

Results from temperature-controlled tests with the DPTS



Tests

- 5°C steps from 15-40°C
- 1 set of Time over Threshold scans
- 3 sets of Threshold scans
 - different v_{casb} 250&300 mV + fixed threshold
- 3 sets of Fake-Hit rate scans
 - V_{casb} (250/300mV) and n_{trg} (10k / 100k)
- 1 set of GID/PID calibrations
- No control but tracking of humidity

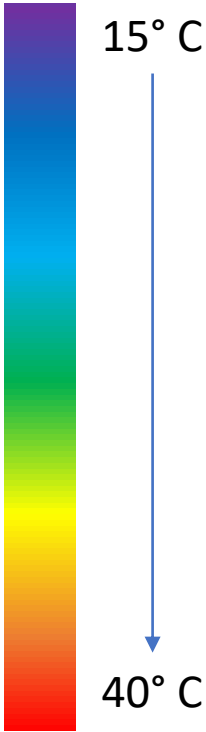
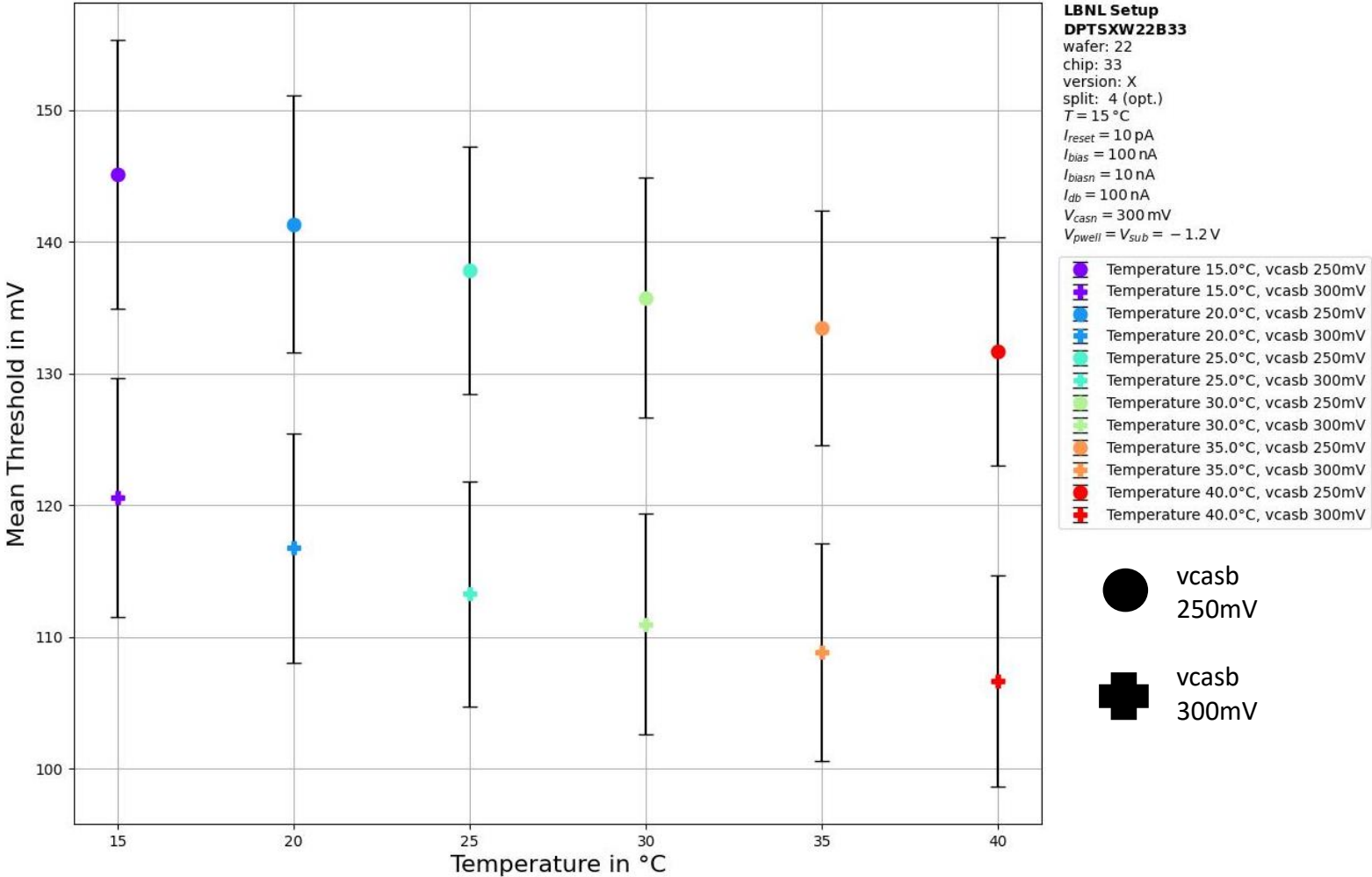




