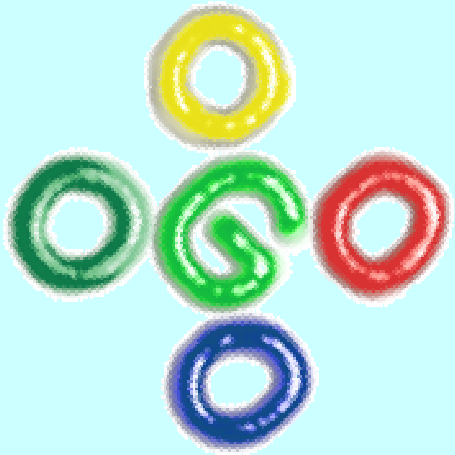


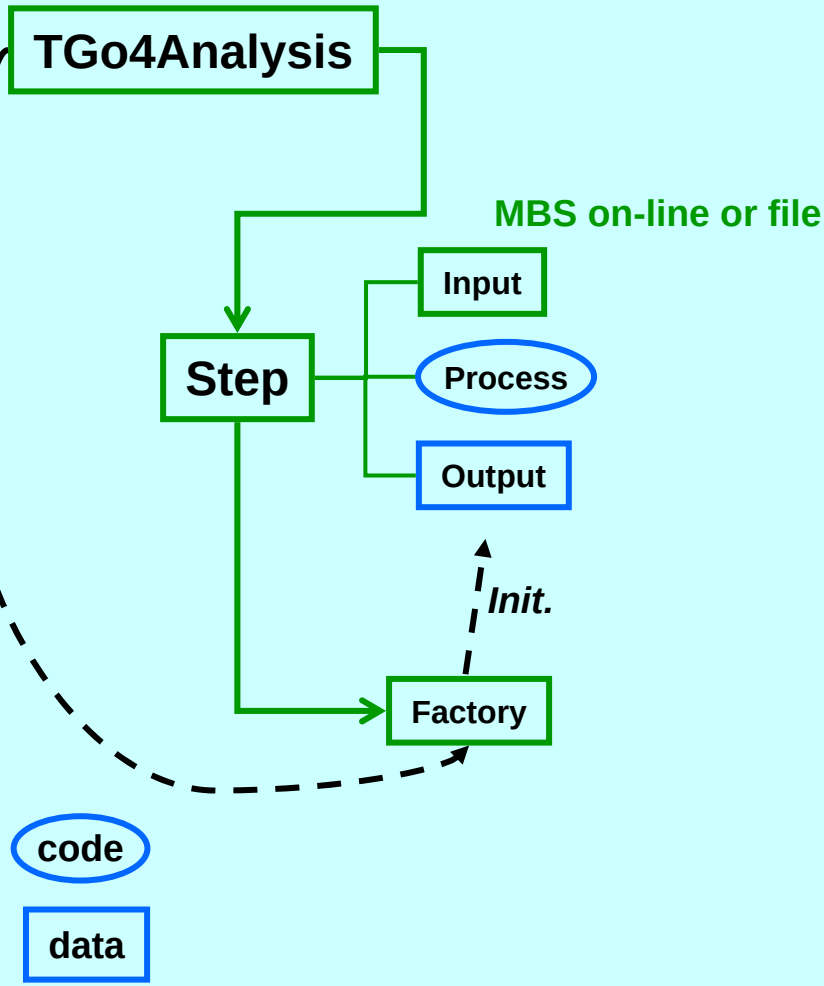
GO4 Version 3

J.Adamczewski, H.G.Essel, S.Linev

Lectures

Demo of simple analysis

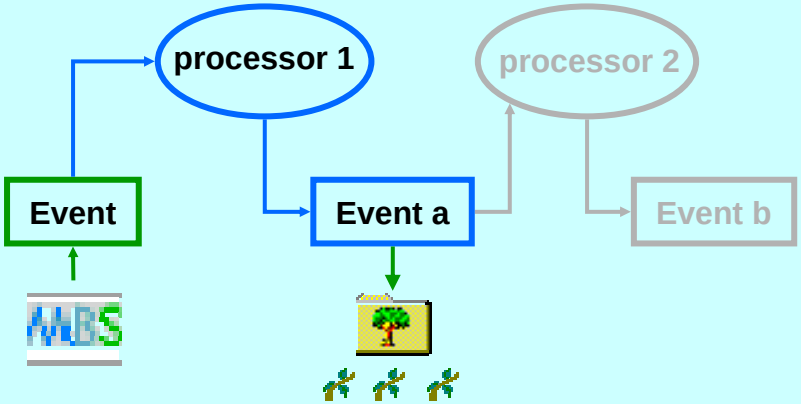
Go4 analysis simple structure



Framework

User Code

Go4 analysis steps calling



Init and Fill called by framework (step)

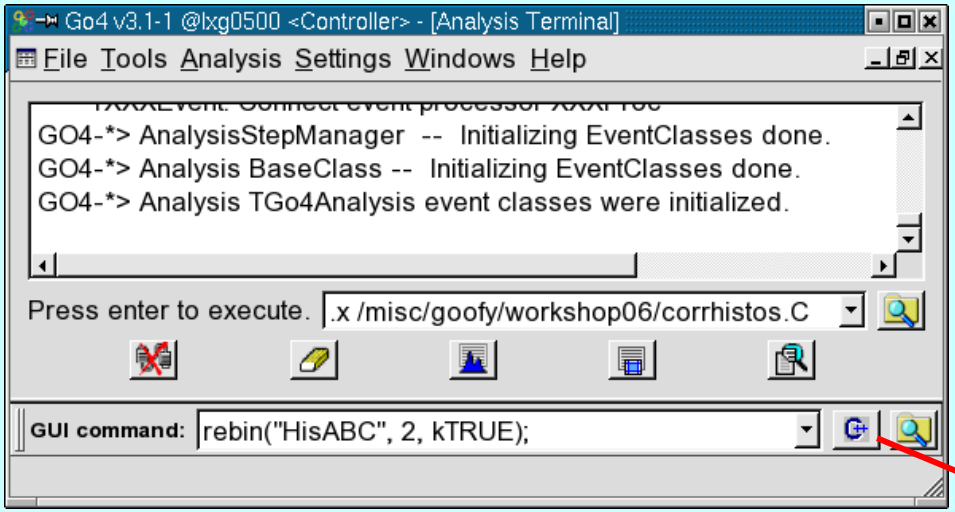
If no steps follow:

