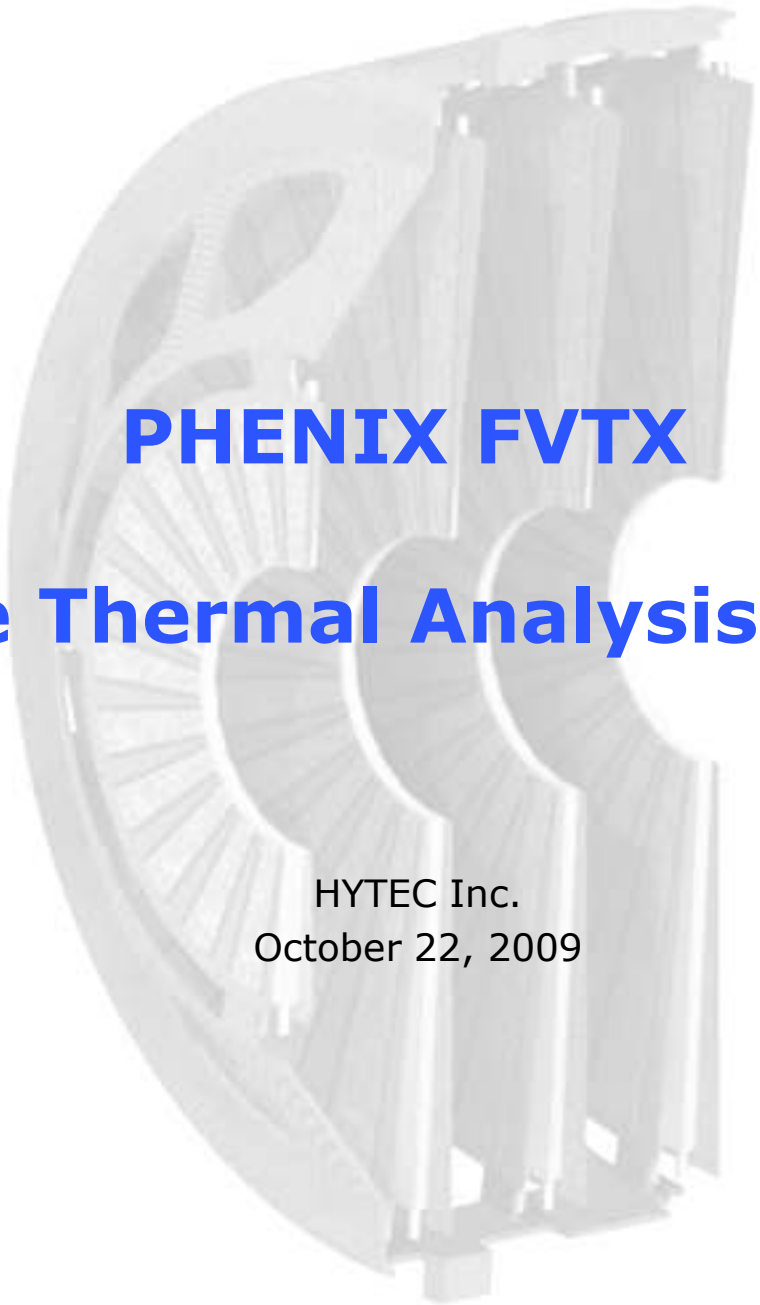


PHENIX FVTX

Wedge Thermal Analysis Update

HYTEC Inc.

