

G04 Version 3

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

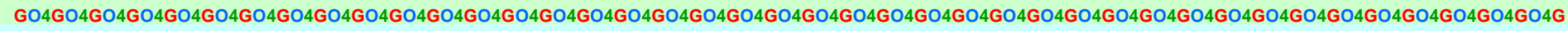
Lectures





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





10.00h	Adamczewski	Analysis design with Go4	The Go4 analysis steps Modular analysis (analysis classes)
10.45h	Adamczewski	Go4 Trees in CINT	Go4 libraries, trees, make class
11.00h	Break		
11.20h	Essel	Using macros in Go4	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	User written GUI	Qt designer API to Go4 environment Macro execution
12.20h	Linev	Fitting with Go4	Interactively, save fitter batch using fitter



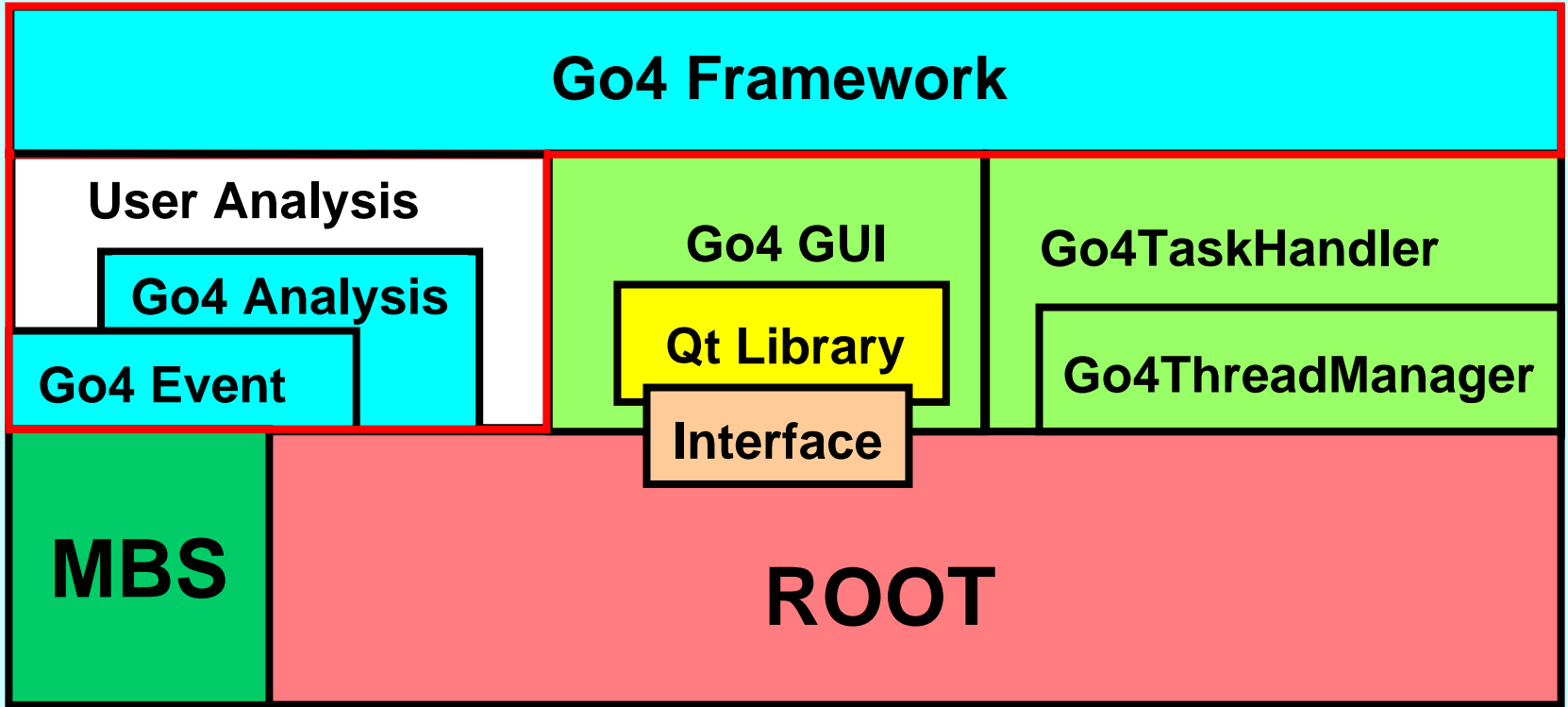
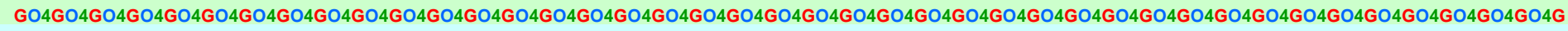


- Go4 features
- Status
- New in v.3.0
- Analysis framework
- Interactive analysis





- 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>**



Go4 v3.0-0a @lxg0516 <Administrator>

File Tools Analysis Settings Windows Help

scatter No Errors Cartesian X: Lin Y: Lin Z: Lin Divide Pad into 2 x 2 2 s All items

Analysis Configuration

Panel1: Set conditions

Name	Class
Workspace	
gauss_XXXAn1.root	TFile
AnalysisxTree	TTree
XXXAn1Event.	TXXXAn1Event
XXXAn1Event...	TXXXAn1Event
XXXAn1Event...	TXXXAn1Event
Analysis	TGo4Analysis...
Histograms	TFolder
Crate1	TFolder
Crate2	TFolder
Cr1Ch1x2	TH2I
His1	TH1I
His2	TH1I
His1g	TH1I
His2g	TH1I
Sum1	TH1I
Sum2	TH1I
Sum3	TH1I
Sum1Calib	TH1I
Eventsize	TH1D
Conditions	TFolder
Parameters	TFolder
123 XXXPar1	TXXXParameter
123 XXXPar2	TXXXParameter
123 CaliPar	TXXXCalibPar
123 sizefitter	TGo4FitterE...
123 specfitter	TGo4FitterE...
DynamicLists	TFolder
Trees	TFolder
Pictures	TFolder
Canvases	TFolder
EventObjects	TFolder
UserObjects	TFolder

Condition Histogram 14:01:49

Crate 1 channel 1x2 14:00:16

Crate 1 channel 6 14:00:56

Condition histogram 14:01:49

Marker Modes

Analysis/Conditions/cHis1

Returns Result Regular

All counts: 13624895 True: 10729137

Limits Draw Stats Mean

Xmin: 2069.72 Xmax: 3850.31

Ymin: Ymax:

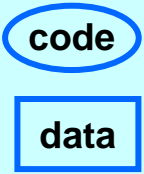
Date	Time	Description	Type
22.09.05	13:54:15	Analysis namelist was requested from client Display-lxg0516-5652	Info
22.09.05	13:54:15	Client Display-lxg0516-5652 is logged in at MyAnalysis-lxg0516-5630 as Administrator	Info

/GSI/lea/gauss **20459** Current Ev/s 19738 Average Ev/s 1135 s 2241000 Events 2005-09-22 14:13:13

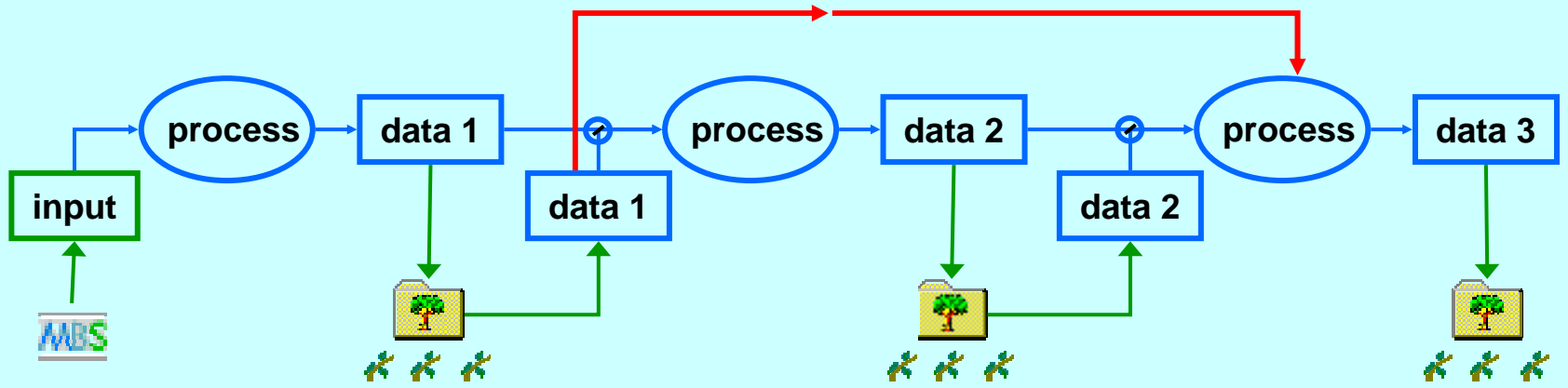


Analysis of event data:
The event loop is executed by framework
User code is plugged in



