Future DAQ System Development Plan

This presentation outlines the development plan for a updated data acquisition (DAQ) system, focusing on high-throughput data handling and online monitoring capabilities.

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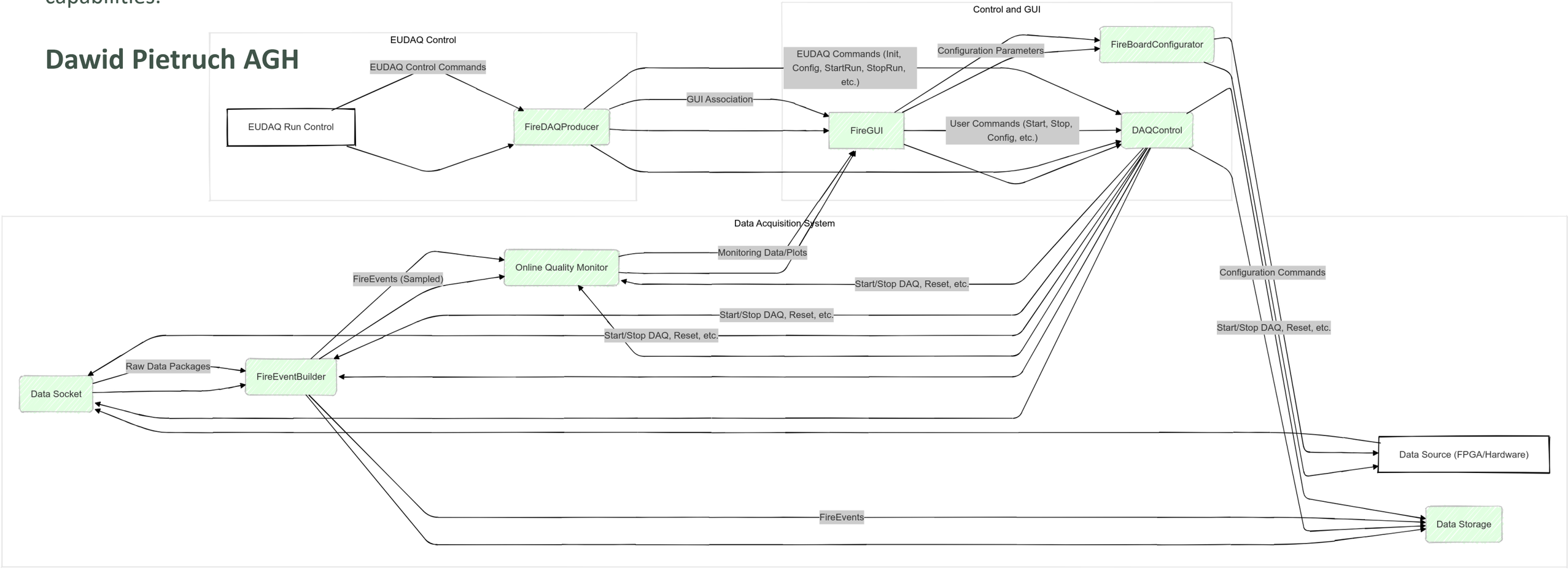


