

## **Presentation of the CALMAR-ECORCES spectrum ajustment package available at the NEA Data bank**

G. Gregoire, C. Fausser, C. Destouches, N. Thiollay

► **To cite this version:**

G. Gregoire, C. Fausser, C. Destouches, N. Thiollay. Presentation of the CALMAR-ECORCES spectrum ajustment package available at the NEA Data bank. 16th International Symposium on Reactor Dosimetry (ISRD), May 2017, Santa Fe, United States. cea-02438722

**HAL Id: cea-02438722**

**<https://hal-cea.archives-ouvertes.fr/cea-02438722>**

Submitted on 28 Feb 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Presentation of the CALMAR-ECORCES spectrum adjustment package available at the NEA Data bank

G. Grégoire, C. Fausser, C. Destouches, and N. Thiollay  
CEA, DEN, DER, Dosimetry, Sensors, Instrumentation Laboratory,  
F-13108 Saint Paul Lez Durance, France  
gilles.gregoire@cea.fr

Adjustment methods are well known for the determination of a multigroup spectrum from foils activity measurements [7, 8] and have been included for many years in ASTM standards [3]. These inversion methods combine information from activity measurements of foils with their respective response functions (cross sections and covariances) to provide a best-estimate multigroup spectrum. According to the selected method, one should provide an optional prior spectrum as input. An adjustment library CALMAR has been developed and some aspects of the library has already been exposed [4], this paper focusses on the public release of the library. Then it describes examples of use of the *ECORCES* code for nuclear data preparation and *CALMAR* code for the adjustment procedure.

**Availability at NEA Data bank** The publication process of CALMAR library is in progress at NEA databank and will be available soon. The library is written in C++ and linked to the ROOT framework [2]. The library is released as a source package under the open source CeciLL-C software license [1]. Open-source release makes technical exchanges easier for the dosimetry community.

**Nuclear data processing - ECORCES** The ECORCES code is a dedicated tool to extract nuclear data from IRDFF [10]. This code processes the dosimetry library in several ways to compute:

- Effective cross sections in an user energy grid, with an optional weighting flux
- Uncertainties (including covariances matrices) in an user grid
- Cumulated reactions rates with associated uncertainties

It has also basic graphing functions. ECORCES code has limitations : only cross section and activation files (files 3/10 in ENDF formalism [5]) and associated covariances (files 33/40 ) can be processed, and not resonance parameters. Example of use will be provided.

**Adjustement procedure - CALMAR** The use of *CALMAR* code follows a classical scheme:

- nuclear data preparation
- prior spectrum extraction from Monte-Carlo transport code for example.
- prior spectrum covariance estimation.
- extraction of measurements ( "experimental reaction rates" ) : results from activation code or analytical solution.
- creating the job file
- running adjustment procedure
- getting results : integral values (integral flux, fast flux , displacements per atom) with uncertainties

All these steps will be applied to a dedicated example showing all the ways for launching the code (standalone, C++ scripting, library call). The numerical results obtained with CALMAR will be compared to other codes (STAYS'L, SAND-II,.. ), a first step to a new benchmark of ajustement procedures [6, 9].

- 
- [1] CeCILL-C open source license. [http://www.cecill.info/licences/Licence\\_CeCILL-C\\_V1-en.txt](http://www.cecill.info/licences/Licence_CeCILL-C_V1-en.txt).
  - [2] I. Antcheva and al. ROOT – a C++ framework for petabyte data storage, statistical analysis and visualization. *Computer Physics Communications*, 182(6):1384 – 1385, 2011.
  - [3] ASTM. E944-13 standard guide for application of neutron spectrum adjustment methods in reactor surveillance E706-IIA. ASTM International, West Conshohocken, PA, 2013.
  - [4] G. Grégoire and C. Fausser. CALMAR : a new versatile code library for adjustment from measurements. In E. Science, editor, *15th Int. Symp. on Reactor Dosimetry*, volume 106, page 7006, Aix en Provence, France, 2016.
  - [5] M. Herman. ENDF-6 formats manual. Technical Report BNL-90365-2009, National Nuclear Data Center Brookhaven National Laboratory, June 2009.
  - [6] N. Kocherov. Neutron metrology file 90 - NMF90, an integrated database for performing neutron spectrum adjustment calculation. Technical Report INDC-NDS-347, IAEA, January 1996.
  - [7] W. McElroy, S. Berg, T. Crockett, and R. Hawkins. A computer automated iterative method for neutron flux spectra determination by foil activation. Technical Report AFWL-TR-67-41-Vol1, Air Force Weapons Laboratory, Kirtland, NM, 1967.
  - [8] F. Perey. Least-square dosimetry unfolding: the program STAY'SL. Technical Report TM-6062 ENDF-254, ORNL, 1977.
  - [9] W. Zijp, E. Zsolnay, H. Nolthenius, and E. Szondi. Final report of the REAL84 exercise. Technical Report INDC-NDS-212, IAEA/BME/ECN, November 1988.
  - [10] E. Zsolnay, R. C. Noy, H. Nolthenius, and A. Trkov. The International Reactor Dosimetry and Fusion File (IRDF release 1.02). Technical Report IAEA-NDS-0616, IAEA, 2012.