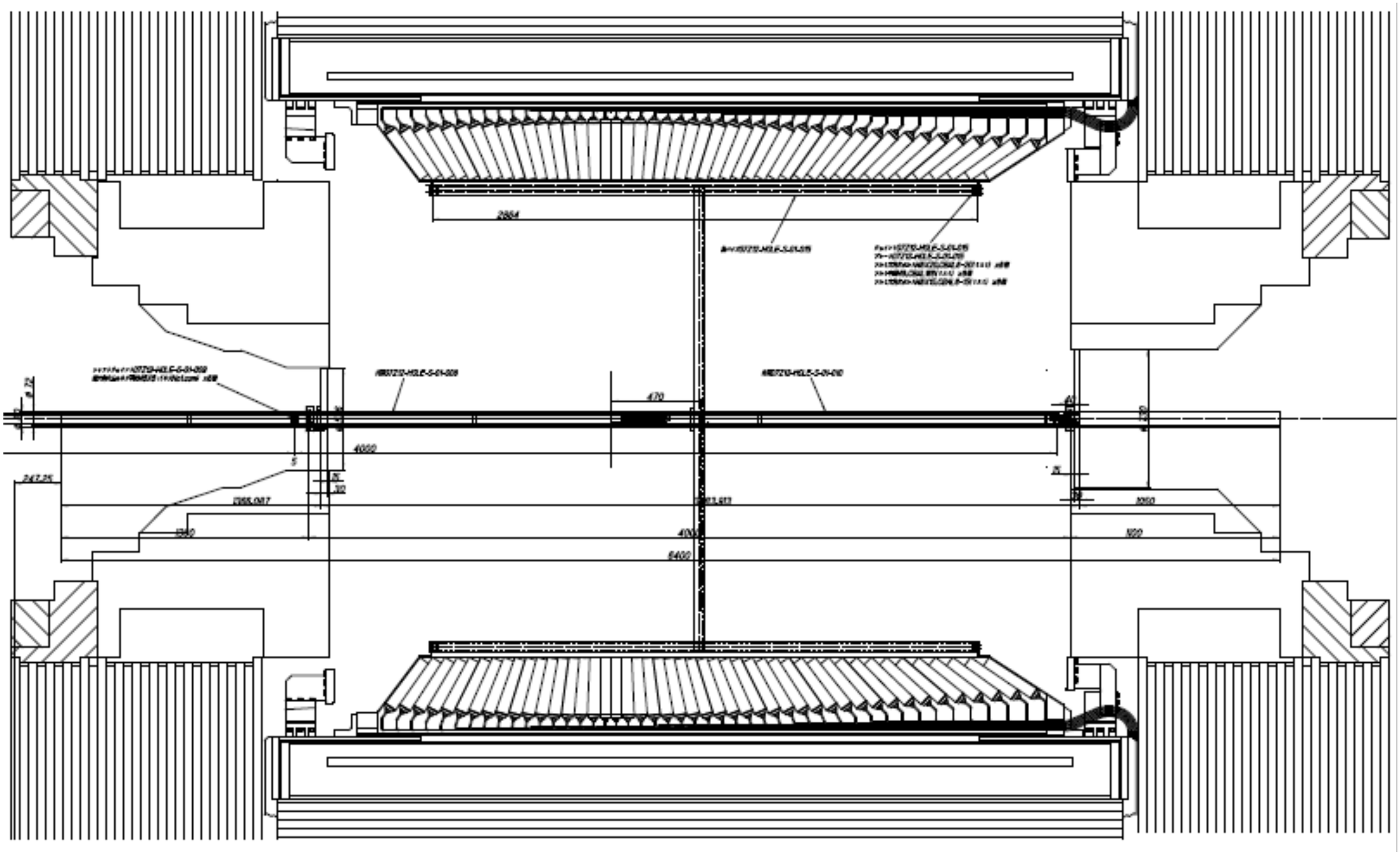
Field measurement of Belle II

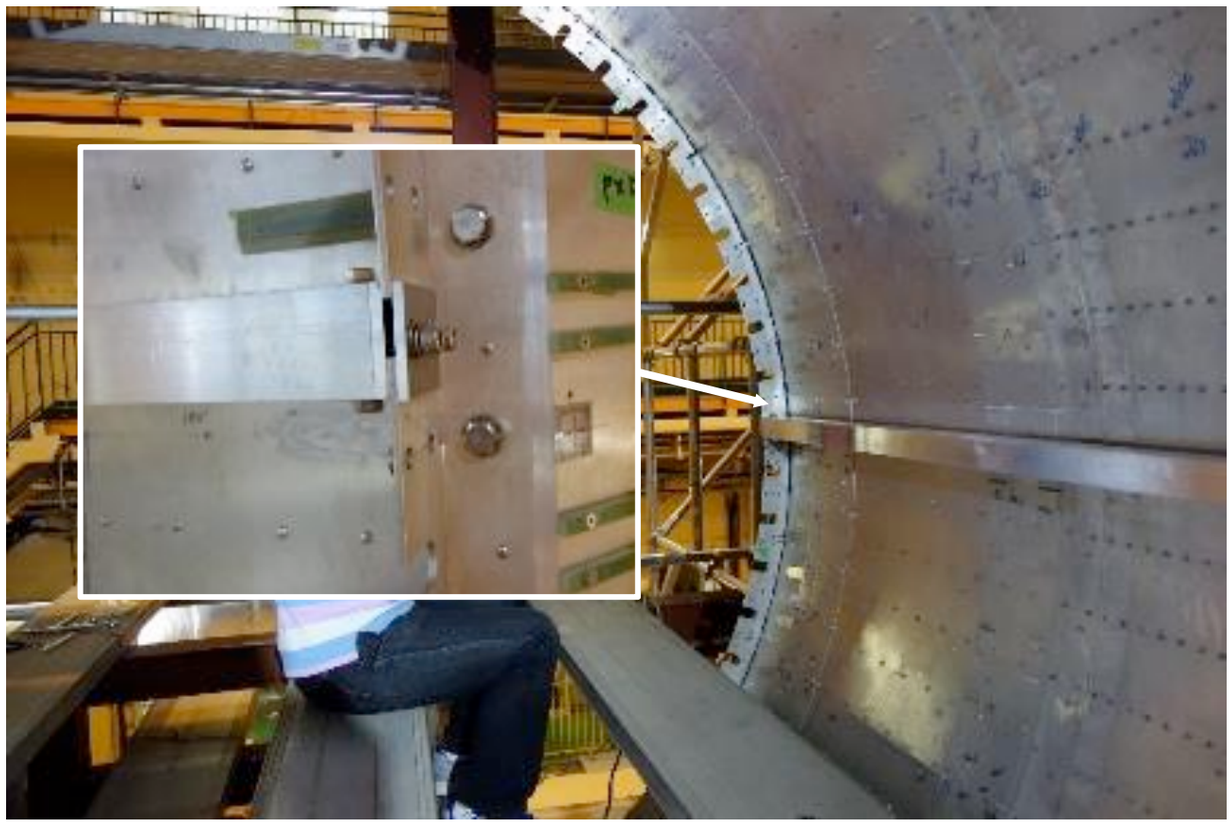
- Targets
  - Improving the analysis model by comparing with the measurement result
  - Getting the relation between the solenoid field strength and the magnet current
- Measuring point
  - The center axis (±3m) of Belle II : Bx, By, Bz
- Probes
  - NMR and 3-axis hall probe

