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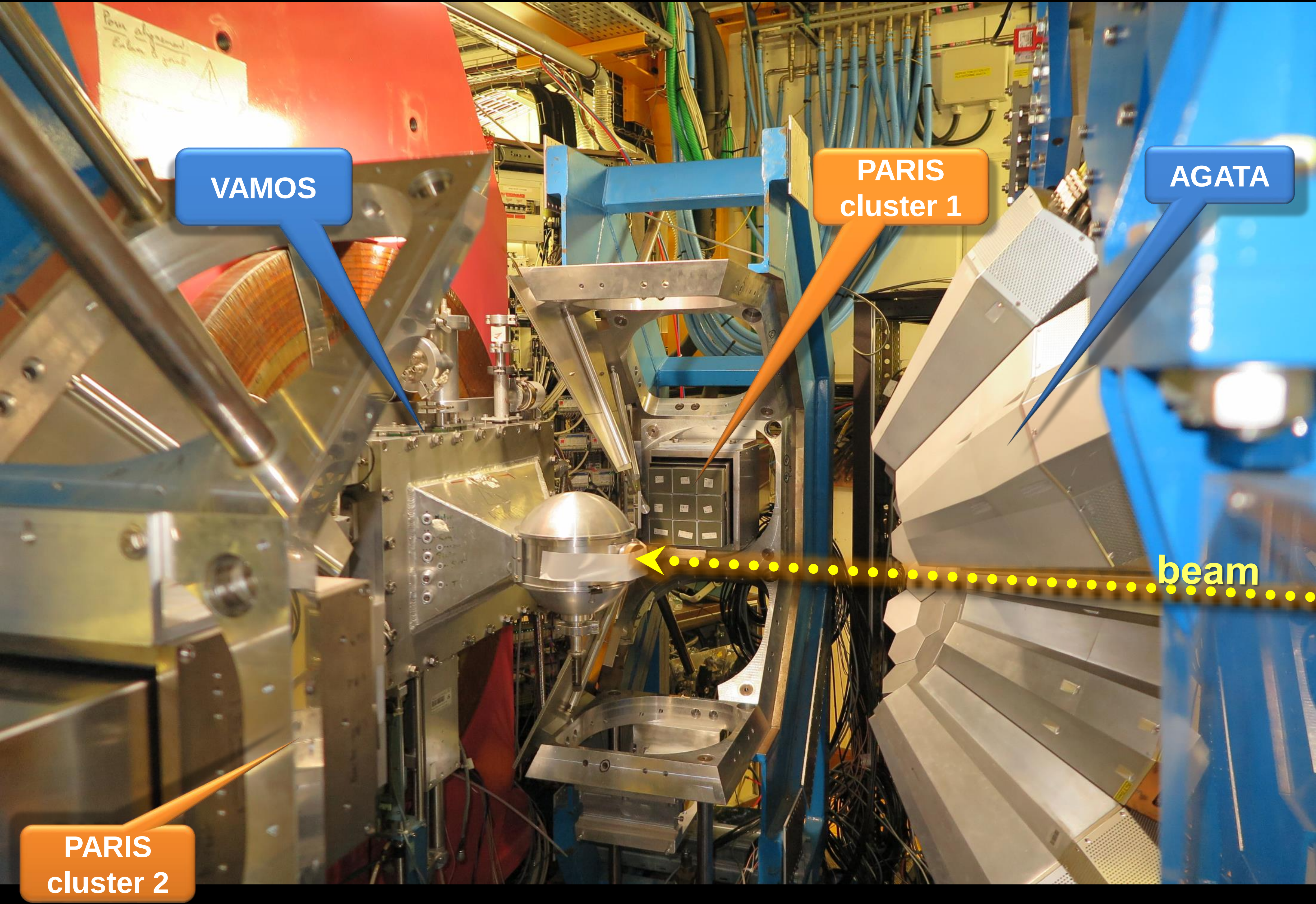
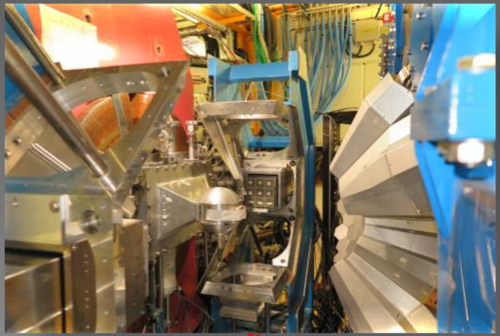
Is it possible to have a „complete” on-line analysis

for „AGATA + VAMOS + PARIS +...” experiments ?


VAMOS
PARIS cluster 1
AGATA
beam
PARIS cluster 2

Idea of analysis (or simple monitoring)

experiment

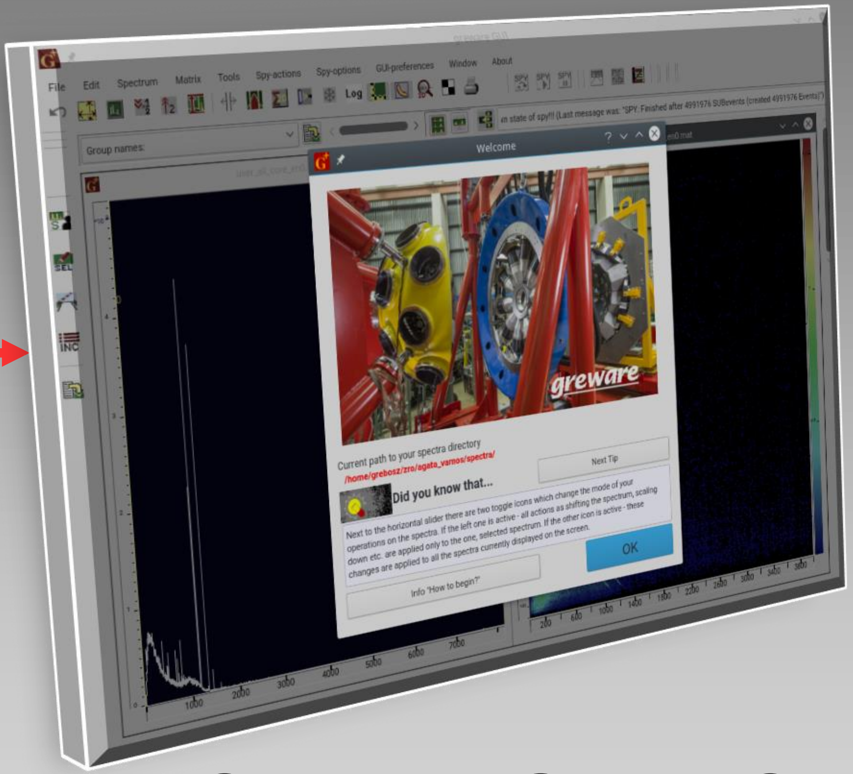


DAQ

online

Data store

near-line



Current path to your spectra directory
/home/grebosz/zro/agata_vamos/spectra/

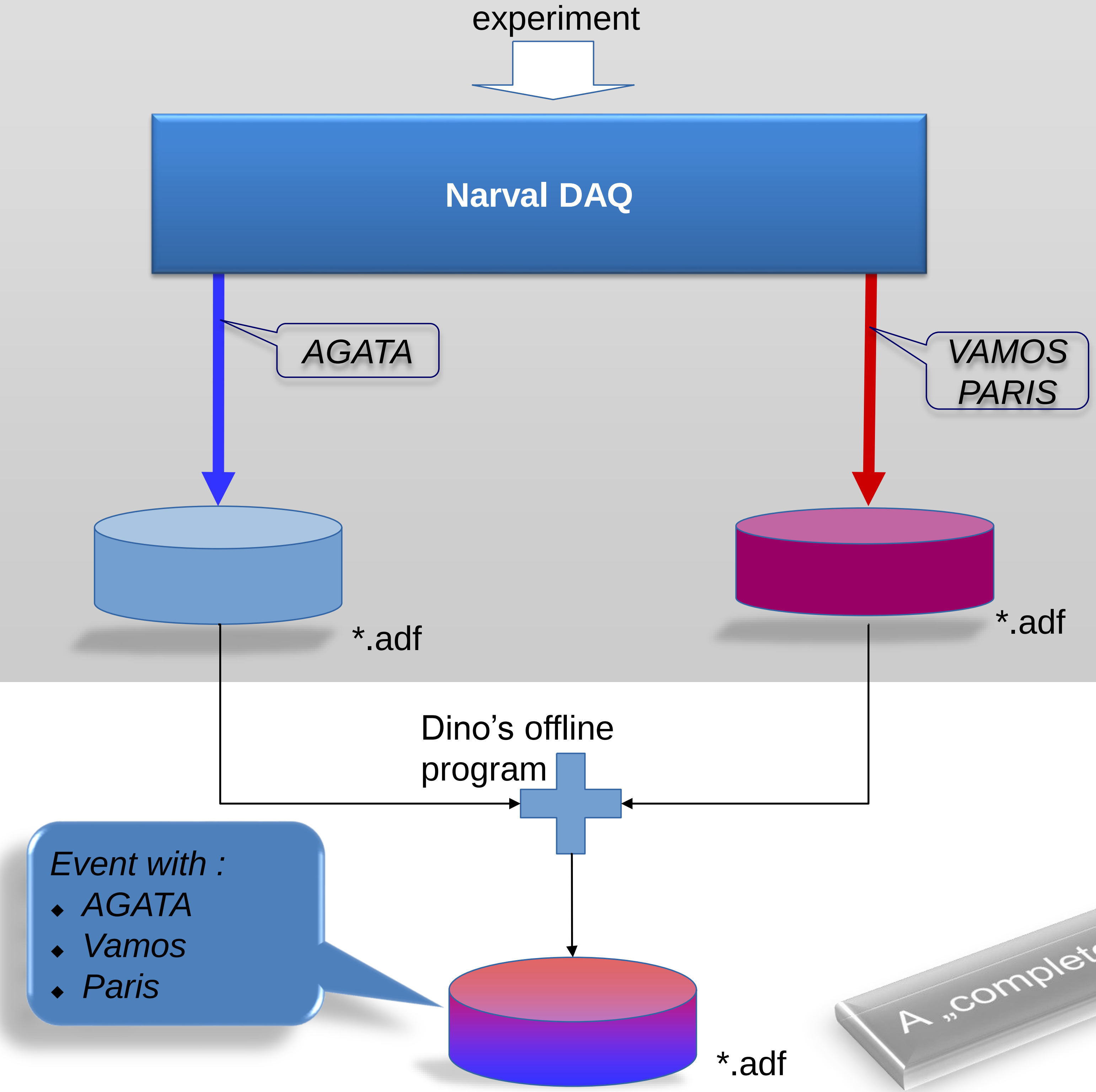
Did you know that...

Next to the horizontal slider there are two toggle icons which change the mode of your operations on the spectra. If the left one is active - all actions as shifting the spectrum, scaling down etc. are applied only to the one, selected spectrum. If the other icon is active - these changes are applied to all the spectra currently displayed on the screen.

