Investigation of the 3DST + KLOE spectrometer configuration

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on behalf of the 3DST working group

DUNE ND Design Group general meeting

24th of July 2019

Introduction

- In 3DST-Spectrometer the detailed designs of ECAL and magnet were lacking

    - ✦ While we had considered KLOE option much earlier, after LBNC meeting we started investigating the option of 3DST+KLOE in earnest

- The 3DST+Tracker model was modified in order to fit the inner volume of the KLOE Magnet+ECAL, trying to keep the same active mass as the original configuration

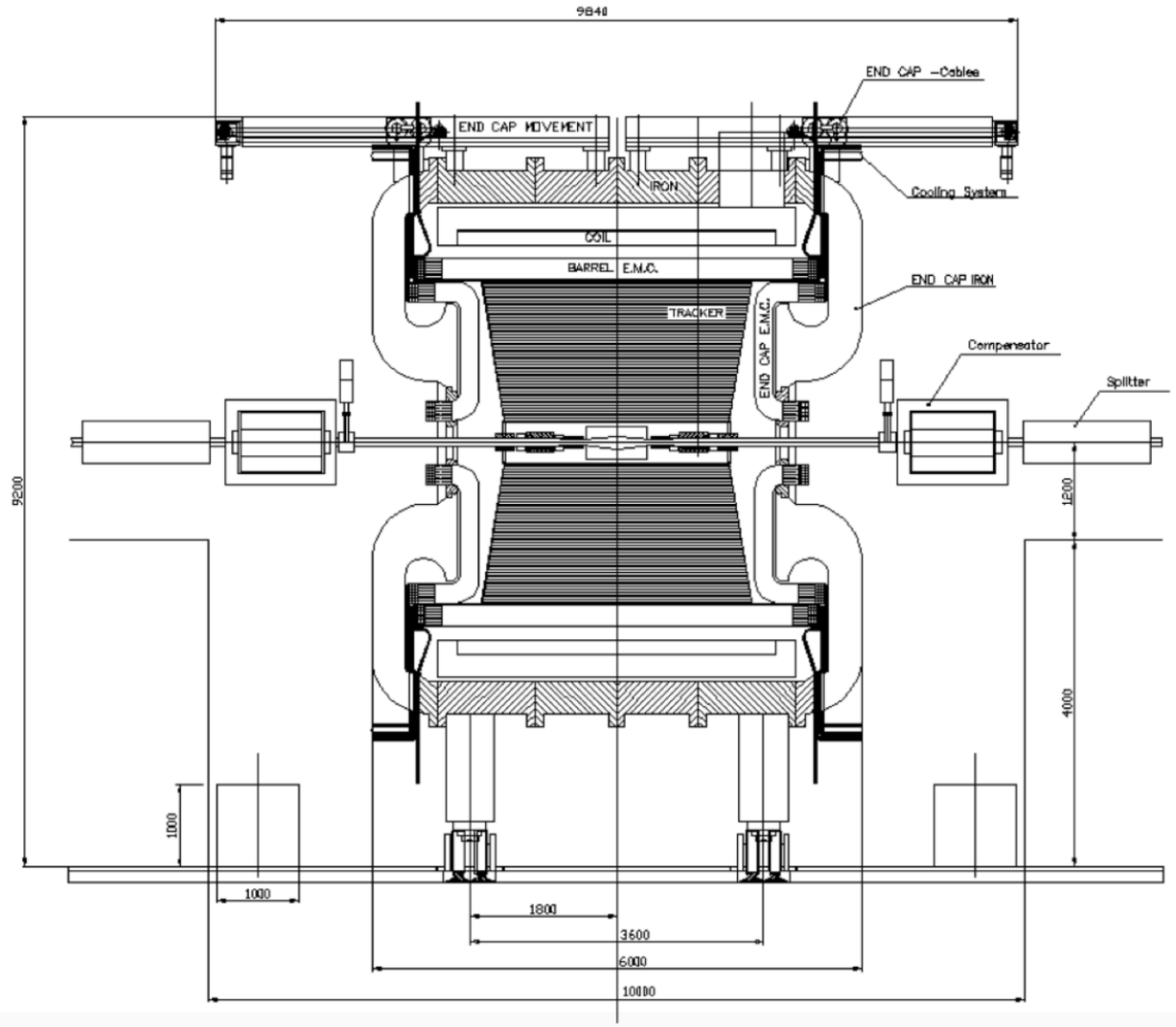
- An initial informal meeting between the KLOE and 3DST representatives was held on July the 17th via video

