What is the consequence of running with radiation damage

- Expected drop in efficiency for 3×10^{12} Neq/cm^2: 5% efficiency reduction

Two track scaling

$$\text{Nevnts} = \frac{1}{\left(\frac{S}{\sqrt{S+B}}\right)^2 \cdot \left(\frac{\sigma_s}{s}\right)^2} = \frac{1}{\left(\frac{S_e \cdot \varepsilon^2}{\sqrt{S_e \cdot \varepsilon^2 + B_e \cdot \varepsilon^2}}\right)^2 \cdot \left(\frac{\sigma_s}{s}\right)^2} = \frac{\varepsilon^{-2}}{\left[\left(\frac{S_e}{\sqrt{S_e+B_e}}\right)^2 \cdot \left(\frac{\sigma_s}{s}\right)^2\right]}$$

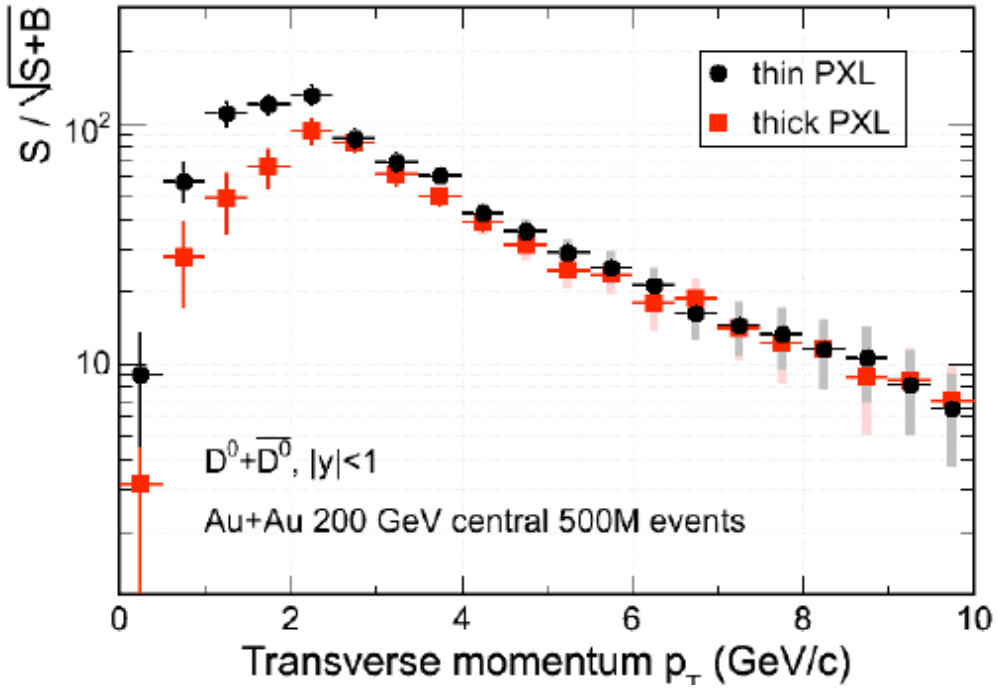
$$\text{Nevents} = \frac{\text{Nstart}}{\varepsilon^2} = \left(\frac{1}{.95}\right)^2 \qquad \text{10 \% increase}$$

For 3 track reconstruction, like Λ_c

scale as $\frac{1}{\varepsilon^3}$ so 17% increase in events required

square for correlations

Effect of detector thickness change



thick/thin .62/.32

factor of ~2 in significance or factor of 3-4 in events required

factor increase for copper vs aluminum (.52/.37) 1.5-2.5

Effect of no IST

- Loose redundancy
- Loose fast readout
  - With TOF and IST can do tracking to reduce pileup especially in 500 pp

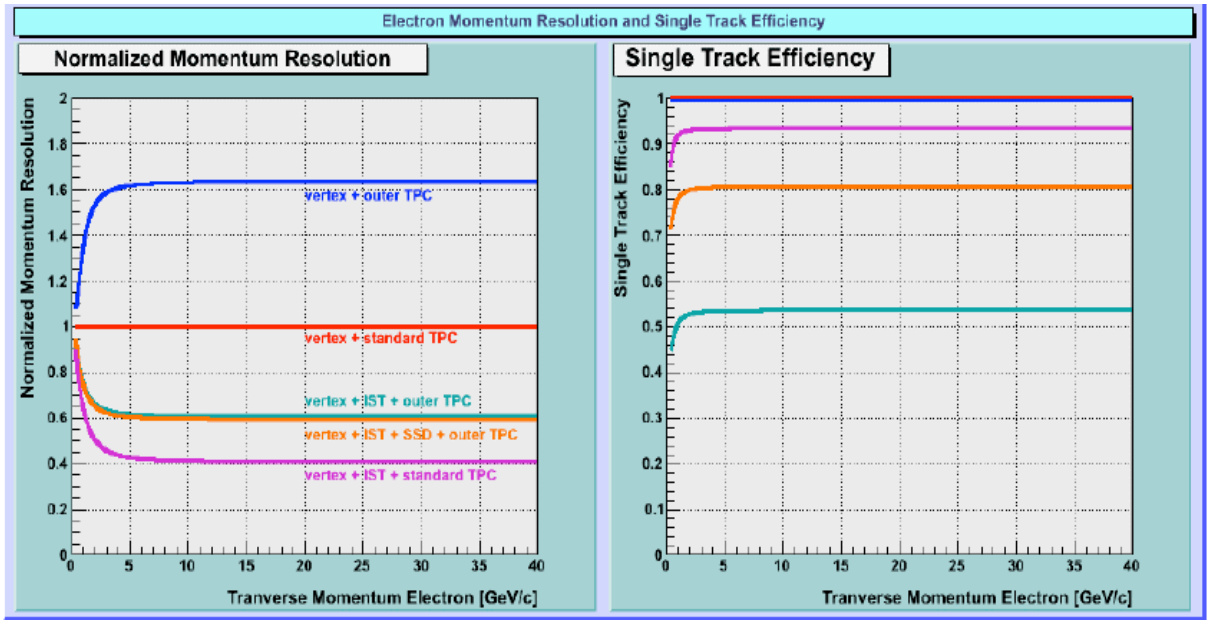
Previous committee emphasized importance of these two points

