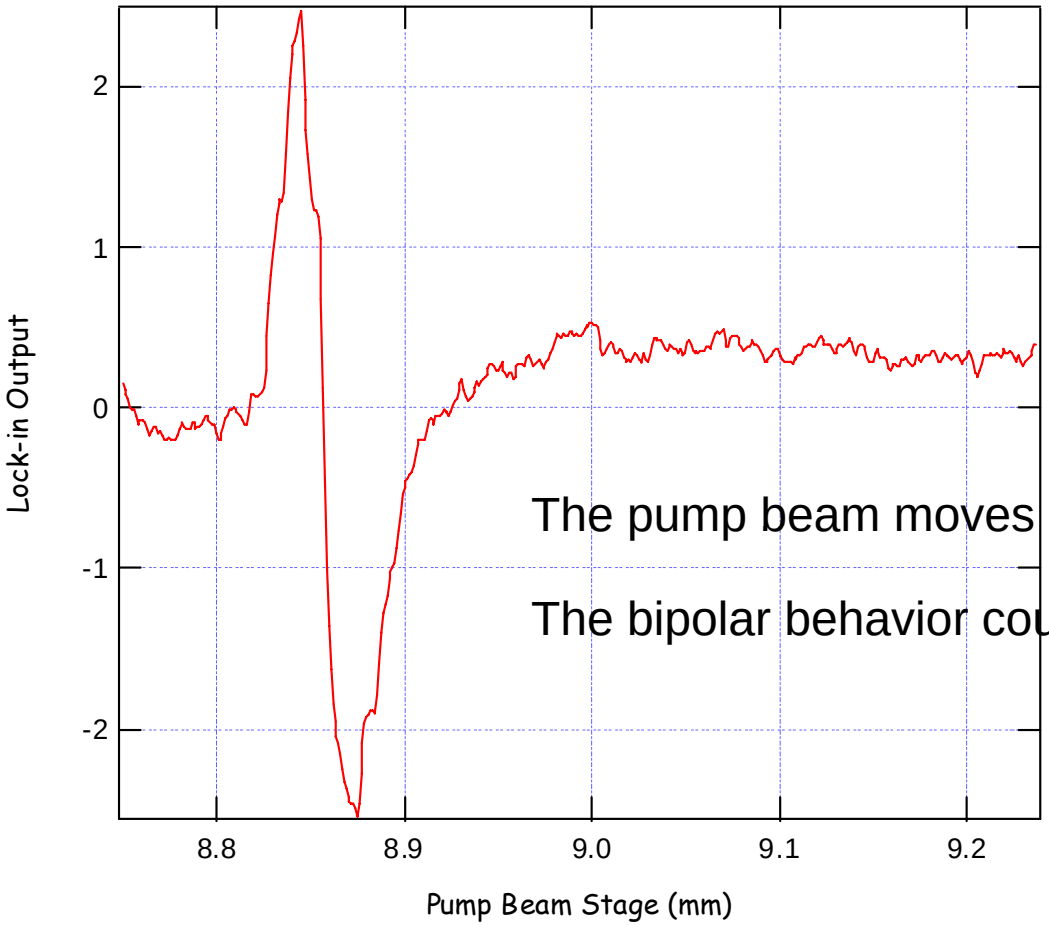
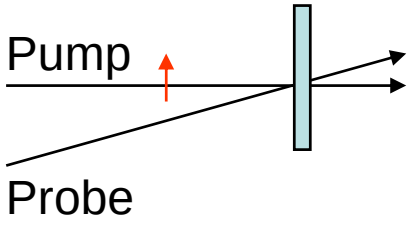
Photocathode R&D

- Faraday rotation
  - Signal still reproducible
  - Computer DAQ written
  - Ordered lapping of n-type bulk GaAs (un-doped, 6×10^{17}, 1×10^{18}) to Valley Design
  - Delay line optics need improvement
  - NEOS AOM
    - RF modulation is checked out (Prepost)

