Go4 Version 4.4
On-line object monitoring

On-line object monitoring with new version v4.4 of Go4

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GSI, experiment electronics
Go4 features

- **Go4 is a framework** for many kinds of experiments (Atomic & Nuclear Physics)
- The analysis is written by the user (C++, **unlimited ROOT**)
- **Linux, Solaris, Windows XP, W7, Mac**
- **Go4 provides services and interfaces** for analysis
- **It runs in batch mode** (CINT or compiled, on/off-line)
- **or interactive mode** (on/off-line):
  - Non blocking Qt4 GUIs control and steer the analysis
  - The analysis **runs independently** and can update graphics asynchronously
  - ROOT objects are transported between analysis and GUI task
  - **One controller, multiple viewers** at one analysis server
  - **Macro execution** in GUI or remote analysis
  - ROOT and Qt graphics are interfaced
  - User may create specific GUIs (Qt designer)

**Go4 well established as GSI “standard” analysis framework**
Go4 package layers

Go4 Framework

User Analysis
  Go4 Analysis
  Go4 Event

Go4 GUI
  Qt Library
  Interface

Go4TaskHandler
  Go4ThreadManager

MBS

ROOT

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H.Essel @ gsi.de   Go4 v4 - http://go4.gsi.de
Go4 history and status

- **Development start:** April 1999
- Go4 v.1.0 May 2002
- Go4 v.2.0 November 2002
- Go4 v.2.10 June 2005
- Go4 v.3.0 December 2005
- **Go4 v.4.4** May 2010
- **Users:**
  - **At GSI:** FRS, SHIP, AP, ESR, Rising, HypHi, HADES online, TASCA...
  - **Outside:** TU Darmstadt, Uni Mainz, Uni Giessen, INFN Milano, Weizman institute, IMPCAS,...
Go4 analysis: modular design

Modular analysis, ROOT based

Event v0

Process

Event v1

Step 1

Event v1

Process

Event v2

Step 2

Event v2

Process

Event v3

Step 3

Controller

Observer

Observer

Observer

Event v2 data objects

Process processing code
Go4 analysis: processing modules

Analysis steps: sequence of **processing** modules

- Event source
- Unpack
- Filter
- Calibrate ⇔ Hits

**Detector1**
- Tracks
- Retrieve

**Detector2**
- Tracks
- Retrieve

- Particle ID
- Physics
- Analysis
- User plug-in

ROOT tree file

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Go4 analysis: object examples

- **Histograms**
- **Conditions**
  - 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) (freeze)
- **Parameters**
  - User classes keeping parameter variables
  - interactive control (generic GUI editor)
  - value protection (update can be 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

Stored / restored in / from auto-save file.
Go4 analysis: batch mode

Set up in code or macros

Analysis process

ANALYSIS loop

Object manager

Event IO Plug-in:
- DAQ
- Server
- Files
- User

Auto save file ROOT

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Go4 analysis: interactive mode

Analysis process

- ANALYSIS loop
- Object manager

CLIENT threads

Event IO
Plug-in:
- DAQ
- Server
- Files
- User

Auto save file
ROOT

SERVER threads

Go4 GUI
Object manager

GUI process

Startup Commands

TSockets

connect

Go4 GUI

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Go4 analysis: server mode

1 Controller process

Go4 GUI

Objects

CLIENT threads

Go4 GUI

Object manager

CLIENT threads

Go4 GUI

Object manager

N Observer processes

CLIENT threads

4 Go4 GUI

Object manager

CLIENT threads

4 Go4 GUI

Object manager

SERVER threads

Object manager

Analysis process

ASSAY

Object manager

ANALYSIS loop

Object manager

Login port

T Sockets

command request

connect request

Event IO

Plug-in:
- DAQ
- Server
- Files
- User

Auto save file

ROOT

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Go4 v4 - http://go4.gsi.de
Go4 GUI, controller and observers

DAQ → On-line Analysis, Objects → DIM server

GUI
Qt4
ROOT

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Go4 GUI: Parameter editor

Remote editing of object (data structure) contents

![Parameter Editor Screenshot](image-url)

