CEPC energy calibration and compton polarimeter

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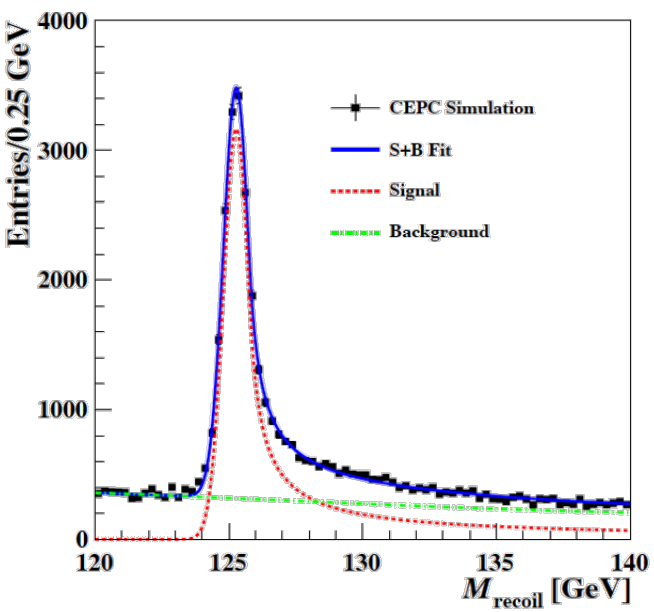
Outline

- **Requirement from the CEPC physics**
- **The overal design: CEPC energy calibration and compton polarimeter**
- **The Design of extraction line for the system**
- **Inverse compton scattering and Compton polarimeter**
- **CEPC energy calibration**
- **The detector of the electron distribution**

The error of CEPC beam energy: δE_B<1~3MeV

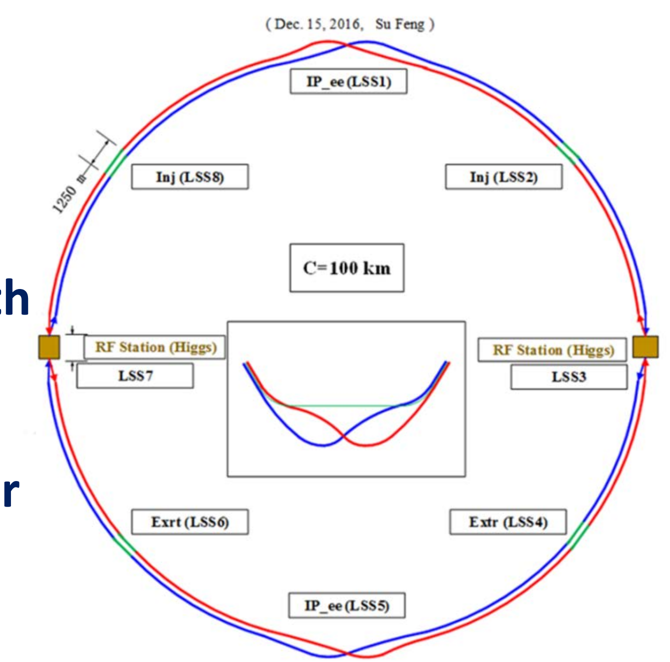
from the Precise measurement of Higgs Mass(by Li Gang)

- **Error=$\sqrt{(\text{Sys. err.})^2\ \ +(\text{Stat. err.})2}$**
- **Sys. err.:**
  $$\begin{cases}(0.31\sim0.81)Sys.err = (0.44\sim1.14)\delta E_B, uncorrelated, Double-ring \\ 2Sys.err = 4\delta E_B, correlated, single-ring\end{cases}$$
- **Stat. err.: δM_{recoil}<5.4MeV----the upper limit**
- $Double-ring\ case\colon \delta E_B \begin{cases} < 3MeV, Error < 6\sim7MeV \\ < 1MeV, Error \approx Ran.Error.\end{cases}$



CEPC Baseline Design

Better performance for Higgs and Z compared with alternative scheme, without bottle neck problems, but with higher cost



Beam energy measurement @e^+e^- colliders

	Beam energy	Relative accurancy		For CEPC
LEP II	80-104GeV	$(1.1{\sim}2.0)\times10^{-4}$	NMR model calibrated by RDP	×
LEP	45GeV	2.4×10^{-5}	Resonant depolarization (RDP)	×
BEPC II	<2.5GeV	$2\ \times10^{-5}$	Compton back-scattering	√
CESR	5GeV	$<1.4\ \times10^{-5}$	RDP	×
VEPP4M	1-5.5GeV	$\sim10^{-6}$	RDP	×
		5×10^{-6}	Compton back-scattering	√
DORIS	5GeV	$2\ \times10^{-5}$	RDP	×

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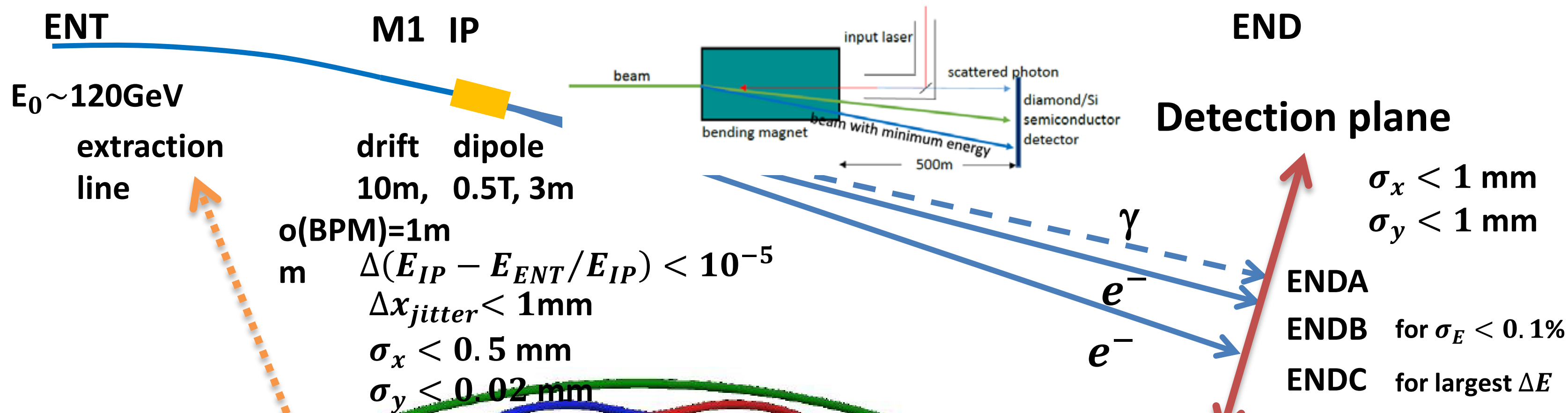
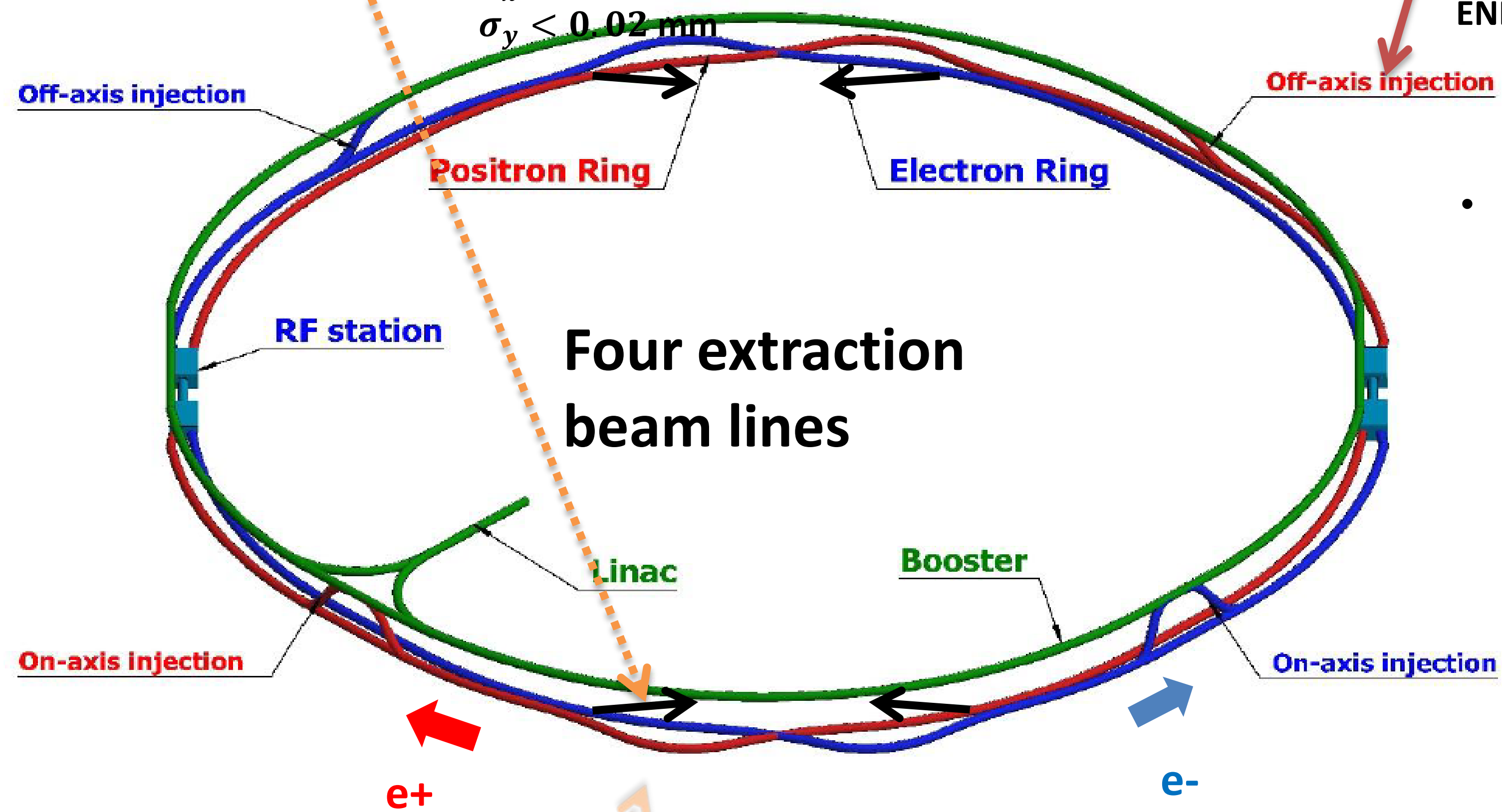
Overal design





- The SPPC locates outside of CEPC, it's better to extract beam to the inner side of CEPC.
  - Upstream of the interaction region for the extraction beam line is chosen to invoid conflict with SPPC.

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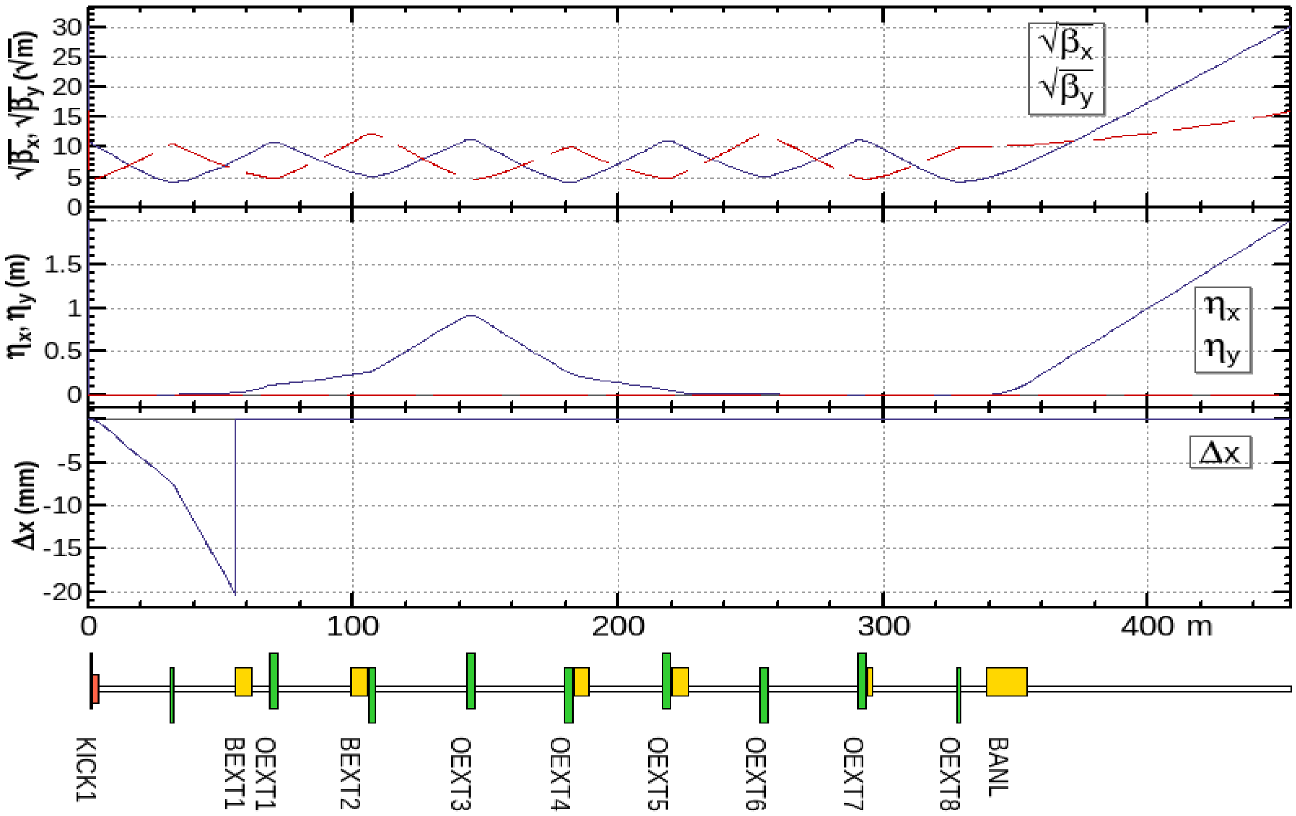
Lattice design of extraction line and line for measurement

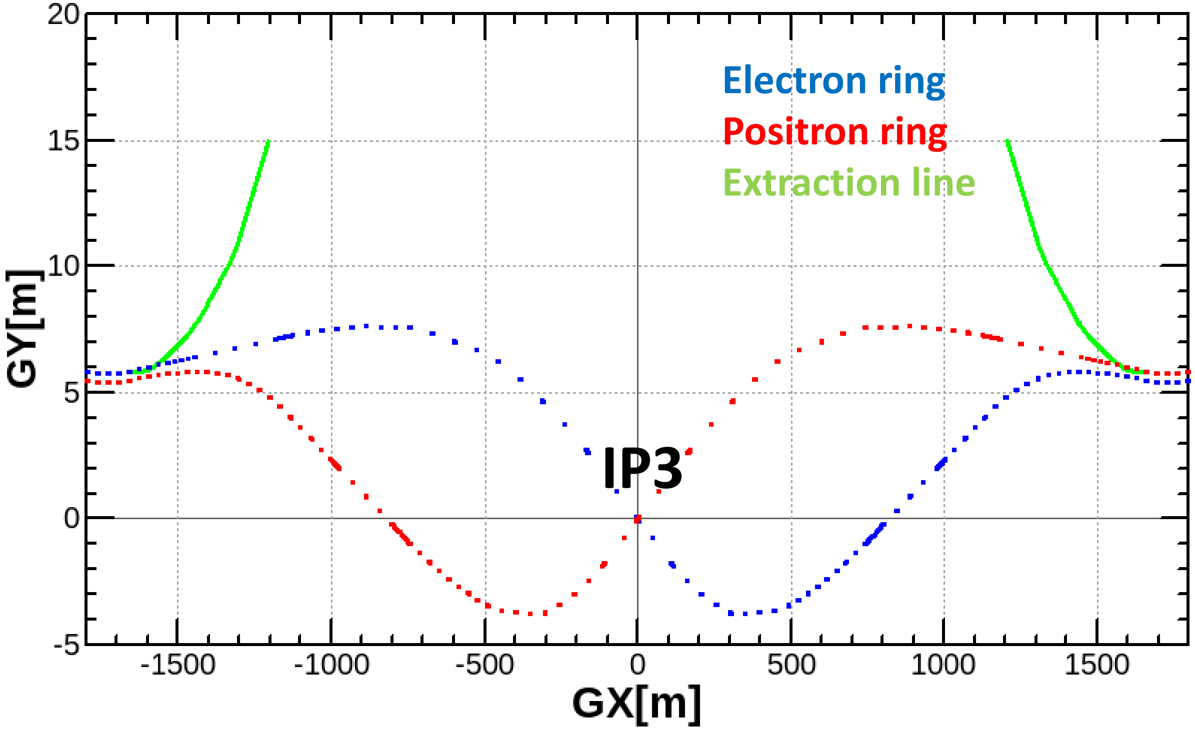
Yiwei Wang
Yuan Chen

- Kicker and septum magnet are used to extract the beam
  - offset=2cm at the entrance of septum
- FODO-like structure to insure the beam not disturb as less as possible
- Quasi- symmetric bends to suppress dispersion function



