

Introduction to Summer Projects at CERN

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Group and Mentor

→ **Professor Christine Aidala:**



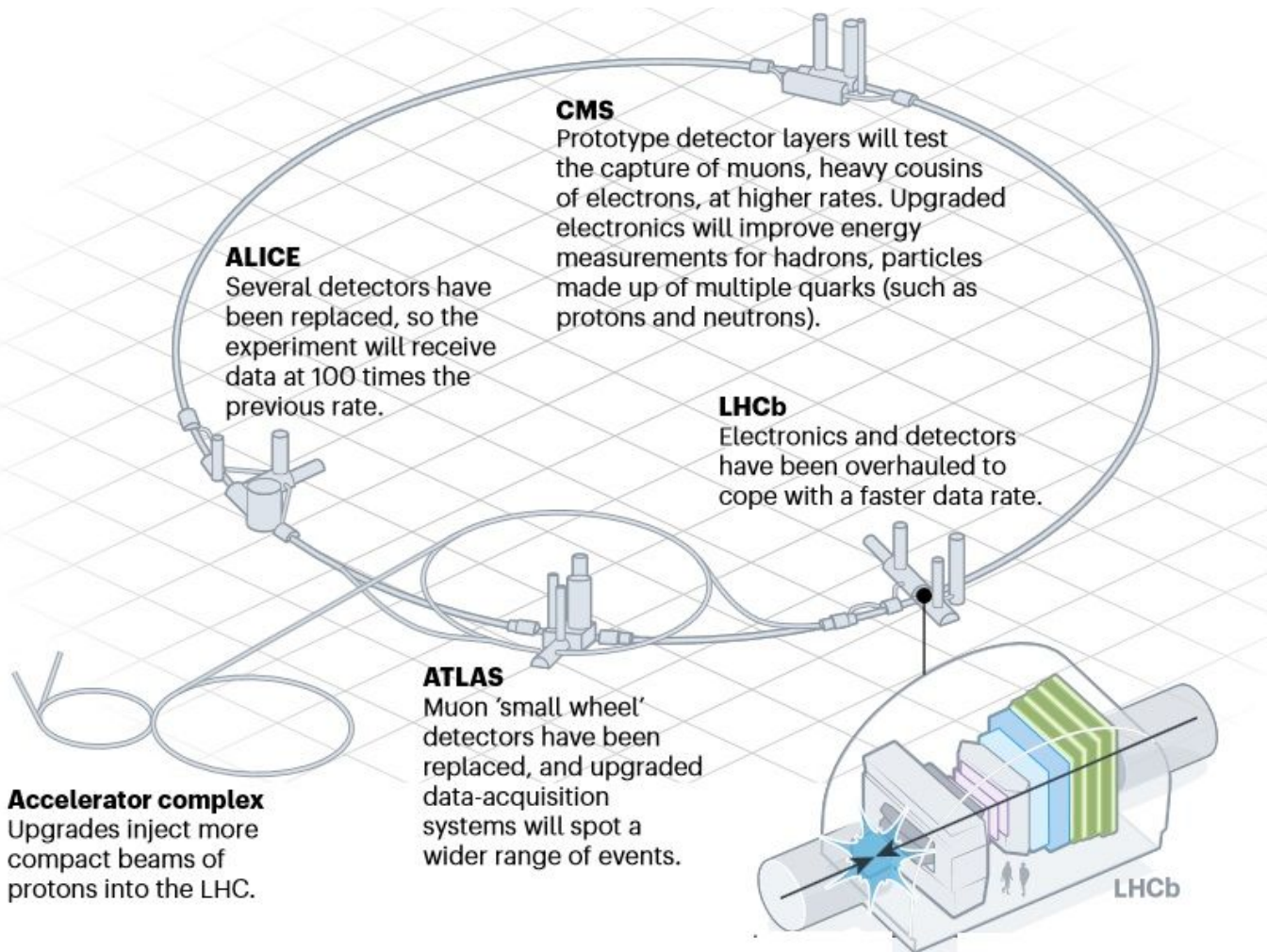
→ **Dr. Ezra Lesser:**



Large Hadron Collider beauty (LHCb)

→ LHCb detector

- ◆ Detect mainly forward particles
- ◆ Lower luminosity-> Reduced background
- ◆ Faster Data Rate
- ◆ Retractable VELO detector

