

GrROOT: S800 and Gretina offline analysis

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- 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)

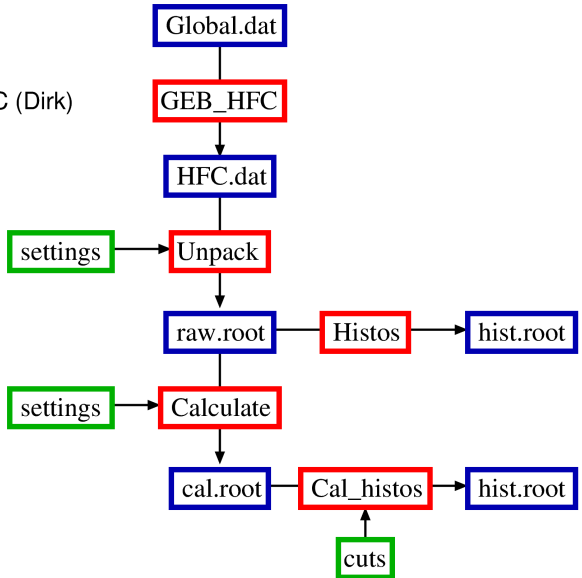
General analysis procedure

- time stamp sorting: GEB_HFC (Dirk)

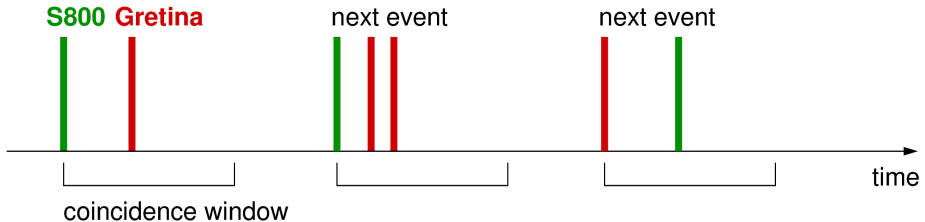
- unpacking and eventbuilding

- calibration and reconstruction

- gating and histogramming

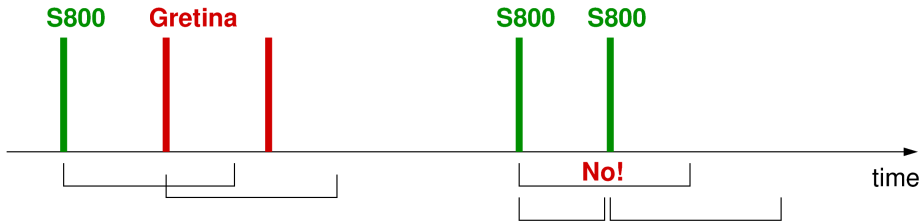


Event-building



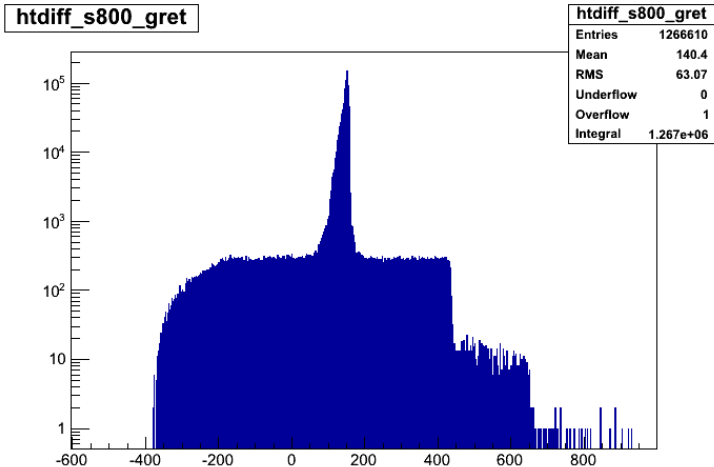
- check whether events are time-ordered
otherwise warning is displayed
- user defines the length of the coincidence window
- either S800 or Gretina start an event window

