

연세대 활동 및 계획 2021/2022

권 영일
(연세대학교)

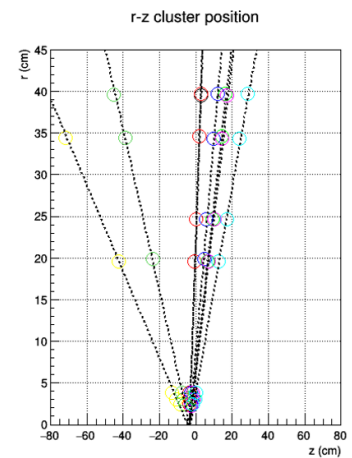
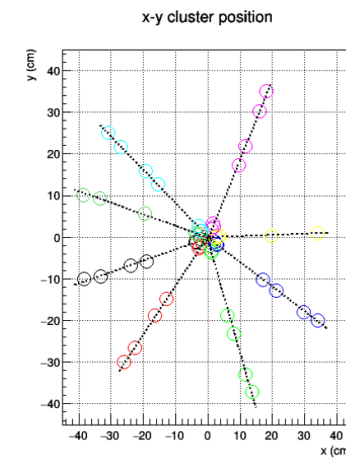
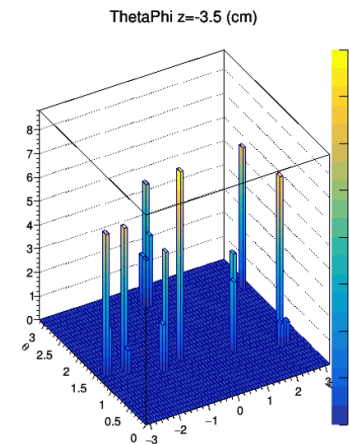
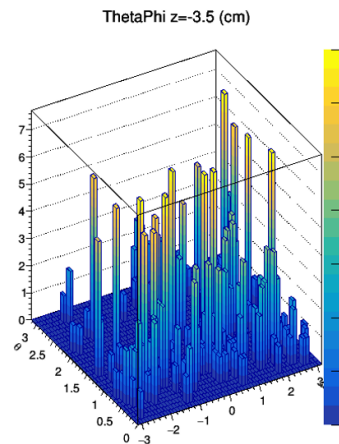
주요 결과 및 진행 상황

- 2 ph.D's 권 영일, 홍 건희
- 인력 양성
 - 석사 과정: 박 태용(석·박 통합), 김 윤석(석사 과정)
 - 박사 과정: 김 태준, 김 재현, 한 영훈, 서 기원(석·박 통합)
- 석사 졸업: 김 윤석(2022.02)

Pilot beam과 ITS2

- Oct. 27th-31st, 2021 (Stable beam for ITS2)
- Involvement in QC & preparation for the real alignment...
- Challenges!
- Matteo Concas?

Quick Track Finding



Run 505600 Orbit 417241153 BC 1782

새로운 Analysis 방식(김 태준)

2. Cumulants란 무엇인가?

$\rho_2(\phi_a, \phi_b)$ 에 내재된 상관 관계

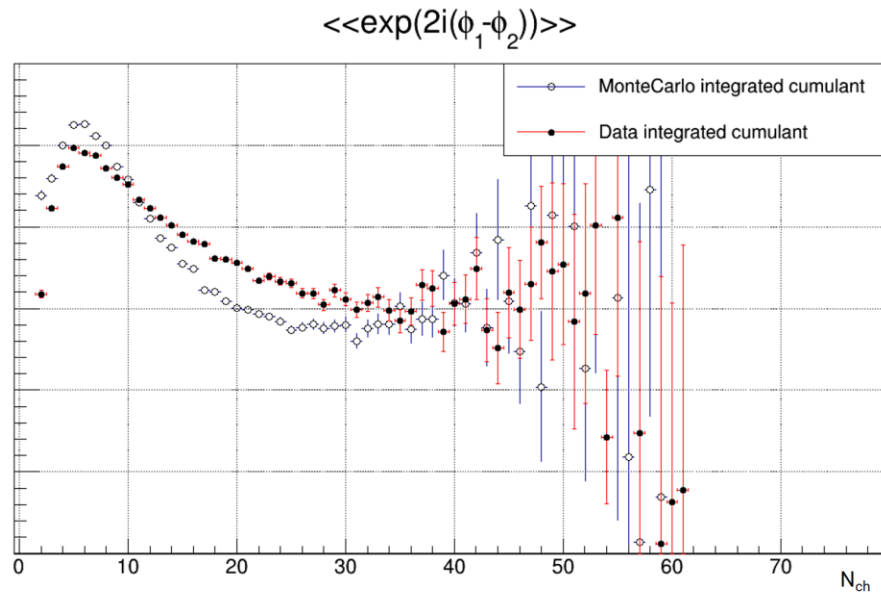
$$\bar{\rho}_2(\phi_a, \phi_b) \equiv \rho_2(\phi_a, \phi_b) - \bar{\rho}_1(\phi_a)\bar{\rho}_1(\phi_b)$$

