



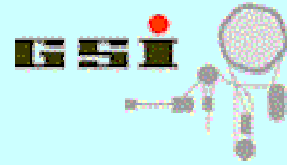
Distributed object monitoring for ROOT analyses with Go4 v.3

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

CHEP 2006 Mumbai



Go4 v3

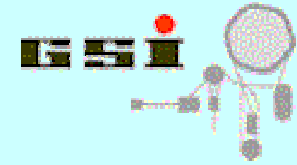


The Go4 framework

New developments for v.3.0

Inter-task communication

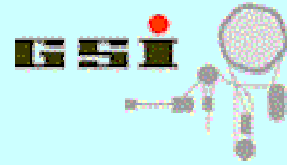
Distributed Go4 monitoring



Go4 overview

Framework for many kinds of experiments (Atomic & Nuclear Physics)

- The analysis is written by the user (**unlimited ROOT**)
- Services and interfaces for **modular analysis setup**
- **Batch mode** (CINT or compiled, on/off-line)
- **Interactive mode** (on/off-line):
 - A **non blocking GUI** controls and steers the analysis
 - **Multithreaded communication layer**
between analysis and GUI task(s)
- Qt based GUI interfaces **ROOT and Qt graphics** (GSI Qt-ROOT)
- **User defined GUI** supported (Qt designer)

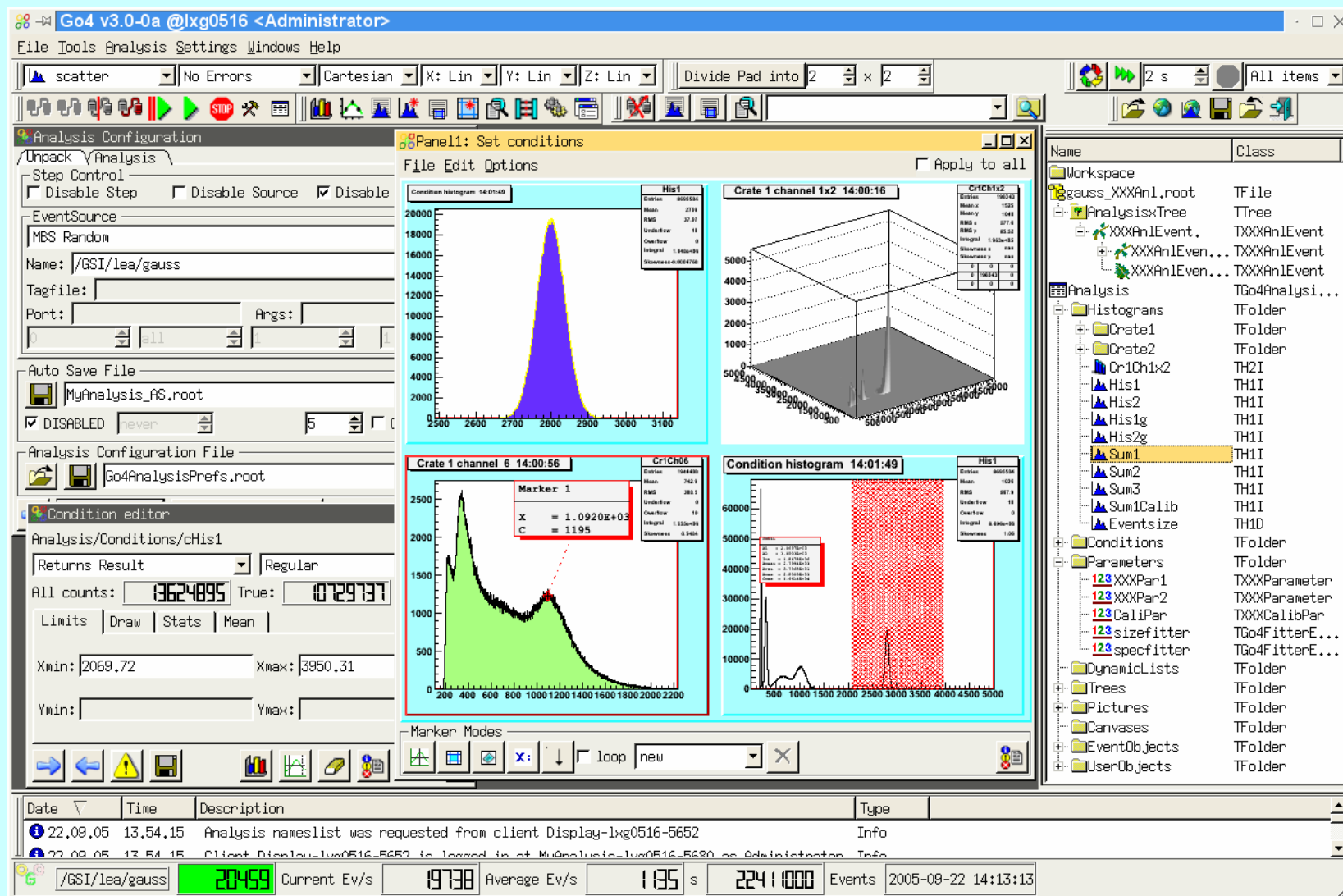


Go4 history and status

- Development start: April 1999
- Go4 v.1.0 May 2002
- Go4 v.2.0 November 2002
- Go4 v.2.9 April 2005 (stable?)
- Go4 v.3.0 (and “final” v2.10) November 2005
- Users:
 - At GSI:** FRS, SHIP, AP, ESR, Rising, HypHI, HADES online, ...
 - Outside:** TU Darmstadt, U Mainz, U Giessen, PTB, INFN, IN2P3, Leuven, Weizman institute, IMPCAS,...

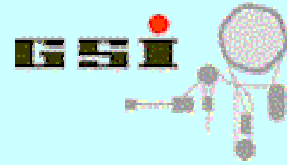


Screenshot of Go4 v3

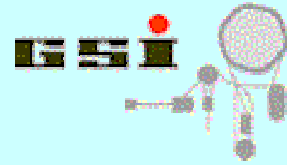




Go4 Analysis framework

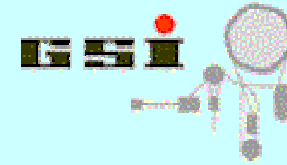


- **TGo4Analysis** base class:
 - Analysis setup (modular: analysis steps)
 - Object organization
 - Event loop, run control
 - Open to wrap „foreign“ frameworks (ROOT/ C++/C)
(virtual methods in user analysis subclass)
- **Event interface classes:**
 - event structure, event IO, processor
 - factories for analysis step initialization
 - implementations for ROOT TTree IO, GSI Mbs DAQ

