



Update progress on CEPC Gaseous Tracker

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On behalf of the gaseous tracker group



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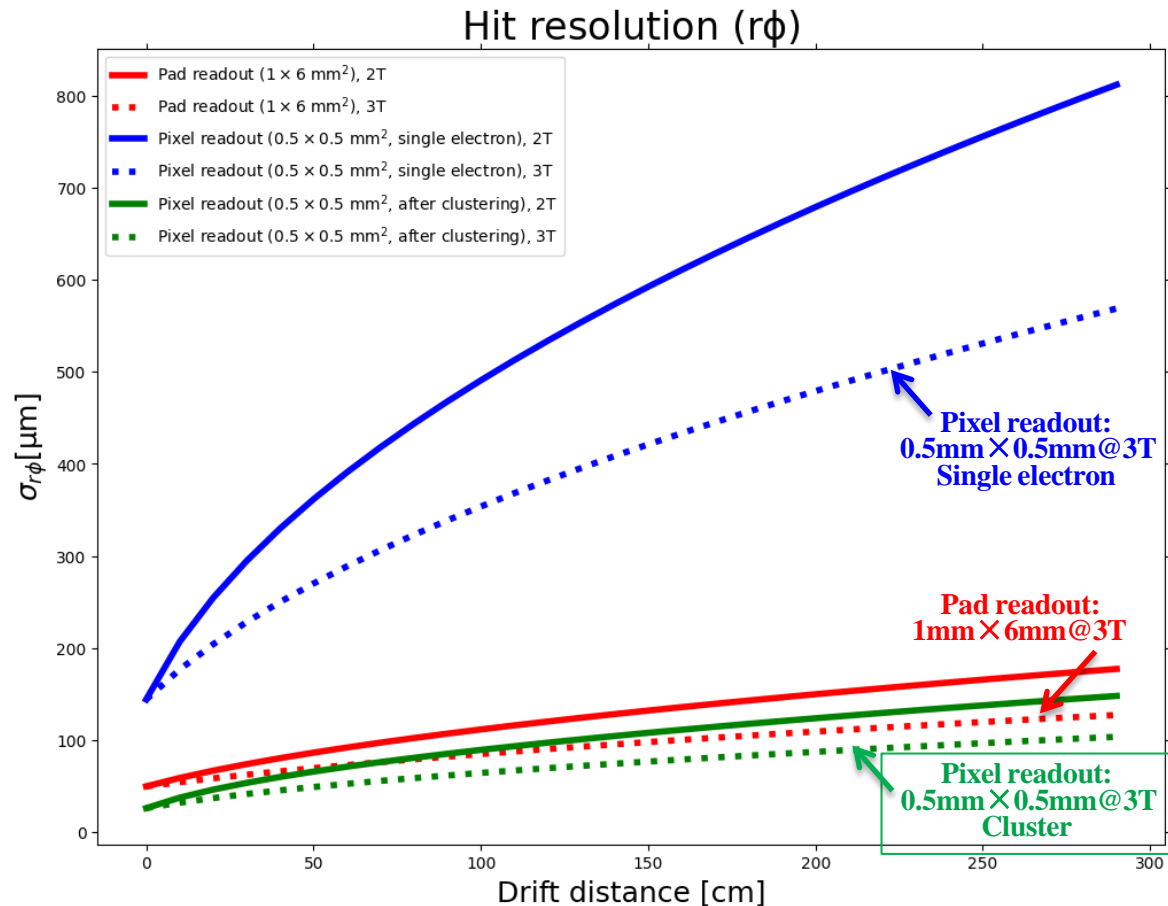
Content

- **TPC operating at low luminosity Z at 3T**
- **PID simulation**
- **International collaboration**
- **Work plan**

TPC operating at low luminosity Z at 3T

Estimation of the **spatial resolution using pixelated readout**.

- The granularity readout and the transverse diffusion are also taken into consideration..
- TPC can operate effectively at 3T B-field.
- Pixelated readout TPC can achieve superior spatial resolution at 3T compared to 2T.



