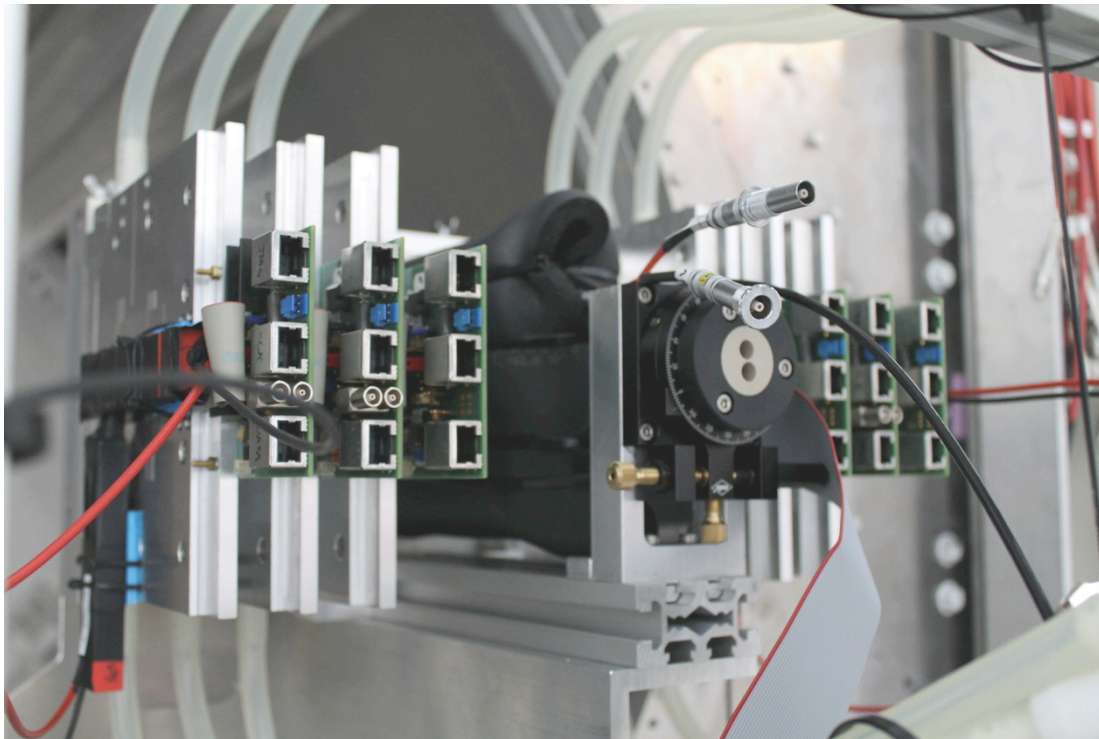


Lorentz Angle Measurement

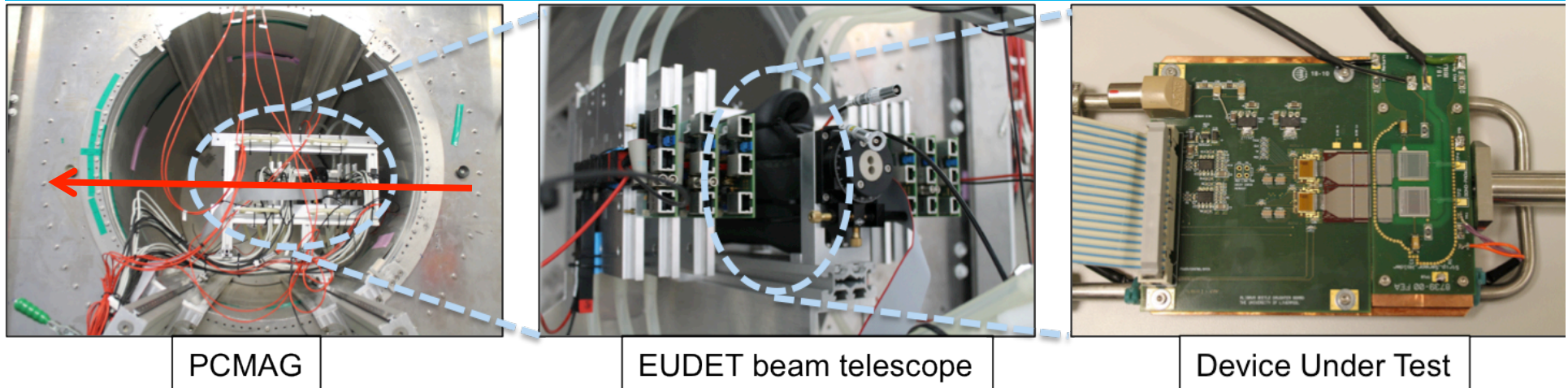
On ATLAS12 Sensors



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ATLAS12 Meeting
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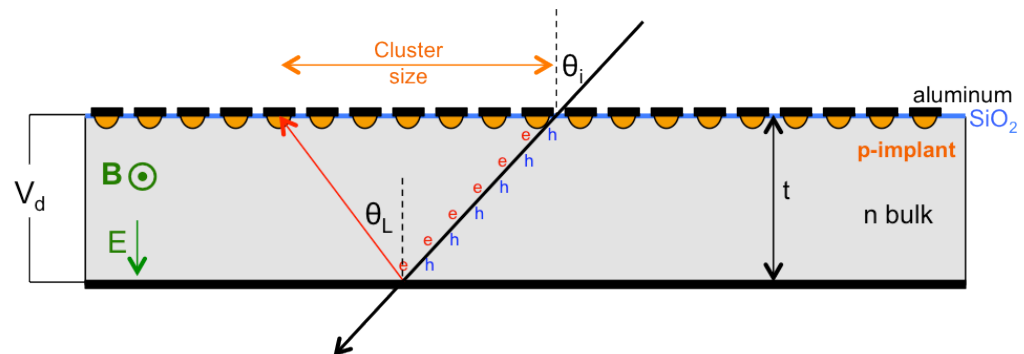
Lorentz Angle Measurement



- Goal:** to measure Lorentz angle on highly irradiated ATLAS12 silicon strip sensors for HL-LHC
- Tools:** Magnet (PCMAG)
Beam Telescope (EUDET)
@ DESY Test beam
- Status:** 8 samples are measured in Oct-Nov test beam

Tested ATLAS12 sensors

