Diploma theme

Straw modeling Garfield++

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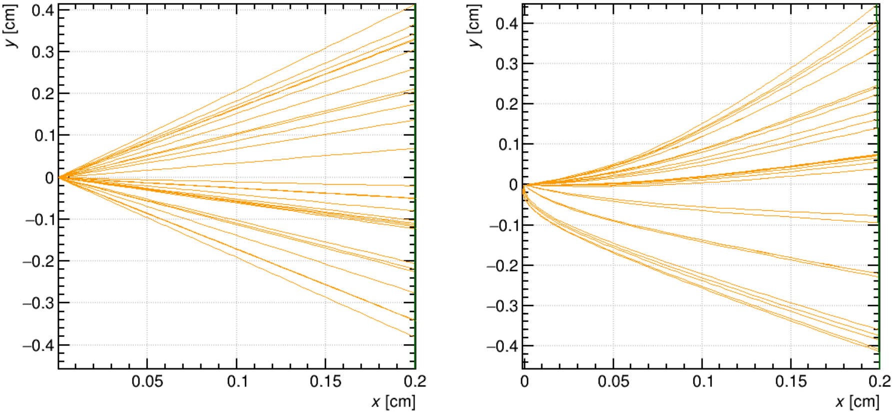
Simulation parameters (SPD setup)

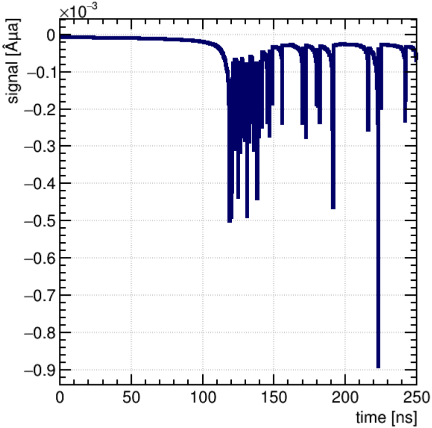
1. Straw diameter: 10 mm
2. Anode diameter: 30 mkm
3. HV: 1750
4. Gas mixture: Ar+CO2 / 70:30 [%]
5. Gas mix temperature: 20 celsius
6. Ionization particle: muon 1 GeV (later we'll add other particles)
7. Track angle α: 90, 14 degree. First, 90 degree, later add other trajectories
8. Magnetic field: 0, 1.0 Tesla – two setups
9. Penning effect is 0
10. Gas Gain is fixed $= 4.5 \cdot 10^4$



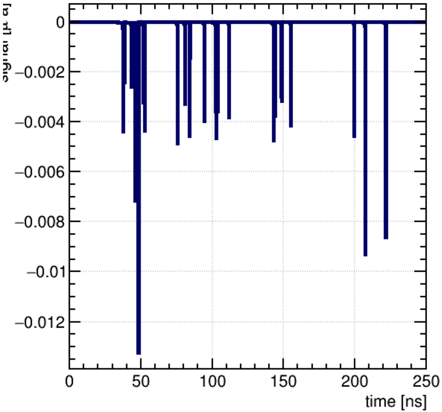
a) b)

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



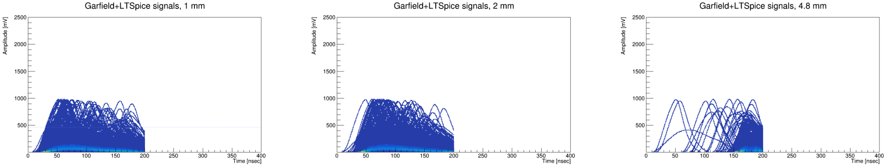
a)



b)

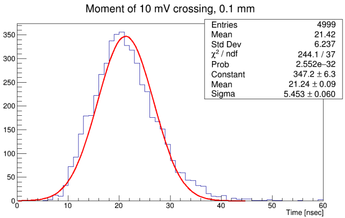
Figure: (a) Signal induced on wire for no field case (b) Signal induced on wire for field case – 0.6 Tl, for example

