

TRANSVERSE FIELD MEASUREMENTS IN A BULK SUPERCONDUCTING MAGNETIC SHELL FOR A CLAS12 TARGET AT JEFFERSON LAB



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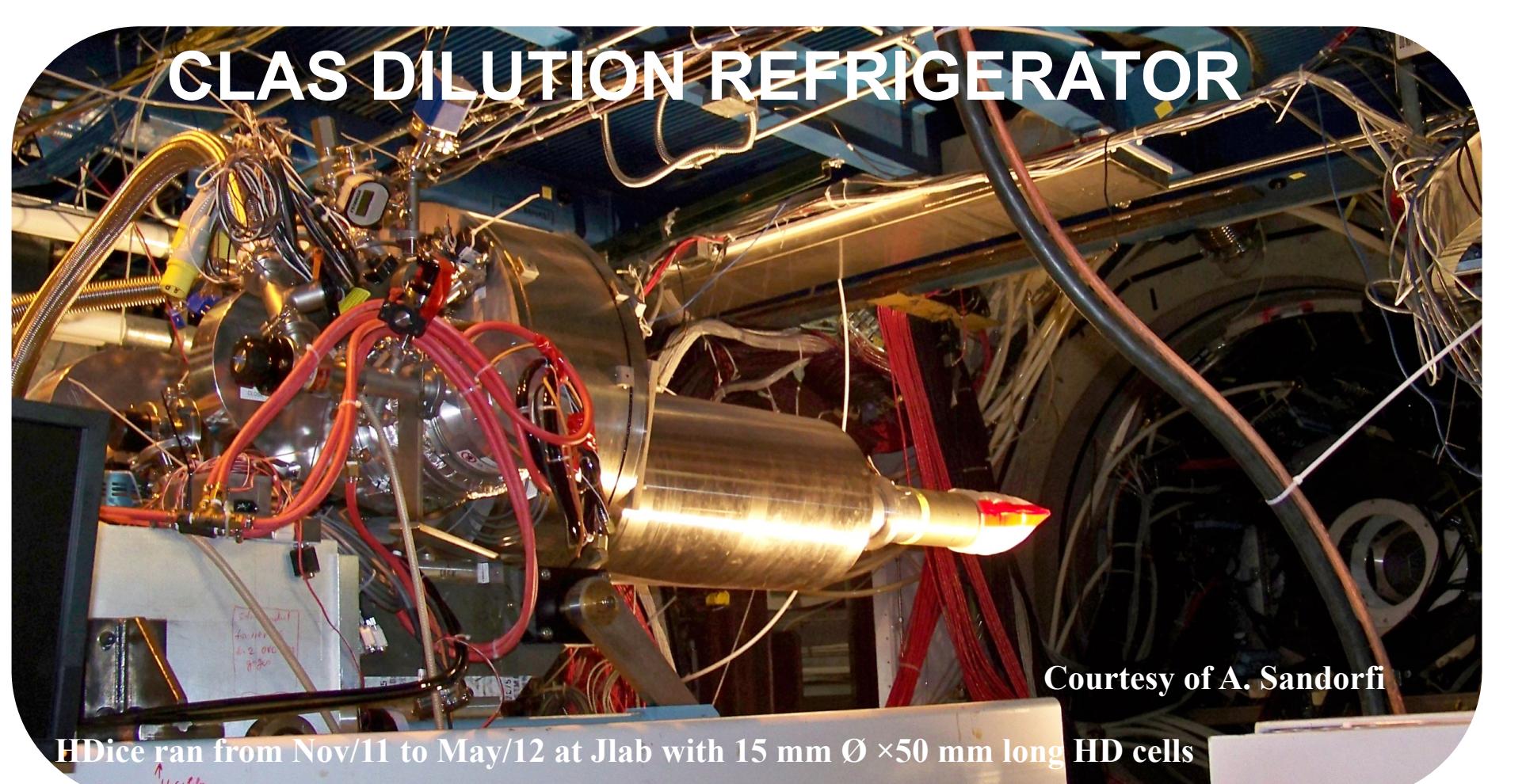
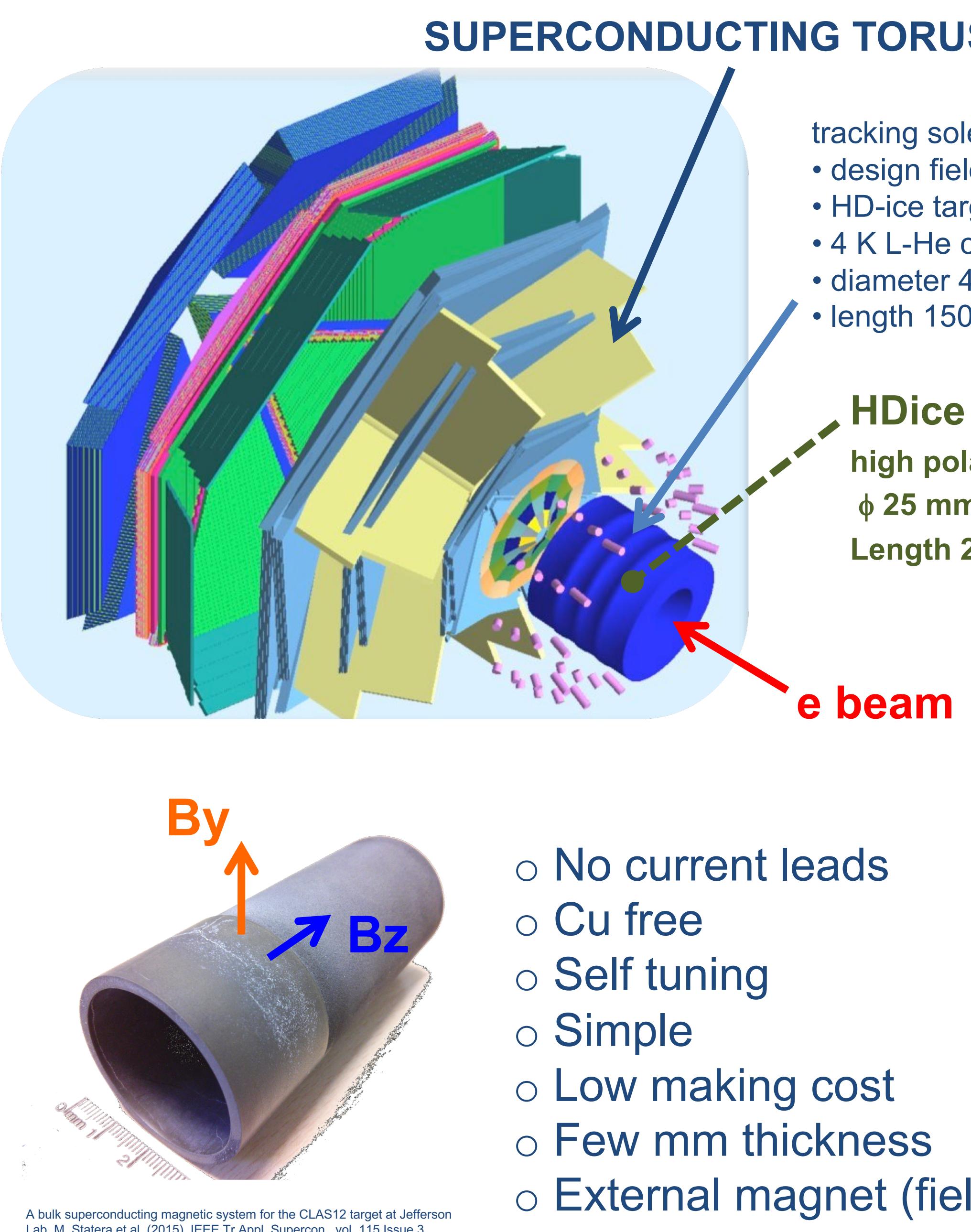


