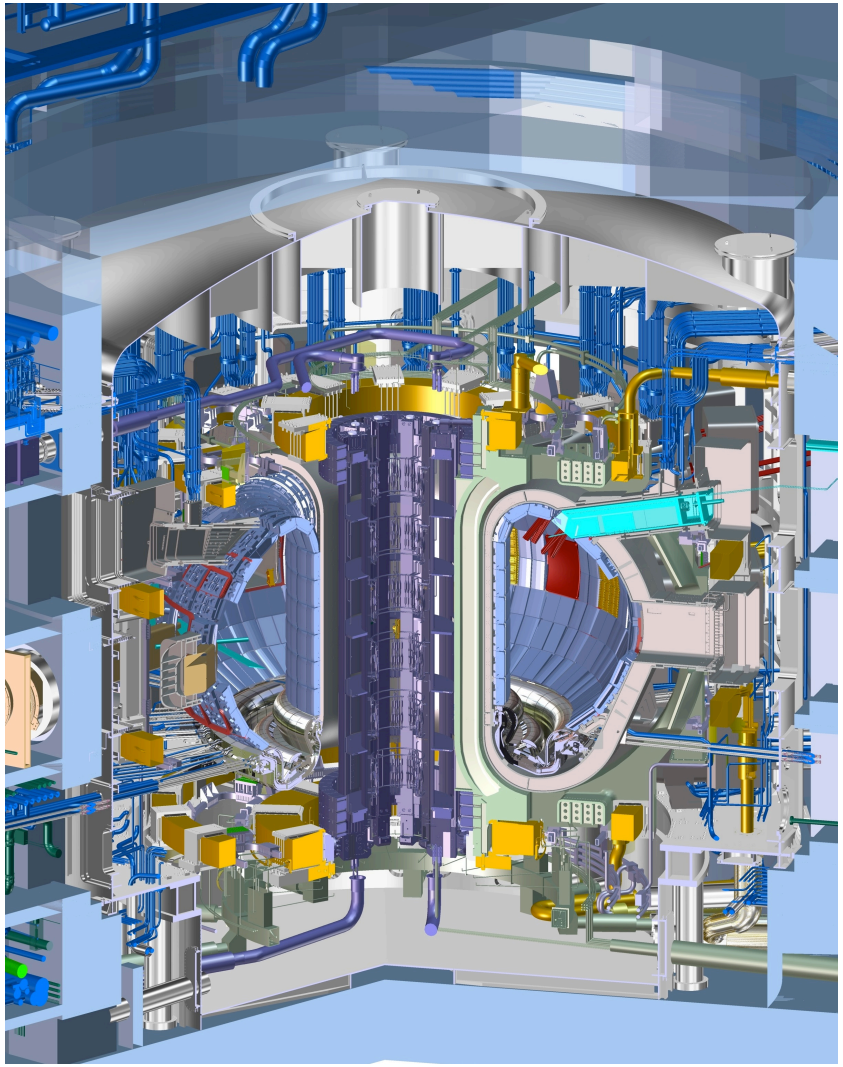
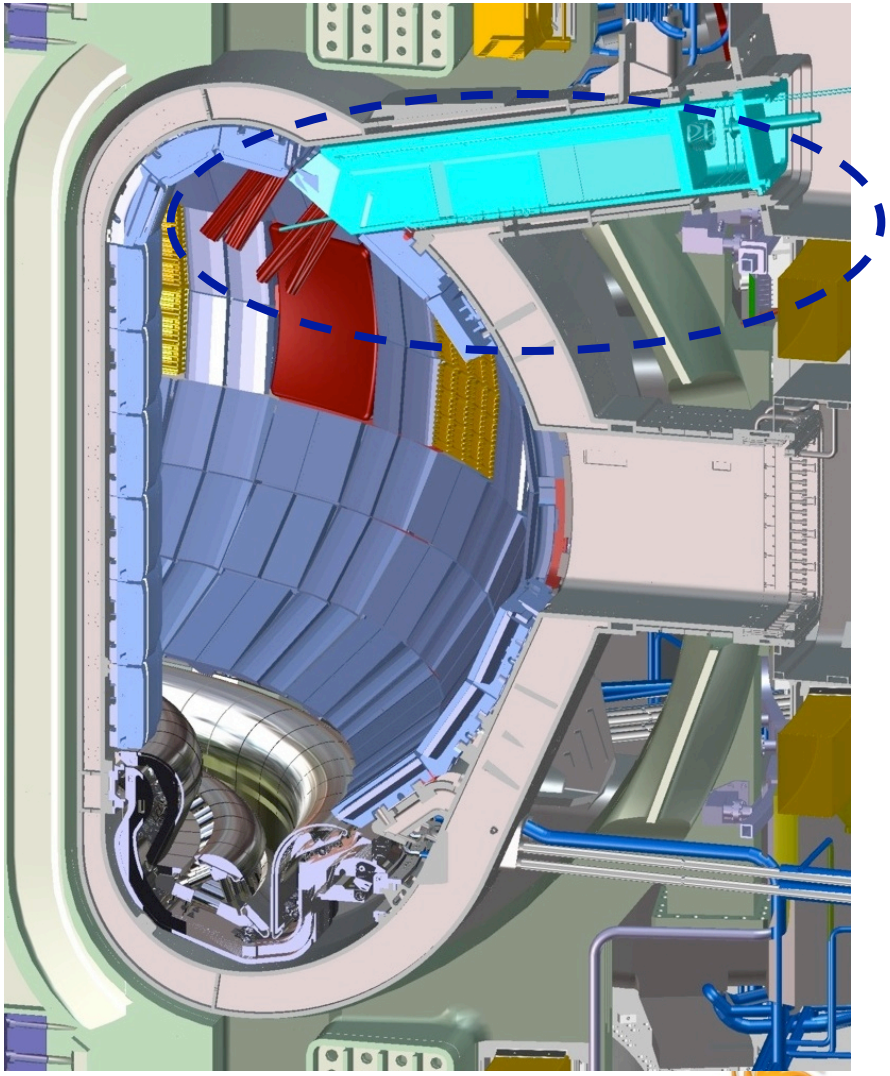
ITER Electron Cyclotron Heating System Vacuum Considerations

