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| **Instrument TG2 SAD Checklist** |
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# INTRODUCTION

Scientific Activities Division (SAD) is responsible for the Science Support Systems (SSS) work package. To be able to support the instruments in construction and operation it is important that the instruments are designed to take SAD requirements, ref [1],[2],[3],[4], into account. This checklist is intended to help instruments be aware of these requirements to a sufficient level before starting detailed design. For its scientific exploration an instrument might require certain sample environment equipment and support laboratories. Such needs shall be discussed and agreed on between the instrument team and SAD according to ref [5].

# SCOPE

This checklist cover interfaces between an instrument team and ESS Scientific Activities Division. It encompasses mainly the areas of mechanical interfaces for sample environment, utilities supplies for sample environment, control system for sample environment and sample handling and instrument specific lab space. The checklist also serves to document that needs for sample environment equipment and support laboratories have been discussed between the instrument team and SAD, ref [5]. Actual requirements and specifications for sample environment equipment and support laboratories are tracked elsewhere [6].

The checklist intends to check if an instrument is mature enough from SAD point of view to pass TG2. Instrument teams should check the box that they think best represents the current instrument status for each row.

# SAD CHEcKLIST FOR INSTRUMENT TOLLGATE 2

Please put a mark in the box that best represents the current instrument status.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SAD Reference Document Checklist for Instrument Tollgate 2** |  |  |  |  |
| **Item** | **Brief descriptions of areas relevant for SAD at TG2** | **Instrument response** | **SAD TG2 Review comment** |
| **Not relevant** | **Not yet considered** | **Considered**  | **Cost allocated in inst. budget** |   |
|  |  |  |  | **importance** |  |   |
|  |  |  |  | **Minor**  | **Major**  |  |   |
| **1. Sample Environment Equipment** |
| Related doc: ESS-0000960 Science Support Systems Work Package Specification; section 1.4.2 |
| **1.1 Instrument-specific sample environment equipment included within instrument construction scope:** |   |   |   |   |   |   |
|   | Scope budget and timelines for each sample environment system adequately defined?  |   |   |   |  Yes |  Yes |  Humidity controller, standard Oxford cryo LN2 |
|  | Responsibilities and interfaces during construction adequately agreed and documented?  |   |   |  Yes |   |  Yes |  NMX takes responsibility |
|  | Responsibilities and interfaces during operation incl. calibration and maintenance adequately agreed and documented?  |  | X |  |  | No ops budget established for NMX |  For repairs NMX or vendor takes responsibility. Incl. maintaining the cryo system (purging, pumping the legs) |
|  | Synergies with other instruments and pool sample environment equipment investigated – both for construction and operation?  |  X |   |   |   |   |   |
| **1.2 Other sample environment equipment as part of the ESS sample environment suite** |   |   |   |   |   |   |
|   | Needs adequately expressed for ‘pool’ sample environment equipment? |   |   |  Yes |   |   |   |
| Requirements and timelines agreed upon? |   |   |  Yes |   |   |   |
|  | Staging and leverage incl. third party funding adequately considered? | X |  |  |  |  |  |
| **2. Support Laboratories** |   |   |   |   |   |   |
| Related doc: ESS-0000960 Science Support Systems Work Package Specification; section 1.4.2 |
| **2.1 Instrument-specific support user laboratories**  |   |   |   |   |   |   |
|  | Scope budget and timelines for each lab adequately defined?  |   |   |   |  Yes |  Yes | Refers to sample prep area by NMX |
|  | Responsibilities and interfaces during construction adequately defined?  |   |   |  Yes |   |   | Basic area with simple instrument requirements  |
|  | Responsibilities and interfaces during operation incl. maintenance adequately defined? |  |  | Yes |  |  | ES&H, SAD, SULF, DEMAX, Logistics, RCT |
|  | Synergies with other instruments and common user laboratories investigated?  |   |   |  Yes |   |   |  SULF, DEMAX |
| **2.2. Common user laboratories** |   |   |   |   |   |   |
|  | Needs adequately expressed and operational workflow considered? |   |   |  Yes |   |   |  Minor use |
|  | Requirements and timelines agreed upon? |  X |   |   |   |   |   |
| **3. Sample environment: Mechanical Interfaces** |
| Related doc: ESS Sample Environment Mechanical Interfaces for Instruments (CHESS reference: ESS-0038078) |
| **3.1 Access** |   |   |   |   |   |   |
|  | Transport path between instrument and SE lab |   |   |   |  Yes |   |  NMX close to E03 |
|   | Provision of an area within 20m of instrument to prepare SEE |  X |   |   |   |   |  NMX close to E03 |
