

# Diploma theme

## Straw modeling Garfield++

S. A. Bulanova<sup>1</sup>

<sup>1</sup>Saint Petersburg Polytechnic University

SPbSTU, March 2023

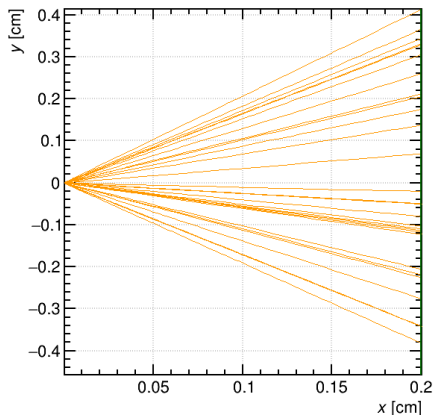
# Table of Contents

- 1 SPD setup
- 2 Before SPICE
- 3 Moment of 10 mV crossing
- 4 Charge problem

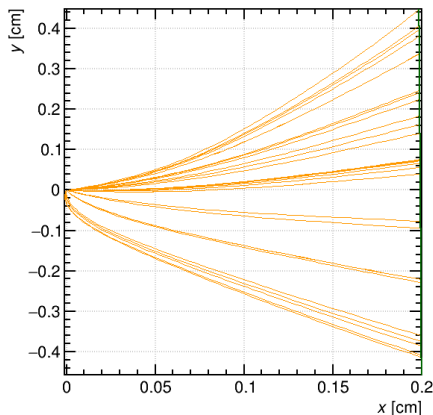
# Simulation parameters (SPD setup)

- 1 Straw diameter: 10 mm
- 2 Anode diameter: 30 mkm
- 3 HV: 1750
- 4 Gas mixture: Ar+CO<sub>2</sub> / 70:30 [%]
- 5 Gas mix temperature: 20 celsius
- 6 Ionization particle: muon 1 GeV (later we'll add other particles)
- 7 Track angle  $\alpha$ : 90, 14 degree. First, 90 degree, later add other trajectories
- 8 Magnetic field: 0, 1.0 Tesla – two setups
- 9 Penning effect is 0
- 10 Gas Gain is fixed  $= 4.5 \cdot 10^4$

# Drift Line Examples



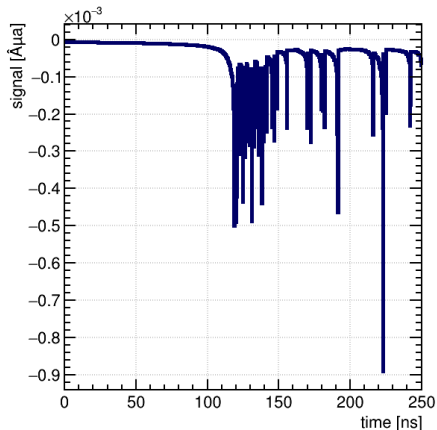
a)



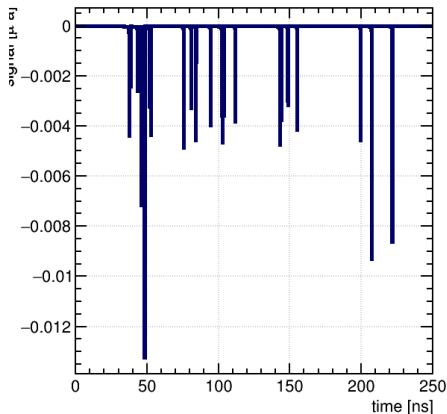
b)

**Figure:** (a) Drift lines for no field case (b) Drift lines for field case –  $0.6$  Tl, for example. Drift lines are twisted in magnetic field

# Signal Examples



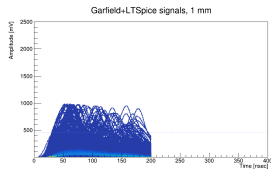
a)



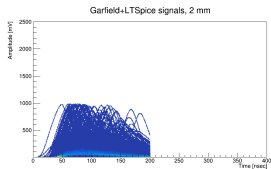
b)

**Figure:** (a) Signal induced on wire for no field case (b) Signal induced on wire for field case – 0.6 TI, for example

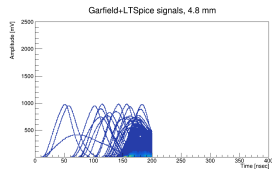
# Set of signals after SPICE, no Magnetic, compare distance



a)



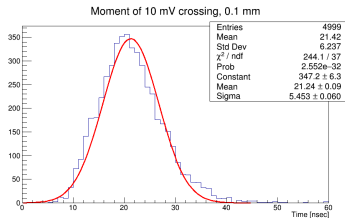
b)



