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Electronics for PARIS

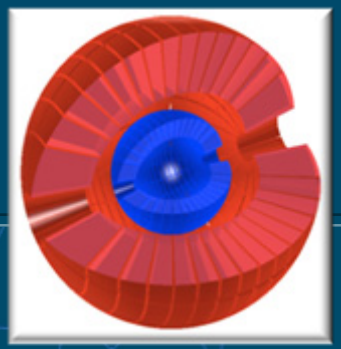
Searching for optimum solution

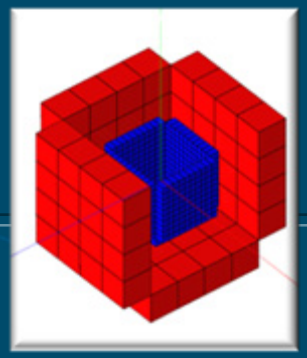
Meetings:

- York, May 2008 (kick of meeting)
- Debrecen, Apr 2009 (dedicated digital card)
- Krakow, April 8, 2009 (integration with GANIL-NUMEXO2)
- Krakow, Oct. 2009(existing solutions – Strasbourg TNT2)
- Valencia, Nov. 2010 (synergy with NEDA)

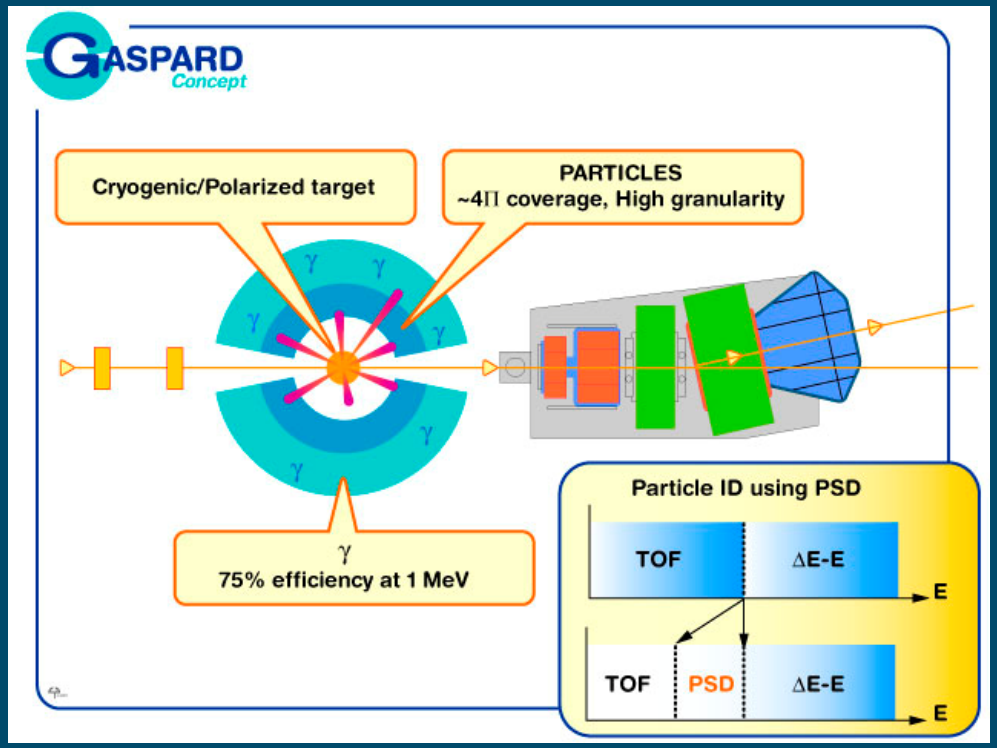
PARIS design goals:

- Design and build high efficiency detector consisting of **2 shells** for medium resolution spectroscopy and calorimetry of γ–rays in **large energy range**.
- Inner sphere, **highly granular**, will be made of new crystals **$LaBr_3(Ce)$**, rather short (up to 2-4 inches). The readout might be performed with **PMTs or APDs**.
- **Inner-sphere** will be used as a **multiplicity filter** of **high resolution**, sum-energy detector (calorimeter) and detector for the gamma-transition up **10 MeV** with medium energy resolution (better than **3%**). It will serve also for fast timing application (**$\Delta t < 1ns$**).
- **Outer sphere**, with lower granularity but with high volume detectors, rather long(at least 5 inches), could be made from conventional crystals (BaF_2 or CsI), or using existing detectors (Chateau de Crystal or HECTOR). The outer-sphere will measure **high-energy photons** or serve as an **active shield** for the inner one.





