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COG - Publicly Available Now to Criticality Safety Practitioners

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Overview

COG code development

- History
- People
- Philosophy

COG geometry features (examples)

- vim2cog
- Surface-of-revolution
- LLC “Strela” (Snezhinsk, Russia) collaboration

COG cross-sections

COG ICSBEP benchmark results

COG website

COG code development history

L-Div

- Effort started in the 1980s
- Radiation detection and signal processing for UGT
- General-purpose Monte-Carlo particle transport
- Deep penetration problems
- Shielding

CSAC and CSS

- Criticality

Today

- LLNL (AX, B, CSS, NHI, N)
- Collaborators (GE, Strela)

COG code developers

Physicists

- Tom Wilcox (inactive)
- Rich Buck
- Ed Lent

Computer scientists

- Stella Hadjimarkos (inactive)
- Susan Post (inactive)

COG code development philosophy

User friendly

- Error diagnostics (**example**)
- Pictures (cross-sectional and perspective) (**examples**)
- Fill
- Trace and volume

Complex 3-D geometry

- Finite limits to surfaces
- Special surfaces (revolution, topographical)
- Define Unit and Use Unit

Accurate Solution

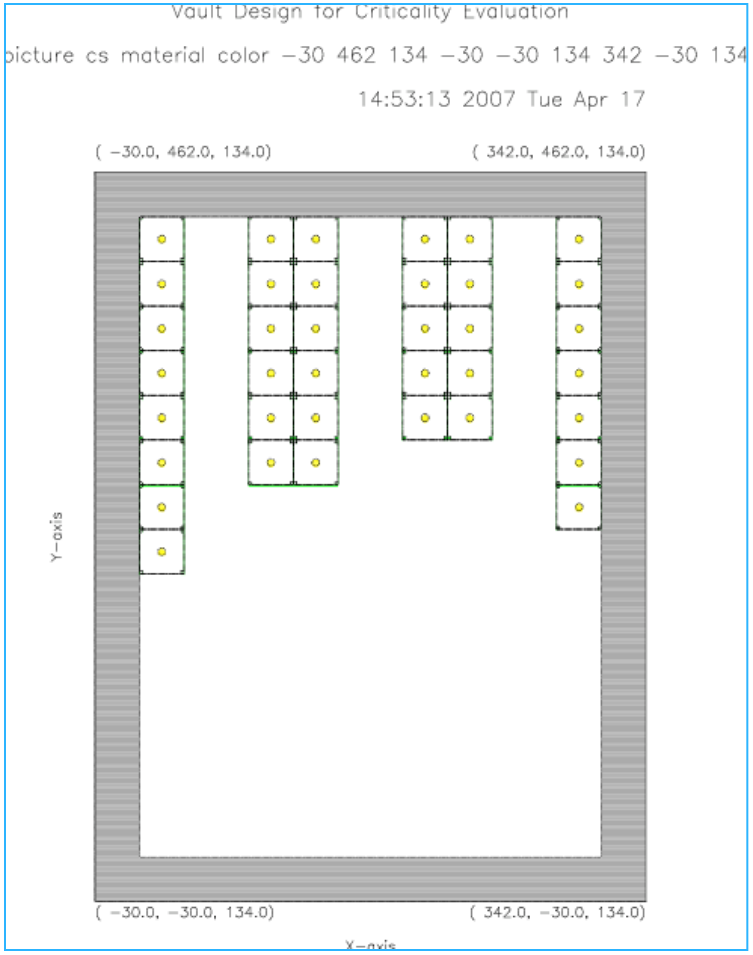
- State-of-the-art physics (models and databases)
- No approximations to “speed up” execution
- Developed on super-computers and now available on PCs

