Hyper Nuclear Simulations on Decay Pion Spectroscopy

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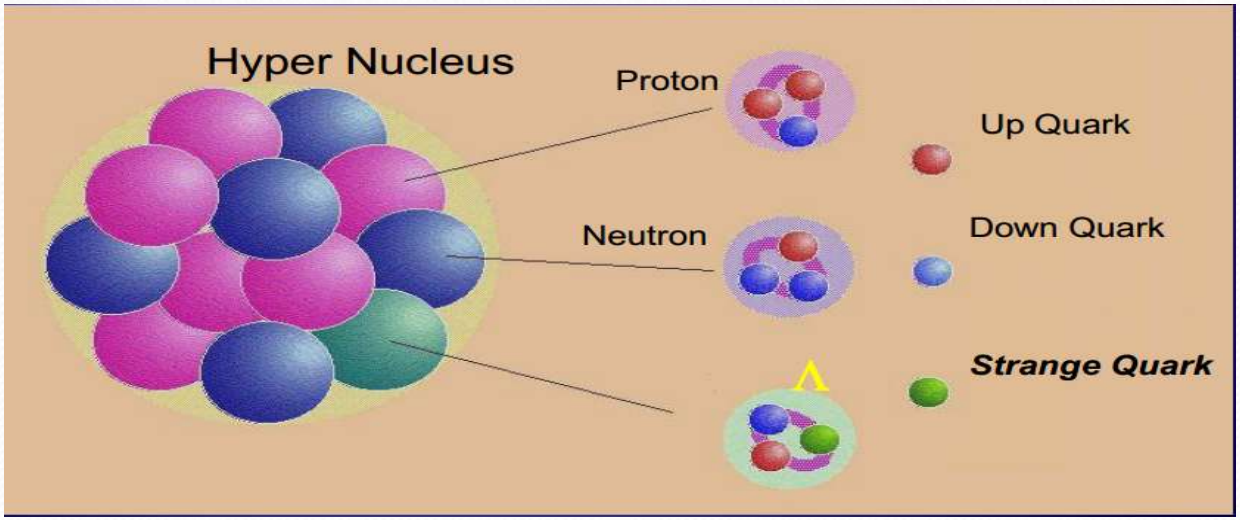
Out Line

- Introduction
- Purpose of the simulation
- Kinematic calculations
- Results
- Future plans

Introduction

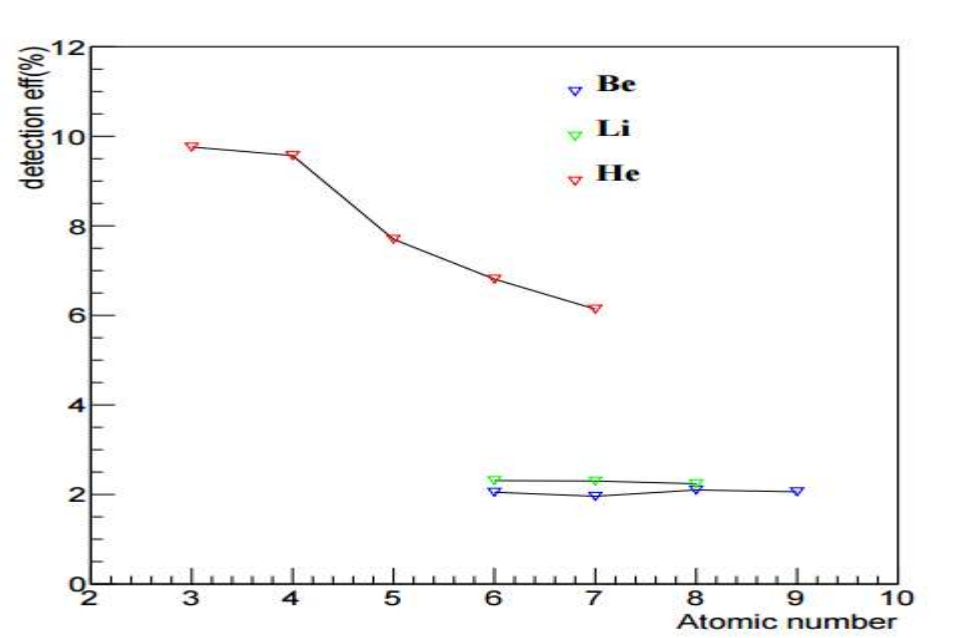
- A hyper nucleus is a nucleus which contains at least one hyperon
- Hyperon- Baryon containing one or more strange quarks
- Lambda is the lightest hyperon.



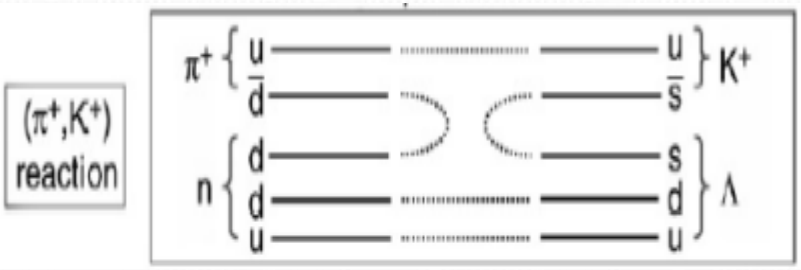
Purpose of the simulation

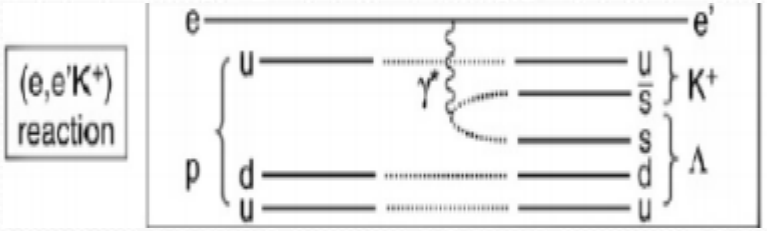
- In previous experiments Detecting efficiency of the fragment is less .

