GrROOT: S800 and Gretina offline analysis

Kathrin Wimmer and Eric Lunderberg

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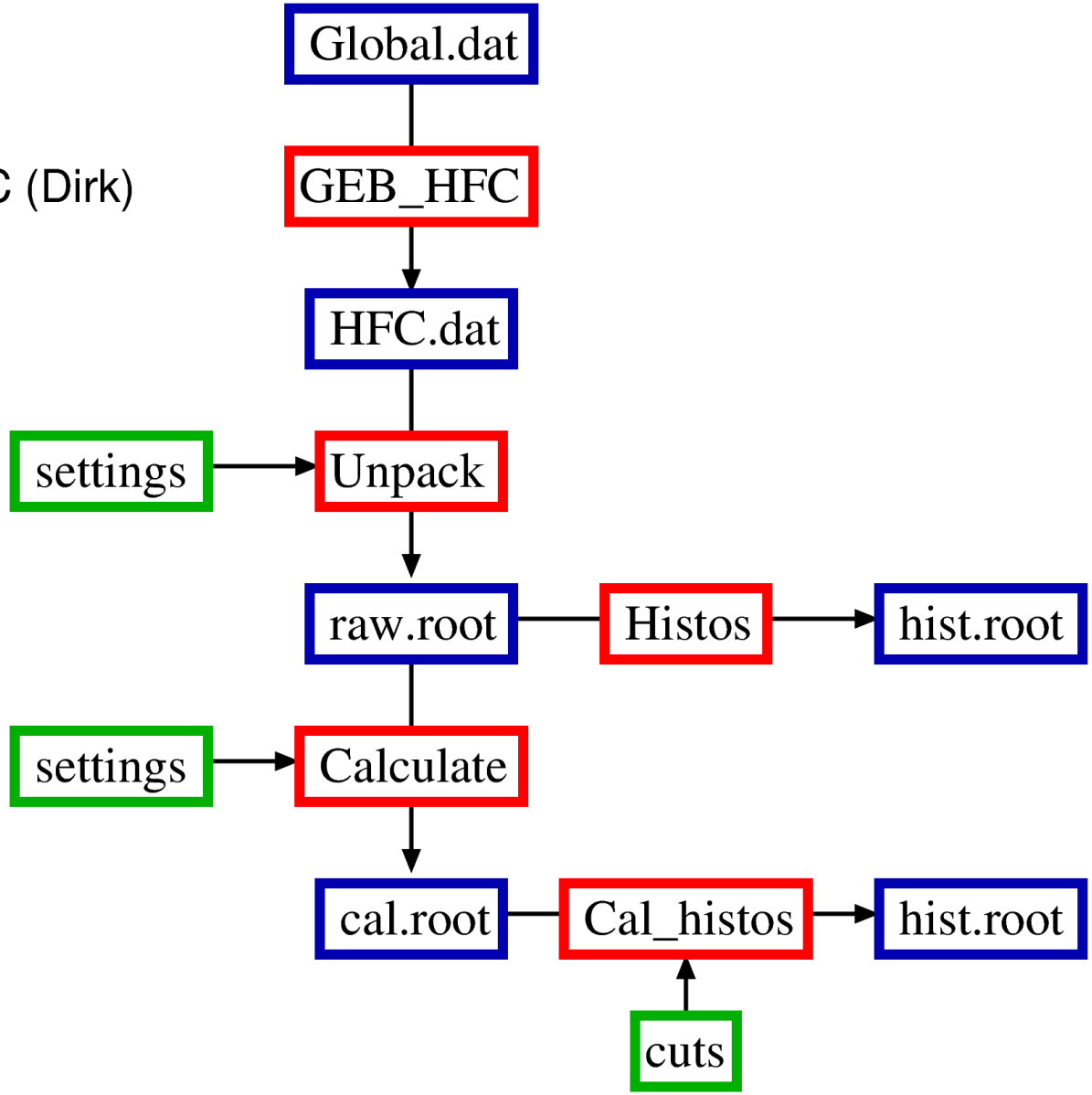
GrROOT

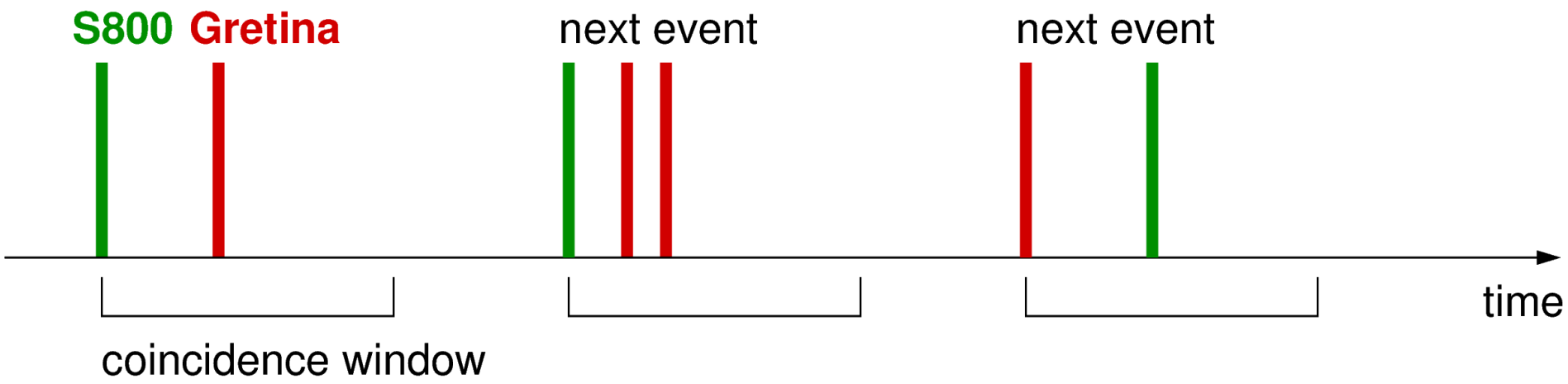
- ROOT analysis framework for S800 and Gretina
- based on my S800 + anything software
- object oriented:
  Gretina class inherits from TObject, and this object is written to the tree
- download at: www.nscl.msu.edu/~wimmer (email me for password)

General analysis procedure

- time stamp sorting: GEB_HFC (Dirk)
- unpacking and eventbuilding
- calibration and reconstruction
- gating and histogramming

