

Hands On Session: SHINE and SHOE

Homework #1 – Basics

- make sure to increase AFS disk space to the max:
<https://twiki.cern.ch/twiki/bin/view/NA61/SHINEOfflineHome>
- familiarize yourself with the SHINE Offline TWiki
<https://twiki.cern.ch/twiki/bin/view/NA61/SHINEOfflineHome>
- have a first look at doxygen documentation at
<https://shinedoc.web.cern.ch/shinedoc/doxygen/>
- add the TWiki and doxygen to your browser's bookmarks

Tasks:

- using the doxygen write down the “path” through the SHOE to get the momentum of `rec::VertexTracks` at the main vertex
- what is the difference between a `rec::Track` and a `rec::VertexTrack`?

Homework #2 – Getting Started

Follow the instructions on

<https://twiki.cern.ch/twiki/bin/view/NA61/SHINEOnLxplus>

- set the SHINE environment on lxplus
(Hint: type

`SetShineEnv v1r17p1/x86_64-centos7-gcc8-opt` at the bash prompt but make sure to also look at the release page at <https://twiki.cern.ch/twiki/bin/view/NA61/SHINEReleases>

- locate reconstructed data files on eos
`/eos/experiment/na61/data/prod/` (ignore the instructions for castor)
- open one or more files with the `eventBrowser`
 - look at all the tabs and options, right-click a track, zoom into the event etc

Tasks:

- what are the yellow, green, red and azure things shown in the `eventBrowser`?
- make screen shots of interesting, weird, beautiful events and bring them to the Tuesday session for discussion

Homework #3 – Analysis Examples

Follow the instructions at

https://twiki.cern.ch/twiki/bin/view/NA61/SHINEOnLxplus#step_5_Run_and_modify_the_analys

to get a local copy of the `SimpleAnalysis` folder and compile the examples with `make` (you will need the SHINE environment as set in homework #2).

- read and understand the `simpleSelection.cc` program
- run `simpleSelection` over an eos file
- read and understand the `lambdaAnalysis.cc` program
- run `lambdaAnalysis` over one or several eos files

Tasks:

- understand the printout of `simpleSelection`
- open `lambdaAnalysis.root` and plot the mass histogram. Can you see the peak of the Λ baryon?

Homework #4 – Transforming SHOE files

In the `SimpleAnalysis` directory from homework #3

- add a cut to `selectEvents`, run it and inspect the output file with the `eventBrowser`
- run `nanoSHOE` over an `eos` file

Tasks:

- what could be a good use case for `selectEvents`?
- compare the file size of a full SHOE file (subdirectory `shoe.root` on `eos`), `miniSHOE` (subdirectory `minishoe.root`) and `nanoSHOE` you produced
- open the same event in three types (full, mini, nano) with the `eventBrowser`, make a screenshot and bring it to the discussion

Homework #5 – Track Particles through NA61/SHINE

Just as in the previous examples

- copy and compile the example from `apps/Examples/Detector/MagneticFieldTracker`
- read and understand the `tracking.cc` program
- run the program

Tasks:

- calculate the x position of a particle with momentum along z of 1, 10, 100, 1000 GeV/c starting at the target at $(x, y, z) = (0, 0, -580)$ cm after traversing the detector to $z = +730$ cm

Homework #6 – Create and run a SHINE Module

Run the script

```
createShineModuleSkeleton.py
```

and inspect the created files.

Compile the Module with `make` and run it with

```
userShineOffline -b bootstrap.xml
```

Tasks:

- understand the meaning of the `xml`, `xsd` files
- change the Module such that it does not end in an error

Homework #7 – Play with Units and Geometry

- read the sections at

https://twiki.cern.ch/twiki/bin/view/NA61/SHOEAnalysis#Geometry_package

and

<https://twiki.cern.ch/twiki/bin/view/NA61/SHOEAnalysis#Units>

- create a copy of one of e.g. the `recEventLoop` example (see `SimpleAnalysis` from homework #3) and put some of the code from these sections at adequate places

Tasks:

- compare the transverse momentum distribution of main-vertex particles in the detector and in the beam-momentum frame

Homework #8 – Explore the SHOE event with ROOT

- read the sections at

https://twiki.cern.ch/twiki/bin/view/NA61/SHOEAnalysis#Quick_Plots_with_TTree_Draw,

https://twiki.cern.ch/twiki/bin/view/NA61/SHOEAnalysis#File_Inspection_using_TTree_Scan

https://twiki.cern.ch/twiki/bin/view/NA61/SHOEAnalysis#Adding_the_SHINE_Event_library_t

Tasks:

- use `TTree::Scan()` to print the momentum parameters of the tracks in the first event of your favourite SHOE file
- use `TTree::Draw()` to create a momentum distribution, dE/dx vs. $\lg(p)$ plot and a three-dimensional plot of cluster positions as shown on the TWiki link above.