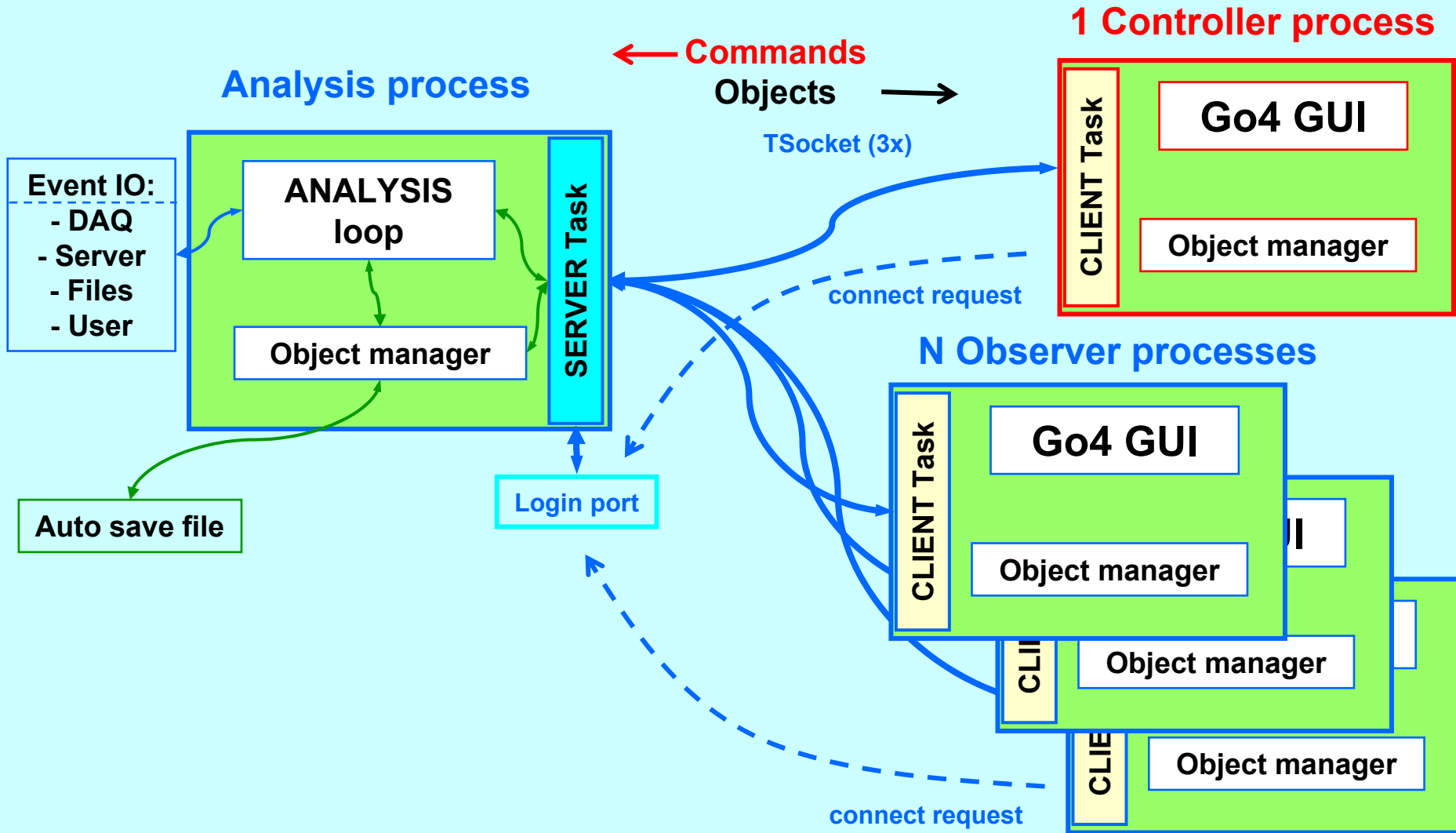


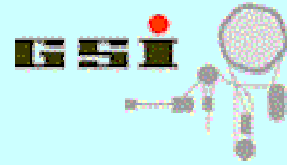
Developments for v.3

- **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,...
- **ROOT session** (macro) **may be controlled** by Go4 GUI
- **ROOT session** (TBrowser) **may control** Go4 analysis
- Go4 distribution for **Windows XP** (without Qt!)



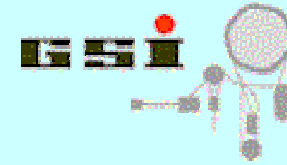
Go4 inter task communication





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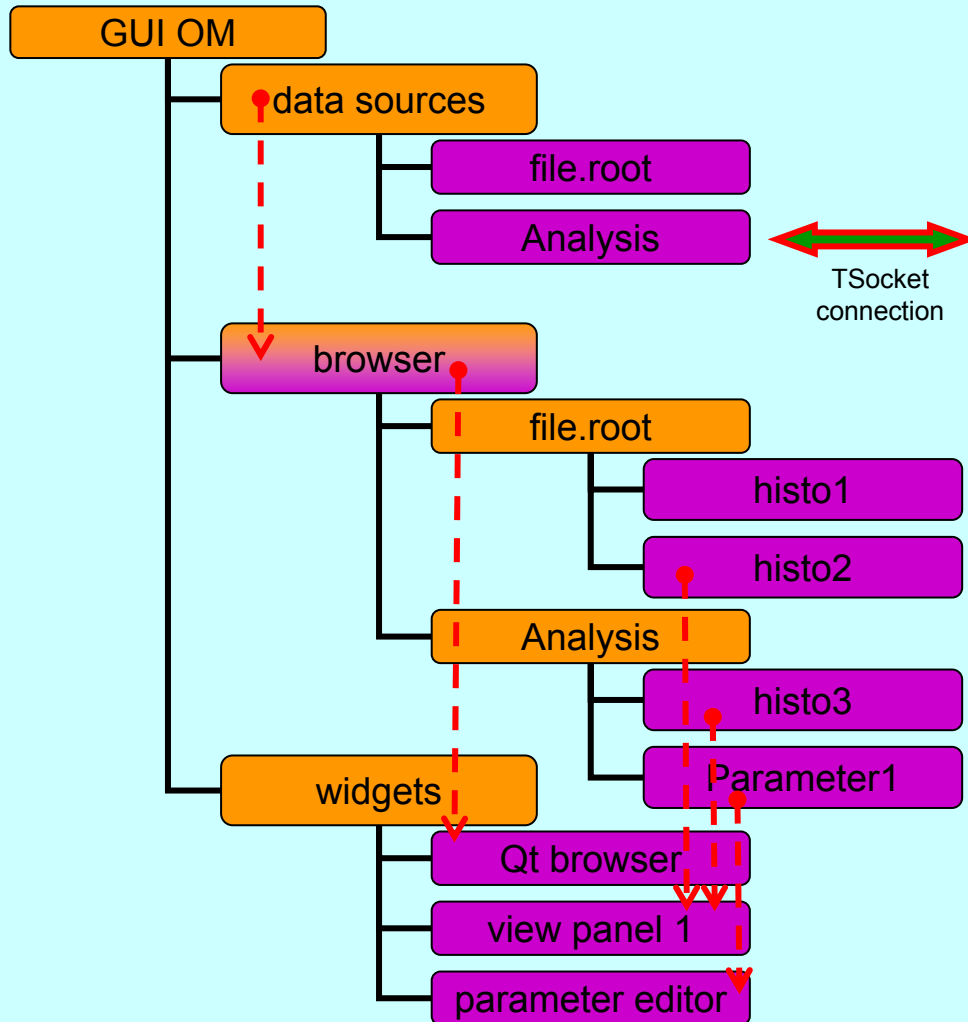


