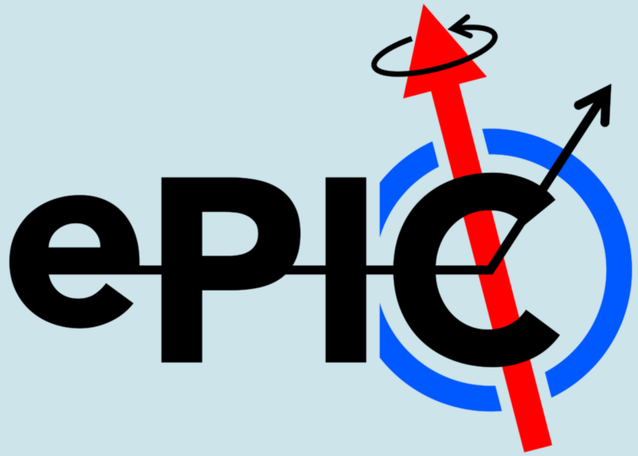


AC-LGAD TOF Status

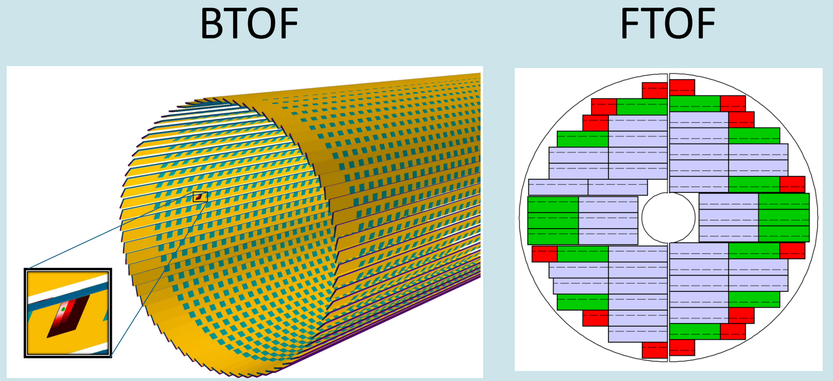
Satoshi Yano (Hiroshima University)

TIC meeting

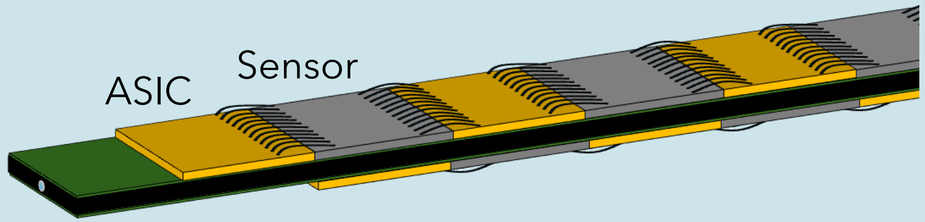
10/21/2024

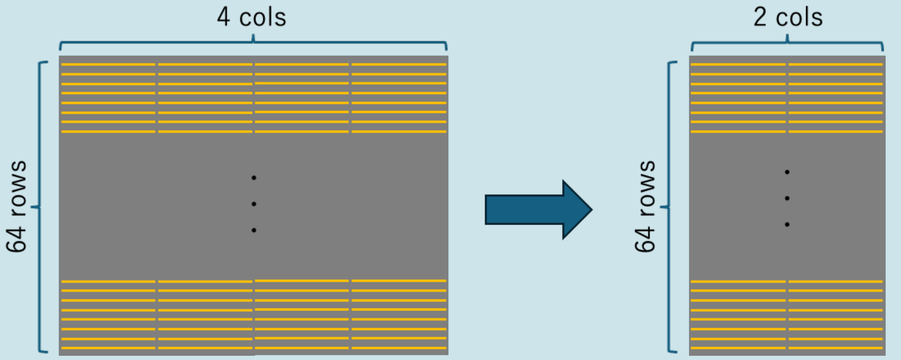
Recap of recent TOF design

- AC-LGAD TOF (BTOF and FTOF) is the PID detector covering low-*p* region
  - BTOF is composed of 144 tilted staves to form a cylindrical shape
  - FTOF is composed of modules with multiple lengths of rectangle shape to make the double-face disk



- The baseline of BTOF design has been changed
  - Stave design
    - Previous: Single side has sensors and ASICs
    - New: Double sides have sensors and ASICs
      - No acceptance gap between sensors and no direct contact between ASIC and sensor
  - Sensor
    - Previous: 3.2x4 cm^2 with 64x4=256 strip-type electrodes
    - New: 3.2x2 cm^2 with 64x2=128 strip-type electrodes

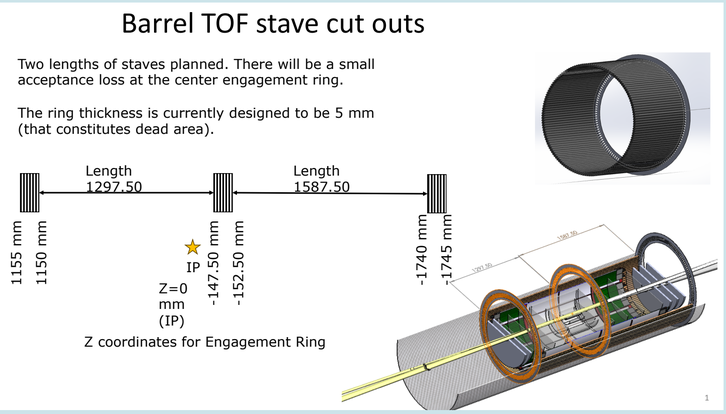




Issue induced by engagement ring

- An asymmetric global support structure (engagement ring) is planned to use
  - 130cm (electron-goin side) + 160cm (hadron-goin side) from the center ring

