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Title:	MCNPs Easy Sources for (a,n) (MESA):Verification with Sources4c
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MCNPs Easy Sources for (α,n) (MESA): Verification with Sources4c

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1 Introduction

MESA is intended to be a direct re-implementation of the algorithms documented in the Sources manual in C++. However, some fundamental changes to the computational structure and logic were made to avoid the use of `goto`, require consistency in input definition, and reduce computational approximations in later steps of three-layer problems. In addition, MESA uses α-decay information from ISC libraries (based on ENDF). In most cases, differences between Sources4c and MESA are dominated by differences in decay energy spectra and intensities. To verify this we have reproduced 6 problems that are documented examples or samples in Sources4c. These problems cover the three types of problems MESA currently supports: homogeneous, interface, and three-layer.

2 Homogeneous

Homogenous problems involve the calculation of all neutrons produced in an approximately infinite medium as the alphas slow down. In the first case Sources4c and MESA agree on the spectral shape, but disagree on the overall intensity by 3%.

The second case has a disagreement in overall intensity of less the 1% and excellent agreement on shape.

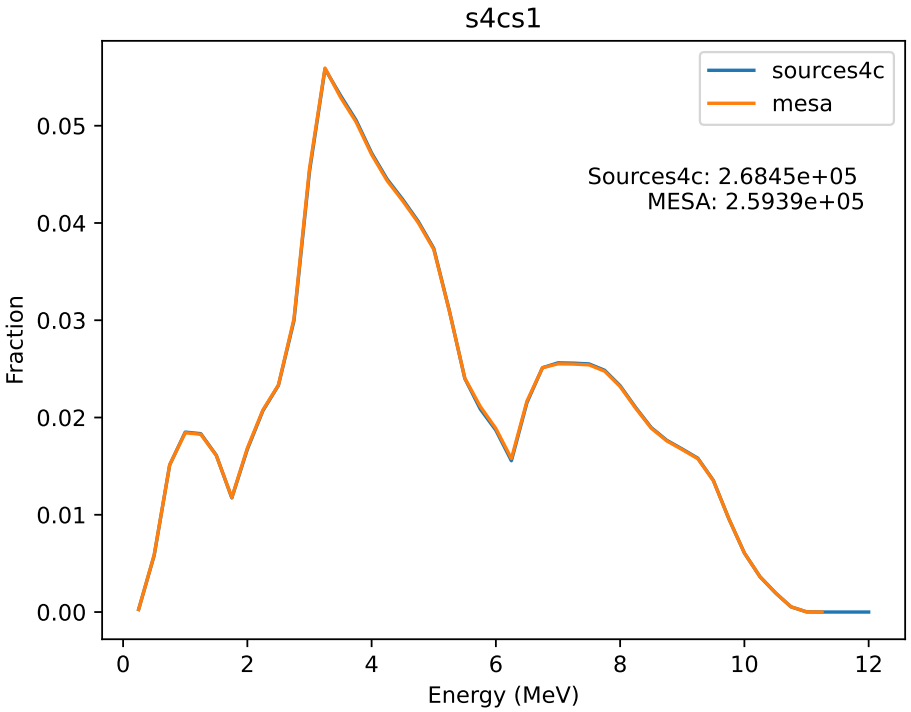

Figure 1: Sources4c sample problem 1 compared with MESA setup of the same problem.

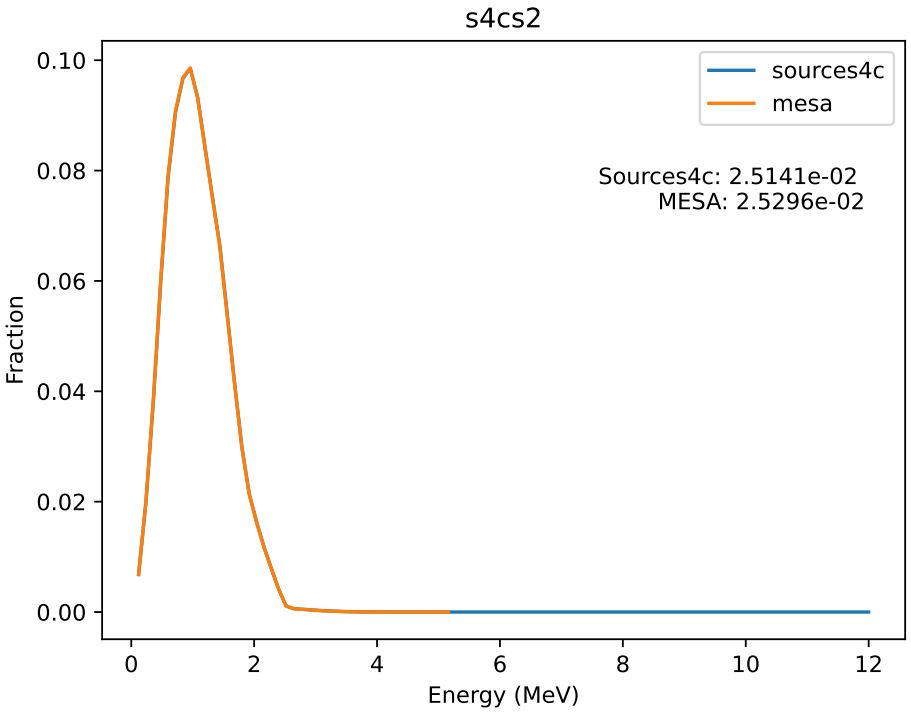

Figure 2: Sources4c sample problem 2 compared with MESA setup of the same problem.

