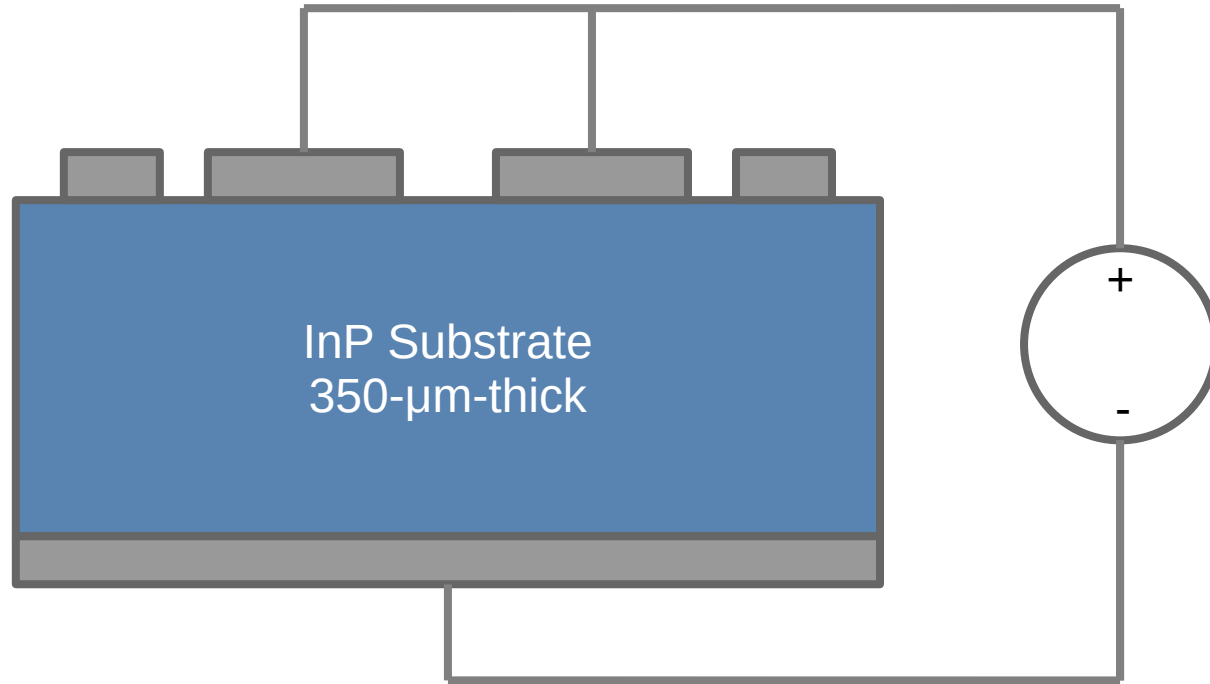


InP TCAD Characterization Progress

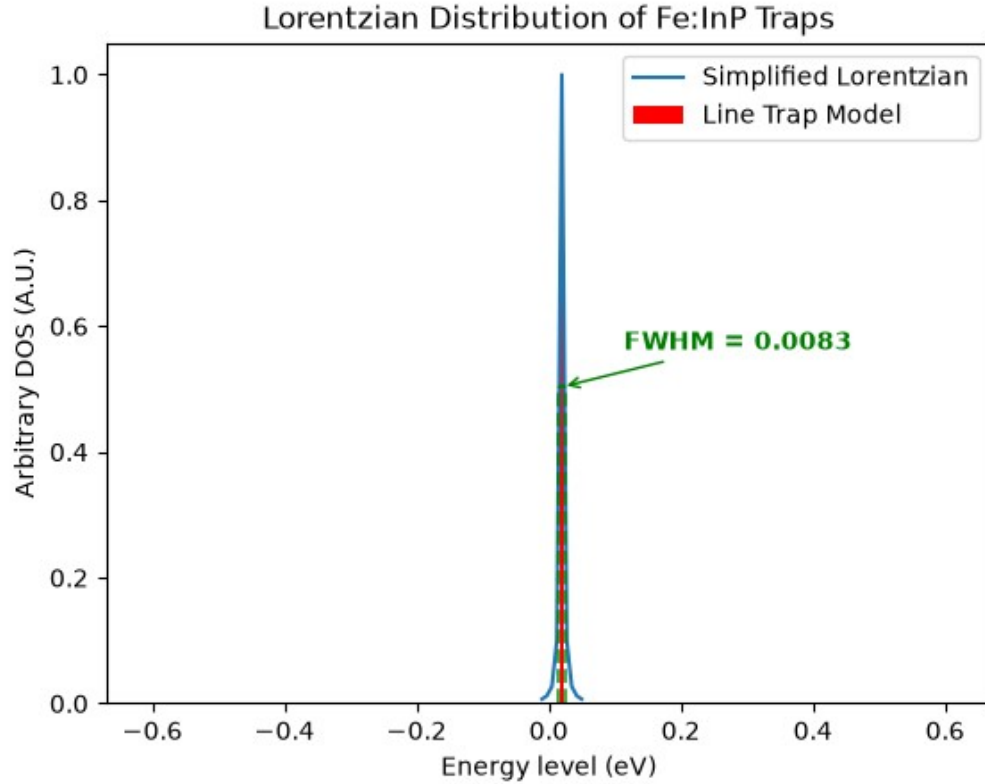
Oct. 9th 2026

Taylor Shin

Simulation Overview

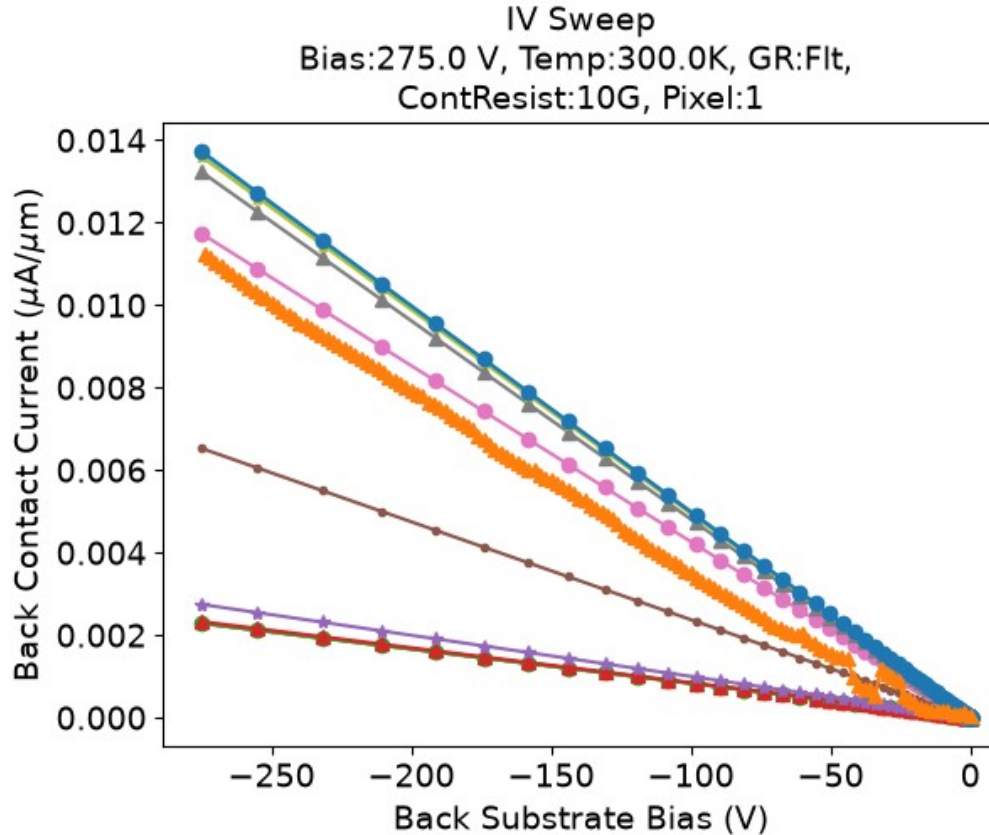


A few changes made so far



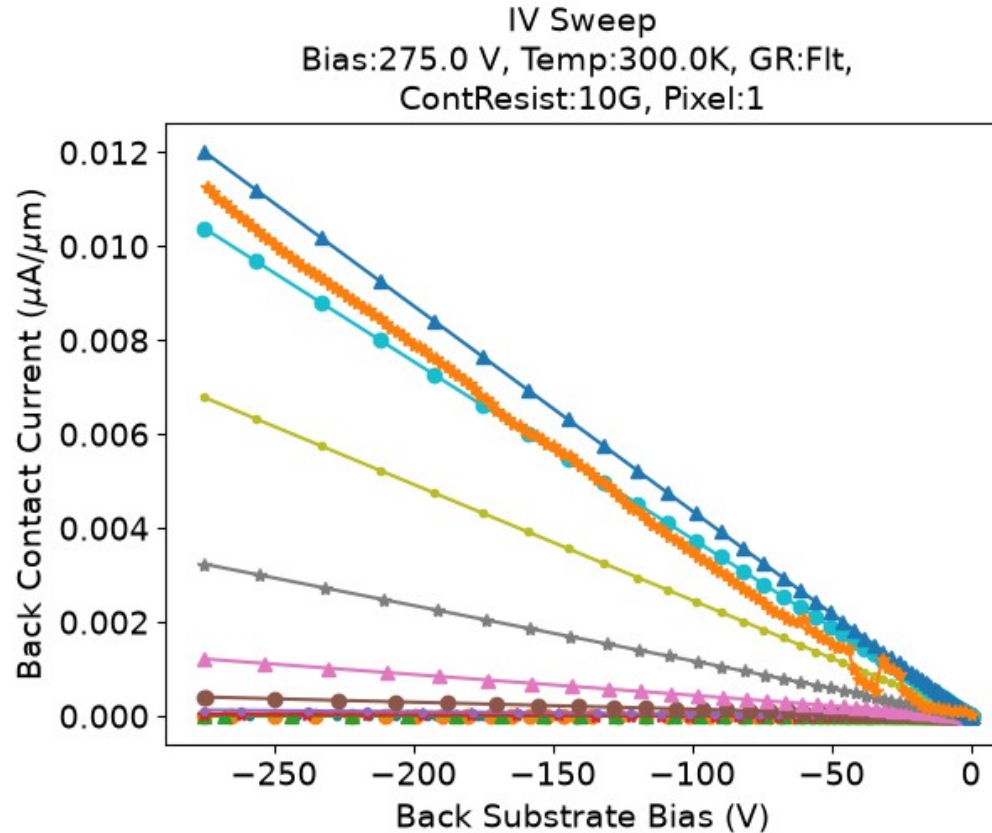
- Distributed Resistance $\rightarrow$ Lumped Resistance: Sheet Resistance at the contact now just Resistance.
 - Easier to make comparison to possible contact resistance measurement.
 - Now the contact resistance is simple 'resistance(Ω)'
- Conduction/Valence Band carrier occupancy change $\rightarrow$ Effective mass affected (N_{c300}/N_{v300})
 - N_{c300} : $5.66e17 \rightarrow 1.1e14$ [$/cm^3$]
 - N_{v300} : $2.03e19 \rightarrow 2.2e15$ [$/cm^3$]
- Trap Model change
 - Line based to Lorentzian based profile.
 - Trap profile has Γ of 0.005 eV.

