

# Simulations for PEPPo

$e^+$  production

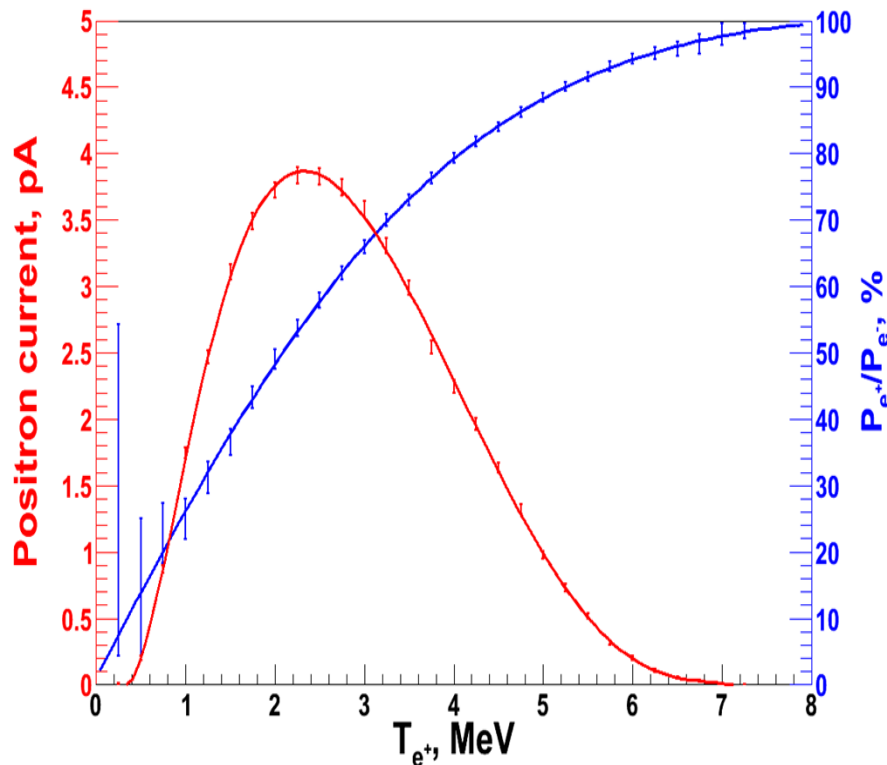
Spectrometer optimization

# Positron production

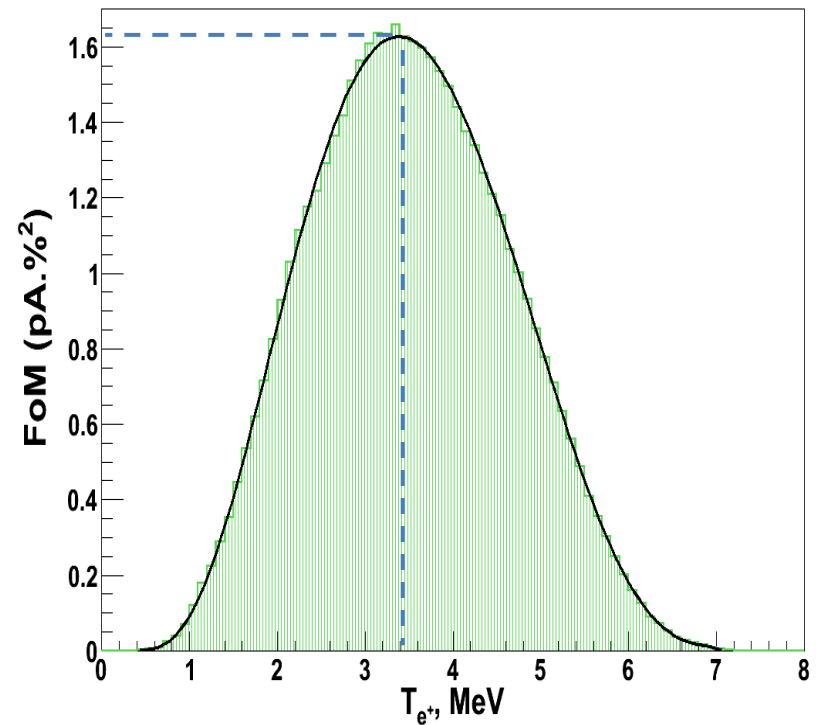
For the benefit of a polarization measurement, it is interesting to maximize the figure of merit ( $IP^2$ ). The target thickness can be optimized to let the EM shower, created by the electrons, expand and get out of the target.

