

INFRASTRUCTURES

3.1 Introduction

The SPES project requires a completely new development of buildings and related services. The Infrastructures bid for alpha phase of the project was ran in September 2012 and the contract with the selected constructor company is expected to be signed in December 2012.

A preliminary and executive design was carried out taking care of all the needs requested by the safety and radioprotection rules (specific study were carried out by a company with expertise in the domain of nuclear safety).

LNL has already implemented some preliminary activities to allow the construction. A new electrical power station has been installed and commissioned. It allows a power of 30 MW for the new project and 10 MW for the other activities of LNL. The power station has been designed and built in order to give a final power capability of 100 MW. Furthermore the station is linked to the 132 KV RTN in order to reduce the problem of micro interruption (few micro seconds).

A set of new main roads around the area was realized and the access to the new area is now available. The construction of first part of a new technological platform has been started as well as a tunnel to distribute to new sites all the technical facilities (compressed air, cooling water, cryogenics fluids) and is included in this activity.

To allow the construction of the SPES building, a preliminary work was done on the site with the deviation of the catch water drain crossing the designated area on the west side of the third LNL experimental hall so the continuity with this hall is already guaranteed.

3.2 The buildings

The SPES building is a new construction located west of the third experimental hall, it will house the Cyclotron, the production target area, the Applications (Protons and Neutrons facility) and the RadioIsotope Facility as shown in Figure 3.1. The characteristics of this infrastructures complex are mainly dictated by the shielding requirements provided by the LNL Radiation Protection expert.

Manens TiFS released the Executive Design of the infrastructures of the SPES project in March 2012. This design included the realization of the infrastructures and services needed to run the cyclotron and one ISOL target, and the rough realization of the whole SPES building complex. The SPES Team has worked for the last year close to TiFS engineers reviewing and optimizing the Infrastructures Preliminary Design provided by Manens TiFS in 2007.

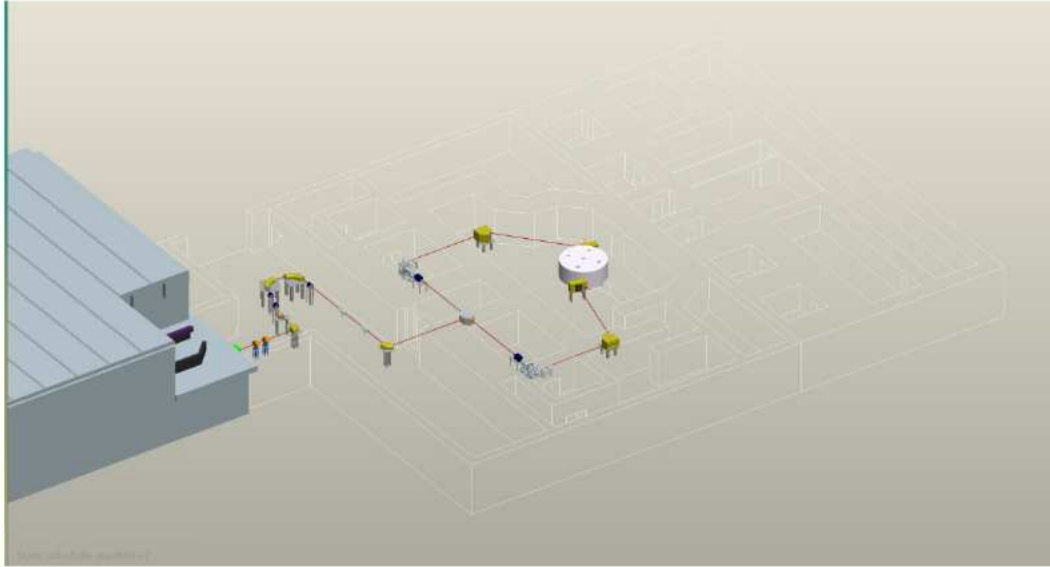


Figure 3.1: 3D Spes building (wireframe) on the west of the existing LNL third experimental hall (plain grey) .