- 2 non-irradiated
- 4 neutron irradiated ($1\text{MeV } n_{\text{eq}} \text{ cm}^{-2}$)
 5×10^{14} , 1×10^{15} , 2×10^{15} , 5×10^{15}
- 2 annealed @ 60°C 80min
 5×10^{14} , 1×10^{15} ($1\text{MeV } n_{\text{eq}} \text{ cm}^{-2}$)
annealed neutron irradiated



Lorentz angle = angle of incidence @ minimum cluster size

Magnetic Field: up to 1T
Beam Energy: 4.4 GeV
Bias Voltage: -500V



LAM - non-irradiated

Tilt angle is not the incidence angle on sensor.

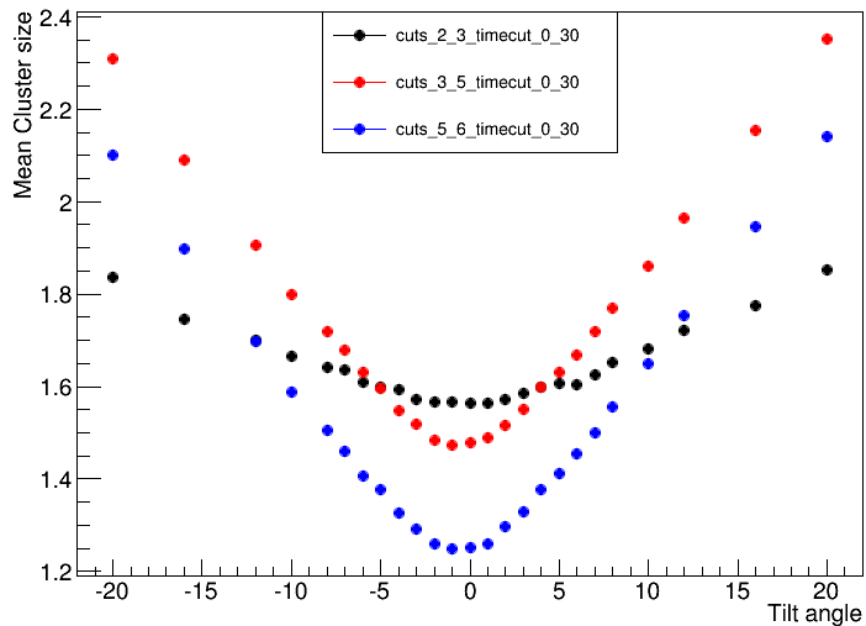
Tilt angle is the tilt angle of the box.