Mean Threshold

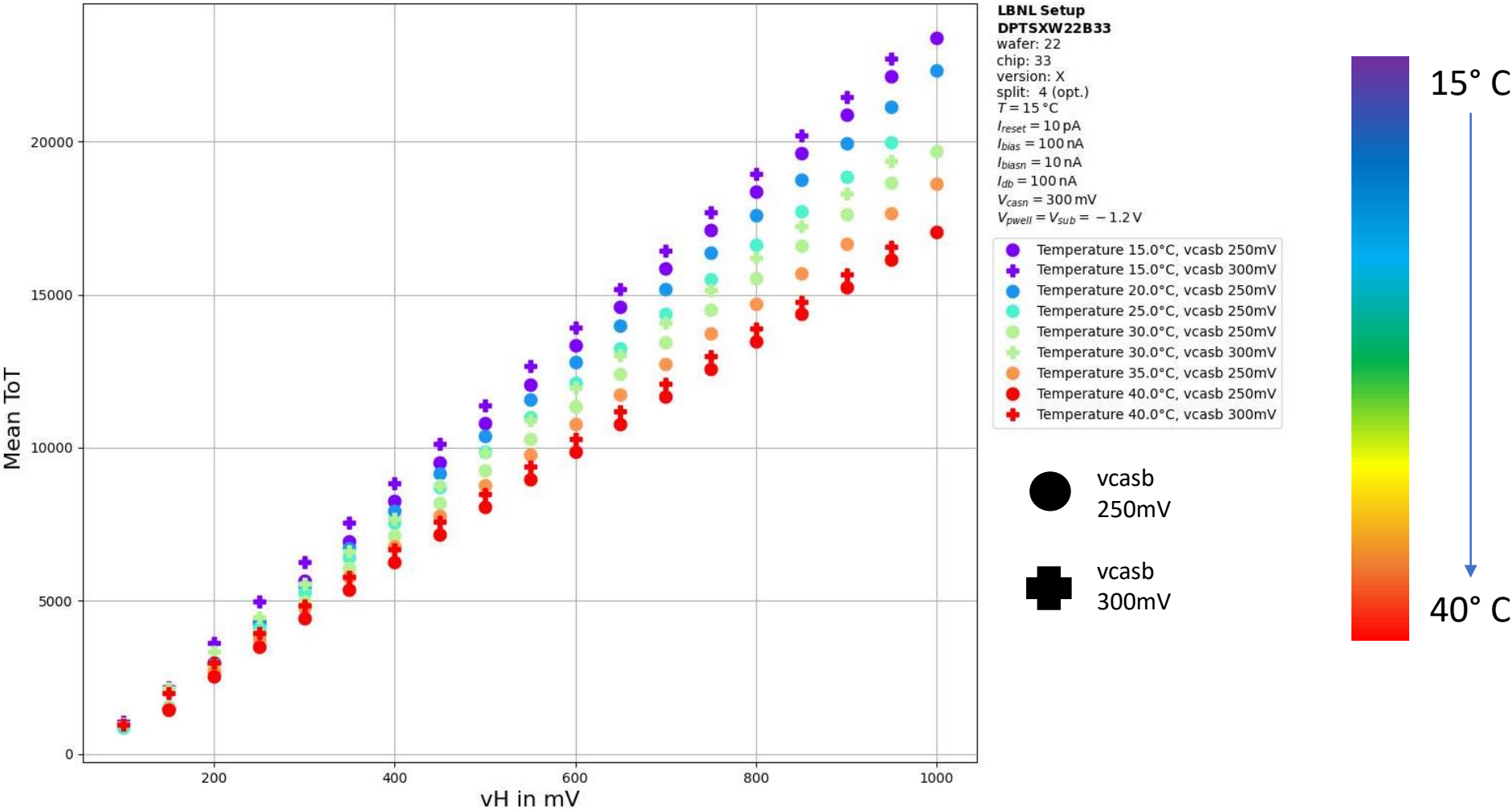
Mean Threshold vs Temperature

-> Mean threshold
decreases
with increasing
temperature



Mean Time over Threshold

Mean ToT vs vH at different temperatures



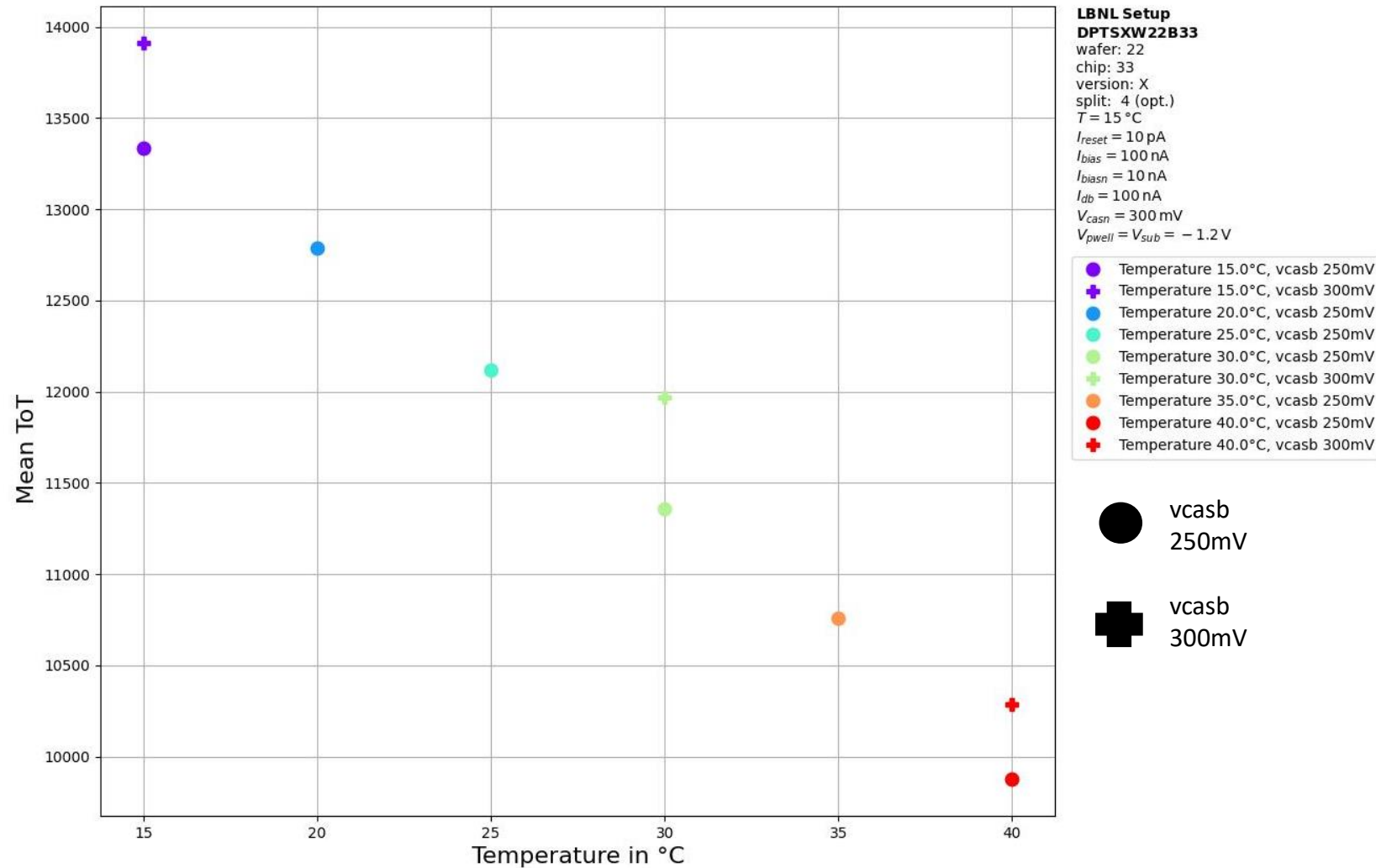
ToT vs Temperature for fixed vH

Mean ToT vs Temperatures at vH = 600



BERKELEY LAB

-> ToT decreases
with increasing
temperature

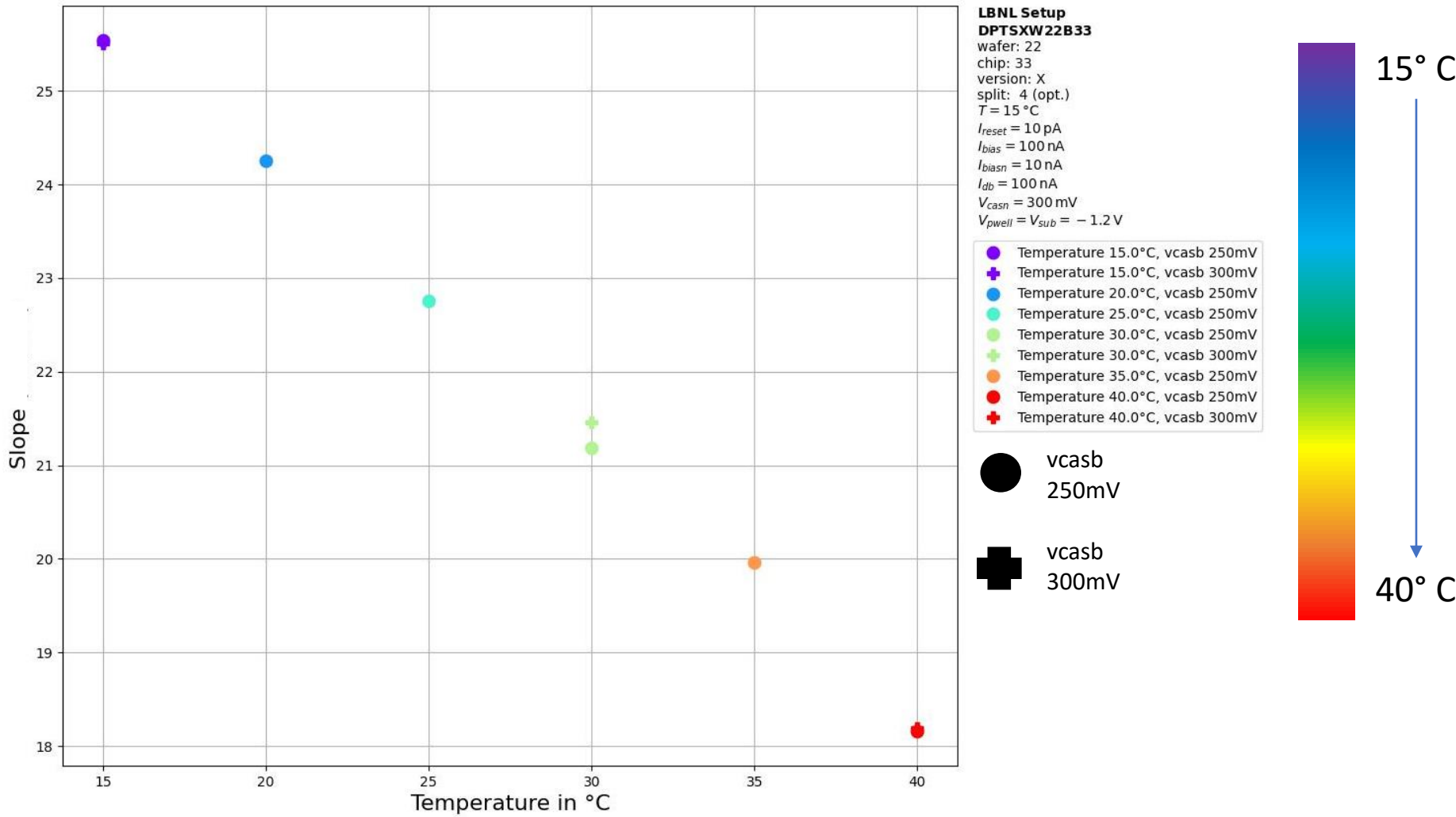


ToT linear slope vs Temperature



BERKELEY LAB

Slope for ToT vs vH fit vs Temperatures



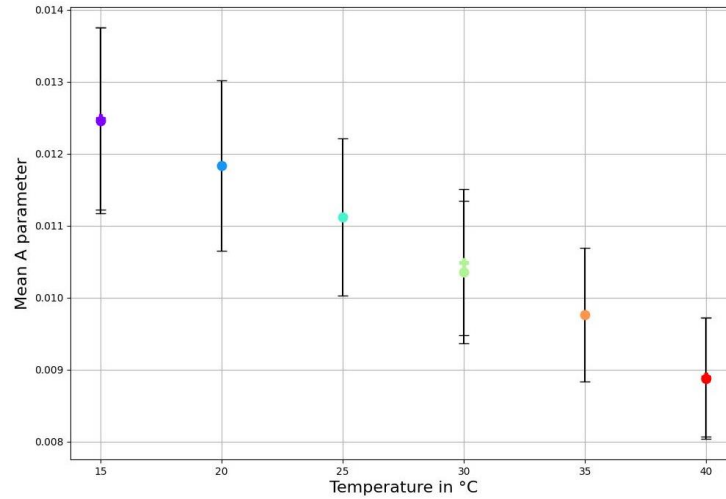
