TASCA Go4 Analysis

OpenOffice document tascaGo4intro.odt (H.Essel, 26. June 2009) SVN rev. 307

Setups

Set up account

The tasca account should be customized for more convenience. One should define a variable for the repository path:

```
export SVN=https://subversion:443/goofy/go4/applications/tasca
```

To create a new working copy of the repository, create a directory and

```
mkdir myws
svn checkout $SVN myws
cd myws
svn info
```

Then one can use svn commands like

```
svn list $SVN
```

to get a listing of the subversion repository. Some useful alias:

```
svndiff='svn diff --diff-cmd /usr/bin/diff -x "-EwbB" '
svndiffl='svn diff --diff-cmd /usr/bin/diff -x "-qEwbB" '
```

On a workspace directory these give a list of files different from repository (second line file list only).
Above has been added to .bashrc file (HE). Other useful alias can be defined here.

Set up working directory

Once the directory is made an svn working directory (by checking out a repository to it) there are few commands to deal with the repository:

svn info
: show the repository the workspace belongs to

svn list $SVN
: list of repository

svn update
: update workspace from repository

svn commit -m “enter here comment” [file]
: copies all changed files to repository. If a file is specified, only this file is copied (if modified).

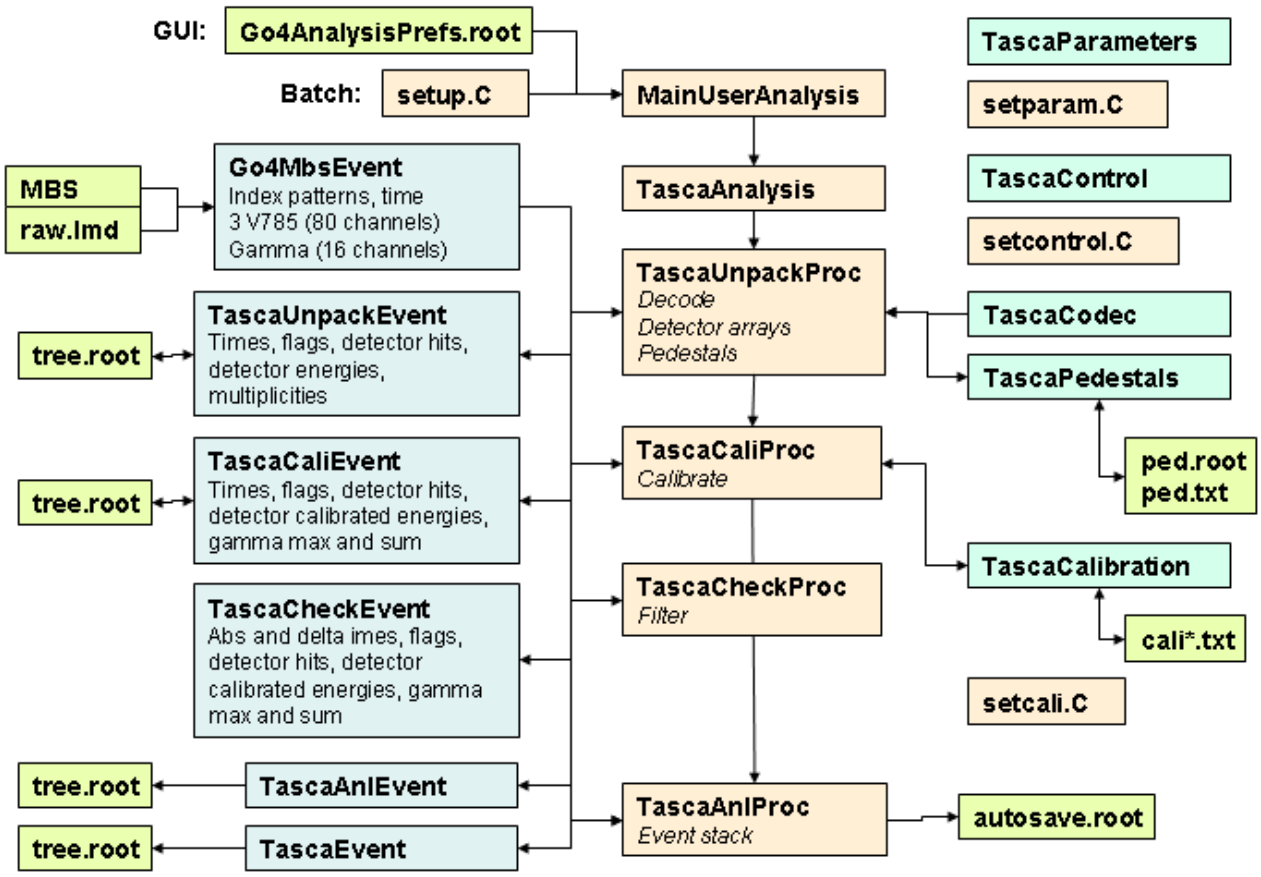
After login

Setup everything for Go4 (**now already done in .bashrc**)

```
. go4login 402-00
```

```
. lealogin
```

(Note the space behind the dot.)



Go4 analysis steps

The Go4 analysis

To build the Tasca analysis, simply:

make

The executable made is

MainUserAnalysis

It can be called from shell or is started from GUI. In principle it does the same in both cases.

Batch mode

The analysis is steered by a ROOT macro file setup.C. You can edit this file before running the analysis. There are the following lines:

```
TString unpackProcess("yes");
TString unpackStore("no");
TString unpackOverWrite("yes");

TString caliProcess("yes");
TString caliStore("no");
TString caliOverWrite("yes");

TString checkProcess("yes");
TString checkStore("no");
TString checkOverWrite("yes");

TString analysisProcess("yes");
TString analysisStore("no");
TString analysisOverWrite("yes");

TString autosave("yes");
Int_t autosaveinterval=0; // after n seconds, 0 = at termination of event loop
```

Examples:

MainUserAnalysis -f file.lmd
MainUserAnalysis -f @file.lml

processes file or list of files. respectively.

MainUserAnalysis -t r4-4 10000

connects to MBS transport node R4-4 and processes 10000 events.

Usually in batch mode one either writes an auto-save file (containing all histograms, parameters, etc.), and/or any event file. The auto-save file name and the event file names are prefixed by the input file or node name

b_r4-4_AS.root, b_r4-4_Unpacked.root, b_r4-4_Calibrated.root, b_r4-4_Checked.root, b_r4-4_Analysis.root

The b_ is added in batch mode only. Any of these can be opened by ROOT or in the GUI. To process these in batch:

MainUserAnalysis -f r4-4

The pre and postfixes are added automatically.

To process files from a data directory, the variable

export TASCASTORE=/data.local3/x/x/x

must be set. Then all files are read and stored from/to it. Currently no files can be stored on a directory different from the source directory.

Interactive mode

In interactive mode the analysis is started by the GUI. In this case, the file name prefix is the analysis name specified in the Start Client panel. This name is saved by Save Settings. In addition the prefix b_ is changed to i_. Further setup is

specified in the configuration panel coming up after starting the analysis. Default settings are the ones from setup.C. This setup can be modified interactively and can be stored (NOTE: after Submit!) in

Go4AnalysisPrefs.root

from where it is retrieved next time the analysis is started. If this file is present, the settings from setup.C are overwritten.

The analysis steps

The analysis is divided into four steps as shown in the figure.

Unpacker step

Input: LMD file or MBS (transport, stream server, event server)

Output: ROOT tree with values of all detector channels and detector hit lists. Details in TascaUnpackEvent.h

Autosave: Controls, Parameters, Pedestals and Codec
Histograms in directory Unpack: Adc_nn GammaE_n GammaT_n Pedestals Contents AdcAllRaw AdcAllCal TraceRaw_nn TraceE_nn Hist_nn Pileup_nn

Processing: TascaUnpackProc constructor creates the parameters, histograms and pictures. Method *TascaUnpack* uses parameter class TascaCodec to decode Adc values, gamma values, and fills the data fields of TascaUnpackEvent. TascaCodec also contains the mapping tables for the multiplexed channels.

Calibrator step

Input: TascaUnpackEvent (from Unpack step or from file)

Output: ROOT tree with calibrated values of all detector channels and gammas. Hit indices of all detectors and their values.
Details in TascaCaliEvent.h

Autosave: Controls, Parameters, Calibration, CaliFitter
Histograms in directory Cali: All detector channels, gamma channels, Sum of detector channels.

Processing: Filling histograms and TascaCaliEvent data fields.

Checker step

Input: TascaCaliEvent (from Unpack step or from file)

Output: ROOT tree with calibrated hits. Hit indices of all detectors and their values.
Condition filters: EvrH, AlphaL, Alpha1L, Alpha2L, Fission1H, Fission2H, BackH
Limits set in setparam.C
Details in TascaCheckEvent.h

Histograms in directory Check: 2d histograms of stop detector (Energy-Xstripe) for each Ystripe.
Autosave: Controls, Parameter

Processing: Filling histograms and TascaCheckEvent data fields.

Analysis step

Input: TascaCheckEvent (from Checker step or from file)

Output: ROOT tree with data from TascaAnlEvent.h (currently none) or TascaEvent.h

Autosave: Creates parameters Controls, Parameters
Processing: Looking for chains, Create plain ROOT tree from TascaEvent

Control files

There are some ROOT macro files to setup several parameter values.

setcontrol.C : Lines to change:

```
  fControl->writeChainTree =kTRUE; // used by Analyzer
  //fControl->ChainCounter =0; // used by Analyzer. Without Autosave: will be 0
  fControl->UnpackHisto  =kFALSE; // used by Unpacker
  fControl->CaliHisto    =kFALSE; // used by Calibrator
  fControl->CheckHisto   =kFALSE; // used by Checker
  fControl->AnlHisto     =kFALSE; // used by Analysis
  fControl->checkTof     =kFALSE; // used by unpacker
  fControl->checkChopper =kFALSE; // used by unpacker
  fControl->checkMacro   =kFALSE; // used by unpacker
  fControl->checkMicro   =kFALSE; // used by unpacker
  fControl->TofMustbe    =kTRUE;  // used by unpacker
  fControl->ChopperMustbe=kTRUE;  // used by unpacker
  fControl->MacroMustbe  =kFALSE; // used by unpacker
  fControl->MicroMustbe  =kFALSE; // used by unpacker
```

setparam.C : Lines to change:

```
// Used by Checker
// Energy windows MeV
       Float_t EvrHmin     = 4.000,  EvrHmax     = 15.000;
       Float_t Alpha0Lmin  = 9.800,  Alpha0Lmax  = 10.200;
       Float_t Alpha1Lmin  = 9.700,  Alpha1Lmax  = 10.100;
       Float_t Alpha2Lmin  = 8.970,  Alpha2Lmax  =  9.3700;
       Float_t Fission1Hmin=60.000,  Fission1Hmax=220.0000;
       Float_t Fission2Hmin=60.000,  Fission2Hmax=220.0000;
       Float_t BackHmin    =10.000,  BackHmax    = 80.000;
// Time windows sec
       Float_t fAlphaTmin   =0.,     fAlphaTmax   =900.;
       Float_t fAlpha1Tmin  =0.,     fAlpha1Tmax  = 20.;
       Float_t fAlpha2Tmin  =0.,     fAlpha2Tmax  =180.;
       Float_t fFission1Tmin=0.,     fFission1Tmax=900.;
       Float_t fFission2Tmin=0.,     fFission2Tmax= 70.;
...
       fp->shift=5;               // Unpacker gamma decoder for energies
       fp->Adc80TofMin=300;       // signals Tof (instead of TOF register)
       fp->AdcThreshold=100;      // Unpacker uses this is minimum raw value
       fp->EventStackSize=100000; // used in Analysis
       fp->AlphaMaxL=16000.;      // Calibrator take low value up to this limit. Above
       fp->AlphaMaxH=30000.;      // take high value up to this limit as low
       fp->AlphaMinL=1000.;       // Unpacker raw minimum value for alpha
       fp->AlphaMinH=1000.;       // Unpacker raw minimum value for alpha
```

setcali.C steers the calibration:

```
  fCalibration->EnableCalibration(kTRUE);   // use calibration or not
  fCalibration->SetPrefix("cali2");         // prefix for coefficient files
```

Processing LMD files

To process several LMD files at once and store the results in one root file, one must create a text file with extension .lml and specify this file preceded by an @ instead of the LMD filename. The runbatch.sh script does that on the fly (see below). File names are t018fRRRFFFF.lmd, where RRR is the run number, FFFF the file number.