Set of signals after SPICE, no Magnetic, compare distance

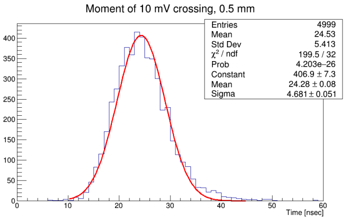


a) b) c)

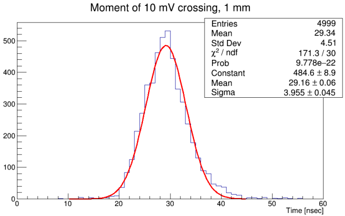
Figure: (a) Distance 1 mm, (b) Distance 2 mm, (c) Distance 4.8 mm



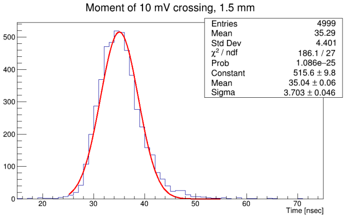
a)



b)



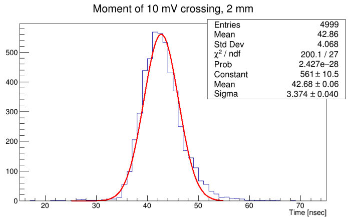
c)



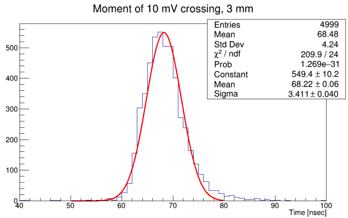
d)

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

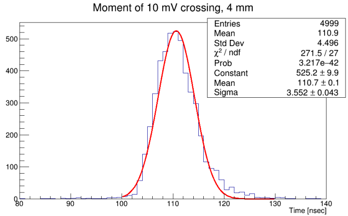
Moment of 10 mV crossing (continue)



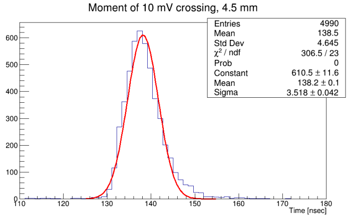
e)



f)



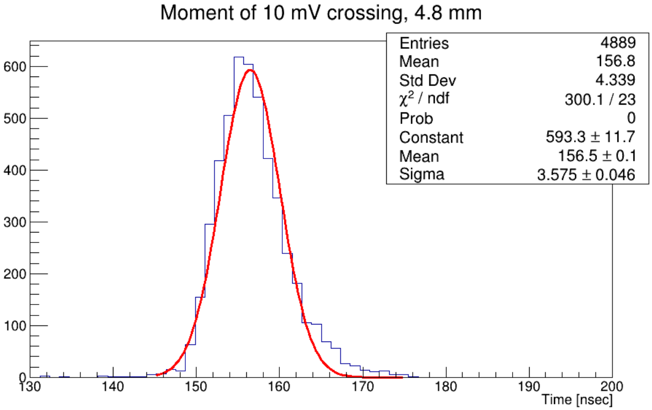
g)



h)

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

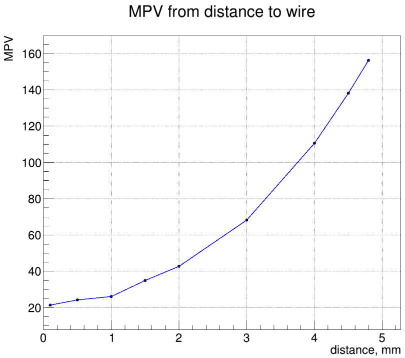
Moment of 10 mV crossing (continue)