COG error diagnostics

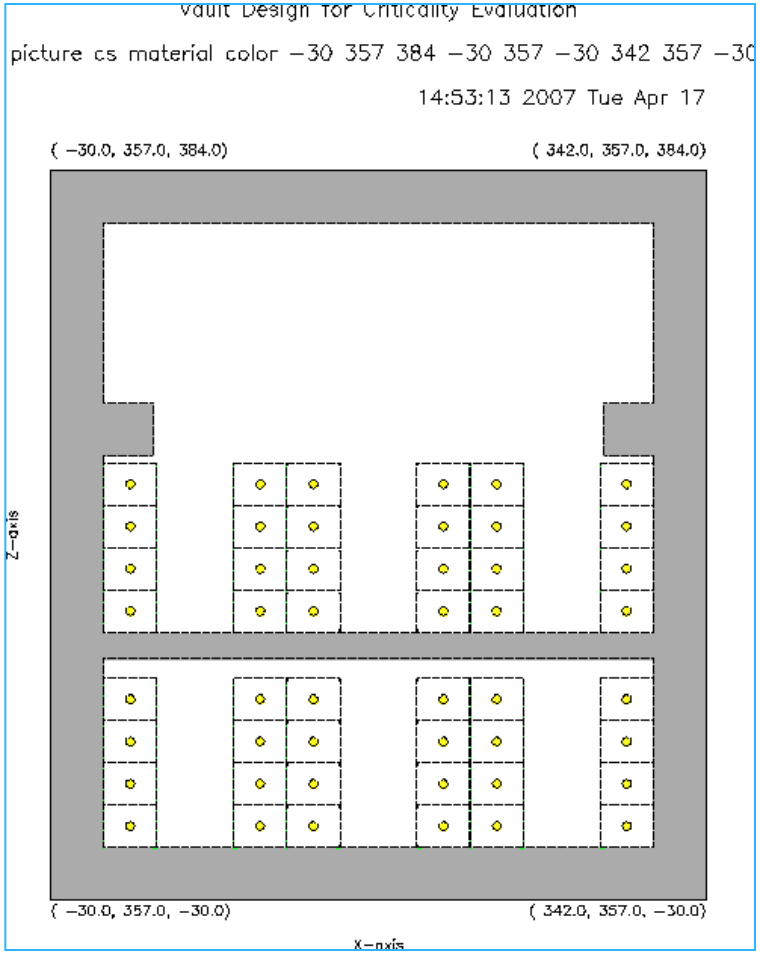
```
**********
**********  ERROR  —point found which is in at least two sectors
                        given point in level-0 coordinates
                            x = -0.50000000E+01
                            y = -0.24700000E+00
                            z =  0.00000000E+00
                        direction cosines
                            u =  0.00000000E+00
                            v =  0.10000000E+01
                            w =  0.00000000E+00
                        relation to each surface at this point
                              equation    evaluation
                                  1            -
                                  2            +
                                  3            -
                                  4            —  (just crossed this surface)
                                  5            -
                                  6            +
                                  7            -
                                  8            -
                                  9            -
                                 10            -
                                 11            +
                                 15            +
                                 20            -
                                 21            +
                                 22            +
                                 23            +
numbers and names of sectors which contain this point
                                      2  zr2
                                      3  al

 **********
 **********
```

COG pictures (cross-sectional)

Plane view



Axial view



COG pictures (perspective)

COG manual (p. 117)

GEOMETRY Data Block
PICTURES of the Geometry
Perspective Pictures 9/1/02

PICTURE — Perspective

A perspective picture is the kind you would get if you stood back and took a "photograph" of your geometry. The edges and boundaries between SECTORS (or MATERIALS or REGIONS) are drawn, and the surfaces optionally colored in. The user must specify which SECTORS (or MATERIALS or REGIONS) are visible. The remainder are invisible. Thus, a picture can illustrate just one part of the geometry, or the user can look *inside* outer surfaces to see inner structure.

Perspective pictures are requested by:

PICTURE [**P** / **PERSPECTIVE**] [**SECTOR** or **SEC** or **S** / **MATERIAL** or **MAT** or **M** / **REGION** or **REG** or **R**]

{COLOR} {NOFRAME} {RES resmin resmax} x_c y_c z_c
r d θ ϕ s_1 s_2 s_3 . . . {TITLE = " . . ."}

where:

P (or **PERSPECTIVE**) specifies that a perspective picture is wanted;

SECTOR (or **MATERIAL** or **REGION**) (or the shorter aliases) specifies what volumes will be drawn in the PICTURE;

x_c y_c z_c specify the point P_c at the center of the perspective view;

r specifies the radius of a sphere centered on P_c. Everything within the sphere will be included in the picture.

d, *θ*, *ϕ* are spherical coordinates identifying where the viewer will stand to look at the geometry.

d is the distance of the viewer from the P_c;

θ is the azimuthal angle measured in the x,y plane, from the x-axis to the Observer's position (degrees);

ϕ is the elevation angle measured upward from this plane toward the +z- axis (degrees).

s_1 s_2 s_3 . . . ... is a list of SECTORS (or MATERIAL or REGIONS) that the viewer wishes to see. Any sector that is not in this list is transparent.

