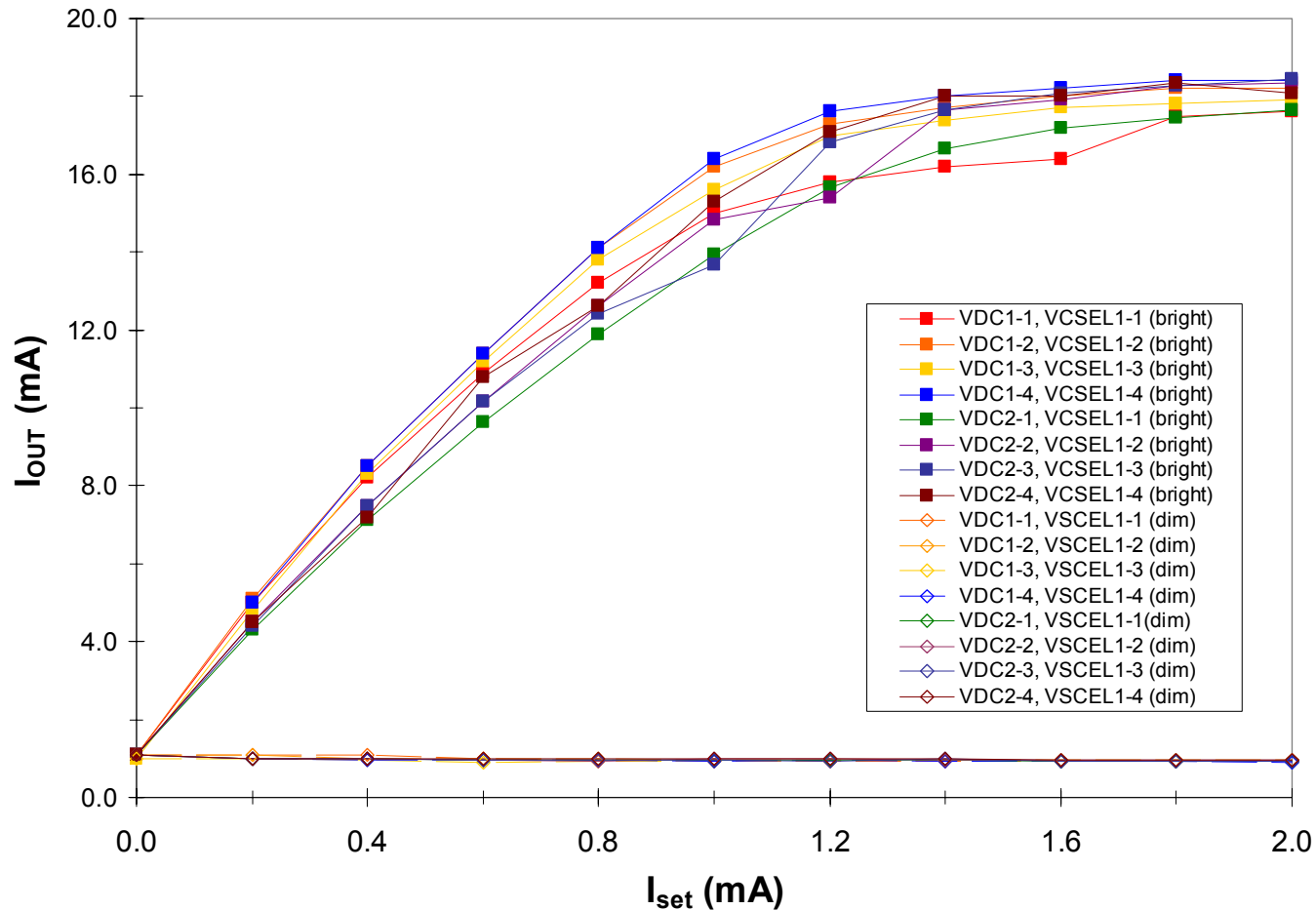
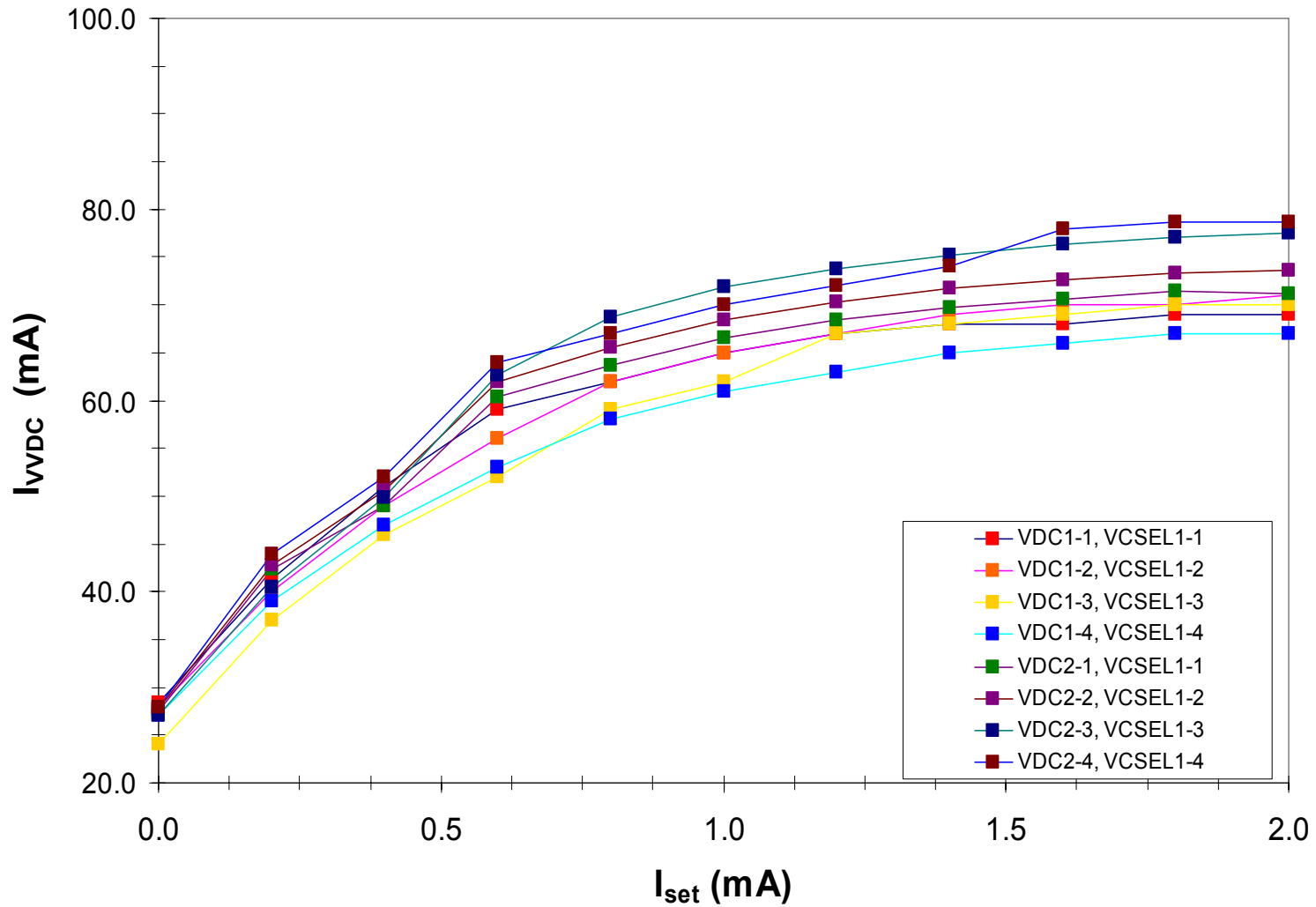


I_bright and I_dim with P+



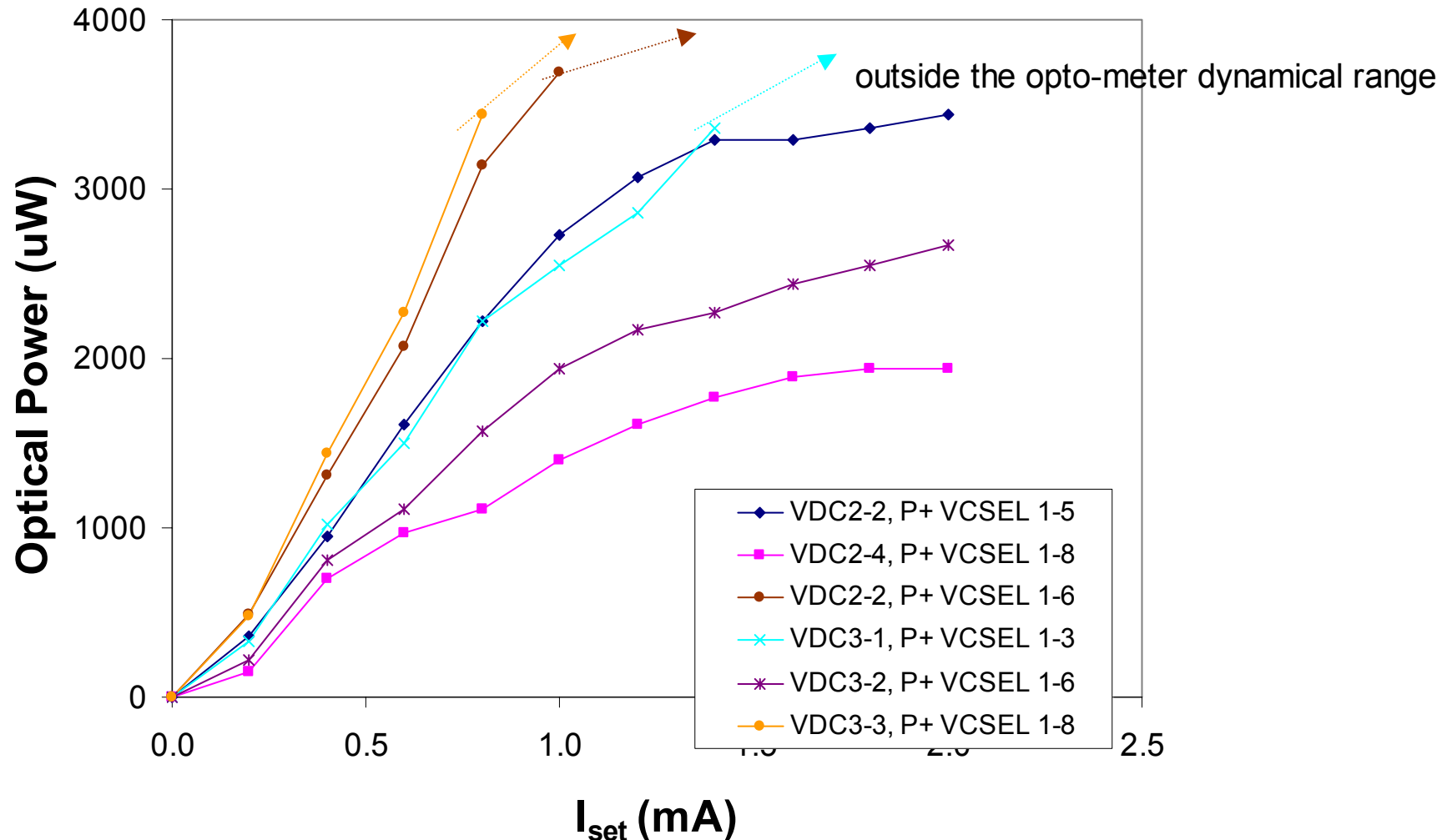
- I_{bright} was measured with VDC output at all high
- I_{dim} was measured with VDC output at all low