Event a->Init:
get processor 1 (from framework)
Event a->Fill:
call user event function of processor 1
optionally store Event a (by framework)

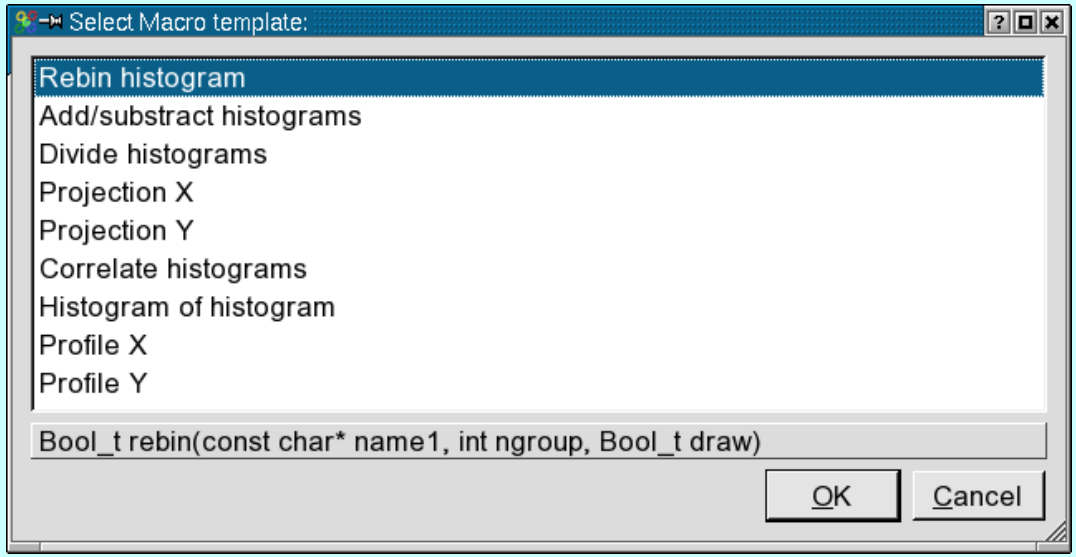
Macro usage demo

- **Macro execution in analysis code**
  - gROOT->ProcessLine(command)
  - Set up analysis
  - Set parameter values
  - Set condition values
- **Macro execution in analysis called in GUI**
  - Selective clearing of histograms
  - Saving conditions
  - Saving parameters
- **Macro execution in GUI**
  - Histogram calculations
  - Set up monitoring (hot start)
  - Elaborate graphics

Remote (analysis) and local (GUI)



