

Outline

■ Relativistic Kinematics

- ▶ **(4-momentum)² invariance, invariant mass**
- ▶ Hypothesis testing, production thresholds
- ▶ Cross sections, flux and luminosity
- ▶ Particle lifetime, decay length, width

■ Classification of particles

- ▶ Fermions and bosons
- ▶ Leptons, hadrons, quarks
- ▶ Mesons, baryons

■ Quark Model

- ▶ Meson and baryon multiplets
- ▶ Isospin, strangeness, c, b, t quarks

■ Particle Interactions

- ▶ Virtual particles and range of forces
- ▶ Strong and weak decays, conservation rules
- ▶ Parity, charge conjugation, CP
- ▶ Weak decays of quarks
- ▶ Colour charge, QCD, gluons
- ▶ Charmonium and upsilon systems

■ Electroweak Interactions

- ▶ Charged and neutral currents
- ▶ W, Z, LEP experiments
- ▶ Higgs and the future

■ LHC Experiments

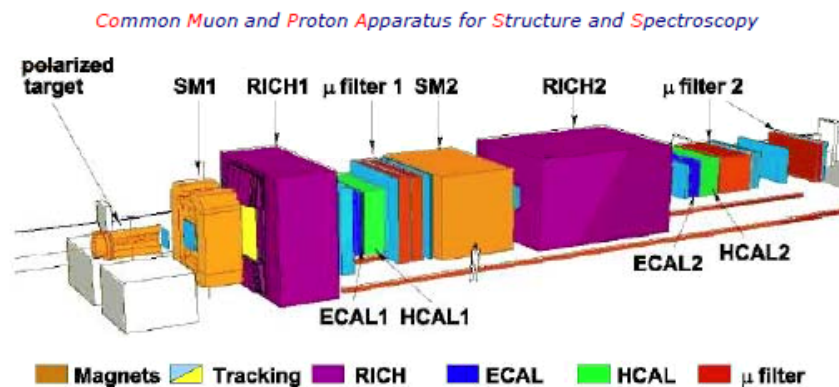
■ Future - introduction to accelerator physics

Today

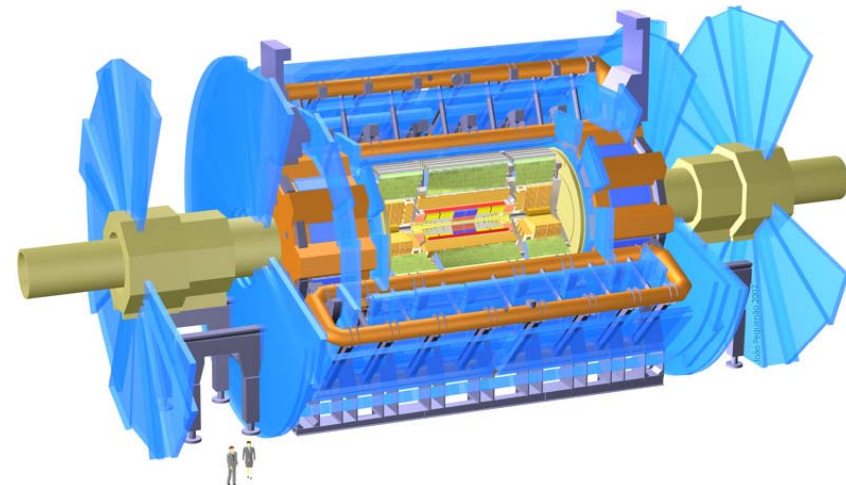
- Lecture 2 (4 slides/page) - Relativistic kinematics and four momenta
 - Griffiths, pages 89-103
 - Williams, page 159
 - Handout on kinematics and units
 - Units: see also Perkins (3rd edition), pg.25.

