# AGATA Analysis Workshop 2025

## PostPSA Calibration. Hands on

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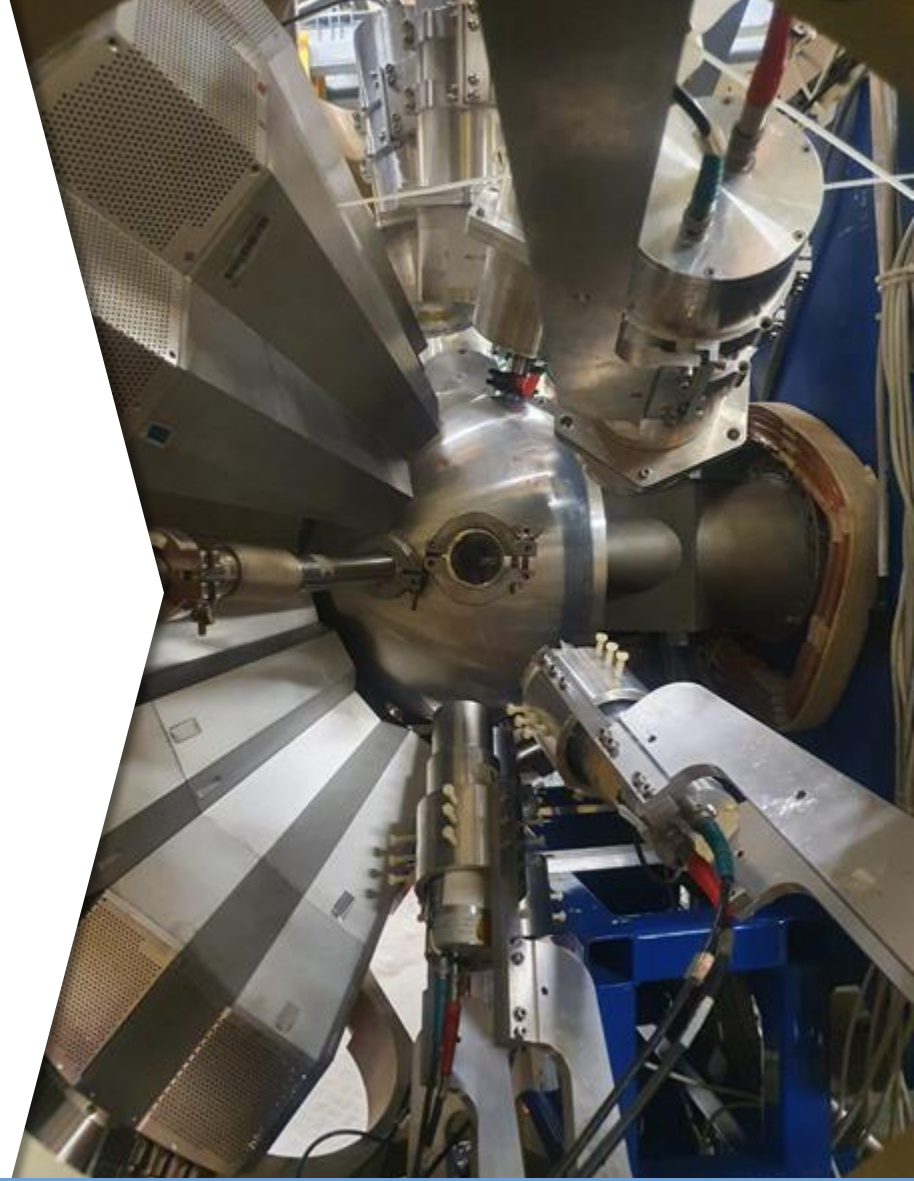
# Hands On

## AGATA configuration

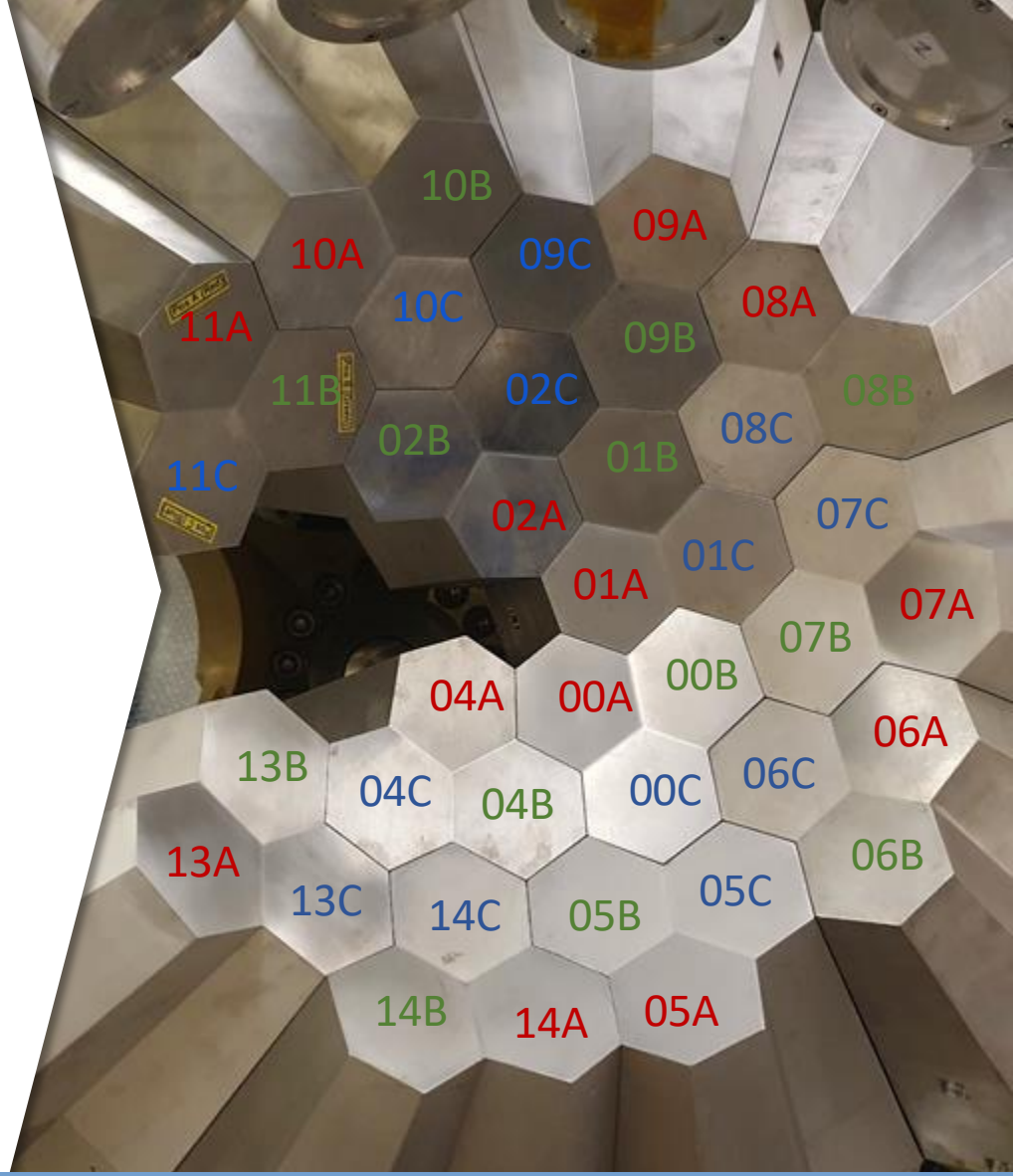
- AGATA data set taken in July 2024
- Counting rate per crystal : 1-2 kHz
- MWD-risetime: 2.5 µs
- Chamber closed, Without absorbers
- Position: Nominal
- Data sets with $^{60}$Co, $^{152}$Eu and target ($^{66}$Ga)



# Hands On

## Data sets in example directory

- **run_1003_60Co_ATC02 (33Gb)**
  - Neutron damage correction
  - 1 ATC: 02A 02B 02C with traces
- **run_1002_152Eu_ATC02 (3.7Gb)**
  - Energy recalibration
  - 1 ATC: 02A 02B 02C
- **run_1010_60Co (Gb)**
  - Global time aligment
  - 36 ATC: 00 01 02 04 05 06 07 08 09 10 11 14
- **run_1010_66Ga_3ATC (8.4Gb)**
  - Tracking
  - 3 ATC: 02 10 11



# Hands On

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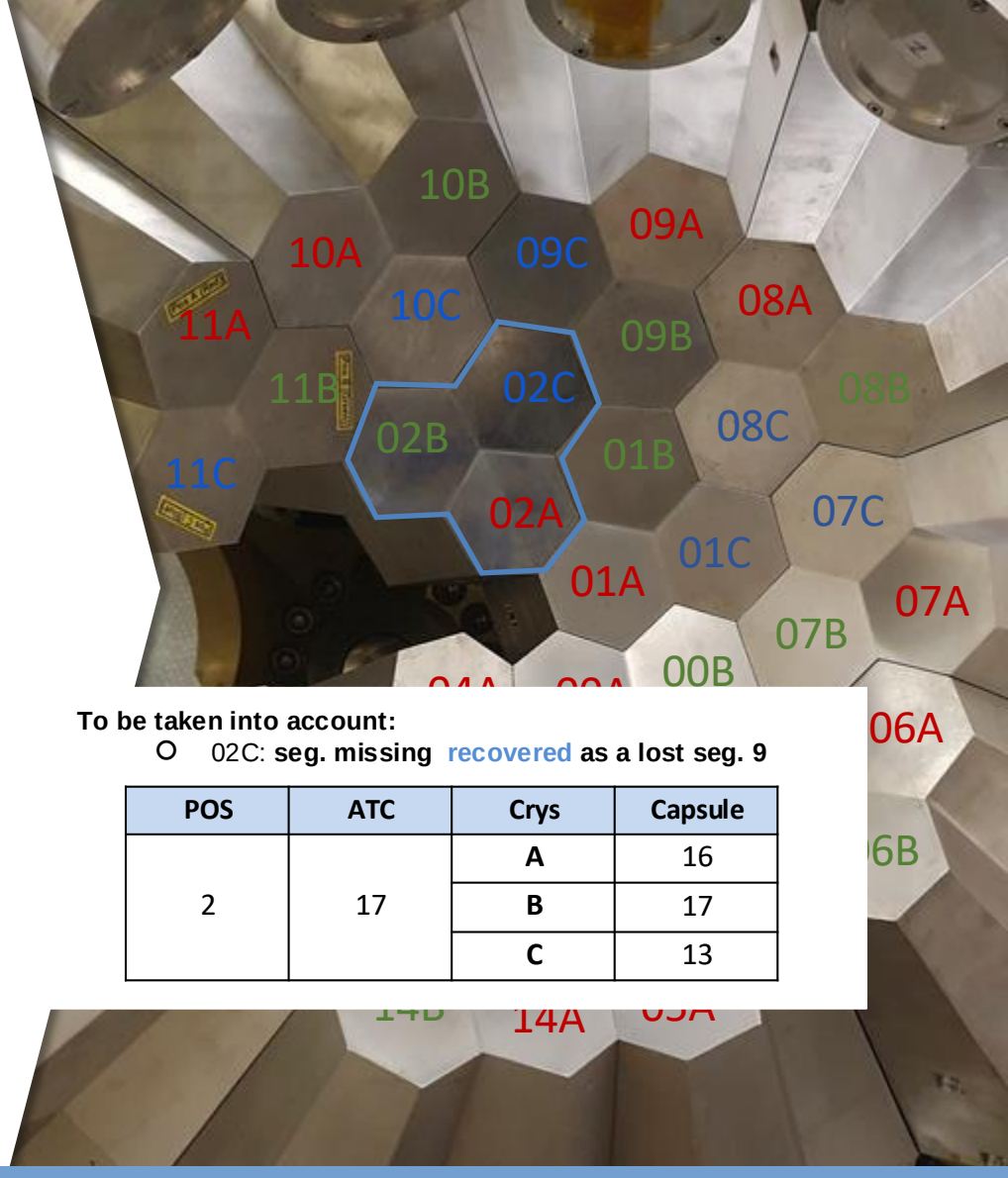
- **run_1002_152Eu_ATC02 (3.7Gb)**
  - Energy recalibration
  - 1 ATC: 02A 02B 02C
- **run_1010_60Co (3.2Gb)**
  - Global time alignment
  - 36 ATC: 00 01 02 04 05 06 07 08 09 10 11 14
- **run_1010_66Ga_3ATC (8.4Gb)**
  - Tracking
  - 3 ATC: 02 10 11




