# Milano test setup for Paris phoswich detectors

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IFJ PAN Kraków - Klęk SLCJ Warszawa - INFN Milano

Test of detector performances energy & time:
PMT, NIM and VME electronics QDC, TDC, ADC, Digitizer

# Test bench: one pure LaBr$_3$ – three Paris phoswiches



- 2"x2"x2" LaBr$_3$
- Phoswiches s.n. A207, A209, A302
- advaTech ET Enterprises 9815B PMT
- Hamamatsu R7723-100
- BaF$_2$ as time reference
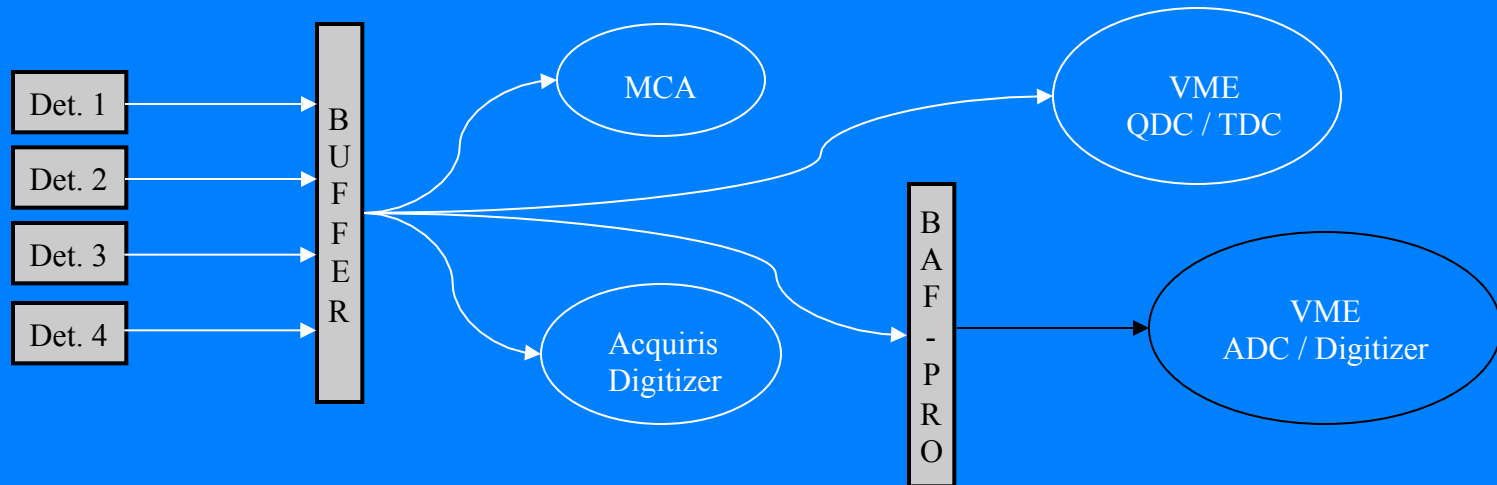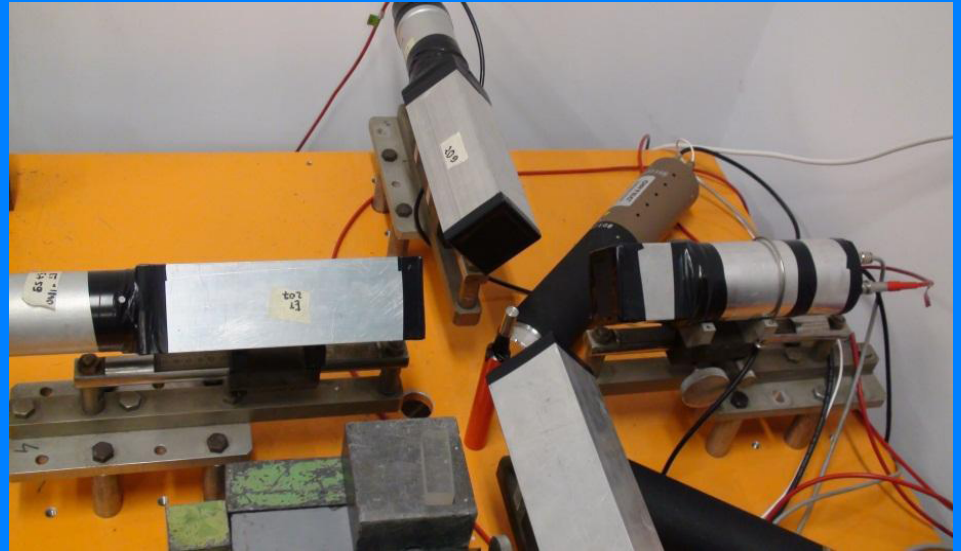
# Milano BaF$_2$ detectors