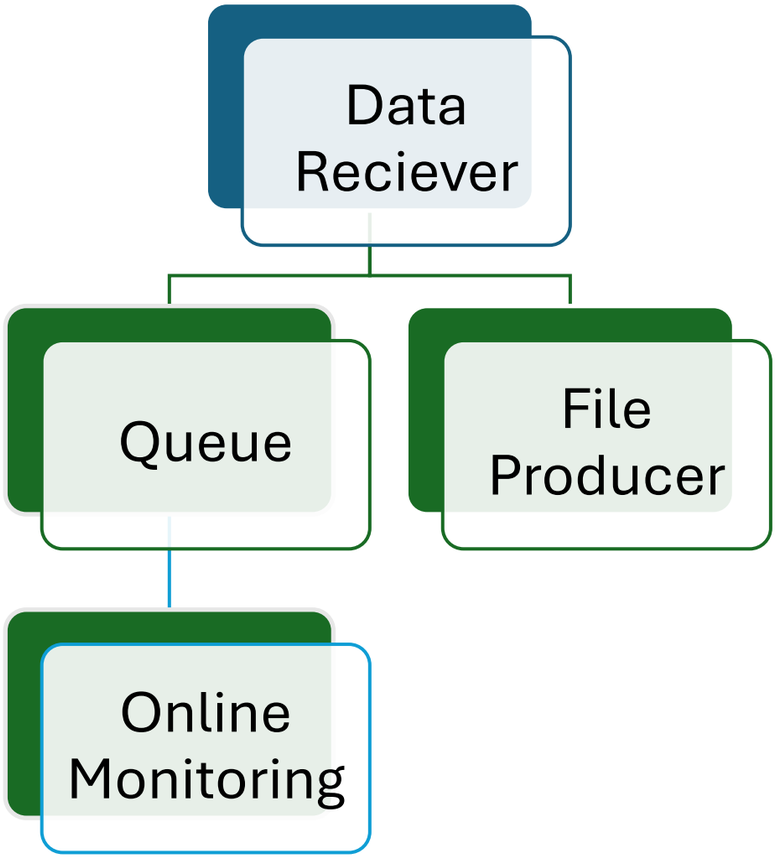
Introduction: Updated Data Acquisition

Goal

Develop a robust and efficient DAQ system for next test-beam

Key Focus

High-throughput data handling and online monitoring capabilities.



Core DAQ Tasks: The Producer

1 Data Receiver

Receives data from 4 UDP sockets simultaneously and merges data streams into a single output.

2 File Producer

Writes raw binary data to HDD with high priority for reliable data recording.

3 Online Monitoring

Visualizes data in near real-time with lower priority than File Producer.

```
22
23  class DataSocket {
24  public:
25          DataSocket(boost::asio::io_service& io_service, short port, FireEventBuilder& eventComposer)
26                  :       io_service_(io_service),
27                          socket_(io_service, udp::endpoint(udp::v4(), port)),
28                          _associatedEventComposer(eventComposer)
29          {
30                  MSG(DEB, "DataSocket initialized. " );
31          }
32
33          ~DataSocket() {
34                  MSG(INFO, "End of transsmision. DataSocket is being deleted. "  );
35          }
36
37          void handle_receive_from(const boost::system::error_code& error, size_t bytes_recvd);
38
39          void read_package();
40
41          boost::asio::io_service& io_service_;
42          udp::socket socket_;
43          udp::endpoint sender_endpoint_;
44          enum { max_length = MAX_SIZE };
45          std::vector<int> data;
```

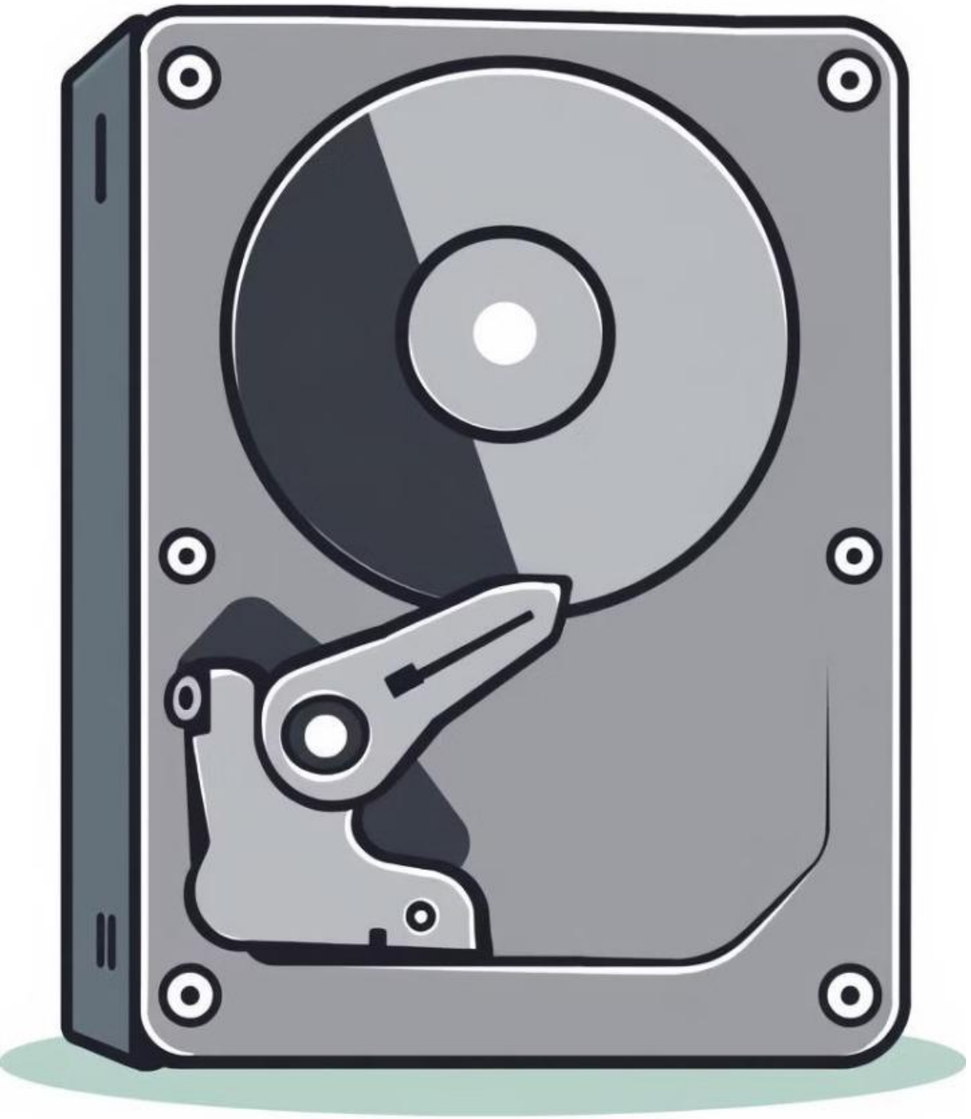
Data Receiver: UDP handling and Stream Management