**To be taken into account:**

- 02C: **seg. missing recovered as a lost seg. 9**

| POS | ATC | Crys | Capsule |
|---|---|---|---|
| 2 | 17 | **A** | 16 |
| | | **B** | 17 |
| | | **C** | 13 |

# Hands On

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  - 36 ATC: 00 01 02 04 05 06 07 08 09 10 11 14
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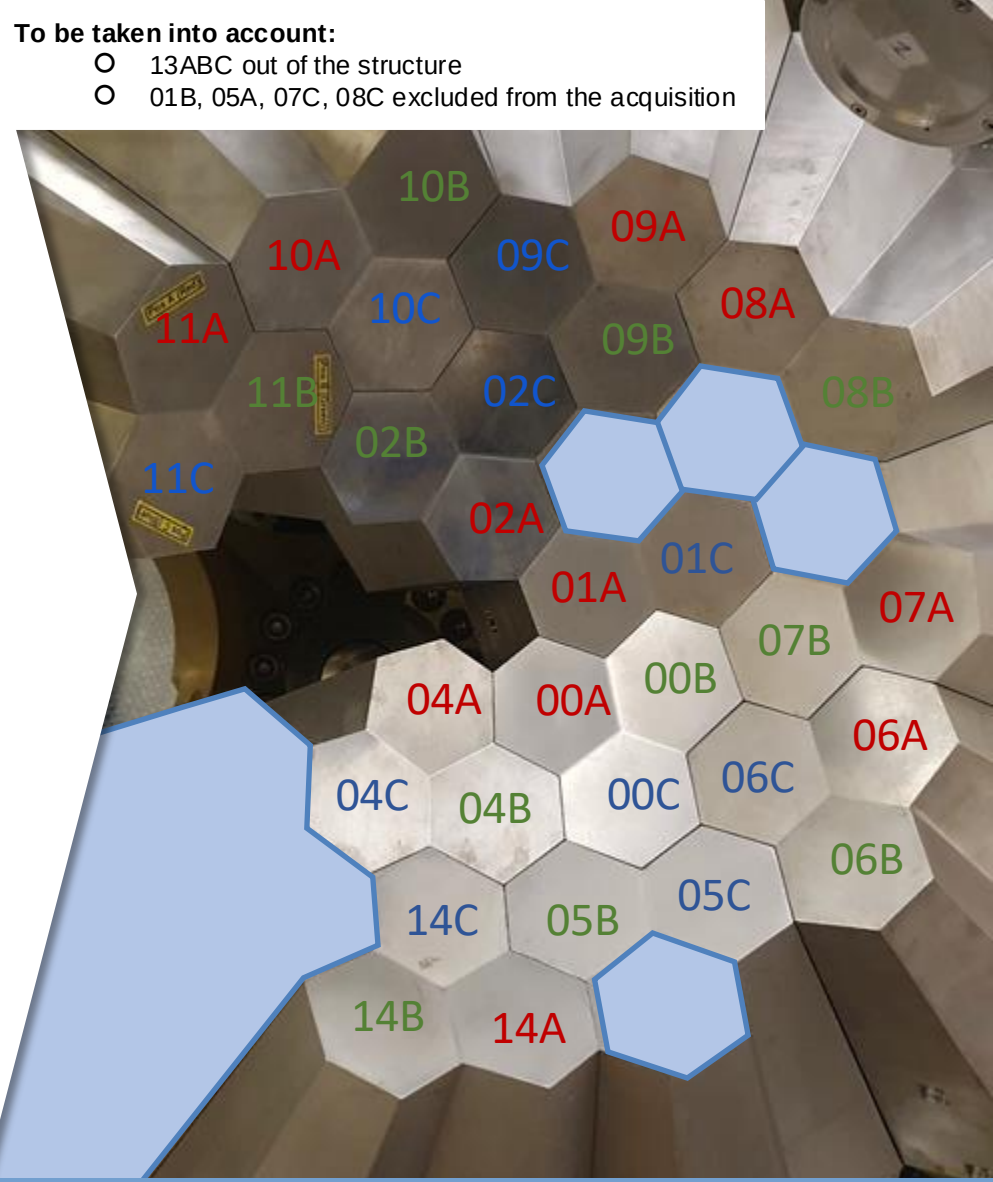
  - Tracking
  - 3 ATC: 02 10 11

**To be taken into account:**

- 13ABC out of the structure
- 01B, 05A, 07C, 08C excluded from the acquisition



# Hands On

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  - Global time alignment
  - 36 ATC: 00 01 02 04 05 06 07 08 09 10 11 14
- **run_1010_66Ga_3ATC (8.4Gb)**
  - Tracking
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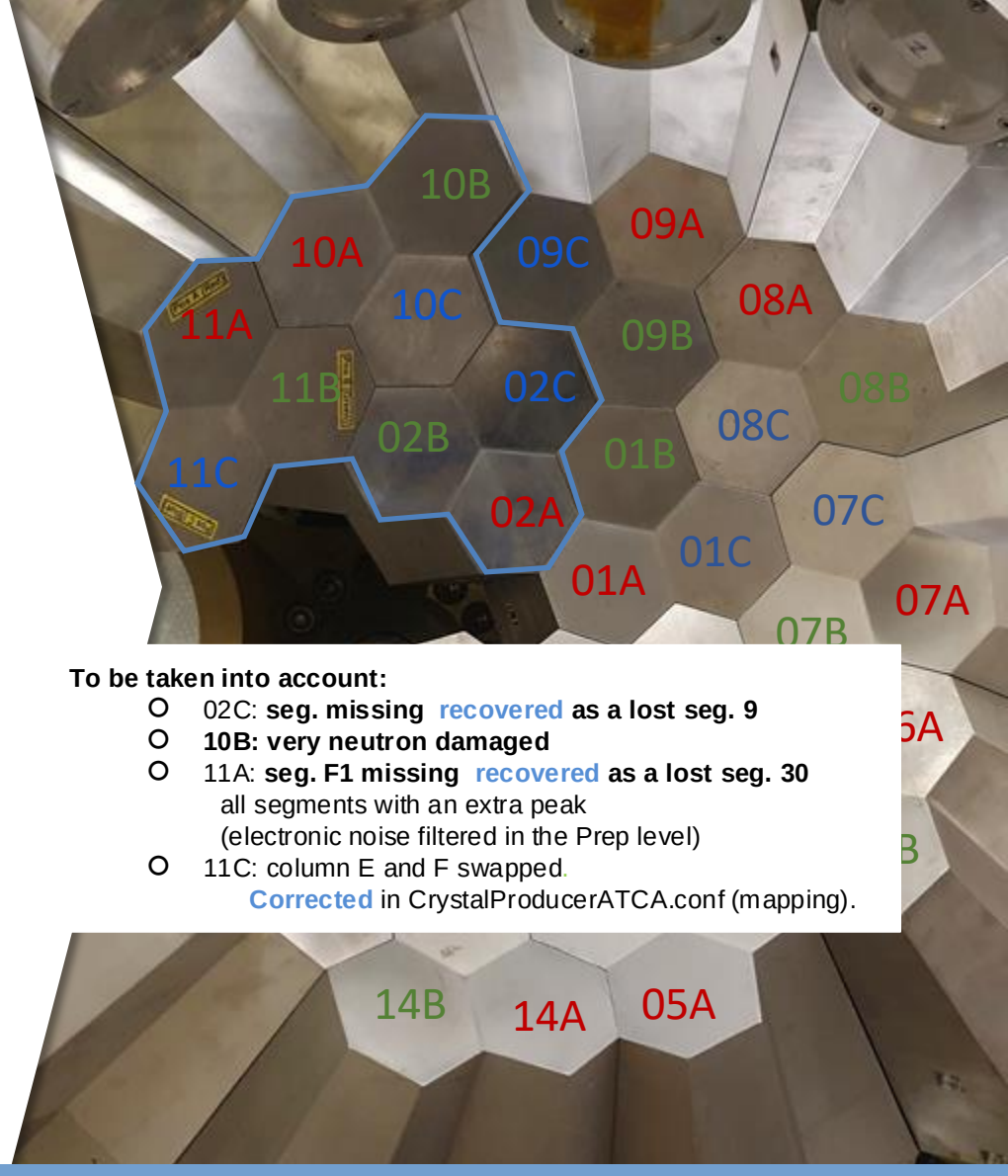



**To be taken into account:**

- 02C: **seg. missing** recovered **as a lost seg. 9**
- **10B: very neutron damaged**
- 11A: **seg. F1 missing** recovered **as a lost seg. 30**
  all segments with an extra peak
  (electronic noise filtered in the Prep level)
- 11C: column E and F swapped.
  **Corrected** in CrystalProducerATCA.conf (mapping).

# Hands On

## Files in example directory

- **In run_*:**
  - Conf/ — configurations, read during initialization
  - Data/ — part of original data and full PSA hits
  - Out/ — created by gen_conf.py
- **bases_ADL/** — calculated signal basis for 02A (A016), 02B (B017) 02C (C013)
- **In TemplatePrep/**
  - Topology_Local.conf — using Data/*/event_mezzdata.cdat.0000
  - Topology_Global.conf — using Data/*/psa_0000.adf
  - Topology_Global_Tree.conf — using Data/*/psa_0000.adf
  - gen_conf.py — generator of configuration
  - ADF.conf — definition of adf frames used for this analysis
  - 1-Neutron.sh — some analysis scripts
  - 2-RecalSegs.sh
  - 3-Recal_CC-SumSeg.sh
  - 4-GlobalTime.sh
  - solveTT.py
  - colupdate.py

# Hands On

## Files in example directory: run_1003_60Co

**Neutron Damage correction**

- Conf/ 02A

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

- Data/02A

  - **event_mezzdata.cdat.0000**
  - **event_energy.bdat.0000**
  - **psa_0000.adf**

  - Prod__100-42-100-S__Traces.samp
  - Prod__38-16384-UI__Baseline.spec
  - Prod__4-38-32768-UI__Ampli.spec

  - Prep__100-44-100-S__Traces.samp
  - 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

  - Psa__100-2-42-60-F__Traces.samp
  - 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
  - **Psa__0-16-F__Hits.fdat**

# Hands On

## Files in example directory: run_1011_152Eu

**Recalibration**

- Conf/ 02A

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

- Data/02A

  - **psa_0000.adf**

  - Prod__38-16384-UI__Baseline.spec
  - Prod__4-38-32768-UI__Ampli.spec
  - 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
  - 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

# Hands On

## Files in example directory: run_1010_60Co

**Global Time Aligment**

- Conf/ 00A

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

- Data/00A

  - **psa_0000.adf**

# Hands On

## Files in example directory: Topologies

Topology_Local.conf

```
LOOP CRYS 02A 02B 02C

Chain 4     CRYS
Producer    CrystalProducerATCA
Filter      PreprocessingFilterPSA
Filter      PSAFilter
Consumer    BasicAFC
ENDLOOP
```

# Hands On

## Files in example directory: Topologies

Topology_Global.conf

```
LOOP CRYS 02A 02B 02C

Chain 3       CRYS
Producer      BasicAFP
Filter        PostPSAFilter
Dispatcher    EventBuilder
ENDLOOP

Chain 2       Builder/
Builder       EventBuilder
#Consumer     BasicAFC
Dispatcher    EventMerger

Chain 3       Merger/
Builder       EventMerger
Filter        TrackingFilterOFT
Consumer      None
```

# Hands On

## Files in example directory: Topologies

Topology_Global_Tree.conf

```
LOOP CRYS 02A 02B 02C

Chain 3       CRYS
Producer      BasicAFP
Filter        PostPSAFilter
Dispatcher    EventBuilder
ENDLOOP

Chain 2       Builder/
Builder       EventBuilder
#Consumer     BasicAFC
Dispatcher    EventMerger

Chain 3       Merger/
Builder       EventMerger
Filter        TrackingFilterOFT
Consumer      TreeBuilder
```

# Data Processing

## Useful programs. PostPSA Filter

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
- **SortPsaHits:** Sort of PSA hits (special format) to determine neutron damage correction parameters
- **solveTT.py:** Optimize time alignment of “equal” detectors
- **colupdate.py**: change columns of coefficients between files

# TkT & Mat

## Download the software

After installing the agata software by following this procedure (https://agata.pages.in2p3.fr/handbook/install-P1/install ) you will find the software to visualize the spectra dumped by the actors in the AGAPRO package (**GammaSoftware/agapro/zUseful**):

**TkT** spectrum viewer (**TkT64.exe TkT.exe**)
**Mat** matrix viewer (**Mat64.exe, Mat.exe)**

To execute them:

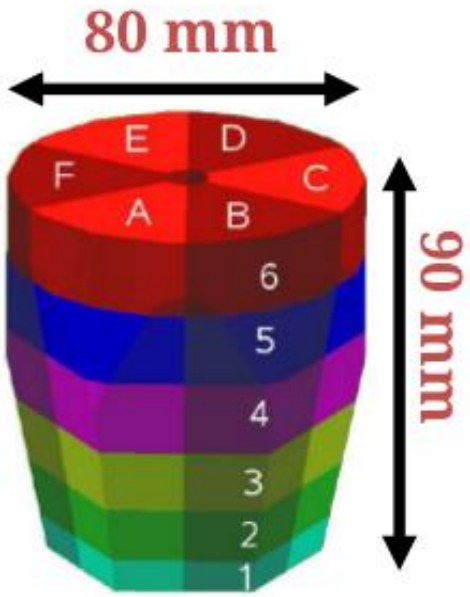
```
wine TkT64.exe
wine Mat64.exe
```

To the access to the program you can make an alias in your .bashrc

```
alias TkT='wine ~/YourPath/gammaSoftware/agapro/zUseful/TkT64.exe'
alias Mat='wine ~/YourPath/gammaSoftware/agapro/zUseful/Mat64.exe'
```

# TkT

## Channels correspondence after Replay

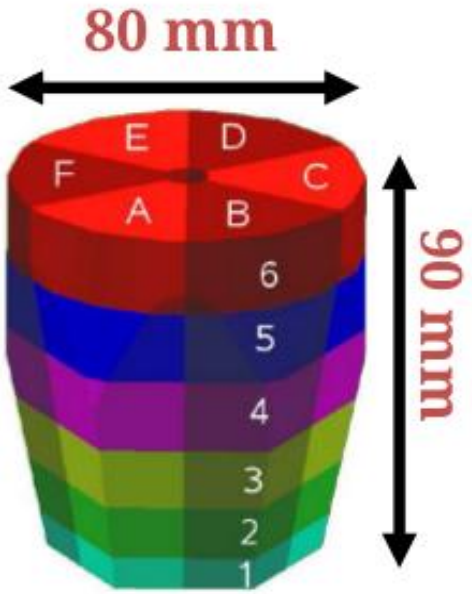



6x6 segmented cathode

| | | 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

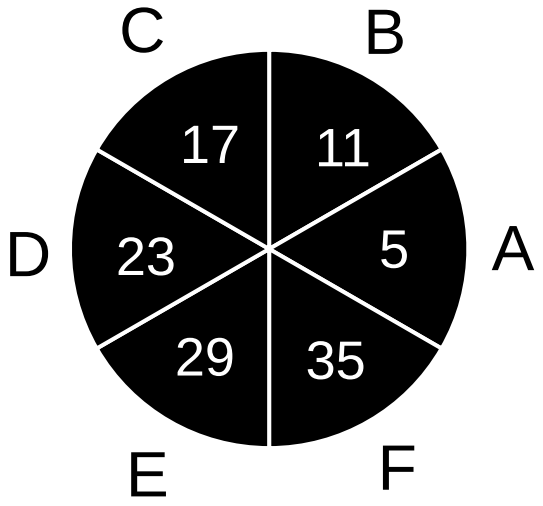



6x6 segmented cathode

TkT

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

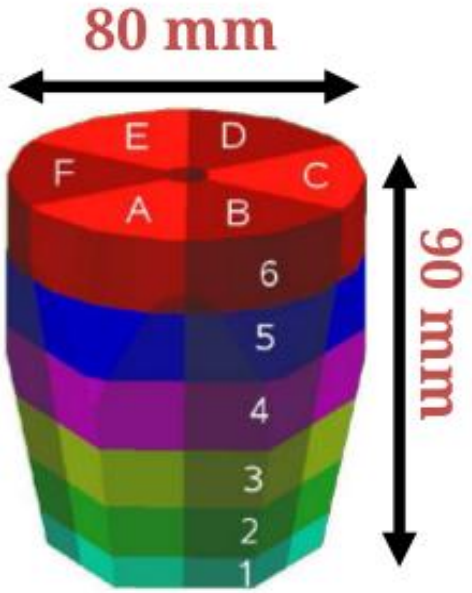
Mat




Slice 6

# TkT & Mat

## Channels correspondence after Replay

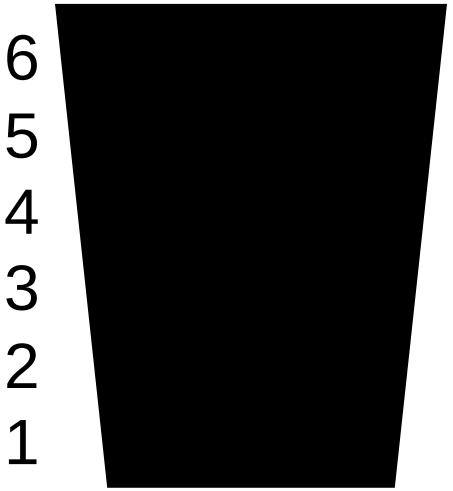



6x6 segmented cathode

TkT

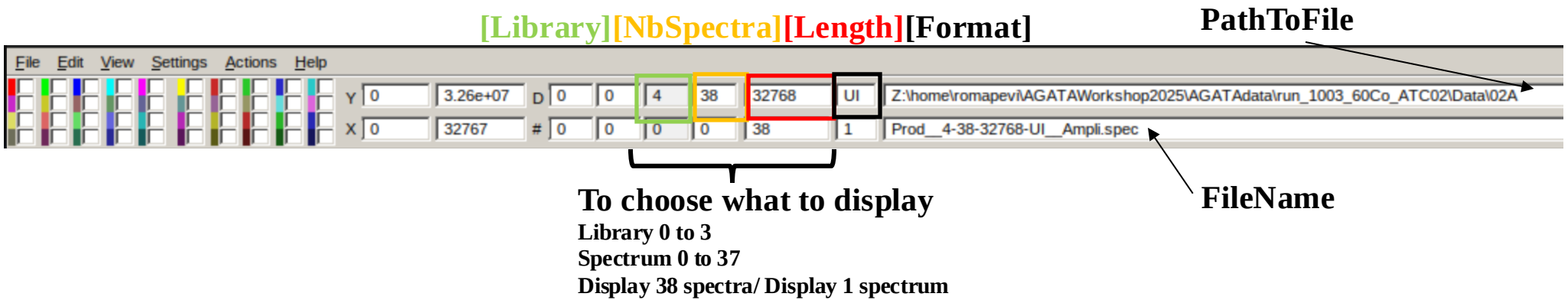
| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 6 | 5 | | | | | |
| 5 | 4 | | | | | |
| 4 | 3 | | | | | |
| 3 | 2 | | | | | |
| 2 | 1 | | | | | |
| 1 | 0 | 6 | 12 | 18 | 24 | 30 |