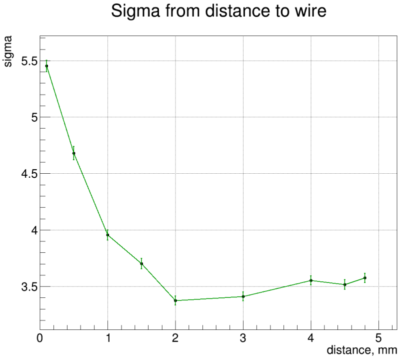
i)

Figure: (i) Distance 4.8 mm

MPV & sigma from distance to wire



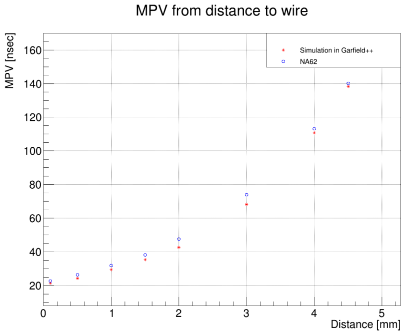
a) No noises



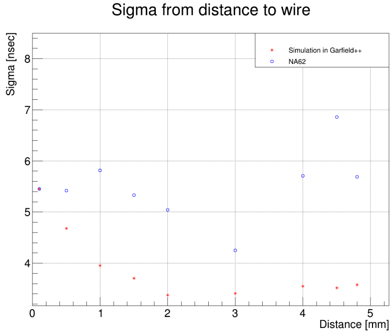
b) No noises

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



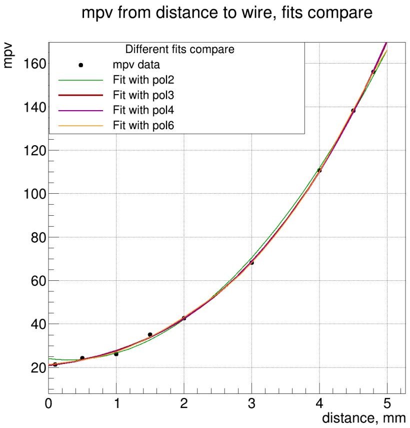
a)



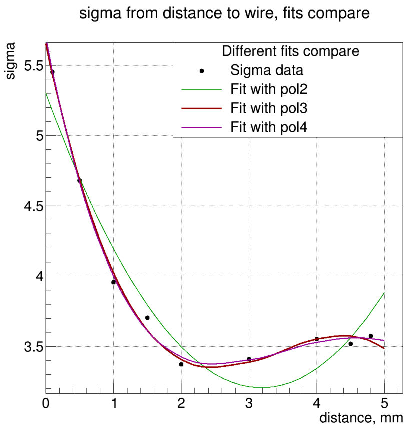
b)