- **Name**: cHist2, polycon, wincon, policon
- **Object Members**:
  - Name: flP1, flP2, fBHist0
  - Type: Float_t, Float_t, Bool_t
  - Value: 100.000000, 200.000000, 1
  - Comments: Offset for calibration, Factor for Calibration, Enable Histogramming

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Go4 GUI: Local and remote Macro execution

GUI command: rebin("Workspace/pm20058raw", 4, 10, kFALSE);

Browser:

Name

- Workspace
- Analysis
- Histograms
- Conditions
  - wincon1
  - wincon2
  - chHis1
  - chHis2
  - polycon
  - winconar
  - polyconar
- Parameters
  - XXXXParameter
- DynamicLists
- Trees
- Pictures
- Canvases
- EventObjects

/misc/goofy/ Current Event Mins / 00:00

Total size of all histograms is: 639428 bytes.

Go4 v4.4.1 @ lxg0523 <Administrator name:Monitor>

GUI command: rebin("Workspace/pm20058raw", 4, 10, kFALSE);

@PrintHistograms()
Go4 GUI: Fit panel

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

Go4 v4.4.0 @lxg0523 <2>

Fit panel

Name: Fitter

Minimizer: Gauss

Peak finder

Data: Data0

Models: Gauss4, Gauss5, Gauss6, Gauss7, Gauss8, Gauss9, Gauss10, Gauss11

Fixed Value Error Epsilon

Ampl: fix 92.8146 3.29964
Pos: fix 2717.64 0.787184
Width: fix 11.6812 0.663406

HistObject.root/hDeg120_CND

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17
IEEE Real Time conference history (~30 years)

<table>
<thead>
<tr>
<th>Year</th>
<th>Conference</th>
<th>Chair</th>
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<tbody>
<tr>
<td>1979</td>
<td>RT-01 Sante Fe</td>
<td>(Dennis Perry, conference chair)</td>
</tr>
<tr>
<td>1981</td>
<td>RT-02 Oak Ridge</td>
<td>(Dave Hensley, conference chair)</td>
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<tr>
<td>1983</td>
<td>RT-03 Berkeley</td>
<td>(Creve Maples, conference chair)</td>
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<tr>
<td>1985</td>
<td>RT-04 Chicago</td>
<td>(Lester Welch, conference chair)</td>
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<tr>
<td>1987</td>
<td>RT-05 San Francisco</td>
<td>(Dennis O’Brien, conference chair)</td>
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<td>1989</td>
<td>RT-06 Williamsburg</td>
<td>(Roy Whitney, conference chair)</td>
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<td>1991</td>
<td>RT-07 Julich</td>
<td>(Klaus Mueller, conference chair)</td>
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<td>1993</td>
<td>RT-08 Vancouver</td>
<td>(Renee Poutissou, conference chair)</td>
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<td>1995</td>
<td>RT-09 East Lansing</td>
<td>(Ron Fox, conference chair)</td>
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<td>1997</td>
<td>RT-10 Beaune</td>
<td>(Patrick Le Du, conference chair)</td>
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<td>1999</td>
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<td>(Antonio Ferrer, conference chair)</td>
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<td>(Richard Jaconsson, conference chair)</td>
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<td>2007</td>
<td>RT-15 Batavia</td>
<td>(Margaret Votava, conference chair)</td>
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<tr>
<td>2009</td>
<td>RT-16 Beijing</td>
<td>(Yifang WANG, conference chair)</td>
</tr>
<tr>
<td>2010</td>
<td>RT-17 Lisbon</td>
<td>(Carlos Varandas, conference chair)</td>
</tr>
</tbody>
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- **DARSY**  DAte Reduction SYstem (DAQ & analysis)
- **GOOSY**  Gsi Online Offline SYstem (DAQ & analysis)
- **MBS**    Multi Branch System (DAQ)
- **TOM&LEA** Therapy Online Monitor & LEan Analysis
- **GO4**    ROOT and Qt based analysis
- **DABC**   Data Acquisition Backbone Core