TS Modeling Discussion

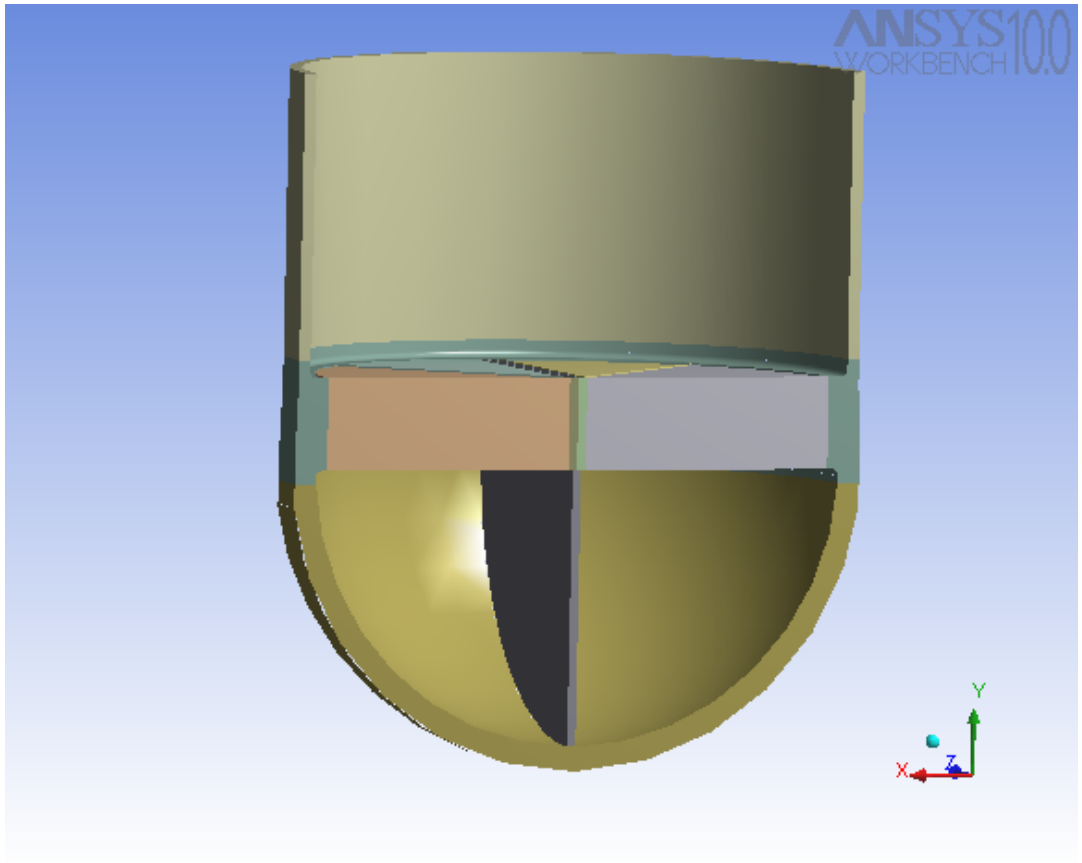
Working meeting between ANL, Westinghouse and NRC

12-17-2008

Model Comparison

- The goal was to compare, as closely as possible, the TS displacements and the resulting contact pressures, for SLB and NOP conditions.
- The specified conditions were that a uniform temperature (isothermal) with uniform HL/CL and secondary side pressures would be applied for SLB and NOP conditions.
- Contact Pressures and Displacements calculated along a 45 degree angle from HL face of divider plate, taken at coordinates 30 in, 30 in from a top view of the TS.
- Pcrev = 0 psi, except at crack location (BTS).
- Coefficient of Friction = 0.2.
- Intact DP, DP = 0.399.
- Residual Contact Pressure = 0 psi.

3D Model for ANL Comparison



No TS Support Ring Included in the model.
Boundary Conditions changed to reflect new model.

