

Design strategy of the PIP-II cryomodules

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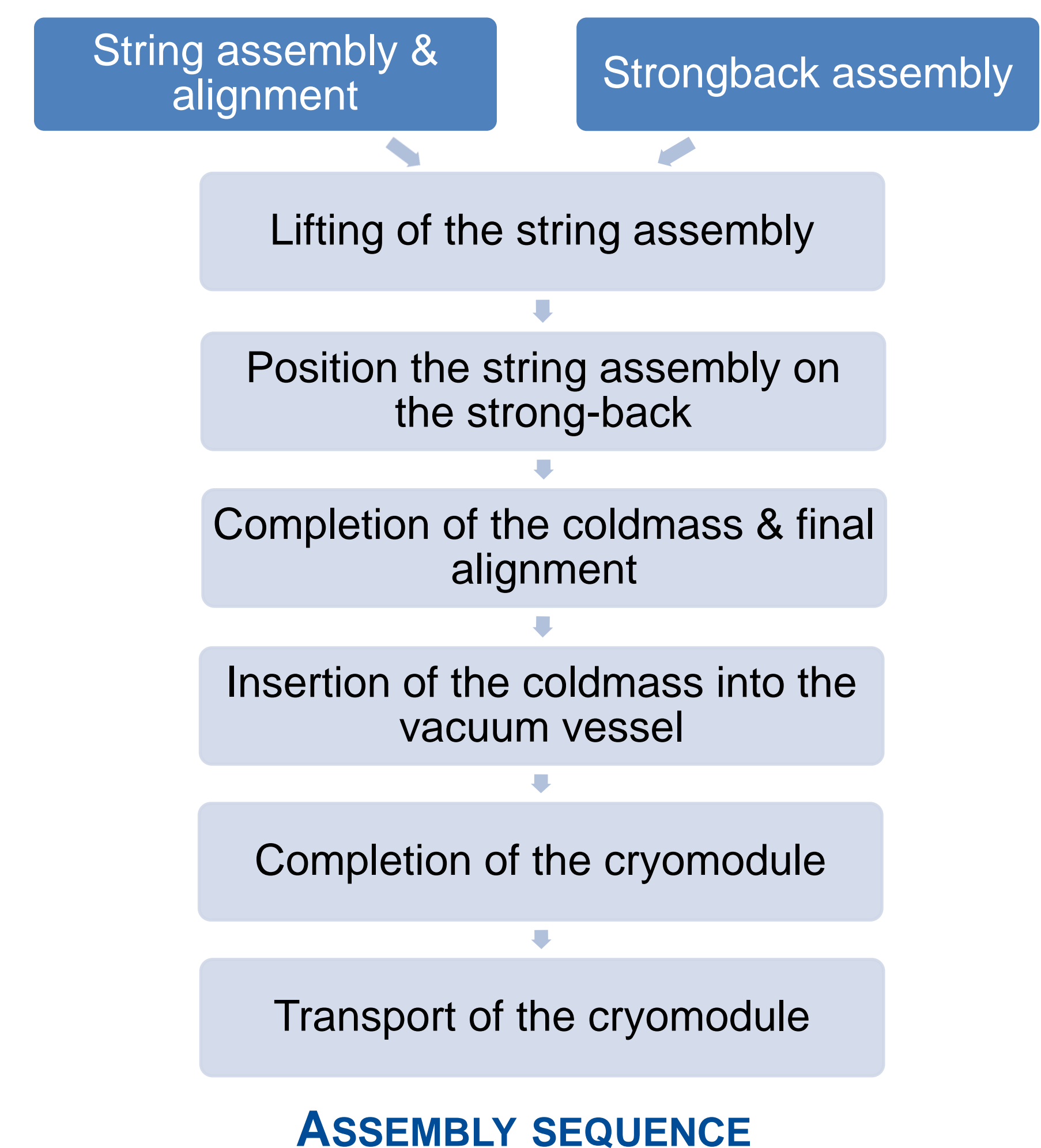
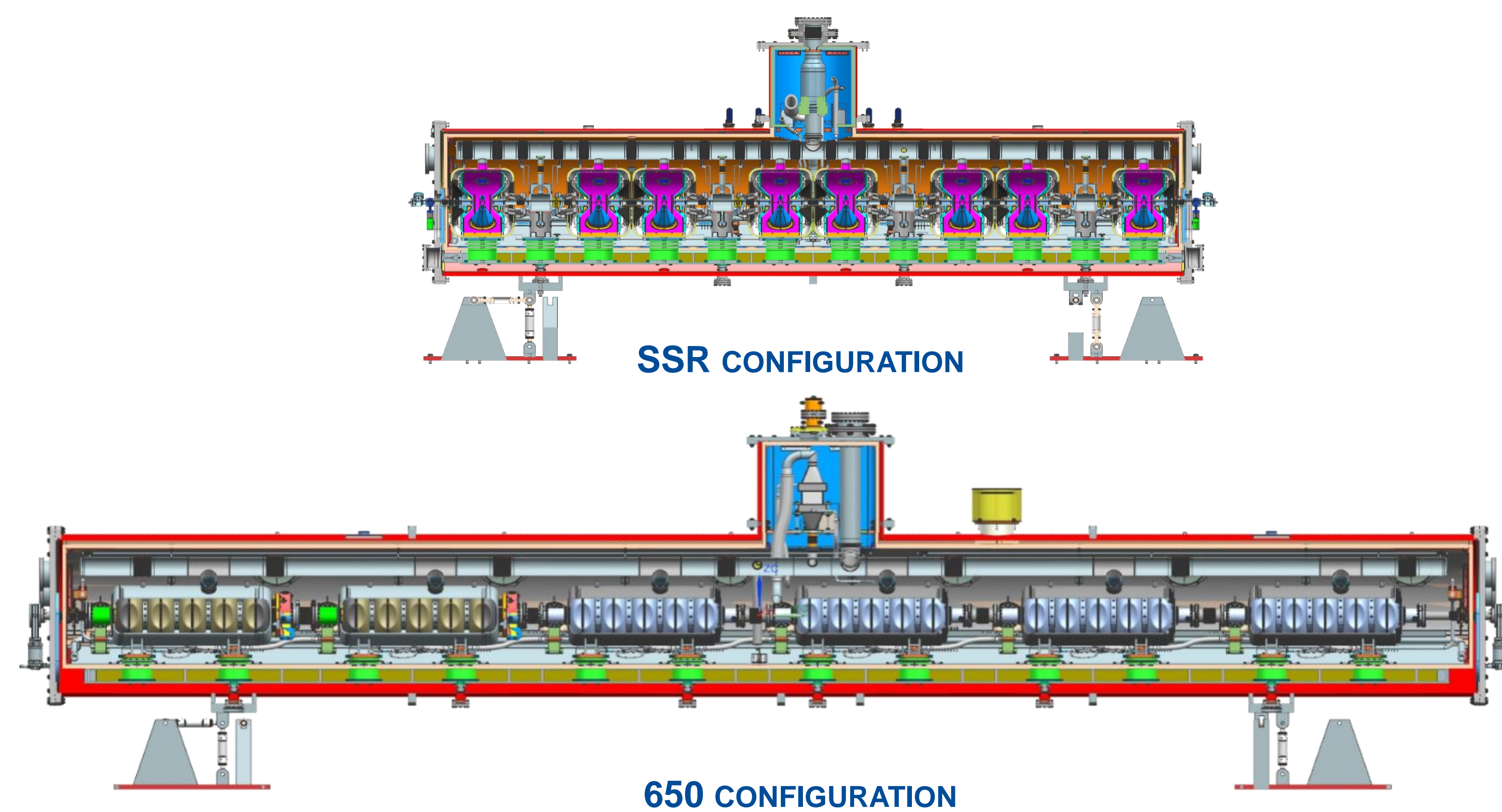