Pad readout:

$$\sigma_{r\phi}^{\text{pad}} = \sqrt{(\sigma_{r\phi 0}^{\text{pad}})^2 + \sigma_{\phi 0}^2 \sin^2(\phi_{\text{track}}) + L \frac{D_{r\phi}^2}{N_{\text{eff}}} \sin(\theta_{\text{track}})}$$

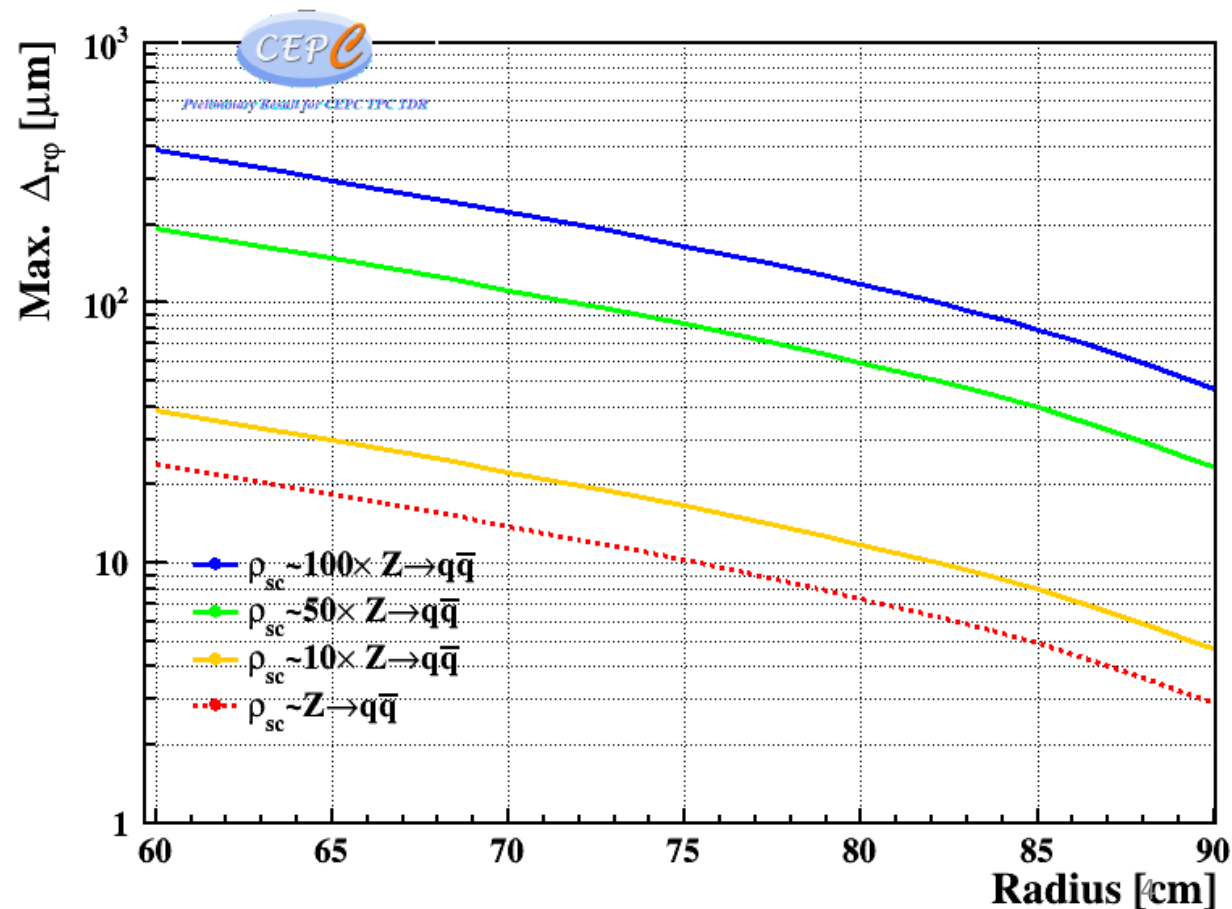
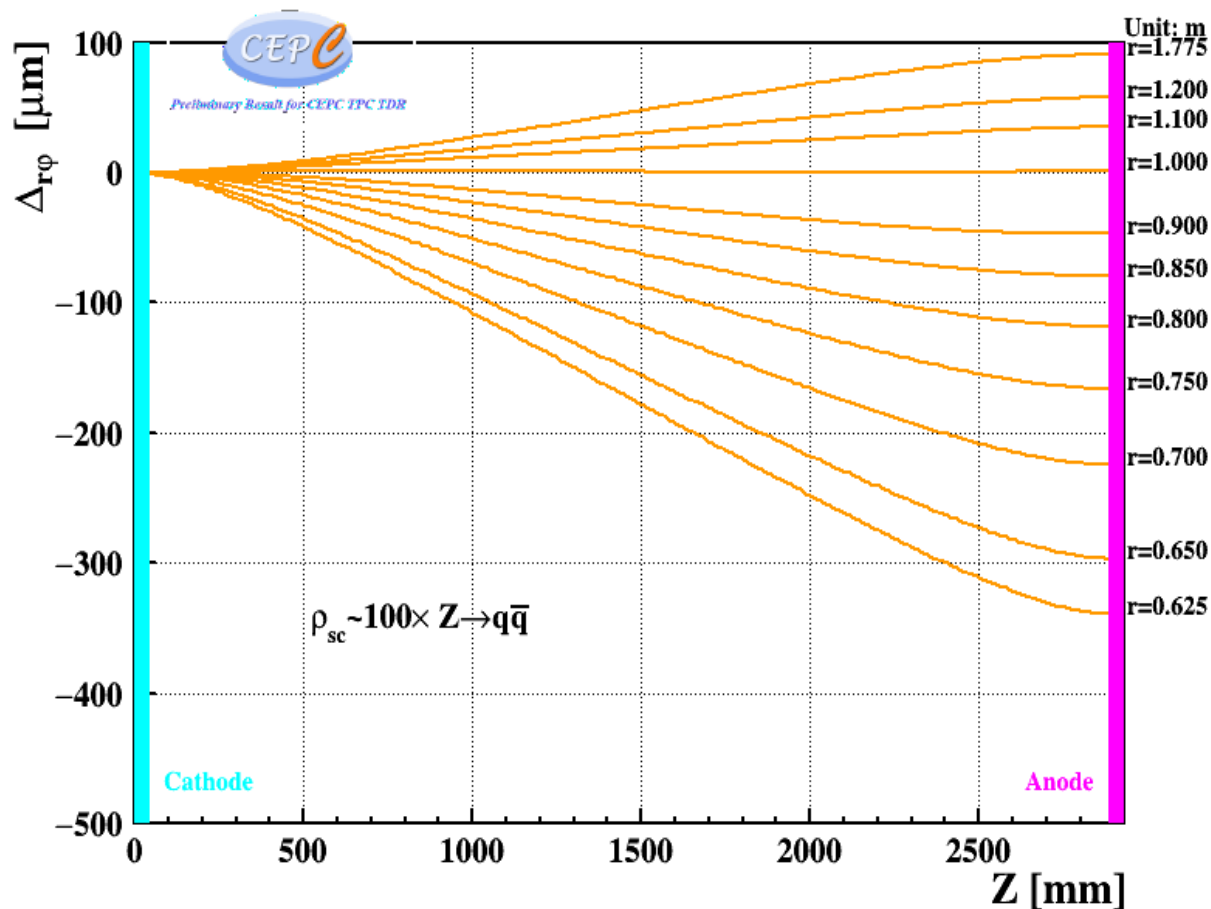
Pixel readout:

$$\sigma_{r\phi}^{\text{pixel}} = \sqrt{(\sigma_{r\phi 0}^{\text{pixel}})^2 + LD_{r\phi}^2}$$

TPC operating at low luminosity Z at 3T

Xin She, Haoyu Shi

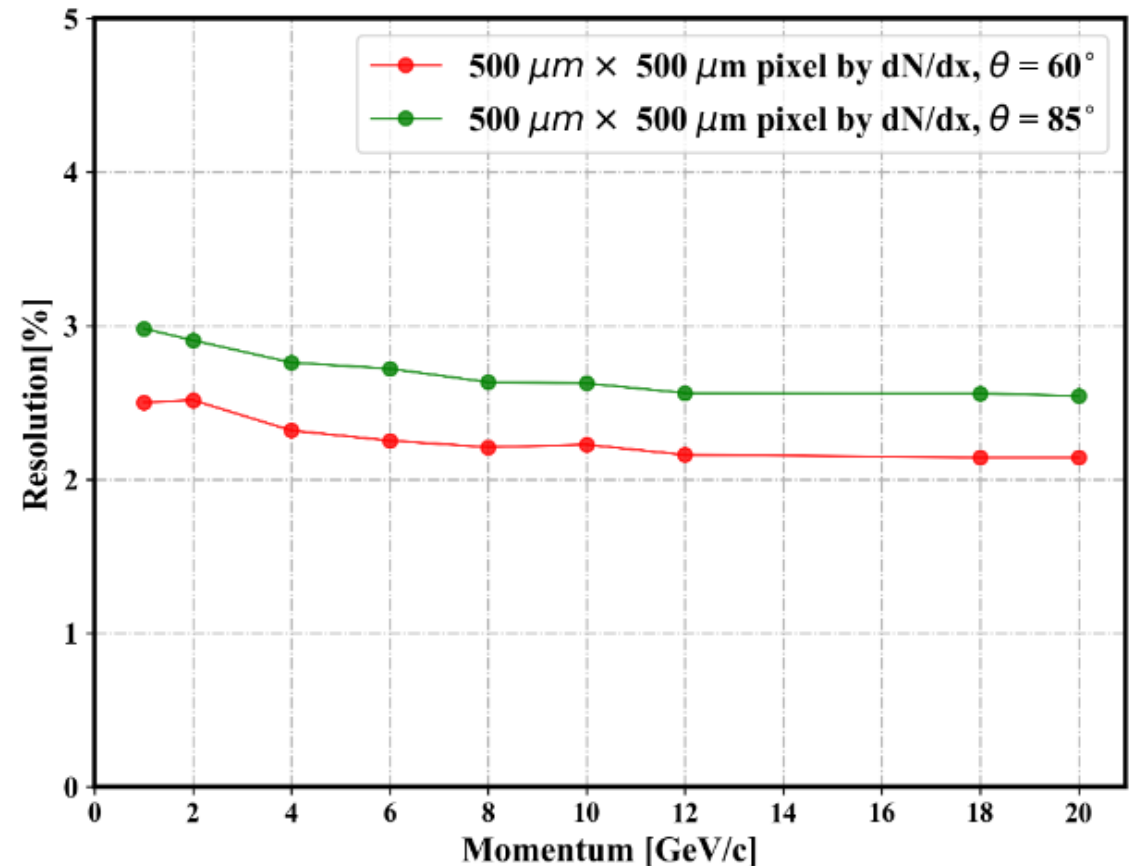
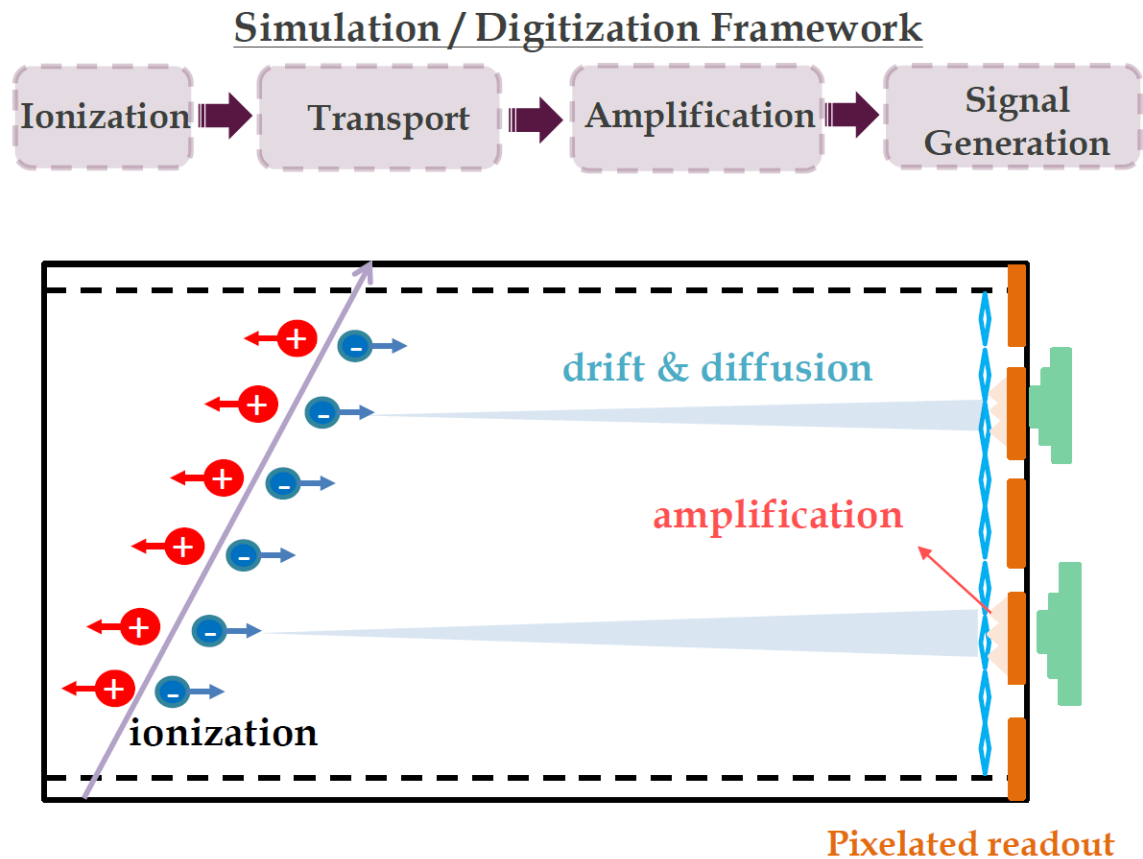
- Maximum distortion with e+e- to qq at Z pole (Physics events only)
- Maximum distortion under various bremsstrahlung backgrounds ($\times 10$, $\times 50$, $\times 100$ Physics Events)
 - The BK simulation data will be input at the low luminosity Z run at 3T **next week**.



