ROOT Users Workshop – May 10, 2022

Help yourself with the proper tools to tame ROOT

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Introduction

- Errors are a term of the equation, not an exception/accident
- There are memory leaks and thread races waiting for you
- ROOT can be particularly complicated for simple things, documentation is thus paramount!
- Equip yourself with a set of tools that optimizes these workflows
- Think of debugging as a daily tool, rather than contingency plan
- → You'll find ROOT more comfortable and user-friendly

https://root.cern/blog/code-horsepower-f1/

Don’t burn your (only two) eyes

- A text editor + terminal are great, but not always...

```
/tmp/zdt/gui/MainWindow.cpp: In constructor ‘MainWindow::MainWindow(const TGWindow*, UInt_t, UInt_t, PulseSurfer*, uint32_t, uint32_t, bool)’:
/tmp/zdt/gui/MainWindow.cpp:447:77: warning: passing ‘uint16_t’ {aka ‘short unsigned int’} chooses ‘int’ over ‘unsigned int’ [-Wsign-promo]
         fSensors[ch] = new TGSpeedo(temps,0.,100., "Temp", std::to_string(ch).c_str());
                                                                           ^
/tmp/zdt/gui/MainWindow.cpp:447:77: warning:   in call to ‘std::__cxx11::string std::__cxx11::to_string(int)’ [-Wsign-promo]
/tmp/zdt/gui/MainWindow.cpp:460:79: warning: passing ‘uint16_t’ {aka ‘short unsigned int’} chooses ‘int’ over ‘unsigned int’ [-Wsign-promo]
         fSensors[ch] = new TGSpeedo(rpms,0.,20000., "Speed", std::to_string(ch).c_str());
                                                                           ^
/tmp/zdt/gui/MainWindow.cpp:460:79: warning:   in call to ‘std::__cxx11::string std::__cxx11::to_string(int)’ [-Wsign-promo]
/tmp/zdt/gui/MainWindow.cpp:480:81: warning: passing ‘uint16_t’ {aka ‘short unsigned int’} chooses ‘int’ over ‘unsigned int’ [-Wsign-promo]
         fSensors[ch] = new TGSpeedo(vlts,0.,12000., "Voltage", std::to_string(ch).c_str());
                                                                           ^
/tmp/zdt/gui/MainWindow.cpp:480:81: warning:   in call to ‘std::__cxx11::string std::__cxx11::to_string(int)’ [-Wsign-promo]
[ 82%] Building CXX object gui/CMakeFiles/ZDTgui.dir/G__PulseSurfer.cxx.o
/tmp/zdt/gui/MainWindow.cpp: In member function ‘void MainWindow::UpdateSensors()’:
/tmp/zdt/gui/MainWindow.cpp:789:37: warning: ‘#’target_mem_ref’ not supported by dump_expr#<expression error>’ is used uninitialized in this function [-Wuninitialized]
             float value = std::round(values[ch]);
                           ~~~~~~~~~~^~~~~~~~~~~~
```


https://root-forum.cern.ch/t/trentrantrwlock-thread-lock-program-freezes/45116/12?u=ferhue

Equip yourself with an IDE

- One click. No back and forth search. Warning parsed for you.

```
447         fSensors[ch] = new TGSpeedo(temps,0.,100., "Temp", std::to_string(ch).c_str());
448         fSensors[ch]->SetDisplayText("Temp", "C");
449         fSensors[ch]->SetThresholds(30,50,70);
450         fSensors[ch]->EnableThreshold();
451         fSensors[ch]->EnableMeanMark();
452         fSensors[ch]->EnablePeakMark();
453         fSensors[ch]->SetBufferSize(kSensorAverage);
454         temps->AddFrame(fSensors[ch], lSpeedo2);
455     }
456     TGGroupFrame* const rpms = new TGGroupFrame(vSens, new TGString("Ventilator monitori
457     vSens->AddFrame(rpms, lCols);
458     for( uint16_t ch = 14; ch < 17; ++ch )
459     {
```

```
Issues                                                    sign-promo
passing 'uint16_t' {aka 'short unsigned int'} chooses 'int' over 'unsigned int' [-Wsign-promo]
/tmp/zdt/gui/MainWindow.cpp: In constructor 'MainWindow::MainWindow(const TGWindow*, UInt_t, UInt_t, PulseSurfer*, uint32_t, uint32_t, bool)':
/tmp/zdt/gui/MainWindow.cpp:447:77: warning: passing 'uint16_t' {aka 'short unsigned int'} chooses 'int' over 'unsigned int' [-Wsign-promo]
        fSensors[ch] = new TGSpeedo(temps,0.,100., "Temp", std::to_string(ch).c_str());
                                                                                  ^
/tmp/zdt/gui/MainWindow.cpp
warning:  in call to 'std::__cxx11::string std::__cxx11::to_string(int)' [-Wsign-promo]
passing 'uint16_t' {aka 'short unsigned int'} chooses 'int' over 'unsigned int' [-Wsign-promo]
warning:  in call to 'std::__cxx11::string std::__cxx11::to_string(int)' [-Wsign-promo]
passing 'uint16_t' {aka 'short unsigned int'} chooses 'int' over 'unsigned int' [-Wsign-promo]
warning:  in call to 'std::__cxx11::string std::__cxx11::to_string(int)' [-Wsign-promo]
```