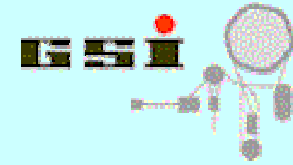
GUI object manager

Supported data sources:

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

- 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



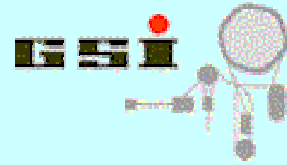


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Go4 GUI remote features

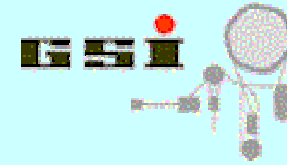


connected as observer:

- **Object browser, view, property display**
(histograms, conditions, parameters, event structure,...)
- **Object monitoring** (frequent refresh **from analysis**)
- **MBS DAQ status monitor** (**from mbs node**)

login as controller required!

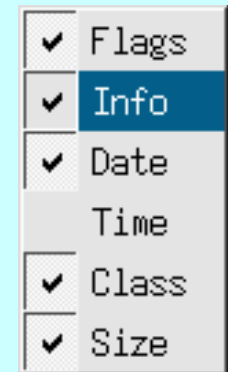
- **Control and Go4 analysis setup**
- **Object editing** (window, polygon condition, parameter,...)
- **Dynamic histogramming** (on TTree or event structure)
- **ROOT macro execution** (**in remote process**)



Go4 browser

browser

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	TGo4CondArray	132
[-] polyconar	spw	TGo4PolyCond	2005-10-04	14:24:51	TGo4CondArray	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 O...			TTree	
[-] XXXAn1Event.		XXXAn1Event.			TFolder	
[-] XXXAn1Event.TGo4Event...		XXXAn1Event.TGo4EventE...			TFolder	
[-] XXXAn1Event.TGo4Ev...		XXXAn1Event.TGo4EventE...			TFolder	
[-] XXXAn1Event.TGo4Ev...		XXXAn1Event.TGo4EventE...			Bool_t	428
[-] XXXAn1Event.TGo4Ev...		XXXAn1Event.TGo4EventE...			Short_t	428
[-] XXXAn1Event.frData[16]		XXXAn1Event.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

