Lessons Learned : Commissioning the 17T Birmingham Cryomagnet

PRESENTED BY ALEX HOLMES

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The Birmingham 17 T magnet for small angle neutron/X-ray scattering

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Max field 17 T, parallel to beam

Temperatures 60 mK – 300 K
±10° access entry and ±11° exit

0.1% uniformity in B over 1 cm^3

In-situ sample change
(by trained operator)

Room temperature access
to bore (with additional insert)

Very low background

Fast cooldown (~20 mins 300K to base) and field ramp (40 mins to 17 T)

400 kg with cryogens

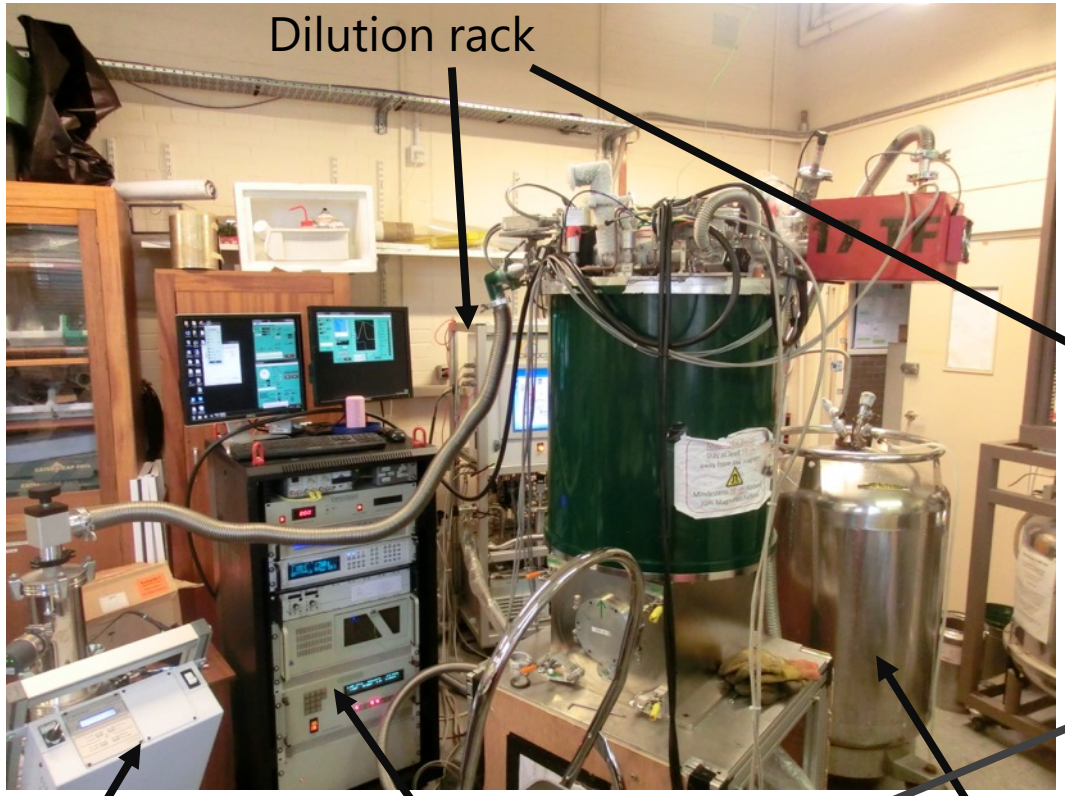
Labview running on PC with RS232 connection to facility