**HECTOR**: 8 big BaF$_2$ detectors
$\varnothing$ = 14.5 cm, L = 17.5 cm
**HELENA**: 38 small hexagonal BaF$_2$
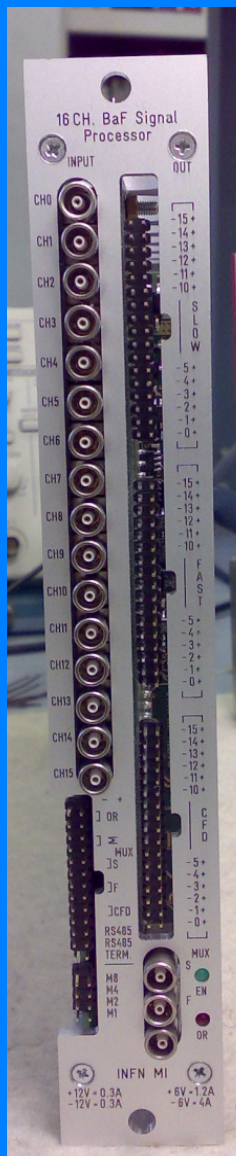$\varnothing$ = 5.06 cm, L = 7.62 cm

- Good time information
- Low background
- Lifetime measurements
- High efficiency
- Multiplicity filter
- Particle identification
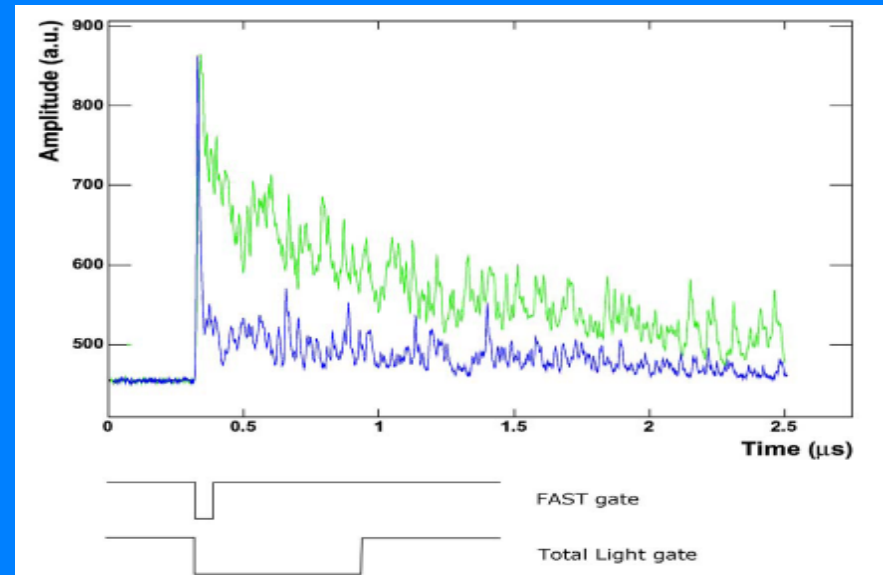


