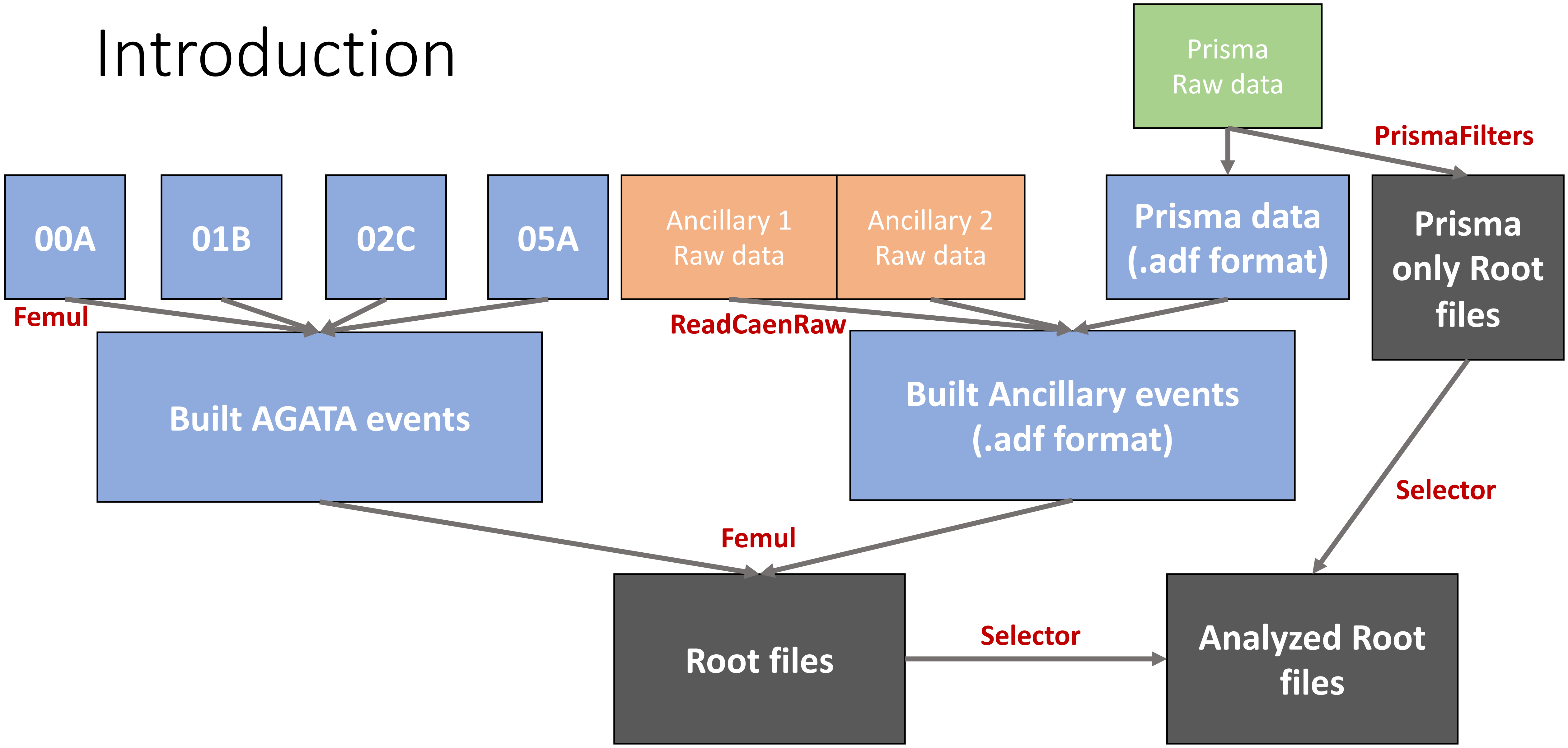
Introduction to ancillary analysis

D. Brugnara

Talk Outline

- Introduction
- How to do a global replay
- Ancillary specific:
  - Prisma
  - Other ancillaries
- Reading and building ancillary events
- Optimizations

Introduction



Running the replay

- Although the replay.py script is present in agataselector/Scripts/Replay/, it is mainly meant for the nearline users. It can, in principle be adapted but is not very useful
- In this case on the femul side of things there is not much to do except setting the **appropriate time windows to build events**, the rest is done in the selector
- As a consequence, once Agata is time aligned and calibrated the replay will be run once

The Topology

Topology_FromPSAToTreePRISMA.conf 510 B

```
LOOP CRYS 00A 00B 00C 01A 01B 01C 02A 02B 02

Chain 3       CRYS
Producer      BasicAFP
Filter        PostPSAFilter
Dispatcher    EventBuilder
ENDLOOP

Chain 2       Builder/
Builder       EventBuilder
#Consumer      BasicAFC
Dispatcher    EventMerger

Chain 2       prisma/
Producer      BasicAFP
Dispatcher    EventMerger

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

Topology_FromPSAToTreeEUCLIDES.conf 512 B

```
LOOP CRYS 00A 00B 00C 01A 01B 01C 02A 02B 02C 04A

Chain 3       CRYS
Producer      BasicAFP
Filter        PostPSAFilter
Dispatcher    EventBuilder
ENDLOOP

Chain 2       Builder/
Builder       EventBuilder
#Consumer      BasicAFC
Dispatcher    EventMerger

Chain 2       euclides/
Producer      BasicAFP
Dispatcher    EventMerger

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

The gen_conf.py

- The event builder builds agata events

```
EventBuilder=(
"ActualClass            EventBuilder",
"SaveDataDir            $SAVEDIR/$BUILDER",
"Window                 45",
#"TstampWindow    ui64 ui64",
"keyIn                  data:psa",
"keyIn                  data:psa",
"keyOut                 event:data:psa",
"MinFold                1",
#"TimestampCorrect        0   -128",
#"TstampLimits    ui32 ui32",
#"TstampRegions   ui64 ui64 str",
#"RateProfile     ui64 ui64 i32",
#"Details         15 ",
"Verbose",
)
```

- The event merger builds agata+ancillary events. The ancillary events need to be already built

```
EventMerger_MERGER=(
"ActualClass                EventMerger",
"SaveDataDir                $SAVEDIR/$MERGER ",
"Window                    45",              # Eve
#"TstampWindow    ui64 ui64",
"keyIn                      event:data:psa",
"keyIn                      event:ranc",
"keyOut                     event:data",
#"MandatoryKey               event:ranc",
#"keyIn                      data:psa",
#"keyIn                      data:psa",
#"keyOut                     event:data:psa",
"MinFold                    1",
"TstampCorrect          0   0",
#"TstampLimits    ui32 ui32",
#"TstampRegions   ui64 ui64 str",
#"RateProfile     ui64 ui64 i32",
#"Details         i32 ",
"Verbose",
)
```

The gen_conf.py

- The tracking and TreeBuilder are the last steps

```
TreeBuilder=(  #From 2022
"ActualClass    TreeBuilder",
"SaveDataDir    $SAVEDIR/$ANALYSIS   Tree_  TreeMaster ",
"AddDetector    AGATA_BUILDER    event:data:psa          0",
"AddDetector    AGATA_TRACKING   data:tracked            0",
"AddDetector    PRISMA           event:ranc              0",
#"AddDetector    SPIDER           event:ranc              0",
#"AddDetector    EUCLIDES           event:ranc              0",
"AddDetector    LABR             event:ranc              0",
#"AddDetector    DANTE event:ranc             0",             # Add
"MaxRootFileSize 600",
"MergerMode",
)
```

```
TB_PRISMA=(
"ConfPath        $CONFDIR/prisma",
"LUTFile         lutPRISMA.txt",
"ManagerFile     manager.conf",
"WriteRawTree",
"WriteAnaTree",
#"DoPrismaAnalysis",
#"Verbose",
)
```

```
TrackingFilter=(
"ActualClass           TrackingFilterOFT",
"SaveDataDir           $SAVEDIR/$MERGER",
"EnergyGain            4",
#"ExcludeTracking",
"OftParams           0.05 0.02 0.8 1",
#"MgtParams            0
"SourcePosition        0 0 0",
"DiscardEmpty          0",
#"RecoilDirection       0 0 1",
#"RecoilBeta            0.05",
#"CoreEnergyGate        20 20000",
#"NumDetsGate          i32 i32",
#"NumHitsGate          i32 i32",
#"WriteRootTree",
#"WriteRootTree         InputHits",
#"WriteMgtData",
#"WriteTracked",
#"RotoTranslations CrystalPositionLookUpTable",
#"Matrixgg1             4096 1",
#"Matrixgg2             4096 1",
#"MatrixZYX            f32 f32 i32 f32",
#"OutputModel           kSafe",
#"Verbose",
"NumGeDets  39",
```

Agata leaves

- In general, the leaves contain the following information for:
  - Single hit (within a segment)
  - Single core
  - Addback (nearest cores)
  - Tracking

Leaf name	Data type	Content
nb	int	Number of gammas/interactions
id	int[nb]	Id of the core/segment
Energy	float[nb]	Energy of the gamma/hit
TS	unsigned long/unsigned long[nb]	Lowest timestamp/array of all triggered channels
(G)X/(G)Y/(G)Z	float[nb]	Position of the hit/first interaction
T	float[nb]	Cfd time, needs to be added to TS

Agata leaves

- Some leaves are more specific

Leaf name	Data type	Content
trackX2/trackY2/trackZ2	float[nb]	Position of the second interaction of the gamma (for polarization analysis puroposes)
hitX/hitY/hitZ	float[nb]	Position of a hit in the crystal frame of reference
trackFOM	float[nb]	Figure of merit of tracking
trackType	float[nb]	Compton/photoelectric/pair production

Other ancillaries (aka CAEN digitizers)

- Caen digitizers provide a common input data as a consequence each of these detectors (Euclides, Spider, Dante, Labr, …) require a lookup table (LUT) that assigns to board+channel a given signal that is used in the analysis.

Leaf name	Data type	Content
nb	int	Number of channels in an event
Channel	int[nb]	Channel that has triggered
Board	int[nb]	Board that has triggered
TS	unsigned long	Lowest timestamp of all triggered channels
TSHit	unsigned long[nb]	Timestamp of the single hit
Time	float[nb]	Interpolated time, needs to be added to TSHit
Energy	float[nb]	Energy of trapezoid (PHA) of Qlong (PSD)
QShort	float[nb]	Short integration (PSD only)

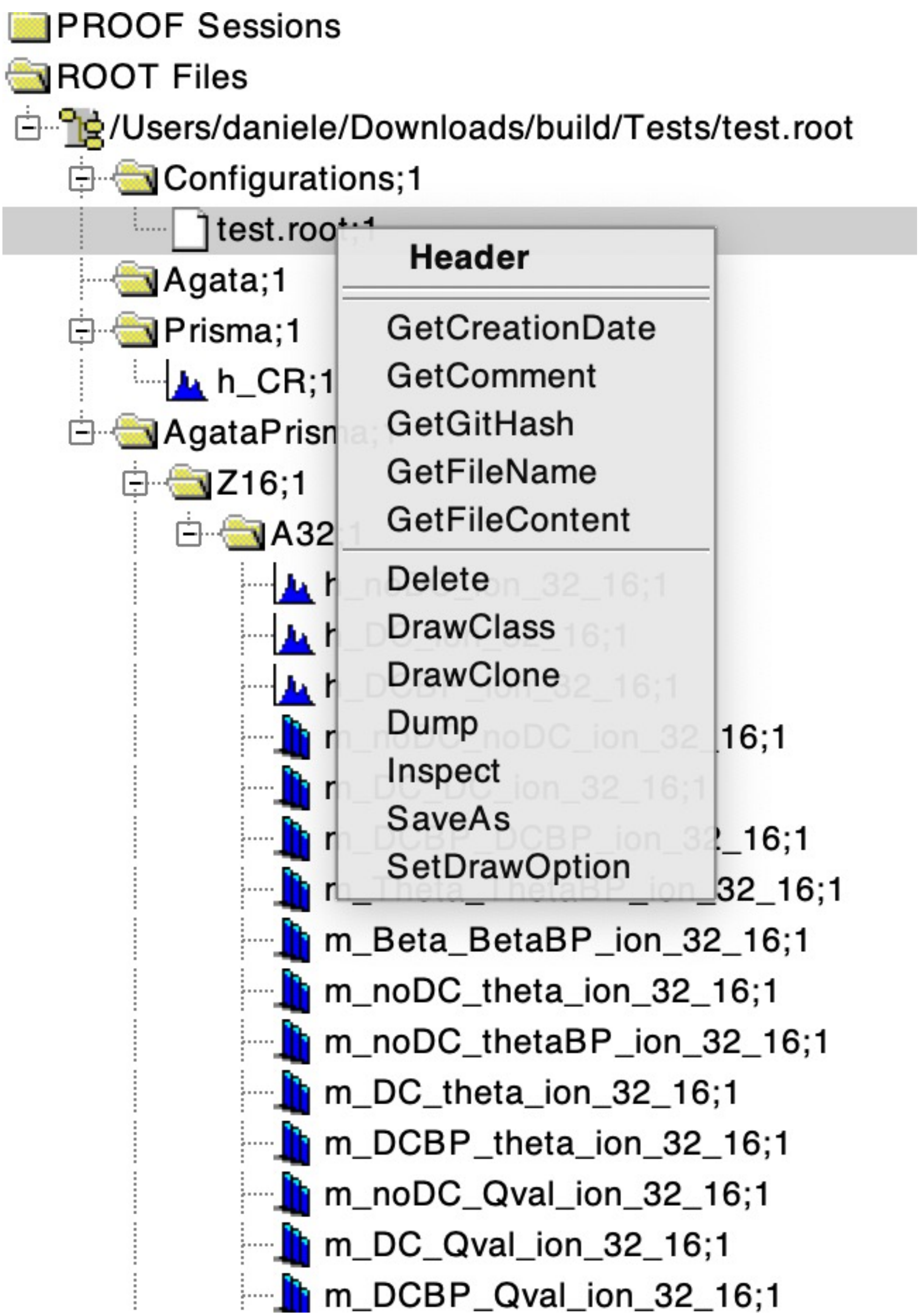
Introduction

- The rest of the analysis is handled by the selector with the exception of Prisma
- The selector represents the last step of the analysis procedure, where the coincidences between different detectors are analyzed
- It allows to generate histograms (and possibly also other root files) with high-level analyzed data
- Can perform optimization procedures to improve on its parameters
- Can place gates and select data based on cuts or intervals
- It can be made user (or experiment) specific to produce ad-hoc spectra
- **It is meant to be modified it at your will as it represents a starting point for the final analysis**

