Station-0 optimization

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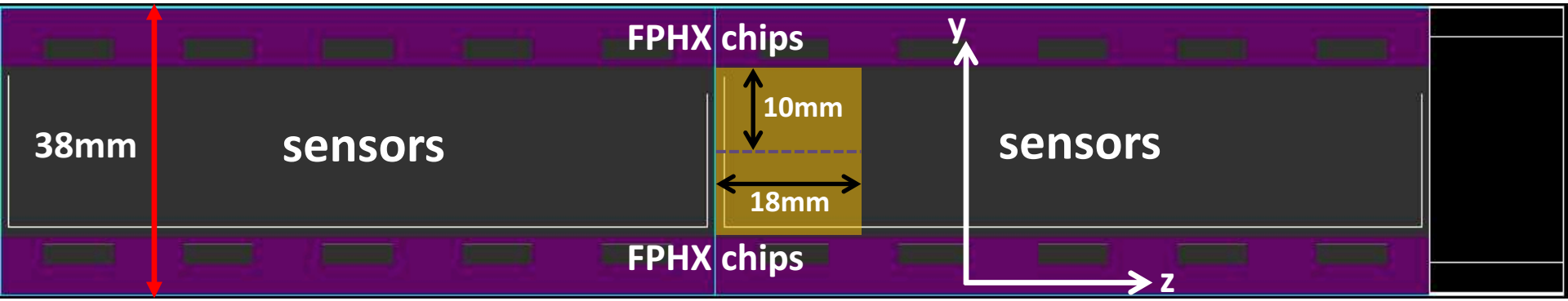
Why we're revisiting L0 ladder design?

- Smaller material budget = less INTT ladders were required with the current INTT layer layout.
  - ✓ Implemented in the current master G4 simulation
  - ✓ But not need to care about the material budget now
- The first choice of INTT layer configuration = L0 (z-sensitive) + L1,2,3 (phi-sensitive)
  - ✓ Using all available ports of ROC for L0 (48ports) → smaller sensor size
  - ✓ Less rotation angle for a ladder with single sensor cell (= half-size ladder)

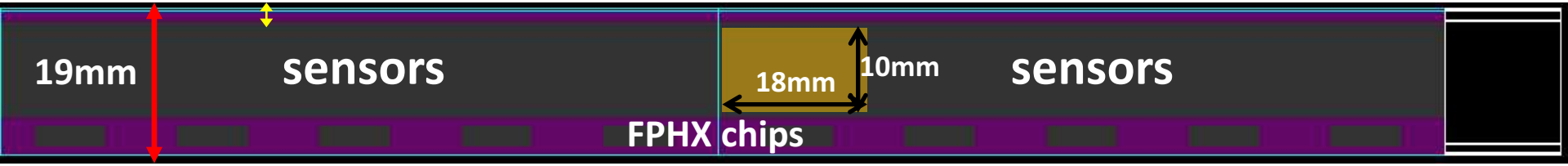
Half-size ladder

Default design (both-side sensor readout)



- Sensor area (y-length) = active: 10mm(128x78μm) x 2 + inactive: 1.305mm x 2 = 22.6mm
- Gap between sensor and FPHX chip = 1mm
- FPHX chip = 2.7mm
- Margin from FPHX chip (each side) = 4mm