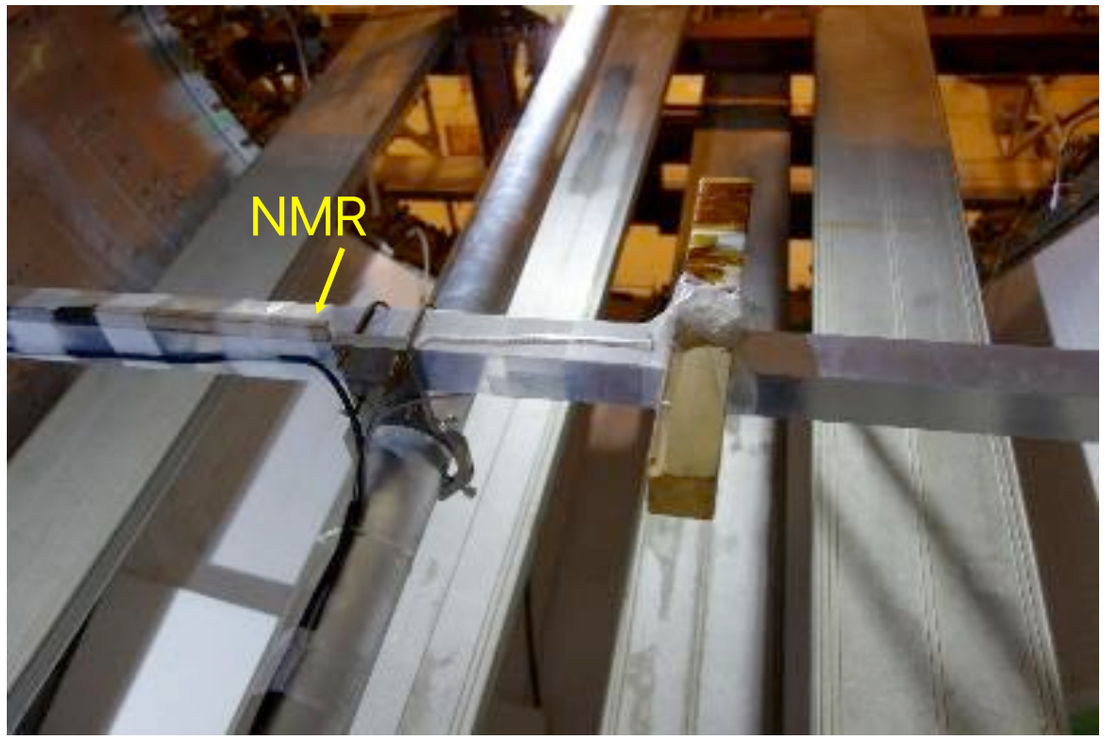
QCS group
Xudong Wang

Set-up of the measurement



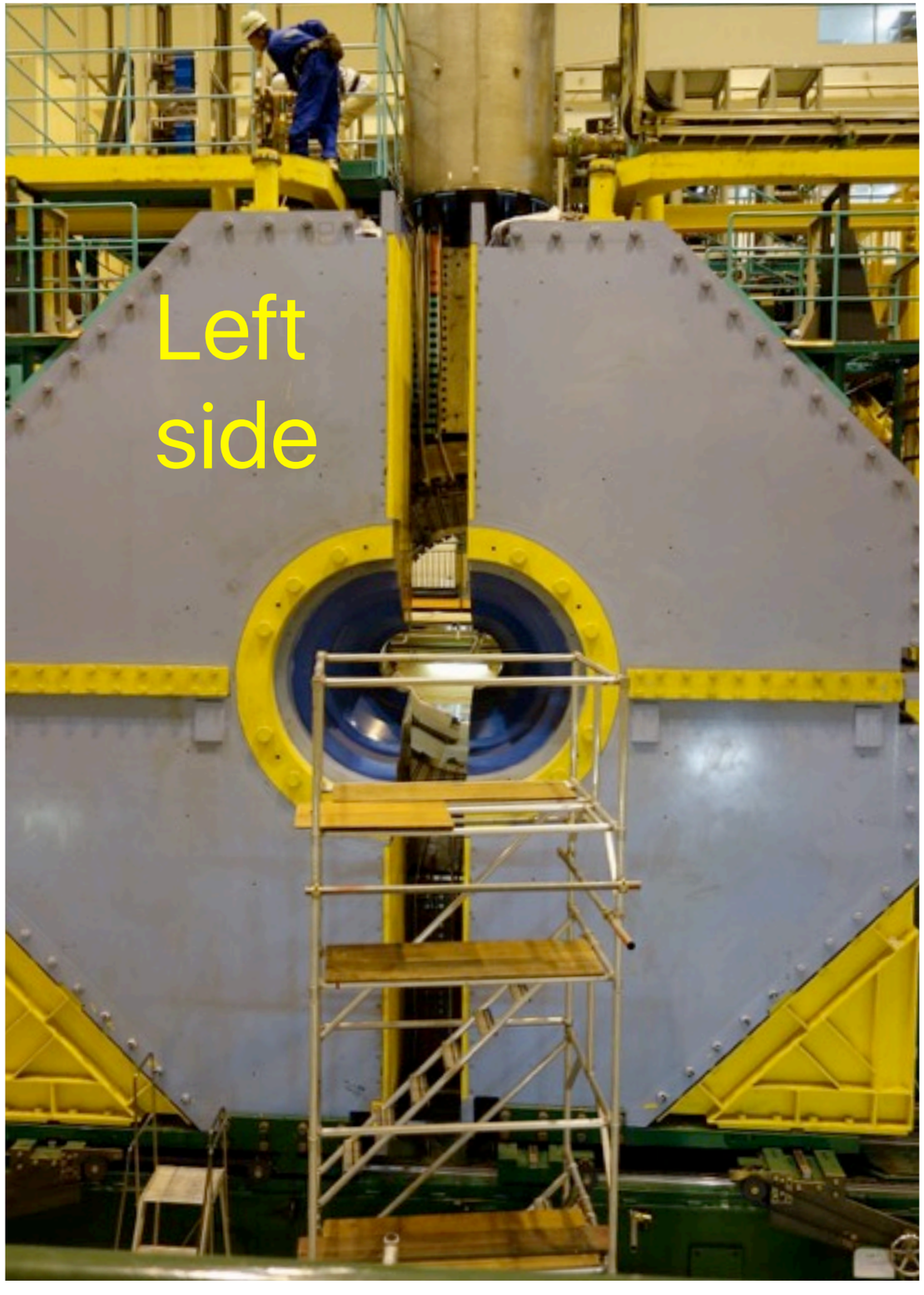
Setup of the aluminum pipes and NMR