Greware: Spy + GUI

for example: Galileo

GANIL



experiment

Narval DAQ

AGATA

VAMOS
PARIS

*.adf

*.adf

online

Dino’s offline program

when a run is finished

Event with :

- *AGATA*
- *Vamos*
- *Paris*

*.adf

A „complete” online – impossible

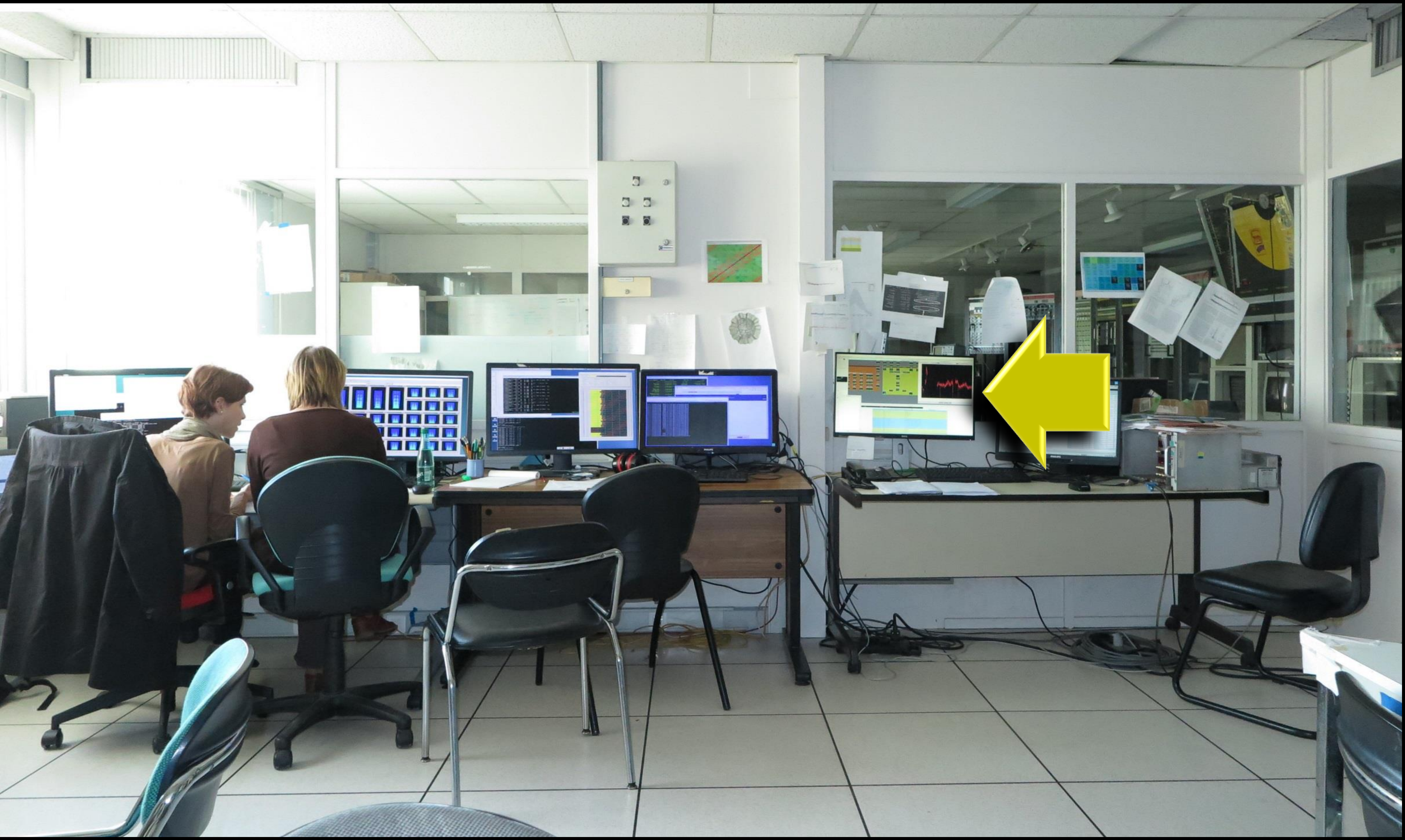
What we need for our experiment?

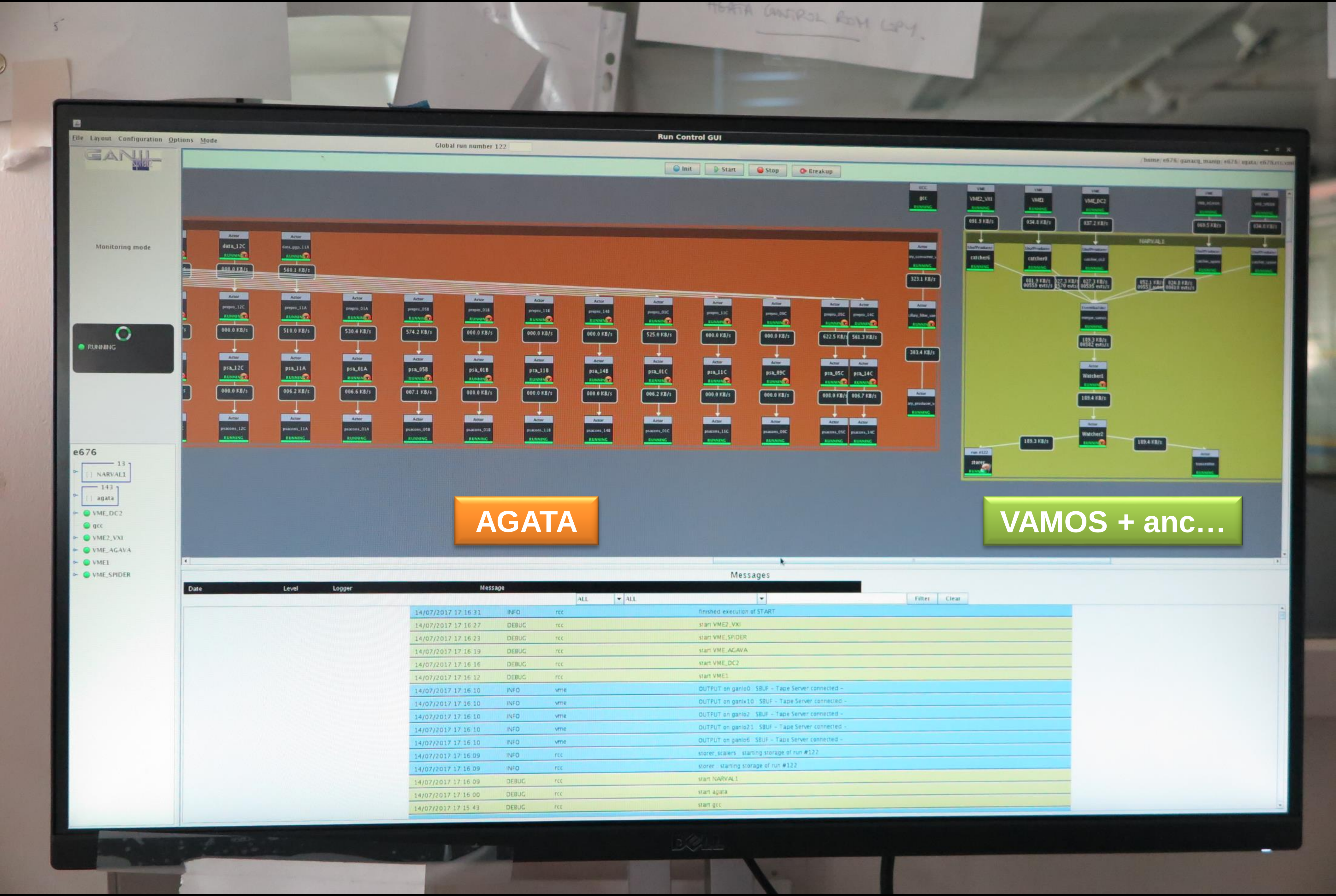
Adam Maj (the chief of PARIS detector), being at GANIL some months ago asked me to prepare an online analysis for the coming PARIS experiment.
He said:

We need to have Paris + AGATA **coincidence** data
on a screen - online

without necessity to wait for making so called „replay”, making root trees, etc.

...

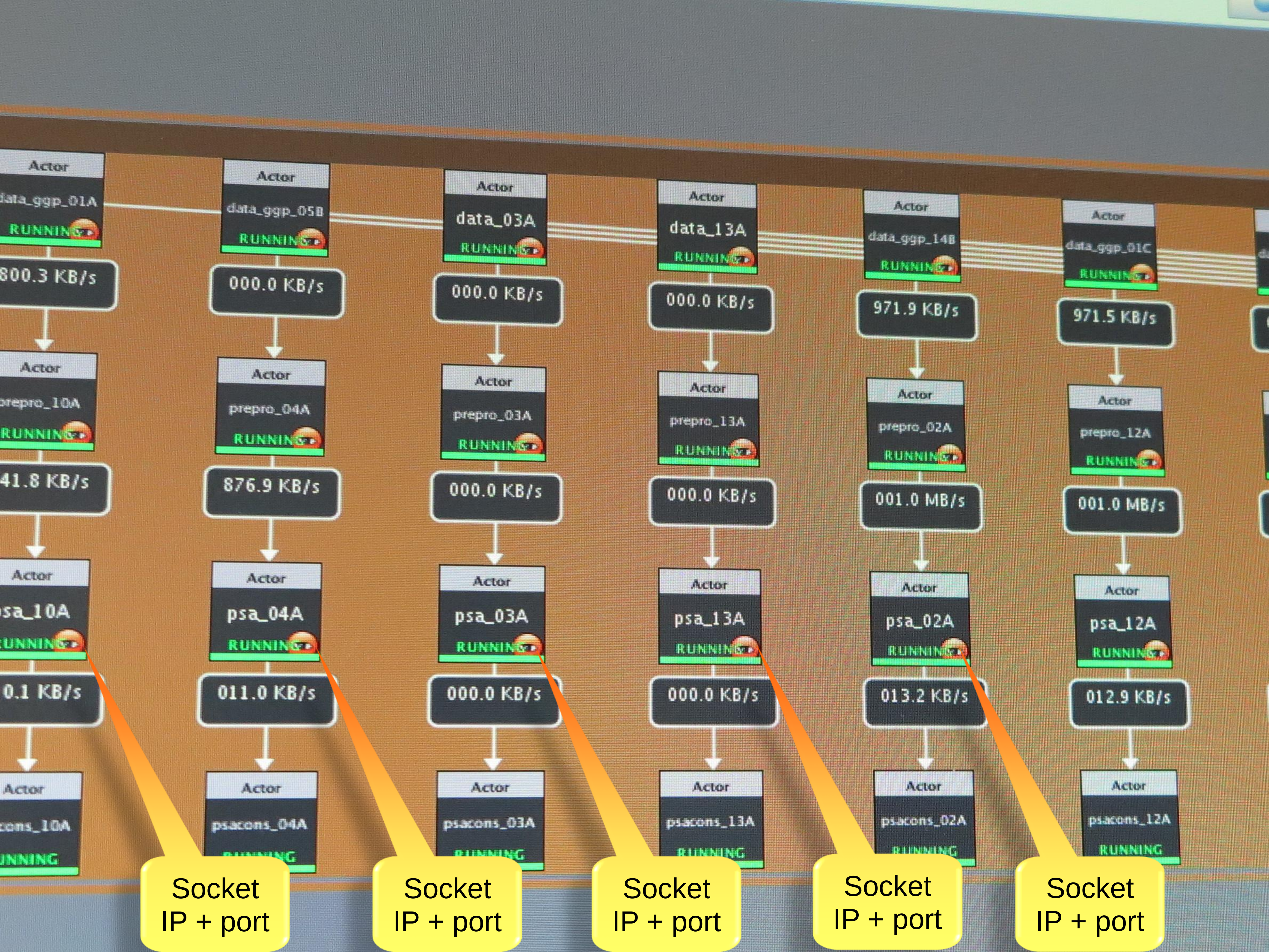




AGATA

VAMOS + anc…

```
Date                 Level     Logger        Message
14/07/2017 17 16 31  INFO      rcc           finished execution of START
14/07/2017 17 16 27  DEBUG     rcc           start VME2_VXI
14/07/2017 17 16 23  DEBUG     rcc           start VME_SPIDER
14/07/2017 17 16 19  DEBUG     rcc           start VME_AGAVA
14/07/2017 17 16 16  DEBUG     rcc           start VME_DC2
14/07/2017 17 16 12  DEBUG     rcc           start VME1
14/07/2017 17 16 10  INFO      vme           OUTPUT on ganlo0  SBUF - Tape Server connected -
14/07/2017 17 16 10  INFO      vme           OUTPUT on ganlx10  SBUF - Tape Server connected -
14/07/2017 17 16 10  INFO      vme           OUTPUT on ganlo2  SBUF - Tape Server connected -
14/07/2017 17 16 10  INFO      vme           OUTPUT on ganlo21  SBUF - Tape Server connected -
14/07/2017 17 16 10  INFO      vme           OUTPUT on ganlo6  SBUF - Tape Server connected -
14/07/2017 17 16 09  INFO      rcc           storer_scalers  starting storage of run #122
14/07/2017 17 16 09  INFO      rcc           storer  starting storage of run #122
14/07/2017 17 16 09  DEBUG     rcc           start NARVAL1
14/07/2017 17 16 00  DEBUG     rcc           start agata
14/07/2017 17 15 43  DEBUG     rcc           start gcc
```



Socket
IP + port

Socket
IP + port

Socket
IP + port

Socket
IP + port

Socket
IP + port

It is still before event builder

Event has to be build according to timestamps of every subevent

GSI „RISING” → GER, FRS, DGF, HEC,
(4 types of subevents to be matched into one event)

GANIL → Vamos + ~~AGATA?~~ (2 types of subevents?)

