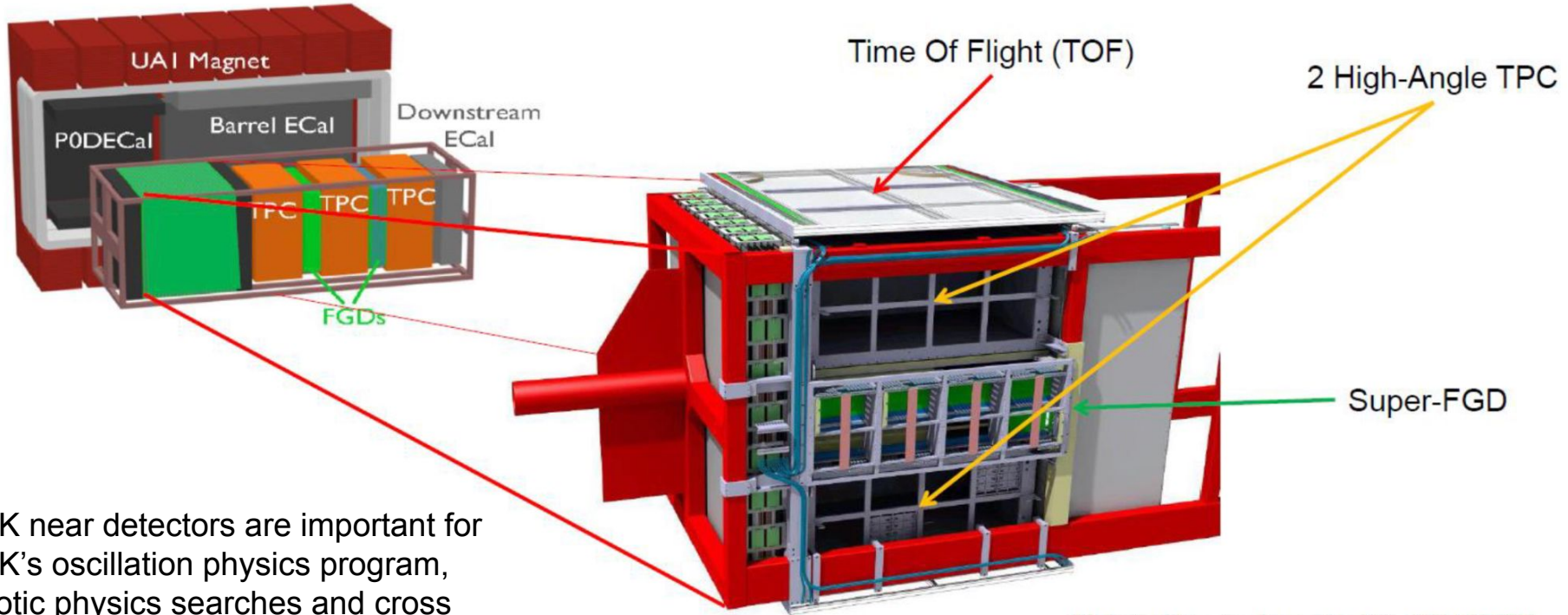


T2K ND upgrade
- *positive or negative
experience with MIDAS*

Kendall Mahn for T2K ND DAQ and Slow Control
Michigan State University

ND280 and upgrade - *slide lovingly stolen from Thorsten Lux*



T2K near detectors are important for T2K's oscillation physics program, exotic physics searches and cross section measurements.

Specific challenges and approach

We are resuming operation of (old, original) ND280 after COVID

- Old hardware (SL6 and CentOS 6), older version of MIDAS (2011)
- Combination of aging hardware and software interfaces

And, we are now adding ND upgrade (new detectors: sFGD, TOF, HATPC)

- Newer hardware, software interfaces (new version used 2022-05-c.)

