Scintillator Signal & Background at e-LASER IP

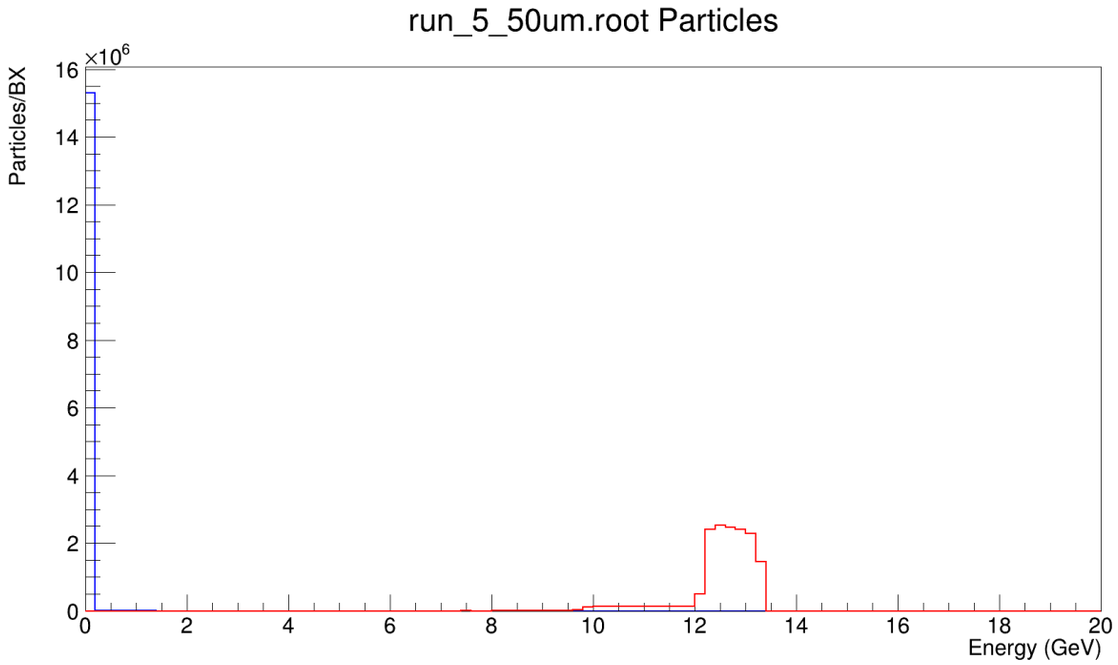
John Hallford

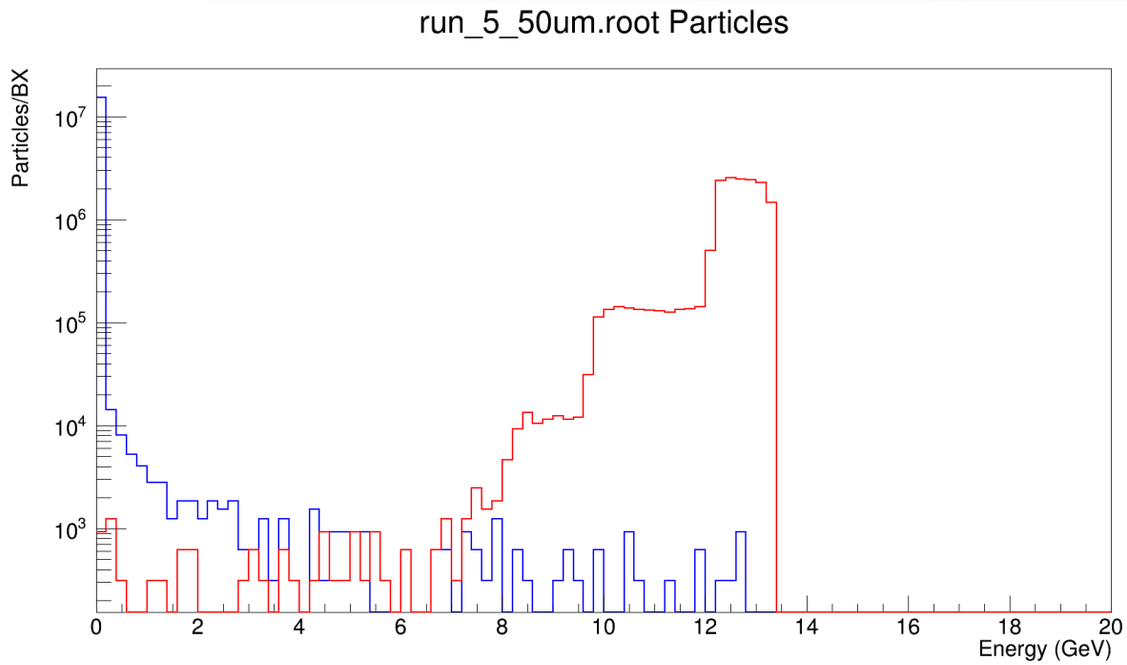
University College London

29/10/2020

LUXE

DESY.





Blue - 'Background'

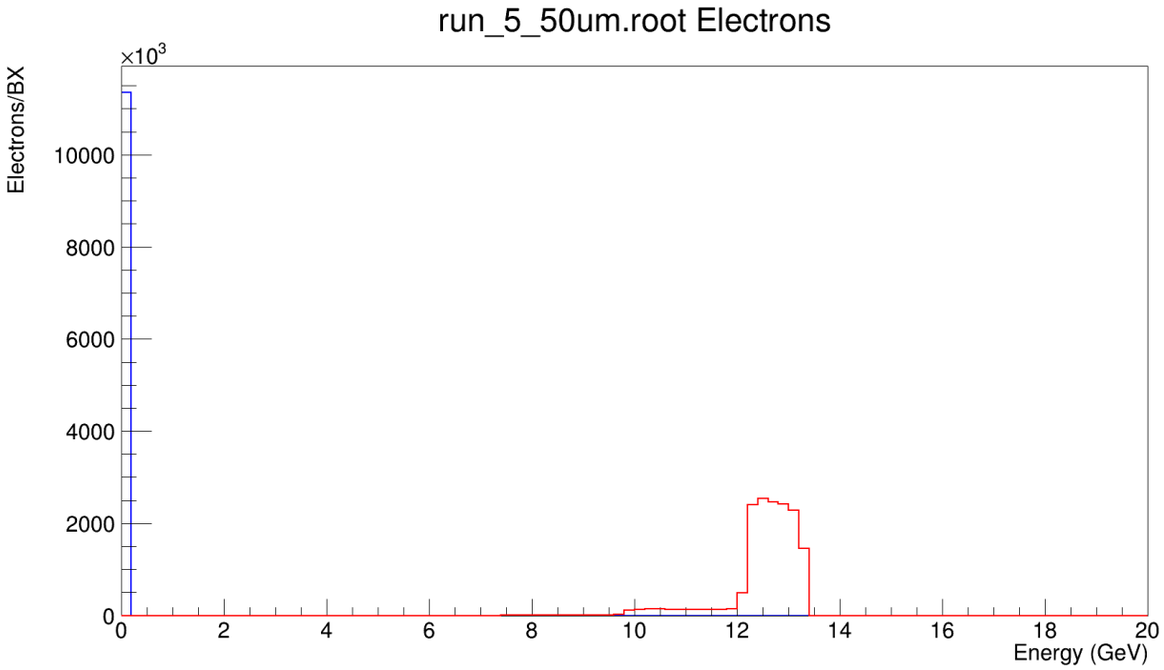
Red - 'Signal'

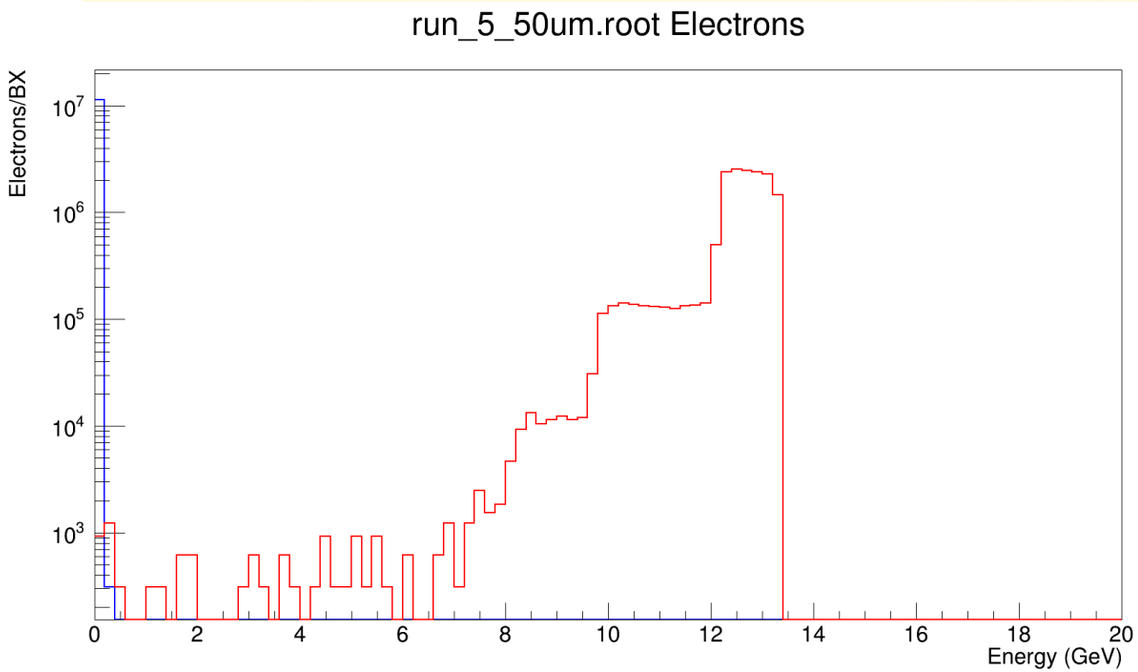
All Bkg – 1.535 x 10^7

All Sig – 1.566 x 10^7

Low xi_{max} = 0.31,

w_0 = 50 µm, n_{BX} = 485





Blue - 'Background'

