Science & Technology Facilities Council
ISIS

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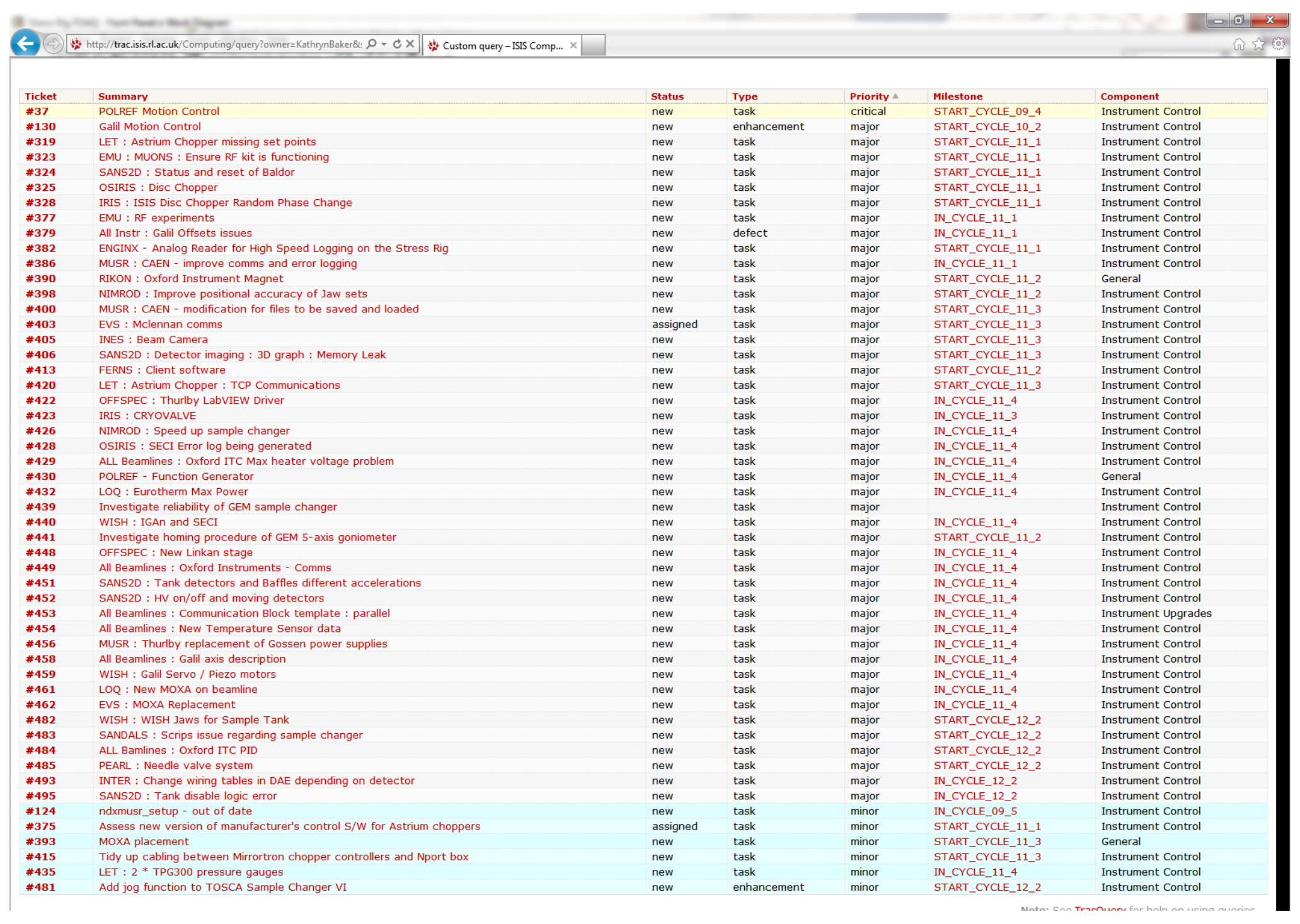
