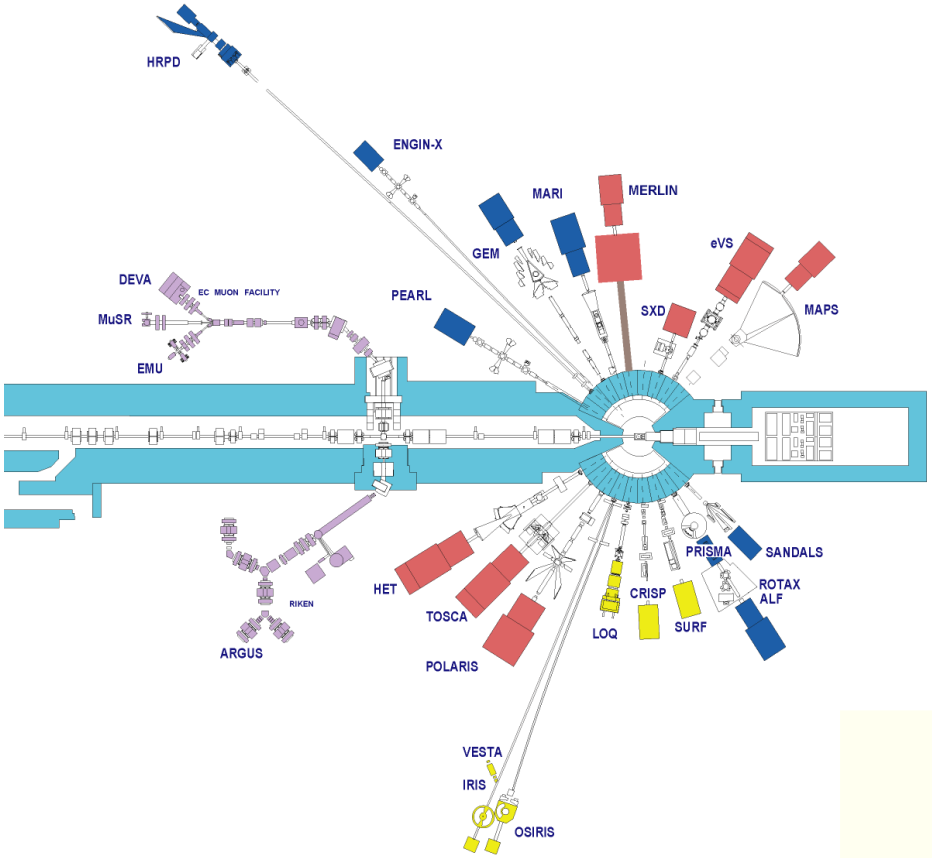
TS1 Upgrade



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Start Point

- Belief that with modern analytic tools we can make neutron production twice as efficient at a modest cost
  - £15m TS1 upgrade = 1 or 2 instruments
- Important to understand the upgrade possibilities with the existing machine

Plan of approach

- Run as a project
  - Feasibility first
    - Quantify options

      Performance

      Risk

      Time

      Cost
- Three tasks feeding back progress
  - Neutronic and activation calculations
  - Instrument desires
  - Engineering assurance

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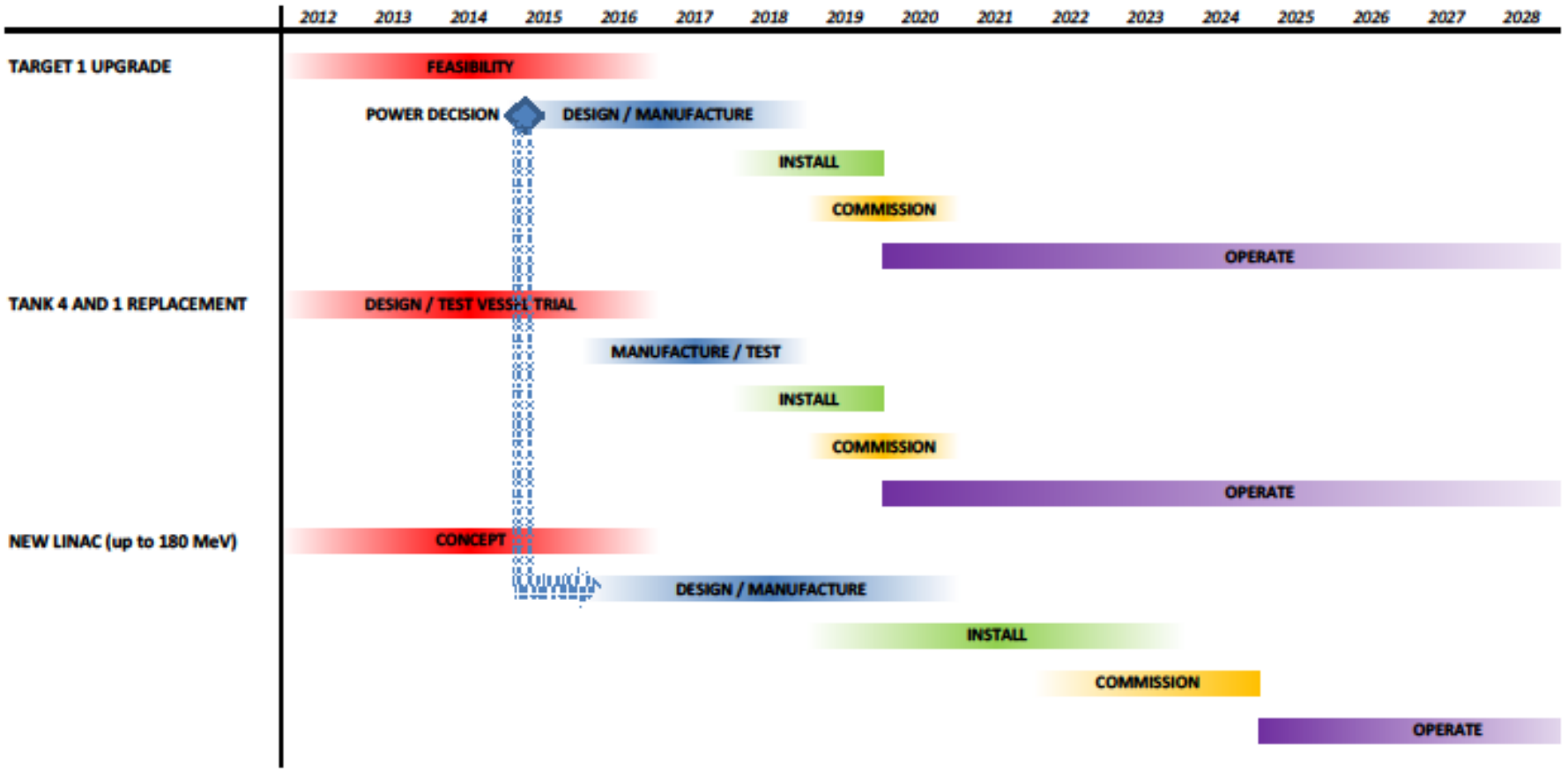
PASI interactions

- Internal ISIS expertise on
  - Neutronics, and benchmarking performance
  - Moderator and instrument interactions / impact
  - Thermo-mechanics
  - Operations
    - Diagnostics
    - Practical
    - Installation etc etc
  - Knowledge of the existing equipment (no small task)

PASI Interactions

- Expertise and effort in neutronic and thermo mechanics calculations related to targets
  - Neutronics modelling with MCNPX - Ali Ahmad
  - Neutronics modelling with GEANT4 - Cristian Bungau
  - Thermo-mechanical and Fluka simulations - Tristan Davenne
- Material understanding / testing all relevant
  - Erosion, stress, etc

