The State of ROOT

http://root.cern
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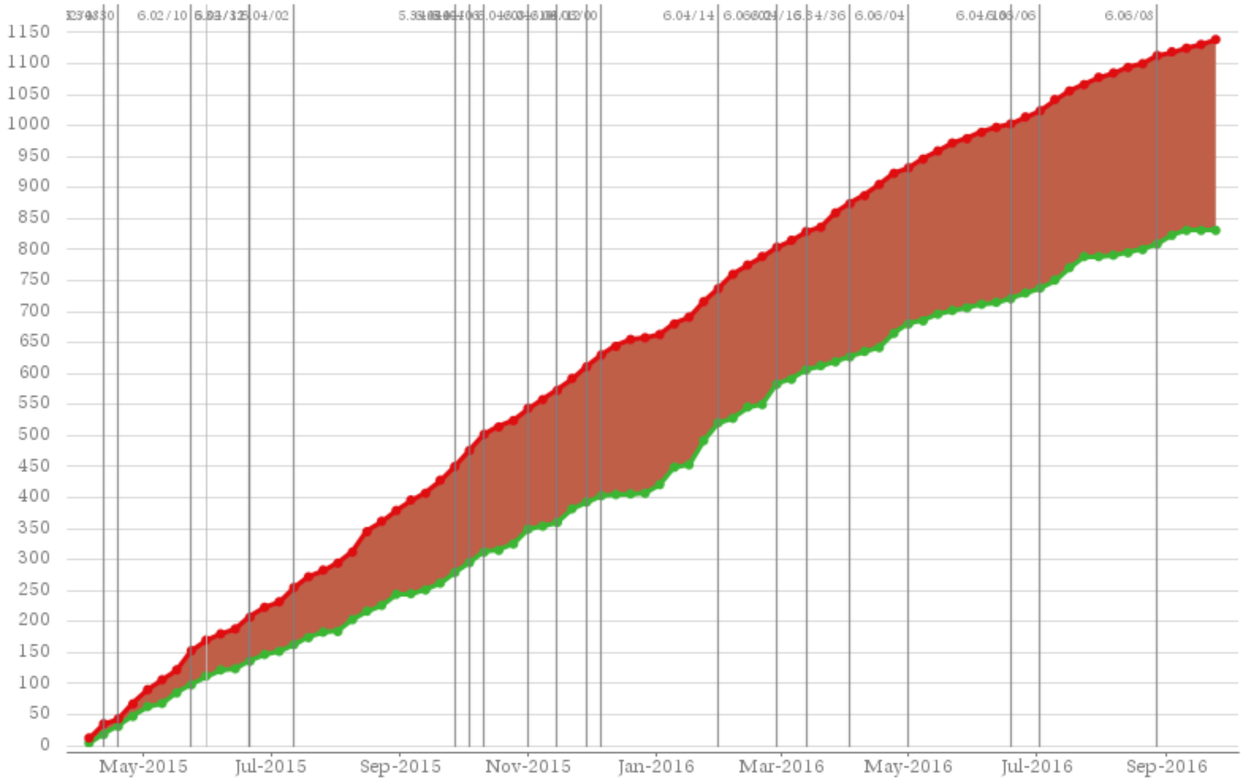
2016-10-10, CHEP 2016 / San Francisco

Stats since Okinawa

- v6.04: June, 2015; v6.06: Dec, 2015; v6.08: Oct, 2016; ROOT 5 frozen
- 1150 new bugs, 850 resolved
- Forum: 14k posts in 18 months, now 10k users



Stats since Okinawa (2)

- >5k commits
- About 90 authors
- >200 pull requests @ github.com/root-mirror
  - with 34 open ones