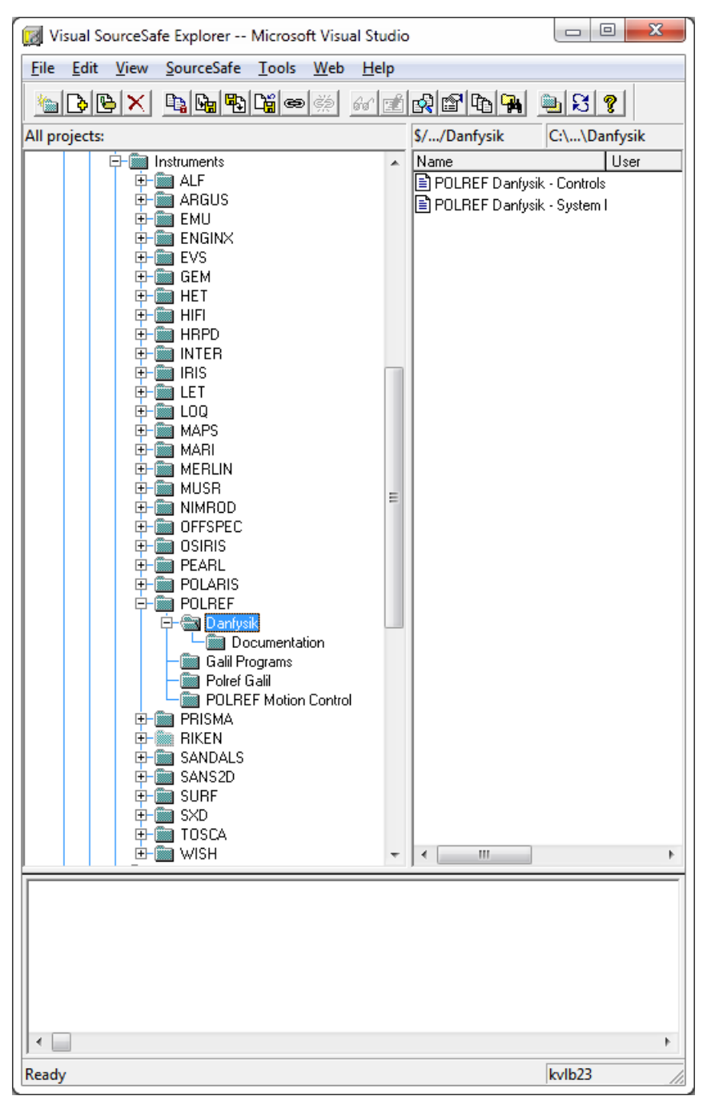
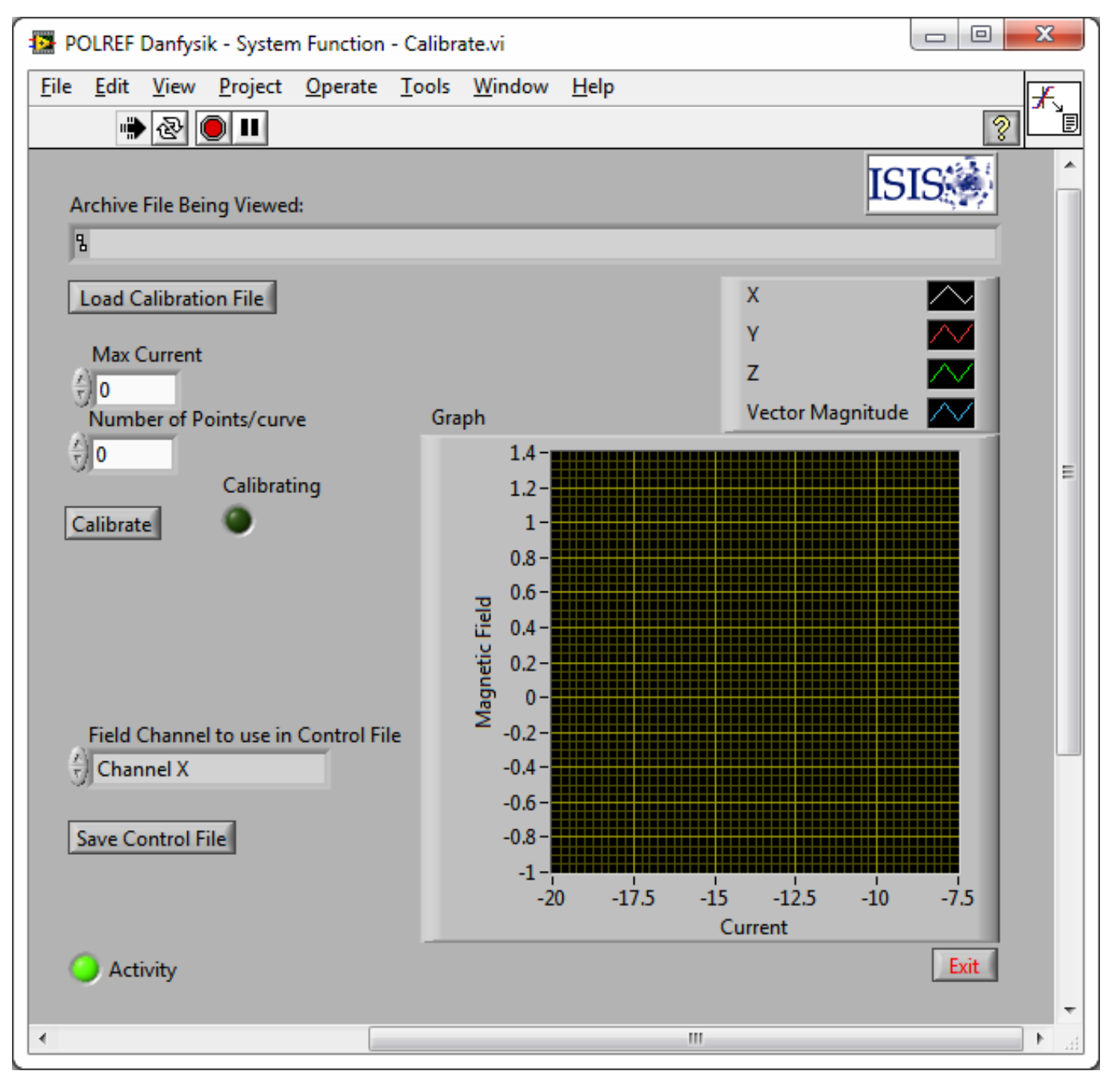
The use of LabVIEW in Sample Environment and Instrument Control