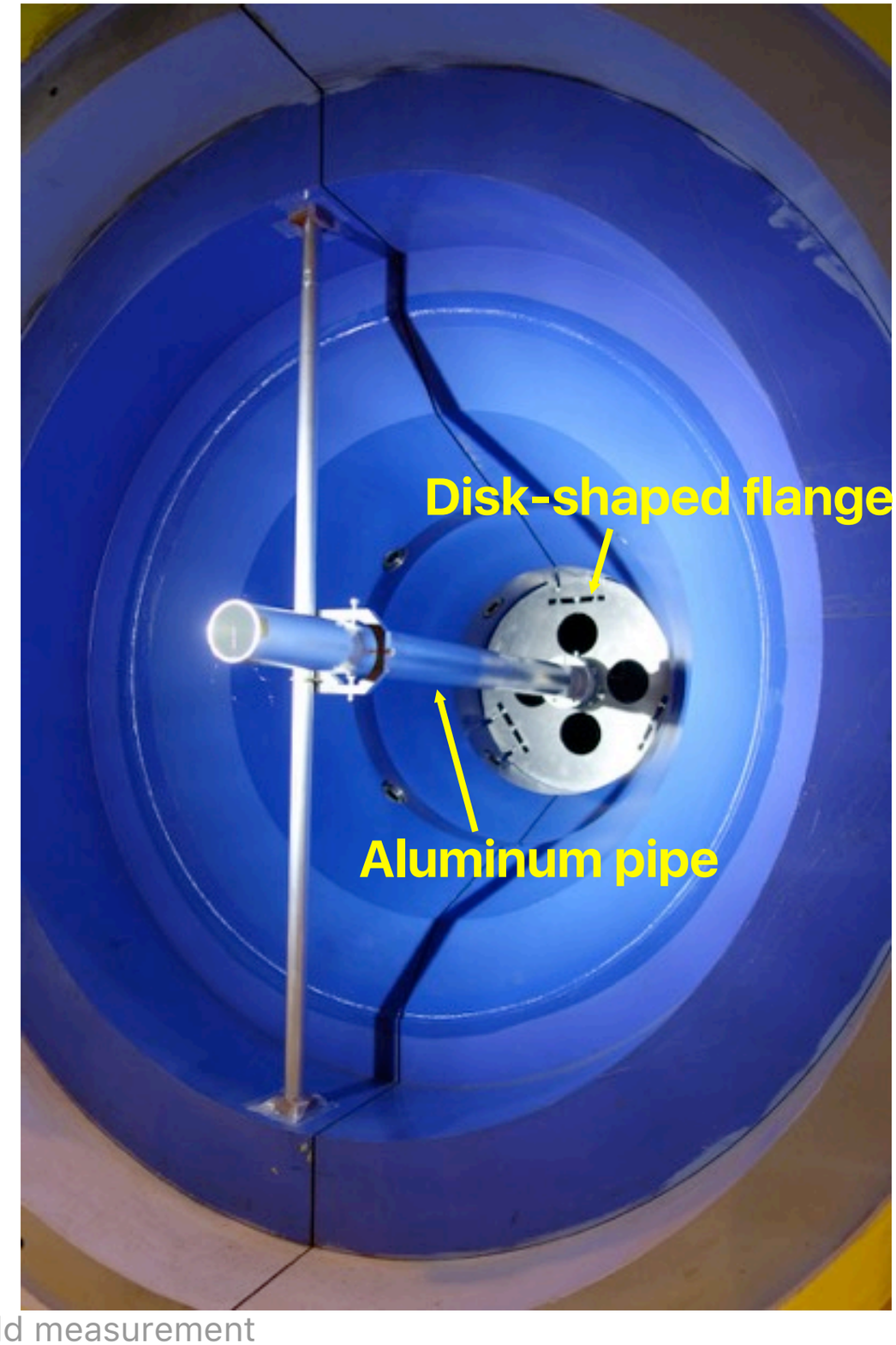




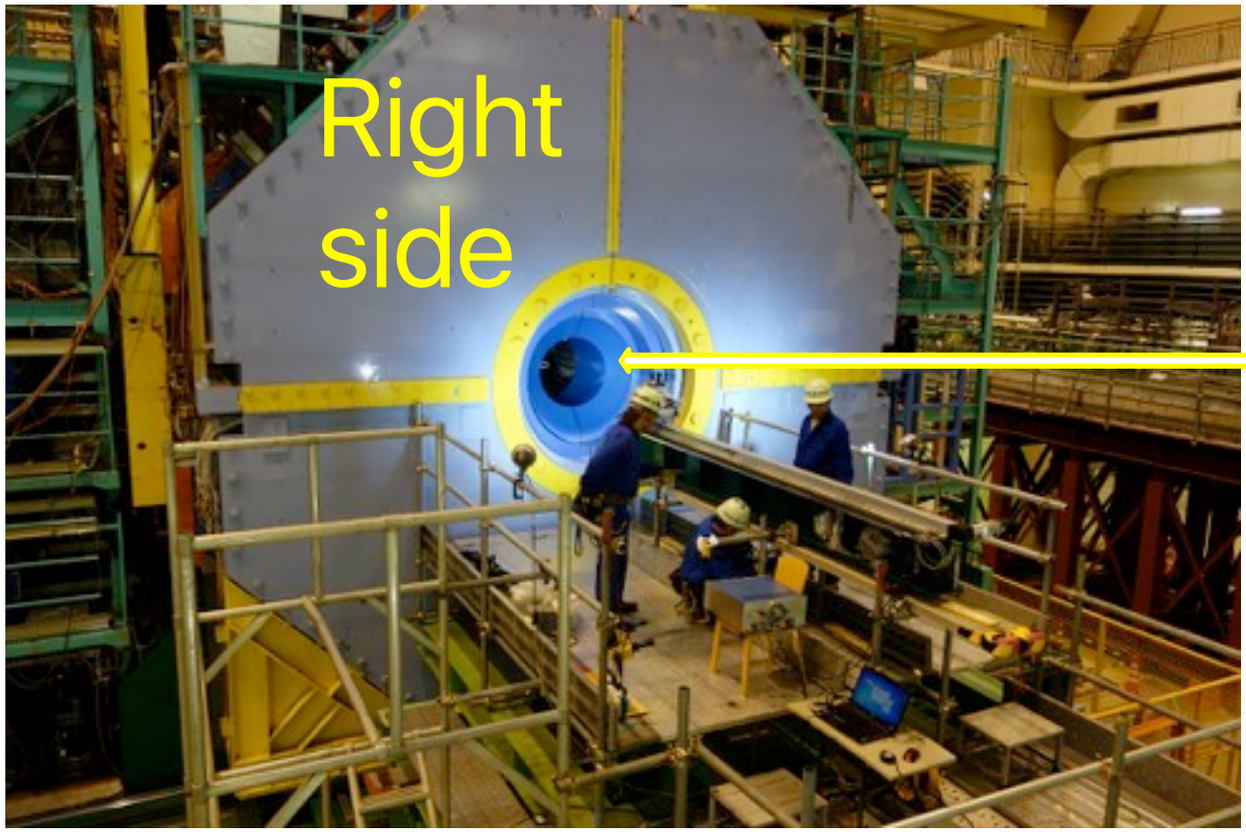
d measurement

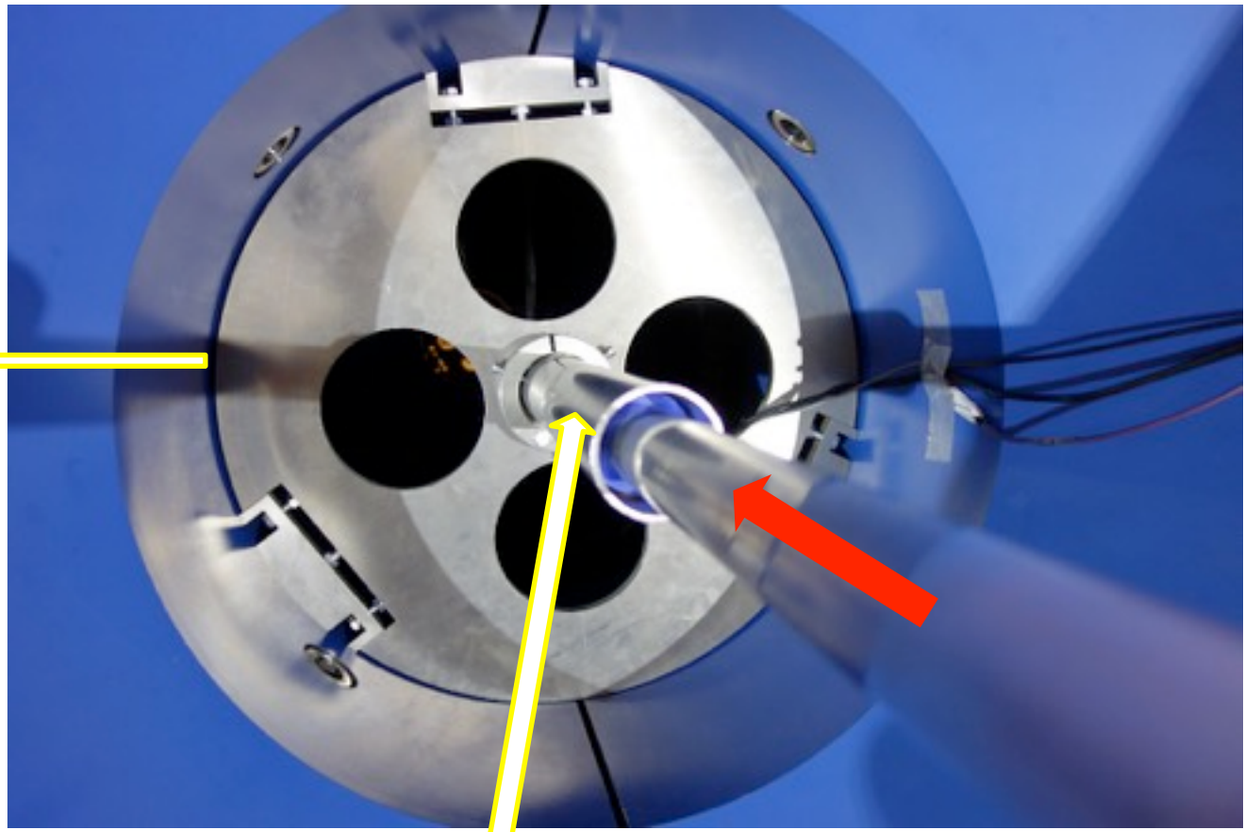
Fixing the aluminum pipe

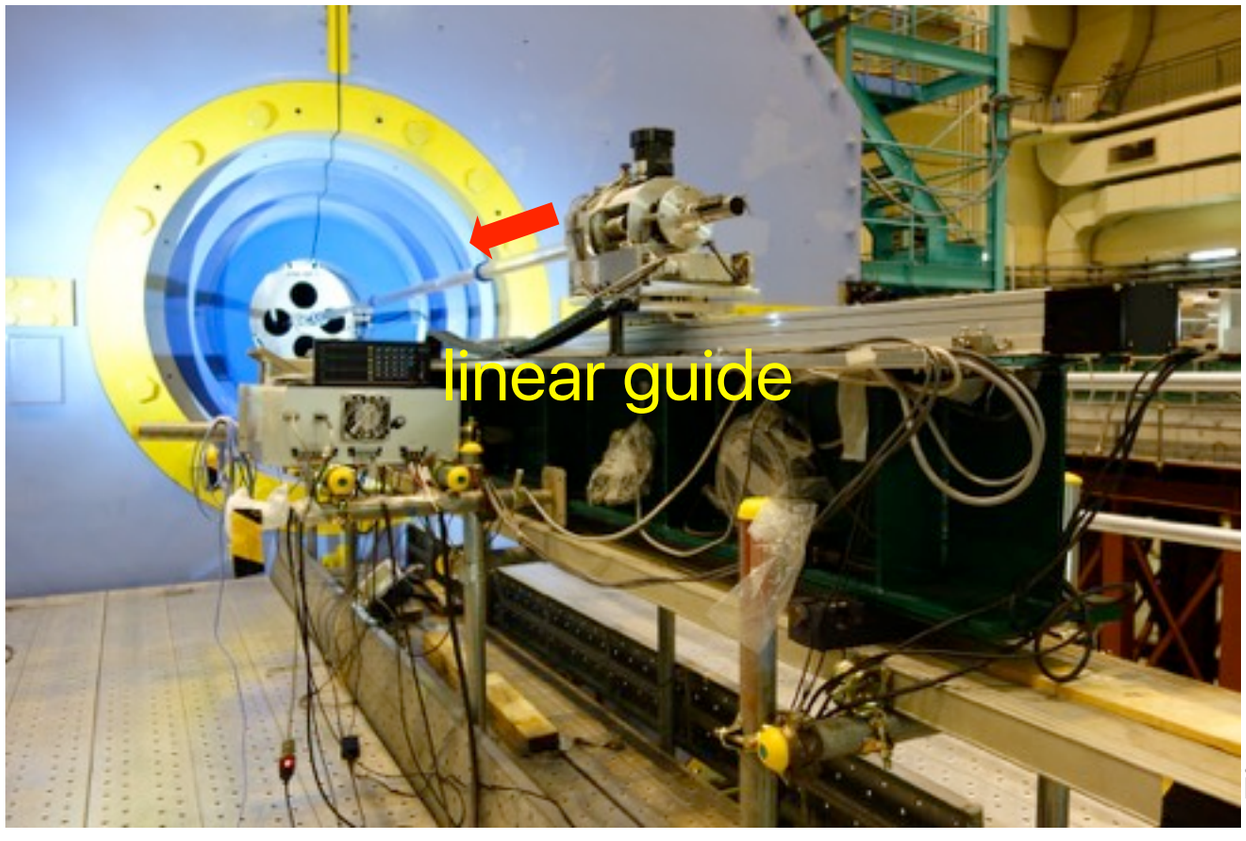