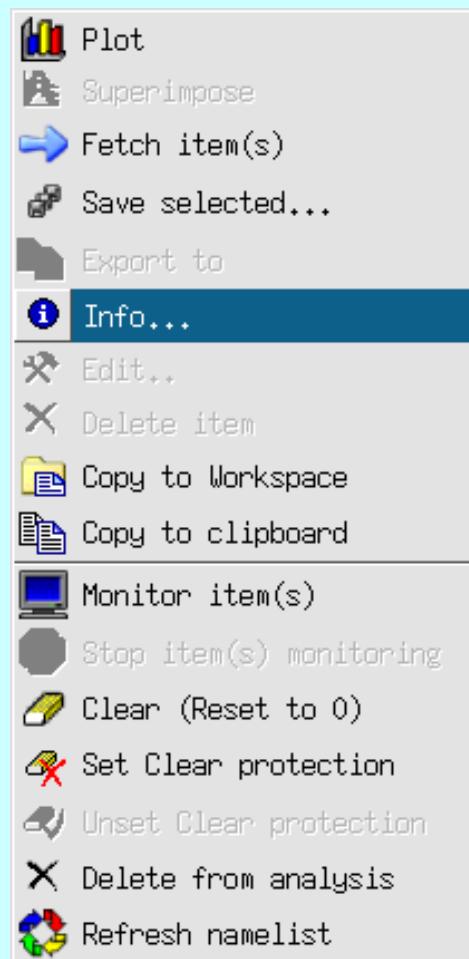


column popup

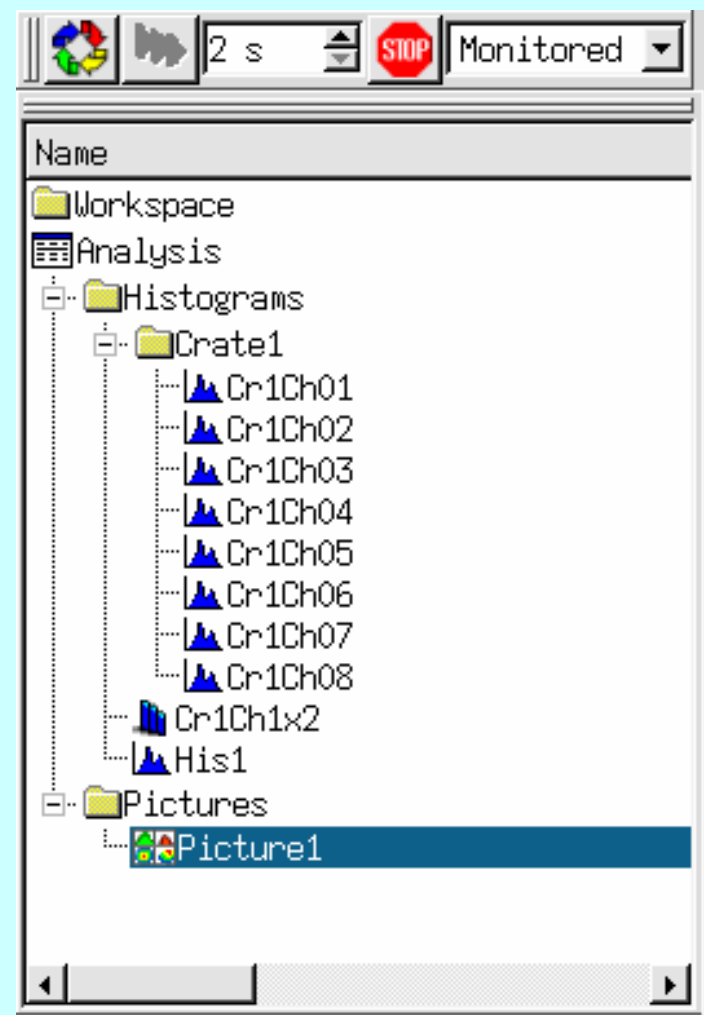


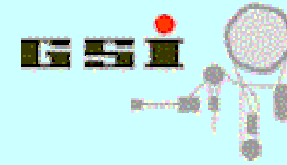
Go4 browser

monitor and filter tool



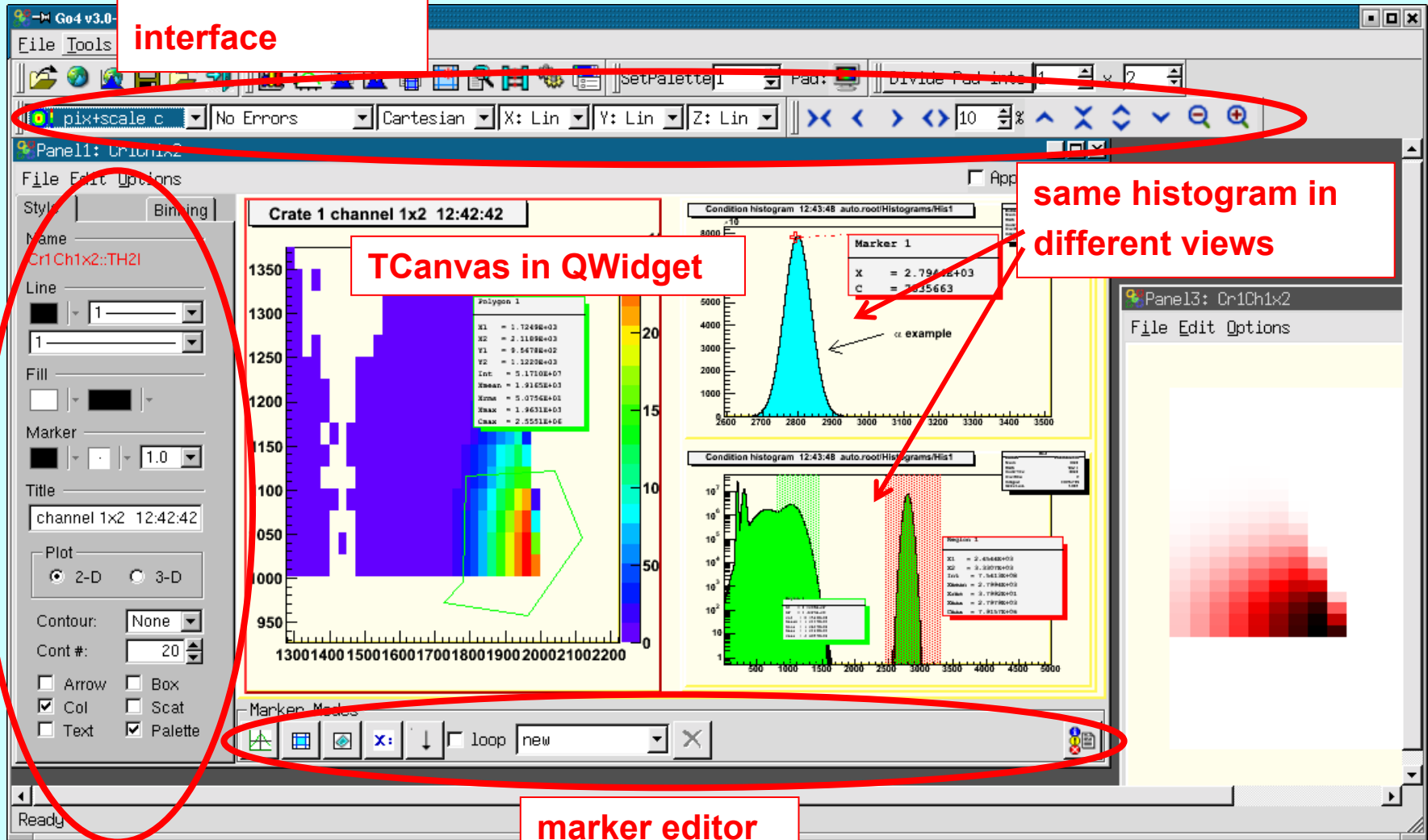
context menu





View panel

multi document
interface



ROOT editor

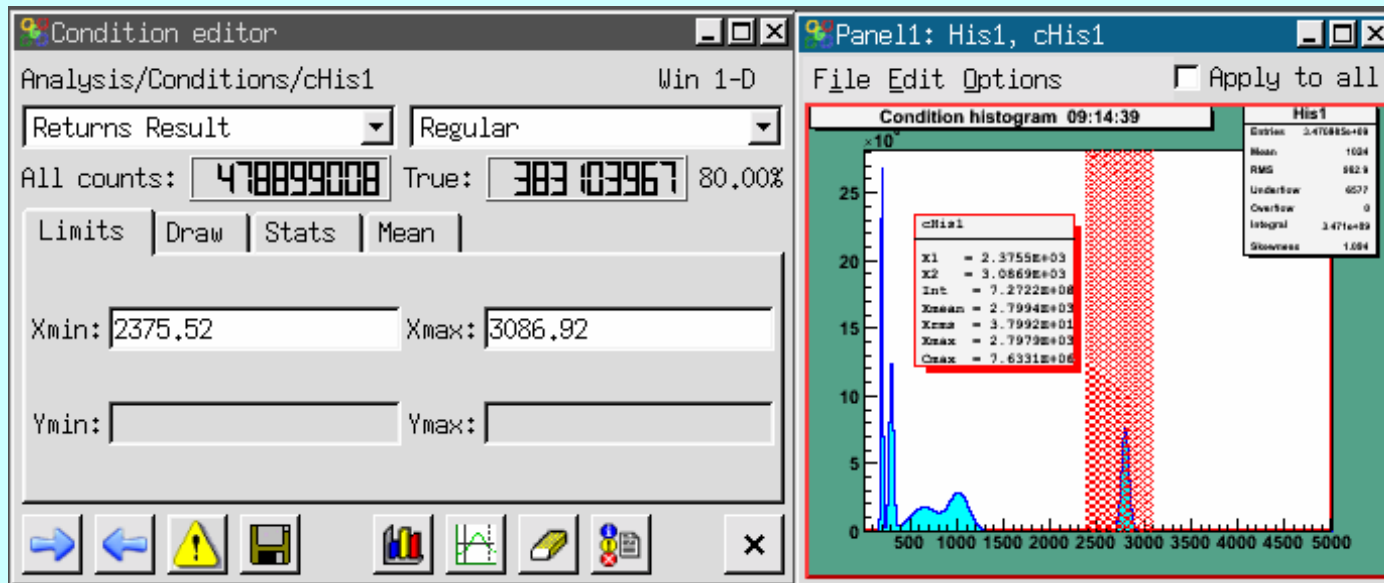
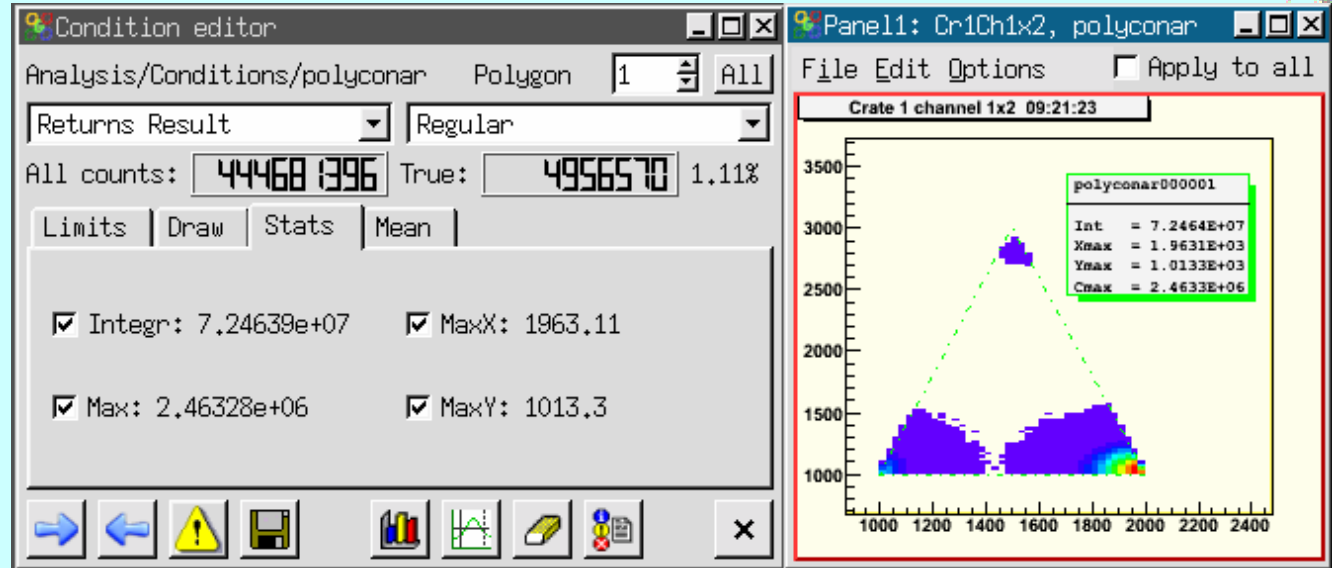
marker editor



Condition editor