https://root.cern/blog/code-horsepower-f1/

https://root-forum.cern.ch/t/trentrantrwlock-thread-lock-program-freezes/45116/12?u=ferhue

Equip yourself with an IDE

- Learn your compilation errors before compiling, in real-time
- Saves you tons of time!

```
445     for( uint16_t ch = 0; ch < 3; ++ch )
446     {
447         fSensors[ch] = new TGSpeedo(temps,0.,100., "Temp", std::to_string(ch).c_str());
448         fSensors[ch]->SetdisplayText("Temp", "C");                    no member name
            ...(30,50,70);
            ...d();
            fSensors[ch]->EnableMeanMark();
452         fSensors[ch]->EnablePeakMark();
453         fSensors[ch]->SetBufferSize(kSensorAverage);
454         temps->AddFrame(fSensors[ch], lSpeedo2);
455     }
456     TGGroupFrame* const rpms = new TGGroupFrame(vSens, new TGString("Ventilator monitoring
```

Semantic Issue
448:23: error: no member named 'SetdisplayText' in 'TGSpeedo'
Annotation Settings

https://root.cern/blog/code-horsepower-f1/

https://root-forum.cern.ch/t/trentrantrwlock-thread-lock-program-freezes/45116/12?u=ferhue

Equip yourself with an IDE

- Get Autocomplete features while writing:

```
for( uint16_t ch = 0; ch < 3; ++ch )
{
    fSensors[ch] = new TGSpeedo(temps,0.,100., "Temp", std::to_string(ch
    fSensors[ch]->SetDisp                    no member named 'SetDisp'
    fSensors[ch]- SetDisplayText   void SetDisplayText(const char *text1, const char *text2 = "")
    fSensors[ch]->EnableThreshold();
    fSensors[ch]->EnableMeanMark();
    fSensors[ch]->EnablePeakMark();
    fSensors[ch]->SetBufferSize(kSensorAverage);
    temps->AddFrame(fSensors[ch], lSpeedo2);
}
```

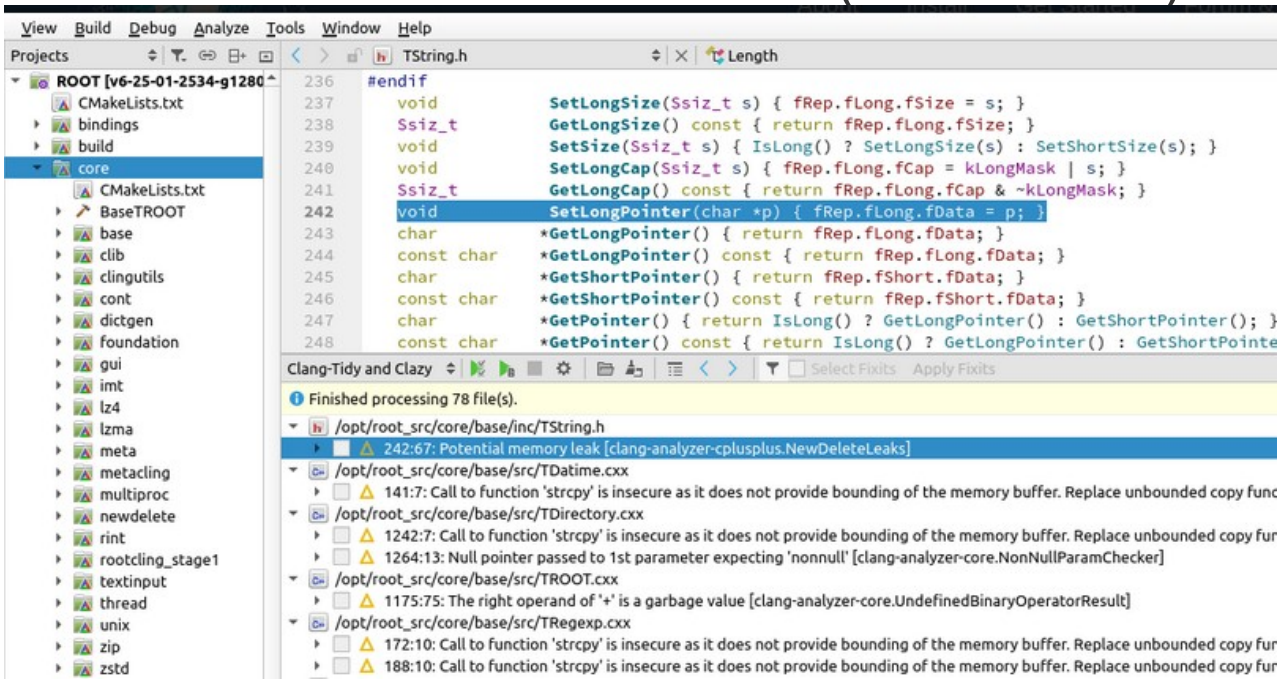
https://root.cern/blog/code-horsepower-f1/