## Typical problems:

- signals need to be delayed
- individual gate

# BaFPro (for BaF$_2$ and … also for LaBr$_3$::Ce)

## Main functions

**NIM standard module**
**16 channels**
**Fast output = 2µS Time to peak**
**Energy output = 2µS Time to peak**
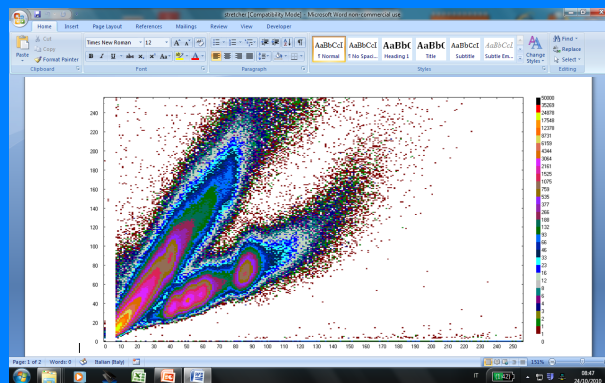
**CFD resolution < 100pS**
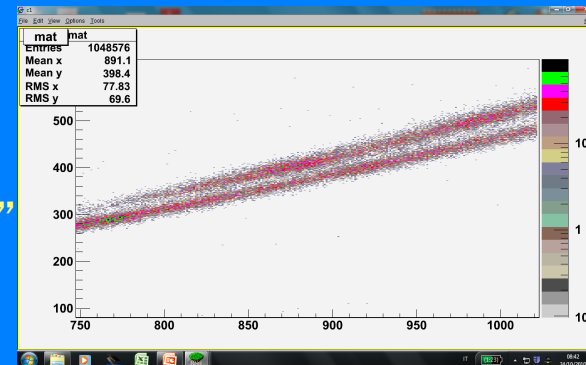**CFD OR output**
**Multiplicity Output**

**RS485 dedicated software control**
**Coarse & Fine Gain, CFD thresholds**

1"x1"

2"x2"

3"x3"



