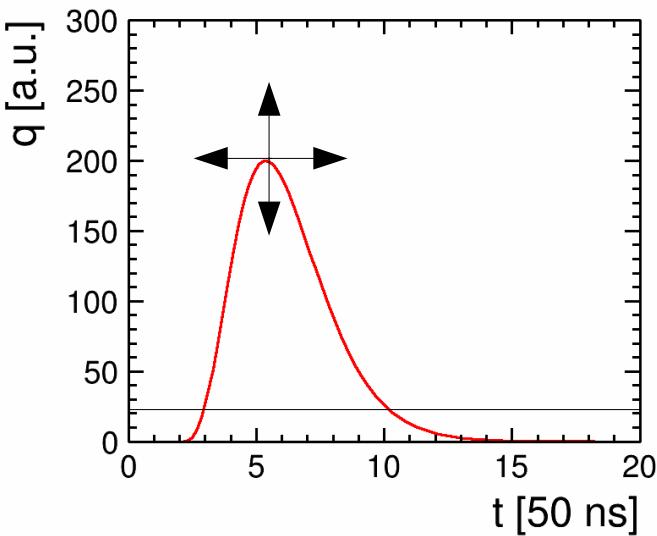


# Pulse Time Study

Felix Müller  
Analysis meeting #19  
23.04.2014

# Time Walk and Binning Effects

- > Check the time walk and binning effects of the pulse time algorithms
  - Center of Gravity ( pulse max +/- 3 time bins )
  - Inflection Point
- > Standard pulse from data
- > Change pulse height -> time walk
- > Change time offset -> binning effects

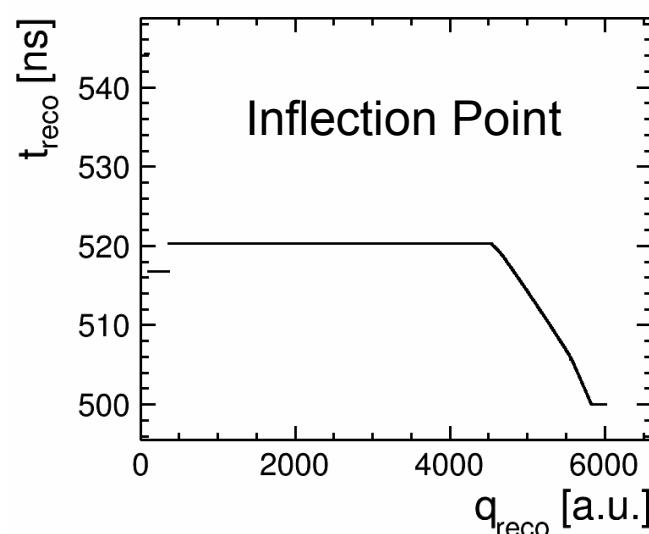
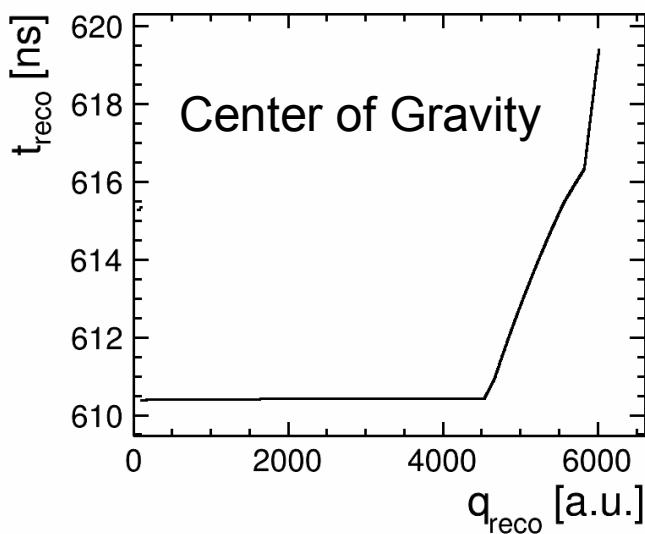


$$f(t) = a \cdot \exp(\kappa) \left( \frac{t-t_0}{\tau} \right)^\kappa \exp - \left( \kappa \frac{t-t_0}{\tau} \right) \Theta(t-t_0)$$

