



*4th AGATA-GRETINA/GRETA Tracking Arrays Collaboration Meeting,
November 2024 - Argonne National Laboratory*

Recent achievements in analysis techniques & software eco-system in AGATA

O.Stézowski, on behalf of
Reprocessing, Analysis and Data Manager team



Jérémie involved in the preparation of the
EURO-LABS Advanced Training : Open Science & Data management

AGATA Data Analysis [DA] - Generalities



Great deal of the DA codes in a package called AGAPRO

- Since the beginning of the project, framework approach = collaborative developments
- Mostly C++ (C) language (even dependencies), cmake as building system, software repositories
- The package has been maintained to follow evolutions of tools / standards
 - ❖ C++97 \rightsquigarrow C++11 \rightsquigarrow C++17/20
 - ❖ make \rightsquigarrow cmake \rightsquigarrow modern cmake
 - ❖ csv \rightsquigarrow svn \rightsquigarrow git \rightsquigarrow gitlab

More and more other languages (Ex: python for Machine Learning applications)

In term of open science, we have been working for software with quite good practices

➡ However we have to go further* i.e. more open code, more tested/solid code ...

* see the NuPECC Long Range Plan 2024 for European Nuclear Physics 2024 / Open Science and Data section

AGATA Data



Great deal of the DA codes in a

- Since the beginning of the project
- Mostly C++ (C) language (even though)
- The package has been maintained

- ❖ C++97 → C++11 → C++17/20
- ❖ make → cmake → modern cmake
- ❖ csv → svn → git → gitlab

More and more other languages (Ex: python for Machine Learning applications)
In term of open science, we have been working for software with quite good practices

➔ However we have to go further* i.e. more open code, more tested/solid code ...

IPNL_GAMMA > agapro > Commits > b58fc1cd

Commit b58fc1cd authored 9 years ago by dino

git-svn-id: svn://gal-serv.lnl.infn.it/agata/trunk/narval_emulator@736 170316e4-aea8-4b27-aad4-0380ec0519c9

parent f52e8da4 master

No related merge requests found

Changes 1

Showing 1 changed file with 0 additions and 0 deletions

filters/Ancillary/includeVME/DANTE.h → filters/Ancillary/includeVME/Dante.h

File moved

* see the NuPECC Long Range Plan 2024 for European Nuclear Physics 2024 / Open Science and Data section

AGATA Data Analysis [DA] - Generalities



Great deal of the DA codes in a package called AGAPRO

2

- Since the beginning of the project, framework approach = collaborative developments
- Mostly C++ (C) language (even dependencies), cmake as building system, software repositories
- The package has been maintained to follow evolutions of tools / standards
 - ❖ C++97 → C++11 → C++17/20
 - ❖ make → cmake → modern cmake
 - ❖ csv → svn → git → gitlab

More and more other languages (Ex: python for Machine Learning applications)

In term of open science, we have been working for software with quite good practices

↳ However we have to go further* i.e. more open code, more tested / solid code ...

1

* see the NuPECC Long Range Plan 2024 for European Nuclear Physics 2024 / Open Science and Data section