Example t018f0790.lml

```
/data.local1/tasca/t018f0790381.lmd
/data.local1/tasca/t018f0790382.lmd
/data.local1/tasca/t018f0790383.lmd
/data.local1/tasca/t018f0790384.lmd
/data.local1/tasca/t018f0790385.lmd
/data.local1/tasca/t018f0790386.lmd
/data.local1/tasca/t018f0790387.lmd
/data.local1/tasca/t018f0790388.lmd
/data.local1/tasca/t018f0790389.lmd
```

I recommend to process in batch mode Unpacker and Calibration steps from one file set into one root file. Then run Checker from this root file. Append output of all inputs (output files from one file set of 4 GB are few 10 MB). Resulting ROOT file can be fast scanned by Analysis step.

It might be necessary to find events by event number in LMD files. For this purpose in each event the run and file number is stored (Run is high two bytes, file number low two bytes). In the ROOT files these events can be found easily via macros like filter...C or print...C macros. If one wants to create an LMD subset,

Create the LML files by changing into LMD file directory, then:

lmlrmake t018f 3 146

This creates files t018fRRR.lml with RRR=003 to 146 containing lists of files t018fRRR*.lmd including full path.
Create the LMD directory files by command:

lmdirmake <directory of LMD files>
lmdirmake -f file

The second command processes only one file. Search for events by command:

lmdirshow <directory> [event number]
lmdirshow -f file [event number]

Again the second command checks only one file.

LMD files have been moved to directories

/d/ship01/tasca/t018/badfiles
/d/ship01/tasca/t018/backup
/d/ship01/tasca/t018/calibration
/d/ship01/tasca/t018/targettest

Because working directly from /d was incredible slow, we first copy the data to local disk, then process, and remove the LMD files (from local disk). The place for the processed ROOT files and LMDIR files is on lxg0708:

/data.local3/offlinedata
/u/tasca/GO4_offline_t018/data

second being a soft link to the first for convenience.

GO4 analysis is in directories of

/u/tasca/GO4_offline_t018

The code for the actual batch run is in checked01, data on data/stepdata/lmdir,calibrated0x,checked0x. There is also a shell script to execute:

runbatch.sh first last

First and last are numbers xxx mentioned above.

collectchecked.C(dirfile,rootfile,events)

root -b -l “collectchecked.C(\”p01.list\”,\”b_p01_Checked.root\”,0)”

copies all checked ROOT files from a container text file into one. Additional filters could be applied.

filtercheckedY.C

copies all checked ROOT files with fast filter. Similar to collectchecked.C but uses partial read. One event cane be printed by

printcheckevent.C

root -b -l “printcheckevent.C(\”b_p01_Checked.root\”,event)”

Analysis chain

1. Produce ROOT files with calibrated and checked events. All LMD files of a run go into one ROOT file.
   Adjust runbatch.sh script to the correct directories. In setup.C activate the Unpacker, Calibrator, and Checker. Activate output for Calibrator and Checker.
   time runbatch.sh 196 206 >> runbatch196-206.log
2. Collect ROOT files with checked events into phase ROOT files like phase p04:
   time root -b -l "collectchecked.C(\"t018p04-196-206.list\",\"../data/stepdata/checked03/b_p04_Checked.root\",0)"
3. Run GO4 Analysis to search for chains. In setcontrol.C parameter writeChainTree steers the production of ROOT tree file with the chains named xxx_Chains.root, where xxx is the first name part of the input tree file. In setup.C Deactivate all steps and activate Analysis.
   ./MainUserAnalysis -f p04 >> chainsSFoffp04.log
4. To get a complete printout of the data of a chain, use
   printevent.C(rootfile,chain number)
   root -b -l “printevent.C(\”b_p04_Chains.root\",23)"

Analysis results

Unpacker sets isTof when adc[80] is above Adc80TofMin (set to 300 in setparam.C).
Unpacker sets isVeto when any VetoL is above 0.
Unpacker calculates multiplicities for StopXY above AdcThreshold (set to 100 in setparam.C).

Calibrator copies XH(YH) to XL(YL) when XL(YL) is above AlphaMaxL (set to 16000 KeV in setparams.C).
Calibrator skips events with true isVeto.

Checker filters out Evr, SF and Alpha.
Evr: isTof & isMacro & energy XH in [4 , 15] MeV.
Alpha: NOT isTof & energy XL or energy (XL+BL) in [8.97, 10.2] MeV.
SF: NOT isTof & energy XH in [60 , 220] MeV.

Analyzer looks for SF & NOT isMacro & YHindex>=0. Then it steps back 250 [s] looking for Alphas and Evrs which have the same X and Y±1 stripe.
Runs 32-222 show 139 chain candidates. All raw data files containing chain fragments (113 files, 52GB) were composed into ROOT files with calibrated events (8 files, 8 GB) and ckecked events (1 file, 0,6GB).

This takes 140m

Time covered: 274450 s (~3d).

Unpacker writes 228.934.411 events.
Calibrator writes 180.700.217 events (79%) 8 GB
Checker writes 12.826.941 events (6%) 0.6 GB
Analyzer reads 12.826.941 events, SF 3.930.899 (processed 725), Alphas 412.806, EVRs 8.483.310.
Analyzer writes 139 chains with 872 events. (Some Alphas and Evrs are counted double when chains overlap). 59KB