VDCI5 Current Consumption with P+



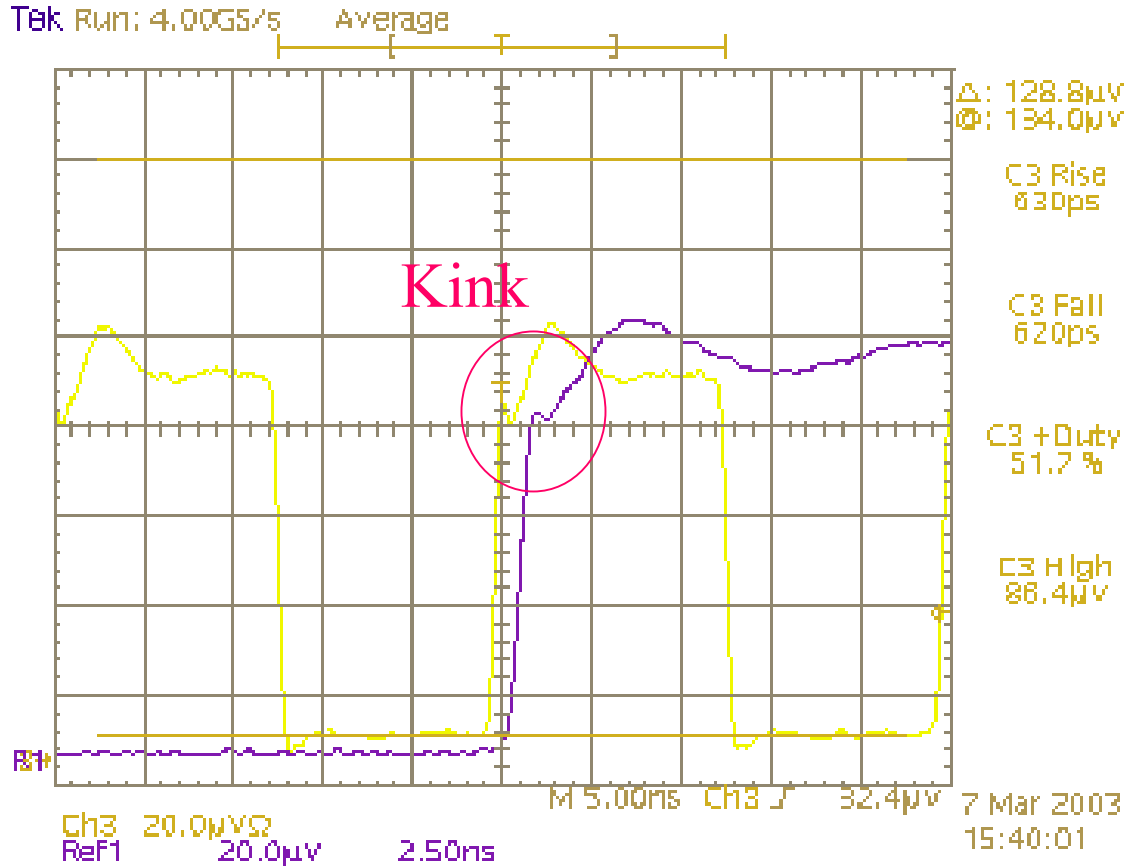
- Current consumption plateaus at about 70mA

Optical Power with P+



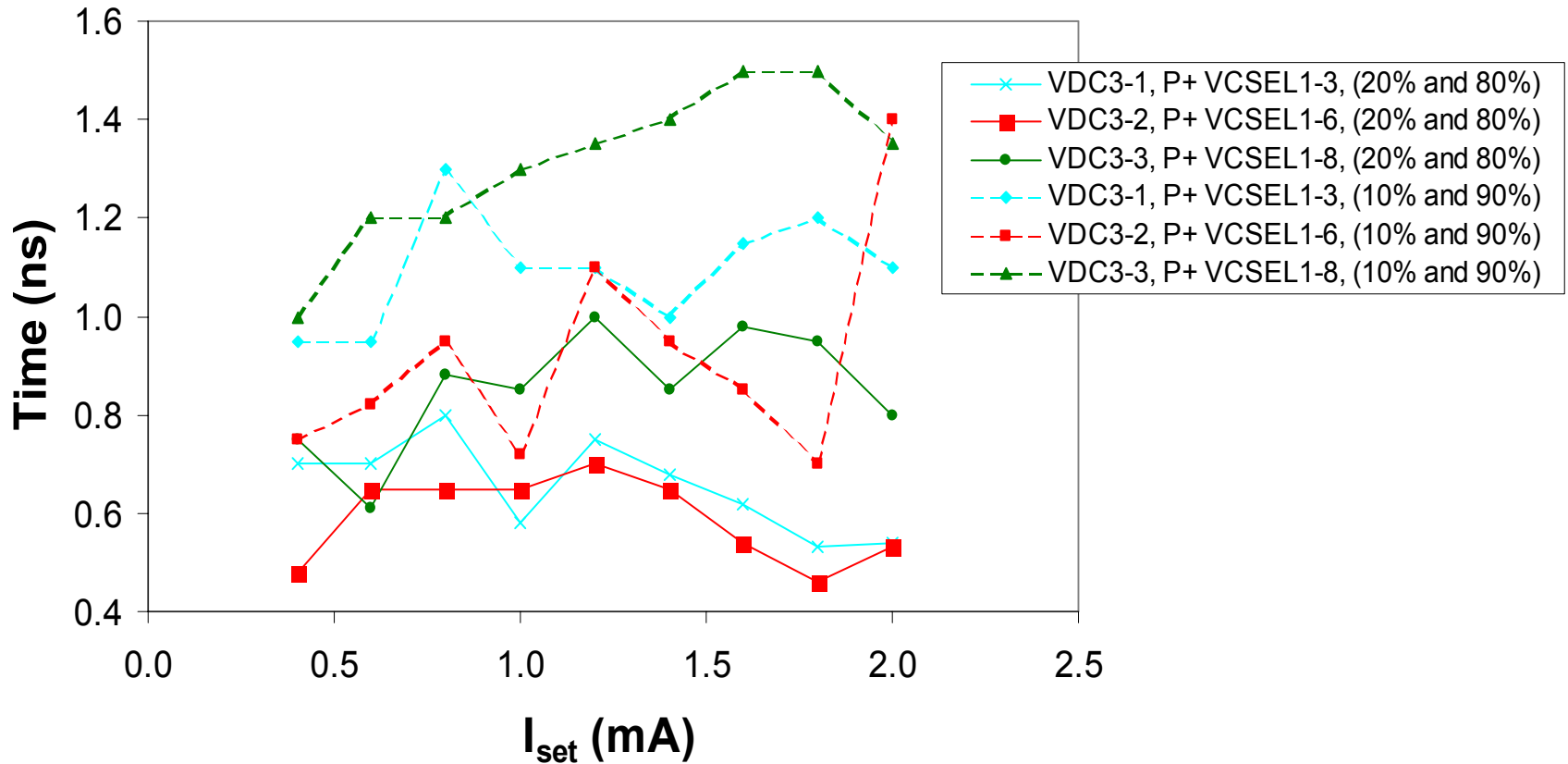
- Optical power was measured using opto-meter, with VDC output at all high

Example of an Optical Trace



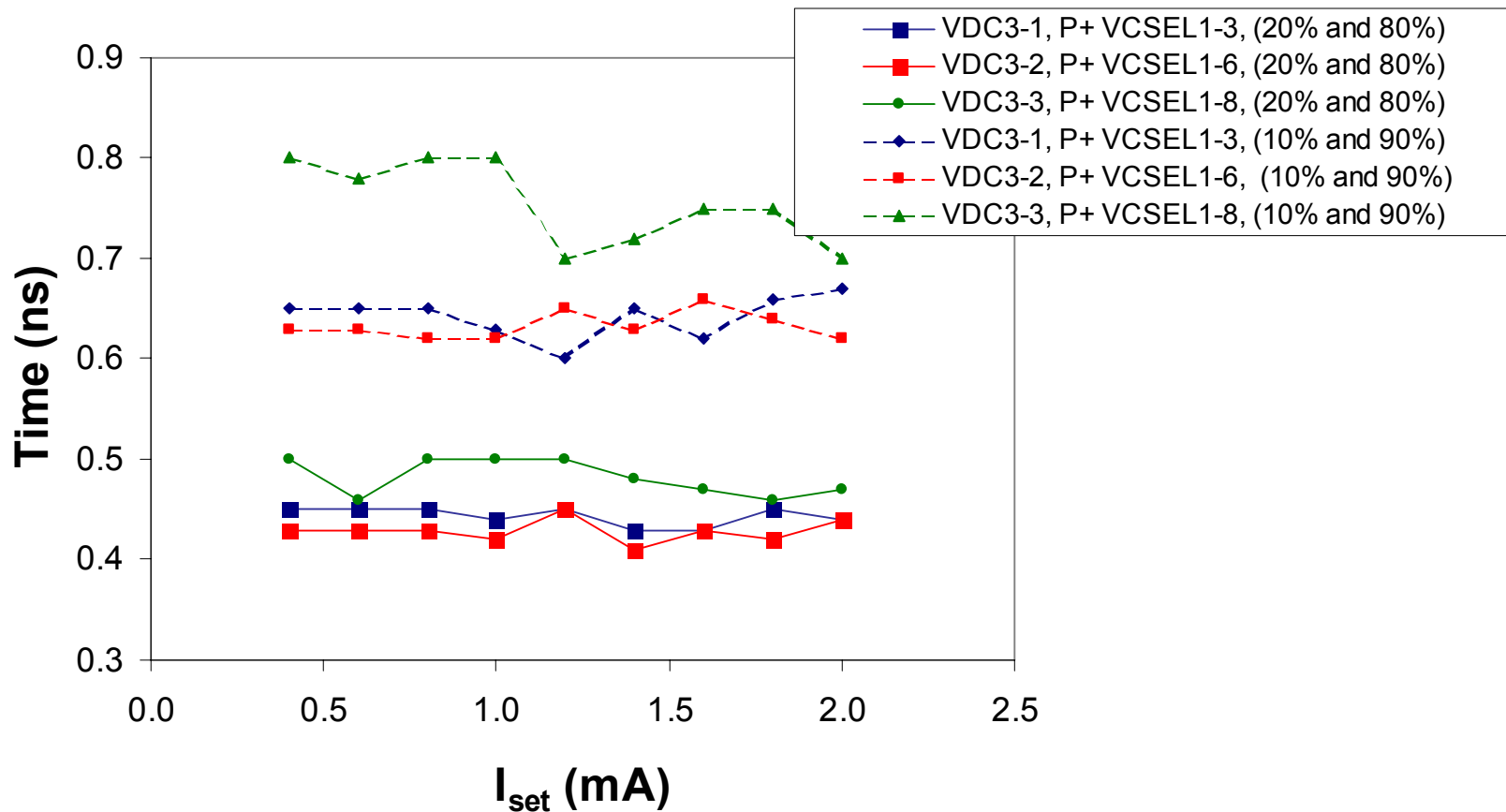
- Distortion in the pulse shape can result in a large rise times as calculated by the scope, particularly at 10% and 90% reference levels

Overlay of P+ Rise Times at (10%, 90%) and (20%, 80%)



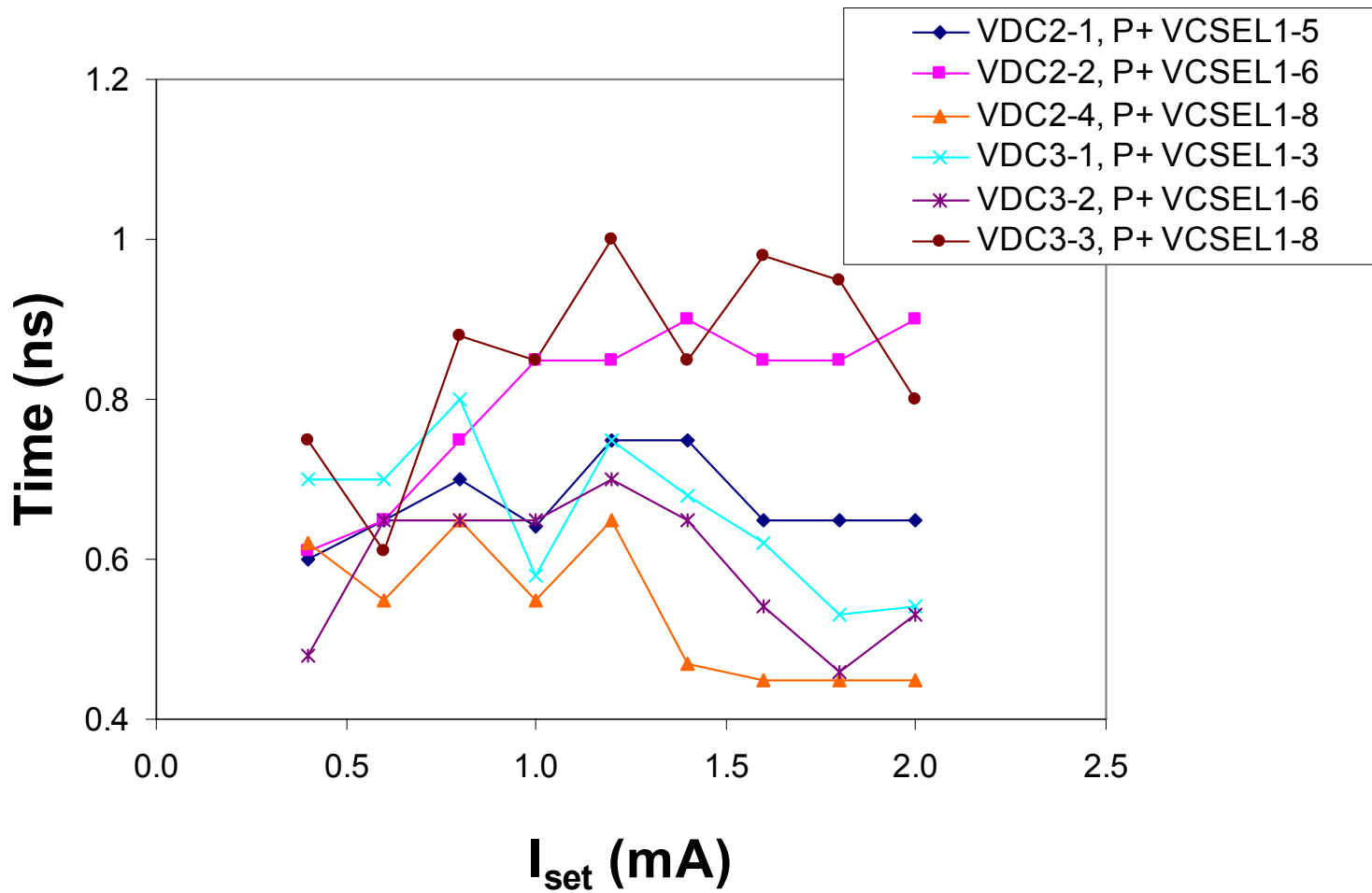
- Same channels are plotted with the same colors
- The (10%, 90%) data tends to be larger by roughly a factor of 1.6

