

UKAEA

Introduction to CAD focused group meeting

• Ivo Kodeli

WPEC SG47 Geometry/CAD meeting, Apr. 20, 2021

WPEC Subgroup 47 (SG47) on Use of Shielding Integral Benchmark Archive and Database for ND Validation

Objective: Contribute to a wider scope and more diversified nuclear data validation and verification using shielding benchmark use. This activity should ultimately contribute to a production of (more) general-purpose cross-section evaluations. Obtain feedback from the users and discuss the improvement of SINBAD needed to meet the above goal.

Drawbacks, critics to be addressed:

- evaluations and review process less complete/thorough than ICSBEP/IRPhE
- proposals for new benchmark evaluations (FNG, CIAE, Rez, LLNL, ...)
- computer code inputs missing: mostly MCNP inputs are available;
contribute other transport code models and means to generate them more easily (CAD)
- long CPU time calculations (study of acceleration techniques)
- other useful data & issues: sensitivity profiles, CAD, format,

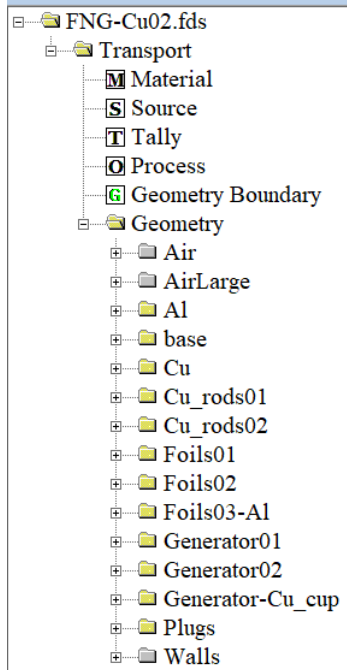
Shielding benchmarks considered in the scope of WPEC SG47: FNG (Cu), LLNL spheres, ASPIS (Fe88), TIARA, FNS, OKTAVIAN, Rez Iron spheres, CIAE Iron.