The graph of detection efficiency Vs. Atomic number

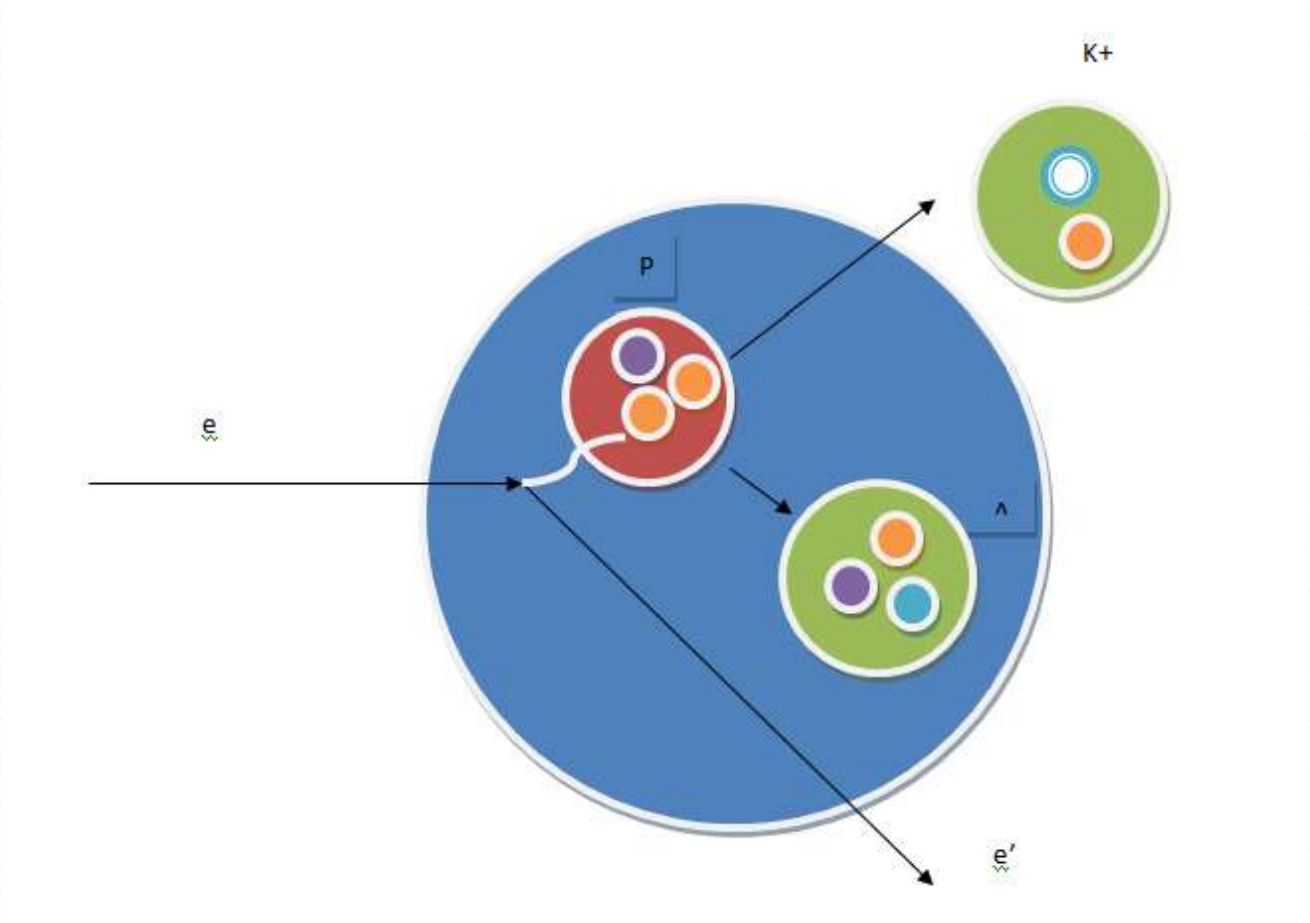


Production of hyper nuclei

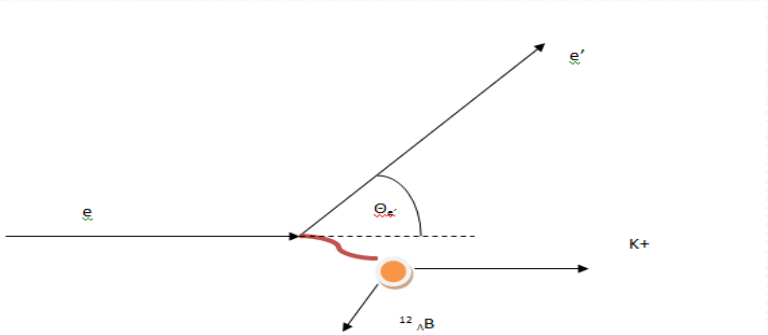
- 

- 

$^{12}C(e,e',K+)^{12}{}_{\Lambda}B$



Define kinematics



- Electron beam energy E=4.524 GeV
- virtual photon energy =0.7 -95%E GeV
- Scattered electron energy=3.826-0.226 GeV
- $\Theta_{e'} \geq 1.57$ rad will not considered.
- For small $\Theta_{e'}$, $\Theta_{\Upsilon k}$

$$\Theta_{e'k} = \Theta_{ek} = 0$$

Virtual flux factor

$$\tau = \frac{k\alpha}{4\pi^2 - q_\mu^2} * \frac{E}{E0} * \frac{2}{1-\epsilon}$$