INTRODUCTION

The Proton Improvement Plan II (PIP-II) is the first U.S. accelerator project that will have significant contributions from international partners : CEA & CNRS (France), INFN (Italy), STFC (UK) and RRCAT & BARC (India). To reduce the cost of the project and to increase the quality, a cryomodule design strategy which includes a level of standardization has been defined and an international joint design has been set up. This joint-design also brings additional challenges to the project including the transport of cryomodules overseas.

DESIGN STRATEGY

The design of SSR1, SSR2, LB650 and HB650 cryomodules are based on a strong-back at room temperature supporting the coldmass from the bottom. The shape of the single spoke cavities is very different from the elliptical cavities, making it was necessary to support and align these cavities in a different way. To validate this design strategy and mitigate the risk from the project point of view, one prototype for each cryomodule type will be manufactured. The first prototype will have a major impact on the project because it will validate the assembly sequence common to all cryomodules



SSR1 PROTOTYPE CRYOMODULE

The SSR1 prototype cryomodule is under-assembling now at Fermilab. Its achievement will be a major milestone for the project because it will validate the design strategy including the assembly sequence.

The SSR1 prototype cryomodule is expected to be completed in October 2019. Then, based on this experience, the design of the HB650 prototype cryomodule will be updated to get the preliminary design review by the end of 2019.



STRONG-BACK ASSEMBLY

STRING ASSEMBLY UNDER THE LIFTING TOOLING

MAGNETIC SHIELD INSIDE THE VACUUM VESSEL

LESSONS LEARNED

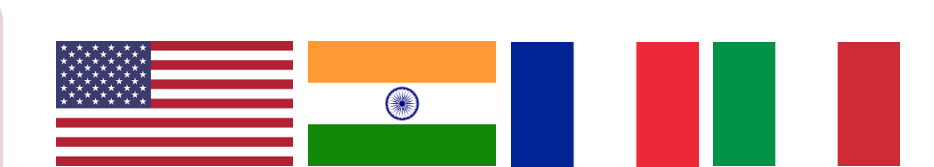
- Reduce the number of procurements by having a purchase order including several assemblies.
- Define the procurement specifications and quality control ahead of the procurement.
- A level of standardization is important to reduce the cost and increase the quality.
- Documentation and communication are key factors to manage an international joint design.

HB650 PROTOTYPE CRYOMODULE

The HB650 and LB650 cryomodules will have both important contributions from international partners which includes the transportation of cryomodule overseas.

