Implementation of T_0 calculation with RS algorithm

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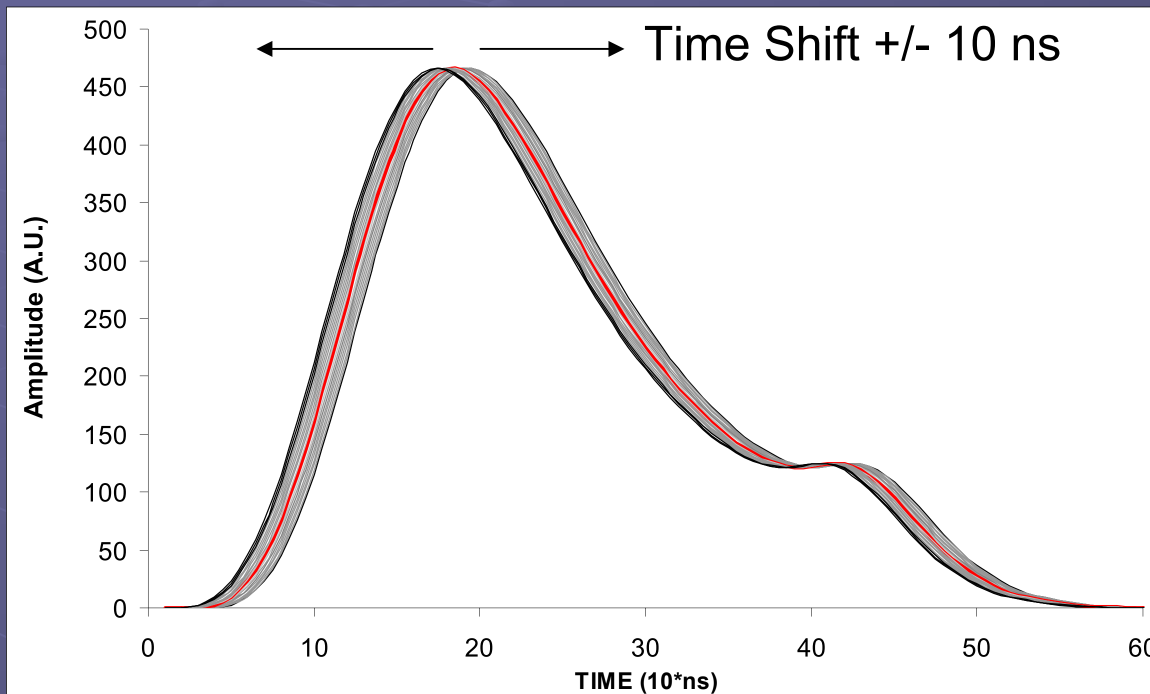
T0 determination with RS algorithm (Only very preliminary tests):

