MHD pressure drop is perceived by many as main concern for LM blankets

Feasibility issue – Lorentz force resulting from LM motion across the magnetic field:

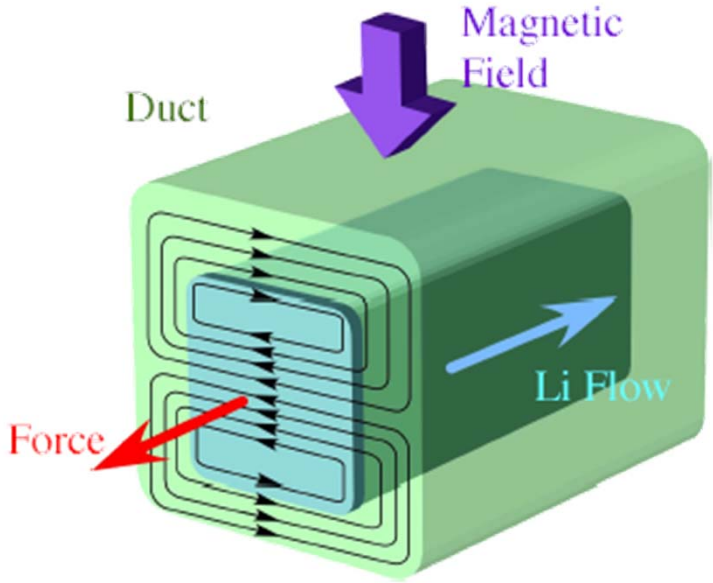
- generates MHD retarding force (*Pressure Drop*) that is very high for electrically conducting ducts and complex geometry flow elements

- *Thin wall MHD pressure drop formula*

$$\Delta p_{MHD} = LJB \approx L\sigma VB^2 \underbrace{\frac{\sigma_w t_w}{\sigma a}}_{c}$$

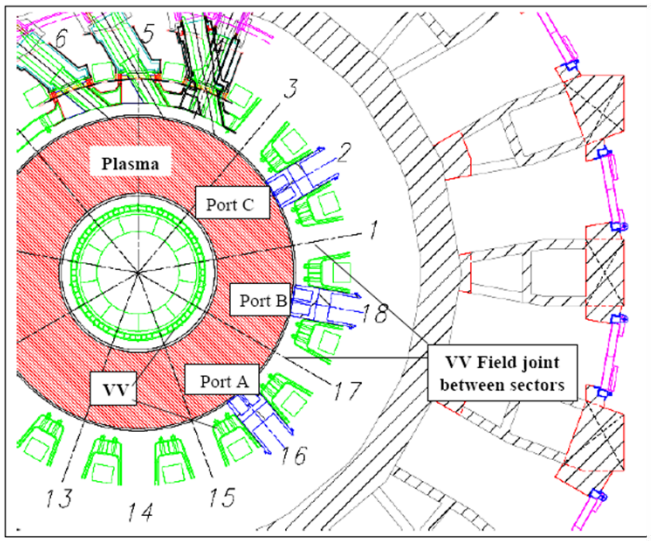
p, pressure
L, flow length
J, current density
B, magnetic induction
V, velocity
σ, conductivity (LM or wall)
a,t, duct size, wall thickness

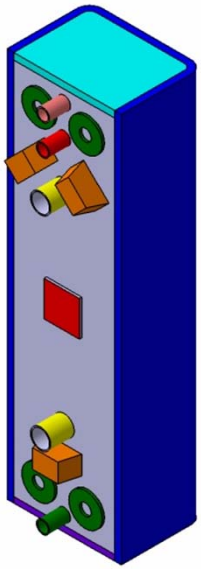
0.48 MPa for Li (3×10^6 /Ohm/m)
(2m, 0.1m/s, 4T, c=0.05)

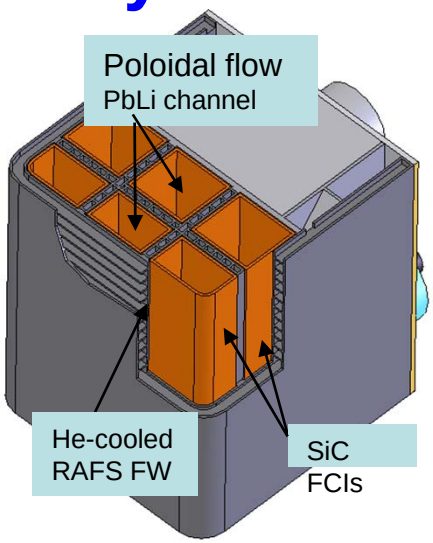


- MHD pressure drop can be much larger if any 3D pressure drop effects exist (space varying, 3 component fields)
- Insulator coating or FCI (flow channel insert) is being developed to have a manageable pressure drop/pumping power

