Data Quality Monitoring (DQM) Overview

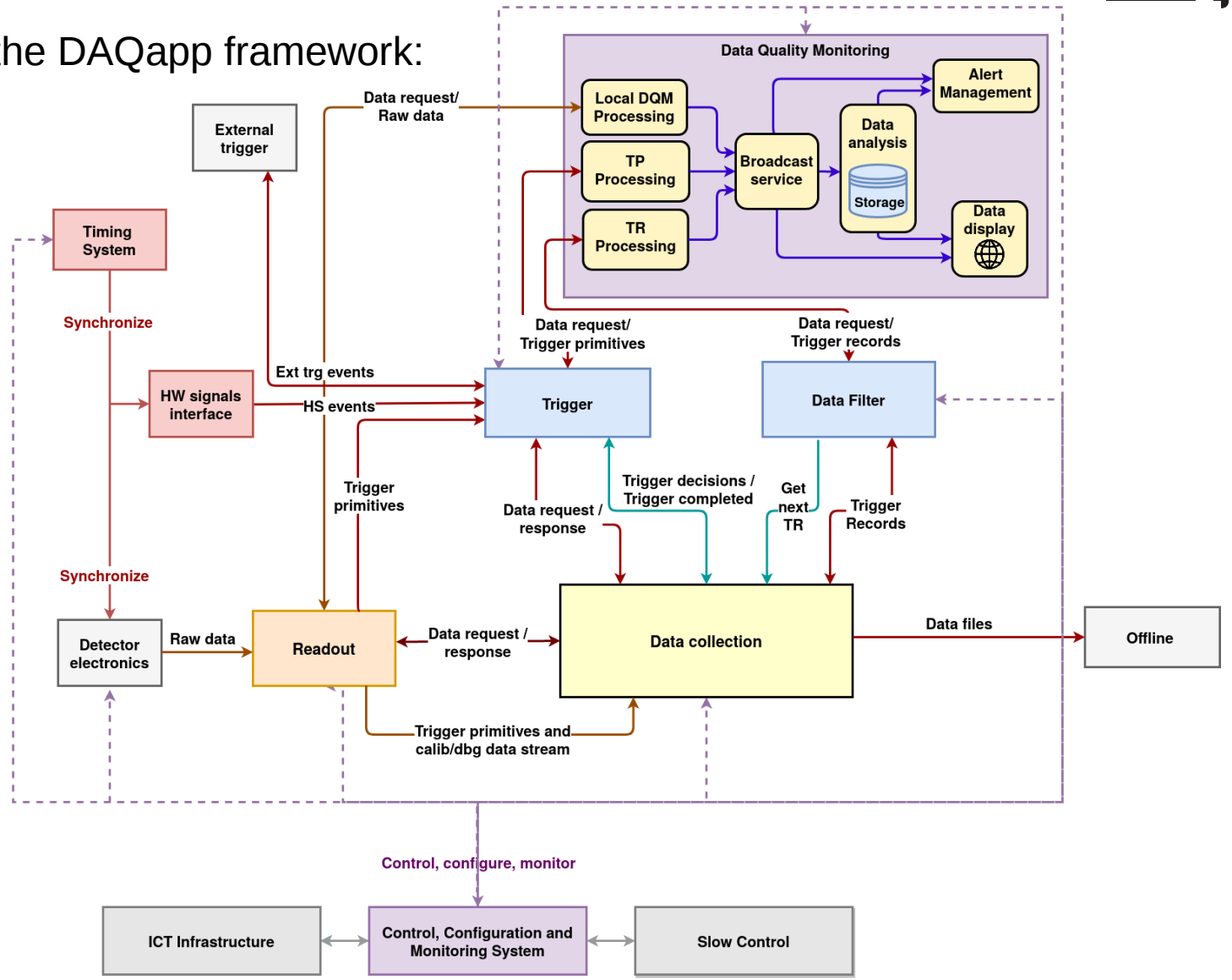
Introduction & Scope

The role of the DQM system is:

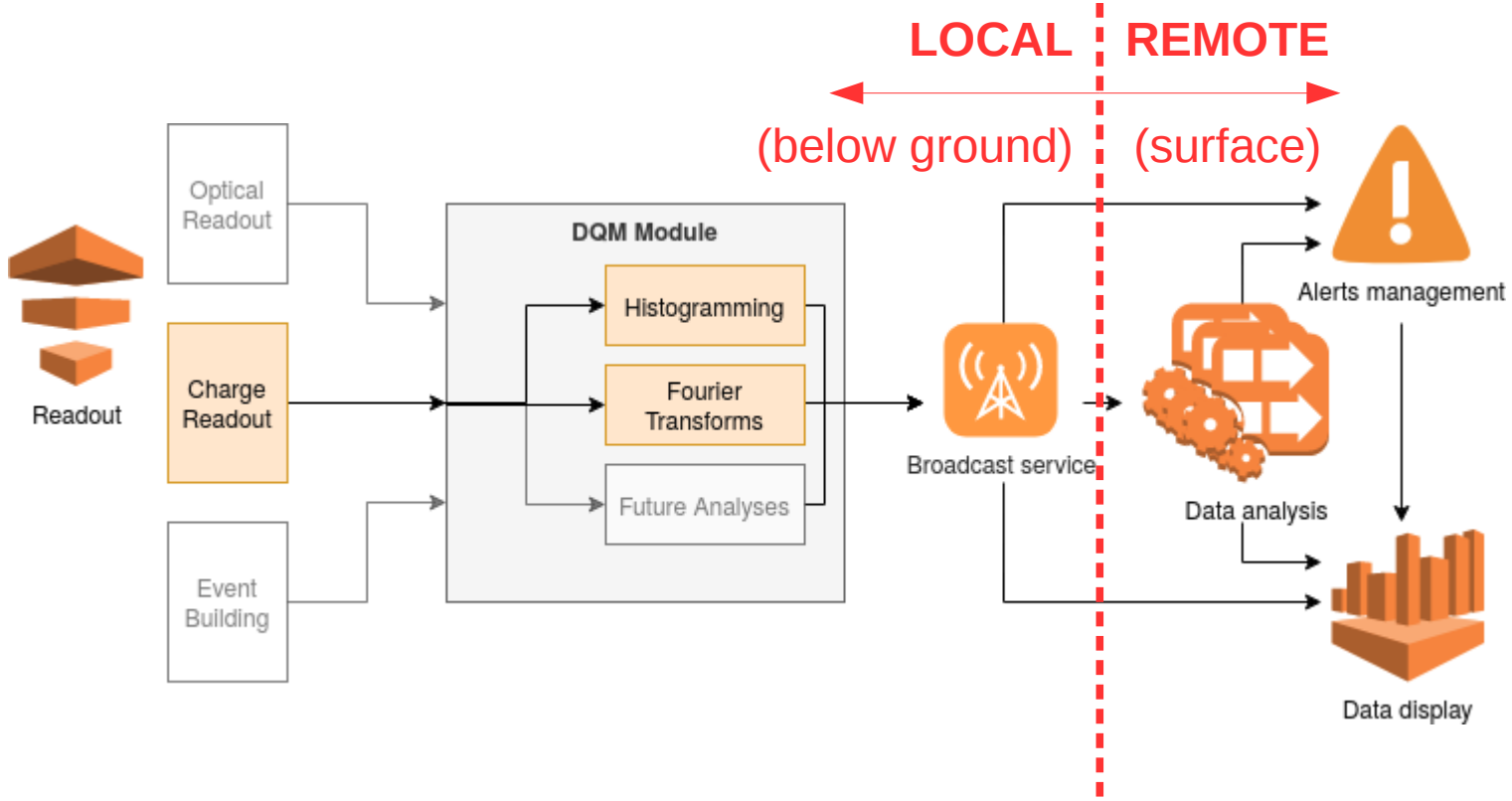
- Live **sampling** of the data from all detectors.
- **Automated analysis** of the sampled data, and generation of **alerts** when quality degrades.
- Visualisation of the data quality for operators through a **web-based UI**.
- **Archiving** of data quality results for past run periods.