https://root-forum.cern.ch/t/trentrantrwlock-thread-lock-program-freezes/45116/12?u=ferhue

https://root.cern/blog/code-horsepower-f1/

Equip yourself with an IDE

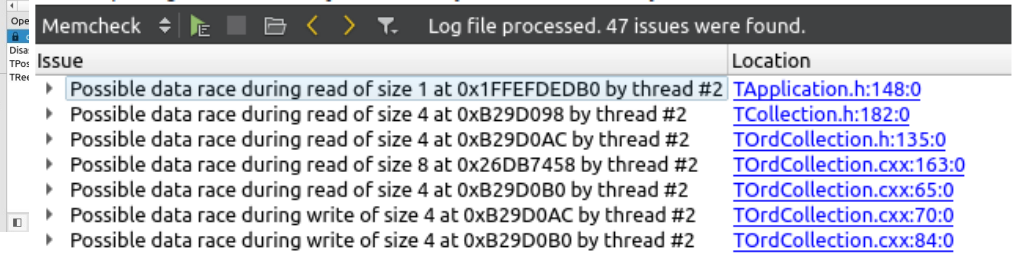
- Relax… and let Clang-Tidy find your bugs (static analyzer)
  - Take you with a click to the problematic place
    - And another click to fix it (sometimes)

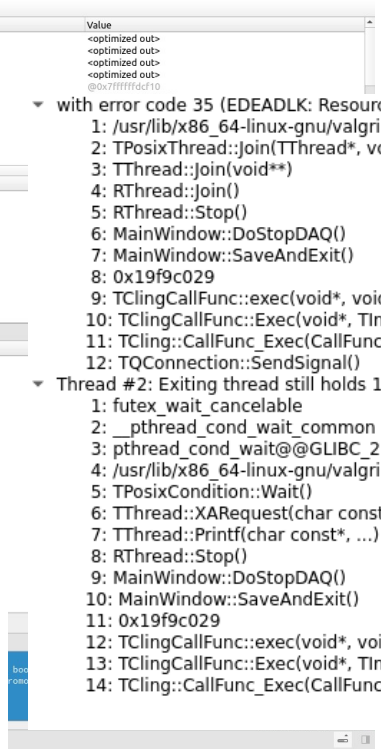


https://root.cern/blog/code-horsepower-f1/
https://github.com/root-project/root/issues/8365

And if your script crashes...

- Find your segfaults, memory leaks or data races
  - Stop looking at bare Helgrind / Valgrind logs...





