AGATA Analysis Workshop 2025
Preprocessing Calibration

R.M. Pérez-Vidal

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Data Processing

Replay

Topology. conf List of Narval actors to run and chain together all the configuration files

ADL/ Calculated signal basis for each ATC, needed for the PSA

ADF.conf Definition of adf frames used for this analysis

gen_conf.py Generator of the configuration files for each actor and output directory.

Conf/ Configurations of actors and calibrations directory, read during initialization

Data/ Link to the experimental data and spectra directory (ln -s Path_to_Data/Data/Data)

Out/ Output data and spectra directory produced during data replay. It is created by gen_conf.py. Same structure as Data directory.

FEMUL Narval-emulator program used when the data needs to be replayed after an experiment has been performed

Data Processing

Directories structure

The directory where you produce your data contains some standard sub-directories
(e.g. /agatadisks/ExpName(*_EXP_XXX) /run_XXXX_date)

Conf: Configuration of actors, calibrations, ... for each detector
       00A, 00B, 00C ... Builder, Ancillaries, Global, Merger
       with minimal differences between online and offline

Data: Data and spectra produced during the experiment
       Online writes data here
       Offline replay takes data from here

Out: Data and spectra produced during data replay
       Offline writes data here

Data Processing

Configuration directory

Conf/Crystals(00A,…)

- BasicAFC.conf
- BasicAFP.conf
- CrystalProducerATCA.conf
- CrystalProducer.conf
- PreprocessingFilter.conf
- PreprocessingFilterPSA.conf
- PSAFilter.conf
- PostPSAFilter.conf
- RecalEnergy2.cal
- Trapping.cal
- xdir_1325-1340.cal
- xinv_1325-1340.cal

Conf/Builder

- EventBuilder.conf

Conf/Merger

- EventMerger.conf
- TrackingFilter.conf
- CrystalPositionLookUpTable
- TreeBuilder.conf

Data Processing

Useful programs

The number of channels (38 x number of detectors) to be calibrated and checked at each analysis level is too large to be done one by one: **automatic tools and procedures are distributed**

o **TkT & Mat spectrum viewer:** to plot any spectrum produced all along the actors chain

o **RecalEnergy:** Analysis of spectra looking for peaks

o **xTalkSort, xTalkMakex,TalkInvert:** to sort and analyze the AGATA events dumped into event energy.bdat.0000 to determine the crosstalk correction coefficients

o **SortPsaHits:** Sort of PSA hits (special format) to determine neutron damage correction parameters

o **solveTT.py:** Optimize time alignment of "equal" detectors

Data Processing

Binary spectra

- Simple C-style multidimentional (max 6) arrays written mostly in binary format

- Format not recorded in the file, typically written as a part of the file name:

 **Actor__Library-NbSpectra-Length-Format__Type.spec** dump file of an array defined as:

  Format ActorSpecType**[Library][NbSpectra][Length]**

  E.g. **Prod__4-38-32768-UI__Ampli.spec** is a file dumped by the **Crystal Producer actor** containing

  the **amplitude spectra** of segments and cores organized in **4 libraries of 38 spectra** written in **32768**

  unsigned integer bins

- The viewers TkT and Mat can decode an interpret the format and length from the file name

- Other programs (e.g. RecalEnergy) can interpret the spectrum format and length from the file name but

  the user have to specify the number of spectra to act upon.

TkT

Channels correspondence after Replay

80 mm

6x6 segmented cathode

90 mm
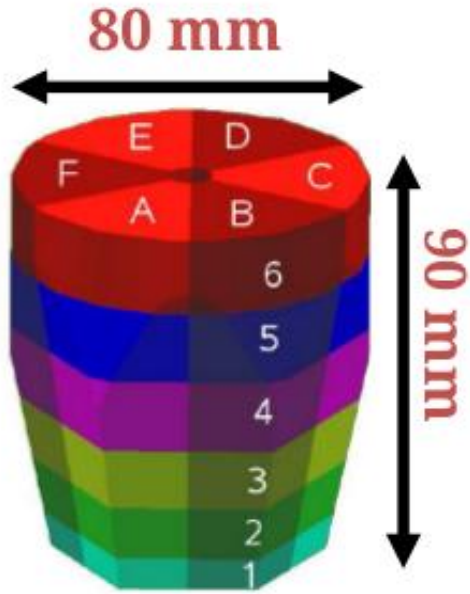
	A	B	C	D	E	F	CC	
Back segs. 6	5	11	17	23	29	35		
5	4					34		
4	3					33		
3	2					32		
2	1					31	37	1 Low gain
Front segs. 1	0	6	12	18	24	30	36	0 High gain & trigger

TkT & Mat

Channels correspondence after Replay

80 mm

90 mm

6x6 segmented cathode

TkT

	A	B	C	D	E	F
6	5					
5	4					
4	3					
3	2					
2	1					
1	0	6	12	18	24	30

Mat

Slice 6

TkT & Mat

Channels correspondence after Replay

80 mm

90 mm

6x6 segmented cathode

TkT

	A	B	C	D	E	F
6	5					
5	4					
4	3					
3	2					
2	1					
1	0	6	12	18	24	30

Mat

| 6 |
| 5 |
| 4 |
| 3 |
| 2 |
| 1 |

Data Processing

Narval actors

AGATA detectors

cdat | cdat | ... | cdat — **Raw data**

LOCAL Processing

...

Crystal Producer ← Read-in the data from the disk

- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction

→ Preprocessing Filter

...

PSA Filter ←
- Differential Cross-talk correction
- Pulse shape analysis
- Grid search Adaptive
- T_0 alignment

...

Write-out the data on the disk → Consumer

PSA.adf | PSA.adf | ... | PSA.adf — **Reduced data PSA**

- Re-calibration
- Neutron damage correction
- Global Time alignment

→ PostPSA Filter

GLOBAL Processing

Complementary Det.

...

*.adf — **Built data**

- Global reference frame
- Event validation
- TimeStamp Wwndow

→ Event Builder

Event Merger ←
- Merging AGATA & complementary Det.
- Coincidence Window

- Gamma-ray path reconstruction
- OFT algortihm

→ Tracking Filter

Consumer ← Write-out the data on the disk

Tree.root — **Root tree data Tracking**

Tracking

First Interaction pattern

Pulse Shape Analysis

(a) XY plane   (b) XZ plane   (c) YZ plane

Data Processing

Narval actors

AGATA detectors

cdat — cdat — cdat   **Raw data** → No traces stored during LNL campaign

LOCAL Processing …

Crystal Producer ← Read-in the data from the disk

- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction

Preprocessing Filter …

PSA Filter ←
- Differential Cross-talk correction
- Pulse shape analysis
- Grid search Adaptive
- T_0 alignment

Write-out the data on the disk → **Consumer**

PSA.adf PSA.adf … PSA.adf   **Reduced data PSA**

Online
Configuration prepared before the experiment

- Re-calibration
- Neutron damage correction
- Global Time alignment

PostPSA Filter

GLOBAL Processing …

Complementary Det.

*.adf   **Built data**

- Global reference frame
- Event validation
- TimeStamp Wwndow

Event Builder

Event Merger ←
- Merging AGATA & complementary Det.
- Coincidence Window

- Gamma-ray path reconstruction
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Tracking Filter

Consumer ← Write-out the data on the disk

Tree.root   **Root tree data Tracking**

Data Processing

Narval actors

AGATA detectors

cdat — cdat   **Raw data** → No traces stored during LNL campaign

LOCAL Processing …

Crystal Producer ← Read-in the data from the disk

- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction

Preprocessing Filter …

PSA Filter

- Differential Cross-talk correction
- Pulse shape analysis
- Grid search Adaptive
- T_0 alignment

Write-out the data on the disk → Consumer …

PSA.adf   PSA.adf … PSA.adf   **Reduced data PSA**

Online
Configuration prepared before the experiment

- Re-calibration
- Neutron damage correction
- Global Time alignment

PostPSA Filter

GLOBAL Processing …

- Global reference frame
- Event validation
- TimeStamp Wwndow

Event Builder

Complementary Det.

*.adf   **Built data**

- Gamma-ray path reconstruction
- OFT algortihm

- Merging AGATA & complementary Det.
- Coincidence Window

Event Merger

Tracking Filter

Consumer ← Write-out the data on the disk

Tree.root   **Root tree data Tracking**

Nearline/Offline
Configuration prepared after the experiment

Local Level Processing

Narval actors

Operations up to the PSA need to be carefully prepared before the experiment and checked online

No traces stored during LNL campaign

AGATA detectors

cdat | cdat | ... | cdat **Raw data**

LOCAL Processing
...

Crystal Producer ← Read-in the data from the disk
...

- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction

Preprocessing Filter
...

PSA Filter ←
...

- Differential Cross-talk correction
- Pulse shape analysis
- Grid search Adaptive
- T_0 alignment

Write-out the data on the disk → Consumer
...

PSA.adf | PSA.adf | ... | PSA.adf **Reduced data PSA**

- Re-calibration
- Neutron damage correction
- Global Time alignment

PostPSA Filter

GLOBAL Processing
...

Complementary Det.

*.adf **Built data**

- Global reference frame
- Event validation
- TimeStamp Wwndow

Event Builder

Event Merger ←
- Merging AGATA & complementary Det.
- Coincidence Window

- Gamma-ray path reconstruction
- OFT algortihm

Tracking Filter

Consumer ← Write-out the data on the disk

Tree.root **Root tree data Tracking**
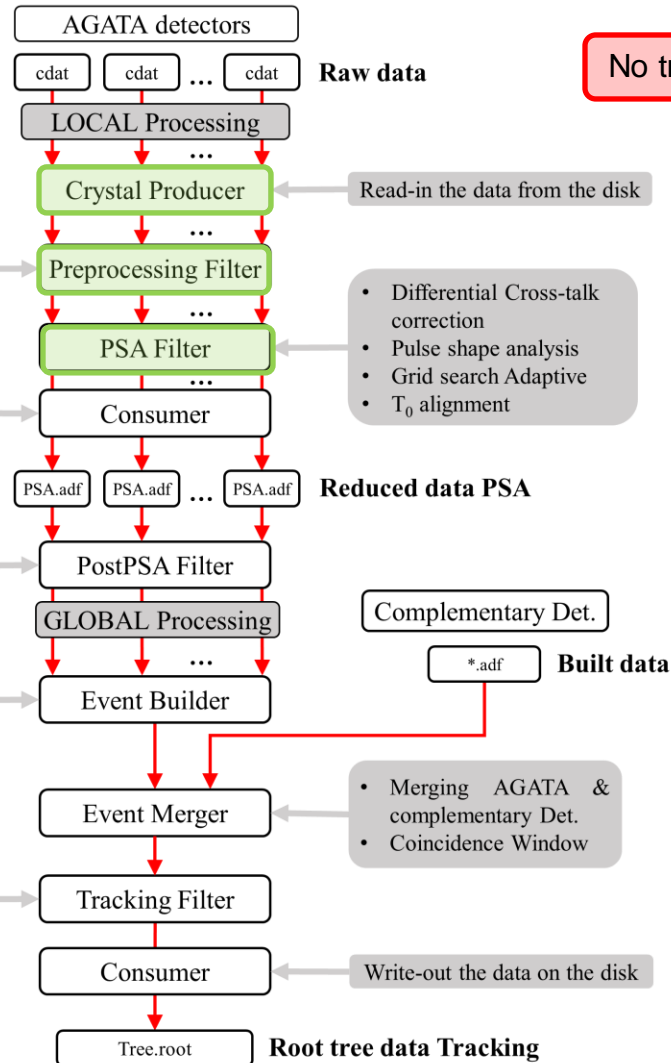
Local Level Processing

Narval actors
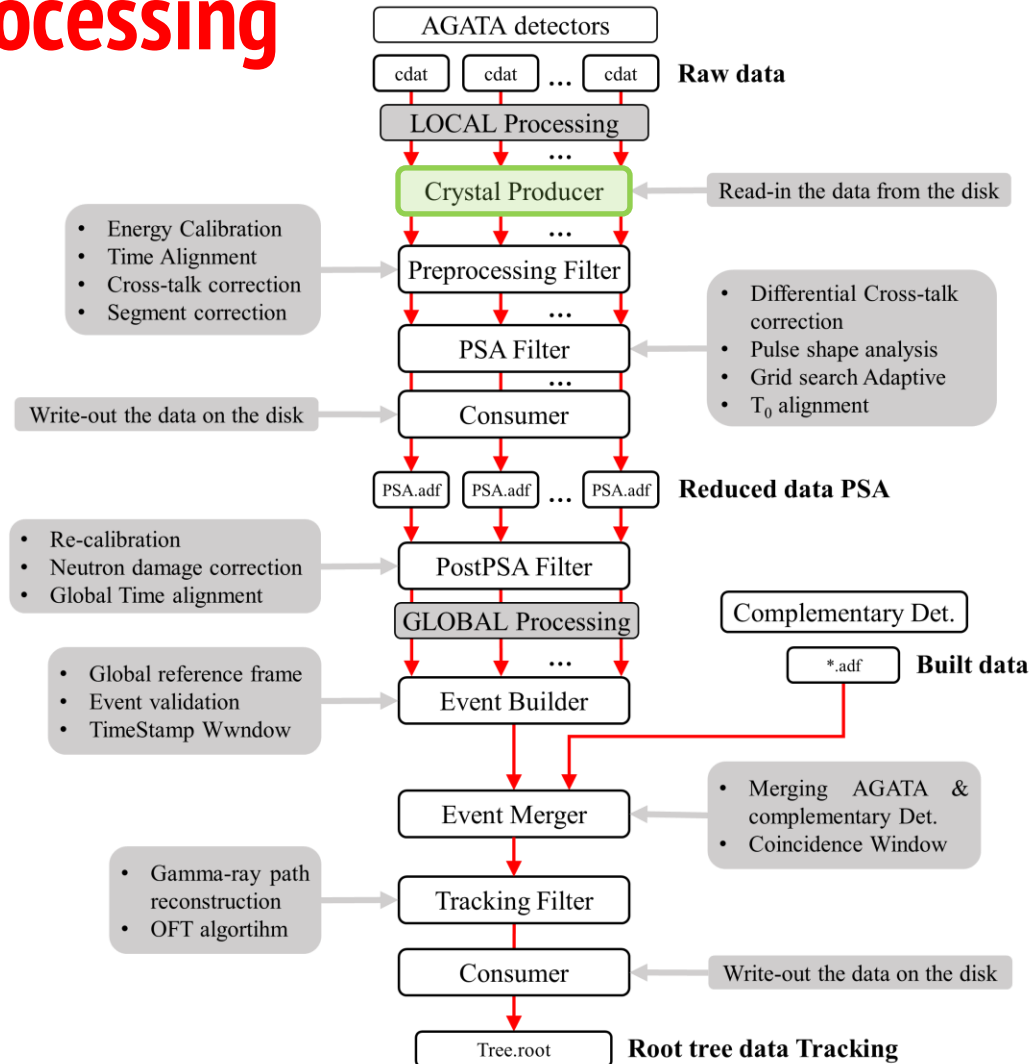
Local Level Processing

Crystal Producer

o Reads the data from:
- The PCI express driver connected to the GGP electronics, **online**
- Raw data files (event_mezzdata.cdat) , **offline**

o Acts as a local event builder to assemble data coming from the GGP readout (or from the raw data file) according to mapping specified in:
- **CrystalProducerATCA.conf** ⟶ **Files in Conf/00A e.g.**

o Prepares data:crystal frames and send it to the data flow

o **Configuration for this actor done by the local team**

o Writes the original/raw data files (optional) and generate raw spectra for amplitudes and baselines:
- **event_mezzdata.cdat**
- **event_energy.bdat**
- Prod__100-42-100-S__Traces.samp
- Prod__38-16384-UI__Baseline.spec
- **Prod__4-38-32768-UI__Ampli.spec**

Files in Data(Out)/00A e.g.