Geometry

- Beam lines of the CEPC double rings and the extraction lines



Magnet parameters

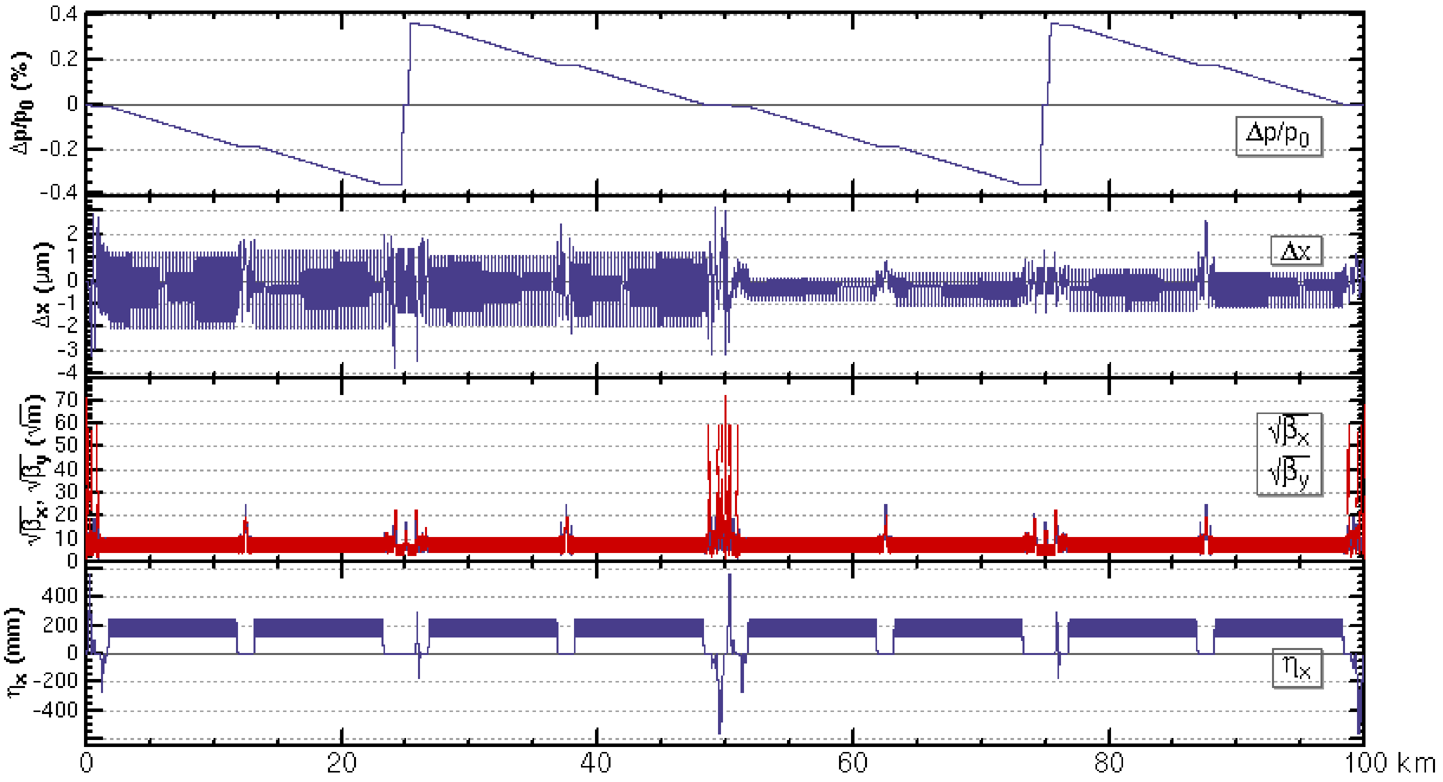
- The requirement of aperture and good field region is the same with collider ring.
  - Good field region: Hgf=(18*sigmax+3mm)+orbx, Vgf=(22*sigmay+3mm)
  - All are normal conducting magnets
- Parameters of bends and quadruples

Name	Quant	Gap[mm]	Fmax[G] F	op(tt) F	op(H)[F	op(W)[F	op(Z)[L	eff[mm	Hgf[mm]	Vgf[mm]	Fie. Un	core	Lc[mm]
KICK1	1	66	729.671	729.671	500.346	333.564	189.715	2000	9.841	3.166	3.00E-04	1	2000
BEXT1	1	66	7296.71	7296.71	5003.46	3335.64	1897.14	6000	8.892	3.216	3.00E-04	1	6000
BEXT2	1	66	3836.99	3836.99	2631.08	1754.05	997.62	6000	9.995	3.414	3.00E-04	1	6000
BEXT3	1	66	3836.99	3836.99	2631.08	1754.05	997.62	6000	9.295	3.337	3.00E-04	1	6000
BEXT4	1	66	6328.56	6328.56	4339.58	2893.05	1645.42	6000	9.92	3.207	3.00E-04	1	6000
BEXT5	1	66	729.671	729.671	500.346	333.564	189.715	2000	9.883	3.168	3.00E-04	1	2000
BANL	1	66	7296.71	7296.71	5003.46	3335.64	1897.14	15000	8.599	3.356	3.00E-04	3	5000

Name	Quant	Ape[mm]	Fmax[T/m Fo	p(tt)[Fo	p(H)[T Fo	p(W)[T Fo	p(Z)[T Le	ff[mm]	Rgf[mm] Ha	rm. er	Ftip[T]
QEXT1	1	74.8999	7.7324	7.7324	5.3022	3.5348	2.0104	3000	10.5453	3.00E-04	0.2896
QEXT2	1	74.8999	-7.6297	-7.6297	-5.2318	-3.4879	-1.9837	3000	10.8494	3.00E-04	-0.2857
QEXT3	1	74.8999	7.7513	7.7513	5.3152	3.5434	2.0153	3000	26.6446	3.00E-04	0.2903
QEXT4	1	74.8999	-7.6592	-7.6592	-5.2521	-3.5014	-1.9914	3000	10.2392	3.00E-04	-0.2868
QEXT5	1	74.8999	7.7386	7.7386	5.3065	3.5377	2.012	3000	10.154	3.00E-04	0.2898
QEXT6	1	74.8999	-7.6296	-7.6296	-5.2317	-3.4878	-1.9837	3000	6.2274	3.00E-04	-0.2857
QEXT7	1	74.8999	7.7449	7.7449	5.3108	3.5405	2.0137	3000	10.0946	3.00E-04	0.29
QEXT8	1	74.8999	-7.6713	-7.6713	-5.2603	-3.5069	-1.9945	1500	5.6613	3.00E-04	-0.2873

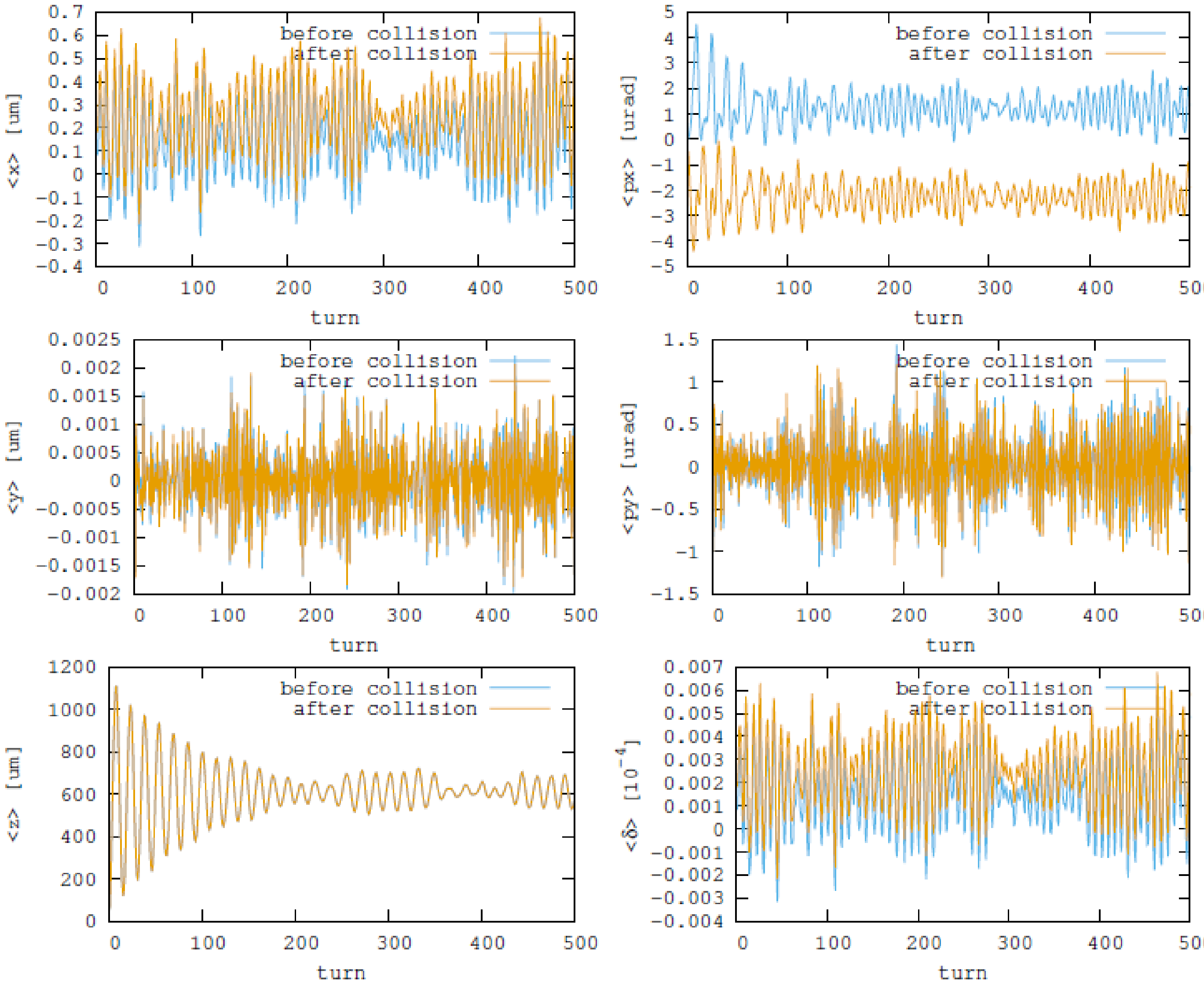
Tracking

- Start from the position just in front of IP
- Extracting the beam to the extraction line after 500 turns
- Including beam-beam (weak-strong), aberration, synchrotron radiation



Beam before and after collision

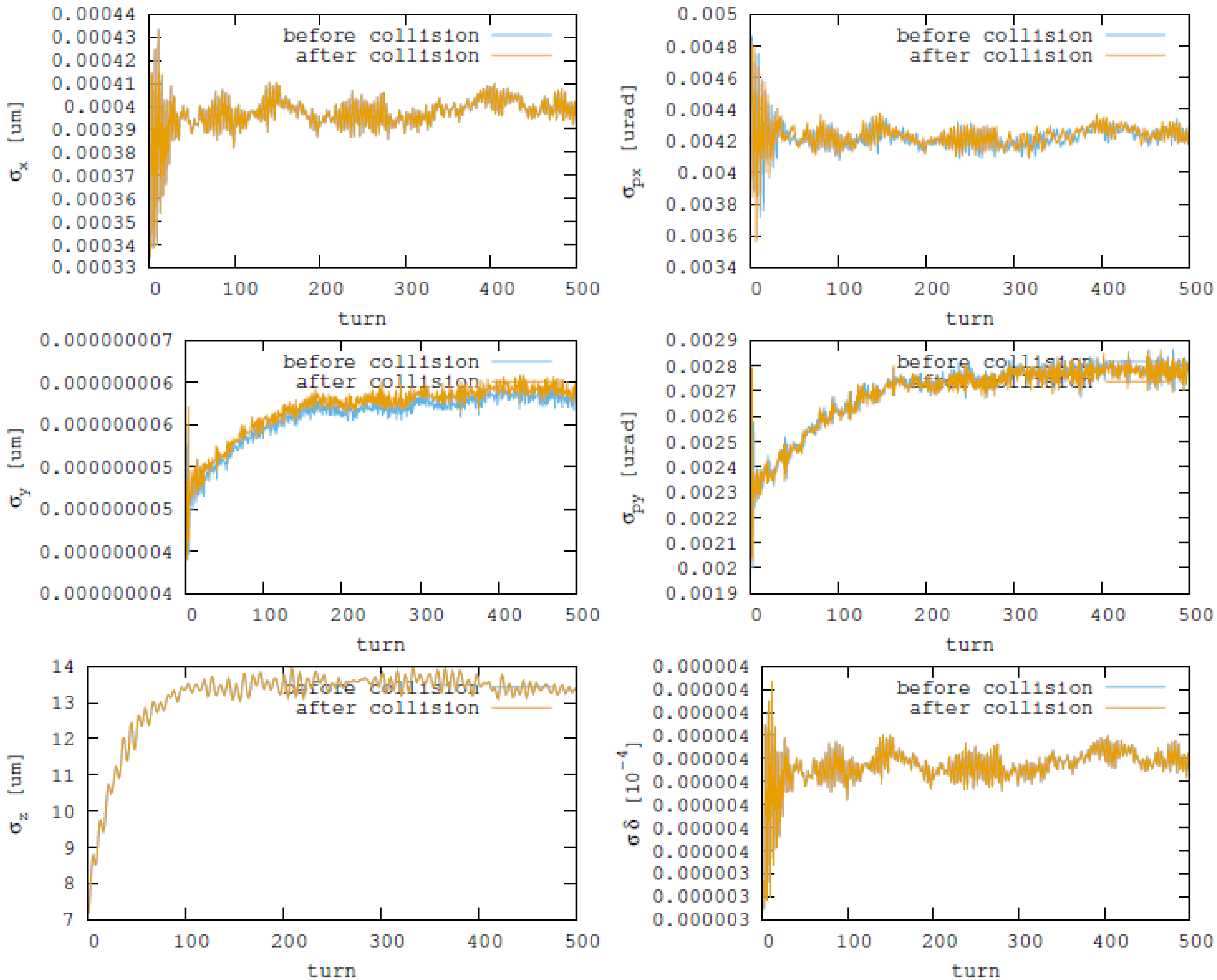
Mean of 10000 particles, initially Gaussian distribution



angle induced by the offset

Beam before and after collision

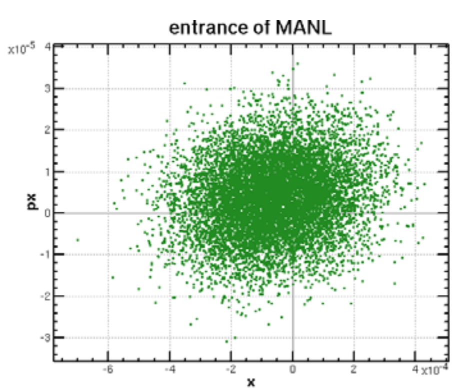
Standard deviation of 10000 particles, initially Gaussian distribution

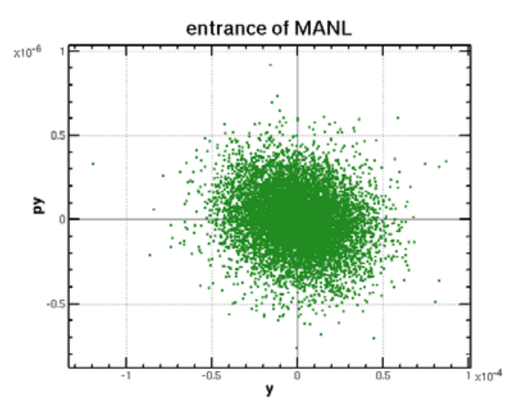


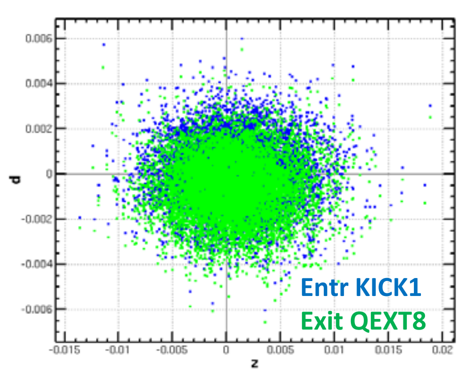
Beam size

- Horizontal beam size is similar between tracking and linear one
- Tracking: Sqrt[Mean[(xx-Mean[xx])^2]
- Linear: Sqrt[Twiss["BX",elename]*emittx+(Twiss["EX",elename]*sigmae)^2]
  - $\varepsilon x=1.21\text{E-}9$, $\varepsilon y=0.002\varepsilon x$, $\sigma E=0.134\%$

Name	S [m]	Xtrk [m]	Xlin [m]	Ytrk [m]	Ylin [m]
KICK1	1.522	3.57E-04	3.68E-04	9.50E-06	7.10E-06
BEXT1	55.522	3.07E-04	2.77E-04	1.16E-05	9.80E-06
MANL	329.066	1.51E-04	1.45E-04	2.02E-05	1.58E-05
BANL	339.066	1.86E-04	1.68E-04	1.99E-05	1.58E-05
DANL2	354.066	3.44E-04	3.16E-04	1.99E-05	1.62E-05
END	454.066	0.0029618	0.002898	2.71E-05	2.48E-05







<d>=-0.000526

Summary of the extraction line

- A preliminary lattice design of the extraction line for beam energy measurement at Higgs mode was finished.
- Upstream of the interaction region for the extraction beam line is chosen to invoid conflict with SPPC.
- The beam size from tracking including beam-beam (weak-strong), aberration, synchrotron radiation was got and roughly fulfilling the requirement.
- Further work
  - round beam at the interaction point of beam and laser
  - static and dynamic errors of the transport line

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1. Inverse Compton Scattering

