

# Magnetic field measurements and Si detector cooling test

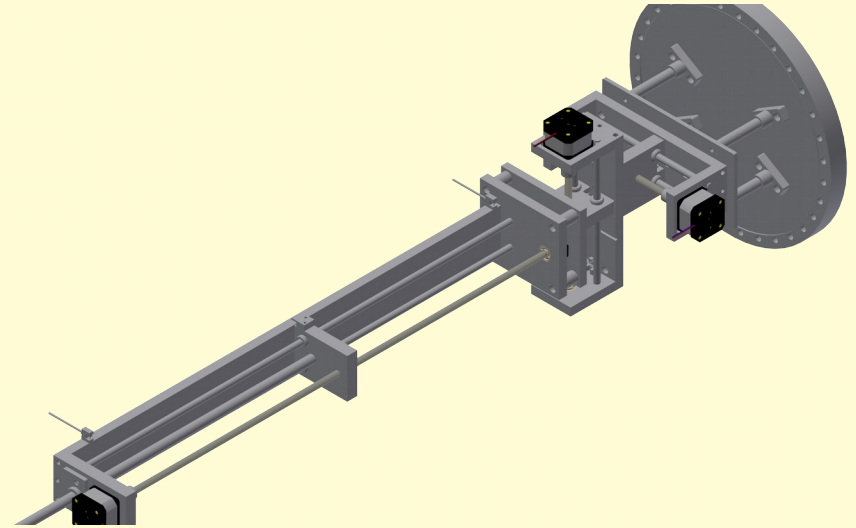
WISARD collaboration meeting march 2020

# B measurement

- The magnet was last measured in 2001 by manufacturer.
- Little data on an off axis B field.
- Data is needed for beam simulation and proton trajectories simulation.

# Initial approach

- Make a simple 3D movement stage using stepper motors.
- Use the stage in vacuum.
- Use Hall probe for actual measurement
- Initial design by Philipp Wagenknecht, improved by me.

