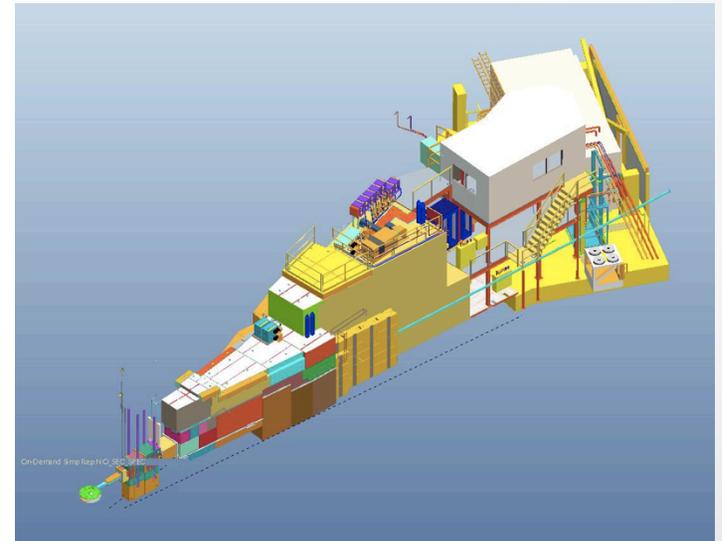
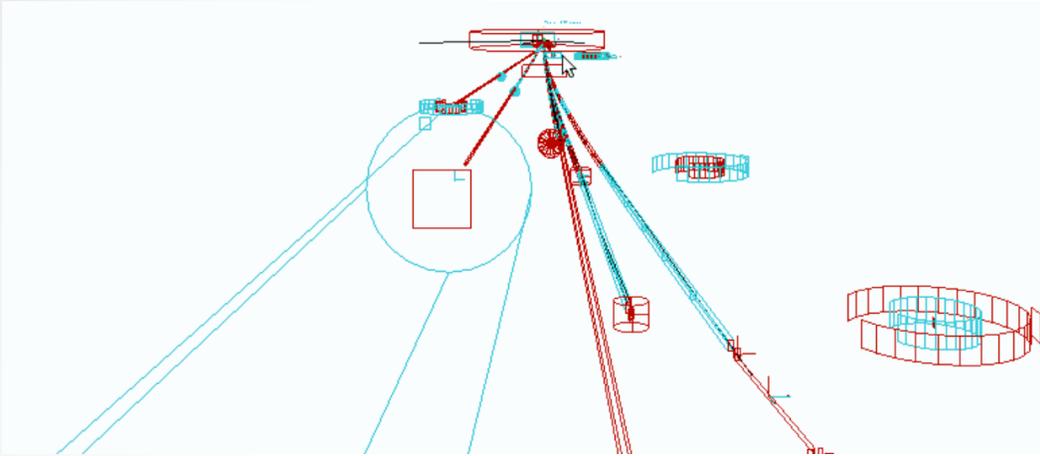


Constructability

Getting real ...

Robert McGreevy

These are the easy bits ...

