The contribution of Time Walk

$$\sigma_{\rm t}^2 = \sigma_{\rm Time \ Walk}^2 + \sigma_{\rm Landau \ Noise}^2 + \sigma_{\rm Distortion}^2 + \sigma_{\rm Jitter}^2 + \sigma_{\rm TDC}^2$$

In our work, the "Time Walk" term is dominated by Landau variation in signal amplitude:



The contribution of Landau Noise

$$\sigma_{\rm t}^2 = \sigma_{\rm Time \ Walk}^2 + \sigma_{\rm Landau \ Noise}^2 + \sigma_{\rm Distortion}^2 + \sigma_{\rm Jitter}^2 + \sigma_{\rm TDC}^2$$

In our work, the "Landau Noise" term is dominated by the non-uniform charge deposition and scatter effects:



The contribution of Distortion

$$\sigma_{\rm t}^2 = \sigma_{\rm Time \ Walk}^2 + \sigma_{\rm Landau \ Noise}^2 + \sigma_{\rm Distortion}^2 + \sigma_{\rm Jitter}^2 + \sigma_{\rm TDC}^2$$

In our work, the "Distortion" term is dominated by the non-uniform weighting field distribution which induce variations in signal shape as a function of the hit position.

In our work, we model an ideal planar detector to simulate the time resolution. It has uniform weighting field distribution. So the contribution of "Distortion" is not considered. (But we guess the influence could be neglected due to large electrode size up to 5mm*5mm scale)

The contribution of Jitter



In our work, the "Jitter" term is dominated by electric noise:





In the RASER tool, we add a random noise to the each signal pulse. The Noise PDF is from the measurement. So the jitter contribution is determined by N/(dV/dt) in our work.

The contribution of TDC



In our work, the "TDC" term is dominated by the finite size of the TDC bin of waveform:



We applied a same bin interval with sampling time step ($50ps/bin$ for 20 GSa/s) in Mea &
Sim, so we declare " consider it" in the simulation.
The reviewer say we need to define the TDC value. In the original submitted version, we think
it adds a contribution to time uncertainty equal to $\frac{50 \text{ ps}}{\sqrt{12}}$, but the reviewer say it is not correct.
We also check the definition of TDC in the below literature
"An Introduction to Ultra-Fast Silicon Detectors", p27, Sec 2.5.4
https://www.taylorfrancis.com/books/oa-mono/10.1201/9781003131946/introduction-ultra-fast-silicon-detectors-marco-ferrero-roberta-
arcidiacono-marco-mandurrino-valentina-sola-nicol%C3%B2-cartiglia
They also use the same definition of TDC term.
We sincerely hope the reviewer could give us more specific definition of TDC contribution
based on your understanding due to our limited knowledges if we make mistakes on this area