHD MEETING IN ASTRO-COSMO-HEP 2023

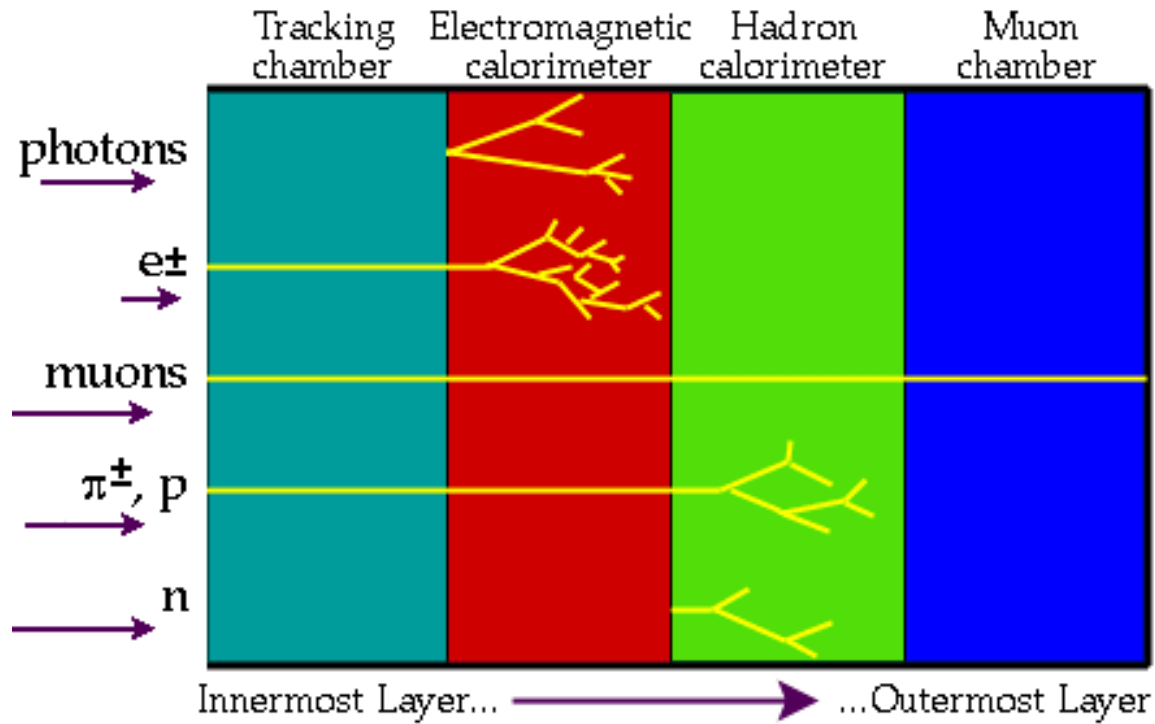
UNIVERSITY OF BARCELONA, OCTOBER 6TH, 2023

