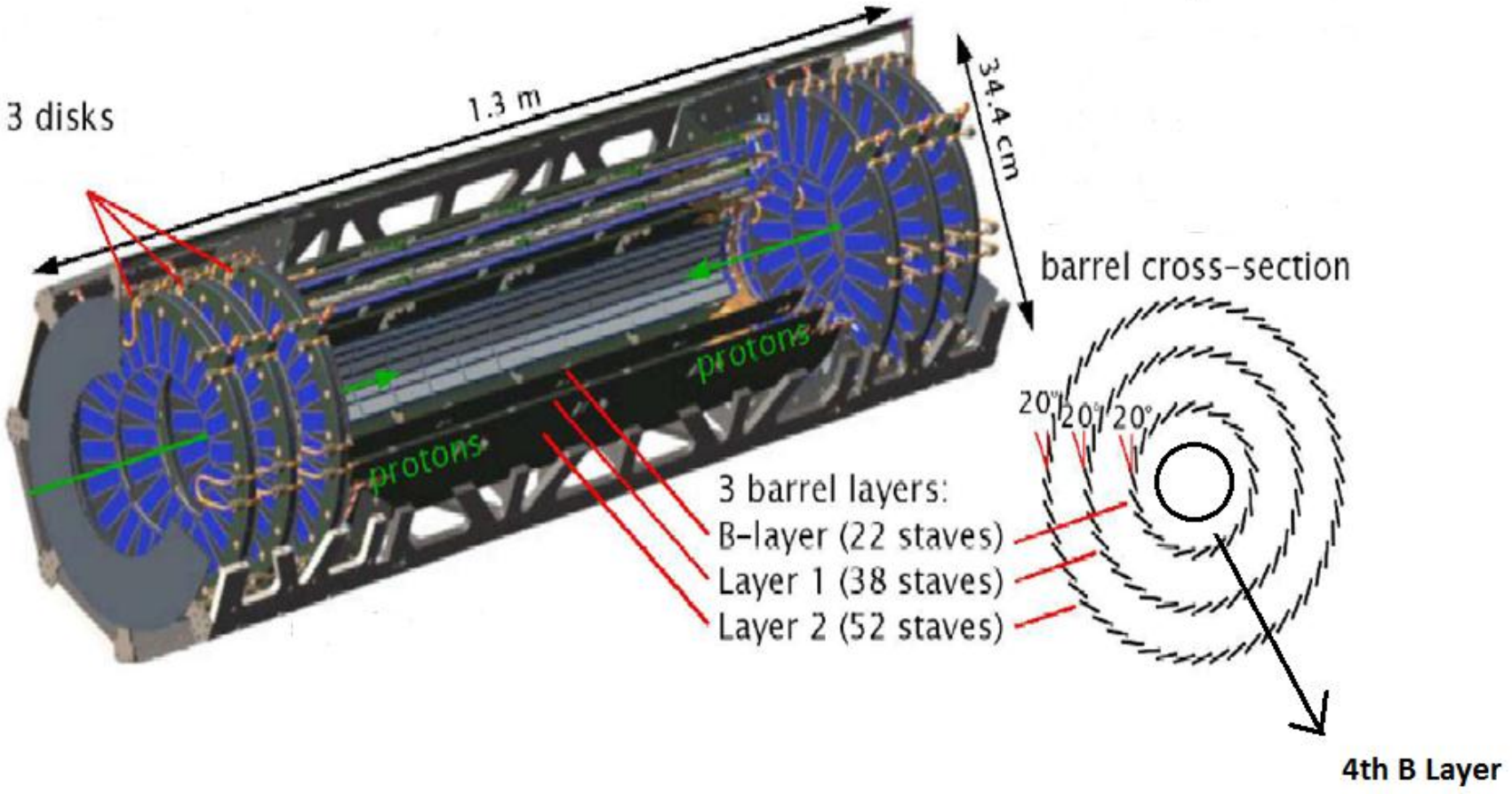
ATLAS Front End FE-I4 ToT – Charge Calibration