At ISIS, National Instruments' LabVIEW is used to produce software to control sample environment and beamline components. LabVIEW is a system design software particularly suited to device control.

The three-person team develop and support code across all 30 beamlines at ISIS.







The process

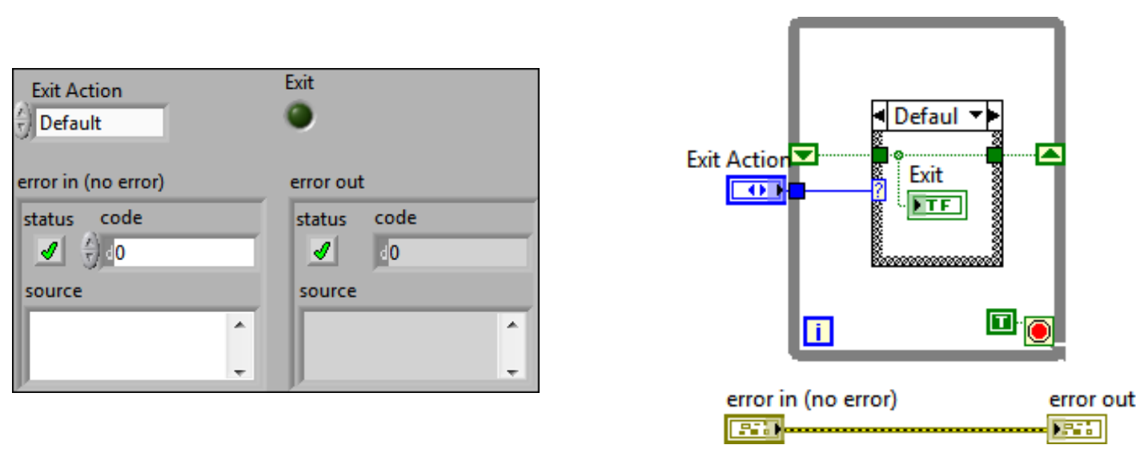
- When new software or additional functionality is required the developer submits it into the TRAC system. This Wiki-based functionality is used to list the jobs that are active.
- All source code is stored in a code repository using a standard file structure which is common to all instrument control computers. This is done to simplify code portability.
- As a team we have agreed to a set of rules in how we code and lay out our block diagrams. This ensures that we can easily read and understand each other's code.
- Once the code has been completed and tested, it is checked into the repository ready for distribution as appropriate.

Coding Techniques

- Like any computing language LabVIEW allows for good and bad coding.
- There are best practices, as recommended by both NI and the LabVIEW community as well as our own internal standards.
- The number of coding techniques and tools in LabVIEW has increased over the years, for example OOP, events, EPICS support, unit testing, and MATLAB integration.

Functional Globals

These are a standard LabVIEW programming technique, used to maintain values between calls acting as a data node.

