M E M O R A N D U M

To/A : Sergio Bertolucci, Steve Myers

From/De : Ilias Efthymiopoulos - EN/MEF

cc : S. Baird, P. Collier, K. Cornelis, D. Forkel-Wirth, L. Gatignon, E. Gschwendtner, M. Lamont, R. Losito, R. Saban, SPS Coordinator

Subject/Sujet : SPS North Area Startup Delay due to TAX Failure

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During the annual maintenance before the startup of the North Area, a problem with the **Target Absorber** (TAX) appeared, that would cause a substantial delay in the North Area startup.

The TAXs, installed downstream of the primary targets (T2, T4 and T6) of the North Area, are made of massive blocks of Al-Cu-Fe (8 blocks, 3.2m long in total) put on motorized tables that can move up/down to serve either as beam dump or as aperture limiters to the downstream secondary beams when the beam passes through predefined small diameter holes in the blocks (see *Figure 1*). The TAXs are vital safety elements for the North Area beams, are part of the beam interlock, and no beam can be operated without them working properly. There are in total 6 TAXs: for H2, H4, H8 (H6), P41 (K12), M2 and P61 beams, each one split in two parts, making a total of 12 assemblies and motorizations.

The TAX blocks intercept about 10^{19} protons/year and although they are surrounded with massive shielding, the radiation levels in the vicinity remain quite high, even at the end of the shutdown after few months of cool-down: ~6mSv/h outside the shielding, and probably ~30-40mSv/h at the blocks, and for sure even higher near the beam impact point as recent experience with the WANF showed. It is for this reason that the annual maintenance of the TAXs (greasing of the jacks, check for water leaks of the cooling circuits, tests of motorizations), is scheduled at the very end of the yearly shutdown.

During the annual maintenance scheduled before the Easter break on week-18, **two TAX motors for the P41 and M2 beams failed**. To exclude the problem comes from the power cables to the motors being damaged by the high-radiation levels in TCC2, an intervention was scheduled on **Friday 29/4** to exchange them. During the intervention it was discovered that for one of the motors the short circuit was in the motor already (see *Figure 2*). The cable was changed for the second one but unfortunately didn't work as well, showing a short circuit to ground. In the meantime **a third TAX motor for the M2 beam failed**, again with the same symptoms.

In summary today we have both TAXs for the **M2/COMPASS** beam and one TAX of the **P41/ECN3/NA62** beam out of order and stuck in intermediate non-safe positions.

We (EN/MEF & EN/STI) are presently preparing the intervention to remove the faulty TAXs from their shielding and replace the motors with new ones. It is a major intervention that requires work in radioactive areas and on highly radioactive equipment (see *Figure 3*), and a discussion and approval in an ALARA-L3 committee.

In a first rough estimate, assuming the existing procedures for the TAX replacement will be still acceptable, and we will be able to find new motors (we have only two spares), a minimum of **five weeks** will be required to complete the repairs. This means **four weeks lost for the physics program** that would affect COMPASS, H4IRRAD/R2E, and other test beam users scheduled for the first period. I will contact the SPS

coordinator (also cc in this memo) to inform the users, and I've asked CCC not to extract any beams in the North Area until all repair works are completed.

A better estimate will be made by next **Monday (9/5)** after a more detailed investigation of the required operations and contacts with suppliers is completed.

The North Area TAXs were last renovated in 2001-2003 (blocks and motorizations). We believe the motors are specially ordered for high-radiation environment; we'll go back to the old orders and documentation to find out, but even so it is difficult to predict their exact lifetime. The motors that failed are for the high-intensity beams, however the state of the others may not be that good either.

A TAX exchange once beam has been delivered in TCC2 risks being a major operation and rather costly in terms or collective dose and beam down time.

In parallel to the repair work a consolidation plan for the TAXs should be launched including an engineering study to further optimize their design, needs for maintenance and possible interventions in view of today's knowledge and application of the ALARA principle. This was discussed in a meeting with EN/STI, EN/MEF and EN/DH on Friday 29/5 and will be discussed again next **Monday 9/5**.

Figure 1: A TAX assembly in TCC2 (H2/H4 beams) - before the outside shielding is put in place

