Motivation for fast electron transport

- Observed emission spectrum

$$Y = (1 - R)\frac{\tau_1}{\tau_1 + \tau_{em}}\alpha d$$

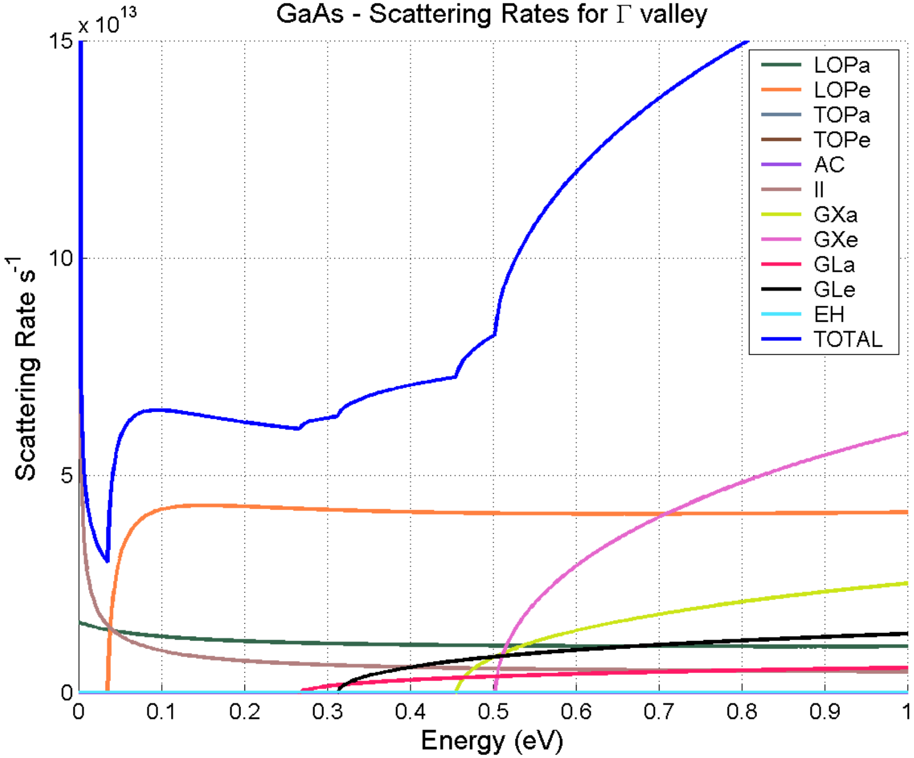
- Emitted electron polarization

$$P = P_0\left(1 - \frac{d}{S_0 \tau_S}\right)\frac{\tau_{S1}}{\tau_{S1} + \tau_{em}}$$

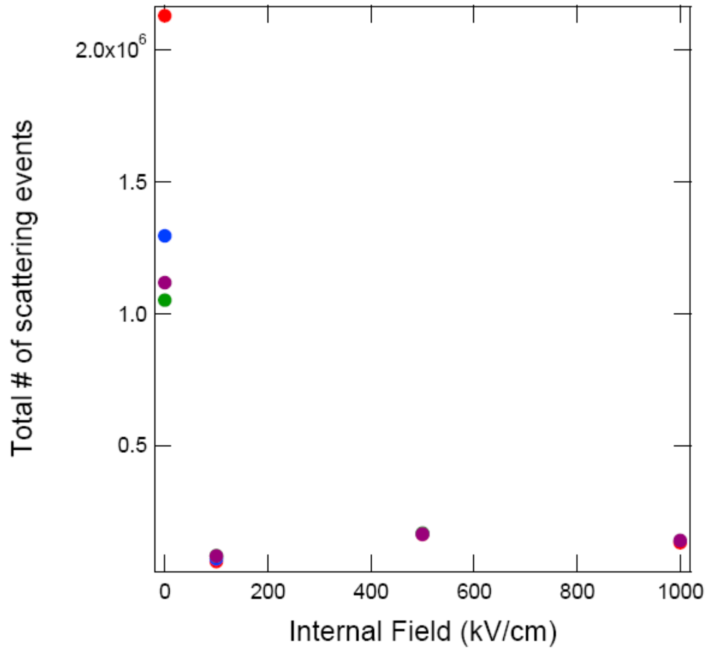
α: optical absorption
R: reflection coefficient
τ_1: electron lifetime in BBR
τ_{em}: time of electron emission in vacuum
P_0: initial electron polarization upon excitation with circularly polarized light
S_0: surface recombination velocity
τ_S : spin relaxation time in SL
τ_{S1} : spin relaxation time in BBR