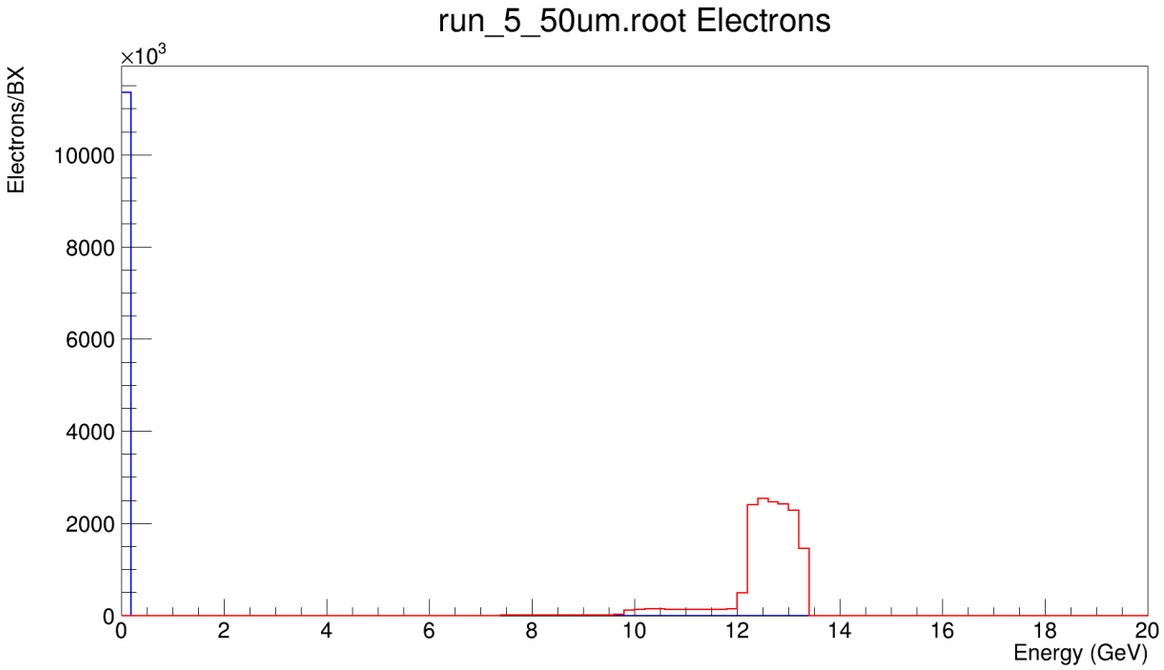
Red - 'Signal'

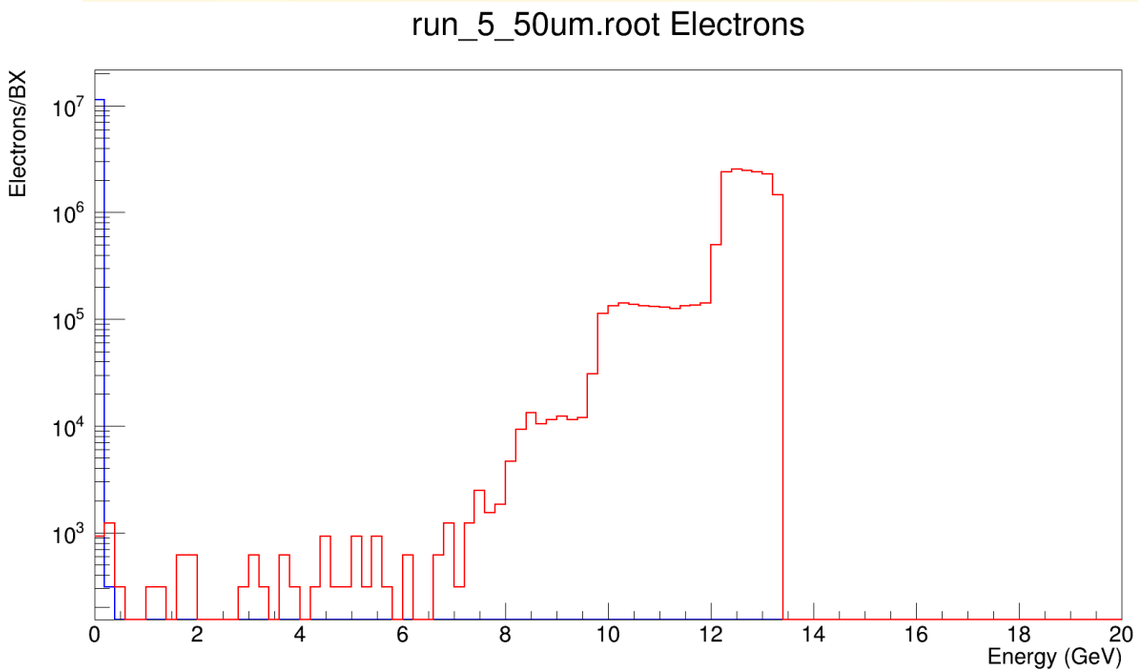
e^- Bkg – 1.135 x 10^7

e^- Sig – 1.566 x 10^7

Low xi_{max} = 0.31,

w_0 = 50 µm, n_{BX} = 485





Blue - 'Background'

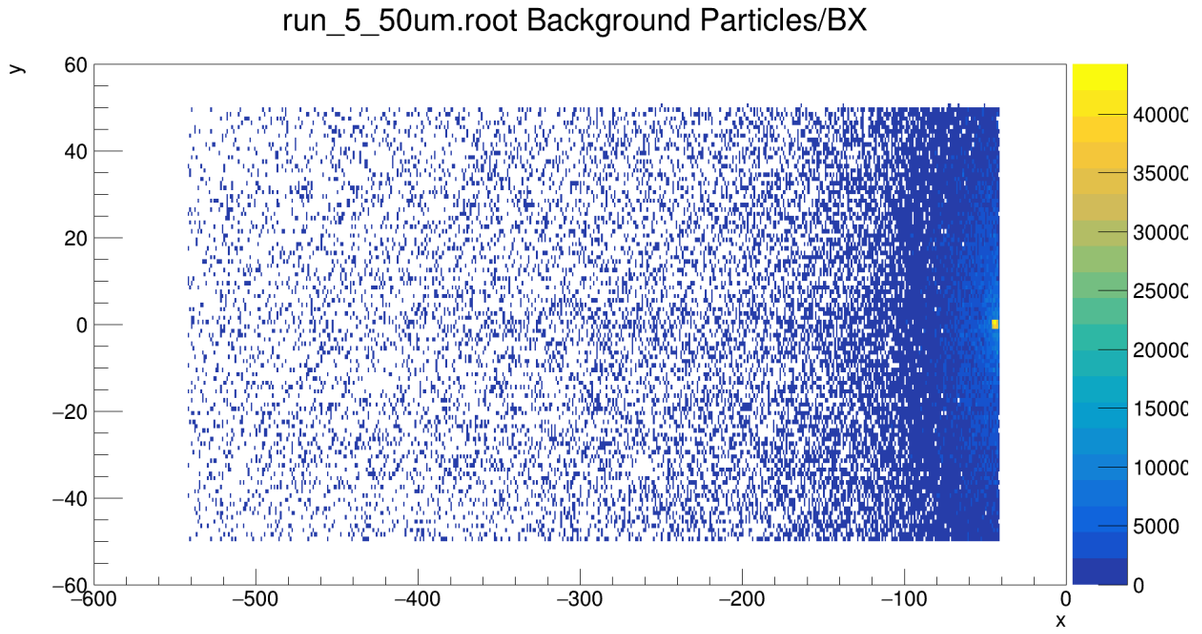
Red - 'Signal'

