A simple and rapidly executable way of getting rid of Halo events as if they were noise.

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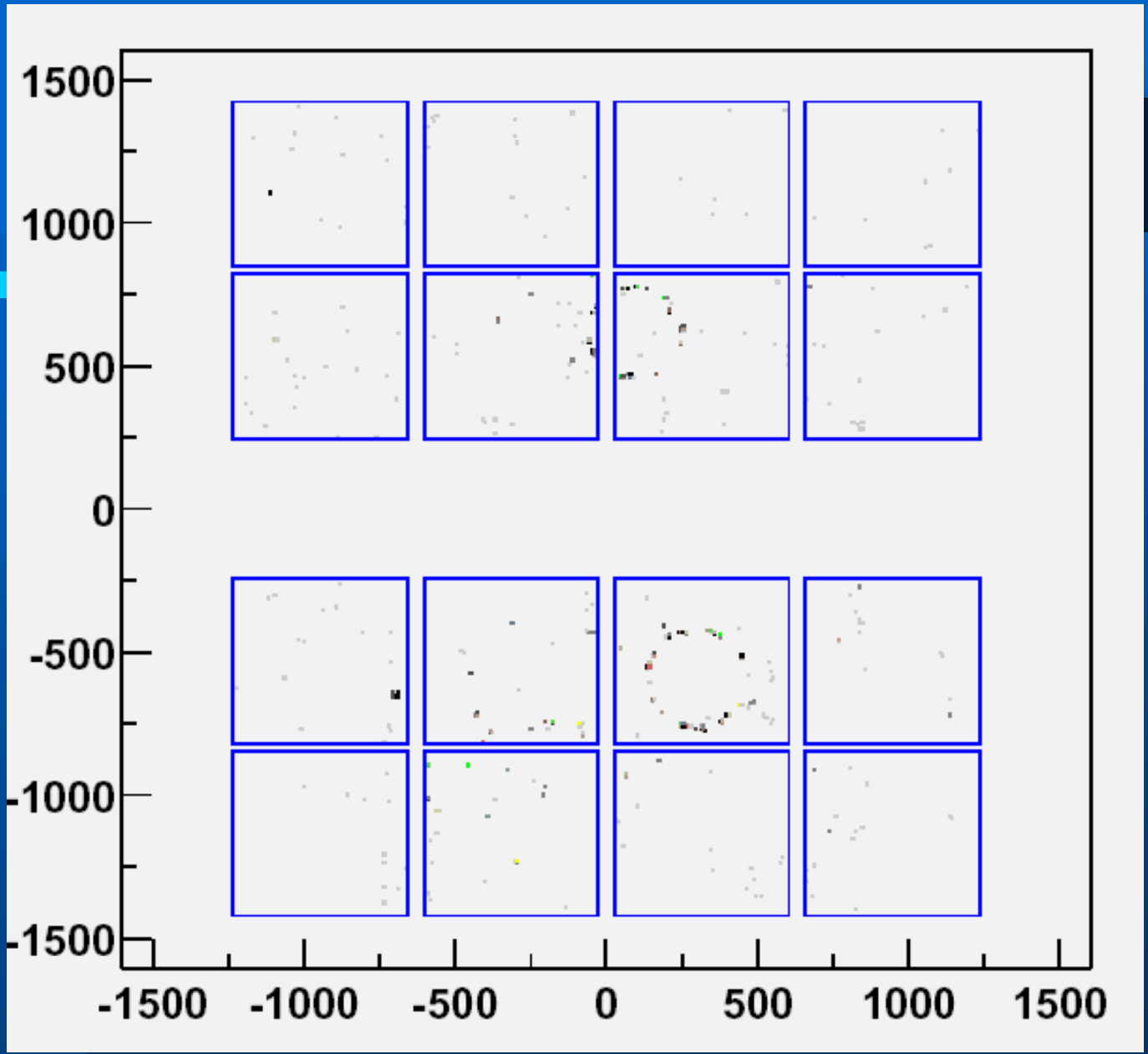
1500
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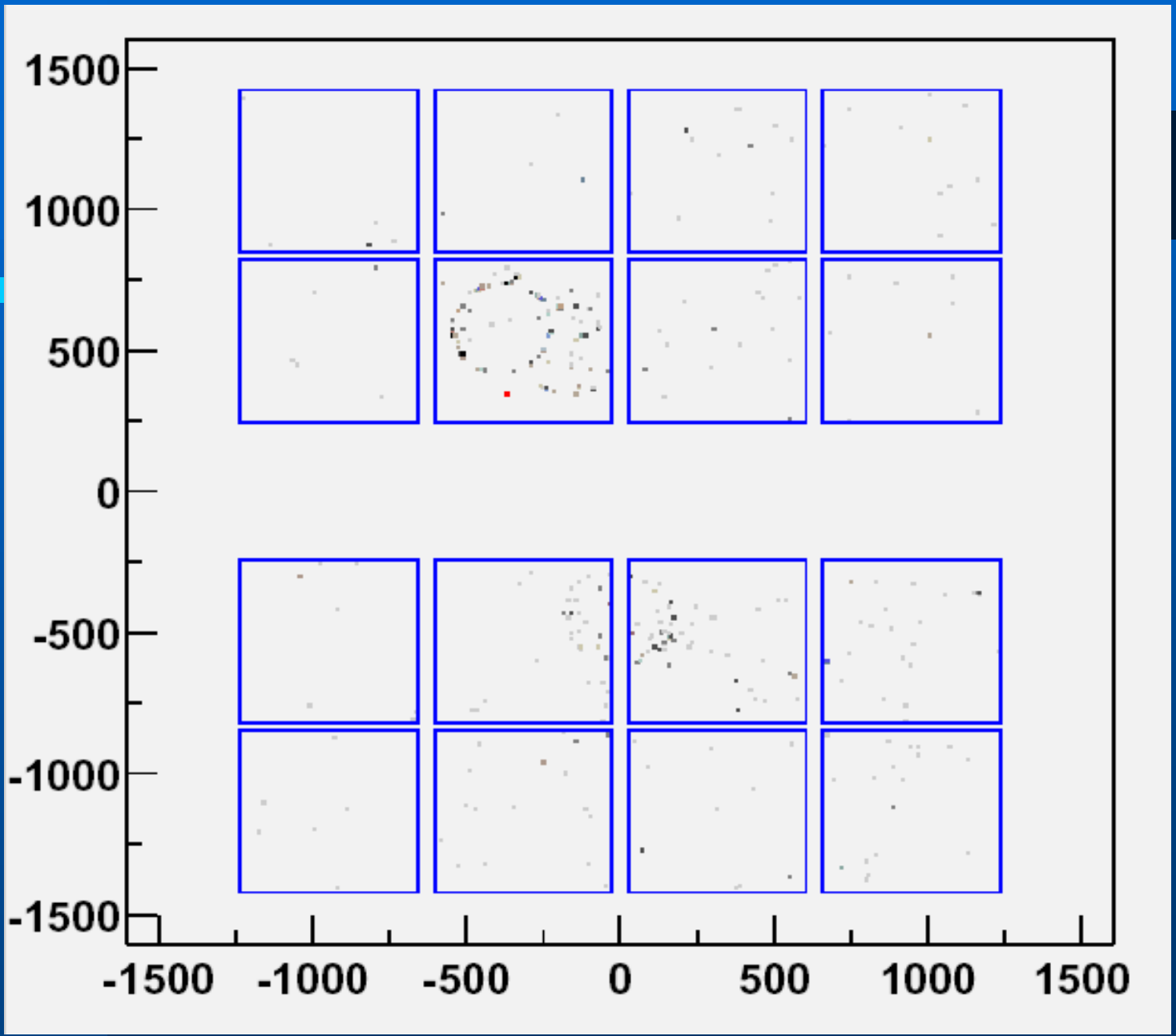
1500