Reproducibility

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

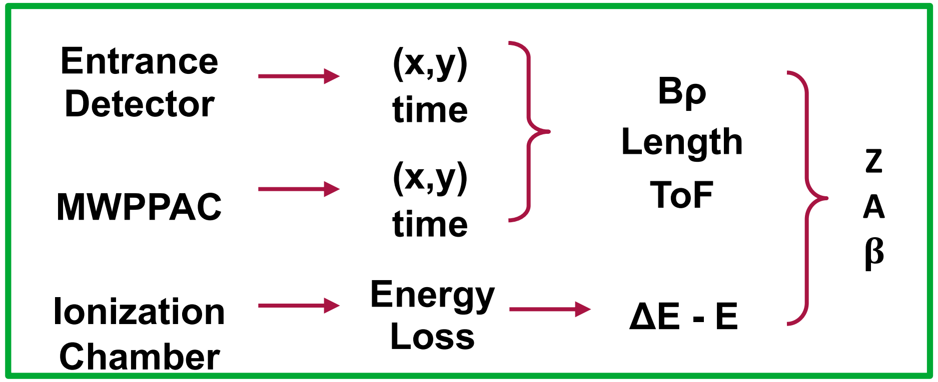
DOI 10.5281/zenodo.8329198



Prisma

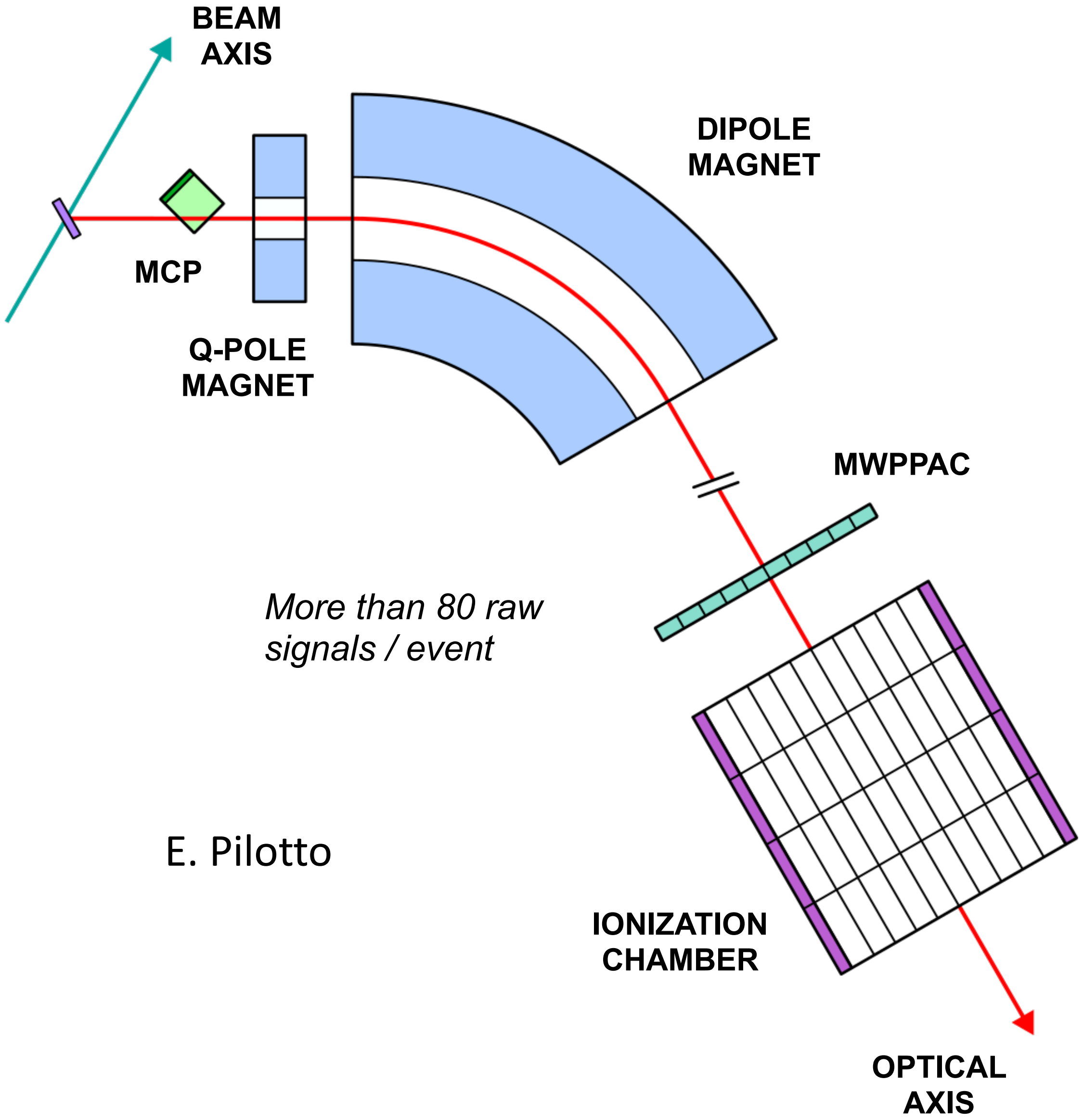
Introduction

See presentation of Elia Pilotto on Wednesday



Typical performance

- Z resolution: ~ 1/60
- A resolution: ~ 1/300



E. Pilotto

E. Pilotto

Workflow

MCP (x,y)
- 2D – gate
- Calibration

PPAC (ToF)
- Thresholds
- *Calibration*

PPAC (x,y)
- Thresholds
- 2D – gates
- Calibration

IC (energy)
- Thresholds
- *Calibration*

SIDE (veto)
- Thresholds

↓

Z – identification (ΔE – E)

- ToF alignment coarse (ToF vs X_{FP} gated on Z)
- ToF alignment fine-tuning (A/q vs X_{FP} gated on Z)
- Set ToF offset

Optical parameters optimization

TRAJECTORY RECONSTRUCTION

↓

Q – identification (E – Rβ)

↓

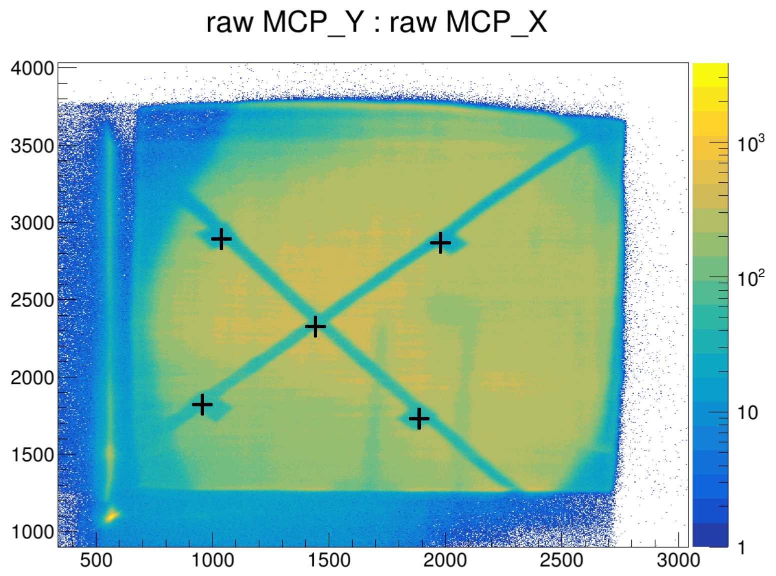
A/q Aberration correction

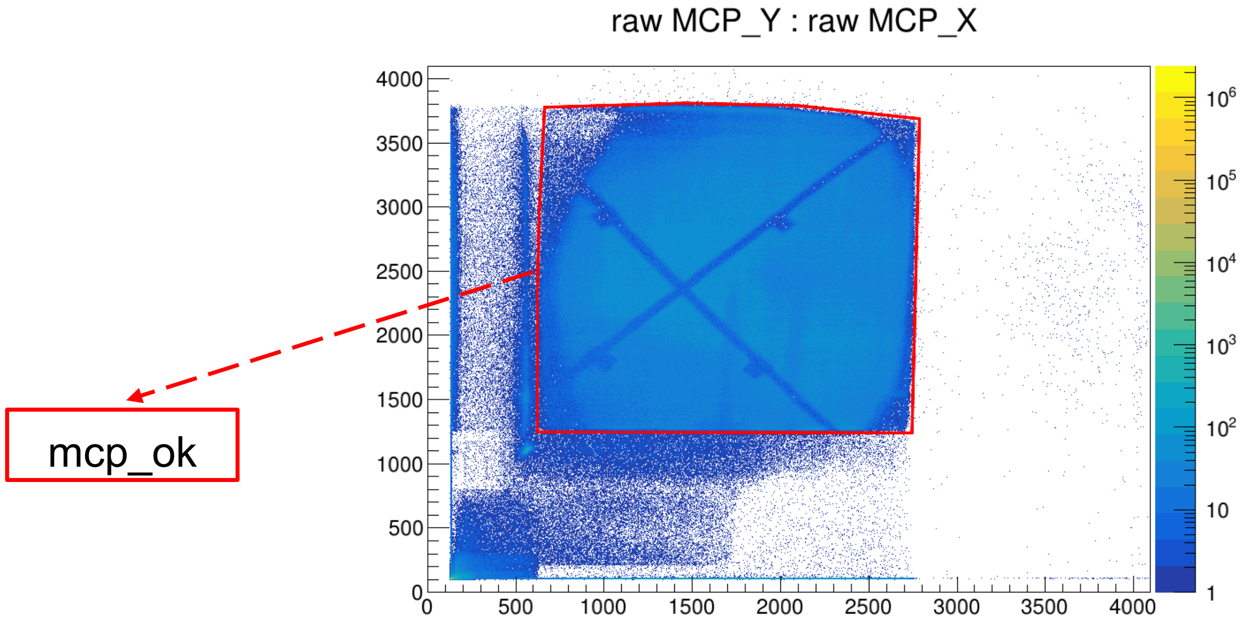
Mass calibration

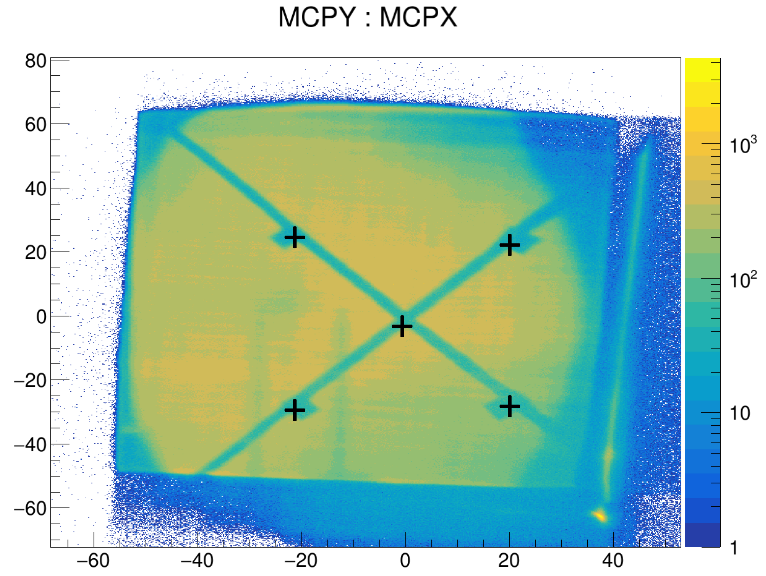
E. Pilotto

MCP alignment

- The MCP needs to be aligned to reference points for:
  - An optimal trajectory reconstruction
  - A correct angle of emission







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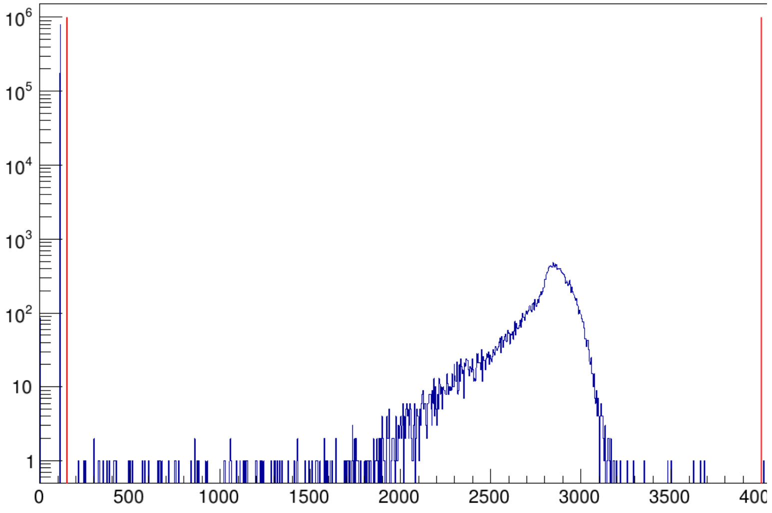
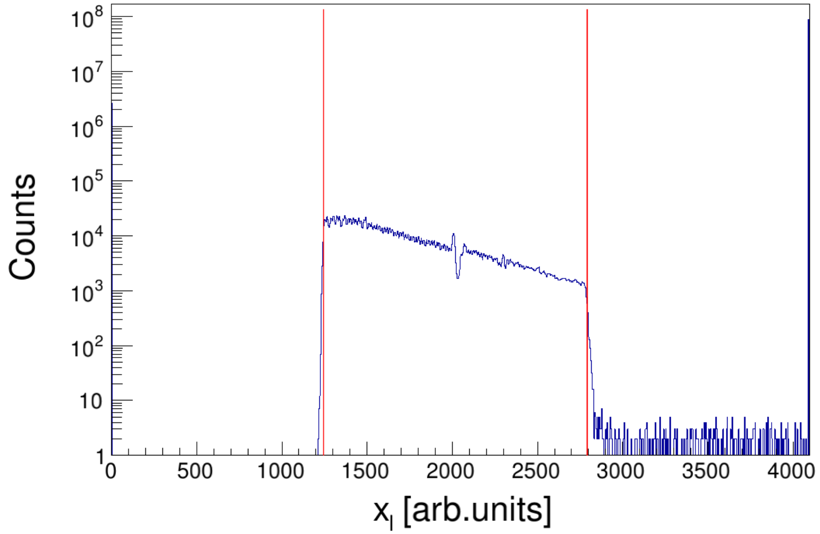
PPAC

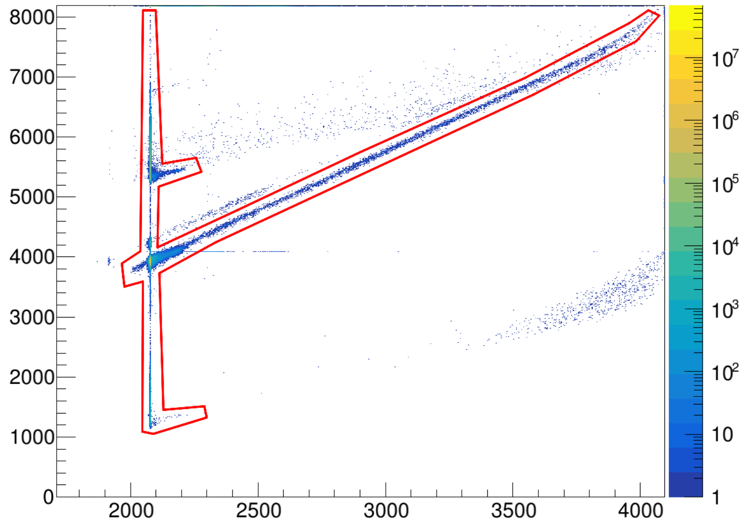
- TOF thresholds



- X,Y position calibration



- L+R: recovering missing statistics



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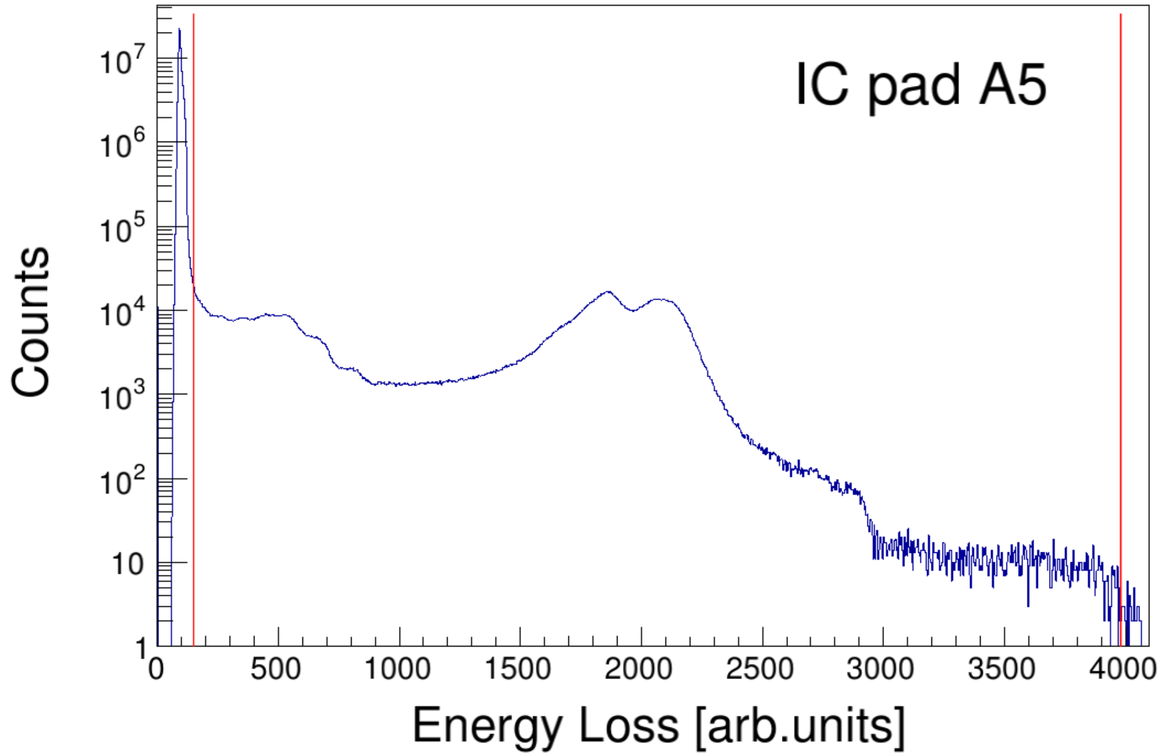
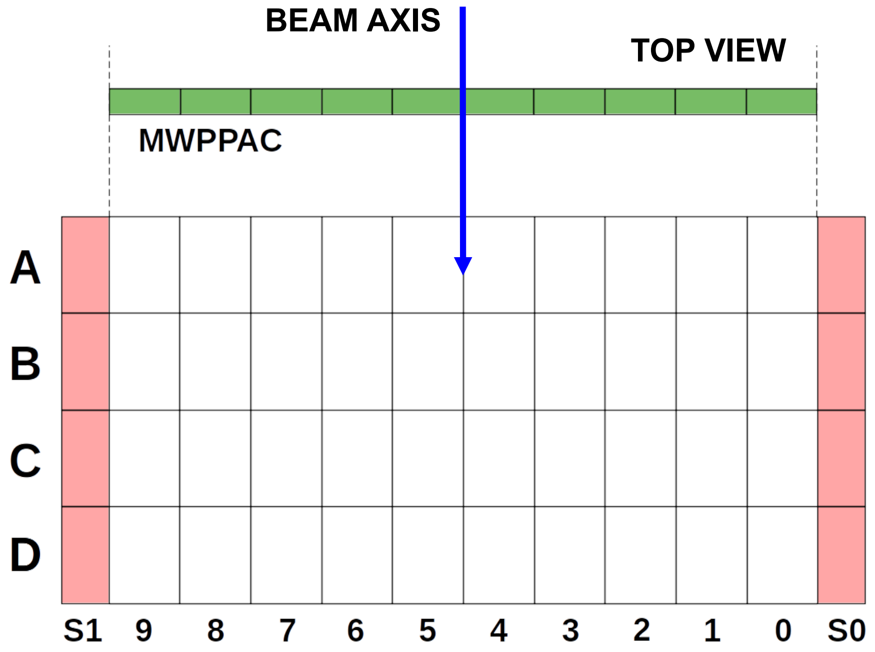
Ionization chamber

