ROOT prompt usability features and the strict option

Yuka Takahashi - Princeton University, CERN
Vasil Geogiev Vasilev - Princeton University
Axel Naumann - CERN

ROOT Prompt

```
$ root <options>
root [0]
```

`--strict`

(Available in 6.16!)

To begin with,
What are existing options right now?

Agenda

1. Summary of older options - Available NOW
2. Summary of fairly new options - Available NOW
3. Strict option - Will be available in the next release

Summary of older options

Summary of older options

- memstat `$ root -memstat hsimple.root`

Available since 5.28
Requires: Nothing :)

- Benchmark your codes' memory usage
- Records all calls to malloc and free

```
$ root -memstat tutorials/hsimple.C -q -l
Info in <TMemStatMng::Close>: Tree saved to file memstat_27174.root
Info in <TMemStatMng::Close>: Tree entries = 33558, file size =
0.957537
Info in <Memstat::TMemStatMng::~TMemStatMng>: >>>
All free/malloc calls count: 321995
Info in <Memstat::TMemStatMng::~TMemStatMng>: >>>
Unique BTIDs count: 63363
```

Summary of older options

Available since long time ago
Requires: External compiler

ACLiC

```
$ root hsimple.C+
```

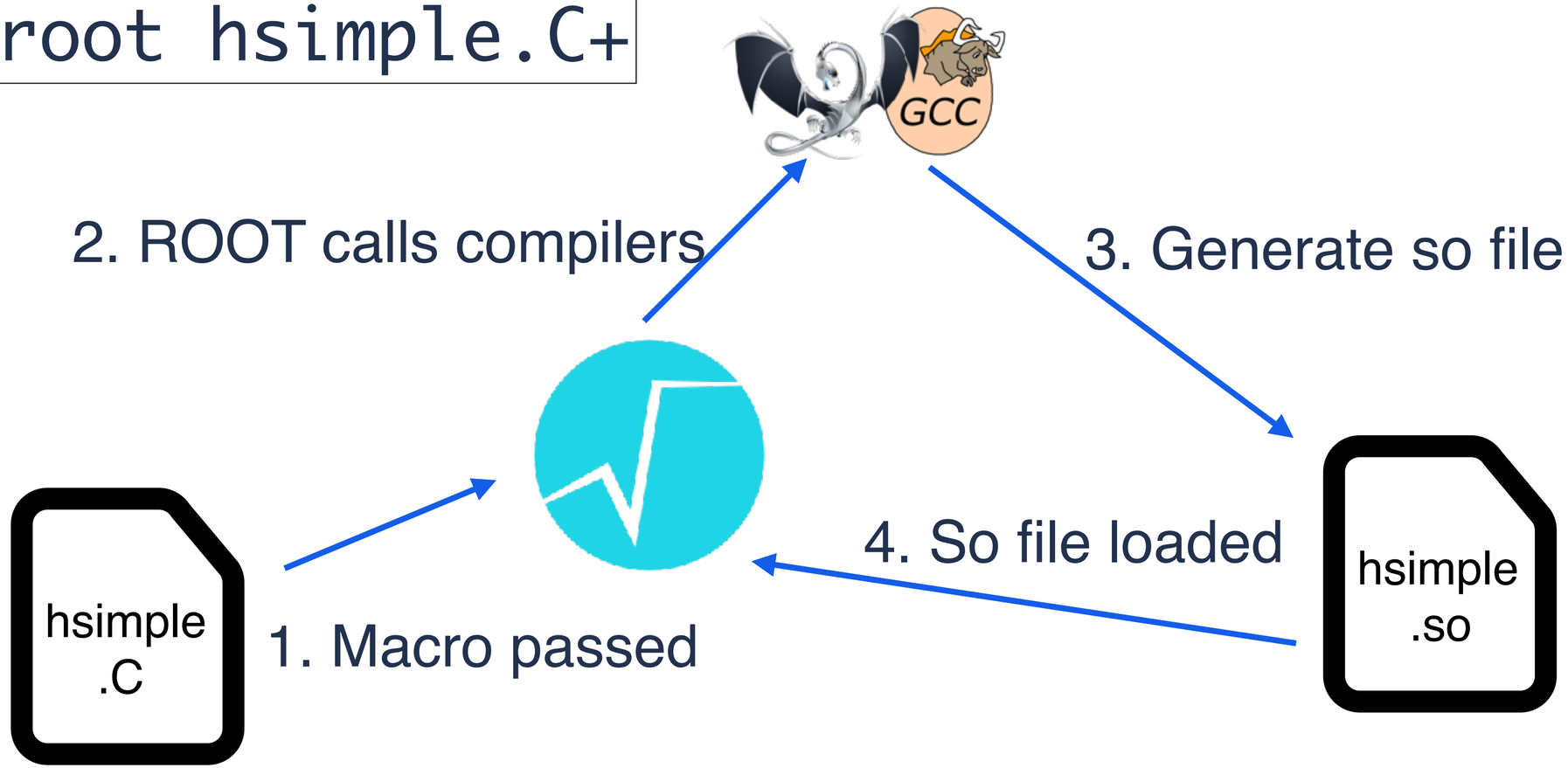
- Ensure the code is correct enough
- Code run in the speed of compiled C++