We will get incidence angle from tracking, which is not included in these results.

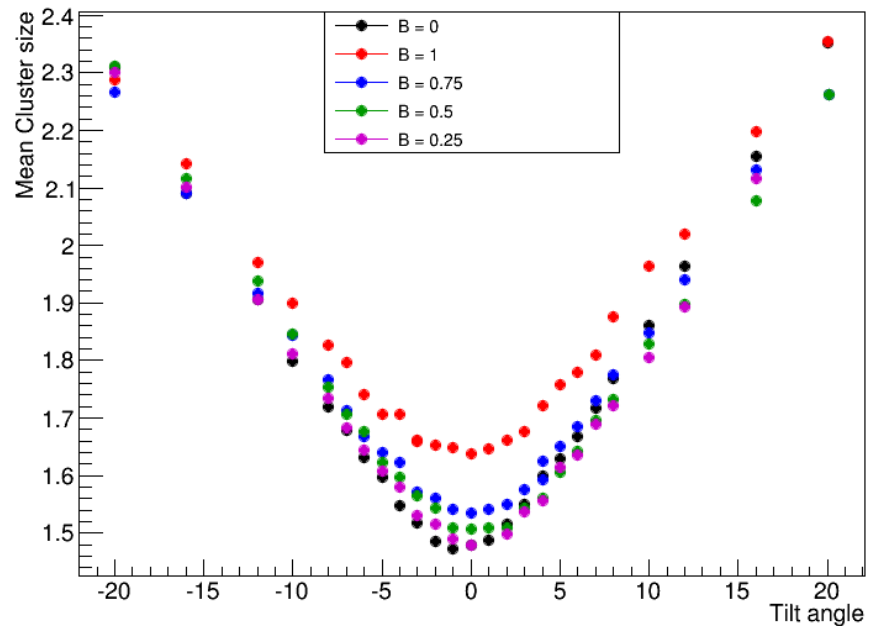
There might be few degrees of offset in tilt angle and LA because of the offset in angle setting

Notation: cuts_X_Y_timecut_Z_W means only events with tdc time between Z-W are used in clustering neighbor S/N > X, seed S/N > Y

