Personal Introduction

Wang Haiyun

Feb. 28th 2017， Experimental physics department， IHEP， Beijing

Outline

- Basic Information
- Education
- Scientific Research
- Prospective

Basic Information

- **Name: Wang Haiyun**
- **Gender: Female**
- **Date of Birth: October, 14th, 1991**
- **Telephone:**

  +86 010 8820 0015

  +86 188 1019 6356

- **Email: wanghy91@ihep.ac.cn**

Education

- **2010.09-2014.07** **Nuclear Reactor Engineering, University of South China** **Bachelor of Engineering**
  GPA : 88.1/100 Ranking : 1/74

- National Scholarship
- Academic scholarship

- **2014.09-2016.07** **Particle Physics and Nuclear Physics, University of Chinese academy of sciences/ Institute of high energy physics** **Master of Science**

- National Scholarship
- Excellent service for students award,2015

- **2016.09-now** **Particle Physics and Nuclear Physics, University of Chinese academy of sciences/ Institute of high energy physic** **Ph.D. Student**

- **Master & Ph.D. Supervisor: Chen Yuanbo & Qi Huirong**

- **Paper**
- Investigation of the hybrid structure gaseous detector for ion backflow suppression, Chinese Physics C, SCI. the co-author
- Study of Reducing the Time Projection Chamber ion backflow in different collision model, conference paper
- The physical requirements analysis and simulation research of the Time Projection Chamber in the circular collider, ready to contribute

Scientific Research

Ph.D. project :

Some critical technology research on the CEPC-TPC

Simulation

Working gas simulation and optimization

Detector model simulation and optimization

Experiment

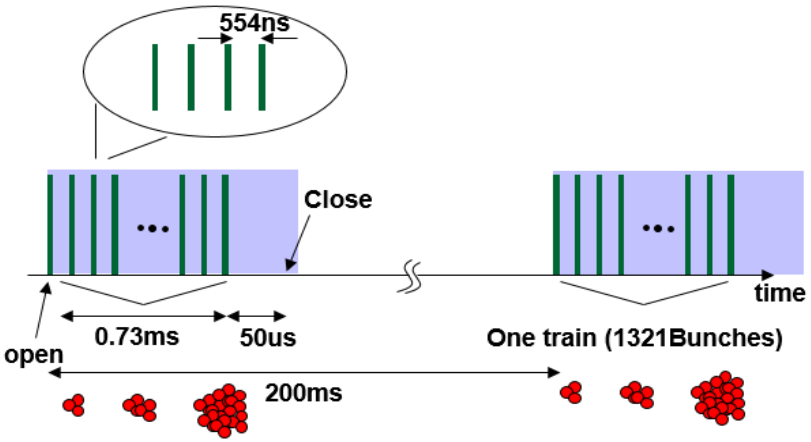
Laser performance test

Laser optical path design

Detector model building and laser calibration test

Scientific Research

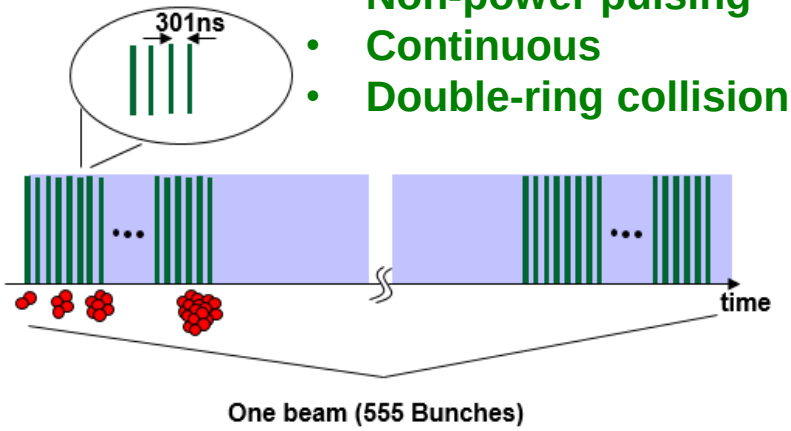
Critical Challenges on CEPC-TPC:



