Positronium intensity measurement preparation (GBAR)

SNU

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12월 meeting preparation

제목 : GBAR simulation framework

목표: Make full simulation in free-fall chamber region

- to estimate signal and BG from detector.
- to optimize detector, chamber and obstacle's design
- to estimate systematic uncertainty

Simulation issues

- Chamber →pressure(1.e-11mb), thickness(2~3mm(side),6mm(bottom)), design changes
- TOF
- Tracker → geometry, timing
- Paul trap → energy distribution, open angle
- Magnetic field

 - outside fringe field effect will be negligible(2gauss/s→1%error) by shielding

 - inside field

Source of error or bias

Main source

- H-bar kinetic energy
- Start time and position

} 1% by 1500# measurement

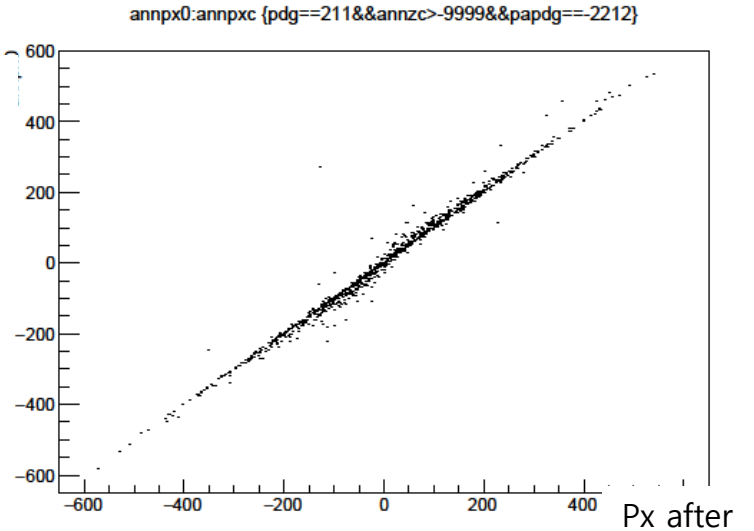
- Time, spatial resolution and tracking algorithm

Extra

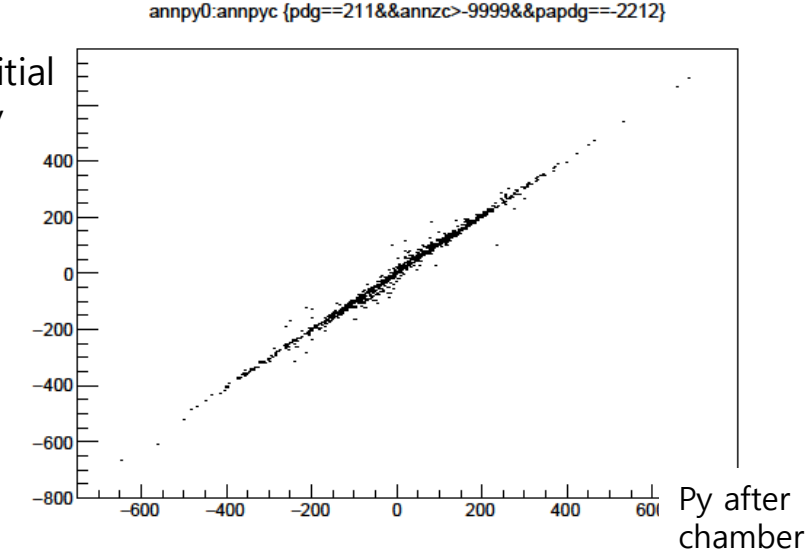
- Fringe field (magnetic), electric field?,
- Vibration, pressure, temp, reflection
- Annihilation in extra obstables