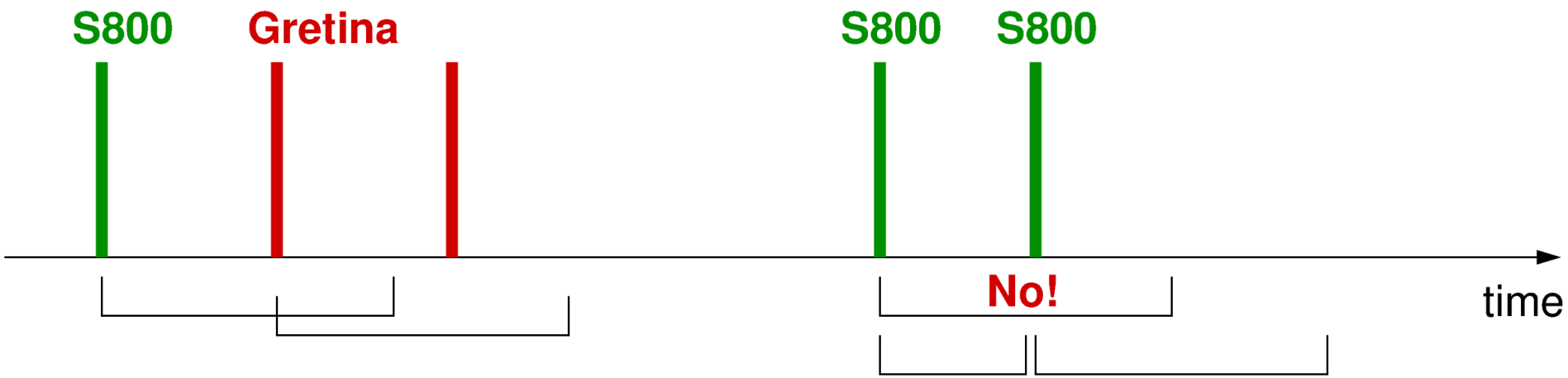


Event-building



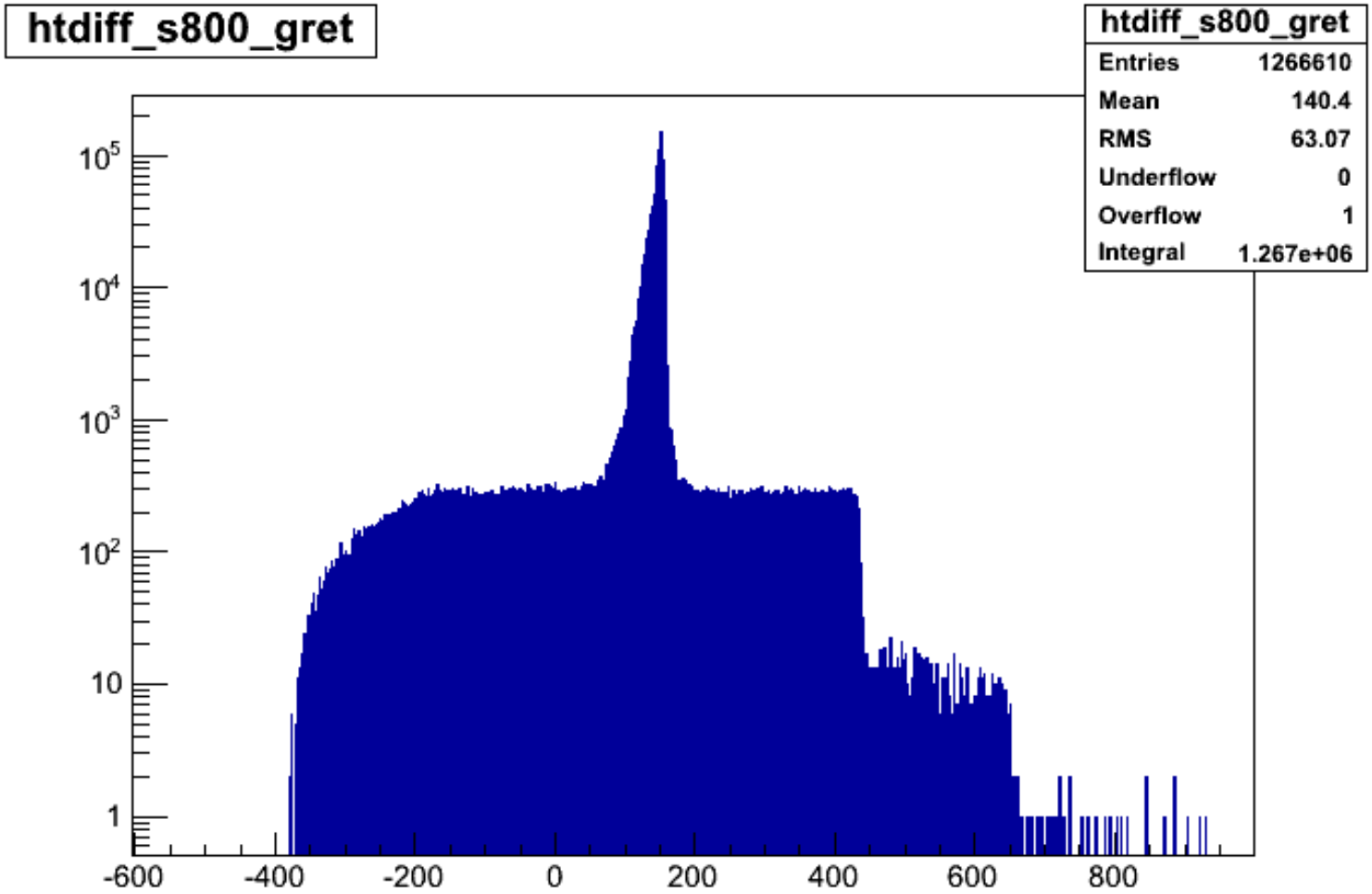
- check whether events are time-ordered
  otherwise warning is displayed
- user defines the length of the coincidence window
- either S800 or Gretina start an event window

Event-building, special cases



- Gretina hits extend the coincidence window
- two S800 events in coincidence: not possible
- second S800 automatically closes the event

Event-building, time difference



- real coincidences
- random background

Unpacking

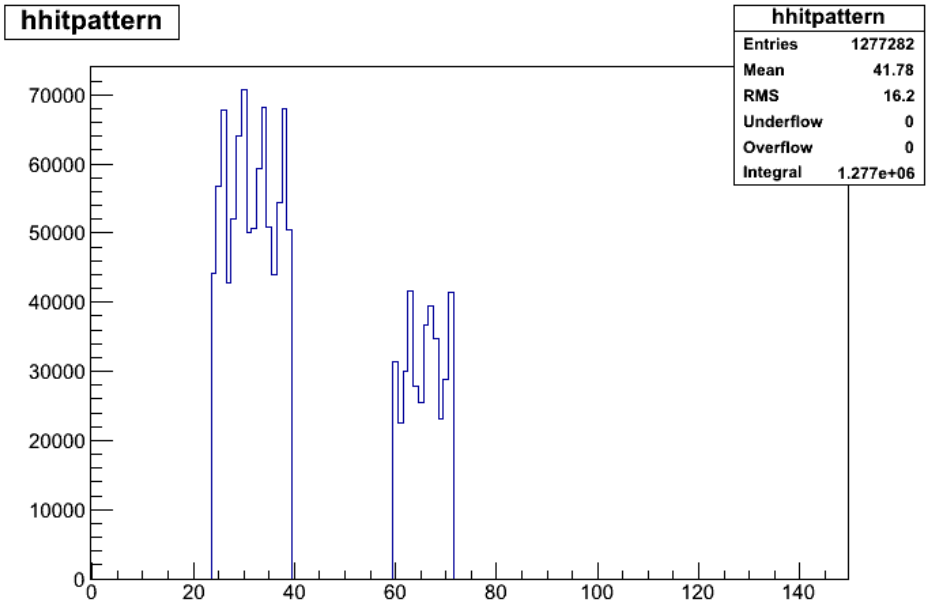
- raw data, no calibrations are performed
- events are stored in a ROOT TTree
- three branches
  - S800
  - Mode3Event (includes S800 timing card29)
  - Gretina (Mode2 data)
- S800 derives from TObject, contains sub-detector systems
- user interacts through setter and getter methods

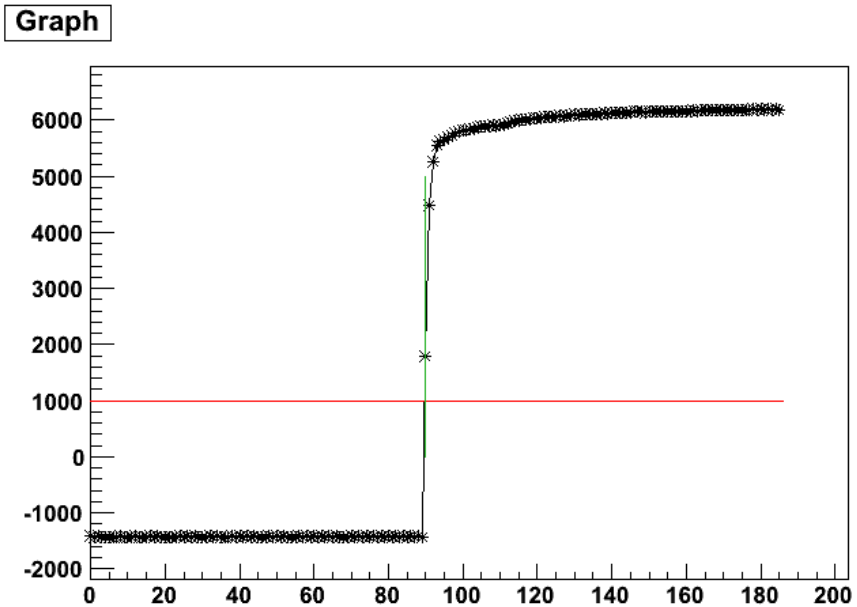
```
s800->GetTS();
s800->GetTimeOfFlight()->GetOBJ();
s800->GetCrdc(0)->GetAnode();
gretina->GetHitPattern();
gretina->GetHit(2)->GetMaxEn();
gretina->GetHit(0)->GetIPoint(7)->GetEnergy();
mode3->GetMult();
mode3->GetHit(1)->GetTS();
mode3->GetHit(0)->GetCoreTrace()->GetBoard();
```