Beam structure of ILC

VS

- Non-power pulsing
- Continuous
- Double-ring collision model



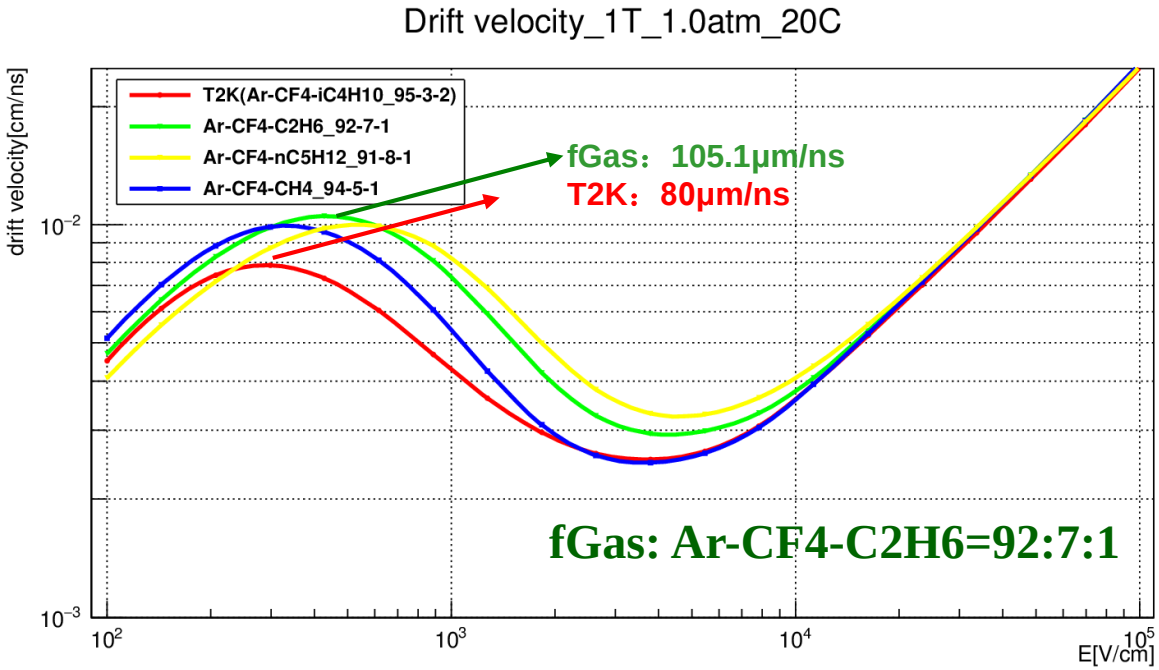
Beam structure of CEPC

No gating device, heavy IBF, IBF optimization &Laser calibration
The shorter focal length L* , E×B effect, Laser calibration
The continuous collision structure, Faster electron drift velocity, Gas Simulation

Scientific Research—working gas simulation

Goal: Choose an appropriate working gas for the CEPC-TPC

Gas properties simulation



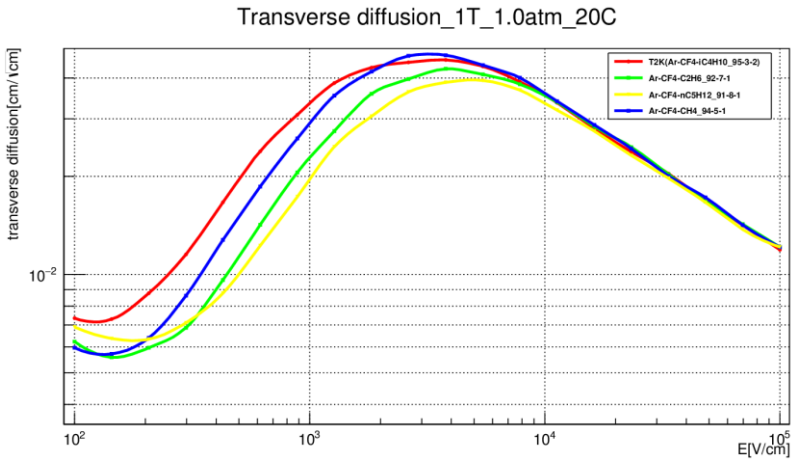
Drift velocity of some mixture working gases

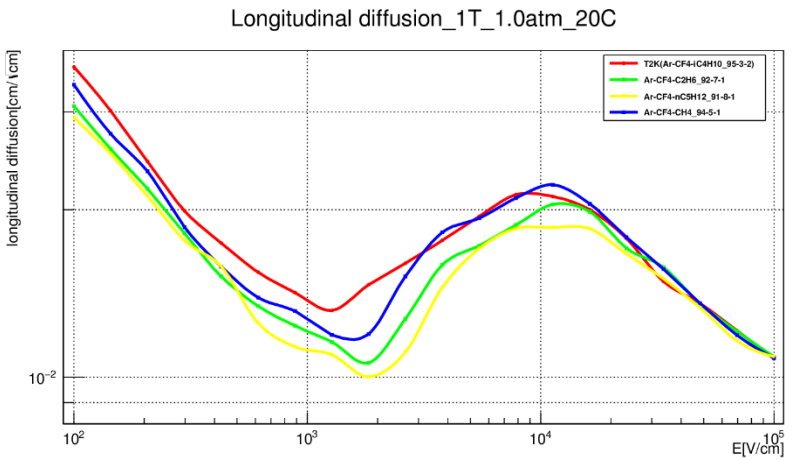
- Garfield++
- High electron drift velocity
- Appropriate diffusion coefficients, attachment coefficient, etc.
- T2K gas as reference gas
- Variables: temperature, humidity, press, electric field, magnetic field, components, proportion
- Simulate different components and proportion of gas: Ar/CO2/CF4/iC4H10/nC5H12/ C2H6

