

AGATA Analysis Workshop 2023

Preprocessing Calibration

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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. This program is essentially the same

Data Processing

Directories structure

The directory where you produce your data contains some standard sub-directories
(e.g. /agatadisks/exptname (EXXX) /((Config EXXX)/run_XXX_date)

Conf: Configuration of actors, calibrations, ... for each detector
→ **00A, 00B, 00C ... 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/12A

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

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**

- **TkT & Mat spectrum viewer:** to plot any spectrum produced all along the actors chain
- **RecalEnergy:** Analysis of spectra looking for peaks
- **xTalkSort, xTalkMakex, TalkInvert:** to sort and analyze the AGATA events dumped into event energy.bdat.0000 to determine the crosstalk correction coefficients
- **SortPsaHits:** Sort of PSA hits (special format) to determine neutron damage correction parameters
- **solveTT.py:** Optimize time alignment of “equal” detectors

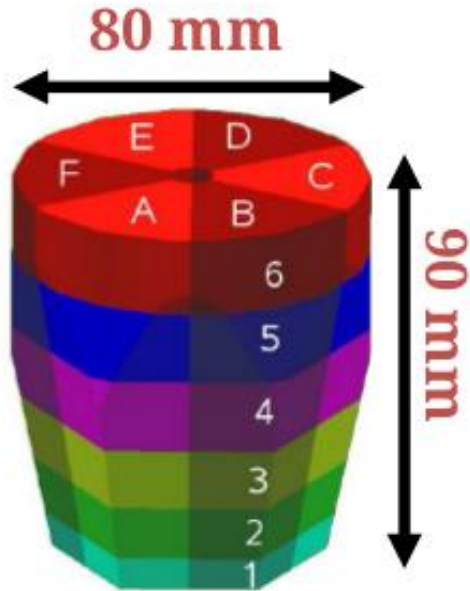
Data Processing

Binary spectra

- Simple C-style multidimensional (max 6) arrays written mostly in binary format
- For historical reasons the format is not recorded in the file
 - Often written as part of the file name:
Prod__4-38-32768-UI__Ampli.spec is a file dump of an array defined as:
unsigned integer Ampli[4][38][32768],
containing $4*38 = 152$ spectra of **32768** channels
- The viewers **TkT** and **Mat** can decode and interpret the format.
- Other programs (e.g. RecalEnergy) can interpret the spectrum length and type but the user have to specify the number of spectra to act upon.

TkT

Channels correspondence after Replay



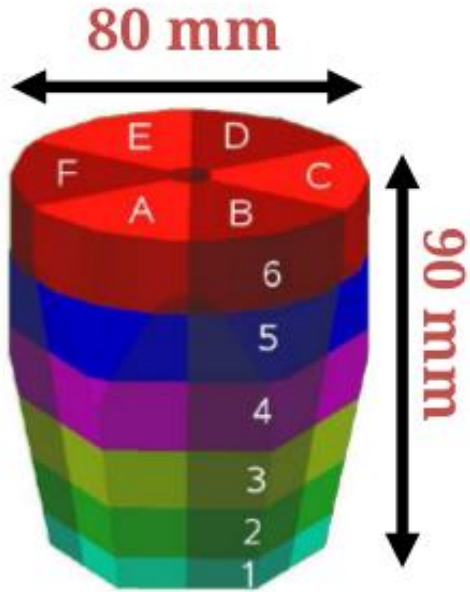
	A	B	C	D	E	F	CC
Back segs. 6	5	11	17	23	29	35	
5	4					34	
4	3					33	
3	2					32	
2	1					31	37
Front segs. 1	0	6	12	18	24	30	36

