



Science and
Technology
Facilities Council



EPAC Project

Response to ISTAC3 recommendations

Project	Doc Type	Work Package	Number	Version	Status
EPAC	RP	WP1	1	A	OFR

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1. Introduction

The EPAC International and Technical Advisory Committee (ISTAC) held its third meeting (ISTAC3) on 30th November and 1st December 2022. The report summarising the findings of ISTAC3 was submitted by the ISTAC Chair, Prof Jon Zuegel, in January 2023, and he presented a summary to the EPAC Project Board (PB) at the PB meeting in February 2023.

The ISTAC3 report contained 20 recommendations, and the EPAC PB requested that a document summarising of the response of the Project to the points raised be presented to the PB meeting in September 2023.

This report contains the text included in that summarising document, detailing what the EPAC team was currently doing, or was planning to do, in a response to each recommendation, together with an update where the situation has changed since September 2023.

2. ISTAC3 recommendations and responses

Recommendation 1	<i>ISTAC3 recommends establishing a shared folder before meetings to archive materials for each ISTAC meeting, including all presentations downloadable as a single .zip file.</i>
Response	For meetings to date, the agenda and a progress report have been circulated in advance of the meeting. At the meetings themselves, the talks were shared through the Indico website that enabled everyone to download each talk. We will now set this up in advance of future meetings, to allow the ISTAC members to see the presentations in advance and familiarise themselves with the information to be presented.
Recommendation 2	<i>The ISTAC understands that difficulties continue in hiring and retaining staff. ISTAC fully encourages and supports the use of special allowances to improve hiring and retaining staff.</i>
Response	Recruitment remains difficult. Update: The recent UKRI/STFC STEM uplift should help with future recruitment; however, the ability to use additional Recruitment and Retention Allowances has disappeared.
Recommendation 3	<i>ISTAC requests an overview of the number of people and FTEs working on the project, and their general areas of responsibility so it might provide advice and potential leads for candidates.</i>
Response	This information will be shared with the ISTAC at the next meeting as part of the Project Update given by the EPAC Project Manager.

<p>Recommendation 4</p>	<p><i>ISTAC reiterates the importance of system engineering to the entire project. ISTAC requests each WP present this using a common format at future ISTAC meetings. Clear functional requirements and primary criteria (FRPC: shall, should and nice-to-have) need to flow down to commissioning plans.</i></p>
<p>Response</p>	<p>At the next ISTAC meeting, the presentations will include clear requirements. We are currently developing the commissioning plans with commissioning criteria.</p>
<p>Recommendation 5</p>	<p><i>ISTAC recommends focusing project efforts on filling the open liaison position, if industrial applications still have priority.</i></p>
	<p>The recruitment activity has been ongoing for the past 12 months. We have recently filled one of the positions for an industrial applications scientist for EPAC, with this person expected to join in the next few months.</p> <p>Update: The application scientist joined EPAC a few months ago.</p>
<p>Recommendation 5</p>	<p><i>The grating compressor represents one of the biggest technical risks to the EPAC project. ISTAC supports investing in parallel approaches to acquire diffraction gratings to (1) first, demonstrate peak power/intensity on target at a reduced, 1-Hz repetition rate, and (2) realise full high-average power capability on a longer timeline given needed R&D and production process development.</i></p>
<p>Response</p>	<p>Following approval from the EPAC Project Management Board and additional funding through an MOD grant, we have started the procurement of two sets of substrates. The team is currently negotiating the contract with one manufacturer (LLNL) and aims to place contracts for the first type of gratings operating at 1 Hz. LiDT tests continue on the MLD solution for the 10 Hz operations. Work is progressing well to develop the cooled solution, with a prototype test underway.</p> <p>Update: The MLD grating tests have now concluded and cooled grating prototyping continues, as well as modelling.</p>
<p>Recommendation 6</p>	<p><i>The project needs to flesh out details to fully define the data management system, including mechanisms for data flows from the experimental areas back to the laser system and secondary sources to take full advantage of machine learning and artificial intelligence. This includes developing a system to integrate metadata.</i></p>
<p>Response</p>	<p>This system is being developed, although more work is needed. We will have capabilities for machine learning routines to provide feedback to the laser, as well as experimental interactions via the Experimental Orchestrator and the control system. However, implementation of this needs to be done carefully and only after tests at lower powers. A good fraction of the metadata would be captured as part of the EPICS-Area detector modules and the rest, including configurations, would need to be captured manually. We are in discussions with STFC's Scientific Computing Department</p>

