



AGH UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

# **Development of readout electronics for straw tubes - status**

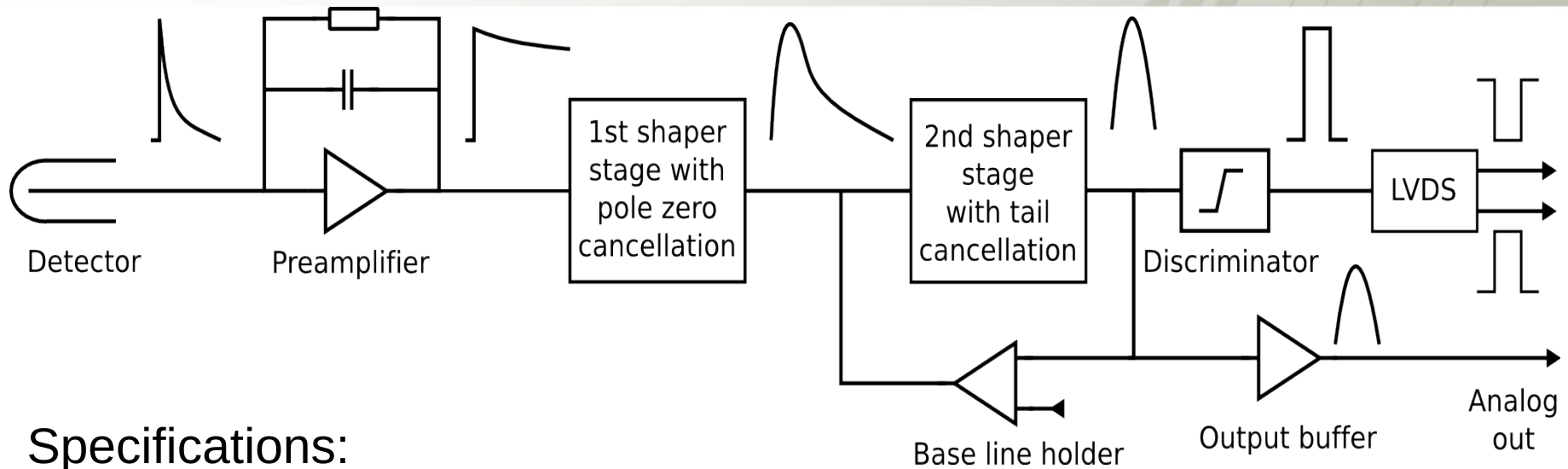
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## Front end architecture

