Positronium intensity measurement preparation (GBAR)

SNU

Bongho Kim

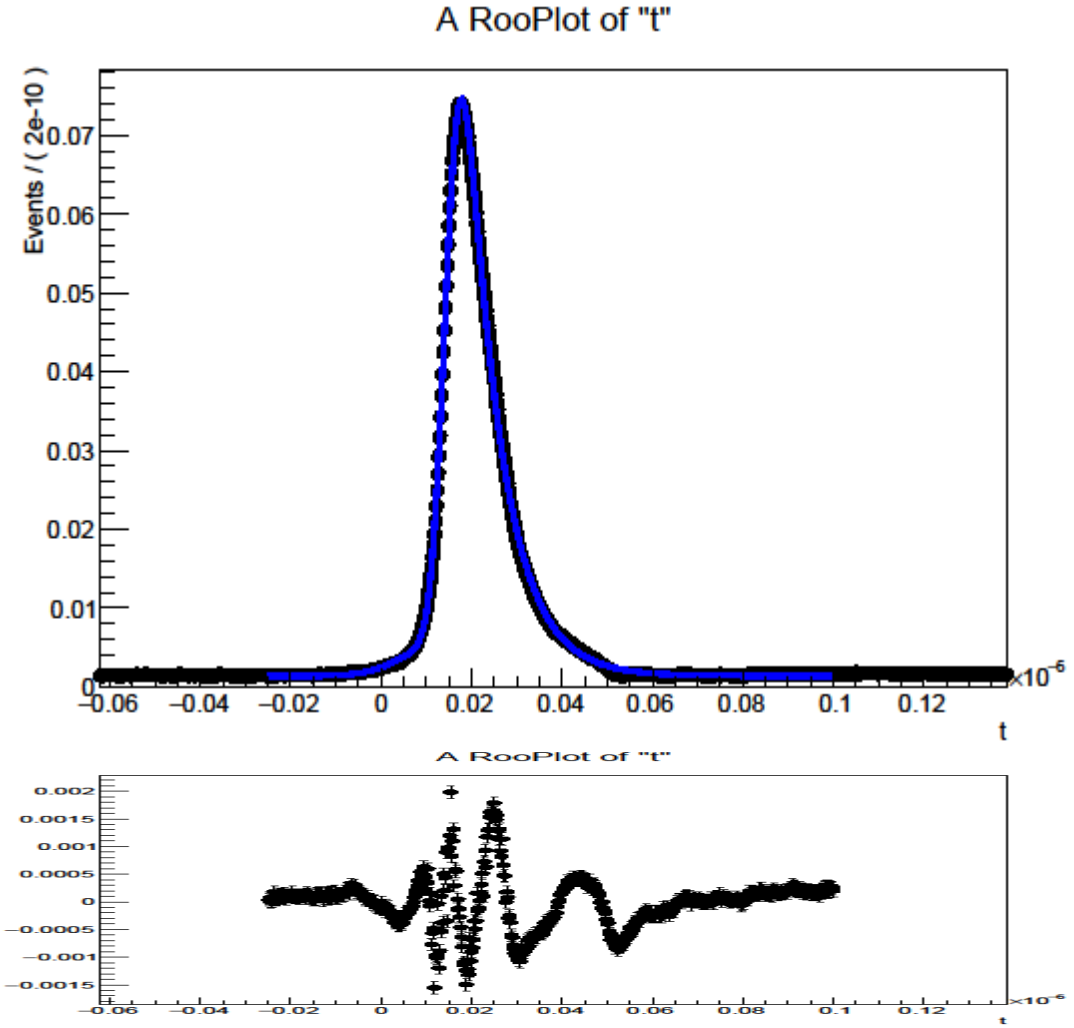
PWO detector preparation

Raw signal fitting

- Gauss (x) exp(-t/tau) + Gauss_a + poly(0)
- χ^2/ndf = 10357(wrong error)