October 22, 2009

New HDI Model

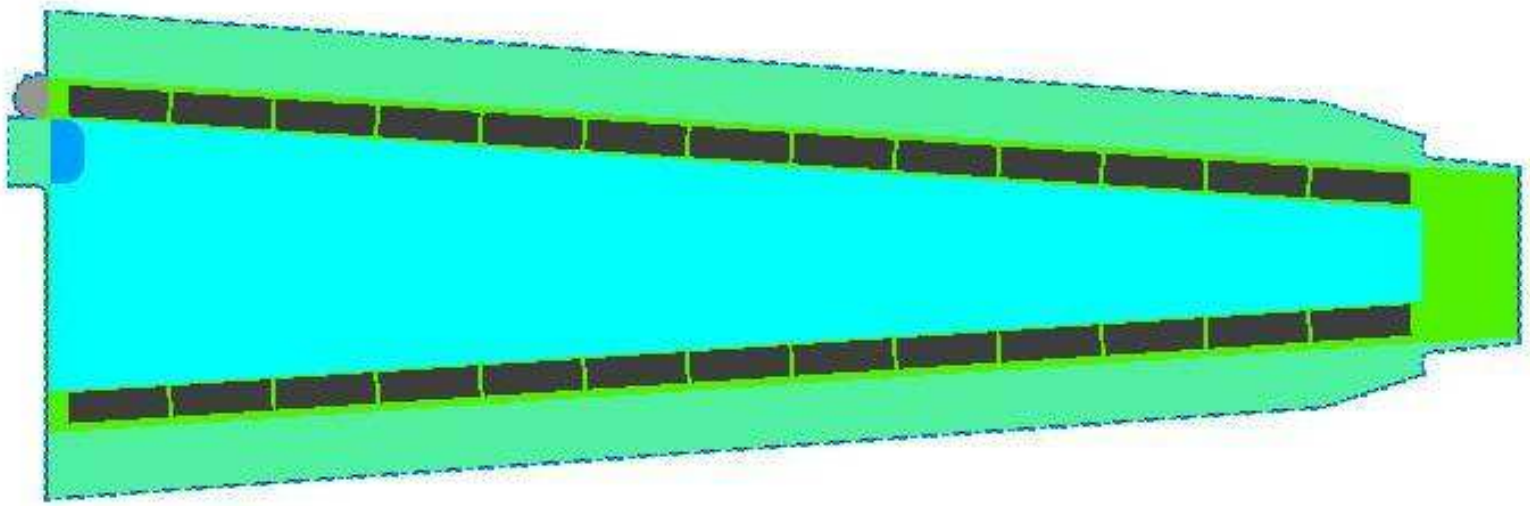
- FEA model was updated to represent the new HDI
  - HDI is thicker and overhangs CF thermal plane
  - Layup from as-built Dyconex Data from 7-13-2009

UNM – KAPTON HDI STACK_UP FROM DYCONEX 7-13-2009

Layers:	number of layers	fraction of layers	thickness (μm)	Thick	R_L	thickness (μm)	Actual Production Version
top covercoat	1	0.2	38	38	0.171287	10	**10**
copper 1	1	0.8	12	12	6.713287	25	**18**
kapton 1	1	1	25	25	0.874126	25	**20**
epoxy 1	1	1	12	12	0.270453	12	**15**
copper 2	1	0.9	12	12	7.552448	12	**11**
kapton 2	1	1	40	40	1.398601	25	**20**
epoxy 2	1	1	12	12	0.270453	12	**15**
copper 3	1	0.1	12	12	0.839161	12	**9**
kapton 3	1	1	50	50	1.748252	50	**50**
copper 4	1	0.9	12	12	7.552448	12	**11**
epoxy 3	1	1	12	12	0.270453	12	**15**
kapton 4	1	1	40	40	1.398601	25	**20**
copper 5	1	0.1	12	12	0.839161	12	**11**
epoxy 4	1	1	12	12	0.270453	12	**15**
kapton 5	1	1	40	40	1.398601	25	**20**
copper 6	1	0.9	12	12	7.552448	12	**11**
epoxy 5	1	1	12	12	0.270453	12	**15**
kapton 6	1	1	25	25	0.874126	25	**20**
copper 7	1	0.2	12	12	1.678322	25	**18**
bottom covercoat	1	0.7	38	38	0.599504	10	**10**
				440	42.54264	365	**334**

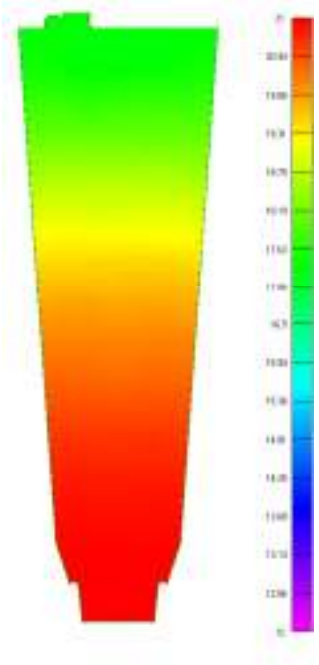
FEA Model

- Built from laminate plate elements with specific layups for each of the regions
  - Chips, Sensor, HDI, etc.

