Introduction to Summer Projects at CERN

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Group and Mentor
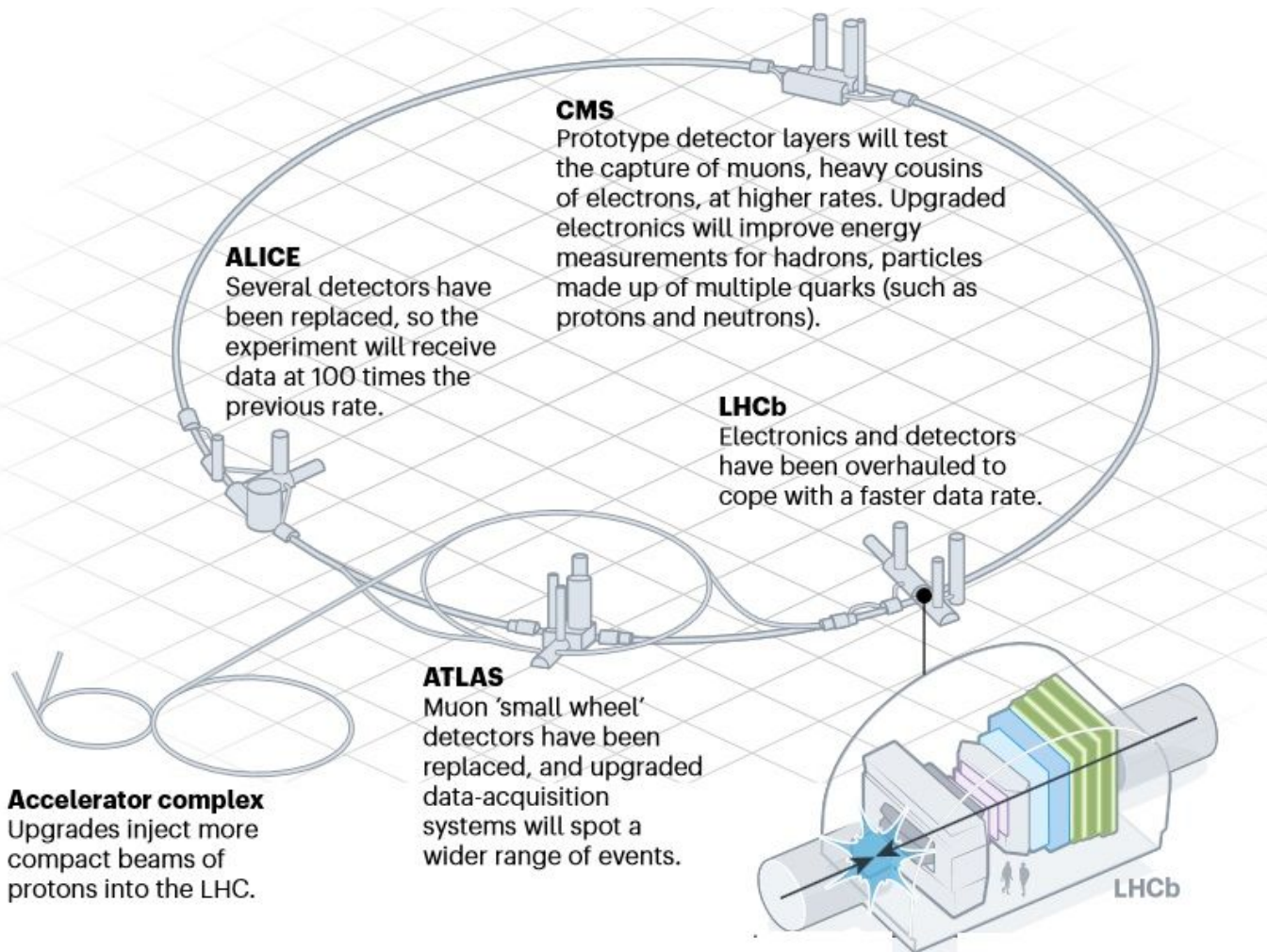
→ **Professor Christine Aidala:**

→ **Dr. Ezra Lesser:**

Large Hadron Collider beauty (LHCb)

➔ **LHCb detector**

◆ Detect mainly forward particles

◆ Lower luminosity-> Reduced background

◆ Faster Data Rate

◆ Retractable VELO detector

CMS
Prototype detector layers will test the capture of muons, heavy cousins of electrons, at higher rates. Upgraded electronics will improve energy measurements for hadrons, particles made up of multiple quarks (such as protons and neutrons).

