

Magnet status

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Bid history

- First bid went desert since firms wanted a pre-payment to order the the magnetic material
- Second bid with «acceptable conditions» sent to three firms
- Only one responded: sigma-phi
- Conditions in the bid:
 - Magnet intensity in the magnet centers
 - Integral of the field, diameter of the central hole
 - Clearence between the magnets (where IT will be placed)
 - No request on the magnet material



First project

• Material: Samarium-Cobalt permanent magnet



(325) Magnetic field By along ZAxis 1.6 1.4 1.2 1 - distance=50 By (T) 0.8 distance=55 0.6 - distance=60 distance=65 0.4 0.2 0 -400 -200 200 400 600 -600 0 Z axis (50±0.1)

Magnet M1





- Front faces not flat up to +5mm per face
- Up to 4 kN repulsion internal forces
- Several magnet elements broke during assembly
- Magnet fragments between the two disks of magnet material
- Disassembly and reassembly option not workable (brittle elements)
- Looks on the edge to explode



- «most of the elements fragmented in the insertion procedure»
- «Curvature of the front faces even worse»

• We never accepted this situation

End of April 2022

- The firm decided **to restart the entire project from scratch**, changing the magnet material
- Niombium-Iron-Cobalt
- No additional cost for us, just delays
- They started the design from the magnet and later the mechanical part. We asked for FEA to be performed before production
- We (Eleuterio, Sandro, Andrea, Vincenzo, myself) have now weekly meetings with Sigm-Phi. Asked Lucia Sabbatini (magnet expert at LNF) to be present to our meeting.



Thanks, Lucia!

New magnet design





Model Opera



Field at the magnet centers (T)



dB/B Transverse homogeneity

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So far, so good ...

Last problem (end of may)

- M1: 24 magnets; M2: 36 magnets, each with a max dimension of 10 cm and specific field orientation
- How are they produced?
- When staring from powder, they are first shaped in the desired form, compressed in a (weak) magnetic field and then heated up to a key temperature inside a stronger magnetic field to align all ferromagnetic domains. A cold thermal cycle is usually applyed at the end.

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- Sigma-phi providers cannot work individual pieces larger than 6 cm
- They are looking for a solution ...

Conclusions

- The firm underestimated the difficulties at the beginning
- They are willing to resolve all the problems
- Now there is a clear plan to follow all the steps in the production
- No one has a clear time plan (too many uncertainties)
- Hope for a delivery in autumn (3 working monthes, but large uncertainties)
- We foresee a visit at Sigma-phi during assembly
- After delivery, add 1-2 monthes for magnet characterization at LNF
- Executive summary: in 2022 we'll probably not have a magnet to use!