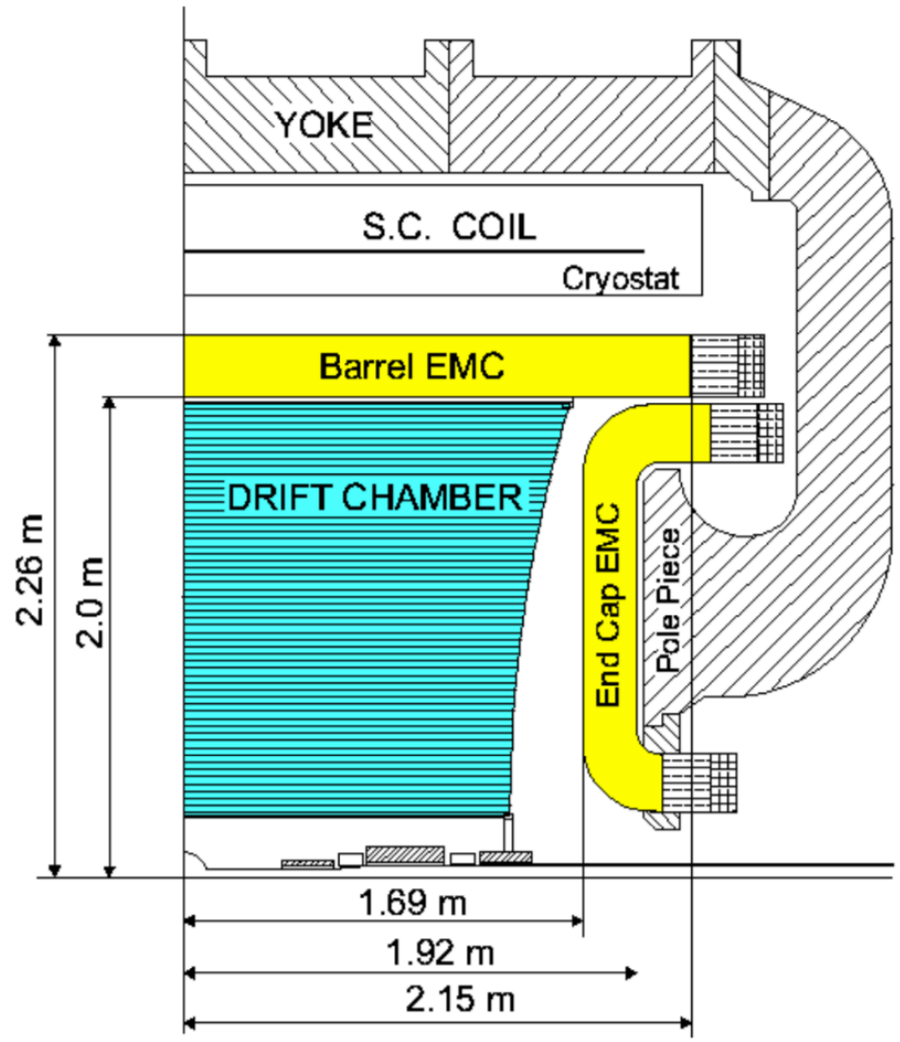
- In the meeting the above study has been shared and discussed

- We agreed to report on the content of the meeting to the NDDG

The KLOE geometry

- We extracted the informations about the KLOE detector from:
  - ✦ https://indico.fnal.gov/event/15025/contribution/0/material/slides/0.pdf
  - ✦ Nuclear Instruments and Methods in Physics Research A 419 (1998) 320–325
- KLOE parameters: B-field ~ 0.6 T in the center, ~15 X_0 ECAL