ALICE
Several detectors have been replaced, so the experiment will receive data at 100 times the previous rate.

LHCb
Electronics and detectors have been overhauled to cope with a faster data rate.

ATLAS
Muon 'small wheel' detectors have been replaced, and upgraded data-acquisition systems will spot a wider range of events.

Accelerator complex
Upgrades inject more compact beams of protons into the LHC.
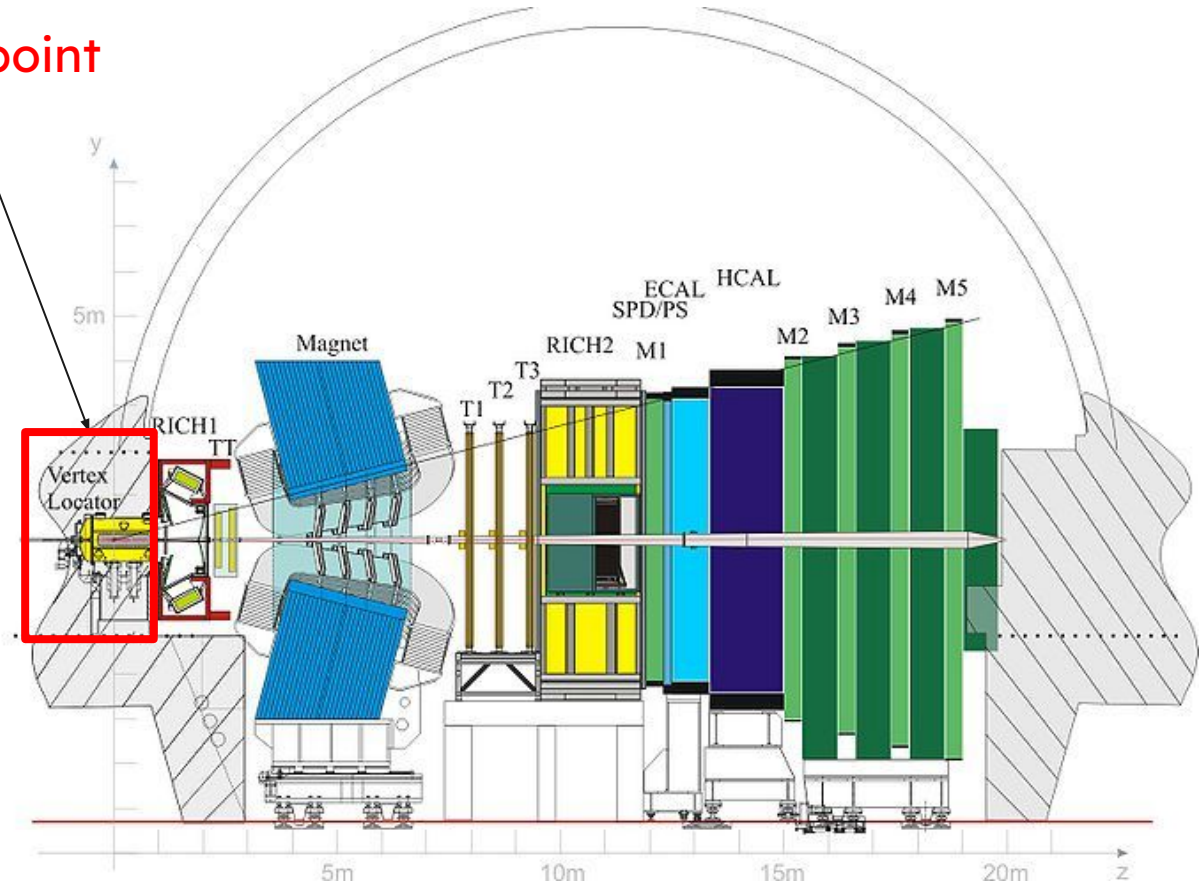
LHCb