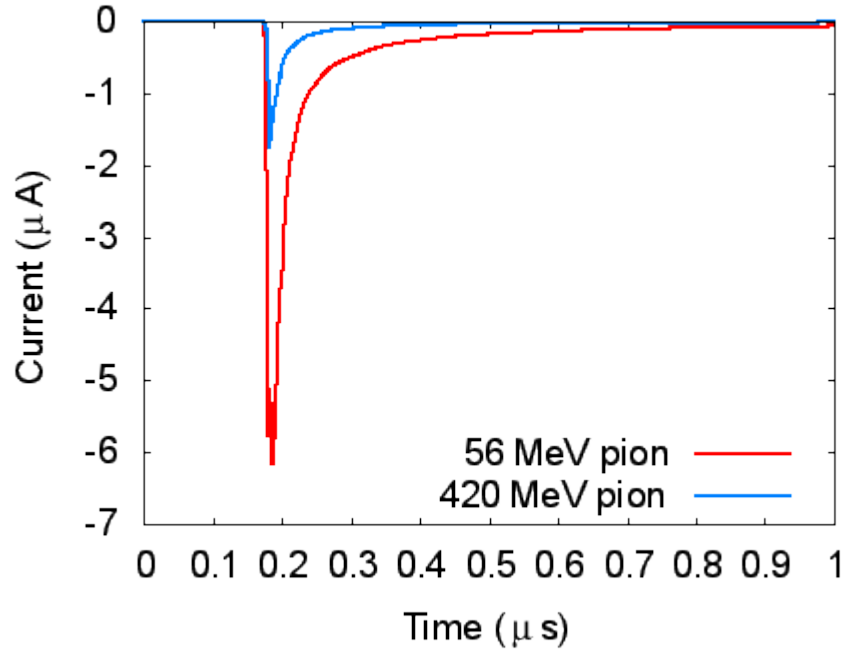


### Specifications:

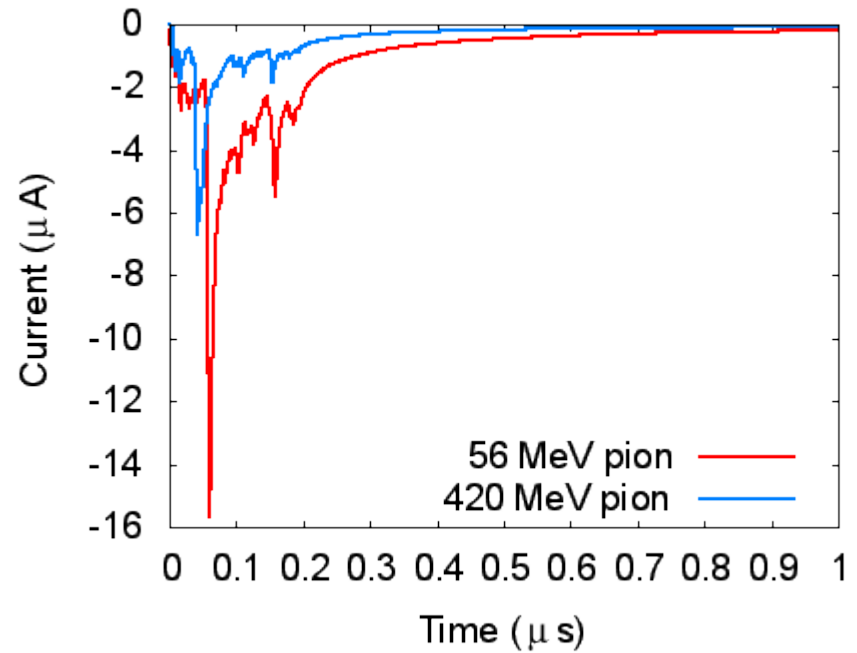
- Technology – AMS 0.35  $\mu\text{m}$  (1<sup>st</sup> prototype)
- Two readout versions: single ended and differential
- 1<sup>st</sup> prototype should give: Timing information, Amplitude and Time over Threshold
- Preamplifier with variable gain
- CR – RC<sup>2</sup> with peaking time  $\approx 15$  ns (for delta pulse), if possible variable...
- Ion tail cancellation circuit
- Baseline stabilised by BLH circuit
- Leading edge discriminator for time measurement
- Fast LVDS output
- Equivalent Noise Charge  $\approx 0.4 - 0.6$  fC for 25 pF detector capacitance

