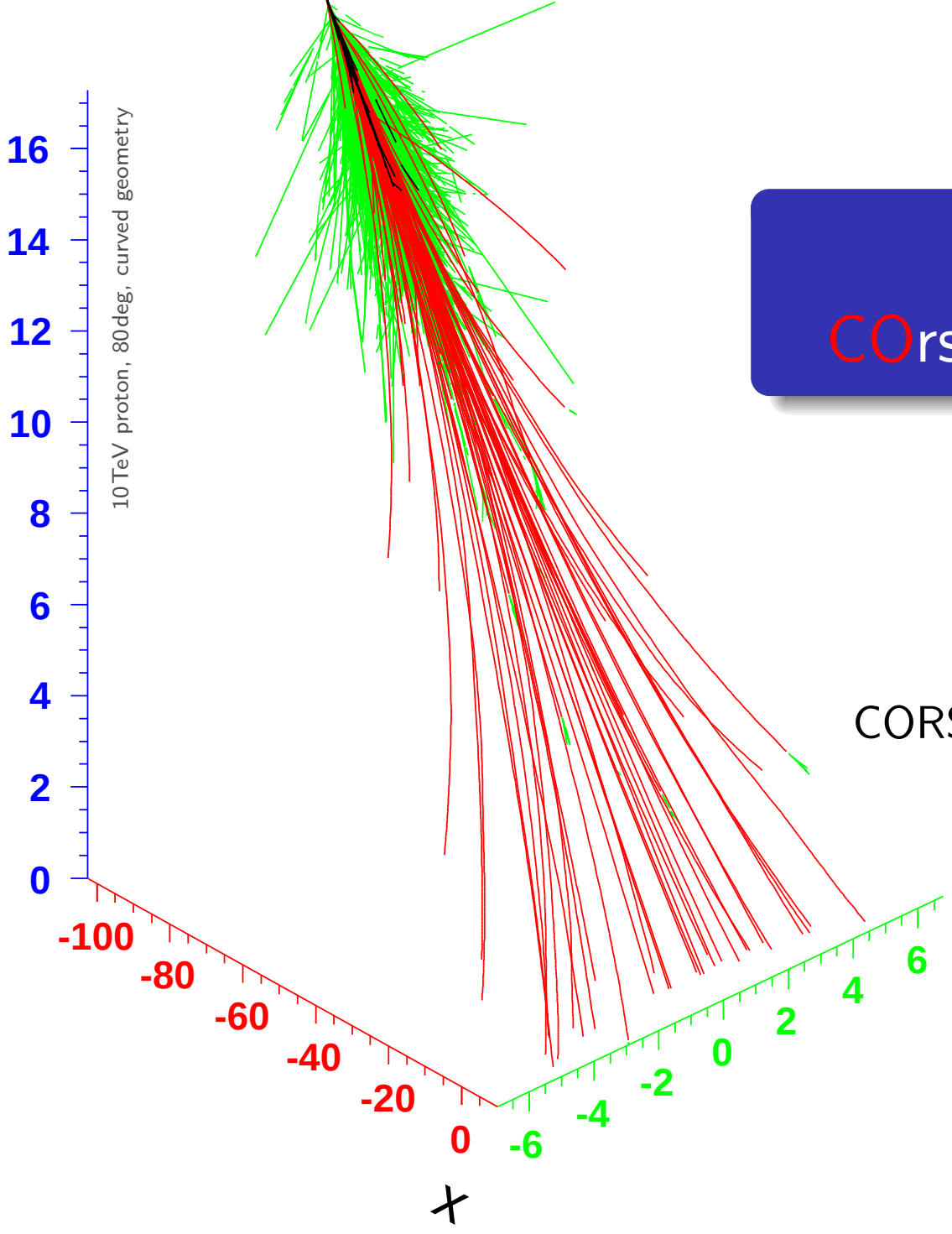

COAST

COrsika dAta accesS Tools

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Pennsylvania State University

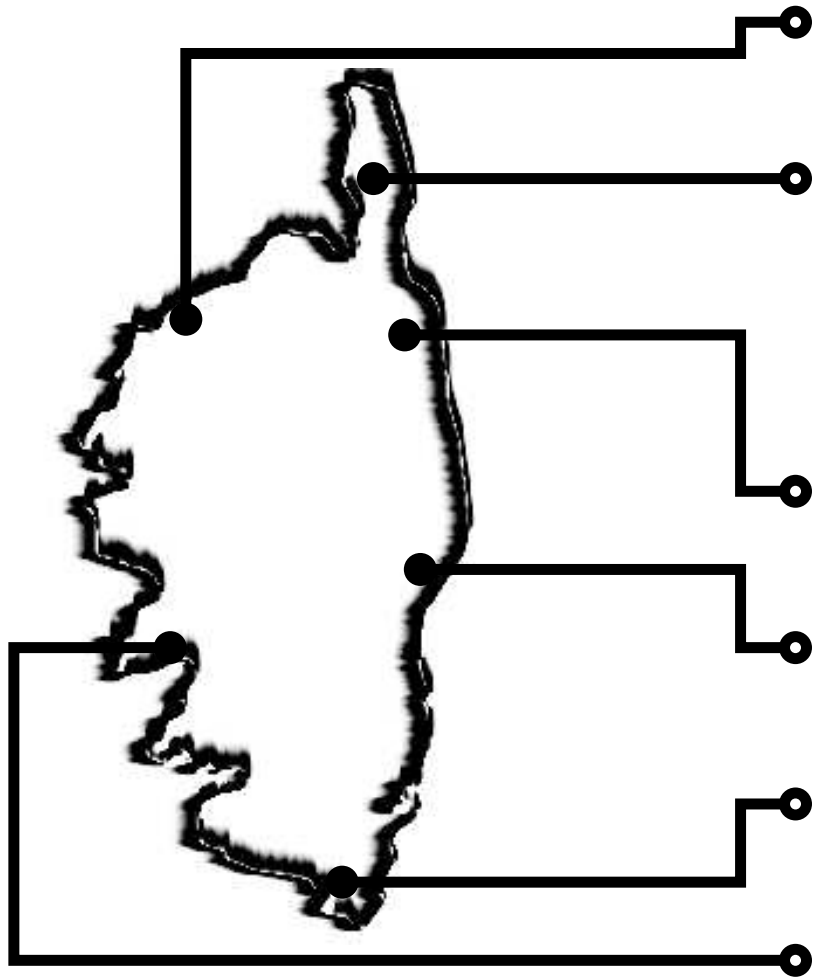
CORSIKA School 2010, Ooty, India

CORSIKA

CORSIKA

COAST

CORSIKA **COAST** **Interface**



USER CODE

Level 1 Interface

Functions (C++)

- inida
- wrida
- cloda

Structures (C++ classes)

- TBlock
- TSubBlock

- MRunHeader
- MEventHeader
- MParticleBlock
- MLongitudinalBlock
- MMuonProductionInfo
- MCherenkov
- MParticle
- MRunEnd
- MEventEnd

- Access to CORSIKA blocks and subblocks (RUNH, EVTH, PART, LONG, etc.)
- Also suited to read and process binary CORSIKA data files

Level 2 Interface

Functions (C++)