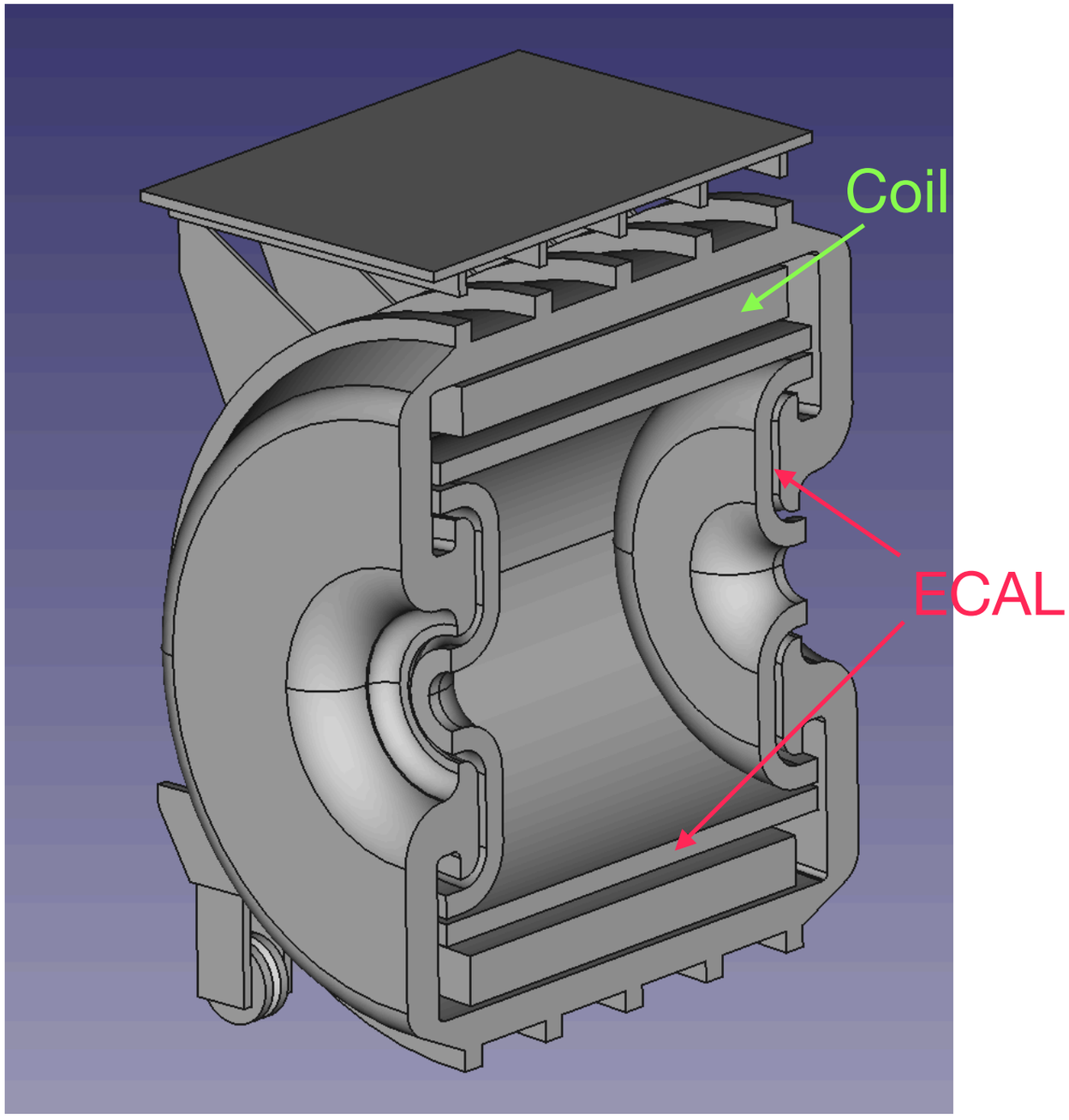


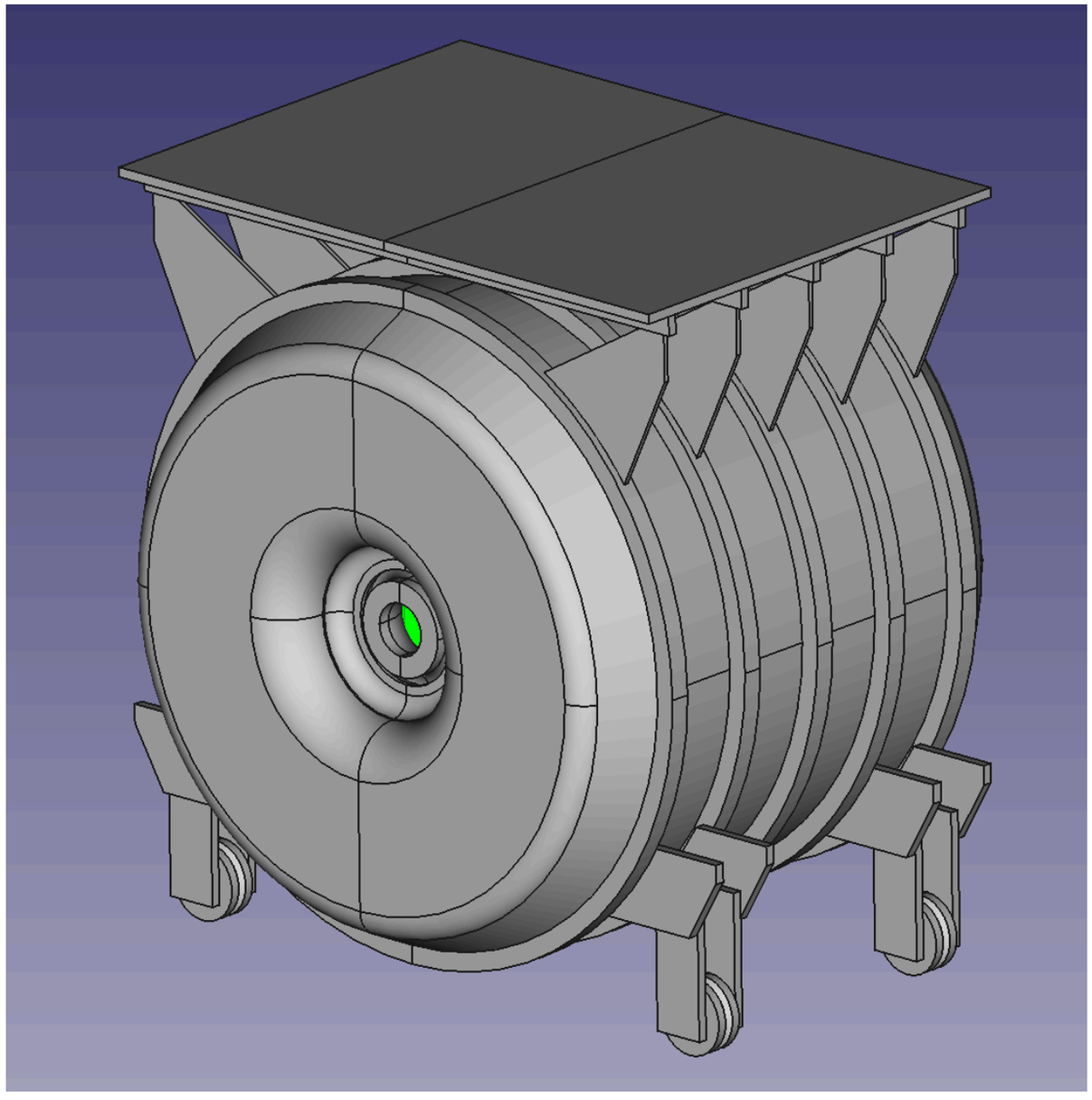


- Bob Flight (engineer at U. Rochester) took these drawings and extracted all the necessary informations (digitized the dimensions where needed)

