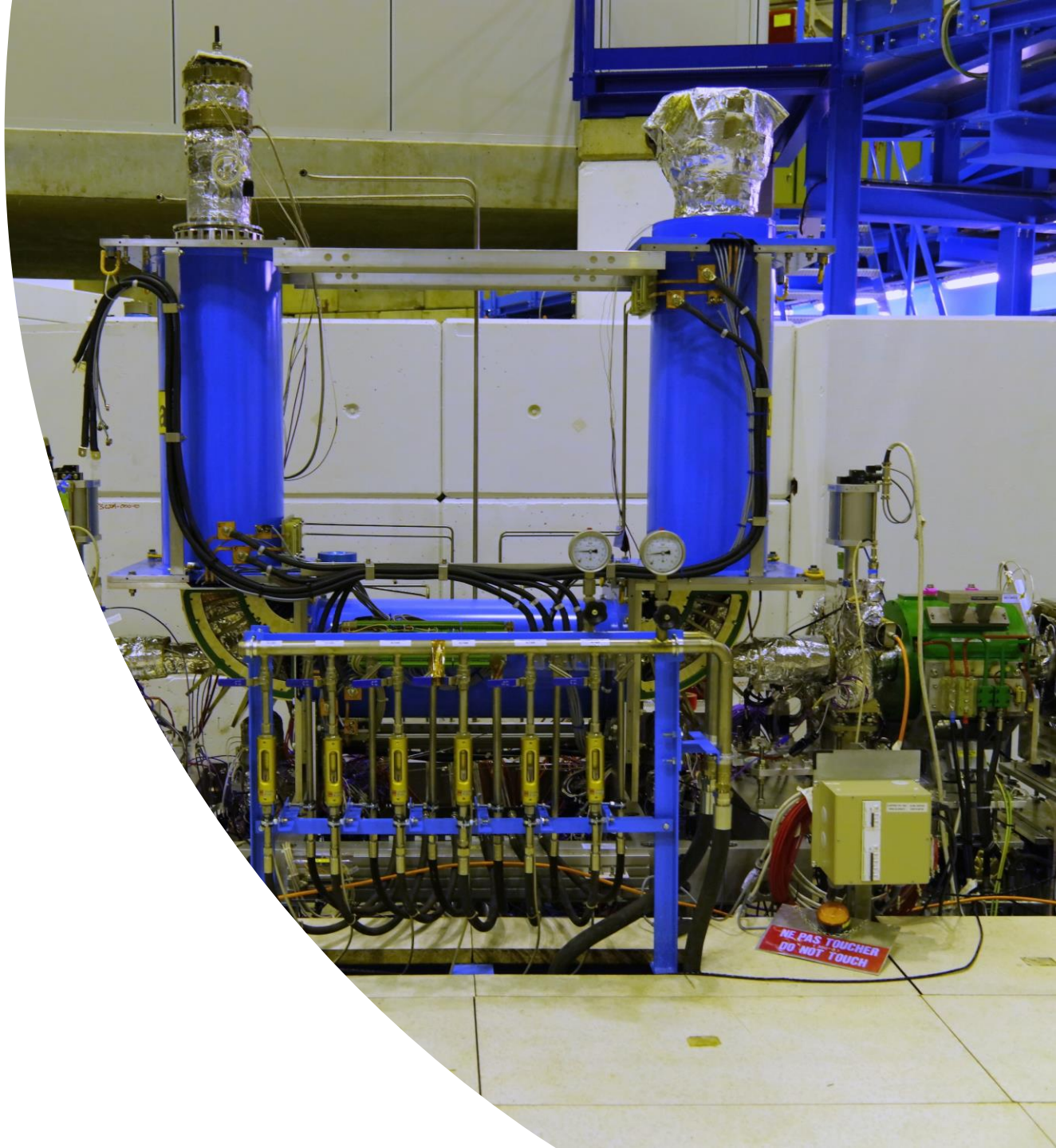
ELENA electron cooler status



Magnetic Measurements

Measure each (4) standard solenoid to determine how to place the solenoids during assembly ($B_t/B_{||} \leq 5x10^{-3}$).

Measure the remaining magnetic circuits (42).