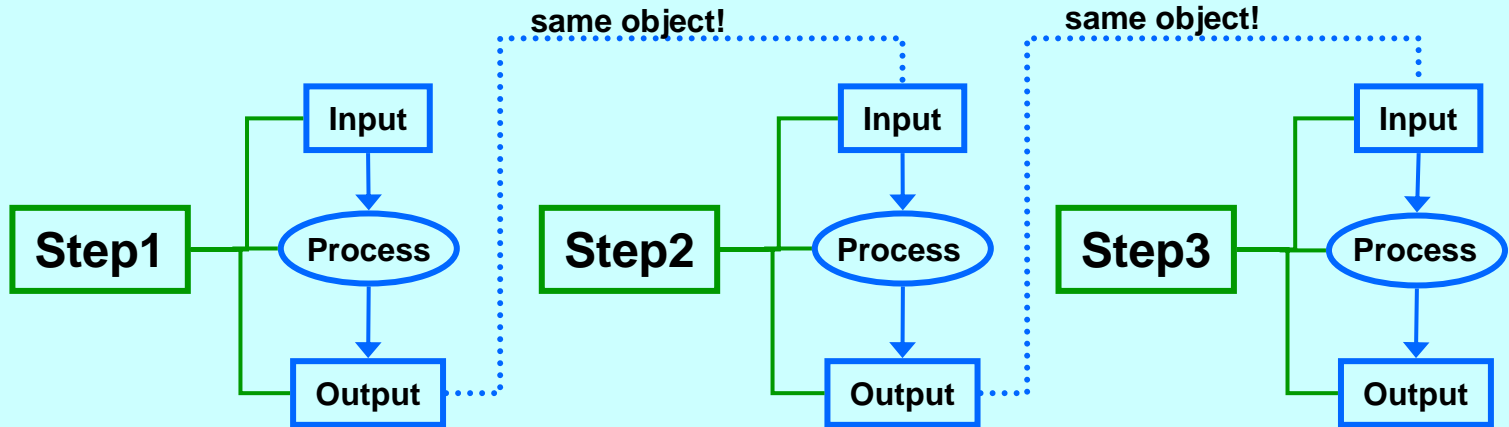


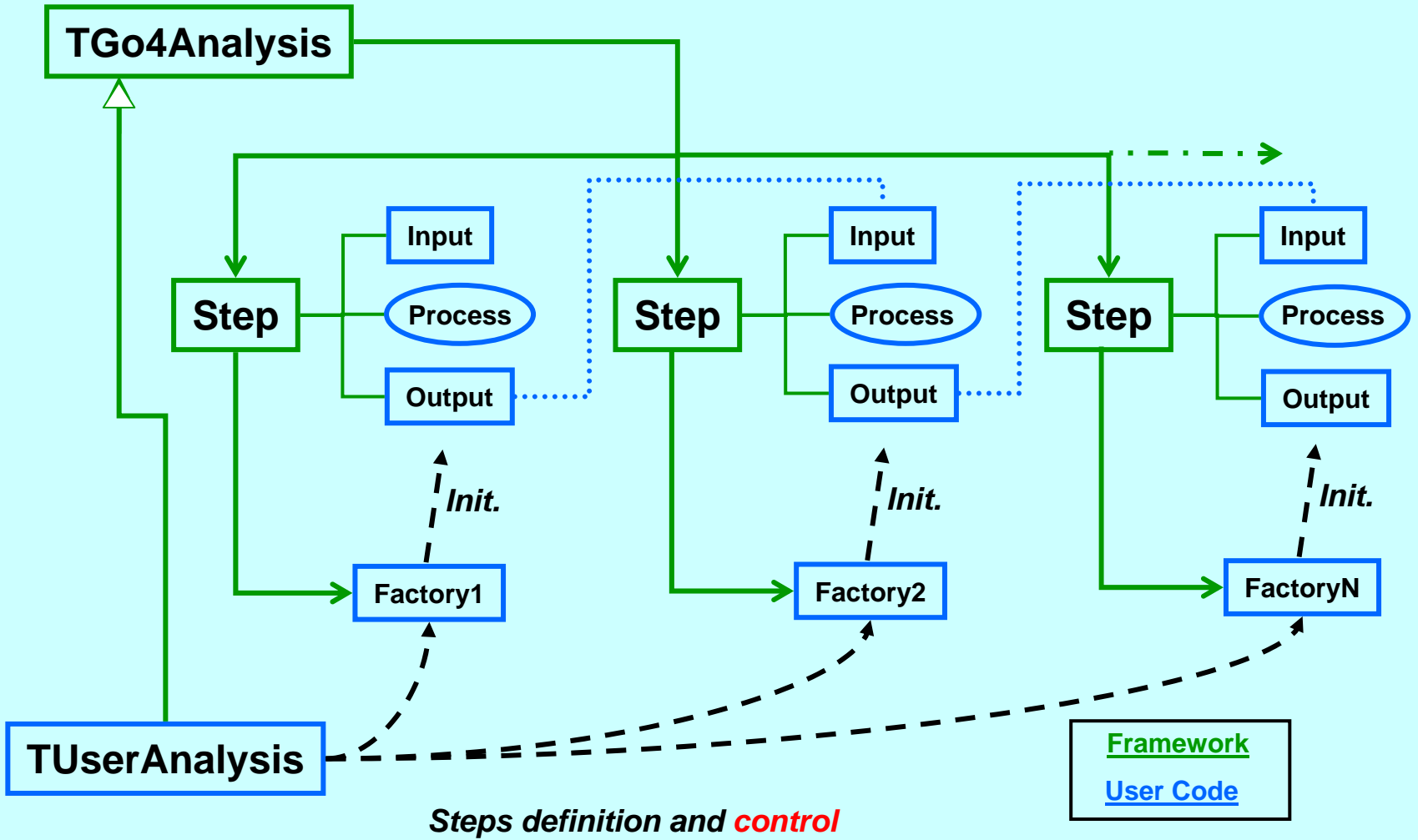
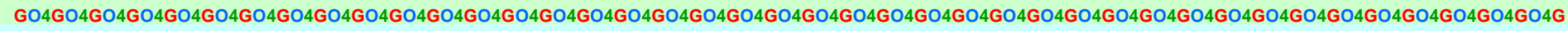
Analysis steps!





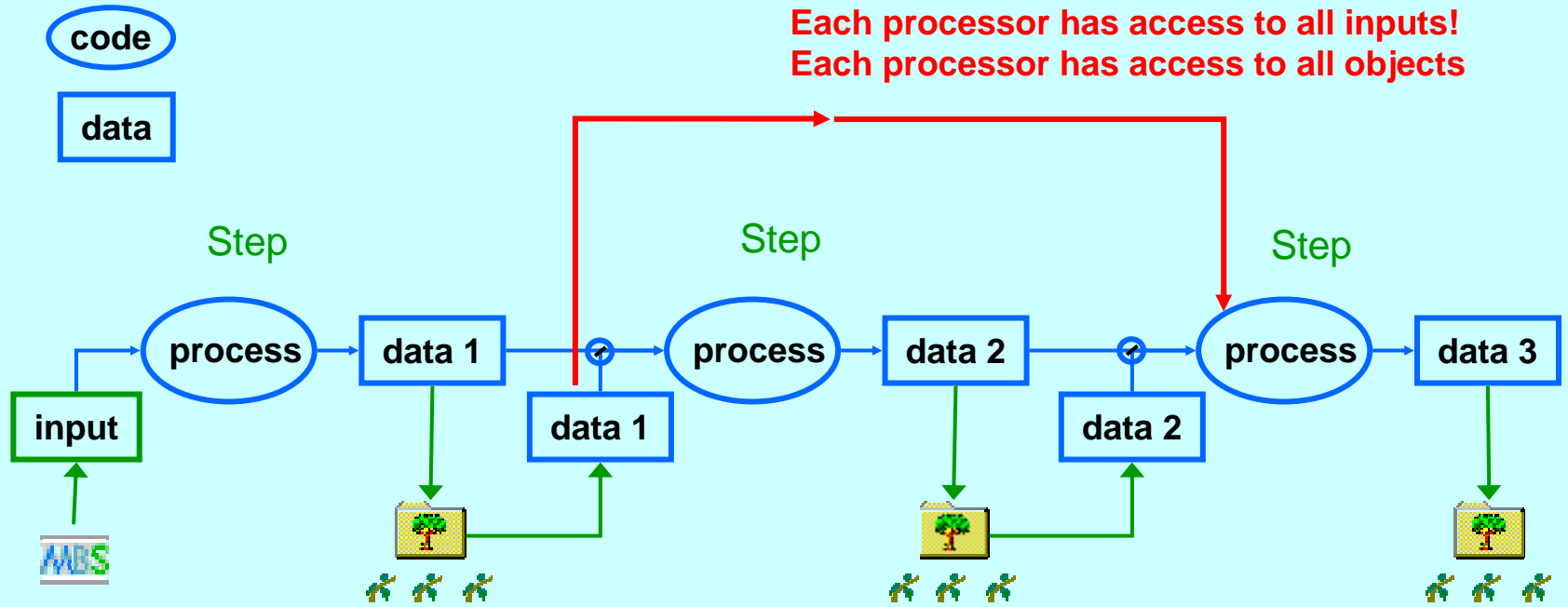
Analysis steps!

