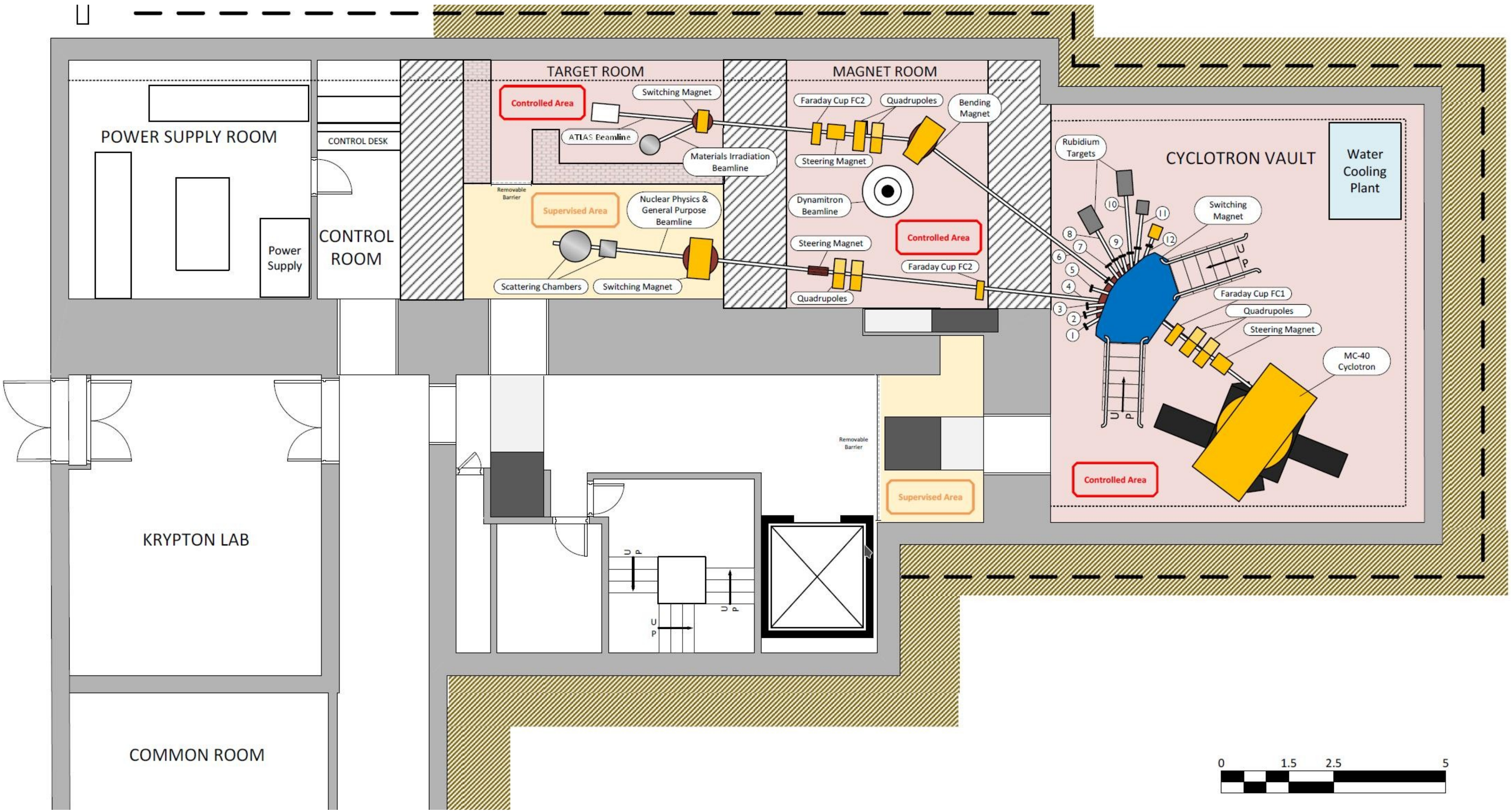
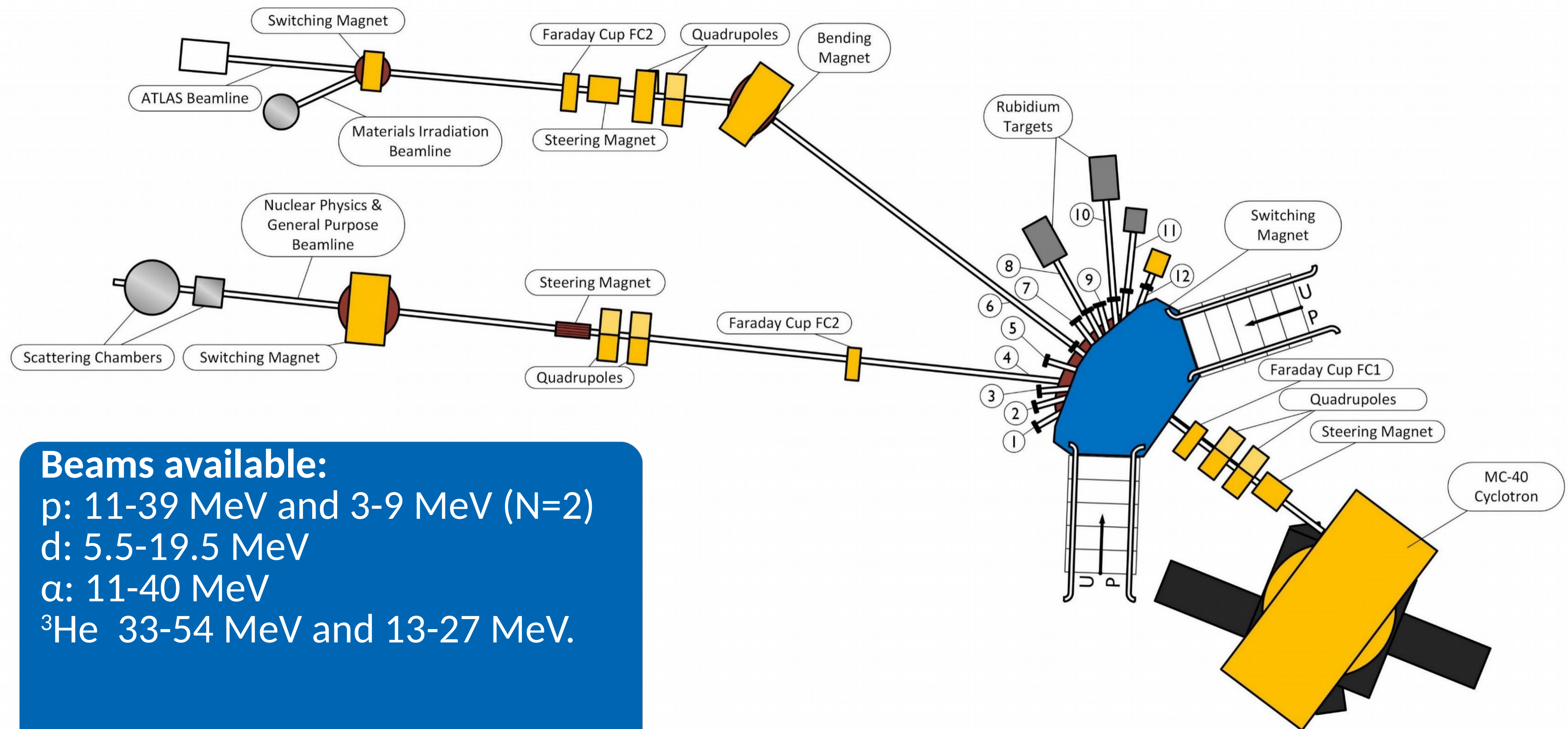
A national user facility – the Birmingham accelerators