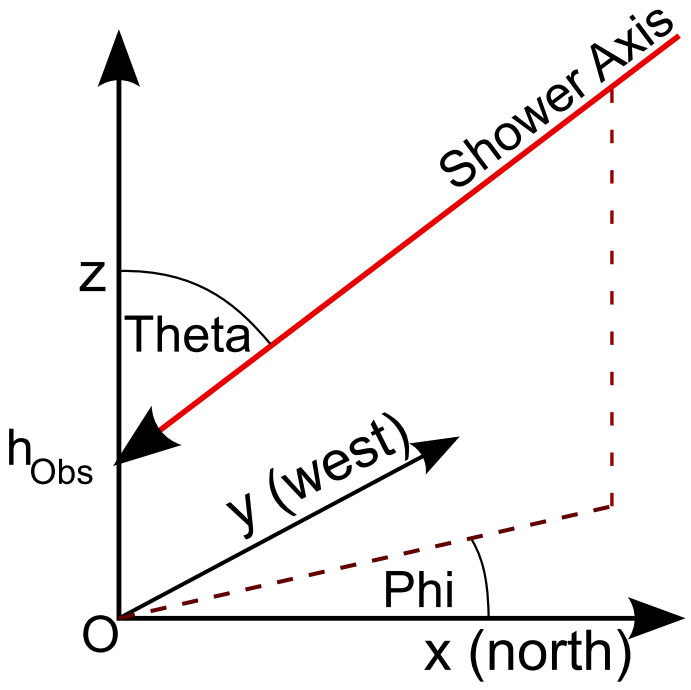
- track
- interaction

Structure (C++ classes)

- CParticle
- CInteraction

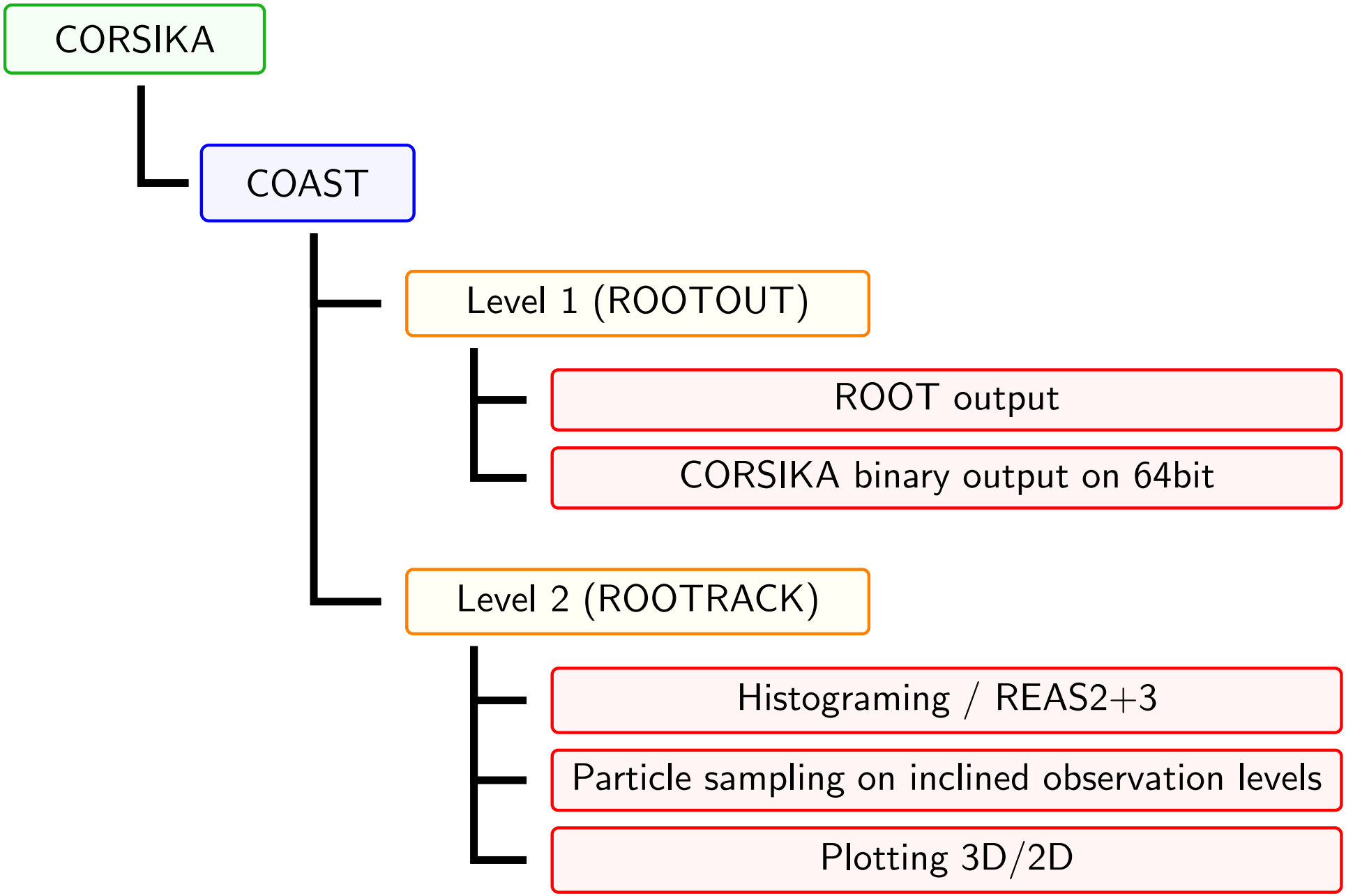
- Access to every single particle tracking step
- Information about all interactions in the air shower

Geometry in COAST (Level 2)



- Consistent coordinate system (for all options, e.g. CURVED)
- Shower core is at (0, 0, h_{obs})
- North in x-direction and West in y-direction

Overview


CORSIKA
COAST
Level 1 (ROOTOUT)
ROOT output
CORSIKA binary output on 64bit
Level 2 (ROOTRACK)
Histograming / REAS2+3
Particle sampling on inclined observation levels
Plotting 3D/2D

How To Use COAST Level 1 Interface

ROOT Output

Use **ROOTOUT** option of CORSIKA

⇒ Redirects standard binary CORSIKA output to convenient ROOT format

Showers are saved in ROOT TTree structures:

Subblock		ROOT Object	TTree
RUNH	⇒	TRun	run.
EVTH+data	⇒	TShower	sim.
		(TParticle TLongitudinal TCherenkov)	

`run->Show(0)` to see the content of TRun, the equivalent of `RUNH`

ROOT Output

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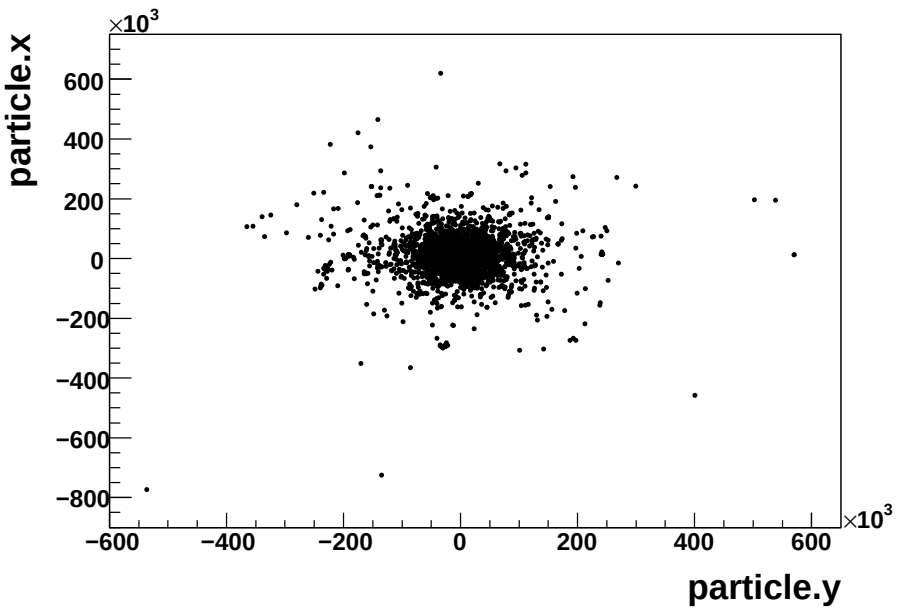
RUNH	⇒	TRun	run.
EVTH+data	⇒	TShower	sim.
		(TParticle TLongitudinal TCherenkov)	

```
sim->Draw("particle.x:particle.y")
```



