**Summary**

- **Single hit resolution**
  - For the 25 µm pixels:
    - \( \sigma_{\text{tot}}(\phi) = 2 \mu \) m
  - Maintained after full layer 3 lifetime fluence: \( \sigma_{\text{tot}}(\phi_{\text{eq}} = 2 \times 10^{15} \text{ cm}^{-2}) = 3 \mu \) m

**Dependence of optimal angle from fluence and bias voltage needs to be taken into account**

**Intrinsic resolution**

- Non-irradiated, 120 V, optimal angle
  - \( \sigma_{\text{tot}} = 2.4 \pm 0.6 \mu \) m
  - \( \sigma_{\text{tot}} = 2 \pm 0.2 \mu \) m

- Irradiated sensors:
  - CERN PS @ 3.3 \( \times \) 10^{15} p/cm^2 (\( \phi_{\text{eq}} = 2.1 \times 10^{15} \text{ cm}^{-2} \)) → Layer 3
  - Ljubljana TRIGA reactor (\( \phi_{\text{eq}} = 4 \times 10^{15} \text{ cm}^{-2} \)) → Layer 3 < \( \phi_{\text{eq}} < \) Layer 2

**Single hit resolution extraction**

- From the uncertainty propagation:
  - Uncertainty on single hit \( \Delta s_{B} \) independent from \( \Delta s_{C} \) and \( \Delta s_{A} \)
  - For non-irradiated sensors
    - \( \Delta s_{B} = \Delta s_{C} = \Delta s_{A} = \Delta s \)
  - For irradiated sensors
    - \( \Delta s_{B} = \Delta s_{C} = \Delta s_{A} = \Delta s \)

**The Phase-2 Inner Tracker**

- Radiation hard
- Thin n/p sensors
- 6 times smaller pixels
- Increased granularity
- Increased pseudo-rapidity coverage

**Tested HPK planar pixel sensors**

- 150 µm thickness & 100 x 25 µm^2
- Bump bonded to PSI ROC4SENS analog ROC

**Why precision resolution measurements?**

- What is the resolution of the small pitch pixel sensors?
- Does resolution degrade with radiation damage?
- How to measure the spatial resolution with 25 µm pitch?

**“The DREIMASTER”**

- 3 parallel planes of sensors
- Does not rely on an external reference tracking detector
- Resolution measurement by the triplet method
- Measurements @ DESY test beam facility → electron beam @ 1-6 GeV

**Single hit resolution**

- Non-Irradiated @ 120 V, room temperature
- Irradiated @ 800V, cooled @ ~ -24°C
- Foreseen Lorentz angle in CMS: 11° @ 300V before irradiation

**Incline angle dependence on beam incidence angle**

- \( \Delta s_{A} = 0.03 \pm 0.01 \mu \) m, proton, 600 V, optimal angle
- \( \Delta s_{B} = 0.07 \pm 0.05 \mu \) m, proton, 600 V, optimal angle

**Optimal angle for charge sharing**

- \( \text{Optimal angle for } \sigma = \text{pitch} \times \text{thickness} / \text{pitch} = 9.5° \)

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