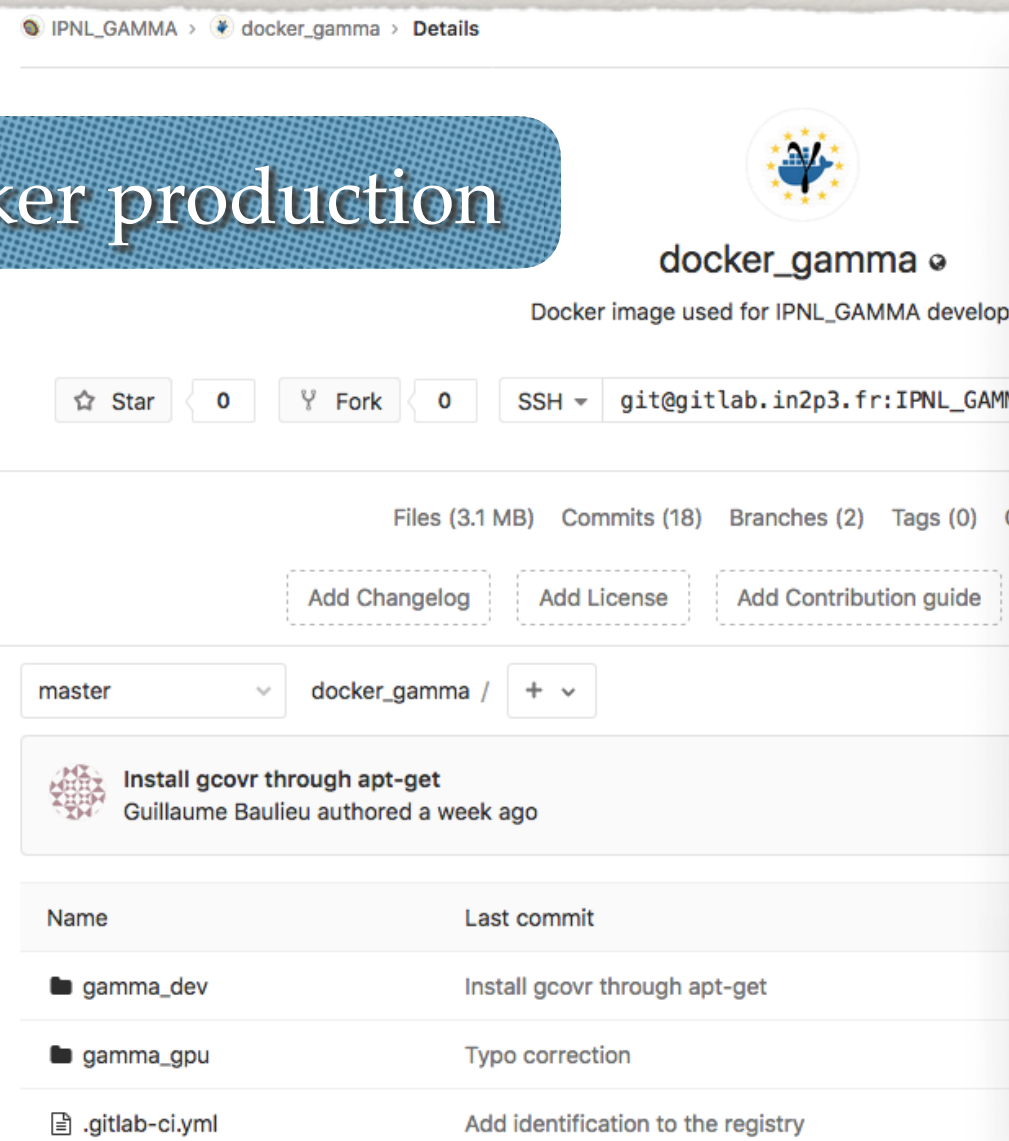
1 Software management - recent achievements

gitlab functionalities in action

AGAPRO package containerised (docker → apptainer)

- Container code in gitlab, built in gitlab
- Container used to distribute an operational AGAPRO package whatever linux the distribution of his computer
- Used for continuous integration : automatic tests performed any time modifications are pushed on git
 - ➔ compilation is tested / code checking using dedicated tool cppcheck + sonarcube
 - ➔ documentation produced on git <https://agata.pages.in2p3.fr/handbook/>

Docker production



IPNL_GAMMA > docker_gamma > Details

docker_gamma 1.0

Docker image used for IPNL_GAMMA development

Star 0 Fork 0 SSH git@gitlab.in2p3.fr:IPNL_GAMMA

Files (3.1 MB) Commits (18) Branches (2) Tags (0)

Add Changelog Add License Add Contribution guide

master docker_gamma / +

Install gcovr through apt-get
Guillaume Baulieu authored a week ago

Name	Last commit
gamma_dev	Install gcovr through apt-get
gamma_gpu	Type correction
.gitlab-ci.yml	Add identification to the registry

IPNL_GAMMA > ganpro > Pipelines > #14130

passed Pipeline #14130 triggered 6 days ago by Guillaume Baulieu

Merge branch 'ReplayReadOrder' into 'preprod'

Replay read order

See merge request

Check compilation

2 jobs from preprod in 2 minutes 19 seconds (queued for 2 seconds)

e176ca3e

Pipeline Jobs 2

Build

Publish

compile

sonar

Check quality of the code



Overview Issues Measures Code Activity

Quality Gate **Passed**

Bugs 0 Vulnerabilities 0

Leak Period: since previous version started 10 months ago

New Bugs 0 New Vulnerabilities 0

Code Smells 18

Debt 2h New Debt 2h New Code Smells 18

Coverage 22.5%

Coverage on 5.9k New Lines to Cover 19.6%

Duplications 11.4%

Duplicated Blocks 55

Duplications on 16k New Lines 13.7%

9.7k Lines of Code C++ (Co... 9k Python 706

No tags

Activity

September 10, 2018 1.0

September 9, 2018 Project Analyzed

September 8, 2018 Project Analyzed

Show More

Quality Gate gamma

Quality Profiles (C++ (Community)) Sonar way (outdated c... (Python) Sonar way (outdated copy)

