

Issues

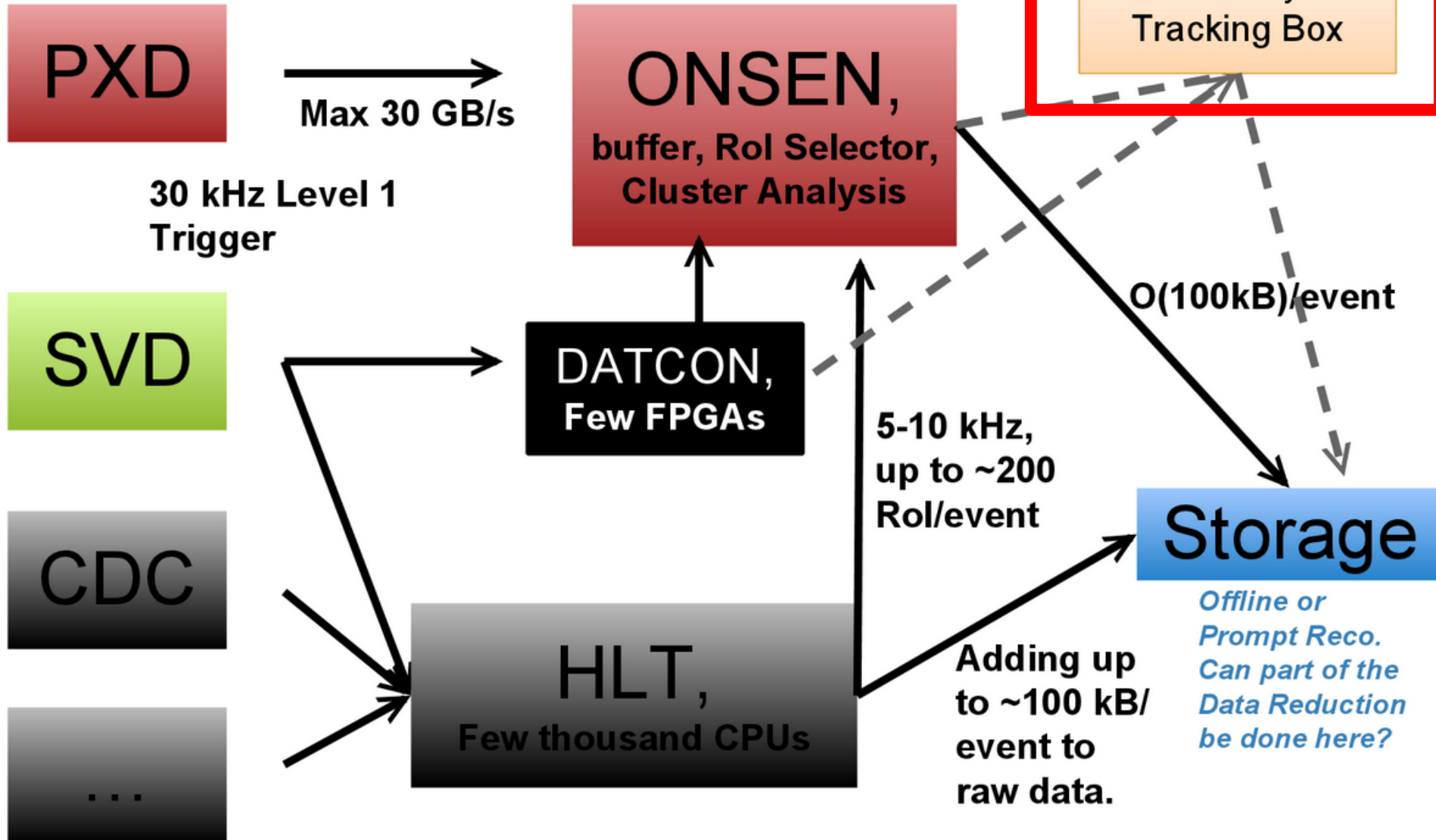
Need to have Full Online Data Reduction chain running in Software

- In November the funding applications for 15H2 to 18H1 in Germany are due.
 - Some people propose to go for 6-layer tracking online.
 - It is important for us to know at least roughly the efficiency with which we get clusters from slow pions with our default scheme.
(Although I think the 6-layer tracking is realistically undoable; more about this later)

Data Flow in the DAQ

Someone tries to revive this thing.

Probably useless option; not in baseline, but considered.



What is the HLT + Cluster Rescue based mechanism?