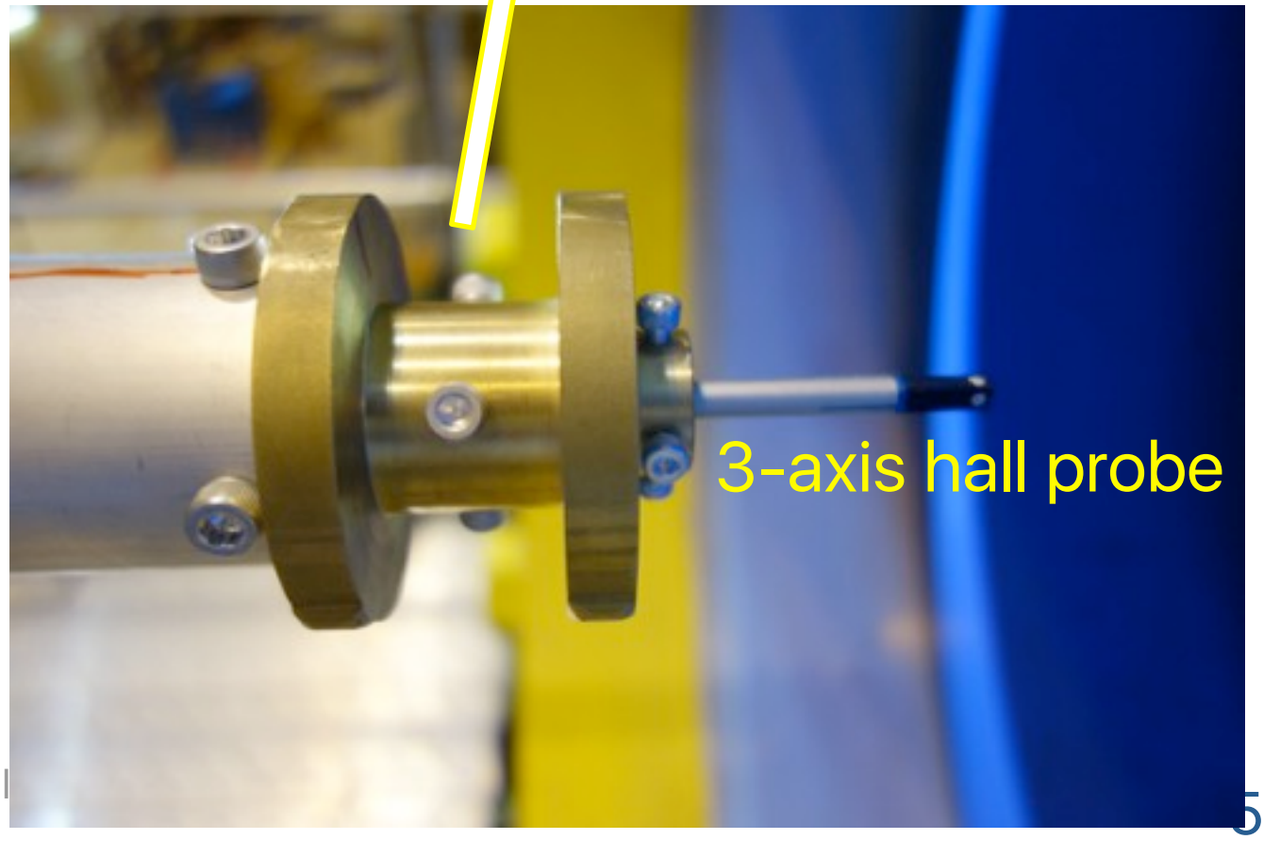


Setup of the linear guide system

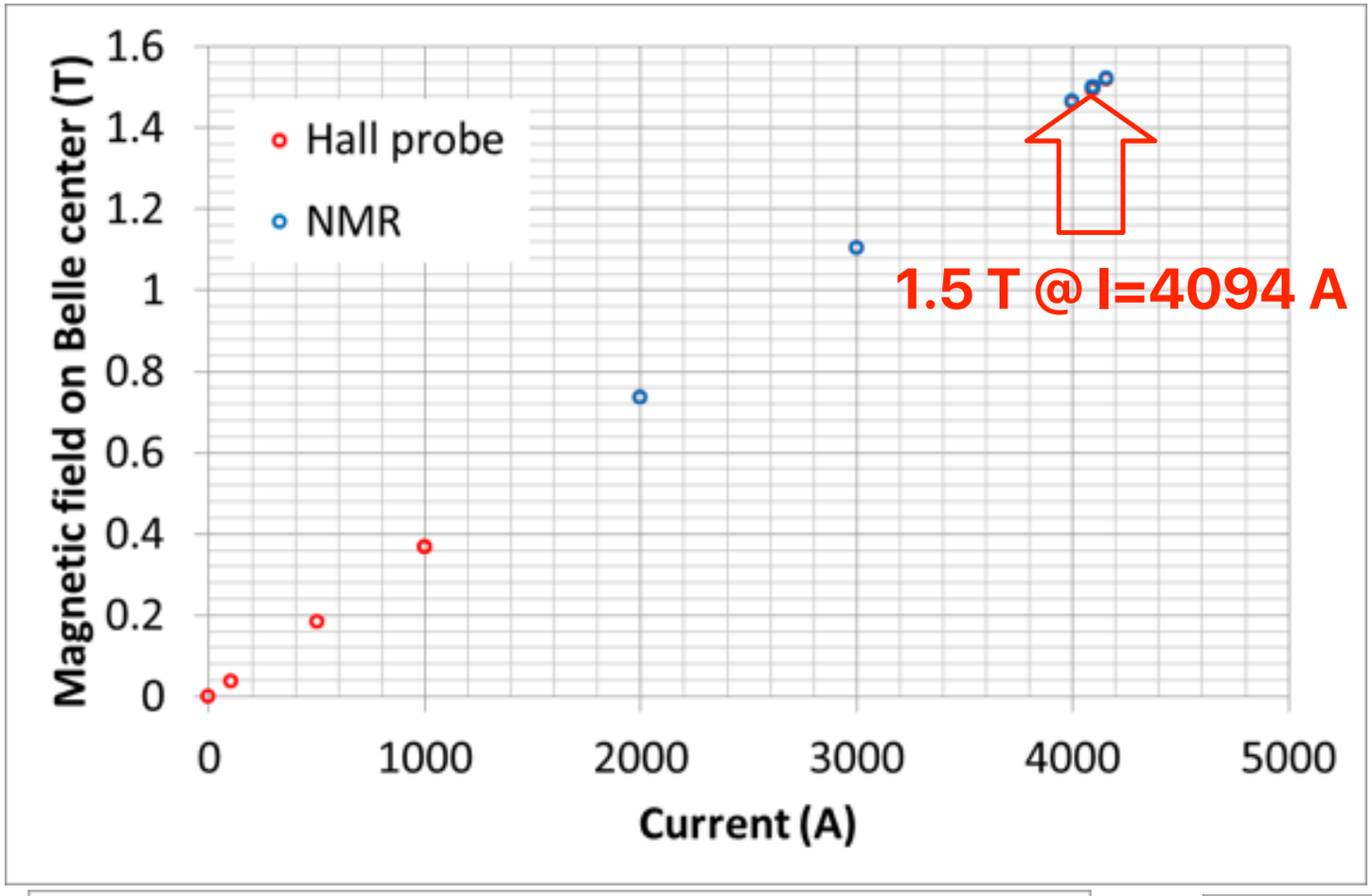


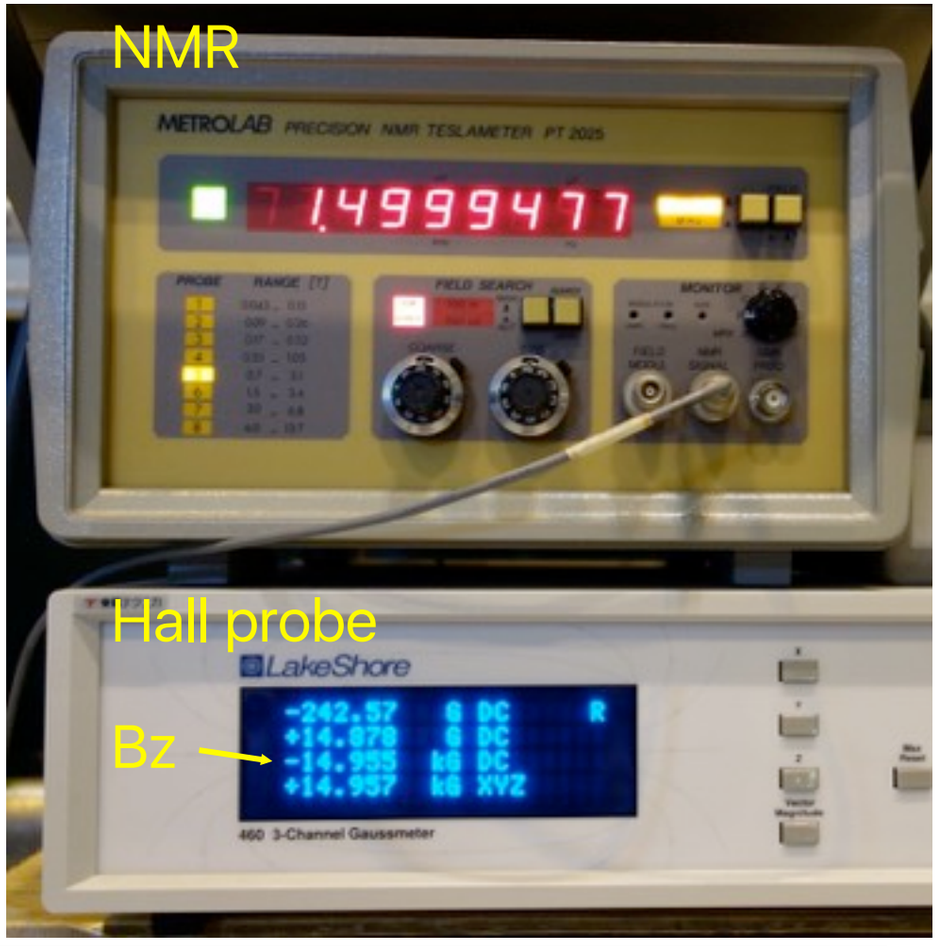