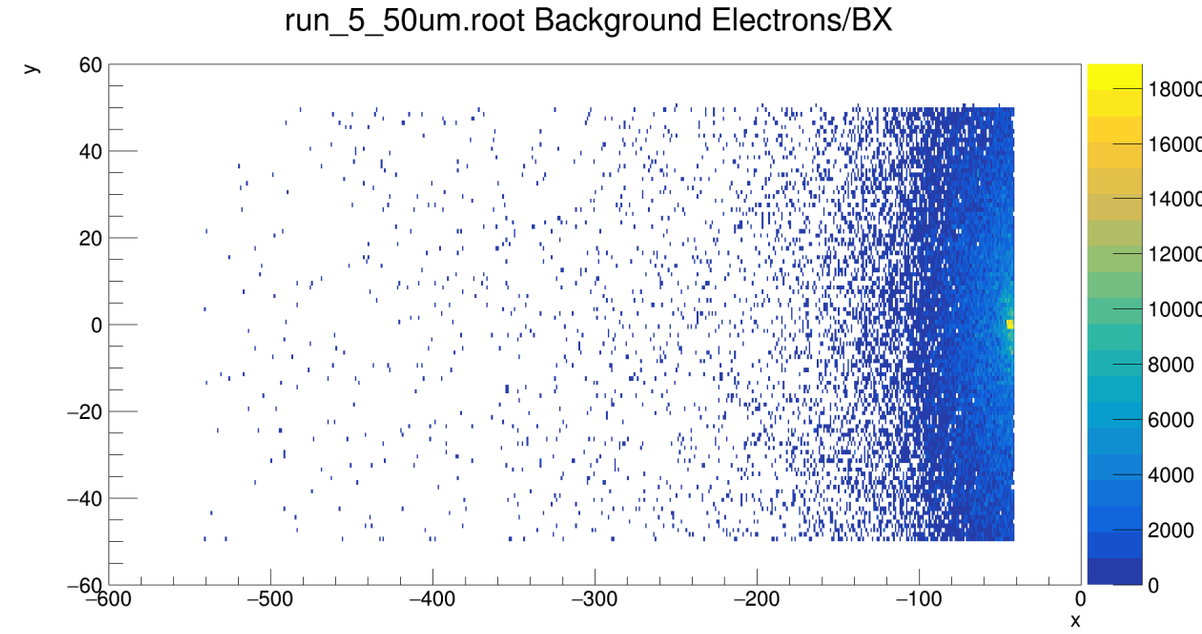
e^- Bkg < 1 GeV → 1.135 x 10^7

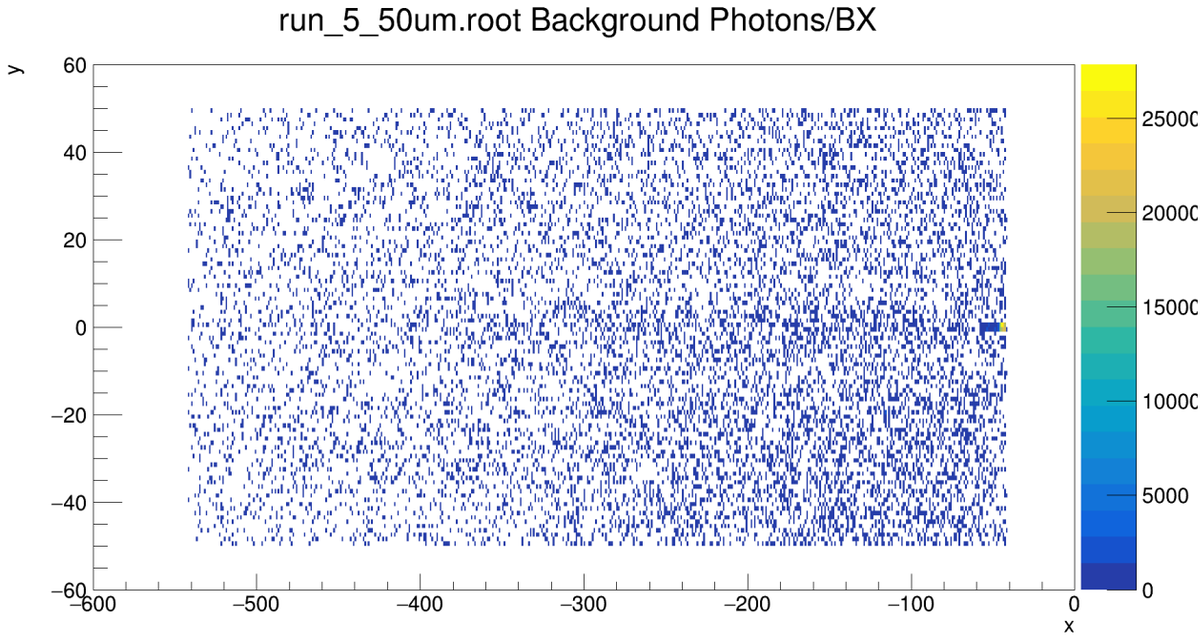
e^- Sig < 1 GeV → 928

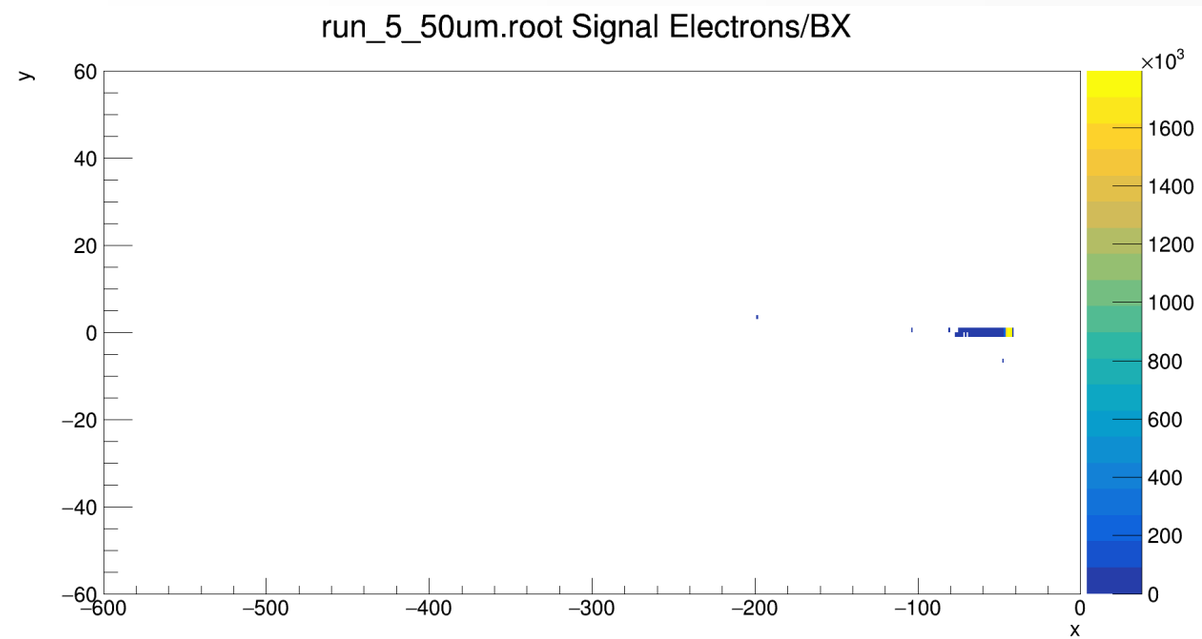
Low xi_{max} = 0.31,

w_0 = 50 µm, n_{BX} = 485


run_5_50um.root Background Particles/BX
y
x


run_5_50um.root Background Electrons/BX
y
x


run_5_50um.root Background Photons/BX
y
x


run_5_50um.root Signal Electrons/BX
y
x

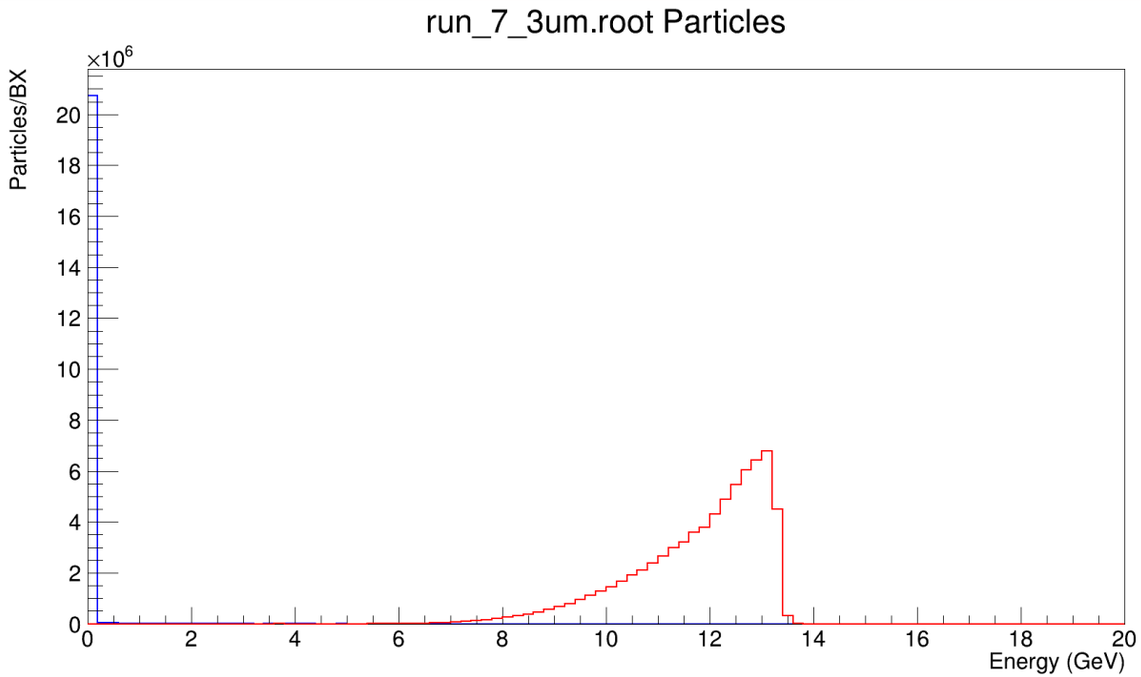
At first look, for 0.5 mm GadOx screen in Geant:

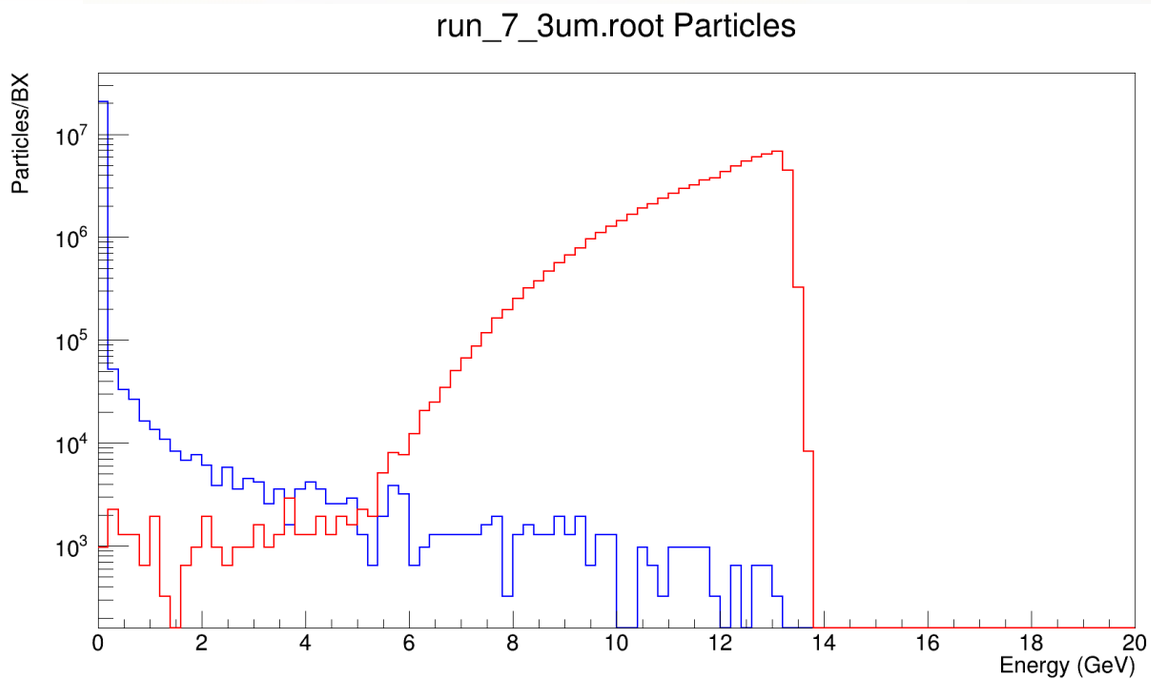
1 GeV e^- → 480 keV depos.
1 GeV γ → 15 keV depos.

