Study of the spatial resolution for binary readout detectors

In spatial resolution plots as a function of the width of diffusion cloud, bump structure is found.

\[
\left( \frac{\sigma_x}{\text{pitch}} \right)^2 = \text{Term 1} + \text{Term 2}
\]

To understand the behaviors, we divide the resolution form into 2 terms.

Left plots show the sum of Term1 and Term2 can correctly reproduce our independent simulation results for several conditions.

Physical interpretation:

Term 1: Diffusion effect. Monotonic increasing.

Term 2: Systematic effect. Bump structure.
Top: Newly developed formula to explain Term 2 behaviors

The formula derivation clarifies that periodic structure comes from the readout strip pitches.

Bottom: Comparing the formula with the actual Term 2. The discrepancy seen in the large diffusion region can be reasonably explained by the assumption used in the derivation.

This basic understanding could help ... 

- to optimize detector parameters,
- to bring ideas for new detectors.