Unpacking

raw data can be displayed

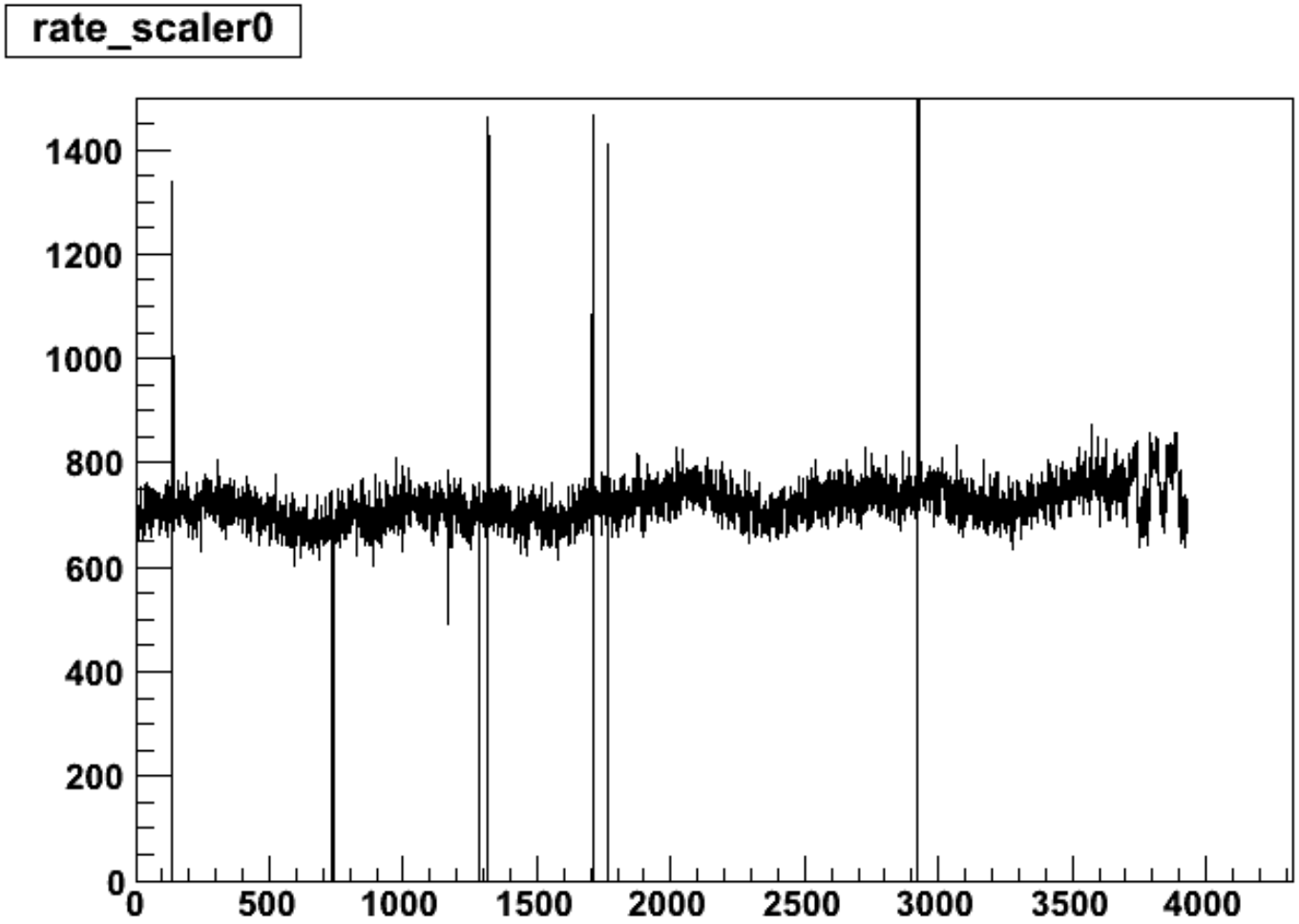
- in histograms (program “Histos”) for debugging purposes
- script “ViewTrace.C” to look at signals (Mode3 or S800/card29)





Scalers

- additional tree for the scaler data
- program “ScalerAnalysis” to calculate and display rates