Mat



# TkT

## Reading the format




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

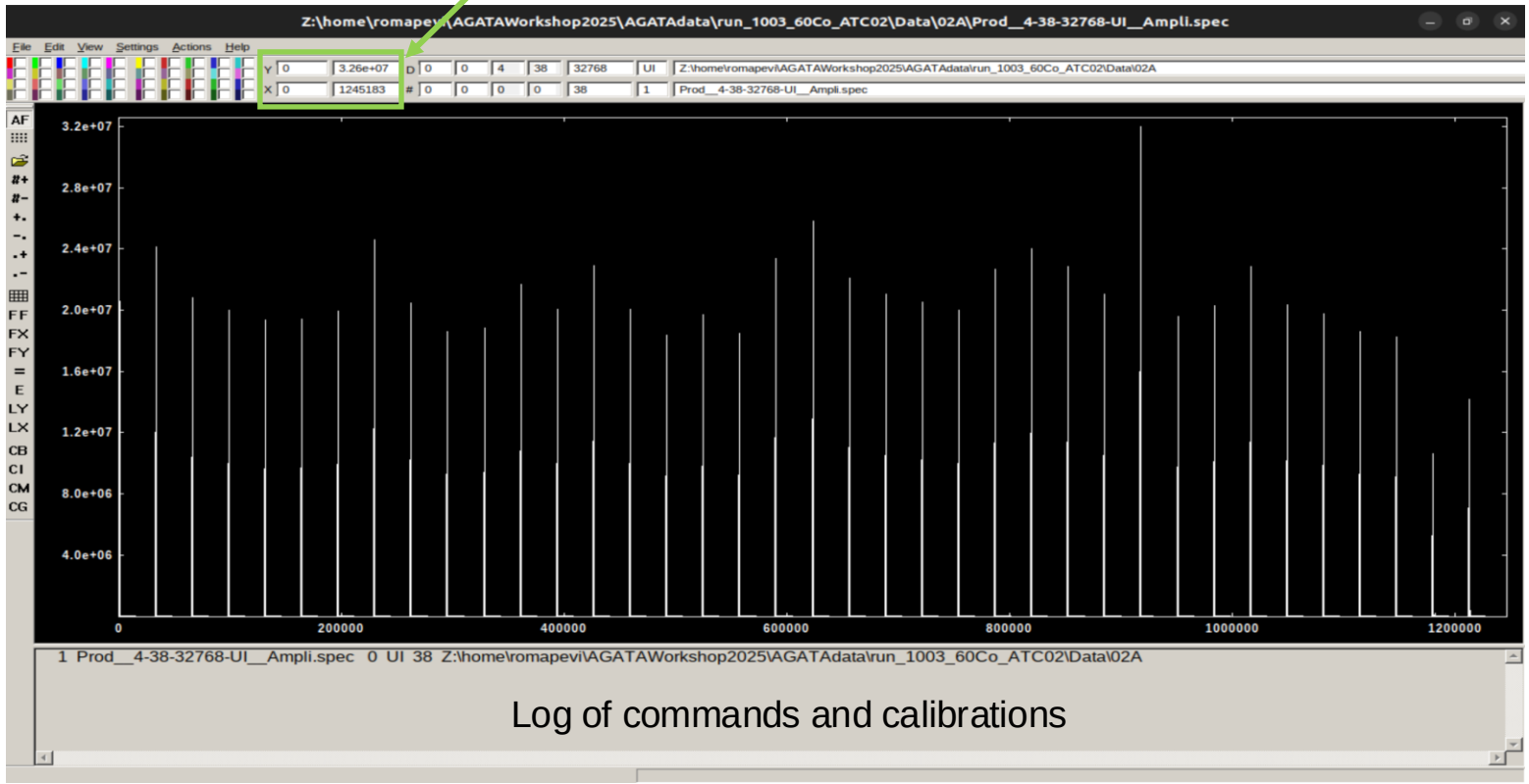
# TkT

## Some basics to get started

Boxes to store spectra

Axis ranges

Shortcuts

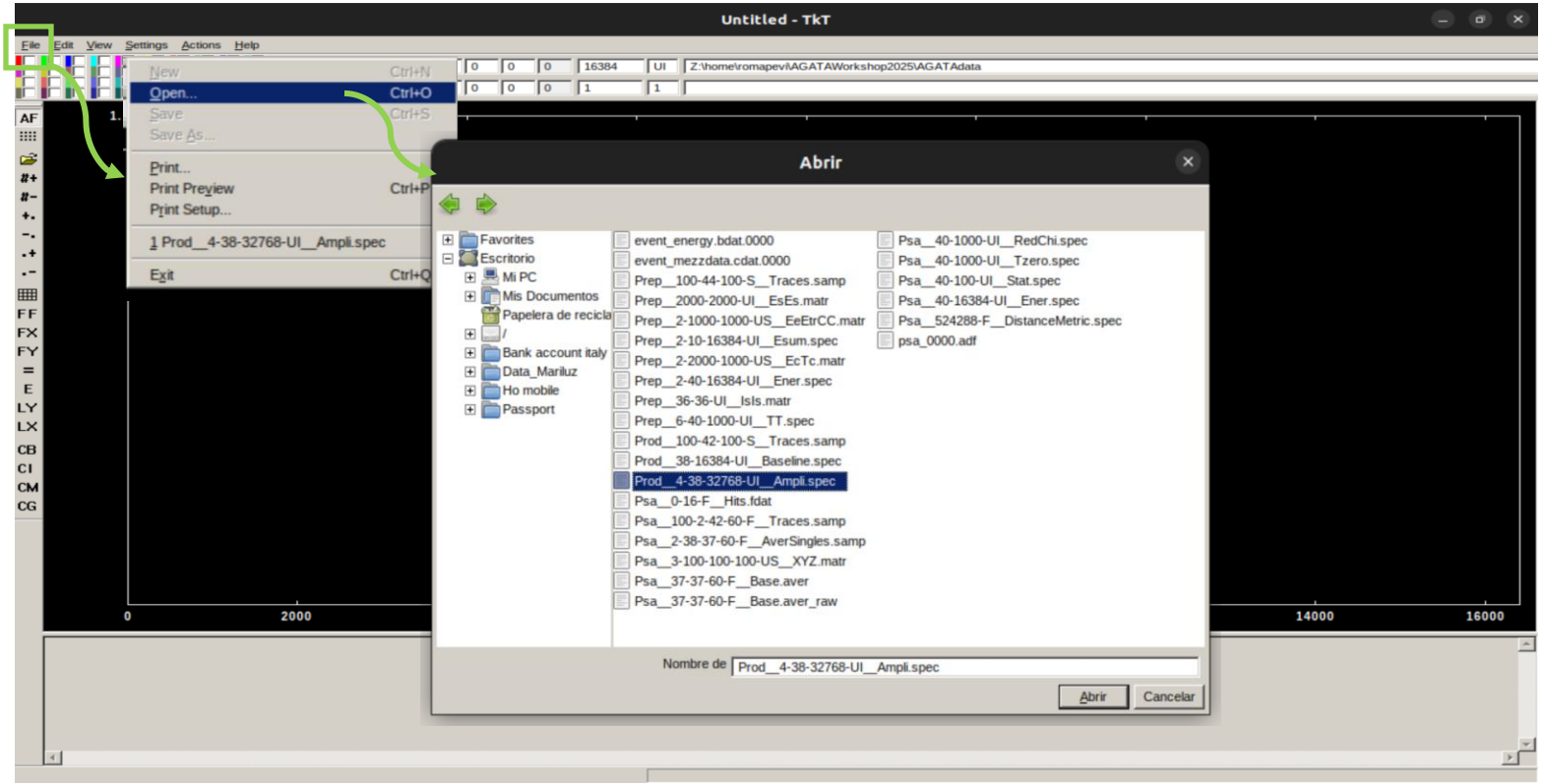



Log of commands and calibrations

# TkT

## How to open a file

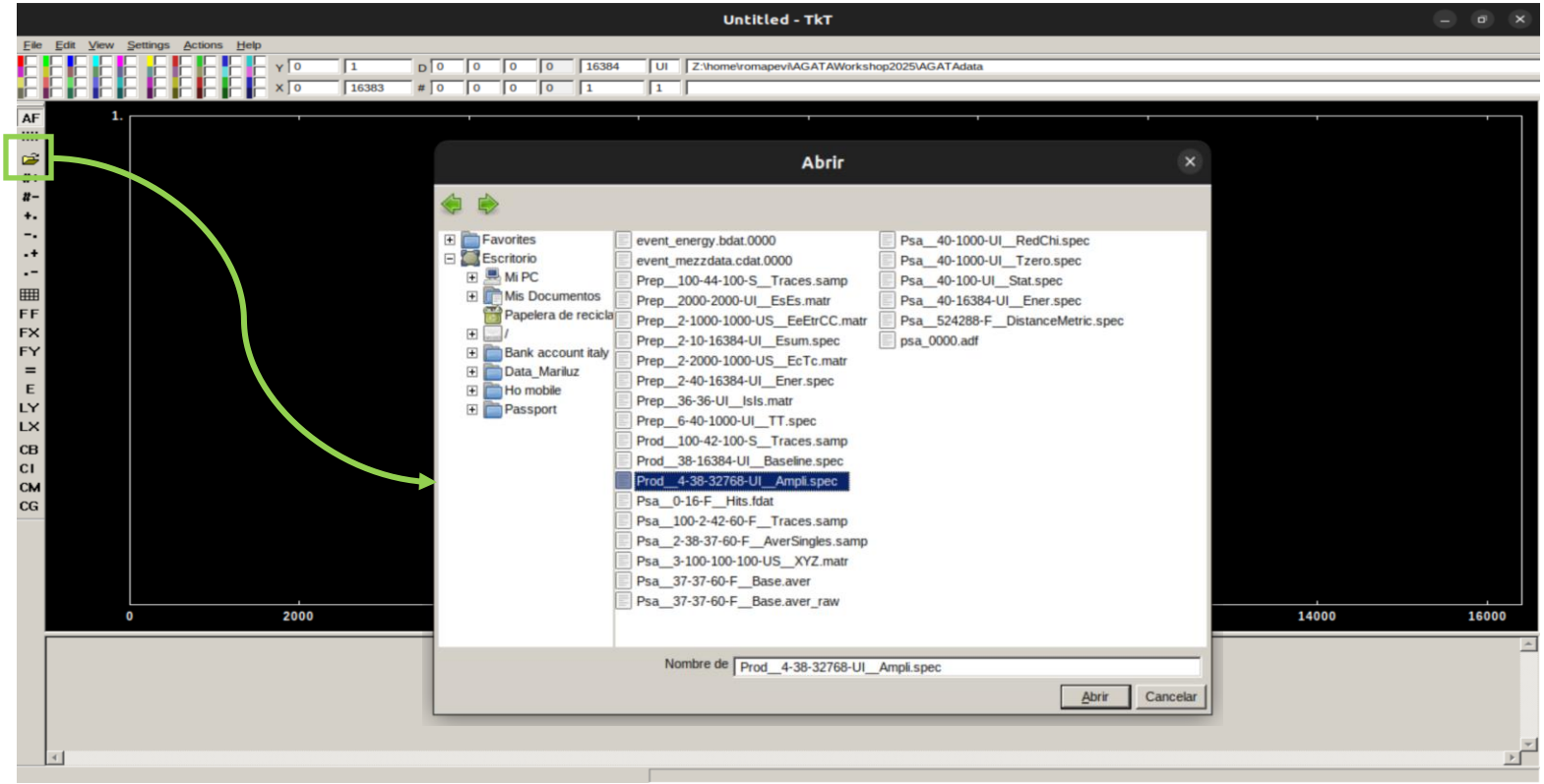
Execute TkT ➡ go to File ➡ Open ➡ select a file (e.g. Prod__4-38-32768-UI__Ampli.spec)



# TkT

## How to open a file

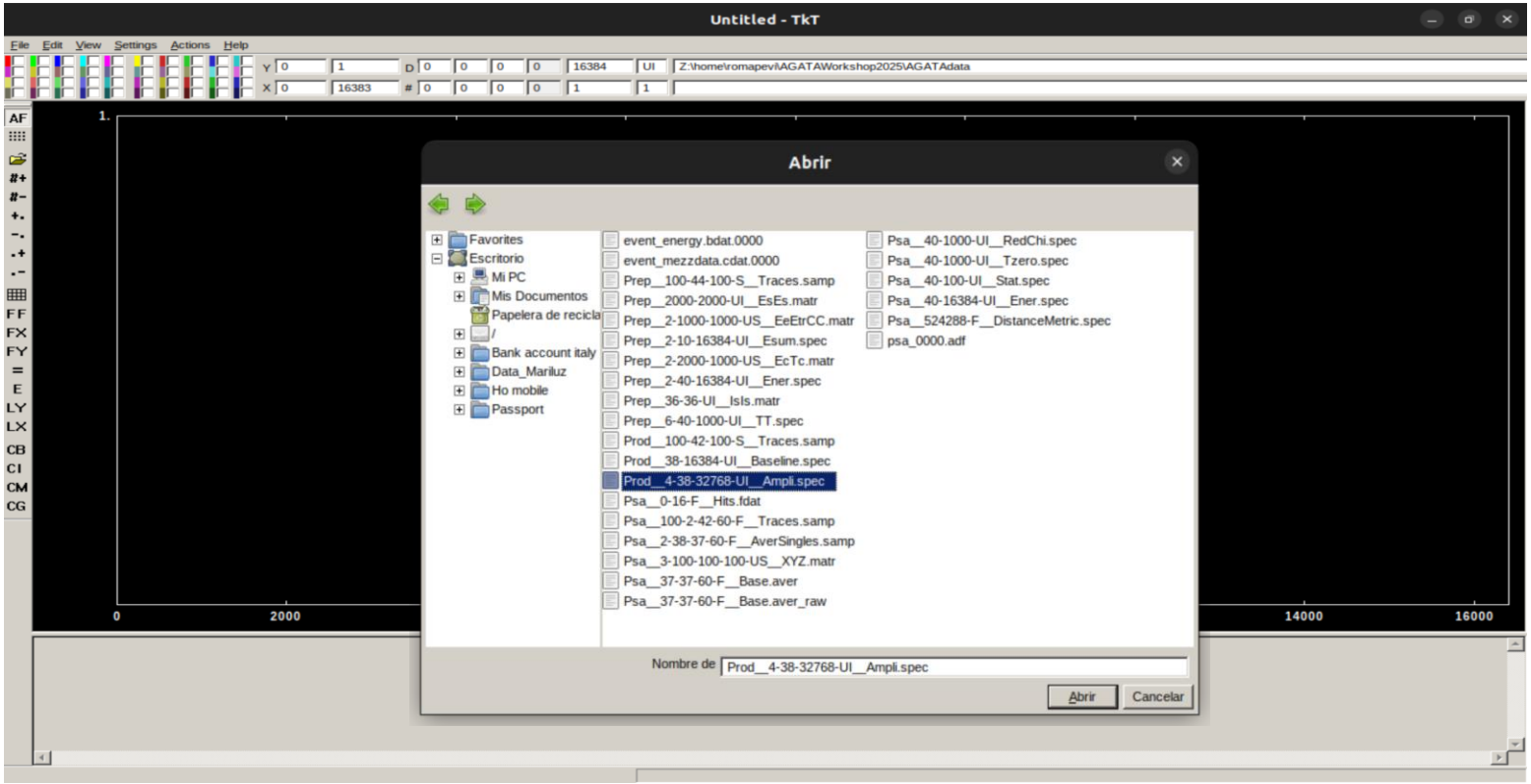
Execute `TkT` ➡ click on the icon  ➡ select a file (e.g. Prod__4-38-32768-UI__Ampli.spec)



# TkT

## How to open a file

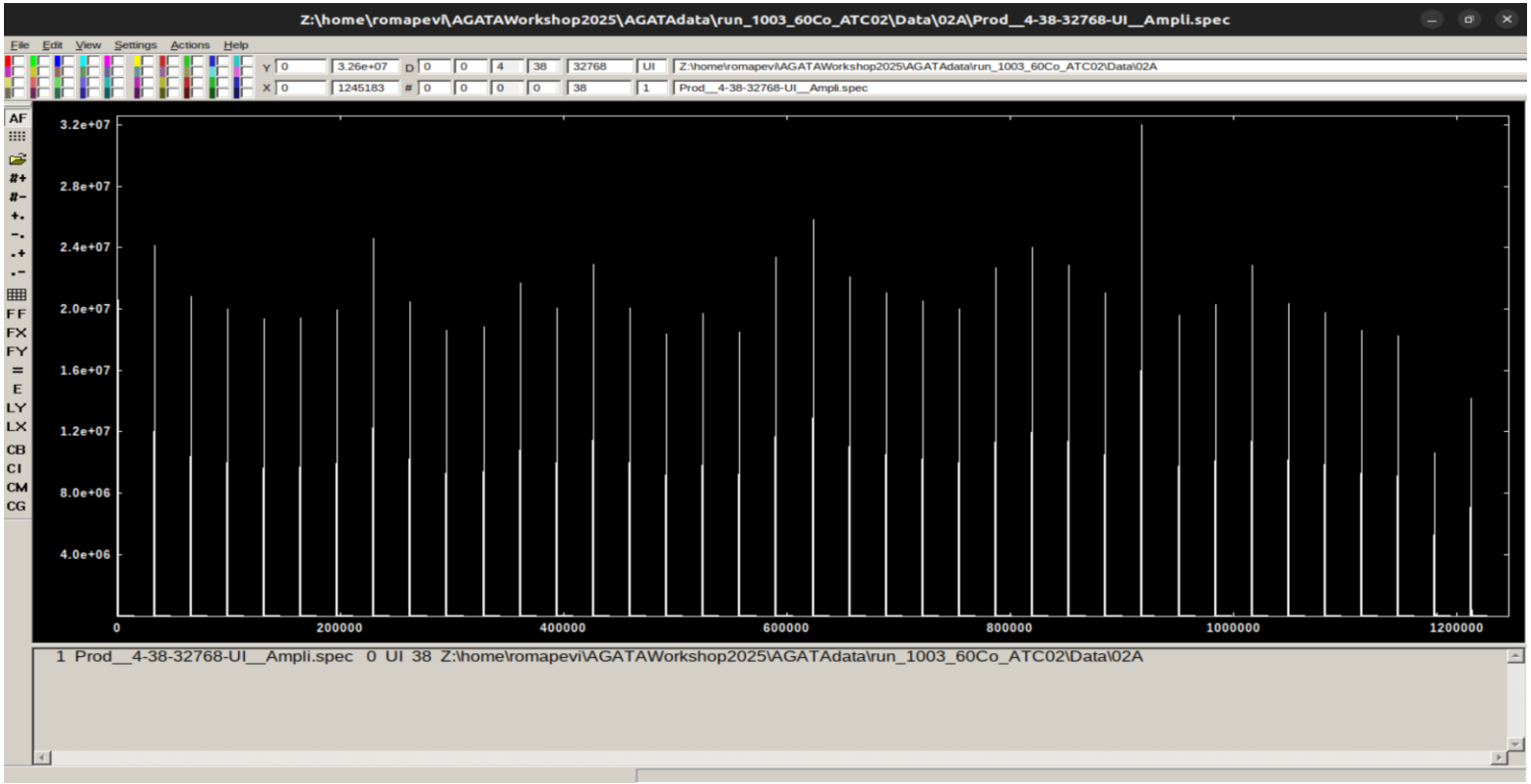
Execute TkT ➡ CTRL+O ➡ select a file (e.g. Prod__4-38-32768-UI__Ampli.spec)