Nc300/Nv300 (Default)



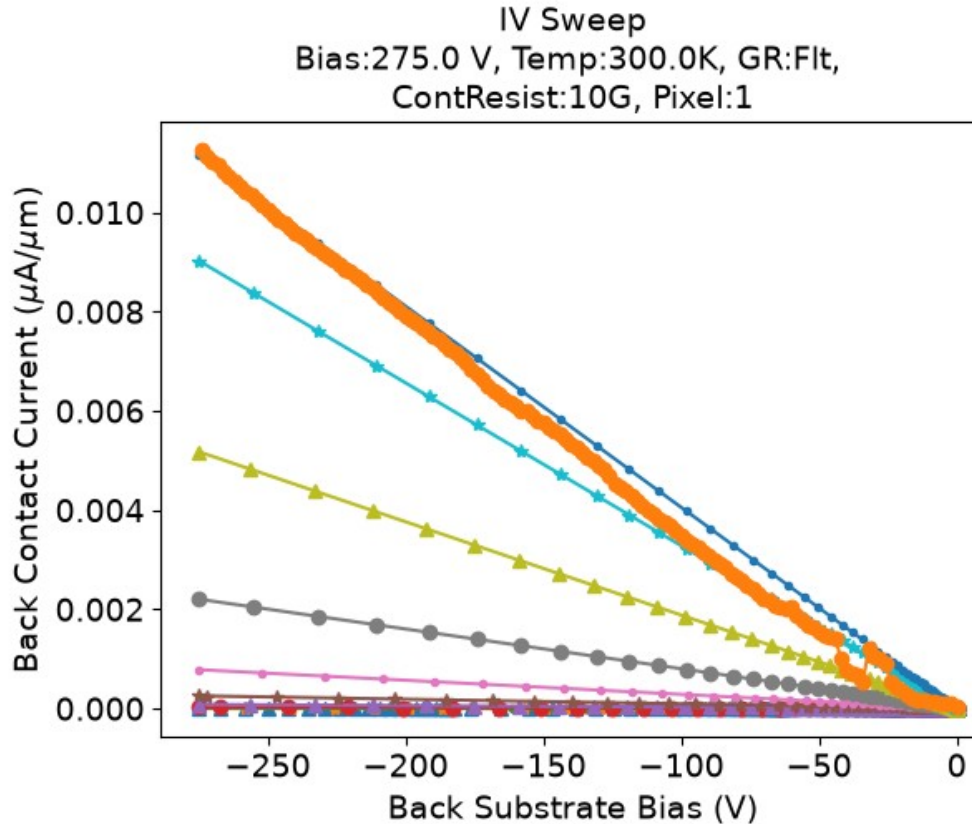
- Trap: $1.00\text{E}+03$ /cm³
- Trap: $1.00\text{E}+04$ /cm³
- Trap: $1.00\text{E}+05$ /cm³
- Trap: $1.00\text{E}+06$ /cm³
- Trap: $1.00\text{E}+07$ /cm³
- Trap: $1.00\text{E}+08$ /cm³
- Trap: $1.00\text{E}+09$ /cm³
- Trap: $1.00\text{E}+10$ /cm³
- Trap: $1.00\text{E}+11$ /cm³
- Trap: $1.00\text{E}+12$ /cm³
- Trap: $5.00\text{E}+12$ /cm³
- InP_singlePad_A42NH_25C_posV_275V.csv (Normalized)

Nc300/Nv300 (Reduced+Line)



- Trap: $1.00\text{E}+03$ /cm³
- Trap: $1.00\text{E}+04$ /cm³
- Trap: $1.00\text{E}+05$ /cm³
- Trap: $1.00\text{E}+06$ /cm³
- Trap: $1.00\text{E}+07$ /cm³
- Trap: $1.00\text{E}+08$ /cm³
- Trap: $1.00\text{E}+09$ /cm³
- Trap: $1.00\text{E}+10$ /cm³
- Trap: $1.00\text{E}+11$ /cm³
- Trap: $1.00\text{E}+12$ /cm³
- Trap: $5.00\text{E}+12$ /cm³
- InP_singlePad_A42NH_25C_posV_275V.csv (Normalized)