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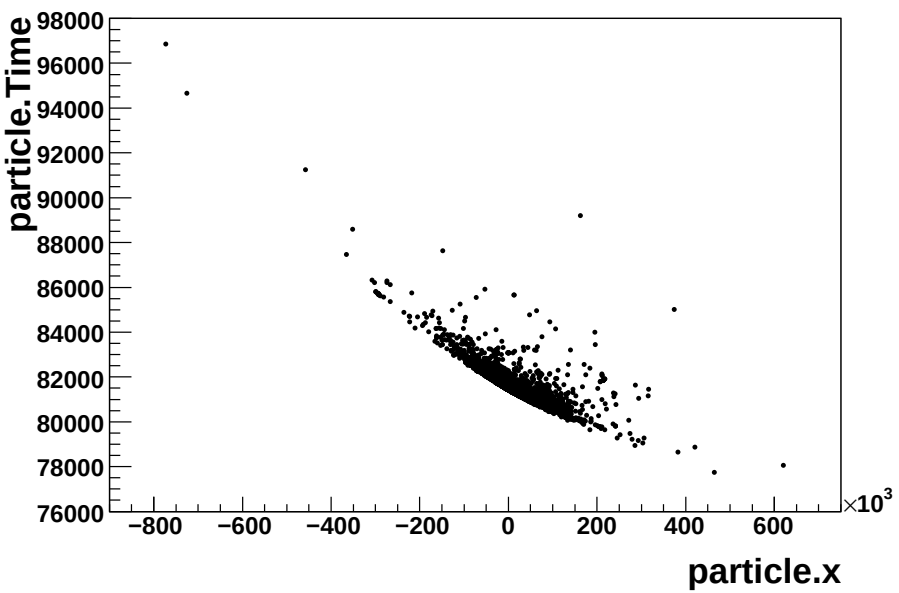
EVTH+data	⇒	TShower	sim.
		(TParticle TLongitudinal TCherenkov)	

```
sim->Draw("particle.Time:particle.x")
```



ROOT Output

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RUNH	⇒	TRun	run.
EVTH+data	⇒	TShower	sim.
		(TParticle TLongitudinal TCherenkov)	

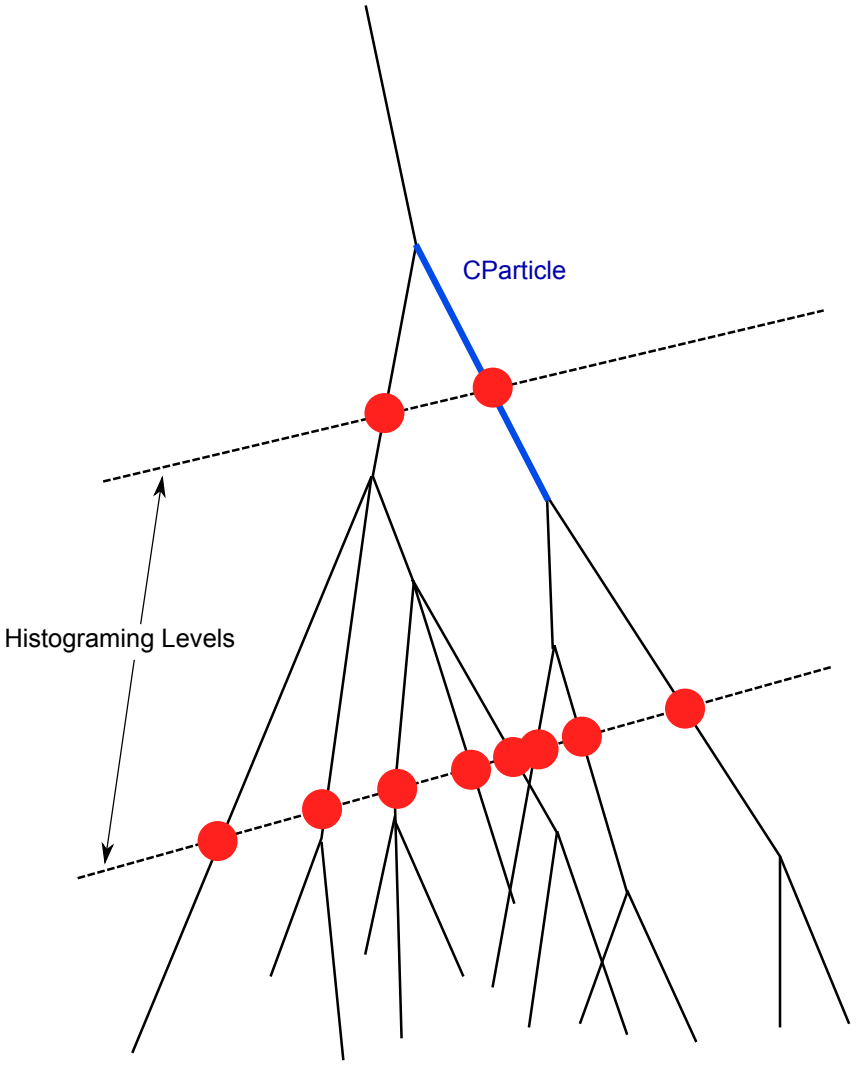
Warning:
ROOTOUT not (yet) full replacement for standard CORSIKA output.

Individual shower size is limited to computer memory, so it does not work for high energy, low thinning level showers.

Outlook:
We are working on an improved version with no limitations.