Word cloud of commit logs

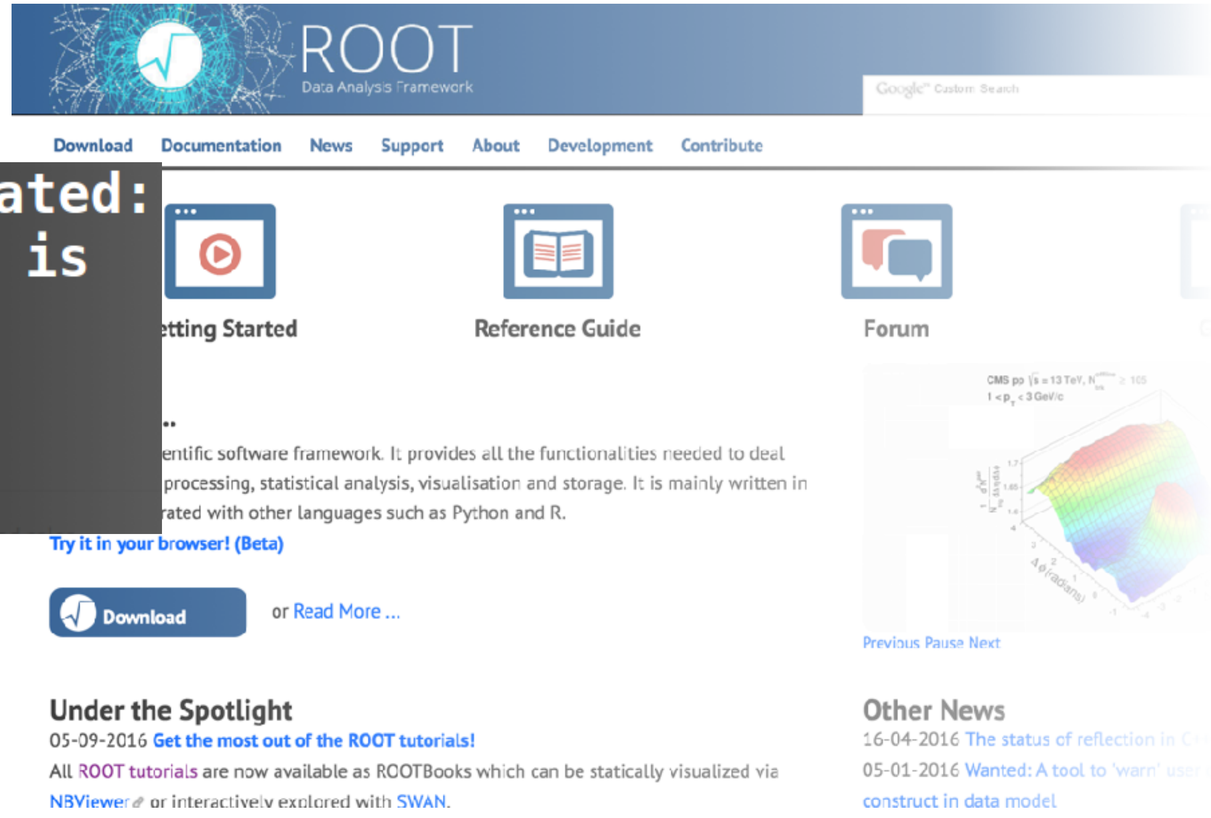
Word cloud of commit logs
minus “doxygen”

News

- New-style interfaces: #include “ROOT/TFoo.hxx”, ROOT::TFoo
- Started to deprecate interfaces

```
deprec.cxx:9:23: warning: 'Old' is deprecated:
      will be removed in ROOT v6.10: This is
      Old(), please use New()!
      [-Wdeprecated-declarations]
int var = TSomeClass::Old();
                      ^
```