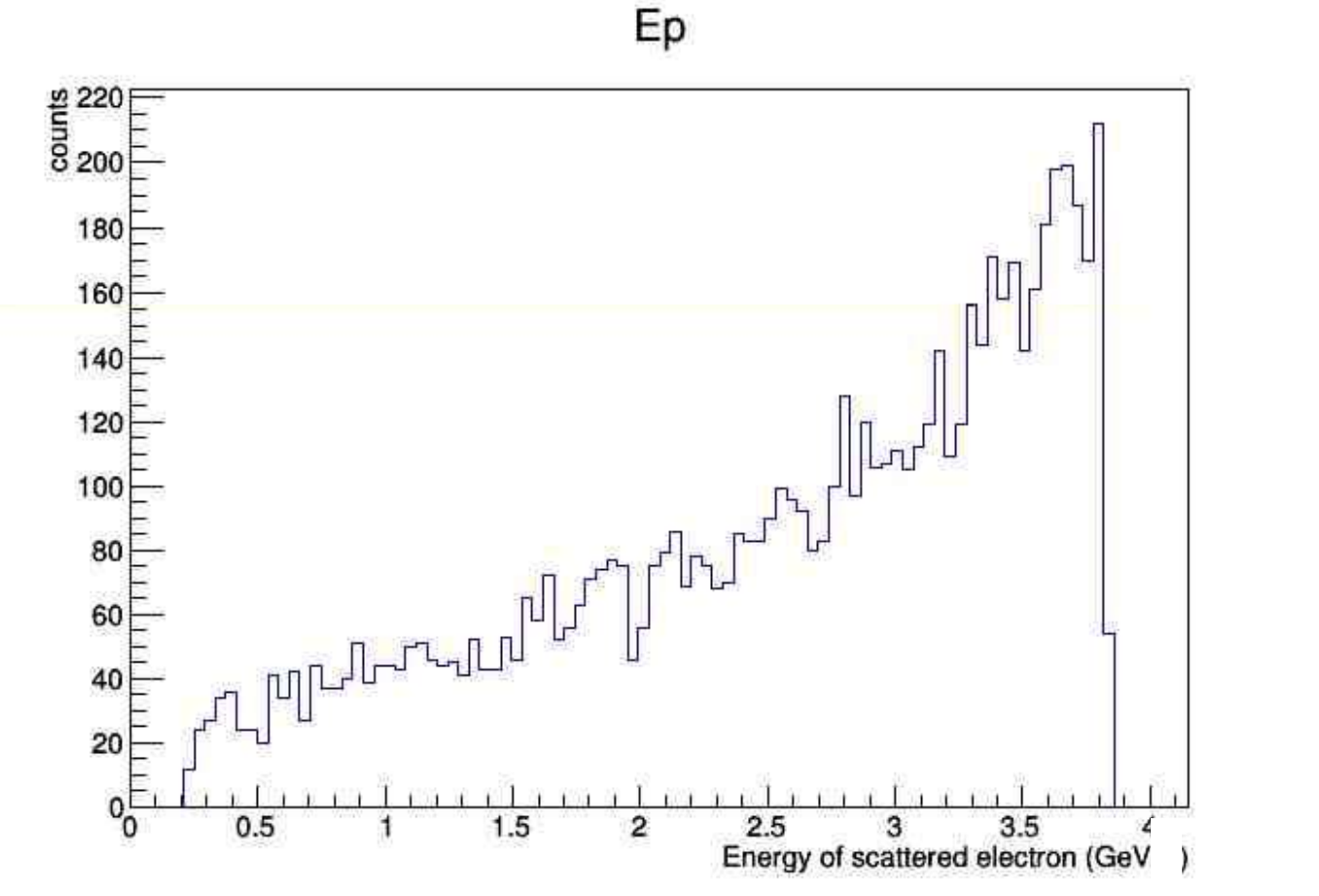
$$\epsilon = \frac{2E0^2E^2\sin^2\theta'}{2\,E0^2E^2\sin^2\theta' - q^2q_\mu^2}$$

