Proton Driver – Target Station Interfaces

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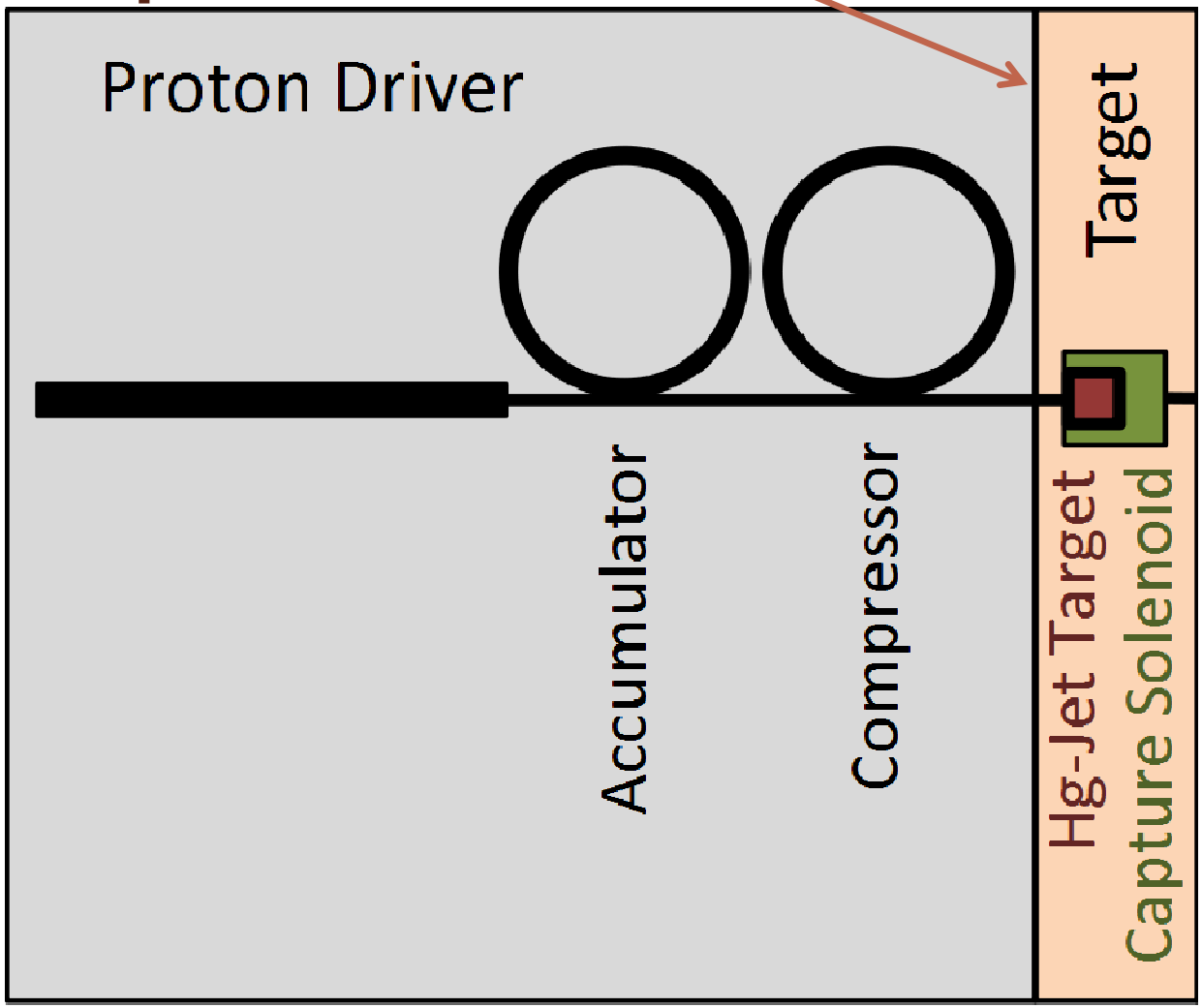