- New web site

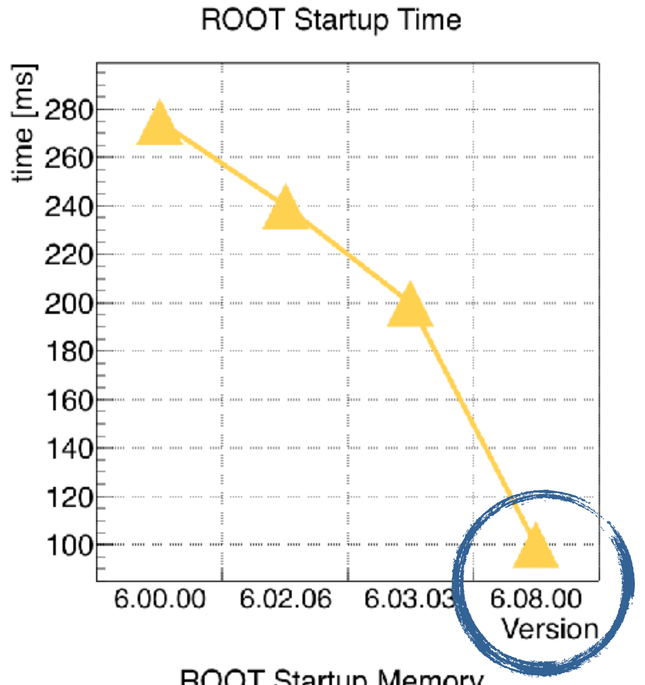


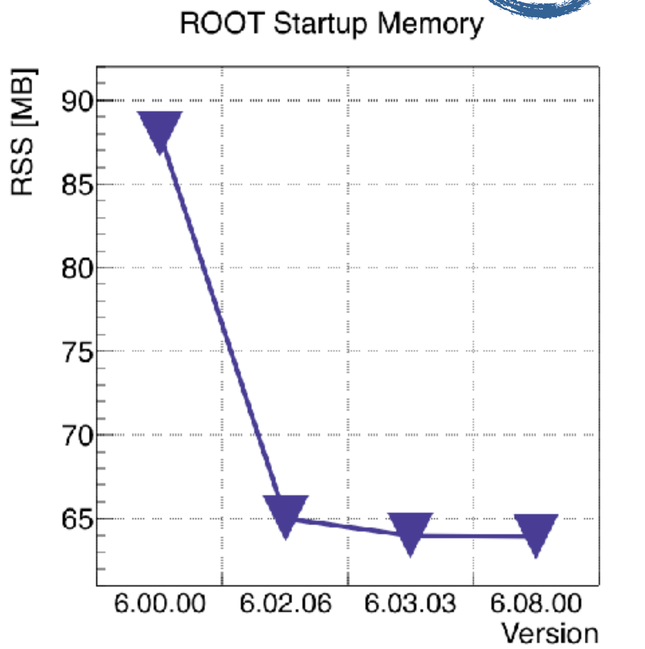
Core

- Pulling in std::string_view, std::array_view, std::apply from the future
- Support for builds with C++ modules (clang only) - thanks, US-CMS!
- ROOT::TSeq: integer range a la python xrange;
  ROOT::TThreadedObject: one object per thread, merge on demand
- **Still coming**: thread safe ROOT memory management (“list of cleanups”), const == thread safe

I/O, Dictionaries

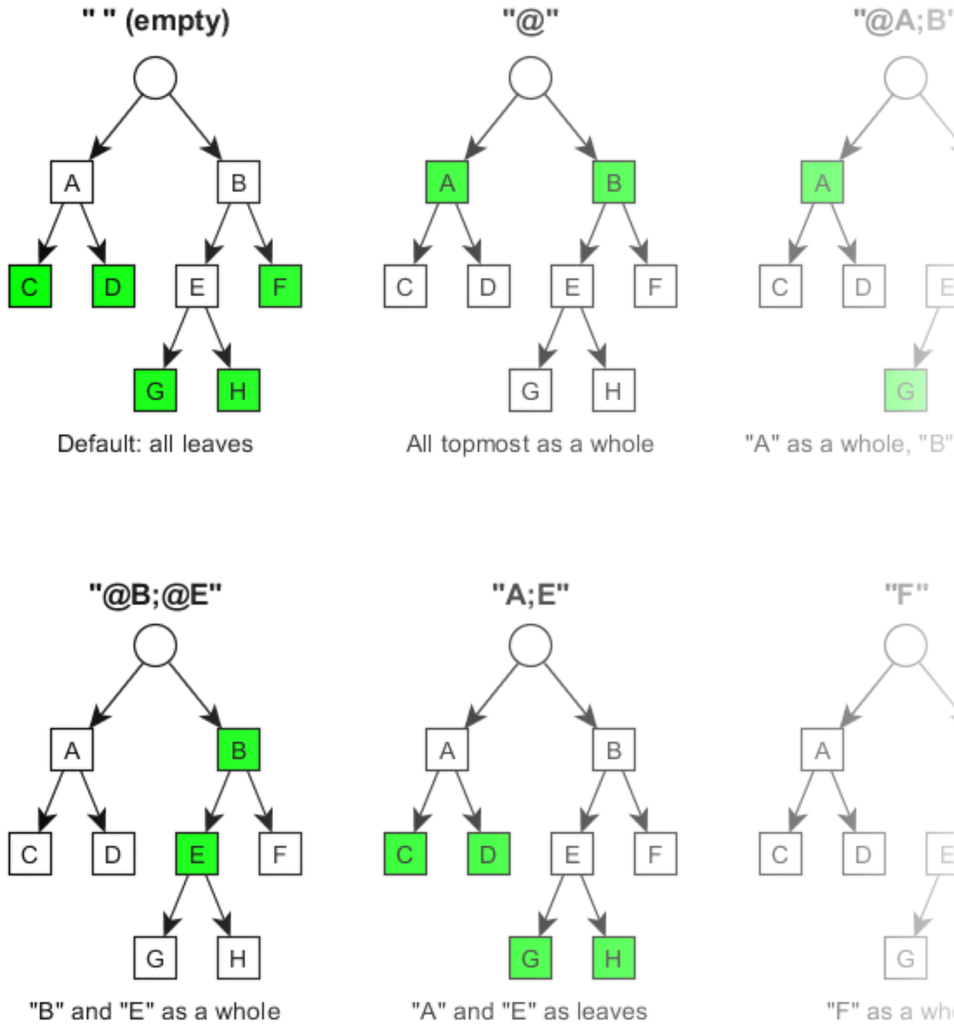
- New C++ types for I/O: unique_ptr, array, tuple (already had unordered_*, forward_list)
- Memory reduction; more thread safety
- **Still coming**: zero-copy I/O, byte swapping, atomic<T>, shared_ptr, parallel write, schema evolution write rules, improved type system, use JIT, I/O for interpreted classes, improve compression of branch of unsplit collections, reduce overhead for deep hierarchy, thread safe (slower) version of TFile