1 Functionality

- listen to 4 UDP sockets,
- merge data streams,
- extract events for Online Monitoring,
- process FPGA statistic packages,
- recognize the trigger distribution mode and do not write these packages onto HDD

2 Priority

Absolute highest priority thread for minimal data loss.



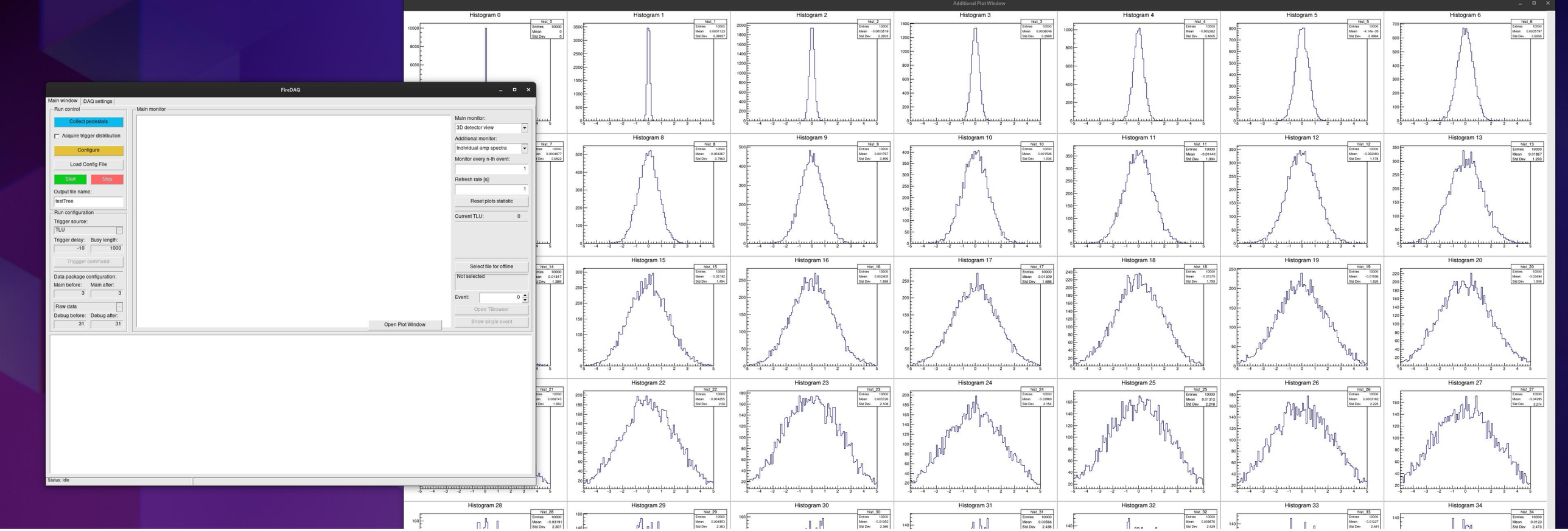
File Producer: Raw Data Recording

1 **Functionality**

Write raw binary data to HDD with minimal processing and **no online event building.**

2 **Priority**

Absolute high priority to ensure no data loss.