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MOTIVATION

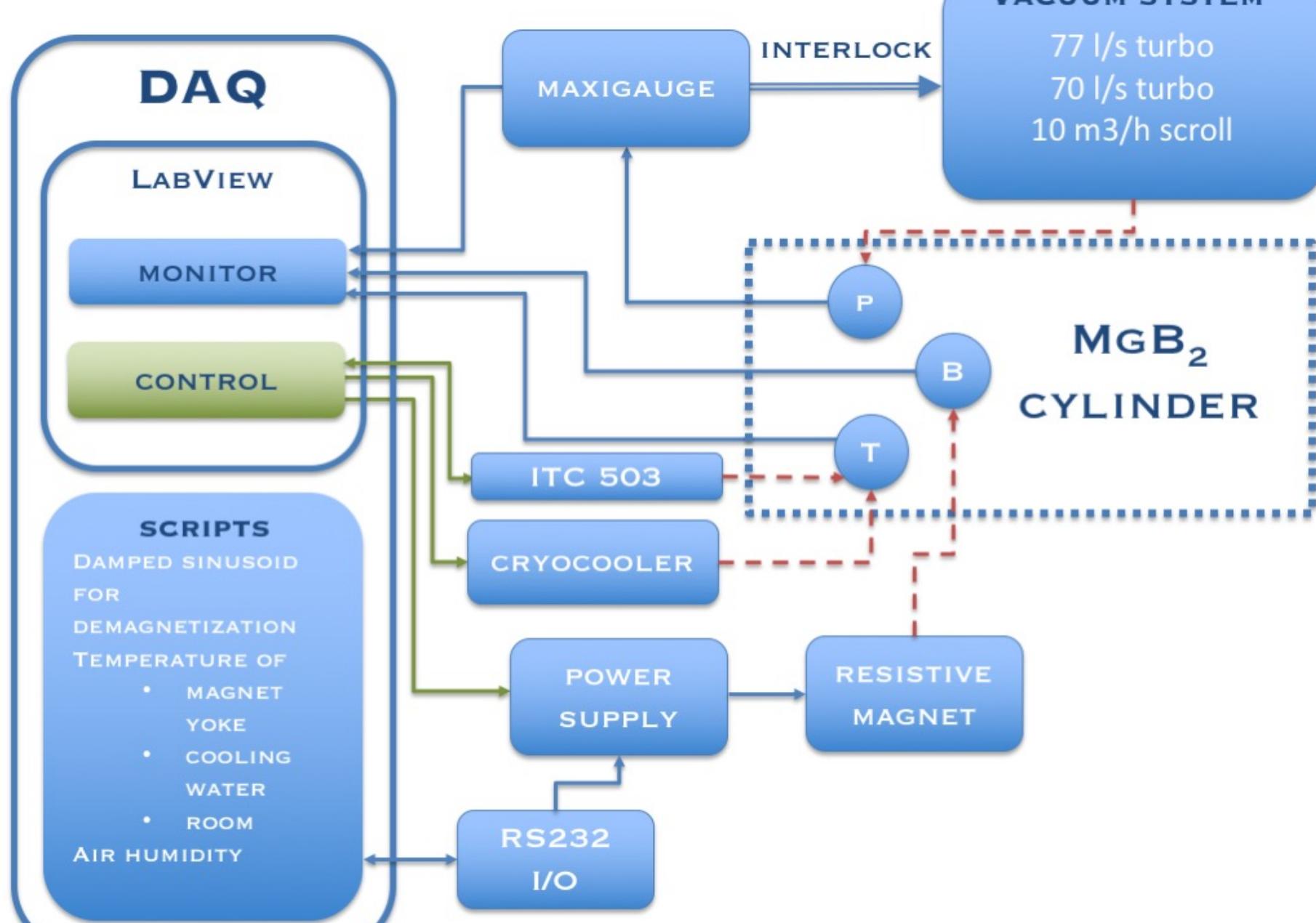
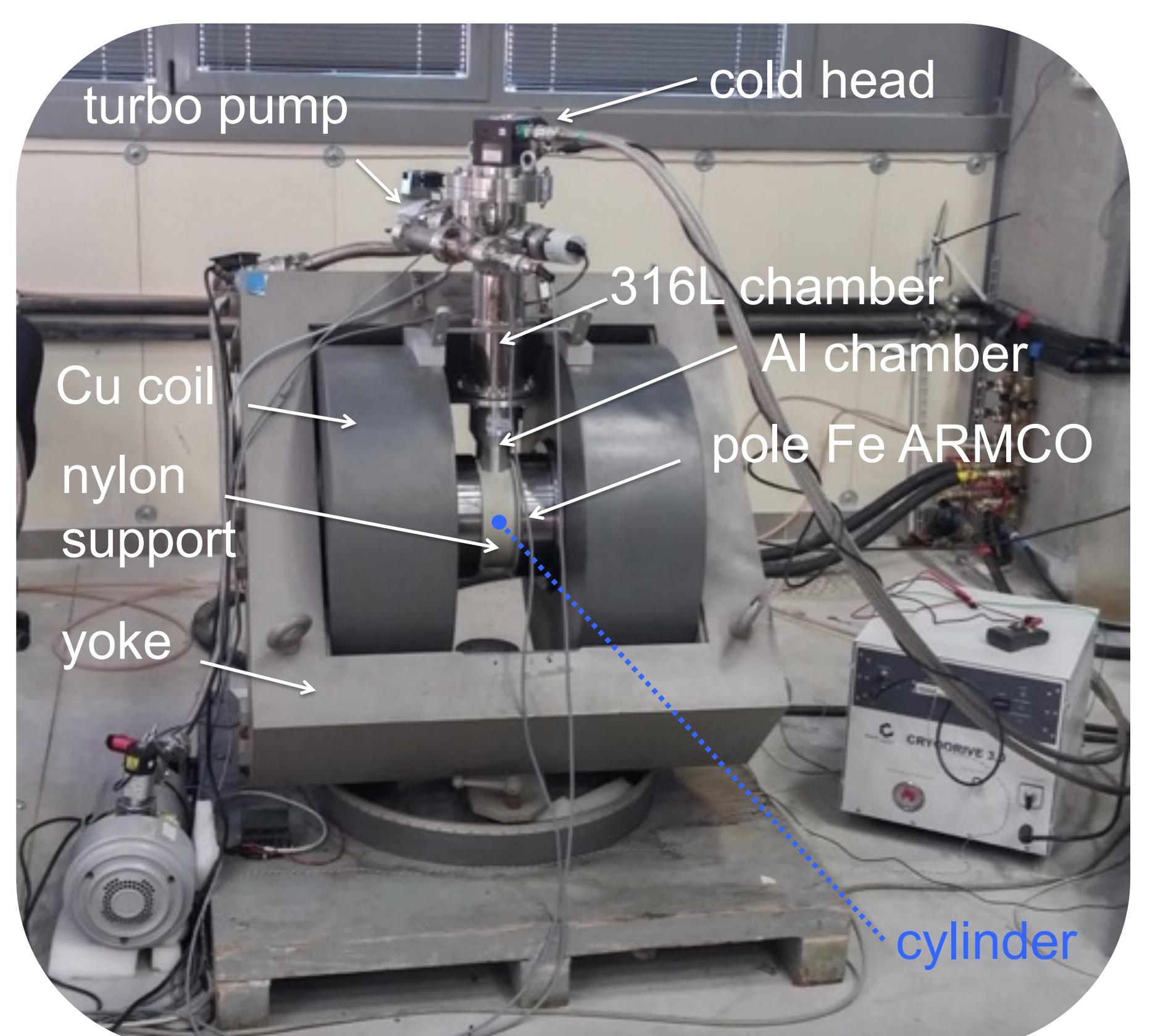