ToT vs vH fitting parameters

$$f = aQ_{inj} + b - \frac{c}{Q_{inj} - d}$$

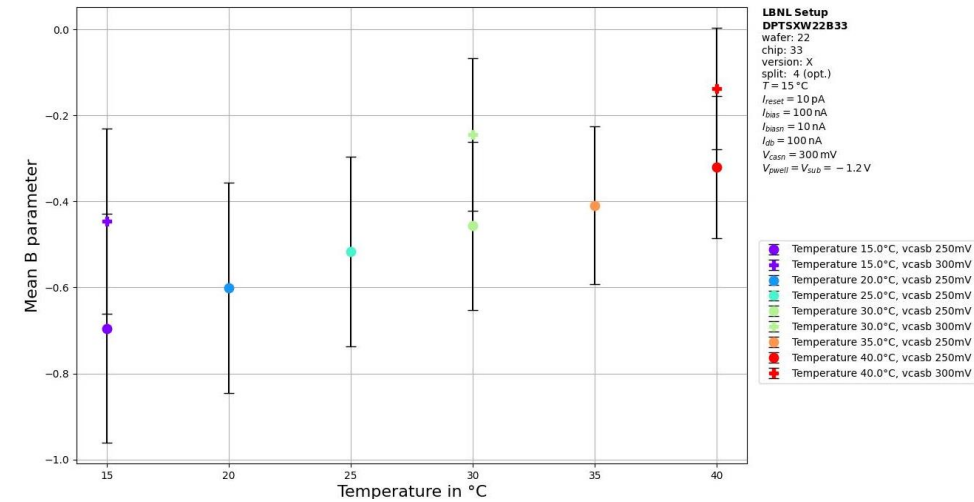


BERKELEY LAB

Mean Slope A vs Temperature for Tot vs VH fit



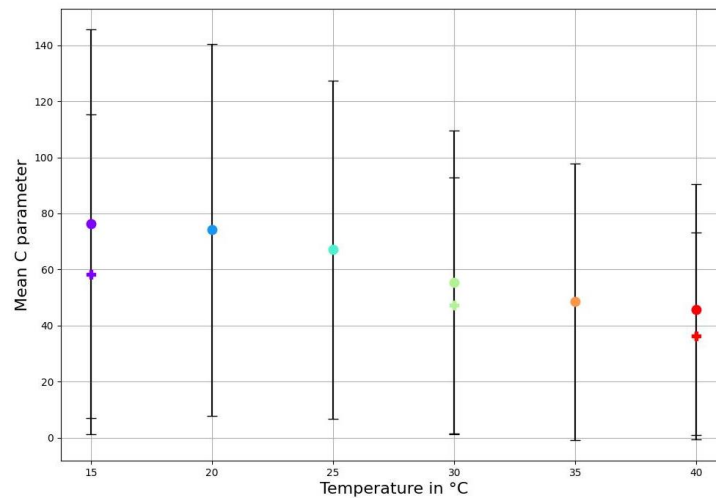
Mean Intercept B vs Temperature for Tot vs VH fit



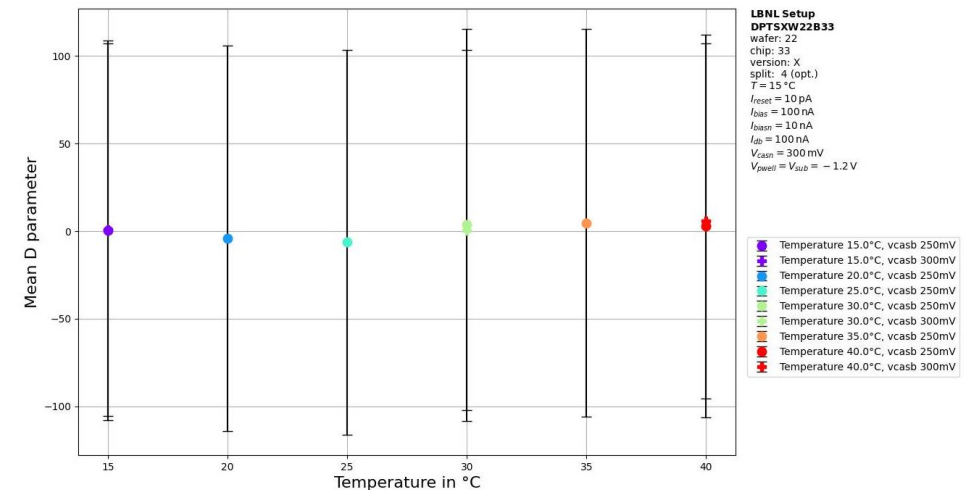
LBNL Setup
DPT5XW22833
wafer: 22
chip: 33
version: X
split: 4 (opt.)
T = 15 °C
I_{reset} = 10 pA
I_{bias} = 100 nA
I_{cb} = 10 nA
I_{ap} = 100 nA
V_{casn} = 300 mV
V_{well} = V_{sub} = -1.2 V

Temperature 15.0°C, vcasb 250mV
Temperature 15.0°C, vcasb 300mV
