T-REX instrument project: Report of activities for the STAP Meeting in October 2025

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1. INSTRUMENT PROJECT OVERVIEW

The T-REX instrument project is a collaboration between the German JCNS (75%) and the Italian CNR (25%). The instrument is a bi-spectral, direct geometry chopper spectrometer with full polarisation analysis. It uses repetition rate multiplication mode to use the full intensity of the ESS pulse.

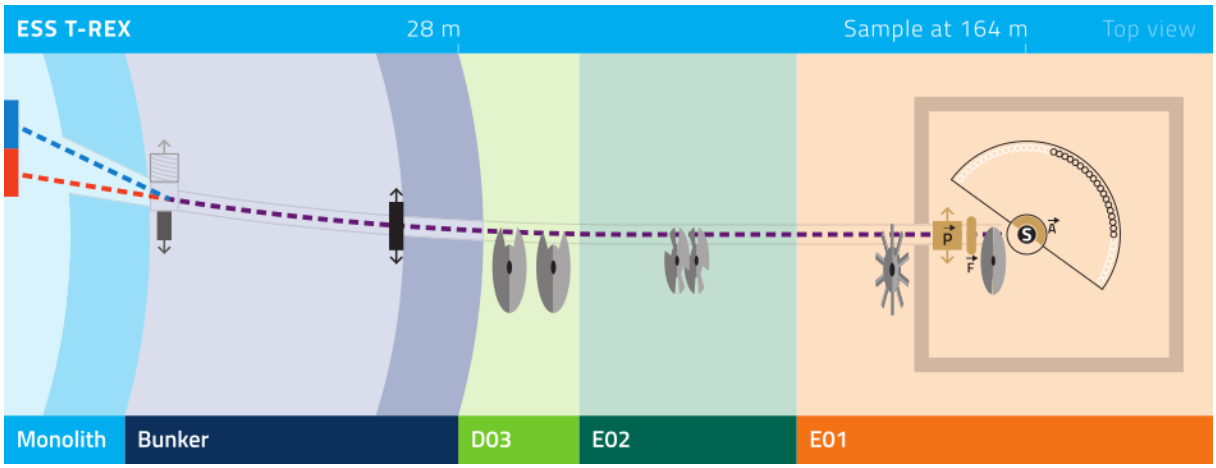

Figure 1: T-REX layout overview

The agreed scope includes the delivery of a world class Direct Geometry Chopper Spectrometer (DGCS), capable to perform INS experiments for a broad user community spanning from magnetism to functional materials and functional soft matter, including the option of using polarized neutron for x-y-z neutron spin analysis. In the first-day, T-REX was planned to be equipped with about 40% of detector area, equivalent to 0.8 sr. The instrument specific sample environment will be a dedicated cryofurnace for polarisation analysis.

The project of T-REX is expected to achieve completion in late 2027. Our main concern for the timeline is the fast-spinning chopper discs. An important milestone is the construction of the instrument cave, necessary for the installation of several other components. The installation is foreseen for mid 2026.

In the following we provide a brief overview of the progress of all workpackages in Q1-Q3 2025, in preparation of the next STAP meeting in October 2025.