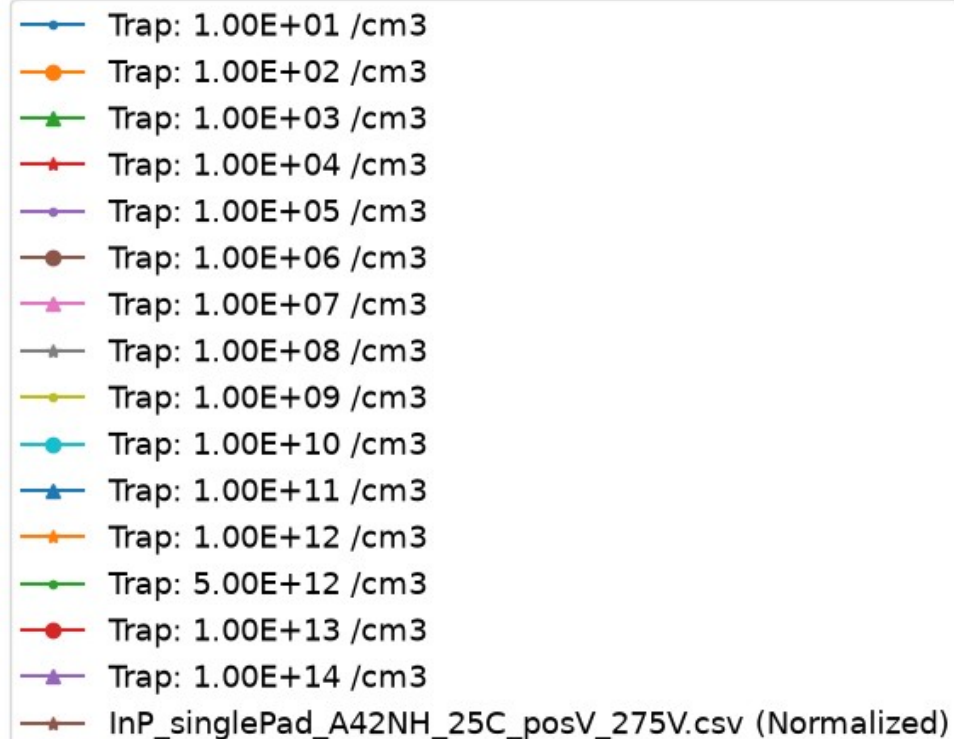
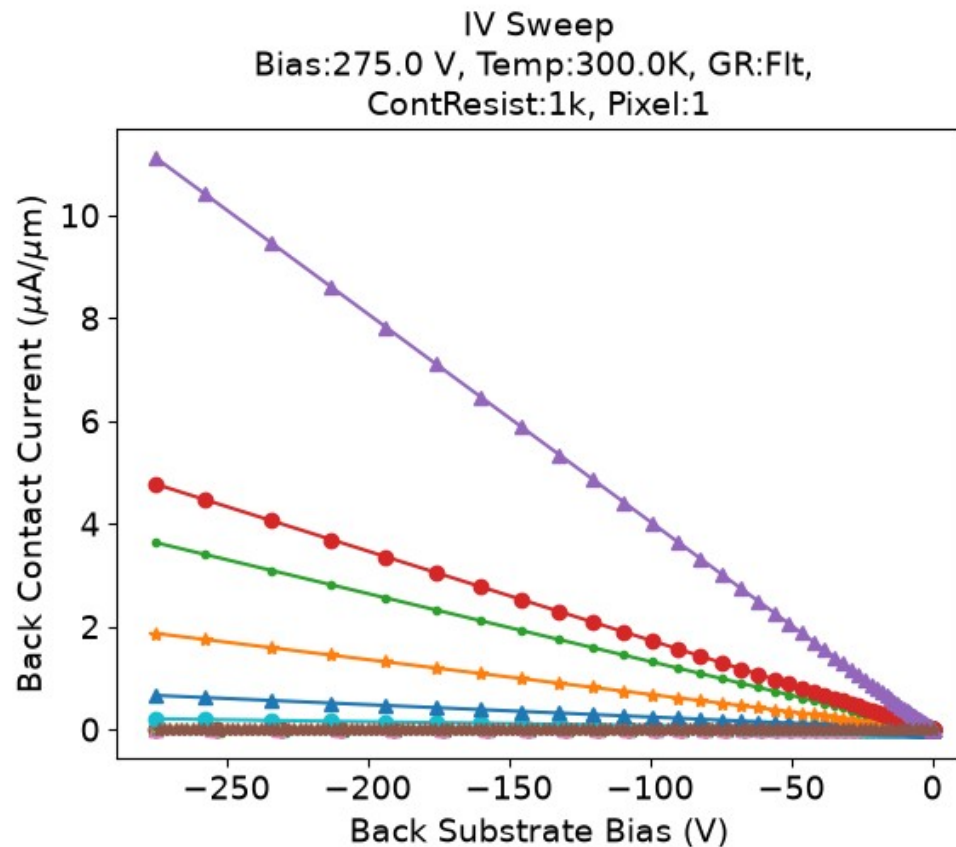
Nc300/Nv300 (Reduced+Lorentzian)



