Matt study, Nuclear transparency

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2024
September

0.1 Strategy

0.1.1 Carbon target

Carbon runs : 018339, 018340, 018341, 018342, 018343, 018344, 018346, 018440, 018441, 018442, 018443, 018444, 018445, 018475, 018498, 018524, 018756, 018850

path: `/cache/hallb/scratch/rg-d/production/Bspot/v5dstCxC/dst/recon/`

- Find event with a trigger electron(`REC::Particle::pid == 11` and `status<0`), at least a π^+ and at least a π^-.
- Apply cut on electron: $-5 < \chi^2_{pid} < 5$ and $-12 < v_z < 5$
- Find all π^+ in event: `REC::Particle::pid == 211`
- Apply cut on π^+: $-10 < \chi^2_{pid} < 10$
- Find all π^- in event: `REC::Particle::pid == -211`
- Apply cut on π^-: $-10 < \chi^2_{pid} < 10$
- Find all combinaison of π^+ and π^-
- Cut to select reaction :
  - $W = (p_i + \gamma^\star)^2 > 2GeV$, with $p_i = (0, 0, 0, M_p)$, $M_p = 0.938GeV^2$
  - $z_h = \frac{E_{\rho^0}}{v} > 0.9$
  - $0.1 < -t = (\gamma^\star - p_{\rho^0})^2 < 0.5GeV^2$
  - $l_c \leq 0.5fm$
- Fill invariant mass of ρ^0 for the Q^2 bins : $1 \leq Q^2 < 2$, $2 \leq Q^2 < 2.5$, $2.5 \leq Q^2 < 3$, $3 \leq Q^2 < 3.5$, $3.5 \leq Q^2 < 4.5$, $4.5 \leq Q^2 < 6$
- Fit the distribution with a Breit-Wigner and a 3rd order polynom between 0.3 and 1.4 GeV/c^2:

$$\mathrm{BW}(x; x_0, \Gamma, \alpha) = \alpha \times \frac{1}{\pi} \times \frac{\frac{1}{2}\Gamma}{(x - x_0)^2 + \frac{1}{2}\Gamma} \tag{1}$$

$$\mathrm{pol3}(x; a, b, c, d) = a + b \times x + c \times x^2 + d \times x^3 \tag{2}$$

  where x_0 is the location parameter, specifying the location of the peak of the distribution, γ is full width at half maximum (FWHM).
- Take the integral of the fit function using `Integral` root function between 0.3 and 1.4 GeV/c^2.