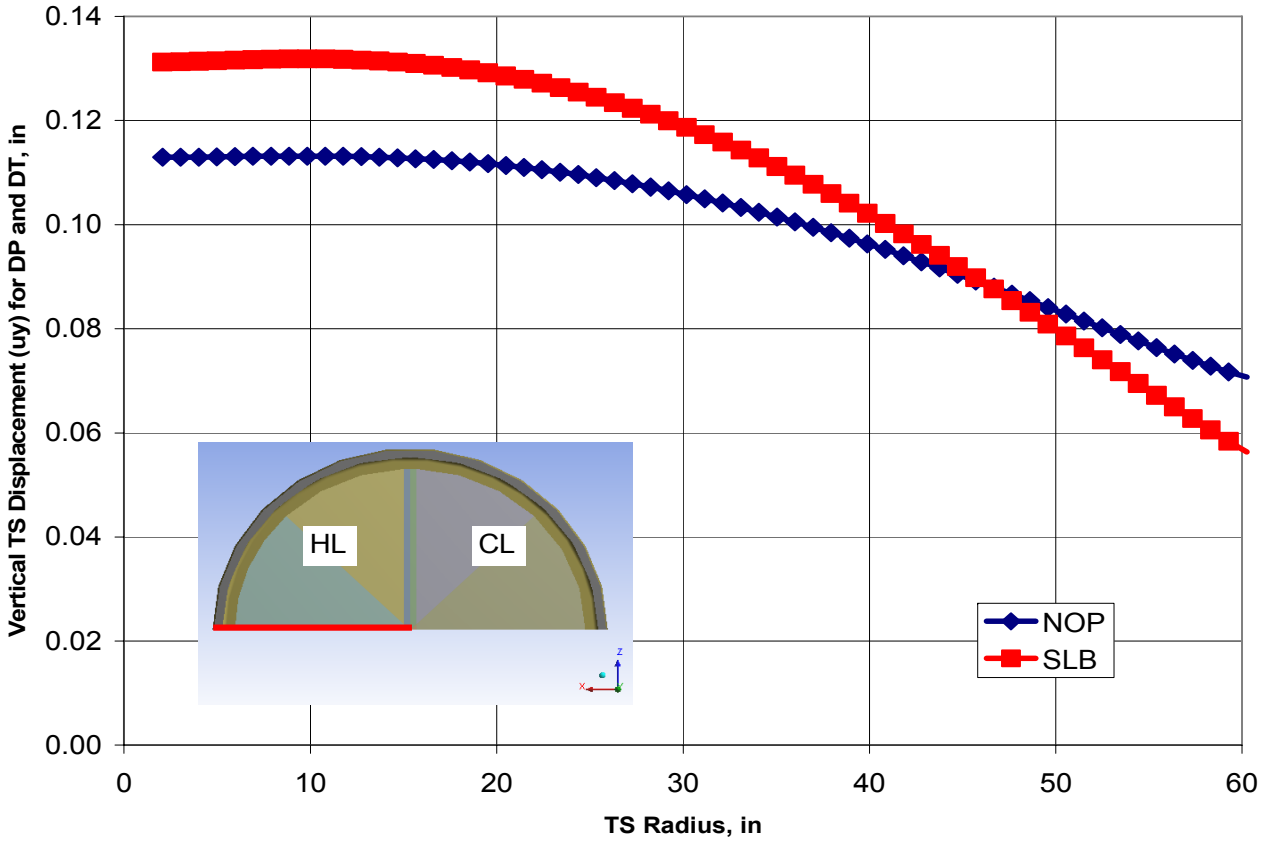
NOP Model Conditions

- Primary Fluid Temp. = 600 F
- Secondary Fluid Temp. = 600 F
- Primary Pressure = 2250 psi
- Secondary Pressure = 800 psi
- Vessel End Cap Load = 9610 psi
- No TS support ring
- ANL Alloy 600: Divider plate
- ANL SA-508: Non-perforated TS, Channelhead, Lower Shell
- ANL Effective properties used for TS