POLARIZED TARGET

TRANSVERSE MAGNET

- MgB₂ bulk cylinder
- longitudinal shield 2T
- transverse magnetization 0.5 T – 1.25 T

TEST SETUP

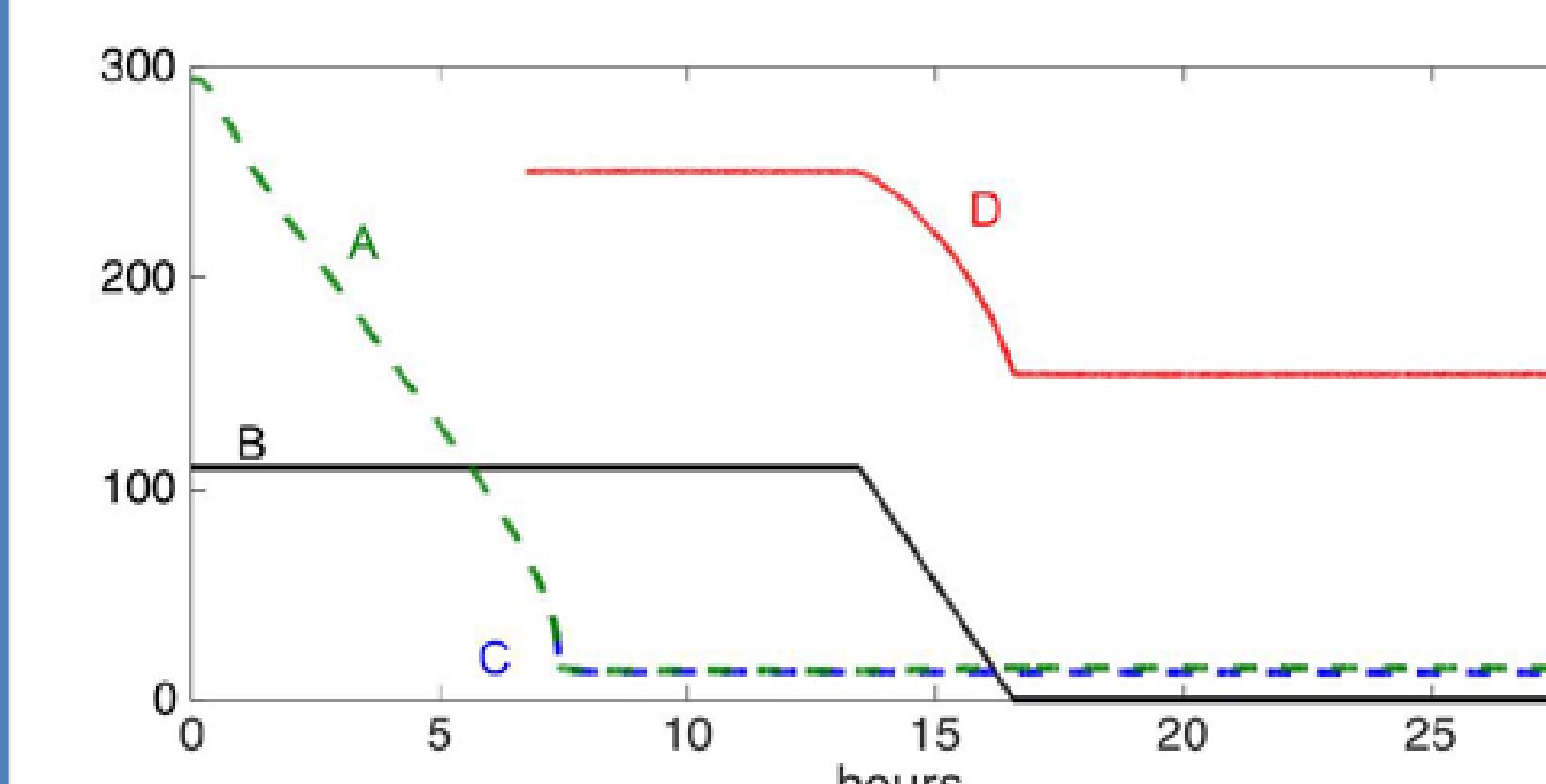


- Resistive magnet with custom poles
- max field about 1 T
 - vacuum chamber (316L and Al)
 - liquid free cryostat
 - controlled cylinder temperature
 - minimum temperature <15 K
 - field on the cylinder $\Delta B/B < 2 \cdot 10^{-3}$

