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Memo

date: *February 10, 2014*

to: *RSC-BLIP Target Subgroup*

from: *K. Yip*

subject: *Comparison of MCNPX/CINDER simulation/calculations*

In the last few days, I have compiled the "CINDER" software, taken Arnold Aronson's files (thanks for his patient advice/education) and run. Cinder is not the most modern software and seems to be last updated in 2008. It has taken me some time to get it running and from time to time, I have needed to check on A. Aronson's area in spot.bnl.gov.

By chance, A. Aronson's last usage of CINDER was actually exactly what Nick Simos' project that we discussed about last Friday (Feb. 7, 2014). I had run it a few times before our meeting. Basically, I have used A. Aronson's MCNPX inputs (ie. using the same target shape/densities etc.) as well as the cinder inputs, and run the same programs (MCNPX 2.7.0 and CINDER package "1.05" or called version "7.4.2"). The only major differences (that I'm aware of) are that some cross-section data files used in MCNPX are different between his and mine. (This difference probably makes the comparison slightly more interesting.) I have compiled my own MCNPX and CINDER which are in principle different, too but this aspect should not matter at all.

One thing that A. Aronson could not tell me (as he forgot) is one normalization factor used (6.2×10^{14}). But on Friday, after I talked with N. Simos and by reading Nick's report, I realized that 6.2×10^{14} is just the no. of protons per second corresponding to 100 micro-amp.

There are many output files from running the CINDER. After the Friday meeting, I have been smart enough to locate the one file for each target that seems to have been used in N. Simos' report. In fact, the numbers (in curies) shown in Table A3.1 – A3.3 are for the foremost Molybdenum target --- which gives the highest activity and the largest number of isotopes. There are 325 isotopes in that output file and N. Simos' report has shown 91 of them with the largest activity (only).

I have inserted the CINDER outputs (in ascii/text format) into a modern Excel spreadsheet, sorted and analyzed. There I show the activity (in curies) for both calculations and the differences in activity (at the end of bombardment, EOB) in % for the top 91 of them. They are

very close (and the biggest difference is <15%). The plot of "differences in %" is shown in Figure 1 and is also contained in the spreadsheet attached.

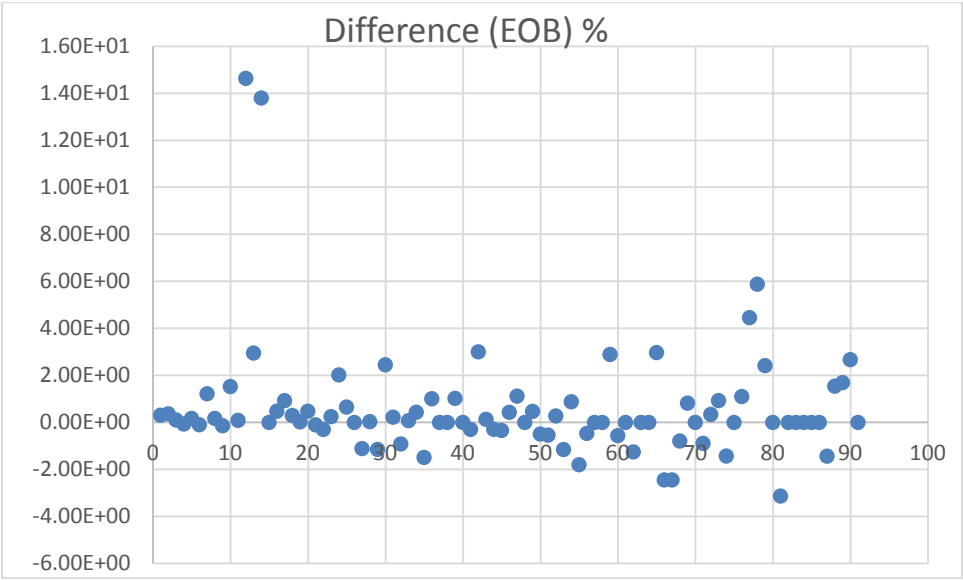

Figure 1: Differences of the activity (in curies) at the end of bombardment (EOB), (Kin-Arnold)/Kin, in %, between the simulation results from Arnold Aronson's and those from Kin Yip.

After the above exercise, I have tried to use the same MCNP(X) cross-section files as A. Aronson has used. With this change, I have obtained identical results (activity in curies) as what A. Aronson has. It is so "identical" that when I did a "diff" (a Linux command) on my output file (in ascii format) and A. Aronson's output file, there was no difference at all.