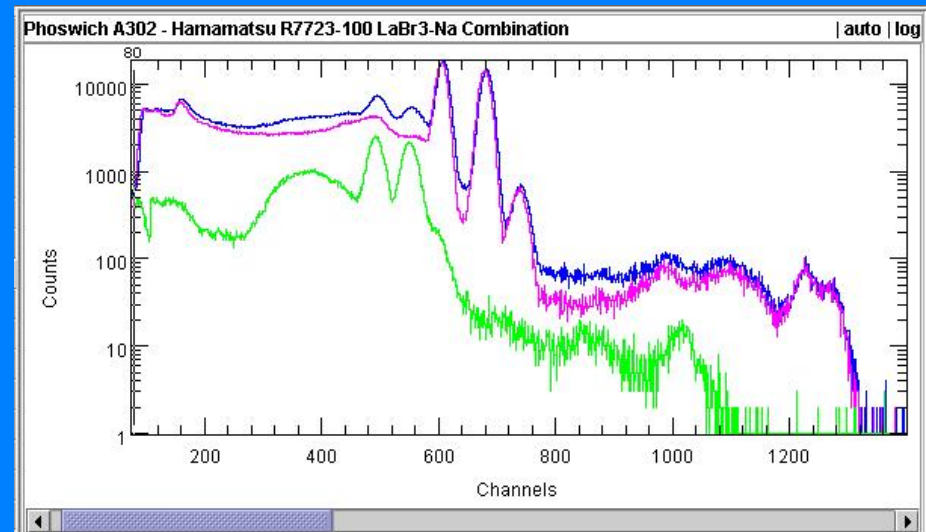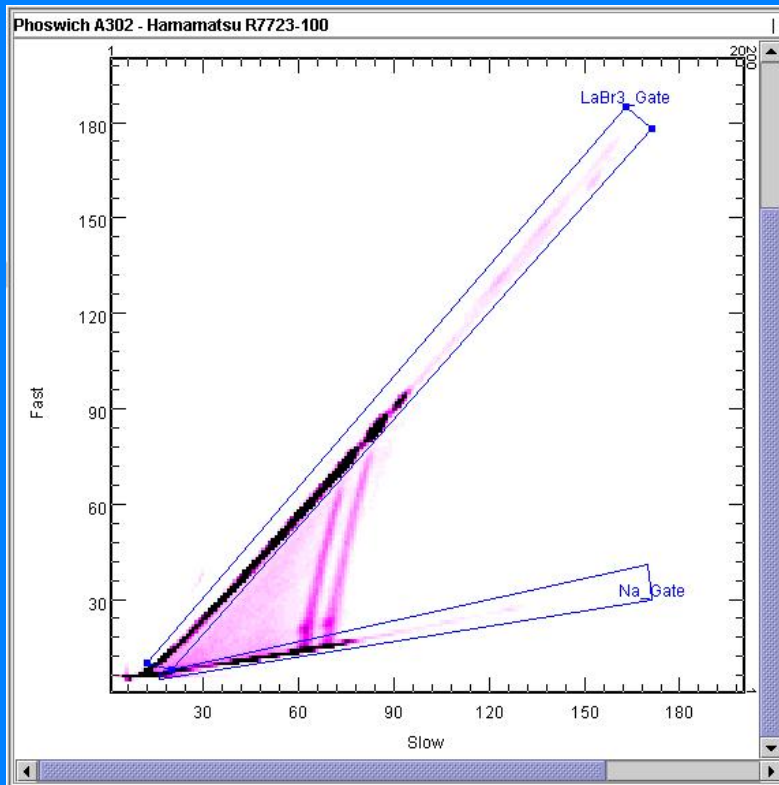*S.Brambilla, PARIS collaboration meeting, Bormio, Tuesday, 21 February 2012*