Melih Solmaz

CERN Summer Student

Supervisor : Christian Gallrapp

ATLAS PIXEL DETECTOR



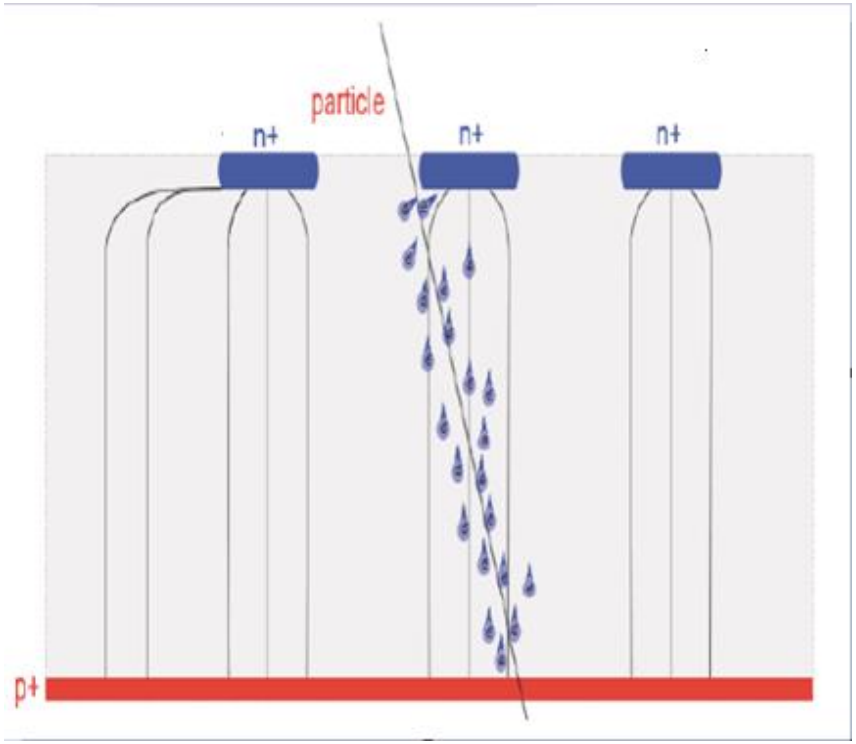
ATLAS IBL UPGRADE (2013)

- ✓ Improvement of the existing inner detector
- ✓ Radiation damage to sensor and electronics diminishes detector efficiency-> Compensation of radiation detriment of existing system
- ✓ With higher luminosity new design is necessary for higher hit rate

