

Glowing backplanes

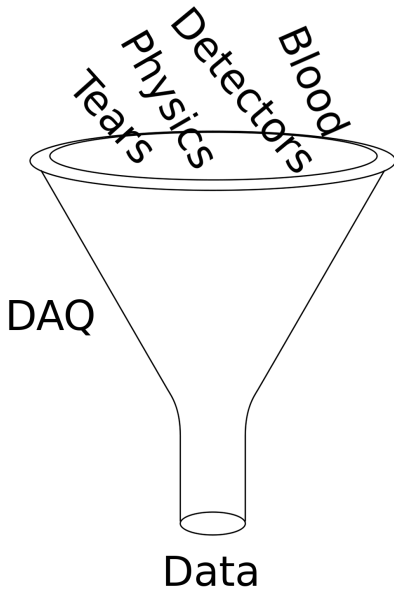
VME Readout at and Below the Conversion Time Limit

Michael Munch

Department for Physics and Astronomy, Aarhus University

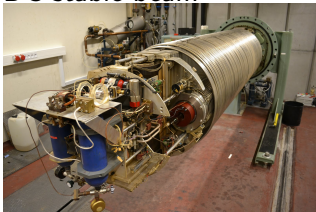
May 27th 2019, DFS2019

Experiments

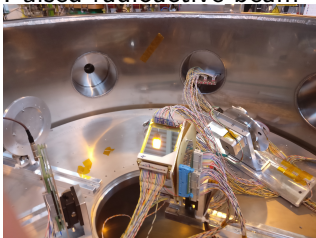


The physics

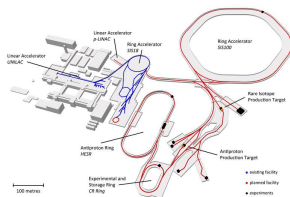
Van de Graaf @ AU
DC stable beam



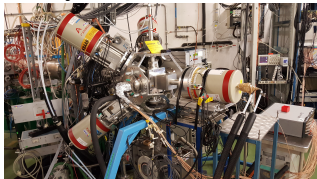
SEC @ HIE-ISOLDE, CERN
Pulsed radioactive beam



R3B @ GSI
Relativistic radioactive beam



IDS @ ISOLDE, CERN
Decay studies



Truth

More (good) data
=
easier (better) analysis

Man power

MAGISOL \sim 20 people

ATLAS \sim 3000 (scientific) people

Money

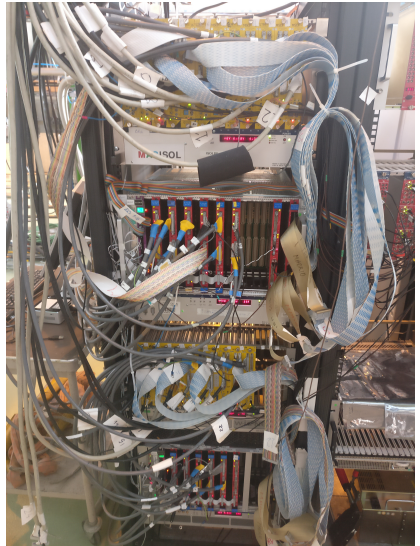
MAGISOL \sim 0.5 MCHF

ATLAS \sim 500 MCHF

Solution?

Modular electronics.