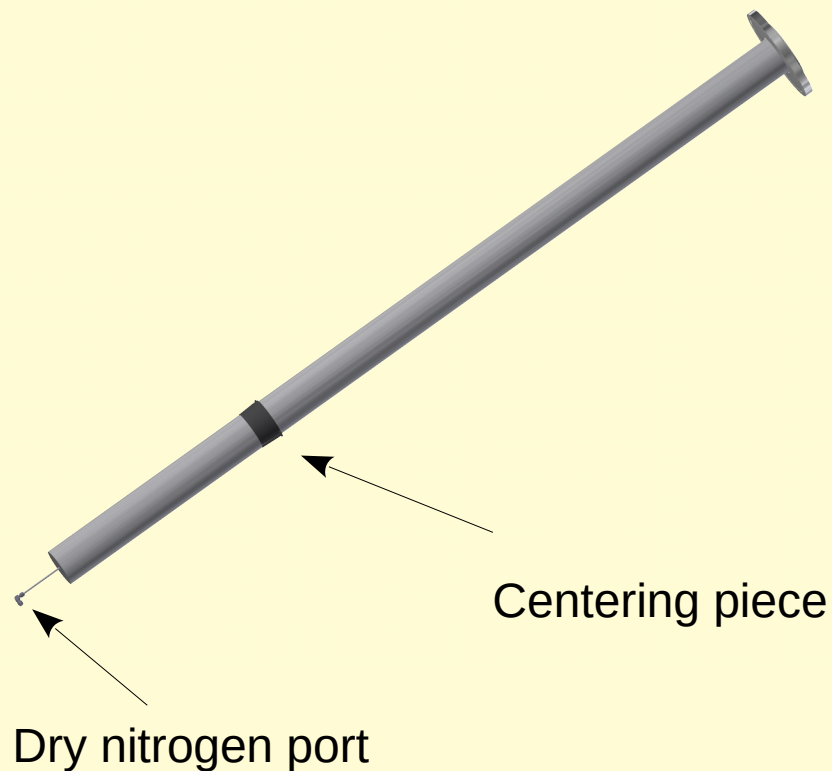


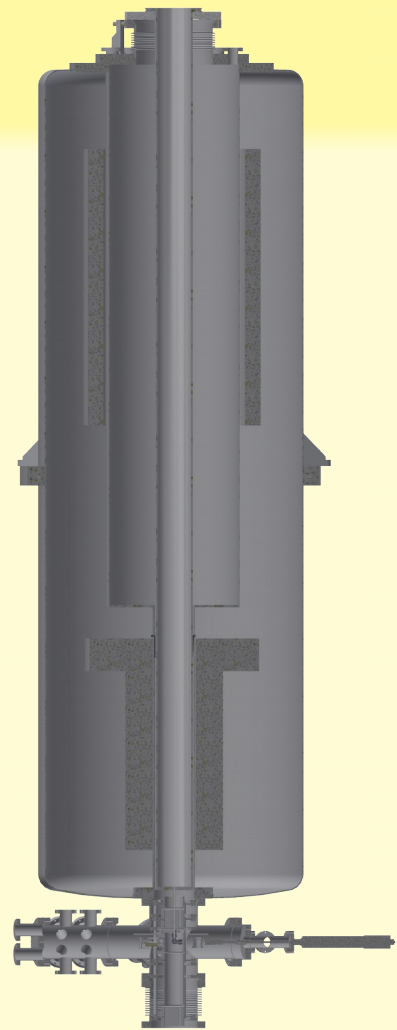
# Things turned out not to be that simple...

- We contacted CERN Magnet Measurement group about hall probe...
- ... and learned its results depend on probe's temperature rather strongly.
- MM group suggested creating anti-cryostat and using their new system for measurement.
- Measurement using coils and induction measurement → insensitive to changes in temperature.

# Anti-cryostat

- Anti-cryostat allows measurement to be made in air.
- Made of aluminum for best properties.
- Flushed with dry nitrogen to eliminate any freezing.





# Outlook

- Anticryostat to be manufactured off-site due to aluminum welding. Design is ready, first offer arrived.
- Magnet Measurement group to supply entire measurement and data ACQ setup.
- On track for measurements after Simons experiment (modulo COVID-19).

# Cold silicon resolution tests

- Silicon detectors resolution depends on detectors temperature.
- The goal is to find “point of diminishing returns”.
- Once optimum temperature is found, prepare cooling solution.



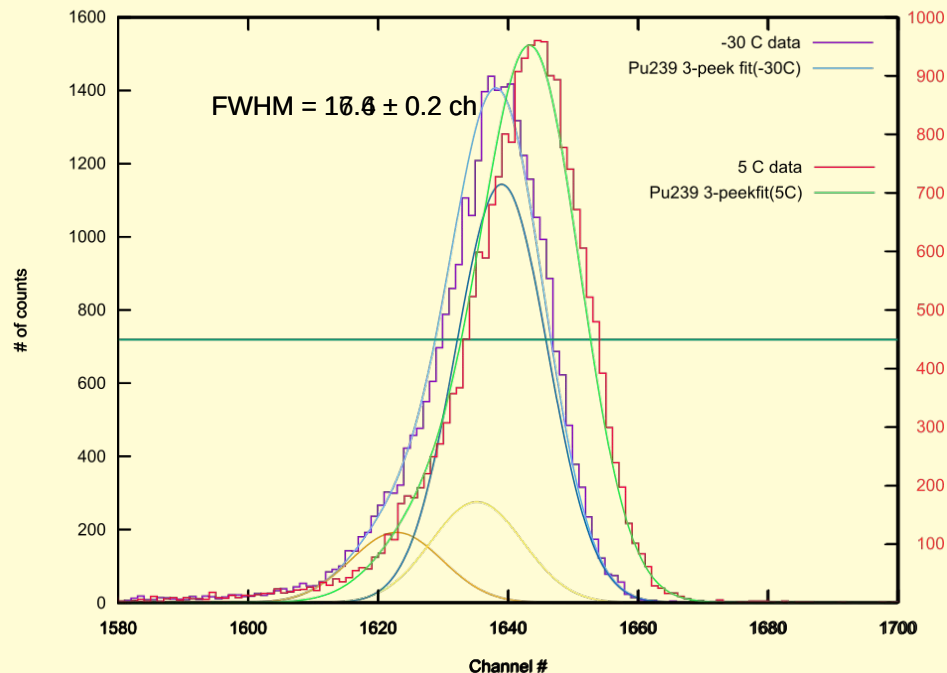
# Testing setup

- Chiller with radiator fluid (ethyl glycol based) cools down to -30C. Copper heat exchanger.
- Thermocouple for temperature measurements. (Vacuum feedthrough to come soon™).