q - Momentum of virtual photon

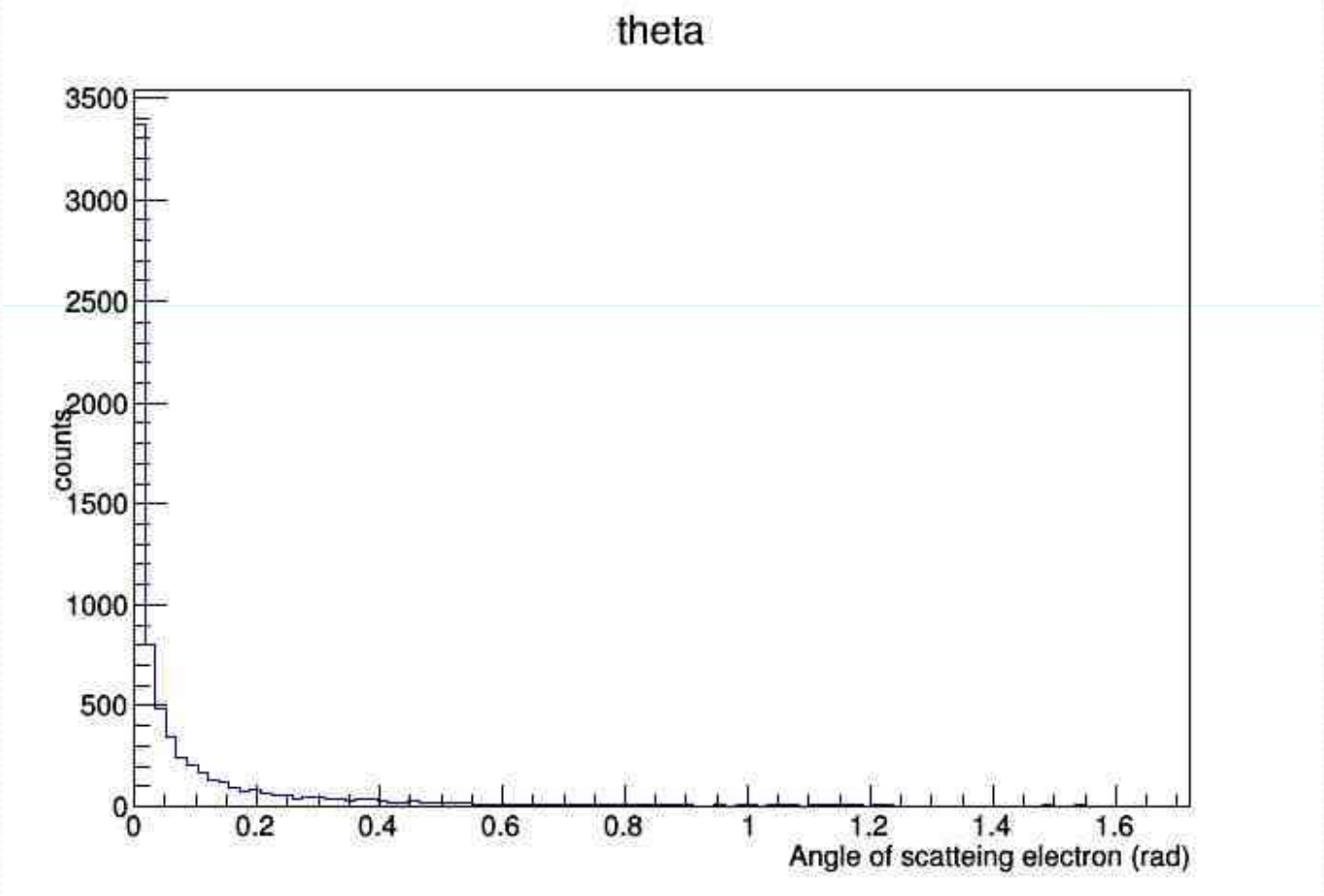
q^2_μ -Invariant four momentum

$q^2_\mu = k^2 - q^2$

Graph of scattered electron energy



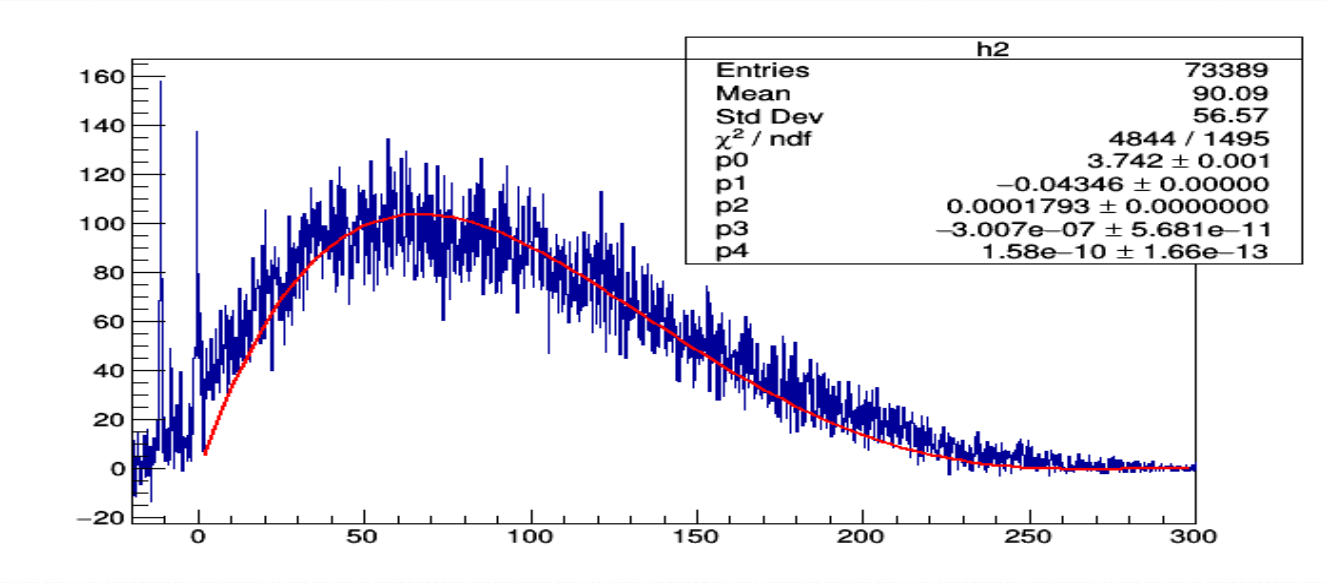
The graph of scattering electron angle



Generate Hyper nucleus mass

The quasi free mass distribution of ${}^{12}_{\Lambda}$B in terms of binding energy