- Thresholds





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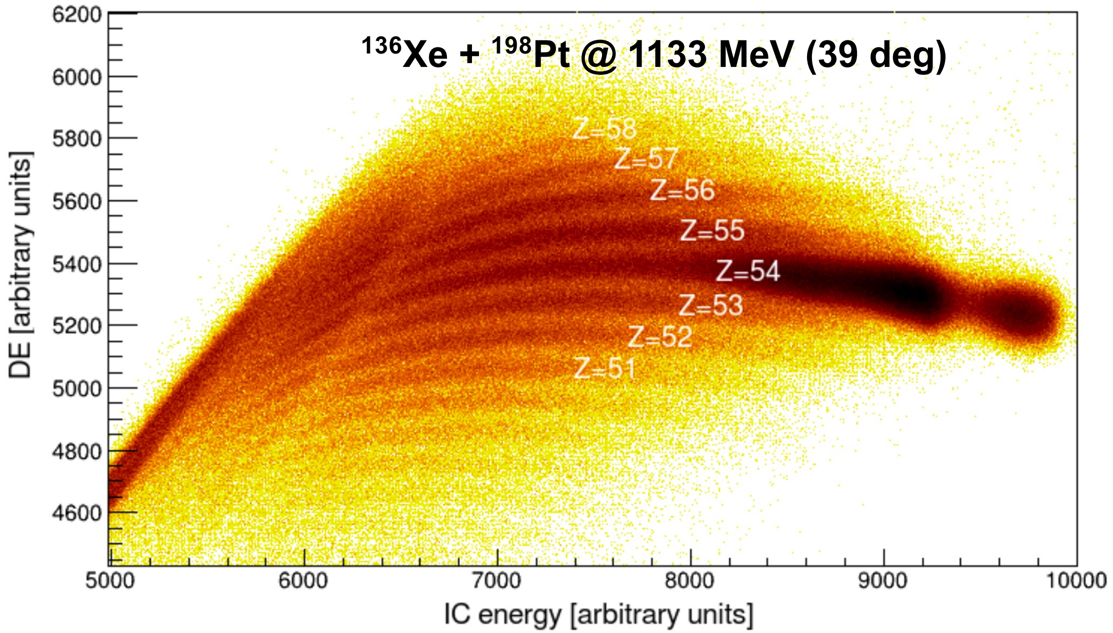
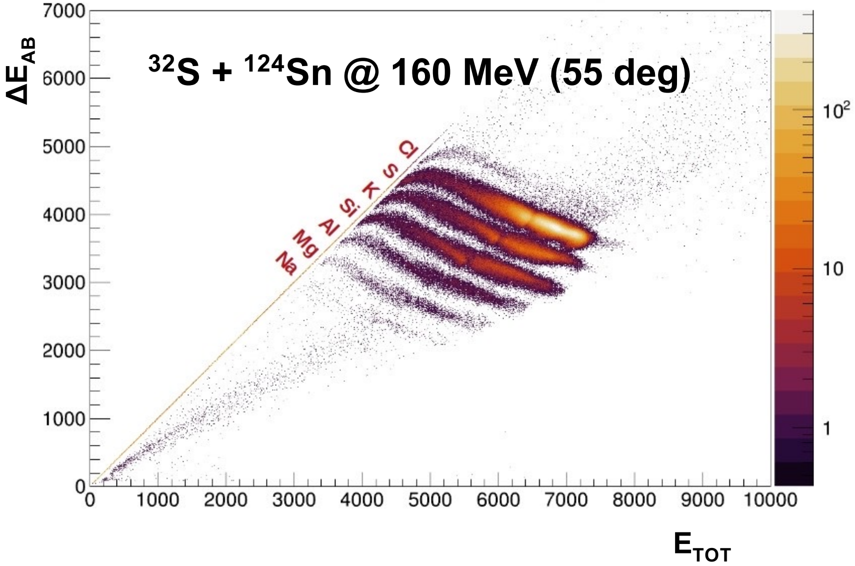
Z identification

- Z selection, can be done on ΔEA or ΔEAB
- Good separation for Z=58, higher Z remains untested but at the limit
- Some alignment is possible but not straightforward



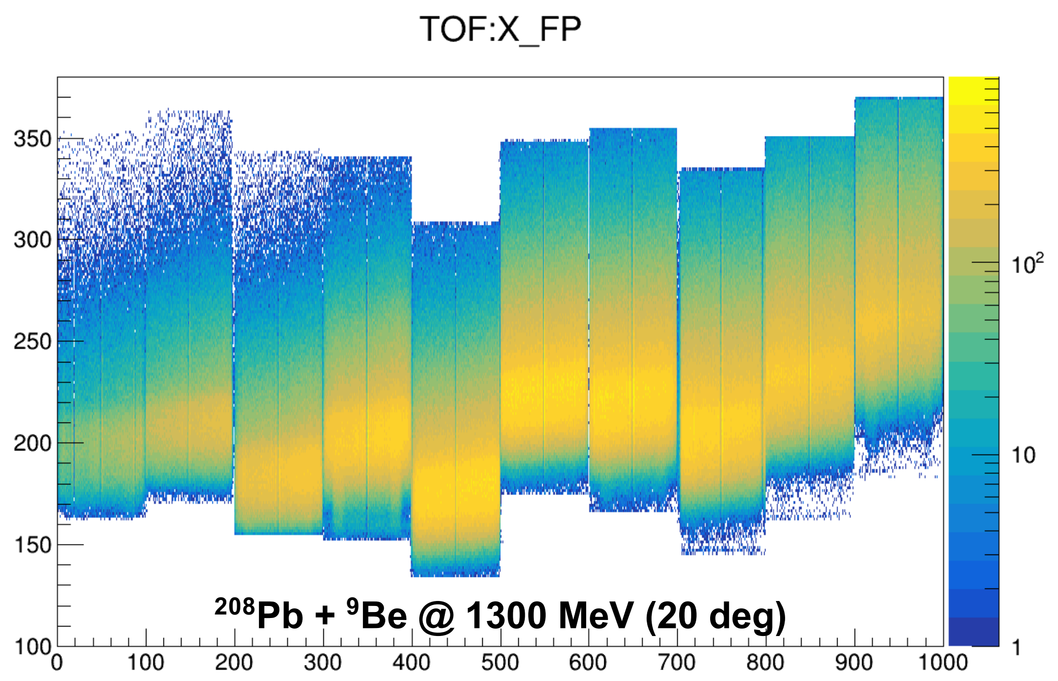
J. Pellumaj PhD thesis

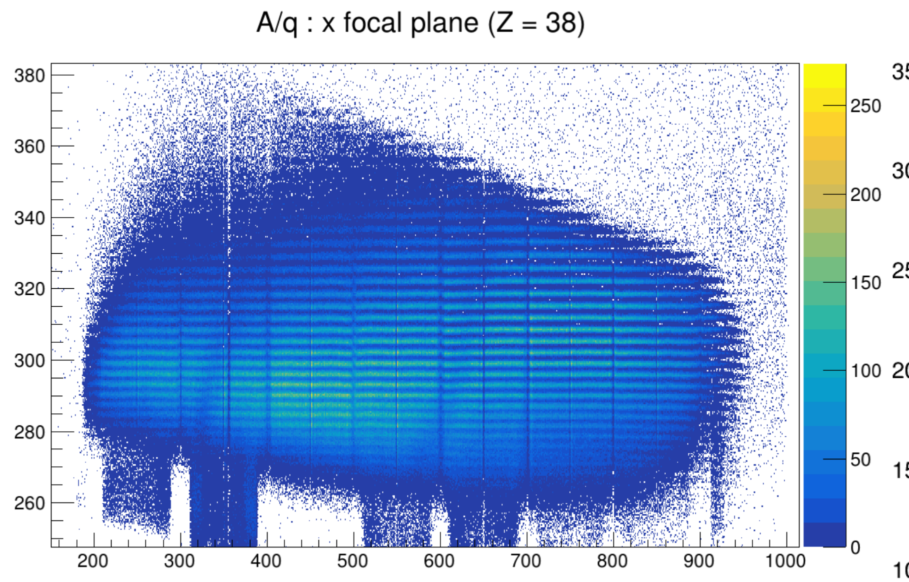
R. Nicolas Master Thesis



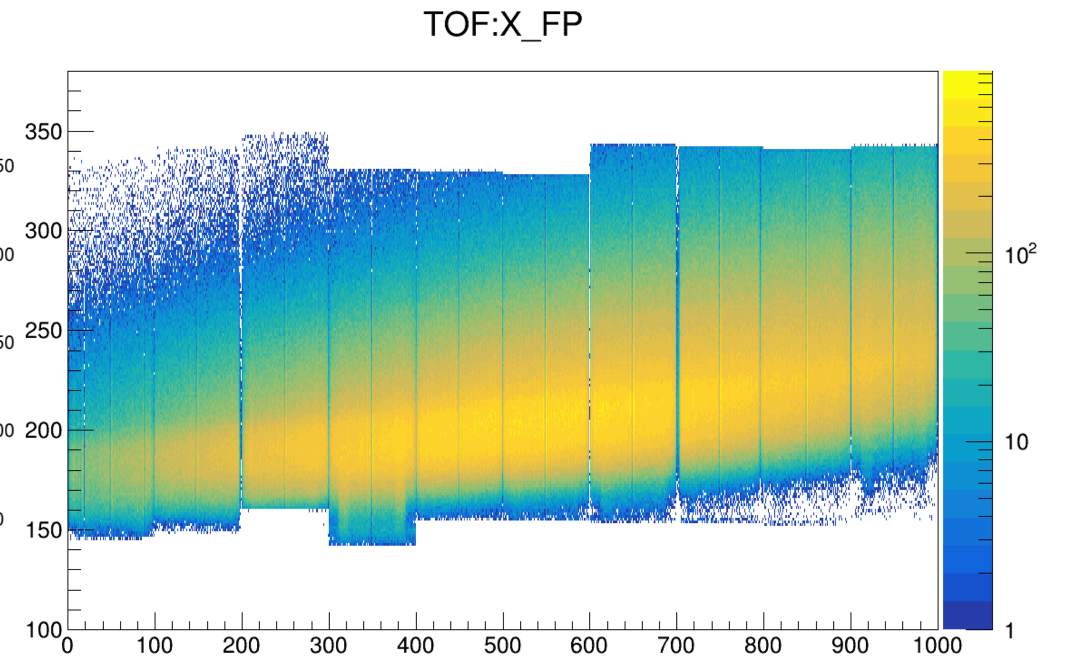
TOF alignment

- Sections need to be aligned with a TOF offset
- A/Q for fine tuning
- Global TOF offset based on gammas and TKEL

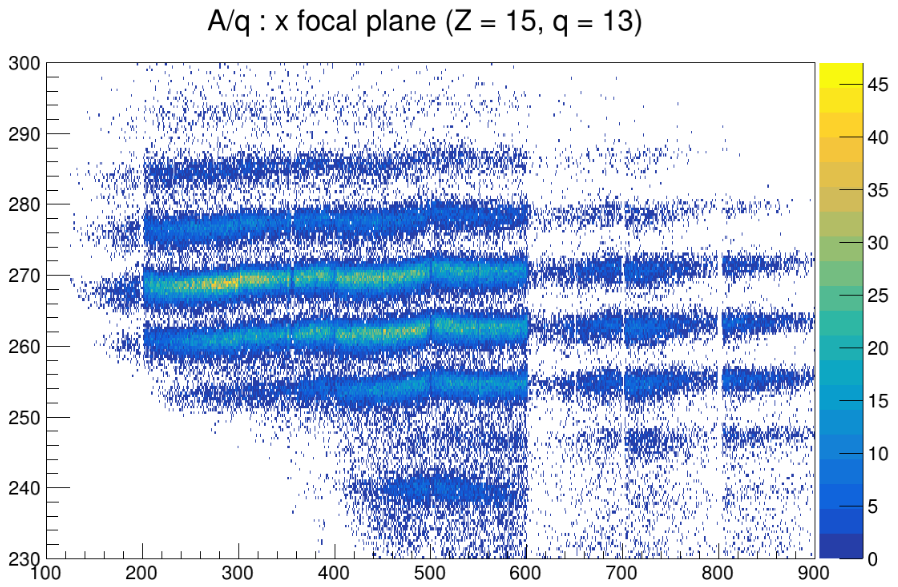




F. Angelini PhD thesis

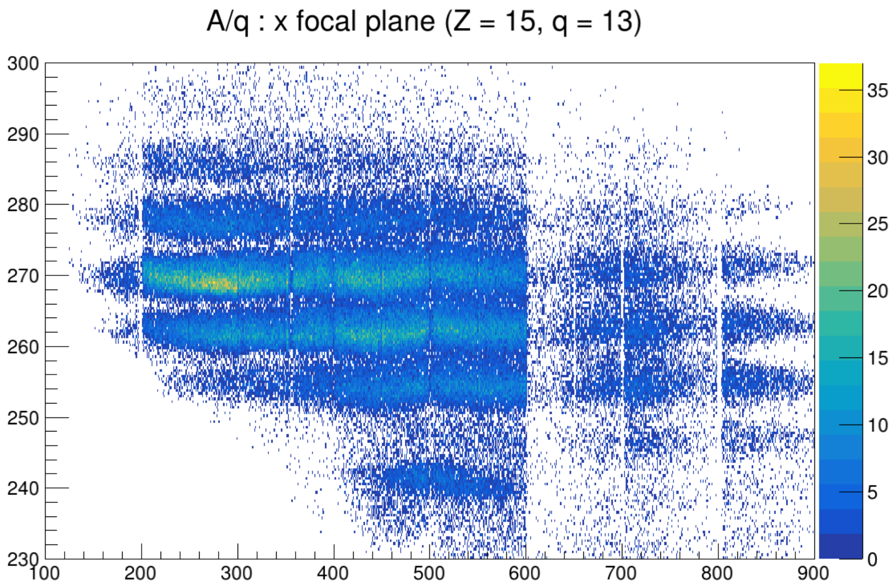


Optimization of optical parameters



^{32}S + ^{208}Pb @ 230 MeV (51 deg)