Overlay of P+ Fall Times at (10%, 90%) and (20%, 80%)



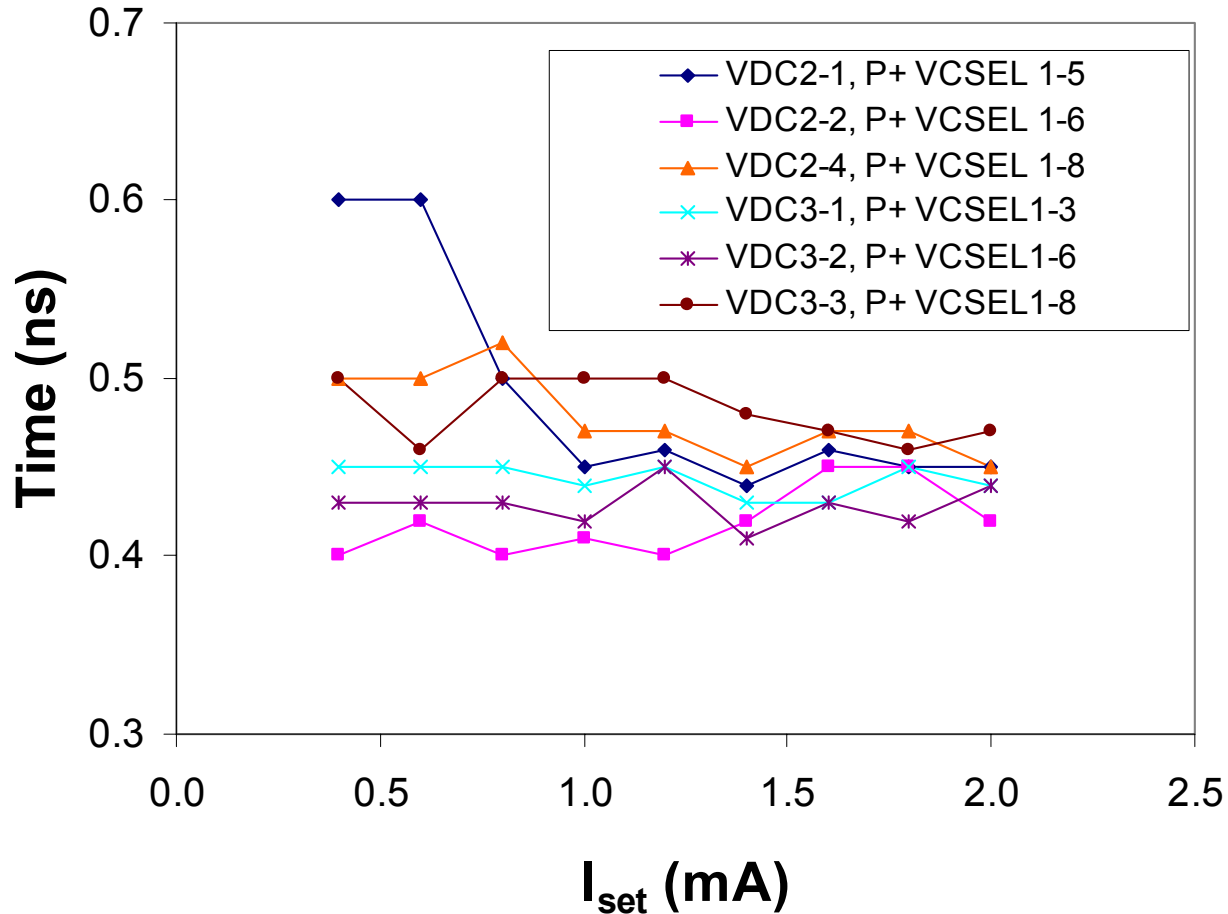
- Same channels are plotted with the same colors on the plot
- Fall times are under 1.0ns in both reference levels

P+ Rise Time at (20%, 80%)

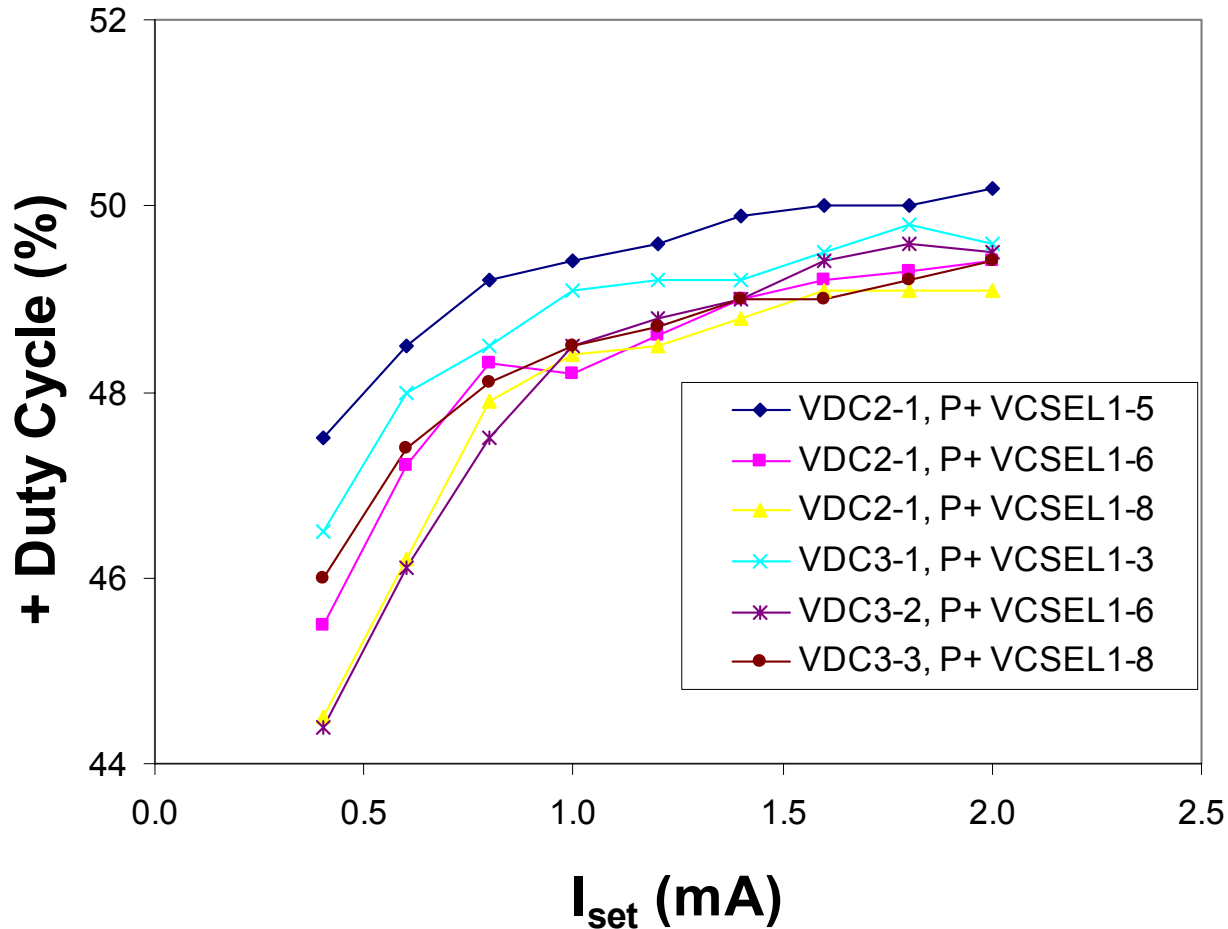


- Rise times are under 1.0ns

P+ Fall Time at (20%, 80%)

