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THE SuperB PROJECT SITE LAYOUT

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Abstract

The SuperB collider project aims at the construction of an asymmetric high luminosity B-Factory in the Tor Vergata University campus in Rome (Italy). The engineering aspects of the SuperB design and construction, aiming at reusing the PEP II components is be presented here. Synergies with the Italian FEL project SPARX, which will start civil construction this year, will be discussed. The two projects can share the LINAC tunnel and other facilities.

INTRODUCTION

The SuperB project [1] aims at the realization of an asymmetric energy $e^+ e^-$ collider capable of reaching a luminosity of the order of 10^{36} $cm^{-2}s^{-1}$. The design relies on a new collision scheme with large Piwinski's angle and very small IP beam sizes, where possible harmful resonances will be cancelled by the newly proposed "crab waist" method. Such a machine can provide a uniquely sensitive probe of New Physics in the flavour sector of the Standard Model.

This paper presents and describes the preliminary designs and studies on the infrastructure layout and site issues related to this project. Synergies with the SPARX-FEL project are discussed.

SuperB SITE LAYOUT AT TORVERGATA

The Tor Vergata site is located in the south of Rome near the Tor Vergata University campus and not far from the Frascati National Laboratories. Other research institutions are located in the area like the National Research Council (CNR) partner of the SPARX-FEL project also foreseen in this area [2]. A new science faculty directly connected to the SPARX-FEL (see Fig. 1) is foreseen in the University Campus. From a geological point of view, the area was formed by the Colli Albani volcano more than 600000 years ago. The underground composition reflects the volcano activity as it is possible to see in Figure 2 where a cross section of the ground is reported up to 30 m of depth. Below the soil (thickness 1 m) there are two layers of pyroclastic rock very similar from a mechanical point of view. These rocks are a sort of sand able to support heavy loads and to damp vibrations coming from natural sources like seismic activity or surface roads and railways. Moreover it is easy to dig, and water is only below this level, so allowing for costs reduction of the civil infrastructures construction.

Figure 1: View of the Tor Vergata site in Rome.

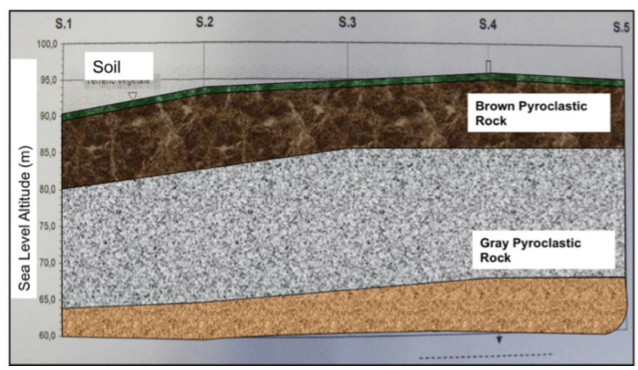

Figure 2: Ground cross section.

From a seismic point of view the area is very stable even if it is located near the boundary of a very active region. Strong earthquake epicentres were never registered in Rome. The maximum ground acceleration here is between 0.17g and 0.15g where g is the gravitational acceleration (see Fig. 3).

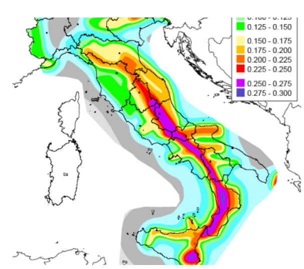

Figure 3: Seismic map of Italy.

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Civil infrastructures

The SuperB facility will require a big complex of civil infrastructures. The main constructions, which will house the LINAC, the injection lines and the damping rings, will be underground. A footprint of the SuperB layout on the Tor Vergata area is shown in Figure 4. The storage rings will have an elliptical shape with the major axis of about 600 m and the minor axis of 500 m, for a total length of the circumference of about 1800 m.

Figure 4: Footprint of the SuperB on the Tor Vergata campus site.

There will be just one main surface building above the Collider Hall and a certain number of auxiliary surface buildings distributed along the LINAC line and along the rings, which will house electrical power stations, the radio frequency and cooling plants (Fig. 5).