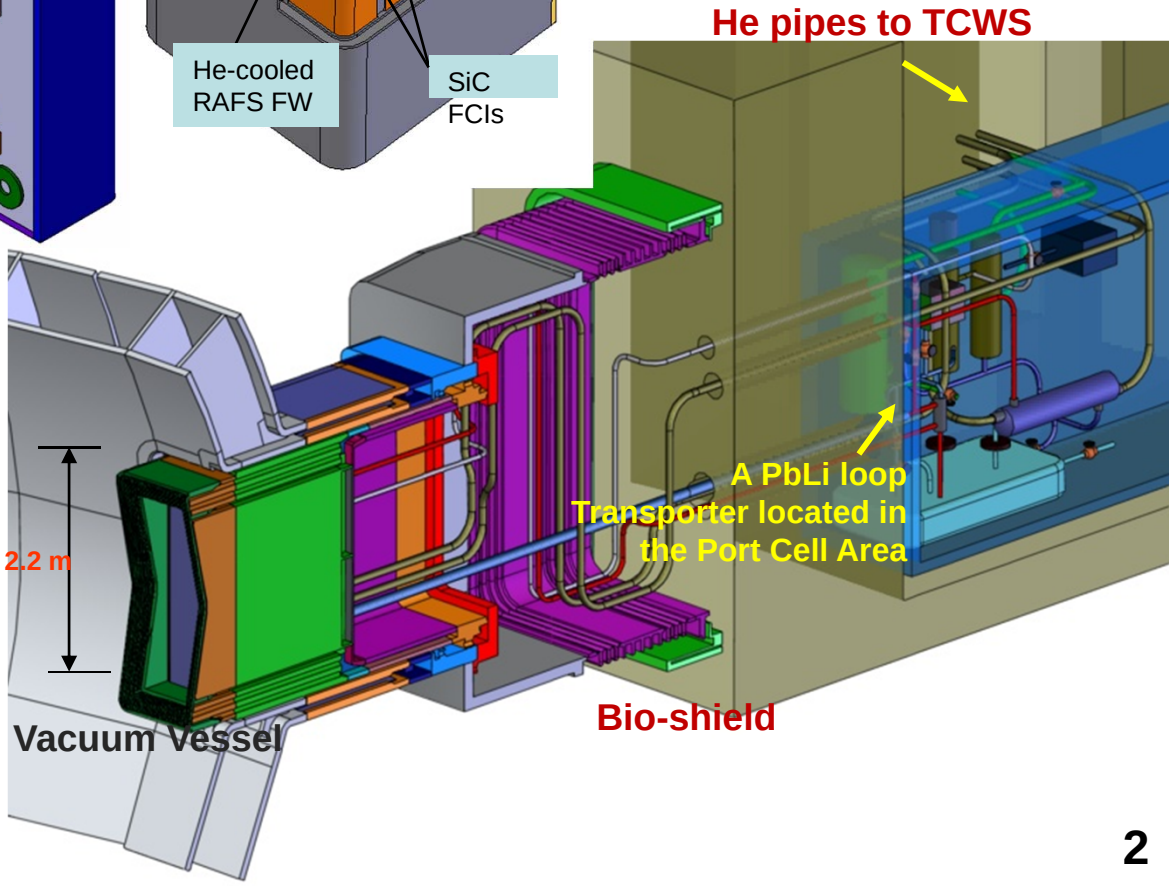
ITER Provides Substantial Capabilities for Testing of Blanket System

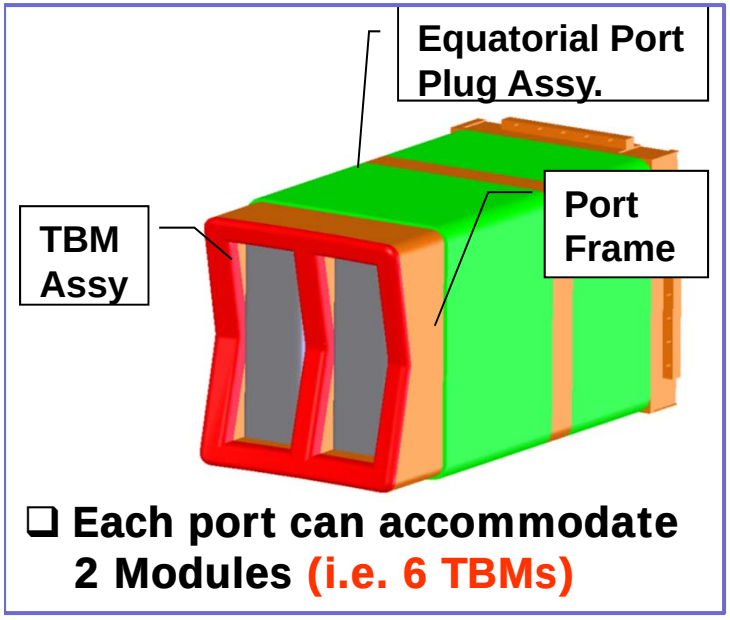




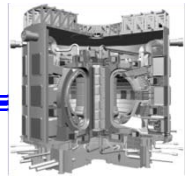


Note that DOE has not yet decided on the US' participation in the ITER TBM program



