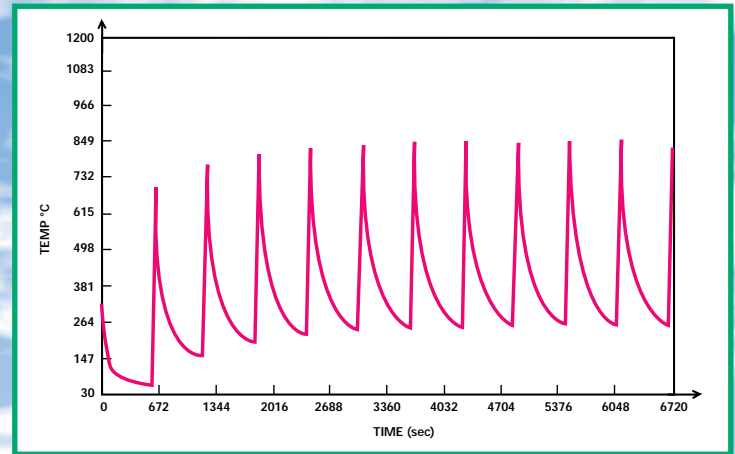


Engineering Analysis, Design, and Manufacturing

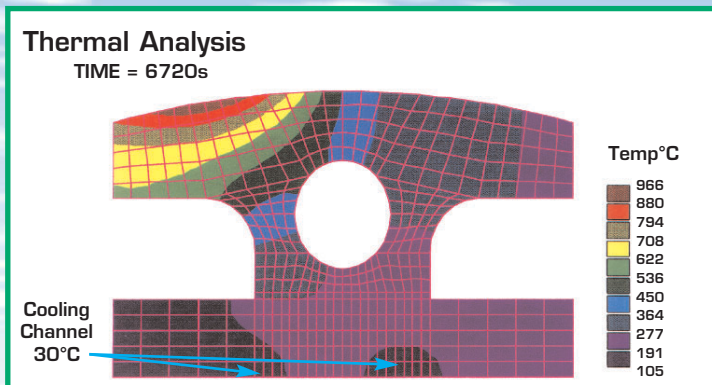
Problem: How to protect the inside wall of the DIII-D Tokamak vacuum vessel from high temperatures (1000°C). Use protective tiles?

Analysis: Apply heat flux to the tile surface; on for 10s off for 600s. Tile is continuously cooled by 30°C water in channels outside vessel wall. Only thermal/stress analysis shown.

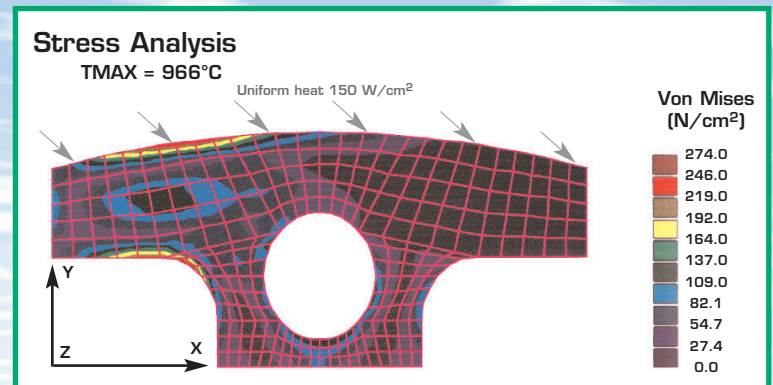
Solution: Cover the entire inner surface of vacuum vessel with tiles, much like those used on the underside of the Space Shuttle.



Temperature response of tile surface over time



The final temperature distribution at 6720s



The resulting stress during the first 10s of temperature rise

Design: All modeling and drawings are performed on a CAD system

- Parameters:**
- A. Graphite; Sublimation 1000°C, Compressive limit 3400 N/cm²
 - B. Must be small enough to wrap around curvature of vessel
 - C. Tiles must overlap so no vessel surfaces are exposed.
 - D. Provide area under tiles for thermocouples, waveguide, etc.
 - E. Develop system to fasten tiles to wall.

Manufacturing: Machines Used: Milling Machines & Numerically Controlled Milling