Guangyi Tang
Yongsheng Huang

- System layout

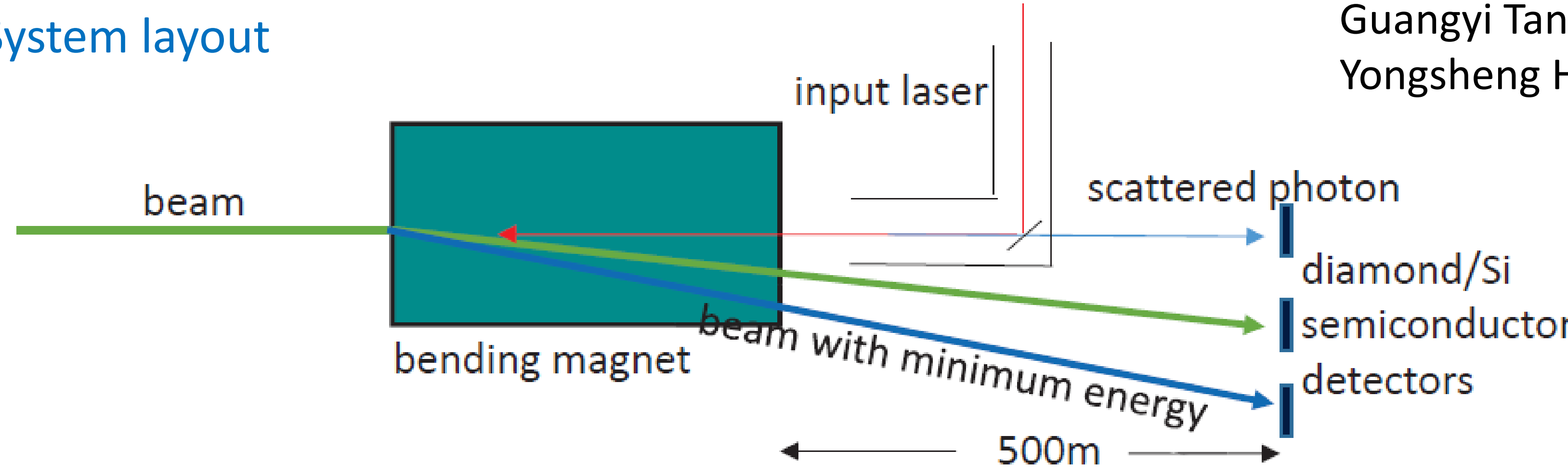


Figure 1. System layout

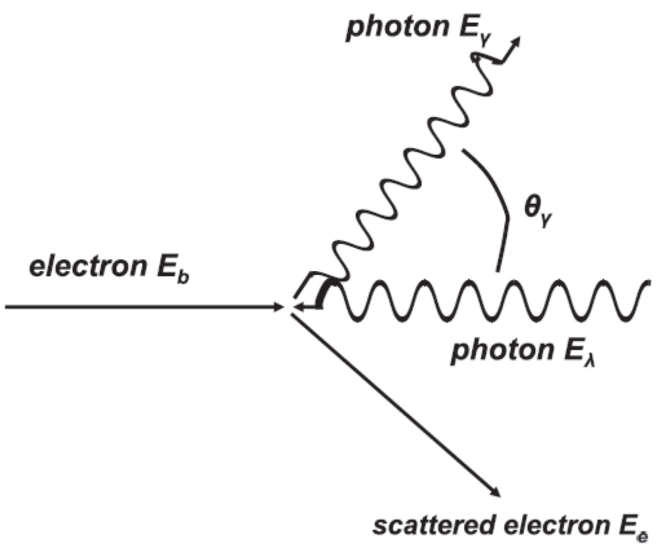


Figure 2. Inverse Compton scattering

$$E_b = \frac{m^2}{4w_o}\frac{X_{edge} - X_{beam}}{X_{beam} - X_\gamma}$$

ICS cross-section

Guangyi Tang
Shanhong Chen
Yongsheng Huang

- Definition

ICS cross section is sensitive to polarization of photon and electron

$$d\sigma = d\sigma_0 + d\sigma_{||} + d\sigma_{\perp}$$

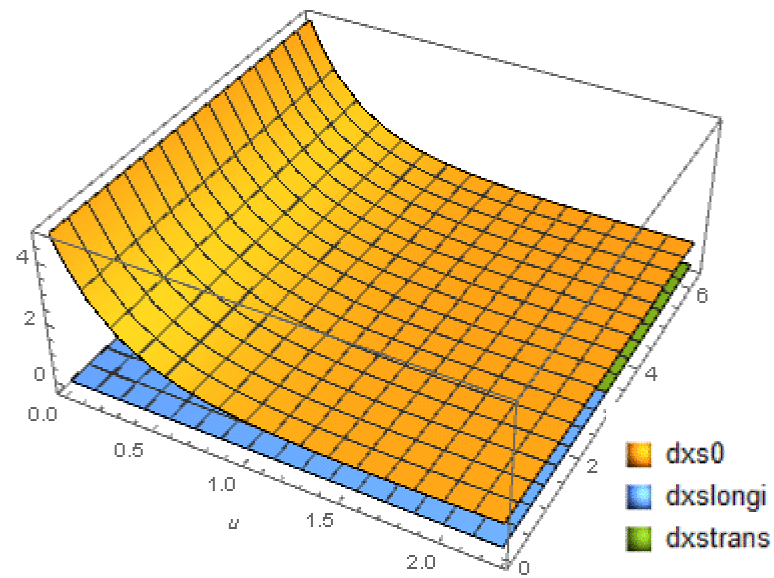
unpolarized cross section — longitudinal electron polarization — transverse electron polarization

✓ At the (u,φ) plane

$$d\sigma_0 = \frac{r_e^2}{\kappa^2(1+u)^3}\left(\kappa(1+(1+u)^2) - 4\frac{u}{\kappa}(1+u)(\kappa-u)\left[1-\xi_\perp\cos\left(2(\varphi-\varphi_\perp)\right)\right]\right)dud\varphi$$

$$d\sigma_{||} = \frac{\xi_\circlearrowright\zeta_\circlearrowright r_e^2}{\kappa^2(1+u)^3}\mathrm{u}(u+2)(\kappa-2u)dud\varphi$$

$$d\sigma_\perp = -\frac{\xi_\circlearrowright\zeta_\perp r_e^2}{\kappa^2(1+u)^3}2u\sqrt{u(\kappa-u)}\cos(\varphi-\phi_\perp)dud\varphi$$



The parameters on MC

- parameters

符号	物理意义	取值
ebeam	The beam energy	120GeV
elaser	Laser energy	1.24eV
L_1	IP to Detector	510m
L_2	Dipole to Detector	501.5m
θ_0	The bending angle	0.003747rad
σ_x	Beam size at IP	$20.9\mu m$
σ_y	Beam size at IP	$0.06\mu m$
	The STOKES Parameters	
$\xi_\perp \in [0:1]$	Laser linear polarization	0
$\xi_\circlearrowright \in [0:1]$	Laser circular polarization	**+1(Fig3)或-1(Fig4)**
$\zeta_\perp \in [0:1]$	Transverse e beam polarization	Random(0,1)
$\phi_\perp \in [0:2\pi]$	Transverse e beam azimuthal angle	π/2
$\zeta_\circlearrowright \in [-1:1]$	Electron longitudinal spin polarization	0
$\varphi_\perp \in [0:\pi]$	Laser azimuthal angle	**0**
φ	Observer's azimuthal angle	Random(0,2 π)

The MC distribution of scattered electrons

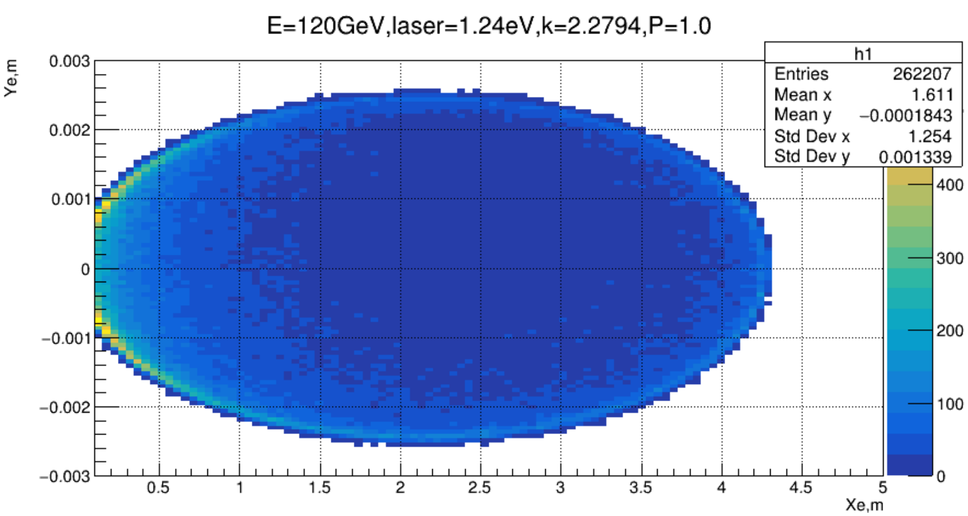
- Methods

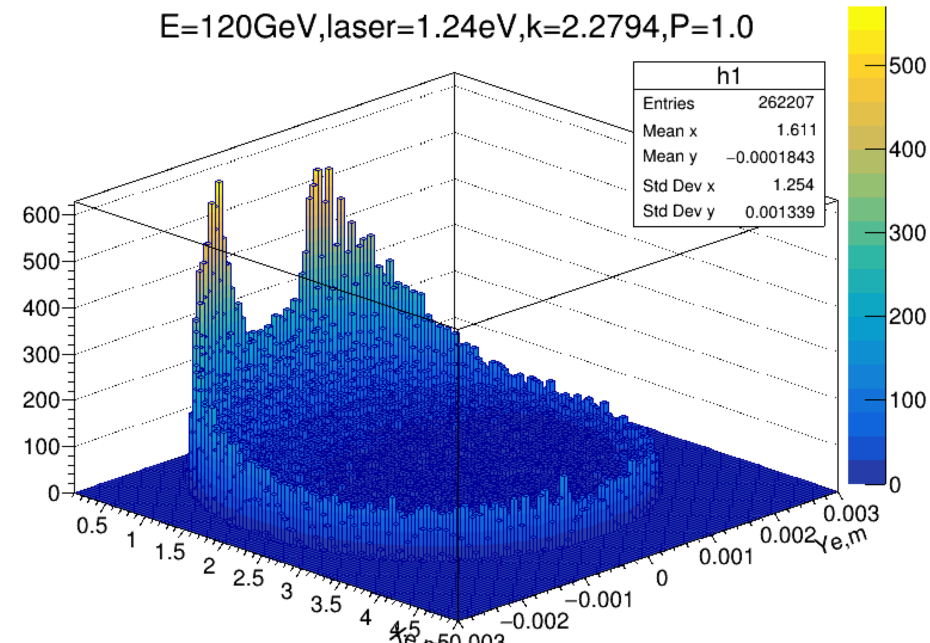
$$X_e = x' L_1 + \frac{L_1}{\gamma}\sqrt{u(\kappa - u)}\cos\varphi + u\theta_0 L_2$$

$$Y_e = y' L_1 + \frac{L_1}{\gamma}\sqrt{u(\kappa - u)}\sin\varphi$$

- The distribution of scattered electrons

  - *The scattered electrons distribution starts from* $\boldsymbol{x = 100mm}$:





  - *The results presented in Fig were obtained with* 1×10^6 *backscattered MC event , and about* 2×10^5 *of them was accepted by scattered electrons detector.*

The MC distribution of scattered electrons

- The difference between the figures is the laser polarization $\xi_{\circlearrowright}$ =+1(Fig.3) and $\xi_{\circlearrowright}$ =-1(Fig.4)
- The 1D distribution in the bottom of each figure are the projections of 2D distribution to the vertical axis y

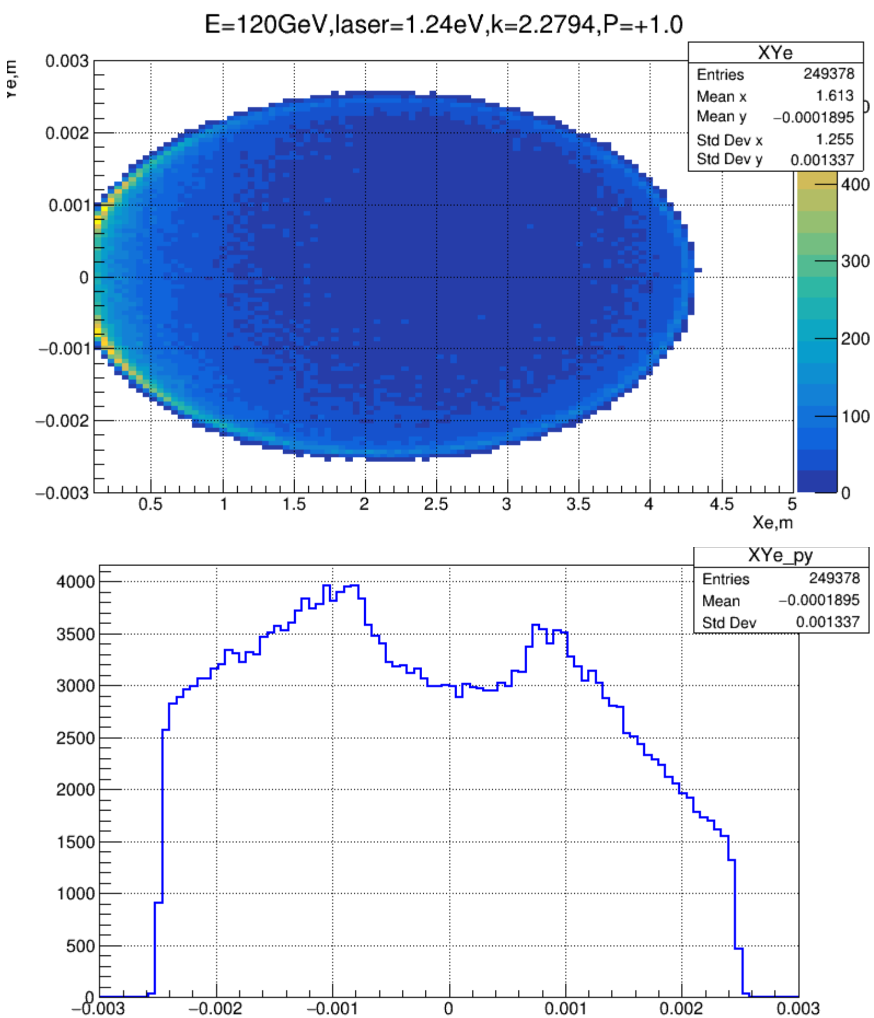


Figure 3: MC result for $P_{\perp}$ =+1

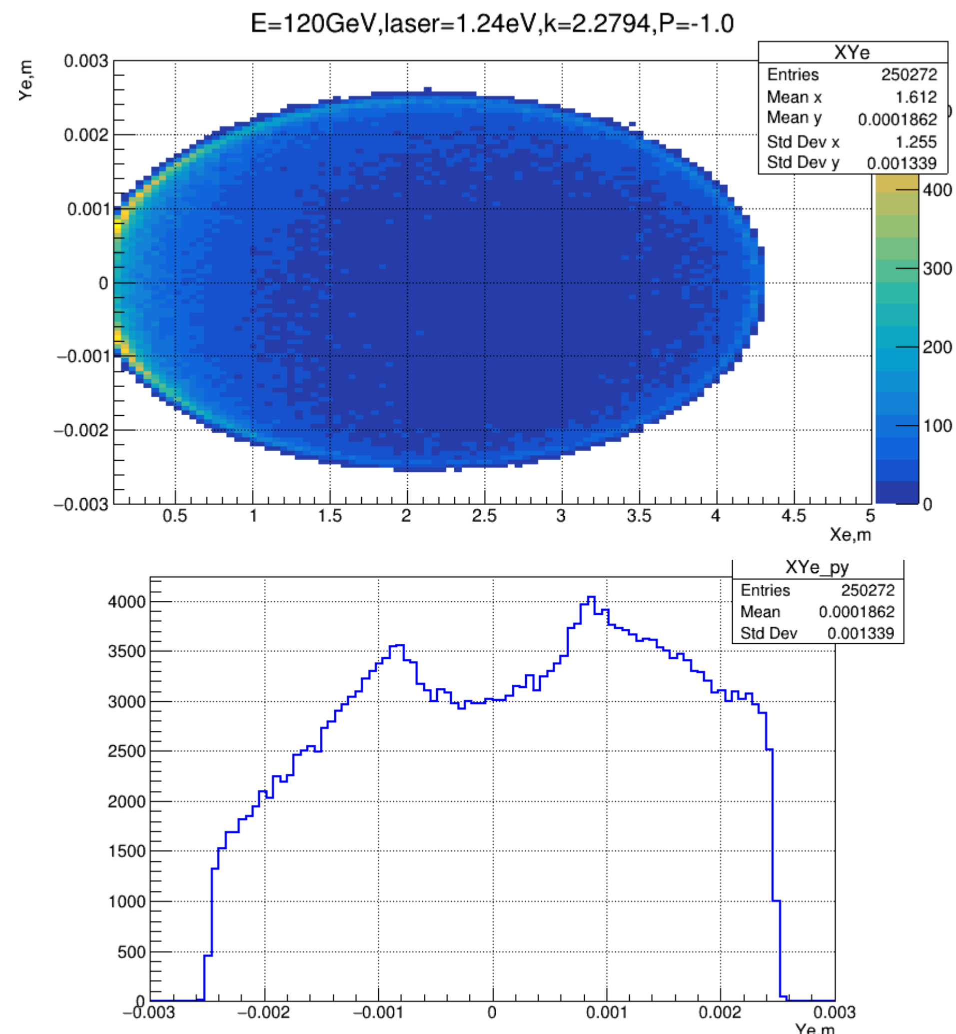
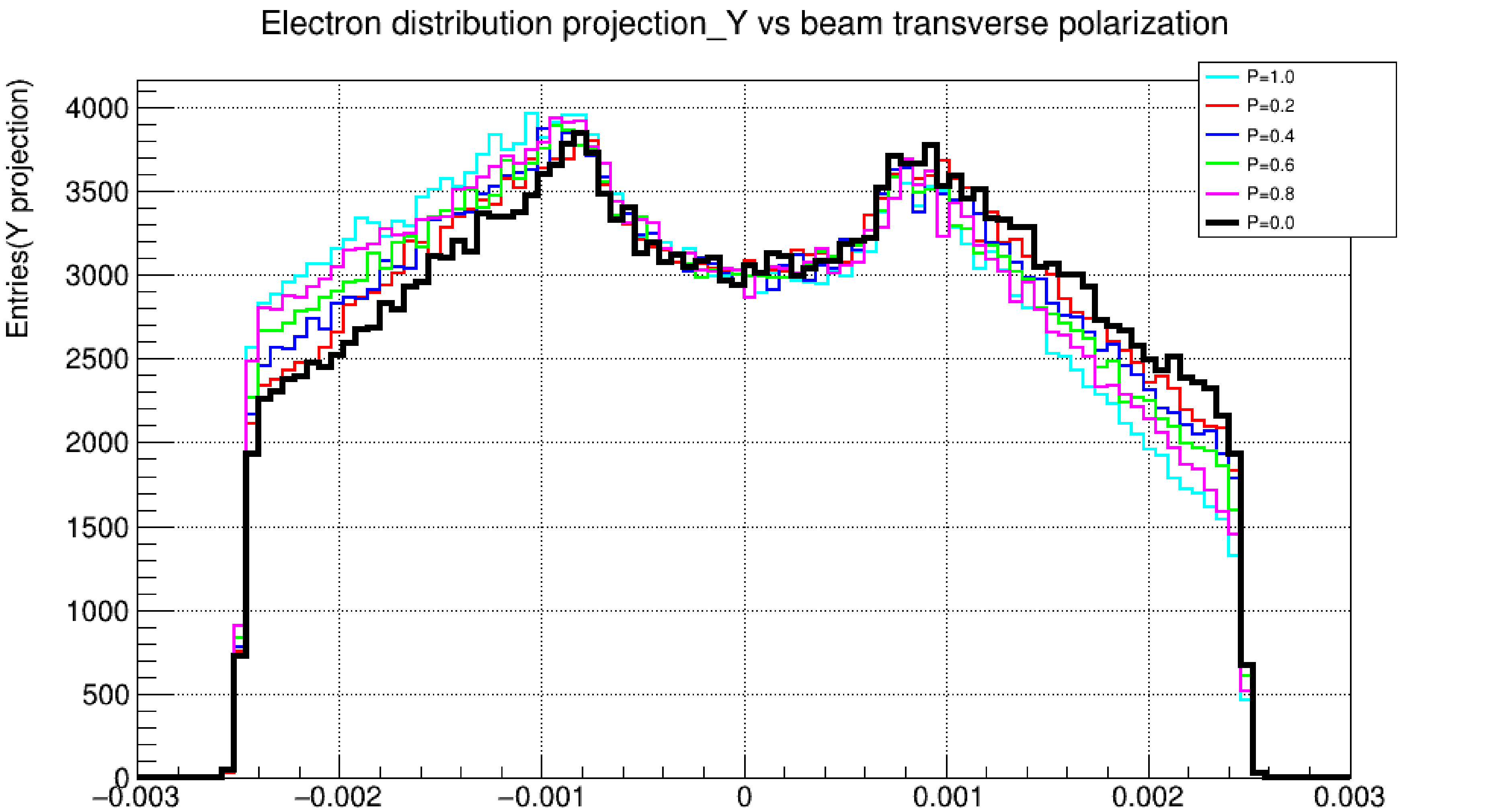