some macros provided by Go4

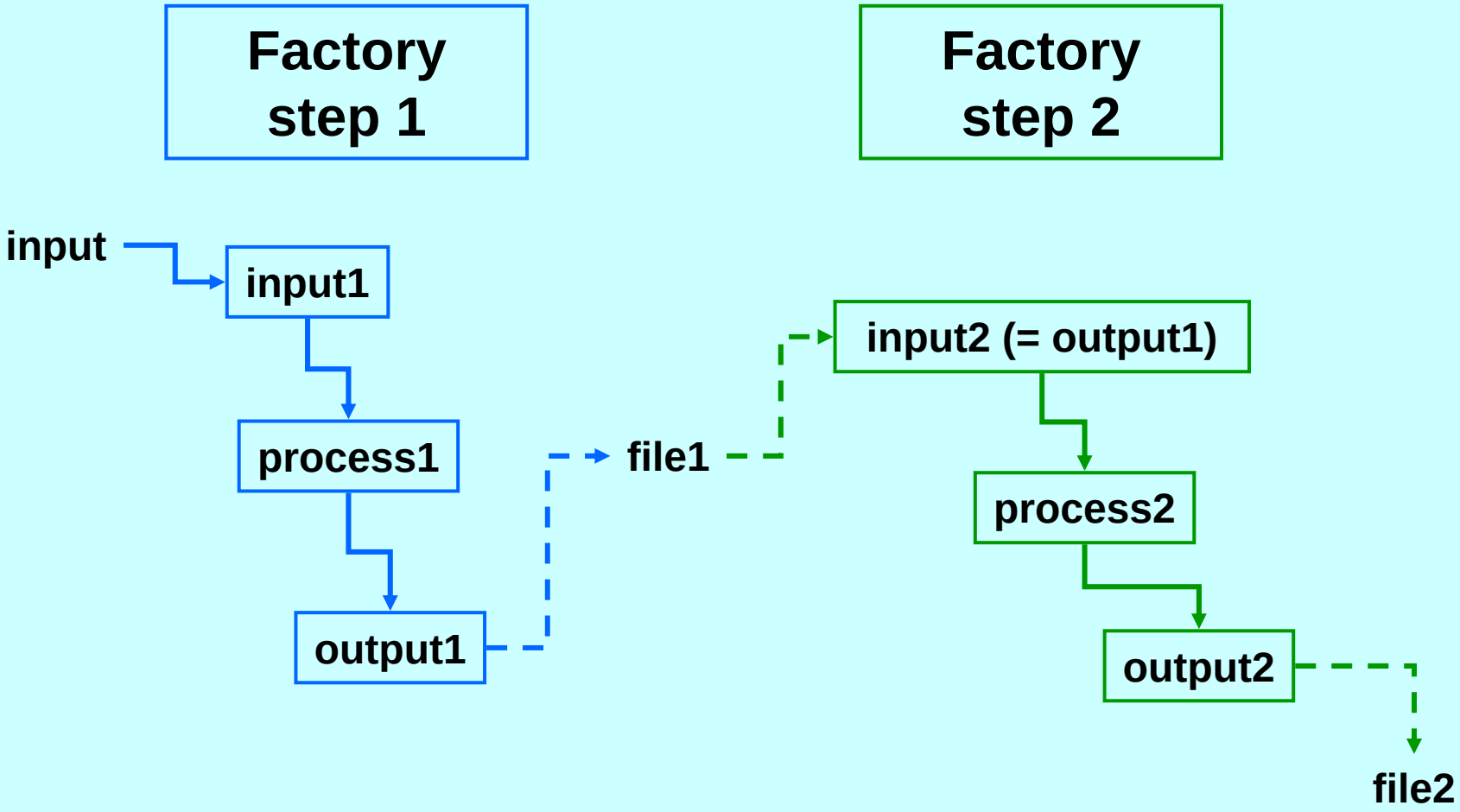


Full description in Go4 reference manual

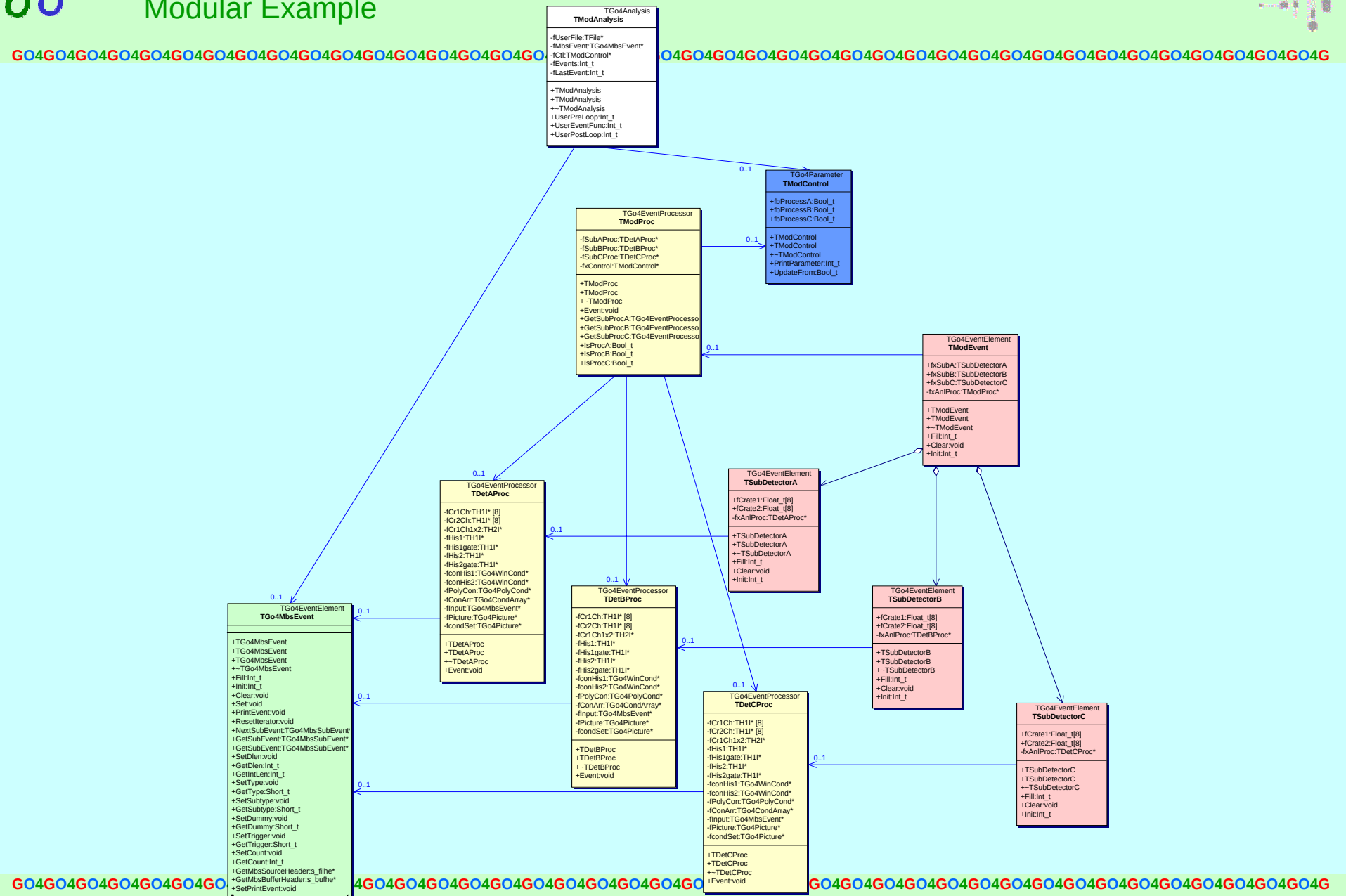
- **Macro execution in analysis**
  - go4 = *TGo4Analysis::Instance()*
  - *TGo4Condition* *cond = go4->*GetAnalysisCondition*(name)
  - *TH1* *histo = go4->*GetHistogram*(name)
  - *TGo4Parameter* *par = go4->*GetParameter*(name)
  - *TObject* *object = go4->*NextMatchingObject*(wildcard,folder,createlist)
- **Macro execution in GUI**
  - #ifdef __GO4MACRO__ ... #endif
  - go4 is already set to *TGo4AbstractInterface::Instance()*
  - *TString* *fullname = go4->*FindItem*(name)
    TObject *object = go4->*GetObject*(fullname)
  - *TString* *fullname = go4->*SaveToMemory*(workspace-folder,object,ownership)
  - go4->*MonitorItem*(name,enable)
  - *ViewPanelHandle* *view = go4->*StartViewPanel()*
    go4->*DrawItem*(fullname,view,options)

- **Called by gROOT->ProcessLine in analysis**
  - setup.C
  - stream.C
- **Called in GUI analysis command line**
  - savecond.C(file,1)
  - savepar.C(name,file)
- **Called in GUI command line**
  - draw1.C(#) #=16,48
  - draw2.C(#,channel) #=16,48 channel=100-500
  - draw3.C(#) #=16,48 dPicture.root(DataPict)

Using several analysis classes in one step


Factory step 1
Factory step 2
input
input1
process1
output1
file1
input2 (= output1)
process2
output2
file2

Modular Example



Using browser and graphical editors

- **Browser functionality**
- **Usage as ROOT files browser**
- **Displaying data in view panel**
- **Objects in GUI workspace**
- **Export data from browser**

- One browser for all data sources
  (analysis, file, histogram server, memory,...)
- Full control by context menu
- Different objects properties displayed in columns
- Objects monitoring tool
- Objects filter tool by state (monitored, fetched, all)
- Local memory workspace with user subdirectories
- Support of drag-&-drop of items

- Go4 GUI can be used in offline as ROOT files browser
- To create example ROOT file:

```
shell$ cd
shell$ cp $ROOTSYS/tutorials/hsimple.C .
shell$ root -l hsimple.C
shell$ go4
go4$ Open file “hsimple.root”
```