First Faraday data

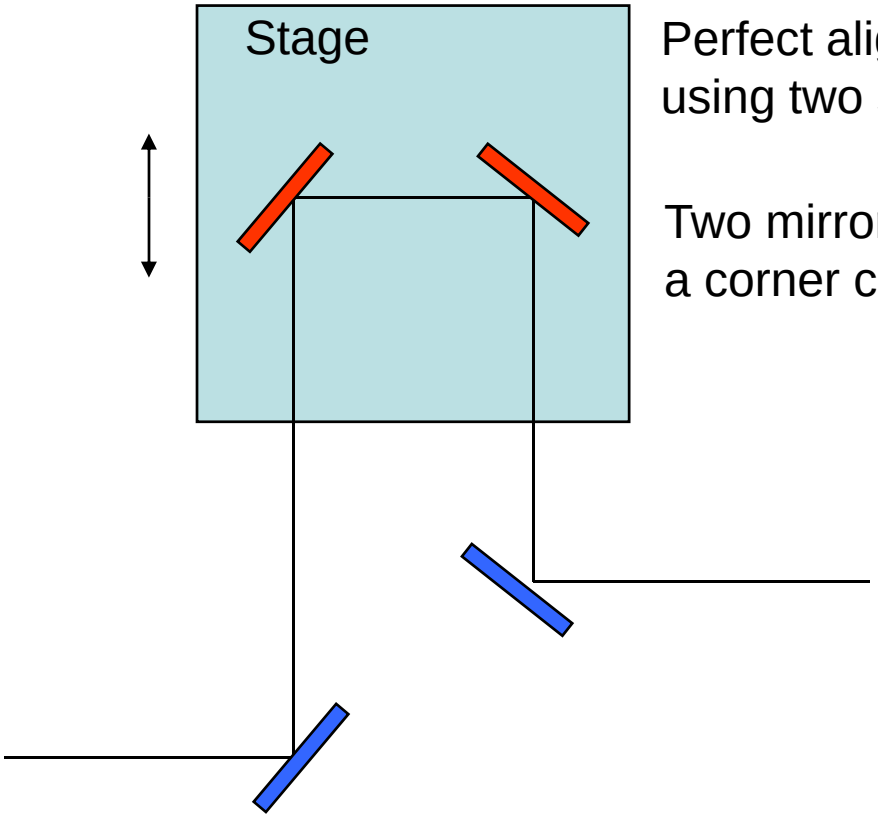




The pump beam moves as the stage is moved.

The bipolar behavior could be due to this movement.

Delay line optics



Perfect alignment is very difficult using two separate mirrors.

Two mirrors will be replaced by a corner cube retro reflector.

SBIR Phase I with SVT Associates

- Status
  - One CRADA (AlGaAsSb) has been signed, and the second CRADA will be signed shortly.
  - In the meantime, SVT has gone ahead on calibrating the growth conditions.
  - Two test samples have been grown without our input.

- $Al_xGa_{1-x}As_{1-y}Sb_y$-GaAs superlattice
  - Structurally similar to InAlGaAs-GaAs
    - Indium is replaced by Antimony

Proposal:

#	x	y	well	barrier	Bandgap	LH-HH splitting	a_w/a_b
1	0.4	0.13	1.5nm	4nm	1.63eV	49meV	1
2	0.5	0.13	1.5nm	4nm	1.72eV	62meV	
3	0.4	0.15	1.5nm	4nm	1.63eV	54meV	1.2
4	0.5	0.15	1.5nm	4nm	1.70eV	65meV	
5	0.4	0.18	1.5nm	4nm	1.63eV	58meV	1.4
6	0.5	0.18	1.5nm	4nm	1.72eV	67meV	

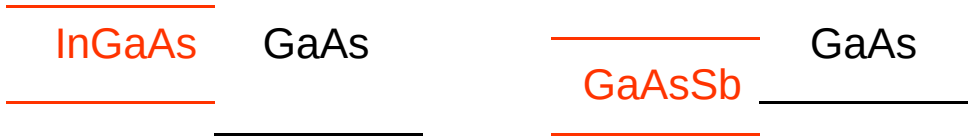
Sample #1 has been grown. QE was too small (~10^{-4}@650nm).