$t_0$  : time offset  
 $\tau$  : rise time  
 $\kappa$  : pulse width  
 $a$  : pulse height

# Time Walk

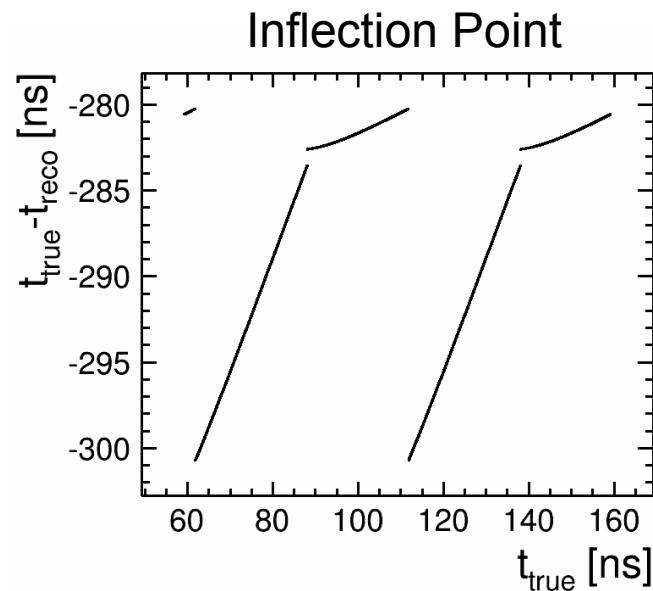
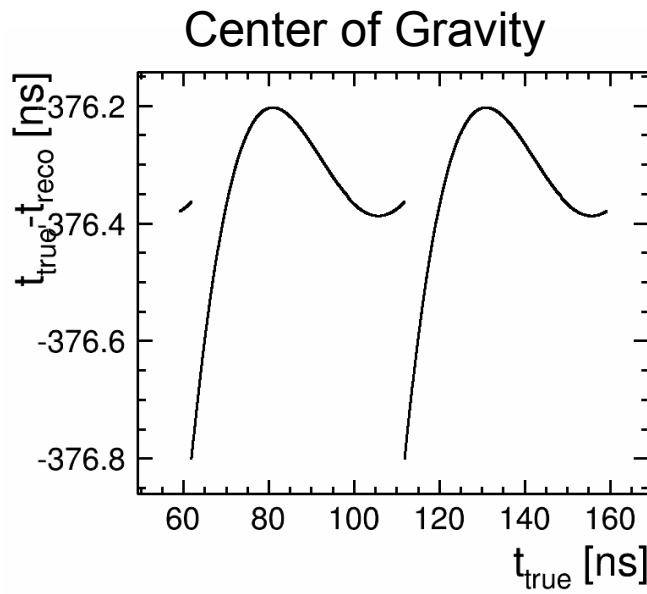
- The algorithms do not use a single fixed threshold
  - > no time walk effect visible
- Only over range pulses show bad behavior