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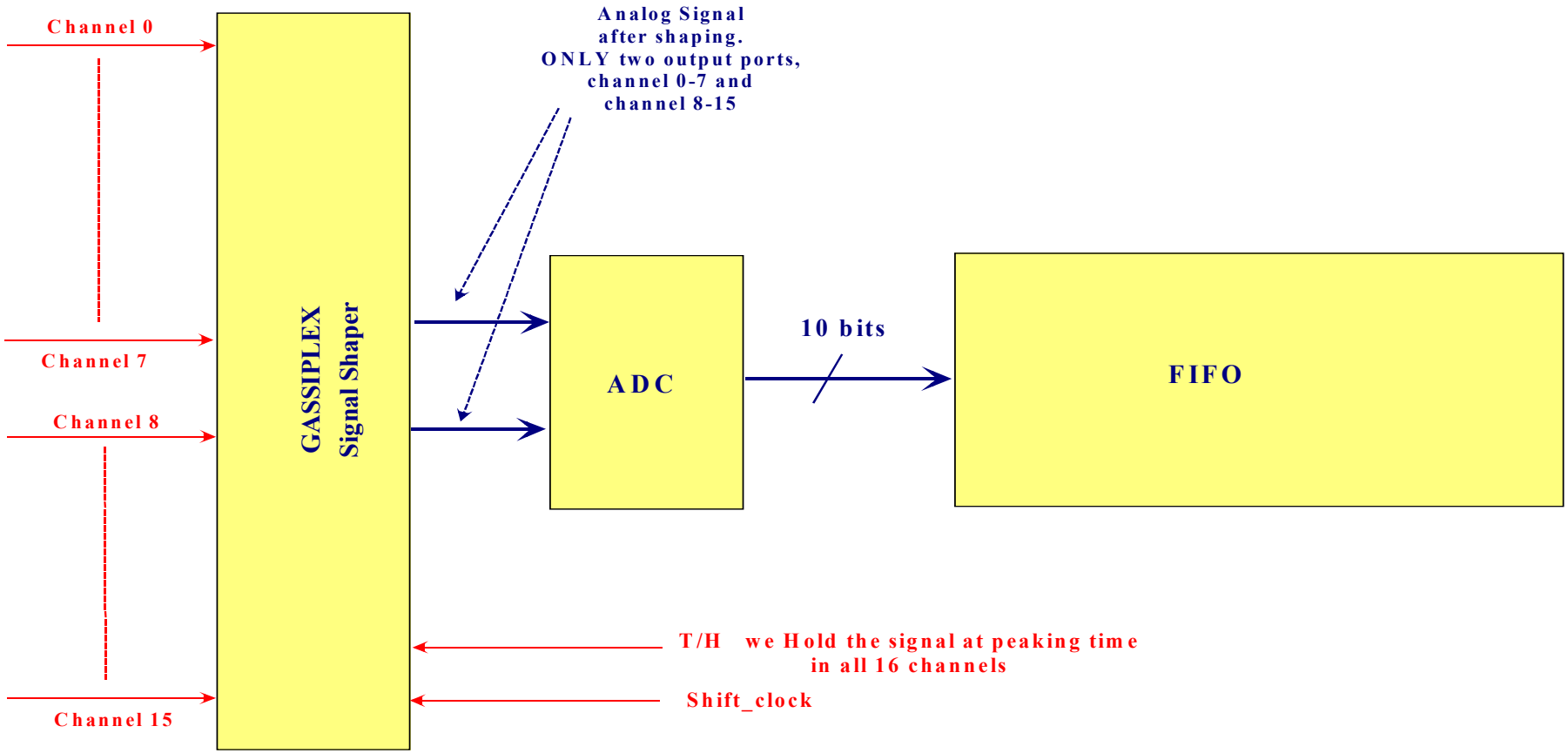
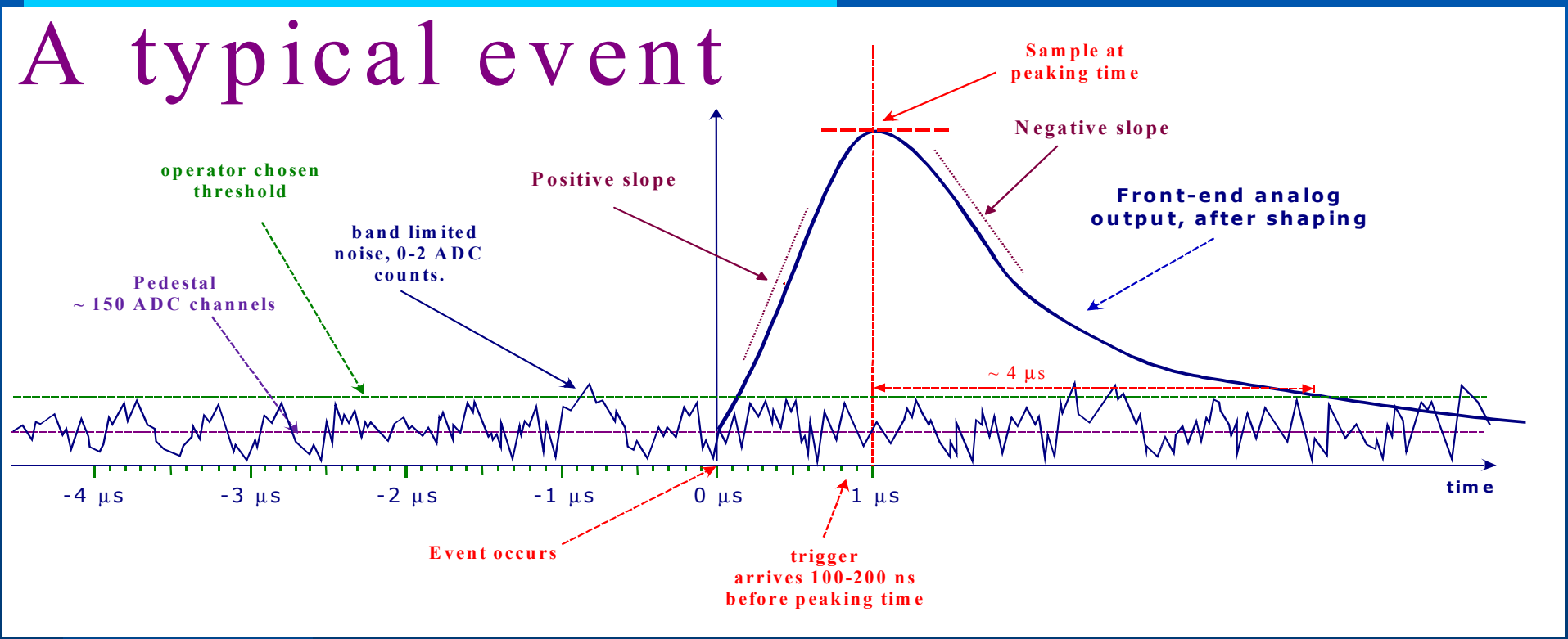
1000
1500

