MODIFIED SRF PHOTOINJECTOR FOR THE ELBE AT HZDR

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Abstract

The superconducting radio frequency photoinjector (SRF photoinjector) with Cs2Te cathode has been successfully operated under the collaboration of HZB, DESY, HZDR, and MBI [1]. In order to improve the gradient of the gun cavity and the beam quality, a new modified SRF gun (SRF-gun 2008) has been designed.

The main updates of the new cavity design for the new photoinjector were published before. (ID THPPO022 on the SRF09 Berlin) This cavity is being fabricated in Jefferson Lab.

In this paper the new ideas of the further parts of the SRF-gun 2008 will be presented. The most important issue is the special design of half-cell and choke filter. The cathode cooler is also slightly changed, which simplifies the installation of the cathode cooler in the cavity.

The next update is the separation of input and output of the liquid nitrogen supply, for the purpose of the stability of the nitrogen pressure as well as the better possibility of temperature measurement.

Another key point is the implementation of the superconducting solenoid inside the cryomodule. The position of the solenoid can be accurately adjusted with two stepmotors, which are thermally isolated to the solenoid itself.

INTRODUCTION

For ELBE LINAC (**E**lectron **L**inear accelerator with high **B**rilliance and low **E**mittance) a new SRF-gun has been redesigned (see Figure 1). This paper presents the revised design and discusses the advantages.

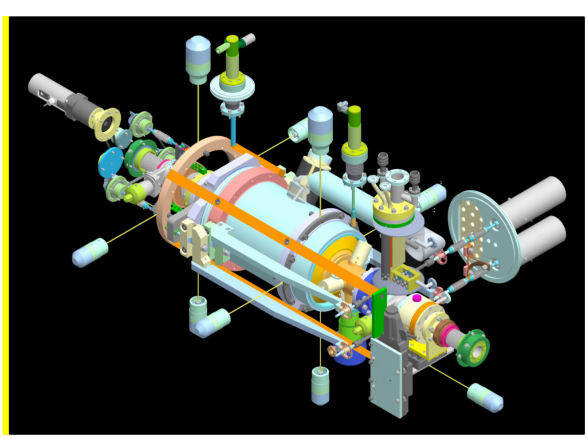

Figure 1: View of the inside parts.

SPECIAL DESIGN OF HALF-CELL AND CHOKE FILTER

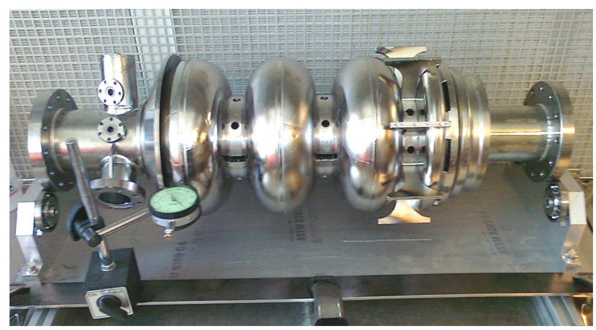

Figure 2: The status of the cavity fabrication.

The Figure 2 is the latest photograph of the new cavity, which is currently produced and assembled in Jefferson Lab. There, the whole process, including production, tuning and welding in the tank will be done [2][3]:

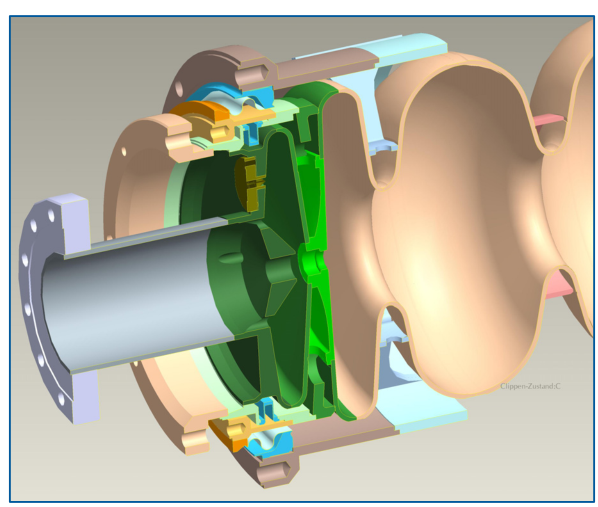

Figure 3: New cathode opening design.