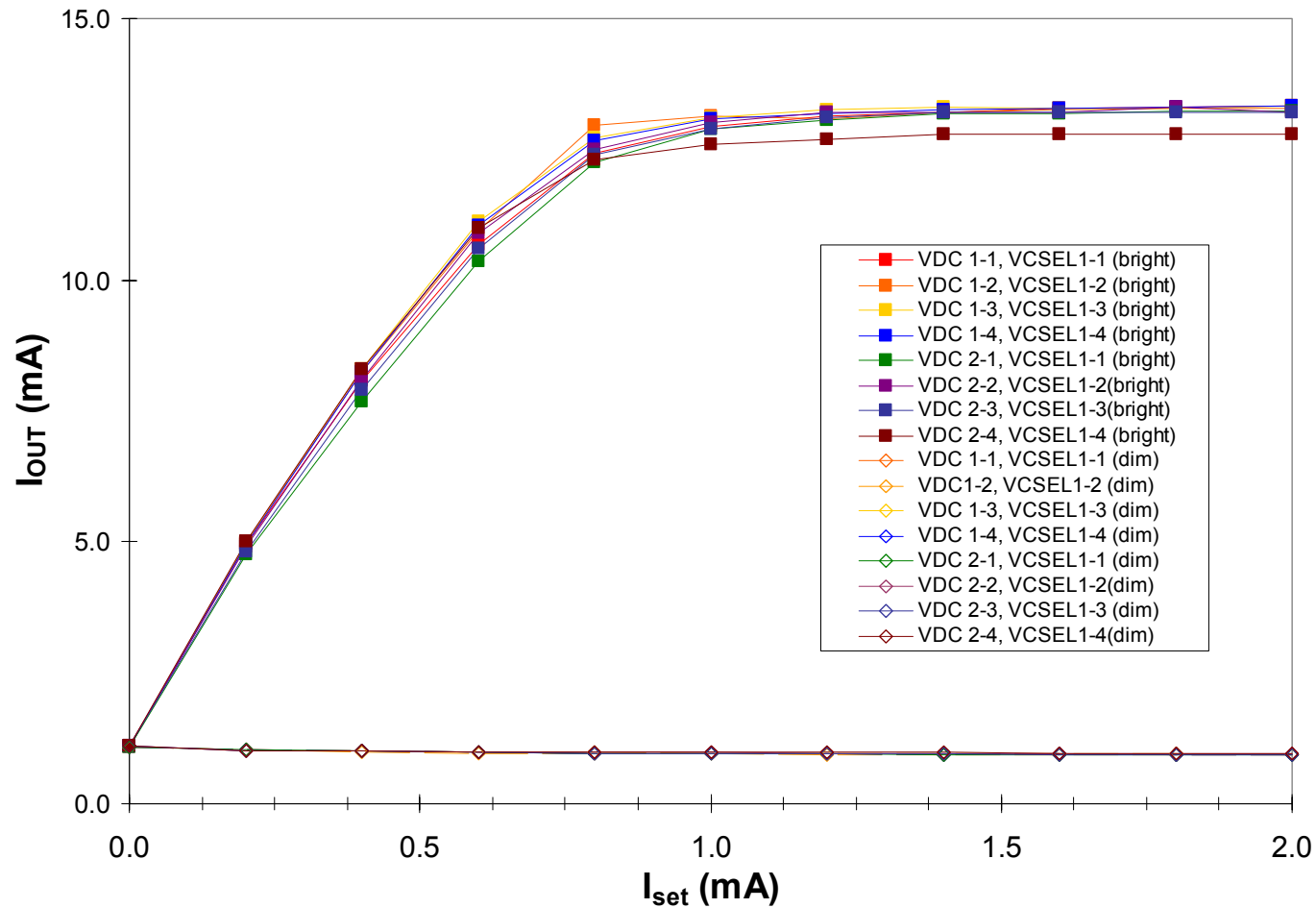


P+ Duty Cycle



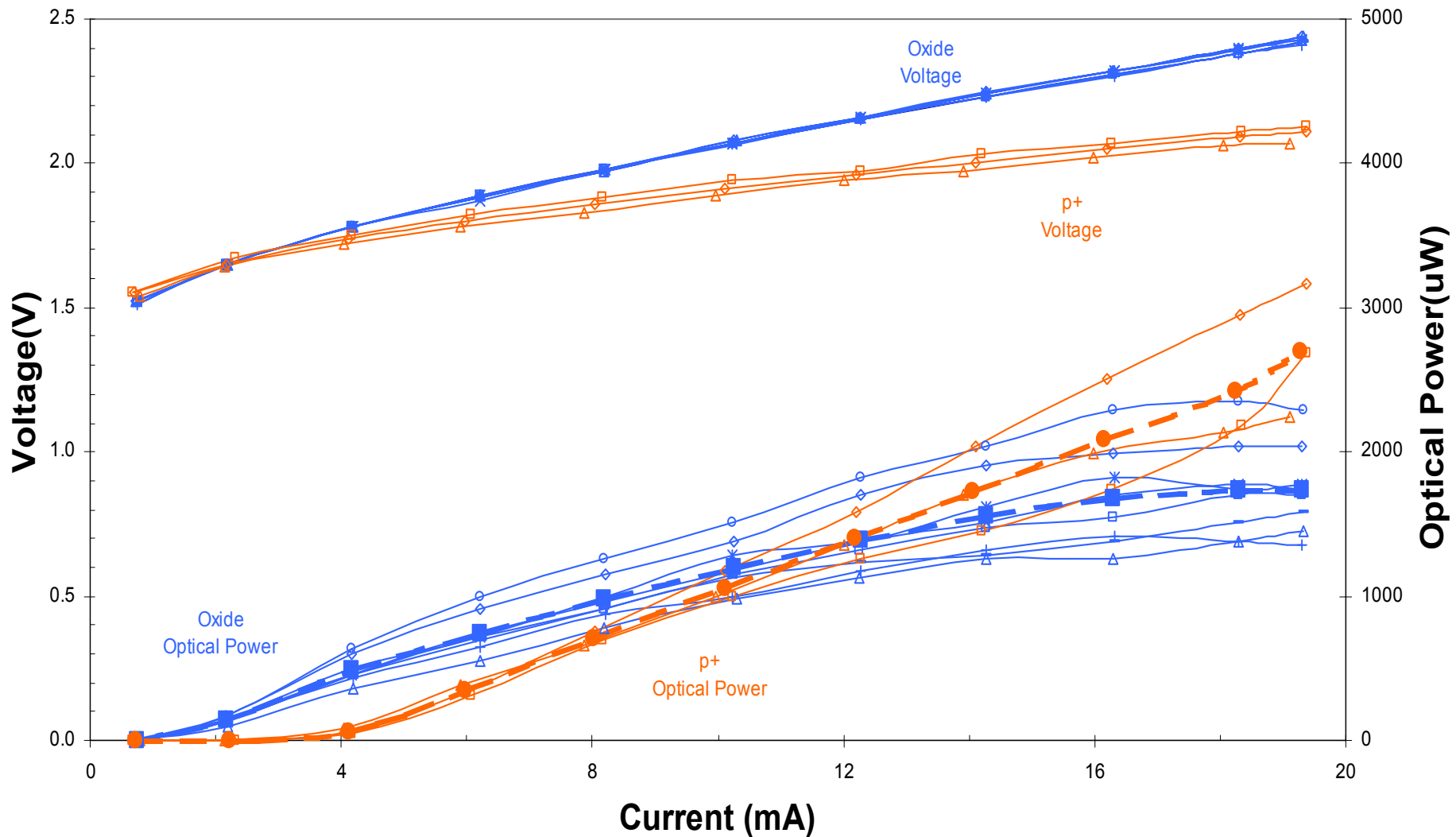
- Duty cycle is lower at low I_{set} and rises to about 50% at higher I_{set}

I_bright and I_dim with Oxide



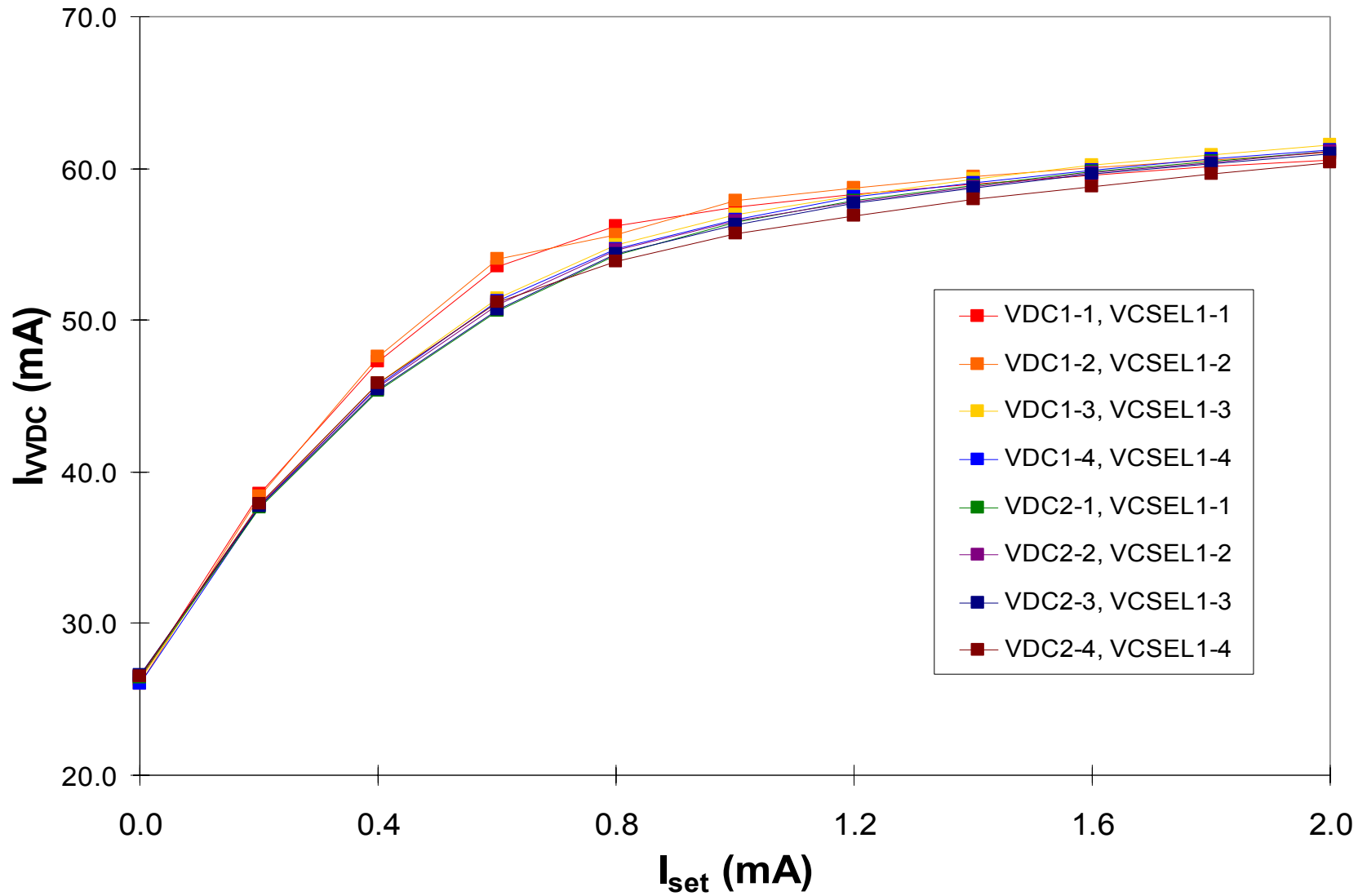
- I_{bright} was measured at all high
- I_{dim} was measured at all low
- Oxide plateaus at about 14 mA. This is about 3 mA lower than P+

V vs. I and P vs. I curves for P+ and Oxide



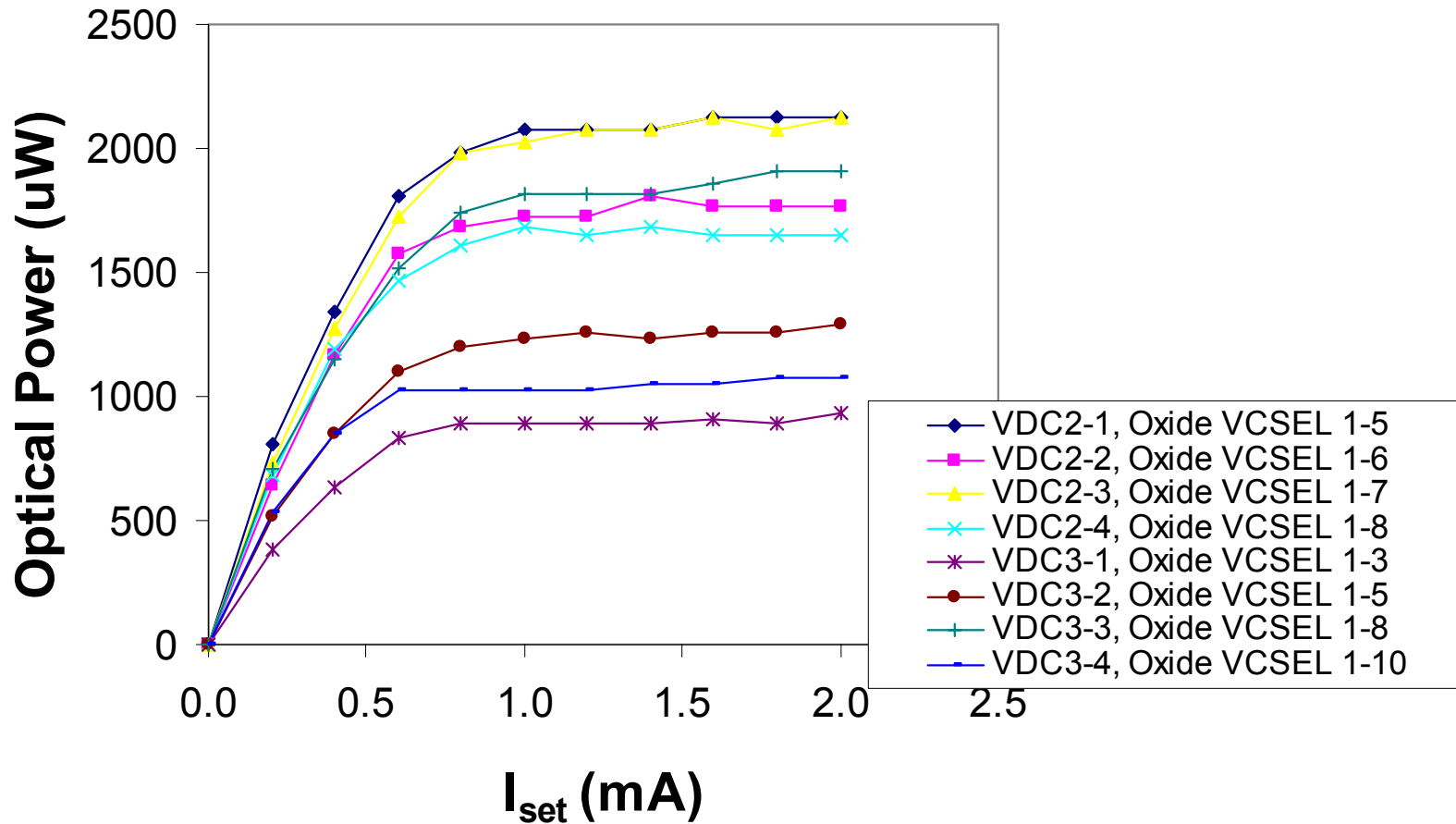
- Oxide turns on faster than P+
- P+ forward voltage is lower than Oxide by about 0.3V at I = 17mA