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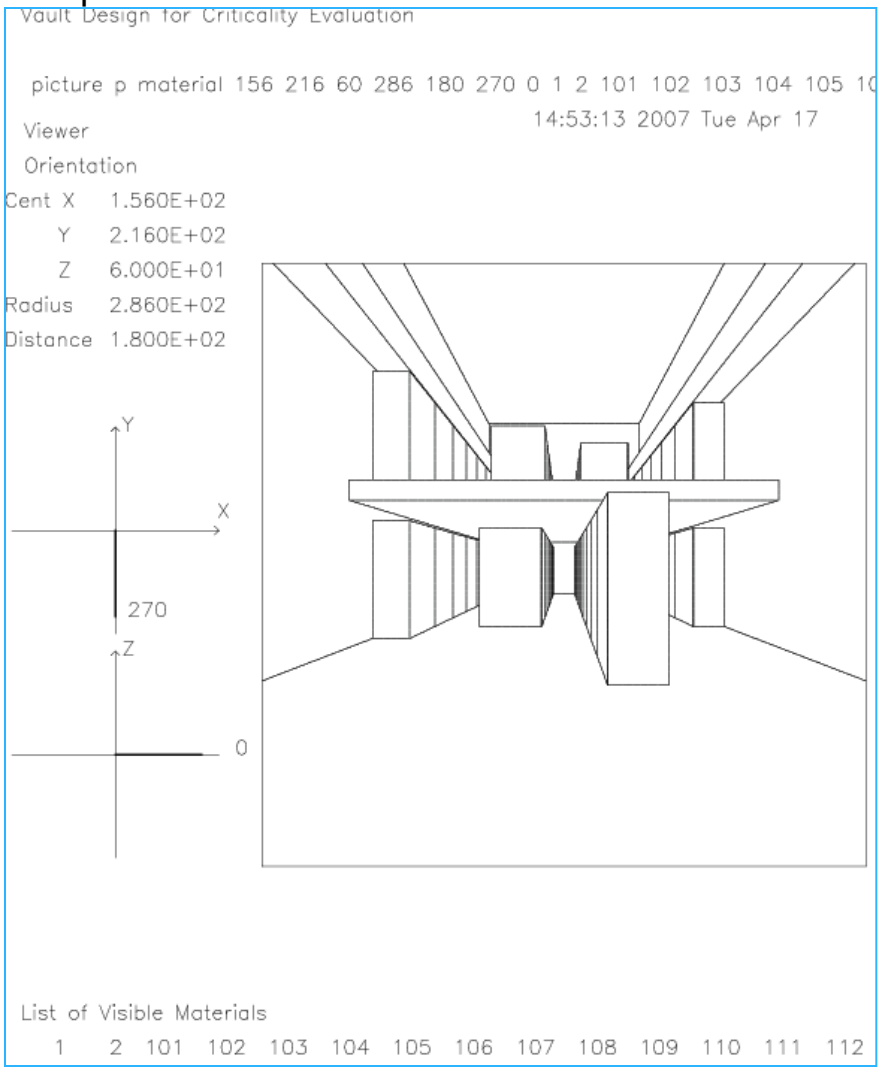
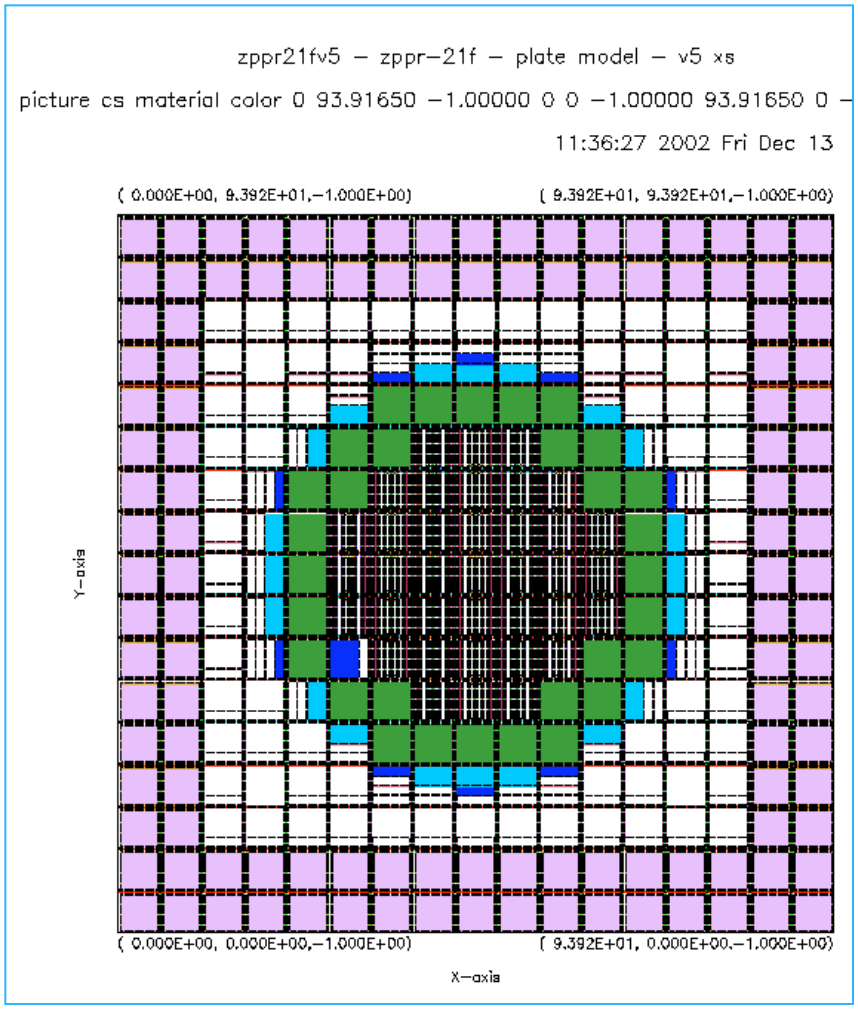
Perspective view