# Garfield signals generated in straw tube (examples)

Generated 4.7 mm from anode

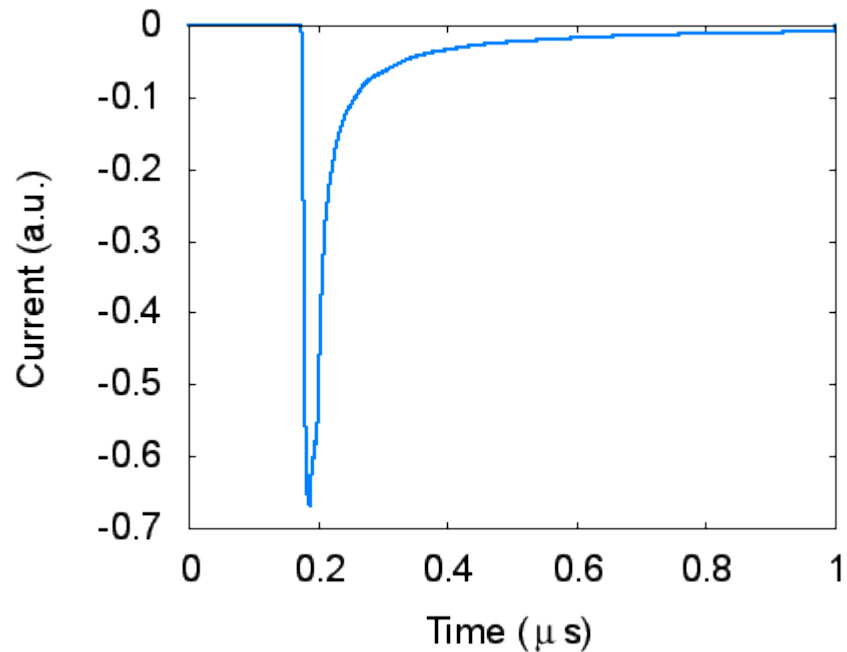


Generated  $\sim 0$  mm from anode



## Reference signals from straw tube

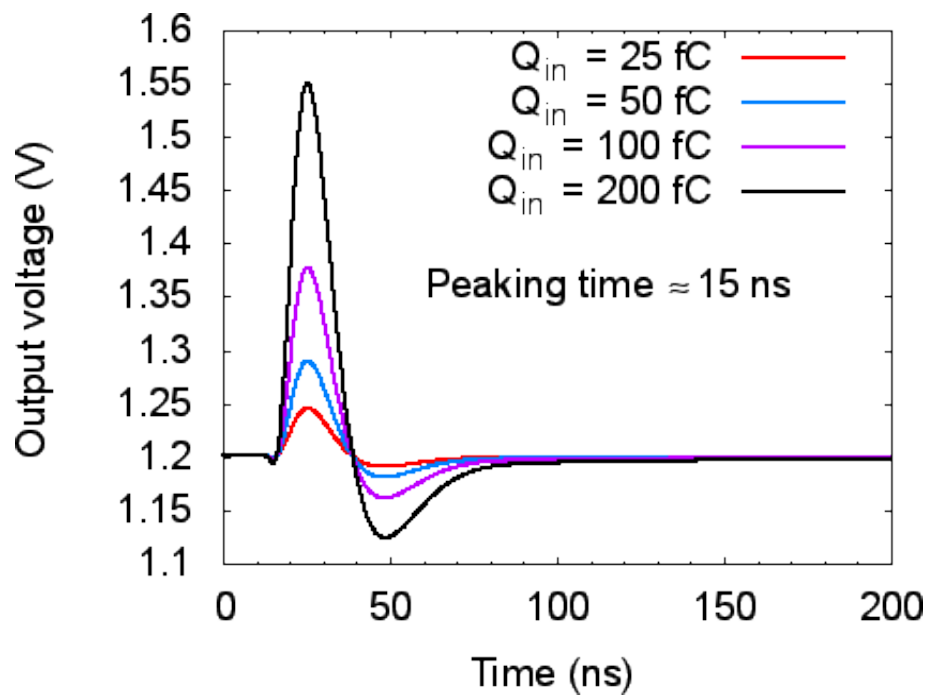
To simulate ion tail cancellation in front-end electronics a reference straw tube signal was generated as an average of 100 MIP pion signals