← Normalized signal by 6321event

- Tau = 7.65ns
- Fraction(Gauss (x) exp /Gauss_a) = 0.905



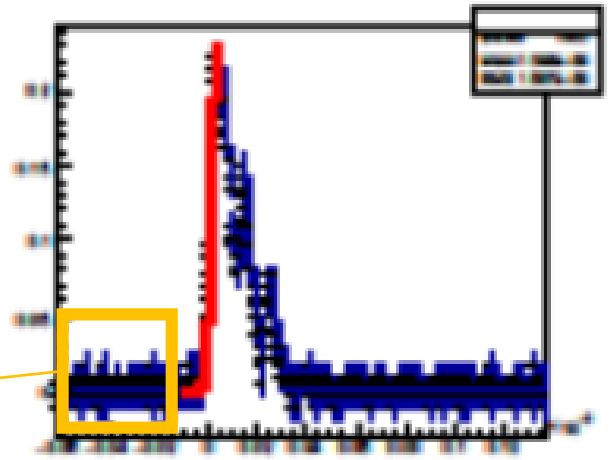
About histogram error

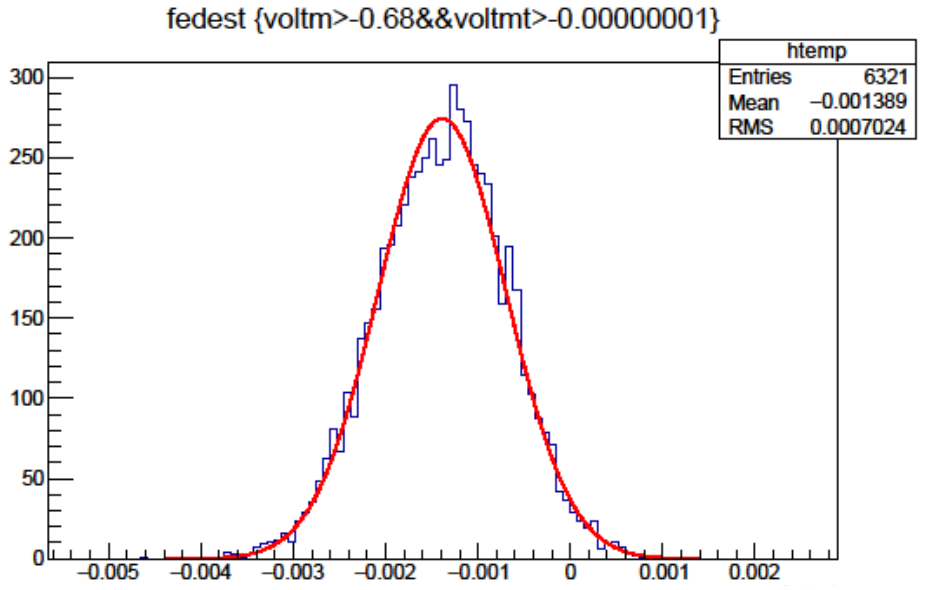
- Each raw signal has bin error about 7.5meV

