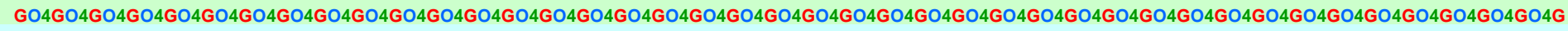






10.00h	Essel	<b>Go4 V3</b>	Overview Analysis design GUI control
10.45h	Essel	<b>Simple Analysis</b>	First look into analysis code
11.15h	Break		
11.30h	Adamczewski	<b>Analysis control</b>	Analysis server with controller/observer GUIs MBS monitoring
12.10h	Linev	<b>The Go4 browser</b>	Analysis, Files, Workspace folders Monitoring, I/O, Treeviewer Update/frozen modes
12.40h	Linev	<b>GUI Editors</b>	Condition usage and editor Markers and conditions General purpose parameters and editor Dynamic list editor





10.00h	Adamczewski	<b>Analysis design with Go4</b>	The Go4 analysis steps Modular analysis (analysis classes)
10.45h	Adamczewski	<b>Go4 Trees in CINT</b>	Go4 libraries, trees, make class
11.00h	Break		
11.20h	Essel	<b>Using macros in Go4</b>	Analysis setup, GUI setup (hot start) Remote execution in analysis Execution in GUI environment API to Go4 environment Compose pictures to be used in batch Standard ROOT graphics in Go4 GUI
11.50h	Linev	<b>User written GUI</b>	Qt designer API to Go4 environment Macro execution
12.20h	Linev	<b>Fitting with Go4</b>	Interactively, save fitter batch using fitter



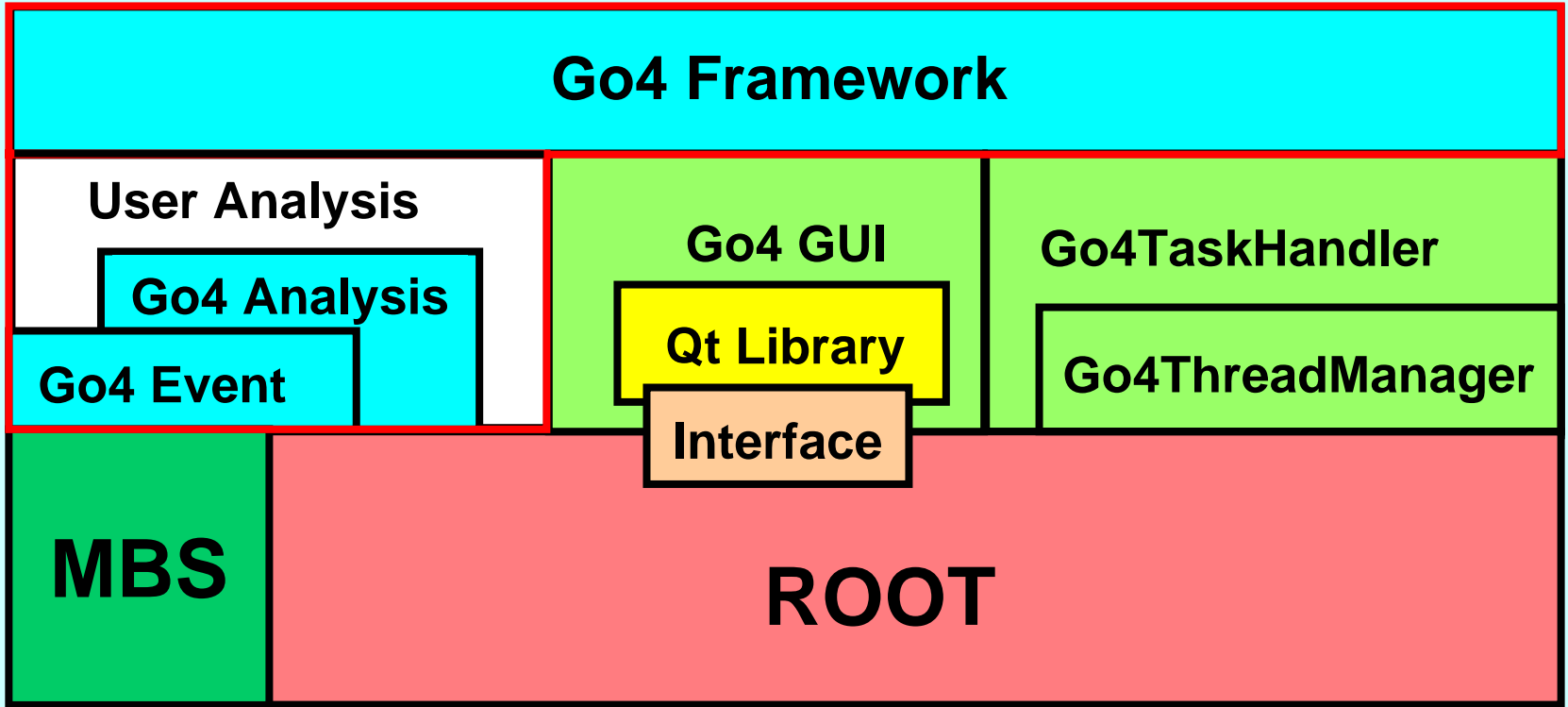
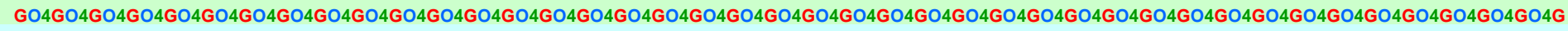


- Go4 features
- Status
- New in v.3.0
- Analysis framework
- Interactive analysis





- Go4 is a framework for many kinds of experiments (Atomic & Nuclear Physics)
- The analysis is written by the user (C++, unlimited ROOT)
- Go4 provides services and interfaces for analysis
- It runs in batch mode (CINT or compiled, on/off-line)
- or interactive mode (on/off-line):
  - A non blocking GUI controls and steers the analysis
  - The analysis runs independently and can update graphics asynchronously
  - ROOT objects are transported between analysis and GUI task
  - ROOT and Qt graphics are interfaced
  - User may create specific GUIs (Qt designer)





- Development start: April 1999
- Go4 v.1.0 May 2002
- Go4 v.2.0 November 2002
- Go4 v.2.10 June 2005 (stable?)
- Go4 v.3.0 (and “final” v2.10) December 2005
- Users:
  - At GSI: FRS, SHIP, AP, ESR, Rising, HypHi, HADES online, ...
  - Outside: TU Darmstadt, Uni Mainz, Uni Giessen, INFN Milano, Weizman institute, IMPCAS,...





- **Inter-task communication** redesign:  
multiple viewers at one analysis server
- **New Object manager** for GUI organization:  
decoupling of functionality and surface
- Redesign of **GUI elements**:  
browser, viewpanel, editors, new MBS monitor,...
- Macro execution in GUI
- **ROOT session** (macro) **may be controlled** by Go4 GUI
- **ROOT session** (TBrowser) **may control** Go4 analysis
- **ROOT session** (TBrowser) **may control other ROOT session** (macro)
- Go4 distribution for **Windows XP** (without Qt!)





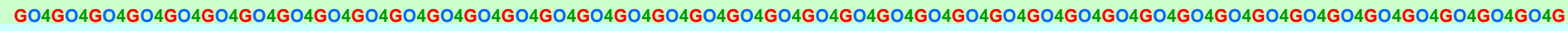


- **Go4 well established as GSI “standard” analysis framework**
- v2.10: development finished, used in production
- new v.3.0:
  - First internal redesign stage (OM, communication)
  - GUI layout and functionality improved
  - Other graphical surfaces than Qt? **possible now!**
  - ROOT session can control Go4 analysis
  - ROOT macros can be controlled from Go4 GUI
  - Port to other OS than Linux?  
**WindowsXP partially done; MacOS(?)**
- v3.0 to do:
  - Testing, bug fixes, user interface improvements
  - Replace analysis object management with new OM
  - Redesign of analysis framework?  
**Backward compatibility!**
- **Go4 v3.1 released and available at <http://go4.gsi.de>**









**Analysis of event data:  
The event loop is executed by framework  
User code is plugged in**

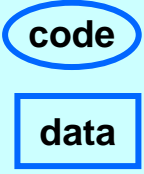
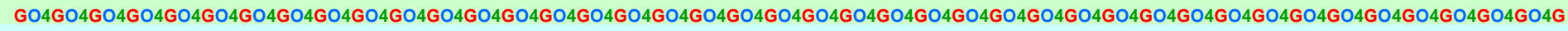




