

NA62 DAQ Update, Daqling Developments

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CERN Summer Student 2019

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August 20, 2019

Presentation Structure

First: briefly introduce myself.

Then: (*very*) briefly introduce NA62, Daqing and cover my contributions.

Lastly: questions (if time allows it).

Who am I?

Viktor “tmplt” Vilhelm Sonesten

- ▶ Born in Sweden, Eskilstuna.
- ▶ Finished three years of CS studies at Luleå Technical University.
- ▶ Second time at CERN. Held seminar last Summer regarding Allpix² as a participant of Google Summer of Code.
- ▶ This summer: CERN Summer Student.

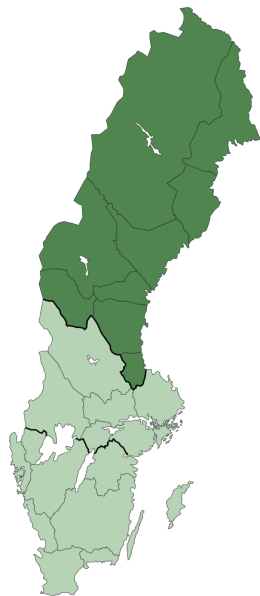


Figure: source: Wikimedia

What is NA62?

Experiment for precision tests for the Standard Model by studying rare decays.

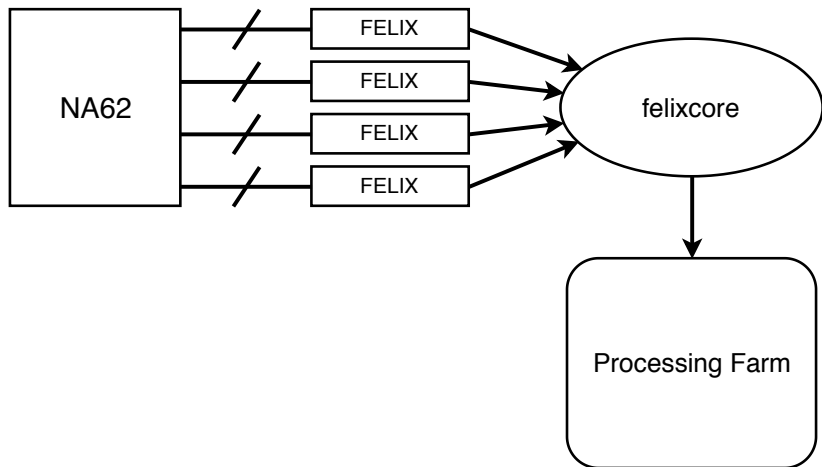
Why upgrade:

- ▶ LHC shutdown opportunity.
- ▶ new TDC (time-to-digital converter) in development to replace the TEL62; faster data rate required downstream.
- ▶ FELIX, the detector readout system used in ATLAS, for downstream.



Figure: NA62 cavern; source: CERN

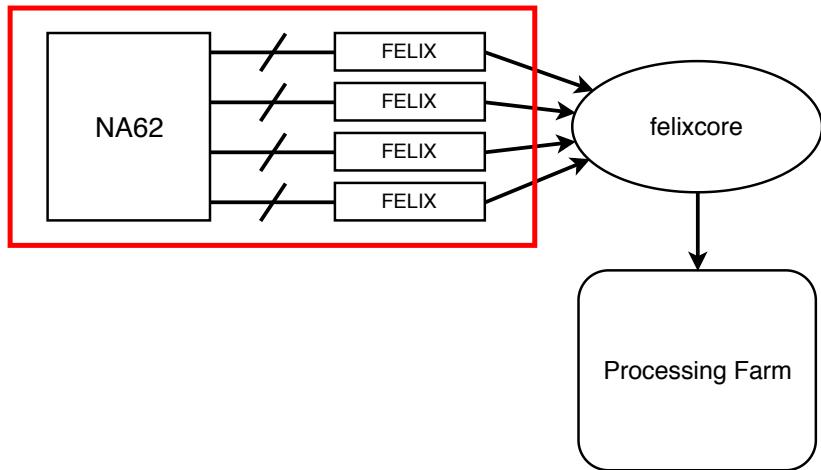
Planned NA62 Upgrade



Planned NA62 Upgrade

```
$ felixcore --help
```

```
-f, --file <file>    Use the given filename as input
```