←Fedestal : mean of 111bin for each picture

Fedestal fluctuation : 0.7meV

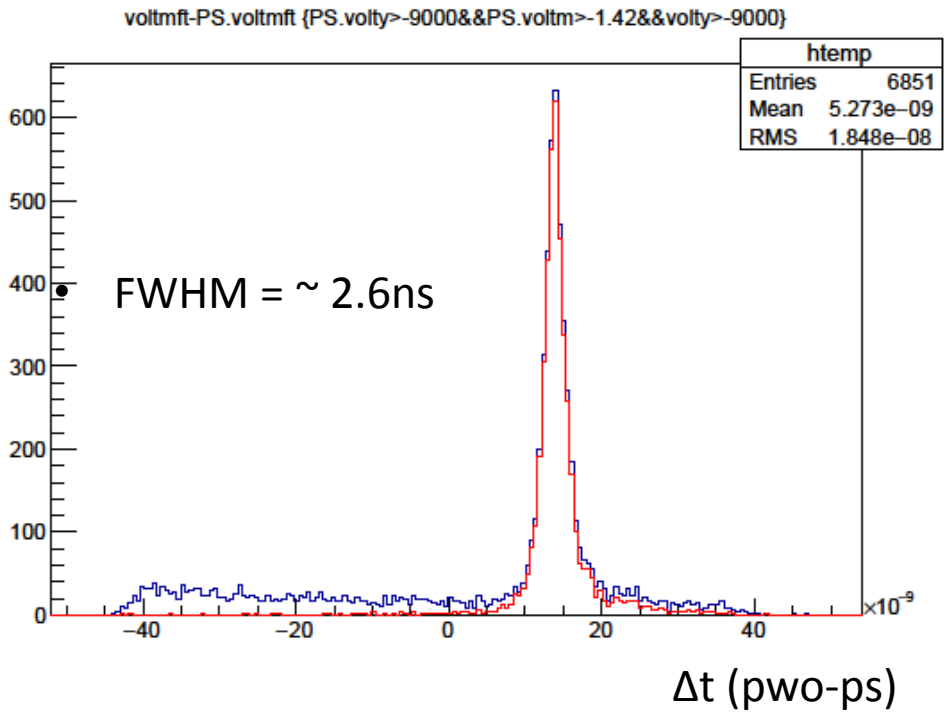
Bin Error : 0.7xSqrt(111) = 7.5meV

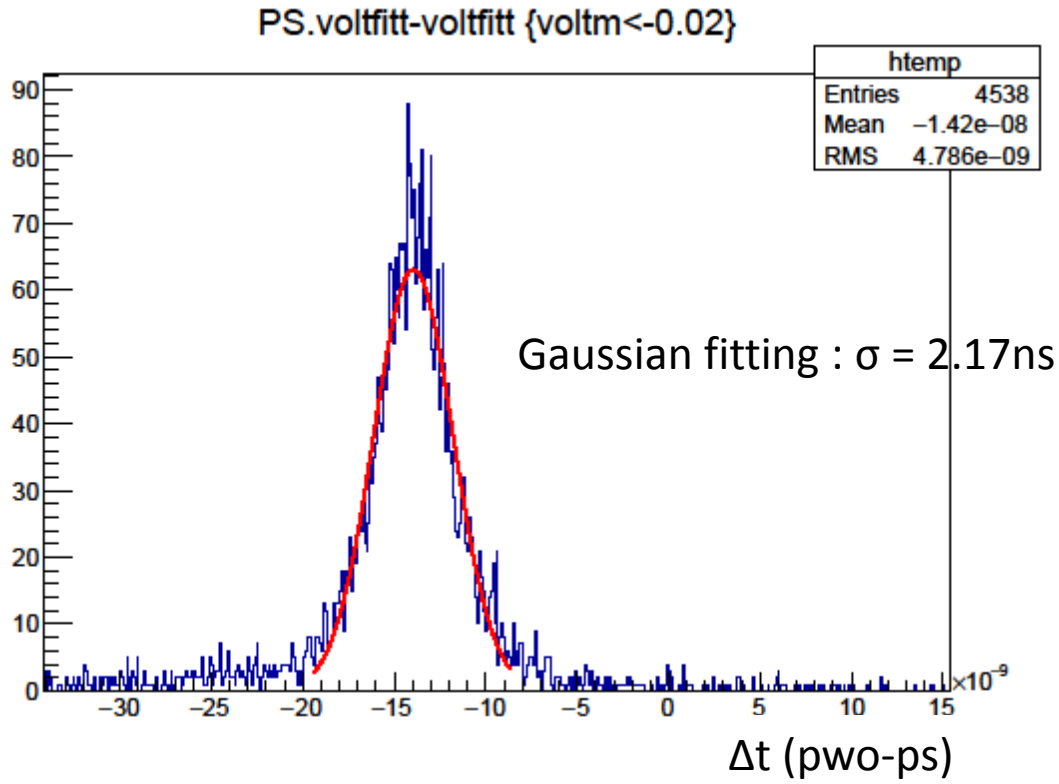


