

TOWARDS ELETTRA 2.0 – R&I PREPARATION ACTIVITIES

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Abstract

The “Dark Period” (DP), that is the final shutdown for the Elettra Storage Ring (SR) with its ancillary equipment and most of its beamlines, is scheduled to start on July 2nd, 2025. During the DP we will remove the complete SR lattice structure with annexed cabling, piping, and supports; the Service Area, where most of the equipment to operate the SR is installed, will be completely renovated; the majority of the photon beamlines will be removed, moved, updated or “brand-new” installed, causing the reconfiguration of a large part of the outer wall of the SR tunnel. Several activities are running in order to reduce the Removal and Installation (R&I) workload – already quite significant – during the DP. These activities are mostly related to the beamlines in the Experimental Hall and some shielding wall reconfiguration. The paper summarizes the most relevant activities done in preparation to the DP, with focus also on the logistics aspects related to the installation of a new machine while removing the old one (Elettra) being very closed to another operating one (FERMI).

INTRODUCTION

The Elettra 2.0 Project [1, 2] is approaching the executive phase when we will “dump the electron beam” for the last time on the existing Elettra light source. During the following “Dark Period” (DP) the Storage Ring (SR) and the Service Area (SA) will be emptied, all components and large part of plants will be removed either for decommissioning or – a few – for re-use on Elettra 2.0 (E2.0) [3].

In the Experimental Hall (EH), some of the existing 28 beamlines [4] will be updated but not moved from their current position, some will be moved to another “Beam-Exit”, some will be decommissioned, and some brand-new ones will be installed for a total of 32 foreseen beamlines [5]. While Elettra is still operating for users, most of the preparatory activities pre-DP are concentrated in the EH, particularly during the scheduled periodic shutdowns.

WORKING ZONES AND COMPONENTS MANAGEMENT

We have defined a detailed Zone Breakdown Structure (ZBS) in order to assign univocally an identification code to any zone and sub-zone interested by the E2.0 activities. The coding is then used in the project documentation and planning. Figure 1 shows the main zones inside the Elettra building.

Similarly, a common naming syntax and grammar has been established to identify the “objects” – parts of the accelerator, of the beamlines, and of the infrastructure – that

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are located inside the Elettra Main Building and are “associated” or “connected” to E2.0 in order to facilitate their identification and localization.

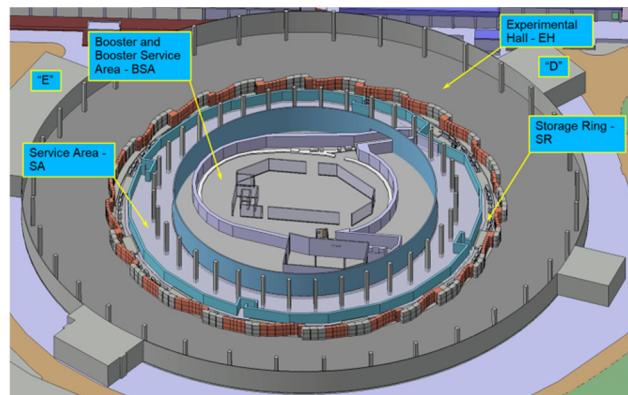


Figure 1: Main Zones inside the Elettra Building.

ONGOING ACTIVITIES IN EH

During 2023 and the first quarter of 2024, the Removal and Installation (R&I) activities were mainly located in the EH, as described in [6].

Beamlines' Hutes Removal and Modification

The photogrammetry of the EH, described in [7], is extensively used in planning the activities in the EH, helping to identify the extension of the working areas and potential critical situations. At the end of 2023 the IUVS beamline has ceased its operations and has been dismantled, removing the photon-transport line, the experimental end-station, the laboratory, and the hutch. Figure 2 shows the extension of the IUVS beamline and its very close proximity to the – still operational – BaDELPh beamline.