The KLOE model

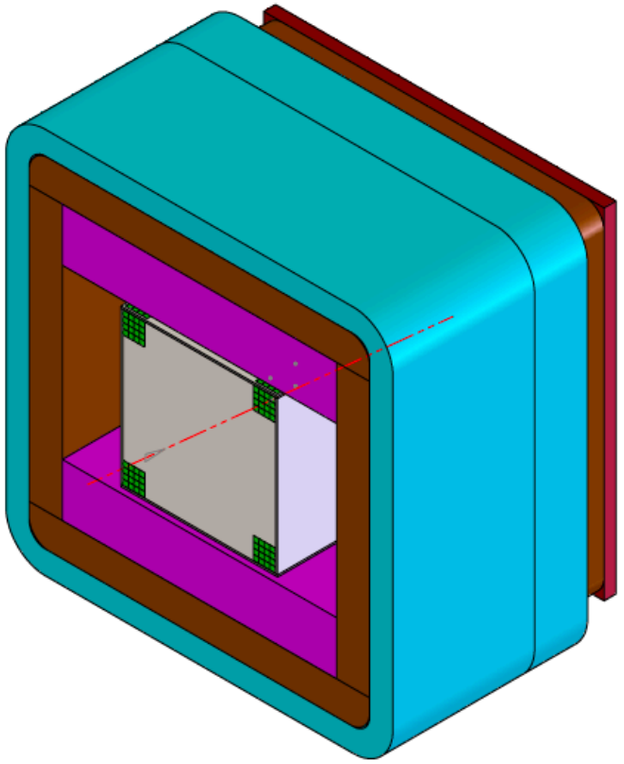
By Bob Flight

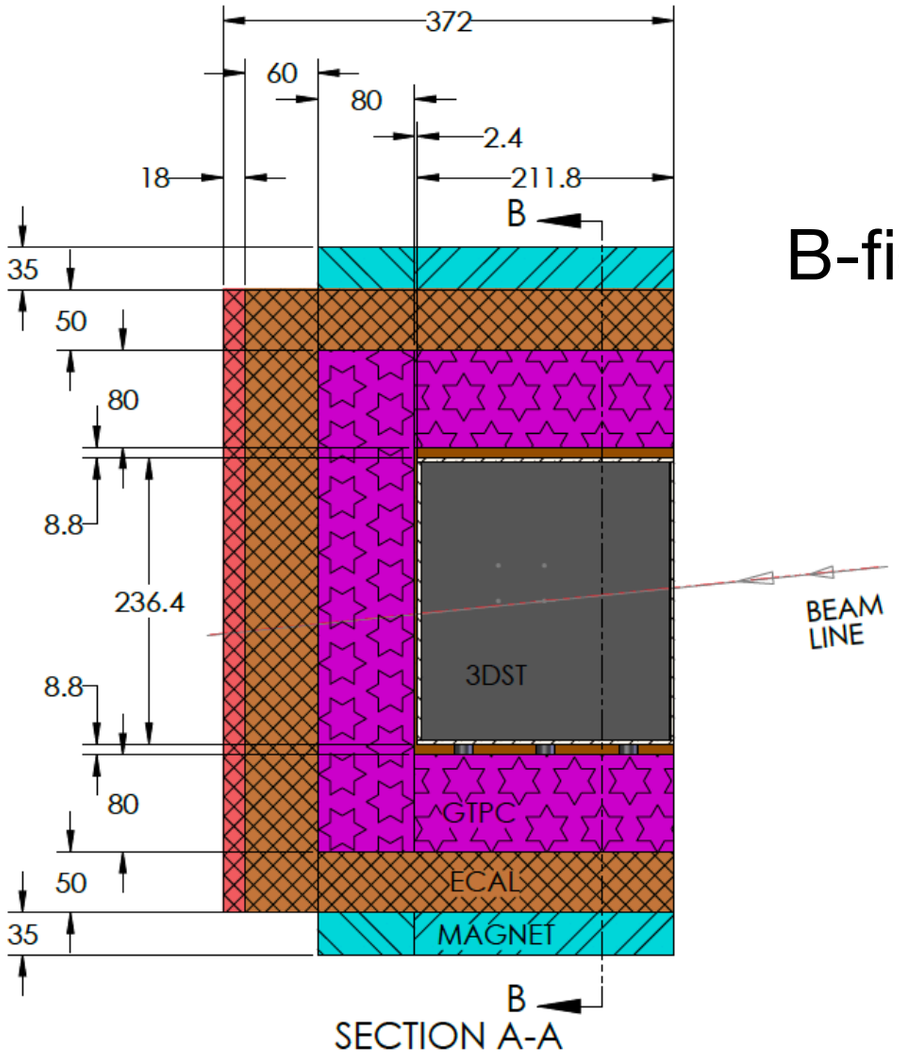




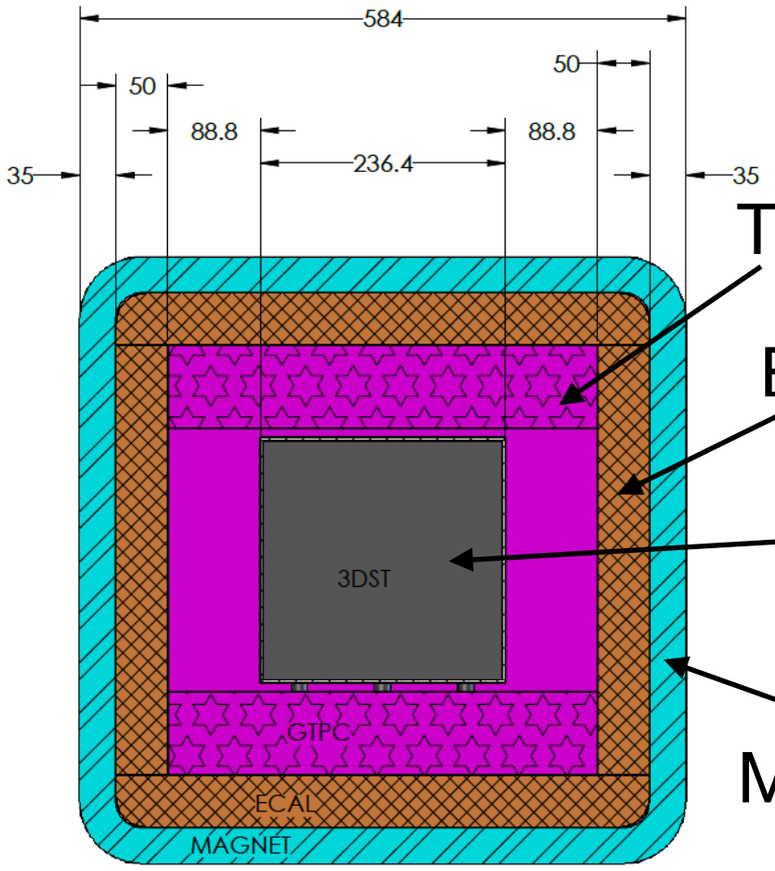
- Estimated the available space in the ECAL inner volume
- Update the dimensions of 3DST + Tracker to keep the same mass as in the original configuration and at the same time to fit the available space