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

MPV & sigma parametrisation

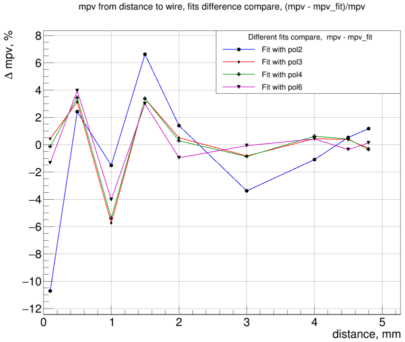


a) No noises

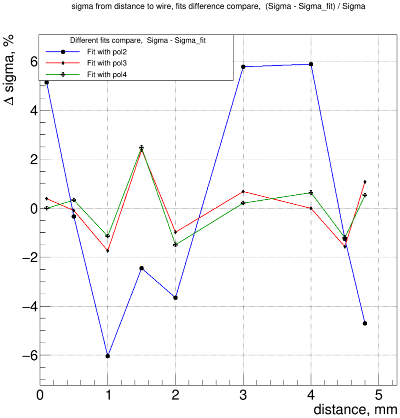


b) No noises

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



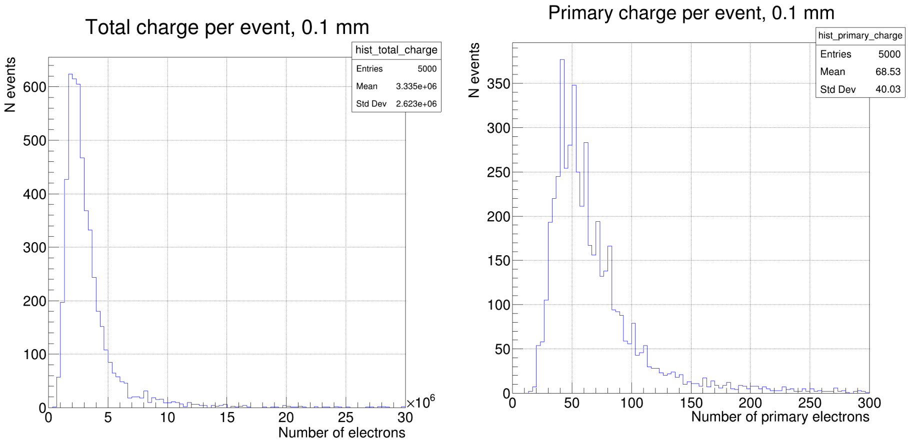
a) No noises



b) No noises

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. Getting total charge and number of primary electrons

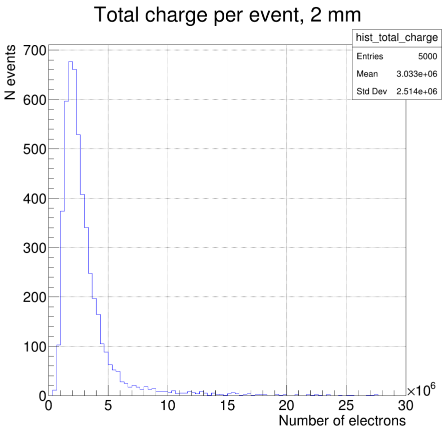


a) total charge, 0.1 mm

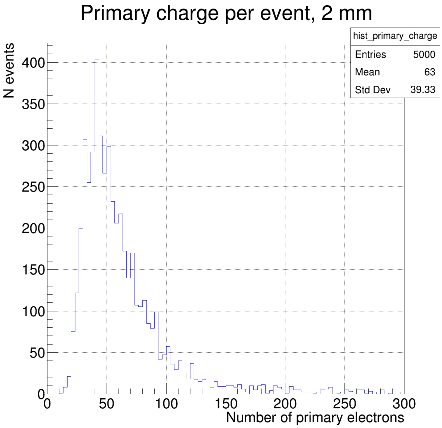
b) number of primary electrons, 0.1 mm

Figure: Total charge vs number of primary clusters, 0.1 mm distance

Charge problem. Getting total charge and number of primary electrons (continue)



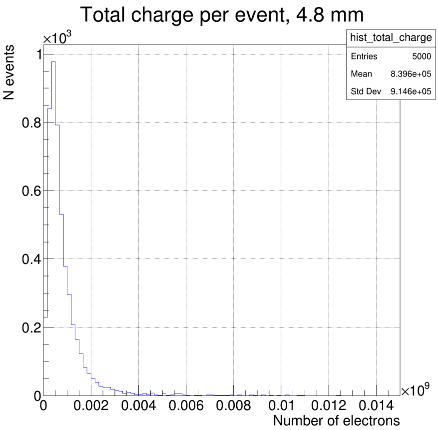
a) total charge, 2 mm



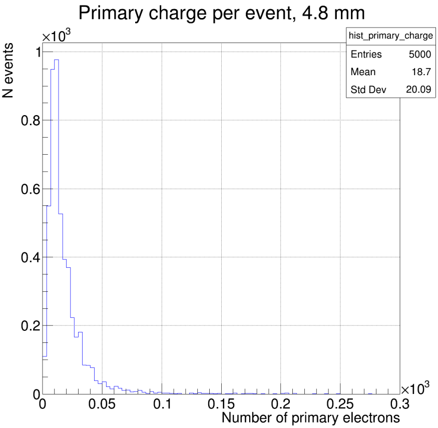
b) number of primary electrons, 2 mm

Figure: Total charge vs number of primary clusters, 2 mm distance

Charge problem. Getting total charge and number of primary electrons (continue)