Tracking uncertainty

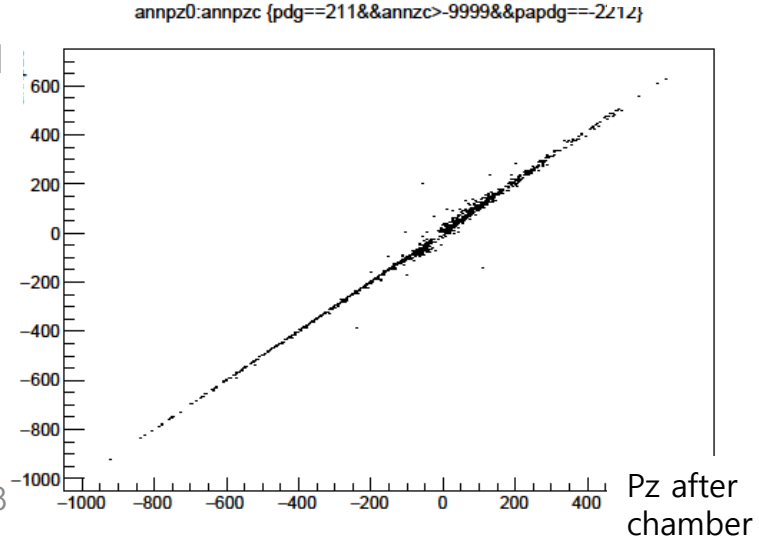
Initial Px

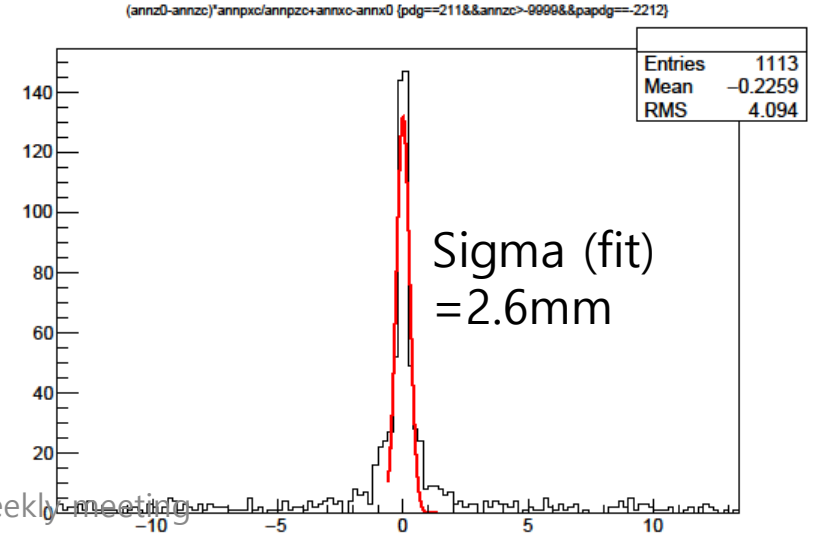


Initial Py



Initial Pz





Δx = p_x 를 통해 기대되는 x0 지점(z0에 대한) – x0

Last collaboration meeting

Magnetic Field limitations

Hydrogen has magnetic moment

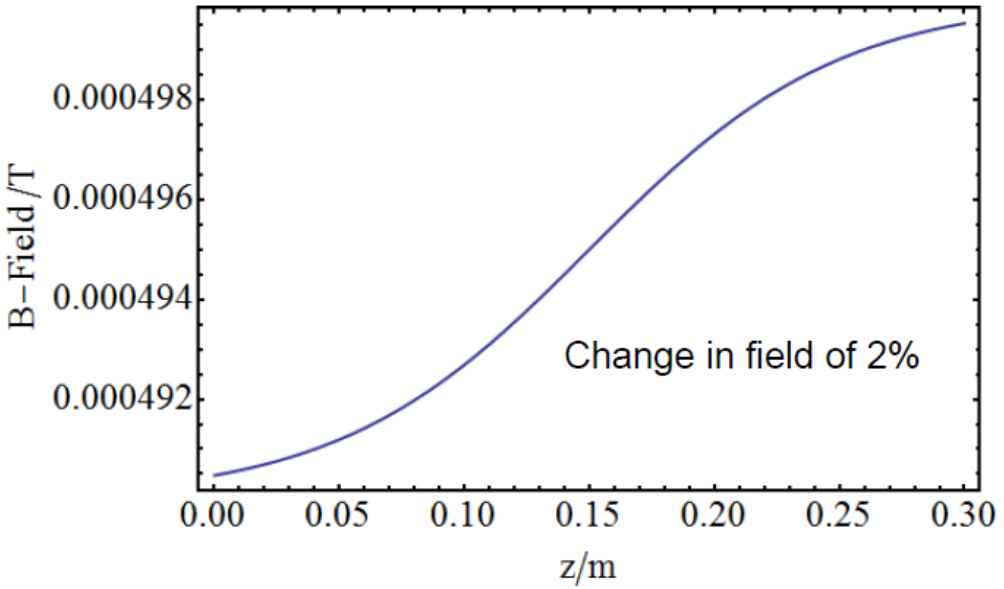
T.E. Phipps and J.B. Taylor,
Phys. Rev. **29**, 309 (1927)