Large Hadron Collider beauty (LHCb)

➜ **Goal of the LHCb**

◆ Measure parameters of the CP violation in the interactions of b hadrons

◆ Insight to matter-antimatter Asymmetry

◆ Insight to strong interaction and production

interaction point

Jet Background

→ **What are jets/Why study jets**

◆ Narrow cones of hadrons and other particles created by hadronization of quarks and gluons under high-p collision

◆ Hadronization: quarks and gluons turn into hadrons

◆ Probes of strong interaction(or Quantum Chromodynamics)

● We know little about strong interactions(hadronization, non-perturbative)

strong interaction binds quarks in nucleons

Stolen from Ezra's presentation
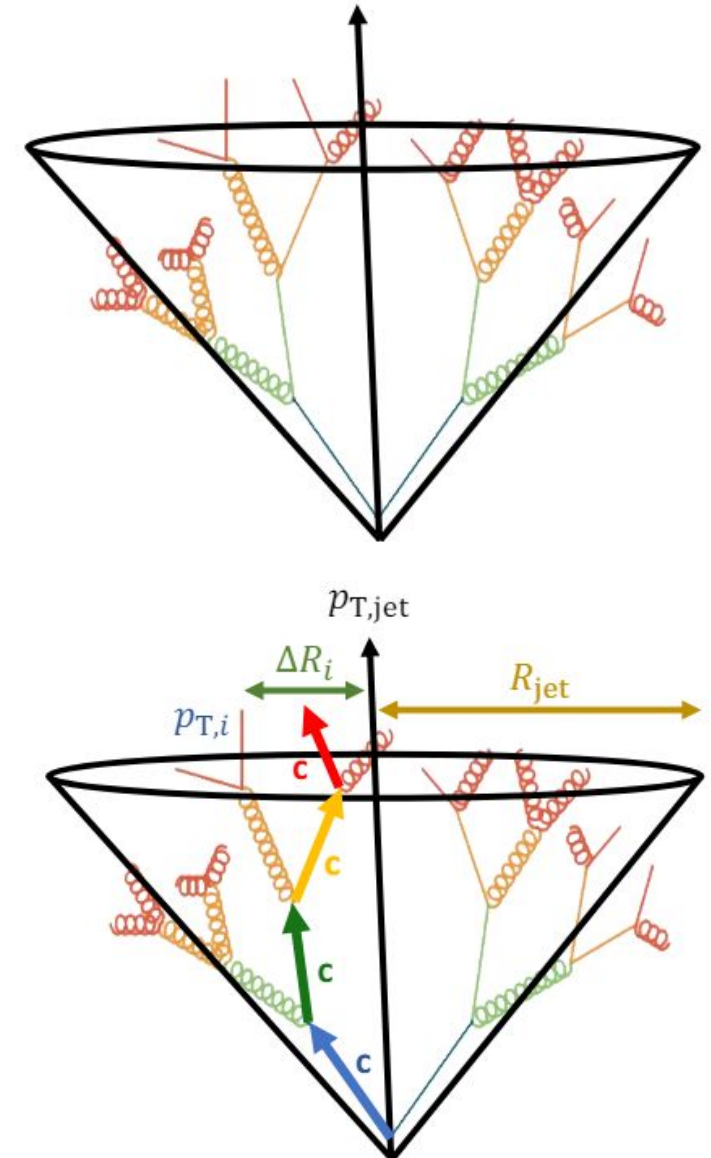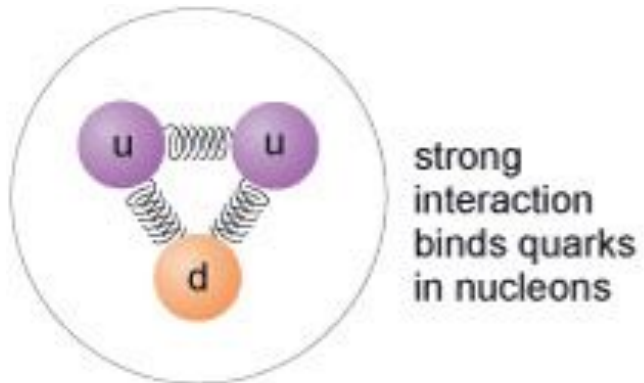
Jet Reconstruction