Third Workshop on Operation of Large Vacuum Systems

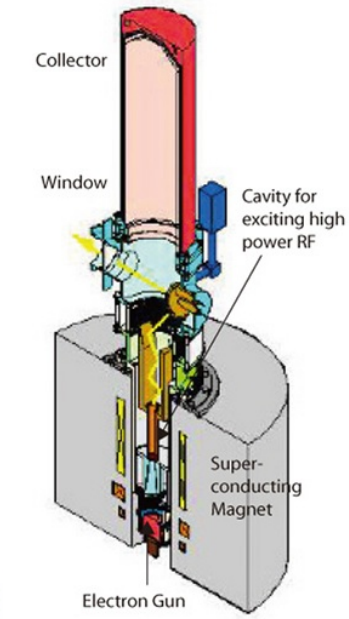
July 11-14, 2011
Oak Ridge, Tennessee

Electron Cyclotron Heating is Used to Heat and Control ITER Plasmas

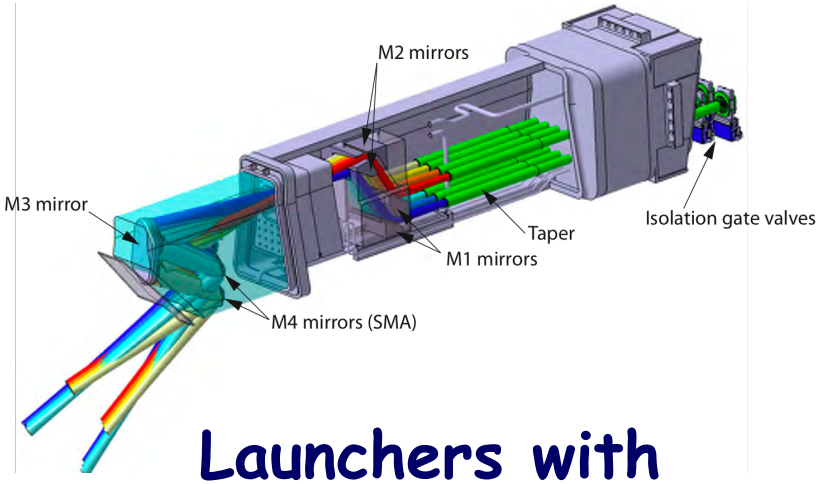




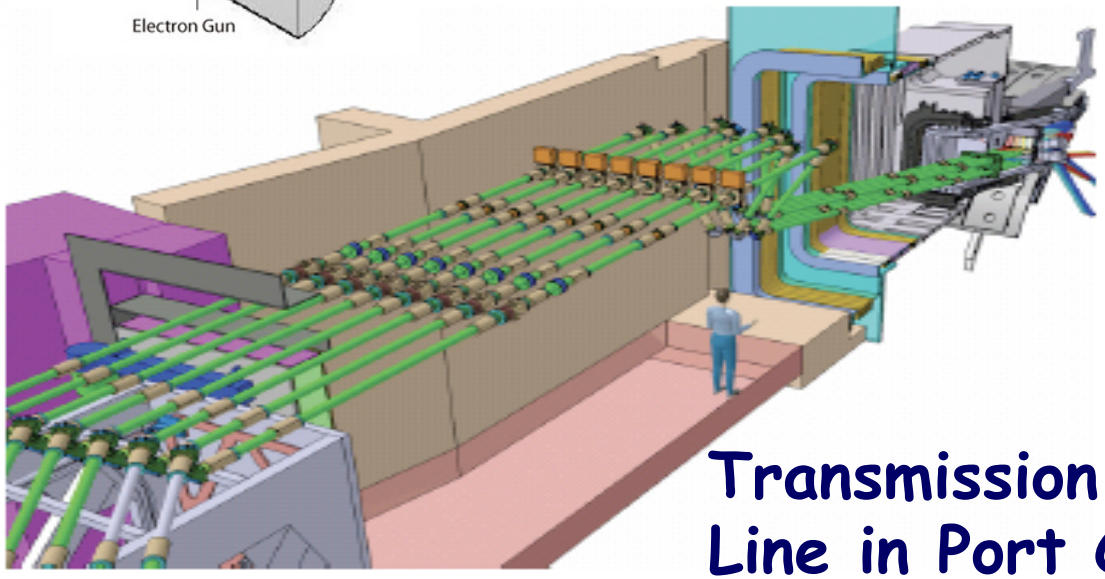
Electron Cyclotron Heating Subsystems



