

P42 XTAX Issue

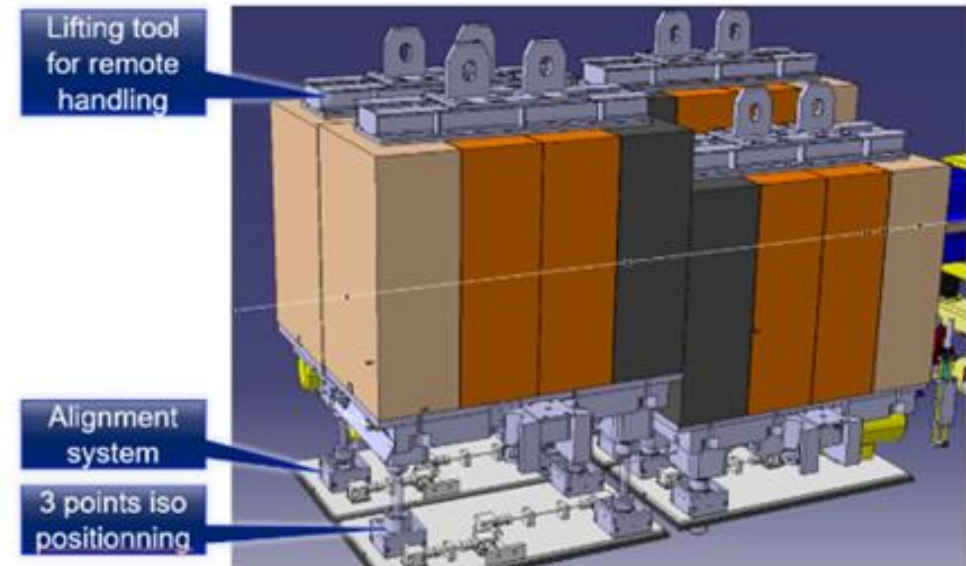
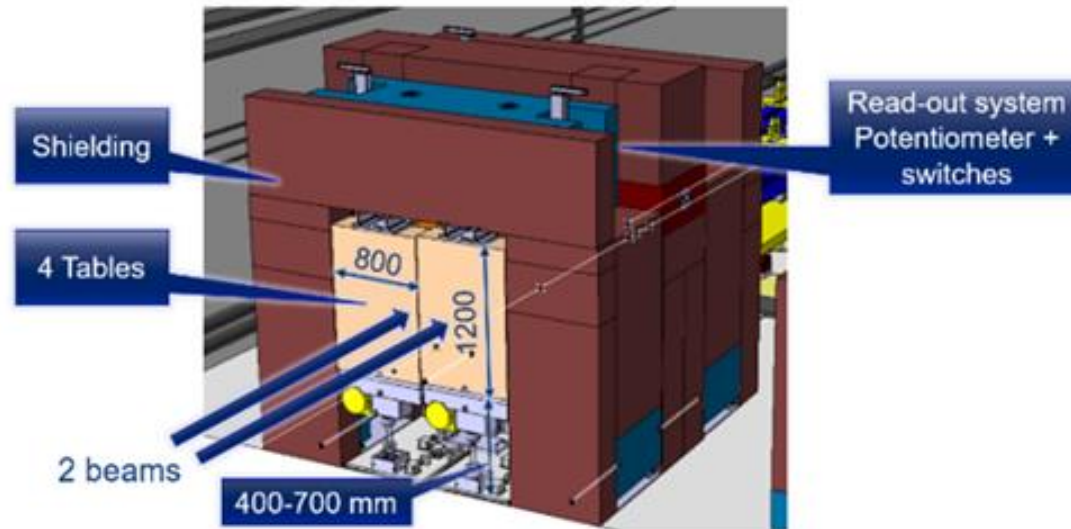
Initial Assessment / Post-Mortem

Johannes Bernhard (BE-EA) with input and the great help of S. Girod, M. dos Santos, A. Herty, M. di Castro, C. Mitifiot, R. Fröschl, S. El-Idrissi, D. Vaxelaire, M. Peryt, G. Papotti, L. Gatignon, R. Folch, M. Brugger, the SPS operators, the SBA operation team and many others