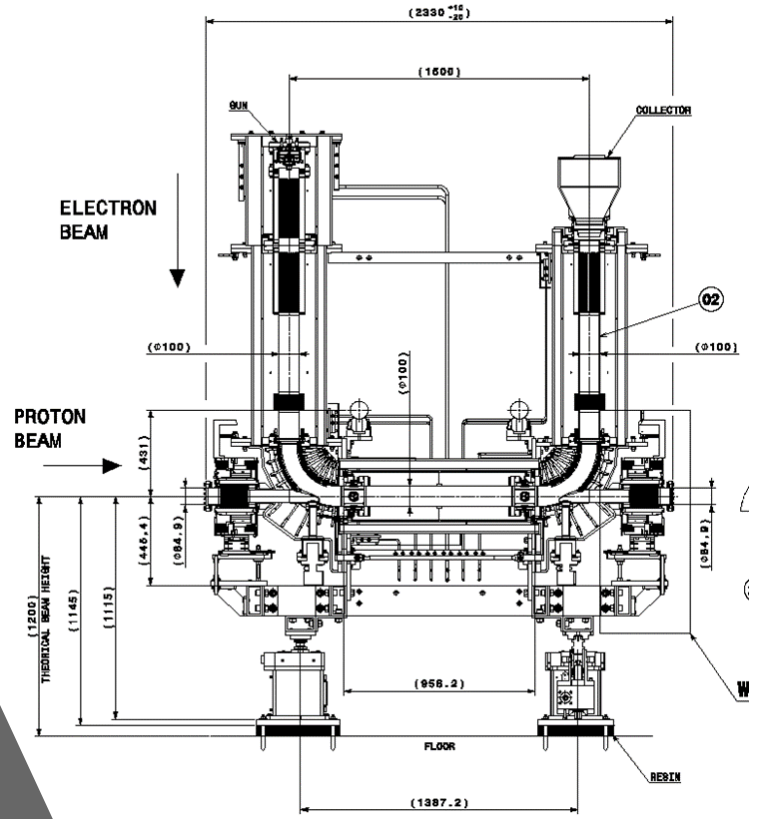
- expansion solenoid, toroids, saddle coils, circular coils, fine-tune coils, Helmholtz coils.

Check the magnetic field model.

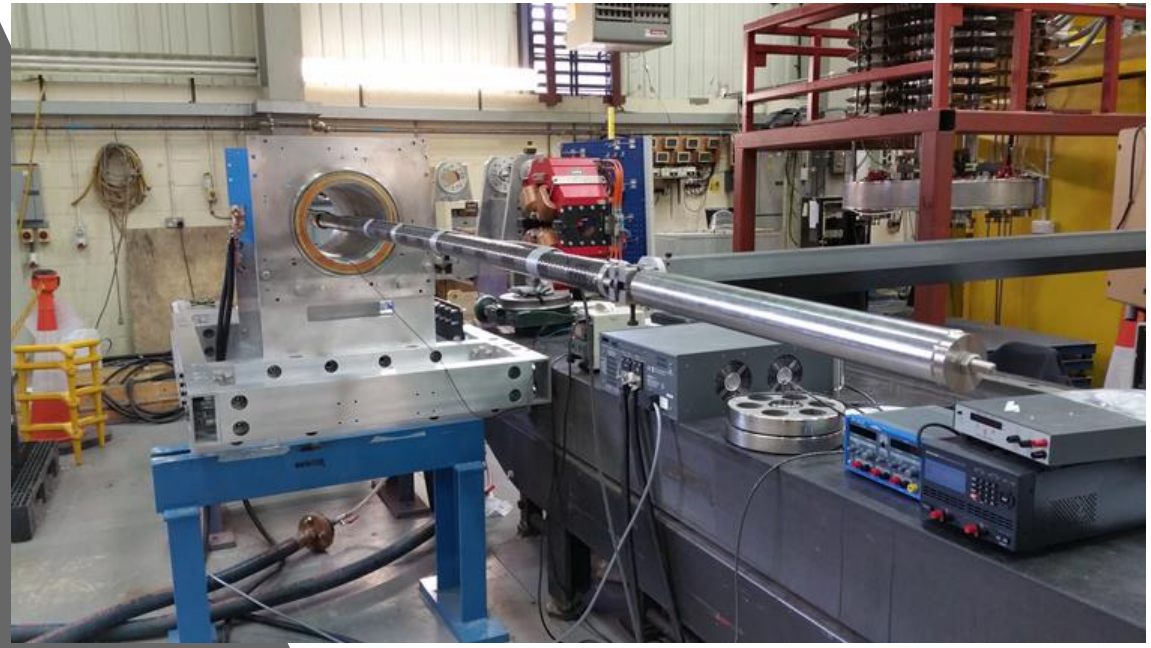
- effect of saddle coils, circular coils, fine-tune coils on the transverse field components.

