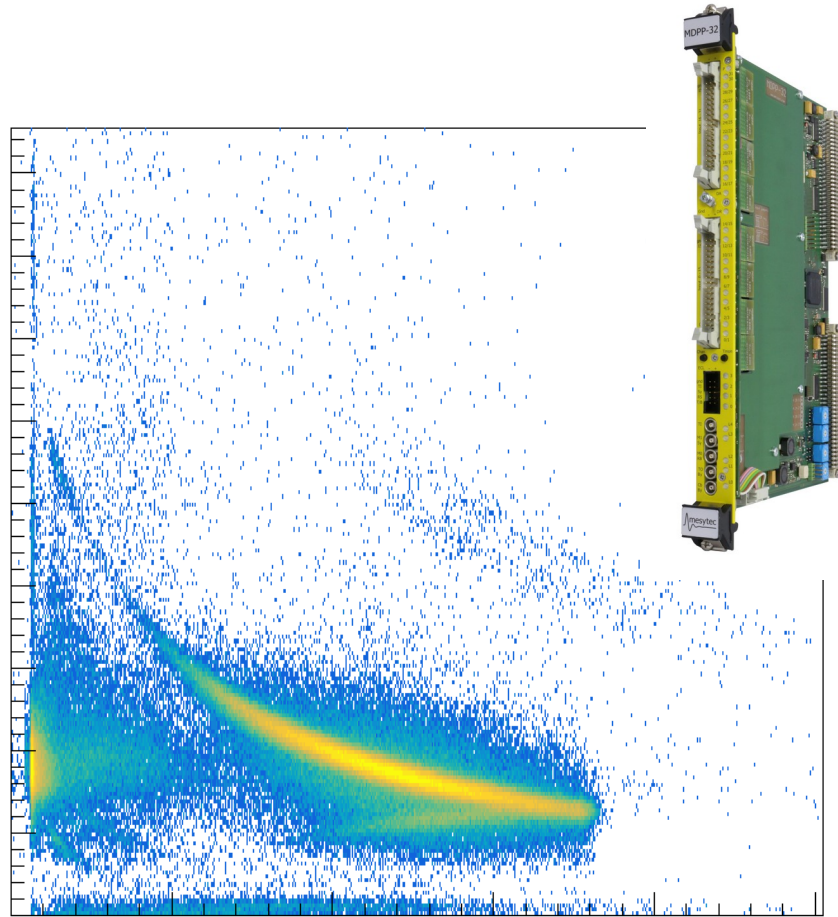


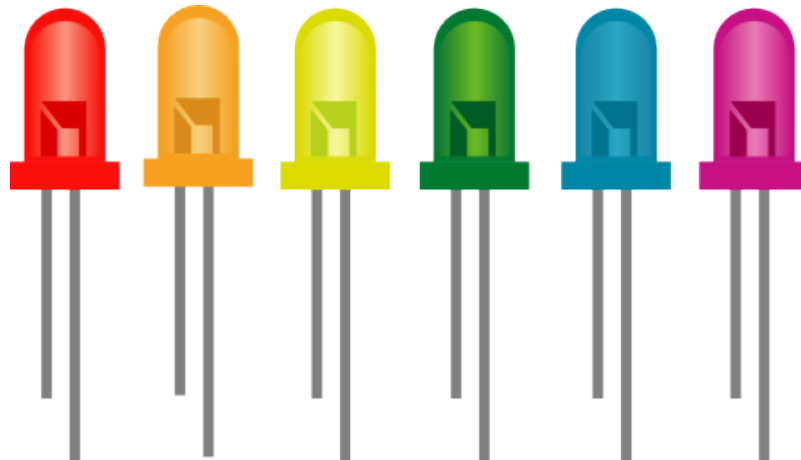
Free-running MDPP-32 at ISS



Håkan T. Johansson, Chalmers, Göteborg

Outline

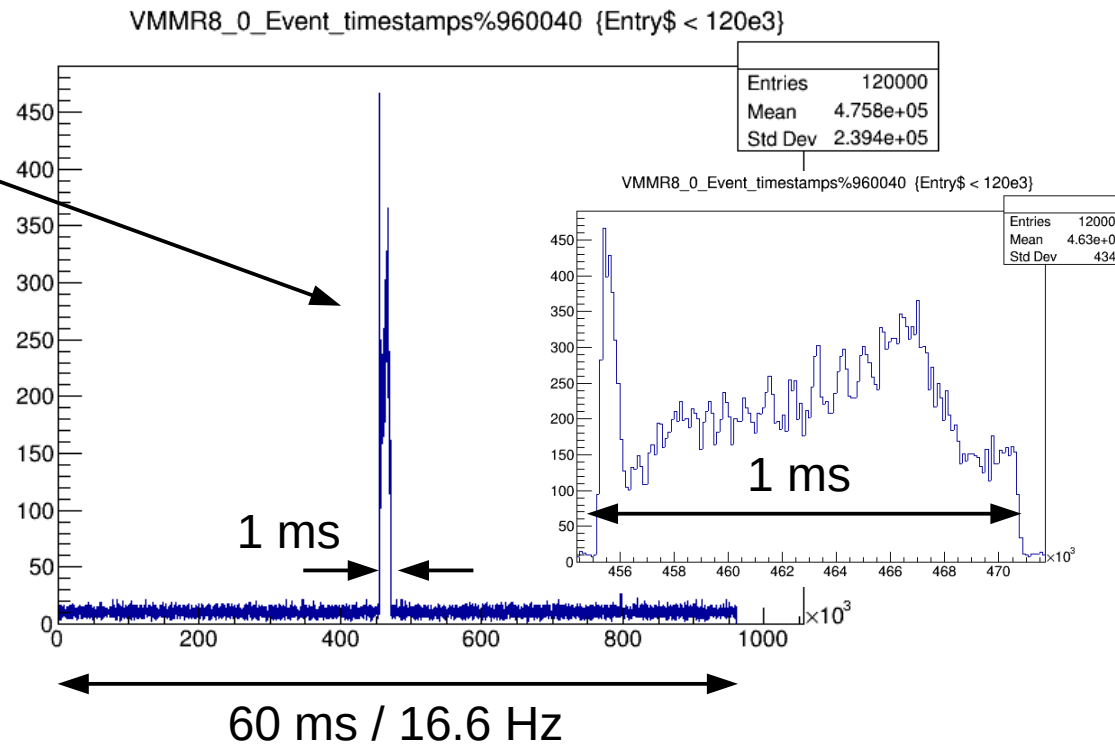
- REX/HIE-ISOLDE duty cycle vs. triggers
- Free-running DAQ with Mesytec MDPP-32 digitizers
- Three new detectors and a DAQ
 - How to be prepared?



To hardware trigger or not

REX/HIE-ISOLDE
duty cycle limited by
EBIS release time.

DAQ
awake!



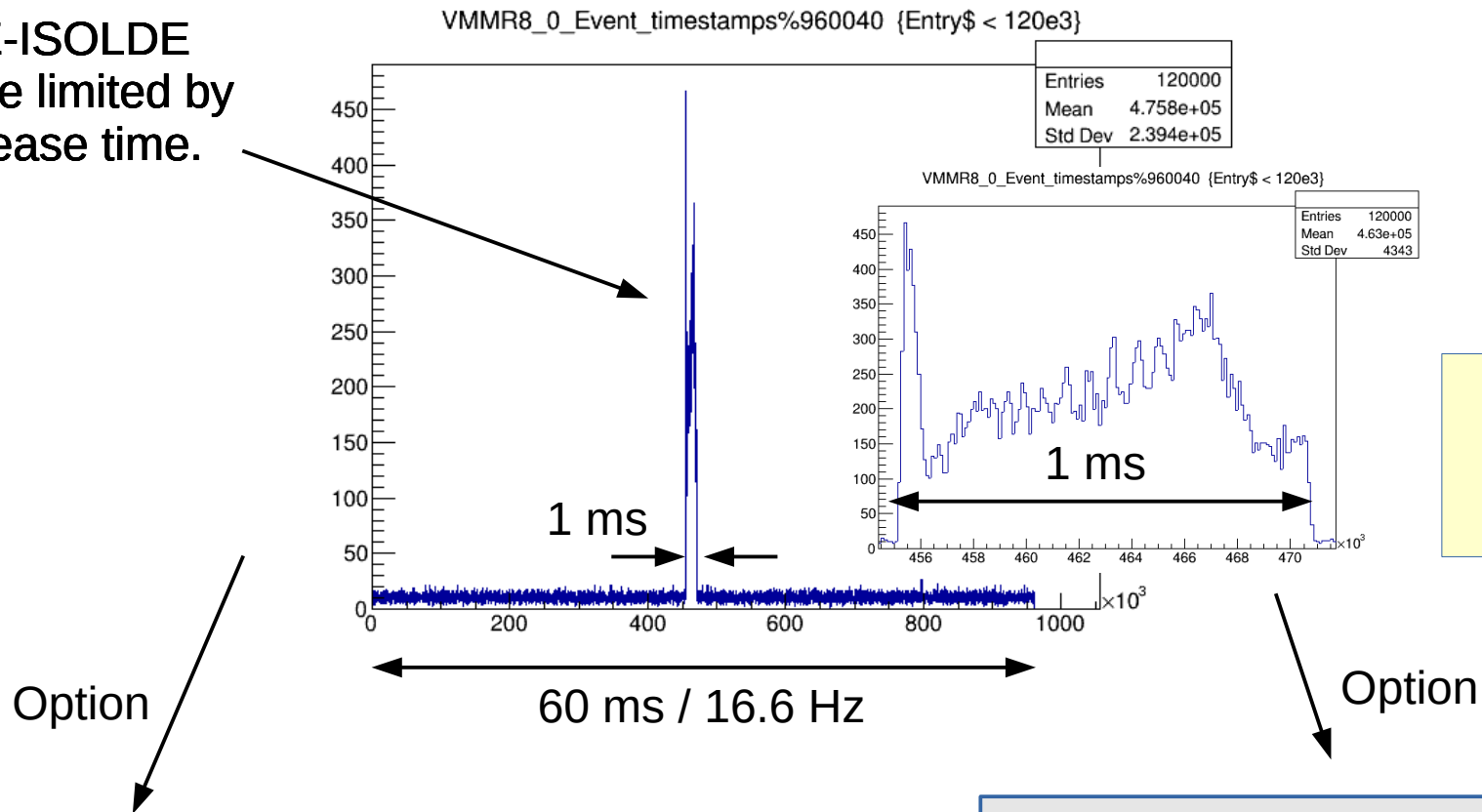
Courtesy:
Mavi, Erik,
Jeppe, Karsten
IS690 @ SEC

How about...