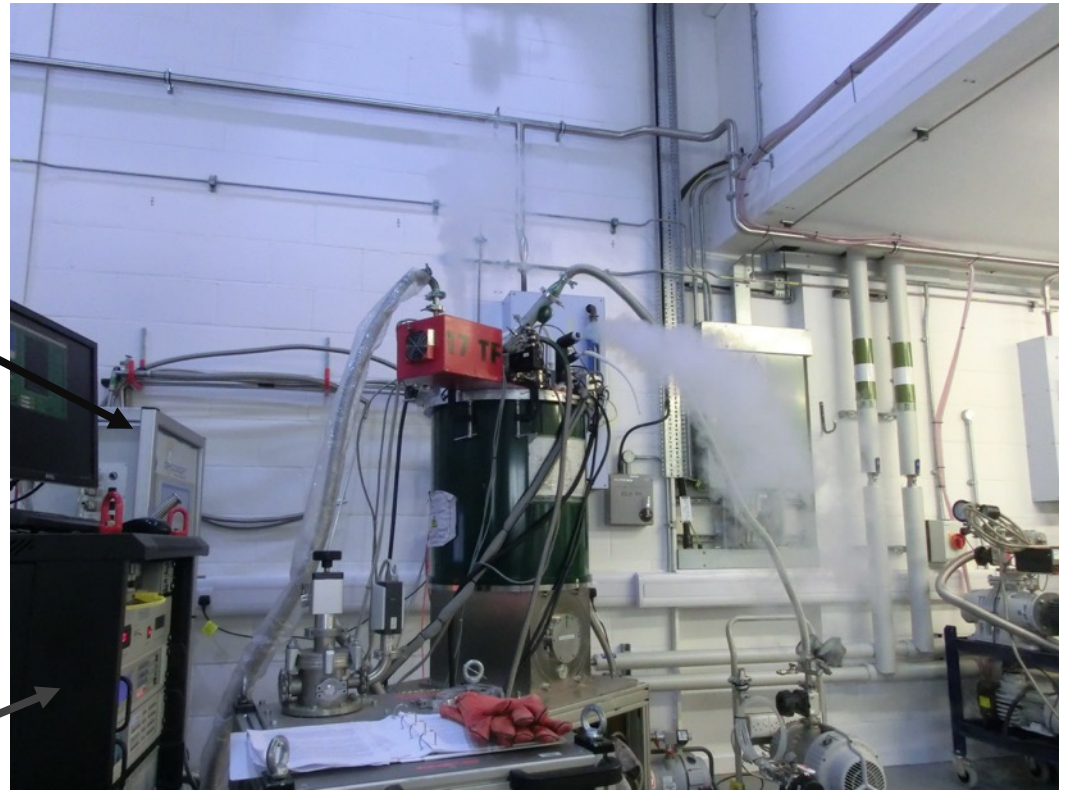
Rev. Sci. Instrum. **83**, 023904 (2012

Magnets come with lots of additional crap!