The group

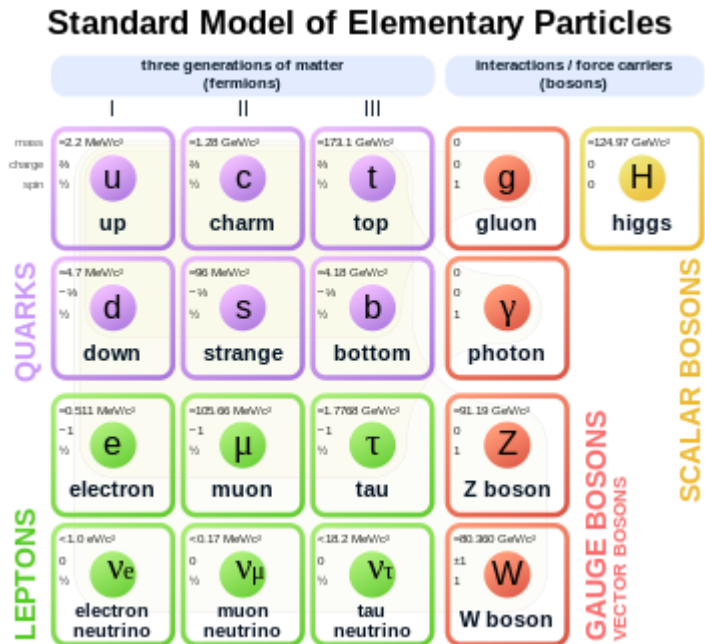


Introduction

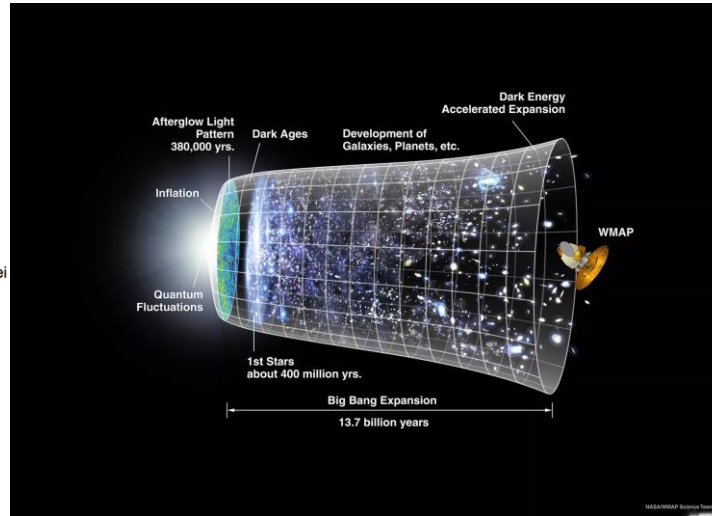
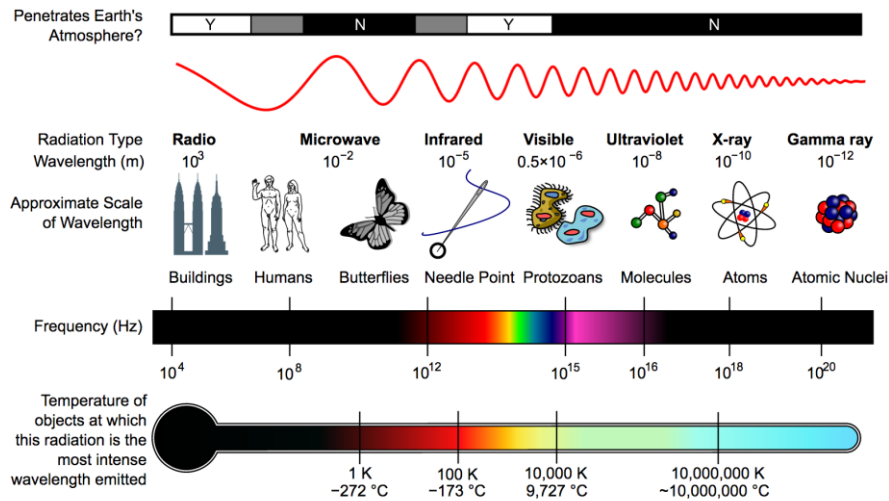
- **Detector**