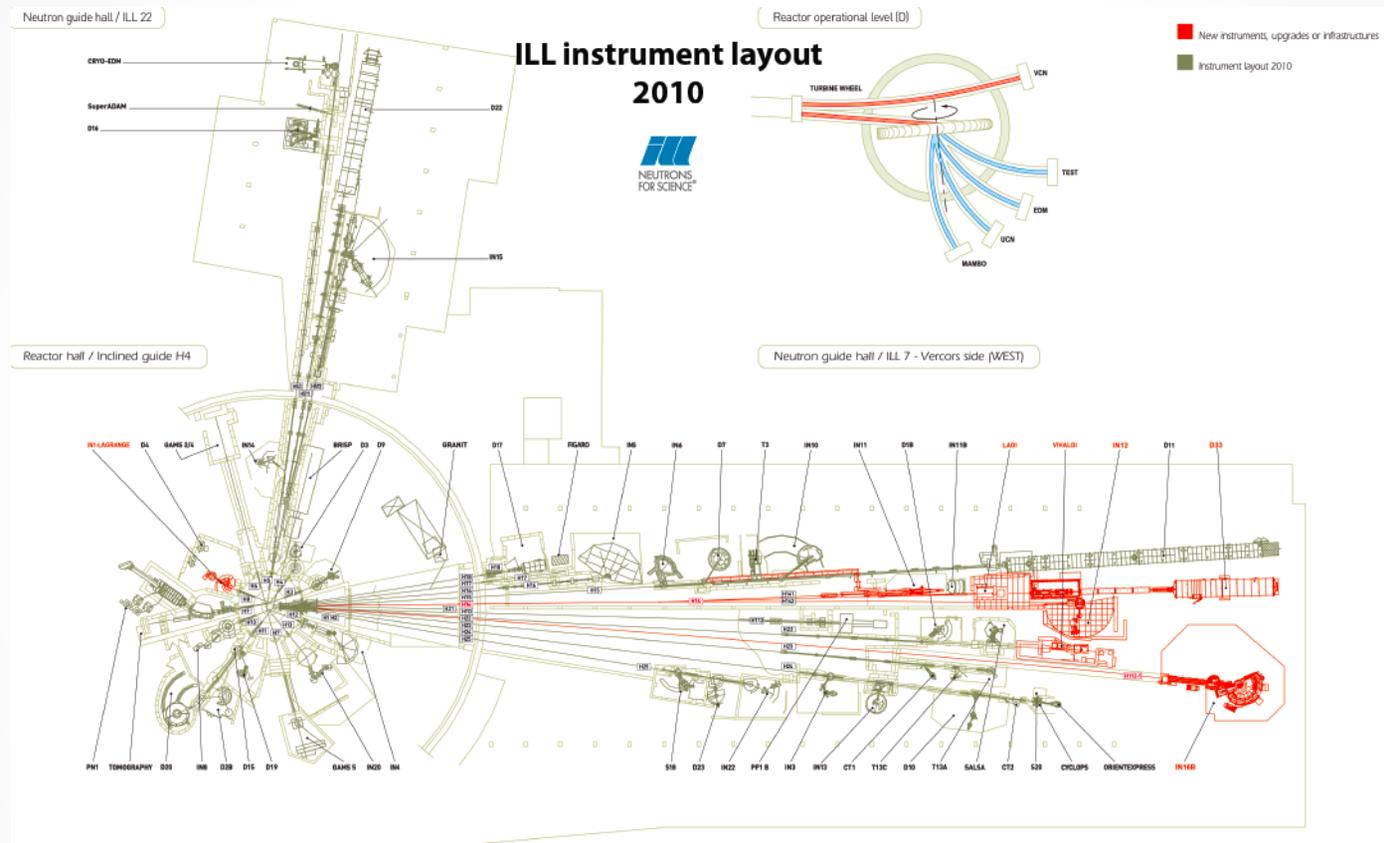


A real instrument will have a budget, and it will never be big enough ...

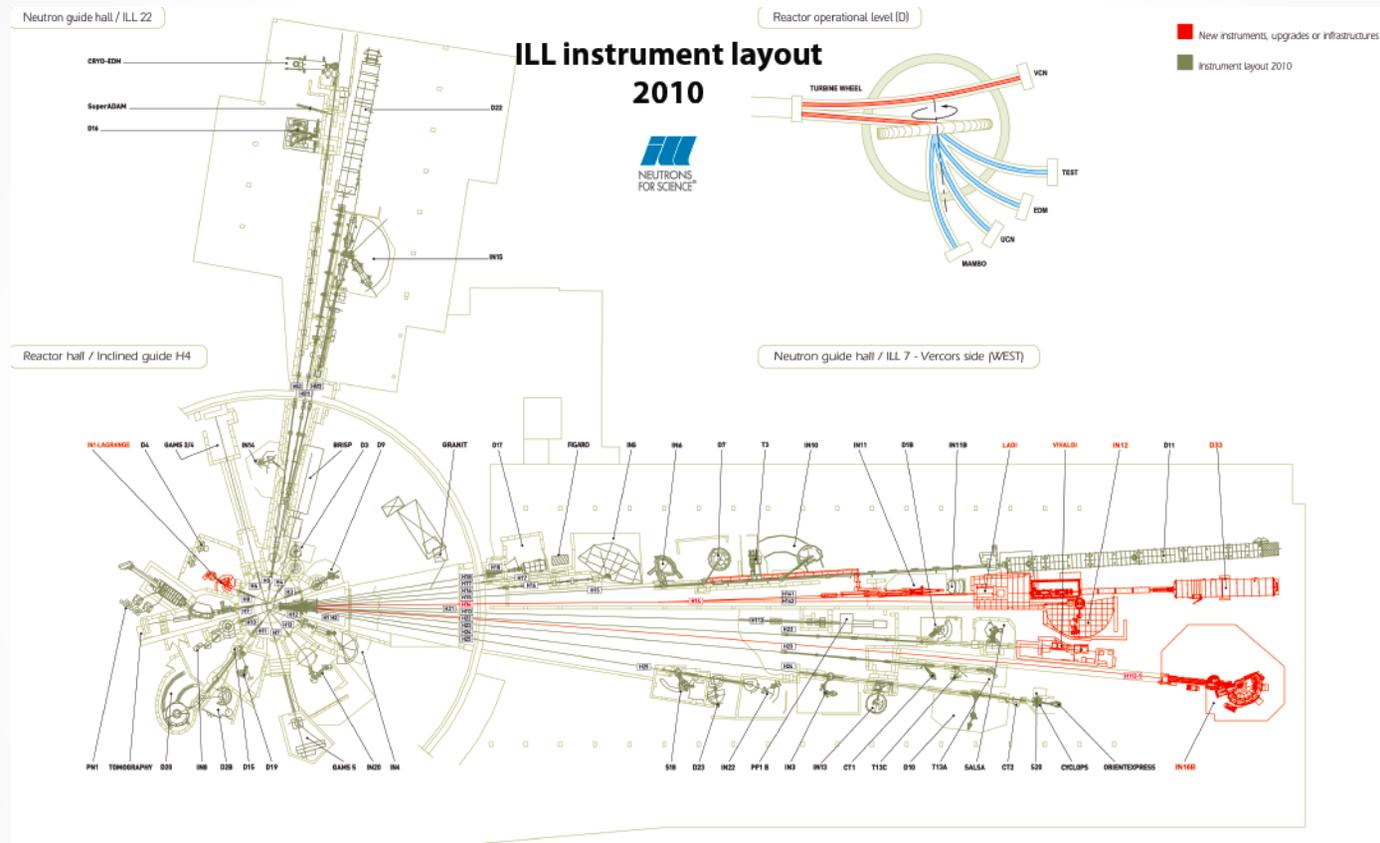


More later ...

