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U.S. DEPARTMENT OF ENERGY
Office of Science

PPA Preliminary Test Results

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Current Progress

- Out of 22 panels, only 7 fully passed all electrical tests
- An additional 5 panels only failed Temperature tests
- Still have 2 database bugs to iron out
- All panels photographed and inspected

Panel #	Registered?	Visually inspected?	Electrically Tested?	Comments
3000001	Success	Todo	Success	guinea pig, some boards already on modules
3000002	Todo	Todo	Todo	not singulated
3000003	Todo	Todo	Todo	Amtech
3000004	Success	Success	Problem	Failed Toggle Input, HV enable (missing HVSENSE), OF, and temp
3000005	Success	Success	Success	Transitioned to THERMAL
3000006	Success	Success	Success	Transitioned to THERMAL
3000007	Success	Success	Problem	Failed one temp test
3000008	Success	Success	Problem	Failed three temp tests
3000009	Success	Success	Success	Transitioned to THERMAL
3000010	Success	Success	Problem	Failed one temp test
3000011	Success	Success	Problem	Failed one temp test
3000012	Success	Success	Problem	Board 5 and 9 have issues 5:DCDC 9:LDx2EN
3000013	Success	Success	Problem	Failed 3 temp tests, toggle output
3000014	Problem	Success	Success	104, 199 wont upload
3000015	Success	Success	Problem	P6 failed padid, so missing tests, failed nine temps, OF, ToggleOutput, and PADID
3000016	Success	Success	Problem	failed four temp tests
3000017	Success	Success	Problem	failed temp and toggle output
3000018	Success	Success	Problem	Typo on passive board 89 not 88, 2 failed toggle outputs
3000019	Problem	Success	Problem	AMAC 5,9 bugged, not uploaded bc current too high, broken linpol
3000020	Success	Success	Success	transitioned to THERMAL
3000021	Success	Success	Success	transitioned to THERMAL
3000022	Success	Success	Problem	P3 failed padid
3000023	Success	Success	Problem	seven failed temp tests, Board 0 might have wirebond issue
3000024	Success	Success	Problem	failed toggleoutput, hv enable and missing hvsense
3000025	Success	Problem	Success	dropped panel, fix wirebonds on 1, 5 ,7, 9