2D polygon



1D limits



Parameter editor

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 - TXXXCaliPar

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

Modify Fitter
Edit...

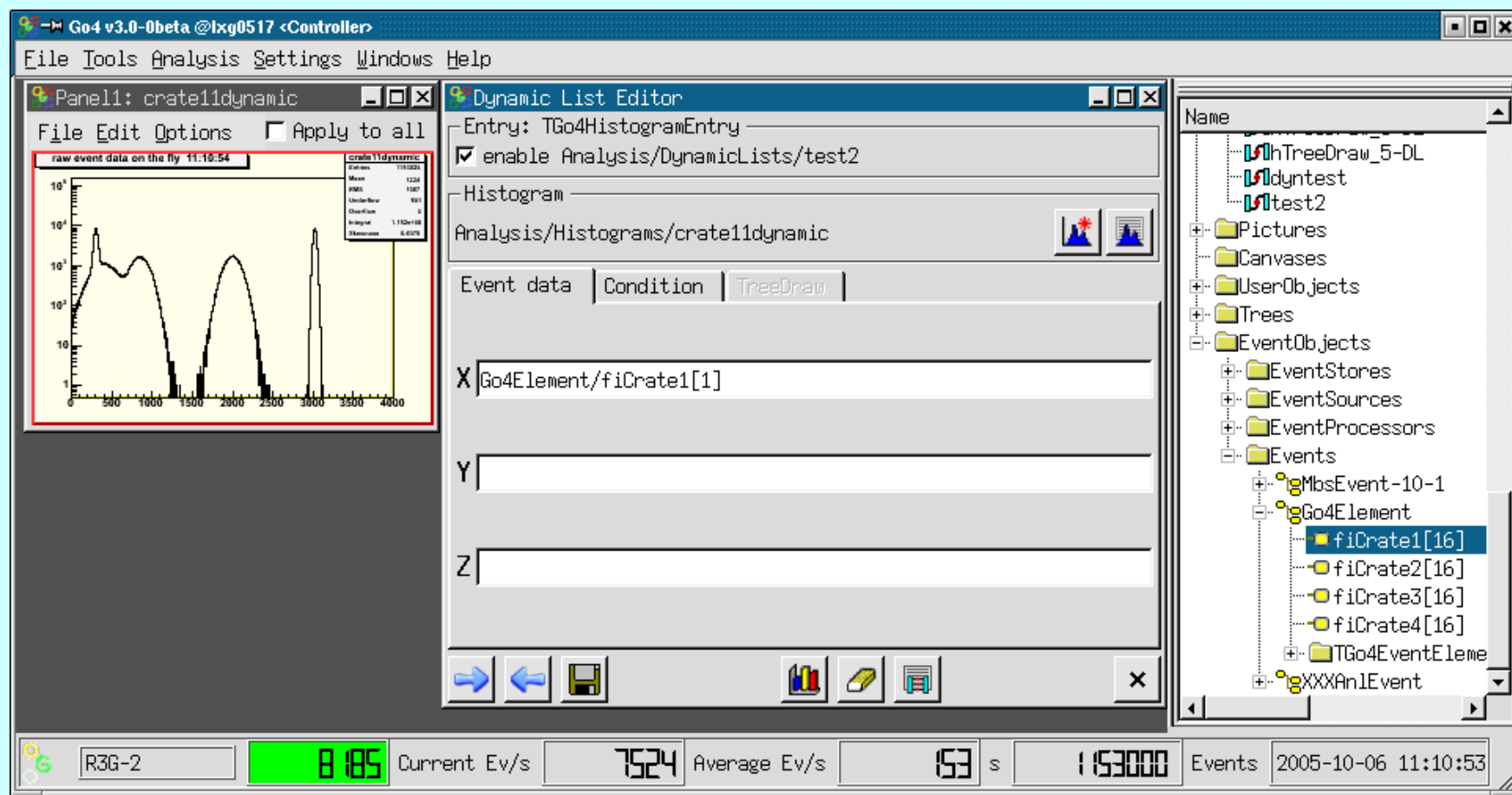
Workspace
Analysis
Histograms
Conditions
Parameters
XXXPar1
XXXPar2
sizefitter
specfitter
CaliPar
DynamicLists
Trees
Pictures
Canvases
EventObjects
UserObjects