This takes 7m

12.826.941 events in 274450 sec is 46/sec is 12000/250sec
412806 Alphas in 274450 sec is 2/sec in 376/250sec

```
/data.local1/tasca/b_t018selection_Chains.root
Event Chain    2 Run  42 File  196 Evt  74546917 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 475187373 [mysec] Sys    373588 Gam         0 Adc 2640062660, d [msec] Sys  0.000 Gam  0.000 Adc 17.946
  StopXL(H) i  22 ( 22), [MeV]   5.556 (  5.504)  StopYL(H) i  11 ( 11), [MeV]   2.064 (  1.473)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 7.600589 Max 7.233443  XMulti  1 ( 1)
Event Chain    2 Run  42 File  196 Evt  74612240 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 475267016 [mysec] Sys     16379 Gam         0 Adc 2719706683, d [msec] Sys 79.643 Gam  0.000 Adc 55.580
  StopXL(H) i  22 ( 22), [MeV]   9.956 ( 10.072)  StopYL(H) i  11 ( 11), [MeV]   9.961 ( 10.129)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.709099 Max 0.709699  XMulti  1 ( 1)
Event Chain    2 Run  42 File  196 Evt  74632116 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 475291217 [mysec] Sys    217849 Gam         0 Adc 2743908524, d [msec] Sys 24.201 Gam  0.000 Adc 38.748
  StopXL(H) i  59 ( 22), [MeV]   4.577 (  4.577)  StopYL(H) i  10 ( 10), [MeV]   4.610 (  4.358)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 12.459943 Max 7.103706  XMulti  2 ( 2)
Event Chain    2 Run  42 File  197 Evt  74694172 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 475367111 [mysec] Sys    111299 Gam         0 Adc 2819803149, d [msec] Sys 75.894 Gam  0.000 Adc 21.505
  StopXL(H) i  22 ( 22), [MeV]  11.274 ( 11.462)  StopYL(H) i  12 ( 12), [MeV]  11.267 ( 11.118)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain    2 Run  42 File  197 Evt  74695731 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 475368970 [mysec] Sys    970763 Gam         0 Adc 2821662642, d [msec] Sys  1.859 Gam  0.000 Adc  0.553
  StopXL(H) i  22 ( 22), [MeV]   9.119 (  9.145)  StopYL(H) i  12 ( 12), [MeV]   9.093 (  8.972)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain    2 Run  42 File  197 Evt  74701476 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 475376071 [mysec] Sys     71825 Gam         0 Adc 2828763814, d [msec] Sys  7.101 Gam  0.000 Adc  1.130
  StopXL(H) i  22 ( 22), [MeV]   6.406 (  6.364)  StopYL(H) i  11 ( 11), [MeV]   6.370 (  6.282)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 8.031973 Max 7.192440  XMulti  1 ( 1)
Event Chain    2 Run  42 File  197 Evt  74704396 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 475379660 [mysec] Sys    660687 Gam         0 Adc 2832352732, d [msec] Sys  3.589 Gam  0.000 Adc  8.862
  StopXL(H) i  22 ( 22), [MeV]   9.896 ( 10.006)  StopYL(H) i  11 ( 11), [MeV]   9.900 (  9.992)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain    2 Run  42 File  197 Evt  74722476 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 475401807 [mysec] Sys    807987 Gam         0 Adc 2854500375, d [msec] Sys 22.147 Gam  0.000 Adc 21.269
  StopXL(H) i  22 ( 22), [MeV]   9.259 (  9.344)  StopYL(H) i  11 ( 11), [MeV]   9.263 (  9.374)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain    2 Run  42 File  197 Evt  74727108 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 475407496 [mysec] Sys    496125 Gam         0 Adc 2860188602, d [msec] Sys  5.689 Gam  0.000 Adc 35.001
  StopXL(H) i  22 ( 22), [MeV]   8.785 (  8.880)  StopYL(H) i  11 ( 11), [MeV]   8.776 (  8.824)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain    2 Run  42 File  197 Evt  74727109 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 475407500 [mysec] Sys    500177 Gam         0 Adc 2860192654, d [msec] Sys  0.004 Gam  0.000 Adc  4.052
  StopXL(H) i  22 ( 22), [MeV] 136.062 (178.575)  StopYL(H) i  11 ( 11), [MeV] 135.172 (135.172)
  BackL(H)  i  51 ( 51), [MeV]  18.345 ( 42.513)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  3 ( 3)
---------------------------------------
Event Chain   16 Run  59 File  278 Evt  83423174 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 690737305 [mysec] Sys    305031 Gam         0 Adc 455613435, d [msec] Sys  0.000 Gam  0.000 Adc 23.749
  StopXL(H) i  59 ( 59), [MeV]  13.517 ( 13.792)  StopYL(H) i  26 ( 26), [MeV]  13.513 ( 13.771)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 11.353019 Max 6.999854  XMulti  1 ( 1)
Event Chain   16 Run  59 File  278 Evt  83459103 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 690780714 [mysec] Sys    714829 Gam         0 Adc 499023902, d [msec] Sys 43.409 Gam  0.000 Adc  0.483
  StopXL(H) i  59 ( 59), [MeV]   6.779 (  6.714)  StopYL(H) i  24 ( 24), [MeV]   6.767 (  6.563)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.026585 Max 0.731617  XMulti  3 ( 3)
Event Chain   16 Run  59 File  278 Evt  83469984 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 690793806 [mysec] Sys    806402 Gam         0 Adc 512115677, d [msec] Sys 13.092 Gam  0.000 Adc 19.263
  StopXL(H) i  59 ( 59), [MeV]   5.478 (  5.341)  StopYL(H) i  24 ( 24), [MeV]   5.474 (  5.305)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.947235 Max 0.667122  XMulti  1 ( 1)
Event Chain   16 Run  59 File  278 Evt  83537291 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 690874675 [mysec] Sys    675958 Gam         0 Adc 592986481, d [msec] Sys 80.869 Gam  0.000 Adc 22.073
  StopXL(H) i  59 ( 59), [MeV]   5.593 (  5.413)  StopYL(H) i  24 ( 24), [MeV]   5.582 (  5.371)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.727135 Max 0.727835  XMulti  1 ( 1)
Event Chain   16 Run  59 File  278 Evt  83539772 Tof:0 Off:0 EVR:0 Al:1 SF:0
  [ms] 690877700 [mysec] Sys    700722 Gam         0 Adc 596011292, d [msec] Sys  3.025 Gam  0.000 Adc  2.372
  StopXL(H) i  59 ( -1), [MeV]   9.997 ( -5.985)  StopYL(H) i  25 ( -1), [MeV]   0.597 ( -4.436)