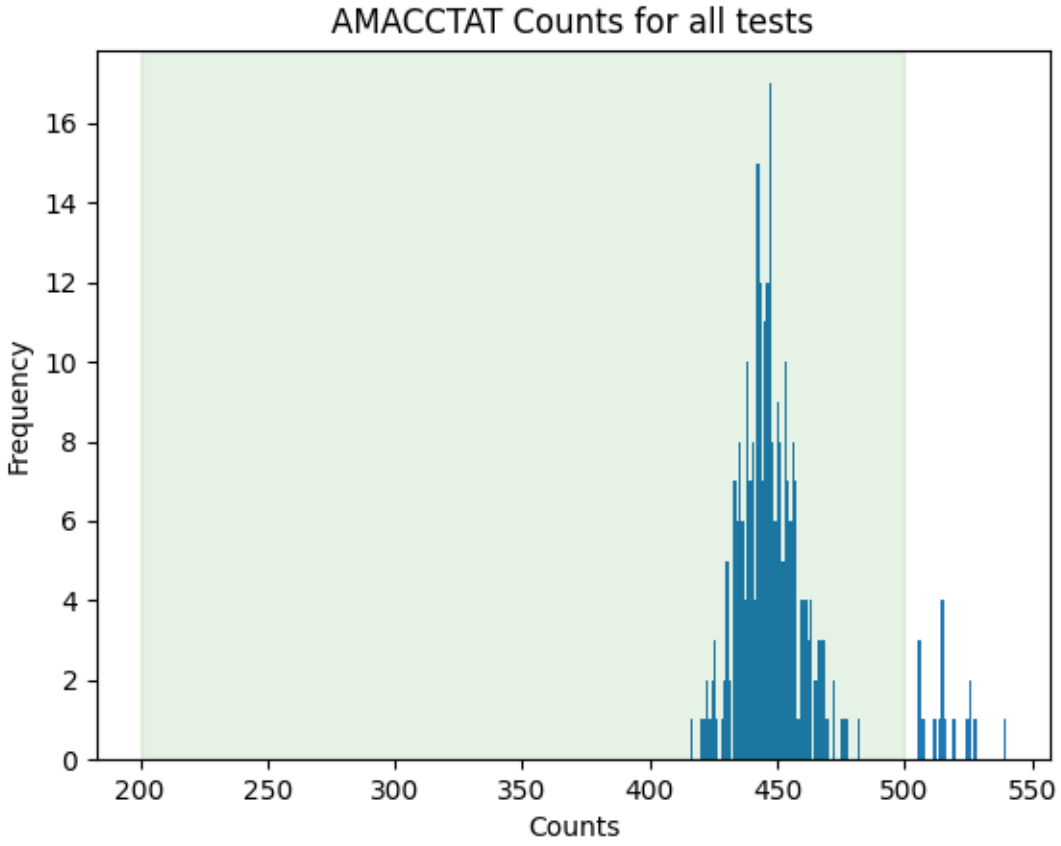
Panel #	Powerboard #	Date tested	Issue?	Comment	Link to test in DB
3000004	4	3/10/2021	linPOL ON failed (.01V)	NZ:popped wirebonds by j39	6049501c308715000aa205e0 (OF Test)
3000004	0	3/10/2021	Shuntx and Shunty failed (above 1.3V)	NZ:No visible wirebond damage	60494fa3308715000aa1fc6d(ToggleOutput)
3000004	1	3/10/2021	Calx failed (OFF=.95V ON=.62V) Shuntx failed (OFF = 1.05V ON = .67V) HVout failed (ON=6.1e-8A) HVret failed (ON = 117 counts) LDx1EN failed (OFF = 1.04V ON = .67V) LDx2EN failed (OFF = .42V ON =.27V) LDy2EN failed (OFF = 1.04V ON = .67V) Temperature NTCx failed (range [500,700] actual 257 counts)	NZ:Has popped wirebonds	60495081308715000aa21020(ToggleOutput), 60495083308715000aa2104d (HV Enable), 60495082308715000aa2102d (Temperature), Missing HVSENSE (cd07e0b00f3eb02e82d9f6ccd8169f59)
3000004	8	3/10/2021	CALy failed (OFF = .7V ON = .45V) Shuntx failed (OFF =1.08V ON = .7V) LDy2EN failed (OFF = 1.06V ON = .68V) NTCx failed (range [500,700] actual 255 counts)	NZ: popped wirebonds below amac to passive	60495051308715000aa20bc0(ToggleOutput), 60495052308715000aa20bcd (Temps)
3000007	7	3/11/2021	PTAT over threshold [600,750] but actual 752		604a8503308715000aa28a15 (Temp)
3000008	5	3/5/2021	Temperature test failed (AMACNTCPB over range) Range:700-1000, actual failed test:1023		6047d8379880c6000a41550d (Temp)
3000008	7	3/5/2021	Temperature test failed (AMACNTCPB over range) Range:700-1000, actual failed test:1023		6047d81e9880c6000a4152dc (Temp)
3000008	8	3/5/2021	Temperature test failed (AMACNTCPB over range) Range:700-1000, actual failed test:1011		6047d8059880c6000a4150ac (Temp)
3000010	2	3/11/2021	Low Voltage Scan 23 counts whole scan	NZ: Nothing obvious under microscope, no popped bonds	
3000010	2	3/11/2021	PTAT over threshold [600,750] actual 752		604bda841f7cd9000a50181e (Temp)
3000010	8	3/9/2021	PTAT over threshold [600,750] actual 752		604be0b31f7cd9000a501c05 (Temp)
3000010	2	3/4/2021	PTAT over threshold [600,750] actual 752		604be6ed1f7cd9000a5056a4(Temp)
			Failed DCDC Enable, PTAT under threshold		604be72e1f7cd9000a505c56(DCDC Enable), 604be72c1f7cd9000a505c40 (DCDC Adjust), 604be72d1f7cd9000a505c47 (Temp), Missing

Issues

- I've documented all 59 errors that I encountered during the testing
- 38 are temperature only
- 16 boards failed non-temp tests
- Final five boards didn't necessarily fail a test, but had issues in the graphs of the scans done in the advanced tests.