Guides transformed neutron scattering

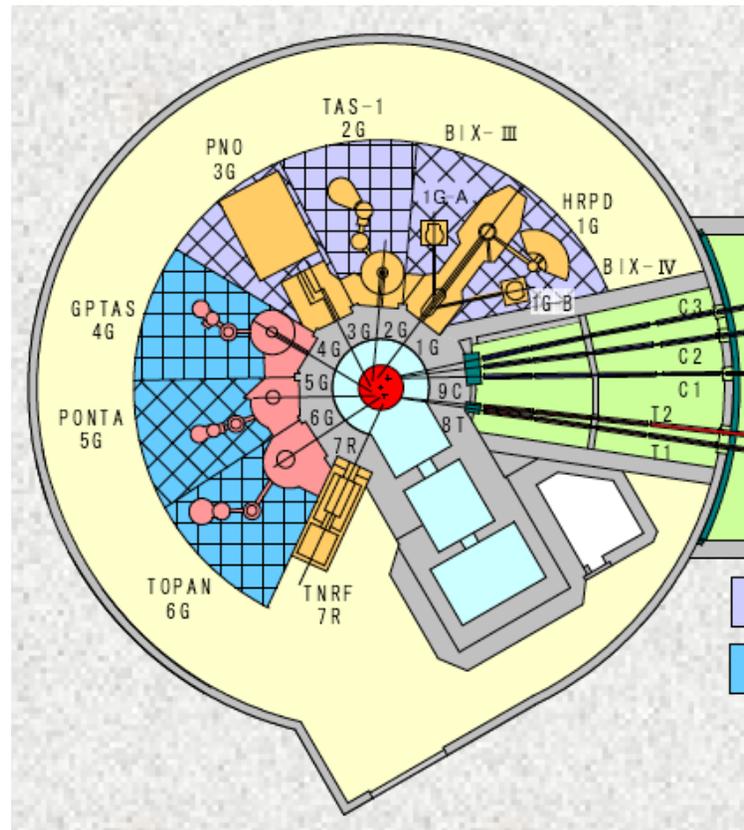


A real instrument will have to fit in a real space, and it will never be big enough ...



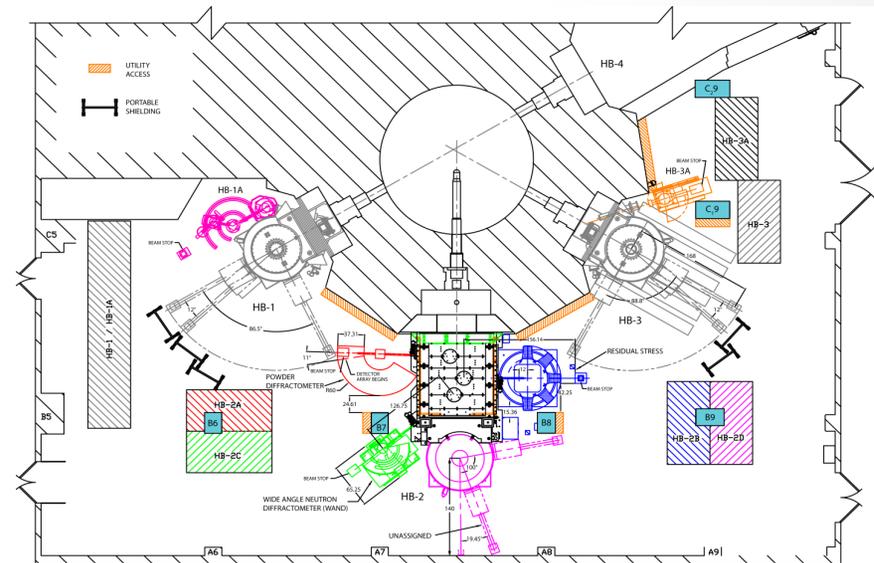
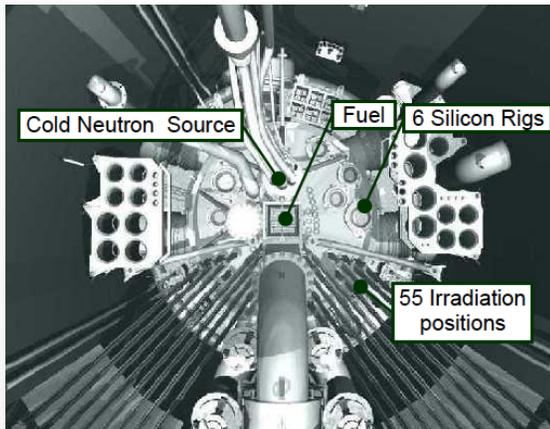
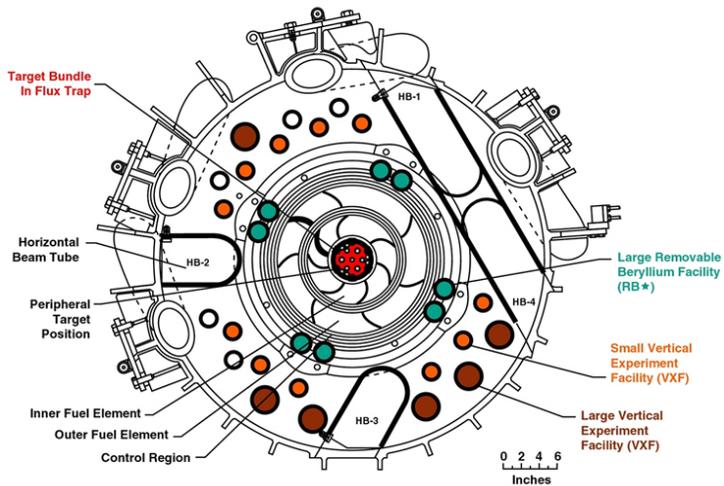
For many continuous source instruments, the length is not a parameter; for all pulsed source instruments it is.

A real instrument will have to fit in a real space,
and it will never be big enough ...



Continuous sources can build multiple (narrow bandwidth) instruments on a single
beamline, for pulsed sources you (generally) cannot

A real instrument will have to fit in a real space, and it will never be big enough ...



