



Fit Panel

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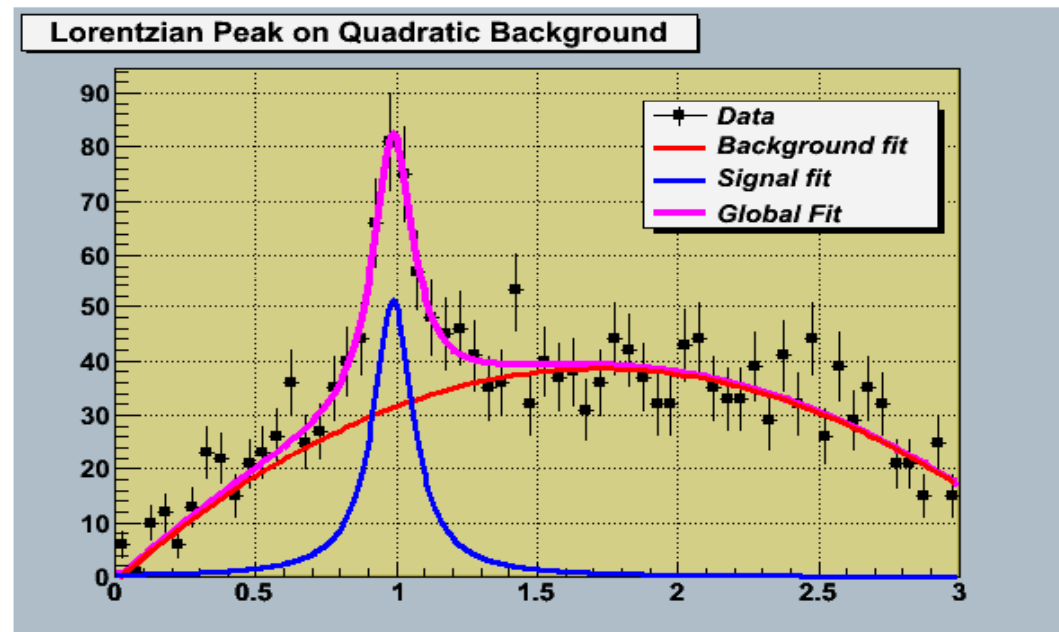


Fitting in ROOT



Fitting in ROOT is possible :

- λ Histograms (1D, 2D, 3D)
- λ Graphs (also 1D, 2D, 3D)
- λ Trees
- λ User defined data
- λ etc...



Example:

```
TH1D* h = new TH1D(...);  
// Fill the Histogram  
h->Fit("gaus", "LE+", "SAME", 2.4, 8.6);
```

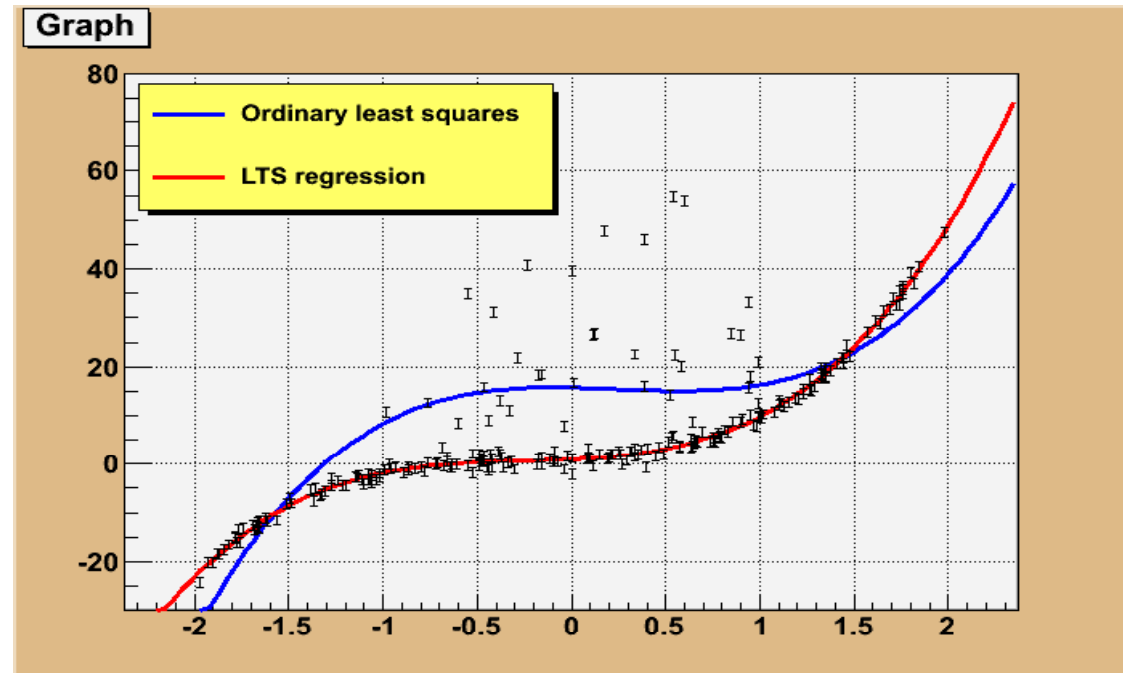


Fitting Options



Several options are available:

- λ Binned/Unbinned fit
- λ User defined model and objective functions
- λ Choice of minimization method.
 - λ Minuit and Minuit2
 - λ Fumili
 - λ GSL
- λ Automatic use of linear fits for linear functions
- λ Robust fit option for linear fits



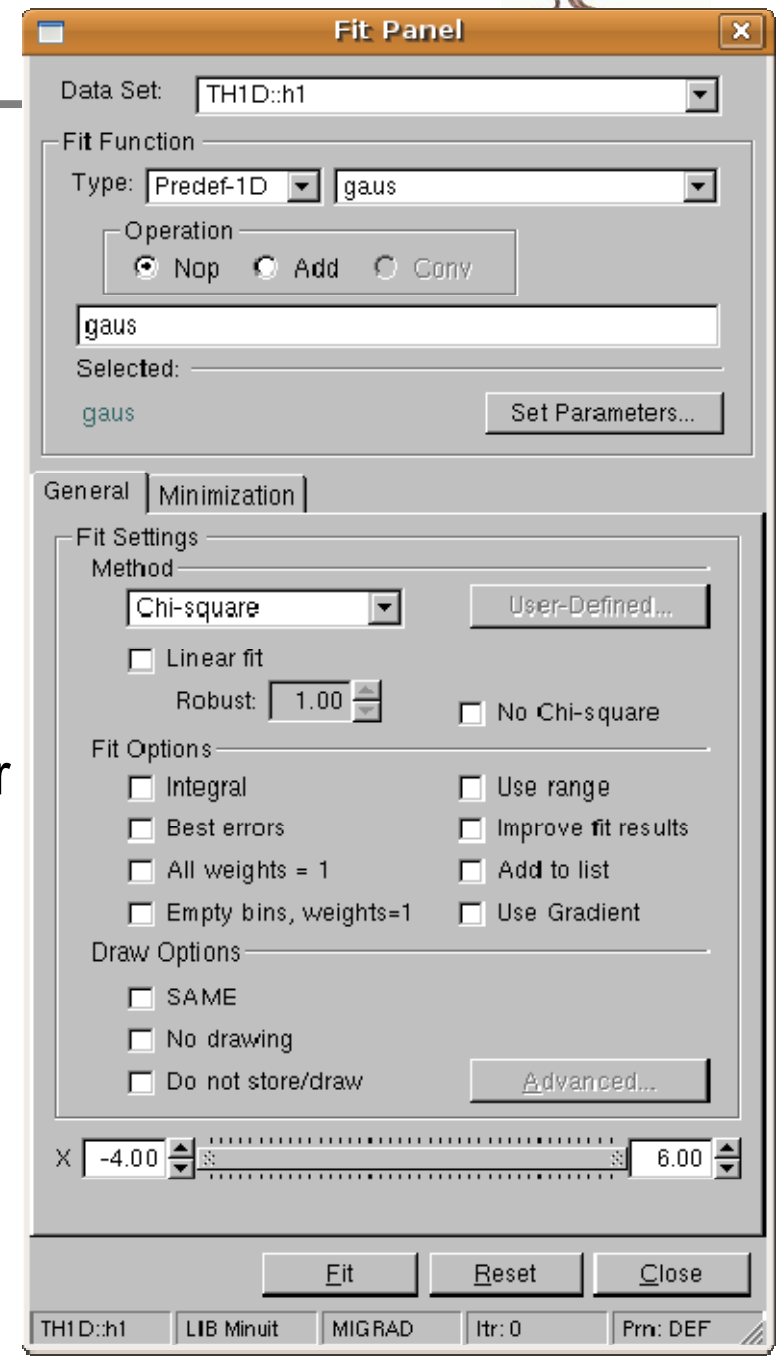


Presenting the FitPanel



GUI for fitting all ROOT data analysis objects:

- λ Histograms
 - TH1, TH2 and TH3
 - TProfile, TProfile2D and TProfile3D
- λ TGraph, TGraphErrors and TGraphAsymError
- λ TGraph2D, TGraph2DError
- λ Trees

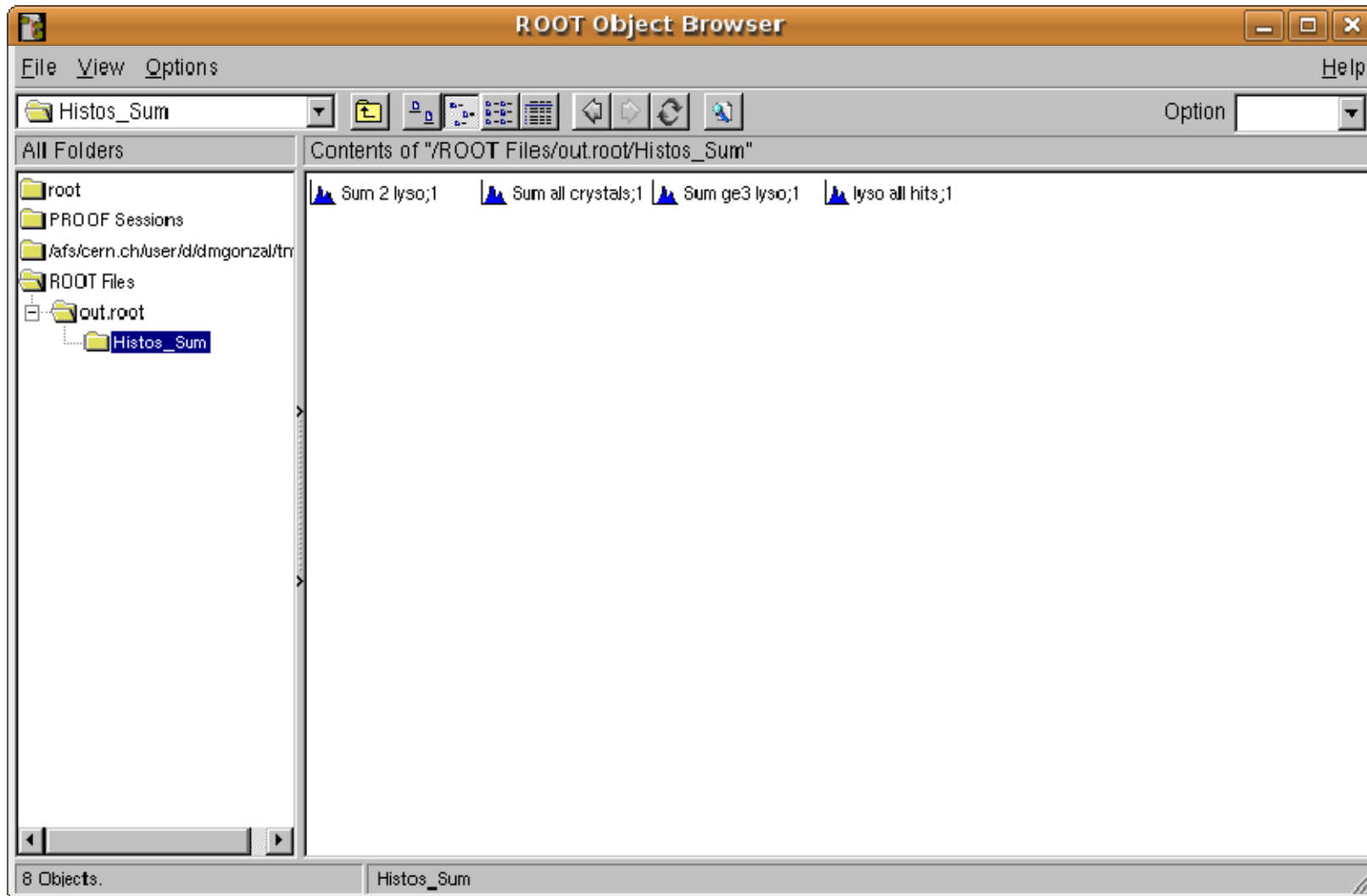




How to get the FitPanel



It can be reached from 3 different places...

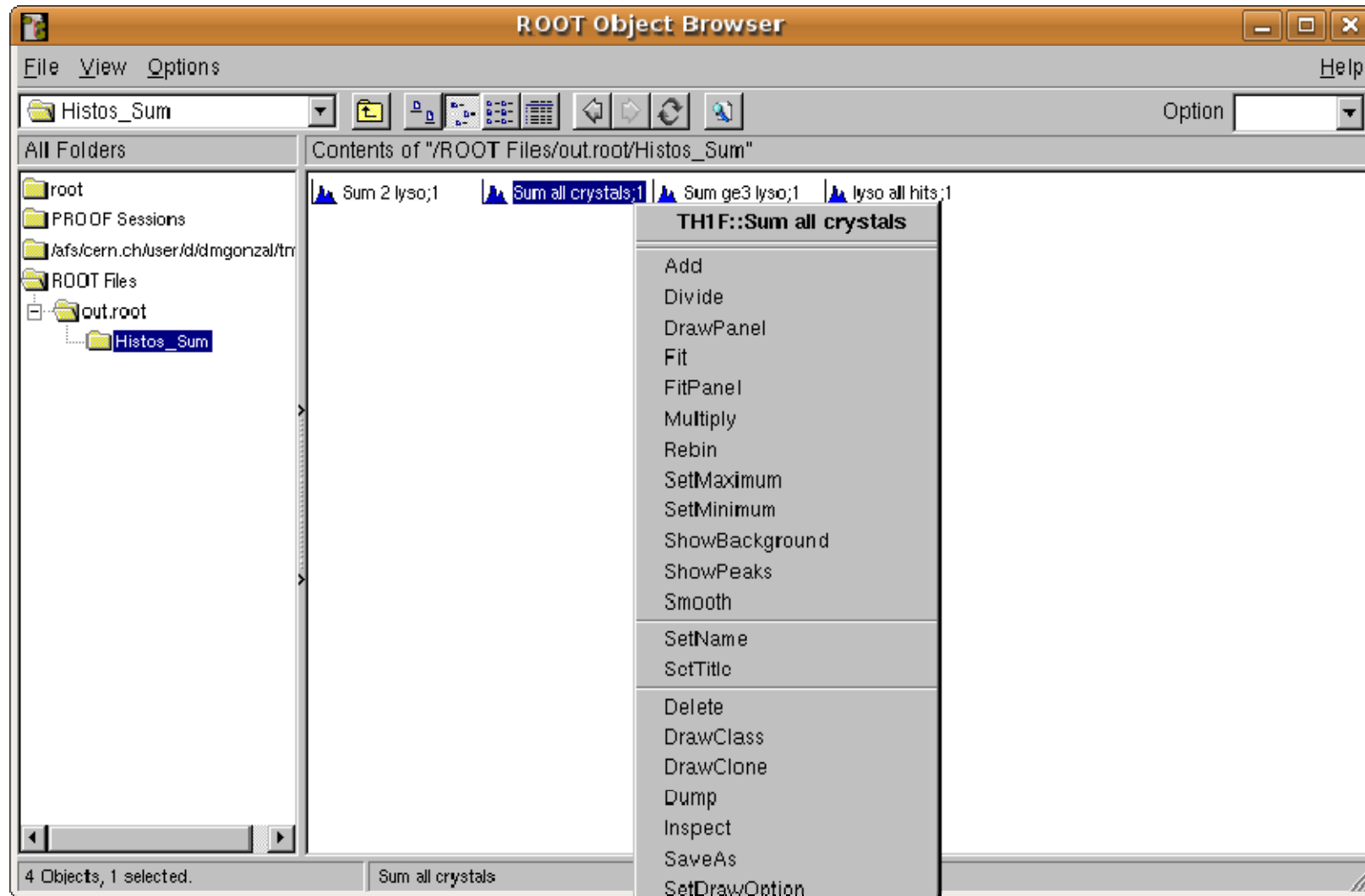




How to get the FitPanel



It can be reached from 3 different places...