Tree

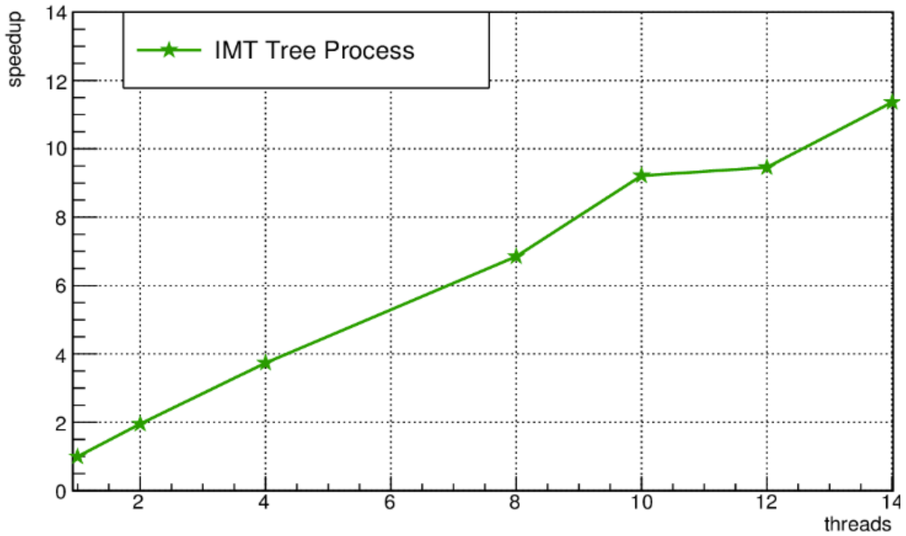
- MakeSelector uses TTreeReader (thank you, summer student Akos!)
- **Still coming**: parallel basket compression, compression of individual entries, production quality Parallel Tree Merger, faster + smarter TTreeFormula (using JIT), TTree::SetBranchAddress matching input type and branch content, vectorization in TTree::Draw and TTree interfaces



Parallel ROOT

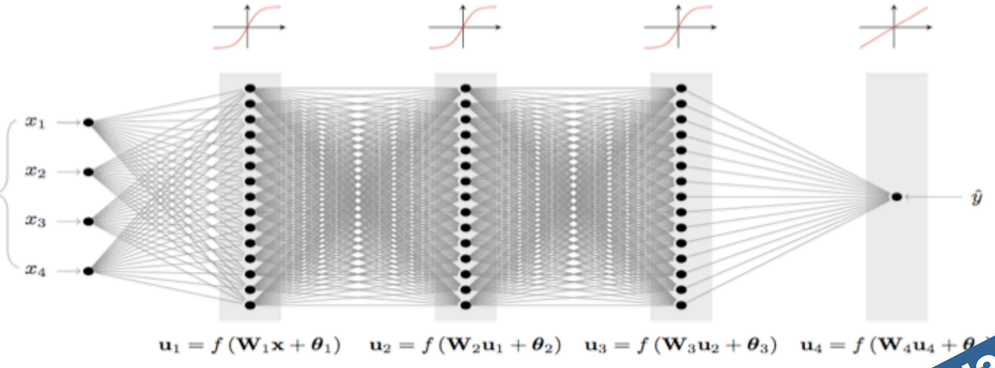
id258
Here @ 14:45
Danilo Piparo

- Multi-threaded TTree::GetEntry(), lambda-on-a-tree
  - enable with -Dimt=ON and ROOT::EnableImplicitMT()
- MultiProc tree analysis



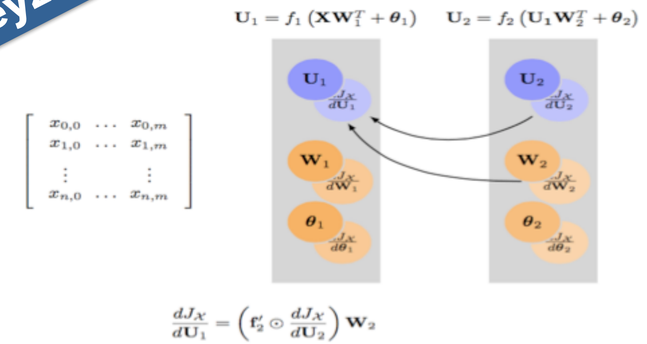
- **Still coming**: parallel analysis with functional programming, focusing on Python

Math



id321
Here @ 15:15
Sergei Gleyzer

- TMVA: deep learning in TMVA, RMVA, PyMVA (scikit-learn), JsMVA 20/90 authors! First time on GPU! Thank you, summer students + GSOCs: Omar +Simon + Attila!