# TkT

## How to open a file

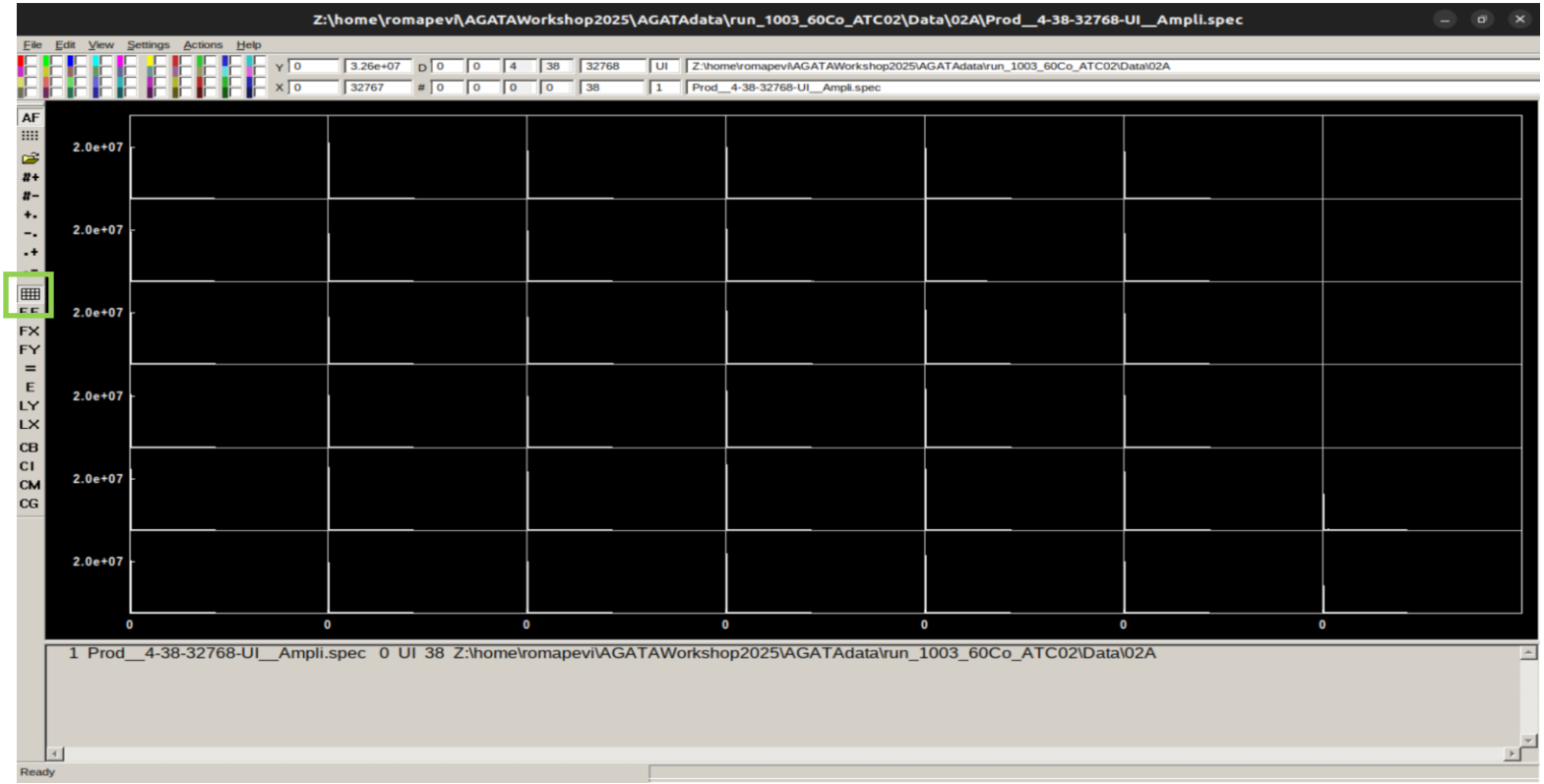
Execute: `TkT PathToFile/Prod__4-38-32768-UI__Ampli.spec`



TkT

# How to split the screen

Click on the icon 



TkT

# How to split the screen

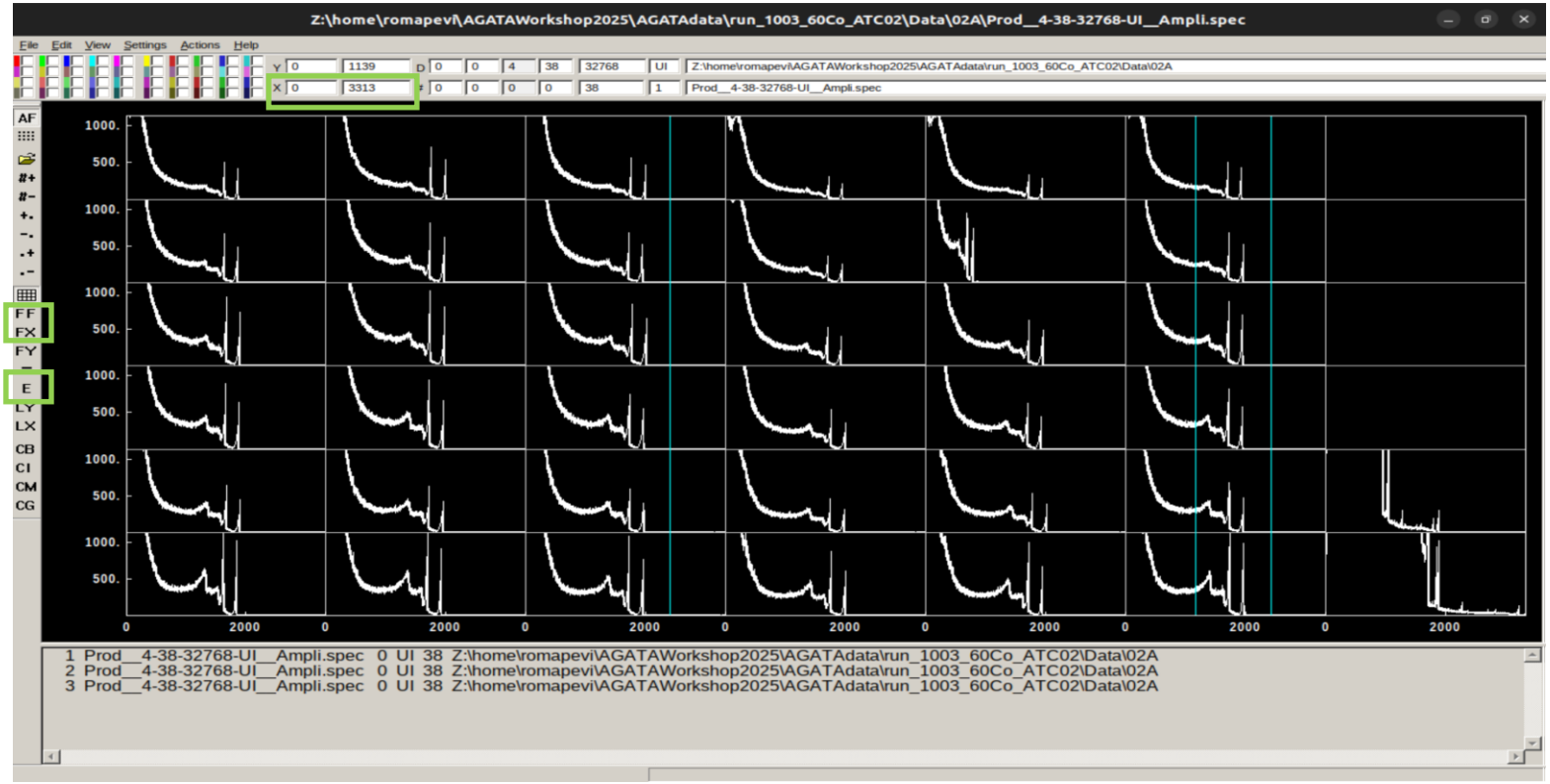
By default, the screen splits in modules of 6 and displays all the spectra. You can change the settings with the command CTRL+ 

CTRL+ 

# TkT

## How to zoom in the X axis

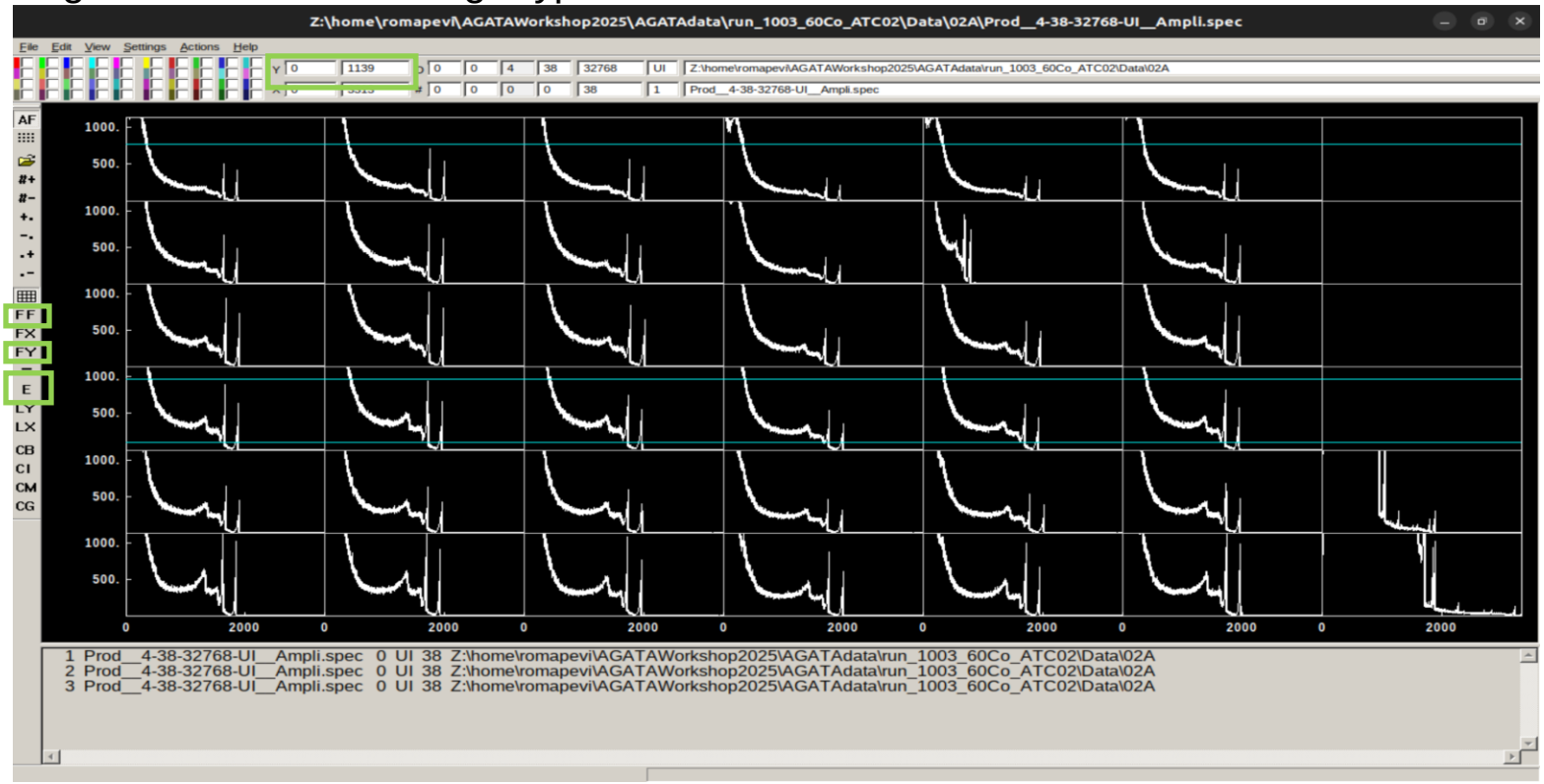
Change the X axis ranges / click on one part of the Energy spectra | and type E or click E / click on both sides of the region to zoom | | and type E or click E . To go back to the full range type FX or FF FF FX