  BackL(H)  i   7 (  7), [MeV]   9.314 (  9.222)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   16 Run  59 File  278 Evt  83545501 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 690884655 [mysec] Sys    655893 Gam         0 Adc 602966568, d [msec] Sys  6.955 Gam  0.000 Adc 13.553
  StopXL(H) i  59 ( -1), [MeV]   9.261 ( -5.985)  StopYL(H) i  25 ( -1), [MeV]   0.615 ( -4.436)
  BackL(H)  i  42 ( 42), [MeV]   8.566 (  8.555)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   16 Run  59 File  278 Evt  83547306 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 690886833 [mysec] Sys    833853 Gam         0 Adc 605144563, d [msec] Sys  2.178 Gam  0.000 Adc 89.755
  StopXL(H) i  59 ( 59), [MeV] 165.836 (195.177)  StopYL(H) i  25 ( 25), [MeV] 151.843 (151.843)
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  BackL(H)  i  45 ( 45), [MeV]  18.387 ( 29.341)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  4 ( 4)
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Event Chain   29 Run  67 File  316 Evt  32415799 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 787281271 [mysec] Sys    271469 Gam         0 Adc 2509981432, d [msec] Sys  0.000 Gam  0.000 Adc 39.920
  StopXL(H) i  91 ( 91), [MeV]   6.587 (  6.436)  StopYL(H) i  66 ( 66), [MeV]   6.605 (  6.364)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.145004 Max 0.145204  XMulti  1 ( 1)
Event Chain   29 Run  67 File  316 Evt  32490150 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 787372594 [mysec] Sys    594093 Gam         0 Adc 2601281933, d [msec] Sys 91.323 Gam  0.000 Adc 77.630
  StopXL(H) i  91 ( 91), [MeV]   6.844 (  6.696)  StopYL(H) i  66 ( 66), [MeV]   6.845 (  6.695)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 3.467192 Max 1.391349  XMulti  1 ( 1)
Event Chain   29 Run  67 File  316 Evt  32577430 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 787480009 [mysec] Sys      9865 Gam         0 Adc 2708653542, d [msec] Sys 107.415 Gam  0.000 Adc 18.430
  StopXL(H) i  91 ( 91), [MeV]   6.522 (  6.371)  StopYL(H) i  66 ( 66), [MeV]   6.521 (  6.364)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 2.376957 Max 1.765118  XMulti  1 ( 1)
Event Chain   29 Run  67 File  316 Evt  32577619 Tof:0 Off:0 EVR:0 Al:1 SF:0
  [ms] 787480251 [mysec] Sys    251775 Gam         0 Adc 2708895455, d [msec] Sys  0.242 Gam  0.000 Adc  2.360
  StopXL(H) i  91 ( 91), [MeV]  10.034 (  9.948)  StopYL(H) i  66 ( 66), [MeV]   9.991 (  9.939)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.535911 Max 0.879197  XMulti  1 ( 1)
Event Chain   29 Run  67 File  316 Evt  32577729 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 787480382 [mysec] Sys    382207 Gam         0 Adc 2709025889, d [msec] Sys  0.131 Gam  0.000 Adc 109.607
  StopXL(H) i  91 ( 91), [MeV] 195.023 (203.766)  StopYL(H) i  66 ( 66), [MeV] 181.280 (181.280)
  BackL(H)  i   9 (  9), [MeV]   8.696 (  8.743)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  3 ( 3)
---------------------------------------
Event Chain   38 Run  72 File  345 Evt  88298931 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 859389924 [mysec] Sys    924937 Gam         0 Adc 1603883621, d [msec] Sys  0.000 Gam  0.000 Adc  3.498
  StopXL(H) i 103 (103), [MeV]   5.561 (  5.363)  StopYL(H) i  80 ( 80), [MeV]   3.279 (  3.186)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 5.696070 Max 5.033726  XMulti  1 ( 1)
Event Chain   38 Run  72 File  345 Evt  88390045 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 859500986 [mysec] Sys    986420 Gam         0 Adc 1714905767, d [msec] Sys 111.062 Gam  0.000 Adc  2.859
  StopXL(H) i 103 (103), [MeV]  10.014 (  9.984)  StopYL(H) i  80 ( 80), [MeV]   9.235 (  9.344)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.841992 Max 1.576165  XMulti  2 ( 2)
Event Chain   38 Run  72 File  345 Evt  88491887 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 859624203 [mysec] Sys    203916 Gam         0 Adc 1838125155, d [msec] Sys 123.217 Gam  0.000 Adc 37.076
  StopXL(H) i 103 (103), [MeV]  11.904 ( 11.874)  StopYL(H) i  79 ( 80), [MeV]   0.731 (  1.134)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 4.854714 Max 4.461099  XMulti  1 ( 1)
Event Chain   38 Run  72 File  345 Evt  88500429 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 859634570 [mysec] Sys    570488 Gam         0 Adc 1848491890, d [msec] Sys 10.367 Gam  0.000 Adc  0.246
  StopXL(H) i 103 (103), [MeV]   7.592 (  7.533)  StopYL(H) i  79 ( 79), [MeV]   7.597 (  7.725)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   38 Run  72 File  345 Evt  88501551 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 859635918 [mysec] Sys    918969 Gam         0 Adc 1849840391, d [msec] Sys  1.348 Gam  0.000 Adc 27.477
  StopXL(H) i 103 ( -1), [MeV]   9.690 ( -5.985)  StopYL(H) i  79 ( 79), [MeV]   1.421 (  1.198)
  BackL(H)  i  13 ( 13), [MeV]   8.294 (  8.427)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   38 Run  72 File  345 Evt  88501605 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 859635977 [mysec] Sys    977564 Gam         0 Adc 1849898985, d [msec] Sys  0.059 Gam  0.000 Adc 42.361
  StopXL(H) i 103 (103), [MeV] 129.841 (175.959)  StopYL(H) i  79 ( 79), [MeV] 128.302 (128.302)
  BackL(H)  i  16 ( 16), [MeV]  17.069 ( 46.118)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.426496 Max 0.318658  XMulti  3 ( 3)
---------------------------------------
Event Chain   46 Run  86 File  422 Evt 237942673 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1057001958 [mysec] Sys    958744 Gam         0 Adc 1646692288, d [msec] Sys  0.000 Gam  0.000 Adc  2.498
  StopXL(H) i 102 (102), [MeV]   8.537 (  8.483)  StopYL(H) i  71 ( 71), [MeV]   8.548 (  8.483)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   46 Run  86 File  422 Evt 238022029 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1057104359 [mysec] Sys    359551 Gam         0 Adc 1749094674, d [msec] Sys 102.401 Gam  0.000 Adc  0.735