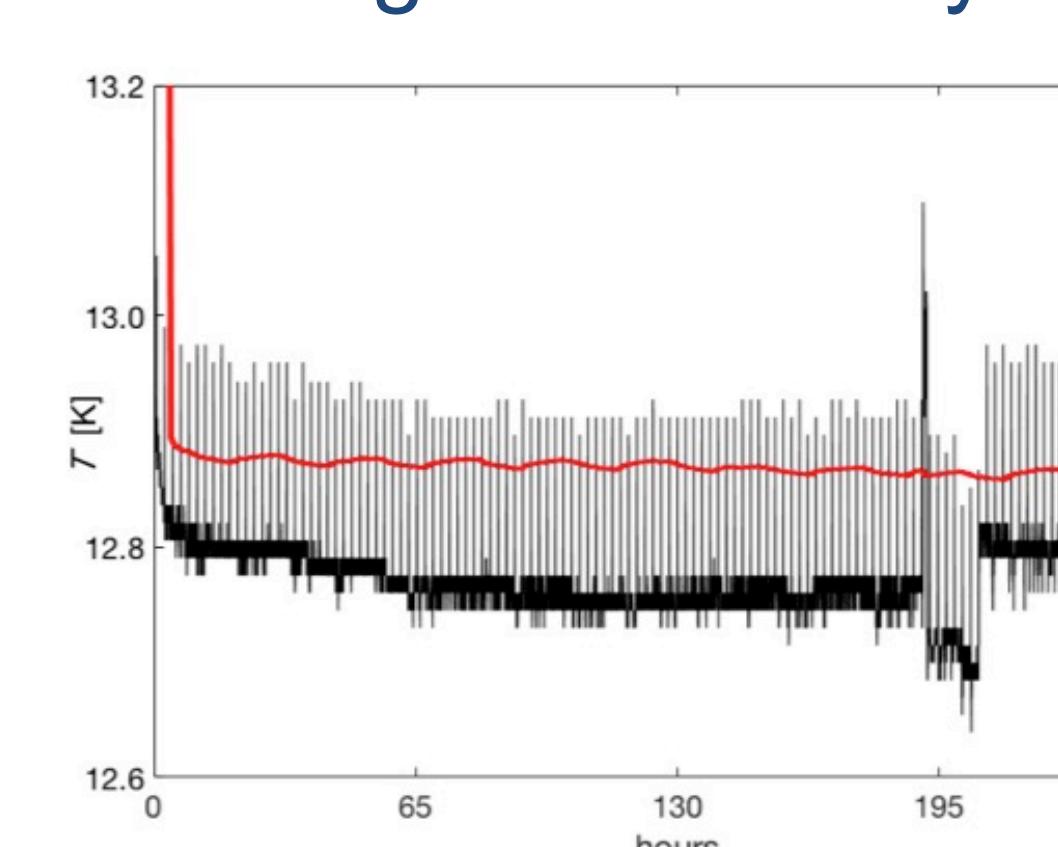
further details in M. Statera, M. Contalbrigo, G. Ciullo, P. Lenisa, M. Lowry, A. Sandorfi, "A Bulk Superconducting Magnetic System for the CLAS12 Target at Jefferson Lab", IEEE Trans. On Applied Superconductivity, Issue 99 (2015)
M. Statera, et al., "A bulk superconducting MgB2 cylinder for holding transversely polarized targets", NIM-A 882, Pages 17-21 (2018)