DUT nonirradiated, B = 0



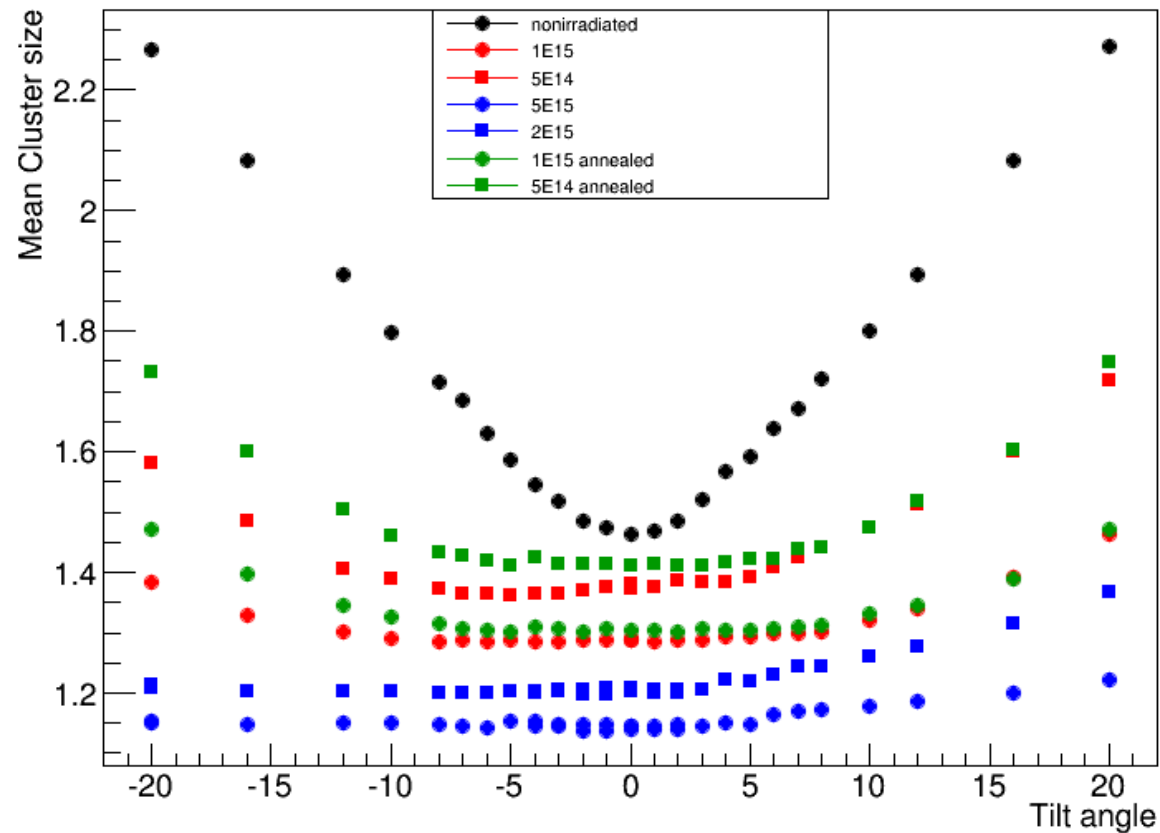
DUT nonirradiated, cut = cuts_3_5_timecut_0_30



LAM - irradiated

- Similar plot for $B > 0$
- Problem is on irradiated sensors we don't see much change in cluster size between ± 5 degrees, where LA should be.

$B = 0$, cut = cuts_3_5_timecut_0_30



Tilt angle \neq incidence angle
There might be shifts in LA because of the offset in angle setting