More statistics?

Trigger (or not) options

REX/HIE-ISOLDE
duty cycle limited by
EBIS release time.



Courtesy:
Mavi, Erik,
Jeppe, Karsten
IS690 @ SEC

State-of-the-art
asynchronous multi-event readout

[VME Readout at and Below the Conversion Time Limit](#),
M. Munch et al, IEEE TNS, Vol. 66, 2019, pp 575-584

Free-running readout

No hardware trigger

Event-build (= software trigger)
during analysis

Option at ISS

Three new detectors

Existing ("CAEN")
V1725 digitisers

Few (32) ch
Si

36 ch
CeBr₃

dE + E
2 x Micron S3

2 x (24 + 32) ch
Si

dE-E telescope with
pinhole attenuator

Faraday cup

Luminosity detectors

Target ladder

Fission fragments dE-E

Si array

Existing ("R3B ASIC")

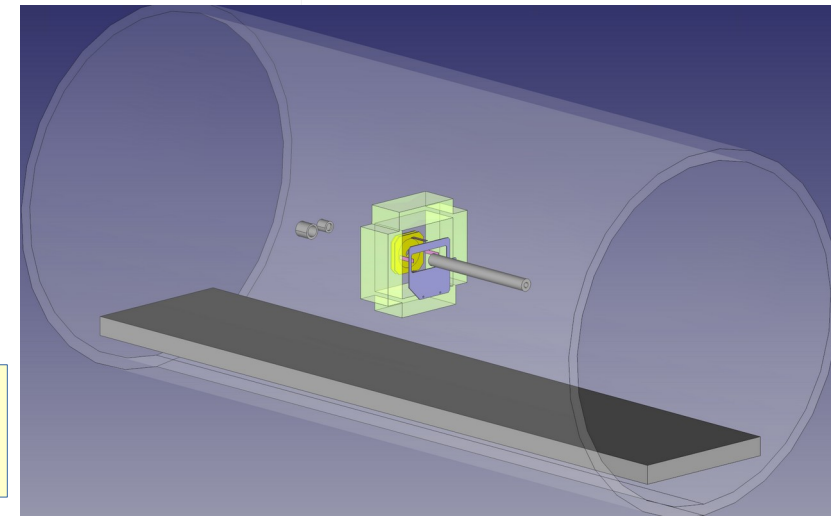
3 x (4 x 128 + 2 x 22)
= 1668 ch

1d resistive readout
4 x (near + far + back)

4 x 3 = 12 ch
Si

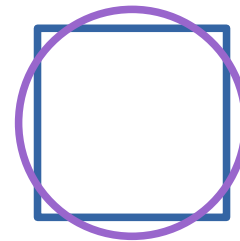
20 cm

Courtesy:
Hans T. T.

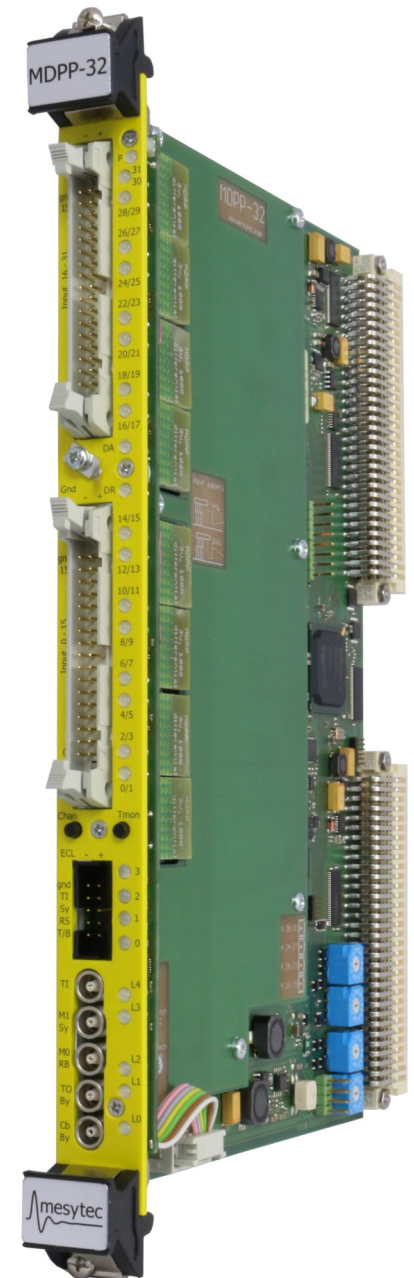


Mesytec MDPP-32

- 32-channel digitizer (80 Mhz)
 - FPGA DSP modules
- Hardware stage:
 - Variable input amplifier
 - Variable hardware differentiation
- External clock input
 - But not driving ADC
- Two high-resolution trigger inputs
 - 25 ps timing
 - Heimtime ("speaking clock")
- Originally not free-running
 - Implemented for this project (2023)



Mesytec is very responsive!



DAQ dilemma

Knowledge

The difficult part is not to make a DAQ work.

The difficulty is to have it help you when it does not work.

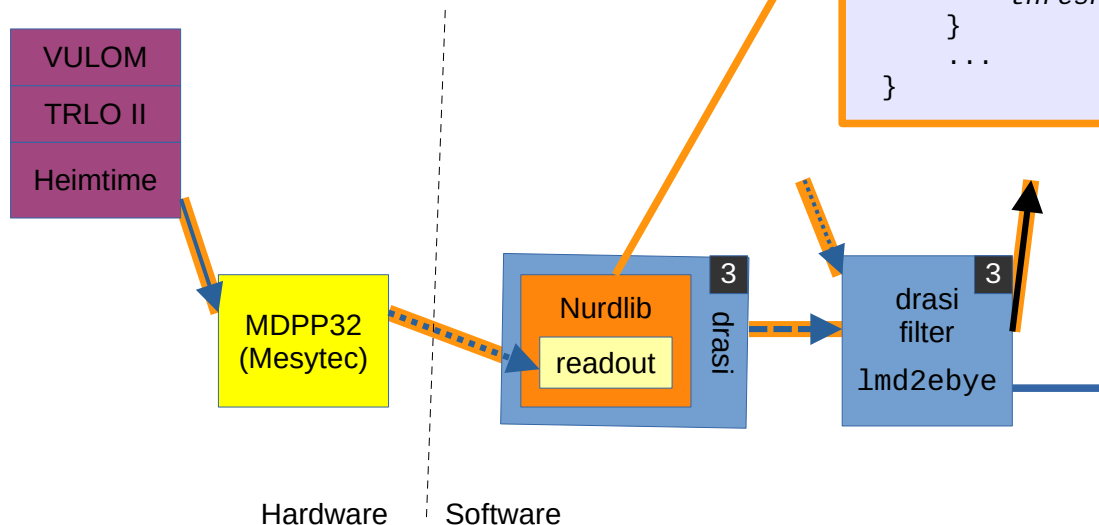
Experience

Readout by Nurdlib

Hans Törnqvist
Bastian Löher
Anna Kawecka (MDPP)

