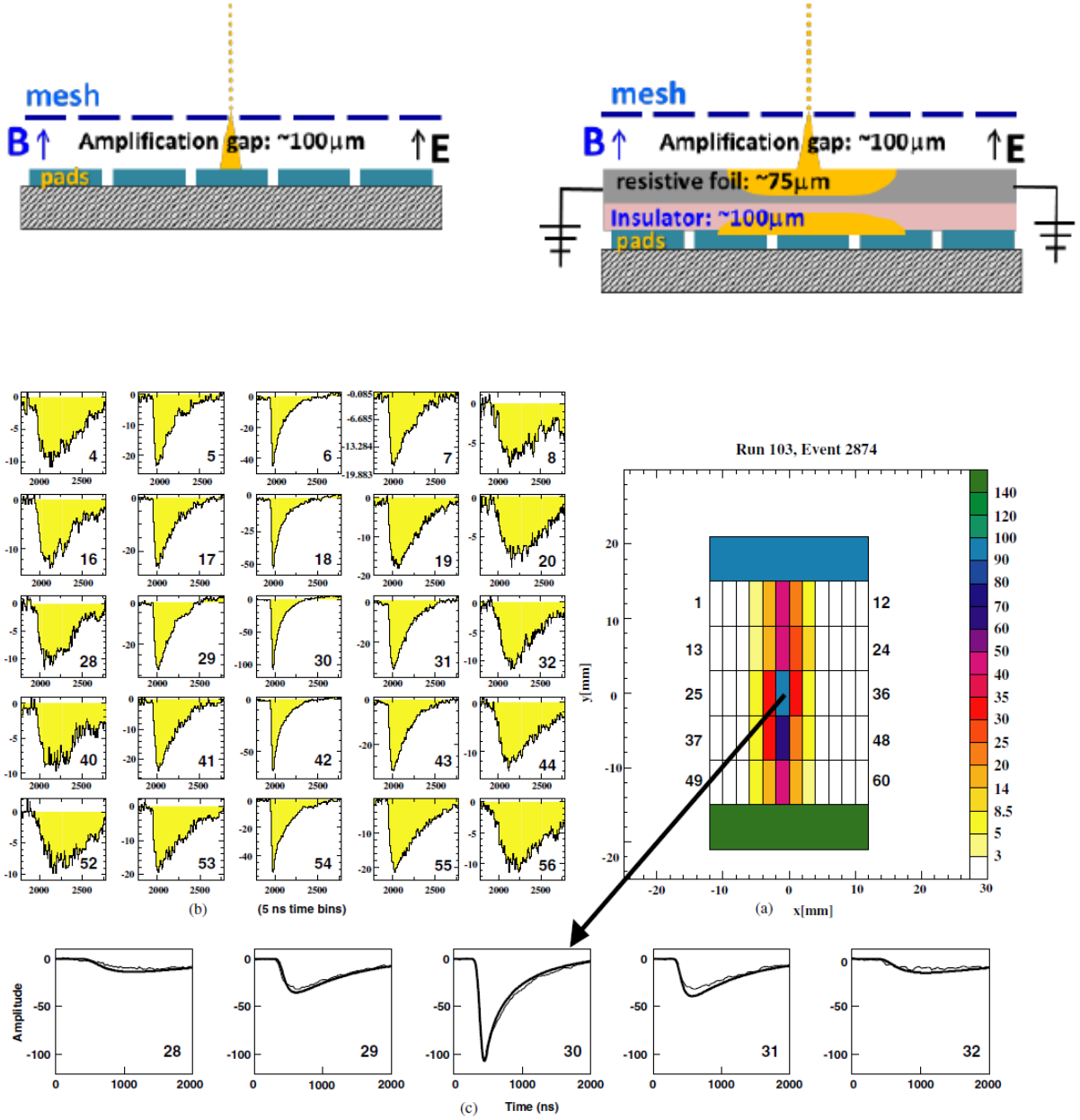
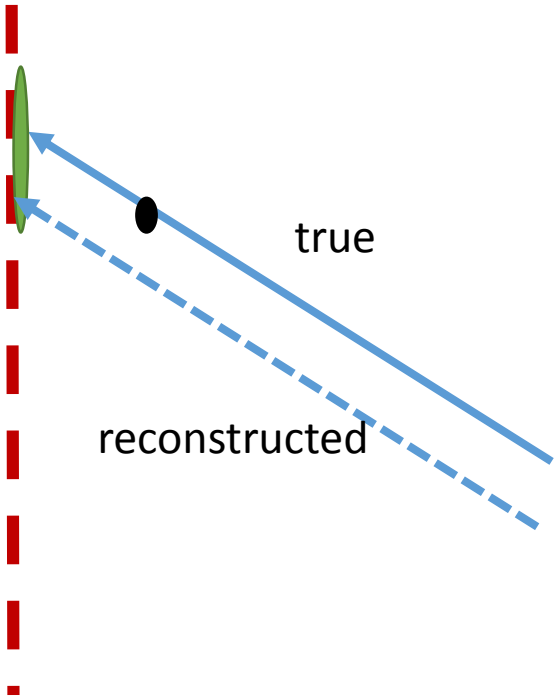
Resisitive MM TPC MC