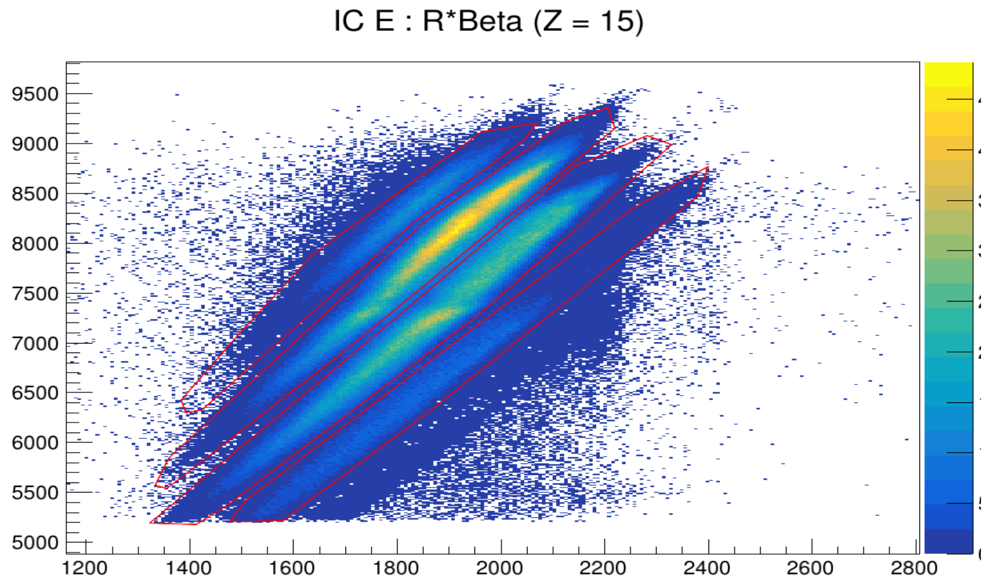
GOOD



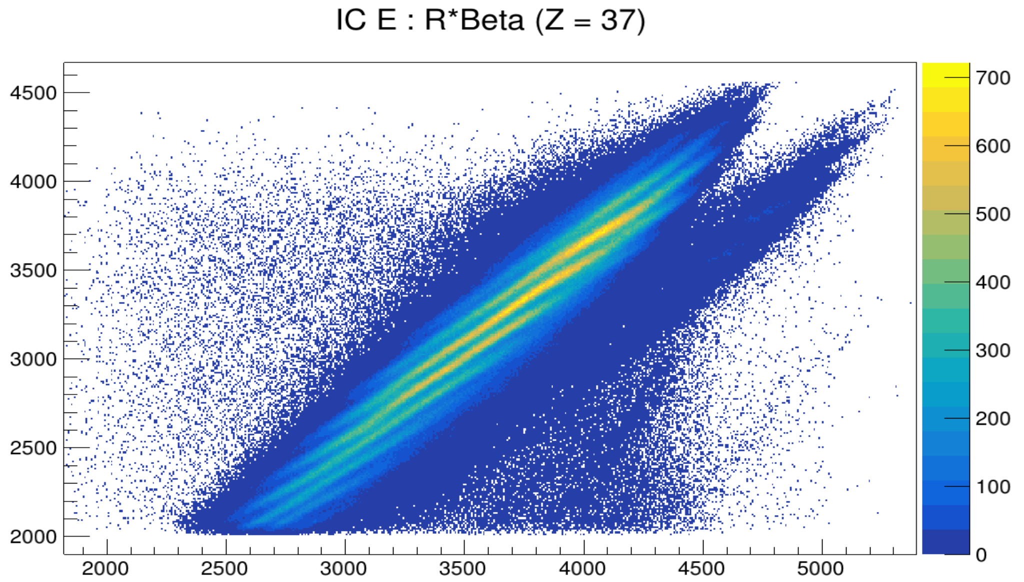
^{32}S + ^{208}Pb @ 230 MeV (51 deg)

BAD

Q identification



$^{36}S + ^{208}Pb$ **@ 250 MeV (51 deg)**

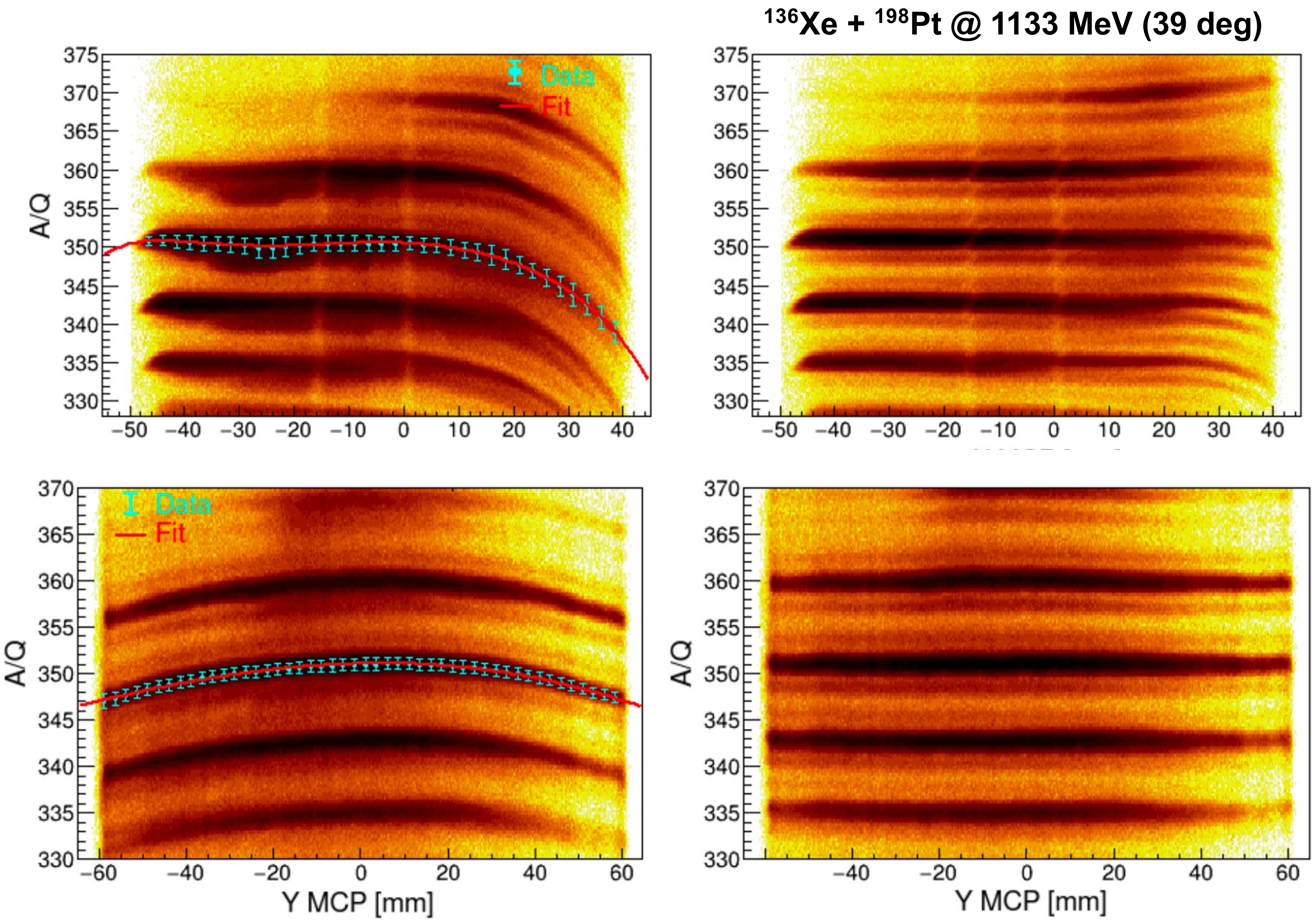


$^{208}Pb + ^{9}Be$ **@ 1300 MeV (20 deg)**

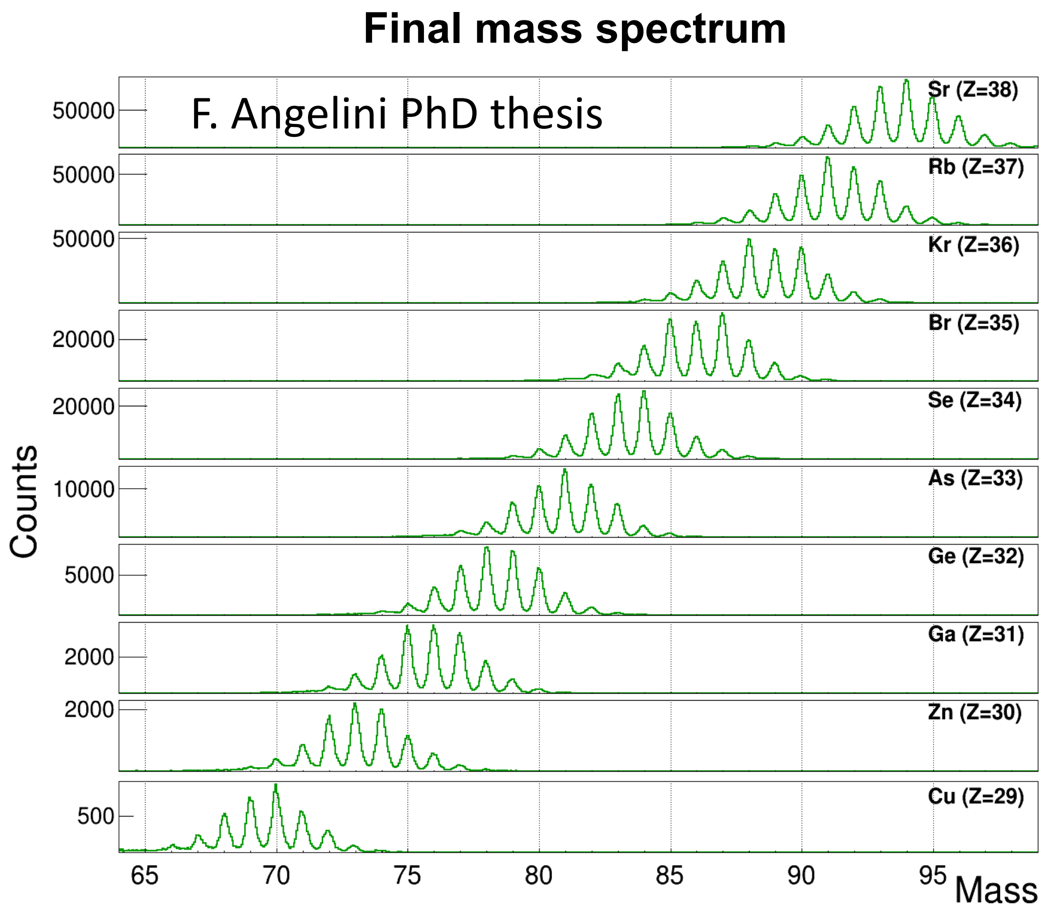
Aberration corrections

J. Pellumaj PhD thesis

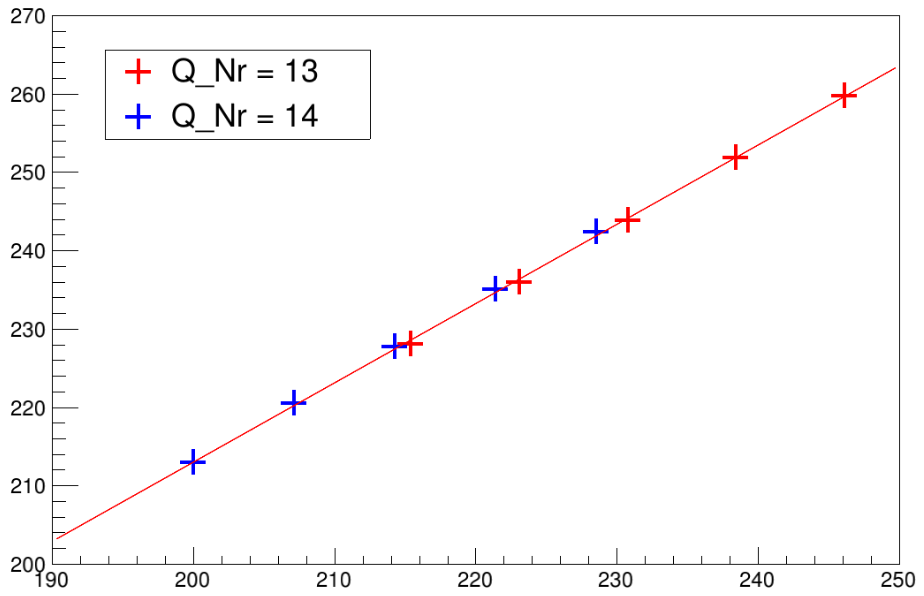
- Correcting for aberrations can help to achieve the nominal resolution 1/300



Mass calibration



^{208}Pb + ^{9}Be @ 1300 MeV (20 deg)



- Final step of the analysis

Other ancillaries and the selector

Structure of the selector.conf

KEYWORD | value(s) | unit of measure | comment

Detectors considered in the analysis

Configuration of the folders, the file patterns, and the TTree names

Configuration of the reaction, multiple ions of interest can be added

Target thickness and rotations, used for energy loss calculaitons. The presence of a degrader before or after the target is also possible.

```
#Configuration file for the selector
#Format: | KEYWORD | value(s) | Unit of measure | Comment |
#Comments are ignored unit of measure # means none
#------------------------------------------------------------

#------------------------------------------------------------
DETECTORS_PRESENT
EUCLIDES                        NO      #               Euclides is present YES/NO
PRISMA                  NO      #               Prisma is present YES/NO
DANTE                   NO      #               Dante is present YES/NO
LABR                    NO      #               Labr is present YES/NO
SPIDER                  NO      #               Spider is present YES/NO
AGATA                   NO      #               Agata is present YES/NO
#------------------------------------------------------------

#------------------------------------------------------------
REPLAY_CONF
ENABLED_HISTOS                  enabled_histos.conf     #               File name with list of enabled histograms
TREE_NAME                       TreeMaster      #               Input tree name
SUM_FILE_PATTERN                        sum     #               Hadded file pattern
OUT_FILE_PATTERN                        run_    #               Output file pattern
IN_FILE_PATTERN                 Tree_   #               Input file pattern
REPLAY_DIR_PATTERN                      run_    #               Replay directory pattern
IN_SUB_PATH                     /Out/Analysis   #               Input sub path
CONF_PATH                       ./Conf  #               Replay conf folder path
OUT_PATH                        ./Out   #               Output path
IN_PATH                 ./Data  #               Input path
#------------------------------------------------------------

#------------------------------------------------------------
REACTION_CONF
REACTION_POSITION                       0.5     #               Position of the reaction in the taget 0->front 0.5->middle, 1->back
ENERGY                  0       MeV             Beam energy
TARGET                  1 1     #               Target ion A Z
BEAM                    1 1     #               Beam ion A Z
ION                     1 1     #               Fragment of interest for binary reaction calculation: A Z (those detected)
#------------------------------------------------------------

#------------------------------------------------------------
TARGET_CONF
DEG_DISTANCE                    0       um              Degrader distance in um
DEG_THICKNESS                   0       mg/cm2          Degrader thickness in mg
ROTATIONZ                       0       deg             Target rotation on the Z axis in degrees
ROTATIONX                       0       deg             Target rotation on the X axis in degrees
TILT                    0       deg             Target tilt in degrees; Negative values for clockwise rotations
THICKNESS                       0       mg/cm2          Target thickness-density in mg/cm2 or units alike
DEG_PRESENT                     NO      #               Degrader present YES/NO
DEG_MATERIAL                    none    #               Degrader material
MATERIAL                        none    #               Target material
DEG_POS                 AFTER                   Degrader position BEFORE/AFTER
#------------------------------------------------------------
```