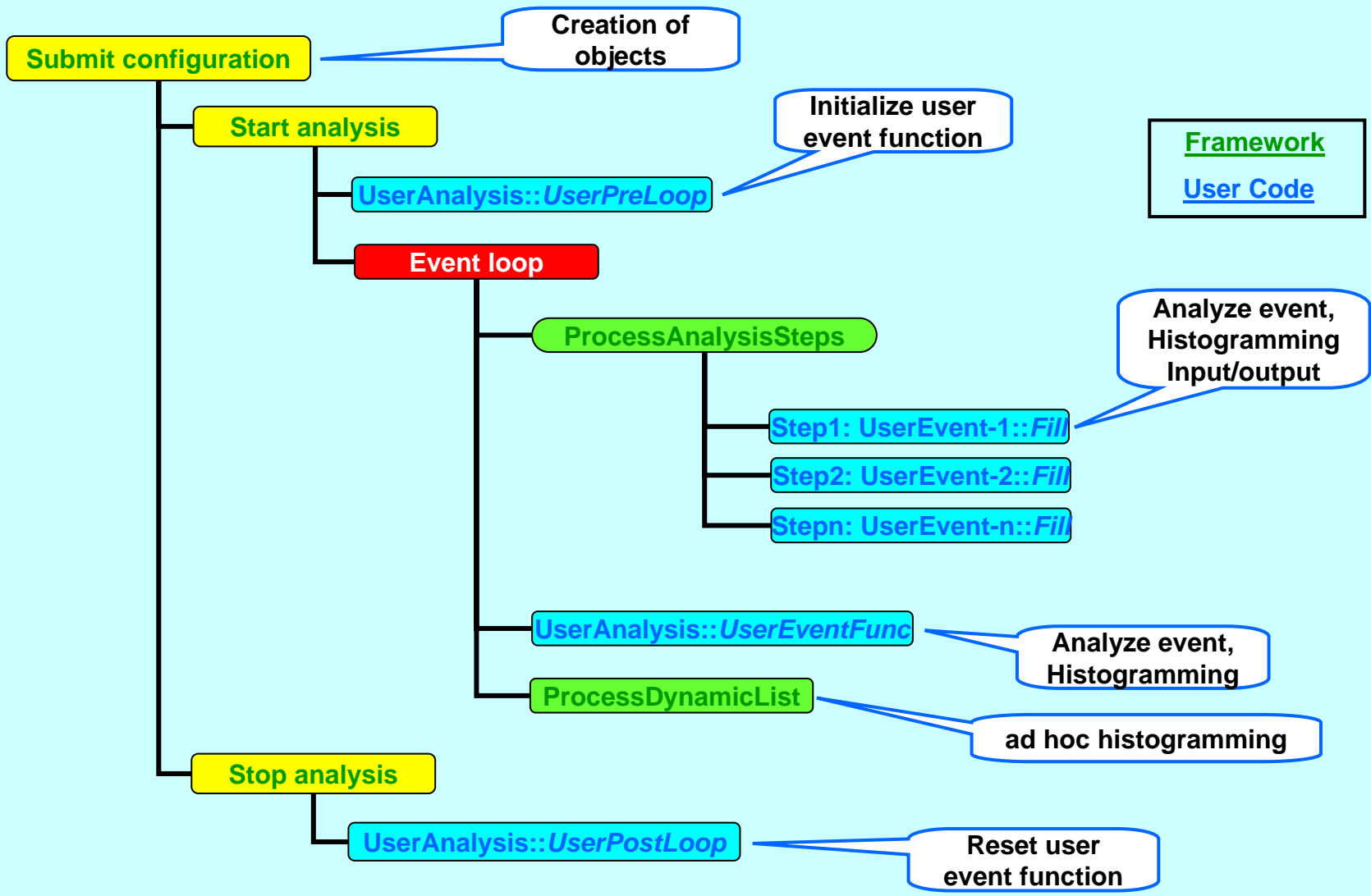


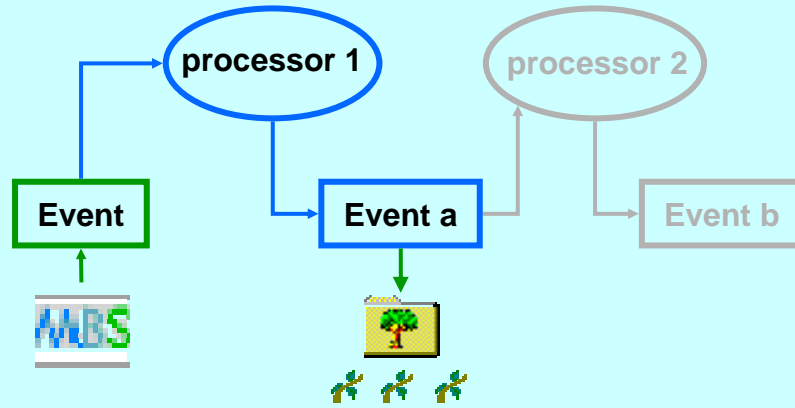
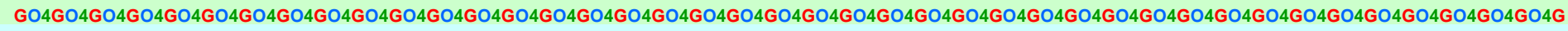




Chain of analysis steps processed **sequentially**
 Each step can be **en/disabled** (framework)
Input/output can be switched (framework)







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

If no steps follow:

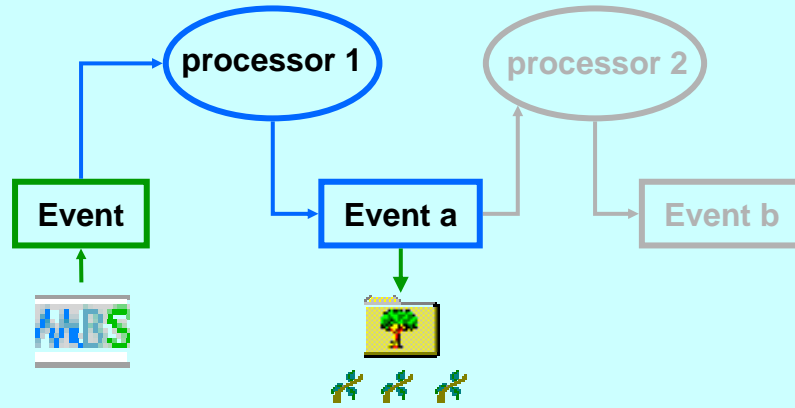
Event a->*Init*:

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)

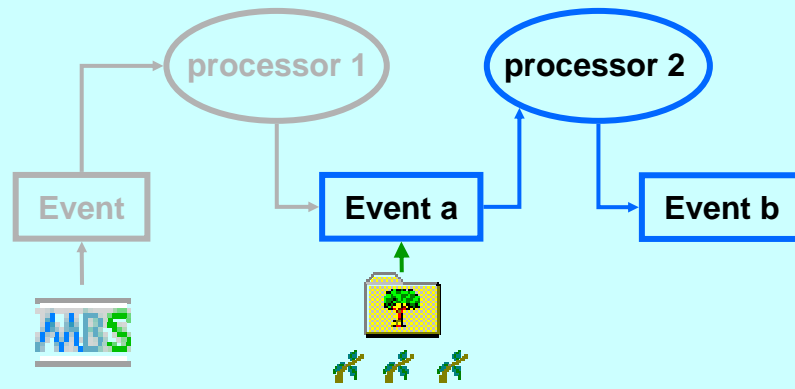
If no steps follow:

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





Classes



<i>Go4 class</i>	Derived user class	<i>implements</i>	calls
<i>TGo4Analysis</i>	MyAnalysis (optional)	<i>PreLoop</i> <i>UserEventFunc</i> <i>PostLoop</i>	Create steps (factories) Configure analysis Central management
<i>TGo4EventServerFactory</i>	MyFactoryStep_N (optional)	<i>CreateEventProcessor</i> <i>CreateOutputEvent</i> <i>CreateInputEvent</i>	
<i>TGo4AnalysisStep</i>	none		Calls from MyFactoryStep-N: <i>CreateEventProcessor</i> <i>CreateOutputEvent</i> <i>CreateInputEvent</i>
<i>TGo4EventElement</i>	MyEvent_N (optional)	<i>Init</i> <i>Clear</i> <i>Fill</i>	<i>Fill</i> calls the event function of processor (below), e.g.: <i>BuildEvent (*MyEvent_N)</i> Argument is event object self
<i>TGo4EventProcessor</i>	MyProcessor_N (required)	<i>BuildEvent</i> or as called in <i>MyEvent_N</i>	Calls <i>GetInputEvent</i> Gets output event as argument
<i>TGo4Parameter</i>	MyParameter1	<i>UpdateFrom</i>	Update data as wanted



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 mrevers
<i>TGo4FileSource</i> <i>TGo4FileStore</i> <i>TGo4BackStore</i>		ROOT TTree in TFile ROOT TTree in memory online TTree::Draw()
<i>TGo4EventElement</i>		Default event class no data, no output calls BuildEvent
<i>TGo4EventProcessor</i>		Default processor class hook for input event
<i>Go4ExampleUserSource</i>		User event source



Tabs for steps
2Step example

} **Event input**

} **Event output**

} **Object persistency**

} **Load/save config**



- **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)

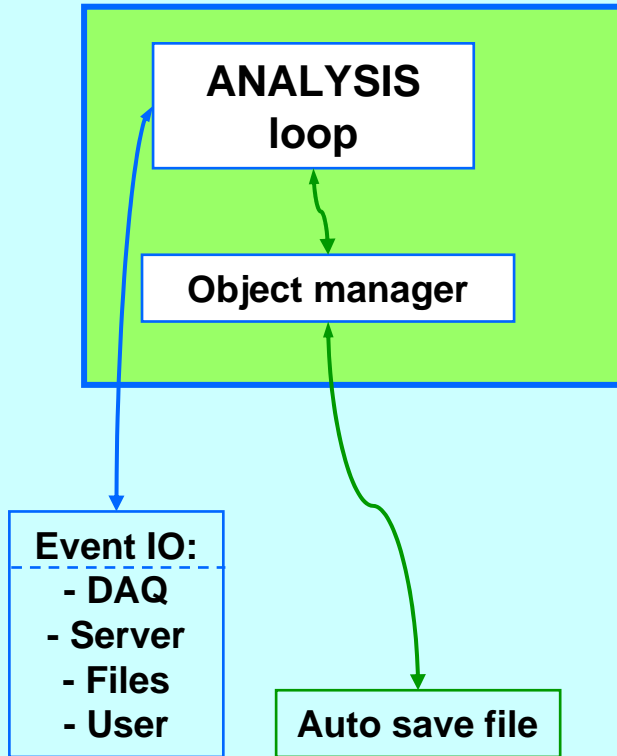
- **Parameters**

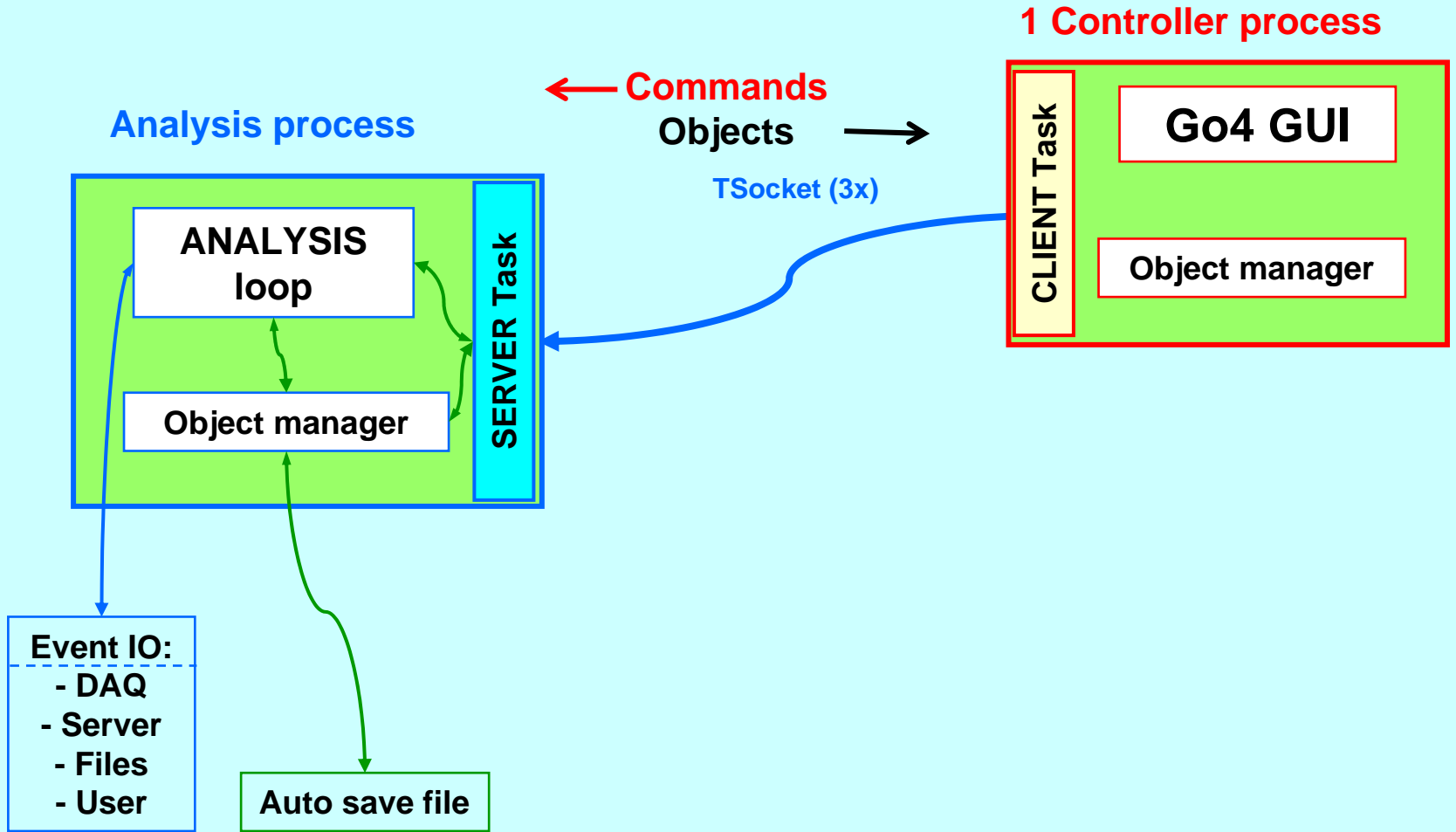
- **User classes** keeping parameter variables
- **interactive control** (generic GUI editor)
- value protection (update controlled by user function)
- allows for specific **analysis control**
- "**cheap**" **commands** (executed through editor) easy to implement
- supports besides **atomic data** types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