1 Low gain
0 High gain & trigger

6x6 segmented cathode

TkT & Mat

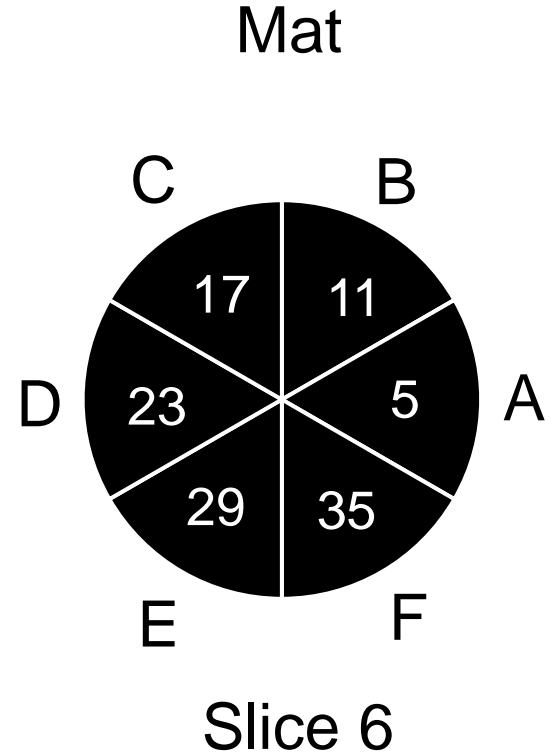
Channels correspondence after Replay



6x6 segmented cathode

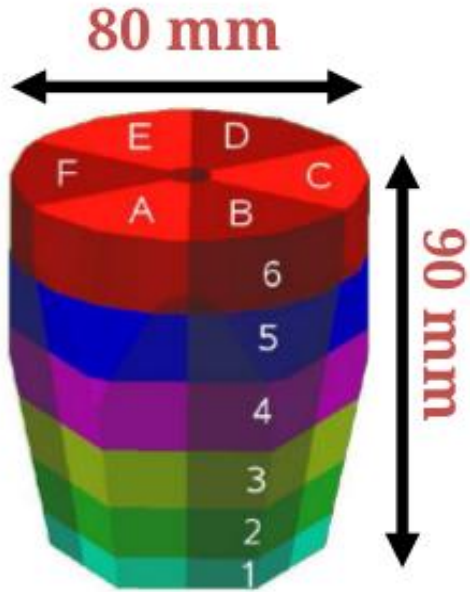
TkT

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



TkT & Mat

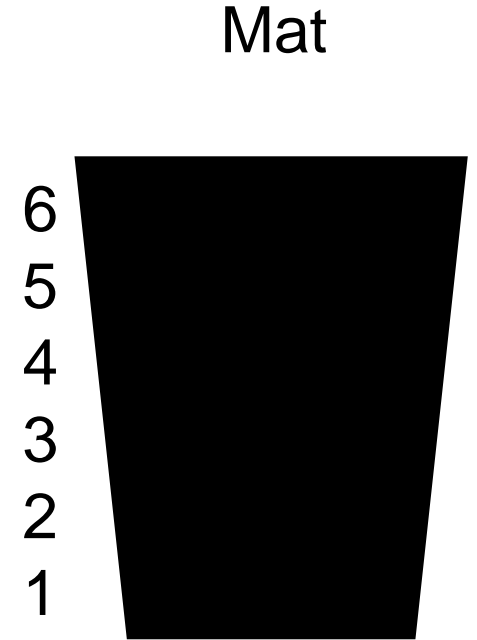
Channels correspondence after Replay



6x6 segmented cathode

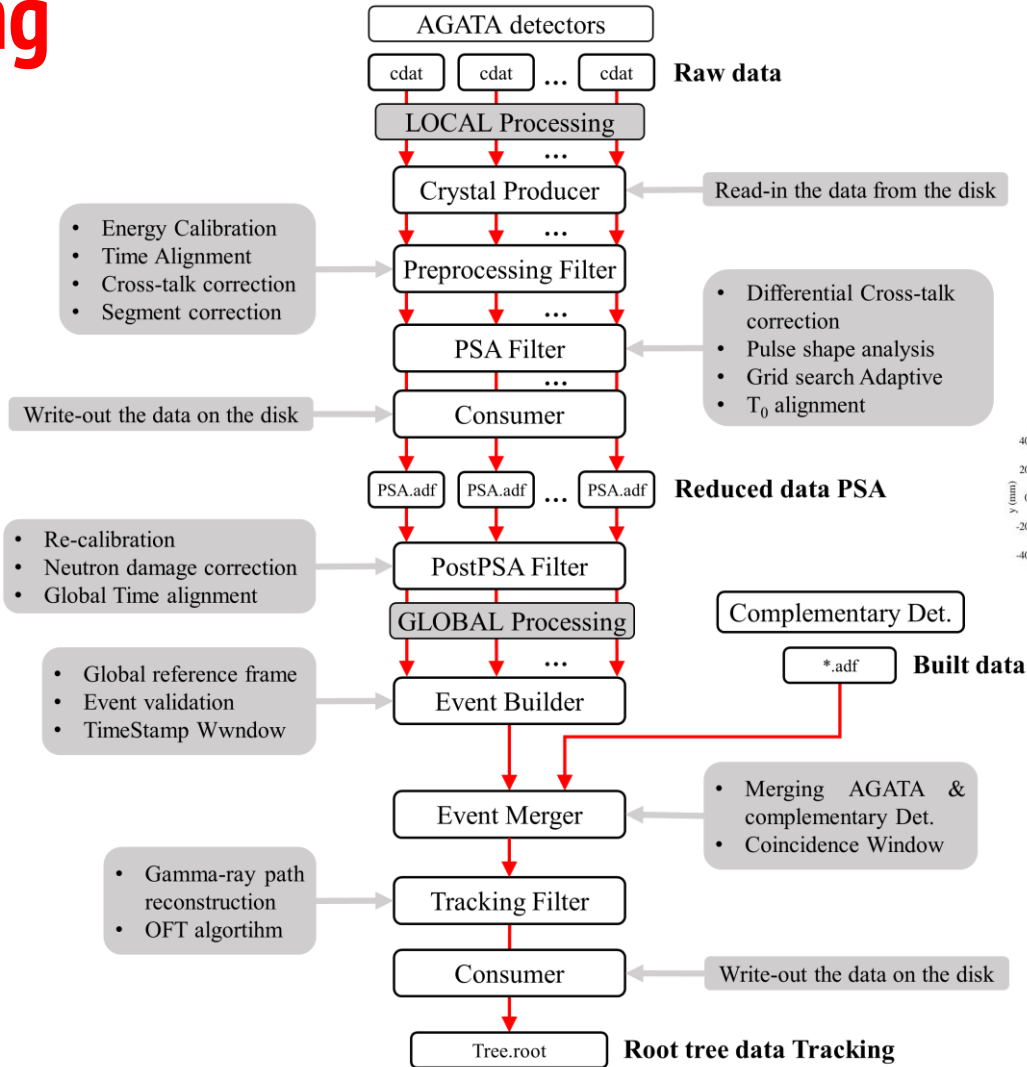
TkT

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

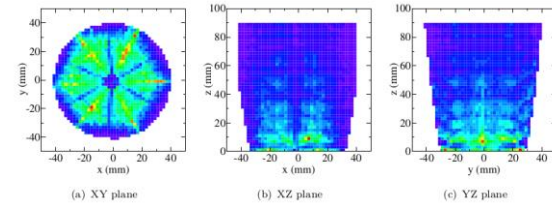


Data Processing

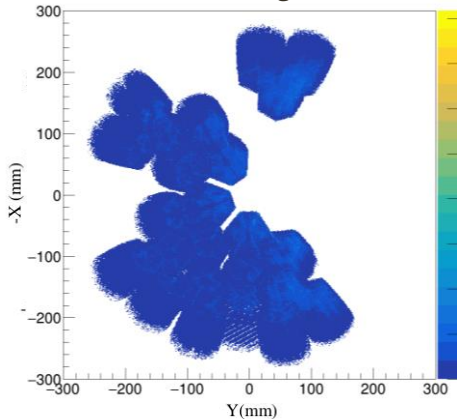
Narval actors



Pulse Shape Analysis

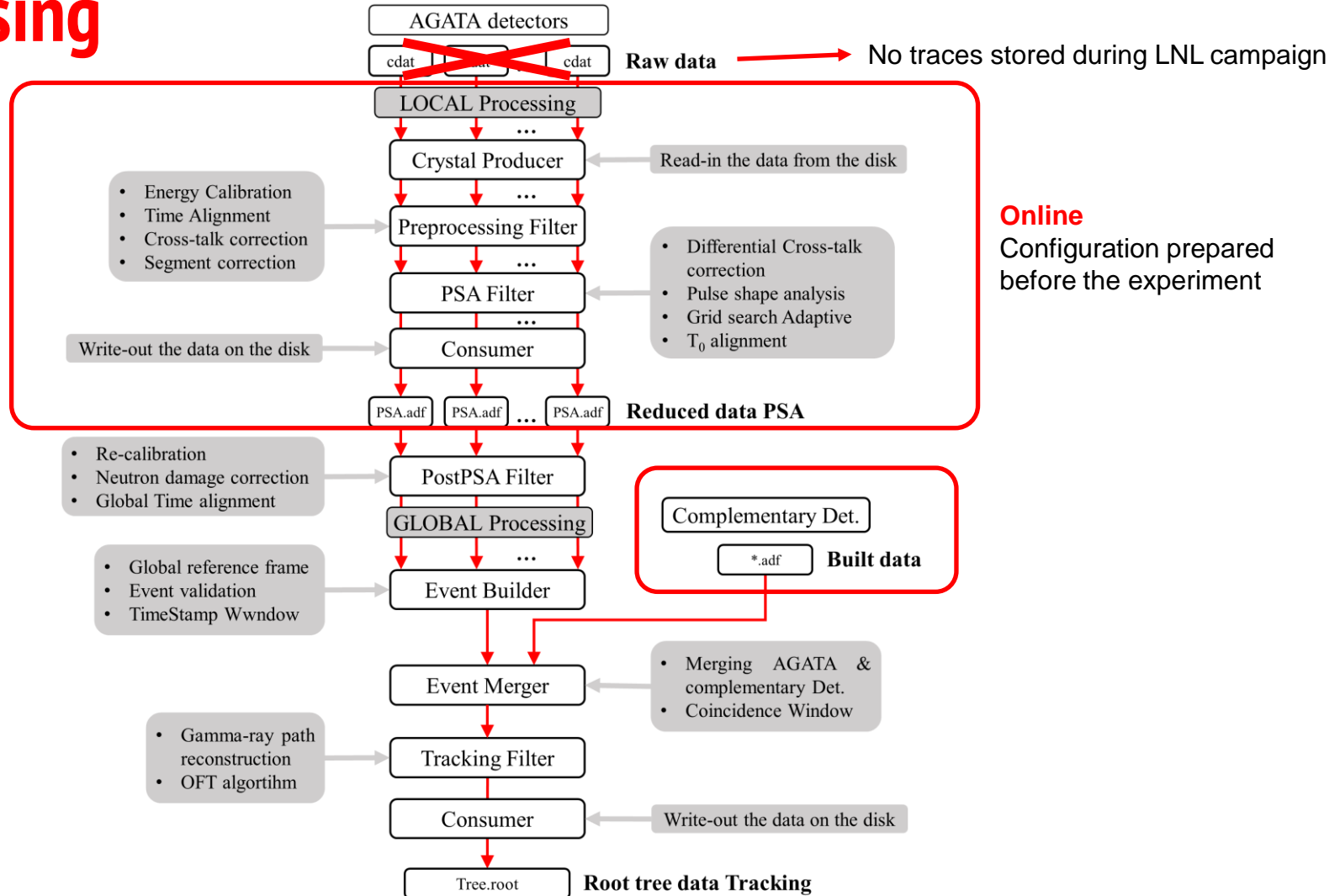


Tracking



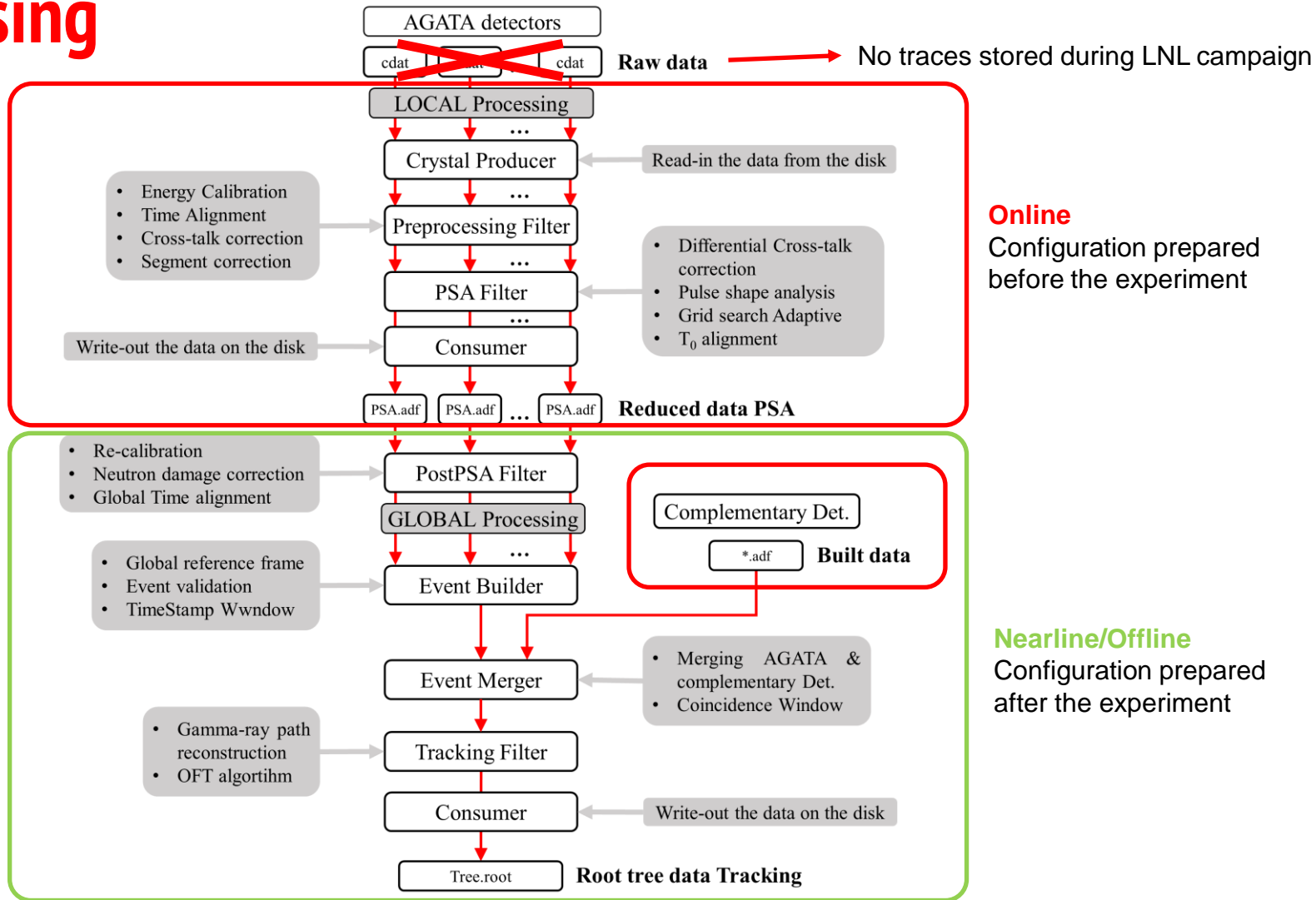
Data Processing

Narval actors



Data Processing

Narval actors



Local Level Processing

Narval actors

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

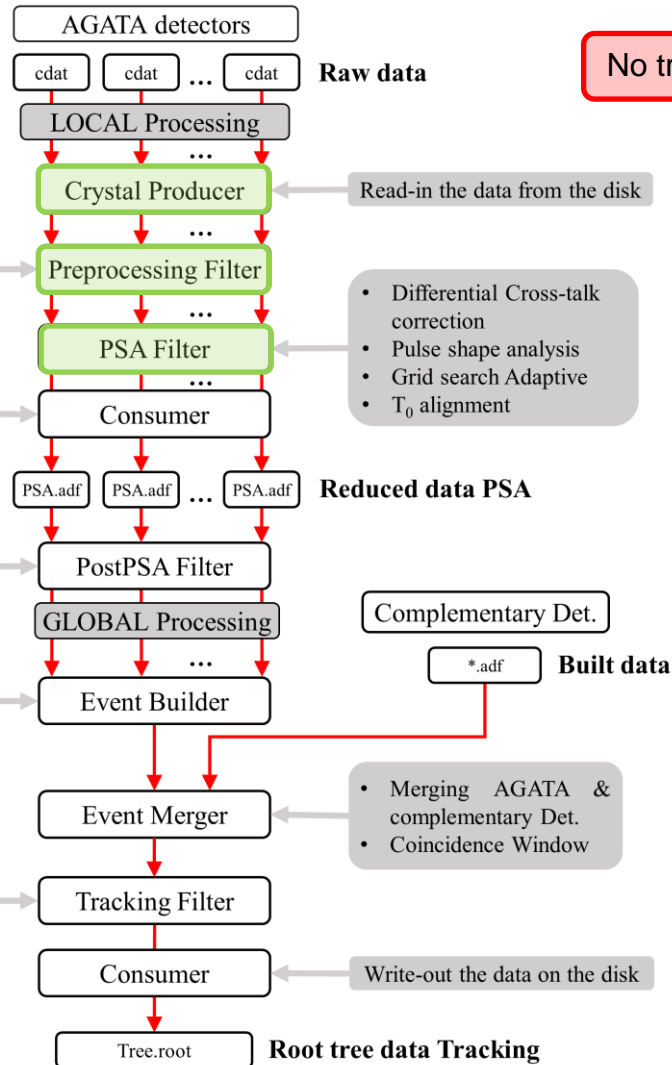
- Energy Calibration
- Time Alignment
- Cross-talk correction
- Segment correction

Write-out the data on the disk

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

- Global reference frame
- Event validation
- TimeStamp Wwndow

- Gamma-ray path reconstruction
- OFT algorithm



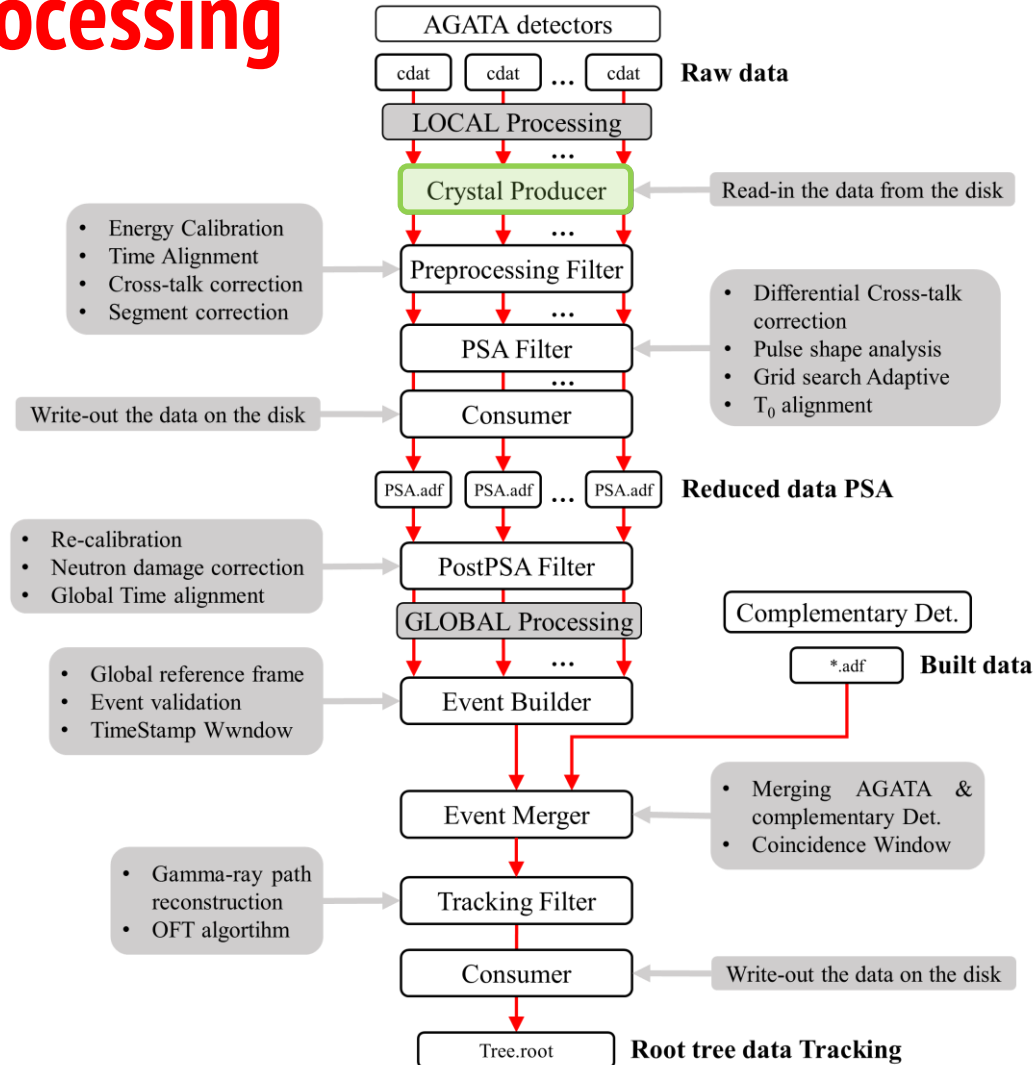
No traces stored during LNL campaign

- Merging AGATA & complementary Det.
- Coincidence Window

Write-out the data on the disk



Local Level Processing

Narval actors



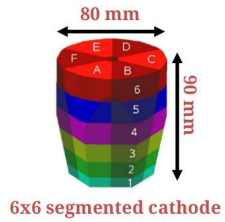
Local Level Processing

Crystal Producer

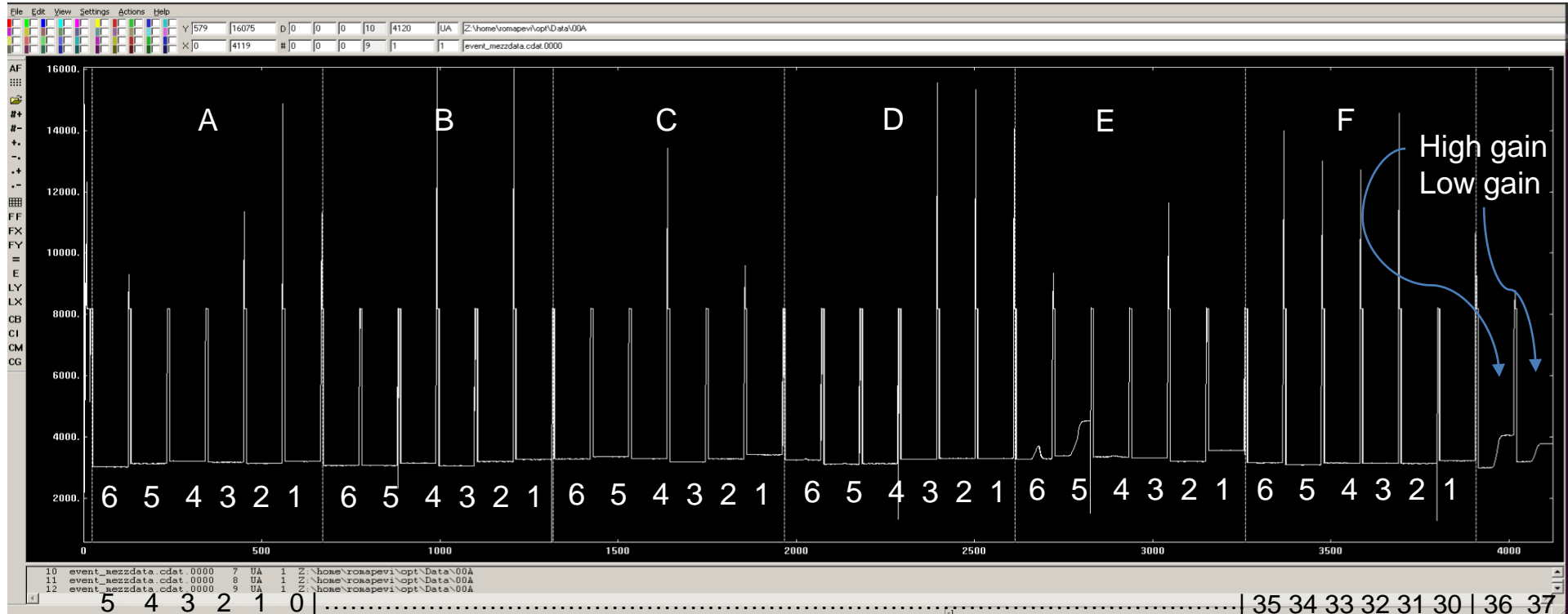
- Reads the data from:
 - The PCI express driver connected to the GGP electronics, **online**
 - Raw data files (event_mezzdata.cdat) , **offline**
- Acts as a local event builder to assemble data coming from the GGP readout (or from the raw data file) according to mapping specified in:
 - **CrystalProducerATCA.conf**  **Files in Conf/00A e.g.**
- Prepares data:crystal frames and send it to the data flow
- **Configuration for this actor done by the local team**
- 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)



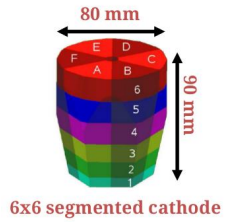
event_mezzdata.cdat.0000 (format: 4120-UA)



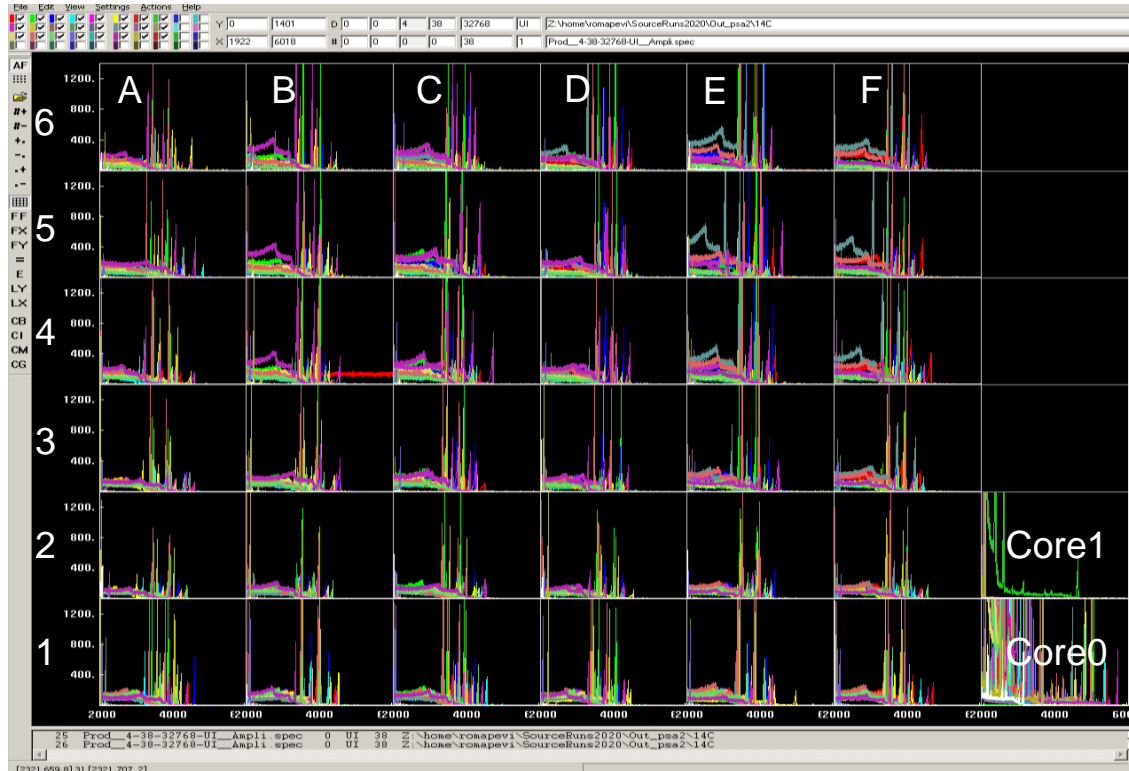
TkT

Crystal Producer

Amplitude spectra

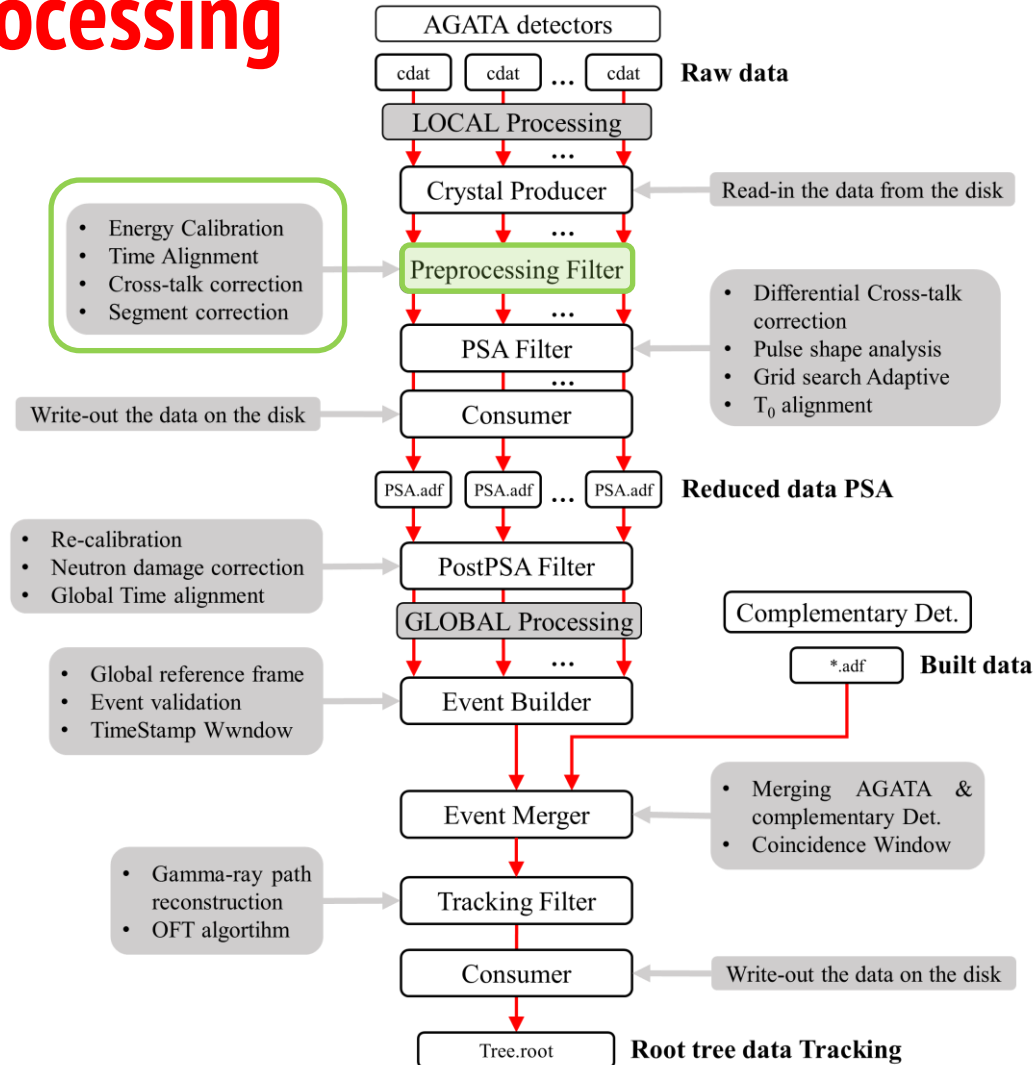


Prod__4-38-32768-UI__Ampli.spec [1][0-37]



Local Level Processing

Narval actors



Local Level Processing

Preprocessing Filter

- 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**
- 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
- **Configuration for this actor done by the local team**
- 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
Conf/00A e.g.