Scientific Research—working gas simulation

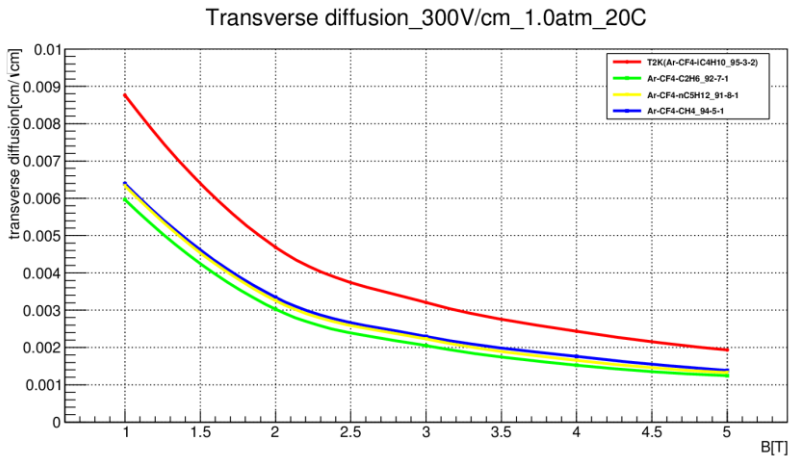
Transverse diffusion coefficient simulation：

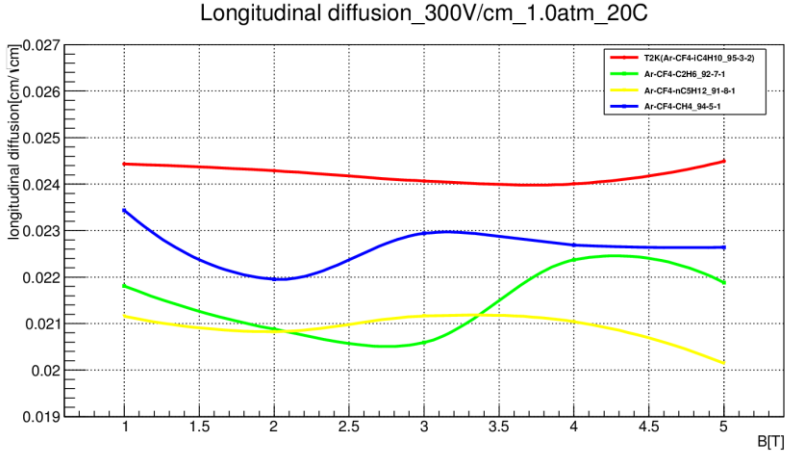
fGas(green): Ar-CF4-C2H6=92:7:1





Longitudinal diffusion coefficient simulation：





Further simulation with consideration of inflammability, toxicity, compression ratio, etc.

Scientific Research — Laser calibration

Goal: Use the laser to calibrate the TPC to reach ~100μm position resolution

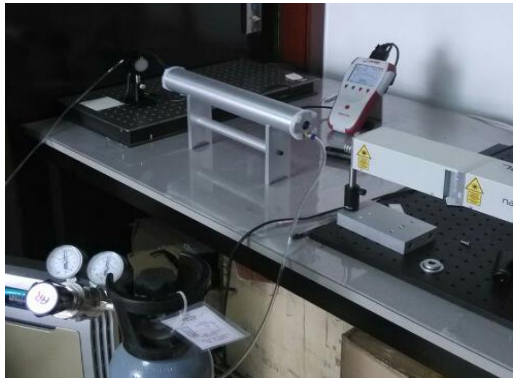
- Influence of the IBF
- The shorter focal length L*
- Temperature、humidity
- mechanical tolerance
- etc.