$$\rho_2(\phi_a, \phi_b) = \bar{\rho}_2(\phi_a, \phi_b) + \bar{\rho}_1(\phi_a)\bar{\rho}_1(\phi_b)$$

$\bar{\rho}_2(\phi_a, \phi_b)$: 두 개의 입자가 갖는 본질적인 상관(intrinsic correlation)

$$\begin{aligned} \langle\langle e^{in(\phi_j - \phi_k)} \rangle\rangle &= \int_0^{2\pi} \int_0^{2\pi} e^{in(\phi_j - \phi_k)} \{ \rho_2(\phi_j, \phi_k) - \bar{\rho}_1(\phi_j)\bar{\rho}_1(\phi_k) \} d\phi_j d\phi_k \\ &= \int_0^{2\pi} \int_0^{2\pi} e^{in(\phi_j - \phi_k)} \rho_2(\phi_j, \phi_k) d\phi_j d\phi_k - \left[\int_0^{2\pi} e^{in\phi_j} \bar{\rho}_1(\phi_j) d\phi_j \right] \left[\int_0^{2\pi} e^{-in\phi_k} \bar{\rho}_1(\phi_k) d\phi_k \right] \\ &= \langle e^{in(\phi_j - \phi_k)} \rangle - \langle e^{in\phi_j} \rangle \langle e^{-in\phi_k} \rangle \end{aligned}$$

새로운 Analysis 방식(김 태준)



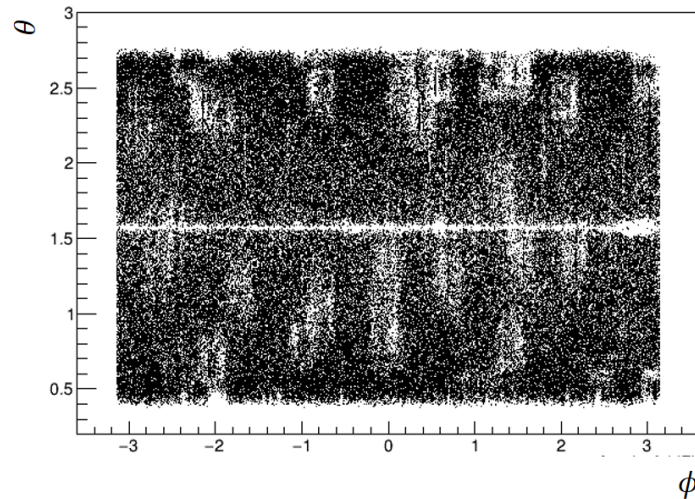
- How do we decouple efficiency?
- Cumulants for selected particles
 - p_T ?
 - Proton?
 - Deuteron?
 - Electron & p_T ?

Alignment의 끝을 향하여(김 재현)

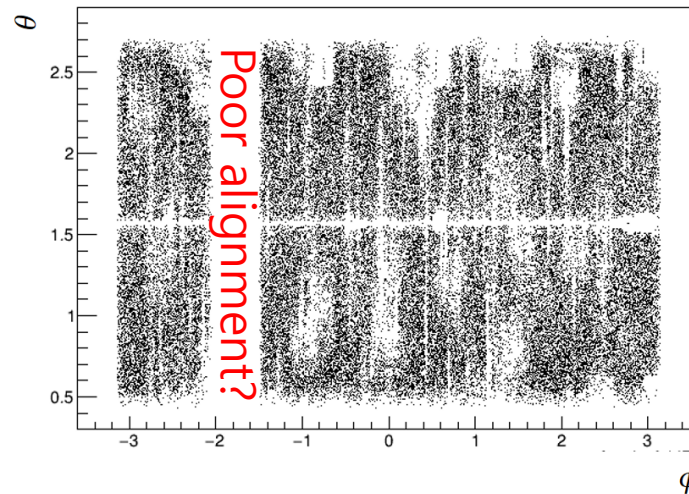
Self-sufficient track finding (no bias in the azimuthal angle ϕ)