Low Beta 650 MHz (LB650) cryomodule

- Contributions: USA, India, France, Italy
- Quantity: 9

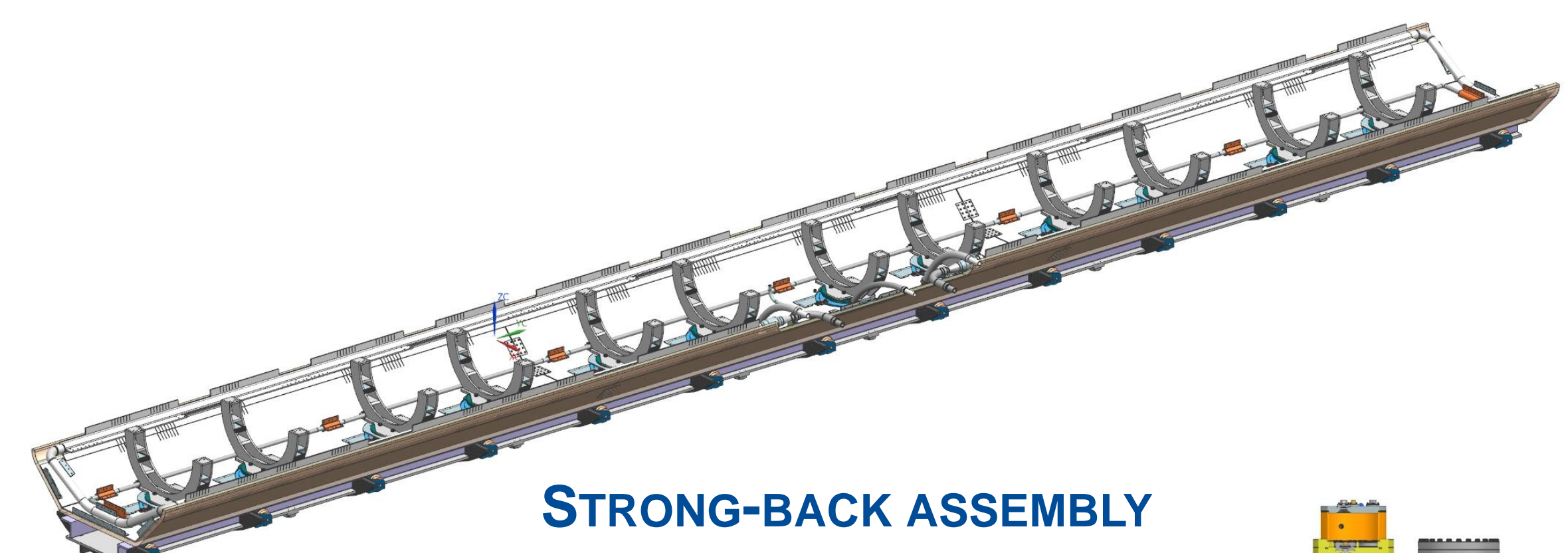


High Beta 650 MHz (HB650) cryomodule

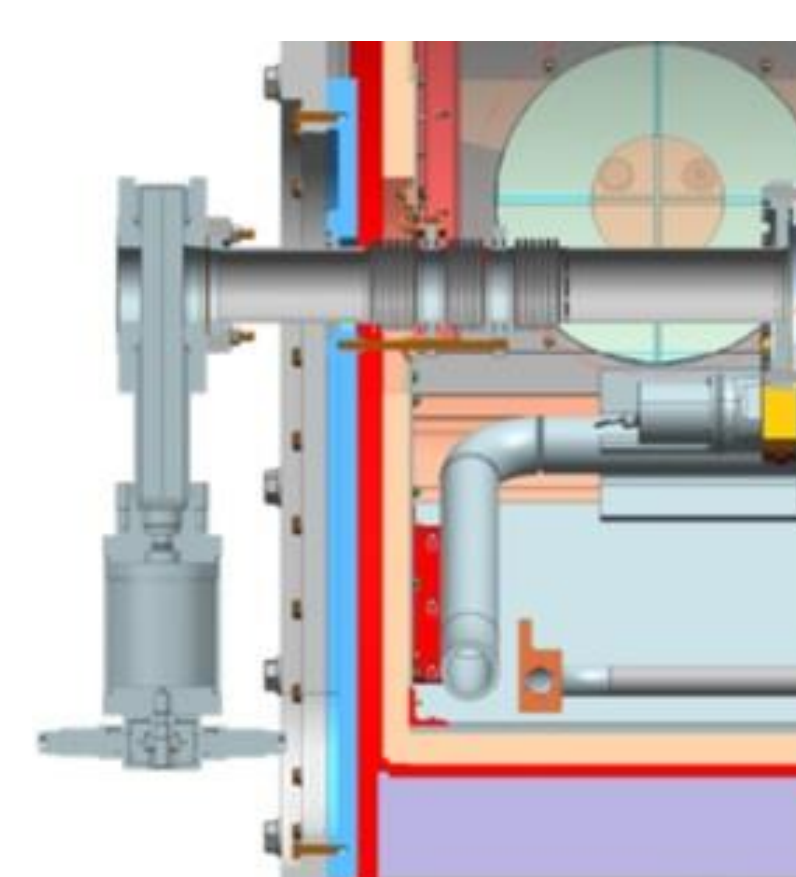
- Contributions: USA, India, France, United Kingdom
- Quantity: 4