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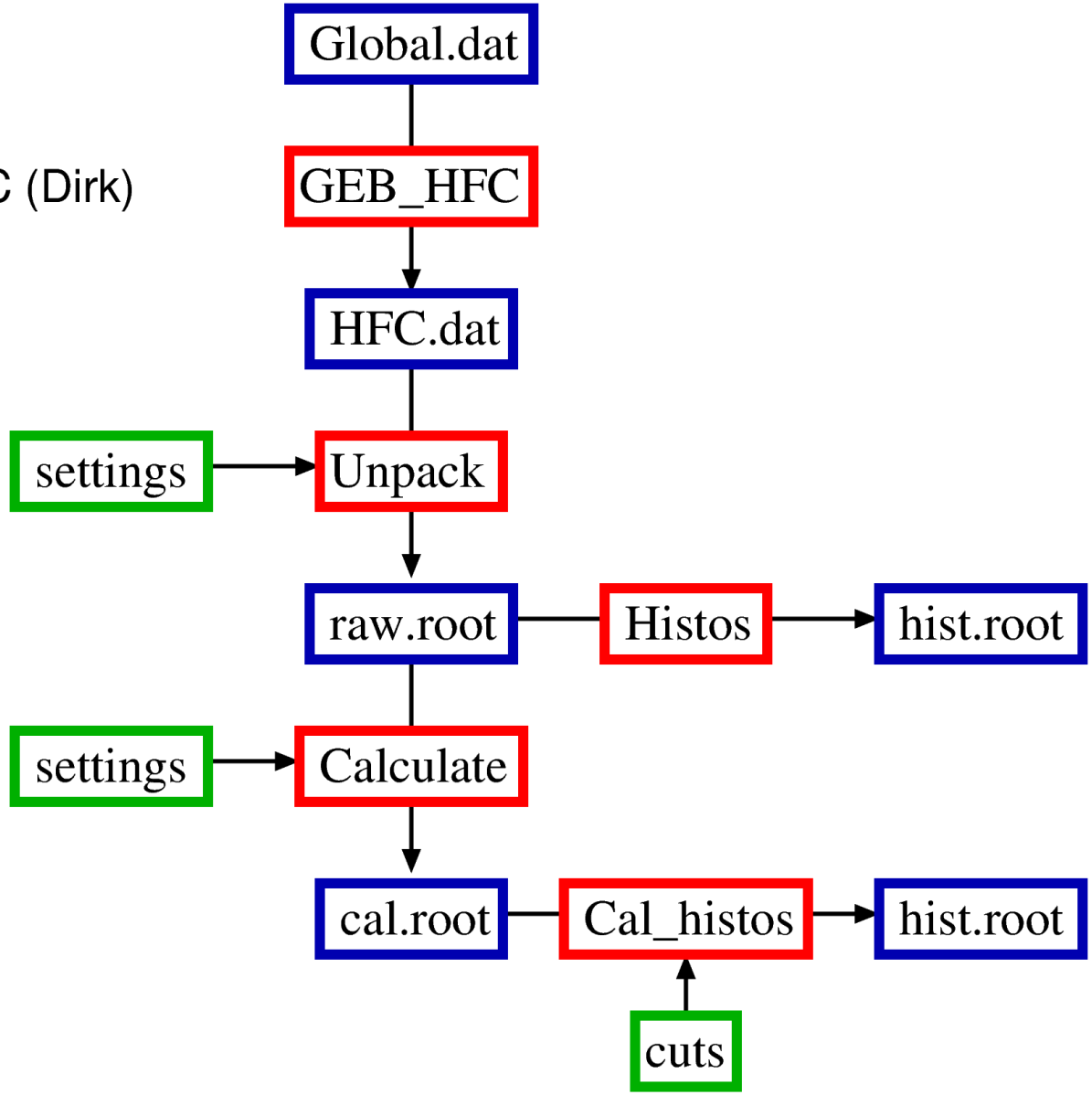
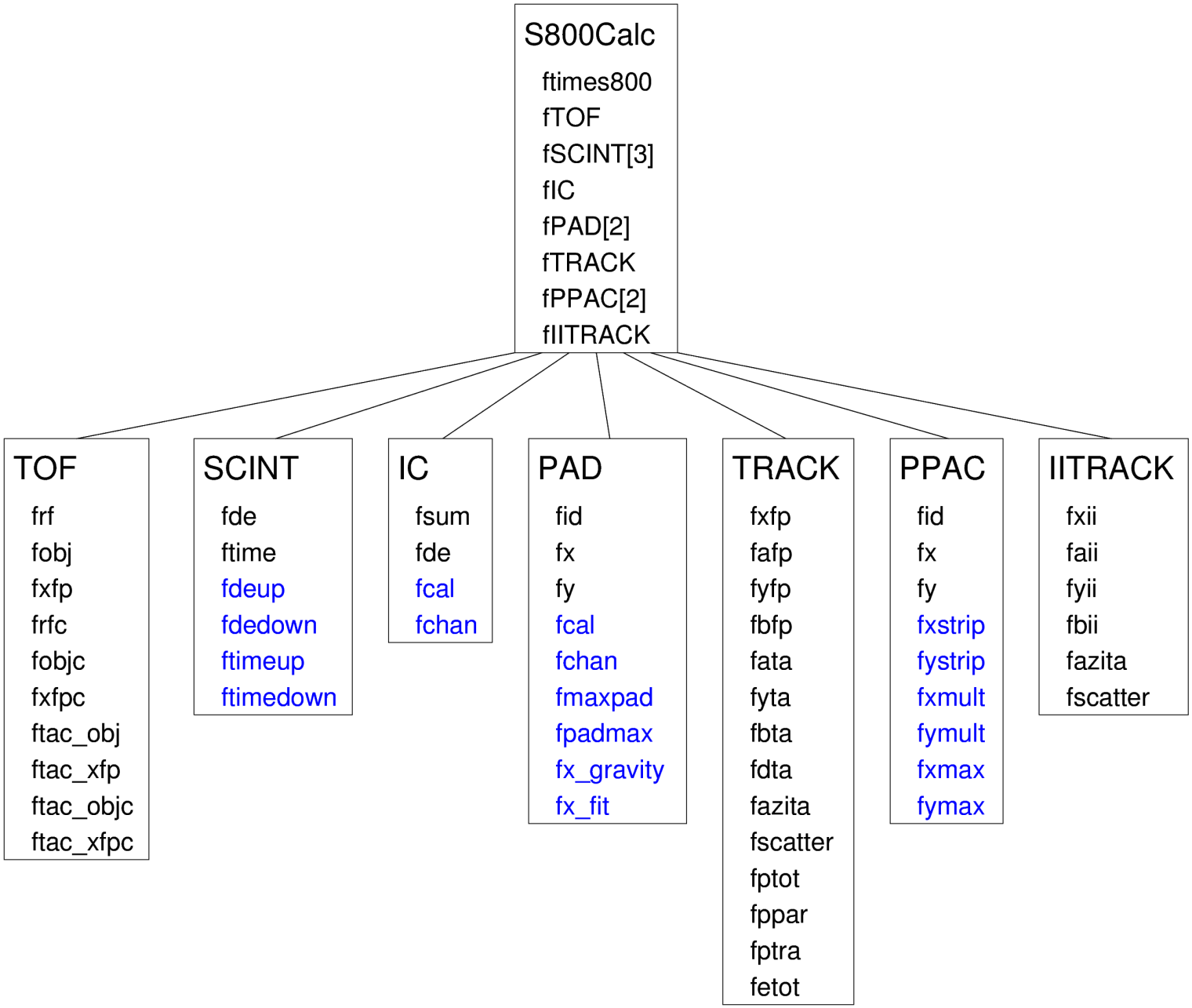


Calibration

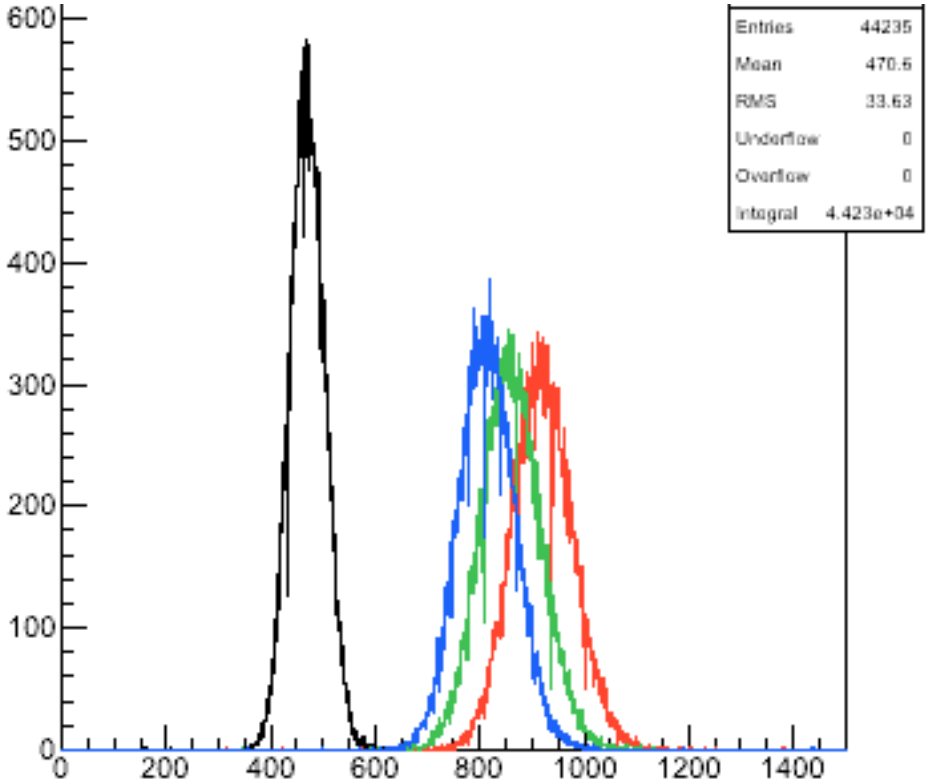
- the average user will probably jump directly into the calibration step
- program “Calculate”:
  - takes raw data from an input tree
  - works on it:
    calibration
    reconstruction (inverse map)
    add-back, tracking
  - creates new objects: S800Calc, GretinaCalc, Mode3Calc
  - and stores them in a new output tree
- all settings, calibration and correction parameters are in a settings file
- we provide tools, scripts and programs to generate parameters for all detector sub-systems