Online Monitoring: Real-time Data Visualization

1 Purpose

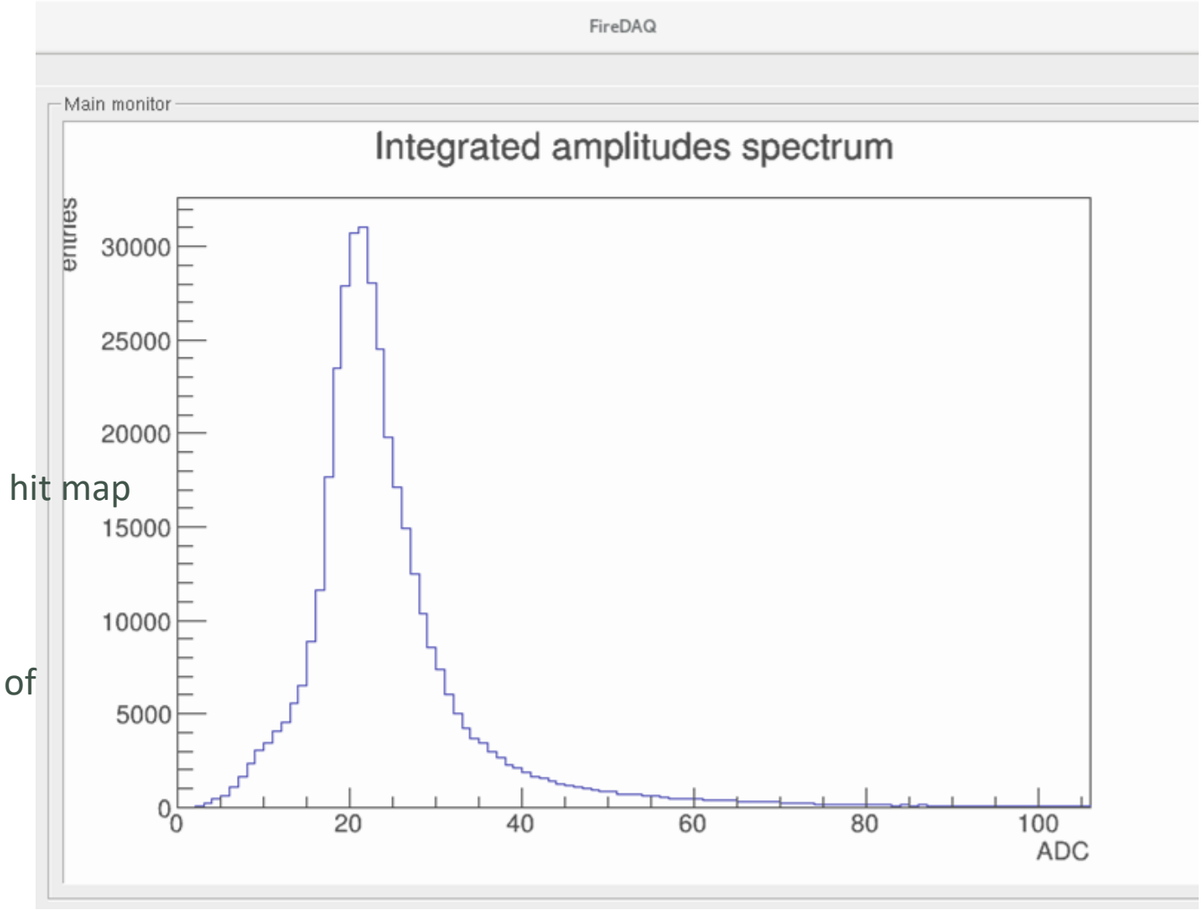
Provide quick feedback on DAQ system and detector performance.

2 Data Flow

Queue-based system from Data Receiver, designed not to interfere with File Producer.

Online Monitoring Plots:

New window will be added for online monitoring plots



1 Plot 1 - Amplitude

Amplitude Spectrum (per layer) with two histogram types:

- Pad Histogram
- Cluster Histogram

2 Plot 2 - Geometry

Hit Map (per layer) with two hit map types:

- Binary Hit Map
- Deposition Hit Map (sum of amplitudes in channel)

3 Plot 3 – Rate monitoring

- Received event rate
- Trigger rate
- Channel rate
- Empty event rate

4 Possible upgrade

I will try to create assiociated web page for remote online monitoring.

Summary

- 4 UDP Socket will be used to handle 12 layers
- Raw binary data will be written to disk without event building
- Additional window for online monitoring
- Modification of amlplitude histogram, hit map and new event rate monitoring