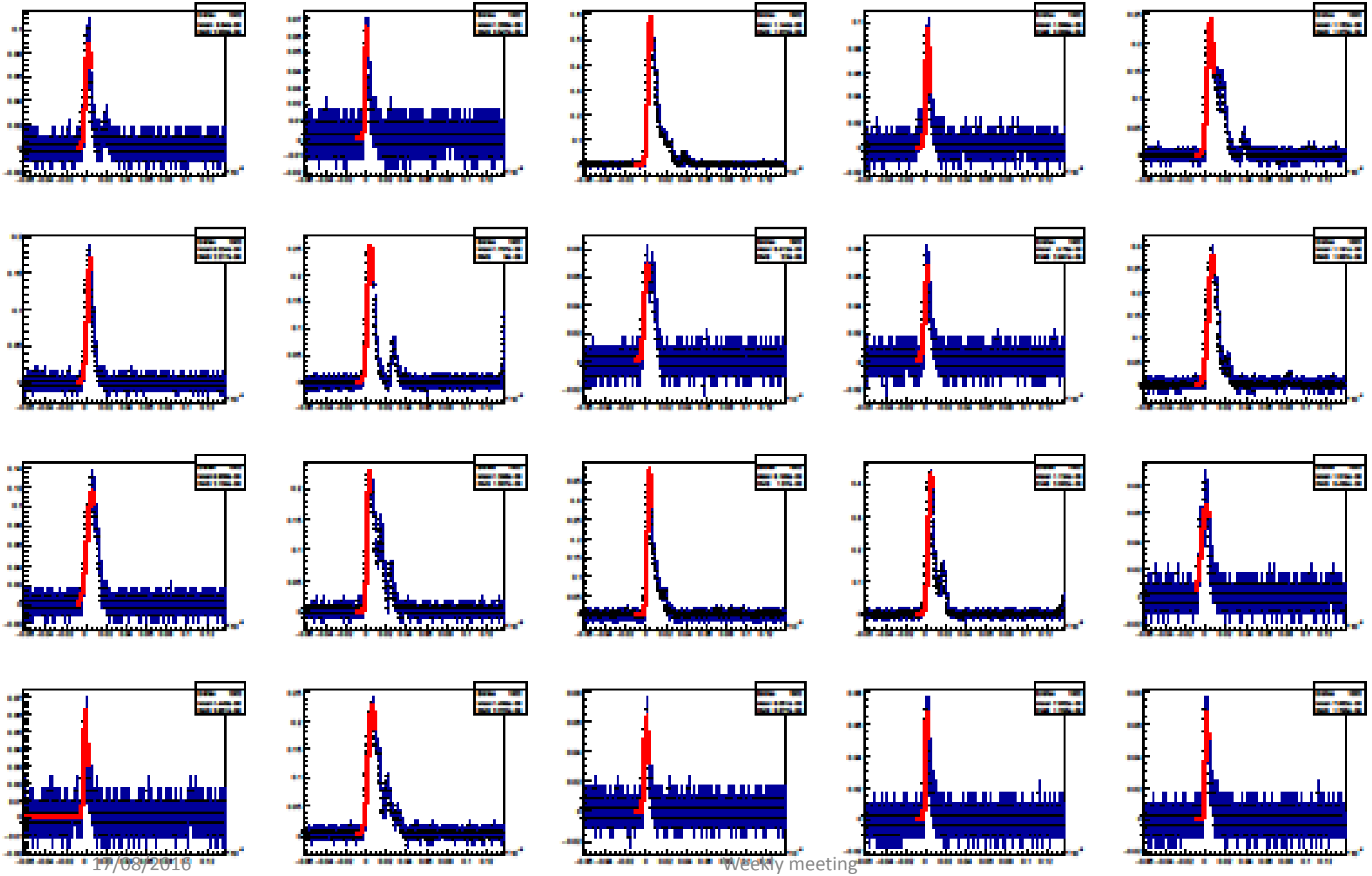


Volt_mean

PWO time resolution check





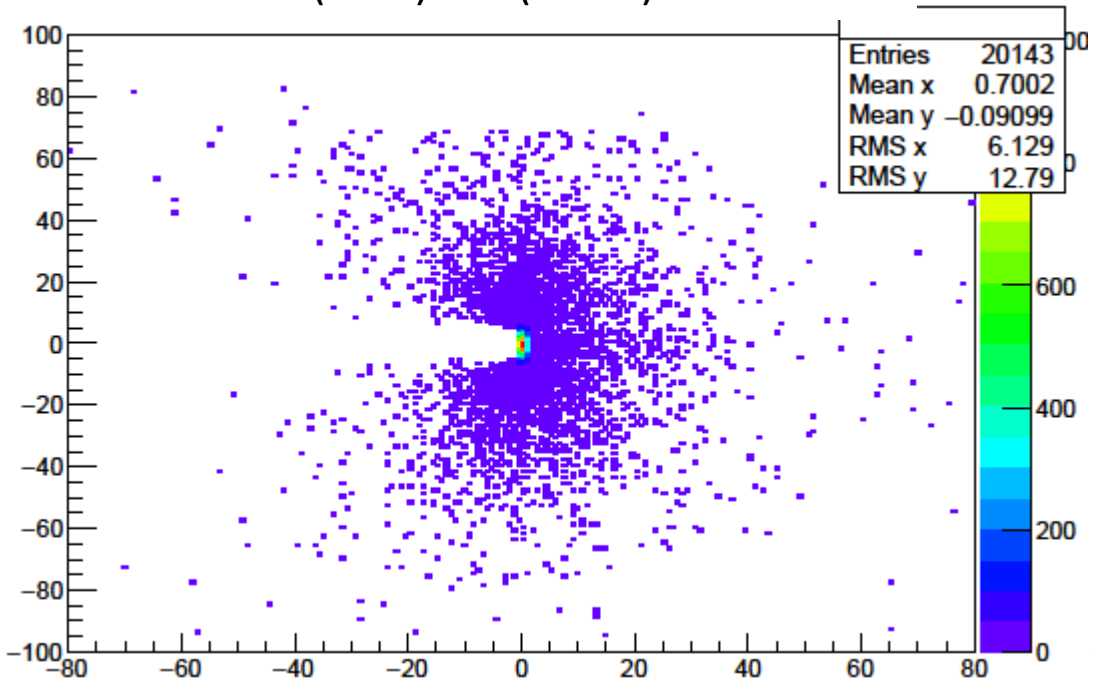


Simulation for Ps

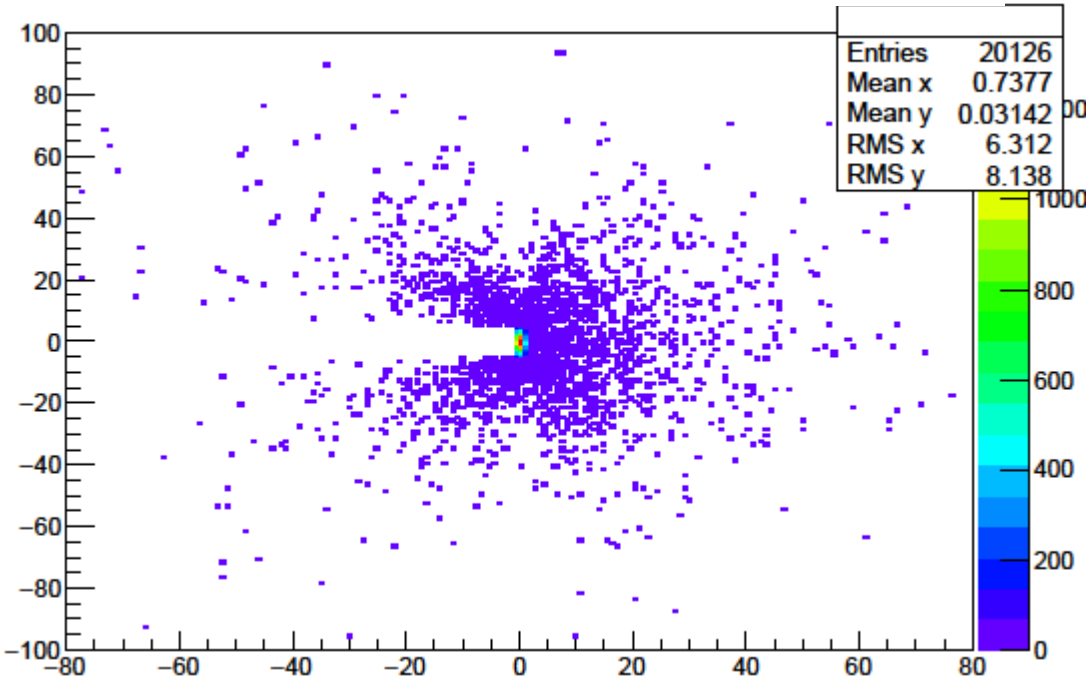
Positronium diffusion (reflection)

