An Analysis Of A Spent Fuel Transportation Cask Under Severe Fire Accident Conditions

CHRISTOPHER S. BAJWA

SPENT FUEL PROJECT OFFICE

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

U.S. NUCLEAR REGULATORY COMMISSION

ASME PRESSURE VESSEL AND PIPING CONFERENCE

AUGUST 5, 2002

VANCOUVER BC, CANADA

Introduction

- Baltimore Tunnel Fire
- Spent Fuel Transportation Cask
- Preliminary Results
- Conclusions and Future Work

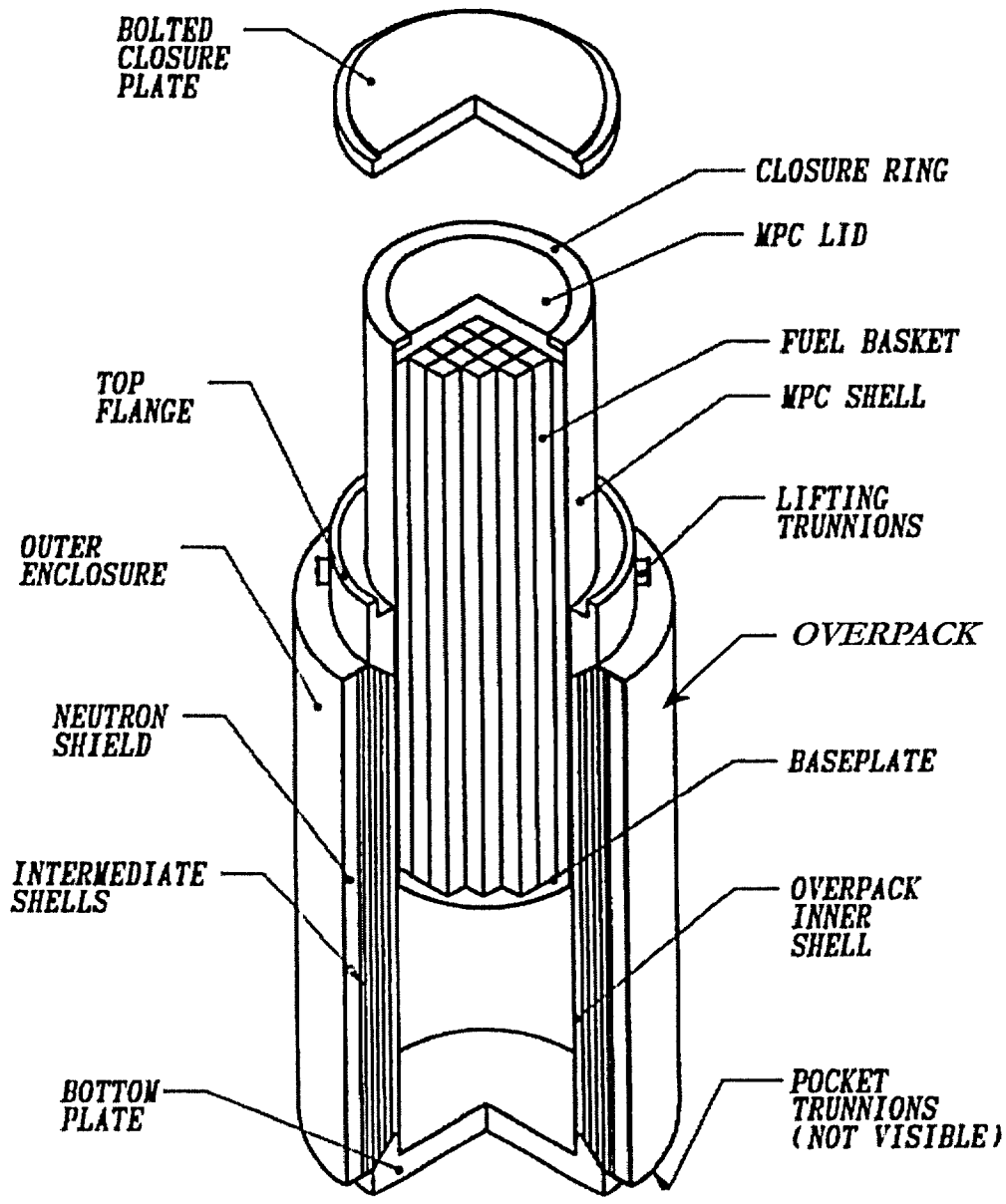
Baltimore Tunnel fire

- July 18th, 2001
- Howard Street Tunnel
- CSX Freight Train
- Derailment and Fire
    - Tripropylene