LUT

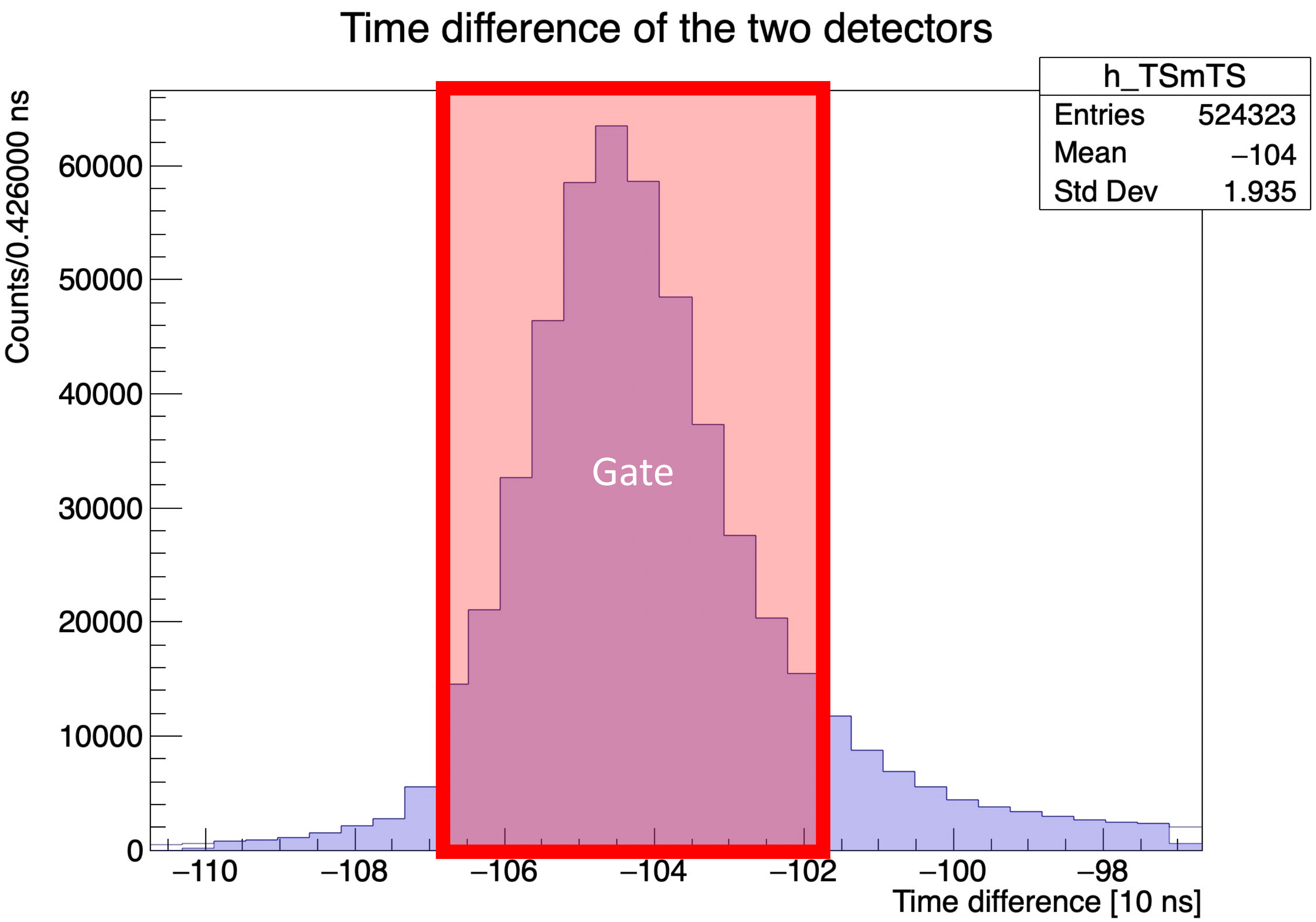
- The default LUTs can be found in User/EXP/Template/Conf/LUT/.
- The name of a channel+board combination is important for the analysis
- Generally, they allow to add an energy threshold (low, high), a time offset for alignment, and a N-degree polynomial calibration
- The remaining parameters are detector dependent and include angles or positions in space

LUT_LABR.dat 1.16 KiB Edit

```
#LaBr Co+Cs
#board (V1730)  channel map     name    thr_lo  thr_hi  theta   phi     TimeOffset      npar_gl p0_ql   p1_q2   npar_qs p0_qs   p1_qs
1       0       0       D0      0       16000   90.422684  124.92098   0       2       -8.590549465 0.5683940043  2     -16.614035 0.584031
1       1       1       D1      0       16000   84.308418  97.489398   0       2       4.994643769  0.441859949   2  10.570262 0.443247
1       2       2       D2      0       16000   90.572804  73.768608   0       2       -4.882700373 0.4567364497  2  -9.782321 0.473778
1       3       3       D3      0       16000   99.968116  51.748253   0       2       -2.68135951  0.4616749283  2  -9.040133 0.473527
1       4       4       D4      0       16000   93.353077  26.901224   0       2       -3.368474921 0.4774816369  2  0.609657 0.481297
1       9       9       D5      0       16000   94.007297  1.3778600   0       2       0            1             2  0        1
1       5       5       D6      0       16000   99.883486  -28.723198  0       2       10.52197059  0.4435828877  2  18.918459 0.444711
1       6       6       D7      0       16000   86.180070  -45.908423  0       2       12.53667474  0.4240481389  2  28.411274 0.421525
1       7       7       D8      0       16000   91.699165  -66.505287  0       2       16.78408614  0.3897415818  2  35.049303 0.387539
1       8       8       D9      0       16000   85.591641  -95.344627  0       2       -12.39452343 0.4289130669  2  -38.673472 0.452371
##########
1       15      15      monitor 0       16000   0                      0       0       2       0       1       2       0       1
```

Time coincidences

- All ancillary detectors need to be time-gated
- All coincidences will have a time difference histogram that is used to select the gate in the ***_CONF
- Some detectors such as Euclides, Agata have an internal time gate
- All time gates are set with the parameter:
  - COINC_W_LEFT
  - COINC_W_RIGHT

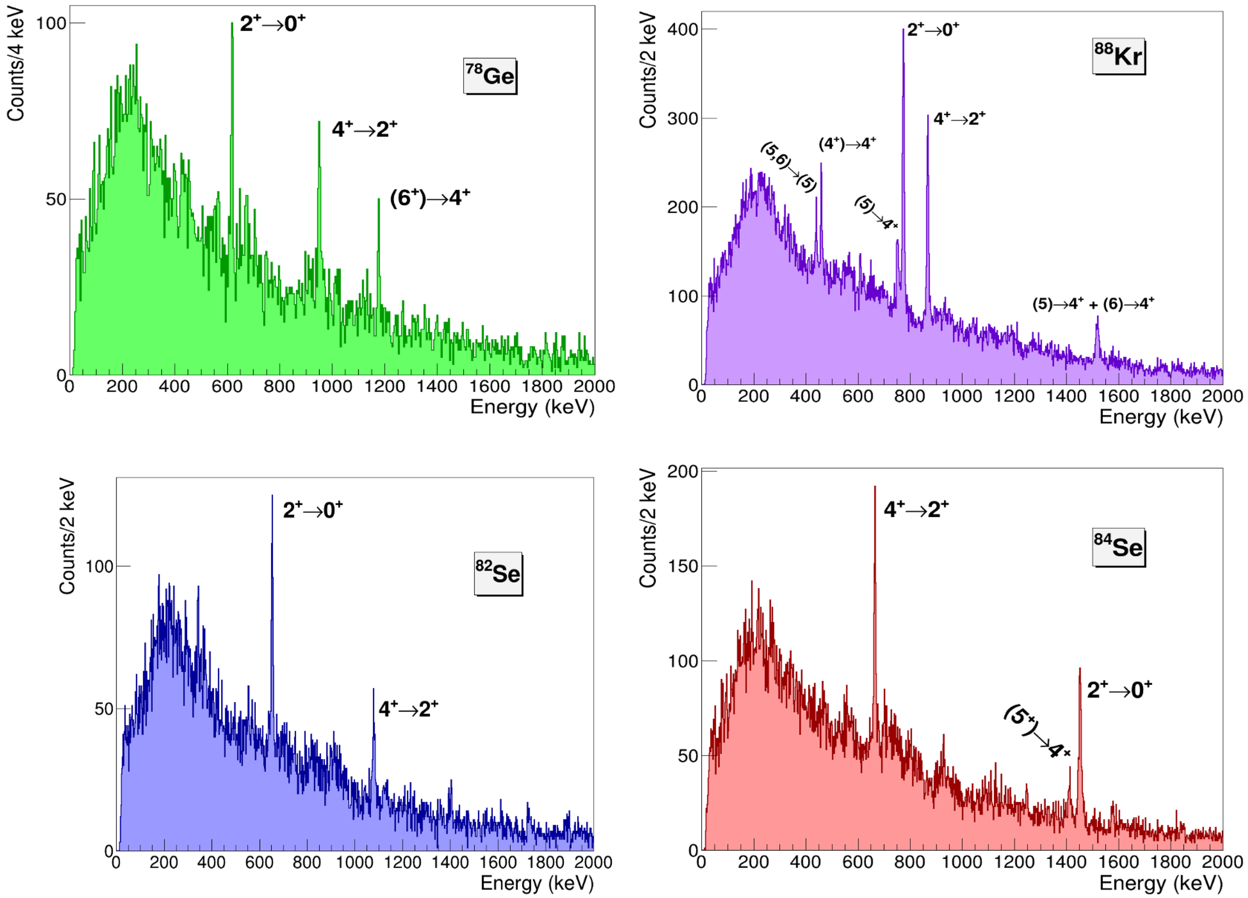


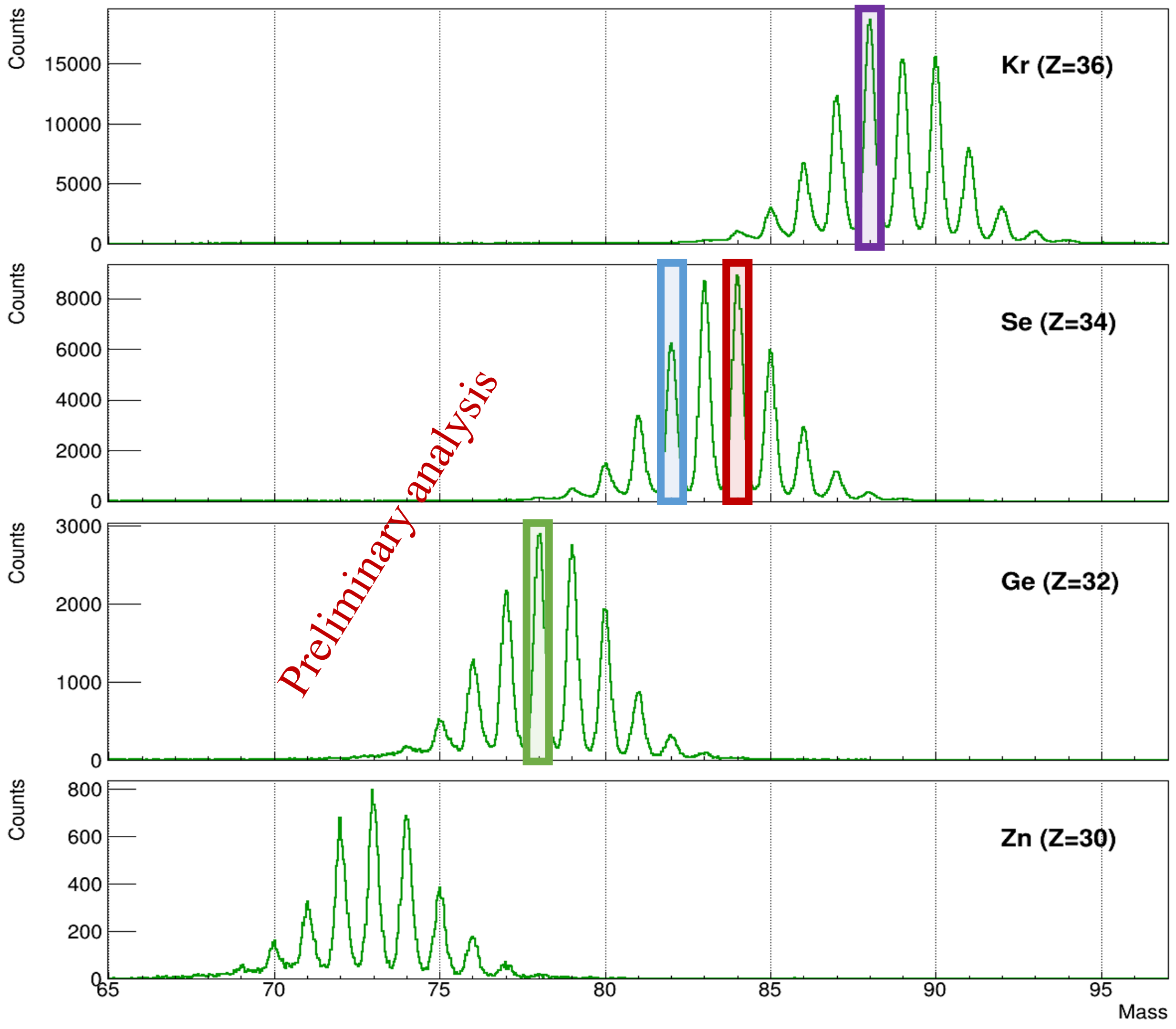
Prisma

- Broken IC or PPAC channels can be disabled
- The TOF offset can be set in the selector to optimize the Doppler correction without disrupting the identification
- One can require or discard some parameters such as TOF_OK, IC_OK to perform the analysis
- Cuts in Z can be placed in Conf/CUT/Prisma/IC/ to produce histograms in coincidence
- In AGATAPRISMA_CONF it is possible to set EX_VALUES to gate on specific values of TKEL and generate additional histograms

