Development of FRS electronic, DAQ and detectors

Report on the FRS000 experiment of 2009

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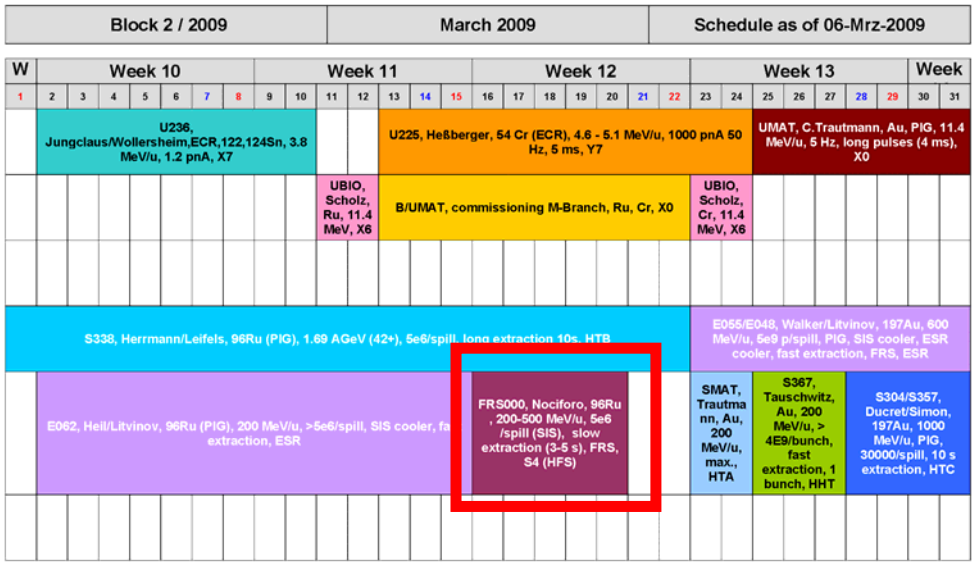