Need for new sensor and new front end

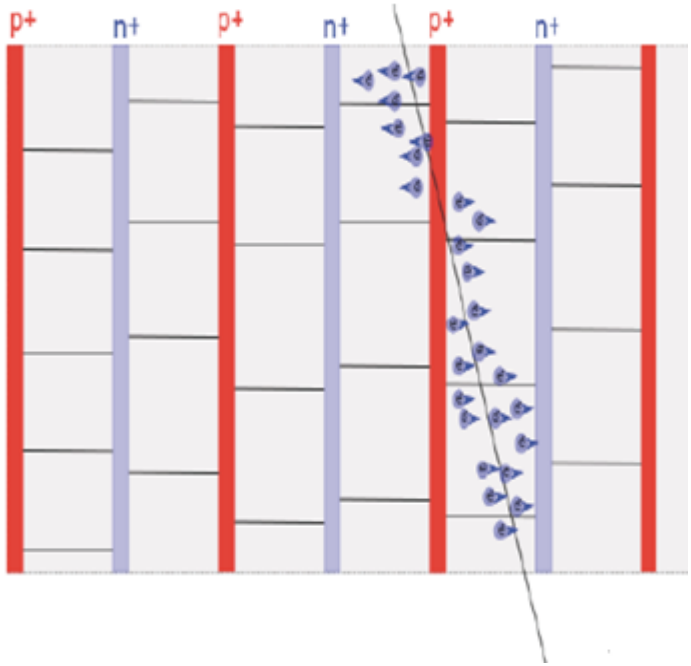
TWO PIXEL SENSORS FOR IBL

Planar Pixel Sensor



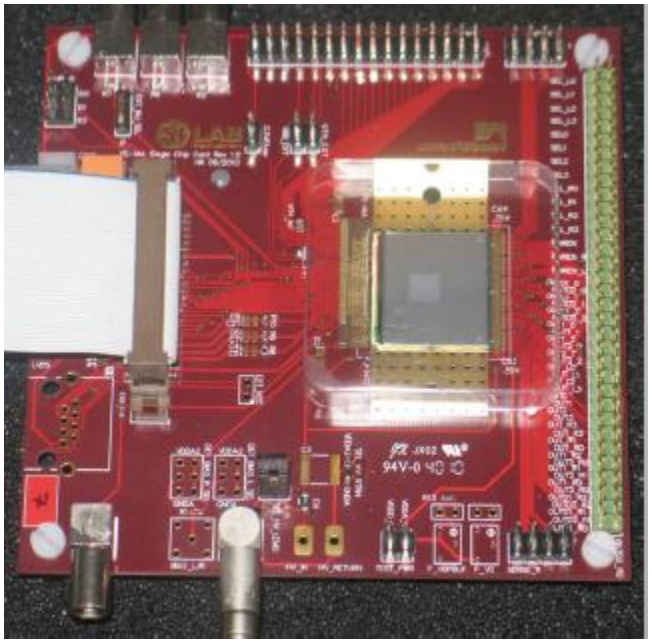
E-Field is in vertical position

3D Pixel Sensor



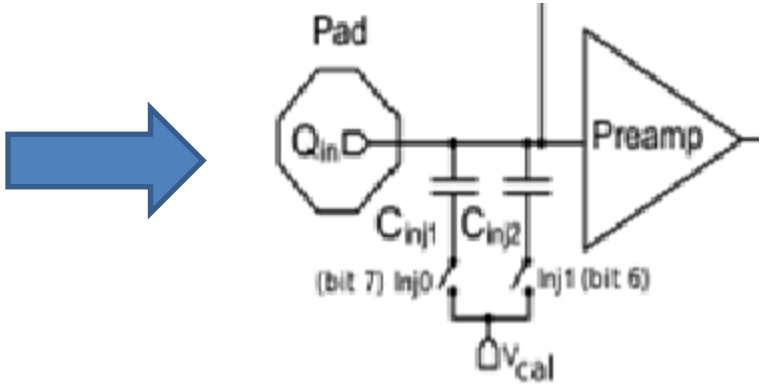
E-Field is in horizontal position

NEW FRONT-END FE-I4

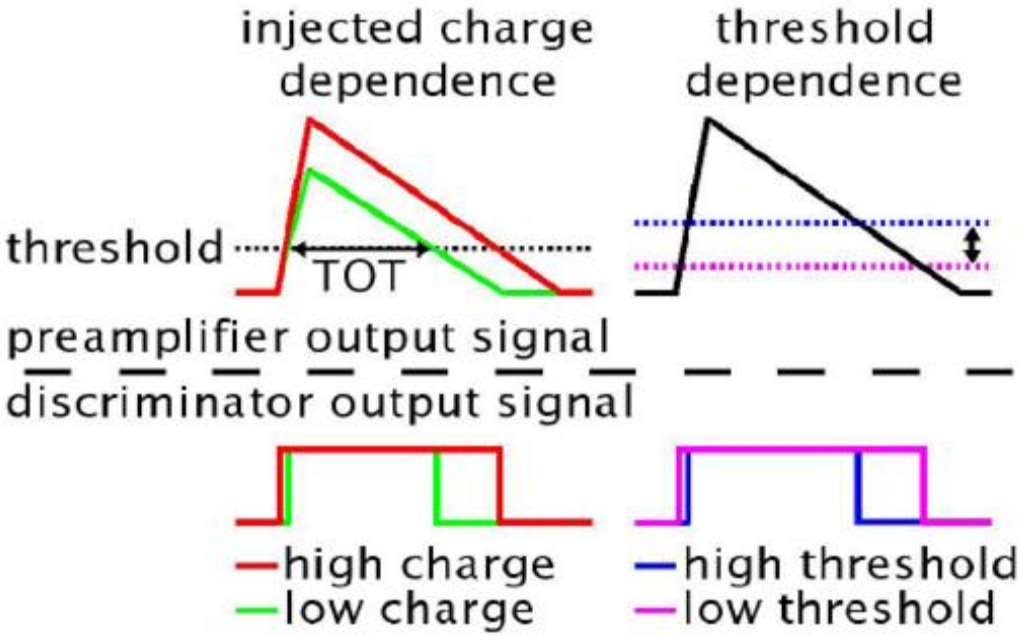


COMPARISON OF FE-I4 WITH EXISTING FE-I3

	FE-I3	FE-I4
Pixel Size	50µmx400µm	50µmx250µm
Pixel Array	18x160	80x336
Chip Size	7.6mmx10.8mm	20.2mmx19mm