Figure 4: MC result for $P_{\perp} = -1$

Measurement of beam transverse polarization

Method 1

- The asymmetry of the projections of 2D distribution scattered electrons has a very strong relationship with the **electron transverse polarization**.

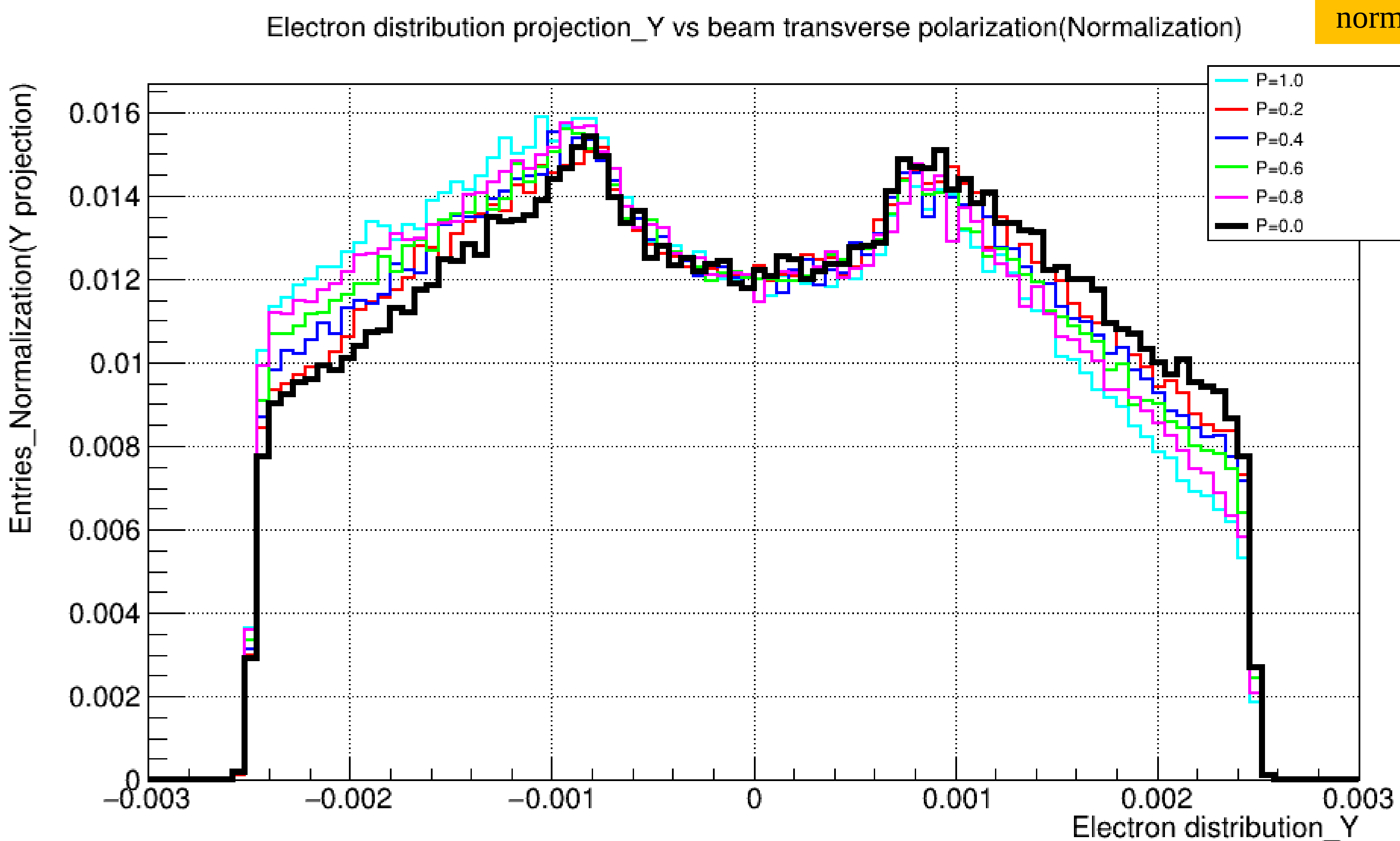


Measurement of beam transverse polarization

Method 1

- The asymmetry of the projections of 2D distribution scattered electrons has a very strong relationship with the **electron transverse polarization**.

normalization

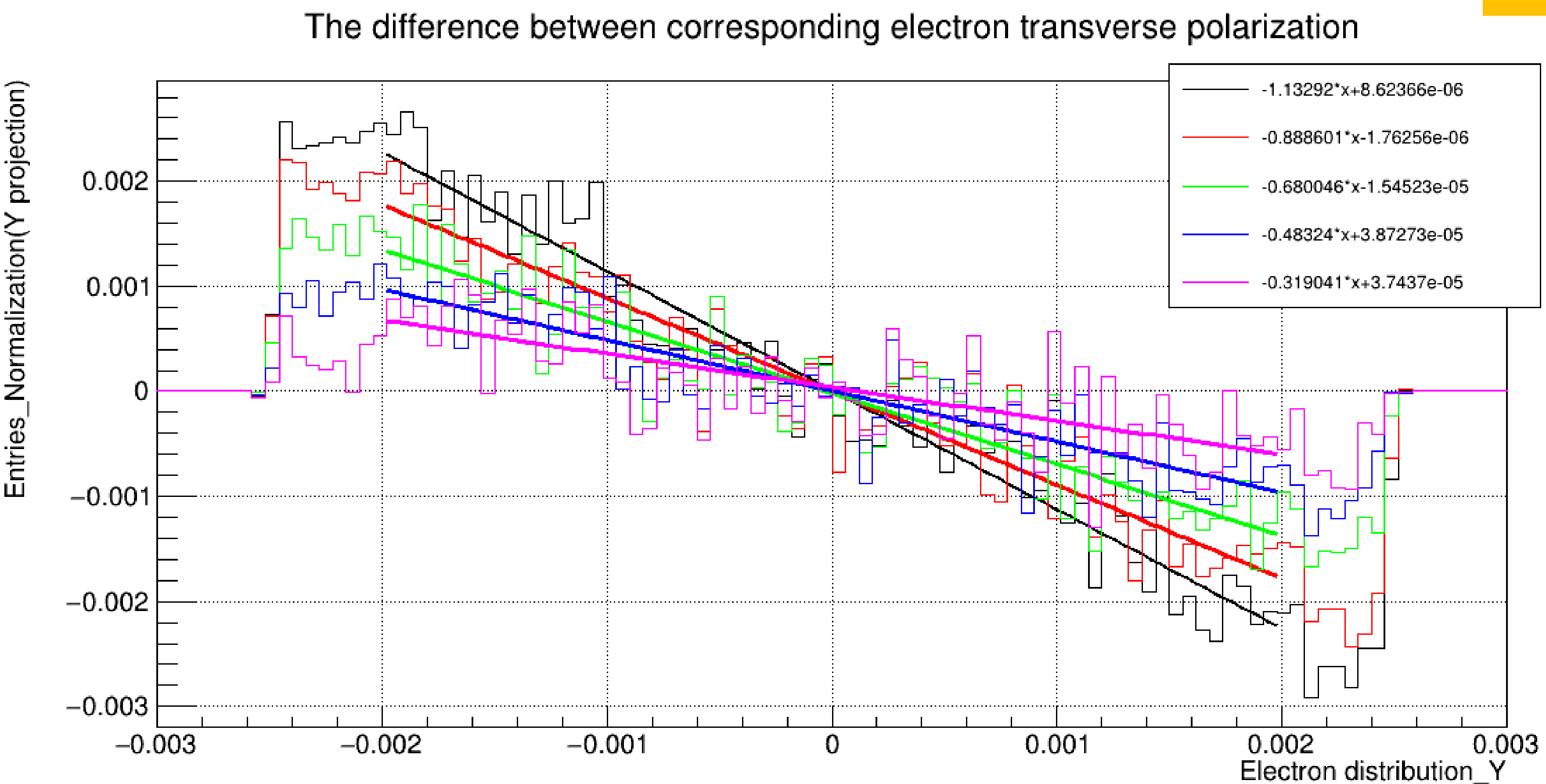


Measurement of beam transverse polarization

Method 1

- ◆ Find the relationship between the asymmetry and the electron transverse polarization.

Fit

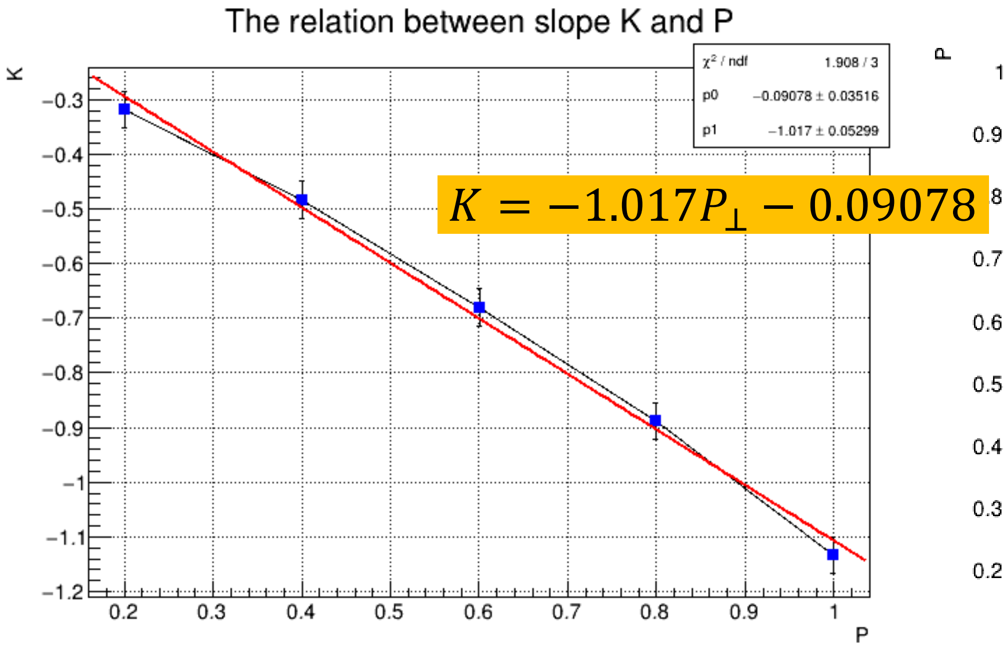



```
NDf     =     64
p0      =     3.7437e-05    +/-    3.92429e-05
p1      =     -0.319041     +/-    0.033542
```

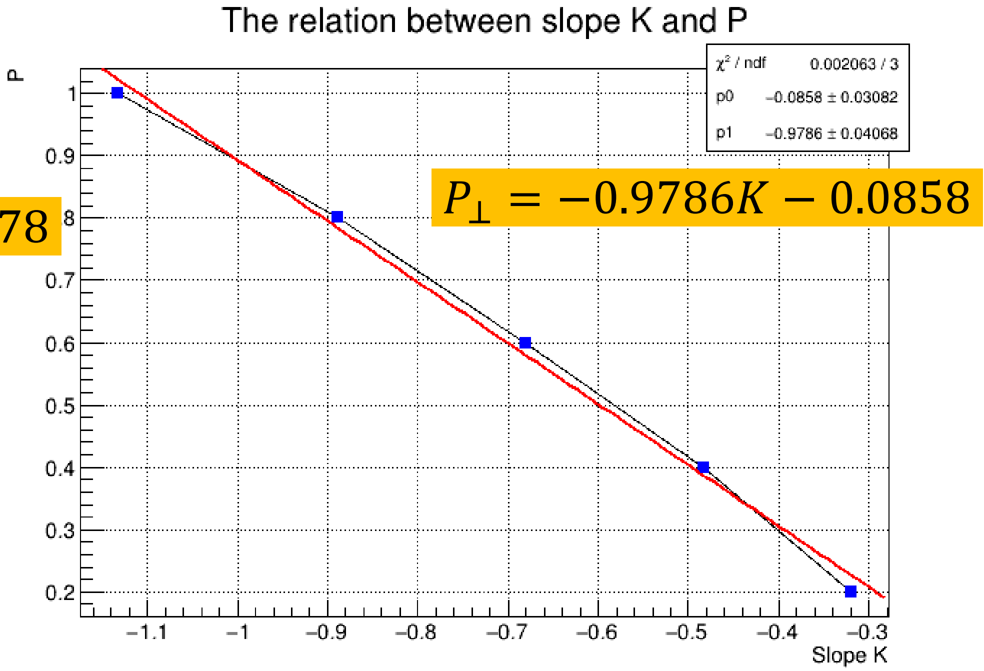
Measurement of beam transverse polarization

Method 1

◆ Find the relationship between the asymmetry and the electron transverse polarization.