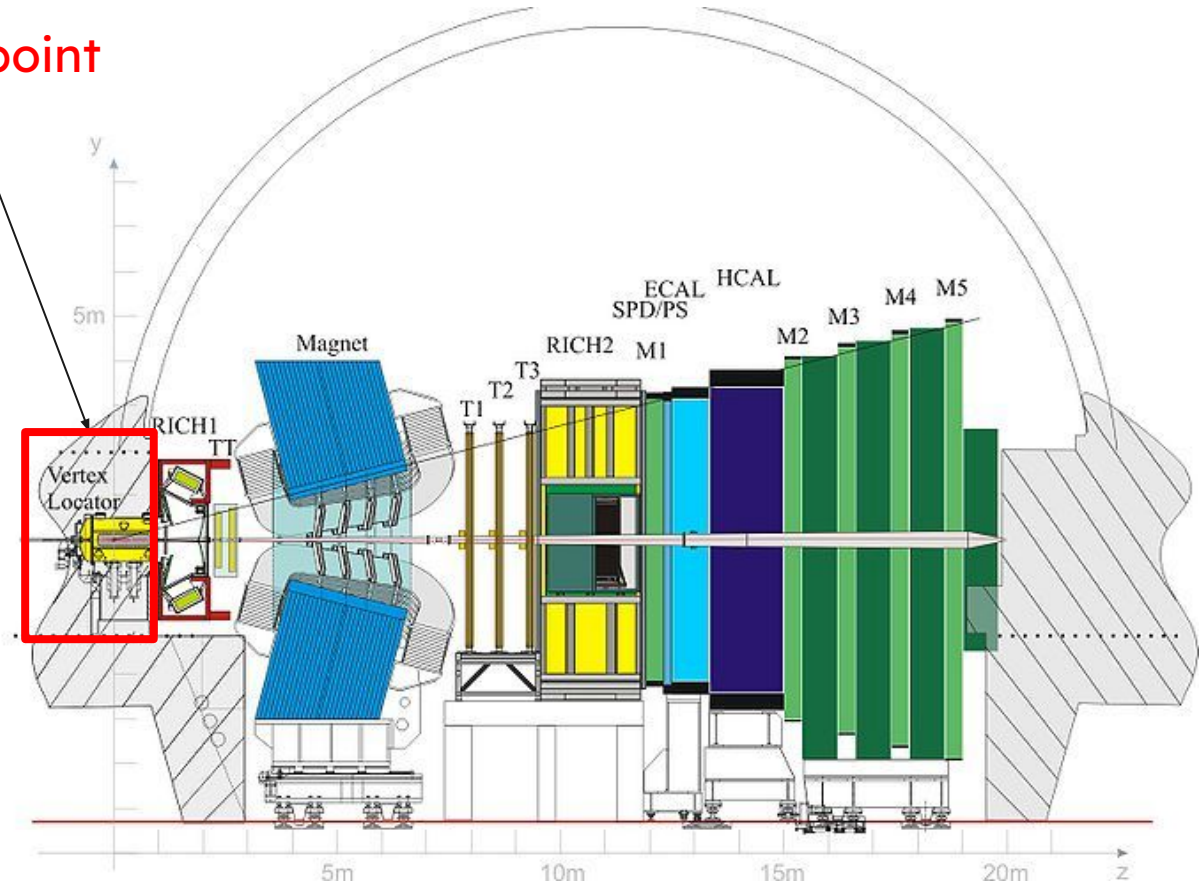


Large Hadron Collider beauty (LHCb)