Timeline



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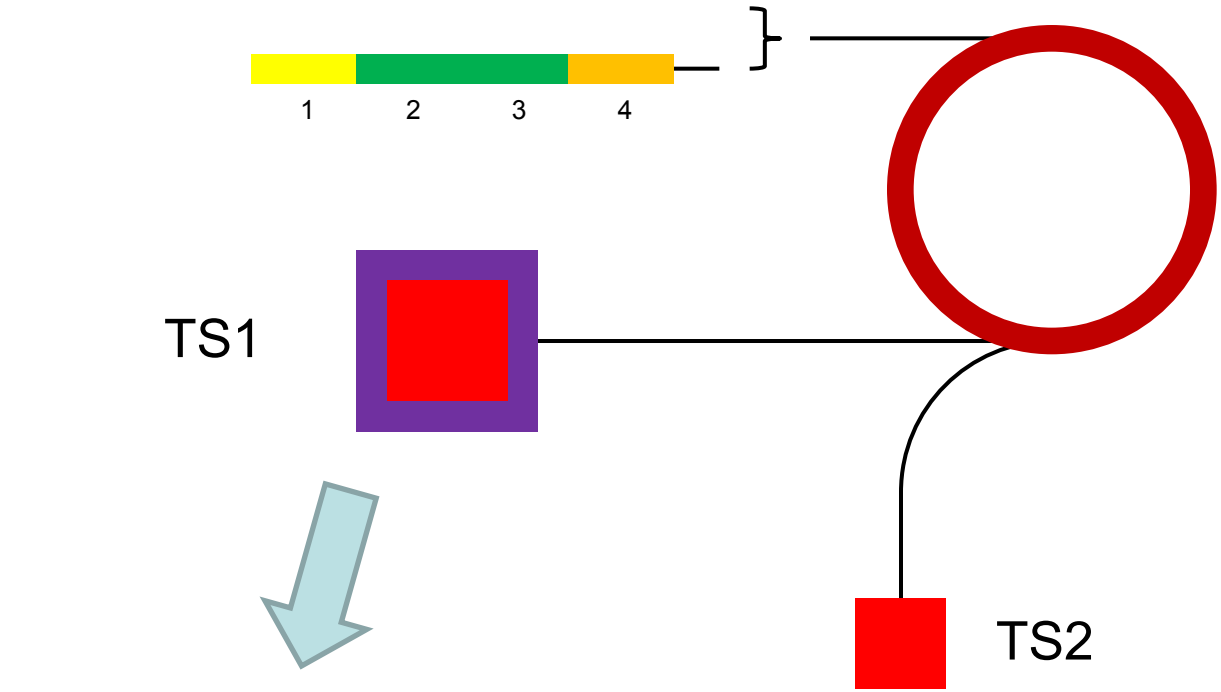
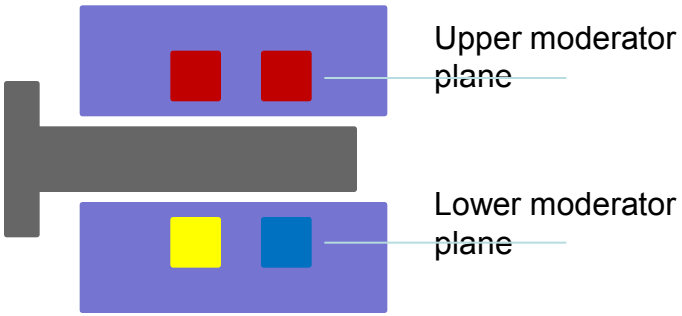
Existing 2012





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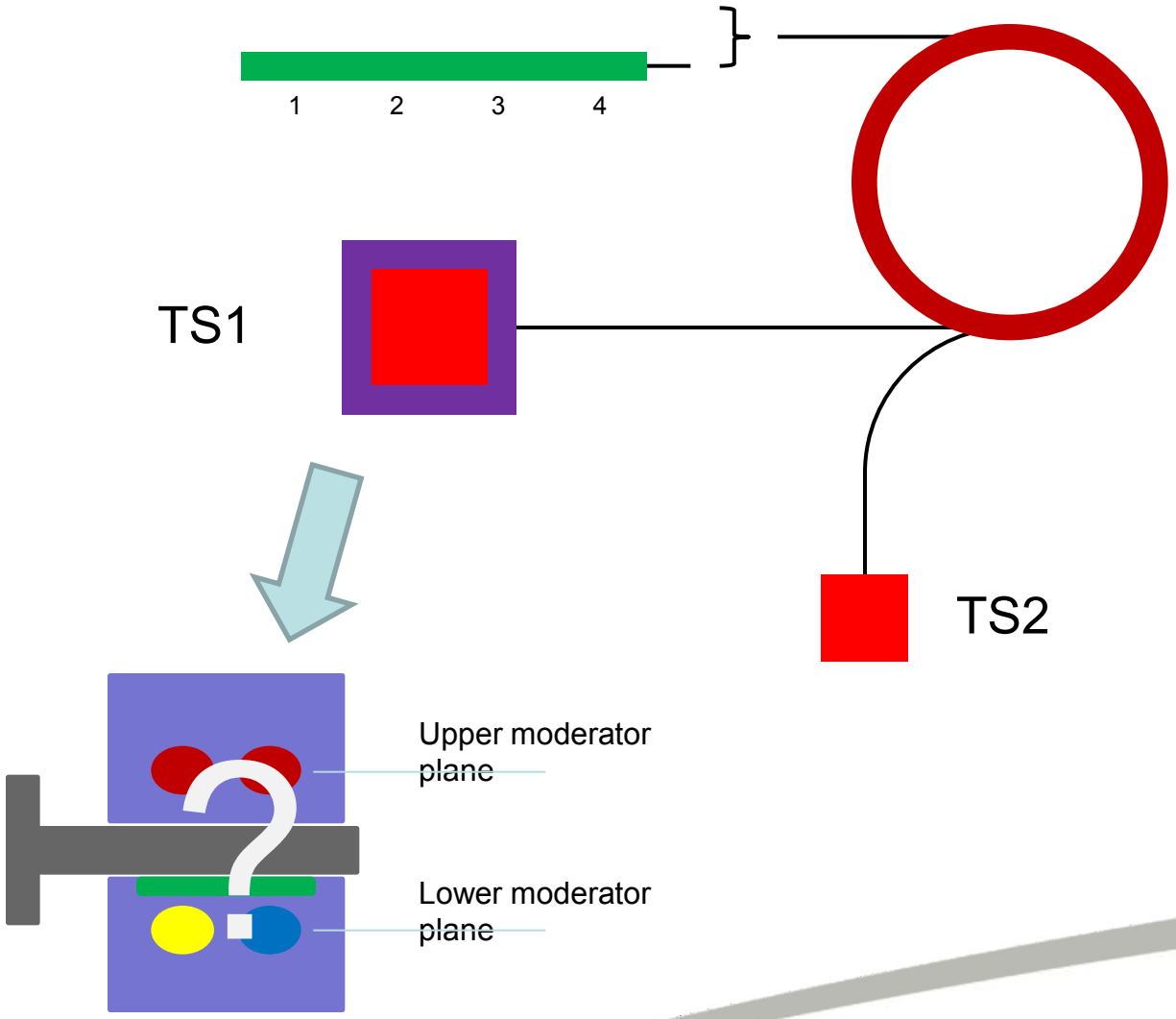
2019 / 20



TS1 Reflector, Moderators, Target change circa £15m

Tank 4 and 1 replacement £3m each

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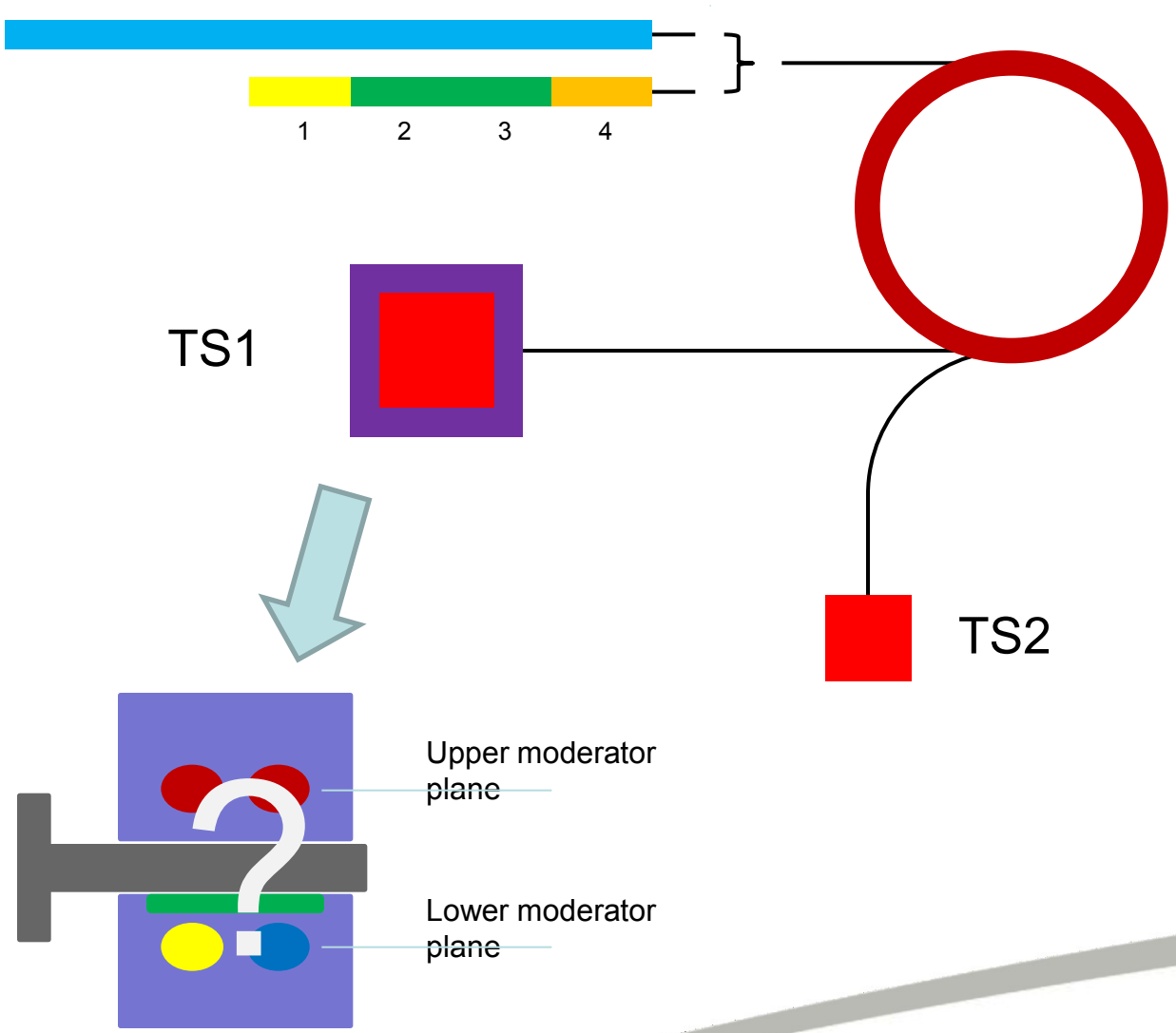
2025