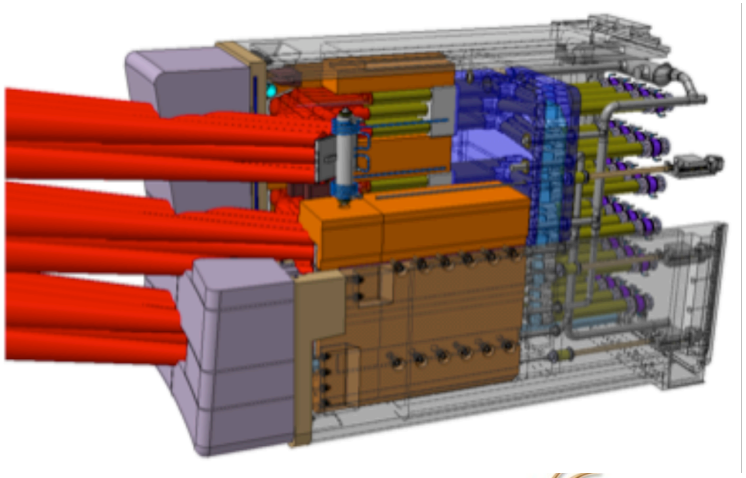
170 GHz Gyrotron Sources



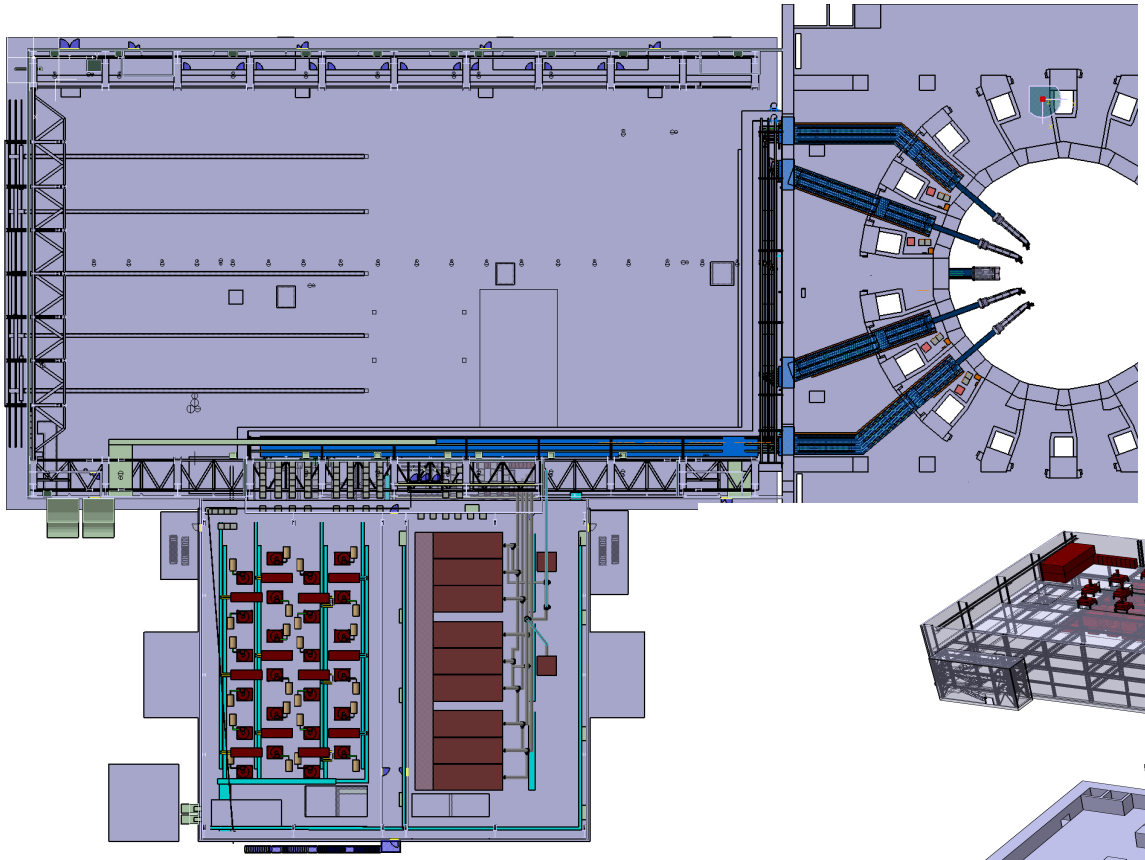
Launchers with Steering Mirrors



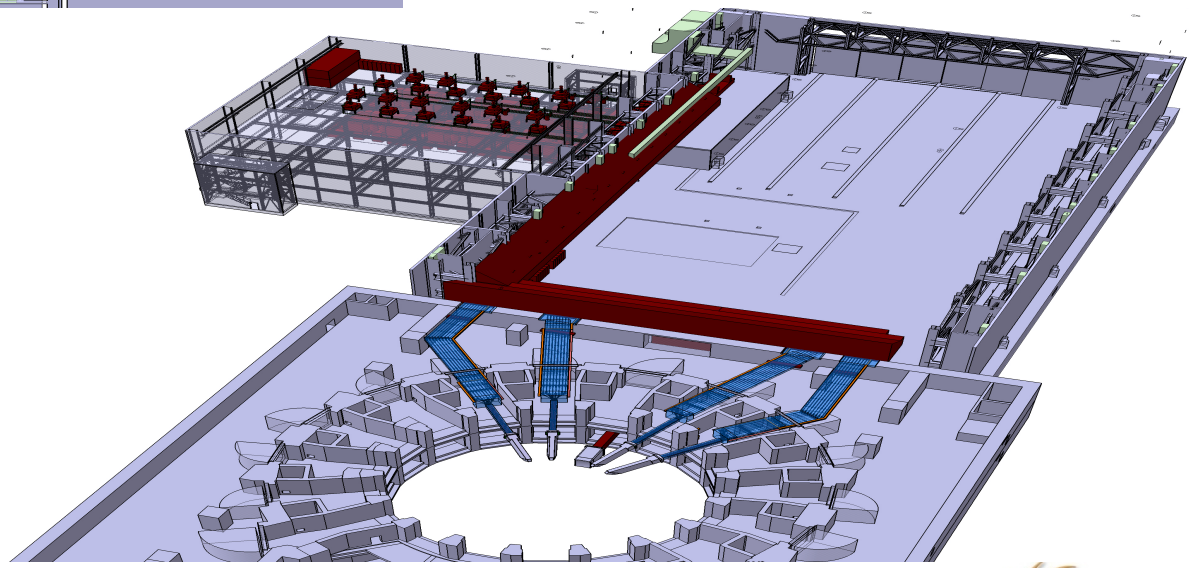
Transmission Line in Port Cell



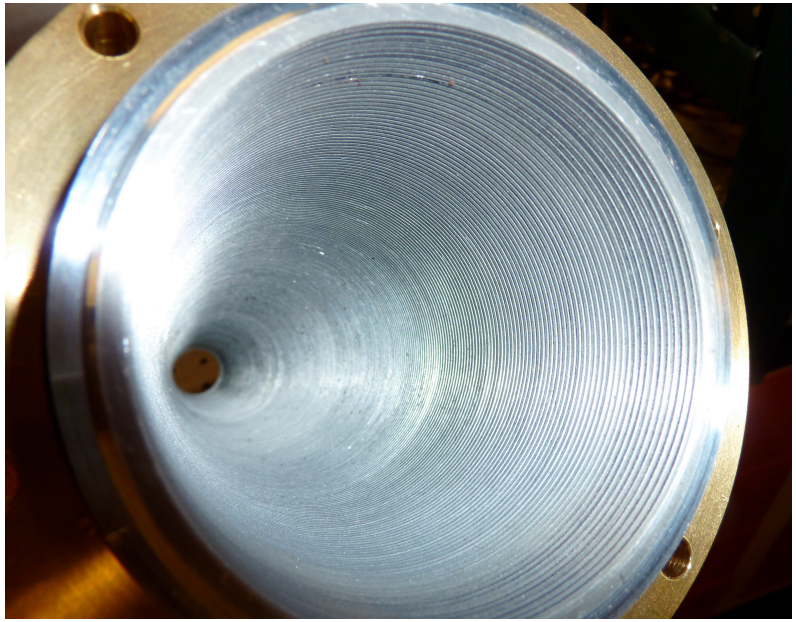
Overview - Electron Cyclotron Heating system