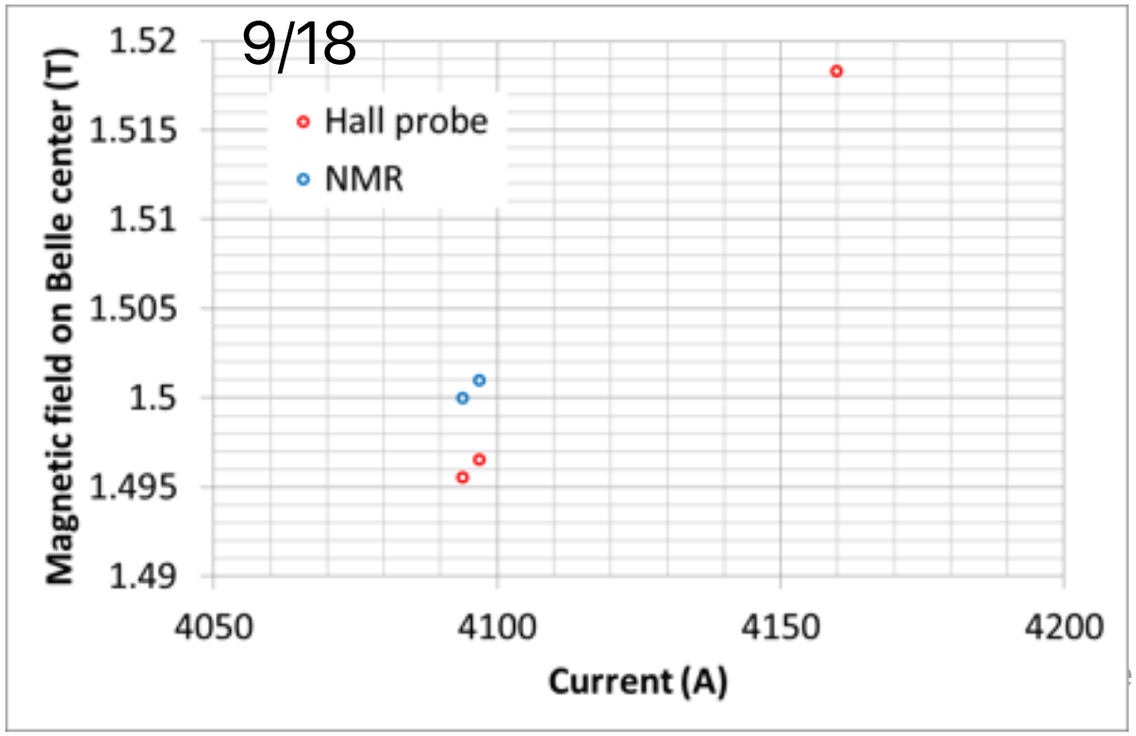


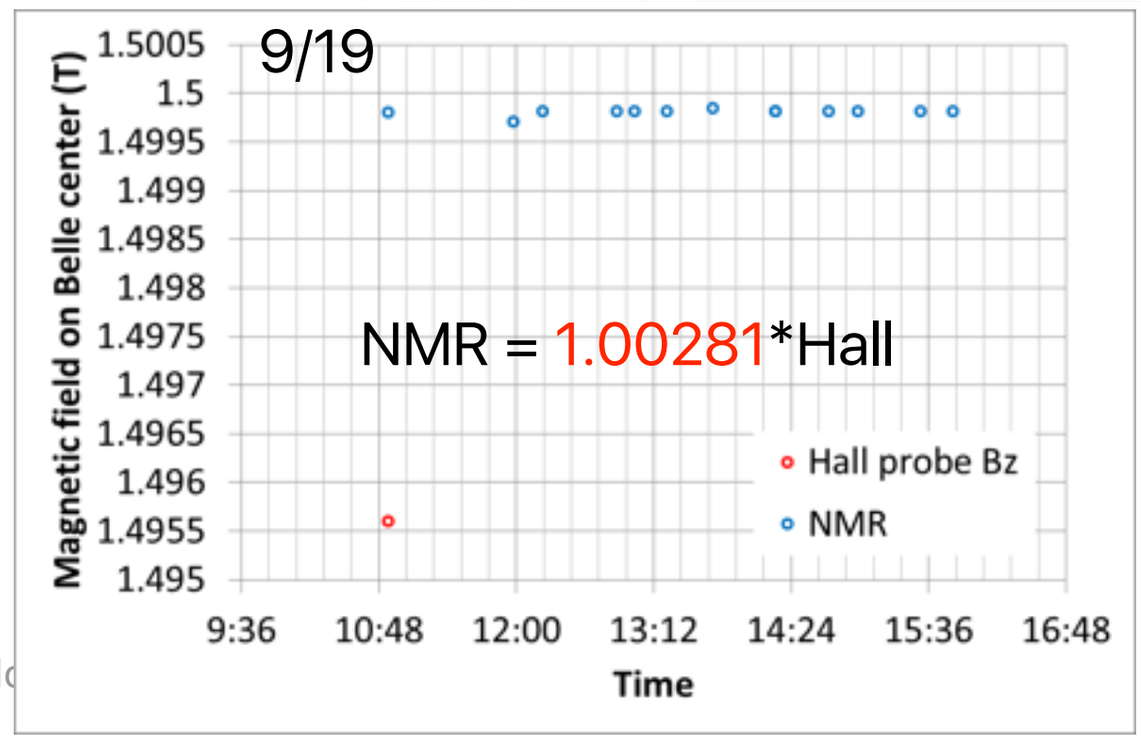


Excitation of the Belle solenoid to 1.5 T





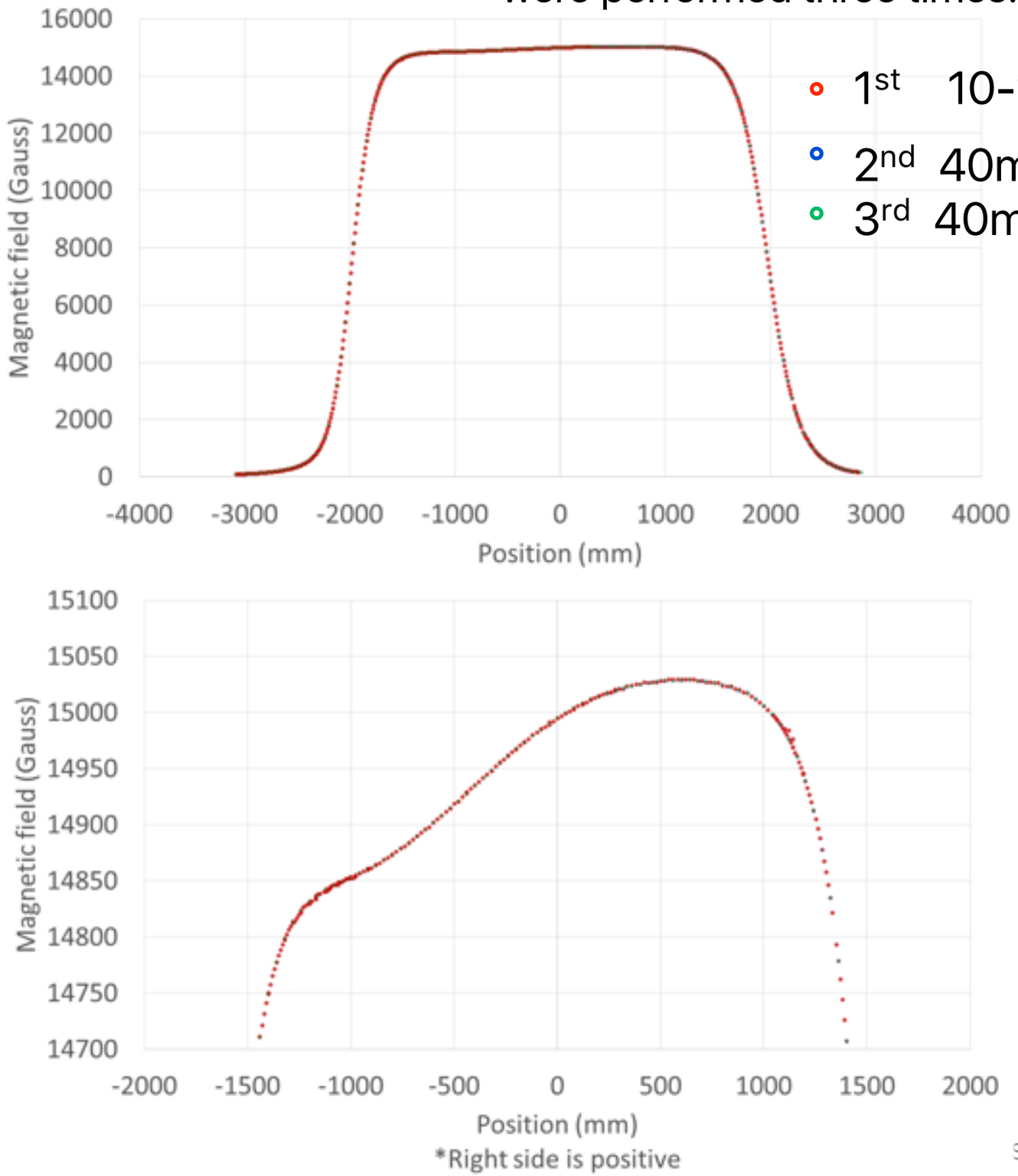




