

Effects Compton Currents and Polarity in Large Electron Radiation Fields

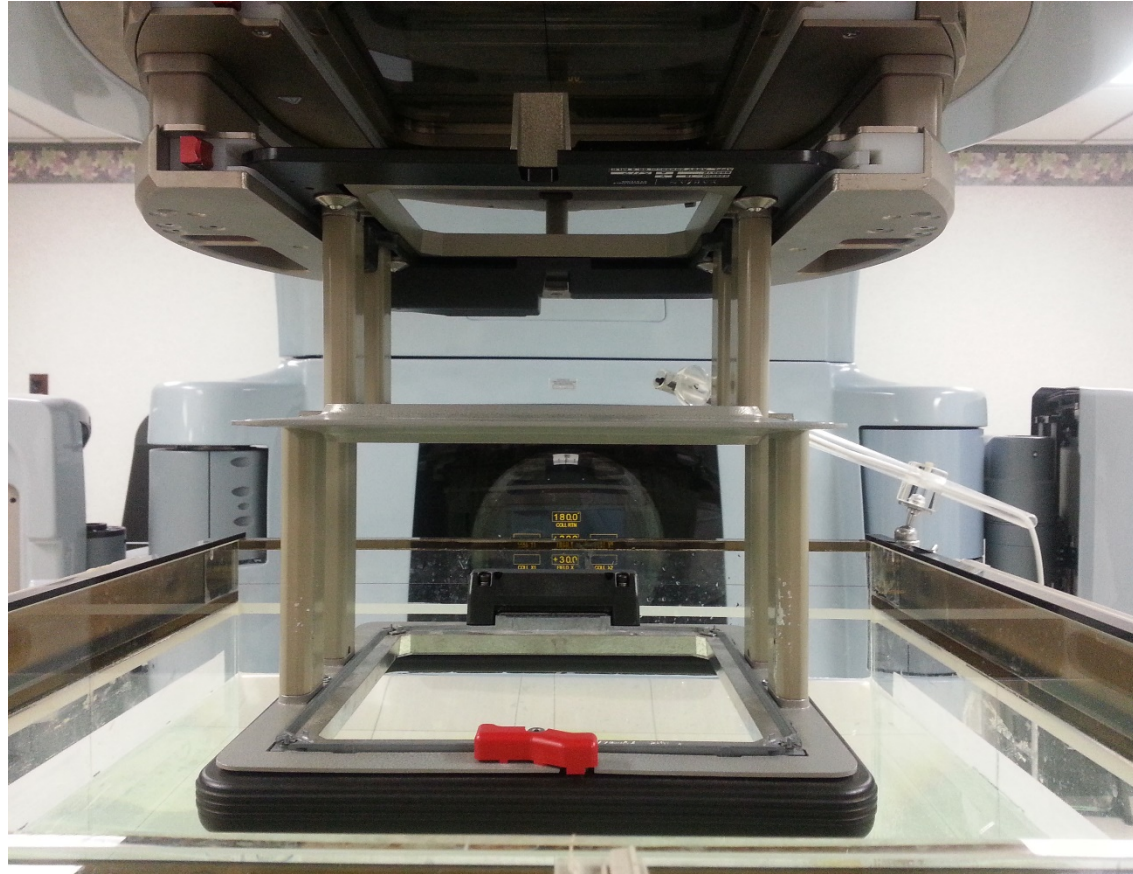
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The University of Toledo Medical Center