Simulated NA62 Downstream

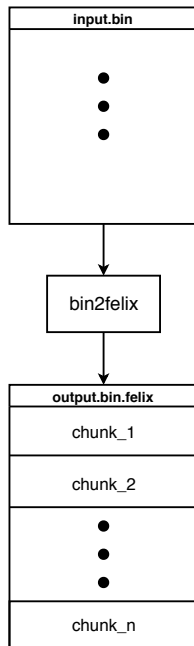
with bin2felix

bin2felix usage:

- ▶ `-w <word-size>`
- ▶ `-p <words-per-chunk>`
- ▶ `-e <elinks>`
- ▶ `-s <wordtype>`
- ▶ `<filename>`

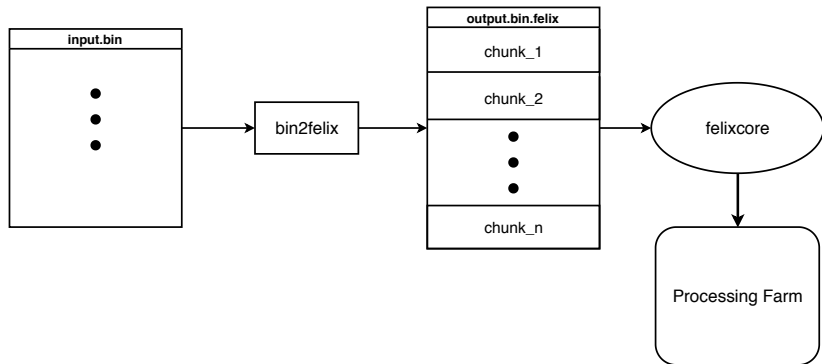
$$\text{sizeof}(\text{chunk}_i) = w \times p \text{ bytes}$$

A general tool; applicable in other experiments.



Simulated NA62 Downstream

with bin2felix



What is Daqling?

Framework for generic data acquisition. The aim is to be as general as possible. Developed by DT-DI. Employed by FASER among other experiments.

JSON configuration, modules in C++ loaded dynamically during run-time.

Daqing contributions

FileWriterModule

- ▶ Concept implementation made production ready.
- ▶ File rotation with (printf like) configurable filename.
- ▶ Configurable buffer and payload queue sizes.

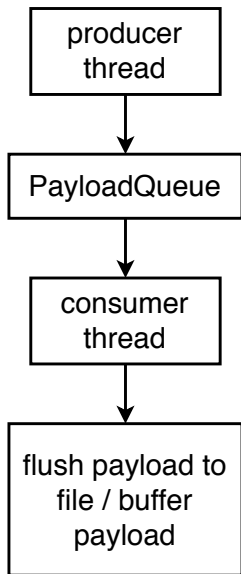
/tmp/output-%D.%n.%c.bin

↑ ↑ ↑
date + timestamp

output file number (how many rotations)

channel ID

/tmp/output-2019-08-16-17:14:55.0.1.bin



Daqing contributions

Revamped CMake configuration

```
_____ before (source file) _____  
1  extern "C" SomeModule *daqing_create_module() {  
2      return new SomeModule();  
3  }  
4  extern "C" void daqing_destroy_module(SomeModule *object) {  
5      delete object;  
6  }  
7  
8  SomeModule::SomeModule() {}  
9  SomeModule::SomeModule() {}  
10 void SomeModule::start() { ... }  
11 // ...  
_____ before (cmake file) _____  
1  file(SOMEMODULE_SOURCES "SomeModule.cpp")  
2  add_library(somemodule SHARED ${SOMEMODULE_SOURCES})  
3  target_link_libraries(somemodule PUBLIC DaqingCore DaqingUtils ...)
```

Daqing contributions

Revamped CMake configuration

_____ after (source file) _____

```
1 SomeModule::SomeModule() {}
2 SomeModule::SomeModule() {}
3 void SomeModule::start() { ... }
4 // ...
```