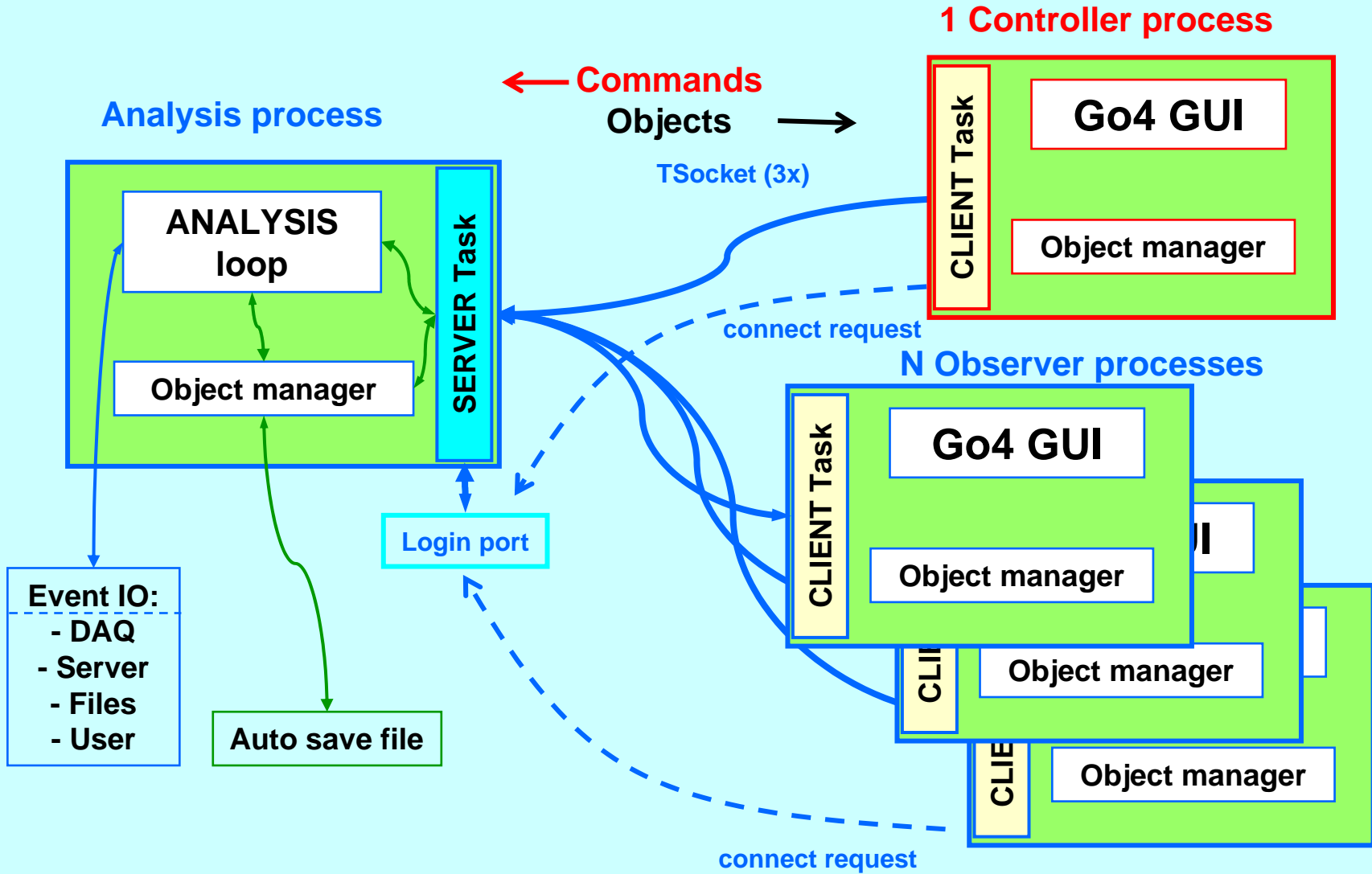
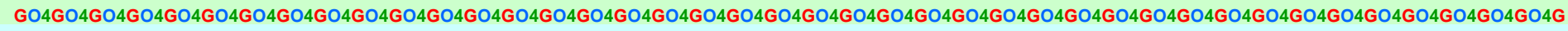


Set up in code or macros

Analysis process









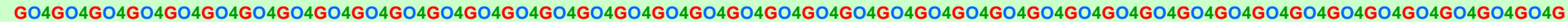
Browser
Graphics
Interacvtive tools
Editors





- 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

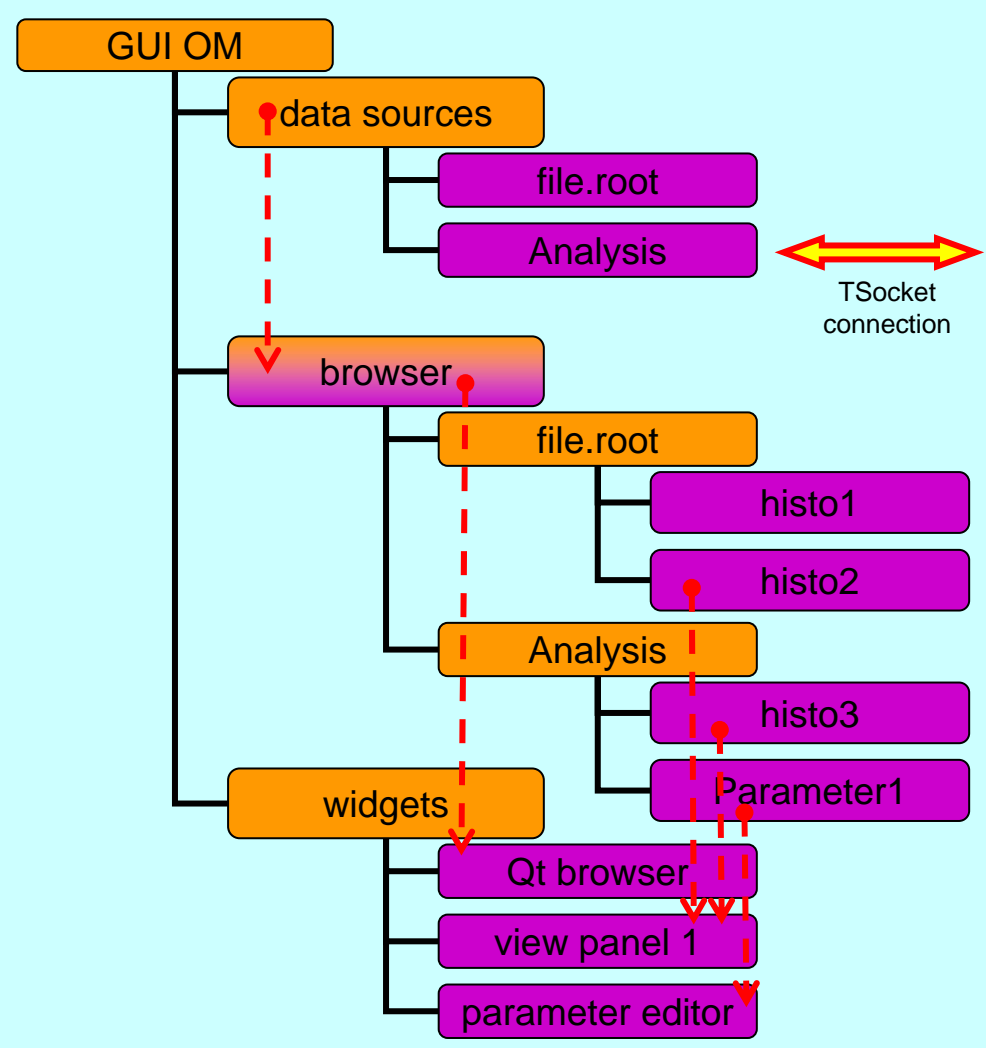
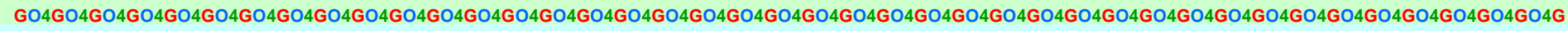




Instead of direct objects hierarchy (like TFolder) mediator **proxies** are used.
Proxy functionality:

- 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





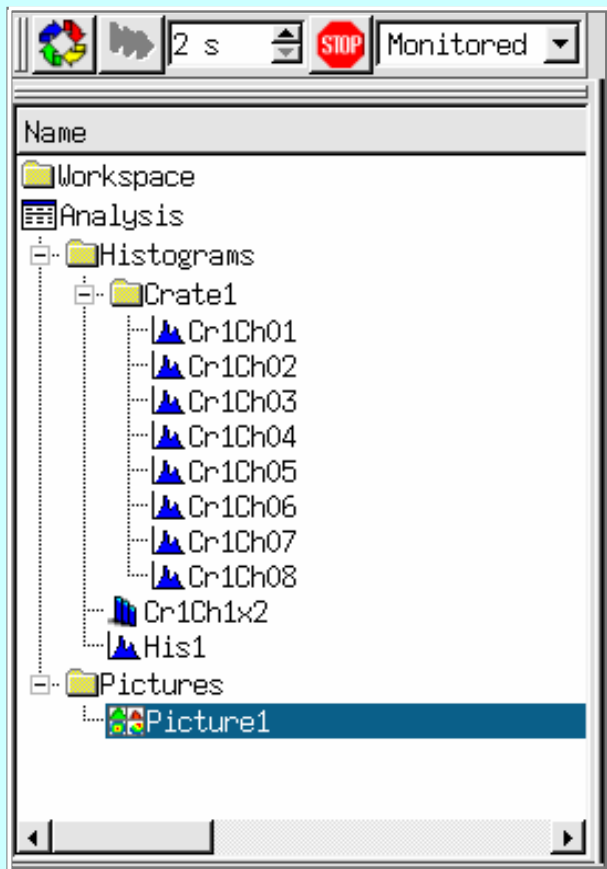
Name	Info
Workspace	folder
↳ histo1	histo title
↳ d0016.root	
↳ decay-times.root	
↳ Decay_1	frequencies
↳ Decay_2	frequencies
↳ Analysis	Controller
↳ Histograms	All Histogram objects
↳ Crate1	UserFolder
↳ Crate2	UserFolder
↳ Cr1Ch1x2	Crate 1 channel 1x2
↳ His1	Condition histogram
↳ His2	Condition histogram
↳ 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**

