





**Go4 features**

**Go4 run modes**

**Analysis framework and plug-ins**

**GUI elements**

**Summary**





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

Based on C++, ROOT (CERN) and Qt (Nokia)

Provides **services and interfaces** for user written analysis

**Batch mode** (CINT or compiled, online/offline)

**Interactive mode** (online/offline):

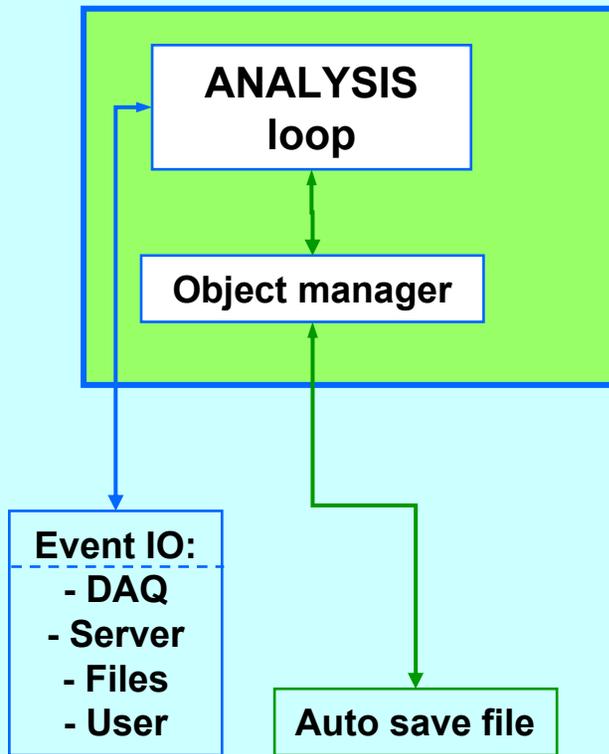
- **A non blocking GUI controls and steers the analysis**
- GUI interfaces **ROOT and Qt graphics**
- Analysis can **update graphics asynchronously: live monitoring**
- User can create and **add specific GUIs** (Qt designer)





