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LOGISTICS STRATEGIES FOR ELETTRA 2.0

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Abstract

Logistics is not "rocket science" nevertheless a poor coordination and planning of procurement, transportation, and storage can cause congestion in the supply and movimentation of components and systems, increasing the risk of delays, damages and - worst of all - injuries to the personnel. Upgrading an existing machine doubles the difficulties, handling the old parts and the new ones, almost at the same time. This paper deals with the activities carried on so far for Elettra 2.0 Project, with main focus on the removal and handling of the existing Storage Ring (SR) and the associated systems. Different approaches have to be adopted for what is contained in the SR tunnel – subject to radio protection verification – and what is external to the tunnel and can be more easily handled. Additionally, parts to re-use and those that must be temporary removed, protected and stored require different procedures from the other ones to discard and dispose.

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.

From the logistics point of view, the issues related to the upgrade of an existing Facility are more than doubled compared to the construction from "green field" of a new one. Besides dealing with the new components and systems to install there is a complete old machine with its equipment to remove and – partially – store onsite.

This paper will provide an overview of the logistics challenges mostly related to the removal.

EXISTING OBJECTS CLASSIFICATION

Well before removing the SR, the ancillary equipment in the SA, and beamlines equipment, the first step is identifying the provenance – accelerator tunnel or outside – and its future destination: discard and re-use.

Storage Ring Components and Parts

Due to radioprotection (RP) rules – according to national authorities – there is a "red zone" centered on the beam trajectory that is mandatory subject to the extensive characterization of present radionuclides before letting the material exit the Facility premises, in particular for discard. Adequate space for a temporary storage – time scale is months or years – must be preliminary found and provided on-site. Not having received a formal indication on the "size of the red zone", so far, we had to consider the complete content of the 260-meter long Elettra SR as subject to RP characterization. Figure 1 shows the SR: all what is present – including the concrete girders and the cooling water piping on the wall – have been taken into consideration.

Figure 1: View of the Elettra Storage Ring.

A new "light", 700 m^2, 4.5-m high building, equipped with heavy-duty shelves has to be built within the Facility premises. Figure 2 shows the arrangement of the material inside the RP building.

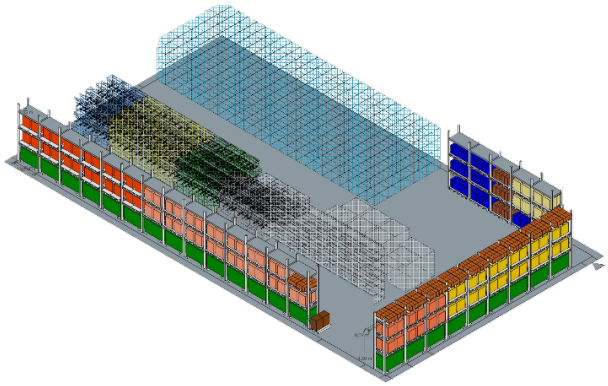

Figure 2: Proposed arrangement of SR components and parts inside the RP building.

Magnets are placed on standard pallets and stored on the shelves, while the space in the middle is reserved for the girders and boxes with the cabling and piping cut in small pieces for ease of handling.

Service Area Equipment

The Service Area contains the magnet power supplies' (MPS) cabinets (they are show in Fig. 3, the color is related to the magnet they energize) and more instrumentation – vacuum, beam diagnostics, etc. – in standard 19" racks. All

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MPS cabinets and the majority of racks will be removed and replaced. Most of cables that run under the false floor from the cabinets and racks to the SR will be removed and disposed as well.

Figure 3: View of the Elettra Service Area.

Beamlines in the Experimental Hall

The third area of intervention is the Experimental Hall, where some beamlines will be moved on different "photon-beam exits" while others will be "brand new" ones. In order to have a real overview of the actual situation, in January 2022 we made a "crane-photogrammetry" of the Experimental Hall mounting a camera on one of the two bridge cranes (Fig. 4).

Figure 4: "Crane-Photogrammetry" of EH.

The resulting Hi-Res mosaic (Fig. 5 shows the North hemicycle of the EH) is particularly valuable for the identification of potential storage areas and the actual shape/size of hutches and other installations, including the not-updated changes to the original drawings.

MOVIMENTATION AND TRANSPORT

The identified (and all those which could not be counted) objects to remove/re-allocate/install require adequate lifting and moving devices and routes.

Internal Movimentation

As previously mentioned there are two 7.5-tons bridge cranes that cover the complete EH and SR but only partially the SA. All the stuff from/to the SR or the beamlines will exit/enter the Elettra building though two truck gates (named "D" and "E" in Fig. 6).