Fixed target vs. collider

COMPASS experiment

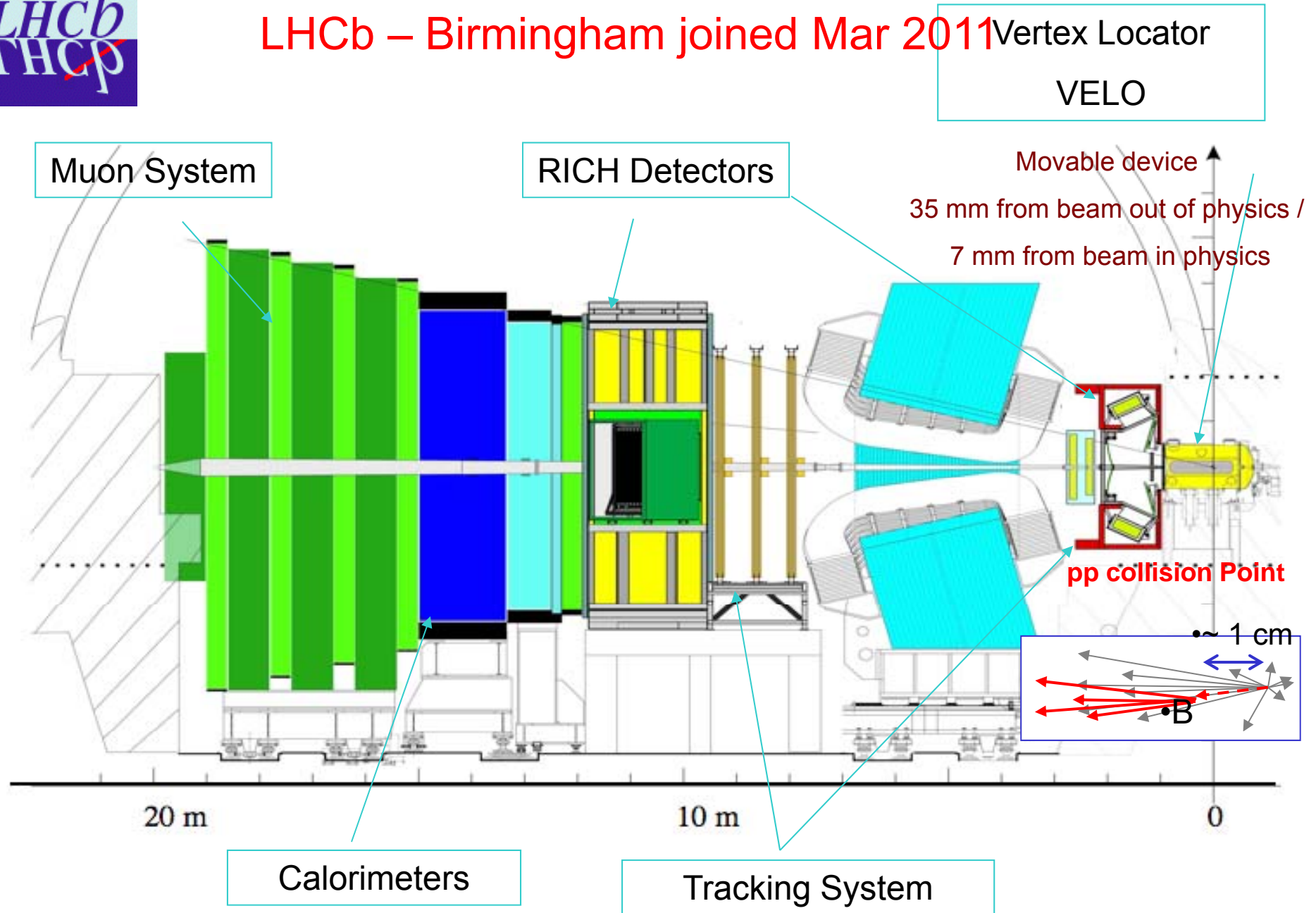


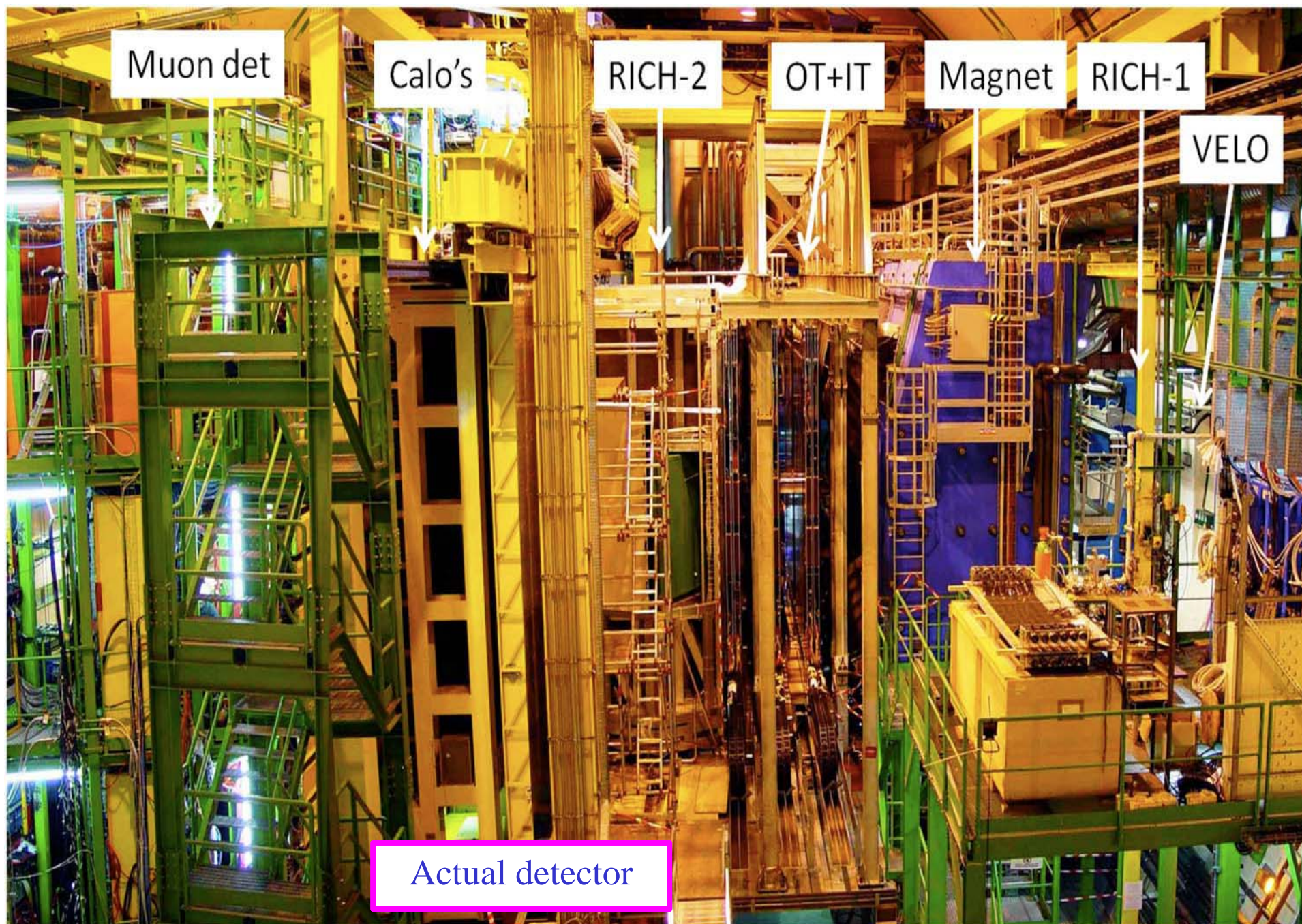
ATLAS experiment