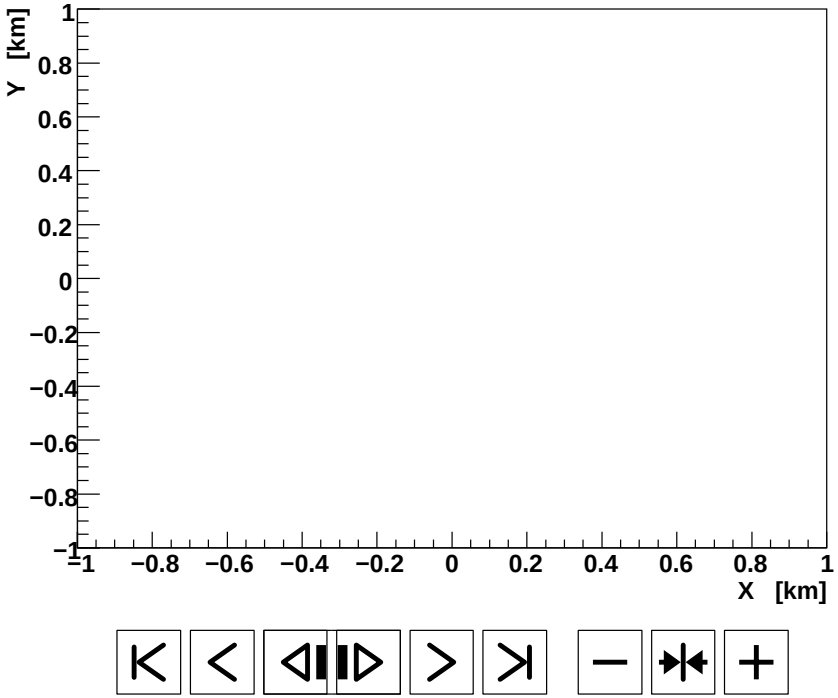
How To Use COAST Level 2 Interface

Histograming, REAS2/3

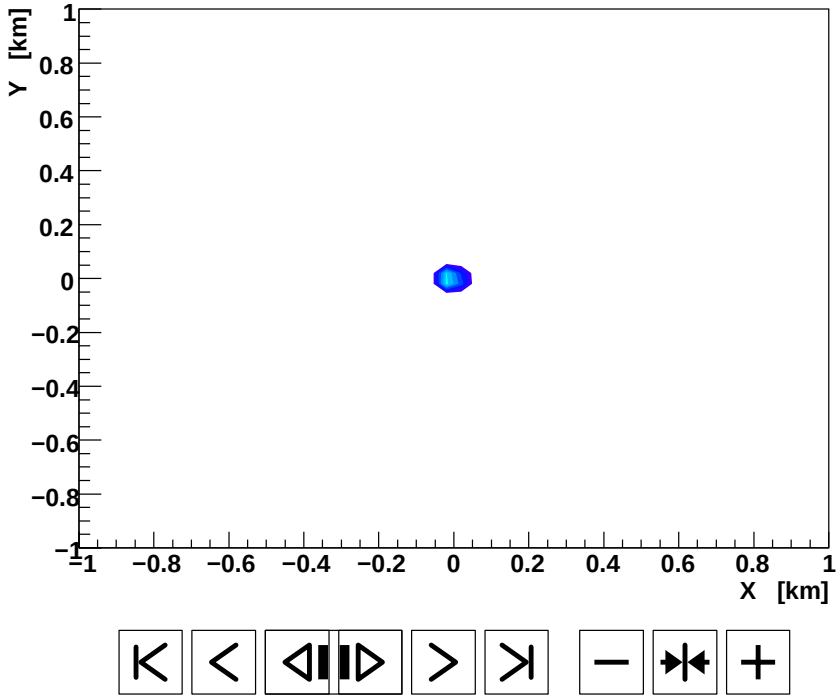


Histograming

muons

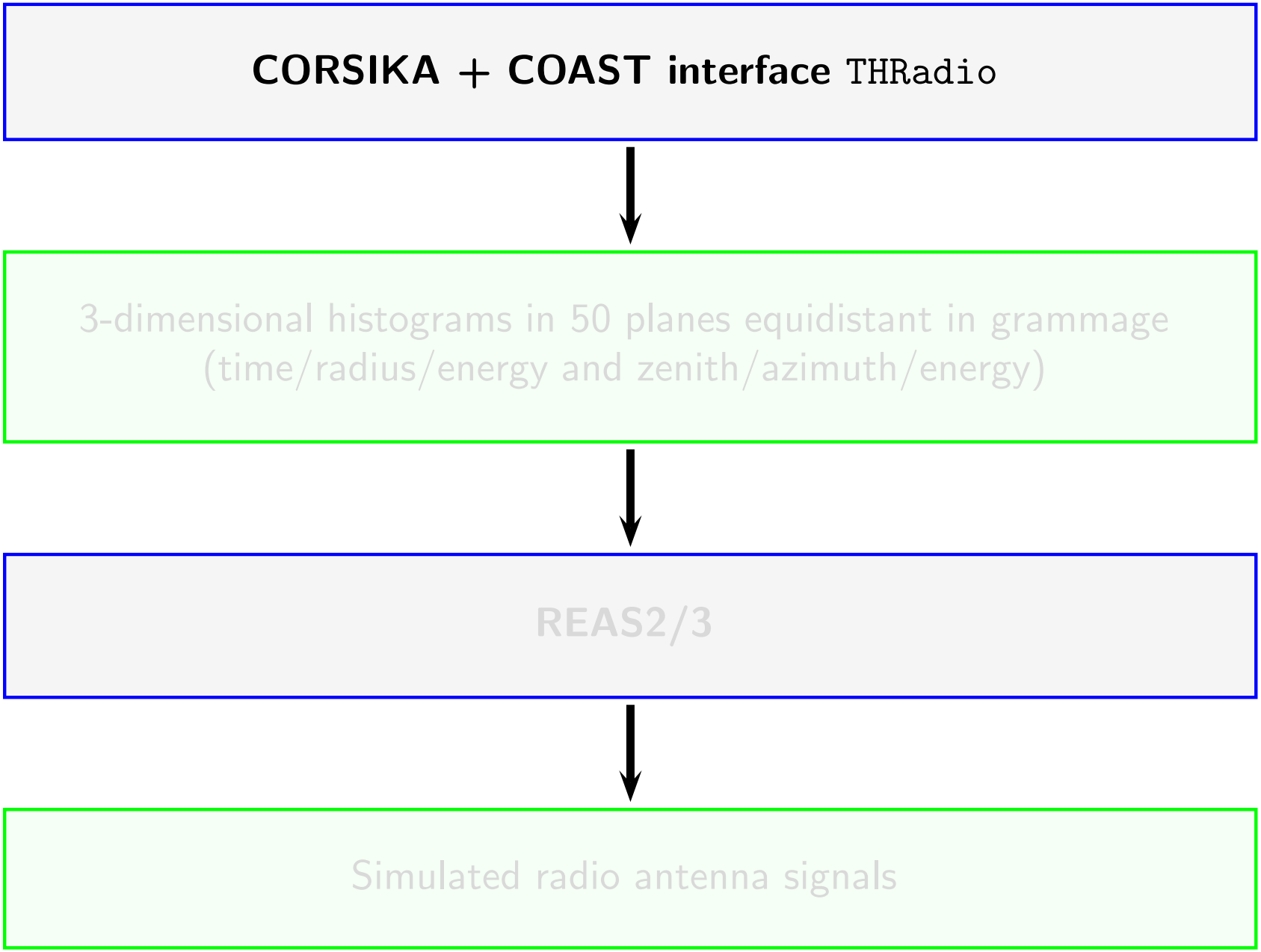