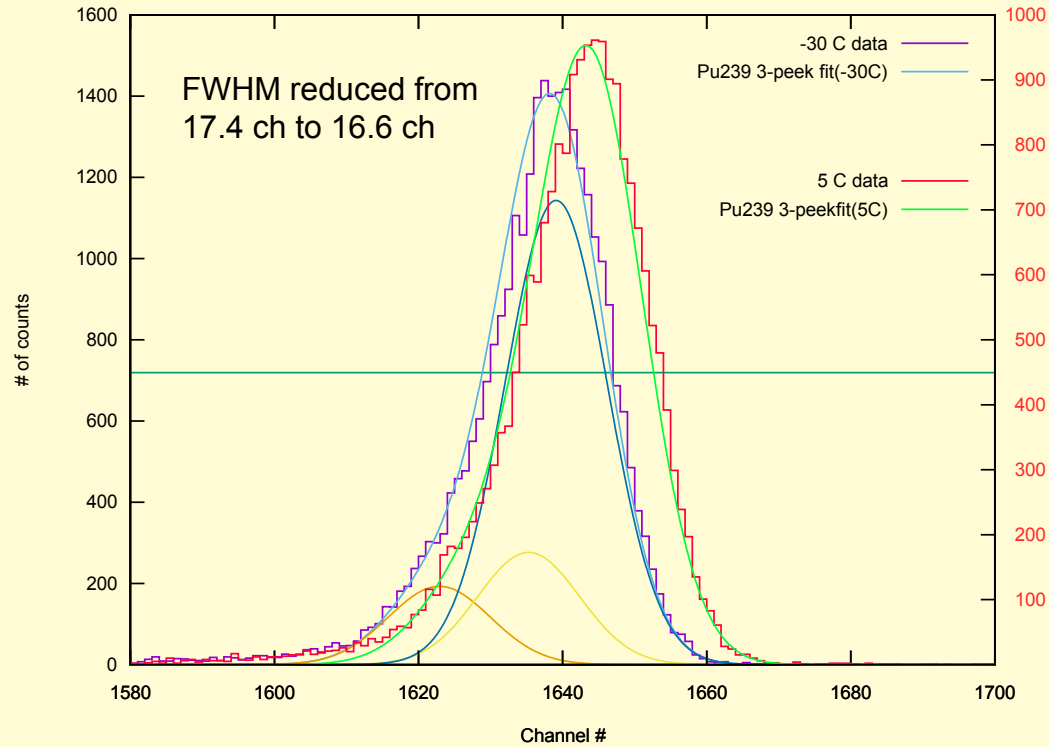


# First results

- Using 30yrs old detectors.
- $^{239}\text{Pu}$  source.
- With very rough vacuum.
- Little dependence on temperature observed.
- $\sigma \approx 23 \pm .5 \text{ keV}$

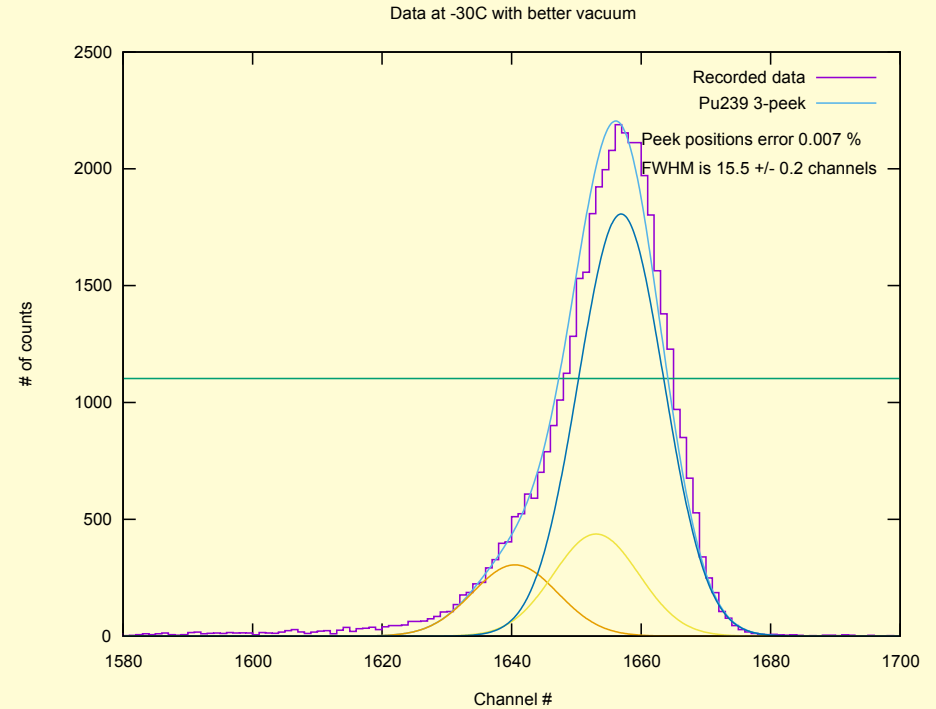


# Comparison



# Vacuum effect

- Very rough vacuum (4 mbar) is insufficient
- Between 4mbr and  $4e-2$  mbar change in FWHM is as big as change from 5C to -30C.



# Why resolution changes so little?

- Try another preamp.
- Test with another detector. Possibly unusually thick dead layer.
- Cooling preamp.
- Possibly due to source construction.

# Next to do

- Test prototype WISArD detector
- Chose cooling from three options
  - TEC cooling
  - Liquid cooling
  - Conductive cooling (long copper rod)