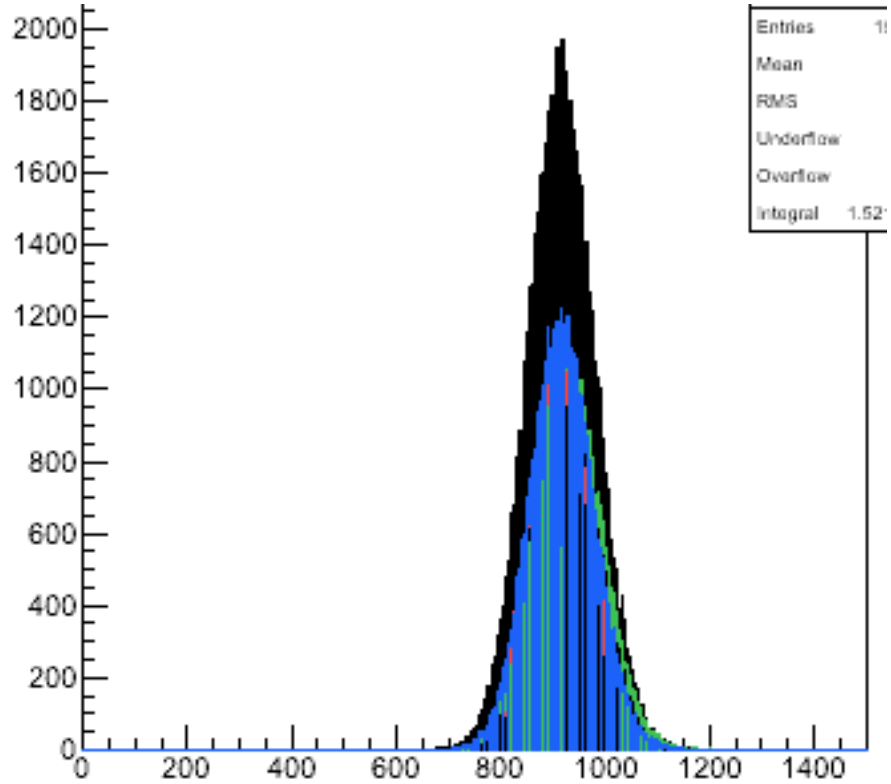
Example: the S800Calc class



Calibration: first steps

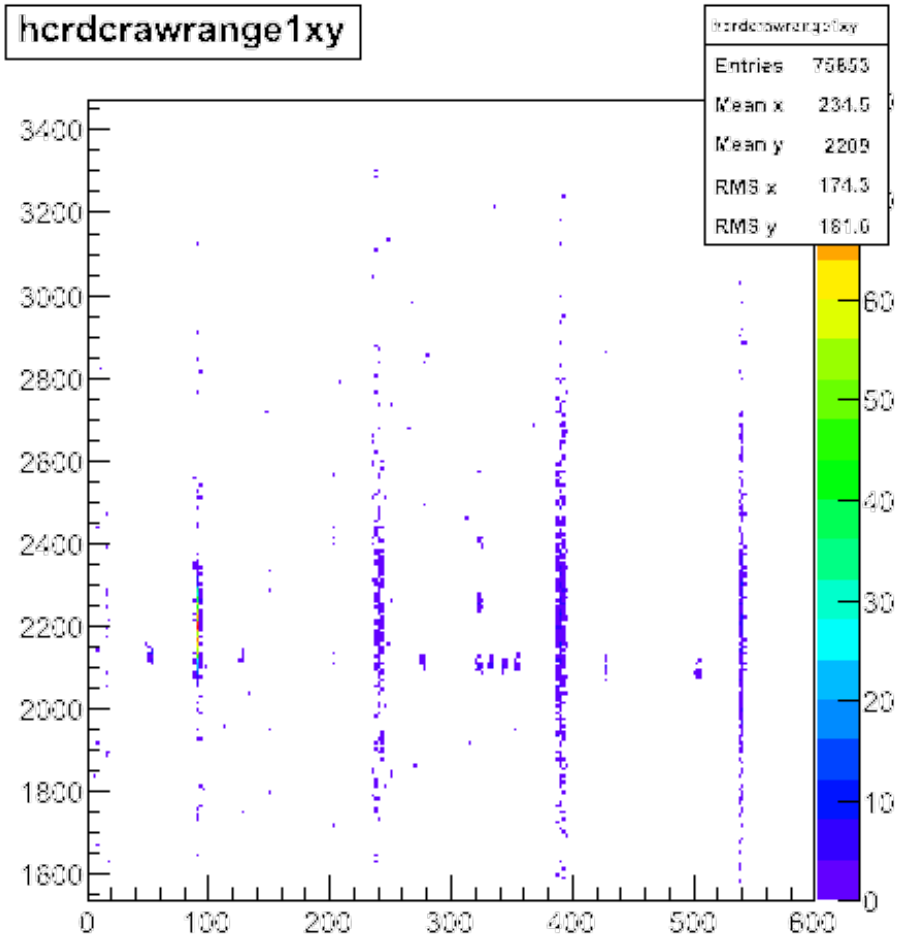
- gain matching for CRDCs and ion chamber channels
- gate on different elements using a rough PID
- programs “ICCal” and “PadCal” to match the gains

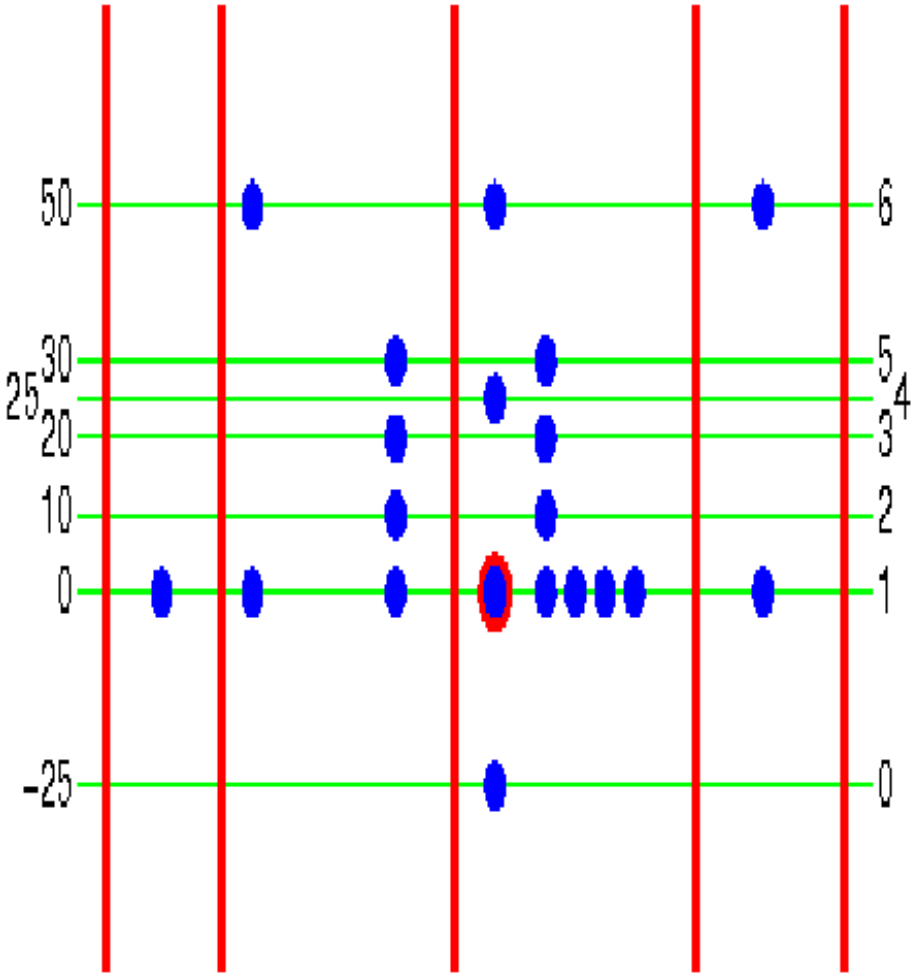




CRDC mask calibration

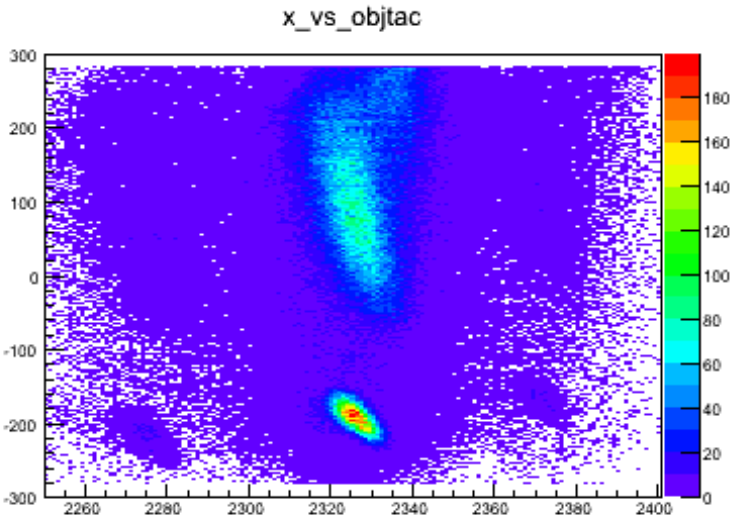
- script “mask.C”
- calibrate by clicking!