R3G-2 Current Ev/s 14495 Average Ev/s 4 s 58893 Events 2005-10-06 10:51:13



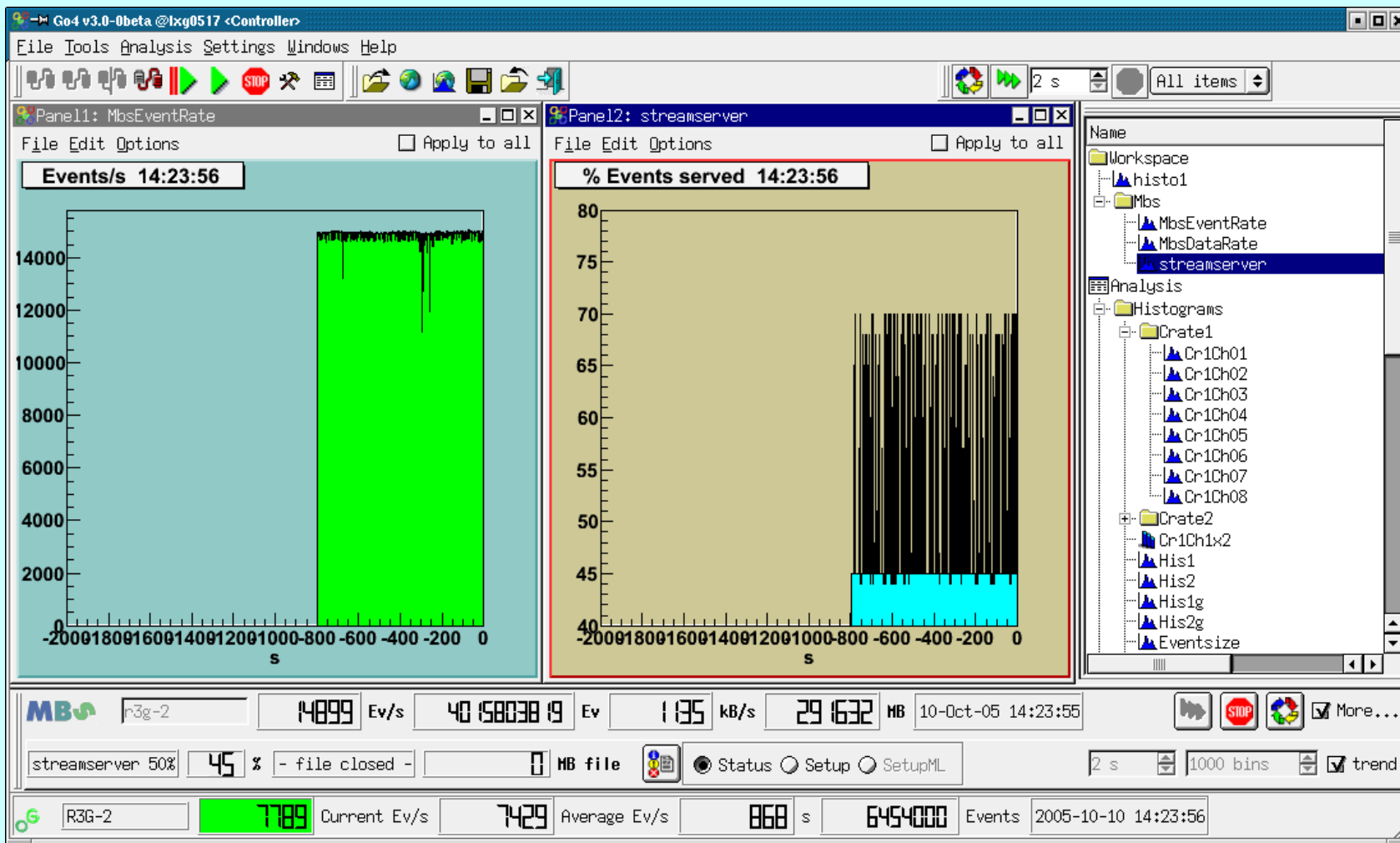
Dynamic list editor

Histogramming “on the fly”
from remote TTree , or event structure in memory

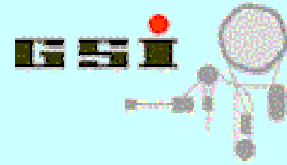




Mbs DAQ status monitor



Online event ratemeters, trending, remotely inspect status and setup



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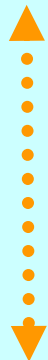