→

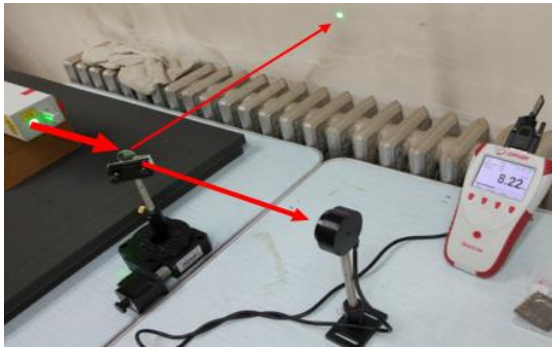
- Distortion of drift velocity and drift path
- Difference between reconstruction track and original track

→ Laser Calibration

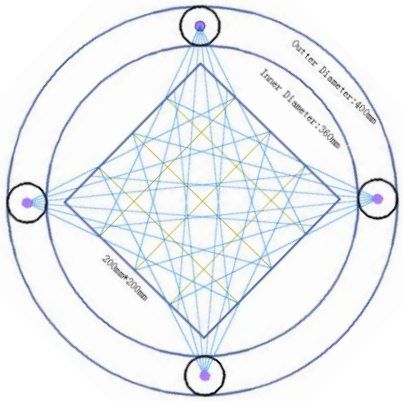
Laser test



Laser performance test
(laser dispersity, energy loss in argon, transmission feasibility in argon)



Optical device test
(high reflection mirror, anti-reflection mirror, beam splitter mirror, etc.**)**

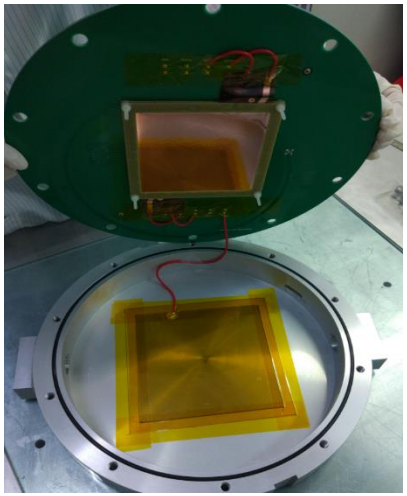


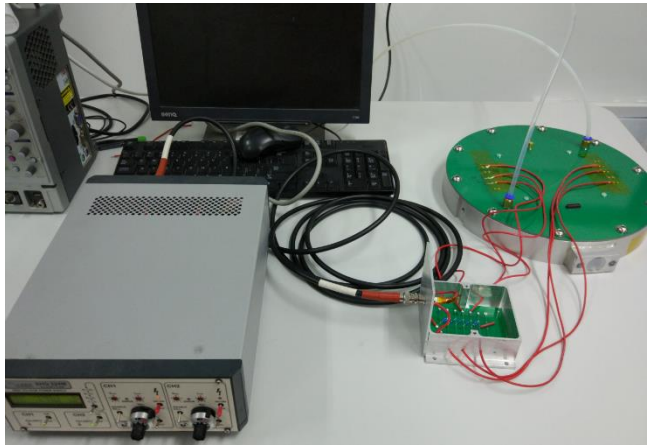
Laser optical path optimization
(modify the 6 rods laser map to 4 rods laser map, Combine the laser path with the readout pad)

Scientific Research — Laser calibration

Testing laser signal using side window detector

- Litron Nano-SG 150-10
- Wavelength,266nm
- Laser two-photon ionization with organic impurities
- Fused quartz window
- Active area: 100mm×100 mm
- Triple-GEM detector
- Readout: 100mm×100mm single pad
- The space can satisfy the height of MM+GEM





Laser test module

Prospective

Study in the IRFU institute at CEA-Saclay for a period of 6 months in 2017

- Study the data analysis/event reconstruction software
- Learn some more about IBF test and optimization
- If possible, to participate in the beam test of Micromegas
- Learn more about the TPC and gaseous detectors

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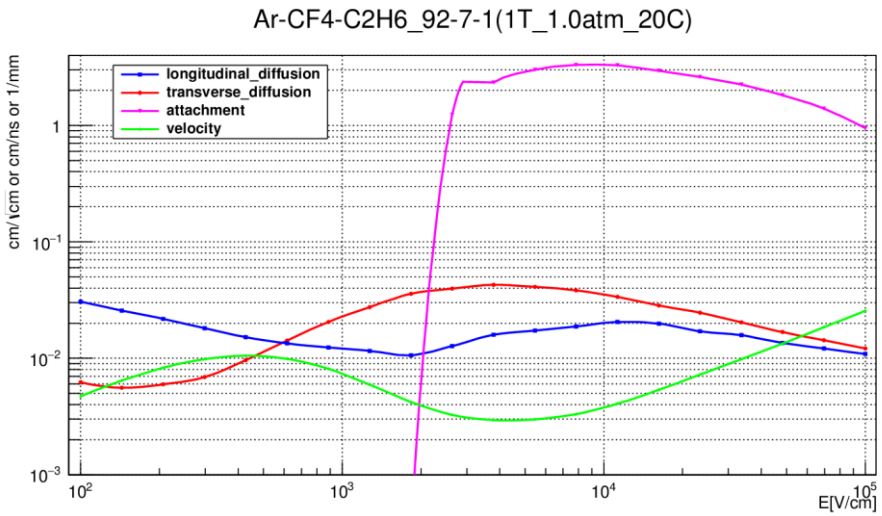
Thanks very much for your attention~