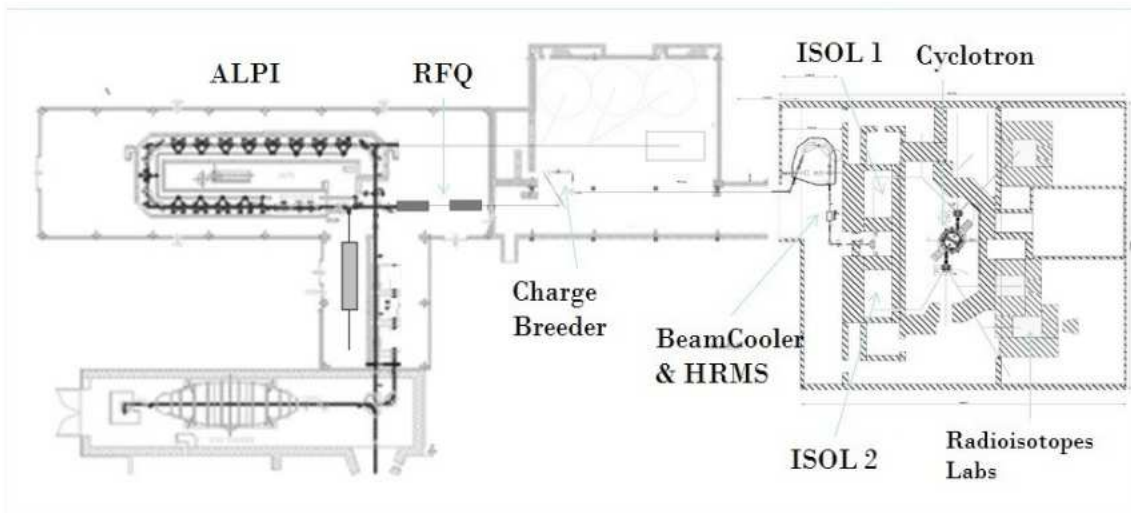


Figure 3.2: 2D Spes building (striped grey) on the west of the existing LNL third experimental hall (plain grey) .

The SPES facility will be realized in three levels: the main RIB facility components will be installed at level -1 (at underground level, to be easily connected to the RIB post accelerator, already installed at LNL); laboratories servicing the facility will be installed at level 0; level 1 will be occupied by offices. Figure 3.3 shows a 2D view of the level -1 buildings. The cyclotron room will be realized at the centre of the facility. The ISOL production target area and the RIB selection area will be located at the east side of the cyclotron room; the Applications area will be located at the west side of the cyclotron area.