- Constructability

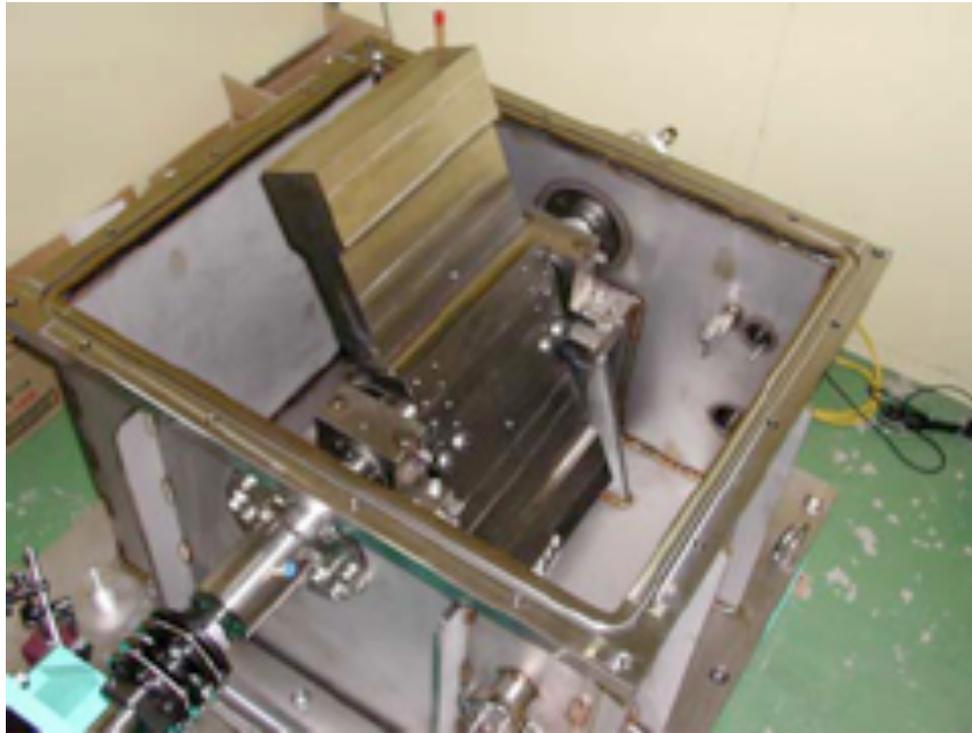
A real instrument will have to fit in a real space,
and it will never be big enough ...



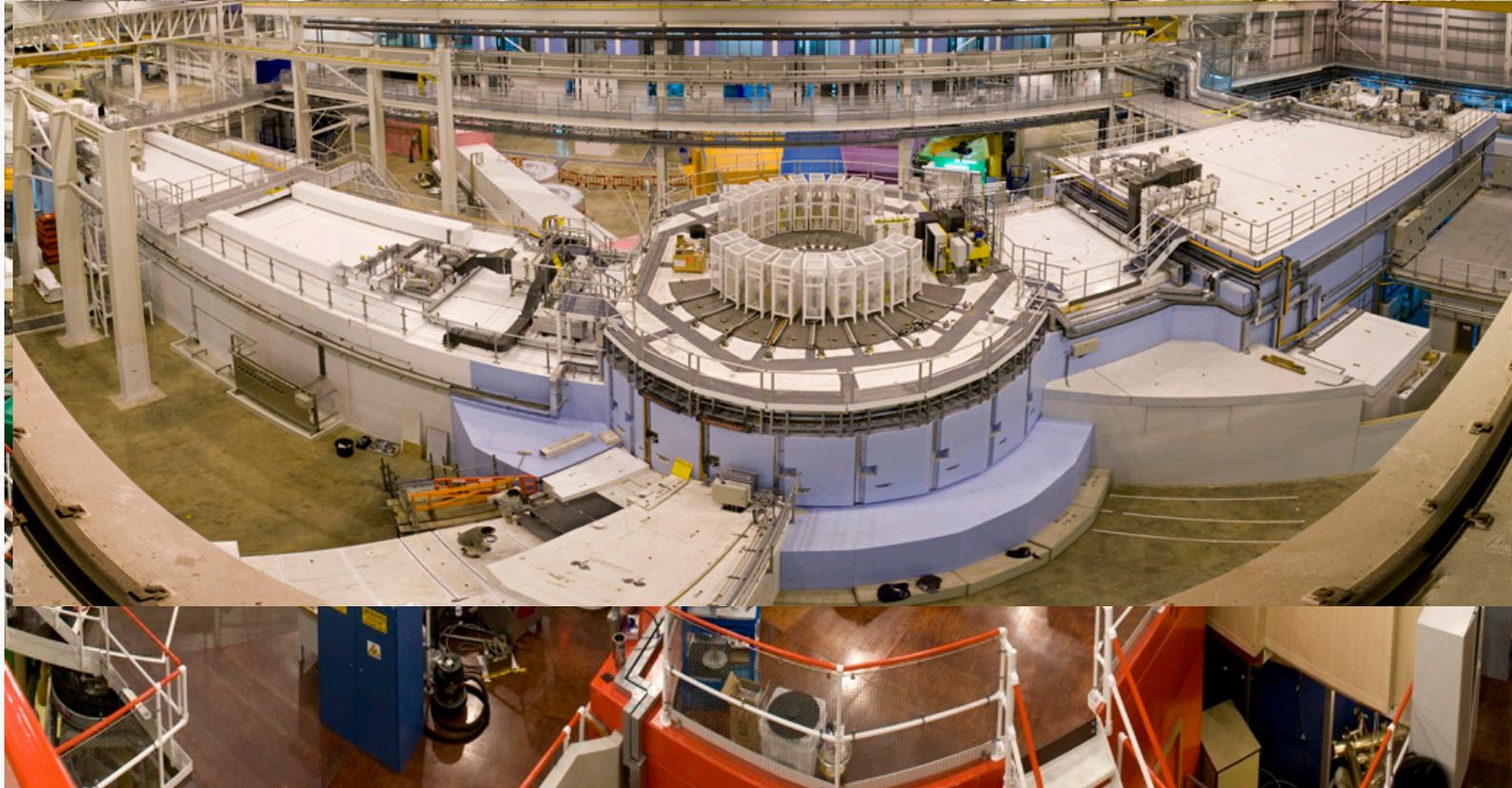
Unless yours is the first instrument ...