ORVC Spring Meeting April 12, 2014

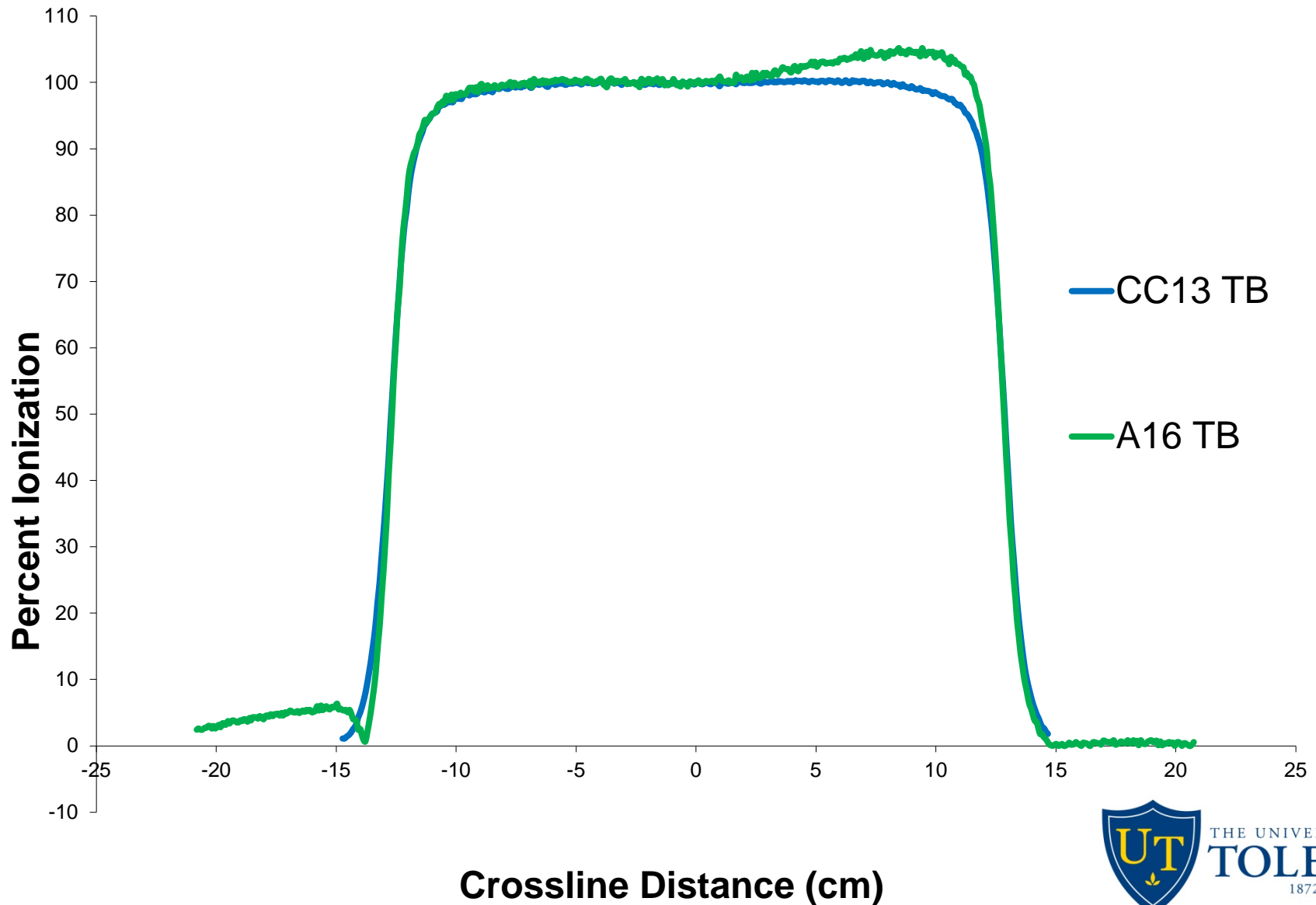


Outline

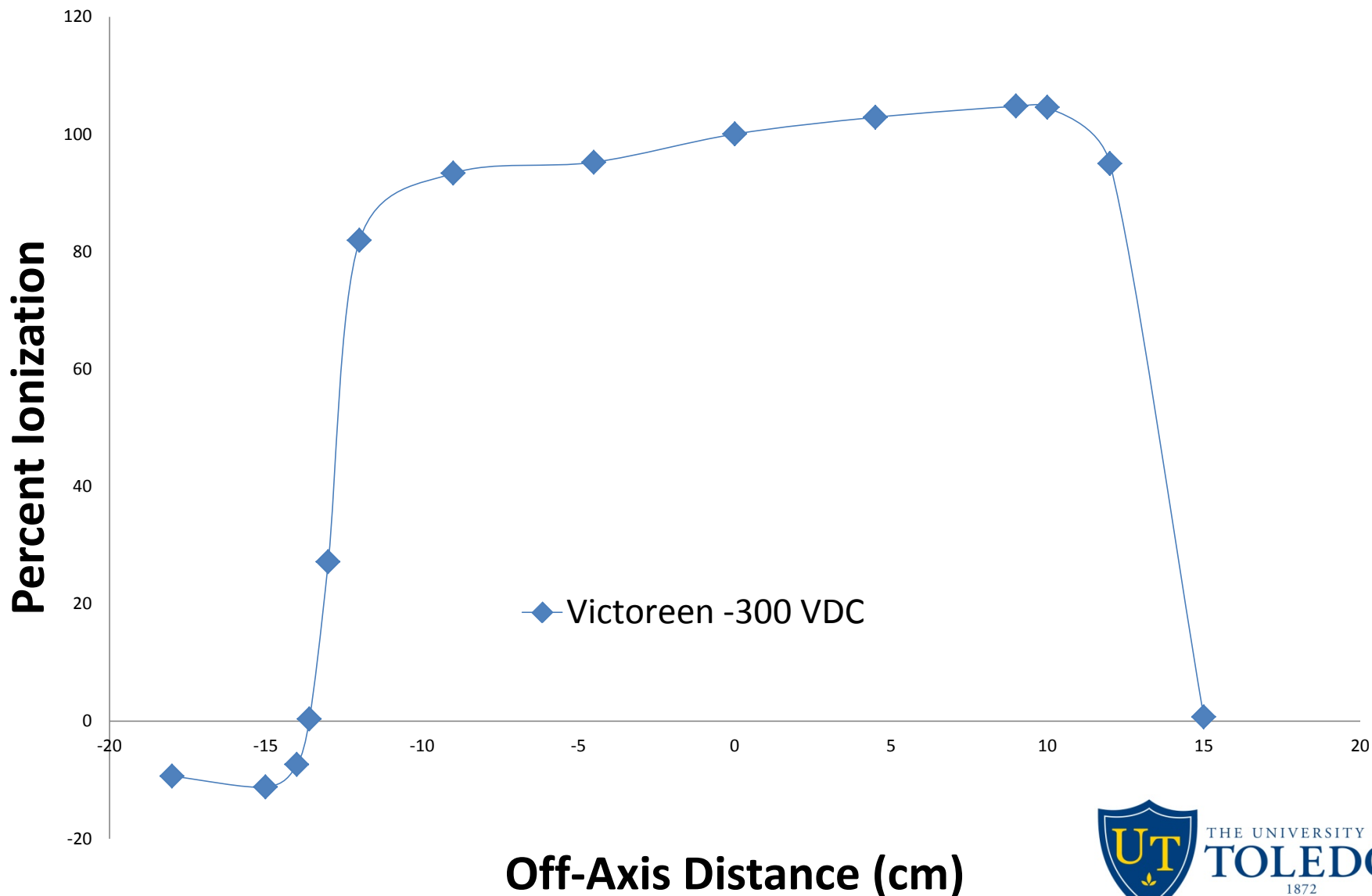
- Motivation and Initial Investigations
- Polarity Effect
- Chamber Dependence
- Compton Current Deposition
- Stem and Cable Investigation
- Conclusions