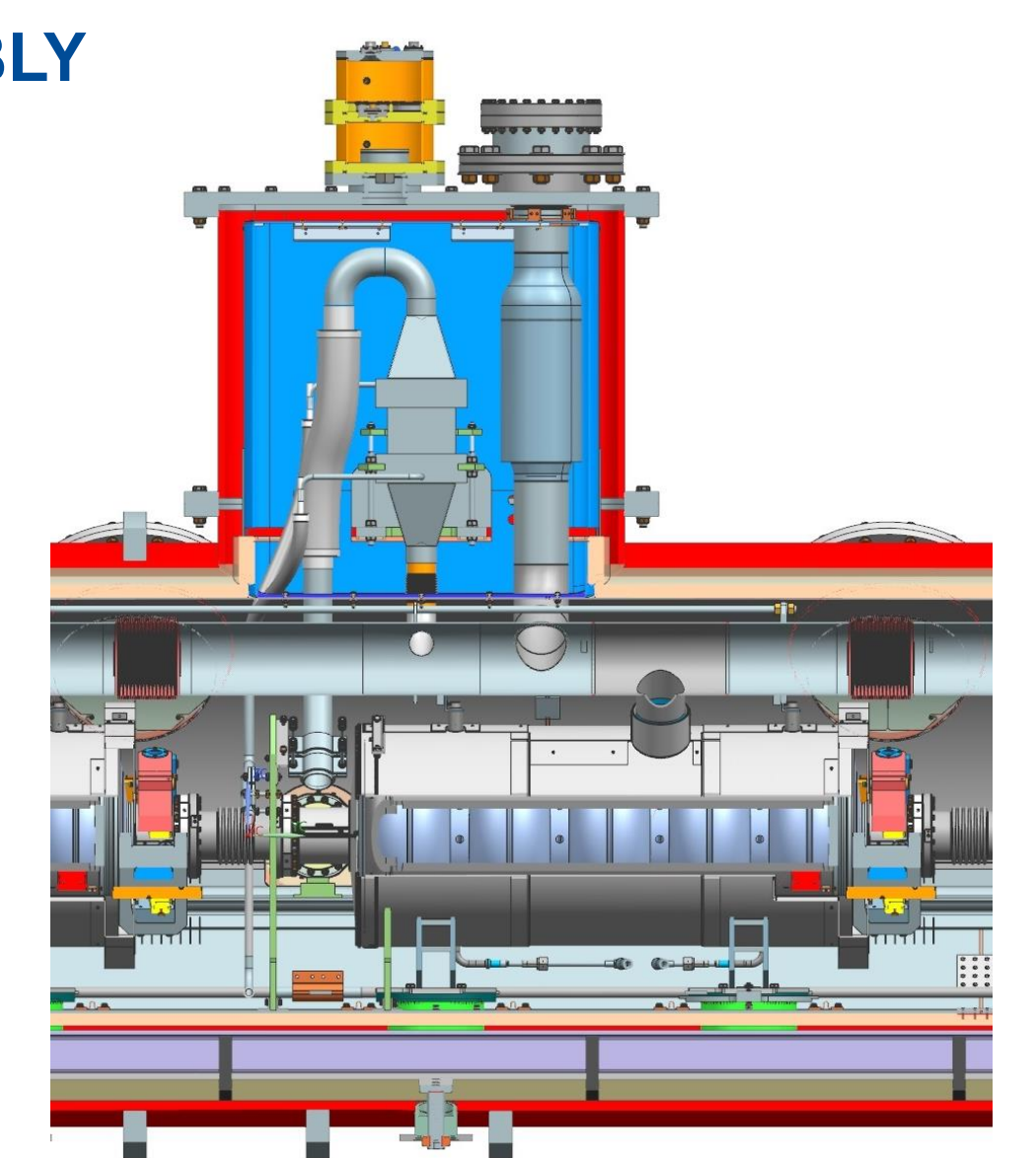
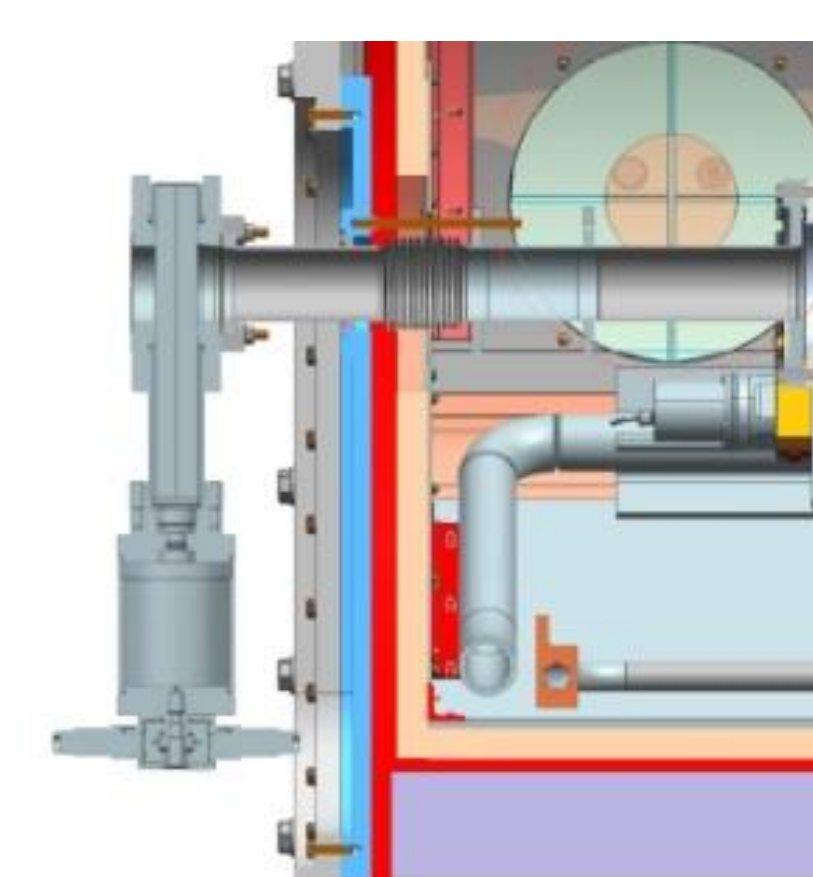
A joint design of the HB650 prototype cryomodule is on progress. Based on the experience of the SSR1 prototype cryomodule, improvements have been done in order to make easier the assembling and to avoid problem during transportation.



STRONG-BACK ASSEMBLY



BEAM PIPE END ASSEMBLY



INTERFACE WITH RELIEF LINE & HEAT EXCHANGER