10 GeV e^- → 480 keV depos.
10 GeV γ → 15 keV depos.

Or electrons are ~30 times more effective

Working on plots of a more complete evaluation





Blue - 'Background'

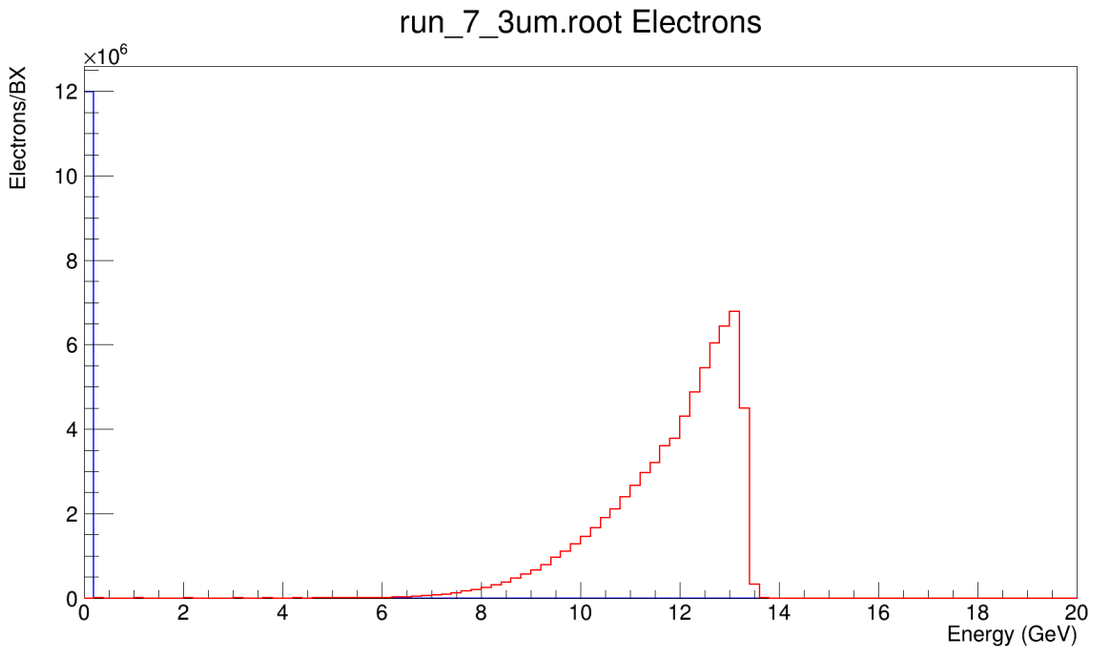
Red - 'Signal'

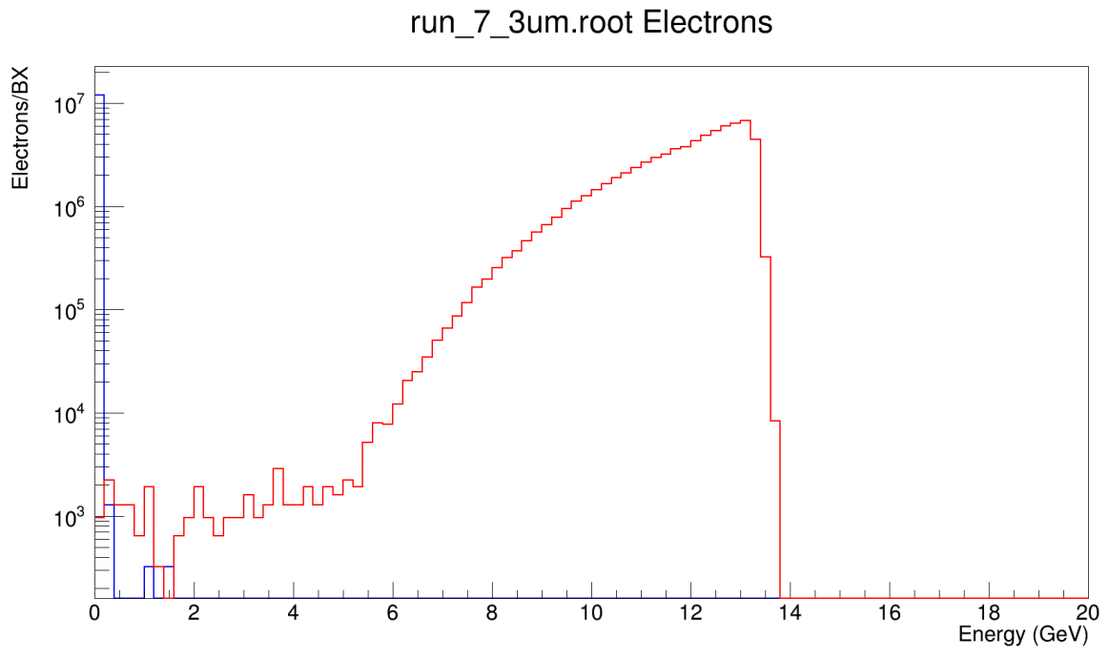
All Bkg → 2.09 x 10^7

All Sig → 7.21 x 10^7

High xi_{max} = 5.12,

w_0 = 3 µm, n_{BX} = 467





Blue - 'Background'

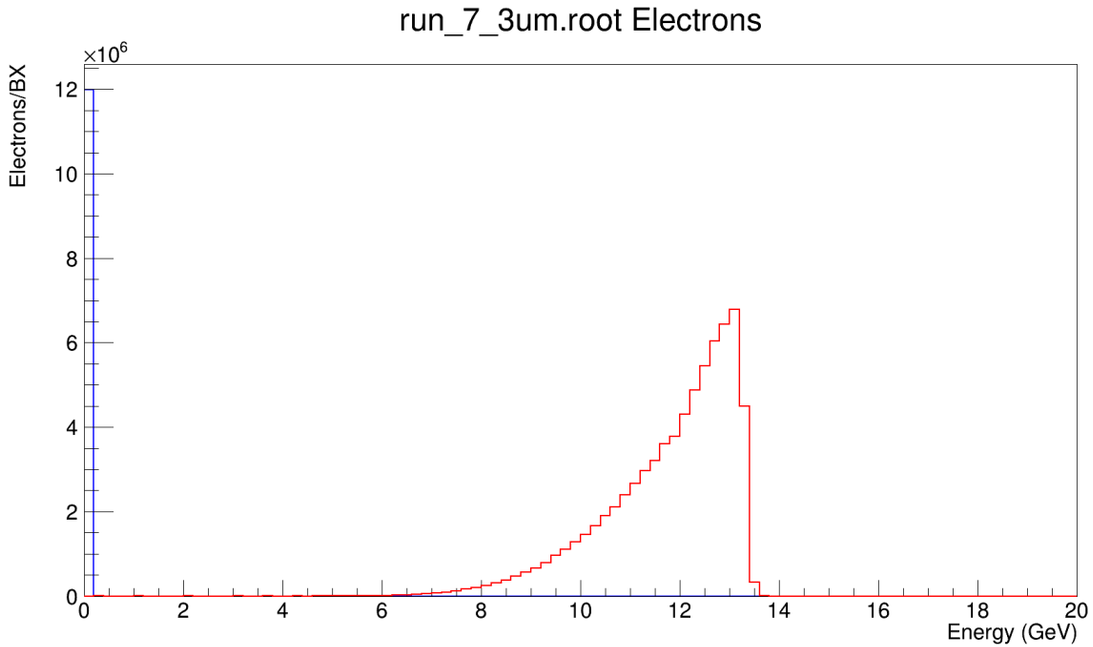
Red - 'Signal'

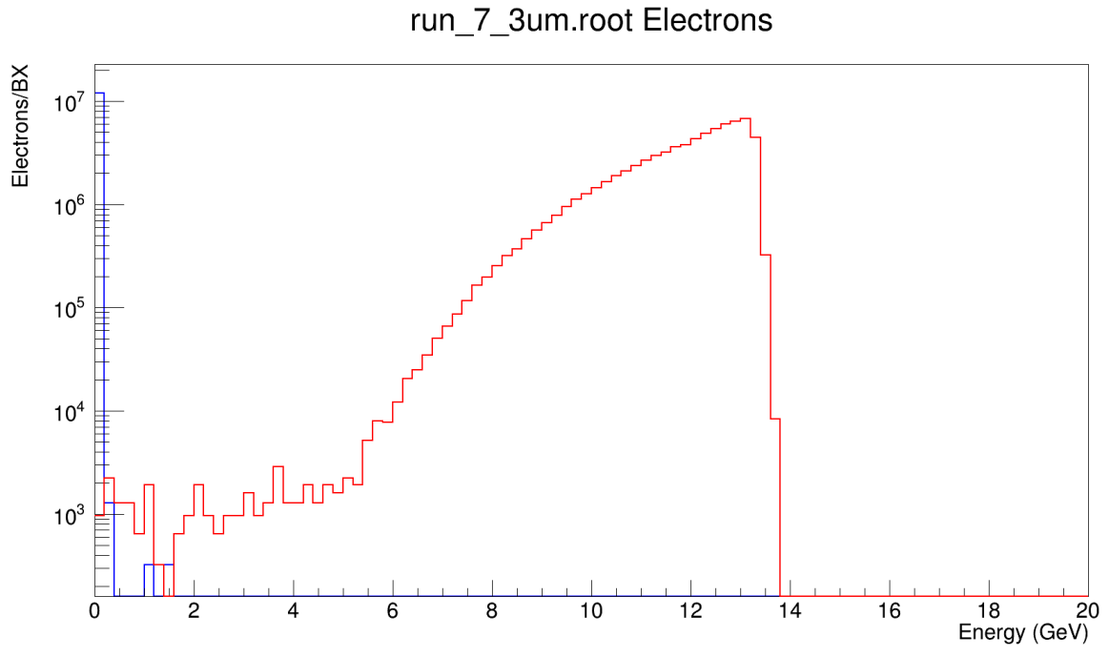
e^- Bkg → 1.20 x 10^7

e^- Sig → 7.21 x 10^7

High xi_{max} = 5.12,

w_0 = 3 μm, n_{BX} = 467





Blue - 'Background'