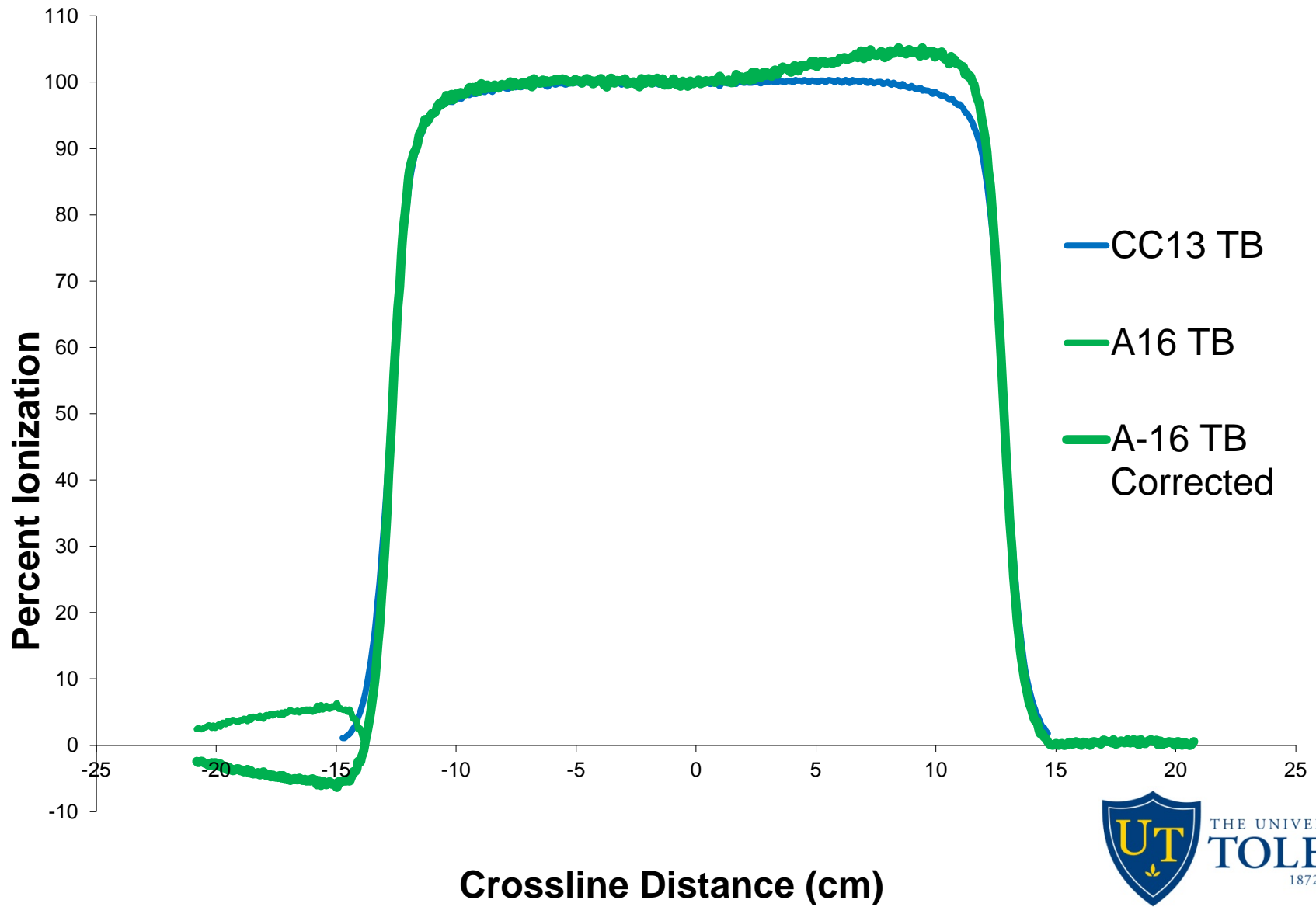
The Measurement that Started It All



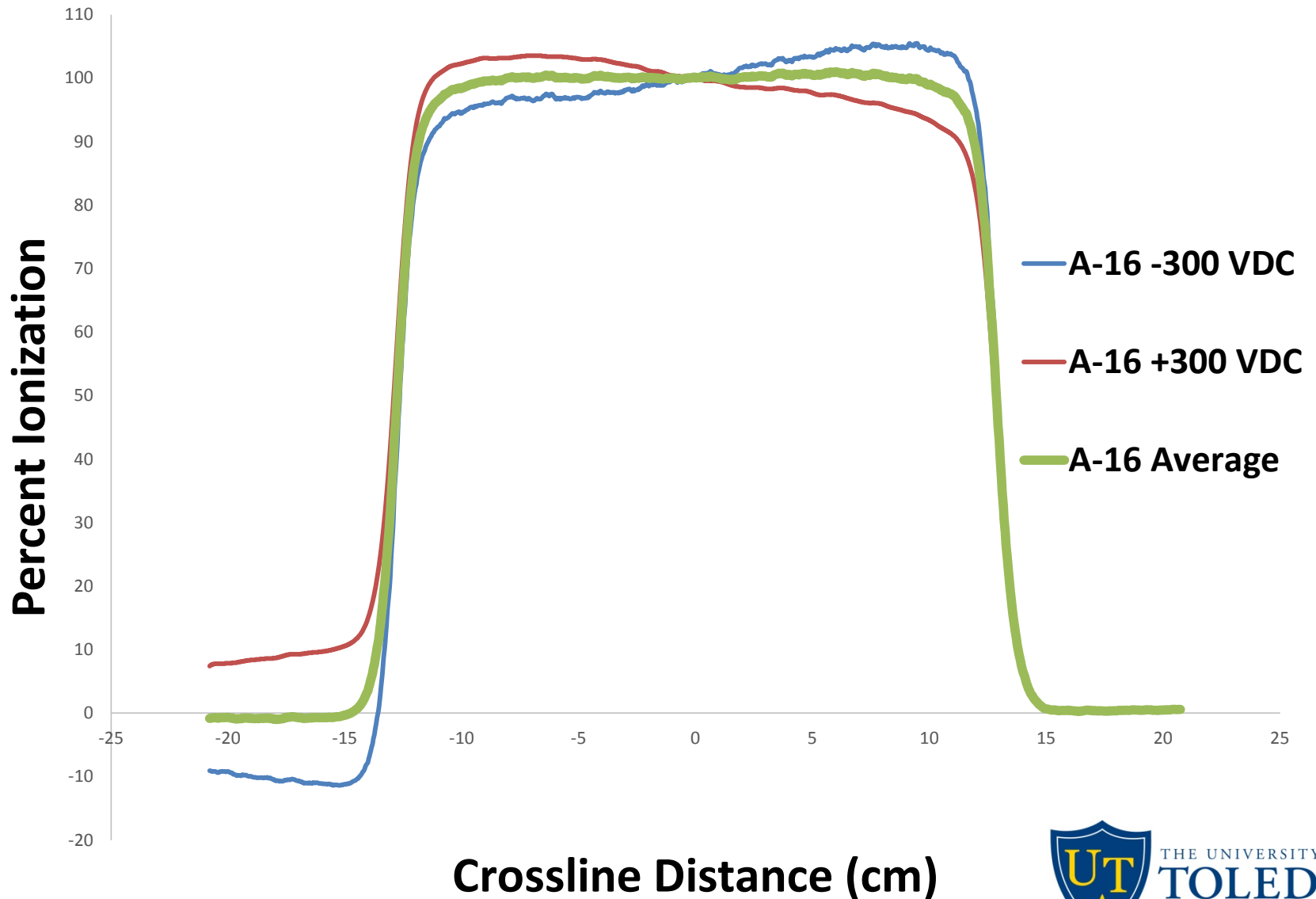
Measurements With Independent Electrometer