Interface to FD DAQ

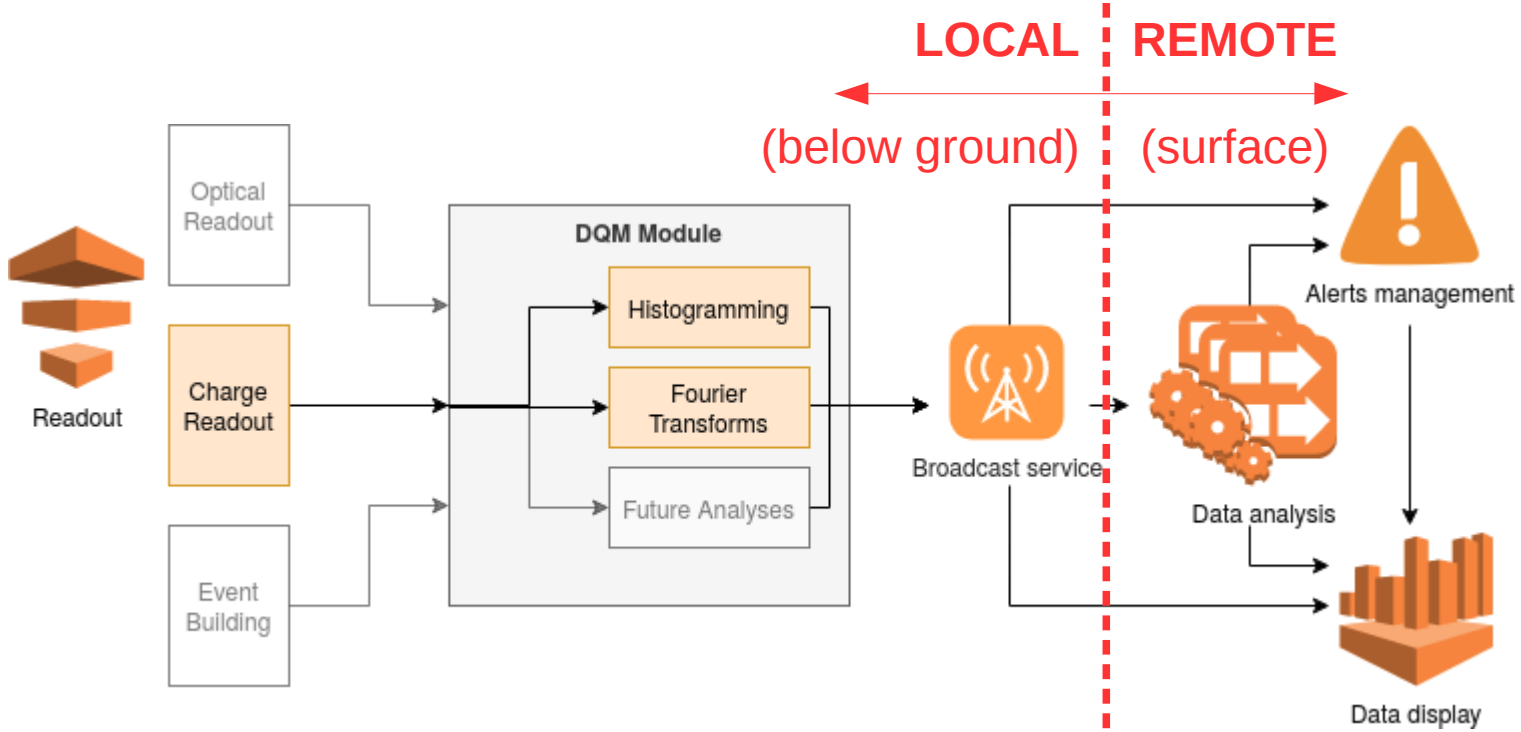
The DQM is part of the DAQapp framework:



System Overview



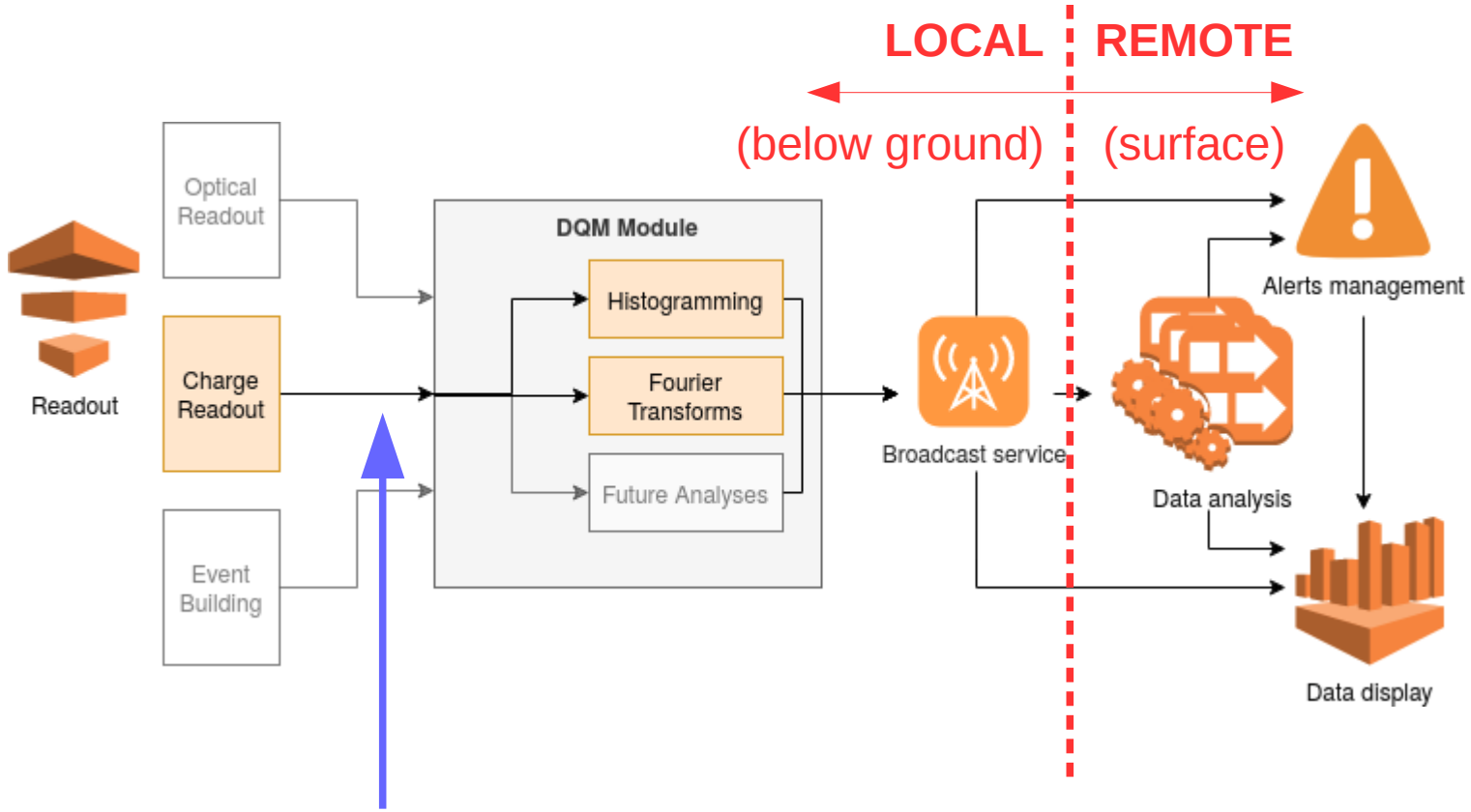
System Overview



- **Resource-constrained (1 core per APA)**
- **Minimal dependencies, basic computation.**
- **Running within the DAQ app fwk**

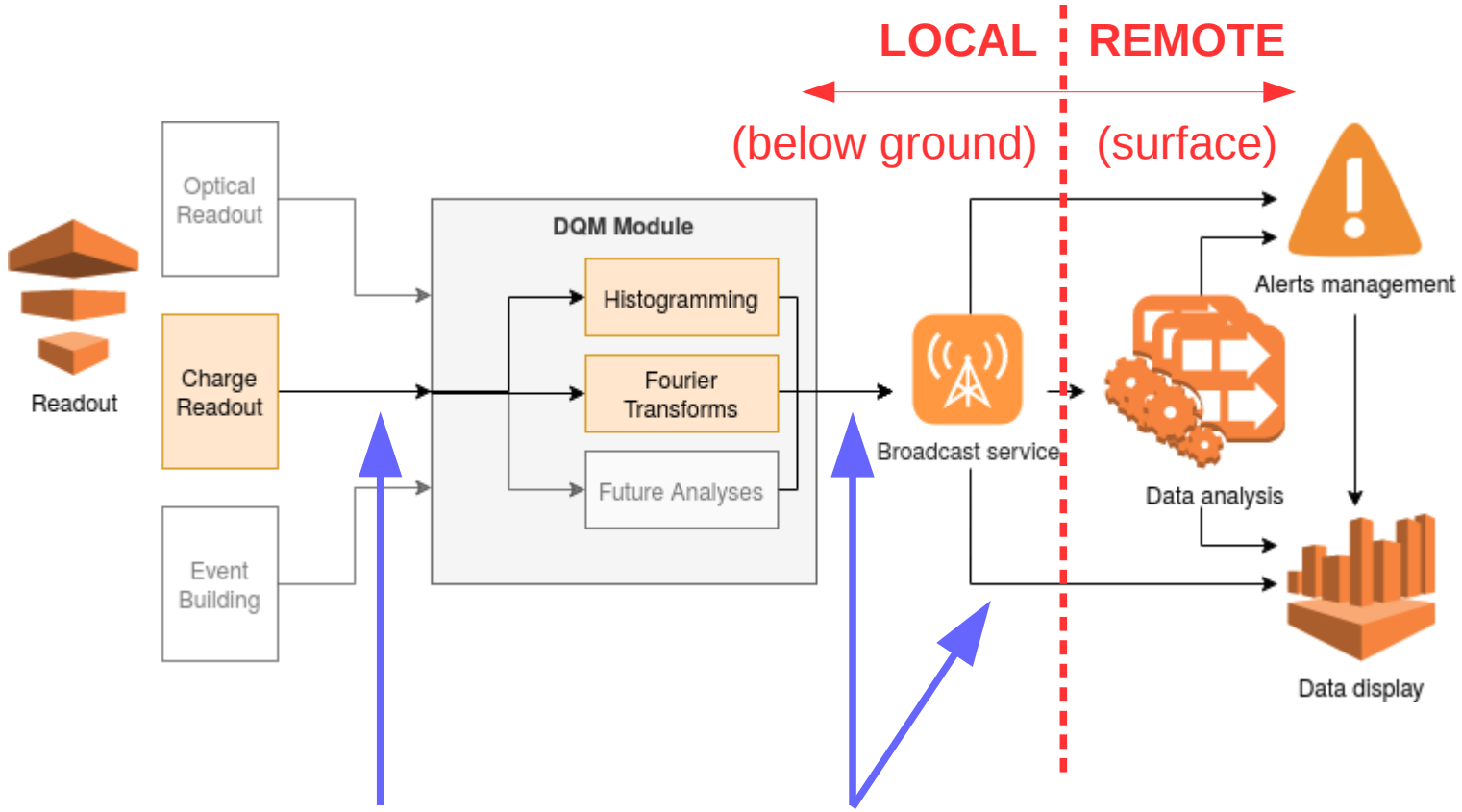
- **Running on its own server.**
- **Advanced capabilities (e.g. machine learning).**
- **Outputs interface to CCM and web.**