- Full tracking with CDC and SVD in the HLT.
 - For slow pions this is basically the same as SVD only, although in events with a lot of tracks the number of SVD hits might be already sizable reduced, if we can identify SVD clusters, that clearly belong to a high momentum track (I interpret stuff from Jakob that way anyway).
 - Regions of interest are defined and transmitted to the ONSSEN.
- Cluster Analysis to identify slow pion clusters without considering correlations between different clusters.

More Details on HLT based Tracking

- So it is essentially Jakob's 4-layer tracking.
 - We can accept a maximum of almost 100 fake tracks per event as we can handle ~200 Regions of Interest.
 - We assume fairly small regions of interest as otherwise they are fairly useless.
 - In principle we can add a soft beamspot or vertex constraint to define the region of interest for low momentum particles, as they will not be used for measuring the lifetime of anything.

We need input from Belle to roughly define the momentum where this is OK.

How many clusters do we expect?

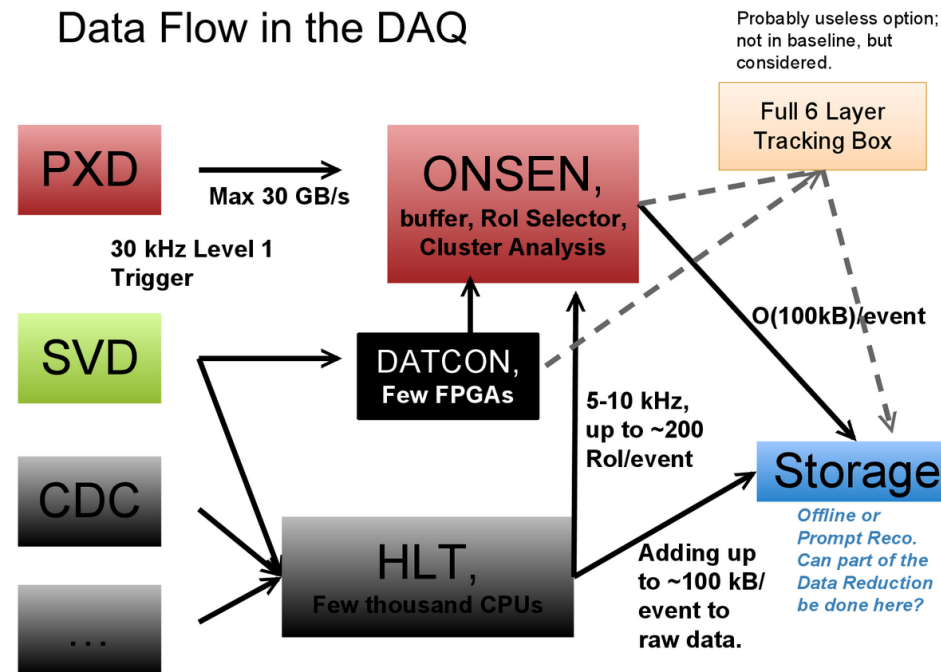
What reduction do we need?

- A cluster with 2 pixels has 8 byte size.
We expect roughly an average cluster size of 2 pixels
- We can handle at least 100 kB output, probably a bit more.
→ We can write out to storage a bit more than 10^{**4} clusters.

- The hardware is designed for a maximum occupancy of 3%.

8 Million pixels *
4 Byte per pixel *
3%
~ 1MB
→ factor ~10

This means about 10^{5} clusters in the PXD!**



DATCON

- DATCON is an alternative way to make Rols with FPGA based tracking. We can try to be complementary, but if we define one region twice, there is no additional output, so there is no problem from that side.

Current Background Estimate

Current Occupancy:

$$\begin{aligned} & 0.6 * \text{Occupancy from Layer 2} \\ & + 0.4 * \text{Occupancy from Layer 1} \\ & = 0.5\% \end{aligned}$$

→ Less than factor 2 of background reduction is needed with current background as there are about 160 kB of raw data from the PXD. Perhaps we can even handle this?!

Details about Cluster Rescue Mechanism

From Christian's thesis; NO ADC conversion!