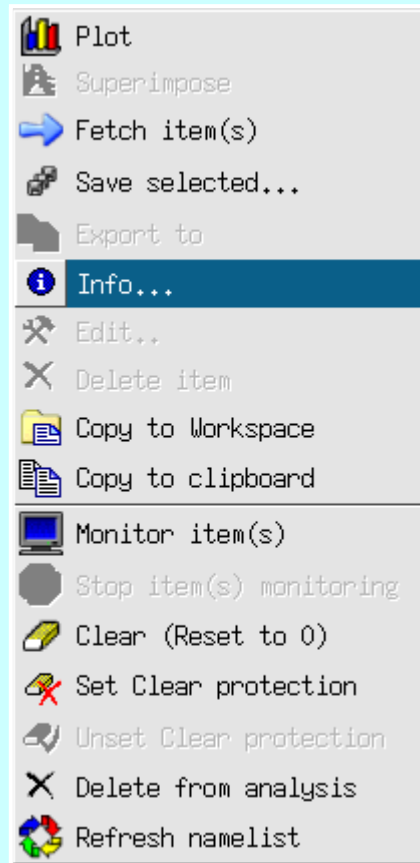




monitor and filter tool



context menu (RMB)





New Go4 browser blown up

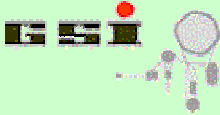


Name	Flags	Info	Date	Time	Class	Size
Analysis		Controller			TGo4Analys...	= 692068
Histograms		All Histogram objects	2005-10-04	14:24:51	TFolder	= 686280
Conditions		All Condition objects			TFolder	= 1456
Subfolder		UserFolder			TFolder	= 252
wincon1	spw	Go4 window condition	2005-10-04	14:24:51	TGo4WinCond	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...			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





View panel



Panel1: His2, wincon1 - □ ×

File Edit Options Apply to all

Style **Binning**

Name
His2::TH1

Line
1

Fill
[Color Selection]

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

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

Analysis/Conditions/polyconar Polygon 1 All

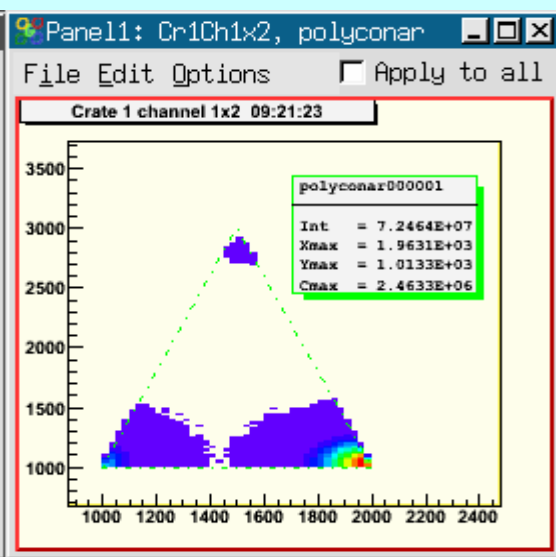
Returns Result Regular

All counts: 44468 1396 True: 4956570 1.11%

Limits Draw Stats Mean

Integr: 7.24639e+07 MaxX: 1963.11

Max: 2.46328e+06 MaxY: 1013.3



1D limits

Condition editor

Analysis/Conditions/cHis1 Win 1-D

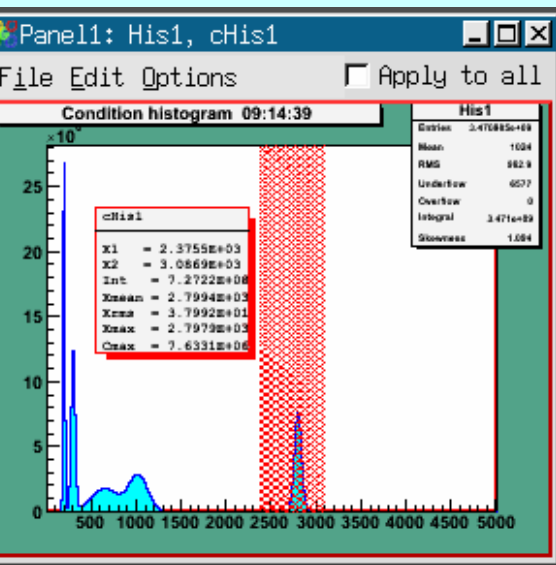
Returns Result Regular

All counts: 478899008 True: 383 103967 80.00%

Limits Draw Stats Mean

Xmin: 2375.52 Xmax: 3086.92

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

Modify Fitter 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 displays the Go4 v2.5-0 software interface. The main window is titled "Go4 v2.5-0" and contains a menu bar (File, Tools, Analysis, Settings, Windows, Help) and a toolbar. The "Fit panel" is open, showing the "Fitter" tab. It includes a "Name" field with "Fitter" entered, a "Data" list with "Data0" selected, and a "Models" list with "Pol_0", "Pol_1", "Gauss0", "Gauss1", "Gauss2", "Gauss3", and "Gauss4" checked. The "use polynomial of order" is set to 1, and the "Noise factor" is 2. The "Minimal noise" is set to 5, and the "Channel sumup" is 2. The "ADC150H" window shows a histogram plot with a blue fit line and red error bars. A statistics table for "ADC150H" is visible on the right of the plot.

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



Histogramming adhoc

The screenshot shows 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" displays a histogram of "raw event data on the fly" at 11:10:54. The histogram shows a distribution with a peak around 2000. A small table next to it provides statistics for "crate11dynamic":

Entries	110323
Mean	1224
Width	1287
Underflow	991
Overflow	0
Integral	1.120e138
Maximum	0.0075

The central "Dynamic List Editor" window shows the following configuration:

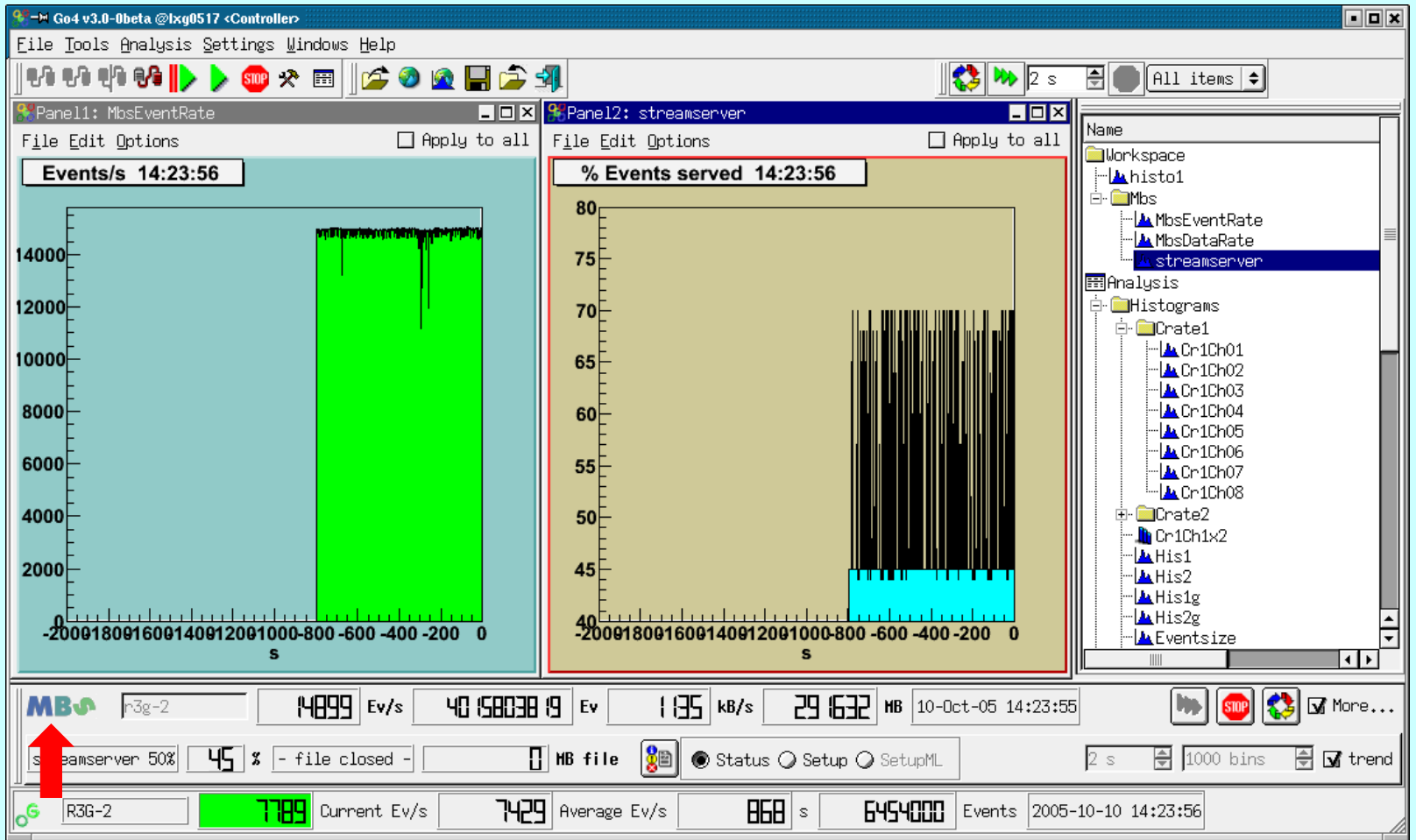
- Entry: TGo4HistogramEntry
- enable Analysis/DynamicLists/test2
- Histogram: Analysis/Histograms/crate11dynamic
- Event data | Condition | TreeDraw
- X: Go4Element/fiCrate1[1]
- Y: (empty)
- Z: (empty)