Temperature 20.0°C, vcasb 250mV
Temperature 25.0°C, vcasb 250mV
Temperature 30.0°C, vcasb 250mV
Temperature 30.0°C, vcasb 300mV
Temperature 35.0°C, vcasb 250mV
Temperature 40.0°C, vcasb 250mV
Temperature 40.0°C, vcasb 300mV

Mean Curvature C vs Temperature for Tot vs VH fit

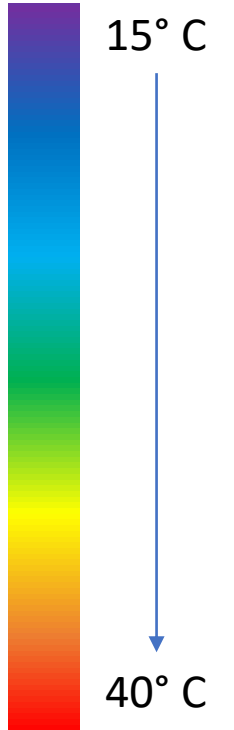


Mean Vertical Asymptote D vs Temperature for Tot vs VH fit



LBNL Setup
DPT5XW22833
wafer: 22
chip: 33
version: X
split: 4 (opt.)
T = 15 °C
I_{reset} = 10 pA
I_{bias} = 100 nA
I_{cb} = 10 nA
I_{ap} = 100 nA
V_{casn} = 300 mV
V_{well} = V_{sub} = -1.2 V