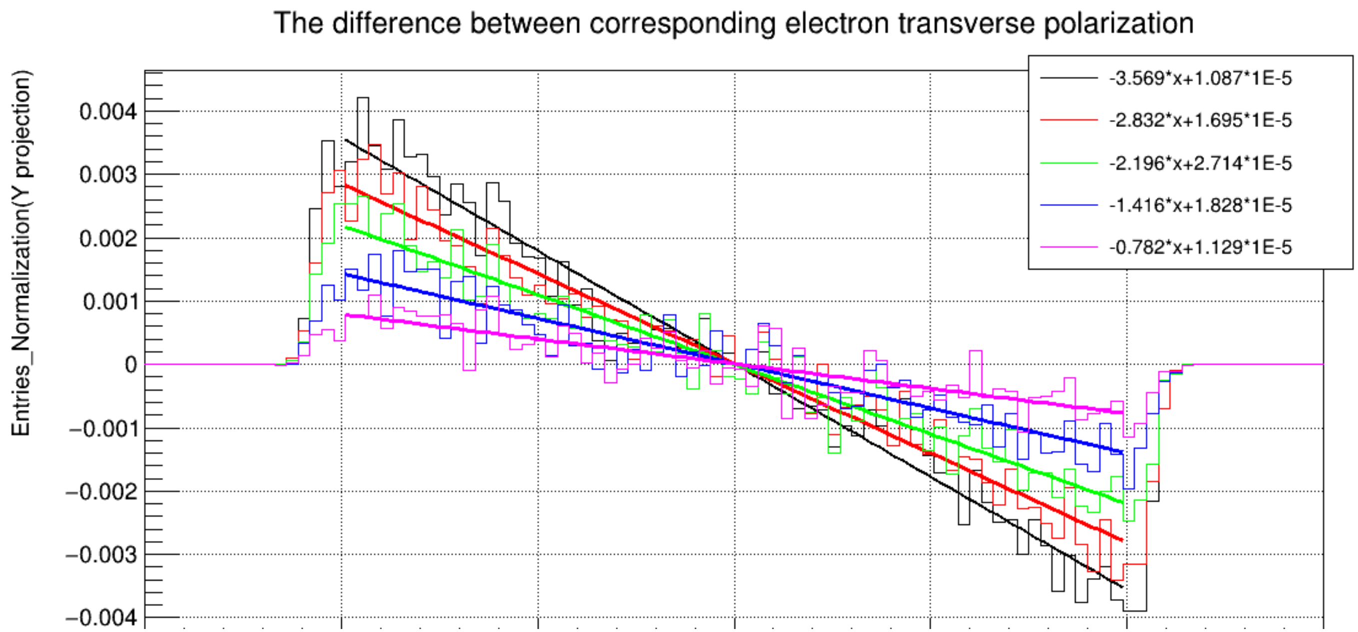


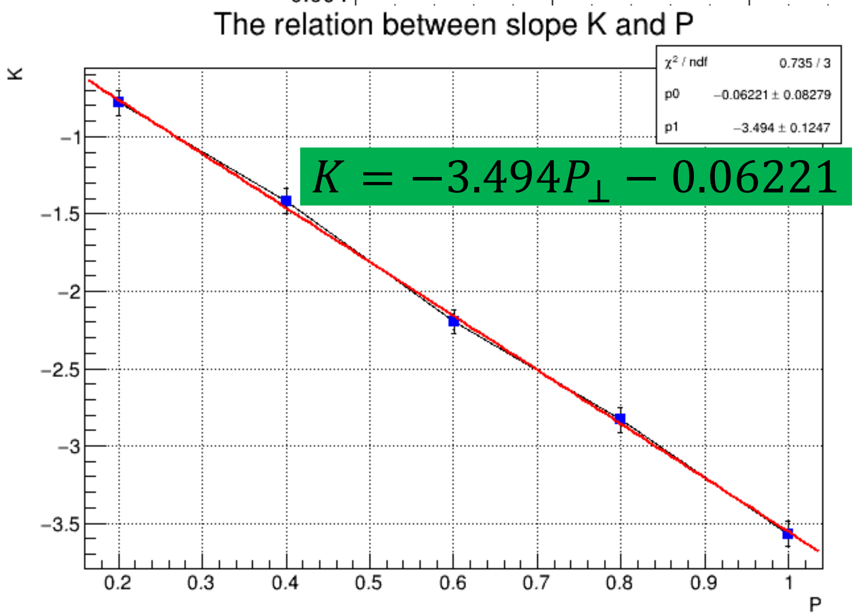
$$K = -1.017P_{\perp} - 0.09078$$



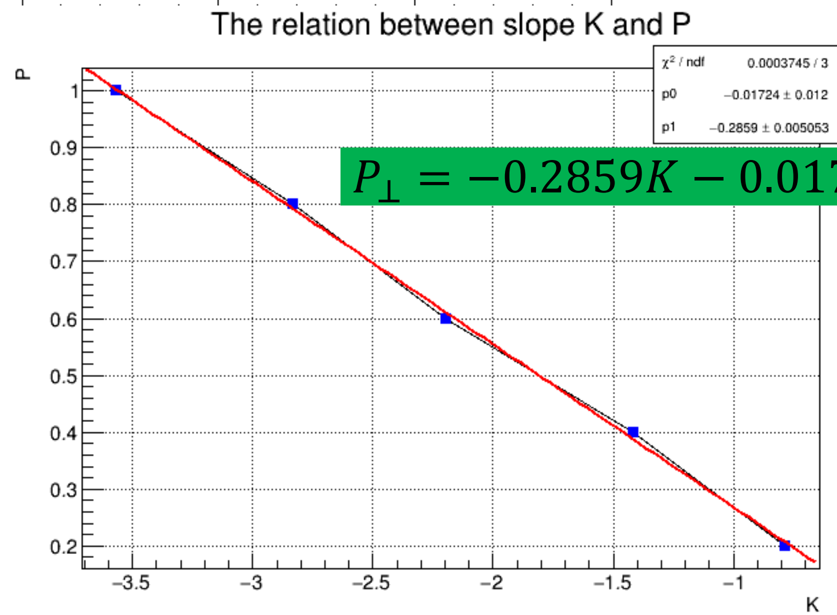
$$P_{\perp} = -0.9786K - 0.0858$$

Measurement of beam transverse polarization@ FCC



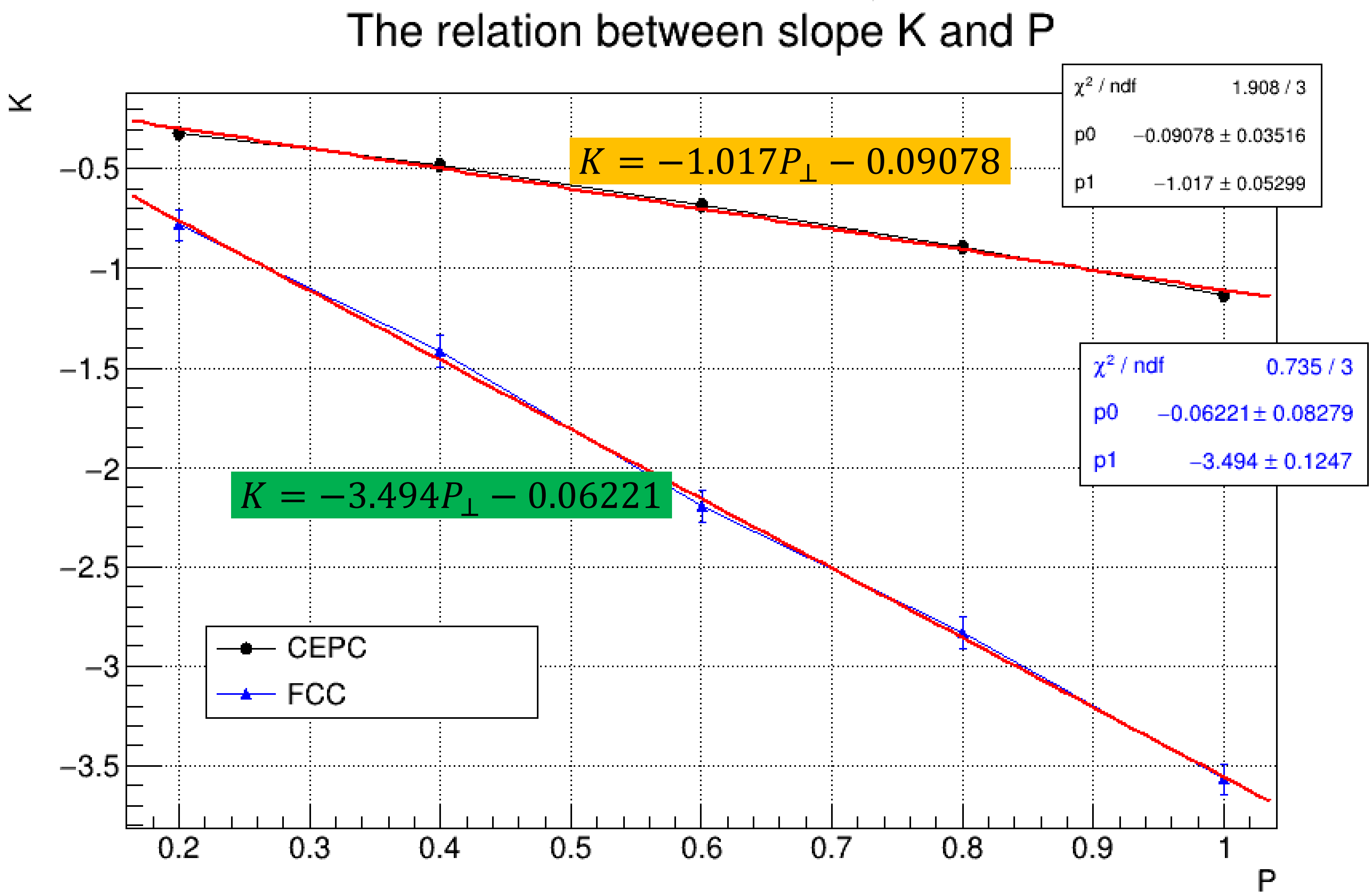


$$K = -3.494P_{\perp} - 0.06221$$



$$P_{\perp} = -0.2859K - 0.01724$$

CEPC vs FCC

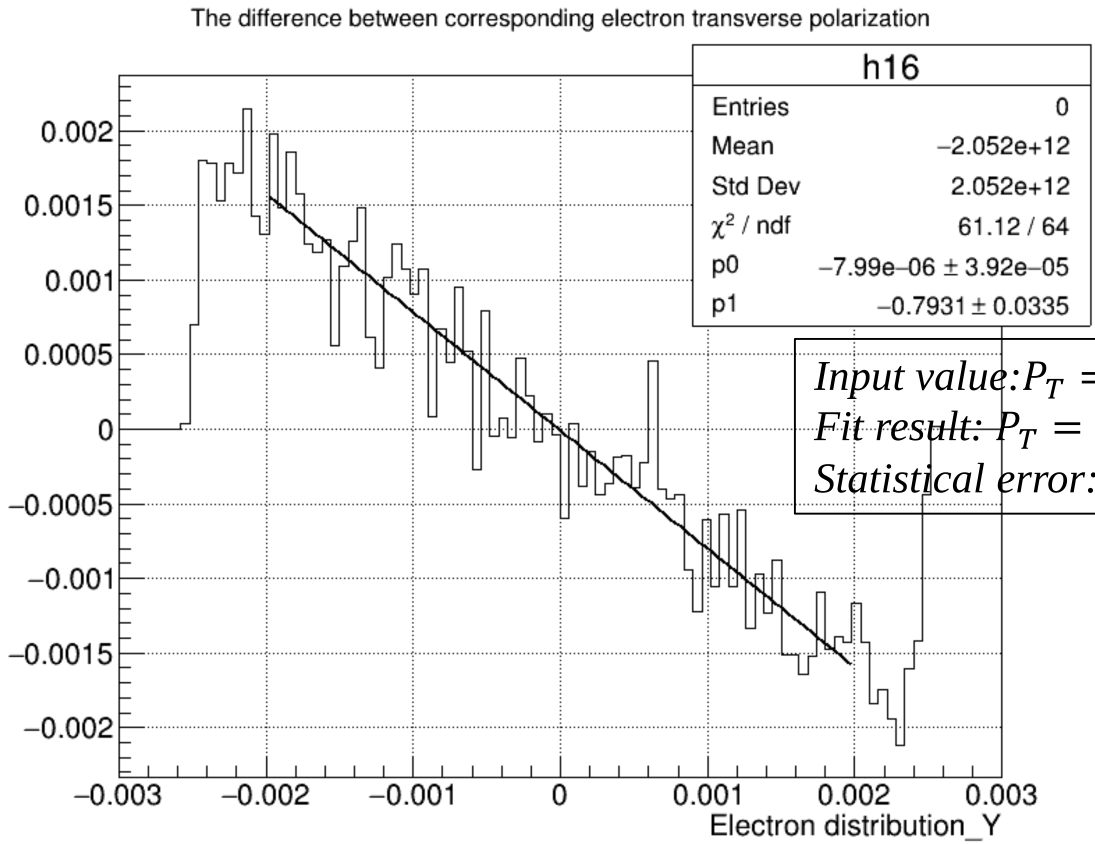


The relation between slope K and P
K
P
χ² / ndf 1.908 / 3
p0 −0.09078 ± 0.03516
p1 −1.017 ± 0.05299
$K = -1.017P_{\perp} - 0.09078$
χ² / ndf 0.735 / 3
p0 −0.06221 ± 0.08279
p1 −3.494 ± 0.1247
$K = -3.494P_{\perp} - 0.06221$
CEPC
FCC
−0.5
−1
−1.5
−2
−2.5
−3
−3.5
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Test the fit result

test 1

$P_{\perp} = -0.9786K - 0.0858$



Input value: $P_T = 0.7$
Fit result: $P_T = 0.6903 \pm 0.0335$
Statistical error: $\leq 3\%$

Transverse Polarization Measurement at CEPC

Method 2

- The method for the determination of the electron transverse polarization involves the measurement of the Y distribution of the scattered electrons on the detector surface, which is placed perpendicular to the beam direction.

- In order not to be dependent on the exact y position of the IP： to determine the polarization via the measurement of the difference in <y> between the left and right helicity states of the laser ($\xi_{\circlearrowright} = \pm 1$), i.e.

$$< y > = \frac{\int d\sigma * y}{\int d\sigma}$$

$$\Delta < y > = \frac{< y >_L - < y >_R}{2} = P_T \Pi$$

Π： The Analyzing Power (AP) of the polarimeter.

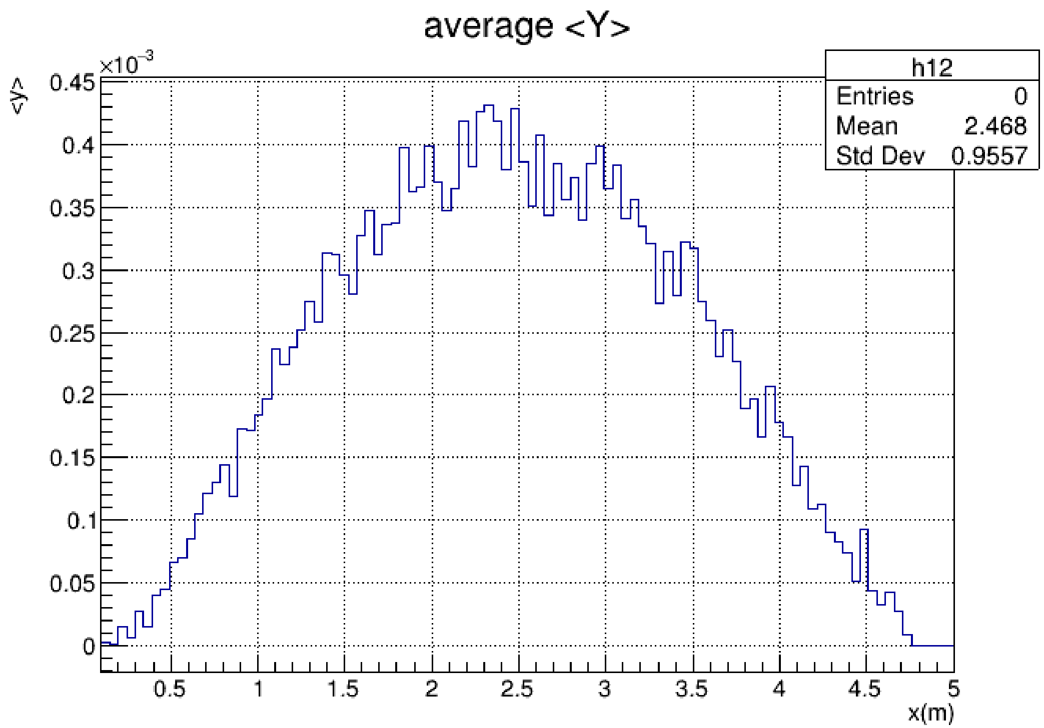
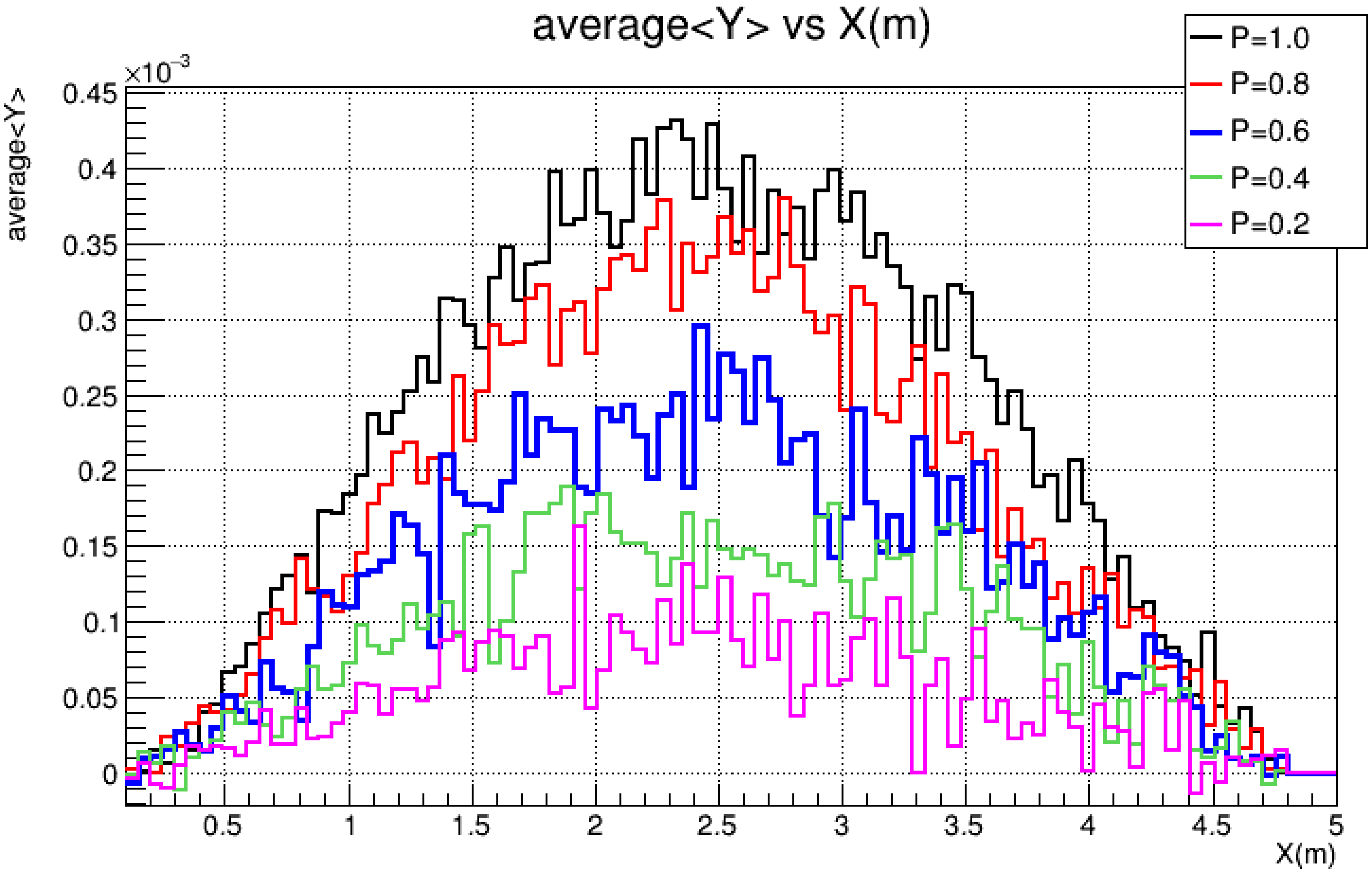