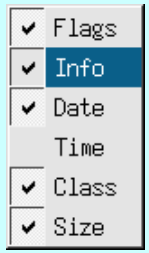
- Subdirectories and TTree brunches/leafs can be seen
- Display of any histogram by double click

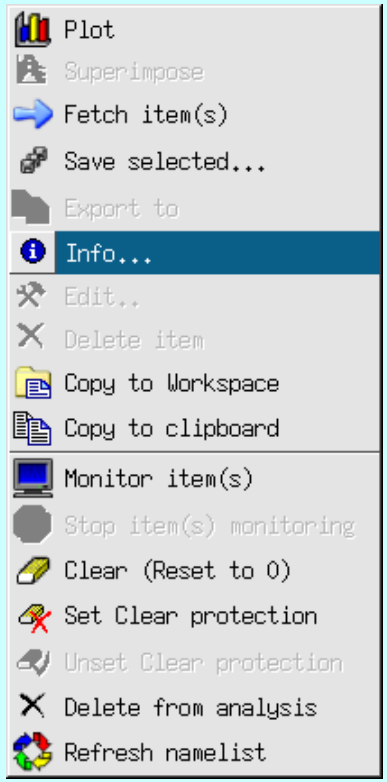
- Open file “hsimple.root”
- Tree viewer activated by double-click on any tree leaf item
- 1-D, 2-D and 3-D tree draw is possible with cut condition
- Drag & drop of leafs names to viewer fields
- Automatic histogram creation or via special dialog

- Same in ROOT session:

```
shell$ root -l
root [0] TFile::Open(“hsimple.root”);
root [1] new TBrowser;
root [2] “double click” leaf item in TBrowser
```

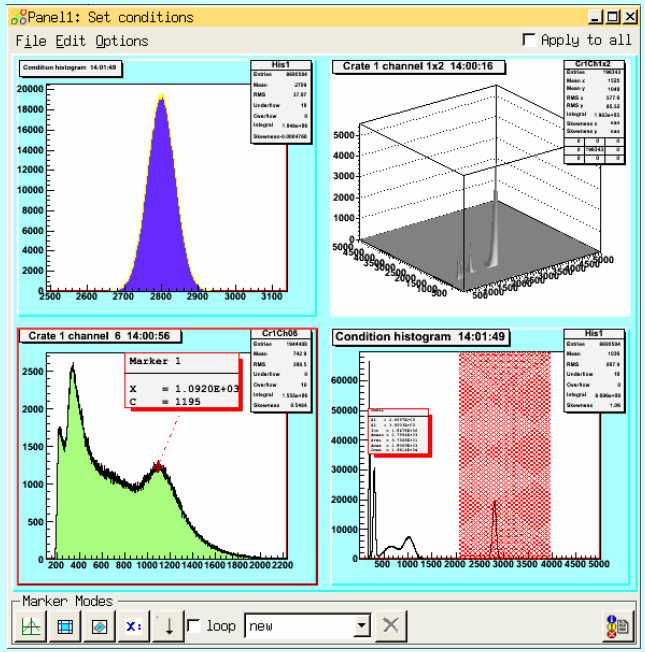
- Browser displays up to 7 columns:
  - **Name** – item name
  - **Flags** – item status (monitored, fetched)
  - **Info** – object title
  - **Date, Time** – time when object is fetched
  - **Class** – object class
  - **Size** – object size or sum for folders
- To activate/deactivate columns, use right-mouse menu out of the **Name** column
- For each element context menu via right-mouse click on item name is available





Display of data in view panel

- Display by double click or via Draw in context menu
- Start empty view panel and drag & drop from browser
- View panel features:
  - subpads division
  - superimpose mode
  - different draw / log scale options
  - zooming tools
  - ROOT editor
  - markers editor (described later)
  - save as picture / canvas / image
  - date / time / name info in pads
- Superimpose via context menu in browser
- Usage of “Apply to all” flag
- “Fetch when drawing” flag from setting menu



- Place for fixed (non-updated) objects copy
- Any ROOT-generated objects (like projections) will (should) appear in workspace
- For most objects in browser “Copy to workspace” context menu can be activated
- Copy & paste functionality for any object / folder
- Subfolders can be created / renamed / deleted
- Store of Workspace folders in ROOT file
- “Fetch when copying” flag from setting menu

- Complete content can be store in ROOT file via “Save memory” menu command
- Binary ROOT and XML format are supported
- Any selected item(s) can be stored in ROOT file
- “Fetch when saving” flag from setting menu
- Export of histograms content to ASCII (Excel, Origin) and Radware

- **Condition editor**
- **Marker editor**
- **Parameter editor**
- **Dynamic list editor**

- For demonstration example $GO4SYS/Go4Example2Step will be used
- To run example:

