



# New development in Go4

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**ROOT 2005**

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S.Linev: Go4 - <http://go4.gsi.de>

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## Current status of Go4

- **Framework** for many kinds of experiments (Atomic & Nuclear physics)
- The analysis code is written by the user
- **Services and interfaces** for analysis
- A **non blocking GUI controls and steers the analysis**
- Analysis **runs independently** and can **update graphics asynchronously**
- Socket communication between **analysis** and **GUI task**
- **Qt based GUI** with interface to **ROOT graphics**
- **User defined GUI** supported (Qt designer)



# Screenshot of Go4 GUI

Go4 v3.0-0a @lxxg0516 <Administrator>

File Tools Analysis Settings Windows Help

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

Analysis Configuration

Step Control

Disable Step Disable Source  Disable

EventSource

MBS Random

Name: /GSI/lea/leagauss

Tagfile:

Port:

Angs:

Auto Save File

MyAnalysis\_AS.root

DISABLED never 5

Analysis Configuration File

Go4AnalysisPrefs.root

Condition editor

Analysis/Conditions/cHis1

Returns Result Regular

All counts: 13624895 True: 10729737

Limits Draw Stats Mean

Xmin: 2069.72 Xmax: 3950.31

Ymin: Ymax:

Marker Modes

X: loop new

Condition histogram 14:01:49

His1

Crate 1 channel 1x2 14:00:16

C1Ch1x2

Crate 1 channel 6 14:00:56

Marker 1

X = 1.0920E+03

C = 1195

Condition histogram 14:01:49

His1

Tree

Name	Class
Workspace	
gauss_XXXAn1.root	TFile
AnalysisxTree	TTree
XXXAn1Event...	TXXXAn1Event
XXXAn1Event...	TXXXAn1Event
XXXAn1Event...	TXXXAn1Event
Analysis	TGo4Analysis...
Histograms	TFolder
Crate1	TFolder
Crate2	TFolder
C1Ch1x2	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