Prisma

- Example of identification

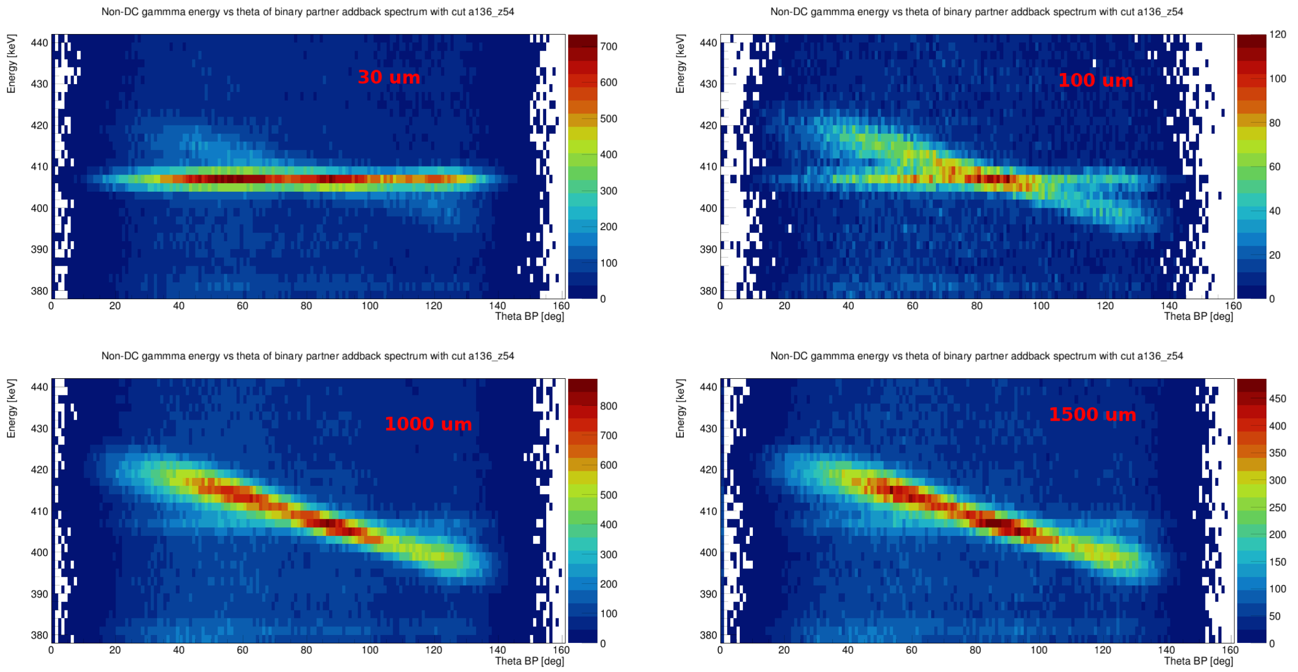




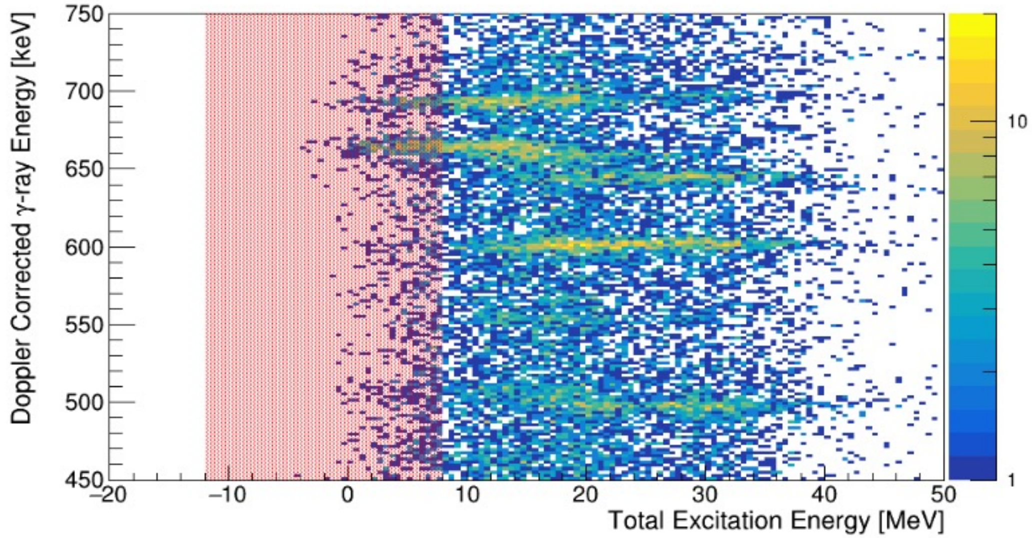
F. Angelini PhD Thesis

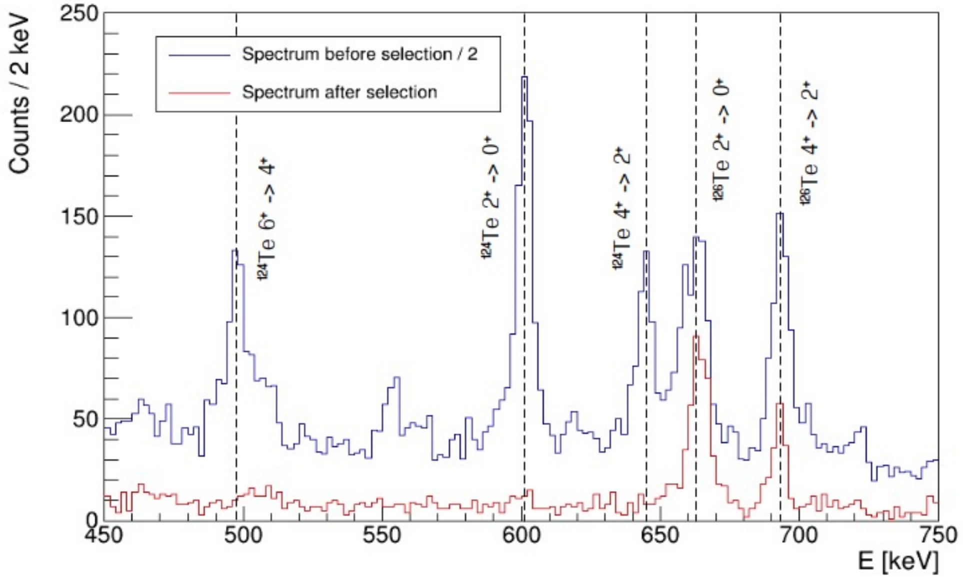
Prisma example

- Prisma provides the possibility of a fine kinematics reconstruction
- The Q-value matrices are often a very powerful tool
- The angle reconstruction is also great



E. Pilotto Master Thesis

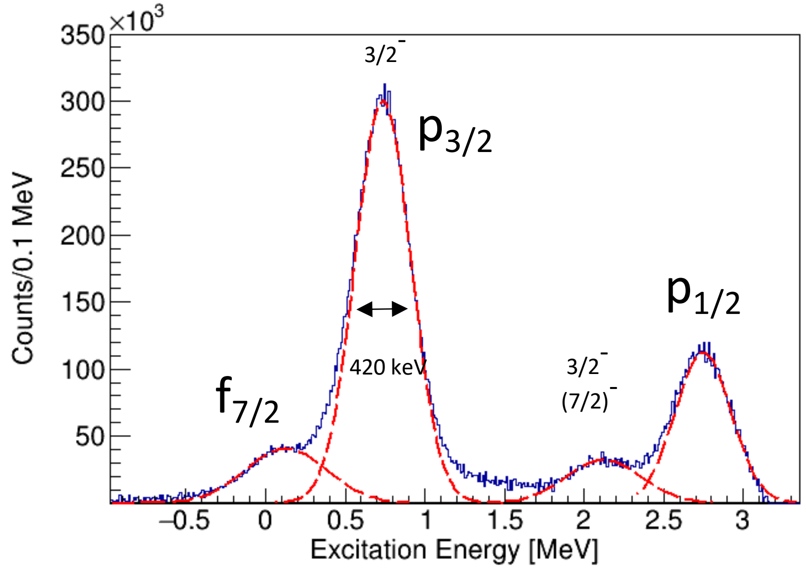


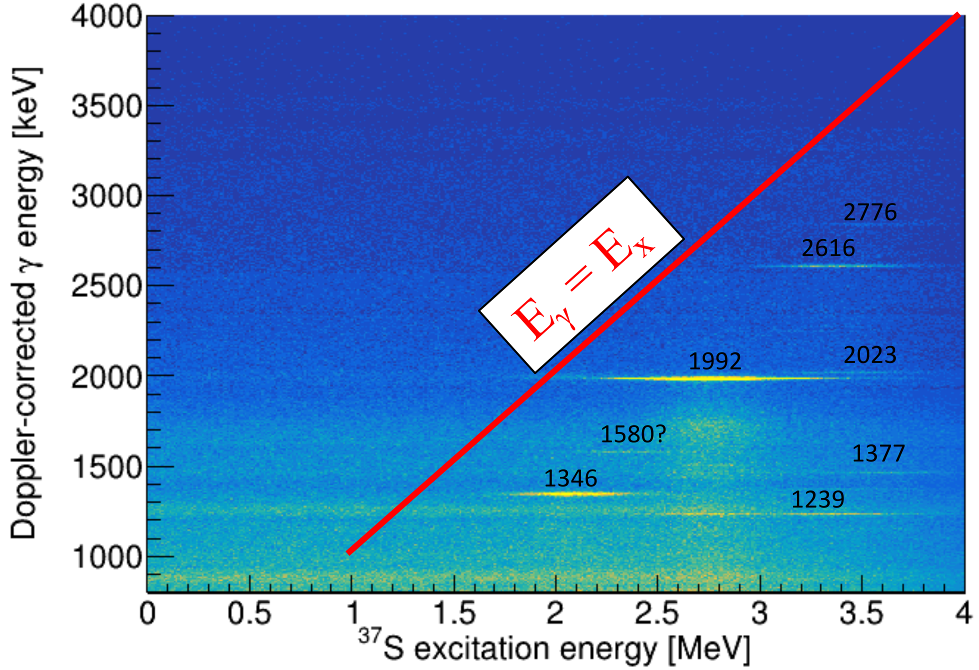


Spider

- The first step
- In some cases, the excitation energy can be very helpful
- The EX_VALUES keyword allows to generate histograms gated on the right value

L. Zago PhD Thesis





Spider

- Additionally, it is possible to gate on a gamma-ray to generate additional histograms in coincidence with it such as additional gamma-gamma matrices with the keyword GAMMA_GATE of AGATASPIDER_CONF
- Kinematic line TCuts can be placed in the Conf/CUT/SPIDER/ThetaLabELab folder
- To extract the optimal results it is possible to tune theta and phi of each spider channel to optimize the Doppler correction. This feature is under construction and testing and can be compiled running cmake with the option –DSPIDER_ANGCAL=On

main ⌄   agataselector / User / EXP / Template / Conf / LUT / LUT_SPIDER.dat   Find file   Blame   History   Permalink

LUT_SPIDER.dat   3.64 KiB   Edit ⌄

Spider

- Detector dependent parameters:
  - Theta
  - Phi
- Channel names are not important but are helpful for the user

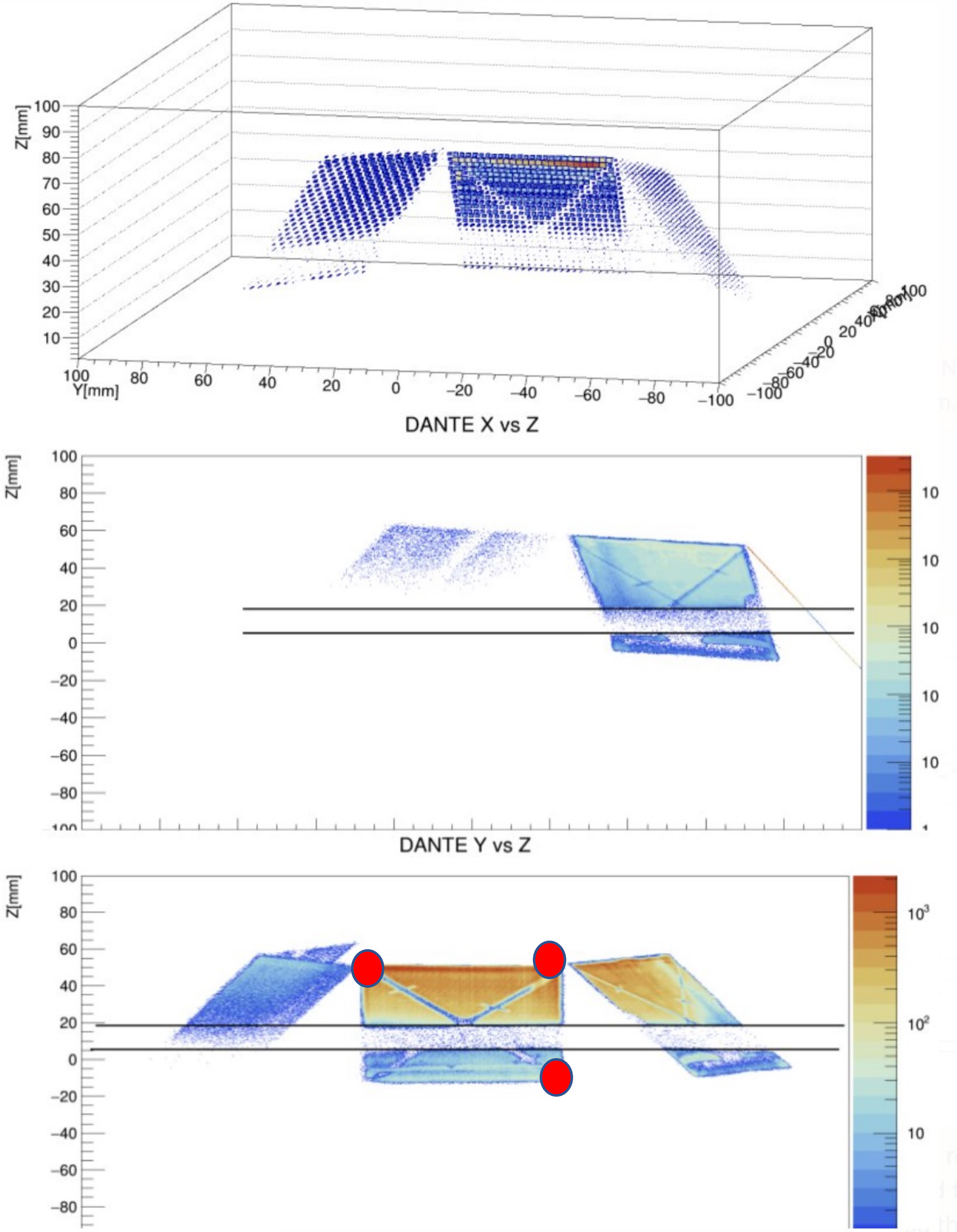
```
####### SPIDER ######
#
# the "map" number conversion into detector and strip:
# strip = (map % 10) + 1
# detector = (map / 10) + 1
#
# Board channel map     name    thr_lo  thr_hi  theta   phi     TimeOffset      ncalpar calpars
2       0       11      D2S2    5.00    200.00  155.2   103.99  0       2        0.015509 0.007579
2       1       10      D2S1    5.00    200.00  159.6   103.99  0       2        -0.007763 0.007412
2       2       13      D2S4    5.00    200.00  146         103.99  0   2        -0.106650 0.007794
2       3       12      D2S3    5.00    200.00  150.6   103.99  0       2        -0.053865 0.007696
2       4       15      D2S6    5.00    200.00  136.8   103.99  0       2        0.024495 0.007678
2       5       14      D2S5    5.00    200.00  141.4   103.99  0       2        -0.105075 0.008076
2       6       17      D2S8    5.00    200.00  128         103.99  0   2        0.596364 0.006813
2       7       16      D2S7    5.00    200.00  132.3   103.99  0       2        -0.007975 0.007406
2       8       1       D1S2    5.00    200.00  155.2   52.56           0       2       -0.020980 0.007575
2       9       0       D1S1    5.00    200.00  159.6   52.56           0       2       0.020538 0.007667
2       10      3       D1S4    5.00    200.00  146         52.56          0    2       -0.074459 0.007833
2       11      2       D1S3    5.00    200.00  150.6   52.56           0       2       0.069455 0.007586
2       12      5       D1S6    5.00    200.00  136.8   52.56           0       2       0.069455 0.007586
2       13      4       D1S5    5.00    200.00  141.4   52.56           0       2       0.002820 0.007616
2       14      7       D1S8    5.00    200.00  128         52.56          0    2       -0.068986 0.007928
2       15      6       D1S7    5.00    200.00  132.3   52.56           0       2       -0.069752 0.007978
3       0       21      D3S2    5.00    200.00  155.2   155.42  0       2        -0.092525 0.007750
3       1       20      D3S1    5.00    200.00  159.6   155.42  0       2        0.019792 0.007567
3       2       23      D3S4    5.00    200.00  146         155.42  0   2        -0.095189 0.007730
3       3       22      D3S3    5.00    200.00  150.6   155.42  0       2        -0.083473 0.007729
3       4       25      D3S6    5.00    200.00  136.8   155.42  0       2        -0.129812 0.007645
3       5       24      D3S5    5.00    200.00  141.4   155.42  0       2        -0.014150 0.007764
3       6       27      D3S8    5.00    200.00  128         155.42  0   2        -0.298379 0.008233
3       7       26      D3S7    5.00    200.00  132.3   155.42  0       2        -0.076554 0.008127
3       8       31      D4S2    5.00    200.00  155.2   -153.15 0       2        -0.070739 0.007672
3       9       30      D4S1    5.00    200.00  159.6   -153.15 0       2        -0.024926 0.007658
3       10      33      D4S4    5.00    200.00  146         -153.15  0  2        -0.080259 0.007892
3       11      32      D4S3    5.00    200.00  150.6   -153.15 0       2        0.030901 0.007860
3       12      35      D4S6    5.00    200.00  136.8   -153.15 0       2        -0.055390 0.007706
3       13      34      D4S5    5.00    200.00  141.4   -153.15 0       2        -0.027635 0.007842
3       14      37      D4S8    5.00    200.00  128         -153.15  0  2        0.734327 0.006771
3       15      36      D4S7    5.00    200.00  132.3   -153.15 0       2        -0.155590 0.007960
4       0       51      D6S2    5.00    200.00  155.2   -50.3           0       2       -0.020294 0.007366
4       1       50      D6S1    5.00    200.00  159.6   -50.3           0       2       -0.018177 0.007397
4       2       53      D6S4    5.00    200.00  146         -50.3          0    2       -0.044438 0.007546
```

Dante

- In general, a “perfect” Dante event should contain at least 3 events, corresponding to x, y (TACS) and T (cfd logic signal)
- Additionally, a TAC can be placed between Dante and Prisma, this is also handled by the analysis
- This does not happen all the time and the selector should handle this, some options are present in the selector.conf file
- The spatial calibration is performed by selecting the (x,y) points of the extremities of the
- The analysis should be expanded and improved for Dante

Dante

- The position is used to refine the Doppler correction
- It is possible to set gates in Conf/Cuts/PrismaDante/TOF_TKEL
- In this case of the triple coincidence AGATA-PRISMA-DANTE it is necessary to set two time gates: agata-prisma and agata-dante