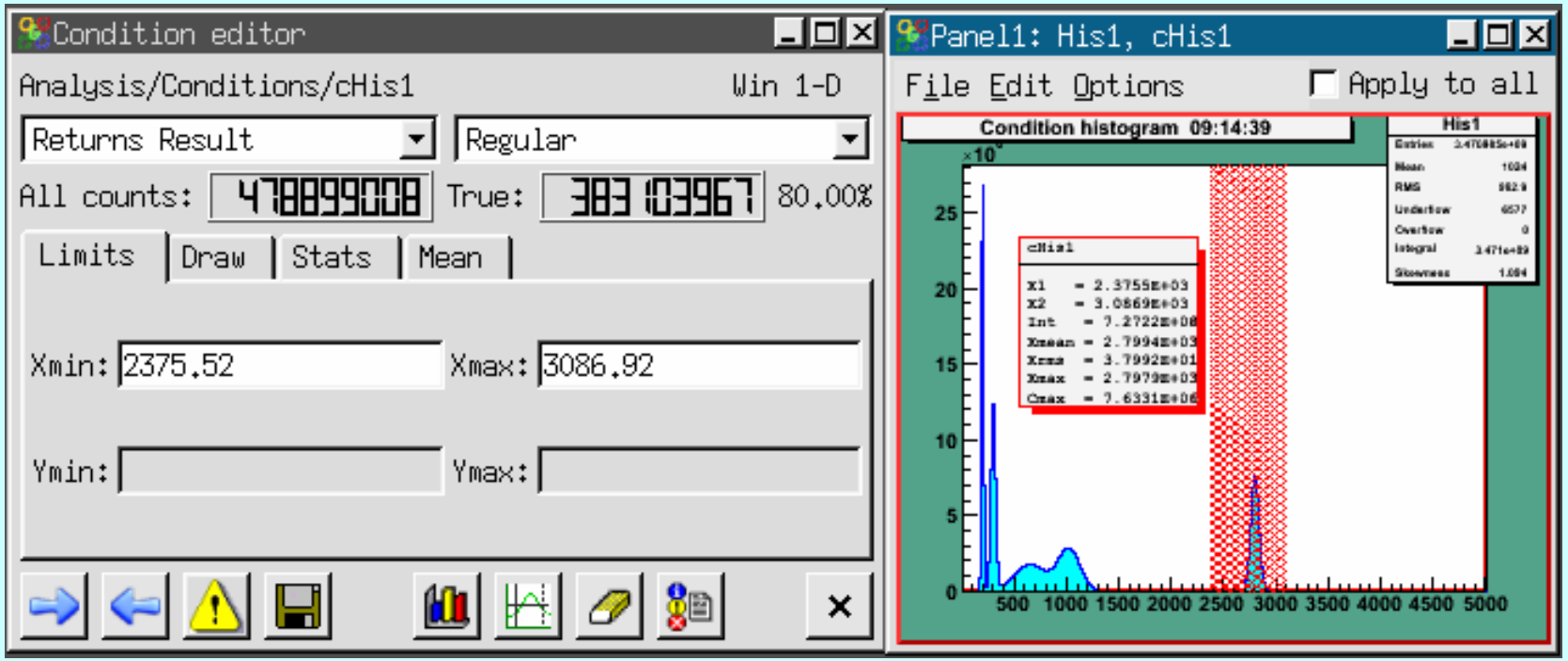
```
shell$ . go4login new
shell$ cd $GO4SYS/Go4Example2Step
shell$ go4
go4$ “Launch analysis”
go4$ Configure without Autosave
go4$ Submit & start analysis
```

- TGo4Condition – base class for any condition
- TGo4WindCond – 1-D or 2-D window condition
- TGo4PolyCond – 2-D polygon condition
- TGo4CondArray – array of conditions

- To be used in analysis for testing event data against boundary condition, activating/deactivating analysis code

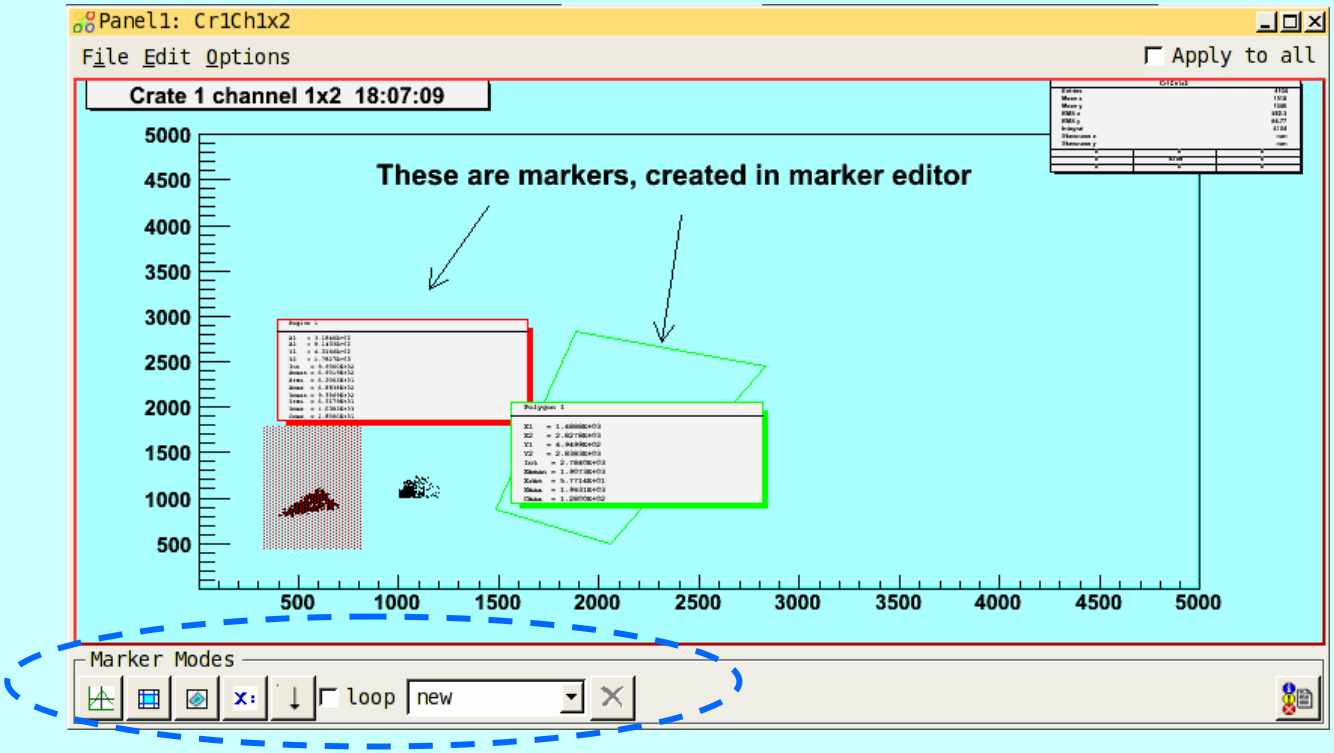
- Main methods:
  - Test(x), Test(x,y) – check if tested value(s) comply to condition
  - SetHistogram(name) – connect condition with histogram for displaying

