

# **AGATA Analysis Workshop 2023**

## **PostPSA calibration. Hands on**

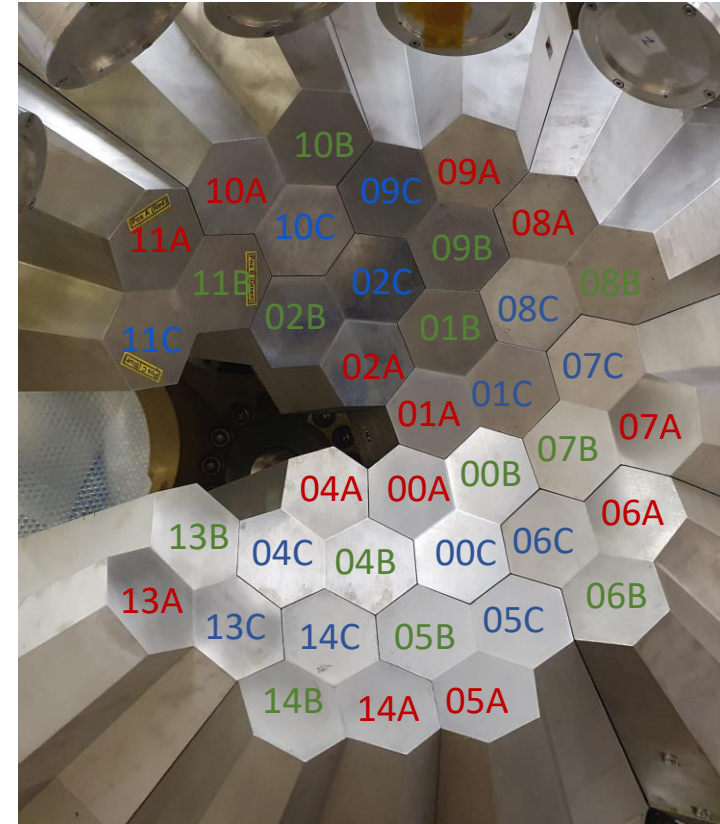
**R.M. Pérez-Vidal**

12/09/2023, Legnaro

# Hands On

## AGATA configuration

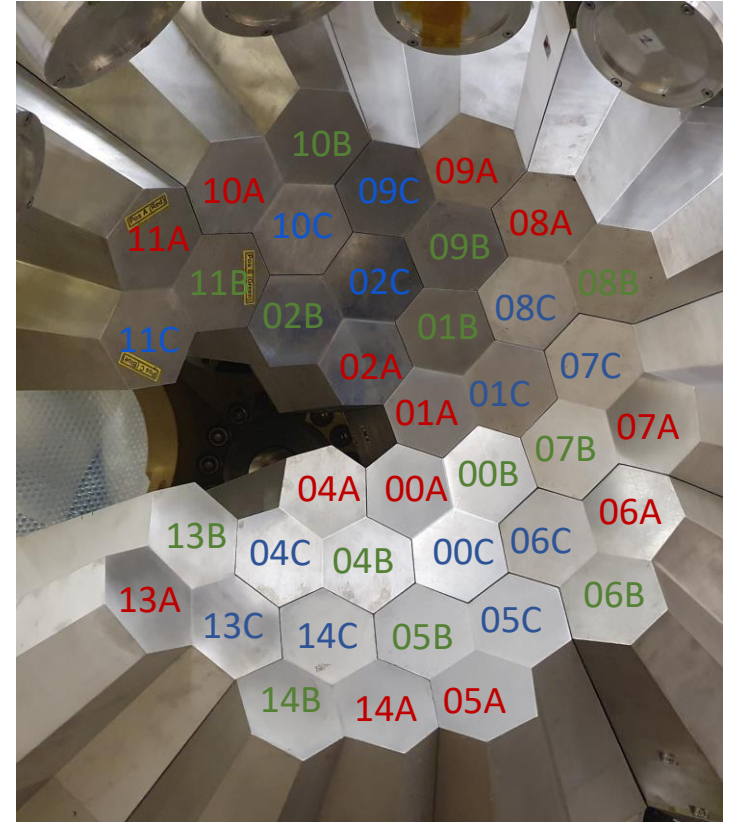
- AGATA data taken in May
- Counting rate per crystal : 500-900Hz
- MWD-risetime: 2.5  $\mu$ s
- Position: Nominal
- Backward angles
- Data sets with  $^{60}\text{Co}$  and  $^{152}\text{Eu}$