Crystal Producer

Raw data (traces)
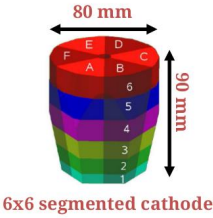
event_mezzdata.cdat.0000 (length and format: 4120-UA)

80 mm
90 mm
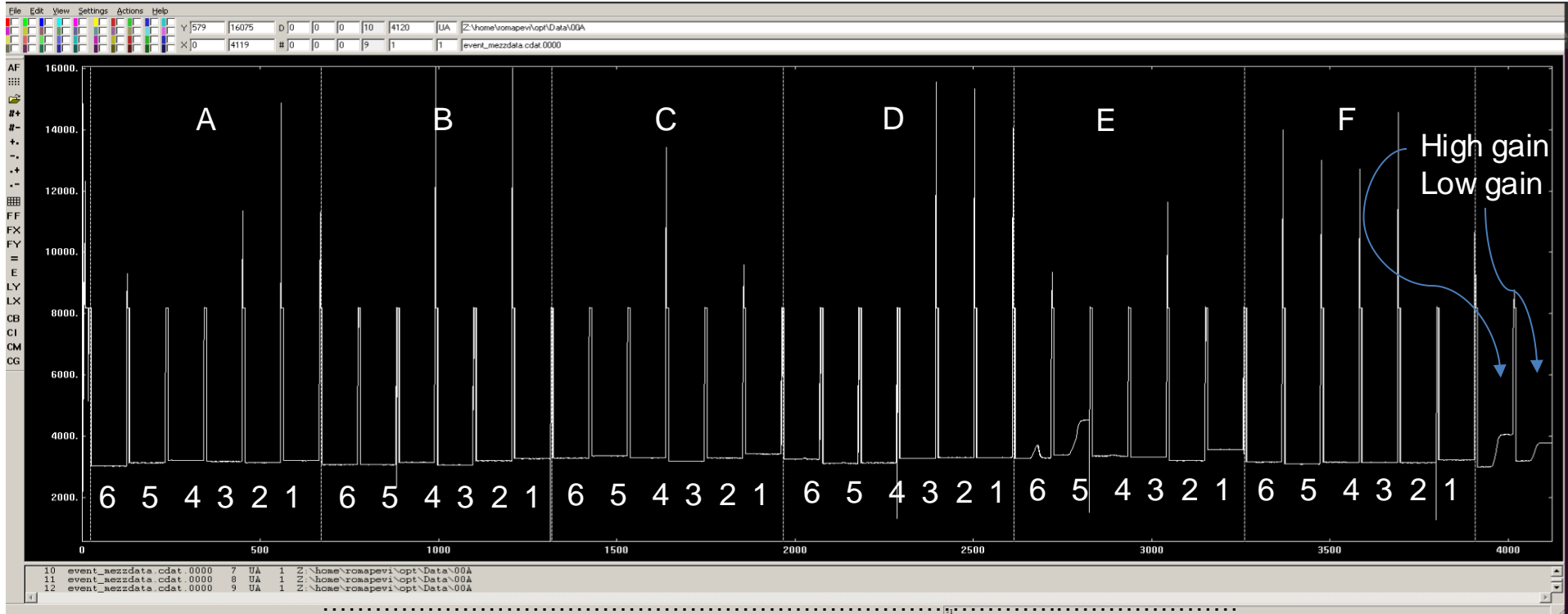
6x6 segmented cathode

Crystal Producer
Amplitude spectra
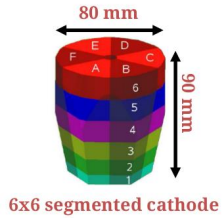
Prod__4-38-32768-UI__Ampli.spec [1][0-37]

Local Level Processing

Narval actors

AGATA detectors

cdat   cdat   ...   cdat   **Raw data**

LOCAL Processing
...

Crystal Producer ← Read-in the data from the disk
...

Preprocessing Filter
- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction
...

PSA Filter ←
- Differential Cross-talk correction
- Pulse shape analysis
- Grid search Adaptive
- T_0 alignment
...

Consumer ← Write-out the data on the disk

PSA.adf   PSA.adf   ...   PSA.adf   **Reduced data PSA**

PostPSA Filter ←
- Re-calibration
- Neutron damage correction
- Global Time alignment

GLOBAL Processing
...

Event Builder ←
- Global reference frame
- Event validation
- TimeStamp Wwndow

Complementary Det.

*.adf   **Built data**

Event Merger ←
- Merging AGATA & complementary Det.
- Coincidence Window

Tracking Filter ←
- Gamma-ray path reconstruction
- OFT algortihm

Consumer ← Write-out the data on the disk

Tree.root   **Root tree data Tracking**

Local Level Processing

Preprocessing Filter

o Performs:
  - Energy calibrations, Time alignment, Calculation of T0 from core: **PreprocessingFilterPSA.conf**
  - Cross talk corrections and unstable/dead segments corrections: **xdir_1325-1340.cal, xinv_1325-1340.cal**

Files in Conf/00A e.g.

o After Preprocessing:
  - energies are stored in units of keV
  - times are in units of samples (10 ns) (but time calibration parameters are in ns)
  - positions are given in mm, when they show up after the PSA

o **Configuration for this actor done by the local team**

o Generates various files:
  - Prep__2000-2000-UI__EsEs.matr
  - Prep__2-1000-1000-US__EeEtrCC.matr
  - **Prep__2-10-16384-UI__Esum.spec**
  - Prep__2-2000-1000-US__EcTc.matr
  - **Prep__2-40-16384-UI__Ener.spec**
  - Prep__36-36-UI__IsIs.matr
  - **Prep__6-40-1000-UI__TT.spec**

Files in Data(Out)/00A e.g.

Local Level Processing

Preprocessing Filter

Quality of the PSA is highly dependent on the good calibrations at the Preprocessing level!

○ Check all segment and core signals detector by detector (36detectorsx38 signals=1368 spectra)

○ In case of problematic signals, check producer level and cdat

○ Once all the detector status are identified:

1. Energy calibration
2. Crosstalk correction
3. Correction of missing/unstable segments
4. Time alignment of the segments to core
5. T0 alignment

Preprocessing Filter

1. Energy Calibration

Gain-only!
no offset coefficient needed because of the way the amplitude is generated in the preprocessing electronics.

80 mm

90 mm

6x6 segmented cathode

What is needed:

o Long 60Co run
o Spectra file : Data/{crystalID}/**Prod__4-38-32768-UI__Ampli.spec**
o Conf File: **PreprocessingFilterPSA.conf**
o Auxiliary files: recal.out
o Programs/scripts:

RecalEnergy: generate calibration coefficients

```
RecalEnergy -spe Data/{crystalID}/Prod__4-38-32768-UI__Ampli.spec -sub 38
-num 38 -gain 2 > {crystalID}/recal.out
```

# indx	#spec	#pks	#ok	rEnergy	FW05	FW01	Area	Position	Width	Ampli	WTML	WTMR	slope*gain	rChi2%
0	38	5	2	1332.97	4.415	12.823	714	3680.72	6.0	44	9.956	1.823	0.699782	48.88
1	39	3	2	1335.59	8.039	23.827	347	3711.46	9.6	11	11.935	1.823	0.723994	999.99
2	40	3	2	1332.30	8.950	26.884	514	3640.05	9.5	15	13.674	1.823	0.721332	10.58
3	41	3	2	1332.53	8.673	26.794	481	3686.95	7.0	14	19.428	1.823	0.718859	0.09
4	42	3	2	1332.81	6.896	20.926	252	3589.82	6.6	10	15.345	1.823	0.709819	20.18
5	43	2	2	1332.57	5.938	17.682	113	3696.65	6.8	5	12.501	1.823	0.701714	0.82
6	44	6	2	1332.38	5.013	14.396	763	3752.69	7.4	41	9.112	1.823	0.701904	4.08
7	45	4	2	1334.55	9.863	30.491	405	3825.30	8.2	10	19.599	1.823	0.685733	958.61
8	46	7	2	1328.15	18.390	34.136	479	3668.08	50.8	9	1.890	1.823	0.728990	999.99
9	47	2	2	1331.97	10.845	30.086	630	3836.94	19.3	15	7.157	1.823	0.703097	67.76
10	48	2	2	1334.70	8.340	25.498	424	3830.68	7.8	13	16.823	1.823	0.698238	999.99
11	49	2	2	1332.41	3.877	11.714	143	3831.25	4.1	9	14.578	1.823	0.711943	2.47
12	50	3	2	1333.21	4.817	14.359	601	3669.83	5.5	33	12.625	1.823	0.719321	111.38

colupdate.py: Add these coefficients to the 5th column of PreprocessingFilterPSA.conf

```
./colupdate.py {crystalID}/PreprocessingFilterPSA_old.conf
{crystalID}/recal.out -c 4 13 -o {crystalID}/PreprocessingFilterPSA.conf
```

More details in AGATA_LLP_UsersGuide

PreprocessingFilterPSA.conf

#segm/core	%d(id)	%f(tfall)	%f(trise)	%f(egain)	%f(emink)	%f(tmove)
segm	0	4800	600	0.699782	15	7.117
segm	1	4800	600	0.723994	15	8.970
segm	2	4800	600	0.721332	15	6.384
segm	3	4800	600	0.718859	15	5.505
segm	4	4800	600	0.709819	15	4.557
segm	5	4800	600	0.701714	15	4.868
segm	6	4800	600	0.701904	15	7.136
segm	7	4800	600	0.685733	15	6.002
segm	8	4800	600	0.728990	15	6.143
segm	9	4800	600	0.703097	15	6.255
segm	10	4800	600	0.698238	15	4.892
segm	11	4800	600	0.711943	15	5.229
segm	12	4800	600	0.719321	15	5.633
segm	13	4800	600	0.691592	15	3.298
segm	14	4800	600	0.719889	15	4.436
segm	15	4800	600	0.699936	15	4.799
segm	16	4800	600	0.724667	15	4.957
segm	17	4800	600	0.711515	15	5.091
segm	18	4800	600	0.730854	15	6.039
segm	19	4800	600	0.691051	15	5.029
segm	20	4800	600	0.706594	15	3.751
segm	21	4800	600	0.717657	15	3.090
segm	22	4800	600	0.715001	15	5.138
segm	23	4800	600	0.714159	15	4.982
segm	24	4800	600	0.716068	15	4.994
segm	25	4800	600	0.699619	15	5.645
segm	26	4800	600	0.708694	15	4.529
segm	27	4800	600	0.700469	15	3.817
segm	28	4800	600	0.726621	15	4.035
segm	29	4800	600	0.699717	15	4.644
segm	30	4800	600	0.700183	15	6.348
segm	31	4800	600	0.701122	15	6.565
segm	32	4800	600	0.720491	15	6.755
segm	33	4800	600	0.704997	15	4.734
segm	34	4800	600	0.713051	15	3.888
segm	35	4800	600	0.721396	15	4.347
core	0	4800	600	0.767652	0	21.000
core	1	4700	600	1.374411	0	21.000
tntf	-1					

Preprocessing Filter

80 mm

90 mm

6x6 segmented cathode

Preprocessing Filter: 1. Energy Calibration

Prod__4-38-32768-UI__Ampli.spec [1][0-37]   Prep__2-40-16384-UI__Ener.spec [0][0-37]
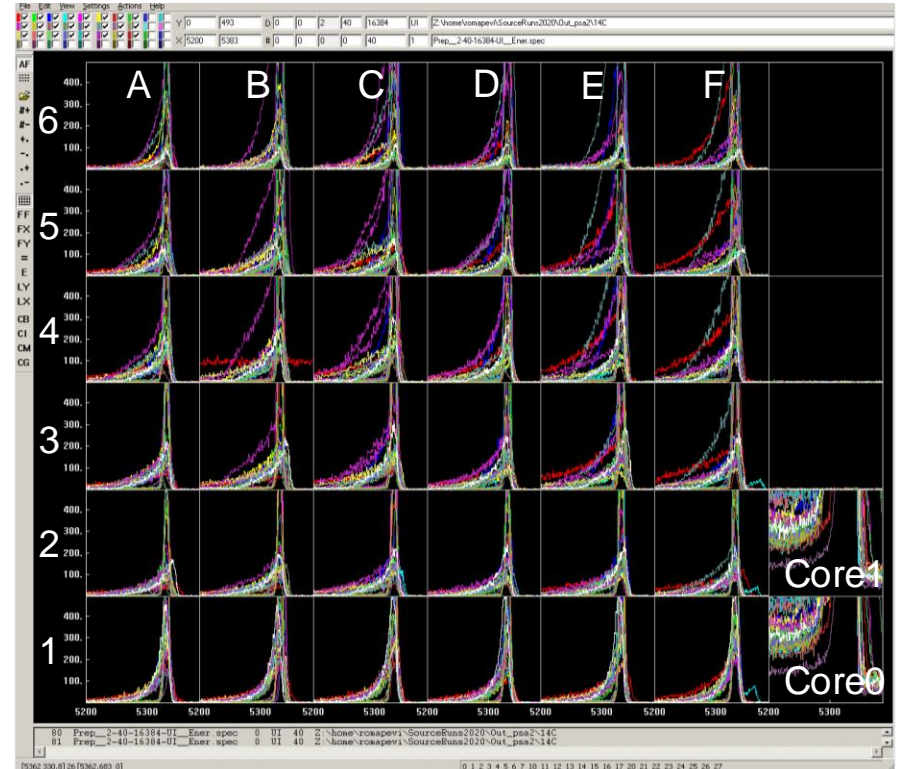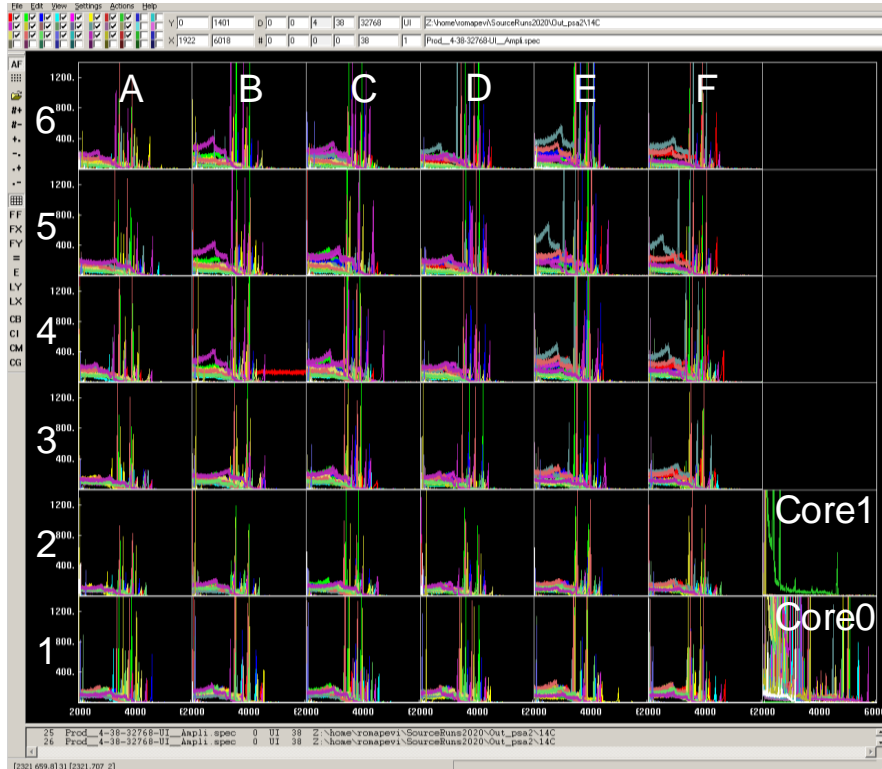
Preprocessing Filter
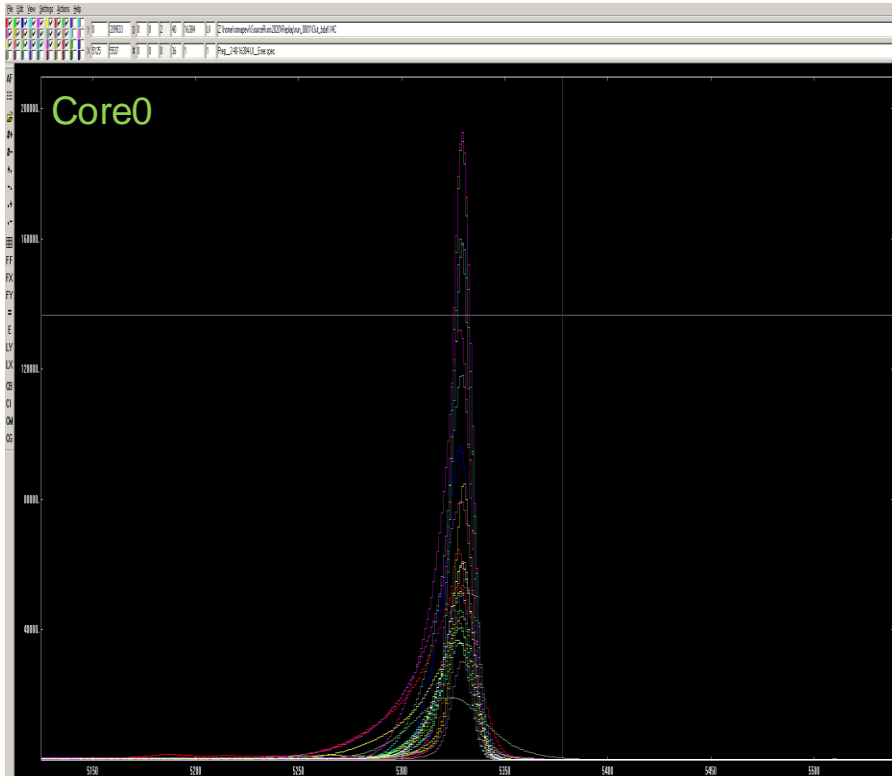
1. Energy Calibration