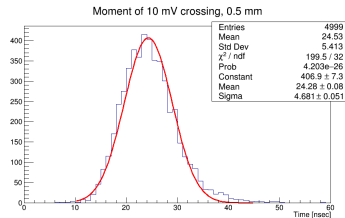
c)

Figure: (a) Distance 1 mm, (b) Distance 2 mm, (c) Distance 4.8 mm

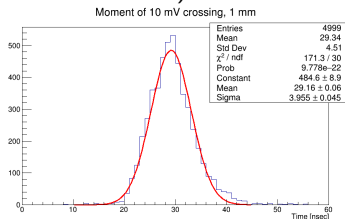
# Moment of 10 mV crossing



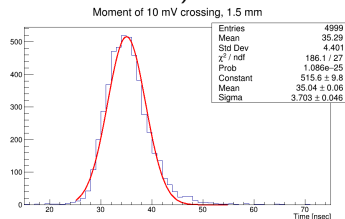
a)



b)



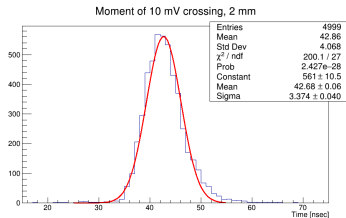
c)



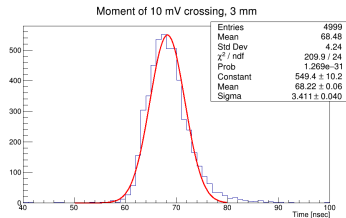
d)

Figure: (a) Distance 0.1 mm, (b) Distance 0.5 mm, (c) Distance 1 mm, (d) Distance 1.5 mm

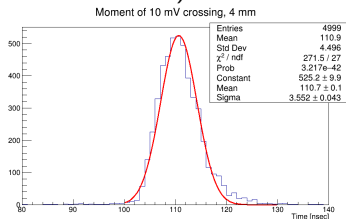
# Moment of 10 mV crossing (continue)



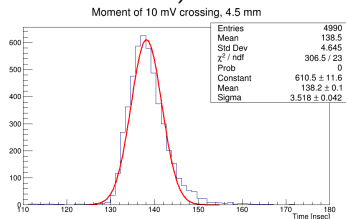
e)



f)



g)

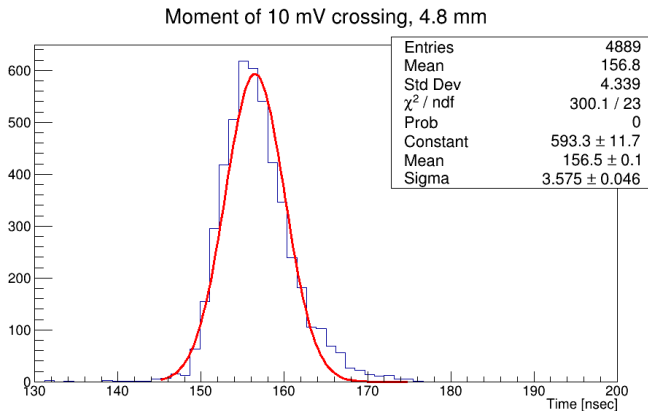


h)

Figure: (e) Distance 2 mm, (f) Distance 3 mm, (g) Distance 4 mm, (h) Distance 4.5 mm



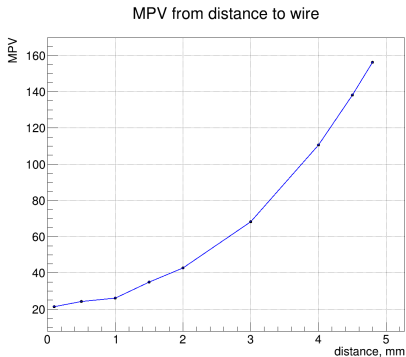
# Moment of 10 mV crossing (continue)



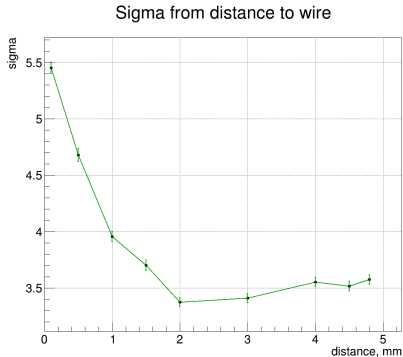
i)

Figure: (i) Distance 4.8 mm

# MPV & sigma from distance to wire



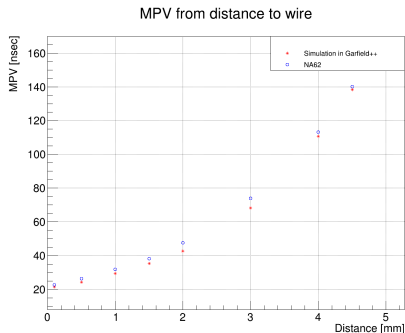
a)