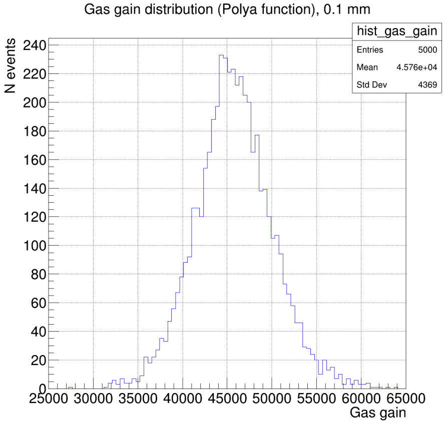
a) total charge, 4.8 mm



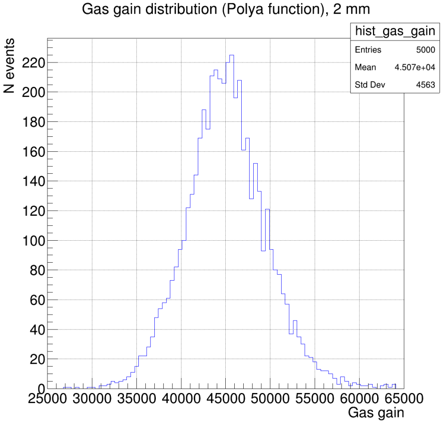
b) number of primary electrons, 4.8 mm

Figure: Total charge vs number of primary clusters, 4.8 mm distance

Gas gain: $4.5 \cdot 10^4$



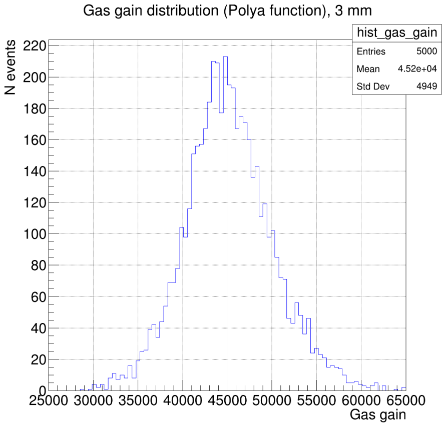
a) gas gain, 0.1 mm



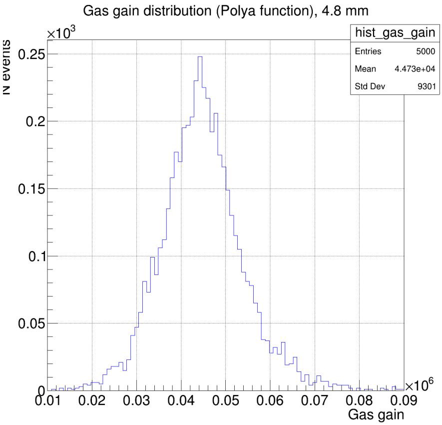
b) gas gain, 2 mm

Figure: Gas gain for different distances

Gas gain: $4.5 \cdot 10^4$ (continue)



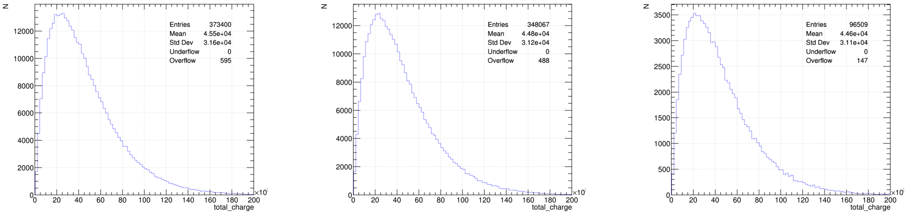
c) gas gain, 3 mm



d) gas gain, 4.8 mm

Figure: Gas gain for different distances

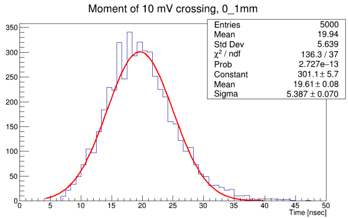
Number of total electrons per one primary electron



