IKON19

NETWORK INFRASTRURE UPDATE IN LUND EXPERIMENTAL HALLS
REPORT FOR IKON19

Author(s): Jonathan Taylor.

Date/time of session: [*Tuesday, 29 September 2020*] 13:00

INTRODUCTION.

This document serves two purposes

i. A brief update on the discussions held during IKON 18 on the subject of DMSC, including commissioning of neutron instruments.

ii. A brief update on DMSC activities.

COMMISSIONING

Anton Khaplanov will be coordinating the commissioning documentation for NSS. For that he has written a draft generic commissioning document presented at last IKON. It currently serves to define activities for CC and HC and estimate the time needed. It will be updated based feedback and further details as they become available.

Our objective is to work towards an instrument specific commissioning plan that covers both the cold & hot commissioning phases. With a prioritisation on instruments 1-3 followed by 4-8.

Whilst there is some way to go on developing documentation for each instrument, the high level strategy is worth highlighting here for discussion.

Cold commissioning strategy

Integrating devices into the control system soon after physical installation is the key to success.

The reasoning behind this is threefold:

1. Resource requirements for integration are evenly distributed rather than being peaked at the end of the installation phase of each project.

2. Gaps in functionality (of the control system / timing system, low level infrastructure or devices) are identified early, allowing mitigations to be put in place and hopefully reducing delays.

3. The hot commissioning phase can proceed using a verified control system, minimising the amount of low-level controls verification during the hot commissioning.

The strategy relies heavily on understanding the installation schedule for each instrument project.

The bulk of controls commissioning work will be carried out by the ECDC group. ECDC also acts as the coordinating interface to the low-level epics integration effort for instruments provided by ICS. To be able to effectively deploy resources ECDC needs to be in the loop during installation planning.

For calibration activities in hot commissioning to be as efficient as possible, the surveyed positions of instrument components are required. We shall plan an effective way to store the survey results as instrument installation proceeds.

Installation of low-level infrastructure for power, network and timing is a prerequisite for cold commissioning.

The ICS infrastructure group has a plan for the detailed design work for instrument network cabling (see IKON report on network). This detailed design does not include the instrument specific cable tray routing or installation and termination of network cables.

The Electrical Infrastructure common project will undertake detailed design and installation of cable trays ladders and conduits, along with the installation of network cables (via contract effort) if instruments agree to participate at the level 3 of the project. Use of this project at this level is recommended.

Update on current activities

The BIFROST project is receiving its sample tank in Q4 2020, and has requested that the tank motion control systems are installed, and commissioned as soon as possible thereafter.

We are currently planning for the installation of network from the E04 & E03 comms rooms to the BIFROST and NMX build areas.

For BIFROST we will connect the preliminary motion control system to the EPICS and NICOS controls servers in the H01 server room such that we can test the tank motion systems within the envisioned controls architecture of ESS.

It is worth noting that this is a very good example of the cold commissioning strategy and the plan for this was developed rapidly after a short coordination meeting between the BIFROST team and representatives of the subsystem stakeholders. (DMSC, ICS, NSS and MCA.)

It would be a good plan to organise a similar discussion with other instrument projects to coordinate requirements for their first on site installations.

We will be installing the basic level compute and storage hardware in the H01 data centre later this year to facilitate the BIFROST sample tank commissioning, and the commissioning of other systems for other instrument projects.

Hot commissioning is some way away, but it is worth discussing the high-level objectives such that a specific hot commissioning plan for each instrument can be developed.

From a controls perspective cold commissioning will result in a number of subsystems integrated into the specific controls and acquisition environment of each instrument, such that remote control from the high-level NICOS interface can be made to execute control and readback.

The as installed surveyed positions will be documented for instrument components such that the engineering flightpaths, chopper positions, sample position and detector (& monitor) positions are known. The relative accuracies required for these initial instrument geometry positions might need to be reviewed. The metrology equipment used however will almost certainly be sufficient for what is required.

The chopper group will survey the chopper disc cut out geometry in the lab (using a laser alignment system) that will provide the disc geometry and the relative offset from the TDC signal or encoder 0 position.

Here is a very short list of pertinent needs for hot commissioning taken from notes from last ikon session (Appendix 1) and the draft plan (PDF on indico for IKON).

- DAQ / timing system testing with neutrons and control system choppers detectors / monitors ...
- Calibration of flight paths – fine tuning the engineering locations with neutrons
- Calibration of chopper positions - fine tuning the engineering locations with neutrons
    - Calibration of chopper cascade
- Calibration of detectors
    - Location / geometry
    - Efficiency

We should plan to document a specific set of tests and procedures that is specific to each instrument to fulfil the hot commissioning needs.

DMSC UPDATE

The role of the instrument data scientist (IDS) during cold & hot commissioning.

We have been recruiting instrument data scientists and by Q4 will have an IDS for each neutron technique area.

The IDS is as part of the instrument team the link between the instrument and the developers and software engineers at DMSC.

The IDS will be working on the refinement of the software requirements for each instrument and developing a data pipeline for each instrument from raw TOF data to data reduction to data analysis and visualisation. Until BOT this is very much a draft data pipeline based on experiences from similar instruments at other facilities with the ESS and its instruments in mind. An example of this is the data pipeline for SANS based on data processing of McStas generated neutron events with a data reduction workflow based on the SANS2D instrument (with the LOKI geometry) feeding a SASView data analysis model. This workflow has been productive and helped steering developments and we will carry this forwards for other instruments. Currently powder diffraction workflows are in development.