- 24 Gyrotrons
- 24 => 56 Transmission Lines
- 5 Launchers with 56 outputs

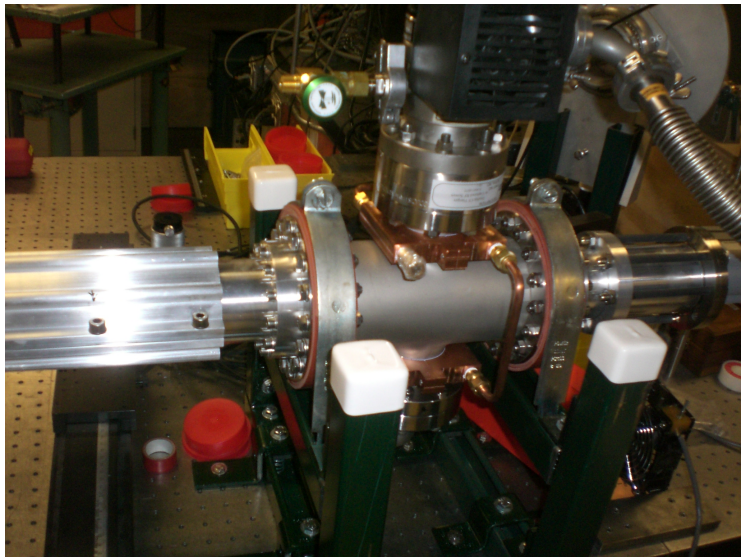


Corrugated Aluminum Waveguide Components

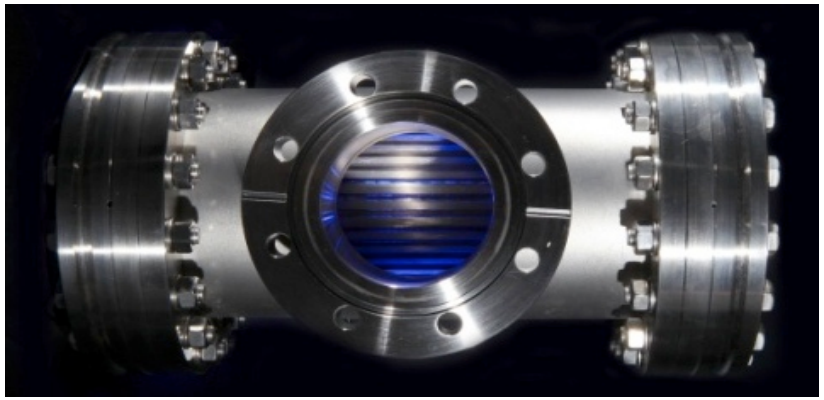


Waveguide Vacuum Pumping Tees

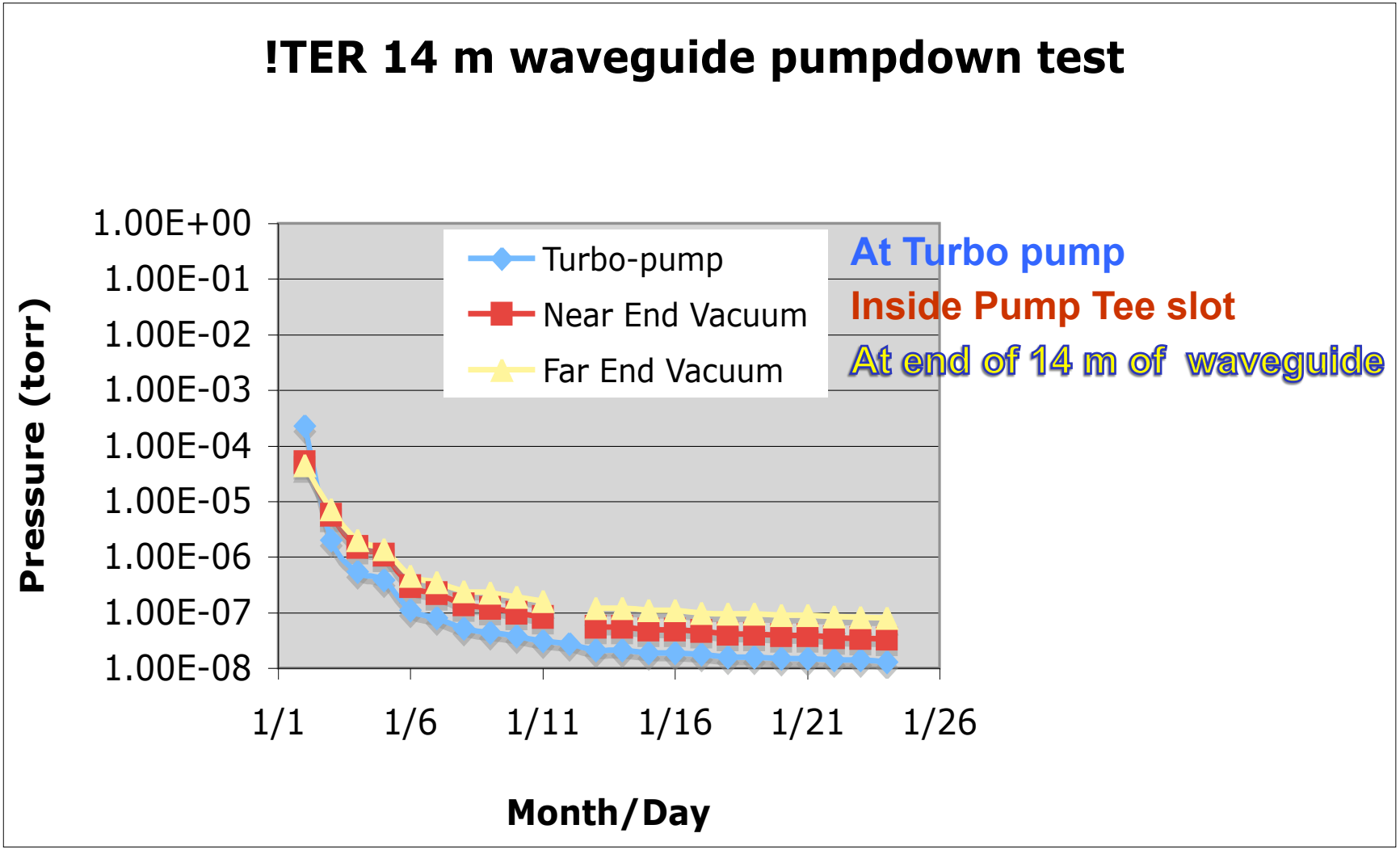
Linear slot type with microwave screening



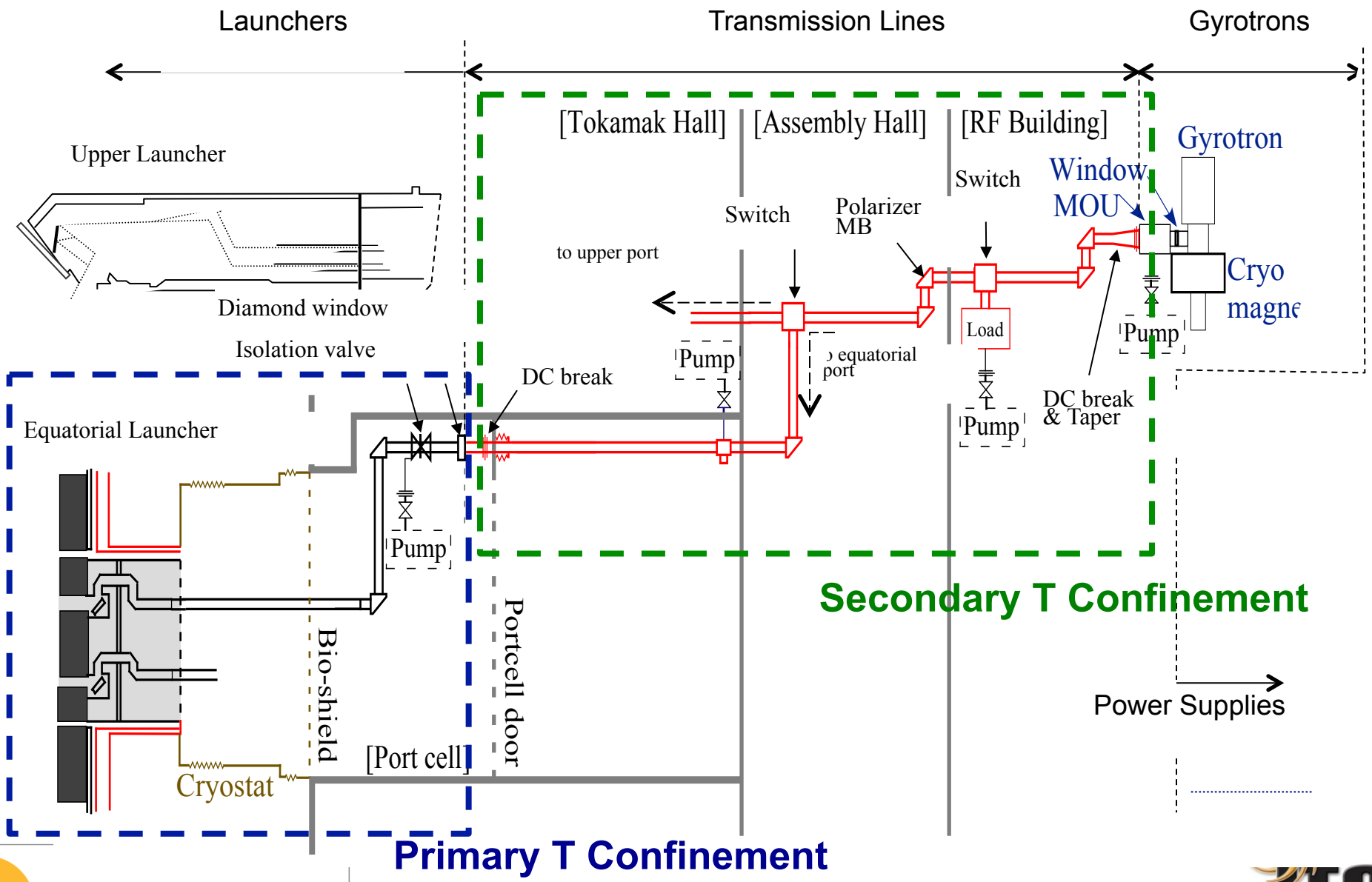
Circular slot type with microwave absorber