Compatibility with other devices is key



+ NEDA,HYDE, RFD etc……

Basic requirements for the PARIS electronics

- Serve 200-1000 detector channels (energy and time per channel)
- Deal with fast signals of $LaBr_3$: risetime <1ns, decaytime ~20 ns
- Stand rates up to 100 kHz per channel
- Perform pulse shape analysis ~~for neutron and gamma discrimination~~ (?) and for disentanglement of overlapping signals from phoswitch detectors
- Keep time resolution better than 1 ns, for TOF purposes
- Measure energies up to ~50 MeV with 3% resolution.
- Trigger less readout with timestamping
- Provide gamma time and energy relative to an external signal

GAMMA-TELESCOPE

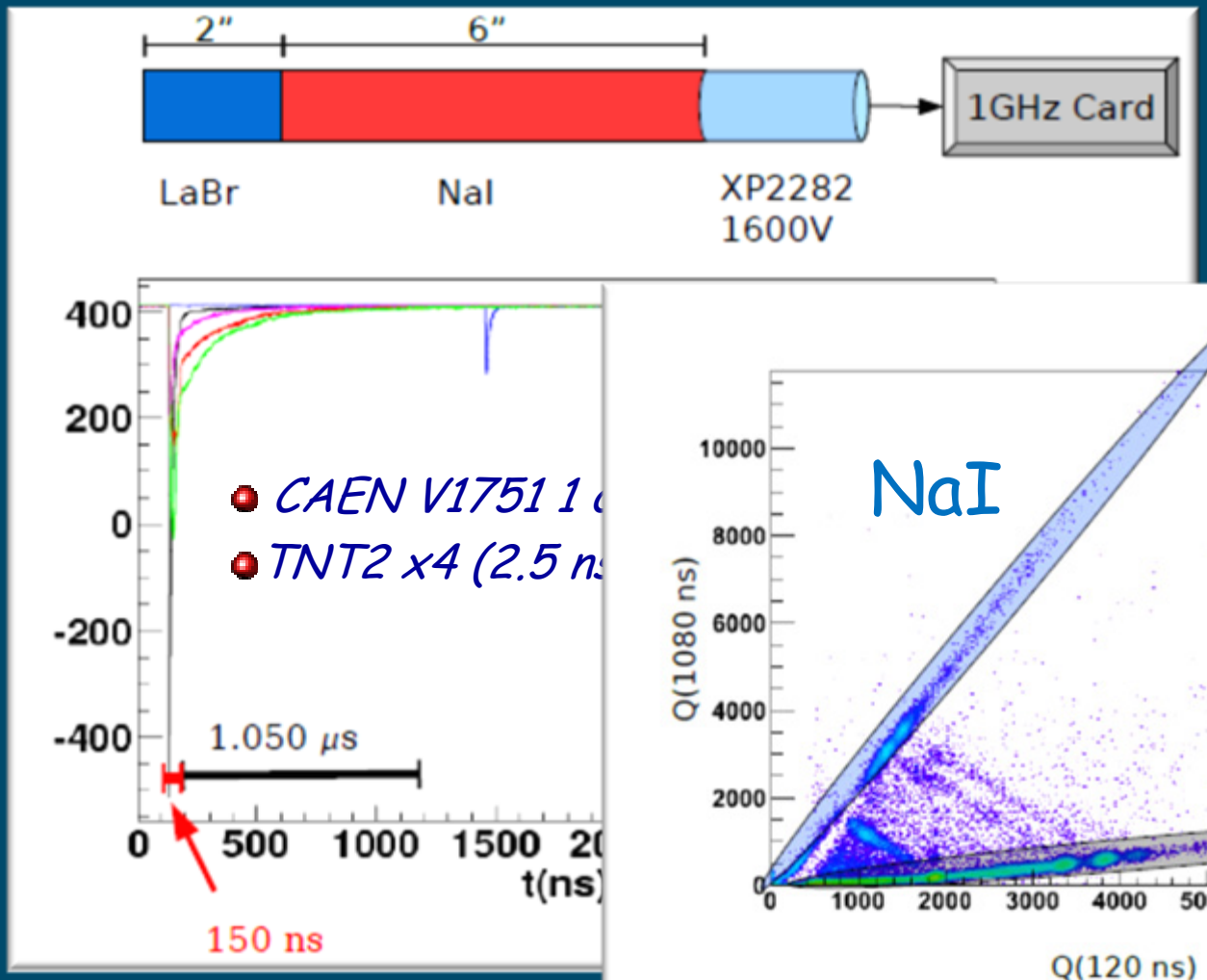
- I
- II
- III

•PMT
•E2
•t2

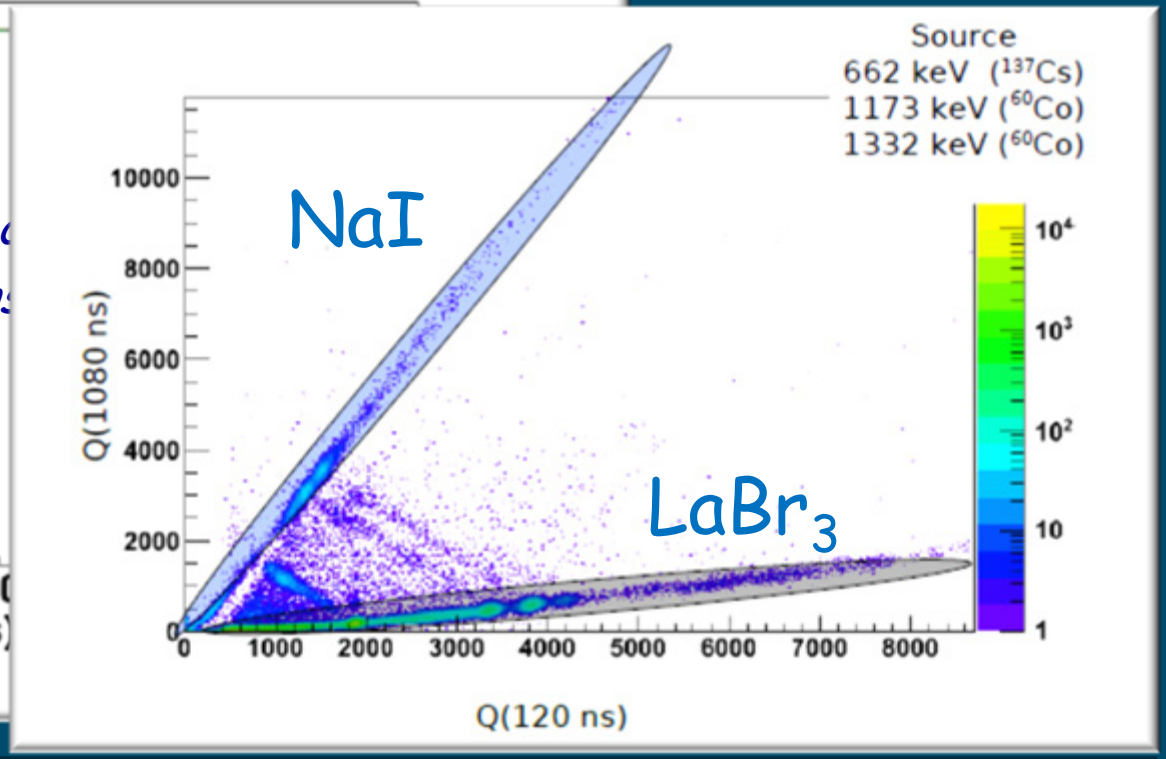
•E2
•t2

•LaBr3 •(2"x2")
•CsI(Na) •(2"x6")
•PMT
•E1,E2
•T1,T2

Phoswich tests in Strabourg



O.Dorvaux, D.Lebhertz, C.Finck, et al



Possible solutions for the PARIS FE

- A hybrid consisted of analog and digital electronics for time and energy determination respectively
- Fully digital electronics with the fastest possible flash ADC (3-8Gsample, 8 bit ?)
- Milano solution: a card consisted of a first analog stage used to shape a $LaBr_3$ signal and a consecutive digital part (100MHz sampling frequency) that is used to extract both energy and time

  (sub ns precision)