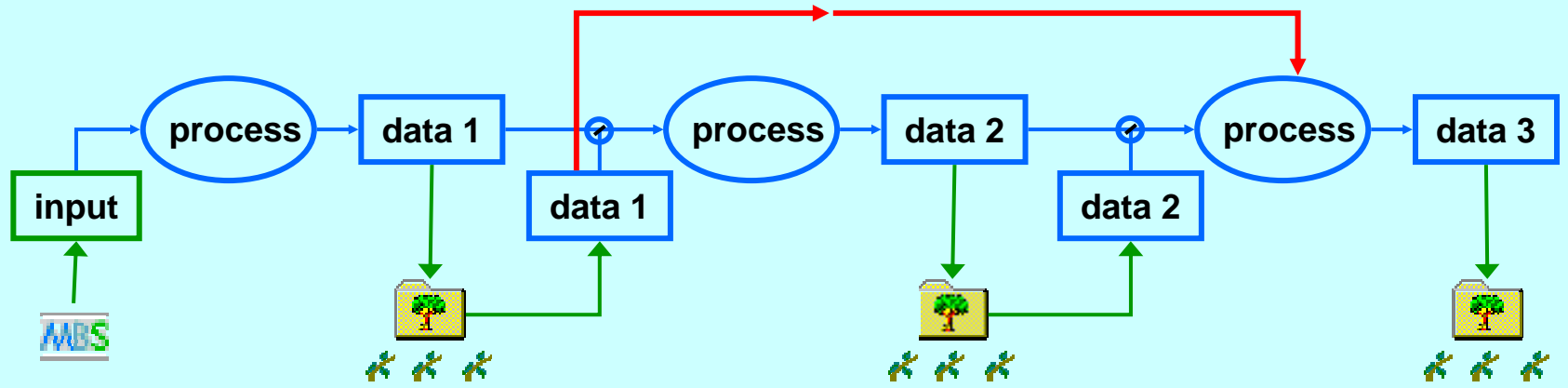




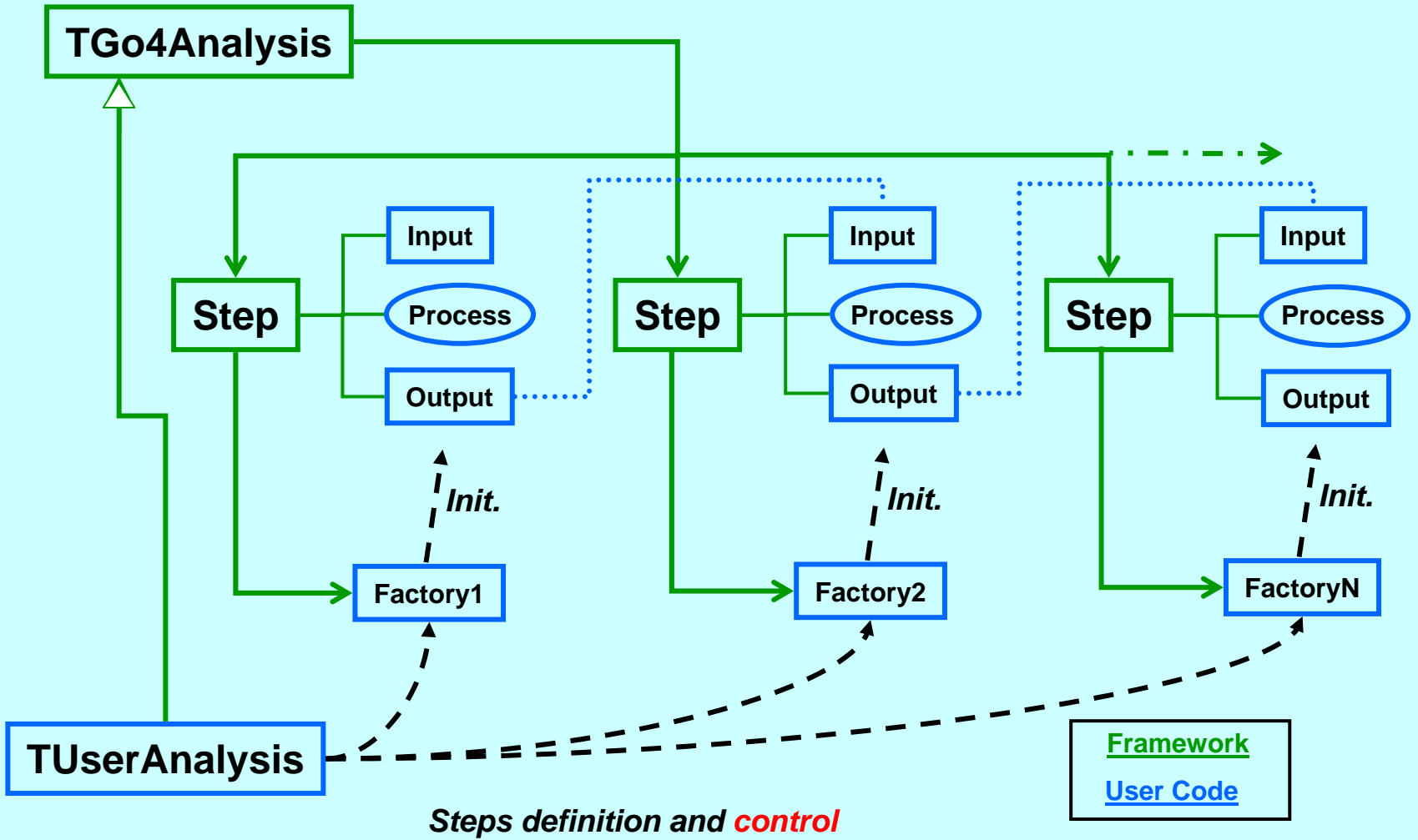
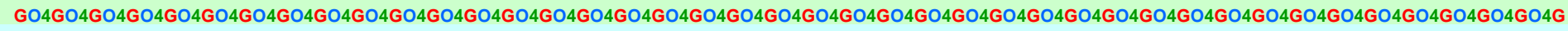




Analysis steps!