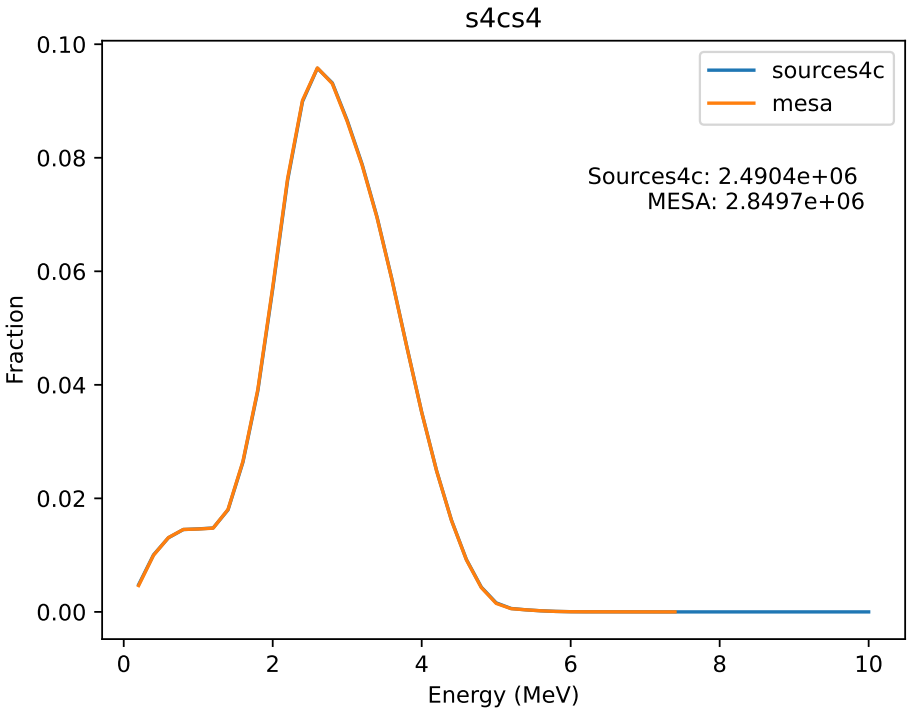

Figure 3: Sources4c sample problem 4 compared with MESA setup of the same problem.

3 Interface

Interface problems in Sources4c assume both the source and target layers are infinitely thick. These problems are relatively straightforward to cross-validate. Both sample 4 and example 4 in sources 4c were used for comparison and the results were of similar quality. Again the primary difference was the change in half-life used from sources4c to MESA.

4 Three-layer

Three layer problems include a source layer, a finite thickness barrier layer, and a target layer. Example 7 results differ by less than 1%. Example 8 results differ by nearly a factor of 2, but is likely due to code issues in

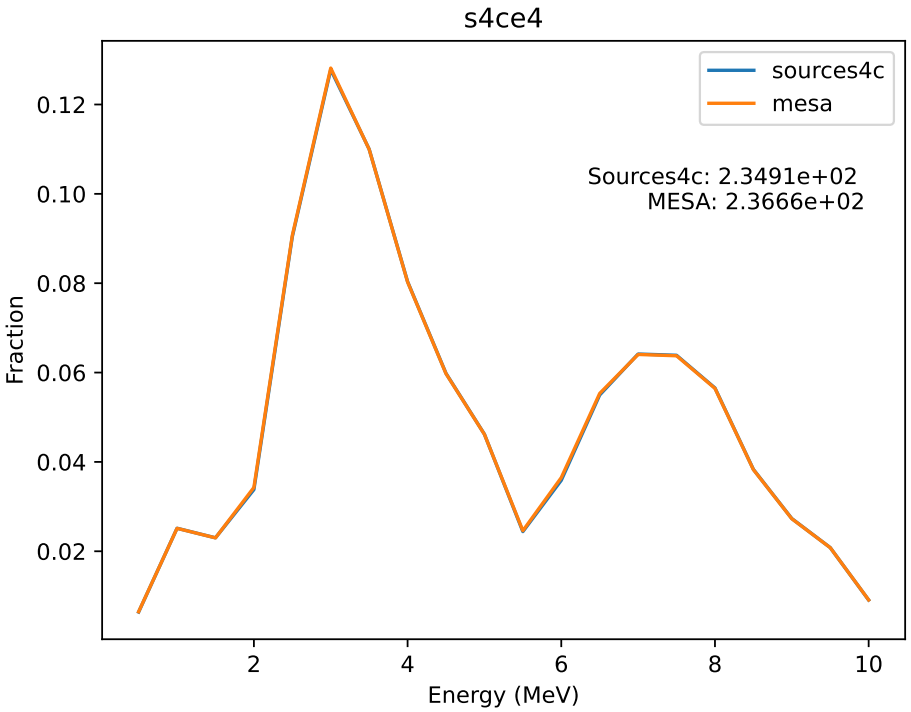

Figure 4: Sources4c example problem 4 compared with MESA setup of the same problem.