Schematic view of the presently installed front-end

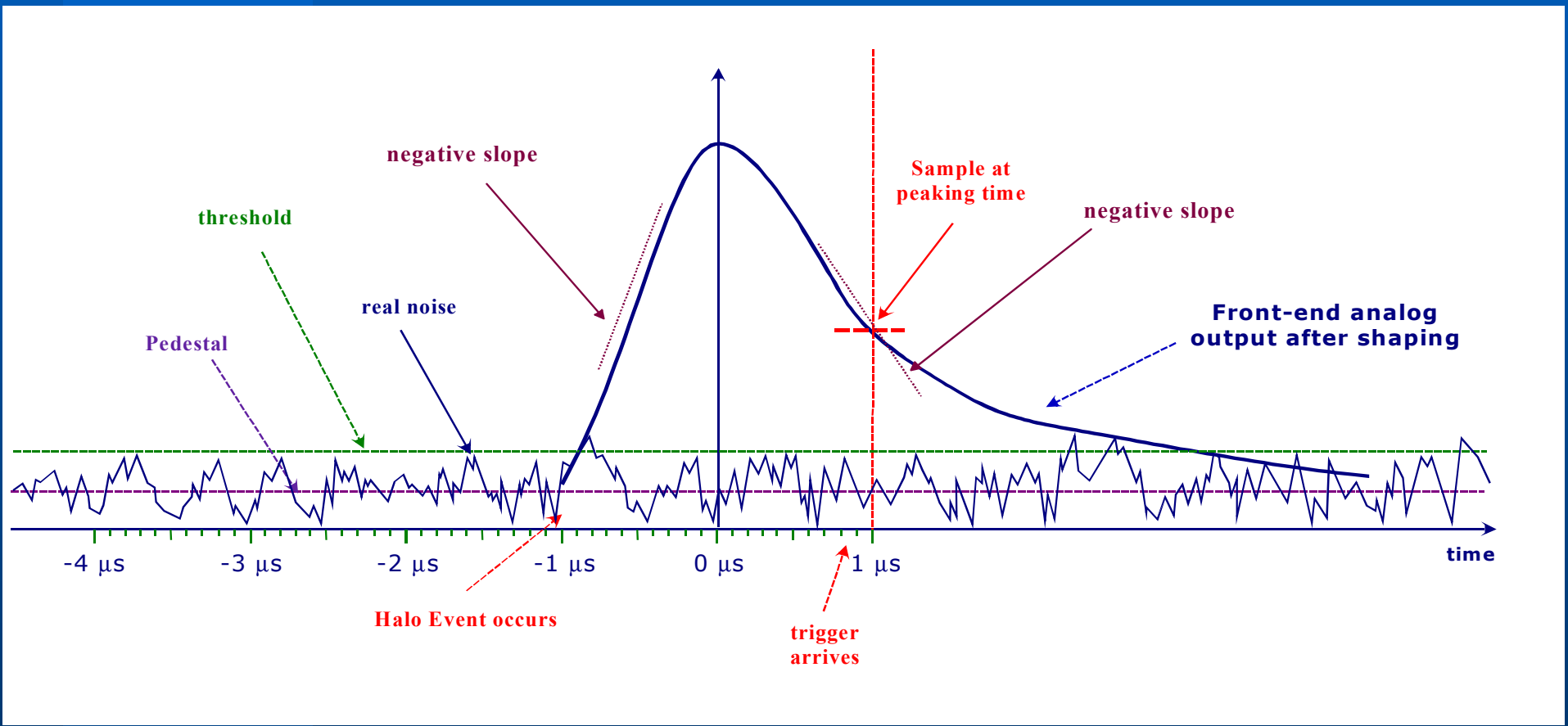


The shape of a normal signal of an event.