  StopXL(H) i 102 (102), [MeV]   8.690 (  8.615)  StopYL(H) i  72 ( 72), [MeV]   8.679 (  8.615)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.002754 Max 1.002954  XMulti  1 ( 1)
Event Chain   46 Run  86 File  422 Evt 238022363 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1057104805 [mysec] Sys    805637 Gam         0 Adc 1749540765, d [msec] Sys  0.446 Gam  0.000 Adc 26.686
  StopXL(H) i 102 (102), [MeV]   9.977 (  9.939)  StopYL(H) i  72 ( 72), [MeV]   9.921 (  9.873)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   46 Run  86 File  422 Evt 238022435 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 1057104892 [mysec] Sys    892197 Gam         0 Adc 1749627327, d [msec] Sys  0.087 Gam  0.000 Adc 17.031
  StopXL(H) i 102 (102), [MeV] 189.887 (189.887)  StopYL(H) i  72 ( 72), [MeV] 178.500 (178.500)
  BackL(H)  i  35 ( -1), [MeV]   1.159 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.701475 Max 0.701675  XMulti  5 ( 5)
---------------------------------------
Event Chain   47 Run  89 File  428 Evt   2042375 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1069867040 [mysec] Sys     40572 Gam         0 Adc 1626795135, d [msec] Sys  0.000 Gam  0.000 Adc 40.852
  StopXL(H) i 110 (110), [MeV]  13.726 ( 14.045)  StopYL(H) i  68 ( 68), [MeV]  12.566 ( 12.654)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
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  Gamma [MeV] Sum 0.935364 Max 0.721272  XMulti  1 ( 1)
Event Chain   47 Run  89 File  428 Evt   2053036 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1069880261 [mysec] Sys    261238 Gam         0 Adc 1640016003, d [msec] Sys 13.221 Gam  0.000 Adc  1.745
  StopXL(H) i 110 (110), [MeV]   9.738 (  9.854)  StopYL(H) i  66 ( 66), [MeV]   9.738 (  9.675)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 3.317190 Max 2.208689  XMulti  2 ( 2)
Event Chain   47 Run  89 File  428 Evt   2122701 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1069966731 [mysec] Sys    731913 Gam         0 Adc 1726488005, d [msec] Sys 86.470 Gam  0.000 Adc 22.929
  StopXL(H) i 110 (110), [MeV]   7.086 (  6.969)  StopYL(H) i  67 ( 67), [MeV]   7.101 (  7.038)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.911466 Max 1.912166  XMulti  2 ( 2)
Event Chain   47 Run  89 File  428 Evt   2240128 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1070112465 [mysec] Sys    465113 Gam         0 Adc 1872223444, d [msec] Sys 145.734 Gam  0.000 Adc  0.212
  StopXL(H) i 110 (110), [MeV]   7.982 (  7.999)  StopYL(H) i  67 ( 67), [MeV]   5.841 (  5.801)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.568638 Max 1.568838  XMulti  1 ( 1)
Event Chain   47 Run  89 File  428 Evt   2241099 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1070113629 [mysec] Sys    629140 Gam         0 Adc 1873387489, d [msec] Sys  1.164 Gam  0.000 Adc 25.609
  StopXL(H) i 110 (110), [MeV]   9.945 ( 10.061)  StopYL(H) i  68 ( 67), [MeV]   5.447 (  4.564)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   47 Run  89 File  428 Evt   2241393 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 1070113972 [mysec] Sys    972201 Gam         0 Adc 1873730554, d [msec] Sys  0.343 Gam  0.000 Adc  9.970
  StopXL(H) i 110 (110), [MeV] 157.776 (183.718)  StopYL(H) i  67 ( 67), [MeV]  97.934 ( 97.934)
  BackL(H)  i  17 ( 17), [MeV]  17.345 ( 25.942)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.057711 Max 1.057911  XMulti  2 ( 2)
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Event Chain   48 Run  89 File  428 Evt   2590881 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1070548244 [mysec] Sys    244598 Gam         0 Adc 2308009625, d [msec] Sys  0.000 Gam  0.000 Adc 60.143
  StopXL(H) i 119 (119), [MeV]   9.454 (  9.410)  StopYL(H) i  76 ( 76), [MeV]   9.475 (  9.410)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 6.183044 Max 3.669946  XMulti  1 ( 1)
Event Chain   48 Run  89 File  428 Evt   2790005 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1070795225 [mysec] Sys    225862 Gam         0 Adc 2554994682, d [msec] Sys 246.981 Gam  0.000 Adc 60.609
  StopXL(H) i 119 (119), [MeV]   9.112 (  9.079)  StopYL(H) i  77 ( 77), [MeV]   9.135 (  9.781)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.798545 Max 0.798545  XMulti  1 ( 1)
Event Chain   48 Run  89 File  428 Evt   2790208 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1070795468 [mysec] Sys    468072 Gam         0 Adc 2555236896, d [msec] Sys  0.243 Gam  0.000 Adc 41.980
  StopXL(H) i 119 (119), [MeV]  10.022 ( 10.006)  StopYL(H) i  77 ( 77), [MeV]  10.035 ( 10.864)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   48 Run  89 File  428 Evt   2790226 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 1070795494 [mysec] Sys    494392 Gam         0 Adc 2555263216, d [msec] Sys  0.026 Gam  0.000 Adc 26.320
  StopXL(H) i 119 (119), [MeV] 184.524 (184.524)  StopYL(H) i  77 ( 77), [MeV] 200.141 (200.141)
  BackL(H)  i  12 ( -1), [MeV]   0.828 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.004251 Max 0.747463  XMulti  4 ( 4)
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Event Chain   77 Run 114 File  559 Evt  58617751 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1384231230 [mysec] Sys    230961 Gam         0 Adc 2457176455, d [msec] Sys  0.000 Gam  0.000 Adc 22.457
  StopXL(H) i  86 ( 86), [MeV]   6.565 (  6.364)  StopYL(H) i  69 ( 69), [MeV]   3.742 (  3.602)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 3.497565 Max 2.237984  XMulti  1 ( 1)
Event Chain   77 Run 114 File  559 Evt  58618108 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1384231575 [mysec] Sys    575942 Gam         0 Adc 2457521436, d [msec] Sys  0.345 Gam  0.000 Adc 26.632