Last slide

Lambert(emit)&iso(reflec) distribution

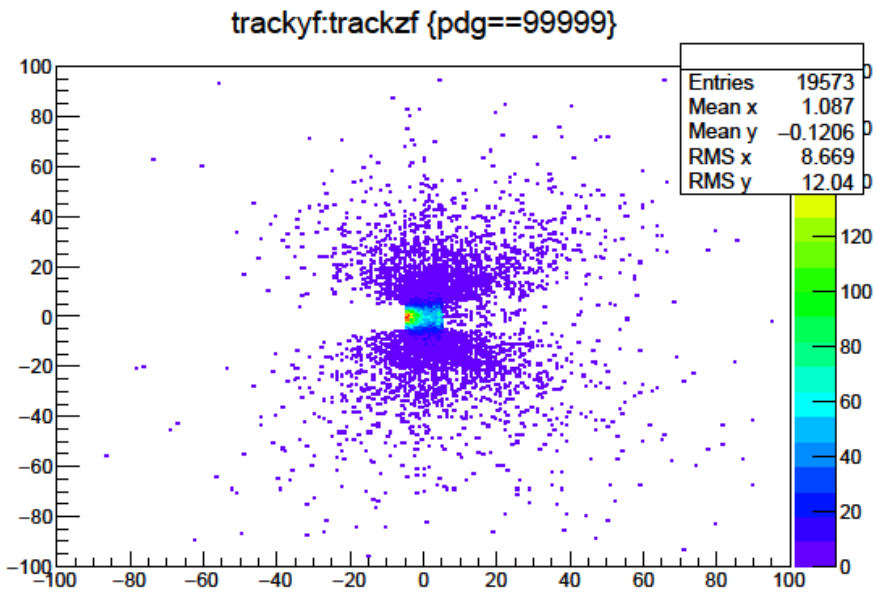


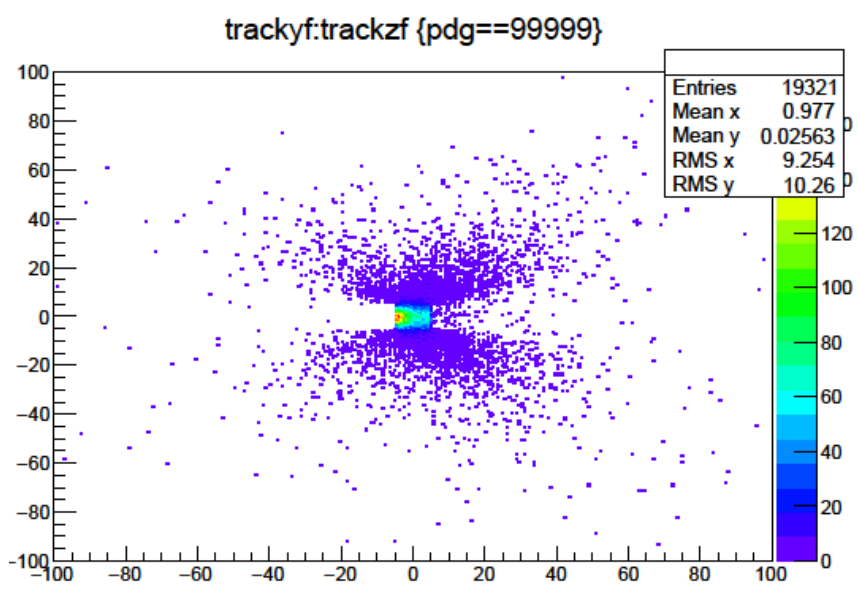
Lambert(emit)&Lamber(reflec) distribution