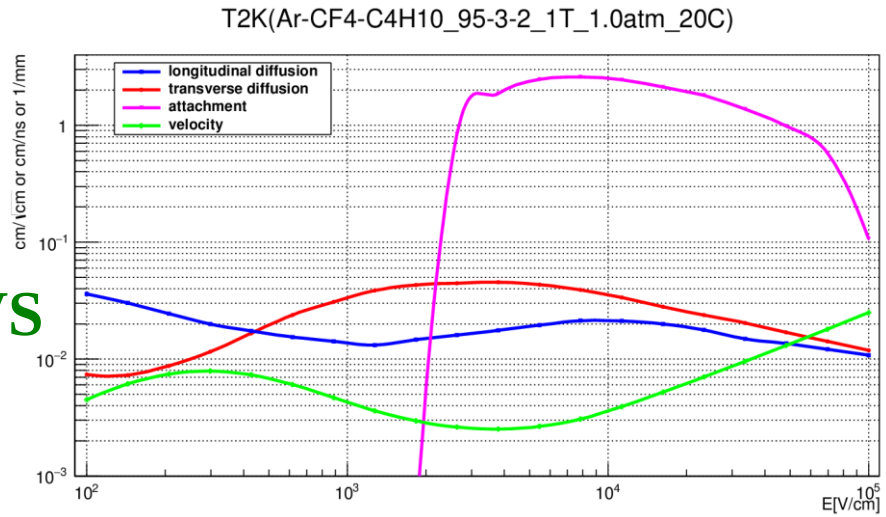
Some questions

- Preparation? Papers, software?
- About the housing. Dormitory? Or rent the house outside?

fGas(Ar-CF4-C2H6=92:7:1) VS T2K(Ar-CF4-iC4H10=95:3:2)工作特性参数



VS



Main Work — Laser calibration research

Using laser to calibrate the TPC ⇨ to reach ~100μm position resolution

- The shorter focal length L*
- the variation of temperature
- the variation of humidity
- mechanical tolerance
- etc.

⇨

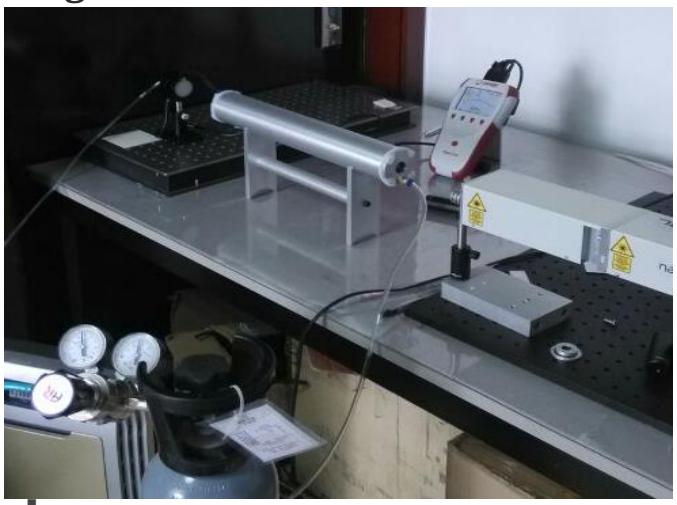
- Distortion of drift velocity and drift path
- Influence the diffusion coefficient
- Difference between reconstruction track and original track

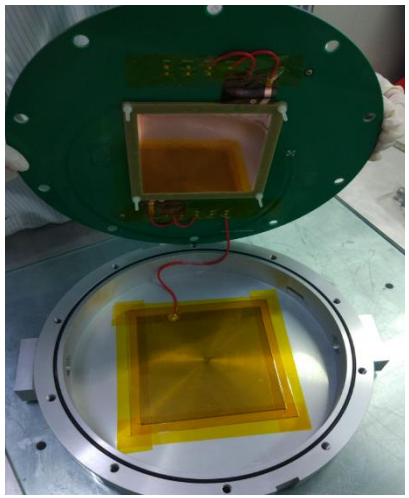
⇨

- Laser calibration is necessary for a high precision detector

Advantages

- Transportable and flexible
- Good resolution in space and time
- No curvature in magnetic fields
- Ionization density controllable and small fluctuation
- Simple beam reflection similar to light