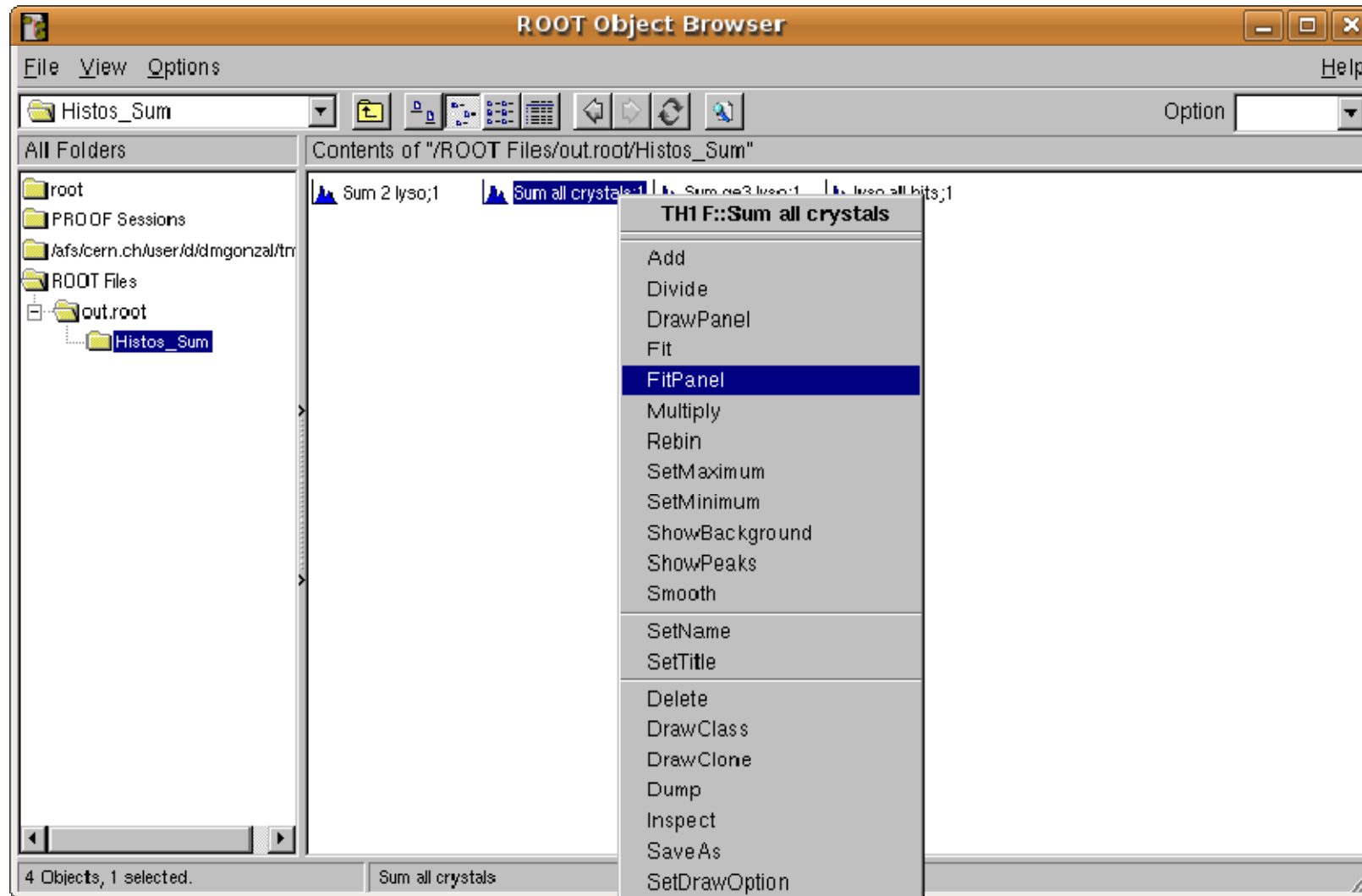




How to get the FitPanel



It can be reached from 3 different places...

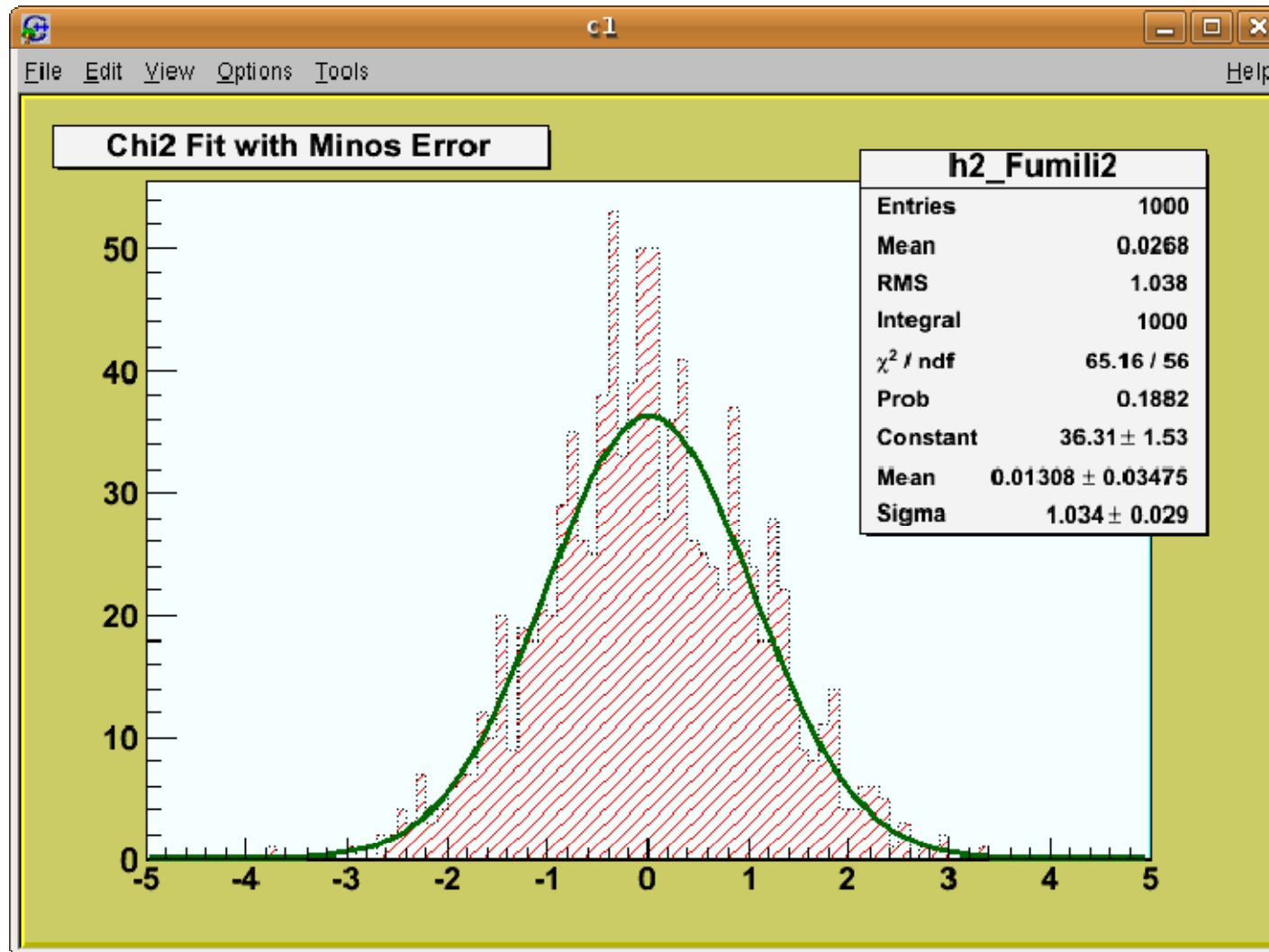




How to get the FitPanel



It can be reached from 3 different places...

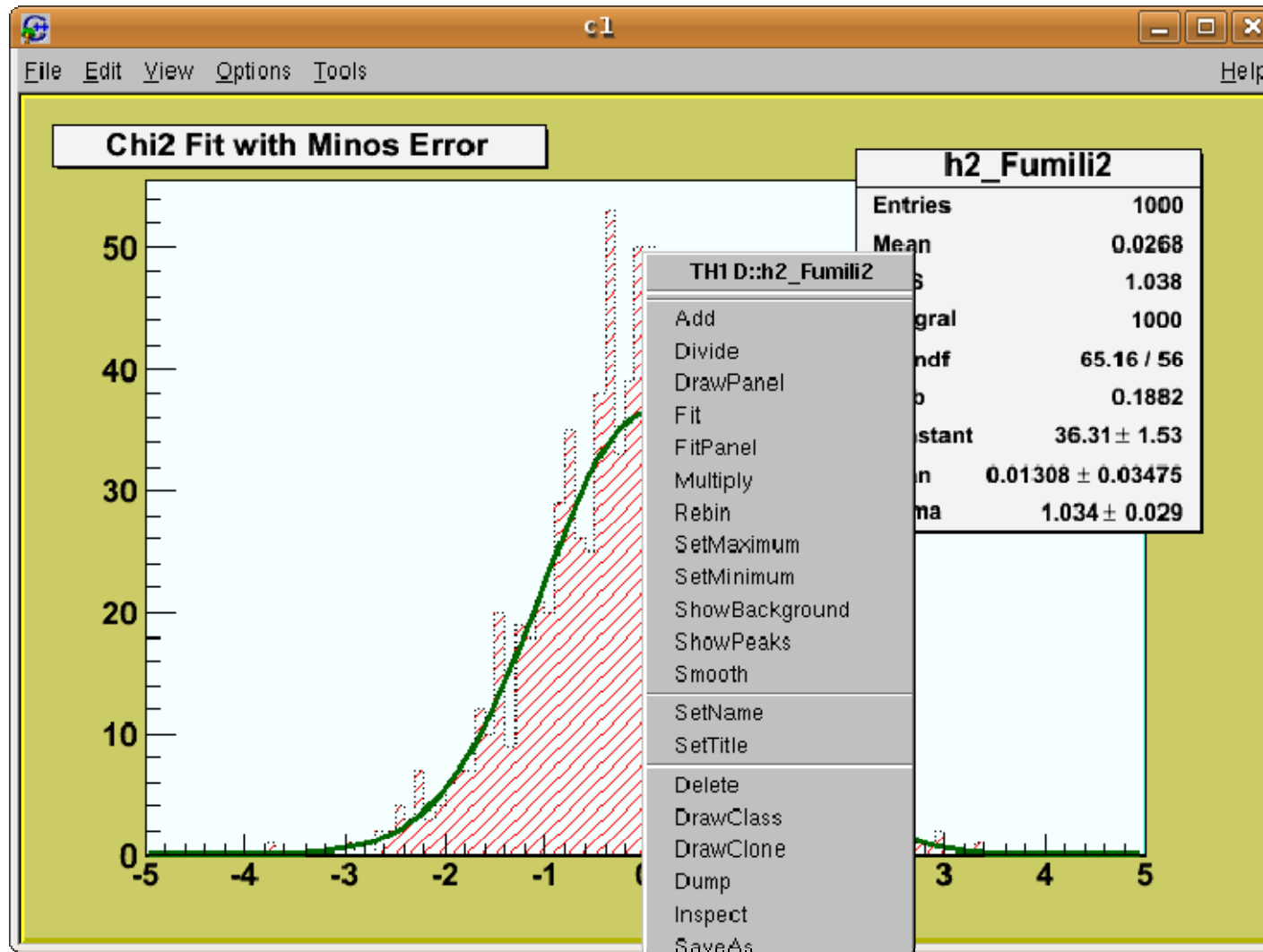




How to get the FitPanel



It can be reached from 3 different places...

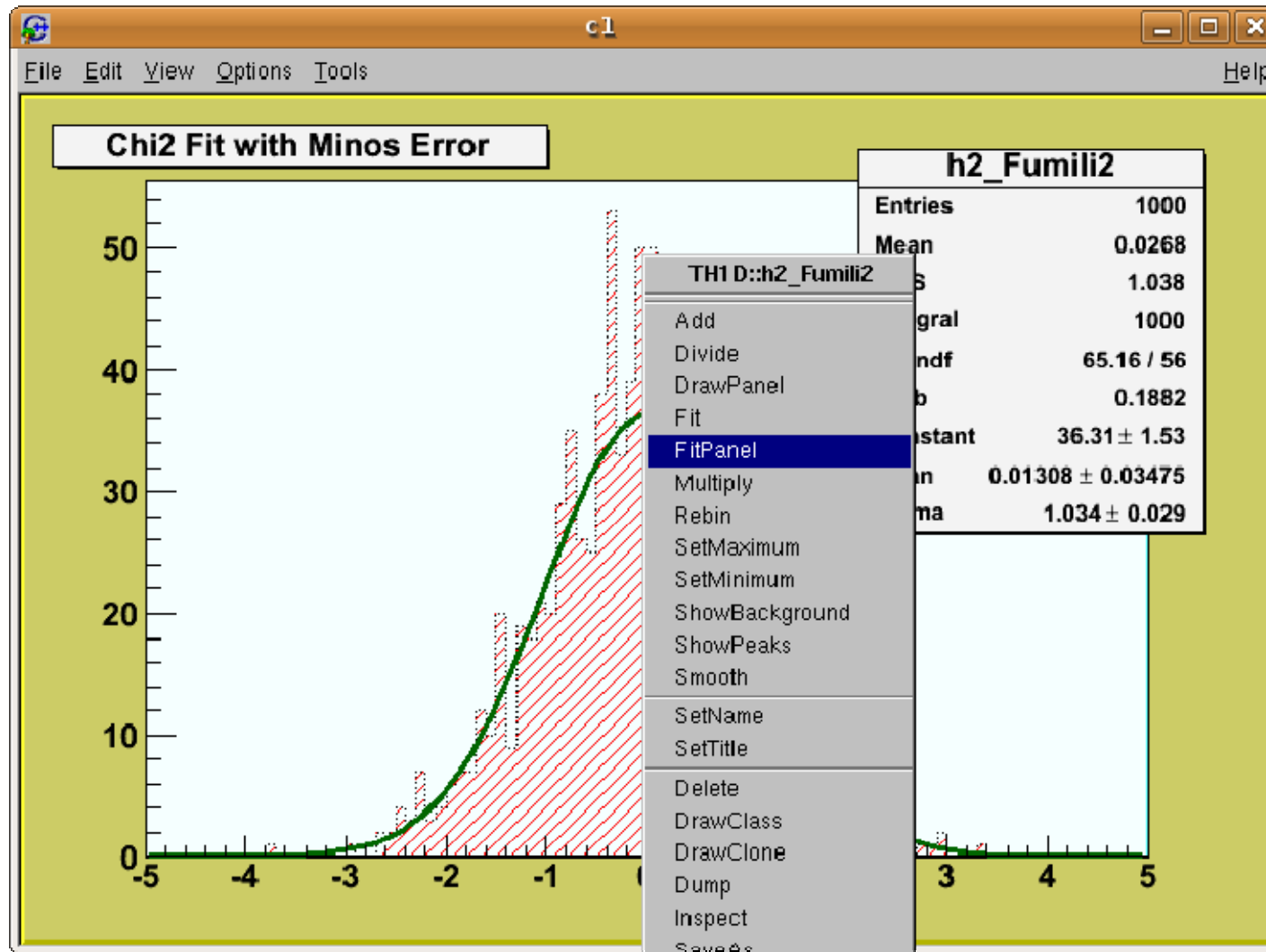




How to get the FitPanel



It can be reached from 3 different places...