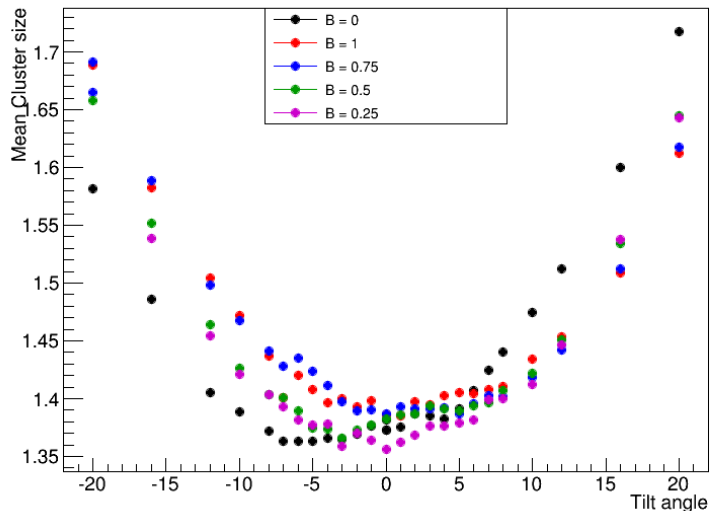


LAM – annealed

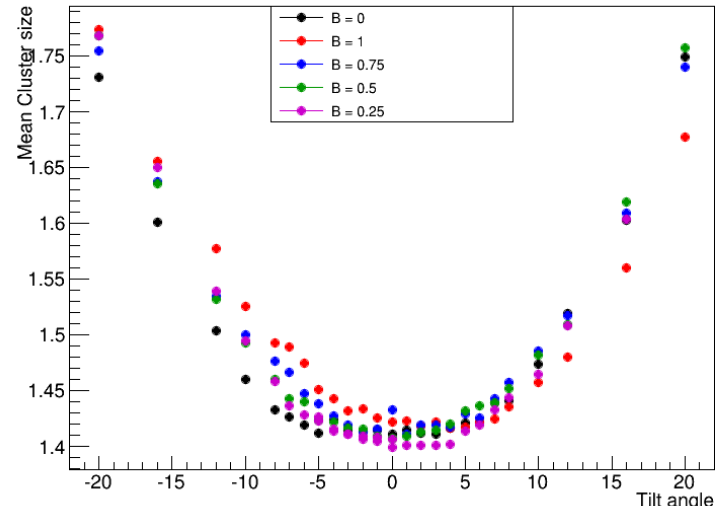
Annealing improves the shape of LAM plot a little bit.

On 1E15 non-annealed sensor, minimum cluster size point is not clear.

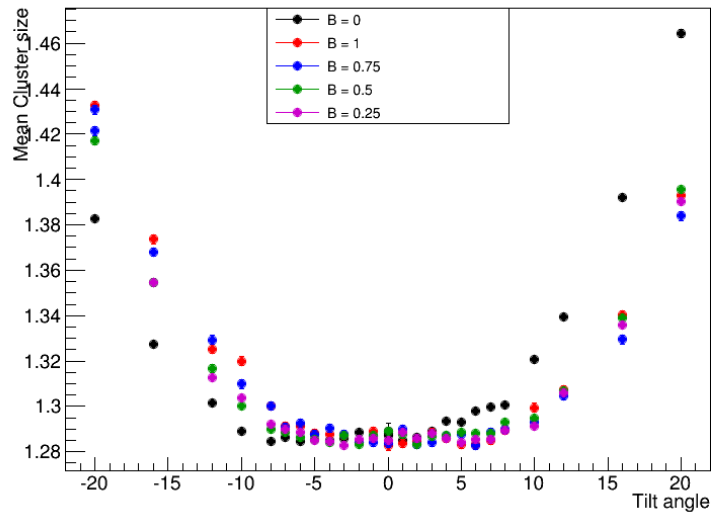
DUT 5E14, cut = cuts_3_5_timecut_0_30



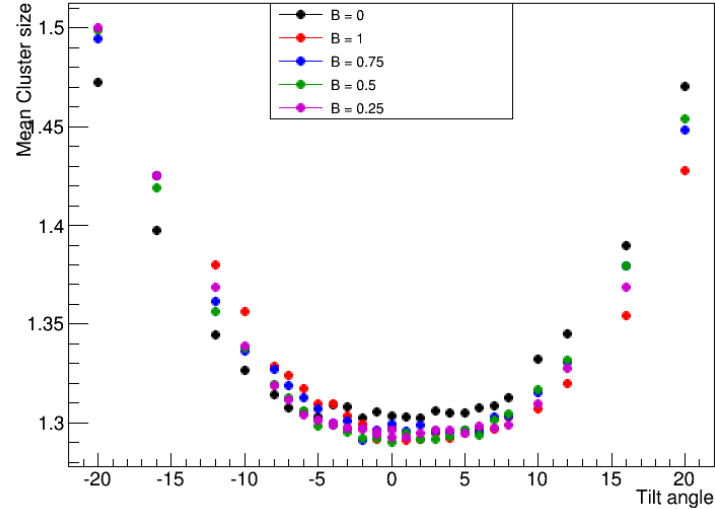
DUT 5E14 annealed, cut = cuts_3_5_timecut_0_30