- **Theory**



Introduction – please bear with me



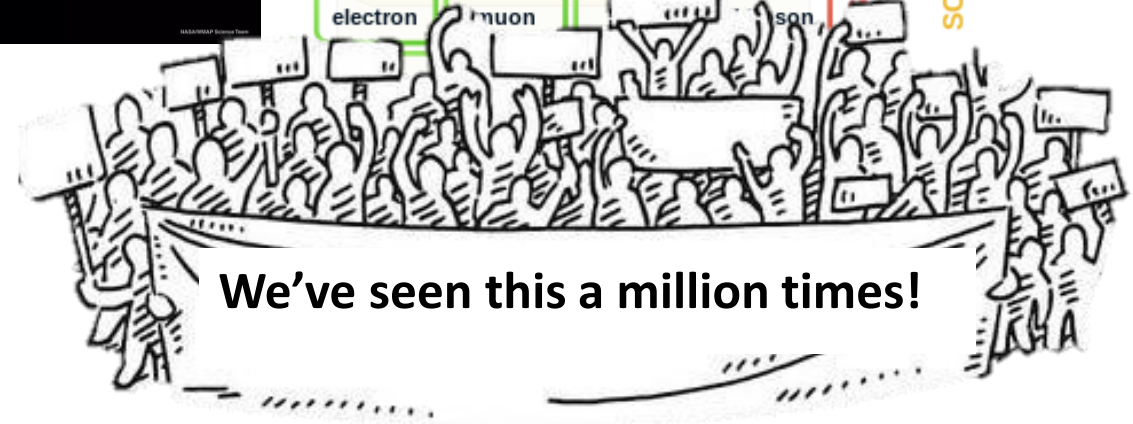
Standard Model of Elementary Particles

three generations of matter (fermions)			interactions / force carriers (bosons)	
I	II	III		
mass charge spin	mass charge spin	mass charge spin	mass charge spin	mass charge spin
≈ 2.2 MeV/c ² $\frac{2}{3}$ $\frac{1}{2}$ u up	≈ 1.28 GeV/c ² $\frac{2}{3}$ $\frac{1}{2}$ c charm	≈ 173.1 GeV/c ² $\frac{2}{3}$ $\frac{1}{2}$ t top	0 0 1 g gluon	≈ 124.97 GeV/c ² 0 0 0 H higgs
≈ 4.7 MeV/c ² $-\frac{1}{3}$ $\frac{1}{2}$ d down	≈ 96 MeV/c ² $-\frac{1}{3}$ $\frac{1}{2}$ s strange	≈ 4.18 GeV/c ² $-\frac{1}{3}$ $\frac{1}{2}$ b bottom	0 0 1 γ photon	
≈ 0.511 MeV/c ² -1 $\frac{1}{2}$ e electron	≈ 105.66 MeV/c ² -1 $\frac{1}{2}$ μ muon	≈ 1.7768 GeV/c ² -1 $\frac{1}{2}$ τ tau	0 0 0 Z Z boson	