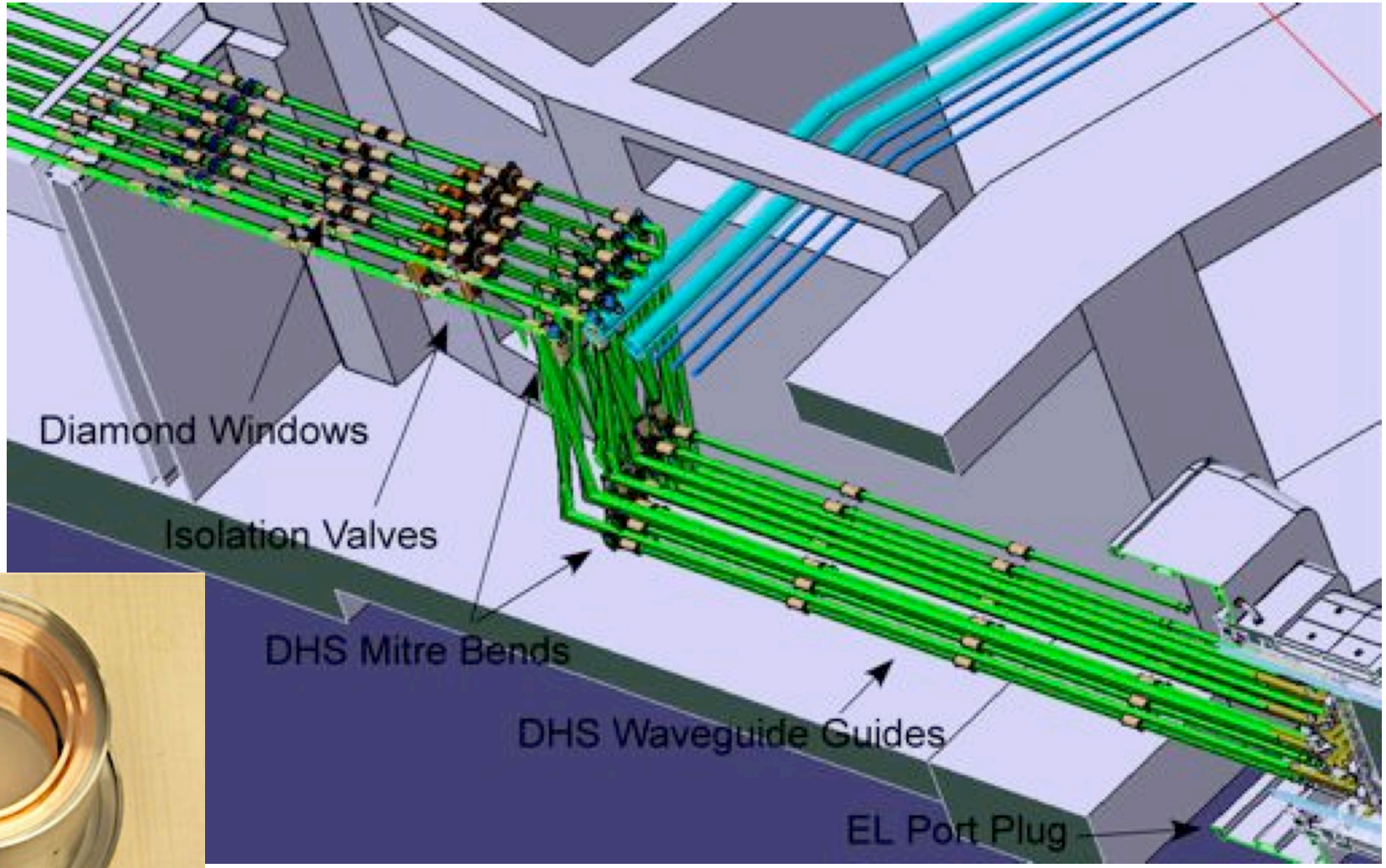
Vacuum Pumpdown data



Line Components and T Confinement

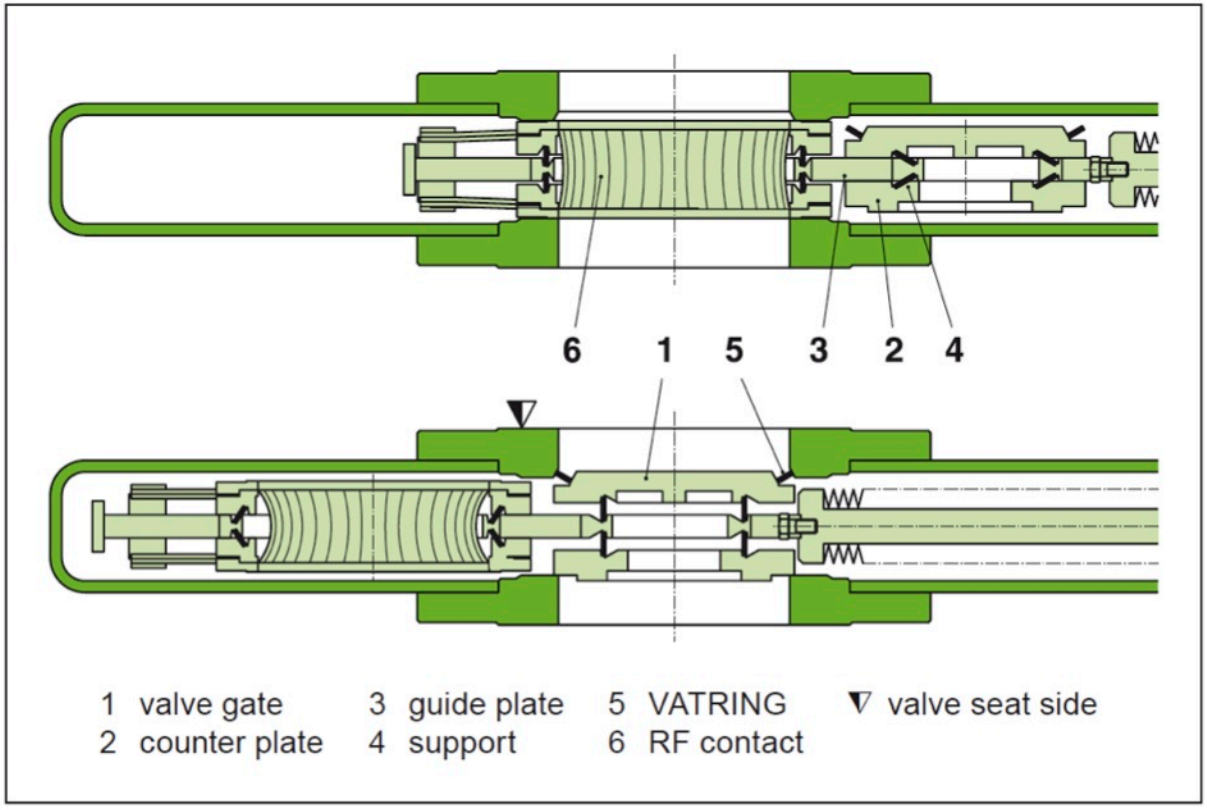


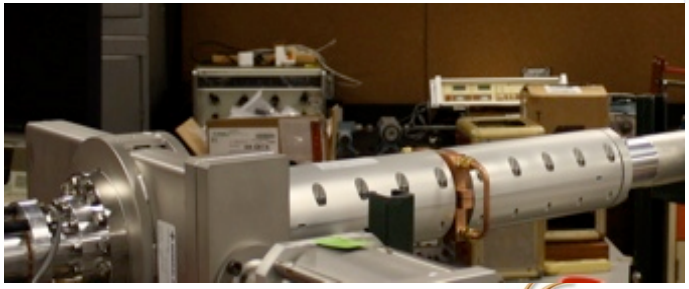
Transmission Line in Port Cell



Diamond Window Assembly