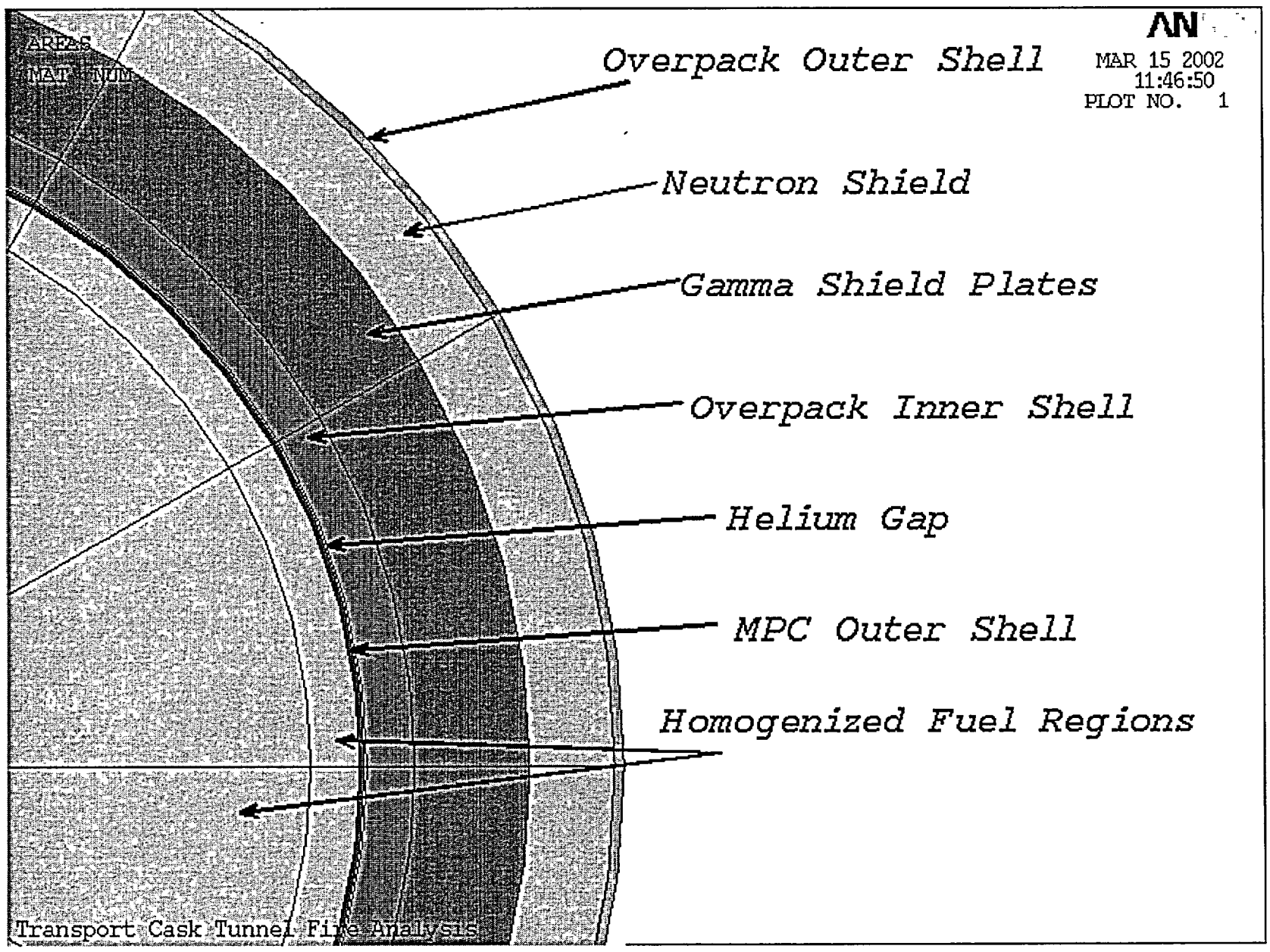
Spent Fuel Transportation Cask

- 10 CFR 71.73 Fire Accident
- Cask Performance
- Finite Element (ANSYS®) Model

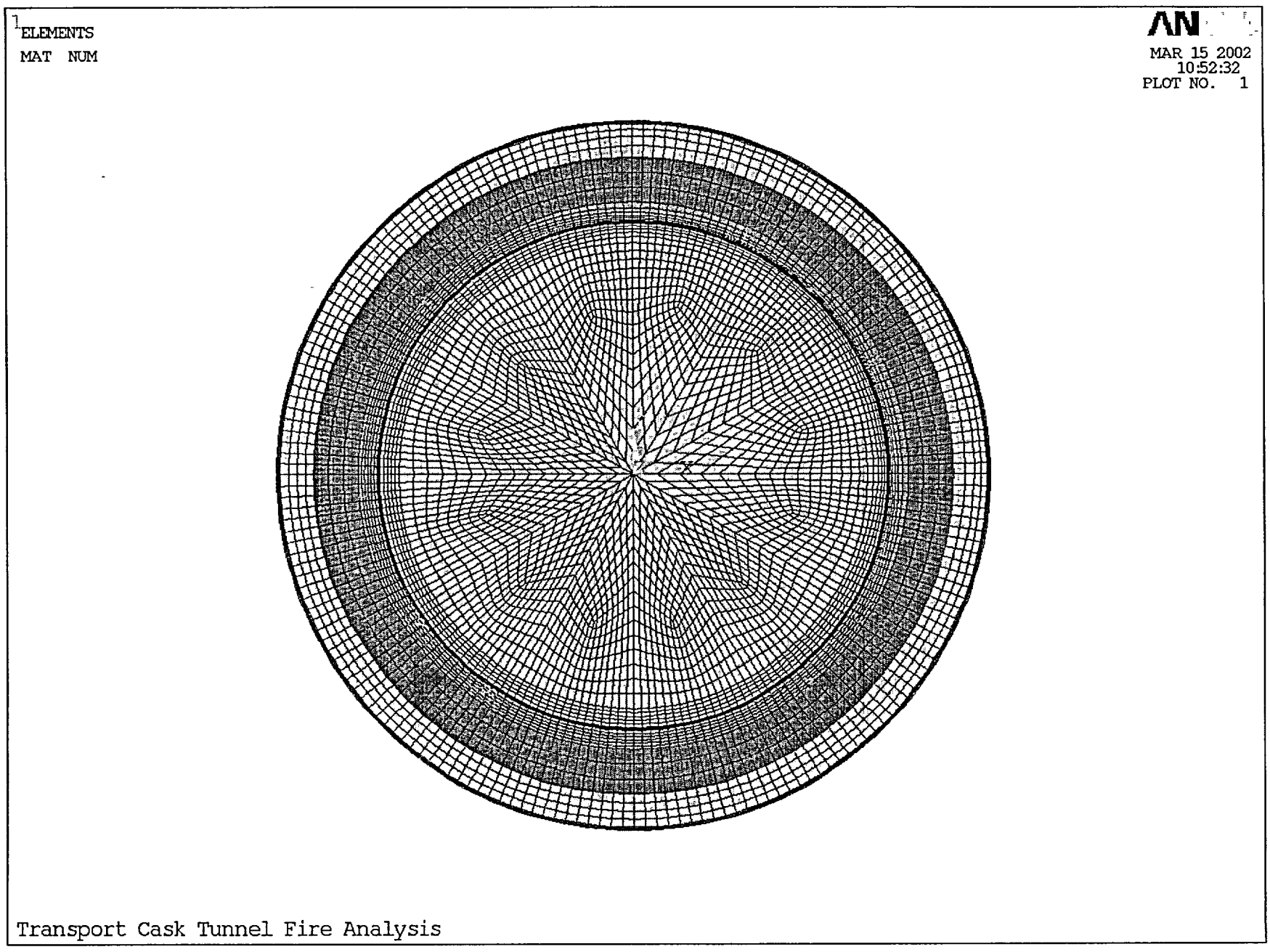
SPENT FUEL TRANSPORTATION CASK



ANSYS® Model


AN
MAR 15 2002
11:46:50
PLOT NO. 1
Overpack Outer Shell
Neutron Shield
Gamma Shield Plates
Overpack Inner Shell
Helium Gap
MPC Outer Shell
Homogenized Fuel Regions
Transport Cask Tunnel Fire Analysis