Number of additional events required for D of average pt (1.0 GeV/c) 60%

100% more events required for Λ_c (3 body decays)

Impact of IST/SSD - pp program

- pp - W program



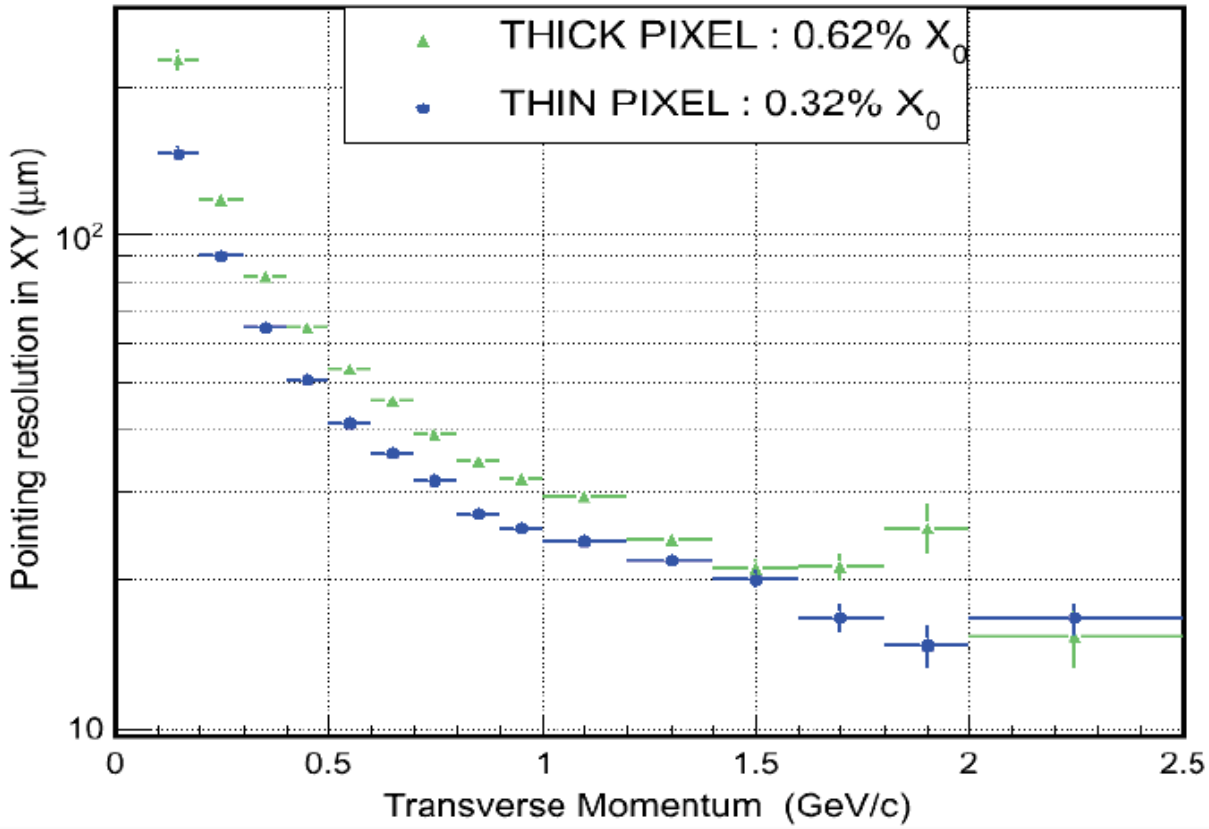
Normalized to Vertex + standard TPC

- Evaluated impact of IST/SSD improvement over Vertex and outer TPC only due to potential TPC performance degradation of TPC inner sectors at 500GeV high-luminosity pp collisions
- Normalized momentum resolution dramatically improves with IST layer Vertex+outer TPC ⇒ Vertex+IST+outer TPC
- The role of the SSD layer in addition to an IST layer is to increase the single-track efficiency at the level of ~30% (absolute)
- Exchanging the IST to the SSD layer is not expected to change this conclusion significantly!
- Therefore: The combination of both, the IST and SSD layers are essential for efficient high-p_T tracking

- **Preliminary CD-4 requirements**

HFT Parameters	
Pointing resolution for kaons	< 50 μm
Thickness of PXL1 layer	< 0.4 % X0
Internal alignment PXL	< 20 μm
Internal alignment IST	< 300 μm
PXL integration time	< 200 μs
PXL and IST Readout speed and dead time	Follow STAR DAQ for TPC, no more than 5 % additional dead time
SSD Readout Speed	< 12% deadtime at 750Hz
Detector hit efficiency	> 95%
Live channels (PXL and IST)	> 97%
Software and procedures ready	Tested and functional software

Full simulation



Fast simulation