Crude Tracking based on collision location assumption

$\theta_{fit} - \phi_{fit}$ distribution



$\theta_{fit} - \phi_{fit}$ distribution
with fit residual-based cut



RUN 505673 / 0640, 0650, 0720, 0730 , 16000 files

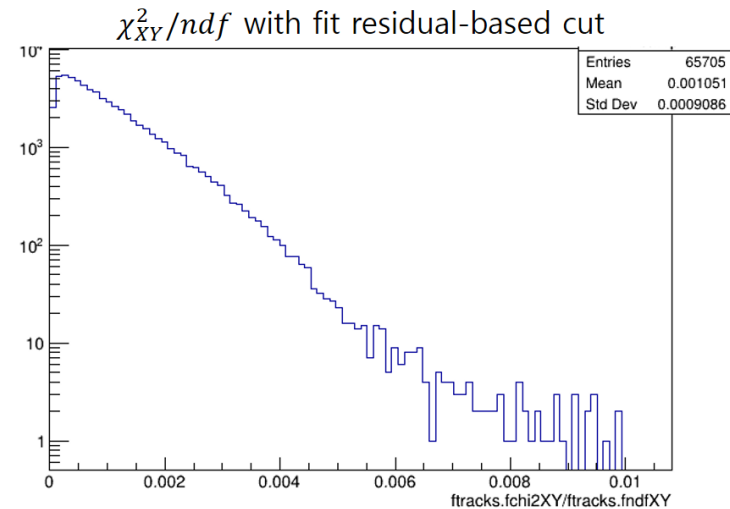
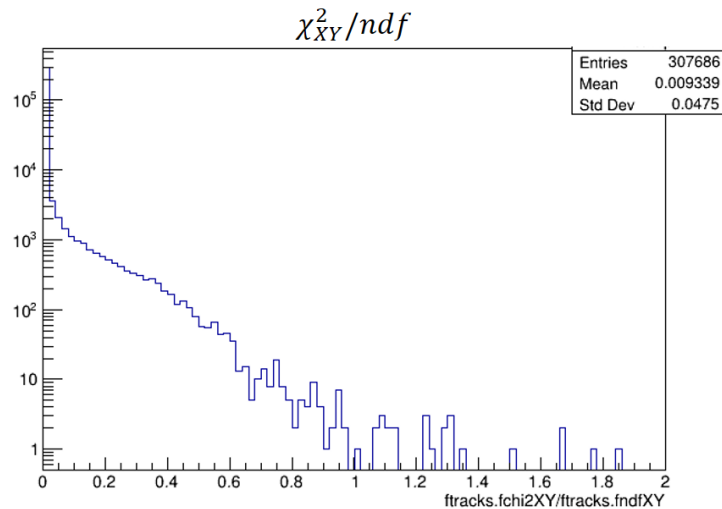
Alignment의 끝을 향하여(김 재현)

Estimated mean deviation suggests baseline alignment is ~ a few 100's μm



Crude Tracking

based on collision location assumption

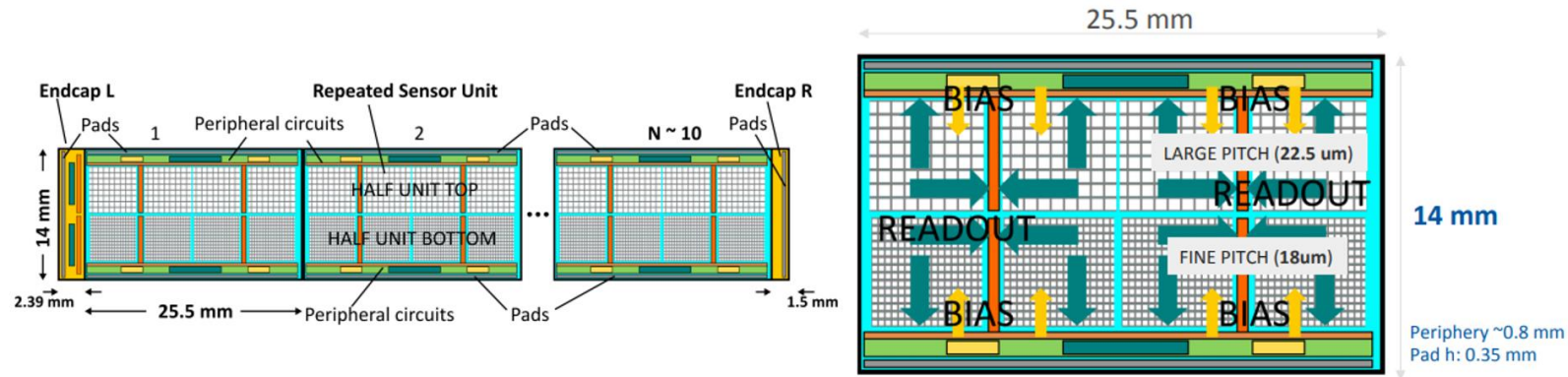


RUN 505673 / 0640, 0650, 0720, 0730 , 16000 files

ITS3 & 한국의 아이디어 (홍 건희, 한 영훈, 서 기원)

We are making contributions towards the ITS3 in design!

