



2022年5-8月考核报告

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文章情况

- Articles

1. 一作, *JINST*, *A toy Monte Carlo simulation for the transverse polarization of high-energy electron beams* (已发表)
2. 一作, *NIMA*, Two-dimensional simulations on calibrating beam energy with Compton scattering method (二审)
3. 三作, *INT.J.MOD.PHYS.A*, Progress of beam polarization design studies for CEPC (一审)
(我的贡献: 负责CEPC polarimeter部分)

- Meeting

[Beam Polarization Group Meeting](https://indico.ihep.ac.cn/event/17698/) (https://indico.ihep.ac.cn/event/17698/)

CEPC 束流能量标定

较之前的更新:



Reviewers

- Magnet产生的SR怎么考虑?
- Reviewers: Spectrometer magnet with 0.5 T field with 120 GeV electron beam will produce intense multi MeV synchrotron radiation that will hit the backscattered photon detector. This is the serious problem which is not discussed in the submission.

Solutions

- ✓ 详细计算评估了SR: critical energy, critical frequency, flux spectrum distribution
- ✓ 提出两个Photon detection layout:
 - Photon detection 1: Scattered photons(signal) + SR(background)
 - Photon detection 2: SR(background)

solution

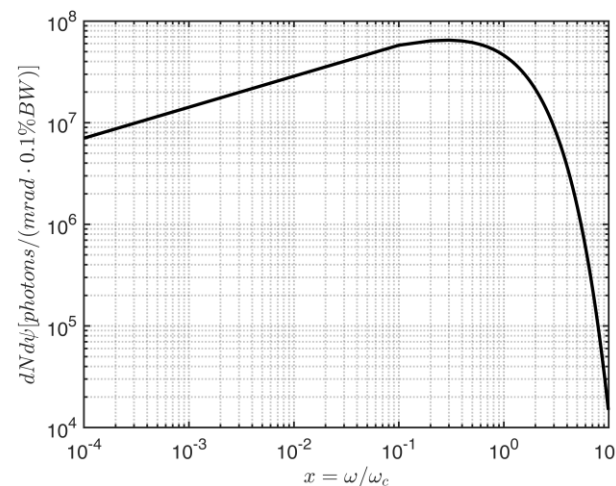
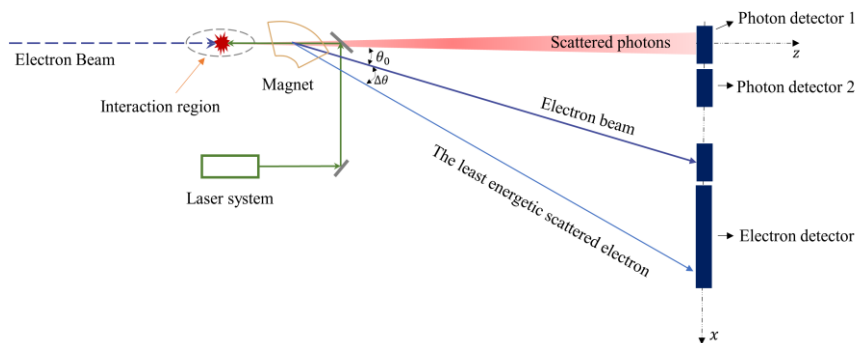


Table 3: Parameters of system SR.

Parameters	Symbols	Values	Units
Beam Energy	E_b	120	GeV
Dipole length	l_B	3	m
Bending radius	ρ	800.5	m
Critical energy	E_c	4.79	MeV

CEPC polarimeter

✓ 探讨同时测量三种极化的可能性

• Definition

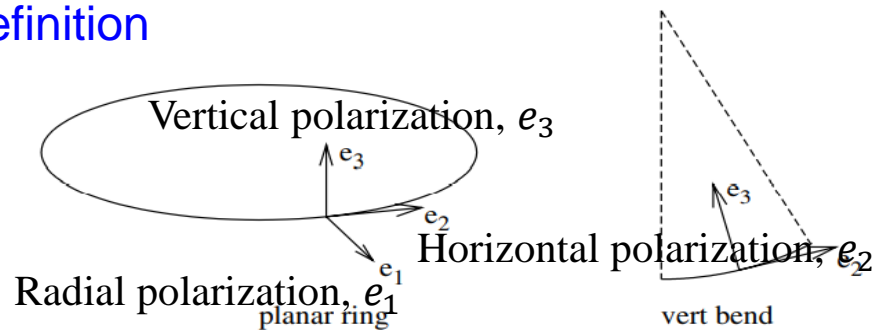


Figure 23. Sketch of the coordinate basis for a planar ring and a vertical bend.