- Resistive MM spreads the charge signal over several PADs
- Helps to improve point resolution
- But spread is not only to the sides but in 2D
- Could introduce relevant correlations
- Spreaded signal arrives later but not for tracks under and angle



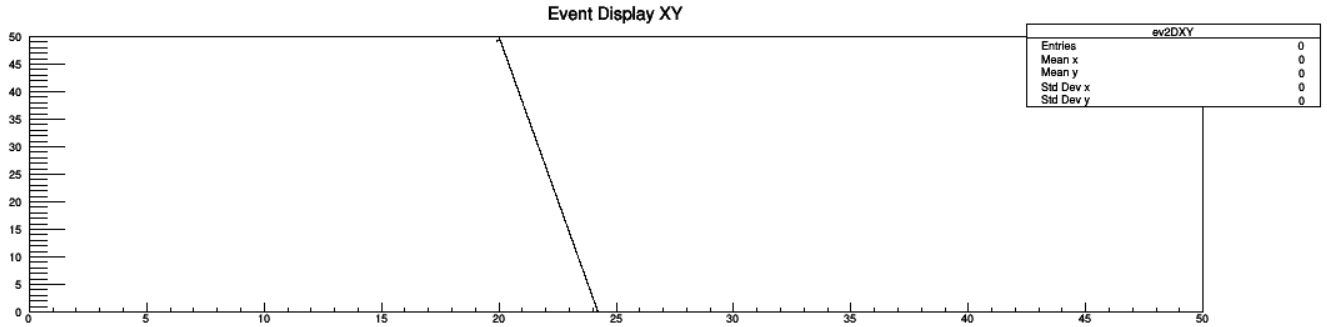
- If spread is faster than electron drift, track might be wrongly reconstructed
- For ILC TPC with small pads of 2x6 mm2 less an issue but T2K has almost rectangular pads of 9.6x7 mm2
- Not studied until now
- Idea: Develop MC to study this effect