Carl Wheldon

Current basement layout



Current cyclotron beam lines

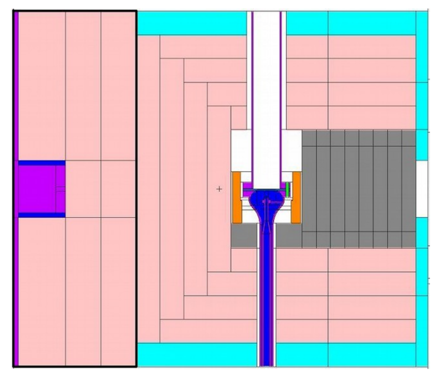


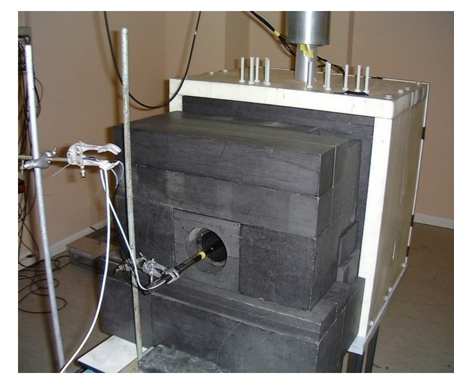
Beams available:
p: 11-39 MeV and 3-9 MeV (N=2)
d: 5.5-19.5 MeV
α: 11-40 MeV
^{3}He 33-54 MeV and 13-27 MeV.