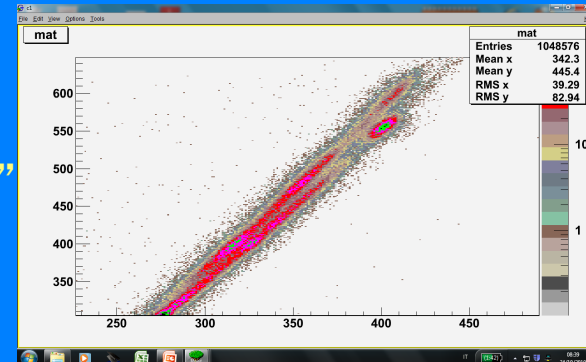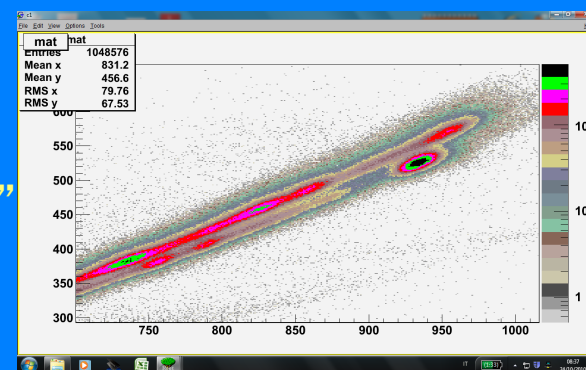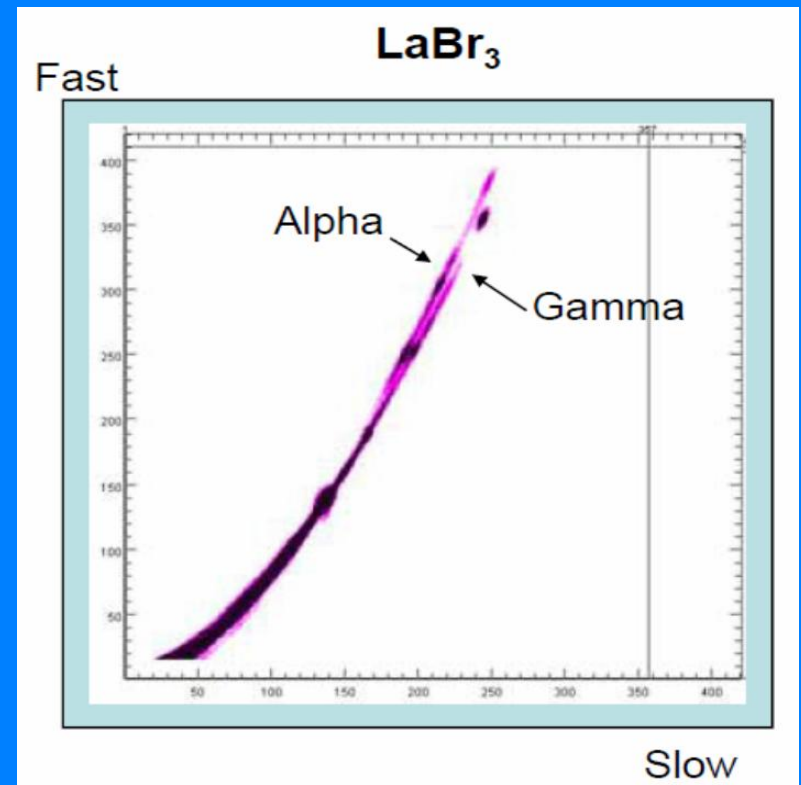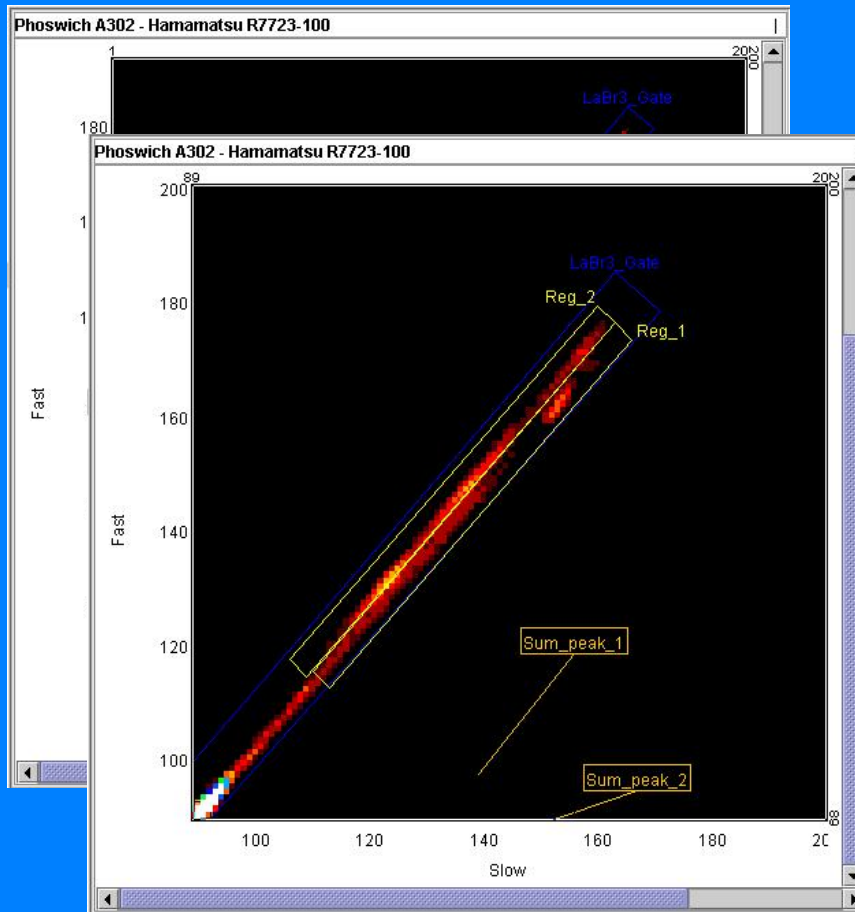
# BaFPro (for Paris phoswiches)