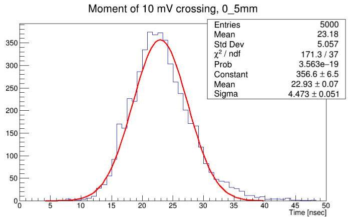
a) 0.1 mm b) 2 mm c) 4.8 mm

Figure: Number of total electrons per one primary electron (ne)

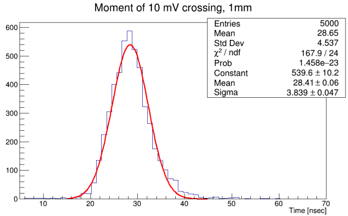
Moment of 10 mV crossing, magnetic



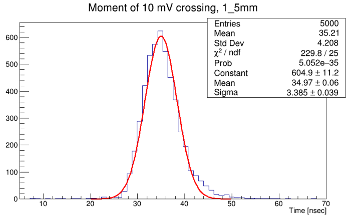
a)



b)



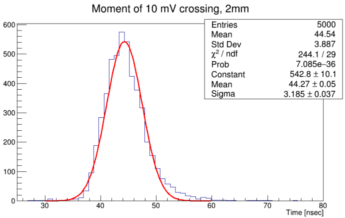
c)



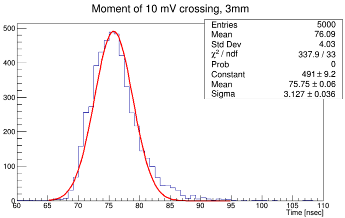
d)

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

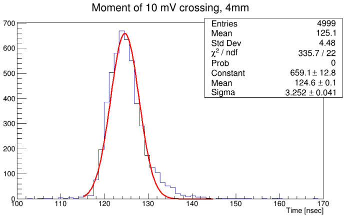
Moment of 10 mV crossing, magnetic (continue)



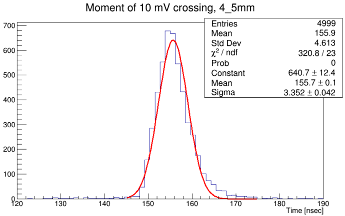
e)



f)



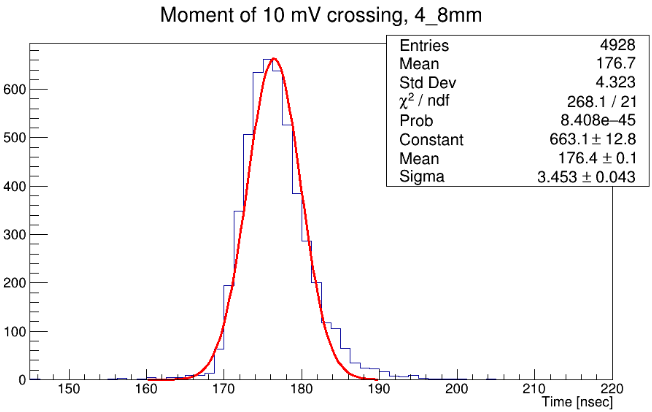
g)



h)