SLB Model Conditions

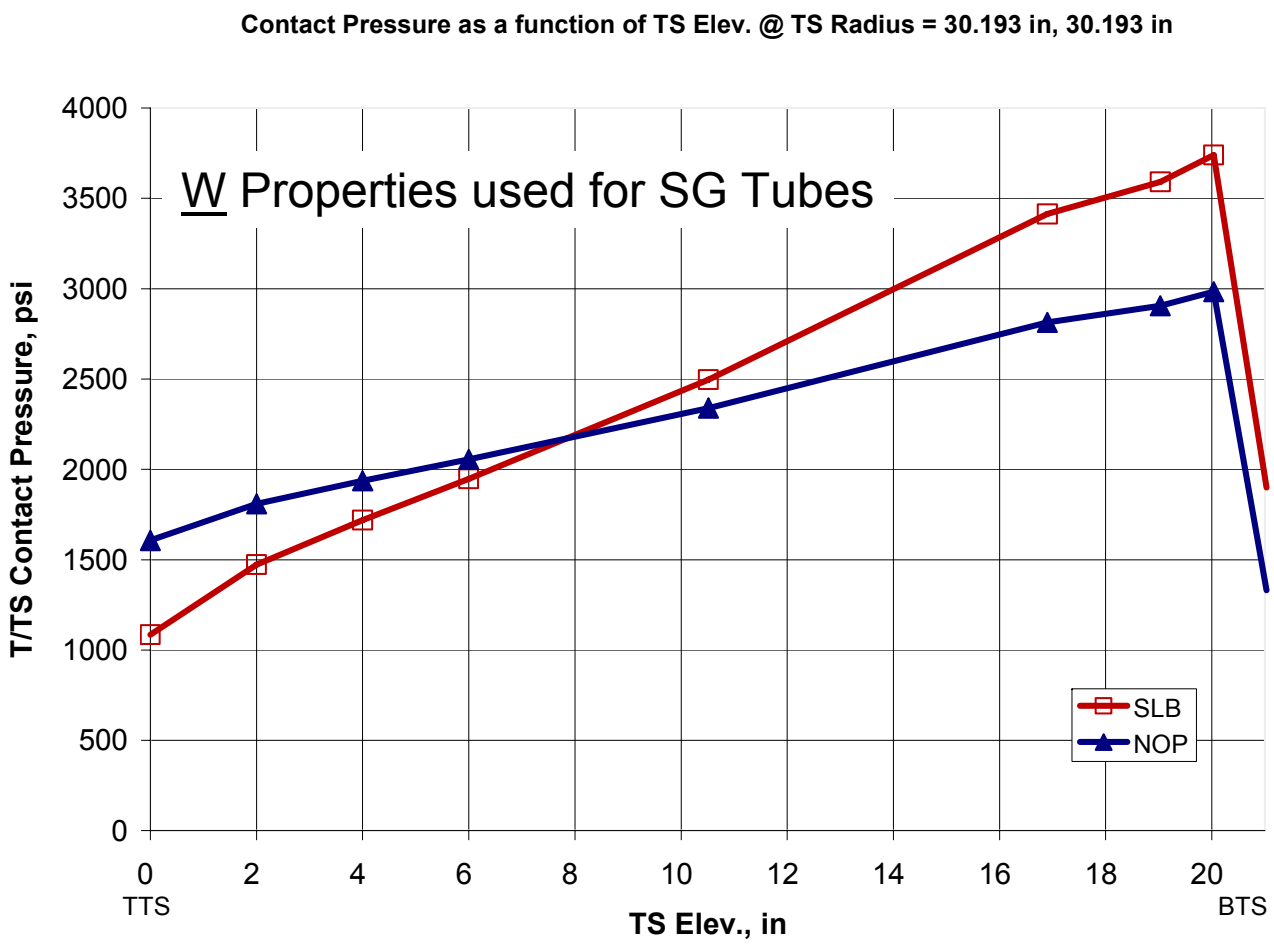
- Primary Fluid Temp. = 450 F
- Secondary Fluid Temp. = 450 F
- Primary Pressure = 2560 psi
- Secondary Pressure = 15 psi
- Vessel End Cap Load = 180 psi
- No TS support ring
- ANL Alloy 600: Divider plate
- ANL SA-508: Non-perforated TS, Channelhead, Lower Shell
- ANL Effective properties used for TS

TTS TS Displacements



Displacement magnitude and relative values similar to ANL Results.
Small Difference in Uy between 0° and 45°.