Many similarities: LaBr$_3$ fast part, Na slow part

VME system with Kmax software environment:
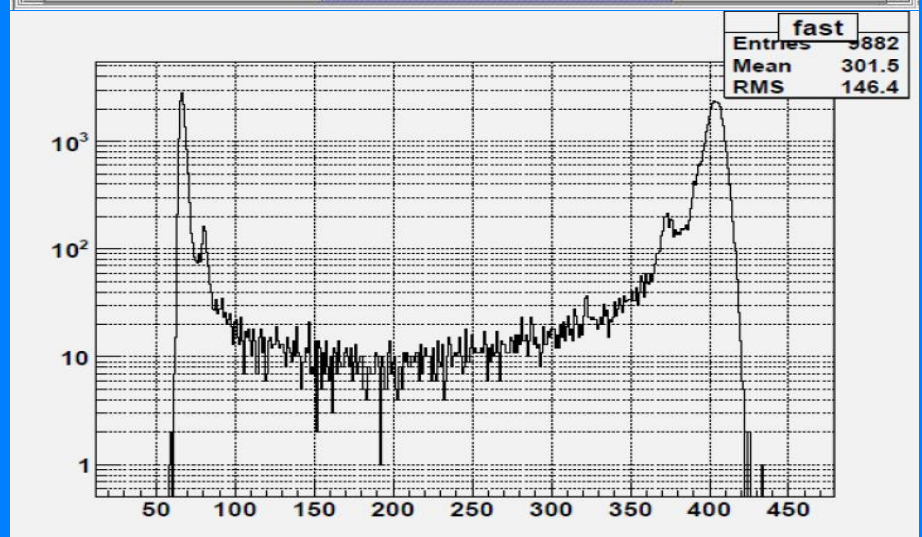  • Struck SIS3100 & CAEN V785 32 channel peak sensing ADC