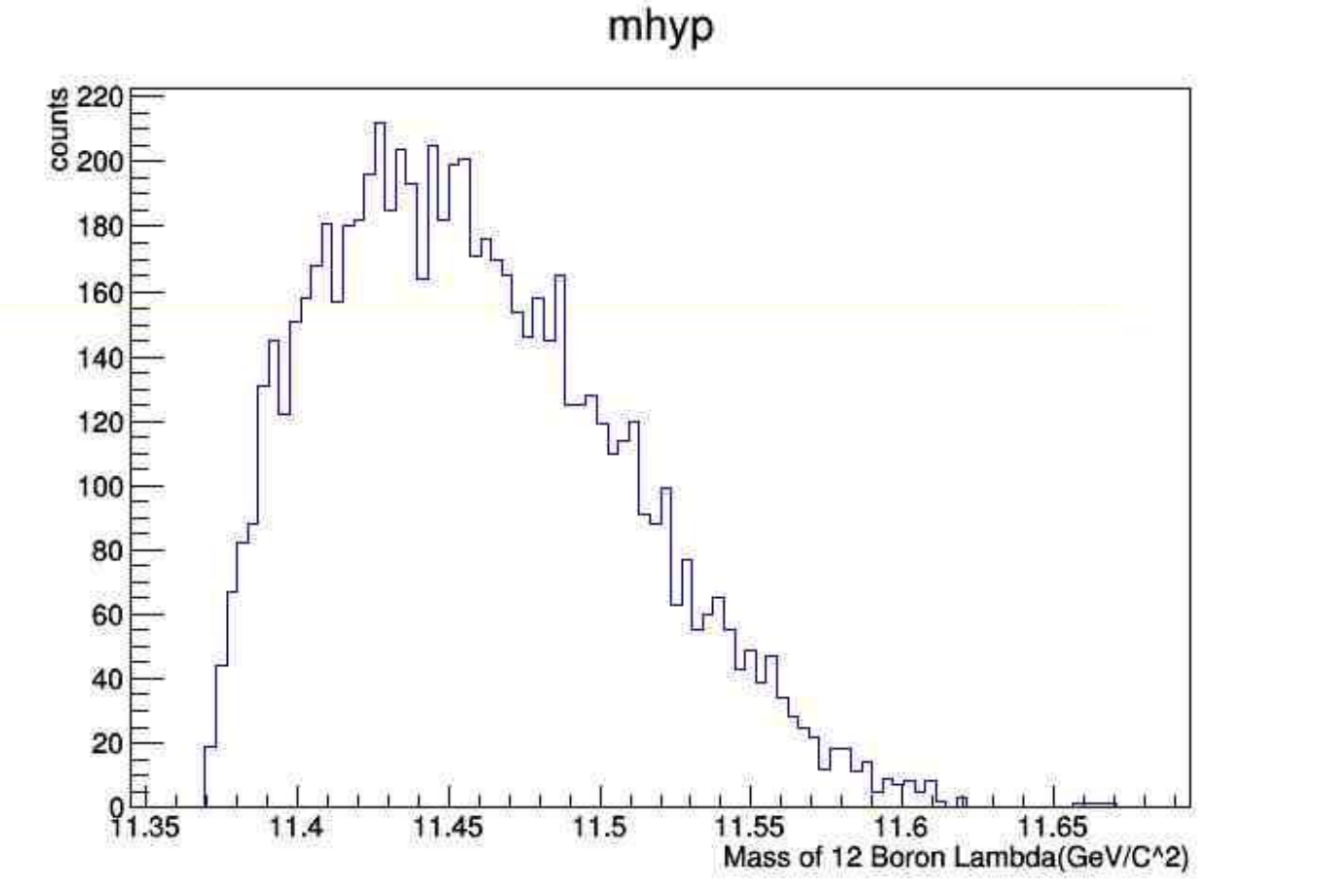
$$N(B_\Lambda)=3.742\times B_\Lambda - 0.04346\times B_\Lambda^2 + 1.793\times10^{-4}\times B_\Lambda^3 - 3.007\times10^{-7}\times B_\Lambda^4 + 1.58\times10^{-10}\times B_\Lambda^5$$



- Mass of Lambda particle=1.11563 GeV/C^2
- Mass of ^{11}B core= 10.2526 GeV/C^2
- Mass of $^{12}{}_{\Lambda}B$ =