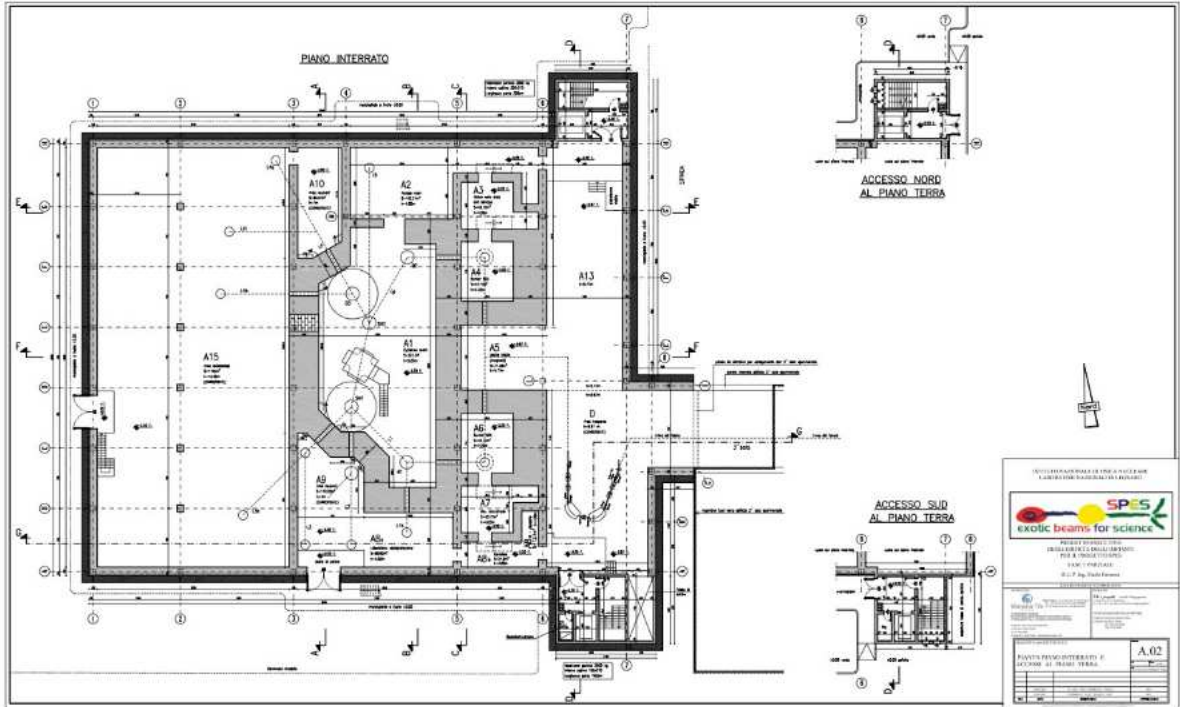


Figure 3.3: 2D view of the SPES Building, level -1.

Similarly at level 0 the laboratories servicing the underground components will be realized, as shown in Figure 3.4.

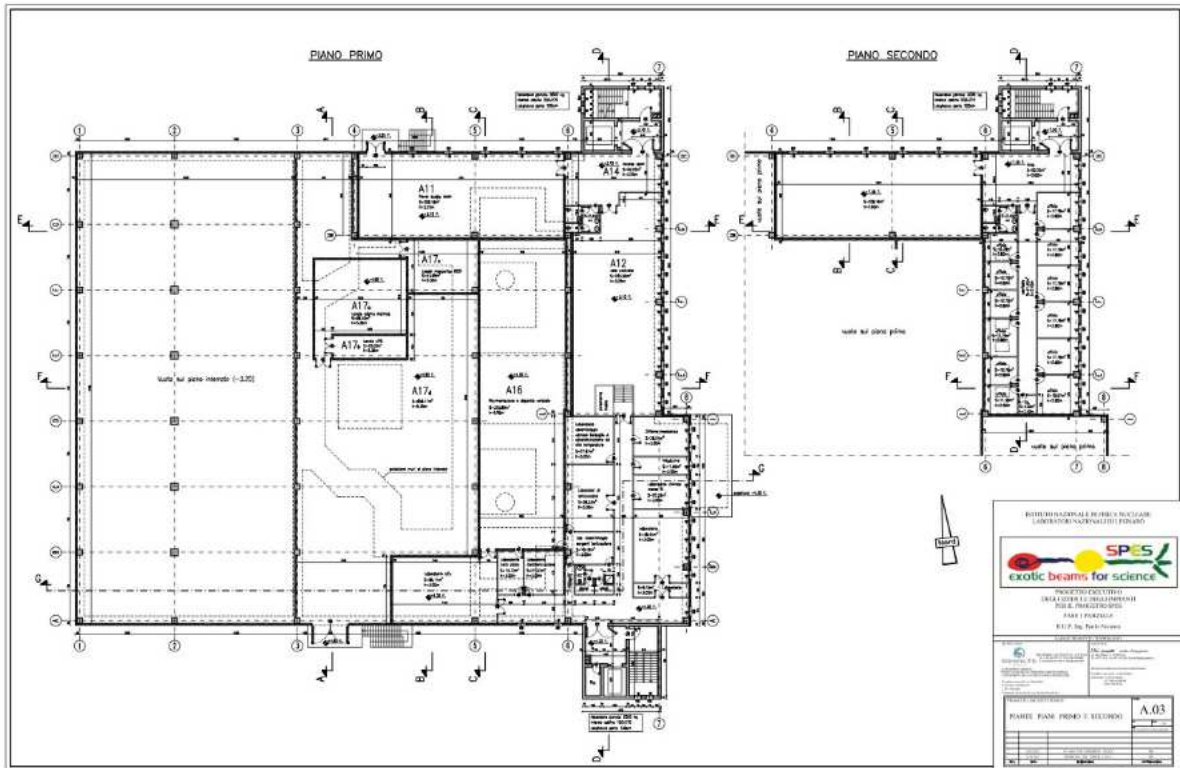


Figure 3.4: 2D view of the SPES Building, level 0 and level 1 (on the right).