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();
```

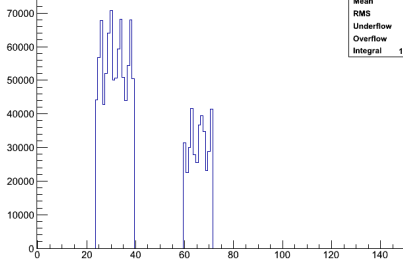
```
mode3->GetHit(0)->GetCoreTrace()->GetBoard();
```

Unpacking

raw data can be displayed

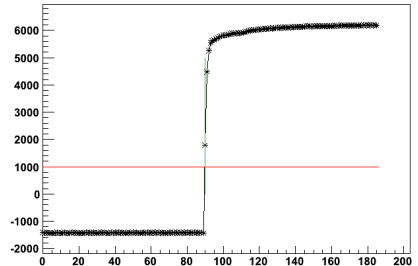
- in histograms (program “Histos”) for debugging purposes
- script “ViewTrace.C” to look at signals (Mode3 or S800/card29)

hhitpattern



hhitpattern	
Entries	1277282
Mean	41.78
RMS	16.2
Underflow	0
Overflow	0
Integral	1.277e+06

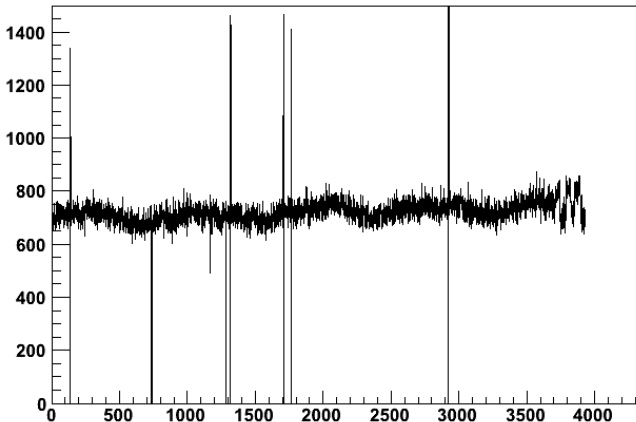
Graph



Scalers

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

rate_scaler0



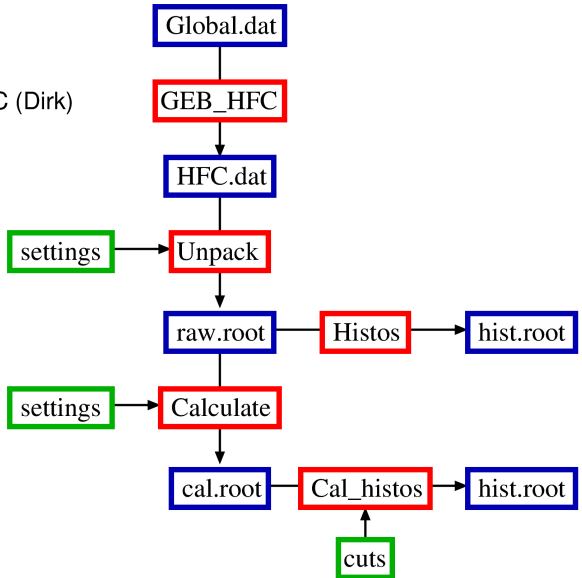
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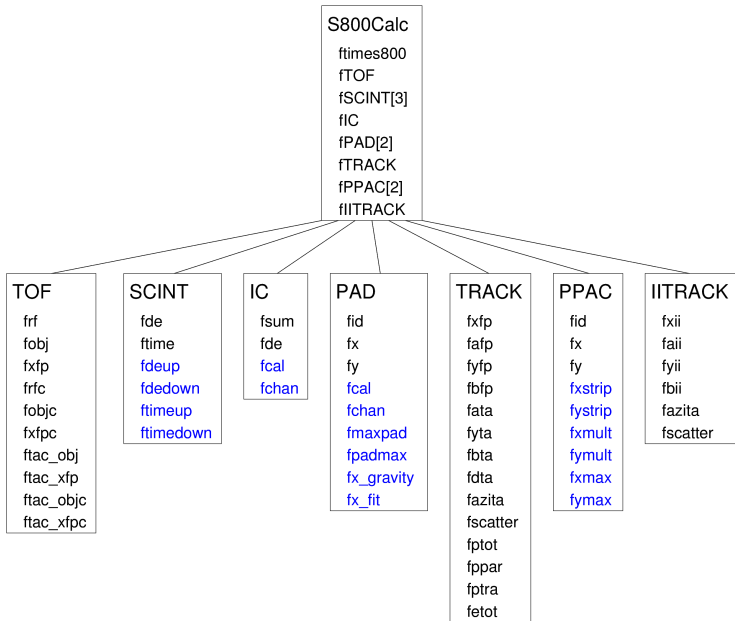
- calibration and reconstruction

- gating and histogramming



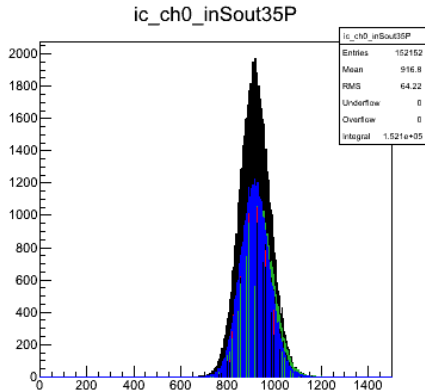
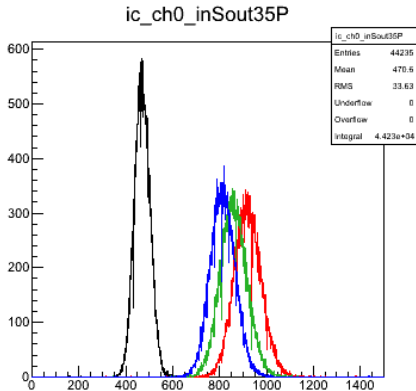
- the average user will probably jump directly into the calibration step