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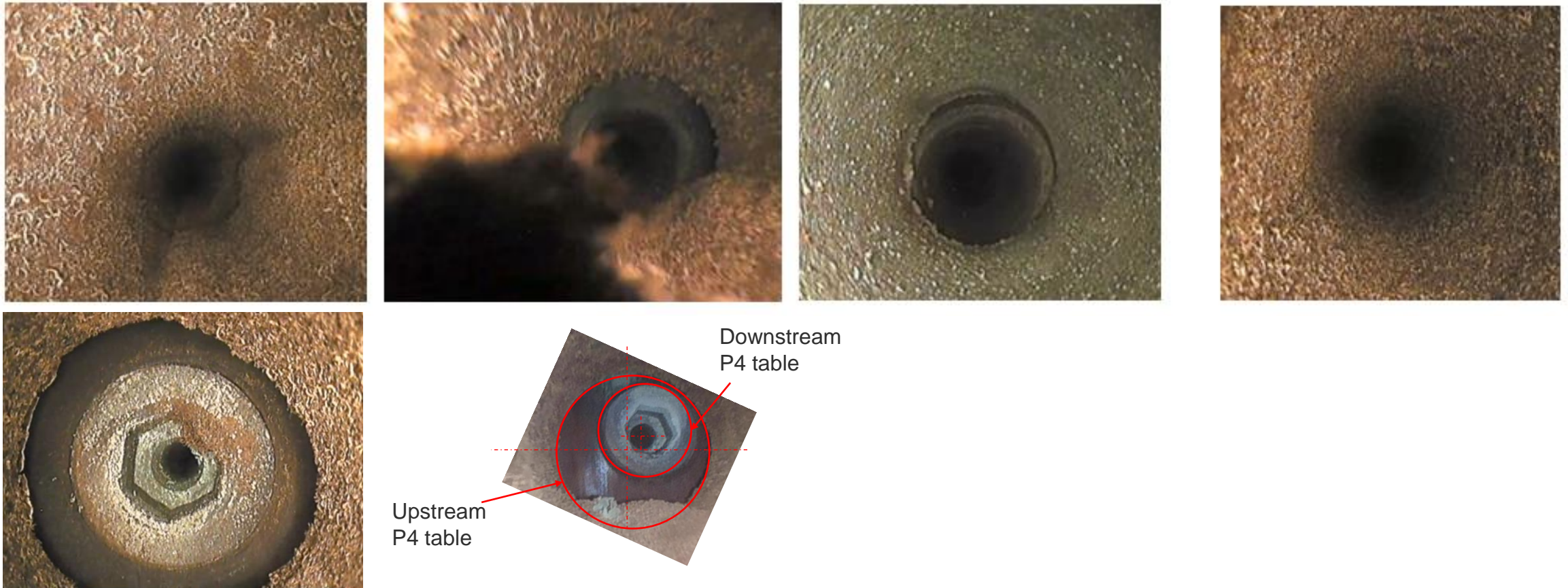
Observations

- Since 2018, several issues have been observed with the beam transport towards the T10 target via the P42 line: Without going into details, these are, e.g., VXSS chamber in beam, magnet issues (MSN fire + polarities), transfer functions in TT20, beam instrumentation...
- After most issues have been addressed, the beam spot on the T10 target returned to the expected size, however transmission is somewhat lower than expected when selecting small apertures in the P42 XTAXs.
- Also since several years, we have to scan and adjust the vertical XTAX position every year to optimise transmission (now -74.5 mm instead of -80 mm nominal), which goes hand-in-hand with a scan of the TT24 BSM in front of the target, and its positioning also needs to be adapted every year.



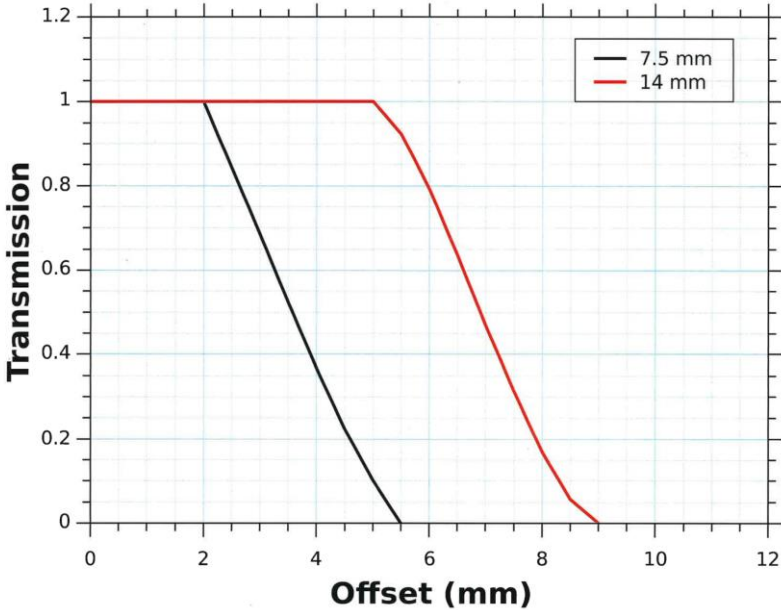
Observations

- Alignment and position measurement of the XTAXs is critical for operation. Suspecting at some point misalignment between the holes, several endoscopic checks were performed, showing no blocking material or melted material in the apertures, however some offsets, but nothing to fully explain the situation.