Standard executable **go4analysis** with user parameters; or CINT

## Analysis process





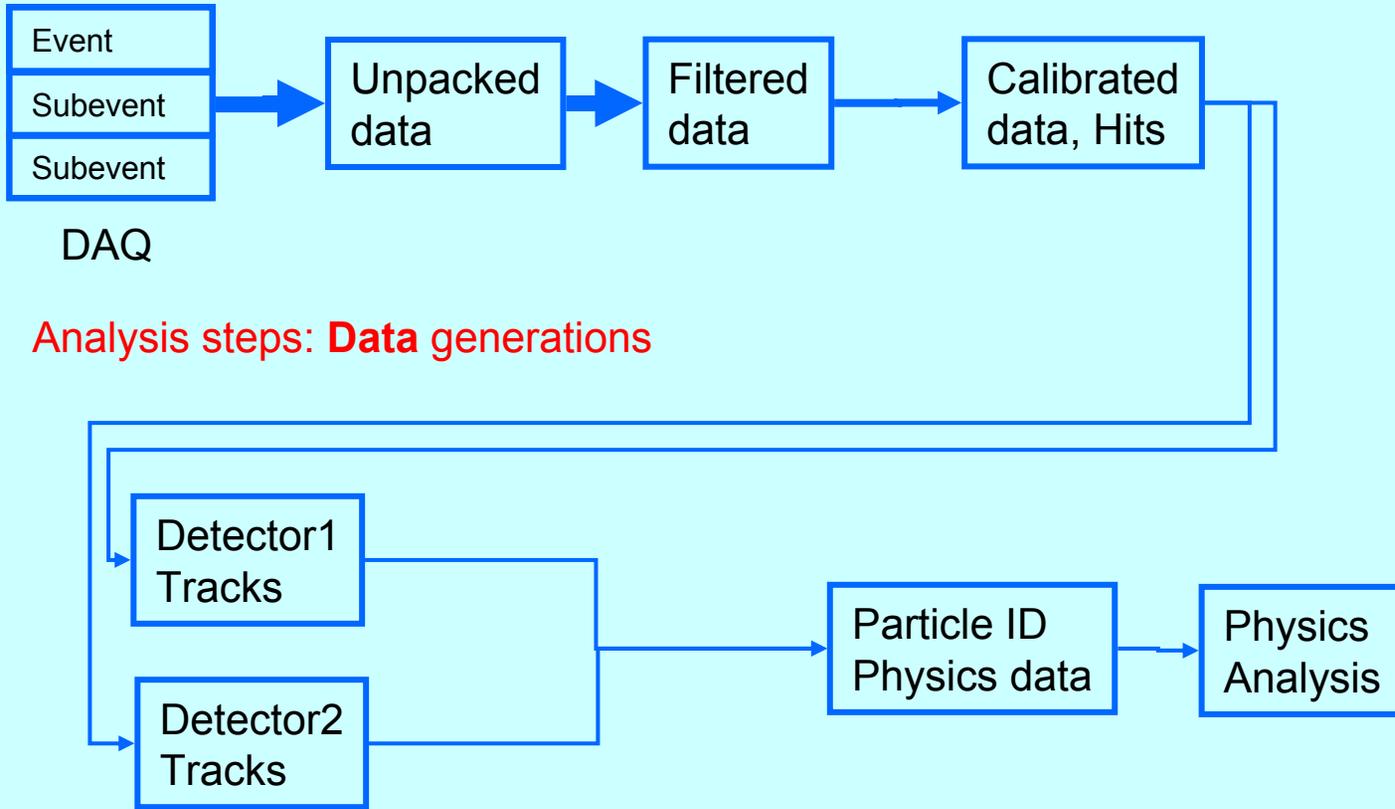








# Analysis process: Data flow

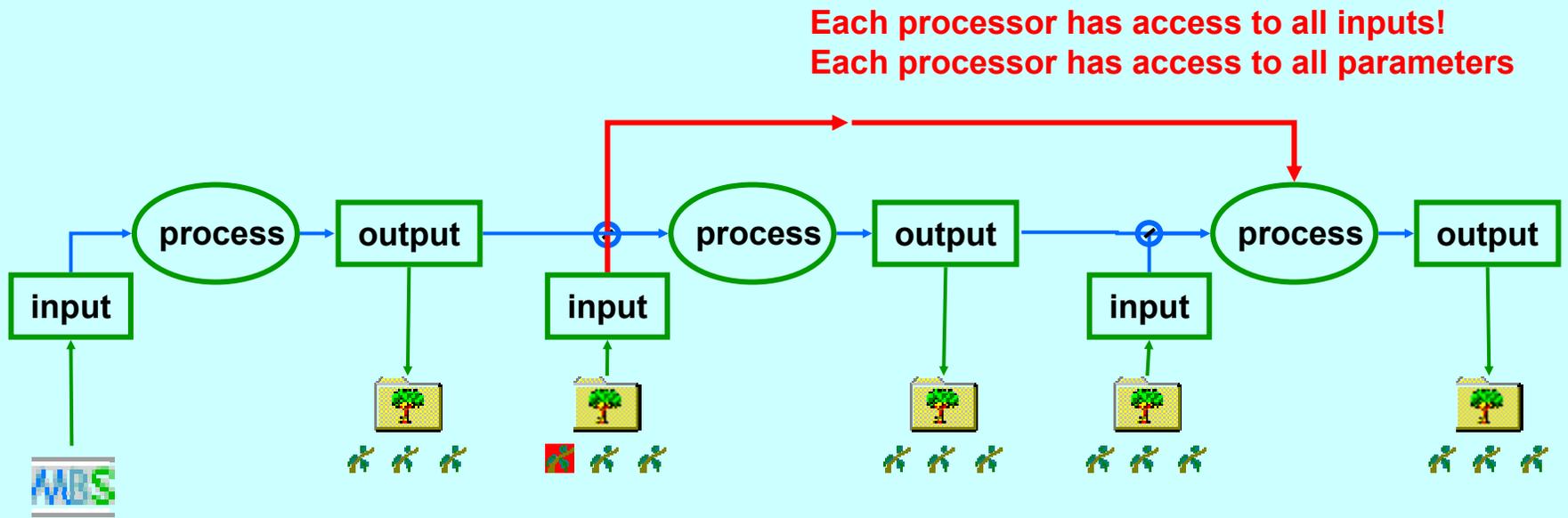


Analysis steps: **Data** generations



# Analysis steps

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







## Framework Services:

- **GSI standard DAQ (Mbs)**  
data formats, data input (\*.lmd file and DAQ sockets)
- **Root I/O :**  
event source and store with TTree; object manager TFile i/o

