Second Arm Simulation

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1 Introduction

We report here studies of the momentum resolution of 2nd arm in WA98 experiment. To investigate the effects of the He bag, the target spot size, chamber resolutions on the momentum resolution, we performed Monte Carlo simulations using GEANT.

2 Setup of geometry in GEANT

Installation of material in GEANT ; Figure 1.

Geometry and Resolution of chambers

	Pad Chamber	Streamer Tube
No. of chamber	2	2
Dimension	120 × 85 × 0.0082 cm	139.3 × 127.5 × 0.5 cm
Resolution	$\Delta x = 0.02$ cm	$\Delta x = 0.4$ cm
	$\Delta y = 0.4$ cm	$\Delta y = 0.8$ cm
material	Wire (Fe)	Plastic

Geometry of others ;

- Region of magnetic Field ; 100 (radius) × 160 (height) cm [column]
- Vac. bag : 200 × 200 × 400 cm
- He bag : 200 × 200 × 140 cm
- He bag 2 : 240 × 200 × 800 cm

Target spot ; uniform distribution in circle with a diameter of 3mm

3 Setup parameter of experiment

- Chamber Efficiency : 100 %
- Particle : π^+
- Magnetic Field : 1 T in Homogeneous
- No. of events : 1000 (for each momentum)

4 Results

Momentum resolution as a function of momentum ;

- Effect of He bag : Figure 2
- Details of various effects : Figure 3
- Effect of Target spot : Figure 4

5 Conclusions

From these results, it is expected that the momentum resolution is improved by installing He bag. The momentum resolution is mainly determined by the multiple Coulomb scattering, the target spot size and the chamber resolutions. (see Figure 3) We defined the size of the target spot from the veto hole. If the size of target spot is 3mm in diameter, its effect is small, but the size is 10mm, its effect is as strong as chamber resolution.