80 mm
90 mm
6x6 segmented cathode

Prep__2-40-16384-UI__Ener.spec [0][36]

Prep__2-10-16384-UI__Esum.spec [1][0]

Core0

Sum of Segments
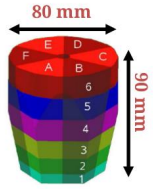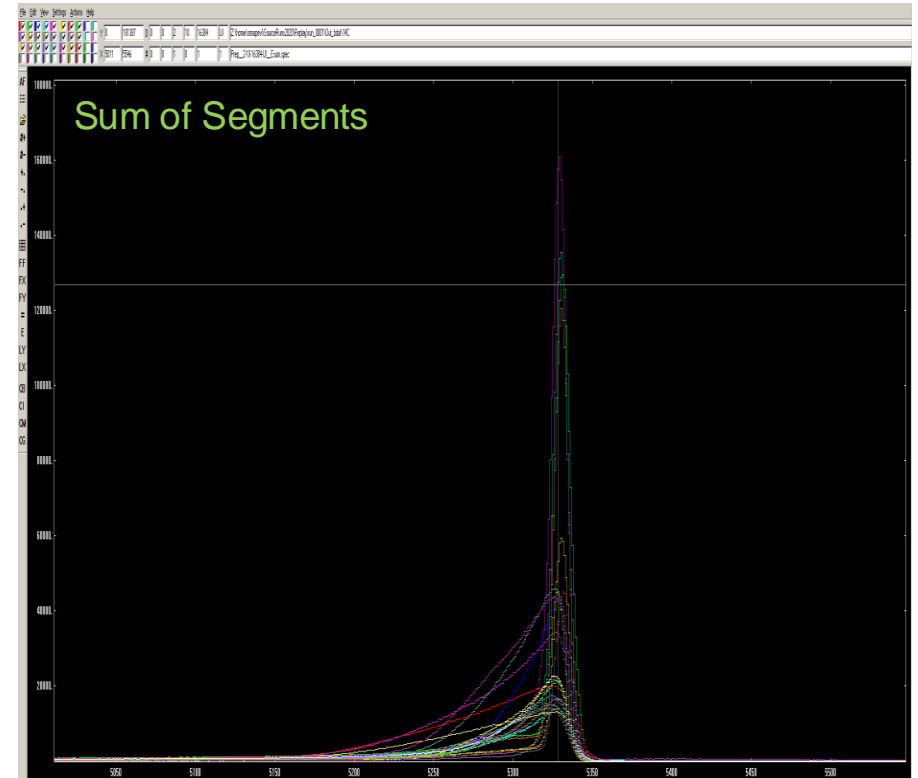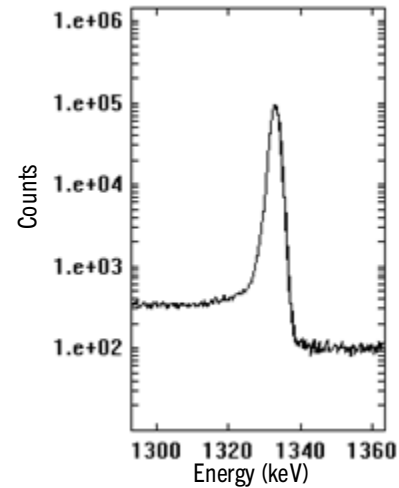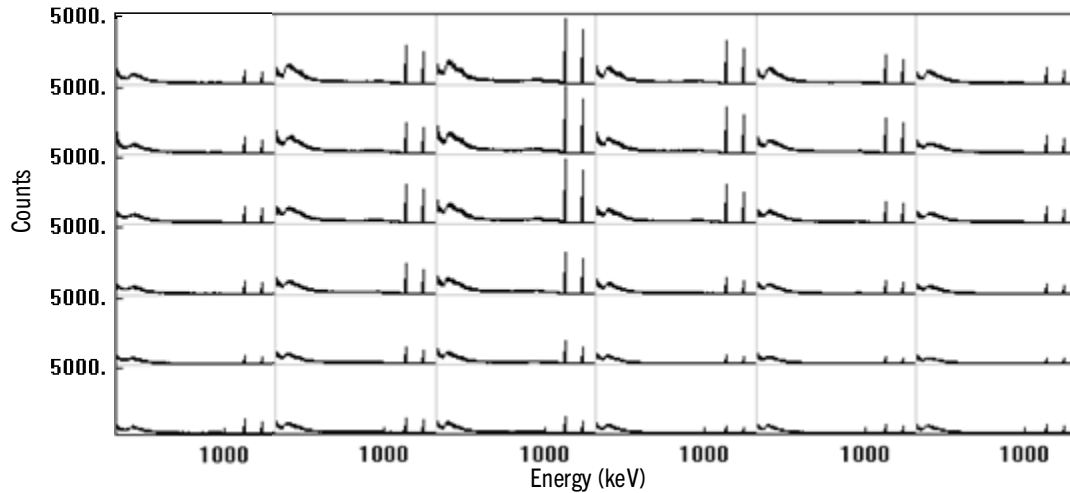
Preprocessing Filter

2. Crosstalk correction

Crosstalk **appears in any electrically segmented detector** due to the electronic coupling among channels.

- o **proportional**: proportional to the net charge signal ➡ affects energy spectra with M>1

- o **differential**: proportional to the derivative of that signal ➡ affects PSA

Creates strong energy shifts proportional to fold.

Sum of segment Energies vs fold

1–fold 20 %
2–fold 38 %
3–fold 27 %
4–fold 11 %
5–fold   3 %

Corrections are made according to **a linear combination of the signal amplitudes of the other segments** using a 60Co source. With the software *xTalkSort*, the energies recorded in the segments are sorted according to the segment multiplicity (i.e. number of firing segments). From that, the shift from the nominal energy of the two transitions of the 60Co source is deduced to build the **cross-talk matrix of coefficients**.
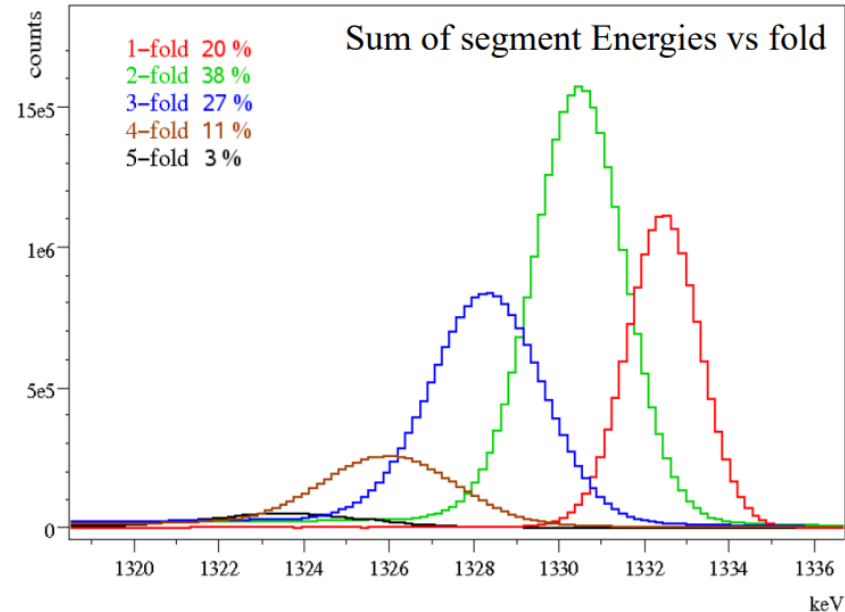
Preprocessing Filter

2. Crosstalk correction

36*36=1296 coefficients to correct capacitive coupling correlations between segments and core

6x6 segmented cathode

80 mm

90 mm

What is needed:

- Long 60Co run
- Raw file : Data/{crystalID}/**event_energy.bdat**
- Conf File: **xdir_1325-1340.cal, xinv_1325-1340.cal**
- Auxiliary files: ecalF1.cal, xspe__36-37-16384-UI__cal.spe, xdir_1325-1340.txt
- Programs/scripts:

xTalkSort: Sort and analysis of Agata events without traces

```
xTalkSort -ifile ../Data/{crystalID}/event_energy.bdat.0000 -ecalF1
ecalF1.cal -egain 5 -specXT -trigewin 1325 1340
```

RecalEnergy: generate calibration coefficients

```
RecalEnergy -spe xspe__36-37-16384-UI__cal.spec -num 1332 -ener 1332.5 -
gain 5 -offs 1000 -Xtalk 37 > xdir_1325-1340.txt
```

xTalkInvert: construct the file xinv_1325-1340.cal of cross talk coefficients.

```
xTalkInvert -f xdir_1325-1340.cal
```

Replay to generate event.bdat files
femul key in CrystalProducer:
"WriteDataMask 8",

More details in AGATA_LLP_UsersGuide

Prepare the ecalF1.cal file with the format:

```
0 %id  2 0 %CalibCoeff
0 0 2 0 0.301769
0 1 2 0 0.313686
...
0 36 2 0 0.484332
0 37 2 0 1.740927
```

Prepare the crosstalk files I with the proper format :
```
grep -v "^#" xdir_1325-1340.txt | grep -v "^
*36 " | cut -b15-102 --complement | tee
xdir_1325-1340.cal
```

%id	%id	%Crosstalk coeff
0	0	1.0000742
1	0	-0.0004010
2	0	-0.0016104
3	0	-0.0021275
4	0	-0.0021282
5	0	-0.0020902
6	0	-0.0019210
7	0	-0.0010441
8	0	-0.0017013
9	0	-0.0022207
10	0	-0.0022316
11	0	-0.0023822
...		
35	35	1.0001122

Preprocessing Filter

2. Crosstalk correction

80 mm

90 mm
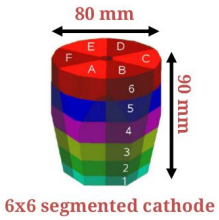
6x6 segmented cathode

Prep__2-10-16384-UI__Esum.spec [0][0-4]

Prep__2-10-16384-UI__Esum.spec [1][0-4]

M=1
M=2
M=3
M=4

M=2
M=1
M=3
M=4

Preprocessing Filter

3. Dead/unstable segment correction

PREAM.

DIGITIZER
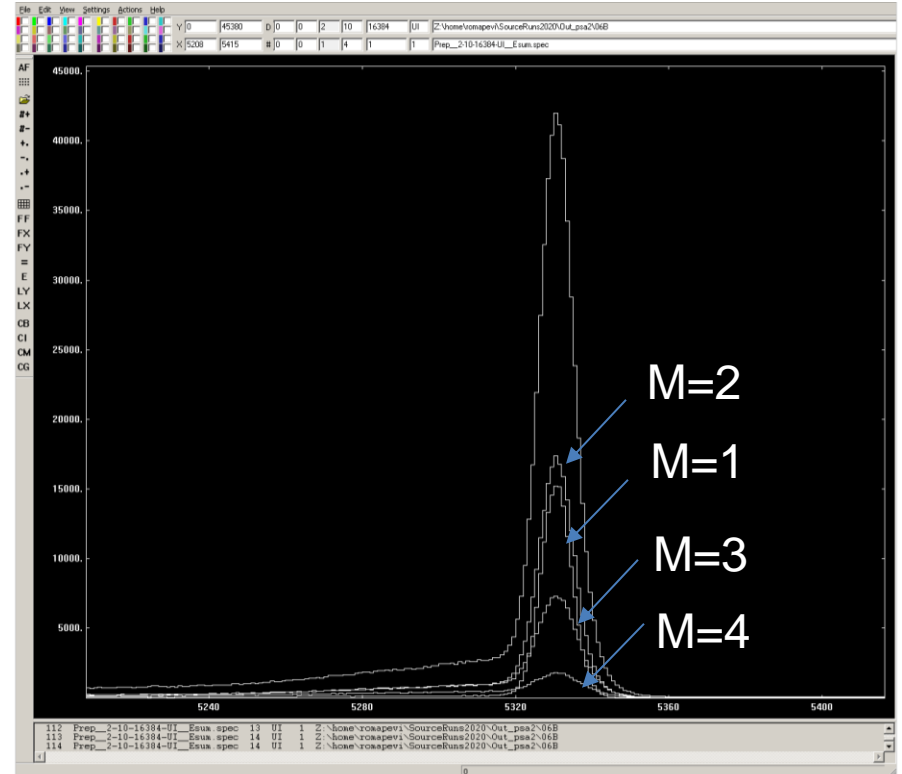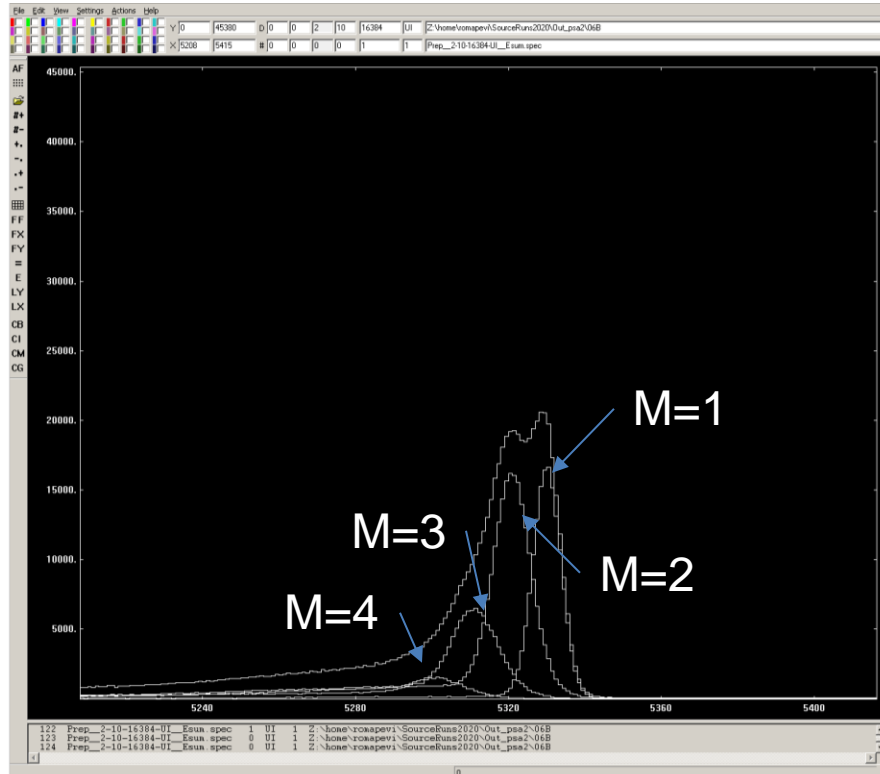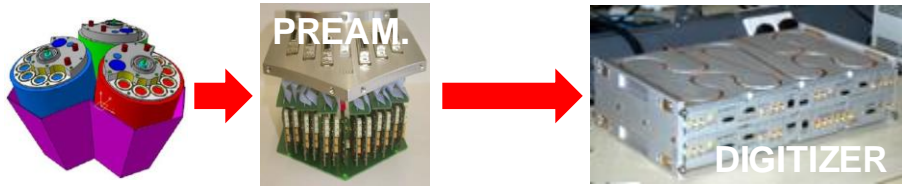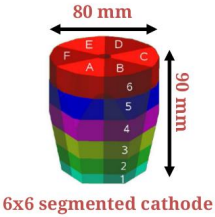
--Example of Detector Ok--

Preprocessing Filter

3. Dead/unstable segment correction

PREAM.