TkT

# How to zoom in the Y axis

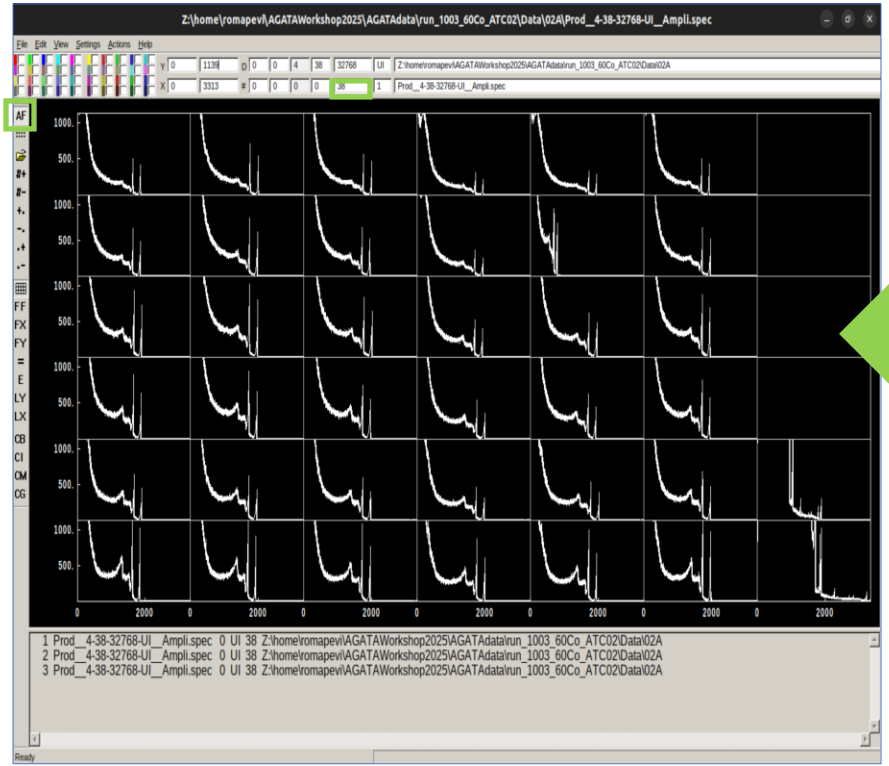
Scroll up and down with the mouse / change the Y axis ranges / SHIFT + click on one part of the Energy spectra — and type E or click E / SHIFT+ click on both sides of the region to zoom = and type E or click E. To go back to the full range type FY or FF FF FY

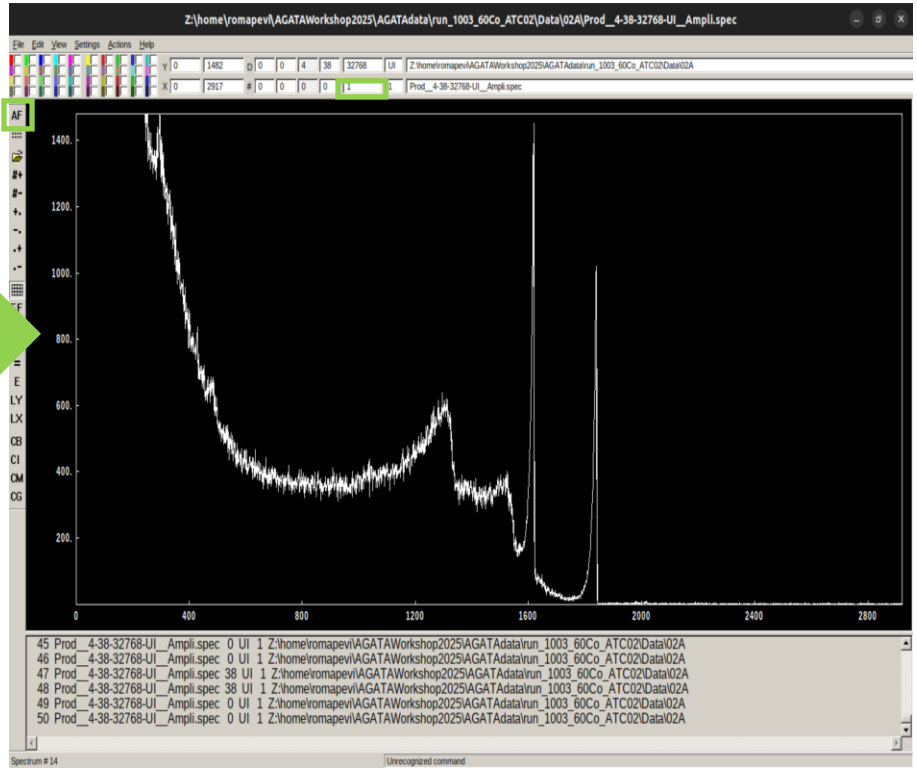


TkT

# Display modes,  all spectra <-> one spectrum

Deactivate AutoFormat (CTRL+ AF ). Switch between the display modes with CTROL + click on the box or by changing the number in the box

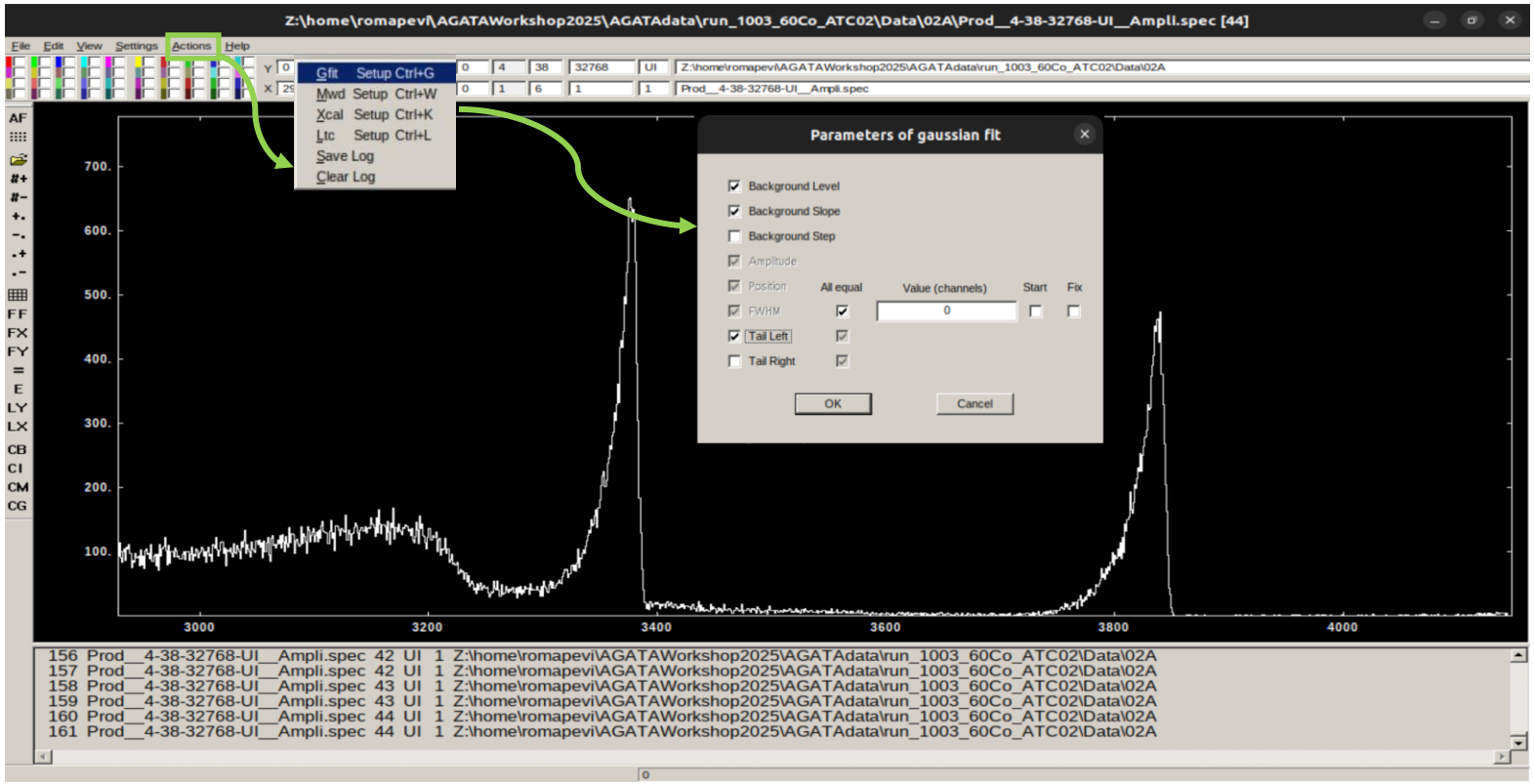


# TkT

## Fit

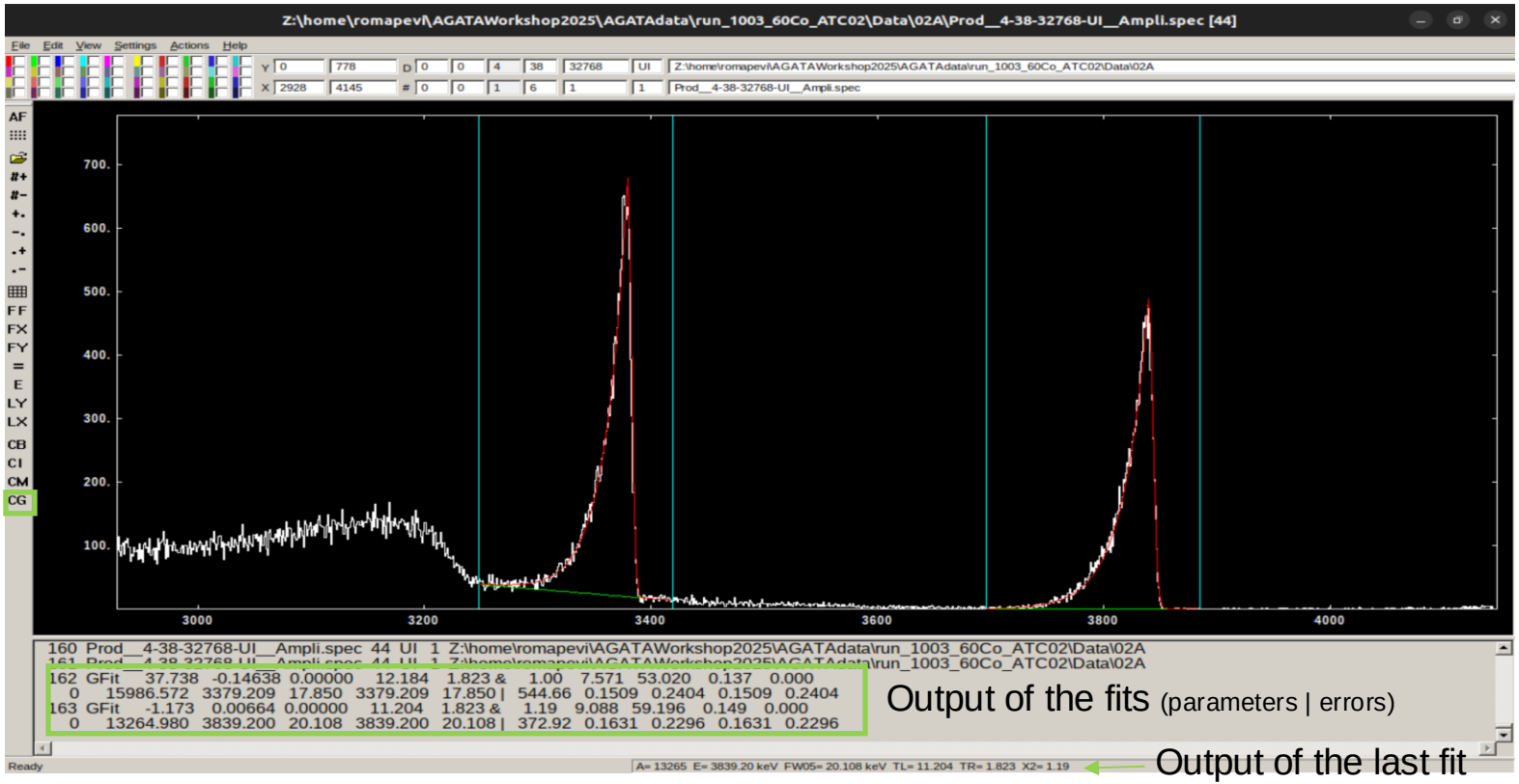
Display 1 spectrum. Set up the parameters of the gaussian fit (Actions ➡ Gfit or CTROL+G).