Key matruc:GanPro

1 Software management - recent achievements

AGAPRO p

- Contain
- Contain
- Used fo



IPNL_GAMMA > docker_gamma > Details

Docker production

Docu

Star 0 Fork 0 SSH

Files (3.1 MB) C

Add Changelog Add

master docker_gamma / +

Install gcovr through apt-get
Guillaume Baulieu authored a week ago

Name	Last comm
gamma_dev	Install gcov
gamma_gpu	Typo corre
.gitlab-ci.yml	Add identifi

Home

Home

↑ Back to top

Welcome on the AGATA softwares handbook



This web page aims to help AGATA users with the different softwares distributed to the collaboration

Contacts

- Guillaume Baulieu (IP2I Lyon): guillaume.baulieu@cnrs.fr
- Jérémie Dudouet (IP2I Lyon): jeremie.dudouet@cnrs.fr
- Olivier Stézowski (IP2I Lyon) : olivier.stezowski@cnrs.fr

Search

Table of contents

Welcome on the AGATA softwares handbook

Contacts

computer

Quality of the code

9.7k Lines of Code
C++ (Co... 9k
Python 706

No tags

Activity



September 10, 2018

1.0

September 9, 2018

Project Analyzed

September 8, 2018

Project Analyzed

Show More

Quality Gate

gamma

Quality Profiles

(C++ (Community)) Sonar way (outdated c...
(Python) Sonar way (outdated copy)

Key

matruc:GanPro

Duplications

Duplicated Blocks

16k New Lines

① Software management - recent achievements

gitlab functionalities in action

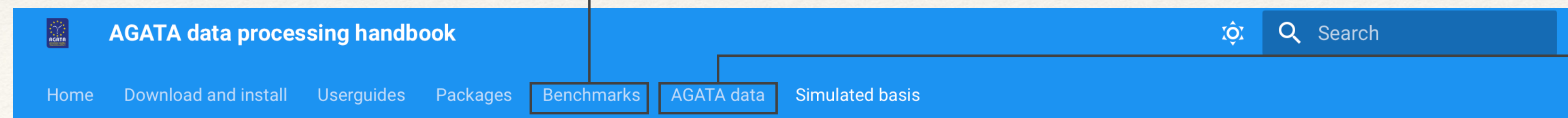
AGAPRO package containerised (docker → apptainer)

- Container code in gitlab, built in gitlab
- Container used to distribute an operational AGAPRO package whatever linux the distribution of his computer
- Used for continuous integration : automatic tests performed any time modifications are pushed on git
 - ↳ compilation is tested / code checking using dedicated tool cppcheck + sonarcube
 - ↳ documentation produced on git <https://agata.pages.in2p3.fr/handbook/>
- More software added recently on git related to PSA studies - signal generation & Strasbourg scanning table

Our colleagues @ LNL have been further in gitlab

- ↳ results of a processing chain automatically tested [physical result]
- ↳ we plan to add this on the AGATA side [Ex : a full chain PSA + Tracking with test on the FWHM of some peaks]
- ↳ a reference data set is ready for that (also use to benchmark improvements in PSA/Tracking codes)

Getting data for the GRID requires a User Interface. Not all lab. have one → a container is provided



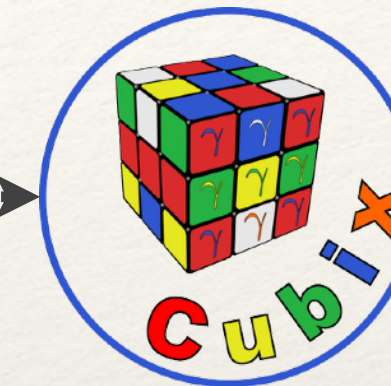
② Highlight on some recent productions

A C++ interface to nuclear databases

([PubChem](#), [X-RAY DATA BOOKLET](#), [IAEA-NDS](#), [NUDAT3](#), [ENSDF](#), [XUNDL](#))



Cubix uses TkN



<https://cubix.in2p3.fr/>

Zenodo DOI [10.5281/zenodo.10683241](https://doi.org/10.5281/zenodo.10683241)

<https://tkn.in2p3.fr/>

Zenodo DOI [10.5281/zenodo.10255692](https://doi.org/10.5281/zenodo.10255692)