DIGITIZER
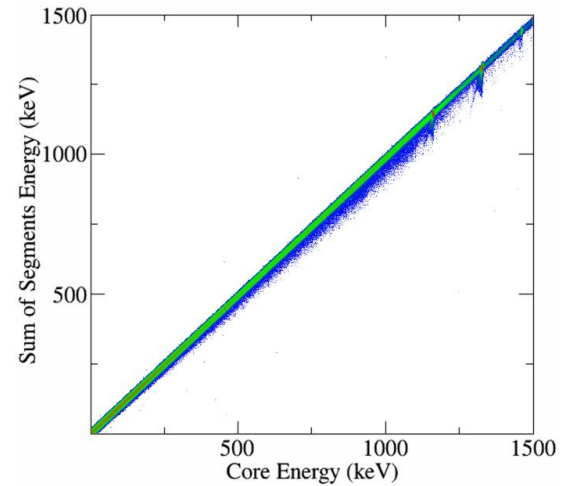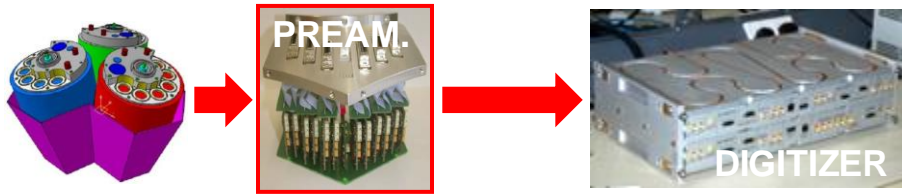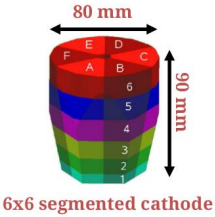
o **Broken segment:** the net charge is not properly collected but flows to the neighbouring segments

o Problem at the cold part of the preamplifier

--Example of Detector with a broken segment--
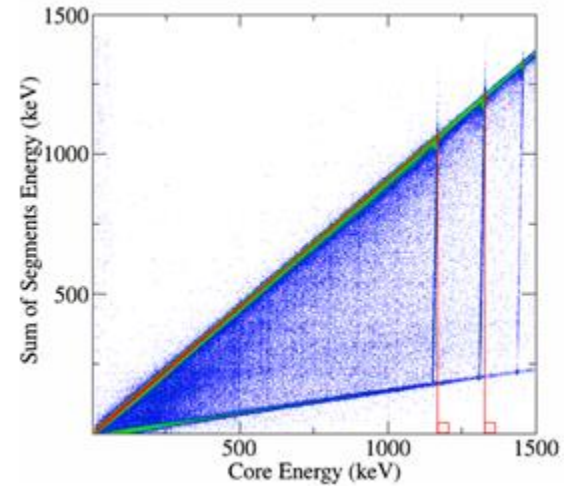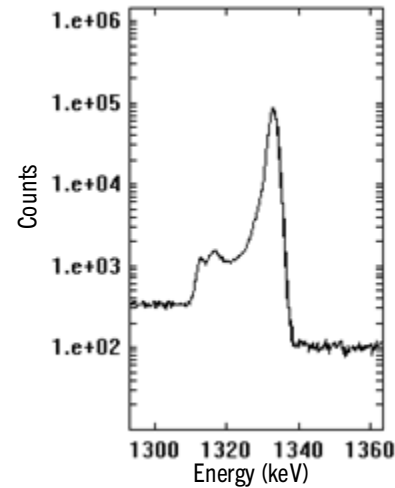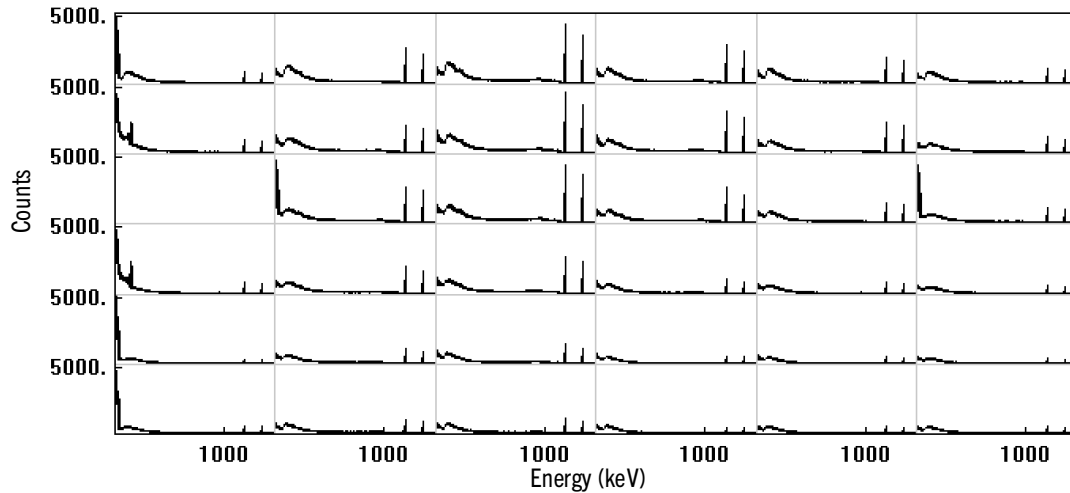
Local Level Processing

3. Dead/unstable segment correction

80 mm

90 mm

6x6 segmented cathode

PREAM.

DIGITIZER
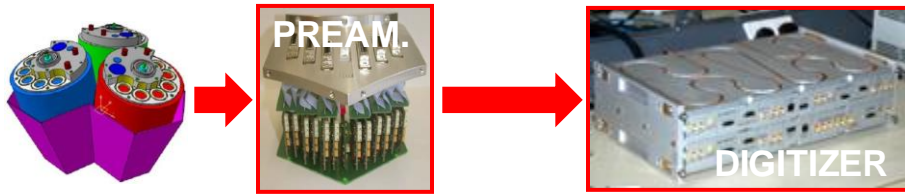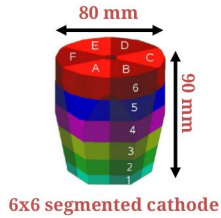
o **Lost segment:** the net charge is collected, but there is no information inside the data flow

o Problem after the cold part of the preamplifier

--Example of Detector with a lost segment--
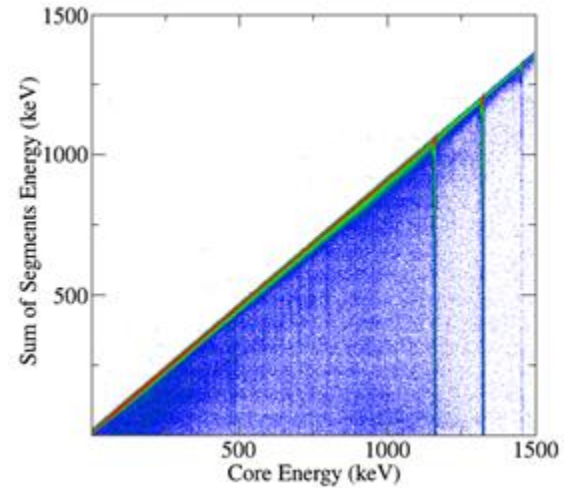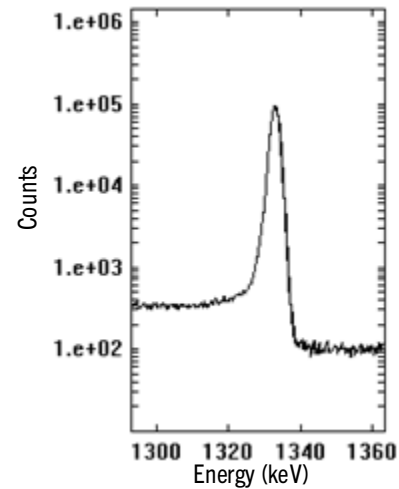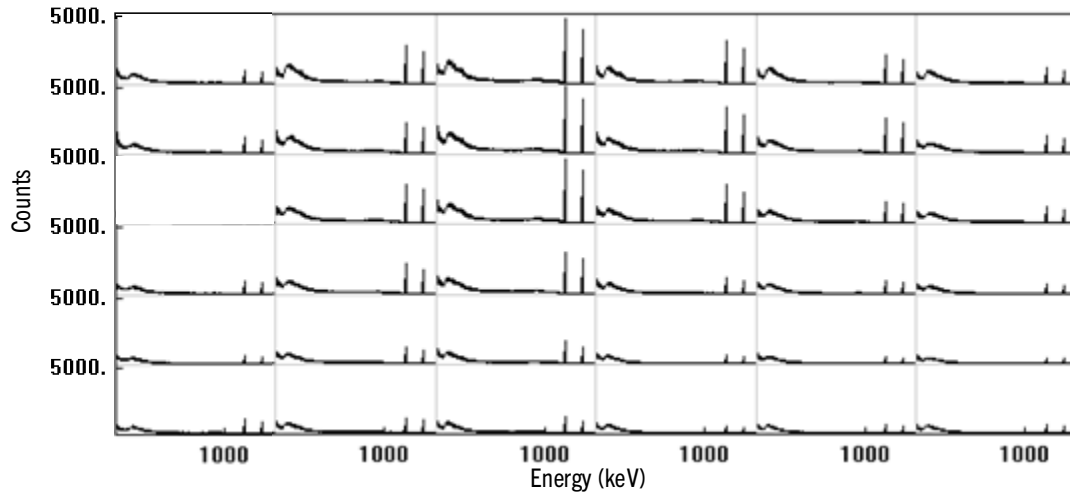
Preprocessing Filter

3. Dead/unstable segment correction
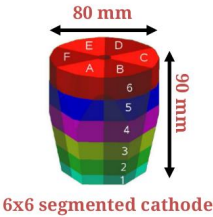
- o **Correction** in the crosstalk matrices considering that the **sum of the energies released in the segments is equal to the energy in the core** with the software *xTalkSort*.

$$\sum E_{seg} = E_{core}$$

- o Quantify the amount of missing energy of the **dead** segment. $E_{missing} = E_{core} - \sum E_{seg}$

- o For **broken** segments, also compensate the loss of energy in the core and generate a specific set of cross-talk correction coefficients capable of removing the ghost peaks from the affected neighbours.

- o Segments with **unstable** gain could be transformed into (and treated as) "lost" segments by setting their energy calibration to zero.

- o **Possible only if all other segments in the detector work correctly**

Preprocessing Filter

Preprocessing Filter: 3. Dead/unstable segment correction

What is needed:
- Long 60Co run
- Raw file : Data/{crystalID}/**event_energy.bdat**
- Conf file**: xdir_1325-1340.cal, xinv_1325-1340.cal**
- Auxiliary files: ecalF1.cal, CC-SG__50-1500-1500-US__ma.matr, xSG__36-36-100-1536-US__ij.matr
- Programs/scripts: **xTalkSort, RecalEnergy, XTalkMake**

Replay to generate event.bdat files
femul key in CrystalProducer:
`"WriteDataMask 8",`

Types of correction (femul keywords):

Dead segment correction: recovers E and T ➡️
- Broken
- Lost
- "Noisy"

Correction procedure
Broken: deadXsg, deadXcc
Lost: deadXsg, deadXcc=0

Replay:
- add new cross talk files
- add in the gen_conf.py Prep:
  `'Det' : ("DeadSegment Seg FactorS FactorC"),`
- add in the gen_conf.py PSA:
  `'Det' : ("DeadSegment Seg "),`
- set coeff seg to 0 in the PreprocessingFilterPsa.conf

Unstable segment correction: recovers E ➡️ Gain shift, etc

Correction procedure
treatment as a "lost" segment: deadXsg

Replay:
- add new cross talk files
- add in the gen_conf.py Prep:
  `'Det' : ("UnstableSegment Seg FactorS"),`
- keep de old coeff of calibration for the seg (different from 0) in the PreprocessingFilterPsa.conf

More details in AGATA_LLP_UsersGuide

Preprocessing Filter

3. Unstable segment correction

80 mm

90 mm
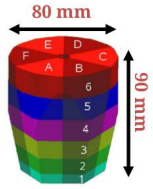
6x6 segmented cathode

00B **seg 7** Prod__4-38-32768__Ampli.spec [0][7]
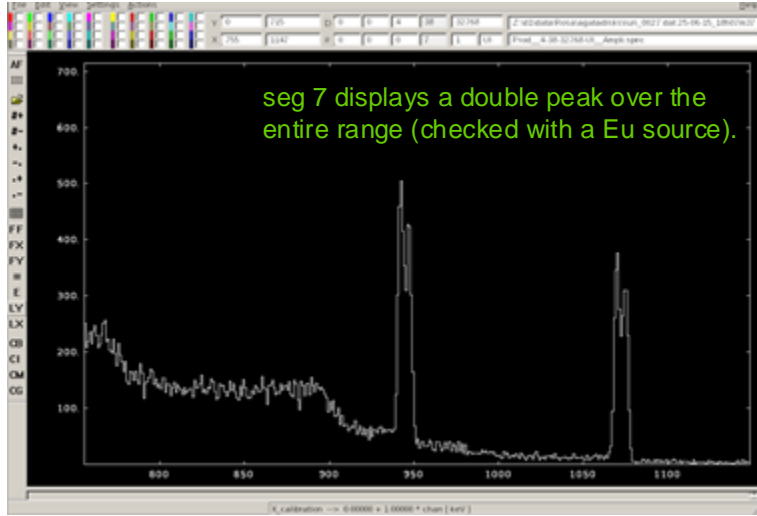
seg 7 displays a double peak over the entire range (checked with a Eu source).

Replay to generate event.bdat files
femul key in CrystalProducer:
`"WriteDataMask 8",`

ecalF1.cal file seg 7 **coeff 1.242457**
CC-SG__50-1500-1500-US__ma.matr [36]
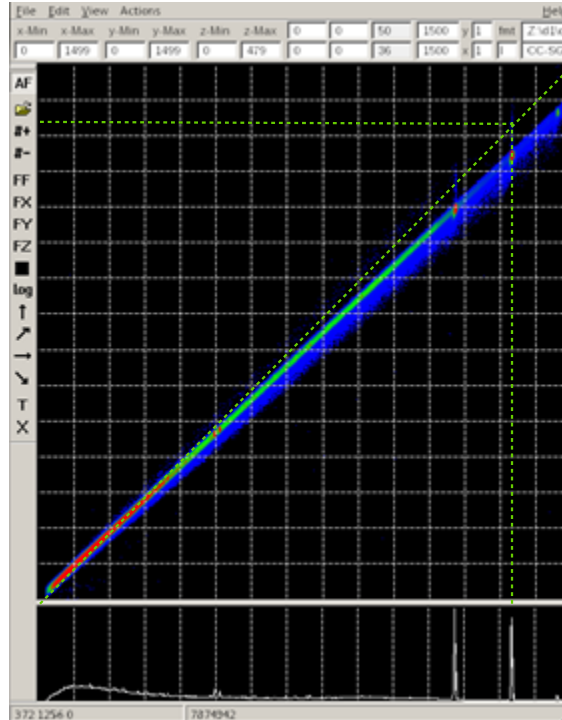
ecalF1.cal file seg 7 **coeff 0.00000** to treat it as a lost segment correction
CC-SG__50-1500-1500-US__ma.matr [36]

[1332.4,1247.8]
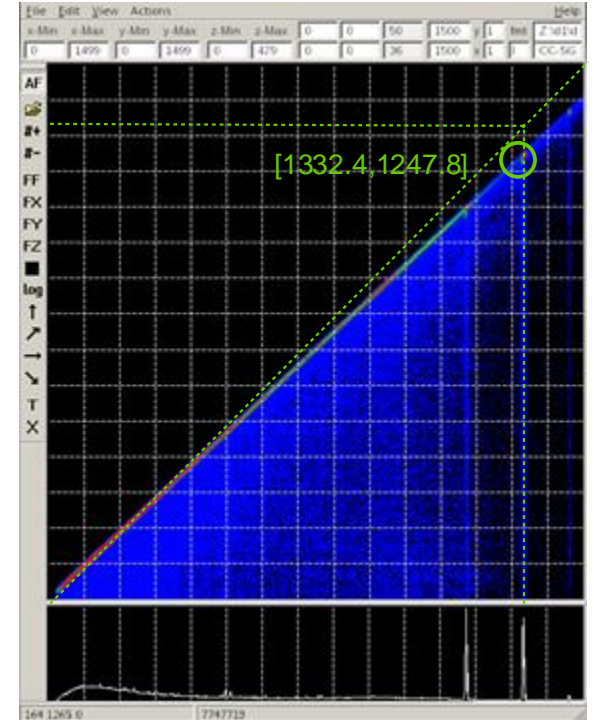
Slope of main diagonal ==> **DeadXsg=0,93574**
No core loss ==> **DeadXcc=0**