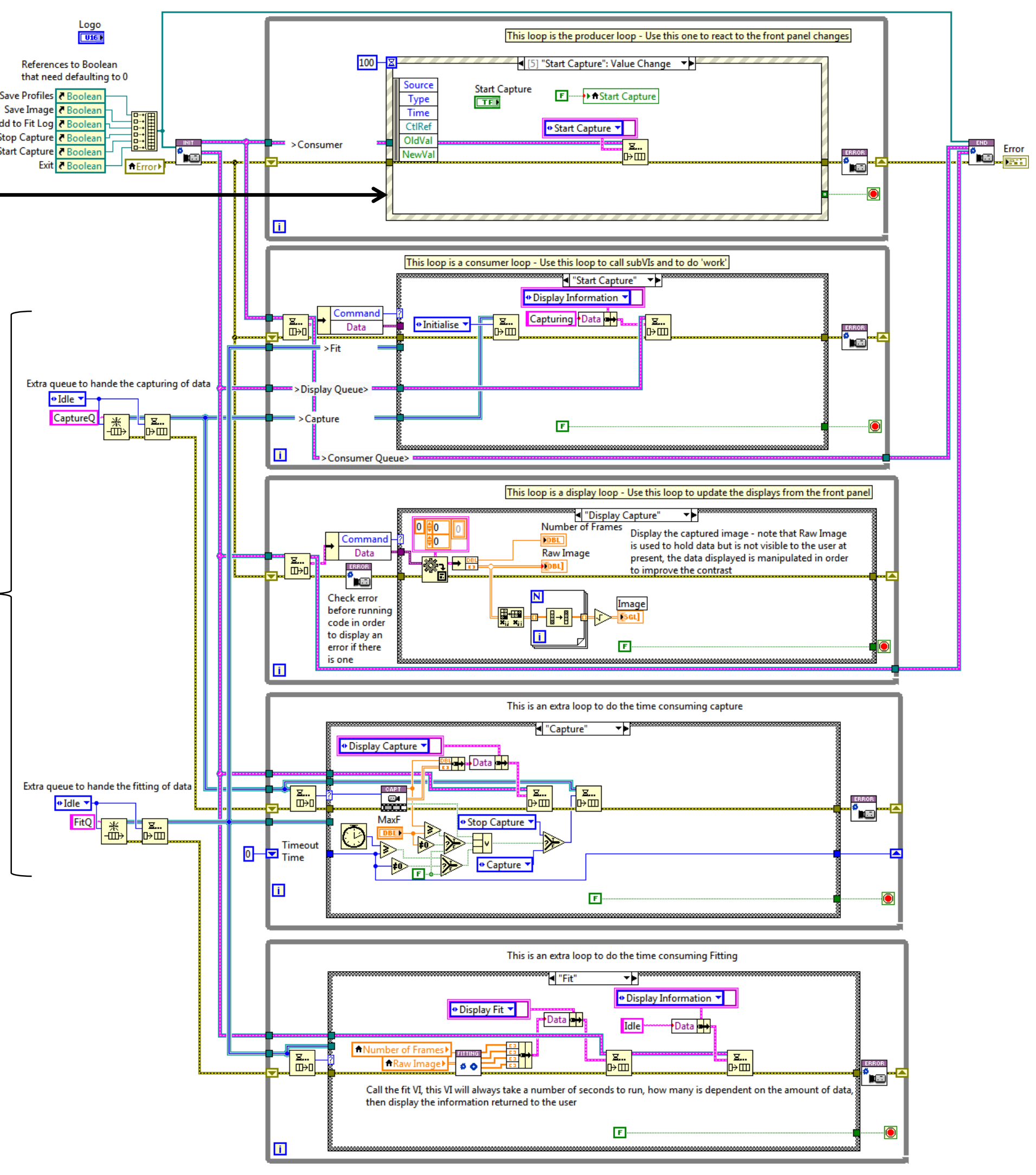


Event Structure

Reacts to front panel or user generated events

Queued Systems

Queues can be used to ensure that actions are undertaken in a requested/required order.