# TkT

## Fit

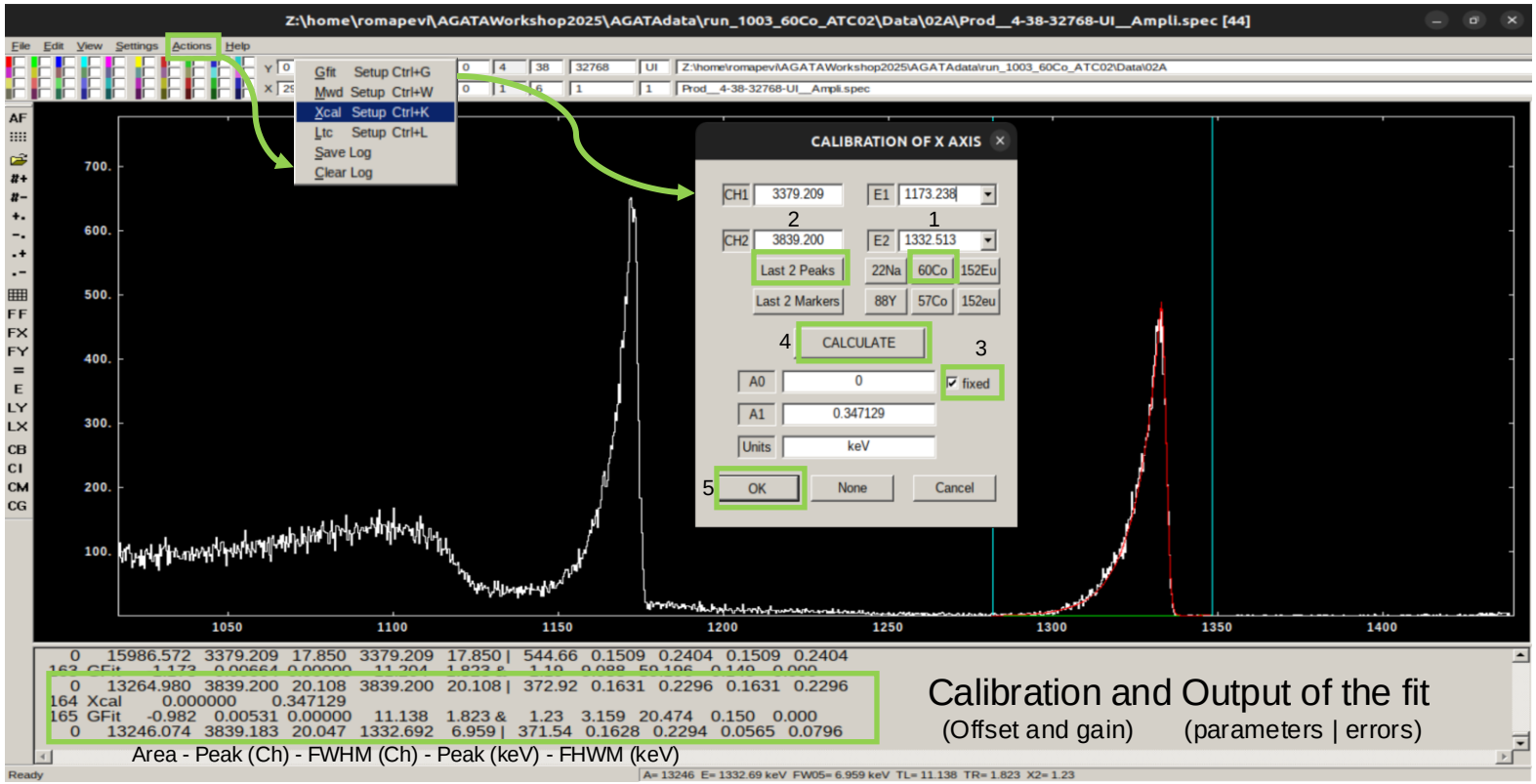
Display 1 spectrum. Set up the parameters of the gaussian fit (Actions ➡ Gfit or CTROL+G).
Click on both sides of the peak to select the range | |, type CG or click CG . To erase the fit type CZ



TkT

# Fit + Calibration

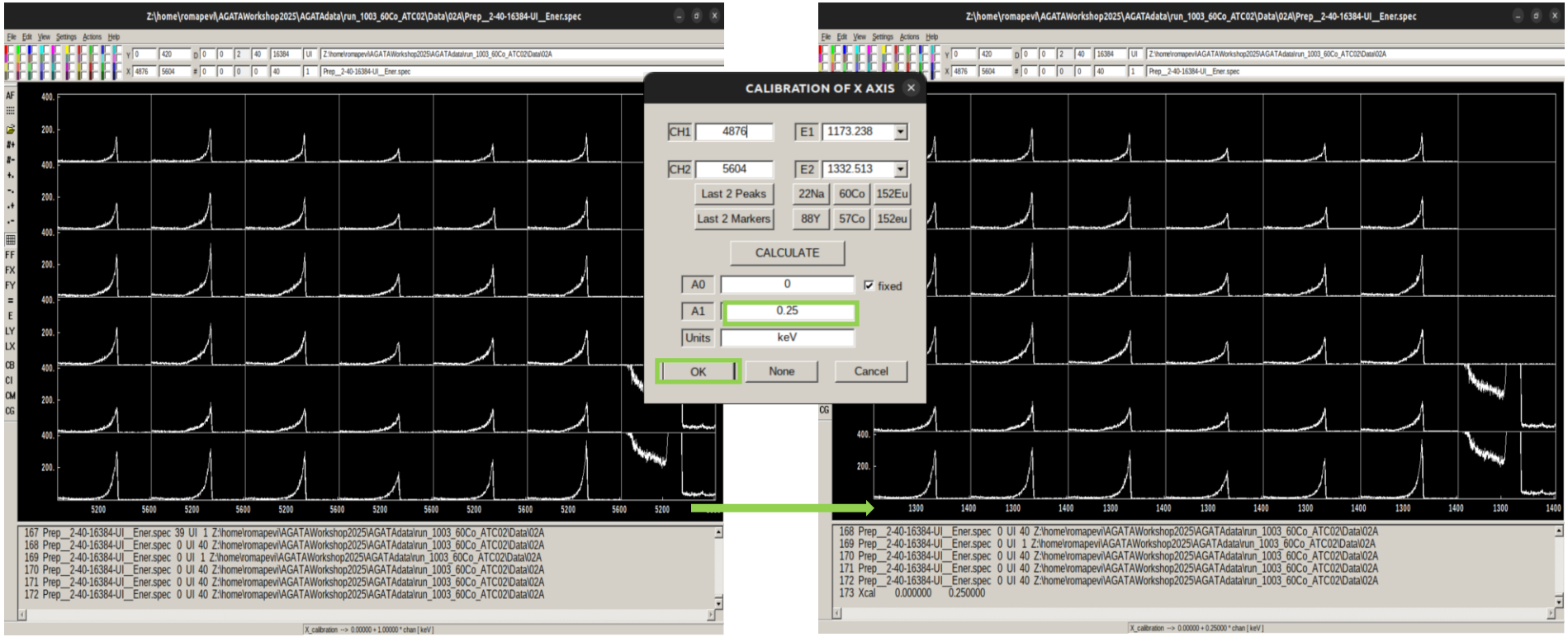
After fitting the 2 peaks, open the calibration panel (Actions ➡ Xcalt or CTROL+K).
Select the source (1), select Last peaks (2), fix the offset (3) and calculate (4). OK to apply the calibration factor (5).



TkT

# Calibration factor

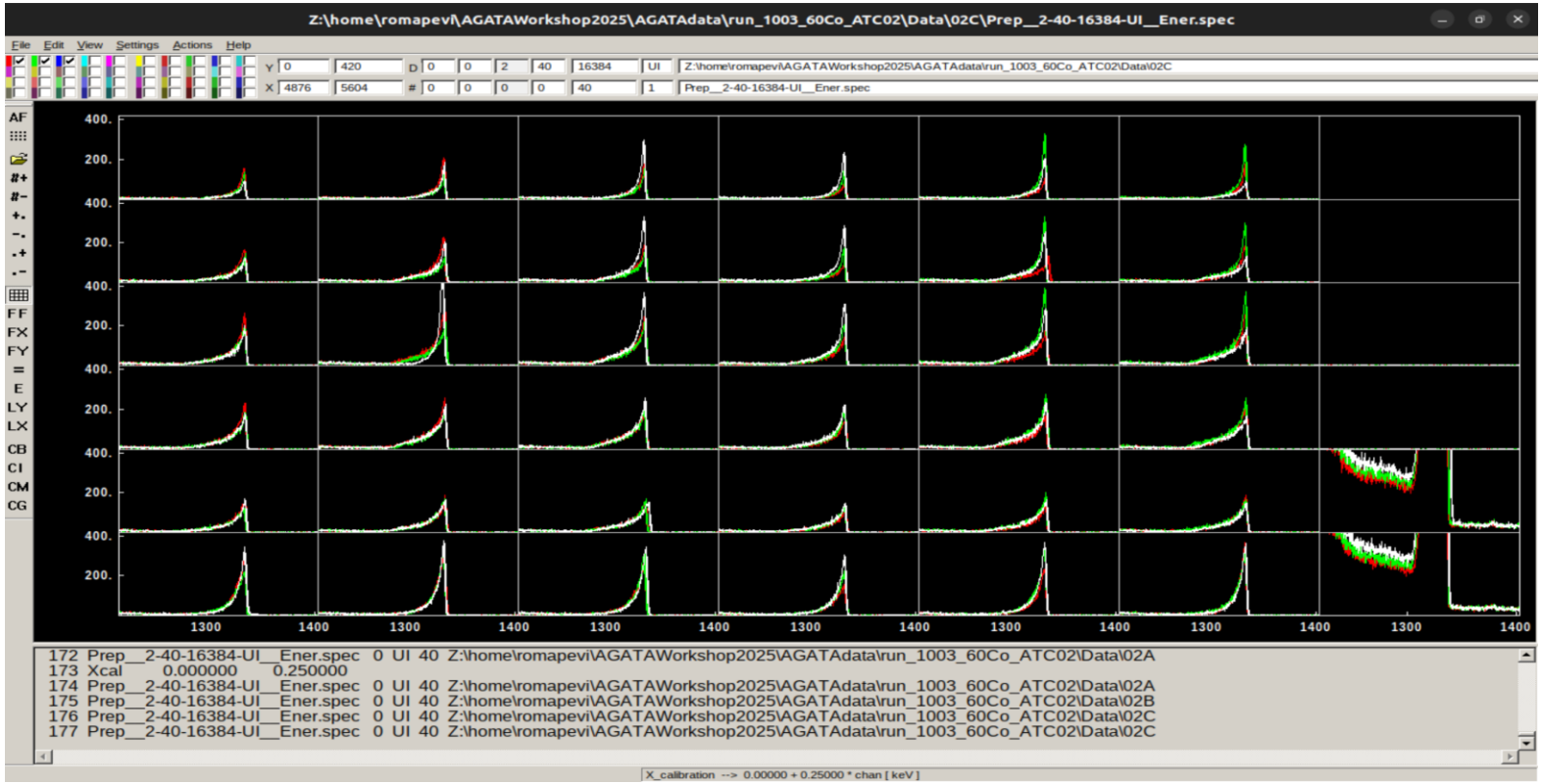
For the spectra files calibrated in energy apply the gain factor selected in the gen_con.py. Typically gain 4 (0.25) or gain 2 (0.5).