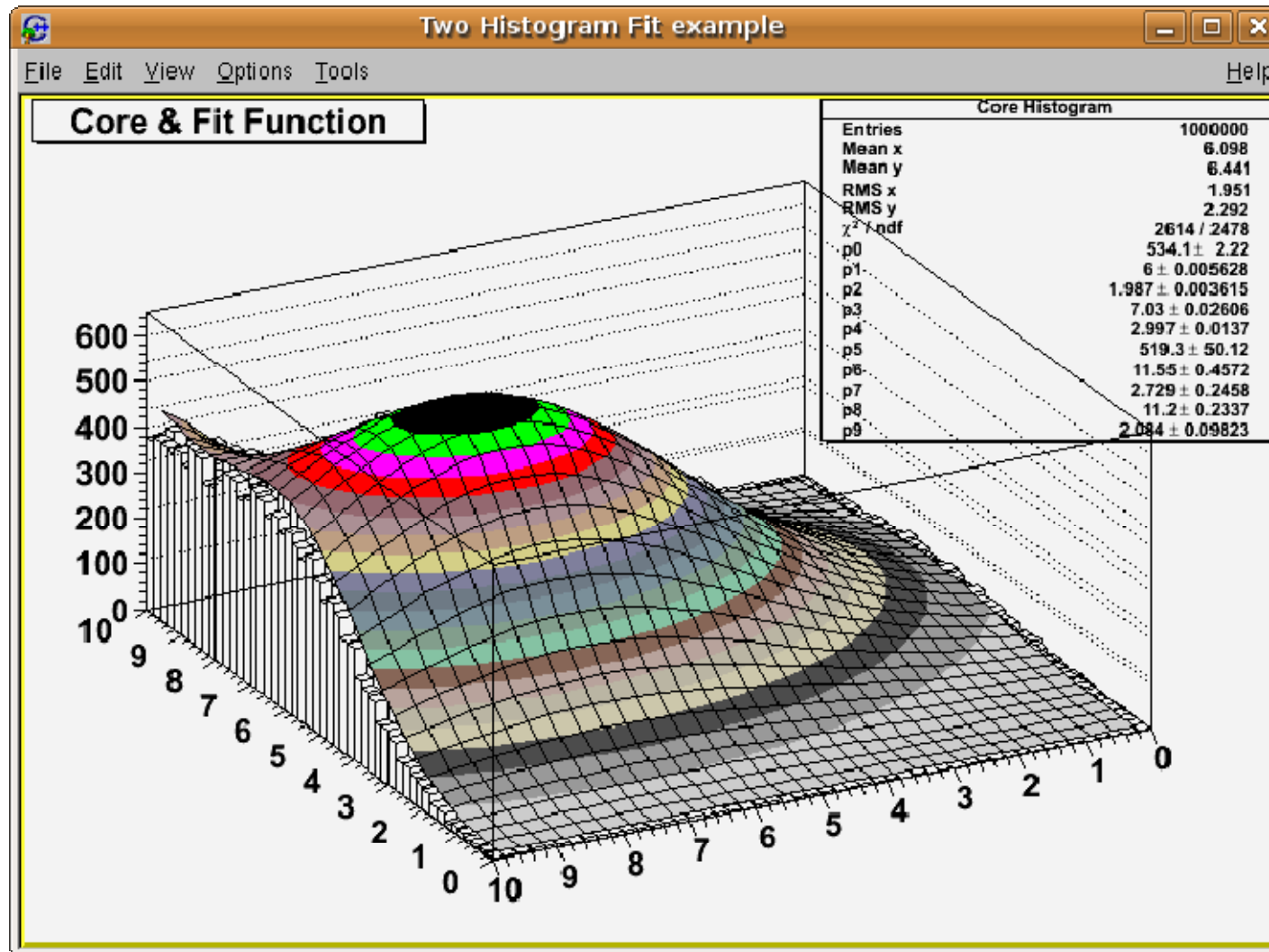




How to get the FitPanel



It can be reached from 3 different places...

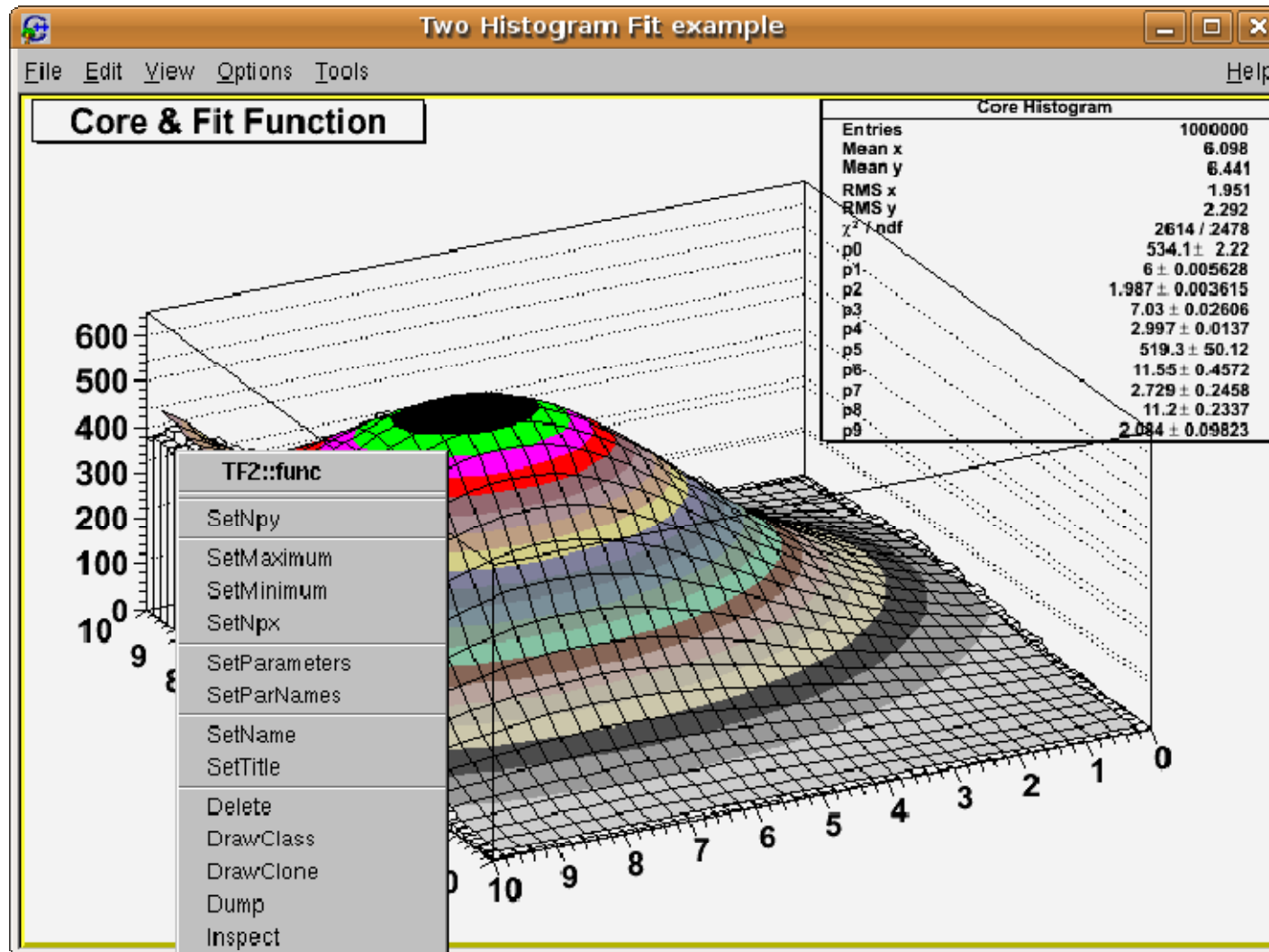




How to get the FitPanel



It can be reached from 3 different places...

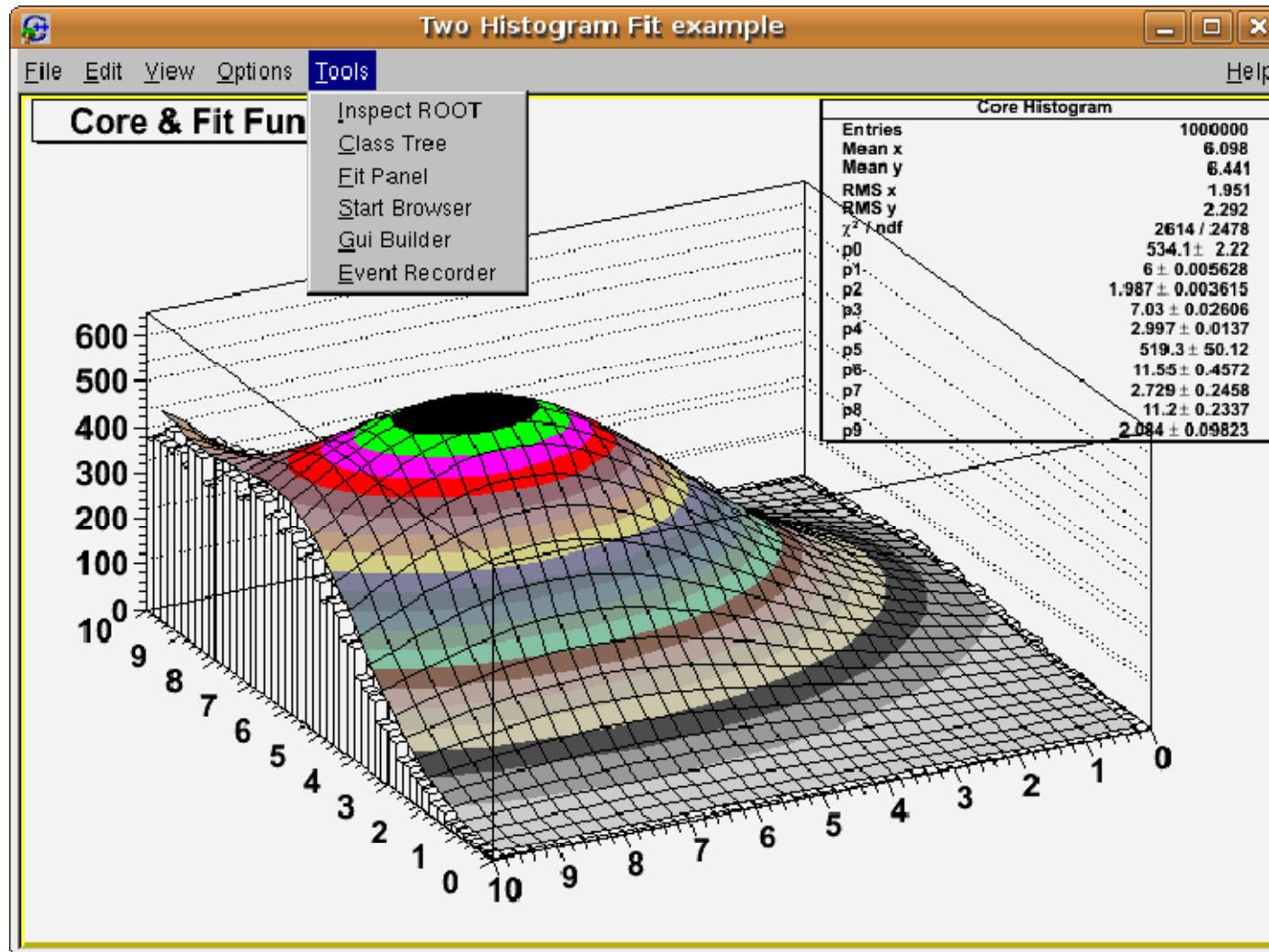




How to get the FitPanel



It can be reached from 3 different places...

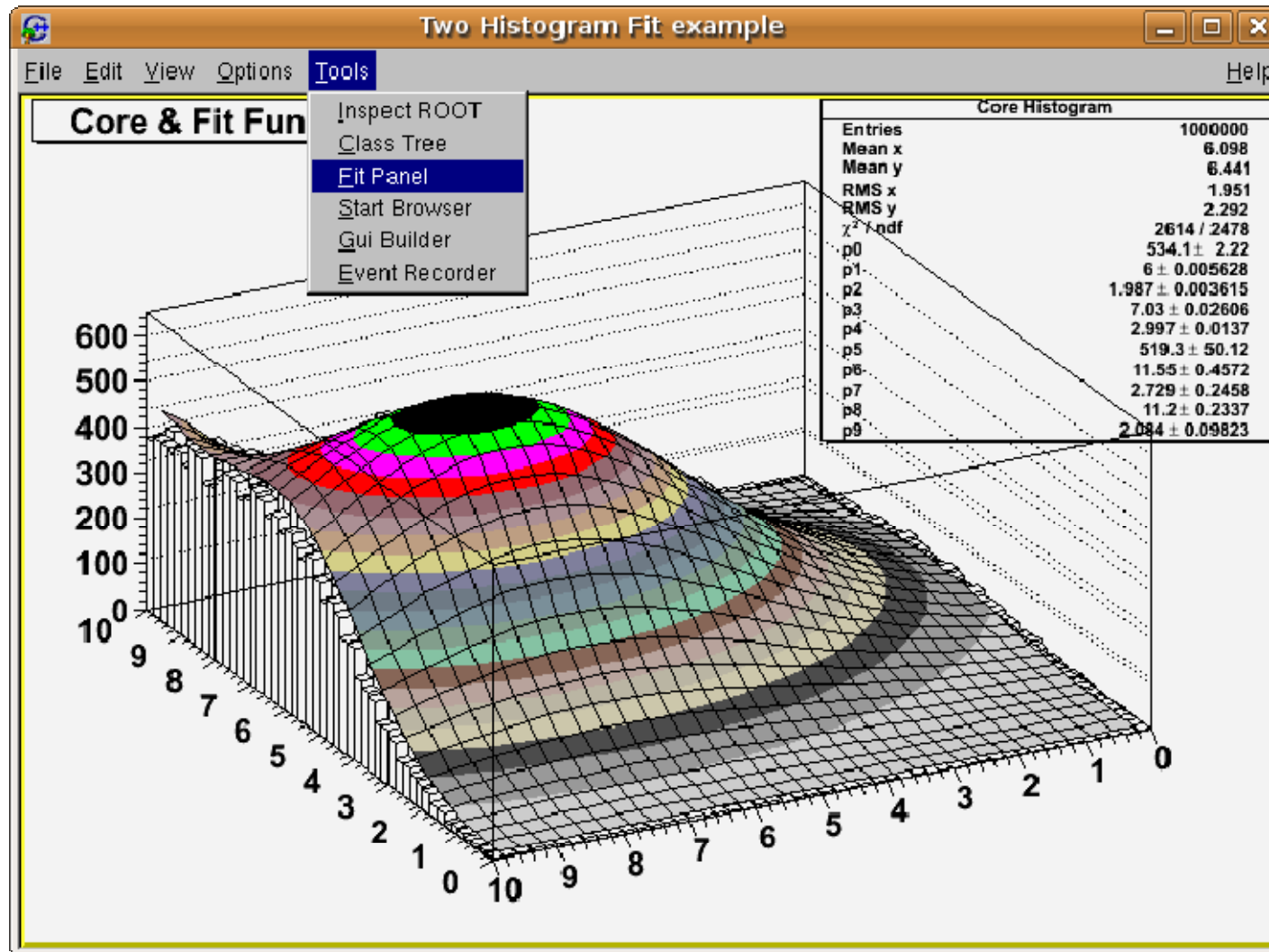




How to get the FitPanel



It can be reached from 3 different places...