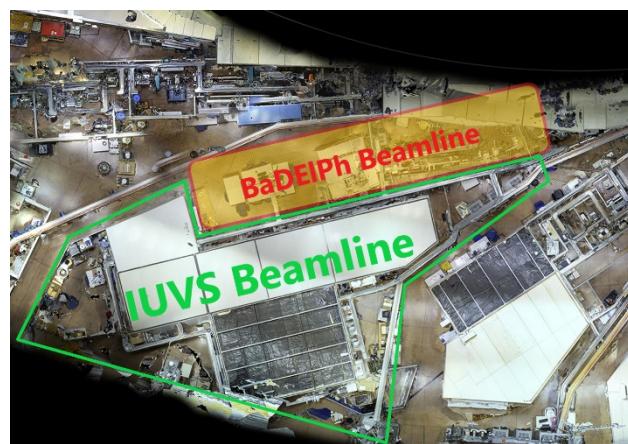


Figure 2: IUVS (inside the green polygon, now dismantled) and BaDELPh beamlines in the Elettra Experimental Hall.

The removal of the IUVS beamline and its hutch was fundamental to free the access to the EH through the “Superdoor D” (Figure 1, top-right) to trucks for the handling of bulky and heavy loads. Figure 3 shows a truck entering the EH through “Superdoor E” (Figure 1, top-left) to carry in the concrete blocks for the SR tunnel reconfiguration.



Figure 3: Truck accessing the EH through “Superdoor E”.

Similarly, the modifications to the hutches of the Twin-Mic and XPRESS beamlines has been completed in the “Winter Shutdown” 2023-2024, creating the space for the installation of the future SYRMEP-LS beamline, one of the new beamlines for Elettra 2.0. Figure 4 shows the entity of the intervention (red filled polygon) that required also the reallocation of some network and instrumentation racks.



Figure 4: SYRMEP-LS preparation, in red the area interested by the removal and modifications of the hutches.

According to the planning for the SYRMEP-LS hutch and beamline, the space is available as temporary storage for the assembled girders carrying the magnets of Elettra 2.0 [8] before their installation in the SR. Figure 5 shows the available space from the floor perspective (some racks are still in place and allows the appreciation of the available space).



Figure 5: Available space prior re-allocation of racks in the future SYRMEP-LS beamline zone.

Storage Ring Shielding Wall Modification

As mentioned in [6], before the Dark Period it is possible to install four new “Beam-Exits” for the future beamlines of Elettra 2.0. It was not possible to complete the foreseen modifications during the shutdowns of 2023 due to unexpected irregularities of the floor of the Experimental Hall.

At the beginning of 2024, during the “Winter Shutdown”, we have installed two out of three “Beam-Exits” that required a detailed survey and reworking of the floor, to level the peaks and fill the valleys. The irregularities are small – some millimetres – but large enough to prevent the proper installation of the concrete blocks, avoiding any slit that would make visible the EH from the inside the SR tunnel. Figure 6 shows the analysis of the results from the survey of the floor under the new position of the SR shielding blocks (thin black lines), this is fundamental for the definition of the subsequent mitigating actions.

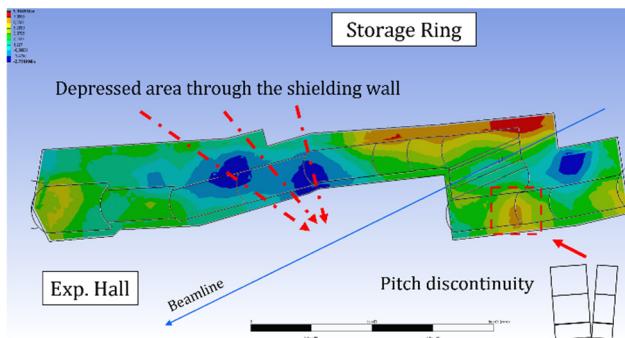


Figure 6: Analysis of the survey of the floor under the new position of the SR shielding blocks (thin black lines).