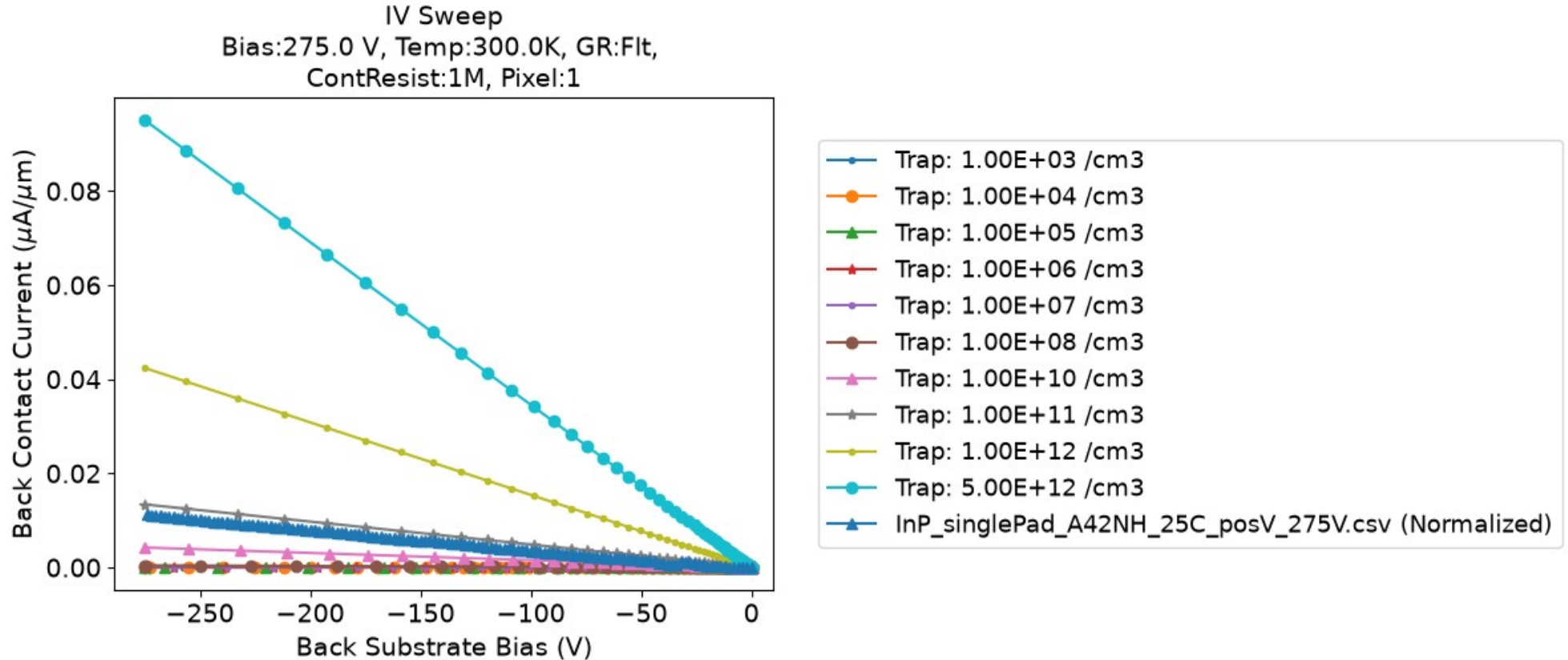
- Trap: $1.00\text{E}+03$ /cm³
- Trap: $1.00\text{E}+04$ /cm³
- Trap: $1.00\text{E}+05$ /cm³
- Trap: $1.00\text{E}+06$ /cm³
- Trap: $1.00\text{E}+07$ /cm³
- Trap: $1.00\text{E}+08$ /cm³
- Trap: $1.00\text{E}+09$ /cm³
- Trap: $1.00\text{E}+10$ /cm³
- Trap: $1.00\text{E}+11$ /cm³
- Trap: $1.00\text{E}+12$ /cm³
- Trap: $5.00\text{E}+12$ /cm³
- InP_singlePad_A42NH_25C_posV_275V.csv (Normalized)

Contact Resistance Sweep (Line Trap vs. Lorentzian Trap)

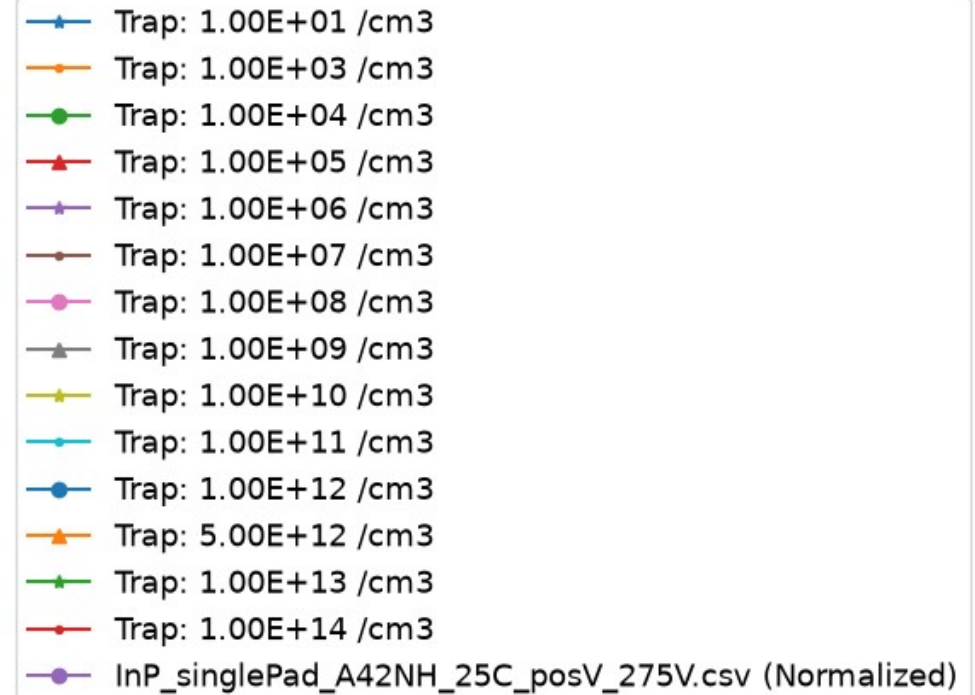
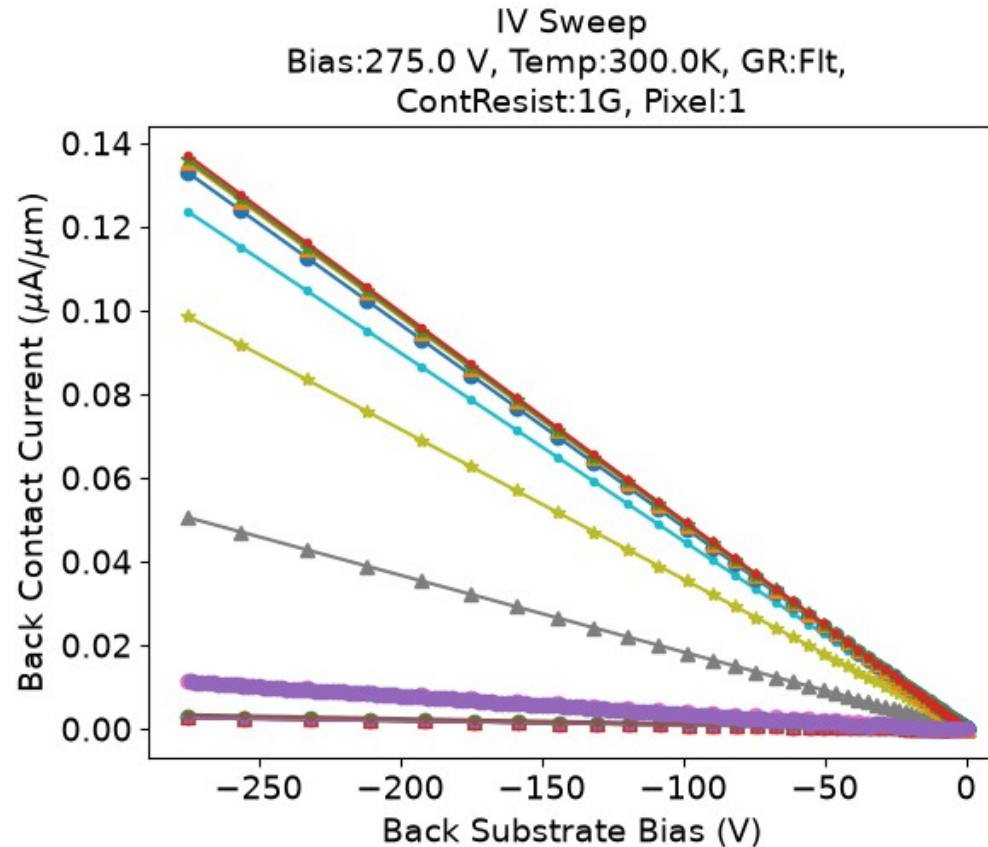
Cont. Res. @ 1k (Line)