…not so easy

GANIL → Vamos + ~28 Agata crystals

all (29) of them we should take from sockets…

Opening a socket with **proper** parameters

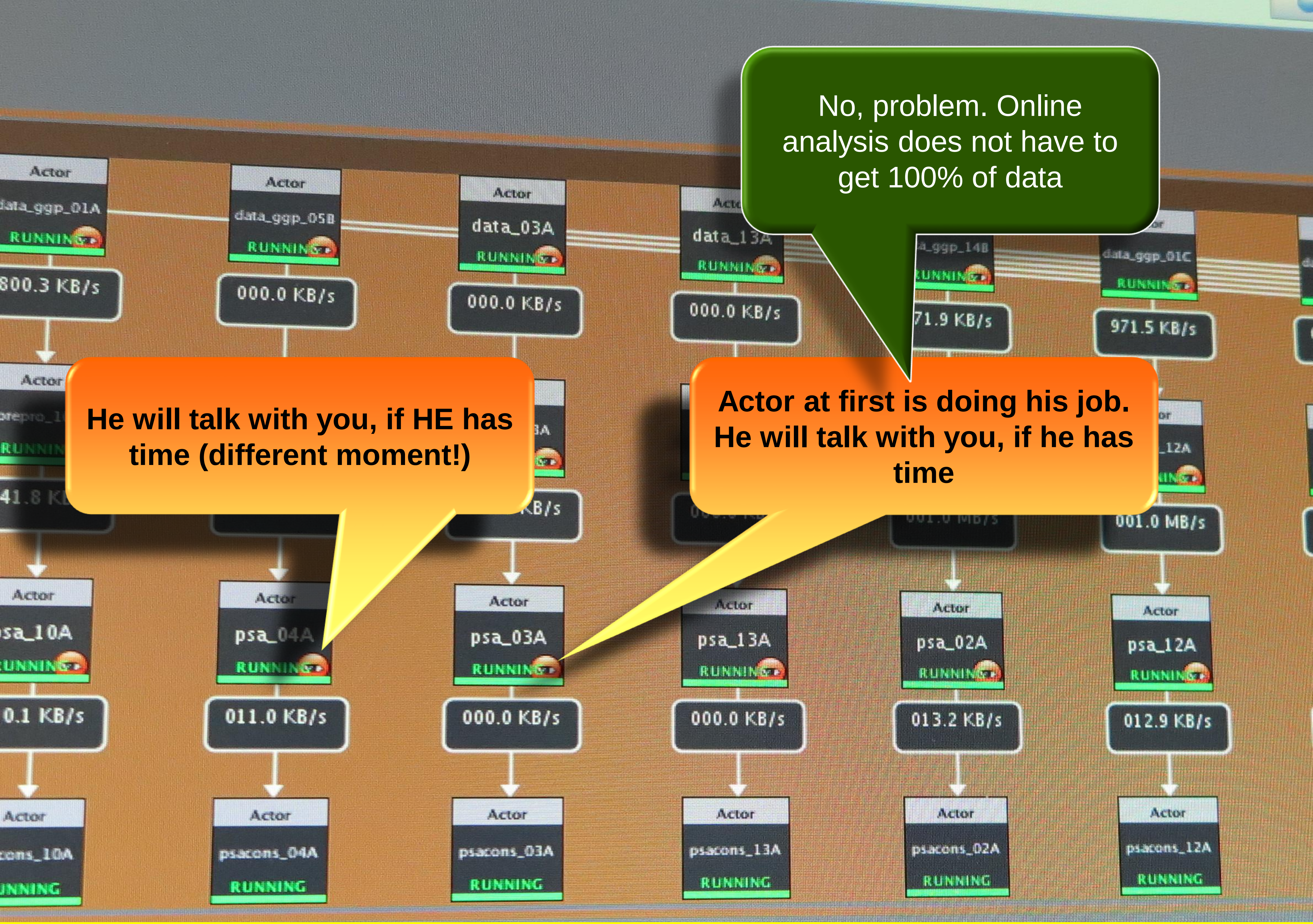
```
int Tsocket_for_data::open_socket (string hostname, int port)
{
    struct hostent *he;
     struct sockaddr_in their_addr;
     struct sockaddr_in l_addr;

       if ( ( sockfd = socket ( PF_INET, SOCK_STREAM, 0 ) ) == -1 )
       { /*…*/ }

        l_addr.sin_family = PF_INET;
        l_addr.sin_port = htons ( 0 );
        l_addr.sin_addr.s_addr = htonl ( INADDR_ANY );
        memset ( & ( l_addr.sin_zero ), '\0', 8 );

        if ( setsockopt ( sockfd, SOL_SOCKET, SO_REUSEADDR, &sock_opt, sizeof ( int ) ) == -1 )
        {  /*…*/  }

        if ( bind ( sockfd, ( struct sockaddr * ) &l_addr, sizeof ( struct sockaddr ) ) == -1 )
        {  /*…*/  }

        if ( ( he=gethostbyname ( hostname.c_str() ) ) == NULL )
         {  /*…*/  }

        their_addr.sin_family = PF_INET;
        their_addr.sin_port = htons ( port );
        their_addr.sin_addr = * ( ( struct in_addr * ) he->h_addr );
        memset ( & ( their_addr.sin_zero ), '\0', 8 );

        // cout << "Trying to connect... "  << endl;
        if ( connect ( sockfd, ( struct sockaddr * ) &their_addr, sizeof ( struct sockaddr ) ) == -1 )
        {
            perror ( (description + " ---> connect error: ").c_str()  );
        }
        cout << description << ": Succes with opening host "<< my_host << " port nr ---> " << port  << endl;
        return 1;
}
```

Reading
a block of bytes
from the socket

```
//...
    nread = recv ( sd, buf, nleft, MSG_DONTWAIT );       //       nread = recv ( sd, buf, nleft, 0 );

    if (nread < 0)
    {
        if(errno == EAGAIN)
            cout << "Error called: EAGAIN" << endl;
        else if(errno == EWOULDBLOCK)
            cout << "Error called: EWOULDBLOCK" << endl;

        throw Tsocket_recv_error{ " Can not receive data"};
    }
    else if (nread == 0)
    {
        if(errno == EAGAIN)
            cout << "Error called: EAGAIN" << endl;
        else if(errno == EWOULDBLOCK)
            cout << "Error called: EWOULDBLOCK" << endl;

         throw Tsocket_recv_no_data_now{ " No data available\n"};
    }
     // >0  success
    //  cout << "Tsocket_fo_data::reads     recv:  nread = " << nread << endl;
```

What am I doing wrong?

Nightmare!



No, problem. Online analysis does not have to get 100% of data

He will talk with you, if HE has time (different moment!)

Actor at first is doing his job. He will talk with you, if he has time

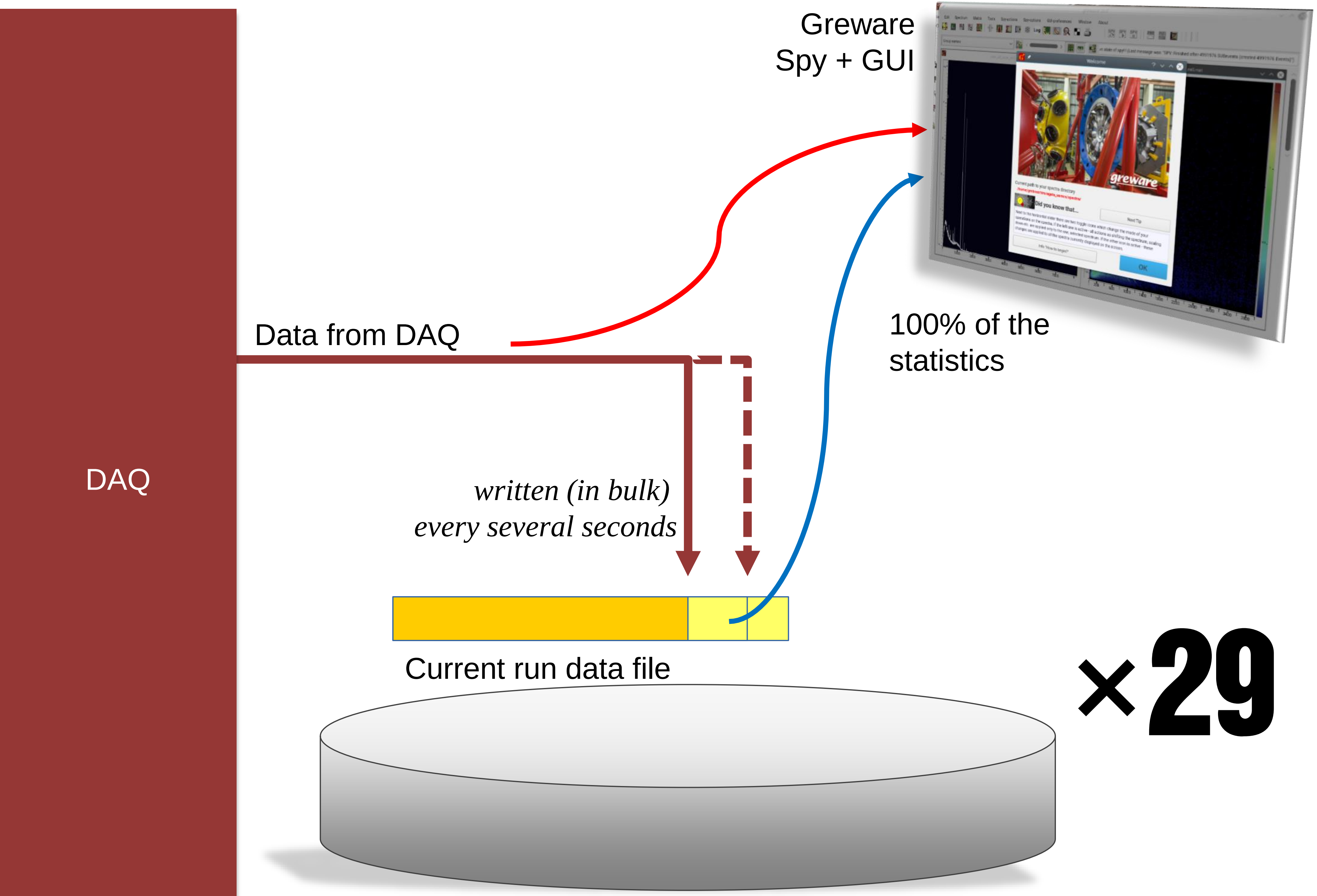
No guarantee, that the subevents belong to the same event.

end of a dream

the socket connection with PSA actors – is unreliable (for me).