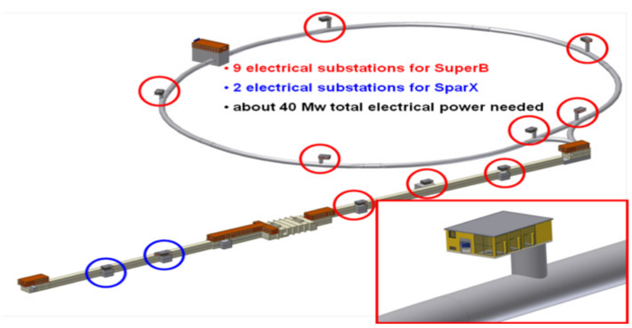

Figure 5: Electrical substations distribution.

The LINAC tunnel will be made of two tunnels, one on top of the other, in order to minimize the surface buildings and reduce the digging costs. Moreover the double channel cross section gives high mechanical rigidity helping in the alignment and increasing stability. The lower tunnel will house the accelerator components while supporting equipment and devices such as modulators, klystrons and power supplies will be installed in the upper one (Fig. 6). The total length is 400 m with an area foreseen half length of the LINAC tunnel for the damping ring housing. Three emergency exits are foreseen. The SuperB LINAC has been placed just down stream the SPARX one in order to have the possibility of using it as upgrade of the FEL injector in the future.

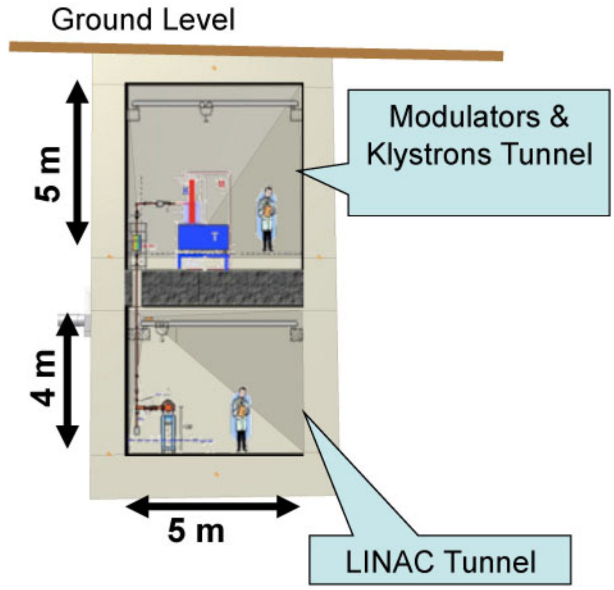

Figure 6: LINAC and Klystrons tunnel cross section.

The storage rings and the injection system will be installed in a round shaped cross section tunnel. The inner bore of the tunnel will be 5.8 m. The floor level inside the tunnel will be properly chosen trying to find a good balance between the need to maximize the width of the tunnel at ground level and the need to have good availability of space in height. A possible solution is shown in Fig. 7.

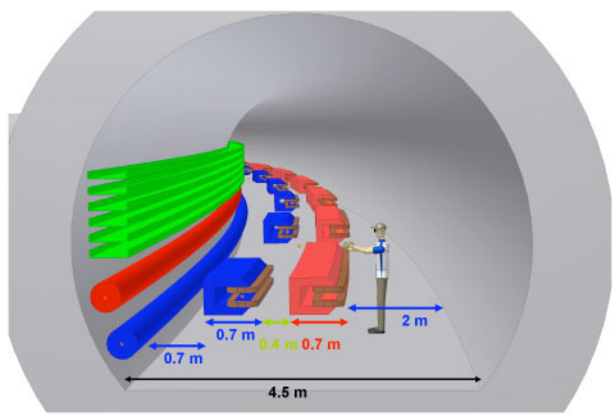

Figure 7: Storage rings tunnel occupancy.

In this configuration the High Energy Ring (HER) and the Low Energy Ring (LER) are positioned adjacent to the inner radius wall of the tunnel, one close to the other, leaving as much space as possible on the external part of the tunnel for the transit of forklifts or small electrical trucks necessary to carry in accelerator components or other heavy and cumbersome components. Another possible configuration (Fig. 8) would be to place the HER and the LER at the two sides of the tunnel (one close to the inner wall and the other one close to the external wall) leaving a large aisle at the center of the tunnel and making it easier and more comfortable to reach the components of both rings for installation and maintenance.