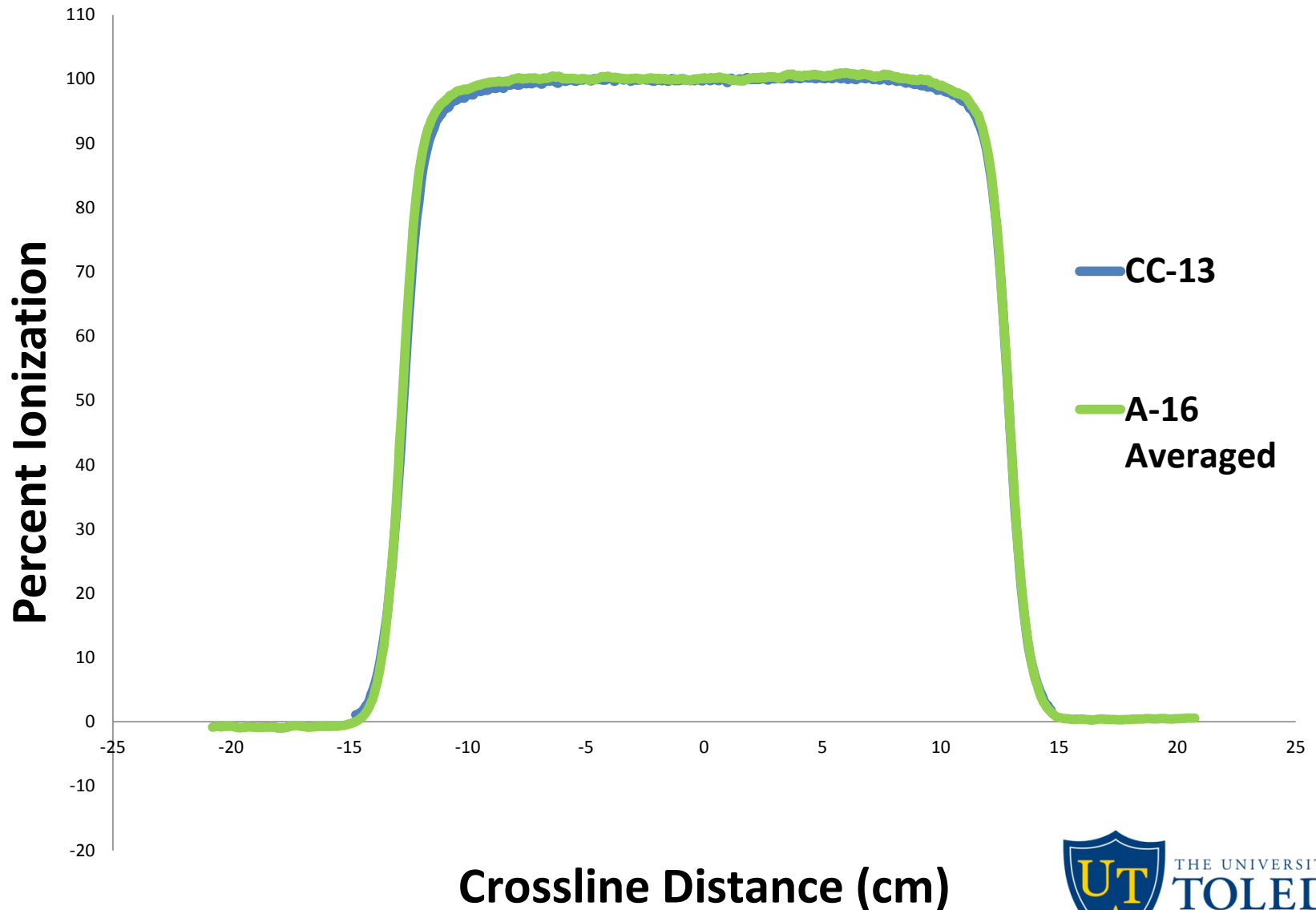
Actual Charge Collected



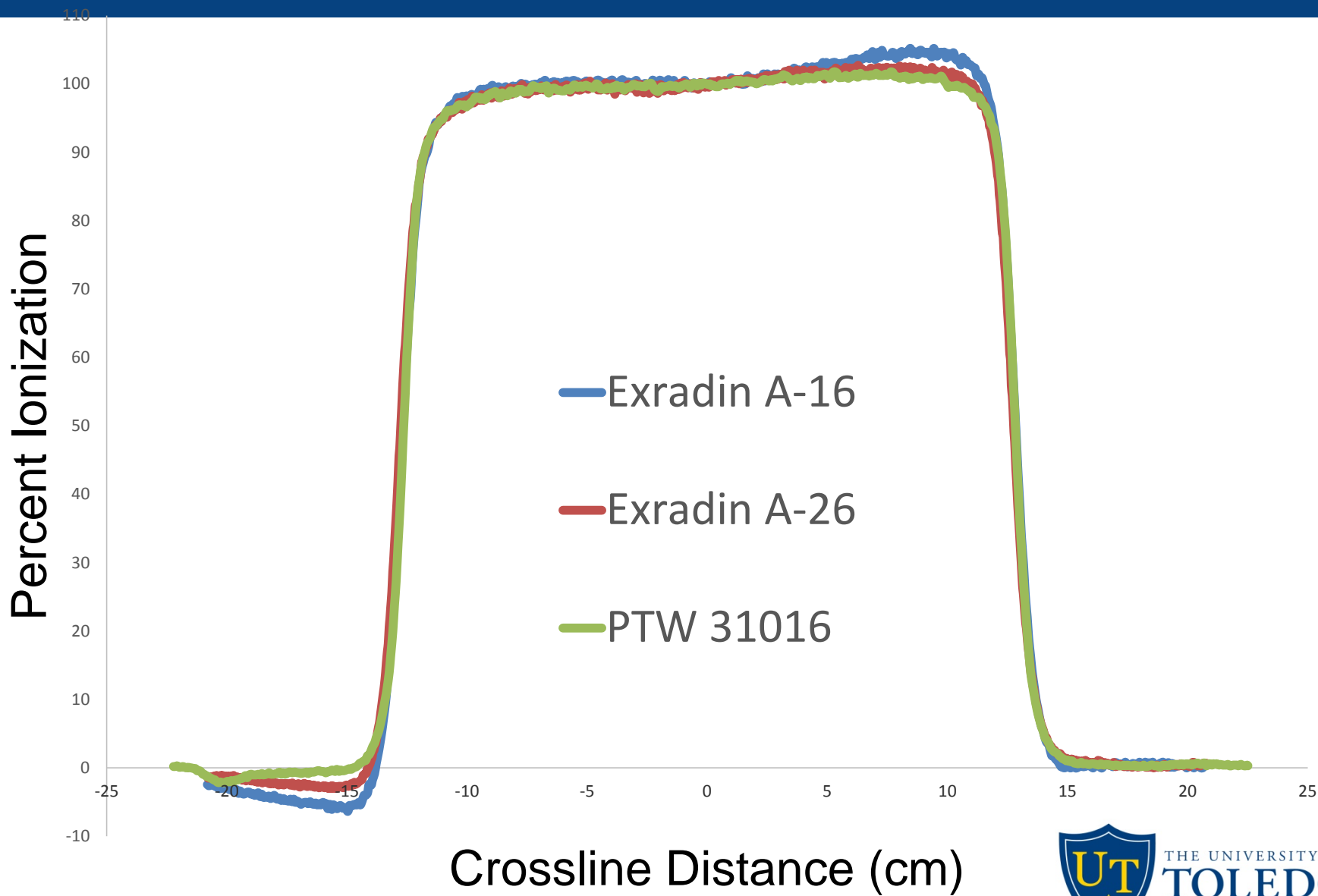
Changes with Polarity



Changes with Polarity

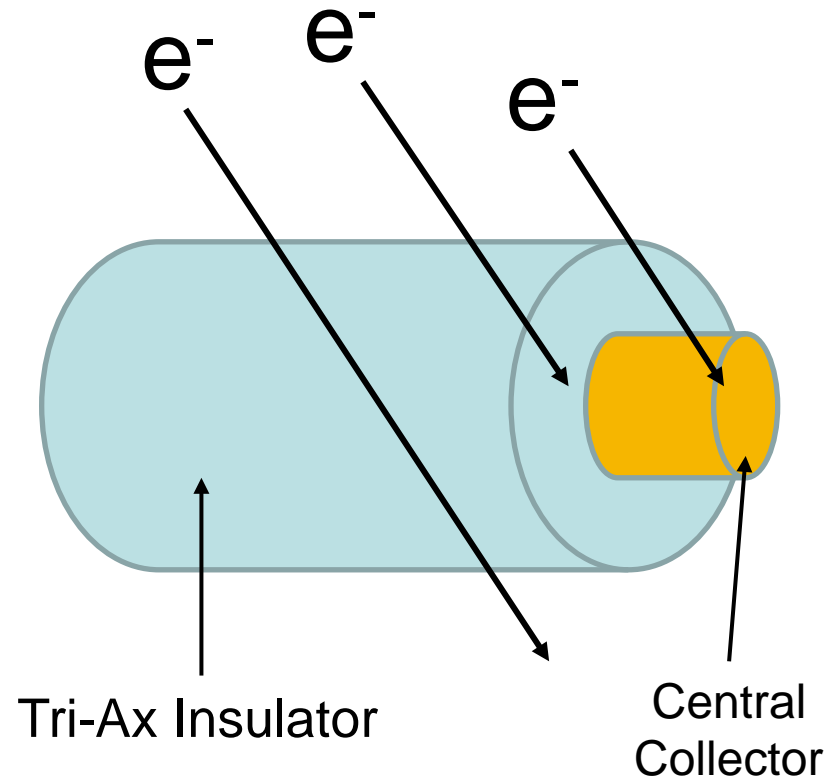


Comparison of 3 Micro-chambers

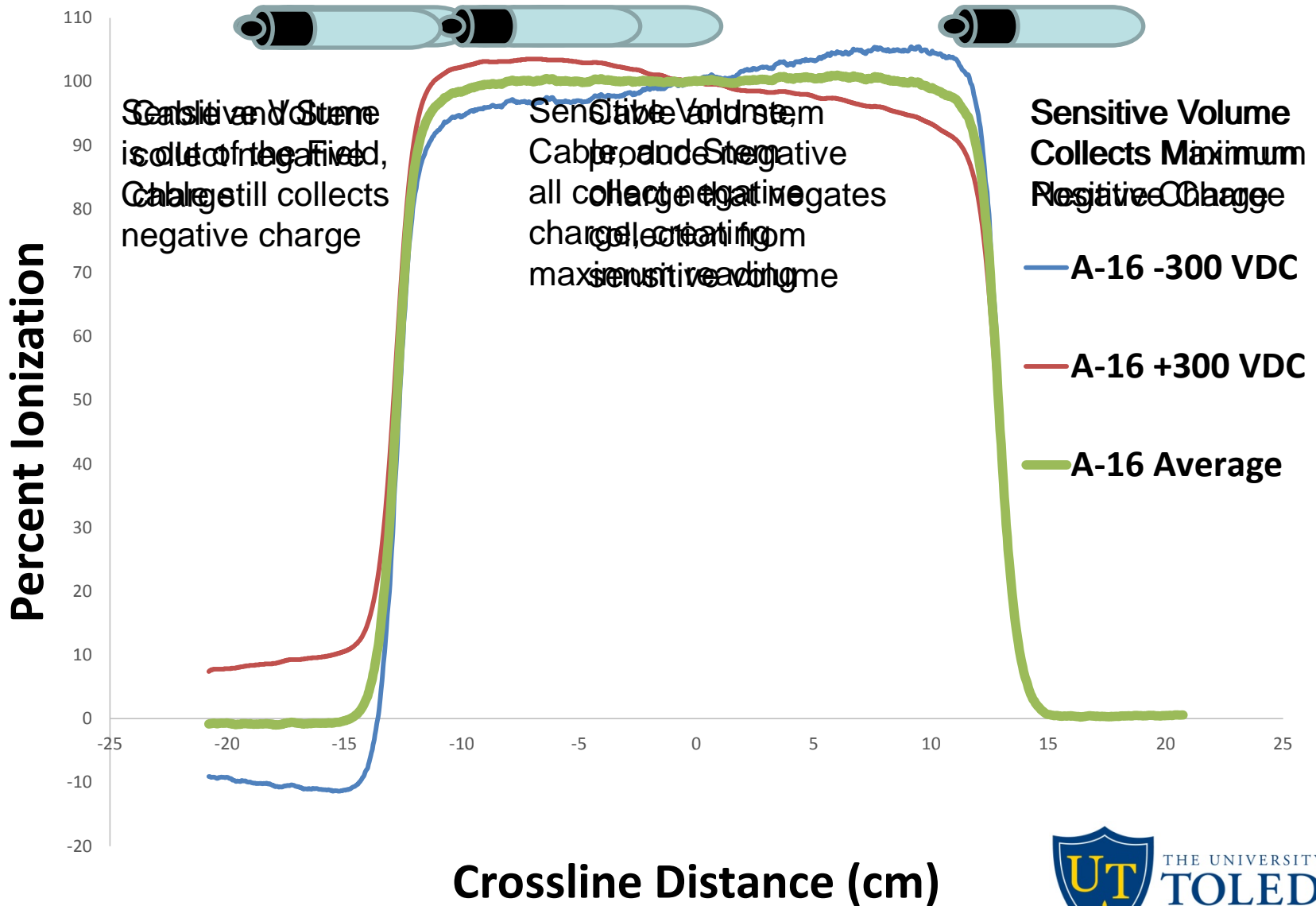