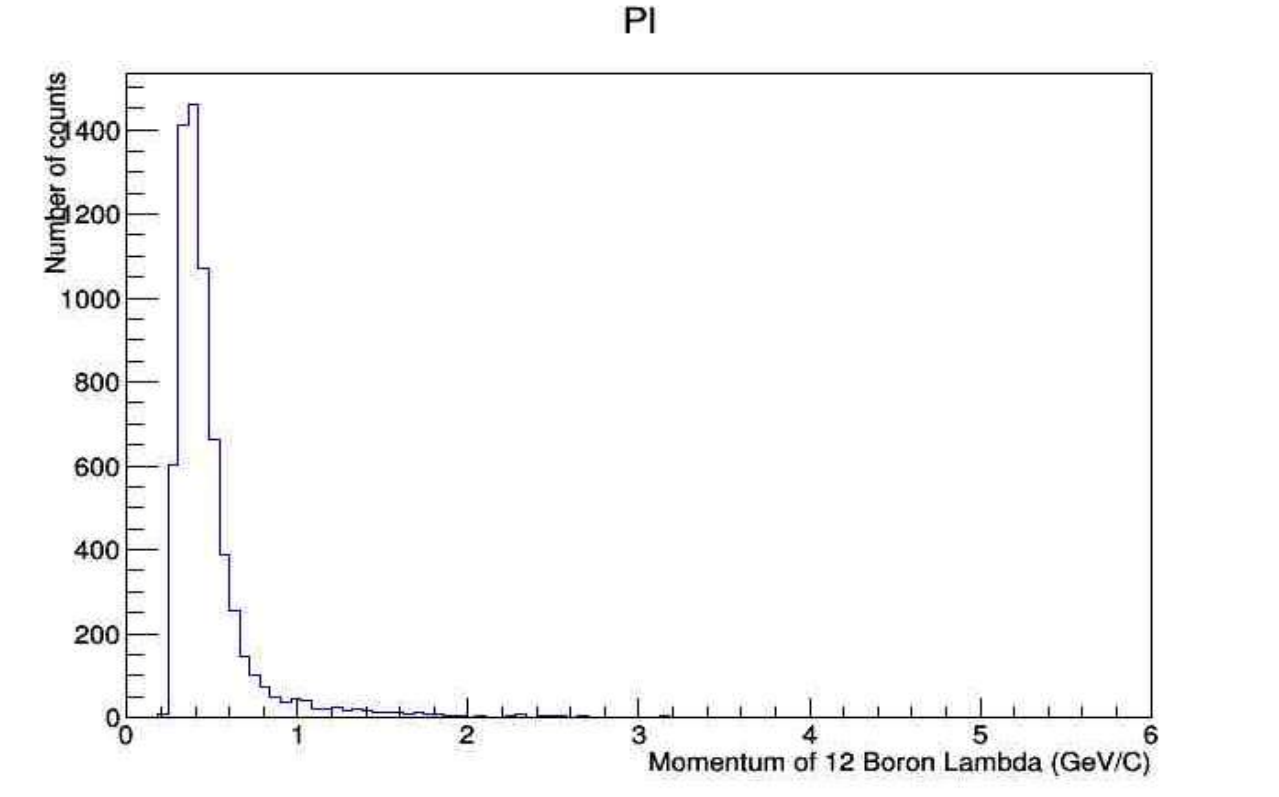
Mass of Lambda Particle+ Mass of ^{11}B core +binding energy

Graph of $^{12}{}_{\Lambda}B$ mass distribution



Graph of $^{12}{}_{\Lambda}B$ momentum distribution

- Using the momentum conservation and energy conservation , the momentum of $^{12}{}_{\Lambda}B$ particle is,



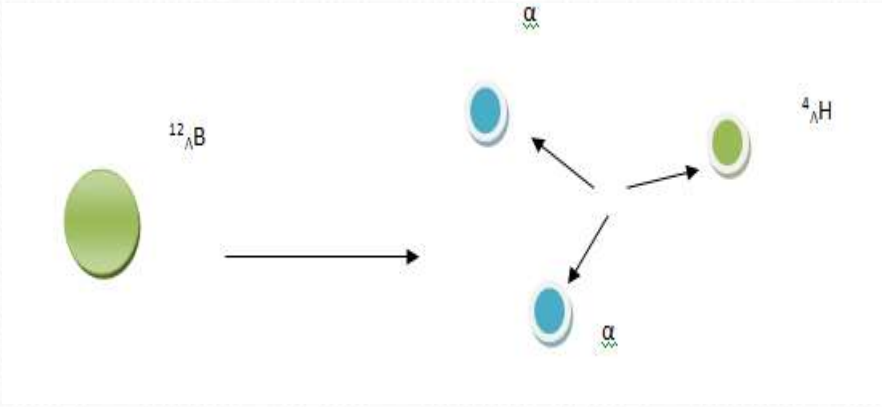
3-Body decay

Then $^{12}_{\Lambda}B$ decay in to three particles.

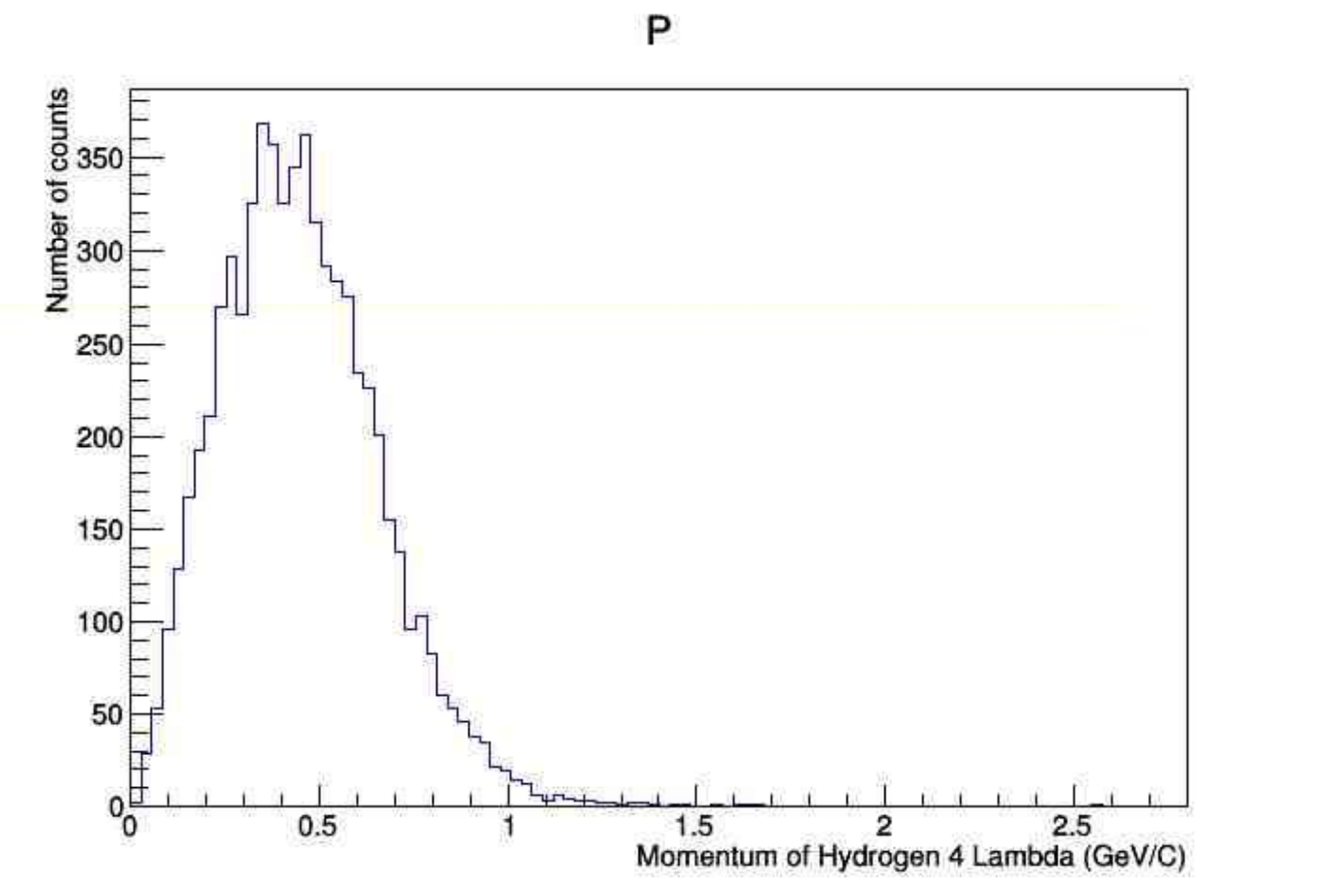
$$^{12}_{\Lambda}B \rightarrow \alpha + \alpha + ^{4}_{\Lambda}H$$