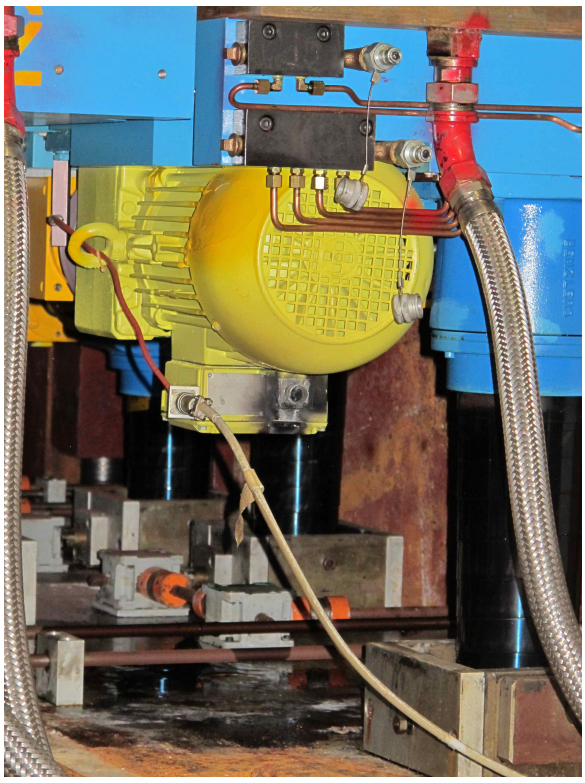

Figure 2: Photo of one of the damaged motors. The signs of the short circuit at the connector are clearly visible.

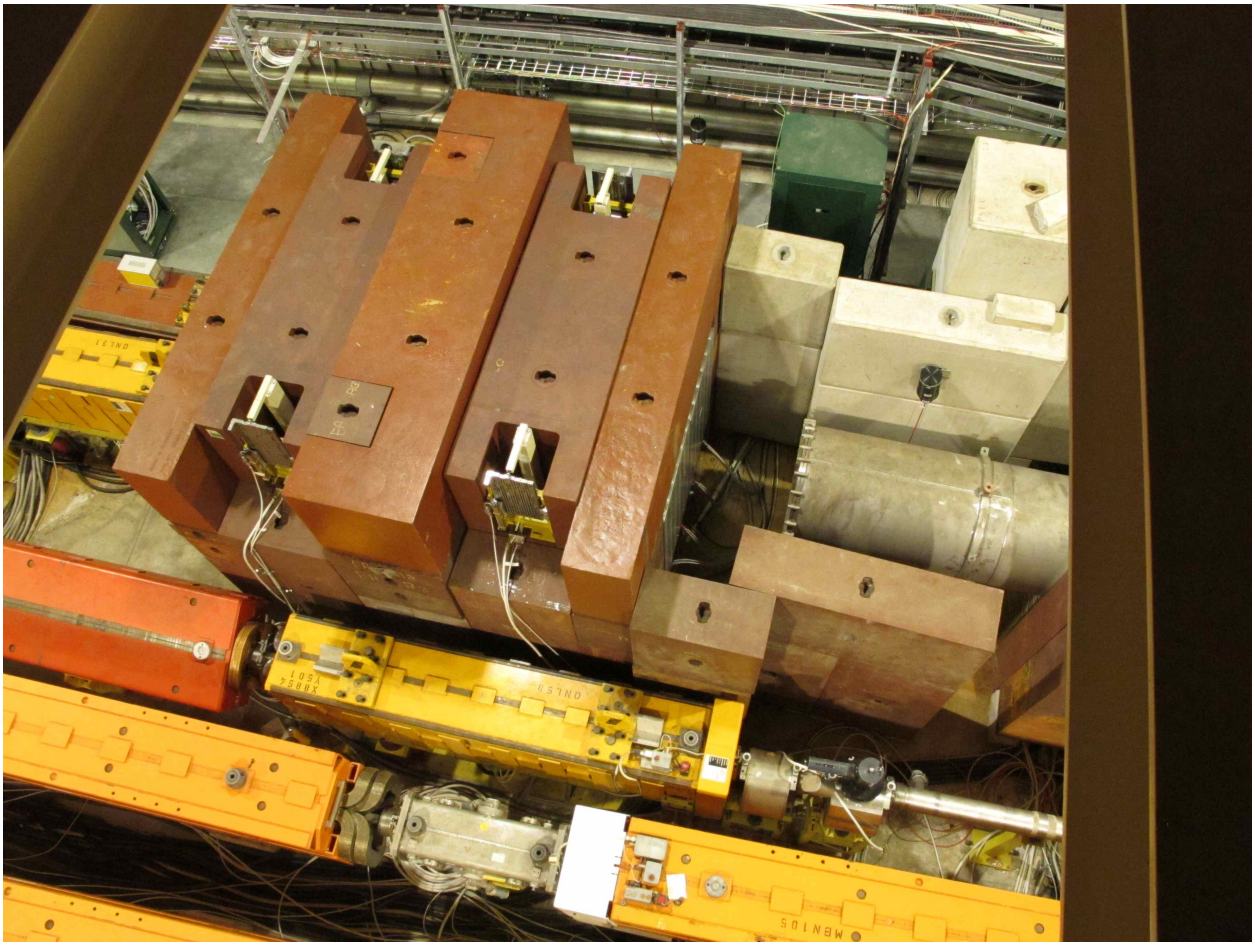

Figure 3: Photo from the TCC2 overhead crane showing the M2 TAX assembly. The TAX blocks are inside the iron shielding