Dante

- Detector dependent parameters:
    - P1, P2, P3
    - pos1, pos2, pos3

- Channel names distinguish X, Y, T and TOF

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LUT_DANTE_3det_0deg.dat 2.75 KiB Edit ⌄

```
#            2                  X        Y          Z
#                       D1P1  72.8361   25.3272    23.7575
#              D1       D1P2  41.2708   77.7189   -11.2993
#                       D1P3  35.3073   25.3272    57.5486
#          3 1     3
#                       D2P1  72.8935  -25.2499    23.7059
#     D2        X       D2P2  80.2628  -25.2499   -46.4078
#                       D2P3  72.8935   25.2500    23.7059
#  2       1 3     1
#                       D3P1  35.3073  -25.3272    57.5486
#              D3       D3P2   3.7420  -77.7189    22.4917
#                       D3P3  72.8361  -25.3272    23.7575
#                  2
#
#Board channel name  thr_lo thr_hi P1(x,y,z) P2(x,y,z) P3(x,y,z) pos1 pos2 po3  Time Offset
1      0       D1X   4726   6700    72.8361   41.2708   35.3073  6700 4726 6700 0
1      1       D1Y   3110   4535    25.3272   77.7189   25.3272  3110 3110 4535 0
1      2       D1T   0      2000    23.7575  -11.2993   57.5486  0    0    0    0
#
1      4       D2X   4060   5990    72.8935   80.2628   72.8935  5990 4060 5990 0
1      5       D2Y   3850   5570   -25.2499  -25.2499   25.2500  3850 3850 5570 0
1      6       D2T   0      2000    23.7059  -46.4078   23.7059  0    0    0    0
#
1      8       D3X   4381   6597    35.3073    3.7420   72.8361  6597 4381 6597 0
1      9       D3Y   3605   5625   -25.3272  -77.7189  -25.3272  3605 3605 5625 0
1      10      D3T   0      2000    57.5486   22.4917   23.7575  0    0    0    0
#
1      12      D4X   10000  5000    36.0146  -24.5866   59.1902  5000 2200 5000 0
1      13      D4Y   10000  3500   -27.7491  -60.1032  -52.9991  2100 2100 3500 0
1      14      D4T   0      2000    56.3766   40.5354   19.2878  0    0    0    0
```

The lookup table also performs the 3D position reconstruction of DANTE, mapping 2D points (pos1, pos2, pos2) to 3D points (P1, P2, P3)

LaBr

- They share the same base class of Agata: GammaDetector
- As a consequence, the analysis of coincidences with Agata is exactly the same, so you can perform the same analysis as for Agata.
- In some cases, they were acquired without external trigger, meaning that they will have a lot of data. In this case you can use the --labr_slave option of ReadCaenRaw and/or the mandatoryKey of femul to process their data only if it is in coincidence with other ancillaries in the first case or femul in the second.
- In the case of experiments with Prisma, we discovered that they are strongly affected by the magnetic field despite the shielding so they require a calibration when the magnet was on

Labr

- Detector dependent parameters:
  - Theta
  - Phi

main ⌄ agataselector / User / EXP / Template / Conf / LUT / LUT_LABR.dat

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LUT_LABR.dat 1.16 KiB

Edit ⌄

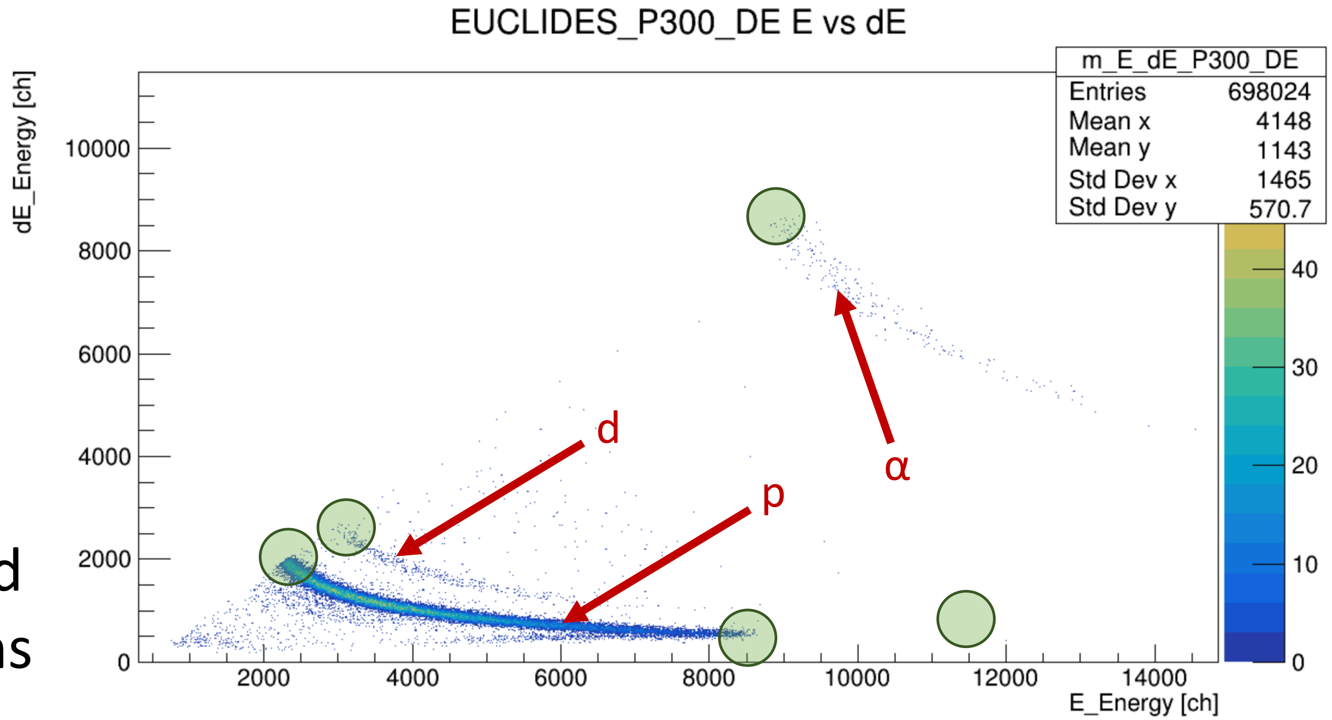
```
#LaBr Co+Cs
#board (V1730)  channel map      name     thr_lo   thr_hi   theta    phi      TimeOffset      npar_gl p0_ql    p1_q2    npar_qs p0_qs    p1_qs
1       0       0       D0       0        16000    90.422684  124.92098   0       2       -8.590549465 0.5683940043  2     -16.614035 0.584031
1       1       1       D1       0        16000    84.308418  97.489398   0       2       4.994643769  0.441859949    2  10.570262 0.443247
1       2       2       D2       0        16000    90.572804  73.768608   0       2       -4.882700373 0.4567364497   2  -9.782321 0.473778
1       3       3       D3       0        16000    99.968116  51.748253   0       2       -2.68135951  0.4616749283   2  -9.040133 0.473527
1       4       4       D4       0        16000    93.353077  26.901224   0       2       -3.368474921 0.4774816369   2  0.609657 0.481297
1       9       9       D5       0        16000    94.007297  1.3778600   0       2       0            1              2  0        1
1       5       5       D6       0        16000    99.883486  -28.723198  0       2       10.52197059  0.4435828877   2  18.918459 0.444711
1       6       6       D7       0        16000    86.180070  -45.908423  0       2       12.53667474  0.4240481389   2  28.411274 0.421525
1       7       7       D8       0        16000    91.699165  -66.505287  0       2       16.78408614  0.3897415818   2  35.049303 0.387539
1       8       8       D9       0        16000    85.591641  -95.344627  0       2       -12.39452343 0.4289130669  2  -38.673472 0.452371
##########
1       15      15      monitor 0        16000    0                      0       0       2       0          1          2   0          1


```

Euclides

- Set gates for all telescopes in Conf/CUT/EUCLIDES/EdE/
- The naming scheme to adopt should be z1_m1_mapnr for while for alphas it should be z2_m2_mapnr
- Check the time alignment
- Calibrate with alpha run or with punch trough points
- In this case the reaction of interest could be a Nbody reaction. In this case the ions of interest need to be specified with:

  IONS A1 Z1 A2 Z2 A3 Z3 END Comment



Mirco Del Fabbro PhD Thesis

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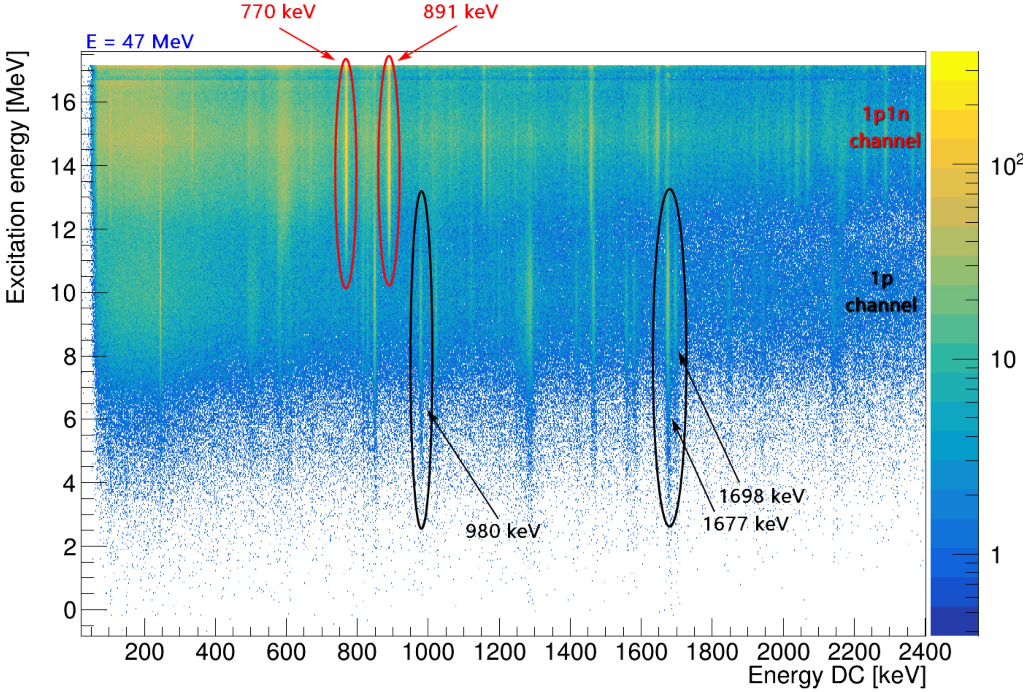
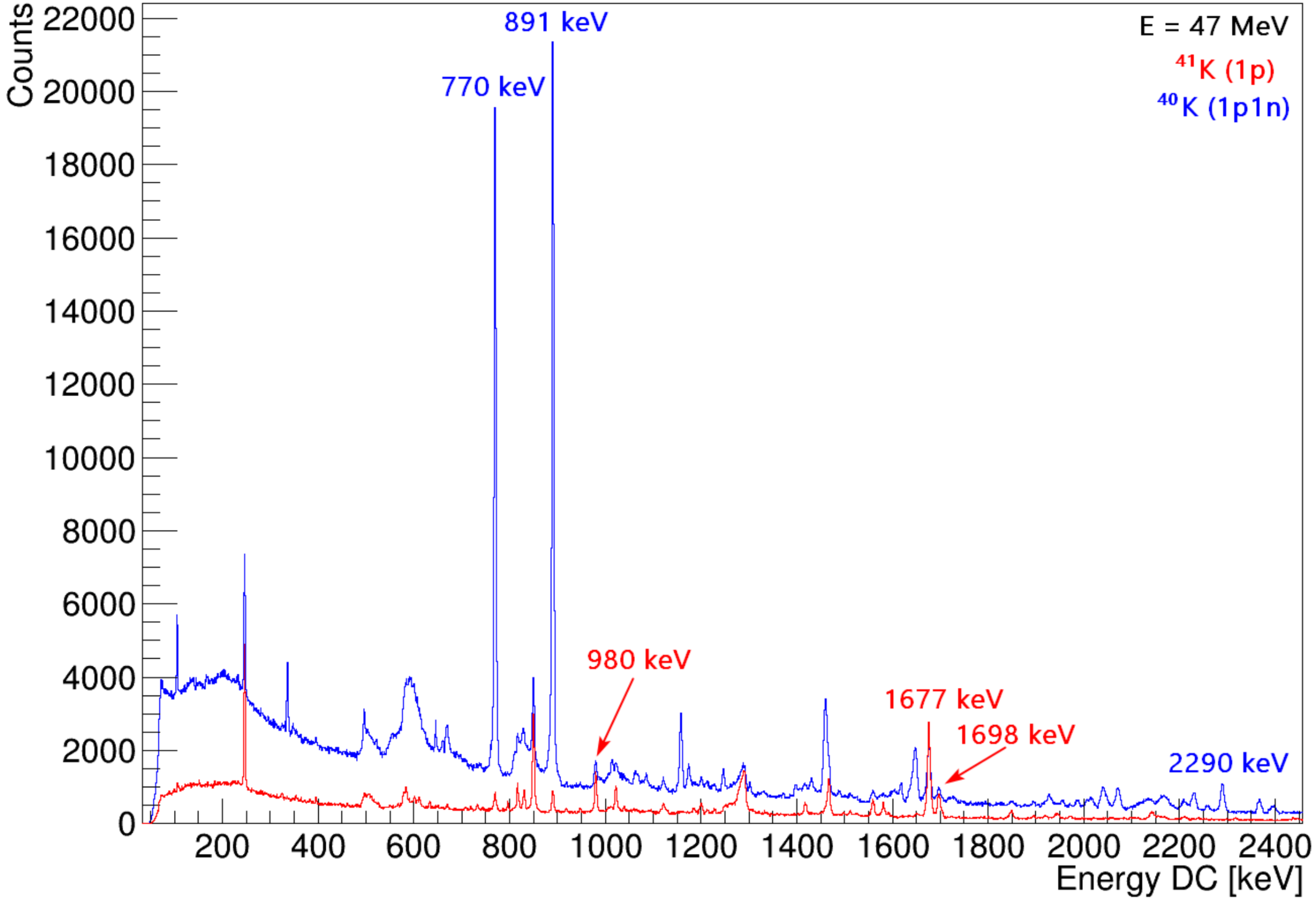
Euclides





- Constructing a "rough" compound system excitation energy it is possible to discriminate not only protons, deutrons and alphas but also the 1p1n channel from the 1p channel (as an example) main ⌄ agataselector / User / EXP / Template / Conf / LUT / LUT_EUCLIDES.dat

Find file | Blame | History | Permalink

Euclides

- Detector dependent parameters:
  - Theta
  - Phi
- Channel names distinguish E and dE