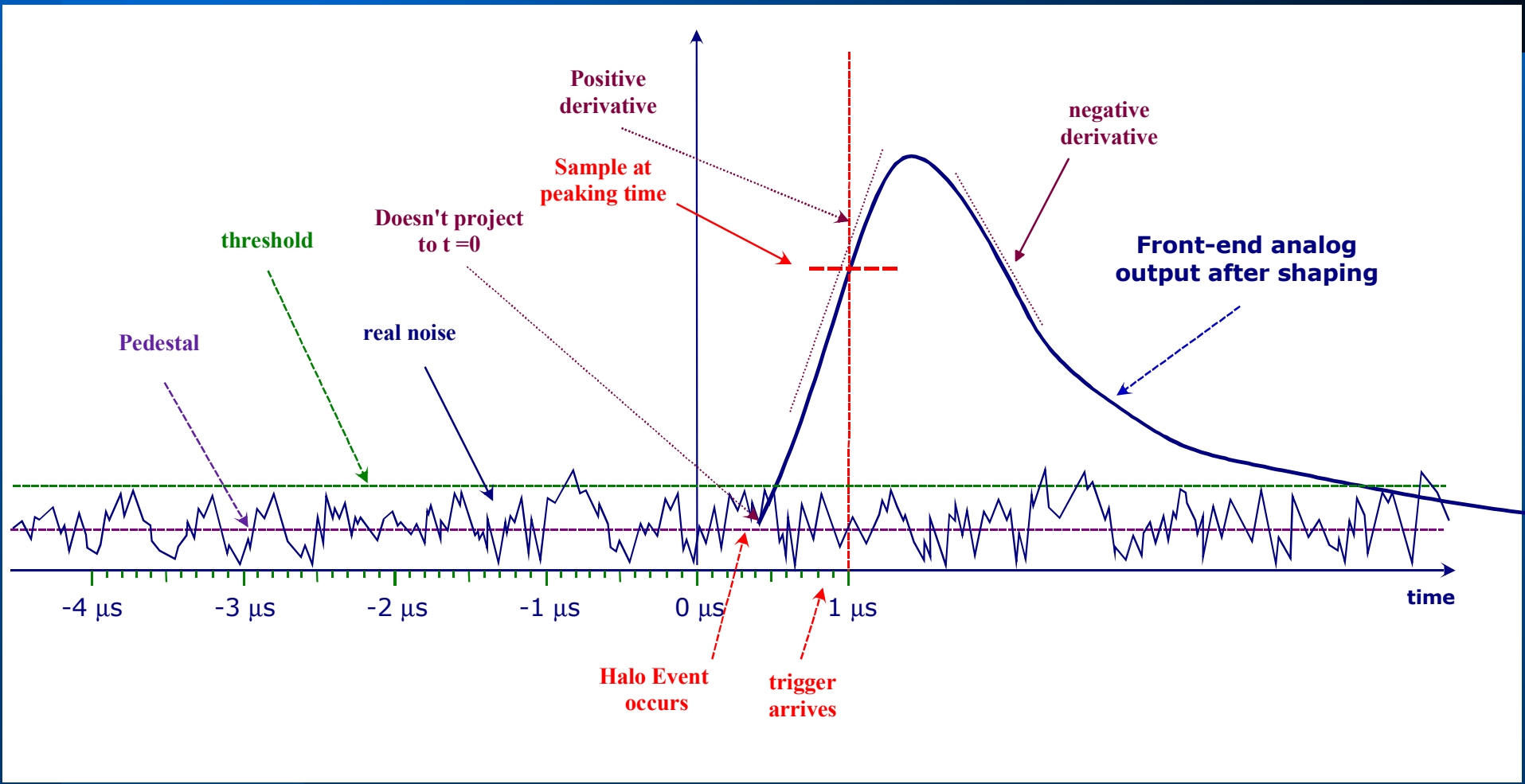


upgrade_0.dsf

Halo event, $t_0 < 0$



Halo event, 1 μs > t_0 >0



What separates Halo events from good events ?

- **The only discriminating parameter is the “time history” of the signal.**
- **We need to memorize the past and and part of the future.**
- **Detectors can be fast (PM) or slow (gaseous), in both cases history is the determining factor.**

Upgrading 4 – Half Chambers

- ~ 21000 pixels (pads), 60 BORAs.
- To save the history of the signal we need to save at least ~ 10 - 60 samples per signal channel taken every ~ 100 ns.
- We need processing power in order to identify the Halo events from good events.
- We need better time definition to describe, without too much error, the start of the shaped signal.

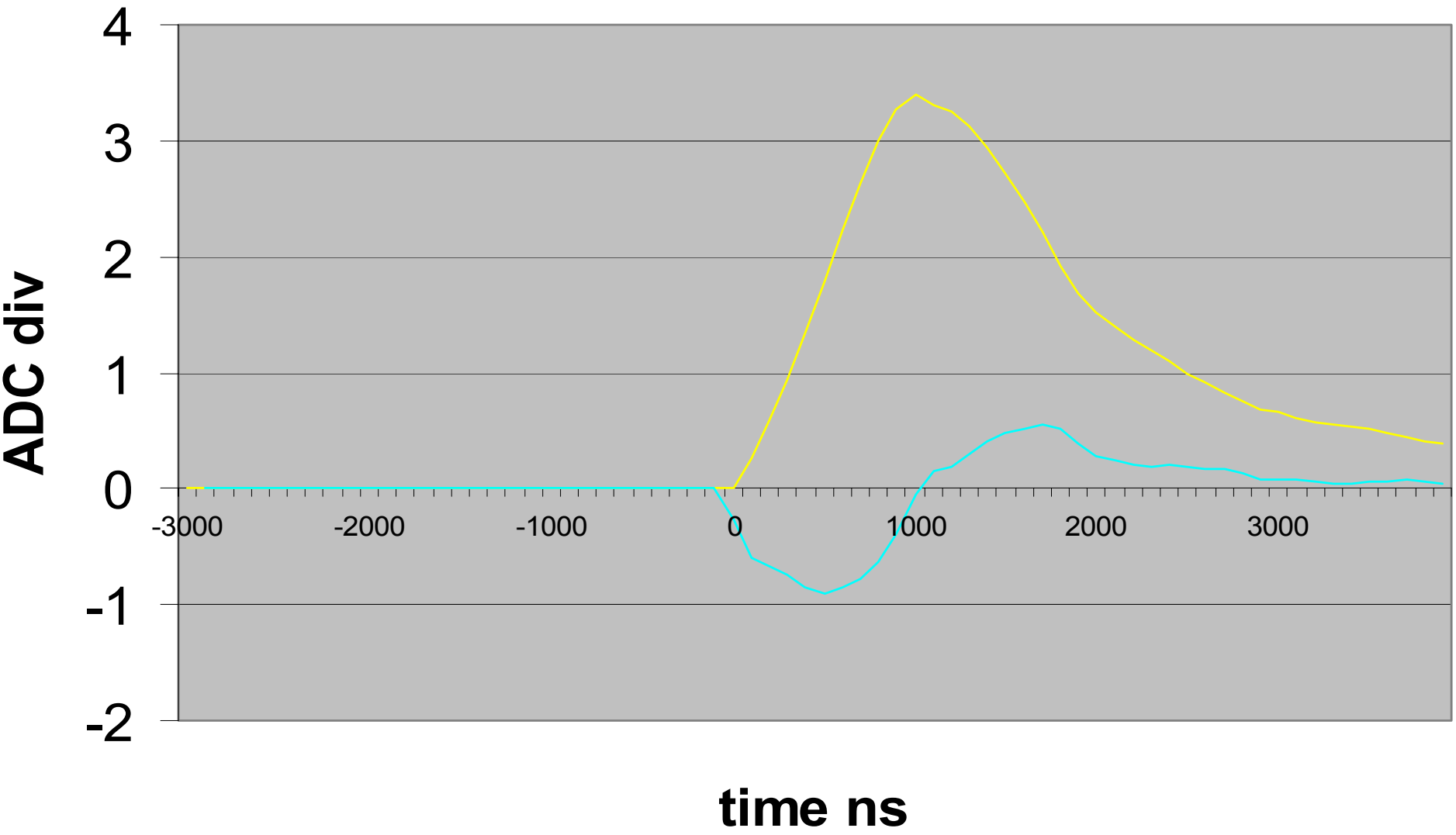
Two ways to pull the trick (a)