Equip yourself with an IDE

- Several options
  - QtCreator https://root.cern/blog/code-horsepower-f1/
  - VS-Studio https://root.cern/blog/root-on-vscode/
  - Eclipse https://root.cern/blog/debuging-root-scripts-in-eclipse/

- You can debug your ROOT macros (and it’s worth!), not only big applications.
- You can “debug” your Doxygen documentation-build

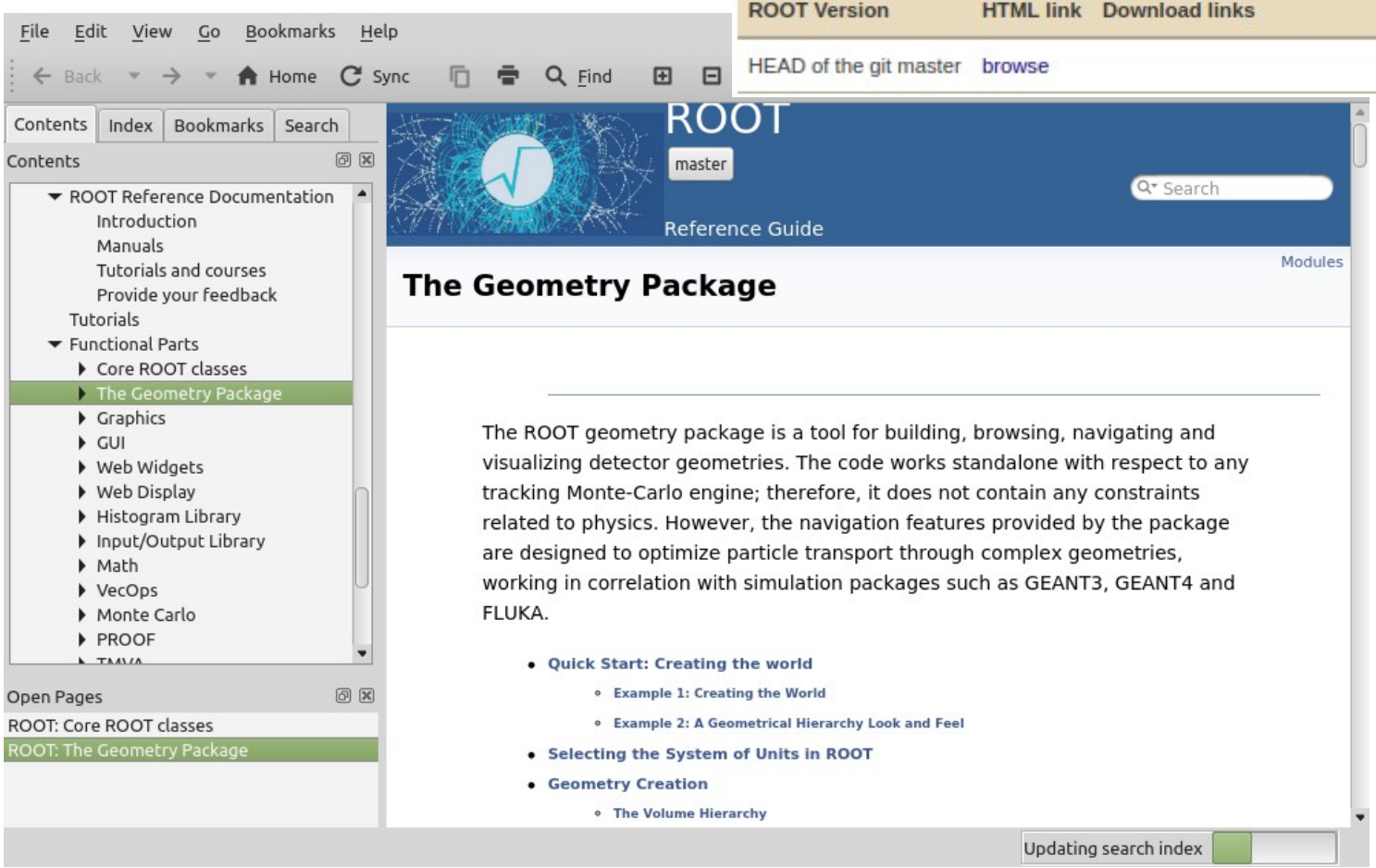
Help Book

All Reference Guides

https://root.cern/reference/

The Reference Guide is available for all major ROOT releases. This page gives the list of all the past versions.