A real instrument will have to fit in a real space,
and it will never be big enough ...

T0 chopper 0.7m diameter + 2*0.6m shielding @ 11m = 18°



What is the most important piece of equipment in an instrument hall?



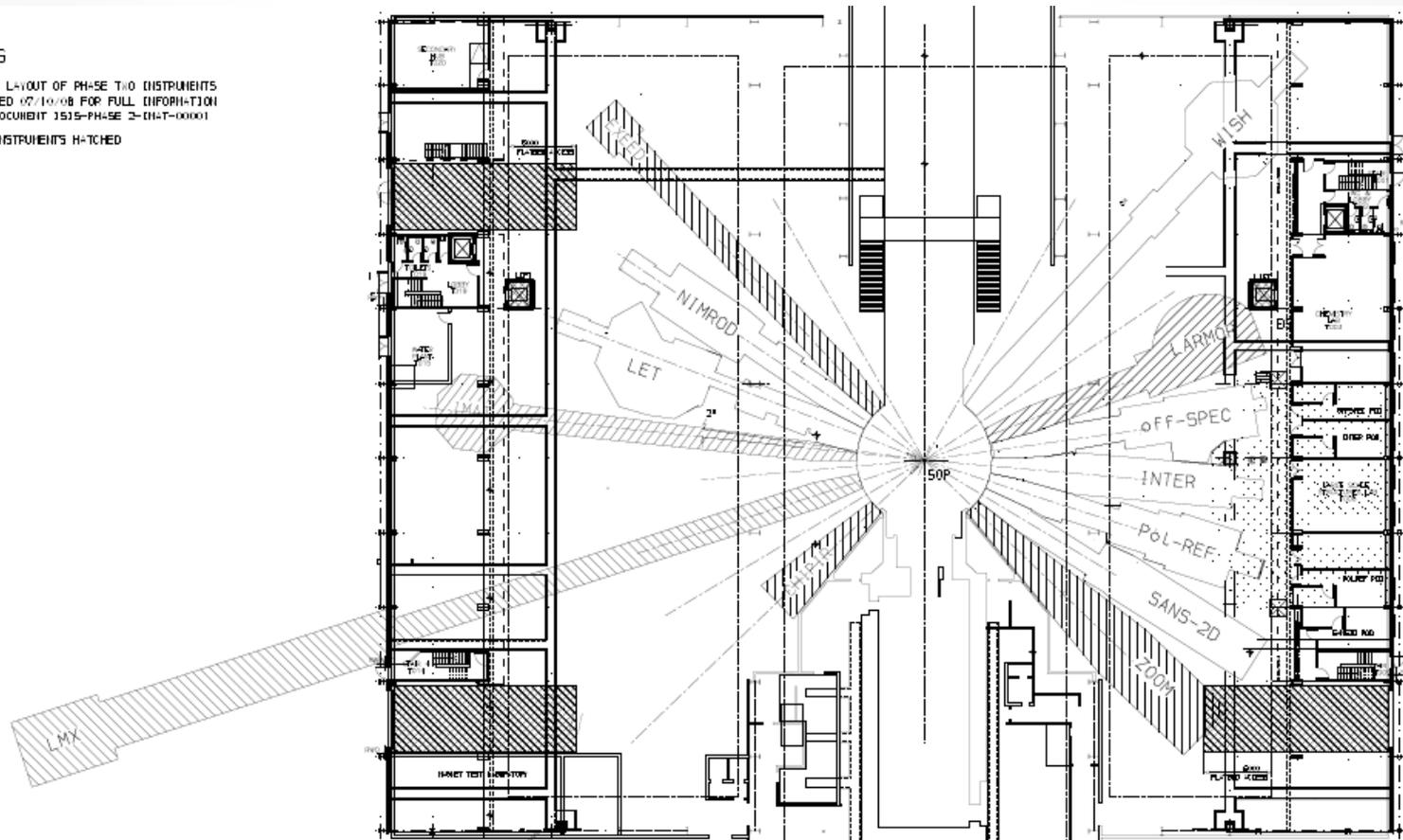
The crane!

A real instrument will have to fit in a real space,
and it will never be in the right place ...

