

## TASCA Go4 Analysis

OpenOffice document `tascaGo4intro.odt` (H.Essel, 17. June 2009) SVN rev. 243

### *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" '
svndiff1='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).

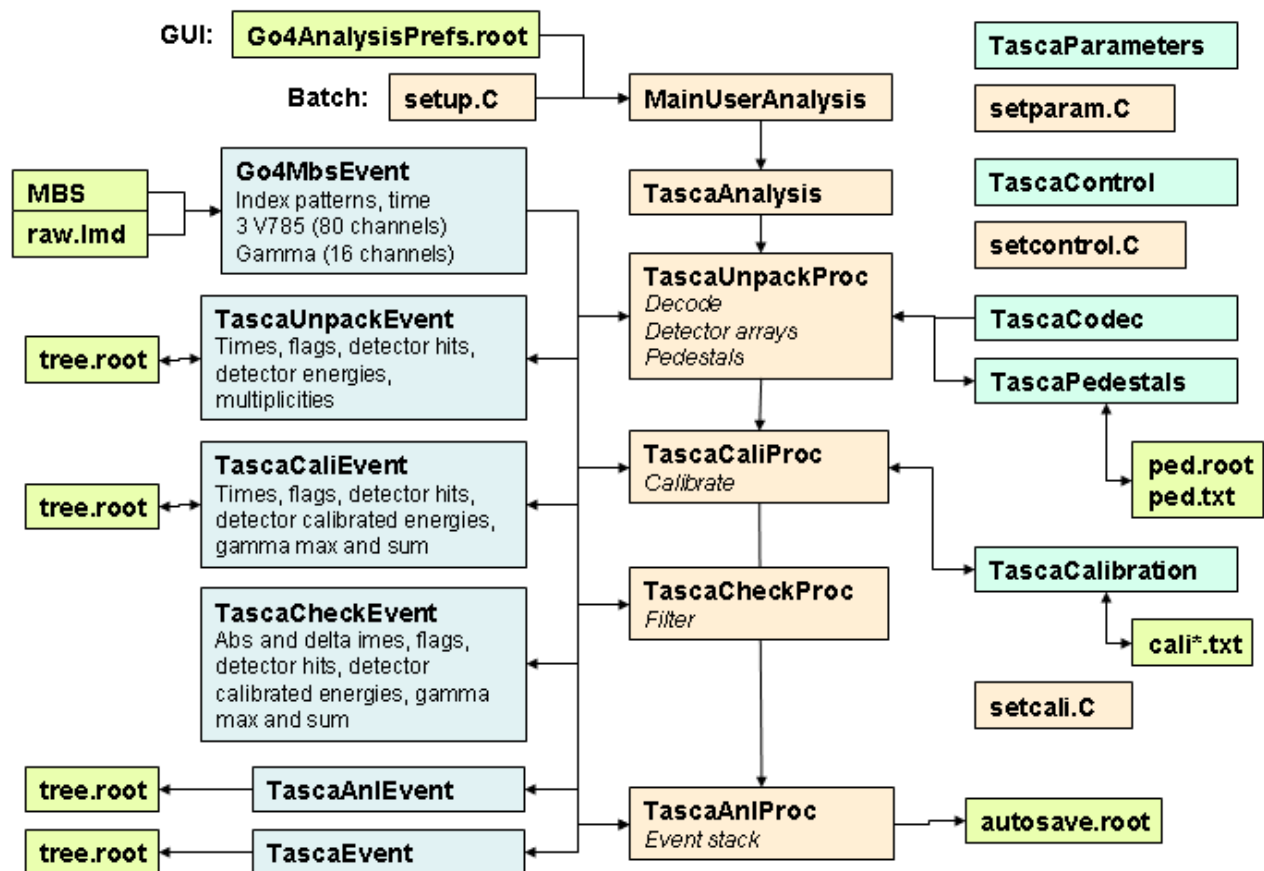
#### After login

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

```
. go4login 402-00
```

```
. leallogin
```

(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.

### **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 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.

### **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 *TascaCaliEvent* data fields.

### **Analysis step**

**Input:** *TascaCheckEvent* (from Checker step or from file)

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

**Autosave:** Creates parameters Controls, Parameters

**Processing:** Fills histograms

## ***Control files***

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

**setcontrol.C** : Lines to change:

```
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 T0F 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.

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 each LMD file a directory file (LMDIR file) must be made. Then one can get very fast the filename of a specific event.

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

```
lmlrmake t018f 3 146
```

This creates files t018fxxx.lml with xxx=003 to 146 containing lists of files t018fxxx\*.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.

Bad LMD files have been moved to directory

```
/d/ship01/tasca/t018/badfiles
```

New directory

```
/d/ship01/tasca/t018/checked01
```

is forseen for the calibrated and checked ROOT files.

GO4 analysis is in

```
/u/tasca/GO4_offline_t018
```

There is also a shell script to execute in batch farm

```
runbatch.sh
```

This can be started by

```
bsub -q betch32 runbatch.sh -o <logfile>
```

```
bjobs
```

shows job status

```
bkill -q betch32 <jobID>
```

kills a job

## 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.