➔ **Anti k_t algorithm**

◆ resistant to soft radiation(particles with low p)

◆ gives circular boundary

◆ IRC(Infrared-Collinear) safe

  ● Yield result friendly to the theorists

➔ **Algorithm**
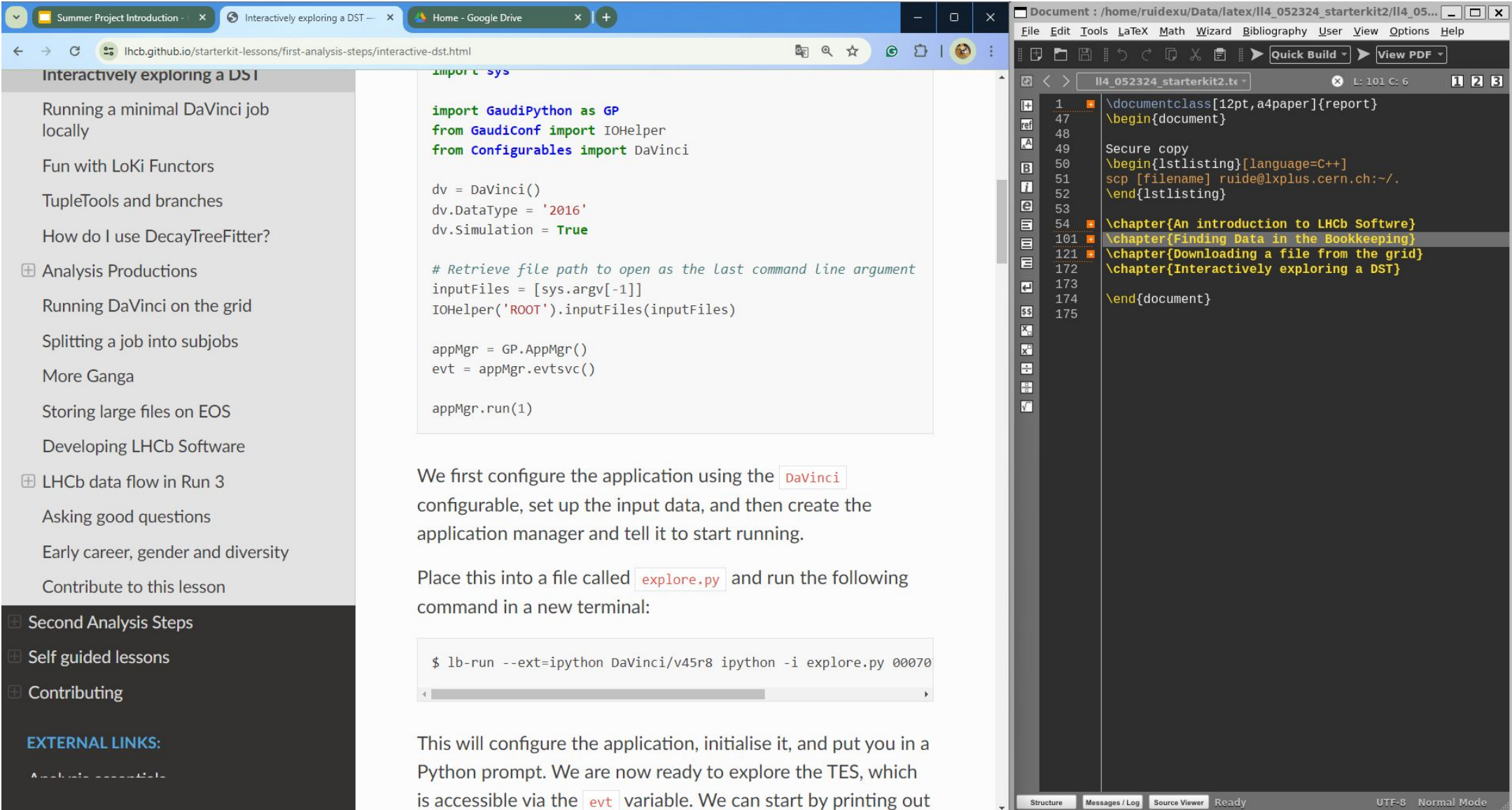
◆ Find the hardest particle