Half size

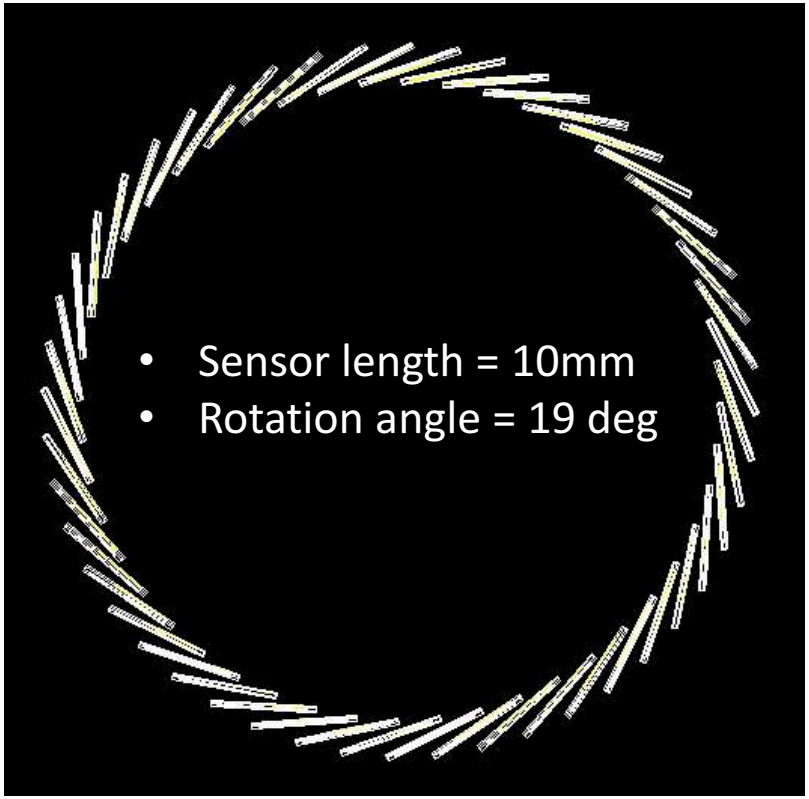


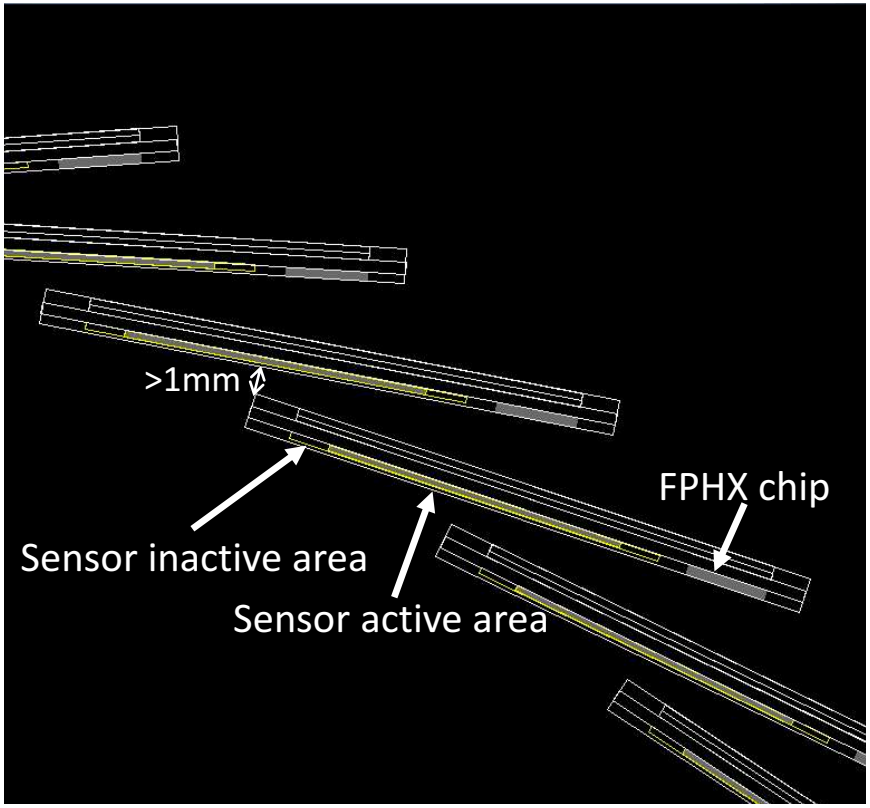
- Sensor area (y-length) = active: 10mm + inactive: 1.305mm x 2 = 12.6mm
  - Active area can be smaller, but larger than 8mm at least.
- Gap between sensor and HDI edge = 1.5mm

Layout with half-size ladders

Criteria for half-size ladder layout

- # of ladders = 48 (all ROC ports)
  - Minimum sensor length = 8mm comes from the ladder number requirement, but sensor should be larger than 8mm to have overlapping between neighboring ladders.
- Gap between neighboring ladders > 1mm

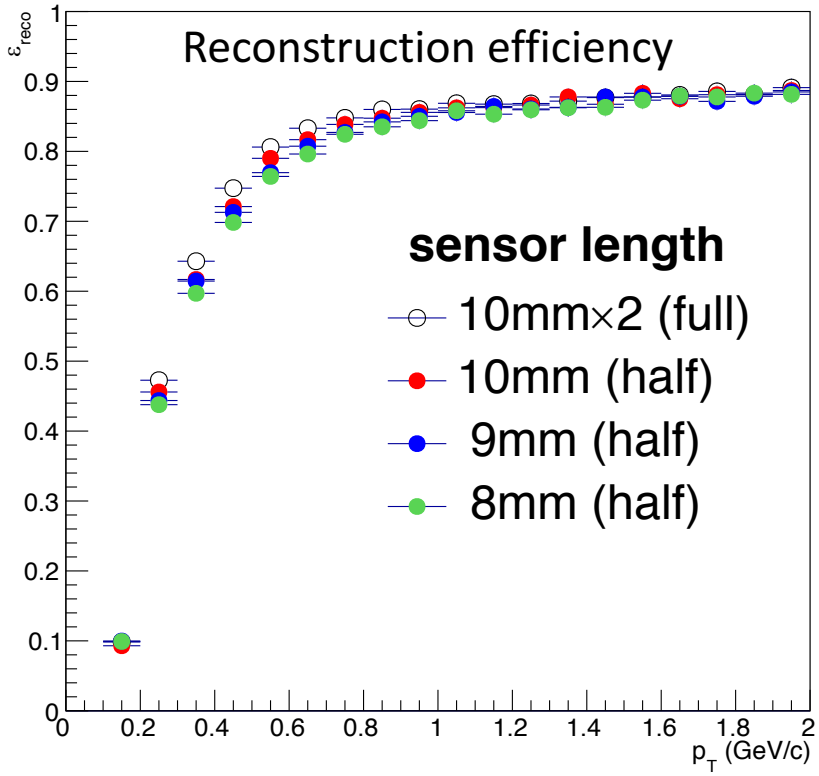




Reconstruction efficiency

Reconstruction efficiency = reconstructed tracks associated with Station-0 hit/input tracks

- 100k event: $10e^-$ & $10e^+$ in phi<2π & |eta|<0.5
  - ✓ Flat pT for 0.1-20GeV/c & zvtx = 0
- Station-0 is NOT z-sensitive because the current tracking algorithm doesn't work with z-sensitive layer.
- Slightly worse efficiency with smaller sensor length
- Possibly 10% reduction of sensor length (10mm→9mm) at most



- ○ 10mmx2 case: Current default setup with 2 sensor cells. Note that the closest gap between the neighboring ladders is about 0.5mm. # of ladders = 20 (equivalent to 40 ladders with single cell case.) Rotation angle = 14deg
- ● 10mm single cell: # of ladders = 48, Rotation angle = 19deg
- ● 9mm single cell: # of ladders = 48, Rotation angle = 17.5deg
- ● 8mm single cell: # of ladders = 48, Rotation angle = 17deg