New Linac – up to 180 MeV.
£100m

Built alongside.

Energy directed by Target optimisation

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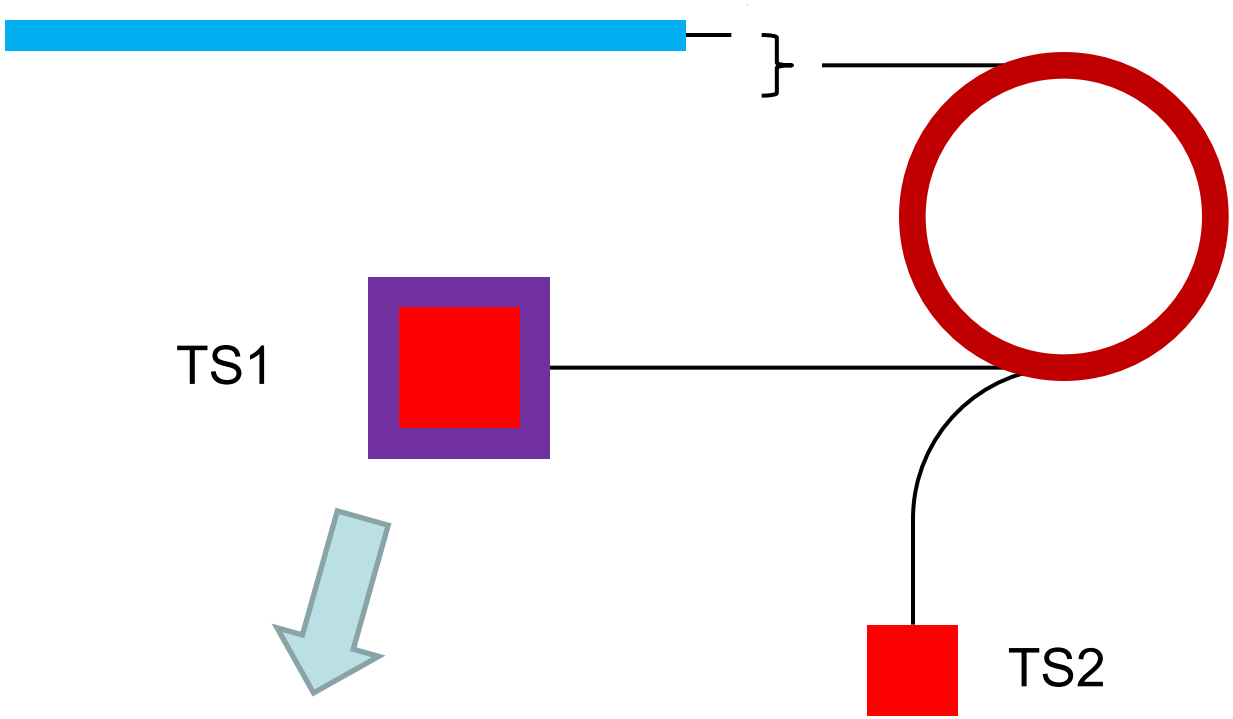
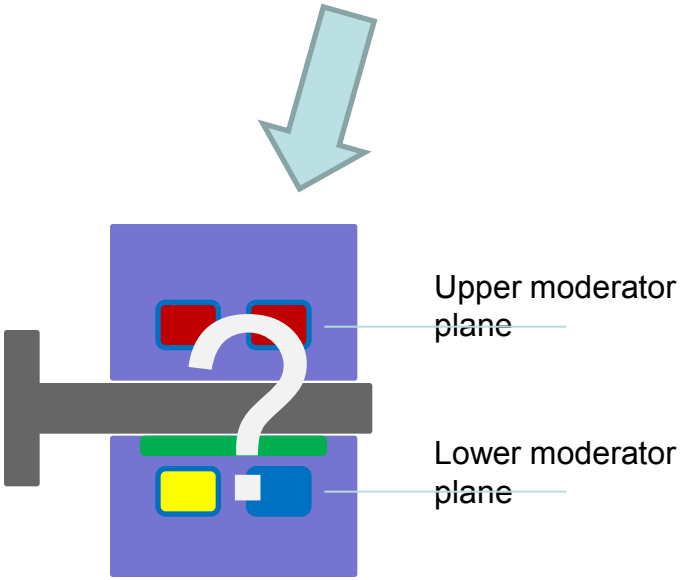
Beyond



Moderator changes possible



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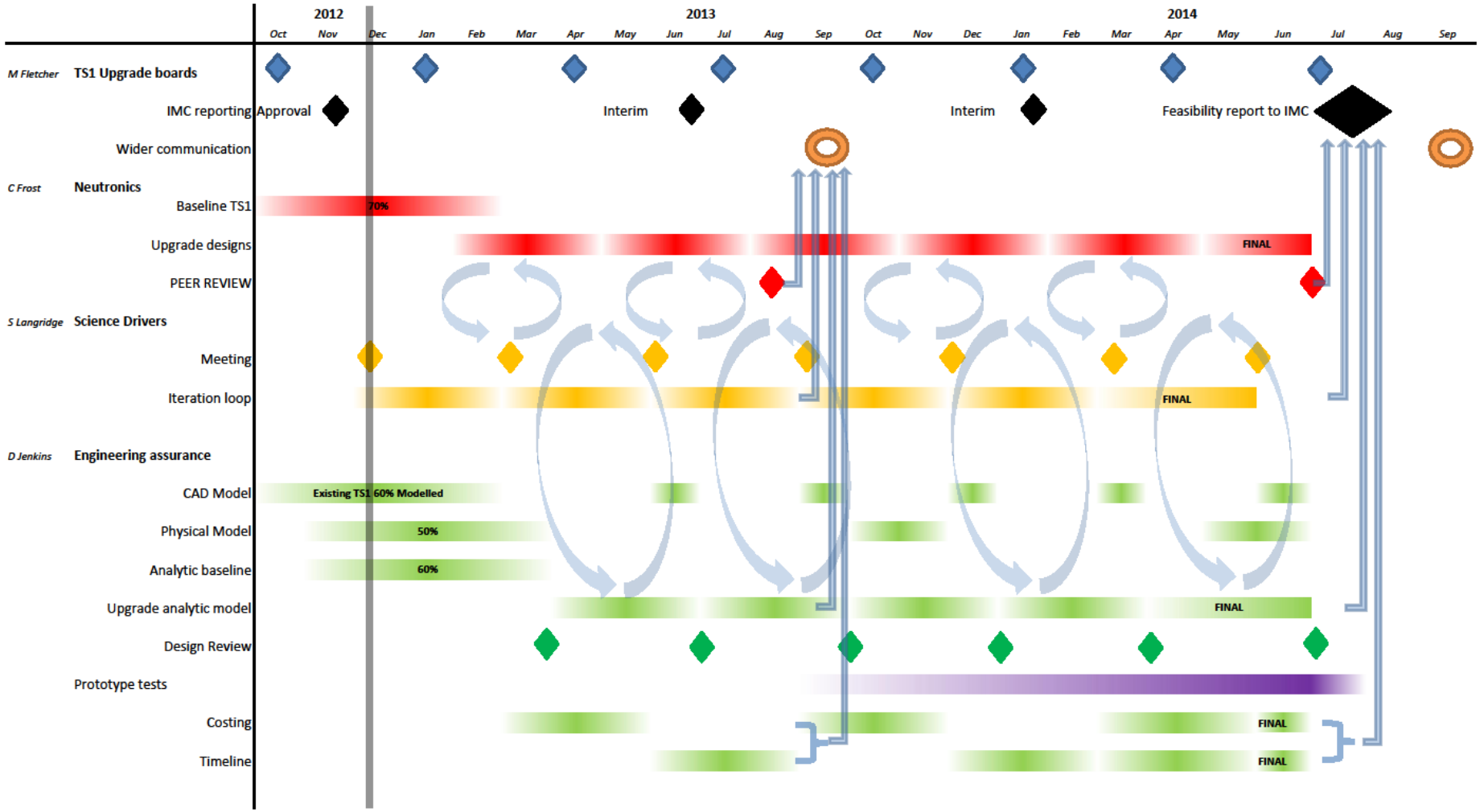