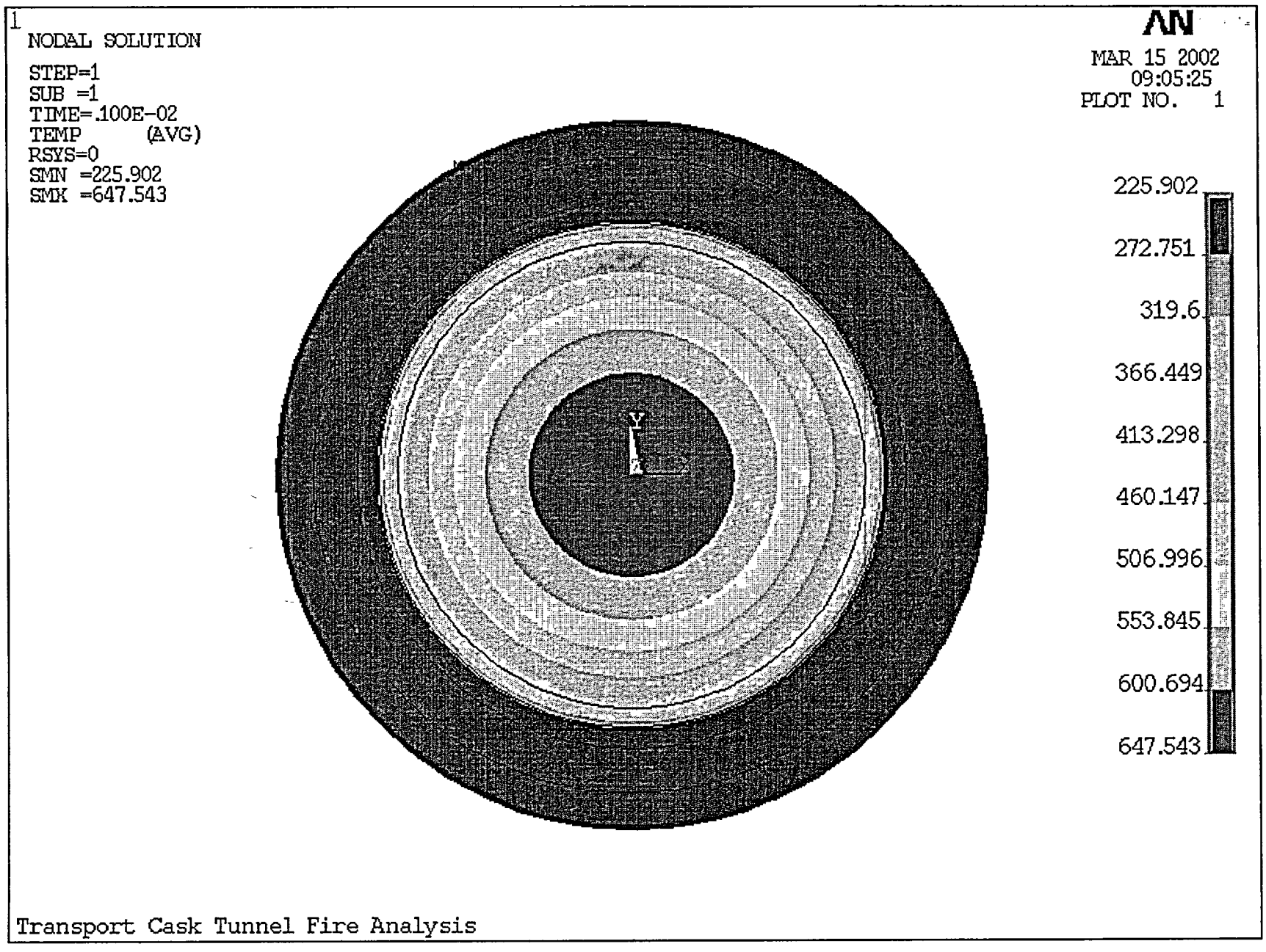
ANSYS® Model Mesh



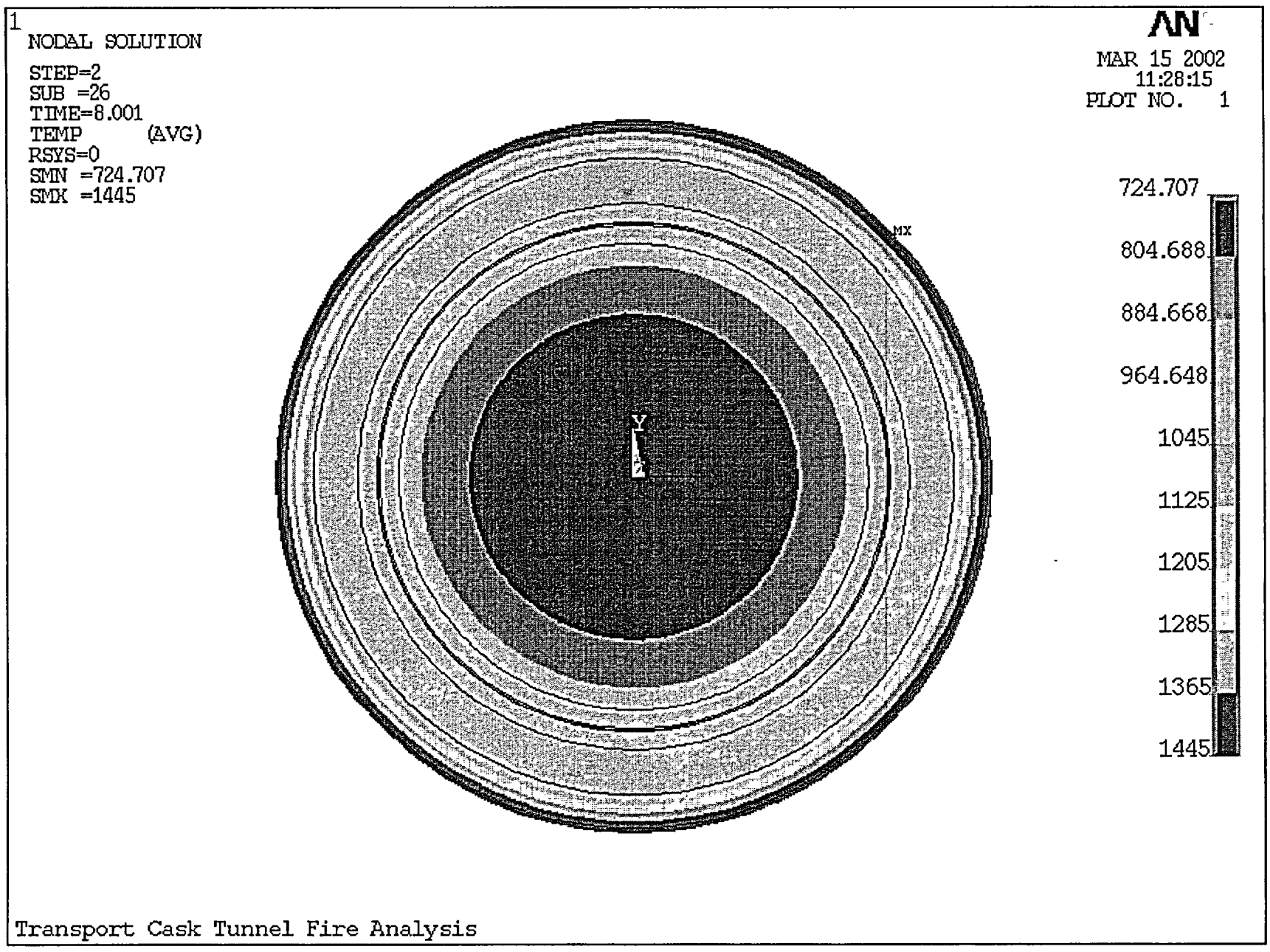
Boundary Conditions

- Heat Transfer Mechanisms
- Initial Conditions
- Fire conditions