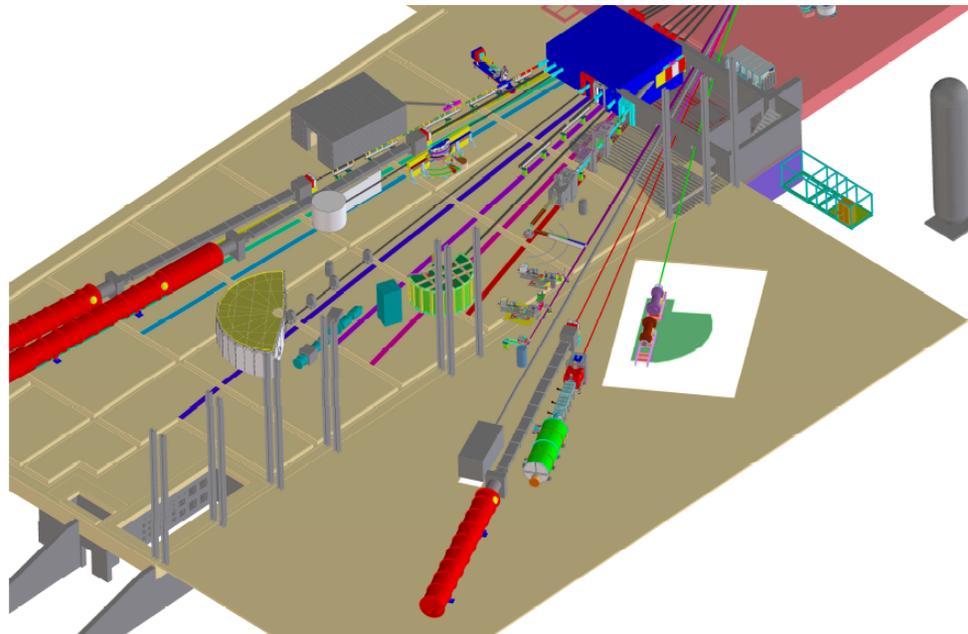
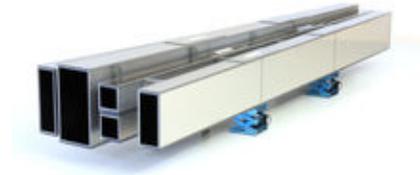
NOTES

1. FINAL LAYOUT OF PHASE TWO INSTRUMENTS
CHANGED 07/10/08 FOR FULL INFORMATION
SEE DOCUMENT 1515-PHASE 2-INT-00001

2. NEW INSTRUMENTS HATCHED

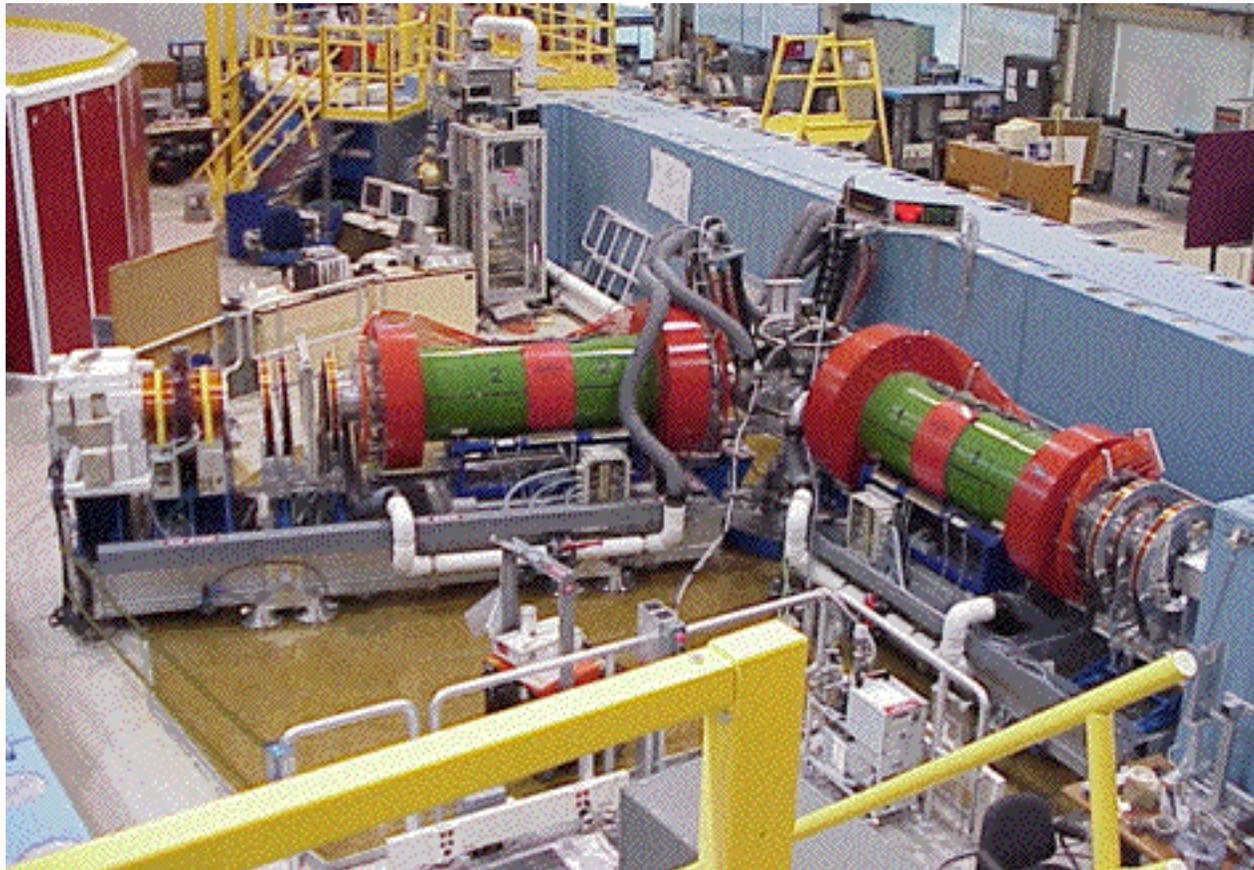


Integrating and optimising multiple instrument designs



NCNR new guide hall

Many neutron instruments use (and are sensitive to) magnetic fields



Magnetic field policies are a nuisance for some, but life and death for others ...

Shielding stops radiation from getting out, and from getting in ...