LUT_EUCLIDES.dat 7.89 KiB

Edit

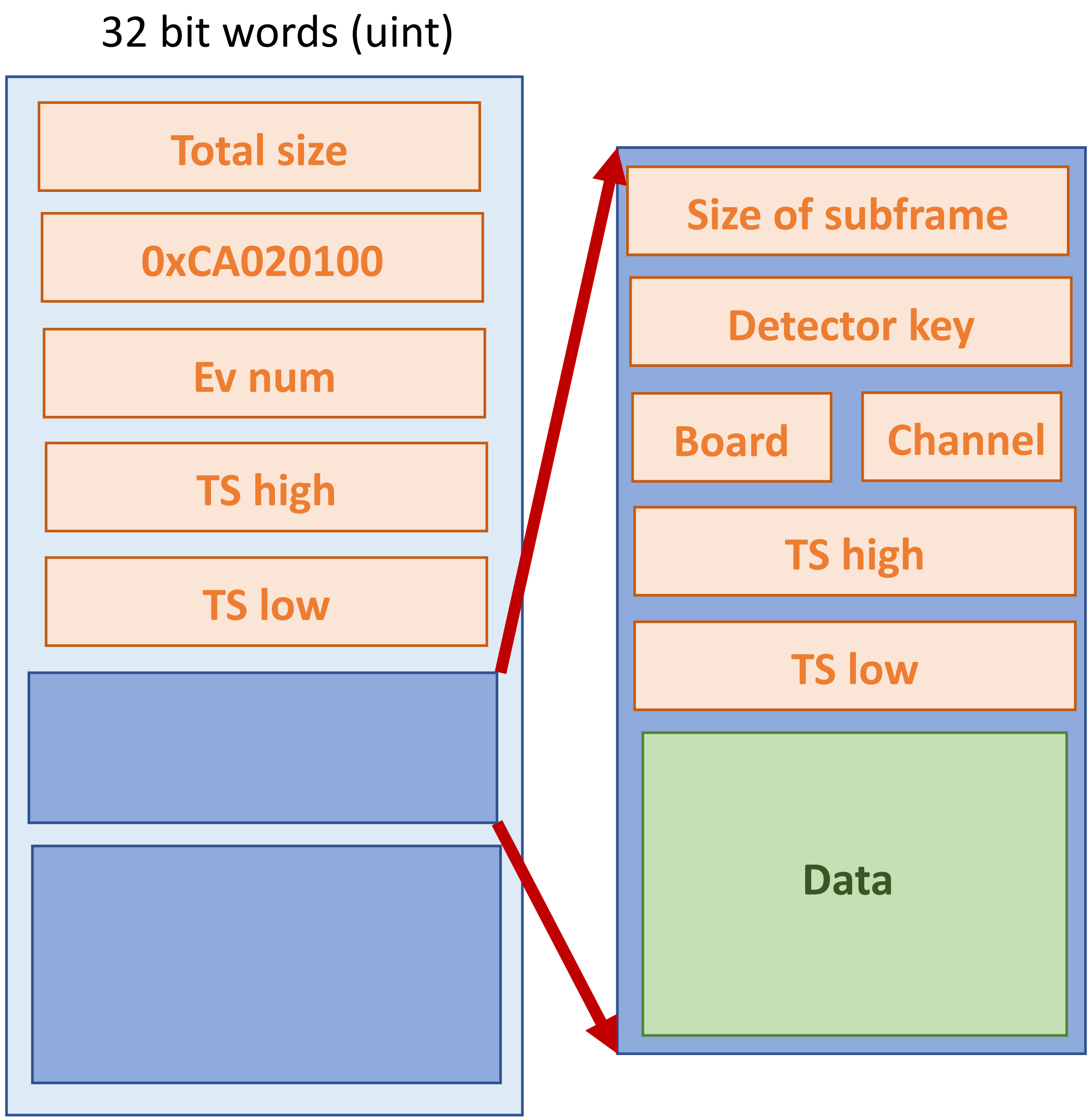
```
####### EUCLIDES        ######
#
#       bool    isE     =       (map    /       1000)   Err:520 1       ?       TRUE    :       FALSE
#       int     ring    =       (map%1000)      /       100
#       int     det     =       (map    %       100)    10
#       int     seg     =       (map    %       10)
#
#       the     ring    1       at      theta=116-122   degree, the     phi     of      each    det     is      not     necessary       correct!
#       we      can     get     in      total   43      DE-E    matrix  according       to      the     current LUTUP   table
#
#       Board   channel map     name    thr_lo  thr_hi  theta   phi     TimeOffset      ncalpar calpars
#       2       0       1000    ring0_det0_E    5       100000  148.281 90      0       2       0.0000  1.0000
#       2       0       2000    ring0_det0_dE   5       100000  148.281 90      0       2       0.0000  1.0000
#       2       0       1010    ring0_det1_E    5       100000  148.286 161.999 0       2       0.0000  1.0000
#       2       0       2010    ring0_det1_dE   5       100000  148.286 161.999 0       2       0.0000  1.0000
#       2       0       1020    ring0_det2_E    5       100000  148.279 -125.995        0       2       0.0000  1.0000
#       2       0       2020    ring0_det2_dE   5       100000  148.279 -125.995        0       2       0.0000  1.0000
#       2       0       1030    ring0_det3_E    5       100000  148.279 -54.005 0       2       0.0000  1.0000
#       2       0       2030    ring0_det3_dE   5       100000  148.279 -54.005 0       2       0.0000  1.0000
#       2       0       1040    ring0_det4_E    5       100000  148.286 18.001  0       2       0.0000  1.0000
#       2       0       2040    ring0_det4_dE   5       100000  148.286 18.001  0       2       0.0000  1.0000
#
#       5       0       1100    phiphin_E       5       100000  116.565 90      0       2       0.0000  1.0000
#       5       0       2100    phiphin_dE      5       100000  116.565 90      0       2       0.0000  1.0000
        2       2       1110    P800_E  5       100000  121.72  125.996 0       2       0.0000  1.0000
        2       3       2110    P800_dE 5       100000  121.72  125.996 0       2       0.0000  1.0000
        5       6       1120    P500_E  5       100000  116.564 162.003 0       2       0.0000  0.00169
        5       7       2120    P500_dE 5       100000  116.564 162.003 0       2       0.0000  0.00189
#       2       0       1130    H7A_E   5       100000  121.717 -162.006        0       2       0.0000  1.0000
#       2       0       2130    H7A_dE  5       100000  121.717 -162.006        0       2       0.0000  1.0000
        5       4       1140    P101_E  5       100000  116.562 -125.999        0       2       0.0000  1.0000
        5       5       2140    P101_dE 5       100000  116.562 -125.999        0       2       0.0000  1.0000
        5       2       1150    H551_E  5       100000  121.719 -90     0       2       0.0000  1.0000
        5       3       2150    H551_dE 5       100000  121.719 -90     0       2       0.0000  1.0000
        5       0       1160    H0_E    5       100000  116.562 -54.001 0       2       0.0000  1.0000
#       5       1       2160    H0_dE   5       100000  116.562 -54.001 0       2       0.0000  1.0000
        0       8       1170    P10_E   5       100000  121.717 -17.994 0       2       0.0000  0.00176
        0       9       2170    P10_dE  5       100000  121.717 -17.994 0       2       0.0000  0.00177
        0       12      1180    H29_E   5       100000  116.564 17.997  0       2       0.0000  0.00178
        0       13      2180    H29_dE  5       100000  116.564 17.997  0       2       0.0000  0.00195
        0       6       1190    P600_E  5       100000  121.72  54.004  0       2       0.0000  0.00161
        0       7       2190    P600_dE 5       100000  121.72  54.004  0       2       0.0000  0.00192
#
        1       14      1200    H57_E   5       100000  90      108.001 0       2       0.0000  0.00149
```

Generating the .adf files from the raw data

- The script to read the raw data and build ancillary events is contained in Scripts/AncMerging. To build it, run “cmake -DBUILD_SCRIPTS=On .”
- It builds events within the ancillary within a window
- It handles coincidences also with prisma+other ancillary
- It adds time offset based on the necessary delays
- It applies the correct key for each detector
- The output can then be used by femul to build Agata+ancillary events

ADF composite frame scheme for built events

- The TS is the lowest subframe's TS
- Has a key (0xCA020100) that is associated to the event merger
- Contains other ADF frames
- Can be checked with the **ListFrames** utility



Building ancillary events

- Compile the selector with the option –DBUILD_SCRIPTS=On
- This will create an executable called ReadCaenRaw (note that boost libraries need to be installed)
- Run with

  RunCaenRaw [--labrslave] [--dante MinMultDante] [--prisma InputPrismaFileName] [--global-anc-tsoffset value] [--root file_name] OutputADFFileName

  - labrslave only adds labr events if other detectors are in coincidence
  - dante Nr only adds dante events if Nr channels are present
  - global-anci-tsoffset adds an offset to all timestamp to merge data with Agata
  - You can add a root file for debugging purposes

Issues flow chart

Issue	Cause	Solution	
Coincidences stop at some point	Online building problem		Run ReadCaenRaw and femul
Loss of statistics	Online building problem		Run ReadCaenRaw and femul
Multiple peaks	Ancillaries or cores not aligned	Align with genconf.py or ReadCaenRaw.set	Run ReadCaenRaw and femul
Exponential shape	The global time offset is wrong	Find the coincidence peak as explained in Scripts/TimeOffsetPeak	Run ReadCaenRaw and femul
No peak	There is no global offset	Find the coincidence peak as explained in Scripts/TimeOffsetPeak	Run ReadCaenRaw and femul

Tracking optimization

M. Siciliano PhD Thesis

- One should optimize the P/T of the tracking efficiency at the energy of interest as a function of the tracking parameters
- **See presentation of Araceli Lopez-Martens on Friday**

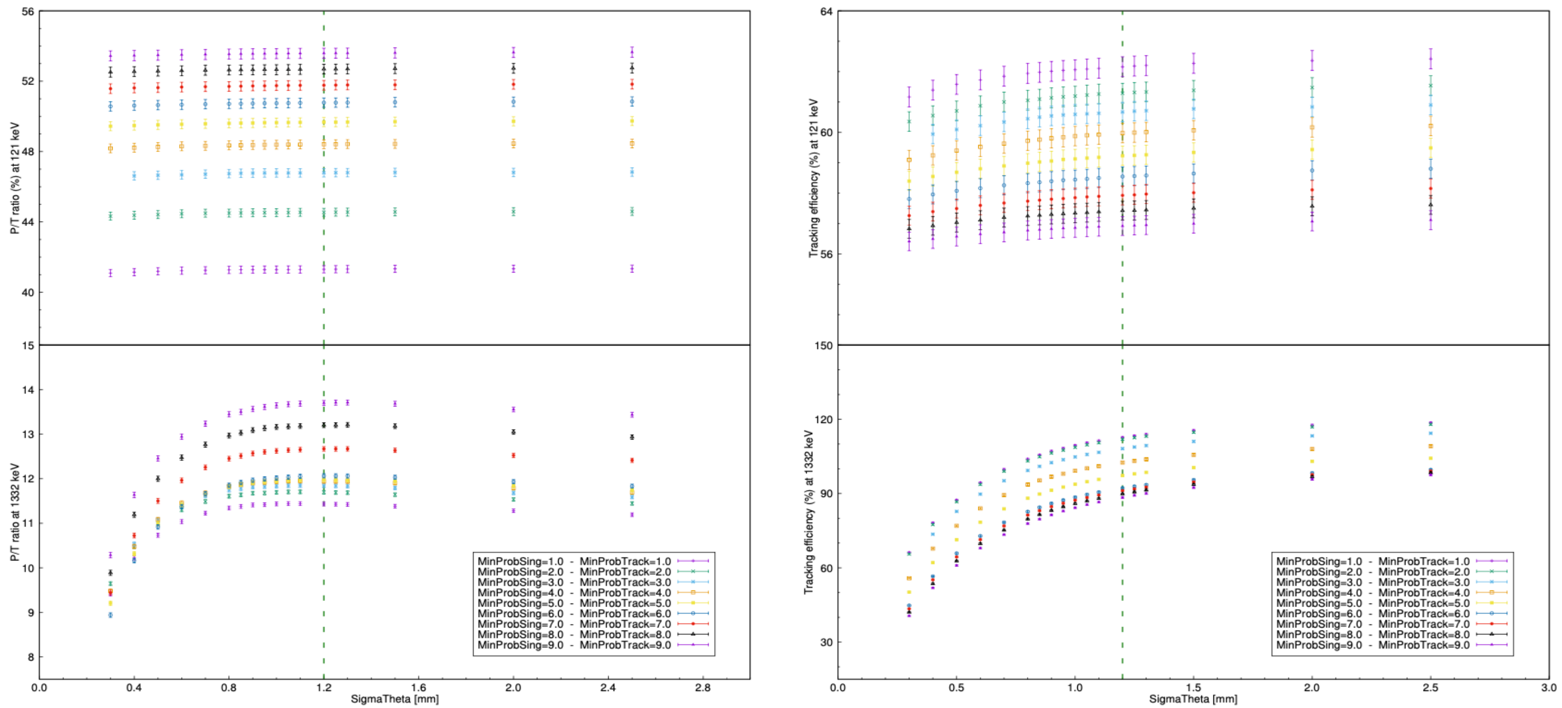
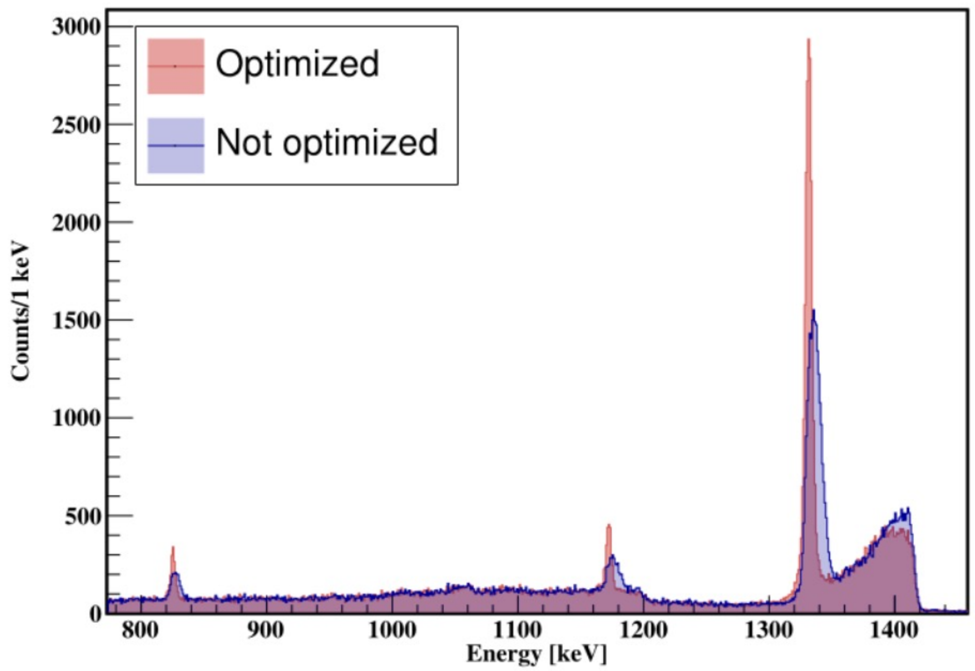
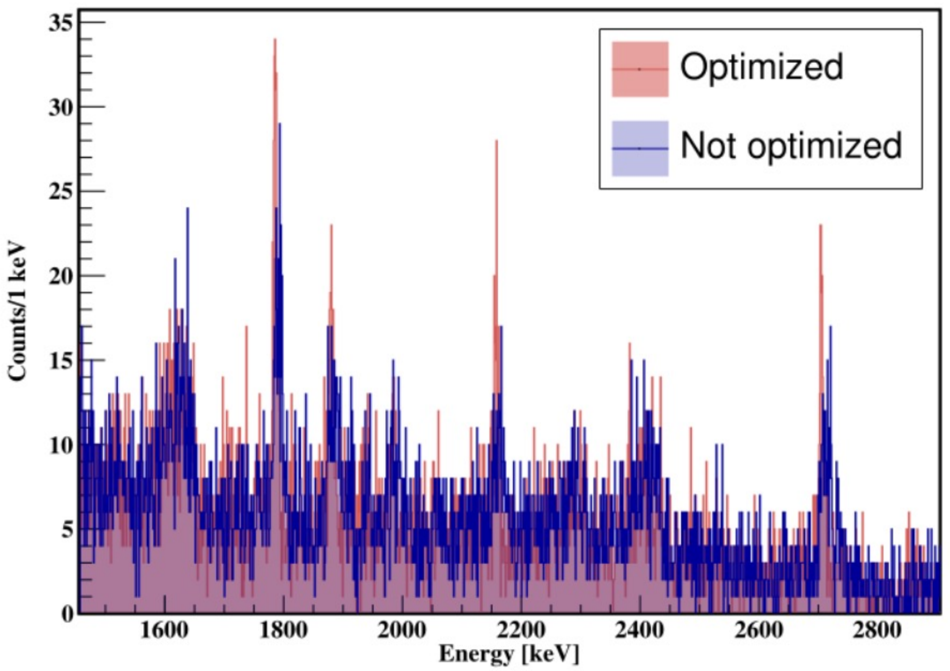


Figure B.1.: Tracking optimisation for OFT algorithm: SigmaTheta. (left) Peak-to-Total ratio (P/T) and (right) tracking efficiency as function of SigmaTheta for several combinations of the other two parameters. The tracking efficiency is defined as the ratio between the area measured with the tracking and the one without the tracking. Both P/T and efficiency are estimated at (top) 121 keV transition of ^{152}Eu and (bottom) 1332 keV of ^{60}Co. The green dashed line represents the optimal value of the parameter, chosen at the beginning of the plateau of both P/T and tracking efficiency.

The optimization procedure





- Remarkable improvements are possible with the optimization but are experiment dependent.
- The selector contains a procedure to find the optimal parameters by running

  RunSelector - -optimize 2