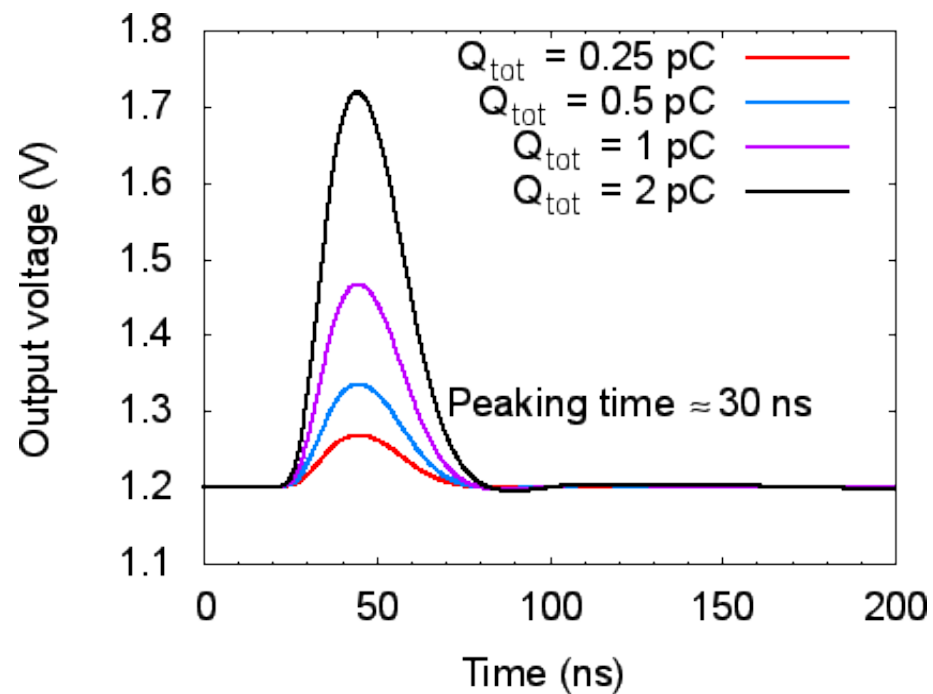
# Front end response

Analog pulses available at shaper output

Response to delta input

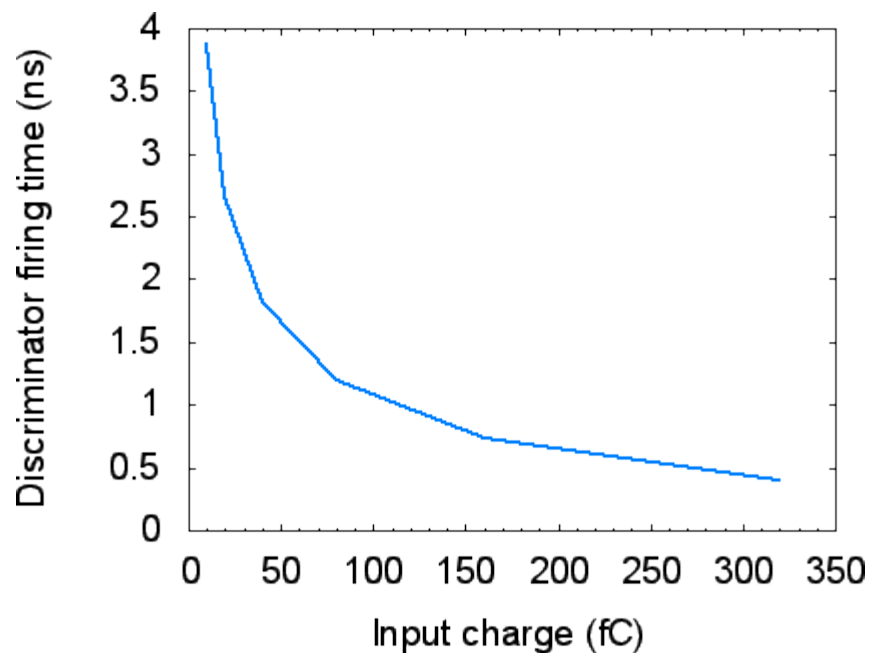


Response to reference pion

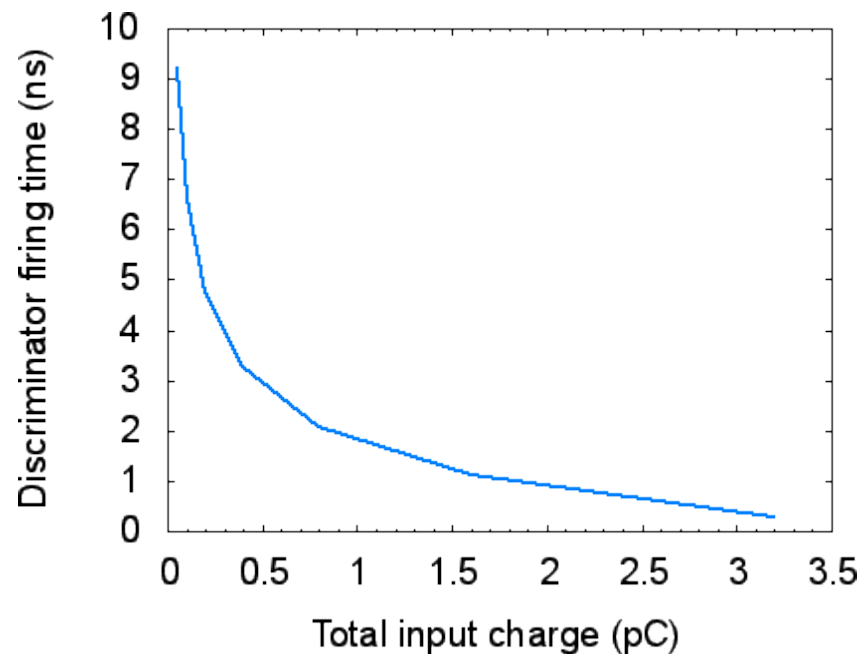


# Discriminator response time vs input charge

Response to delta pulses

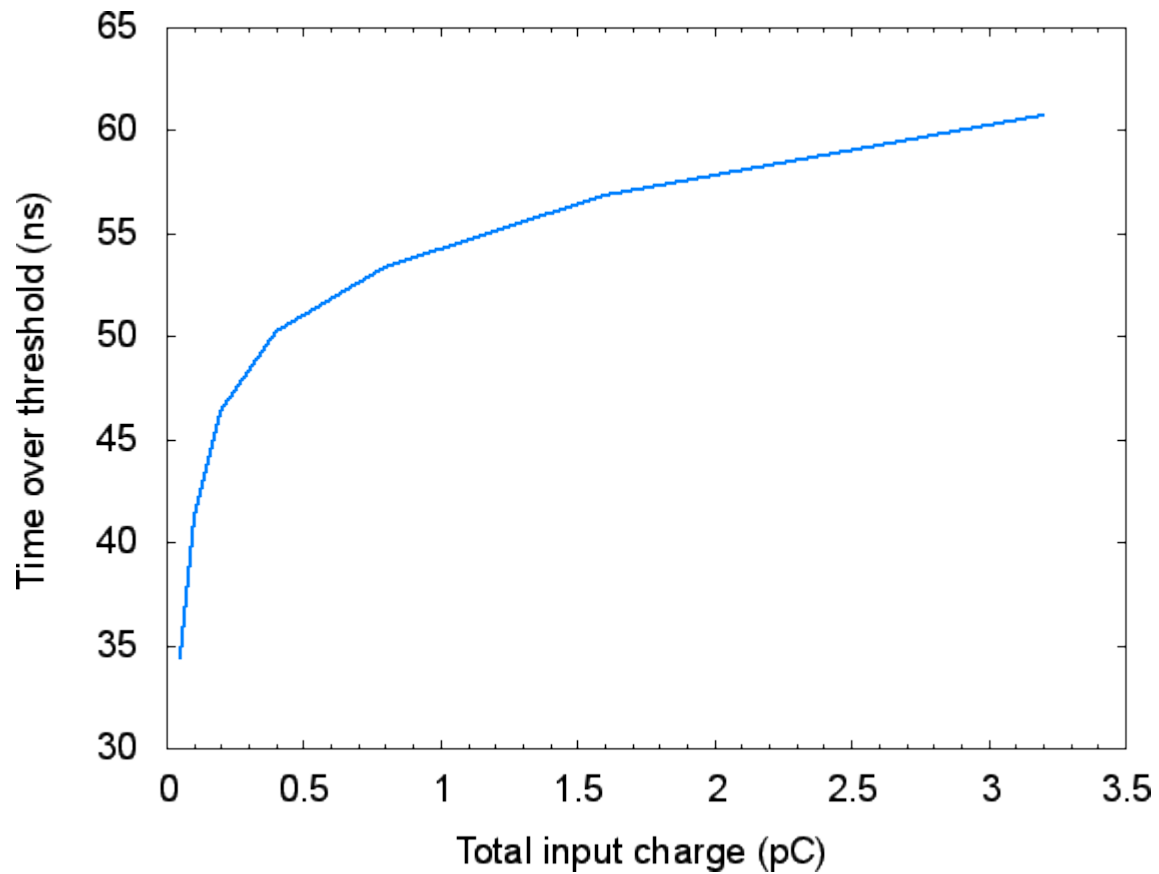


Response to reference pion pulses



# Discriminator Time over Threshold

Response to reference pion pulses



## Design status, question marks and plans

- 1<sup>st</sup> version of single ended readout: preamplifier, shaper, PZC, tail cancellation, BLH and discriminator designed and in optimisation phase, layout design will be started soon
- Design of differential version in progress...
- Peripheral blocks: LVDS, bandgap reference, DACs – prototypes already done, will be integrated in the design
- Main design parameters like input charge range, peaking time and time resolution have not been completely fixed yet. There is still time for modifications if needed ???
- Number of channels have not been decided yet ???
- What are the constraints for power consumption ???
- Submission originally planned before the end of 2010 will move by ~ 2 months (due to complicated design)