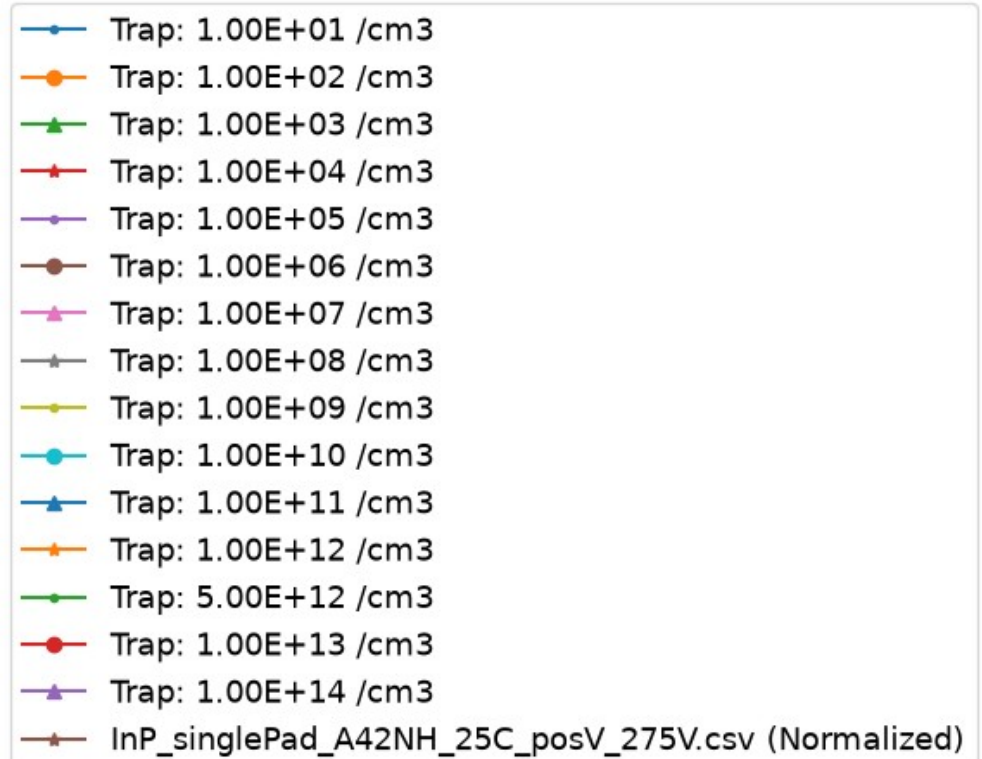
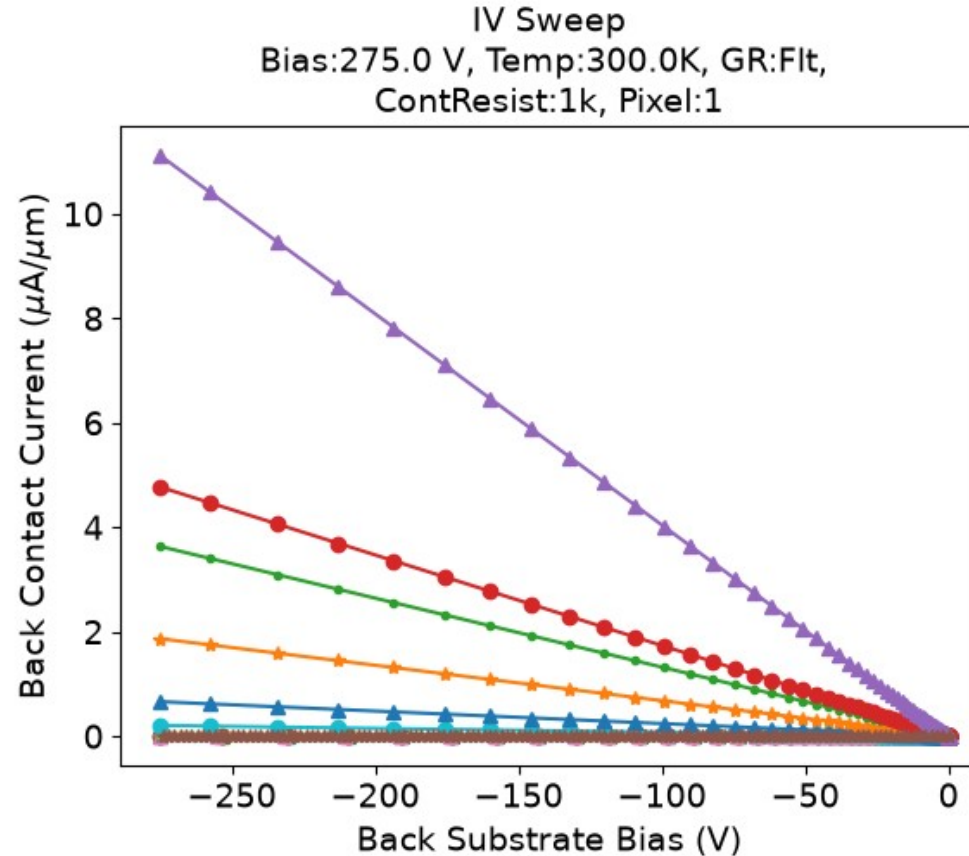
Cont. Res. @ 1MEG (Line)