- Originally BTOF was to use the symmetric half-stave (135cm)
  - Each half-stave has 64 sensors + ASICs (32 sensors + ASICs are attached to each side)



Andy's slide

- Designs using two staves of different lengths are now the default
  - **It is very challenging to make a 160 cm long FPC with a low material budget (a few % X/X0)**
  - Various ideas are being considered, but the material budget is likely to be large
- The asymmetric design raises the new options,

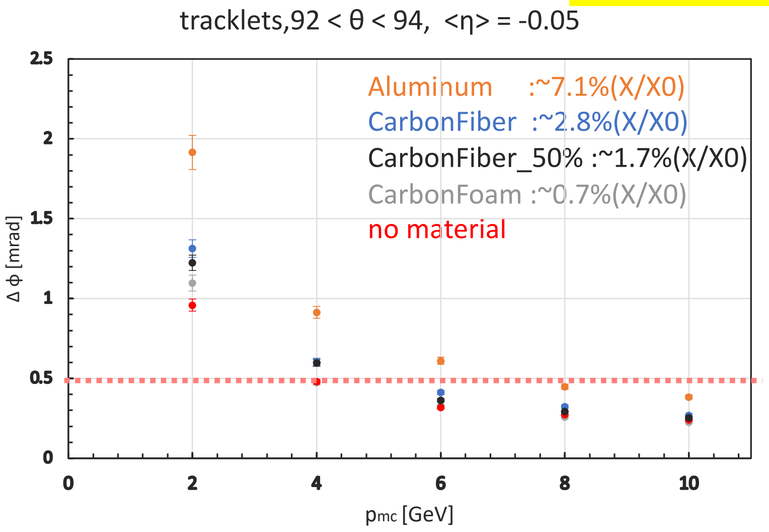
1.: Each half-stave has 64 sensors + ASICs as before, but the longer side has a space at the edge of the stave (~30cm)
  - Pros: No significant design modification is necessary
  - Cons: Acceptance hole at the edge ($-1.33<\eta<$**1.54**)

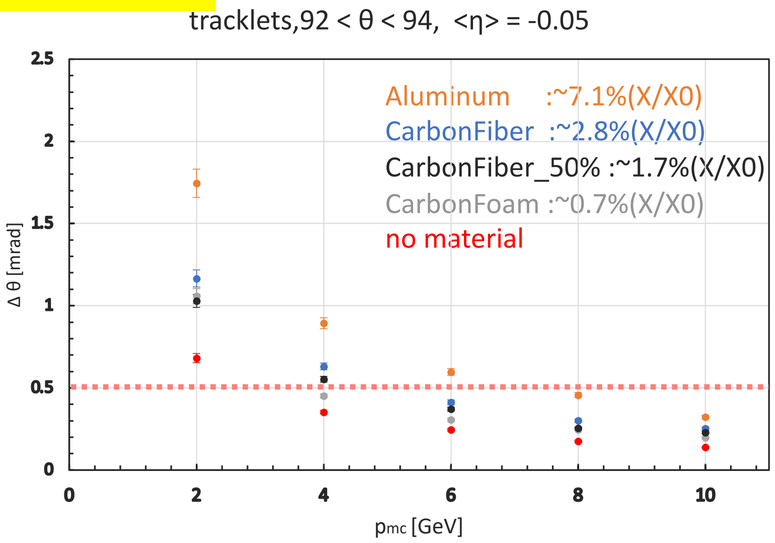
2.: The shorter half-stave side has 64+α (~15) sensors + ASICs and the longer half-stave side has 64+α (~15) sensors + ASICs
  - Pros: Large acceptance ($-1.33<\eta<$**1.71**)
  - **Cons: The cost increases (+13% for sensor) and some points must be redesigned especially the readout electronic.**

Impact on angular resolution from BTOF material

- Evaluation of the effect on angular resolution on the hpDIRC surface is ongoing (by Shunichiro Muraoka, Hiroshima Univ.)
  - Single pion is injected into the full detector simulation
  - Tracklets of oMPGD and BTOF hits are used (there are still room to improve the resolution)
  - BTOF with the single-side version is used (the double-side version will be available very soon)
- The angular resolution on the hpDIRC is evaluated by varying BTOF material (**WORK-IN-PROGRESS**)
  - Several stave support structure materials are tested, no material, carbon foam, carbon fiber, or Aluminium (baseline is carbon foam)
  - The final results will be available in a month

WORK-IN-PROGRESS





- The hpDIRC requested baseline is 0.5 mrad @ 6 GeV
- Angular resolution meets the requirement even when using carbon fiber (~3% X/X0).
- The other method to estimate the track angle on the hpDIRC will be able to improve the resolution
- The information will be used to optimize BTOF design while meeting hpDIRC requirements

- **Effects on the electron identification capability by Barrel EMCal are also ongoing**

The other items

- The power supply, readout cables, and cooling pipe will be put at both sides of the stave edge