Current Consumption with Oxide



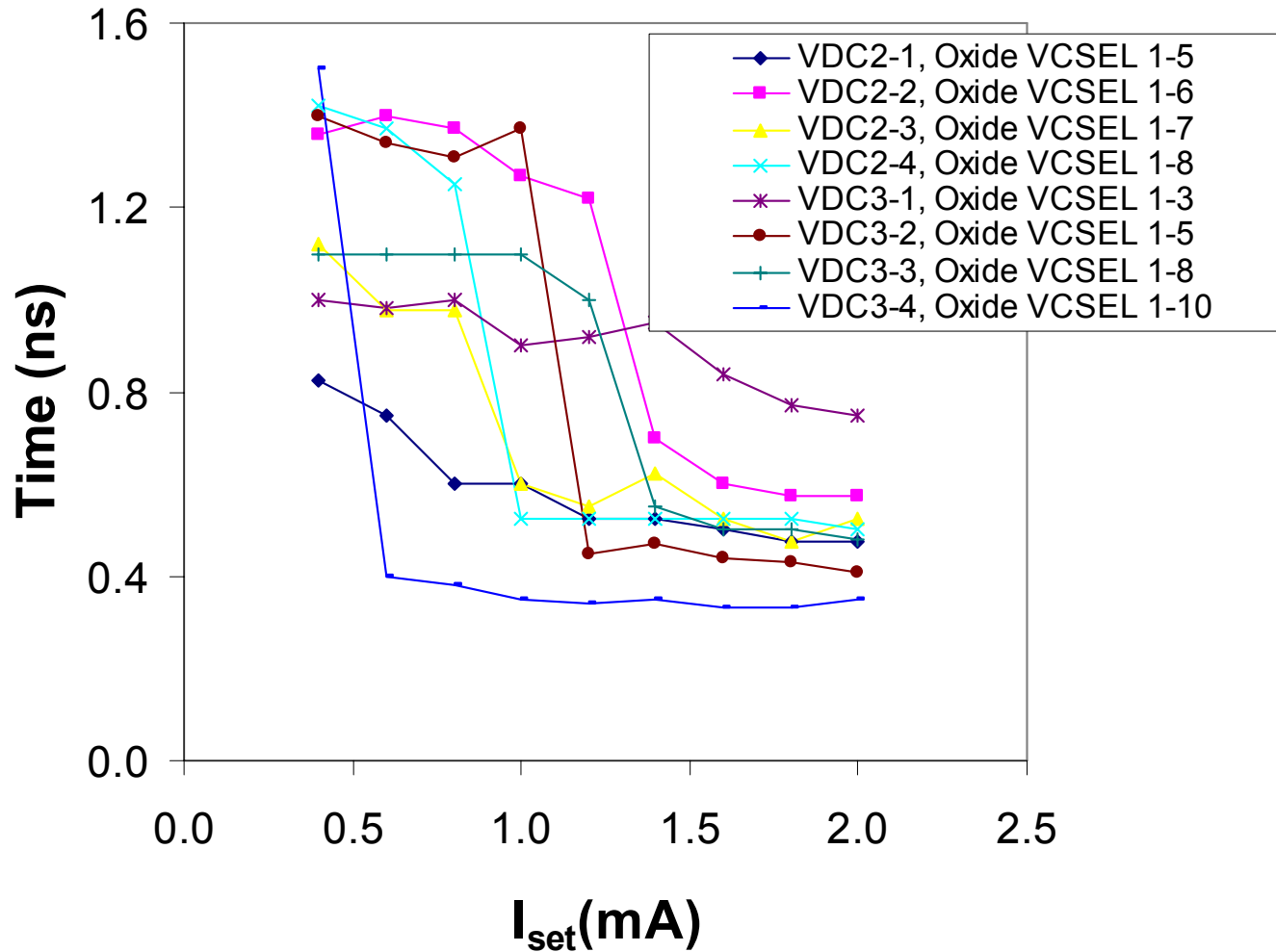
- Current consumption plateaus at about 60mA

Optical Power with Oxide

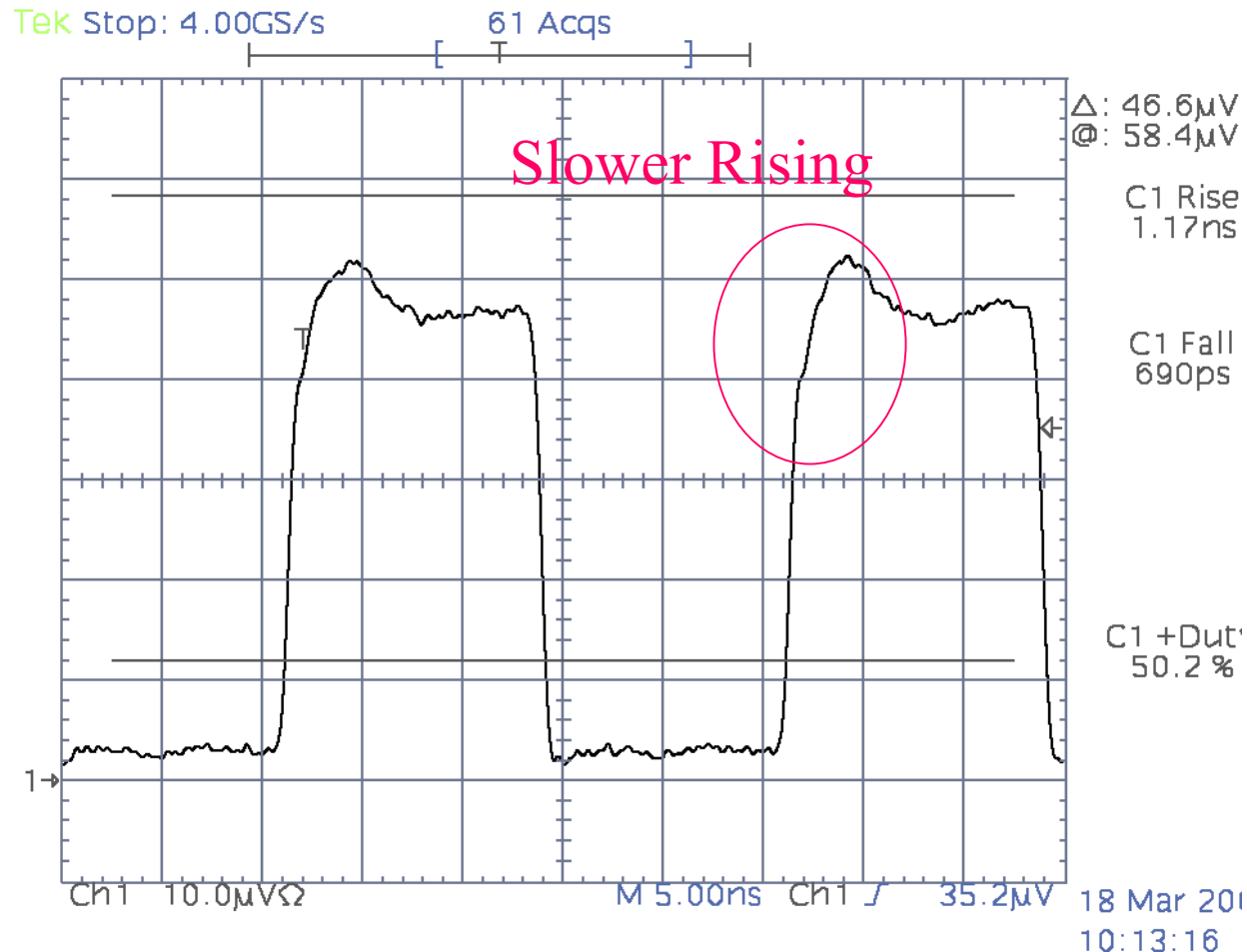


- Optical power was measured at all high mode, using an opto-meter

Oxide Rise Times at (20%, 80%)

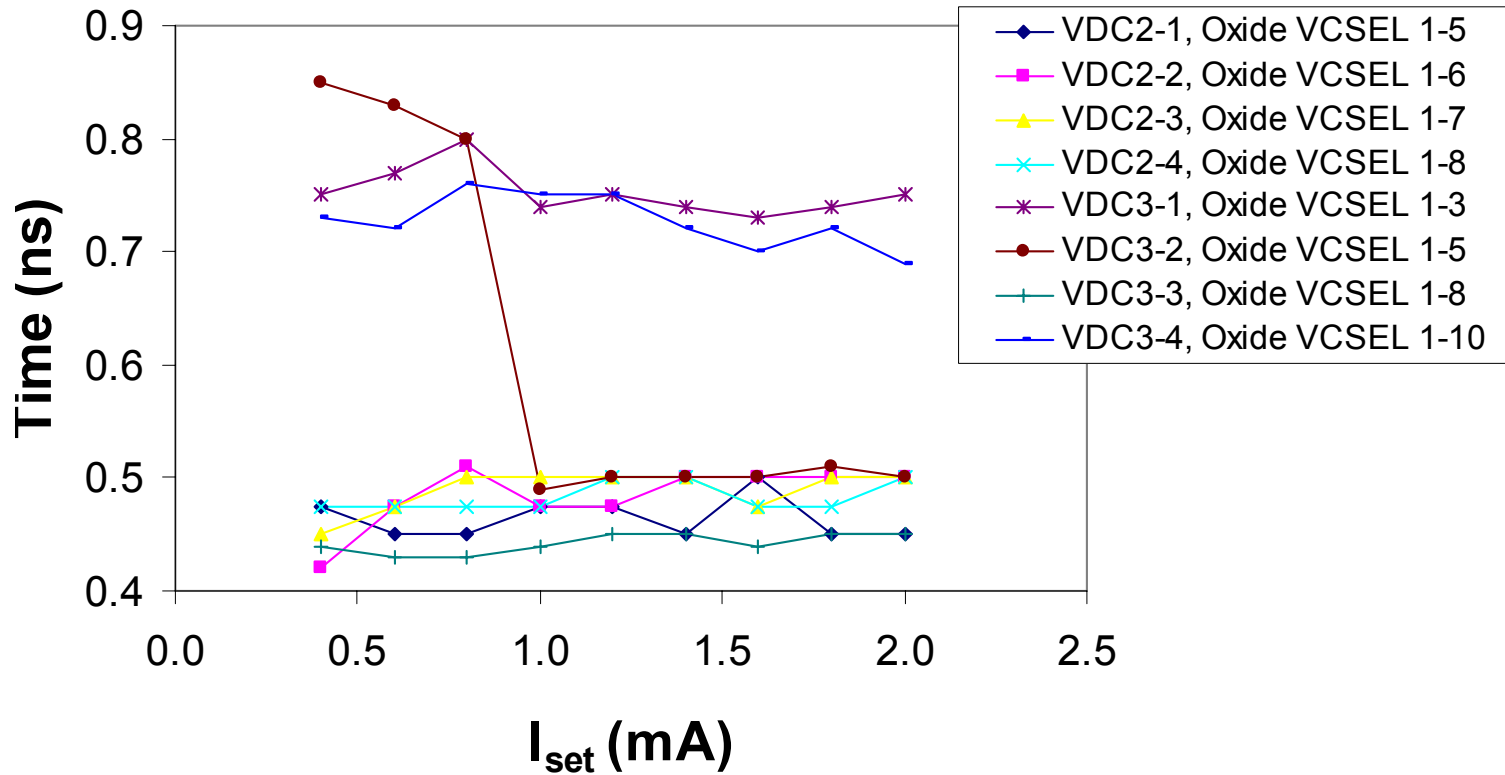


Oxide VCSEL Clock Signal



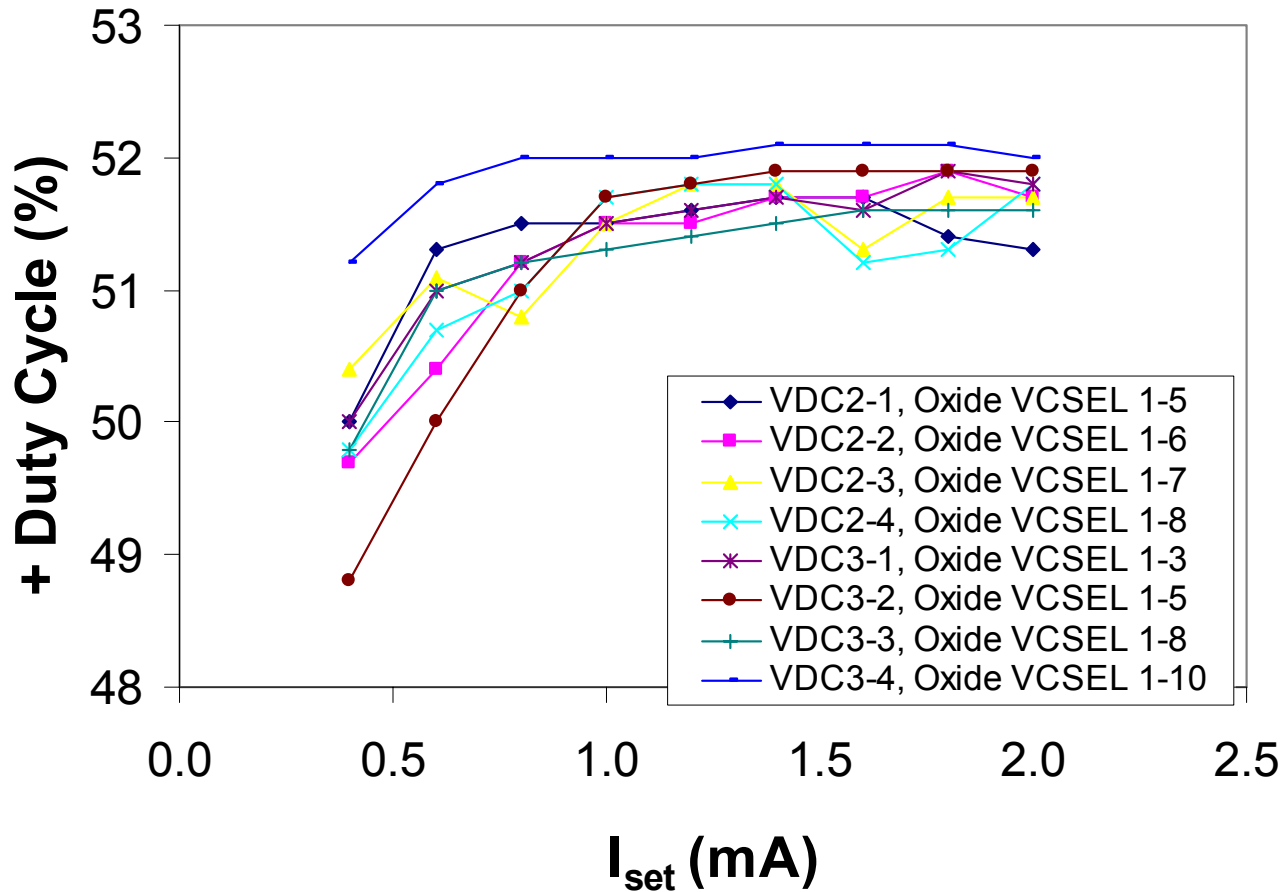
- There is a slow rising segment in the rising edge which may elevate the rise time significantly
- We see a similar pattern with P+