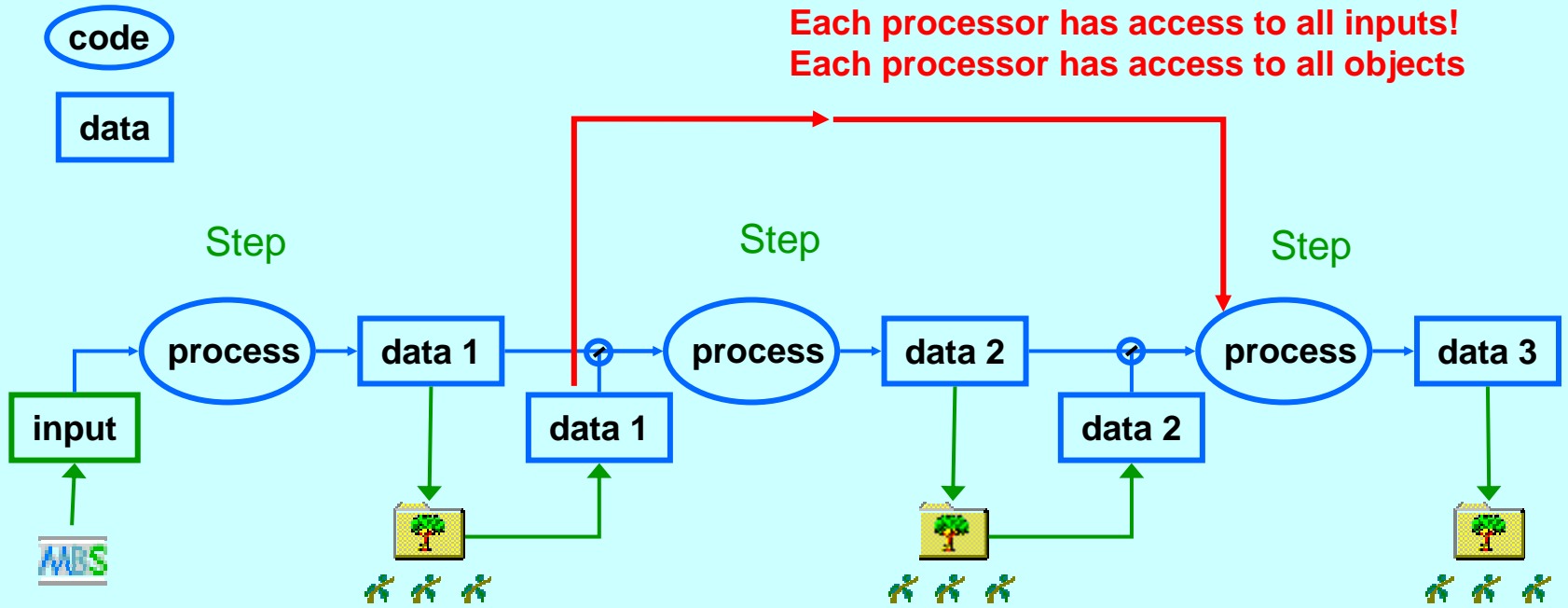


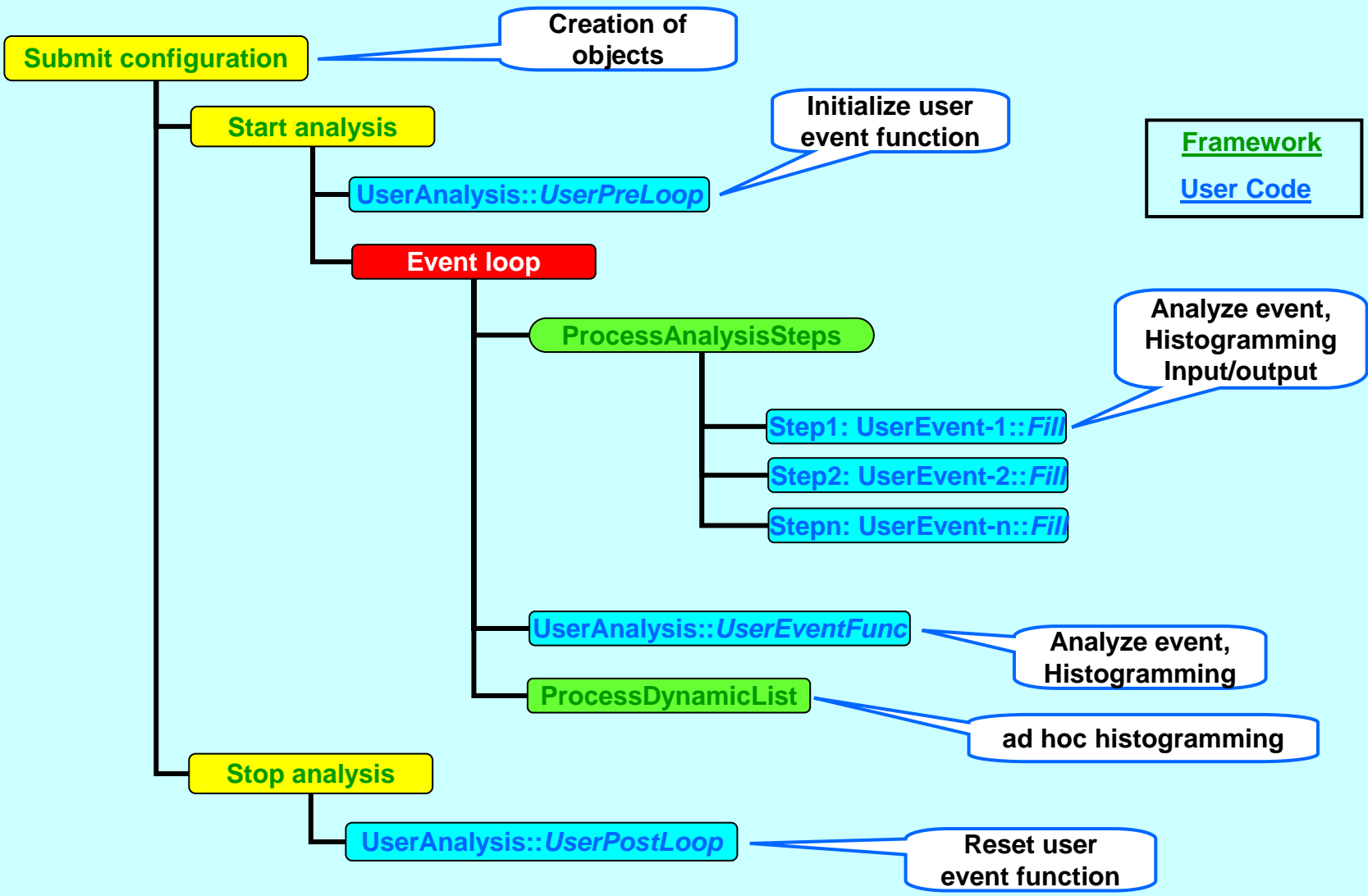
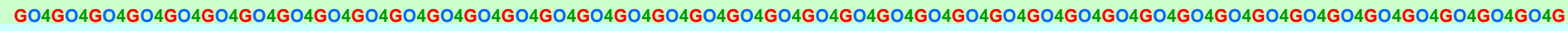


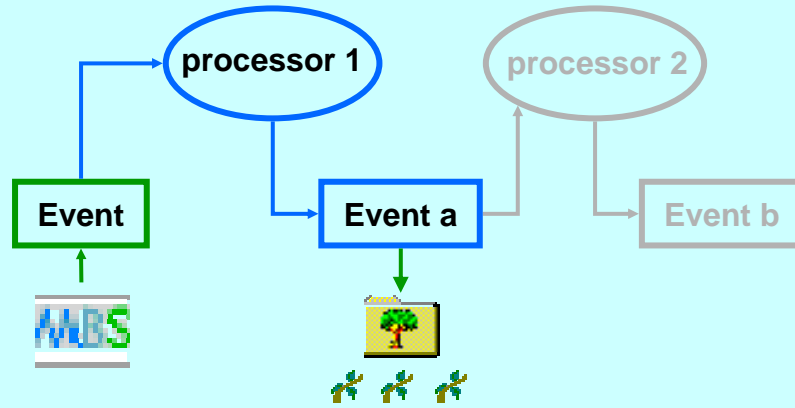




Chain of analysis steps processed **sequentially**  
 Each step can be **en/disabled** (framework)  
**Input/output** can be switched (framework)







Event::*Init* and *Fill* called by framework (step)

If no steps follow:

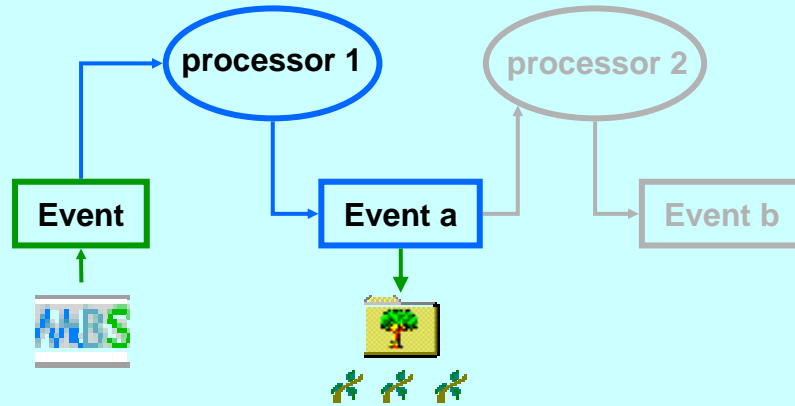
Event a->*Init*:

get processor 1 (from framework)

Event a->*Fill*:

call user event function of processor 1  
optionally store Event a (by framework)





Event::*Init* and *Fill* called by framework (step)

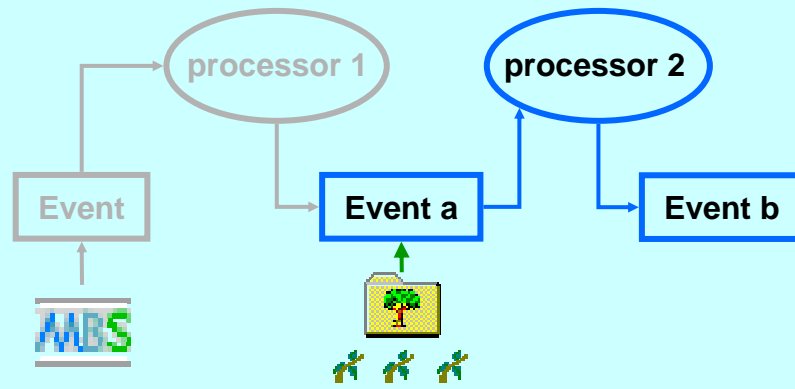
If no steps follow:

Event a->*Init*:

get processor 1 (from framework)

Event a->*Fill*:

call user event function of processor 1  
optionally store Event a (by framework)



Event a->*Init*:

1. is event source = processor 1?

YES: get processor 1 (from framework)

2. is event source a file (*TGo4FileSource*)?

YES: get file source

Event a->*Fill*:

1. processor 1?

YES: call user event function of processor 1

2. file source?