On the right, a tree view shows the event structure, with "fiCrate1[16]" selected under "Go4Element".

At the bottom, a status bar displays: R3G-2, 8.185 Current Ev/s, 7524 Average Ev/s, 153 s, 1153000 Events, and the timestamp 2005-10-06 11:10:53.

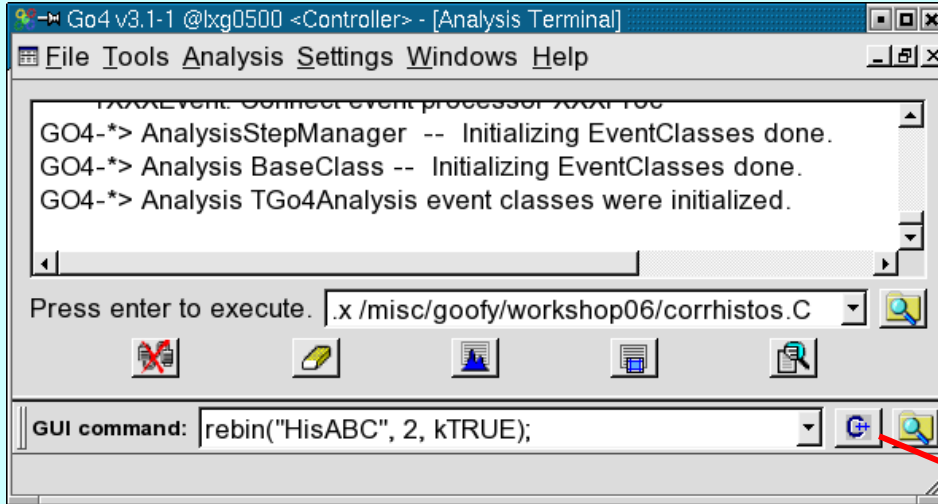


Online event ratemeters, trending, remotely inspect status and setup

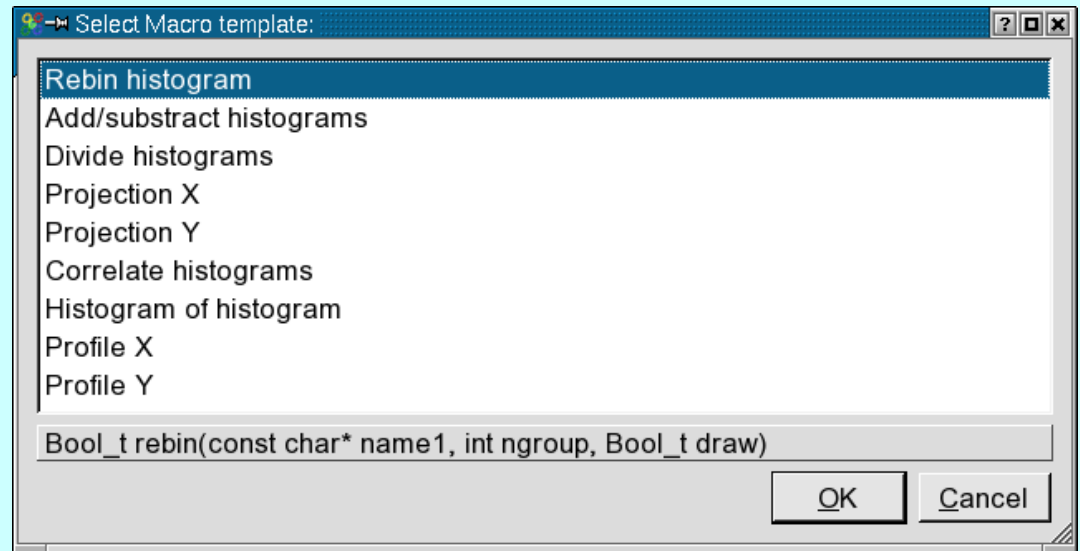




Remote (analysis) and local (GUI)