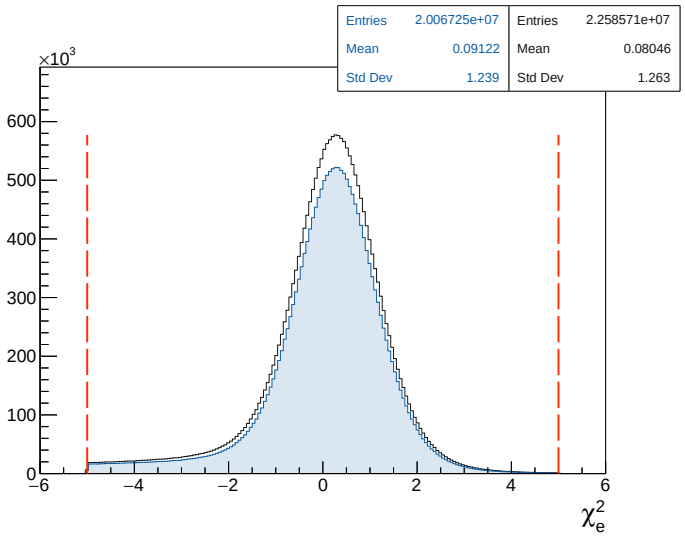
0.2 Carbon data

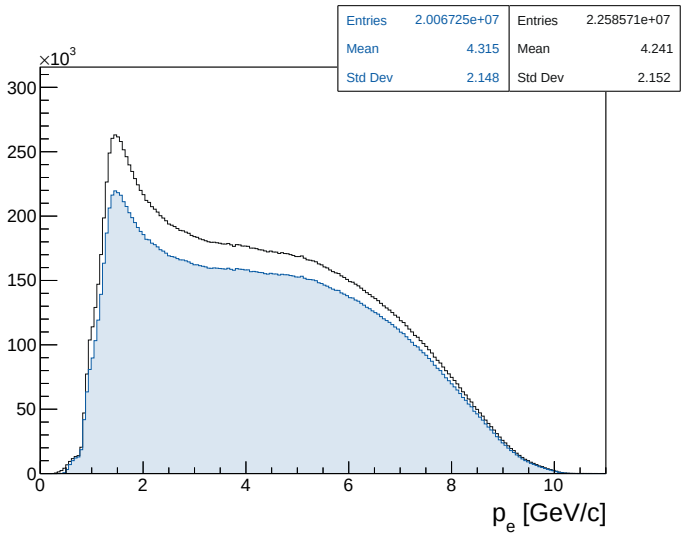
0.2.1 Numbers

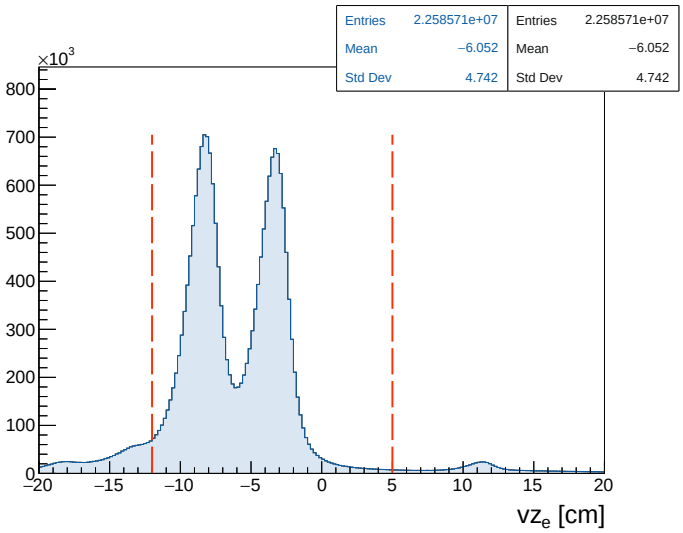
- Total number of event : 354888652
- Number of event with a trigger electron (`REC::Particle::pid == 11` and `status<0`) and at least a π^+ and at least a π^- : 22585713; ratio between this one and the previous number : 0.0636417
- Number of event with a good electron : 20067249; ratio : 0.888493
- Number of π^+ after electron cuts: 27575088
- Number of good π^+ after electron and π^+ cuts : 18219354; ratio : 0.660718
- Number of bad π^+ after electron and opposite π^+ cuts: 9355734; ratio : 0.339282
- Number of π^- after electron cuts: 25090248
- Number of good π^- after electron and π^- cuts: 20446619; ratio : 0.814923
- Number of bad π^- after electron and opposite π^- cuts: 4643629; ratio : 0.185077
- Number of ρ^0 : 20411533;

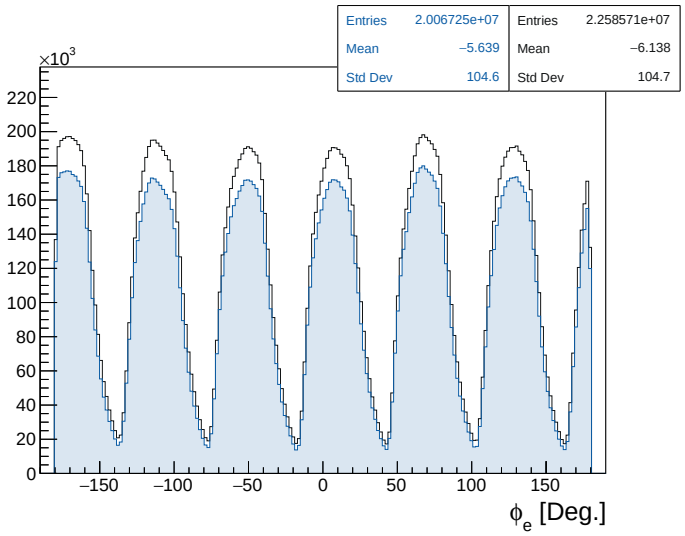
- Number of ρ^0 that pass the W cut : 19735078; ratio : 0.966859
- Number of ρ^0 that pass the W and z_h cuts : 355804; ratio : 0.018029
- Number of ρ^0 that pass the W, z_h and t cuts : 163572; ratio : 0.459725
- Number of ρ^0 that pass the W, z_h, t and l_c cuts : 10173; ratio : 0.0621928