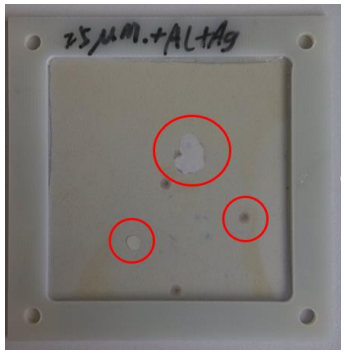
Laser test

Laser investigation, purchase, test

- Litron Nano-SG 150-10
- Wavelength: 266nm
- Energy：~15mJ
- Frequency：10Hz

Scientific Research — Laser calibration

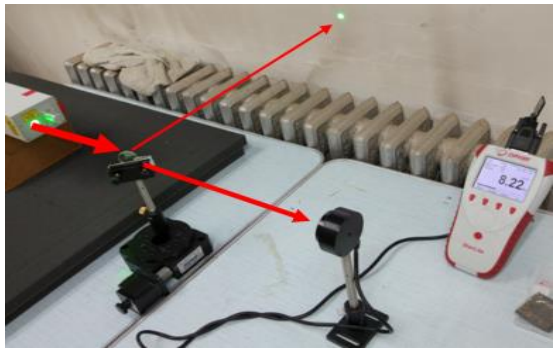
1、Laser performance test



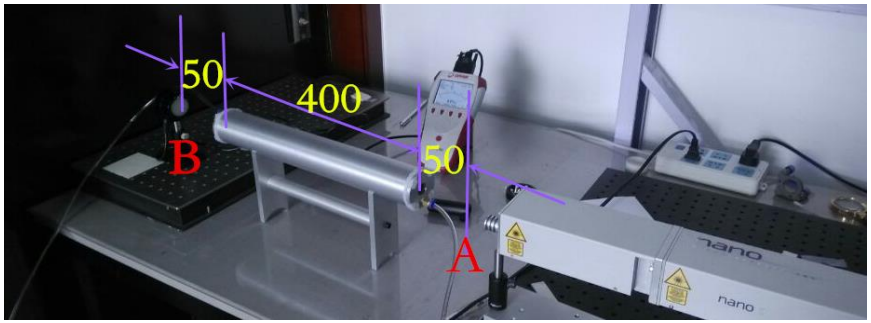
Mylar

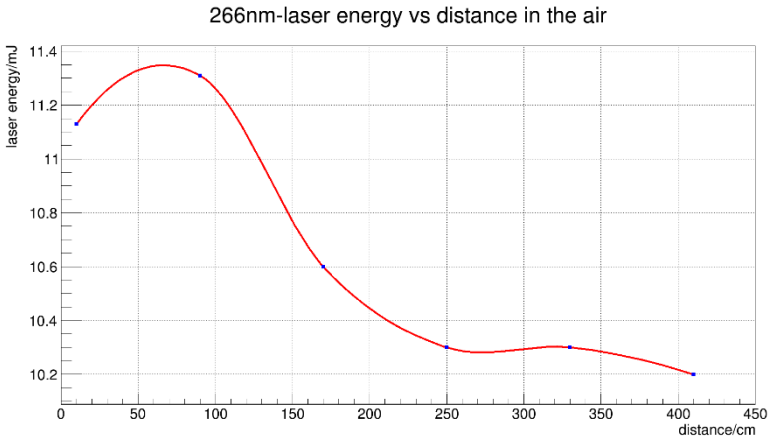
Fused quartz

Wave plate



- high reflection mirror, anti-reflection mirror, beam splitter mirror, etc.

