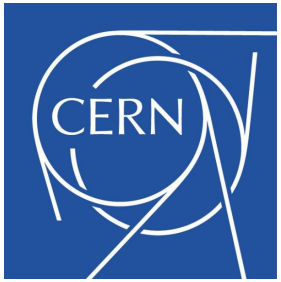
Google
Summer of Code



Improving performance of BioDynaMo using ROOT C++ Modules

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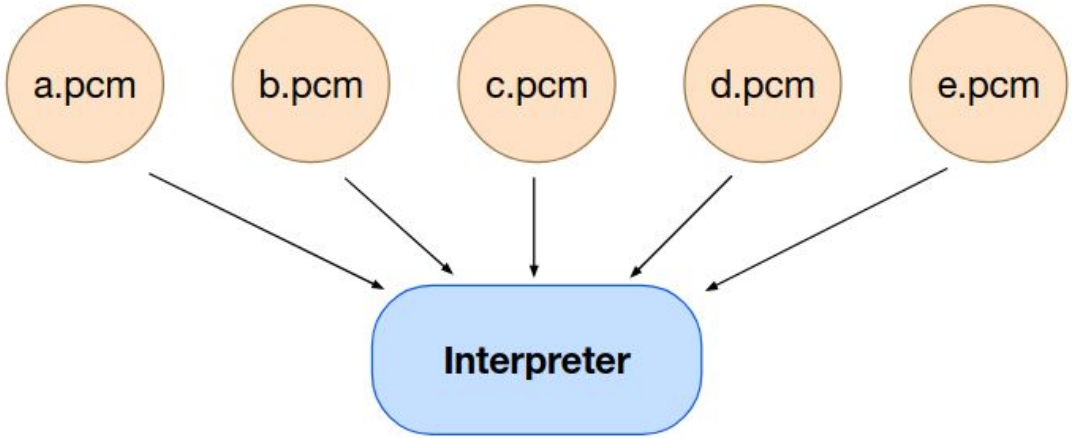
Mentors: Vassil Vassilev and Lukas Breitwieser

Status

- **Rework the cmake rules to incorporate efficiently ROOT via FetchContent**
  - Completed: PR #365 and #387
- **Replace invocations of genreflex in favor of rootcling**
  - Waiting to merge #379
- **Enable C++ modules in rootcling**
  - All unit test passes. Working on a PR.

What are the C++ Modules?

- An efficient on-disk representation of C++ Code
- Designed to minimize the reparsing of the same header content
- Capable to reduce build times and peak memory usage



Migrating large codebases to C++ Modules, ACAT 2019

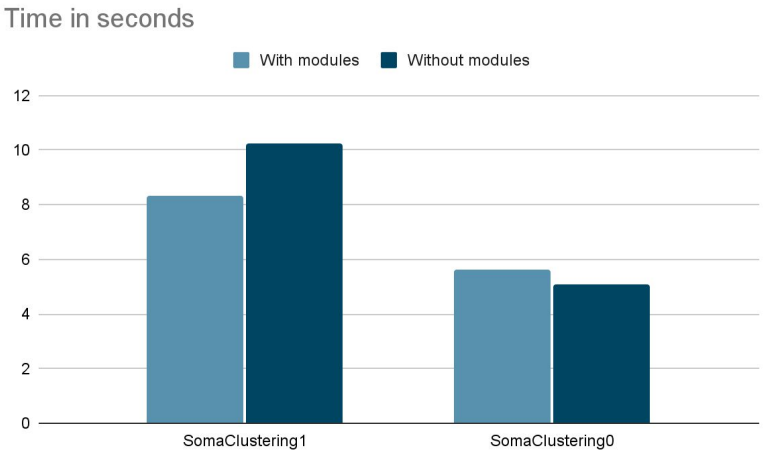
What are the C++ Modules?

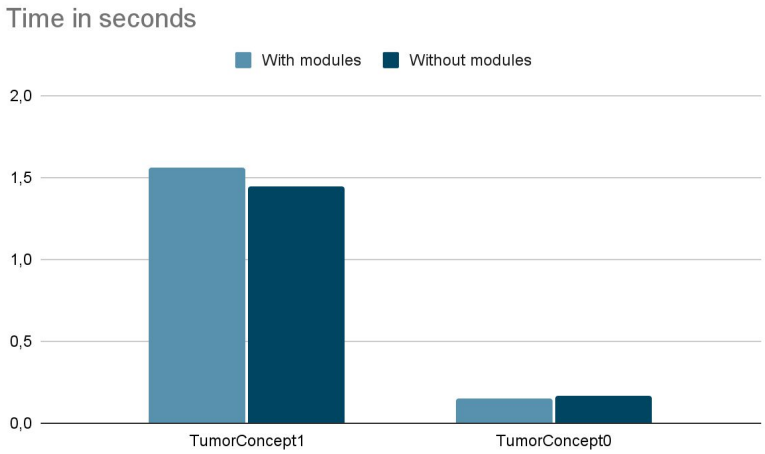
```cpp
// A.h

int pow2(int x) {

  return x * x;

}
```

```cpp
// B.cpp
#include "A.h" // clang rewires this to import A.
int main() {
  return pow2(42);
}
```

```
// A.h module interface, aka module map file
module A {
  header "A.h"
  export * // clang exports the contents of A.h as part of module A.
}
```

Performance comparison





18,7% improvement!
in the first simulation

Work to do

- Run extensive benchmarks.
- Fix builds outside main folder
- Fix build for macOS: `fatal error: 'bits/stdint-uintn.h' file not found`
- Fix notebooks error: `Kernel died while waiting for execute reply.`
- Clean the code

Questions?