electrons

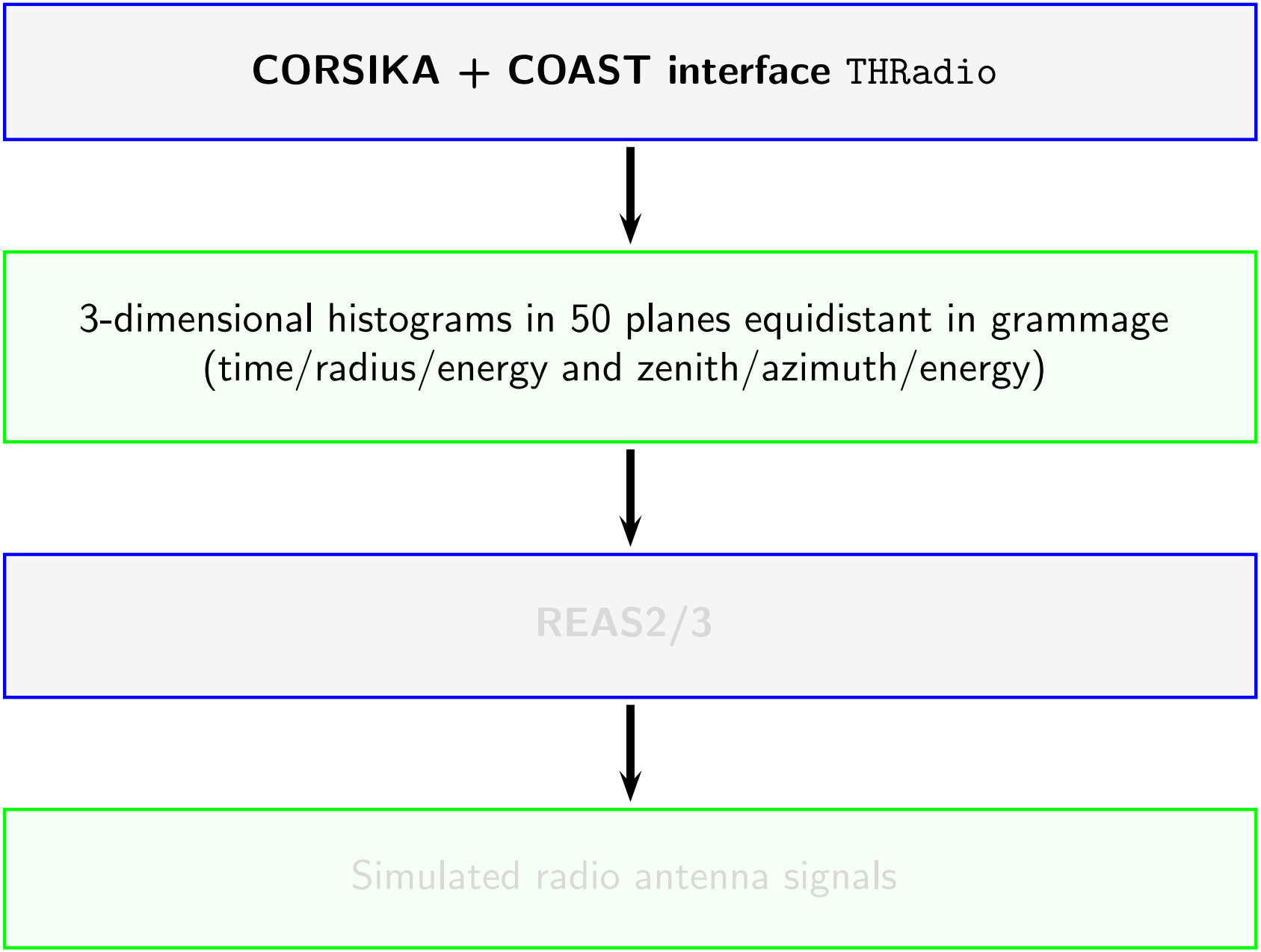


CORSIKA + COAST interface `Histogram`

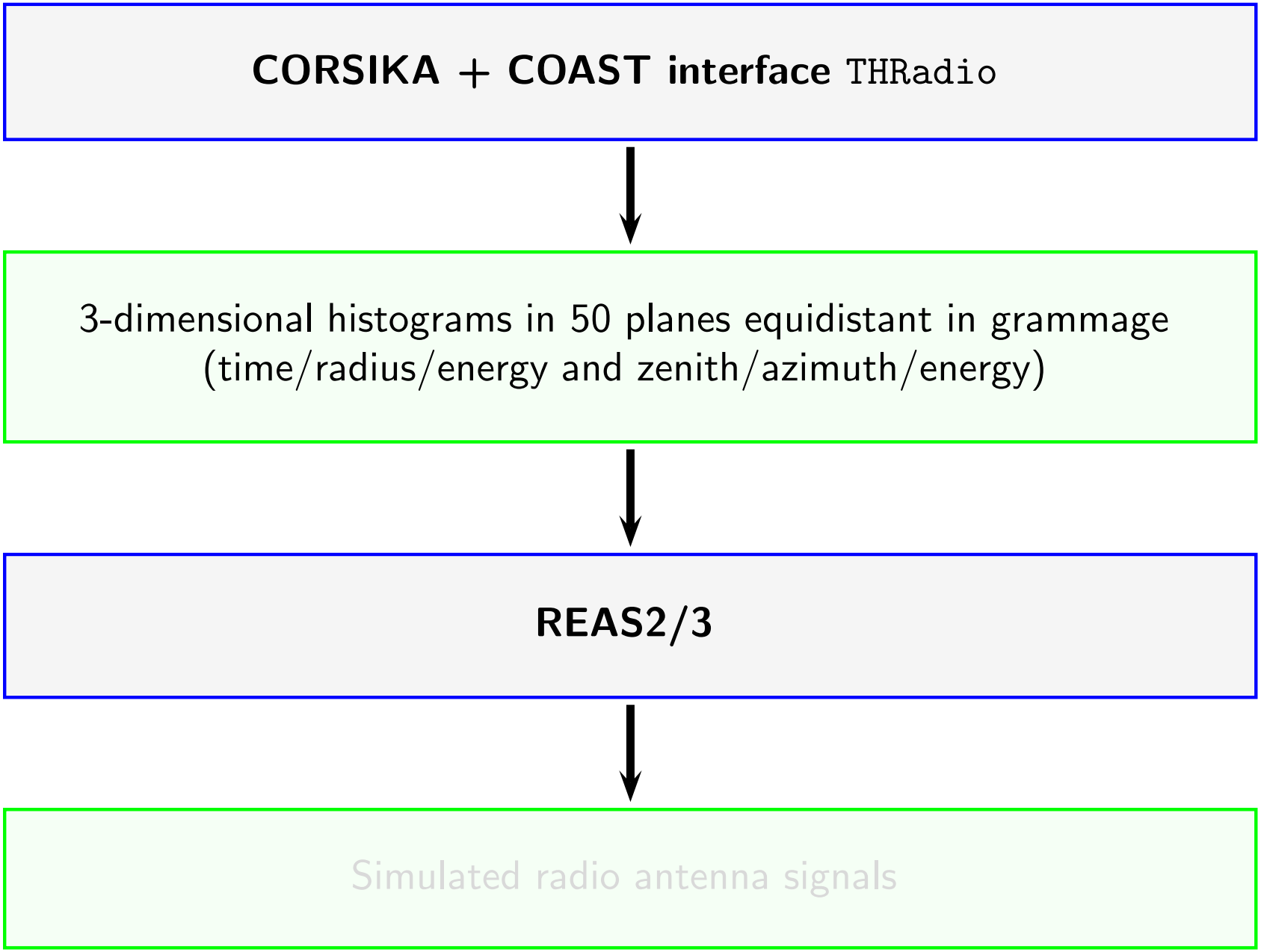
Histograming for Radio Simulation with REAS2/3