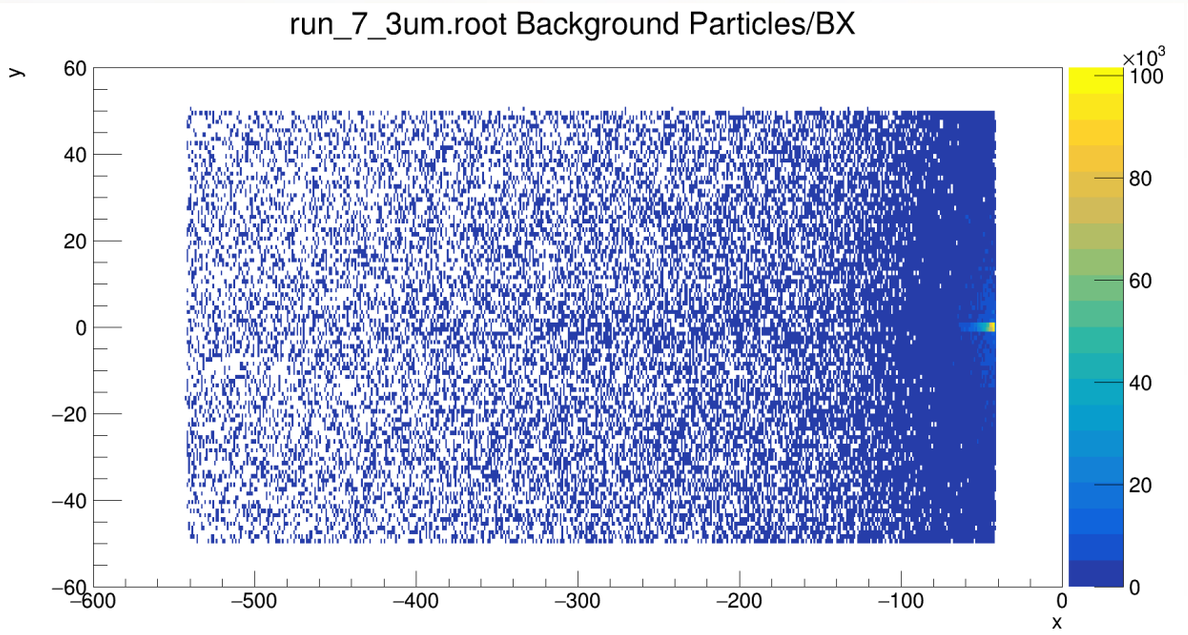
Red - 'Signal'