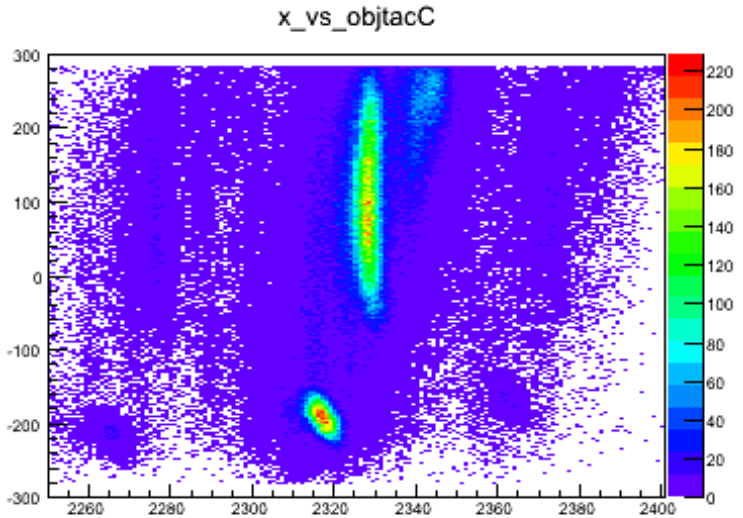


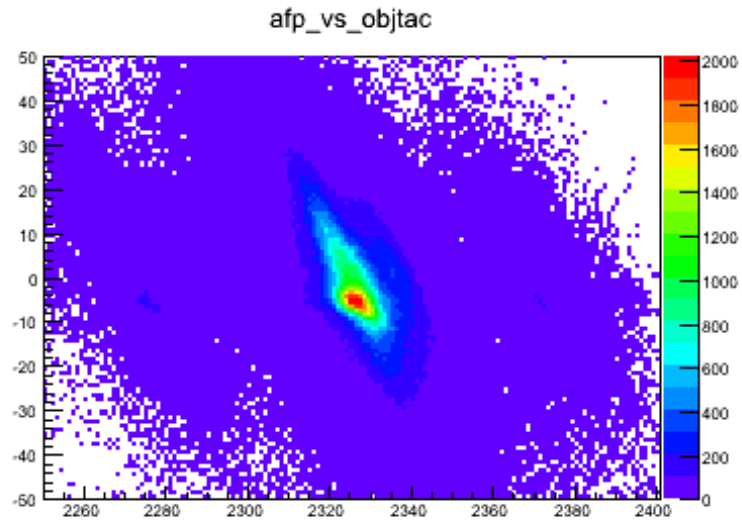


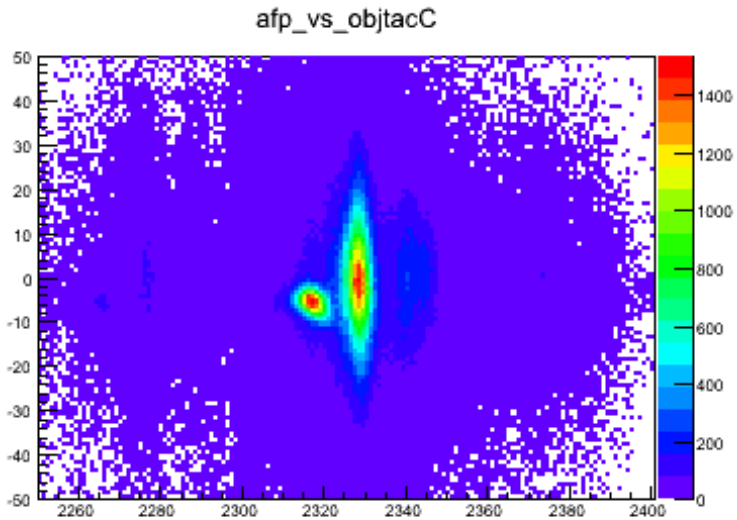
time-of-flight corrections

- “rotating” in position vs time plane,
- fast way: guess parameters
- script for fitting the resulting TOF peak-width, optimized parameters



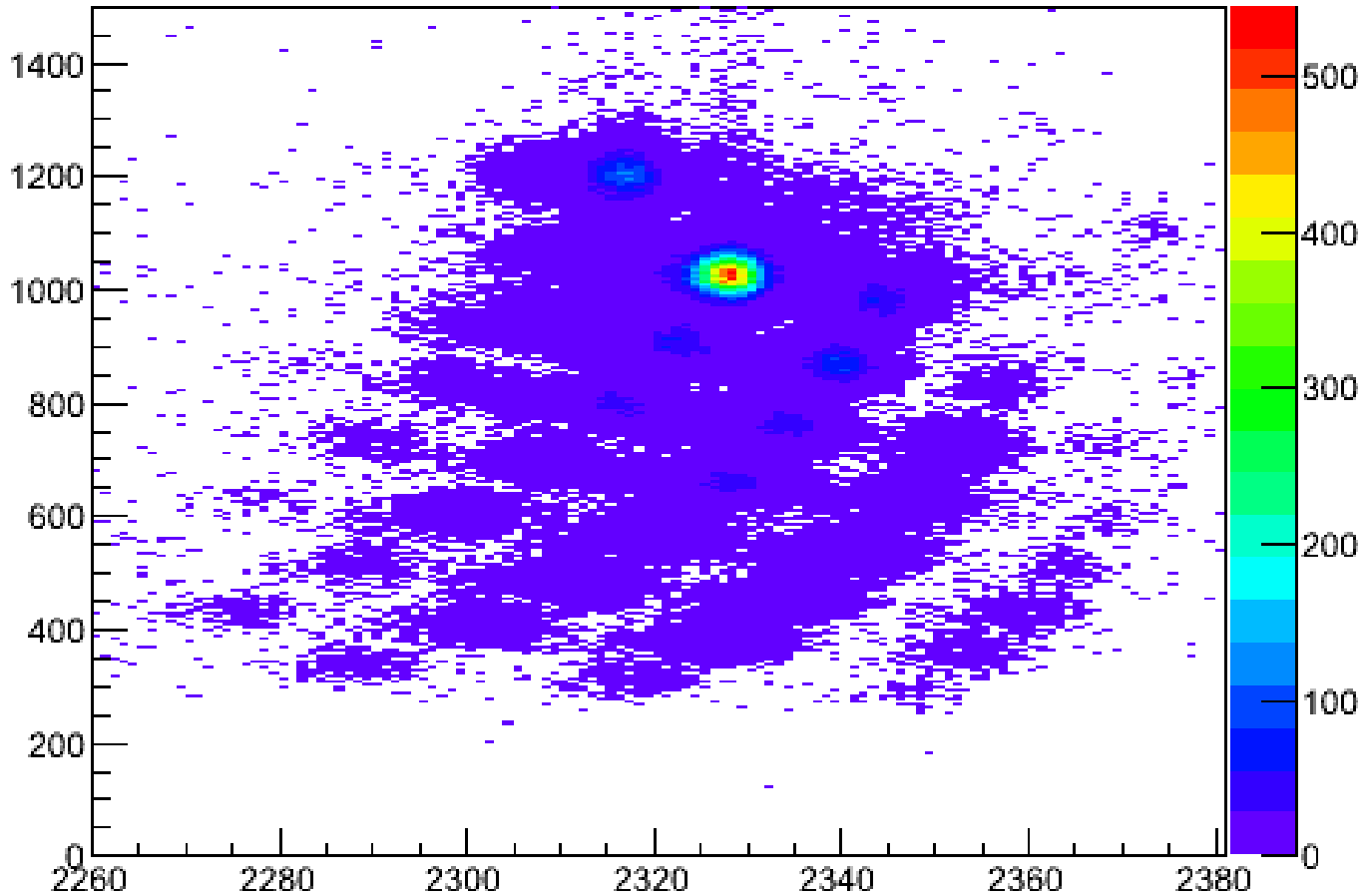






Final PID

- all calibrations and corrections done $\rightarrow$ final PID
- script “makeCuts.C”: draw your cuts and save them



