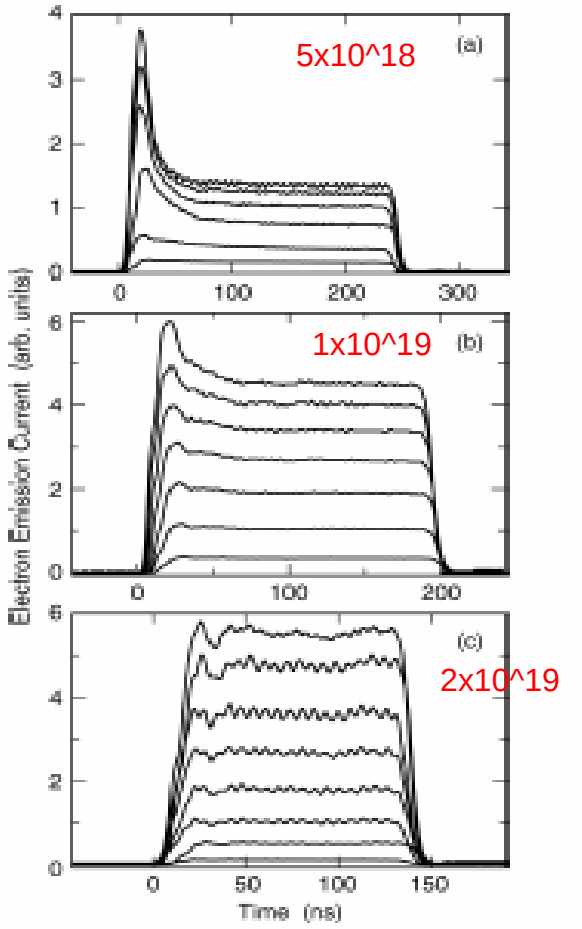
Surface Charge Limit in 40 ps Extraction

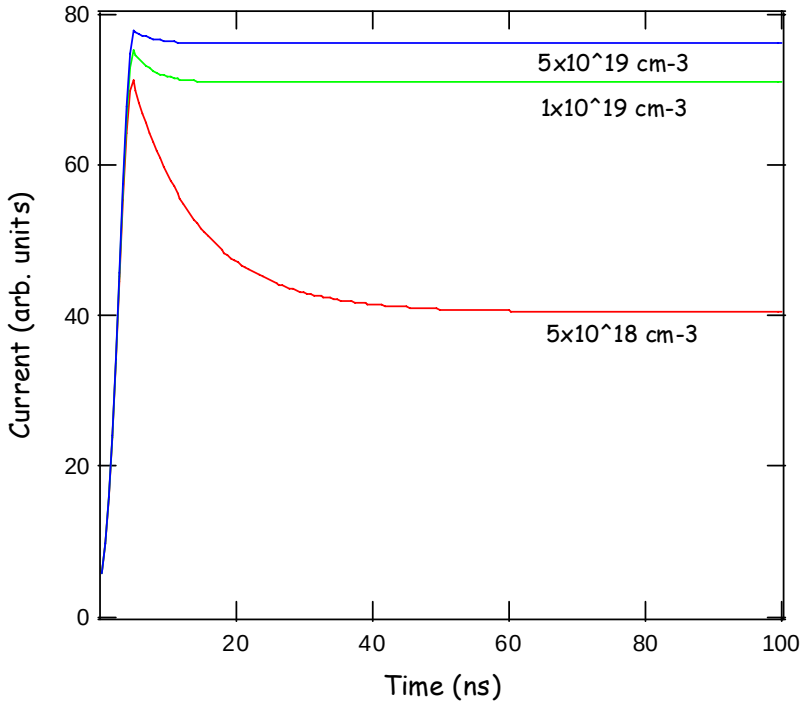
- The surface charge limit can be very serious in polarized RF gun.
- We measured the surface charge limit as a function of doping level - Phys. Lett. A282, 309 (2001)
- The photovoltage decay time has a strong dependence on the doping level.
  - τ < 4 ns at 5x10^19 cm-3
- τ < 4 ns is not good enough to make predictions for 40 ps.
- Wrote a simulation program.
  - Based on Herrera-Gomez-Spicer model.
  - Tunneling current based on metal-semiconductor junction