The original 3DST-Spectrometer conceptual design



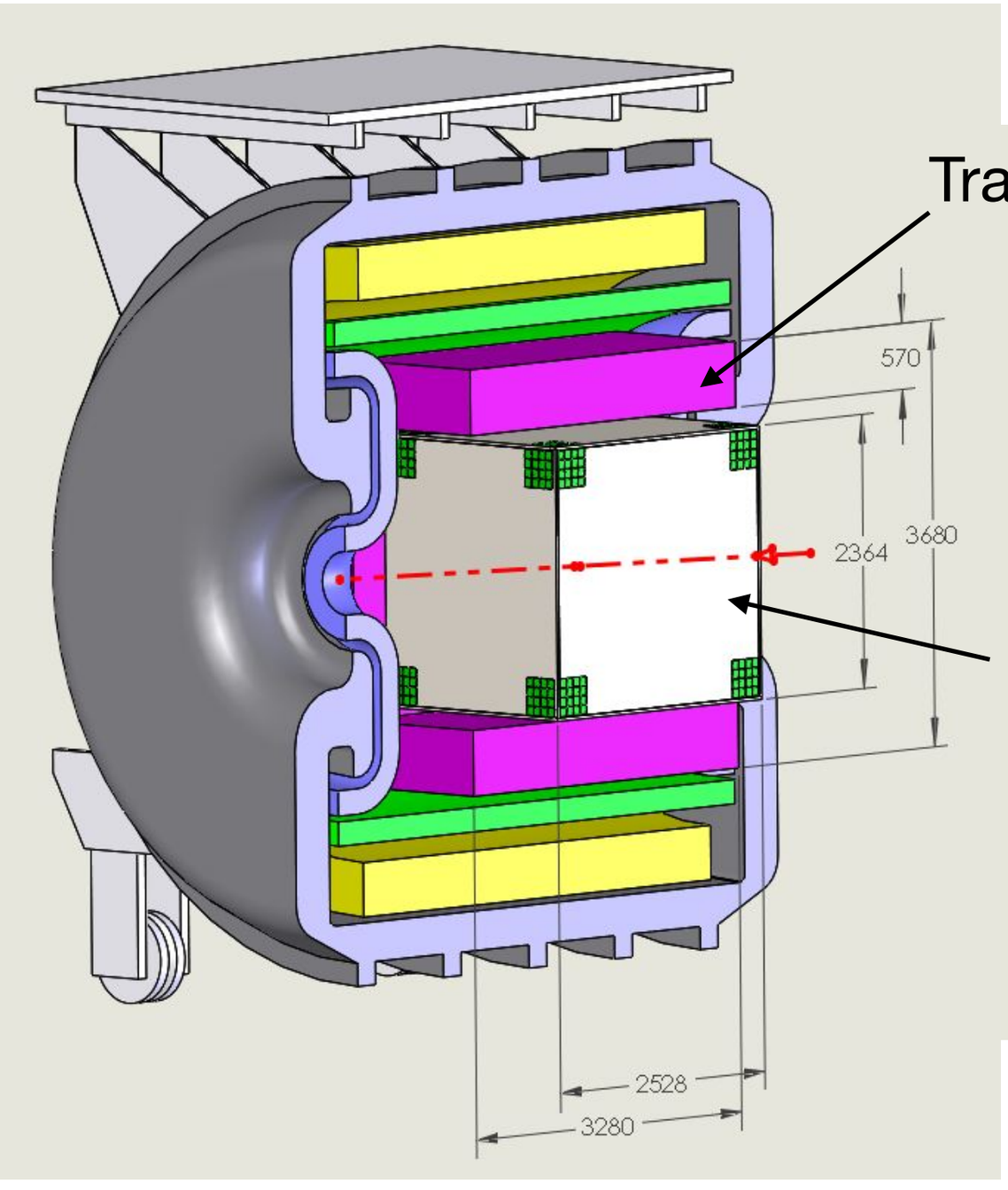


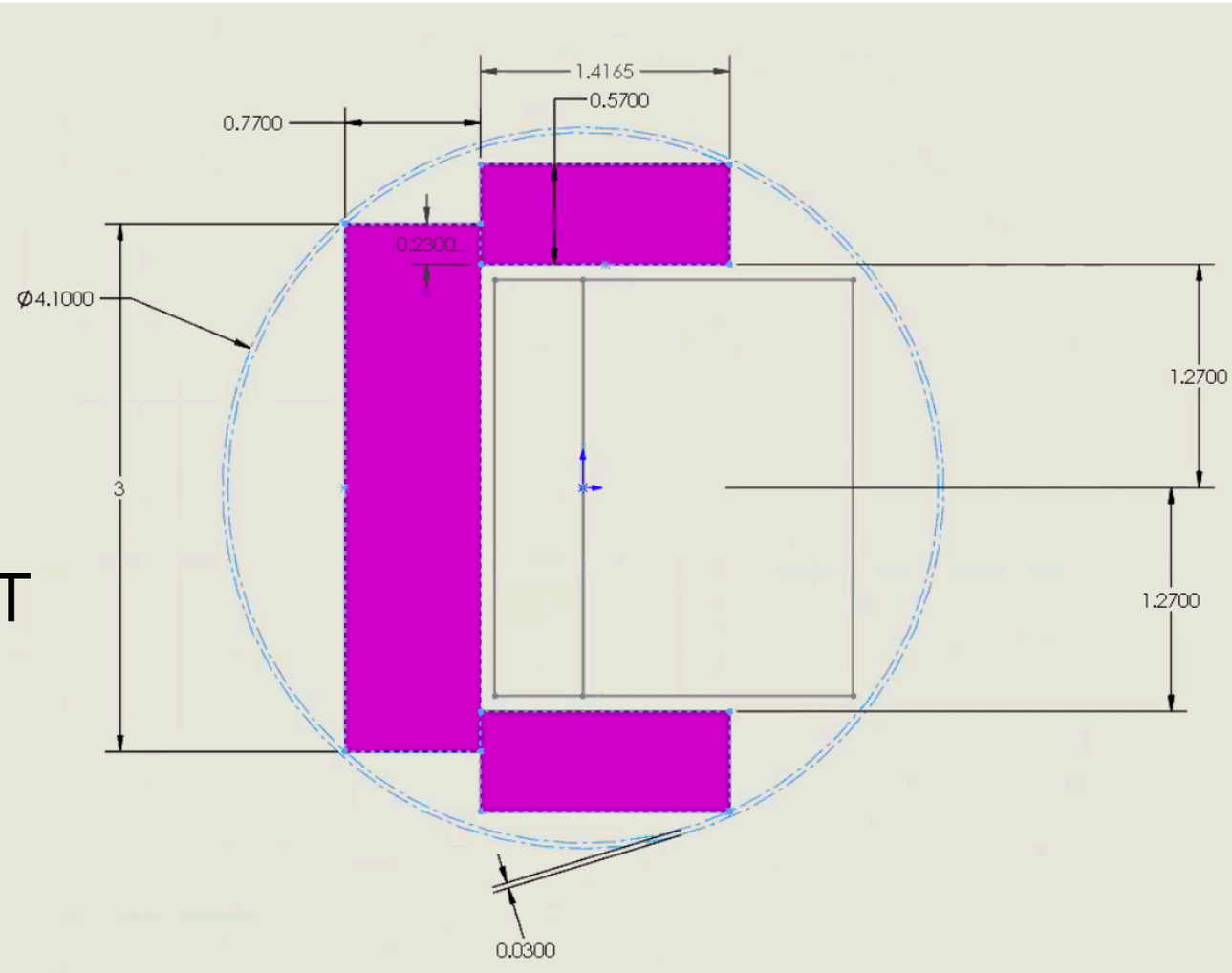
B-field = 0.6 T



- The initial configuration size was 2.4x2.4x2 m^3
- The dimensions were updated when moving from a concept to a more detailed design, that includes the mechanical box, the light readout system, the segmentation due to the channel readout (e.g. SiPM-PCBs with 8x8 channels)
- The 3DST active volume is then 2.24x2.24x2 m^3