DUT 1E15, cut = cuts_3_5_timecut_0_30



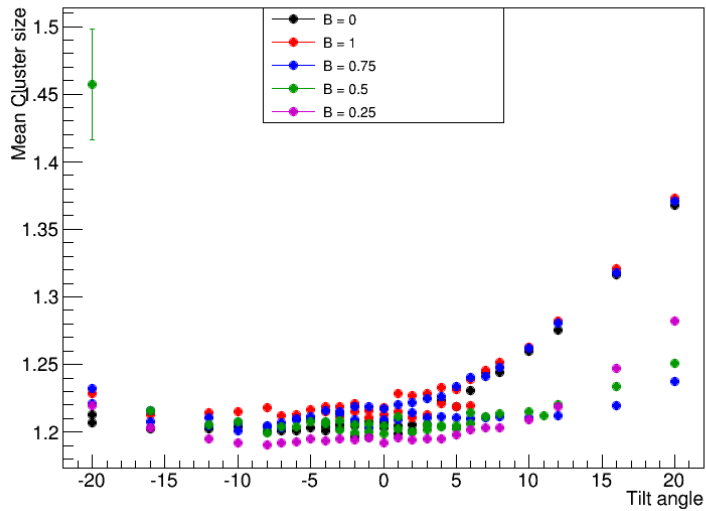
DUT 1E15 annealed, cut = cuts_3_5_timecut_0_30



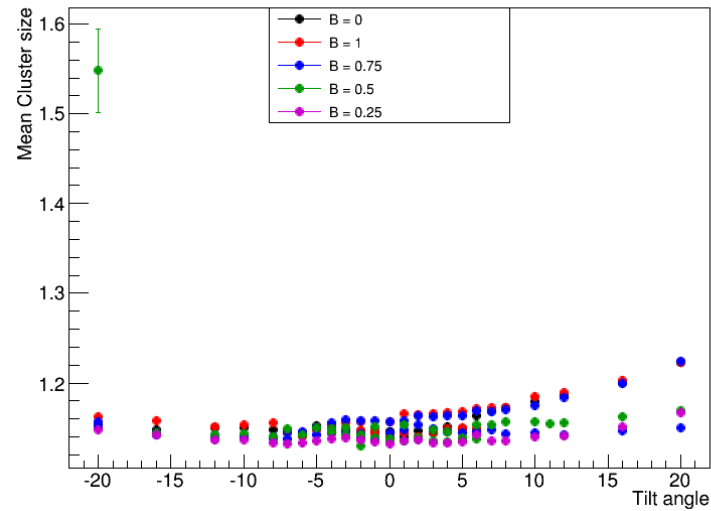
LAM – highly irradiated

On highly irradiated sensors (2E15 and 5E15) we don't get see a meaningful change in cluster size, and it doesn't get any better with changing the cuts