ROOT Version	HTML link	Download links	Link to the Tag file	Link to the QCH file
HEAD of the git master	browse		tag file	qch file



- Works offline
- Is quicker than Web

https://root.cern/blog/code-horsepower-f1/

qt-assistant

https://root.cern/blog/code-horsepower-f1/#the-power-of-f1

The power of an F1 – QtCreator

File Edit View Build Debug Analyze Tools Window Help

PulseSurfer.cpp | PulseSurfer::PulseSurfer(const TString) ... | Unix (LF) | Line: 97, Col: 2

```
96  fTimer(nullptr)
97  {
98      //Set automatic cleanup
99      SetCleanup(kDeepCleanup);
100     DontCallClose();
101
102     //Create Canvas
103     fCanvas = new TRootEmbeddedCanvas(kCanvasName,this,1200,750);
104     fCanvas->SetBit(kCannotPick);
105     fCanvas->GetCanvas()->Connect("ProcessedEvent(Int_t,Int_t,Int_t,TObject*)", "PulseSurfer",
106               this, "CaptureEvent(Int_t,Int_t,Int_t,TObject*)");
107     AddFrame(fCanvas, new TGLayoutHints(kLHintsExpandX | kLHintsExpandY, 2, 2, 2, 2));
108
109     //Event status bar below Canvas
110     Int_t parts[] = {45, 15, 10, 30};
111     fStatusBar = new TGStatusBar(this, 2, 2, kVerticalFrame);
112     fStatusBar->SetParts(pa
113     fStatusBar->Draw3DCorne
114     AddFrame(fStatusBar, new TGLayoutHints(kLHintsExpandX, 2, 2, 2, 2));
115
116     //File dialog text entry below Canvas and event status bar
117     /* This is the idea:
118     ------------------------ fileFrame ----------------------------
119     |                                                              |
120     |  Open file icon    Filename entry box     Event status bar   |
121     |                                                              |
122     ----------------------------------------------------------------
123     */
124     // Create horizontal group frame
125     fFileFrame = new TGHorizontalFrame(this,400,25);
126
127     // Create now the open file picture button and add it to the horizontal group frame
128     fOpenIcon = new TGPictureButton(fFileFrame,gClient->GetPicture("bld_open.png"));
129     fOpenIcon->SetToolTipText("Open file browser");
130     fOpenIcon->Connect("Clicked()", "PulseSurfer", this, "OpenFileBrowser()");
131     fFileFrame->AddFrame(fOpenIcon, new TGLayoutHints(kLHintsNormal,2,2,1,1));//padleft, padright, padtop, padbottom
132
133     // Create now the reload file picture button and add it to the horizontal group frame
134     fReloadIcon = new TGPictureButton(fFileFrame,gClient->GetPicture("bld_replace.xpm"));
135     fReloadIcon->SetToolTipText("Reload opened file");
136     fReloadIcon->Connect("Clicked()", "PulseSurfer", this, "ReloadFile()");
137     fFileFrame->AddFrame(fReloadIcon, new TGLayoutHints(kLHintsNormal,2,2,1,1));//padleft, padright, padtop,
padbottom
138
139     // Create now a text entry box inside the horizontal group frame and push it to the left.
140     fFileEntry = new TGTextEntry(fFileFrame);
141     fFileEntry->SetEnabled(kFALSE);
142     fFileEntry->SetToolTipText("Binary file name");
143     fFileEntry->Connect("TextChanged(char*)", "PulseSurfer", this, "OpenFromGUI()");
144     fFileFrame->AddFrame(fFileEntry, new TGLayoutHints(kLHintsExpandX,2,2,1,1));
145
146     TGLabel* fLabel;
147     //Combo boxes to select file format parameters
148     fLabel = new TGLabel(fFileFrame,"SP"); fLabel->ChangeOptions(fLabel->GetOptions() | kFixedSize); fLabel-
>Resize(25, 20); fFileFrame->AddFrame(fLabel, new TGLayoutHints(kLHintsNormal,2,2,1,1));
149     fSamplesPerPulseBox = new TGComboBox(fFileFrame, "4096");
150     fSamplesPerPulseBox->EnableTextInput(kFALSE);
151     fSamplesPerPulseBox->Resize(60,22);
```

TGStatusBar::TGStatusBar(const TGWindow *p, UInt_t w, UInt_t h, UInt_t options, Pixel_t back)

Open in Help Mode

ROOT
Reference Guide

TGStatusBar Class Reference

GUI » Low level GUI widgets

List of all members | Public Member Functions | Static Public Member Functions | Protected Member Functions | Static Protected Member Functions | Protected Attributes | Static Protected Attributes | Private Member Functions | Friends | List of all members

Provides a StatusBar widget.

Definition at line 21 of file TGStatusBar.h.