# Binning effects

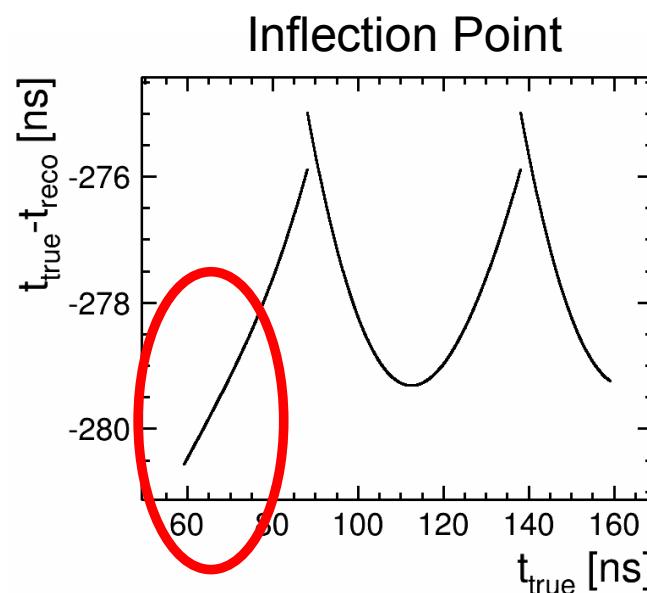
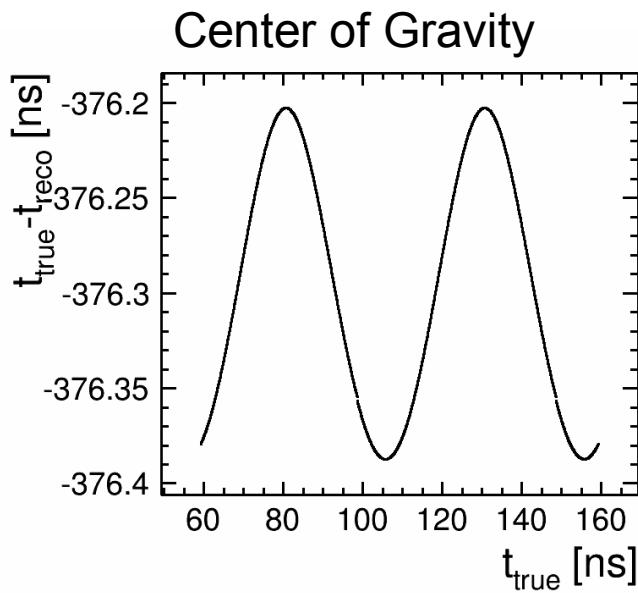
➤ Take into account bins which are higher than the threshold

- loose information of the bin before the threshold
- More stable when performed with pulse splitting



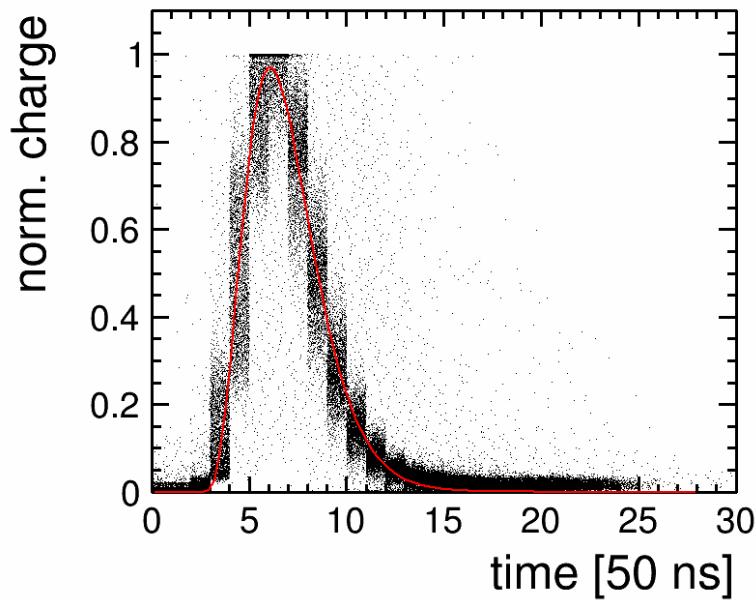
# Binning effects

- Take all bins into account (pre samples)
- Better time estimation, but problems when fewer pre samples are available (pulse splitting)