	<p>(SCD) regarding a platform for capturing metadata and various solutions, including digital lab-books, are under discussion.</p> <p>Update: We are working with SCD on developing the facility data pipeline.</p>
Recommendation 7	<p><i>ISTAC notes and appreciates initial efforts on integrating separate data systems in TA1, but they involve only a relatively small number of systems. ISTAC3 recommends procuring and implementing full-scale testing as soon as possible to identify and address any potential weaknesses in the conceptual framework.</i></p>
Response	<p>This is also under development. Systems for the initial operations of EPAC have already been purchased and are being installed. The plan is to commission parts of the system with the installed laser systems (e.g. the pump laser) so that any potential flaws can be identified. In parallel, we will develop and test a full, end-to-end data acquisition and management system in TA2/TA1 that will yield scalable data.</p> <p>Update: We have now installed the initial data management system in EPAC and this is being tested. We are also testing the concepts of experimental orchestrator in Gemini TA1. An update will be provided at ISTAC4. We have now sub-contracted part of the development to a local company (Observatory sciences), with an ex-Diamond Light Source (DLS) Control/Data Acquisition expert leading the development.</p>
Recommendation 8	<p><i>ISTAC recommends establishing close working arrangements between operations and data/computational teams.</i></p>
Response	<p>Data management/control is now part of the Operational Working Group.</p>
Recommendation 9	<p><i>ISTAC recommends managing user expectations because it will be key to success. Involving key users at every stage will mutually benefit the facility and the user community. ISTAC further recommends working with existing activities, including those at Diamond and STFC's CCPi activities who have already developed software for this purpose.</i></p>
Response	<p>We have established close links with CCPi via the Tomography group in SCD, who are developing our tomography solutions. An internal workshop with SCD, ISIS and Diamond, who all employ tomography tools, is being planned, after which we will arrange a workshop with key users.</p> <p>Update: We have held a workshop with some key plasma accelerator groups regarding the development of tomography solutions in EPAC. The solution is currently under test by someone embedded in WMG (who are experts in this area). The plan is to get more feedback on this at the DXCT workshop we are organising in June.</p>

<p>Recommendation 9</p>	<p><i>Controls integration, and back-end data processing must be integrated in real time (although not necessarily at 10 Hz), to provide “quick looks” at data, especially in tomography experiments. CT data – users need an on-the-fly reconstruction of at least one pickable slice. It does not need to be the final filtered, cleaned image. It does however require removal of any jitter in the source, stages, etc. ISTAC recommends additional integration efforts with teams from synchrotron tomography end stations (and other groups like and STFC’s CCPi) to define the user requirements for monitoring of data during acquisition and to share existing software.</i></p>
<p>Response</p>	<p>As above; we will have a quick-look solution for CT via either the SCD system being developed or Mantid Imaging that ISIS uses – we have a workshop arranged at which we will discuss some of the details.</p>
<p>Recommendation 11</p>	<p><i>ISTAC C3 recommends EPAC implement a structured approach to involve users at different levels of the project to identify first experiments, especially in new areas and for new users to CLF.</i></p> <p><i>-ISTAC2 recommended maintaining and boosting efforts to connect with the user communities and present a general “marching plan” that will continue to develop as the project and commissioning proceed.</i></p> <p><i>Link EPAC industrial liaison staff with other facilities (DLS) and develop a plan for training users and growing science areas.</i></p>
<p>Response</p>	<p>User engagement continues to be a top priority for the EPAC team. Through our User Forum, special workshops and 1:1 discussions, we have a strong connection with the academic community and Dstl group. It is likely that the first experiments will involve these two communities.</p> <p>We continue to work with and learn from others like DLS. We have also established new links with potential industrial users and other institutes working in relevant areas.</p>
<p>Recommendation 12</p>	<p><i>ISTAC recommends that EPAC participate in meetings where potential new users might be identified.</i></p>
<p>Response</p>	<p>We continue to try to identify relevant meetings, conferences and workshops, and attend where possible, to establish a wider network and identify new users.</p>
<p>Recommendation 13</p>	<p><i>ISTAC recommends including poster presentations for future ISTAC meetings, including potentially from prospective academic and industrial users to better integrate them into future operations.</i></p>
<p>Response</p>	<p>This will be organised for the fourth ISTAC meeting.</p> <p>Update: The poster session will include a few examples of initial user collaborations, as well as technical posters that will provide ISTAC members with more detail than can be presented during the talks</p>