- program “Calculate”:
 - takes raw data from an input tree
 - works on it:
 - calibration
 - reconstruction (inverse map)
 - add-back, tracking
 - creates new objects: S800Calc, GretinaCalc, Mode3Calc
 - and stores them in a new 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

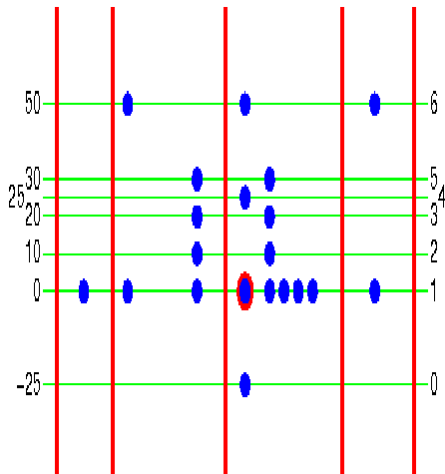
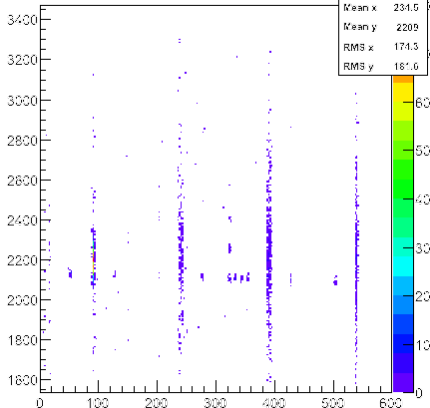
- gain matching for CRDCs and ion chamber channels
- gate on different elements using a rough PID
- programs “ICCal” and “PadCal” to match the gains



CRDC mask calibration

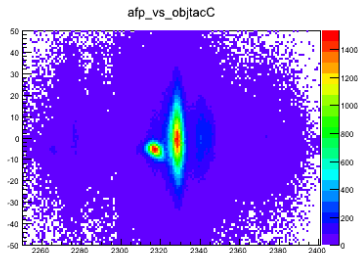
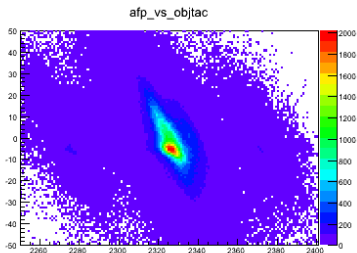
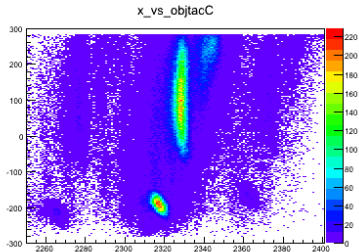
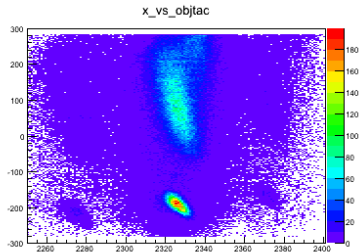
- script "mask.C"
- calibrate by clicking!

hrcdcrawrange1xy



time-of-flight corrections

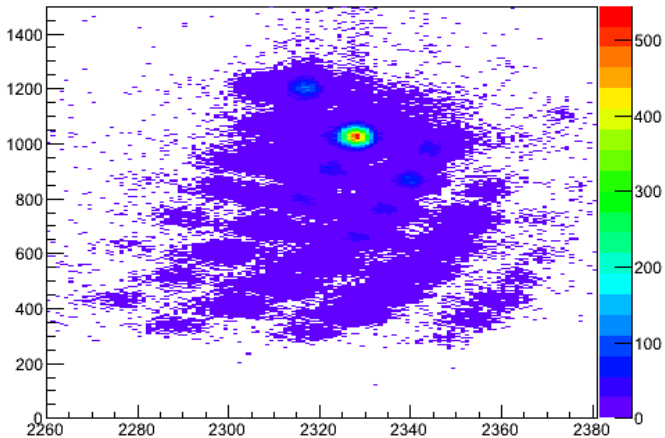
- “rotating” in position vs time plane,
- fast way: guess parameters