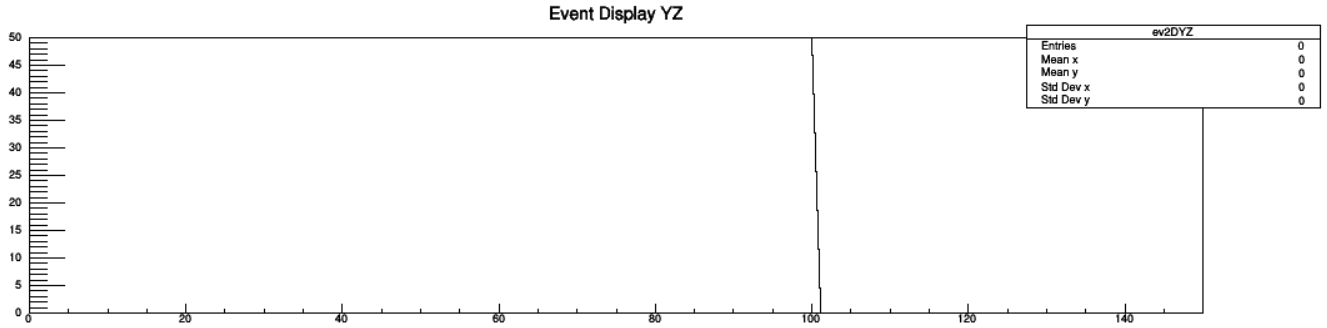
MC Concept

- Garfield++ framework as basis
- Magboltz to simulate gas properties for T2K gas at 0 and 0.2 T
- HEED to simulate gas ionization along a track
- Parametrizations for drift, gain and spread
- Parametrizations in own class

Steps

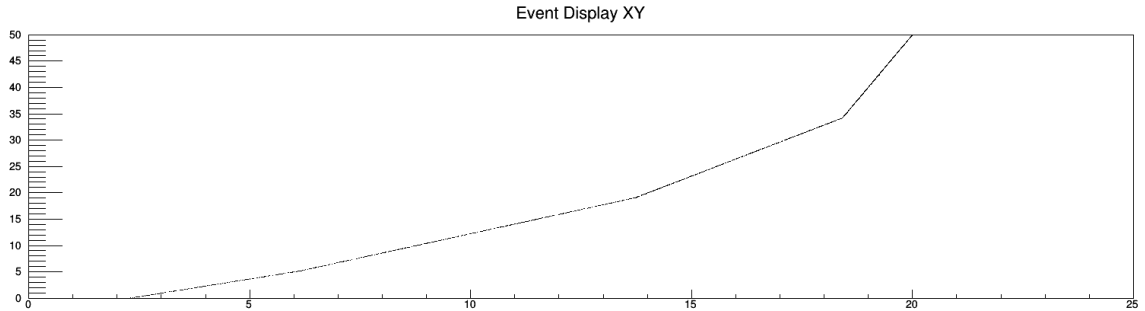
- Simulate track with HEED (fixed or random position and direction)
- Get back position and time of each electron released in ionization
- Simulate diffusion for each e- with Gaussian function with Magboltz input
- Simulate gain following a Polya distribution for each electron
- Spread gain electrons with 2D Gaussian over the anode plane

