THE UNIVERSITY of EDINBURGH

Analysing AIDA Data

From an AIDA Point of View

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Aims when Analysing the Data

General Aims:

- ❑ Maximise the effective beta efficiency
- ❑ Maximise signal to noise ratio

Our Aims:

- ❑ Accomplish with little to no use of thresholds
- ❑ Run with no multiplicity cuts to the data

How we Plan to Accomplish This

- Logical conditions applied to the data
  - Conditions should be based on physical reasoning
    - Timing conditions applied to clusters

- Correlation conditions based in physical reasoning
  - Maximise the use of our knowledge on the location of implants and decays

What we Need

- Well defined definitions of what is a beta and what is an implant

Event Type Definition

- All ADC Events (Strips) should be from the same event window
  - Event Window: Successive ADC events until time difference between events greater than 2µs
- A pairing of front and back clusters
  - Adjacent strips of the same type of signal (high/low energy) within 2µs of each other

Implants:

- Defined to be in the stopping layer of the detector
  - No high energy events downstream
  - At least one high energy event in every detector upstream
  - Final detector must have an event in the front and back
- Front and back clusters within 2µs
- Front and back clusters match an equal energy cut of ±300MeV

Betas:

- Front and back clusters in the same detector
- Front and back clusters within 2µs
- Front and back clusters match an equal energy cut of ±150keV
  - This is a generous value can be tuned more to the accuracy of your offsets

What we Need

- Well defined definitions of what is a beta and what is an implant
- Accurate time information for the ADC events
  - Involves correcting for the multiplexed output

Time Corrections of Multiplexed Output

What do we mean by multiplexed output:

Each ASIC multiplexes out “active” channels sequentially with one every 2µs (200 AIDA clock cycles)

This leads to an offset of a signals timestamp of up to 32µs

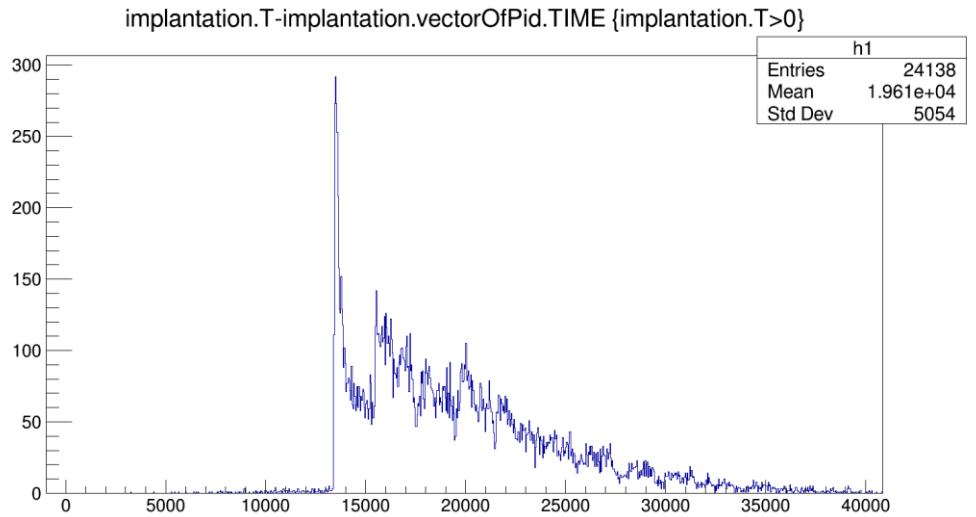
How we correct for this:

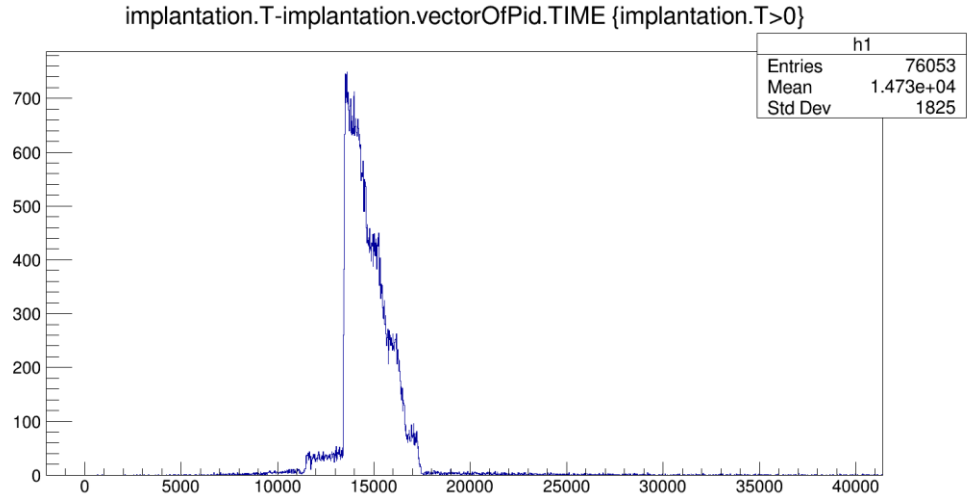
Keep track of number of ADC items as they are added to an event window