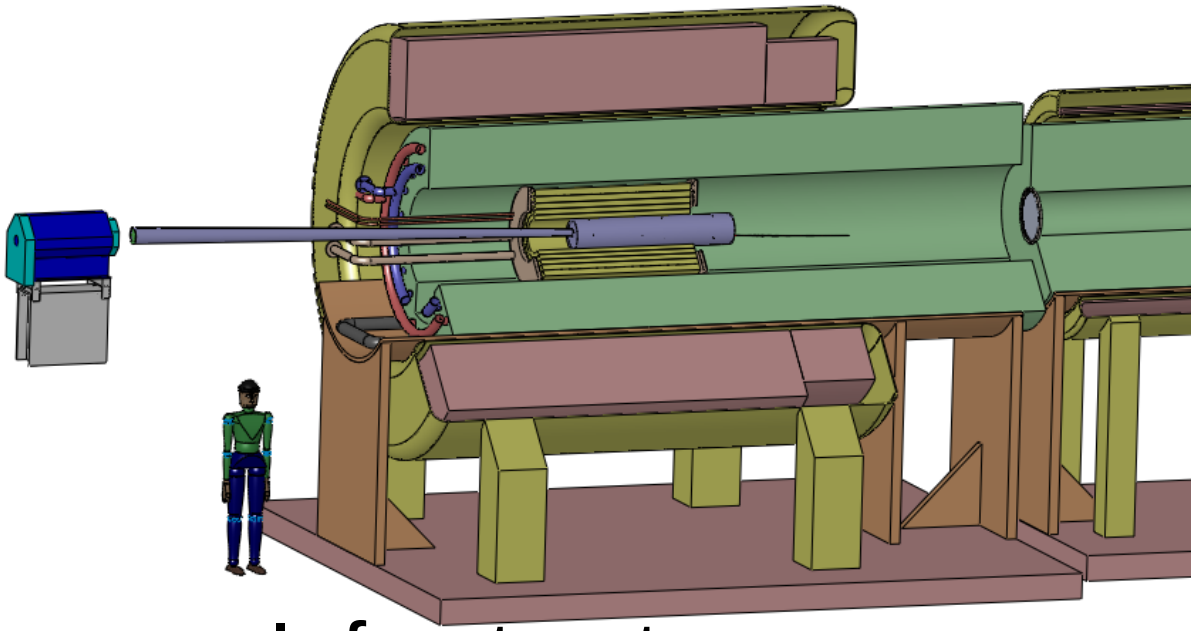
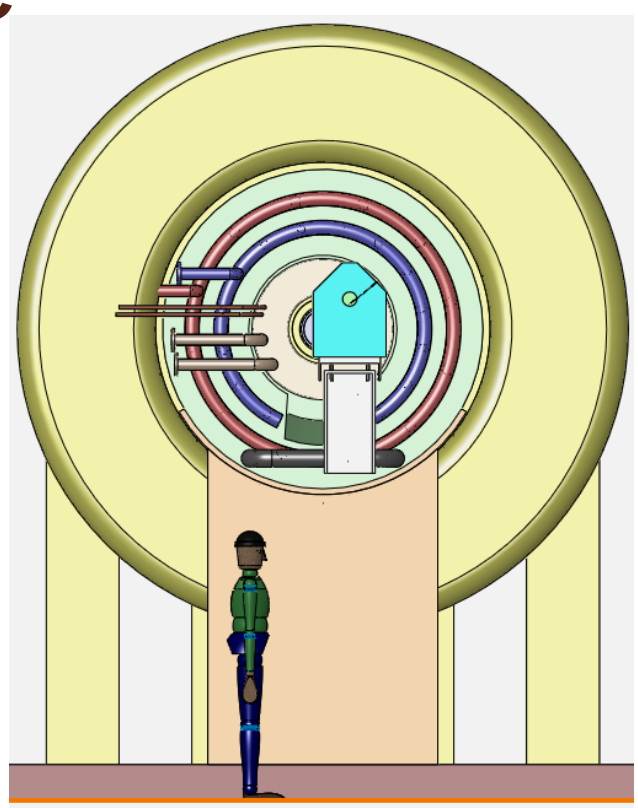
Simple Interface