- Internally biased AlGaAs-GaAs superlattice

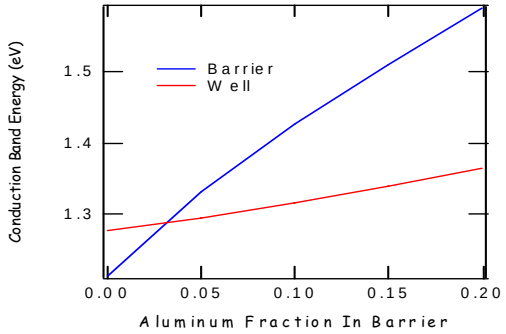
To study the graded bandgap structures we propose to begin with AlGaAs/GaAs superlattice structures with the Al concentration varying in each barrier (from 0.15 to 0.05) to provide the 0.1eV grading of the bandgap.

AlGaAsSb-GaAs superlattice

- Replacing the column III Indium with the column V Antimony has a significant effect.
  - InGaAs-GaAs is type I but GaAsSb-GaAs is type II



  - Flat conduction band requires ~3% Aluminum, but we need more than 10% Al for Eg > 1.42 eV.



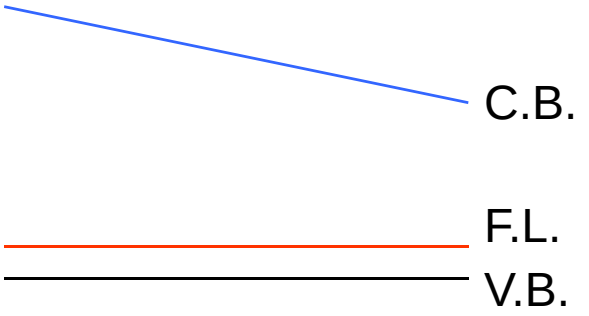
  - The electron confinement energy becomes too large for x > 0.15. The test sample had x=0.4; consistent with low QE.

$Al_xGa_{1-x}As_{1-y}Sb_y$-GaAs superlattice structures

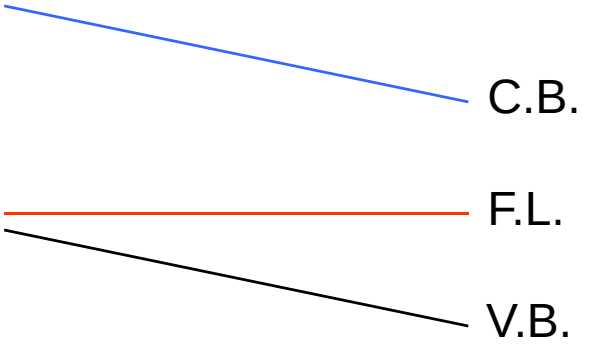
- Duplicate InAlGaAs-GaAs structures
  - Same lattice mismatch $\rightarrow$ y=0.18
  - Same barrier (4 nm) and well (1.5 nm) width
- Three Aluminum fractions
  - X=0.05, 0.10 and 0.15

Internally biased AlGaAs-GaAs

- Three structures
  - Reference $Al_{0.35}Ga_{0.65}As$ (3nm) – GaAs (2nm)
  - Aluminum graded sample
    - $Al_xGa_{1-x}As$ x=0.35 $\rightarrow$ 0.25



  - Doping graded sample
    - Doping level graded from $5\times10^{18} \rightarrow 5\times10^{17}$



Russian AlInGaAs-AlGaAs superlattice

- Four wafers (7-632, 633, 634, 635) have been grown.
  - Two wafers are duplicate of 7-307.