Public Member Functions

	TGStatusBar (const TGWindow *p=nullptr, UInt_t w=4, UInt_t h=2, UInt_t options= kSunkenFrame|kHorizontalFrame, Pixel_t back=GetDefaultFrameBackground())
	Create a status bar widget. More...
virtual	~TGStatusBar ()
	Delete status bar widget. More...
void	AddText (const char *text, Int_t partidx=0)
void	Draw3DCorner (Bool_t corner)
virtual void	DrawBorder ()
	Draw the status bar border (including cute 3d corner). More...
TGCompositeFrame *	GetBarPart (Int_t npart) const
	Returns bar part. More...
TGDimension	GetDefaultSize () const
	Return default size. More...
const char *	GetText (Int_t partidx=0) const
	return text in the part partidx More...
virtual TClass *	IsA () const

Welcome | Edit | Design | Debug | Projects | Help | zdt-daq | Debug

Type to locate (Ctrl+K) | 1 Issues 2665 | 2 Search Results | 3 Application Output | 4 Compile Output | 5 QML Debugger Console | 6 General Messages | 7 Version Control | 8 Test Results

https://root.cern/blog/code-horsepower-f1/#the-power-of-f1

Other useful IDE features

- Auto clang-format

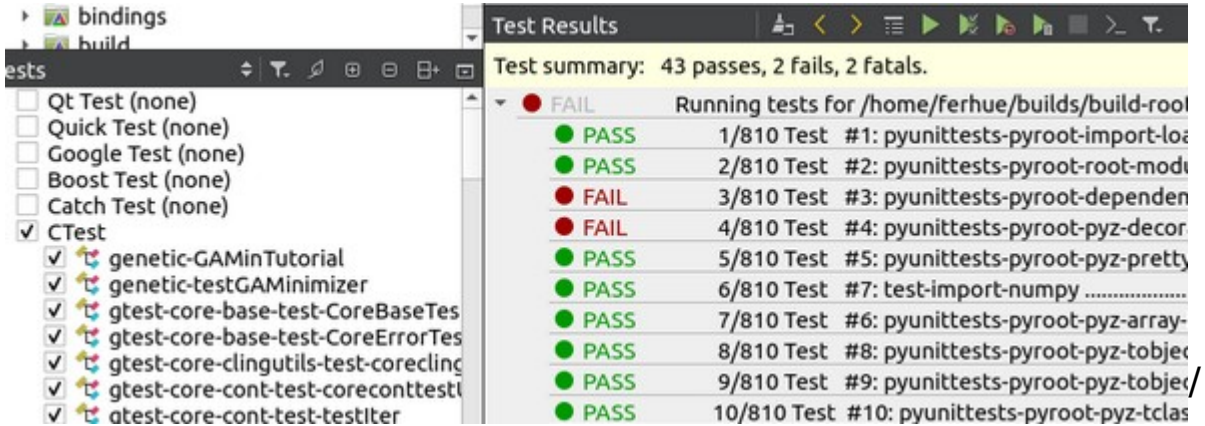
```
int main(int argc, char* argv[])
{
```

```
int main(int argc, char *argv[]) {
```

- Git version control

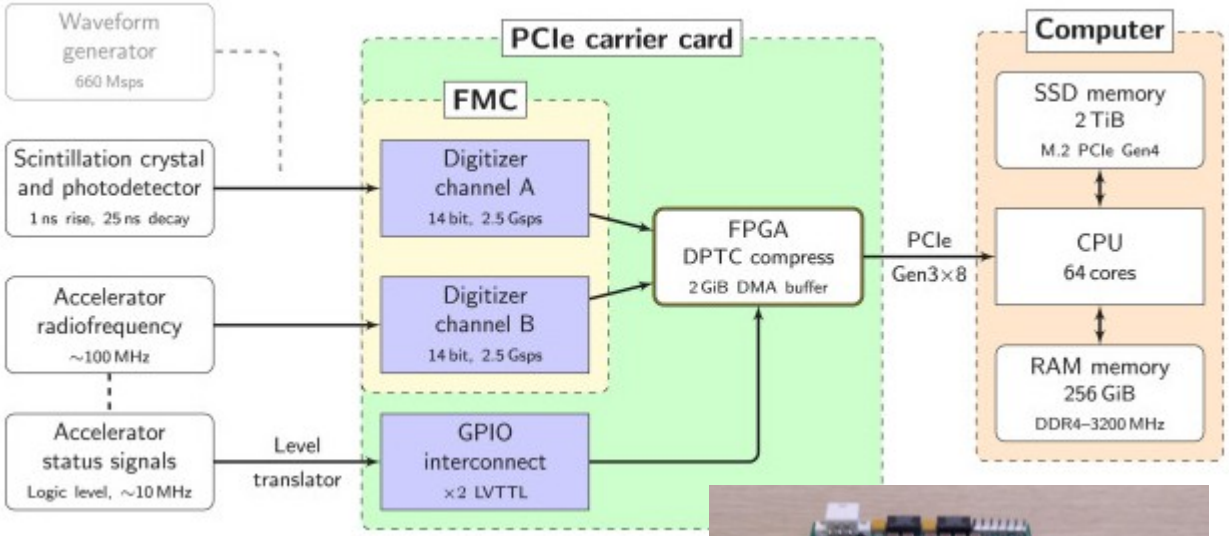
```
[a0107b45e5] cmake/modules/RootConfiguration.cmake
[Skipped 783 lines...]  configure_file(${CMAKE_SOURCE_DIR}/cmake/scrip
string(REGEX REPLACE "(^|[ ]+)-W[^ ]+" "" __cxxflags "${CMAKE_CXX_FLAGS
string(REGEX REPLACE "(^|[ ]+)-W[^ ]+" "" __cflags "${CMAKE_C_FLAGS}")

if(MSVC)
  string(REPLACE "-I${CMAKE_SOURCE_DIR}/build/win" "" __cxxflags "${__c
  string(REPLACE "-I${CMAKE_SOURCE_DIR}/build/win" "" __cflags "${__cfl
endif()

if (cxxmodules)
  # Re-add the -Wno-module-import-in-extern-c which we just filtered ou
  # We want it because it changes the module cache hash and causes modu
[Skipped unknown number of lines...]
```