  StopXL(H) i  86 ( 86), [MeV]  10.008 (  9.873)  StopYL(H) i  69 ( 69), [MeV]   5.865 (  5.664)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   77 Run 114 File  559 Evt  58674508 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1384282612 [mysec] Sys    612576 Gam         0 Adc 2508558867, d [msec] Sys 51.037 Gam  0.000 Adc 12.078
  StopXL(H) i  86 ( 86), [MeV]   9.279 (  9.145)  StopYL(H) i  69 ( 69), [MeV]   7.345 (  7.312)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain   77 Run 114 File  559 Evt  58713496 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 1384318088 [mysec] Sys     88960 Gam         0 Adc 2544035806, d [msec] Sys 35.476 Gam  0.000 Adc 12.784
  StopXL(H) i  86 ( 86), [MeV] 201.076 (201.076)  StopYL(H) i  69 ( 69), [MeV] 103.705 (103.705)
  BackL(H)  i  40 ( 40), [MeV]   3.338 (  3.245)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.224585 Max 0.124354  XMulti  8 ( 8)
---------------------------------------
Event Chain  109 Run 124 File  606 Evt 134861899 Tof:0 Off:0 EVR:0 Al:1 SF:0
  [ms] 1473821636 [mysec] Sys    636030 Gam         0 Adc 1852920615, d [msec] Sys  0.000 Gam  0.000 Adc 320.190
  StopXL(H) i 131 (102), [MeV]   8.549 (  8.549)  StopYL(H) i  75 ( 75), [MeV]   8.730 (  8.618)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  6 ( 6)
Event Chain  109 Run 124 File  606 Evt 134973068 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1474011423 [mysec] Sys    423905 Gam         0 Adc 2042711388, d [msec] Sys 189.787 Gam  0.000 Adc  2.348
  StopXL(H) i 131 (131), [MeV]   7.358 (  7.393)  StopYL(H) i  74 ( 74), [MeV]   7.325 (  7.093)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  4 ( 4)
Event Chain  109 Run 124 File  606 Evt 134973563 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1474012246 [mysec] Sys    246822 Gam         0 Adc 2043534321, d [msec] Sys  0.823 Gam  0.000 Adc 105.165
  StopXL(H) i 131 (131), [MeV]   9.997 (  1.232)  StopYL(H) i  74 ( -1), [MeV]   0.846 ( -4.436)
  BackL(H)  i  35 ( 35), [MeV]   9.163 (  9.176)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.746787 Max 0.746787  XMulti  1 ( 1)
Event Chain  109 Run 124 File  606 Evt 134973601 Tof:0 Off:1 EVR:0 Al:0 SF:1
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  [ms] 1474012309 [mysec] Sys    309876 Gam         0 Adc 2043597376, d [msec] Sys  0.063 Gam  0.000 Adc 27.325
  StopXL(H) i 131 (131), [MeV] 170.446 (170.446)  StopYL(H) i  74 ( 74), [MeV] 133.811 (133.811)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.449835 Max 0.438038  XMulti  2 ( 2)
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Event Chain  115 Run 156 File  707 Evt 136137319 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1841789274 [mysec] Sys    274476 Gam         0 Adc 451946690, d [msec] Sys  0.000 Gam  0.000 Adc 139.253
  StopXL(H) i  89 ( 89), [MeV]   8.789 (  8.824)  StopYL(H) i  72 ( 72), [MeV]   8.787 (  8.748)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  115 Run 156 File  707 Evt 136146267 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1841803782 [mysec] Sys    782697 Gam         0 Adc 466455133, d [msec] Sys 14.508 Gam  0.000 Adc 82.991
  StopXL(H) i  89 ( 89), [MeV]   8.697 (  8.687)  StopYL(H) i  72 ( 72), [MeV]   8.715 (  8.615)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 9.975562 Max 9.550147  XMulti  1 ( 1)
Event Chain  115 Run 156 File  707 Evt 136146568 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1841804265 [mysec] Sys    265100 Gam         0 Adc 466937544, d [msec] Sys  0.483 Gam  0.000 Adc 23.535
  StopXL(H) i  89 ( 89), [MeV]  10.011 ( 10.129)  StopYL(H) i  72 ( 72), [MeV]   9.903 (  9.939)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  115 Run 156 File  707 Evt 136146841 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 1841804665 [mysec] Sys    665604 Gam         0 Adc 467337998, d [msec] Sys  0.400 Gam  0.000 Adc 65.127
  StopXL(H) i  89 ( 89), [MeV] 161.417 (161.417)  StopYL(H) i  72 ( 72), [MeV] 142.086 (142.086)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.706054 Max 0.706654  XMulti  4 ( 4)
---------------------------------------
Event Chain  119 Run 163 File  738 Evt  35256655 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1932028149 [mysec] Sys    149899 Gam         0 Adc 496160551, d [msec] Sys  0.000 Gam  0.000 Adc 58.174
  StopXL(H) i 100 (100), [MeV]   8.507 (  8.484)  StopYL(H) i  53 ( 53), [MeV]   7.839 (  7.887)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.533983 Max 0.534583  XMulti  1 ( 1)
Event Chain  119 Run 163 File  738 Evt  35285660 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] 1932073816 [mysec] Sys    816623 Gam         0 Adc 541827970, d [msec] Sys 45.667 Gam  0.000 Adc 40.096
  StopXL(H) i 100 (100), [MeV]   7.690 (  7.666)  StopYL(H) i  53 ( 53), [MeV]   7.689 (  7.688)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 4.372772 Max 3.224428  XMulti  1 ( 1)
EVR missing with 6.926 MeV and following 0.774 sec Alpha.
Event Chain  119 Run 163 File  738 Evt  35316464 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1932123304 [mysec] Sys    304518 Gam         0 Adc 591316619, d [msec] Sys 49.488 Gam  0.000 Adc 52.059
  StopXL(H) i 100 (100), [MeV]   9.913 (  9.982)  StopYL(H) i  53 ( 53), [MeV]   9.879 (  9.939)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  2 ( 2)
Event Chain  119 Run 163 File  738 Evt  35322483 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] 1932132846 [mysec] Sys    846813 Gam         0 Adc 600859061, d [msec] Sys  9.542 Gam  0.000 Adc 15.179
  StopXL(H) i 100 (100), [MeV]   9.293 (  9.301)  StopYL(H) i  53 ( 53), [MeV]   9.279 (  9.344)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  4 ( 4)