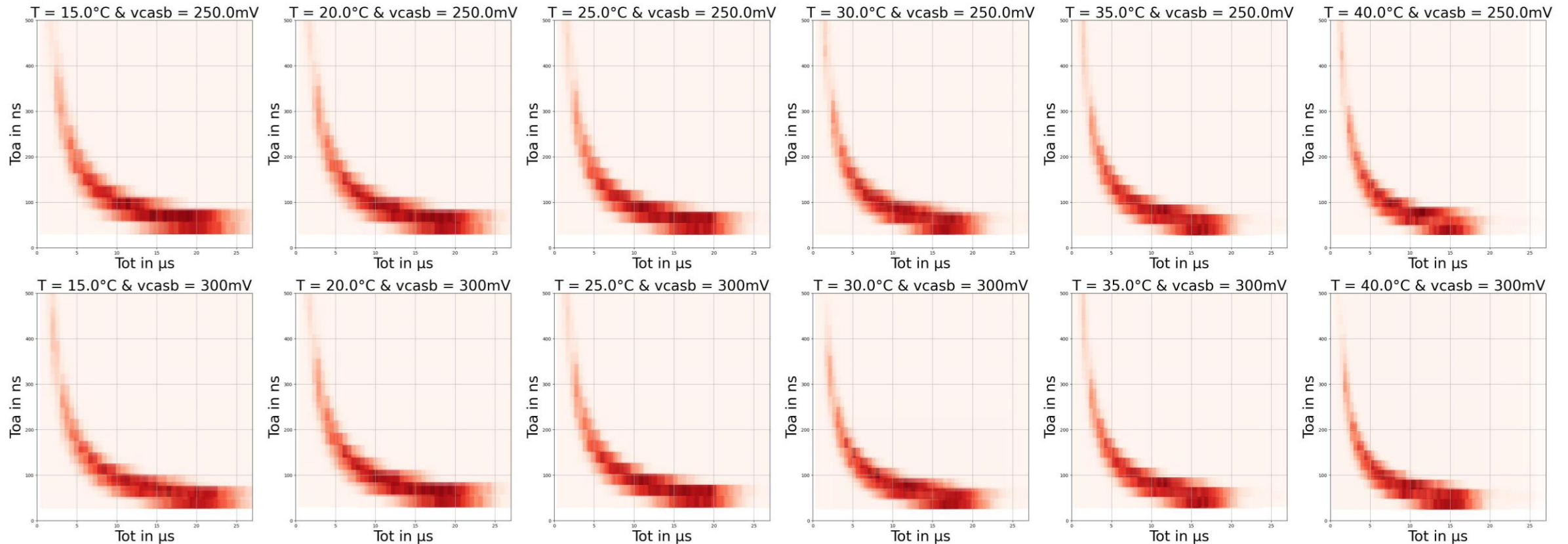
Temperature 15.0°C, vcasb 250mV
Temperature 15.0°C, vcasb 300mV
Temperature 20.0°C, vcasb 250mV
Temperature 25.0°C, vcasb 250mV
Temperature 30.0°C, vcasb 250mV
Temperature 30.0°C, vcasb 300mV
Temperature 35.0°C, vcasb 250mV
Temperature 40.0°C, vcasb 250mV
Temperature 40.0°C, vcasb 300mV