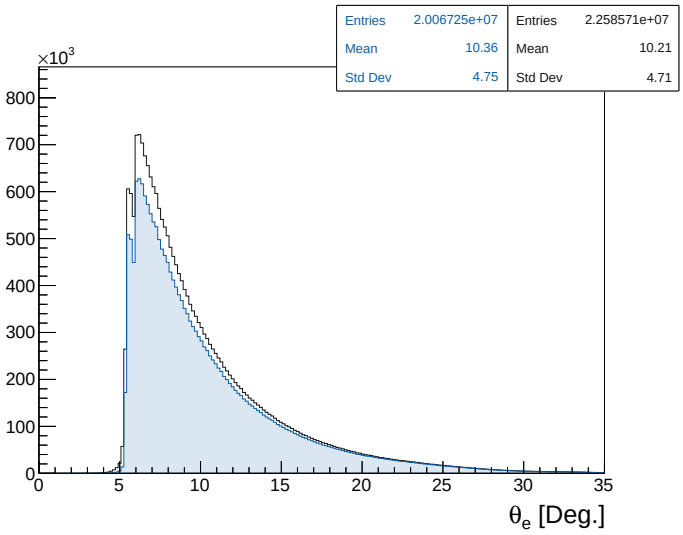
0.2.2 Electron



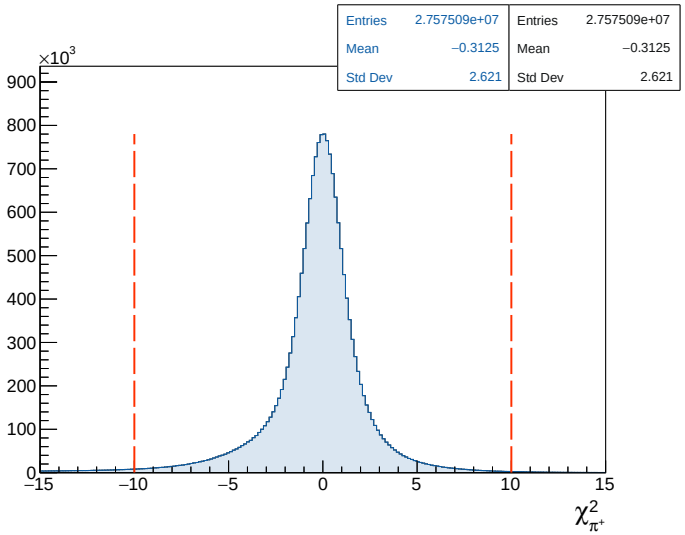


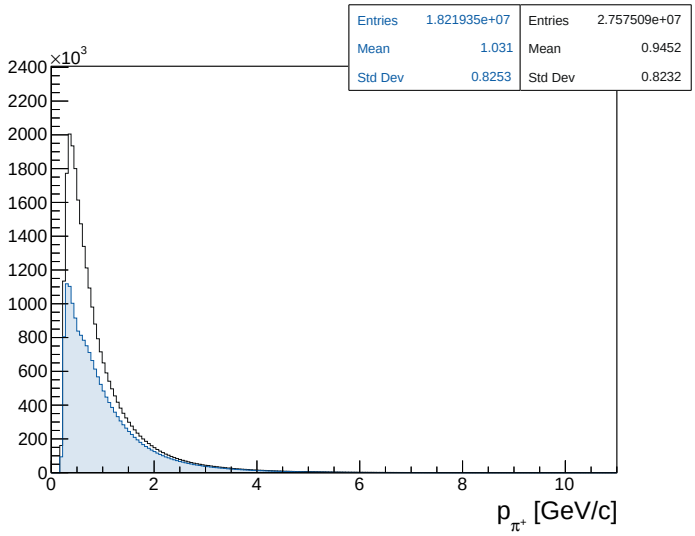


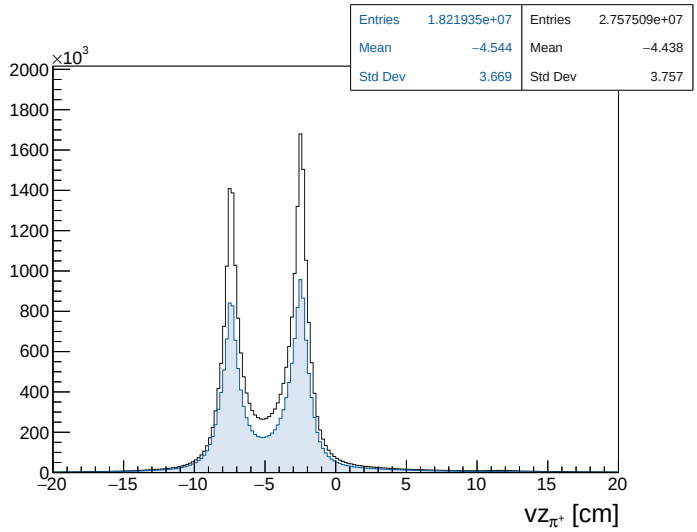


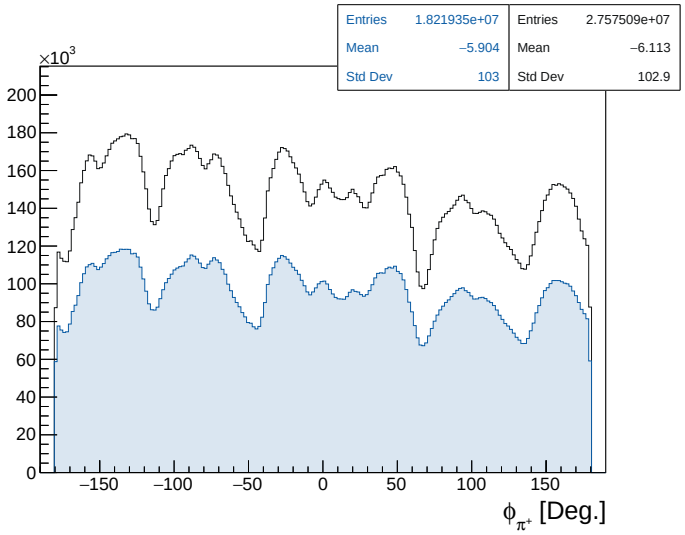


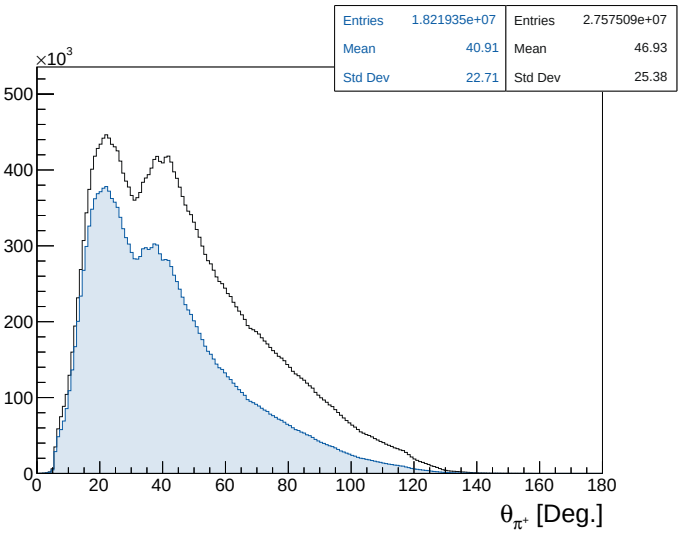
0.2.3 π^+


Entries 2.757509e+07
Mean −0.3125
Std Dev 2.621
Entries 2.757509e+07
Mean −0.3125
Std Dev 2.621
×10^3
χ²_π+

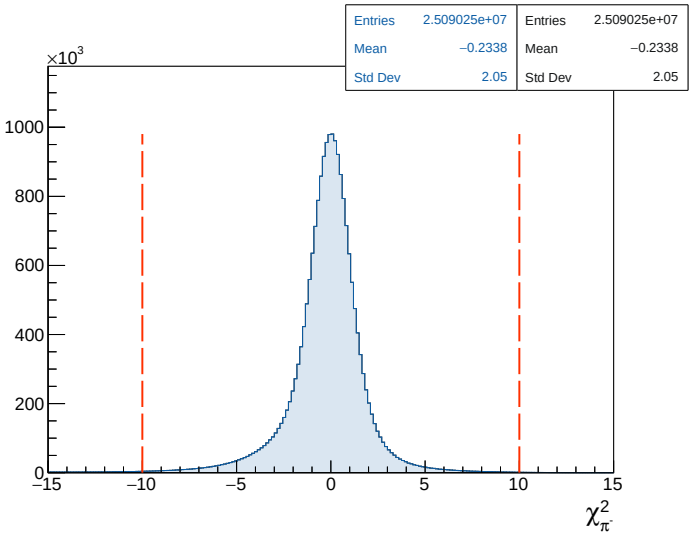