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

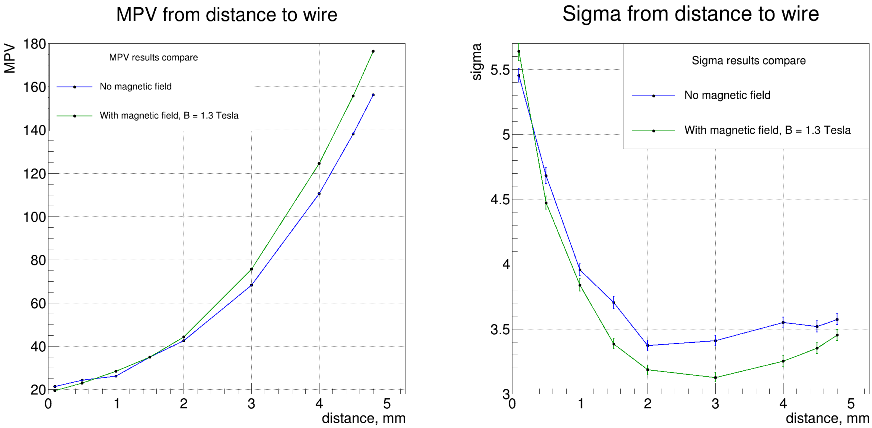
Moment of 10 mV crossing, magnetic (continue)



i)

Figure: (i) Distance 4.8 mm

MPV & sigma with field 1.3 Tesla

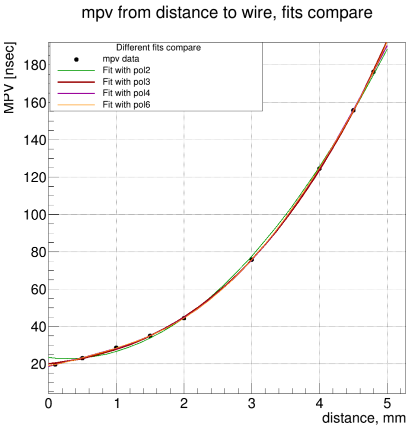


a) No noises

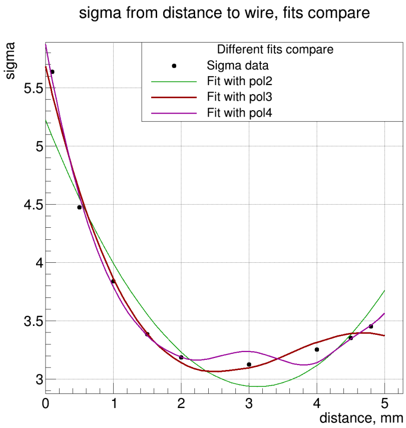
b) No noises

Figure: (a) MPV (nsec) from distance to wire, B = 1.3 Tl (b) Sigma from distance to wire, B = 1.3 Tl

MPV & sigma parametrisation (B = 1.3 Tesla)



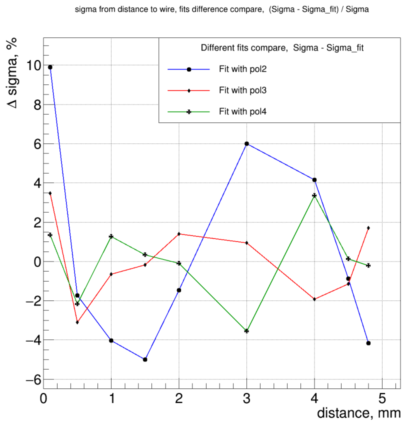
a) No noises

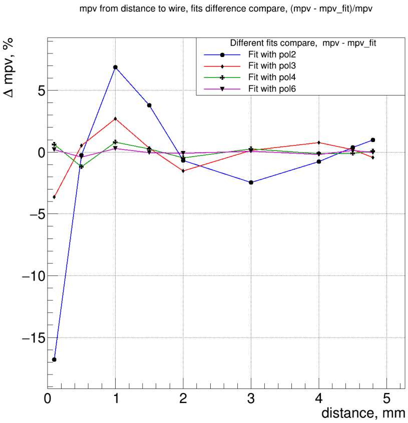


b) No noises

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

MPV & sigma parametrisation (B = 1.3 Tesla) (continue)





a) No noises

b) No noises

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