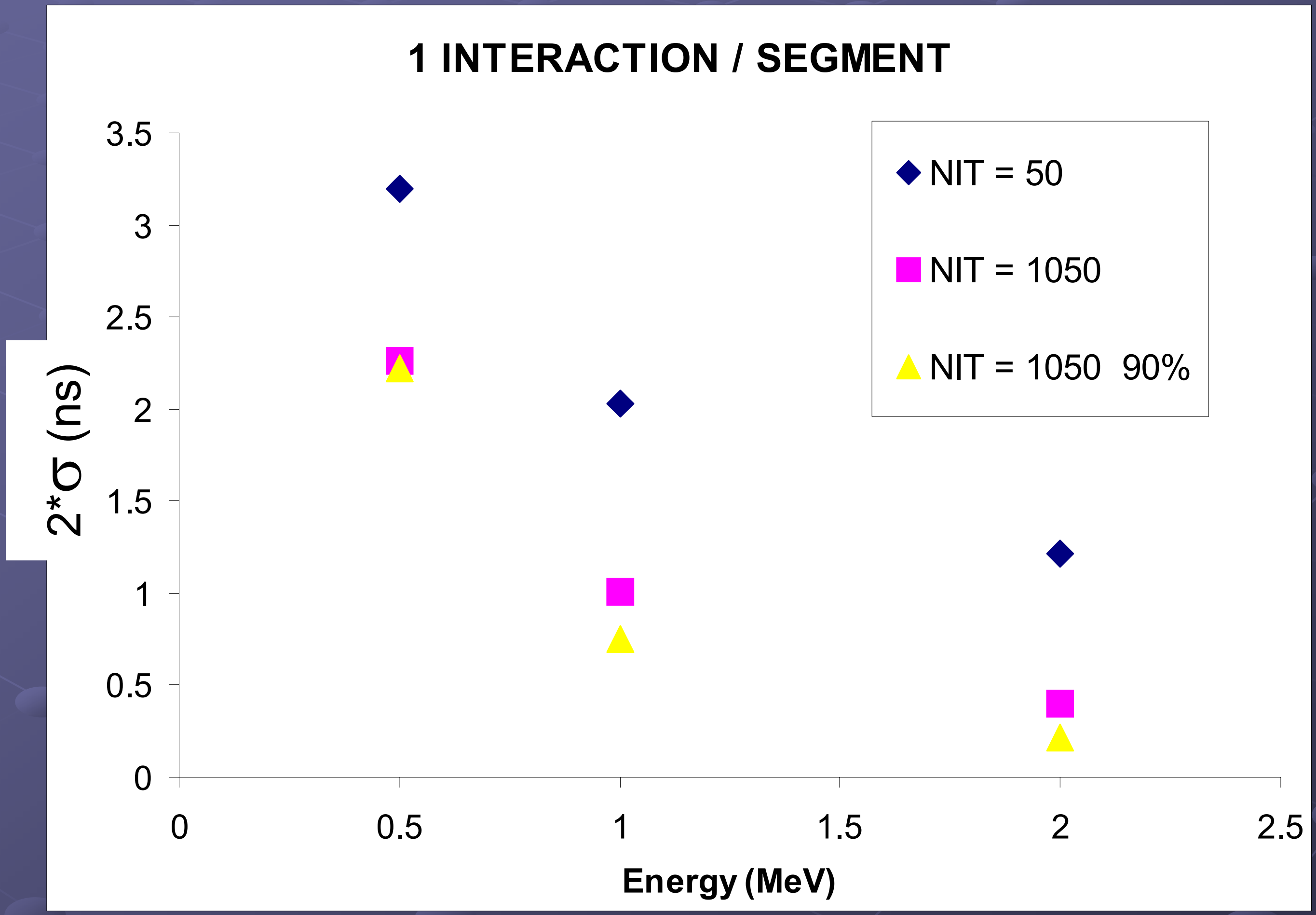
- Time shifted signals have been added in the basis



- From the decomposed signal we get:
  - r (radial coordinate)
  - N (number of interactions / segment)