Mass of $^{4}_{\Lambda}H$ =3.922445 GeV/C²

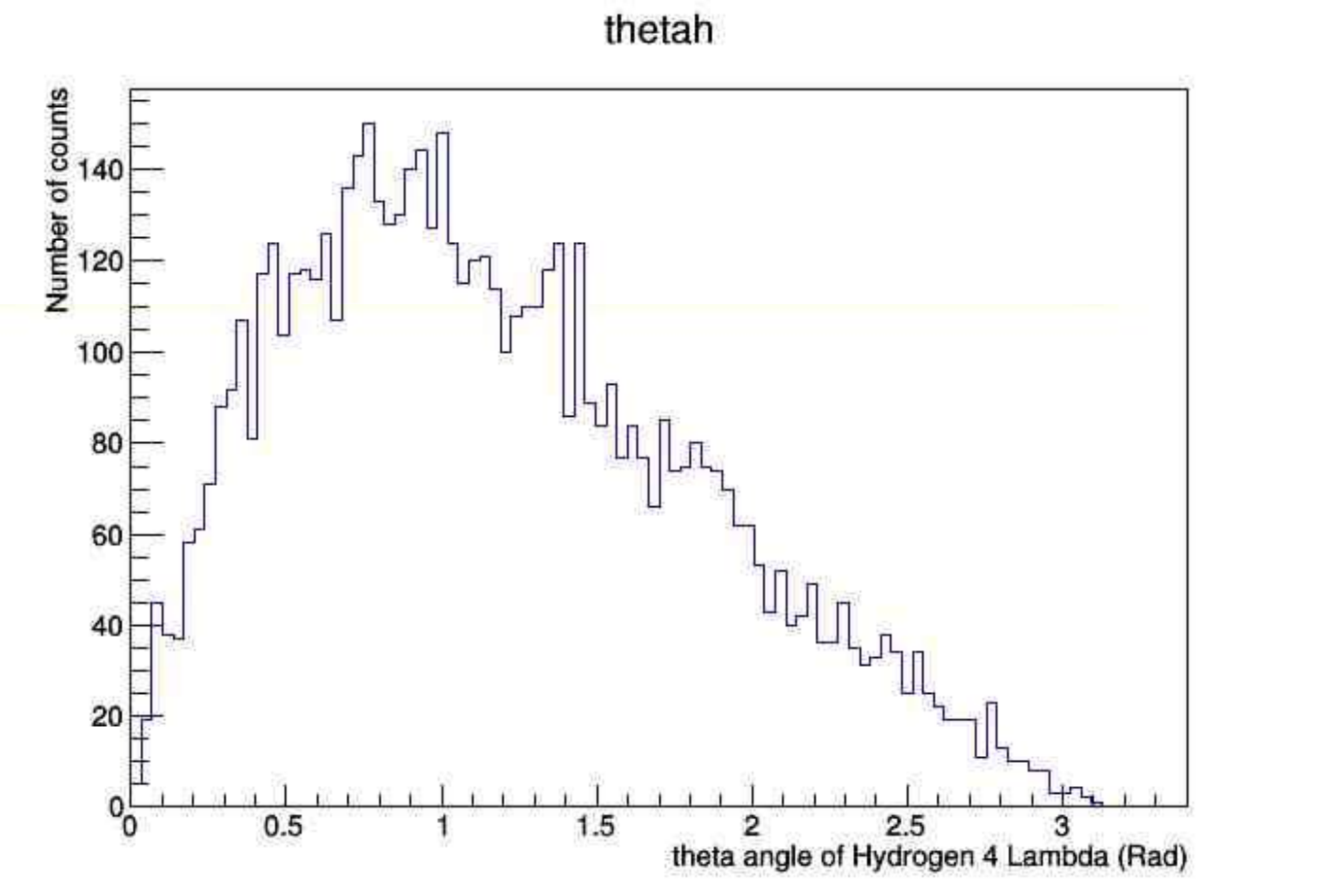
Mass of α =3.727408 GeV/C²



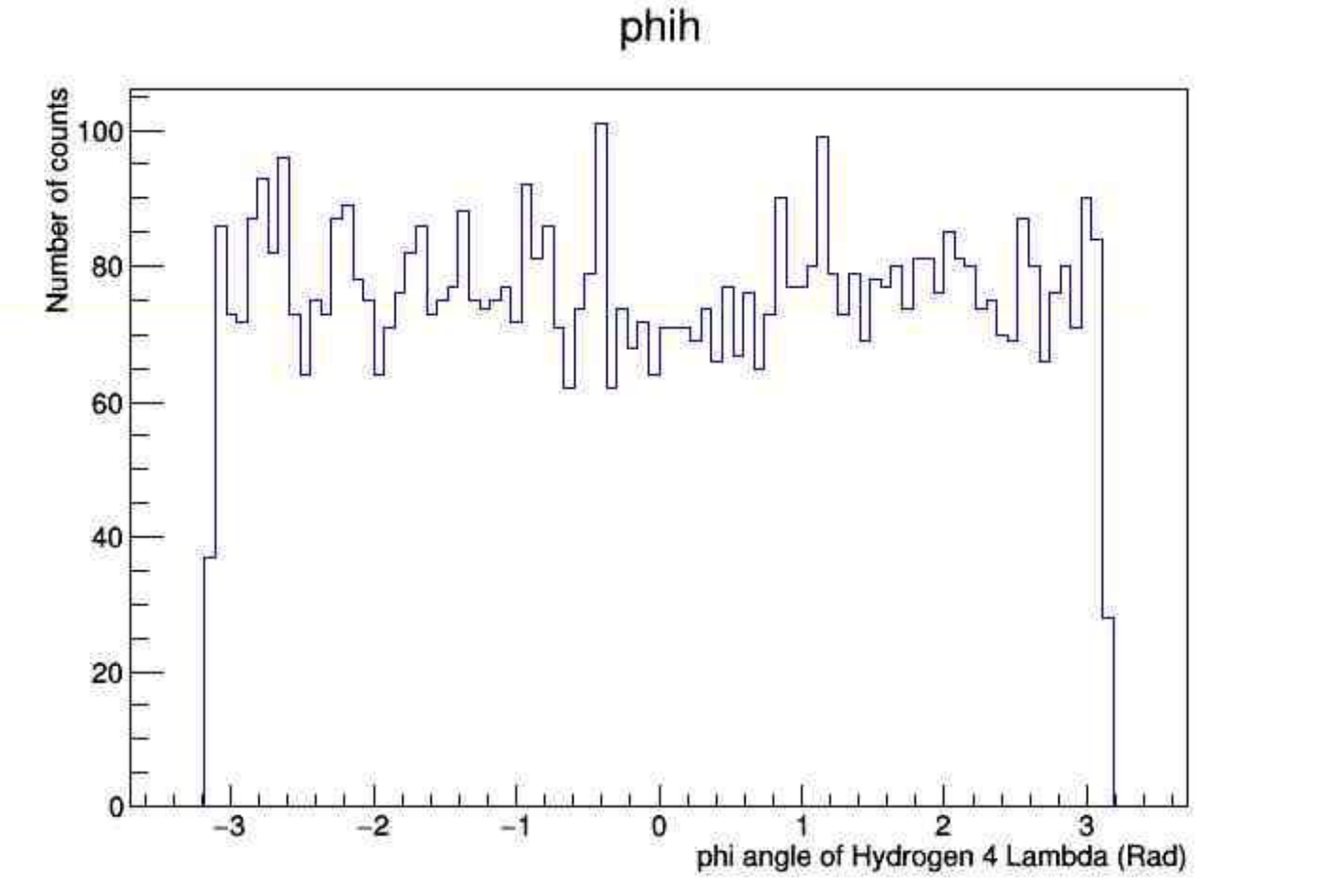
Graph of $^{4}_{\Lambda}H$ momentum distribution



Graph of $^{4}_{\Lambda}$H theta angle distribution



