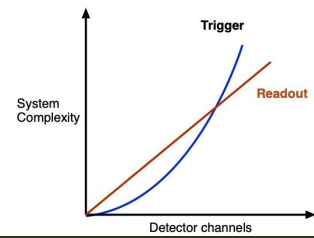
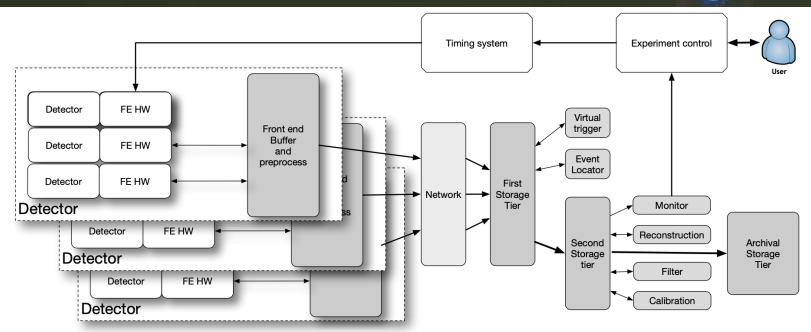


## The problem



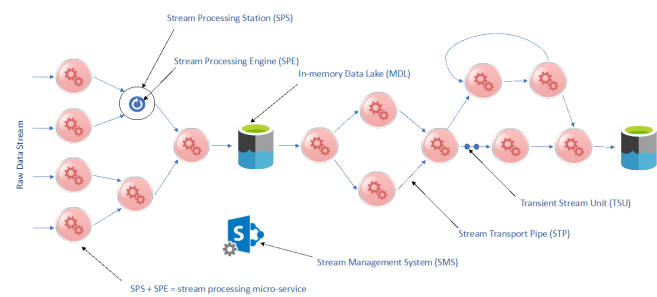
- The role of a trigger is to reduce the data rate from the detector to something the readout can handle
- With current detector and readout technologies we can readout the detector without a global trigger, but can't store data at the acceptable rates
- Need a different approach

## A Solution: Streaming Readout. Tiered storage model



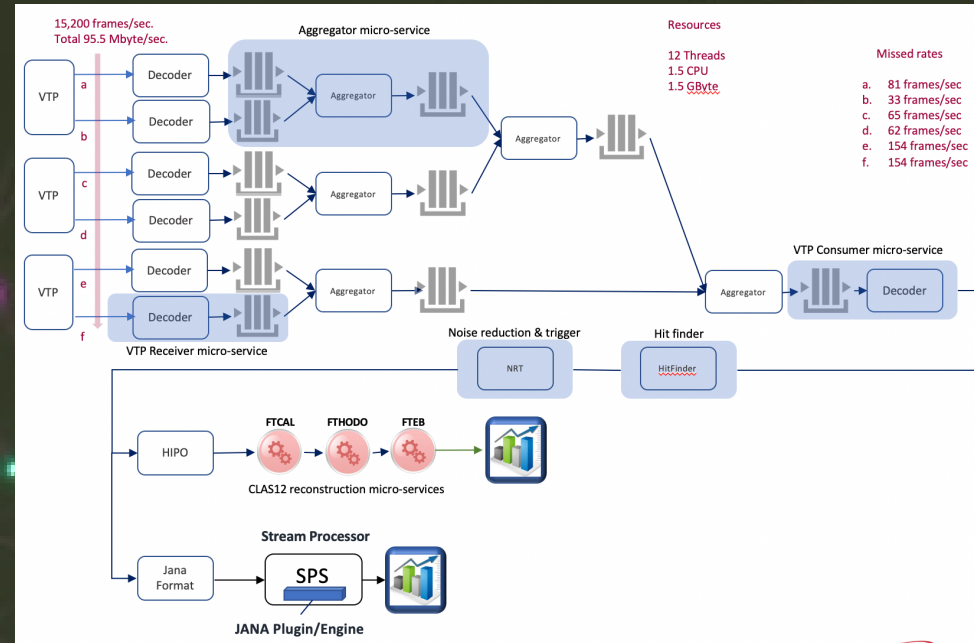
## A new design effort:

### Environment for Real-time Streaming, Acquisition and Processing

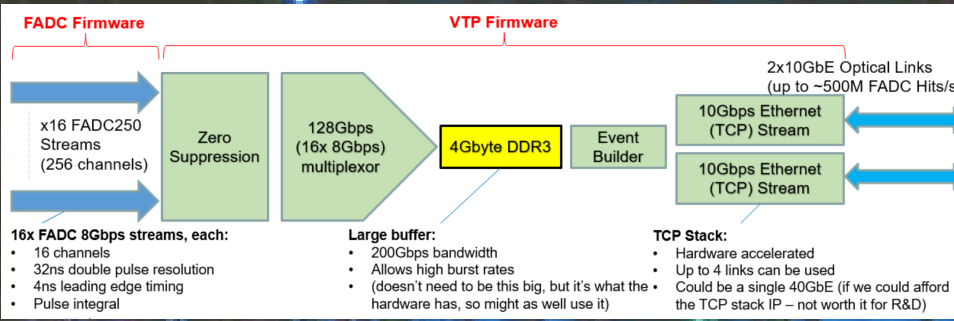


ERSAP Architectural Design: Reactive micro-services architecture within the flow based programming paradigm. Diagram shows streaming data production pipe-line emphasizing framework components.

## Streaming readout data acquisition for the CLAS12 FT detector

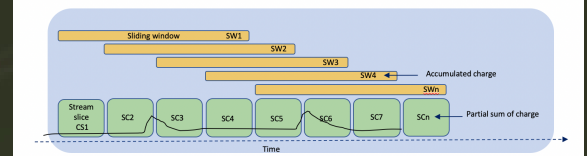


Beam studies. 6 streams off the detector are presented by a VXS crate specific VTPs, reading data streams from 250MHz Flash ADCs through VXS serial. Highlighted sections of the diagram indicates ERSAP micro-services, utilizing tiered micro-storages. By means of these 3 components an arbitrary complex stream aggregation and event building can be implemented.



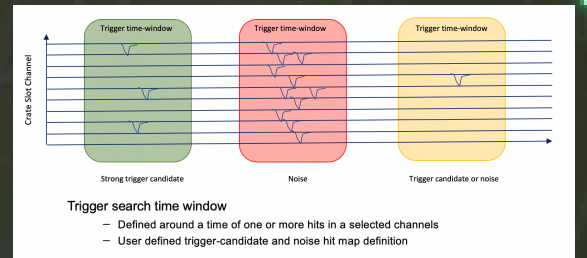
Two streams per VTP/crate. VTP combines all fADC hits correspondent to a programmable time window.

## HitFinder. Stream slicing technique

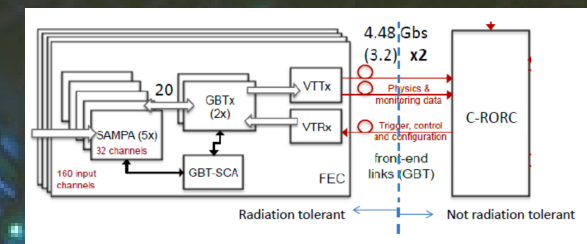


- Slicing a stream to non-overlapping time windows
  - Small memory footprint
  - Store only partial sums, instead of individual tuples
  - Less computation for hit finding
    - No duplicate computation for every sliding window
- Sliding window
  - Produces time dependent hits for each channel (rate, slot, channel)

## Noise reduction and event triggering



## Future tests. GEM detector readout prototype



Streaming readout prototype system that uses SAMPA ASIC chip. FEC: front end card (160 channels/per card, total 800 channels for 5 FECs), C-ROR: Common readout receiver card (PCIe), GBTx: Gigabit transceiver, GBT-CSA: slow controls adapter, VTTx, VTRx: fiber optics transceivers.