System Overview



Native format data
e.g. raw data,
trigger primitives,
trigger records

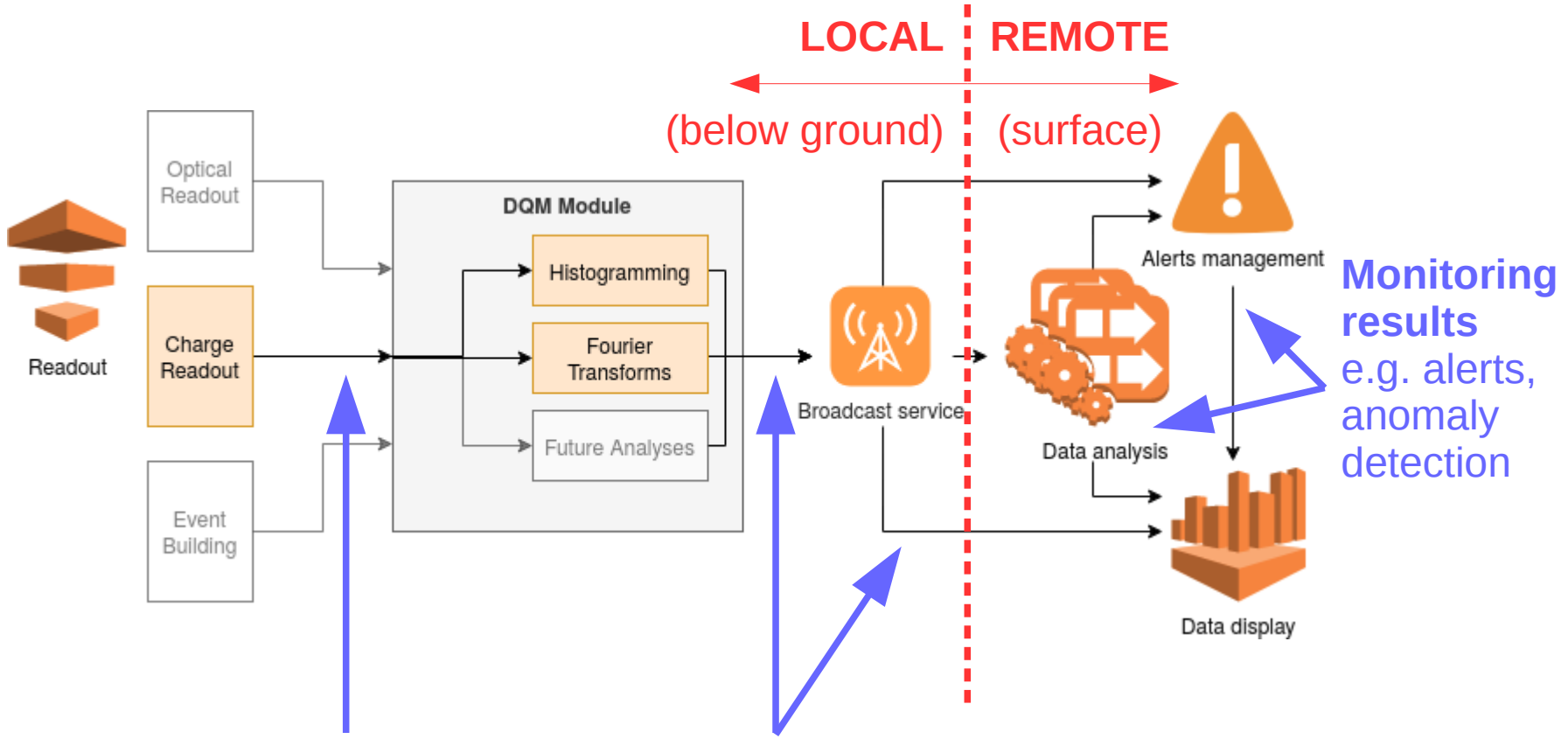
System Overview



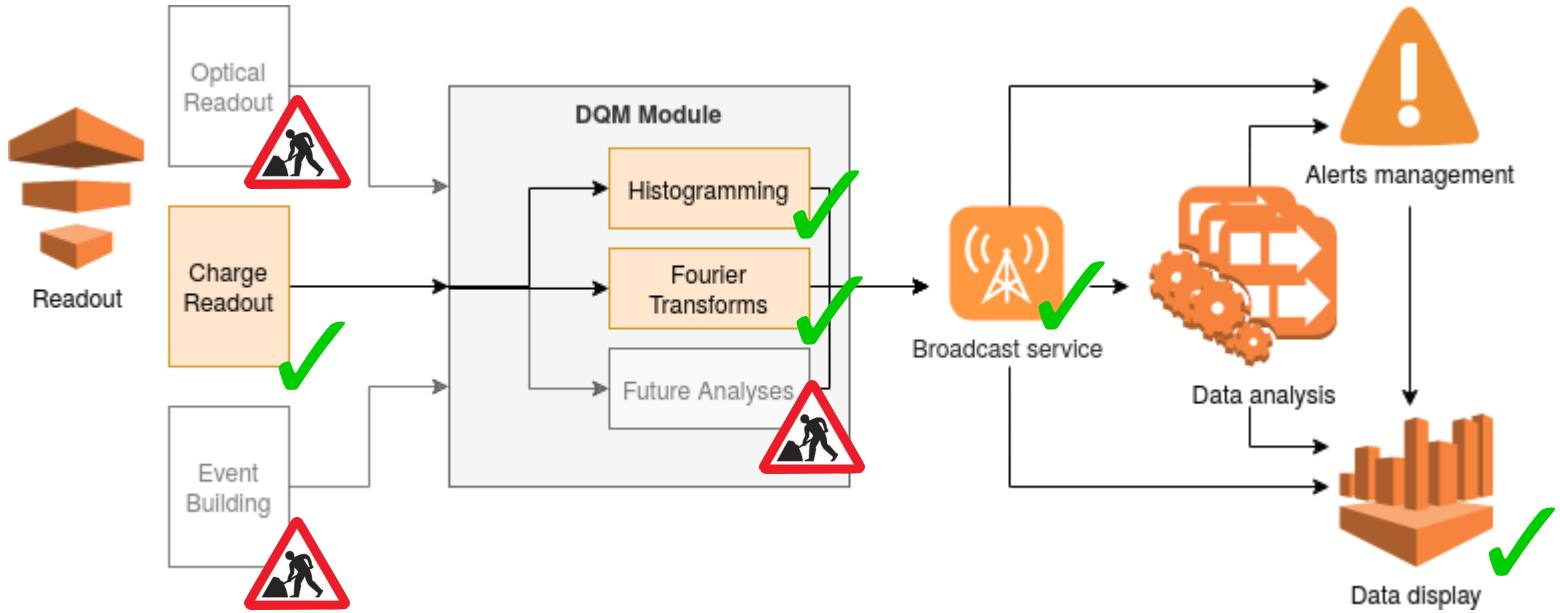
Native format data
e.g. raw data,
trigger primitives,
trigger records

Monitoring plots
e.g. histograms,