Shield against fast neutrons, thermal neutrons, gammas

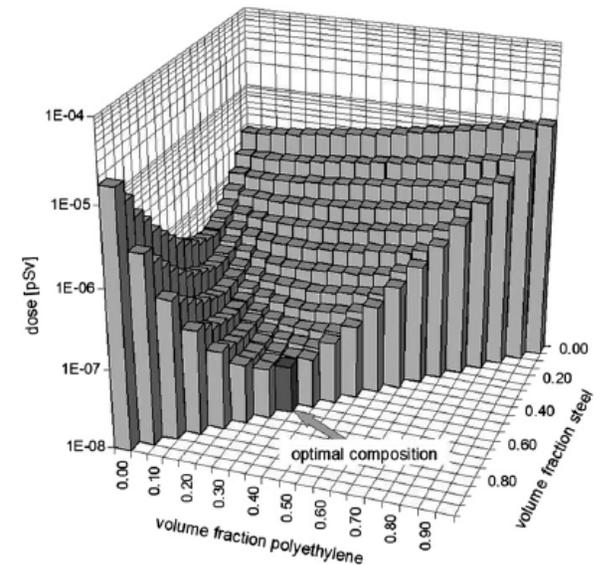
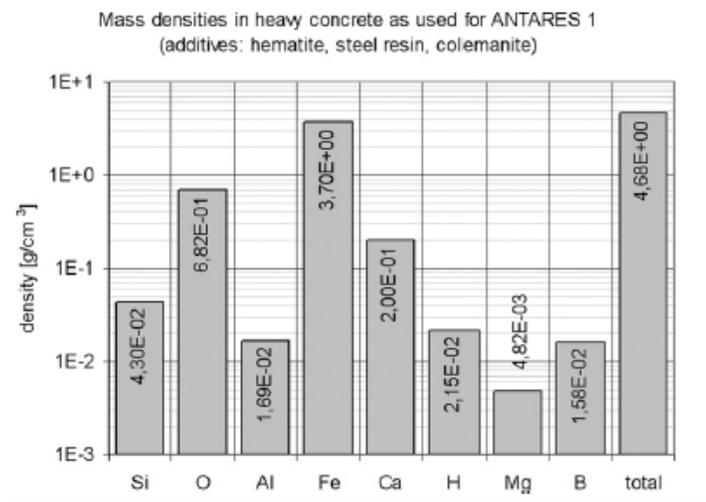
- Hydrogeneous (concrete, wax, polyethylene, water)
- Iron (steel), lead
- Boron (B_4C , BN, $AlMgB_{14}$)
- 6Li
- Cd
- Gd/GdO

Need to consider neutron thermalisation and gamma production

Shielding stops radiation from getting out, and from getting in ...

Table 1

Mass densities in heavy concrete as used for the former ANTARES facility.

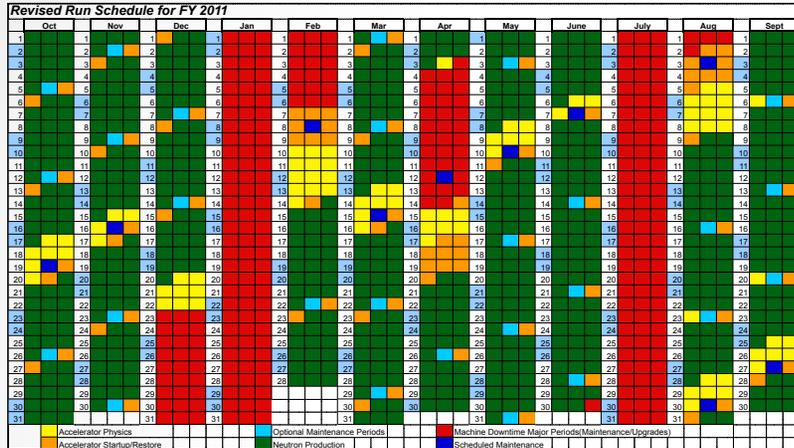


Shield against fast neutrons, thermal neutrons, gammas

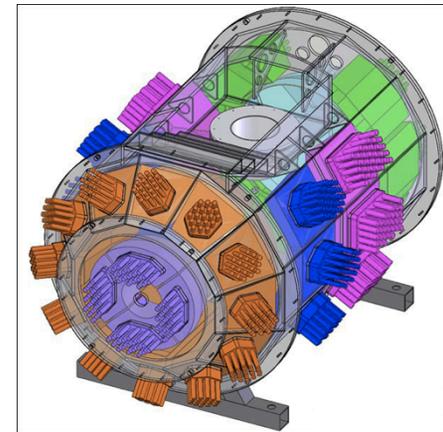
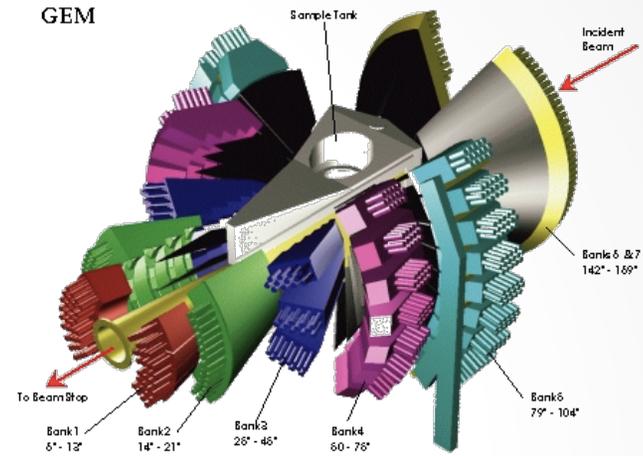
Steel, ferroboron, paraffin composite
Calzada et al. (Munich) NIMA 2011

We need to develop better (and cheaper) shielding ...

Building new instruments at a new facility is much easier (of course ...)



Instruments must be accessible for people ...



GEM and POLARIS instruments (ISIS powder diffraction)

Instruments must be inaccessible for people ...



Instruments must be accessible for samples and sample environment ...