For a electron beam: 1  $\mu\text{A}$ , 8 MeV

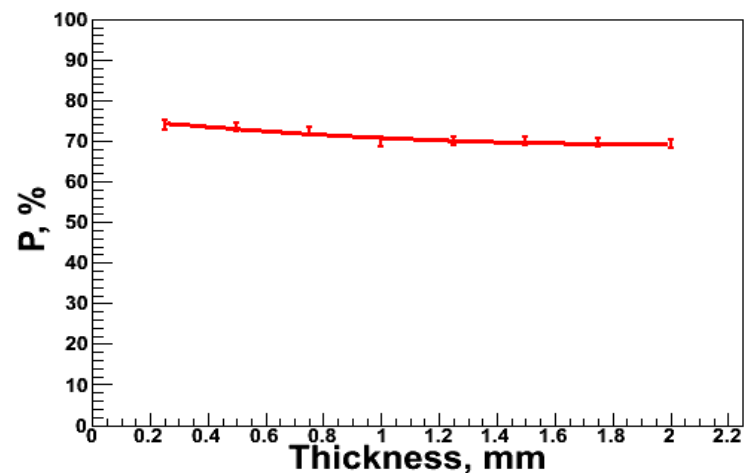
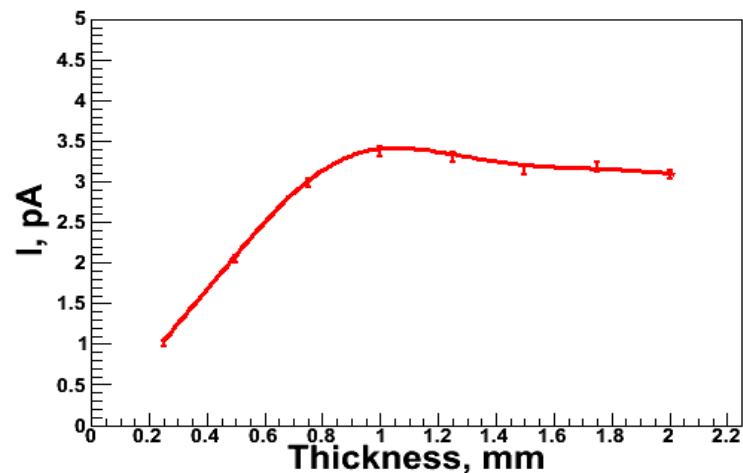
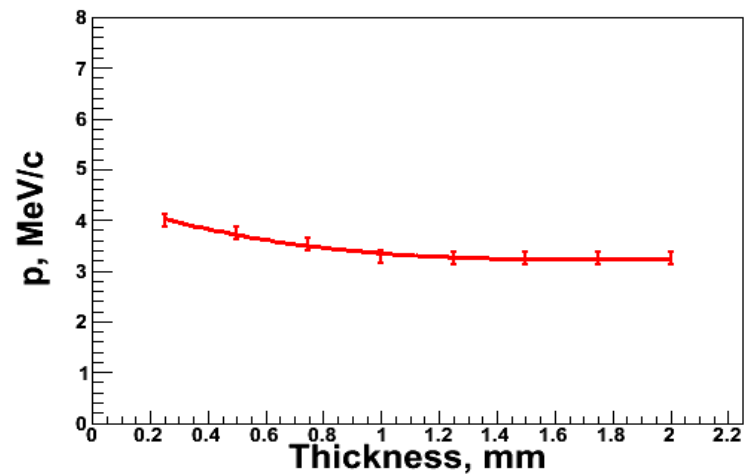
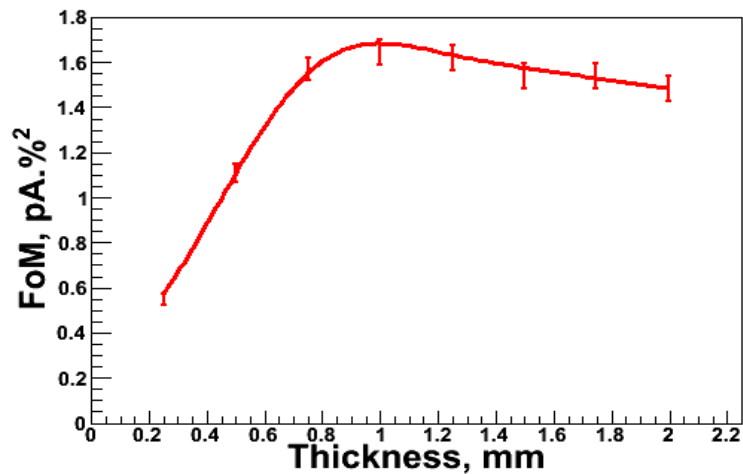
Target thickness=1.25mm,  $\Delta\theta=\pm 10^\circ$  and  $\Delta p/p=\pm 10\%$