YES: call *BuildEvent* function of file source









IO classes	Event objects	Functionality
	<i>TGo4MbsEvent,</i> <i>TGo4MbsSubEvent</i>	MBS format 10,1
	<i>TGo4CompositeEvent</i>	Complex event structures „toolbox“
<i>TGo4MbsFile</i> <i>TGo4MbsEventServer</i> <i>TGo4MbsStream</i> <i>TGo4MbsTransport</i> <i>TGo4RevServ</i>		read from MBS *.lmd connect to Mbs  connect to remote event server mrevserv
<i>TGo4FileSource</i> <i>TGo4FileStore</i> <i>TGo4BackStore</i>		ROOT TTree in TFile  ROOT TTree in memory online TTree::Draw()
<i>Go4ExampleUserSource</i>		User event source







- **Conditions**

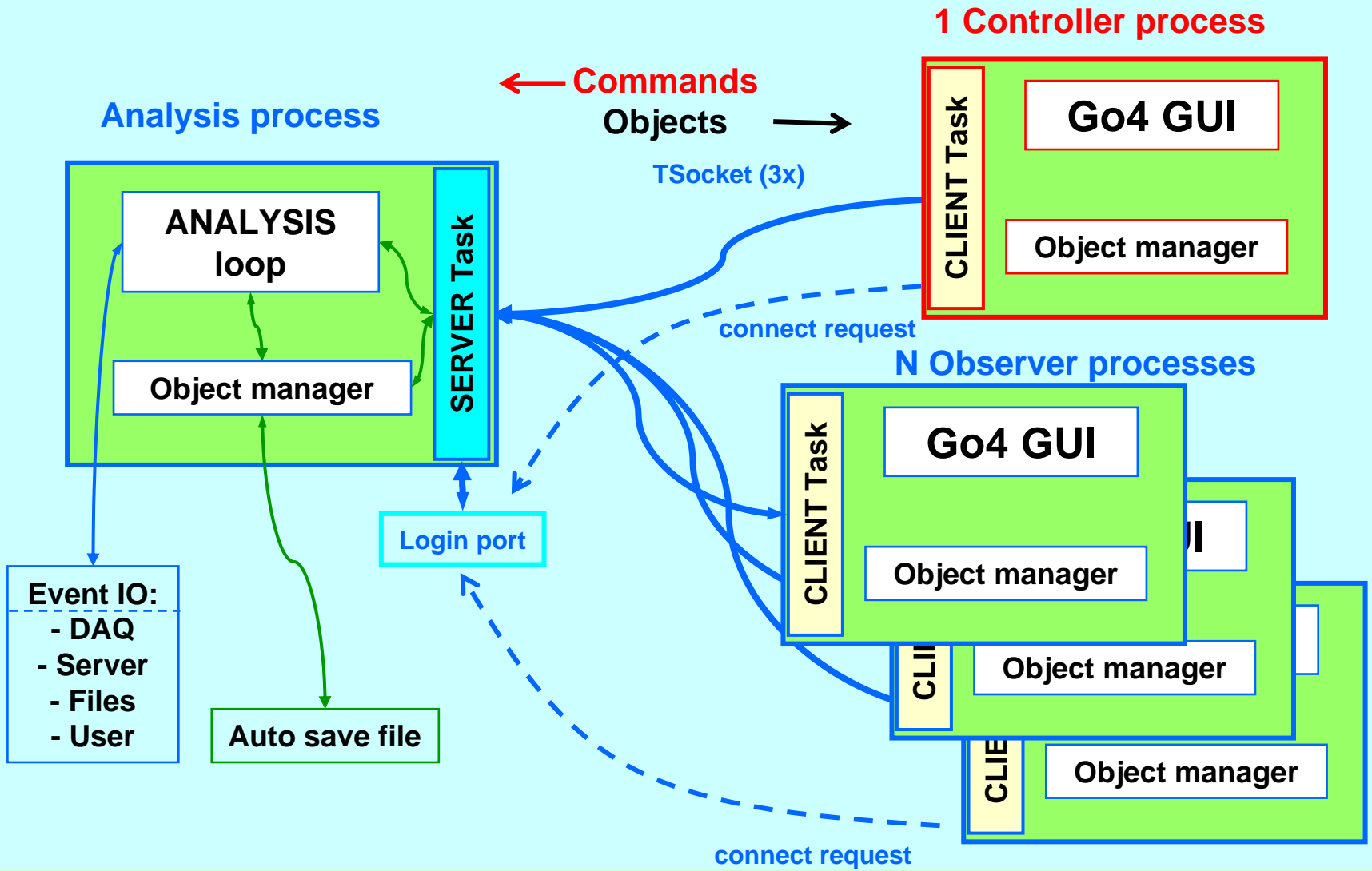
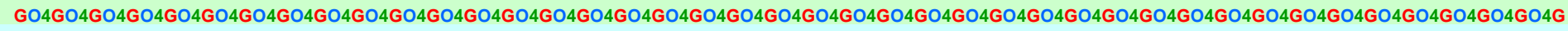
- inspired from GOOSY
- **window condition**: check 1 (2) value(s) against 2 limits (pairs of limits)
- **polygon condition**: check if point (x,y) is inside/outside polygon
- indexable arrays of conditions
- allows for analysis **flow control**
- **statistics** (true/false counters)
- **interactive control** (GUI editor)

- **Parameters**

- **User classes** keeping parameter variables
- **interactive control** (generic GUI editor)
- value protection (update controlled by user function)
- allows for specific **analysis control**
- "**cheap**" **commands** (executed through editor) easy to implement
- supports besides **atomic data** types also **fit objects**









Browser  
Graphics  
Interacvtive tools  
Editors

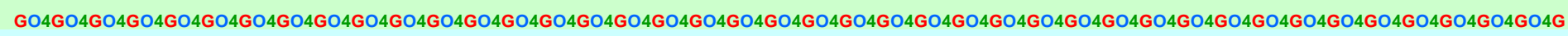




- New object organization and management (great work of Sergey)
- Decoupled from object management  
    functionality independent from graphical surface
- One browser for all data sources  
    (analysis, file, histogram server, memory,...)
- Full control by context menu
- Properties displayed in definable columns
- Monitoring is set as object property
- Object filter tool by state (monitored, fetched, all)
- Local memory workspace with user subdirectories  
    copy & paste, drag'n drop, create subdir, rename

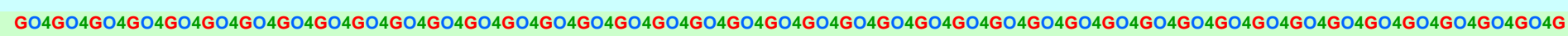






## Requirements:

- central **registry** for all data
- naming like “**Analysis/Histograms/His1**”
- common **API to browse and access** data from different sources like TFolder, TDirectory, remote analysis and so on
- decouple functionality and graphical surface
- possibility of **interactive** interface



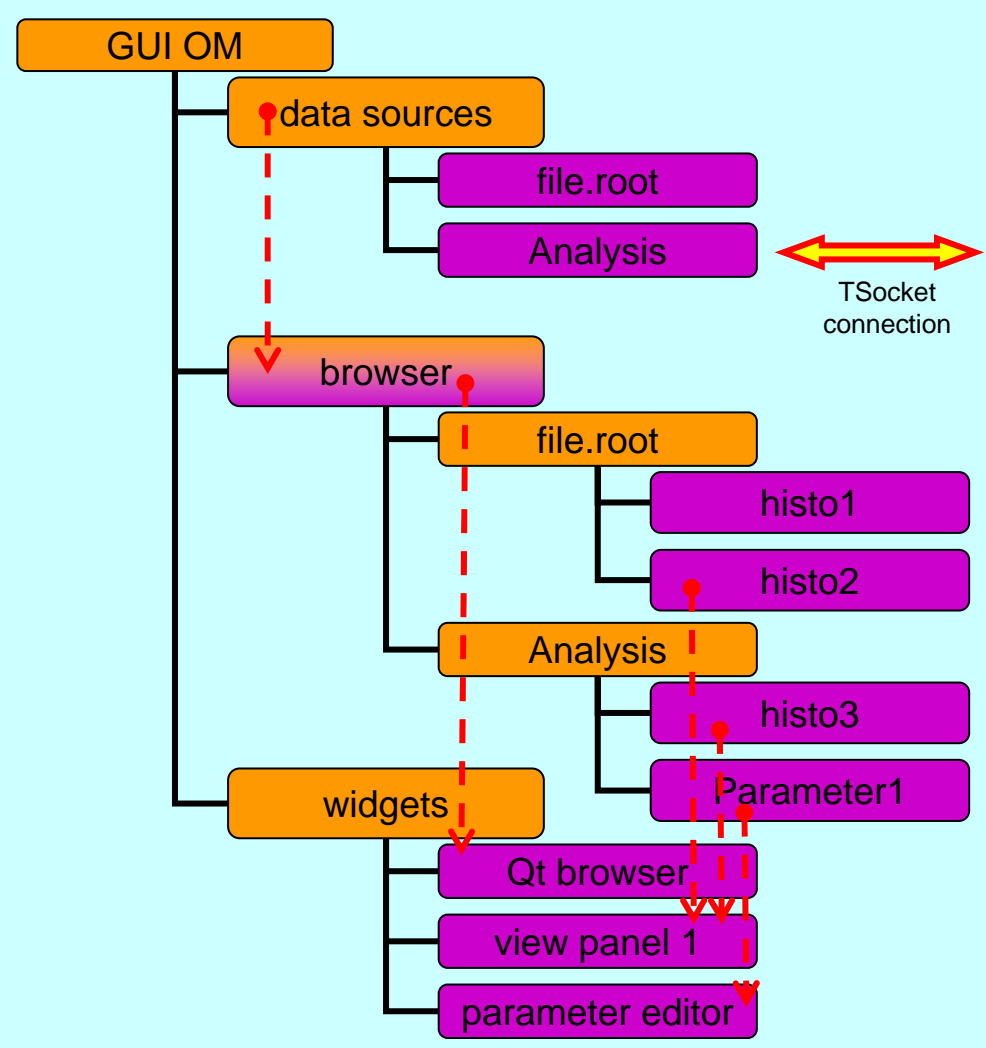
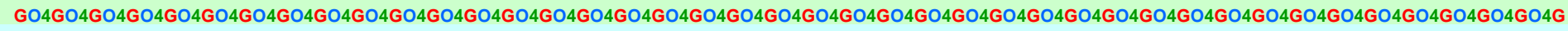


Instead of direct objects hierarchy (like TFolder) mediator **proxies** are used.

