

Minutes of the Solenoid Movement

GSI, 30 Oct. 2008, 14:00-19:00

Inti Lehmann

2nd November 2008

5 This meeting was held on 30th Oct. 14:00-19:00 to find the most promising solution on how to move the solenoid magnet as a whole.

Participants

Andrea Bersani, Alexander Efremov, Inti Lehmann, Bernd Lewandowski, Yuri Lobanov, Jost Lühning, Renzo Parodi, Jerzy Smyrski, Edward Lisowski, and Lars Schmitt.

10 Minutes

Jerzy showed at first something relating to a slightly different topic, namely the proposed placement of the chambers between the solenoid and dipole. The idea is to keep them together with the pumping cross. The mounting sequence was debated for some while.

15 Edward showed two possibilities for the movement of the solenoid which were considered in detail at CUT: i.e. a railway solution or low pressure air cushions.

- The railway solution is conceptually similar to a waggon of a train. 4 pairs of two wheels carry the load. The wheel carriage would need a height of 830 mm in total, where each of the 8 wheels could carry a max load 60 t. This would give enough safety margin for the Target Spectrometer of about 300 t total weight. It was pointed out that the perpendicular suspension rods would impede the access to the target dump. Thus a solution should be found where these can be omitted using the strength of the upper frame. The most severe problem for this solution seems to be the fact that the rails need to be placed inside the floor of the hall. (This is due to the height required for the carriage.) The depth of the rails inside the floor is foreseen to be 30-50 mm. Bernd and Lars will ask the people responsible for the construction whether such a solution is viable.
- For the air cushions 2 legs, weighing 12 t each, are foreseen. These would be quite broad and hence leave less space below the magnet. Again the perpendicular suspensions should be omitted. This means that Dubna's door suspensions must be designed to sit on that system. According to Edward this would be moving very slowly. Jost expressed his doubt that this may pose a problem. However, he was concerned that oscillations may occur with these type of cushions. He had some personal experience with such oscillations appearing with low-pressure air cushions. These may become more severe the more cushions are used. The current idea for air cushions is that the magnet would be moved by manpower. Lars pointed out

that one would be very flexible with air cushions, as one could also move along not predefined paths. It remained unclear how a guiding system should look like. Jost pointed out that to his knowledge to date no cushion was build for more 41t. Hence the proposed 6 cushions would be a world first.

40 Jost showed a price comparison for the different solutions. Low-pressure air cushions are slightly more expensive than railway wheels. The preferable high-pressure air cushions are by a factor of 2.5 more expensive. The rollers would be a factor of 10 cheaper. They should probably be considered though it is not clear how to drive them.

45 Yuri showed the redesigned yoke and suspension from Dubna. The cut outs in the yoke have been redesigned to $140 \times 420 \text{ mm}^2$ on each of the 16 corners longitudinally and transversely to the beam direction, respectively. As learnt during the mechanical workshop earlier on the same day this seems to fulfil the requirements. The suspension of the yoke and doors has been redesigned according to a request by Lars in order to allow for sufficient space in the accelerator tunnel. In any case the current planning for the
50 placement of the concrete blocks in the hall inhibits the full opening of the doors by a few cm only. It does not seem obvious why this restriction should not be eased by moving the blocks away from the beam pipe. The proposal foresees 7930 mm total width of the system, which would leave more than 80 cm to the side of the solid wall. On the other side there would be a bit less space. This is a minimum requirement in order to guarantee
55 the mechanical stability of the system when the doors are fully open. Furthermore the yoke suspension would also suffer if the beams would have to be shortened further. Bernd sees no problem with the proposed dimensions though this is slightly larger than what was suggested by Lars.

It was agreed that only one viable solution should be shown in the TDR. During the
60 discussion the railway system was clearly favoured and it was decided that we would envisage to show this system in the TDR, provided it seems feasible from the builder's perspective. It became clear that the best way for the design is to treat the suspension of the yoke and the carriage together, as it seems difficult to estimate the consequences of the different proposals to the design of the solenoid mounting frame and the door suspension
65 and their overall stability. The Dubna and CUT groups have exchanged their designs or will do that in the next days. Then both groups will work out a common design for the railway option. It would be greatly appreciated if 3D FEM calculations could be done for the whole system.

In any movement scenario a separate alignment procedure will be required to position
70 the solenoid precisely. Bernd anticipates that a precision of 0.5–1 mm may be required. A combination of hydraulic jacks and blocks may be used. Jost suggested to use mechanical jacks which could stay in place.