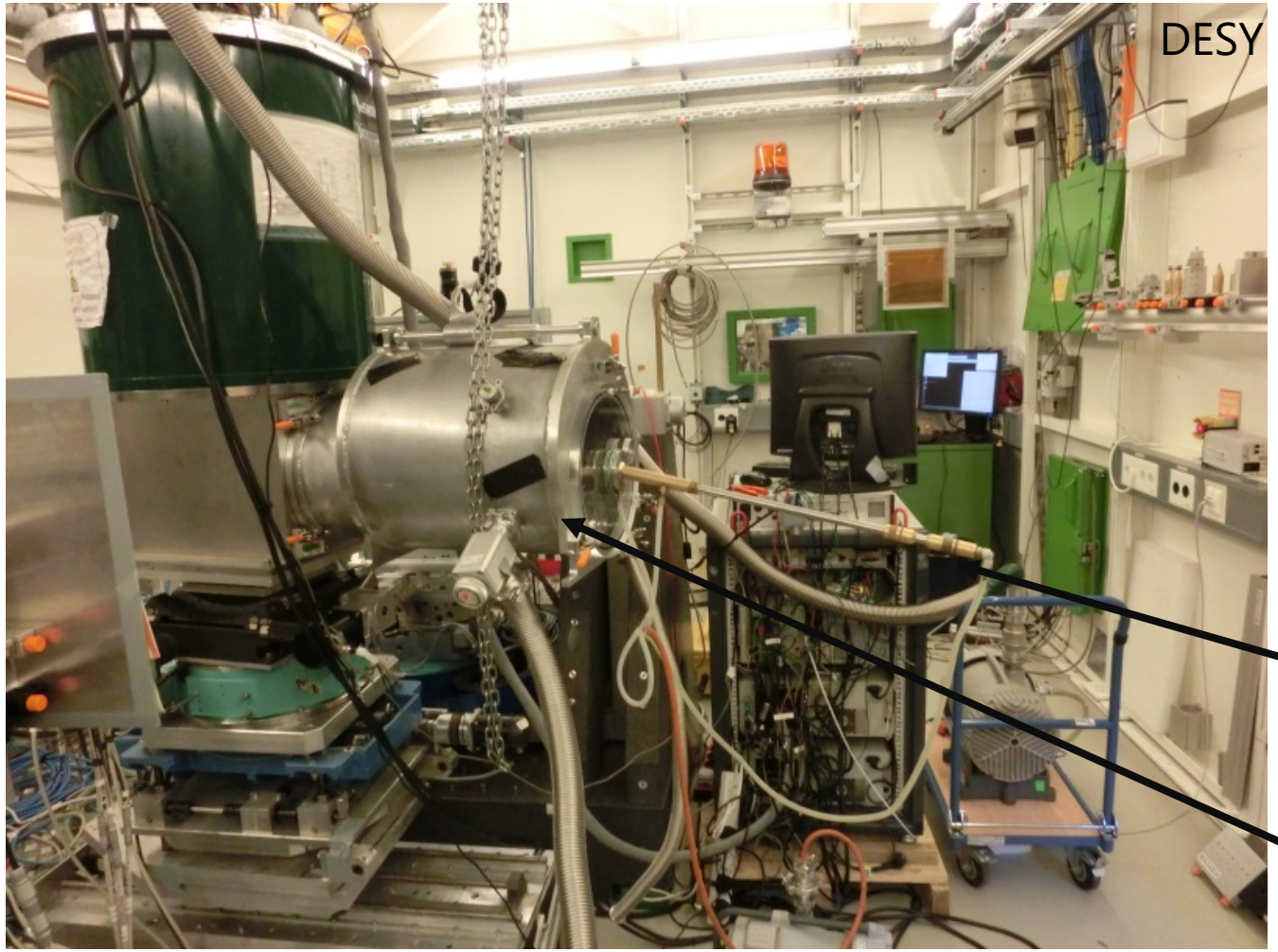
Birmingham Lab setup

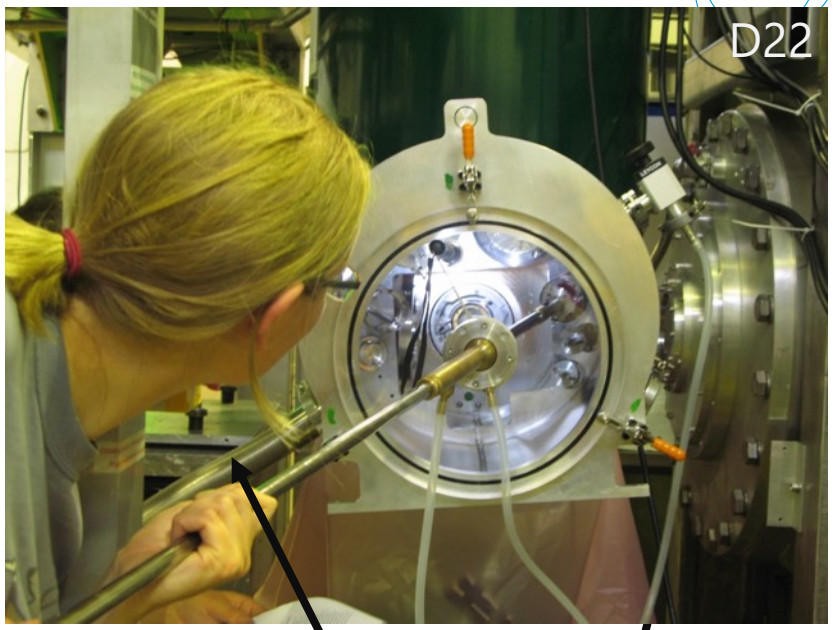
ISIS prep area setup





Sample change