Entries 1.821935e+07
Mean 1.031
Std Dev 0.8253
Entries 2.757509e+07
Mean 0.9452
Std Dev 0.8232
×10^3
p_π+ [GeV/c]

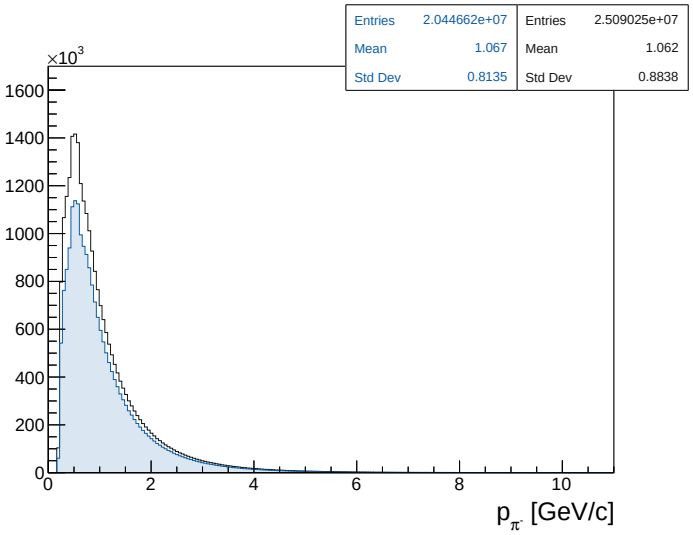

Entries 1.821935e+07
Mean −4.544
Std Dev 3.669
Entries 2.757509e+07
Mean −4.438
Std Dev 3.757
×10^3
vz_π+ [cm]

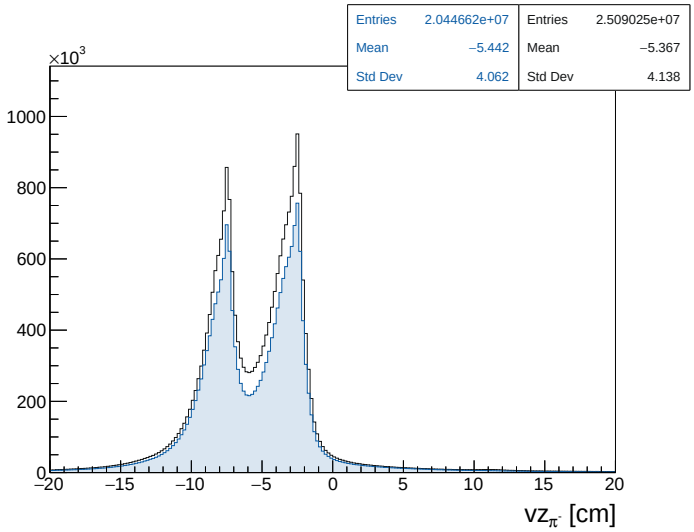

Entries 1.821935e+07
Mean −5.904
Std Dev 103
Entries 2.757509e+07
Mean −6.113
Std Dev 102.9
×10^3
ϕ_π+ [Deg.]