Also 46 MeV $^{14}N^{4+}$ and 70 MeV $^{14}N^{5+}$ for nuclear physics.

The Dynamitron – present capabilities

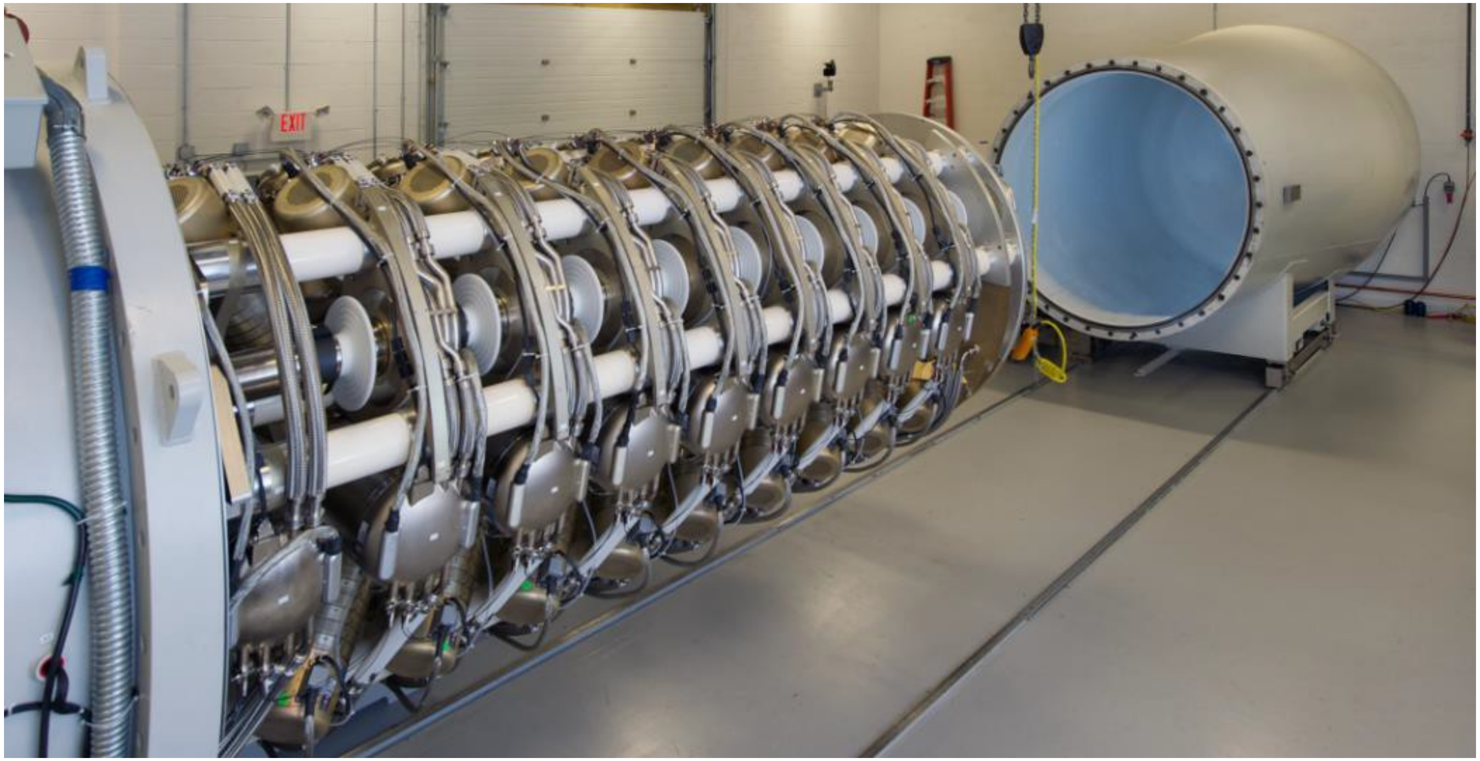
RDI 3MV Dynamitron
(1970 – v. soon)
3 MeV (1-2 mA) of protons on ^{nat}Li (B'ham developed target).
Neutron sources is > 1x10^{12} n/s at 1 mA at 2.8 MeV.
Peak epithermal fluence ~2x108 n/cm^{2}/s
This machine will retire in 2 years.





Current bid for replacement (top of NNUF priority list) neutron irradiation machine using protons or deuterons.

