Second Arm Simulation

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Momentum reconstruction

0. Introduction

This report is study of momentum resolution of 2nd arm in WA98 experiment. Calculating momentum reconstruction for GEANT, We estimated momentum resolution with effect of gas, target spot, chamber resolution and so on.

1. Setup of 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

2. Setup parameter

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

3. Results

Momentum resolution vs p

- Effect of gas ; Figure 2
- Physical effect at He bag ; Figure 3
- Effect of Target spot ; Figure 4

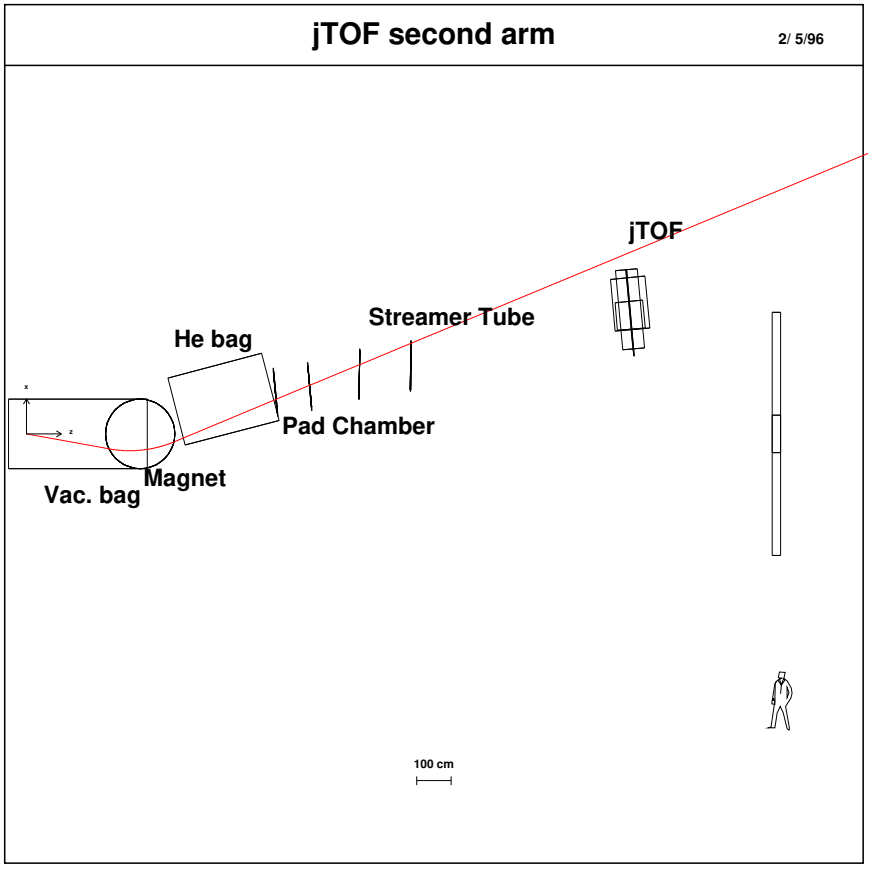

Figure 1: Installation of material in GEANT

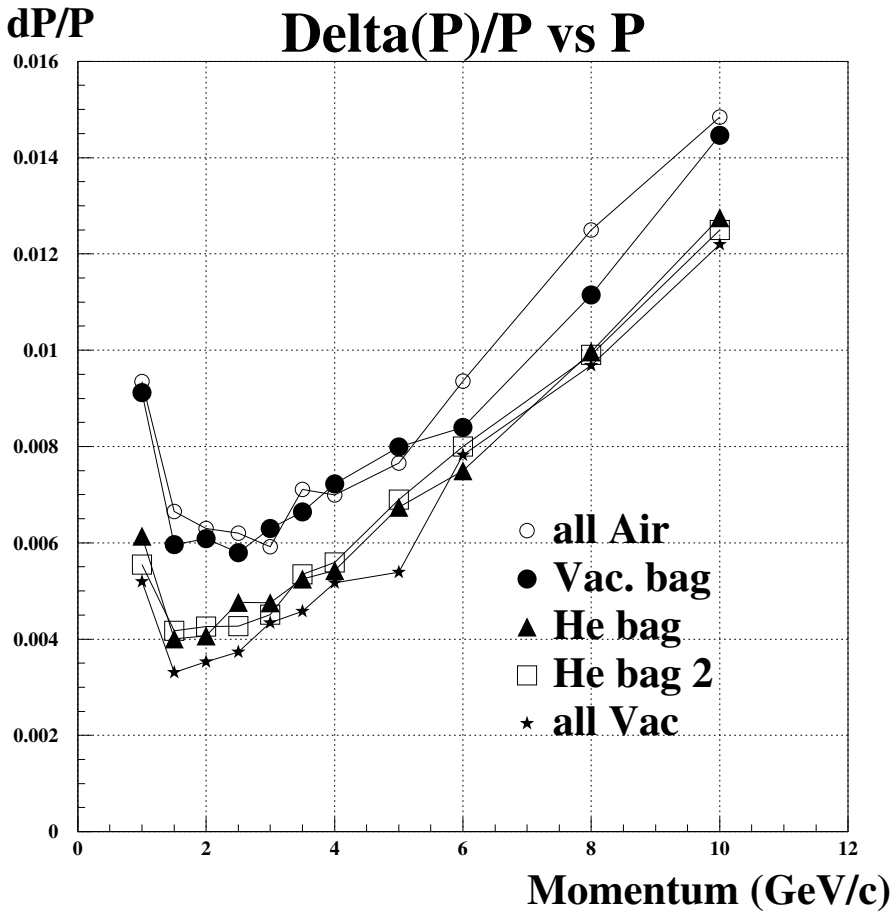

Figure 2: momentum resolution (dp/p) as a function of momentum with air [open circle], with vacuum [star], with **Vac. bag** (Vacuum bag between the target and the magnet)[full circle], with **He bag** (Vac. bag & He bag between the magnet and the first chamber)[triangle], and **He bag2** (Vac. bag &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

