Renewing Crio 1 Lab.

A.M. Porcellato, E. Bissiato, F. Chiurlotto, A. Conte, M. De Lazzari, D. Giora, A. Minarello, M. Rigato, A. Rossi, S. Stark, F. Stivanello

INFN, Laboratori Nazionali di Legnaro, Legnaro (Padova), Italy.

INTRODUCTION

CRIO1, the laboratory where the ALPI Nb/Cu cavities are tested [1], obtained in 2013 the possibility to increase the accelerating fields allowed during the rf cryogenic tests up to 15 MV/m.

The new limits, which give the possibility to perform resonator conditioning in laboratory, were subordinated to the enhancement of the cryostat shielding. The shield upgrade gave the opportunity to think back also the general safety criteria of the laboratory that was in use since the early eighties. Some of the improvements that we completed in 2014 are here presented.

The cryostat structure was modified in order to allow the closure of the nitrogen thermal shield so to enable the collection and ejection of the evaporated gas to the outside (the helium and nitrogen gases produced during the cold mass cooling were also previously collected or conveyed to the external of the building). We rearranged the devices and the pipe connections on the cryostat top flanges (fig.1) in order to enable the motion of shielding movable structure while minimizing the unshielded surface. We cleaned and rinsed in an ultrasonic bath the cryostat inner components as far as possible.

The electrical power distribution of the laboratory was designed and is now waiting for being implemented; also both the laboratory cooling water piping and the obsolete distribution gas system are going to be dismantled.

THE NEW CRYOSTAT SHIELDING

The shield consists of a fixed part that embraces the lateral surface of the cryostat and a mobile structure that shields the cryostat top.

Fig. 1 Inner part of the test cryostat. We rearranged the rf and cryogenic connections on the top flange to better fit them inside the shielding. The He tank is visible on the bottom. The cavity to be tested will be hanged up to it.

Fig. 2. Circumferential cryostat shielding
The circumferential part (fig. 2) was designed in the LNL workshop and built by an external factory [2].

It consists of 3 self-supporting independent sectors that rest on the groove housing the cryostat. Two calendred lead sheets, each 5 mm thick are coupled so as to obtain a thickness of 10 mm. They are screwed on aluminum electro-welded support.

Fig. 3 shows the shielding structure assembled around the cryostat tank. The three sectors are assembled around the cryostat in order to maximize the overlap of their lead edges. They are anchored between them and fixed in the right position with respect to the groove walls by adjustable spacers.

The top shielding structure (fig.4) was designed in the LNL technical office and commissioned to the same factory that built the first part.

It consists of a fixed part, stuck to the floor, and of a mobile structure sliding on guide rails resting on the laboratory floor.

A gear allows the movement of the structure by hand in a safe and easy way.

The frame that supports the lead panels is built in painted iron. The total lead thickness of 1 cm (made from 5 mm thick slabs). The lead panels are assembled in order to avoid slits such that would reduce the shielding power. An adjustable spit on the top of the mobile structure allows the passage of pipes that have to be in place during the measurement. The space between the pipes will be filled by lead sheets that overlap over the other to cover the spit.

Fig. 3. Cryostat vacuum tank; the connection for the vacuum pump is shown on the right. The top of nitrogen shield is visible around it. The new lateral shielding surrounds the cryostat. The μ metal shield is inserted between them. Notice the Pb overlap at the edges of the three sectors.

Fig. 5. Shielding structure when open. The gear on the left allows the movement of the structure; on the left the fixed shield part.

CONCLUSIONS

The technical plants of the laboratory should be implemented in the beginning of the next year. Later on, all cryogenic, vacuum and rf connections of the cryostat will be restored allowing the re-use of the measurement facility.

The possibility of perform Q-Measurements also after conditioning will allow to know in advance the possible cavity performance before the installation of the resonator on line.