Transmission Line Gate Valve



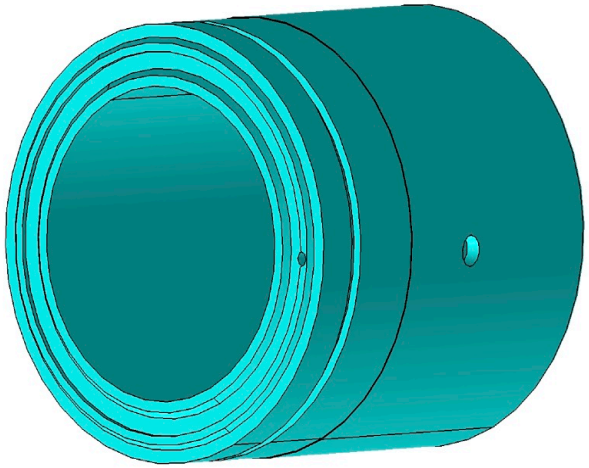


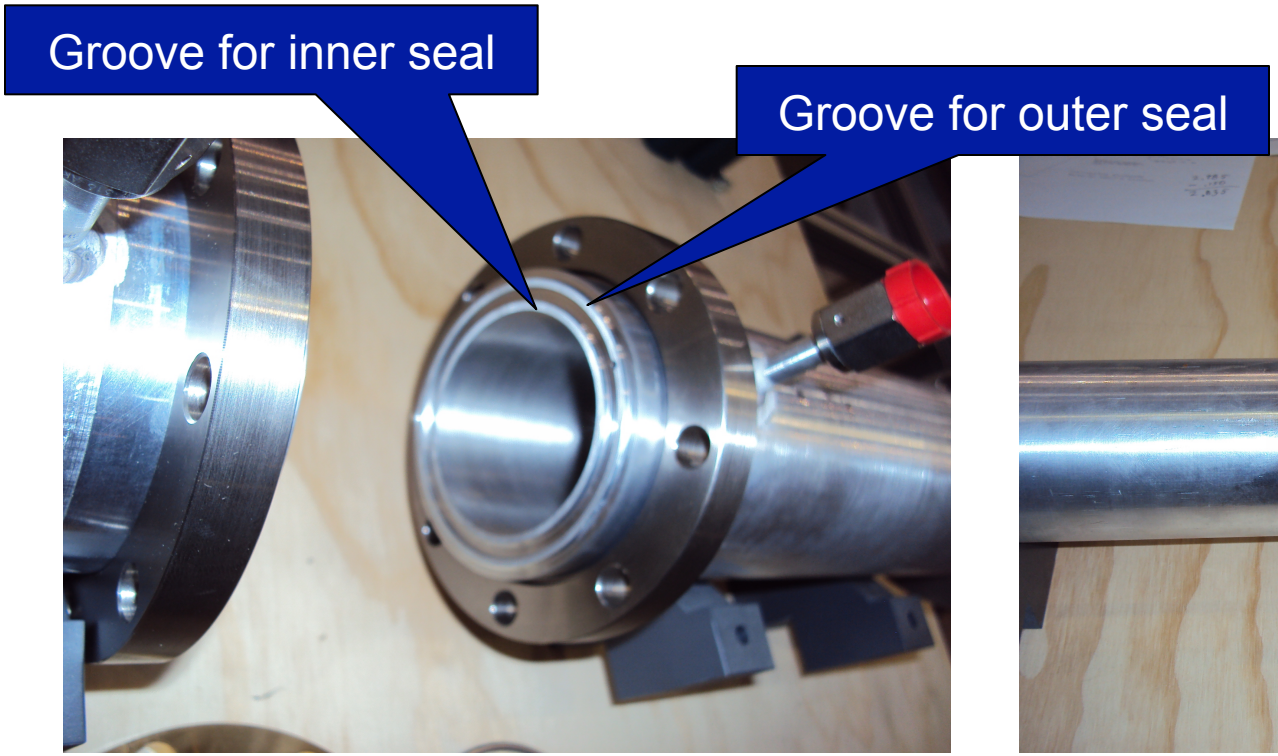
Valve includes internal waveguide corrugations

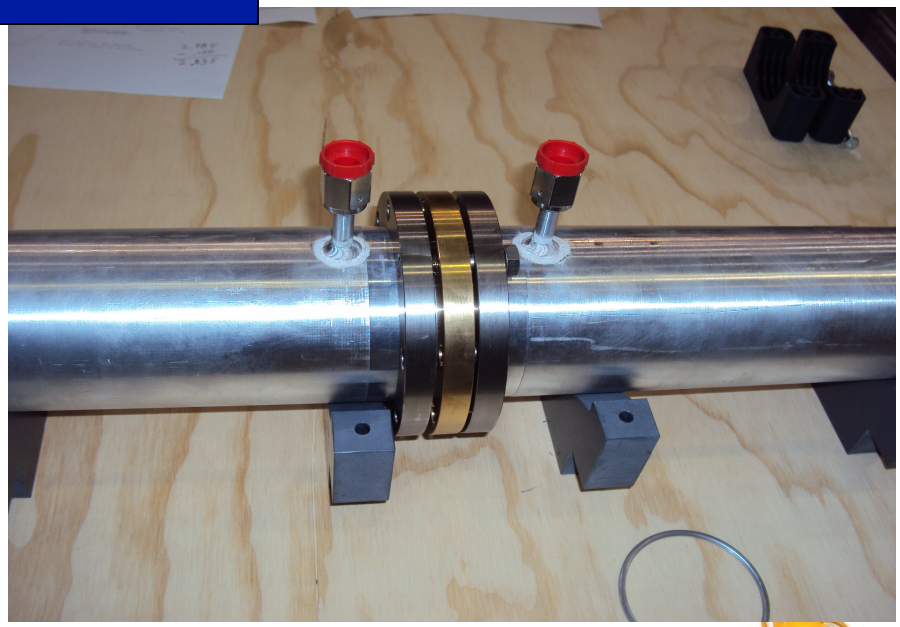
Tritium compatible – metal seals and bellows

