

Reason for direct wire readout for wire scanners

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1. independent double check for maximum PMT readout at beam position  
=> parallel using of PMT- and direct detected wire readout signals
  
2. replacement of PMT-readout  
=> omit the scintillator part  
=> together with the PMTs and their HV-control system at all

Two new ideas for direct wire readout for wire scanners  
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1. replace the classical charge preamplifier against a more noiseless one
2. use a "negative" convolution technique for data recognition

## Charge Amplification with a Logarithmic wide-bandwidth Peak Envelope Detector

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- reference beam-charge :  $5.5 \cdot 10^6$  electrons/bunch =>  
 $5.5 \cdot 10^6 \cdot 1.6 \cdot 10^{-19} \text{ C} = 0.88 \text{ pC} \Rightarrow 1 \text{ pC}$
- charge interaction space :  $\sim 1 \text{ mm}$  / space-dimension
- charge interaction time at the wire :  $\sim 3 \text{ ps}$

- fundamental equation of system theory :

$$\text{Risetime of Inputsignal} \cdot \text{Bandwidth of System} = 0.35$$

$$0.35 \text{ ps} \quad * \quad 1 \text{ THz} \quad = \quad 0.35$$

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-> not realizable up to now

- necessity of input pulse stretching and charge amplification

$$Q = C \cdot U = I \cdot t = U/R \cdot t$$

- direct input of 8313 :  $10 \text{ mVpp} \cdot 1 \text{ ns}$

$$\Rightarrow Q_{in} = 10 \text{ mVpp} / 50 \text{ V/A} \cdot 1 \text{ ns} = 1/5 \text{ pC}$$

- leads to an output of 8313 :  $50 \text{ mV} \cdot 50 \text{ ns}$  ( Gaussian, treated as rectangle )

$$\Rightarrow Q_{out} = 50 \text{ mVpp} / 50 \text{ V/A} \cdot 50 \text{ ns} = 50 \text{ pC}$$

- Charge amplification  $Q_{out}/Q_{in}$  :  $\sim 250$  ( if  $R_{in} = R_{out}$  )

List of problems to resolve

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- sources for noise and their mathematical description
- equivalent network-model of the PED input network
- optimal filter theory for wire-signal-recognition
- other possible primary wire-detectors with preservation of phase-information of wire-signal
- insertion into the existing PMT readout chain
- parallel data-taking for PMT- and PED-signals

Signal recognition for the direct wire readout  
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- Moving Average Filter
- Wiener Filter
- Correlation: Matched Filter