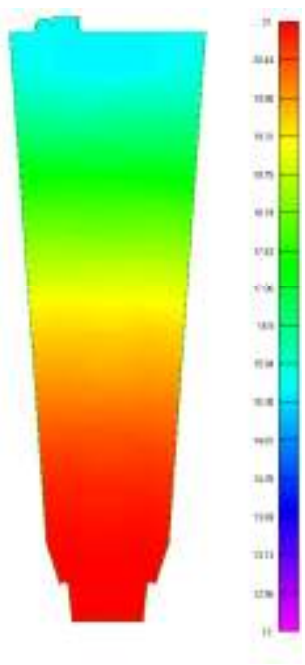


Temperature Distribution

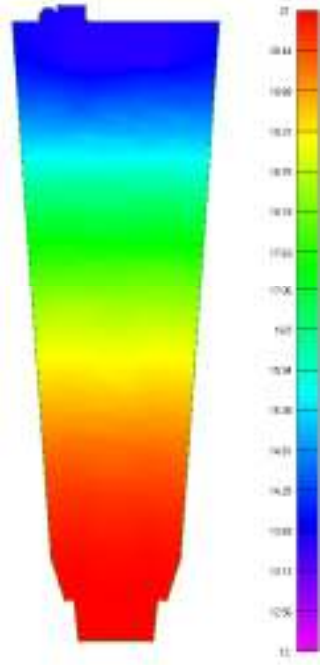
- Constraint temperature was varied to keep peak chip temperature at 21°C



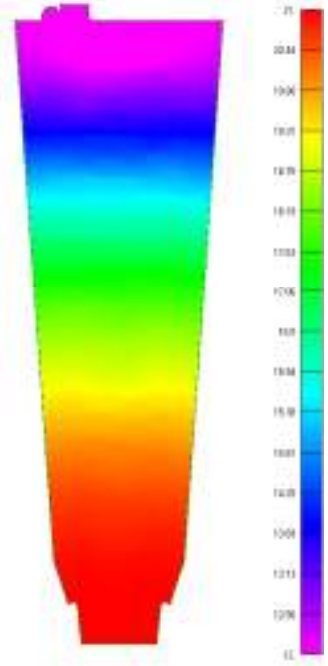
200 µW/Channel
Base Temperature 17.36° C