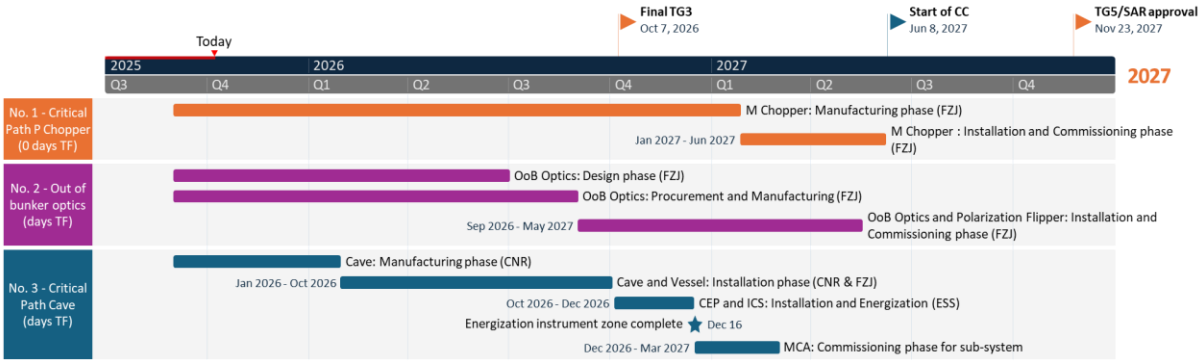

Figure 2: TG5 date for T-REX together with critical path leading to that date

1.1 Beam transport and conditioning system

1.1.1 Neutron guide

- **Neutron guide in-bunker**: All in bunker components installed,
- **Neutron guide out-of-bunker**: Tranche 1A (out of 4 tranches) installed, tranche 2 in production, tranche 3 in detailed design

1.1.2 **Heavy shutter** -> installed

- **Beamline Shielding** -> Joined common project, in manufacturing

1.1.3 Choppers

- **Bandwidth choppers**: Hybrid solution with common project for electronics (ESS) and an external manufacturing company for mechanical components, i.e. discs and housing. Purchase order for discs and housing has been placed. Discs at ESS for coating and integration, housings with their support are in manufacturing.
- **P- and M- choppers:** After the destruction of both P-chopper discs earlier this year, one M-chopper disc successfully passed the FAT procedure. The second disc, however,

Figure 3:Left - M chopper disc M02 before test. Right - Test stand with remains from chopper disc after crash

was destroyed in the test stand. The manufacturer is running a sample program to investigate the incident in more detail. The fast choppers are now the main concern for completion of the instrument.

- **FAN chopper:** A prototype with five blades is finished but revealed mechanical problems during first tests. A workshop addressed these problems and revised

components are in production. In parallel we investigate an alternative solution, the pentagram chopper as a fallback solution.

1.1.4 Primary collimator

The design of the component is undergoing fine tuning after comments from the intermediate design report held last April. Definition of the monitor is needed to finalise the last details of the collimator system.

1.1.5 Polarization

Components such as the thermal polarizer or spin flipper are not commercially available and must be developed according to the instrument needs and constraints. We are in contact with Hal Lee (Polarisation group ESS).

- **Cold neutrons polarizer**: Manufacturing complete, stored in Jülich.
- **Thermal neutrons polarizer**: Design of the thermal polarizer is finished; early procurement of the laser system is done. Start of manufacturing is waiting for the production drawings to be released, anticipated for October or November.
- **Spin flipper, guide field and polarization analysis (Pastis)***:* Priority was given to the thermal polarizer, we try to finish the detailed design by the end of the year.
- **Guide/polarizer exchange unit**: Preliminary design finished, waiting for final design of the thermal polarizer.

1.2 Scattering characterization system

1.2.1 Detector vacuum vessel

The detector vessel is in Jülich. Pre-installation is ongoing, with detector feet and false floor and detector box installed. The ESS vacuum system is installed in Jülich and in use for all tests. The new sample exchange container will have passed FAT by the date of the meeting, Cadmium tender is on the way.

1.2.2 MG-Detector and detector boxes

ESS detector group is providing the Multi-grid detector for T-REX. The development of the detector design is finished, with neutron tests at ISIS showing a suppression of the spurious “shoulder” artefact. The detector grids have entered the production phase. Detector box 1 is ready in Jülich, the tender for boxes 2-4 on the way.

1.2.3 Radial oscillating collimator

The radial collimator is in manufacturing and will be delivered by the end of 2025. The drive is mounted to the vessel as part of the pre-installation in Jülich.

1.3 Experimental cave

The experimental cave is currently in manufacturing, with concrete blocks arriving in Lund early 2026. Installation is foreseen for mid-2026 and requires close agreement with adjacent instruments.

1.4 Miscellaneous

1.4.1 Hutch

Instrument hutch is in manufacturing and will be delivered by the end of 2025.

1.4.2 Sample Environment

Bespoke cryo-furnace for use with polarization analysis is in detailed design, manufacturing will start at the end of 2025.