Oxide Fall Times at (20%, 80%)



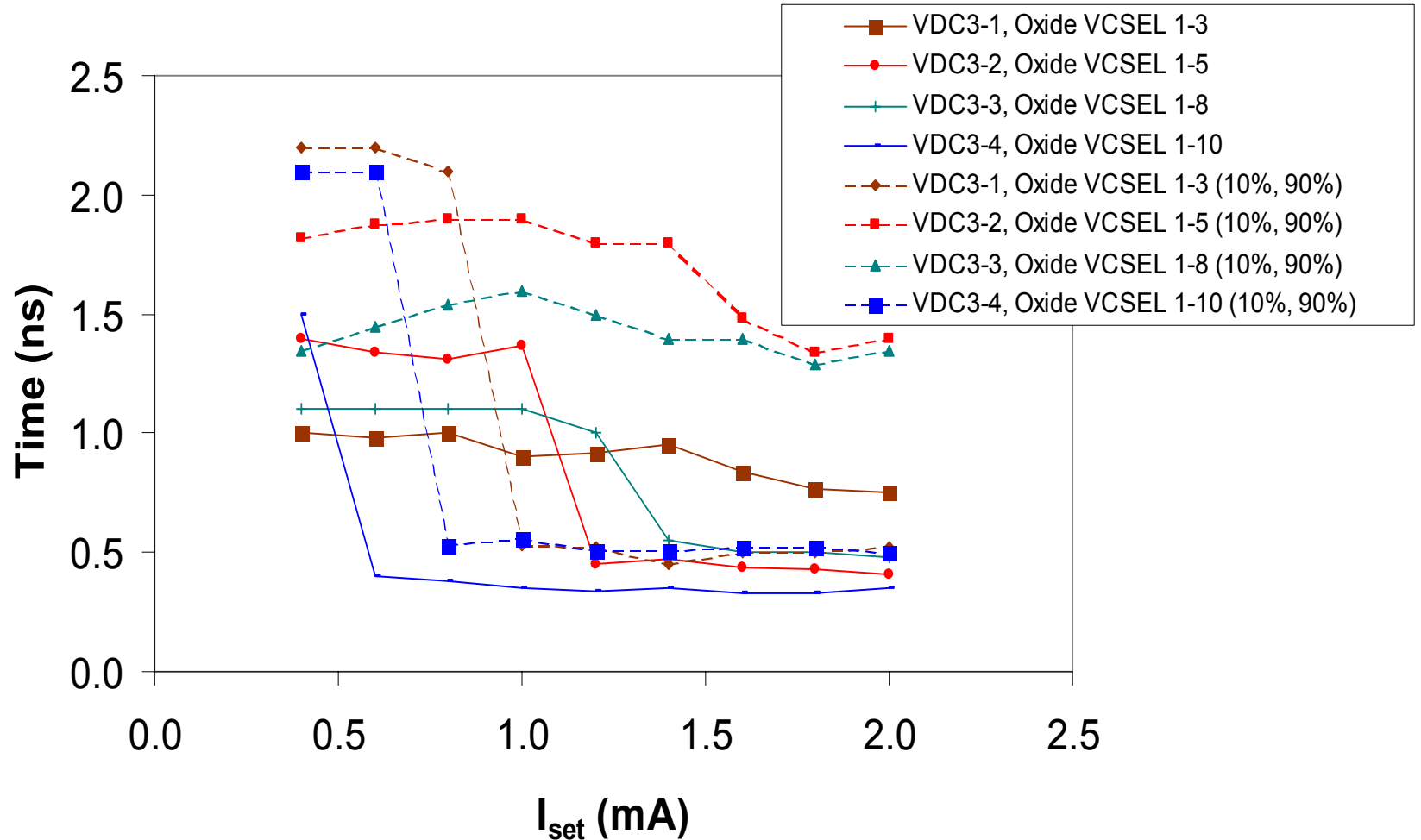
- Fall times are under 1.0 ns

Oxide Duty Cycle



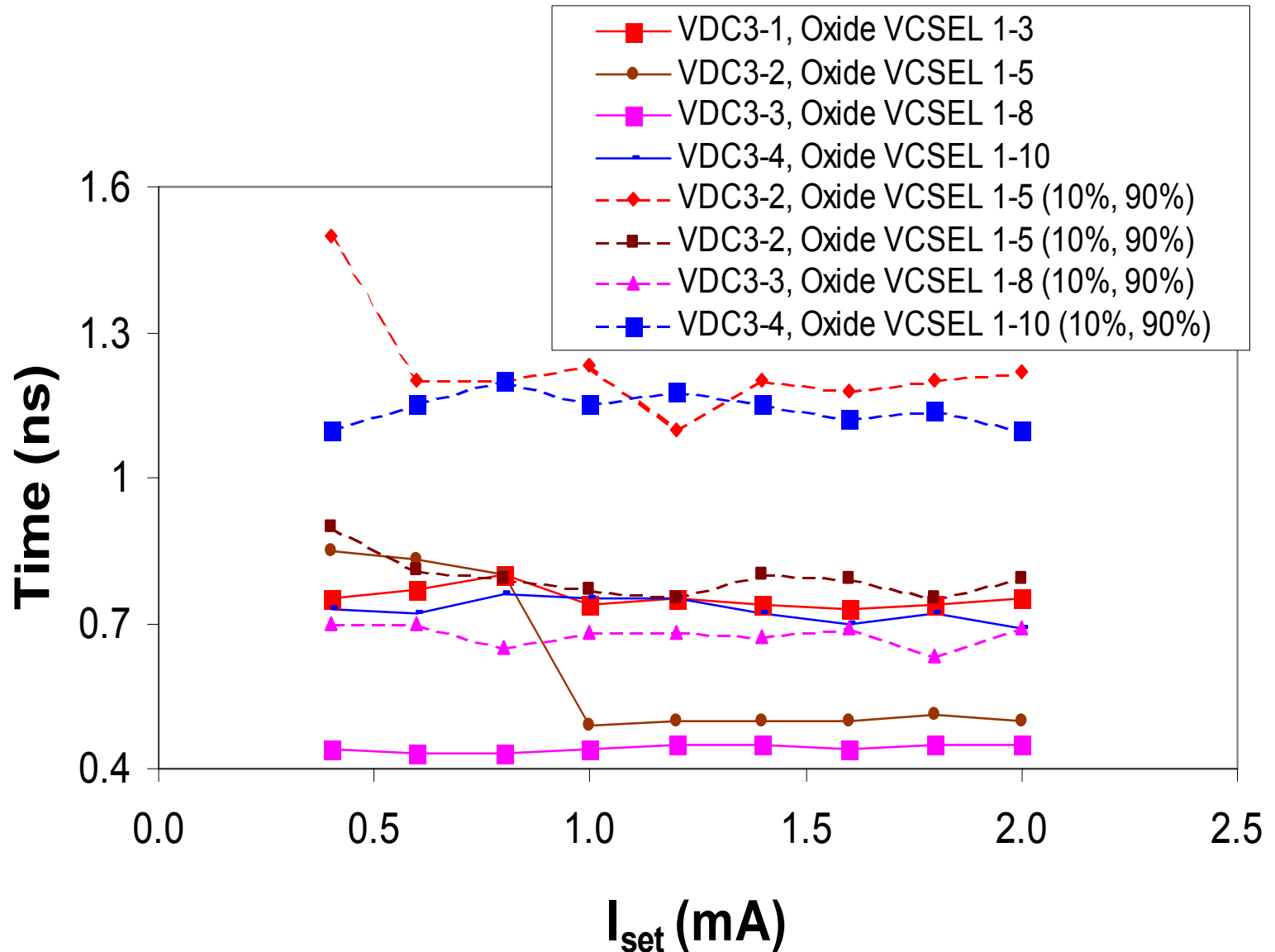
- Duty cycle ranges from 49.5% to 52%

Overlay of Oxide Rise Times at (10%, 90%) and (20%, 80%)



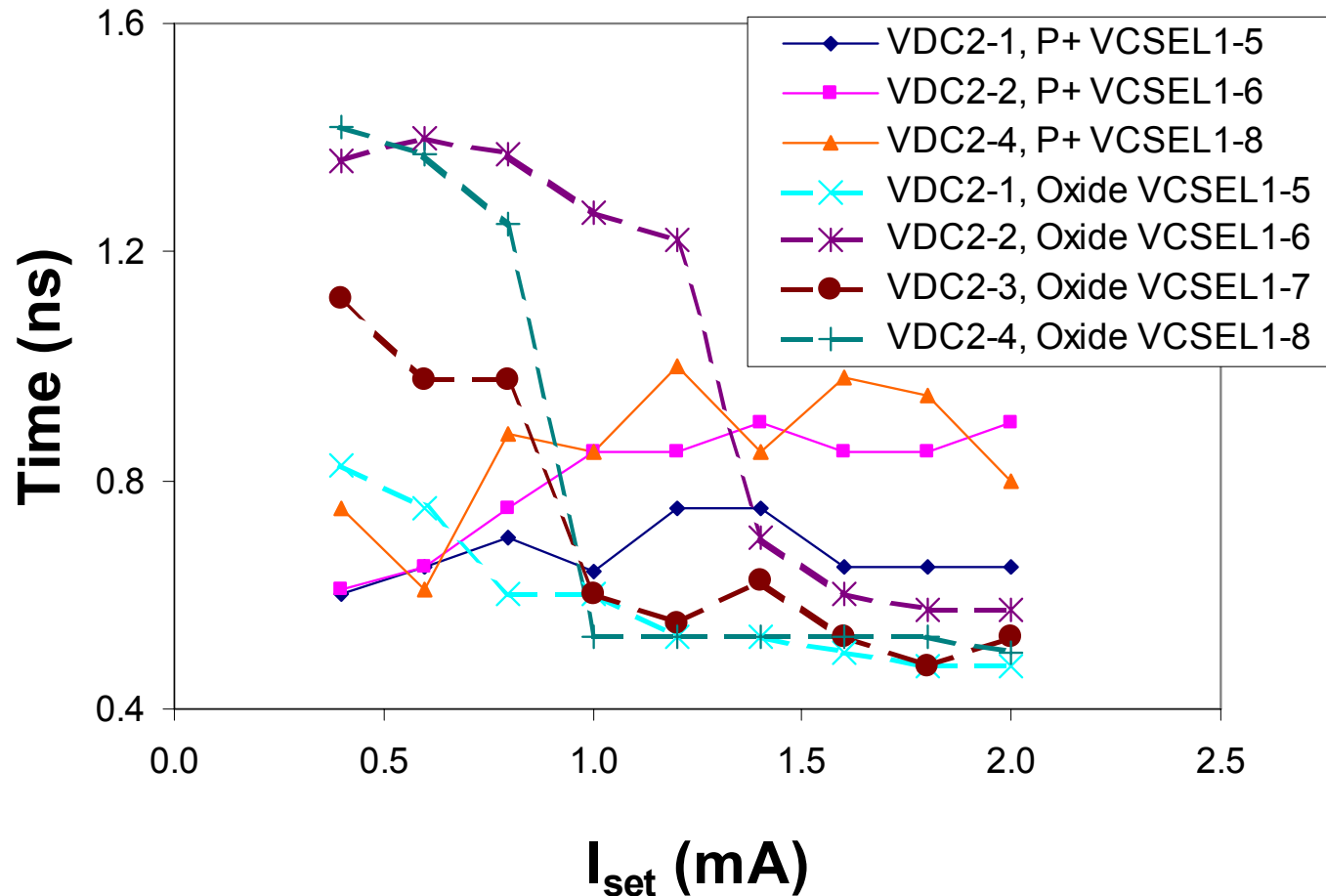
- Same channels are plotted with same colors

Overlay of Oxide Fall Times at (10%, 90%) and (20%, 80%)



