TUPA15

PROCESSING OF HEPS LOW ENERGY TRANSPORT LINE COLLIMATOR

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Abstract

In order to protect the equipment such as BPM at low energy transport line (LB), a momentum collimator is designed with one movable absorber. This paper will show the mechanical design and manufacturing of the collimator.

DESIGN OF THE LB MOMENTUM COLLIMATOR

HEPS is an ultra-low emittance synchrotron light source will be constructed in Beijing. Its injector consists of a 500MeV linac with a thermionic' gun, a 500MeV low energy transport line, a full energy booster which ramping the beam energy from 500MeV to 6 GeV and two high energy transport lines [1]. LB is a transport line connecting the linac and the booster [2].

With the distance of 700mm away from the LBQ4, a momentum collimator with one movable absorber is designed to protect the downstream equipment, the layout is shown in figure1.

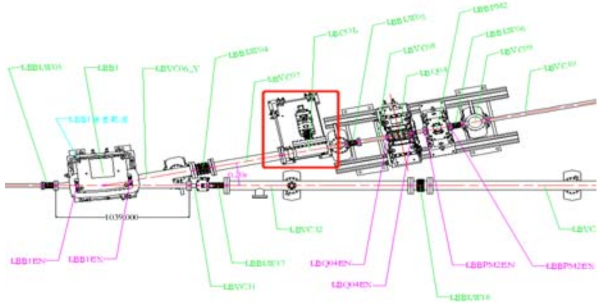

Figure 1: Position of the collimator at LB layout

According to the physical requirements, the absorber should be designed with the material of copper, and the profile is shown in figure 2, the maximum energy deposited on it is 20J. In order to make sure the thermal structure of the absorber, thermal analysis with different power deposition have been done, and the analysis results are shown in figure 3, the maximum temperature on the absorber is 134.5℃ with the load of 20W, and the maximum temperature is 30.5℃ when the load is 1W.

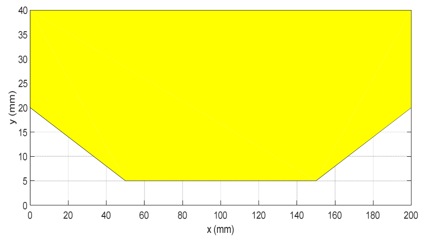

Figure 2: Profile of the absorber

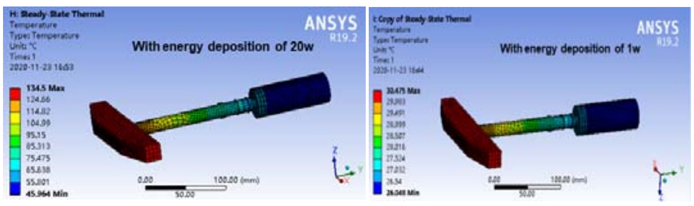

Figure 3: Temperature distribution of absorber component with different energy deposition

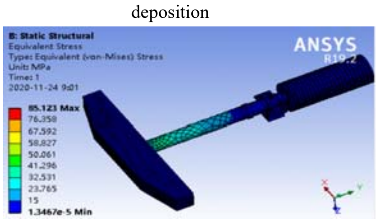

Figure 4: Stress distribution of absorber component with load of 20W

The support structure of the absorber is designed far from the absorber and it is similar to cantilever structure, in order to ensure the straightness of the trajectory while moving, structure analysis of the absorber has been done, the boundary conditions and results are shown in figure 5.

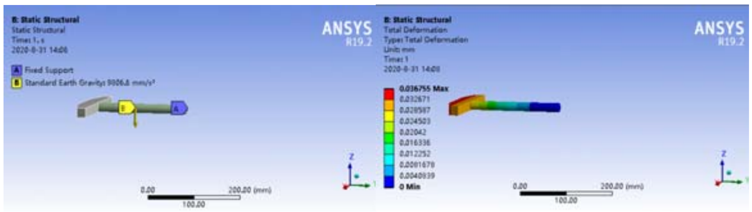

Figure 5: Boundary conditions and stress distribution of the absorber

The vacuum chamber should be designed with the size of 70mmx30mm at the upstream of the absorber, and the size of Φ30mm at the downstream. Structure analysis of the vacuum chamber has been done. Figure 6 shows the stress distribution of the vacuum chamber.

Based on the design and analysis of absorber and vacuum chamber, the structure of the collimator is designed as shown in figure 7.

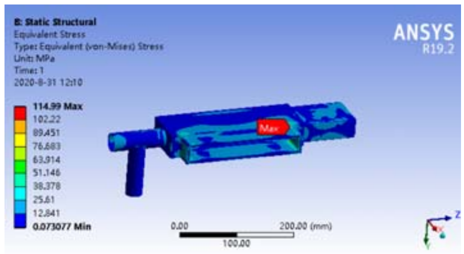

Figure 6: Stress distribution of vacuum chamber

Figure 7: Structure of LB collimator

MANUFACTURE STATUS OF LB COLLIMATOR

Most parts of the collimator have been manufactured, which include vacuum chamber, support, and the absorber component. Straightness of the absorber while moving has been measured, it's within 0.1mm, and the flatness of the absorber has been controlled within 0.05mm. Figure 8 shows some pictures of the collimator while processing.

Figure 8: Processing of the LB collimator

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