Future neutron facilitly



Hyperion: A single-ended electrostatic accelerator, 50 mA+ capability

Now sold by Neutron Therapeutics as part of accelerator BNCT facilities, including a developed high power Li target.

Easily achievable levels - Standard Hyperion Dynamitron at 30 mA protons specified

Neutron Therapeutics target –
fast neutrons at 1.8×10^{11} n/cm^2/s.

Thermal neutrons at 6.6×10^{9} n/cm^2/s
(200 x more intense than available at NPL)

Summary proposal

Phase 1 (years 1 and 2)

Building alteration and hardware procurement

Accelerator delivery and installation

Work-up to 30 mA protons

Fast neutron fluence rate of 2 x 10^{11}n/cm^2/s

Thermal fluence rate of 6 x 10^9 n/cm^2/s

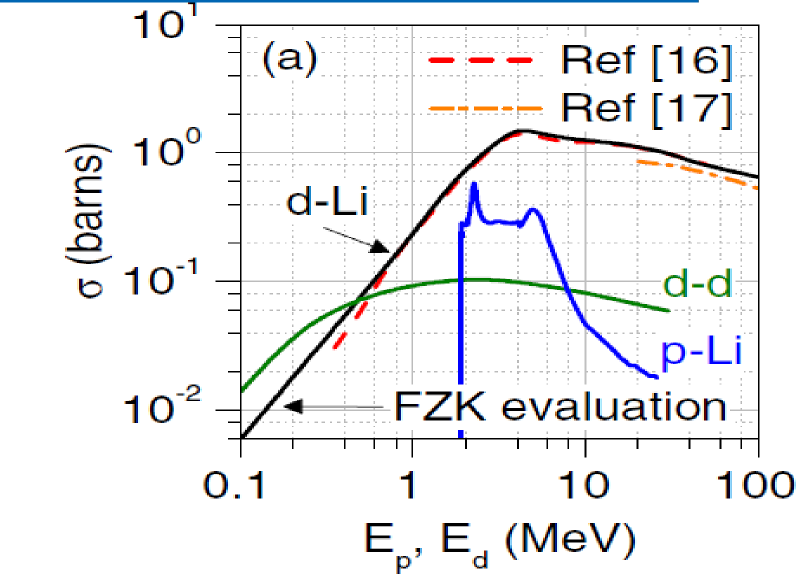


Fig 1. Neutron production cross sections as a function of energy, from [1].

Phase 2 (years 3-4)