Preprocessing Filter

3. Unstable segment correction

Verification with femul replay

80 mm

90 mm
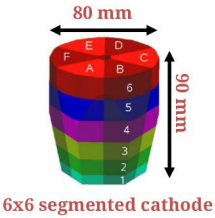
6x6 segmented cathode

CC-SG__50-1500-1500-US__ma.matr [36]
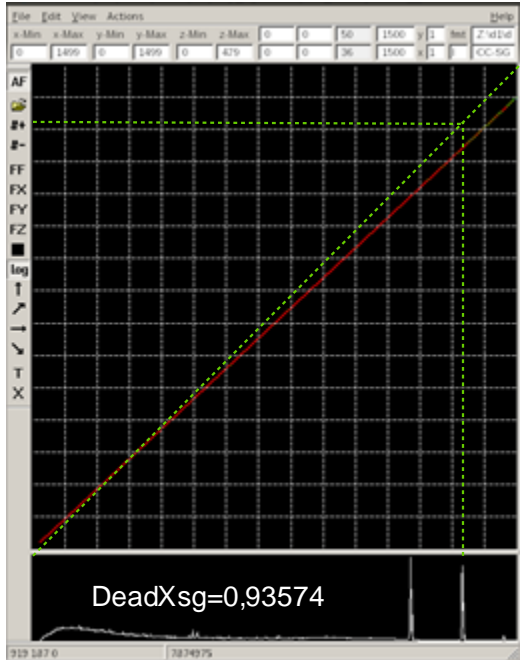
00B **seg 7** Prep__2-40-16384__Ener.spec [0][7] (red) & [1][7] (white)

DeadXsg=0,93574
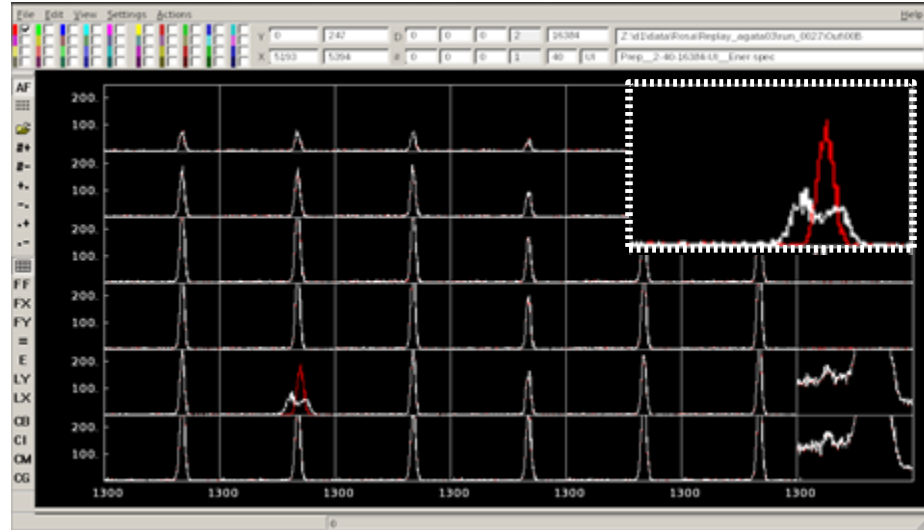
xTalkSort: Generate new crosstalk matrix
```
xTalkSort -ifile event_energy.bdat -ecalF1 ecalF1.cal -egain 5 -deadSeg 7 0.93574 0 -matx1
```
xTalkMake: Generate crosstalk coefficients:
```
xTalkMake -f xSG__36-36-100-1536-US__ij.matr
```

Replay:
- add new cross talk files
- add in the gen_conf.py Prep:
'00B' : ("UnstableSegment
7 0.93574"),
- keep de old coeff of calibration
for the seg (different from 0) in the
PreprocessingFilterPsa.conf

Preprocessing Filter

3. Dead segment correction: Lost segment
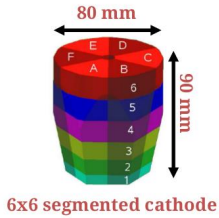
80 mm
90 mm
6x6 segmented cathode

11B **seg 30** Prod__4-38-32768__Ampli.spec [0][30]
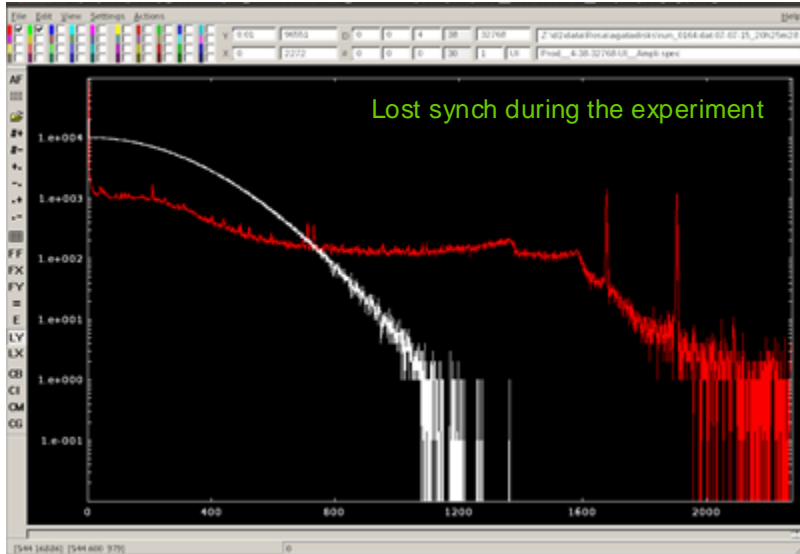
Lost synch during the experiment

Replay to generate event.bdat files
femul key in CrystalProducer:
"WriteDataMask 8",

ecalF1.cal file seg 30 **coeff 0.00000** to treat it as a lost segment correction
CC-SG__50-1500-1500-US__ma.matr [36]

[1332.36,1253.16]
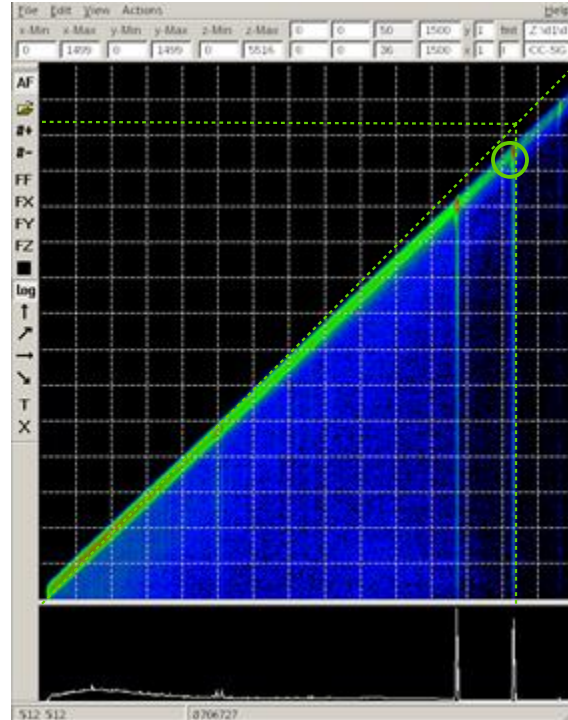
Slope of main diagonal ==> **DeadXsg=0,94055**
No core loss ==> **DeadXcc=0**

Preprocessing Filter

3. Dead segment correction: Lost segment

80 mm

90 mm

6x6 segmented cathode

CC-SG__50-1500-1500-US__ma.matr [36]

DeadXsg=0,94055
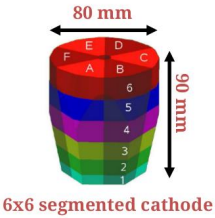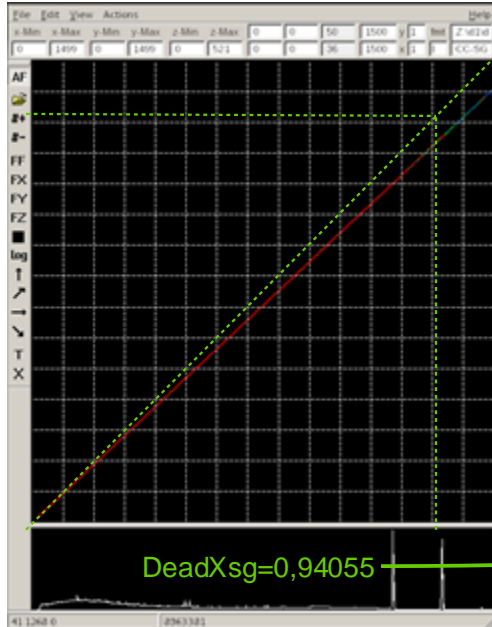
spec__3-38-16384-UI__cal.spec [0][0-35]

Verification with femul replay

Peak Pos=1332,52 keV
FWHM=3,691 keV
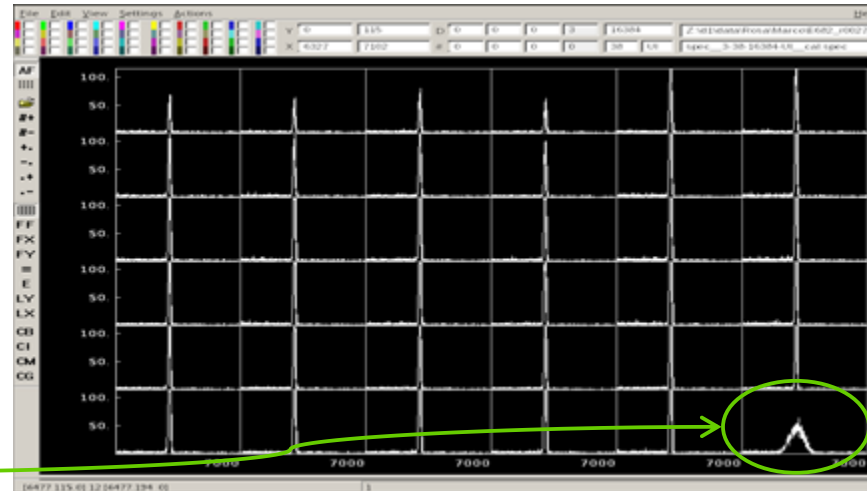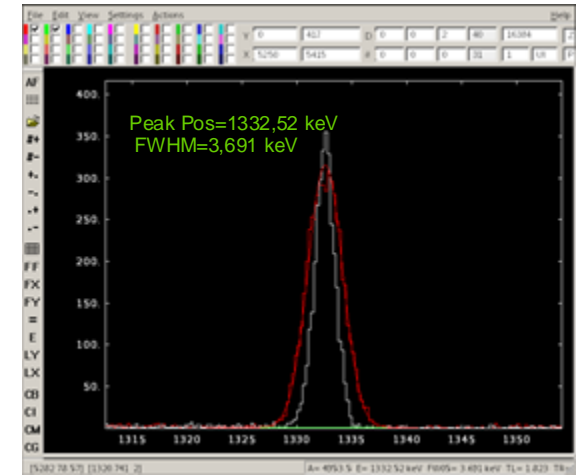
11B **seg 30** Prep__2-40-16384__Ener.spec
[0][30] (red) & [0][31] (white)

Replay:
- add new cross talk files
- add in the gen_conf.py Prep: '11B' : ("DeadSegment 30 0.94055 0"),
- add in the gen_conf.py PSA: '11B' : ("DeadSegment   30 "),
- set coeff seg 30 to 0 in the PreprocessingFilterPsa.conf

Preprocessing Filter

3. Dead segment correction: Broken segment

80 mm

90 mm

6x6 segmented cathode

12B **seg 5** Prep__2-40-16384__Ener.spec [0][0-35]
before (red) and after (white) the experiment
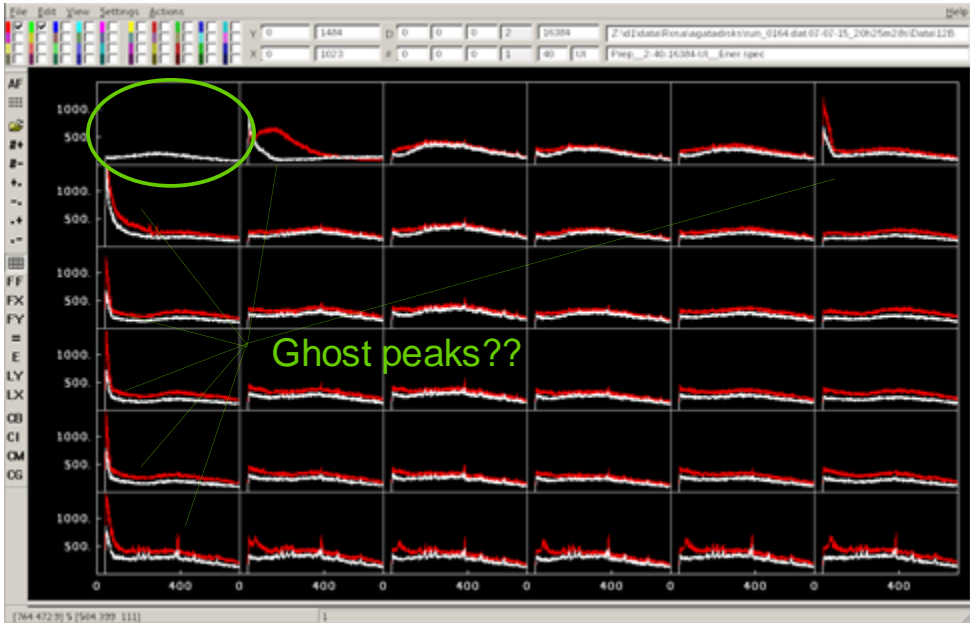
Ghost peaks??