- Text file config
 - Defaults (omit)
- Data checking
- Logging and debugging

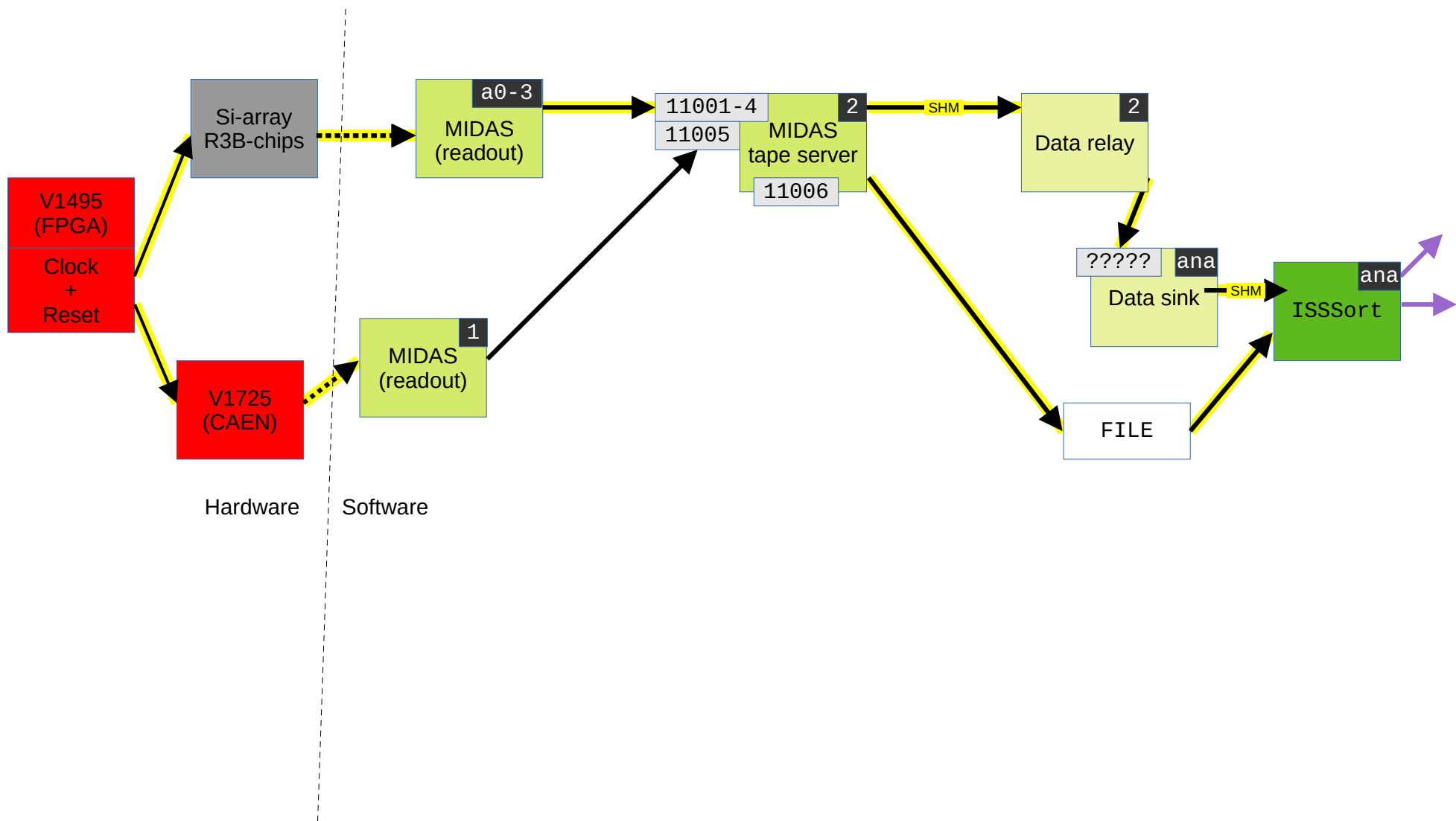
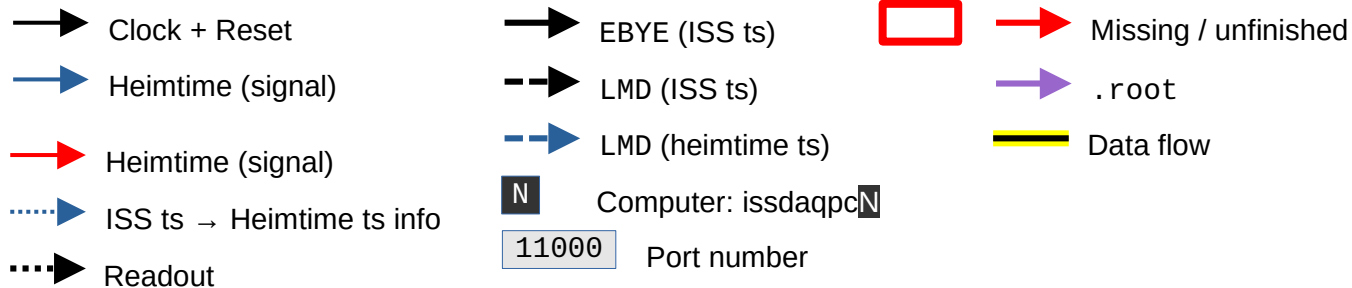
```
CAEN_VMELIB {  
  type = "ETH_V4718_LOCAL"  
  link_ip = "192.168.1.3"  
}  
CRATE("MDPP") {  
  free_running = true  
  ID_SKIP(16)  
  ...  
  MESYTEC_MDPP32SCP(0x05040000) {  
    blt_mode = blt  
    # Configure front-panel in- and output.  
    nim = (busy, on, trig1, off, trig0)  
  
    # Settings for channels in groups of four.  
    gain          = (100 {8}) # Units of 0.01  
    differentiation = (250 ns {8})  
    shaping_time   = ( 10 us {8})  
    signal_risetime = (250 ns {8})  
    blr            = (2 {8})  
  
    # Settings for individual channels.  
    pole_zero      = (30 us {32})  
    threshold       = (80{24}, 20000{8})  
  
  }  
  ...  
}
```



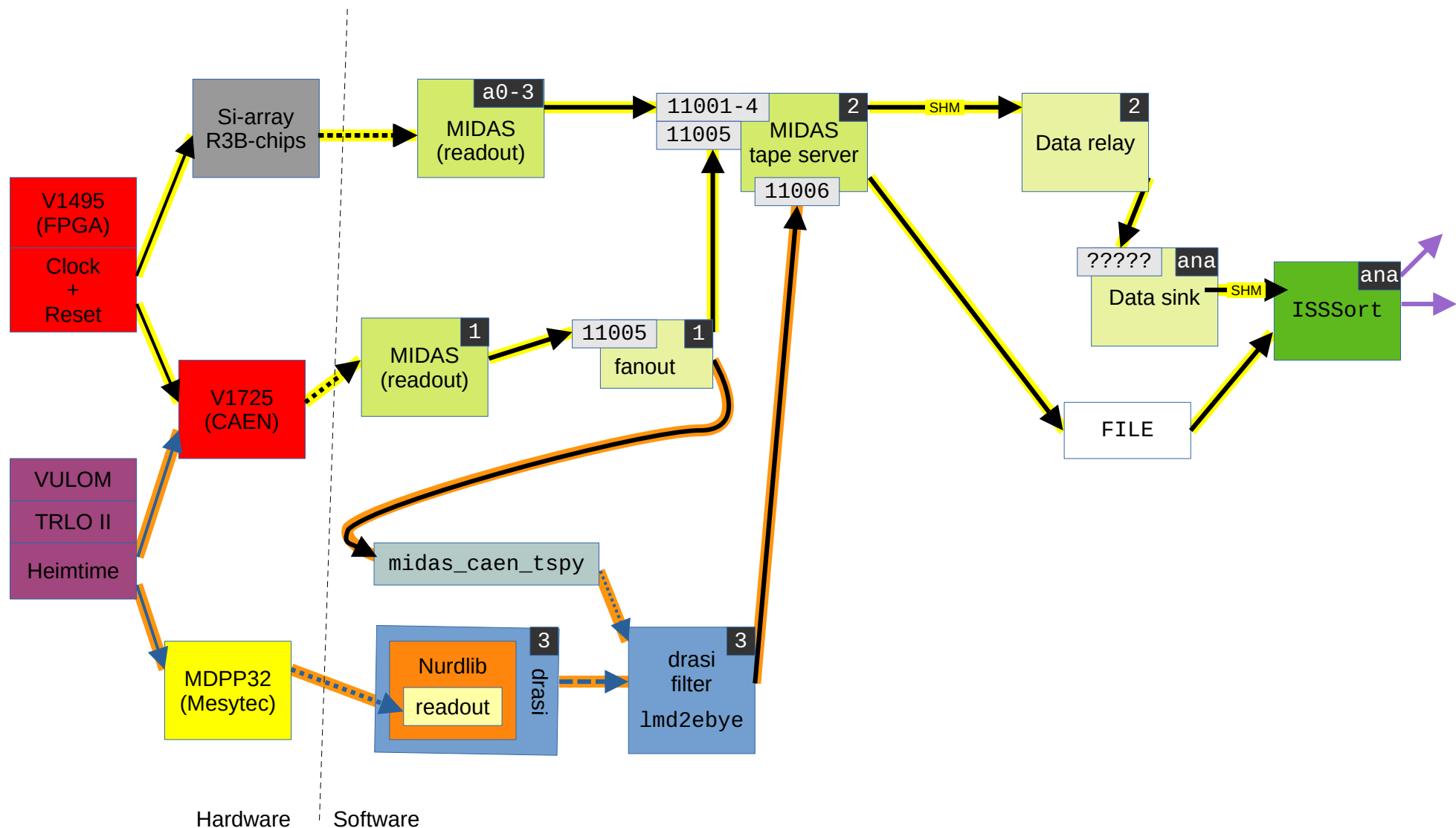
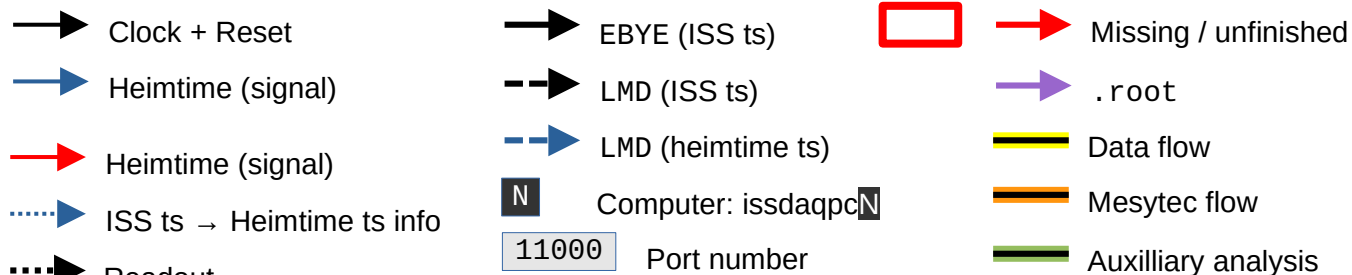
Filter:

- Convert module format → TDR(EBYE)
- Time-sort all hits
- Two-stage time conversion:
 - Internal time → Heimtime
 - Heimtime → CAEN time