Field map of the electron cooler assembly.

- $B_t/B_{||} \leq 5x10^{-4}$ in the centre of the drift solenoid.

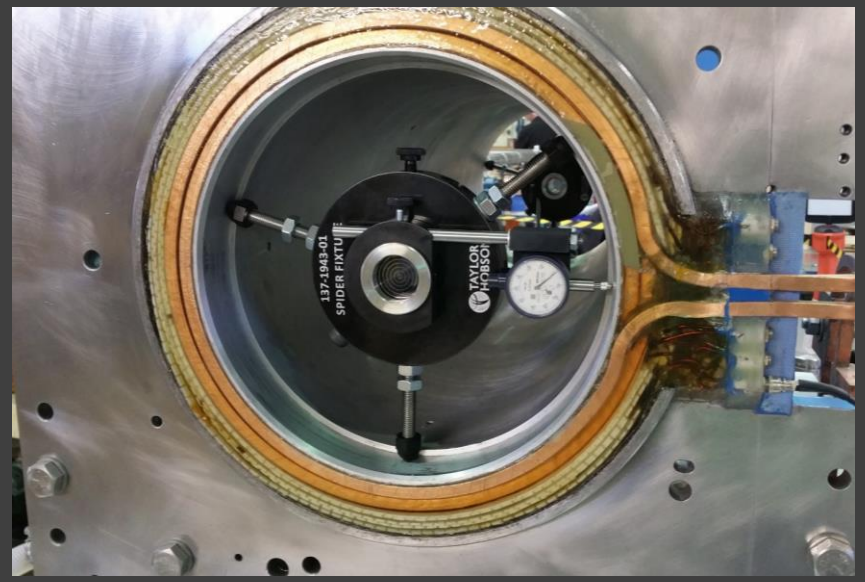


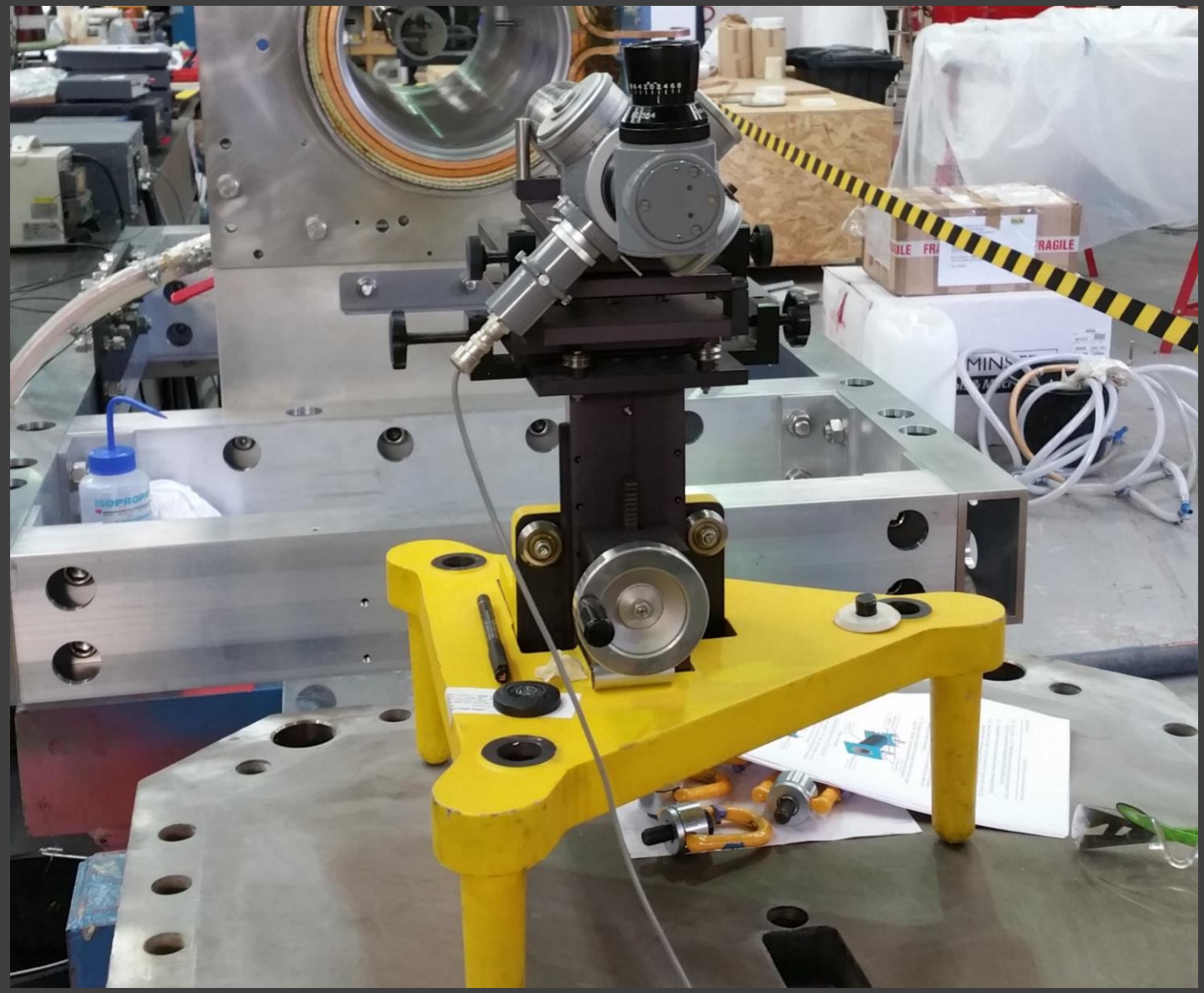
Measurement Setup



- Lakeshore Model 460 Gaussmeter with 3-axis HSE probe (1 mG resolution in range up to 300 G, accuracy of ±0.1%).
- Probe holder with mirror for precise alignment. Has 4 possible rotational positions with 3 mounting points (0, 10 and 25 mm).