Time Over Threshold (ToT)



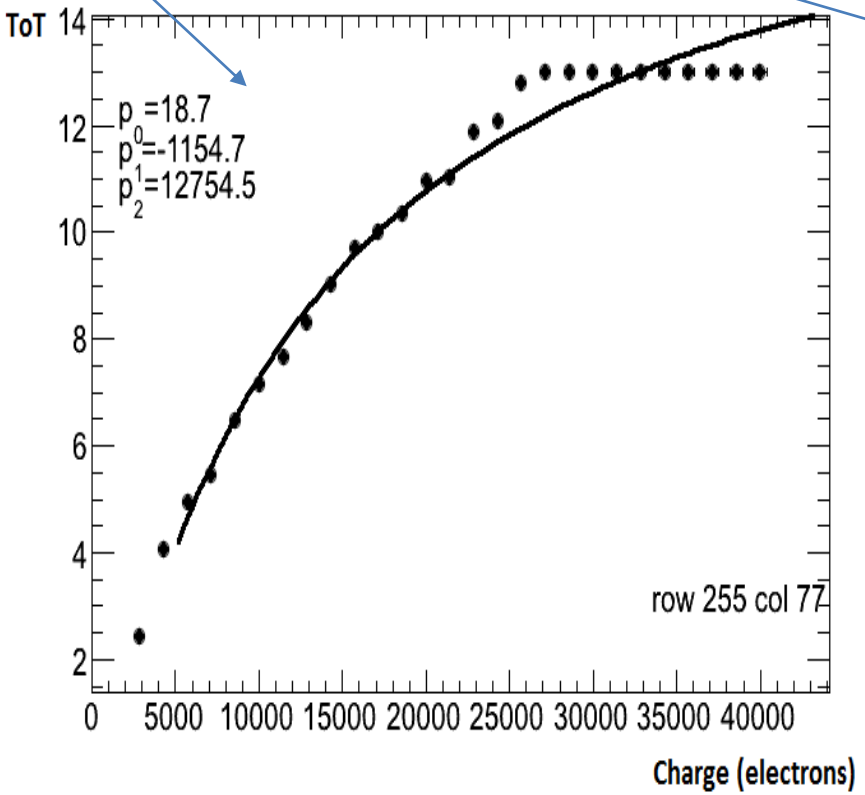
Preamplifier and discriminator signal shapes

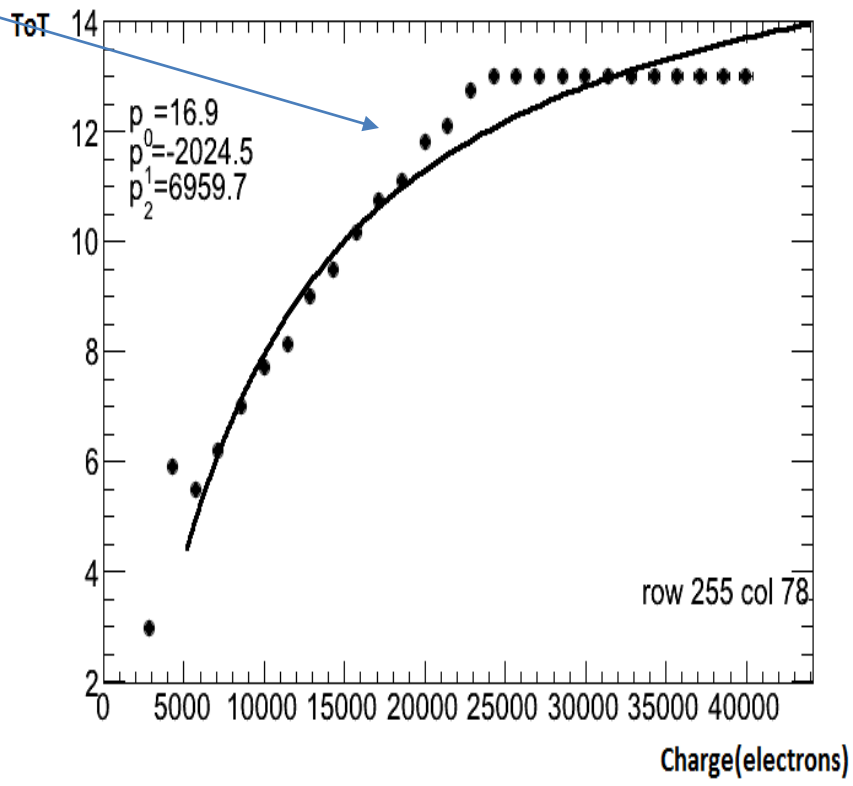
ToT – CHARGE CALIBRATION

- ✓ Injection of charge through injection capacitors
- ✓ ToT value is measured -> Correlation between charge and ToT
- ✓ ToT -> Energy Deposition