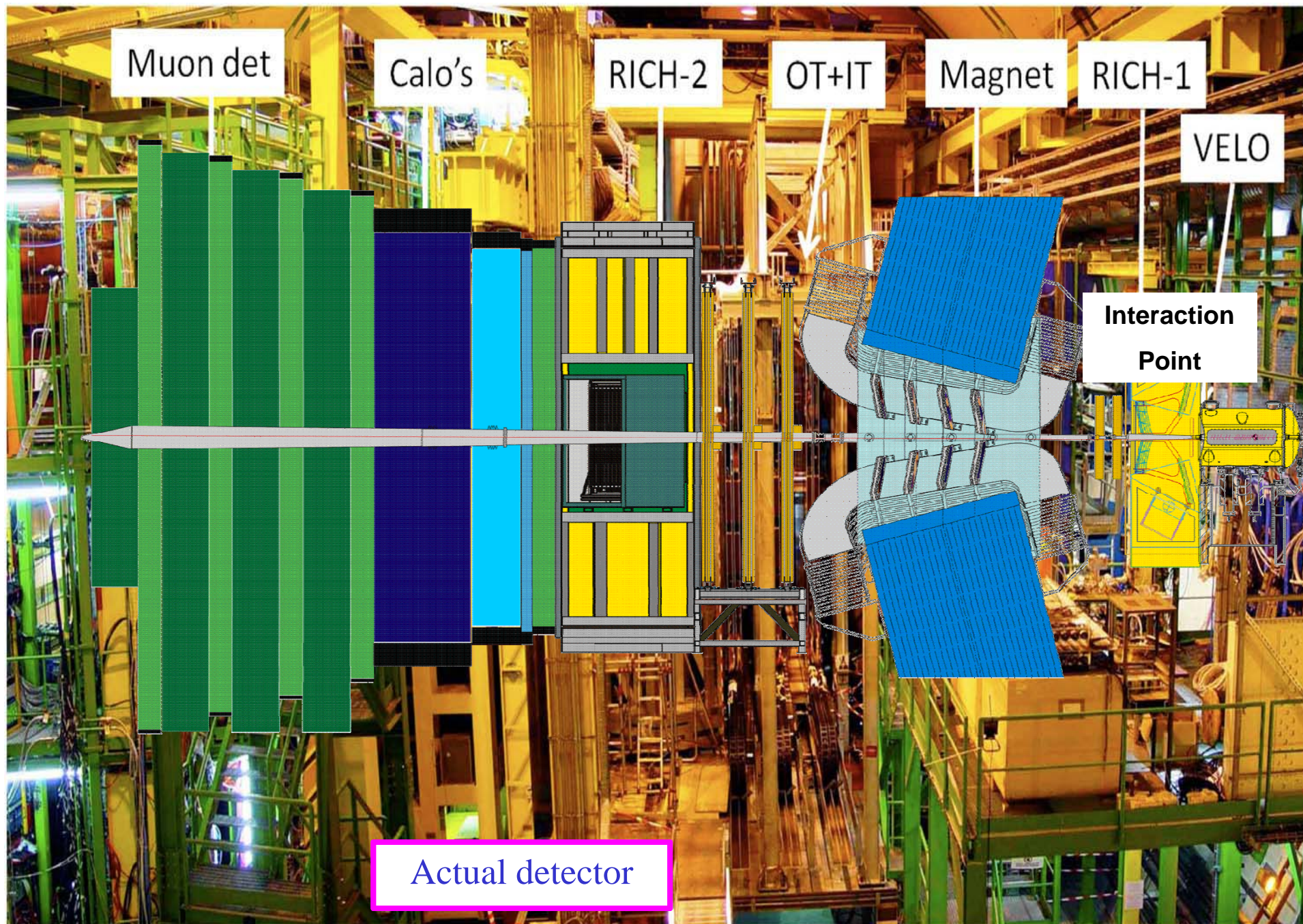




LHCb – Birmingham joined Mar 2011







730 members
15 countries
54 institutes