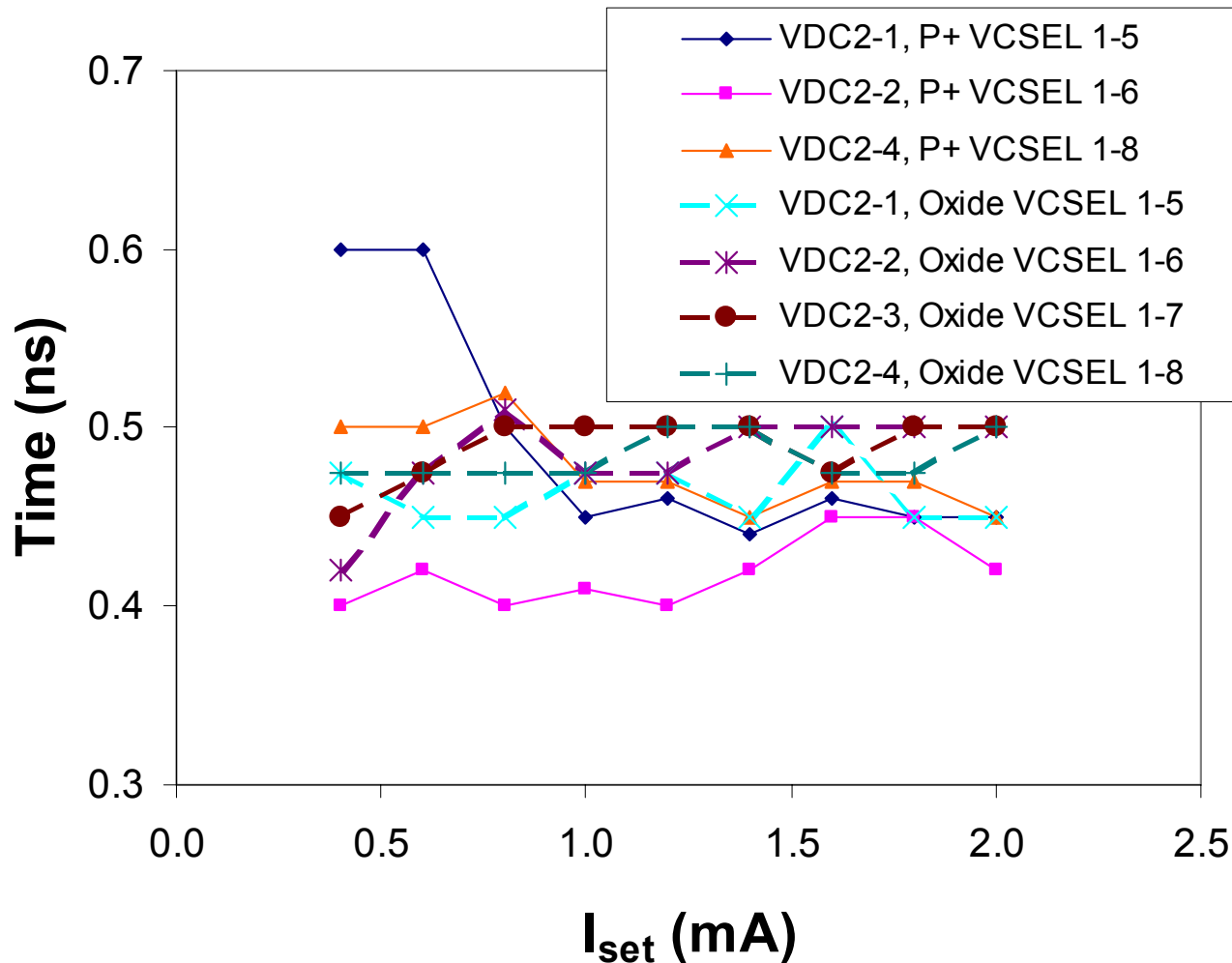
- Same channels are plotted with same colors

Overlay of Rise Times with Oxide and P+ at (20%, 80%)



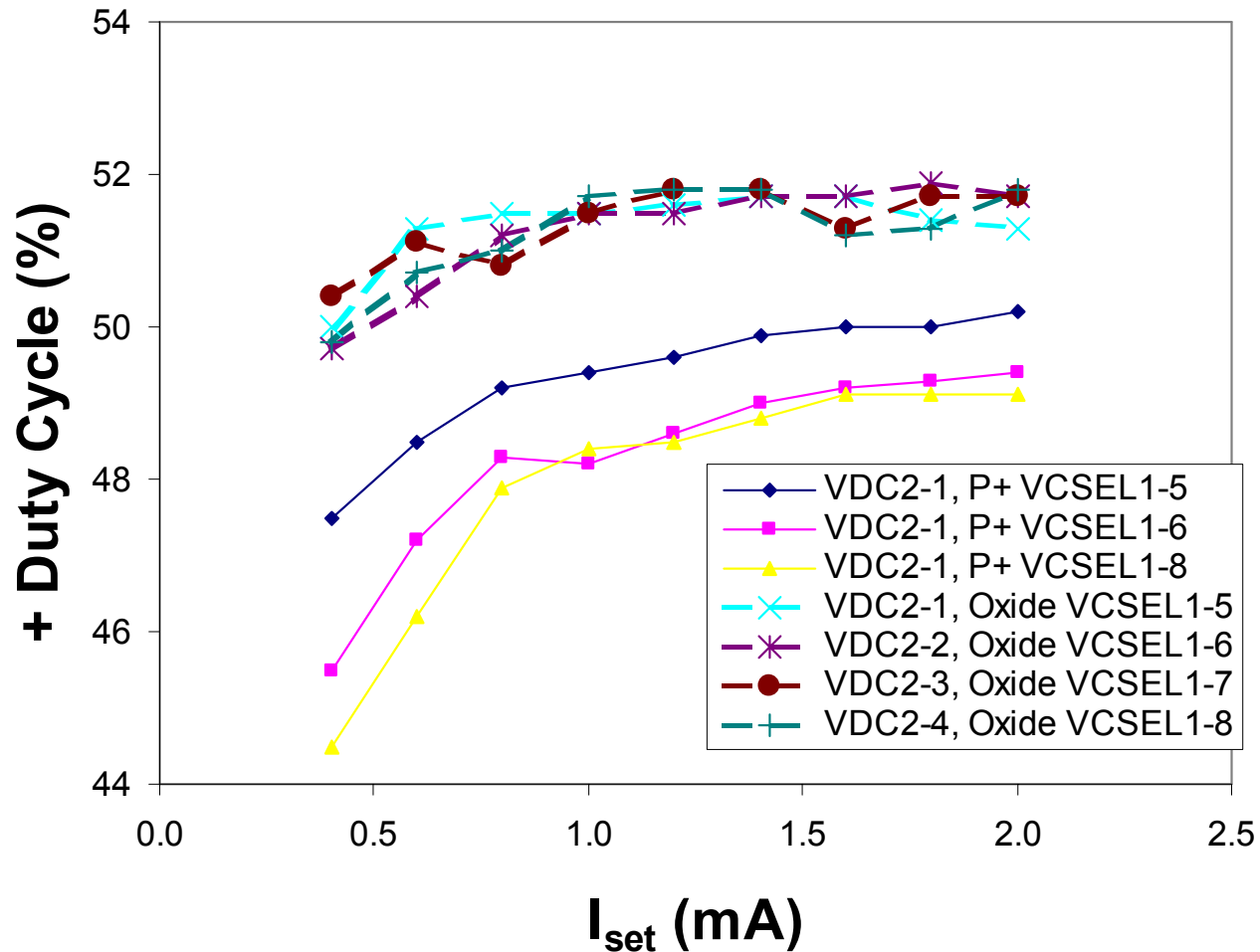
- Dashed lines are Oxide
- Oxide is higher at lower I_{set} and lower at higher I_{set}

Overlay of Fall Times with Oxide and P+ at (20%, 80%)



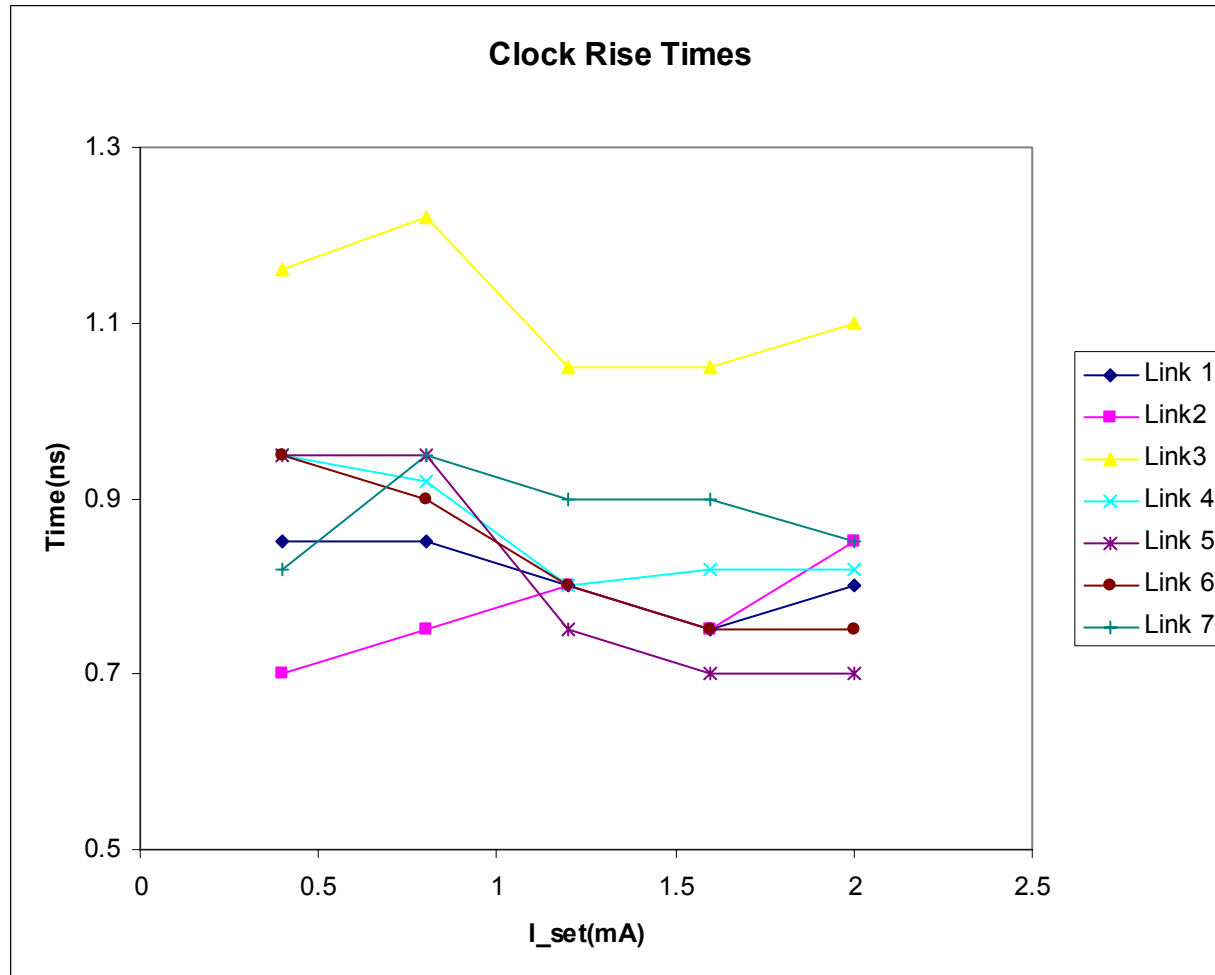
- Dashed lines are Oxide
- Oxide and P+ are consistent

Overlay of Duty Cycles with Oxide and P+



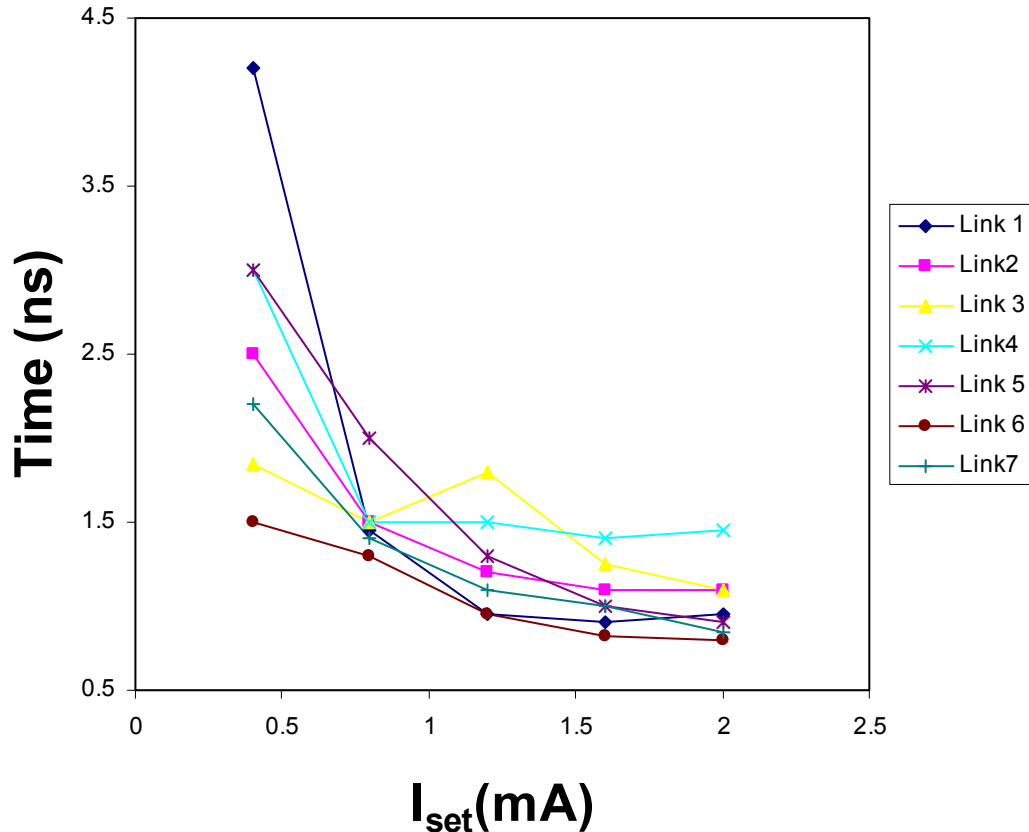
- Dashed lines are Oxide
- P+ has a larger variation across I_{set} and is more spread out