MOSS Monolithic Stitched Sensor Prototype

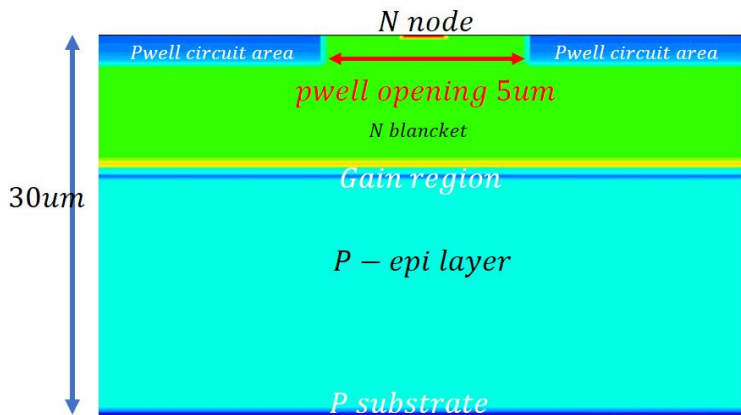


- Implement a large sensor abutting identical but functionally independent sub-units
 - Repeated Sensor Unit, Endcap Left, Endcap Right
 - Stitching used to connect metal traces for **power distribution** and **long range on-chip interconnect busses for control and data readout**

ITS3 & 한국의 아이디어 (홍 건희, 한 영훈, 서 기원)

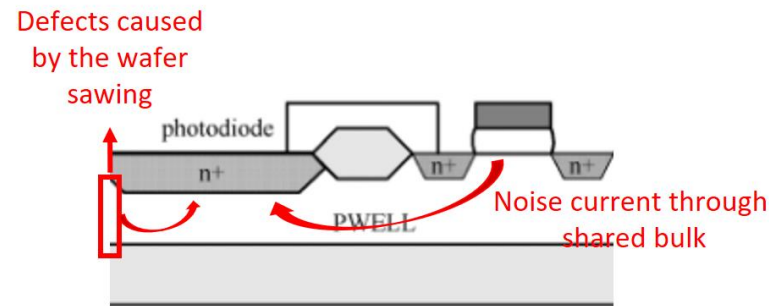
Very challenging, but we will explore a path based on our idea!

APD into the pixel



Younghoon Han

Junction Termination Edge



Kiwon seo

Ultimate resolution
($\sim 10 \mu\text{m}$, $\sim 10 \text{ps}$)

Thin sensor ($\sim 50 \mu\text{m}$ -thick)

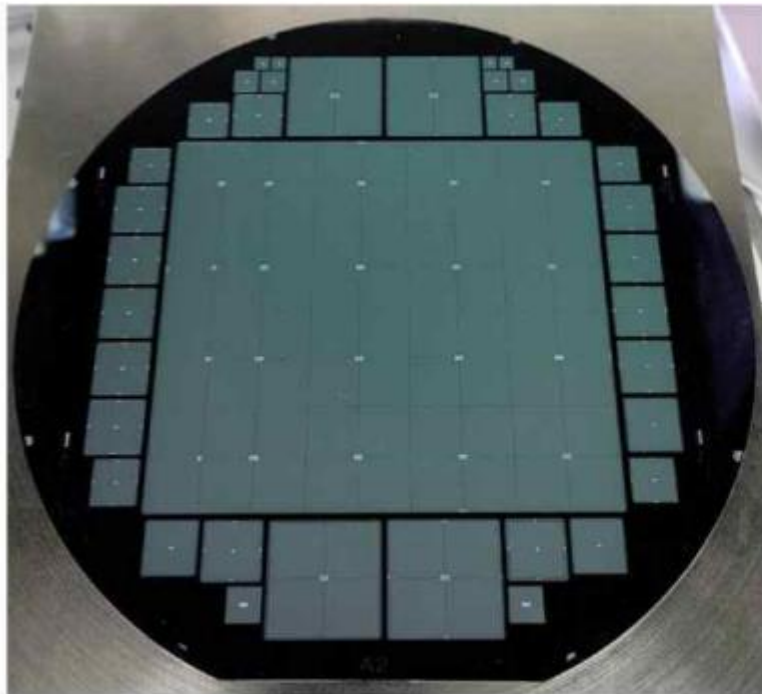
Low operation voltage
(30 V)