Date Time Description Type

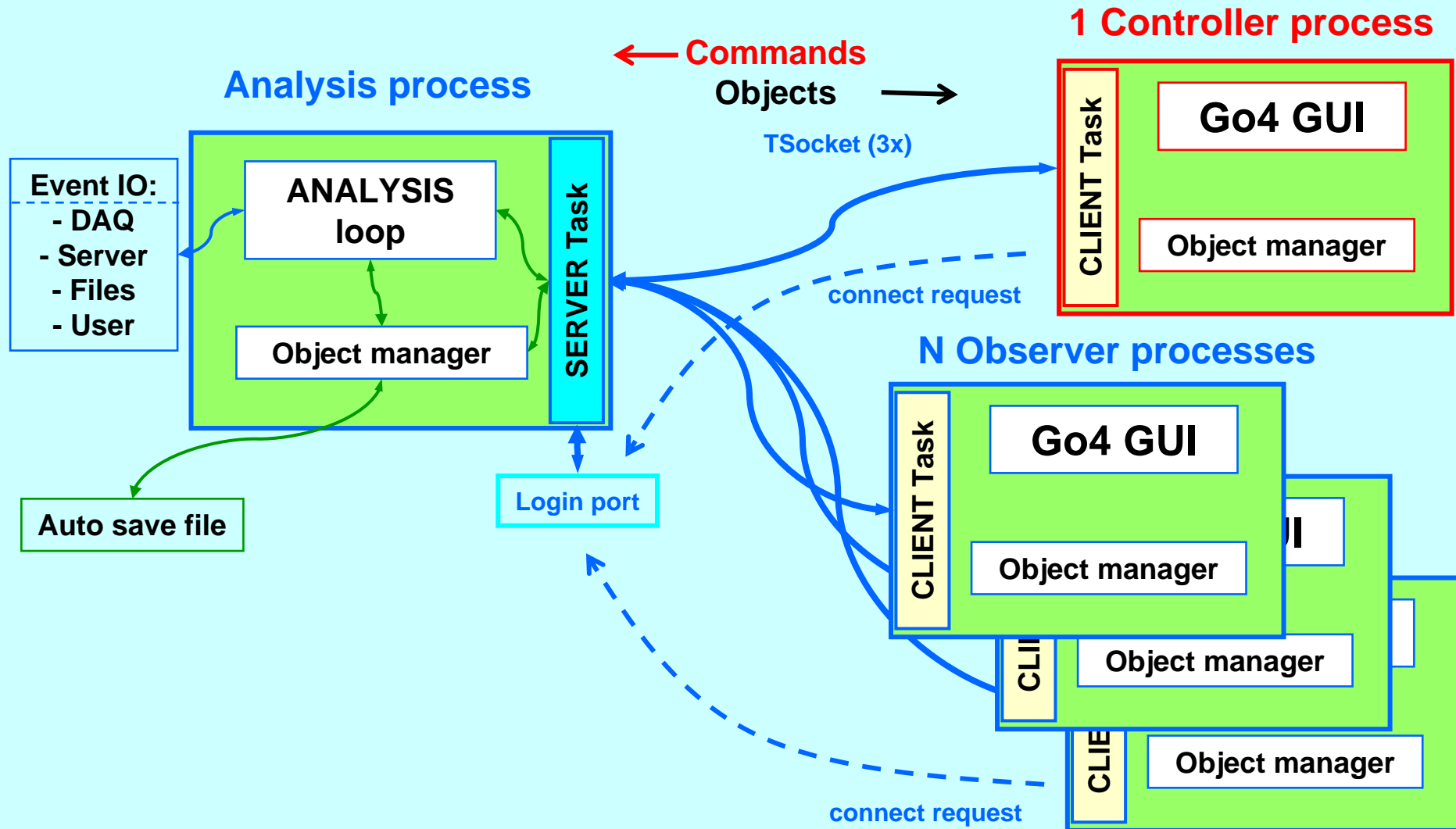
22.09.05 13:54:15 Analysis nameslist was requested from client Display-lxxg0516-5652 Info

22.09.05 13:54:15 Client Display-lxxg0516-5652 is logged in at MyAnalysis-lxxg0516-5680 as Administrator Info

/GSI/lea/leagauss 20459 Current Ev/s 19738 Average Ev/s 1.95 s 2241000 Events 2005-09-22 14:13:13