Summary of older options

ACLiC

Available since long time ago
Requires: External compiler

```
$ root hsimple.C+
```



Summary of older options

- **config**

```
$ root -config
```

Available since long time ago
Requires: Nothing :)

Use for debugging purpose to see cmake CACHE_VARIABLES

```
$ root -config
ROOT ./configure options:
BLAS_Accelerate_LIBRARY=/System/Library/Frameworks/
Accelerate.framework FFTW_INCLUDE_DIR=/usr/local/include
FFTW_LIBRARY=/usr/local/lib/libfftw3.dylib
GL2PS_INCLUDE_DIR=/usr/local/include GL2PS_LIBRARY=/usr/
local/lib/libgl2ps.dylib JPEG_INCLUDE_DIR=/usr/local/
include…
```

Summary of fairly new options

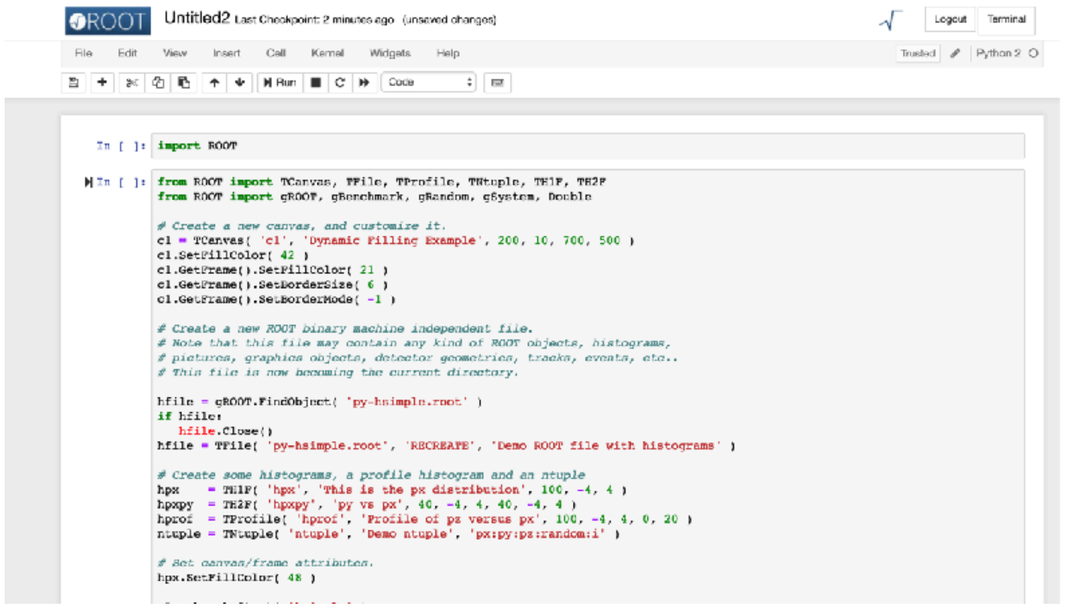
Summary of older options

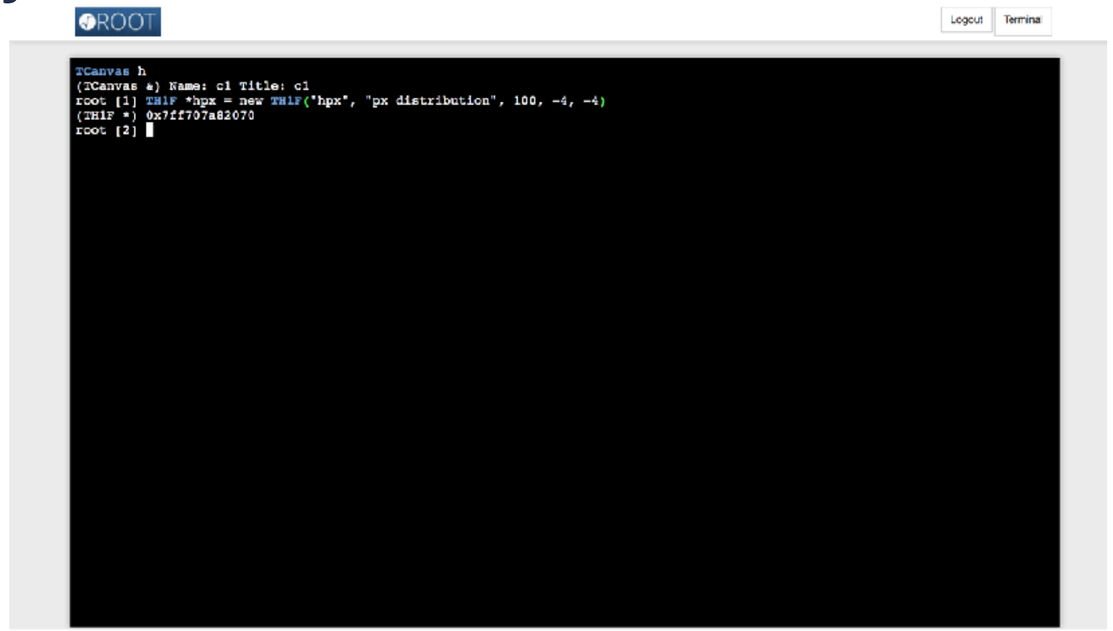
- - notebook

```
$ root --notebook
```

Available since 6.07.06
Requires: Jupyter to be installed
$ sudo pip install jupyter

Activate both ROOT C++ and python