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

What is needed:

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

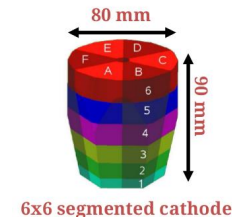
#	indx	#spec	#pks	#ok	rEnergy	FW05	FW01	Area	Position	Width	Ampli	WTML	WTMR	slope*gain	rChi2%
0	38	5	2	1332.97	4.415	12.823	714	3680.72	6.0	44	9.956	1.823	0.699782	48.88	
1	39	3	2	1335.59	8.039	23.827	347	3711.46	9.6	11	11.935	1.823	0.723994	999.99	
2	40	3	2	1332.30	8.950	26.884	514	3640.05	9.5	15	13.674	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	2	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	3	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.pdf](#)

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



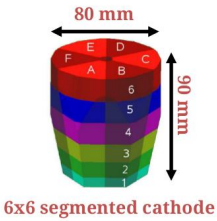
PreprocessingFilterPSA.conf

#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

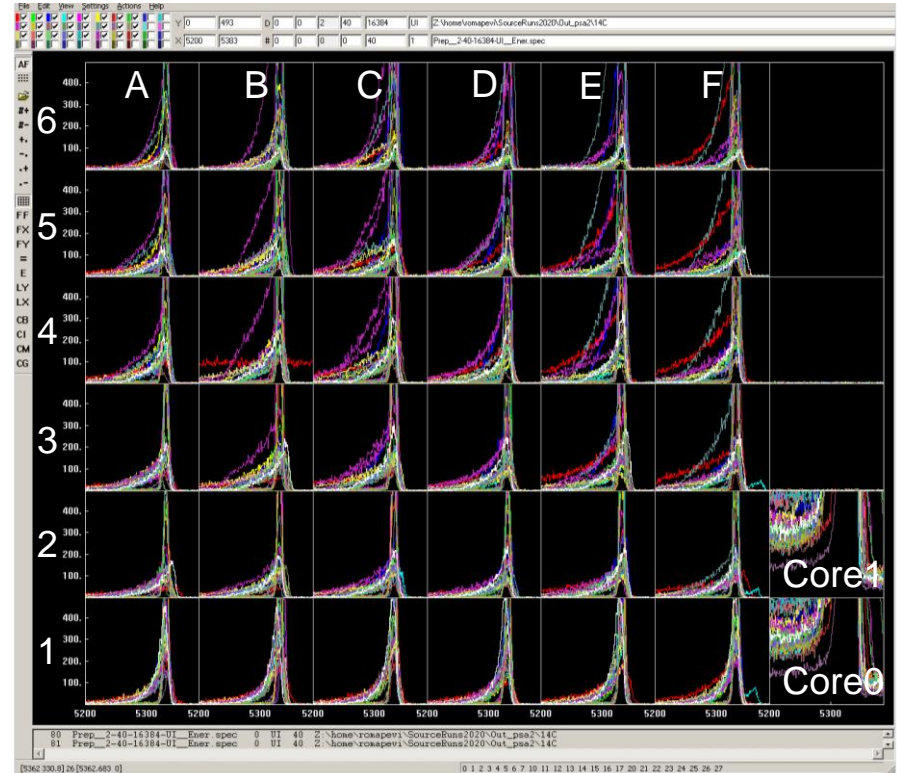
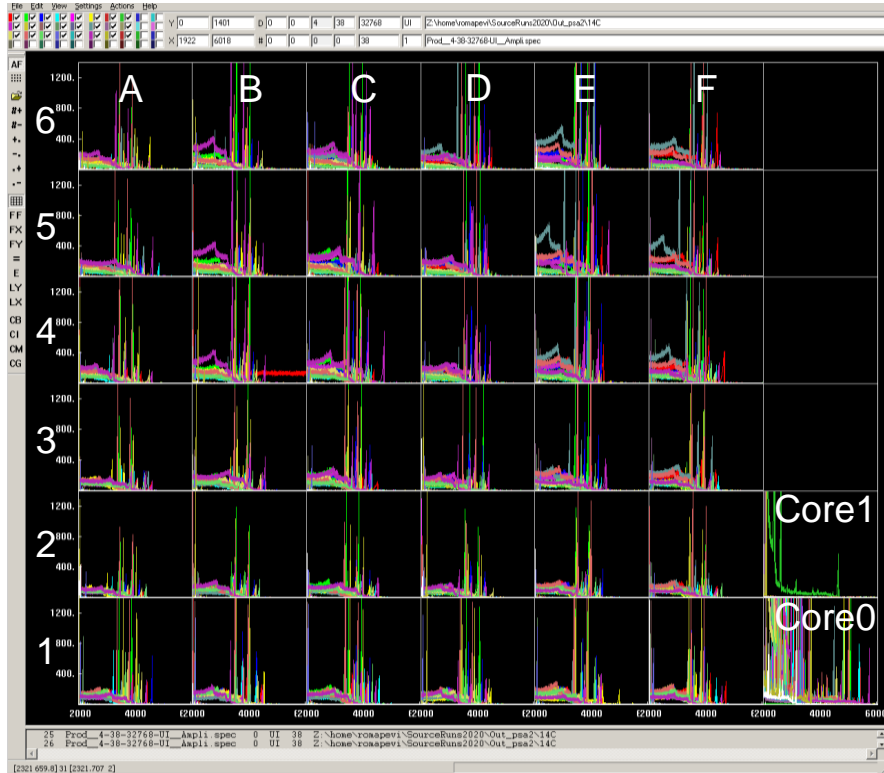
Preprocessing Filter: 1. Energy Calibration

Verification with femul replay



Prod__4-38-32768-UI__Ampli.spec [1][0-37]

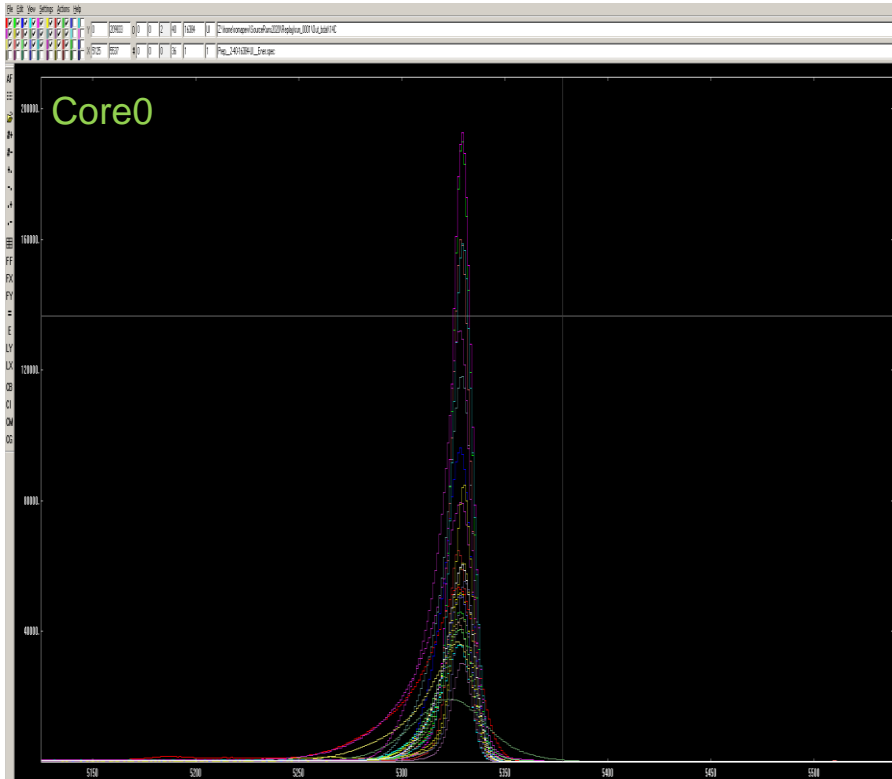
Prep__2-40-16384-UI__Ener.spec [0][0-37]



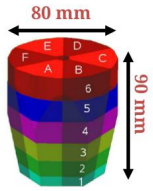
Preprocessing Filter

1. Energy Calibration

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

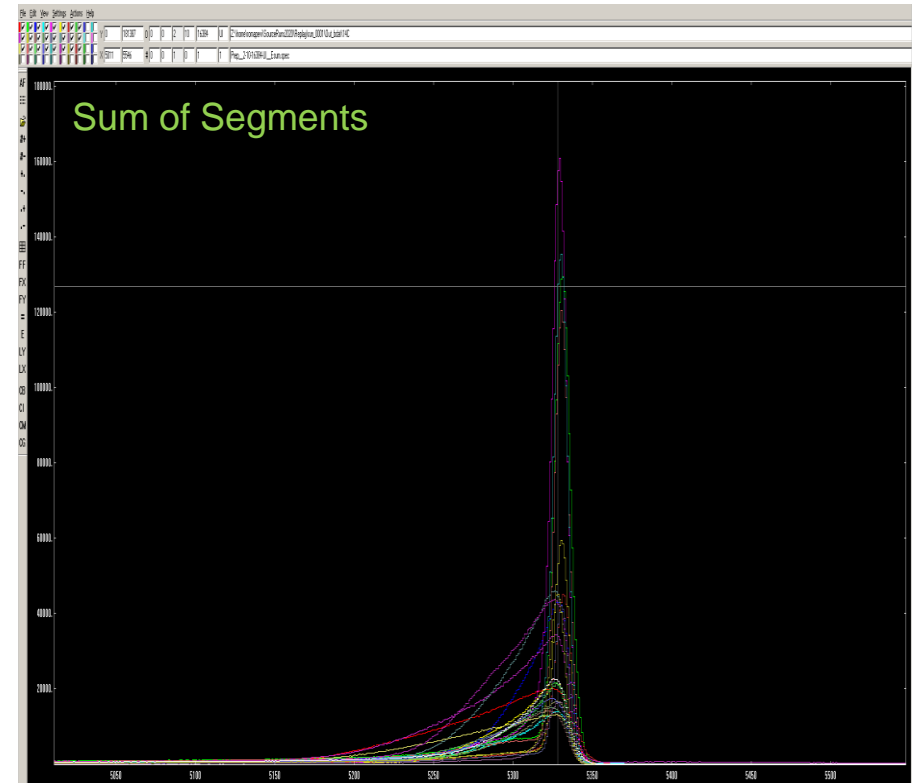


Verification with femul replay



6x6 segmented cathode

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



Preprocessing Filter

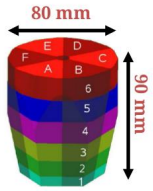
2. Crosstalk correction

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

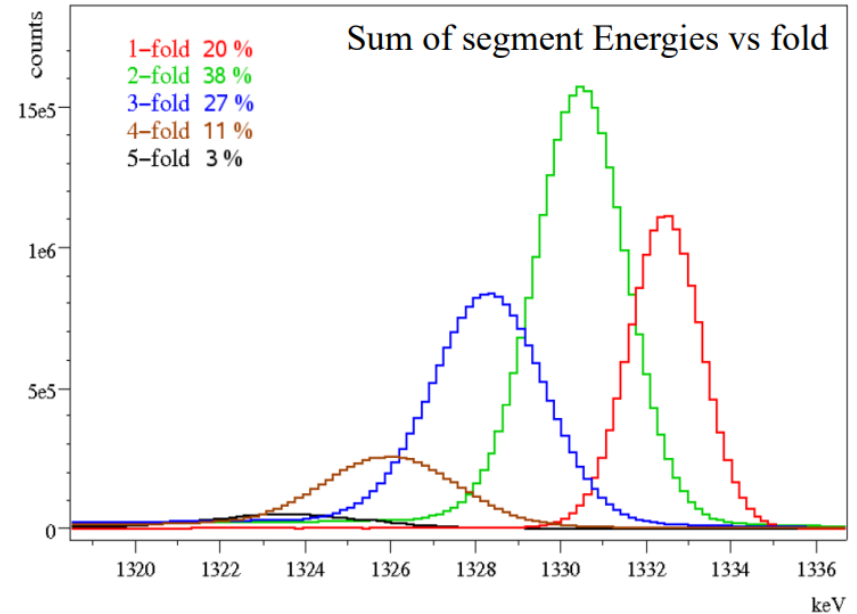
- **proportional:** proportional to the net charge signal → affects energy spectra with $M > 1$
- **differential:** proportional to the derivative of that signal → affects PSA

Creates strong energy shifts proportional to fold.

Corrections are made according to a **linear combination of the signal amplitudes of the other segments** using a ^{60}Co 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 ^{60}Co source is deduced to build the **cross-talk matrix of coefficients**.



6x6 segmented cathode



Preprocessing Filter

2. Crosstalk 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, 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

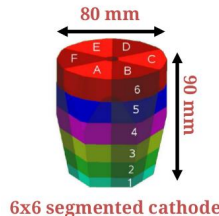
```
RecalEnergy -spe xspe__36-37-16384-UI__cal.spec -num 1332 -ener 1332.5 -
gain 5 -offs 1000 -Xtalk 37 > xdir_1325-1340.txt
```

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

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

More details in [AGATA LLP UsersGuide.pdf](#)