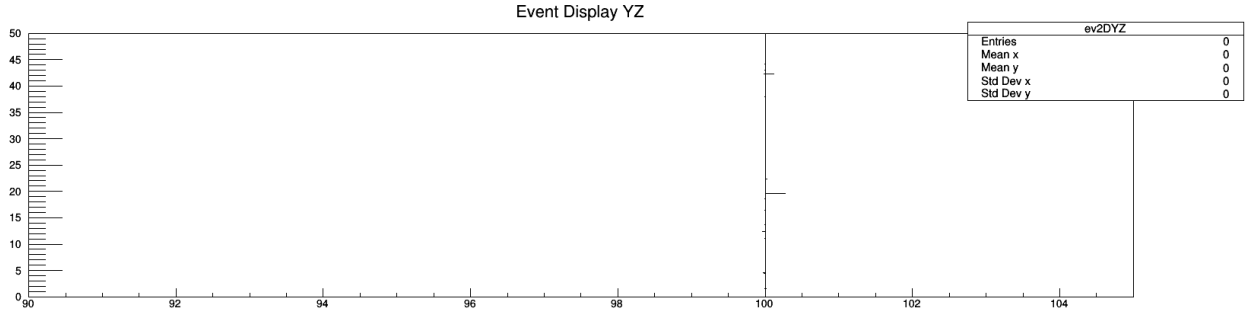




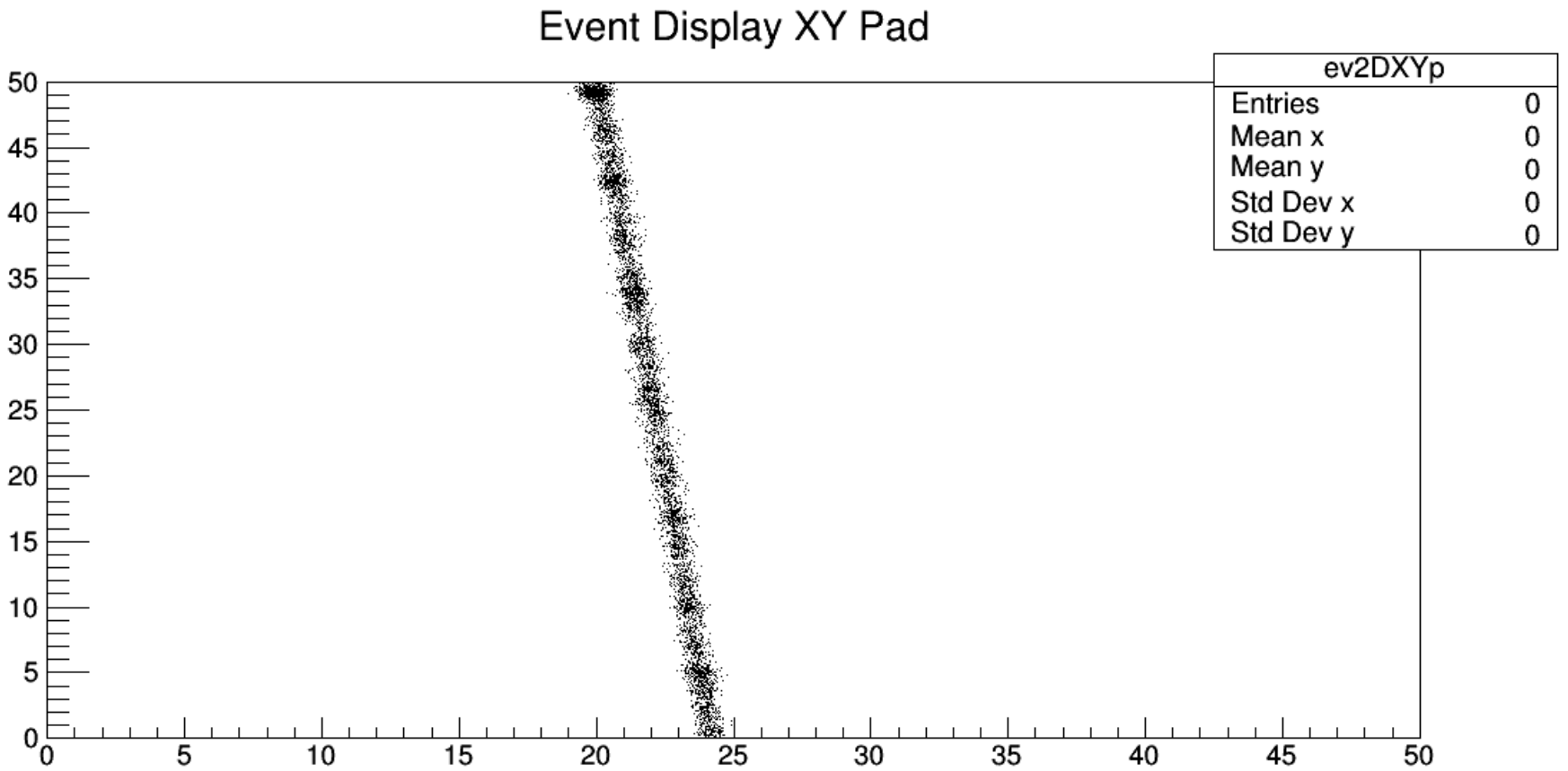
- HEED track very fine line at production point
- Straight for 0 T

- Switching on magnetic field in HEED provides tracks with edges
- Garfield++ team looks into it