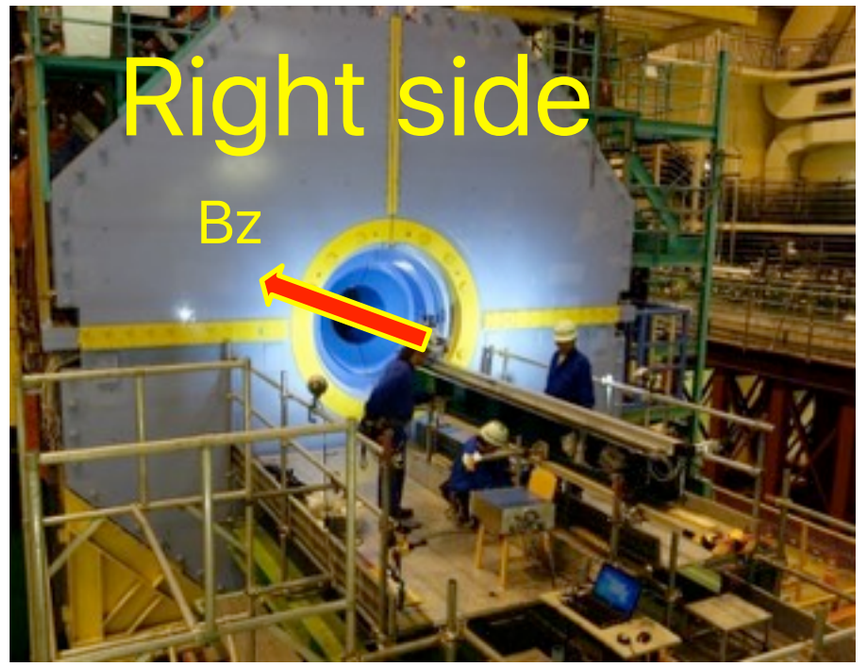
Field measurement results@4094A

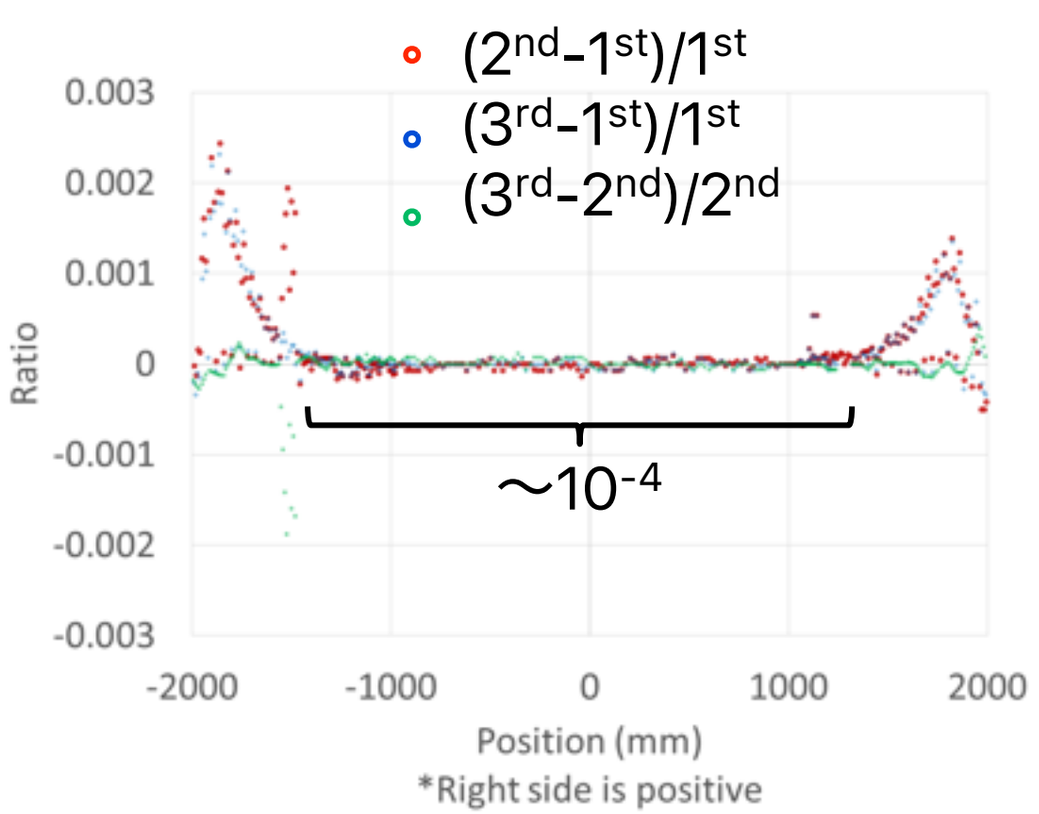
Offset<1G (10^{-4})

The field profile measurements were performed three times.