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



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
```

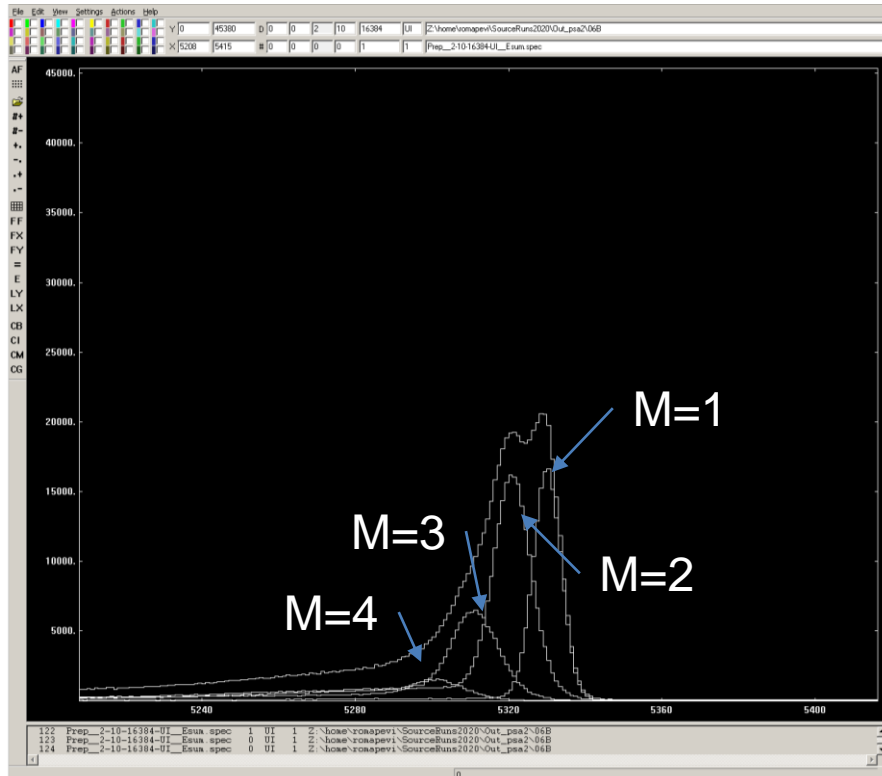
```
%id %id %Crosstalk coeff
0 0 1.0000742
1 0 -0.0004010
2 0 -0.0016104
3 0 -0.0021275
4 0 -0.0021282
5 0 -0.0020902
6 0 -0.0019210
7 0 -0.0010441
8 0 -0.0017013
9 0 -0.0022207
10 0 -0.0022316
11 0 -0.0023822
...
35 35 1.0001122
```

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

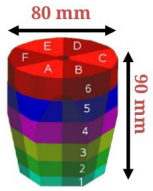
Preprocessing Filter

2. Crosstalk correction

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

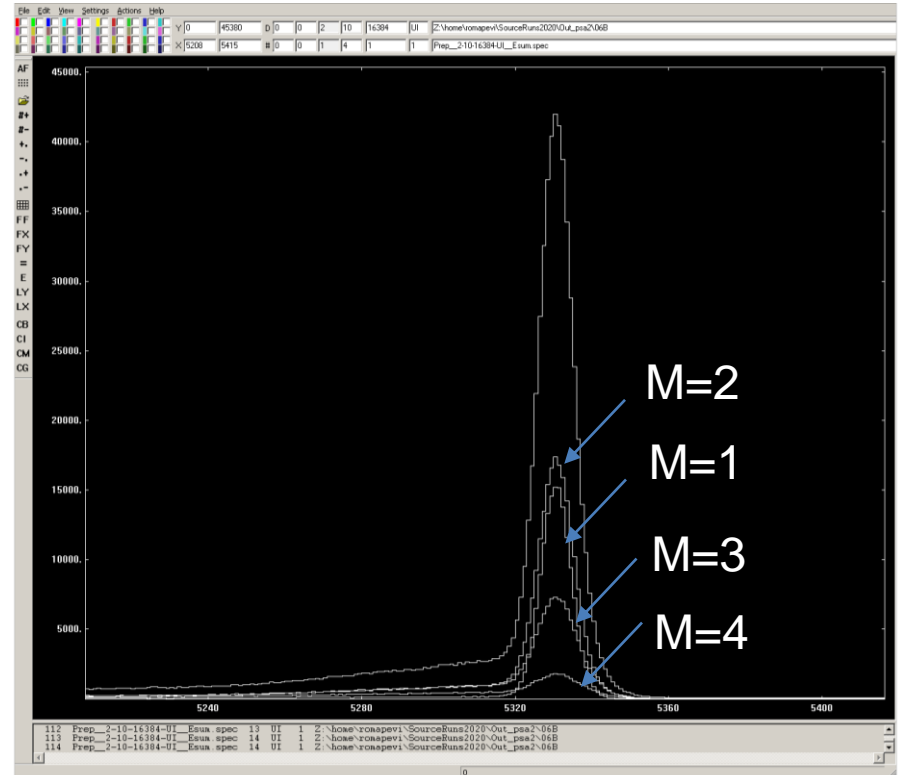


Verification with femul replay



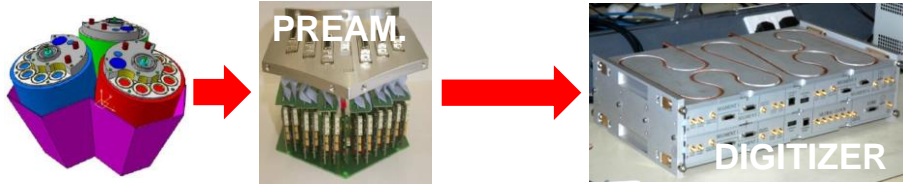
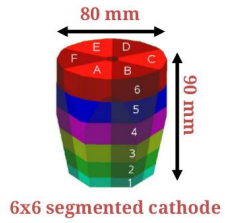
6x6 segmented cathode

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

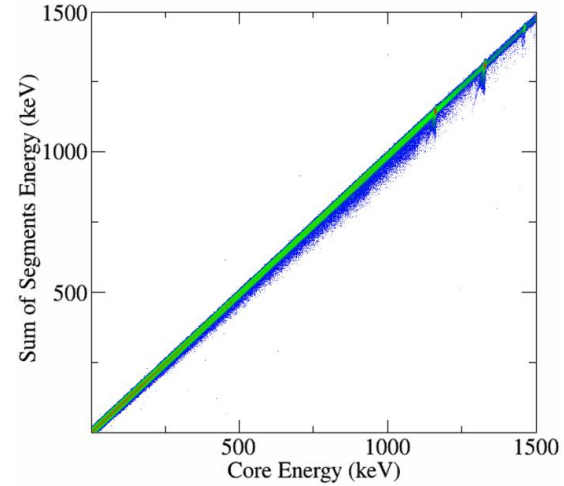
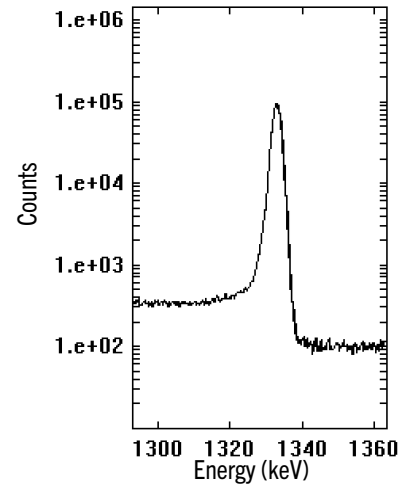
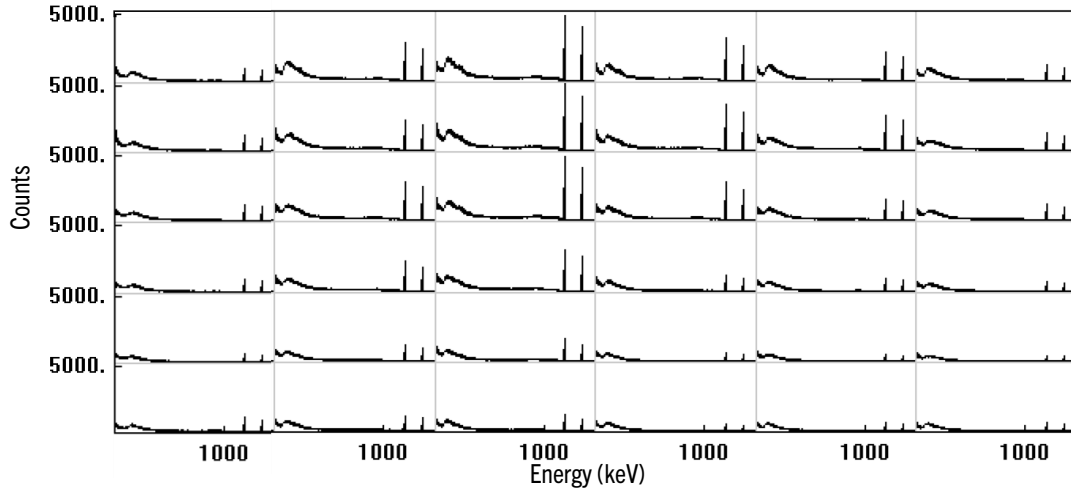


Preprocessing Filter

3. Dead/unstable segment correction

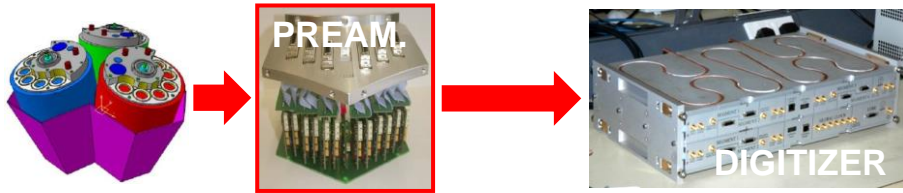
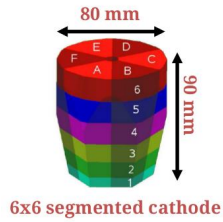


--Example of Detector Ok--



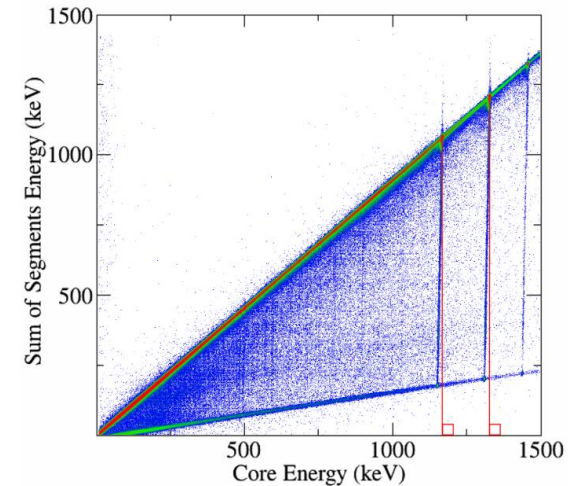
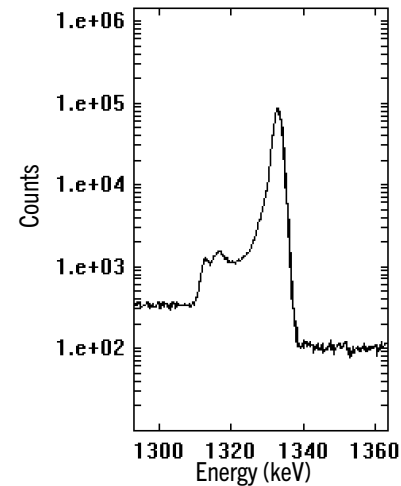
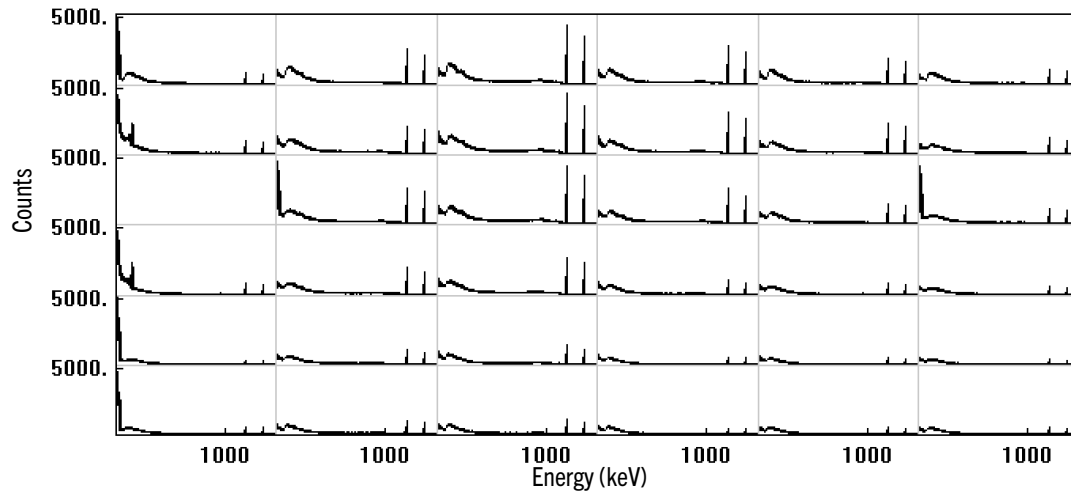
Preprocessing Filter

3. Dead/unstable segment correction



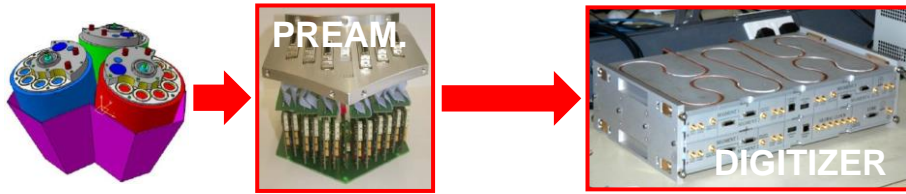
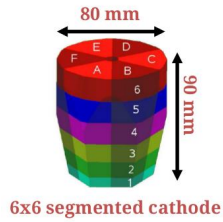
- **Broken segment:** the net charge is not properly collected but flows to the neighbouring segments
- Problem at the cold part of the preamplifier

--Example of Detector with a broken segment--



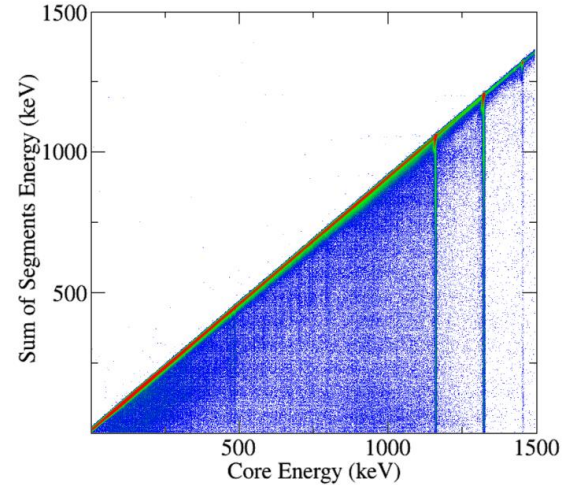
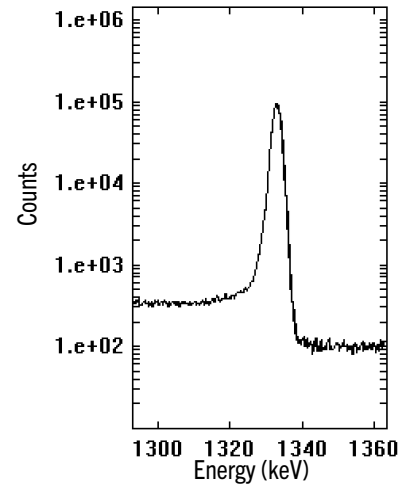
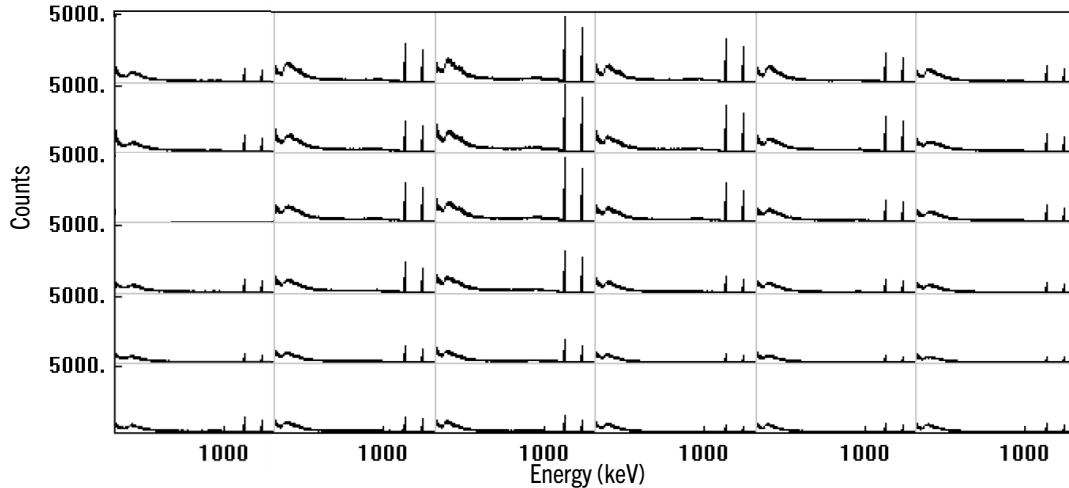
Local Level Processing

3. Dead/unstable segment correction



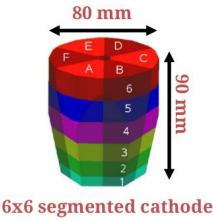
- **Lost segment:** the net charge is collected, but there is no information inside the data flow
- Problem after the cold part of the preamplifier

--Example of Detector with a lost segment--



Preprocessing Filter

3. Dead/unstable segment correction



- **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*.

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

- Quantify the amount of missing energy of the **dead** segment. $E_{missing} = E_{core} - \sum E_{seg}$
- 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.
- Segments with **unstable** gain could be transformed into (and treated as) “lost” segments by setting their energy calibration to zero.
- **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 →

Correction procedure

Broken: deadXsg, deadXcc

Lost: deadXsg, deadXcc=0

- Broken
- Lost
- "Noisy"

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

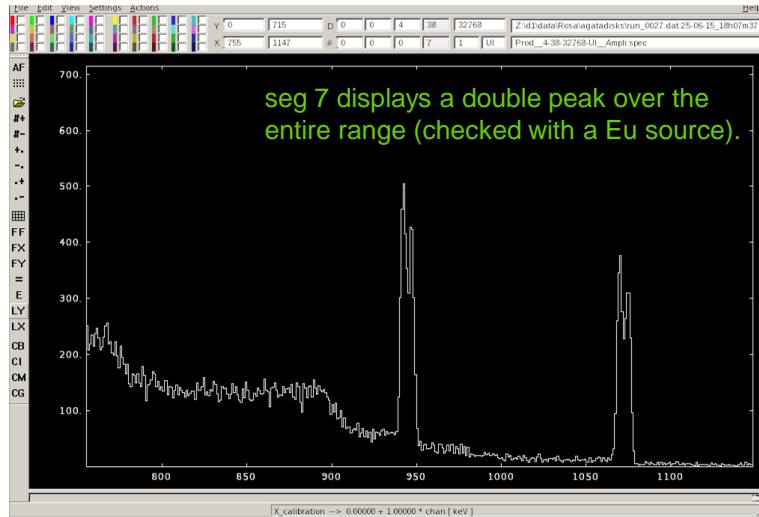
Replay:

- 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

Preprocessing Filter

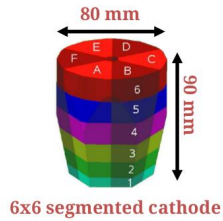
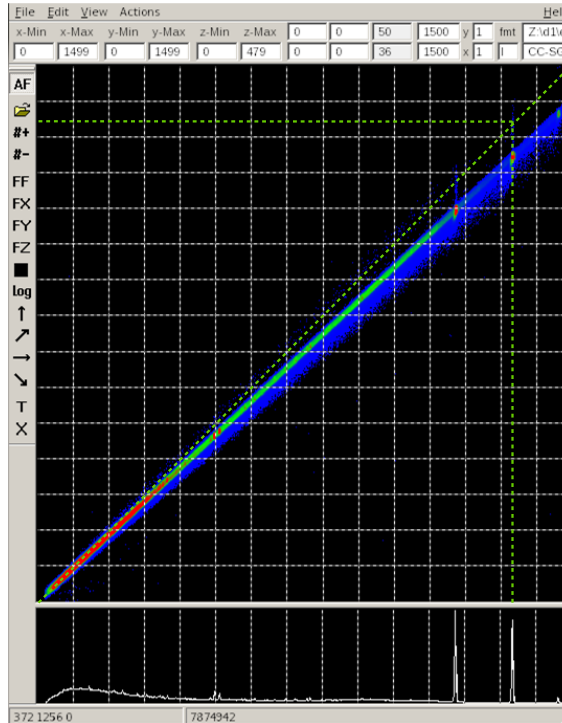
3. Unstable segment correction

00B seg 7 Prod__4-38-32768__Ampli.spec [0][7]

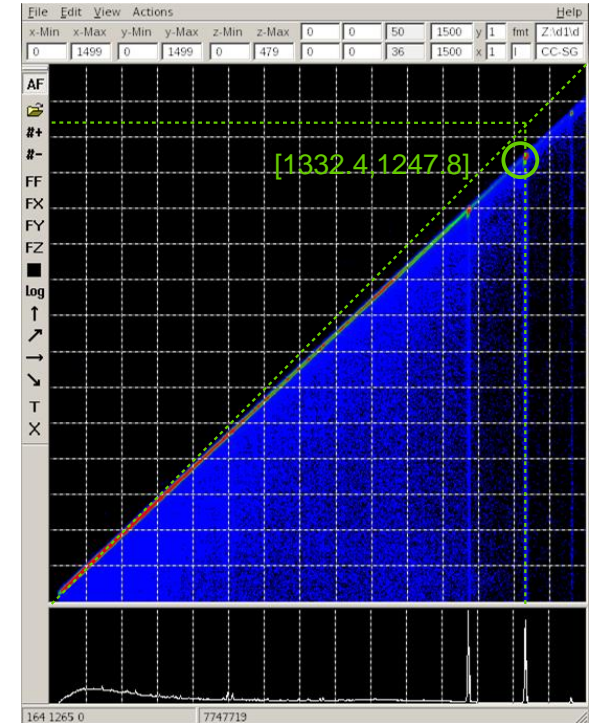


Replay to generate event.bdat files
femul key in CrystalProducer:
"WriteDataMask 8",

ecalF1.cal file seg 7 **coeff 1.242457**
CC-SG__50-1500-1500-US__ma.matr [36]



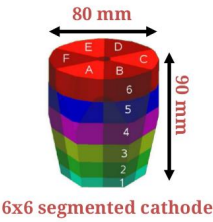
ecalF1.cal file seg 7 **coeff 0.00000** to treat it as a lost segment correction
CC-SG__50-1500-1500-US__ma.matr [36]



Slope of main diagonal ==> **DeadXsg=0,93574**
No core loss ==> **DeadXcc=0**

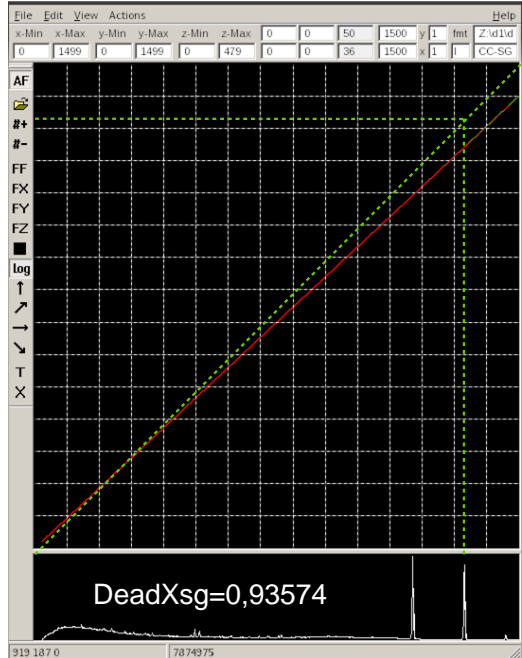
Preprocessing Filter

3. Unstable segment correction

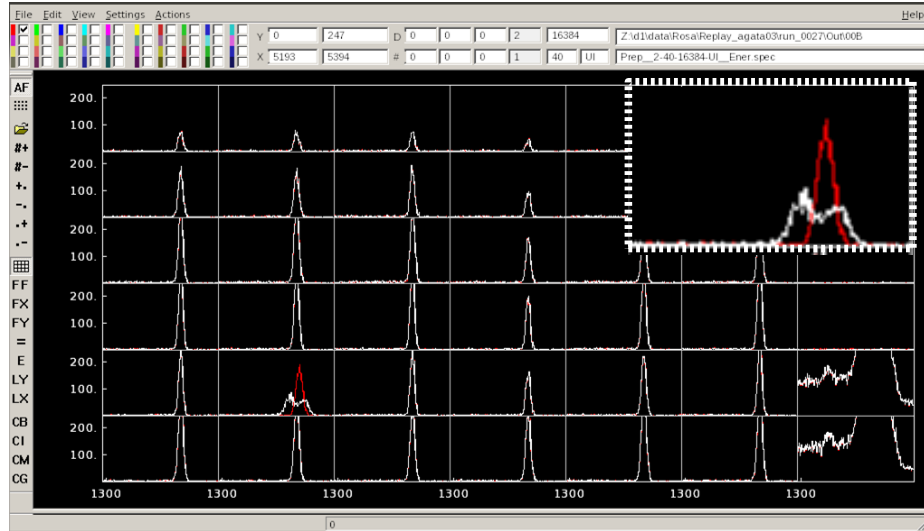


Verification with femul replay

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