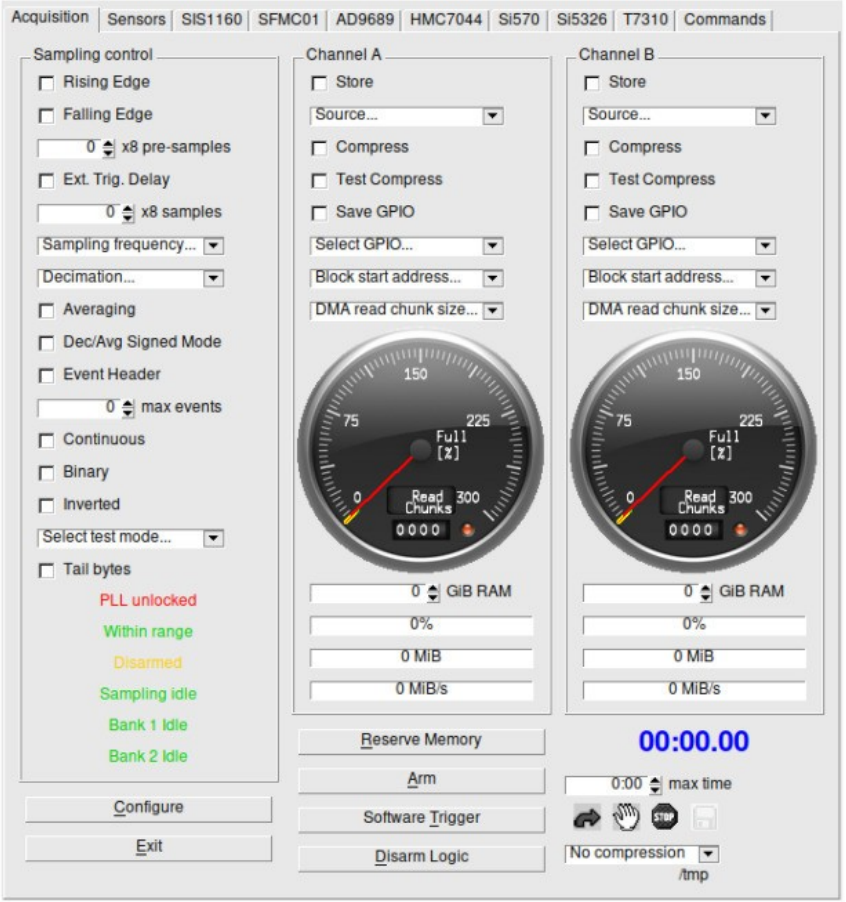
- CTest integration



https://doi.org/10.1016/j.nima.2022.166701

Application: dead-time free DAQ





5.5 GByte/s sustained transfer speed – dead-time free data streaming for 52 seconds @ 2.5Gsps

https://www.struck.de/sis1160-sfmc01.html

https://github.com/root-project/root/pull/8546

Proposals

- There is TH1<int>, but no TH1<long>

implement long long version of th1i th2i th3i #8546

Open **ferdymercury** wants to merge 4 commits into `root-project:master` from `ferdymercury:th1_long`