300 µW/Channel
Base Temperature 15.54° C

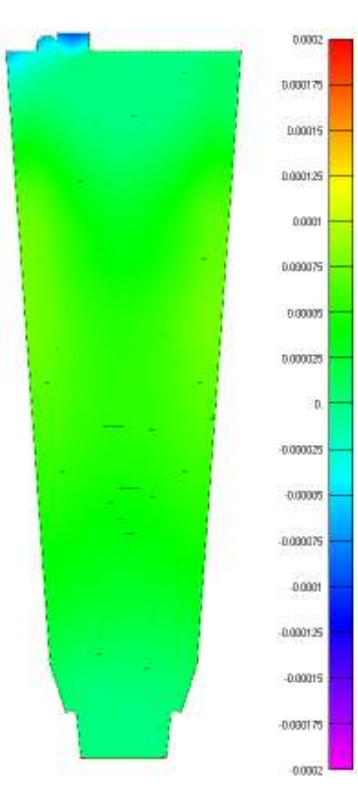


410 µW/Channel
Base Temperature 13.53° C

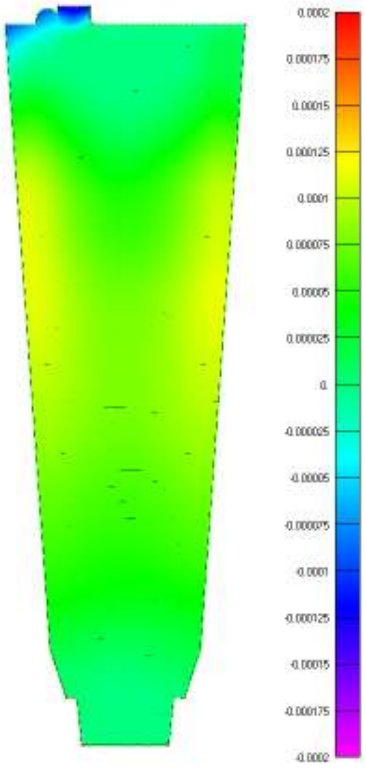


410 µW/Channel
Base Temperature 13.53° C

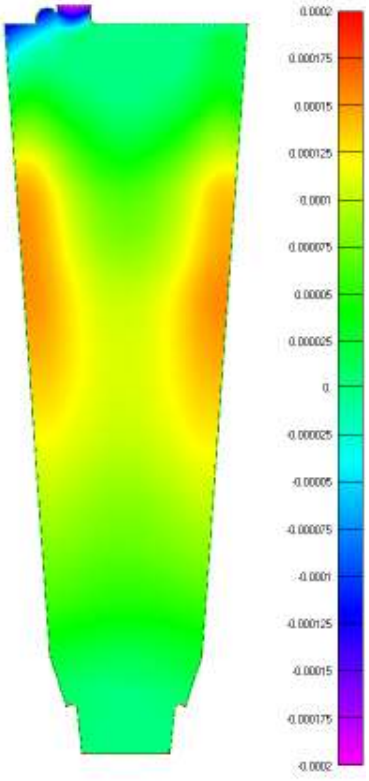
Total Wedge Deflection



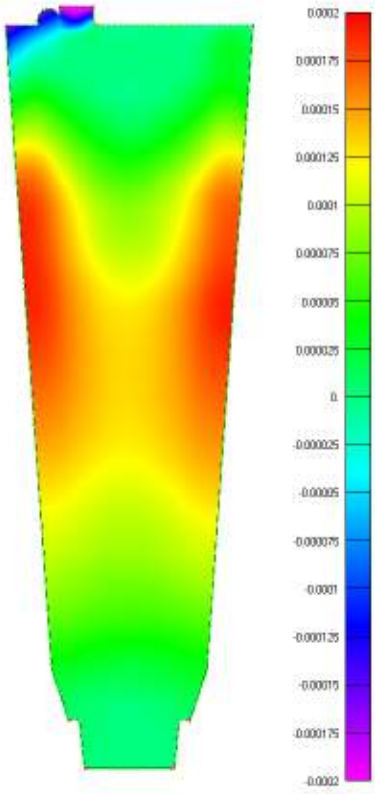
200 μW/Channel



300 μW/Channel

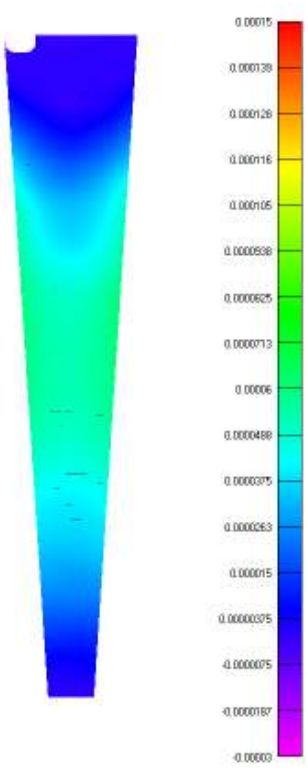


410 μW/Channel

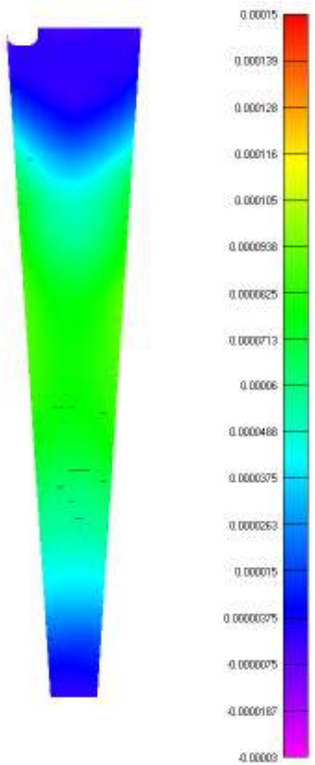