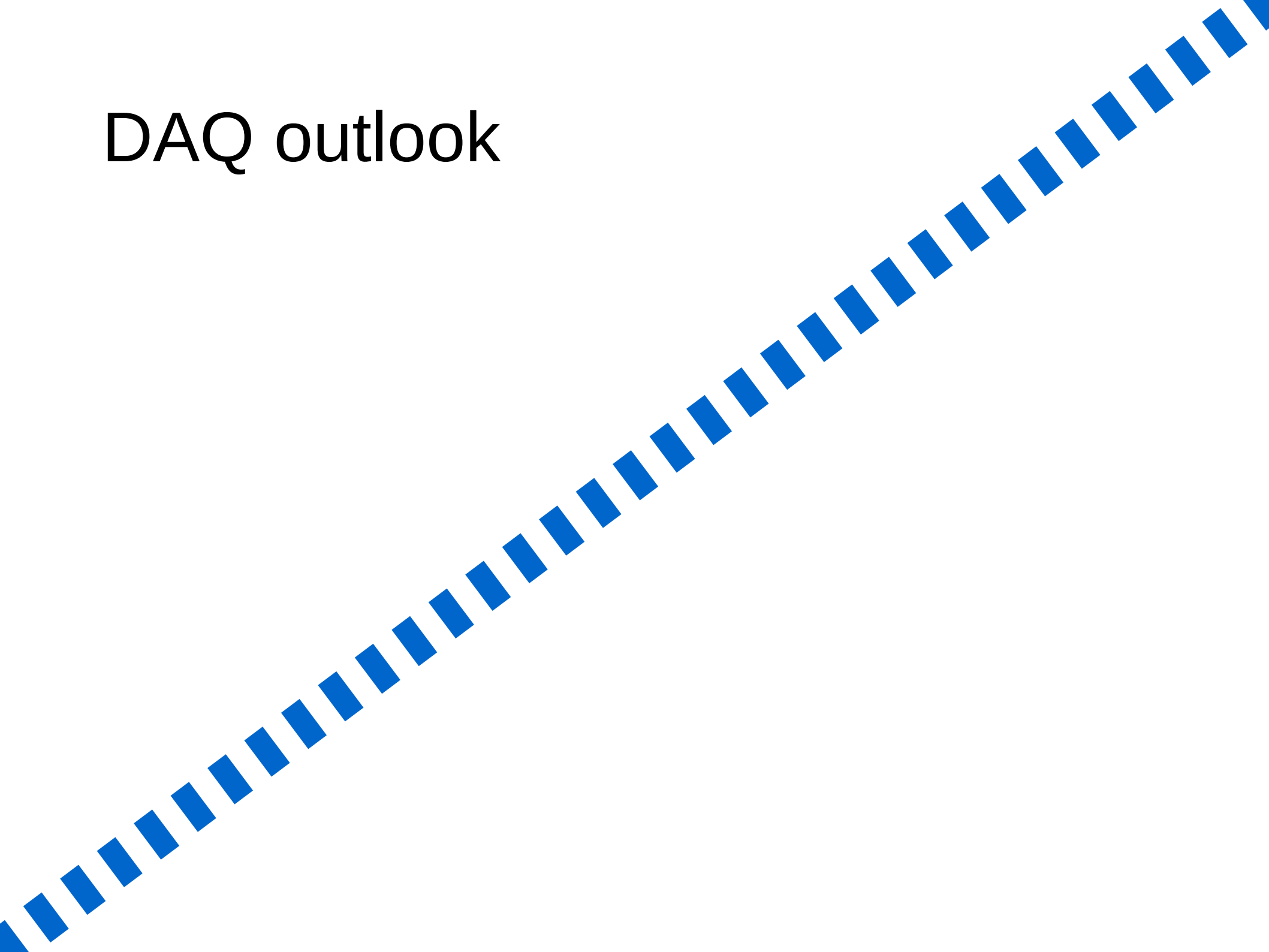
Existing at ISS: Array + CAEN



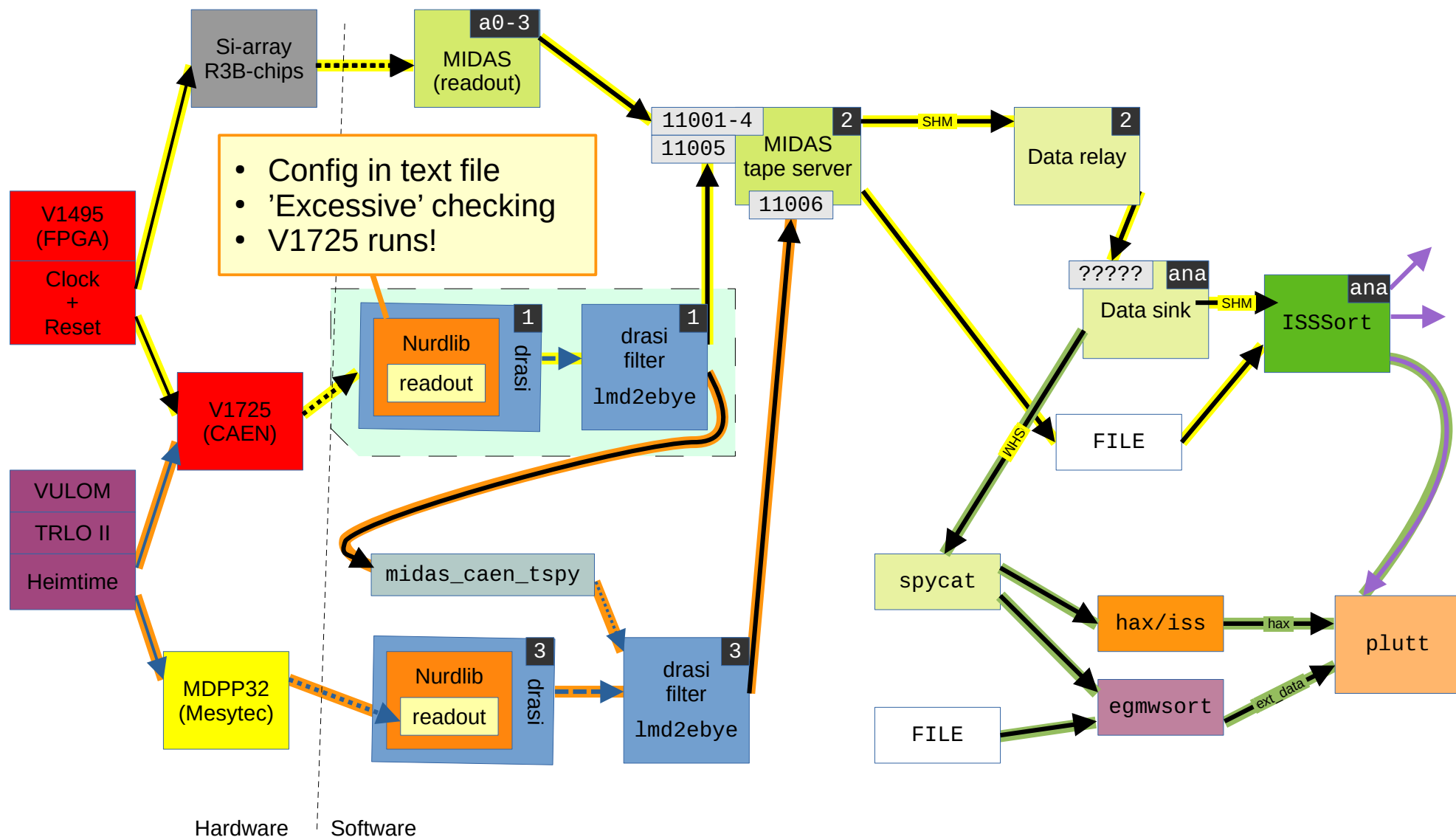
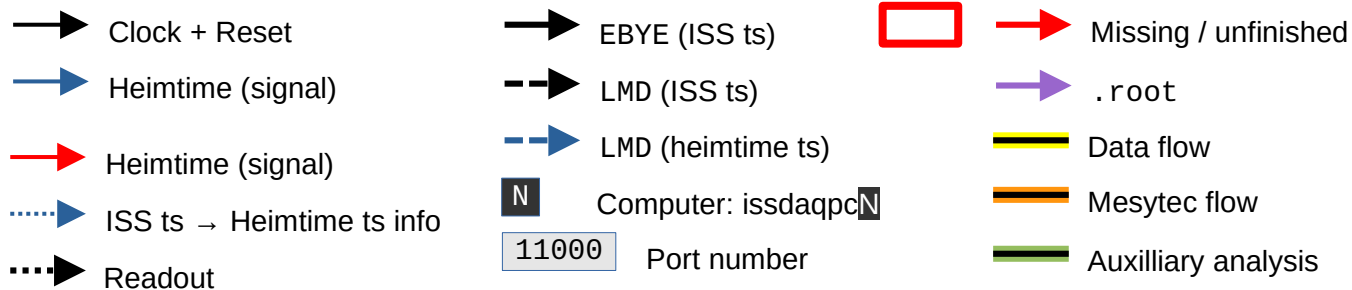
Mesytec DAQ integration (current)



DAQ outlook



Read CAEN by Nurdlib

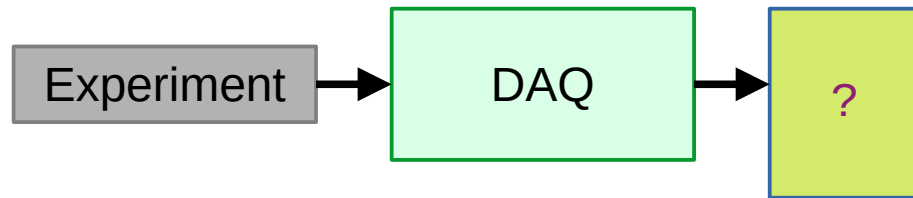


Three new detectors,
and a DAQ...

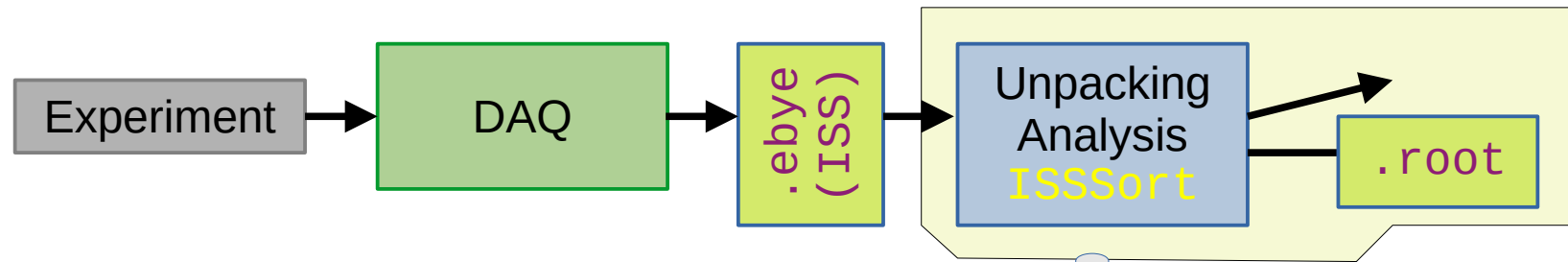
Prepare to meet
thy beam...



Typical experimentalists' view of preparations...