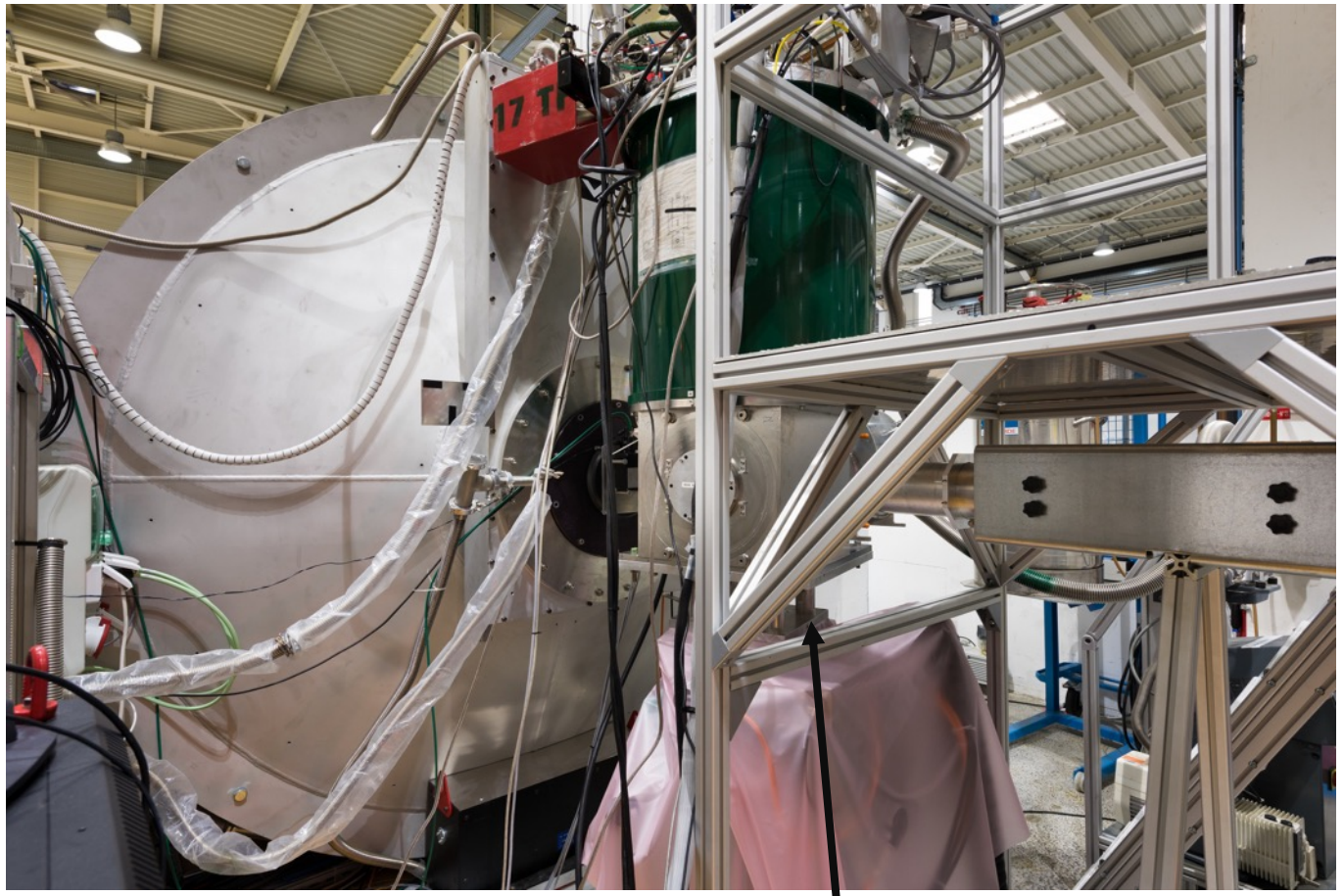
Manipulator rod

Manipulator vacuum chamber

Needs 90° rotation, lots of space.

Installation at D33 (ILL)

