

ELETTRA 2.0: ACTIVITIES IN THE EXPERIMENTAL HALL

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Abstract

Elettra 2.0 is the name of the upgrade project of the existing Elettra Storage Ring (SR) and its ancillary systems. The project comprises also new beamlines (BLs) and the re-allocation of some of the currently operational ones. Consequently, the “Experimental Hall” (EH) of Elettra, i.e. where the beamlines are installed, is another working area with activities that have started well before the scheduled “Dark Period” (DP) when we will dismantle Elettra and install Elettra 2.0. The installation of the beamlines implies, among many more activities, the partial reconfiguration of the shielding wall of the SR tunnel. Some of these local rearrangements can be performed before the DP, during maintenance shutdowns of Elettra, in those portion of the EH not currently occupied by working beamlines.

The reconfiguration of the shielding wall requires a design that merges SR and BLs specifications, as well as careful planning of on-site activities, spanning from survey and tracing of the new positions of the blocks, to plants rearrangement, to handling and transportation of concrete blocks up to 6 tons. This paper illustrates the status of the reconfiguration activities of the Experimental Hall.

INTRODUCTION

At 360 meters above sea level, on the Carso highland in the outskirts of Trieste, Italy, Elettra synchrotron light source is in operation for worldwide users since 1994 [1]. A major upgrade occurred in 2008 when the booster-based new injector replaced the former Linac injector [2] and eventually started its regular operations in Top-Up mode in 2010 [3]. Currently the Elettra 2.0 Project [4, 5] is running to completely replace the Storage Ring (SR), the ancillary equipment in the Service Area (SA), upgrade existing beamlines, and install new ones in the Experimental Hall (EH). The overall logistics aspects are described in [6], here we focus on the Experimental Hall modifications.

ELETTRA LIGHT SOURCE

The Elettra SR tunnel is composed by an inner permanent 0.5 m thick wall while the outer shielding is completely formed by columns of normal or baritic concrete blocks. This allows flexibility in the configuration of the shielding, according to the front-end/beamline design. Figure 1 shows almost one of the 12 achromats of Elettra inside the SR tunnel, with a green dipole magnet, the front-end crossing the outer shield, some quadrupoles, three undulators and the second dipole. The brown blocks on the left are made with baritic concrete, the thicker white ones with standard concrete. About 400 concrete tiles covering

the SR tunnel in a double layer and weighting up to 6 tons constitute the roof.



Figure 1: View of the Elettra SR.

Current Elettra Beamlines Configuration

Currently Elettra operates 28 beamlines from the SR, an updated list is reported in [7]. Figure 2 shows one quadrant of the Experimental Hall of Elettra reporting the number of the building pillars and the names of the beamlines. This photo-mosaic was taken at the beginning of 2022.

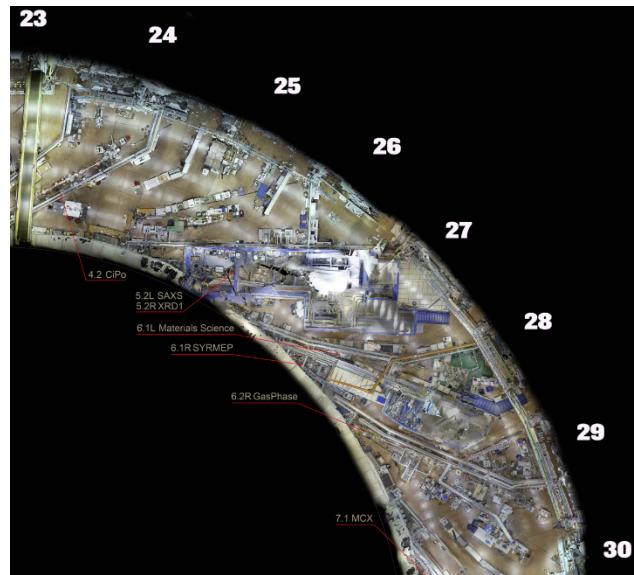


Figure 2: One quadrant of the Elettra Experimental Hall.

Changes in the Beamlines Configuration

In Elettra 2.0 some beamlines will remain in the current position, other will be moved, other will be updated and some new ones will be added. A total of 31 beamlines is foreseen at the end of the three upgrade phases [8]. The first phase is currently running and comprises all predispositions and installations that are not impacting on the normal operation of the beamlines before the start of the “Dark Period”. The second and third phases will occur during and,

respectively, after the “Dark Period” involving the beamlines to re-allocate or install.