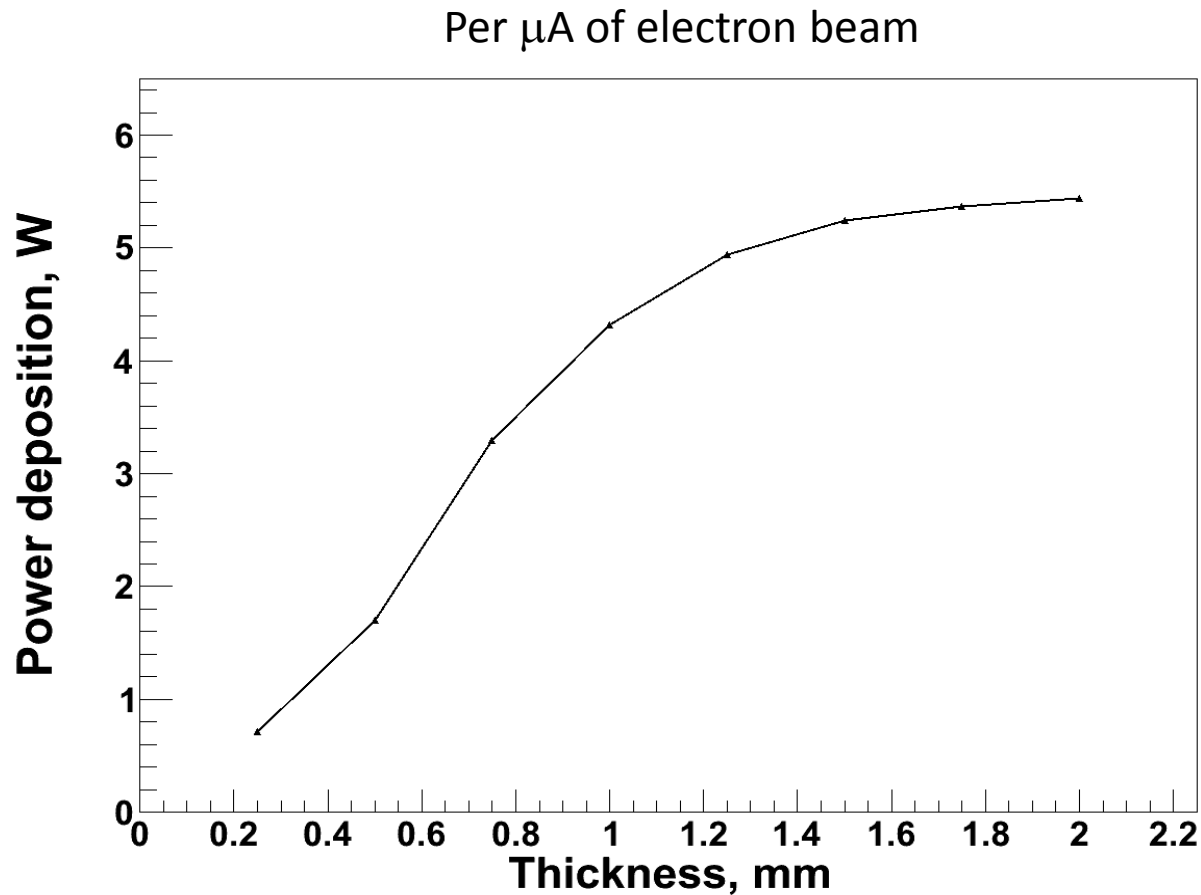
Optimum FoM for a 1.25 mm target



# Target thickness optimization



# Power deposition in W target