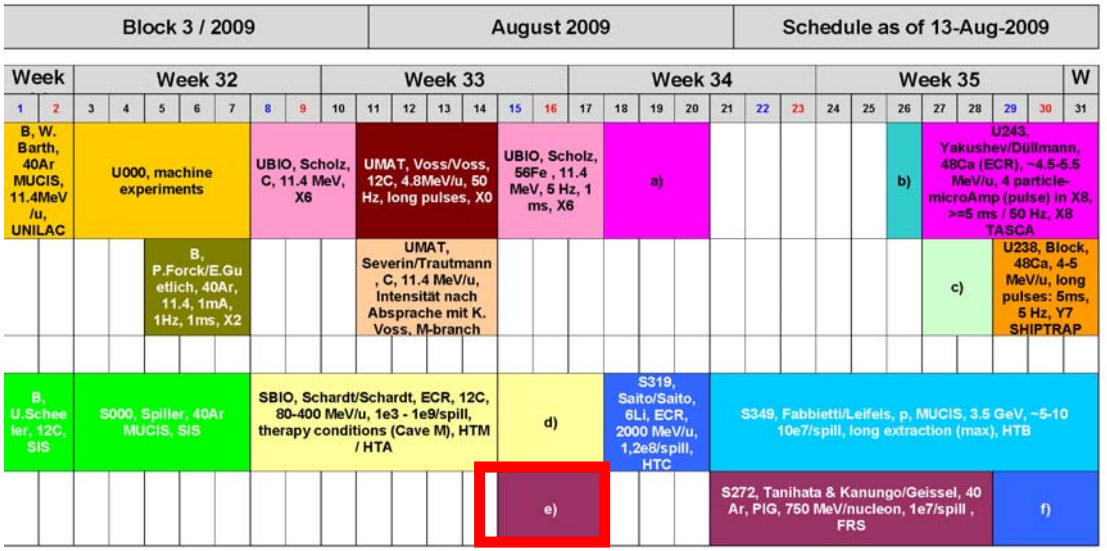
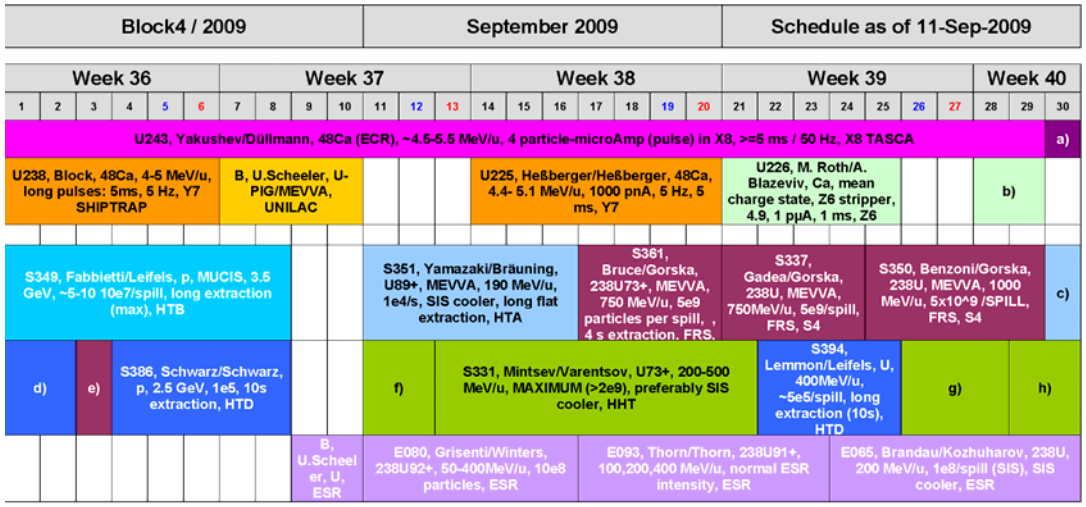
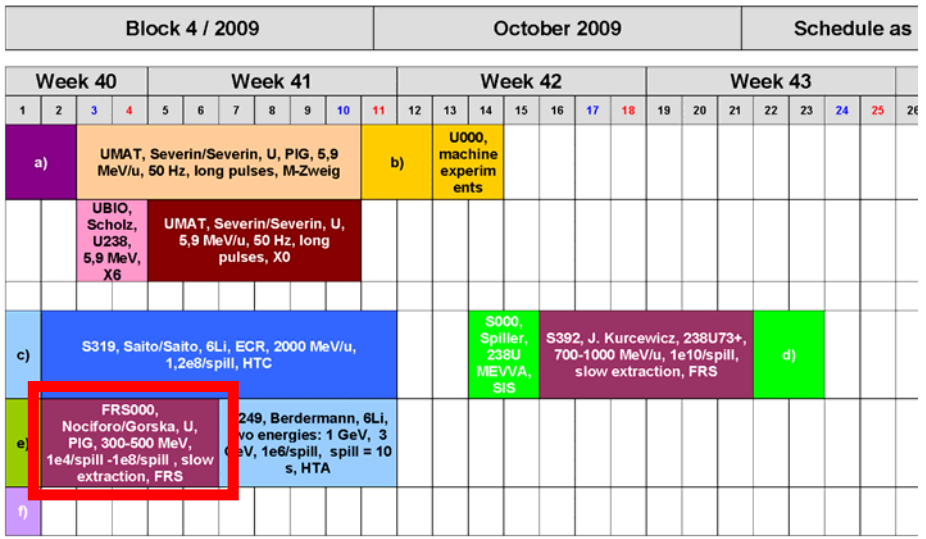
FRS000 experiments 2009