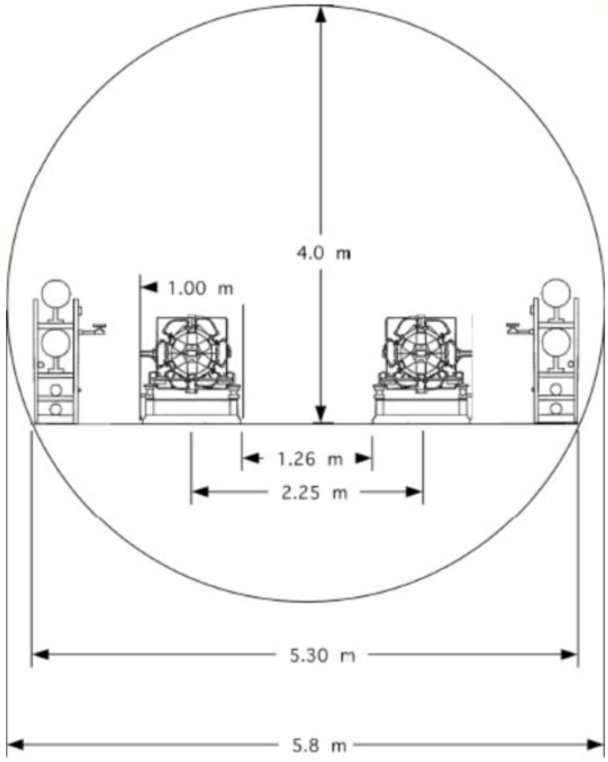

Figure 8: Storage rings tunnel occupancy second scenario.

At the Interaction Point, a big Collider Hall is foreseen. It consists of a large external prefabricated hall with a bridge crane, an area for installation purpose, two control rooms for the detector and the accelerator and an underground area also with a bridge crane. A big shaft will connect the underground area and the external one. The same shaft will be used also to lower in the tunnel heavy machine components, like the bending dipoles for the LER and HER rings. The underground area cuts the storage rings tunnel with a side area for the experimental setup assembly before the detector roll-in or after the roll-out (see Fig. 9).

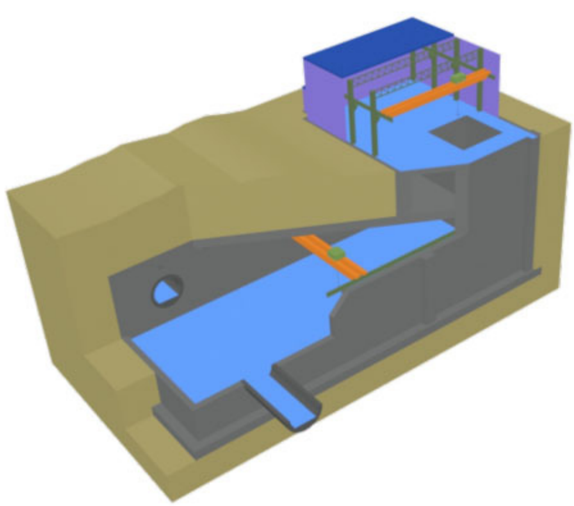

Figure 9: Collider Hall.

PRELIMINARY SUPERB SITE LAYOUT AT LNF

Although the Tor Vergata site represents the first choice, INFN is seriously investigating the possibility to build the SuperB and SPARX complex at the Frascati National Laboratories (LNF) to reuse at maximum the civil LNF infrastructures after the DAΦNE dismantling foreseen in three or four years since now. In this scenario the LINAC tunnel will be reused together the DAΦNE hall that could be the SPARX experimental hall. The existing electrical substation with two transformers of 10 MVA each can be easily upgraded. Two transformers of 63MVA each can be installed in the present civil infrastructure. Two power lines connect the electrical substation to a strong network that can provide the required electrical power. A sketch of this solution is presented in Fig. 10.

Figure 10: LNF SuperB scenario.

The LINAC extension will be dug in a free area where buildings are not present while the storage ring will be entirely underground at a proper level in order to be compatible with the existing buildings. The nearest institution (ENEA) partner of the SPARX-FEL project will be involved and part of the tunnel will be bored underground its laboratories. The Collider Hall will be in the LNF side and will be similar to the one presented for the Tor Vergata site. The tunnel is foreseen with the same cross section and occupancy.

CONCLUSIONS

The SuperB site layout at Tor Vergata has been presented together with the preliminary design of the civil infrastructures. Synergies with the SPARX-FEL have been shown. An alternative site is presently under study at the INFN Frascati National Laboratories (LNF).

REFERENCES

[1] SuperB CDR, arXiv:0709.0451 (2007).
[2] TU5RFP076, this Conference.