- MixMax random number generator, see Computer Physics Communications 196 (2015) 161 / http://arxiv.org/abs/1403.5355

- **Still coming**: vectorization + parallelization of fitting; TMVA + Keras / Theano

Interpreter

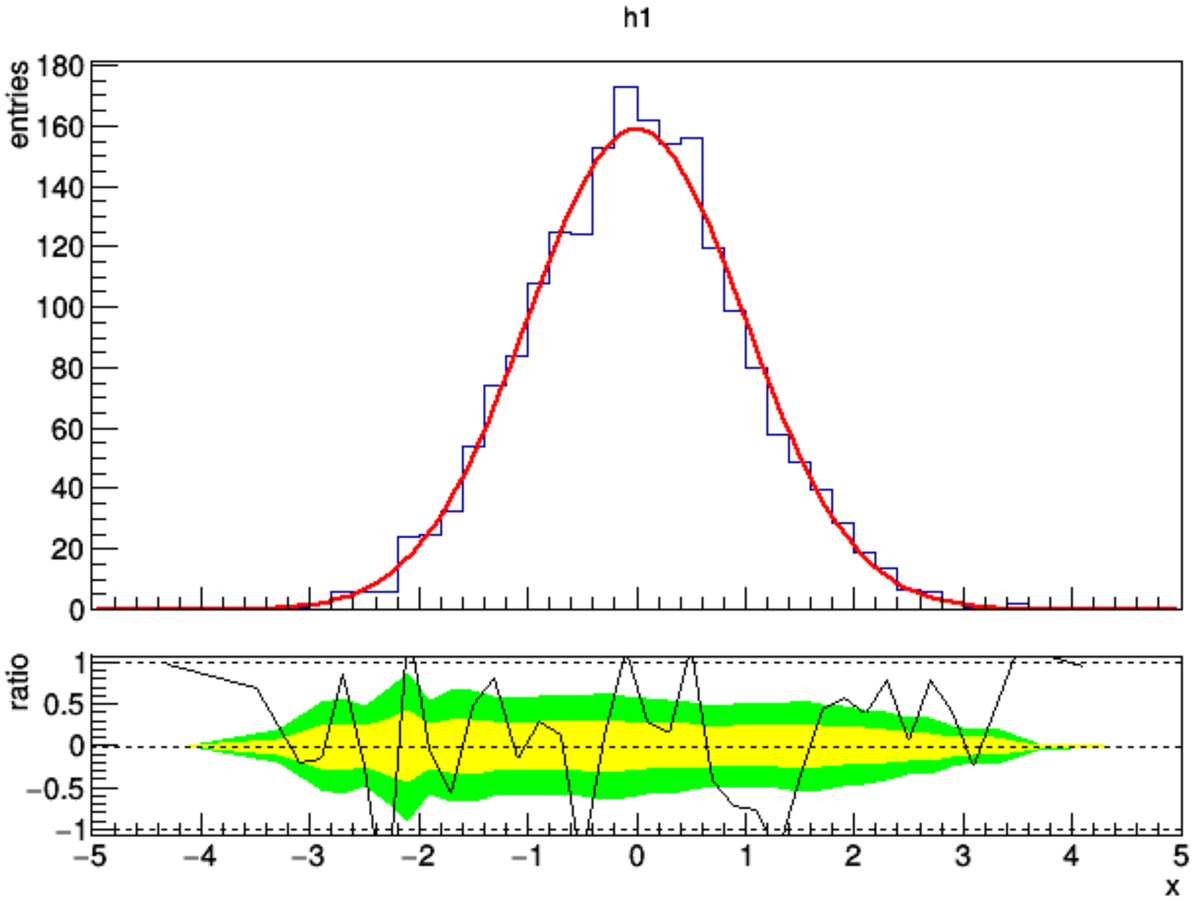
- Exception support, GCC5 ABI, *pointer validity check, more value printing
- Python 3 support

```
Execution of your code was aborted.
ROOT_prompt_1:1:1: warning:
      invalid memory pointer passed
      to a callee:
h->Draw()
^
```

- **Still coming**: unloading, Windows, even lazier compilation (a la Julia), modules for dictionaries