# Hands On

## Data sets in example directory

- **run\_1005\_60Co (40Gb)**
  - Neutron damage correction
  - 4 ATC: 00 01 02 11
- **run\_1002\_152Eu (36Gb)**
  - Energy recalibration
  - 4 ATC: 00 01 02 11
- **run\_1010\_60Co (16Gb)**
  - Global time alignment
  - 36 ATC: 00 01 02 04 05 06 07 08 09 10 11 13



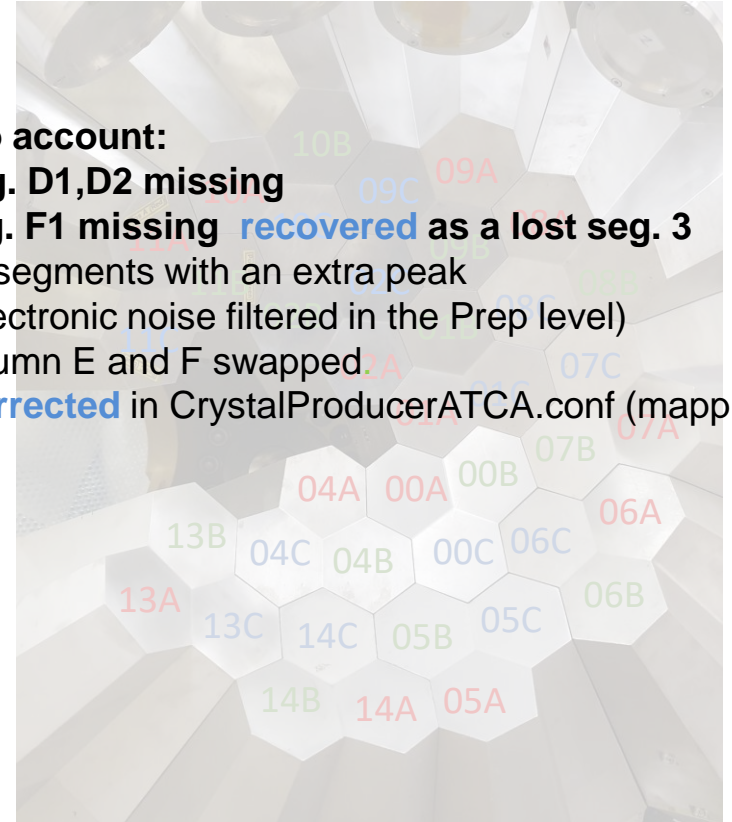
# Hands On

## Data sets in example directory

- **run\_1005\_60Co (40Gb)**
  - Neutron damage correction
  - 4 ATC: 00 01 02 11
- **run\_1002\_152Eu (36Gb)**
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  - 4 ATC: 00 01 02 11
- **run\_1010\_60Co (16Gb)**
  - Global time alignment
  - 36 ATC: 00 01 02 04 05 06 07 08 09 10 11 13

### To be taken into account:

- 01B: **seg. D1,D2 missing**
- 11A: **seg. F1 missing recovered as a lost seg. 3**  
all segments with an extra peak  
(electronic noise filtered in the Prep level)
- 11C: column E and F swapped:  
**Corrected** in CrystalProducerATCA.conf (mapping).

