



Electrical Tests on GLAST2000 Prototypes

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35 SSD delivered:

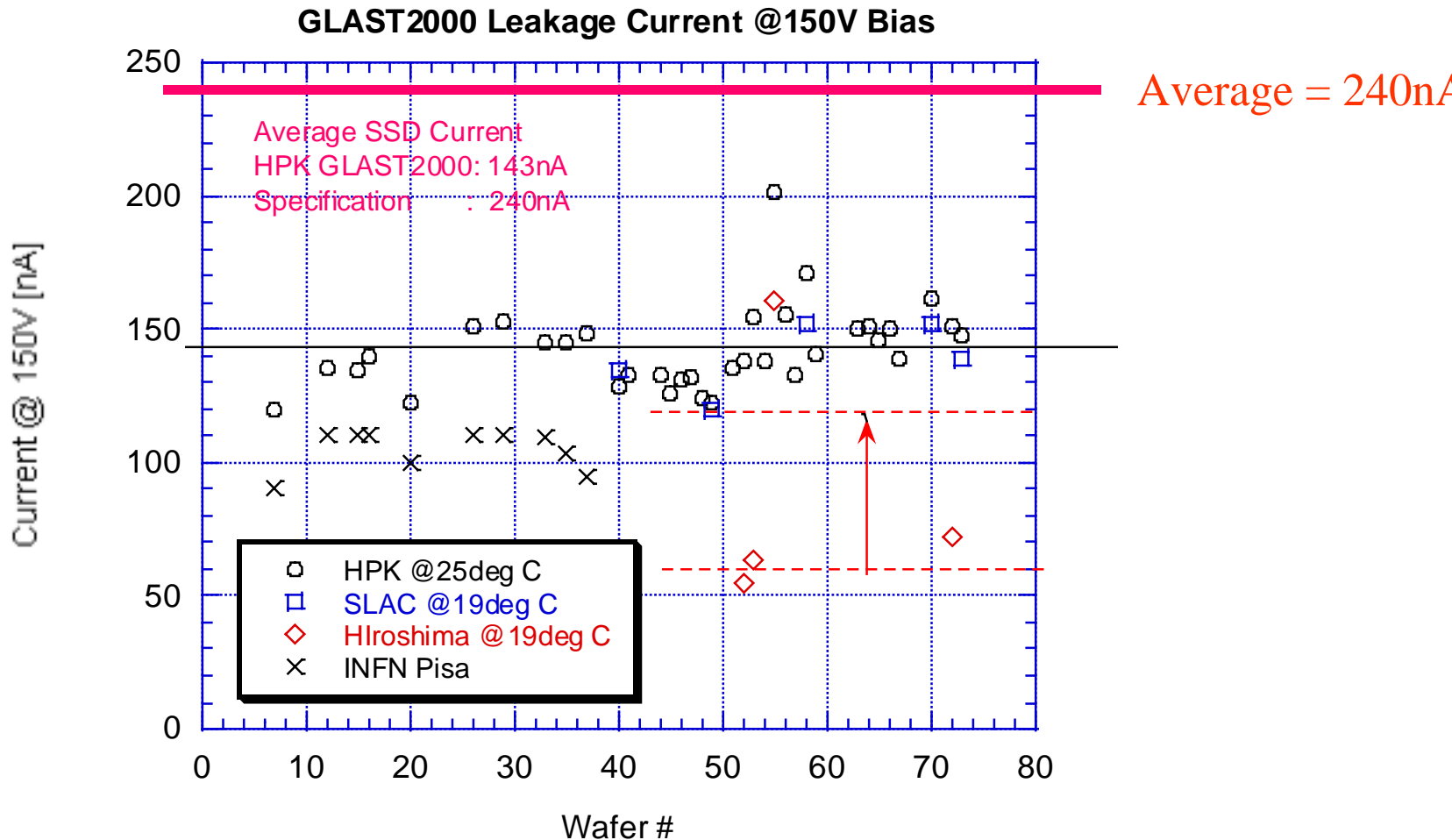
Measurements at Hiroshima U.(20), INFN Pisa(10), SLAC(5)