• motivation

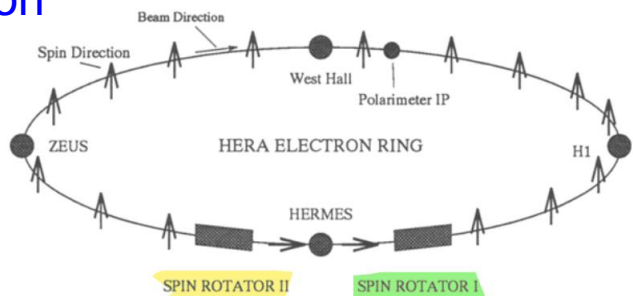
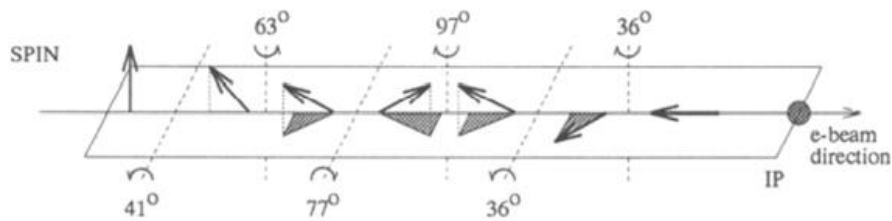
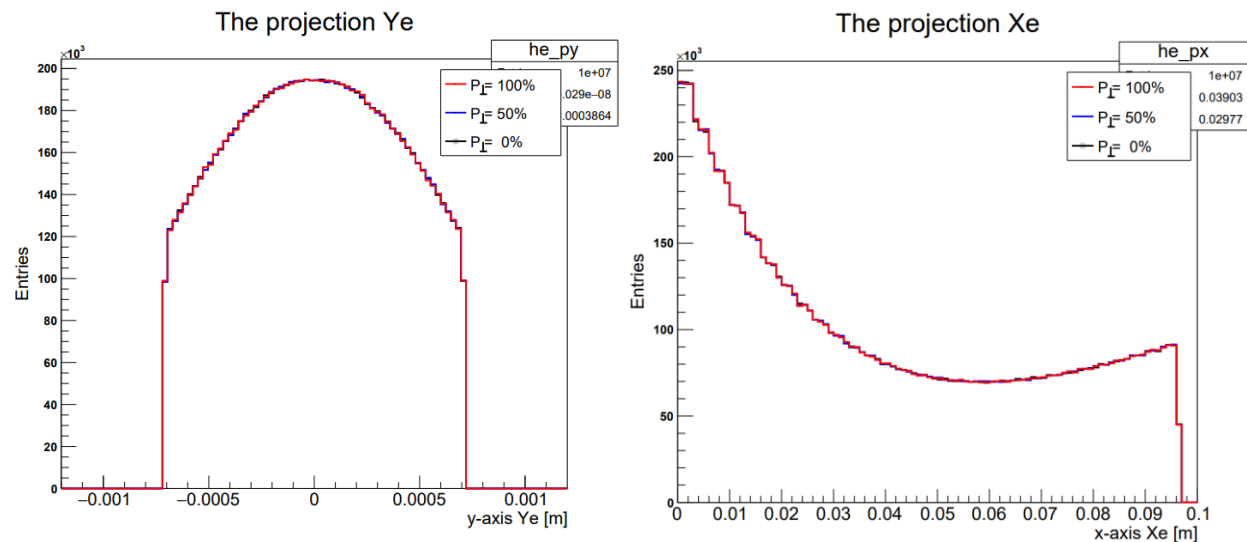


Figure 2: A sketch of the HERA electron ring showing the positions of the spin rotators.



✓ 我的模拟结果



✓ 初步结论:

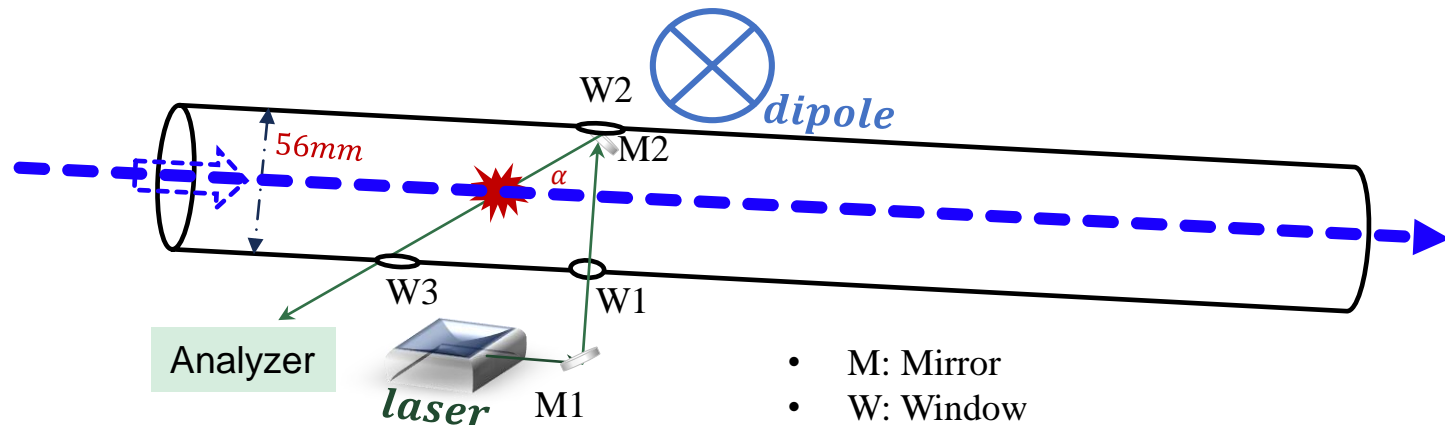
- 改变探测器的方向，让radial polarization也与探测器方位角 ψ 依赖
- 模拟算法验证: asymmetry \rightarrow polarization ?