Refer to https://root.cern.ch/notebooks/HowTos/HowTo_ROOT-Notebooks.html for more information.

Summary of fairly new options

-t

```
$ root -t hsimple.C
```

Available since 6.10
Requires: -Dimt=ON (by default)
$ cmake ../root -Dimt=ON

Equivalent to

```
$ root
root [0] ROOT::EnableImplicitMT()
```

Enable multi-threading in

- RDataFrame
- TTree read and write
- TMVA training
- Fitting

Refer to Danilo's talk for more information

Summary of fairly new options

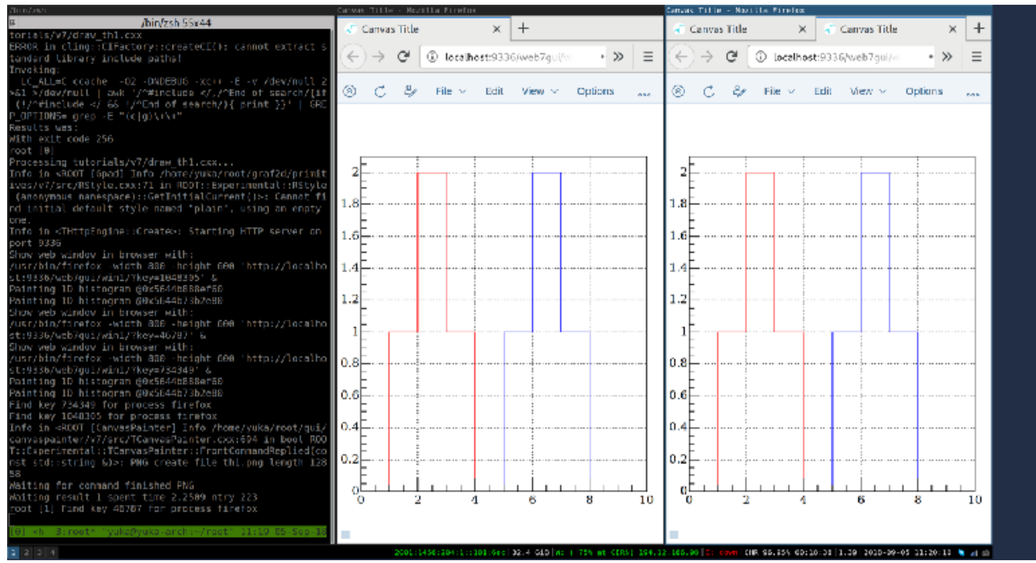
- - web

Available since 6.14
Requires: C++14 (root 7)

```
$ cmake ../root -Dcxx14=ON
```

```
$ root --web firefox draw_th1.cxx
```

- Specify the browser to display graphics
- The default is chrome



Refer to Sergey's talk for more information

Strict option

Strict option

- - strict

Work in progress!
Will be available in 6.16 (or 6.18)
Requires: Nothing :)

Use prompt with proper C++!