Double Metal Seal Waveguide

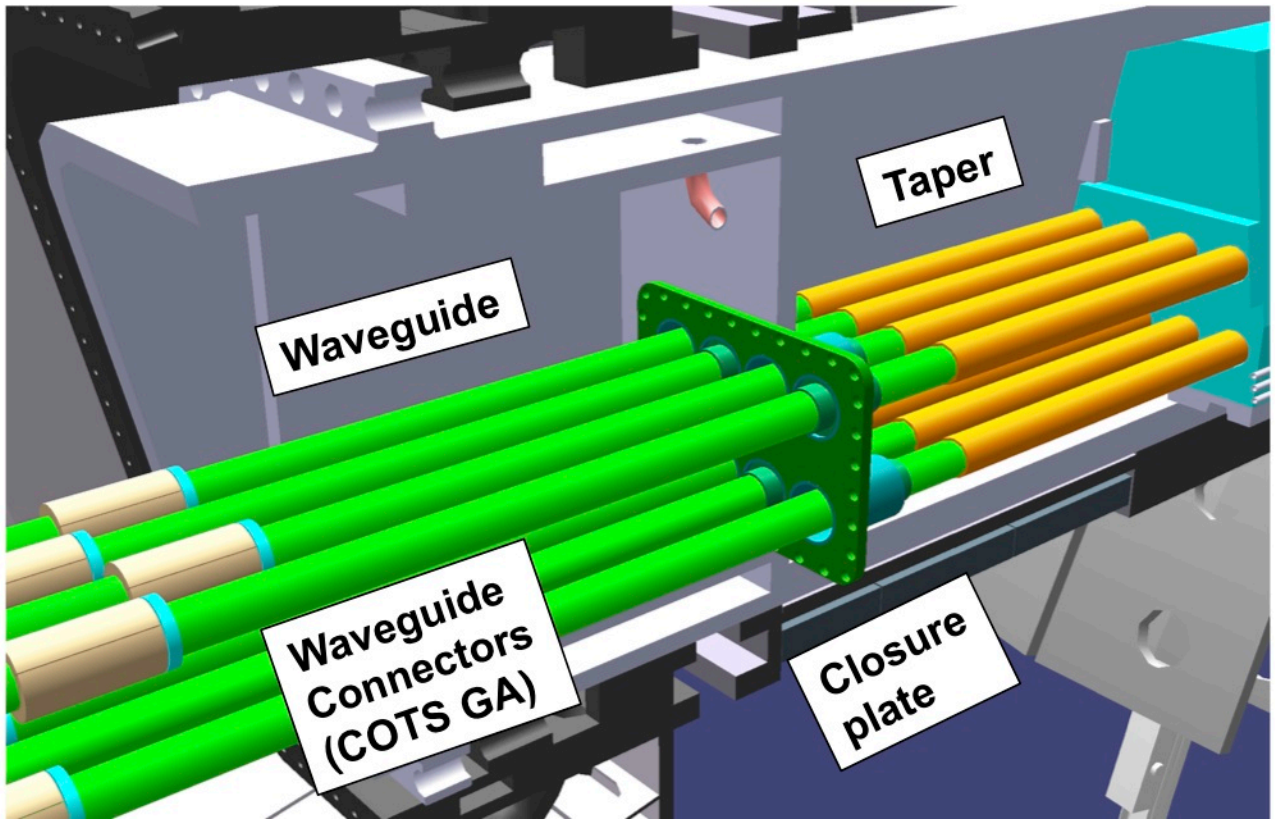
- **Helicoflex and EPDM seals on end of corrugated waveguide section**
- **Vacuum connection for monitoring space between seals**