Rolling by hand



Adapter to match centre of rotation of sample stage

How to do an experiment at a new facility

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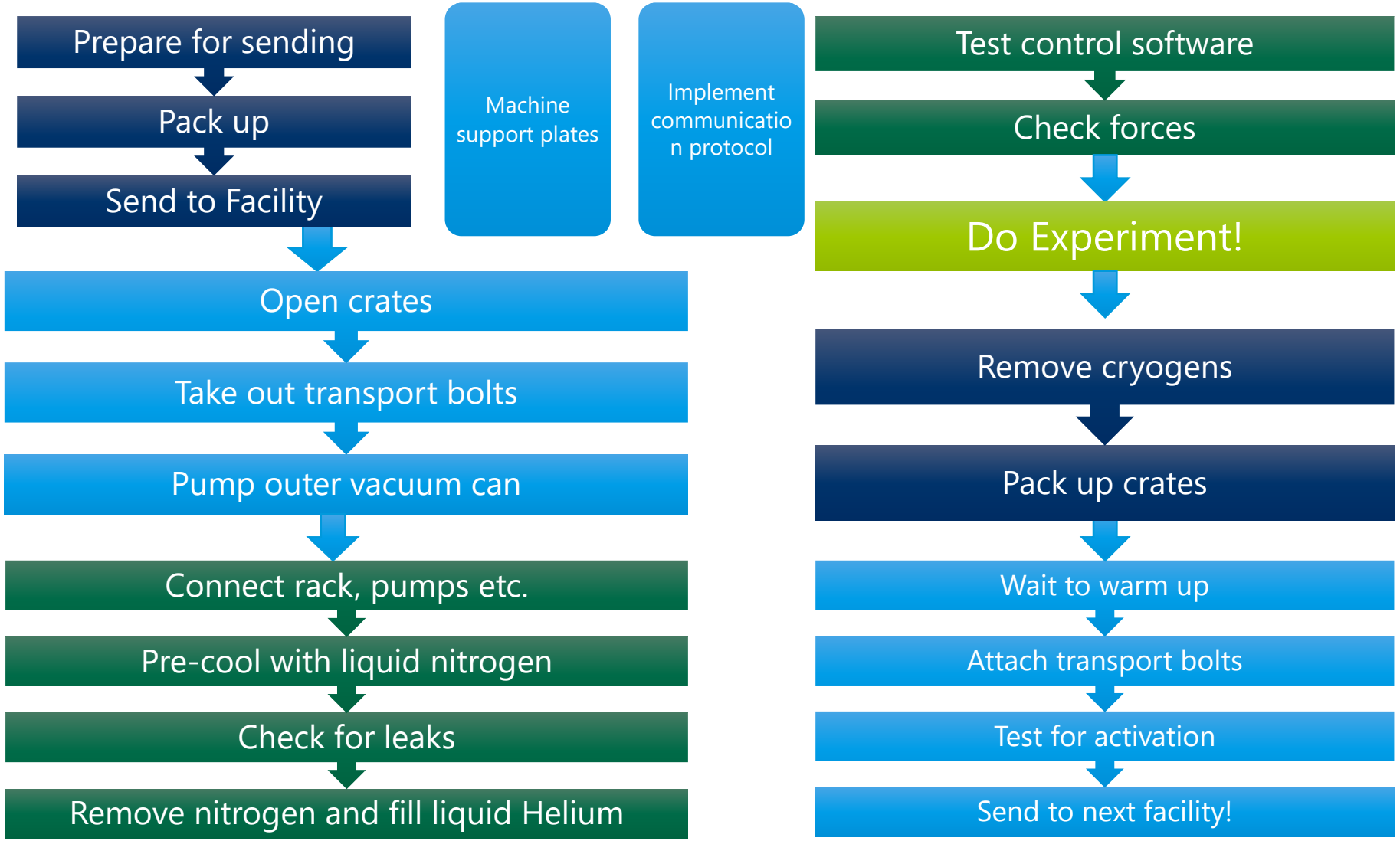

Things to solve

Adaptor/motion

- Design + Workshop time
- Motion stage (non-magnetic, motors at safe distance!)
- Needs chunky z stage.

Utilities

- Power
- He recovery
- Grounding

Integrate communications

- Get list of commands
- Include in User Interface
- Check communications
- Test every command
- Ensure metadata saved with measurements

Cryogenics

- Nitrogen filling/precooling
- Helium filling logistics (off beam & on beam). Special siphon needed? Height differences? How to pressurise dewar?
- He4 Pumping cart
- Turbo cart
- Quench?

Vacuum

- No leaks in magnet
- No leaks to tank? (top loaders)

Safety

- Magnetic Field (Warning signs, lights, 5 G line marking)
- ODH
- Physical - craning 400kg full of cryogens

Force testing

- Testing rig
- Forces unacceptable - change components, or limit field

Sample change (17TF specific)

- Rotation ~90°
- Turbo cart
- Space

Alignment/Background

- Sample position/orientation
- Field orientation (Nb FLL)
- Neutron absorbers

Lessons learned

'Non-magnetic' is not necessarily non magnetic (72 screws, drive shaft on a Huber stage!)

Ensure rarely used/user equipment survives software upgrades, it may not be there at your convenience for testing.

Replaced Sapphire with Silicon windows – former looks OK on monochromatic source, messy on TOF.

Watch out for metadata with user equipment, easy to forget and only realise afterwards.

Stray field effects might not just be forces:

- Beam monitor photomultiplier (SANS2D)
- Reed switches on gate valve (D11/D33)
- Motors need removing (NG7, ouch!)
- Eddy currents in choppers (IN5)
- Polarisation sensitivity to remnant field. (IN20…)

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