[764 472.9] 5 [504 399 111]   1

Replay to generate event.bdat files
femul key in CrystalProducer:
"WriteDataMask 8",

ecalF1.cal file seg 5 **coeff 0.00000** to treat
it as a broken segment correction
CC-SG__50-1500-1500-US__ma.matr [36]

[1332.47,1263.62]

[1316.6,223.10]
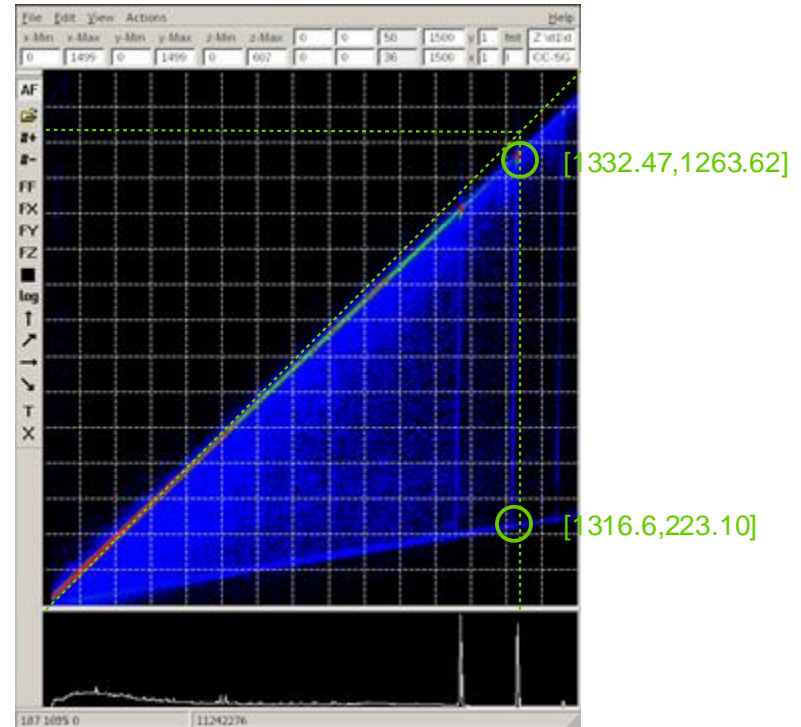
Slope of main diagonal ==> **DeadXsg=0,9483**
No core loss ==> **DeadXcc=0,01621**

Preprocessing Filter

3. Dead segment correction: Broken segment

CC-SG__50-1500-1500-US__ma.matr [36]

CC-SG__50-1500-1500-US__ma.matr [5]

80 mm

90 mm

6x6 segmented cathode

spec__3-38-16384-UI__cal.spec [0][0-35]

DeadXsg=0,9483
DeadXcc=0,01621
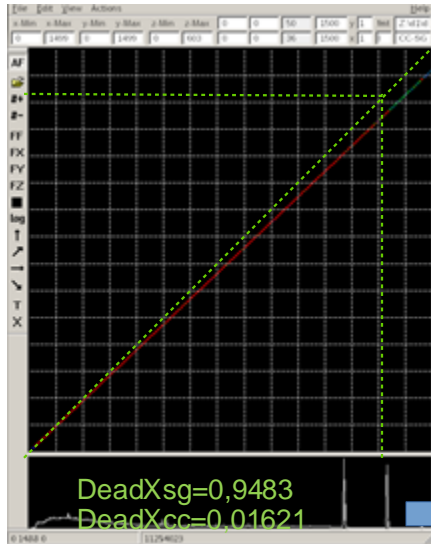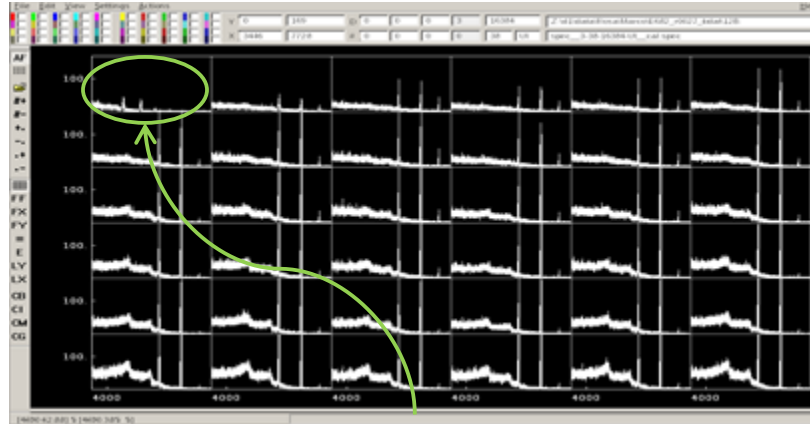
The energy is very small due to part of it is still in the neighbours. For the crosstalk correction, we need the slope of the broken segment after the correction
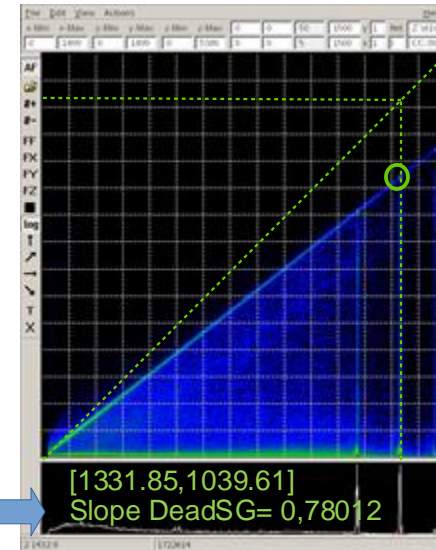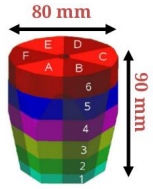
[1331.85,1039.61]
Slope DeadSG= 0,78012

12B **seg 5** Prep__2-40-16384__Ener.spec [0][all]

Verification with femul replay
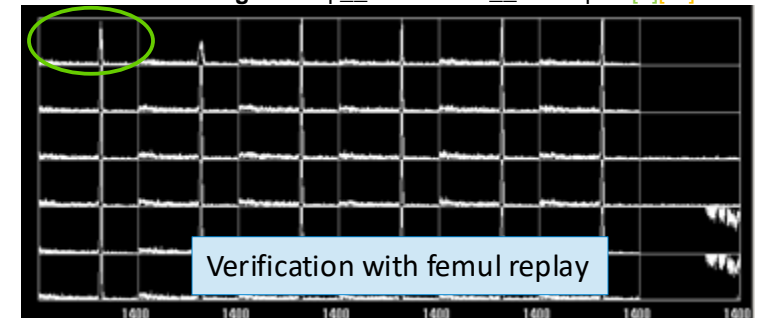
Replay:
- add new cross talk files
- add in the gen_conf.py Prep: `'12B' : ("DeadSegment 5 0.9483 0.1621"),`
- add in the gen_conf.py PSA: `'12B' : ("DeadSegment 5"),`
- set coeff seg 5 to 0 in the PreprocessingFilterPsa.conf

Preprocessing Filter

4. Time alignment segments to core
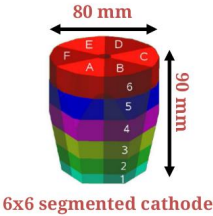
6x6 segmented cathode

What is needed:

o Any run

o Spectra file : Data/{crystalID}/**Prep__6-40-1000-UI__TT.spec**

o Conf File: **PreprocessingFilterPSA.conf**

o Auxiliary file: shift_TT.out

o Programs/scripts:

RecalEnergy: generate shift coefficients

```
RecalEnergy -spe Data/{crystalID}/Prep__6-40-1000-UI__TT.spec -sub 40 -num 36
-T 500 > {crystalID}/shift_TT.out
```

```
# indx  #spec #pks #ok   rEnergy    FW05     FW01     Area  Position  Width   Ampli    WTML     WTMR   shift*gain
#
     0     40    1    1   500.14   17.034   38.743   14865   500.14    16.1    731    2.993    1.823    7.117
     1     41    1    1   503.37   19.629   44.382    9422   503.37    19.5    400    2.382    2.171    8.970
     2     42    1    1   501.04   16.180   36.094   11042   501.04    15.8    574    2.604    1.955    6.384
     3     43    1    1   502.67   16.667   36.949   10726   502.67    16.4    543    2.558    1.958    5.505
     4     44    1    1   503.28   17.366   40.384    8202   503.28    17.1    388    2.484    2.231    4.557
     5     45    1    1   502.21   15.196   37.456    6171   502.21    14.7    323    2.641    2.473    4.868
     6     46    1    1   495.26   15.689   37.220   15836   495.26    14.1    830    3.439    1.823    7.136
     7     47    1    1   494.54   14.848   34.207   10077   494.54    14.3    562    2.771    2.005    6.002
     8     48    1    1   494.75   13.281   30.954   12390   494.75    12.8    768    2.781    2.055    6.143
     9     49    1    1   502.06   18.771   43.533   12570   502.06    18.4    551    2.158    2.570    6.255
    10     50    1    1   498.45   16.276   38.653    9952   498.45    15.9    496    2.587    2.270    4.892
    11     51    1    1   495.62   14.016   34.301    7189   495.62    13.6    410    2.619    2.438    5.229
    12     52    1    1   496.19   16.231   38.875   13783   496.19    14.4    695    3.558    1.823    5.633
```

colupdate.py: Add these coefficients to the 7th column of
PreprocessingFilterPSA.conf

```
./colupdate.py {crystalID}/PreprocessingFilterPSA_old.conf
{crystalID}/recal.out -c 6 13 -o {crystalID}/PreprocessingFilterPSA.conf
```

More details in AGATA_LLP_UsersGuide

PreprocessingFilterPSA.conf

#segm/core	%d(id)	%f(tfall)	%f(trise)	%f(egain)	%f(emink)	%f(tmove)
segm	0	4800	600	0.699782	15	7.117
segm	1	4800	600	0.723994	15	8.970
segm	2	4800	600	0.721332	15	6.384
segm	3	4800	600	0.718859	15	5.505
segm	4	4800	600	0.709819	15	4.557
segm	5	4800	600	0.701714	15	4.868
segm	6	4800	600	0.701904	15	7.136
segm	7	4800	600	0.685733	15	6.002
segm	8	4800	600	0.728990	15	6.143
segm	9	4800	600	0.703097	15	6.255
segm	10	4800	600	0.698238	15	4.892
segm	11	4800	600	0.711943	15	5.229
segm	12	4800	600	0.719321	15	5.633
segm	13	4800	600	0.691592	15	3.298
segm	14	4800	600	0.719889	15	4.436
segm	15	4800	600	0.699936	15	4.799
segm	16	4800	600	0.724667	15	4.957
segm	17	4800	600	0.711515	15	5.091
segm	18	4800	600	0.730854	15	6.039
segm	19	4800	600	0.691051	15	5.029
segm	20	4800	600	0.706594	15	3.751
segm	21	4800	600	0.717657	15	3.090
segm	22	4800	600	0.715001	15	5.138
segm	23	4800	600	0.714159	15	4.982
segm	24	4800	600	0.716068	15	4.994
segm	25	4800	600	0.699619	15	5.645
segm	26	4800	600	0.708694	15	4.529
segm	27	4800	600	0.700469	15	3.817
segm	28	4800	600	0.726621	15	4.035
segm	29	4800	600	0.699717	15	4.644
segm	30	4800	600	0.700183	15	6.348
segm	31	4800	600	0.701122	15	6.565
segm	32	4800	600	0.720491	15	6.755
segm	33	4800	600	0.704997	15	4.734
segm	34	4800	600	0.713051	15	3.888
segm	35	4800	600	0.721396	15	4.347
core	0	4800	600	0.767652	0	21.000
core	1	4700	600	1.374411	0	21.000
tntf	-1					

Preprocessing Filter

4. Time alignment segments to core

80 mm

90 mm

6x6 segmented cathode

Prep___6-40-1000-UI__TT.spec [1][0-35]

Prep___6-40-1000-UI__TT.spec [5][0-35]

Preprocessing Filter

5. T0 alignment

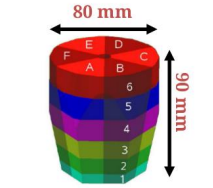6x6 segmented cathode
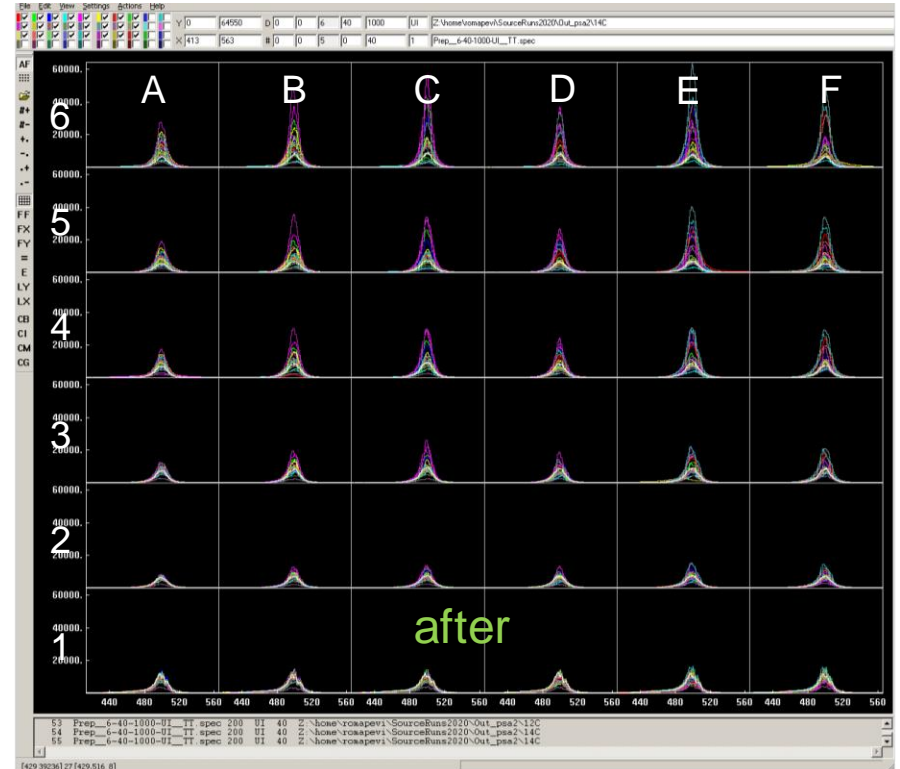
What is needed:

- Any run
- Spectra file : Data/{crystalID}/**Psa__40-1000-UI__Tzero.spec**
- Conf File**: PreprocessingFilterPSA.conf**
- Auxiliary file: shift_TT.out
- Programs/scripts:

TkT: estimate shift coefficients

+21
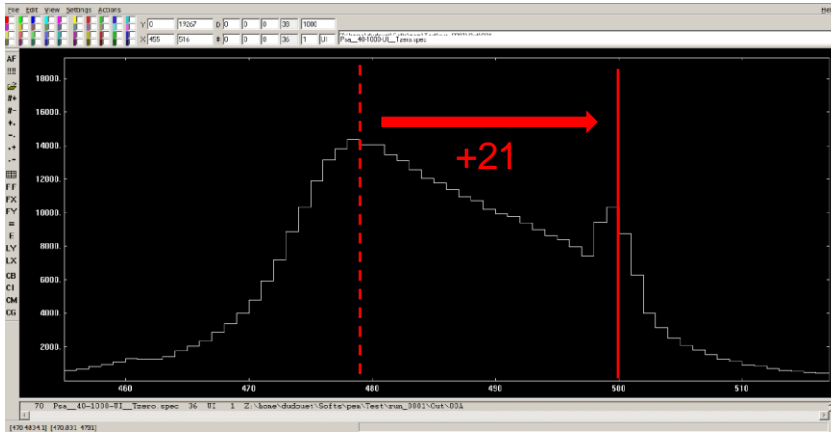
Add these coefficients to the 7th column of PreprocessingFilterPSA.conf last 2 rows

More details in AGATA_LLP_UsersGuide

PreprocessingFilterPSA.conf

#segm/core	%d(id)	%f(tfall)	%f(trise)	%f(egain)	%f(emink)	%f(tmove)
segm	0	4800	600	0.699782	15	7.117
segm	1	4800	600	0.723994	15	8.970
segm	2	4800	600	0.721332	15	6.384
segm	3	4800	600	0.718859	15	5.505
segm	4	4800	600	0.709819	15	4.557
segm	5	4800	600	0.701714	15	4.868
segm	6	4800	600	0.701904	15	7.136
segm	7	4800	600	0.685733	15	6.002
segm	8	4800	600	0.728990	15	6.143
segm	9	4800	600	0.703097	15	6.255
segm	10	4800	600	0.698238	15	4.892
segm	11	4800	600	0.711943	15	5.229
segm	12	4800	600	0.719321	15	5.633
segm	13	4800	600	0.691592	15	3.298
segm	14	4800	600	0.719889	15	4.436
segm	15	4800	600	0.699936	15	4.799
segm	16	4800	600	0.724667	15	4.957
segm	17	4800	600	0.711515	15	5.091
segm	18	4800	600	0.730854	15	6.039
segm	19	4800	600	0.691051	15	5.029
segm	20	4800	600	0.706594	15	3.751
segm	21	4800	600	0.717657	15	3.090
segm	22	4800	600	0.715001	15	5.138
segm	23	4800	600	0.714159	15	4.982
segm	24	4800	600	0.716068	15	4.994
segm	25	4800	600	0.699619	15	5.645
segm	26	4800	600	0.708694	15	4.529
segm	27	4800	600	0.700469	15	3.817
segm	28	4800	600	0.726621	15	4.035
segm	29	4800	600	0.699717	15	4.644
segm	30	4800	600	0.700183	15	6.348
segm	31	4800	600	0.701122	15	6.565
segm	32	4800	600	0.720491	15	6.755
segm	33	4800	600	0.704997	15	4.734
segm	34	4800	600	0.713051	15	3.888
segm	35	4800	600	0.721396	15	4.347
core	0	4800	600	0.767652	0	21.000
core	1	4700	600	1.374411	0	21.000
tntf	-1					

Preprocessing Filter

5. T0 alignment

Psa__40-1000-UI__Tzero.spec [36]