Long pulse extraction

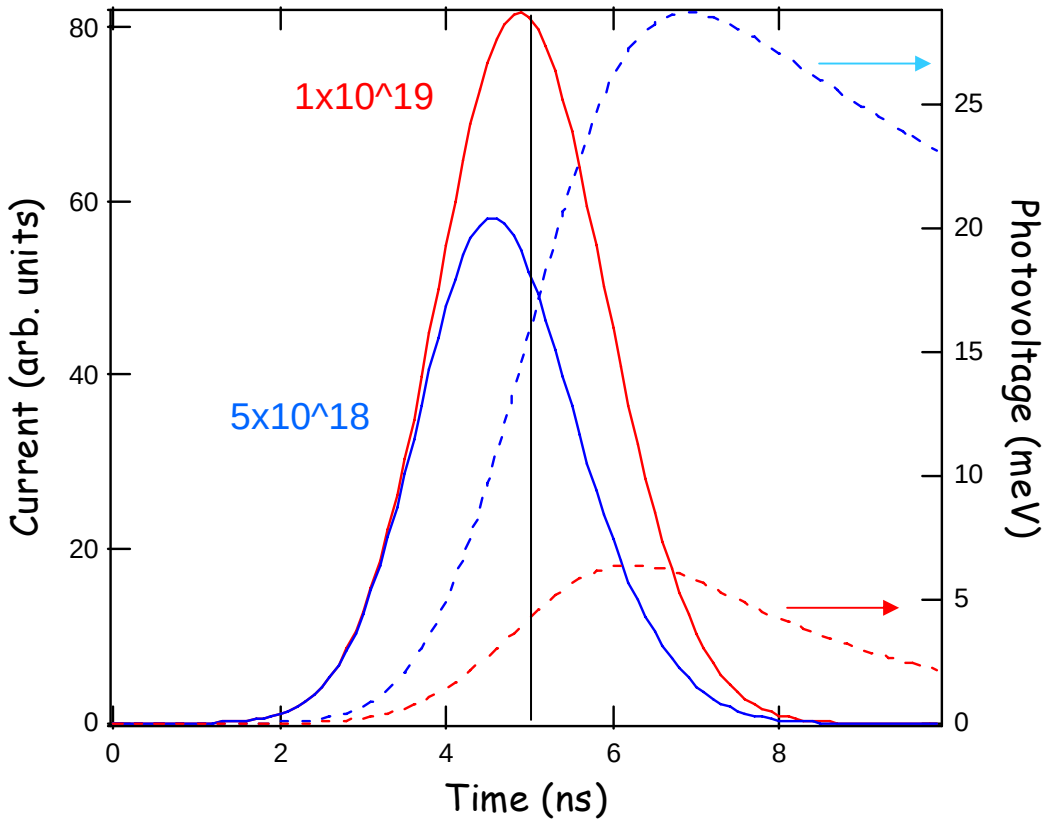
Data



Simulation

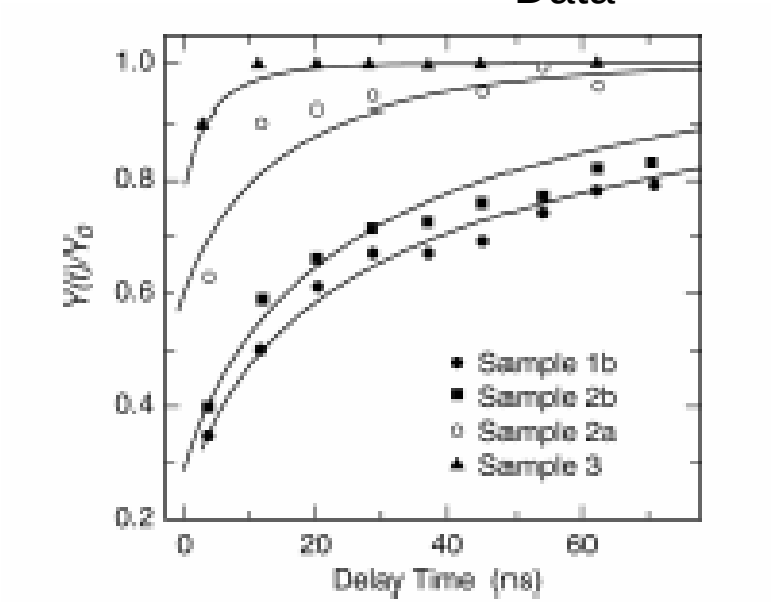


2 ns pulse


1x10^19
5x10^18
Current (arb. units)
Photovoltage (meV)
Time (ns)
0
20
40
60
80
0
5
10
15
20
25
0
2
4
6
8

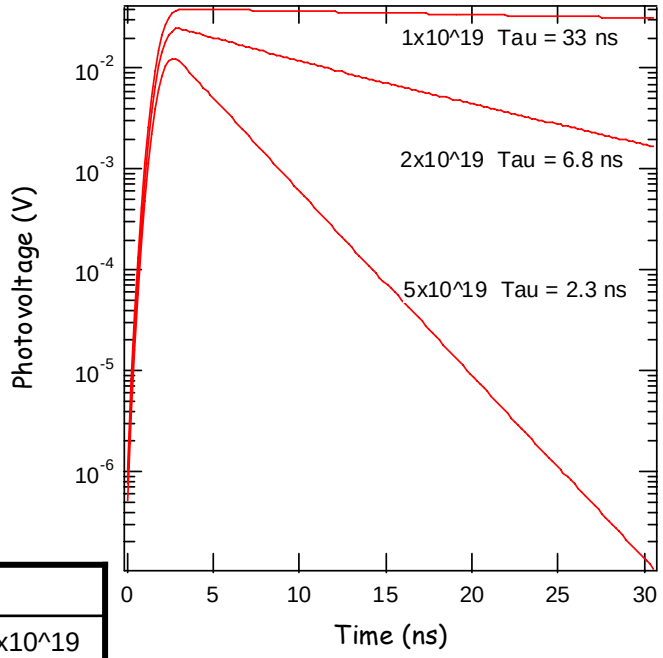
Pump Probe

Data



Photovoltage decay time

Simulation



	1a	1b	2a	2b	3	4
Doping	5x10^18	5x10^18	1x10^19	1x10^19	2x10^19	5x10^19
QE (%)	0.6	0.45	0.9	0.3	0.4	0.4
Tau (ns)	160	130	78	63	6	< 4

Conclusions

- Surface charge limit effect can be simulated.
- The simulation more or less reproduces the data.
- The simulation does not reproduce the doping level dependence of the photovoltage decay time. The doping level dependence is too small.
- Doping level dependence of the tunneling current is not quite right.