Typical experimentalists' view of preparations...

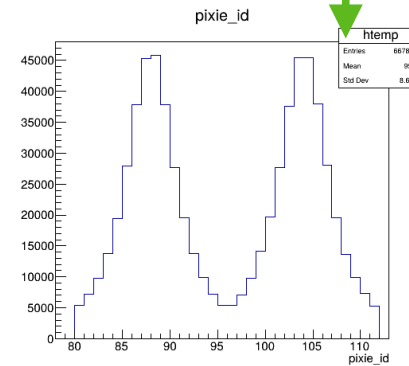
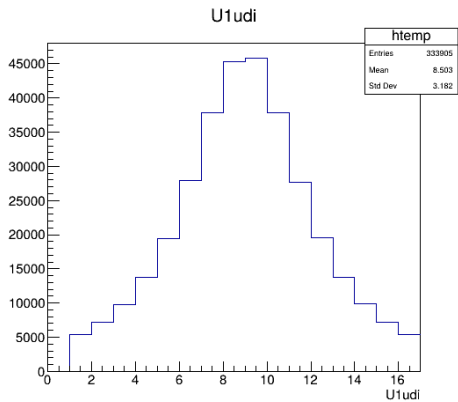
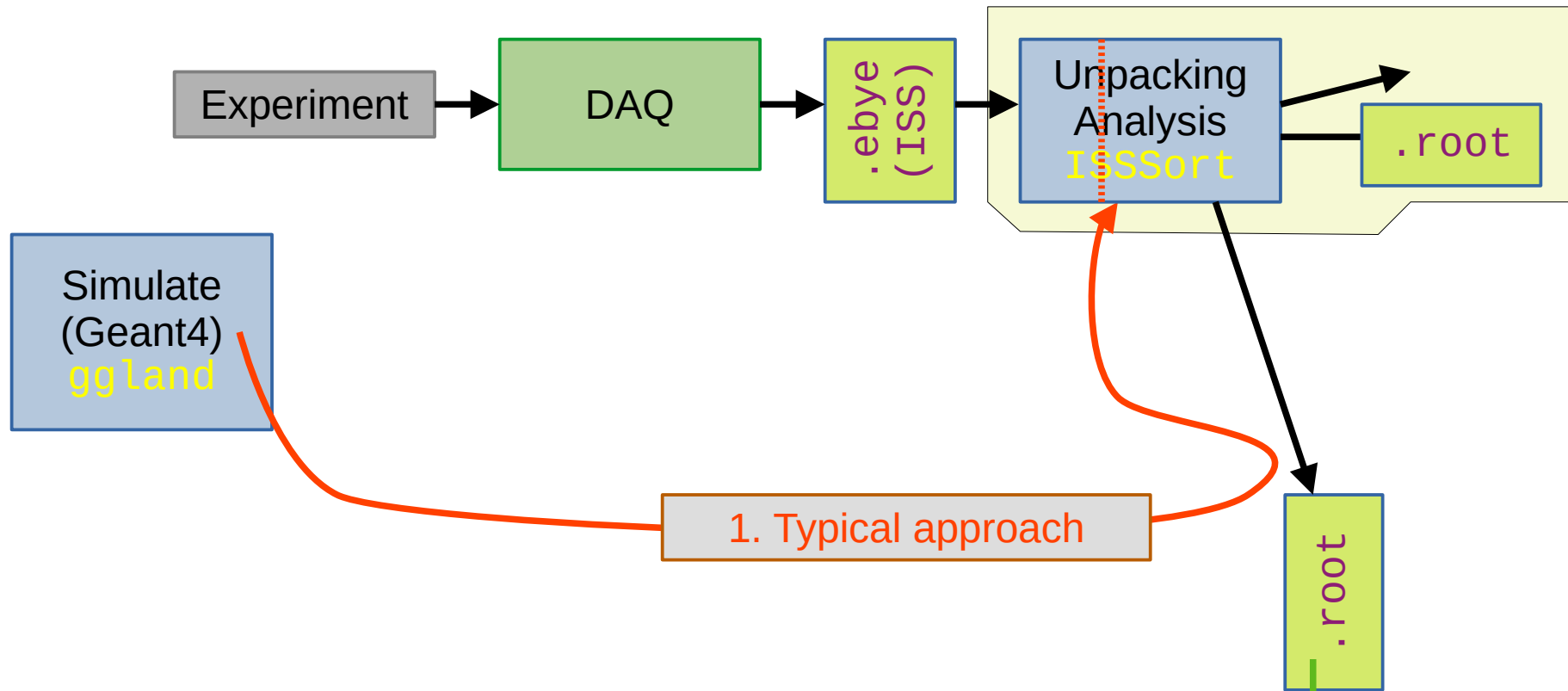


Too often:

A week before
beamtime...?

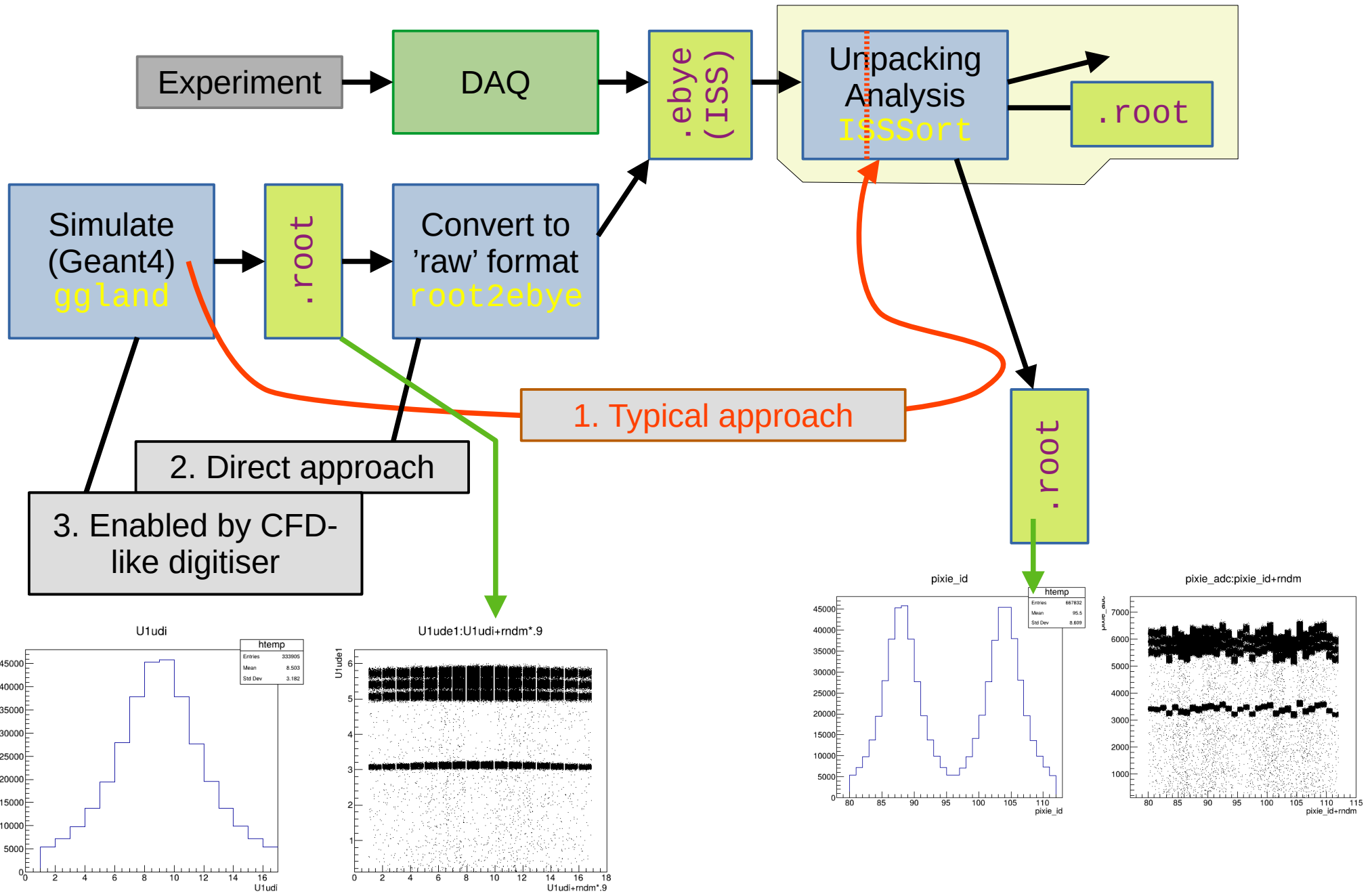
Not at ISS...

Simulate!



Simulate to raw data

"ISxxx @ home"



Summary

- MDPP-32 DAQ integration works and is stable
- No hardware trigger: different – but nice!
- DAQ prospects
- Analysis tools for new detectors
 - But still in 'infancy'...
(More experience with triggered readout.)