Radiation shielding is an issue: in the central part of the building the cyclotron cave has 3m concrete shielding, 5.5 m height and around 150m² areas. A 3 m thick concrete bed below the Cyclotron and 3 m concrete roof are planned to avoid radiation problem in the atmosphere and in the soil. A core boring of the ground showed various layers of clay, silt and sand, with the water layer at -2.5 m from ground level. A specific proposal for the construction of the building under these geological conditions has been done [1].

The buildings layout in figures 3.5 shows an indication of the expected electrical power for each element of the facility.

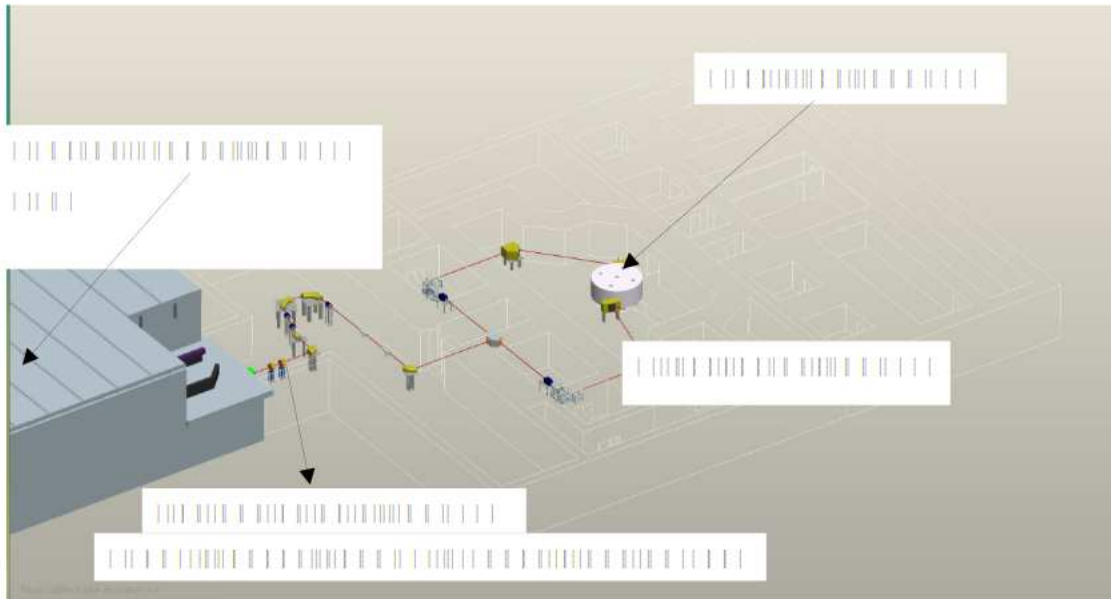


Figure 3.5: SPES layout with main electrical power requirements.

The laboratories for the Direct Target development, located on the south side of the building, are shown in fig. 3.6.

The laboratories will be licensed for UCx handling and equipped with the high level instrumentations developed for the direct target production and already available at LNL and at the Chemical Department of the Padua University.

Radiation and contamination control survey areas and an air control system will ensure the radiation safety. The High Temperature Laboratory is devoted to target production, in the Target laboratory the target will be assembled and sealed inside the target box. A Target Ion Source laboratory is devoted to the off line test and the Hot laboratory is the buffer area toward the accelerator complex. In the Hot laboratory target inspection after irradiation will be possible.