00B seg 7 Prep__2-40-16384__Ener.spec [0][7] (red) & [1][7] (white)



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:

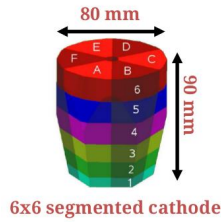
```
xTalkMake -f xSG__36-36-100-1536-US__ij.matr
```

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

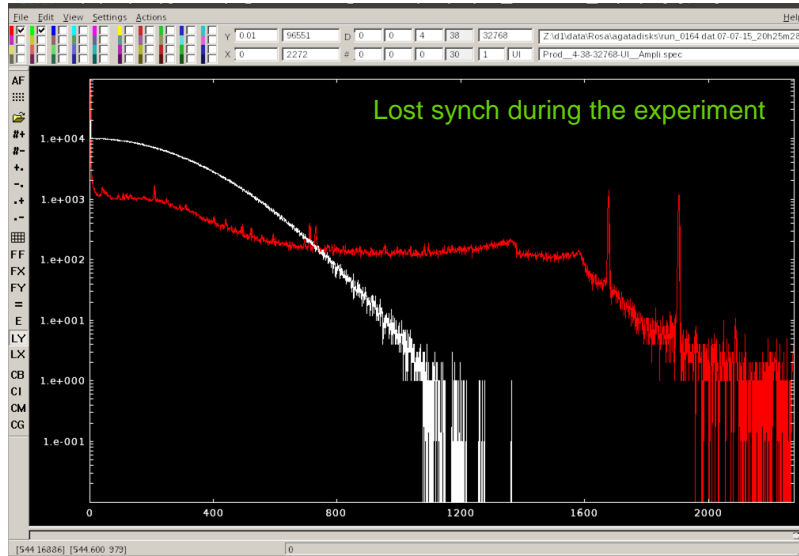
Preprocessing Filter

3. Dead segment correction: Lost segment



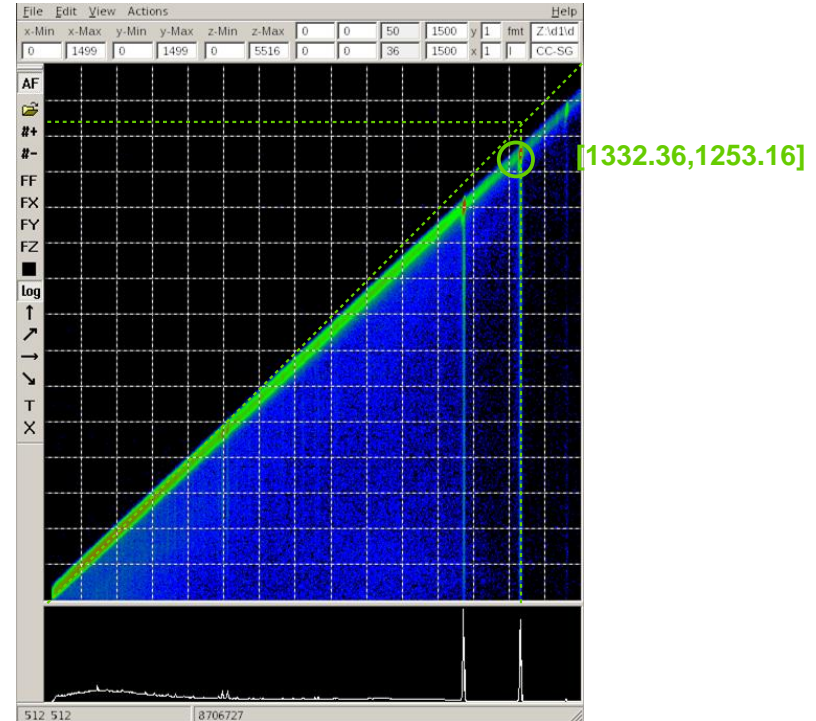
6x6 segmented cathode

11B seg 30 Prod__4-38-32768__Ampli.spec [0][30]



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

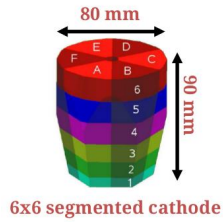
ecalF1.cal file seg 30 coeff 0.00000 to treat it as a lost segment correction
CC-SG__50-1500-1500-US__ma.matr [36]



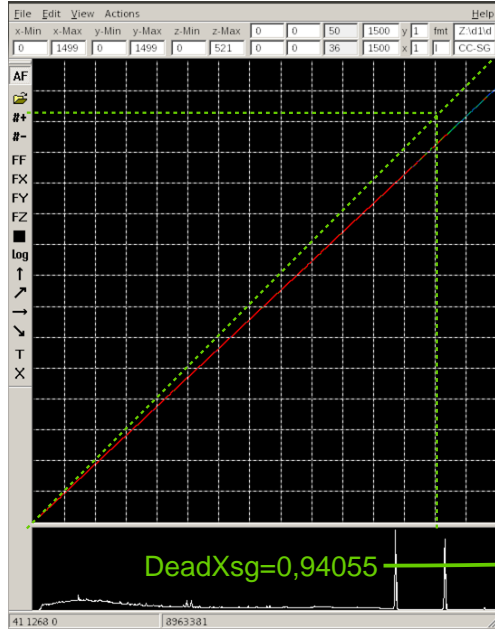
Slope of main diagonal ==> DeadXsg=0,94055
No core loss ==> DeadXcc=0

Preprocessing Filter

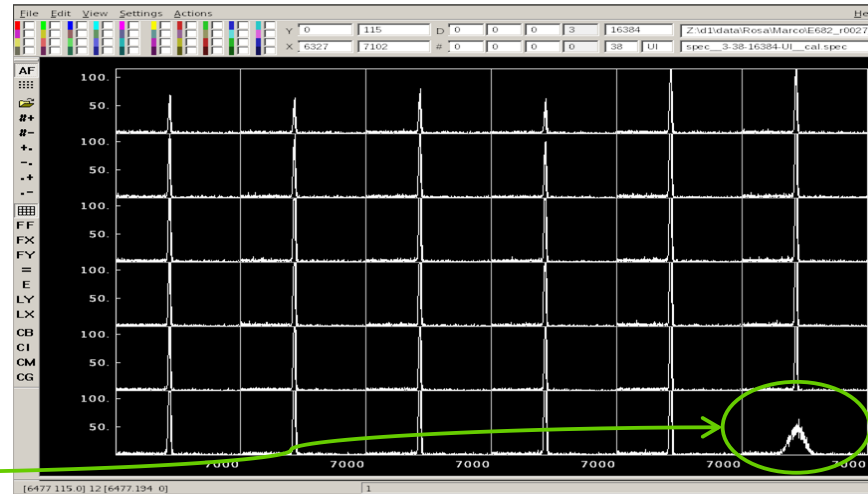
3. Dead segment correction: Lost segment



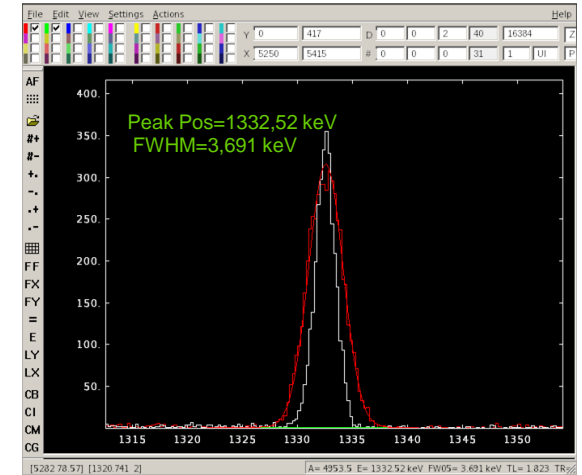
CC-SG_50-1500-1500-US_ma.matr [36]



spec_3-38-16384-UI_cal.spec [0][0-35]



Verification with femul replay



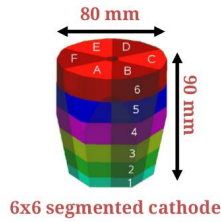
11B seg 30 Prep_2-40-16384_Ener.spec
[0][30] (red) & [0][31] (white)

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

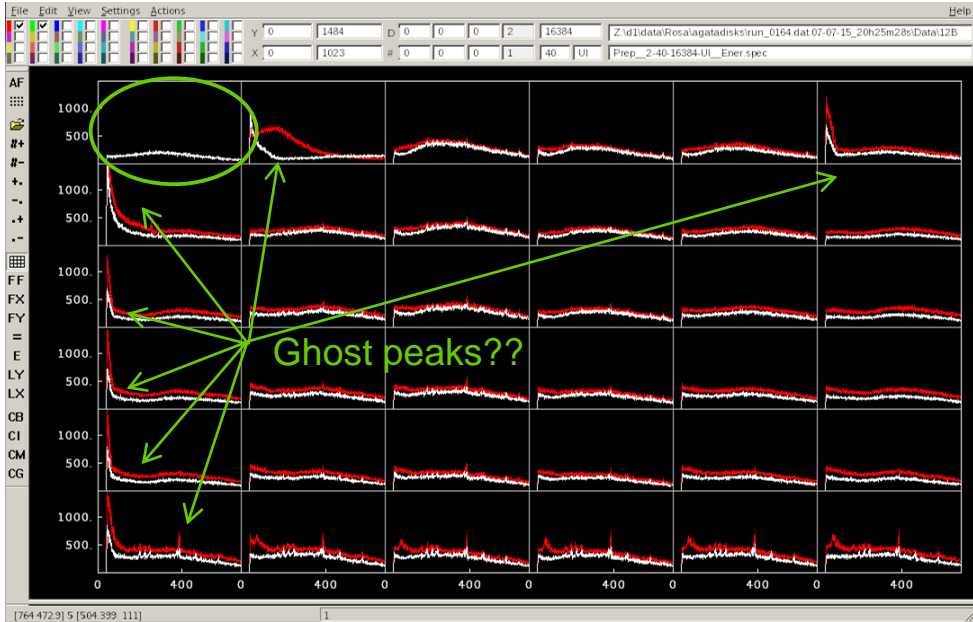
Preprocessing Filter

3. Dead segment correction: Broken segment



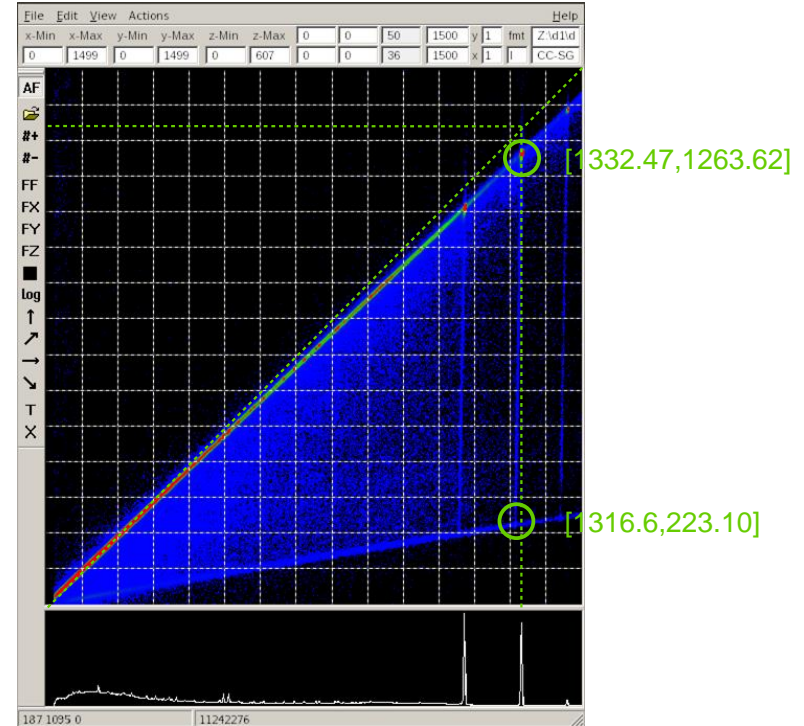
6x6 segmented cathode

12B seg 5 Prep_2-40-16384_Ener.spec [0][0-35]
before (red) and after (white) the experiment



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]

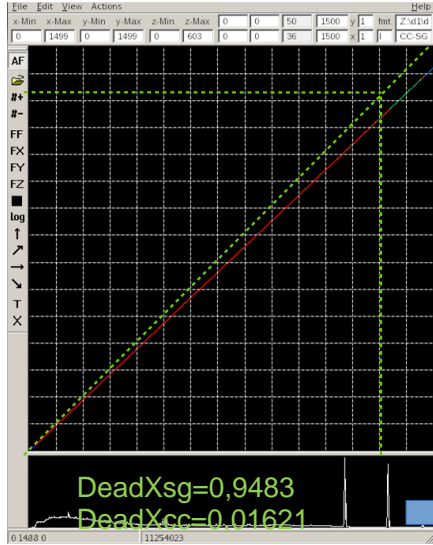


Slope of main diagonal ==> **DeadXsg=0,9483**
No core loss ==> **DeadXcc=0,01621**

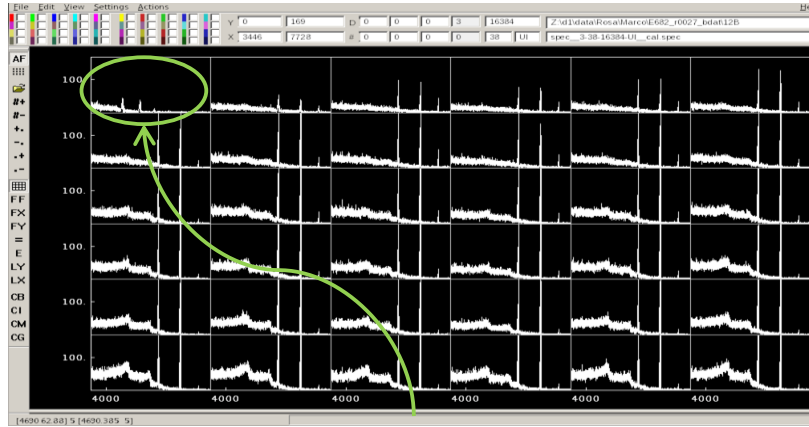
Preprocessing Filter

3. Dead segment correction: Broken segment

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

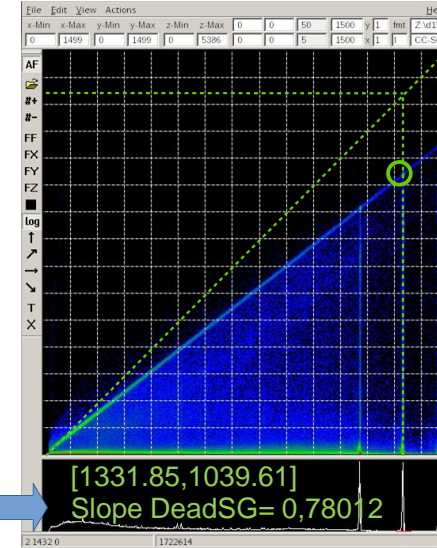
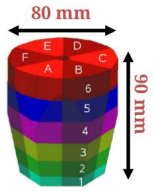


spec__3-38-16384-UI__cal.spec [0][0-35]

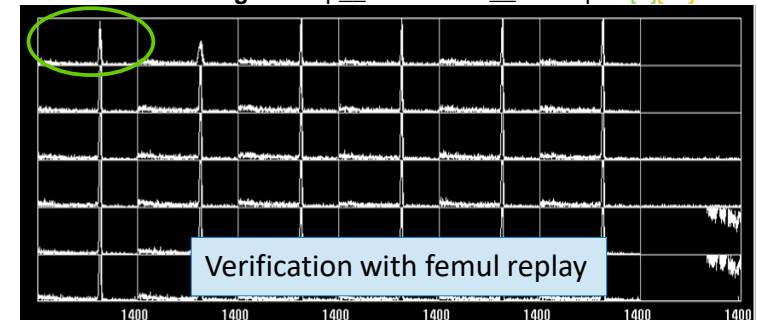


The energy is very small due to part of it is still in the neighbours. For the crosstalk correction, we need the slope of the broken segment after the correction

CC-SG__50-1500-1500-US__ma.matr [5] 6x6 segmented cathode



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



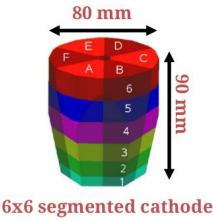
Verification with femul replay

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



What is needed:

- Any run
- Spectra file : Data/{crystalID}/Prep__6-40-1000-UI__TT.spec
- Conf File: **PreprocessingFilterPSA.conf**
- Auxiliary file: shift_TT.out
- 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	1	500.14	17.034	38.743	14865	500.14	16.1	731	2.993	1.823	7.117
1	41	1	1	1	503.37	19.629	44.382	9422	503.37	19.5	400	2.382	2.171	8.970
2	42	1	1	1	501.04	16.180	36.094	11042	501.04	15.8	574	2.604	1.955	6.384
3	43	1	1	1	502.67	16.667	36.949	10726	502.67	16.4	543	2.558	1.958	5.505
4	44	1	1	1	503.28	17.366	40.384	8202	503.28	17.1	388	2.484	2.231	4.557
5	45	1	1	1	502.21	15.196	37.456	6171	502.21	14.7	323	2.641	2.473	4.868
6	46	1	1	1	495.26	15.689	37.220	15836	495.26	14.1	830	3.439	1.823	7.136
7	47	1	1	1	494.54	14.848	34.207	10077	494.54	14.3	562	2.771	2.005	6.002
8	48	1	1	1	494.75	13.281	30.954	12390	494.75	12.8	768	2.781	2.055	6.143
9	49	1	1	1	502.06	18.771	43.533	12570	502.06	18.4	551	2.158	2.570	6.255
10	50	1	1	1	498.45	16.276	38.653	9952	498.45	15.9	496	2.587	2.270	4.892
11	51	1	1	1	495.62	14.016	34.301	7189	495.62	13.6	410	2.619	2.438	5.229
12	52	1	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.pdf](#)

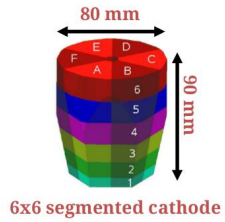
PreprocessingFilterPSA.conf