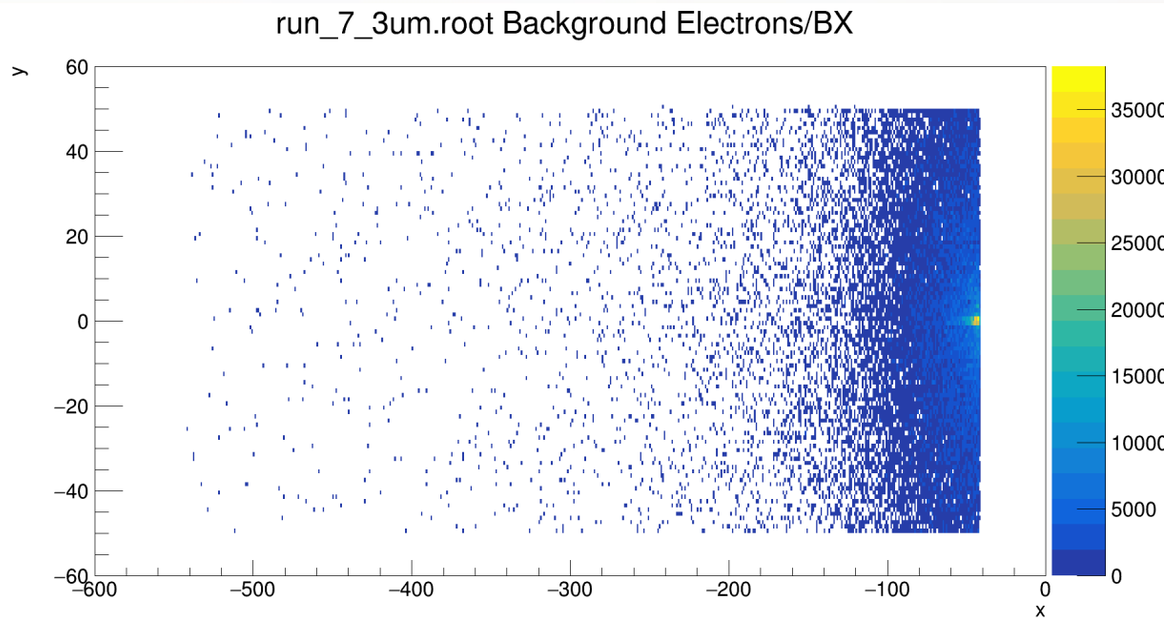
e^- Bkg < 1 GeV → 1.20 x 10^7

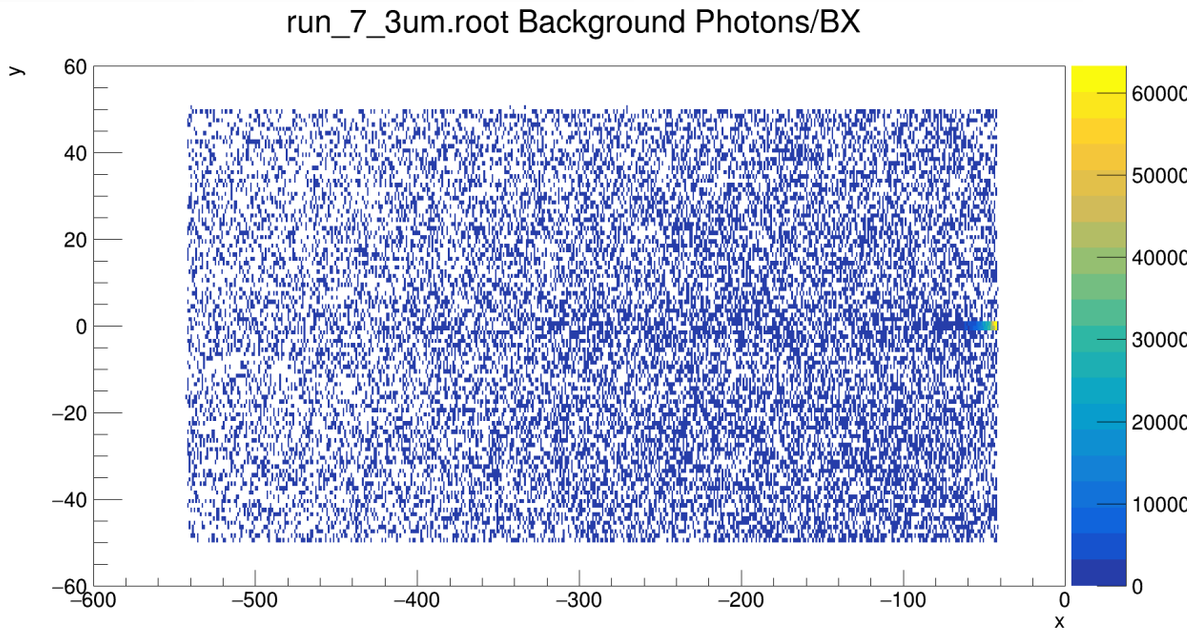
e^- Sig < 1 GeV → 964

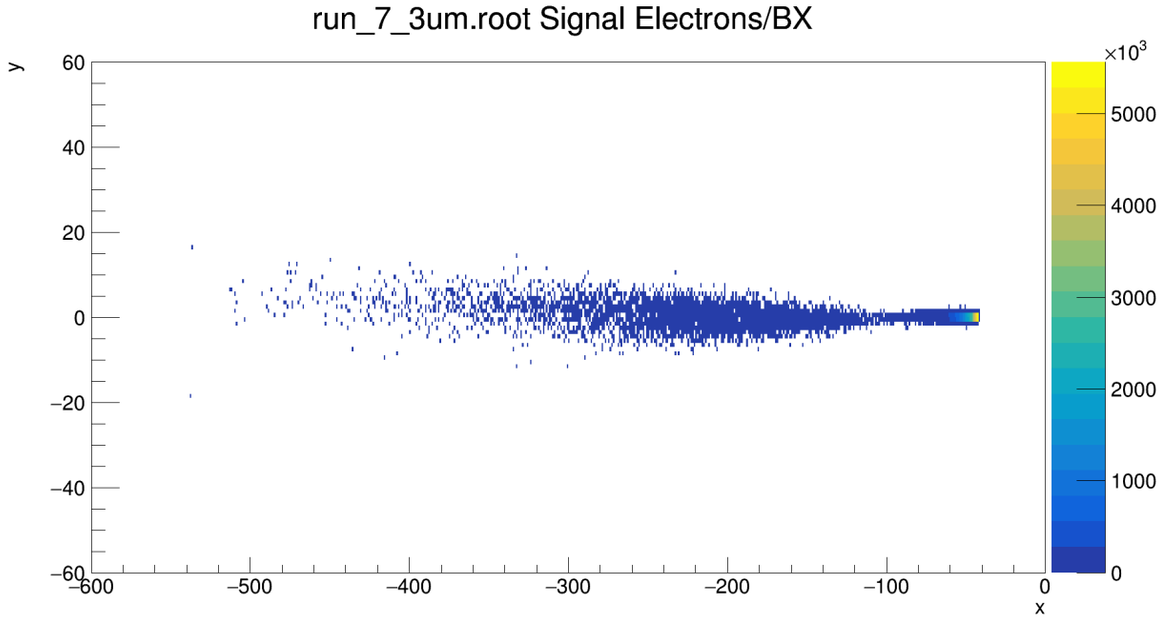
High xi_{max} = 5.12,

w_0 = 3 μm, n_{BX} = 467

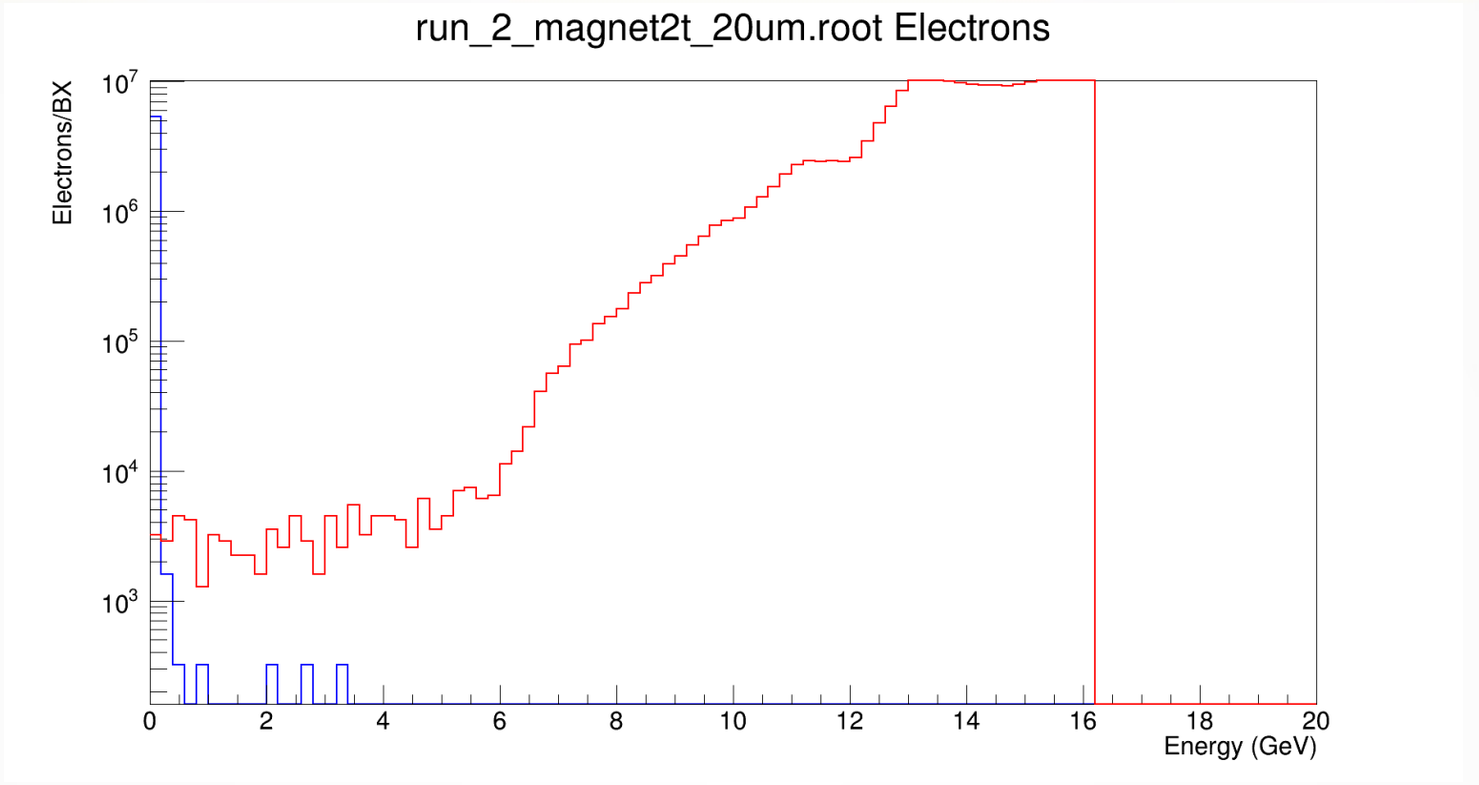

run_7_3um.root Background Particles/BX
y
x
×10^3


run_7_3um.root Background Electrons/BX
y
x


run_7_3um.root Background Photons/BX
y
x


run_7_3um.root Signal Electrons/BX
y
x
×10^3

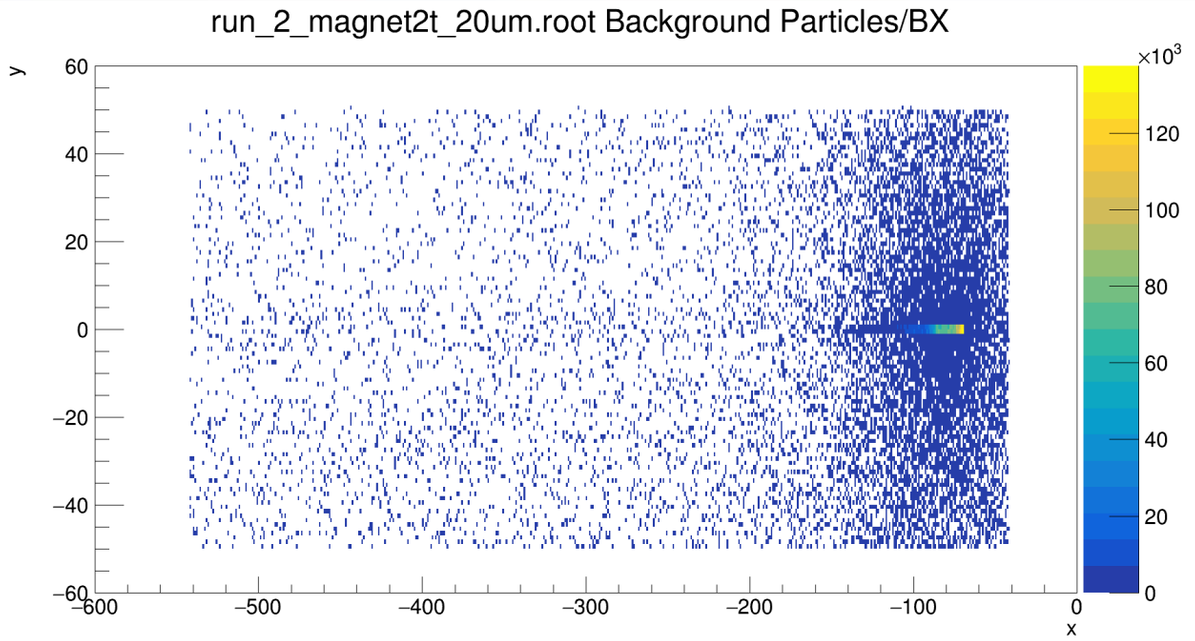
Backup

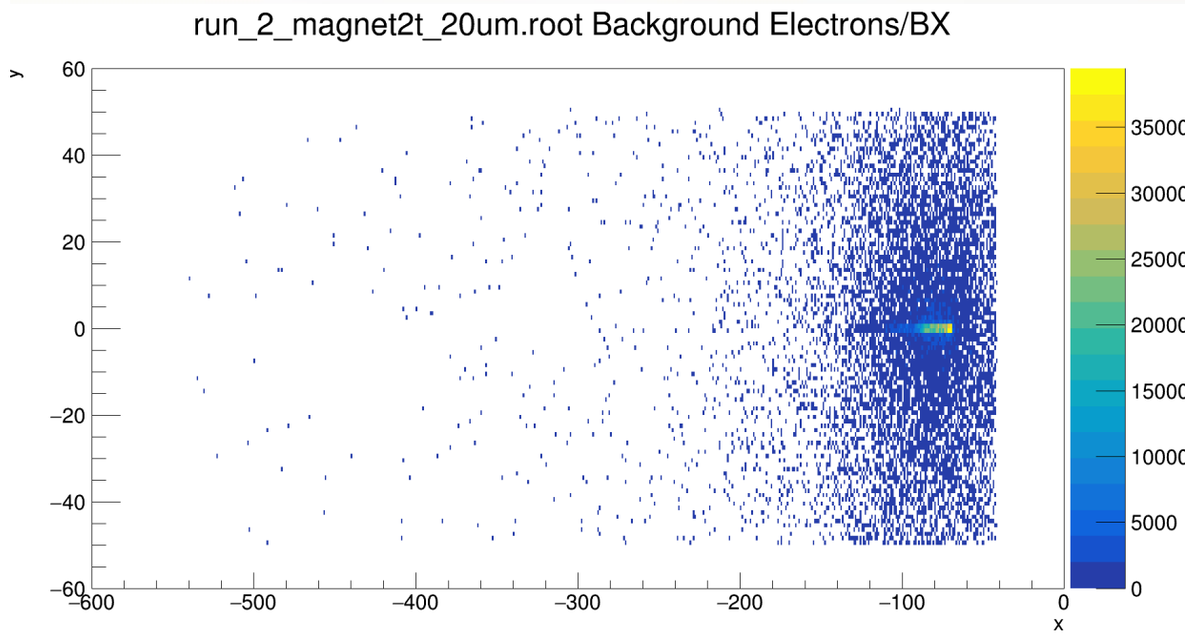