Solution: Compton Currents

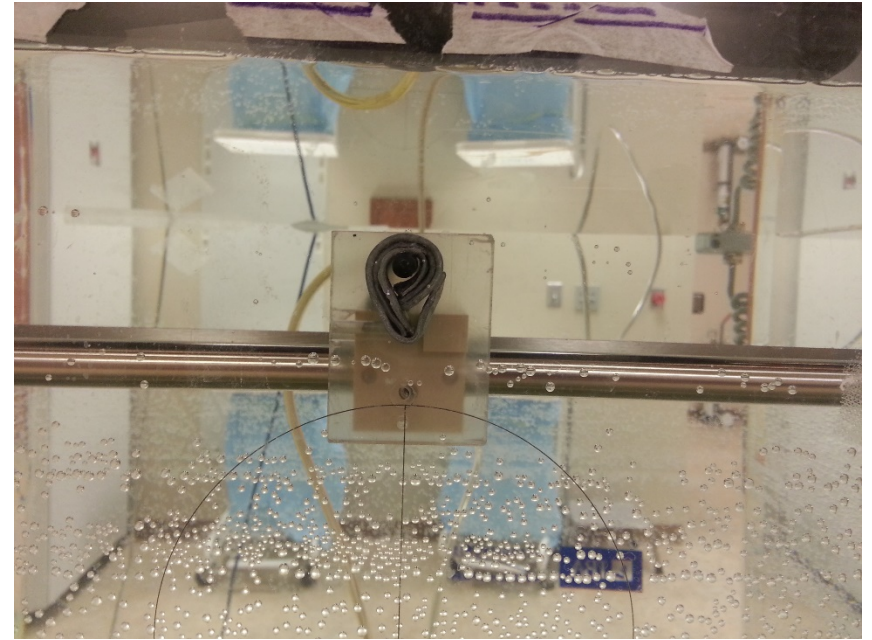
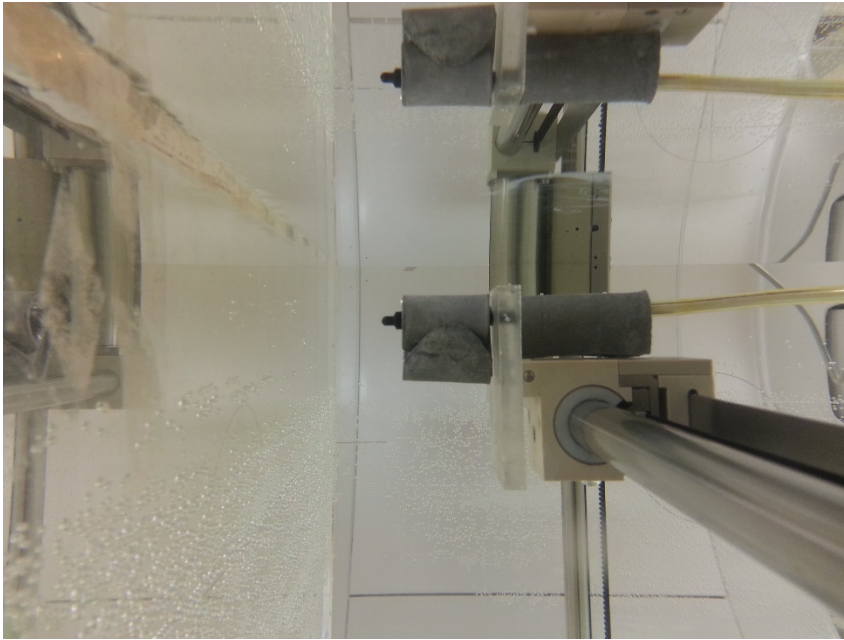
- Electrons brought to rest within collecting wire
- Generate a constant offset in charge for a given irradiation
- Can be averaged out by collecting at both polarities