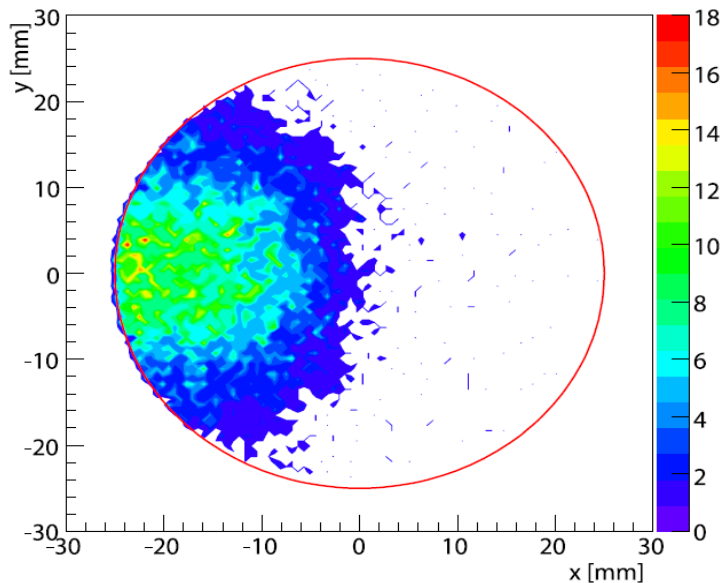


# Spectrometer optimization

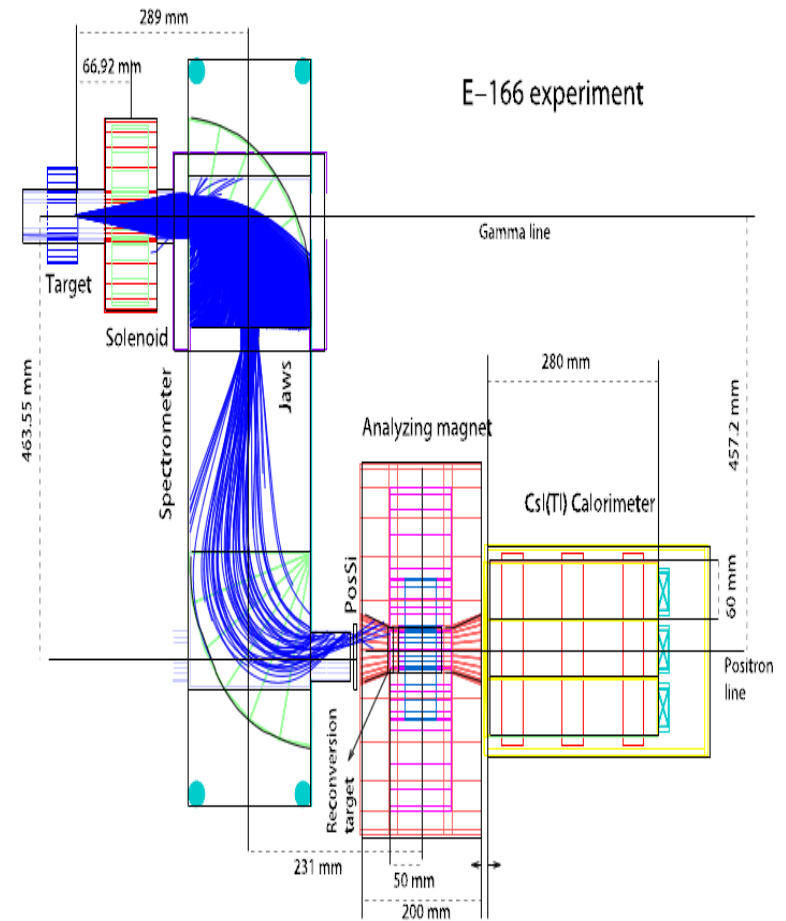
E166: Illustration of positron tracking in the spectrometer