# Improved communication mechanism





## New concept for objects organization

### 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



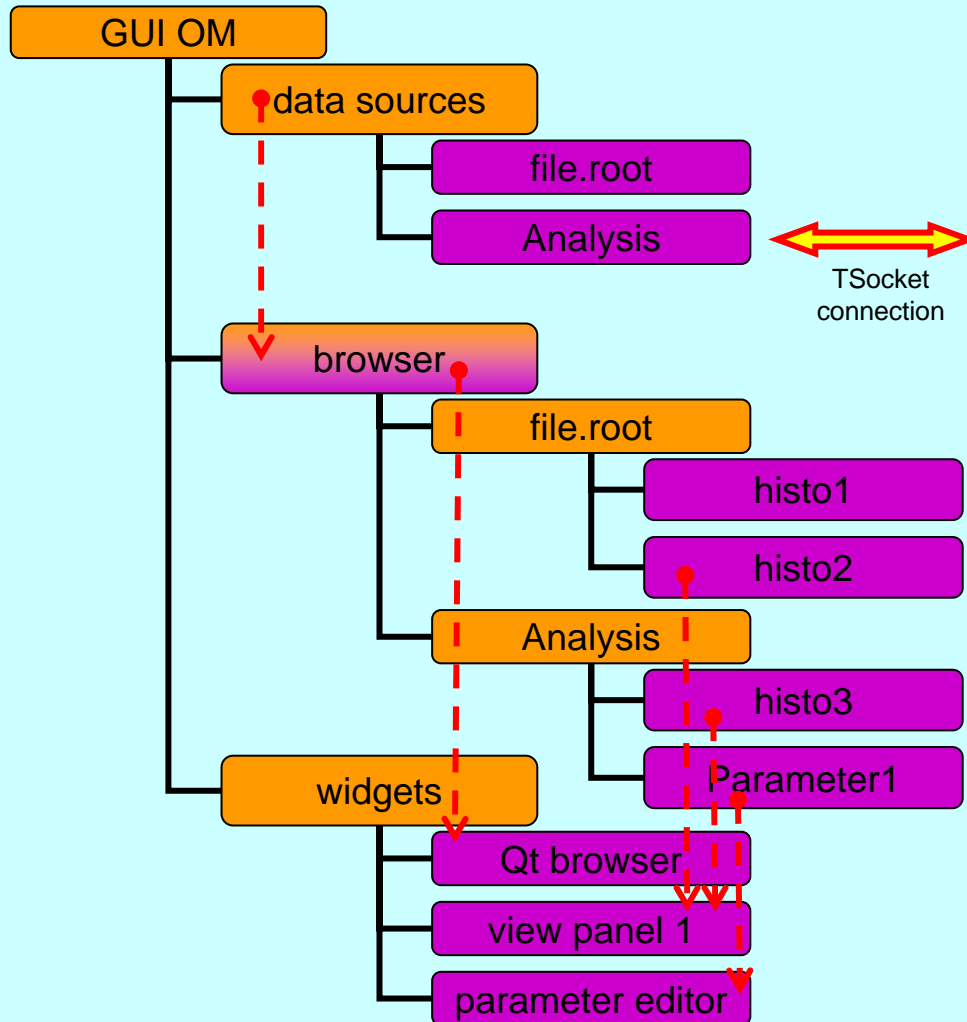
## Proxy approach

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



# GUI object manager



- 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



# Go4 browser

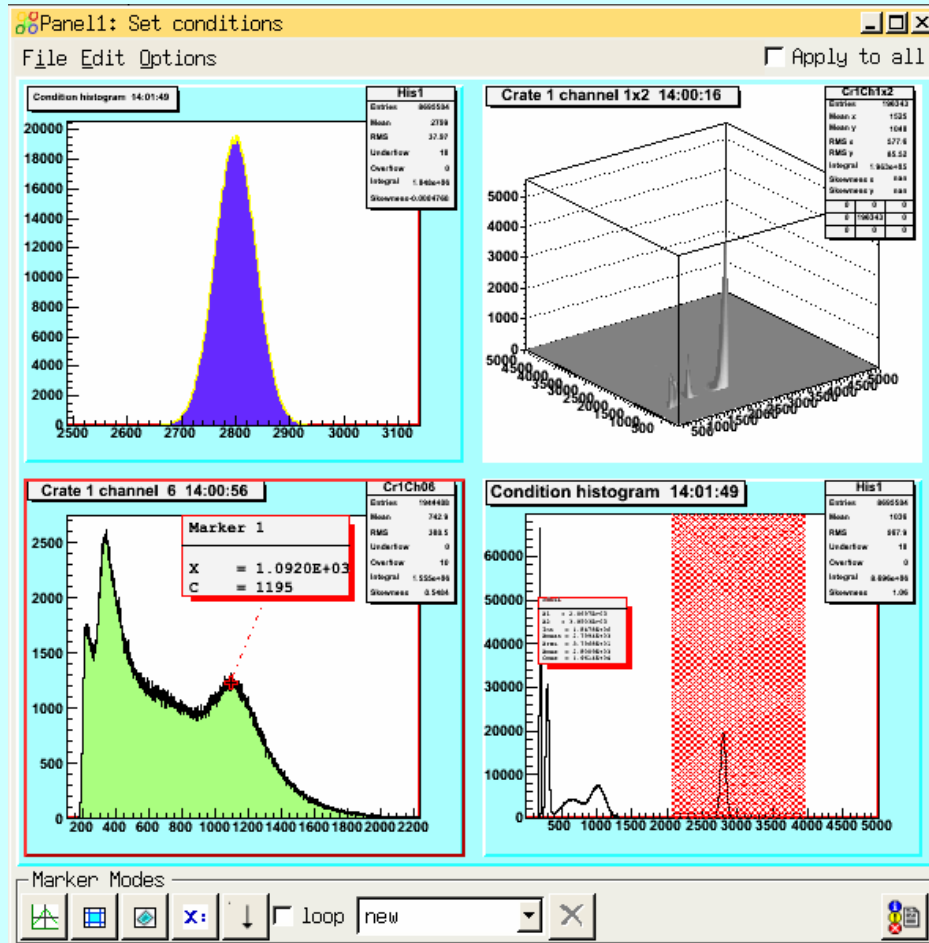
Name	Info	Class
Workspace	folder	
gauss_XXXAn1.root		TFile
AnalysisxTree	Go4FileStore	TTree
XXXAn1Event.	TXXXAn1Event	TXXXAn1Event
XXXAn1Event...	TXXXAn1Event	TXXXAn1Event
XXXAn1Ev...	TGo4EventElement	TGo4EventEl...
XXXAn1Ev...	TGo4EventElement	TGo4EventEl...
XXXAn1Ev...	TGo4EventElement	TGo4EventEl...
XXXAn1Event...	TXXXAn1Event	TXXXAn1Event
hist.root	Go4Fit examples...	TFile
hDeg120_P_c	hDeg120_P_c	TH1D
hDeg120_CND	hDeg120_CND	TH1D
Analysis	Administrator	TGo4Analsi...
Histograms	All Histogram o...	TFolder
Conditions	All Condition o...	TFolder
wincon1	Go4 window cond...	TGo4WinCond
wincon2	Go4 window cond...	TGo4WinCond
polycon	Go4 polygon con...	TGo4PolyCond
winconar	TGo4WinCond	TGo4CondArray
polyconar	TGo4PolyCond	TGo4CondArray
chis1	Go4 window cond...	TGo4WinCond
chis2	Go4 window cond...	TGo4WinCond
Parameters	All Parameter o...	TFolder
DynamicLists	Dynamic List In...	TFolder
Trees	References to t...	TFolder
Pictures	Picture objects	TFolder
Canvases	All TCanvases	TFolder