→ 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

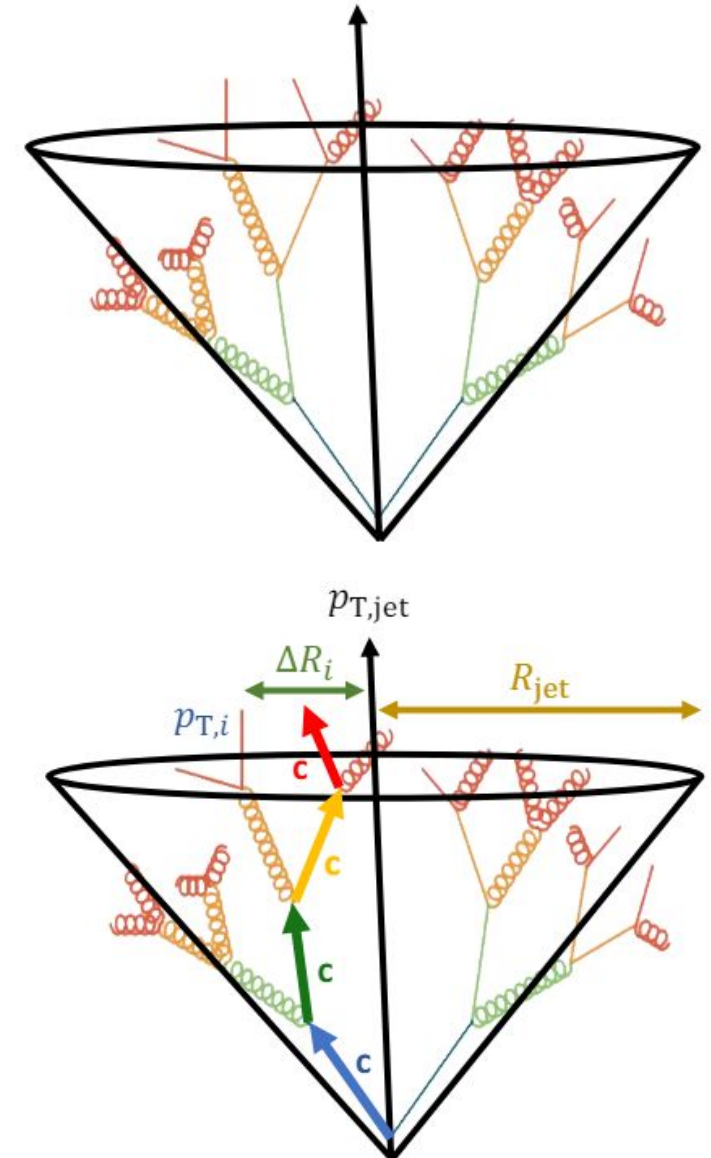
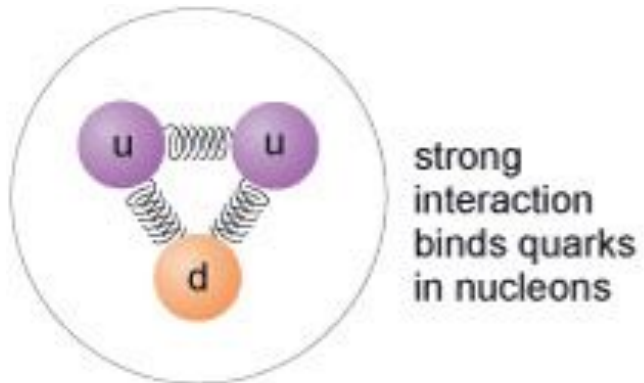
interaction point



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)



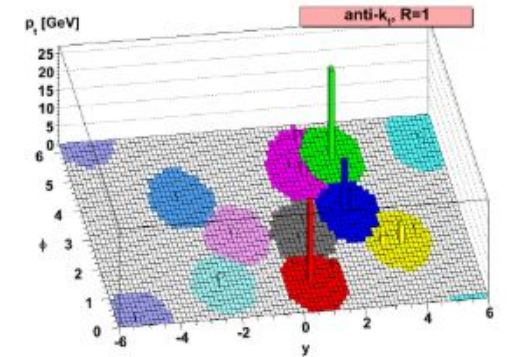
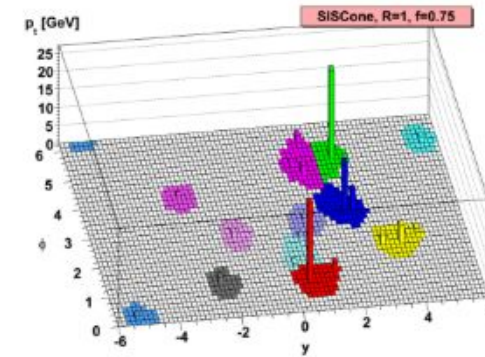
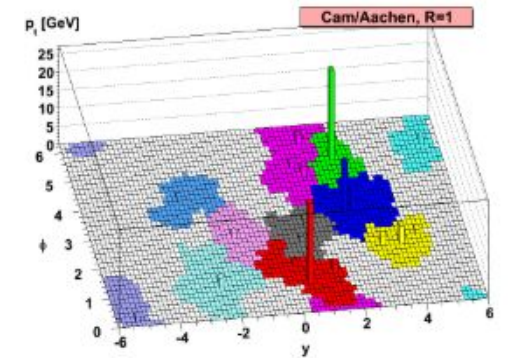
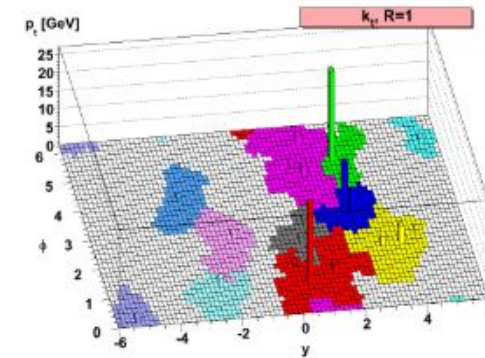
Jet Reconstruction