FRS000 experiments 2009

Chiara Nociforo is organizing them :

Aim : used by the core team to improve/test FRS/super FRS EDAQ and detectors, could be used (sometimes) for Nustar projects (should not be the normal place for commissioning Nustar detectors)

Running mode :

Only parasitic beam time (sharing either block or continuous)
Few days every time (means few hours beam on target) ➔ hard to do difficult FRS settings
Most of the time before/after other FRS beam time (after good ➔ use settings)

➔A lot of effort every time (organization/preparation) for few hours of beam on target
➔Requires proper coordination (lot of tests in parallel)
➔Presently discussion : try only full beam time, only one test at the time??

FRS000 experiments 2009

March 2009

1. **TPC in vacuum**
2. **Isomer TAGger**
3. **TUM-Music high rate test**
4. **Twin music test (for S304-land)**
5. **Multi hit TDC instead of TACs**
6. **RPC test for R3B**

August 2009

1. **TPC calibration for S272**
2. **Diamond test for S1**
3. **Fission@ELISE tof test (people from BIII/Bruyere le Chatel)**

Just before S272, beam only at S2

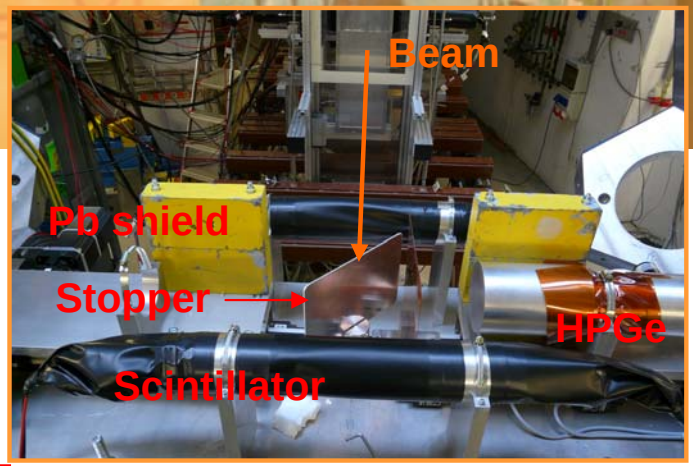
October 2009

1. **Multi event DAQ**
2. **(Ge test for DESPEC)**
3. **Time test for LYCCA plastic**
4. **Diamond "pre-test" for PRESPEC**
5. **Prepare S392**

After RISING beam time and before s392, could use RISING settings. 3 days for point 2 non part of FRS000, point 3 tested in // of point 2

TPC in vacuum with TUM high rate test ➔ TPC efficiency ~80% at 10^5

ITAG @ FRS



Isomeric TAGging system @ FRS consists of:

- 2 movable HPGe detectors mechanically cooled;
- 2 scintillators for particles counting and veto;
- exchangeable passive stopper.

The whole system is foreseen to lift up from the beam line.

First test – March '09:

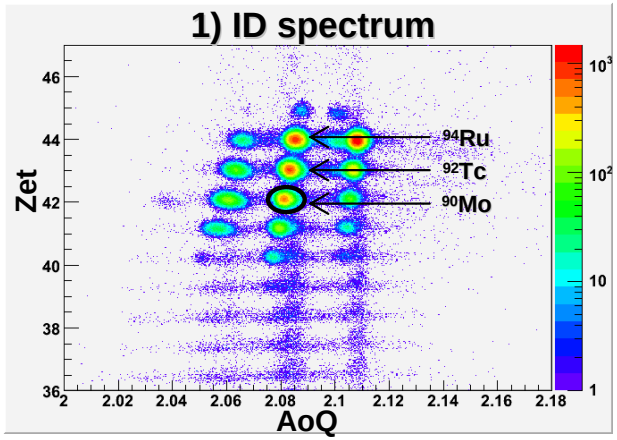
Beam: $^{96}Ru^{42+}$ at 500 MeV/u
5 x 10^4 /spill

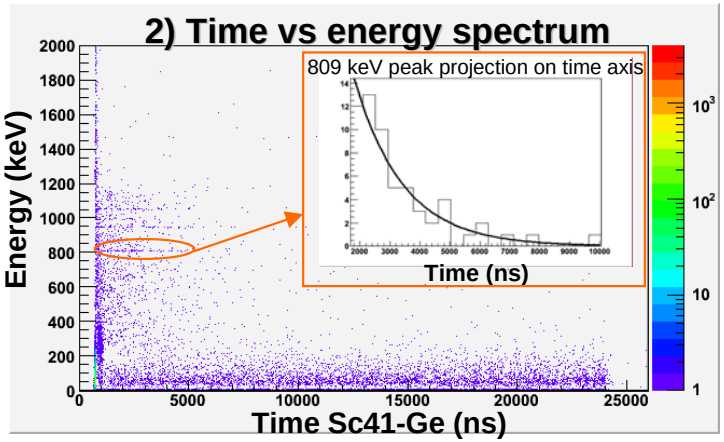
Results (~ 68 min data):
Gamma lines: ^{94}Ru, ^{92}Tc, ^{90}Mo