Editor for TGo4Condition class



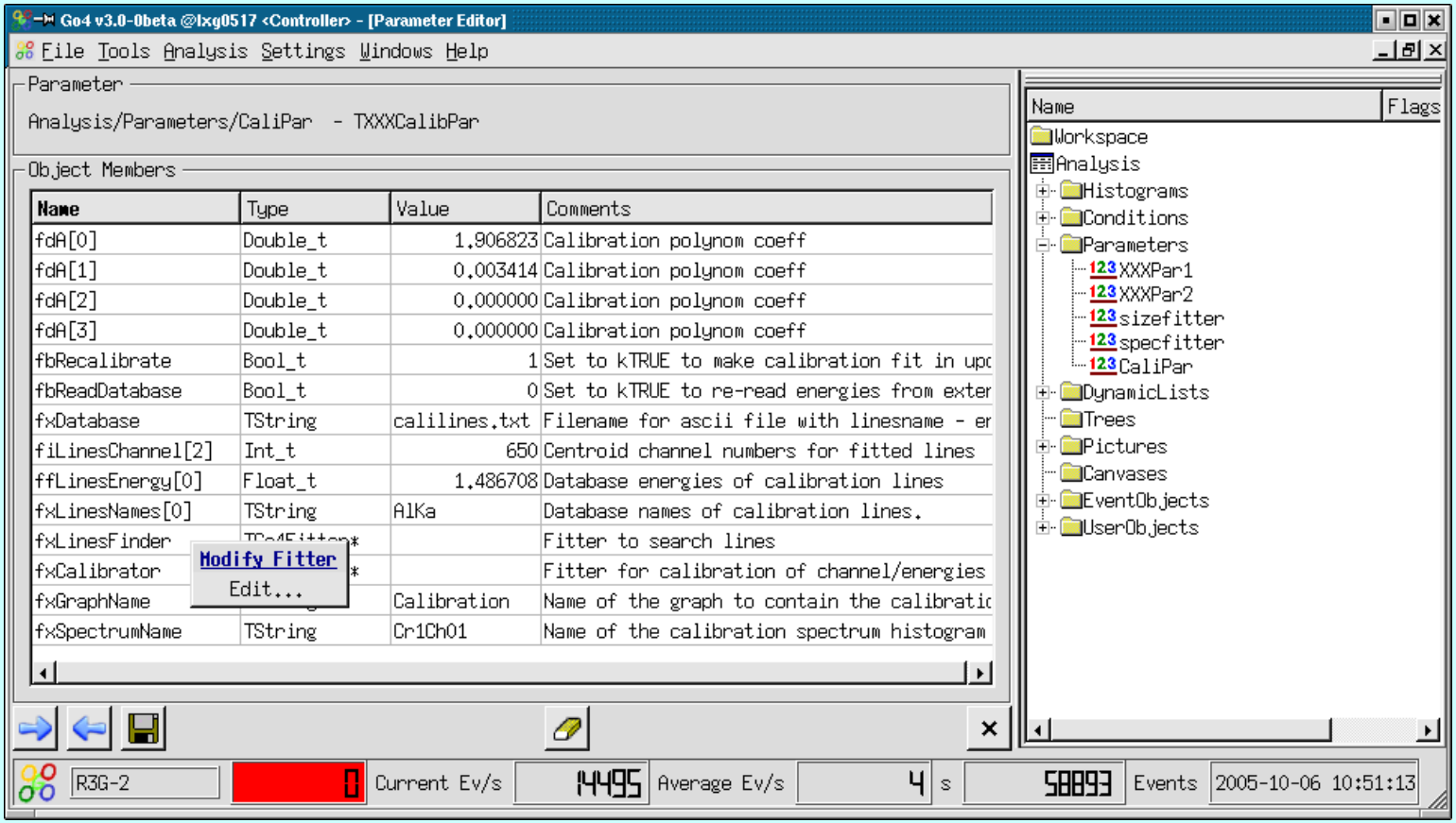
- Activation: double click on condition, condition context menu, drag & drop condition to editor
- Displaying condition on view panel with draw button or drag & drop to viewpanel
- Changing condition values in editor or in view panel
- Update condition in analysis, store / restore condition in file
- Creating new condition in analysis

Add-on for view panel functionality



- User can add following objects:
  - 1-D, 2-D or polygon marker
  - Text label
  - Arrow
- Loop mode to add many objects in once
- Select / change / delete specific markers
- Can be used as reduced condition editor

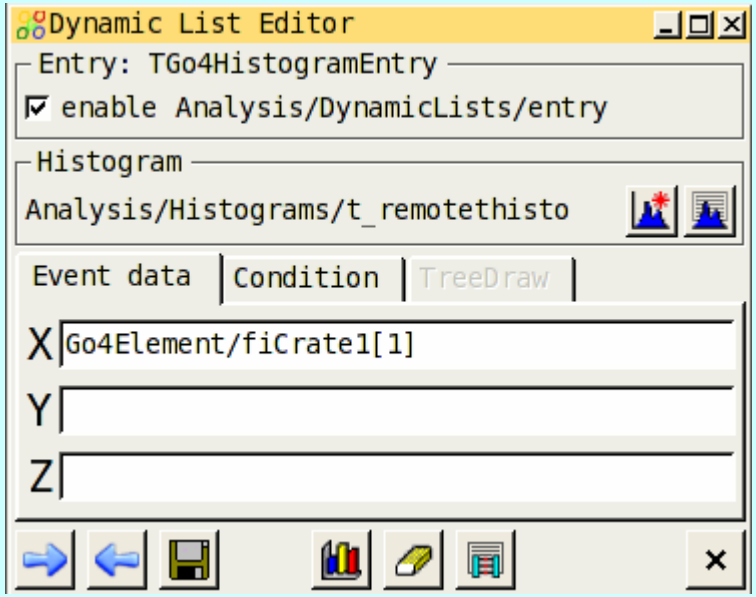
Editing of local/remote TGo4Parameter objects



- User classes, derived from TGo4Parameter, should be used as coefficients table
- TGo4Parameter::UpdateFrom() method can be implemented for user control how values will be assigned in the analysis
- For simple cases UpdateFrom() implementation is no longer required

- Basic data types, array of basic data types, TString and TGo4Fitter are supported for editing
- Array contents can be expanded / shrinked
- Comments in class declaration are visible in parameter editor
- Class library **is not required** for parameter editing (only for file I/O)
- Parameter can be updated in analysis or stored / restored in file