## Required user implementations:

- Event data processing code  
at least **one function *BuildEvent()***

## Optional user implementations:

- Event data structures  
output event class for ROOT TTree
- **Parameter** container (set up, calibration, control)
- **User event source** (input file format, **proprietary DAQ** connection)
- **Initialization factories** (advanced set-up of event classes)



## standard executable **go4analysis**

- provided by framework
- **generic command line arguments** for analysis set up
- **optional arguments** passed to user's TGo4Analysis subclass

### examples:

- `go4analysis -stream r3g2 -step 0 -store workshop_events.root  
-step 1 -store workshop_analyzed.root -asf workshop_auto.root`  
(setup as from gui: mbs stream server as data source, 1. and 2. step storage files, autosave file specified)
- `go4analysis -file gauss.lmd -disable_store  
-step Analysis -store analyzed_events.root -number 100000 -disable_asf`  
(process 100000 events from file gauss.lmd, no store of first step, storage file of step „Analysis“, autosave disabled)
- `go4analysis -user mydaq.gsi.de -server dataserver -norun -v 2 -log logfile.txt`  
(start analysis as data server, user defined DAQ event source, do not start processing, log output to file with verbosity 2)
- `go4analysis -file gauss.lmd -args result.root 1 5000 7.0 42`  
(process file and pass user specific arguments to analysis constructor)
- `go4analysis -help`  
(show all options)





# Some Go4 GUI Features



- **Control** and **setup** analysis steps (remote analysis)
- Extended **browser** and **tree viewer** (local, remote)
- **Viewpanel** with graphical markers
- **Show and edit object properties** (local, remote)
- **Fit panel** for histogram and graphs (local)
- **Event data inspection and dump** (remote analysis)
- Define „ad hoc“ **histogramming** (remote analysis)
- **Macro execution** (local, remote analysis)
- Adding **User written GUI** possible (Qt designer)
- **Hot start mechanism** to save/restore complete set-up