Event Chain  119 Run 163 File  738 Evt  35340259 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] 1932161260 [mysec] Sys    260055 Gam         0 Adc 629272733, d [msec] Sys 28.414 Gam  0.000 Adc 15.554
  StopXL(H) i 100 (100), [MeV] 154.109 (193.221)  StopYL(H) i  53 ( 53), [MeV] 141.689 (141.689)
  BackL(H)  i  29 ( 29), [MeV]  21.159 ( 39.112)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.272122 Max 0.219680  XMulti  4 ( 4)
---------------------------------------
Event Chain  132 Run 179 File  836 Evt 223465063 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -2111787873 [mysec] Sys    423212 Gam         0 Adc 2538336364, d [msec] Sys  0.000 Gam  0.000 Adc 19.203
  StopXL(H) i 122 (122), [MeV]   8.300 (  8.019)  StopYL(H) i  88 ( 88), [MeV]   0.812 (  1.134)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  132 Run 179 File  836 Evt 223479045 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -2111770917 [mysec] Sys    379287 Gam         0 Adc 2555292696, d [msec] Sys 16.956 Gam  0.000 Adc 15.336
  StopXL(H) i 122 (122), [MeV]   5.521 (  5.371)  StopYL(H) i  88 ( 88), [MeV]   5.494 (  5.437)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  132 Run 179 File  836 Evt 223576595 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -2111652219 [mysec] Sys     77780 Gam         0 Adc 2673993021, d [msec] Sys 118.698 Gam  0.000 Adc  0.900
  StopXL(H) i 122 (122), [MeV]   8.391 (  8.350)  StopYL(H) i  87 ( 87), [MeV]   7.278 (  7.244)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 11.749644 Max 6.669339  XMulti  3 ( 3)
EVR missing with 3.26 MeV and following 0.9 sec Alpha
Alpha missing with 9.995 MeV and 92.2 sec
Event Chain  132 Run 179 File  836 Evt 223604065 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] -2111618789 [mysec] Sys    507890 Gam         0 Adc 2707423644, d [msec] Sys 33.430 Gam  0.000 Adc 25.326
  StopXL(H) i 122 (122), [MeV]   9.297 (  9.277)  StopYL(H) i  88 ( 88), [MeV]   9.299 (  9.344)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  2 ( 2)
Event Chain  132 Run 179 File  836 Evt 223629649 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -2111587559 [mysec] Sys    737747 Gam         0 Adc 2738653985, d [msec] Sys 31.230 Gam  0.000 Adc 19.837
  StopXL(H) i 122 (122), [MeV]  14.070 ( 14.243)  StopYL(H) i  88 ( 88), [MeV]  14.041 ( 14.243)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  132 Run 179 File  836 Evt 223642101 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] -2111572506 [mysec] Sys    790910 Gam         0 Adc 2753707379, d [msec] Sys 15.053 Gam  0.000 Adc 13.729
  StopXL(H) i 122 (122), [MeV] 102.098 (131.439)  StopYL(H) i  88 ( 88), [MeV]  88.460 ( 88.460)
  BackL(H)  i  14 ( 14), [MeV]  18.182 ( 29.341)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.563841 Max 0.407735  XMulti  2 ( 2)
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Event Chain  138 Run 198 File  904 Evt 106958183 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -1881425015 [mysec] Sys    281998 Gam         0 Adc 972044888, d [msec] Sys  0.000 Gam  0.000 Adc 46.018
  StopXL(H) i  59 ( 59), [MeV]   4.459 (  4.258)  StopYL(H) i  47 ( 47), [MeV]   4.451 (  4.152)
  BackL(H)  i  10 ( -1), [MeV]   0.819 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  138 Run 198 File  904 Evt 106997000 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -1881358171 [mysec] Sys    125689 Gam         0 Adc 1038889619, d [msec] Sys 66.844 Gam  0.000 Adc 41.288
  StopXL(H) i  59 ( 59), [MeV]   9.139 (  9.169)  StopYL(H) i  46 ( 46), [MeV]   8.968 (  7.133)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.592514 Max 0.593014  XMulti  1 ( 1)
Event Chain  138 Run 198 File  904 Evt 107083748 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -1881209527 [mysec] Sys    769395 Gam         0 Adc 1187535611, d [msec] Sys 148.644 Gam  0.000 Adc 78.274
  StopXL(H) i  59 ( 59), [MeV]   8.459 (  8.447)  StopYL(H) i  47 ( 47), [MeV]   8.445 (  8.412)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 4.443708 Max 3.279788  XMulti  1 ( 1)
Event Chain  138 Run 198 File  904 Evt 107084412 Tof:0 Off:1 EVR:0 Al:1 SF:0
  [ms] -1881208395 [mysec] Sys    901624 Gam         0 Adc 1188667857, d [msec] Sys  1.132 Gam  0.000 Adc 34.593
  StopXL(H) i  59 ( 59), [MeV]  10.004 ( 10.108)  StopYL(H) i  47 ( 47), [MeV]  10.012 ( 10.061)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  138 Run 198 File  904 Evt 107084434 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] -1881208352 [mysec] Sys    944776 Gam         0 Adc 1188711009, d [msec] Sys  0.043 Gam  0.000 Adc 43.152
  StopXL(H) i  59 ( 59), [MeV] 210.041 (210.041)  StopYL(H) i  47 ( 47), [MeV] 193.159 (193.159)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.744879 Max 1.148250  XMulti  4 ( 4)
---------------------------------------
Event Chain  139 Run 219 File 1000 Evt  67896741 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -1562182506 [mysec] Sys    790288 Gam         0 Adc 2385684616, d [msec] Sys  0.000 Gam  0.000 Adc 57.063
  StopXL(H) i  89 ( 89), [MeV]   8.151 (  7.999)  StopYL(H) i  49 ( 49), [MeV]   1.899 (  1.429)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.040753 Max 1.041353  XMulti  2 ( 2)
Event Chain  139 Run 219 File 1000 Evt  67933718 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -1562123567 [mysec] Sys    729816 Gam         0 Adc 2444625035, d [msec] Sys 58.939 Gam  0.000 Adc 80.479
  StopXL(H) i  89 ( 89), [MeV]  10.238 ( 10.267)  StopYL(H) i  48 ( 48), [MeV]  10.205 ( 10.143)
  BackL(H)  i  41 ( 41), [MeV]   3.393 (  3.246)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  139 Run 219 File 1000 Evt  67960814 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -1562080292 [mysec] Sys      4228 Gam         0 Adc 2487900108, d [msec] Sys 43.275 Gam  0.000 Adc 322.037