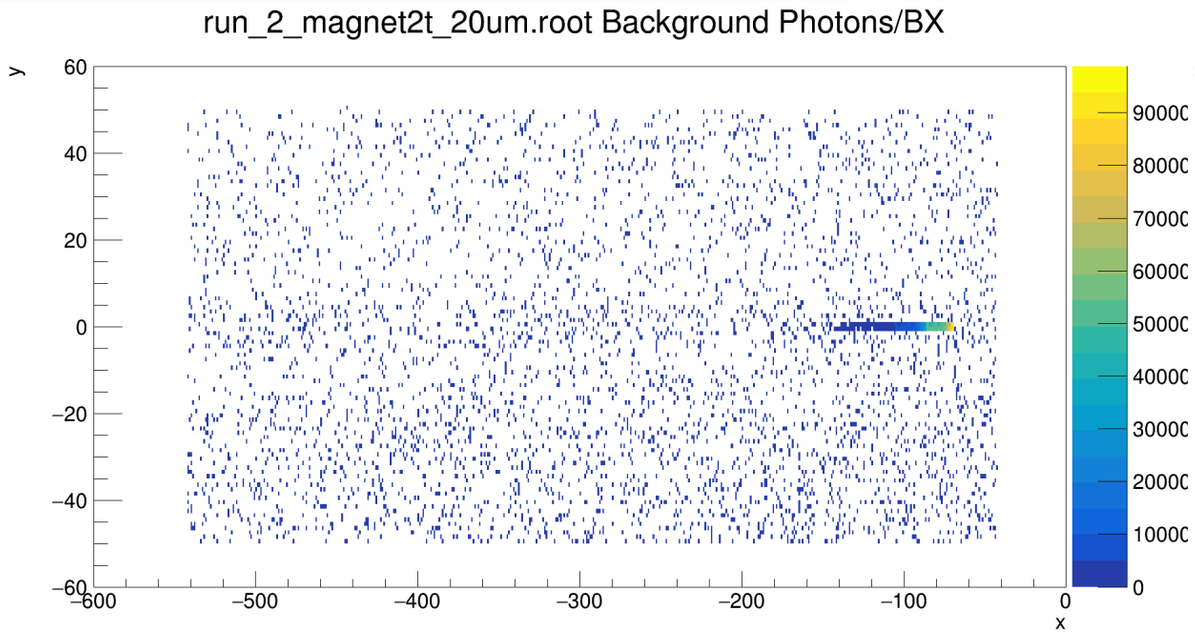
e^- Bkg → 5.33 x 10^6

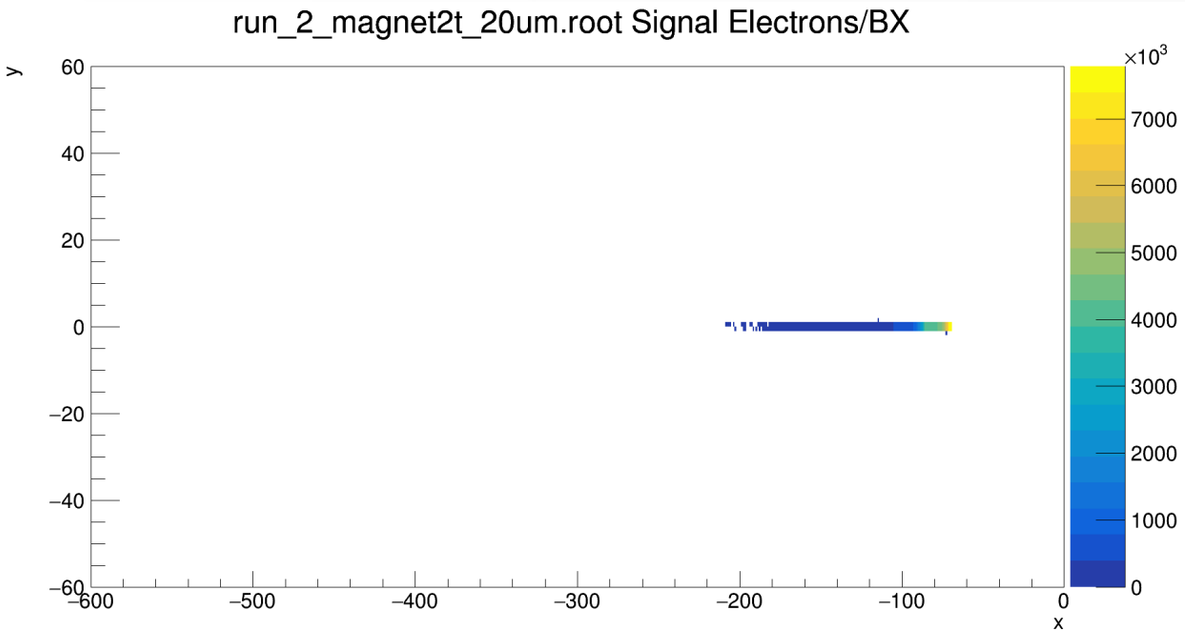
e^- Sig → 2.21 x 10^8

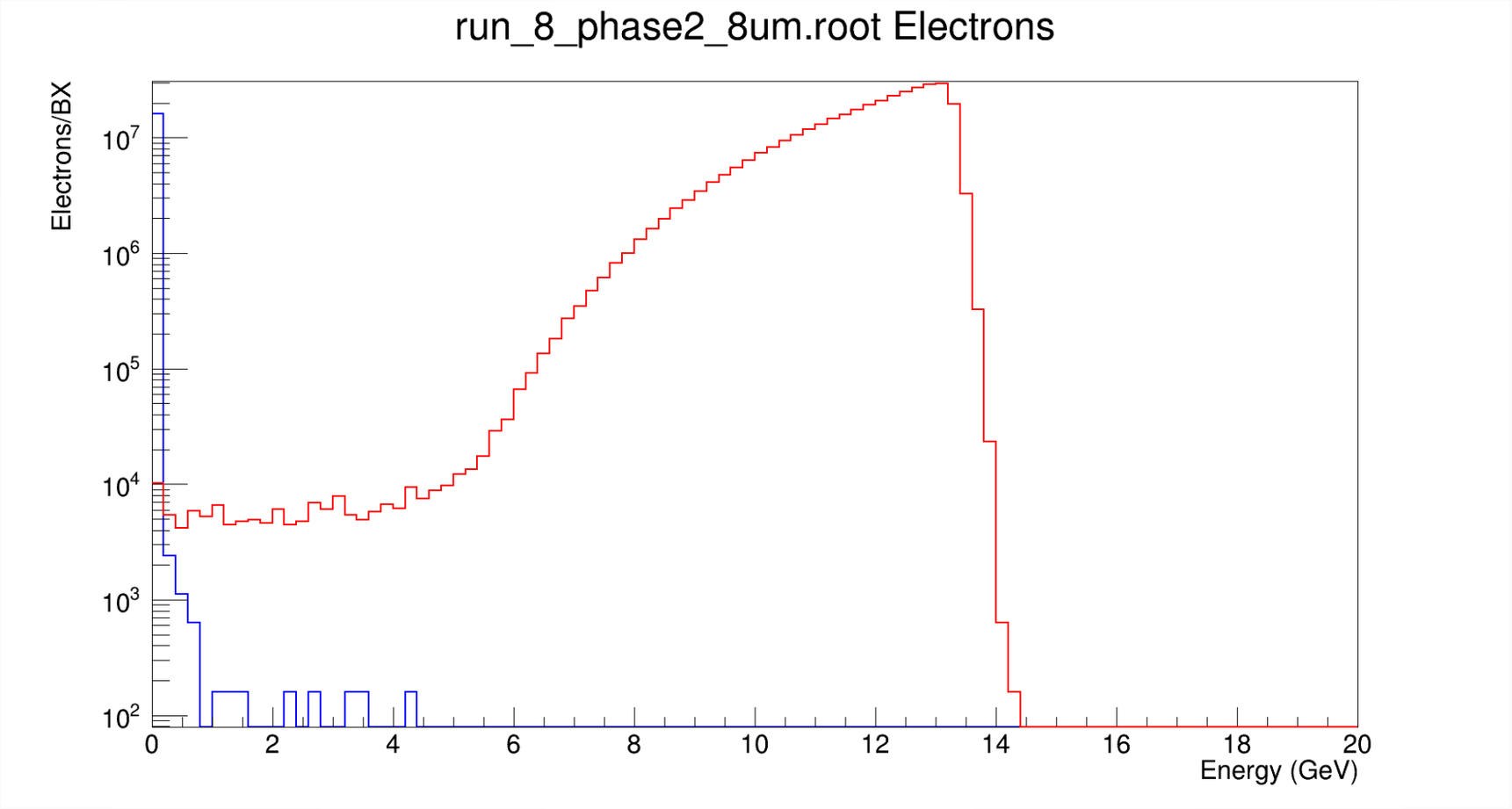
2T magnet – no e^- above 16.2 GeV
Not reliable!..


run_2_magnet2t_20um.root Background Particles/BX
y
x
×10^3
120
100
80
60
40
20
0


run_2_magnet2t_20um.root Background Electrons/BX
y
x
35000
30000
25000
20000
15000
10000
5000
0


run_2_magnet2t_20um.root Background Photons/BX
y
x
90000
80000
70000
60000
50000
40000
30000
20000
10000
0