COG geometry capabilities (vim2cog)

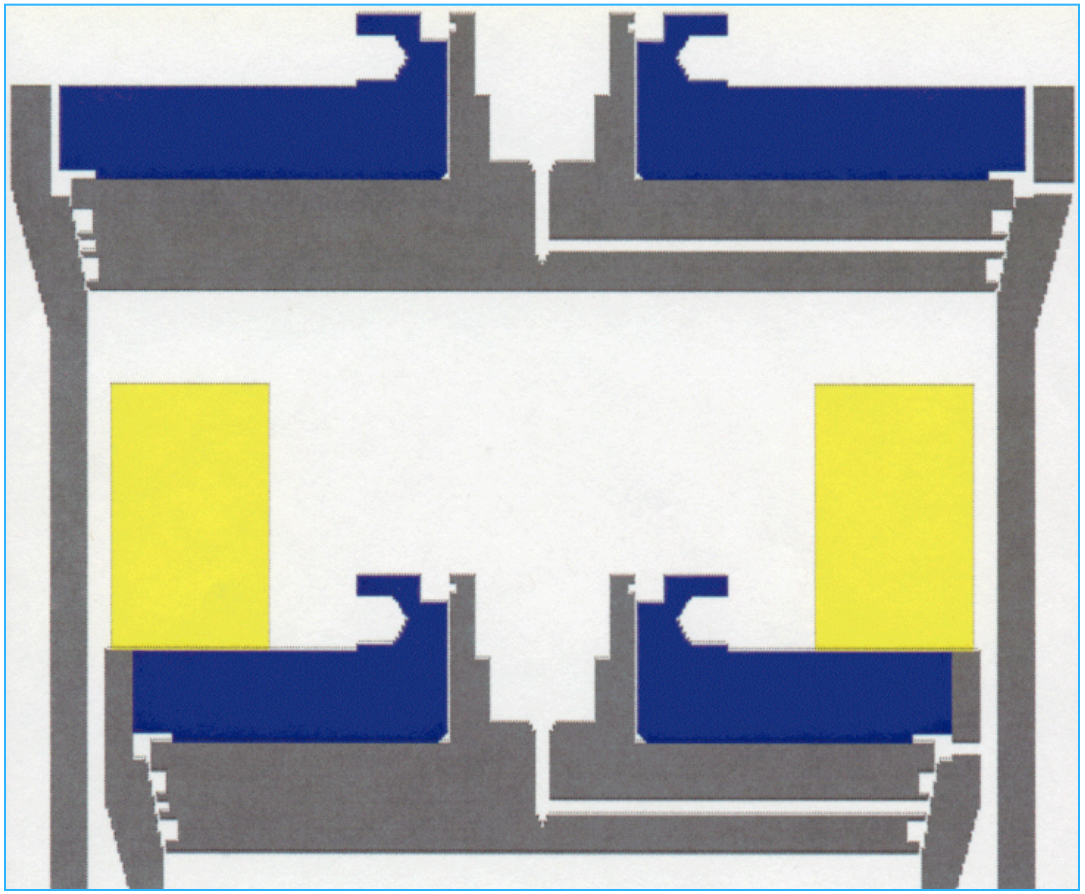
COG	VIM
BOX	RPP
UNIT	CELL



COG geometry capabilities (revolution)