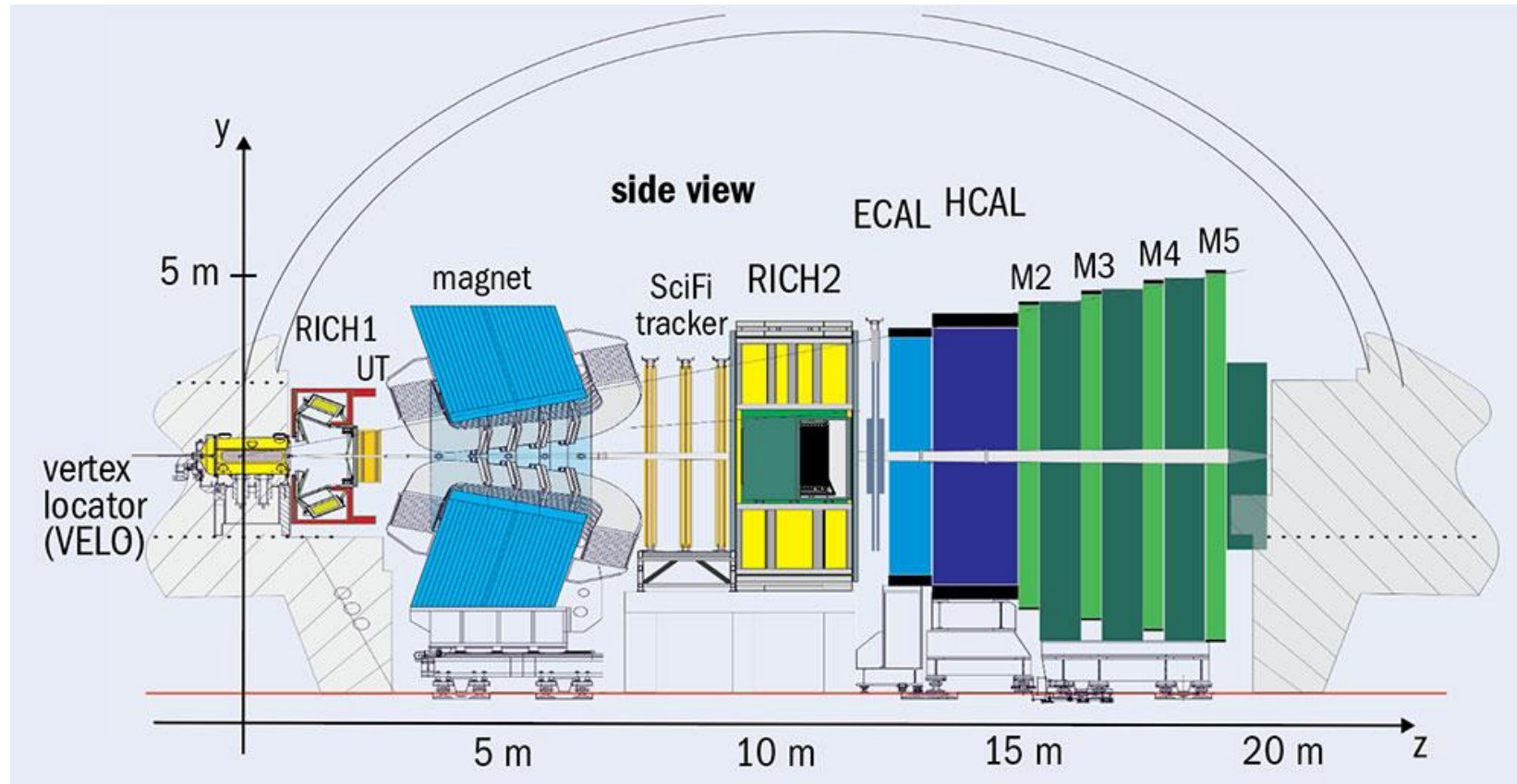
QUARKS

SCALAR BOSONS

BOSONS



The Detector



The Detector



The ingredients: particles

- **Unstable**

B, D, K^*, \dots

- **Stable (ish)**

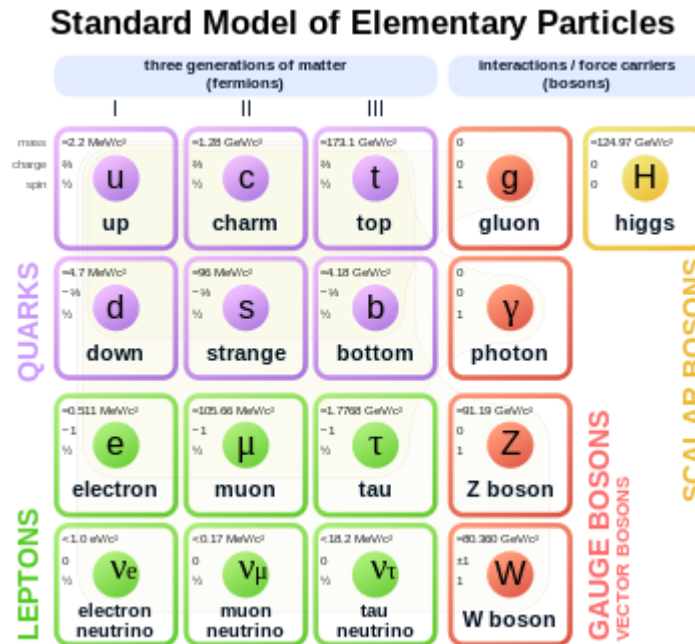