Local Level Processing
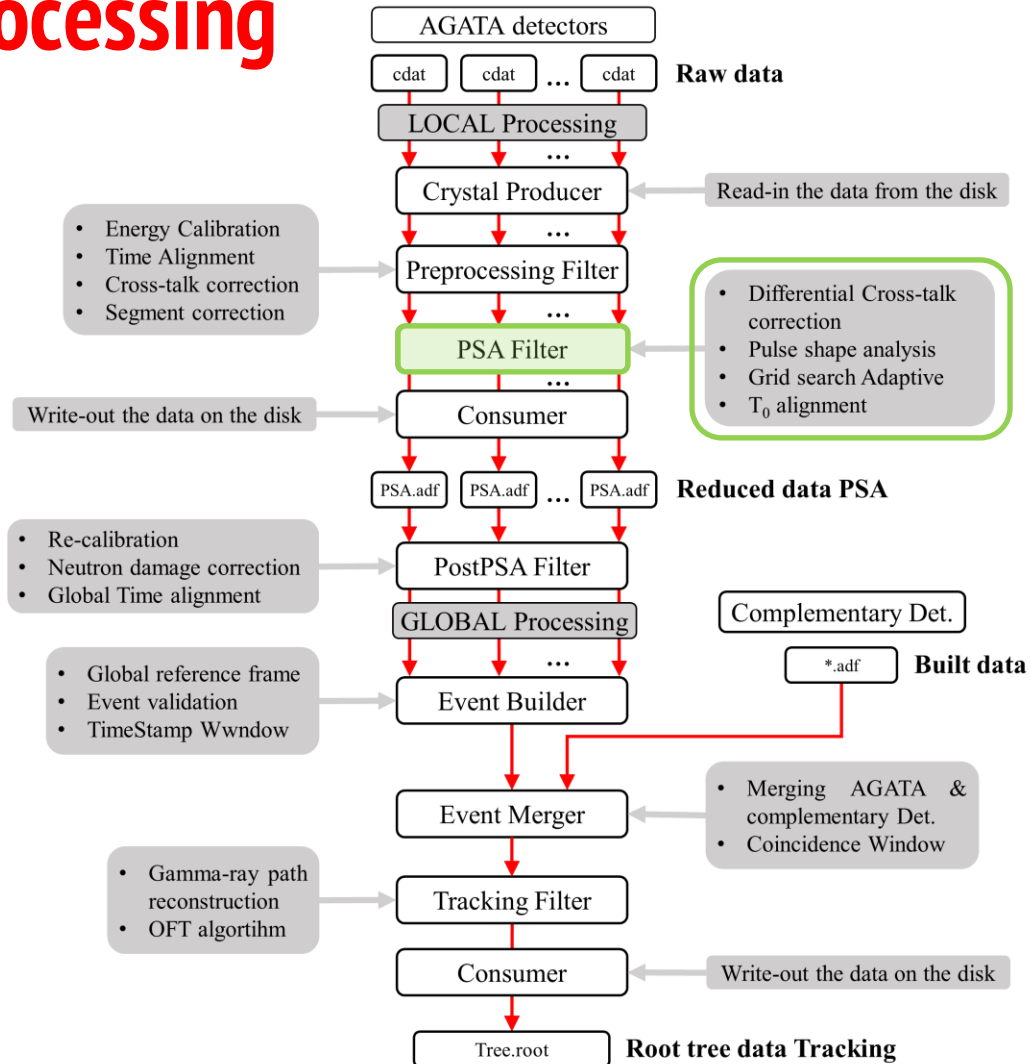
Narval actors

Local Level Processing

PSA Filter

- o Reads the simulated basis (ADL)
- o Applies the preamp response function to the simulated traces
- o Performs the signal decomposition:
  - o Implemented algorithm: **Grid Search**
    - As a full grid search
    - As a coarse/fine search (AGS)
- o Reduces size of data by factor ~80
- o Provides the parameters for the correction of neutron damage
- o **Takes ~95 % of total CPU time**
- o Is the critical point for the processing speed of online and offline analyses

- o **Configuration for this actor done by the local team**

- o Generates various files:
  - **Psa__2-38-37-60-F__AverSingles.samp**
  - **Psa__3-100-100-100-US__XYZ.matr**
  - Psa__37-37-60-F__Base.aver
  - Psa__37-37-60-F__Base.aver_raw
  - Psa__40-1000-UI__RedChi.spec
  - **Psa__40-1000-UI__Tzero.spec**
  - Psa__40-100-UI__Stat.spec
  - **Psa__40-16384-UI__Ener.spec**
  - Psa__524288-F__DistanceMetric.spec

Files in Data(Out)/00A e.g.

Local Level Processing
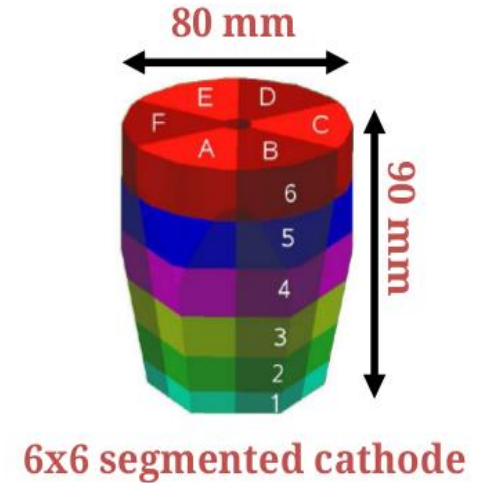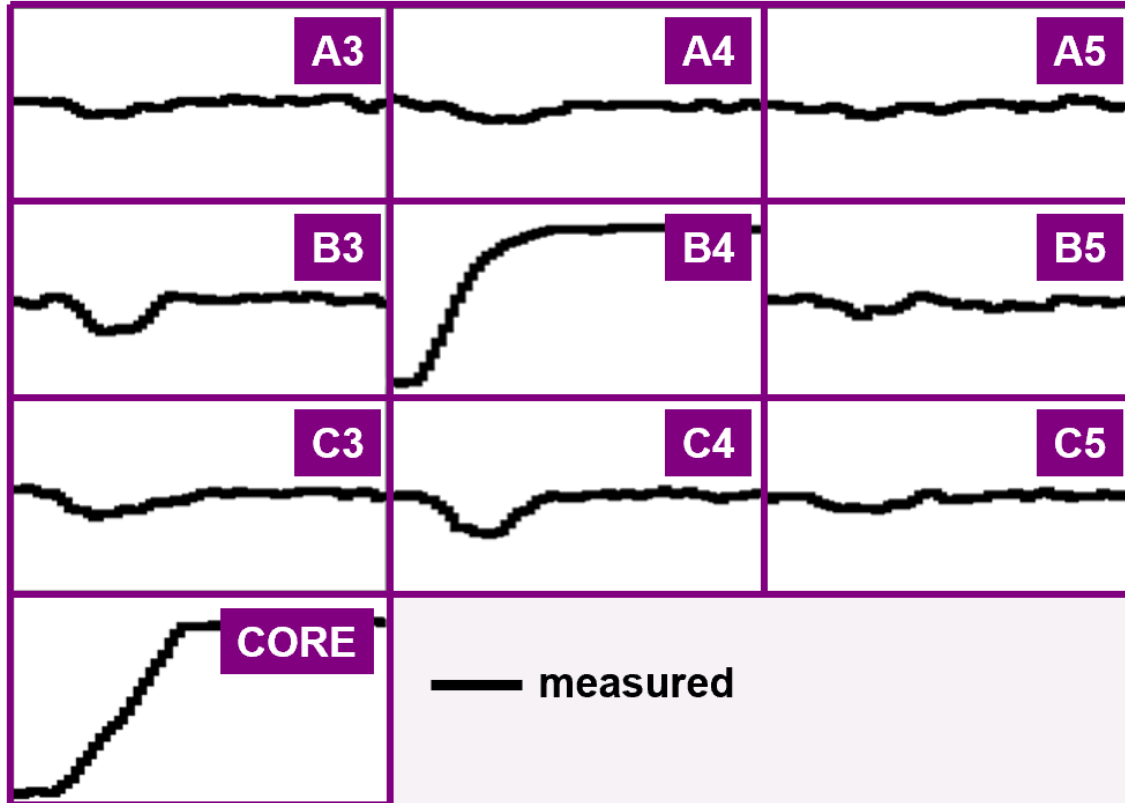
PSA Filter

791 keV deposited in segment B4

Local Level Processing
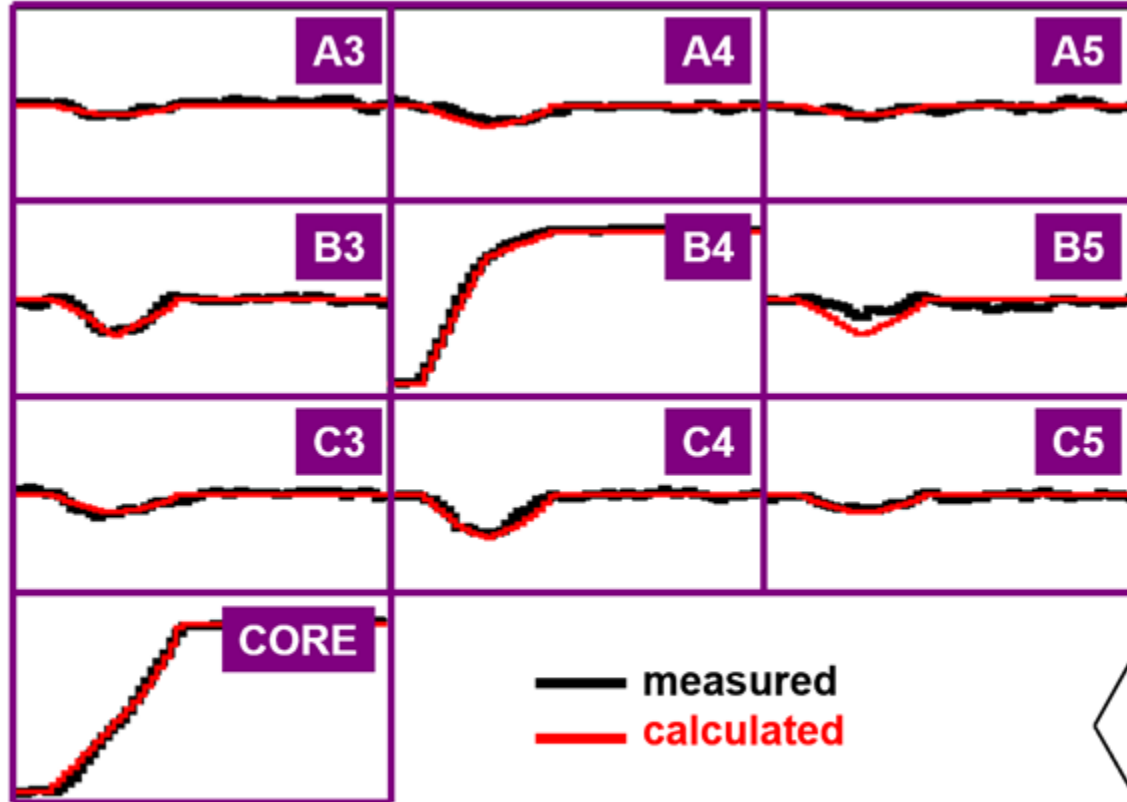
PSA Filter

Result of *Grid Search* Algorithm
(10,25,46)

measured
calculated

791 keV deposited in segment B4

z = 46 mm
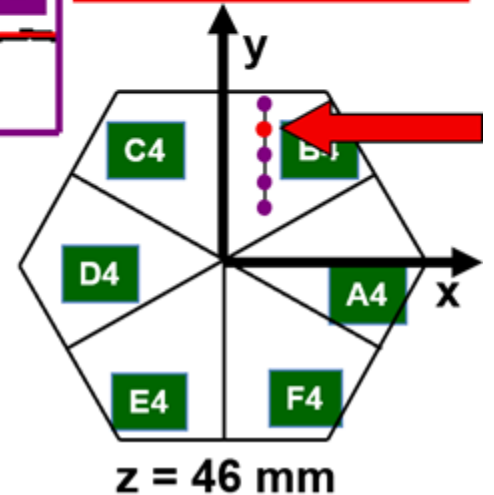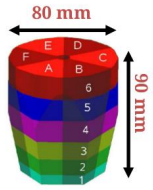
PSA Filter

Traces

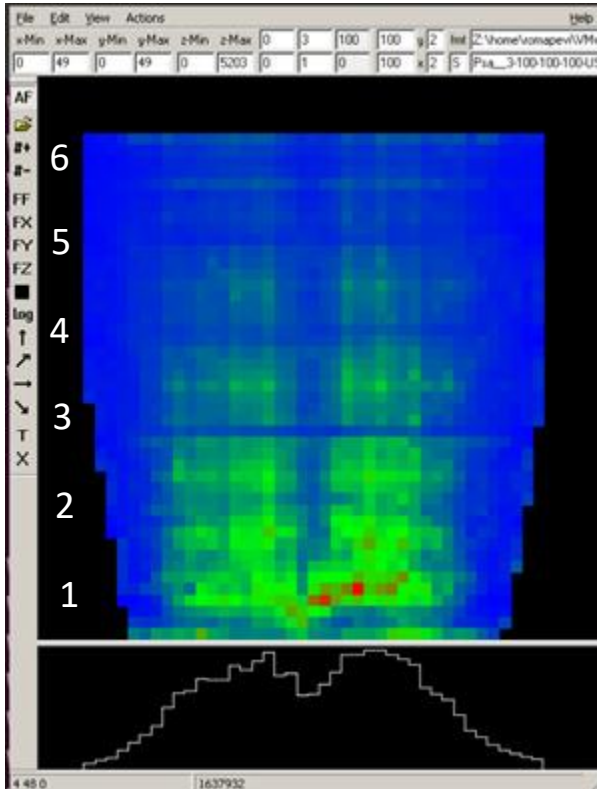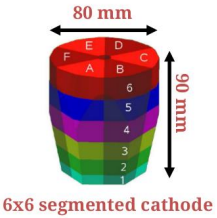Psa__100-2-42-60-F__Traces.samp [0 experimental trace (red) ,1 calculated trace(white)]
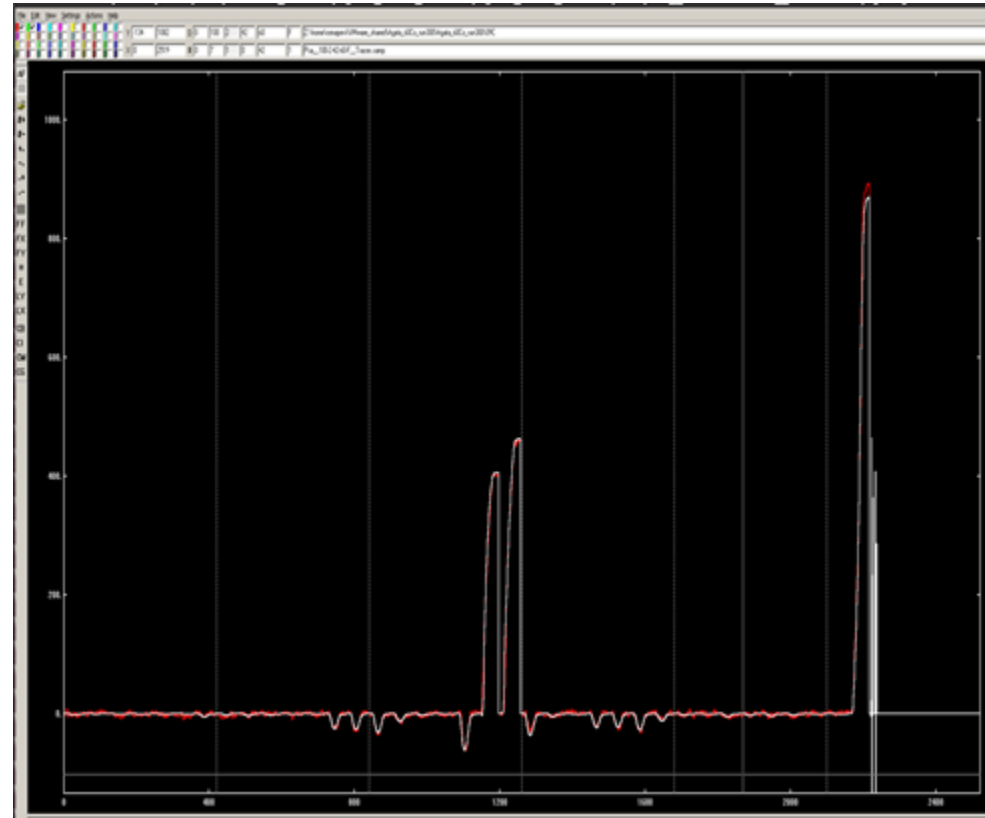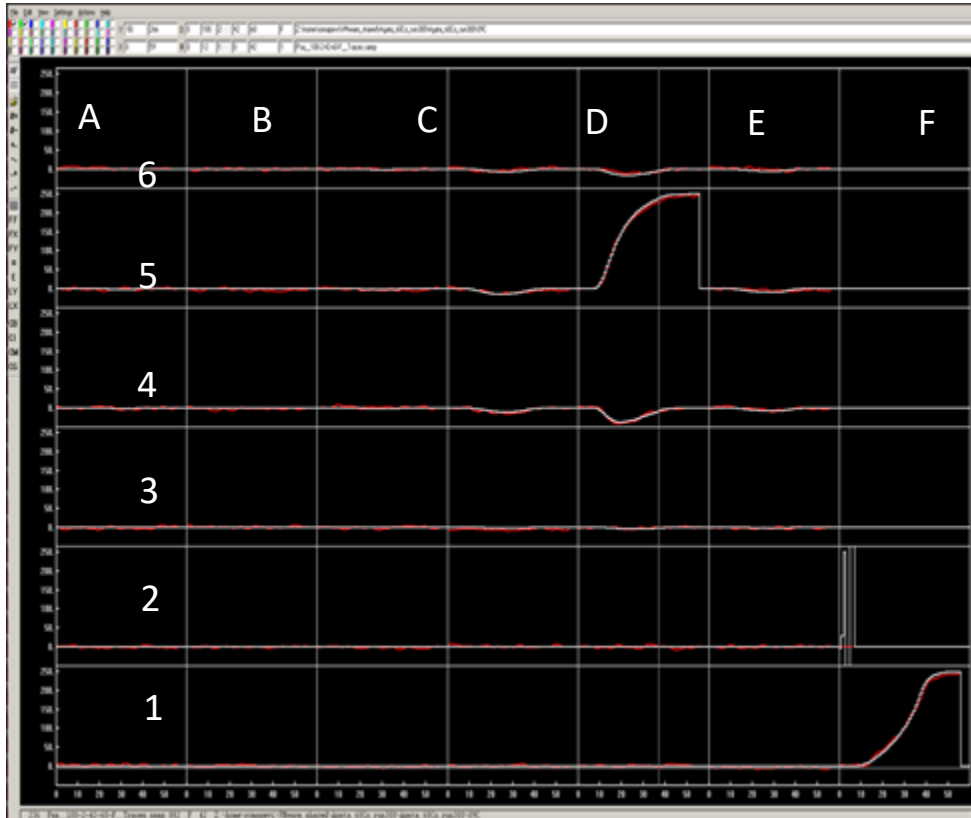
PSA Filter