Just draw a line!

Physical Interface





- Infrastructure
  - Magnet power “cables”
  - Cooling lines for magnets and shielding
- Replacement of target module as consumable
  - Can Final Focus remain in situ? Or move out of the way? Alignment? Vacuum?

Pictures by V Graves via K McDonald

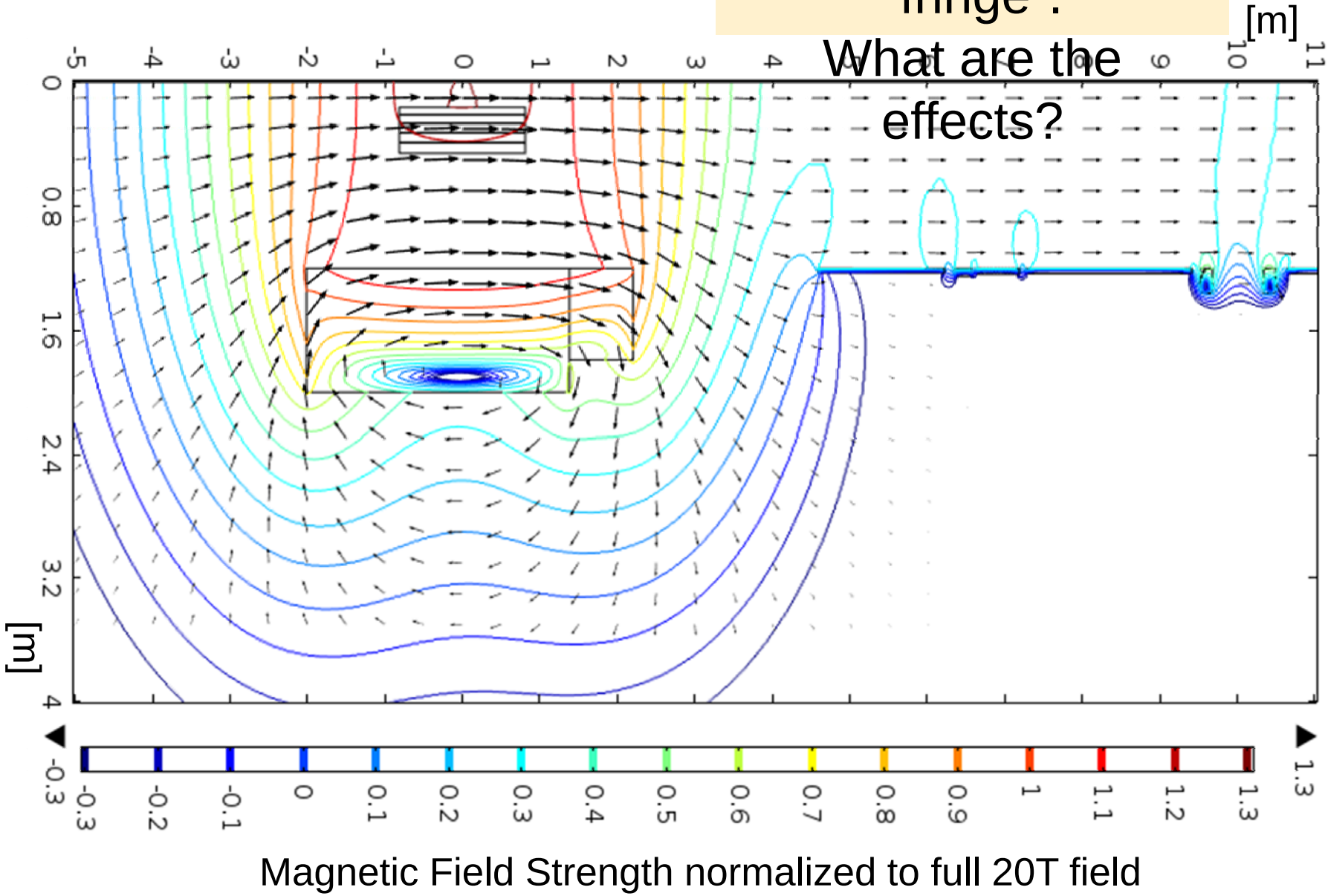
Vacuum Window

- Was necessary for mercury containment
  - In fact, a double window was required
- Any window prior to target station has to withstand full beam power in small area
- Window creates “pre-target” which will create showers prior to solenoid
  - Also increases beam emittance
- If target is in air, then proton beam will activate air within solenoid
  - Will likely have to wait for full-volume air exchange before accessing target station after running beam

Solenoid Field

Final Focus element(s) within "fringe".

What are the effects?



Calculation/Graph by B Weggel via K McDonald

Beam – The True Interface

- Beam goes from Proton Driver Realm to Target Station Domain.
- The physical beam size is set by the size of the target.
- Beam emittance is set by the Proton Driver rings (and transport line collimation)
- One then calculates β*
  - Which in turns determines beam size/lattice parameters at Final Focus elements based upon spacing between target and FF elements

Beam Power Upgrade - Energy

- To handle more charge per bunch, the Proton Driver may have to increase beam energy from 6.75 GeV to 8 GeV.
  - Changes beam path in target station solenoid field
  - Affects beam dump

Beam Power Upgrade - Bunches

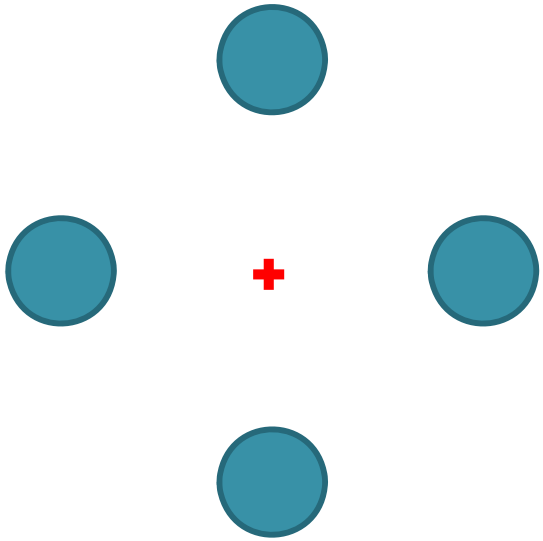
- Beam energy may not be enough and will require several bunches to simultaneously arrive on target
  - Avoiding infrastructure
    - Especially true if liquid target
  - Beam separation at Final Focus to match desired beams-target interactions (crossing-angles)

Possible crazy idea

- 1MW on single rod will last ~month
- 4MW on single rod will last ~week

- Or liquid target
- Or….

- 4MW on four rods will last ~month



- Muon Production Penalty
  - Rods not centered to solenoid “tilted” axis
  - Shadowing

Summary: Not a simple boundary

- Proton beam parameters at target will set scale and location of final focus element(s)
- Target maintenance physical requirements will set distance between final focus element(s) and target infrastructure
- Number of beams will affect target infrastructure