→ 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

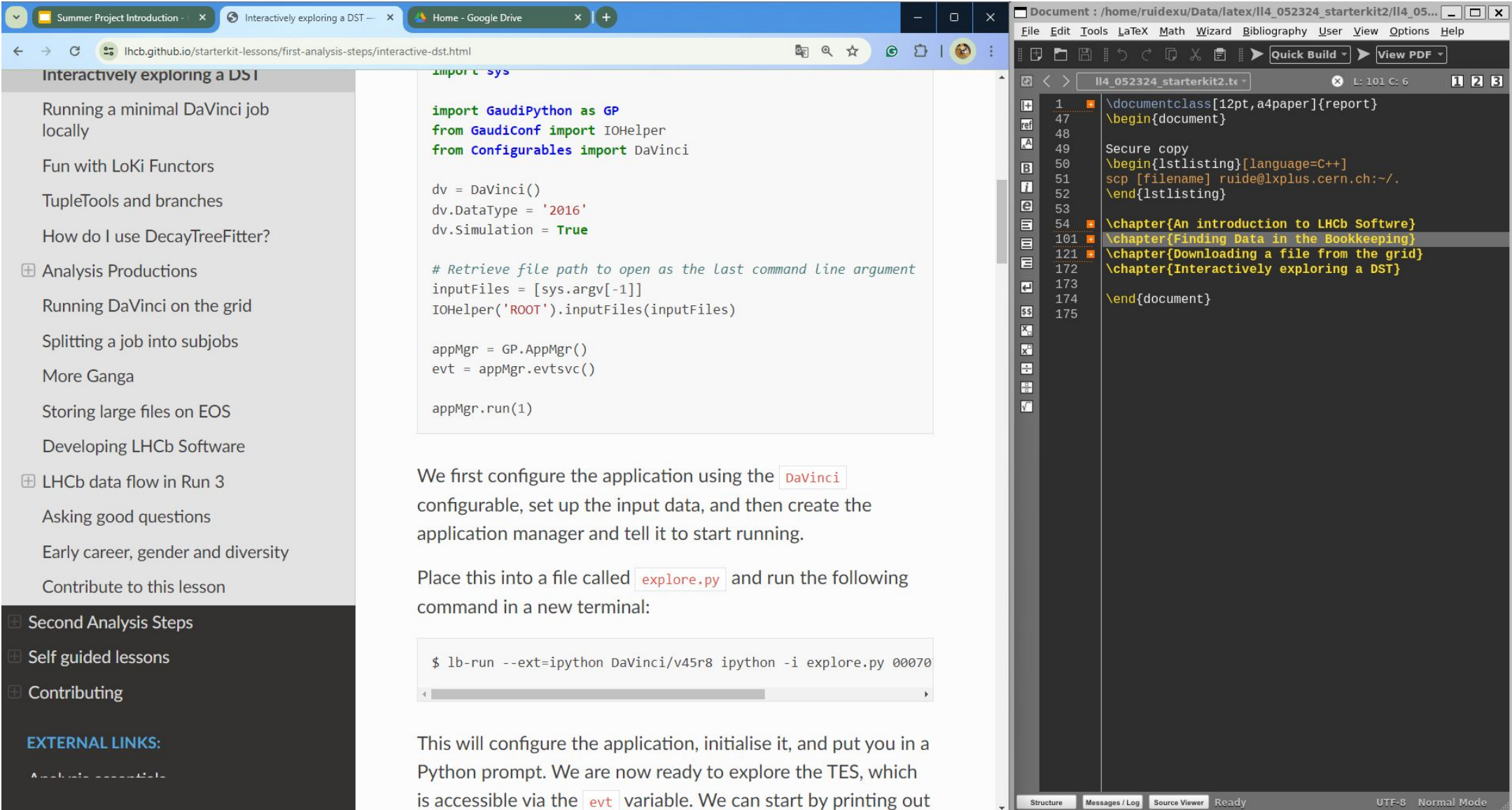
- ◆ Find the hardest particle
- ◆ Group the soft particles around it
- ◆ Find the next hardest particle
- ◆ Group the soft particles
- ◆ Iterate