- script for fitting the resulting TOF peak-width, optimized parameters



Final PID

- all calibrations and corrections done → final PID
- script "makeCuts.C": draw your cuts and save them

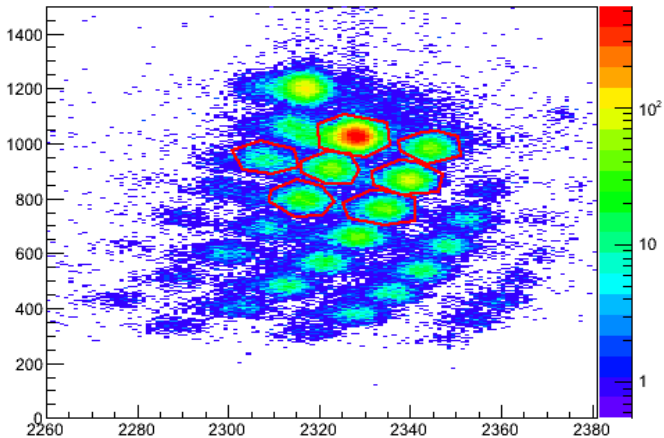
ICde_vs_objtacc_inS



Final PID

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ICde_vs_objtacc_inS

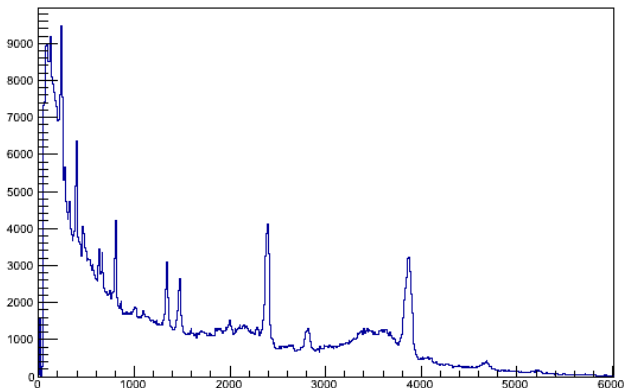


Gammas

mode2 data is stored as a vector of hits

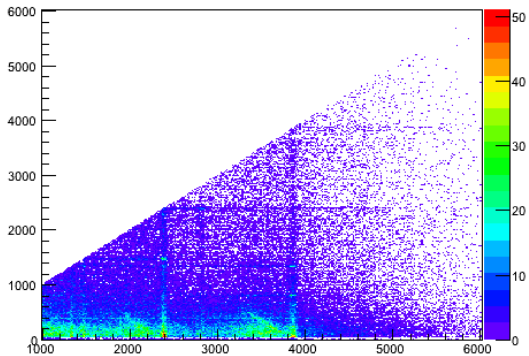
mode3 data is supported, for debugging purposes

- 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.nslc.msu.edu/s800/>)



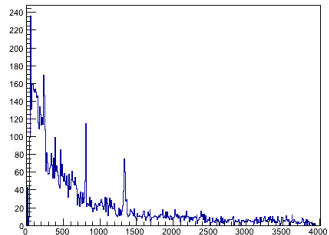
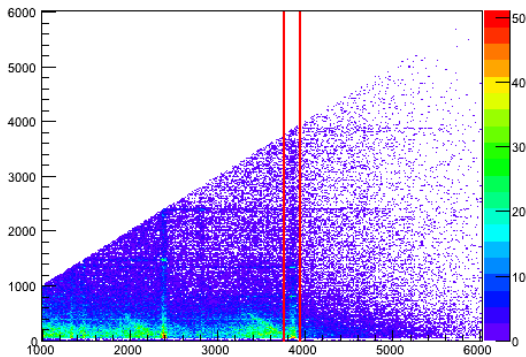
Coincidences

- gates and projections



Coincidences

■ gates and projections



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 is under continuous development
- next steps:
 - tracking
 - “filter” files
- download at: www.nslc.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.