So I changed the tactics:

PSA actors write their data on disk (every minute), so…



Greware
Spy + GUI

Data from DAQ

DAQ

100% of the
statistics

written (in bulk)
every several seconds

Current run data file

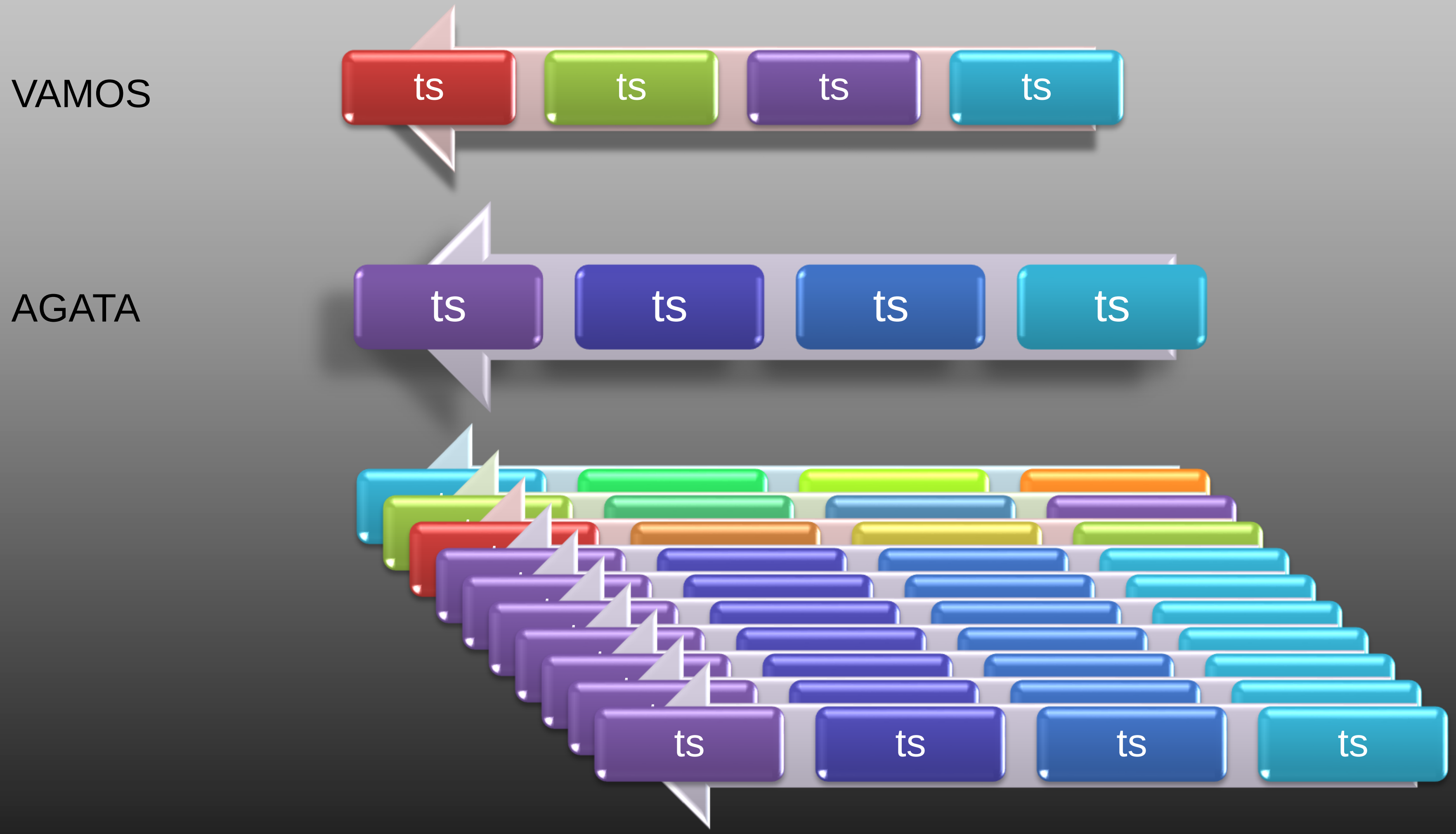
×29

„on-line” is when…

price is: 30 - 60 s of delay

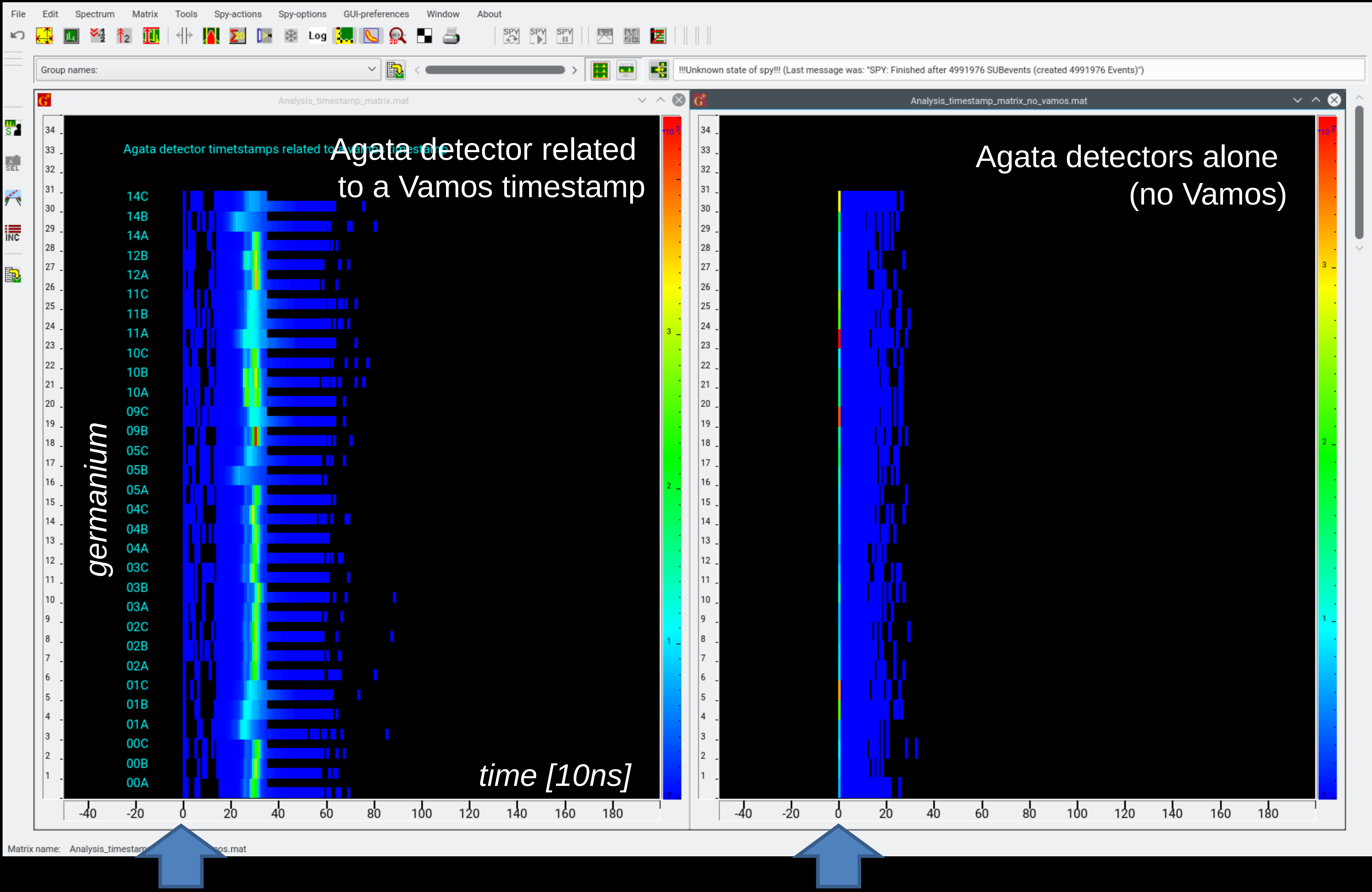
29 types of subevents may create on event

Depending on their timestamps (ts)



I will spare you the details…

Just look at this.



!!!Unknown state of spy!!! (Last message was: "SPY: Finished after 4991976 SUBevents (created 4991976 Events)")

Matrix name: Analysis_timestam[...]os.mat

Agata detector related to a Vamos timestamp

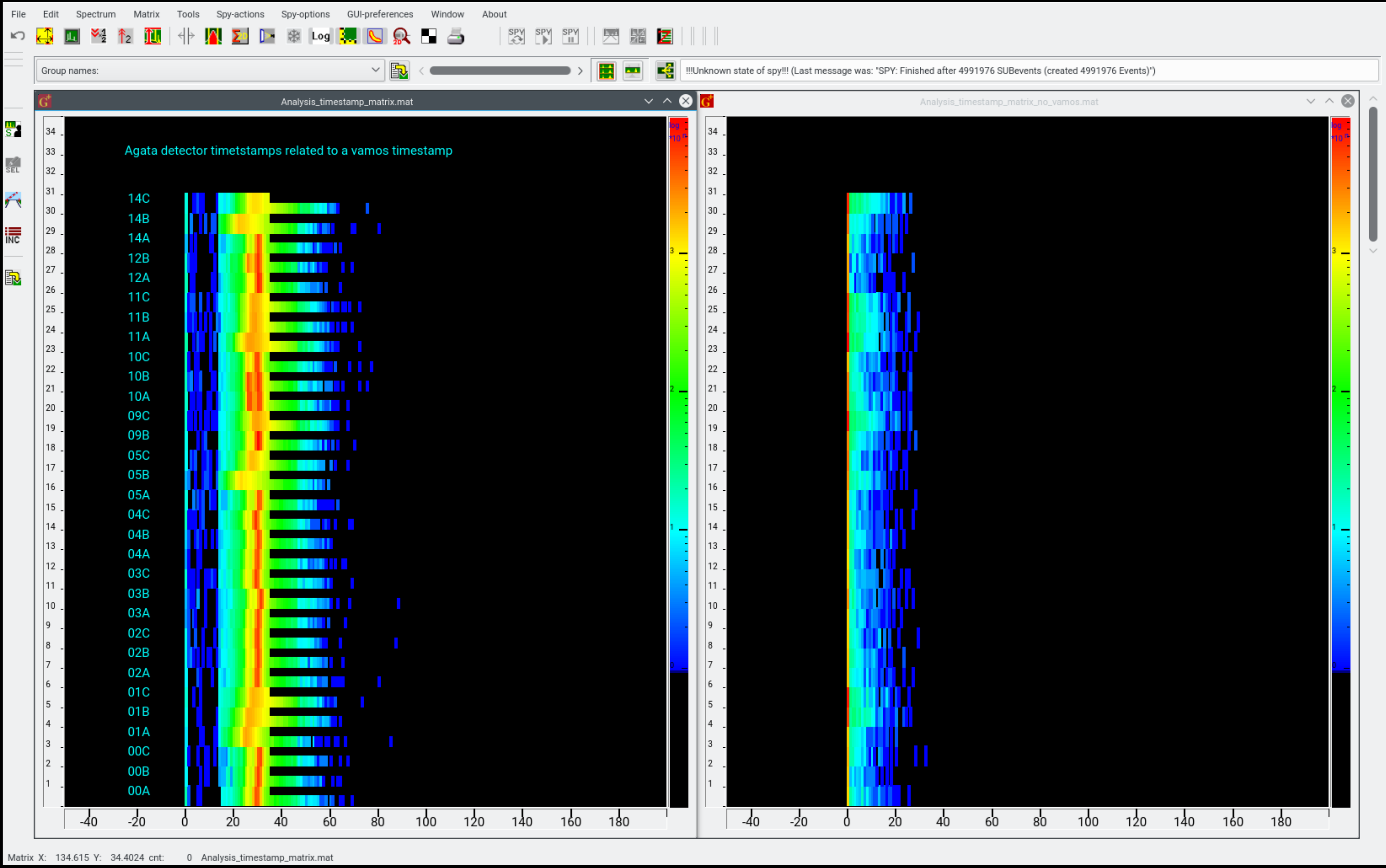
Agata detectors alone (no Vamos)

germanium

time [10ns]