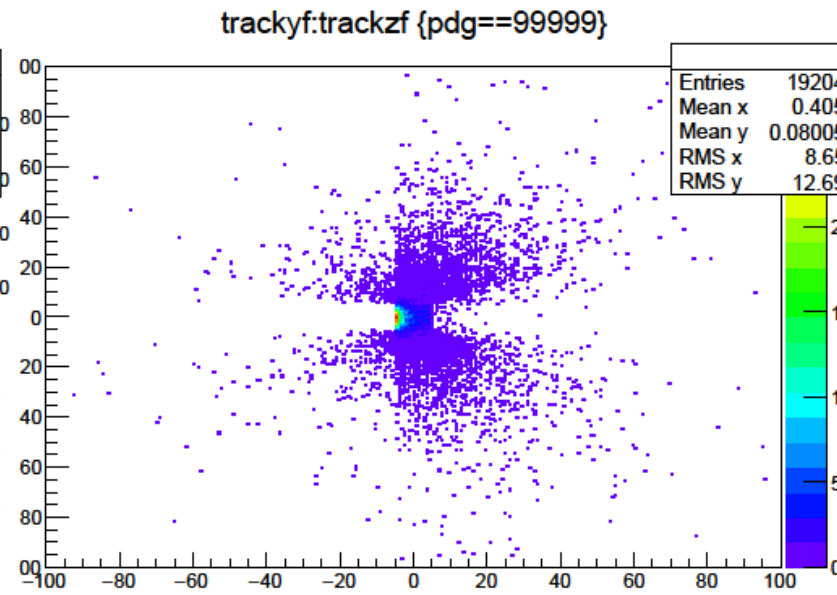


- Lambert(reflection) case : 84.5% of positronium remain in cavity before decayed
- Isotropic case(reflection) : 69.9% of positronium remain in cavity before decayed
- Quite big difference