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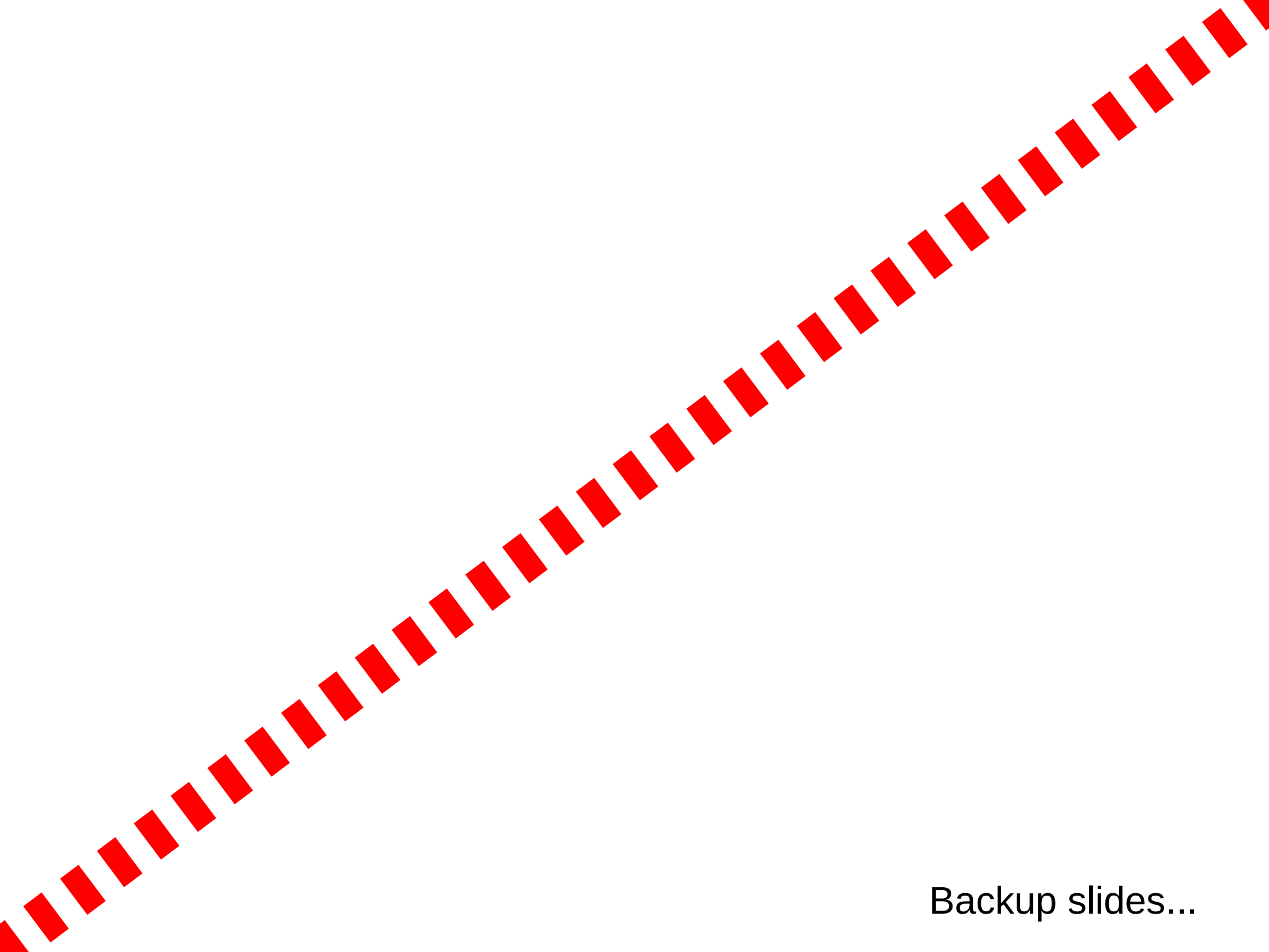
Anna, Mavi, Hans,
Björn, Alice, Erik,
Henna, Gabriel, Alfred,
Nas, Juan, Isabella,
Stina, Björn, Andreas

Liam, Patrick, Ben,
Greg, Faye, Vetle,
Carlotta, Frank, Carl,
Nigel, Ben, Riccardo,
...

Thank you!

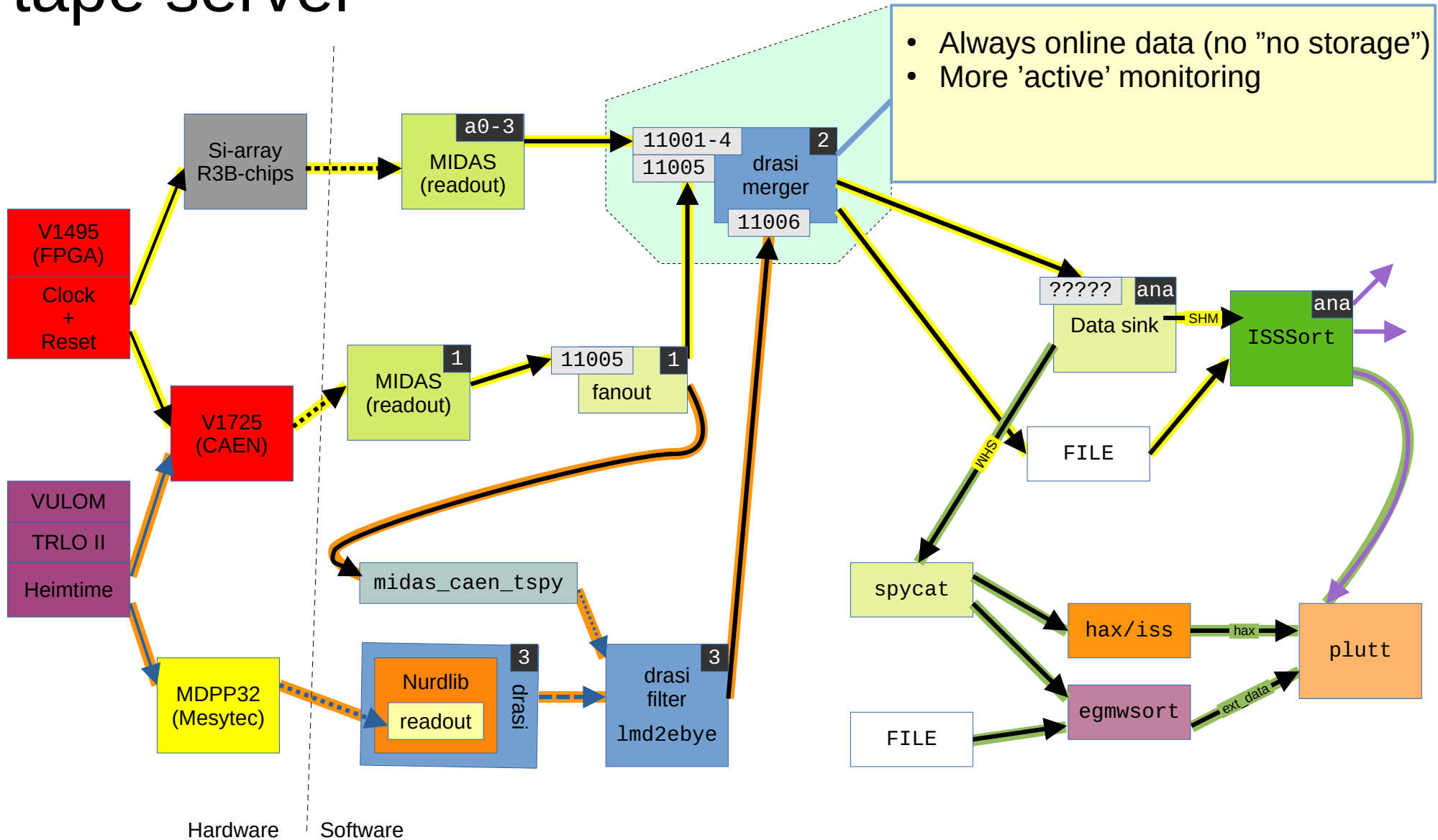
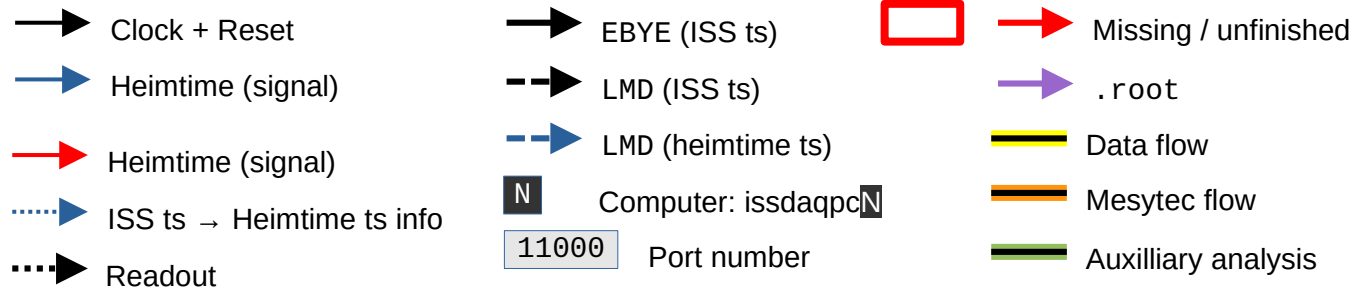
Knut och Alice Wallenberg Foundation





Backup slides...

Drasi merger as "tape server"



Time-sorting...

- Is Drasi an experienced time-sorter?

...

- Yes!

@ GSI
(R3B)

Dead-time
domains...

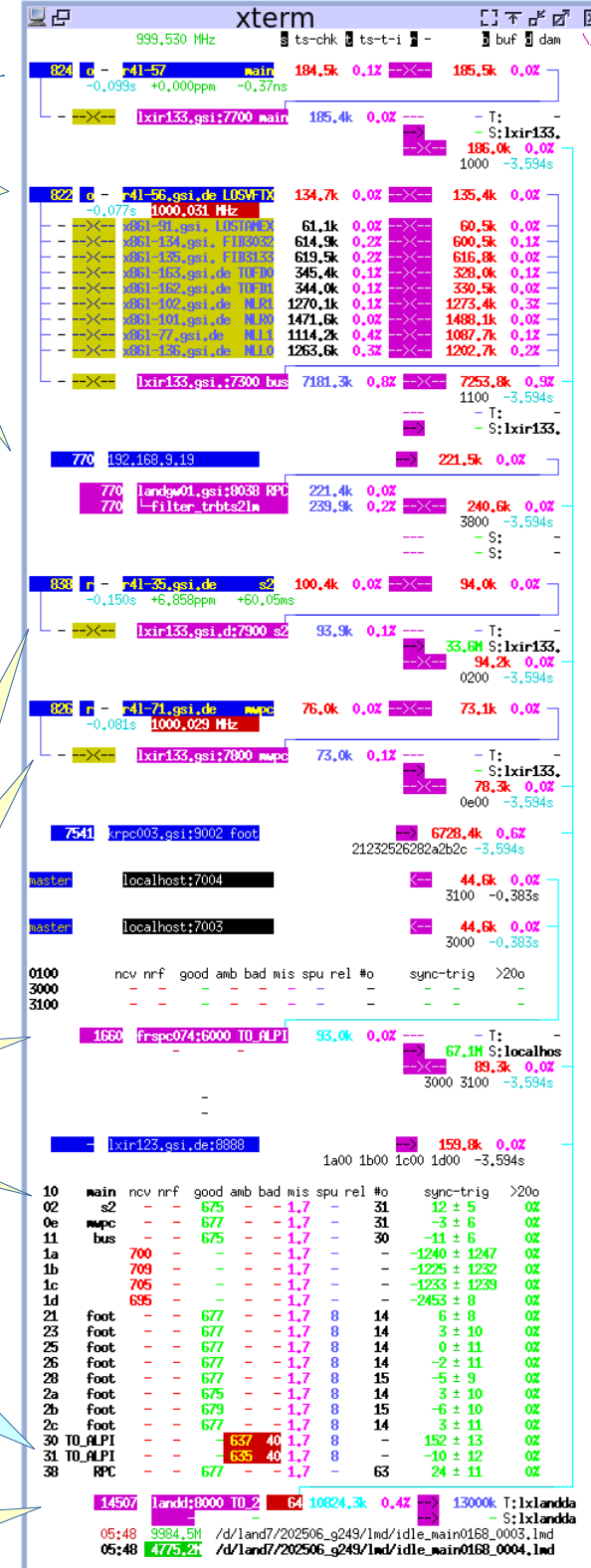
Mergers...