- Welding of the resonator
- Etching
- Cleaning
- Cold test @ 2K
- Field profile measurement
  (Details of the measurement are given in Ref. [4]).
- Passband / Choke
- Tank Welding
- Etching
- Cleaning

THE CATHODE COOLER

The cathode cooler and LN2 reservoir are slightly changed (Figure 4). It simplifies the assembly work in a clean room and prevents contamination of the cavity.

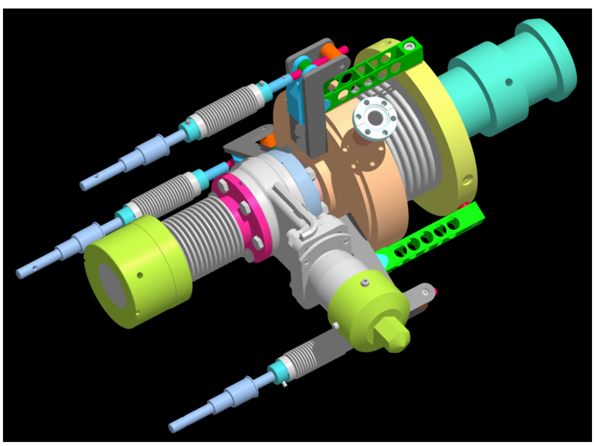

Figure 4: 3D model of the cathode cooler.

The new cooler (Figure 5) is finished and currently tested for leaks. It is planned to be assembling with cavity in the following October.

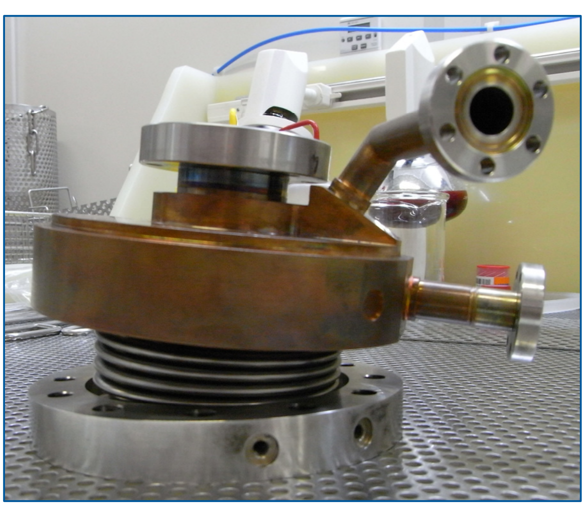

Figure 5: New cathode cooler.