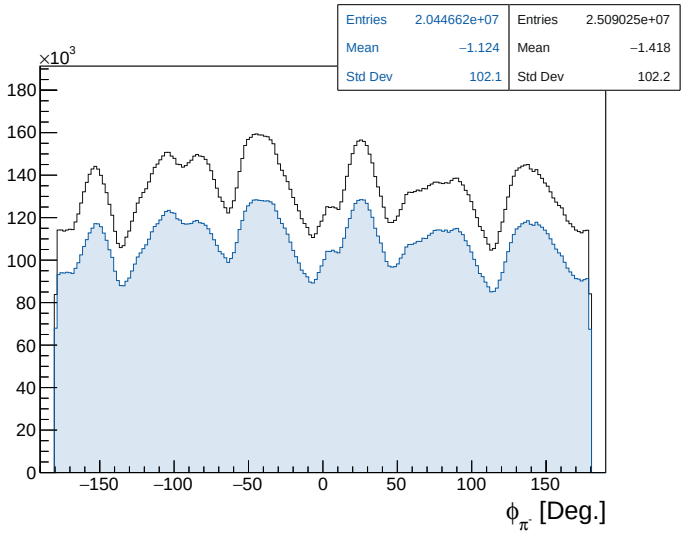

Entries 1.821935e+07
Mean 40.91
Std Dev 22.71
Entries 2.757509e+07
Mean 46.93
Std Dev 25.38
×10^3
θ_π+ [Deg.]

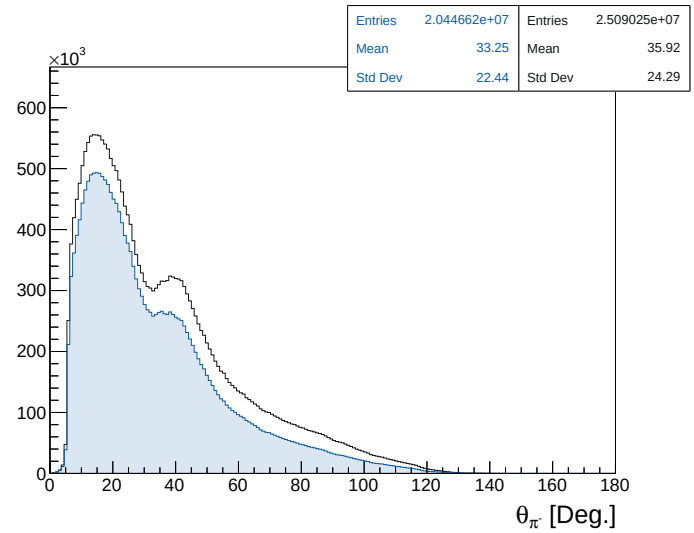
0.2.4 π^-


Entries 2.509025e+07
Mean −0.2338
Std Dev 2.05
Entries 2.509025e+07
Mean −0.2338
Std Dev 2.05
×10^3
χ²_π⁻

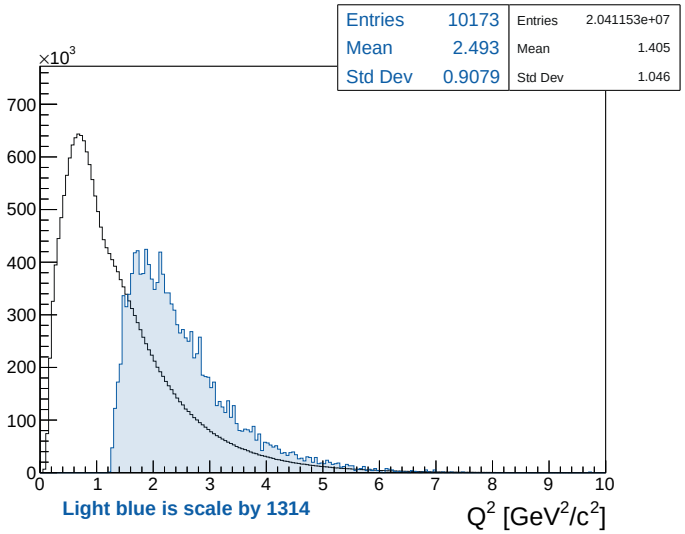

Entries 2.044662e+07
Mean 1.067
Std Dev 0.8135
Entries 2.509025e+07
Mean 1.062
Std Dev 0.8838
×10^3
p_π⁻ [GeV/c]