Synchronisation checks...

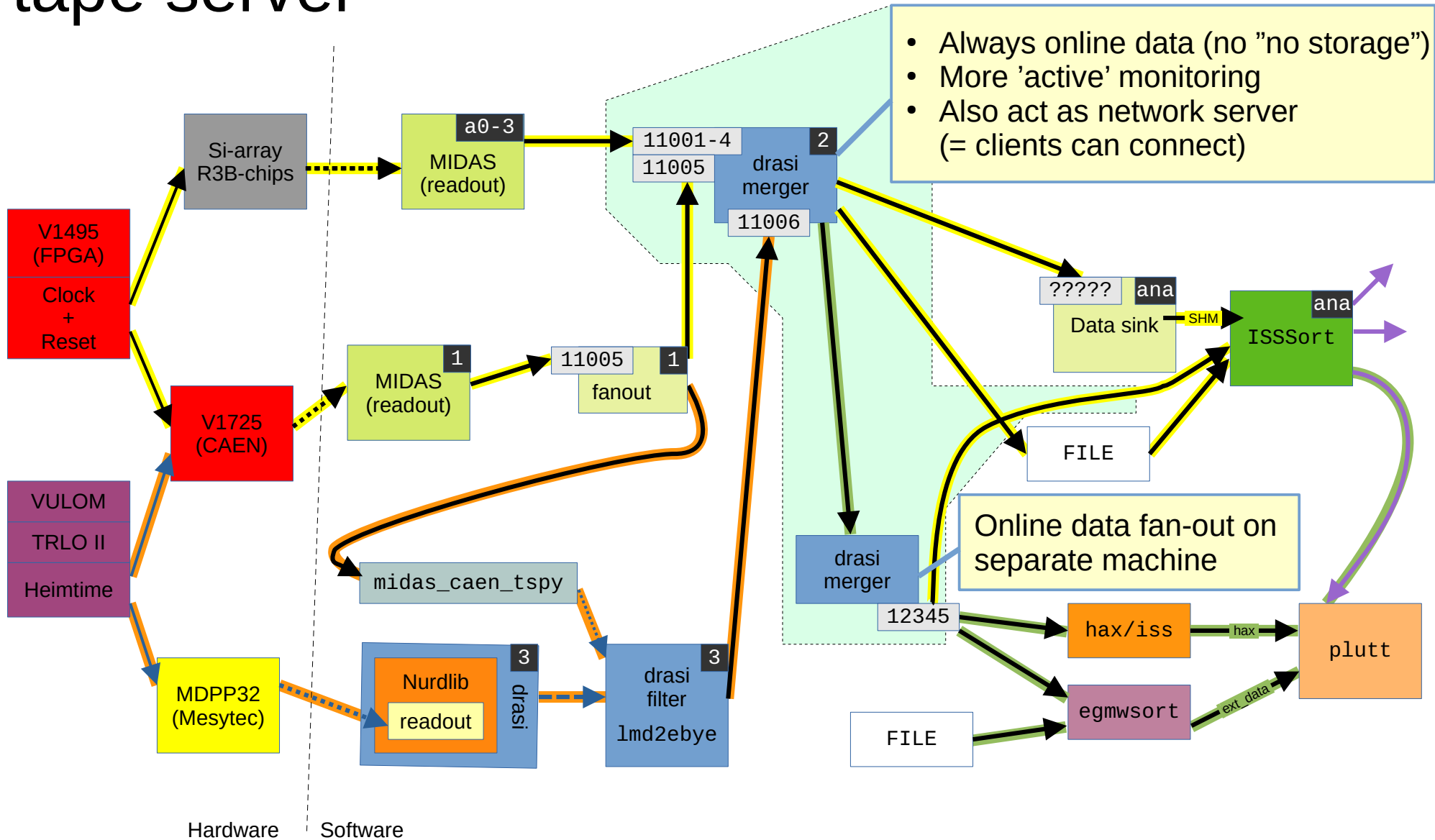
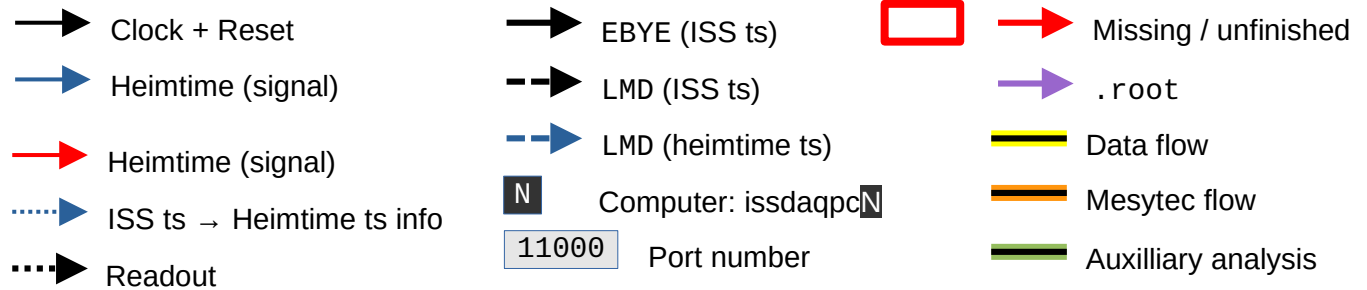
Does not look good,
not our problem today...

But does show monitoring...
(of 'Crudo' – not even
'Al Dente' system)

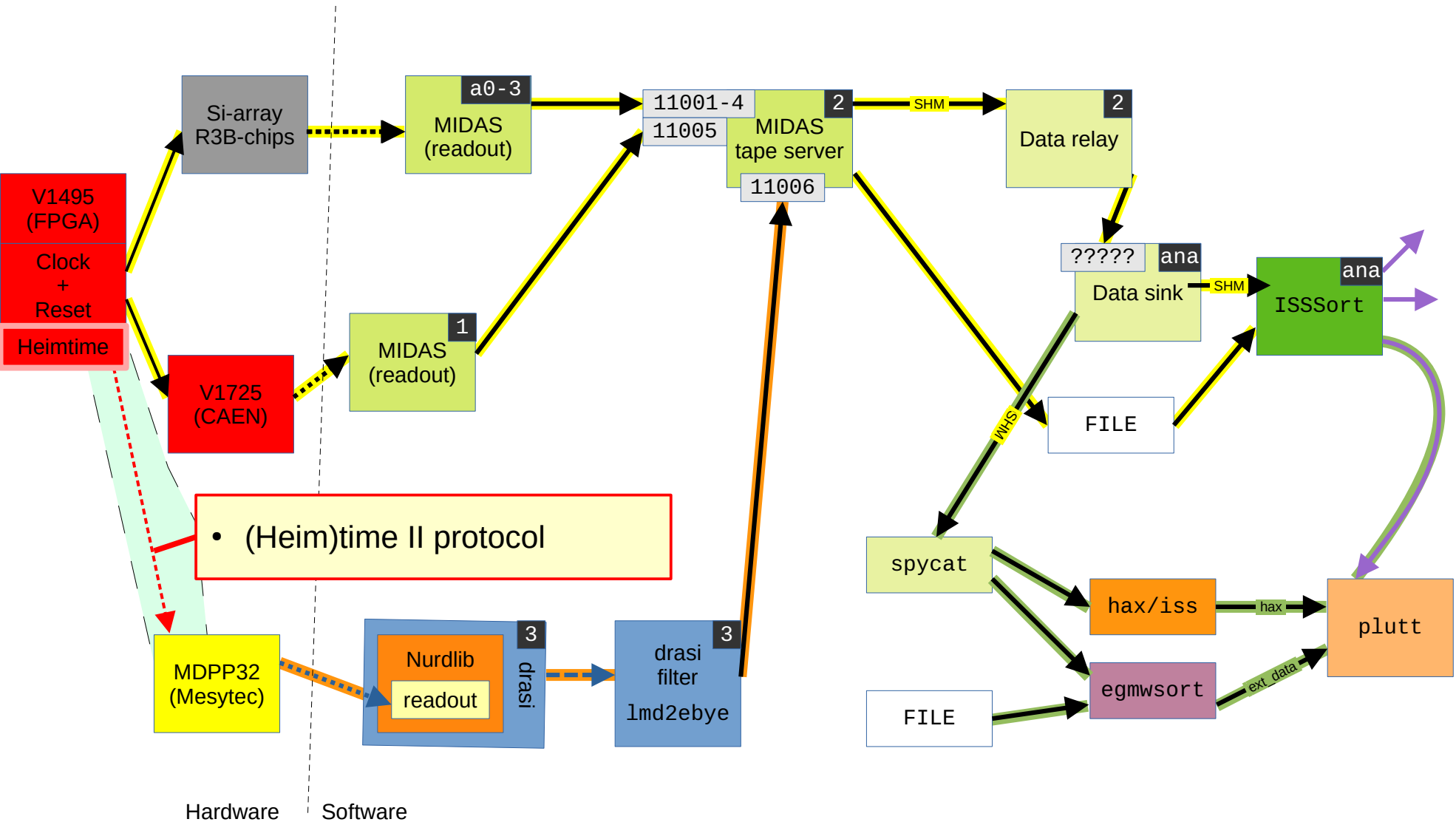
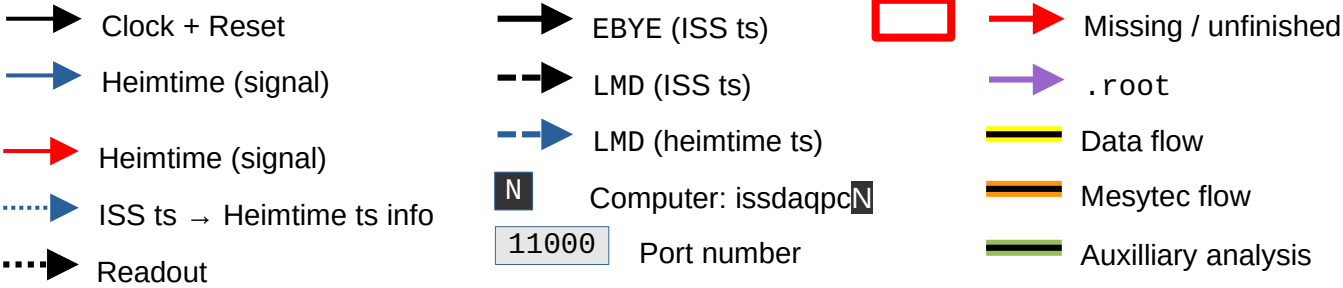
Time sorter