$\pi, K, p, \mu, e \dots$

- **Neutrals**

γ, π^0

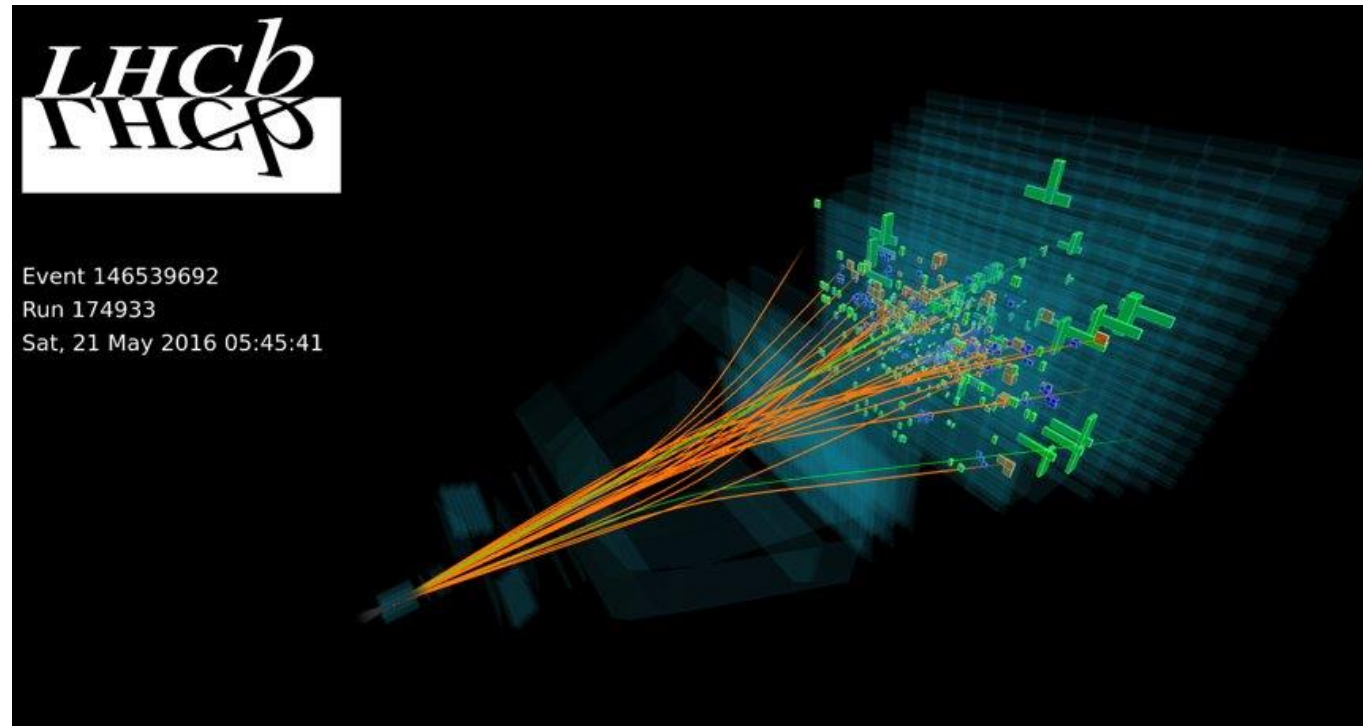
- **Invisible**

ν

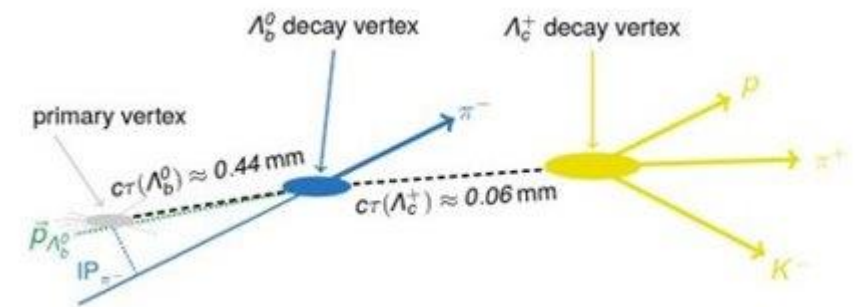
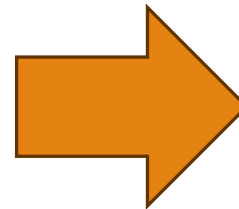
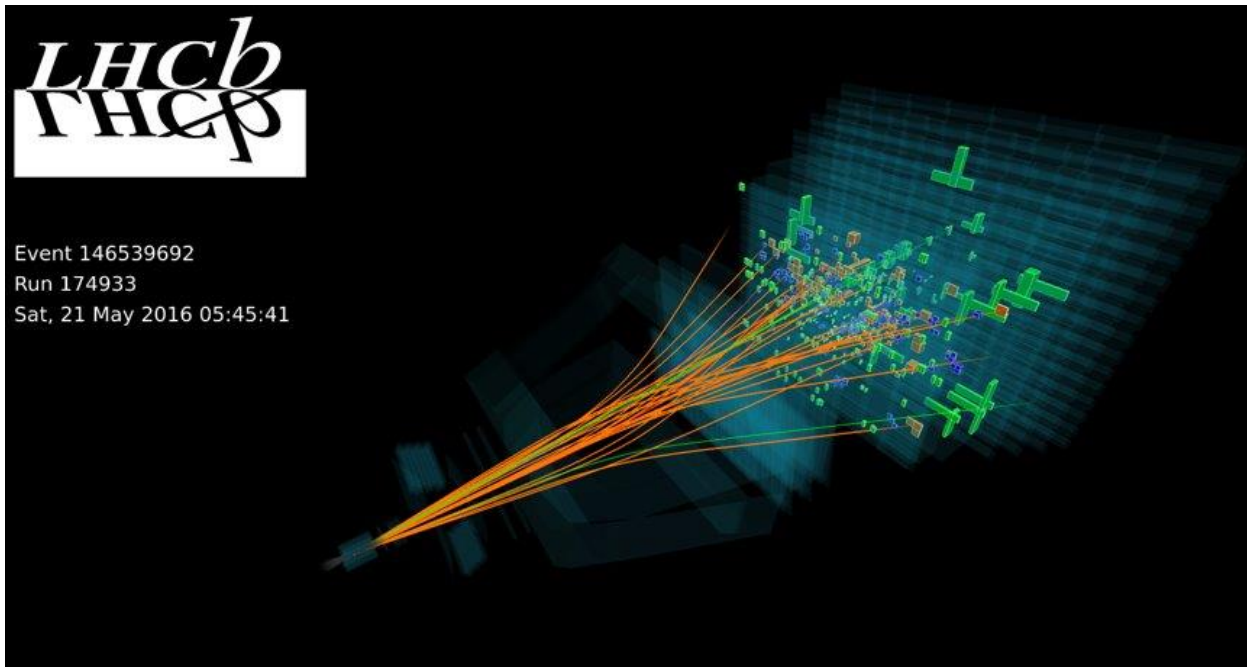