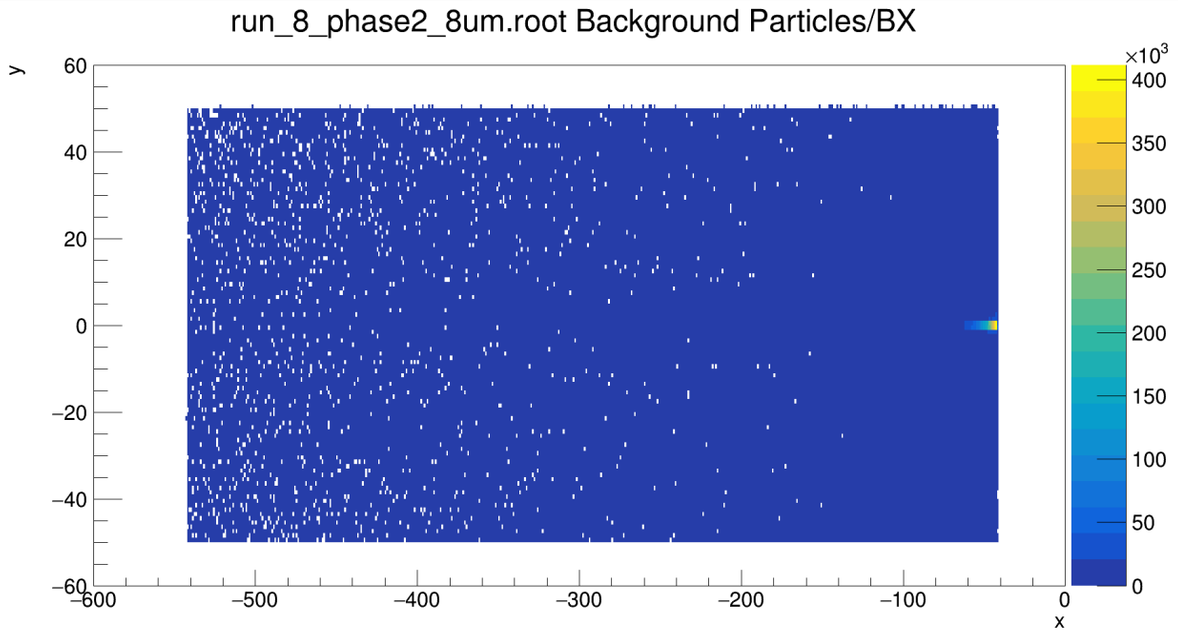

run_2_magnet2t_20um.root Signal Electrons/BX
y
x
×10^3
7000
6000
5000
4000
3000
2000
1000
0

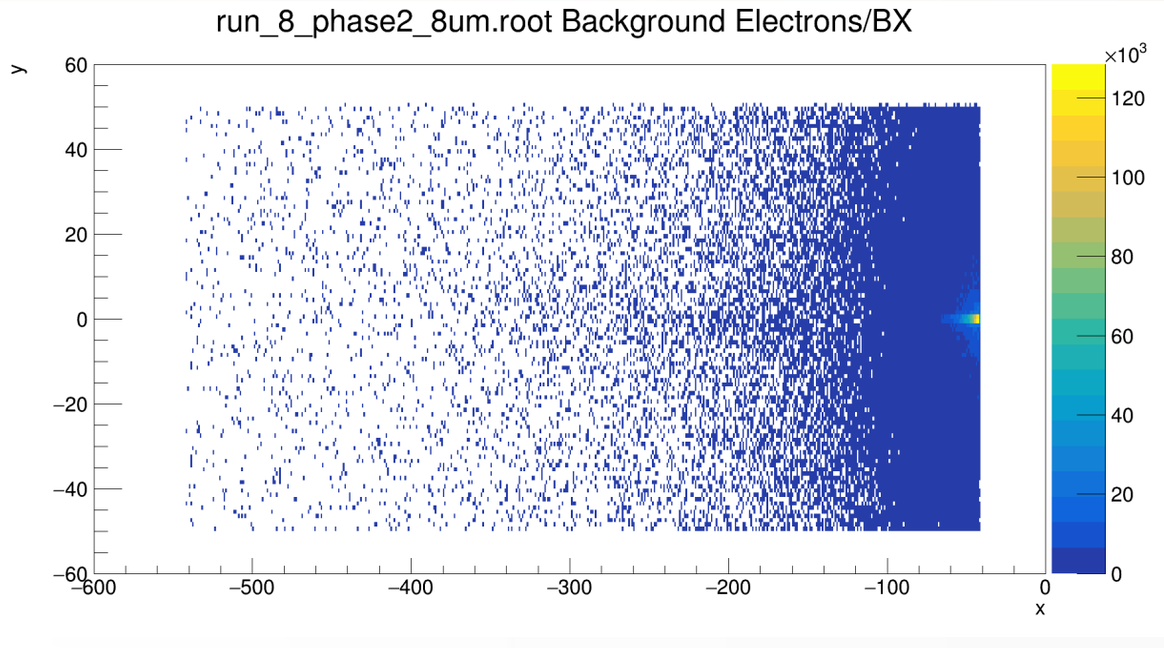


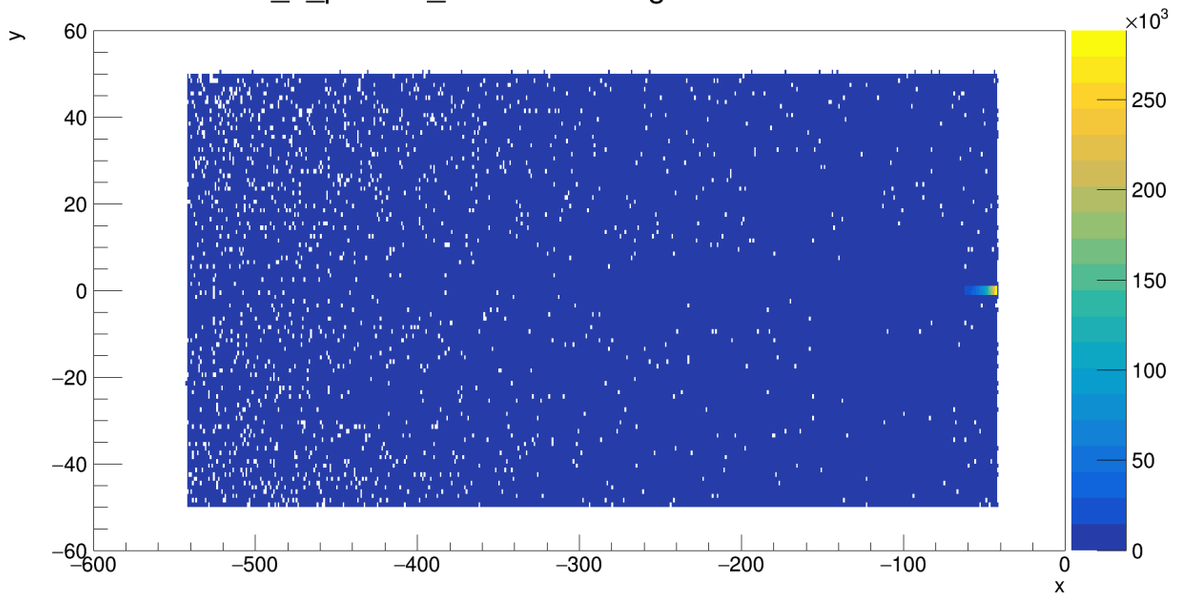
e^- Bkg → 1.62 x 10^7

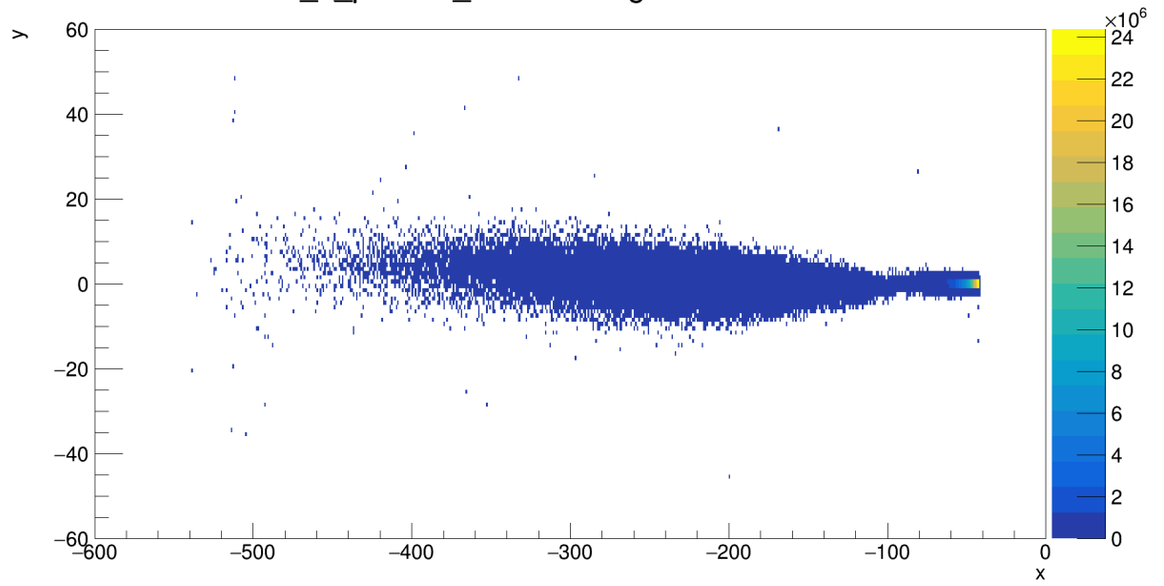
e^- Sig → 3.44 x 10^8

Phase2 simulation


run_8_phase2_8um.root Background Particles/BX
y
x
×10^3
60
40
20
0
−20
−40
−60
−600
−500
−400
−300
−200
−100
0
400
350
300
250
200
150
100
50
0


run_8_phase2_8um.root Background Electrons/BX
y
x
×10^3
60
40
20
0
−20
−40
−60
−600
−500
−400
−300
−200
−100
0
120
100
80
60
40
20
0


run_8_phase2_8um.root Background Photons/BX
y
x
×10^3
60
40
20
0
−20
−40
−60
−600
−500
−400
−300
−200
−100
0
250
200
150
100
50
0


run_8_phase2_8um.root Signal Electrons/BX
y
x
×10^6
60
40
20
0
−20
−40
−60
−600
−500
−400
−300
−200
−100
0
24
22
20
18
16
14
12
10
8
6
4
2
0