Digital readout (fast & easy
Operation, $\sim 100 \text{MHz}$)

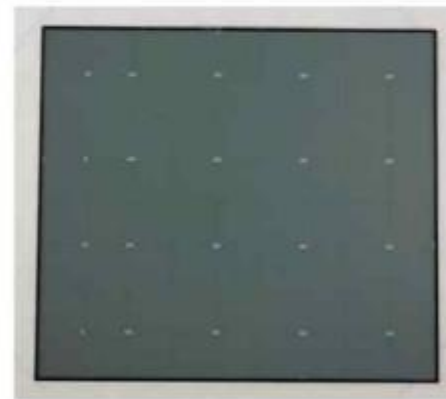
Mass production technology
in which Korea excels (low cost)

FoCal-E & FoCal electronics (박 태용, 한 영훈, 김 윤석)

김 용균(한양대) 교수와 같이 진행함! 김 범규(성균관대) 교수의 참여 예정



N type wafer (A)



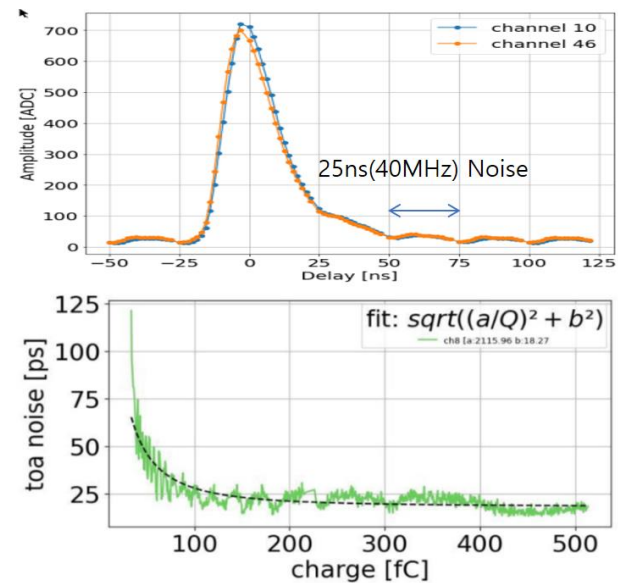
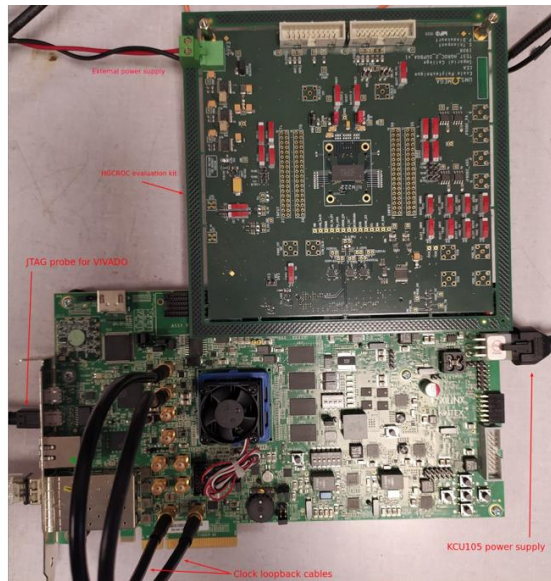
Main pattern (8 x 9)

성공적인 센서 제작!
Leakage current $\sim 20 \text{ nA/cm}^2$
Radiation tolerant

FoCal-E & FoCal electronics (박 태용, 한 영훈, 김 윤석)

김 용균(한양대) 교수, 김 범규(성균관대) 교수와 개별 연구비를 신청함

HGCROC testboard



계획 2022, ko-ALICE와의 조화

- 김 태준 학생의 학위 연구 종료
- 김 재현 학생의 MLP를 활용한 Alignment 실현

계획 2022, ko-ALICE와의 조화

- 하드웨어 연구 개발과 ko-ALICE의 조화
 - 동질적인 면
 - ALICE라는 학문적 목적의 범주에서 진행
 - 학생을 훈련할 기회
 - 이질적인 면
 - 한국의 아이디어 (성사시 회로 설계 전문가의 대거 참여 바람직)
 - FoCal electronics (외부 인력의 관심... 열린 연구 지향)