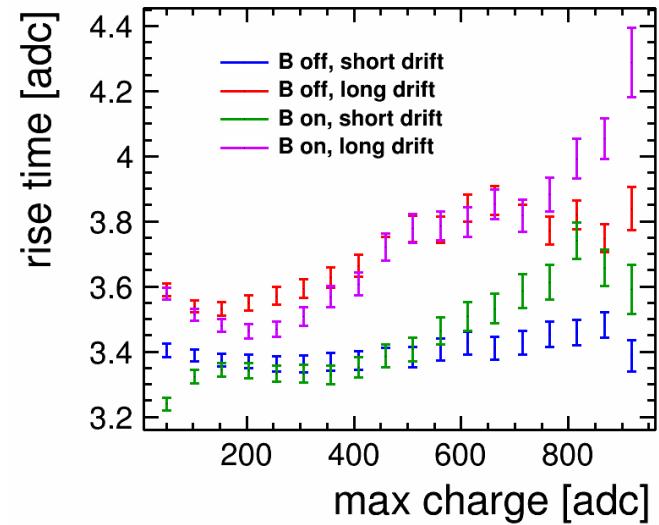
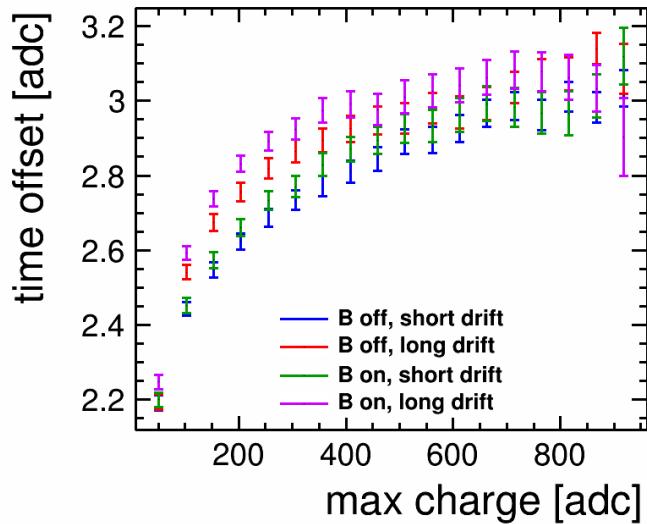
# Test Beam Data

- Difficult to get the effects from test beam data
- Try to create a standard pulse with different cuts
  - Charge of the pulse
  - Position of the pulse in the hit



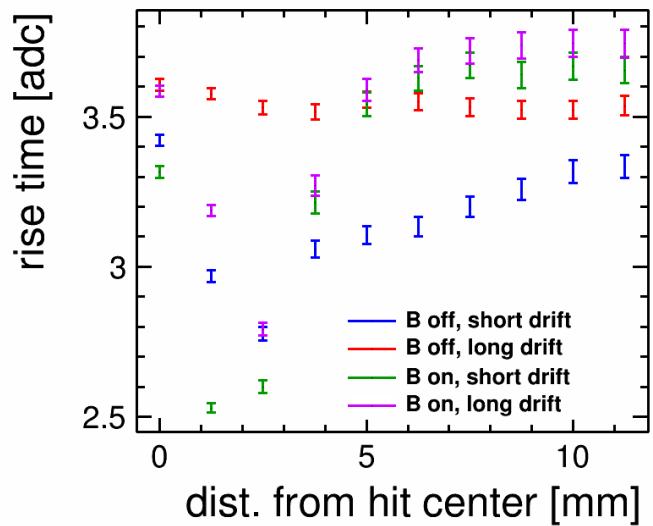
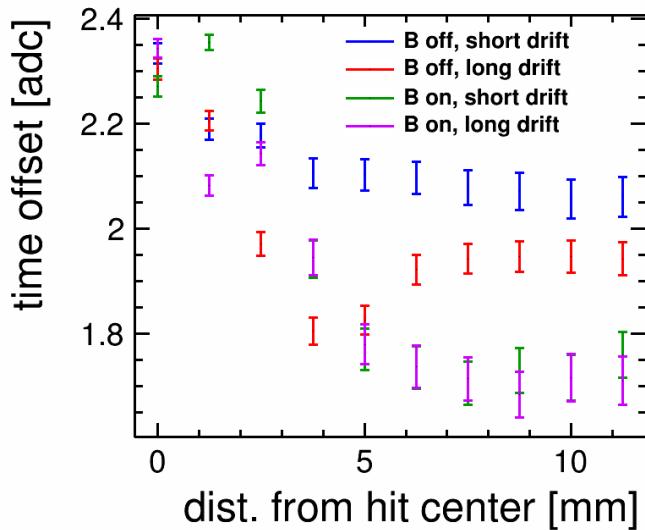
# Charge Dependency