Graphics

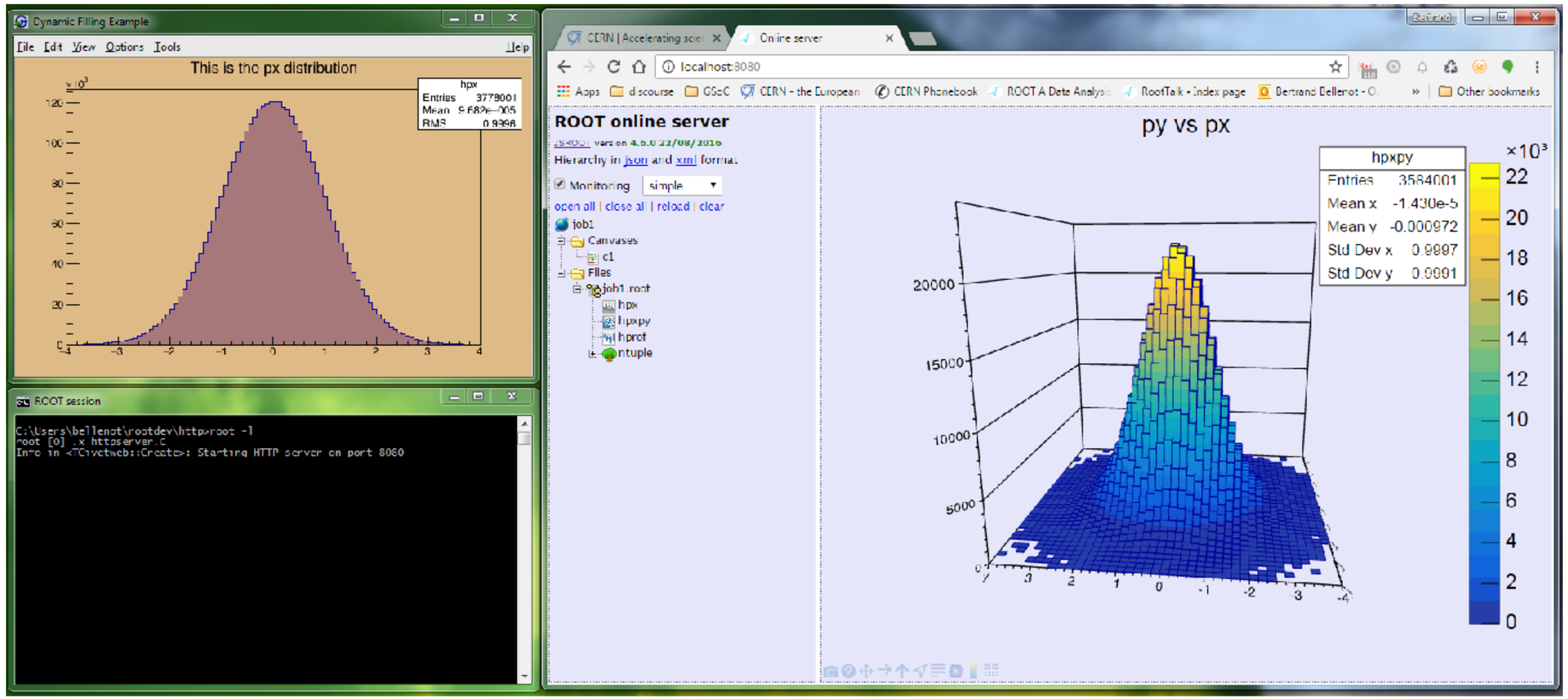
- TRatioPlot (thank you, summer student Paul!)



- **Still coming**: auto-coloring of multiple histograms, auto-placement of legend, fixed size fonts by default; switching to a web-based UI

Net

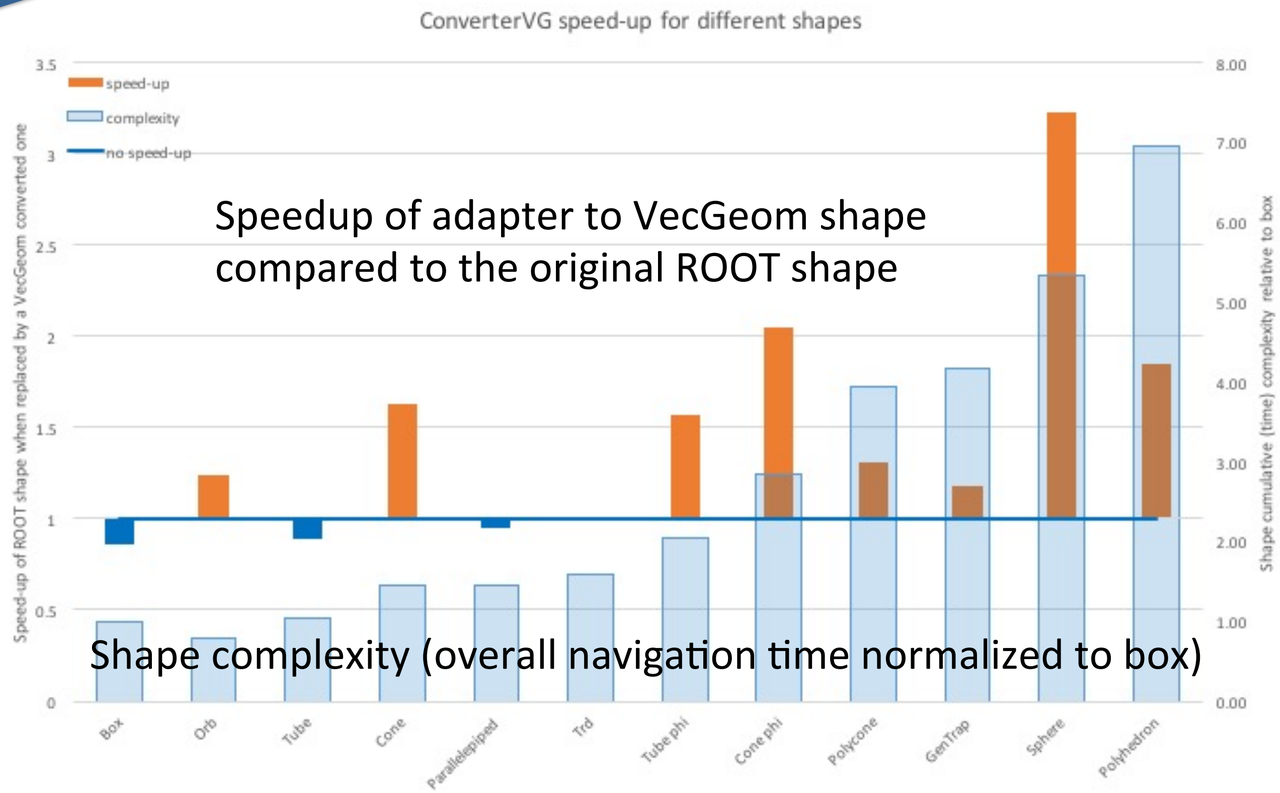
- THttpServer: bi-directional communication enabling interactive use of ROOT from the browser