Challenge: rebuilding expertise and communication channels

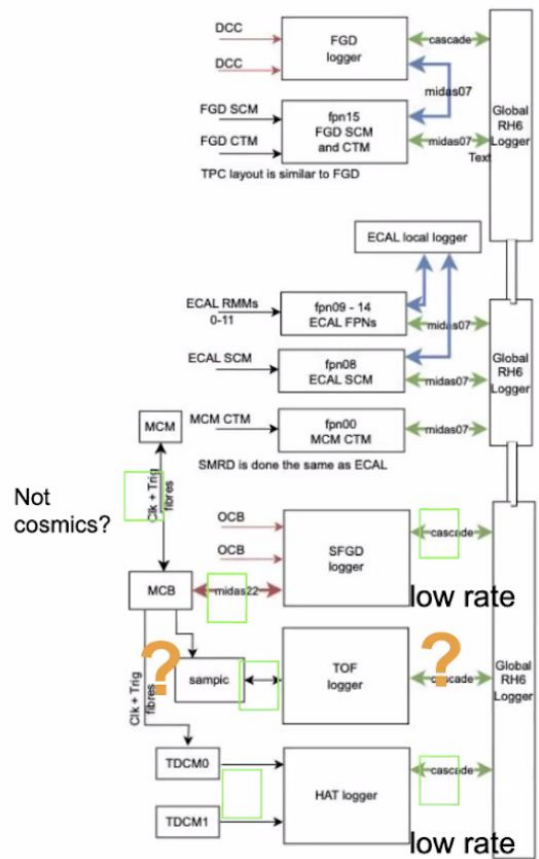
- Institutional memory is a patchwork, onboarding new people
- **We welcome feedback on how we can best channel concerns/issues**
- The person giving this talk (Kendall) has not been a core worker - *apologies, I am not the right person for this talk. We may follow up with specifics later and I will relay questions.*

Aging hardware x software

- It seemed mostly straightforward to update the MIDAS FE for new MIDAS for the older ND280 hardware - *currently working on TripT*
- No major issues migrating history plots and reference to ODB
- Have needed intermediate solutions for older detectors :
 - The magnet is undergoing an overhaul of the control interface
 - Intermediate plan we run main logging of historical data on new GSC, then replicate just the tables that are logging magnet data on the old GSC.
- DAQ: Currently using older MIDAS (DAQ is 2009 vintage)
 - We didn't want to change too many things for the upgrade (i.e. we are upgrading adiabatically, not in a 'big bang').
 - We are preparing to upgrade everything to the 2023 version of MIDAS, but that is aimed at being rolled out next year.
 - The current strategy bridges those gaps using the cascades, which allow us to use the local detectors' Midas loggers (newer versions) as frontends for the global Midas logger (older versions).

Snapshot of DAQ plan and readiness - *from Giles Barr*

Update original diagram, remove new SCMs



Smaller tasks:

- Archiver for NDUp
- Online monitor for NDUp
- Online monitor migration to Alma9

Not done yet:

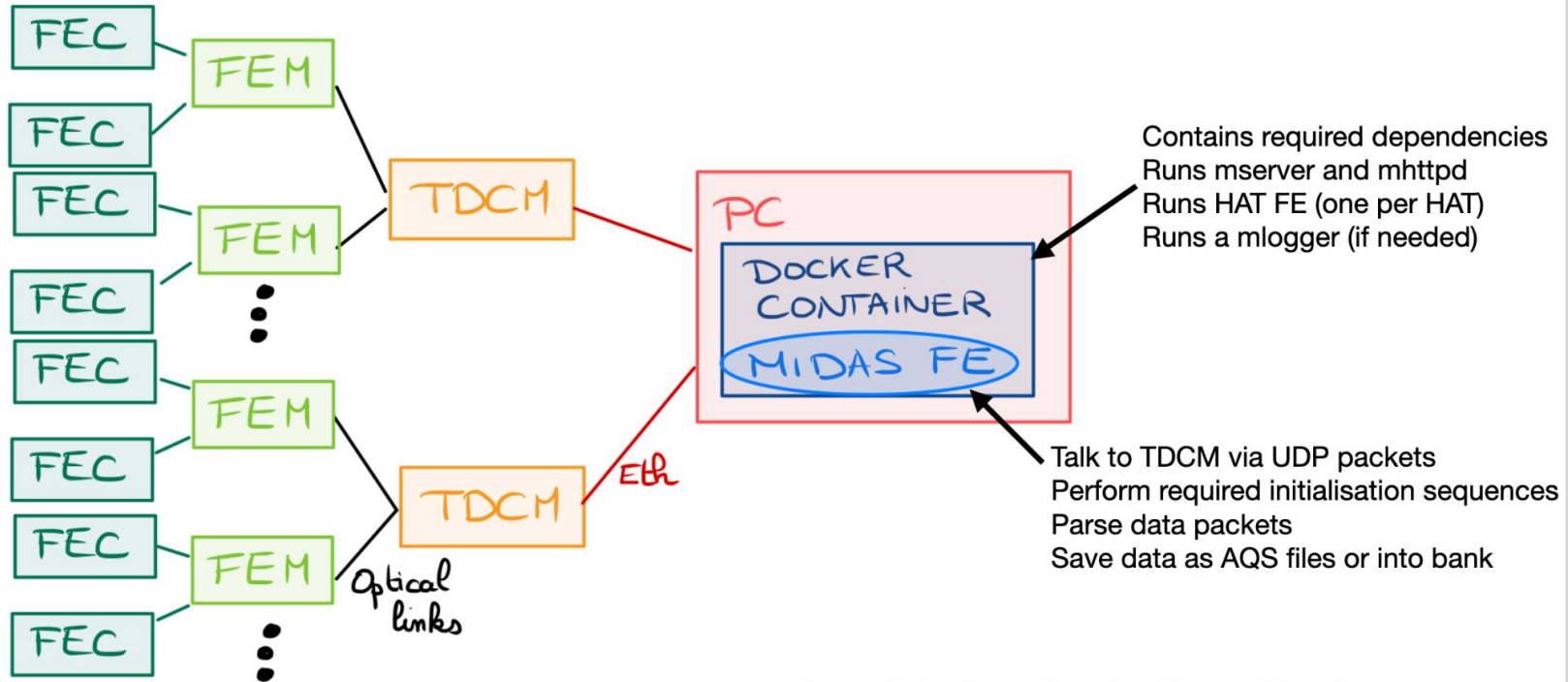
- TOF to global DAQ via cascade; should be easy (done for SFGD and HAT)
- High rate tests
- Starting runs with multiple detectors (e.g. HAT+SFGD+SMRD)
- Stopping runs with multiple detectors
- Dummy beam triggers with multiple detectors
- Cosmic trigger (electronics hard part?)

Not cosmics?

Experience for new detectors

- Initially, had trouble getting MIDAS tutorials to work - *KM to try to get specifics*
- Once we had a new group member join with experience with MIDAS, things got better
- New detectors now have a basic interface for slow control, but not merged yet into global slow control (GSC)
- DAQ troubleshooting is underway - *steady progress*
 - HAT used containers effectively, considering if we want to extend this

Data flow for HATPC - *Mathieu Guigue*



<https://git.t2k.org/hat-daq/desy-midas-daq>

Things which have been fantastic, thank you:

- ELOGs are very helpful
 - (Minor) challenge - remembering where we put information or learning to search it with new people
- “the ODB is pretty great and easy to use, please give them my thumbs up for their work on this”
- Thank you to Konstantin for his helpful offer and help, the forums were very useful:
 - We were directed to email at olchansk@triumf.ca or via the MIDAS forum linked at <https://midas.triumf.ca>.
- Cascade is not an official tool, but “Our NDUp implementation would be much more painful if it wasn't for the cascade.”
- “We are very happy generally with MIDAS, it has been a very good choice to use as DAQ for T2K over the years. It is very nice to read the source code, not only to find some detail, but also because it is very nicely written. The ODB is a superb general concept which has allowed many individual DAQ functions to be addressed where we don't have to think about inter-process communication, we just use the ODB and it does that for us.”

