



**EUROPEAN
SPALLATION
SOURCE**



J-PARC – ESS Commissioning Workshop [*preliminary*] closeout remarks

Integrated Control System

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Summary

ICS approach to commissioning

- ICS is a division under the Technical Directorate organized in four groups with more than 100 people during construction-time (steady state operation staff is planned to be less).
- ICS as a project in its Construction phase delivers an integrated control system for the Accelerator, Target, NSS suite of instruments, and also Machine Protection and Personnel Safety.
- ICS has tailored ESS Ways of Working to the delivery of control systems and related tools and platforms. This is also reflected in its project schedule.
- Commissioning of ICS' core systems (e.g. Technical Network, software platforms, Timing Distribution) relies mostly on ICS.
- Commissioning of control systems for stakeholders is embedded in their (sub-)system lifecycles.
- ICS faces challenges derived from the complexity of the machine, the project size and challenges specific to commissioning.
- This workshop enabled an open dialogue on commissioning between ICS and J-PARC colleagues.



Commissioning challenges

ICS viewpoint, 2022-10-10

Team expansion

- Growing to over 100 people, and keeping the development from diverging.

Inner-resilience

- Trying to cope with changes in the surrounding organization, adjusting our developments accordingly (EAM, CHESS FBS/LBS, IAM...)

Common platforms

- Converging the approaches and requirements of different divisions (ACC, TG, NSS), and create systems that serve all.

Forefront technology

- Taking up a still relatively new technology of MTCA and dealing with all the complexities.

Ways of Working during transitions

- Adjusting from development phase (large freedom) to operation (limited freedom).

Interleaved commissioning

- Stakeholder's activities are running in parallel.

User engagement

- Learning curve with our tools, both for ICS staff and users of our tools. Mix of training and knowledge transfer.

Interfacing new stakeholders

- Finding a good way to support and cooperate with Operations Directorate.

Based on topics discussed (1/4)



Insights gained from J-PARC

- Site acceptance tests began with a reproduction of beam commissioning done at Tsukuba (i.e. FAT)
- J-PARC had some policies and, more importantly, flexibility regarding archiving, data storage and retention.
- J-PARC Accelerator uses EPICS. Target moved to EPICS after some years in operation and neutron instruments are considering it now.
- J-PARC learnt in their early commissioning stages that Controls should provide sufficient monitoring and just-in-time analysis. Controls should allow for long-term stability and reproducibility of commissioning runs.
- Target integration tests [at MLF] included remote handling and control system validation.
- Machine Protection System for J-PARC's Linac/RCS went for a hardware upgrade after 15 years in operation.

Based on topics discussed (2/4)



Insights gained from J-PARC

- Having an “integrator” present and supporting commissioning activities was important at J-PARC.
- At J-PARC, long-term stability and reproducibility was more valuable operation-wise.
- J-PARC’s controls teams were involved only in the final integrated commissioning activities of moderator, neutronics or activated materials.
- Simulations were key to quickly respond to issues and adapt e.g. the beam optics. Later, at the next shutdown or maintenance window, the components could be permanently fixed.
- At J-PARC, detectors are integrated with a central developer with some help from colleagues and outsourcing. Detectors are handled with a tool called IROHA2.
- J-PARC had spares of key components, although it was difficult to estimate the “sufficient” amounts.

Based on topics discussed (3/4)



Insights gained from J-PARC

- Test Beam Line was instrumental to trouble shoot any issues in the instruments by enabling comparison.
- Upstream systems needed to be ready for beam before downstream systems would accept it. (?)
- Beamline commissioning without beam relied on neutron shutters (PSS controlled with key exchange system) to guarantee safety and drive different types of activities in parallel.
- At J-PARC, remote access to the control system is not allowed. It is only allowed from the control room.
- During initial operations, phone calls to key controls personnel could happen, but physical presence at site was required in case urgent trouble-shooting was needed.

Based on topics discussed (4/4)



Insights gained from J-PARC

- Radiation doses (from REMS, etc.) and similar measured hazards should be available at all times to the operators, not only when the alarms go above a certain threshold
- MPS all channels had been checked before beam comes. BLM threshold is set as low as reasonable (not too much interruption) for continuous operation. During beam tuning, BLM MPS is masked. During beam tuning or beam study, BLM or one pulse limiter threshold can be changed by beam tuning coordinator. A hardwire mask for a temporal change requires signed acceptance.
- We need to understand: beam rastering, beam synchronization with target rotation, proton beam window performance, target thermal performance, moderator performance and characterization, hydrogen ortho/para conversion... but also, beam loss management as the beam power raises.

Thank you for
your attention!