heat maps

System Overview



Current System Status

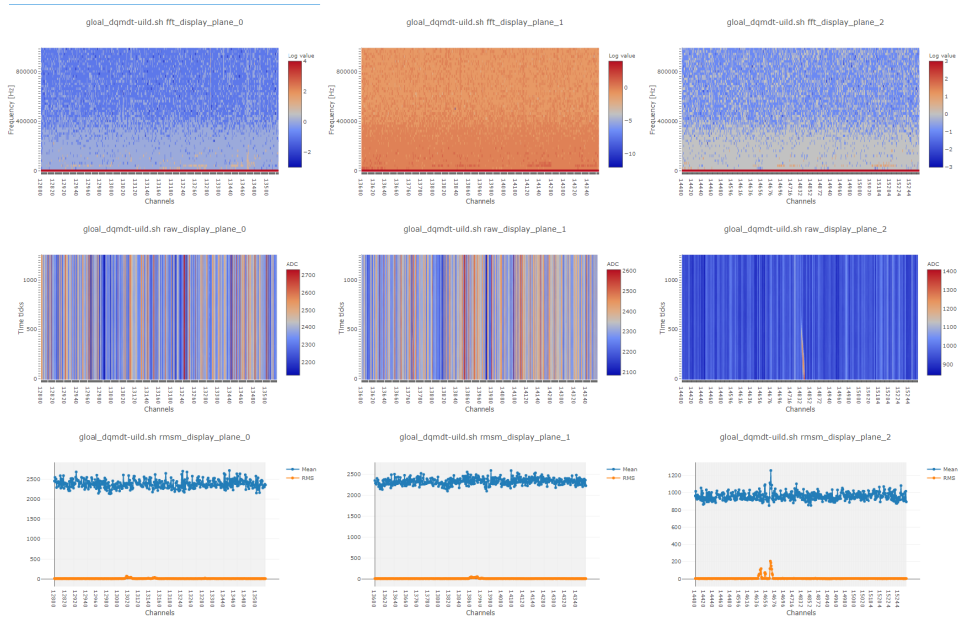


We currently have a path through the system for charge information, from readout to the web UI.

Current Monitoring Suite

Our web UI currently displays 4 types of plot (each with 1 plot per plane).