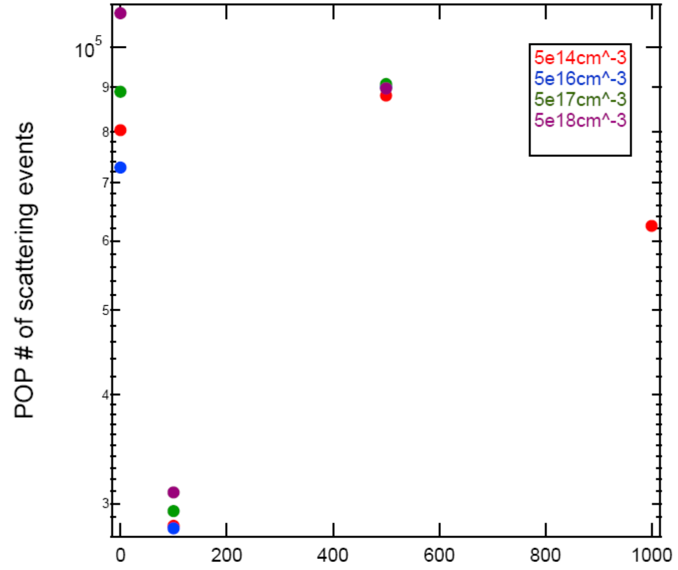
A. Subashiev et. al. SLAC-PUB 10901

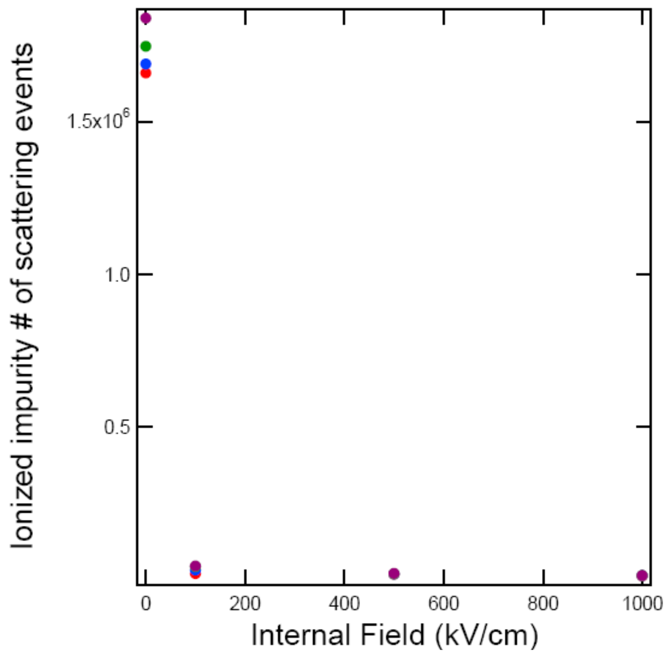
Scattering rates



Scattering statistics



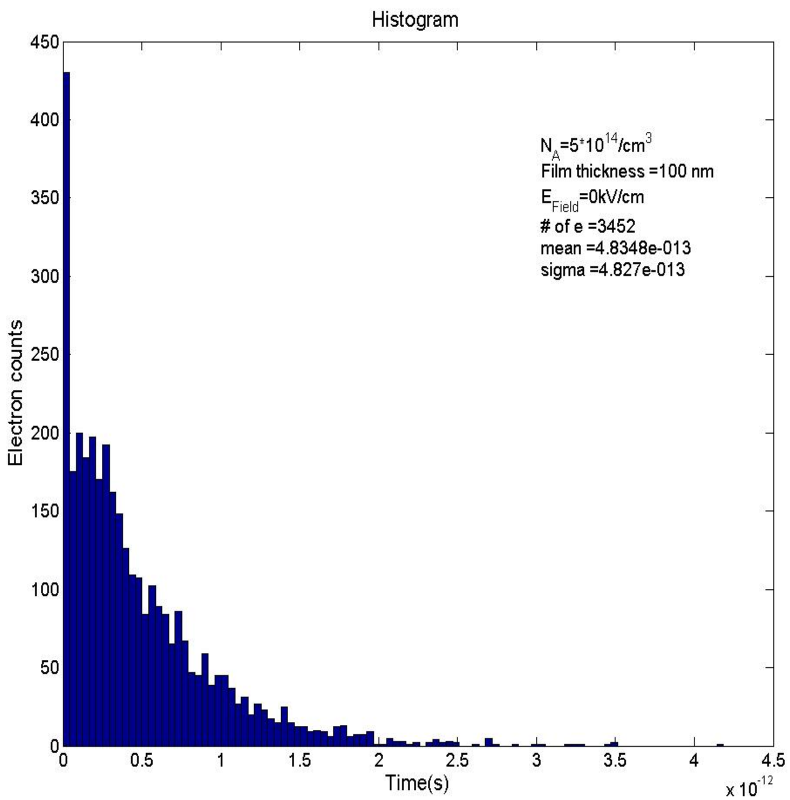


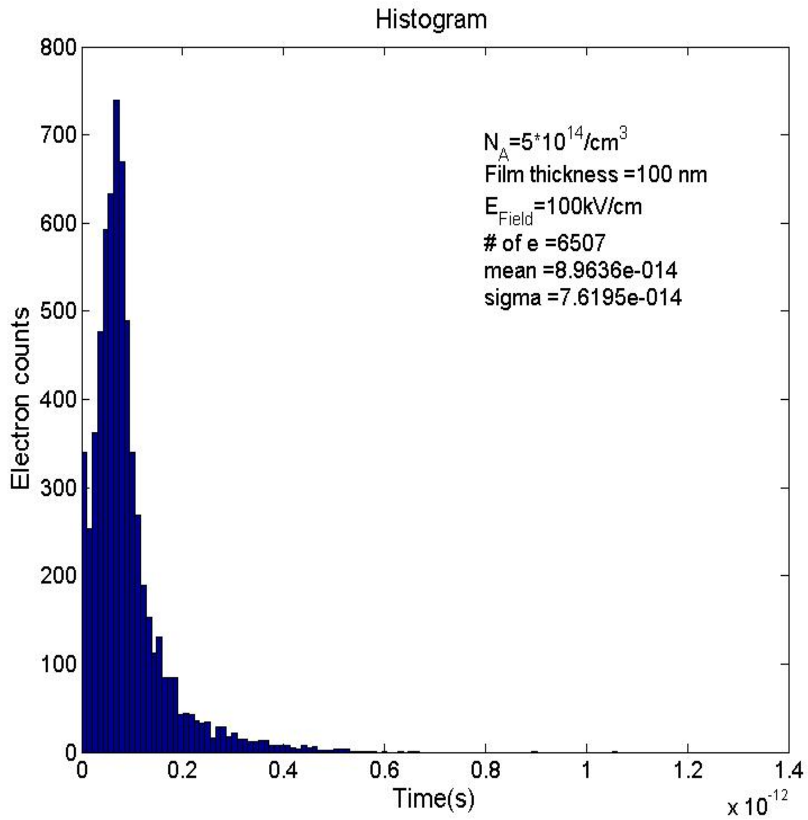


10,000 electrons photogenerated in the active region

Monte Carlo simulations-transit time

Transit time decreases by an order of magnitude with field
Scattering events decrease-no electron hole scattering when the active region is depleted





Conclusions and current work

- Simulations show an optimum field vs doping design for the cathode
- All scattering events decrease for an optimum field value
- After that field level the transit time does not decrease much