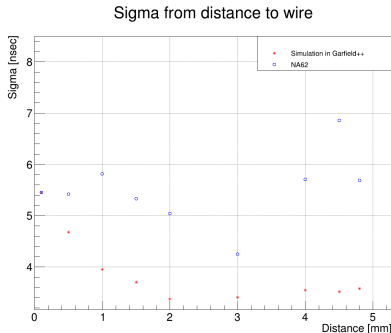
b)

Figure: (a) MPV from distance to wire (b) Sigma from distance to wire  
No mag. field, no angle case

# MPV & sigma from distance to wire, compare to NA62



a)

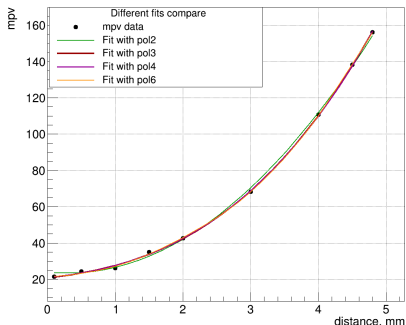


b)

**Figure:** (a) MPV from distance to wire (b) Sigma from distance to wire  
Compare to NA62. No mag. field, no angle case

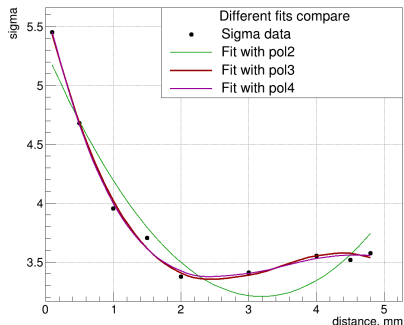
# MPV & sigma parametrisation

mpv from distance to wire, fits compare



a)

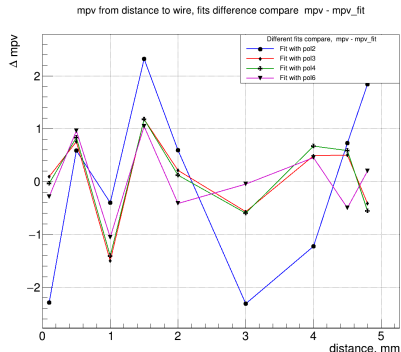
sigma from distance to wire, fits compare



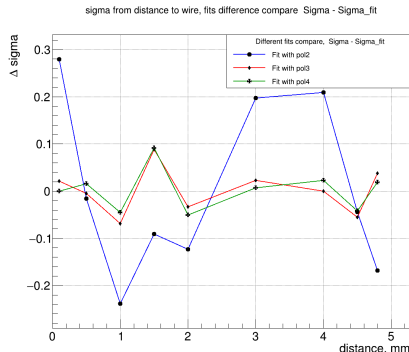
b)

Figure: (a) MPV from distance to wire parametrisation (b) Sigma from distance to wire parametrisation

# MPV & sigma parametrisation (continue)



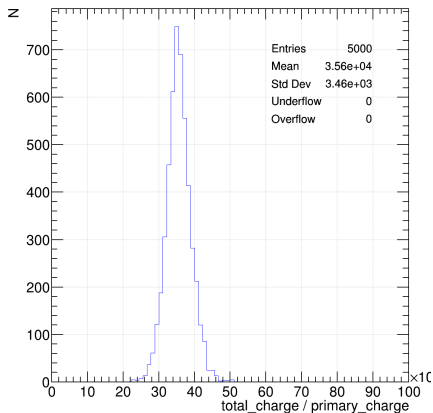
a)



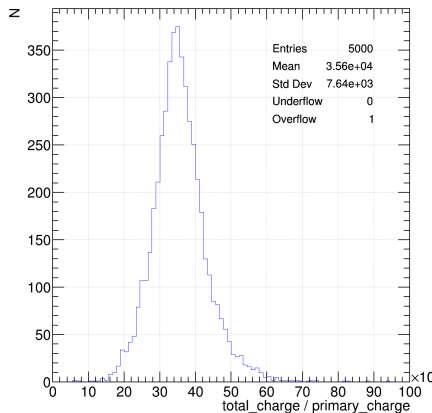
b)

Figure: (a)  $\Delta MPV = MPV_{model} - MPV_{fit}$  for different fitting functions (b)  $\Delta \sigma = \sigma_{model} - \sigma_{fit}$  for different fitting functions

# Charge problem. Trying to get total charge and number of primary clusters



a)



b)

Figure: Ratio of total charge to number of primary clusters (a) 2 mm (b) 4.8 mm