Constrains due to the GANIL DAQ

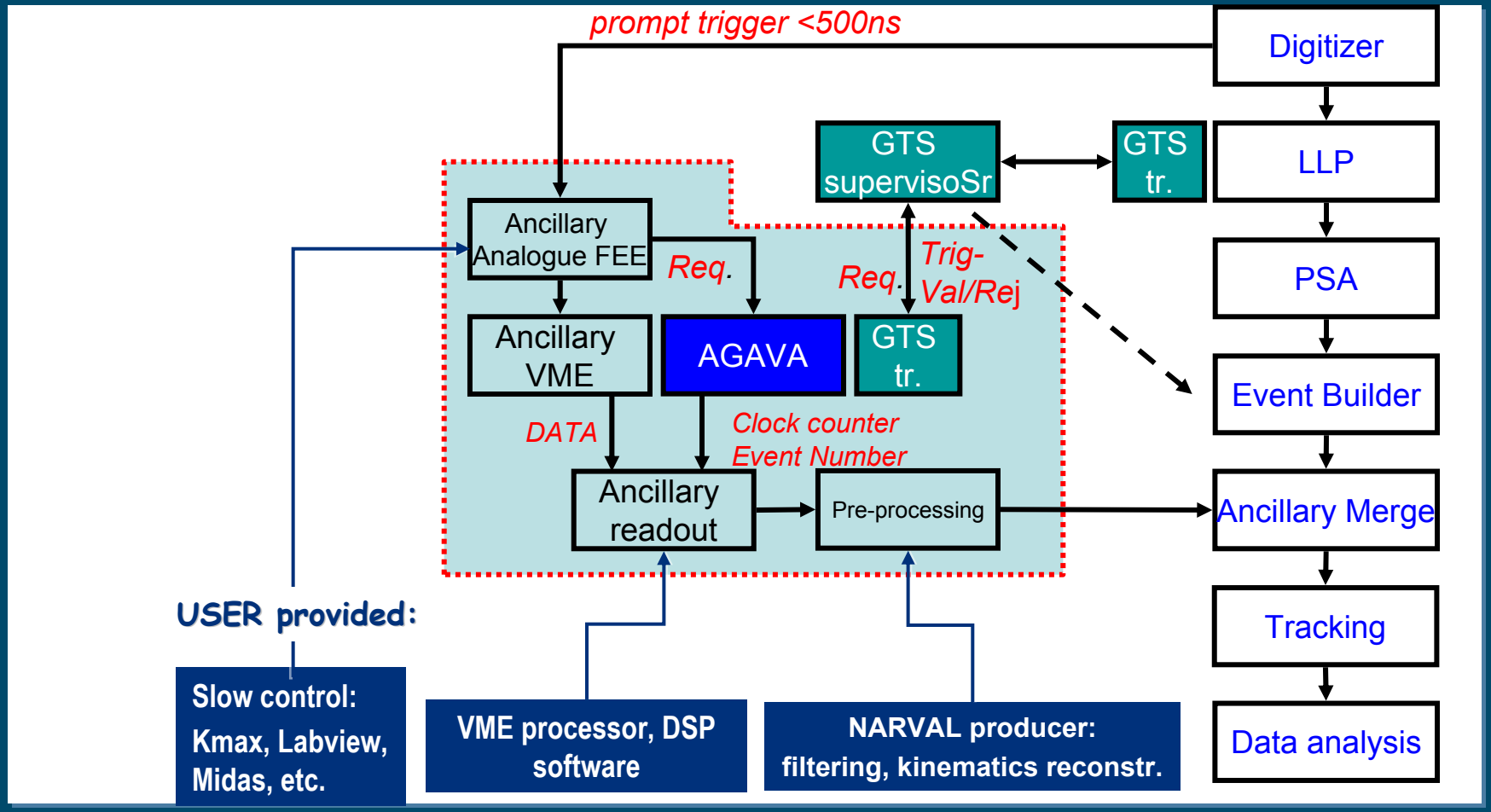
- Compatibility with the GANIL timestamping system.
- Use of AGATA-like timestamps with GTS.
- If used with ancillary detectors as VAMOS a trigger from PARIS shall be generated.

Krakow-GANIL collaboration on a common digitizer for SPIRAL2

- Krakow, April 8, 2009

Integration of the AGATA GTS functionality with the GANIL NUMEOX2 digitizer (VIRTEX)

Example of merging ancillaries to AGATA DAQ through AGATA VME ADAPTER



Block Diagram of NUMEXO2