Remote control of ROOT macro

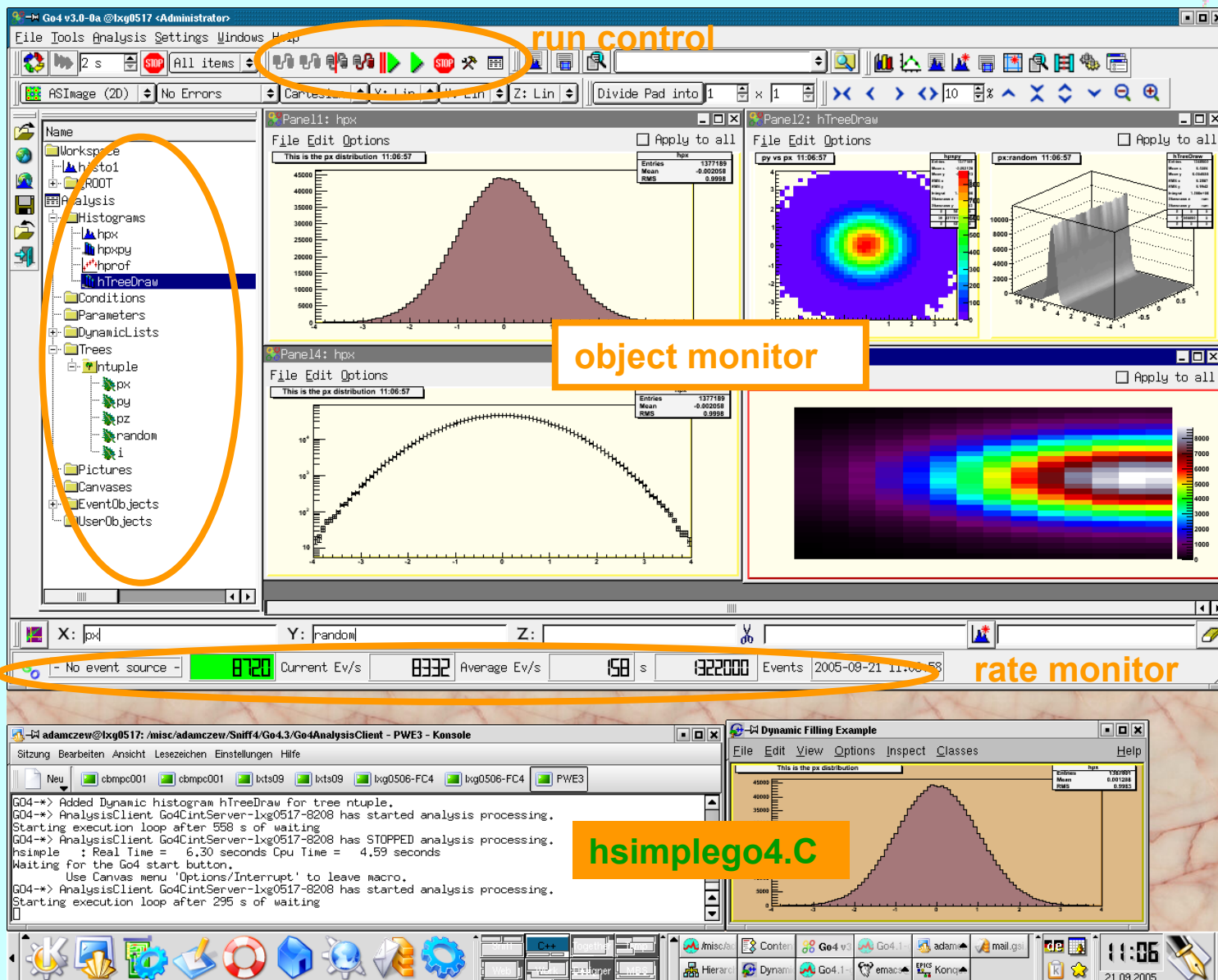


browser

Go4 GUI

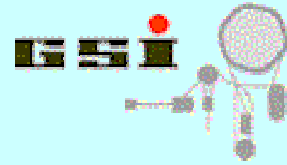


ROOT





Remote control of ROOT macro



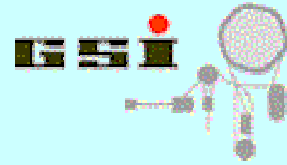
- Use regular ROOT session
- Init script to loads Go4 libraries and starts up analysis server task

```
[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
```



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ROOT session for Go4 control



The screenshot displays a ROOT session interface with several windows:

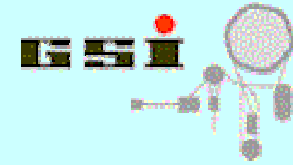
- ROOT Object Browser:** Shows the file structure of the analysis. The 'Analysis' folder is circled in orange, and the 'Histograms' subfolder is also circled in orange. A context menu is open over the 'Histograms' folder, with 'SetMonitorOn' highlighted. This menu is labeled 'Go4 menu' in an orange box.
- Drawing of Panel0:** Displays a histogram of the px distribution.
- Drawing of Panel1:** Displays a 2D histogram of py vs px.
- Drawing of Panel3:** Displays a histogram of the px distribution.
- Console:** Shows the execution of the Go4 analysis. The text 'Go4 menu' is highlighted in an orange box. The console output includes messages such as 'Client Go4CintServer-lxg0517-12291 working function is stopped...' and 'Client Go4CintServer-lxg0517-12291 has STOPPED analysis processing...'.
- Dynamic Filling Example:** Displays a histogram of the px distribution.

Orange boxes with the following text are overlaid on the image:

- Go4 folders** (pointing to the 'Analysis' folder in the Object Browser)
- Go4 menu** (pointing to the 'SetMonitorOn' option in the context menu)
- object monitor** (pointing to the 'SetMonitorOn' option in the context menu)
- run control** (pointing to the console output)
- ROOT** (pointing to the console output)
- hsimplego4.C** (pointing to the console output)

ROOT

Go4
analysis



ROOT for remote analysis control

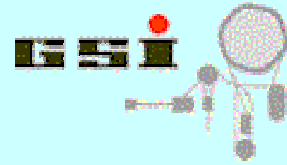
- Use **regular ROOT session**
- **Instantiate TGo4Interface instance**

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

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

```
[root] new TBrowser
```
- **ROOT TBrowser** will contain “go4” folder, where all objects in analysis will be displayed
- **CINT API** (`go4->...`) for remote control

```
LaunchAnalysis(..), ConnectAnalysis(..),  
SubmitAnalysisConfig(), StartAnalysis(), StopAnalysis(),  
ExecuteLine(....),...
```