Proxy functionality:

- Holds object pointer (with or without ownership)
- Provides iterator over object structure
- Provides metainformation about contained data
- Via the names gives an access to object data
- Correctly store/restore object to file
- Delivers messages, when object is inserted, modified or deleted





- hierarchical structure of **containers**
- special **proxies** for different data sources
- single **iterator** for looping over complete structure
- **message** passing between different branches for notification purposes
- ROOT **cleanup** mechanism

### Supported data sources:

- TFolder
- TDirectory (TFile)
- TTree
- TCanvas
- Remote Go4 analysis
- GSI histogram server





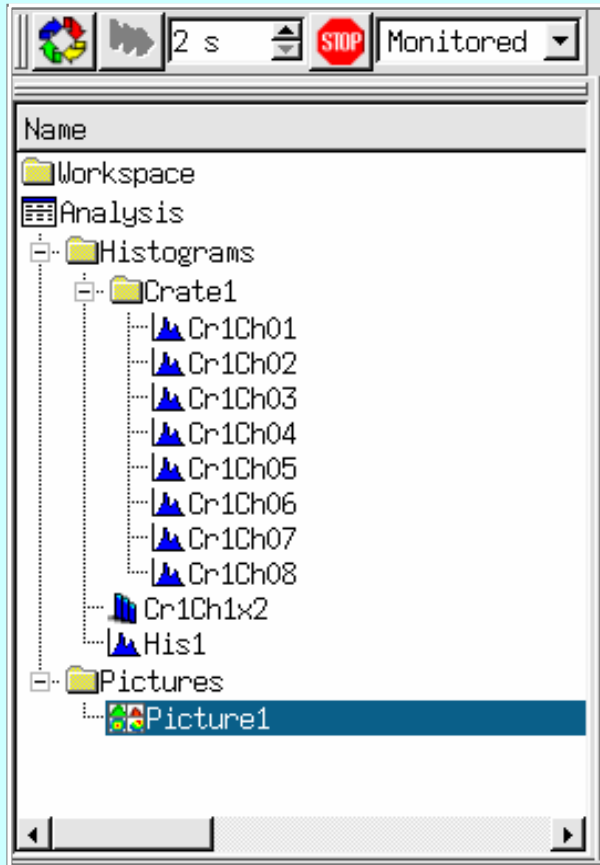
Name	Info
Workspace	folder
↳ histo1	histo title
↳ d0016.root	
↳ decay-times.root	
↳ Decay_1	frequencies
↳ Decay_2	frequencies
↳ Analysis	Controller
↳ Histograms	All Histogram objects
↳ Crate1	UserFolder
↳ Crate2	UserFolder
↳ Cr1Ch1x2	Crate 1 channel 1x2
↳ His1	Condition histogram
↳ His2	Condition histogram
↳ His1g	Gated histogram
↳ His2g	Gated histogram
↳ Conditions	All Condition objects
↳ Parameters	All Parameter objects
↳ 123 Par1	This is a Go4 Parameter Object
↳ DynamicLists	Dynamic List Instances
↳ Trees	References to trees
↳ Pictures	Picture objects
↳ condSet	Set conditions

**Folders for  
Workspace  
Files  
Analysis  
Servers**

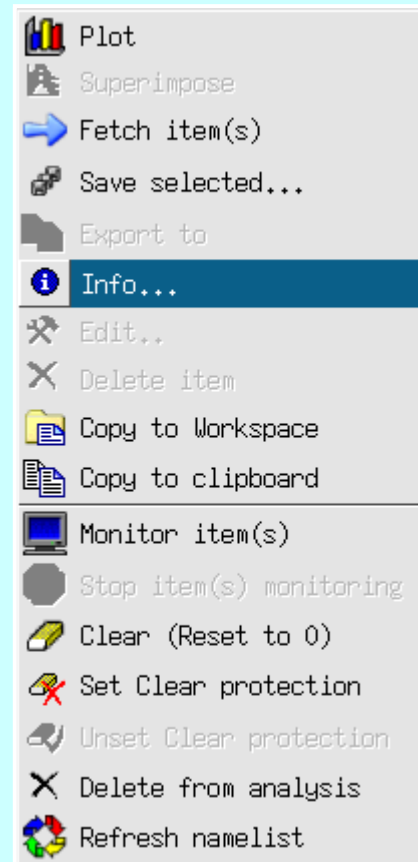




### monitor and filter tool



### context menu (RMB)





# New Go4 browser blown up



Name	Flags	Info	Date	Time	Class	Size
Analysis		Controller			TGo4Analys...	= 692068
Histograms		All Histogram objects	2005-10-04	14:24:51	TFolder	= 686280
Conditions		All Condition objects			TFolder	= 1456
Subfolder		UserFolder			TFolder	= 252
wincon1	spw	Go4 window condition	2005-10-04	14:24:51	TGo4WinCond	164
wincon2	spw	Go4 window condition	2005-10-04	14:24:51	TGo4WinCond	164
polycon	spw	Go4 polygon condition	2005-10-04	14:24:51	TGo4PolyCond	120
winconar	spw	TGo4WinCond	2005-10-04	14:24:51	TGo4CondArra	132
polyconar	spw	TGo4PolyCond	2005-10-04	14:24:51	TGo4CondArra	132
chis1	spw	Go4 window condition	2005-10-04	14:24:51	TGo4WinCond	164
chis2	spw	Go4 window condition	2005-10-04	14:24:51	TGo4WinCond	164
myConny	sdw	1-D window condition	2005-10-04	14:24:51	TGo4WinCond	164
Parameters		All Parameter objects			TFolder	= 2328
123 XXXPar1		This is a Go4 Paramete...			TXXXParameter	920
123 XXXPar2		This is a Go4 Paramete...			TXXXParameter	920
123 sizefitter		This is a Go4 Paramete...			TGo4Fitter...	32
123 specfitter		This is a Go4 Paramete...			TGo4Fitter...	32
123 CaliPar		This is a Go4 Paramete...			TXXXCalibPar	424
DynamicLists		Dynamic List Instances			TFolder	= 884
Pictures		Picture objects			TFolder	= 184
condSet	spw	Set conditions	2005-10-04	14:24:51	TGo4Picture	92
Picture1	spw	Picture example	2005-10-04	14:24:51	TGo4Picture	92
Canvases		All TCanvases			TFolder	
UserObjects		For User Objects			TFolder	= 156
Calibration	spw		2005-10-04	14:24:51	TGraph	100
MultiTest	spw	This is a test multigraph	2005-10-04	14:24:51	TMultiGraph	56
Trees		References to trees			TFolder	
AnalysisxTree		This is a Go4 Status 0...			TTree	
XXXAnIEvent.		XXXAnIEvent.			TFolder	
XXXAnIEvent.TGo4Event...		XXXAnIEvent.TGo4EventE...			TFolder	
XXXAnIEvent.TGo4Ev...		XXXAnIEvent.TGo4EventE...			TFolder	
XXXAnIEvent.TGo4Ev...		XXXAnIEvent.TGo4EventE...			TFolder	
XXXAnIEvent.TGo4Ev...		XXXAnIEvent.TGo4EventE...			Bool_t	428
XXXAnIEvent.TGo4Ev...		XXXAnIEvent.TGo4EventE...			Short_t	428
XXXAnIEvent.frData[16]		XXXAnIEvent.frData[16]			Float_t	428
EventObjects		Event objects of curre...			TFolder	= 780
EventStores		References to event st...			TFolder	= 52
EventSources		References to event so...			TFolder	= 440

- Flags
- Info
- Date
- Time
- Class
- Size

RMB popup





Panel1: His2, wincon1

File Edit Options  Apply to all

Style Binning

Name His2::TH1

Line 1

Fill

Title /S.root/Histograms/His2

Histogram Plot

2-D  3-D

Error: No Errors

Style: No Line

Simple Drawing

Show markers

Draw bar chart

Marker Modes

loop wincon1

Panel1 x=5798.93, y=12831.5

- View management done by **object manager**
- Show **same histogram in different views** (ranges, line and fill colors)
- Improved **marker editor**, may also edit conditions
- Info on **time/date and full object path**



2D polygon

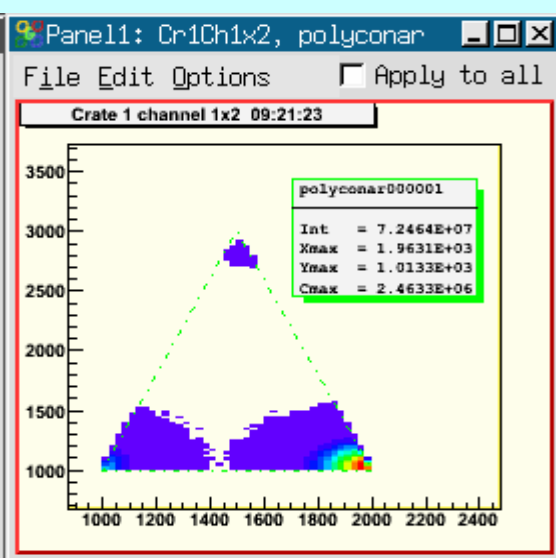
**Condition editor** [Minimize] [Maximize] [Close]