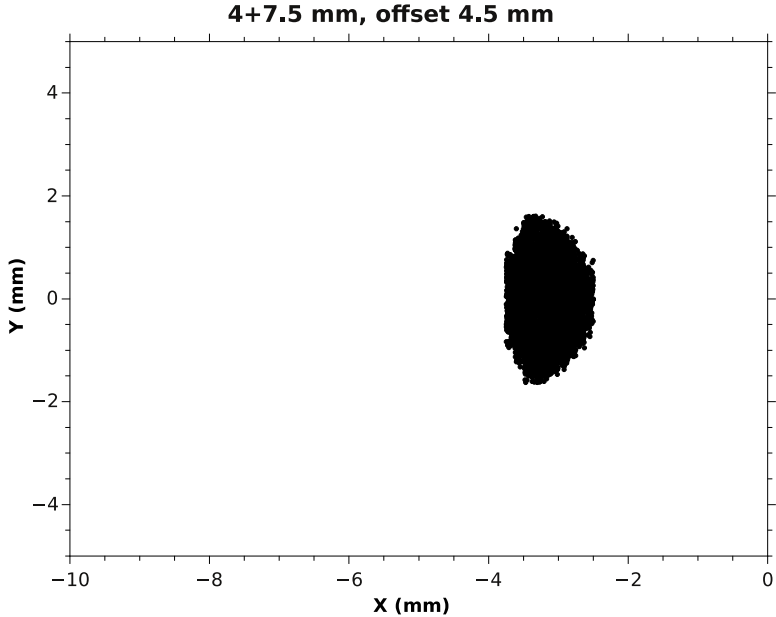


Observations

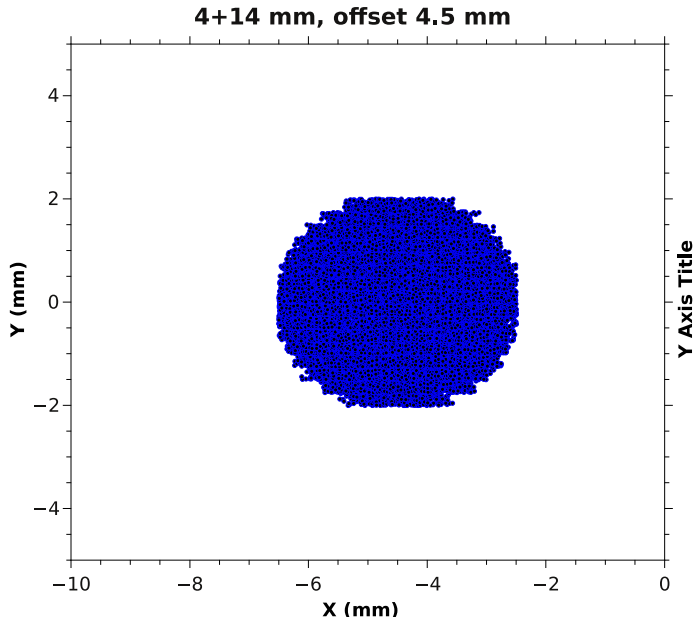
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- A toy MC by Lau revealed that there could be a substantial horizontal offset between the XTAXs.



Expected transmission for a $\sigma = 3$ mm Gaussian beam on the 7.5 mm and 14 mm holes.