Geometry

id393
Wed 12:00, Track 5
Sandro Wenzel

- VecGeom adaptor / conversion
- GDML expression parsing (JITted), treatment of global constants



Usability

- Doxygen documentation
- Jupyter-ized tutorials (thank you, summer student Pau!)
- rootdrawtree -i *.root -o out.root -hs ‘histphi=jets.phi’ / TSimpleAnalysis (thank you, summer student Luca!)

jupyter nbviewer

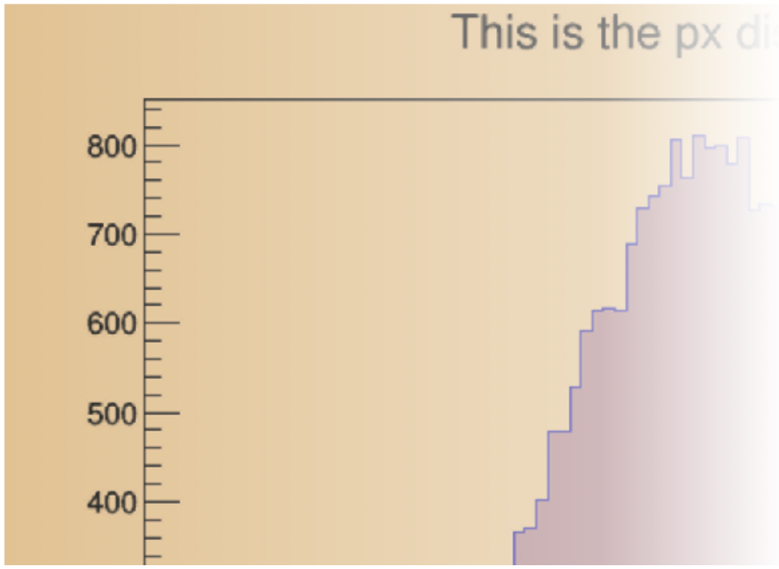
Save all objects in this file

In [8]:
```
hpx->SetFillColor(0);
hfile->Write();
hpx->SetFillColor(48);
c1->Modified();
return hfile;
```

Note that the file is automatically close when application term

Draw all canvases

In [9]:
```
gROOT->GetListOfCanvases()->Draw()
```



CMake

- Many “built-in” external packages
  - downloaded + built with a simple -Dvc=ON etc
- configure/make now deprecated
  - about 1000 changes to CMake files since Okinawa
- **Still coming**: cross-build

R&D

id156
After this one,
Philippe Canal

- New interfaces in ROOT::Experimental

Extensions / Context

- JSROOT: can now draw simple TTree branches; geometry, tracks & hits (“JS-Eve”)
- Jupyter notebooks
  - SWAN

id17
Thu 16:30 / Poster
Sergey Linev

id260
Here @ 15:00
Danilo + Enric

id257
Wed 11:45, Track 6
Danilo + Enric

Fit the function to the generated data.

```
In [3]: f2.SetParameters(0.7, 1.5);  // set initial values for
        f2.SetTitle("Fitted 2D function");
        dte.Fit(&f2);
```

```
 FCN=517.445 FROM MIGRAD    STATUS=CONVERGED       38 CA
                   EDM=2.65702e-12    STRATEGY= 1
  EXT PARAMETER                                        STEP
  NO.   NAME      VALUE            ERROR          SIZE
   1  p0           6.81725e-01   4.37173e-01   2.40425e
   2  p1           1.46084e+00   9.36798e-01   5.15197e
```