Angular correlation studies

Cite this article

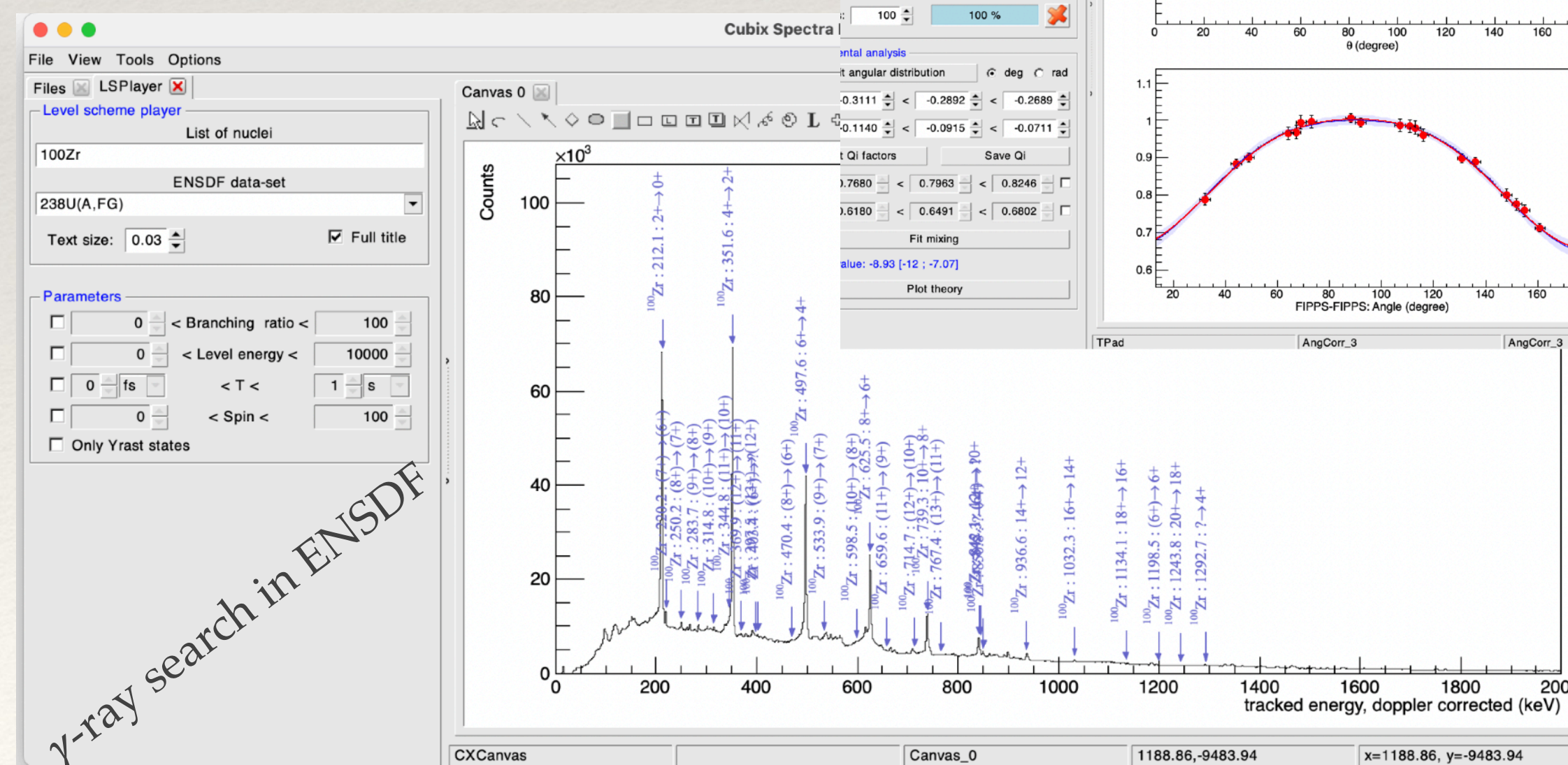
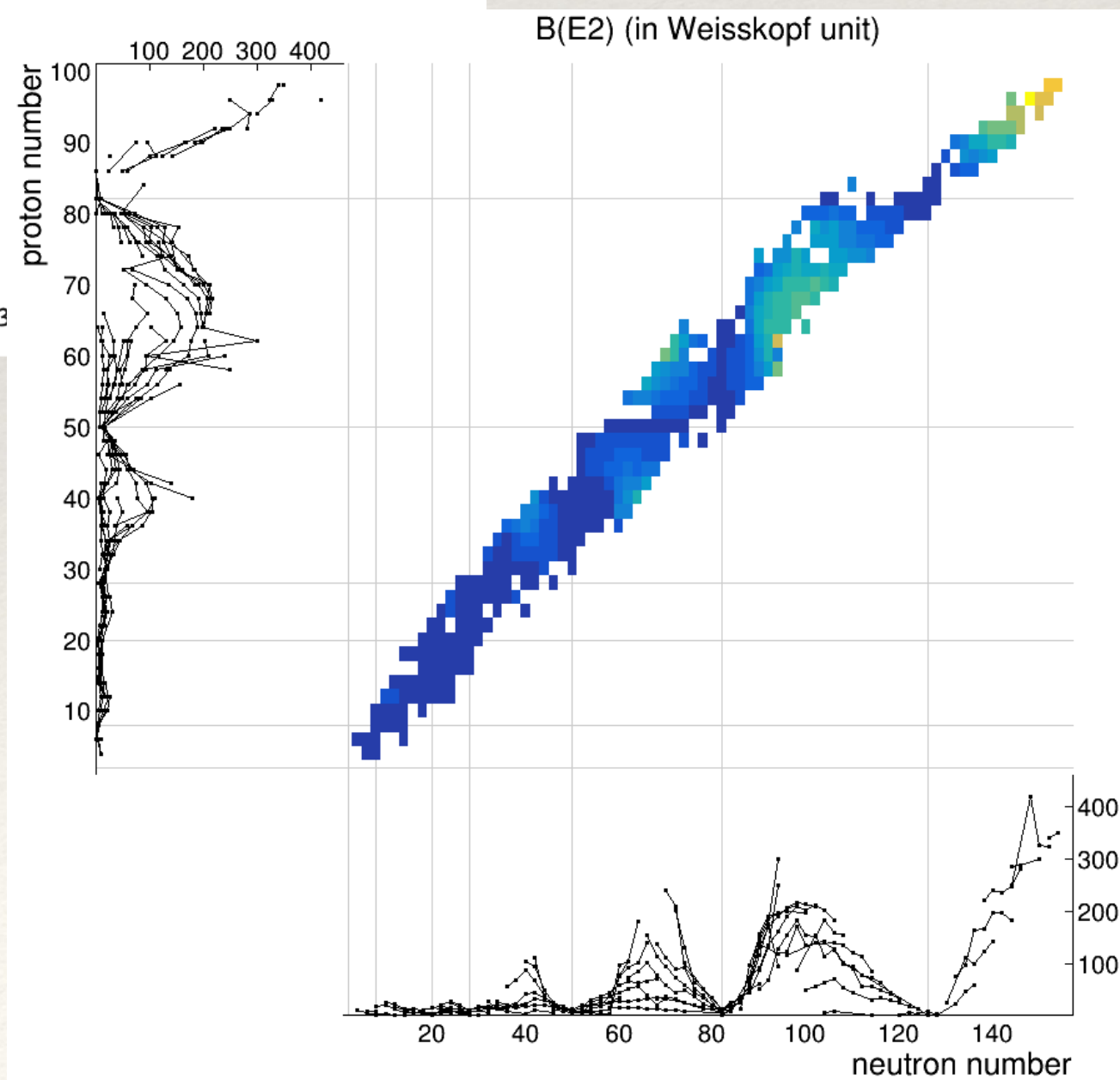
Dudouet, J., Gruyer, D. The toolkit for nuclei library (TKN): a C++ interface to nuclear databases. *Eur. Phys. J. Plus* **139**, 641 (2024). <https://doi.org/10.1140/epjp/s13360-024-05384-9>