Toa vs Tot

Toa vs Tot for different temperatures and vcasbs



-> Time of arrival is temperature independent

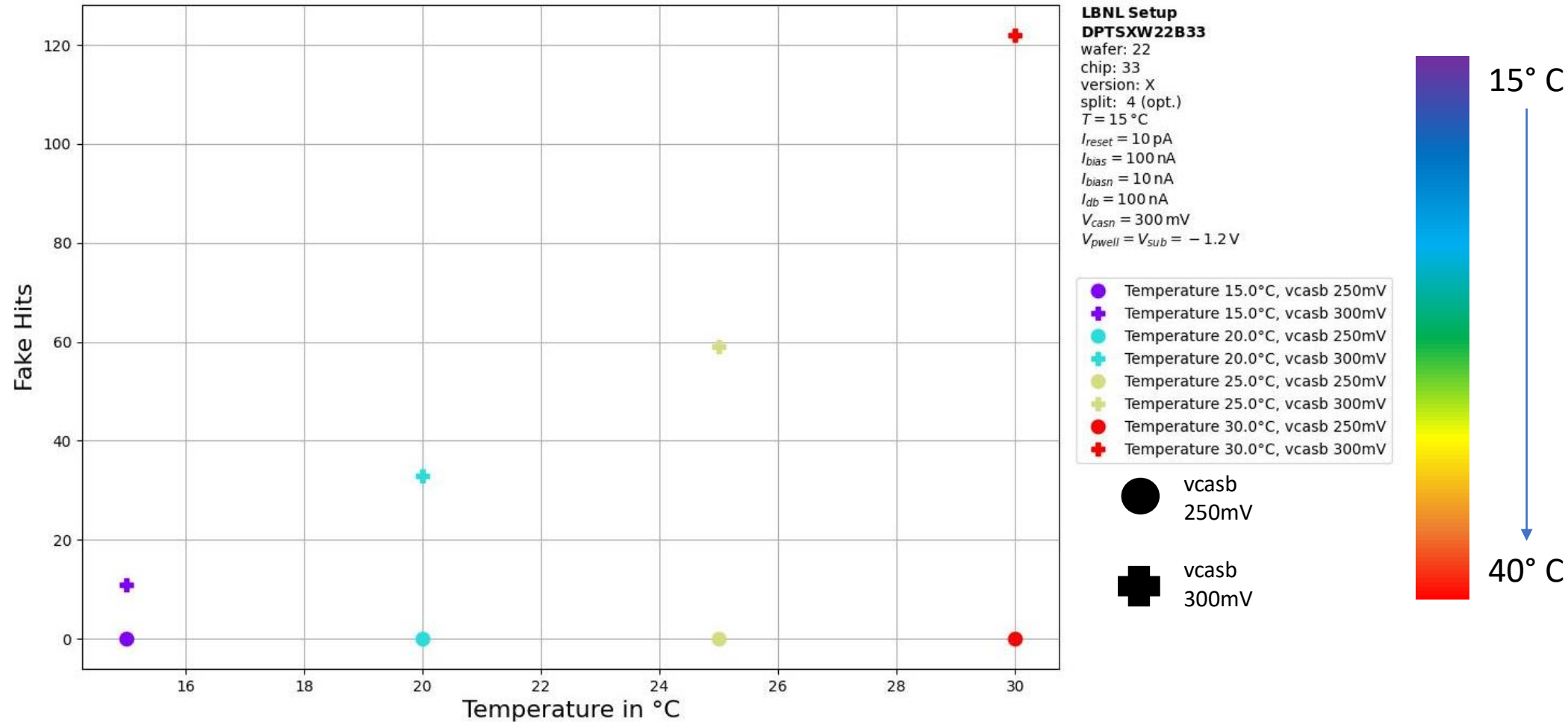
Fake Hit Rate vs temperature



BERKELEY LAB

Fake Hits vs Temperature for Scan with $n = 100000$

-> Fake Hit Rate
increases
with increasing
temperature



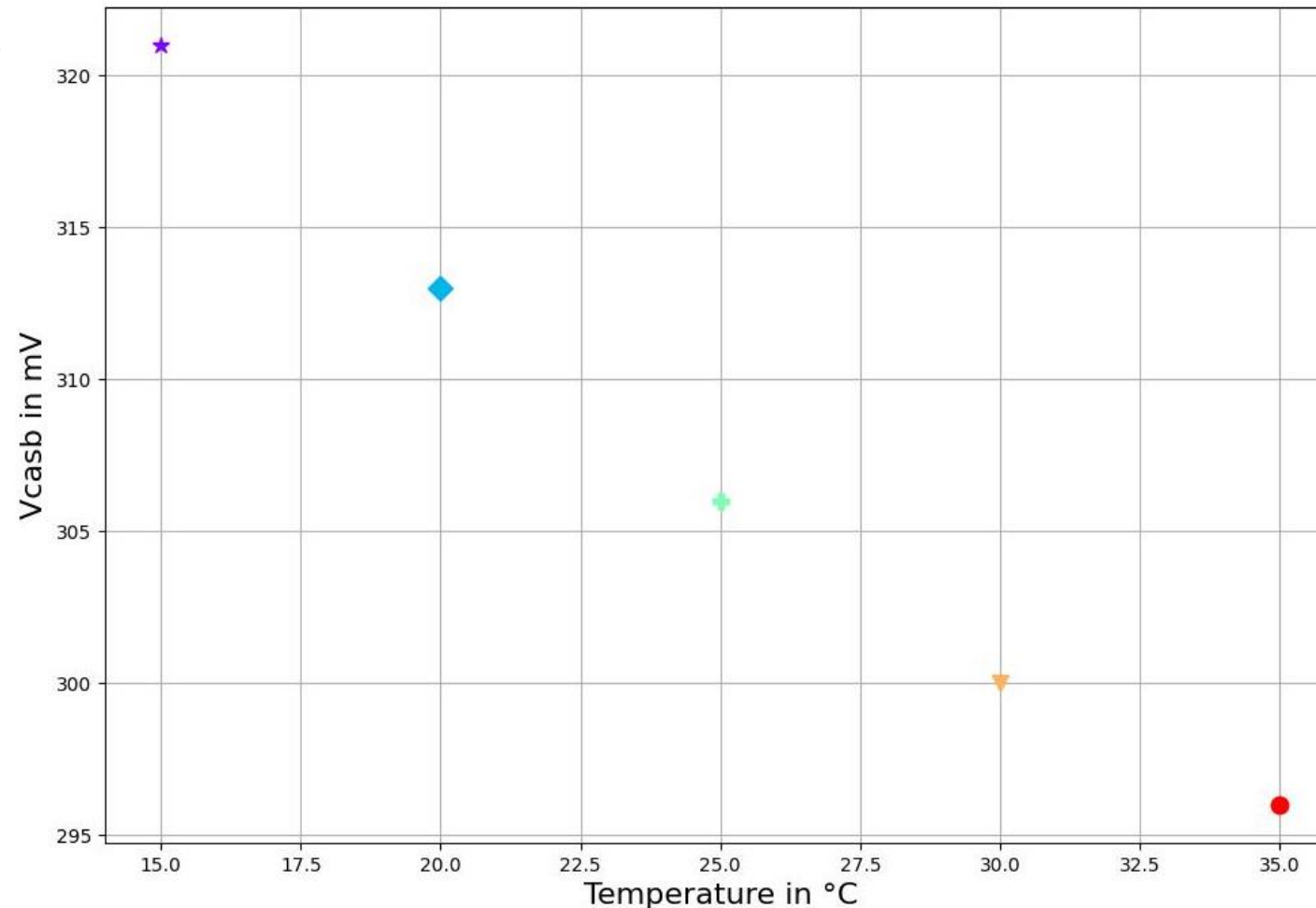
Vcasb vs Temperature for fixed threshold



BERKELEY LAB

Vcasb vs temperature for fixed threshold at 110 +/- 1%

-> Vcasb decreases
with increasing
temperature



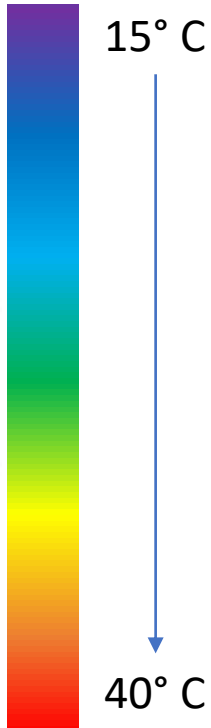
LBNL Setup
DPTSXW22B33

wafer: 22
chip: 33
version: X
split: 4 (opt.)
 $T = 15^{\circ}\text{C}$
 $I_{\text{reset}} = 10\text{ pA}$
 $I_{\text{bias}} = 100\text{ nA}$
 $I_{\text{biasn}} = 10\text{ nA}$
 $I_{\text{db}} = 100\text{ nA}$
 $V_{\text{casn}} = 300\text{ mV}$
 $V_{\text{pwell}} = V_{\text{sub}} = -1.2\text{ V}$

★ Temp. 15.0°C, Thresh. 110.5mV
◆ Temp. 20.0°C, Thresh. 110.55mV
◆ Temp. 25.0°C, Thresh. 110.5mV
▼ Temp. 30.0°C, Thresh. 110.58mV
● Temp. 35.0°C, Thresh. 110.29mV