Hit pattern
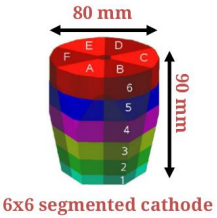
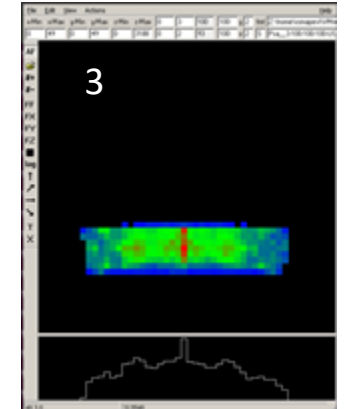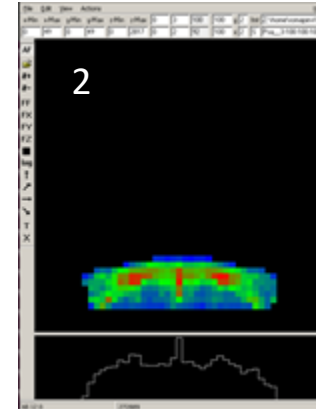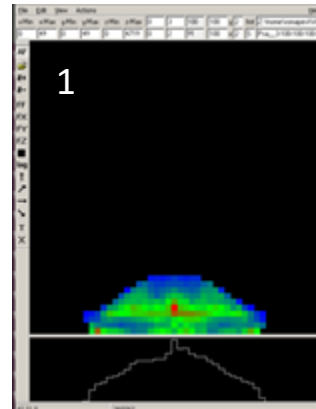Psa__3-100-100-100-US__XYZ.matr [0 projection XY][0 all] [91-96 slices of segments]
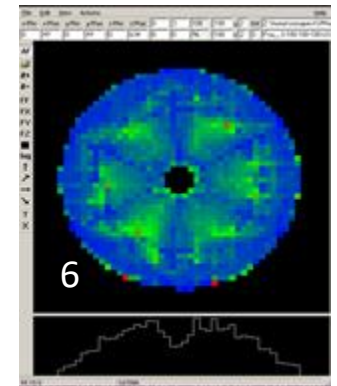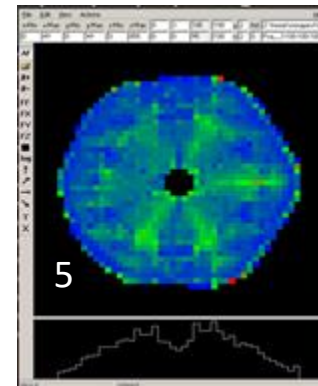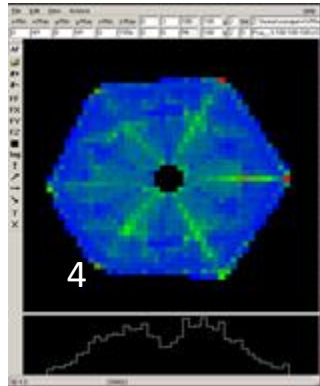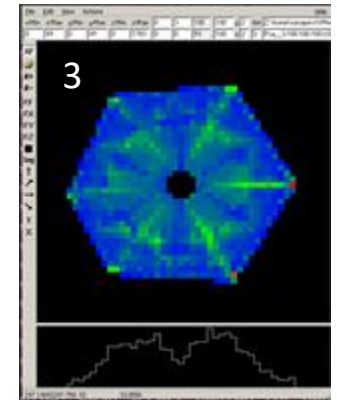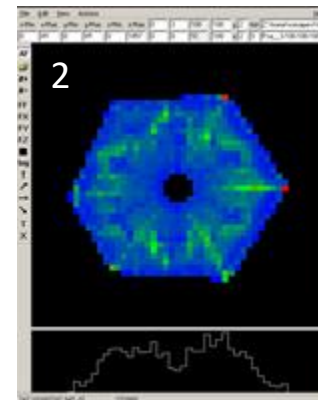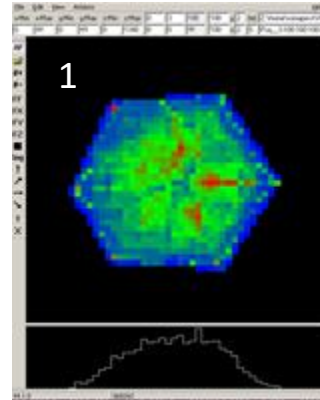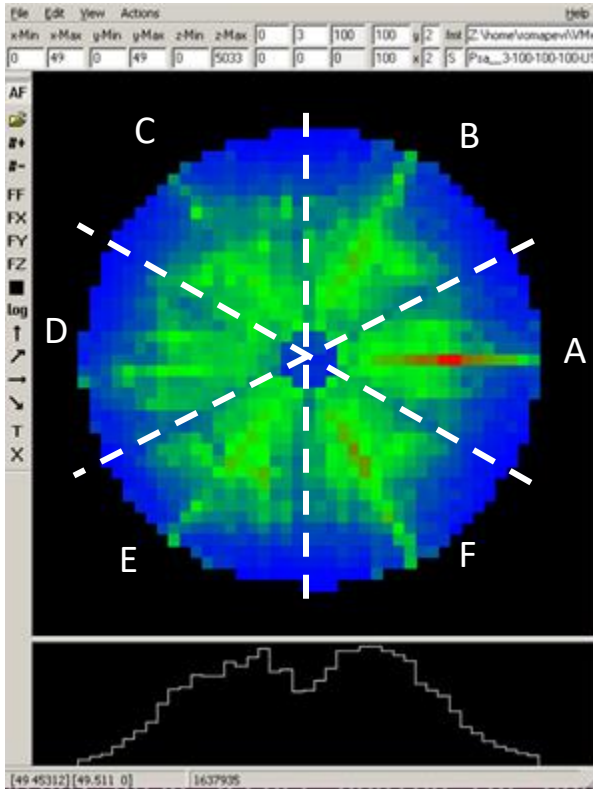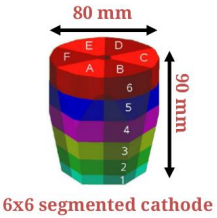
PSA Filter

Hit pattern

Psa__3-100-100-100-US__XYZ.matr [1 projection XZ][0 all] [91-96 slices of segments]
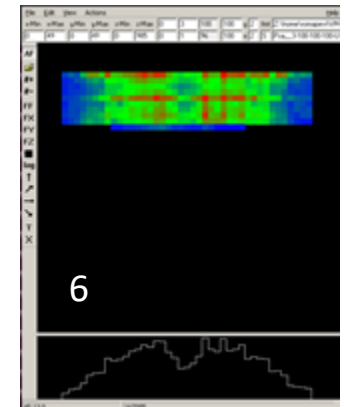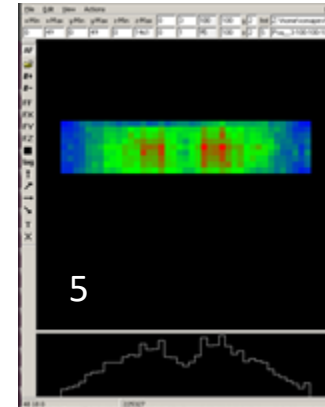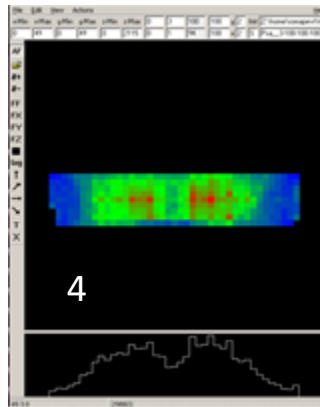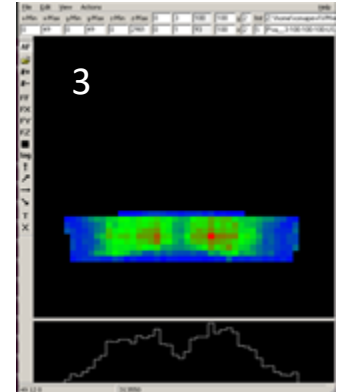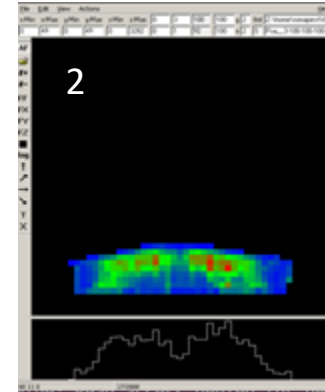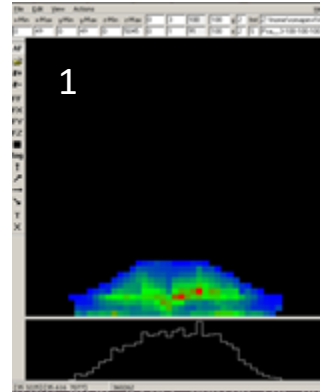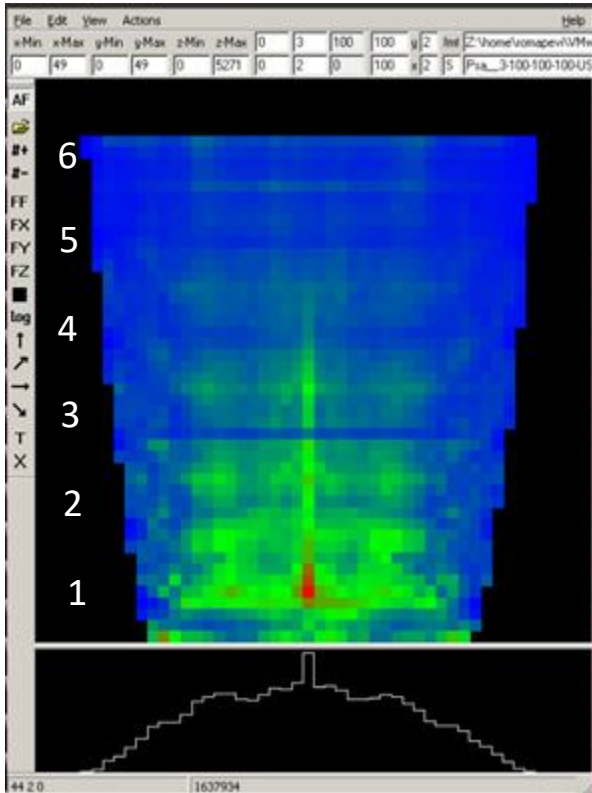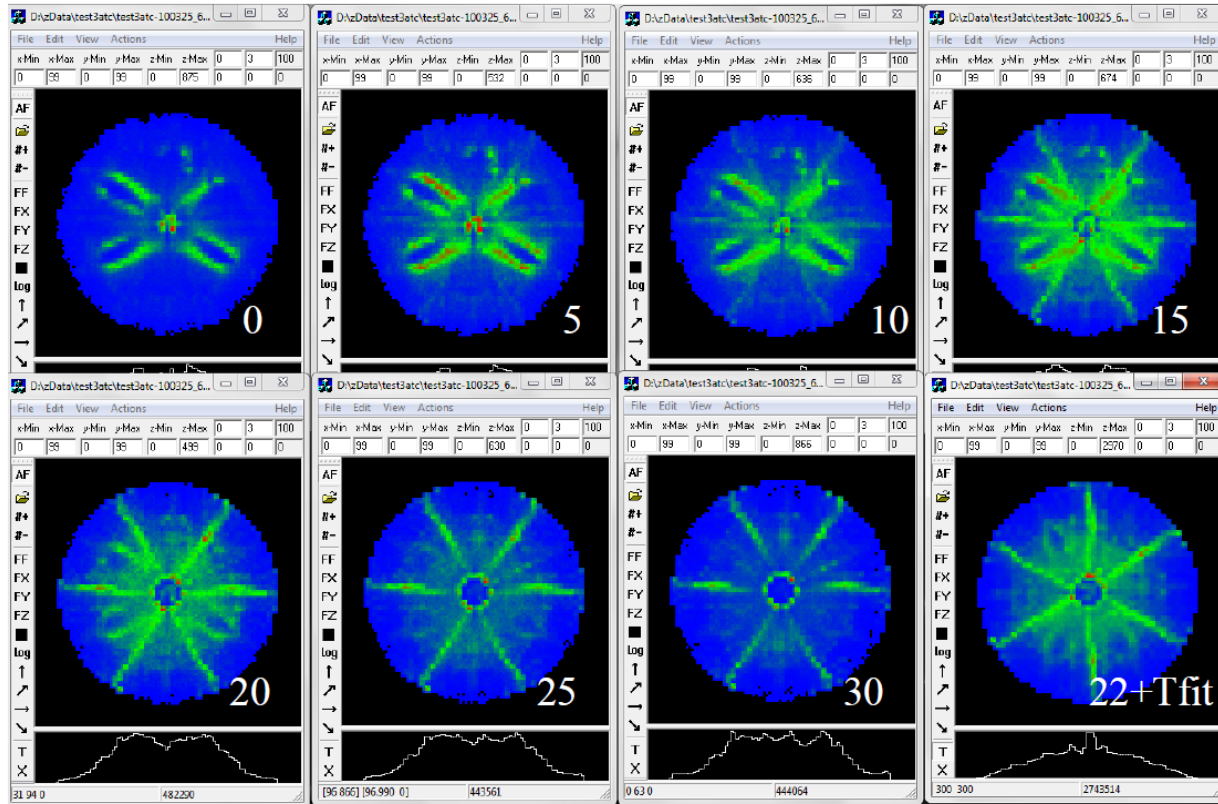
PSA Filter

Hit pattern

Psa__3-100-100-100-US__XYZ.matr [2 projection YZ][0 all] [91-96 slices of segments]

PSA Filter

T0 effect

Effect of time position of the experimental trace