COG	ProE
Revolution	Point Data File

COG Model of the 9975 Type B Shipping Container

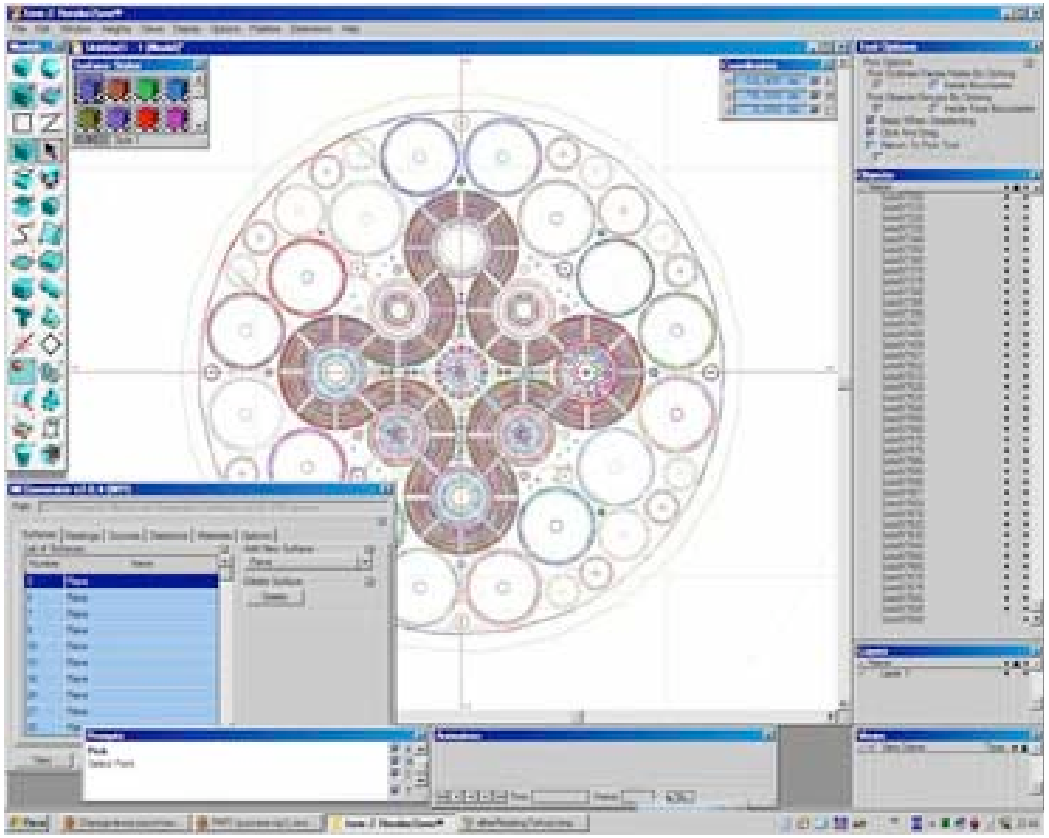


COG geometry capabilities (translation)

Automatic geometry translation between:

- FormZ (plug-ins)
- COG
- MCNP
- Mercury
- ProE
- TART

MCNP → FormZ → COG Model of the Advanced Test Reactor



LLNL collaboration with LLC “Strela”

- http://www.strela.snz.ru/en/projects/b530321.html

COG 1st public release (version 10)

RSICC versions for PC

- Windows
- Linux

and SUN operating systems

- Solaris

COG version 10 databases

ENDFB6R7 the US National Nuclear Data Center (Brookhaven National Laboratory) Evaluated Nuclear Data File, Version 6, Release 7

ENDL90 the 1990 version of the Lawrence Livermore National Laboratory's Evaluated Neutron Data Library

RED2002 the 2002 version of a hybrid library devised by Dr. Dermott E. Cullen of the Lawrence Livermore National Laboratory