Large hole cavity



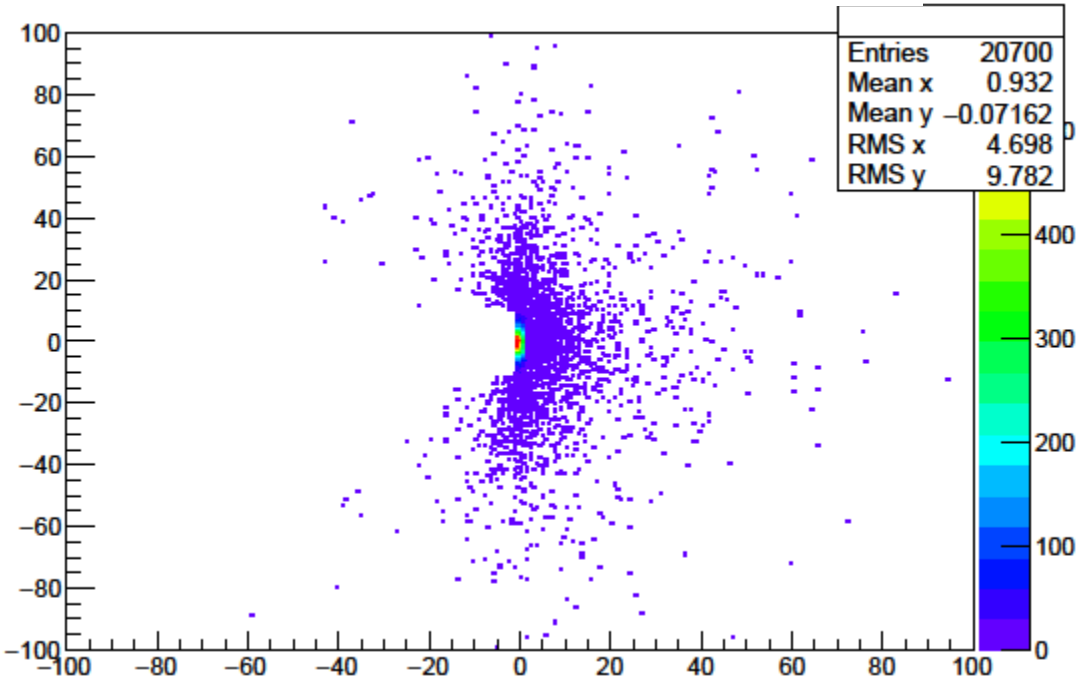




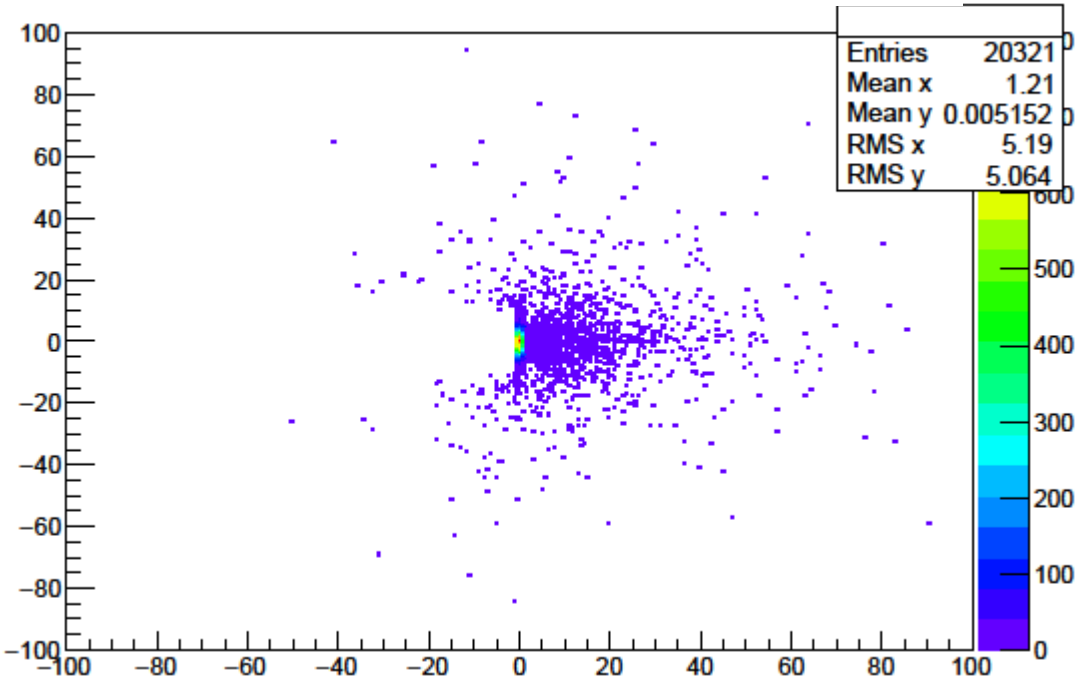
- Lambert(reflection) case : 70.1% of positronium remain in cavity before decayed
- Isotropic case(reflection) : 64.4% of positronium remain in cavity before decayed
- Lamb(ref) & iso(form) : 60.4% of