Subtract 200xn from the timestamp of the item

n is the number of “active” channels from the ASIC already within the event window.

Shown to have a large impact on the spread of implant events.





What we Need

- Well defined definitions of what is a beta and what is an implant
- Accurate time information for the ADC events
  - Involves correcting for the multiplexed output
- Full information on the position of implant and decay events

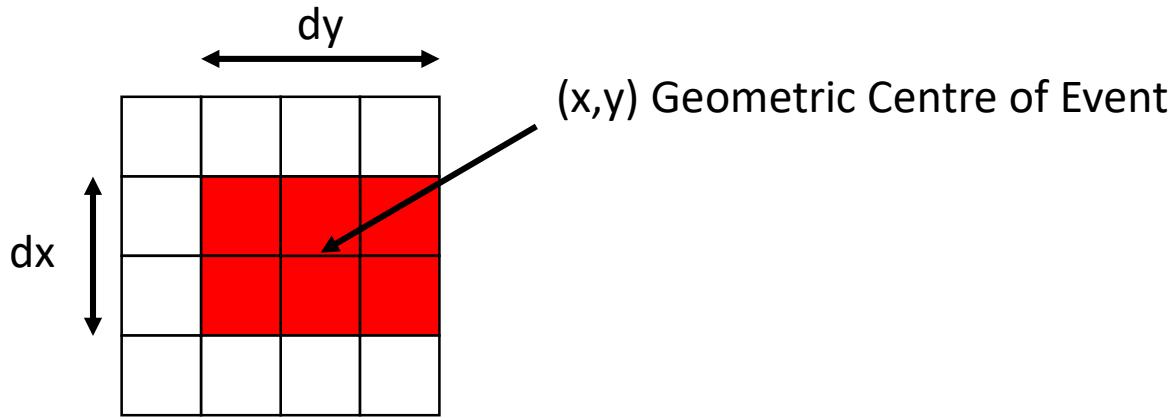
Positions of Implants and Decays

What is currently done:

- Positions of front and back clusters are assigned based on the energy deposition in the strips that they are comprised of.
- A final point is assigned to the implant or decay no matter what the size is

What we propose:

- The position of an event is defined to be its geometric centre
- The height and width of the event are also added into the data stream
  - Currently we are storing these in Tfast a previously unused 64bit number in the data stream
  - The height and width are encoded to be the bottom 16bits of this number



AIDASort v2.0 Processing Steps and Key Info

Steps followed by AIDASort

- Event Window Formed
- Multiplexer time corrections
- Correlation scaler offset applied
- ADC Offsets applied

Key Points to Keep in Mind

- As we run AIDA continuously can’t guarantee first item in a file is a SYN100 item
  - To accurately set the timestamp you need to wait for both a SYNC100 Item and also a correlation scaler item.

Making Use of The Information

Previously we have been casting out a wide net around the implant and seeing what we catch.

Suggest instead going for a more targeted approach

Instead trying to pinpoint the location of decays to a single point accept that they can be anywhere within an area