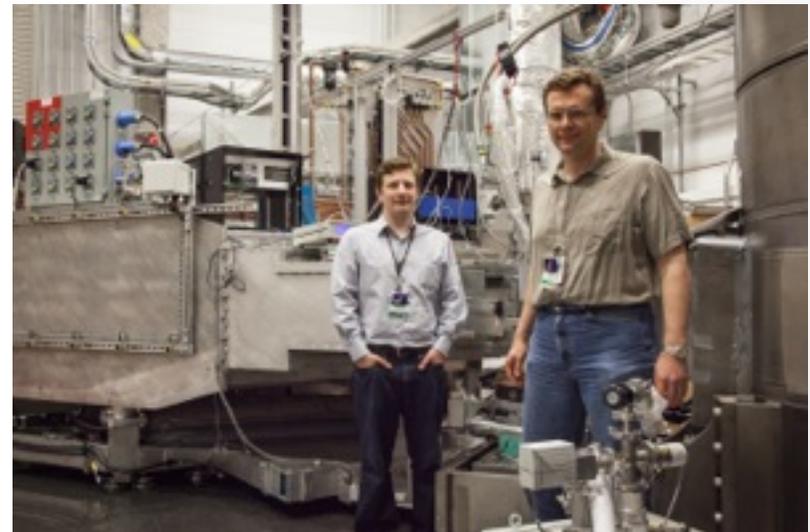
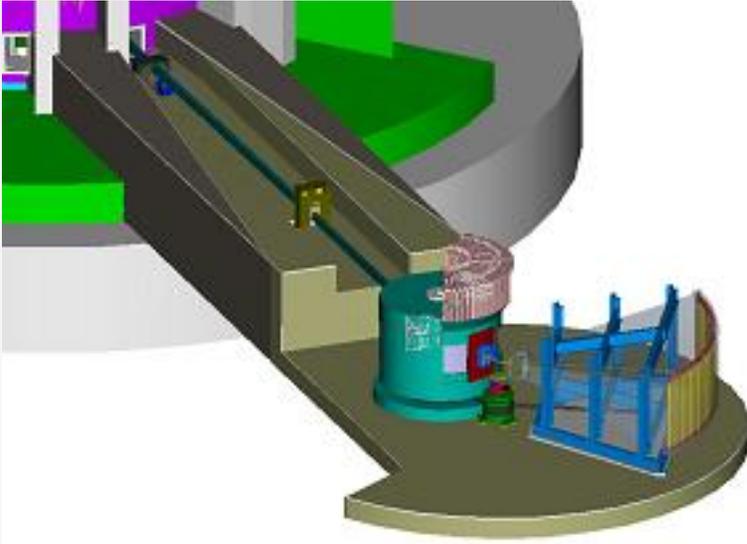


VULCAN instrument (SNS materials/engineering diffraction) with multi-axial load frame

Back to money ...



What does it cost to build an instrument?



What does it cost to build an instrument?

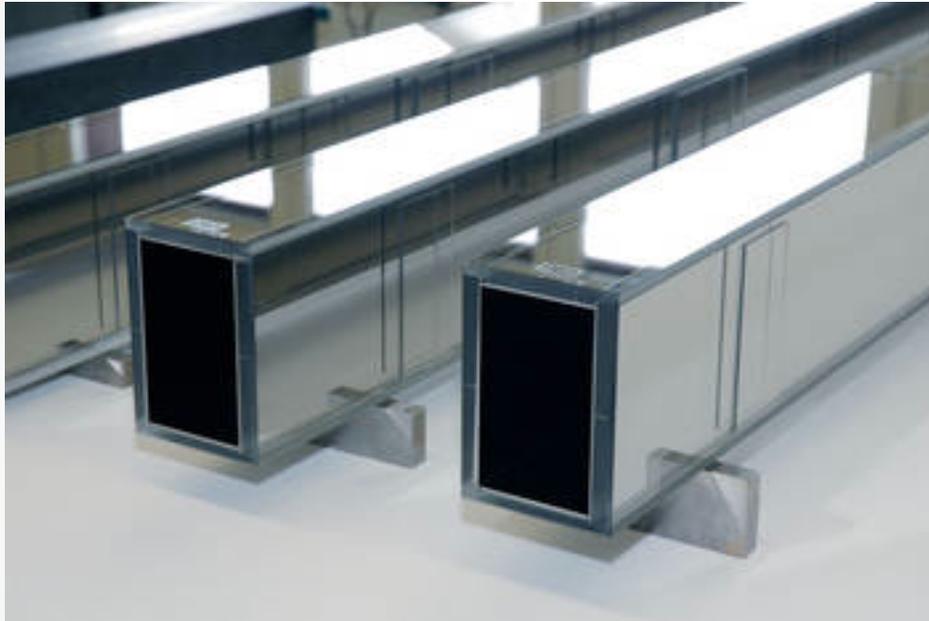
- SNS SING-II: 4 instruments \$60M
 - ISIS TS2 Phase II: 4 instruments £30M
- ... and these are 'incomplete' instruments ...
(usually detectors are descoped)

75% Materials 25% Labour

Front end: shielding (concrete, steel, wax) ≥ guide

and what was missing from the list?

A 'simple' example – optimising the cost of a guide



The higher the m value, the higher the cost

Conclusions

- Neutron scattering is (always going to be) an expensive technique
so you must optimise the cost/benefit
and define the 'benefit'
- Think about the engineering and operational practicalities in the design
or pay for it for the next 15 years
- The 'clever' bits of the instrument are equal in cost and equal in importance to the 'dumb' bits, but both are much cheaper than the source
there is no point in putting effort into the source if you're not also going to put effort into the shielding
- Try not to be developing the technology at the same time as you're building the instrument ...