Vamos time

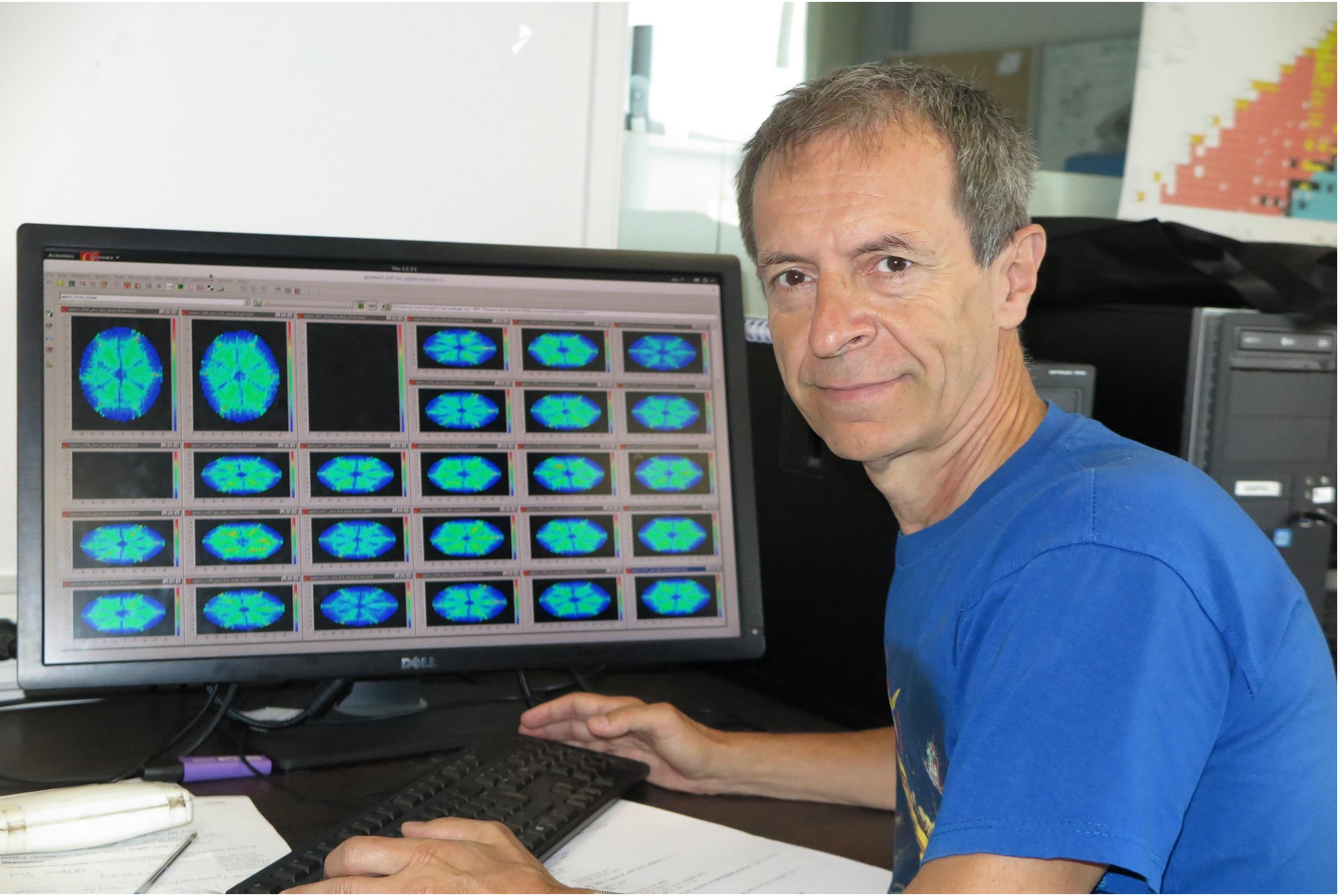
fastest Ge

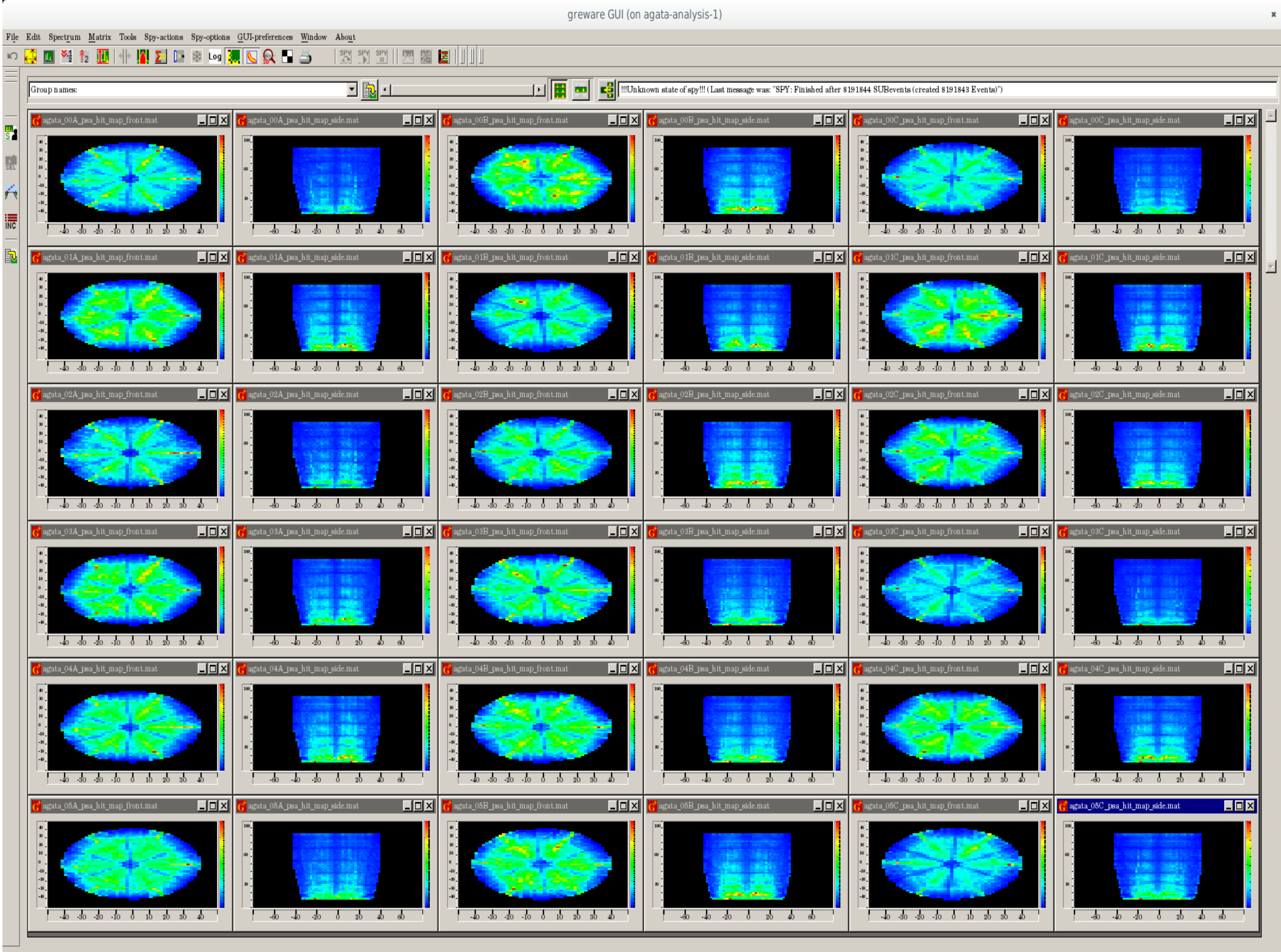


Group names:

!!!Unknown state of spy!!! (Last message was: "SPY: Finished after 4991976 SUBevents (created 4991976 Events)")

Matrix X: 134.615 Y: 34.4024 cnt: 0 Analysis_timestamp_matrix.mat





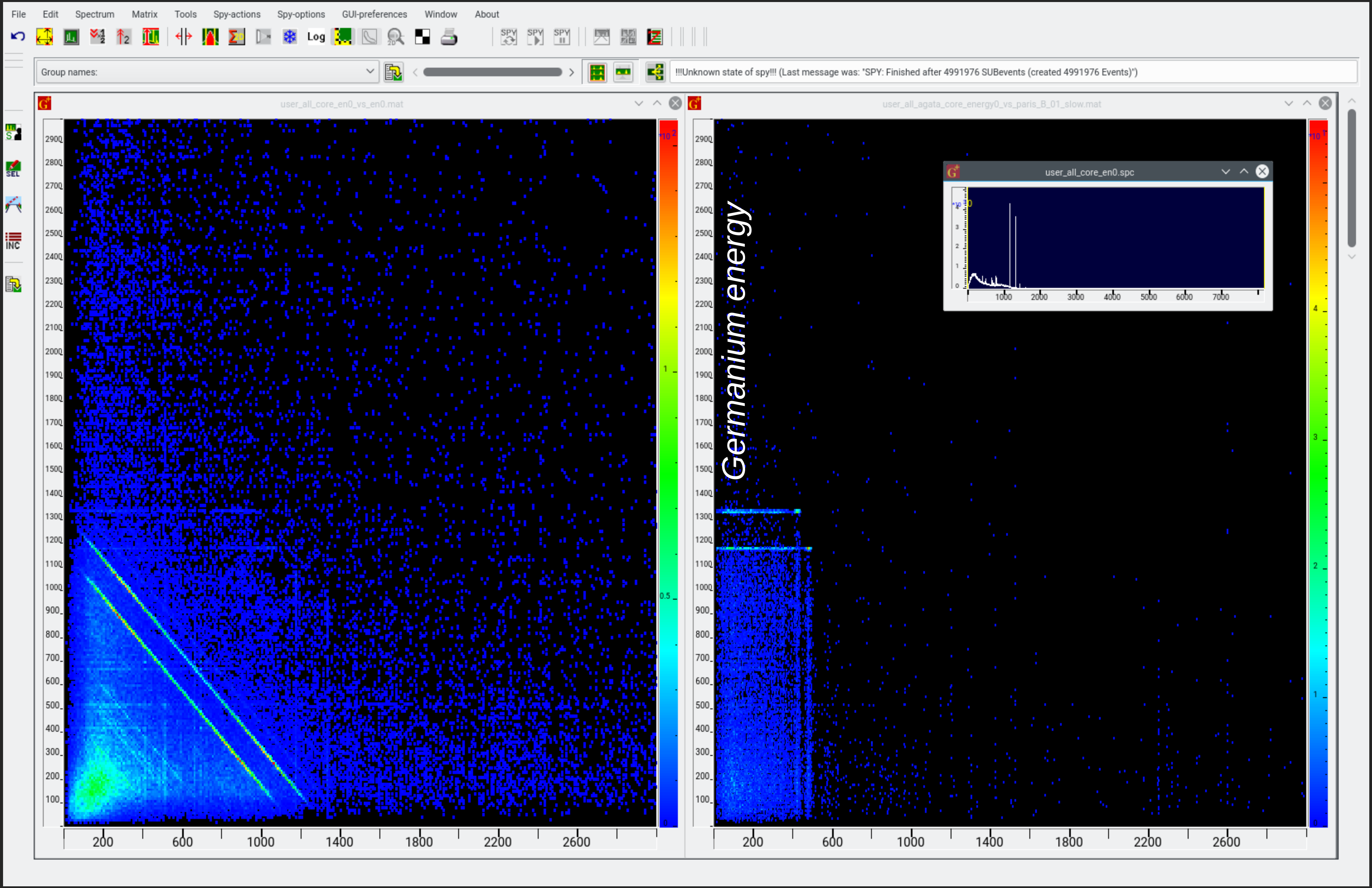
greware GUI (on agata-analysis-1)

Group names:

!!!Unknown state of spy!!! (Last message was: "SPY: Finished after 8191844 SUBevents (created 8191843 Events)")

File
Edit
Spectrum
Matrix
Tools
Spy-actions
Spy-options
GUI-preferences
Window
About
Log
agata_00A_psa_hit_map_front.mat
agata_00A_psa_hit_map_side.mat
agata_00B_psa_hit_map_front.mat
agata_00B_psa_hit_map_side.mat
agata_00C_psa_hit_map_front.mat
agata_00C_psa_hit_map_side.mat
agata_01A_psa_hit_map_front.mat
agata_01A_psa_hit_map_side.mat
agata_01B_psa_hit_map_front.mat
agata_01B_psa_hit_map_side.mat
agata_01C_psa_hit_map_front.mat
agata_01C_psa_hit_map_side.mat
agata_02A_psa_hit_map_front.mat
agata_02A_psa_hit_map_side.mat
agata_02B_psa_hit_map_front.mat
agata_02B_psa_hit_map_side.mat
agata_02C_psa_hit_map_front.mat
agata_02C_psa_hit_map_side.mat
agata_03A_psa_hit_map_front.mat
agata_03A_psa_hit_map_side.mat
agata_03B_psa_hit_map_front.mat
agata_03B_psa_hit_map_side.mat
agata_03C_psa_hit_map_front.mat
agata_03C_psa_hit_map_side.mat
agata_04A_psa_hit_map_front.mat
agata_04A_psa_hit_map_side.mat
agata_04B_psa_hit_map_front.mat
agata_04B_psa_hit_map_side.mat
agata_04C_psa_hit_map_front.mat
agata_04C_psa_hit_map_side.mat
agata_05A_psa_hit_map_front.mat
agata_05A_psa_hit_map_side.mat
agata_05B_psa_hit_map_front.mat
agata_05B_psa_hit_map_side.mat
agata_05C_psa_hit_map_front.mat
agata_05C_psa_hit_map_side.mat
-40 -30 -20 -10 0 10 20 30 40
-60 -40 -20 0 20 40 60
100
60
20

Does the matching of subevents work correctly?



