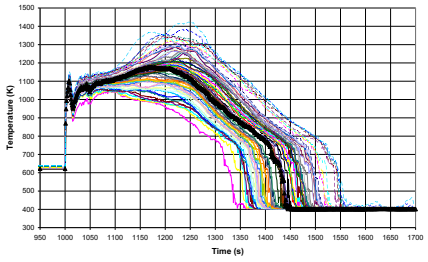
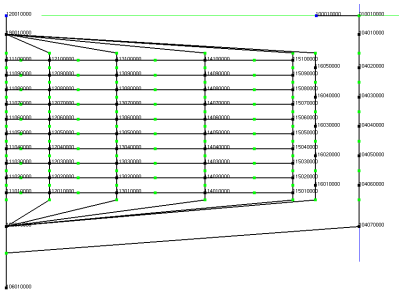
RELAP/SCDAPSIM MODELING CONCEPTS
ADVANCED FLUID SYSTEMS ANALYSIS

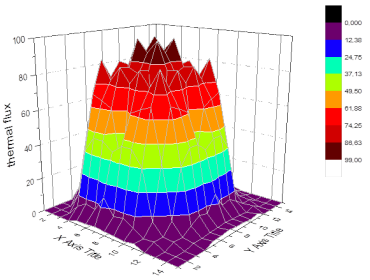
- **Detailed system thermal hydraulics for fluid systems and reactors**
  - Multi-dimensional fluid transport
  - Heat conduction in structures
  - Heat conduction, melting (including molten pool natural circulation) in porous materials
  - Control systems
- **System hydrodynamic solution uses engineering transport approach**
  - Two fluid, non-equibrium conservation equations – liquid, vapor/non-condensable gases
  - Mass, energy, momentum
  - Thermodynamic state for fluids
    - H_2O, D_2O, Pb-Bi, Li-Pb, molten salts, oil, non-condensable gases
    - Other fluids easily added as needed
  - Constitutive relationships for heat, mass transfer developed through international research programs
- **System structures can be modeled with multi-D models**
  - Slab, cylindrical, spherical structures
  - Porous media – used to model 2D structures, pebble beds
    - Convective heat removal (RELAP5 boundary condition)
    - Chemical reactions
    - Heat conduction
    - Melting with in. nat. circulation
- **Control system components to build powerful control logic and computations**
  - Control components can operate on any time-advanced quantity including other control variables
  - Basic functions available for control systems
    - Constant ($Y_i = S$)
    - Addition or Subtraction ($Y_i = S(A_o \pm A_1V_1 \pm A_2V_2 \ldots.)$)
    - Multiplication ($Y_i = S_1V_1V_2$)
    - Division ($Y_i = S/V_1$ or $S_1(V_1/V_2)$)
    - Integer Exponentiation ($Y_i = SV_1^i$)
    - Real Exponentiation ($Y_i = SV_1^r$)
    - Variable Exponentiation ($Y_i = SV_1^v$)
    - Table lookup
    - Integration
    - Differentiation
- **Powerful user options**
  - Integrated uncertainty analysis
  - Hydrodynamic loads analysis
  - Integrated, interactive 3D GUI



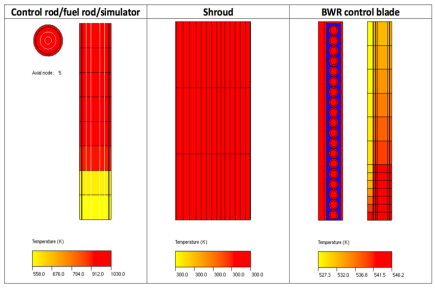


SPECIALIZED REACTOR MODELS AND CORRELATIONS

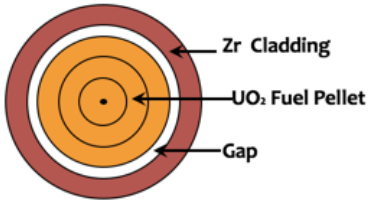
- **Point and 3D reactor kinetics**



- **Fuel and severe accident models and correlations**

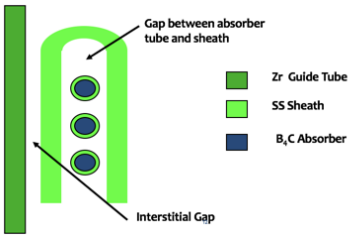


- **Fuel rod components use 2D models to predict temperature (r,z), deformation, chemical interactions and melting**

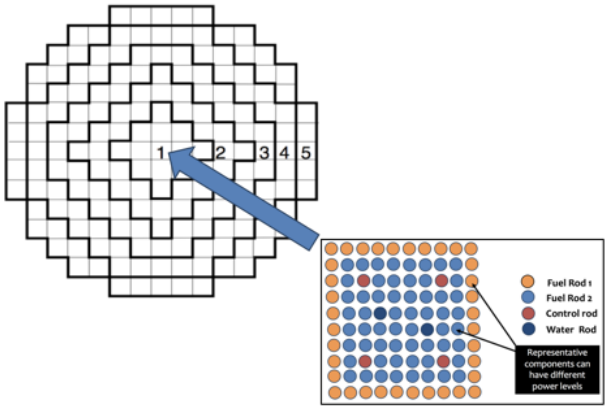


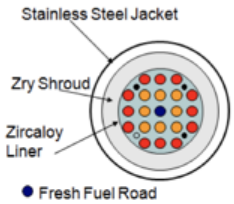
- **Fuel rod simulator components use special electrically-heater models plus fuel rod model**
- **Control rod components use 2D models to predict temperature (r,z), deformation, chemical interactions and melting**

- **BWR control components use 3D models to predict temperature (r,z), deformation, chemical interactions and melting**

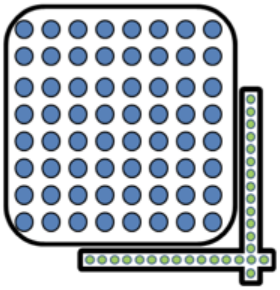


- **Shroud component include heat conduction, oxidation, and melt relocation models**
- **SCDAP core components used to define representative assemblies**





Experimental bundle with combination of SCDAP fuel rods and simulators



BWR assembly with SCDAP fuel rod and control blade/channel

- **Material properties are contained in an easily modifiable separate materials library**