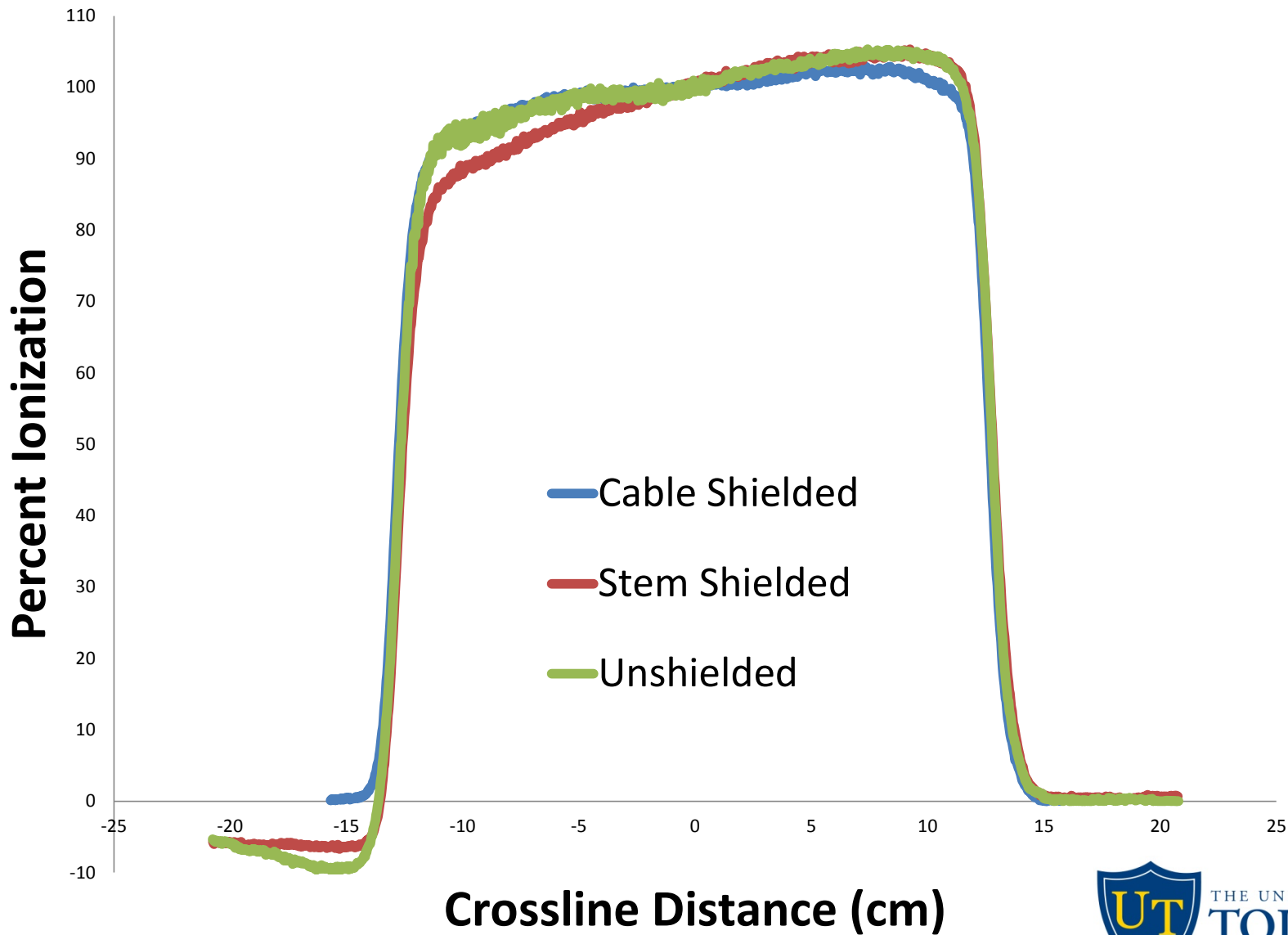
Changes with Polarity



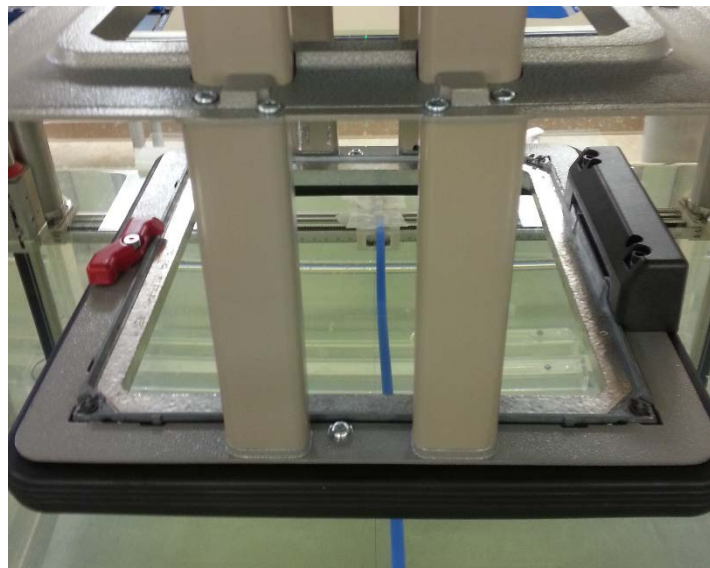
Measurements with Stem and Cable Shielded