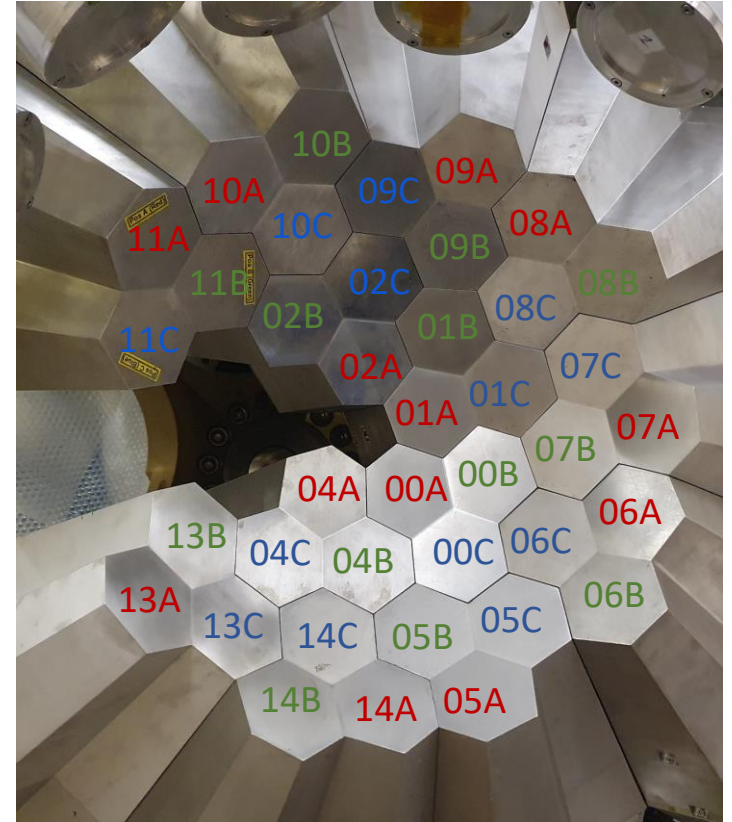


# Hands On

## Data sets in example directory

- **run\_1005\_60Co\_ATC00 (14Gb)**
  - Neutron damage correction
  - 1 ATC: 00A (traces) 00B 00C
- **run\_1002\_152Eu\_ATC00 (7.9Gb)**
  - Energy recalibration
  - 1 ATC: 00A (traces) 00B 00C
- **run\_1010\_60Co (16Gb)**
  - Global time alignment
  - 36 ATC: 00 01 02 04 05 06 07 08 09 10 11 13

POS	ATC	Crys	Capsule
0	12	A	6
		B	5
		C	1



# 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 00A (A006)
- 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
  - Neutron.sh
  - Recalibration.sh some analysis scripts
  - GlobalTime.sh

# Hands On

## Files in example directory: run\_1005\_60Co

Neutron Damage correction

### ○ 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

- **event\_mezzdata.cdat.0000**
- **event\_mezzdata.cdat.0001**
- **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\_1002\_152Eu

### Recalibration

#### ○ 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**
- **psa\_0001.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 Alignment

### ○ 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 CRY5 00A 00B 00C
```

```
Chain 4 CRY5
```

```
Producer
```

```
CrystalProducerATCAFilter
```

```
PreprocessingFilterPSAFilter
```

```
PSAFilter
```

```
Consumer BasicAFC
```

```
ENDLOOP
```

# Hands On

## Files in example directory: Topologies

### Topology\_Global.conf

```
LOOP CRY5 00A 00B 00C
```

```
Chain 3      CRY5  
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 CRY5 00A 00B 00C
```

```
Chain 3      CRY5  
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

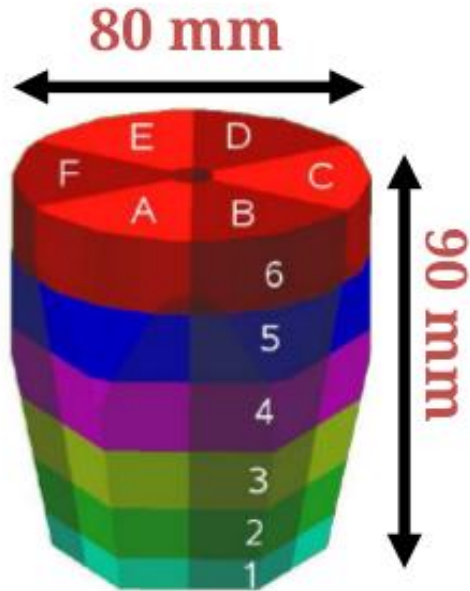
## Useful programs. PostPSA Filter

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

# TkT

## Channels correspondence after Replay



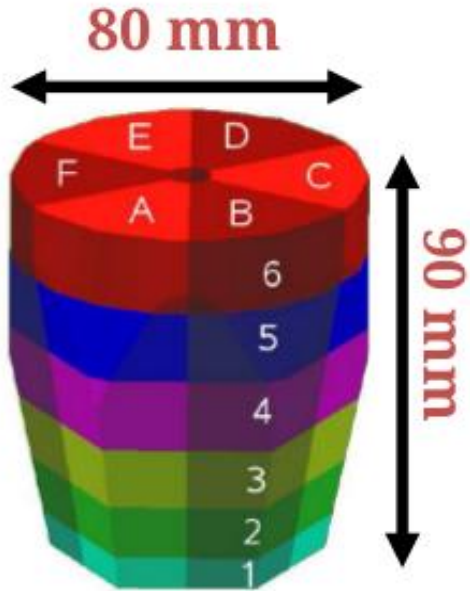
	A	B	C	D	E	F	CC
Back segs. 6	5	11	17	23	29	35	
5	4					34	
4	3					33	
3	2					32	
2	1					31	37
Front segs. 1	0	6	12	18	24	30	36