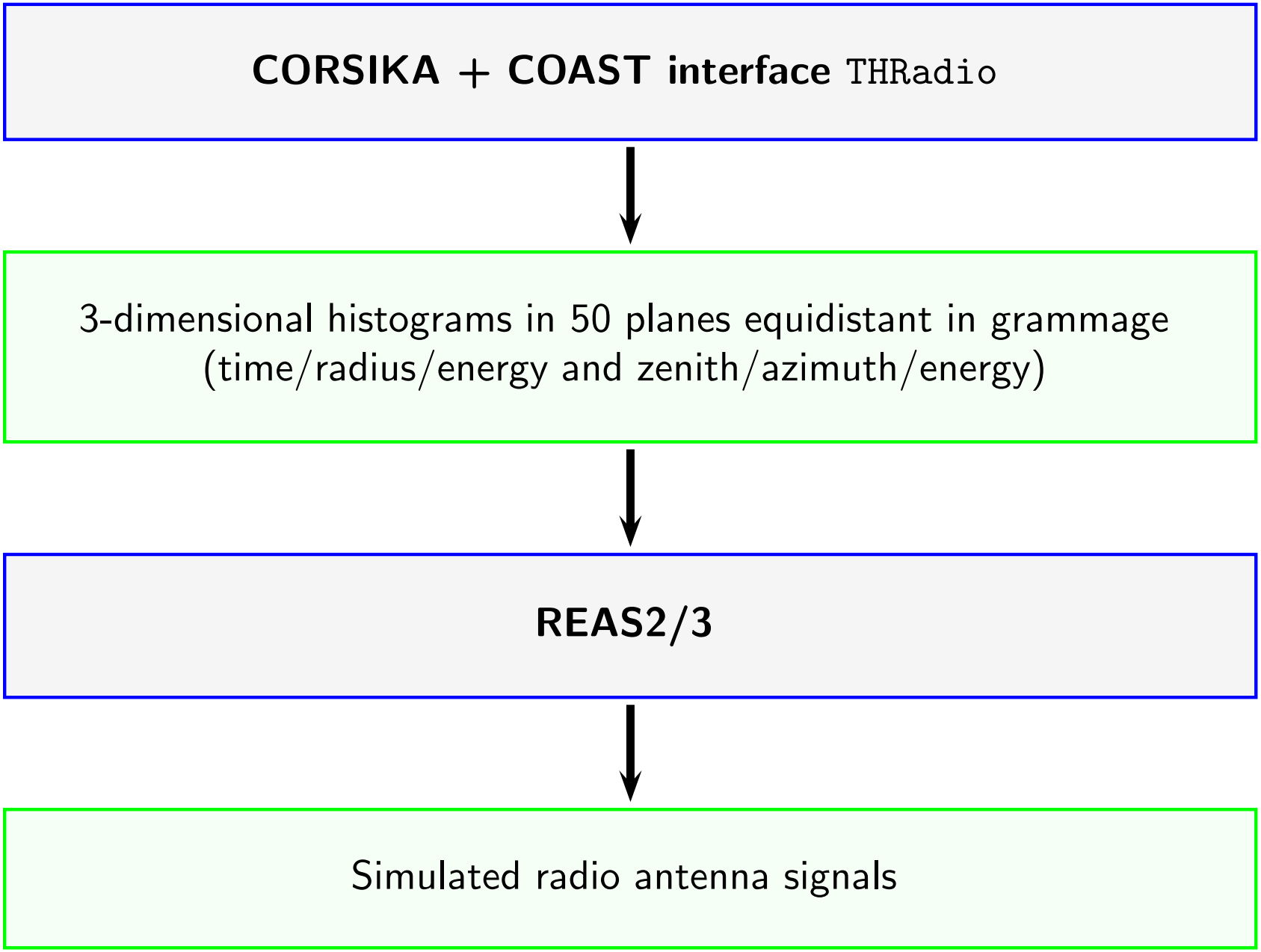
Histograming for Radio Simulation with REAS2/3



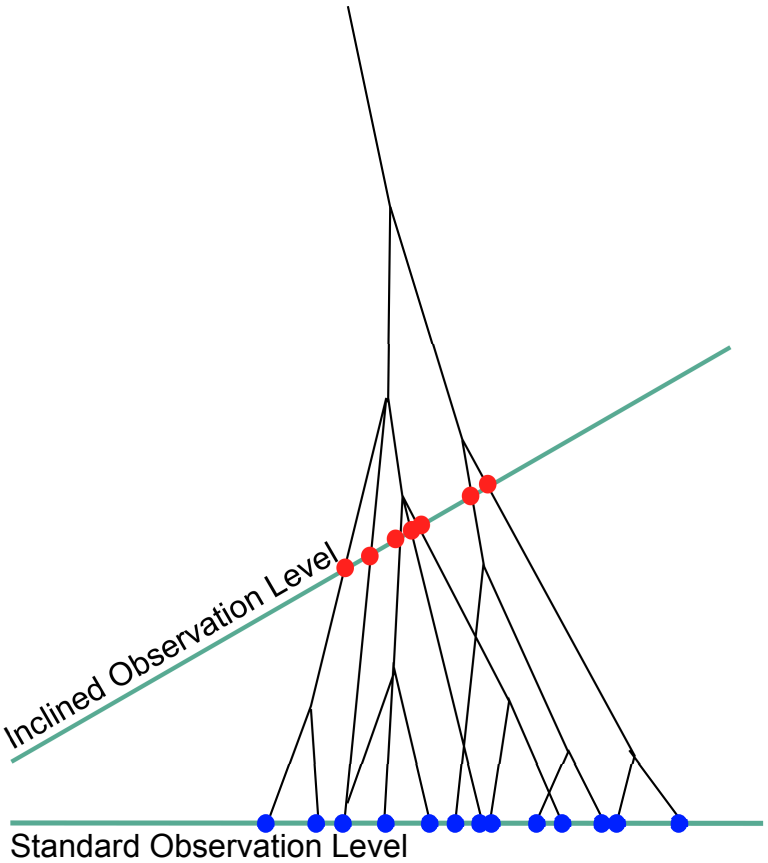
Histograming for Radio Simulation with REAS2/3



Histograming for Radio Simulation with REAS2/3



Inclined Observation Levels (v1r0)

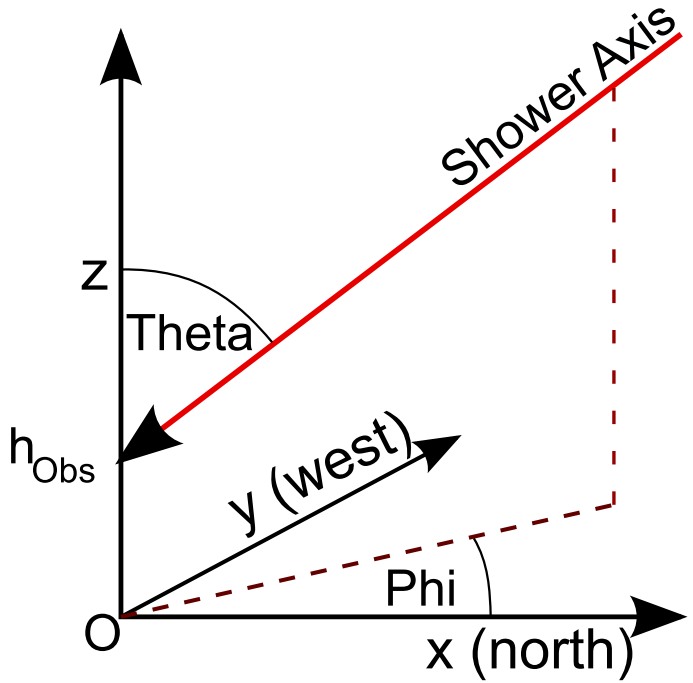


WARNING
The version of InclinedPlane in `coast-interfaces-v4r1` is alpha-v0r1. It works, but produces difficult to interpret output.
The version v1r0 of InclinedPlane will be release soon, and is presented here.