SEPARATION OF INPUT AND OUTPUT OF THE LIQUID NITROGEN SUPPLY

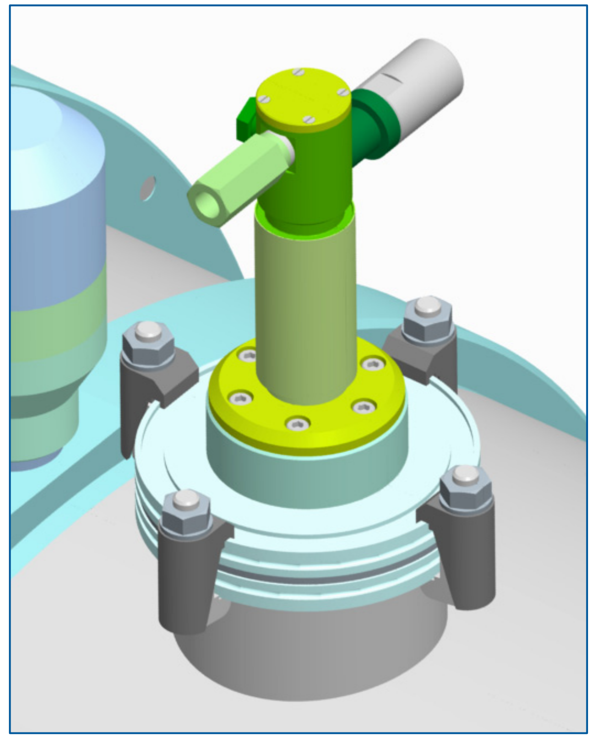

Figure 6: Output of nitrogen supply.

The next update is the separation of input and output of the liquid nitrogen supply, used for the purpose of the stability of the nitrogen pressure as well as the better possibility of temperature measurement (Figure 6 and 7).

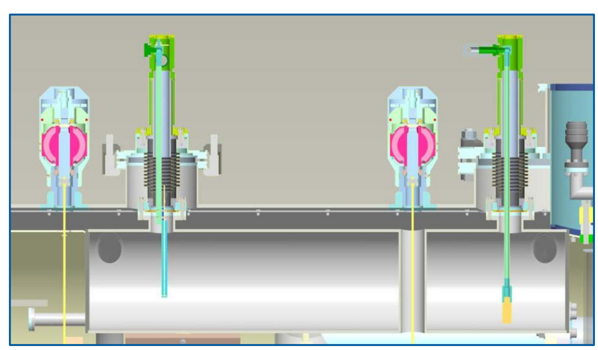

Figure 7: Nitrogen supply with tank.

IMPLEMENTATION OF THE SUPERCONDUCTING SOLENOID INSIDE THE CRYOMODULE

In collaboration with HZB is pursued this idea: Helium-cooled superconducting solenoid is integrated into Cryomodule. Power supplies are realized through the inbuild line from helium tank.

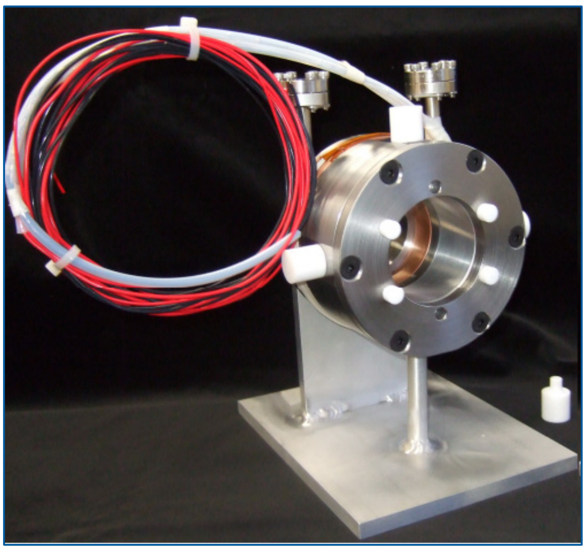

Figure 8: The photo of solenoid.

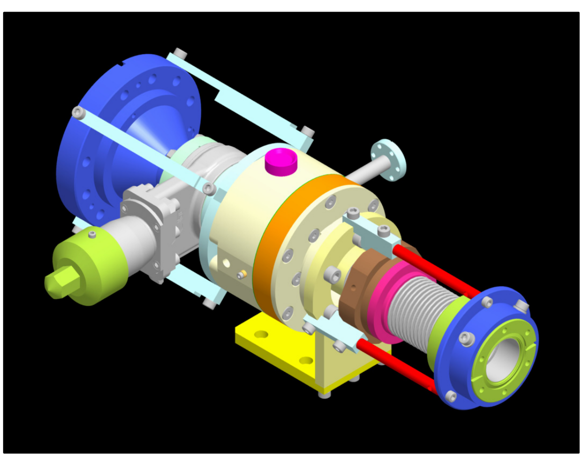

Figure 9: Completed solenoid part on the beam pipe.