[Download citation](#)

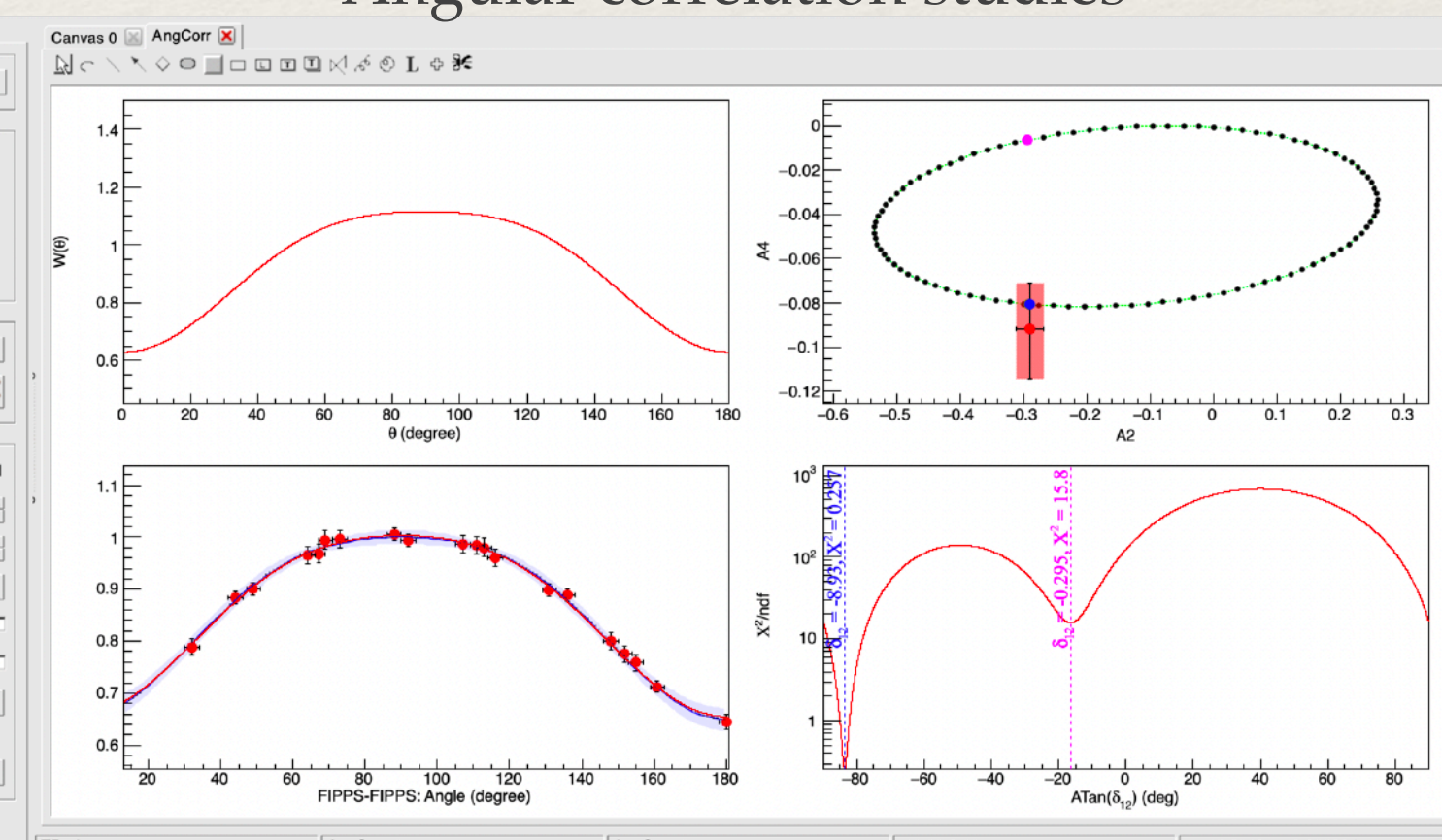
Received
12 December 2023

Accepted
20 June 2024

DOI
<https://doi.org/10.1140/epjp/s13360-024-05384-9>



γ-ray search in ENSDF



→ DA on 'users' facilities

- From root trees
- or new root trees from replay [femul]



2 Highlight on some recent productions

A root file analyser has been developed for AGATA + ancillaries @ LNL
→ MPI based parallelisation on multiple machines

→ DA on 'users' facilities

- From root trees
- or new root trees from replay [femul]

2

D.Brugnara @ AW 2024

Reproducibility

- The output files contain the parameters used to generate it:
 - The entire selector.conf
 - The lookup tables
 - The git hash
 - The date of creation
- This means that the analysis can be reproduced simply by printing the selector.conf used for this specific file and checking out the correct hash
- The nearline analysis and configurations of each experiment can be recalled by compiling it with the right flags
- It is also citable with a DOI:

DOI 10.5281/zenodo.8329198

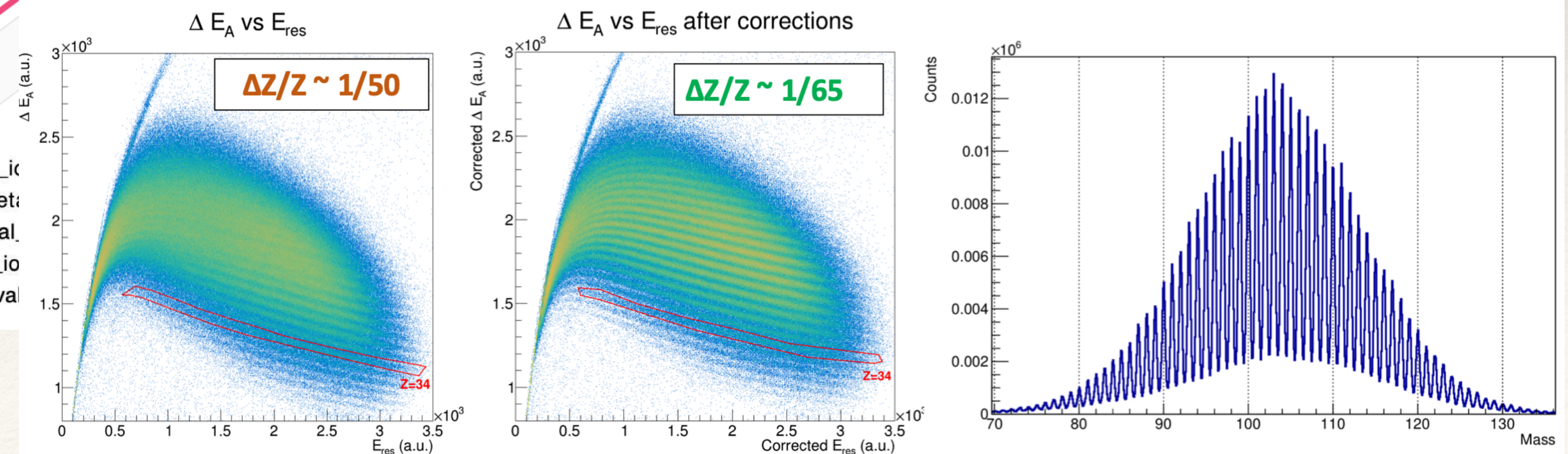
PROOF Sessions
ROOT Files
/Users/daniele/Downloads/build/Tests/test.root
Configurations;1
test.root
Agata;1
Prisma;1
h_CR;1
AgataPrism
Z16;1
A32