PID simulation: dN/dx

Yue Chang, Guang Zhao

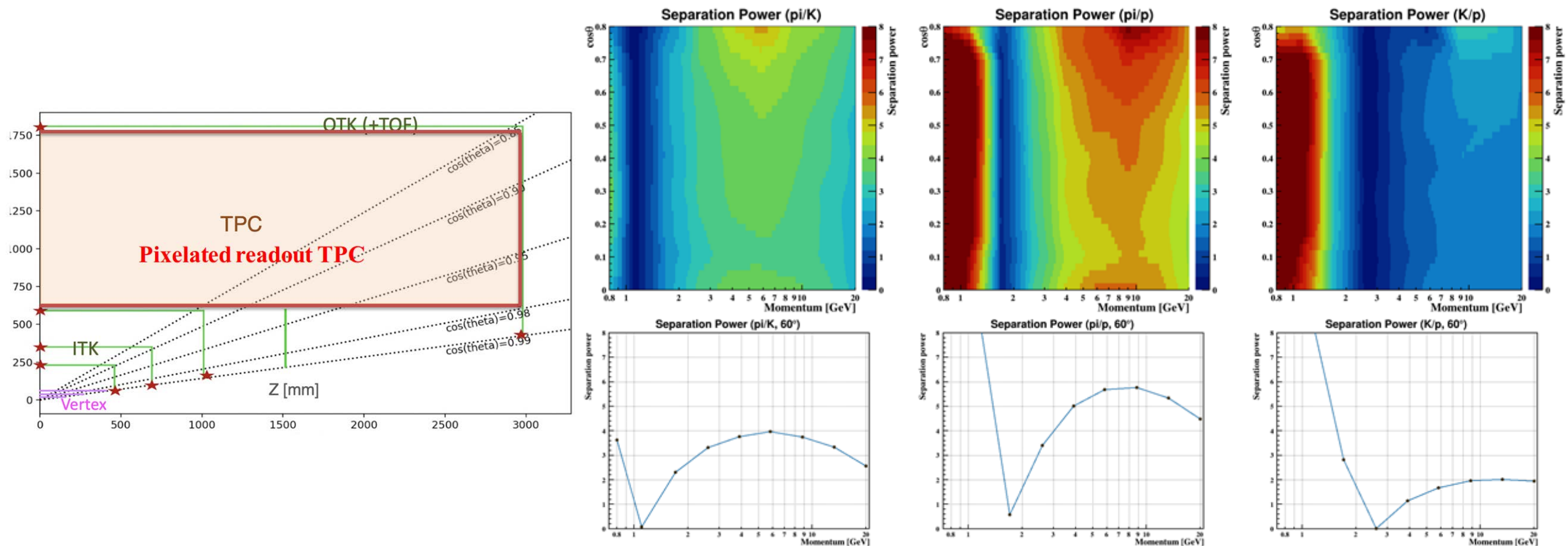
- Performance of the pixelated readout TPC
 - PID resolution using dN/dx at $\theta=60^\circ$ and $\theta=85^\circ$