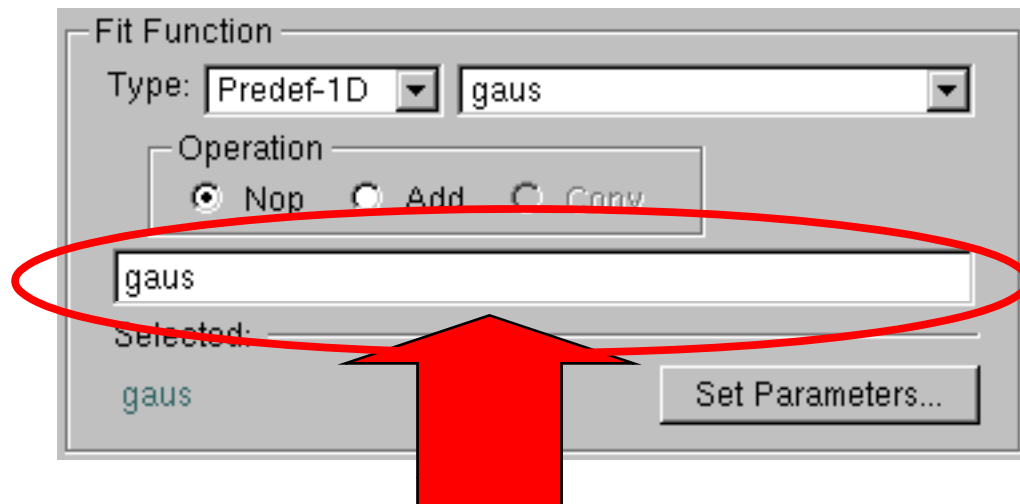
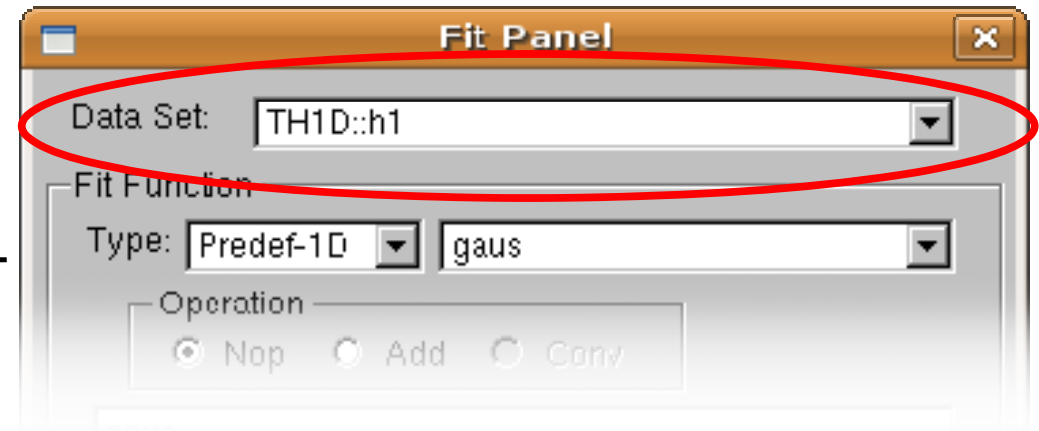


Setting Object and Function



Select the Object in 'Data Set'

- λ It can be an already drawn object
- λ Or any object registered in gROOT



Select the type of function to used:

- λ Predefined 1D and 2D functions
- λ User defined functions
- λ Functions used in previous fits

Select the particular function

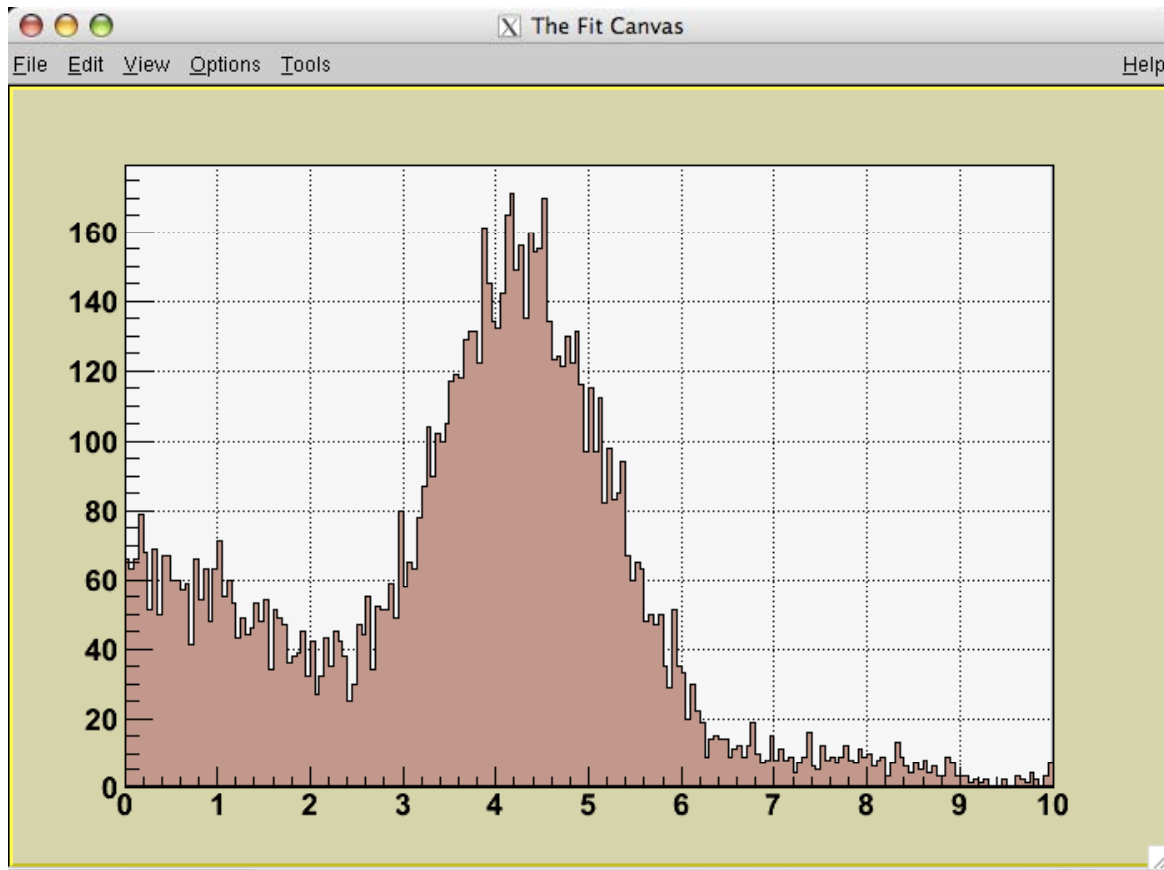
Although, you can specify it by hand!



Tuning Parameters



Immediate preview of the changed function

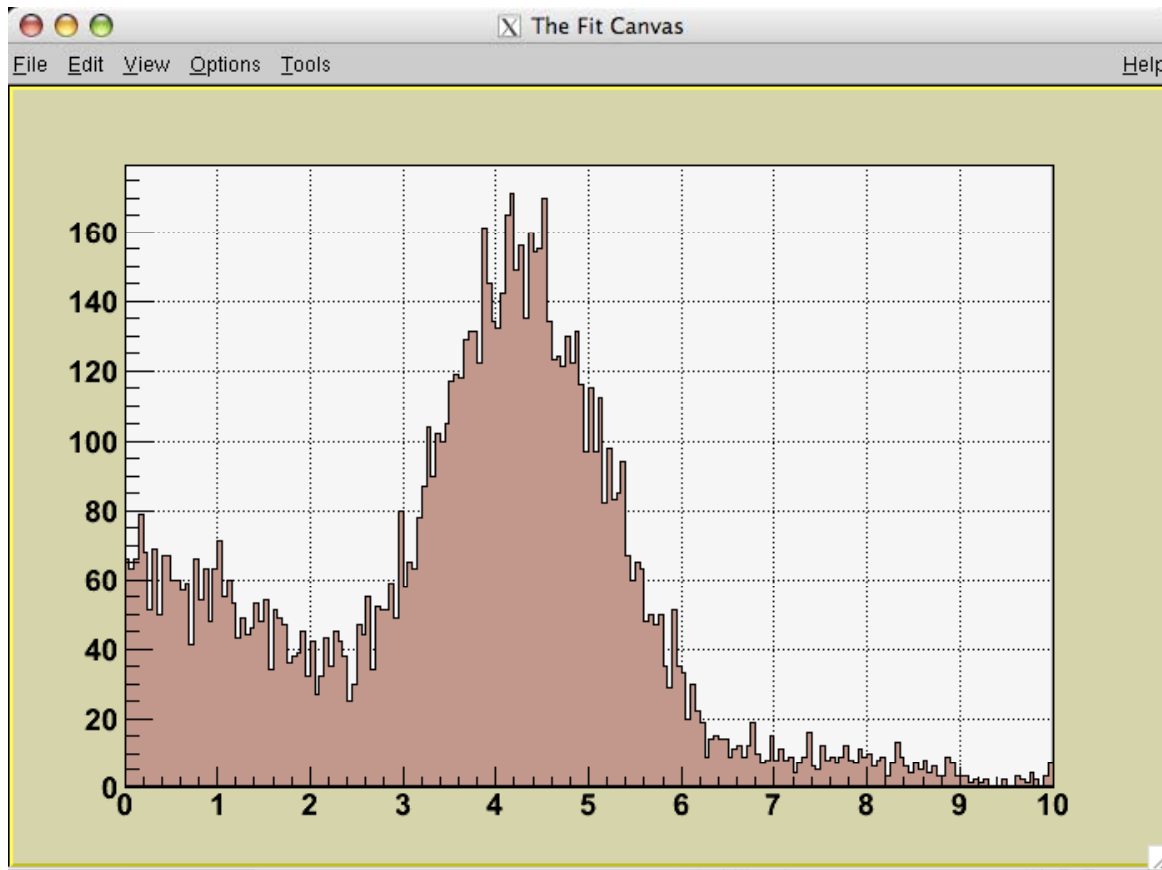




Tuning Parameters



Immediate preview of the changed function

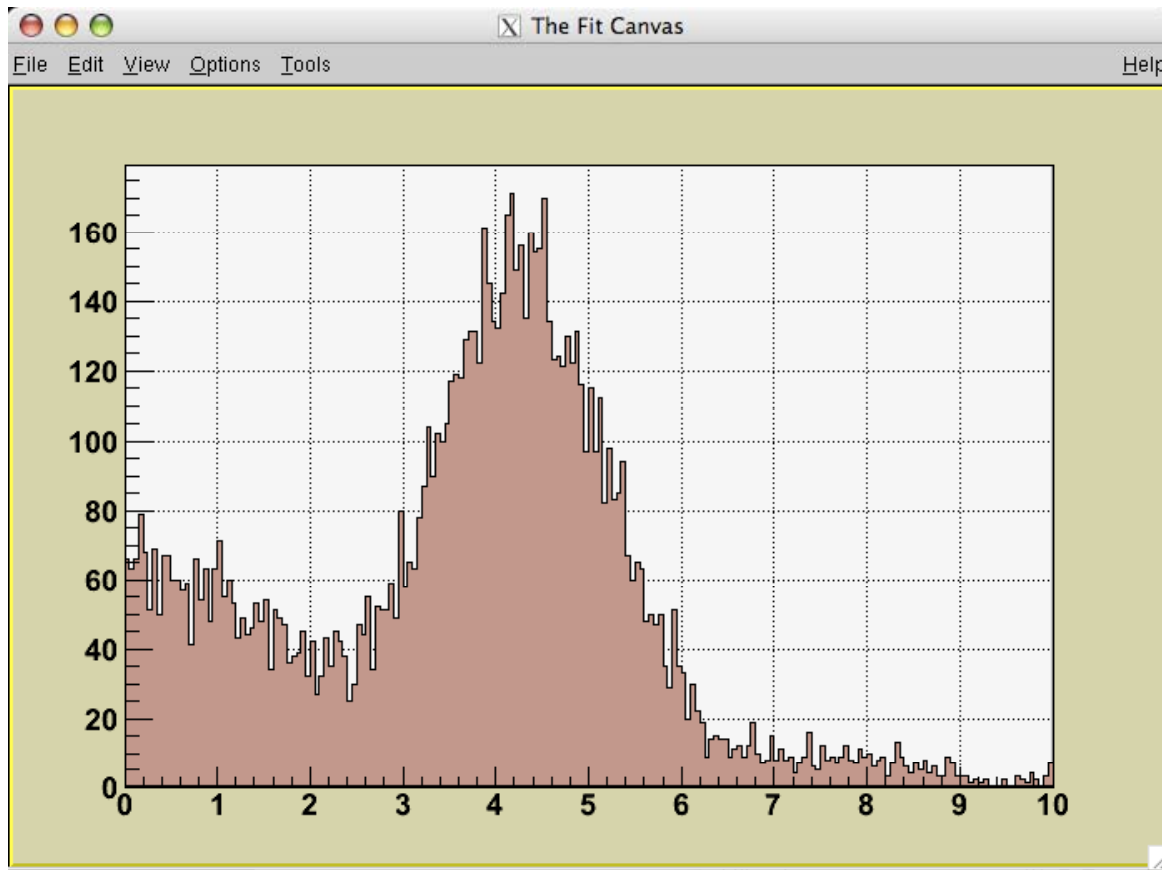




Tuning Parameters



Immediate preview of the changed function



Fit Panel

Data Set: TH1F::h1f

Fit Function

Type: Prev. Fit sqroot

Operation

Nop Add Conv

$(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))$

Selected: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x) \dots$ Set Parameters...

General | Minimization

Fit Settings

Method: Chi-square User-Defined...

Linear fit

Robust: 1.00 No Ch-square

Fit Options

Integral Use range

Best errors Improve fit results

All weights = 1 Add to list

Empty bins, weights=' Use Gradient

Draw Options

SAME No drawing Do not store/draw Advanced...