For fast histogramming without code changing

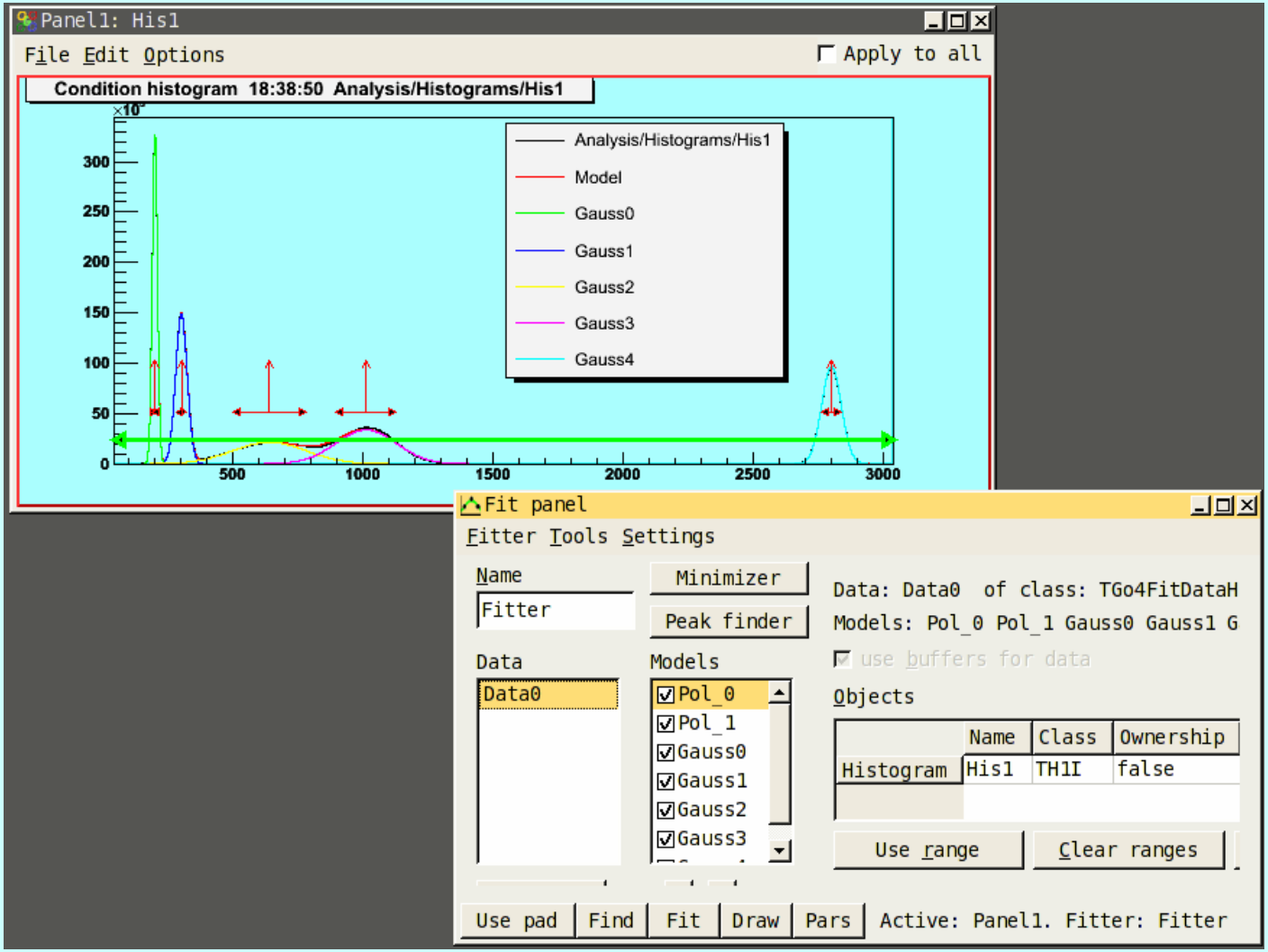


- Browser displays analysis event structure and opened tree in analysis
- These data updated once per event and therefore can be used for histogramming
- Two alternatives for dynamic histogramming:
  - over any element(s) in events structures, including condition
  - TTree::Draw() operation

Fitting interactively and in code

- **Fit panel in Go4**
- **Use of TGo4Fitter in macro**
- **Reuse of fitter in GUI / Analysis**

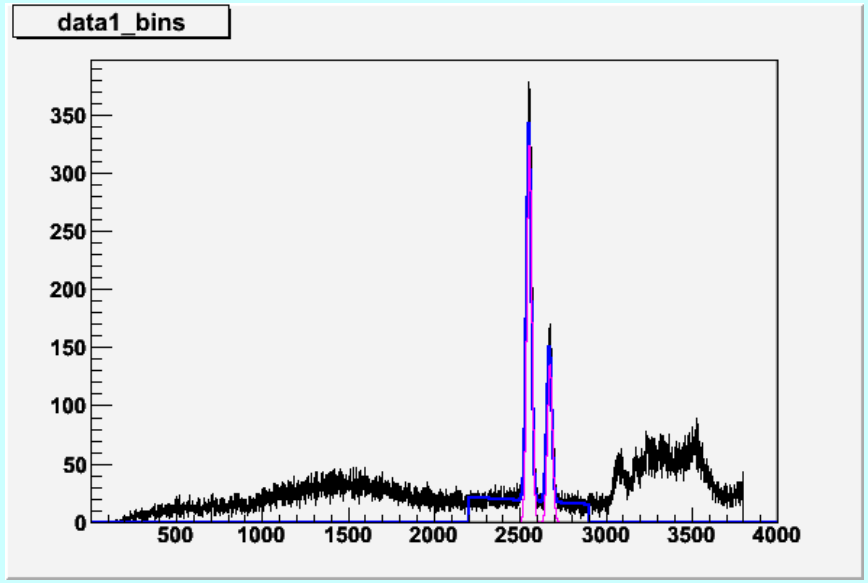
Fit panel


Panel1: His1
File Edit Options
Apply to all
Condition histogram 18:38:50 Analysis/Histograms/His1
Analysis/Histograms/His1
Model
Gauss0
Gauss1
Gauss2
Gauss3
Gauss4
Fit panel
Fitter Tools Settings
Name
Fitter
Minimizer
Peak finder
Data
Data0
Models
Pol_0
Pol_1
Gauss0
Gauss1
Gauss2
Gauss3
Data: Data0 of class: TGo4FitDataH
Models: Pol_0 Pol_1 Gauss0 Gauss1 G
use buffers for data
Objects
Name
Class
Ownership
Histogram
His1
TH1I
false
Use range
Clear ranges
Use pad
Find
Fit
Draw
Pars
Active: Panel1. Fitter: Fitter