PID simulation: Separation power

Jinxian Zhang, Guang Zhao

- Performance of the pixelated readout TPC
 - Simulation of π/K , π/p , and K/p separation power with varying momentum and $\cos\theta$



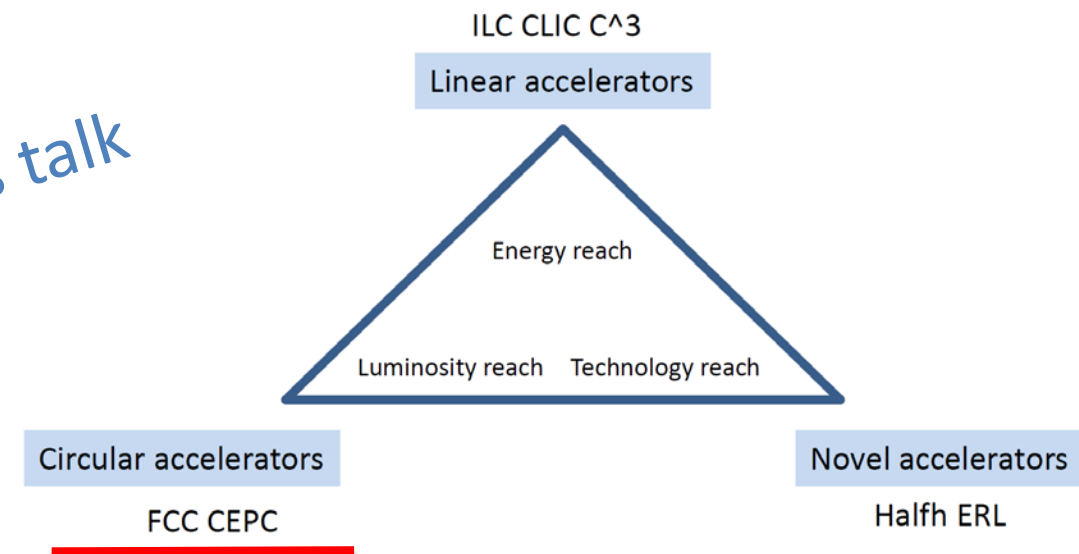
International collaboration

- ILD collaboration: Show that ILD is feasible at a circular collider
 - Huirong will give a CEPC TPC report at ILD meeting on behalf of LCTPC in November.
 - Paul, Maxim, Jochen agreed to join the Chapter of gaseous tracker.
 - Serguei and Paul also join the beam test at DESY.

What do we want to achieve

- Get an update on recent work on ILD
- Get an update in the inclusion of ILD into the circular collider community, FCC-ee in particular
- Status of the ILD group
- Our contribution to the global studies towards a H/EW factory
- Our contribution to the EPPSU effort 2025/ 2026

The environment/ Options



ILD meeting connected to ECFA 2024 <https://agenda.linearcollider.org/event/10442>

Work plan

- Chapter 6: Gaseous tracker
 - ~10 pages (in this week)
 - ~30 pages before 20, Nov.
 - ~50 pages in the end of this month

Chapter 6 Gaseous Trackers

6.1	Physics requirements and detection technology	
6.1.1	Physics requirements of Higgs and Tera-Z	
6.1.2	Technology choice and the baseline gaseous tracker	
6.2	Pixelated readout TPC detection	
6.2.1	TPC detector and readout electronics	
6.2.2	Mechanical and cooling design	
6.2.3	Challenges and critical R&D	
6.2.4	Detector modules toward the validation prototype	
6.3	Performance of TPC tracker	
6.3.1	Overall of the simulation framework	
6.3.2	Spatial resolution and PID performance	
6.3.3	Improvement using the machine learning algorithm	
6.4	Alternative option of Drift Chamber in Tera-Z	
6.4.1	PID for high luminosity Z pole at 2T	
6.4.2	Performance and critical R&D	
6.5	Cost estimation	8. . .

Many thanks!