Search for implants within or adjacent to this area

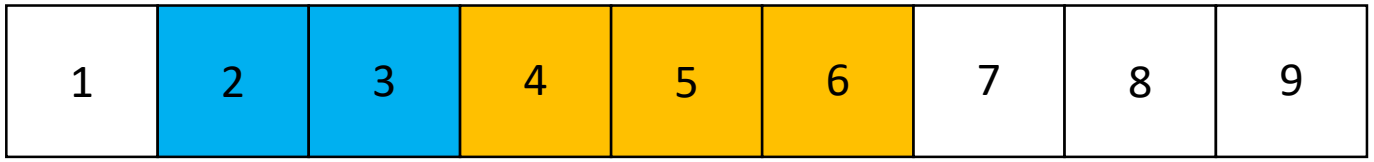
How this is Coded

```
else if(this->DistanceMethod==1){
    if((((MyY-ItY)>=0) && ((MyY-ItY)<=( ItErrY + MyErrY +  this->DistanceCondition)))||
       (((ItY-MyY)>=0) && ((ItY-MyY)<=( ItErrY + MyErrY +  this->DistanceCondition)))){
        if((((MyX-ItX)>=0) && ((MyX-ItX)<=( ItErrX + MyErrX +  this->DistanceCondition)))||
           (((ItX-MyX)>=0) && ((ItX-MyX)<=( ItErrX + MyErrX +  this->DistanceCondition)))){
            //                          if(MyZ==it->second.GetZ()){
            //                          if((((MyZ-ItZ)>=0) && ((MyZ-ItZ)<=1))||
            //                             (((ItZ-MyZ)>=0) && ((ItZ-MyZ)<=1))){
                                if(MyMapKey.Cycle==it->second.CYCLE)
            {
                WriteTreeVectorMutex.lock();
                Vector.push_back(it->second);
                WriteTreeVectorMutex.unlock();
                //                          }
            }
        }
    }
}
```

Code from Jorge Agramunt

- Checks that the difference between the geometric centres of the implant and decay is less than half the width of the implant plus half the width of the decay plus the distance condition which is user specified.
- In the example:
- X_{decay}-$X_{implant}$ = 0.5
- $ErrX_{decay}$+$ErrX_{implant}$=1.5
- Therfore with Distance condition = 1 they would correlate
- But With implant condition = 0 no correlation

X=2.5 dX=1 ErrX 0.5



X=5 dX=2 ErrX = 1

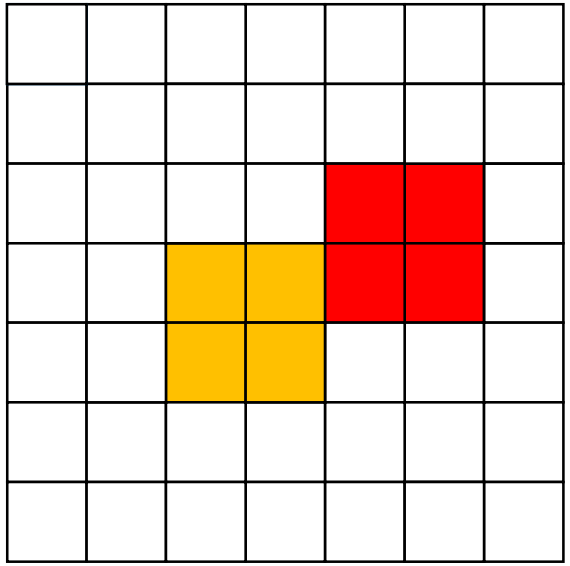
Decay Area Based Correlations

A 2D representation of the correlation method with the strict area condition and also the strict area condition with a 1 pixel border.

The yellow pixels represent an implant area and the red represent the decay.

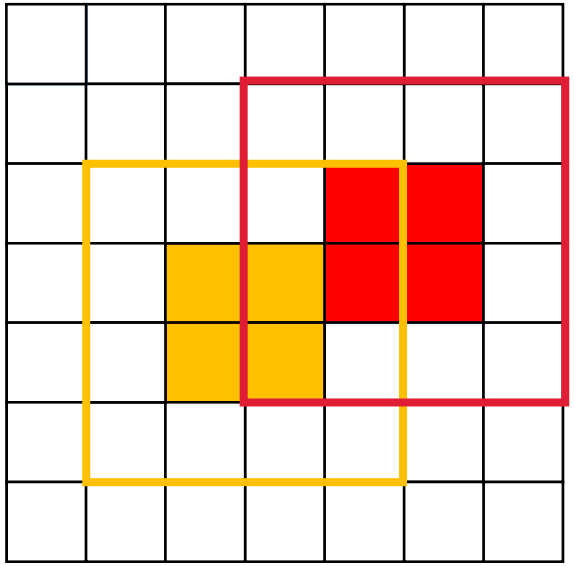
In this case it can be seen in the strict case the two would not be correlated but in the strict + 1 pixel case the decay would be.

Strict



Correlated items are items in which the implant falls within their area

Strict + 1 Pixel



Correlated items are items in which the implant falls within the area and a 1 pixel border
-1 decay event (red)

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