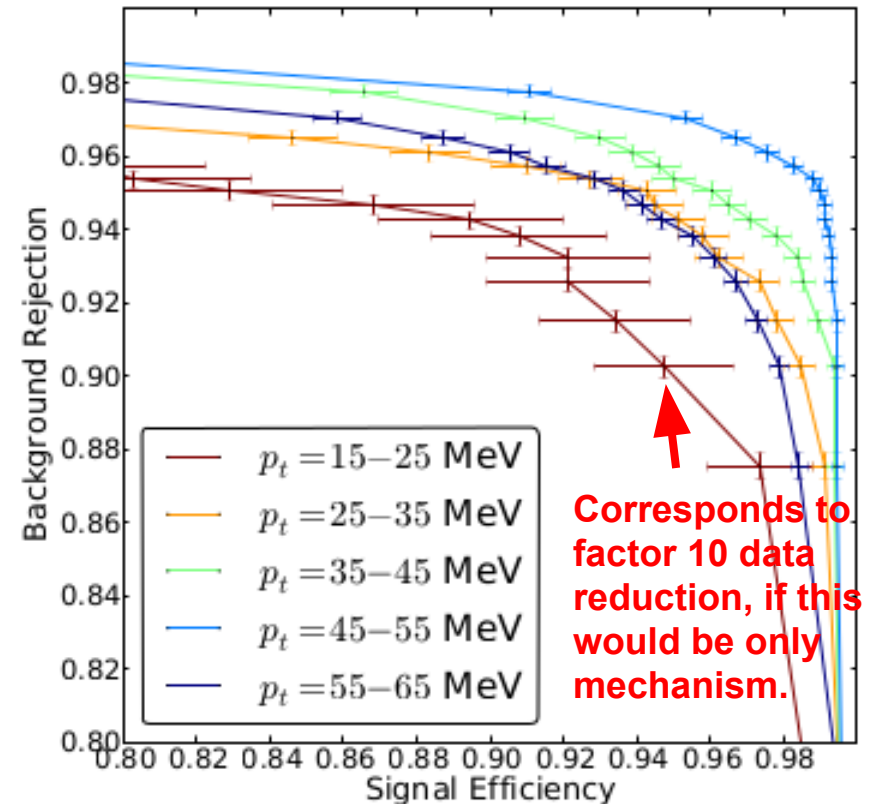
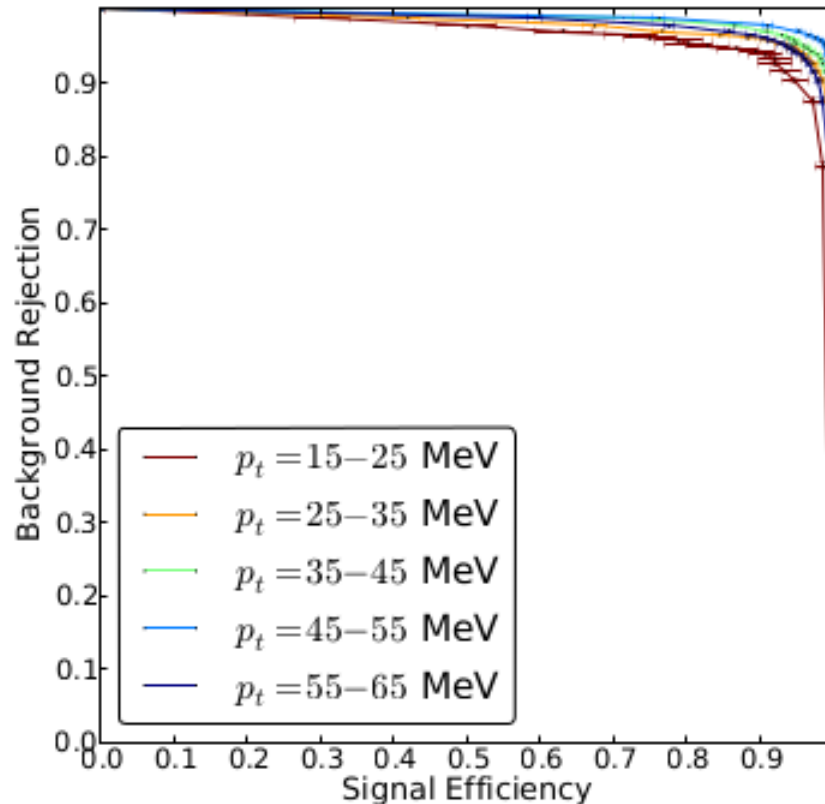
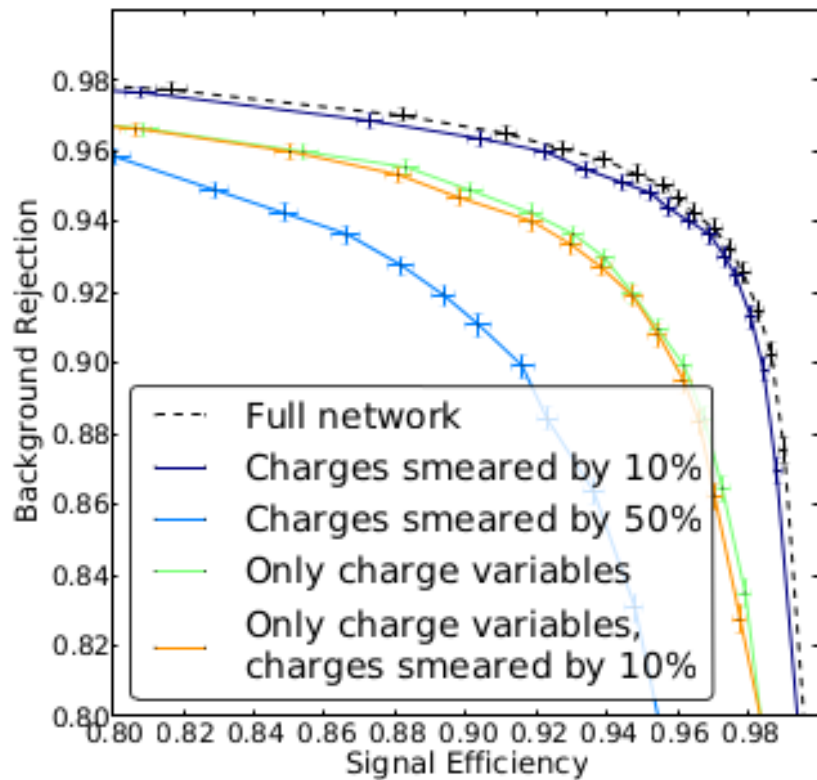
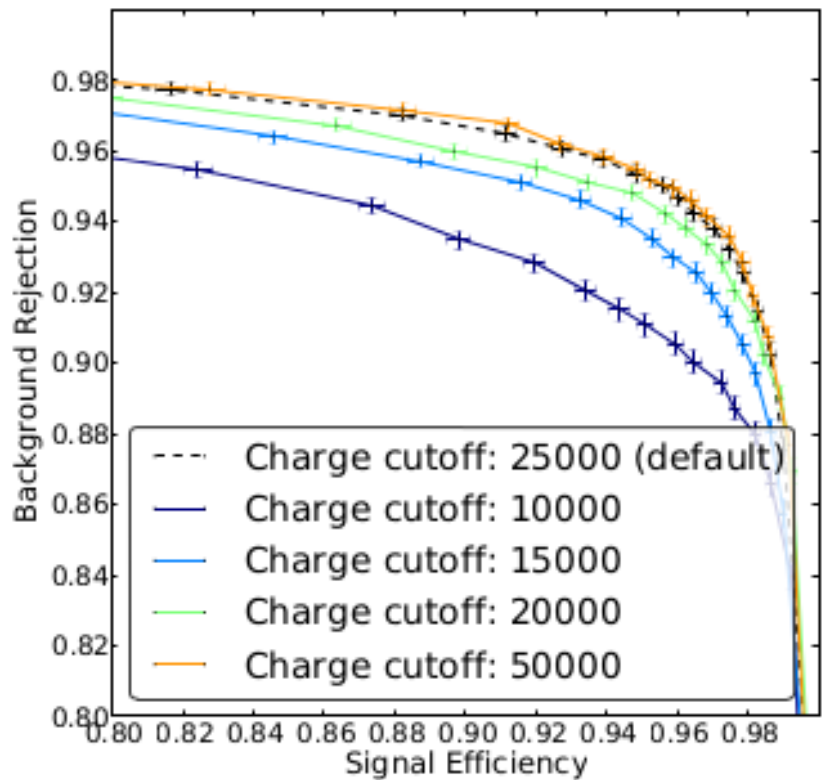