Detector → Preamp →
Amp → ADC → PC





VME

Challenge

More (good) data

=

easier (better) analysis



Push the modules

Digitization time

CAEN v785 ~ **7us**

Mesytec MADC32 ~ **2us**

Readout time

Motorolla MVME ~ **1.3us/word**

Mesytec MADC32 ~ **0.5us/word**

Readout time \gg digitization time


Bottleneck II


Trigger requests

Single-event readout


Multi-event readout


Shadowed multi-event readout

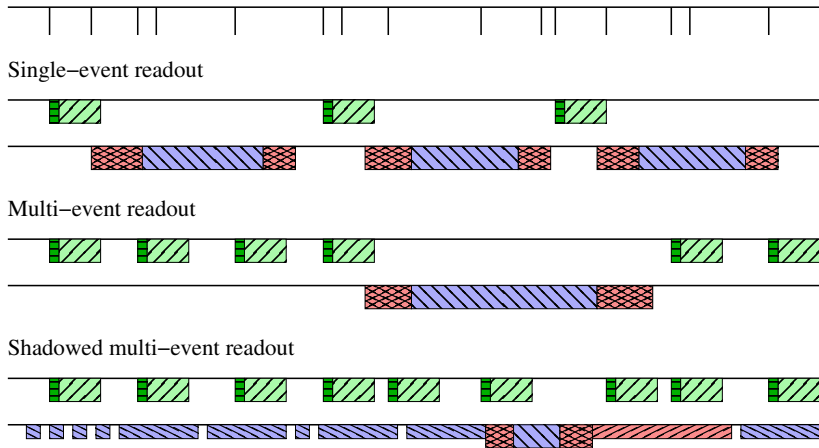
 Gate + Conversion

 DAQ overhead, synchronization check

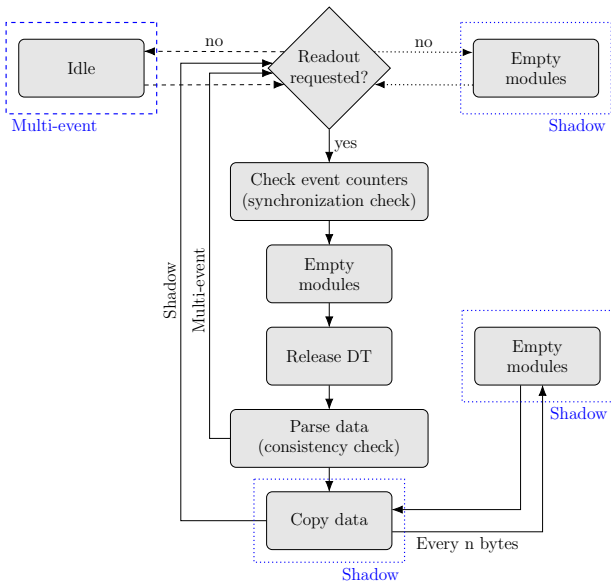
 DAQ read-out

 (after deadtime release)

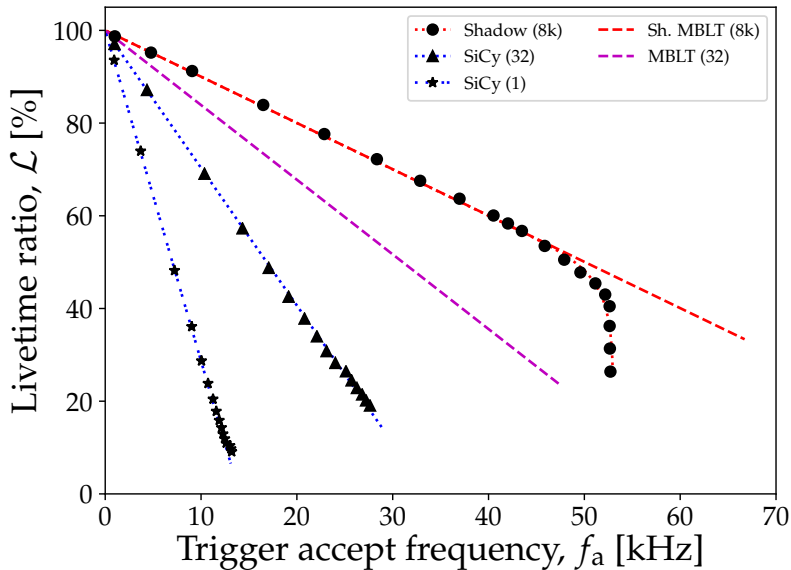
 (shadowed, background)



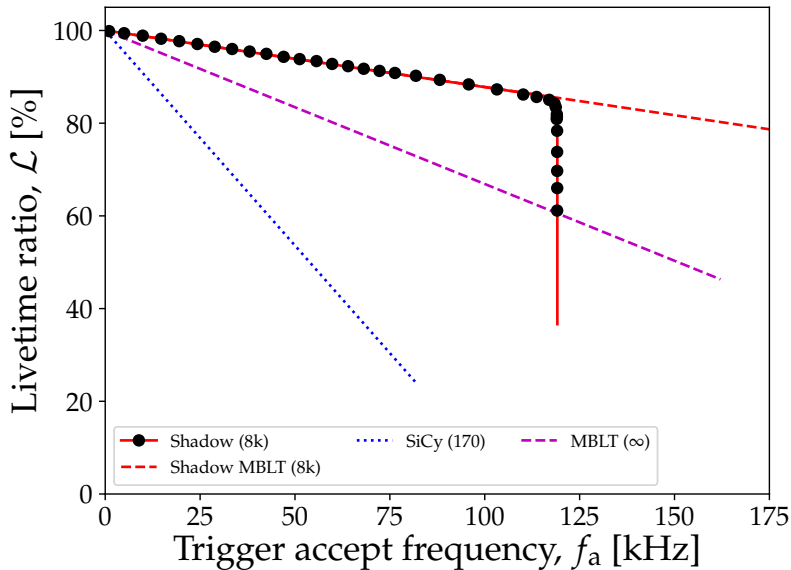
Software



Benchmark CAEN v785



Benchmark Mesytec MADC32



Conclusion

Optimized readout software



More than factor 2 throughput.

Details → [arXiv:1810.03574](https://arxiv.org/abs/1810.03574)

Nomenclature

- ▶ Livetime, LT : Time where triggers are accepted
- ▶ Deadtime, DT, Δt : Time where triggers are *not* accepted
- ▶ Livetime fraction, \mathcal{L} : Fraction of events accepted
- ▶ Deadtime fraction, \mathcal{D} : Fraction of events rejected
- ▶ Trigger request frequency, f_r : Frequency of total triggers
- ▶ Trigger accept frequency, f_a : Frequency of accepted triggers

$$\mathcal{D} + \mathcal{L} = 1$$

$$\mathcal{L} = \frac{1}{1 + f_r \Delta t}$$