- Counter balanced carbon fibre tube to hold probe holder.
- Probe carrier and tube driven and positioned with a CMM arm with ±0.5 mm accuracy.
- Precise probe alignment made with an autocollimator and spider fixtures.


tesla


TAYLOR HOBSON


ISOPROP
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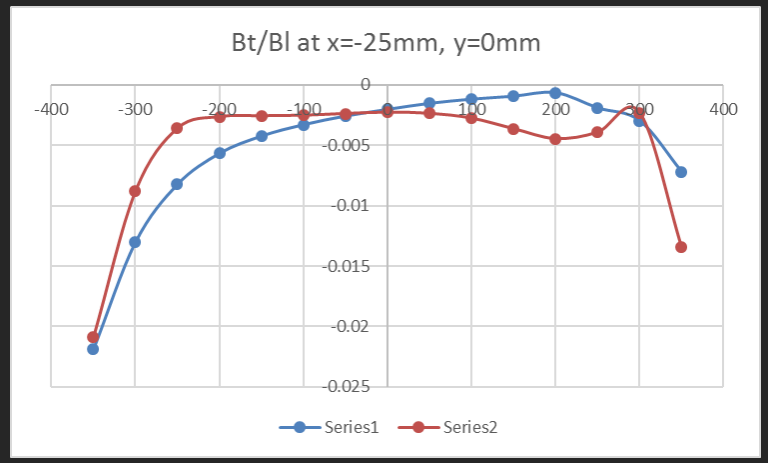
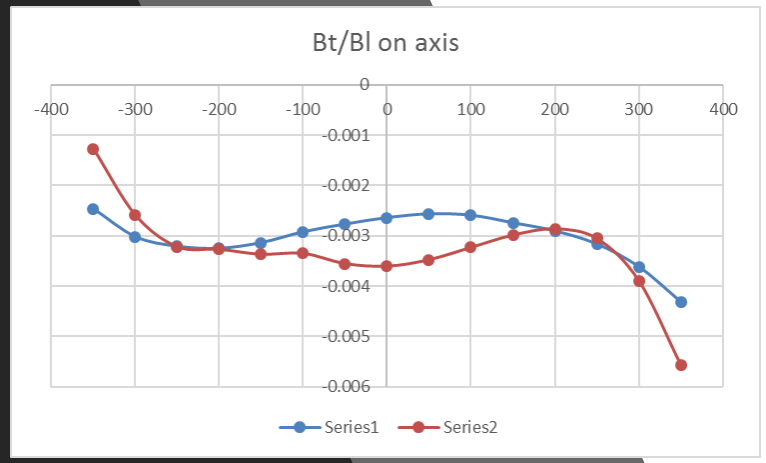
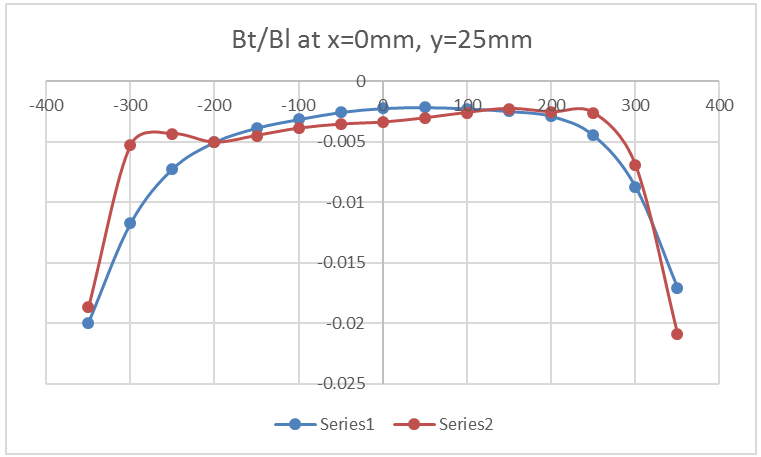