MEASUREMENTS

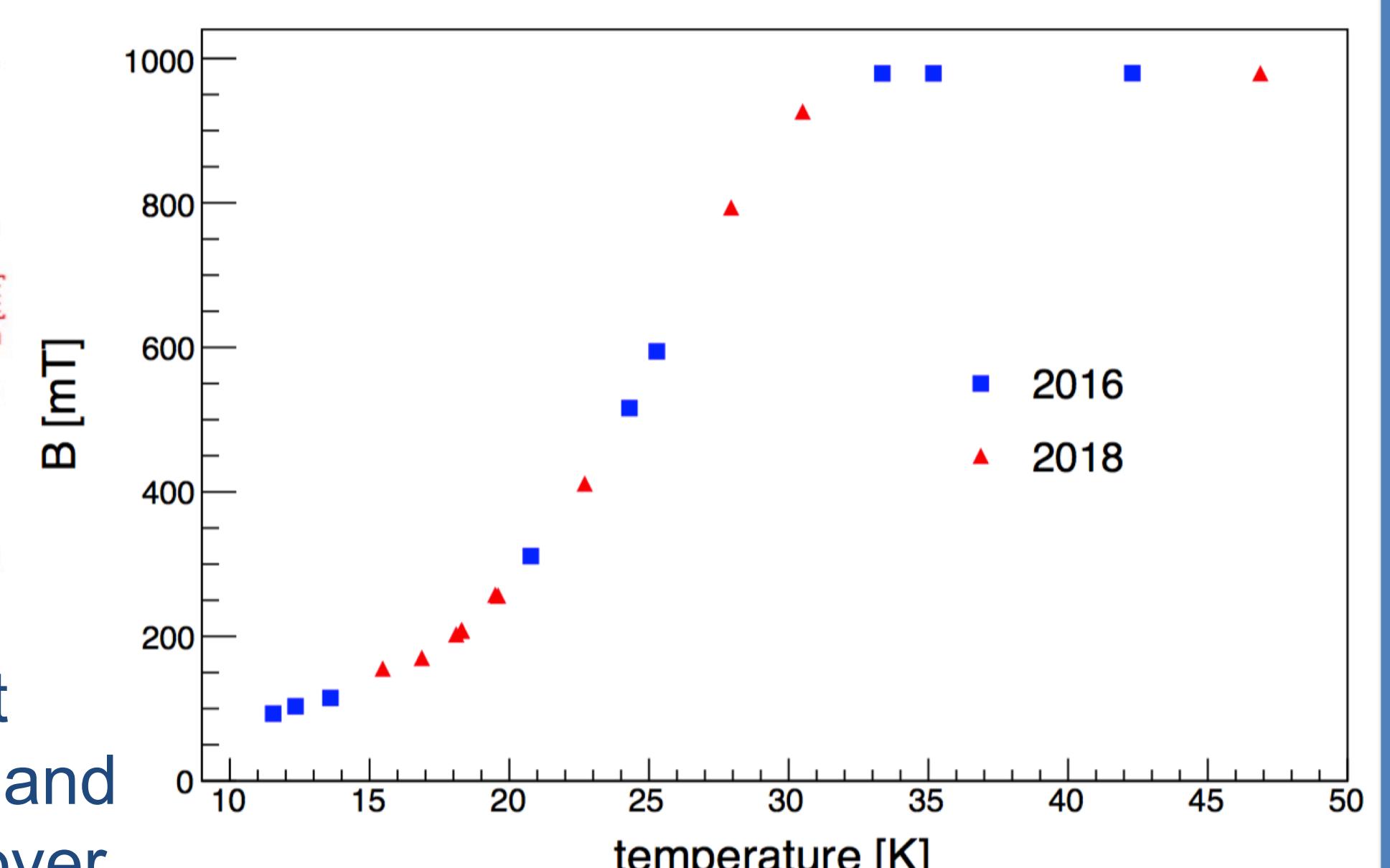
Typical cycle



Long term stability



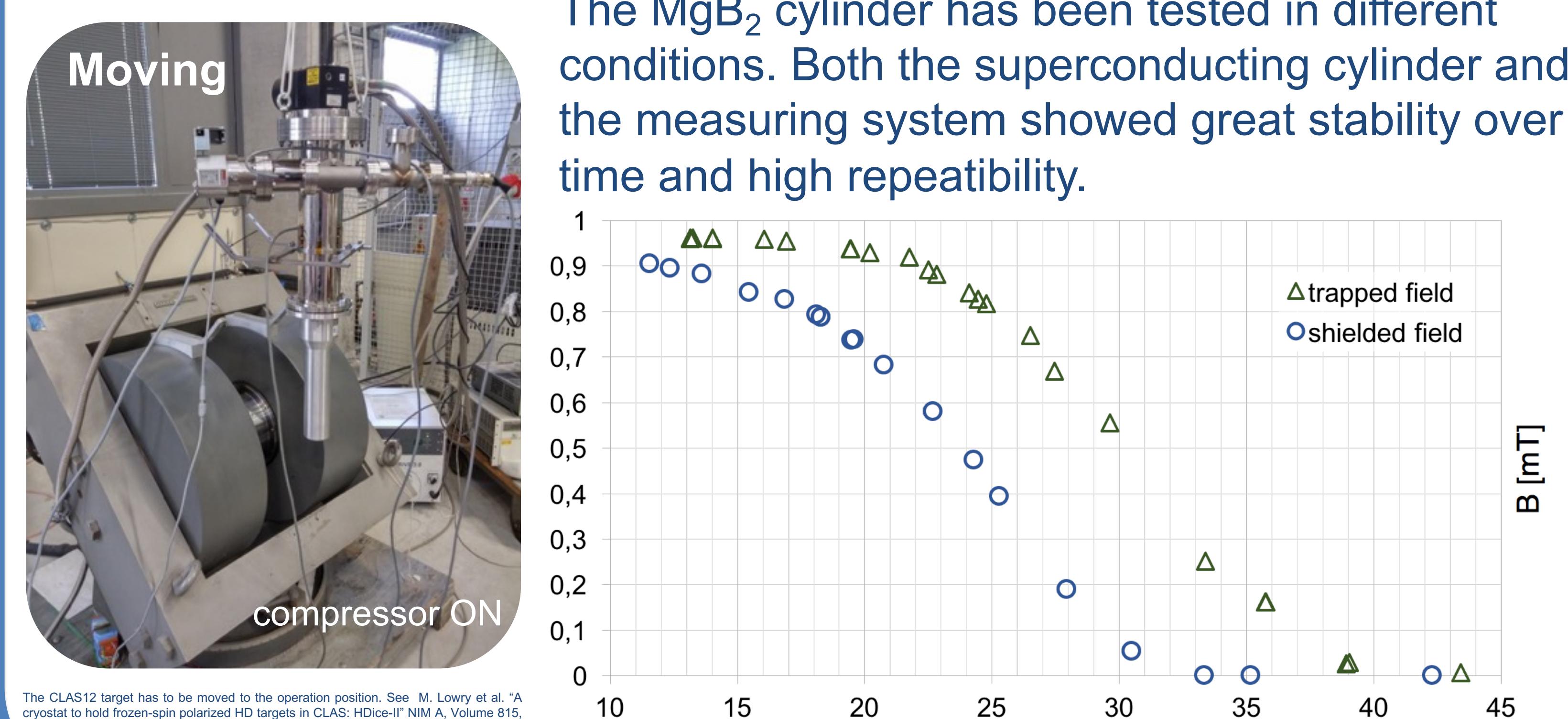
Transverse shielding



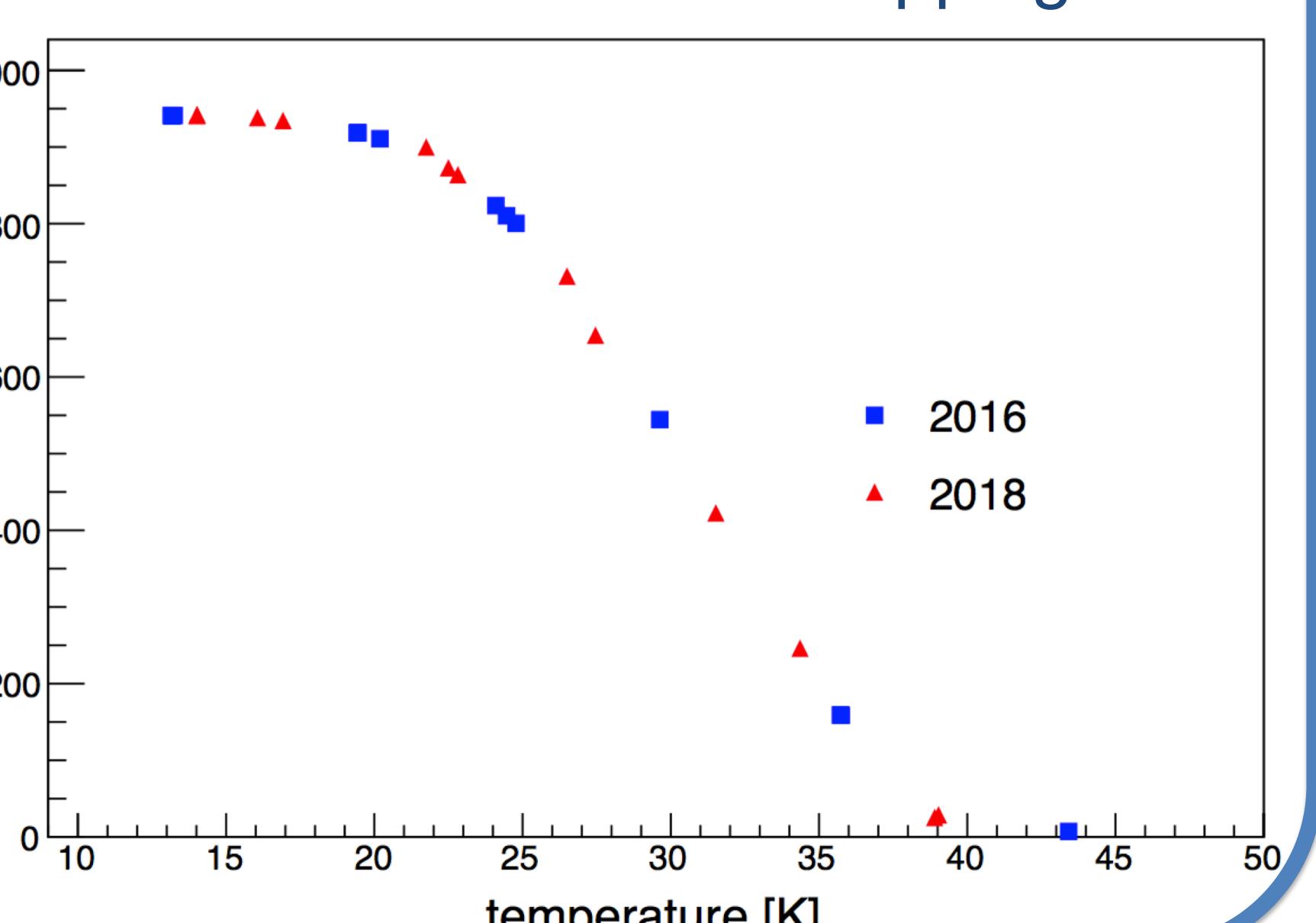
The MgB₂ cylinder has been tested in different conditions. Both the superconducting cylinder and the measuring system showed great stability over time and high repeatability.