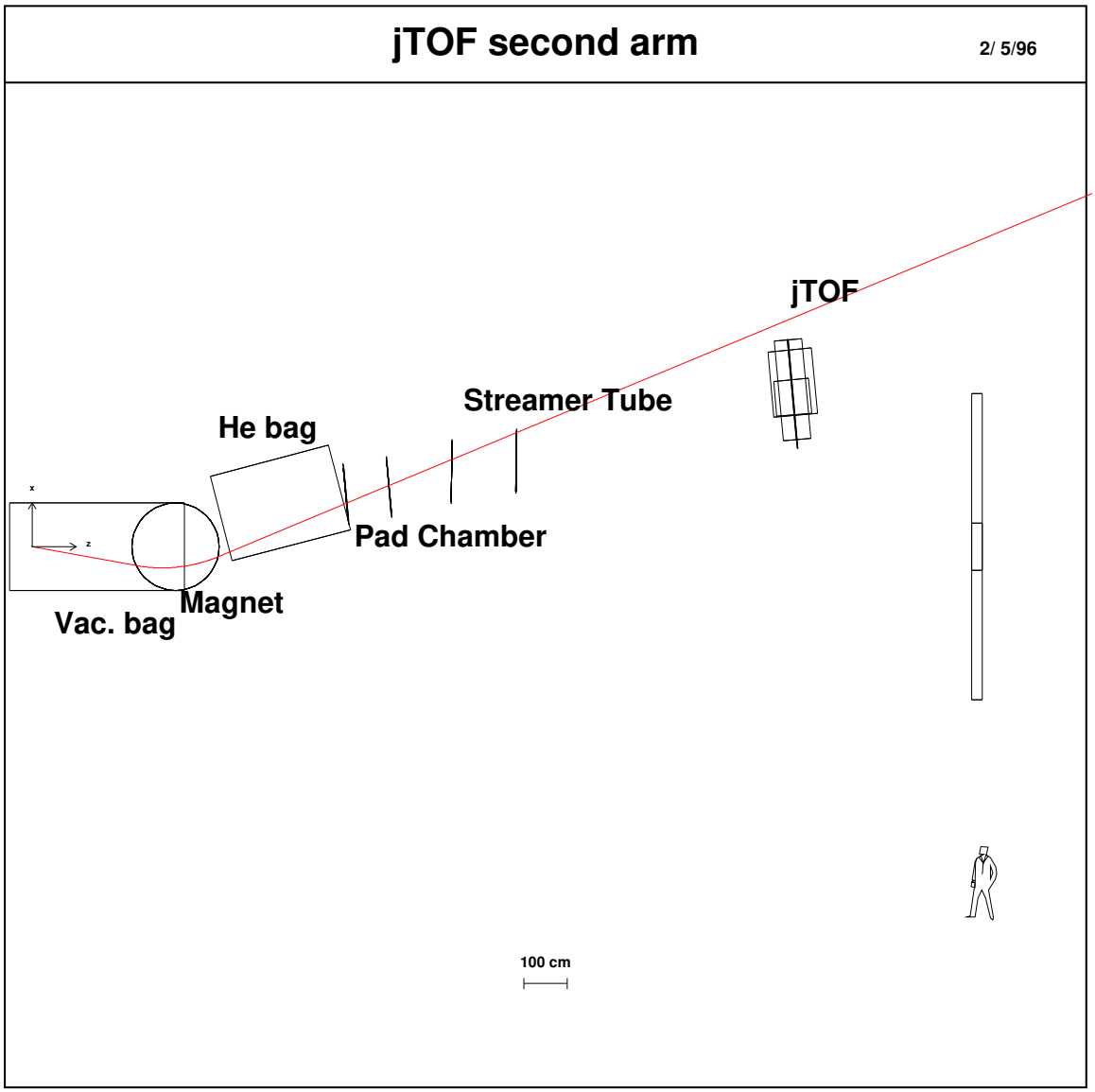

Figure 1: Installation of material in GEANT

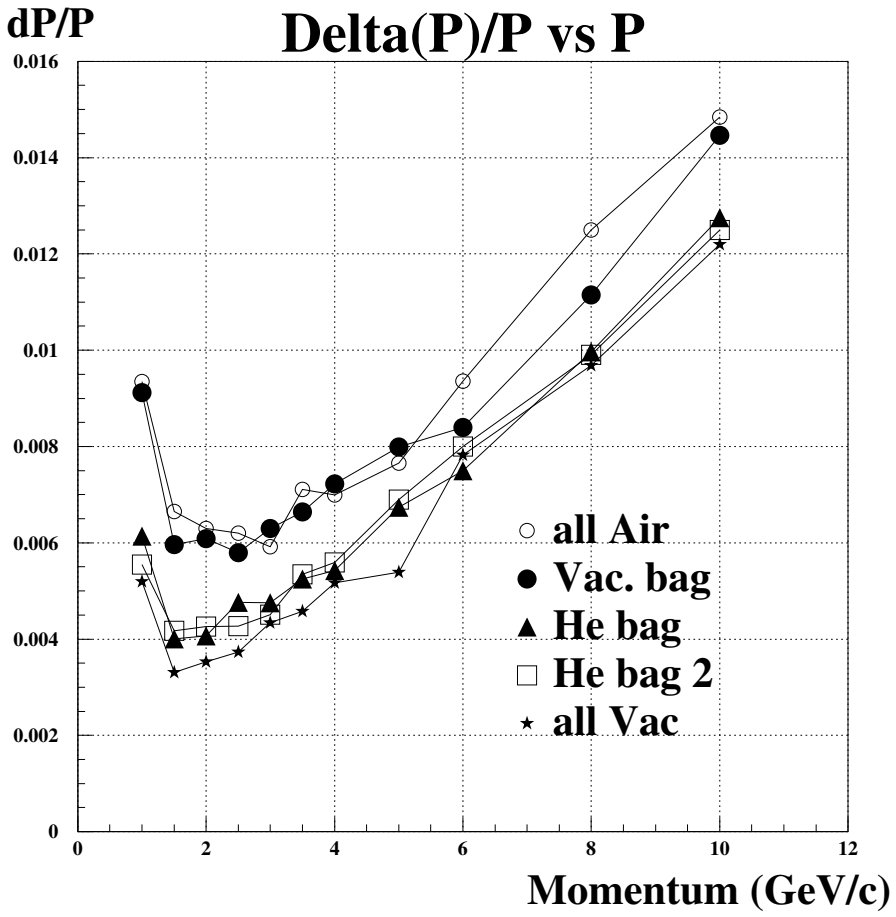

Figure 2: Momentum resolution (dp/p) as a function of momentum with air [open circle], with vacuum [star], with **Vac. bag** (Vacuum bag between the target and the magnet)[full circle], with **He bag** (Vac. bag & He bag between the magnet and the first chamber)[triangle], and **He bag2** (Vac. bag & He bag covering the Pad Chamber and Stream Tube)[square].

Multiple Scattering	Chamber resolution	Target spot
on	on	off

Results

- Momentum resolution is improved by 0.002 by installing He bag.
- Air between the magnet and the first chamber effects on the momentum resolution strongest.