Figure 7 shows the floor levelling to overcome the issue (the Storage Ring is covered with a plastic sheet to protect the machine from dust). In another case, the found “depression” was such to require the filling with lead sheets in order to preserve the adequate radioprotection (RP) requirements.



Figure 7: Levelling activities on the EH floor.

ONGOING LOGISTICS ACTIVITIES

As reported in [7], according to RP regulations, there is a “red zone” centred on the beam trajectory that is mandatory subject to the extensive characterization of the radio-nuclides presence before the material is allowed to exit the Facility premises, particularly for disposal. Since no formal guidance has yet been received from the National Authority on the size of the “red zone”, we had to consider the complete content of the 260-meter long Elettra SR tunnel as subject to RP characterization. Construction of the new RP building has begun and is expected to be available at the end of 2024. It will be equipped with heavy-duty shelves for storing the palletized magnets and ion pumps. Figure 8 shows the planned internal organization: the light-blue block on top-left are piled boxes to store small parts.

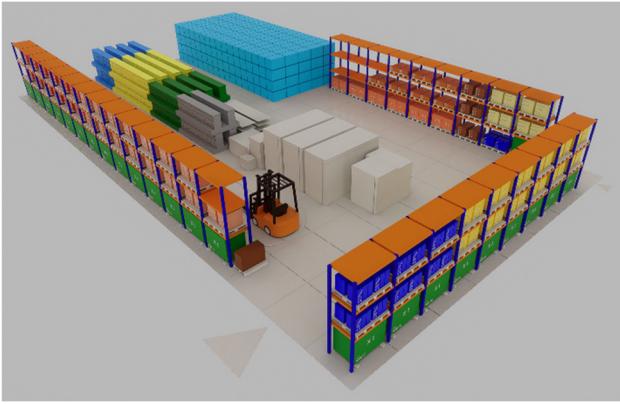


Figure 8: Planned organization inside the RP building.

Another building, named LB, is under construction (Figure 9 is a rendering view, showing the inside), which will house the climatized magnetic measurement and girder assembly hutch, the vacuum laboratory, and the component storage for the assembly of the girders. This building is close to the “Superdoor D” of the Elettra Main Building. It is scheduled to be available by the end of November 2024.

CONCLUSION

In a little over a year, Elettra will cease operation and the Dark Period will begin. We are performing as many preparatory activities as possible during the ordinary shutdowns, particularly in preparing the new “Beam-Exits” in the SR shielding. Unexpected difficulties have arisen from

the irregularities of the floor, the mitigation of which has required a special study, gaining experience for the Dark Period. Two new buildings are being constructed: one to house the magnetic and vacuum measurement laboratories and girders assembly; the other to house all the parts extracted from the Storage Ring of Elettra.

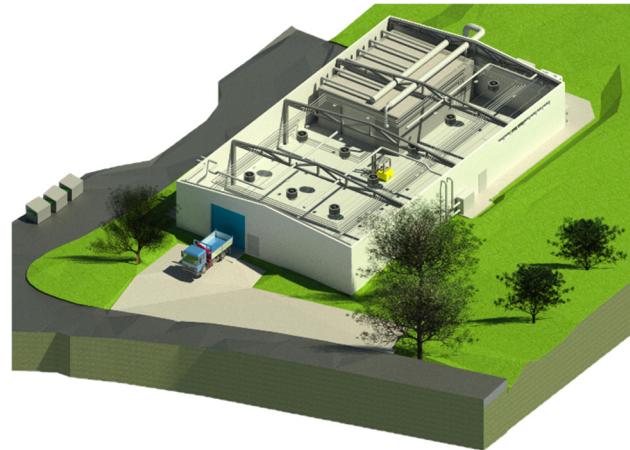


Figure 9: Rendering of the LB building (in construction).

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