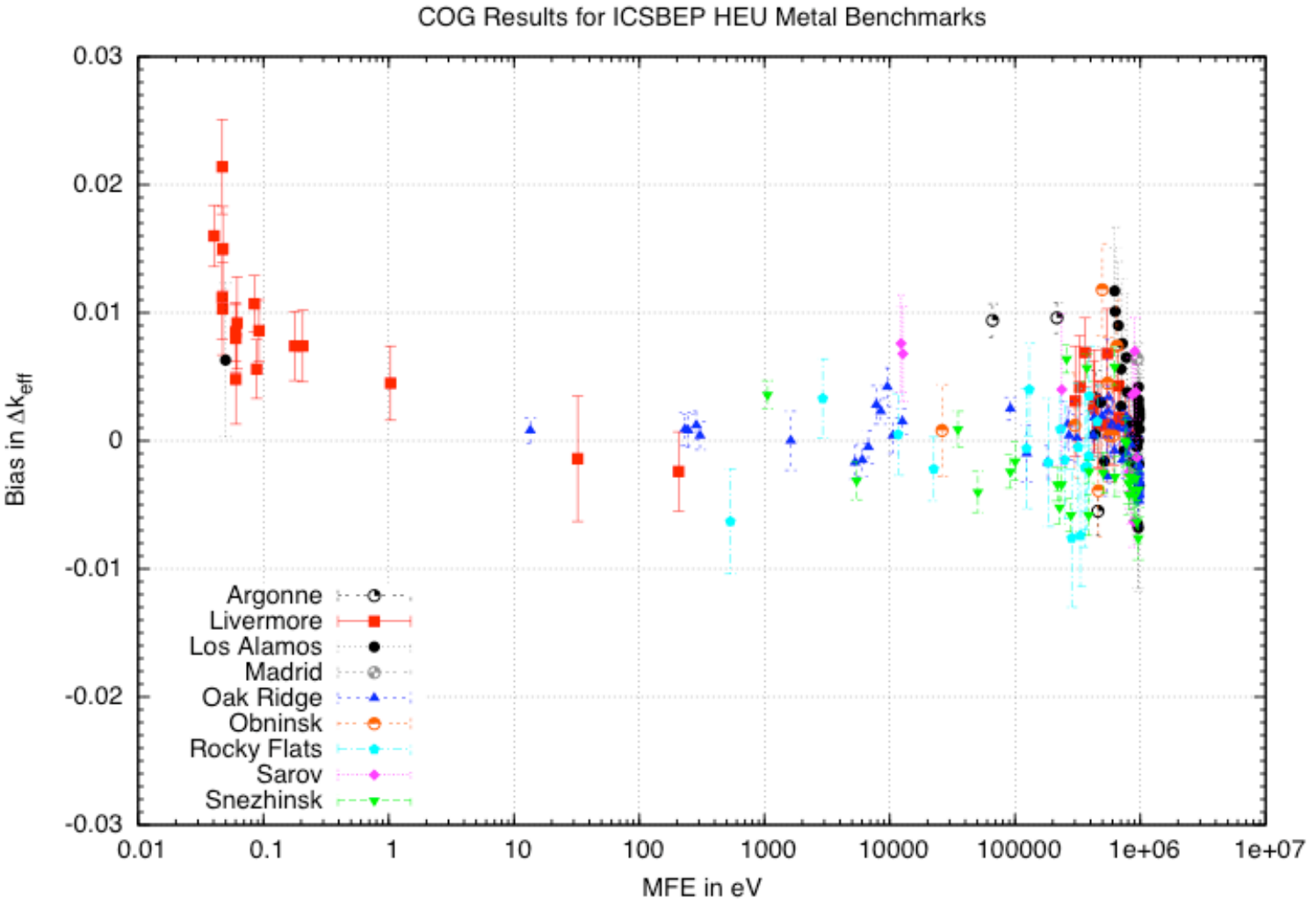
EPDL97 the 1997 version of the Lawrence Livermore National Laboratory Evaluated Photon Data Library

SAB3.0.296 the original 1968 General Atomics thermal scattering law "S(α,β)" data first released by the US NNDC as ENDF/B-III

SAB6.0.296 the ENDF/B-III data in ENDF-6 format first released by the US NNDC as ENDF/B-VI, Release 0

SAB6.2.296 the scattering law data generated at Los Alamos National Laboratory in 1993

COG benchmark results



COG future efforts

Formats and libraries	ACE, ENDF-6, ENDL ENDFB7R0 from BNL, LANL and LLNL JEFF3.1 from OECD
New particles and reactions	D-D, D-T
Geometry processing	FormZ-based (Strela) translator TopAct (Raytheon) translator
User support	cog@llnl.gov
User training	Available upon request

Conclusion

Visit use at:
http://cog.llnl.gov

Contact us:
cog@llnl.gov