Particles are lost in beam pipe at the exit of the spectrometer

XY Distribution Rec-Target



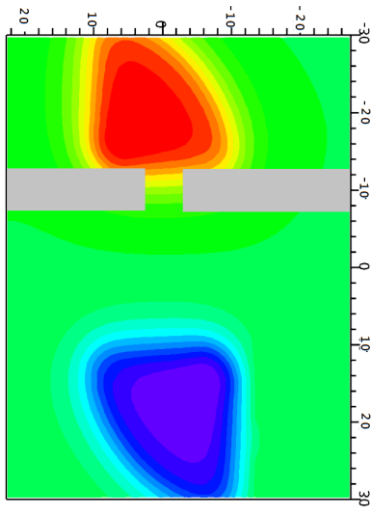
K. Laihem, Thesis



K. Laihem, Thesis

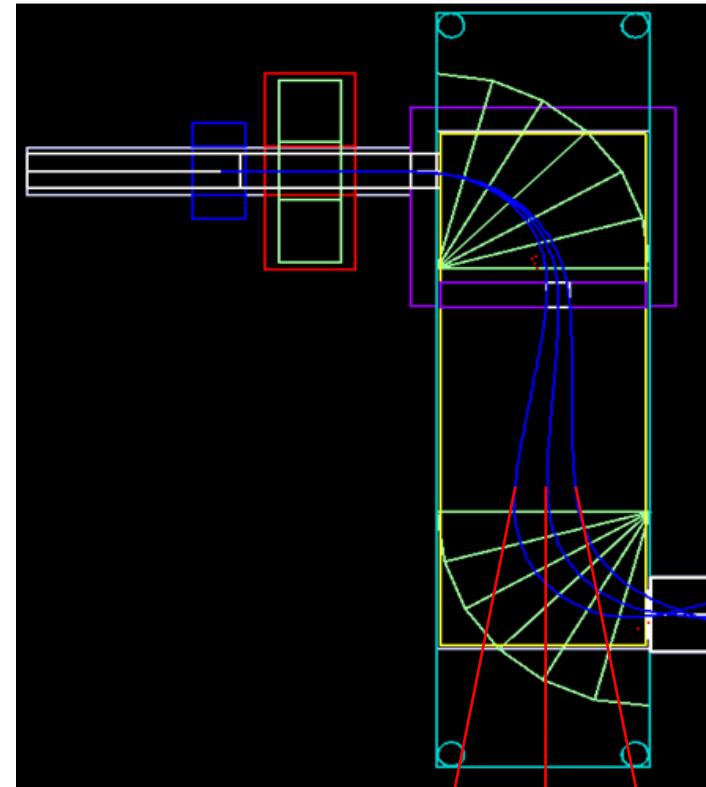
# Ideal path in spectrometer

Ideal path defined as a parallel track before and after the spectrometer



Ideal path shows that the jaws not centered on vacuum box  $\rightarrow$  1.44 cm shift.