| Area to allow SEE to enter/exit instrument |   |   |  Yes |   |   |  Access through the door or roof |
| Adequate volume within instrument to accommodate SEE (and ancillary) at the sample position |   |   |  Yes |   |   |  Defined space for L SEE (not XL) |
| **3.2 Sample area** |   |   |   |   |   |   |
|  | L/XL support level defined |   |   | Yes |   |   |  L only |
|   | Space for SEE  |   |   | Yes |   |   |   |
| Standard sample mounts |   |   | Yes  |   |   |  Will conform to SAD standards |
| Utility supplies |   |   |  Yes |   |   |   |
| Instrument Crane |   |   |  Yes |   |  Yes |  Local crane to be used for LN2 dewars etc. |
| **3.3 Magnetic considerations** |   |   |   |   |   |   |
|  | Support level defined |   |   |  Yes |   |   |  Not suitable for large uncompensated magnets, and no polarizers |
| **4. Sample environment: Control system** |   |   |   |   |   |   |
| Related document: ESS Sample Environment Control System Reference (CHESS reference: ESS-0038165) |
| **4.1 Control system hardware** |   |   |   |   |   |   |
|  | Infrastructure for SE control rack (space, cooling water etc) |   |   |  Yes |   | No |  “orphan scope“ for NMX |
|  | Patch panel, cables and labyrinths between inside of cave and SE control rack. |   |   |  Yes |   |  No |  “orphan scope“ for NMX |
| **4.2 Control system software** |   |   |   |   |   |   |
|  | Potential SE equipment requiring fast data transfer (~ >1 kHz) identified |  X |   |   |   |   |   |
|  | Specific SE equipment requiring high accuracy time-stamping of SE data identified |  X |   |   |   |   |   |
| **4.3 Integration process of sample environment equipment** |   |   |   |   |   |   |
|  | SE equipment integration support required from SAD identified.  |   |   |  Yes |   |   |  Instrument specific SEE can be integrated by ICS – not critical |
|   | Complex SE equipment that is expected to require extra integration effort identified. |  X |   |   |   |   |   |
| **5. Sample environment: Utility Supplies** |   |   |   |   |   |   |
| Related doc: ESS Sample Environment Utility Supplies Reference Document for WBS 13.6.X.5.6 (CHESS reference: ESS-0038163) |
| **5.1 Utility Supplies** |  |   |   |   |   |   |
|  | **Noted the SE requirements for:** |  |   |   |   |   |   |
|  | Electrical power |   |   |  Yes |   |   |   |
| Cooling water |   |   |  Yes |   |   |   |
| Supply for gases, helium recovery and gaseous exhausts |   |   |  Yes |   |   |  Only mention detector gas – it is pointed out here that these are not SEE gases |
| Data connections |   |   |  Yes |   |   |   |
| **5.2 Number of required Utility Supplies Setups** |  |   |   |   |   |   |
|  | At the sample position |   |   |  Yes |   |   |  1 standard set-up |
| At the Area for SEE preparation at the instrument |  X |   |   |   |   |  Very close to SE workshop/lab in E03 – not needed |
| Additional at the cave for Concurrent experiments running |  X |   |   |   |   |  Very close to SE workshop/lab in E03 – not needed |
| For equipment on mezzanine |  X |   |   |   |   |  Very close to SE workshop/lab in E03 – not needed |
| **5.3 Panels** |  |   |   |   |   |   |
|  | Labyrinths considered |  |   |  Yes |   |   |   |
| **6. Infrastructure for sample handling and instrument specific lab space** |   |   |   |   |   |
| Related document: ESS Safety and Sample Workflow for Instruments Reference Document for WBS 13.6.X.7.1 (CHESS reference: ESS-0040840) |
| **6.1 Sample handling** |  |   |   |   |   |   |
|  | **Note the requirements to have:** |  |  |  |  |  |   |
|  | A sample storage cabinet on the instrument dimensioned according to expected sample size, dimension and expected throughput; cabinet has to be equipped according to hazards (flammable, activation,…) |   |   |  Yes |   |   |  Will sample be allowed to be stored in sample prep area (i.e. instrument specific lab?) |
| **6.2 Exhaust line to main stack** |   |   |   |   |   |   |
|  | Use of exhaust line that allows ventilation through the main stack (e.g. for secondary vacuum containment of hazardous samples, for experiments with gas flow,…); If used, HEPA filter and/or liquid trap will be a requirement to avoid particles/liquids from entering the lines  |  X |   |   |   |   |   |
|  **6.3 Fume hood ventilation duct** |   |   |   |   |   |   |
|  | Use of access to standard fume hood ventilation duct (no activated gases, fumes); usable for hoods, powder boxes, glove boxes, … |  X |   |   |   |   |   |
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Narrative/notes after discussing with instrument team (S.Z. Fisher 13 June 2017)

1. Pool & Instrument specific sample environment

NMX has 2 instrument specific SEE planned: humidity controller and a LN2 cryo system. These are budgeted for and are “off the shelf” items. Due to how data will be collected there is not a pressing need to “integrate” these (into EPICS). However, the team states that it may be useful to be able to control these from a computer. Neither piece of equipment requires special utilities. From a SAD perspective these are procurements with little to no effort from our side.