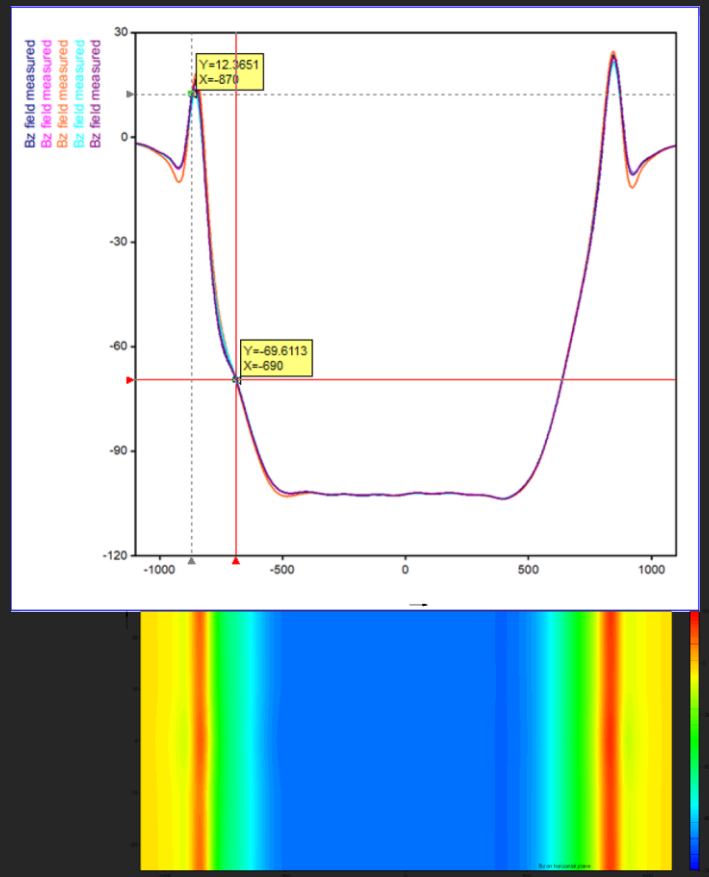
Influence of circular coils on the transverse field of SS#2 (Blue trace without shim, red trace with shim)