Stern-Gerlach-Force:

$$F_{z,magn.}(z) = \mu_B \frac{\partial B(z)}{\partial z}$$

$$F_{tot,z}(z) = m\,g + F_{z,magn.}(z)$$

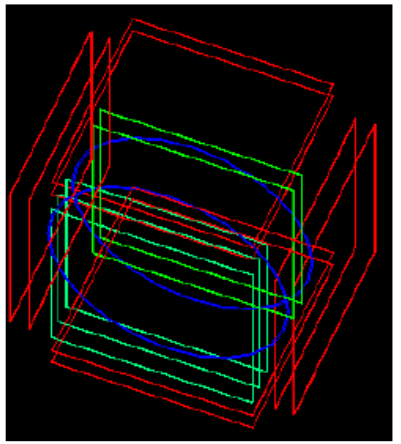
$$\frac{\bar{g}_{meas}}{g} = 1.012$$



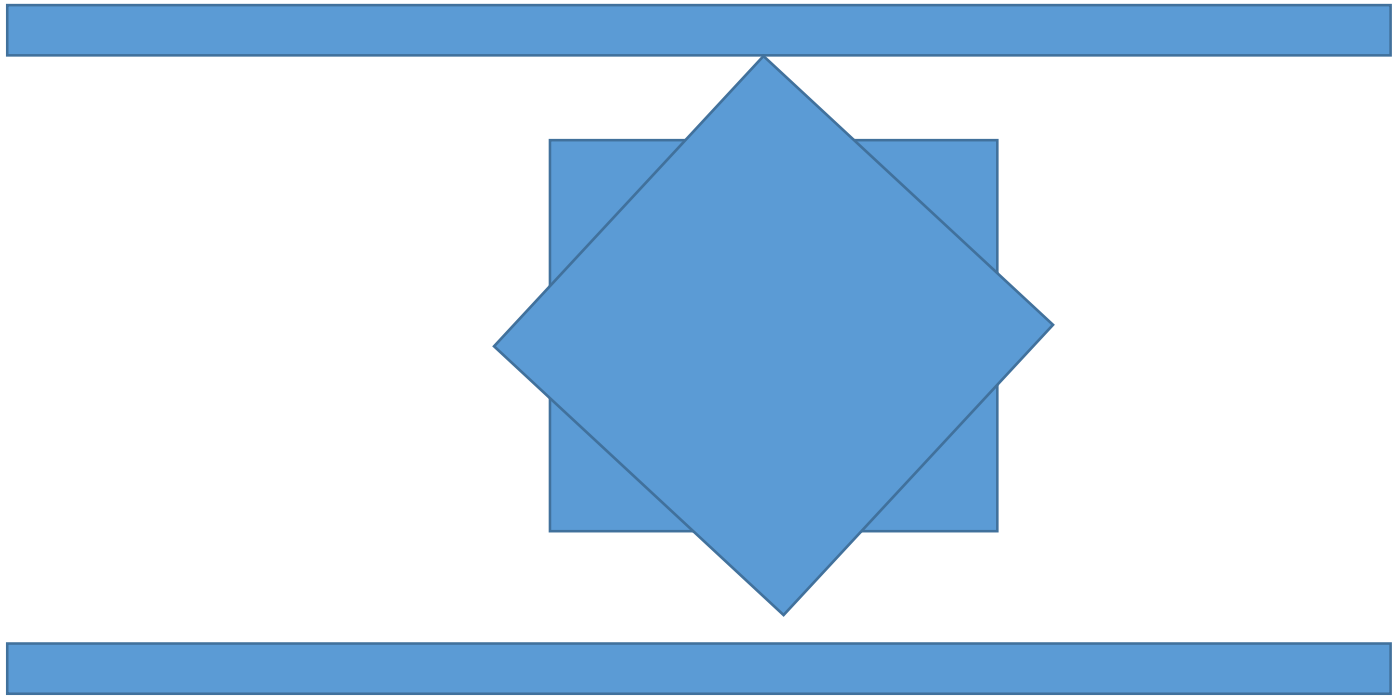
We need to keep the B-field homogeneous with 1% accuracy over trapping height

What are estimated
B-field and B-field gradient
at trap position?

Detector geometry



- At last meeting, Dipanwita Banerjee insisted strange geometry for tracker (3- top, 2-side,bottom)
- Do we need to rotate detector?



To do list

- Patrice mention about some magnetic field with obstacles inside vacuum chamber (need to understand)
- Tracking error can be larger than expected value
- Making list of systematic errors