Feasibility only

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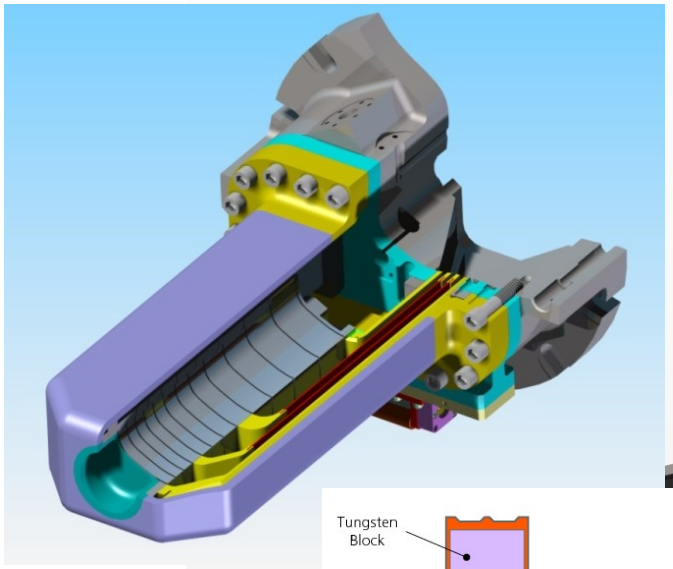
Expectations

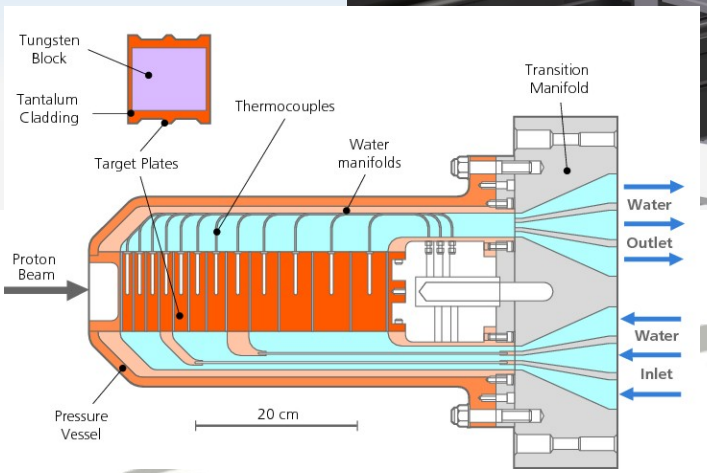
- Average factor two gain in performance minimum
- Possibility of higher but localised / specialised gains
- Proton power as it is, but benefits / consequences understood of increasing to max of 500kW
- RISK – Low on implementation
- Technology understood
  - Target water cooled (H2O or D2O)
  - Moderator tech tested thoroughly
  - Benefits understood
- Re-configuring instruments not in the scope
  - Filters (to limit saturation should this occur) in scope
- Upgradability built in (probably moderator tweaks)
  - Development moderator considered

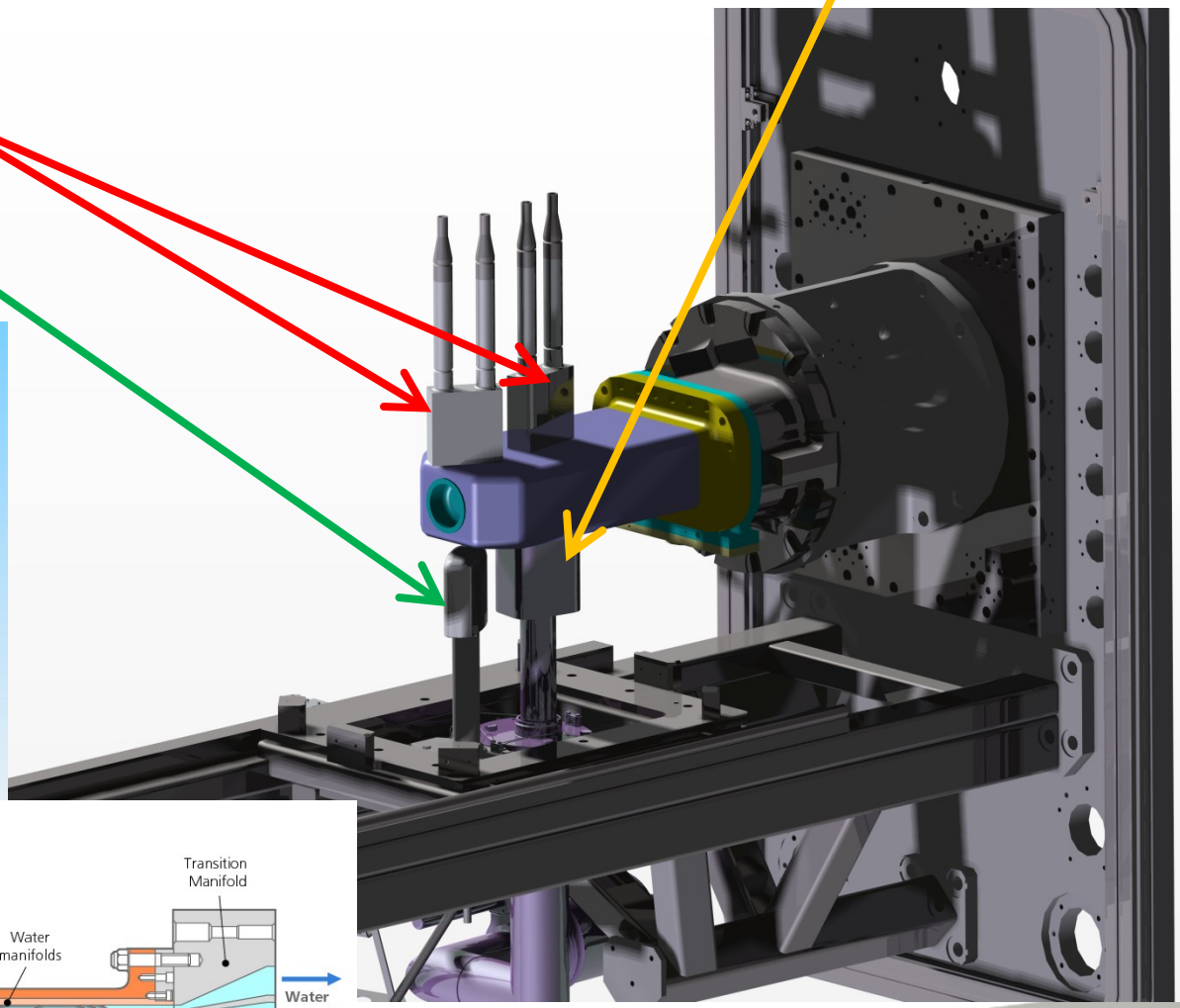
Hydrogen

Ambient Water

Methane







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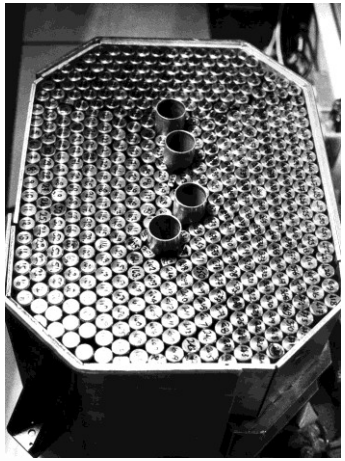