- Fitting of histograms / graphs for any kind of model
- Peak finder
- Manual change of model components / fit parameters
- Fitting and parameters view, parameters output
- Fit panel menu commands
- Different display modes:
  - show only model
  - show model components
  - use different panel for drawing
- Store fitter in file

- Can be used without rest Go4 framework
- Just gSystem->Load(“libGo4Fit.so”) before usage
- $GO4SYS/Go4FitExample package with many different examples of TGo4Fitter usage
- Can be used as macros or compiled into executable

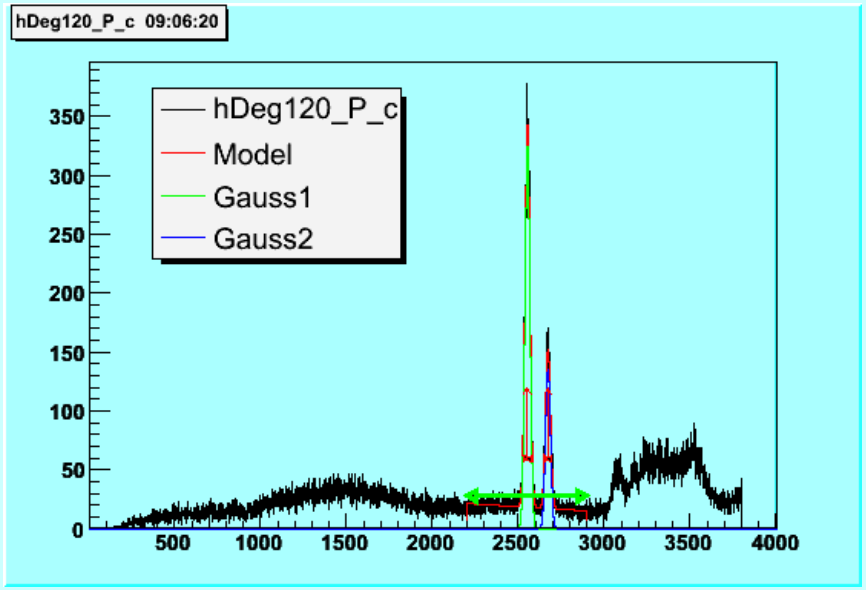
```
// create fitter, select fit function and add standard actions list
   TGo4Fitter fitter("Fitter", TGo4Fitter::ff_ML_Poisson, kTRUE);

// add histogram to fitter, which should be fitted
   fitter.AddH1("data1", GetHistogram("hDeg120_P_c"), kTRUE, 2200., 2900.);

// create polynom of first order
   fitter.AddPolynomX("data1", "Pol", 1);

// create two gaussians
   fitter.AddGauss1("data1", "Gauss1", 2553., 15.);
   fitter.AddGauss1("data1", "Gauss2", 2672., 15.);

// execute all actions
   fitter.DoActions();

// draw data, full model and two gaussains
   fitter.Draw("#data1,Gauss1,Gauss2");
```



- Store fitter in macro:

```
TFile* f = TFile::Open("fitter.root","recreate");
fitter.ClearObjects(0, kFALSE); // do not store histos with fitter
fitter.Write();
delete f;
```

- Load file with fitter in Go4 browser
- Drop fitter on histogram to be fitted
- Press **Fit** button



- Do fitting in fit panel
- Store fitter in file (via browser)
- Load fitter in macro and assign histograms:

```
// read fitter from file
TFile* f = TFile::Open("fitter2.root");
TGo4Fitter* fitter = (TGo4Fitter*) f->Get("Fitter");
delete f;
if (fitter==0) return;

// set histogram in fitter
fitter->SetObject("data1", GetHistogram("hDeg120_P_c"), kTRUE);

// make fitting
fitter->DoActions();

// just draw fitter
fitter->Draw("#data1,Gauss1,Gauss2");
```

- Repeat fitting as many time as necessary

- Simultaneous fit of several histograms
- Fitting model definition via TFormula, sample histogram or shared library
- Different range settings
- Two-dimensional histograms fit
- See Fit tutorial on Go4 webpage

- Most are supported by “Expert” mode in the Fit panel

How to write user GUI

- **User GUI basics**
- **Standard User GUI example**
- **Functionality of QGo4Widget**
- **Getting started with own GUI**

- User GUI is must be placed in shared library
- GO4USERGUI shell variable should specify path and name of shared library
- StartUserPanel() function must be defined
- Top-level widget must be inherited from QGo4Widget class, no extra classes
- Plugin for Qt designer can be generated by:

  make plugin

- In GO4SYS/Go4UserGUI
- Contains one widget, inherited from QGo4Widget
- Shows:
  - drag & drop items from browser
  - draw / edit / info of any item
  - object update/delete notification
  - usage of QtRoot canvas

Via two virtual methods of QGo4Widget:

- bool IsAcceptDrag(itemname, class, kind)
  - Here user should decide if item of that class and kind (object, parameter, tree leasf, event and so on) can be accepted or not
- void DropItem(itemname, cl, kind)
  - when drag is accepted and user drop item on panel, any action can be done. In example label is updated

- Many useful methods of QGo4Widget:
  - EditItem(const char* itemname)
  - DrawItem(const char* itemname)
  - ShowItemInfo(const char* itemname)
  - SaveItemToFile()
  - UpdateItemInAnalysis()
- Methods of TGo4Interface, TGo4BrowserProxy and TGo4AnalysisProxy also accessible

- Object manager can inform user GUI when object is updated / deleted in browser
- To enable, link between browser item and user widget must be established (typically, when item is dropped):

  AddLink(itemname,”LinkName”)
- Virtual methods must be reimplemented:

  QUserPanel::linkedObjectUpdated(linkname, obj)

  QUserPanel::linkedObjectRemoved(linkname)
- In these methods correct update of user panel must be implemented.
- This directly enable monitoring of objects in user panel

- Copy content of $GO4SYS/Go4UserGUI in new location
- Compile:
  shell$ make clean
  shell$ make all
- Set GO4USERGUI variable:
  shell$ export GO4USERGUI=`pwd`
- Run go4 and activate user GUI panel
- If necessary, install designer plugin (from $GO4SYS):
  shell$ make plugin
- Copy plugin to designed plugins location (see comments after make plugin operation)
- Start Qt designer, open project “Go4UserGui.pro”, modify existing panel, create new tabs, new widgets and so on