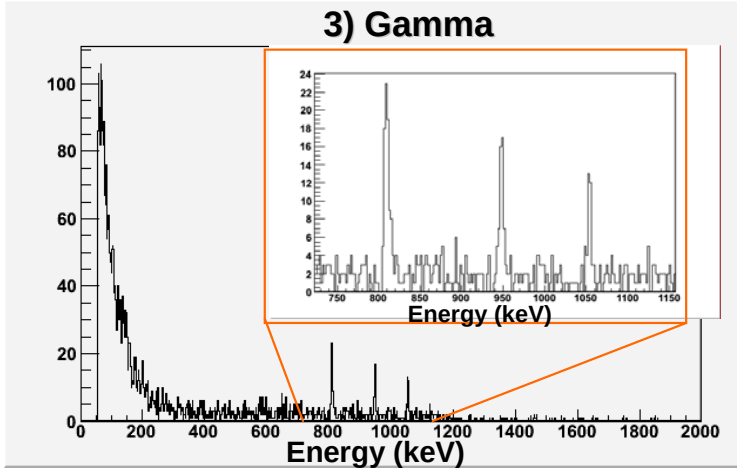
^{90}Mo analysis:

1) Select the expected isomer;
2) Include some conditions to clean the gamma spectrum;
3) Look for γ-lines and eventually for the half-life of the isomeric state.

	Literature	ITAG
$T_{1/2}$ (μs)	1.12	1.13 ± 0.16
γ (keV)	809.57	809.9 ± 4.0
γ (keV)	947.97	947.8 ± 3.9
γ (keV)	1054.10	1053.9 ± 3.9







➔**Development, test and pictures from Fabio Farinon**
➔**Mechanical cooled Germaniums from Ivan Koujouharov**

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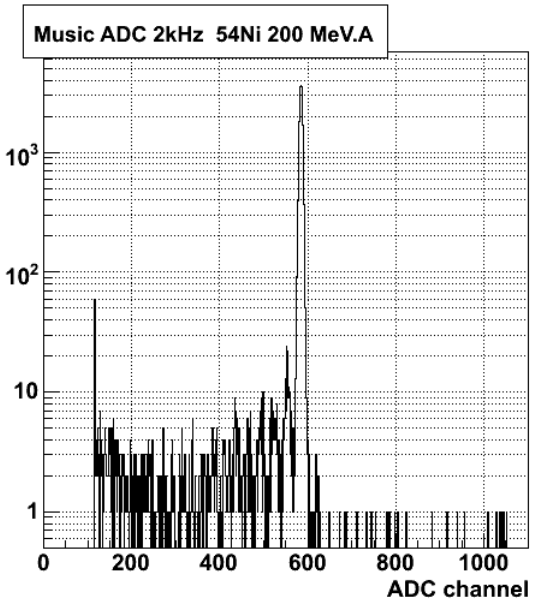
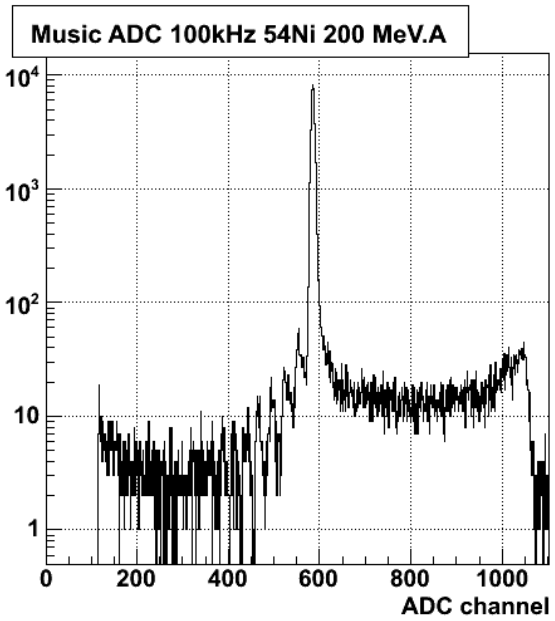
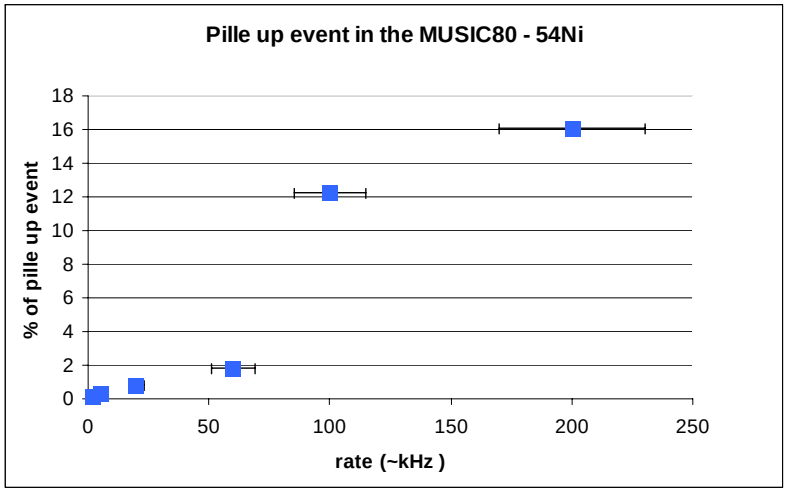
Music faster read-out/pille up problem