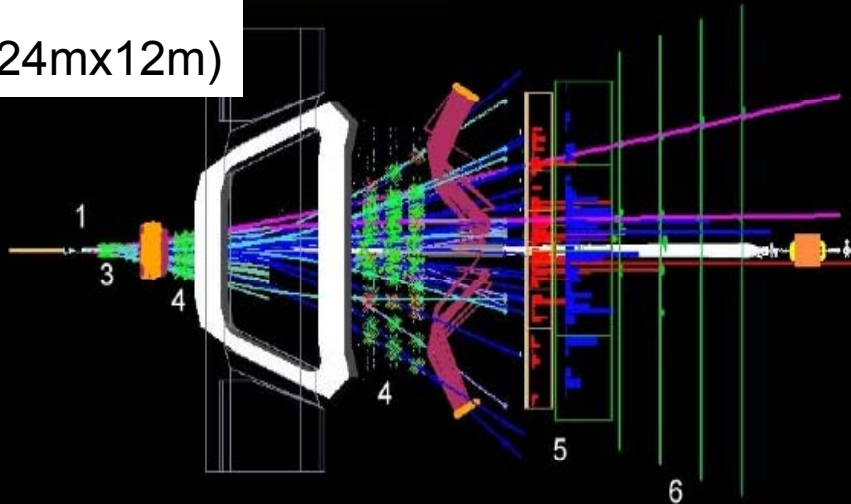


Member countries of the LHCb Collaboration

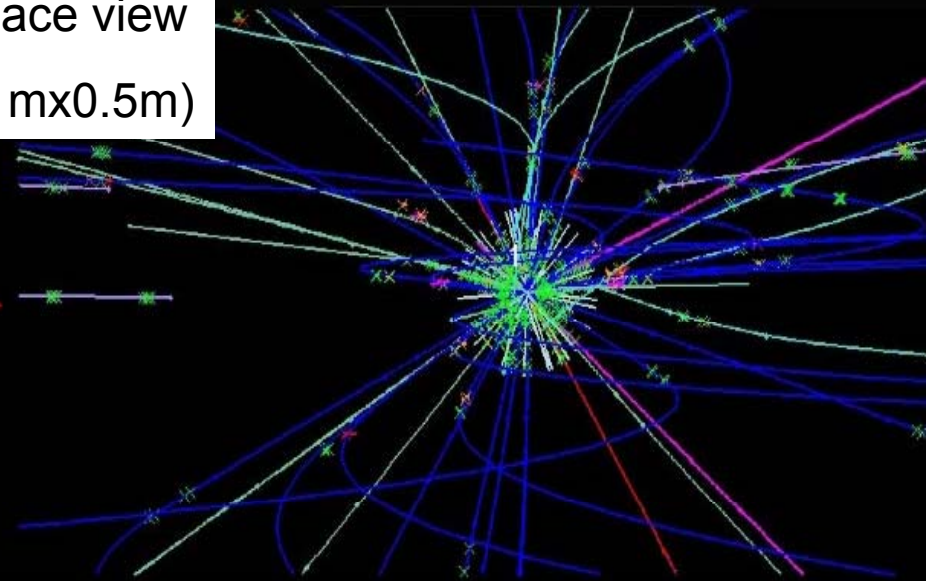


Decoding LHCb event display: $B^+ \rightarrow J/\psi K^+$

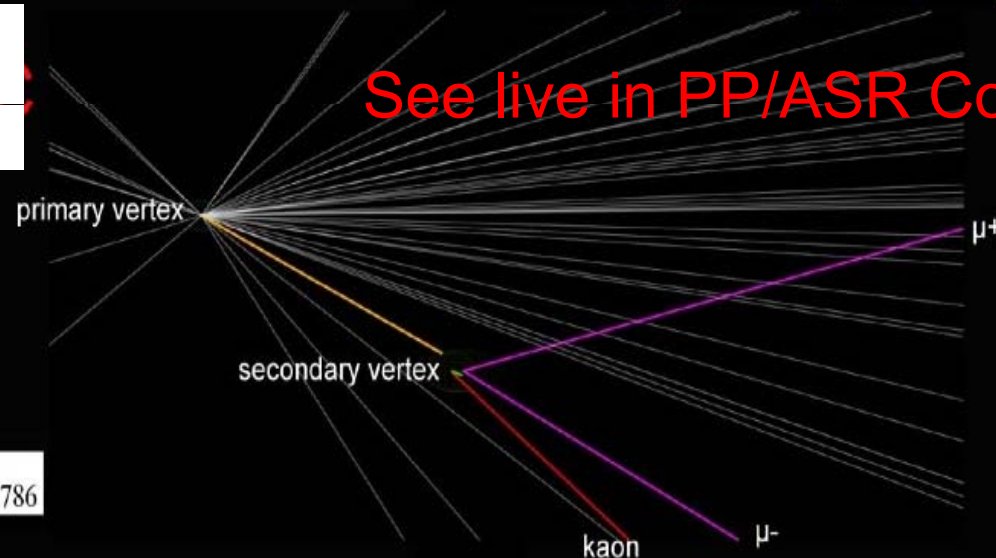
Top view
(24mx12m)



Face view
(1mx0.5m)



Collision region
(0.7mmx10mm)