Figure 16: The <y>distribution as function of x(m) for the CEPC setup with $P_{\perp} = +/-1$

Transverse Polarization Measurement at CEPC

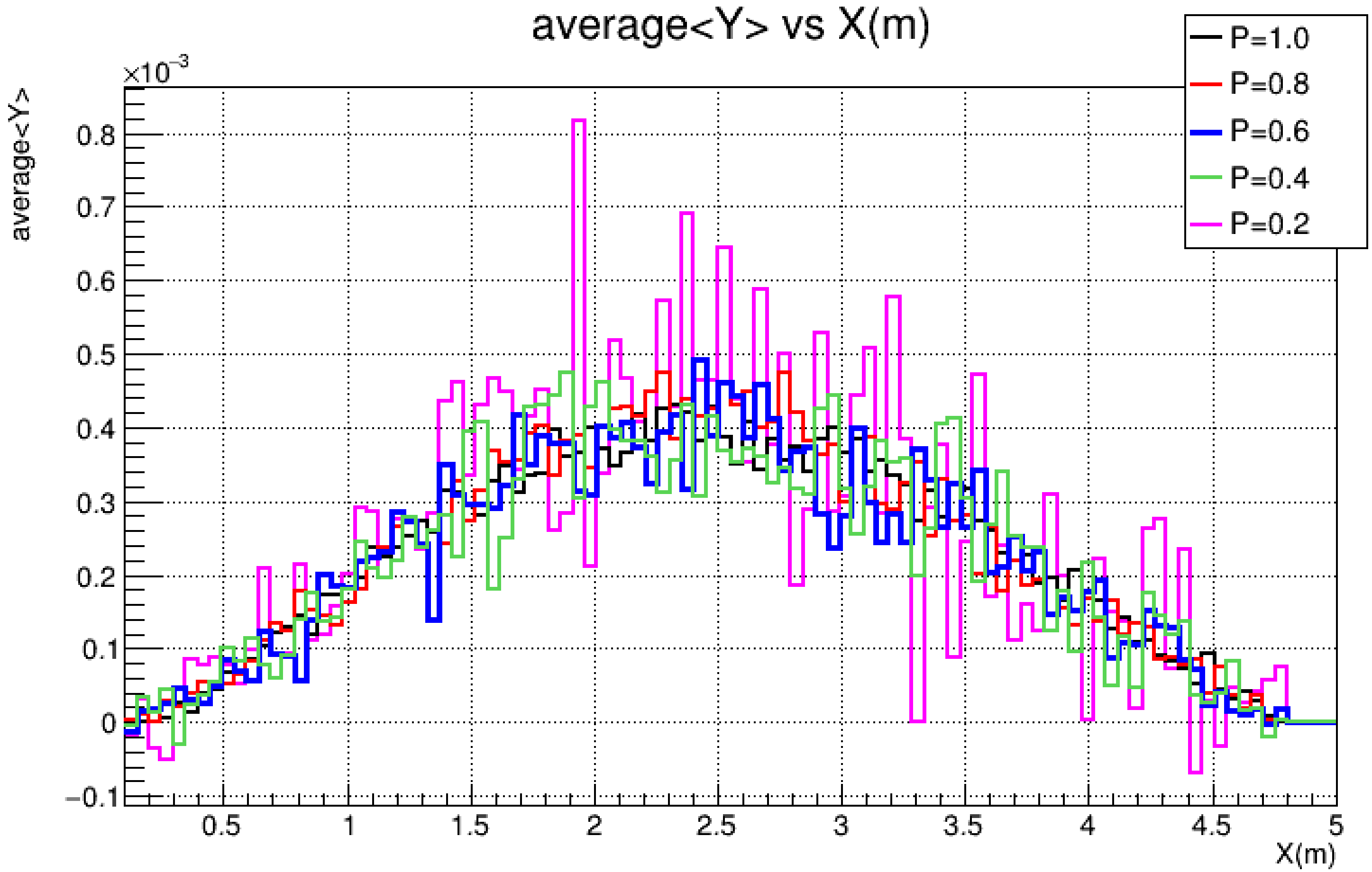
$$\Delta < y > = \frac{< y >_L - < y >_R}{2} = P_T \Pi$$



Transverse Polarization Measurement at CEPC

- **Get $\Pi(x)$**

$$\Delta\!<y>=\frac{<y>_L-<y>_R}{2}=P_T\Pi$$



About Π_x

According to the function function of cross-section to get the Π_x vs x at the angle plane

According to The MC distribution to get the Π_X vs X at the detector plane

Find the relationship between X vs x

Get the Π_X and fit

$$\Delta < y > = \frac{< y >_L - < y >_R}{2} = \boldsymbol{P_T}\Pi$$

Π_x vs x

From the function of ICS cross-section， we get:

$$\Pi_x = \frac{\frac{\pi}{4}(1-x)}{\frac{r_e^2}{\kappa(1+u)^3} \times \left[1+(1+u)^2 - 4\frac{u}{\kappa}(1+u)(1-\frac{u}{\kappa})\right]}$$

$$u = \frac{\kappa}{2}\left(1 + \frac{x\vartheta_0}{\sqrt{1+\vartheta_0^2}}\right)$$

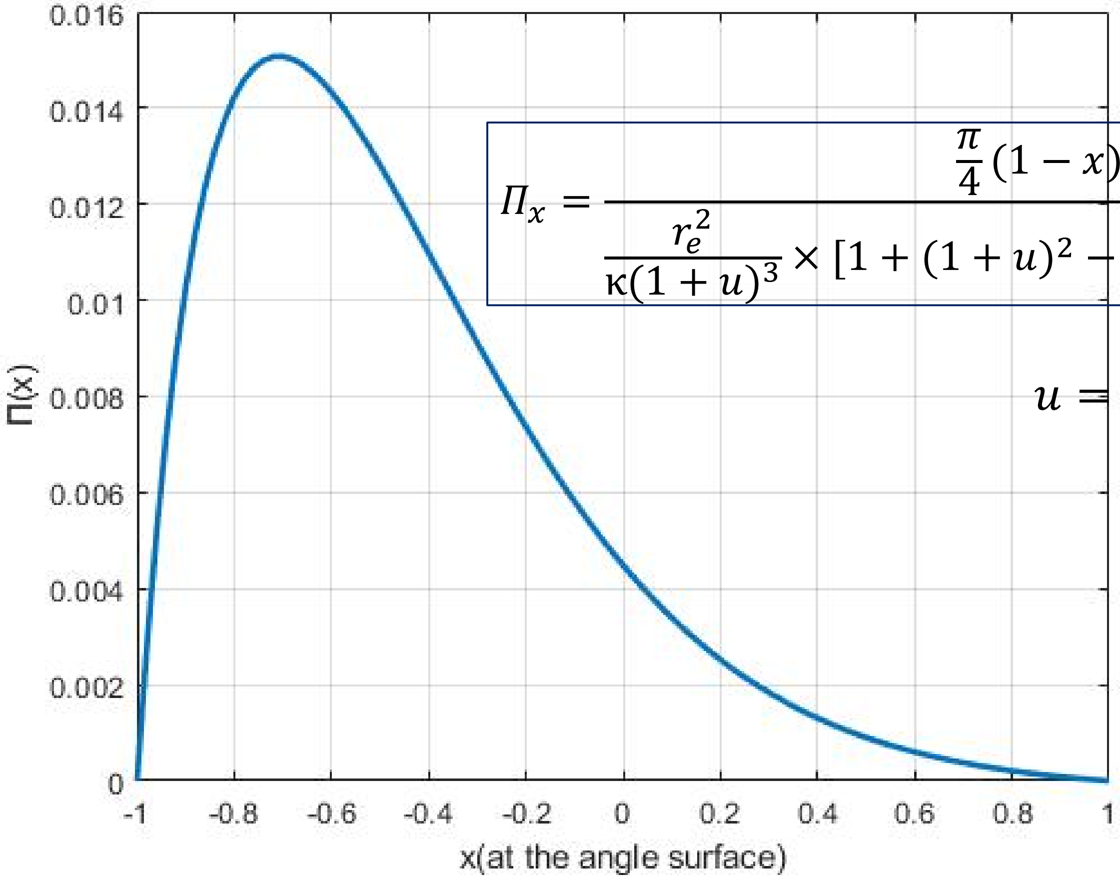


Figure 20: The Π_x distribution as function of x
(at the angle coordinate system)

X vs x

Bending angle

$$\vartheta x = \sqrt{u(\kappa - u)}cos\varphi + u\vartheta_0$$

$$\vartheta y = \sqrt{u(\kappa - u)}sin\varphi$$

The distribution of electrons
(at the detector plane)

$$X_e = x' L_1 + \frac{L_1}{\gamma}\sqrt{u(\kappa - u)}\cos\varphi + u\theta_0 L_2$$

$$Y_e = y' L_1 + \frac{L_1}{\gamma}\sqrt{u(\kappa - u)}sin\varphi$$

ϑ_x vs x
(at the angle plane)

$$x = \frac{\vartheta x - \kappa\vartheta_0/2}{\kappa/2\sqrt{1+\vartheta_0^2}}$$

$$y = \frac{\vartheta y}{\kappa/2}$$

Result

$$X_e = x' L_1 + \frac{L_1}{\gamma}(\kappa/2\sqrt{1+\vartheta_0^2} \times x + \kappa\vartheta_0/2) + u\theta_0(L_2 - L_1)$$

$$Y_e = y' L_1 + \frac{\kappa}{2} \times \frac{L_1}{\gamma} \times y$$

Fit the function Π_X

- For measure $P_\perp$

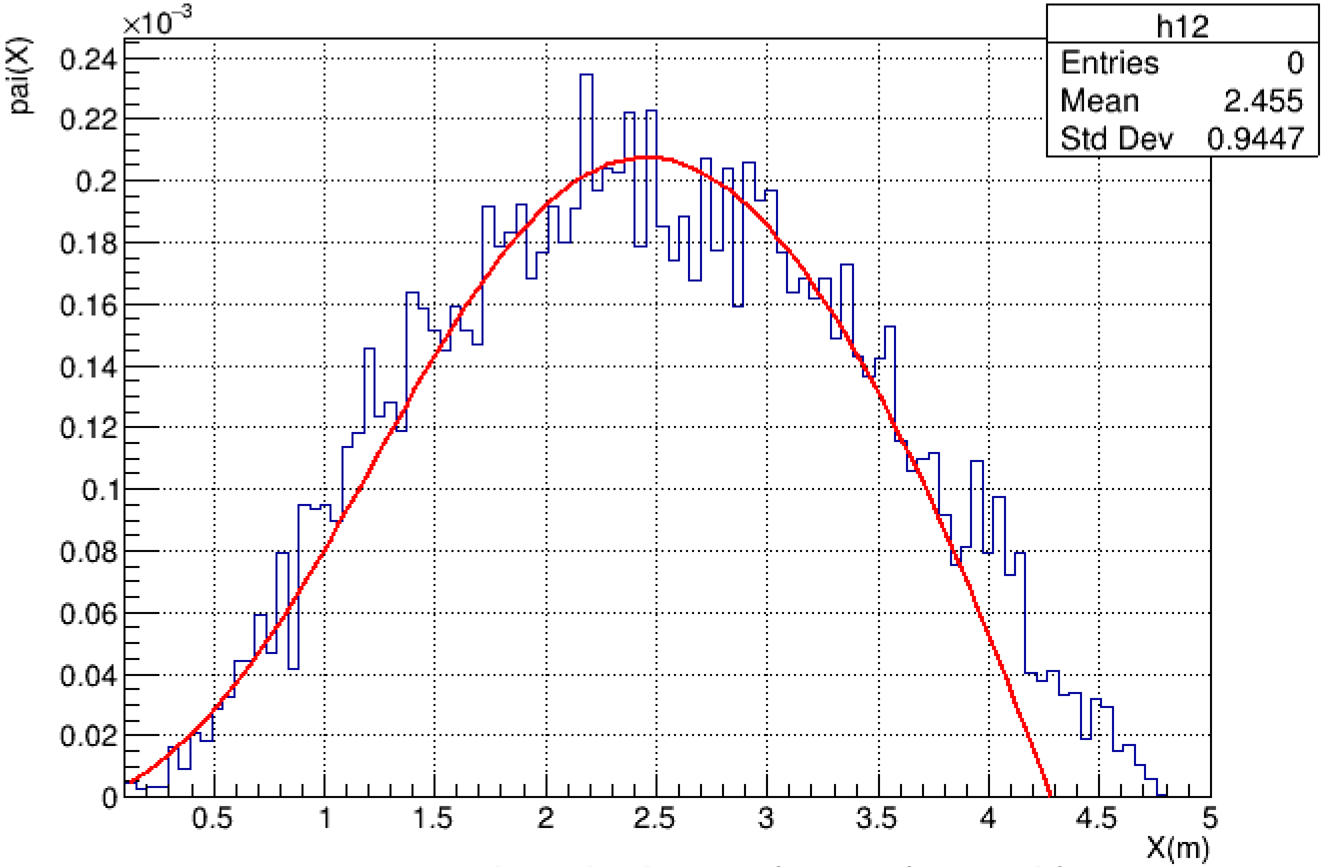


Figure 23: The Π_X distribution as function of X(m) and fit

1. We will measured shift $\Delta < Y > = P_T \Pi(X)$
   with P_T is a free parameter.
2. According to the distribution <Y> and $\Pi(X)$ to fit parameter

Outline

- **Requirement from the CEPC physics**
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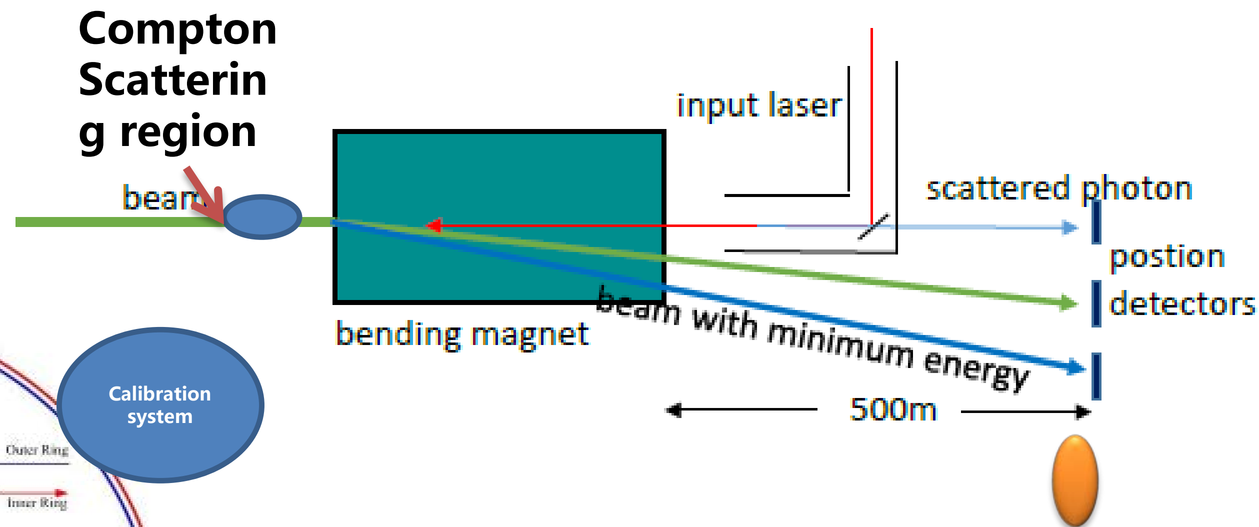
- **CEPC energy calibration**
- **The detector of the electron distribution**

Physics requires and system design

- **Higgs mass measurement: 1MeV@120GeV**



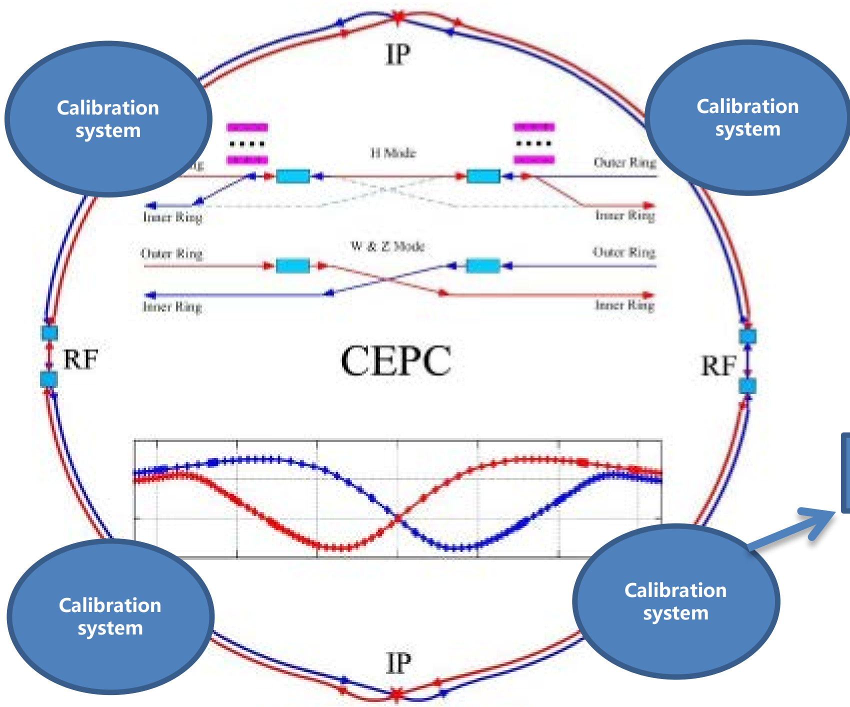


Figure 2.3: Collider layout

extraction → Compton scattering → Magnetic &drift → detection

Compton scattering (Yongsheng Huang,Guangyi Tang,Guangpeng An, et al. IHEP& CIAE)

- **Parameters:**
- **Cross section:600mbar**
- **Scattered photon:** $10^{7-8}/pulse$
- **Time synchronization: 1ns is OK !**
- **Spatial alignment: 10μm is OK !**
- **The scattered electrons:**

From 36GeV---120GeV

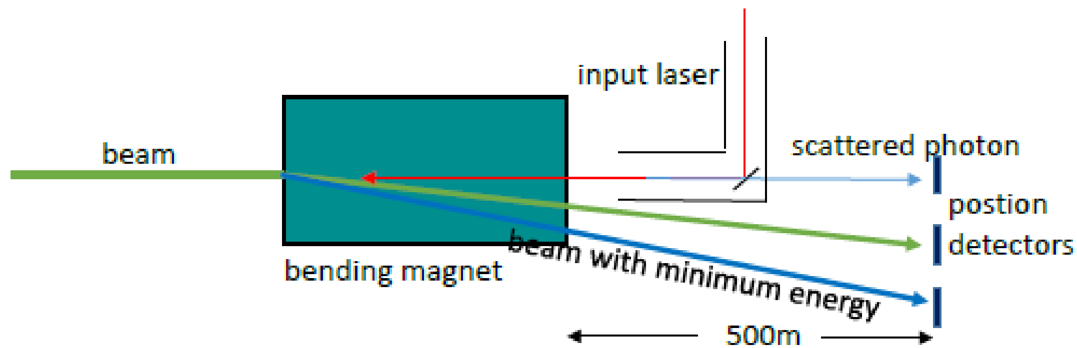
YAG laser pulse			
energy	photon energy	waist radius	pulse length
0.1J	1.24eV	500μm	1m

CEPC bunch	
current	bunch size
16.6mA	$\sigma_x : 200 \sim 450\mu m; \sigma_y : 5 \sim 20\mu m; \sigma_z : 4.4mm$

Note : The LCS gamma ray from Tsinghua University can realize : 216fs time synchronization between the electron beam and the laser beam (30fs) Beam spot size : 10micrometers In 10Hall , we are doing the experiment : 10ns laser+electron beam (10ps) .