1 Low gain  
0 High gain & trigger

6x6 segmented cathode

# TkT & Mat

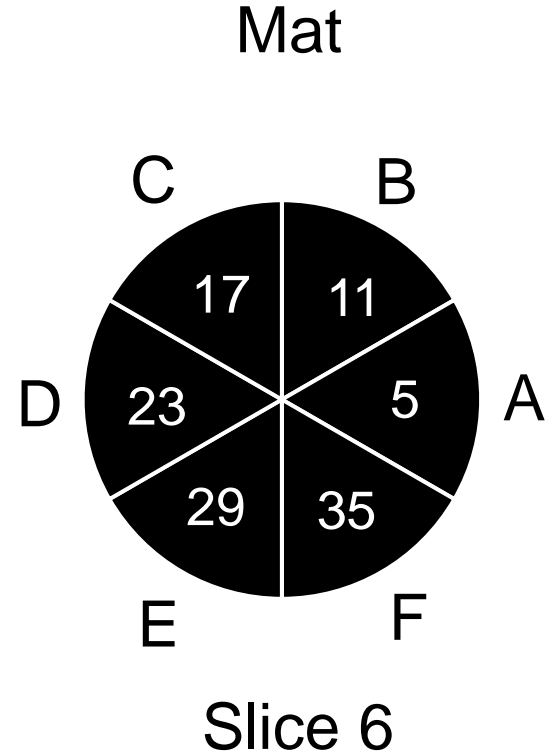
## Channels correspondence after Replay



6x6 segmented cathode

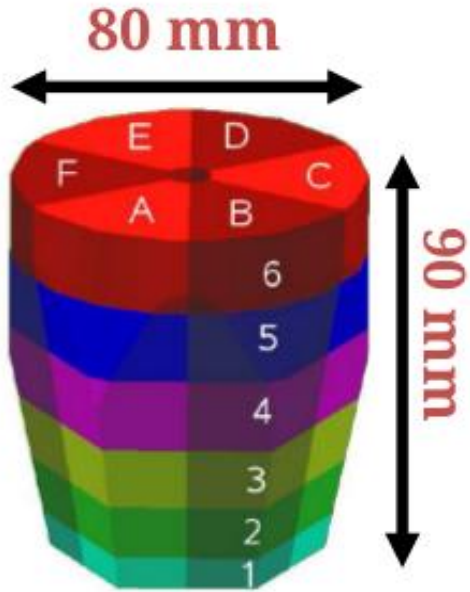
TkT

	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

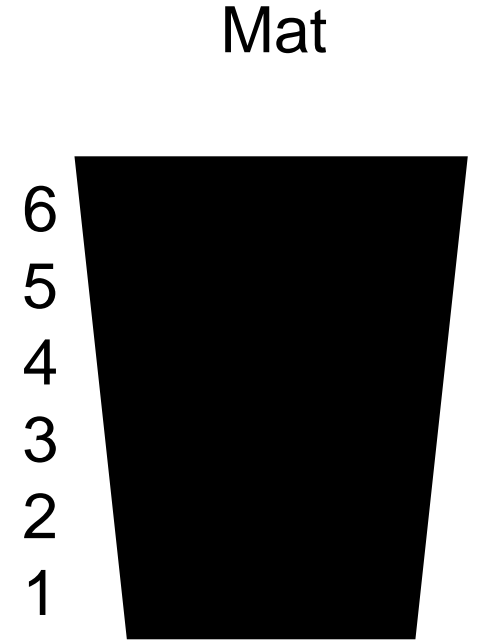
## Channels correspondence after Replay



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





# 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	

Acceptar

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[AV]	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 --> 1/0]
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[+ -*/@S&]nn	Spectrum operation SR = s[nn] op SR @=LUT S=accumulate &=nonzero
S+[ST]	Sum of Stored Spectra or Segment Traces
S=[01FB]	Replace channels between L2Ms with 0, 1, the last fit or background

TkT

## ? → Help

X

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[PO]	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[XV]	Print L2Ms and their difference
E	x-Expand between L2Ms
F[XV]	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[L]	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!**

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**Questions?**