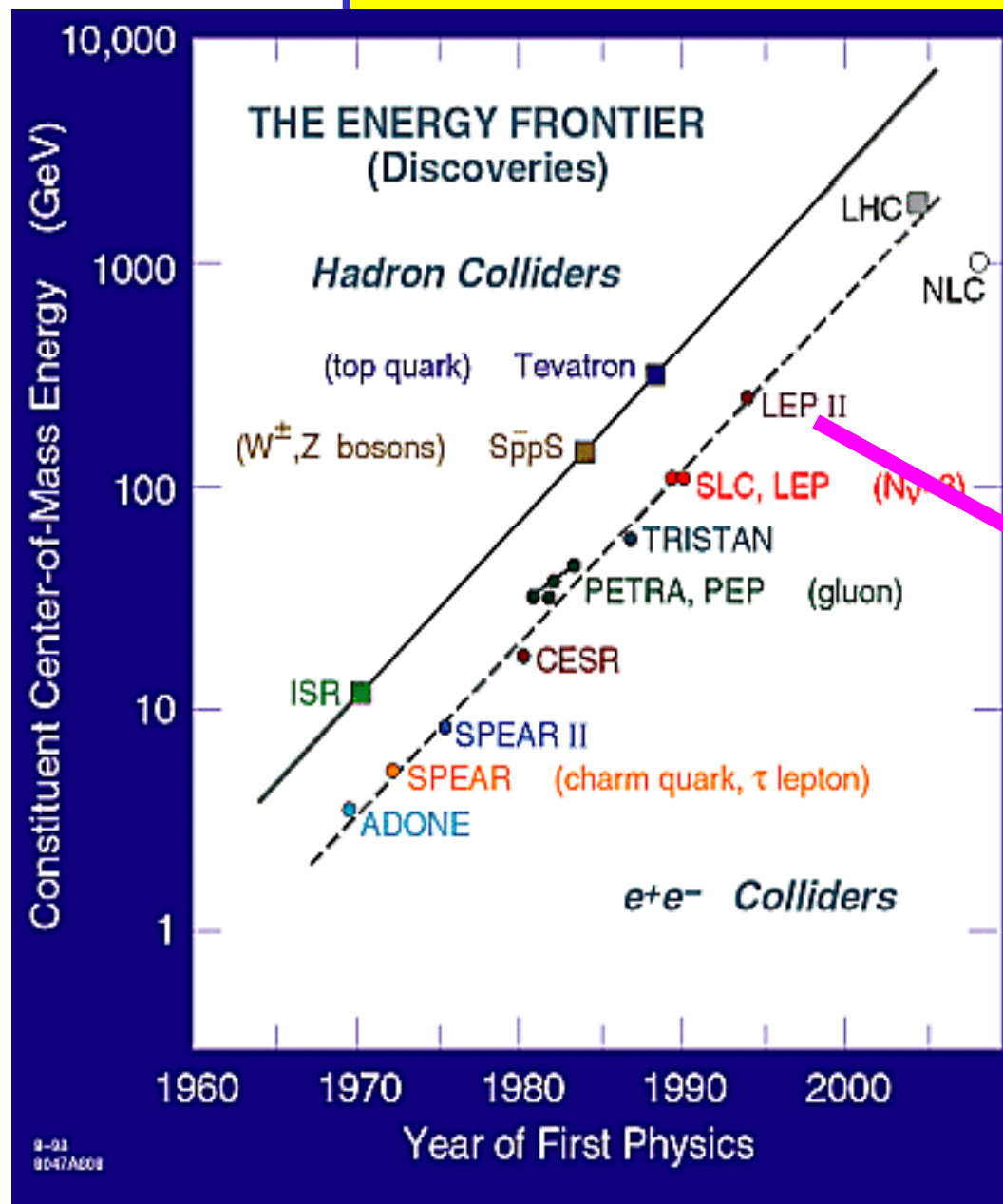


See live in PP/ASR Coffee Area



5.4.2010 1:30:09
Run 69618 Event 12484 bId 1786

"Energy Frontier" Accelerators



LEP II at CERN
 $E_{cm} \sim 209 \text{ GeV}$
 $P_{RF} \sim 30 \text{ MW}$

[c/o/ N.Walker]