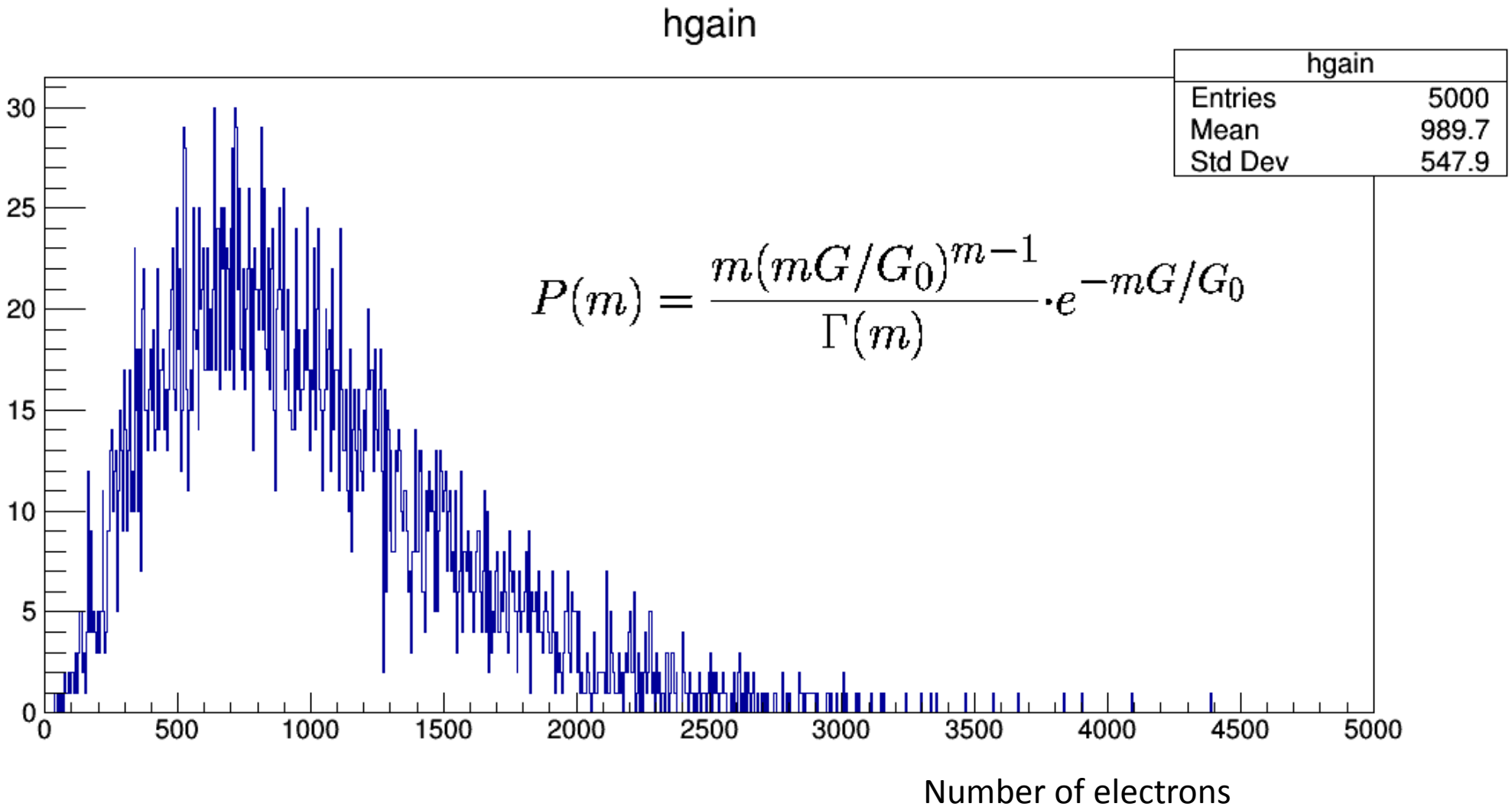




Event at Anode after Diffusion



Gain


hgain
hgain
Entries 5000
Mean 989.7
Std Dev 547.9
$P(m) = \frac{m(mG/G_0)^{m-1}}{\Gamma(m)} \cdot e^{-mG/G_0}$
0
5
10
15
20
25
30
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Number of electrons

Spread

Simulating the charge dispersion phenomena in Micro Pattern Gas Detectors with a resistive anode