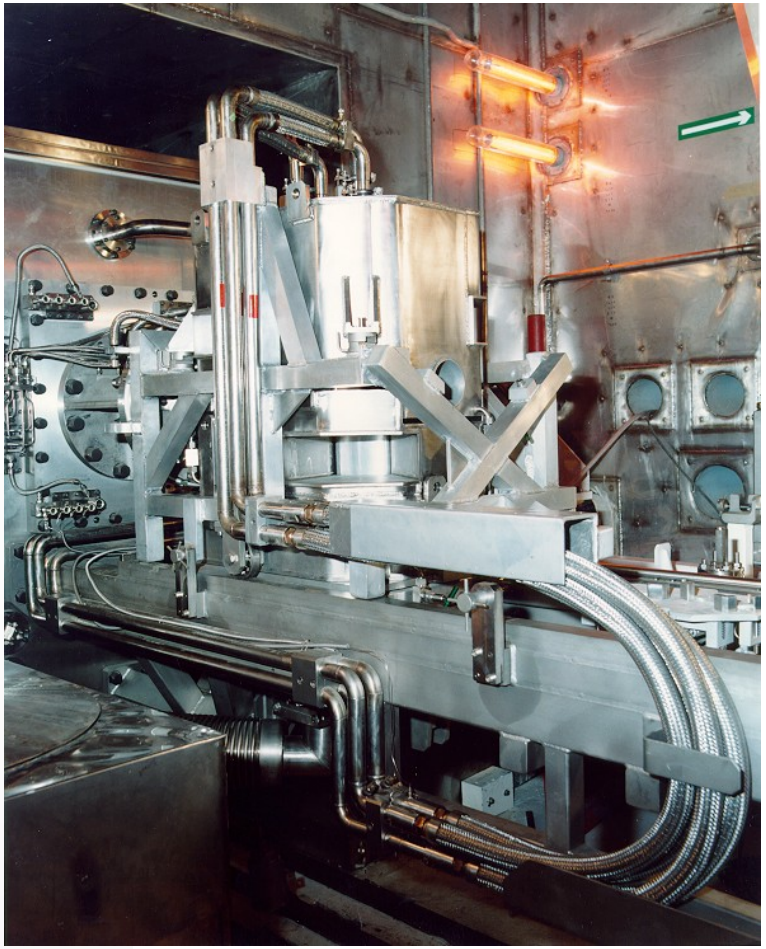

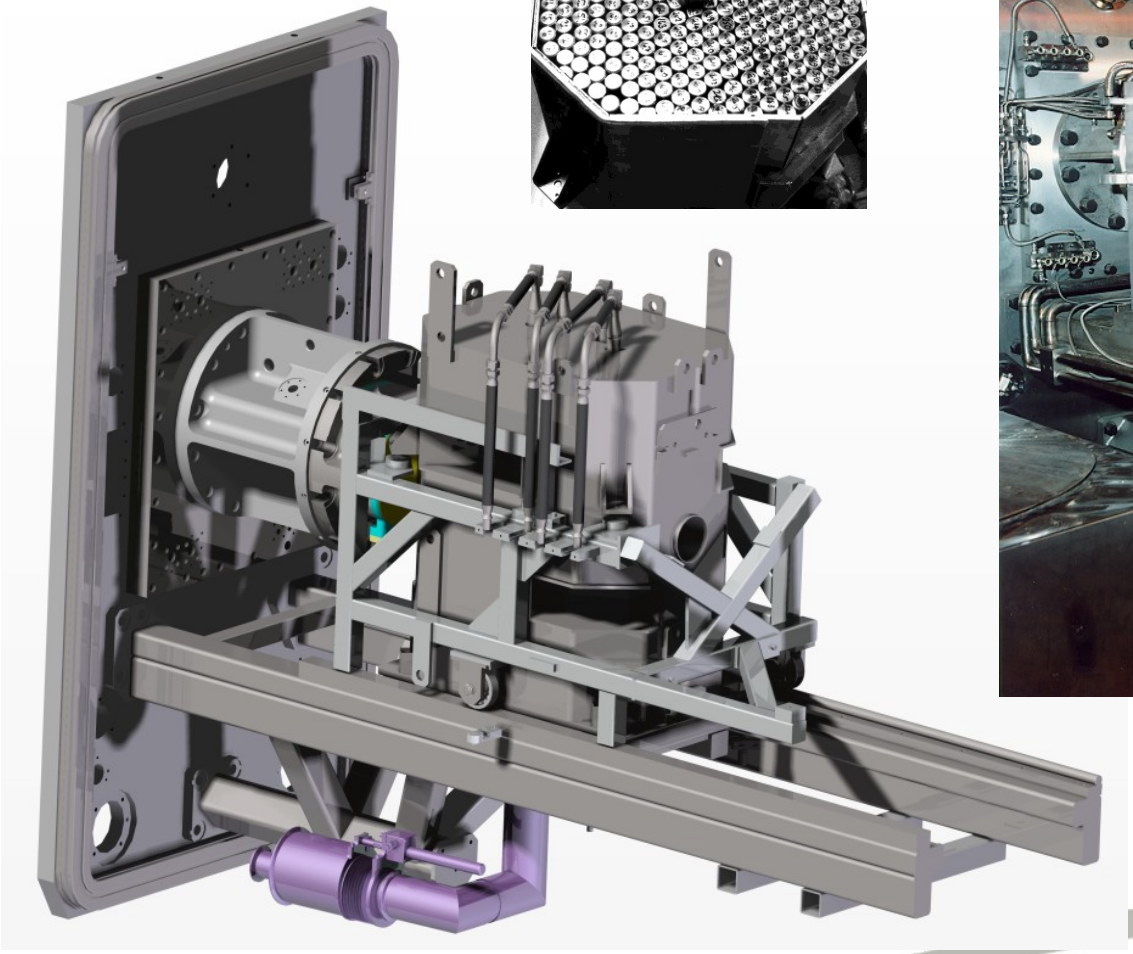

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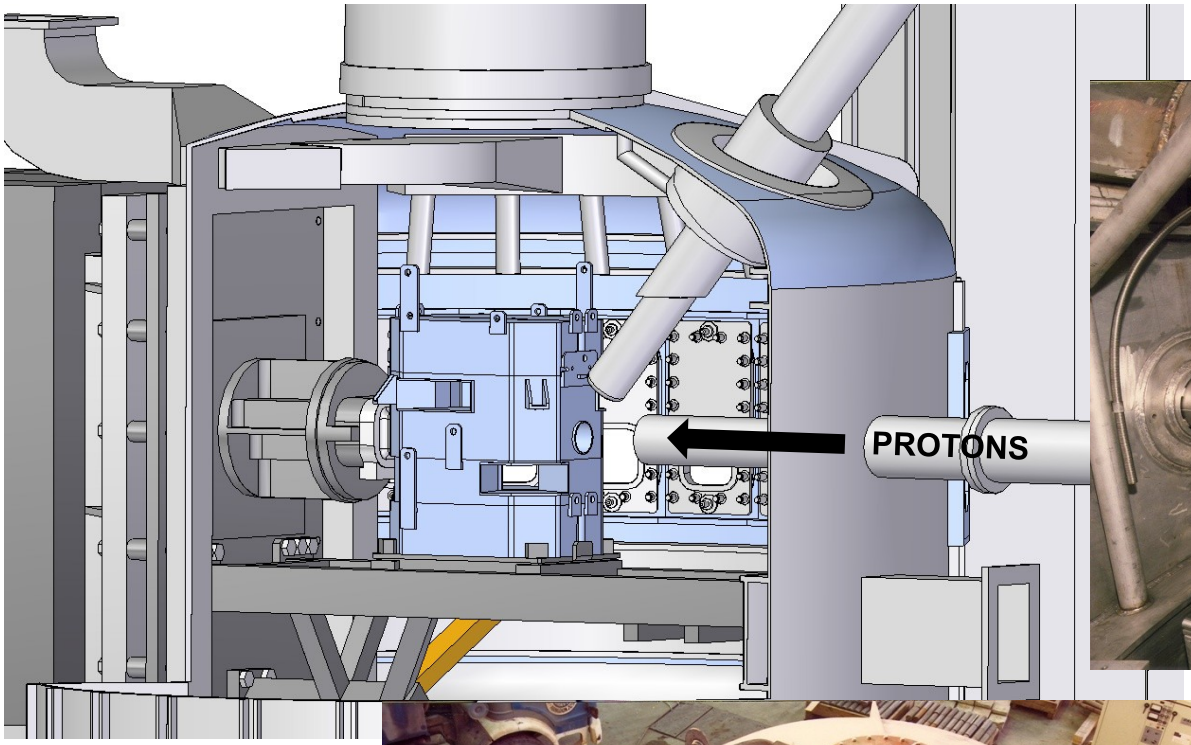