At high rate : pille up in the music shaper output gives wrong Z identification



For comparison : TEGIC chambers at RIKEN 40% pilleup at 200 kHz

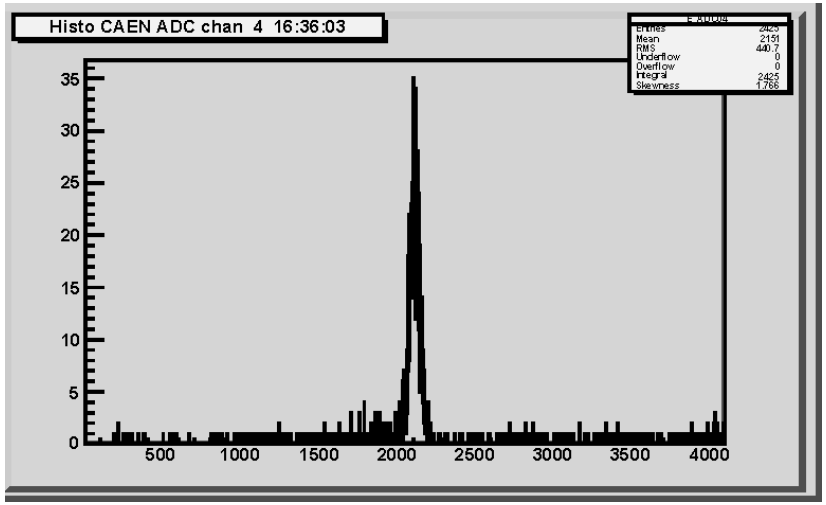
Solutions :

1. **Identify the pileup events in the front end.**
2. **Disentangle piled up events to get their energy (not for 2010?)**

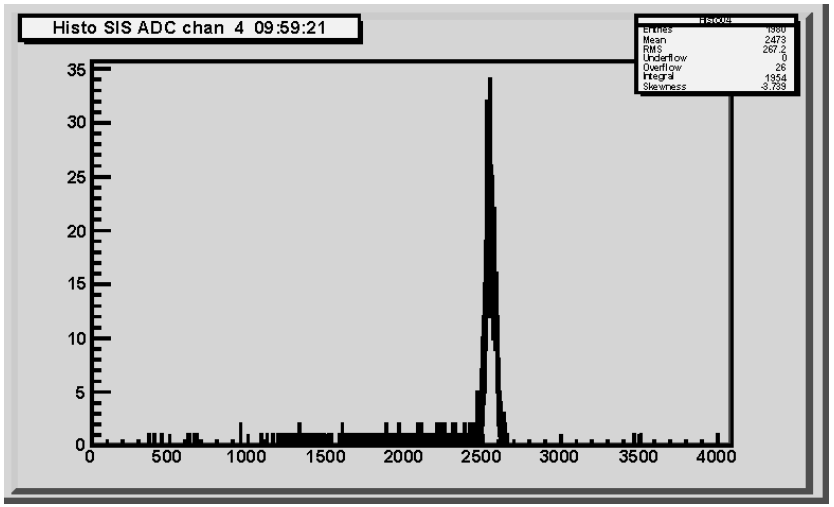
Music faster read-out / pile up problem

March 2009 : comparison SIS3302 module with normal firmware and the normal CAEN peak-sensing ADC