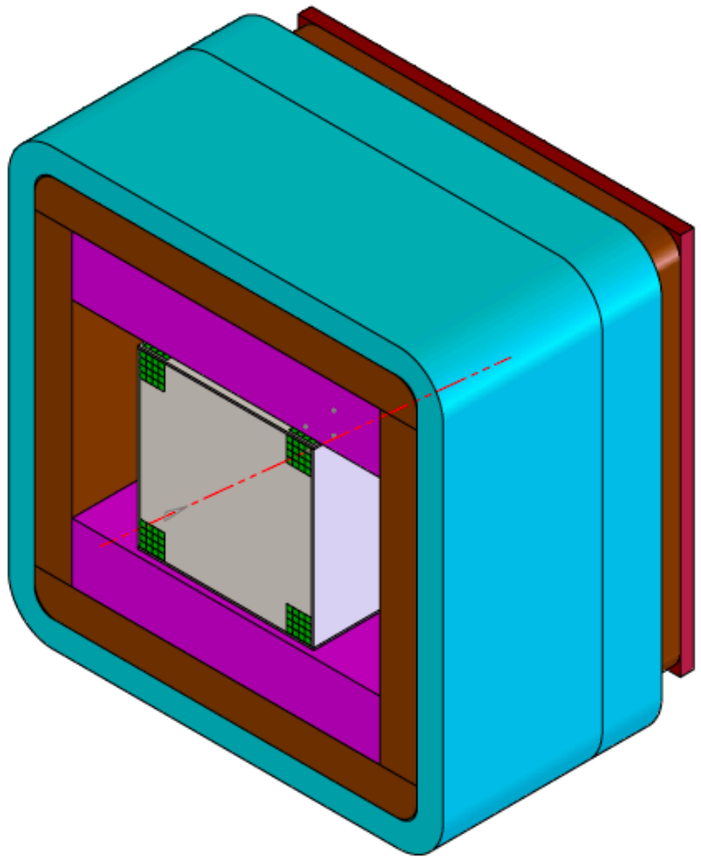
3DST inside KLOE

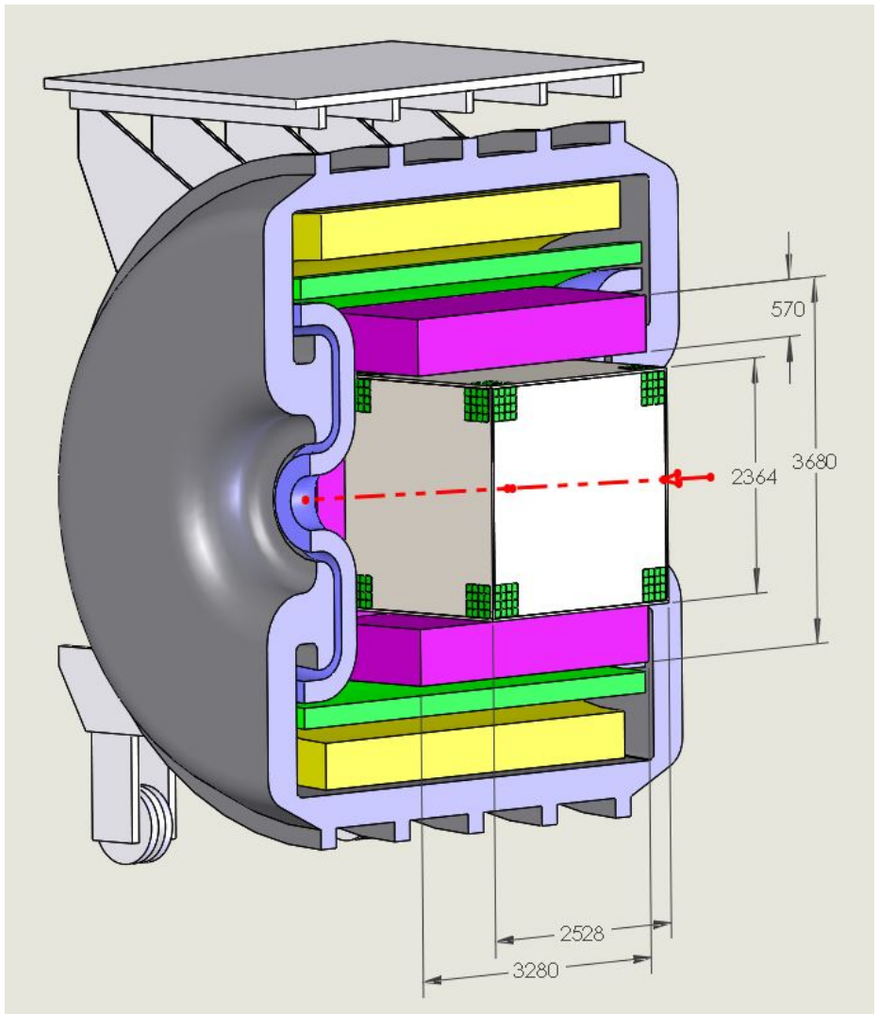




- Some spare KLOE Barrel-ECAL modules would be available to cover the “beam-pipe” holes in the ECAL
- More space along X direction could be available and 3DST could be made wider, in case more active mass is necessary, in particular for beam monitoring

Comparison with the original 3DST configuration



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Original active volume: 2.24x2.24x2 m³
  10,637,312 tons (1x1x1 cm³ per cube, 1.06 g/cm³)
Active volume of 3DST inside KLOE: 2.24x2.4x1.92 m³
  10,941,235 tons (1x1x1 cm³ per cube, 1.06 g/cm³)
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It seems possible to integrate 3DST inside KLOE while keeping the same active mass. Our initial thoughts are that KLOE+3DST combination should provide us approximately performances similar to the original 3DST-S configuration

Outcome of the informal meeting

- We agreed that the time is limited for the preparation of the CDR and TDR and that we need to perform detailed studies of the 3DST+KLOE configuration

  - ✦ Now we are organizing the joint efforts of 3DST and KLOE WGs to move forward with the simulation studies

- Representatives of the 3DST working group will visit the KLOE detector in Frascati next month

- Overall, it was a very positive meeting with a fruitful discussion