Strict option

- - strict

Work in progress!
Will be available in 6.16 (or 6.18)
Requires: Nothing :)

ROOT backend interpreter supports a superset of C++

```
$ root
root [0] vector<int> v = {1, 2, 3}
(std::vector<int> &) { 1, 2, 3 }
```

This is done by an effort of C++ interpreter
It’s not valid C++!

Strict option

- - strict

Work in progress!
Will be available in 6.16 (or 6.18)
Requires: Nothing :)

ROOT backend interpreter supports a superset of C++

```
$ root
root [0] vector<int> v = {1, 2, 3}
(std::vector<int> &) { 1, 2, 3 }
```

This superset support is a nice feature.. but
May mess up your code when debugging

Strict option

- - strict

Work in progress!
Will be available in 6.16 (or 6.18)
Requires: Nothing :)

`--strict` **disables** C++ superset supports

```
$ root --strict
root [0] int a = 1;
root [1] a
(int) 1
root [2] std::vector<int> b;
input_line_7:2:7: error: no member named 'vector' in namespace
'std'
 std::vector<int> b;
 ~~~~~^

…
root [3] #include <vector>
root [4] std::vector<int> b;
root [5] b = {1,2,3}
(std::vector &) { 1, 2, 3 }
```

Valid in C++

NOT Valid C++
(Only works in ROOT)

Valid if you #include vector

Strict option (1/3)

List of `--strict` does NOT support = C++ superset support in ROOT

- Auto auto
  ```
  root [0] i = 12 // Interpreted as “auto i = 12”
  ```
- PCH
  ```
  root [0] TString s;  // Without #include
  ```
- using namespace std
  ```
  root [0] string s;  // Instead of std::string
  ```
- Eval print
  ```
  root [0] 40+2 // without semicolon at the end
  (int) 42
  ```

Strict option (2/3)

List of `--strict` does NOT support = C++ superset support in ROOT

- Auto loading TFile objects

```
root [0] TFile::Open("tutorials/hsimple.root");
root [1] hpx->Draw();
Info in <TCanvas::MakeDefCanvas>:  created default TCanvas with name c1
```

- Auto loading

```
root [0] TTree t;
Info in <TMacOSXSystem::Load>: loaded library
/Users/axel/build/root/cmake/lib/libTree.so, status 0
```

Strict option (3/3)

List of `--strict` does NOT support = C++ superset support in ROOT

- Auto-parsing

```
root [0] gSystem->Load("libGeom")
```

Info in <TMacOSXSystem::Load>: loaded library /Users/axel/build/root/cmake/lib/libGeom.so, status 0…

```
root [1] TGeoManager g; // triggers auto-parsing!
```

Info in <TInterpreter::AutoParse>: Parsing full payload for TGeoManager

- Ptr check

```
root [0] int *p = (int*)(0x120 + 0x3);
root [1] *p
```

ROOT_prompt_1:1:2: warning: invalid memory pointer passed to a callee:
*p
 ^

Conclusion

- Summary of old and new options
  - -memstat, ACLiC, -config
  - - - notebook, -t, - - web
- Strict option
  - Eliminate interpreter support of C++ superset
  - Enhance C++ code quality
  - Debugging purpose
  - “Pure” Cling

Stay tuned for 6.16!

Thank you for your attention!

Backup Slides

```
[yuka@yuka-arch module-release]$ root --pedantic -q -l

****************** CLING ******************
* Type C++ code and press enter to run it *
*             Type .q to exit             *
*******************************************
[cling]$ vector<int> a = {1, 2, 3}
input_line_4:2:2: error: use of undeclared identifier 'vector'
 vector<int> a = {1, 2, 3}
 ^
input_line_4:2:12: error: expected '(' for function-style cast or type construction
 vector<int> a = {1, 2, 3}
        ~~~^
input_line_4:2:14: error: use of undeclared identifier 'a'
 vector<int> a = {1, 2, 3}
             ^
[cling]$ #include <vector>
[cling]$ vector<int> b = {1, 2, 3}
input_line_6:2:2: error: use of undeclared identifier 'vector'
 vector<int> b = {1, 2, 3}
 ^
input_line_6:2:12: error: expected '(' for function-style cast or type construction
 vector<int> b = {1, 2, 3}
        ~~~^
input_line_6:2:14: error: use of undeclared identifier 'b'
 vector<int> b = {1, 2, 3}
             ^
[cling]$ std::vector<int> b = {1, 2, 3}
(std::vector<int> &) { 1, 2, 3 }
[cling]$
```

Strict