100 kHz 96Ru beam



CAEN ADC



SIS3302 processing with pile-up flag rejection in the analysis

➔ **Development, test and pictures from Henning Schaffner**

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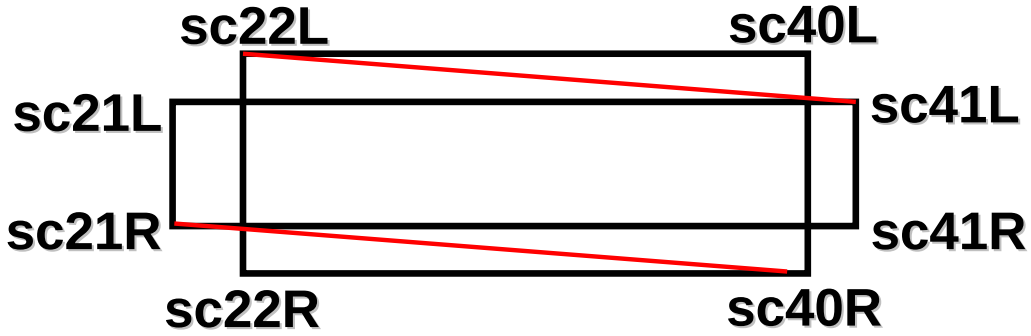
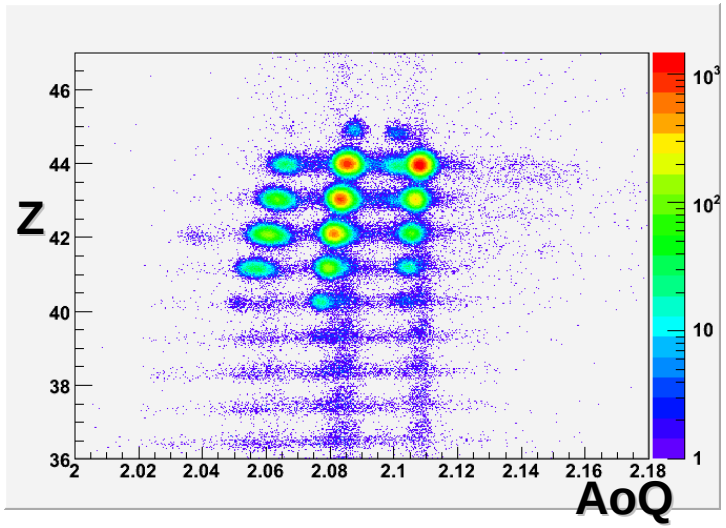
Caen v1290 multi hit TDC instead of TAC?

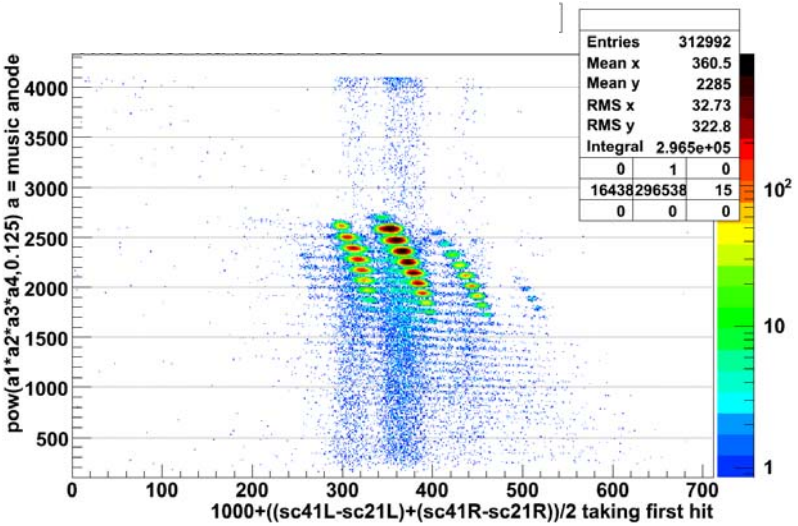
V1290 CAEN TDC :

- **21 bit, 25ps step (up to 51 us range)**
- **32 channels multi-hit**

For ToF and position of plastic we use TACs:







This is a different setting, tof vs ΔE

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Multi event DAQ

Normal cycle for 32 events :
(conversion of the digitiser + read out) x 32

Use the multi event buffer of CAEN digitisers (ADC, TDC, QDC)
(convertion x 32) + 1 big readout

Optimal ➔ readout outside of spill, 32 events too small memory

October 2009 : a crate allowing full FRS ID (tac signals+ADC music+TPC timing) running in multi-event mode (in // of the normal FRS DAQ)

- **At high rate not dead time saturated while normal DAQ was (roughly a x2 faster)**
- **Scalers still not implemented**

➔ Development and test from Chiara Nociforo