The position of the solenoid can be accurately adjusted with two step motors (Figure 10), which are thermally isolated to the solenoid itself.

Heat loading to the He system still must be optimized. After the calculation (Figure 11-13) and construction have been carried out, the practical tests will be performed.

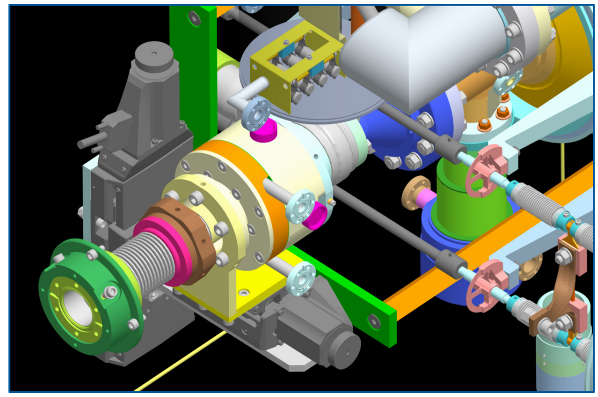

Figure 10: Solenoid with two step motors.

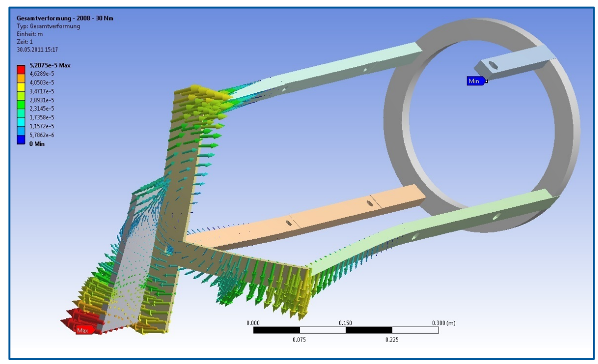

Figure 11: Calculation of mechanical properties.

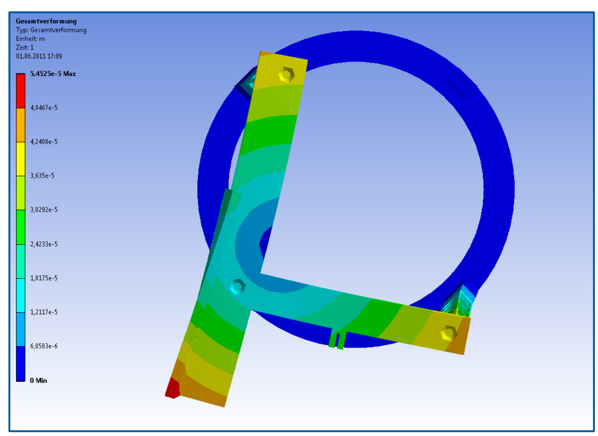

Figure 12: Acceptable deflection.

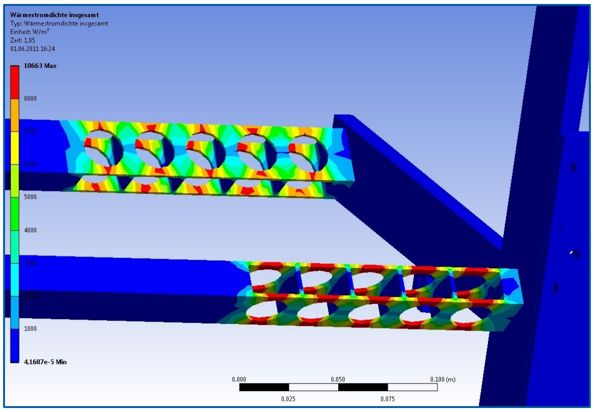

Figure 13: Thermal calculation

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ACKNOWLEDGEMENT

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