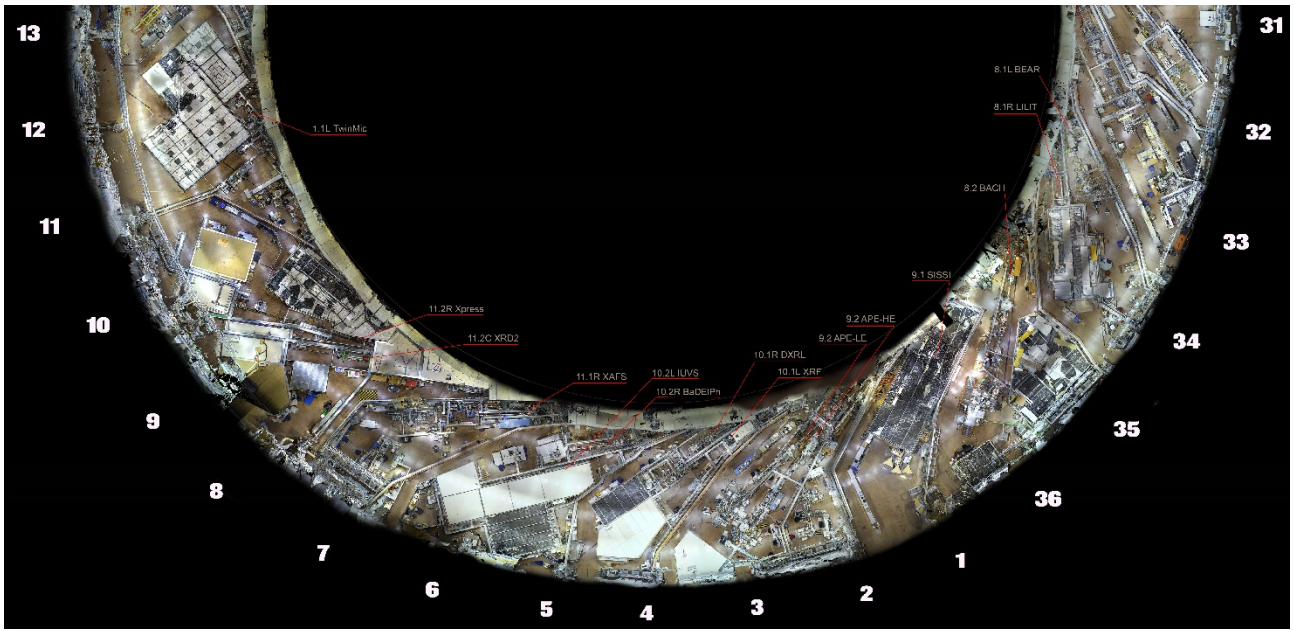

Figure 5: View of the Elettra Experimental Hall (North hemicycle) – the numbers identify the building pillars.

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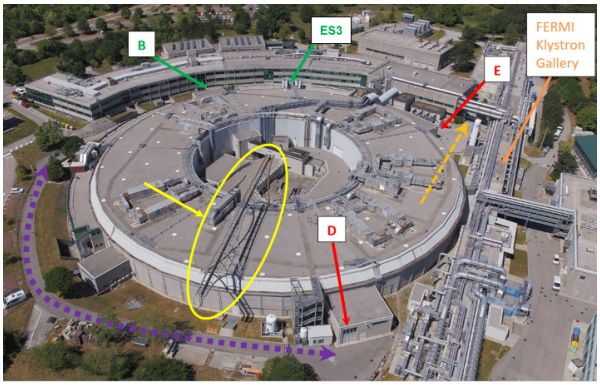

Figure 6: View of the Elettra Building, roof crane, entrances and constraints to transportation.

For what concerns the MPS cabinets and equipment racks in the SA, in 1993 we used the bridge cranes to bring them into the SA. Now – also due to the different boundary conditions (e.g. a fully populated EH) – the bridge cranes are not anymore practical for that purpose and we will use them for the activities on the SR tunnel and EH only.

The stuff in the SA (mostly to discard) will exit the building using a sort of "backdoor". We will reinforce the false floor in the inner side of the SA (the corridor shown in Fig. 3) to bring the loads under the crane mounted on the roof of the Elettra building (yellow oval in Fig. 6) and lift them from the courtyard inside the building itself (Fig. 7).


Figure 7: Roof crane from the courtyard.

External Movimentation

Referring to Fig. 6, either using the bridge cranes of the EH or the crane on the roof, the removed material, as well as the equipment to install, can reach the Elettra Building following a single two-way path (indicated by the orange dashed arrow) close to the FERMI Klystron Gallery.

Entrances "B" and "ES3" are pedestrian ones that allow only hand-moved loads on manual forklifts; entrances "D" and "E" are large and high enough for trucks and large carts. It has to be noted that the load/unload area under the roof crane is close to gate "D".

Due to the presence of the FERMI Experimental Hall (lower right in Fig. 6) there is not anymore another access to gate "D".

EXAMPLE: SR ROOF TILES

There are about 400 concrete tiles covering the SR tunnel in a double layer (Fig. 8), and weighting up to 6 tons.


Figure 8: Moving the SR tunnel roof tiles.

In order to extract the SR magnets and other equipment and install the new machine, as well as reconfigure the outer shielding wall for the new beamlines [6], we have decided to remove all tiles and defined a temporary 1300 m^2 depot – organized in three areas – to store them during the "Dark Period", being the roof removal and installation the first and last major activities, involving for about four weeks in total both bridge cranes.

CONCLUSION

Besides movimentation and transport equipment and strategies, space is the critical asset. One has to consider medium/long – term storage of old SR components for RP characterization and decommissioning; medium/short-term temporary storage for components/parts pre-assembled and ready for installation; short-term storage for equipment removed and ready for disposal.

Logistics is a critical aspect to care about in order to avoid delays, damages to equipment or – worse – injuries to the personnel.

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