Long length cavity

iso(emit)&iso(reflec) distribution

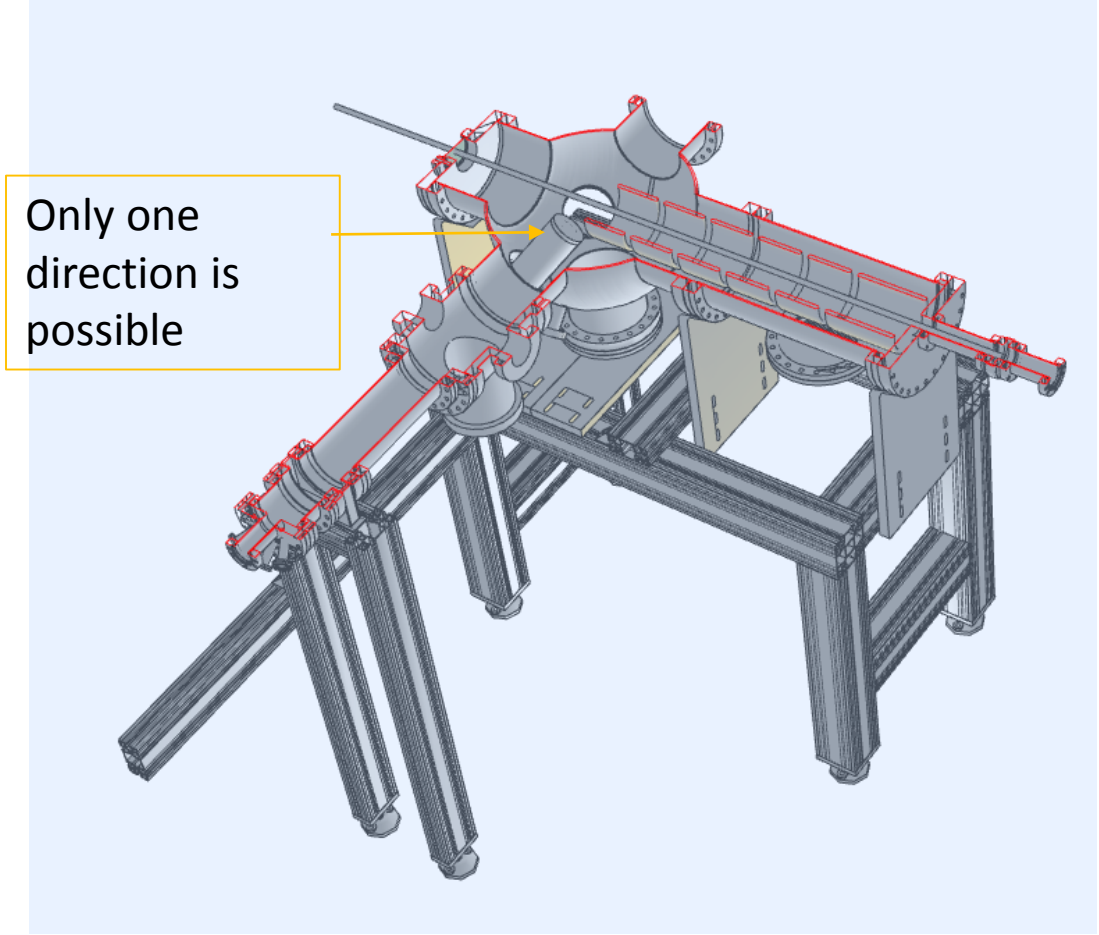


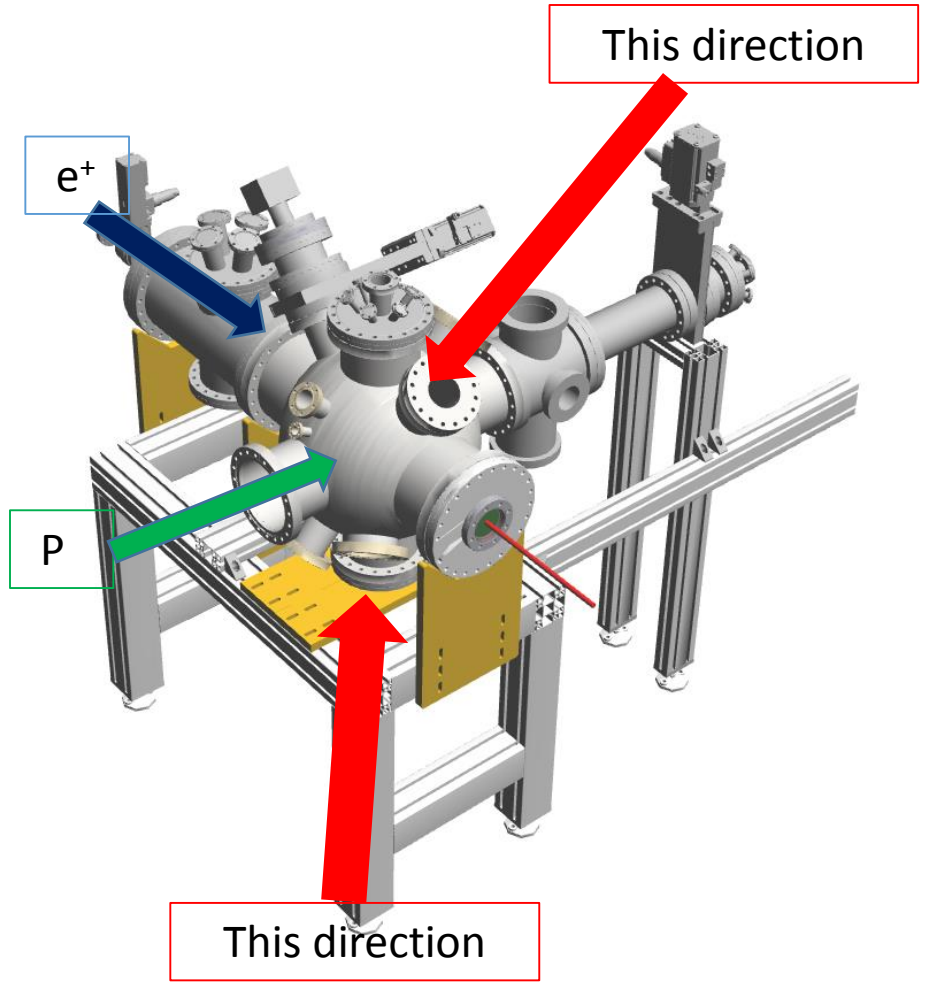
Lambert(emit)&Lamber(reflec) distribution



- Lambert(refl&emit) case : 90.4% of positronium remain in cavity before decayed
- Isotropic case(refl&emit) : 83.8% of positronium remain in cavity before decayed

Laszlo's floorplan





With tunstein block

- Density $\rho = 19.25 g/cm^3$ ($\rho(Pb) = 11.34 g/cm^3$)
- Problem will be compton scattering by W block itself, chamber or other obstacles.
- I need to check but acceptance is not high enough if we use small hole size.

Acceptance check for P-Ps, O-Ps

- Positron hit target : 98351, ps = 20306 (78049 two gamma)
- PWO hit : 9185 (2315 from Ps)

- 11.4% acceptance from Ps
- 8.8% acceptance from two gamma decay

→need to check detail.

What about this?

- If we can use high energy Ps(keV), we can measure profile by MCP

(If energy is too low, secondary electron will not be generated in surface of MCP and just reflection will be happen)

- If we shoot electron beam with collimator to positronium after ~10 ns with specified positiron, we can estimate some position dependency .

- Lazlo try to find some chemical material for annihilation of positronium

Status in CEA saclay

- New pump (2x ion pump) ordered (End of Oct)
- Leak problem : Cutting and welding beam line & install new component.
- Mu metal cage or chamber can be used in free fall chamber.

Next plan

- This week is holiday..
- I will try to check acceptance and try to find how much we can get information by W block.

Reflection angle

- Depends on initial angle?

→ PRL 61 22 (1988)