```
#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

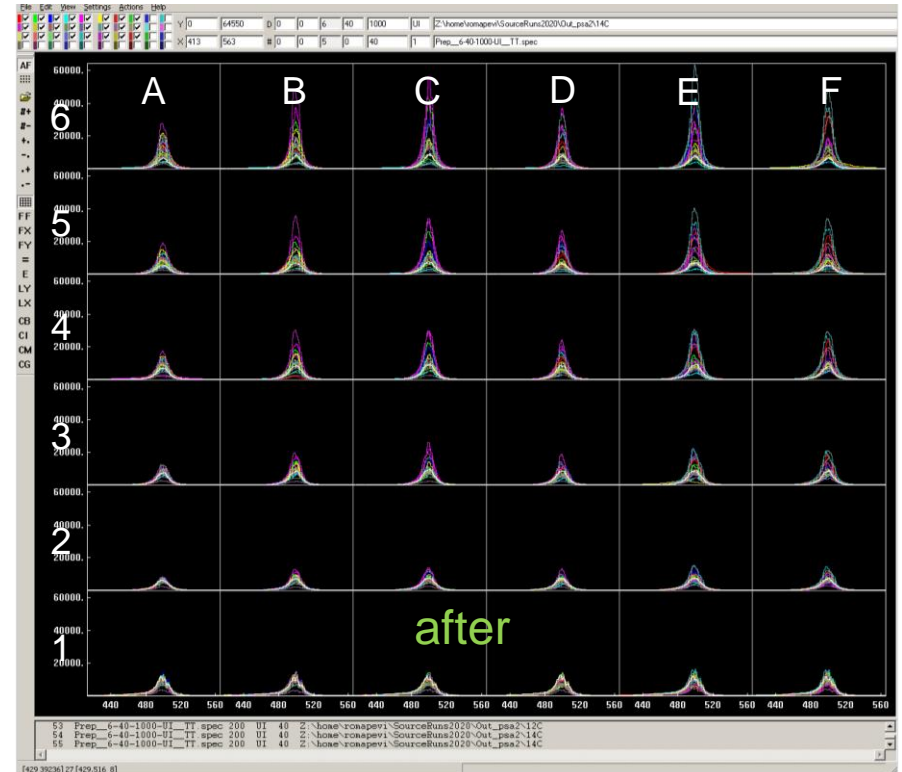
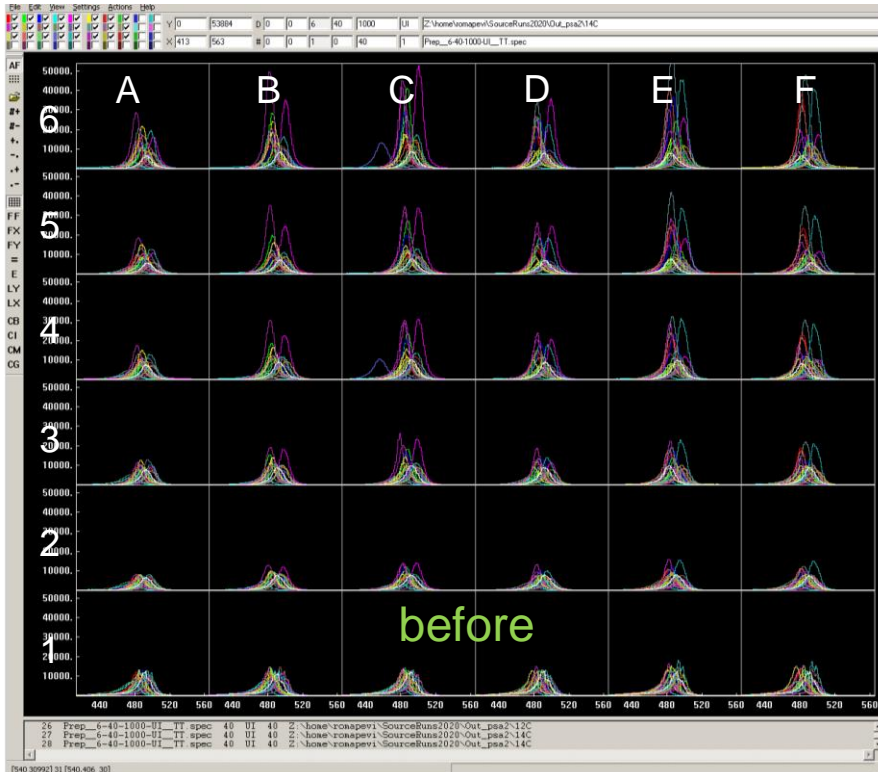
4. Time alignment segments to core

Verification with femul replay



Prep__6-40-1000-UI__TT.spec [1][0-35]

Prep__6-40-1000-UI__TT.spec [5][0-35]