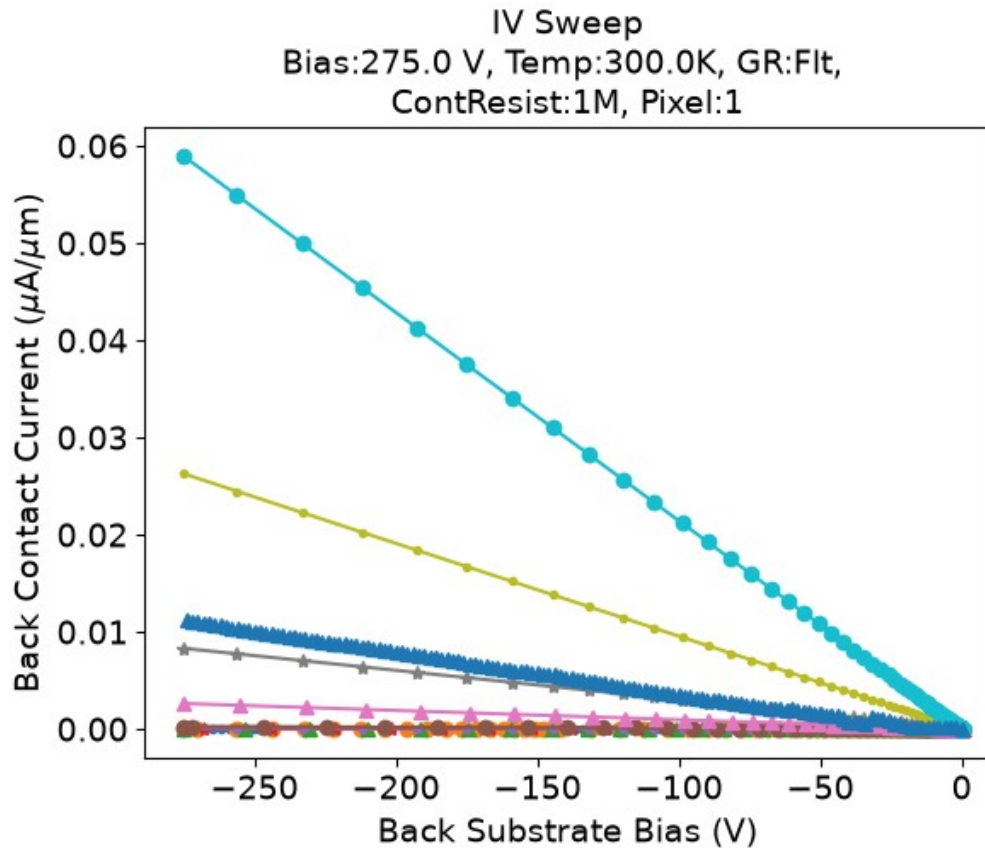
Cont. Res. @ 1G (Line)



Cont. Res. @ 1k (Lorentz)