Analysis/Conditions/polyconar Polygon

Returns Result

All counts:  True:  1.11%

Integr:  $7.24639e+07$      MaxX: 1963.11  
 Max:  $2.46328e+06$      MaxY: 1013.3



1D limits

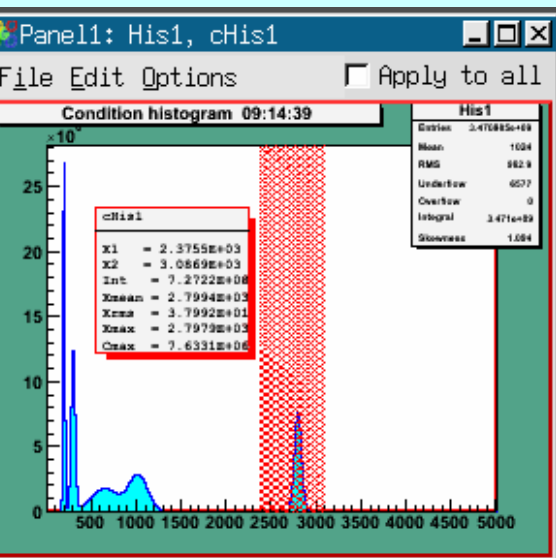
**Condition editor** [Minimize] [Maximize] [Close]

Analysis/Conditions/cHis1 Win 1-D

Returns Result

All counts:  True:  80.00%

Xmin:  Xmax:   
Ymin:  Ymax:







### Remote editing of object (data structure) contents

Go4 v3.0-0beta @lxg0517 <Controller> - [Parameter Editor]

File Tools Analysis Settings Windows Help

Parameter  
Analysis/Parameters/CaliPar - TXXXCalibPar

Object Members

Name	Type	Value	Comments
fdA[0]	Double_t	1.906823	Calibration polynom coeff
fdA[1]	Double_t	0.003414	Calibration polynom coeff
fdA[2]	Double_t	0.000000	Calibration polynom coeff
fdA[3]	Double_t	0.000000	Calibration polynom coeff
fbRecalibrate	Bool_t	1	Set to kTRUE to make calibration fit in up
fbReadDatabase	Bool_t	0	Set to kTRUE to re-read energies from exter
fxDatabase	TString	calilines.txt	Filename for ascii file with linesname - er
fiLinesChannel[2]	Int_t	650	Centroid channel numbers for fitted lines
ffLinesEnergy[0]	Float_t	1.486708	Database energies of calibration lines
fxLinesNames[0]	TString	AlKa	Database names of calibration lines.
fxLinesFinder	TString		Fitter to search lines
fxCalibrator	TString		Fitter for calibration of channel/energies
fxGraphName	TString	Calibration	Name of the graph to contain the calibratic
fxSpectrumName	TString	Cr1Ch01	Name of the calibration spectrum histogram

Workspace  
Analysis  
Histograms  
Conditions  
Parameters  
  123 XXXPar1  
  123 XXXPar2  
  123 sizefitter  
  123 specfitter  
  123 CaliPar  
DynamicLists  
Trees  
Pictures  
Canvases  
EventObjects  
UserObjects

Navigation icons: Home, Back, Save, Edit

R3G-2    ██████████    Current Ev/s    1495    Average Ev/s    4    s    58893    Events    2005-10-06 10:51:13



### Interactive peak finding and fitting. Save fitter for use in macros

The screenshot shows the Go4 v2.5-0 software interface. The main window is titled "Go4 v2.5-0" and has a menu bar with "File", "Tools", "Analysis", "Settings", "Windows", and "Help". Below the menu bar is a toolbar with various icons for file operations and analysis. The "Fit panel" is open, showing a "Fitter" window with the following settings:

- Name: Fitter
- Minimizer: (button)
- Peak finder: (button)
- use polynomial of order: 1
- Models: Pol\_0, Pol\_1, Gauss0, Gauss1, Gauss2, Gauss3, Gauss4 (all checked)
- Noise factor: 2
- Minimal noise: 5
- Channel sumup: 2

At the bottom of the Fit panel are buttons for "Use pad", "Find", "Fit", "Draw", and "Pars". The status bar shows "Ready".

On the right, a window titled "V 0 : ADC150H" displays a histogram plot. The plot shows a distribution with several peaks, overlaid with a blue fit curve. A table of statistics for the fit is shown:

ADC150H	
Entries	3840
Mean	323.4
RMS	72.23
Underflow	0
Overflow	0
Integral	3518

The plot axes are labeled "axis1" (y-axis, 0 to 80) and "axis0" (x-axis, 200 to 550). The status bar of the plot window shows "V 0 : : Ready".



# Histogramming adhoc

The screenshot displays the Go4 v3.0-beta software interface. The main window is titled "Go4 v3.0-beta @lxg0517 <Controller>". It features a menu bar with "File", "Tools", "Analysis", "Settings", "Windows", and "Help".

On the left, a window titled "Panel1: crate11dynamic" shows a histogram plot of "raw event data on the fly" at 11:10:54. The plot has a logarithmic y-axis ranging from 1 to 10<sup>5</sup> and an x-axis from 0 to 4000. A small statistics window for "crate11dynamic" is overlaid on the plot, showing: Entries: 110323, Mean: 1224, RMS: 1287, Underflow: 991, Overflow: 0, Integral: 1.120e130, Minimum: 0.00175.

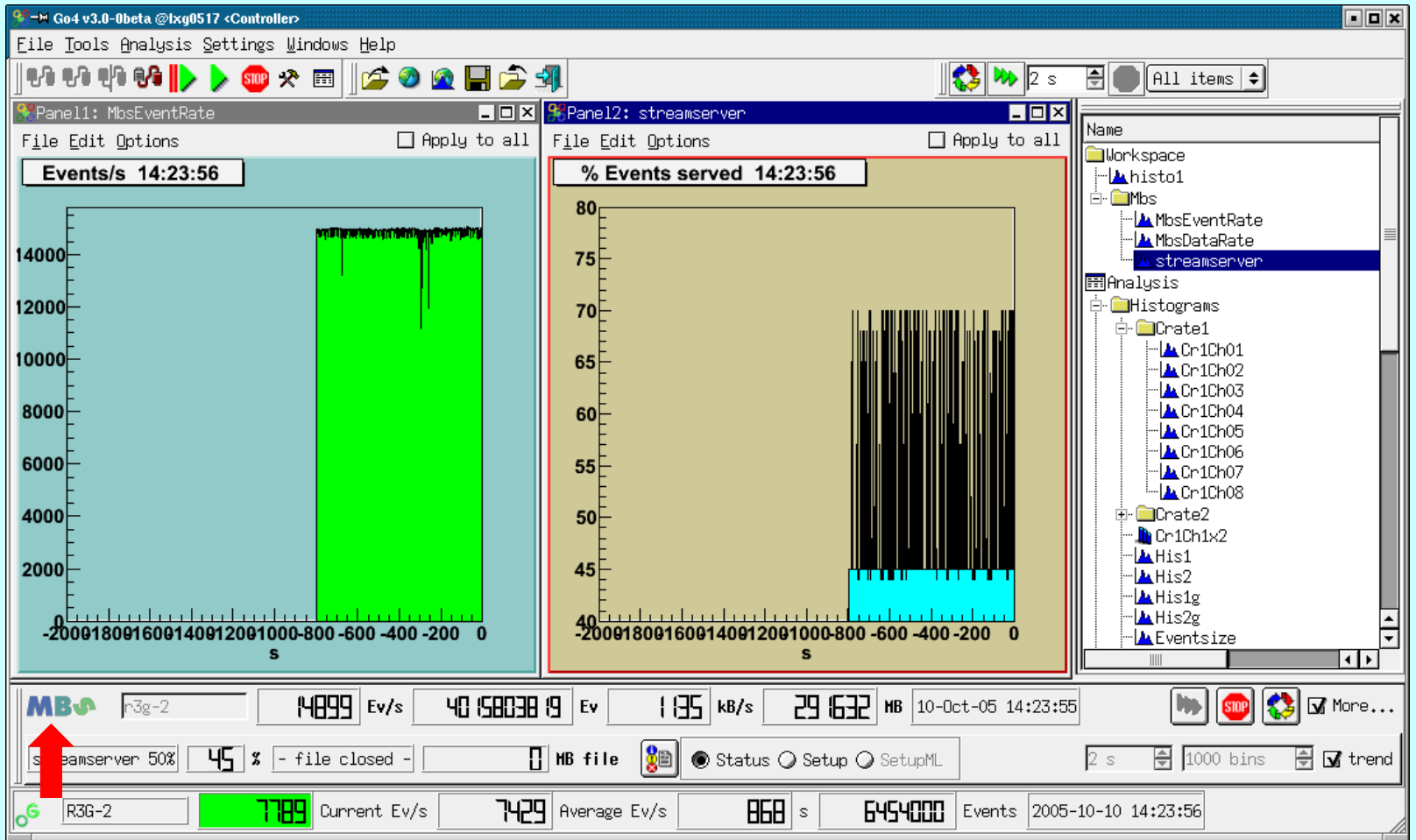
The central "Dynamic List Editor" window shows the entry "TGo4HistogramEntry" with the option "enable Analysis/DynamicLists/test2" checked. The histogram is named "Analysis/Histograms/crate11dynamic". The "Event data" tab is selected, and the X-axis is defined as "Go4Element/fiCrate1[1]".