$Dp/p = 10\% \rightarrow$  jaws aperture = 2.2 cm

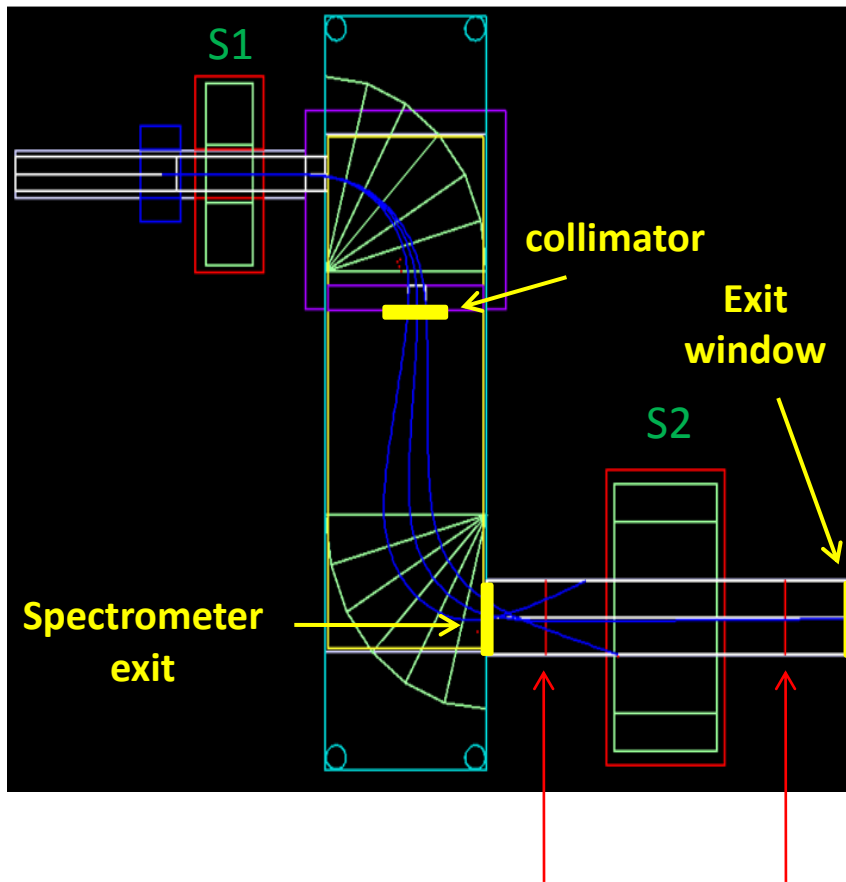


$p-10\%$

$p$

$p+10\%$

# Addition of diagnostics and collection optics



BPM/viewer/positron counter

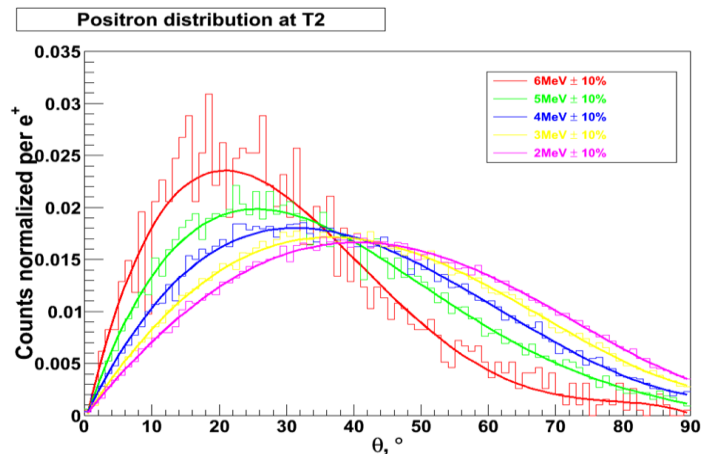
2 BPMs could be added after the spectrometer to control the positron « beam »

An additional solenoid could help refocusing the positrons.

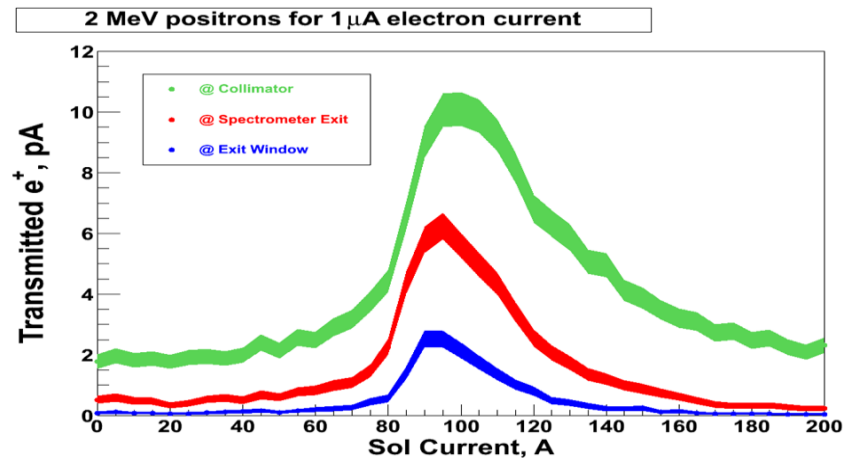
Optimization of solenoidal fields for S1 and S2 to maximize the amount of positron at Exit window

# Positron distribution for solenoidal optimization

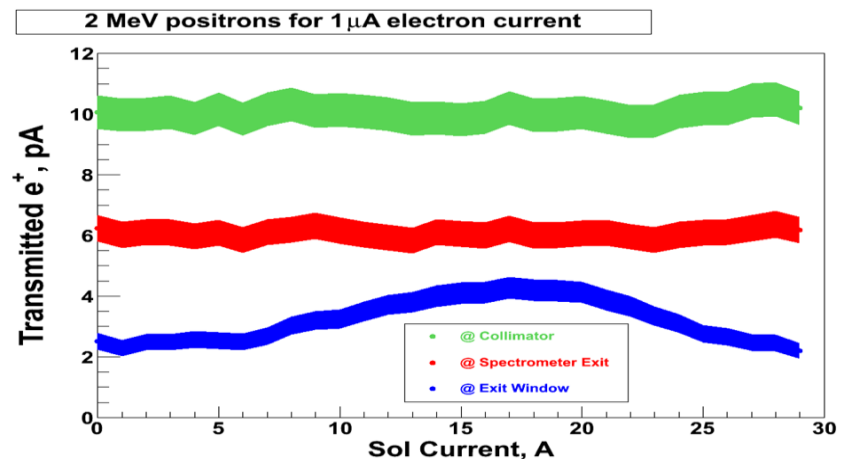
Trying to collect 2 MeV positrons -> worst scenario because of  $e^+$  emission angle