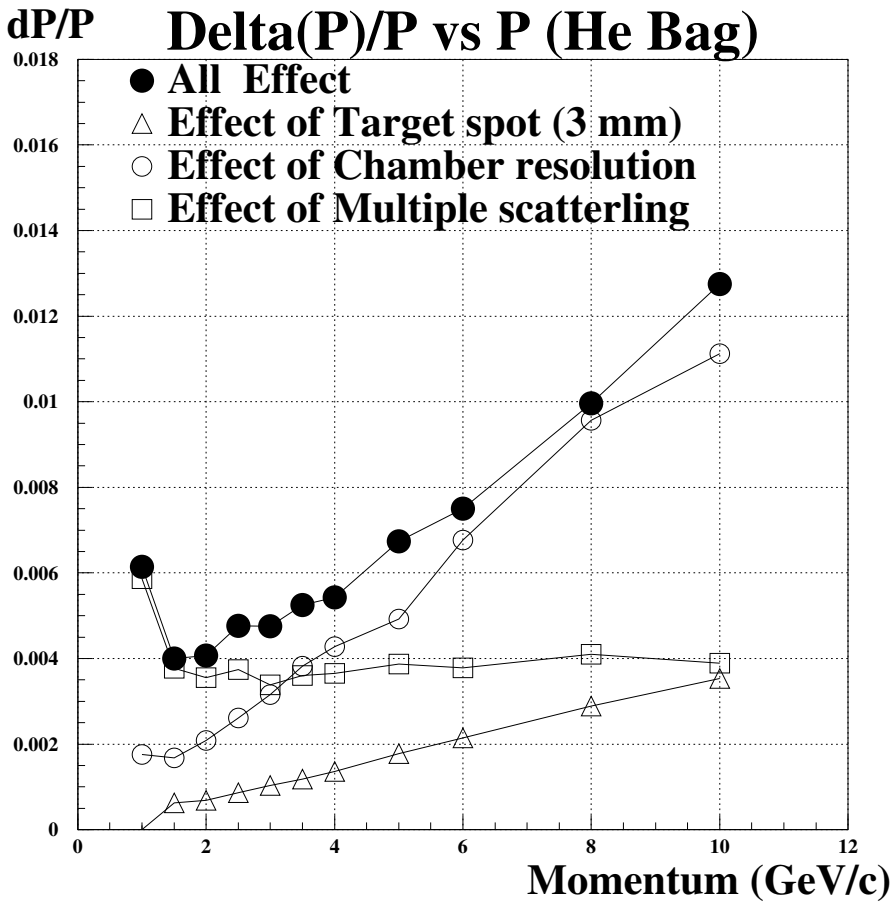

Figure 3: momentum resolution (dp/p) as a function of momentum using He bag, with a target spot (3mm) [triangle], with the chamber resolutions [open circle], with the multiple scattering [square], and with all the three effect [full circle]

Result

- 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.

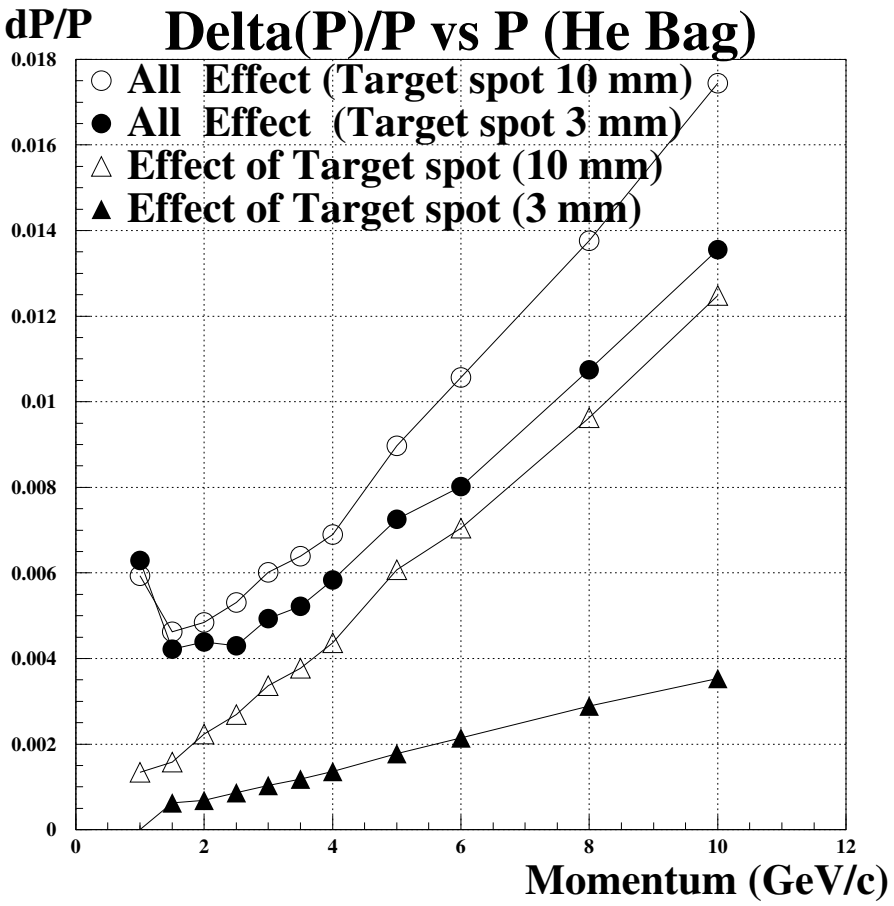

Figure 4: momentum resolution (dp/p) as a function of momentum using He bag, with a target spot (3mm)[full],(10mm)[open],

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.