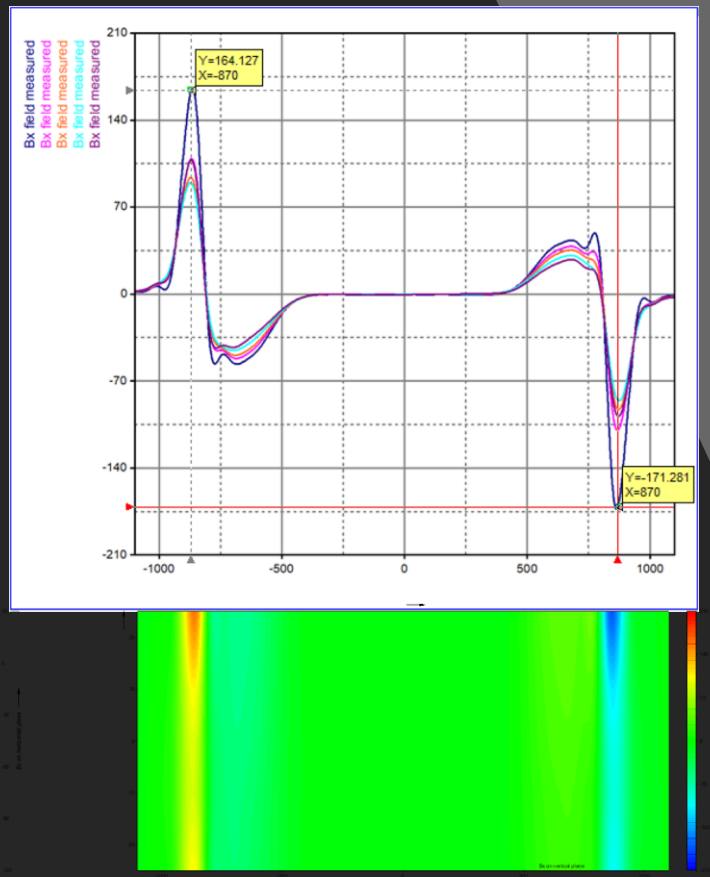
To obtain the required accuracy in the measurement particular attention needs to be paid to:

- Alignment of Hall probe to the mirror
- Systematic errors of the measurement system
  - Transverse Hall effect
  - Hall plate misalignment
    - Determine angles between magnetic field and Hall plates through probe characterisation in dipole and solenoid fields.

Field components calculated using the method outlined by A. Wolf in CERN EP INT 84-01

Full Assembly Measurement





Bz vs. horizontal position

Bx vs. vertical position

Conclusions

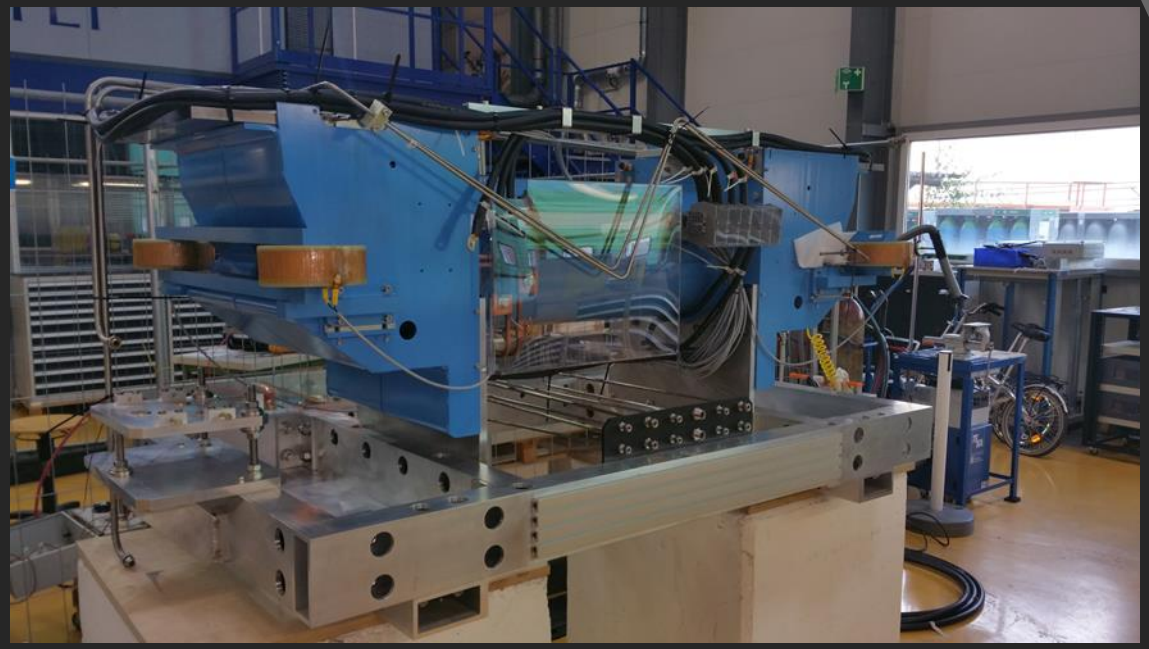
- Probe alignment is very delicate.
  - Probe orientation measured at each point making the measurement sequence very long.
  - Vertical oscillation of the long carbon fibre tube takes a long time to damp.
- Correction of the vertical field component in the full assembly is problematic due to a random offset in the measurement (not present during the measurement of the individual solenoids).
  - The correction algorithm gives too large currents in the fine-tune coils.
- Anomalous behaviour of By and Bz in the vicinity of the toroid shielding and compact corrector magnet.
  - Incorrect model?
  - Shielding touching the yoke?