Analytic magnetic field and the drift segment (Yuan Chen)

- **Magnetic field:**
- **0.5T,3m,5×10^{-4}**
- **The bending angle:**



$$\theta = \frac{ce}{E} \int_{magnet} B \times dl,$$

- **The energy VS the position on the detection:**

$$\frac{E_{beam}}{E_{edge}} = \frac{\theta_{edge}}{\theta_{beam}} \approx \frac{X_{edge} - X_{\gamma}}{X_{beam} - X_{\gamma}}.$$

- **The beam energy:**

$$E_{beam} = \frac{(m_e c^2)^2}{4\hbar\omega_0} \frac{X_{edge} - X_{beam}}{X_{beam} - X_{\gamma}},$$

Guangyi Tang
Yongsheng Huang

Simulation results

- **Systematical errors for 1MeV@120GeV:**
- $\delta E_{beam} = 1.2 MeV$ **for 10μm of** δX_{beam}

beam energy	δX_{edge}	δX_{beam}	δX_{γ}
120GeV	36μm	11μm	16μm

From synchrotron radiation and magnetic field :

With the correction (the energy loss can be calculated): 0.1MeV

The uncertainty of the angle between the detector place and the incident beam: 0.5mradians--------0.9MeV

The derivation of the calculated energy with the truth:11.5MeV, which can be corrected back.

- **Statistical errors : 0.5MeV**

strip width	100μm	80μm	40μm	10μm
X_{edge}/m	$6.163520 \pm 2.0 \times 10^{-5}$	$6.163520 \pm 1.5 \times 10^{-5}$	$6.163490 \pm 1.3 \times 10^{-5}$	$6.163500 \pm 1.7 \times 10^{-5}$
X_{beam}/m	$1.879350 \pm 1 \times 10^{-8}$	$1.879340 \pm 2 \times 10^{-8}$	$1.879340 \pm 1 \times 10^{-8}$	$1.879330 \pm 1 \times 10^{-8}$
X_{γ}/m	0 (fixed)			
E_{beam}/GeV	119.9988 ± 0.0006	119.9997 ± 0.0005	119.9989 ± 0.0004	120.0001 ± 0.0005

Table III. Statistical error with 500m drift distance. Assume the detector resolution is between 10~100μm..

Scattered electrons:

$$\mathscr{L} = N_1 N_2 2\mathrm{cB} f cos^2\phi \int f_1(x,y,z,t) f_2(x,y,z,t) dxdydz.$$

The function to sim. :

The main beam :

$$g(x) = \frac{N'}{2}(1 + Erf(\frac{X_{edge-x}}{\sigma'}))$$

$$f(x) = N \begin{cases} \frac{1}{\sqrt{2\pi}\sigma} Exp(-\frac{(x-X_{beam})^2}{2\sigma^2}) & \frac{x-X_{beam}}{\sigma} < \alpha \\ (\frac{n}{|\alpha|})^n Exp(-\frac{|\alpha|^2}{2})(\frac{n}{|\alpha|} - |\alpha| - \frac{x-X_{beam}}{\sigma})^{-n} & \frac{x-X_{beam}}{\sigma} \geqslant \alpha \end{cases}$$

For other energy modes

	Higgs mode	Z mode	WW scan	$t\bar{t}$ scan
E_{beam}/GeV	120	45	80	175
X_{edge}/m	6.16352	9.29686	7.10343	5.57276
X_{beam}/m	1.87935	5.01178	2.81903	1.28868
$\delta X_{edge}/\mathrm{m}$	2.6×10^{-5}			
$\delta X_{beam}/\mathrm{m}$	6×10^{-8}			
E_{beam}/MeV	1.0	0.3	0.6	1.8

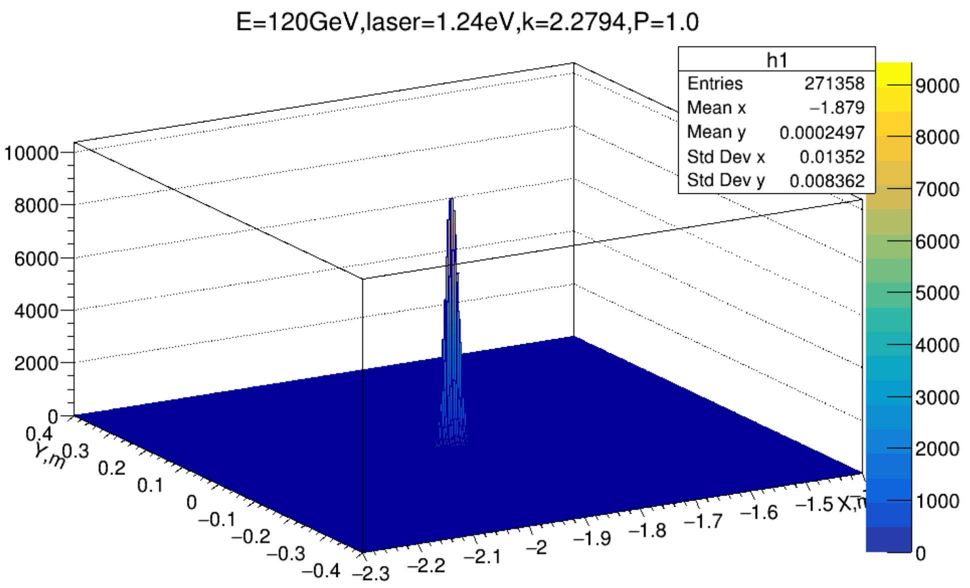
Table VI. Comparison between different modes

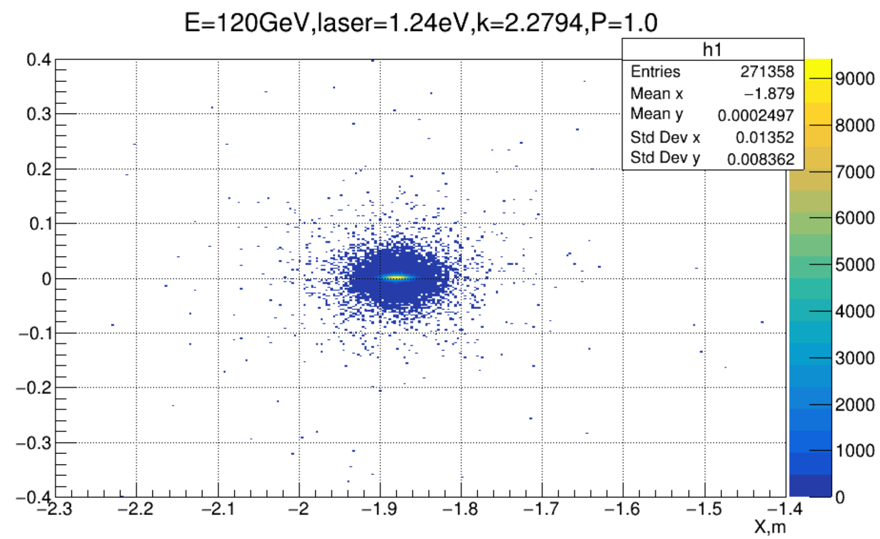
The MC distribution of scattered photons

- Method:

$$X_\gamma = x' L_1 - \frac{L_1}{\gamma}\sqrt{\kappa/u - u}\cos\varphi - \theta_0 L_2$$

$$Y_\gamma = y' L_1 - \frac{L_1}{\gamma}\sqrt{\kappa/u - u}\sin\varphi$$





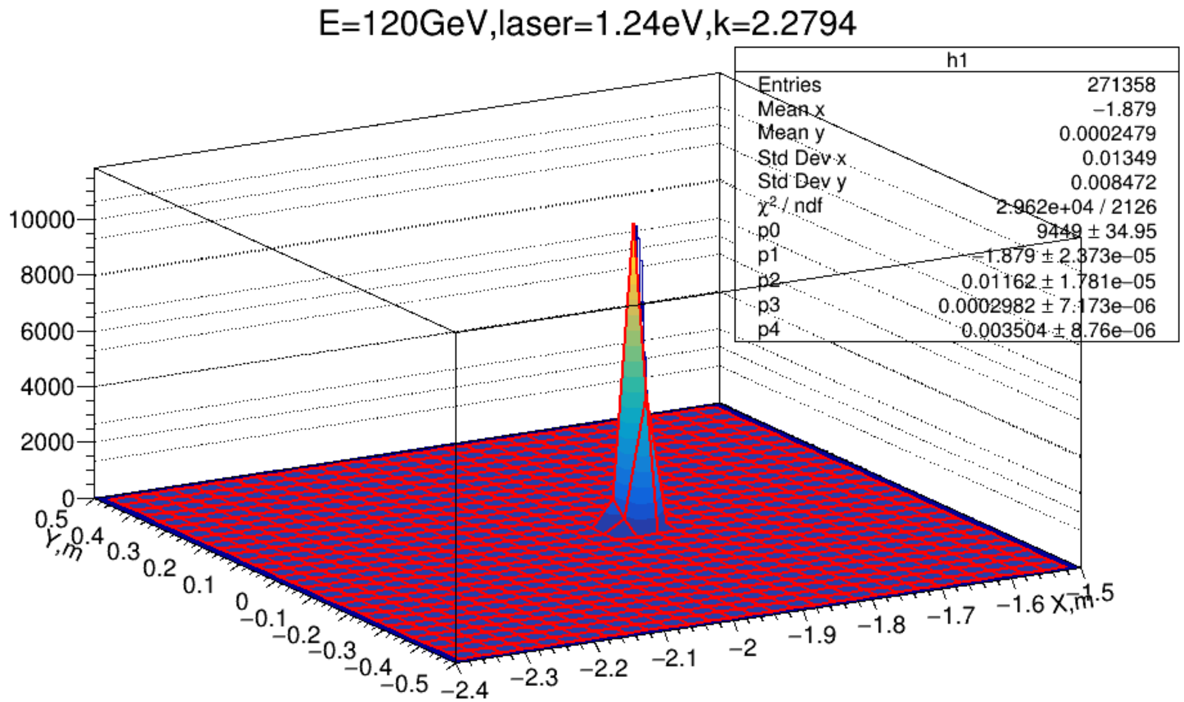
The fit result of scattered photons

- Fit Function:

$$f(x,y) = \frac{1}{2\pi\sigma_x\sigma_y} e^{-[\frac{(x-x_0)^2}{2\sigma_x^2}+\frac{(y-y_0)^2}{2\sigma_y^2}]}$$

$$f(x,y) = par[0] \times e^{-[\frac{(x-par[1])^2}{2\times par[3]^2}+\frac{(y-par[2])^2}{2\times par[4]^2}]}$$

- Fit results:



FCN=29619.2 FROM MIGRAD
STATUS=CONVERGED 484 CALLS 485 TOTAL
EDM=4.81188E-08 STRATEGY=1 0.8 per cent

$$X_0 = -1.879 \pm 2.373e-5$$
$$Y_0 = 0.01162 \pm 1.781e-5$$

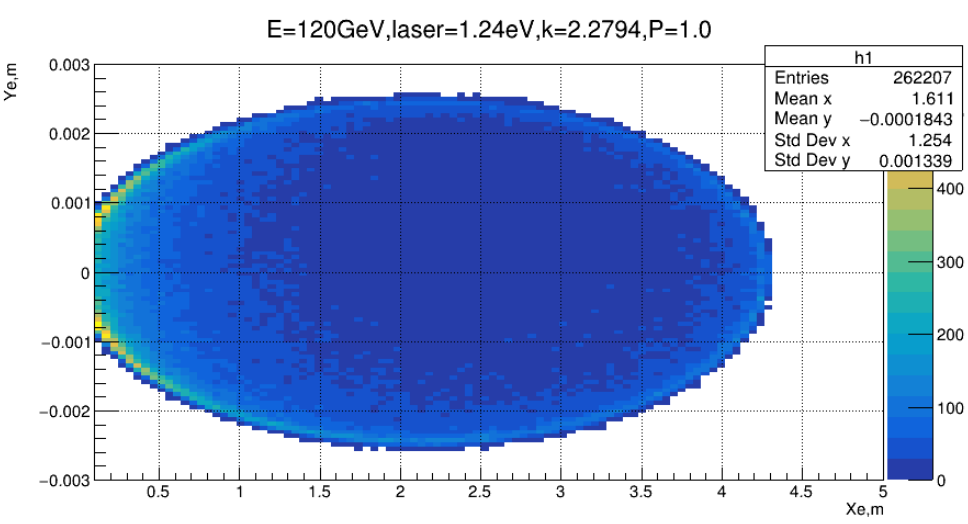
The MC distribution of scattered electrons

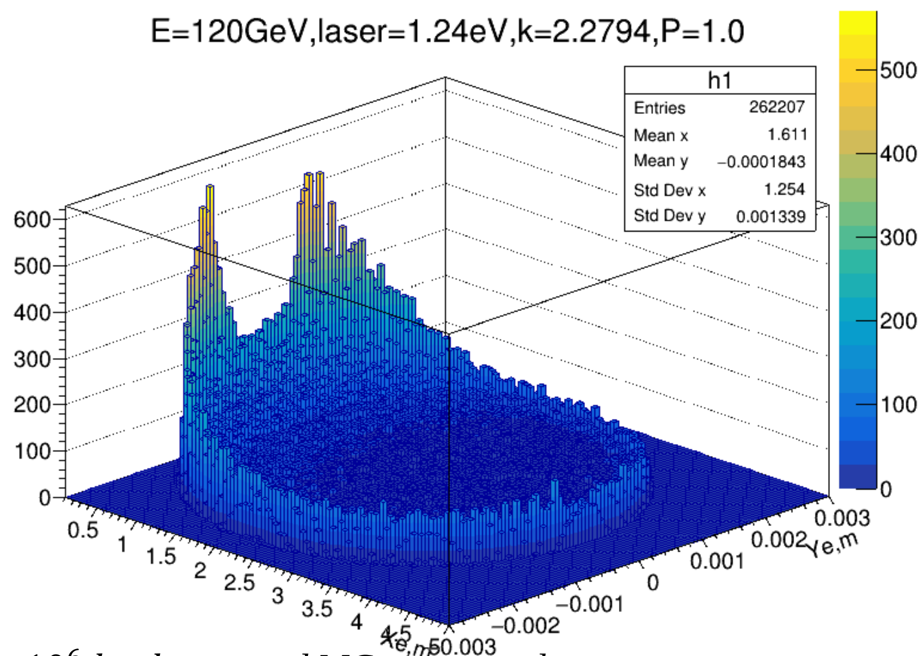
- <u>Methods</u>

$$X_e = x' L_1 + \frac{L_1}{\gamma}\sqrt{u(\kappa - u)}\cos\varphi + u\theta_0 L_2$$

$$Y_e = y' L_1 + \frac{L_1}{\gamma}\sqrt{u(\kappa - u)}\sin\varphi$$

- <u>The distribution of scattered electrons</u>
  - *The scattered electrons distribution starts from* $\boldsymbol{x = 100mm}$:





  - *The results presented in Fig were obtained with* 1×10^6 *backscattered MC event , and about* 2×10^5 *of them was accepted by scattered electrons detector.*