  StopXL(H) i  89 ( 89), [MeV]   9.968 (  9.992)  StopYL(H) i  48 ( 48), [MeV]   8.581 (  8.452)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 1.202417 Max 0.604794  XMulti  1 ( 1)
Event Chain  139 Run 219 File 1000 Evt  68020658 Tof:1 Off:0 EVR:1 Al:0 SF:0
  [ms] -1561985359 [mysec] Sys    937313 Gam         0 Adc 2582834633, d [msec] Sys 94.933 Gam  0.000 Adc 41.069
  StopXL(H) i  89 ( 89), [MeV]   7.623 (  7.519)  StopYL(H) i  48 ( 48), [MeV]   7.636 (  7.476)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.723408 Max 0.558537  XMulti  1 ( 1)
Event Chain  139 Run 219 File 1000 Evt  68021261 Tof:0 Off:0 EVR:0 Al:1 SF:0
  [ms] -1561984438 [mysec] Sys    858020 Gam         0 Adc 2583755354, d [msec] Sys  0.921 Gam  0.000 Adc 39.576
  StopXL(H) i  89 ( 89), [MeV]   9.895 (  9.992)  StopYL(H) i  48 ( 48), [MeV]   9.880 (  9.818)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum -0.000500 Max 0.000300  XMulti  1 ( 1)
Event Chain  139 Run 219 File 1000 Evt  68021522 Tof:0 Off:1 EVR:0 Al:0 SF:1
  [ms] -1561984049 [mysec] Sys    247890 Gam         0 Adc 2584145229, d [msec] Sys  0.389 Gam  0.000 Adc 51.728
  StopXL(H) i  89 ( 89), [MeV] 196.388 (196.388)  StopYL(H) i  48 ( 48), [MeV] 176.164 (176.164)
  BackL(H)  i  -1 ( -1), [MeV]   0.603 ( -2.878)  VetoL(H)  i  -1 ( -1), [MeV]   0.000 (  0.000)
  Gamma [MeV] Sum 0.190875 Max 0.191675  XMulti  4 ( 4)
---------------------------------------
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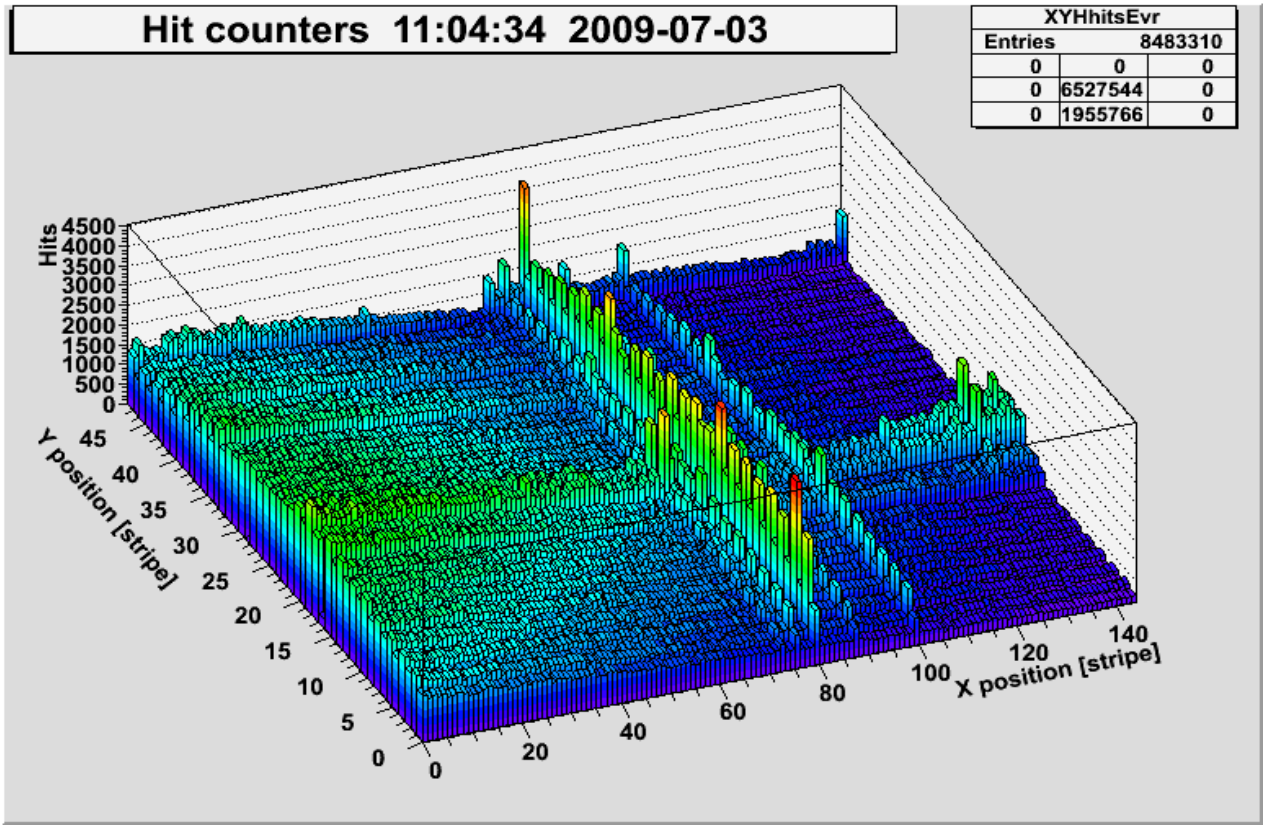
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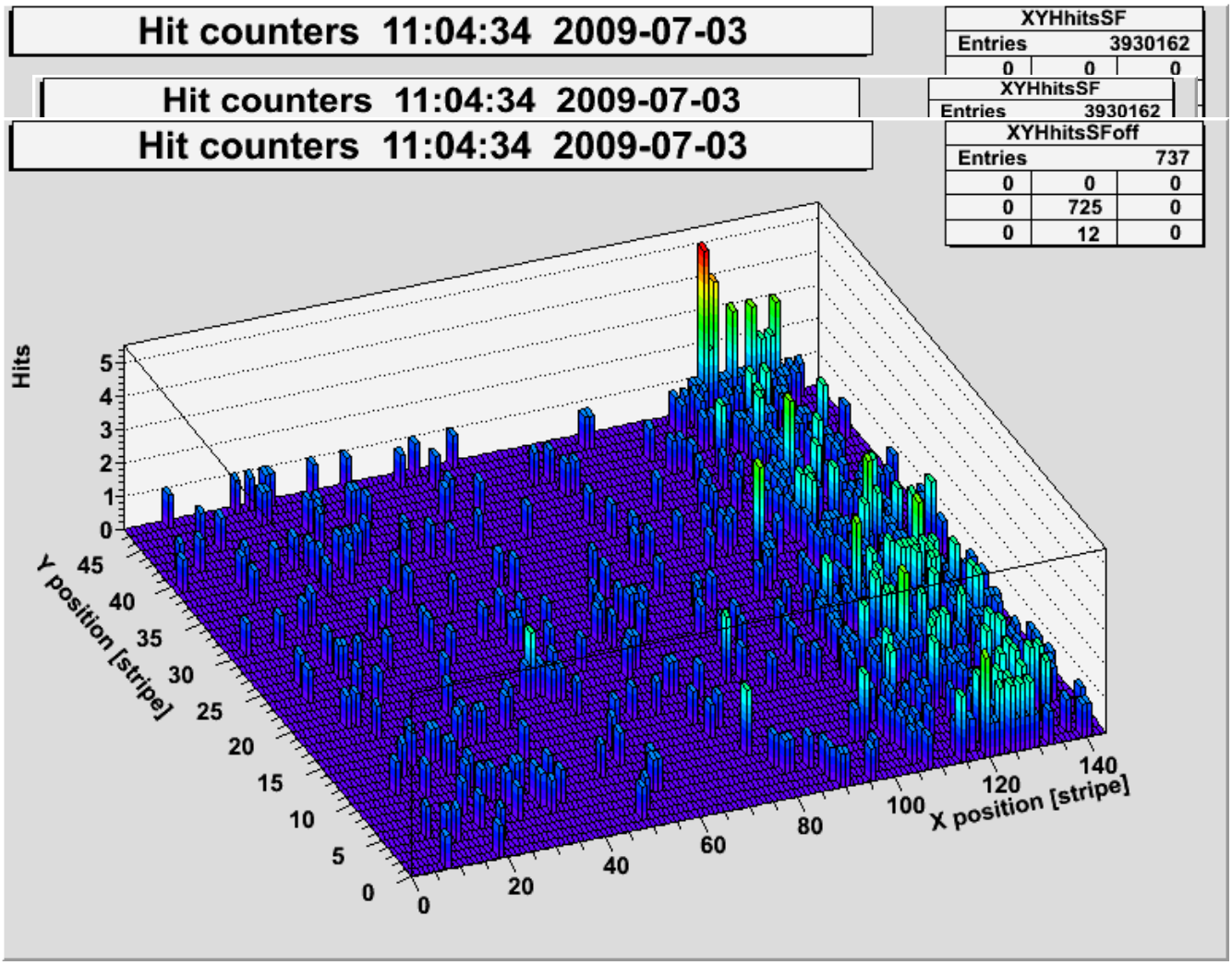
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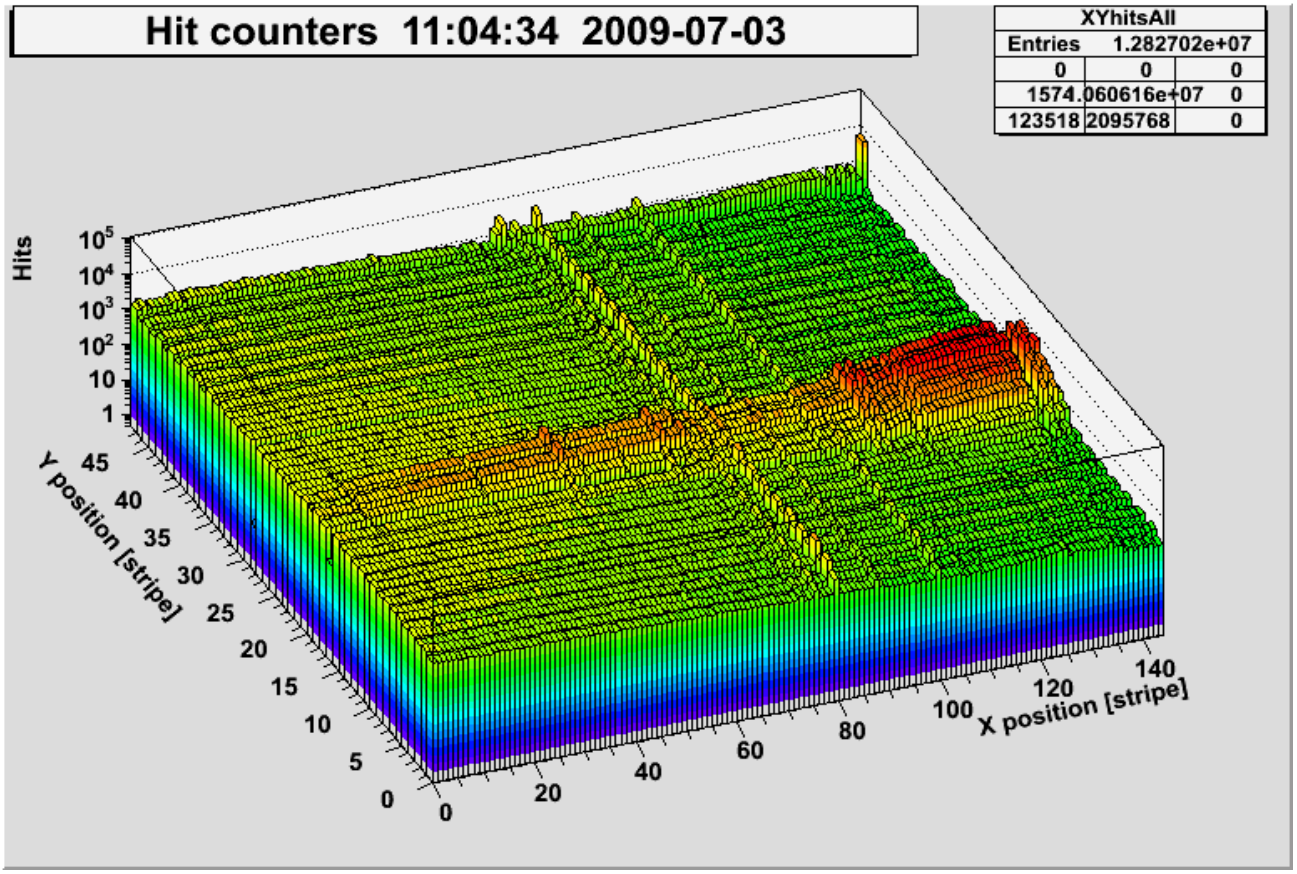
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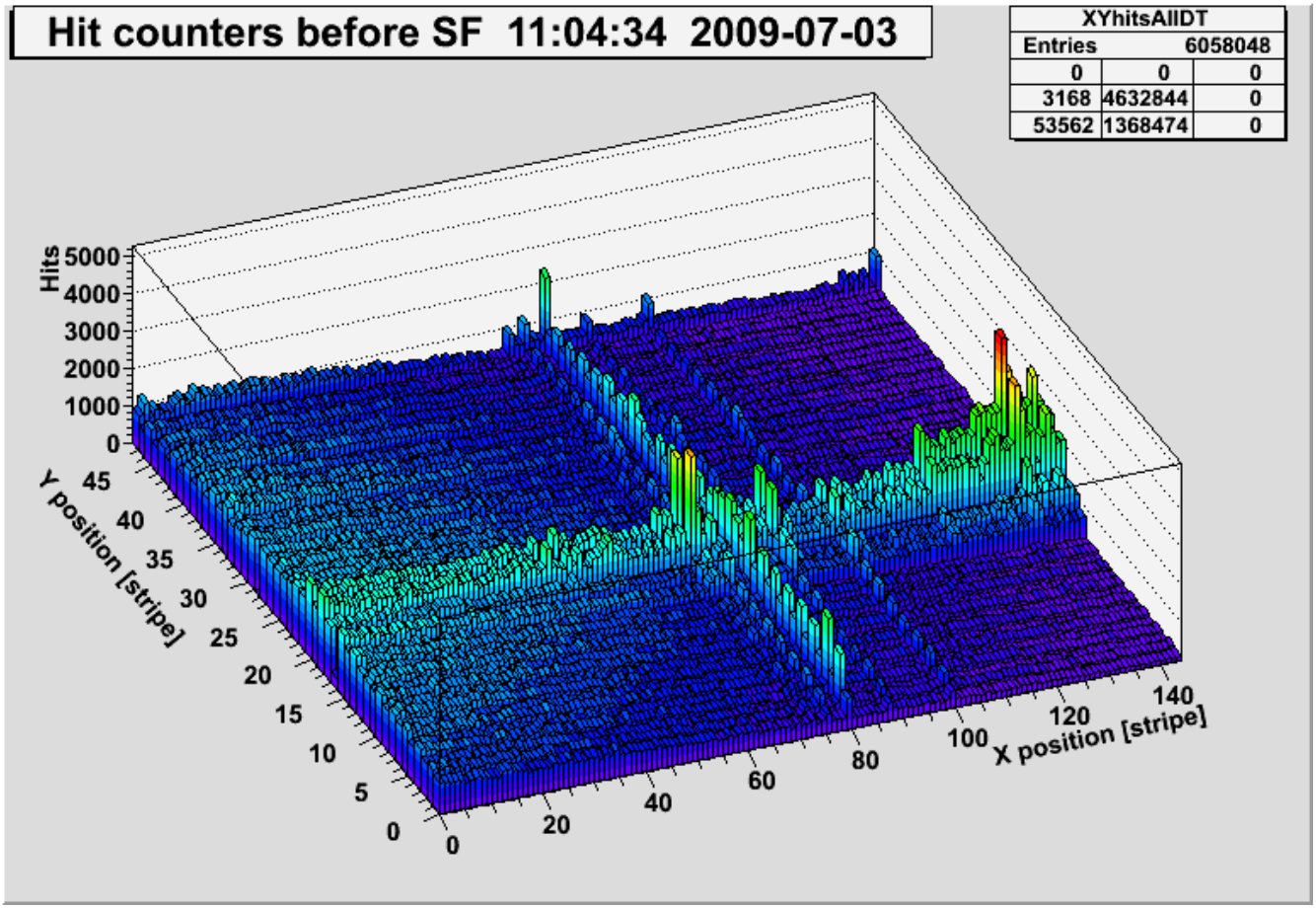
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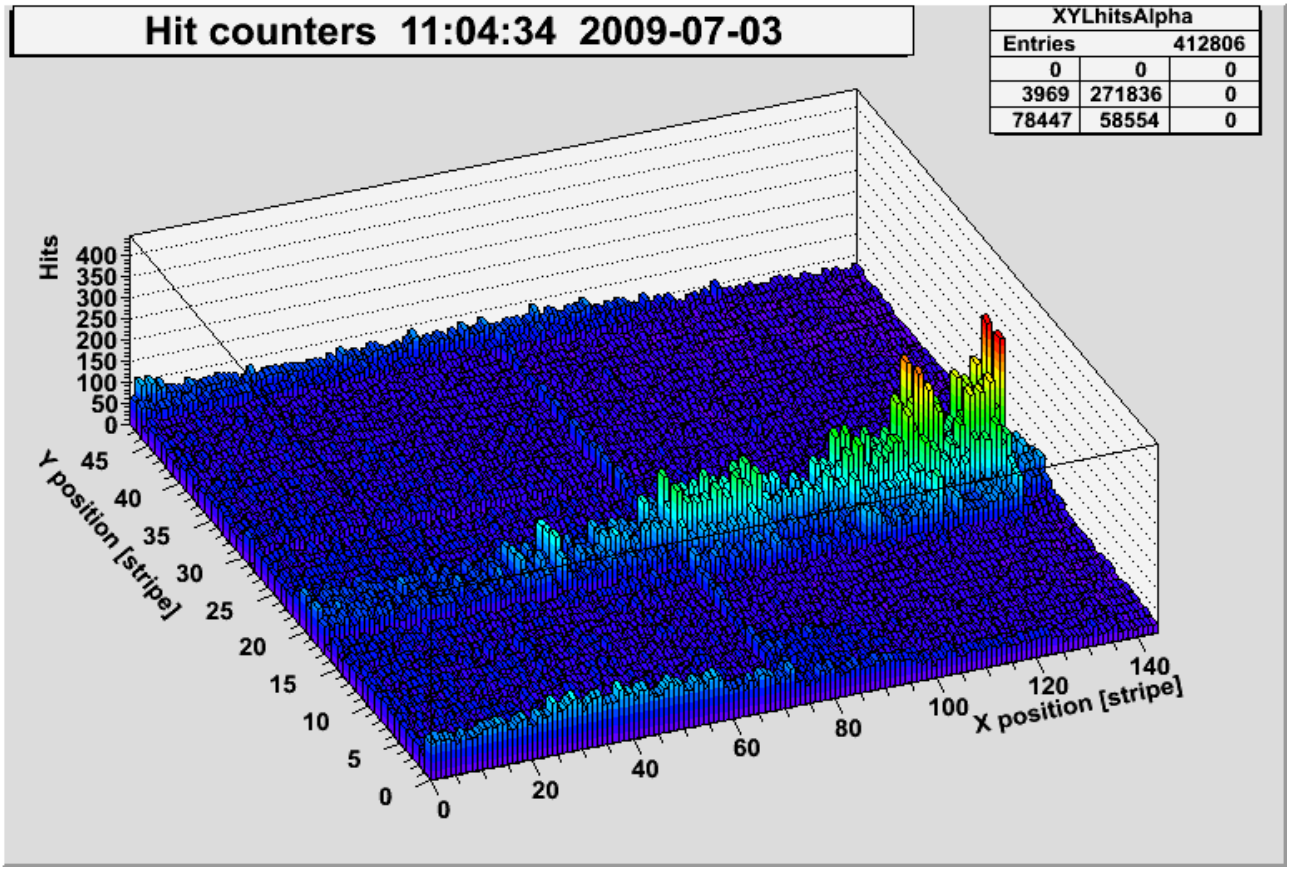
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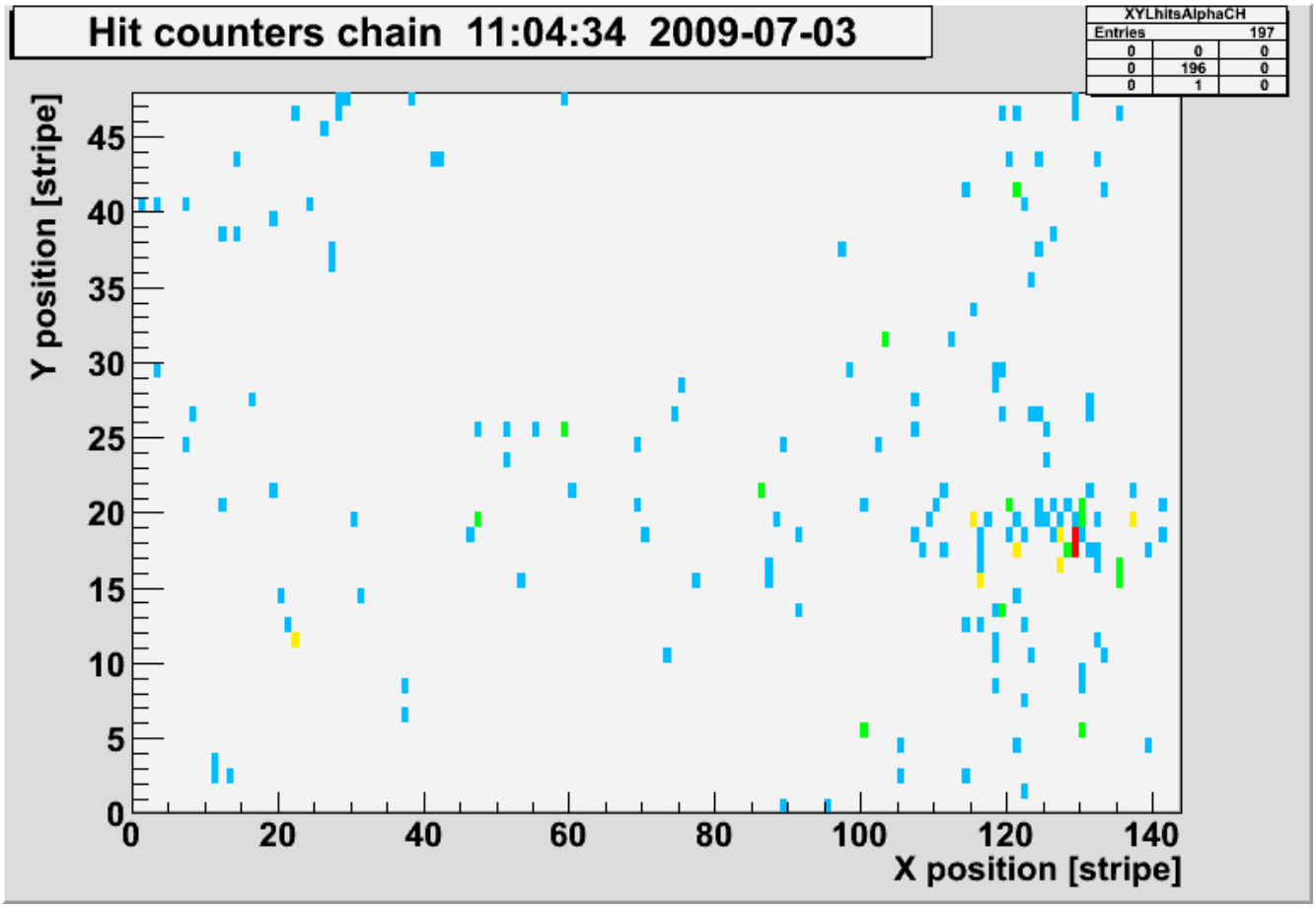
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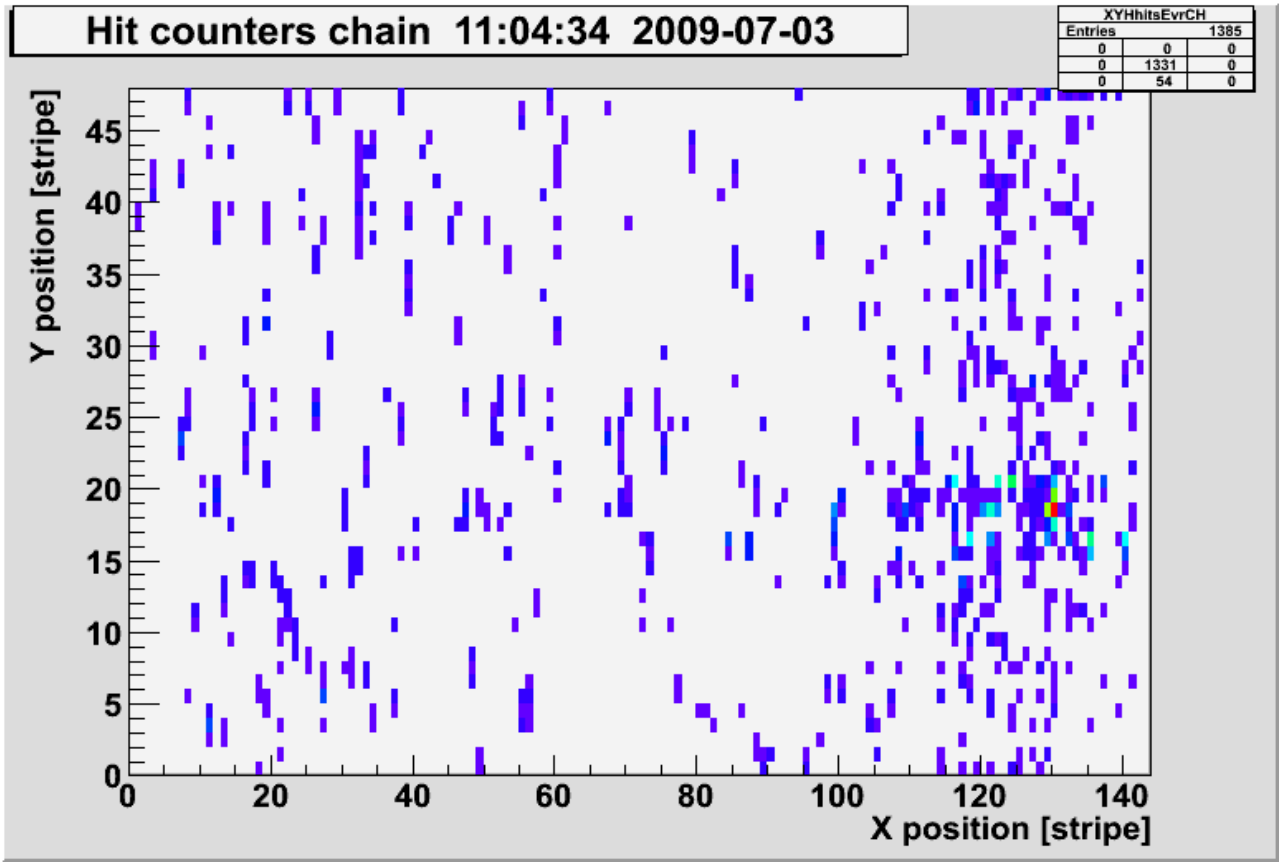
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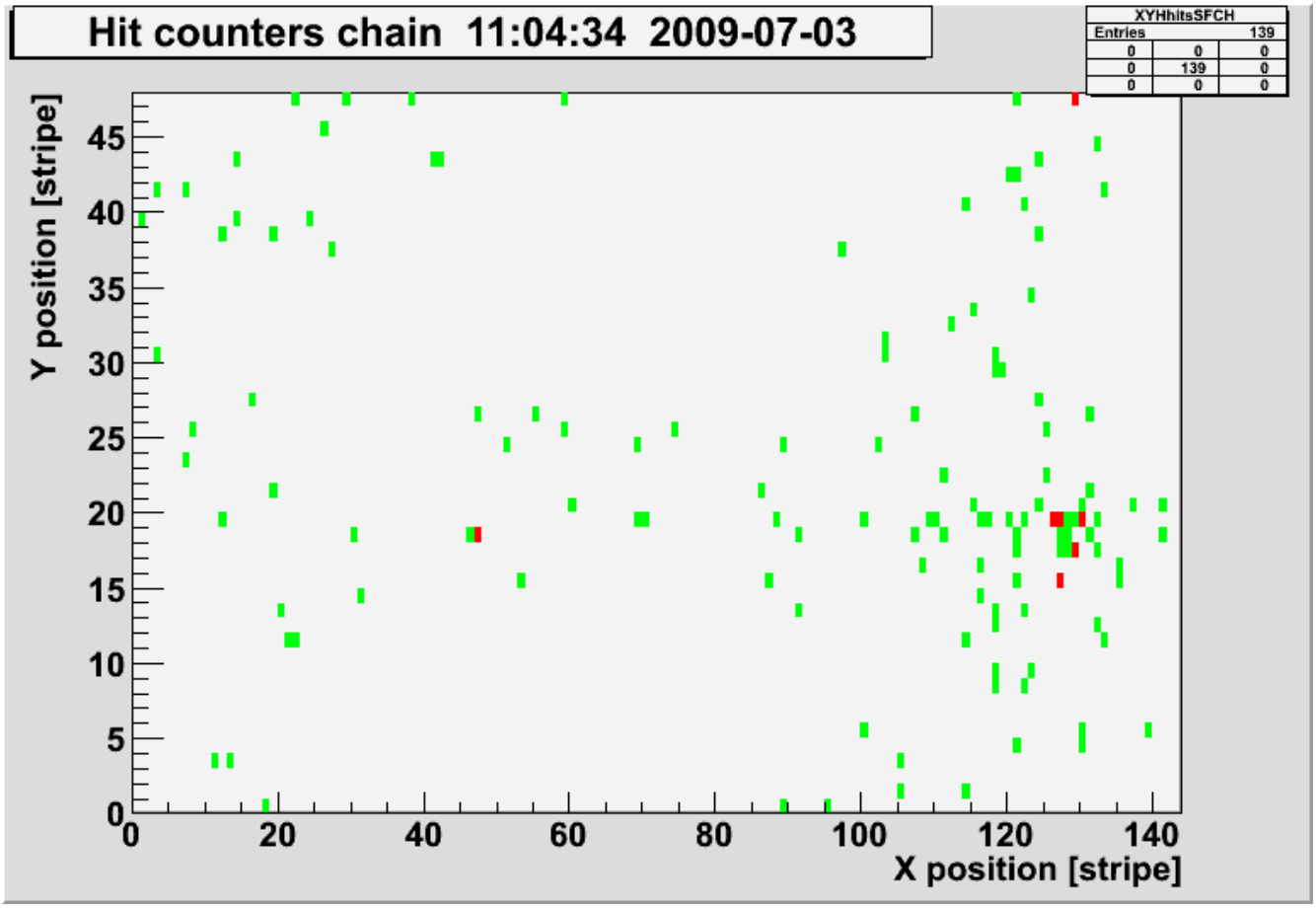
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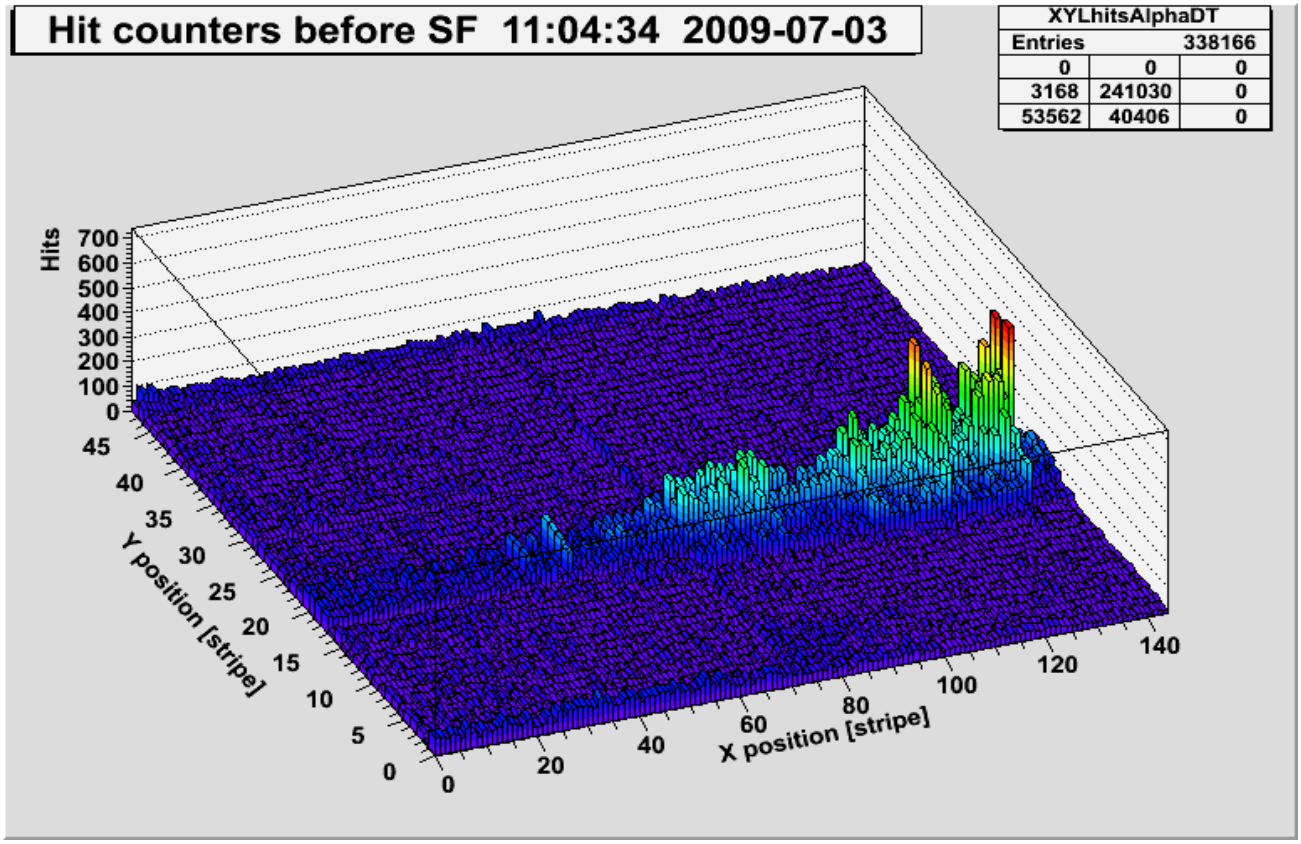
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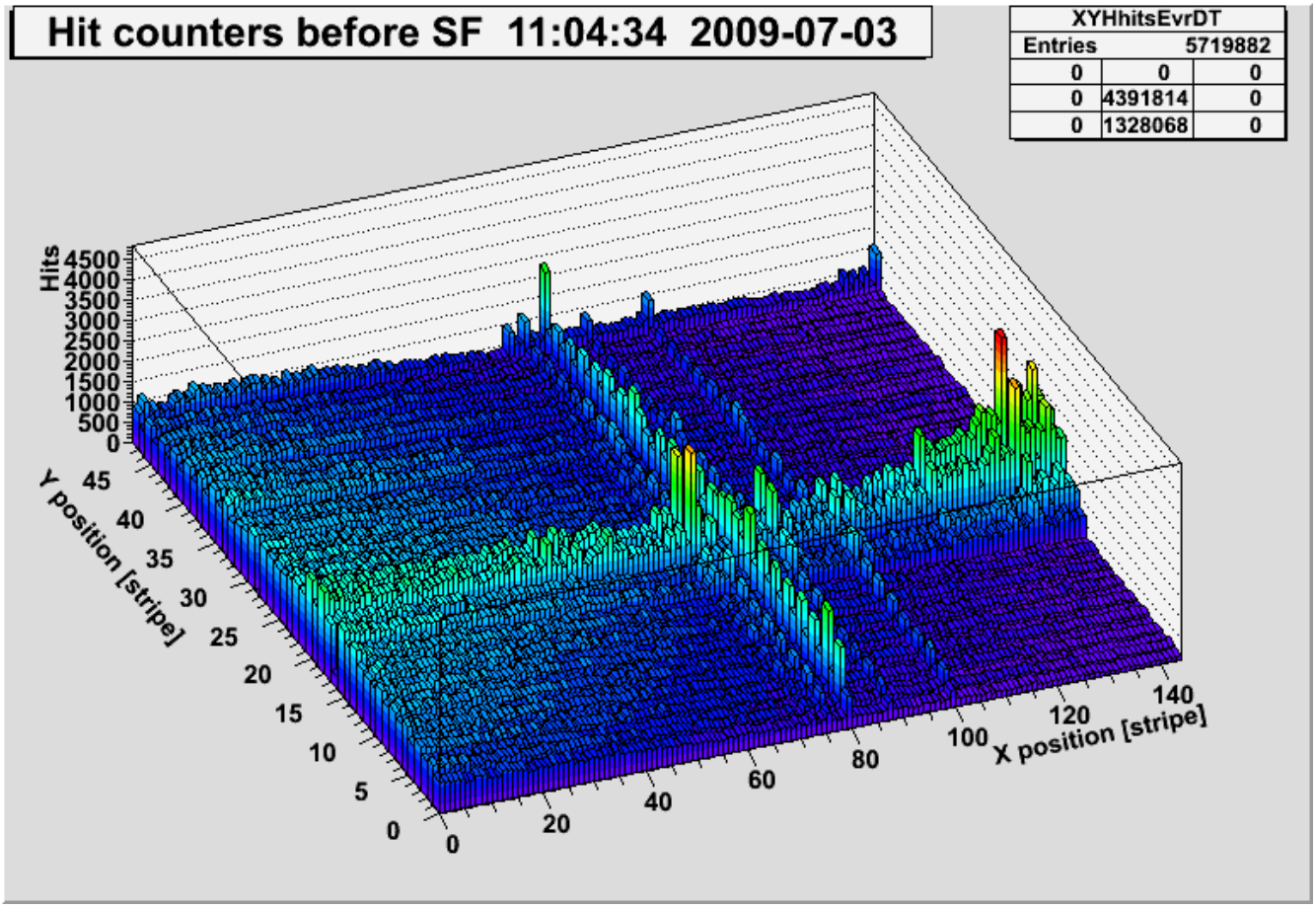
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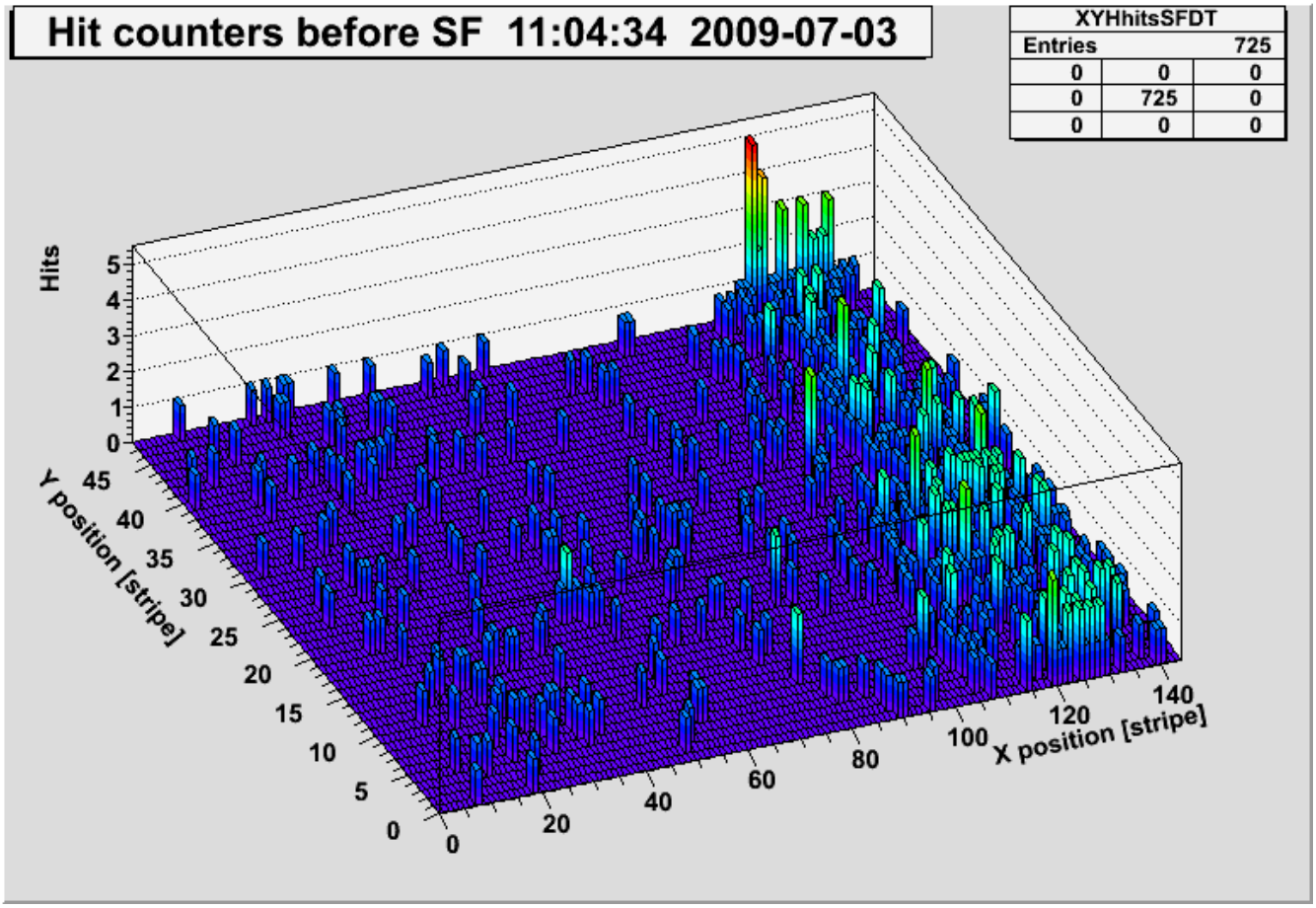
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Calibration

An automated generation of calibration coefficient files is done by macro
makecali.C(prefix, rootfile)
root -b -l "makecali(\"test\",\"test_AS\")"
where prefix is a string used as prefix for all file names generated, rootfile is the name of the ROOT file containing the histograms (given without trailing .root). The macro should be adjusted. Several parameters can be set inside.

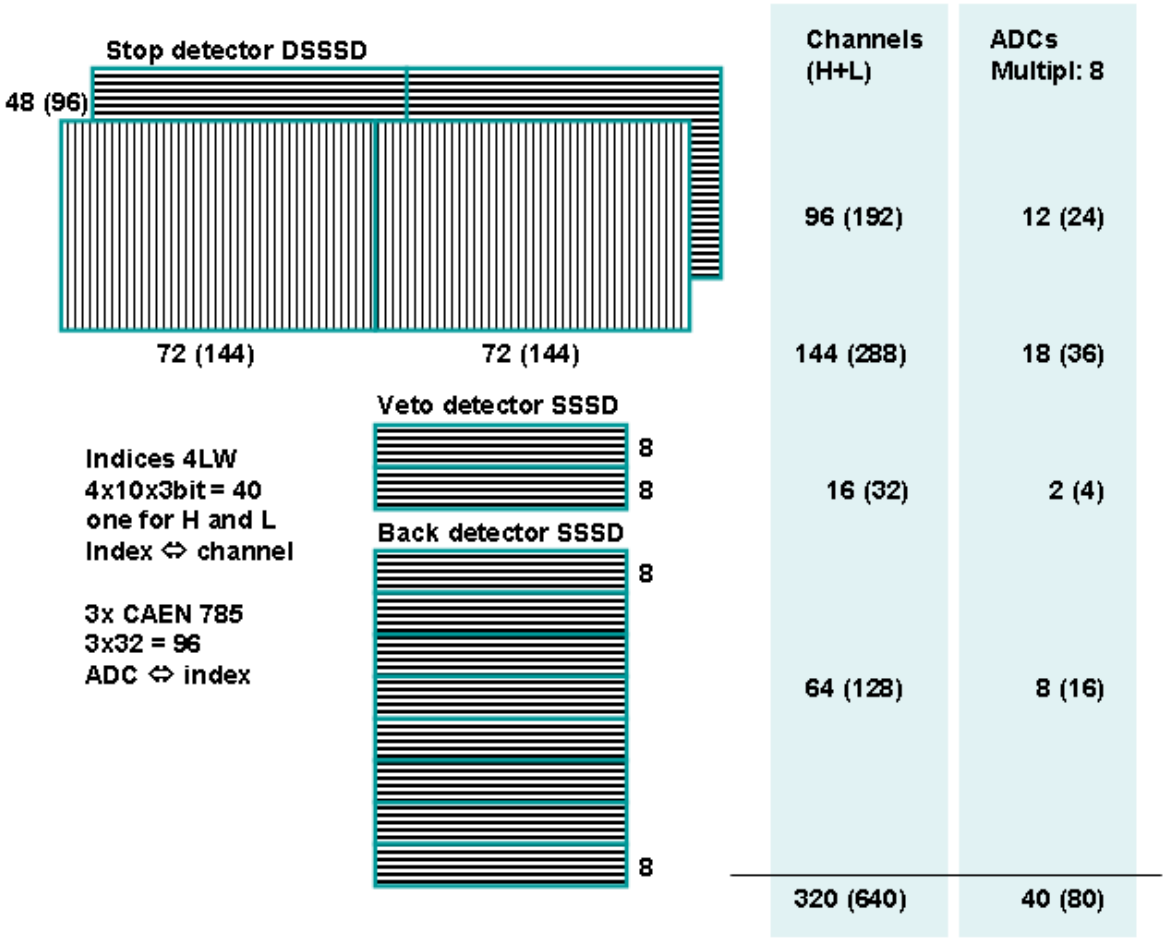
Histograms/Cali/StopXL:	prefix_StopXL[144]
Histograms/Cali/StopYL:	prefix_StopYL[96]
Histograms/Cali/StopXH:	prefix_StopXH[144]
Histograms/Cali/StopYH:	prefix_StopYH[96]
Histograms/Cali/BackH:	prefix_BackH[64]
Histograms/Cali/BackL:	prefix_BackL[64]
Histograms/Cali/VetoH:	prefix_VetoH[16]
Histograms/Cali/VetoL:	prefix_VetoL[16]
Histograms/Unpack/GammaE:	prefix_GammaE[8]
Histograms/Unpack/GammaT:	prefix_GammaT[8]

The format of the calibration files is:
name value
The format of the generated files is:
name index a0 a1 a2 : NOF ChiSquare

Class TascaCalibration is the parameter class holding the coefficients. This parameter is used in the TascaCaliProc processor of the second step.
To enable/disable the calibration the macro
setcali.C
must be edited. If enabled, it reads the files produced by makecali. For these the prefix string must be set.

Class TascaCaliFitter is a parameter class with the purpose of doing the calibration interactively. This might be necessary if the automatic calculations do not work for a histogram. This parameter is used in the TascaCaliProc processor of the second step. Calculating calibration parameters is done in two steps. First we need a histogram with the measured lines and a text file with the energies of these lines. These are present in arrays inside the parameter. First fitter LineFitter is used to find out true channel numbers for corresponding lines in calibration spectrum. This fit should be done interactively on the GUI side:

- Get parameter CaliFitter from analysis (Doubleclick)
- Display calibration spectrum.
- Double click on the LineFitter fitter in the parameter editor. Fit panel will open showing the current settings of the fitter. Press Use pad of the fit panel to assign this fitter to the view panel containing the calibration spectrum and Rebuild button.
- Use peak finder 3 to find the peaks. Enlarging the noise factor removes peaks as well as minimum noise.
- Do Fit. If the positions of the lines are fitted correctly, copy the fitter back to the calibration parameter: right mouse button click on LineFitter, select Get from FitPanel .
- Check if the name of the calibration file is correct.
- Set DoFit variable to 1 (will be set back to 0 after the fit).
- Now press left arrow button. This will perform fit of the calibration curve (polynomial of order 2) in the *UpdateFrom()* method of TascaCaliFitter on the analysis side.
- Pressing right arrow button will get the results of the calibration, present in the polynomial coefficients fdA[0]...fdA[2] and in the Calibrator fitter.
- The corresponding TGraph is UserObjects/CaliGraph and is displayed by double click. Then double click on the Calibrator fitter in the parameter editor to open in a fit panel, press Use Pad, Rebuild and Draw. This will draw the calibration polynomial over the points which indicate the energy/channel of the calibration lines.



The detector layouts