	Instrument Data Scientist	Instrument
Diffraction	Céline Durniak	DREAM & MAGIC
Spectroscopy	Current Recruitment	CSPEC & BIFROST
Imaging and Engineering	Søren Schmidt	ODIN & BEER
Large scale structures – Soft matter and Life science	Wojciech Potrzebowski	LOKI
Large scale structures – Hard condensed matter	Current Recruitment	ESTIA

Core developments and python training

There has been continued development of the data reduction framework scipp which is now forming the foundation of processing ESS event mode data. Development is ongoing and currently focussed on ensuring the framework is performant for the first three instruments. It is worth noting that the performance against a standard data reduction workflow shows significant gains in speed over mantid. Feedback from the LoKI and DREAM instrument teams has so far been positive.

At the last IKON we ran a Python training session which was well received. We will continue this at the next IKON either in person (we hope) or digitally if needs be. For the time being it would be very useful for us for planning purposes to gauge interest for Python training and what level / courses would be beneficial.

At the last IKON we ran several courses simultaneously.

-Introduction to Python and Jupyter

-Intermediate Python

-Advanced Python – development of GUI interfaces

We could augment those with specific courses for data reduction and analysis in Python.

It would be very helpful if you could contact myself and Thomas Rod with requests and suggestion so we can develop something beneficial.

APPENDIX 1

Notes from the previous IKON Discussion on Commissioning from IKON 18.

(Which seems a lifetime ago)

These are the notes taken during the commissioning session which we have taken note of drafting the high-level plan. There is considerable detail here which is not currently included in the draft plan. The rich discussions /points around ESS source behaviour are valuable.

How do we measure target and moderator behavior?

- Use gold foil for activation measurement
- Cadmium mask
- Engineering model of monolith structure
    a. Calculate how much intensity at beam port and compare to real
    b. Same for sample point
    c. Difficulty is neutronics calculation is 80% accurate
    d. Then you can start the choppers etc.
- Full beam won't be until 2025, beam characteristics will change, moderator behaviour
- Beam monitors may not be able to fully give required information?
- CCD, TOF camera, neutron imaging plate etc in direct beam
    - Need to know proton current at time, so can scale estimate flux
- Four initial important parameters, facility intensity, time fluctuation, spatial fluctuation, time structure?
- Later steps will add more info like divergence
- How to do path length calculation?
    - Measure known sample at different positions. Require accurate metrology
    - Need to know exact when neutrons start from
    - Can use different wavelengths
- These things need to be done in the right order
- These will need to be done repeatedly, e.g. for different moderator temperature
- Can we have something in the instrument control that gives moderator temperature, rastering status etc.?
- Can you correct with a monitor at the front of the beamline?
    - Needs to be stable
    - Monitors must be shown to be stable before we start.
    - Will need to be able to see the pulse time structure, but how accurate would be sufficient
- Tobias: we have had conversation with target about getting rastering information etc. via the EPICS system

We should take cold commissioning seriously to make it the real deal, for example: having the time system integrated with motion control, sample environment etc.

This can all be done without neutrons.

Needs to be coordinated so the right staff are available at the right time.

Staff needs won't be fixed, e.g. two instrument scientists + one ECDC + SE etc.

What do we need to do to make cold commissioning a success, i.e. what do we need?

- Well defined SE systems that are working, so won't need debugging during hot commissioning
- Need to know how long it takes to cool, say, an orange cryostat.
- HC: Day 1 (cspec), vanadium, slits, vacuum - can all be done in cold commissioning
- HC: Need to be able to cool stuff down, do background measurements
- There is also stuff that could even be done before cold commissioning
- Need to determine which SE system are priorities for each instrument
  - Some could be bought early (now) but some aren't technically available
  - SE need time to "play" with kit

What needs to be done in HC for SE and MC:

- Background measurements
- Parasitic scattering off slits etc.
  Scattering off SE systems
- Check for sky/floor shine

Need to develop a protocol for background measurement. Need time-of-flight and wavelength measurement independent.

Alignment both physically and in software. Get physical locations from physical measurements. Calibration measurement can be used to fine tune positions in software.

- The wavelength calibration (T0) will be more difficult due to the spectrum and the wavelength dependent time structure. At NMX if you put a line to time-wavelength plot between 1 and 5 A, then the difference is sinusoidal with the amplitude of 40mus that causes inaccuracy in q which is 10% of the reciprocal lattice spacing of the largest unit cell at 2A.

The situation is much worse if there is a rough pulse shaping, where far from the end of the wavelength band you see reduced intensity, better resolution and shifted centre of the pulse.

So it is worth to check these staffs much before hot commissioning, try to produce a script that calculates the T0 for each setting and each wavelength, and which is adjustable to the reality, and thinking on reliable calibration.

- The other is connecting to it, there will be a lot of diagnostic measurement (like running only one chopper) and diagnostic data treatment (like mapping the intensity as a function of q and arrival time) that are the same for most of the instrument, that should be defined, coded and integrated into the high level control and data treatment programs (by DMSC) well in advance the hot commissioning.