◆ Group the soft particles around it

◆ Find the next hardest particle

◆ Group the soft particles

◆ Iterate

Stolen from Ezra's presentation
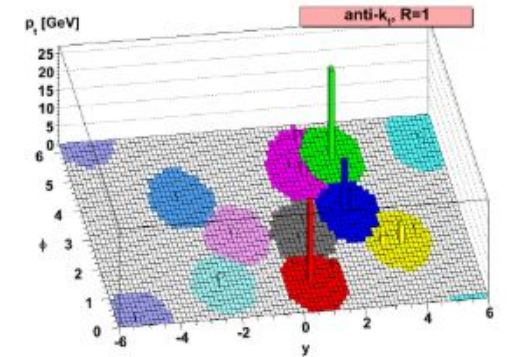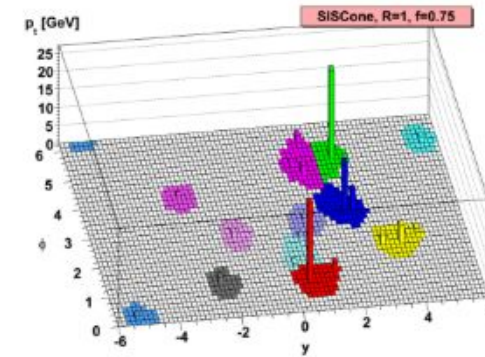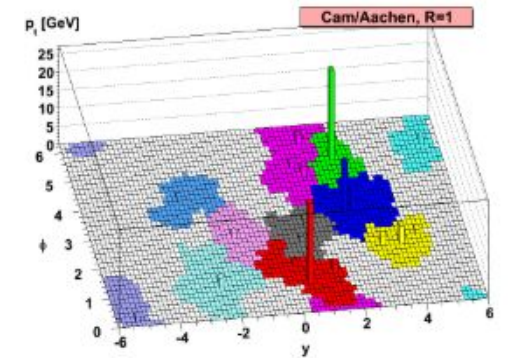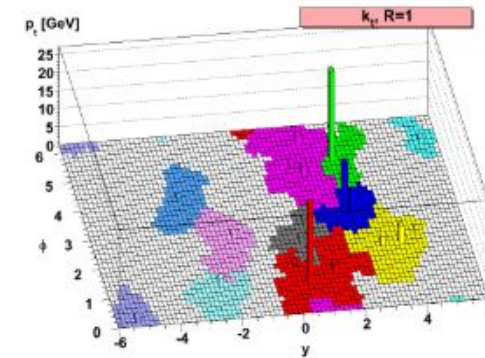
Current Project and Future Prospects

➔ **Goal:** To implement a modified anti k_t algorithm/new algorithm in Davinci and run using an option file

➔ **Current Project**

1. Working through LHCb software starter kit
2. Build Davinci and run jobs

➔ **Plan**

1. Learn to change some parameter(eg. jet radius) in DaVinci and run using an option file(without recompiling DaVinci)
2. Change the current anti k_t algorithm to another one (possibly with a different jet recombination algorithm: k_t, Cone...)
3. Implement the new jet flavor(JetFlav Package) algorithms in DaVinci and produce output

Current Work

Current Work

Cultural Experience

➔ Geneva -> <mark>Zurich</mark> -> Luzern -> Vitznau -> Bern

Cultural Experience

➔ **Geneva -> Zurich -> <mark>Luzern</mark> -> Vitznau -> Bern**

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Thank you!!