Conversation 62 | Commits 4 | Checks 4 | Files changed 22

Changes from **all commits** | **File filter** | **Conversations**

1 `bindings/pyroot_legacy/JupyROOT/helpers/cppcompleter.py`

2 `core/rint/test/TTabComTests.cxx`

2 `documentation/primer/histograms.md`

```
@@ -149,4 +149,4 @@ macros shows how it looks for 2D histograms:
149  149
150  150   ![Two 2D histograms stack on top of each other.\label{f56}][f56]
151  151
152      - [^4]: To optimise the memory usage you might go for one byte (TH1C), short (TH1S), integer (TH1I) or double-precision (TH1D) bin-content.
     152  + [^4]: To optimise the memory usage you might go for one byte (TH1C), short (TH1S), integer (TH1I), long64 (TH1L64) or double-precision (TH1D) bin-content.
```

https://github.com/root-project/root/issues/10474
https://github.com/root-project/root/issues/9491

Proposals

- Save Graph or Histograms as .txt (e.g. for later np.loadtxt)

TGraph SaveAs .csv #9491

Closed **ferdymercury** opened this issue on Jan 4 · 11 comments

ferdymercury commented on Jan 4 • edited

Is your feature request related to a problem? Please describe.

When working with collaborators from other disciplines, it is always problematic to share results and raw data created in ROOT in formats other than PNG or PDF.

THistSaveAs txt or csv #10474

Open **ferdymercury** opened this issue 5 days ago · 0 comments

ferdymercury commented 5 days ago • edited

Explain what you would like to see improved

I open this to keep track of a suggestion by **@lmoneta** to save histograms as csv or txt files.

Proposals

Improving Doxygen documentation, solve warnings:

- from 10k+ warnings down to 1k)
- from 4h to <1h build time

ROOT bugs	Doxygen bugs	Speedup build
https://github.com/root-project/root/pull/9655	https://github.com/doxygen/doxygen/issues/9094	https://github.com/root-project/root/pull/9966
https://github.com/root-project/root/pull/9651	https://github.com/doxygen/doxygen/issues/9144	Migrate to CMake for easier integration

...

...

https://github.com/root-project/web/pull/748

Proposals

https://github.com/doxygen/doxygen/issues/9222

https://github.com/root-project/root/issues/9953

Automated test PR for correct code documentations

Review required Show all reviewers

At least 1 approving review is required by reviewers with write access. Learn more.

2 pending reviewers

Some checks were not successful Hide all checks

1 failing, 2 neutral, and 2 successful checks

✕	**clang-tools code analysis / clang-format (pull_request)** Failing after 41s — clang-format	Details
■	**LGTM analysis: Go** Completed in 2m — No code changes detected	Details
■	**LGTM analysis: JavaScript** Completed in 2m — No code changes detected	Details
✓	**Jenkins CI build** — Build passed	Details
✓	**LGTM analysis: Python** Successful in 25m — No new or fixed alerts	Details

X --- Doxygen: 5 Warnings detected in changed files Details

Proposals

https://github.com/root-project/root/pull/10366

```
root [0] .gh bug
```

Title

Write | Preview

☐ Checked for duplicates

Describe the bug

Expected behavior

To Reproduce

Setup

```
ROOT v6.27/01
Built for linuxx8664gcc on Apr 08 2022, 16:45:48
From heads/ghissue@v6-25-01-3827-gb92902bef3
With c++ (Ubuntu 8.4.0-1ubuntu1~18.04) 8.4.0
Binary directory: /home/builds/build-root_src-Desktop_Qt_5_15_0_GCC_64bit-Debug/bin
```

Additional context

Proposals

https://github.com/LongyuYang/Cling-with-SYCL

Portable parallel programming for CPU, GPU, FPGA...

https://root-forum.cern.ch/t/root-cling-and-sycl/46014

ROOT, cling and SYCL

Cling cling

ferhue

Hello dev's,

I was wondering what are the team's thought / plans with respect to SYCL. support of it within ROOT / cling envisioned? Or only later after it is shown widely accepted / used?

README.md

Cling with SYCL

Cling C++ Interpreter with SYCL extension. The root repository

Installation

Download SYCL compiler with jupyter-patch

Clone and build SYCL Compiler following this guide

Usage

Lauch cling with -fsycl argument:

```
cling -fsycl
```