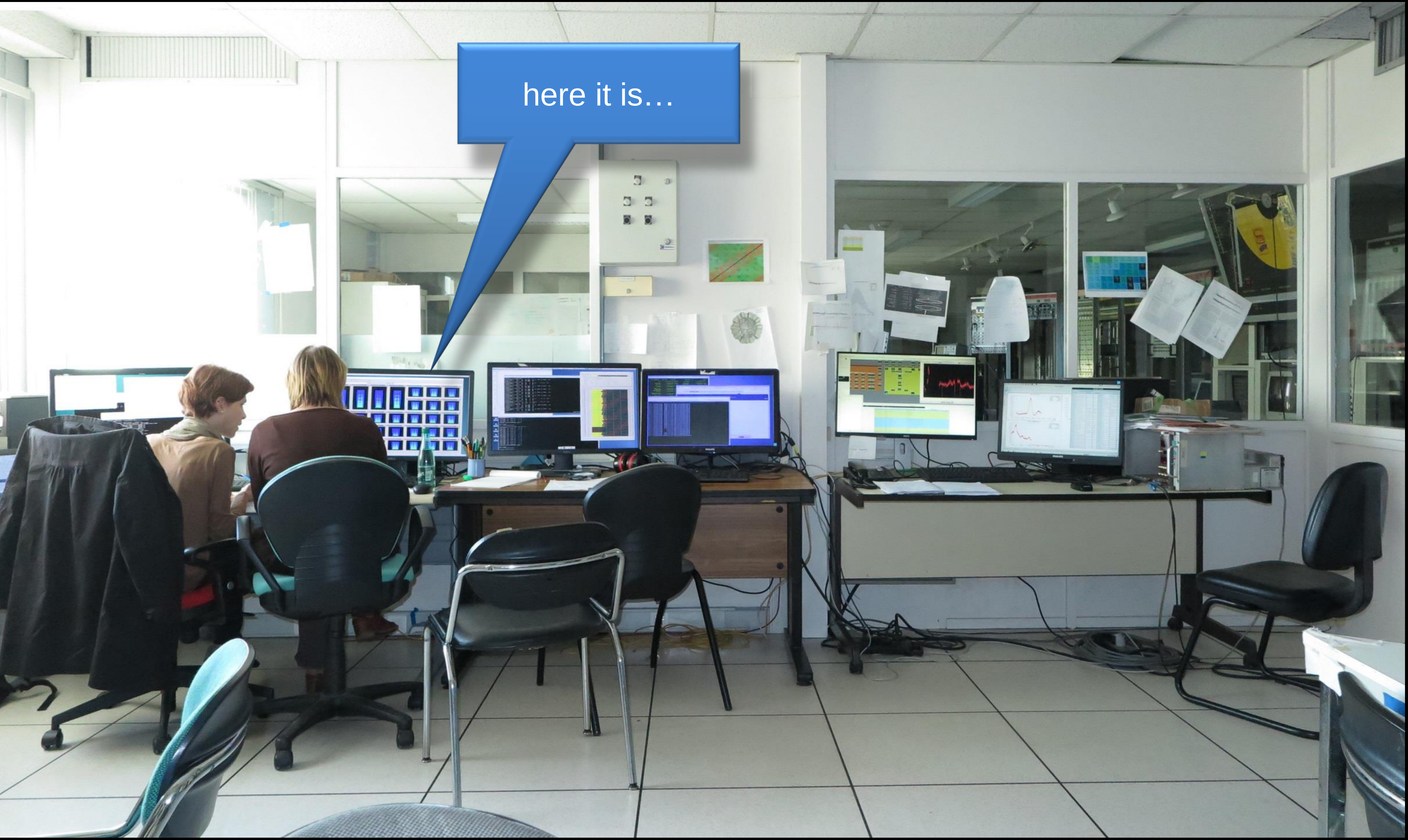
!!!Unknown state of spy!!! (Last message was: "SPY: Finished after 4991976 SUBevents (created 4991976 Events)")

Germanium energy

Germanium energy

Germanium energy

Paris „slow” energy



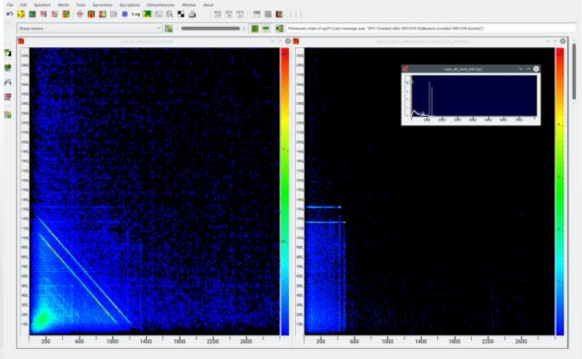
here it is…

Analysing online

To monitor ONLINE the currently collected run, it is enough to type

```
./spy  -online
```

This will work only if there is a run currently opened by NARVAL.



To analyse all the events collected during **current run** you type

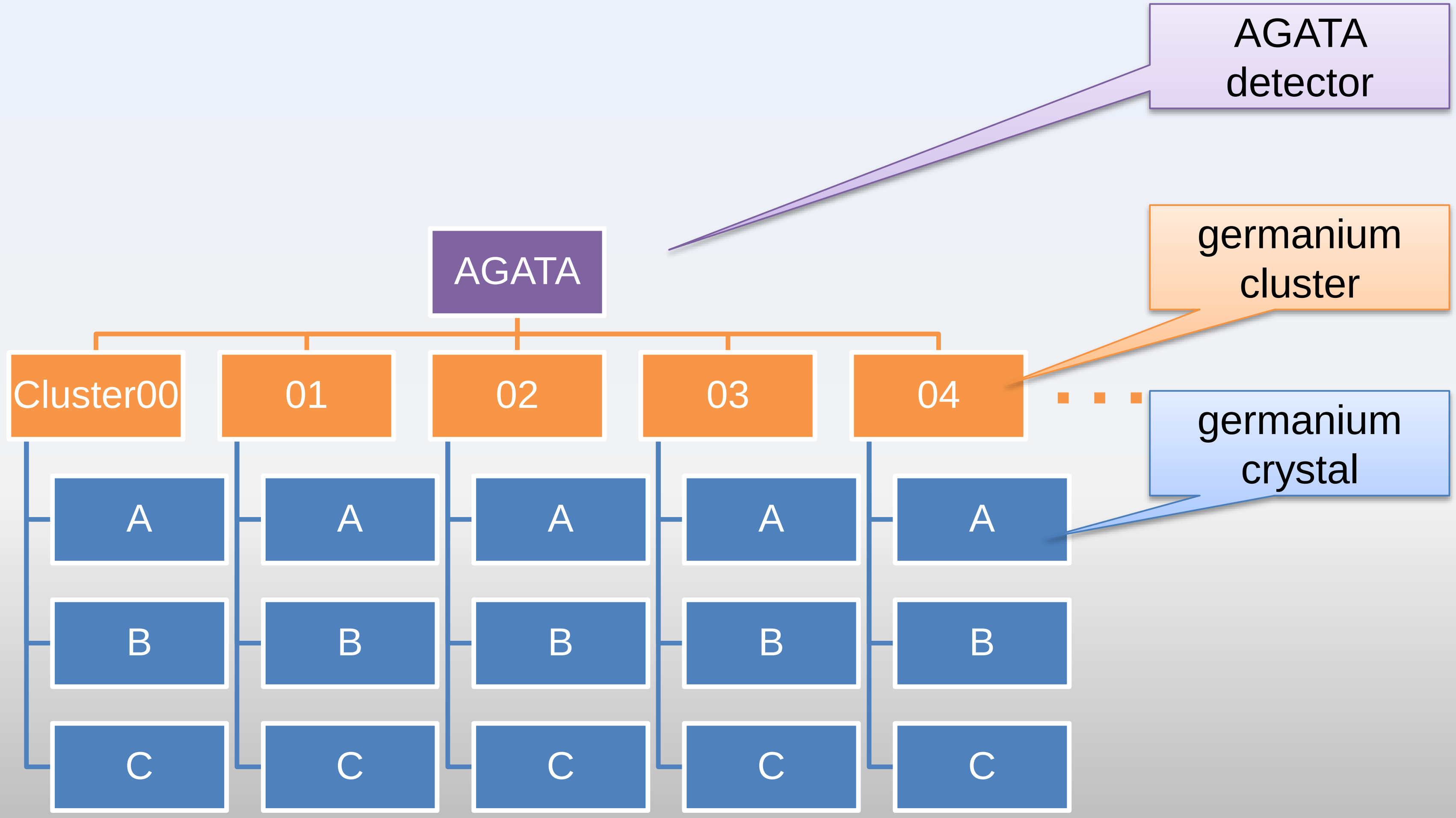
```
./spy   temporary_dir
```

This will work only if there is a run currently opened by NARVAL.
(if the run is already closed, it is available as normal run)

How the spy is designed?

To build an (object oriented) analysis program –

means to build a software model of the experiment



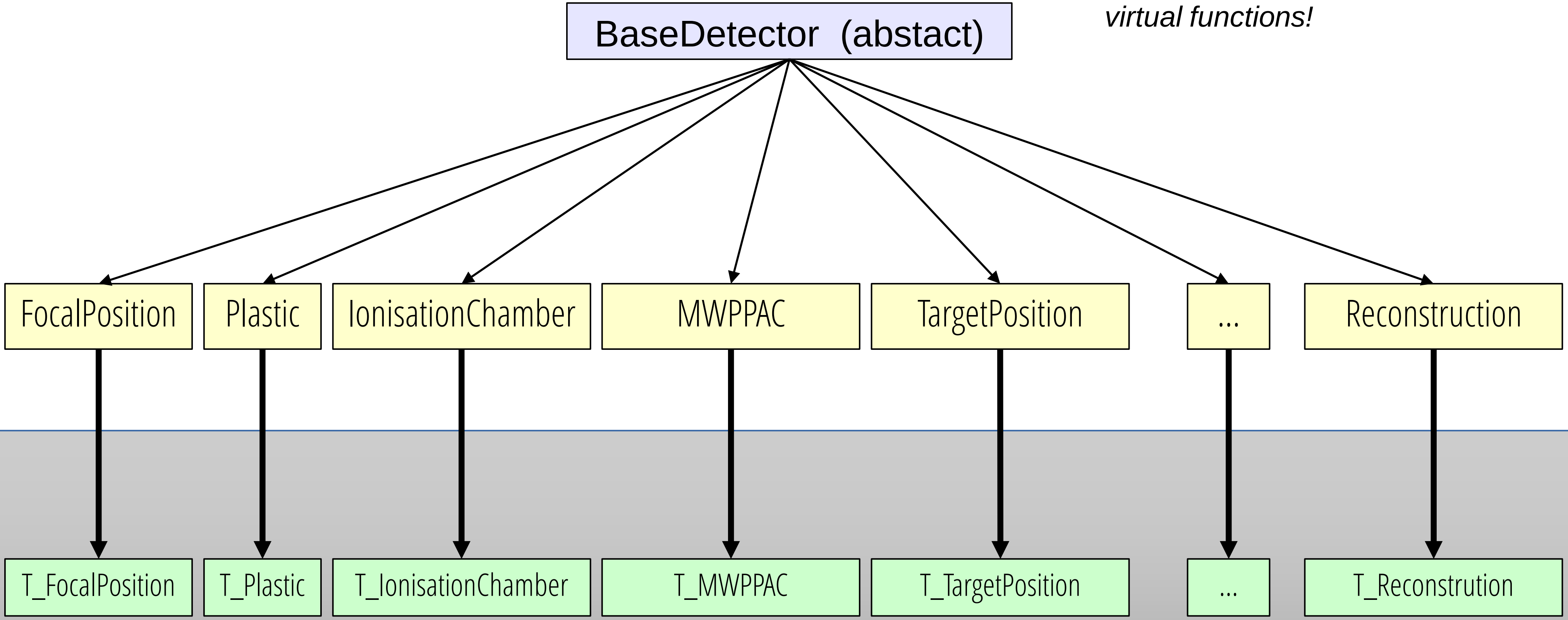
For example objects of AGATA

MFM Library

No CERN
root

Antoine Lemasson

Classes:



virtual functions!