CEPC polarimeter@Z mode

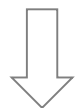
✓ 进一步探讨Compton polarimeter layout

- Input parameters

α : 电子束流和激光脉冲的碰撞角
 dl : 磁铁长度
 B : 磁铁强度
 $dx2$: 自由漂移段长度



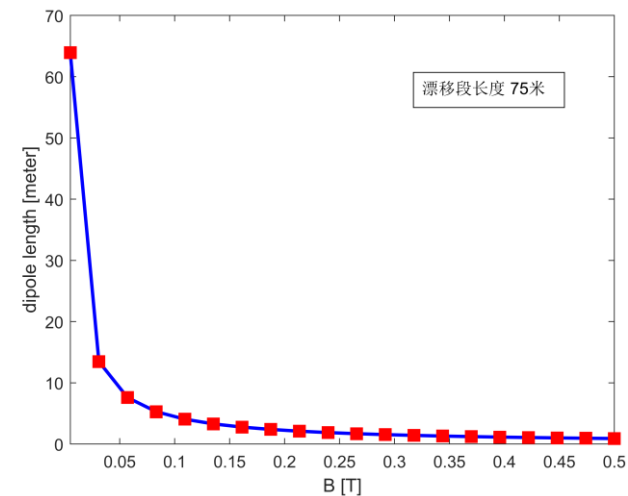
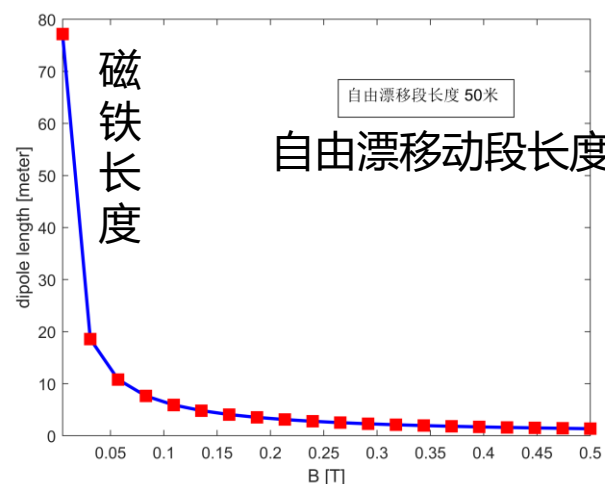
- M: Mirror
- W: Window
- Analyzer: 分析激光光子束的极化



- ✓ 讨论物理需求的优先级
- ✓ 给出参数的制约关系

- ✓ 为保证能量区间在25.11 GeV ~ 40 GeV的散射电子偏移出束管, $L_2\theta_0$ 应满足:

$$\left(\frac{1}{2}dl + dx2\right) \cdot \frac{dl \cdot B \cdot ec}{E_b} > 0.2255m$$



磁铁强度

CEPC polarimeter

✓ W mode 和 Z mode polarimeter系统的比较

- Case: **CEPC W mode** & 激光入射光子的波长取1064 nm

• 几个关键参数

漂移出束管的偏移量: 31 mm

(31 mm = 束管内径半径 28 mm + 壁厚 3 mm)

散射电子的能量分布区间是: 32.92 GeV ~ 80 GeV
(能量低的散射电子先偏移出束管)

- 如果保证飘移出束管的散射电子能量区间是 32.92 GeV ~ 70.33 GeV

则保证以上能量区间的散射电子偏移出束管, $L_2\theta_0$ 的限制范围为:

$$\frac{80 - 70.33}{70.33} L_2\theta_0 > 31\text{mm}$$

$$L_2\theta_0 > 0.2255\text{m}$$

结论: 则关于三个参数变量: 磁铁长度 dl , 磁铁强度 B , 自由漂移动段长度 dx_2 的参数要求, W模式和Z模式相同

接下来准备进行的工作：

- 束流极化测量：
 - Discuss CEPC polarimeter layout with Yiwei Wang
 - 代入更新后的数据模型，给出更新后的结果
 - CEPC 2022 workshop (October 24-28):
 - " **Shanhong Chen, On polarimeter study for CEPC** ",

Thank you!