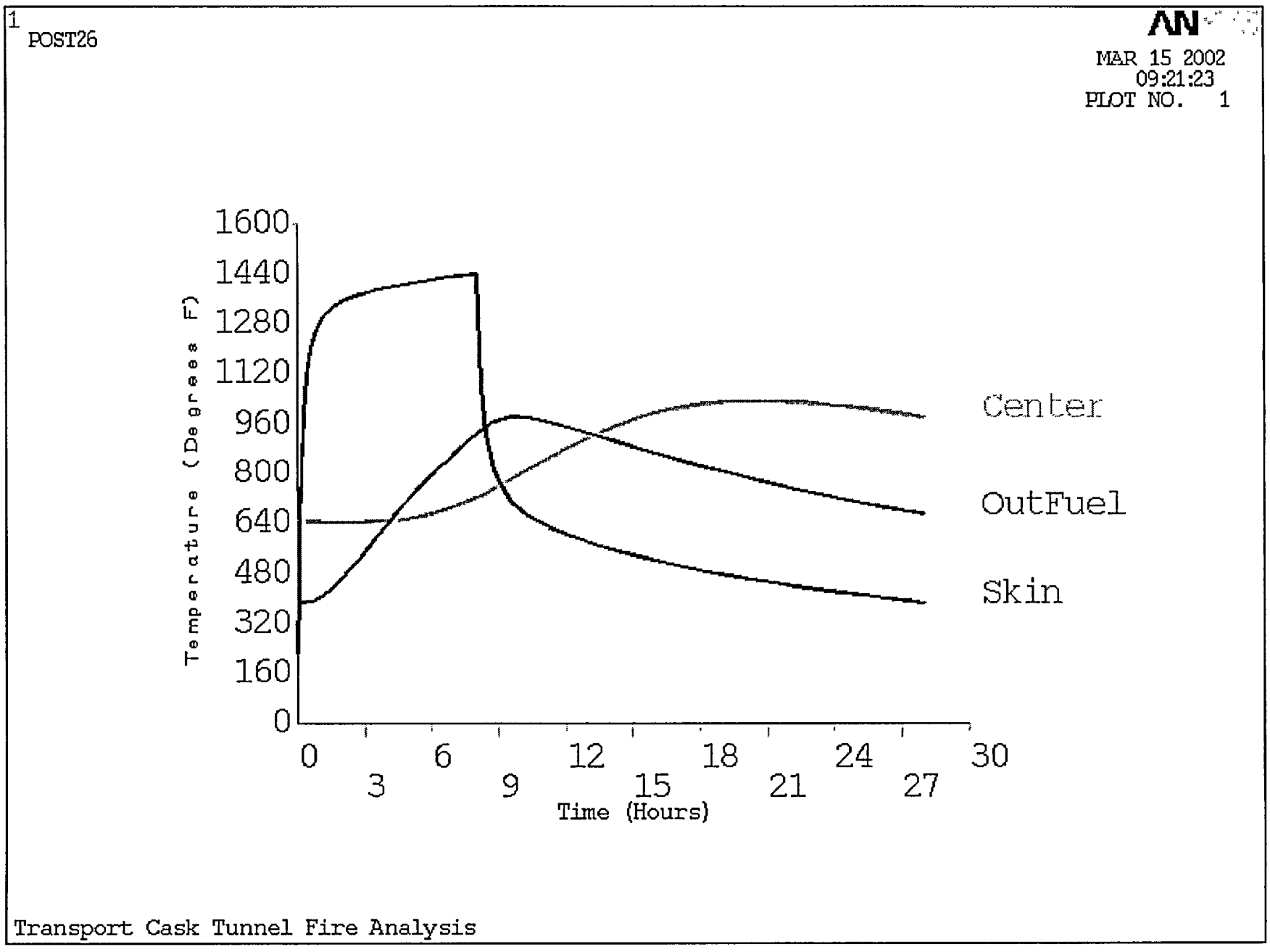
Normal Condition Temperature Profile



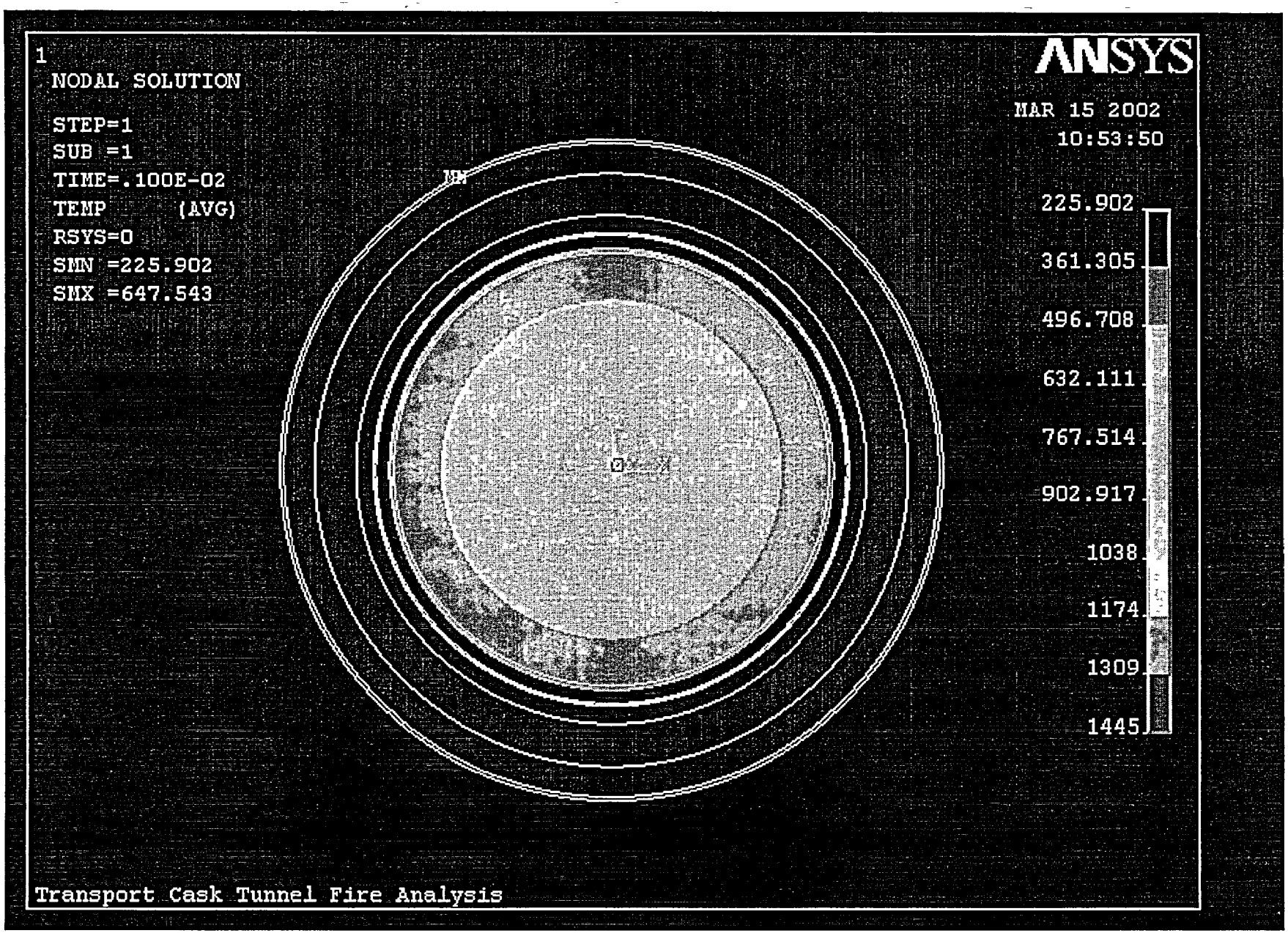
8 Hour Fire Temperature Profile



Cask Component Time vs.Temperature Plot