X 0.00 10.00

_it Reset Close

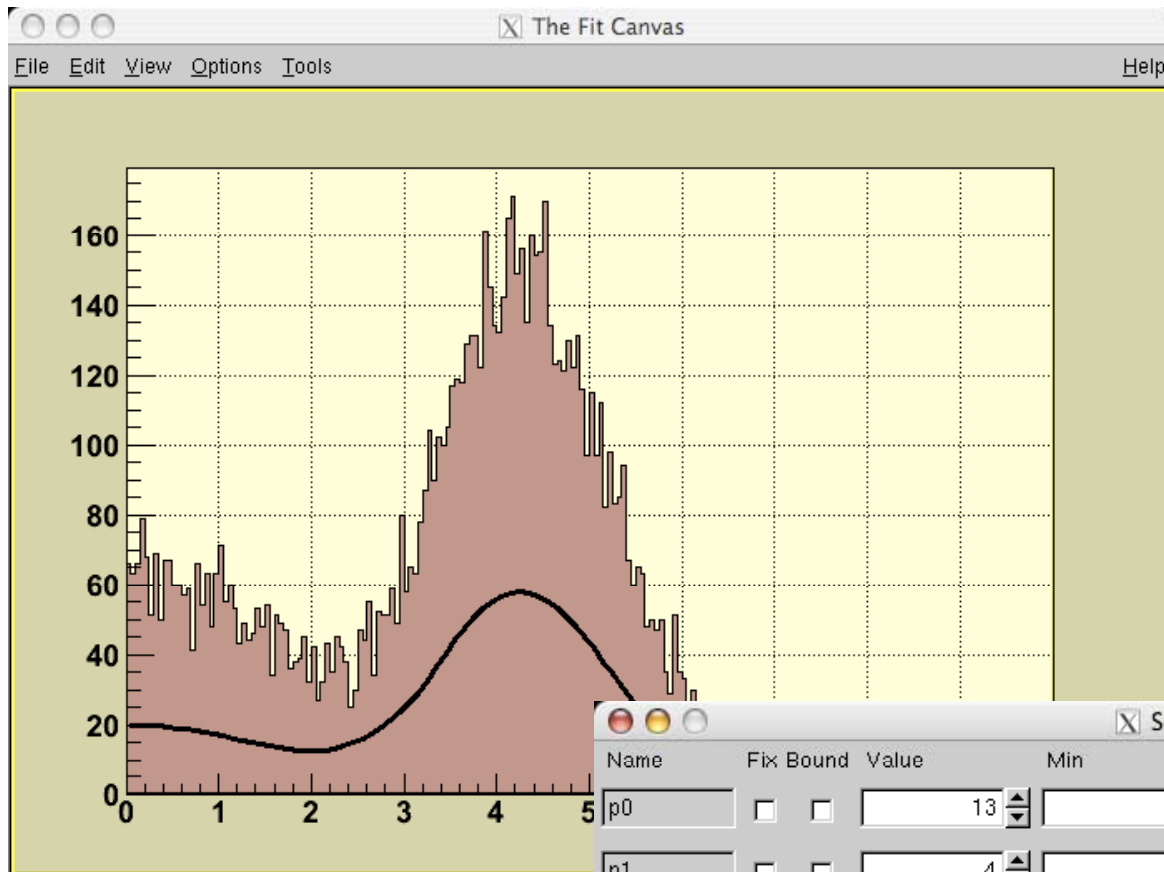
TH1F::h1f LIB Minuit MIGRAD lbr: 0 Prr: DEF



Tuning Parameters



Immediate preview of the changed function



Fit Panel

Data Set: TH1F::h1f

Fit Function
Type: Prev. Fit | sqroot

Operation
 Nop Add Conv

$(x * \text{gaus}(0)) + ([3 * \text{abs}(\sin(x)/x))$

Selected:
 $(x * \text{gaus}(0)) + ([3 * \text{abs}(\sin(x)/x)...$ **Set Parameters...**

General | Minimization

Fit Settings
Method: Chi-square **User-Defined...**

Linear fit
Robust: 1.00 No Ch-square

Fit Options
 Integral Use range
 Best errors Improve fit results
 All weights = 1 Add to list
 Empty bins. weights= Use Gradient

Set Parameters of sqroot

Name	Fix	Bound	Value	Min	Set Range	Max	Step	Errors
p0	<input type="checkbox"/>	<input type="checkbox"/>	13	-39		39	3.9	-
p1	<input type="checkbox"/>	<input type="checkbox"/>	4	-12		12	1.2	-
p2	<input type="checkbox"/>	<input type="checkbox"/>	1	-3		3	0.3	-
p3	<input type="checkbox"/>	<input type="checkbox"/>	20	-60		60	6	-

Immediate preview

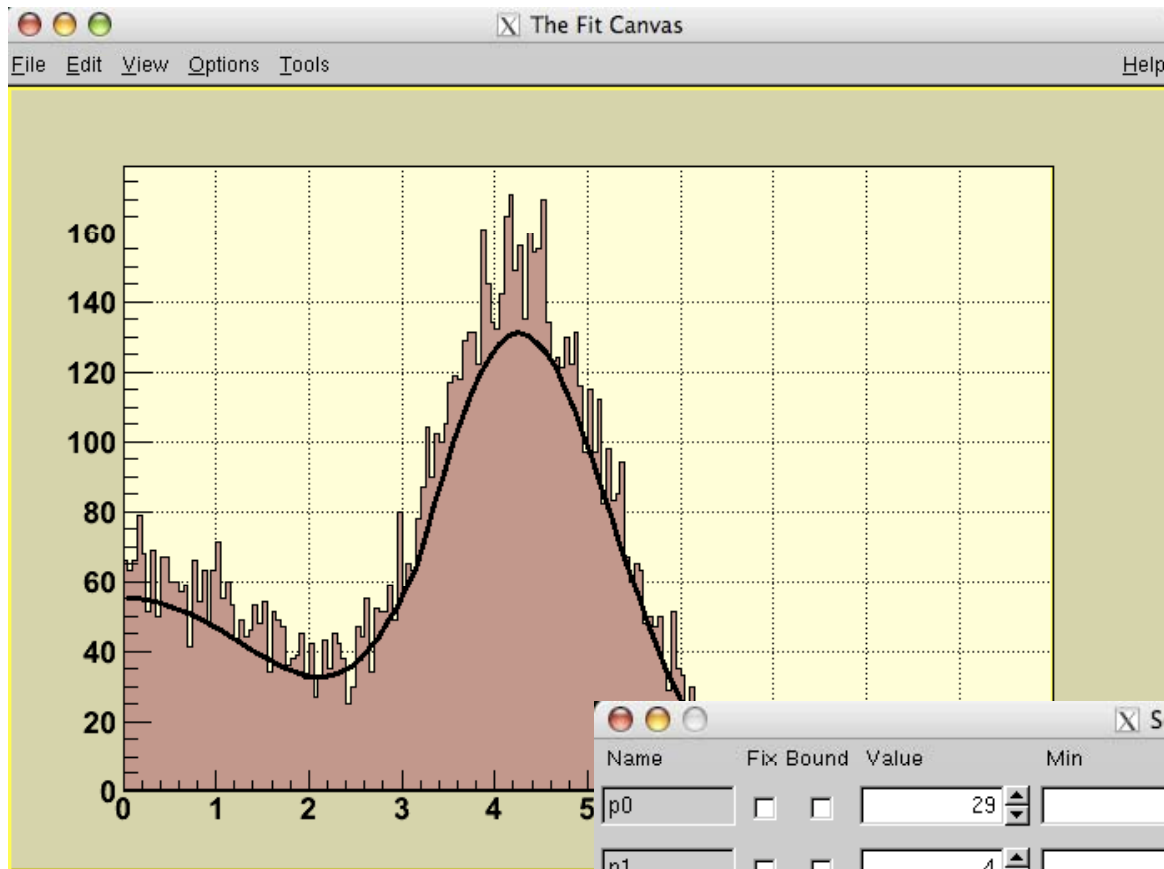
Reset **Apply** **OK** **Cancel**



Tuning Parameters



Immediate preview of the changed function



The Fit Panel dialog box is titled "Fit Panel" and contains the following settings:

- Data Set: TH1F::h1f
- Fit Function Type: Prev. Fit
- Operation: Nop, Add, Conv
- Fit Function: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))$
- Selected: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x)...$
- General tab selected, Minimization sub-tab active.
- Fit Settings: Method: Chi-square, Robust: 1.00, No Ch-square:
- Fit Options: Integral: , Best errors: , All weights = 1: , Empty bins. weights=: , Use range: , Improve fit results: , Add to list: , Use Gradient:

The Set Parameters of sqrt dialog box shows the following parameter values:

Name	Fix	Bound	Value	Min	Set Range	Max	Step	Errors
p0	<input type="checkbox"/>	<input type="checkbox"/>	29	-39		39	3.9	-
p1	<input type="checkbox"/>	<input type="checkbox"/>	4	-12		12	1.2	-
p2	<input type="checkbox"/>	<input type="checkbox"/>	1	-3		3	0.3	-
p3	<input type="checkbox"/>	<input type="checkbox"/>	55	-60		60	6	-

Buttons: Reset, Apply, OK, Cancel

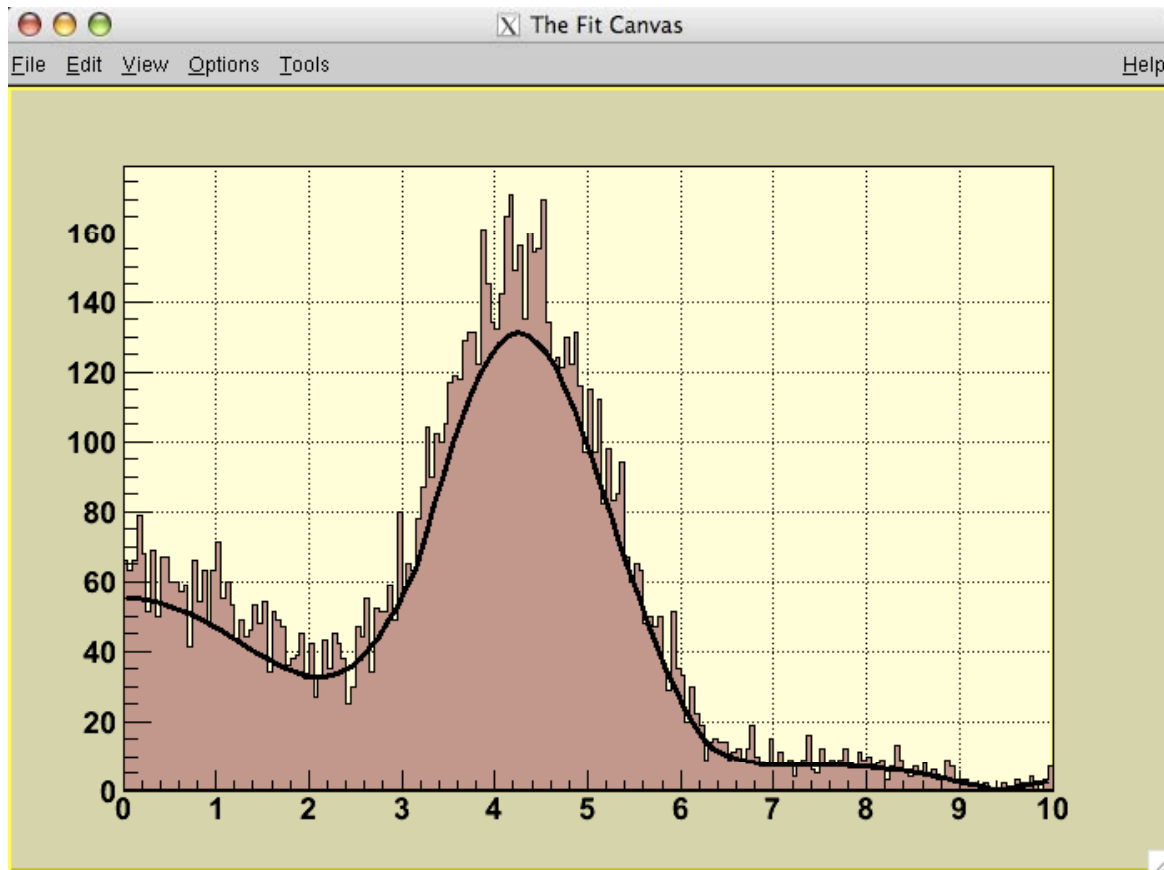
Immediate preview



Tuning Parameters



Immediate preview of the changed function



Fit Panel

Data Set: TH1F::h1f

Fit Function

Type: Prev. Fit | sqroot:

Operation

Nop Add Conv

$(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))$

Selected:

$(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x)) \dots$ Set Parameters...

General | Minimization

Fit Settings

Method

Chi-square User-Defined...

Linear fit

Robust: 1.00 No Ch-square

Fit Options

Integral Use range

Best errors Improve fit results

All weights = 1 Add to list

Empty bins, weights=' Use Gradient

Draw Options

SAME

No drawing

Do not store/draw Advanced...

X 0.00 10.00

_it Reset Close

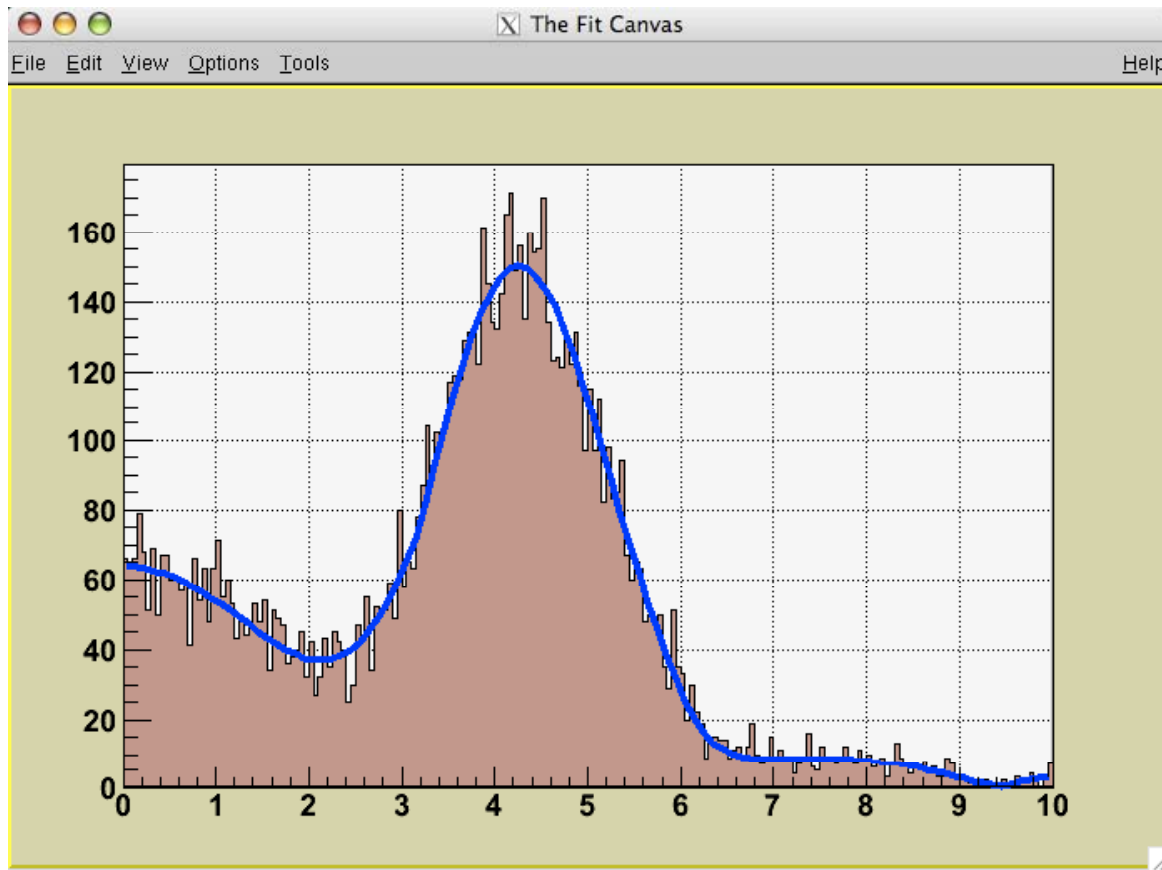
TH1F::h1f LIB Minuit MIGRAD ltr: 0 Prr: DEF



Tuning Parameters



Immediate preview of the changed function



The Fit Panel dialog box is shown with the following settings:

- Data Set: TH1F::h1f
- Fit Function Type: Prev. Fit
- Operation: Nop, Add, Conv
- Fit Function: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))$
- Selected: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))...$
- Method: Chi-square
- Robust: 1.00
- Fit Options: Integral, Best errors, All weights = 1, Empty bins, weights=
- Draw Options: SAME, No drawing, Do not store/draw

Buttons: User-Defined..., Advanced...

