Super-FRS design status report*

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System design

The revised layout of the Energy Buncher Spectrometer [1] has been finalized. It consists of two dipole stages deflecting the beam in opposite direction, forming a S-shape system. The new layout allows for a much simplified rectangular geometry of the required LEB cave. The ion-optical design includes an intermediate focus between the two dipole stages keeping the overall dispersion in limits. Details of the ion-optics are given at [2].

Magnets

CEA Saclay took over the design revision of the superconducting dipole magnets for Super-FRS. Although the existing prototype dipole fulfilled the magnetic parameters it required a revision of the cryostat including the cold mass. The FDR on the revised design (see Fig.1) was already held. CEA is now finalizing the design and preparing the tendering documents including the necessary specification. The magnets will then be tendered by FAIR.

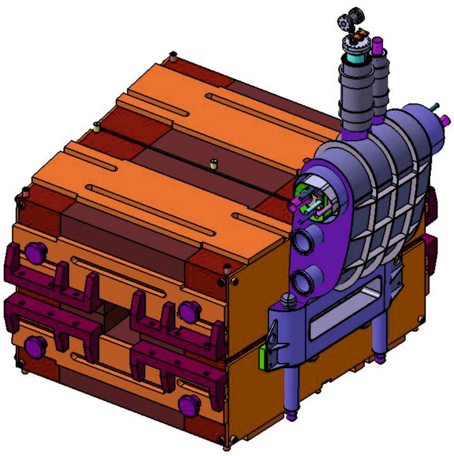

Figure 1: Revised design of SC the dipole magnet.

Unfortunately the tendering of the superconducting multiplets needed to be paused in September2014 due to formal reasons. The already qualified companies were asked to submit new offers. Contract negotiations are ongoing at the moment of writing this report and awarding is expected now for Q2/2015.

A handling test was performed for the existing radiation resistant dipole magnet. Later this 95 ton device must be installed in several parts in the highly shielded target area by means of the overhead crane in the target building of Super-FRS. The installation procedure was simulated with the help of a truck-mounted crane.

Moreover we needed to revise the adjustment support. The alignment of the magnet as well as other components in the target area can only be done remotely without any interivisibility. It turned out that the existing support unit does not satisfy the very high demand on reliability which requires the design of a new adjustment unit.

Figure 2: Simulation of the NC dipole installation.

Local cryogenics

For the planning of the Super-FRS magnet testing at CERN, several important topics related to the cryogenic safety have been investigated by CSCY together with the colleagues at CERN. Those include the final settle-down of the set pressure for the safety devices of the Super-FRS magnets according to the Pressure Equipment Directive (PED), the non-symmetrical forces on the multiplet cryostat in case of sudden loss of insulation vacuum to air, and the vacuum tank protection in case of a possible break-down of the cryogenic piping in the multiplet cryostat. In addition, the dynamic forces on the magnet support struc-

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tures for the test facility in the testing hall 180 have been checked for the case of helium gas release during worst-case quench. The results coming out of the investigations have been evaluated by the Safety Department at CERN and the submitted documents provide the basis to get the approval for the design and the operation of the test facility at CERN. Furthermore, the physical interfaces have been finalized between the cryogenic infrastructures, i.e., the jumper-connection, and the magnet cryostats, which is one of the most important interfaces through the magnet design and fabrication, the magnet testing at CERN and the final installation and operation at FAIR/GSI. Based on the cryogenic parameters including the heat loads of the magnet cryostat, the pressure drops, the flow rates and the cooldown time estimation provided by the CSCY, a preliminary cryogenic design of the test facility has been done at CERN in summer 2014.

Beam instrumentation

The development and production of the slit systems for Super-FRS was contracted as the first project within the framework of the Collaboration Agreement between GSI and KVI-CART. Altogether 18 slit pairs (horizontal as well as vertical) will be installed in the Super-FRS. Most of the slit-jaws will consist of Densimet blocks having dimensions of up to 200x180x250 mm^3. The overall weight of the heaviest slit-systems will be close to 1 ton. The preliminary design could already be finished including aspects like remote handling capability (in the Pre-Separator). Special care was taken on thermal effects which could arise in the Pre-Separator due to high beam/fragment intensities [3].

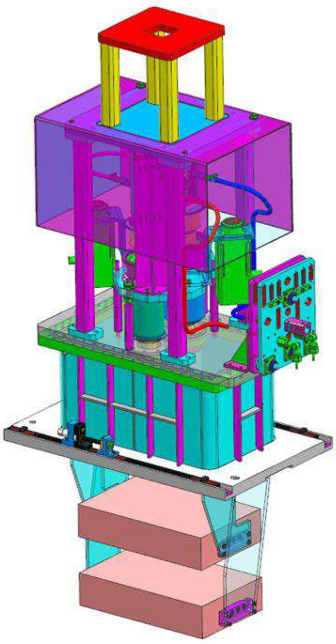

Figure 3: Daesign proposal of the y-slit system including remote controlled media pannel.

Target area / handling system

A Hot-Cell mock-up was installed on the ESR roof (see Fig.4). It consists of a metallic frame and two master-slave manipulators. The frame simulates the front area/shielding window of the future Super-FRS Hot Cell [4] and serves as the support for the manipulators. The manipulators are double telescopic systems with a load capacity of 20 kg and a maximum slave extended length of 3270 mm. The arms are completely equilibrating in all operational positions (with no load). It is foreseen to transfer and install these manipulators to the future Hot-Cell.

Figure 4: Hot-Cell mock-up mounted on the ESR roof

The main purpose of the mock-up is to validate the concepts of the equipment which is under development now and must be designed for remote-handling (target, beam catcher, etc., but also equipment used at the pbar separator). Another important aspect is the training of personnel in advance of ’hot’ operation. Partially we collaborate here with SPIRAL2 in the framework of the EU CRISP project and remote handling tests with our French colleagues could be performed.

References

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