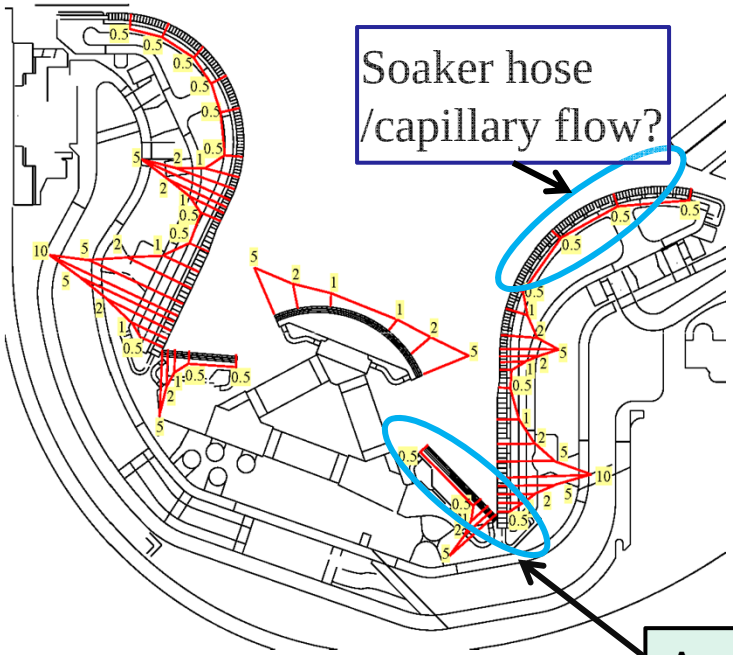


- Each port can accommodate 2 Modules (i.e. 6 TBMs)



1. Thermal analysis of the ITER DOME (ANSYS 11.0)

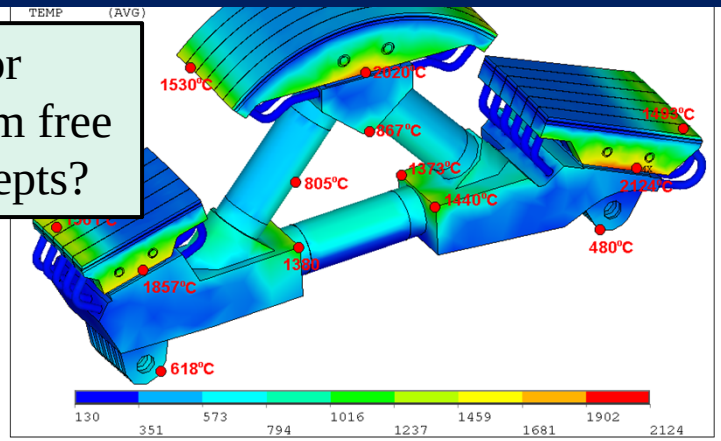
Time-averaged **design** surface th
Plasma Facing Units of PFCs (I

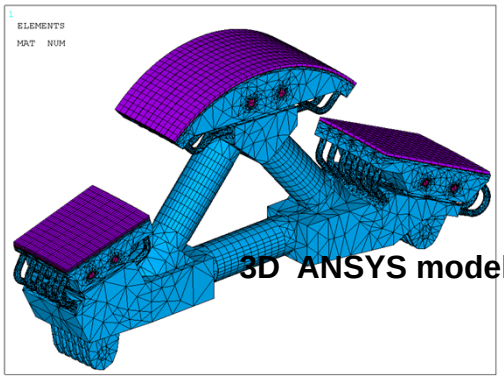


Moving forward: Is lithium PFC viable in magnetic fusion reactors such as ITER?
(Is it possible to test lithium PFCs in ITER, and when?)

- **Functionality (particle pumping, plasma MHD stability, or/and surface heat removal?)**
- **Limitations (such as evaporative flux, surface temperature)**
- **Environmental conditions (3-D surface heat flux map, 3-D magnetic field map)**
- **Flexibility (capillary, soaker hose flow or flowing lithium free surface?)**

A possible location for testing flowing lithium free surface divertor concepts?





3D ANSYS model of ½ DOME