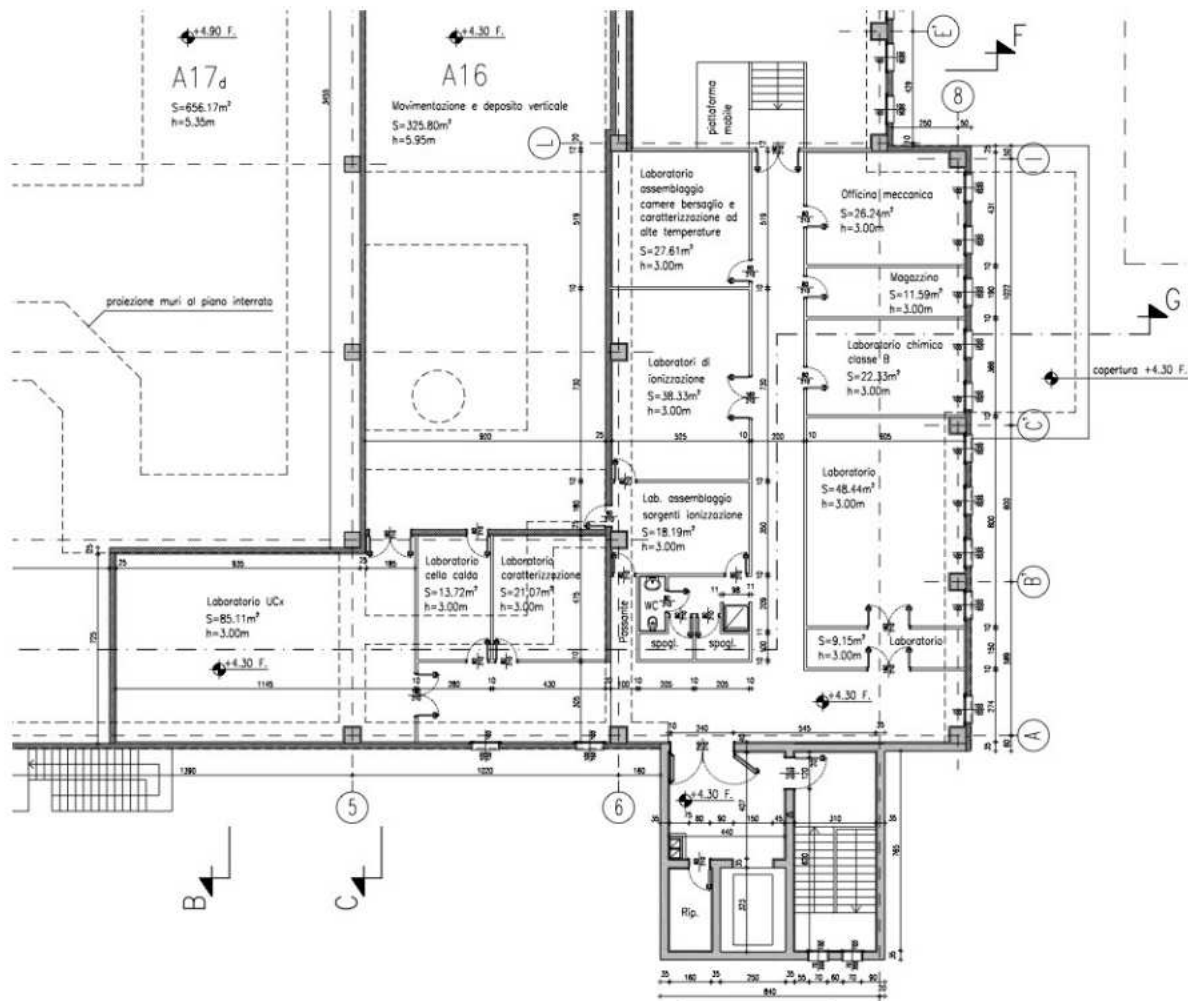


Figure 3.6 Direct Target laboratories

The cyclotron and RIB production areas are shown in figure 3.7. This area is heavily shielded with walls as thick as 3 m (upgradeable to 4m) following the radiation protection requirements. In these areas the delivery of the proton beams up to energy of 70 MeV and 0.75 mA are allowed. The cyclotron vault is 5m heights and well is present behind the cyclotron to allow the machine maintenance.