Header
GetCreatio
GetComme
GetGitHasl
GetFileNar
GetFileCo
Deletr
D

AgataSelector
Project ID: 4513
2 Branches
4 Tags
858.1 MB Project Storage
2 Releases
983 Commits
data analysis
Physics
Data analysis code for the AGATA+ancillary data based on the ROOT framework.
Bug fix with beta vs betaBP in gammadetectorPrisma
Matus Sedlak authored 3 weeks ago

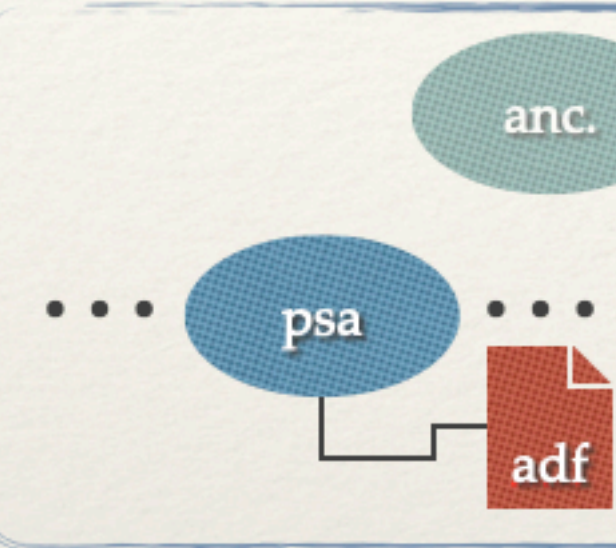
Prisma

- The analysis of the spectrometer has been included in the selector
- This allows to exploit the optimization procedure of the selector even on the optical parameters of the spectrometer
- Some improvements have also been done on the ionization chamber selection



F. Angelini, E. Pilotto

2 Highlight on some recent productions



Great deal of

2

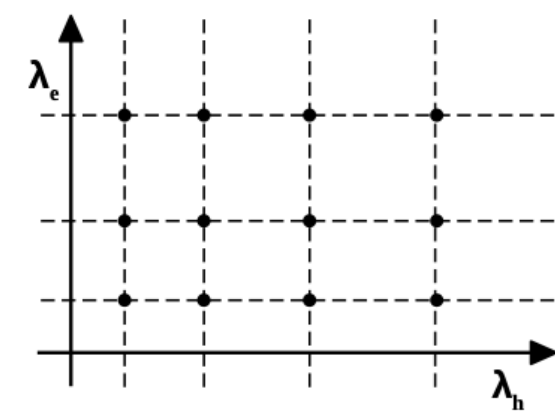
- Sin
- Mo
- The

More and more
In term of op

The objective is to obtain the $\lambda_{e,h}$ parameters that yield the best possible correction and therefore energy resolution

$$\frac{E_{meas}(x)}{E_{corr}(x)} = 1 + \frac{t_e(x)}{\lambda_e} + \frac{t_h(x)}{\lambda_h}$$

Algorithm code: <https://gitlab.in2p3.fr/ip2igamma/agapro/-/blob/preprod/zPrograms/SortPsaHits.cpp>



LOGARITMIC GRID - SEARCH

Fixed 50 x 100 grid

$$\lambda_{e,h}^n = -R \frac{\log_{10} \left(1 - \frac{n}{N_{e,h}} \right)}{\log_{10} N_{e,h}}$$

- Source data (usually ^{60}Co)
- Only segment multiplicity 1 events
- Optimization of SG, CC or SG+CC
- Estimation of a FOM
- Computation in each point of the grid, for each segment of each crystal