## Folders for:

**Workspace (GUI memory)**



**ROOT files**



**Analysis (remote memory)**



**Histogram servers**

**(Mbs, TNetFile, RFIO)**

Browser

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

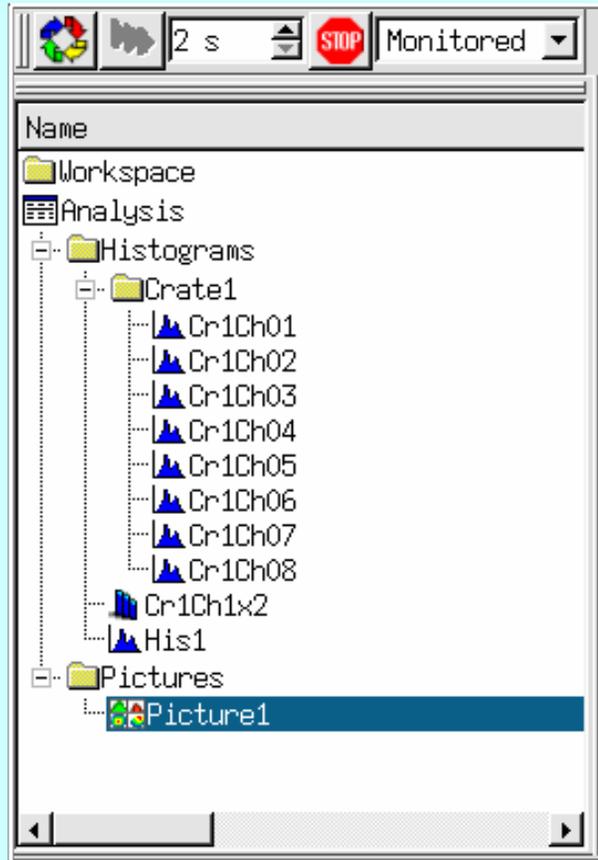
RMB popup

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

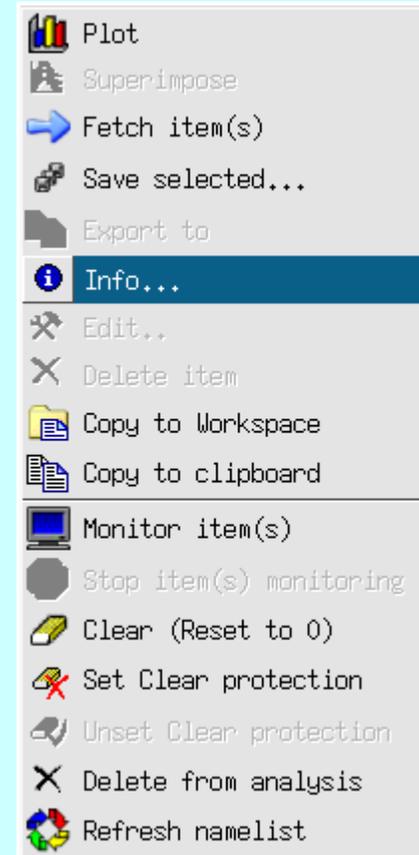




## monitor and filter tool



## context menu (RMB)







## Condition

- **window condition**: check 1 (2) value(s) against 2 limits (pairs of limits)
- **polygon condition**: check if point (x,y) is inside/outside polygon
- **interactive control** (GUI editor)

## Parameter

- User class (plug-in) keeping parameter variables
- supports **atomic data types** and **Go4 fit objects**
- **interactive control** (generic GUI editor)

## Picture

- **Display definition** for histograms, conditions, any ROOT objects...
- Keeps Pad division and **graphical attributes** (ranges, colors, styles,...)
- **Predefined in analysis code** or **saved interactively from GUI**





# Parameter editor



## Remote editing of object (data structure) contents

Go4 v4.4.0 @lxg0523 <Controller name:MyAnalysis>

File Tools Analysis Settings Windows Help

Browser

- Name
- chis2
- polycon
- winconar
- polyconar
- Parameters
  - XXXParameter**
- DynamicLists
- Trees
- Pictures
- Canvases
- EventObjects

Parameter Editor

Parameter

Analysis/Parameters/XXXParameter - TXXXParameter

Object Members

Name	Type	Value	Comments
frP1	Float_t	100.000000	Offset for calibration
frP2	Float_t	200.000000	Factor for Calibration
fbHisto	Bool_t	1	Enable Histogramming

gauss ██████████ Current Ev/s **69843** Average Ev/s **764658** 2010-01-21



# Picture view



Ge4 v4.4.1 @lxg0517 <Controller name:MyAnalysis>

File Tools Analysis Settings Windows Help

2 s All items scatter No Errors Cartesian X: Lin Y: Log Z: Lin

Browser

- Workspace
- Analysis
  - Histograms
  - Conditions
  - Parameters
  - DynamicLists
  - Pictures
    - ADC 00
      - ADC00\_Strip00
      - ADC00\_Strip01
      - ADC00\_Strip02
      - ADC00\_Strip03
      - ADC00\_Strip04
      - ADC00\_Strip05**
      - ADC00\_Strip06
      - ADC00\_Strip07
      - ADC00\_Strip08
      - ADC00\_Strip09
      - ADC00\_Strip10
      - ADC00\_Strip11
      - ADC00\_Strip12
      - ADC00\_Strip13
      - ADC00\_Strip14
      - ADC00\_Strip15
    - ADC 01
    - TDC 00
    - Canvases

Panel2: ADC 00 strip 5 raw - calibrated with gates

File Edit Select Options Apply to all AutoScale

ADC 00 strip 5 Raw 13:20:31

ADC 00 strip 5 Calibrated 13:20:31

ADC 00 channel 5 13:20:31

ADC 00 channel 21 13:20:31

Marker Modes

loop ADC00\_Strip05\_Gate

/data.local Current Ev/s 129.17 Average Ev/s 63 s 824090 Events 2010-03-09 13:23:07

Set up a view of corresponding histograms, conditions,...