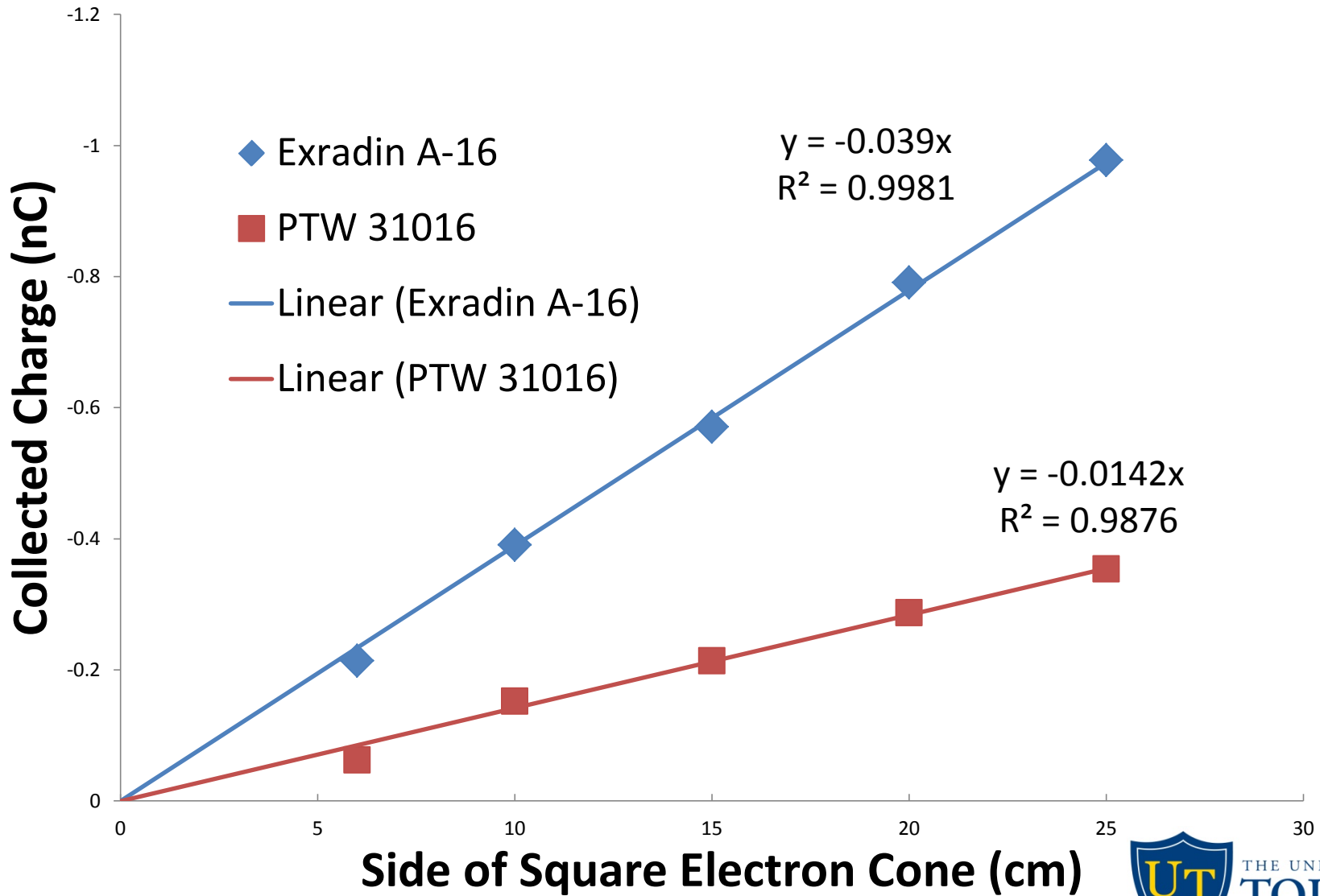
Effects of Shielding Stem and Cable



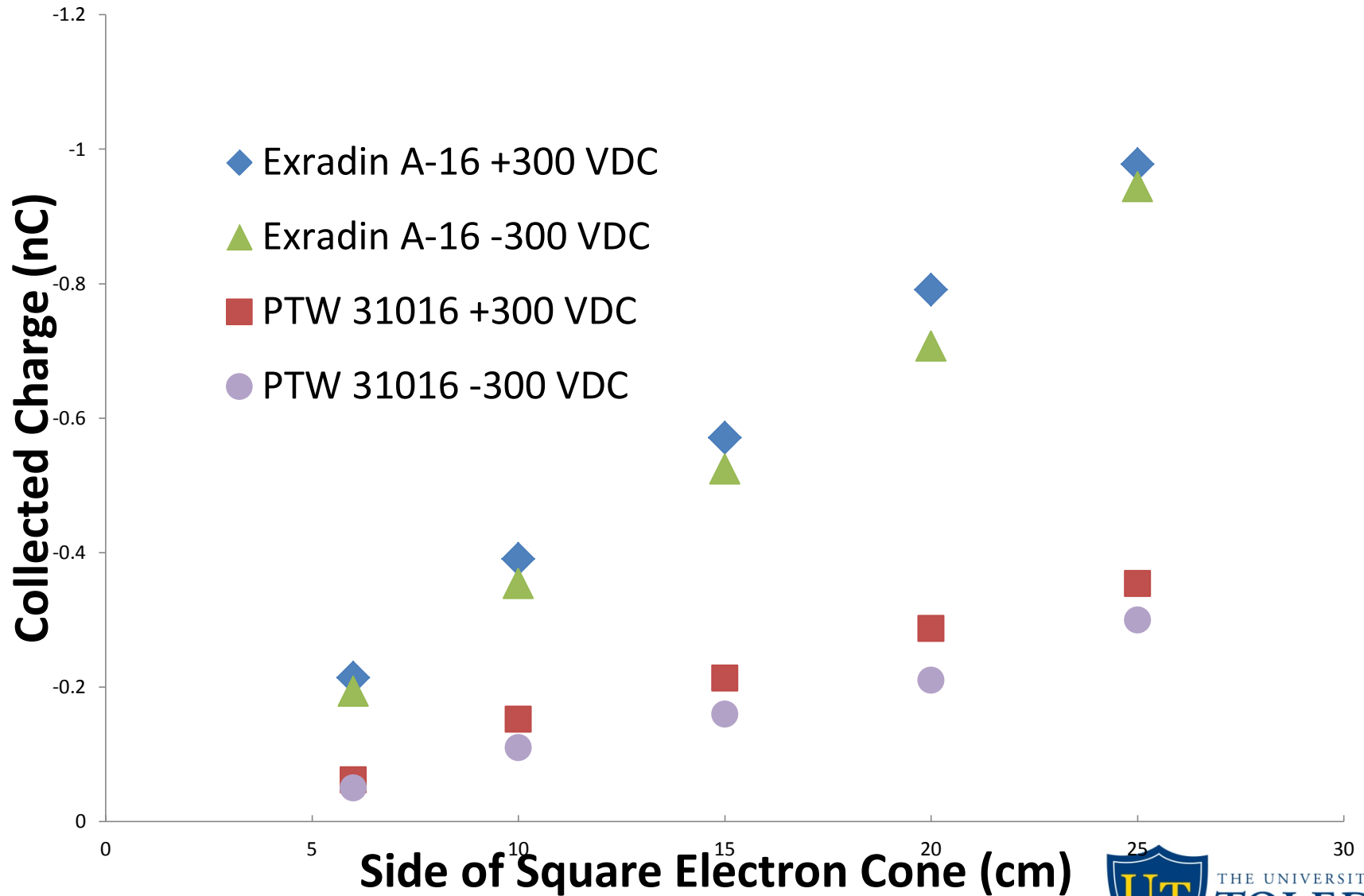
Cable Only Irradiation Setup



Comparison of Cable-only Irradiation



Polarity Comparison of Cable Irradiation



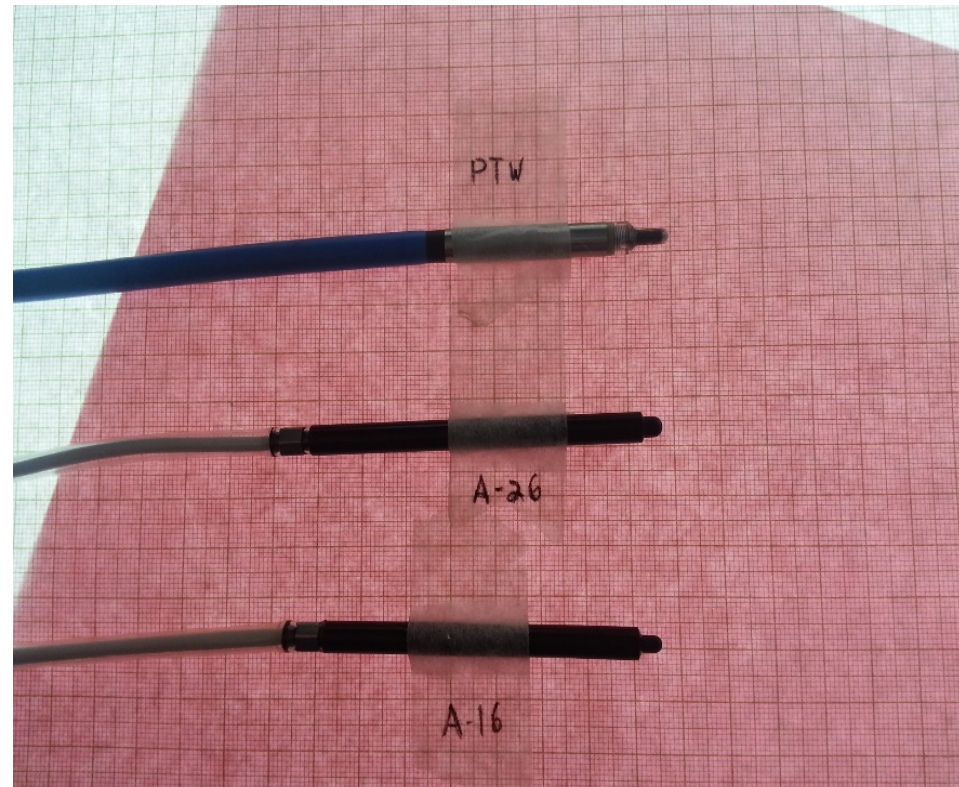
Possible Influences

- Waterproofing sleeve Composition
- Cable Rigidity
- Stem length
- Stem Composition
- Probably not from tri-axial cable itself

	Exradin A-16	Exradin A-26	PTW 31016
Sensitive Volume	0.007 cc	0.015 cc	0.016 cc
Waterproofing Material	PVC	PVC	
Waterproofing Density	1.3 g/cc	1.3 g/cc	
Stem Length	7.5 cm	8 cm	4 cm

Conclusions

- Care always needs to be taken when using small-volume chambers for clinical measurements
- Stem effects particular to charged particles may play a role in electron output factor measurements if polarity effects aren't properly accounted for
- Majority of previously reported polarity effects likely derive from stem and cable charge deposition



Acknowledgements

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