Drasi merger as "tape server"



Drop caen_tspy



Loops: Run several simulations.

```
for B in 2 ; do
  for Ex in 1 2 ; do
    for DIST in 1.85 ; do
      ~/ggland_test/scripts/ggland/land_geant4 \
        --isia=z0=${dist_array}cm \
        --cd-01=z0=8cm \
        --cd-02=z0=9cm \
        --sistrip-01=roty=90deg,x0=7.5cm,z0=4.5cm,rotz=45deg \
        --sistrip-02=roty=90deg,x0=7.5cm,z0=4.5cm,rotz=135deg \
        --sistrip-03=roty=90deg,x0=7.5cm,z0=4.5cm,rotz=225deg \
        --sistrip-04=roty=90deg,x0=7.5cm,z0=4.5cm,rotz=315deg \
        --gcba=z0=5cm,zdets=2\
        --gun=d,dummy,T=0MeV,setboost,feed=target \
        --gun=from=target,Ne22,dummy,T/u=6MeV/u,addboost,feed=cm \
        --gun=from=cm,p,Ne23:dummy:feed:setboost:Eexc,Eexc=${Ex}MeV,\
          isotropic,recoil,phasespace,feed=compound \
        --gun=from=compound,gamma,Ne23:Eexc,Eexc=0MeV,\
          isotropic,recoil,phasespace\
        --world=type=vacuum\
        --fieldbox=d=200cm,Bz=${B}T \
        --events=100000 --np\
        --tree=digi,allevents,Ne22dpNe23_${B}_${Ex}MeV.root
    done
  done
done
```

Simulation tool.

Define setup – the detectors.

Target.

Beam.
(target + beam
gives CM system)

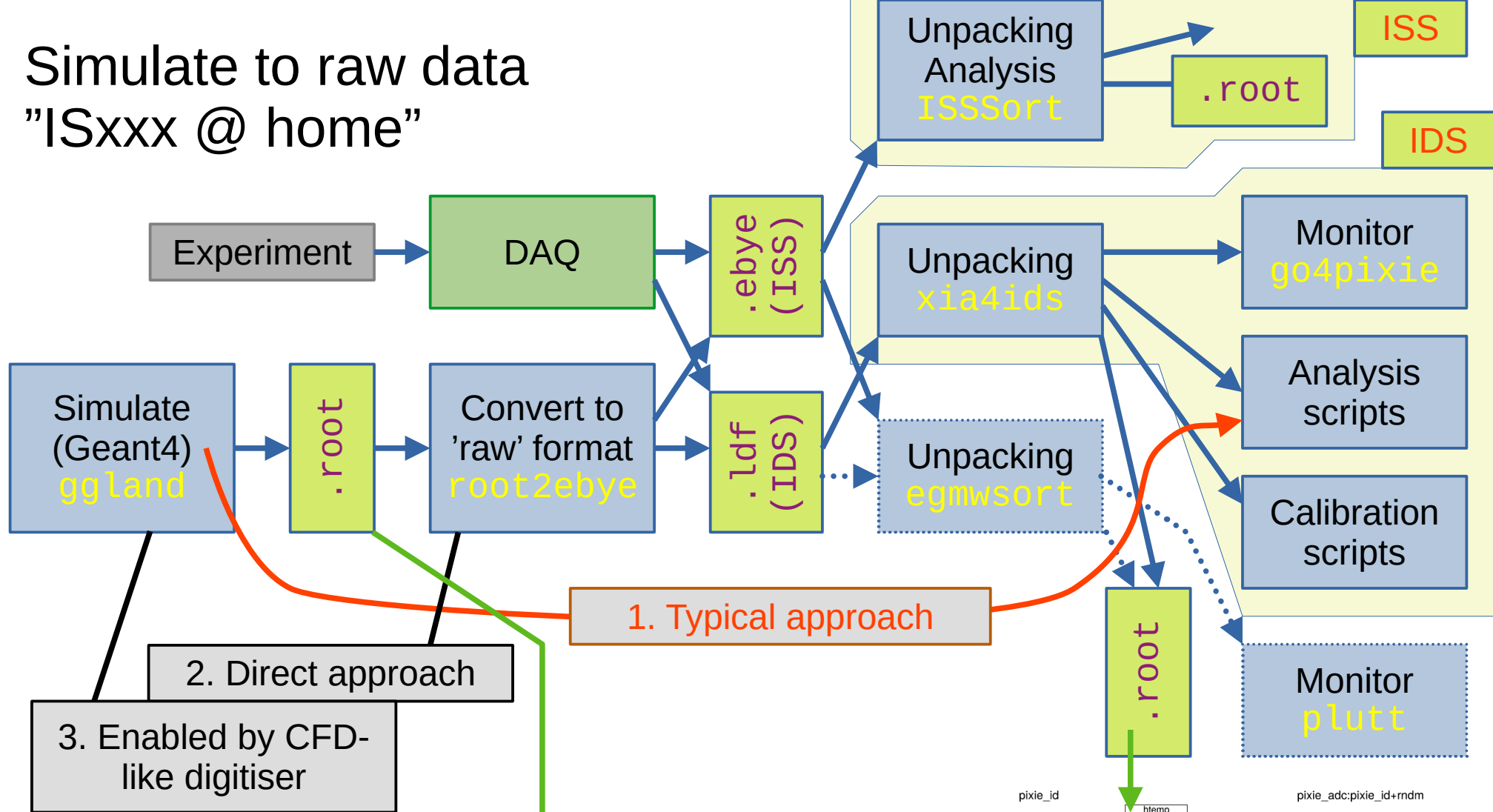
$p + {}^{23}\text{Ne}^*$
(${}^{23}\text{Ne}$ as dummy)

Deexcite: ${}^{23}\text{Ne} + \gamma$

Output.

Vacuum and
magnetic field

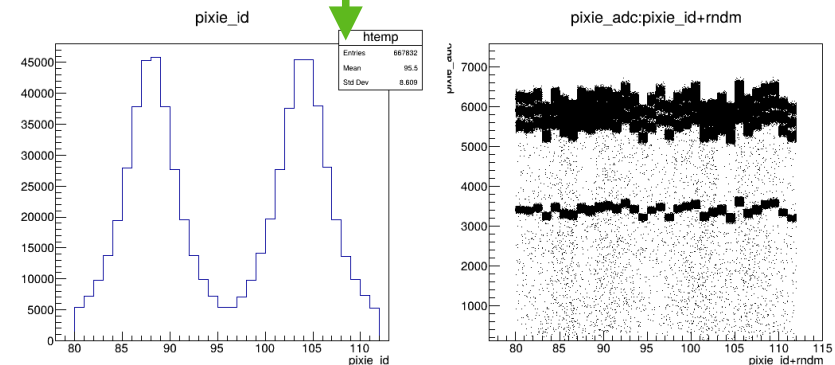
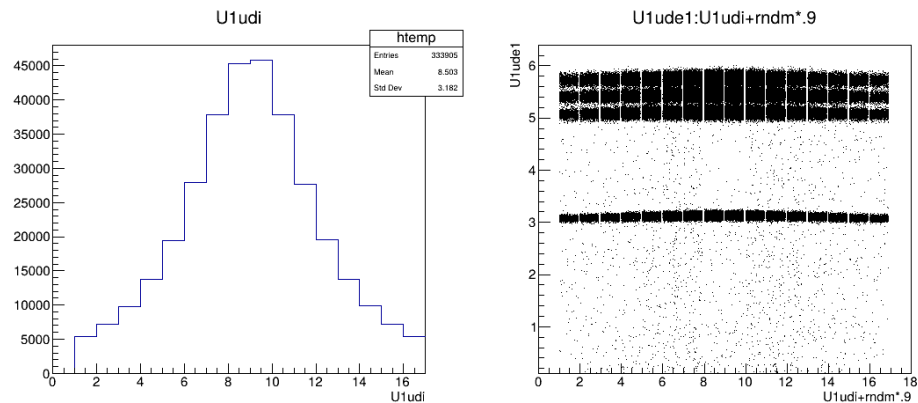
Simulate to raw data "ISxxx @ home"



1. Typical approach

2. Direct approach

3. Enabled by CFD-like digitiser



IS739 benefit: test of tools to debug tools
IS674 benefit: test of tools

Mesytec DAQ integration