Figure 5.8.: Background reduction over signal efficiency for different cuts on the network output, colours indicate different transverse momenta of pions. To help distinguish the curves, the second plot shows the same data with both axes fixed to values larger than 80 %.



(a) using only charge variables as input, and with pixel charges smeared by 10%



(b) for different pixel charge cutoffs

Figure 5.10.: Background reduction over signal efficiency for networks with some additional limitations.

Looks fairly robust, but we need better estimate for dynamic range issues. → Bonn? Goettingen?

6-Layer Tracking with

- several 10,000 clusters in the PXD? I don't think this is doable with realistic hardware.
 - Would need to be done @ 30kHz.
 - Efficiency should not depend strongly on the overall occupancy for that specific event.
 - But I guess Jakob will be asked to have a look at that in the not too distant future... to find out, that the hardware we need would have an electricity bill of several 100,000 Euro per year....

What we need to do for the simulation

- Somewhat tuned 4-layer tracking.
- Proper definition of Rols potentially with beamspot constraint.
- Cluster rescue mechanism with simulation of “damaged” dynamic range.

What other long term improvements can we expect?

- Using hits from curling arm to improve the momentum estimation and reduce fakes in the SVD.
- Improving momentum estimation and therefore extrapolation precision with dE/dx .

For the Integration Build

- Are we still dependent on testbeam package?

Reco Model

I try to do it relation based.