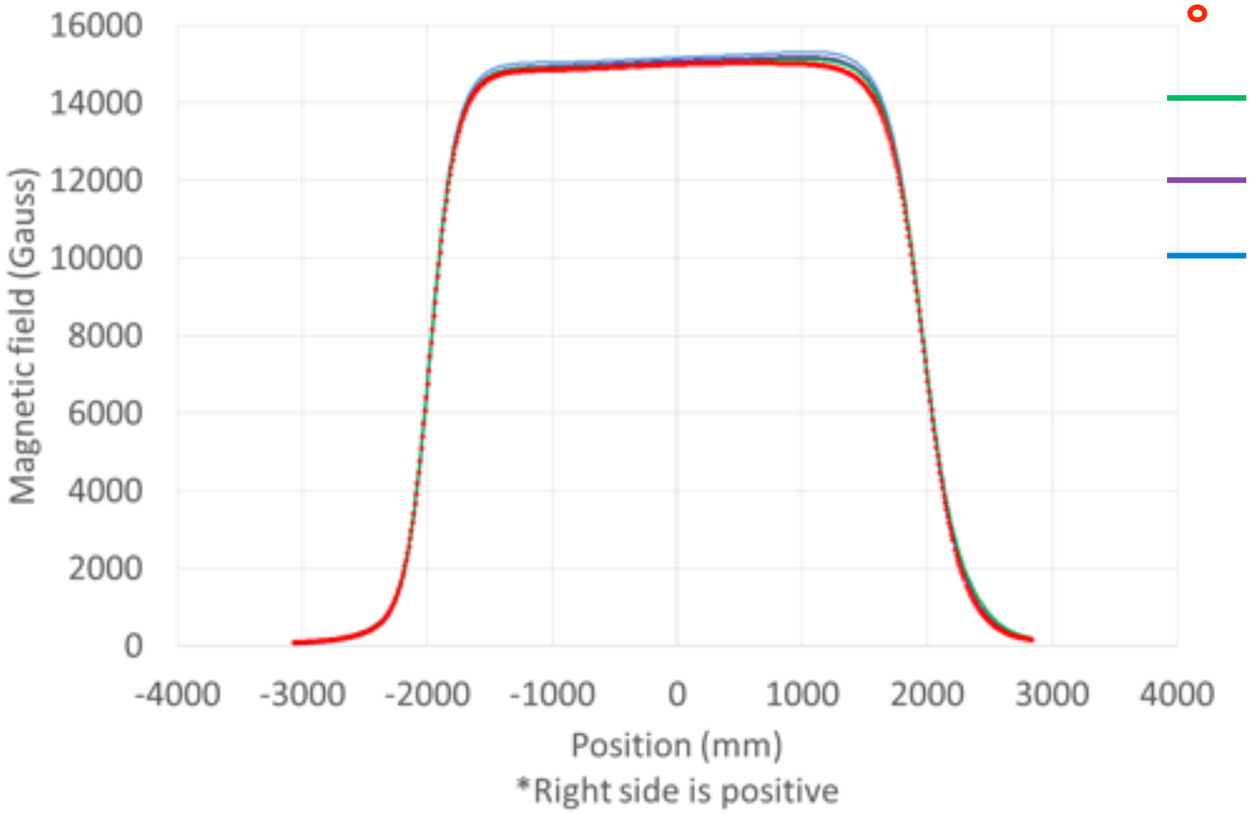


- 1st 10-20mm
- 2nd 40mm
- 3rd 40mm



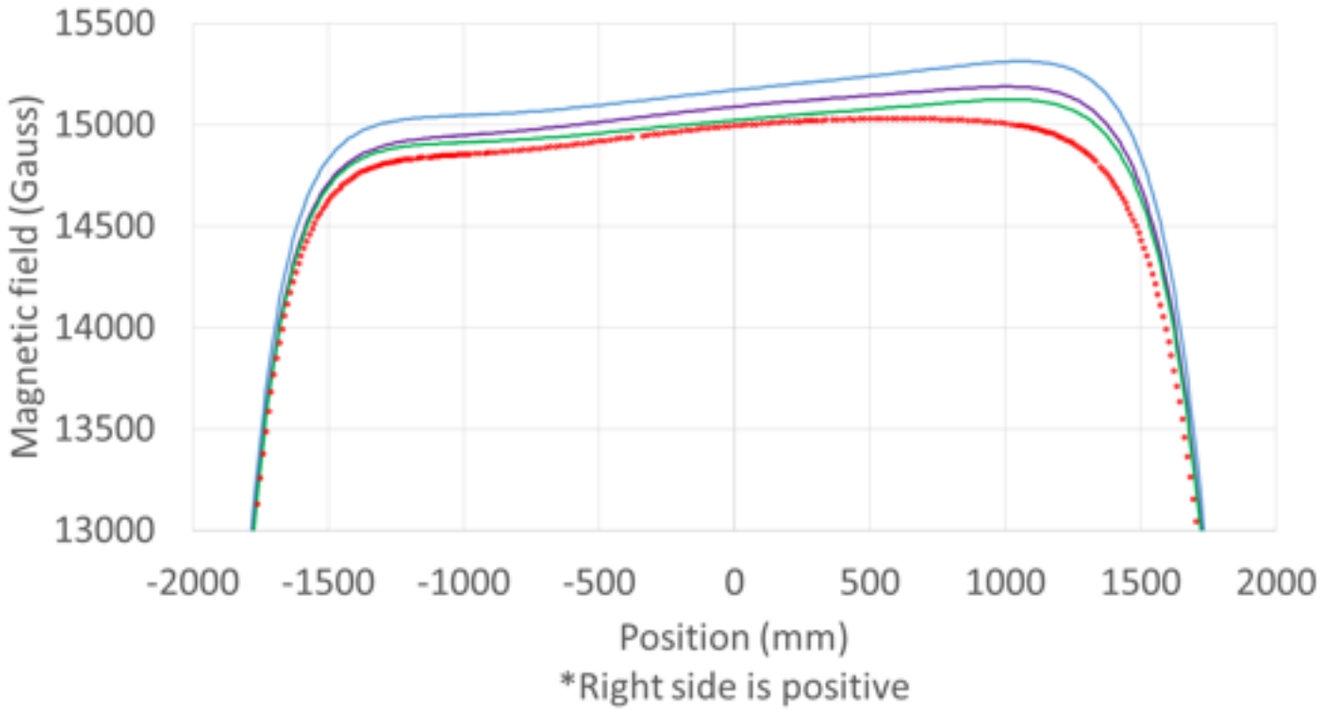


Comparison between measurements and calculations

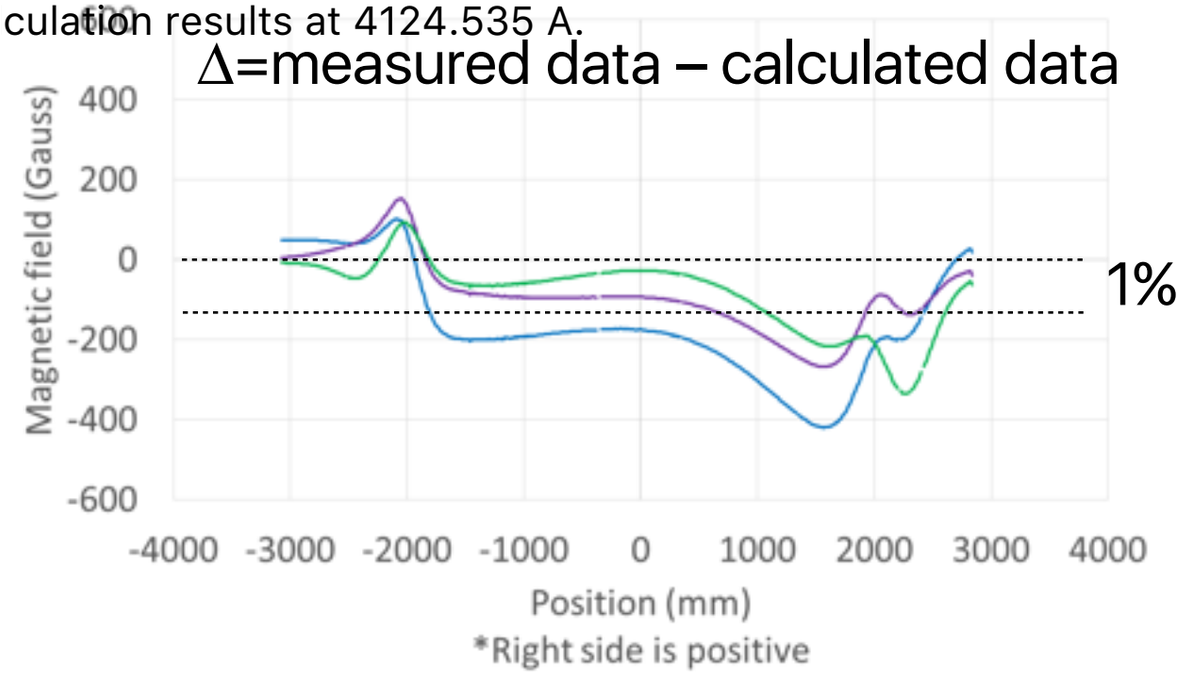


- Experiments
- 2D （calculation model based on the KEKB model)
- 3D_Cylindrical_slot
- 3D_Octagonal

Calculation results with the 3D model are recalculated by rating the current ratio of (4094 A/4124.535A) from the calculation results at 4124.535 A.



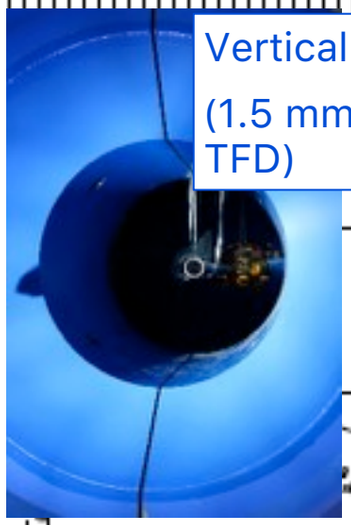
Δ=measured data – calculated data



- ✓ The measurement shows the different field profile from the calculation. （Especially, in the right side)
- ✓ The measurement shows the smaller field value than the calculation.

Difference between the calculation model and the real machine(presently figured out)

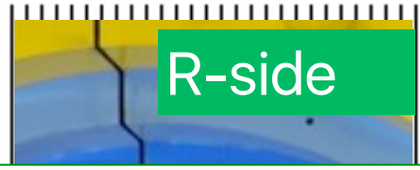
L-side



Vertical gap between end yokes ：～5mm

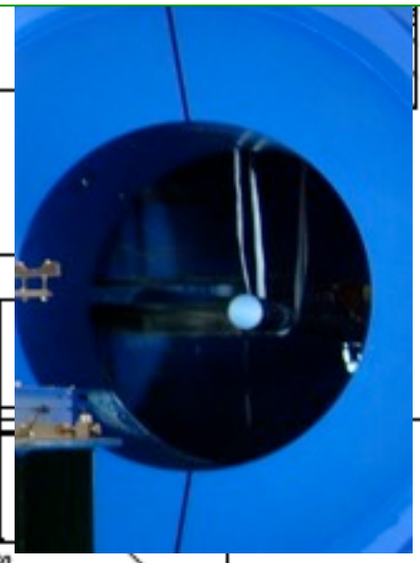
(1.5 mm at Jan. 2001 in the transfer document, TFD)

R-side



Vertical gap between end yokes：～10mm

(2 mm at Jan. 2001 in TFD)