CAD Geometry

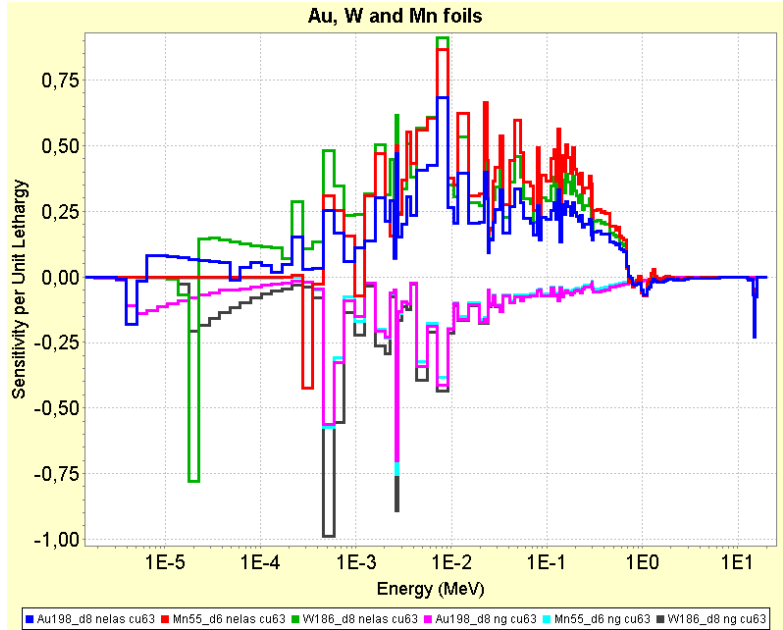
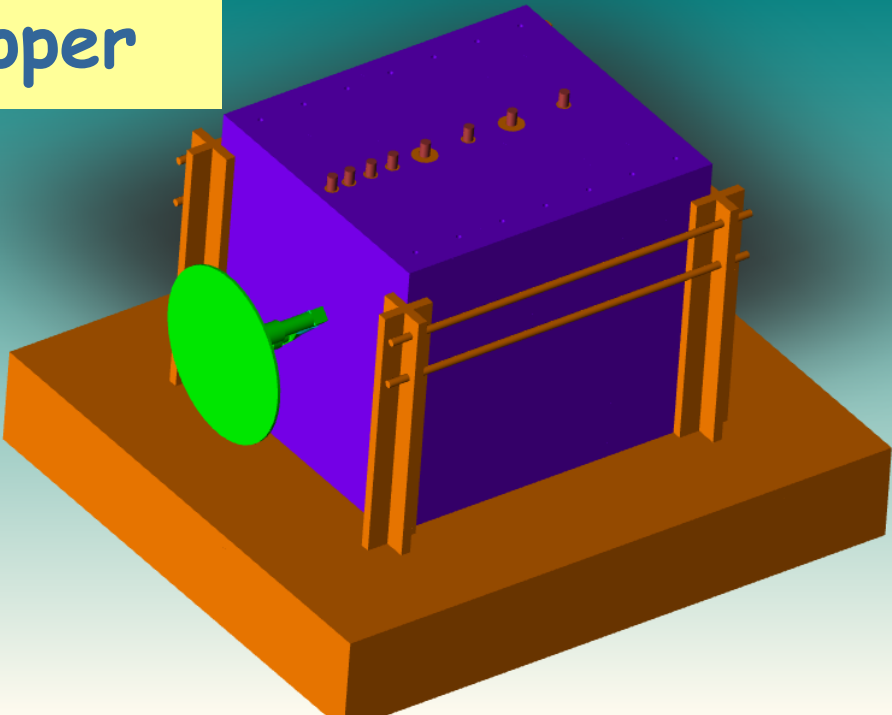
- In the past a drawing was sufficient to describe simple (or simplified) benchmark models
- CAD computer readable format could provide a safer (**less error prone**) **ADDITIONAL** description of the geometry, useful for describing increasingly more complex benchmark geometry of recent benchmarks.
- CAD allows „**automatic**“ **model preparation** for different transport codes; many modern codes or handling tools support CAD formats
- SuperMC provides useful features to produce CAD geometry (**.FDS**).
- To cover future evolution, selected CAD format should be ideally general & **code-independent**, suitable for most transport codes and at the same time provide as **accurate and faithful description** as possible: **geometry, material composition, source (?)**
- CAD format proposed for future SINBAD evaluations: **STP + json material definition; FDS** – material definition in a single file
- **Test case** to define & study the procedure: **ASPIS Fe88 & FNG Cu** geometry files.

CAD Geometry- ASPIS Fe88 test case

- ASPIS FE88 geometry files were prepared by **Žiga Deutschbauer** and **Bor Kos**, IJS, using Rhinoceros 3D, SpaceClaim, SuperMC
- Reviewed by **Alex Valentine**, CCFE, several modifications & improvements proposed and implemented
- Zone volume consistency checked between CAD model, MCNP input and volumes calculated with MCNP based on the SuperMC model created using the CAD model
- Material compositions & densities: jason file with material definitions for each individual step file.
- CADs available for several other benchmarks: FNG-Cu, TIARA, FNG-HCPB, ASPIS, etc.
- Establishing a **review procedure & group** to look and check the files before being included in SINBAD.



FNG Copper



- CAD geometry produced using SuperMC;
 - FNG-Cu Sensitivity profiles of measured RR to Cu XS

Conclusions & reminders

- **Challenges on CAD**

- Selection of a/the format(s) suitable for describing of geometry, material composition, irradiation conditions, radiation source (?)
- Use and exploitation of CAD files: details needed for present transport codes possibilities and to anticipate future modelling development & needs.

- **WPEC SG47 objectives:**

- Provide feedback on present SINBAD benchmarks and recommendations for improvements based on the experience, needs and expectations of the nuclear data community
- Priority list for future evaluations
- In cooperation with EGRTS WPRS participate in future evaluations