  - t_0 (time shift of the basis elements that better reproduce the input signal)

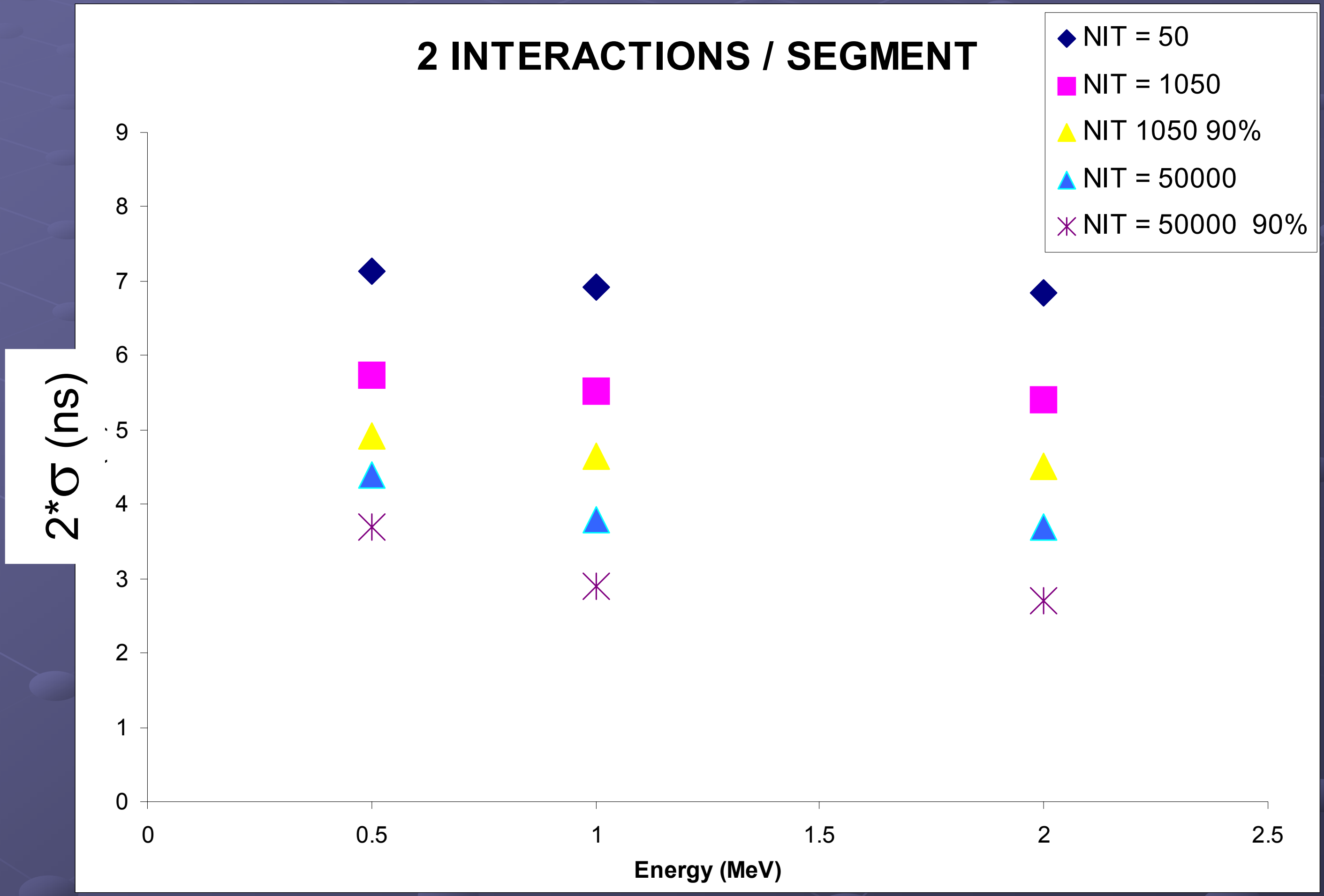
Simulated Single Interaction Events (1):