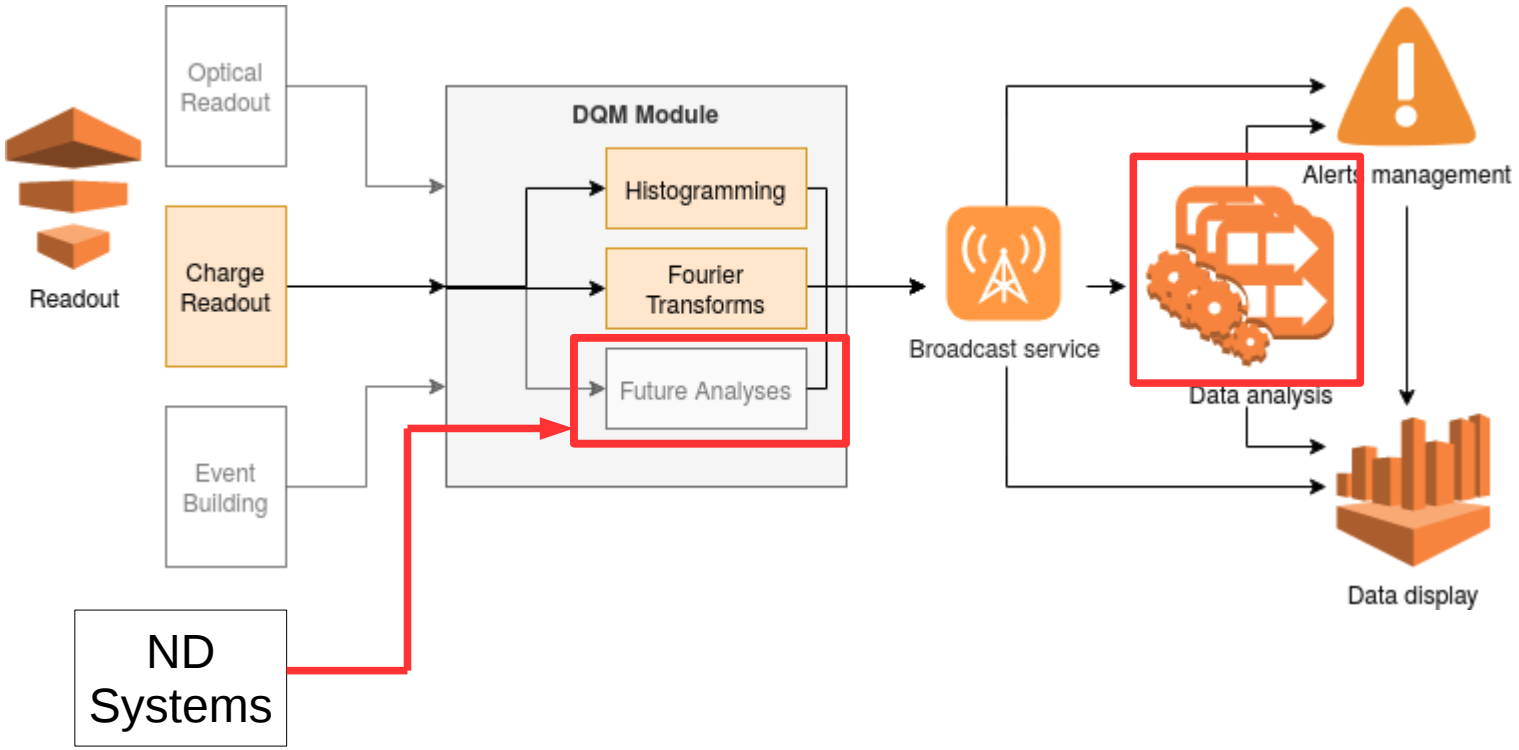
- Raw event display
- ADC Mean & RMS
- Fourier transform
- ADC histogram per channel



https://dune-dqm.app.cern.ch/

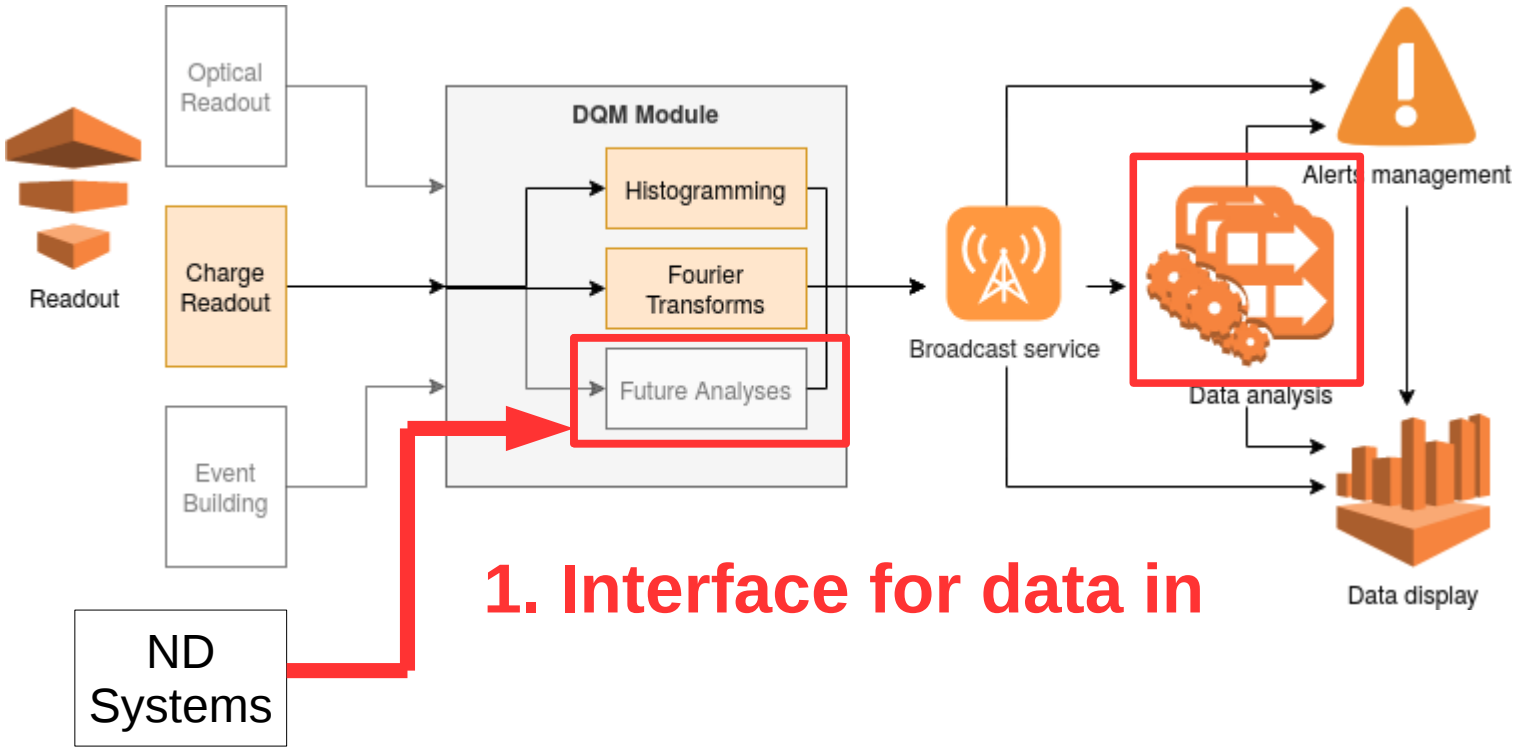
Suggestions/requests very welcome, but may not be implemented immediately – these plots are what will go live for the cold box.