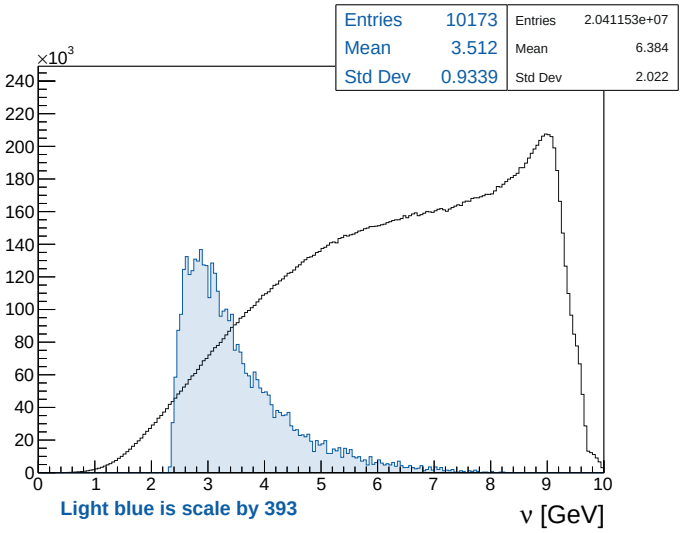

Entries 2.044662e+07
Mean −5.442
Std Dev 4.062
Entries 2.509025e+07
Mean −5.367
Std Dev 4.138
×10^3
vz_π⁻ [cm]

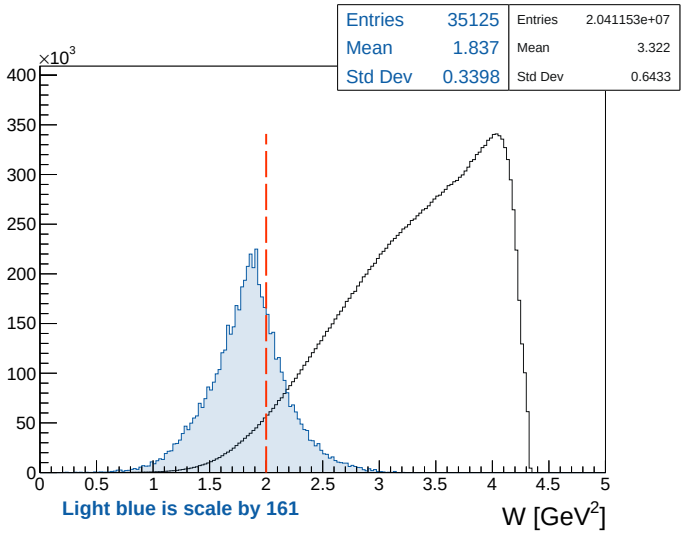

Entries 2.044662e+07
Mean −1.124
Std Dev 102.1
Entries 2.509025e+07
Mean −1.418
Std Dev 102.2
×10^3
φ_π⁻ [Deg.]

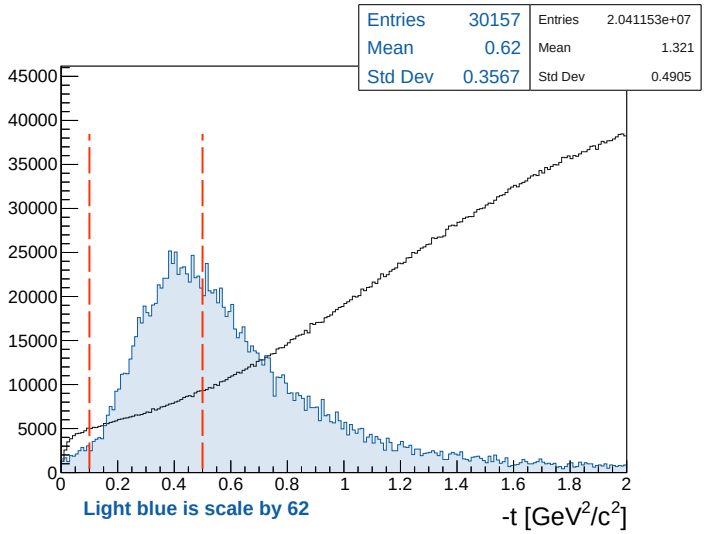

Entries 2.044662e+07
Mean 33.25
Std Dev 22.44
Entries 2.509025e+07
Mean 35.92
Std Dev 24.29
×10^3
θ_π⁻ [Deg.]