- All magnetic elements have been individually measured on and off axis. Data available in EXCEL file.
- The effect of the correction coils on the B field is measured.
- Standard solenoid 2 chosen as the “drift” solenoid.
- Anomalous field behaviour needs to be investigated.
- New correction algorithm will be used.
  - Helmholtz coils correct the offset.
  - Fine-tune coils reduce the spread of the transverse field components.

Magnetic system was delivered mid-August

September to October – conformity tests with TE/MSC

Certification ok except for the three spare toroid coils



All vacuum elements produced in-house

Difficulties with the NEG coating of the vacuum chambers in particular the two toroid chambers

Delivery of the last vacuum element (toroid chamber #2) in November 2017

Drift chamber with pick-ups

Vertical chambers (top with gun and NEG chamber)

Electron beam collector

Toroid chamber during acceptance tests

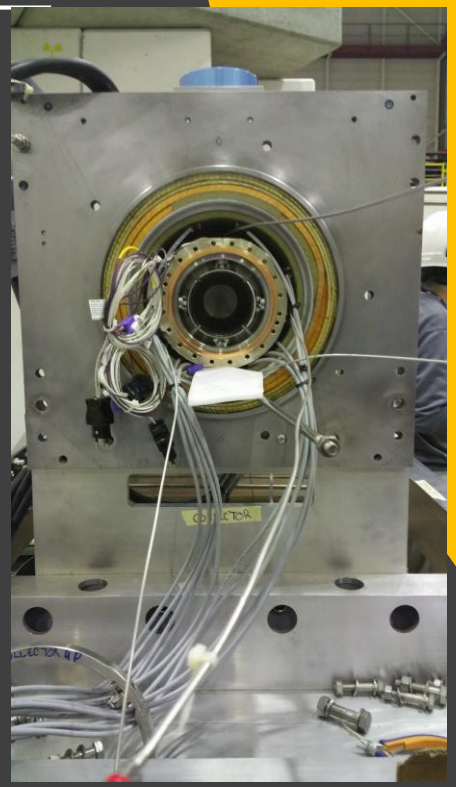
Mechanics

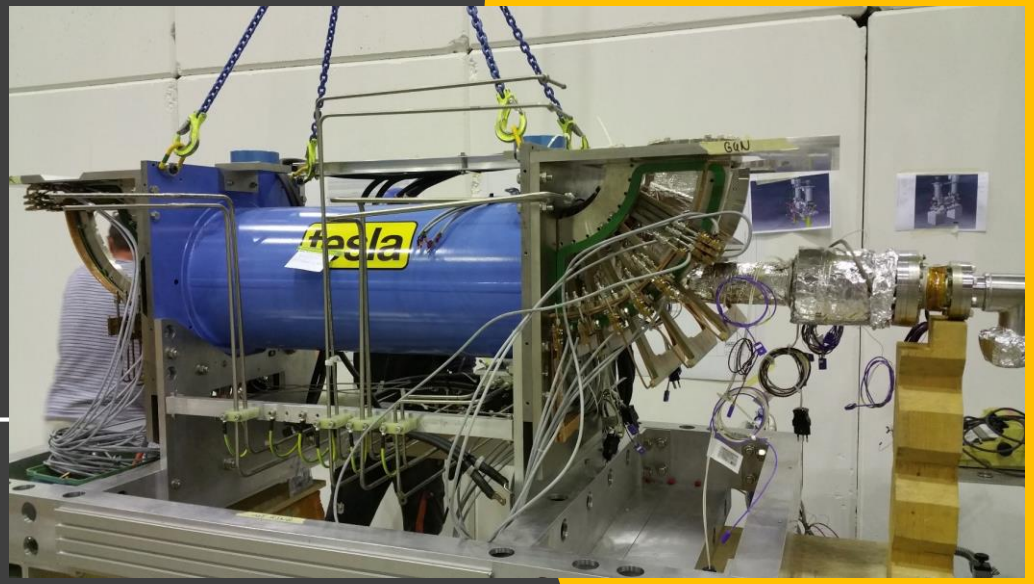
The electron cooler was mounted in the AD hall during November

Connected to ELENA beginning December

Bake-out has just finished …..