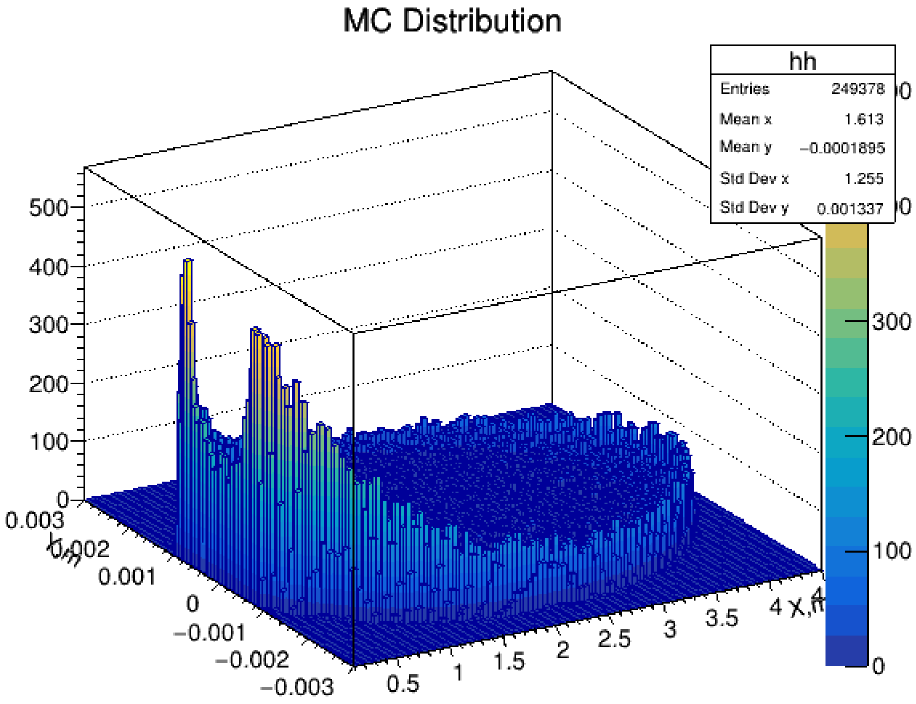
The fit result of scattered electrons

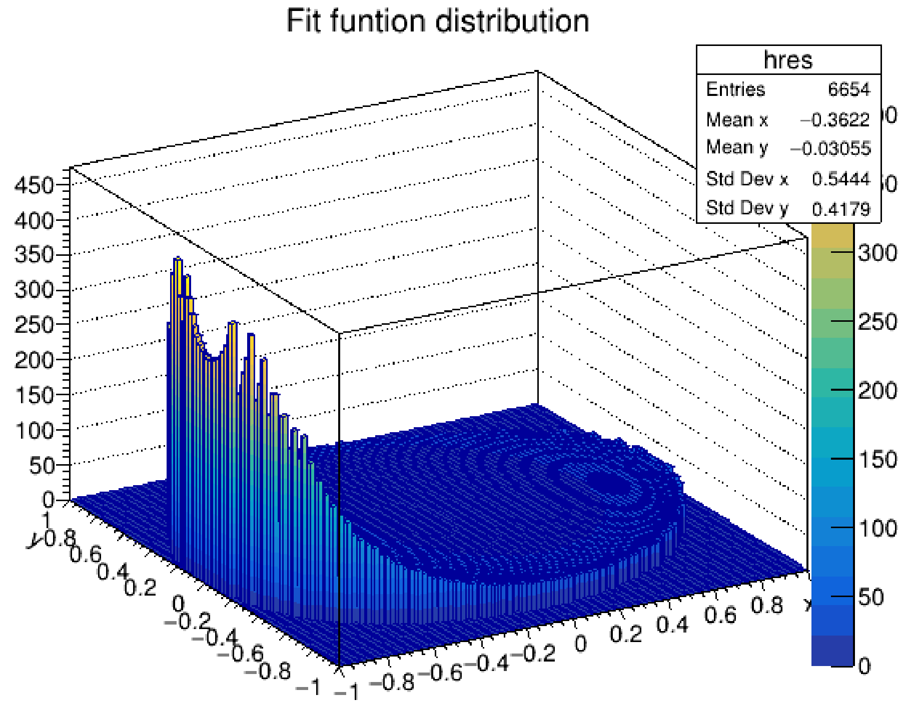
➢ <u>The Method:</u>

1. We will fit the MC distribution of scattered electrons by theoretical cross-section.

2. To convolve the two-dimension normal distribution of initial electrons:

$$P(x,y) = \frac{1}{2\pi\sigma_x\sigma_y} e^{-\left(\frac{x^2}{2\sigma_x^2}+\frac{y^2}{2\sigma_y^2}\right)}$$





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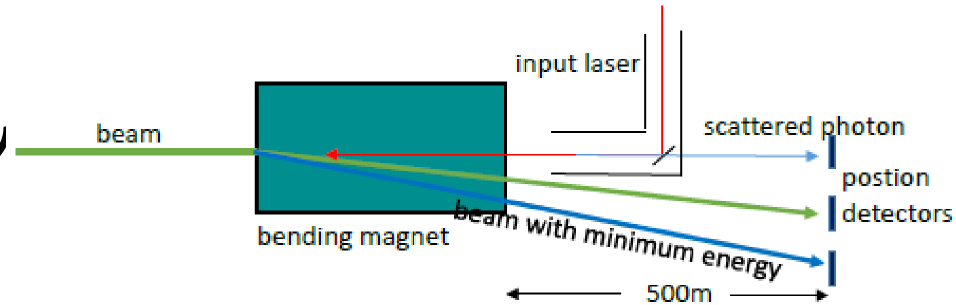
The detection

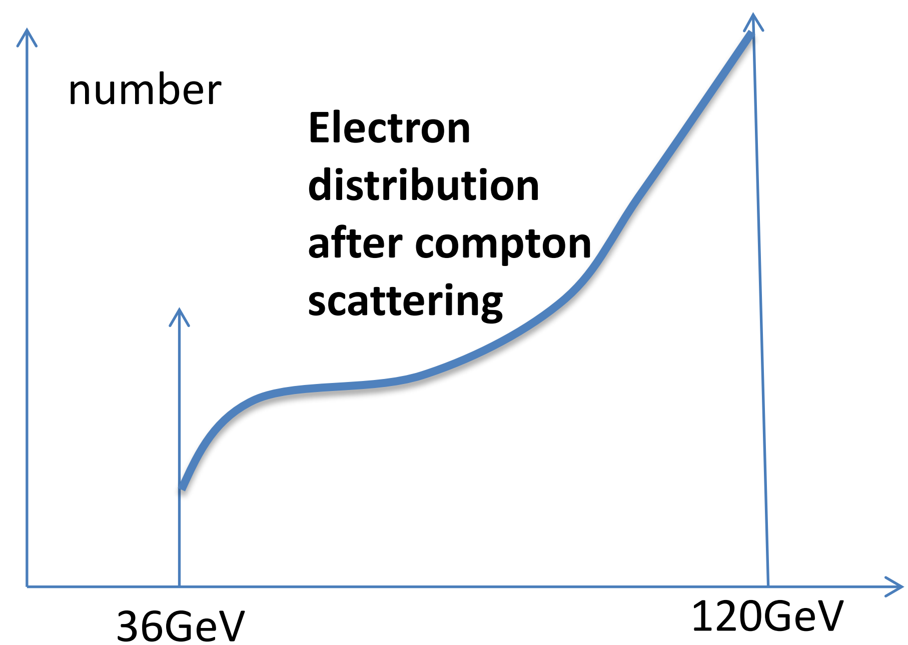
- Three positions:
  - ➢ The center of the gamma ray: Xγ
  - ➢ The center position of the main beam， Xbeam
  - ➢ The edge of the scattered electron beam， Xedge



Strip detector: 1D, 10micrometer per strip

Si Pixel detector: ? micrometer @ 500m drift length; ? micro@50m

Cherenkov radiation: Quartz fiber-array detector:3um-12um



The detectors (Jianyong Zhang)

CVD strip diamond detector+Si pixel detector

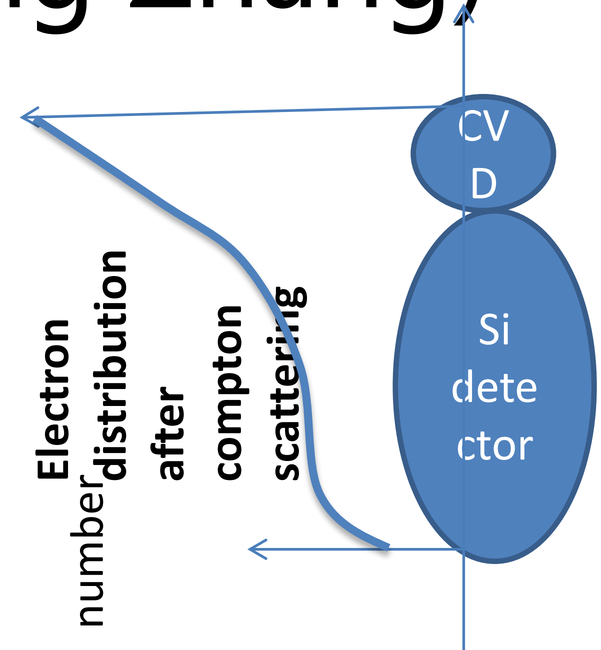
Radiation resistance:

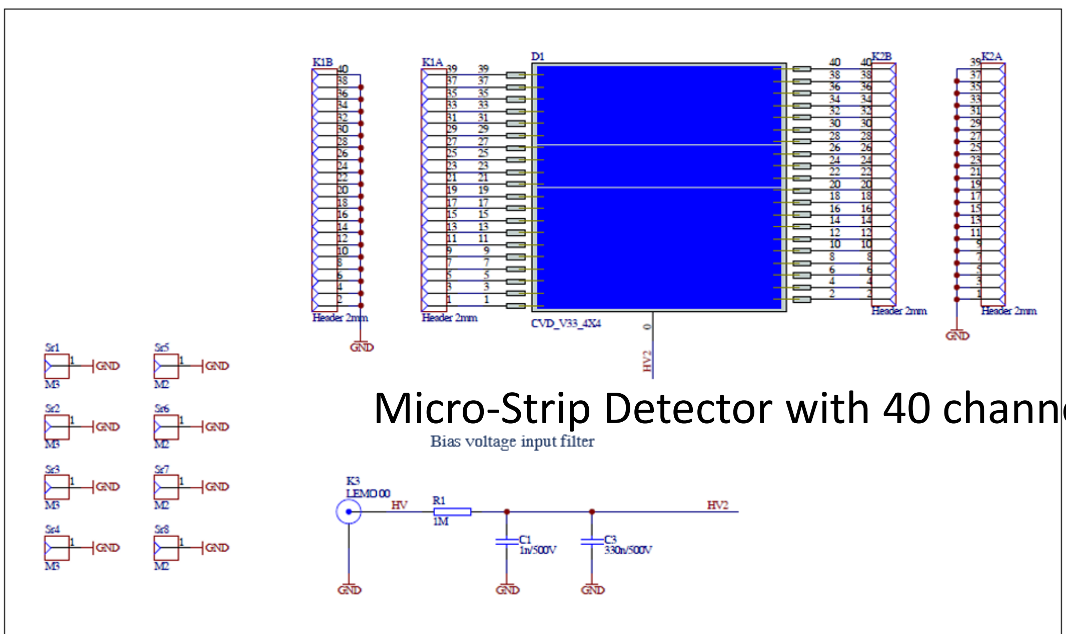
CVD diamond $10^{17}/cm^2$

Si detector: $10^{15}/cm^2$

4.5m*1cm:

so large detector





Micro-Strip Detector with 40 channels.

The calibration of the micro-strip CVD Detector

- The response of all 40 readout channels of the B10205 detector to the 241Am α-source (5.5 MeV -particles)

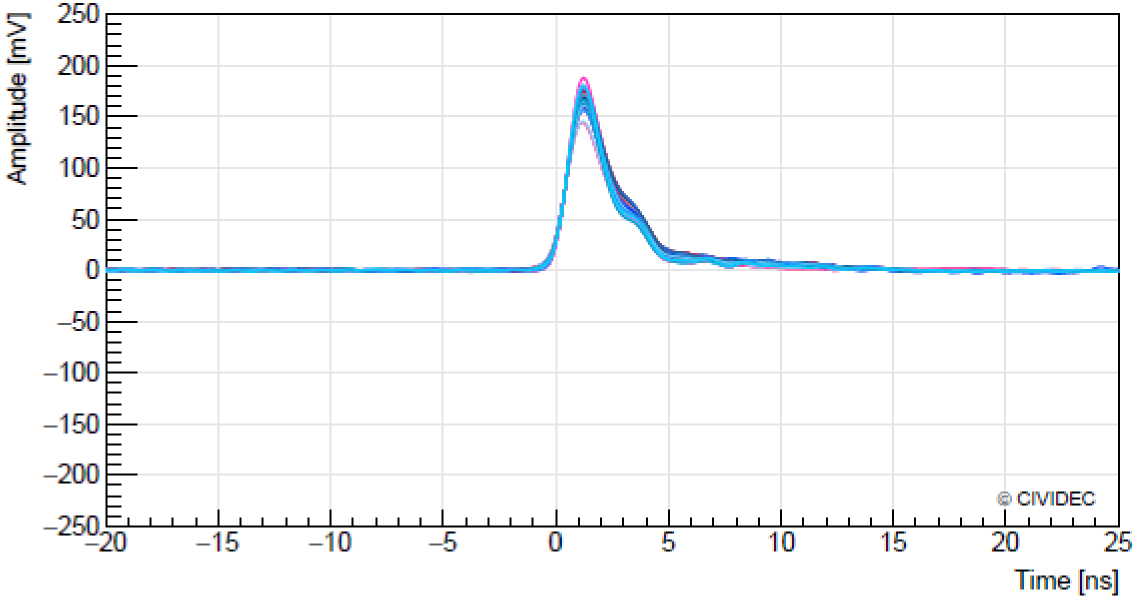
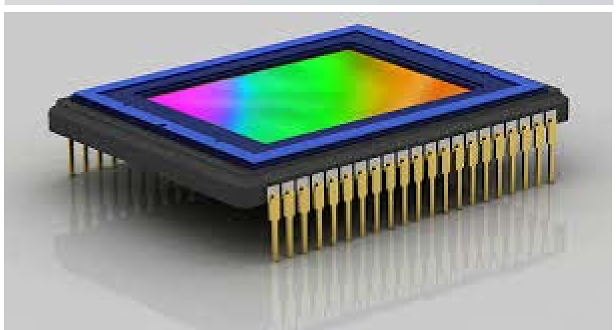


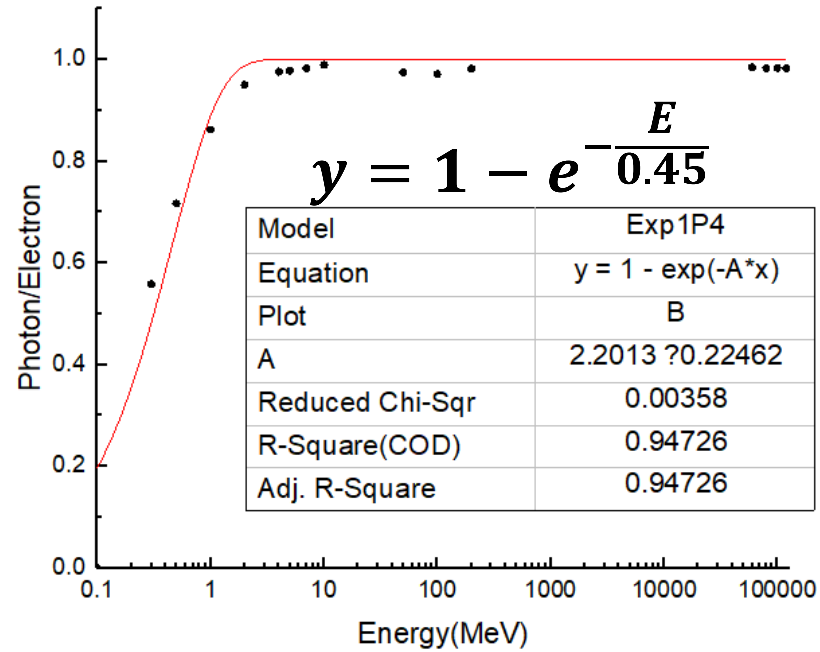
Figure 4: Response to the α-source with the B10205 detector.

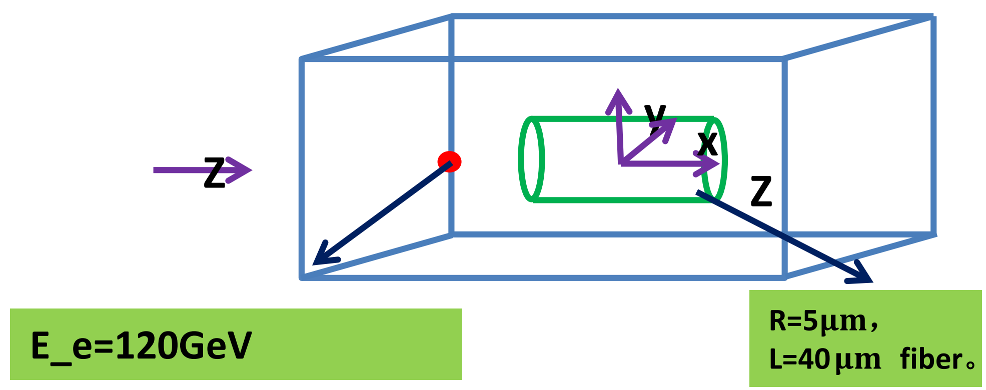
The Cherenkov quarts-fiber-array detector(Xiaofei Lan, Meiyu Si, Jianyong Zhang): 3micrometers-16micrometers available

- **The Cherenkov photon number/electron number satisfies: (the new simulation results)**

$$y' = \frac{L}{10\mu m} \cdot \left(1 - e^{-\frac{E_k}{0.45MeV}}\right)$$







Next to do:

- **Find an efficient algorithm and finish the two-dimensional fitting**
- **Test the compton scattering in IHEP: time synchronization and spatial alignment**
- **Design and Test the CVD diamond detector and Si detector in 10Hall**
- **Design and Test the gamma-ray detector**
- **Design and Test the new Cherenkov fiber detector: flux of photon and the position uncertainty**

Thanks for your attentions!