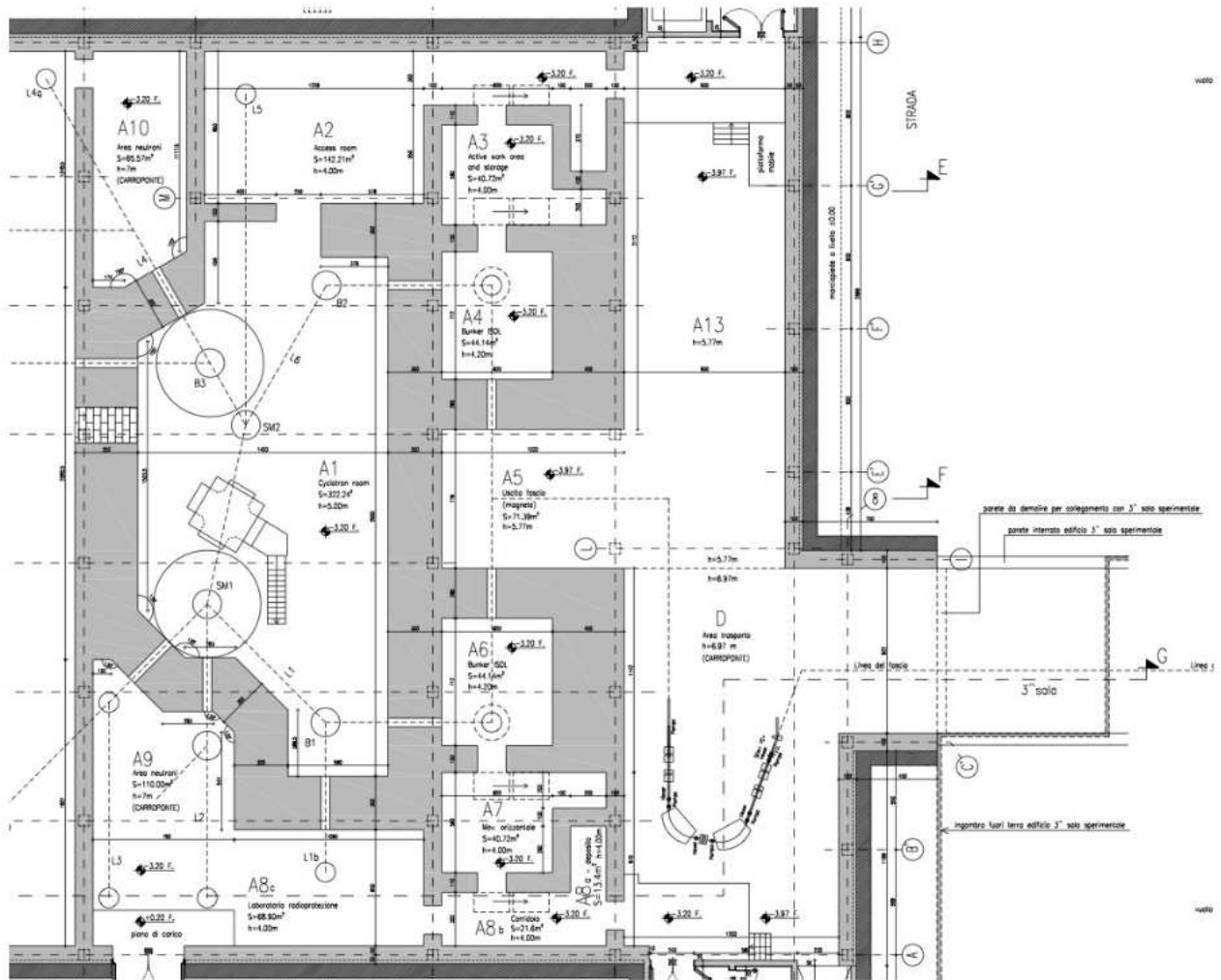


Figure 3.7: Cyclotron and RIB production area

Figure 3.8 shows a transversal view of the facility: the area for future RadioIsotope facility A15 is shown on the left of the cyclotron room A1, while laboratories at level 0 and offices at level +1 are shown on the right.