X: 0.00 to 10.00

Buttons: Fit, Reset, Close

Status: TH1F::h1f | LIB Minuit | MIGRAD | Iter: 0 | Prr: DEF

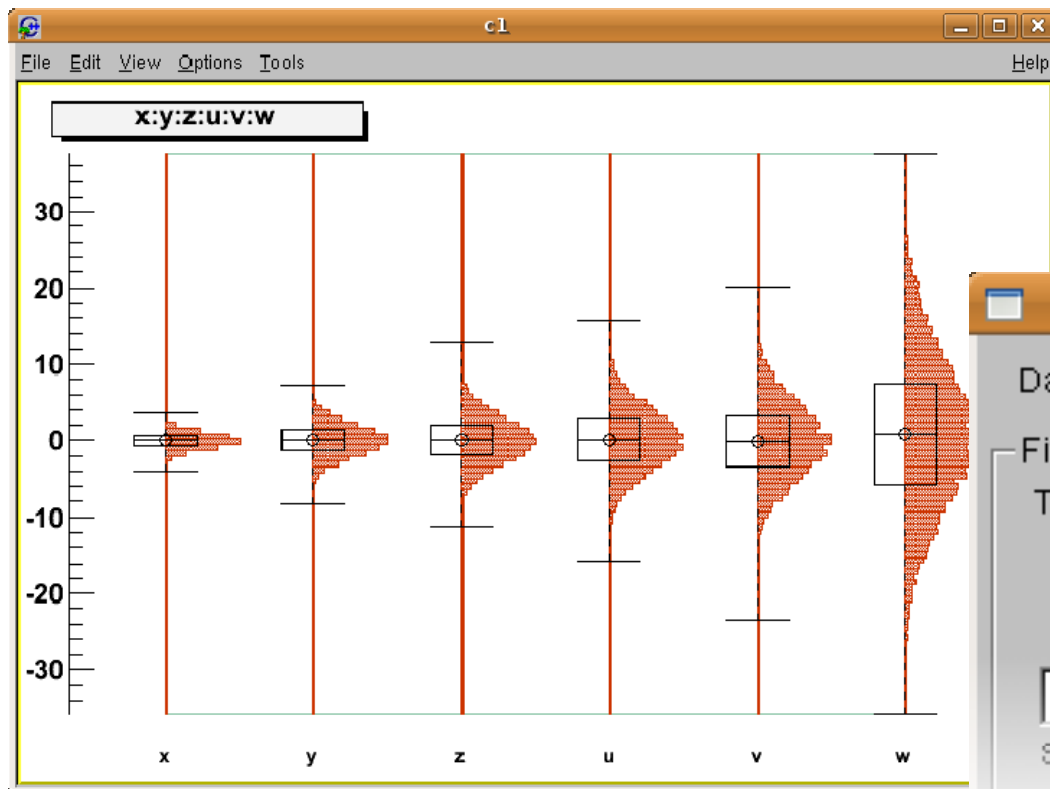


Special Case: TTree



Unbinned fit for un-limited number of variables

- λ Select the variables to use
- λ Select the cuts



Fit Panel

Data Set: No Selection

Fit Function

Type: Predef-1D | gaus

Operation

Nop Add Conv

gaus

Selected: gaus

Set Parameters...

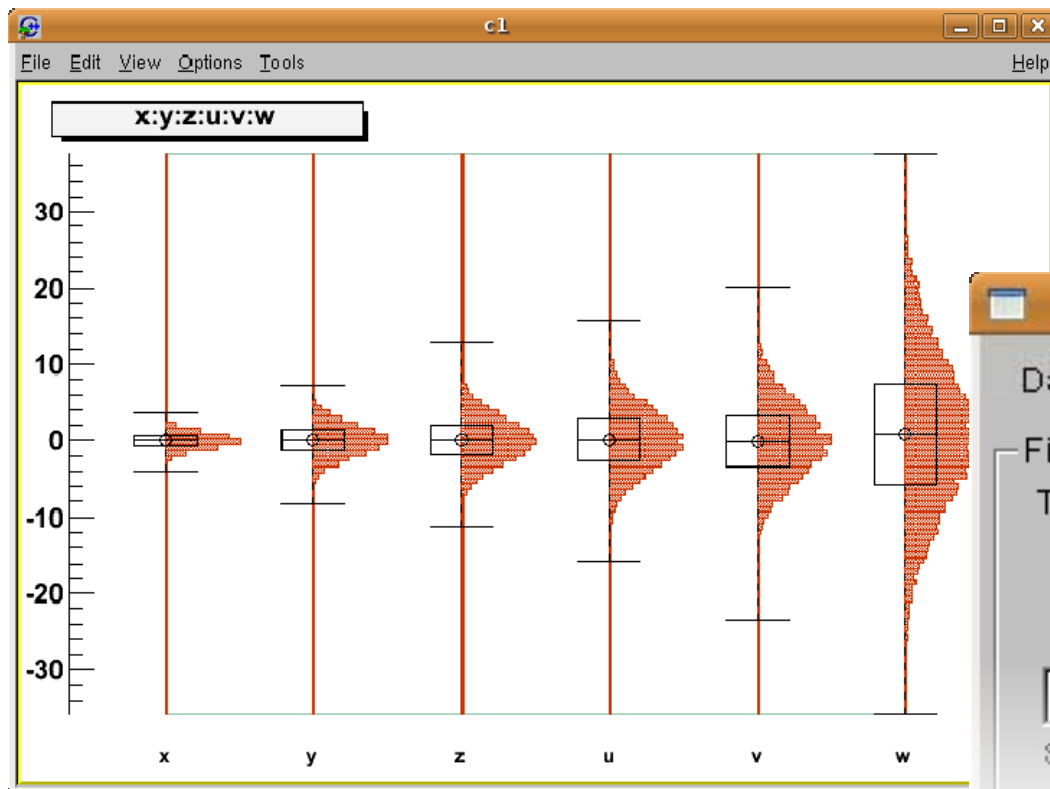


Special Case: TTree



Unbinned fit for un-limited number of variables

- λ Select the variables to use
- λ Select the cuts



Fit Panel

Data Set: No Selection

Fit Function: No Selection

Type: Predef-ID | gaus

Operation

Nop Add Conv

gaus

Selected:

gaus

Set Parameters...

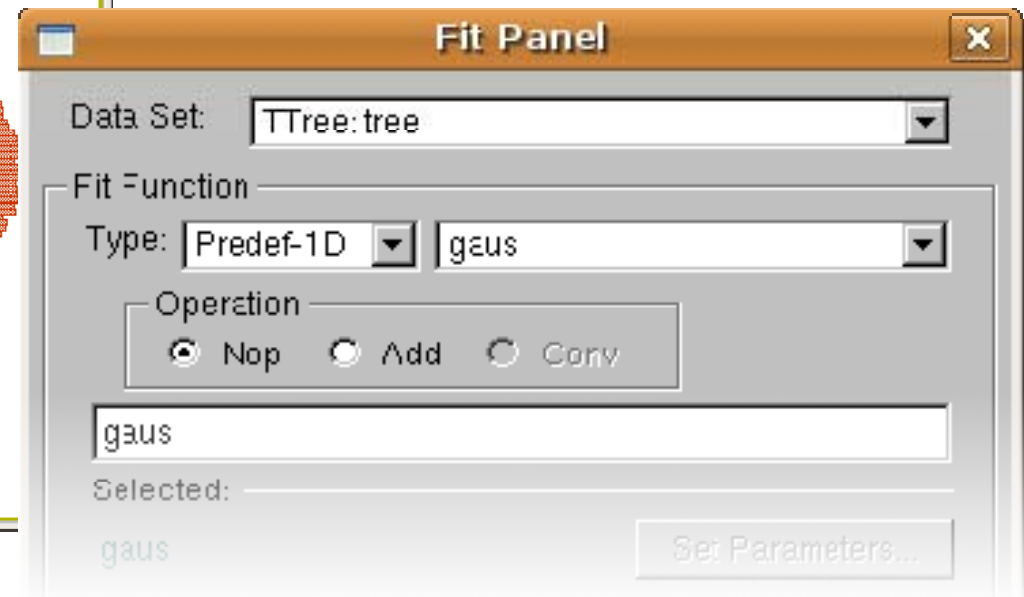
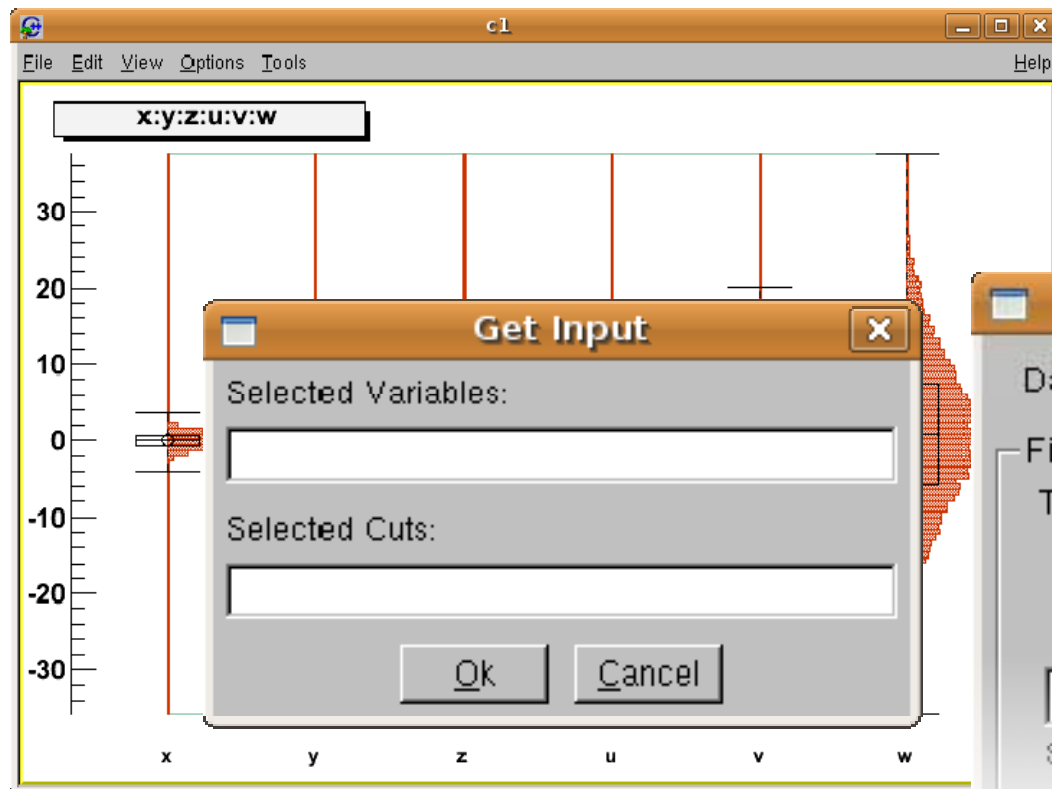


Special Case: TTree



Unbinned fit for un-limited number of variables

- λ Select the variables to use
- λ Select the cuts



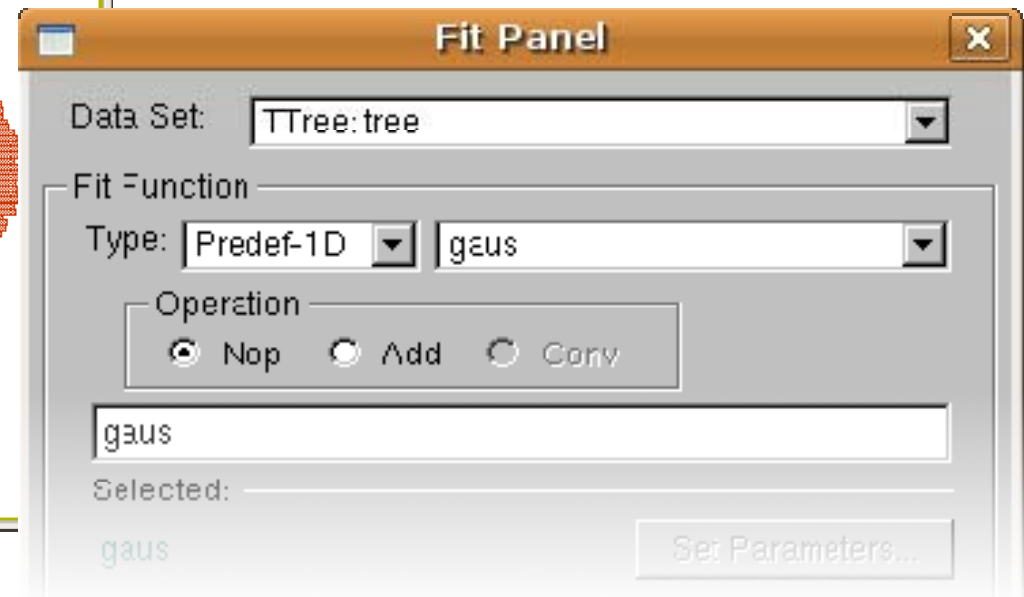
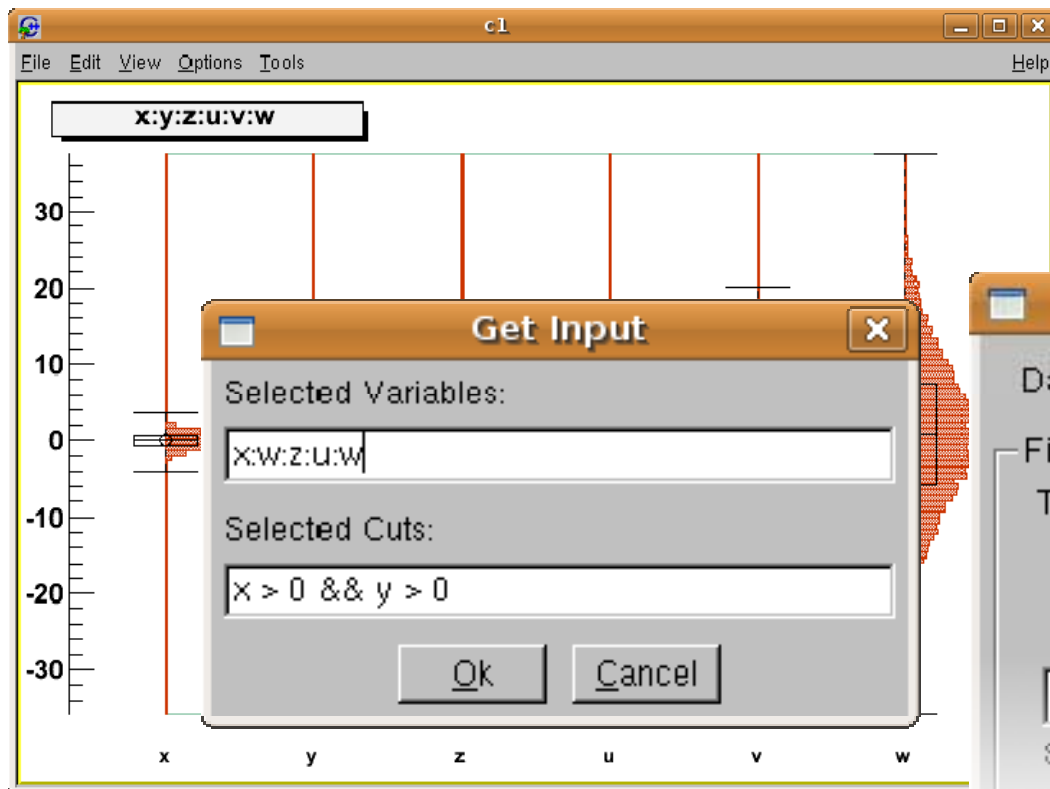