RUNNING ACTIVITIES

Modifying the beamline layout require several preliminary activities both on the tunnel outer shielding wall and in the Experimental hall (e.g. removal or modification of hutches).

Shielding Wall

Even limited interventions on the outer shielding wall require the movement of several tiles. As shown in Fig. 3 it was needed to move 9 tiles for a minor adjustment (highlighted in green and yellow lines) of the wall.

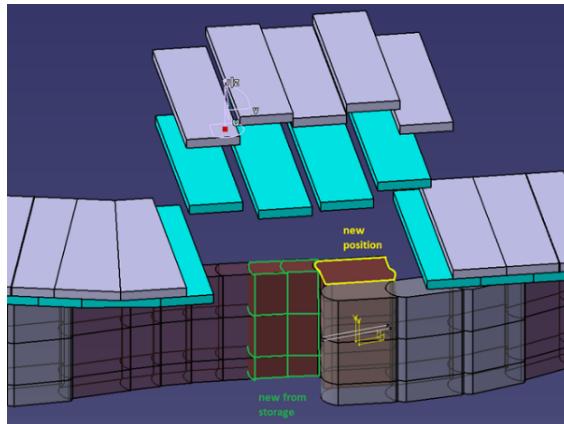


Figure 3: Tile movement for a small wall adjustment.

Figure 4 shows the lifting and placing of the “beam-exit block” for the required reconfiguration.

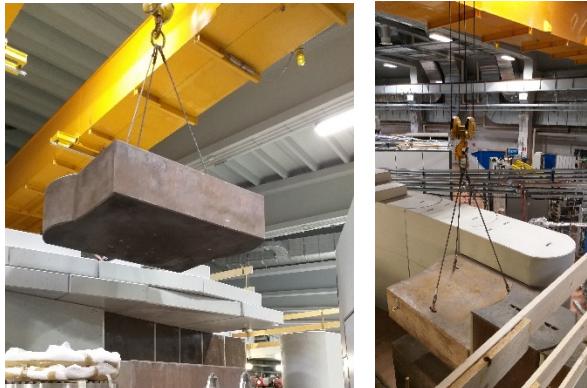


Figure 4: Lifting and placing of a “beam-exit” block.

Major activities in 2022 In October we operated a significant preparatory intervention on the shielding blocks in Section 12.1 to allow, from the Radioprotection point of view the demolition of a not anymore used hutch. Figure 5 summarizes the intervention: two columns with slots for allowing the passage of the previous, dismantled SR-FEL back-end vacuum vessels have to be replaced by two without slots. The number of roof tiles – also due to the removal of vacuum components from the Tunnel – was significant. Figure 6 is an unusual view of the Elettra SR from the hutch of the back-end SR-FEL: the two old columns have been removed, before the placing of the new ones, along with

part of the old vacuum stuff and cabling to remove and dispose.

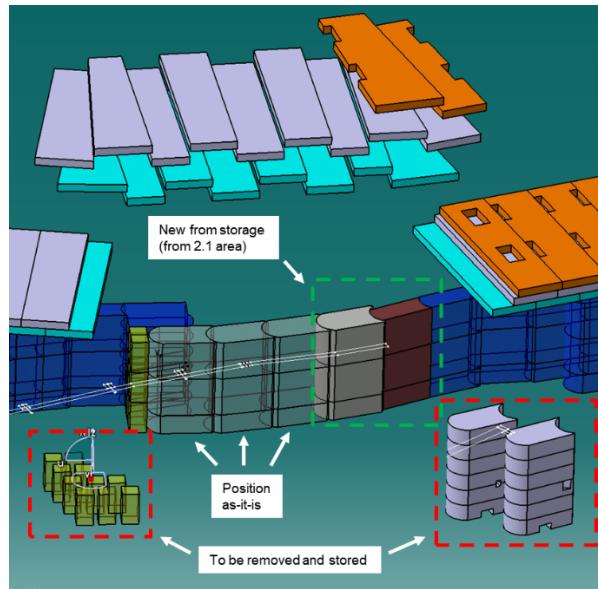


Figure 5: Preliminary activity for the installation of the new beam-exit 12.1.



Figure 6: View of the Storage Ring from the SR_FEL hutch in the Experimental Hall.