EventObjects	Event objects o...	TFolder
UserObjects	For User Objects	TFolder

- Implemented as special proxy
- Replicates structure of data sources
- Keeps pointers on fetched objects
- Objects copy & paste
- Monitoring (periodical update) of specified objects
- Completely independent from graphical surface
- Simple Qt widget to display structure of browser





# Go4 view panel



- Uses QtROOT interface (by D.Bertini)
- List of drawn objects is kept in special branch of OM
- Via special widget proxy view panel notified, when object is modified or deleted
- Possibility to draw same histogram with different ranges, line and fill colors



# Remote dispatching of ROOT macro

- Use regular ROOT session
- Init script to loads Go4 libraries and starts up analysis server task  
`[root] .x go4Init.C`
- All methods of TGo4Analysis::Instance() available in CINT via  
`go4->...()`,
- Register Root objects in CINT / analysis script:  
`go4RegisterAll()` (all histograms in root memory), or  
`go4->AddHistogram(TH1*)`, `go4->AddObject(TNamed*)`, ...
- Optional run control methods for macro:  
`go4->WaitForStart()` - suspend macro until start button pressed  
`go4->Process()` - break eventloop when stop button pressed



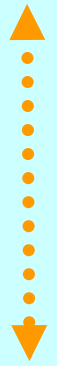
# Remote dispatching of ROOT macro



The screenshot displays the Go4 GUI with several key components:

- run control:** Located at the top, it contains a toolbar with icons for running, pausing, and stopping the process.
- browser:** On the left side, a tree view shows the file structure, including folders like 'Workspace', 'Analysis', 'Histograms', and 'Trees'.
- object monitor:** A central area containing four panels:
  - Panel11: hpx: A 2D histogram showing a Gaussian-like distribution.
  - Panel12: hTreeDraw: A 2D heatmap and a 3D surface plot.
  - Panel14: hpx: A 1D histogram showing a Gaussian-like distribution.
  - A 2D heatmap plot showing a horizontal band of activity.
- rate monitor:** At the bottom, it displays real-time statistics: 'No event source', '8720 Current Ev/s', '8332 Average Ev/s', '158 s', and '1322000 Events'.
- hsimplego4.C:** A terminal window at the bottom left shows the execution of a ROOT macro, including output like 'Added Dynamic histogram hTreeDraw for tree ntuple' and 'AnalysisClient Go4CintServer-lxg0517-8208 has started analysis processing'.

**Go4 GUI**



**ROOT**



# Plain ROOT for analysis control

- Use regular ROOT session
- Instantiate TGo4Interface instance  

```
[root] TGo4Interface::Instance()
```
- Connect to running analysis  

```
[root] go4->ConnectAnalysis("host.domain", 5000, 2);
```
- Create TBrowser instance:  

```
[root] new TBrowser
```
- ROOT browser will contain "go4" folder, where all objects in analysis will be displayed



# Using TBrowser for macro control



Go4 folders

Go4 menu

object monitor

ROOT



ROOT

run control

hsimplego4.C

The screenshot displays a ROOT environment with several windows:

- ROOT Object Browser:** Shows a tree structure of folders under 'go4'. A context menu is open over the 'Histograms' folder, with 'SetMonitorOn' highlighted. The menu items include: DrawItem, CopyToWorkspace, DeleteItem, SetMonitorOn, SetMonitorOff, ToggleMonitoring, SaveAs, SetName, SetTitle, Delete, DrawClass, DrawClone, Dump, Inspect, and SetDrawOption.
- Drawing of Panel0:** A histogram showing a Gaussian-like distribution.
- Drawing of Panel1:** A 2D histogram (heatmap) and a 3D histogram.
- Drawing of Panel3:** A histogram showing a distribution on a logarithmic scale.
- Console Window (top):** Shows the execution of a macro. The output includes:
 

```

      processing.
      root [12] go4->StopAnalysis()
      Message = Go4-> Client Go4CintServer-lxg0517-12291 working function is stopped...
      Message = Go4-> AnalysisClient Go4CintServer-lxg0517-12291 has STOPPED analysis processing.
      root [13] go4->StartAnalysis()
      root [14] Message = Go4-> Client Go4CintServer-lxg0517-12291 working function is started...
      Message = Go4-> AnalysisClient Go4CintServer-lxg0517-12291 has started analysis processing.
      Message = Go4-> Analysis nameslist was requested from client Display-lxg0517-12319
      Message = Go4-> Analysis nameslist was requested from client Display-lxg0517-12319
      
```
- Console Window (bottom):** Shows the execution of 'hsimplego4.C'. The output includes:
 

```

      Starting execution loop after 86 s of waiting
      Go4-> AnalysisClient Go4CintServer-lxg0517-12291 has STOPPED analysis processing.
      hsimple : Real Time = 71,04 seconds Cpu Time = 46,82 seconds
      Waiting for the Go4 start button.
      Use Canvas menu 'Options/Interrupt' to leave macro.
      Go4-> AnalysisClient Go4CintServer-lxg0517-12291 has STOPPED analysis processing.
      Go4-> AnalysisClient Go4CintServer-lxg0517-12291 has STOPPED analysis processing.
      Go4-> AnalysisClient Go4CintServer-lxg0517-12291 has started analysis processing.
      Starting execution loop after 526 s of waiting
      
```
- Dynamic Filling Example:** A histogram showing a distribution.



## Conclusion

- Communication mechanism was improved to enable multiple viewers of running analysis
- Go4 GUI was enhanced and its main functionality was separated from graphical surface
- Running on other node ROOT macro can be observed and controlled from the Go4 GUI or from the normal ROOT TBrowser
- Go4 v3 beta release is available. Production release will be in the next few weeks