On the right, a tree view shows the event structure. The "EventObjects" folder is expanded, showing "EventStores", "EventSources", "EventProcessors", and "Events". Under "Events", "MbsEvent-10-1" is expanded to show "Go4Element", which contains "fiCrate1[16]", "fiCrate2[16]", "fiCrate3[16]", and "fiCrate4[16]".

At the bottom, a status bar displays: "R3G-2", a green display showing "8.185", "Current Ev/s", "7524", "Average Ev/s", "153 s", "153000", "Events", and the timestamp "2005-10-06 11:10:53".

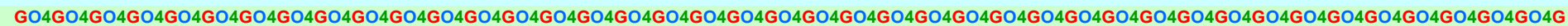


## Online event ratemeters, trending, remotely inspect status and setup



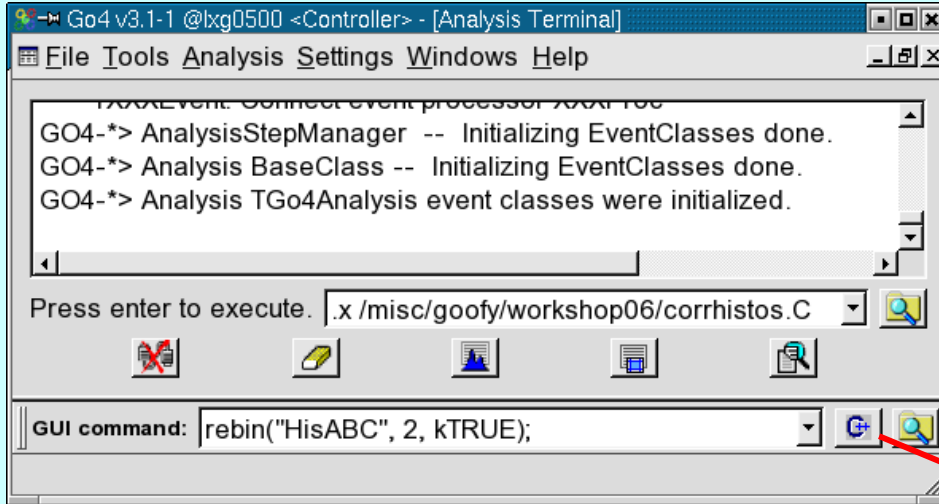


- ROOT macros in analysis**
- ROOT macros in Go4 GUI**
- Remote control of ROOT macros**
- ROOT browser for remote analysis control**

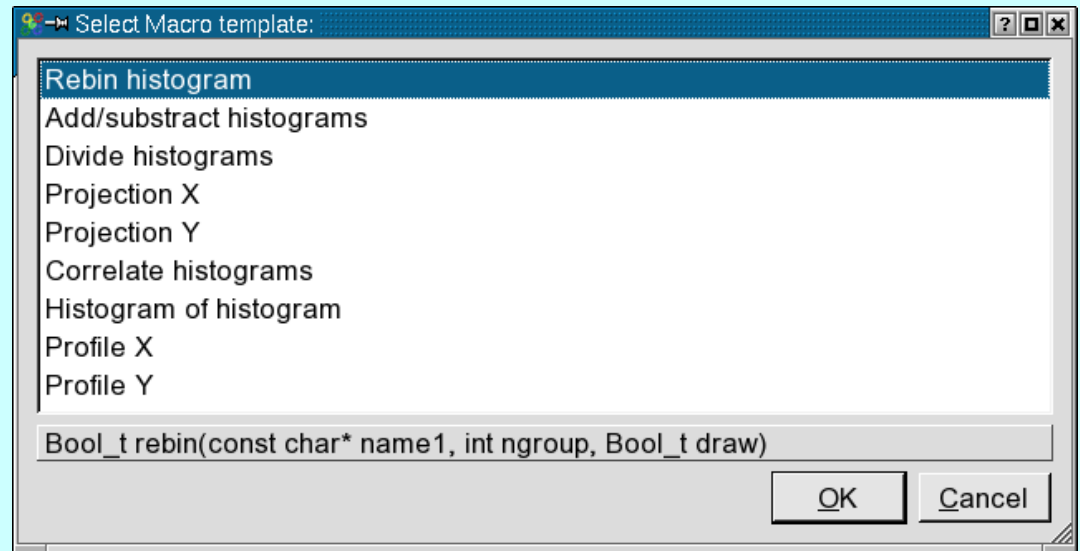




## Remote (analysis) and local (GUI)



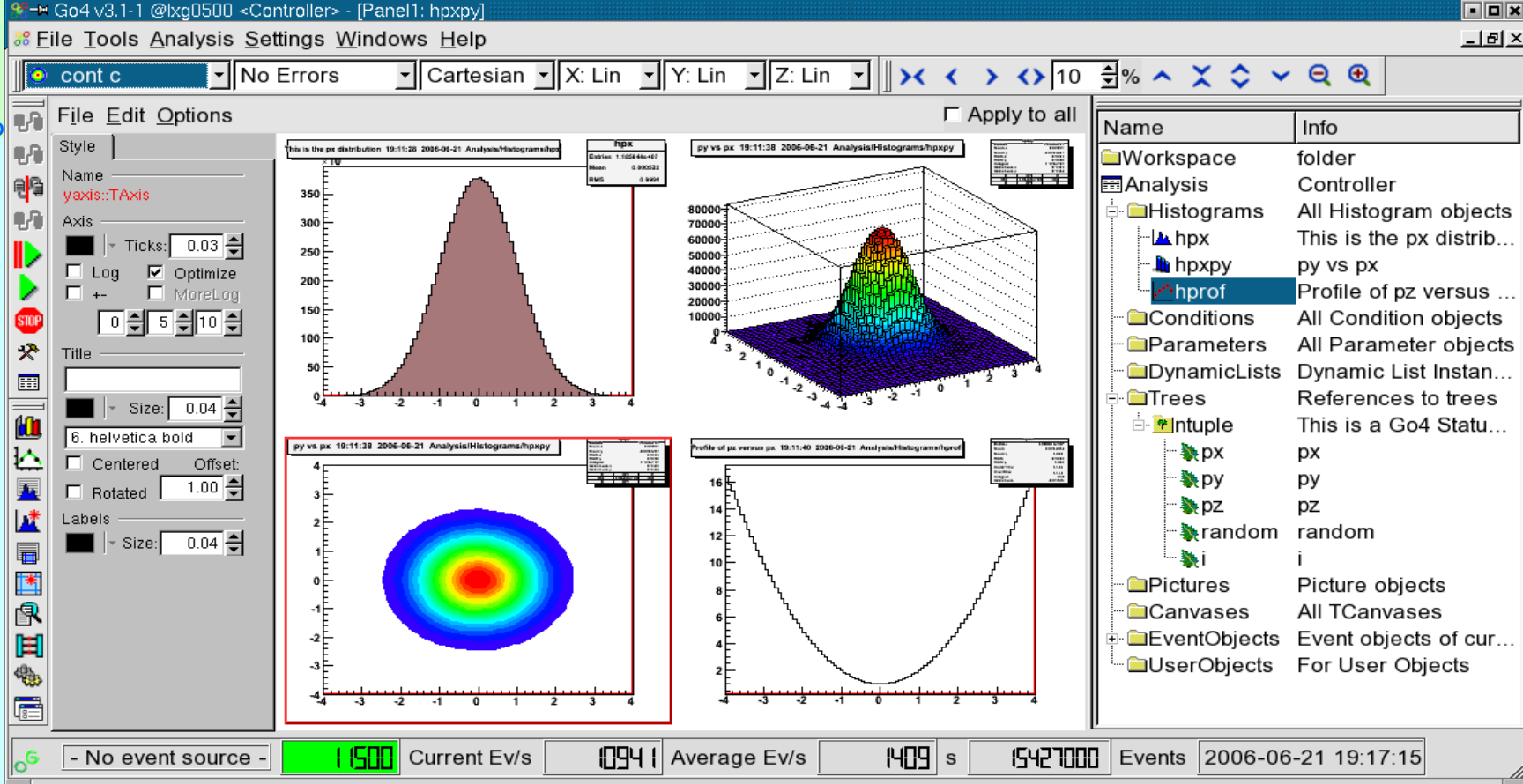
some macros provided by Go4







GO4GO4GO4GO



## Running a ROOT analysis macro in CINT controlled by Go4 GUI

```
root [0] .x go4Init.C
```

```
GO4-> Welcome to Go4 Analysis Framework Release v3.1-0 (build 30100) !root [1]
```

```
GO4-> AnalysisClient Go4CintServer-ixg0500-4525 starting initialization...
```

```
GO4-> Analysis Slave Go4CintServer-ixg0500-4525 waiting for submit and start commands...
```

```
Waiting for client connection on PORT: 5000
```

```
root [1] .x hsimplego4.C
```

```
GO4-> AnalysisStepManager -- Initializing EventClasses done.
```

```
GO4-> Analysis BaseClass -- Initializing EventClasses done.Waiting for the Go4 start button.
```

```
Use Canvas menu 'Options/Interrupt' to leave macro.
```

```
GO4-> TaskManager: Successfully added new client Display-ixg0500-4519 (host ixg0500, ports 5001,5002,5003)
```

```
GO4-> Client Display-ixg0500-4519 is logged in at Go4CintServer-ixg0500-4525 as Controller
```

```
Waiting for client connection on PORT: 5000
```

```
GO4-> AnalysisClient Go4CintServer-ixg0500-4525 has started analysis processing.
```