The CLAS12 target has to be moved to the operation position. See: M. Lowry et al. "A cryostat to hold frozen-spin polarized HD targets in CLAS: HDice-II" NIM A, Volume 815, 11 April 2016

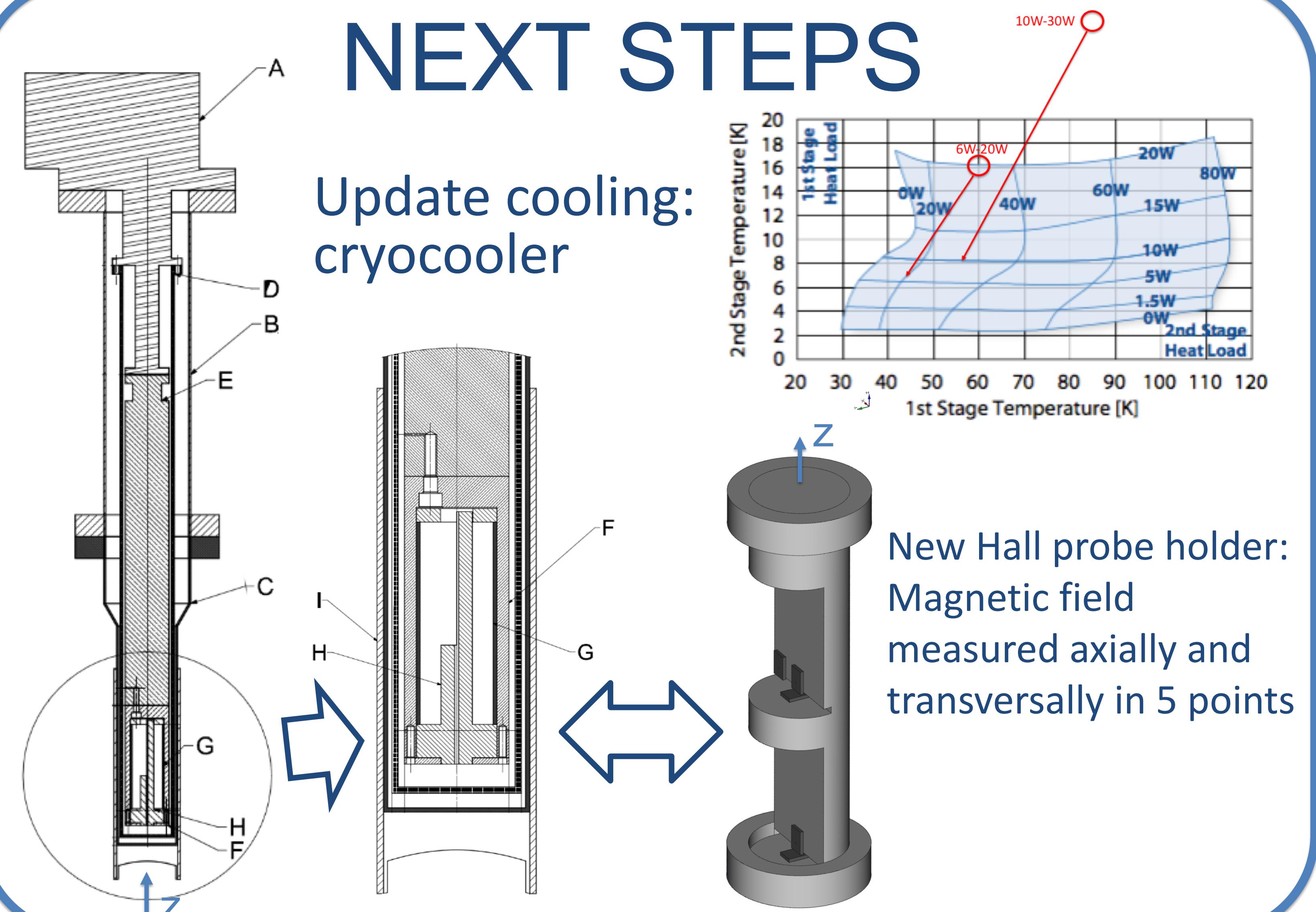


Transverse field trapping



NEXT STEPS

Update cooling:
cryocooler



New Hall probe holder:
Magnetic field
measured axially and
transversally in 5 points

CONCLUSION

The performance of an apparatus dedicated to a preliminary feasibility study for the insertion of a superconducting cylinder to maintain the transverse field for a transversely polarized target in a longitudinal field has been presented. Several tests of field trapping and field shielding on a Magnesium Diboride cylinder have been performed and the system showed great reproducibility and stability. Also after a second assembly of the system, the reproducibility is very good.

- Temperature down to 11 K
- Trapped transverse field 942 mT
- Great stability over time

The limitation of the apparatus is due to the external resistive magnet, whose maximum transverse field is 980 mT, and the cooling power of the cold head.

A new cryocooler is going to be installed, together with a new Hall probe holder, in order to reach a higher magnetic field induction and to measure it in 5 points in the cylinder volume. This feasibility study has demonstrated that a MgB₂ cylinder has the features essential for the installation of a transversely polarized target into the CLAS12 detector at Jefferson Lab, i.e. good stability over time together with the stability in case of movement. The ongoing update is a first step toward a test of dual operation, a field trapping in transverse direction during a shielding in longitudinal direction.