500 μW/Channel

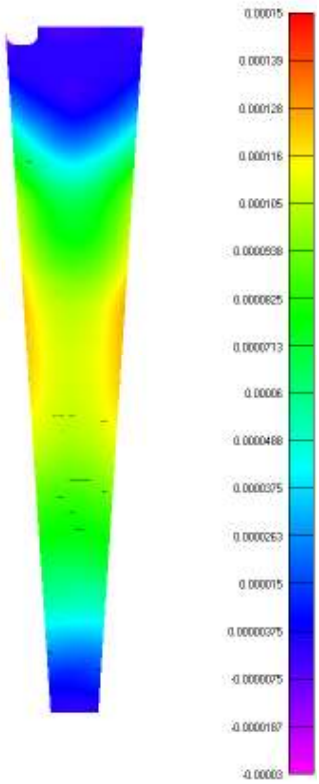
Sensor Deflection



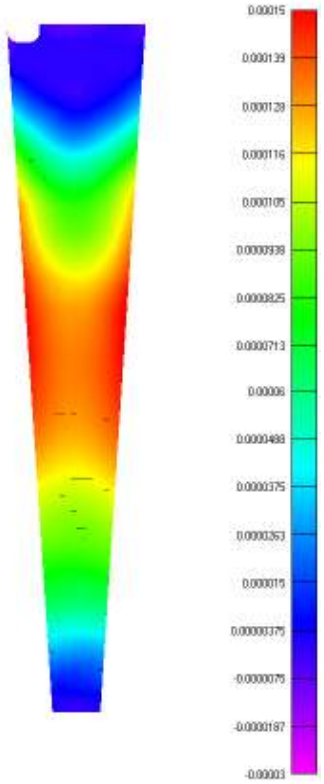
200 μW/Channel



300 μW/Channel

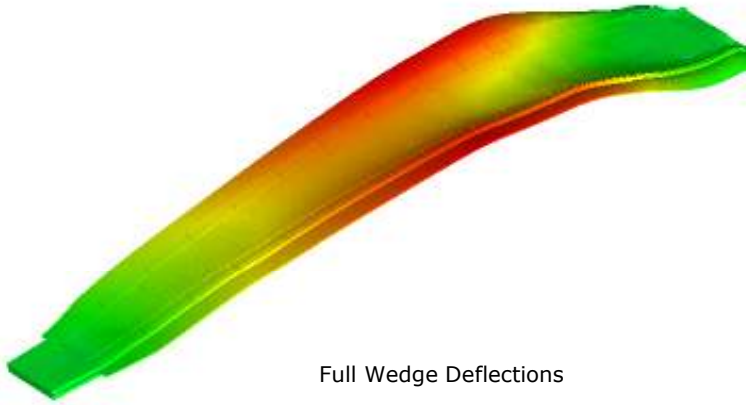


410 μW/Channel

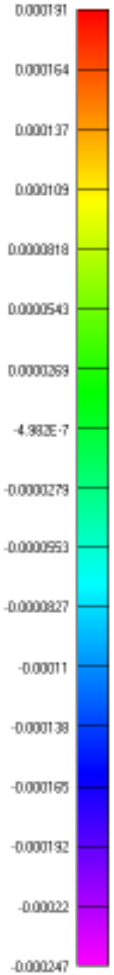


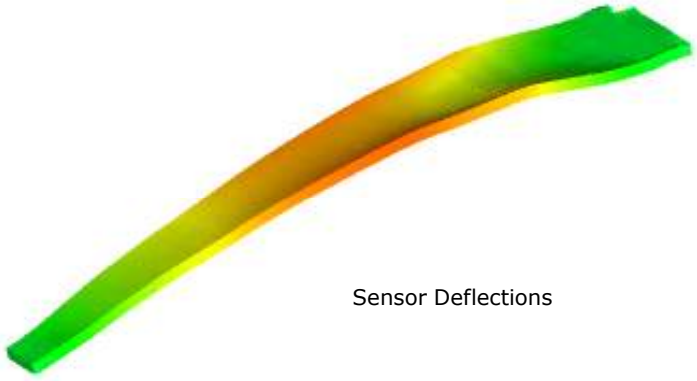
500 μW/Channel

Deflection Shapes



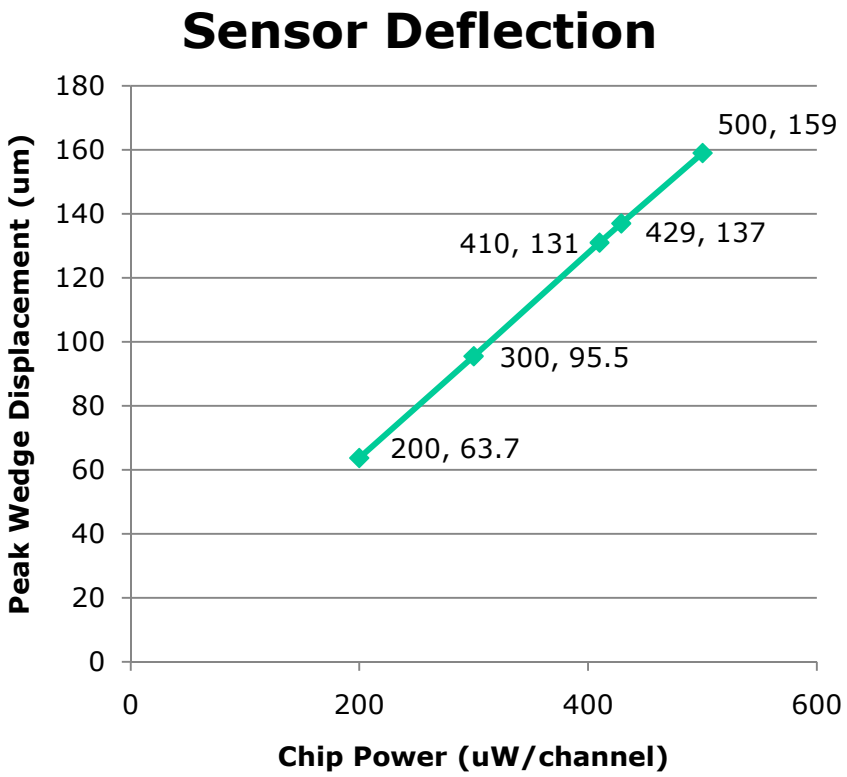
Full Wedge Deflections

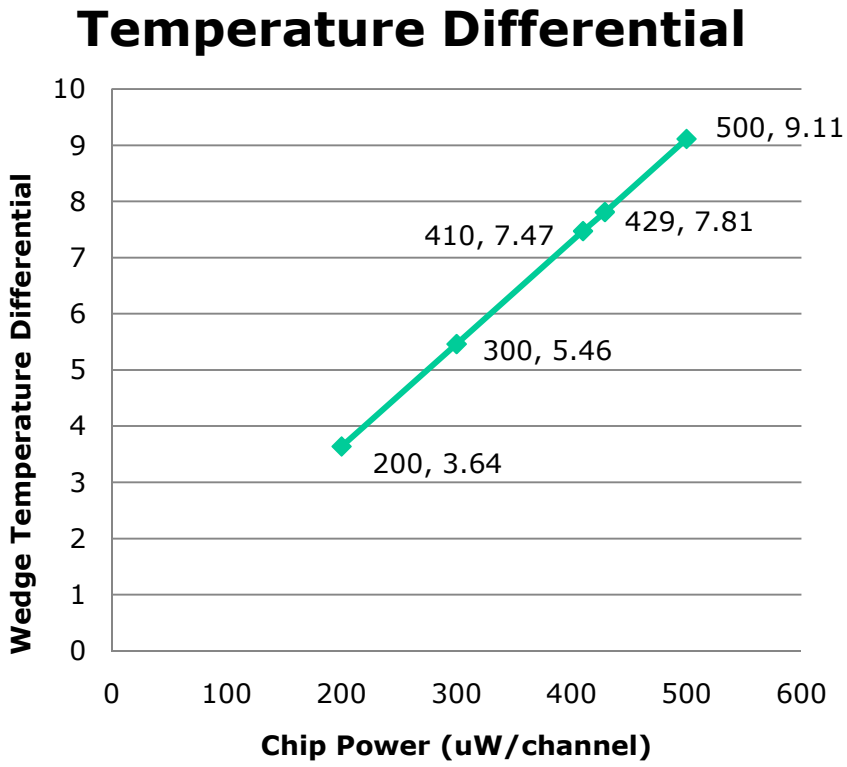




Sensor Deflections

Deflection and Temperature vs. Chip Power





Conclusions

- The sensor deflection is much higher than previous estimates due to a combination of factors
  - The chip power is much higher – 500 μW vs 100 μW
  - The HDI is larger and thicker
  - The carbon fiber backplane while thicker is smaller in width

- Both the sensor deflections and temperature differential across the wedge vary linearly with chip power