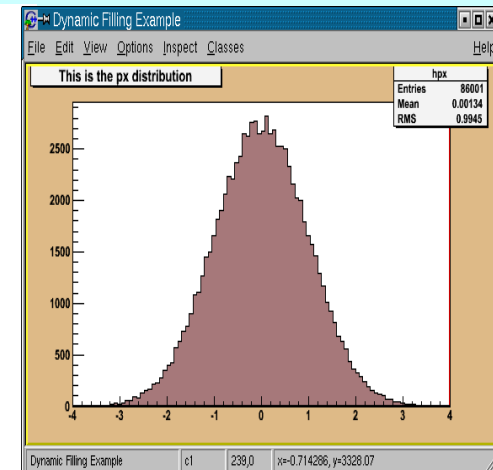
```
Starting execution loop after 33 s of waiting
```

```
GO4-> AnalysisClient Go4CintServer-ixg0500-4525 has STOPPED analysis processing.hsimple :
```

```
Real Time = 7.75 seconds Cpu Time = 5.34 seconds
```

GO4GO4GO4GO

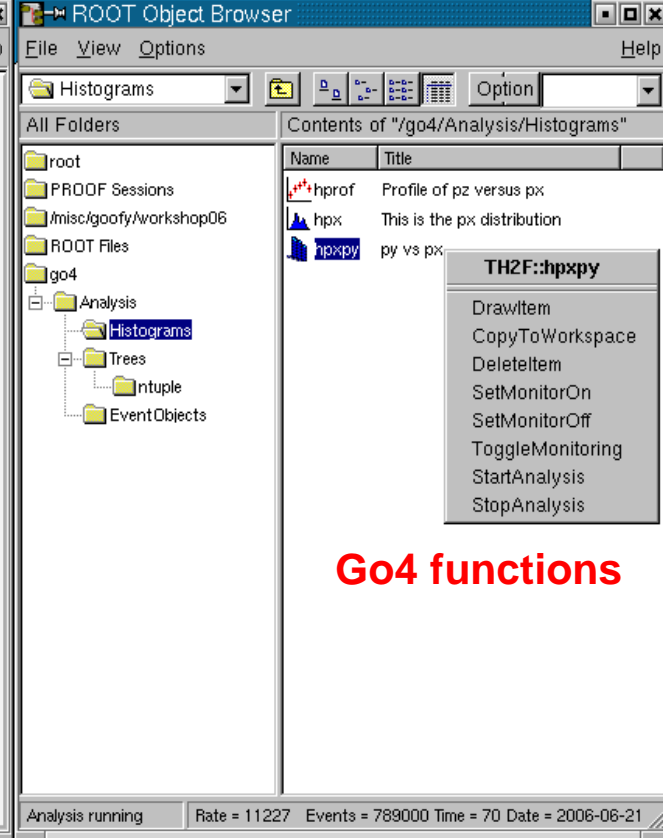
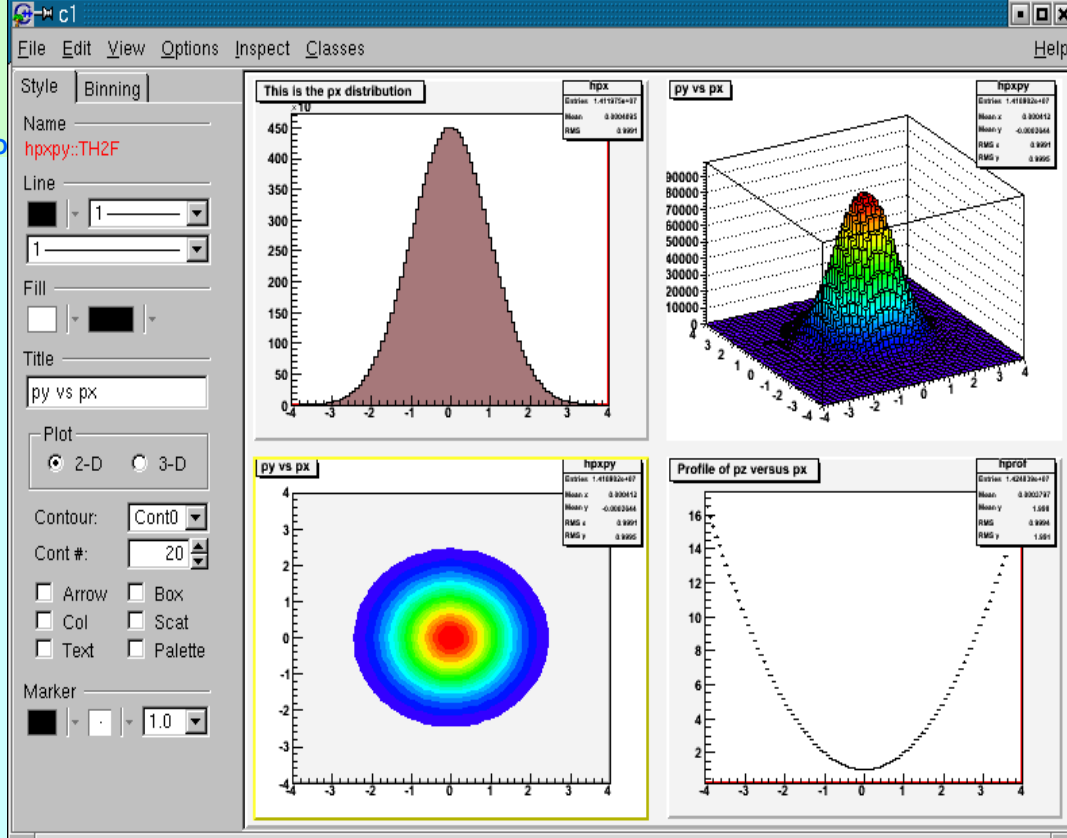
Juni 2







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Go4 functions

## Running a ROOT analysis macro in CINT controlled by ROOT browser

## Windows XP!

```

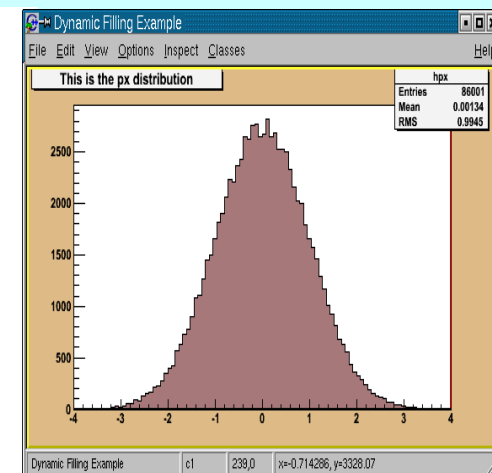
root [0] .x go4LoadLibs.C
root [1] go4 = new TGo4Interface()
(class TGo4Interface*)0x9319318
root [2] go4->ConnectAnalysis("localhost",5000,1)
Loginfo = GO4-*> Analysis nameslist was requested from client Display-Ixg0500-26451
Loginfo = GO4-*> Analysis status was requested from client...
Loginfo = GO4-*> Client Display-Ixg0500-26451 is logged in at Go4CintServer-Ixg0500-16805 as Controller
root[3] new TBrowser()
(class TBrowser*)0x9079c30

```

```

GO4-*> TaskManager: Successfully added new client Display-Ixg0500-4519 (host Ixg0500, ports 5001,5002,5003)
GO4-*> Client Display-Ixg0500-4519 is logged in at Go4CintServer-Ixg0500-4525 as Controller
Waiting for client connection on PORT: 5000
GO4-*> AnalysisClient Go4CintServer-Ixg0500-4525 has started analysis processing.
Starting execution loop after 33 s of waiting
GO4-*> AnalysisClient Go4CintServer-Ixg0500-4525 has STOPPED analysis processing.hsimple :
Real Time = 7.75 seconds Cpu Time = 5.34 seconds

```



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Juni 2