Contact Pressure Results



Westinghouse model closely agrees with ANL results.

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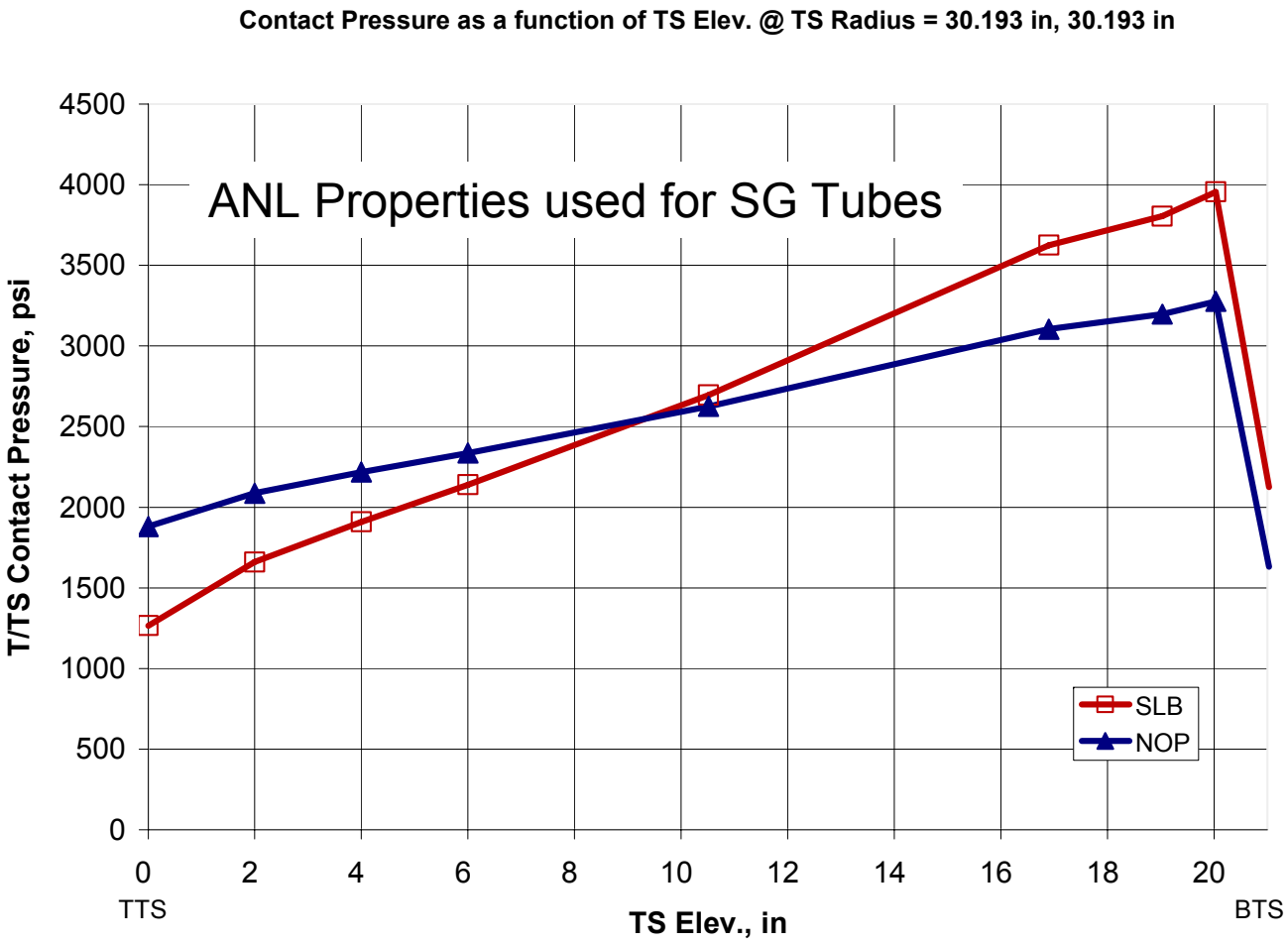

