Proposal for Covariance Processing Subgroup

Processing Covariance Data for the Resonance Region

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WPEC Meeting
Aix-en-Provence
May 26-28, 2004
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Background

• SG20 made significant progress in covariance data generation
  – Covariance data generated for Gd, Rh and Fe
  – New evaluations include resonance-parameter (RP) covariance data and higher energy covariance data
  – SAMMY updated with capability to retroactively generate RP covariance data
  – “Compact Covariance Format” developed and implemented in SAMMY
  – ERRORJ processes existing ENDF/B-VI RP formats
  – New evaluations processed with ERRORJ
  – Demonstrated the generation of group constants from covariance data
  – Covariance data generated for $^{235}\text{U}$ in Compact Covariance Format

• SG20 addressed evaluation and formatting issues

• Covariance processing methods have not been sufficiently developed to produce covariance data files for use in transport applications
Justification for Subgroup

- Many new evaluations use Reich-Moore (RM) formalism
- RM resonance-parameter covariance formats have been developed
- Major processing systems (AMPX, NJOY, PREPRO, etc.) have not been updated to process RM covariance formats
  - JENDL community has developed ERRORJ module to process RM covariance formats
  - No code can process the Compact Covariance Format that is needed for evaluations with large number of resonances (e.g., U-235: 3193 resolved resonances)
- In the past few years, adjoint-based sensitivity/uncertainty (S/U) methods have been developed to propagate covariance data to calculated quantities of interest such as $k_{\text{eff}}$ (SCALE 5 system: TSUNAMI sequences)
- Need:
  - Update processing methods and demonstrate covariance data implementation for specific radiation transport applications
Subgroup Objectives

- Develop & implement methods for processing RP covariance data in cross-section processing systems (NJOY, AMPX, etc.)
- Produce RP covariance data evaluations for important nuclides
  - SG20 produced covariance data for some nuclides
  - Additional evaluations must be developed to further demonstrate the covariance processing methods
- Investigate the generation and use of RP covariance data
  - Use new processing methods to generate covariance data files for use in radiation transport applications
  - Use existing S/U methods to demonstrate the use of the covariance data in various applications—propagate cross-section uncertainty to calculated quantities of interest
Deliverables

- Cross-section evaluations with covariance data for important nuclides
- Updated cross-section processing systems with new processing methodologies
- Generation of covariance data files for use in S/U analyses
- Demonstration S/U calculations that propagate cross-section uncertainty data to calculated quantities of interest
Time Schedule and Milestones

- **2004—2005**
  - Generate RP covariance data evaluations for selected nuclides
  - Initiate RP covariance processing development
  - Update evaluation checking codes to test new covariance formats
- **2005—2006**
  - Complete RP covariance evaluations for selected nuclides
  - Complete covariance processing methods development
  - Test new evaluations with evaluation checking codes
  - Process new evaluations and generate cross-section covariance data files
  - Perform demonstration S/U calculations with cross-section covariance data
- **2006—2007**
  - Prepare final report for subgroup activities