Interface to ND DAQ



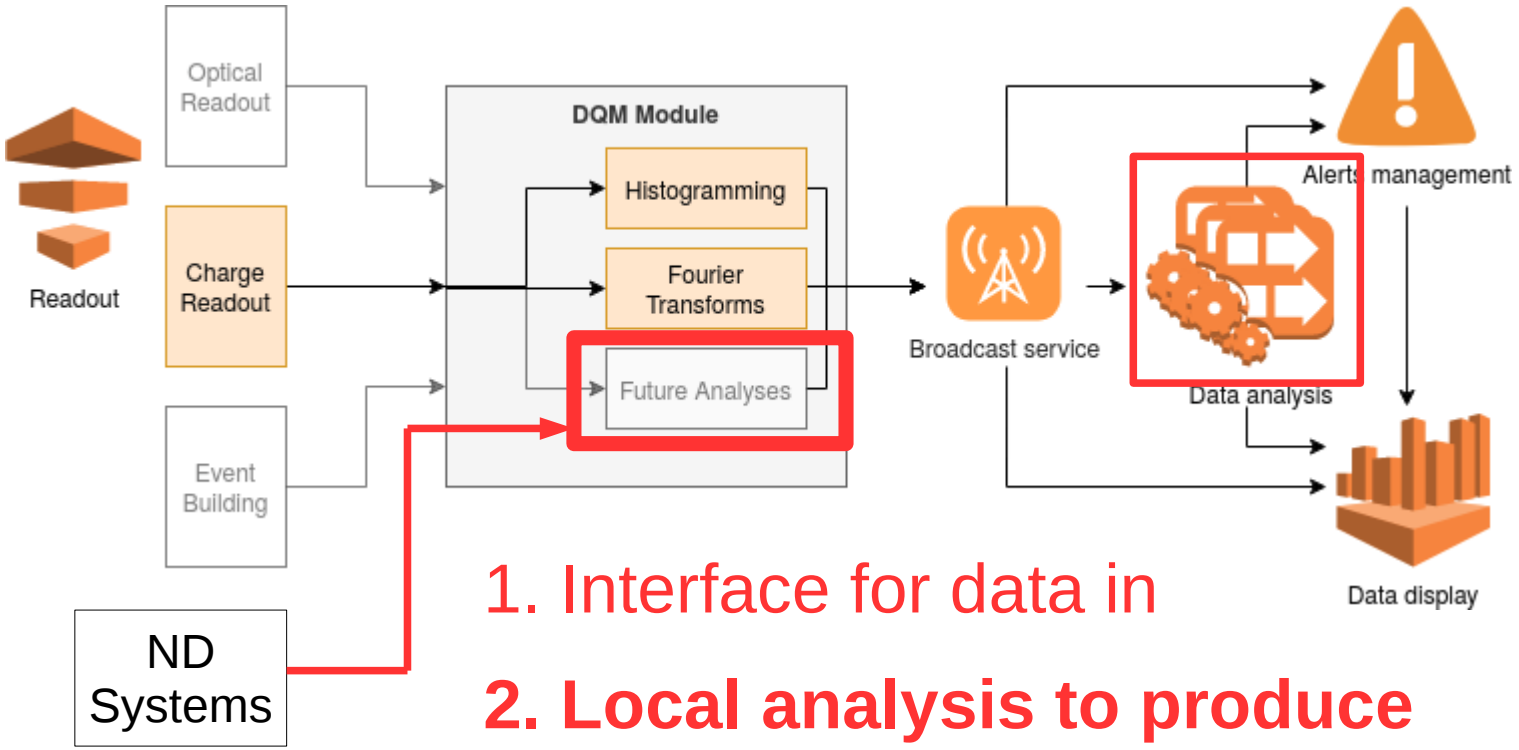
To use an instance of the DQM for the ND DAQ, **these** are the parts of the system that need extension/development.

Interface to ND DAQ



We are already set up to sample data from different sources at different, configurable rates – we just need a way for the systems to exchange requests and data packets. For the FD this is done with queues.