Special Case: TTree



Unbinned fit for un-limited number of variables

- λ Select the variables to use
- λ Select the cuts



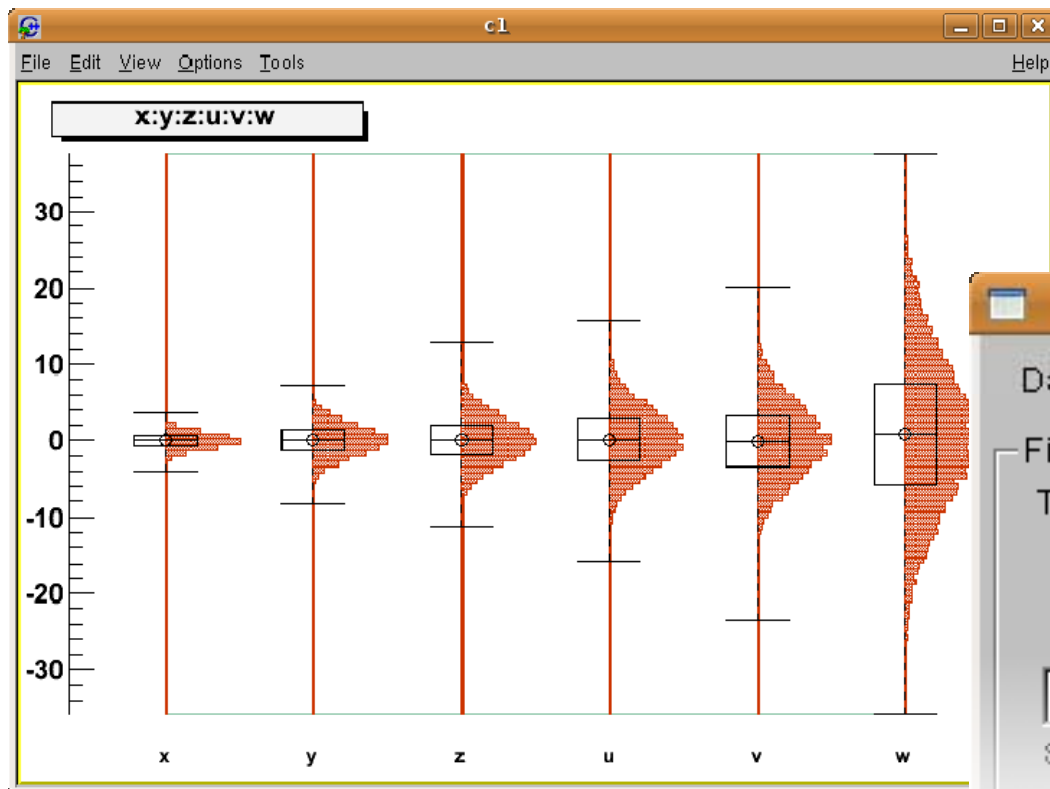


Special Case: TTree



Unbinned fit for un-limited number of variables

- λ Select the variables to use
- λ Select the cuts



The 'Fit Panel' dialog box is shown with the following configuration:

- Data Set: TTree:tree ("x:w:z:u:w", "x > 0 && y > 0")
- Fit Function: Type: Predef-1D, gaus
- Operation: Nop, Add, Conv
- Selected: gaus
- Buttons: Set: Parameters...



Setting the Fit Options



- λ Fit Method
- λ Fitting Options
- λ Drawing options
- λ Range selection

General | **Minimization**

Fit Settings

Method

Chi-square

Linear fit

Robust: 1.00 No Chi-square

Fit Options

Integral Use range

Best errors Improve fit results

All weights = 1 Add to list

Empty bins, weights=1 Use Gradient

Draw Options

SAME No drawing

Do not store/draw

X -4.00 6.00



Setting the Fit Options



General | **Minimization**

Library _____

Minuit Minuit2 Fumili

Method _____

MIGRAD SIMPLEX FUMILI

SCAN Combination

Settings _____

Use ENTER key to validate a new value or click on Reset button to set the defaults.

Error definition (default = 1):

Max tolerance (precision):

Max number of iterations:

Print Options _____

Default Verbose Quiet

- λ Select the minimization algorithm
 - λ Library
 - λ Method
- λ Minimizer parameters
- λ Printing Options

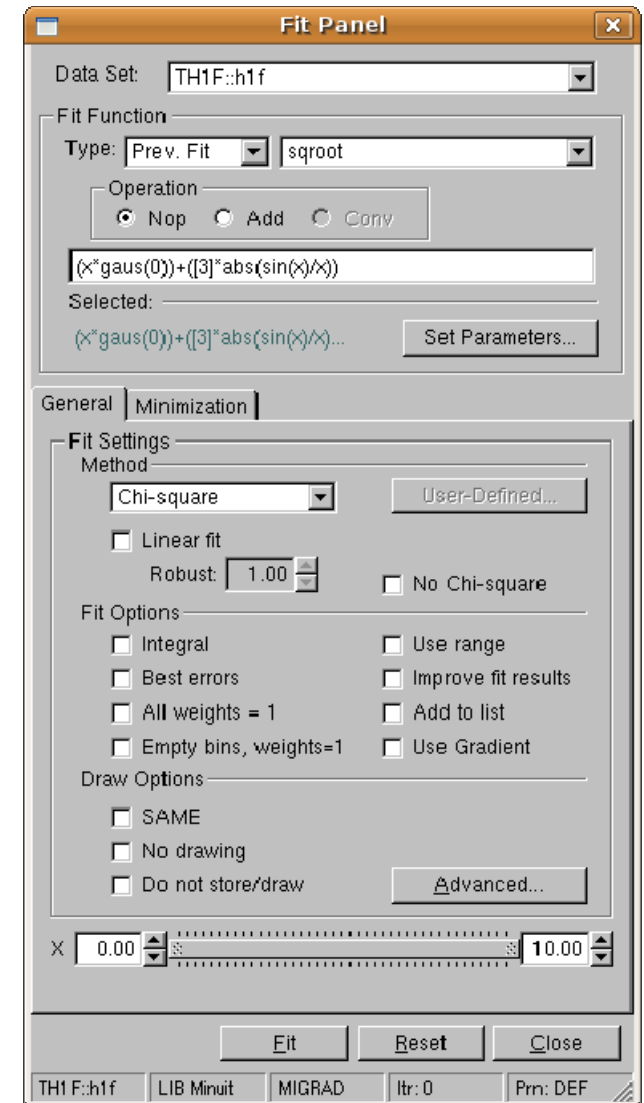


Advanced Options



Advanced drawing options from GUI

- λ Contour plots



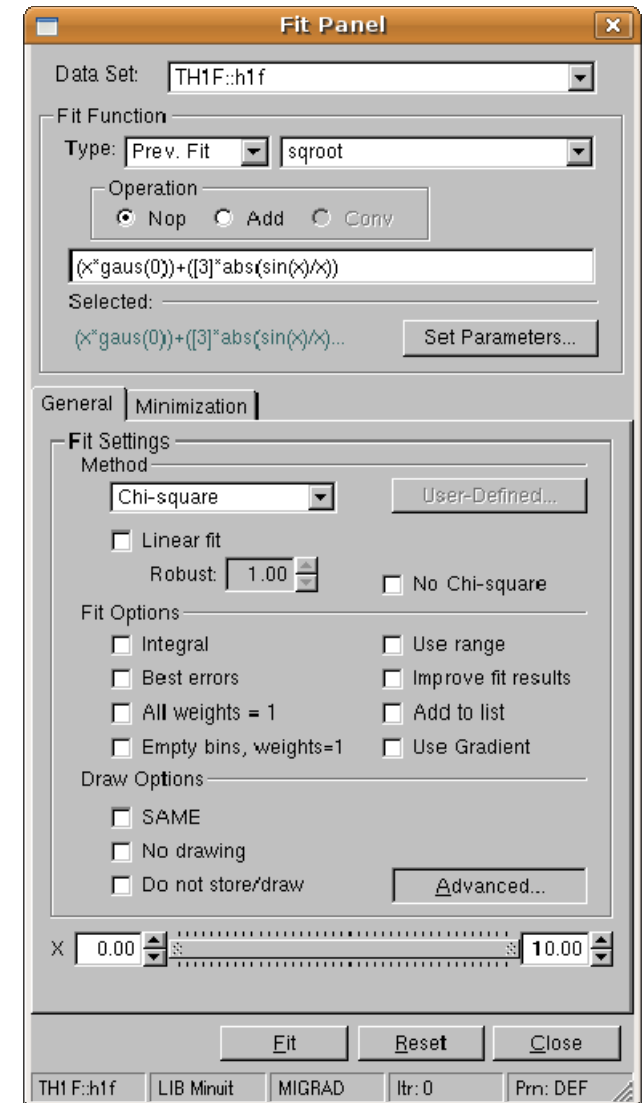


Advanced Options



Advanced drawing options from GUI

- λ Contour plots



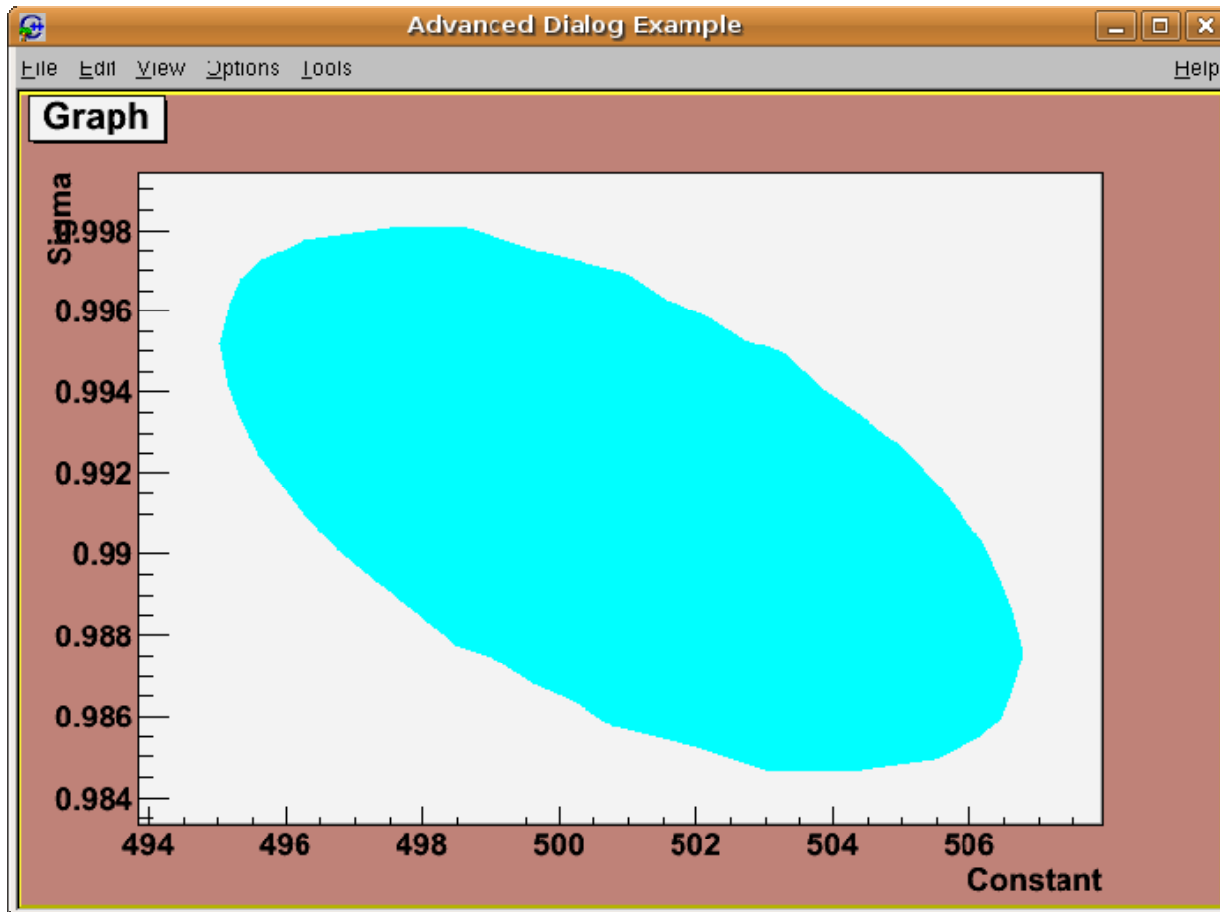


Advanced Options



Advanced drawing options from GUI

λ Contour plots



The figure shows two overlapping dialog boxes. The top one is the "Fit Panel" with the following settings:

- Data Set: TH1F::h1f
- Fit Function Type: Prev. Fit
- Fit Function: sqrt
- Operation: Nop, Add, Conv
- Equation: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))$
- Selected: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x) \dots$
- Buttons: Set Parameters...

The bottom dialog box is "Advanced Drawing Tools" with the following settings:

- Tab: Contour
- Number of Points: 40
- Parameter 1: Constant
- Parameter 2: Sigma
- Confidence Level: 0.683
- Fill Colour: Cyan
- Superimpose
- Buttons: Draw, Close

At the bottom of the Fit Panel, there are buttons for "Fit", "Reset", and "Close", and a status bar showing "TH1 F::h1f", "LIB Minuit", "MIGRAD", "ltr: 0", and "Prn: DEF".