The ingredients: particles

- **Unstable**
 B, D, K^*, τ, \dots
- **Stable (ish)**
 π, K, p, \dots
- **Neutrals**
 γ, π^0
- **Invisible**
 ν

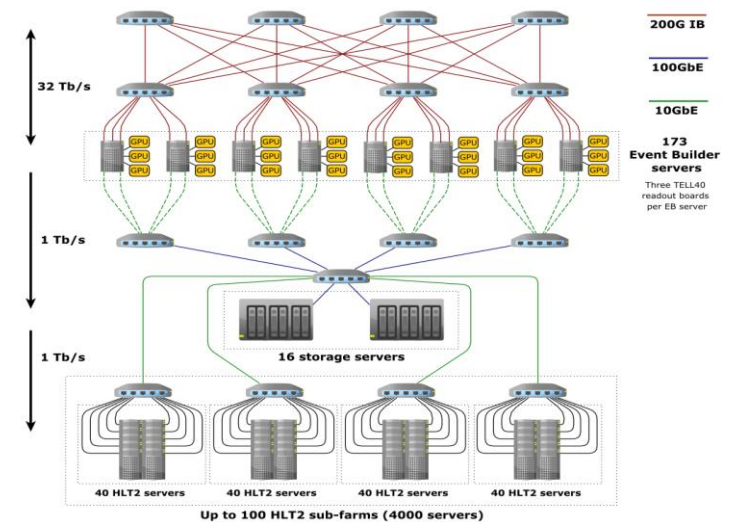
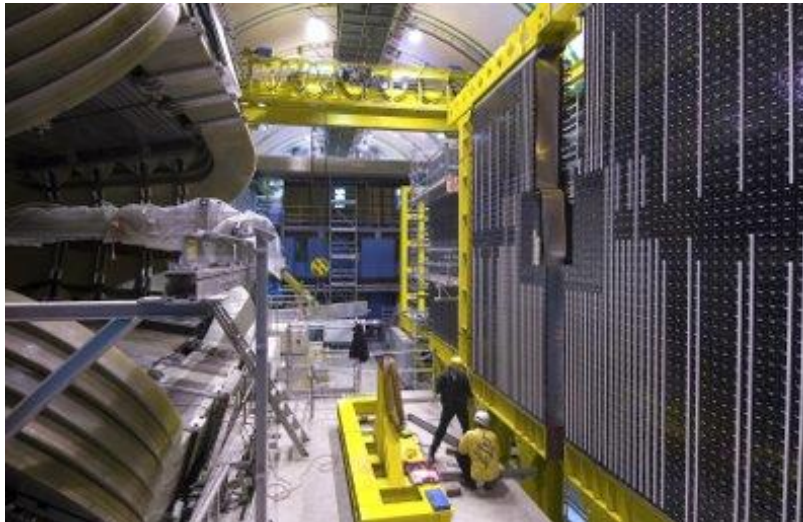