8 Hour Fire with 20 Hour Cooldown

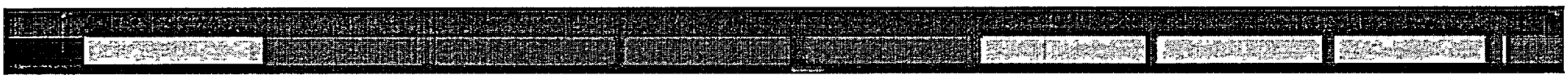


Preliminary Results

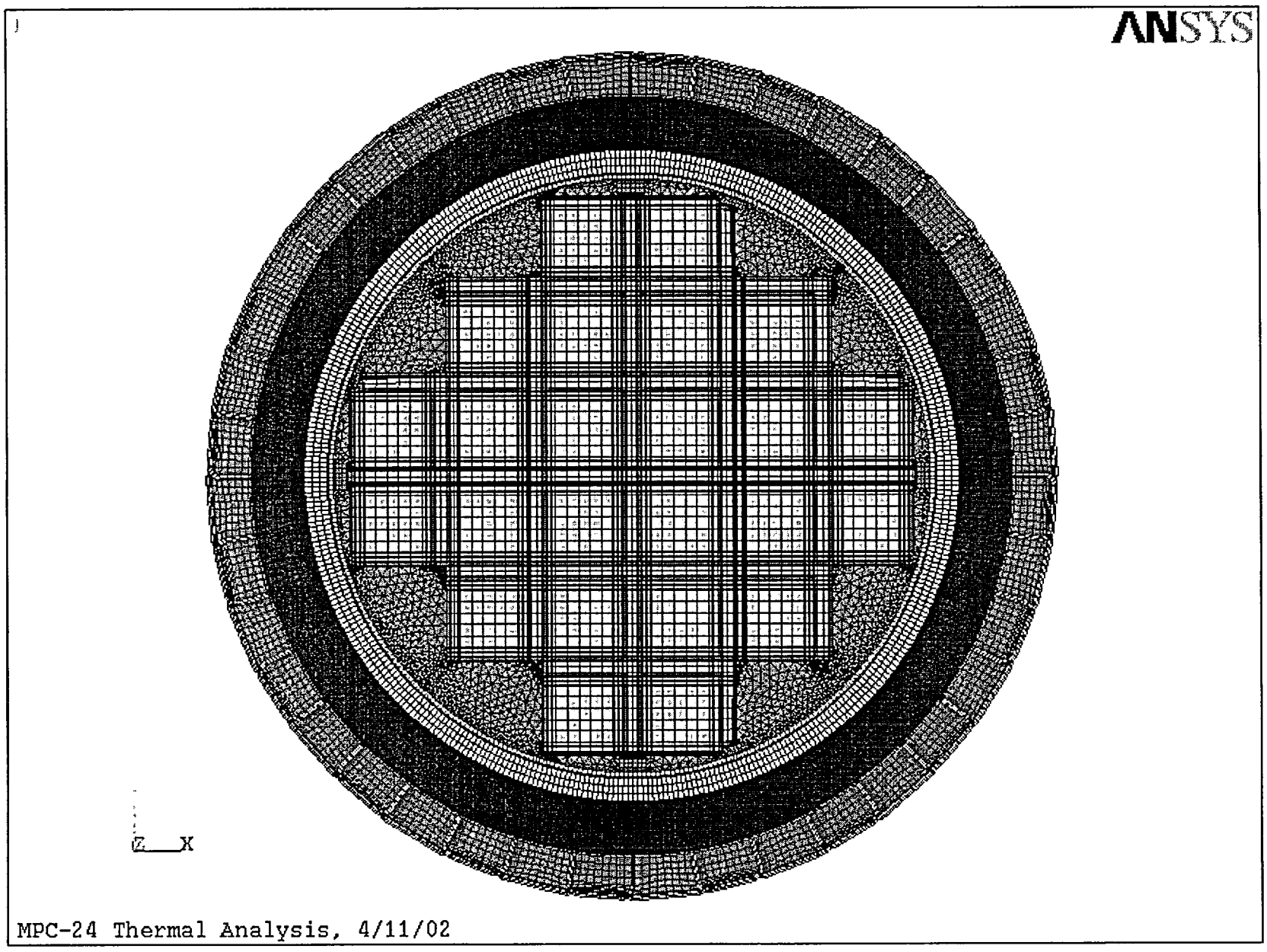
- Fuel Cladding Temperature Limits
- Conservative Assumptions

Conclusions and Future Work

- Cask Performance
- Refined Cask Model
- Model Tunnel and Railcar
- NIST Tunnel Fire Model
- Revise Boundary Conditions



Refined Cask Model



Acknowledgements

- Mr. Brian Kloppel
- Mr. Harold E. Adkins, Jr.

Pacific Northwest National Labs

- Mr. Kevin McGrattan (NIST)
- Mr. Richard Downs (NTSB)