_____ after (cmake file) _____

```
1 daqing_module(module_name)
2 daqing_target_sources(${module_name} SomeModule.cpp)
```

Daqing contributions

Overhauled logging implementation

Before:

```
1 void outside_module()  
2 {  
3     INFO("something informational")  
4     std::string str = "msg";  
5     WARNING("component X crashed: " << str);  
6 }  
7  
8 void SomeModule::start()  
9 {  
10    DEBUG("starting up...");  
11 }
```

```
1 [16:11] [info] [outside_module()] something informational  
2 [16:11] [warning] [outside_module()] component X crashed: msg  
3 [16:11] [debug] [SomeModule::start()] starting up...
```

Daqing contributions

Overhauled logging implementation

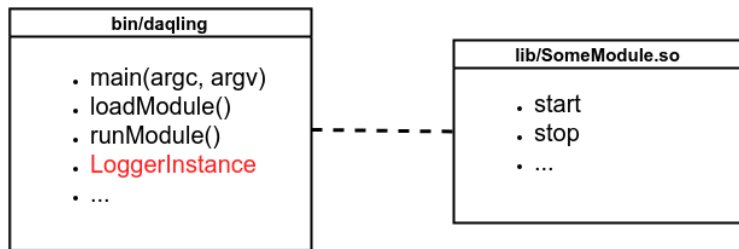
Wanted:

```
1 void outside_module()  
2 {  
3     INFO("something informational")  
4     std::string str = "msg";  
5     WARNING("component X crashed: " << str);  
6 }  
7  
8 void SomeModule::start()  
9 {  
10     DEBUG("starting up...");  
11 }
```

```
1 [16:11] [core] [info] [outside_module()] something informational  
2 [16:11] [core] [warning] [outside_module()] component X crashed: msg  
3 [16:11] [module] [debug] [SomeModule::start()] starting up...
```

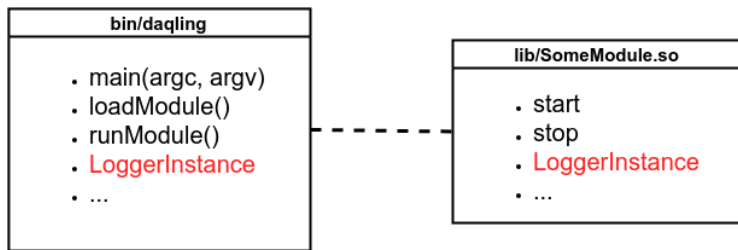
Daqing contributions

Overhauled logging implementation



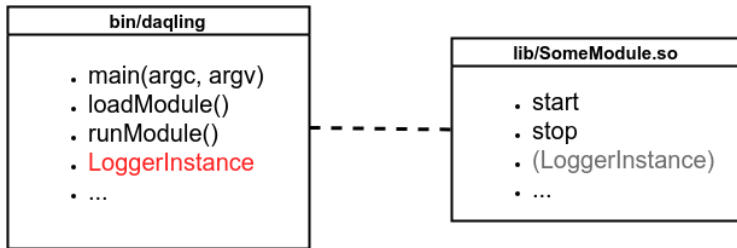
Daqing contributions

Overhauled logging implementation



Daqing contributions

Overhauled logging implementation



Daqing contributions

Overhauled logging implementation

Result:

```
1 void outside_module()  
2 {  
3     INFO("something informational")  
4     std::string str = "msg";  
5     WARNING("component X crashed: " << str);  
6 }  
7  
8 void SomeModule::start()  
9 {  
10     DEBUG("starting up...");  
11 }
```

```
1 [16:11] [core] [info] [outside_module()] something informational  
2 [16:11] [core] [warning] [outside_module()] component X crashed: msg  
3 [16:11] [module] [debug] [SomeModule::start()] starting up...
```

Questions!

Viktor “tmplt” Vilhelm Sonesten

- ▶ Supervisors: Enrico Gamberini, Roland Sipos
- ▶ GitHub: <https://github.com/Tmplt>
- ▶ Daqling: <https://gitlab.cern.ch/ep-dt-di/daq/daqling>
- ▶ vsonesten@cern.ch