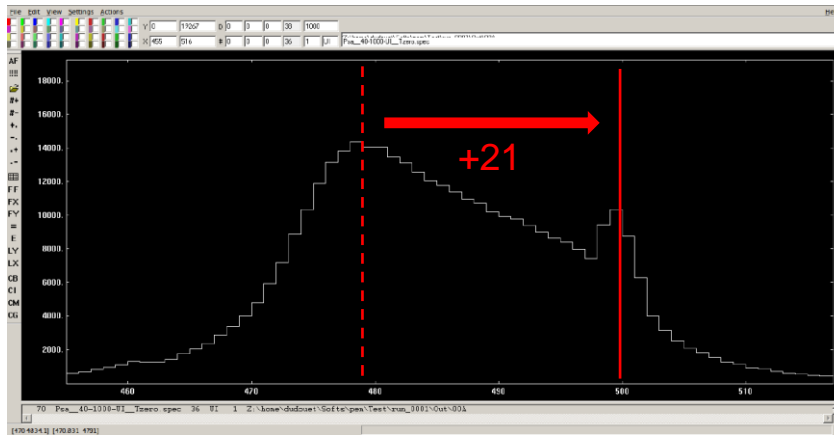


Preprocessing Filter

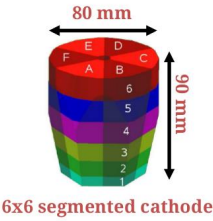
5. T0 alignment

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



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



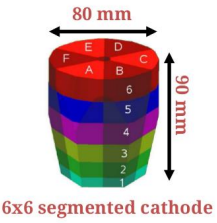
PreprocessingFilterPSA.conf

#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					

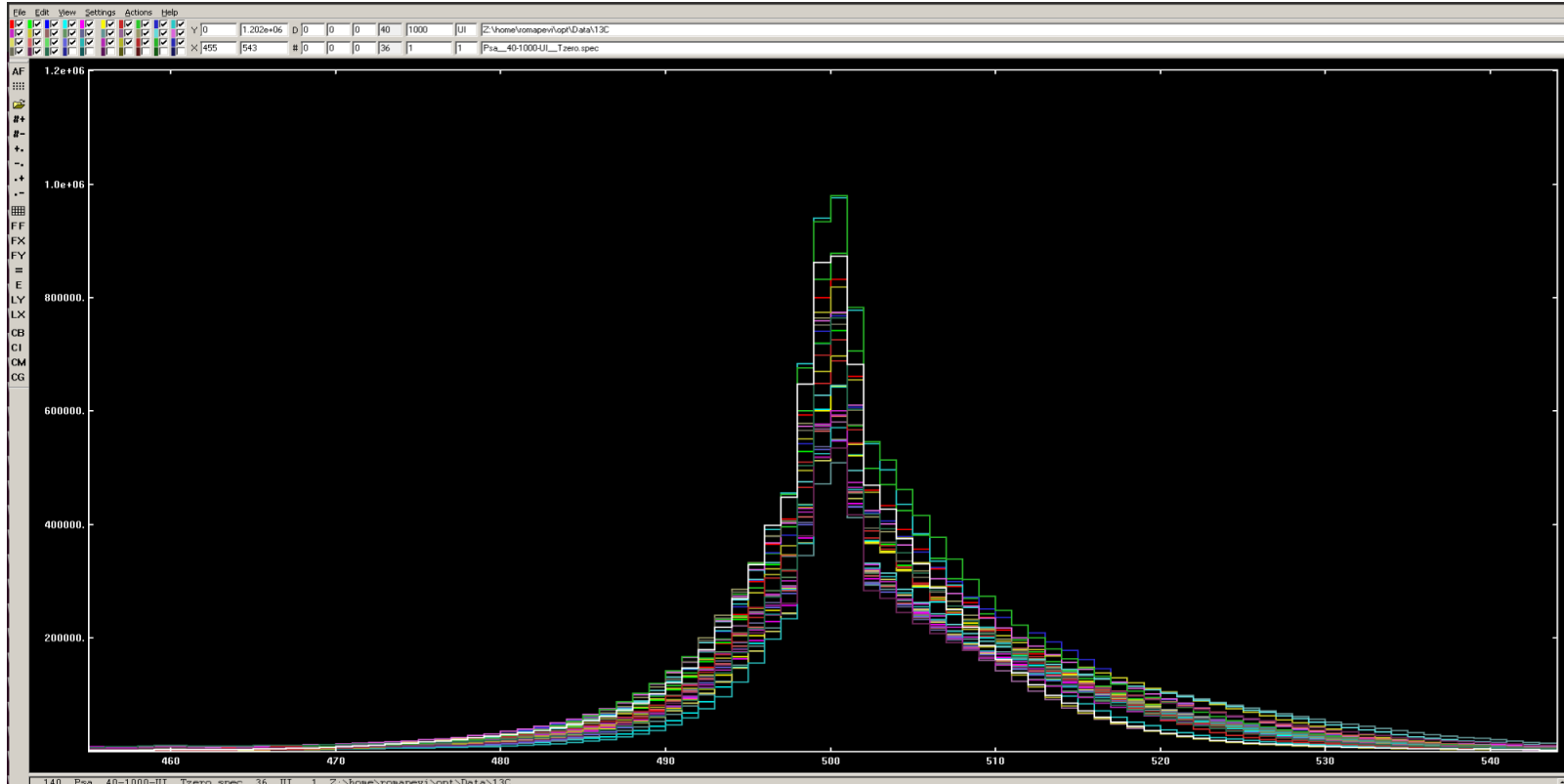
Preprocessing Filter

5. T0 alignment

Verification with femul replay

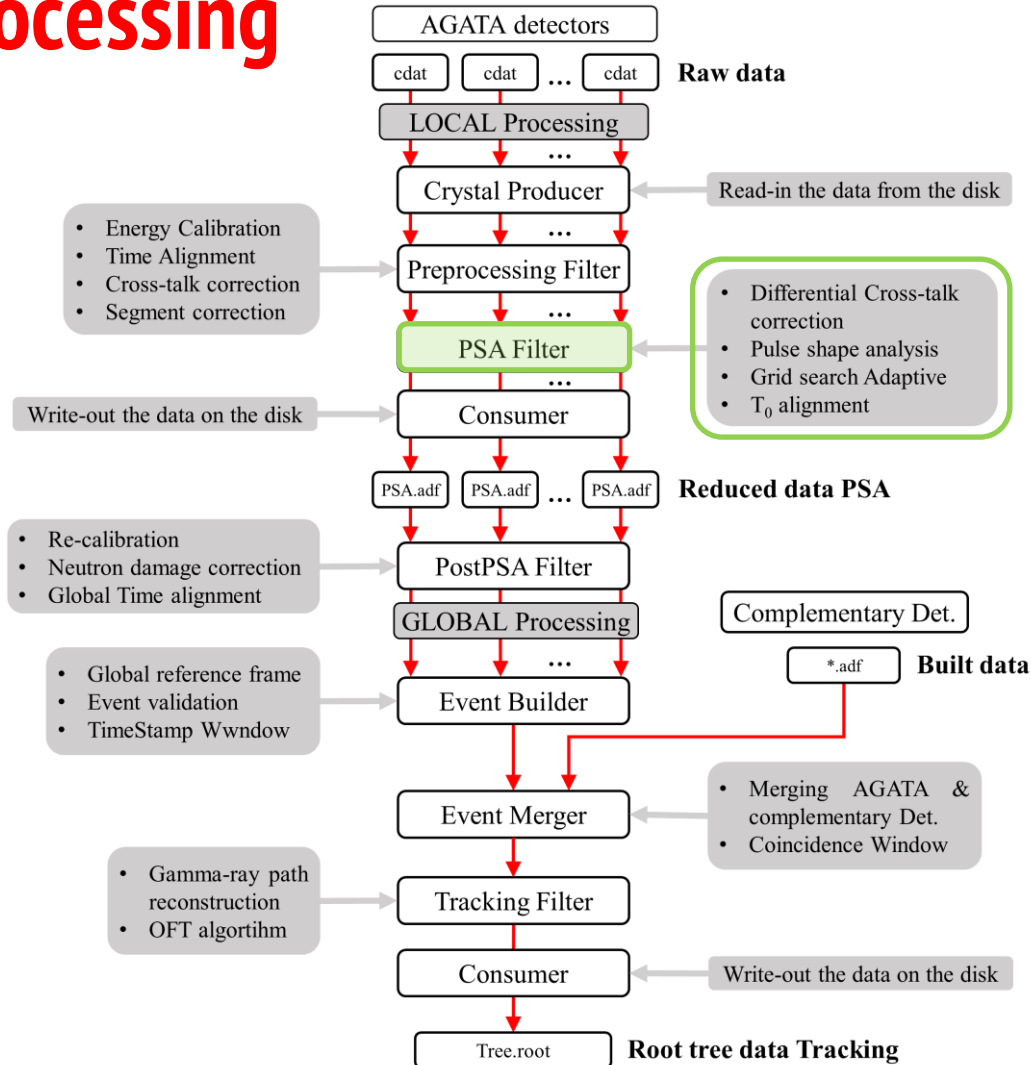


Psa_40-1000-UI_Tzero.spec [36]



Local Level Processing

Narval actors



Local Level Processing

PSA Filter

All up to this points cannot be redone after the experiment (!)

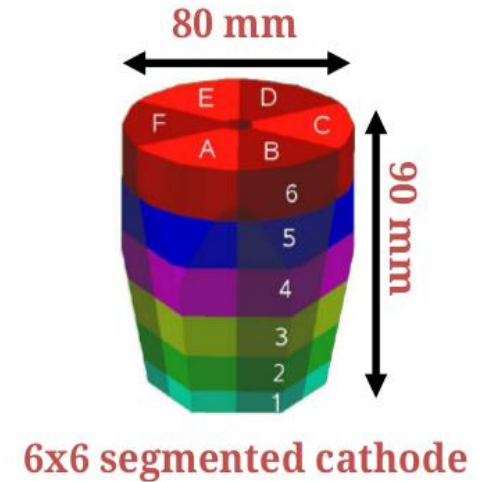
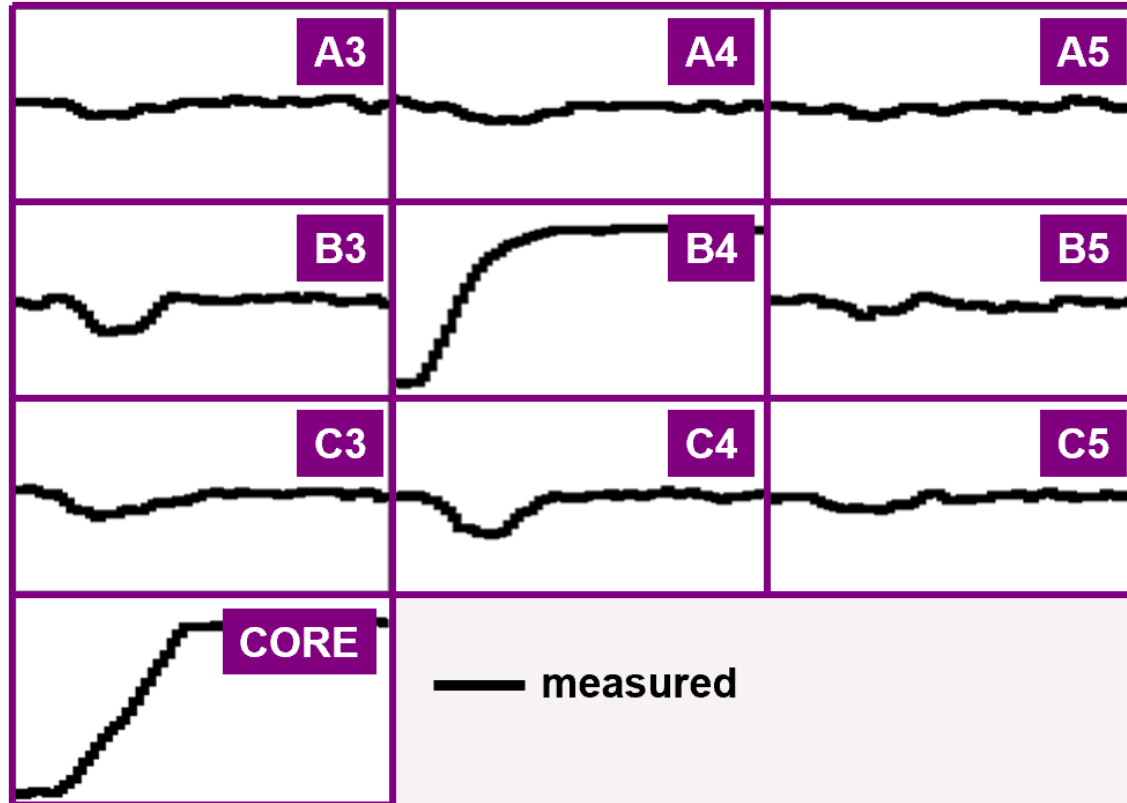
- Reads the simulated basis (ADL)
- Applies the preamp response function to the simulated traces
- Performs the signal decomposition:
 - Implemented algorithm: **Grid Search**
 - As a full grid search
 - As a coarse/fine search (AGS)
- Reduces size of data by factor ~80
- Provides the parameters for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

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

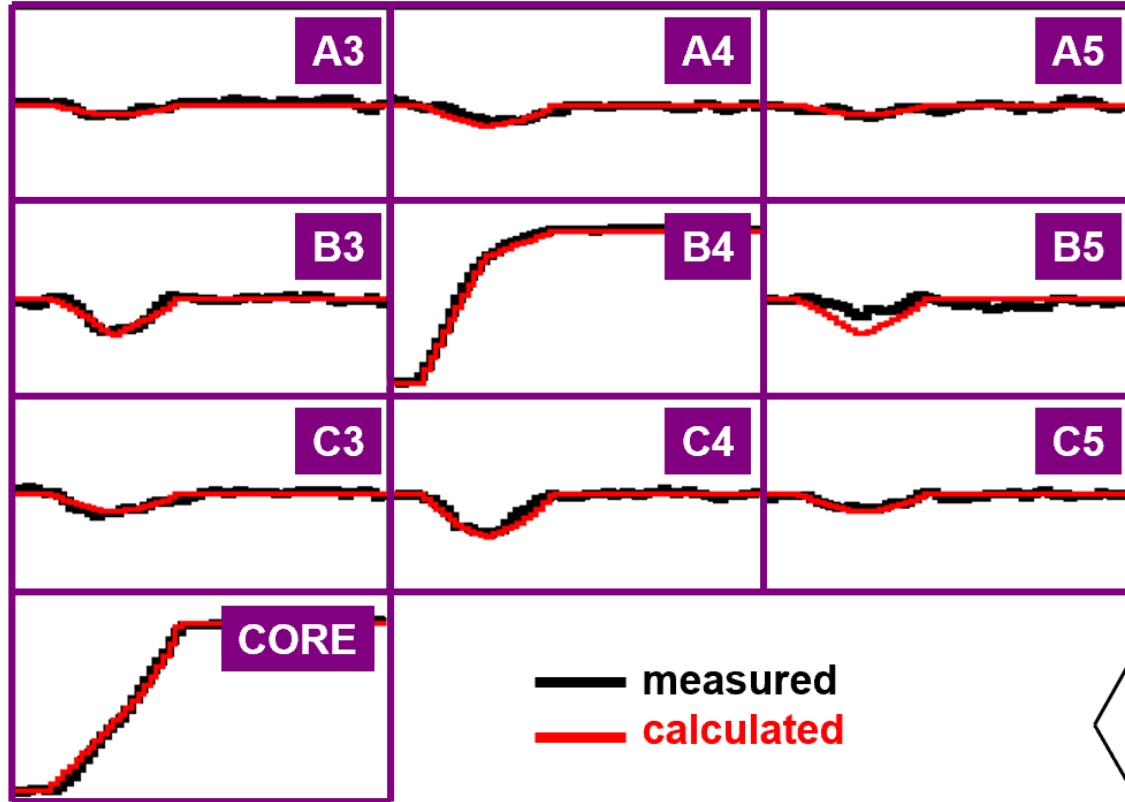
PSA Filter



791 keV deposited in segment B4

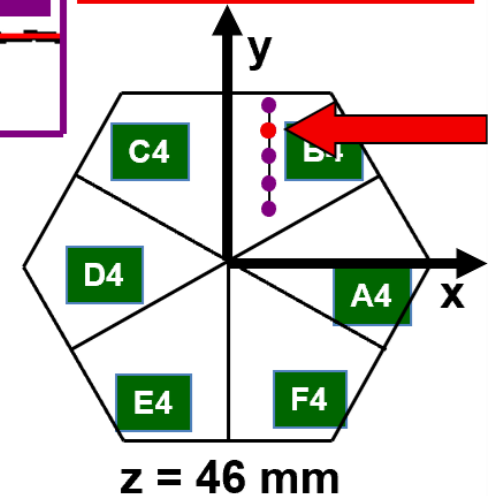
Local Level Processing

PSA Filter



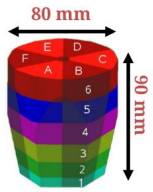
**Result of
Grid Search
Algorithm**
(10,25,46)

791 keV deposited in segment B4



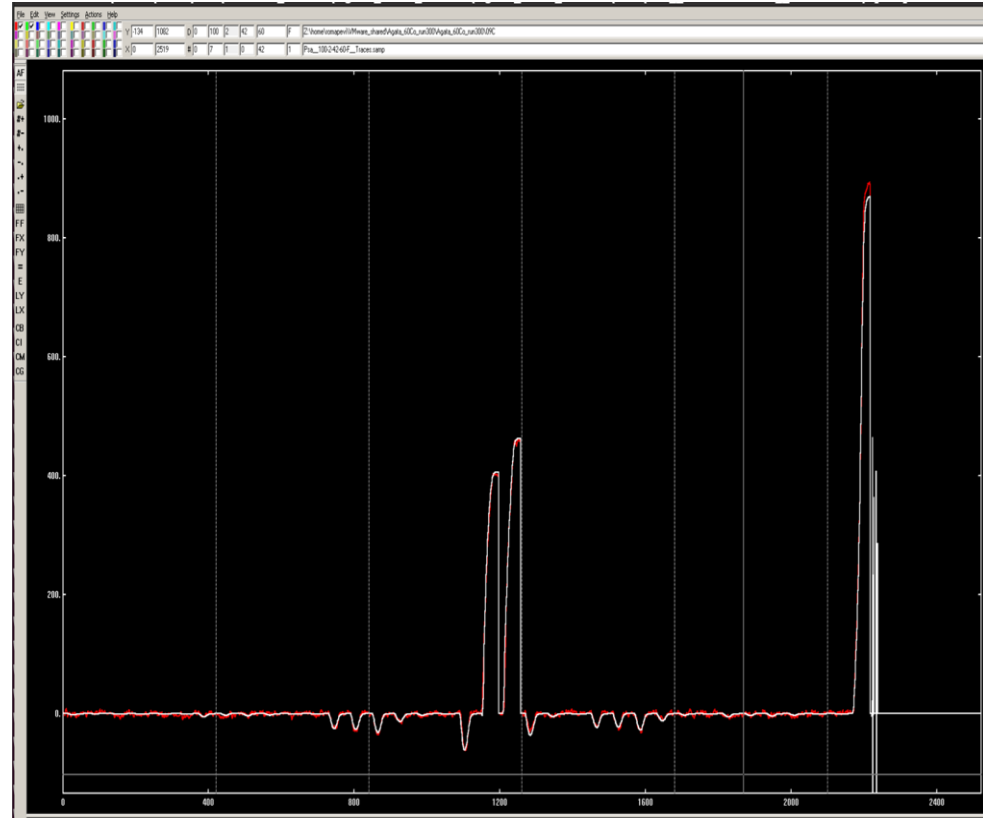
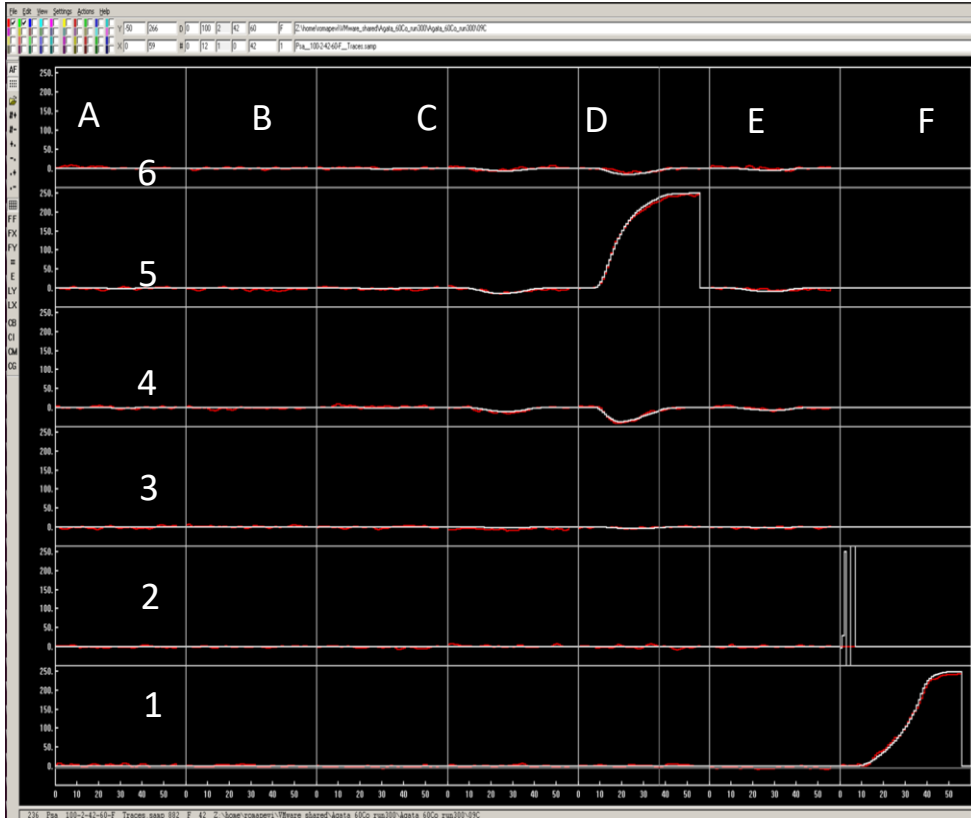
PSA Filter