Transmission efficiency for S1



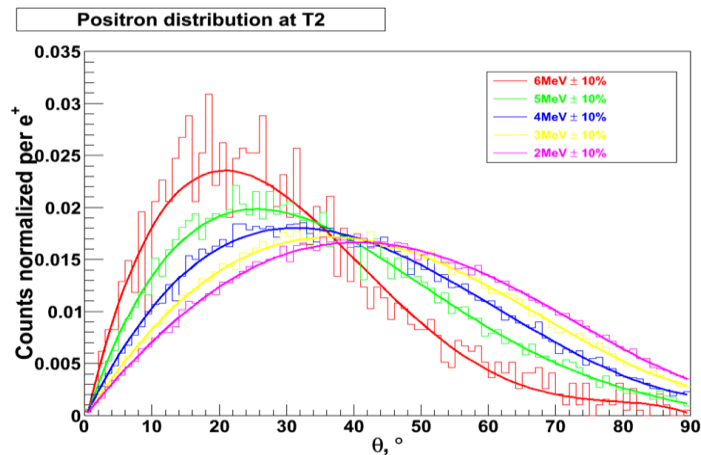
Transmission efficiency for S1 + S2



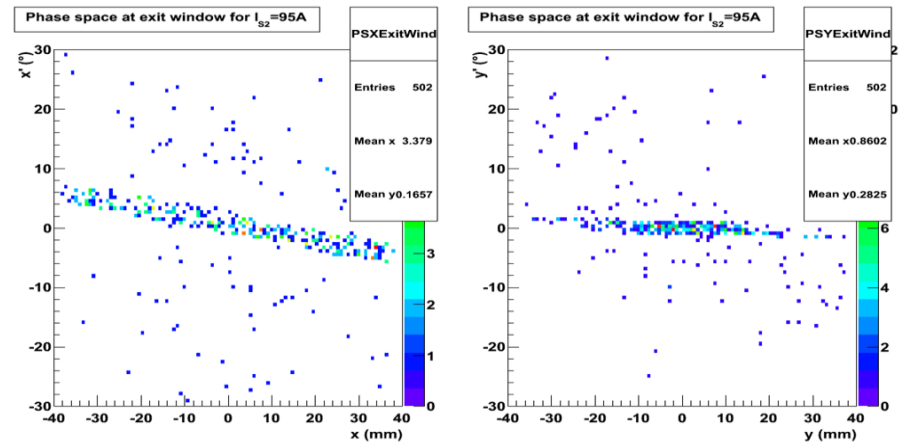


# Positron distribution for solenoidal optimization

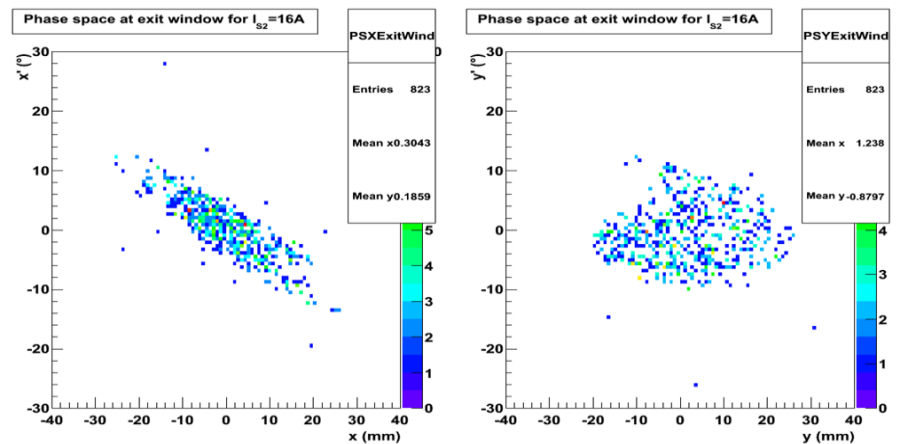
Trying to collect 2 MeV positrons -> worst scenario because of  $e^+$  emission angle