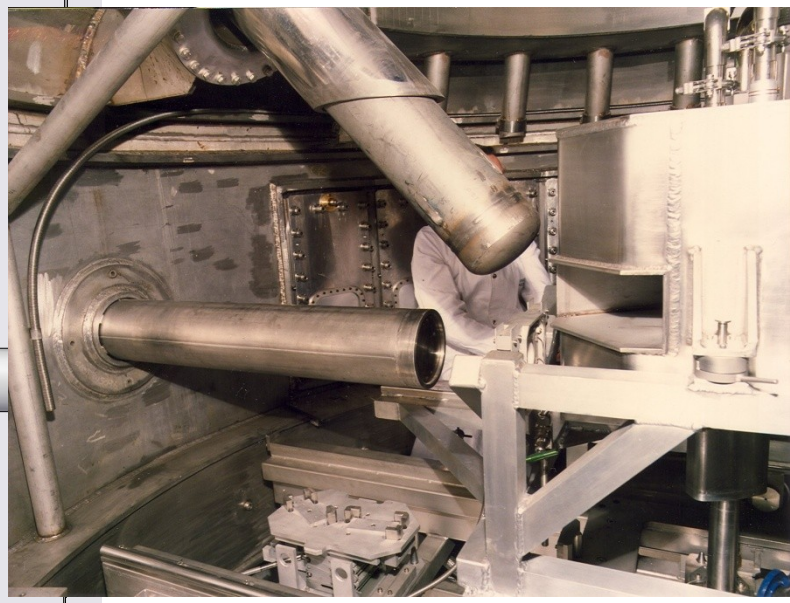

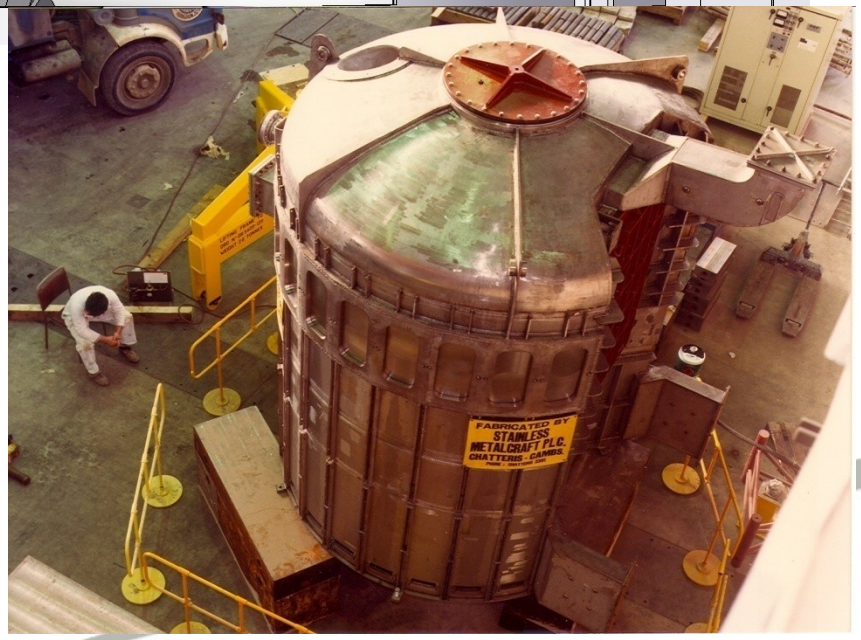

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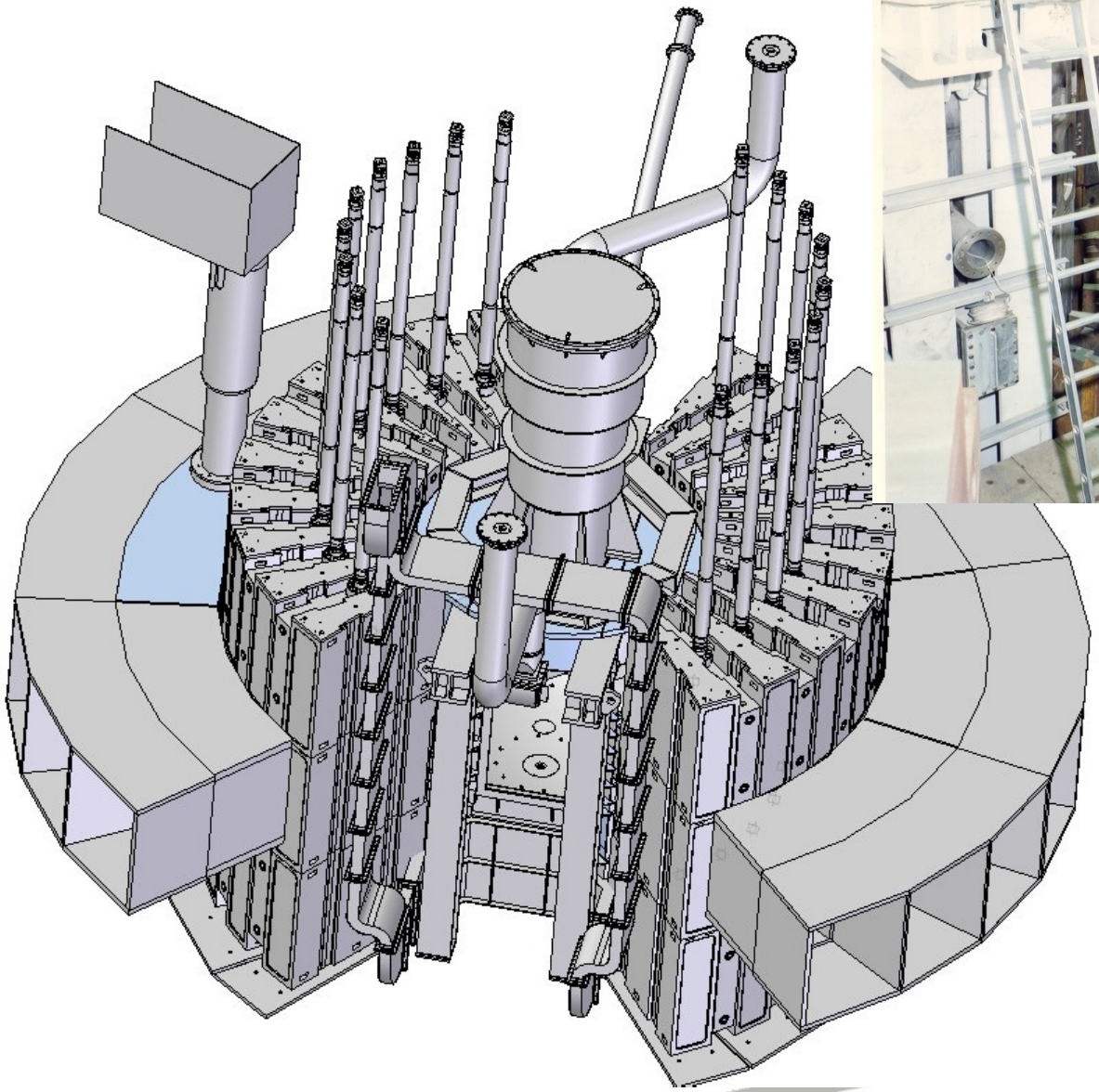