Event reconstruction

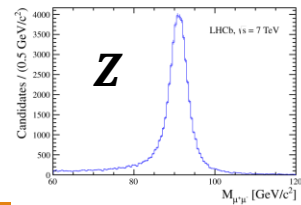
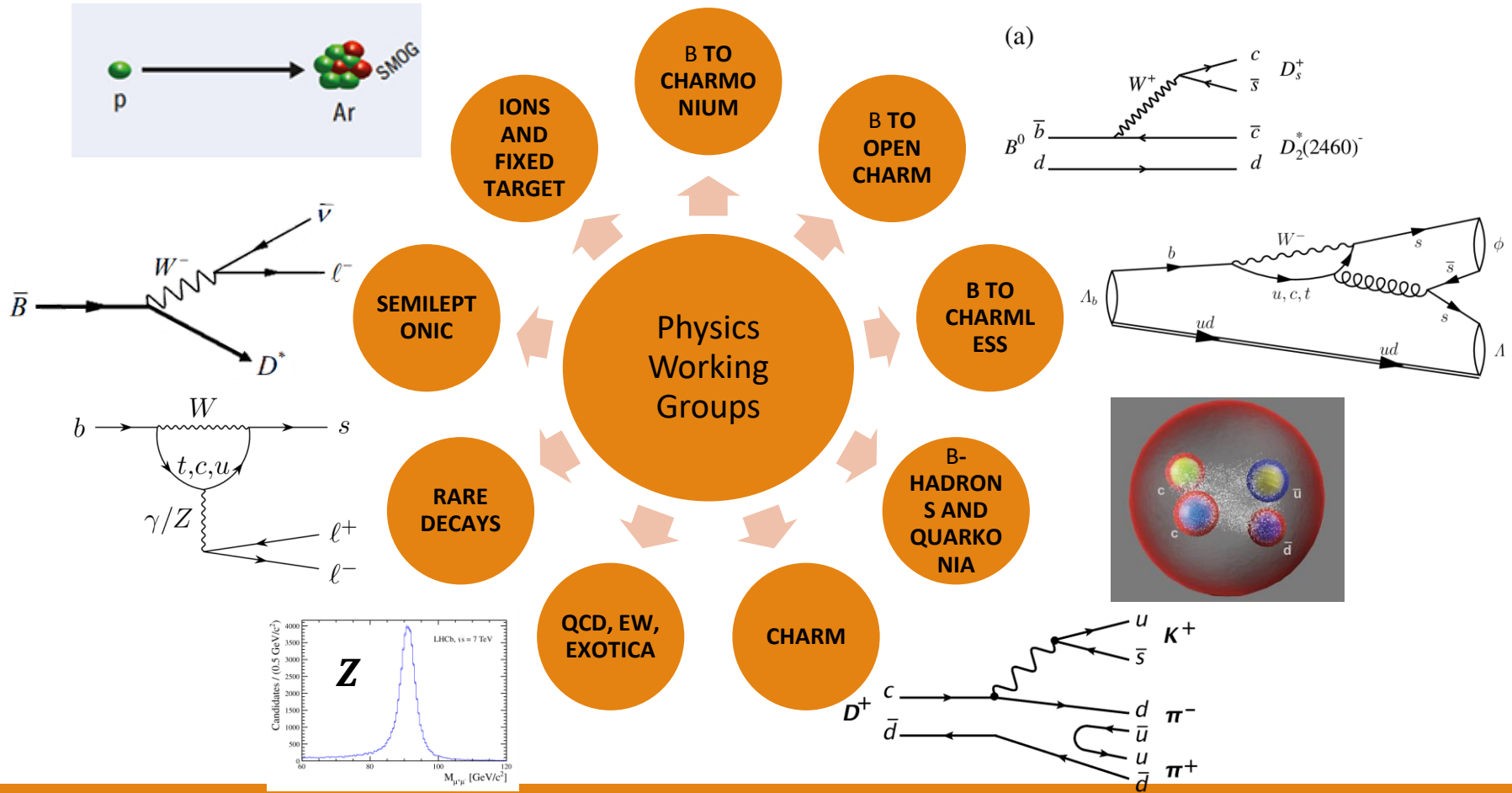
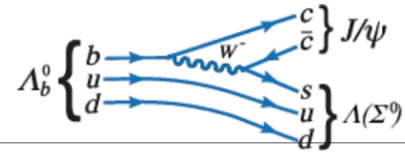