Producer/Consumer Loops

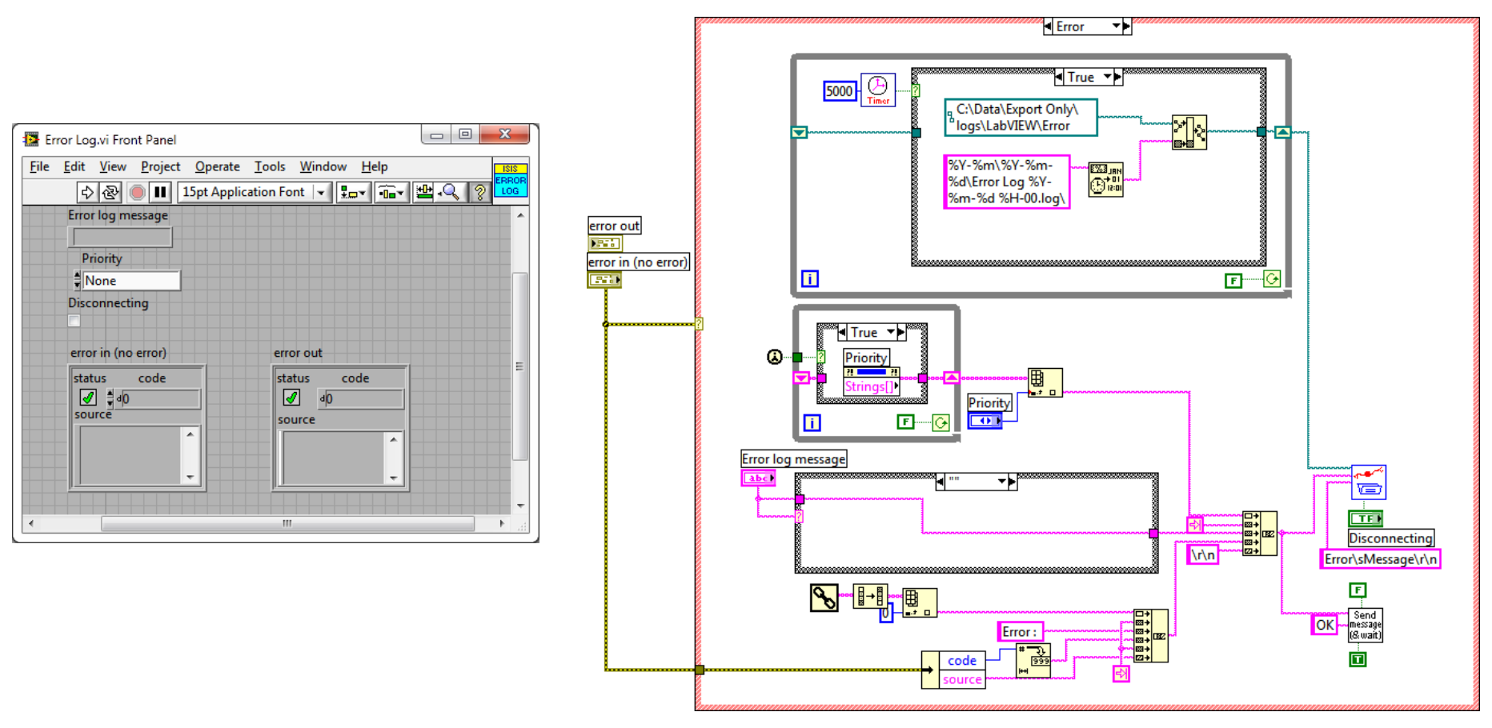
This is a standard LabVIEW architecture. The Producer loop is used to react quickly, while the Consumer loop(s) do the more time consuming work.

Multiple loops

Automatically enables parallelisation allowing the best use of resources. This can be fine tuned.