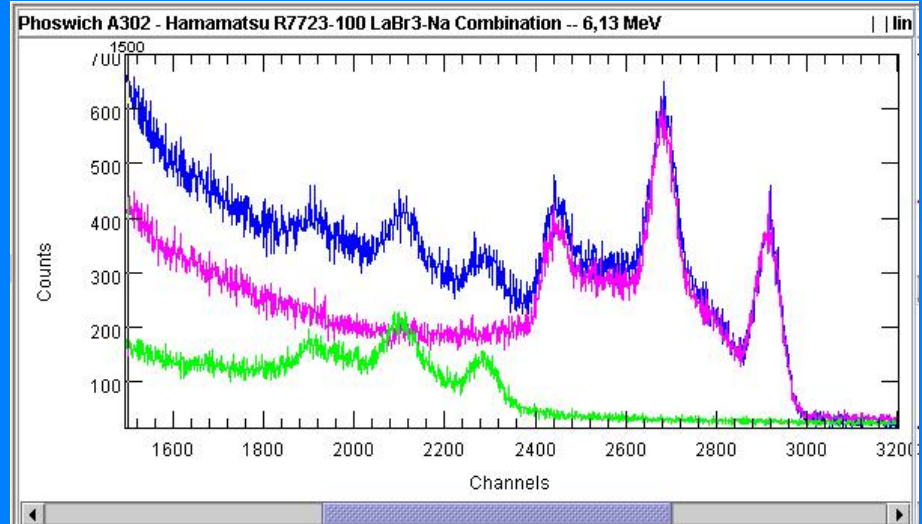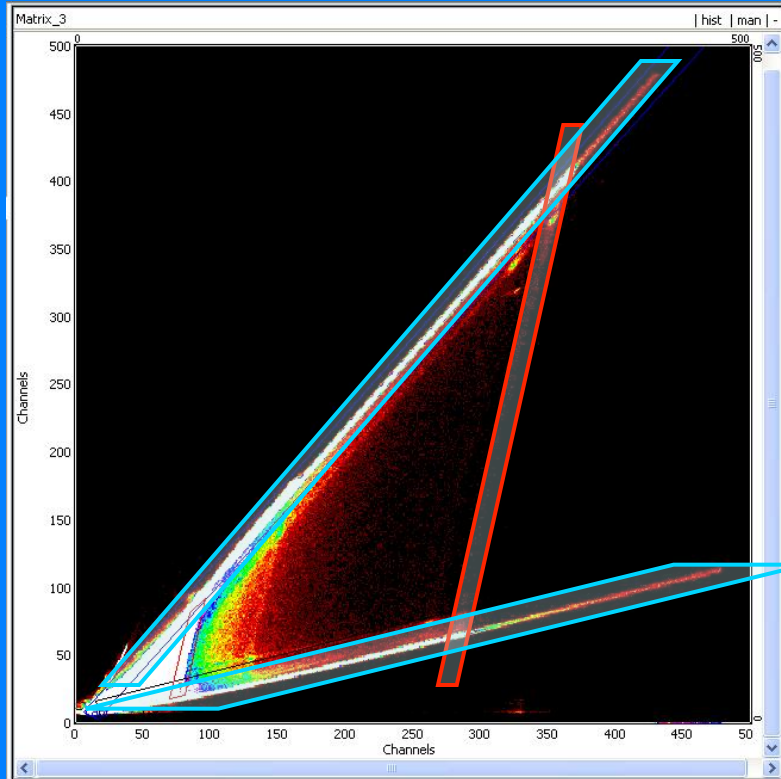# BaFPro (for Paris phoswiches)

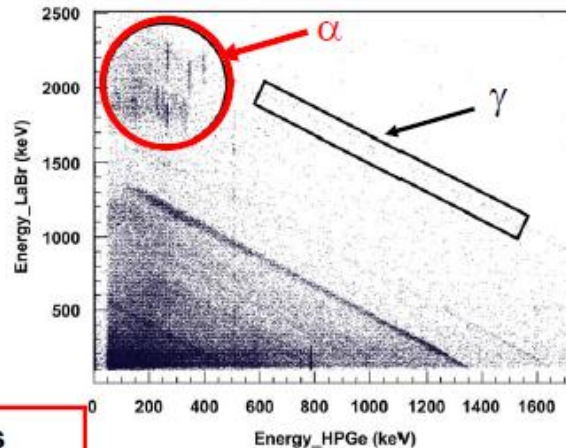# BaFPro (for Paris phoswiches) 6.13 MeV

# Estimation of performances

- Test with: $^{137}$Cs, $^{22}$Na, $^{60}$Co, PuC 6,13MeV

- Source placed in different position

- Too early to say something
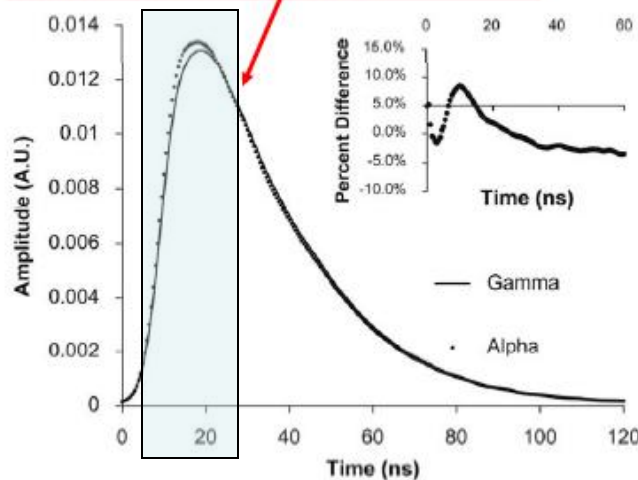
# PSD algorithms for LaBr3, LaCl3