Need to add:

- ** default spectra*
- ** incrementers*

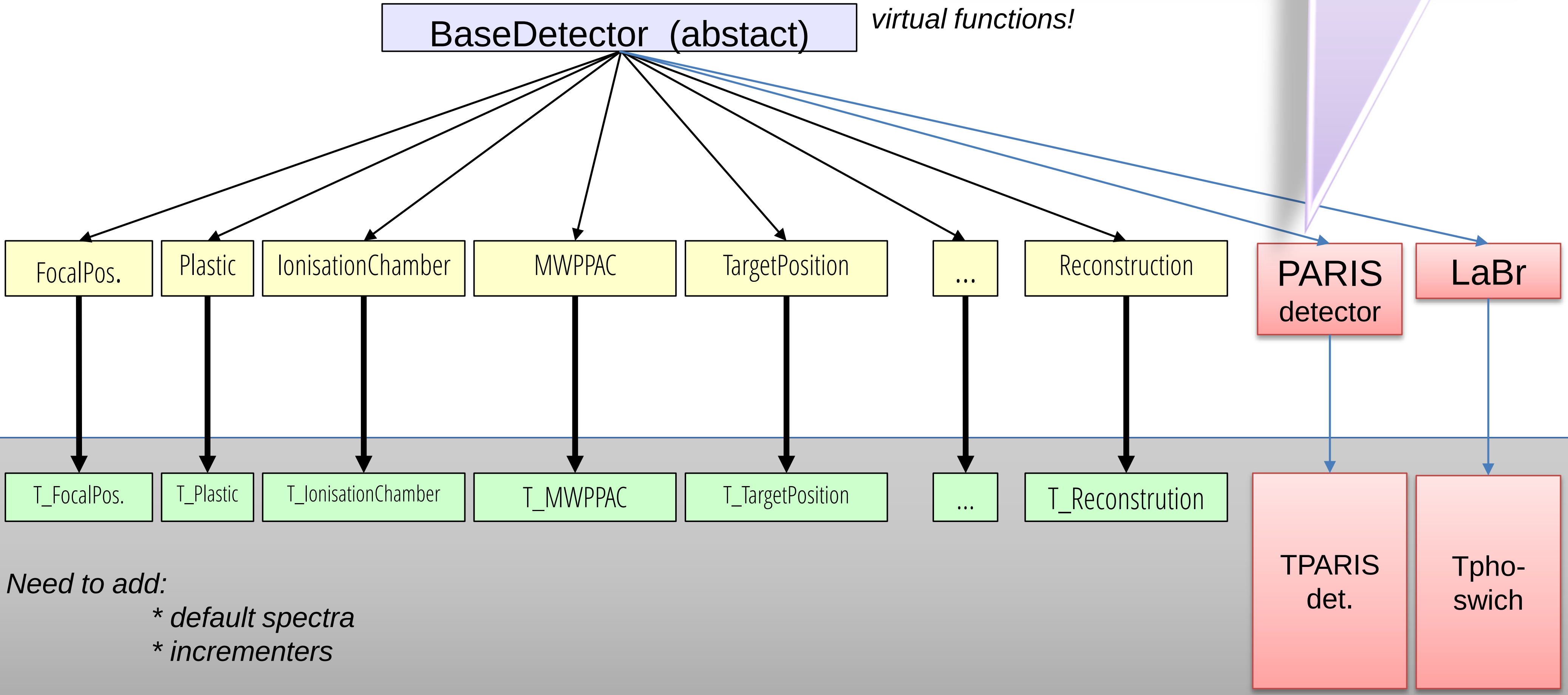
MFM Library

(No CERN root)

Antoine Lemasson

Thanks to this, MFMlib will unpack Paris data for me

Classes:



Need to add:

** default spectra*

** incrementers*

full functionality

„Analysis” – is something more, than just making a simple spectra of all possible signals

This would be a „monitoring”

We want to see some physics

Program variables – which are vital from a physicist point of view – I call:

Incrementers, because

- You can use them to increment your **spectra (or matrices)**
- You can use them to create your **conditions** (and conditional spectra)

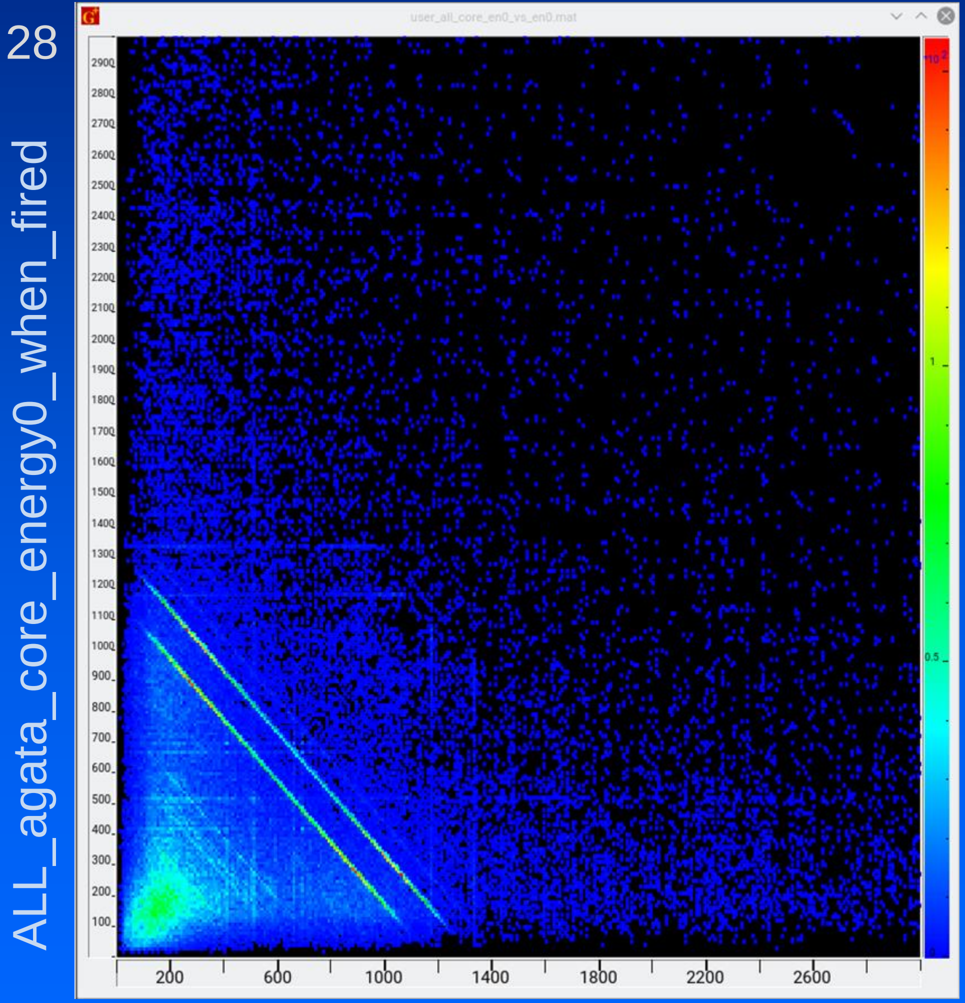
There are plenty of them in the program

Some incrementers available for AGATA crystals

agata_01A_core_energy0_when_fired
agata_01A_core_energy1_when_fired
agata_01A_core_time0_when_fired
agata_01A_core_time1_when_fired

agata_01A_interaction_pt_x1_when_fired
agata_01A_interaction_pt_y1_when_fired
agata_01A_interaction_pt_z1_when_fired