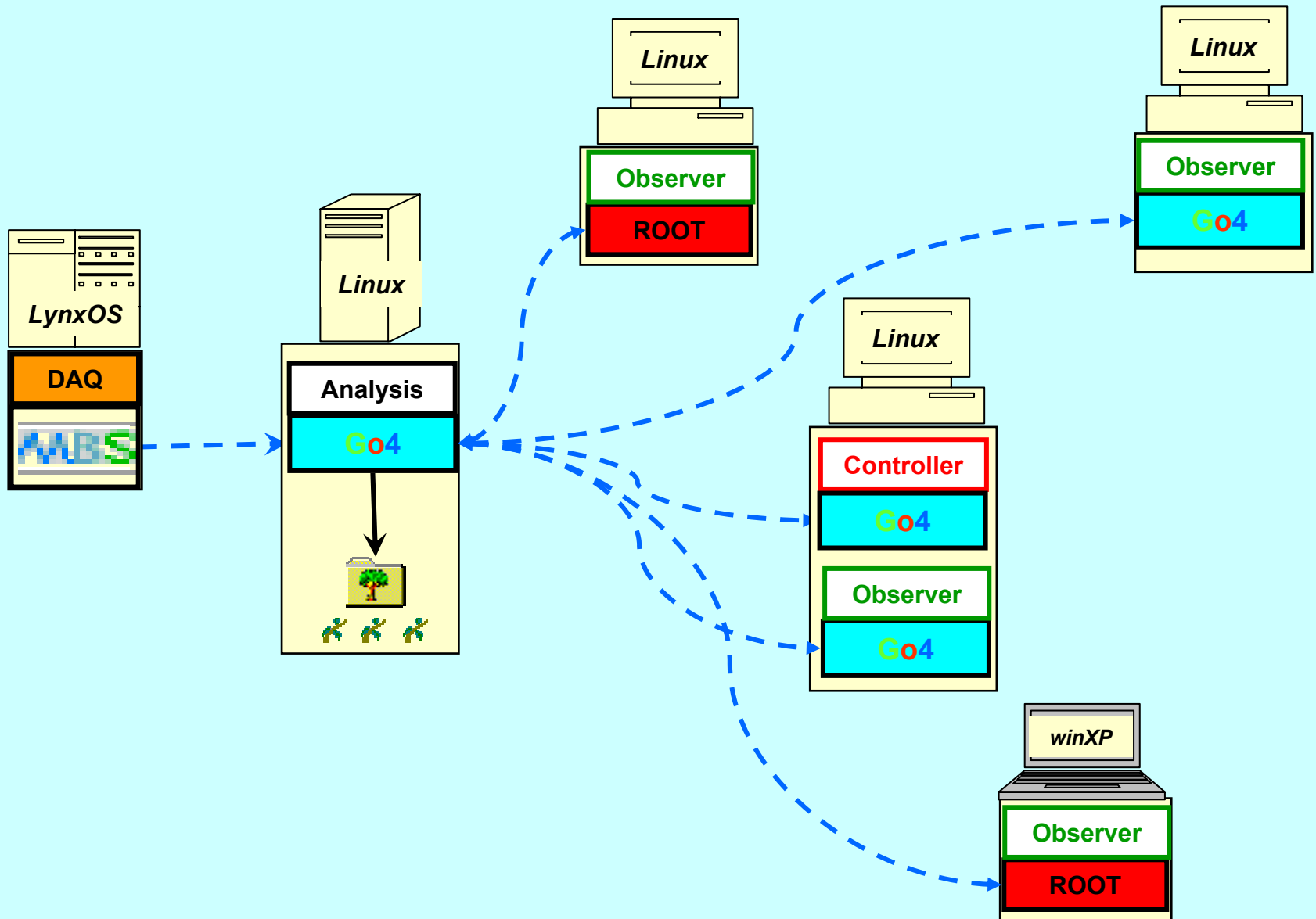


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Distributed monitoring (1)

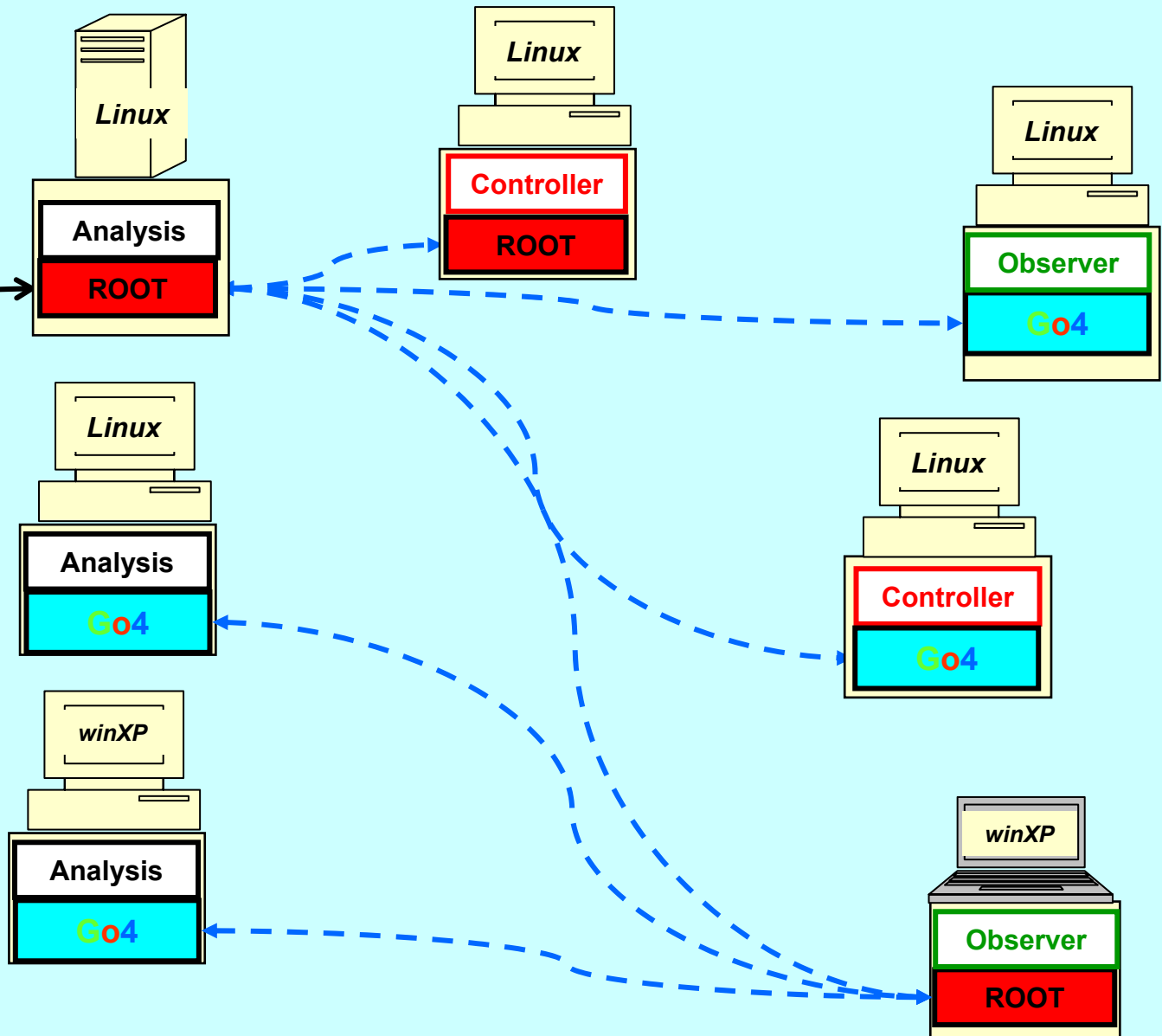
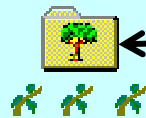


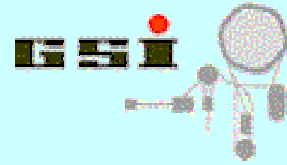


Distributed monitoring (2)



RFIO,
XROOTd,
PROOF?





Summary

Go4 well established as GSI “standard” software

Analysis framework

GUI (Qt and ROOT)

Inter-task monitoring and control mechanism
(Go4-Go4; Go4-ROOT, ROOT-Go4, ROOT-ROOT)

Linux; WindowsXP (non Qt); MacOS(?)

Go4 v3.0 available at <http://go4.gsi.de>