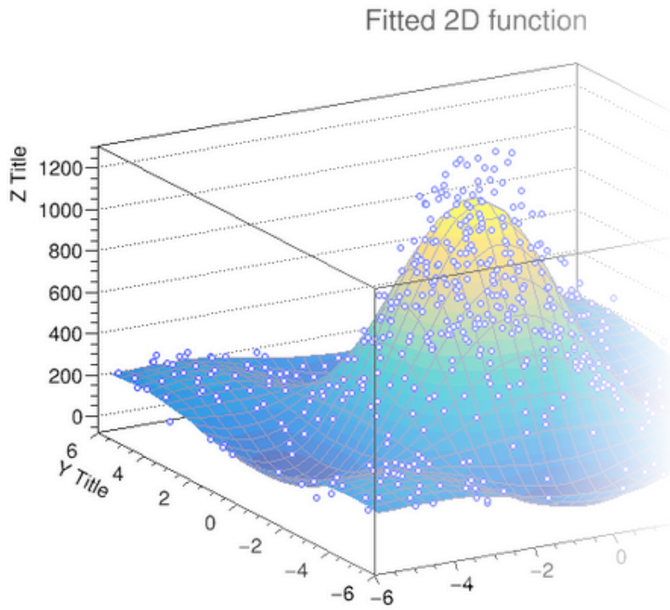
Configure the canvas for plotting the result.

```
In [4]: TCanvas c1;
        f2.SetLineWidth(1);
        f2.SetLineColor(kBlue - 5);
        f2.Draw("Surf1");

        auto Xaxis = f2.GetXaxis(); Xaxis->SetTitle("X Title");
        auto Yaxis = f2.GetYaxis(); Yaxis->SetTitle("Y Title");
        auto Zaxis = f2.GetZaxis(); Zaxis->SetTitle("Z Title");
        dte.Draw("P0 Same");
```

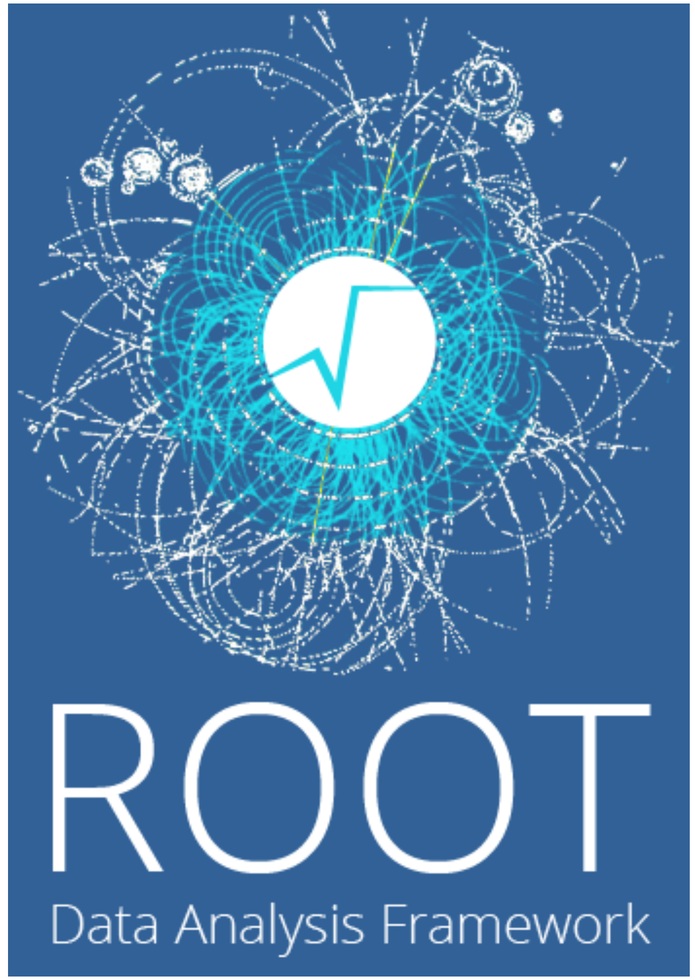
Display the 2D graph in the notebook.

```
In [5]: c1.Draw();
```



Summary

- Ongoing development in many areas
- Keep the contributions coming!
  - feedback: root.cern/forum
  - bugs: root.cern/bugs
  - PRs: github.com/root-mirror/root
- Are we addressing your needs?



Backup

VecGeom adapter/converter

- New VecGeom solids adapter to TGeoShape
  - Providing only navigation functionality
  - Original ROOT shape pointer kept for other functionality (e.g. visualization)
- Converter for any transient TGeo geometry
  - Replacing shapes with the adapted matched in VecGeom
- New library built on demand
- One line usage: TVirtualGeoConverter::Instance()::ConvertGeometry()