<p>Recommendation 14</p>	<p><i>ISTAC recommended visiting facilities that provide rep-rated sources and instruments to users to understand best practices, looking at allocation criteria, planning, resourcing (staff, services, IT, etc.), and effectiveness for outputs.</i></p>
<p>Response</p>	<p>We continue to try and visit other facilities where feasible and establish collaborations. We have excellent links with the EU XFEL teams, DESY, LCLS and DLS.</p>
<p>Recommendation 15</p>	<p><i>ISTAC requests future reports include an appendix that details interactions with existing CLF users and prospective new EPAC users that indicates their level of potential involvement and use of EPAC.</i></p>
<p>Response</p>	<p>The team is now keeping a record of interactions, and this will be presented within the report for the fourth ISTAC meeting.</p>
<p>Recommendation 16</p>	<p><i>ISTAC recommends taking a closer look at the EAs, especially for x-ray radiography/ tomography. For phase contrast imaging, need to easily change the sample/ detector distance – i.e. move the detectors forward/backward.</i></p>
<p>Response</p>	<p>The motorised stages for samples and detectors are not yet fully defined. It is envisaged that one set of stages will be procured for the validation experiments, during which the capabilities of the EPAC driven x-ray sources will be determined. The x-ray imaging diagnostics are being positioned on tables that span the beam dump trench in EA1, permitting free movement during set-up from 2 – 20 m from the source. Individual cameras (sub-micron imager, FOP x-ray panel, etc.) have local motorised stages providing an additional 50 – 250 mm travel. This combination provides the necessary flexibility to scan for phase contrast enhancement.</p> <p>Initial proof-of-principle experiments, carried out in collaboration with facility users, will guide the design and specifications of a comprehensive range of equipment required for operations. We will consult with experts from the x-ray community using existing tomography systems, such as Diamond beamlines I12 and I13, the MuCLS, and conventional scanners and linacs. The sample and detector configuration should be able to cover x-ray CT, absorption spectroscopy, and diffractive imaging.</p>
<p>Recommendation 17</p>	<p><i>Target fab is a major strength of the EPAC environment, but the move to high repetition rate has to be prepared. ISTAC3 recommends exploring sub-μm target delivery as explored in XFEL structural biology end stations, as a means for high repetition solid-target interaction.</i></p>
<p>Response</p>	<p>We have excellent links with both the EU XFEL teams and the UK XFEL project, and have had discussions and visits to see their systems. We are developing liquid targets and tape drive targets as solutions for EPAC, and whilst we are able to collaborate and draw on the experiences of the XFEL structural biology teams, it is noted</p>

	<p>that these systems are x-ray-only delivery systems and therefore do not have to deal with the extreme shock, EMP and debris that will be seen on EPAC. Therefore, whilst learning key lessons from XFELs, we need to enhance and develop systems for the EPAC environment, and we are actively working on developing and testing these solutions.</p> <p>We have a development programme encompassing tape drive, liquid targets, liquid crystal sheet, and array based targetry, to ensure that we have a broad range of solutions to cover a wide range of experimental needs for the first few years of EPAC, which we look forward to reporting on in future meetings.</p> <p>Update: There will be some posters devoted to Targetry.</p>
Recommendation 18	<i>ISTAC recommends prioritization of first light experiments in EA2 to help identify the closest collaborators for user-assisted commissioning of dedicated diagnostics.</i>
Response	<p>As part of the initial commissioning for EA2, a series of experiments is planned to characterise the performance of the EPAC PW laser in an ultra-high intensity, short-focus configuration, and commission our range of high repetition rate diagnostics and targetry systems. Experiments will include single shot measurements as well as a ramp up to operation at 1 Hz. We have identified a number of user groups with the relevant scientific and technical expertise needed to collaborate on diagnosing the fundamental laser-plasma interaction, and characterising the production of secondary sources such as x-rays, protons and neutrons. Detailed discussions with interested groups (as well as broader engagement at user meetings and workshops) will take place in the coming year.</p> <p>Update: The outcome of some of these discussions will be presented at ISTAC4.</p>
Recommendation 19	<i>ISTAC recommends rotating the chair and committee membership to provide fresh perspectives on the EPAC project.</i>
Response	At the EPAC PB meeting in February 2023, the Project Board agreed to retain the current chair to provide continuity at a critical point of the project.
Recommendation 20	<i>ISTAC recommends scheduling the ISTAC4 meeting in April or May 2024. Setting dates early will ease the challenge of coordinating calendars.</i>
Response	<p>A Doodle poll has been set up to find a suitable date in May 2024.</p> <p>Update: Date agreed.</p>