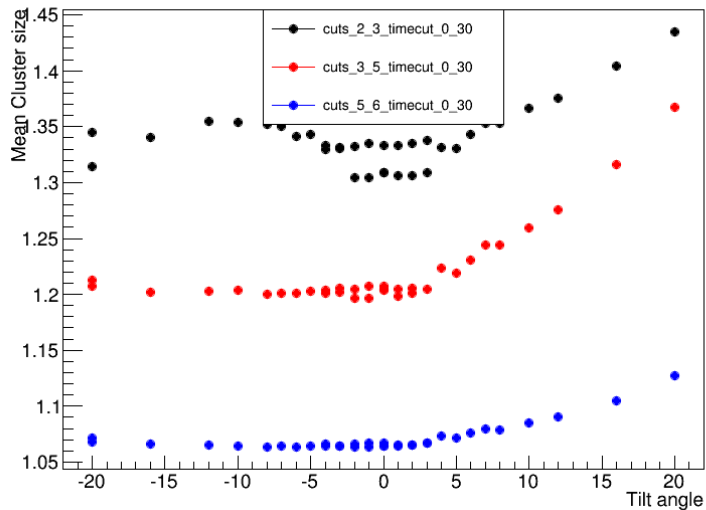
DUT 2E15, cut = cuts_3_5_timecut_0_30



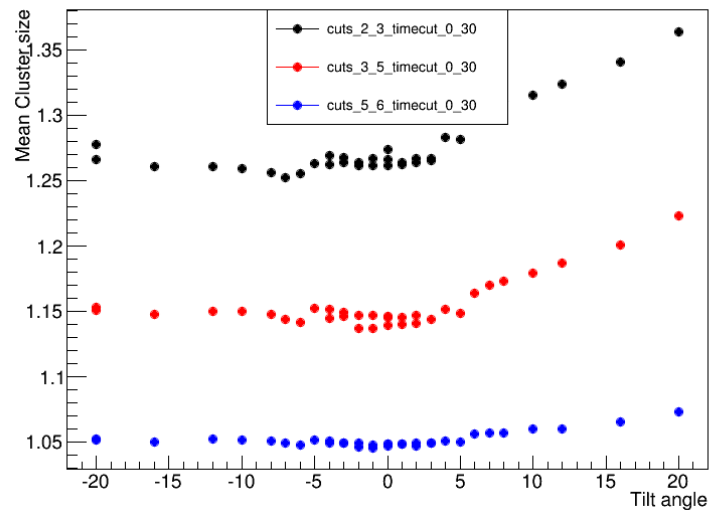
DUT 5E15, cut = cuts_3_5_timecut_0_30



DUT 2E15, B = 0



DUT 5E15, B = 0



Summary

- > On non-irradiated sensors LA plot looks fine.
- > But on highly irradiated ones, we don't see change in cluster size between +/- 5 degrees.
- > We will use telescope track information to get incidence angle on the sensor and get rid of noise hits. This might improve the LAM plot a bit.
- > We will have our last test beam in Feb. where we can measure 4 more sensors. Which sensors to be measured haven't decided yet.

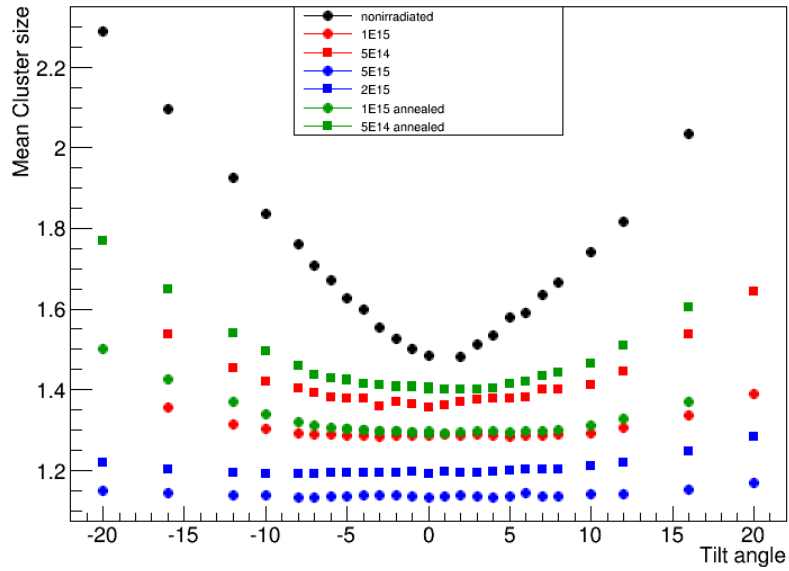


Thank You !