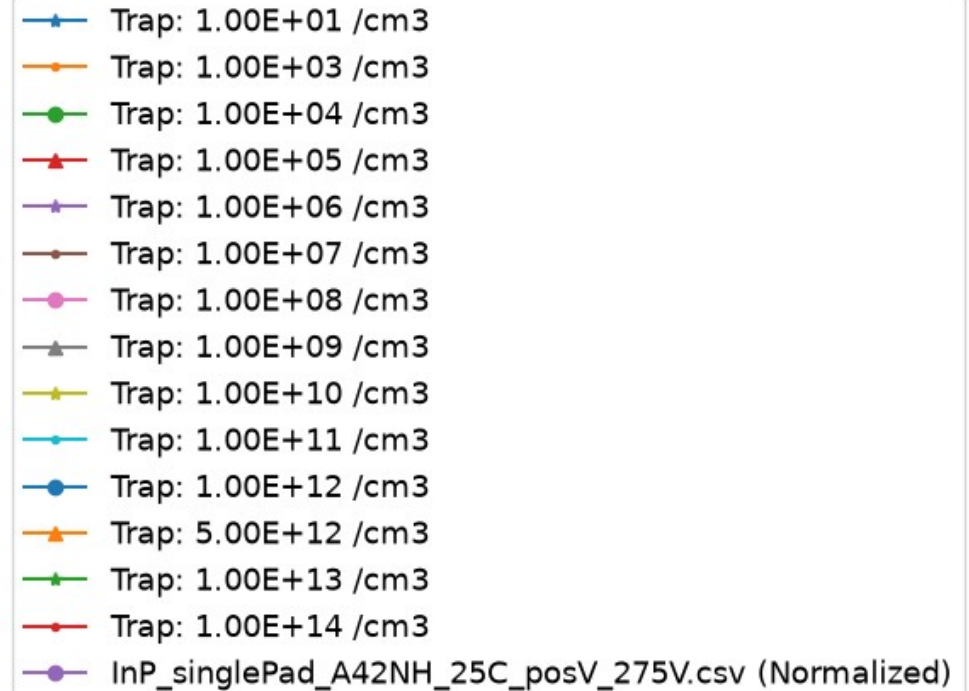
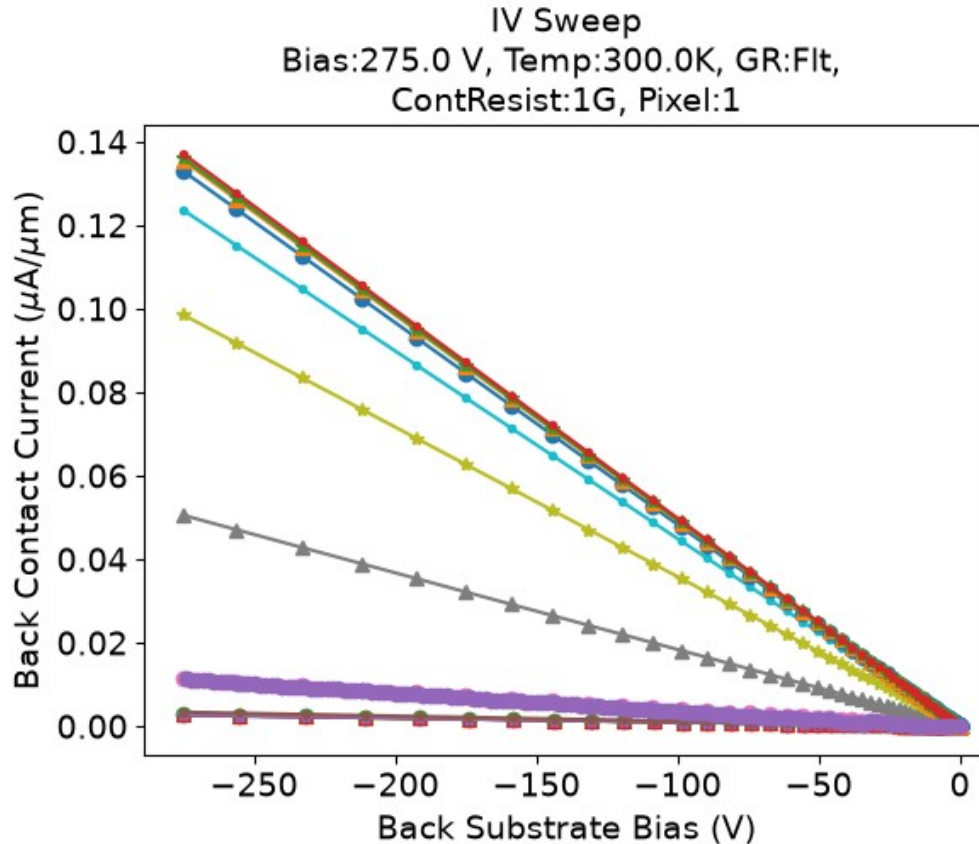


Cont. Res. @ 1MEG (Lorentz)



- Trap: $1.00\text{E}+03 / \text{cm}^3$
- Trap: $1.00\text{E}+04 / \text{cm}^3$
- Trap: $1.00\text{E}+05 / \text{cm}^3$
- Trap: $1.00\text{E}+06 / \text{cm}^3$
- Trap: $1.00\text{E}+07 / \text{cm}^3$
- Trap: $1.00\text{E}+08 / \text{cm}^3$
- Trap: $1.00\text{E}+10 / \text{cm}^3$
- Trap: $1.00\text{E}+11 / \text{cm}^3$
- Trap: $1.00\text{E}+12 / \text{cm}^3$
- Trap: $5.00\text{E}+12 / \text{cm}^3$
- InP_singlePad_A42NH_25C_posV_275V.csv (Normalized)

Cont. Res. @ 1G (Lorentz)



Cont. R vs. Traps: Experimental IV

Cont. Resistance (Ω)	Trap Density (Line) [/cm ³]	Trap Density (Lorentz) [/cm ³]	Default Value → Need re-capture
1k	1e7*	1e7*	...
1MEG	< 1e11	> 1e11	...
1G	1e8	1e8	...
10G	1e12	5e12	...

* Simulation does not consider carrier/trap density less than 1e6.

Conclusions

- The contact resistance metric for Cr contacts are migrated to simple lumped resistance.
- The migrated resistances show the match at 10G of contact resistance each side @ Traps of $1e12 / \text{cm}^3$.
- Changing the trap state model to Lorentzian pushes the 'trap induced(?)' current a bit lower despite more trap states introduced.
 - The 1G Results needs some internal review. It could be scripting bug.
- The temperature dependence issue is still unsolved. Fiddling with 'Thermodynamic' simulation parameters.