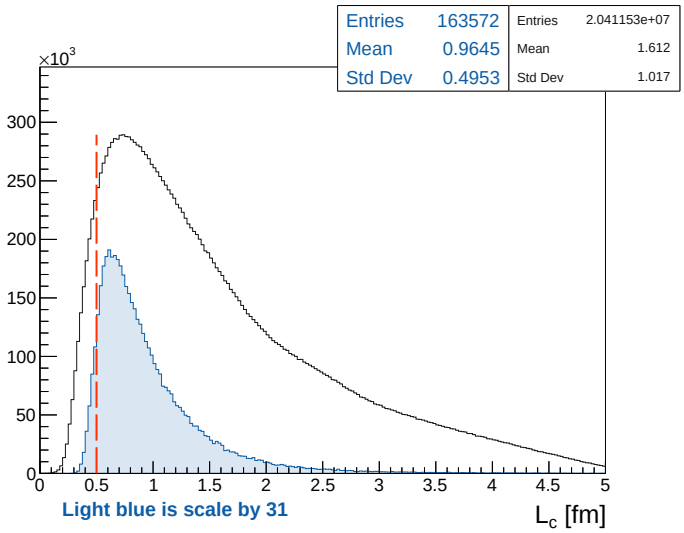
0.2.5 Event selection

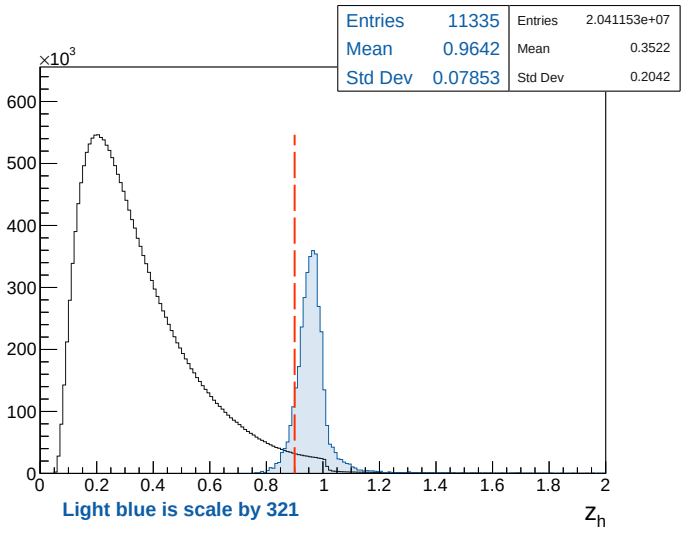




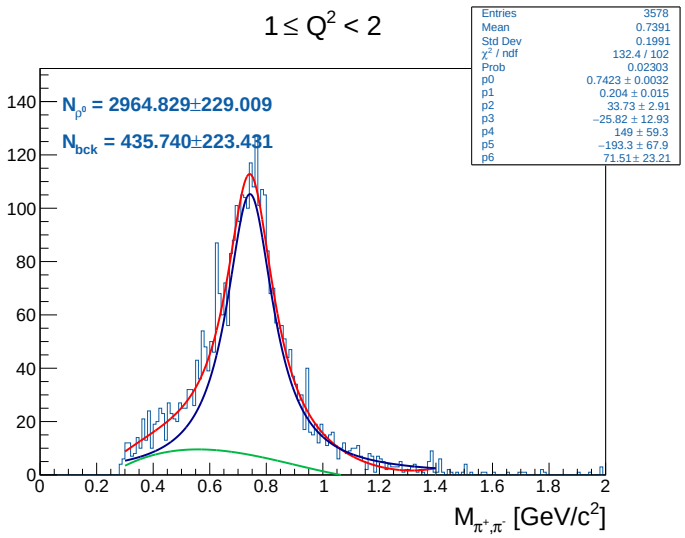


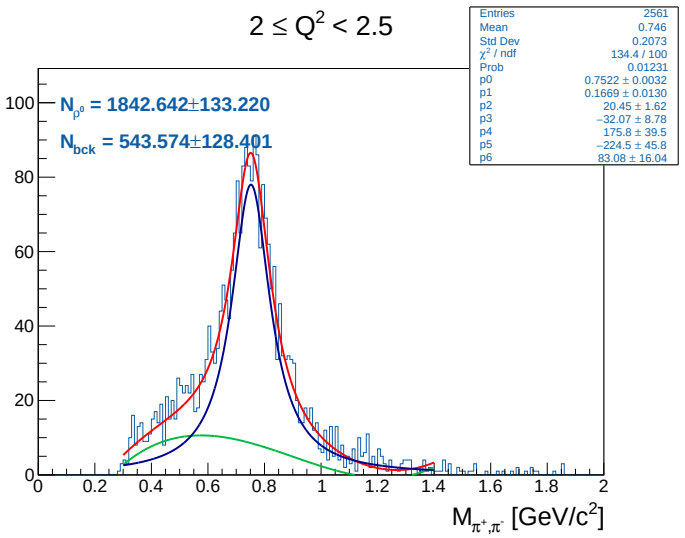


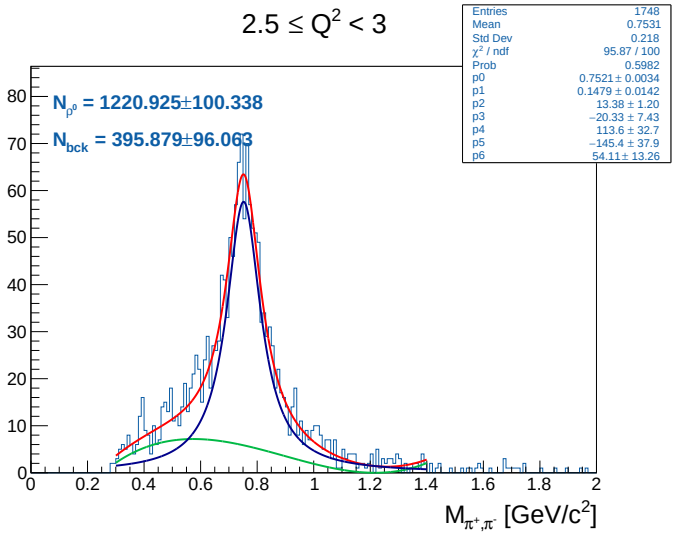


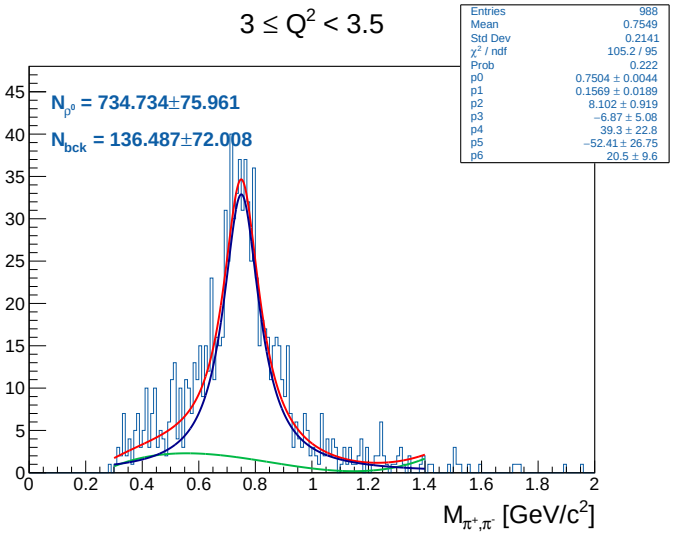


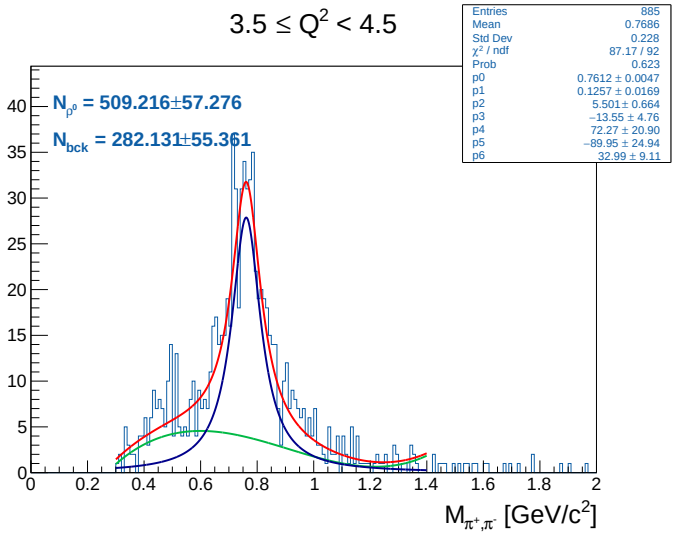
0.2.6 ρ^0 invariant mass

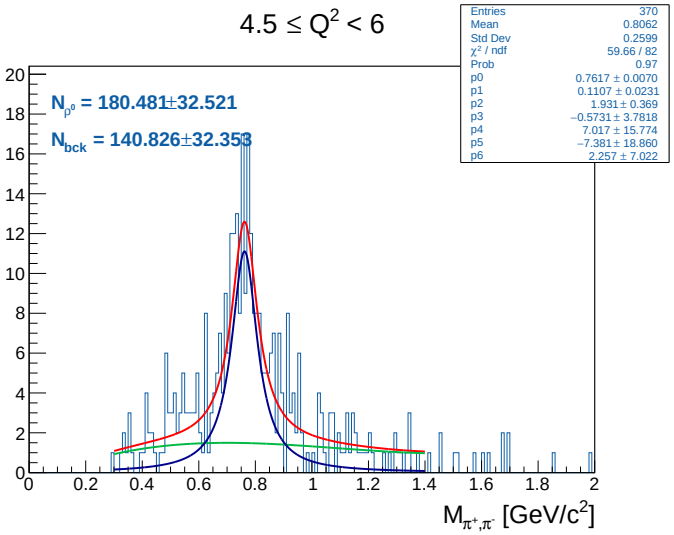












0.2.7 LD2

LD2 runs : 018419, 018421, 018424, 018427, 018428, 018429, 018431, 018432, 018433, 018439, 018528, 018559, 018644, 018656, 018851, 018873, 019021, 019058

path: `/cache/hallb/scratch/rg-d/production/Bspot/v5dstLD2/dst/recon/`

- Select the trigger electron: `REC::Particle::pid == 11` and `status<0`
- Apply cut on electron: $-3 < \chi^2_{pid} < 3$ and $-12 < v_z < 5$

- Find all π^+ in event: `REC::Particle::pid == 211`
- Apply cut on π^+: $-10 < \chi^2_{pid} < 10$
- Find all π^- in event: `REC::Particle::pid == -211`
- Apply cut on π^-: $-10 < \chi^2_{pid} < 10$
- Find all combination of π^+ and π^-
- Cut to select reaction :
  - $W = (p_i + \gamma^\star)^2 > 2GeV$
  - $z_h = \frac{E_{\rho^0}}{v} > 0.9$
  - $0.1 < -t < 0.5GeV^2$
  - $l_c \leq 0.5fm$