Traces



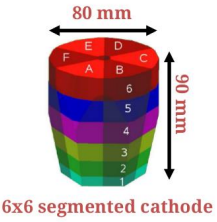
6x6 segmented cathode

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

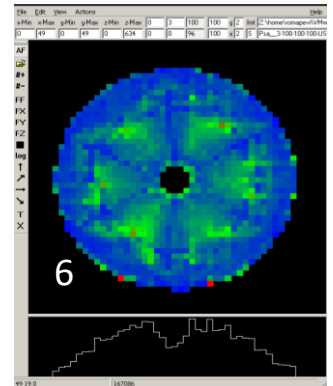
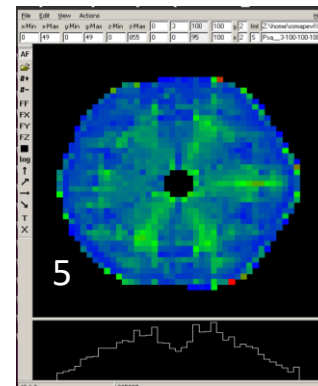
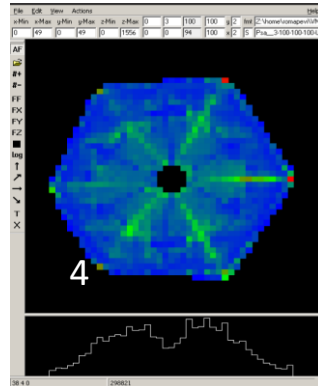
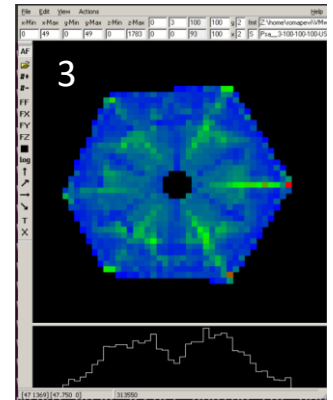
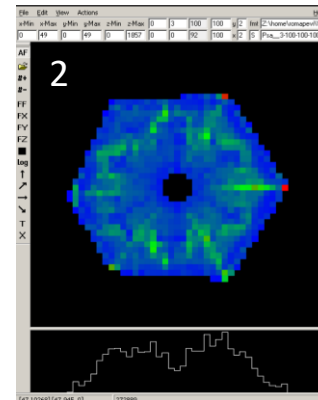
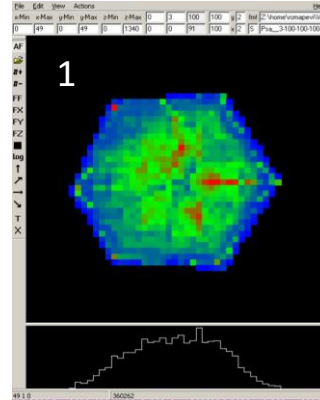
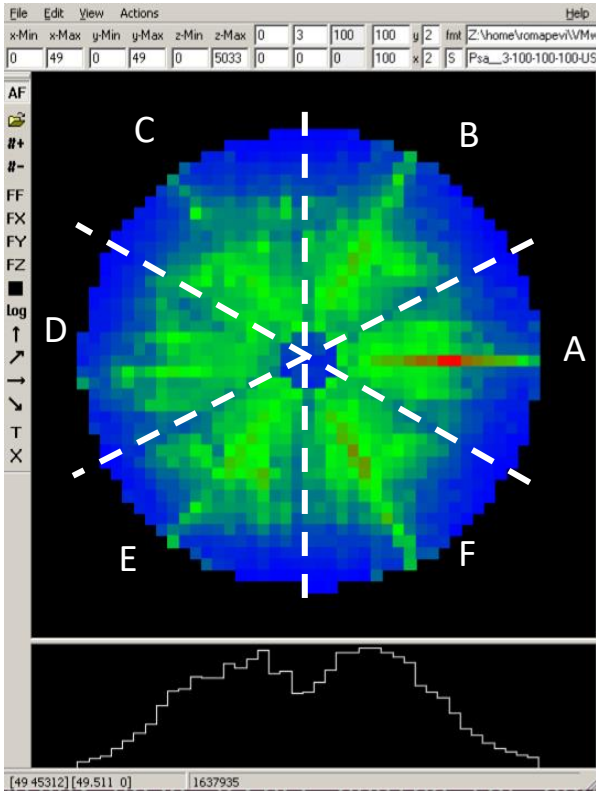


PSA Filter

Hit pattern

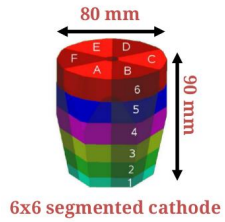


Psa__3-100-100-100-US__XYZ.matr [0 projection XY][0 all] [91-96 slices of segments]

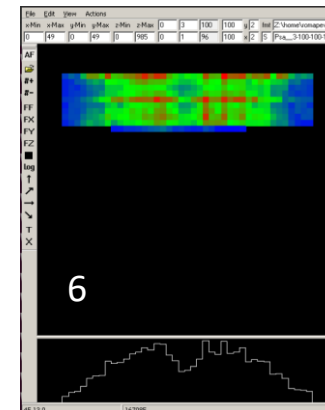
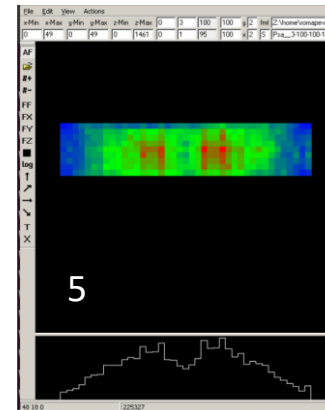
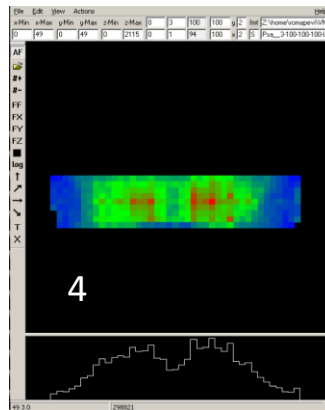
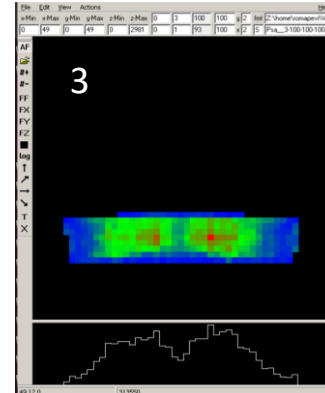
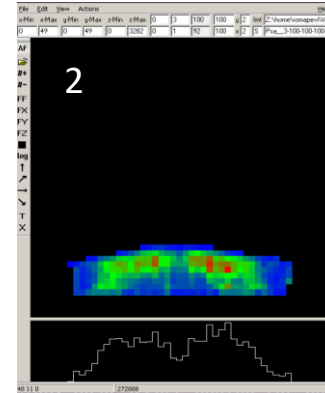
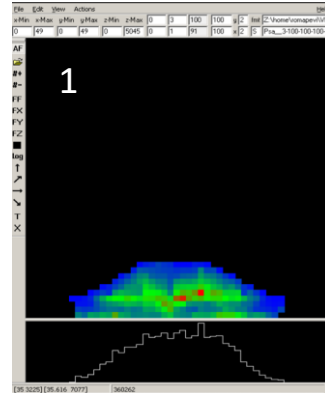
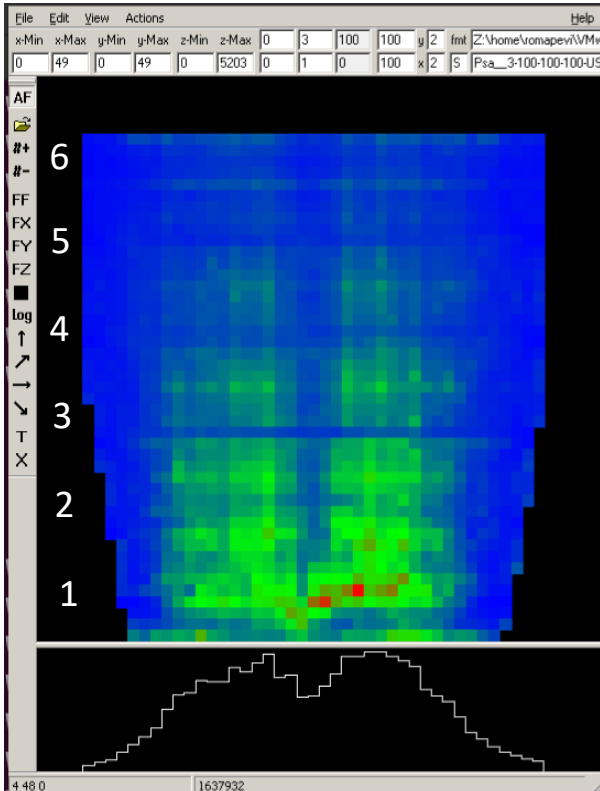


PSA Filter

Hit pattern

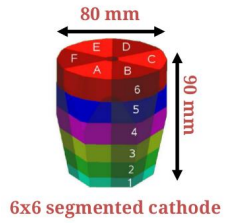


Psa__3-100-100-100-US__XYZ.matr [1 projection XZ][0 all] [91-96 slices of segments]

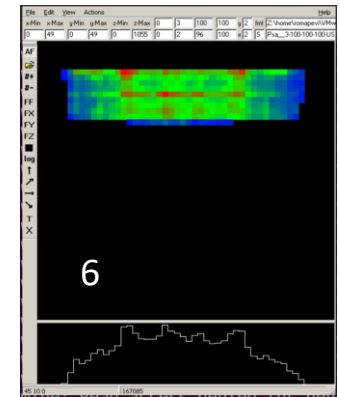
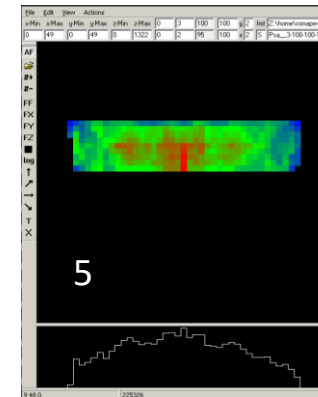
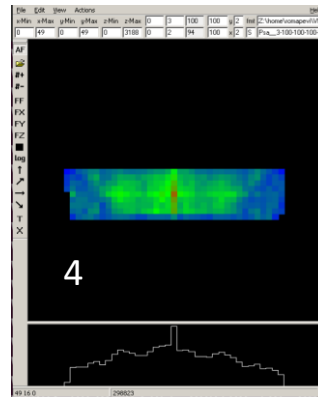
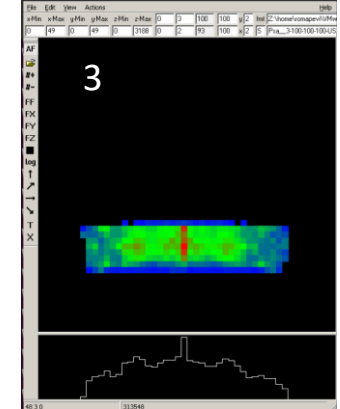
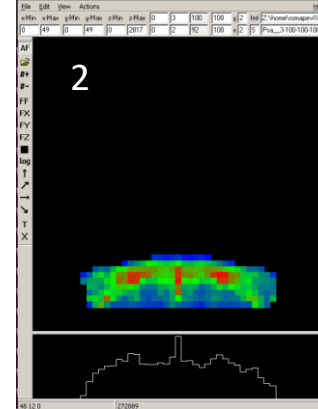
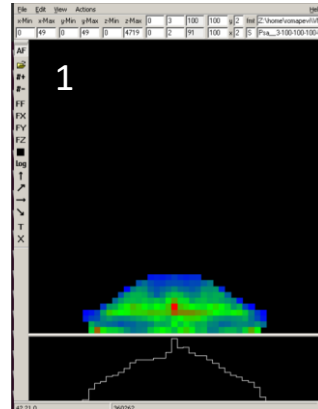
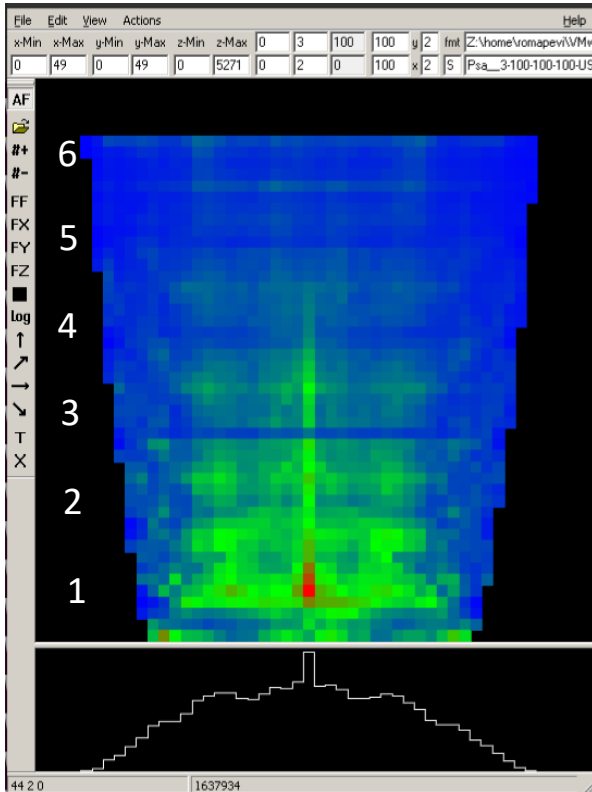


PSA Filter

Hit pattern

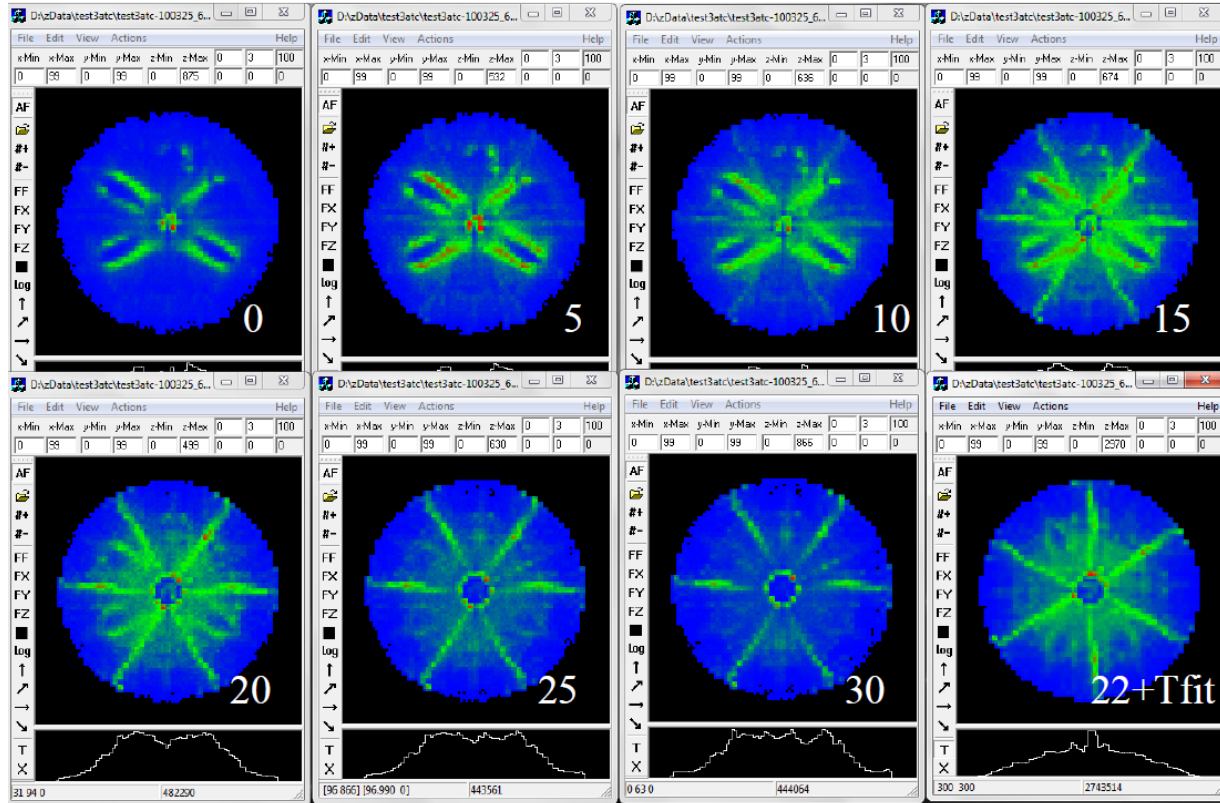


Psa__3-100-100-100-US__XYZ.matr [2 projection YZ][0 all] [91-96 slices of segments]



PSA Filter

T0 effect



Effect of time position of the experimental trace

Thank you!

AGATA Analysis Workshop 2023
Preprocessing Calibration

R.M. Pérez-Vidal

12/09/2023, Legnaro

Questions?