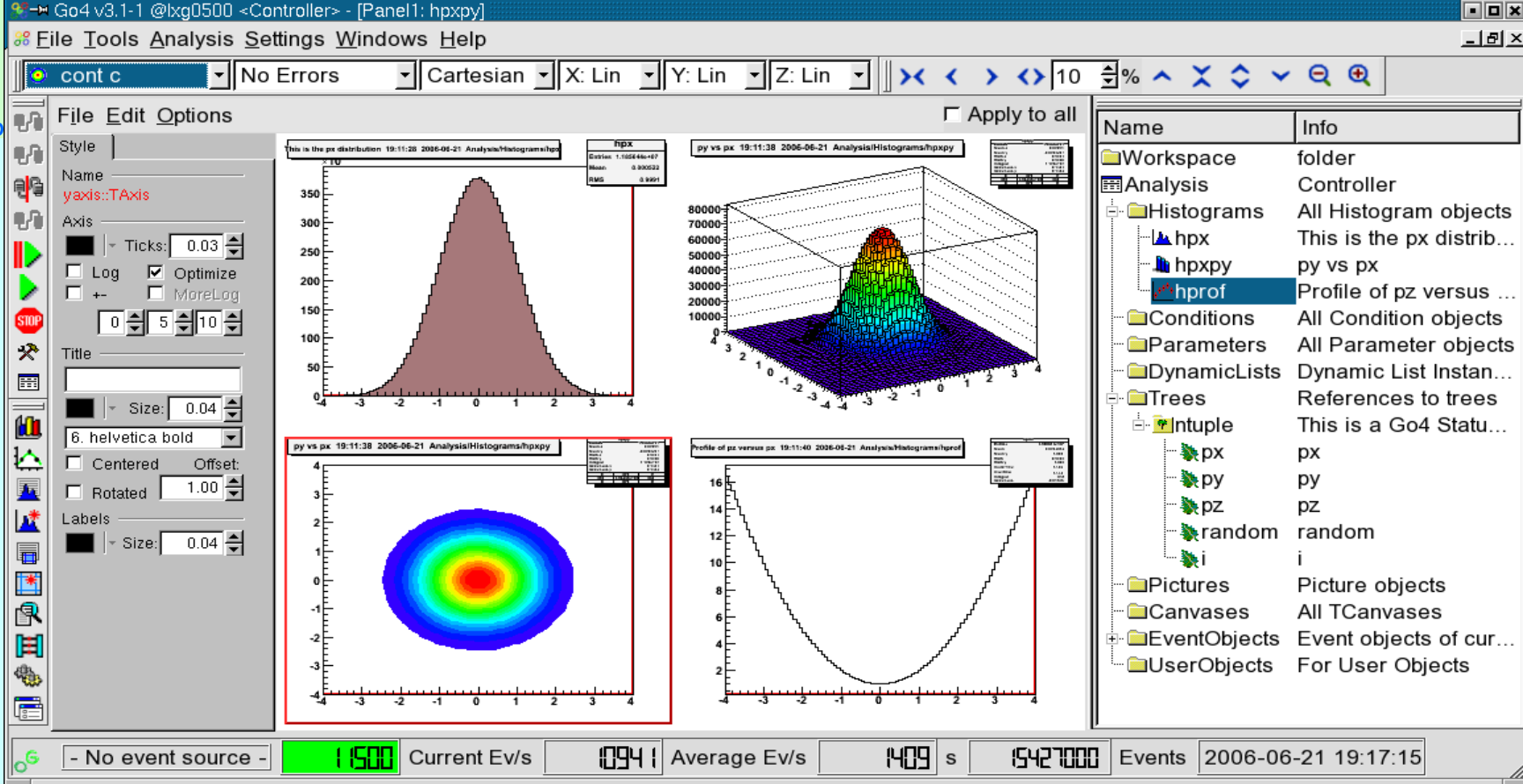


some macros provided by Go4





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.
```

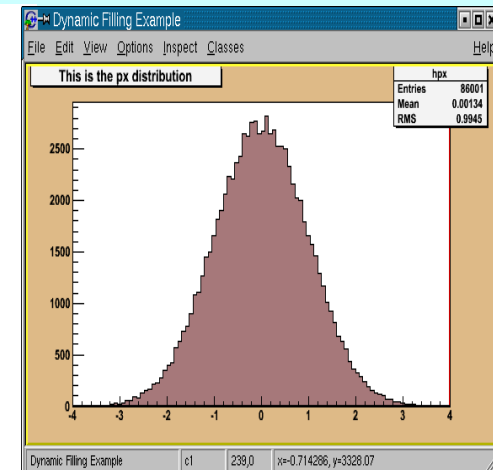
```
Starting execution loop after 33 s of waiting
```

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

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

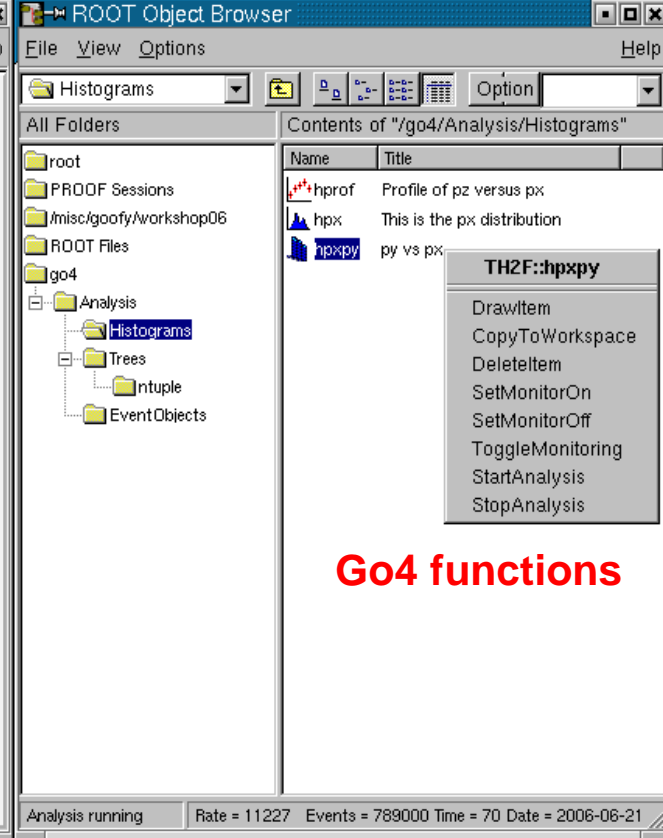
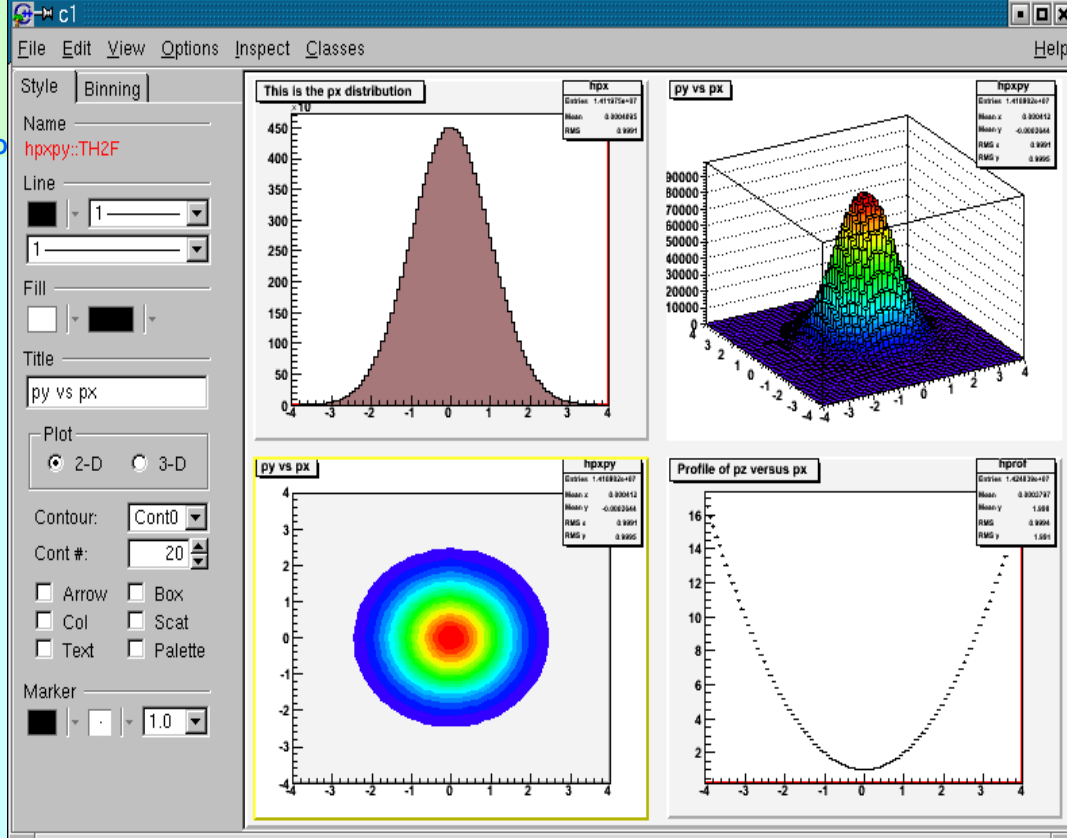
GO4GO4GO4GO

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GO4GO4GO4GO



Go4 functions

Running a ROOT analysis macro in CINT controlled by ROOT browser

Windows XP!

```

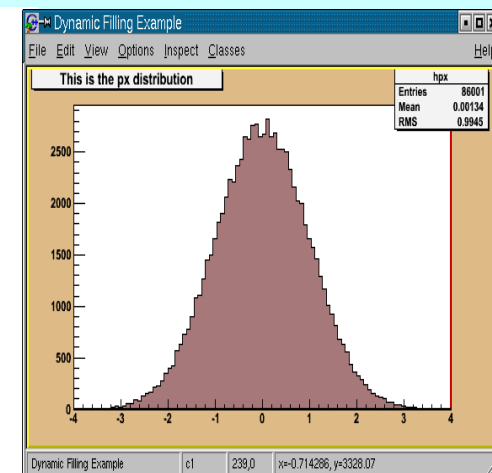
root [0] .x go4LoadLibs.C
root [1] go4 = new TGo4Interface()
(class TGo4Interface*)0x9319318
root [2] go4->ConnectAnalysis("localhost",5000,1)
Loginfo = GO4-*> Analysis nameslist was requested from client Display-lxg0500-26451
Loginfo = GO4-*> Analysis status was requested from client...
Loginfo = GO4-*> Client Display-lxg0500-26451 is logged in at Go4CintServer-lxg0500-16805 as Controller
root[3] new TBrowser()
(class TBrowser*)0x9079c30

```

```

GO4-*> TaskManager: Successfully added new client Display-lxg0500-4519 (host lxg0500, ports 5001,5002,5003)
GO4-*> Client Display-lxg0500-4519 is logged in at Go4CintServer-lxg0500-4525 as Controller
Waiting for client connection on PORT: 5000
GO4-*> AnalysisClient Go4CintServer-lxg0500-4525 has started analysis processing.
Starting execution loop after 33 s of waiting
GO4-*> AnalysisClient Go4CintServer-lxg0500-4525 has STOPPED analysis processing.hsimple :
Real Time = 7.75 seconds Cpu Time = 5.34 seconds

```



GO4GO4GO4GO

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