Major activities in 2023 In the second half of 2023 we plan to operate three more reconfiguration of the shielding wall to insert the “beam-exit” columns of blocks of future beamlines in advance to the “Dark Period”.

Figure 7 shows the required changes in the wall configuration in section 12: in blue the current configuration is shown while in red the new one, comprising the insertion of the “beam-exit blocks” (indicated by the red arrow) and the old hutch to demolish (blue arrows).

Similarly, Fig. 8 and Fig. 9 show the required changes in the wall configuration to prepare for the future beam-exits in section 3.1 and 4.1: also in this case, the current configuration is shown in blue, while the new one is drawn in red,

comprising the insertion of the “beam-exit blocks” (indicated by a red arrow).

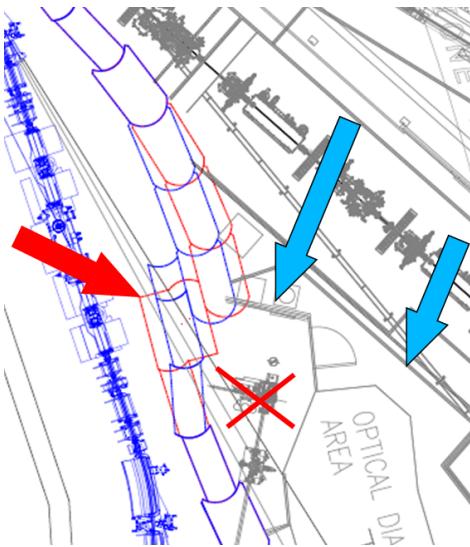


Figure 7: Outer wall reconfiguration for beam-exit 12.1.



Figure 8: Outer wall reconfiguration for beam-exit 3.1.

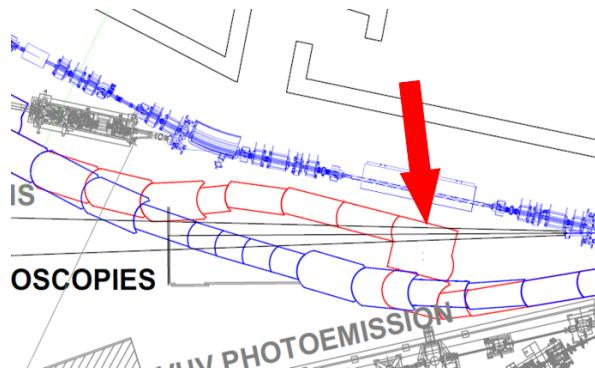


Figure 9: Outer wall reconfiguration for beam-exit 4.1.

In all cases, due the large portion of shielding wall to reconfigure, there is a significant number of tiles to move.

Beamline Hutes

Besides the above mentioned SR-FEL back-end hutch, whose dismantling was completed in April 2023, we foresee to dismantle IUVS beamline hutch within 2023.

The IUVS experimental chamber is going to be relocated in another dedicated laboratory and the beamline hutch (red arrow in Fig. 10) is preventing the effective use of one

of the two truck accesses to the Experimental Hall (green arrow in Fig. 10). The complexity of the intervention is due to the close proximity to other operating beamlines.

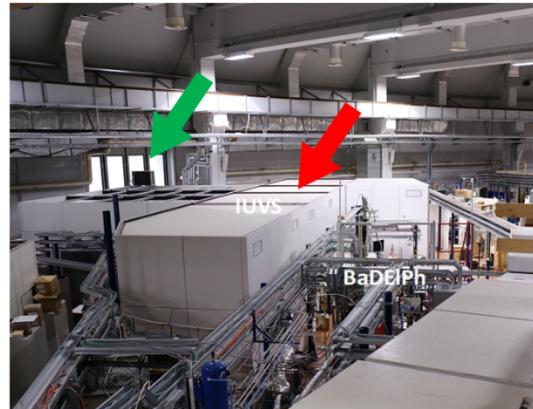


Figure 10: IUVS beamline hutch.

CONCLUSION

The new upgrade project, Elettra 2.0, comprises several modifications on the existing beamlines of Elettra and the installations of new beamlines as well. All activities associated to the beamlines have significant impact both on the Storage Ring shielding wall and on the layout of the Experimental Hall. We are carrying on those preparatory activities that have no effect on the operation of the Elettra beamlines but – at the same time – allow significant time-gain prior the “Dark Period”.

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