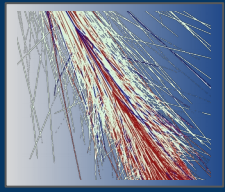

CORSIKA exercise

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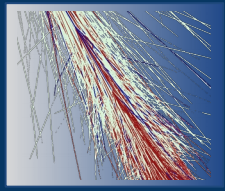
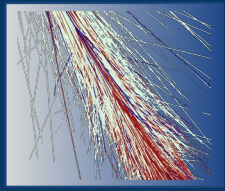
Outline



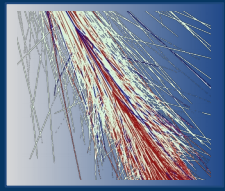
1) Install CORSIKA from tar file
2) Use coconut installer
3) Produce different types of binaries
4) Edit steering card, produce optimized custom version
5) Run CORSIKA
6) Analyse output

Preparation of CORSIKA



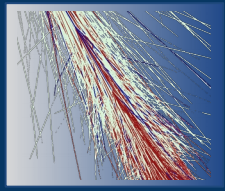
- Start Virtual Machine
- Run source setup_corsika
- Go to directory work cd work
- untar CORSIKA tar xcvf corsika-76400.tar.gz
- Change into new directory
- In doc directory, there is CORSIKA_GUIDE7.6400.pdf this file describes all options in detail. Here we try just very few of them.
  - If you like, you can look at it with atril CORSIKA_GUIDE7.6400.pdf

Configure CORSIKA



- start coconut: ./coconut
- coconut always offers [default] or [cached] choices to make your live easier
- Choose the following options:
  - SIBYLL high energy model
  - URQMD low energy model
  - flat detector
- The result of coconut is a specifically tailored source code of CORSIKA

Run CORSIKA

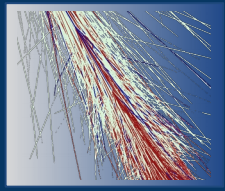


- Got to “run” directory cd run
- Prepare steering card, by copying all-inputs to example.inp
- Edit example.inp emacs example.inp
  - Change run number to 101
  - Generate 1000 events
  - At fixed energy of 1TeV
  - Photon primaries
  - 0 to 70 deg zenith
  - Cut electrons and photons at 100MeV, hadrons and muons at 1GeV
- Start CORSIKA, keep output in example.out

The relevant lines

```
RUNNR   101                              run number
NSHOW   1000                              number of showers to generate
PRMPAR  1                               particle type of prim. particle
ERANGE  1.E3  1.E3                      energy range of primary particle
THETAP  0.  70.                        range of zenith angle (degree)
ECUTS   1.  1.  0.1  0.1               energy cuts for particles
```

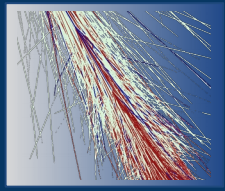
Modify CORSIKA



- Run coconut again, change to volume detector
- Modify example.inp to generate run 102
- Run CORSIKA

- Run coconut again, change to string detector
- Modify example.inp to generate run 103
- Run CORSIKA

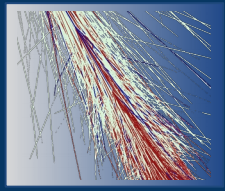
Read output



Here we will use COAST to read output and analyze results

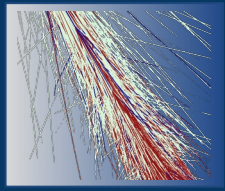
- First prepare COAST, which is part of CORSIKA.
  - Switch to coast directory cd coast
  - Type make install
- Get CorsikaRead.tar.gz from ISAPP2018 school indico page, and put into your work directory. Un-tar there. Change into directory.

Analyze CORSIKA output



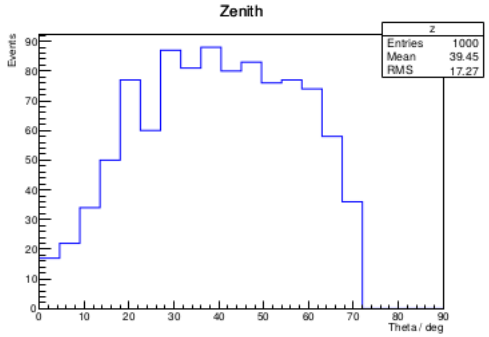
- Edit CorsikPlotter.cc, with editor of your choice, e.g. gedit CorsikaPlotter.cc
- Add ROOT 1D histogram to study shower zenith angle distribution
  - 20 bins from 0 to 90 [degree], name: zenith
- Fill shower zenith into histogram (take care of units)
  - Note: check COAST Documentation link on ISAPP 2018 indico page
- Create TCanvas, draw histogram, save pdf format
- Type make in directory to compile

Compare results

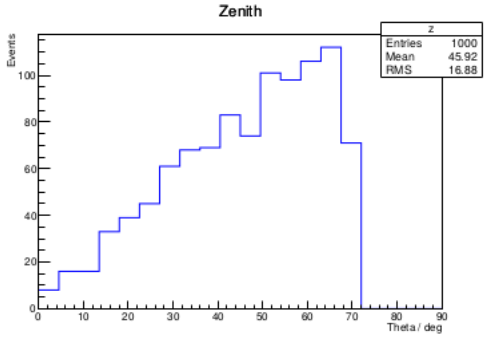


- pdf-viewer on ubuntu MATE is called atril

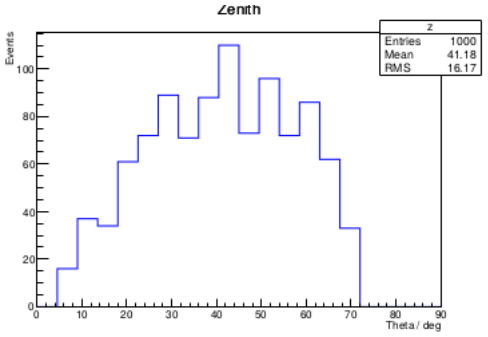
Flat



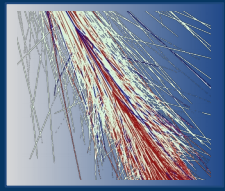
Volume



String



Particles



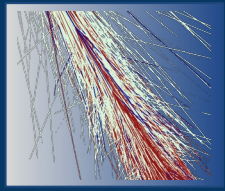
Follow the example, start own investigation!

Create a new particle-level histogram for any quantity that is interesting for you , fill particle-level data, print histogram, show result!

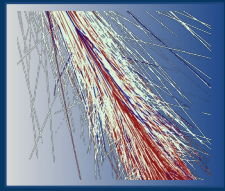
Use COAST Documentation to find out what is possible

If needed simulate new CORSIKA shower for this. Be careful with settings, CORSIKA shower at 10^{18}eV w/o thinning needs probably >>1 month on your laptop.

CONEX 1D [optional today]



- Switch to home directory and type `source setup_crmc`
- Switch to work directory
- Unpack conex, note that it is a bz2 file `tar xjvf conex2r5.64.tar.bz2`
- Change into new directory, type `make epos` (or choose other model)
- Run 10 full showers: proton primary at 10^{19}eV
- Type `bin/conex2r -h` for help
- Open output root file with root `root <youroutputfile.root>`
- Plot Xmax distribution `Shower→Draw("Xmx")` or any other observable



End of exercise. Start of research.