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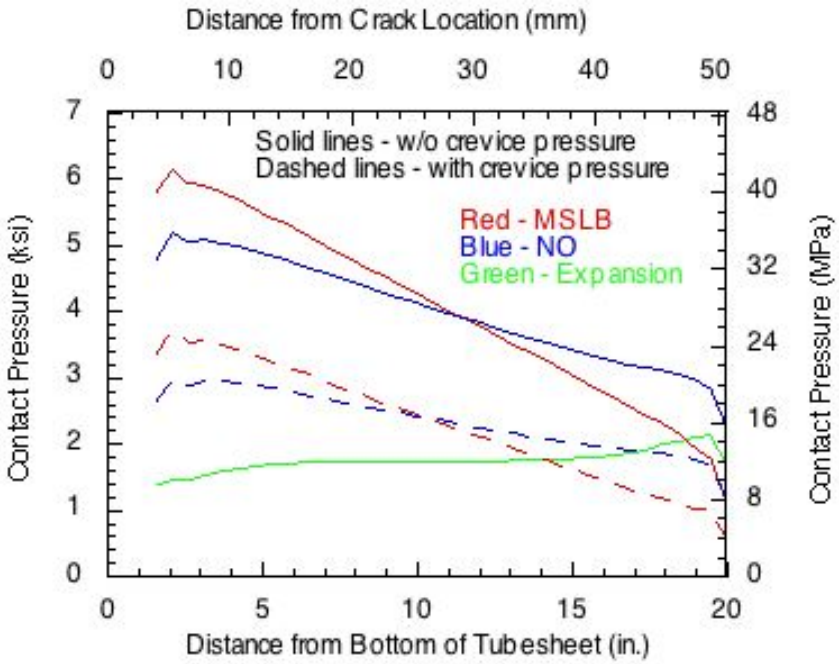
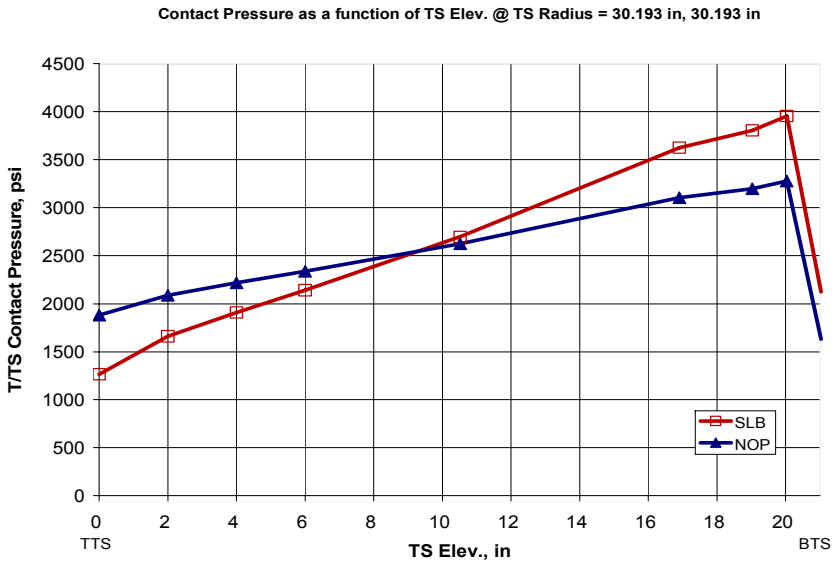
ANL/W Contact Pressures





ANL/W Modeling Differences

- ANL Effective TS properties are different:
  - Thickness properties (Ez) within 3% of calculated W values.
  - Calculated out of plane and shear moduli very different (~40%).
- Poisson's ratio varies with temperature?
- Crevice pressure model fit does not agree with test data.
- Material composition of lower SG complex?
  - Lower Shell and Channelhead are not made of SA-508.
- ANL SA-508: $E=-6\sigma$, $\alpha=+1\sigma$
- ANL Alloy 600: $E=+3\sigma$, $\alpha=-1\sigma$
- Coeff. of Friction (0.2) very conservative.
- Quarter Symmetry = Different Boundary Conditions.
- Variations in model geometry.