Ease of use, speed and robustness are key

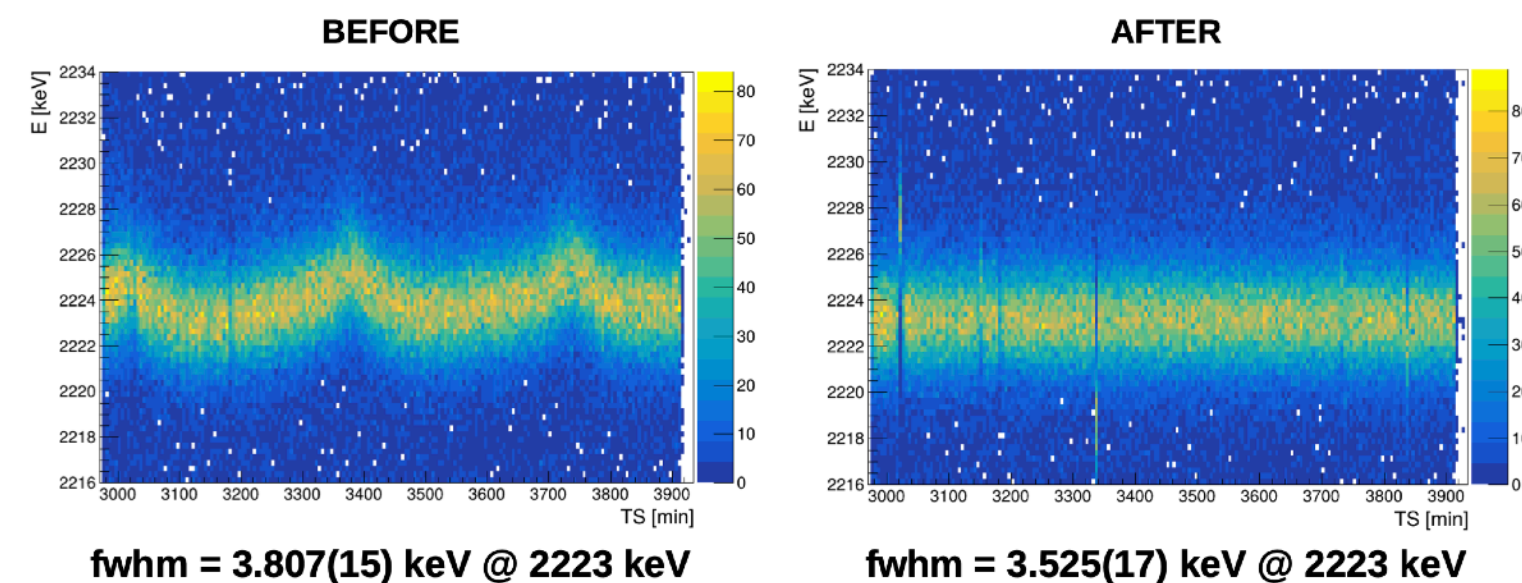
E.Pilotto @ AW 2024

In configuration of PostPSAFilter

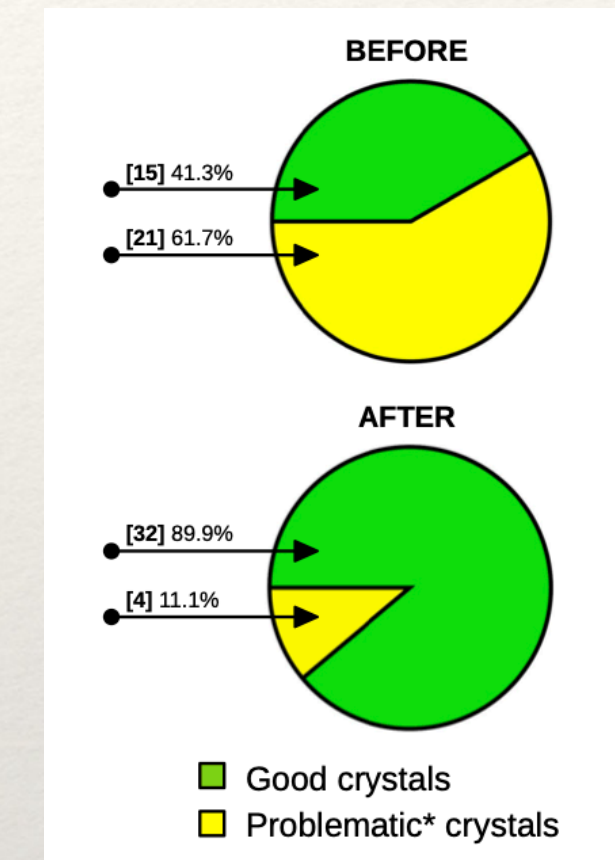
"TimeEvoCCfile TimeEvoCC.conf", #file with time dependent gain...

TimeEvoCC.conf

#TS_start	TS_stop	gain
6150000000000	6210000000000	0.999948755522396
6210000000000	6270000000000	0.999887585155303
...		



Better neutron damages correction



*crystals are defined "problematic" if at least one segment shows a visible tail in the CC spectrum after ND correction

Time dependent energy calibration