# TkT

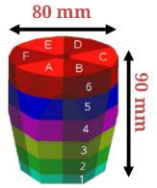
## Ovelap spectra

Store spectra for different detectors in the boxes by clicking in the box after changing to another detector.
**Shortcut:** type in the path box `02[A,B,C]` and press enter



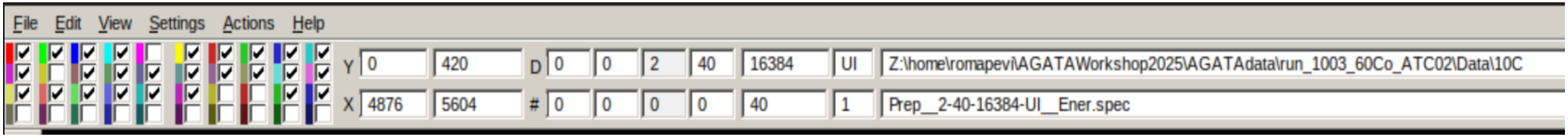
# TkT

## Ovelap spectra




### Shortcuts

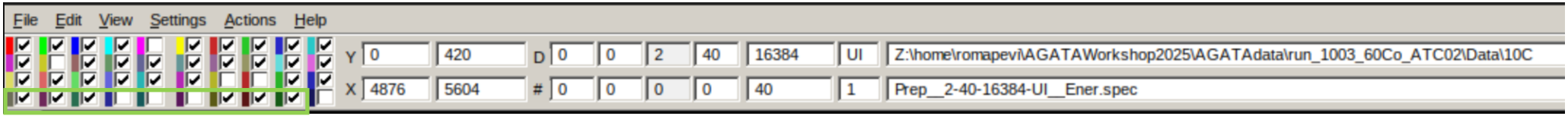
- **[,00,01,02,…,10](ABC)** ➡ [] store #dets in the same raw, () store ABC in the same column




- **Export the command in your .bashrc and usit typing $+the number asigned**

export TKTSYMBOL_8='[,00,01,02,04,05,06,07,08,09,10](ABC)' ➡ $8

export TKTSYMBOL_9='[,11A,11B,11C,13A,13B,13C,14A,14B,14C]( , , ,.)' ➡$9



# TkT

## Short keys:?,s?,w?

**w?** → Help for operations on waves

TkT

The multi-key commands Wx[n] perform Moving Window operations on sampled waveforms (Wx spectra)
Parameters given in n'th column of Moving Window Dialog
CTRL<W> opens the Moving Window Dialog

| | | |
|---|---|---|
| WAn | Average [n=1,2] | |
| | Sum [n=3,4] | |
| WB | Base line follower (continuous average) | |
| WC | CFD timing filter | |
| WDn | Gast's Deconvolution [n=1,2] | |
| WE | Trapezoidal filter = WD1+WA1 | |
| WH | Info and calcs. for top and background windows | |
| WIn | IIR CR [n=1,2] | |
| | RC [n=3,4] | |
| WJn | Jordanov's DSU [n=1,2] | HPD [n=3,4] |
| | DDC [n=5,6] | DPZ [n=7,8] |
| WLn | Leading edge discr. on Left [n=1,2] | |
| | on Max [n=3,4] | |
| WM | Median filter passed over the waves | |
| WO | Subtract offset based on BL width parameter | |
| WS | Slope condition counting | |
| WW | Test of SortMars analysis | |
| WZ | Test of SortMars analysis with integer arithmetic | |

Aceptar

TkT

## s? → Help for operations on spectra

The multi-key commands Sxn perform operations on the spectrum
SR means selected region (expanded or between L2Ms)

| | |
|---|---|
| SAC | Autocorrelation of SR (very slow for large spectra) |
| SADC | Test ADC non-linearity, starting from channel-width spectrum |
| SCx | Constant operation 'SR x= C'; x one of '+ - * / \| & ^ < > %' (%0-->int); constant C taken from dialog |
| SCM | Masking of data digitized with 14 bits (SC& 16383 SC^ 8192) |
| SD | running Differentiation in SR |
| SFn | Recursive Digital Filter n applied to SR |
| SF[AS] | Moving Average or Moving sum in SR |
| SFC | Complex conjugation of SR interpreted as (Ampl,Phase) |
| SFD | Dir. Discrete Fourier Transform of SR |
| SFI | Inv. Discrete Fourier Transform of SR |
| SF[MN] | Median Filter in SR. Filter width 3(M) or 5(N) points |
| SF[RZ] | Set to random or zero the phases of SR interpreted as (Ampl,Phase) |
| SFWn | 0-Square 1-Blackmann 2-Hamming 3-Hanning 4-Bartlett windowing in SR |
| SF[*/] | Operation on 'Fourier' spectra in the (Ampl,Phase) representation |
| SGx | Generate function in SR: Band Delta Exp Gauss bIRestorer Sin Trapezoid |
| SI | running Integration of SR |
| SKnn | Convolution with kernel taken from stored spectrum nn |
| SLB | transform to Bode plot SR |
| SL[XY] | x or y axis mapped to log10 in SR |
| SLI | 10^y in SR |
| SMn | Smooth SR n times [n=0-9, (0->10)] |
| SN[UGS] | add Noise to SR [Uniform Gaussian SpecSigma] |
| SN[AY] | Normalize spectrum to totArea or maxAmplitude given in dialog |
| SP[CDERS] | Pack, Decimate, Filter-out, Reshuffle channels or spectra |
| SPn | pow(spectrum, n) of SR [n=0 --> ask, n=1 --> abs()] |
| SQn | pow(spectrum, 1/n) of SR [n=0 --> (int), n=1 -->1/()] |
| SRnn | Recall stored spectrum nn |
| SR[BED] | Running linear(B) fit, exponential(E) fit, standard deviation(D)] |
| SR[LR] | Rotate Left/Right channels of SR |
| SSnn | Store as spectrum nn |
| SSA | Spectrum shift and accumulate |
| SSBn | Swap bytes [n=2,4] |
| SS[LR] | Shift Left/Right channels of SR |
| SS[OS] | Swap Segments Order, Swap incrStep Sets |
| SSK | Shift spectrum according to calibration coefficients |
| SS[HV] | Swap spectrum Horizontally/Vertically |
| SS? | List of stored spectra |
| SX | Distribute y values on x axis SR |
| SY | Distribution of y-values of SR |
| SV[AN?] | Set/reset/query visibility of spectra |
| SVnn | Toggle visibility of stored spectra |
| SWA[IF] | Write spectrum as ASCII text in Integers or Floats |
| SW[CSILFD] | Write spectrum as binary 8-,16-,32-,64-bit integers, Float or Double |
| SZnn | Remove Stored Spectrum nn |
| S0 | Value of first channel in SR set equal to value of second one |
| S[+-*/@$&]nn | Spectrum operation SR = ss[nn] op SR @=LUT $=accumulate &=nonzero |
| S+[ST] | Sum of Stored Spectra or Segment Traces |
| S=[01FB] | Replace channels between L2Ms with 0, 1, the last fit or backgroud |

TkT

## ? → Help

Set Vertical Markers with <spacebar> or <left_mouse>
Set Horizontal Markers with SHIFT<spacebar> or SHIFT<left_mouse>
LnMs stays for "last n markers" n stays for an integer number between 0 and 9

| | |
|---|---|
| A | Auto fit a peak between L2Ms |
| B | Set a B marker |
| CA | Fit a flat line between L2Ms or in B regions |
| CB | Fit a stright line between L2Ms or in B regions; CRTL<CB> --> flat line |
| CE | Exponential fit between 2 markers (with 4 markers, last 2 define background region) |
| CG | Gauss fit between L2Ms; CRTL<CG> --> toggle left tail; SHFT<CG> --> show fit results |
| C[IJ] | Integration between L2Ms; Background subtracted if 2 R-markers and pairs of B-markers |
| CM | First moments between L2Ms; background from CB or first-last; CRTL<CM> no background |
| C[PQ] | Peak search using first(P) or second(Q) derivative of spectrum |
| CR | Residues of last fit between L2Ms |
| CS | Sinusoidal fit; initial period given by 2 markers (if 4 markers, last 2 define fit region) |
| CZ | Remove drawing of last fit |
| DD | Toggle direction of increments/decrements |
| DFF | Data format float F 100 1000 |
| DFK | Toggle value of K between 1024 and 1000 |
| DFL | Resize spectrum K-length |
| DFT | Data format WT2 1 100000 |
| DMn | Define macro n (0...9) DM? list macros |
| DM[GHV] | Define marker G, H or V |
| DSn | Define symbol n (0...9) DS? list symbols |
| DSS | Define Split Screen |
| DUG | Define User Grid |
| D[XYV] | Print L2Ms and their difference |
| E | x-Expand between L2Ms |
| F[XYF] | Expand to full-X, full-Y, full-XY |
| F[KLN] | FX for the 1st, last or dialog-given "k" |
| G | Set a G marker |
| KA | X-calibration from 2 largest peaks |
| K[MP] | X-calibration from L2Ms or last 2 peaks |
| K[ZL] | X-calibration remove or reset to last |
| LT | Long traces capture from ggp (same as SCC) |
| L[XY] | Toggle Lin/Log X or Y scale (<LX> <LY>) |
| Mn | Execute macro n (0...9) SHFT<M> execute macro 1 |
| N | Re-read spectrum |
| T | Trigger on next peak; SHFT<T> on previous peak (level from cursor) |
| V[LV] | List channels or View value of current channel |
| Y0 | Ymin set to zero |
| Y[OU]n | Y-expand to selected decimal fraction |
| Z[BGHV] | Delete B G H V markers |
| ZS | Erase spectrum between L2Ms |
| ^K | Open X-calibration dialog |
| ^O ^R | Read again present spectrum and redraw or overdraw |
| <ALT>+n | Execute macro n |
| 1 2 | Next/Previous #spectrum (<#+> <#->) (<SHFT> redraws) |
| 3 4 | Increment/Decrement Spectrum Name (<SHFT> redraws) |
| 5 6 | Increment/Decrement Spectrum Type (<SHFT> redraws) |
| = . < > | Redraw, Center spectrum at mouse position, Left / Right shift |
| Sx | Operations on spectra (S? --> help) |
| Wx | Operations on waves (W? --> help) |

# Thank you!

# AGATA Analysis Workshop 2025

## PostPSA Calibration. Hands on

**R.M. Pérez-Vidal**

14/01/2025, Lyon

# Questions?

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CSIC CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

# AGATA Crystal lookup table

| Position | ATC | Crystal | | | Installation date |
|---|---|---|---|---|---|
| | | A | B | C | |
| 00 | 12 | 006 | 005 | 001 | 01/04/2022-15/01/2024 |
| | **18*** | 017 | 018 | 018 | 15/01/2024 |
| 01 | 10 | 011 | 006 | 012 | 01/02/2022- 03/04/2024 |
| | **13** | 003 | 016 | 015 | 03/04/2024 |
| 02 | **17** | 016 | 017 | 013 | 01/02/2022 |
| 04 | 11 | 004 | 004 | 010 | 01/09/2022-04/04/2024 |
| | **7*** | 007 | 014 | 003 | 04/04/2024 |
| 05 | **09** | 001 | 001 | 004<br>006 | ?<br>01/05/2022 |
| 06 | 06 | 008 | 009 | 002<br>014 | ?<br>01/09/2022-14/12/2023 |
| | **19** | 018 | 012 | 019 | 13/02/2024 |
| 07 | 14 | 014 | 010 | 016 | 01/03/2022-18/09/2023 |
| | **2** | 019 | 019 | 020 | 18/09/2023 |
| 08 | **3** | 002 | 007 | 007 | 01/03/2022 |
| 09 | 18 | 017 | 018 | 018 | 01/03/2022-19/10/2023 |
| | **14*** | 014 | 010 | 016 | 19/10/2023 |
| 10 | 15 | 013 | 015 | 011 | 01/03/2022 |
| 11 | **1** | 010 | 011 | 009 | 01/04/2022 |
| 13 | **19** | 018 | 012 | 019 | 01/09/2022 |
| 14 | 7 | 015<br>007 | 014 | 008<br>003 | ?<br>01/09/2022-01/01/2023 |
| | **20** | 009 | 020 | 005 | 01/01/2023 |

*2nd time in the array