Clock Rise Time on Opto-Board at (10%, 90%)



- All the links are lower than 1ns except link 3

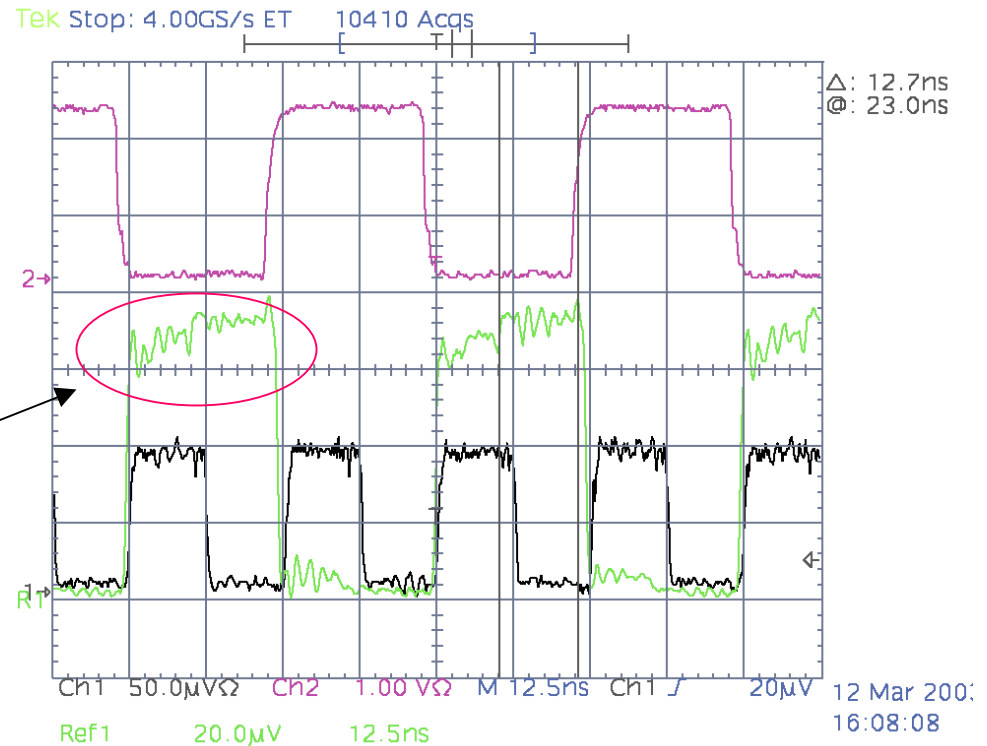
Data Rise Times on Opto-board at (10%, 90%)



- The rise times are high due to a distorted optical signal
- Why are data rise times significantly larger than the clock rise times?
- Looking at the optical pulse for clock and data may shed some light on the cause of the problem

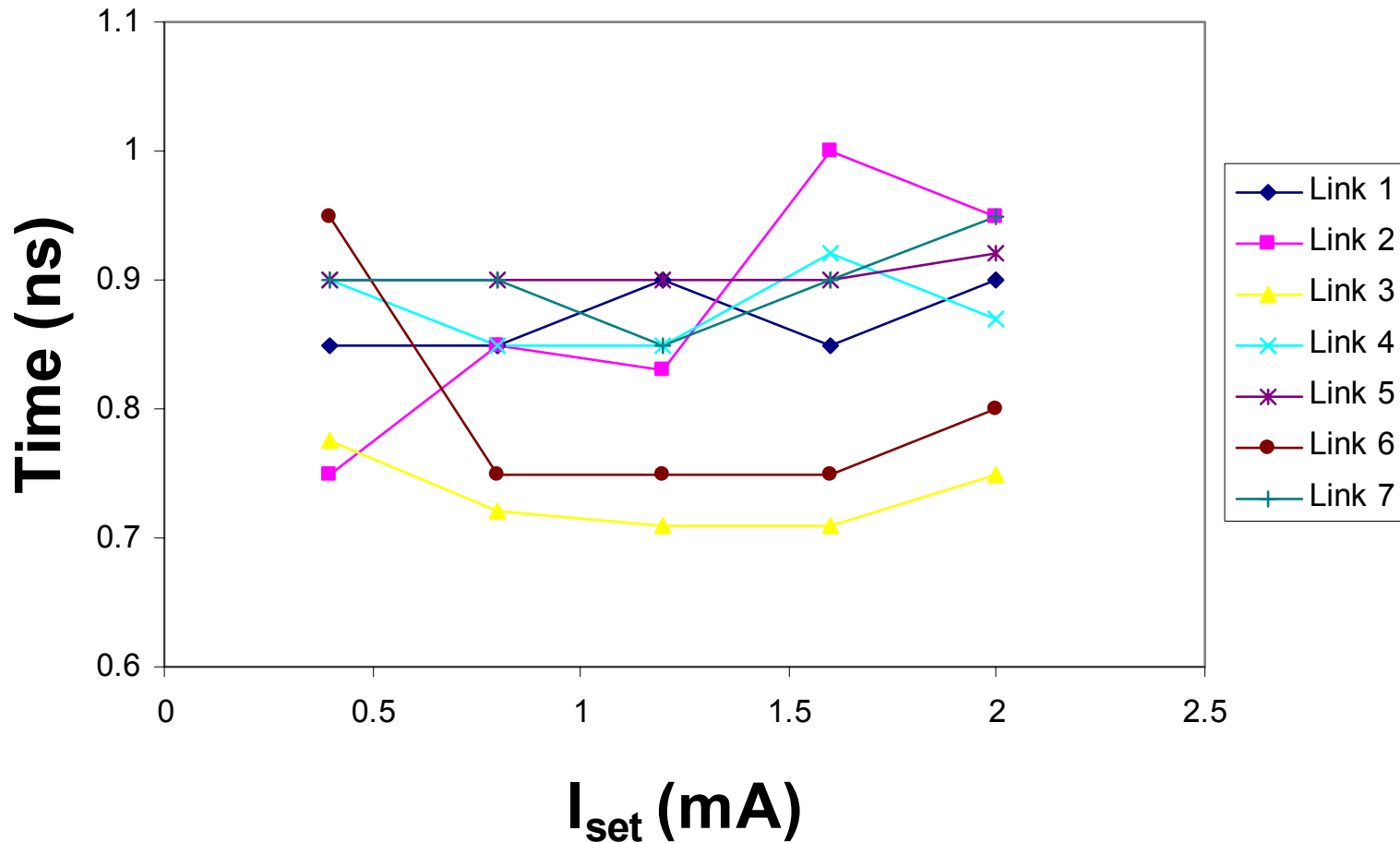
Clock and Data Trace Overlays

- Purple is the 20MHz input data
- Black is the optical clock from opto-board
- Green the optical data from opto-board

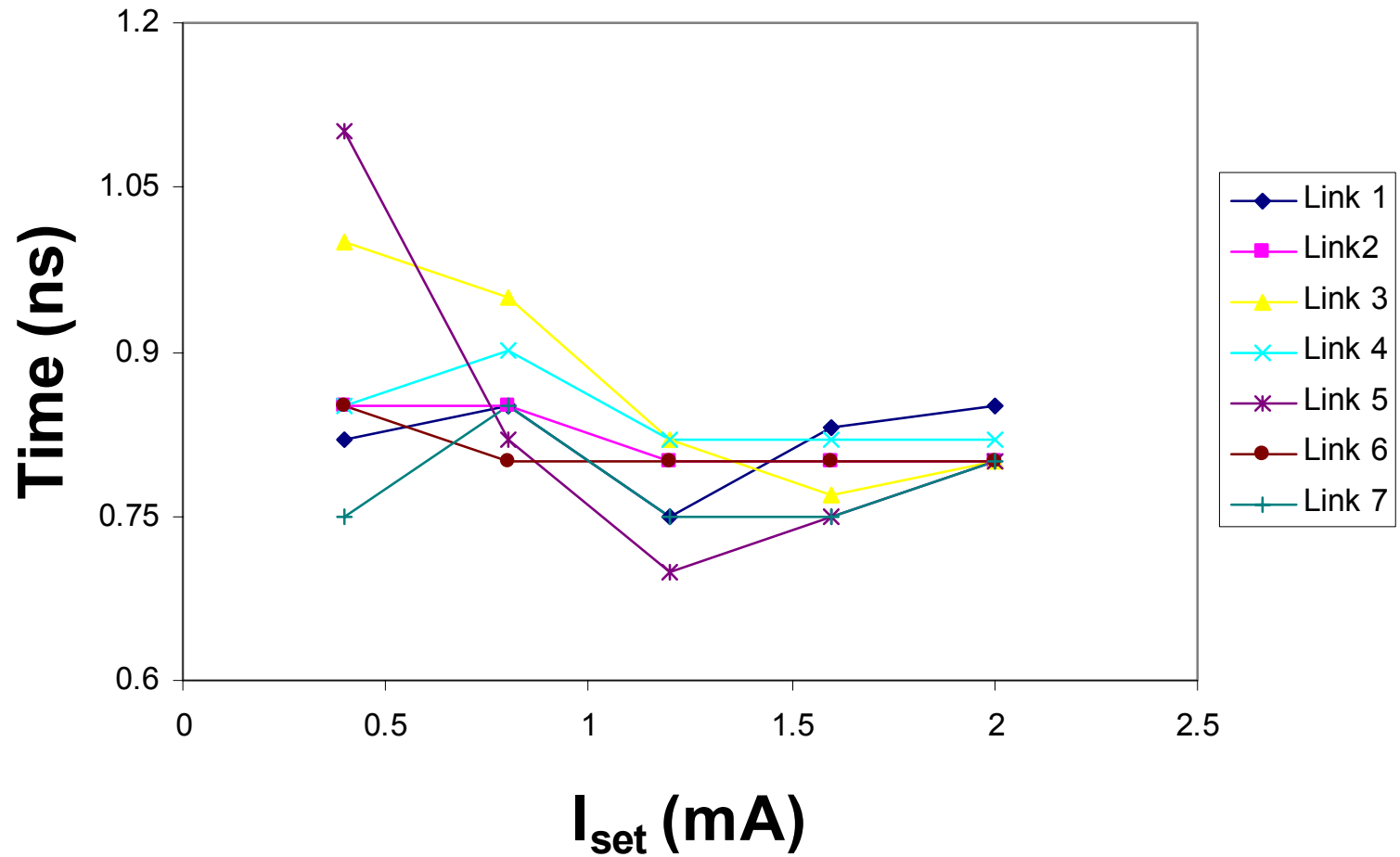


- Looks like a stepwise rise in the data amplitude
- Clock signal is flat
- Even with the clock turned off, data amplitude is rising
- Check the VDC next

Clock Fall Time on Opto-Board (10%, 90%)



Data Fall Times on Opto-board (10%, 90%)



Conclusions

- I_{bright} current with P+ is higher than with Oxide
 - Oxide forward voltage larger by about .4V at $I = 18\text{mA}$
- I_{dim} current is consistent at $\sim 1.0\text{mA}$ for both Oxide and P+
- P+ duty cycle tends to have more channel to channel spread
- Apparent rise times calculated by the digital scope tend to be larger particularly at 10% and 90% reference levels
 - Rise time may appear larger due to pulse distortions
 - There seems to be a slow segment in the rising edge
 - By choosing 20% and 80% references, rise times become less affected by pulse distortions
- Rise times for P+ tend to be smaller than Oxide at $I_{\text{set}} < 1.2\text{mA}$ and larger than Oxide at $I_{\text{set}} > 1.2$
- Fall times for both P+ and Oxide are under 1.0ns
- Data rise times are larger than clock as measured on the I4 opto-board due to a ‘rising amplitude effect’ of the pulse
 - VDC electrical output signal looks flat
 - The rising amplitude is possibly due to internal optical reflections
 - More verification on this is needed
- What is next?