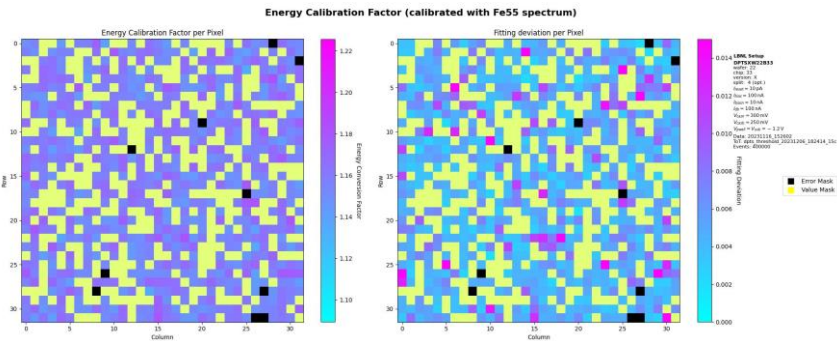
● vcasb
250mV

✚ vcasb
300mV

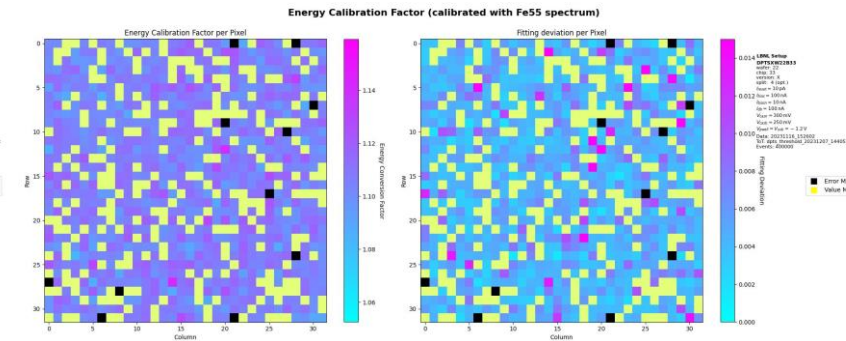


Source data Calibration with different ToT datasets

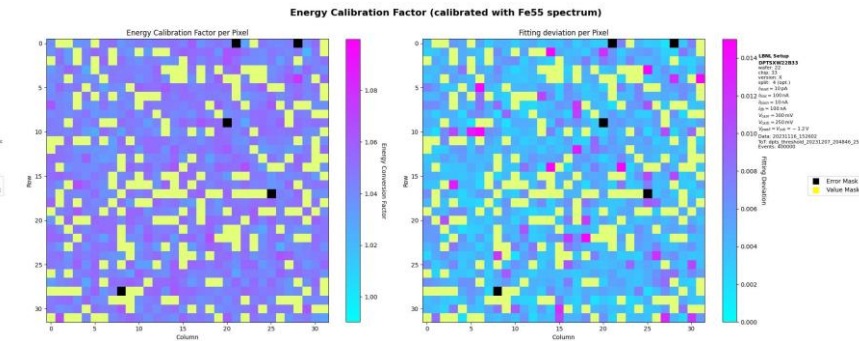
15°C



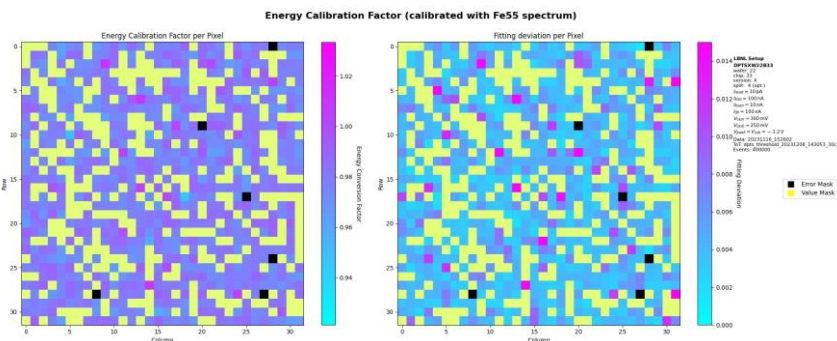
20°C



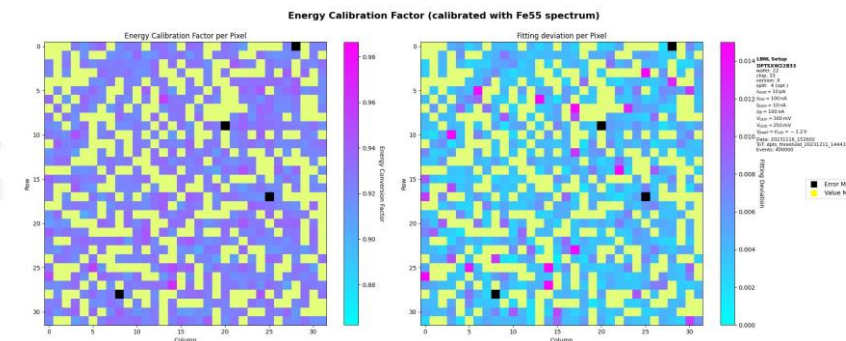
25°C



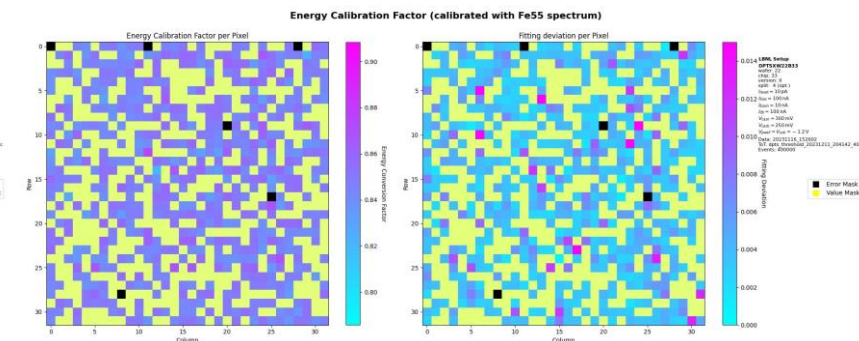
30°C



35°C



40°C

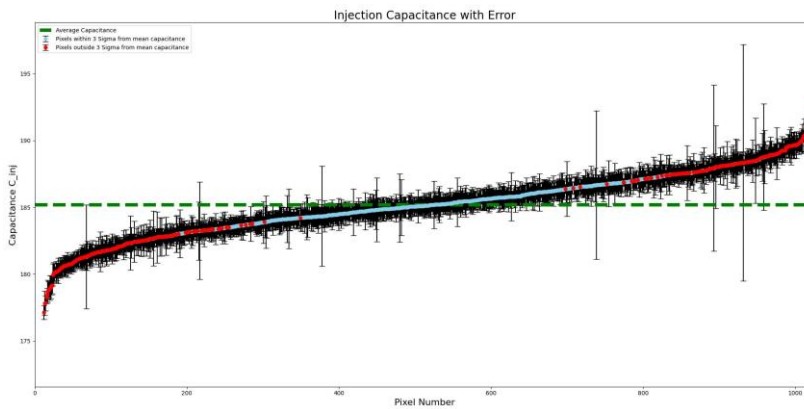


Different Calibration of $\sim 20\text{-}25^\circ\text{C}$ source data set

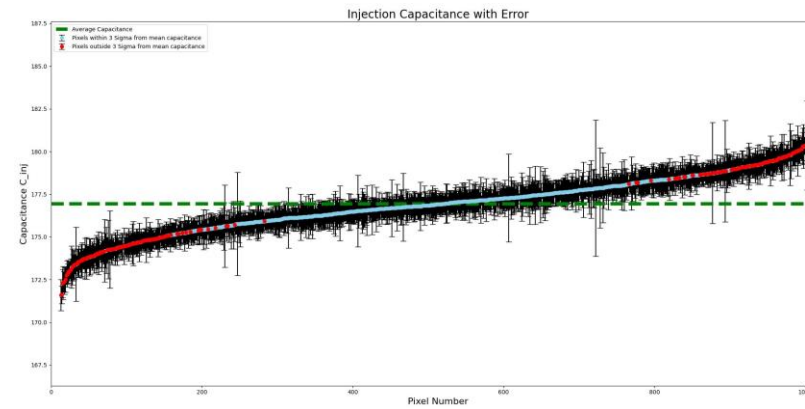


BERKELEY LAB

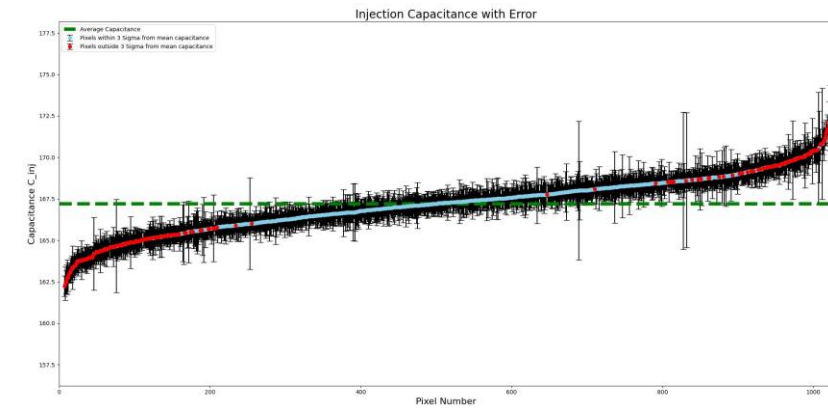
15°C