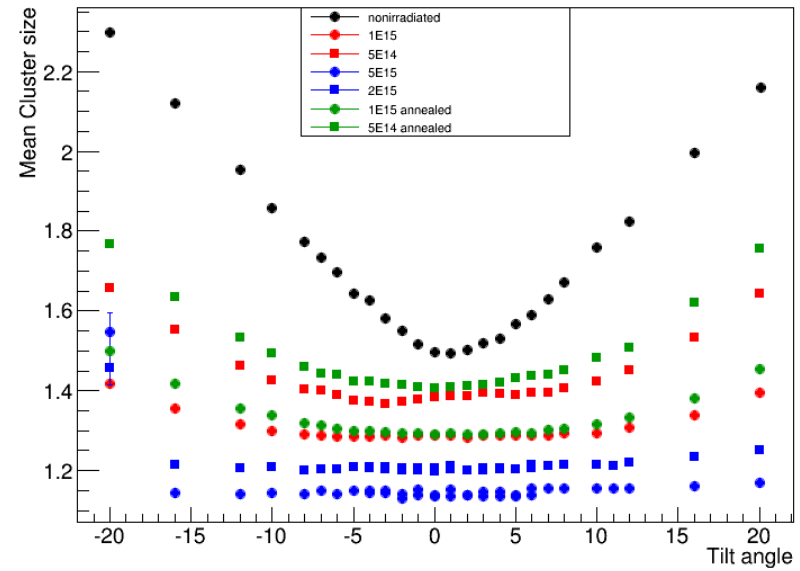
Backup

All DUTs

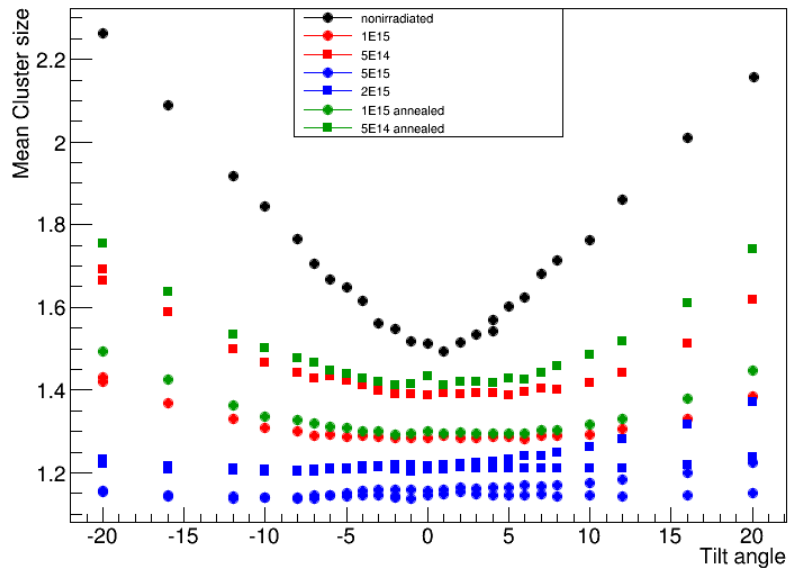
B = 0.25, cut = cuts_3_5_timecut_0_30



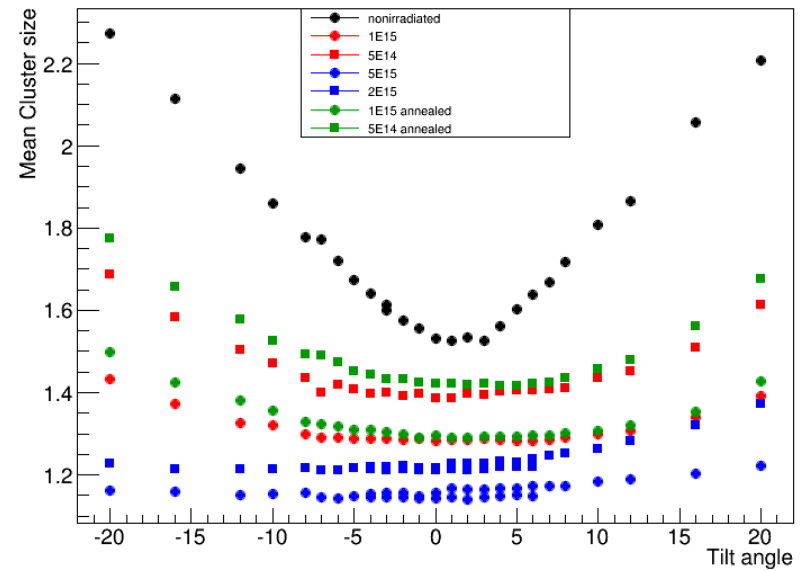
B = 0.5, cut = cuts_3_5_timecut_0_30



B = 0.75, cut = cuts_3_5_timecut_0_30



B = 1, cut = cuts_3_5_timecut_0_30



Tdc time cut

Changing the tdc time cut doesn't change the shape of the plot