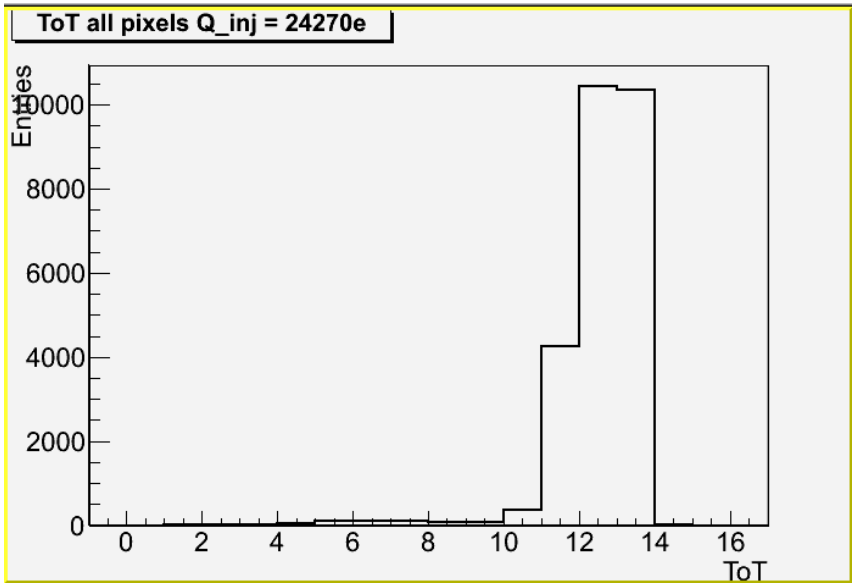
RESULTS

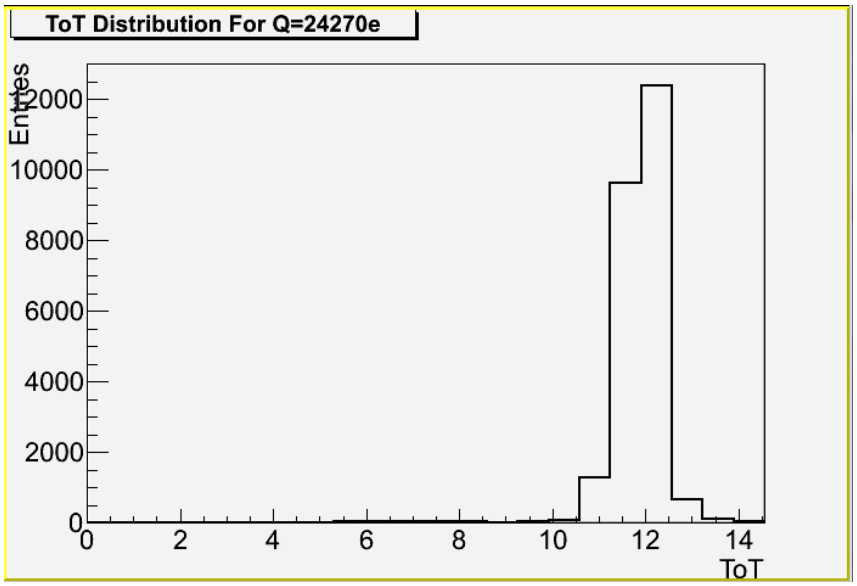
FITTING FOR FE-I3





RESULTS (2)


ToT all pixels Q_inj = 24270e
Entries
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
14
16
ToT


ToT Distribution For Q=24270e
Entries
12000
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
14
ToT

CONCLUSION

- ✓ ToT is important tool for charge measurement
- ✓ Accurate fit function is needed for FE-I4

THANK YOU

Any Question?