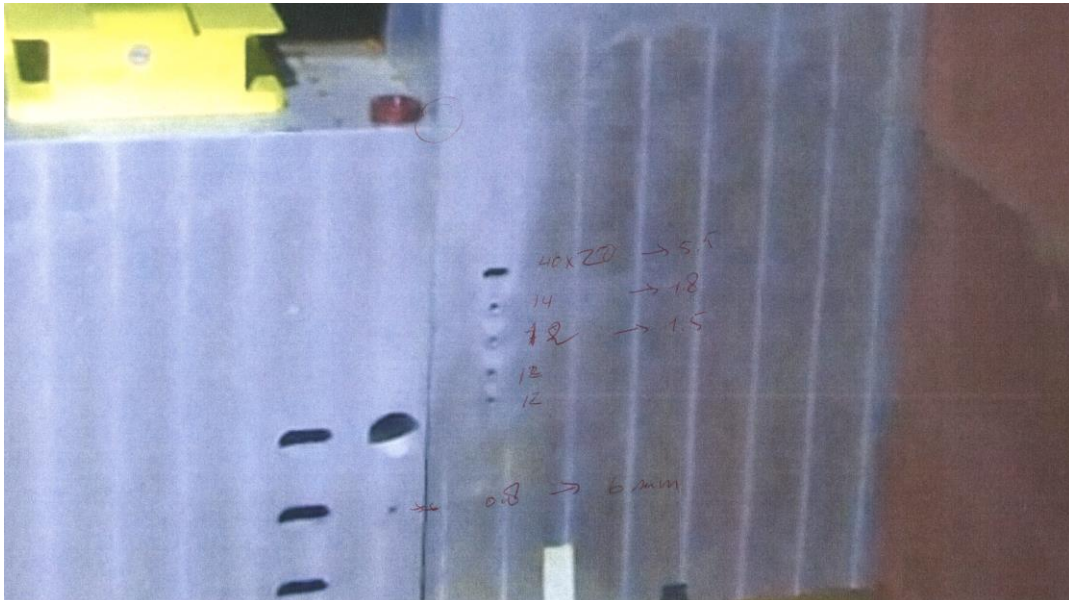
Observation of transmission through 7.5 mm hole hints to offset in the order of 4.5 mm or substantial material inside the aperture.



Lau Gatignon

Issue

- During last YETS, several new pictures were taken, and with the recent stop for the H2 quadrupole exchange in TCC2, another visual inspection confirmed that the first XTAX of P42 is leaning on the first one of H8/H6.
- A physical intervention on the XTAXs in TCC2 is impossible without months of cooldown due to their high activation levels.



First Actions taken

- Crisis team assembled after confirmation of issue on 31.07.24, with the aim of defining a scenario allowing for degraded operation, get towards readiness for safety approval, going through first steps of failure analysis, and checking on possible knock-on problems.
- The beam stop after H2 magnet exchanged was prolonged to understand the problem better and to allow for another access to TCC2, also to do additional inspections with robots on the other XTAX faces (H2, H4, M2) → access on 01.08. did not reveal any obvious issue for the other XTAXs but showed metallic debris between the H8 and P42 XTAXs. Also some grease was found on the floor (more than expected). The tables themselves did not look damaged.
- H8: Decisions taken on 31.07. were (a) to block first H8 XTAX in 80 mm aperture position, (b) to change access system and CESAR as soon as possible to work with second XTAX (no safety implications).
- After the access in the morning of 01.08., beam was given back at 13:00 as no other obvious check could be done in TCC2.



Going back to P42 Operation

- Radiation safety and access to ECN3/TCC8: After the fast analysis of Robert Fröschl and as conformed by Andreas Herty (BE DDSO), it was deemed that the stopping power of one XTAX together with the access bends would be enough to access via the ECN3 access point (mainly NA62 experimental area) without any further mitigations needed. Normally both XTAXs are required to be in dump position. For access to TCC8, the extraction to the North Area will need to be stopped (more upstream, no shielding effect by the K12 XTAXs).
- P0survey interlock: As the system was built to act on XTAX1, the team of M. di Castro and C. Mitifiot re-wired and re-programmed the system to act on XTAX2. This was then successfully tested by switching off randomly selected magnets (without beam).
- The crisis meetings concluded on 01.08. in the afternoon and beam was given back to NA62 in standard conditions.
- The NA62 beam dump run conditions were then analysed further on Monday, 05.08. and also ok for safe access to ECN3. The run started then on Wednesday, 07.08.
- XTAX1 was locked out in the 14 mm aperture position.
- The overall downtime for NA62 was about 20 h.

Next Steps

- NA62 can operate and access normally, the beam dump run is on-going.
- Analysis of the fault will be done in regular meetings that will commence as of next week. Until the issue is better understood, movements of the first H8 and P42 XTAXs have to be put on hold and can only be done if absolutely necessary.
- The impact on the MD programme for HI-ECN3 has to be further assessed. So far, there does not seem to be an issue.
- A recommendation and update on the NA-CONS XTAX consolidation is important, including the lessons learnt from this incident.
- While one can operate in degraded mode, it is far from ideal, and possible further mitigations shall be envisaged. E.g., is it possible to add more access bends to the system for further redundancy? This shall be done keeping in mind operation needs after LS3, in synergy with the HI-ECN3 project.



Thank you very much for your attention!

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