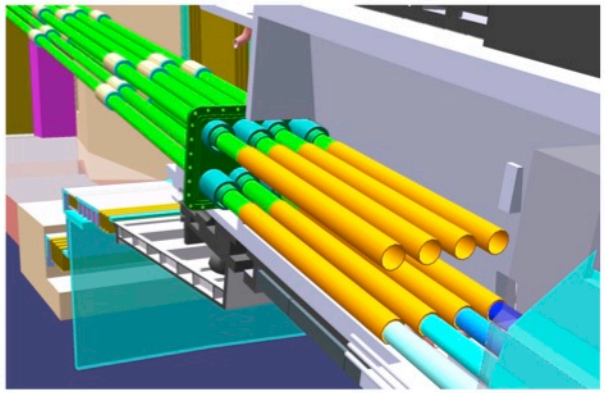


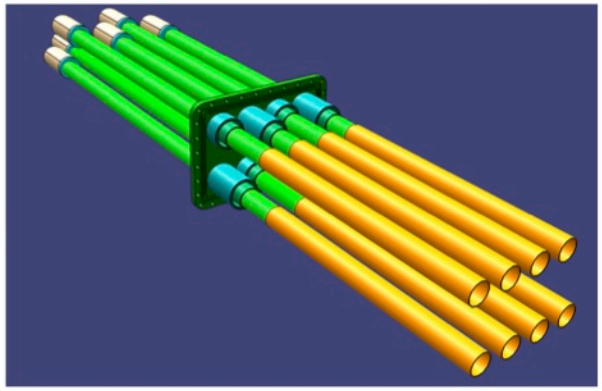




Port Plug Launcher - Waveguide Seal

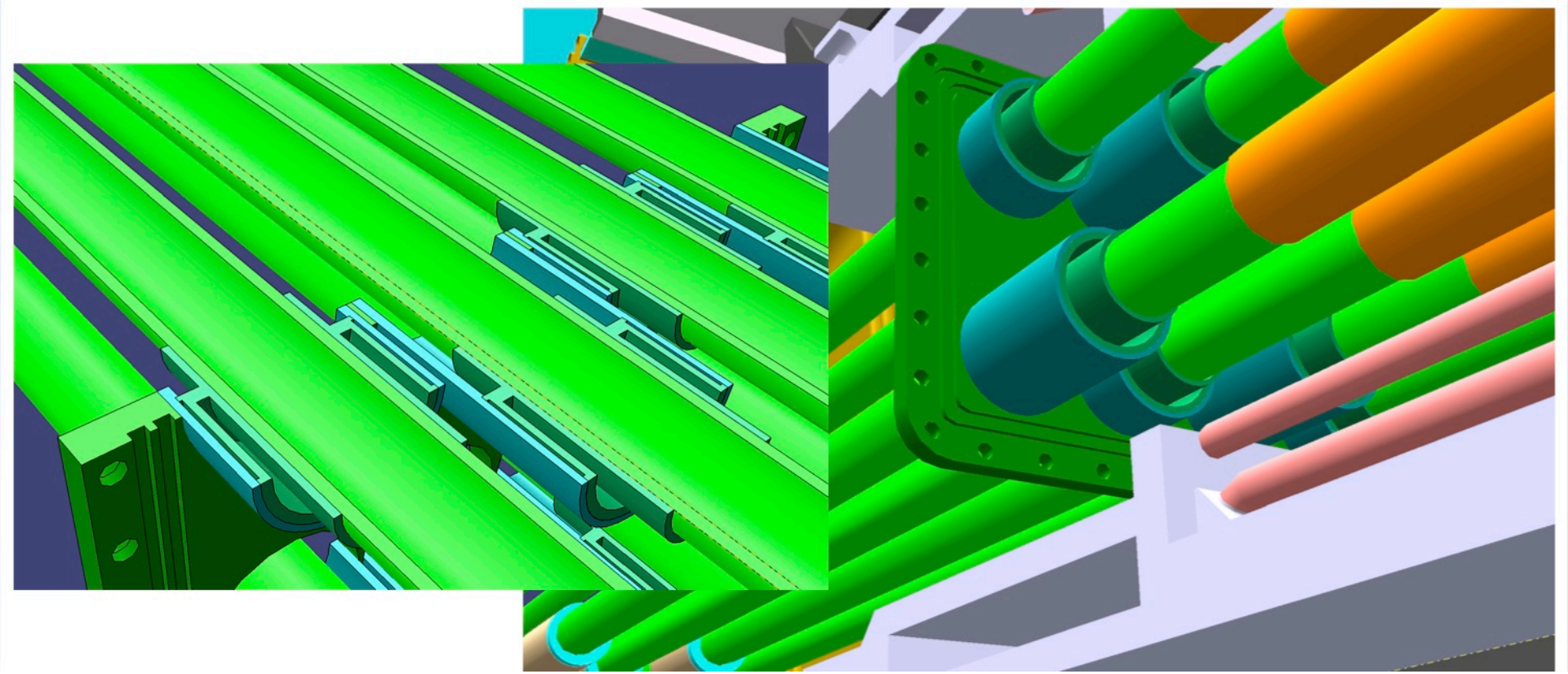






Waveguide to port interface - Primary T containment

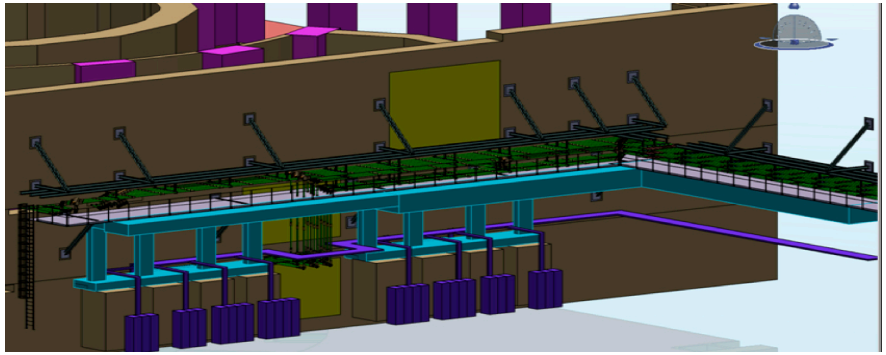
Port Plug Launcher - Waveguide Seal Detail

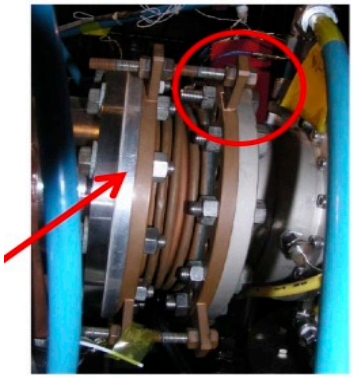


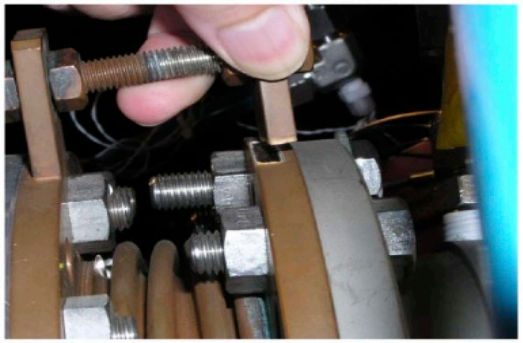
Accommodates thermal expansion without waveguide distortion

Sacrificial Waveguide - Seismic Break

- **Differential movement between Tokamak building and external Buildings**
- **Accommodate 6 cm displacement**
- **Must maintain 2nd T confinement**
- **Sacrificial waveguide inside bellows**







Broken MOU bellow flange

The Japan Earthquake

(The 2011 off the Pacific coast of Tohoku Earthquake)

March 11, 2011 14:46 (JST)

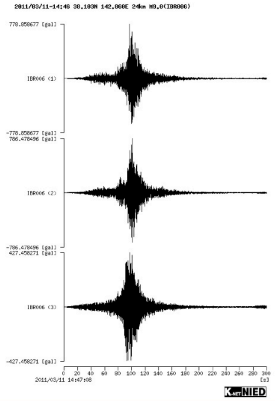
Mw 9.0 (38.10 N 142.86 E)

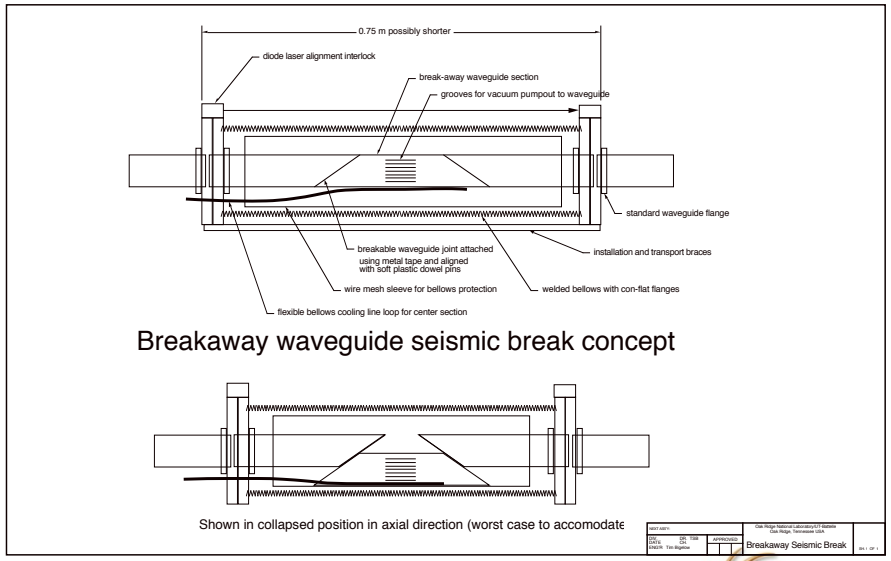
At Mito city, Ibaraki

36.37 N 140.45 E

14km from JAEA-Naka site

Max Accel.: **851 gal**





Thank You