- **Replace slow gaseous detector and front-end with PMs:**
  - **Benefits and drawbacks.**
    - **Great time definition ~ 15 ns.**
    - **Very expensive !!!!!!**
    - **It needs new everything:**
      - **Optics**
      - **Electronics, although rather simple.**
      - **Mechanics. New mechanics precludes that the new system cannot be built when data-taking is under way.**
- **We cannot work in parallel during data taking because of the many modifications**

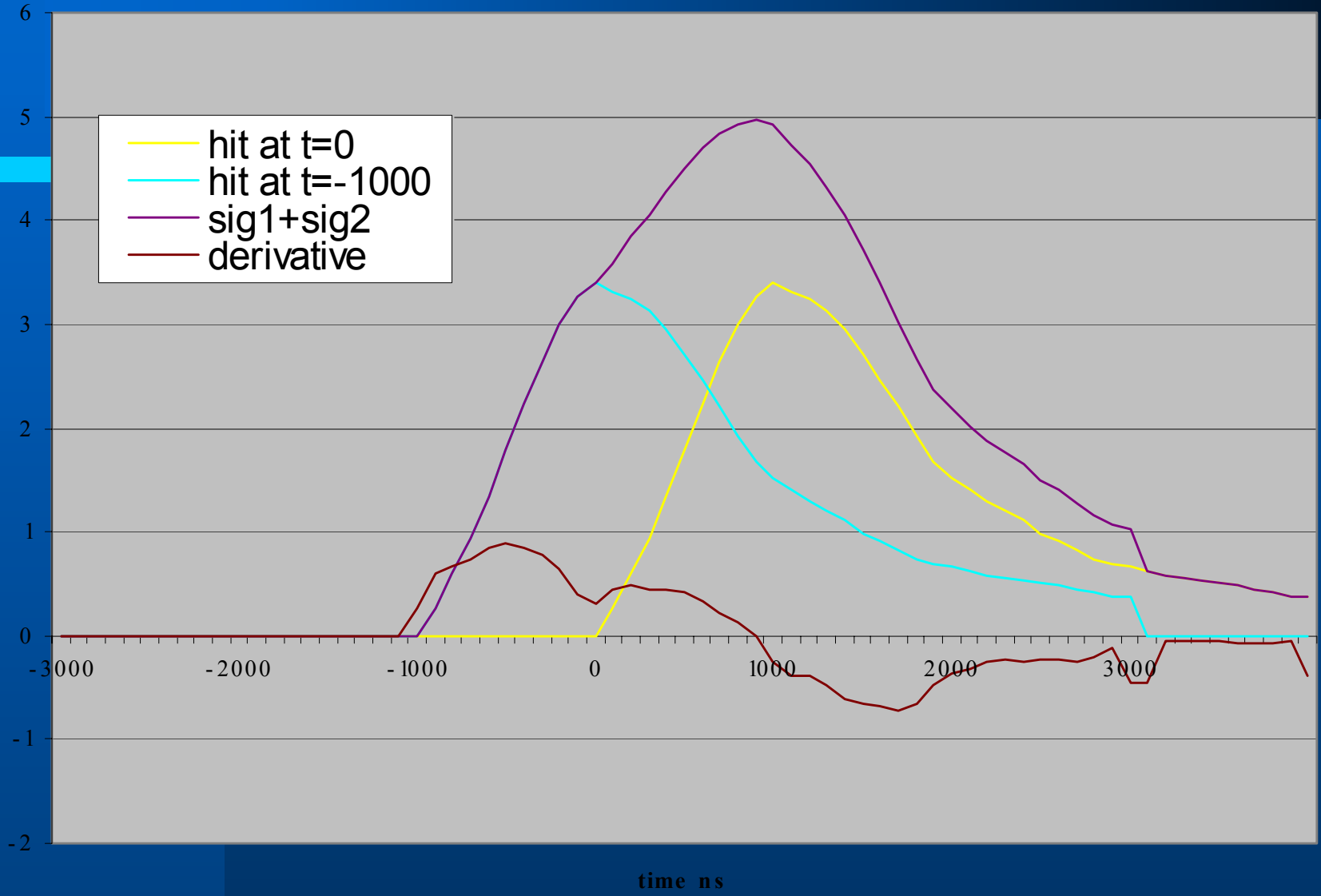
Two ways to pull the trick (b)