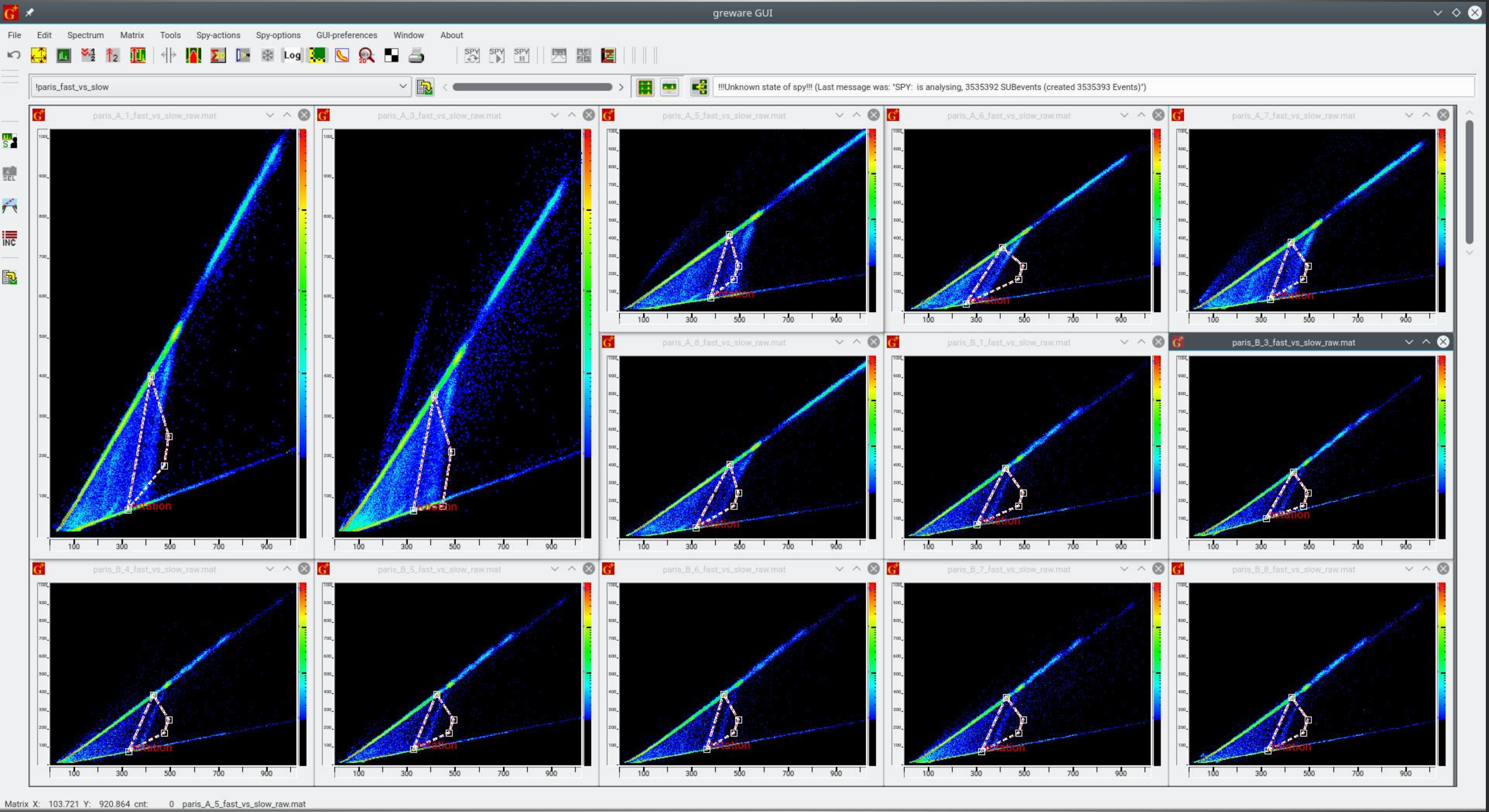
× 28



ALL_agata_core_energy0_when_fired

Incrementers to create TOTAL spectra

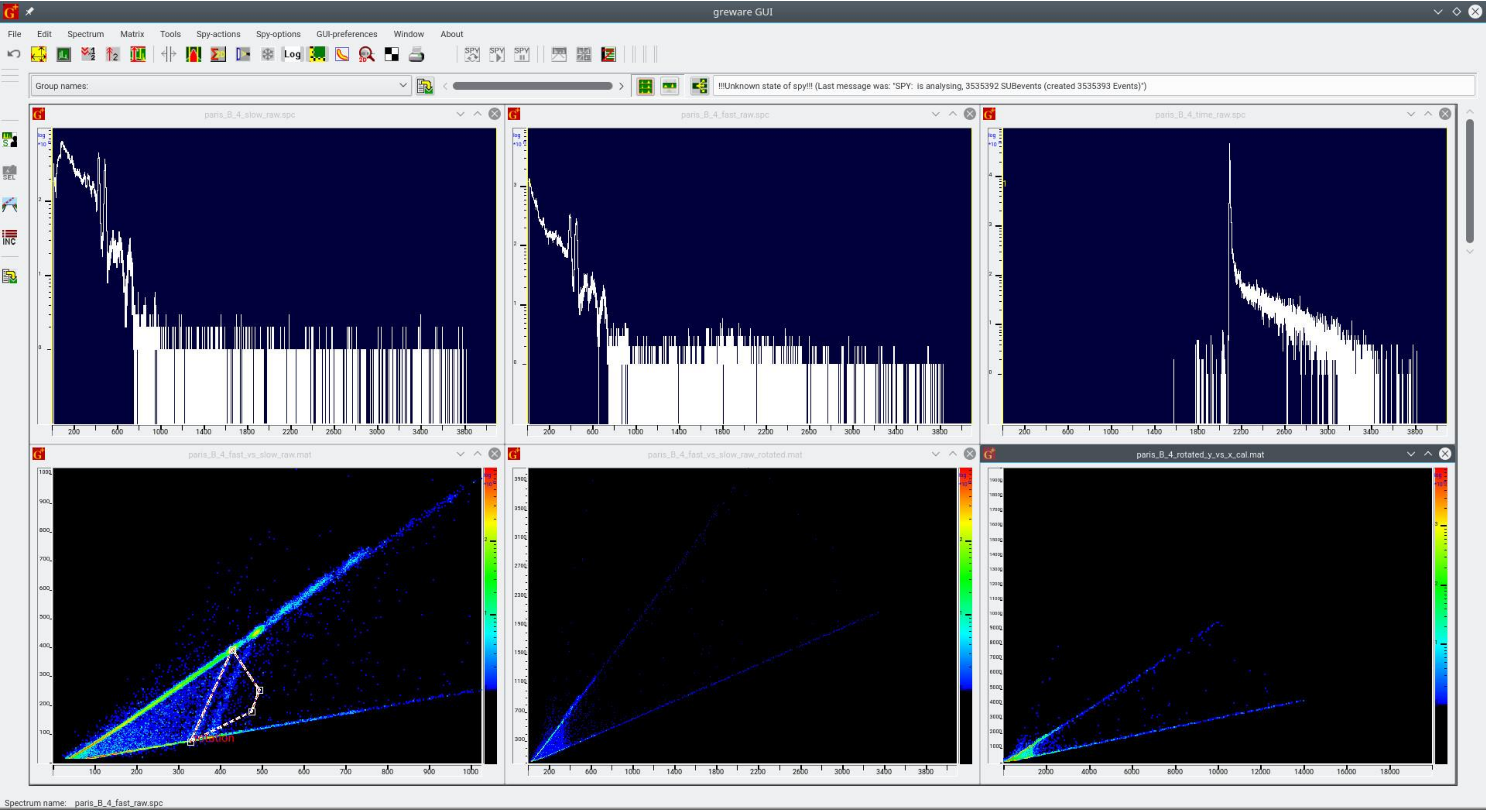
ALL_agata_core_energy0_when_fired
ALL_agata_core_energy1_when_fired
ALL_agata_core_time0_cal_when_fired
ALL_agata_core_time0_cal_when_fired


greware GUI
File
Edit
Spectrum
Matrix
Tools
Spy-actions
Spy-options
GUI-preferences
Window
About
Log
!paris_fast_vs_slow
paris_A_1_fast_vs_slow_raw.mat
paris_A_3_fast_vs_slow_raw.mat
paris_A_5_fast_vs_slow_raw.mat
paris_A_6_fast_vs_slow_raw.mat
paris_A_7_fast_vs_slow_raw.mat
paris_A_8_fast_vs_slow_raw.mat
paris_B_1_fast_vs_slow_raw.mat
paris_B_3_fast_vs_slow_raw.mat
paris_B_4_fast_vs_slow_raw.mat
paris_B_5_fast_vs_slow_raw.mat
paris_B_6_fast_vs_slow_raw.mat
paris_B_7_fast_vs_slow_raw.mat
paris_B_8_fast_vs_slow_raw.mat
100
300
500
700
900

!!!Unknown state of spy!!! (Last message was: "SPY: is analysing, 3535392 SUBevents (created 3535393 Events)")

Matrix X: 103.721 Y: 920.864 cnt: 0   paris_A_5_fast_vs_slow_raw.mat

elementary phoswich, his default spectra and his incrementers



!!!Unknown state of spy!!! (Last message was: "SPY: is analysing, 3535392 SUBevents (created 3535393 Events)")

Spectrum name: paris_B_4_fast_raw.spc

paris_B_4_fast_raw
paris_B_4_slow_raw
paris_B_4_time_raw
…
paris_B_4_fast_cal
paris_B_4_slow_cal
paris_B_4_time_cal

Basic

paris_B_4_phi_degrees_when_fired
paris_B_4_theta_degrees_when_fired
paris_B_4_phi_radians_when_fired
paris_B_4_theta_radians_when_fired

Geometry

paris_B_4_rotated_x_when_ok
paris_B_4_rotated_y_when_ok

specific

How to analyse near-line (offline)?

You can start analysing data from a chosen run. Your runs you can see listed like this:

```
ls /agatadisks/e676/e676
```

```
run_0008.dat.04-07-17_19h42m59s
run_0016.dat.07-07-17_10h20m27s
run_0083.dat.10-07-17_17h45m38s
...
run_0104.dat.12-07-17_18h30m22s
```

If you want to analyse ("sort") the data from any particular run you need

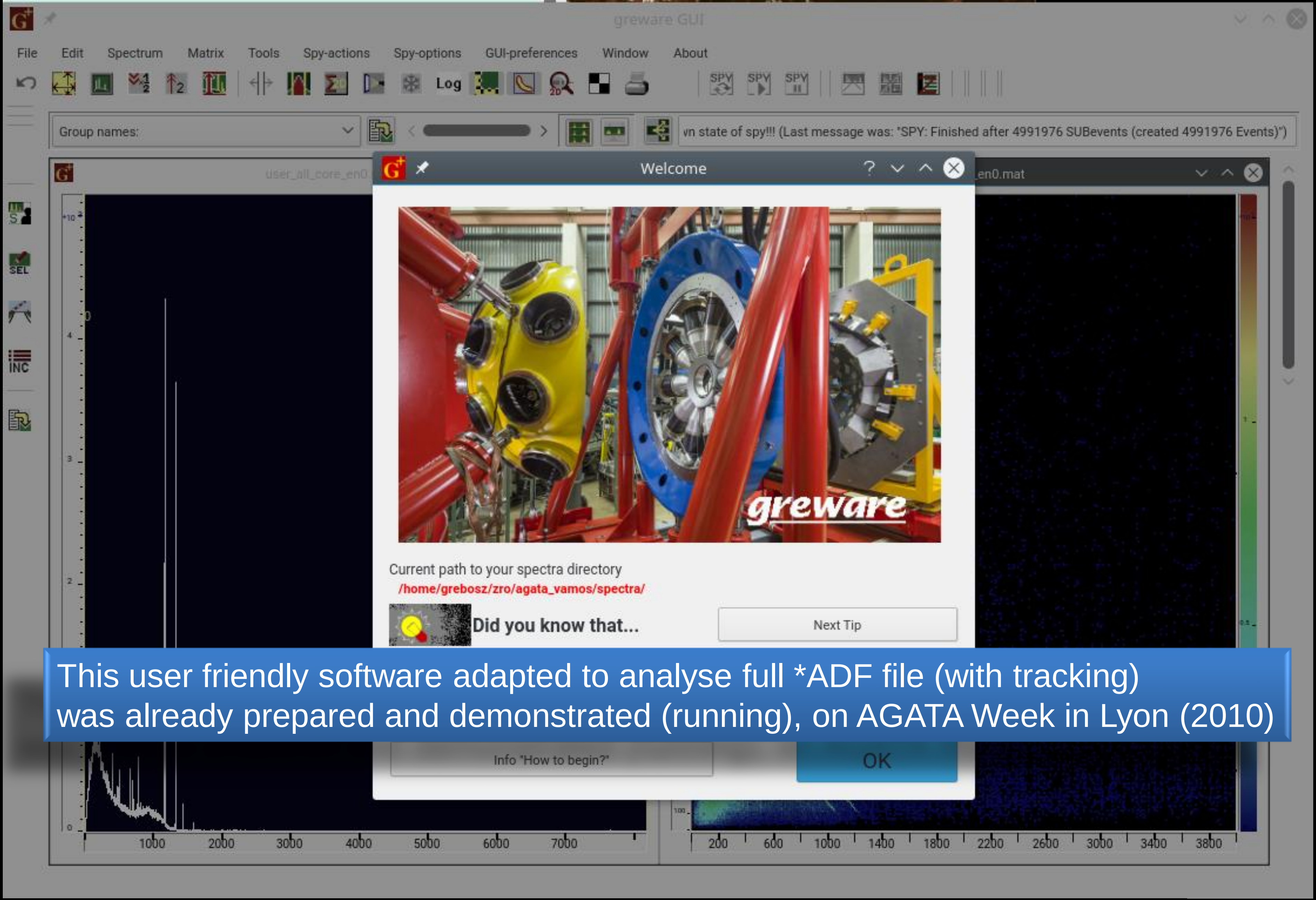
To start the spy you need a command

```
./spy  [name of run directory]
```

For example, to analyse the run_0104.dat.12-07-17_18h30m22s - being int the directory
/opt/data/GANIL/e676/greware/agata_vamos
you type:

```
./spy   run_0104.dat.12-07-17_18h30m22s
```

However – without tracking…



vn state of spy!!! (Last message was: "SPY: Finished after 4991976 SUBevents (created 4991976 Events)")

Current path to your spectra directory
/home/grebosz/zro/agata_vamos/spectra/

Did you know that...

This user friendly software adapted to analyse full *ADF file (with tracking)
was already prepared and demonstrated (running), on AGATA Week in Lyon (2010)

Program for making ad hoc (!)

- User defined spectra,
- User defined conditions

(even very sophisticated), and remembering their definitions for future runs…

Thank you

Jerzy Grębosz
Kraków, POLAND