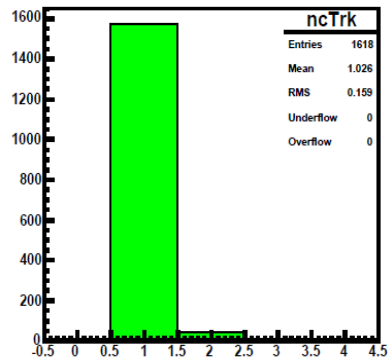
Diamond HV Scan at Angle

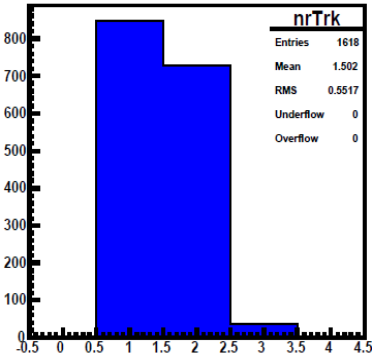
- What we want to extract from the testbeam for different bias HVs:
  - Total charge collected per particle hit in terms of MPV of the Landau distributions.
  - For a fixed threshold how the charge sharing information the detector can deliver, in terms of number of rows, or columns per particle hit cluster.
  - Spatial resolution.
  - Shift of spatial position measurement due to partial charge collection and tracks at angle. This can give us some ideas on effective depth, and charge trapping.
- Status of each task:
  - Need more work on readout electronics gain and pedestal calibrations. It is difficult to compare the absolute charge before that.
  - Numbers of pixels per hit vs bias HV qualitatively agree with expectation. We need to obtain precise thresholds from bench test for MC simulation. Then we can have quantitative comparison to test our understanding.
  - Current resolution is not as good as expectation. Need more work on gain curve and telescope alignment.
  - Shift of center residual shows correct trend. It will be revised after the spatial measurement optimization.