Comparison between HPK and GLAST Results

Comparisons between Full-size SSD and Test Structures

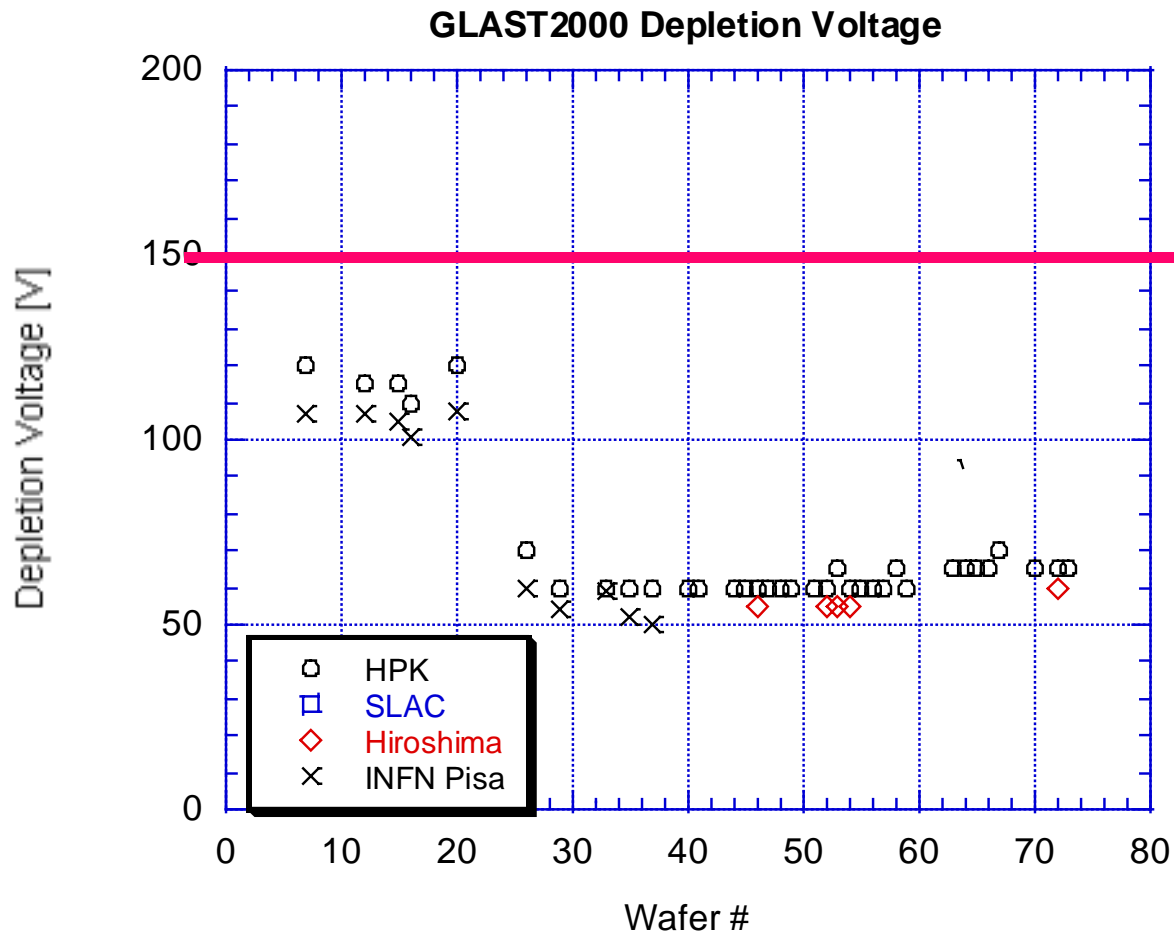
Leakage Current I-V Curves

- Leakage Current depends on Temperature, Humidity, Time
- Use HPK measurement, below specs.



Depletion Voltage C-V Curves

- Depletion Voltage agrees well among different measurements
- Capacitances at depletion indicate good thickness uniformity



Bad Strips

Bad strips are shorted coupling capacitors, open connections or strips shorted together.

- **A total of 4 bad strips were found by HPK: 0.03% (Spec <0.2%)**
- **Hiroshima found the shorted capacitor,**
- **Hiroshima had 3 disconnected Bias resistors**
- **SLAC checked 2 SSD and found no bad strips**
- **INFN Pisa measured ALL capacitors on 10 detectors and found NO bad channels.**

The bad channel rate is 10x better than specified.

The measurements at HPK are confirmed by GLAST

Capacitances

- Don't expect variation of inter-strip capacitance wafer-to-wafer.
- Expect variation of body capacitance wafer-to-wafer only due to thickness variations.
- Strip capacitance
 - Backplane (Body) Capacitance:
 $1860\text{pF}/384\text{Strips}/8.75\text{cm} = 0.55\text{pF}/\text{cm}$
 - Inter-strip Capacitance:
 $5.5\text{pF}/0.82/8.75 = 0.77\text{pF}/\text{cm}$
 - Total strip capacitance = $1.3\text{pF}/\text{cm}$ (Spec $<1.5\text{pF}$)
- Coupling capacitance varies with thickness of dielectric
 - Measure between 550 and 600pF , (Spec $>500\text{pF}$).

Resistances

- **Bias Resistance**

Spec: Polysilicon , $20\text{M}\Omega < R < 80\text{M}\Omega$, wafer uniform to $10\text{M}\Omega$

Observed $\sim 35\text{-}40\text{M}\Omega$, very uniform, agrees with HPK

- **Al Trace Resistance**

Spec: $R < 50\Omega$

Observed $R=25\text{-}30\Omega$, very uniform, agrees with HPK

- **Interstrip Isolation**

Spec: $>1\text{G}\Omega$,

Observed $>1\text{T}\Omega$

Conclusions

- The 35 HPK GLAST2000 SSD exceed the specifications.
- The measurements at HPK and GLAST correlate very well.
- The bad channel count continues to be 10x lower than specified
- The leakage current is very low, below the specifications. We plan to rely on the HPK measurements.
- No u-discharge observed up to 200V bias
- Depletion voltages are low (~60V) except for a batch of 5 SSD.
- Radiation damage is well in hand and understood.
- Based on the measurements, we see no obvious need to change the parameter values at which we reject SSD's.
- Measurements of the correlation between full SSD and test structures are being finished to allow the QA plan to be finalized.