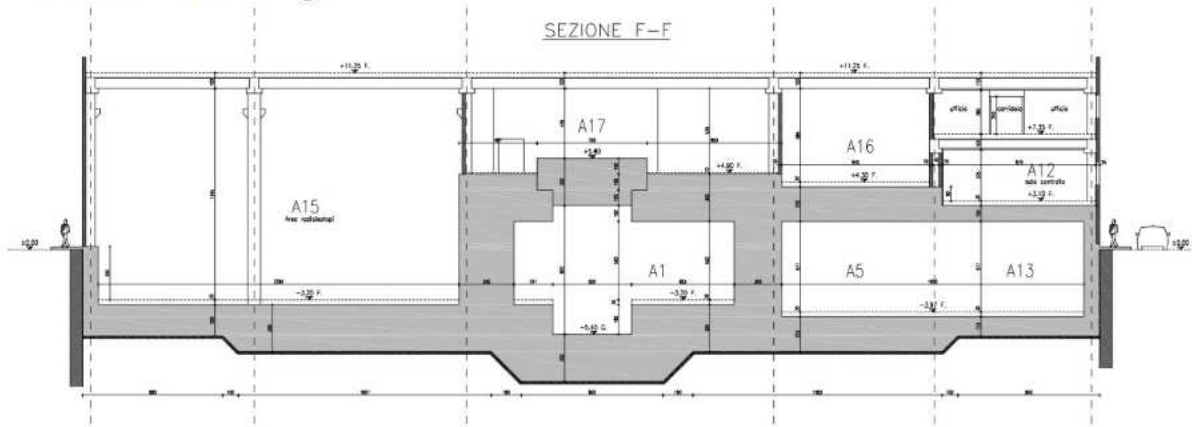


Figure 3.8: Transversal view of the Cyclotron area

Figure 3.9 shows a transversal view of the facility: laboratories A11 at level 0 and offices at level +1 are shown on the right.

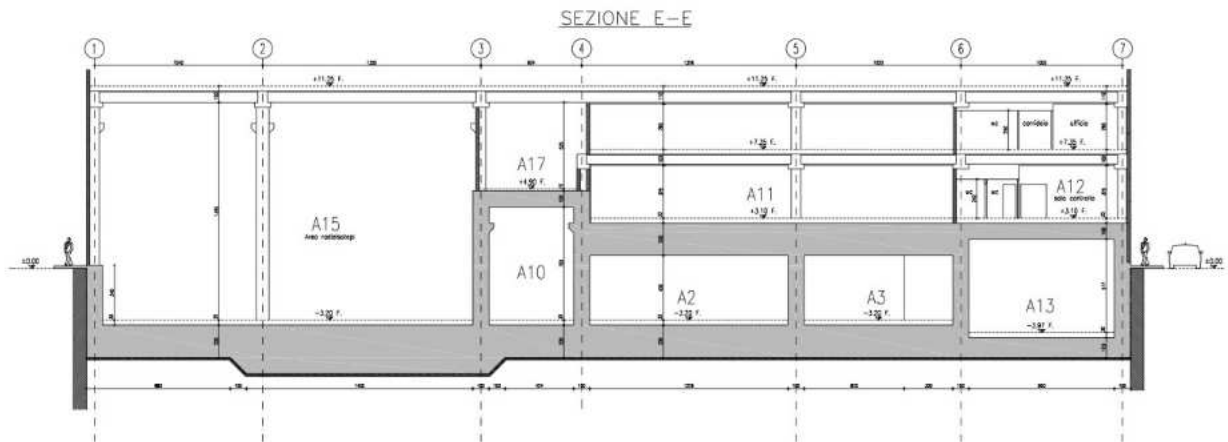


Figure 3.9: Cross view of the Cyclotron and RIB production area

References

[1] Studio di Fattibilità relativo alle opere strutturali di schemature per il progetto denominato SPES (Relazione illustrativa generale by Ing. E. Centis)