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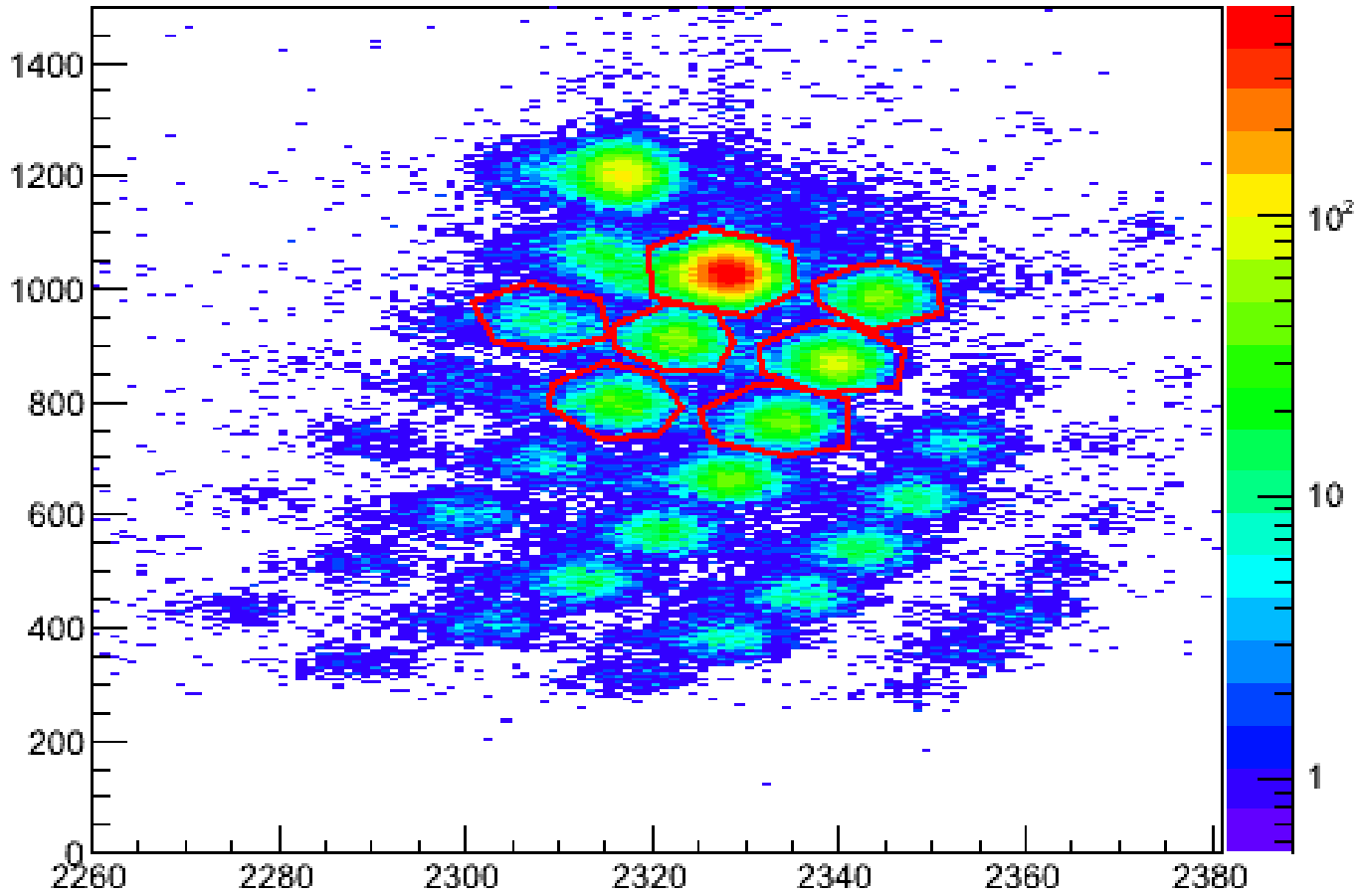
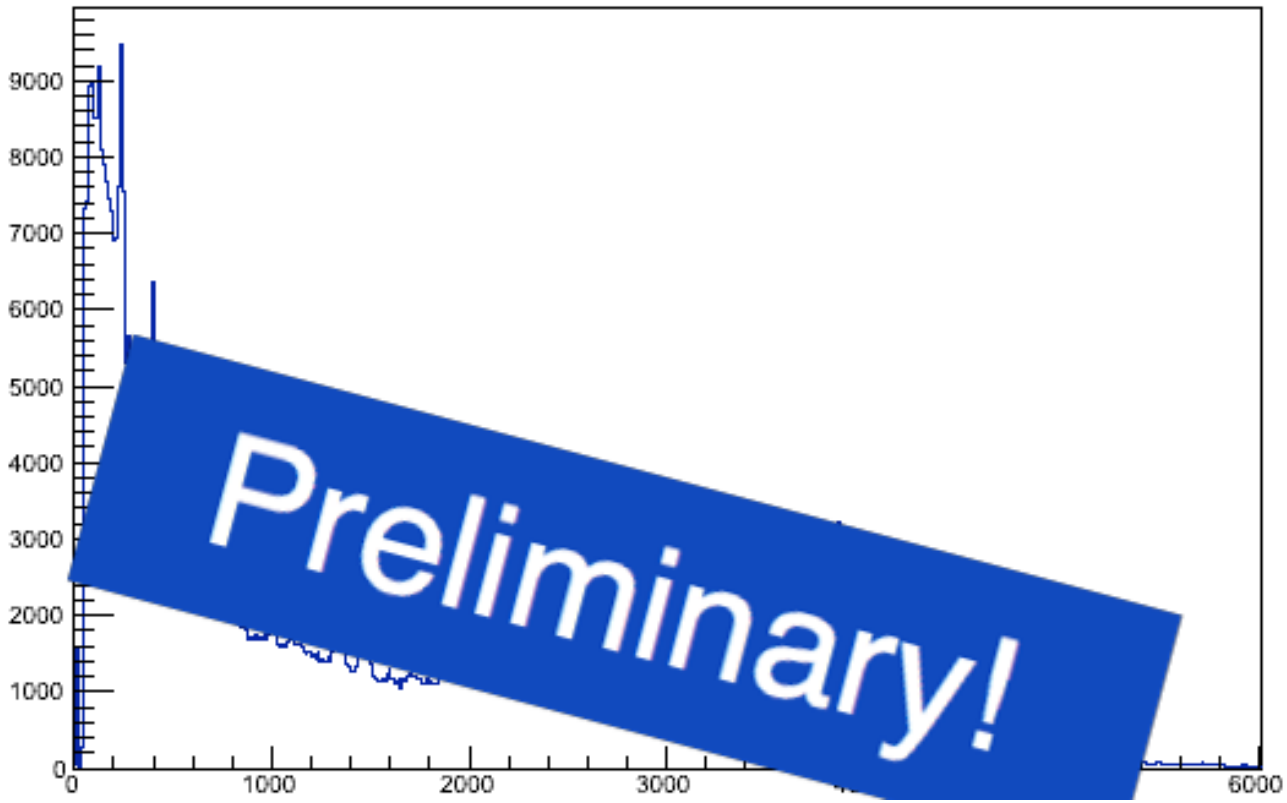