- **Keep slow detector design, add a large degree of local computing power (unprecedented amount)**
  - **Benefits and drawbacks.**
    - **Enough time definition that allows to get rid of 90% of Halo events.**
    - **Expensive, but cheaper than PMs !!!!!!**
    - **It needs:**
      - **New electronics with ~10000 ADC and same amount of DSPs**
      - **No new Mechanics. Then, we can build the new BORAs while data taking. We can try to have by 2004 !!!**

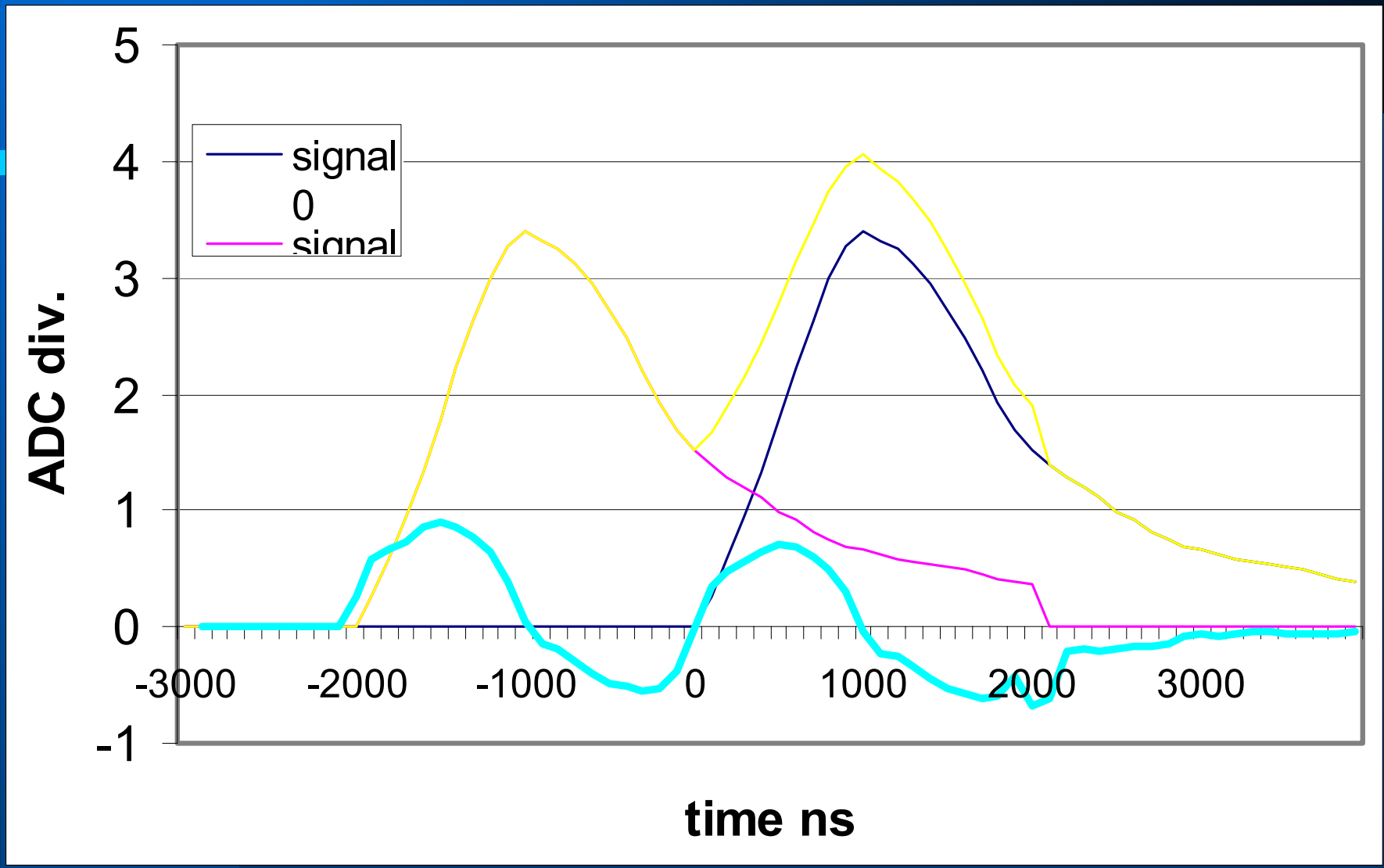
A typical signal and its derivative



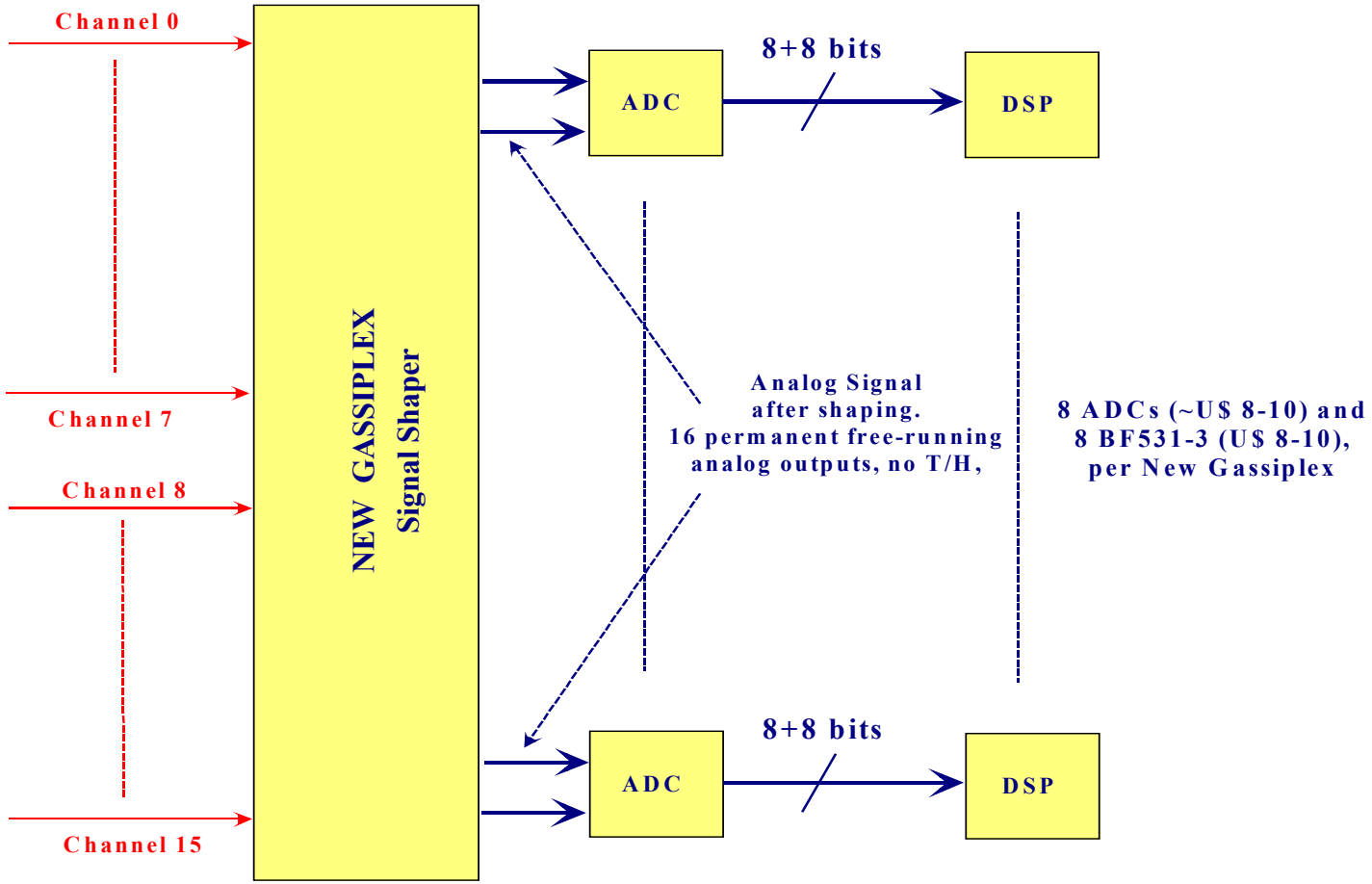
Sum and derivative of two signals (a)



Sum and derivative of two signals (b)



(b) New BORA


Channel 0
Channel 7
Channel 8
Channel 15
NEW GASSIPLEX
Signal Shaper
ADC
8+8 bits
DSP
ADC
8+8 bits
DSP
Analog Signal
after shaping.
16 permanent free-running
analog outputs, no T/H,
8 ADCs (~U$ 8-10) and
8 BF531-3 (U$ 8-10),
per New Gassiplex

(b) Strategy for local data treatment

- **Sample every ~100 ns, place the 8-bit result into a circular buffer of at least 60 bytes deep. A BF531-33 DSP handles circular buffers using internal hardware. The internal memory is large enough for several k-samples within circular buffers. Use as much as possible the 4 internal, parallel MAC (Multiply Accumulate) units.**

(minimum, but no truthful) algorithmic Procedure

- **Check if signal sample is below the threshold. Yes = Pad not hit.**
- **Was the sample taken at the maximum of the signal?**

  Yes = accept value,

  No = Pad not hit.

Etc…

Time, personnel and funding constraints.

- **Time: for development and construction and software development of 60 new BORAs > 1 year.**
- **Personnel: at least 6 scientists with experience.**
- **Funds: roughly about 2 million euros (computed the American way). Expensive since it includes all NREC, even for 25% of the electronics of RICH-1**