Interface to ND DAQ

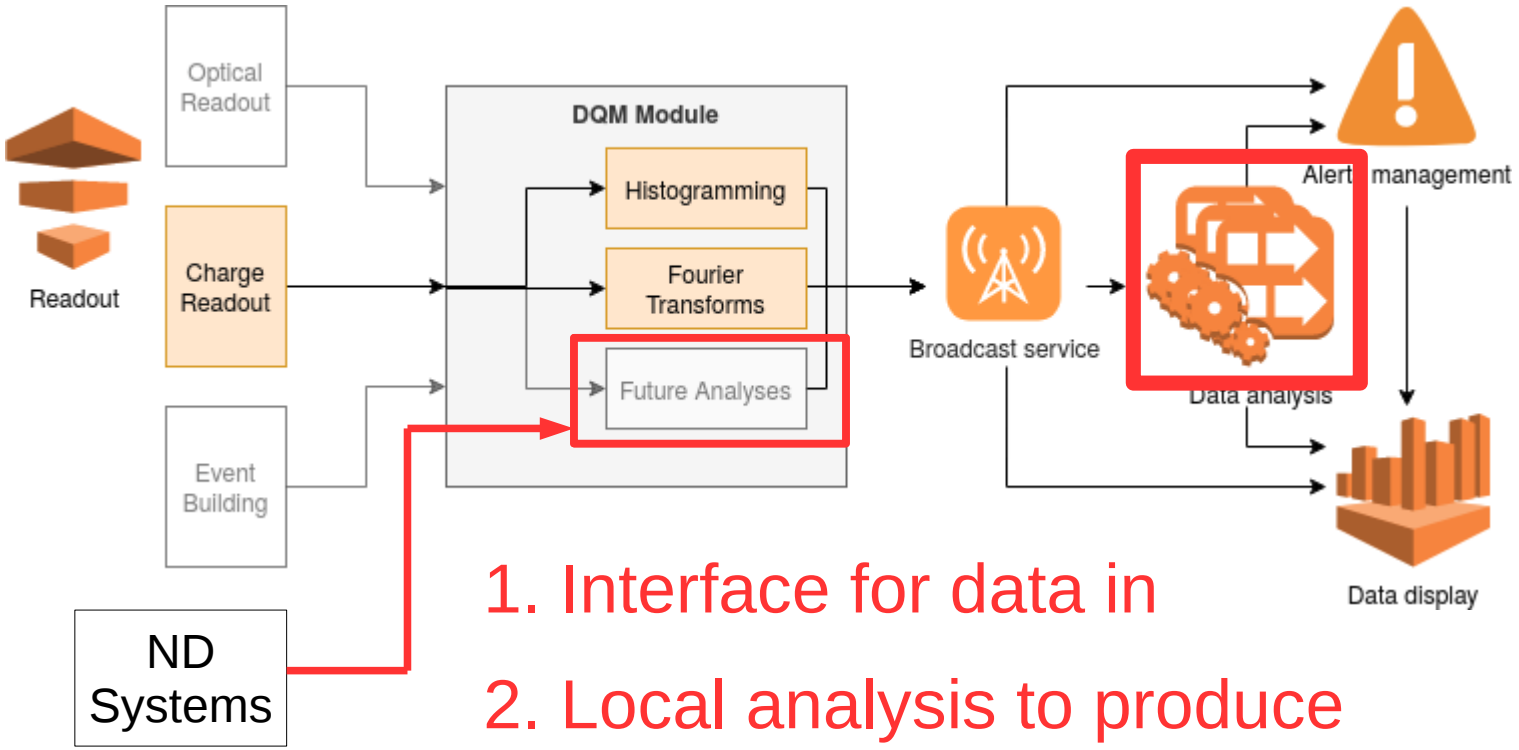


1. Interface for data in

2. Local analysis to produce monitoring plots.

This requires us to know what plots capture the state of the system best, while keeping data volumes manageable.

Interface to ND DAQ

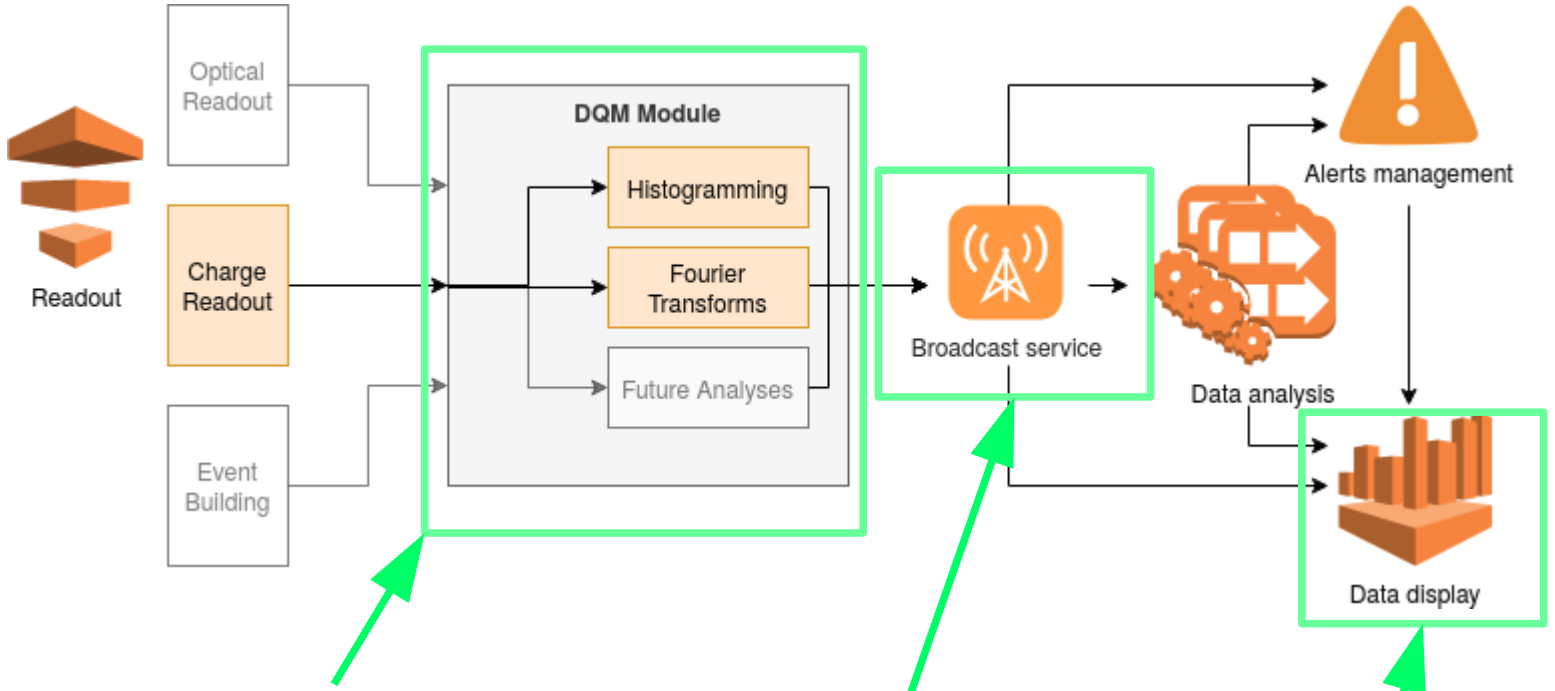


1. Interface for data in
2. Local analysis to produce monitoring plots.
3. **Remote analysis to produce monitoring results.**

Here we need to know what conditions should generate alerts, and what advanced analysis there is a desire for.

Interface to ND DAQ

Things NOT needing adaptation:



The local DQM processing module is designed to run an arbitrary number of algorithms in parallel over data from different sources.

The broadcast service can connect to the DQM database from multiple simultaneous instances/locations.

The display can distinguish between data transmitted from different sources and display them appropriately.

Conclusion

- Structurally, the DQM module ought to be able to take input from ND systems as easily as FD systems.
- The DQM working group is currently very small! We welcome any cross-WG interest that brings people who want to work on something, and will be very happy to show people the ropes.
- We also welcome information & insight from subsystem experts on what we need to be monitoring – getting an overview of the whole DUNE system is a big task, and we need a lot of eyes on the monitoring to make sure it's meeting the needs of the whole experiment.

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