INTRODUCTION

Originally the spoke test cavity crystal was designed to test exclusively SR1 cavities [1] [2]. The goal of the upgrade is to extend this capability to SR2 cavities, and to the low and high beta 650 MHz cavities. Each cavity is tested with its coupler and tuner, and is supported in the same way as it will be inside the cryomodule.

MECHANICAL DESIGN

The vacuum vessel, the magnetic shield and the thermal shield of the existing STC have been extended. The vacuum vessel's extension is 30” long. It has also been decided to add a support post on this extension in order to support the 650 MHz cavities due to their length. Moreover, the height of this support post has been reduced by 1” in order to fit SR2 cavity inside the test station.

Two-phase helium pipe design

In order to fit the high beta and low beta 650 MHz cavity inside the thermal shield, it has been necessary to redesign the two-phase pipe:
- Its length has been increased in order to let the helium container at one end.
- A removable interface has been designed in order to make the connection with the cavity.

CRYOGENIC DESIGN

Due to the fact that the high and low beta 650 MHz cavities have a chimney making an angle with the vertical axis contrary to SR1 and SR2 cavities, it has been necessary to design a dedicated interface. The BNK line with a design pressure of 80 psi will be cooled by using liquid nitrogen. The two-phase helium pipe and the cost down - warm up line will be cooled up to 2K with liquid helium considering a design pressure of 9.5 psi.

Heat loads

The vessel and the thermal shield being longer, and the two support posts shorter, the heat loads are more important and the helium mass flow should be close to 1.24 g/s. This value is close to the maximum flow of the exchanger: 1.25g/s.

Thermal shield design

The new thermal shield will be cooled actively at 80K by expanding the existing ones. The interface will be done with flexible tubes and VCR connections in order to easily connect the two thermal shafts.

CONCLUSION

The main challenge of this upgrade was to be able to fit the high beta 650 MHz cavity inside the thermal shield with regards to the room available. For this, the cavity will slide inside the vessel thanks to a structure on wheels and guided by a rail. As it was the case for SR1 cavity, we will qualify the high beta 650 MHz cavities in “cryomodule” conditions by testing the tuner and the coupler together. By changing the plate on the cavity support post, we will be able to test and qualify all the cavities needed for PIP-II. Therefore, we will have more flexibility and adaptability to follow the project schedule.

The design of this test station is now completed and the procurement is in process. The schedule is to upgrade this test station early 2016 and to start to qualify the high 650 MHz cavities.

REFERENCES