CORSIKA Coordinate Definition, Inclined Planes

New CORSIKA Steering Option

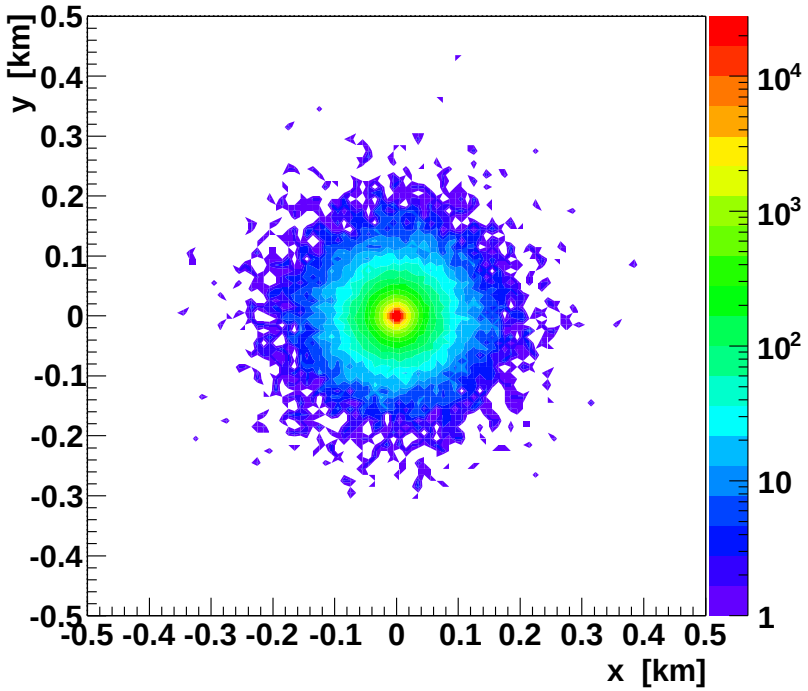
In combination with COAST interface `InclinedPlane`:
INCLIN X Y Z THETA PHI



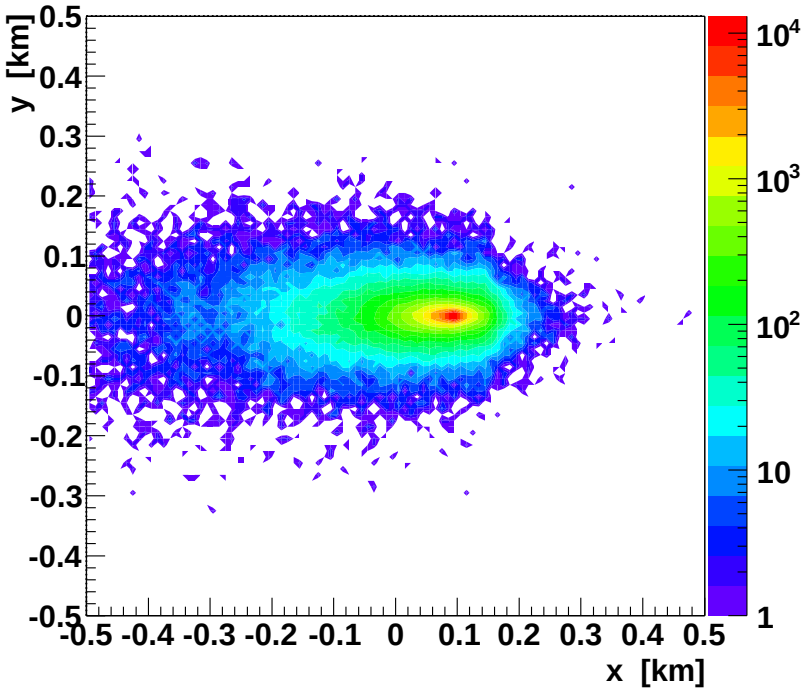
- Particles below the standard flat observation level (OBSLEV) are discarded by CORSIKA
- Output coordinate system of particles in INCLIN is identical to the one for the standard OBSLEV

Inclined Observation Levels

Standard observation level
0 m a.s.l.



Inclined observation level
1 km a.s.l., 70° around x-axis



(vertical proton primary at 10^{16} eV)

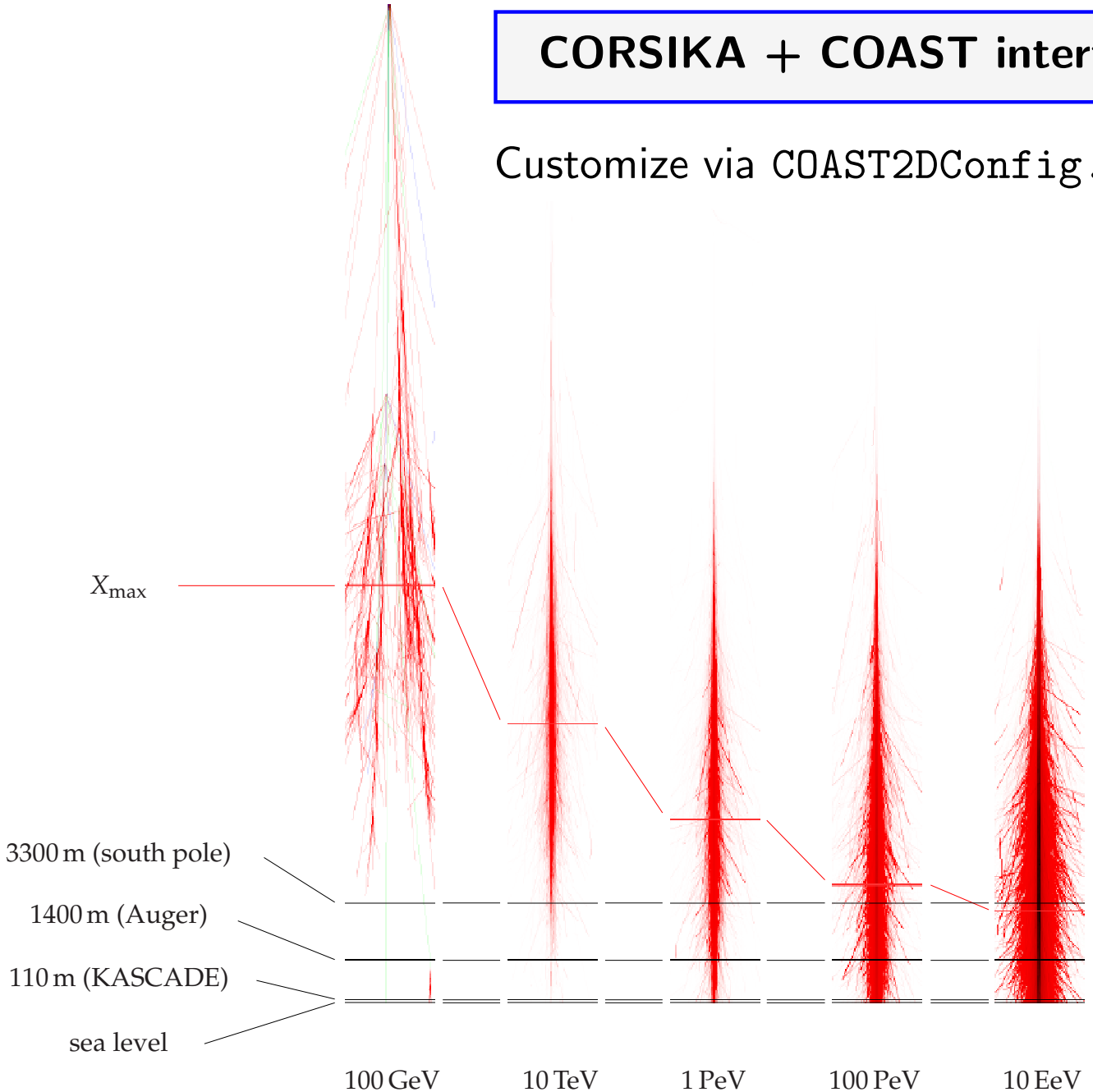
CORSIKA steering card

```
INCLIN 0. 0. 1000.E2 70. 0.
OBSLEV 0.
```