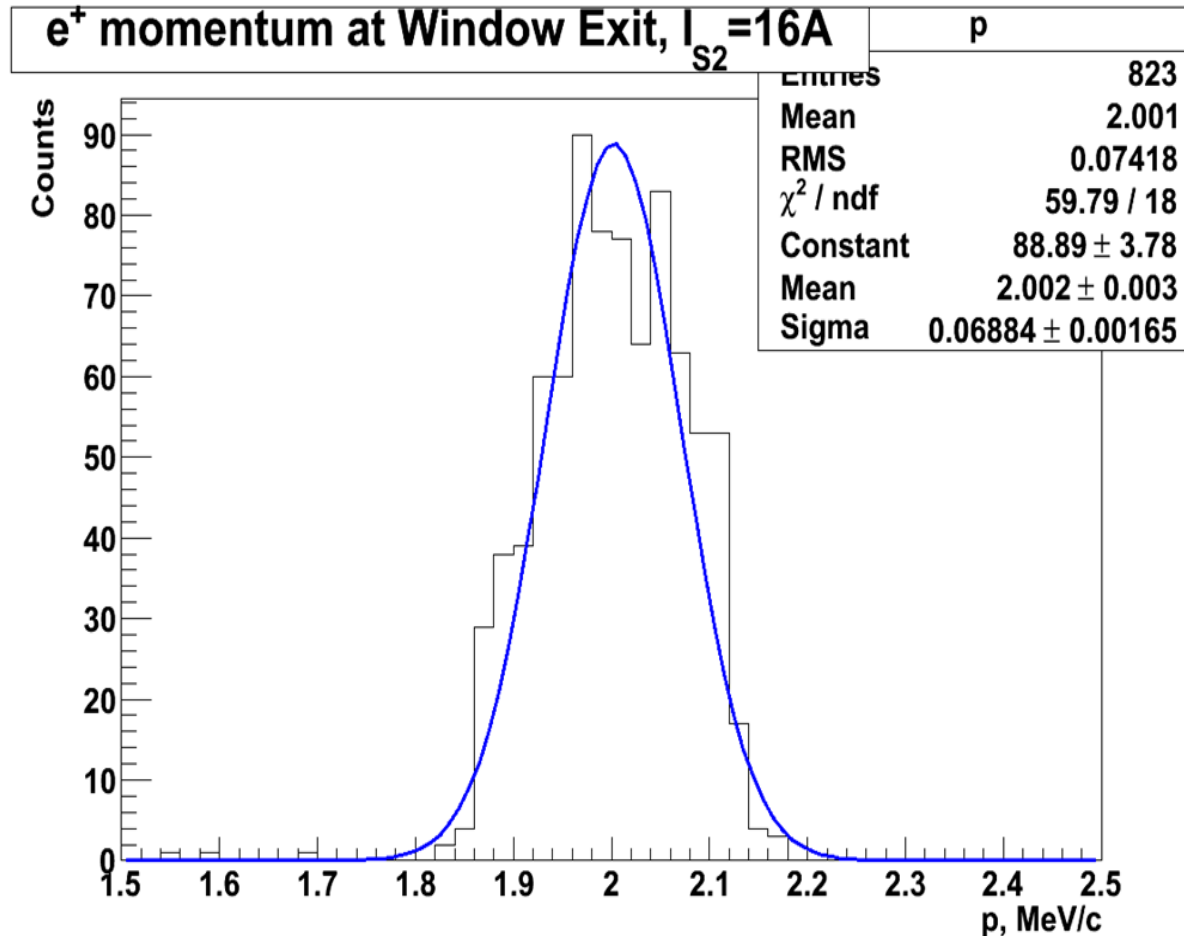
Phase Space at Exit window for S1



Phase Space for S1 + S2



# Momentum distribution



# Conclusion

- Target thickness optimization shows 1 mm is the best option to maximize FoM
- Spectrometer optimization shows that collimator should not be centered on vacuum box
- For additional diagnostic after the spectrometer, a second solenoid could increase positron transmission to the polarimeter and improve phase space