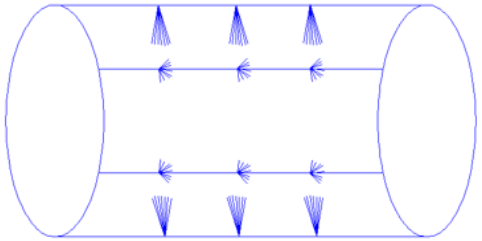


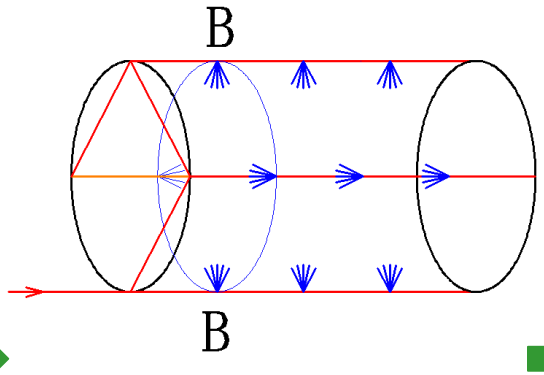


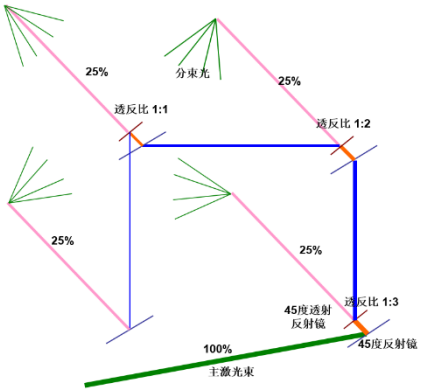
- Feasibility test of the laser transmission in argon
- The laser energy loss in argon
- laser dispersity

Scientific Research — Laser calibration

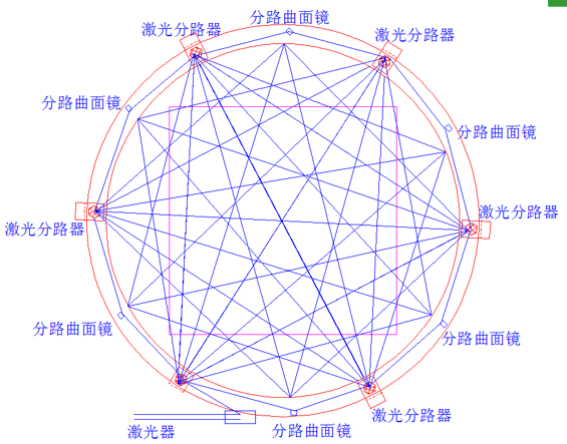
2、Laser optical path optimization



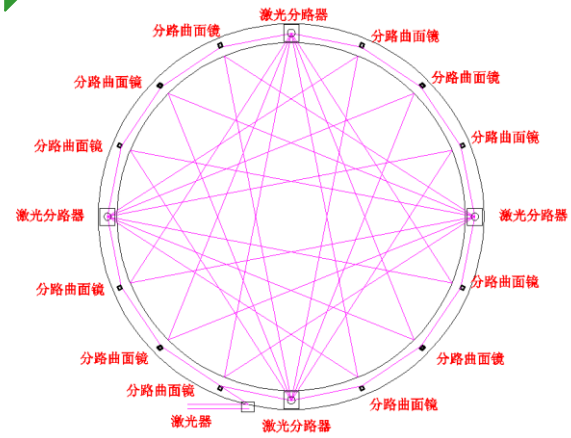




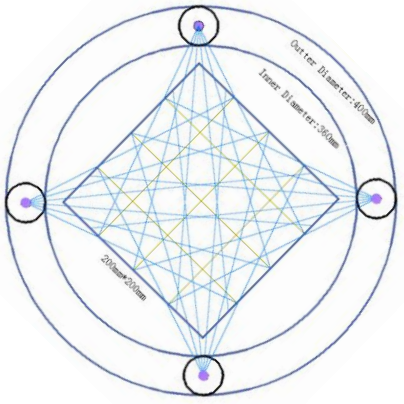
Details of the laser Map



6rod Laser Map



4rod Laser Map



Laser Map combine with readout pad

Laser map design refinement

Education

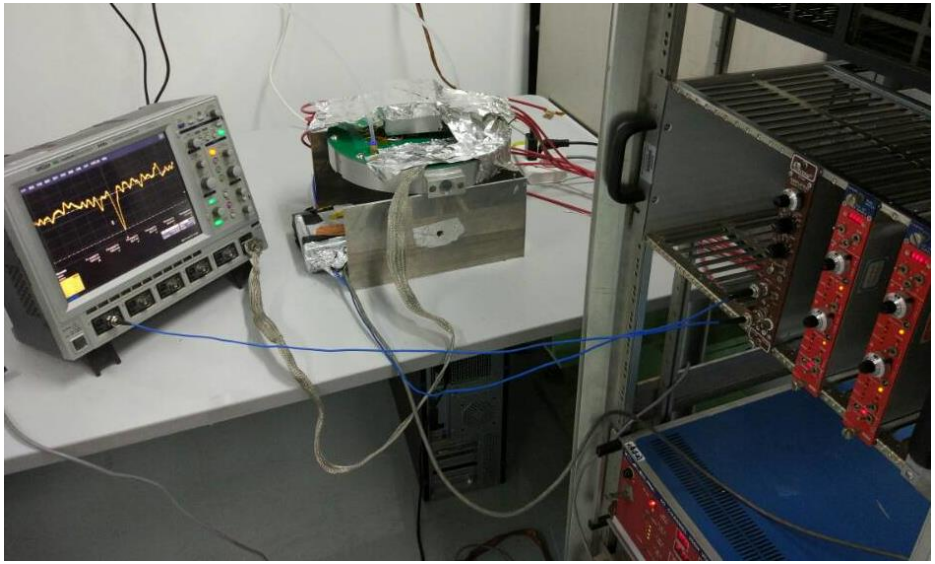
- **Nuclear Reactor Engineering, Bachelor of Engineering**
  University of South China, 2010 – 2014
  - National Scholarship
  - Academic scholarship