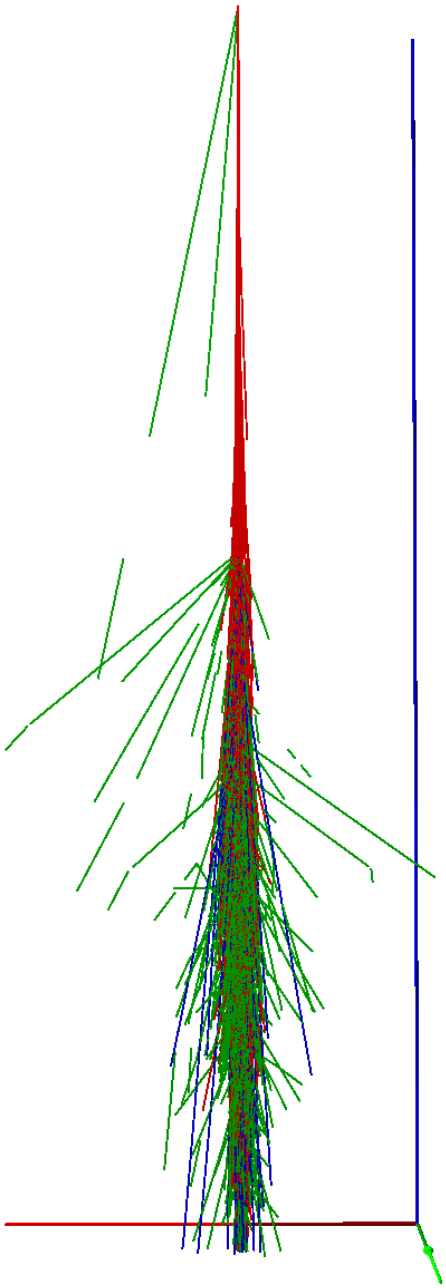
Plotting (2D)

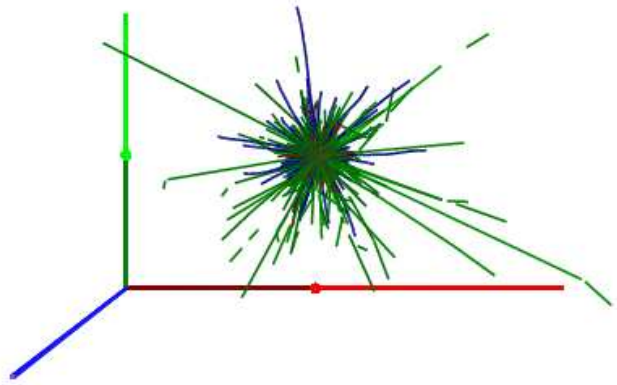
CORSIKA + COAST interface `plot2D`

Customize via `COAST2DConfig.config`



Plotting (3D)





hadrons muons e.m.

- Full ROOT 3D graphics
- Customize via configuration file `COAST3DConfig.config`

CORSIKA + COAST interface 3D

COAST Standalone

CORSIKA to ROOTOUT converter

- Convert existing `CORSIKA` output into `ROOTOUT` format
- Tool at `$COAST_DIR/CorsikaToROOT/corsika2root`

CORSIKA binary data reader

- Read `CORSIKA` binary data
- Auto-detect thinning
- See for example at `${COAST_DIR}/Documentation/Examples/novice/medium` or `${COAST_USER_LIB}/CorsikaReader`

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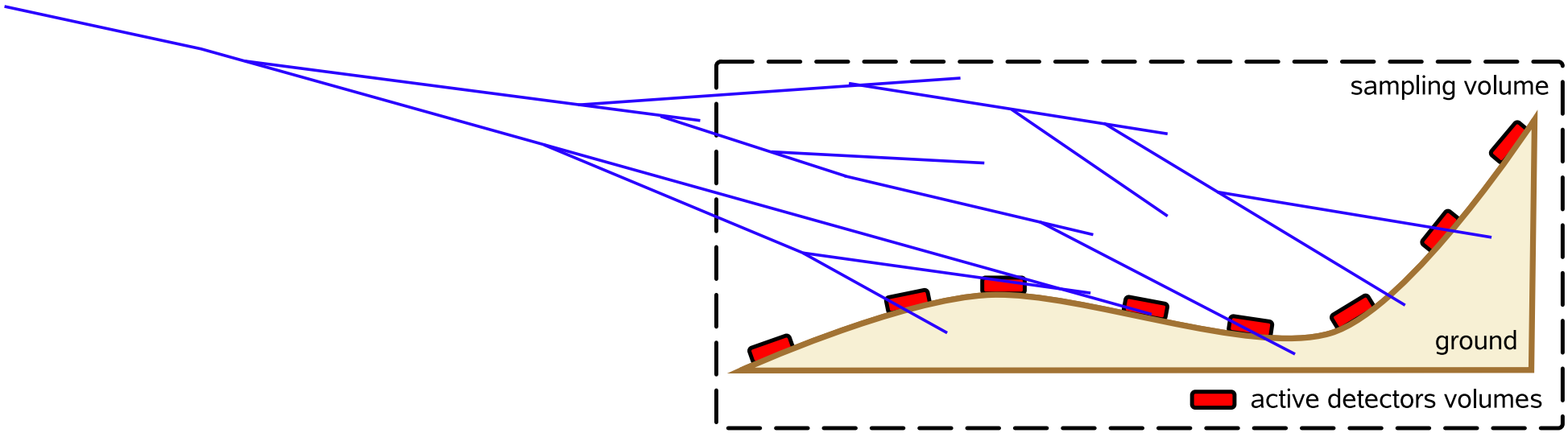
Potential Application of COAST



Extremely inclined showers + complicated detector geometry

⇒ Sampling of air showers on flat observation level is not appropriate

⇒ **Volume sampling**

⇒ **Detector Monte-Carlo (e.g. GEANT4) at run-time within CORSIKA**

Summary

- COAST is a powerful C++ interface for CORSIKA
- Several useful interfaces are provided
  (Histograms, 2D- and 3D-Visualization, etc.)
- Easy to develop own code
- See `http://www-ik.fzk.de/~rulrich/coast` for updates/details
- Soon: full integration into CORSIKA (code + build system)

Preparation for COAST exercise

Requirements: `ROOT` for histograms. There is a recent root tar file on the USB-sticks. Please install (unpack, define ROOTSYS, ./configure, make).

- `coast-v4r1` and `coast-interfaces-v4r1` are on the USB-sticks
- `coast-exercises-ooty.tar.gz` from:
  `www-ik.fzk.de/~rulrich/coast/releases`