Things which have been fantastic, thank you:

- the python integration is also a huge help, especially when we want students who don't know much about midas to get started on this. I guess the simplicity of it (no need to use HANDLE etc) and the real push they did to get a very user-friendly interface for both front-end and simple clients is great, like this

```
client = midas.client.MidasClient("macoun")

# Update or create a directory in the ODB by passing a dict to `odb_set`
client.odb_set("/Equipment/TTi/Settings", {"V1_set": 24.0,
                                           "V1_output": 0,
                                           "OP1_set": 1,
                                           "OP1_output": 1})
client.odb_set("/Equipment/TTi/com_status", 0)

client.odb_watch("/Equipment/TTi/Settings/OP1_set", my_odb_callback)
```

- same for the C++ interface, which I think helps a lot with the implementation details for front-end. an implementation of a midas client (on the C++ side) is missing I think; one can access the midas base functions, but there is no such thing as a midasclient (one can use a midas front-end of course and not implement any start_run and end_run methods, but a simple client interface would be nice to have)

Interesting features we are experiencing

- midas seems to show warnings about ODB entries that have not been modified for 10 years which is about the time since ND280 started operation so we get many of these warnings on-site (not sure if an automatic script was run to "touch" all the entries)
 - <https://daq00.triumf.ca/elog-midas/Midas/2470>
- while not an official midas tool, there is this cascade which was developed by people like Konstantin Olchinski. The original implementation used a custom "KOSocket" for the event data passing, which somehow has platform-dependent issues when sending events larger than 1 MB from a new 2022 midas to an old ~2012 midas, possibly related to OS differences and/or 32/64 bit differences. We managed to get around this by replacing the KOSocket with a zeroMQ ROUTER/DEALER channel. There is still a harmless warning shown about midas version mismatch when the RPC connection is made initially, but apart from that it works fine. This "midas version" doesn't appear to be used for any serious purpose — I think the value was only reset once in the 10 years at a somewhat arbitrary moment (?). Related: <https://bitbucket.org/tmidas/midas/src/afba5cf0ac72f25c3ab465c95dadfd998661c6/src/odb.cxx#lines-1288:1298>

Interesting features we are experiencing

- The new c++ class TMFeEquipment seems to be missing a way to use hot links
- Small issue with writing UINT32 and INT32 with ODB database interface
<https://bitbucket.org/tmidas/midas/pull-requests/33>
- ODB database interface can't use new style history plots (have been exchanging emails with Konstantin about this)

Additional thoughts

- We consider containers as a possible "solution" for QuiXtream (sp?) interface - I.e. the proprietary communication protocol between the RMMs and the DAQ computers, for which we only have a binary library for Scientific Linux 6. So the idea would be to run the parts that need that in an SL6 container, so we can run the other stuff on a PC with a more modern operating system. Basically compartmentalise the problem and hope that it will keep working for as long as the RMMs.
 - Currently, we can run that code on modern compilers and are considering the upgrade of the main global DAQ to newer OSes and MIDAS versions after the November run. I can link and run quixtream on Ubuntu 22.10 and we've also tested Alma9.
- I think the problem we've had is basically the inability of old MIDAS to talk to new MIDAS directly. If we could have added new MIDAS front ends to old MIDAS then we wouldn't have to use the cascade process. The cascade is not an official part of MIDAS I think, and was written specifically for T2K (but may have been deployed elsewhere).

And thank yous

- People who contributed feedback to this talk (and enormous work): Mathieu Guigue, Clarence Wret, Nick Hastings, Giles Barr, Lukas Koch, Alfons Weber, Helen O'Keefe, Joe Walsh, Denis Calvet, Eric Chong, Stefania Bordoni, Nick Thamm, Alex Ramirez, Cristobal Pio Garcia, Lukas Koch, Rick Van Berg, Martin Tzanov, Thorsten Lux, Federico Sanchez, Luke Pickering
- Thank you for having this workshop - our overall experience is positive, with some specific questions to be followed up on.

backup

ND280 and upgrade - *recent events*

Super FGD -

** MCB explain and electronics, installation status**

TOF ** MCB and electronics, installation status**