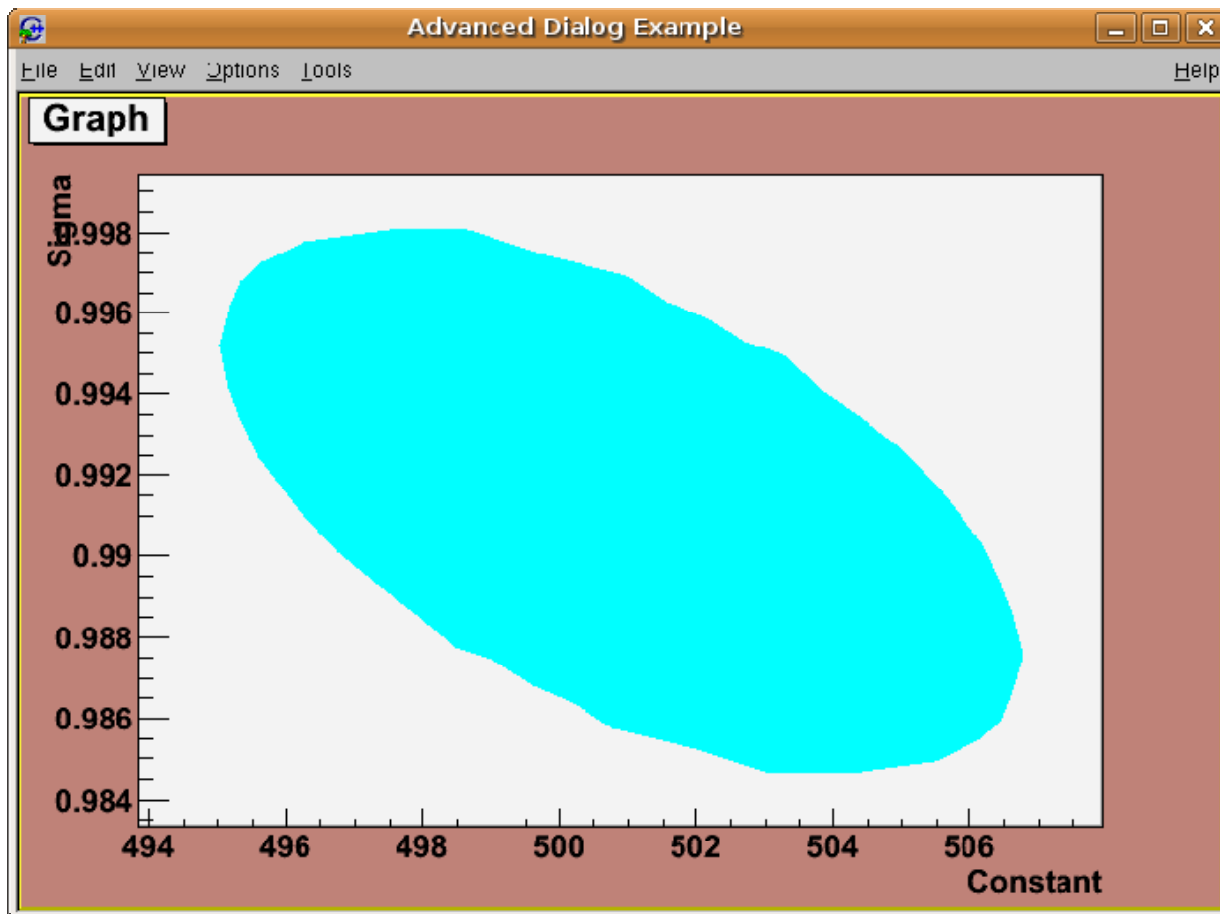


Advanced Options



Advanced drawing options from GUI

λ Contour plots



The figure shows two overlapping dialog boxes. The top one is the "Fit Panel" and the bottom one is the "Advanced Drawing Tools" dialog.

Fit Panel:

- Data Set: TH1F::h1f
- Fit Function Type: Prev. Fit
- Fit Function: sqrt
- Operation: Nop, Add, Conv
- Equation: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))$
- Selected: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x) \dots$
- Buttons: Set Parameters...
- Tabs: General, Minimization

Advanced Drawing Tools:

- Contour | Scan
- Number of Points: 40
- Parameter 1: Constant
- Parameter 2: Sigma
- Confidence Level: 0.521
- Fill Colour: Superimpose
- Buttons: Draw, Close

At the bottom, there are buttons for "Fit", "Reset", and "Close". The status bar shows: TH1 F::h1f | LIB Minuit | MIGRAD | ltr: 0 | Prn: DEF

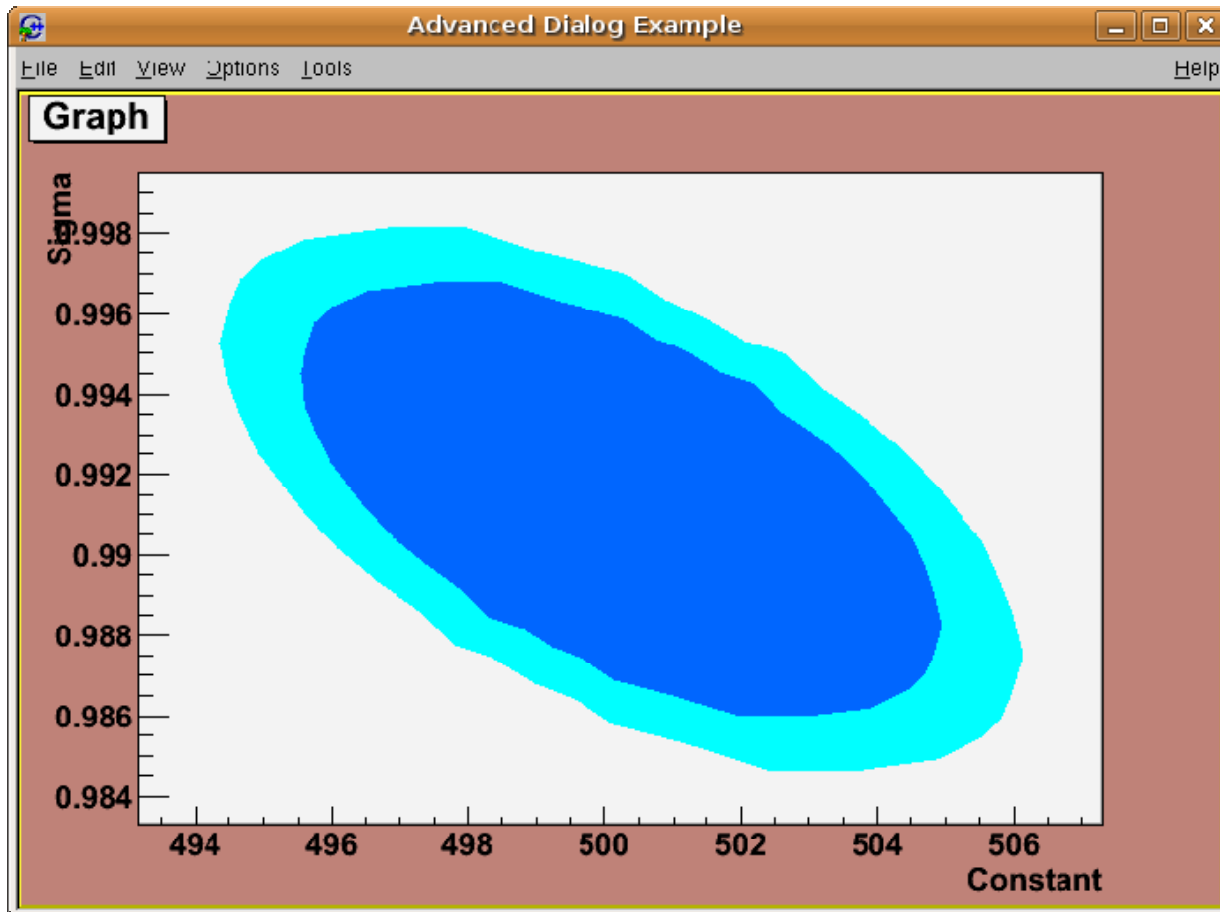


Advanced Options



Advanced drawing options from GUI

λ Contour plots



The "Fit Panel" dialog box contains the following settings:

- Data Set: TH1F::h1f
- Fit Function Type: Prev. Fit
- Fit Function: sqrt
- Operation: Nop, Add, Conv
- Equation: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x))$
- Selected: $(x * \text{gaus}(0)) + ([3] * \text{abs}(\sin(x)/x) \dots$
- Buttons: Set Parameters...
- Tabs: General, Minimization

The "Advanced Drawing Tools" dialog box has the following settings:

- Tab: Contour
- Number of Points: 40
- Parameter 1: Constant
- Parameter 2: Sigma
- Confidence Level: 0.521
- Fill Colour: Blue
- Superimpose
- Buttons: Draw, Close

The bottom status bar displays the following information:

- X: 0.00
- Y: 10.00
- Buttons: Fit, Reset, Close
- Status: TH1 F::h1f | LIB Minuit | MIGRAD | Iter: 0 | Prn: DEF

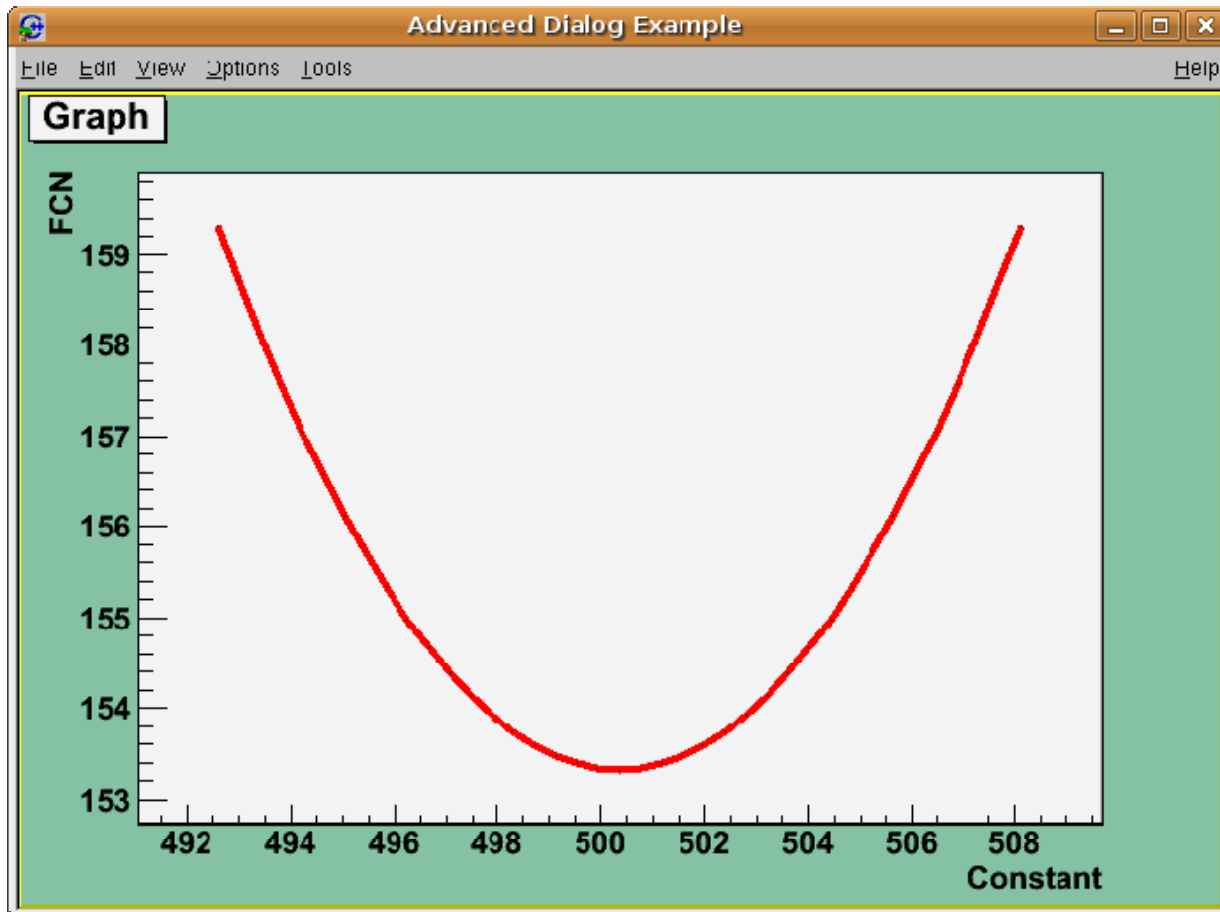


Advanced Options



Advanced drawing options from GUI

λ Scan plot of likelihood



Fit Panel

Data Set: TH1F::h1f

Fit Function

Type: Prev. Fit sqrt

Operation

Nop Add Conv

$(x^* \text{gaus}(0)) + ([3]^* \text{abs}(\sin(x)/x))$

Selected: $(x^* \text{gaus}(0)) + ([3]^* \text{abs}(\sin(x)/x)...$ Set Parameters...

General Minimization

Advanced Drawing Tools

Contour Scan

Number of Points: 40

Parameter: Constant

Min: 492.5937 Max: 508.1276

Draw Close

X: 0.00 10.00

Fit Reset Close

TH1 F::h1f LIB Minuit MIGRAD ltr: 0 Prn: DEF

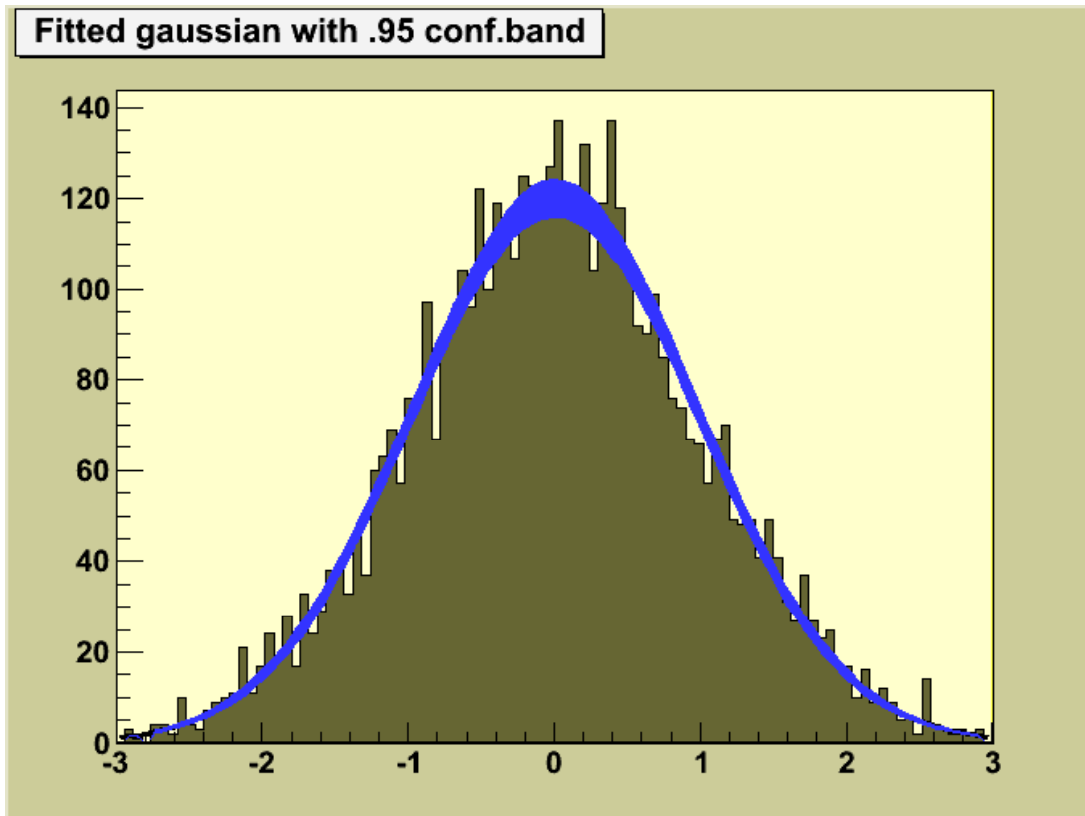


Advanced Options



Advanced drawing options from GUI

λ Confidence Levels of fit function



Fit Panel

Data Set: TH1F::h1f

Fit Function

Type: Prev. Fit | sqrt

Operation

Nop Add Conv

$(x^* \text{gaus}(0)) + ([3]^* \text{abs}(\sin(x)/x))$

Selected: $(x^* \text{gaus}(0)) + ([3]^* \text{abs}(\sin(x)/x))$ [Set Parameters...](#)

General | Minimization

Fit Settings

Method: Chi-square [User-Defined...](#)

Linear fit
Robust: 1.00 No Chi-square

Fit Options

Integral Use range
 Best errors Improve fit results
 All weights = 1 Add to list
 Empty bins, weights=1 Use Gradient

Draw Options

SAME
 No drawing
 Do not store/draw [Advanced...](#)

X: 0.00 | 10.00

[Fit](#) [Reset](#) [Close](#)

TH1 F::h1f LIB Minuit MIGRAD ltr: 0 Prn: DEF



Future Work & Conclusions



Future Improvements:

- λ Integration of the RooFit Functionality
- λ Parallelization interface
 - Control the number of threads

Conclusions:

- λ The fit panel has been widely re-engineered:
- λ Support more classes and methods
- λ Extra functionality (Advance graphics, etc)
- λ Waiting for user's feedback



Demo





Questions?