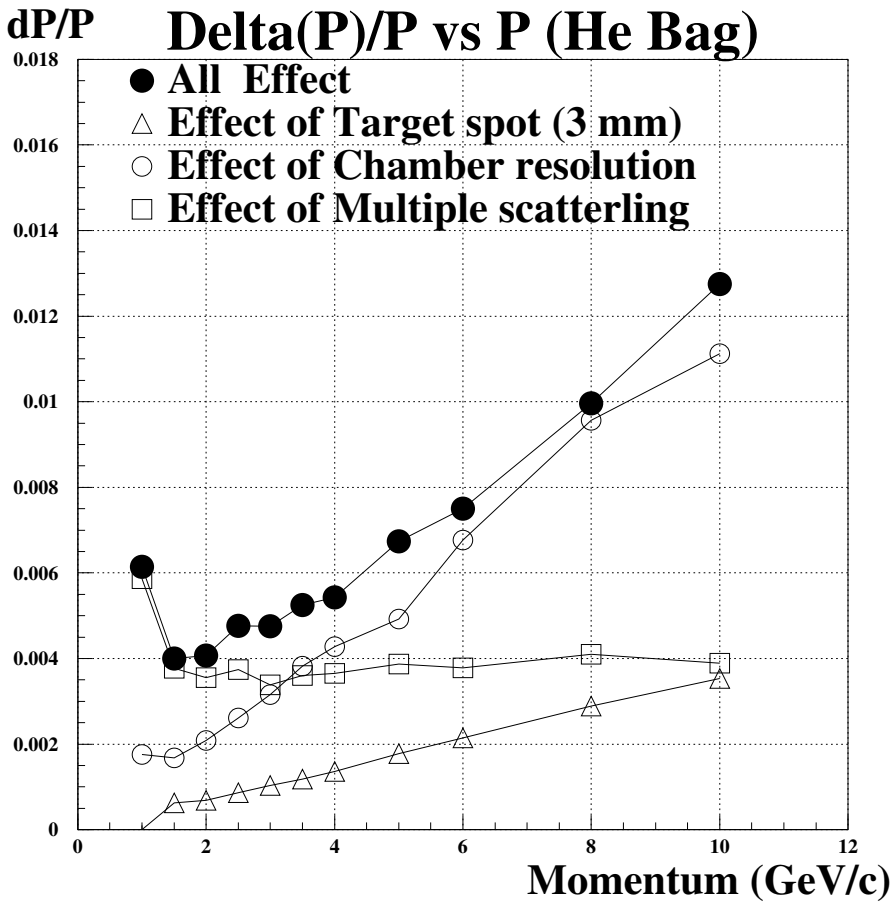

Figure 3: Momentum resolution (dp/p) as a function of momentum using He bag, with a target spot (3mm) [triangle], with the chamber resolutions [open circle], with the multiple scattering [square], and with all the three effect [full circle]

Results

- By the **effect of the target spot and the chamber resolutions**, momentum resolution increases roughly in proportional to momentum.
- Momentum resolution (dp/p) with the **effect of Multiple scattering** is a constantly of 0.004. At low momentum ($\sim$ 1GeV/c), the effect is strongest.

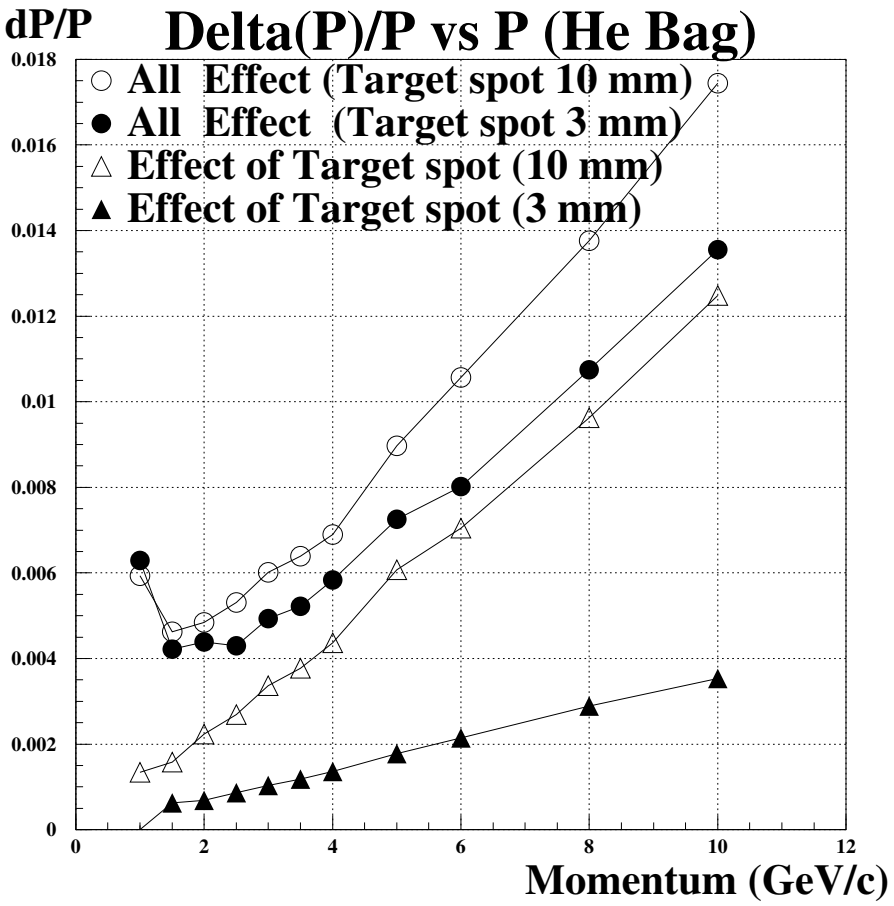

Figure 4: Momentum resolution (dp/p) as a function of momentum using He bag, with a target spot (3mm)[full circle, full triangle],(10mm)[open circle, open triangle],

Results

- At high momentum, the size of the target spot is larger, the momentum resolution is worse.

WA98 target information by S.Nishimura
The target spot size will be smaller than the size of the veto hole.
For the Pb run, the size of the veto hole is 3mm.
For the proton run, the size of the veto hole is 10mm.