- Fitting of histograms / graphs for **any kind of model**
- **Peak finder**
- **Interactive set up** of model and fit parameters
- Fit panel modes:
  - simple (quick fit)
  - **wizard (usual)**
  - expert (full control of TGo4Fitter class)
- Different **display modes**  
(model components, parameter output, etc.)
- Different **minimization functions**  
(Chi square, ML Poisson, ...)
- **Store fitter** object in ROOT file for re-use



# Fit panel



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

Go4 v4.4.0 @lxg0523 <2>

File Tools Analysis Settings Windows Help

Fit panel

Fitter Tools Settings

Name: Fitter  
Minimizer  
Peak finder

Data: Data0

Models:

- Gauss4
- Gauss5
- Gauss6
- Gauss7
- Gauss8
- Gauss9
- Gauss10
- Gauss11

Model: Gauss9 of class: TGo4FitModeGaus

background  use buffers

	Fixed	Value	Error	Epsilon
Ampl	<input type="checkbox"/> fix	92.8146	3.29964	
Pos	<input type="checkbox"/> fix	2717.64	0.787184	
Width	<input type="checkbox"/> fix	11.6812	0.668406	

Rebuild + - \*

Use pad Find Fit Draw Pars Active: Panel2. Fitter: Fitter

Panel2: [hDeg120\_CND], ::DataModel

File Edit Select Options  Apply to all  AutoScale

hDeg120\_CND 13:35:09 2009-12-08 histograms.root/hDeg120\_CND

Legend: histograms.root/hDeg120\_CND (black line), Model (red line)



# Local and remote Tree viewer



Go4 v4.4.0 @lxg0523 <Controller name:MyAnalysis>

File Tools Analysis Settings Windows Help

Browser

Name

- Cr1Ch1x2
- His1
- His2
- His1g
- His2g
- Sum1
- Sum2
- Sum3
- Eventsize
- hTreeDraw
- hTreeDraw\_1
- hTreeDraw\_2
- newhisto1**
- Conditions
- Parameters
- DynamicLists
- Trees
  - UnpackxTree
    - UnpackEvent
      - UnpackEvent.TGo4EventEle
      - UnpackEvent.fICrate1[16]
      - UnpackEvent.fICrate2[16]
      - UnpackEvent.fICrate3[16]
      - UnpackEvent.fICrate4[16]
- Pictures
- Canvases
- EventObjects

**Drag**

Analysis Configuration

Unpack xxx / Analysis xoo

Step Control

Enable Step     Source     Store

Event source

MBS Random

Name: gauss

0    all    1    1 s

Event store

**Go4BackStore**

Name: /gauss\_unpacked.root

1    100 kB    3     Overwrite

Auto Save File

/gauss\_AS.root

Enabled    once    5     Overwrite

Analysis Configuration File

Go4AnalysisPrefs.root

Submit    Submit+Start    Close

Panel1: [newhisto1]

File Edit    Apply to all    AutoScale

histogram title

X: UnpackEvent.fICrate1[0]    Y:    Z:    analysis/Histograms/newhisto1

gauss    **23316** Current EV/s    24508 Average EV/s    221 s    5434000 Events    2010-01-20 14:28:56

## Histogramming "ad hoc" from remote analysis TTree





# Dynamic list editor



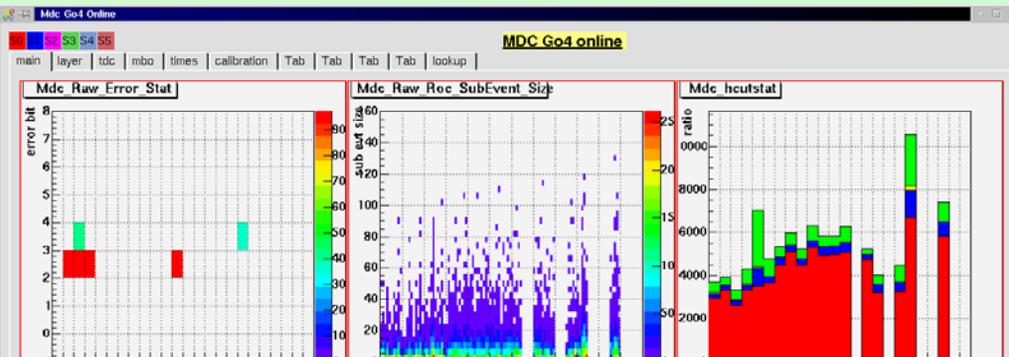
## Histogramming "ad hoc" from event data