Develop of a VME system
- Standard analog chain (shaping amp. + VME ADC)
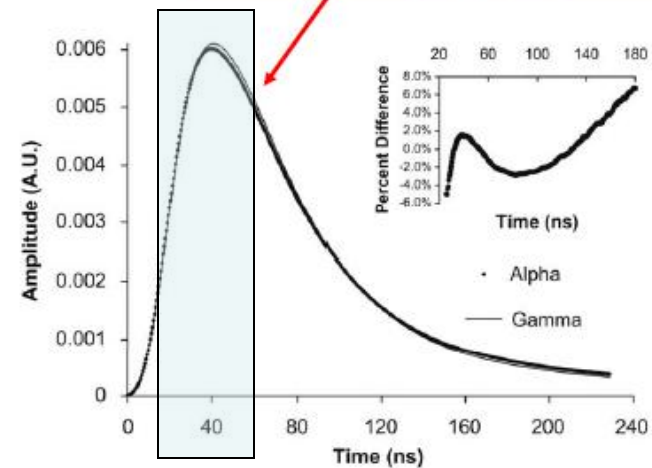- 2 GHz, 12 bits ADC for LaBr3, LaCl3



**Matrix of coincidence events measured with LaBr3:Ce (*y*-axis) and HPGe (*x*-axis) detectors**

**Signal shapes of α-particles and γ-rays in LaBr3:Ce**

**Signal shapes of α-particles and γ-rays in LaCl3:Ce**

Same VME system
- Standard analog chain (BaF-PRO. + VME ADC)
- 2 GHz, 12 bits ADC for phoswich detector
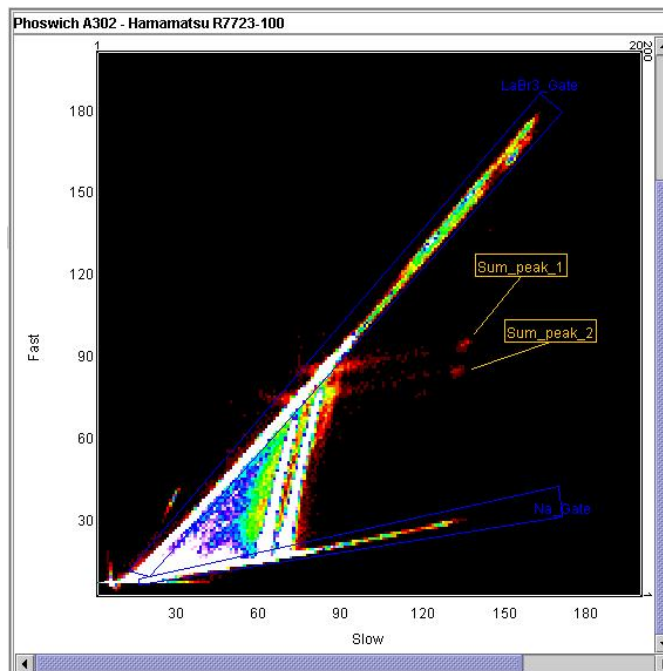


| Signal shape of LaBr$_3$ interaction | Signal shape of well selected regions | Signal shape of Na interactions |

# February 7th – 10th tests

- 7th-9th used for beam
- Few hours dedicated to digitization

- $^{60}$Co, internal radioactivity, PuC 6,13MeV, 8-10MeV, 12MeV

- Selective save on the two part of the detector

- Selective save in internal region

- Rough idea of the signals shape

# Conclusions & perspectives

- Few days of test seems to give reasonable results

- No need of double gate to build the matrix

- Use of Matrix separation to investigate typical detector signals

- A PARIS detector will be available in Milano

- Time information from CFD

- CFD OR and multiplicity output

- Beam test in summer

- A lot of work need to be done

# Thank you for your attention !