World`s highest field actively shielded split coil magnet for neutron scattering

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Demand for actively shielded split coil magnets for scattering methods

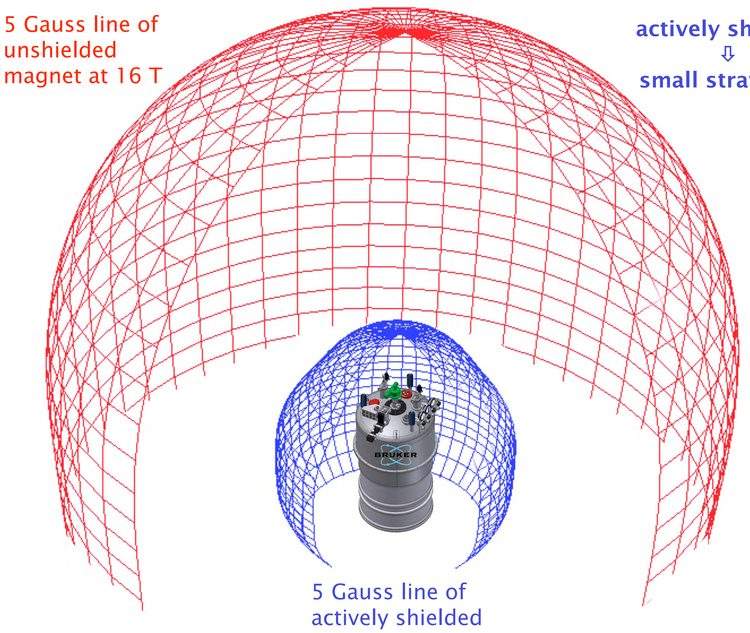
Requirements for neutron scattering:
- high magnetic fields
- open access (→ split coils)
- no large forces from surrounding materials (→ small stray fields)
- no crosstalk with other instruments (→ small stray fields)
- field sensitive devices (He-3 polarizers, photomultipliers) (→ small stray fields)
- polarized neutrons (→ asymmetric option, small stray fields)

Requirements for synchrotron radiation:
- high magnetic fields
- open access (→ split coils)
- no large forces from surrounding materials (→ small stray fields)
- no crosstalk with accelerator (→ small stray fields)

Split coil magnets for neutron scattering

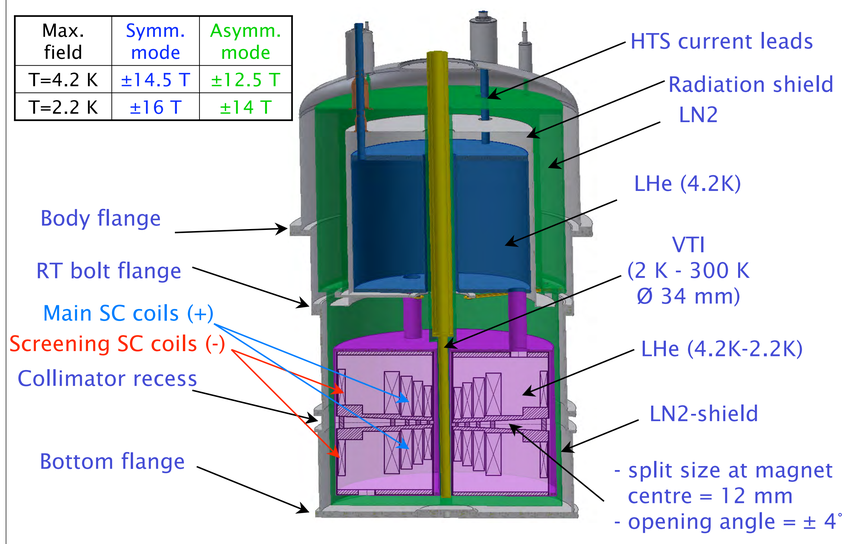
Field	*Location*	*Comments*
≤ 12 T	NIST, LANSCE, ILL, ESRF, JAERI, FRM2, ILL, ISIS, PSI, …	non-shielded
14.9 T	HMI, ILL, PSI, FRM2	non-shielded (Oxford)
16.0 T	**SNS (2009)**	**actively shielded**