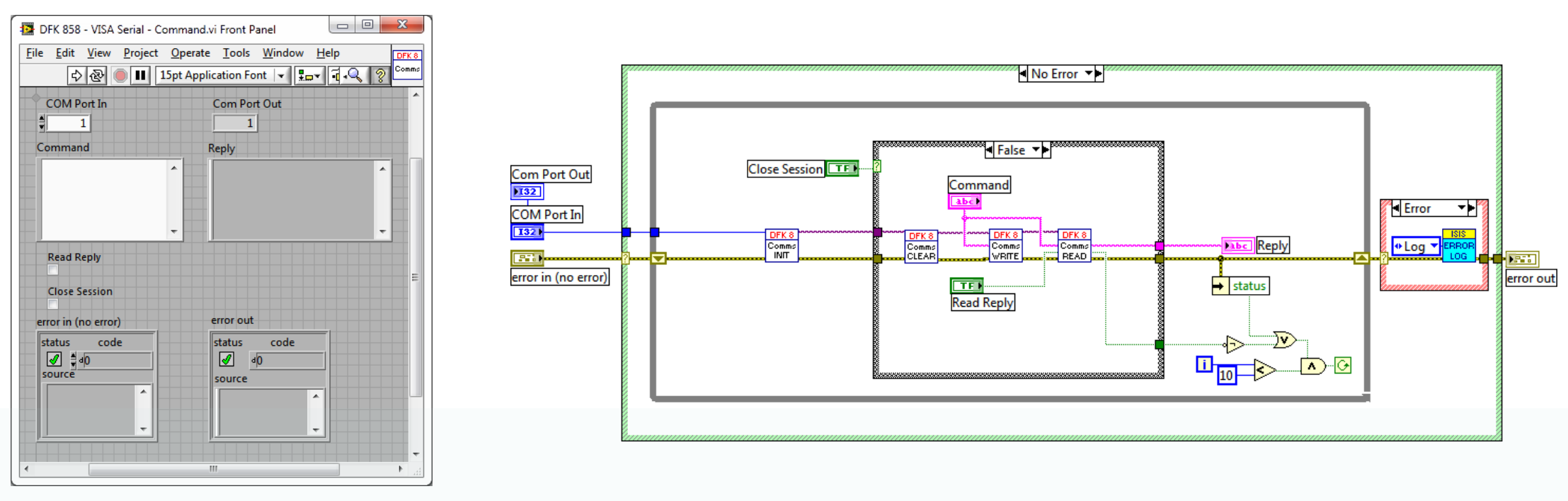
Standard Error Handler

The use of a standard error handling VI ensures that all errors can be dealt with appropriately.



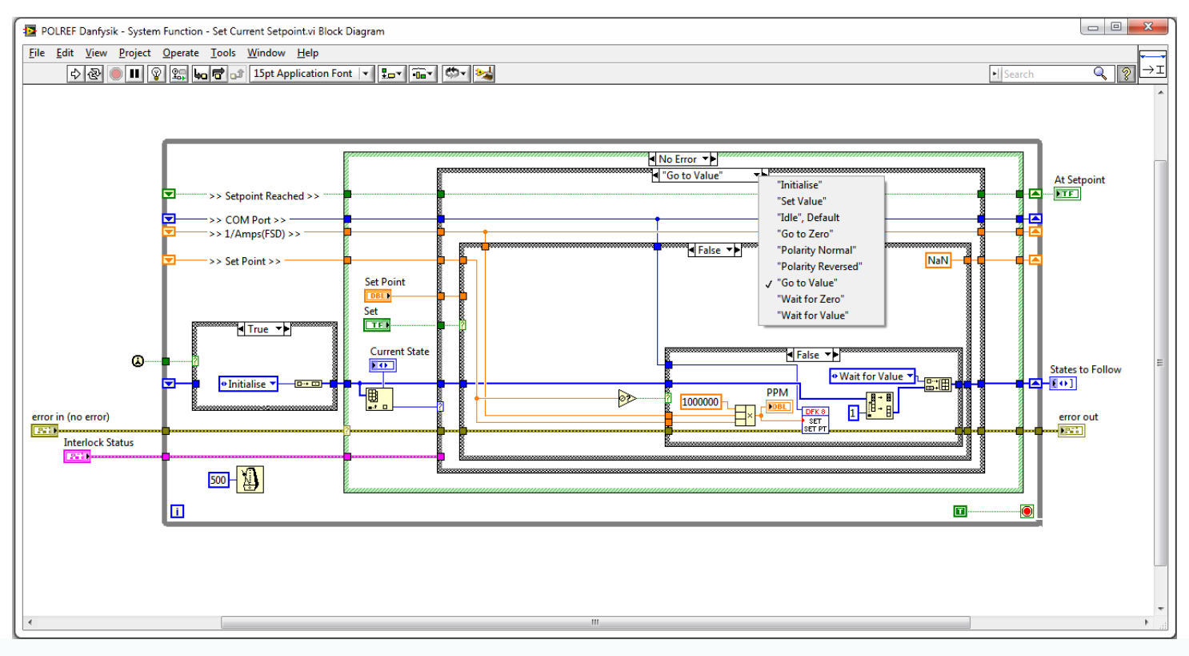
Templates

The use of templates allows us to use standard code, modifying only what is necessary.



State Machines

Used to move between states in a certain order.



The Future

Research is being carried out into the various methods of communicating between separate systems to enable the overall control system to better meet the needs of the different users of the system (e.g. visiting scientists, instrument scientists, sample environment support personnel).

We are seeing increasing complexity in motion control and are having to evaluate how we best tackle this.

We are also reviewing the current architecture and development procedure to see what can be improved.