Online operations (RTA), Calorimeter, Trigger



The Physics



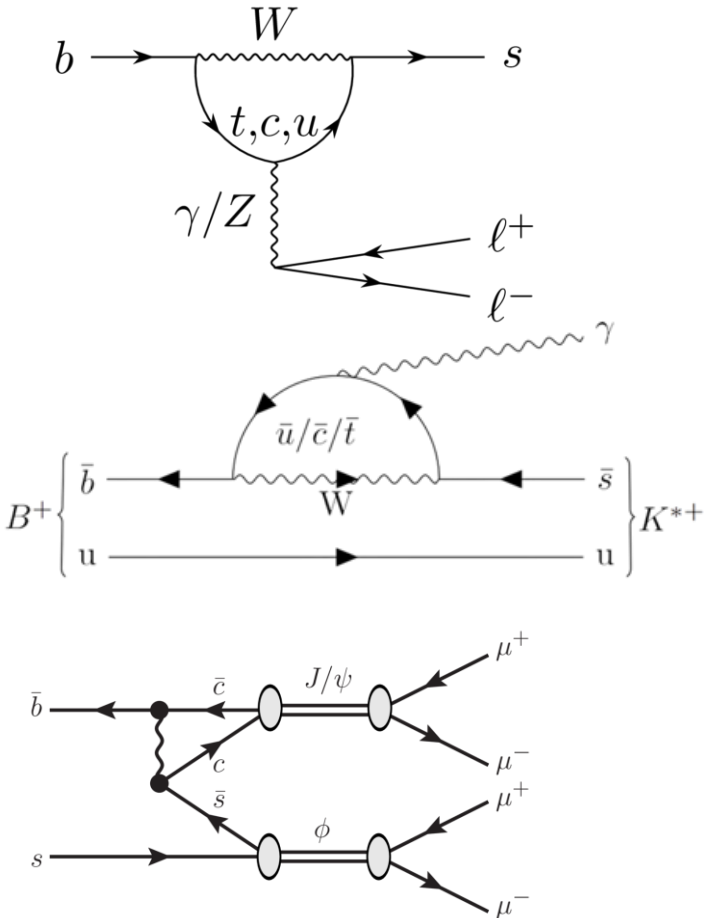
Rare Decays

Rare Decays

EW penguins

Radiative

Very Rare



Aims

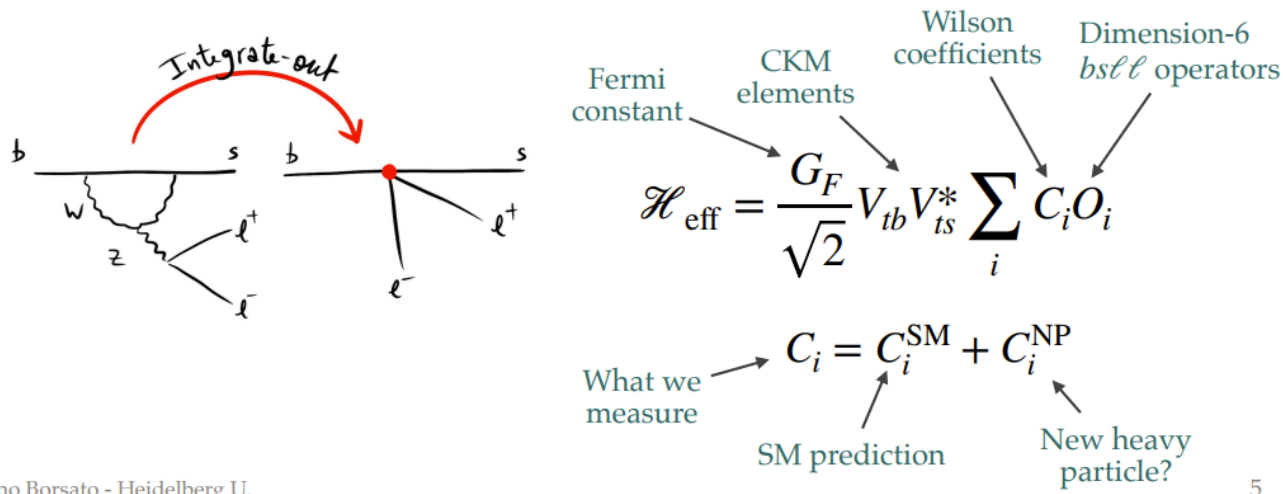
- Tests of the Standard Model
- (Indirect) Searches for New Physics

Via

- Lepton Flavour Universality
- Flavour Changing Neutral Decays
- ...

Talking to theory

- $m_B \ll m_W \rightarrow$ Integrate out electroweak scale and above
 - Includes Higgs, W, Z, top quark or any heavier NP particle
 - Basically the good old Fermi theory of weak interaction
 - Describe $b \rightarrow s \ell^+ \ell^-$ process with dimension-6 operators
 - NP enters in effective couplings (Wilson coefficients)



Martino Borsato - Heidelberg U.

M. Borsato @ [Particle Physics Seminars at BNL 21](#)



Laura Gerwin

Summary

- The LHCb Experiment covers a wide range of physics
- In UB we work in physics analysis in semileptonic and rare decays:
 - LFU in EW penguins, semileptonic
 - CP, Δ_{iso} in radiative decays
- Also engaged in Real Time Analysis and detector
- There's always more to come!