Gammas

mode2 data is stored as a vector of hits

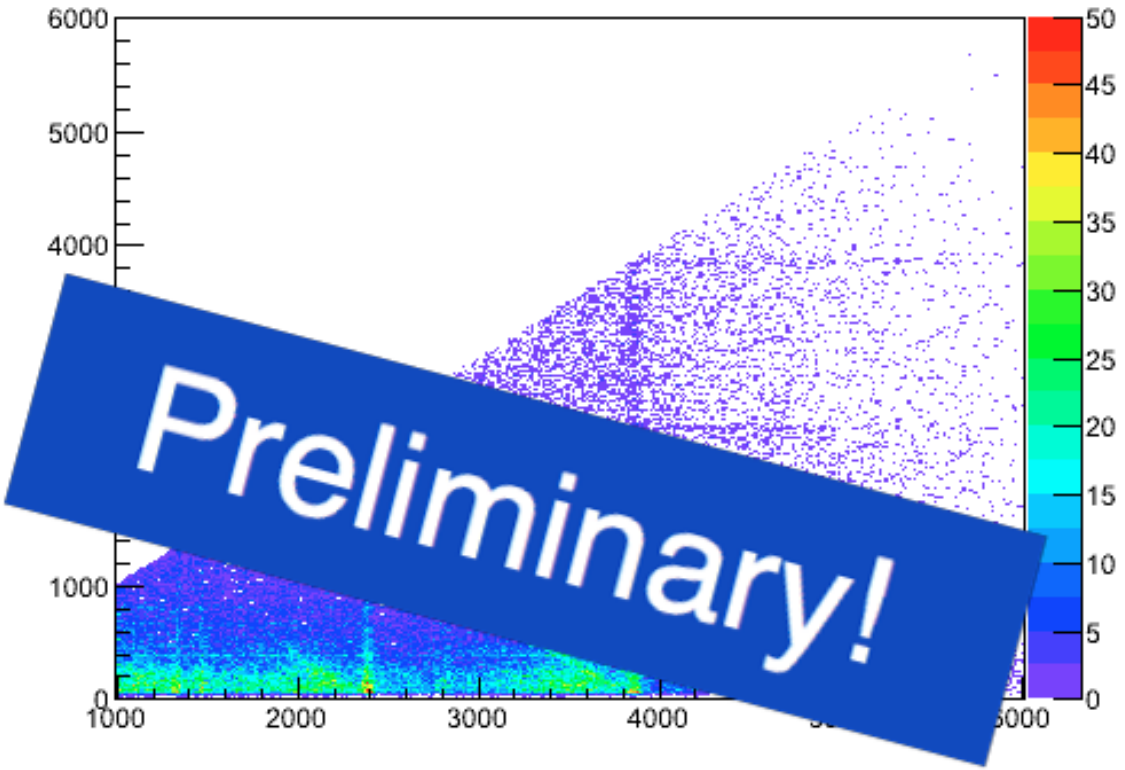
mode3 data is supported, for debugging purposes

- add-back: nearest neighbours are added
- Doppler correction takes the interaction point with the highest energy as first interaction
- S800 information can be used for Doppler correction:
  angles and beta (needs inverse map https://groups.nscl.msu.edu/s800/)



Coincidences

- gates and projections



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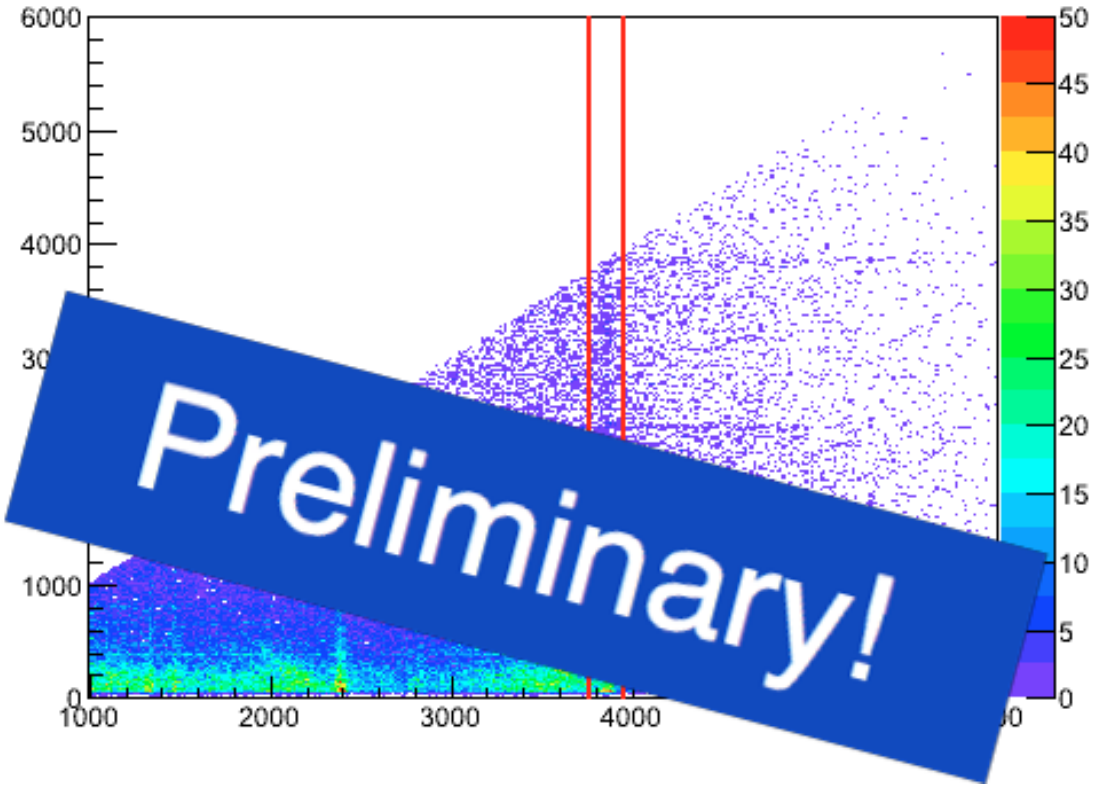

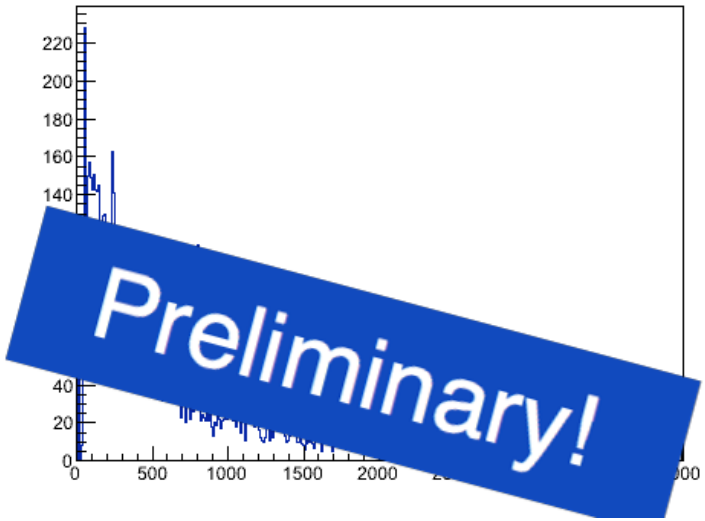

Adding your own histograms

- class CalHistograms
- in CalHistograms::FillHistograms(GretinaCalc* gr, S800Calc* s800, Mode3Calc* m3c)
  add a line like:
  Fill(string name,int bins, double low, double high, double value)

GrROOT

- GrROOT is under continuous development
- next steps:
  - tracking
  - “filter” files
- download at: www.nscl.msu.edu/~wimmer (email me for password)
- reference guide and documentation online
- suggestions are welcome!

This code includes inspirations from: Antoine, Daniel, Dirk, Heather, Mario, Scott, Ron.