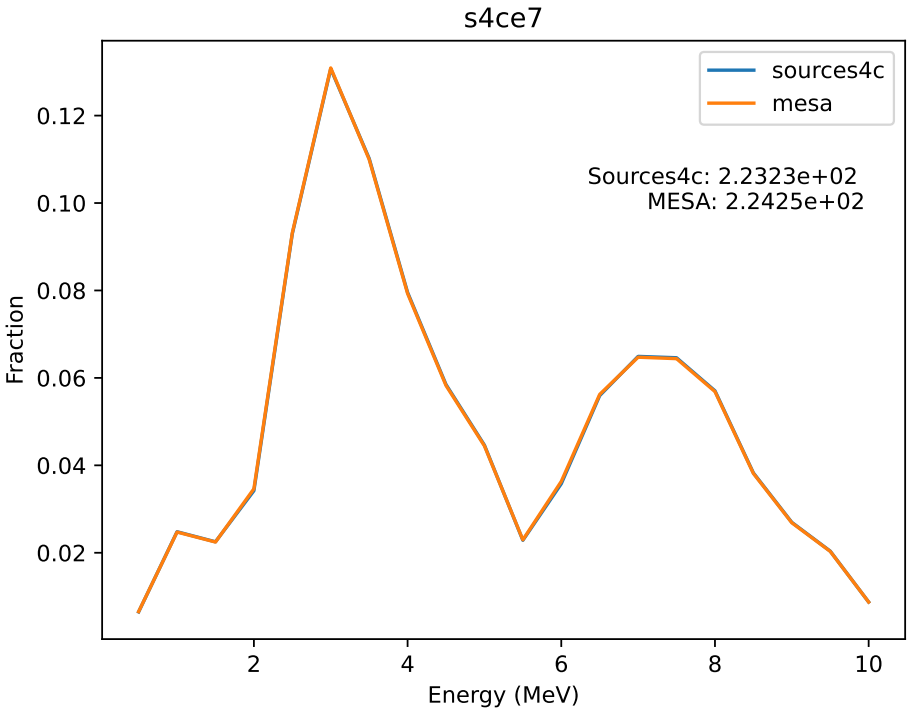

Figure 5: Sources4c example problem 7 compared with MESA setup of the same problem.

Sources4c. When compiled with floating point error traps we find that there are divide by zeros errors effecting the Sources4c results. We do not observe any similar issues in MESA.

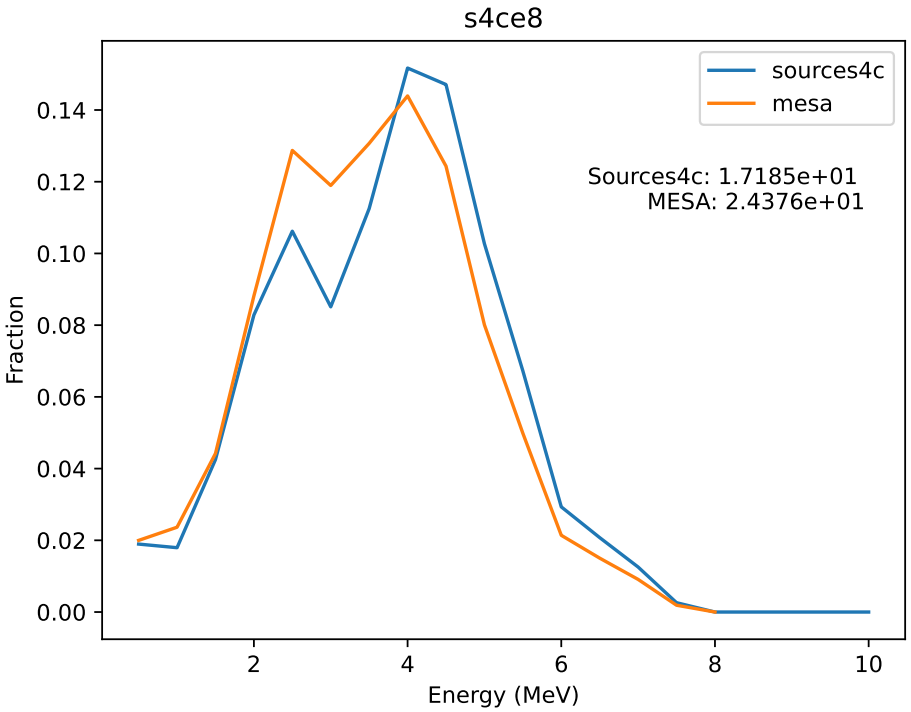

Figure 6: Sources4c example problem 8 compared with MESA setup of the same problem.