

# 2016 Tollgate 2: ESTIA Detectors Systems Review

Date: 15 November 2016

Reviewer: *Francesco Piscitelli*

## **Preamble:**

This document is the review of the Tollgate 2 document of the instrument technologies for the proposed instrument "ESTIA".

## **Executive Summary**

The reviewers looked from the *perspective of detector technologies* at the Tollgate 2 documents. The reviewers note that the level of detail is very sparse in the Tollgate 2 documents provided, and would benefit greatly from more.

The issue of schedule is dealt with partially in the document, and it is very important to clarify it. There does not appear to be a detailed instrument project schedule in the documents provided.

Therefore the reviewers **grade the TG2 documentation: "GREEN"/"AMBER"**. See comments for details of what needs to be added. Most of the comments relate to the lack of information in the documents provided - this is "amber"; based upon discussions - this is "green".



The summary of the review is as follows:

- The reviewers consider that from the *perspective of detector system technologies* the preliminary design is sufficiently complete and mature.
- **Maturity:** The requirements need to be expanded in more detail to commence the detailed engineer design phase. However, the requirements are presented in a clear understandable fashion.
- **Compatibility:** From dialogue, the plan is compatible with ESS standards, if executed as expected.

- **Feasibility:** The overall system performance requirements presented in the concept are technically feasible solutions. The complexity of the system outlined in the base proposal is moderate. The one exception is rate requirement, which is significantly higher than originally requested for the development programme.
- **Risks:** The principal risk is of a delay, and labour cost overrun in the absence of a credible project schedule. The requirements, in particular on rates, need to be clarified – and the relative priority of achieving this rate requirement.
- **Budget:** The total cost indicated for the detector systems is considered to be slightly underestimated, however feasible, within a suitable uncertainty expected for this at this stage. It would be helpful if the two work units (beam monitors and detectors) were clearly separated out, and included all aspects of work related to them, as they stand as individual work units.
- **Schedule:** There does not appear to be a detailed instrument project schedule in the documents provided.
- **Communication:** The team has communicated effectively with the detector group.

Detailed comments:

- In the preliminary system design document (pages 31-32), there is an inaccuracy in the text at page 32: "Neutrons hit a thin B4C coated substrate under a grazing angle ( $\theta$ ) and the charged particle cloud created in the detection gas is measured with a grid of wires, allowing a 2D position sensitivity." The readout is not performed by a grid of wires but by the coincidence of a plane of wires and a plane of cathode strips. Wires and strips are placed orthogonally to have the 2D position reconstruction.
- The system requirements for the detector system are reasonable, however the counting rate capability exceeds the current state of the art technology of a few orders of magnitude, and is much higher than that stated at the beginning of the development process. Moreover, the spatial resolution needed is 3 times smaller than that of the state of the art technology. The Multi-Blade technology has been stated as the preferred option for the ESTIA detector system, which is being developed. The implications of achieving something which is between the state-of-the-art but below the full requirement for the instrument should be stated. It will be difficult to verify the rate requirement as stated prior to operation of ESS at maximum power.
- Beam monitors are mentioned in the system requirements document at page 17 (in Beam Validation System). Further information is needed.
- On monitors, it is mentioned that some are moving. It should be noted that the reliability of this should be considered, and moving monitors in/out should not be

- encouraged, unless strongly needed.
- In the preliminary system design document (page 42) 6 monitors are showed in the picture, while there is no detailed description of them in the text. The requirements and purpose need to be stated.
  - It is not clear whether the detector flight tube system is filled with Argon at atmospheric pressure or evacuated, nor which is the preferred option. The first or the second choice makes a huge difference in the mechanical constraints on the detector entrance window. Moreover, it is stated that the window scattering must be lowered with respect to the current state of the art to  $10^{-4}$ , in order to make the instrument performing. This value is not realizable if the detector is operated in vacuum, regardless of detector technology. It must be stated clearly what is the key point for the scientific case to minimize the window scattering.
  - In the work package specifications document no timeline for detectors is shown, and it is coupled with the sample exposure system. A work unit for detector and monitor systems is needed with a detailed timescale and separated budget. The most detailed schedule, fig 1.2 in the work package specification document shows too high a level.
  - In the system requirement document (page 35) 11.1 DAQ, standard racks will be used. Note that this is part of the detectors work unit.
  - The budget is extremely difficult to follow in details, in particular as parts of the readout are separated out – such as standard racks for DAQ, cabling in utilities, and the labour.
  - In the budget, under “beam validation system” – it is not clear why 62k EUR is allocated for 13.6.9.1.6.1 beam monitors, but 270k EUR is allocated for 13.6.9.1.6.2 flux measurement assembly.