Develop suitable ECR deuteron ion source

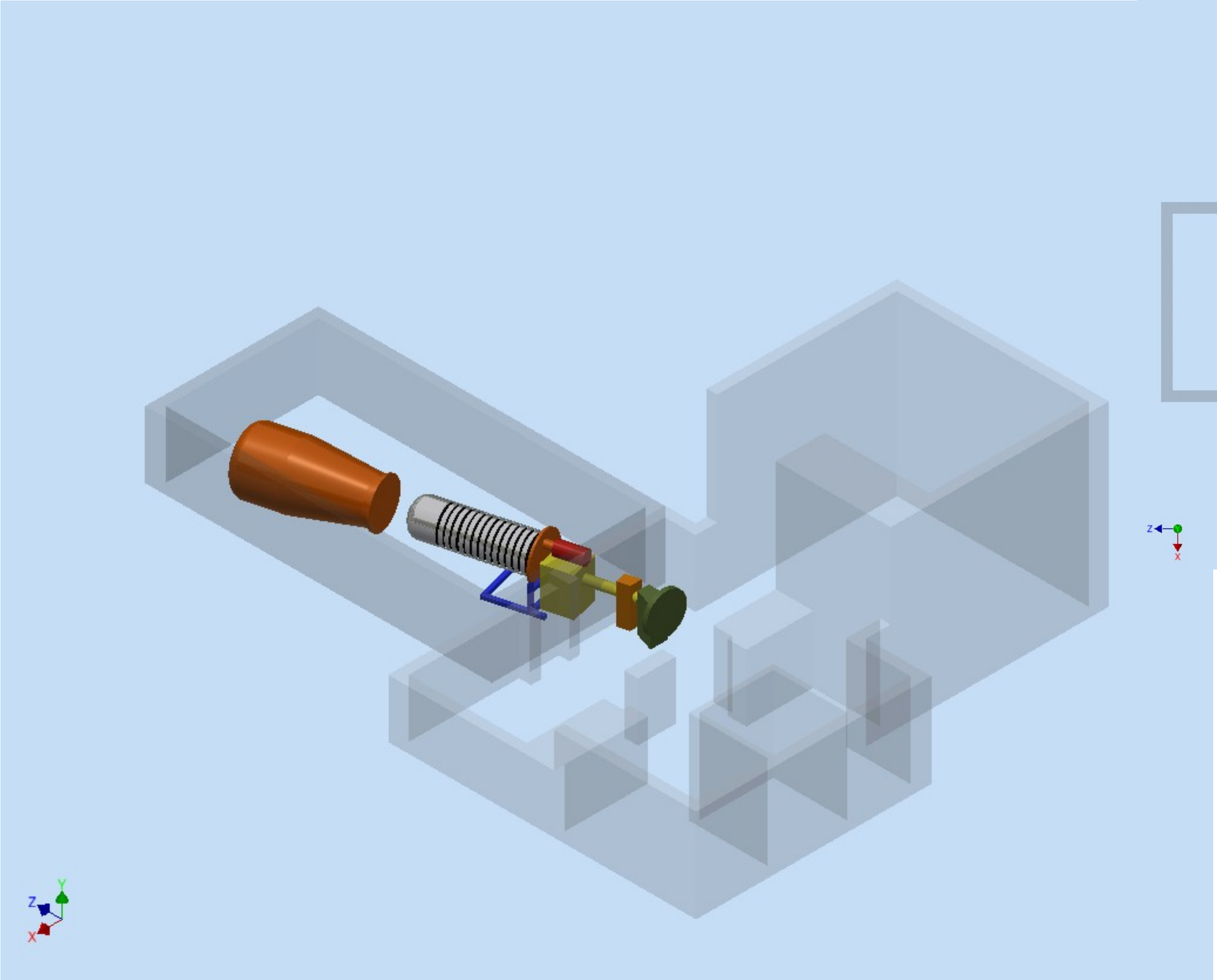
Model and test improved solid Li target

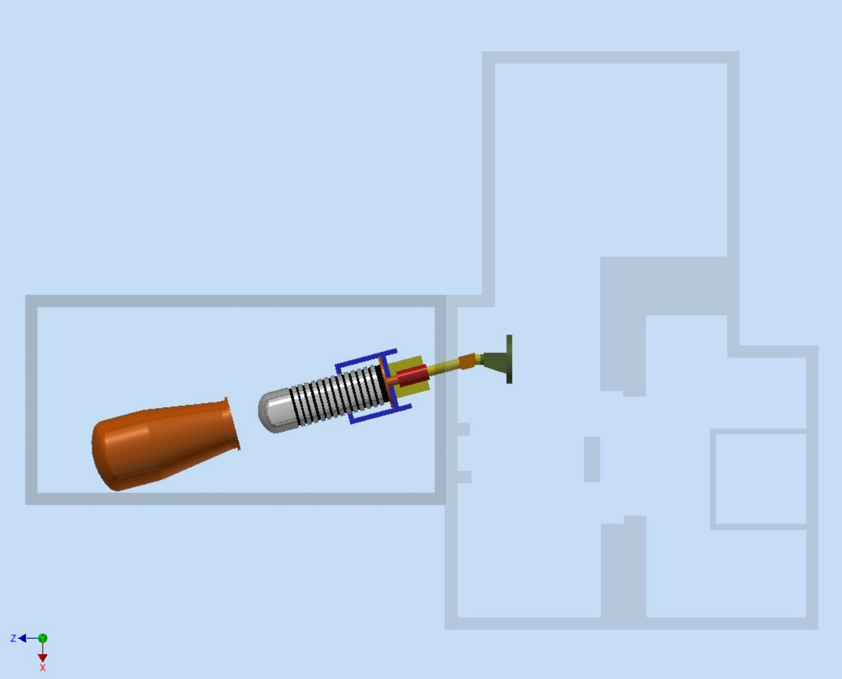
Negotiate access to compact liquid Li target if required

Phase 3(year 5) (separate funding)

Implement capability for approaching ~0.5 x 10^{13} n/cm^2/s

Building overview





Building offers opportunities for expanding the basement (MC40 cyclotron) level.

Future cyclotron opportunities

Neutron machine

Neutron facility building costs ~£1M (survey already completed).

Intense neutron source (much higher than NFS).

- r-process nuclei?

Cyclotron

Potential ECR source availability

- more space for beam lines with room for detectors etc. above neutron facility
- new ion source would offer many more than the current light-ion beams
- to adapt the MC40 would we would need to engage with a company such as IBA.
- funding of a feasibility study as first step?

Community support? – next steps?

Thanks for your attention.