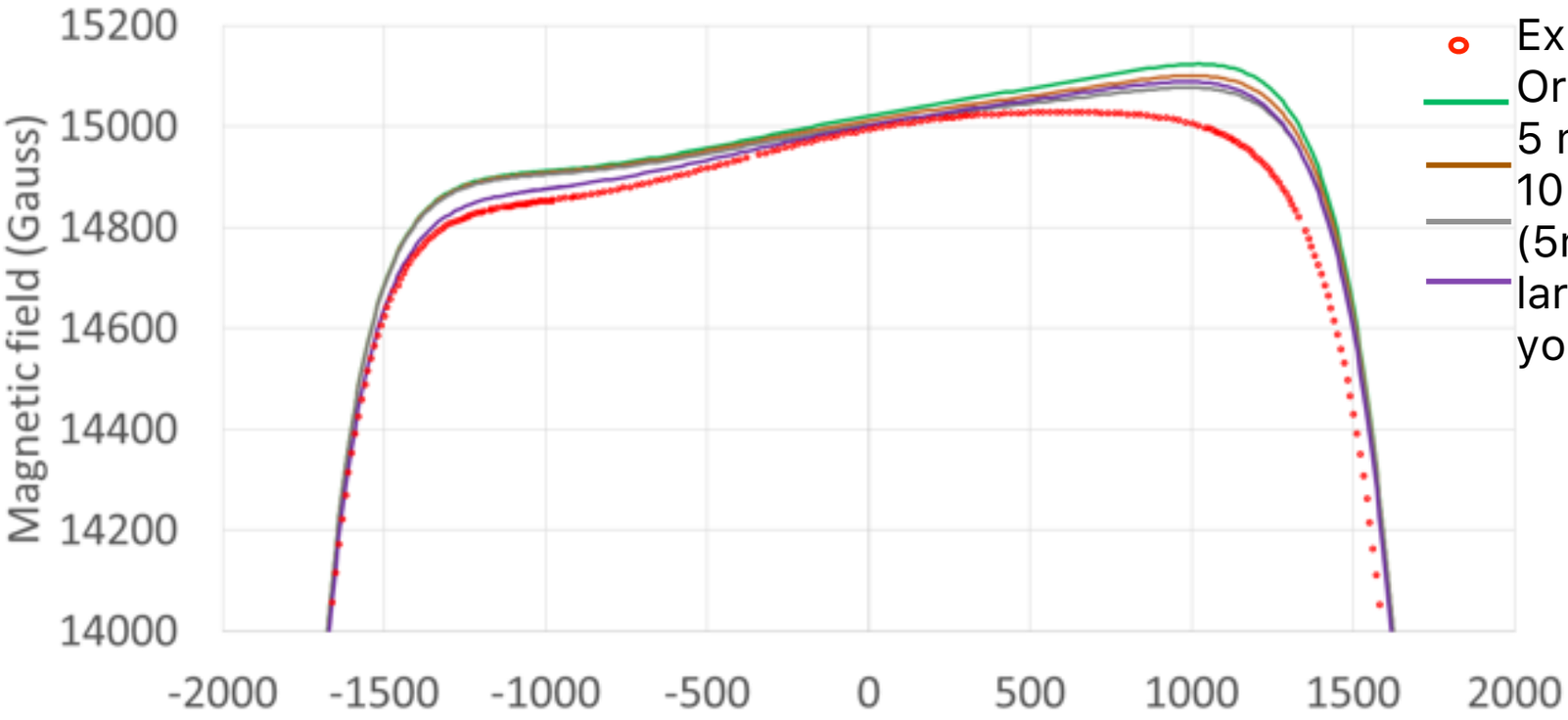
Measured:3914mm (3910 mm in TFD)
Design:3893.5
2D model: 3895 (difference from the real machine:19mm)

At excitation, the yoke moved inward by 5mm

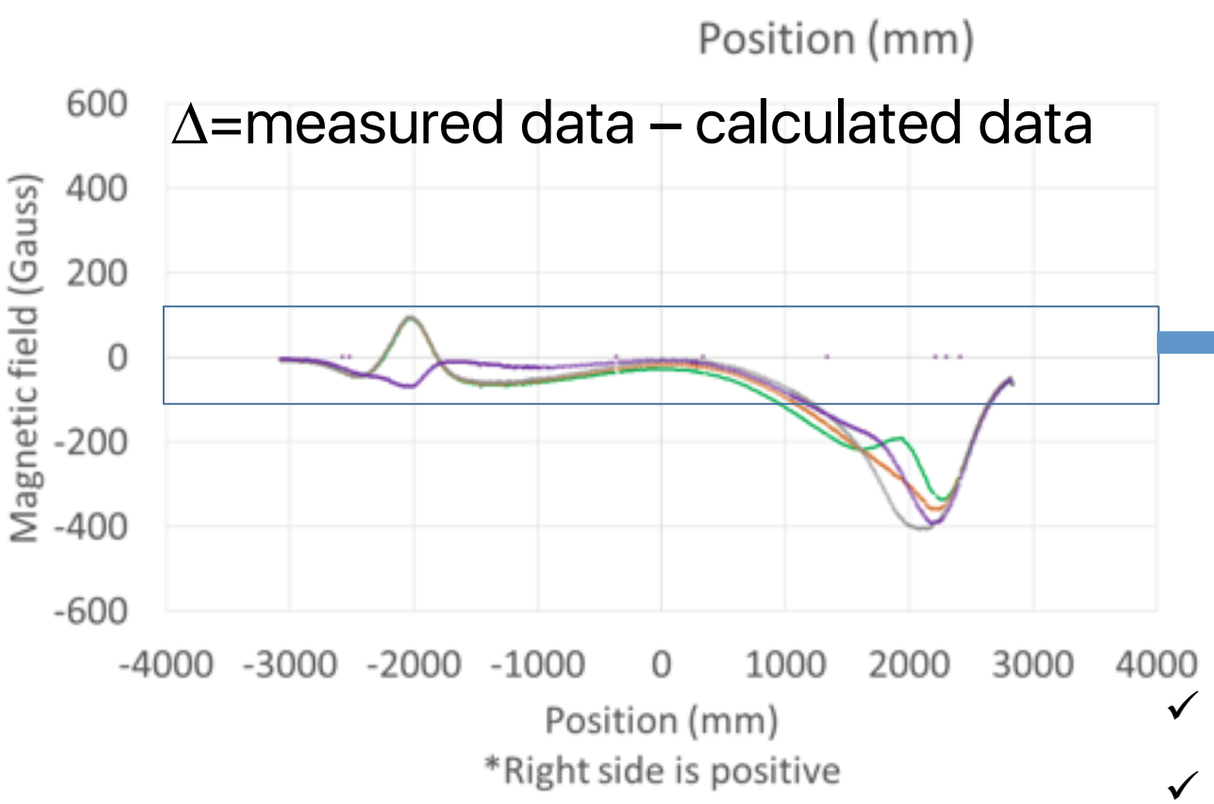
Possible reasons of the difference between measurements and calculations

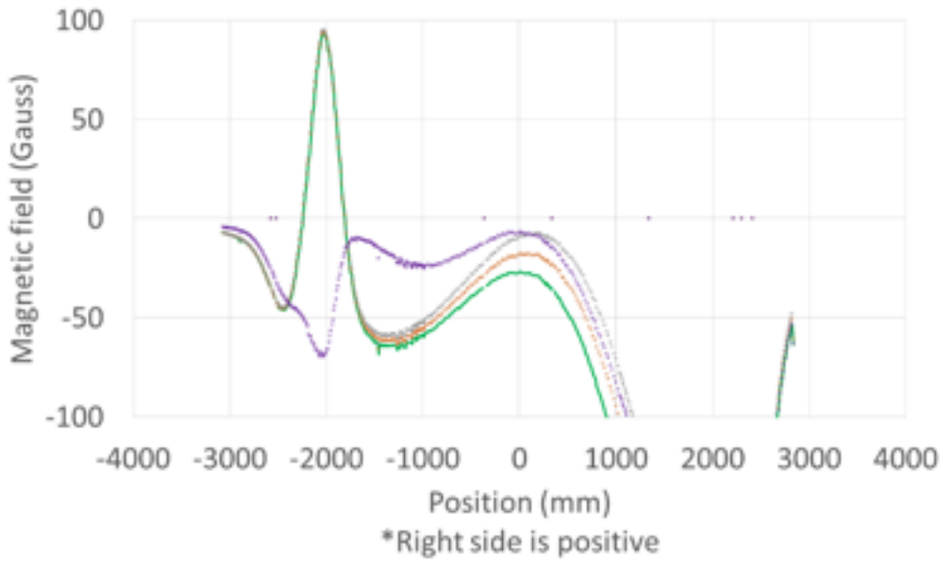
- ✓ By exciting the solenoid, the both end yokes moved inward by 5mm, and the total difference is 9 mm by (19 mm – 5 mm×2).
- ✓ The vertical gaps between yokes.

2D model



Experiments
Original
5 mm shift outward of the right yoke
10 mm shift outward of the right yoke
(5mm shift of the right yoke , and 5mm larger inner bore) + (5 mm shift of the left yoke, and 3 mm larger inner bore)





- ✓ Δin the left side : ～20G @ -2 m
- ✓ Δin the right side : ～100G @ 1m, ～400G @ 2m

Summary

- There exists the difference in the field profile along the solenoid axis between the measurement and the calculation.
- The possible reasons of the difference:
  - The size and shape differences between the calculation model and the real machine
  - The position of the Belle solenoid with respect to the Belle yokes
  - The connecting components between the end yokes and the barrel yoke
  - Material properties: BH parameters
  - etc.
- The closing operation of the Belle yokes might induce the change of the solenoid field profile inside the Belle yokes.