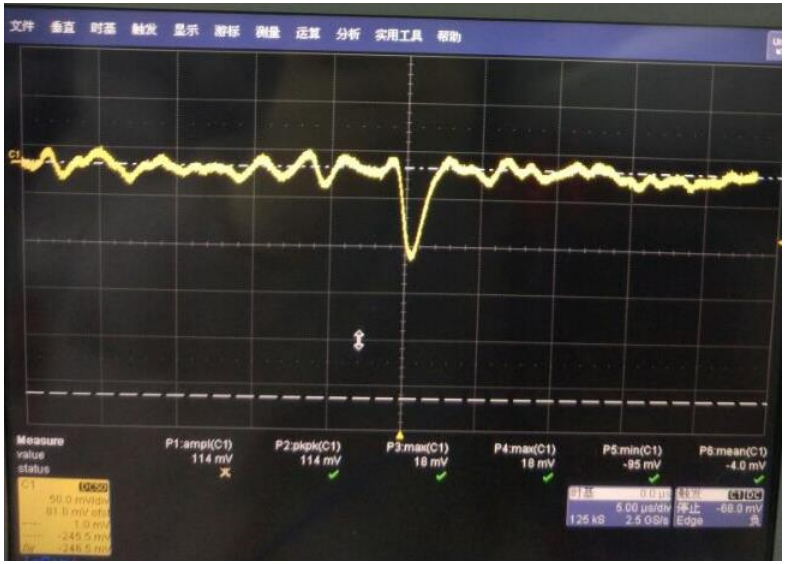
- **Particle Physics and Nuclear Physics, Master of Science**
  UCAS/IHEP,2014 – 2016
  - National Scholarship
  - Excellent service for students award,2015

- **Particle Physics and Nuclear Physics, Ph.D. Student**
  UCAS/IHEP,2016 – now

- **Master & Ph.D. Supervisor: Chen Yuanbo & Qi Huirong**

加高压信号情况（共3层膜，每层膜上压差340V）：





High Voltage：
Drift: -3570V
G1U: -1845V
G1D: -1505V
G2U: -1205V
G2D: -865V
G3U: -565V
G3D:-225V

Source：Fe-55
Pre-Amplifier：ORTEC 142AH
Main Amplifier：ORTEC 572A

- Amplitude：~110mV
- Main Amplifier Gain：10
- Shaping Time：0.5us

激光校正原理与优势：

backup

激光校正原理：

- 在特定的激光光路中，激光与工作气体中的杂质有机气体的发生双光子电离作用，产生可测量的大量原初电子，通过漂移、扩散、放大被端盖读出，重建特定径迹，校正和分析气体径迹探测器的漂移速度、动量分辨和影响等主要性能。

激光校正的优势：

- 测试激光光路易于建立和控制，性价比高
- 激光具有优良的单色性和传输分散性（**~urad**）
- 电离密度极小波动
- 通过简单的光路反射，可实现多灵敏区域及双径迹分辨测量

为何与杂质有机气体反应？

—气体探测器所用工作气体**ionization potential**较高（高于激光光子能量**Nd：YAG 4.68eV**）：

Ar：15.7eV，CO_2：14.4eV，CH_4：13.1eV，C_2H_6:11.6eV, Ne：21eV

激光不足以使**Ar、Ne、CO2**等气体发生电离。

— organic impurities电离电位：C_7H_8: 8.82eV，$C_{10}H_{14}$: 8.69eV，使得激光可与杂质有机气体发生双光子电离作用。

何为双光子电离？

—气体分子同时吸收两个激光光子（ Nd：YAG 4.68eV×2 = 9.36eV ）而而使外壳层电子脱离气体分子。

有机杂质电离能：**C_6H_6：9.24eV , C_7H_8：8.82eV , C_9H_{12}：8.69eV**