There is a leak! Vacuum level reached after bakeout: 2E-9 mbar!!!

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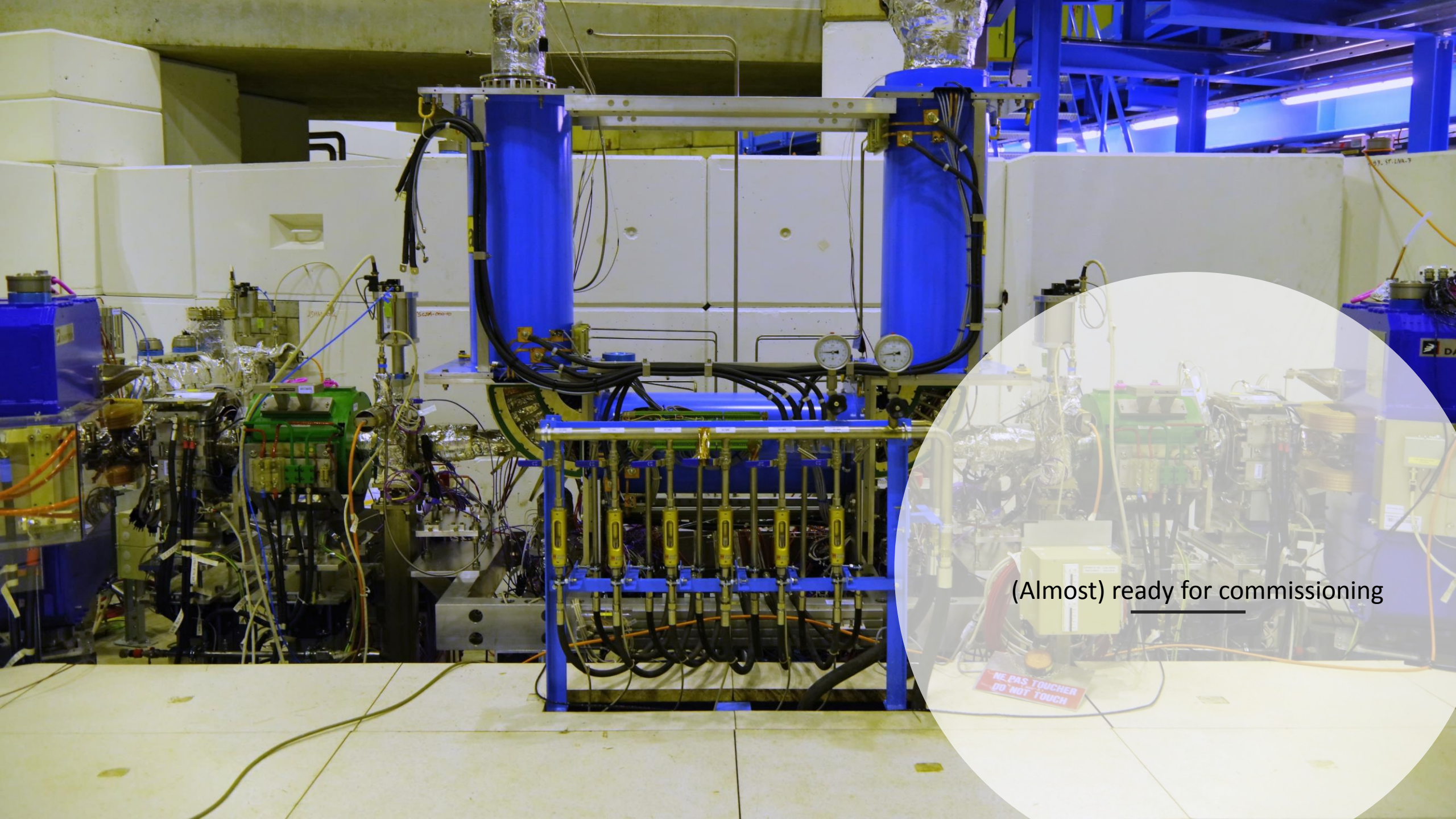

(Almost) ready for commissioning