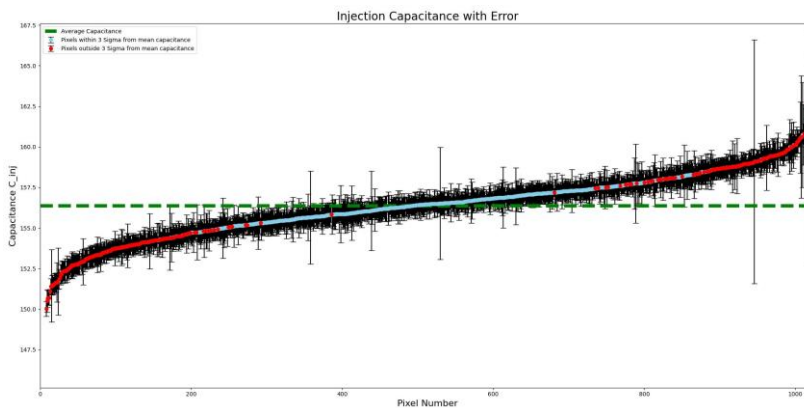
20°C



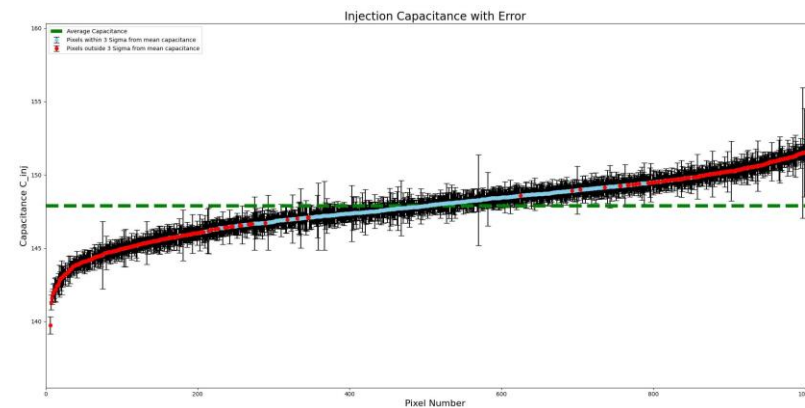
25°C



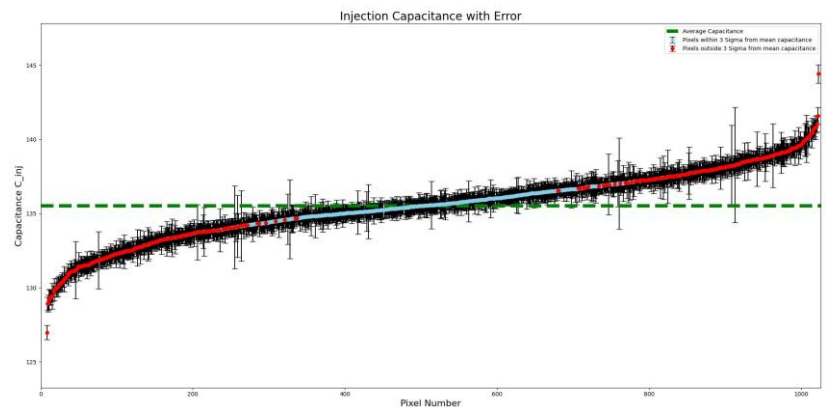
30°C



35°C



40°C





Summary

- Calibration scan under same conditions than source scans is important
 - Strong pixel to pixel variation (at least 250 pixel outside 3σ)
- With increasing temperature 
 - Mean Threshold 
 - Time over Threshold 
- Time of arrival 
- Fake Hit rate 
 - Fake Hite rate = 0 at $v_{casb} = 250\text{mV}$
 - VCASB at fixed threshold 
- Temperature  $\rightarrow v_{casb}$  $\rightarrow$ Threshold  $\rightarrow$ Fake Hit rate 

Backup