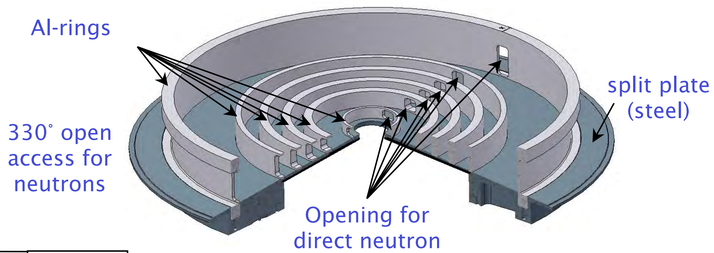
Stray fields: shielded *vs* unshielded magnets

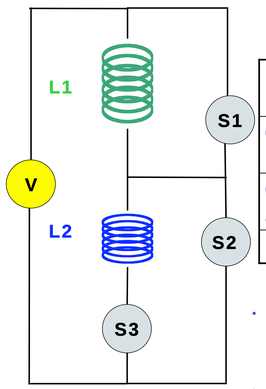


Concept of actively shielded split coil magnet

Max. field	Symm. mode	Asymm. mode
T=4.2 K	±14.5 T	±12.5 T
T=2.2 K	±16 T	±14 T



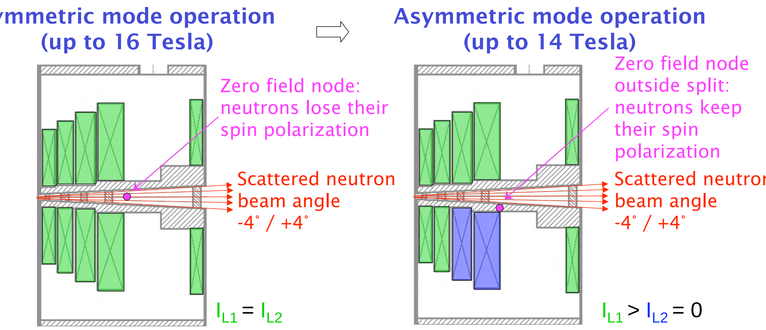




	Switch S1	Switch S2	Switch S3
Charging/discharging in symmetric mode	OPEN	OPEN	CLOSE
Charging/discharging in asymmetric mode	OPEN	CLOSE	OPEN
Persistent mode	CLOSE	CLOSE	CLOSE

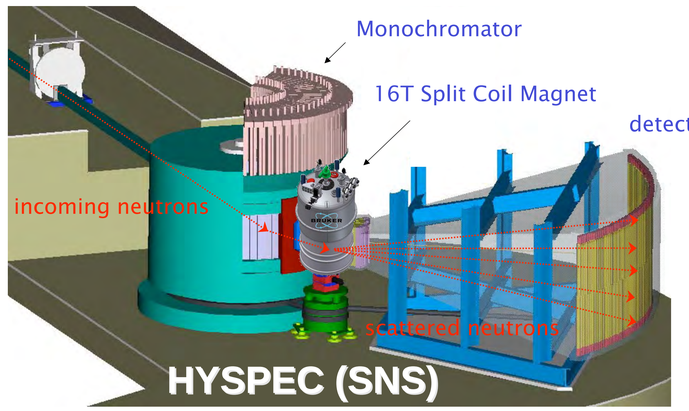
- Field homogeneity:
  < 5000 ppm in 10 mm DSV (symmetric mode)
  < 15000 ppm in 10 mm DSV (asymmetric mode)
- Field stability (persistent mode): < 0.02%/hour
- LHe hold time ≥ 1 day at 2.2 K
  ≥ 4 days at 4.2 K
- LN_2 hold time ≥ 4 days at 4.2 K
- Ramp time to field: ≤ 110 min to 14.5 T at 4.2 K
  ≤ 240 min from 14.5 T at 4.2 K to 16 T at 2.2 K (including cooling to 2.2 K)
- Maximum admissible cryostat tilt (at 16T) = 2°

Polarized neutrons - asymmetric mode operation



Conclusions / Outlook

- Design review with customers took place in January 2008
- 1. quarter 2008 - 3. quarter 2008: construction of magnet system
- 3. quarter 2008 - 1. quarter 2009: magnet tests at Bruker and at PSI
- 2. quarter 2009: delivery to the Spallation Neutron Source (Oak Ridge, USA)



Acknowledgments

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