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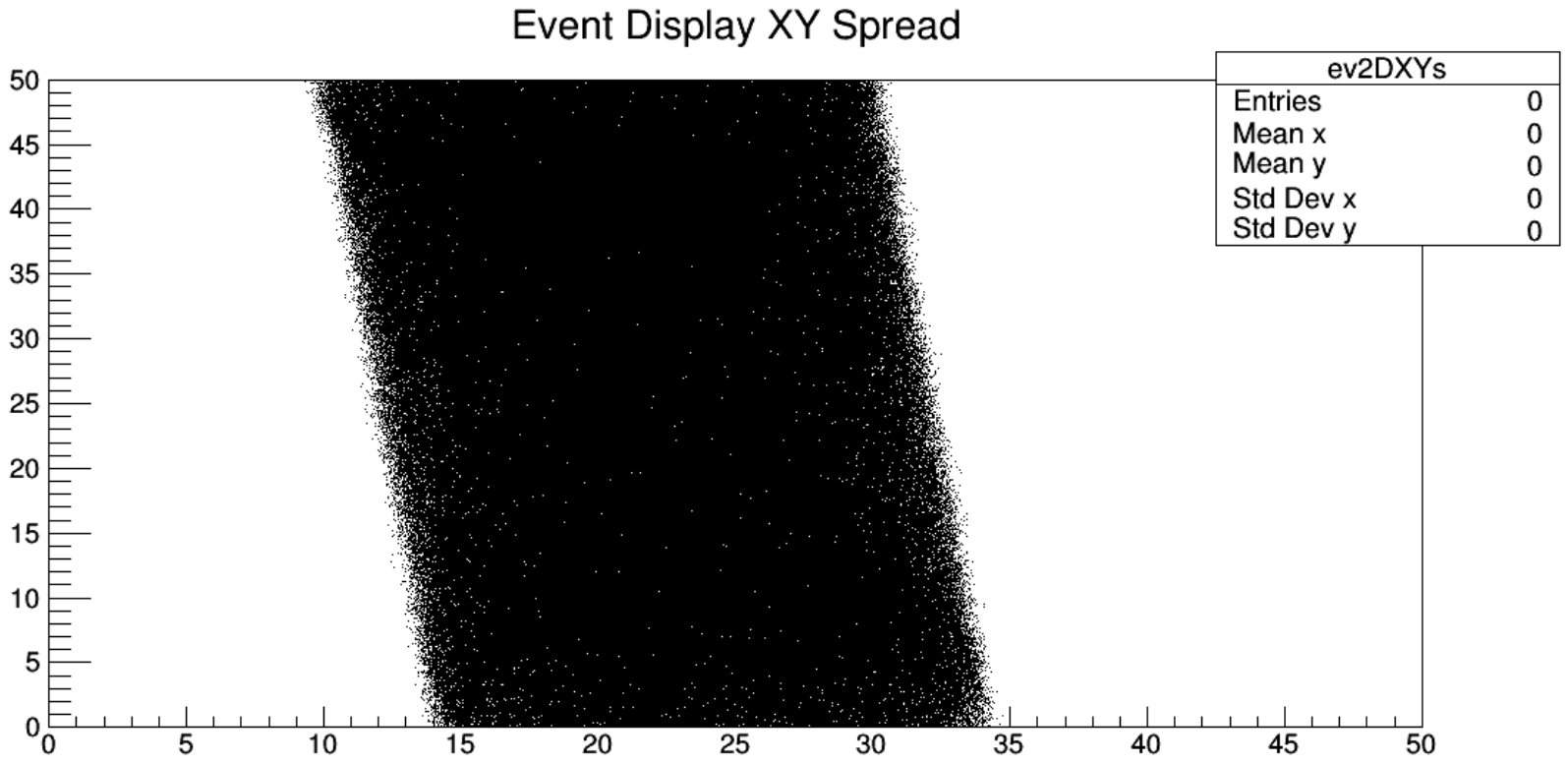
$$\rho_\delta(x,y,t) = \left(\frac{1}{2\sqrt{\pi th}}\right)^2 \exp\left[-\left(x^2+y^2\right)/4th\right].$$



- Following approach from M.S. Dixit
- Some issues here still with values of RC (=1/h)

Next Steps

- Sum for each pad and each time bin => digitize to create waveforms
- Apply thresholds to be closer to real case
- With this understand better issues with spread
- Add electronic noise ...
- ….