The screenshot displays the Go4 v4.4.0 software interface. The main window title is "Go4 v4.4.0 @lxg0523 <Controller name:MyAnalysis>". The menu bar includes "File", "Tools", "Analysis", "Settings", and "Windows". The toolbar contains various icons for file operations and analysis. The "Browser" panel on the left shows a tree structure of the analysis, with "adHocHisto" selected. The "Dynamic List Editor" panel in the center shows the configuration for the histogram. It includes an "Entry" field set to "TGo4HistogramEntry", a checkbox for "enable Analysis/DynamicLists/AdHoc", and a "Histogram" section with "Analysis/Histograms/adHocHisto" selected. Below this, there are tabs for "Event data", "Condition", and "TreeDraw". The "Event data" tab is active, showing a list of event data sources: "X UnpackEvent/fiCrate1[0]", "Y", and "Z". A red arrow labeled "Drag" points to the "X" entry. The "Panel1: [adHocHisto]" panel on the right shows a histogram titled "histogram title". The histogram has a y-axis ranging from 0 to 12000 and an x-axis ranging from 0 to 1000. The histogram shows a distribution with a sharp peak at approximately 200 and a broader peak at approximately 300. The status bar at the bottom displays "gauss", "3442 Current Ev/s", "34853 Average Ev/s", "199 s", and "6968000 Events 2010-01-21 13:58".



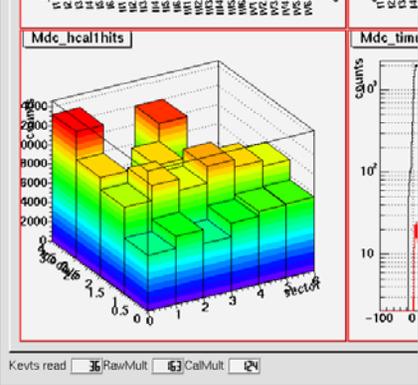


# User GUI (Qt)



04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G

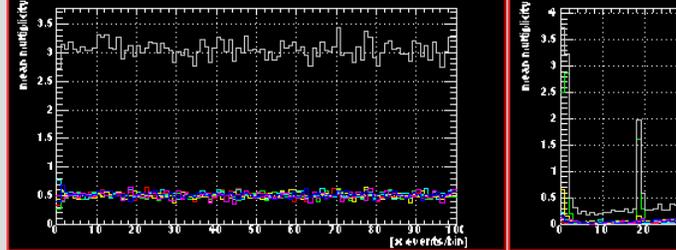
- Created with Qt Designer by user
- Plugged in by dynamic library
- All Go4 services available
- Started inside Go4 GUI workspace



trigger online monitor

/Overview | MultDistr | TOF sub | Shower sub | Rich sub | MatchU sub | Time | Config

#Leptons / #Hits	sec0: 0.74	sec1: 0.79	sec2: 0.75	min 1 ring	100	0.4	1000	0.48	10k	0.49	freeze				
glob:	0.76	sec3: 0.84	sec4: 0.74	sec5: 0.74	min 2 rings	100	0.08	1000	0.66	10k	0.68	freeze			
g:	0.27	s0 0.49	s1 0.48	s2 0.56	s3 0.55	s4 0.62	s5 0.57	g:	0.33	s0 0.05	s1 0.05	s2 0.04	s3 0.05	s4 0.04	s5 0.03



Hades Configuration

General Specs

Tree

Tree Size (kBytes) [0]

Refresh rate (nevt) [0]

Eventloop

nLoop [100]

sleep [100]

maxrate [1000]

Refresh

Triggerrefresh [500]

StartRefresh [500]

RichRefresh [500]

RichODRefresh [500]

MdcRefresh [500]

TofRefresh [500]

TofinoRefresh [500]

ShowerRefresh [500]

Tasks

Trigger

Start [hit]

Rich [cal]

Mdc [fit]

Tof [cal]

Tofino [cal]

ShowerTofino

Shower [hit]

MDC SETUP

Calibrator

TimeCuts [ ] [NoStartAndCal]

TrackFinder

magnet on [ ] [single Chamber]

nLayers [6] [6] [6] [6] [10] [50] [10] [30]

Segments [6] [6] [6] [6] [1] [3]

Fitter [ ] [single Chamber]

get Configuration

submit Configuration

HADES on-line monitoring

Courtesy HADES coll.

04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G04G

04G04G04G04G



# Go4 summary



**A flexible framework for online monitoring and analysis**

**Used in production since 2002**

**Runtime environments: batch, or with asynchronous GUI(s)**

**User code: Go4 plug-ins, or unlimited ROOT**

**Applications: atomic and nuclear physics, detector testing**

**Go4 v4.4 free available under GPL at <http://go4.gsi.de>**