Graph of $^{4}_{\Lambda}$H phi angle distribution



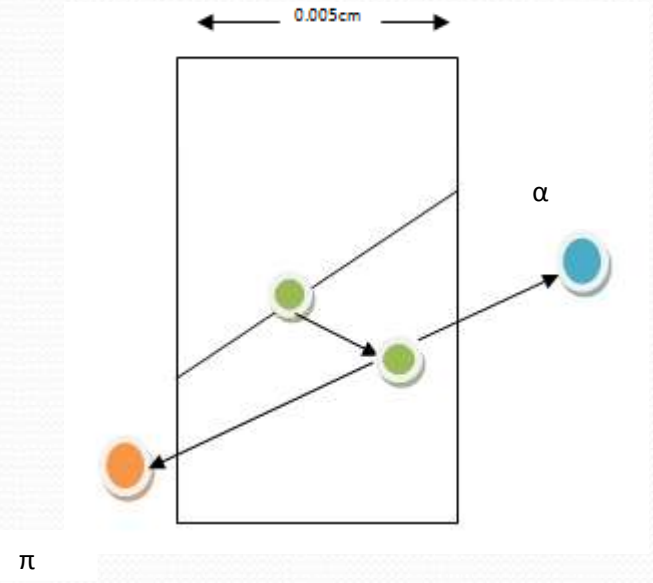
Future work

- Geant 4 simulation for $^{4}_{\Lambda}H$

$$^{4}_{\Lambda}H \rightarrow \alpha + \pi^-$$

Mass of $^{4}_{\Lambda}H$ =3.922445 GeV/C²

Mass of α =3.727408 GeV/C²



Thank you