- The rise time depends on the input signal shape
- Time offset shows clear dependency on the pulse charge
- Unfortunately, the results are not consistent with different drift distances or magnetic fields



# Position Dependency

- The outer pads don't collect electrons  
-> shape of the induced signal varies
- An influence on time offset and rise time can be seen
- Again, the drift distance and magnetic field change the results



# Summary

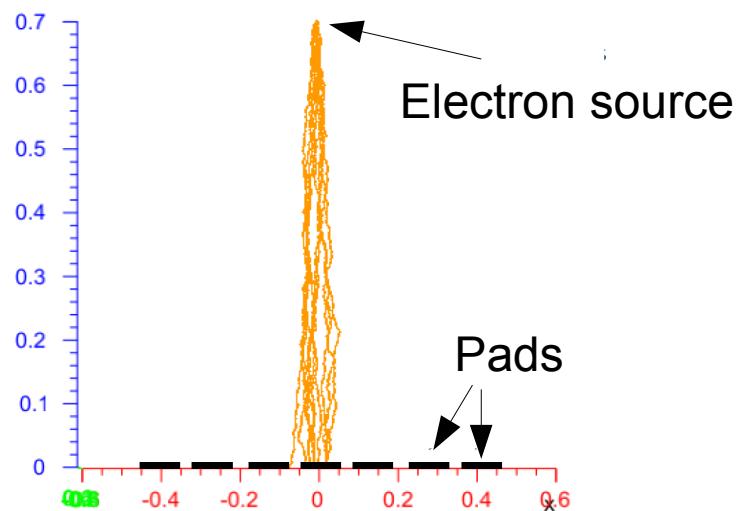
- > Center of gravity seems to be more stable than inflection point, but one must check point resolution performance
- > Pay attention when using the pulse finder
  - Parameter “SaveNBinsBeforeStart” might change your pulse time result
- > Perfect pulses: binning and time walk effects negligible
- > Reality: dependencies on charge and the position of the pulses visible



# Outlook

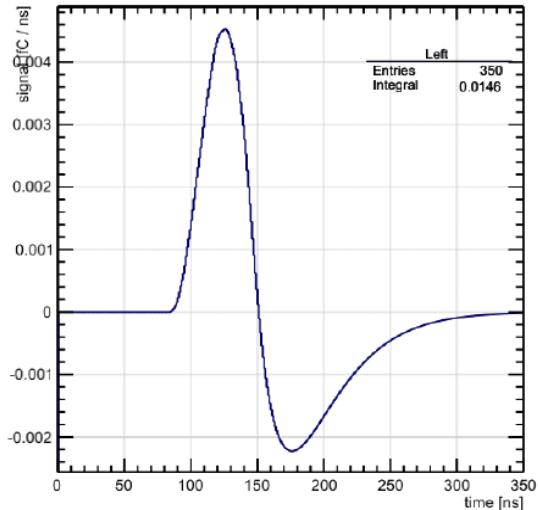
## > Simulation of signal induction in a GEM + pad readout (Oleksiy Fedorchuk)

- CST for calculation of electric and weighting field
- Garfield++ for electron drift in the GEM and signal induction on the Pad

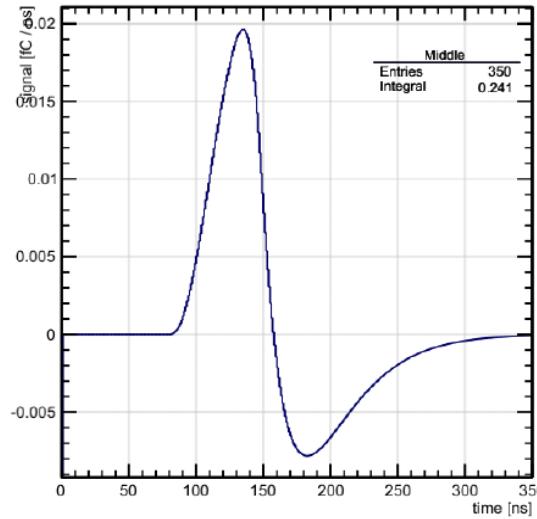


# Signal on Pads

Second Neighbor



First Neighbor



Central Pad