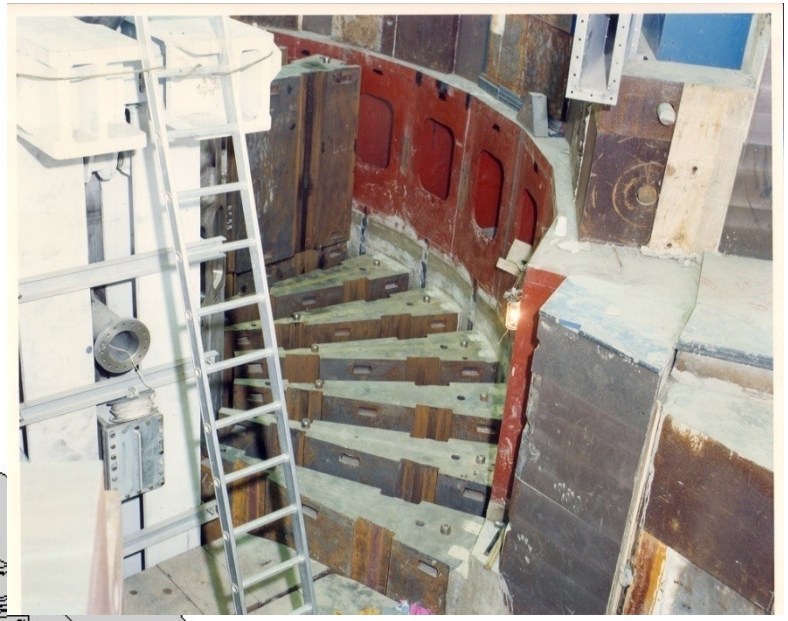

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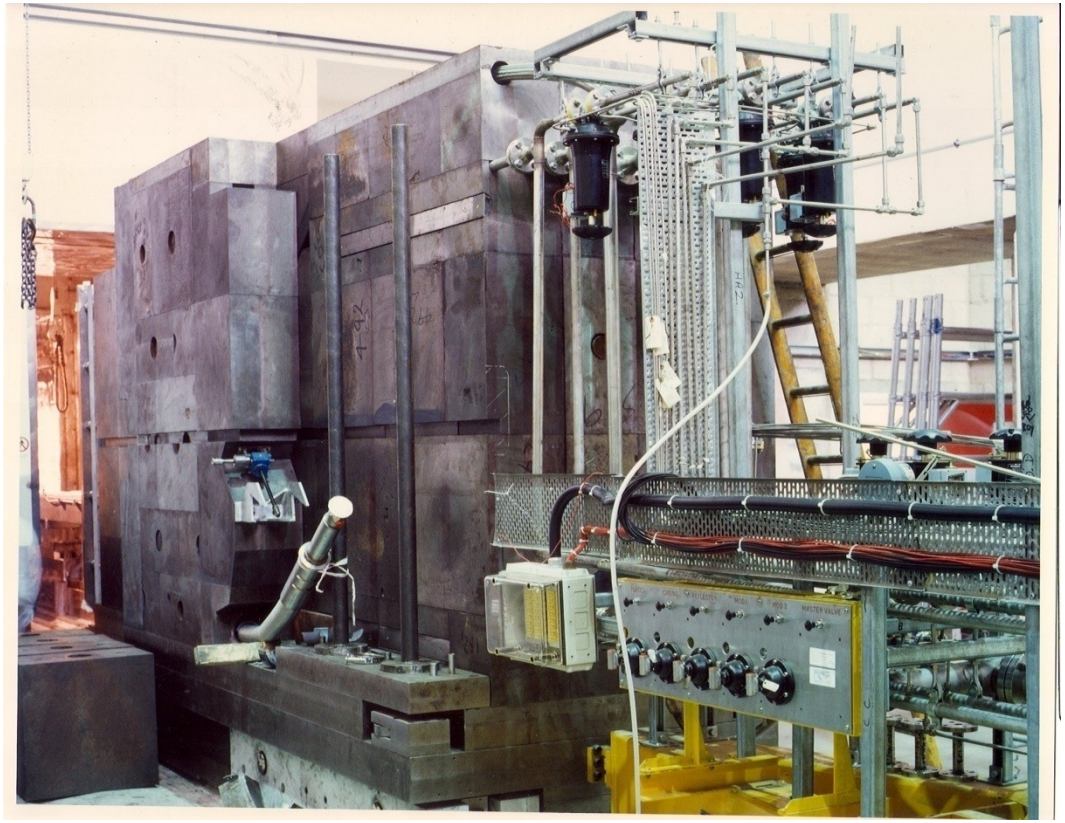
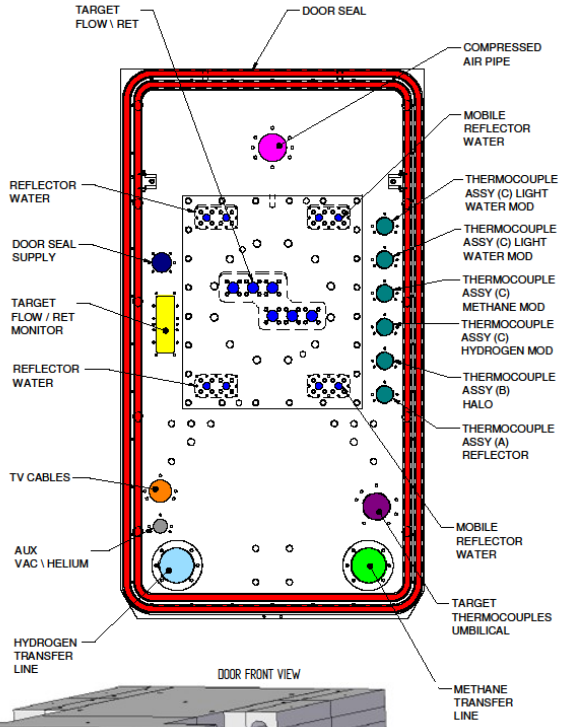
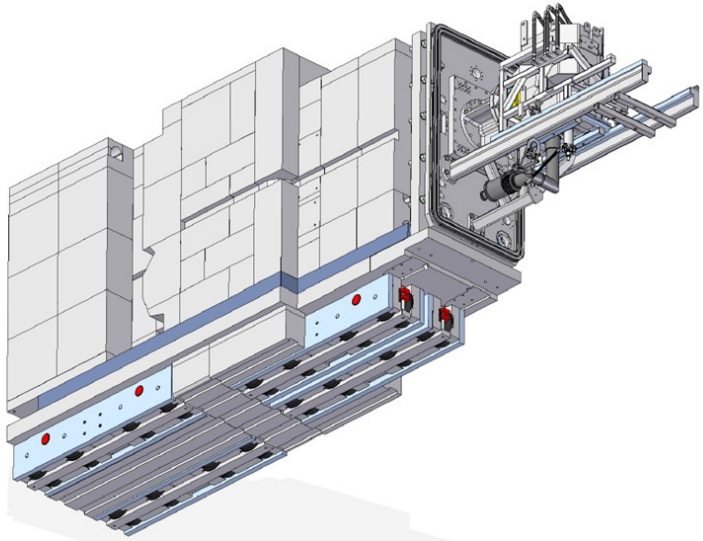
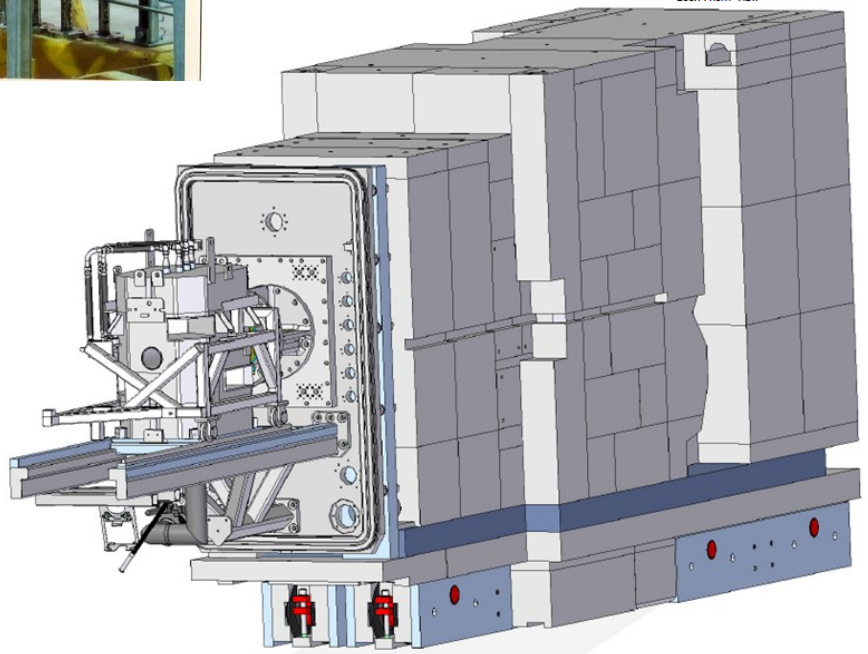
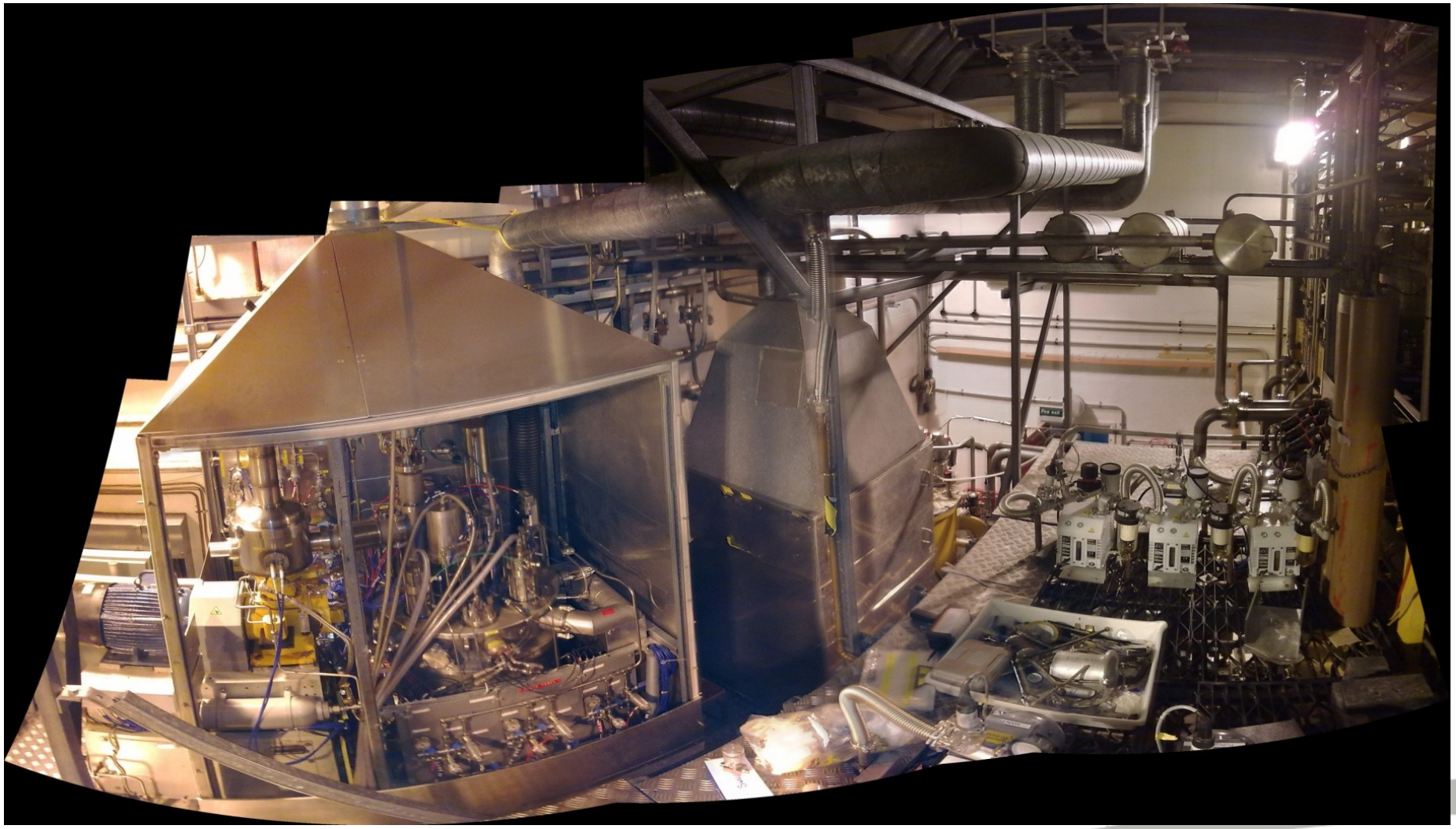