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



The screenshot shows a web browser window on the left displaying a lesson page titled "Interactively exploring a DST". The page content includes a code block for a Python script and a terminal command. The right side of the screenshot shows a LaTeX editor window with a document structure and a code snippet for a LaTeX document.

Lesson Page Content:

- Interactively exploring a DST
- Running a minimal DaVinci job locally
- Fun with LoKi Functors
- TupleTools and branches
- How do I use DecayTreeFitter?
- Analysis Productions
 - Running DaVinci on the grid
 - Splitting a job into subjobs
 - More Ganga
 - Storing large files on EOS
 - Developing LHCb Software
- LHCb data flow in Run 3
 - Asking good questions
 - Early career, gender and diversity
 - Contribute to this lesson
- Second Analysis Steps
- Self guided lessons
- Contributing
- EXTERNAL LINKS:

Python Code Block:

```
import sys

import GaudiPython as GP
from GaudiConf import IOHelper
from Configurables import DaVinci

dv = DaVinci()
dv.DataType = '2016'
dv.Simulation = True

# Retrieve file path to open as the last command line argument
inputFiles = [sys.argv[-1]]
IOHelper('ROOT').inputFiles(inputFiles)

appMgr = GP.AppMgr()
evt = appMgr.evtsvc()

appMgr.run(1)
```

Text: We first configure the application using the `DaVinci` configurable, set up the input data, and then create the application manager and tell it to start running.

Text: Place this into a file called `explore.py` and run the following command in a new terminal:

```
$ lb-run --ext=ipython DaVinci/v45r8 ipython -i explore.py 00070
```

Text: This will configure the application, initialise it, and put you in a Python prompt. We are now ready to explore the TES, which is accessible via the `evt` variable. We can start by printing out

LaTeX Editor Content:

```
\documentclass[12pt, a4paper]{report}
\begin{document}

Secure copy
\begin{lstlisting}[language=C++]
51 scp [filename] ruide@lxplus.cern.ch:~/
52 \end{lstlisting}

54 \chapter{An introduction to LHCb Software}
101 \chapter{Finding Data in the Bookkeeping}
121 \chapter{Downloading a file from the grid}
172 \chapter{Interactively exploring a DST}
173
174 \end{document}
175
```


Current Work

The screenshot shows a code editor window with a file named `explore.py`. The code in the editor is as follows:

```
1 import sys
2
3 import GaudiPython as GP
4 from GaudiConf import IOHelper
5 from Configurables import DaVinci
6
7 dv = DaVinci()
8 dv.DataType = '2016'
9 dv.Simulation = True
10
11 # Retrieve file path to open as the last command line argument
12 inputFiles = [sys.argv[-1]]
13 IOHelper('ROOT').inputFiles(inputFiles)
14
```

Below the code editor is a terminal window with the following output:

```
[ruide@lxplus991 ruide]$ ls
00070793_00000001_7.AllStreams.dst explore.py private public
[ruide@lxplus991 ruide]$ pwd
/afs/cern.ch/work/r/ruide
[ruide@lxplus991 ruide]$
```

Cultural Experience

→ Geneva -> **Zurich** -> Luzern -> Vitznau -> Bern



Cultural Experience

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Cultural Experience

→ Geneva -> Zurich -> Luzern -> Vitznau -> **Bern**



Thank you!!