For repairs NMX will take responsibility and deal with vendor (warranty) directly. This also includes daily operations and preventative maintenance.

2. Instrument specific and general support labs

NMX plans for a sample prep lab/instrument specific lab underneath the control hutch. This will house very simple lab equipment (incubator, microscope, some crystal mounting hardware/tools, a LN2 storage dewar for keeping crystals frozen, and home X-ray source). There are no special requirements for this lab. The instrument team asked if they can store exposed crystals here, especially since they will need to collect X-ray data from the same crystals immediately after the neutron data collection. The following is pointed out to the instrument team, based on our/ESS radiological zoning plan: the experimental hall is considered a (green) supervised zone that includes the lab and workshop building. Within this “green” zone, there are some ‘controlled’ areas included (eg. the cave when beam is on/shutter open, the radiological materials lab in D08 and so on). The sample storage cabinet and X-ray diffractometer could create another specific zone, but this will very much depend on doses/activation levels. Note that the operation within a supervised zone, that includes changing the sample has to be within the boundaries of the definition of being in supervised zone. This refers to e.g. either dose rate or the integrated dose at ANY hour. There is no measurable activation expected for crystals used on NMX, similarly, the X-ray machine is completely self-shielded within a leaded Perspex enclosure.

NMX users and staff will use the nearest labs in E03 for making solution or borrowing chemicals etc.

3. Access & Sample area

NMX is very close to E03 so there is no requirement for them to have a separate SEE staging/set-up area outside of the cave. The current cave design will allow large bulky equipment to come through the roof with the hall 3 overheard crane. They also will have a local crane with ~1 ton capacity and this can be used to get smaller items in. They defined the L sized SEE as fitting in the sample area of the instrument. Magnetic considerations were discussed and it was stated that they will not be able to use large uncompensated magnets or polarizers.

4. SE control systems

NMX does have room for the SAD utility supplies panel, however their current budget does not have this specifically flagged. We agreed that one panel in the cave will cost ~35 kEuro and this is now flagged as (minor) orphan scope.

For integration it is not critical that the cryo system and humidity controller be EPICS integrated, but computer control from the cave would be preferable.

5. SE utility supplies

NMX asks if the panel itself, auxiliary components (e.g. pumps), control racks for the pool SEE will come with it’s own cables/pipes/tubing to the main hall 3 utilities distribution point (i.e. who pays for the connections). The team is reminded of the following: the supply panel includes the hardware components and the required control hardware. The wiring to the galleries is not included and this is considered part of the instrument. The connection points, routing and the racks (for the control hardware) can be combined whenever adequate with the other instrument infrastructure hardware (such as cooling water for instrument components).

NMX would like to use the SEE panel utilities for running some things in the cave (e.g. detector gas).

NMX is considering labyrinths and would like to know from SAD how much space the SEE utility panel connections (water, data network, gas, electricity etc.) will take up in the chicane.

6. Infrastructure for sample handling, instrument labs

There are no special needs for a fume hood or a connection to the main stack. A very important question is will they be able to take exposed crystals from the cave to the sample prep area for storage or X-ray data collection without the need to survey them. Can they have a sample storage cabinet (for exposed samples) in the prep area or does it have to be in the cave?

REFERENCES

[1] ESS-0038078 ESS Sample Environment Mechanical Interfaces for Instruments – Reference Document for WBS 13.6.X.2.3

[2] ESS-0038165 ESS Sample Environment Software Interfaces - Reference Document for WBS 13.6.X.5.7

[3] ESS-0038163 ESS Sample Environment Utilities Supplies - Reference Document for WBS 13.6.X.5.6

[4] ESS-0040840 1 ESS Safety and Sample Workflow for Instruments - Reference Document for WBS 13.6.X.7.1

[5] ESS-0000960 Science Support Systems Work Package Specification; section 1.4.2

[6] https://ess-ics.atlassian.net/wiki/display/SA/Scientific+Activities+Division