TARGET FLOW \ RET
DOOR SEAL
COMPRESSED AIR PIPE
MOBILE REFLECTOR WATER
THERMOCOUPLE ASSY (C) LIGHT WATER MOD
THERMOCOUPLE ASSY (C) LIGHT WATER MOD
THERMOCOUPLE ASSY (C) METHANE MOD
THERMOCOUPLE ASSY (C) HYDROGEN MOD
THERMOCOUPLE ASSY (B) HALO
THERMOCOUPLE ASSY (A) REFLECTOR
REFLECTOR WATER
DOOR SEAL SUPPLY
TARGET FLOW / RET MONITOR
REFLECTOR WATER
TV CABLES
AUX VAC \ HELIUM
MOBILE REFLECTOR WATER
TARGET THERMOCOUPLES UMBILICAL
HYDROGEN TRANSFER LINE
METHANE TRANSFER LINE




DOOR FRONT VIEW

ology



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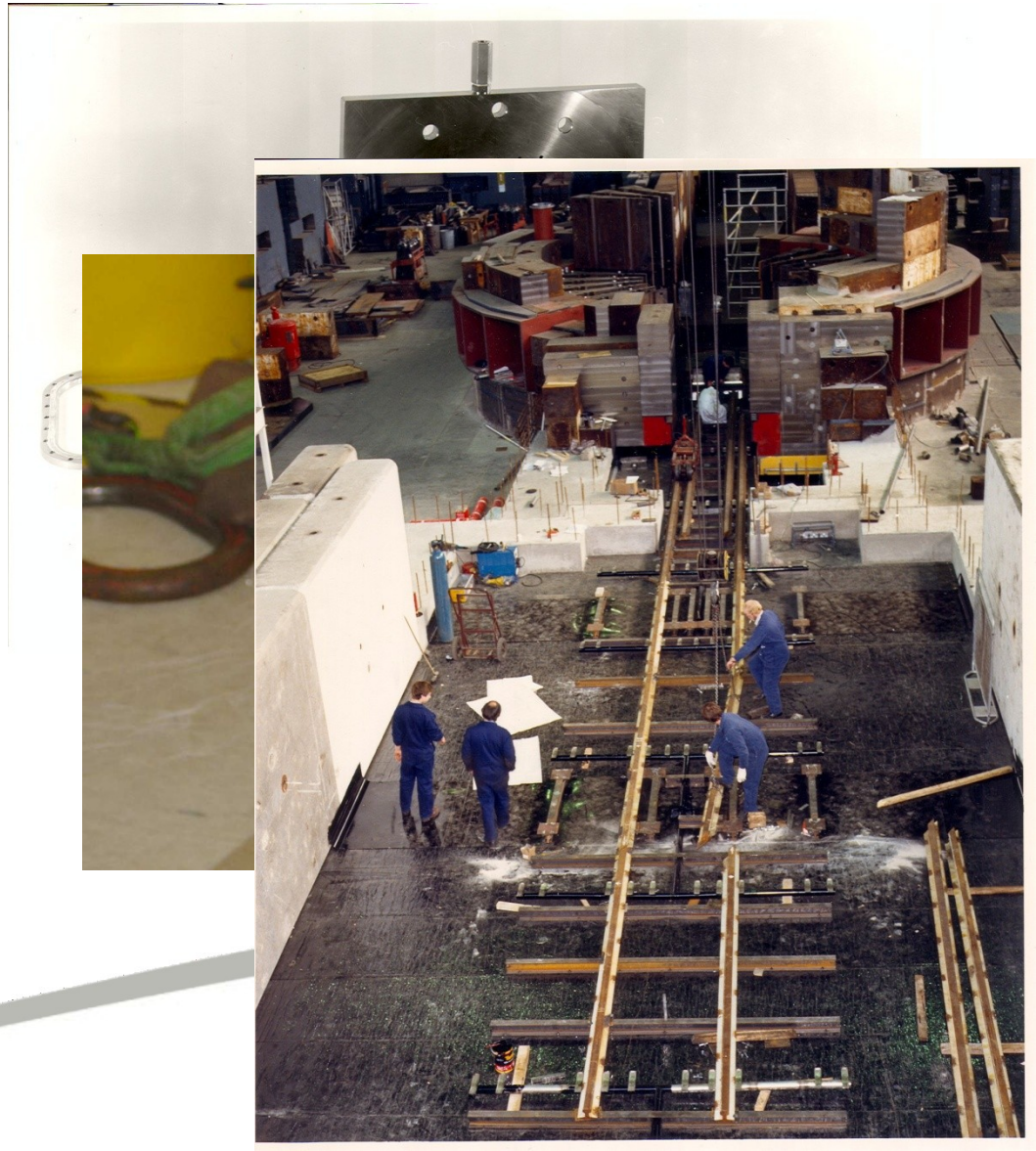
‘Features’

- Neutron windows
  - V difficult to access
- Proton window
  - Possible limit
- Infrastructure



Progress

- Baseline Understanding
  - Neutronic Baseline model 90%
  - Engineering baseline model 70%
  - Physical model 80%
  - Analytic engineering baseline model – heat transfer, fluid flow 80%
  - Understanding / relearning constraints
- Science input – internal discussion started
- Target manufacture in house transfer started

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