Diamond Sensor Charge Sharing vs HV

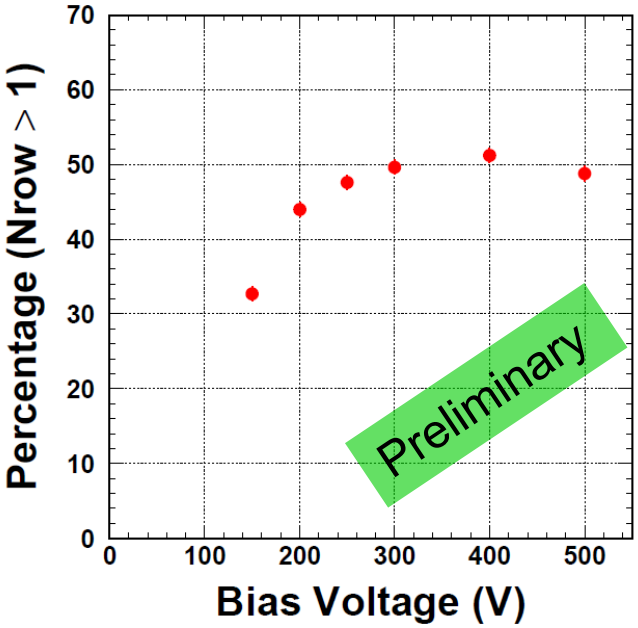
HV = -250 V

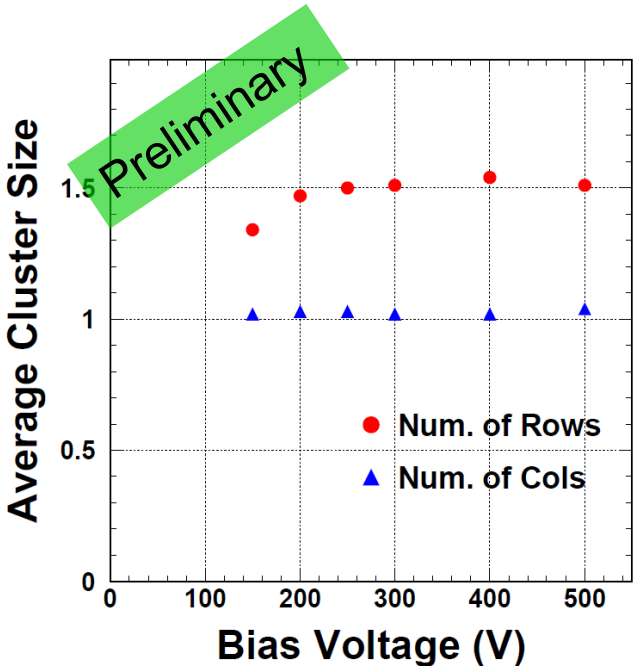


Number of Columns per Cluster



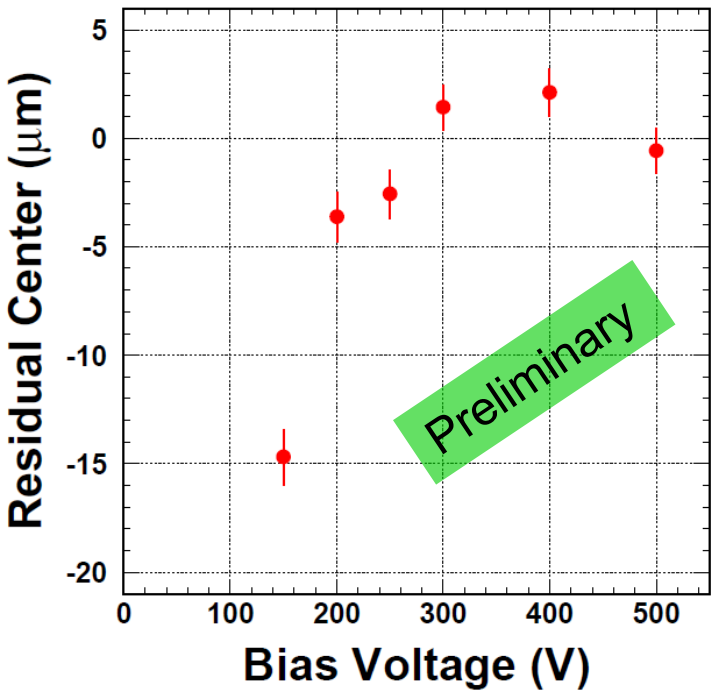
Number of Rows per Cluster

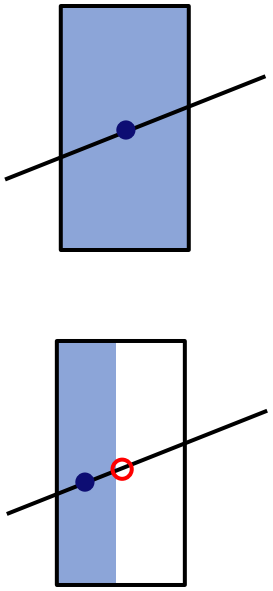




- Sensor rotated to ~ 20° in row direction.
- More charge collected with higher bias HV till saturation.
- Need more work on gain calibration to extract the absolute charge (MPV of Landau distribution).

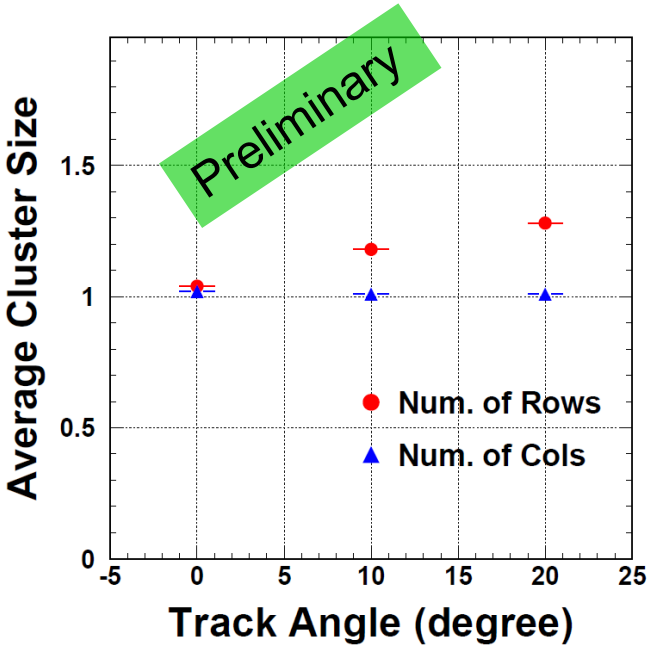
Diamond Sensor Residual Center vs HV

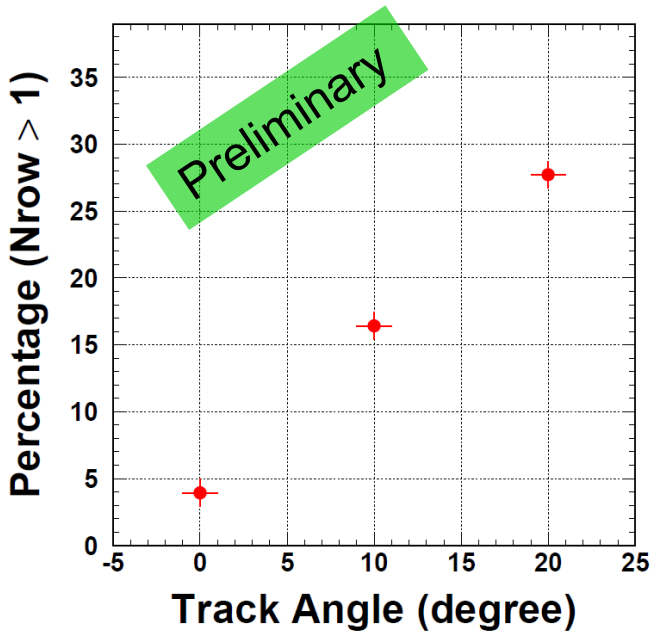




- Tracks are at ~ 20° with respect to normal of sensor plane in row direction.
- Use the same set of telescope spatial configuration parameters.
- With low bias HV, charges generated near readout electronics have more chance to be collected, equivalent to thinner effective sensor. Thus the residual center shifts.
- In extreme case, the maximum possible shift ~ tan(θ)*d/2 ~ 90 μm.

Diamond Sensor Charge Sharing vs Angle





- Diamond sensor is biased at -250 V.
- Sensor was perpendicular to beam, or rotated by ~10° & ~20° in row direction.
- Gain and threshold of the electronics are different from that of HV scan.