- 1 interaction, E_γ = 500 keV, 1 MeV, 2 MeV
- MGS signal basis + 10 keV FWHM gaussian noise + electronic chain response
- position is randomly chosen inside the detector volume
- Input signals are perfectly aligned (signal starting time t_s = 0)

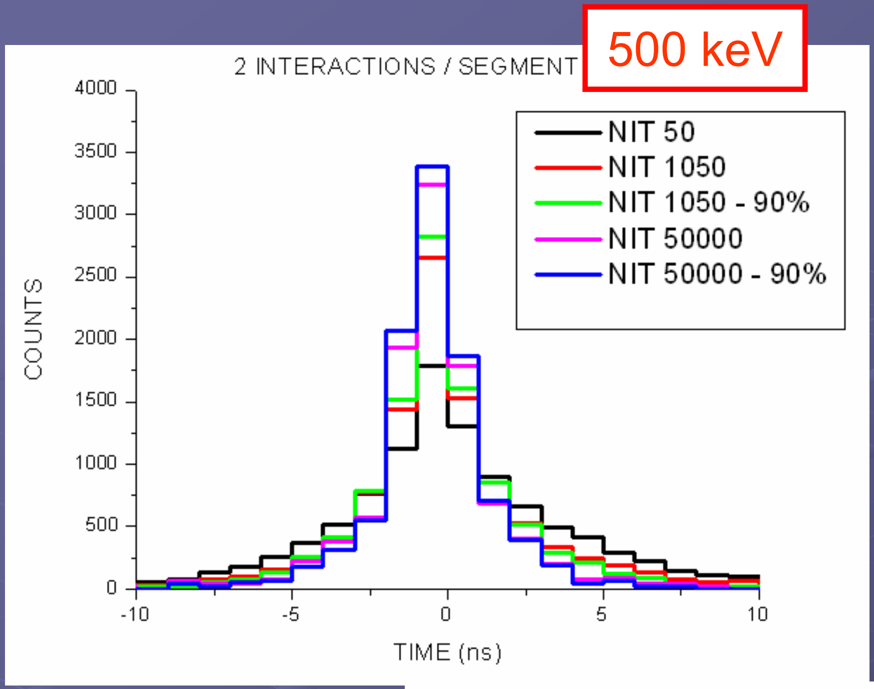


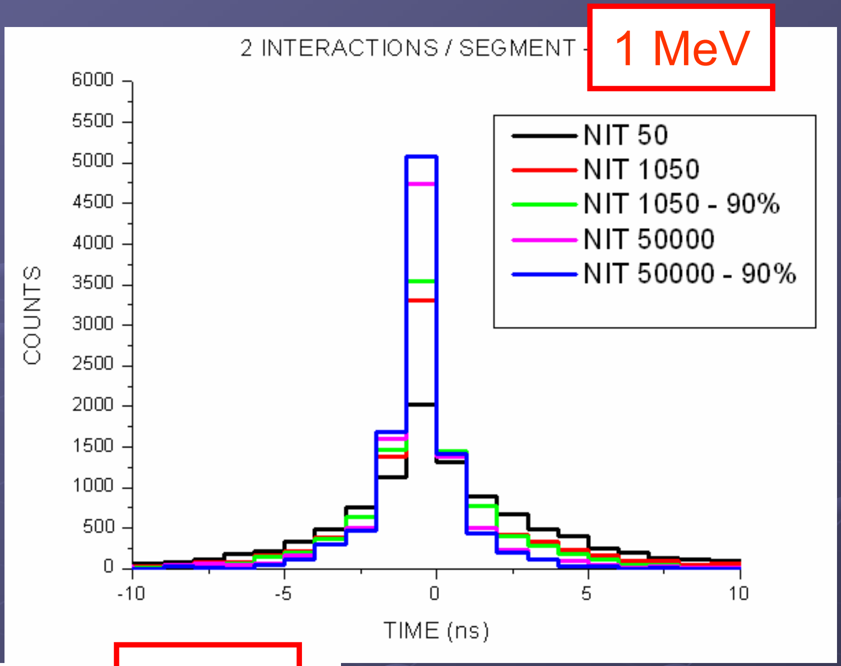
Simulated Double Interaction Events (2):

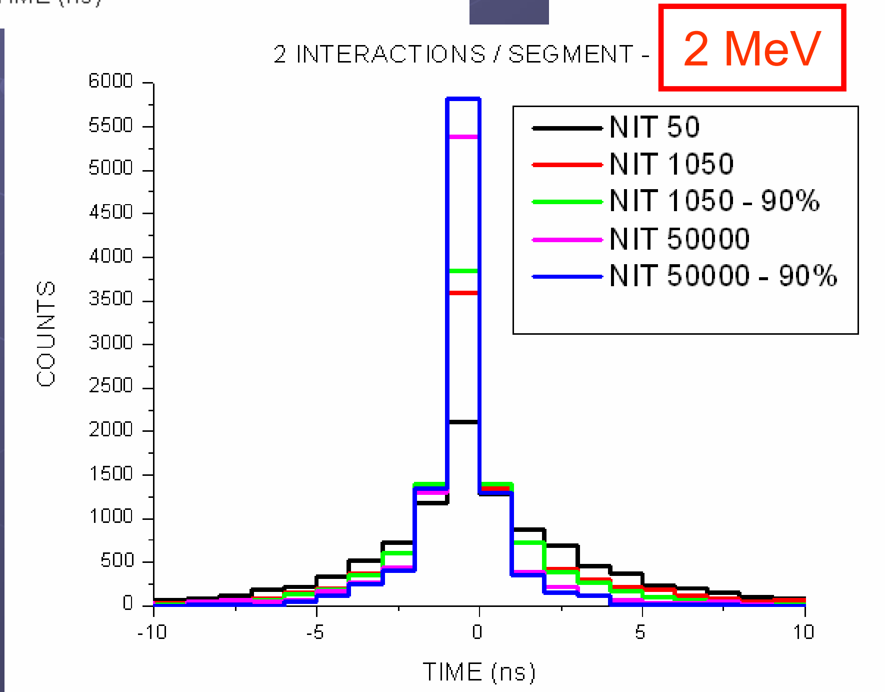
- 2 interaction in 1 detector segment, E_γ = 500 keV, 1 MeV, 2 MeV
- MGS signal basis + 10 keV FWHM gaussian noise + electronic chain response
- position is randomly chosen inside the detector volume
- Input signals are perfectly aligned (signal starting time t_s = 0)



Simulated Double Interaction Events (2):







(Preliminary) conclusions and Perspectives:

- Simple tests have been performed on set of simulates events with 1-2 hits per segment

- The width of the t_0 distributions range from 1-7 ns depending on:

  Gamma Energy
  Number of Interactions / segment
  CPU power

  Even small miss correspondences between the input signal and the reconstructed one can lead to t0 shifts of several ns!

→Test on real signals are mandatory to estimate the time resolution that can be reached with RS algorithm [additional effects (matching calculated / real detector position response) can have a relevant impact on the t_0 calculation performances]

→ An other technique will be tested: NO adding of time shifted elements in the signal basis, but instead associating to each position in the detector a correction factor determined a priori for the CFD timing