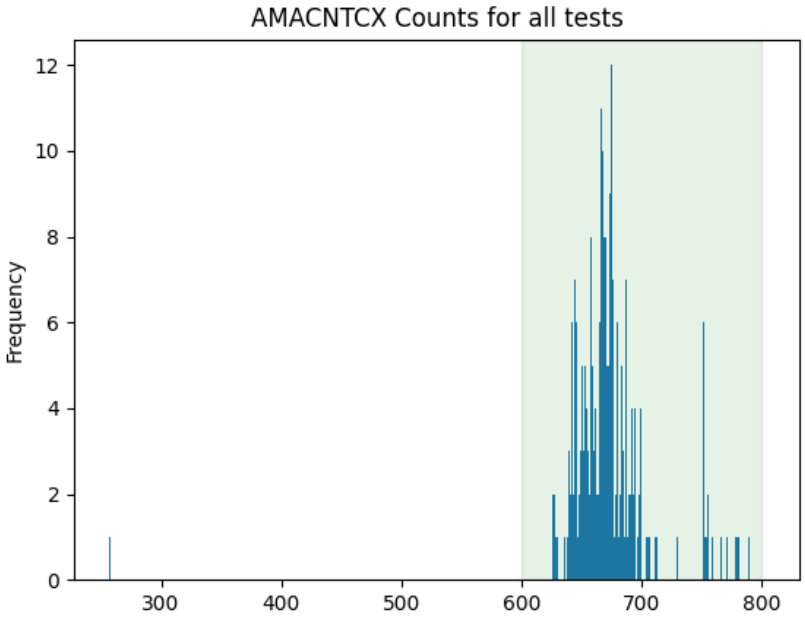
Temperature

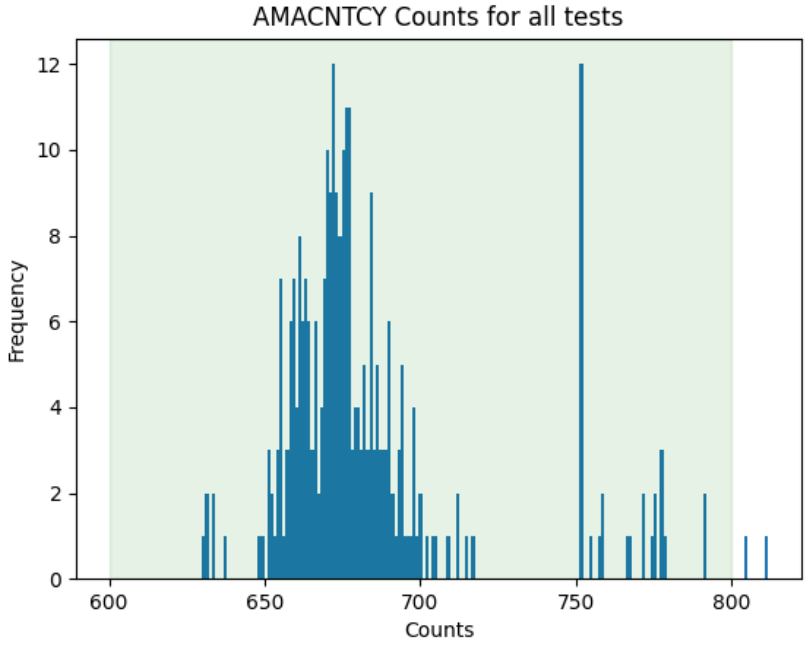
- Makes up a majority of failed tests
- Initially thought that it was a problem with our cuts with some analysis, it seems like a systematic problem
- There is a Gaussian distribution and then a separate set of outliers
- If no outliers, a cut of 400-500 would suffice
- If board outlier in CTAT, high chance it is outlier in all other tests. 16/20 fail all five tests, other 4 fail most.

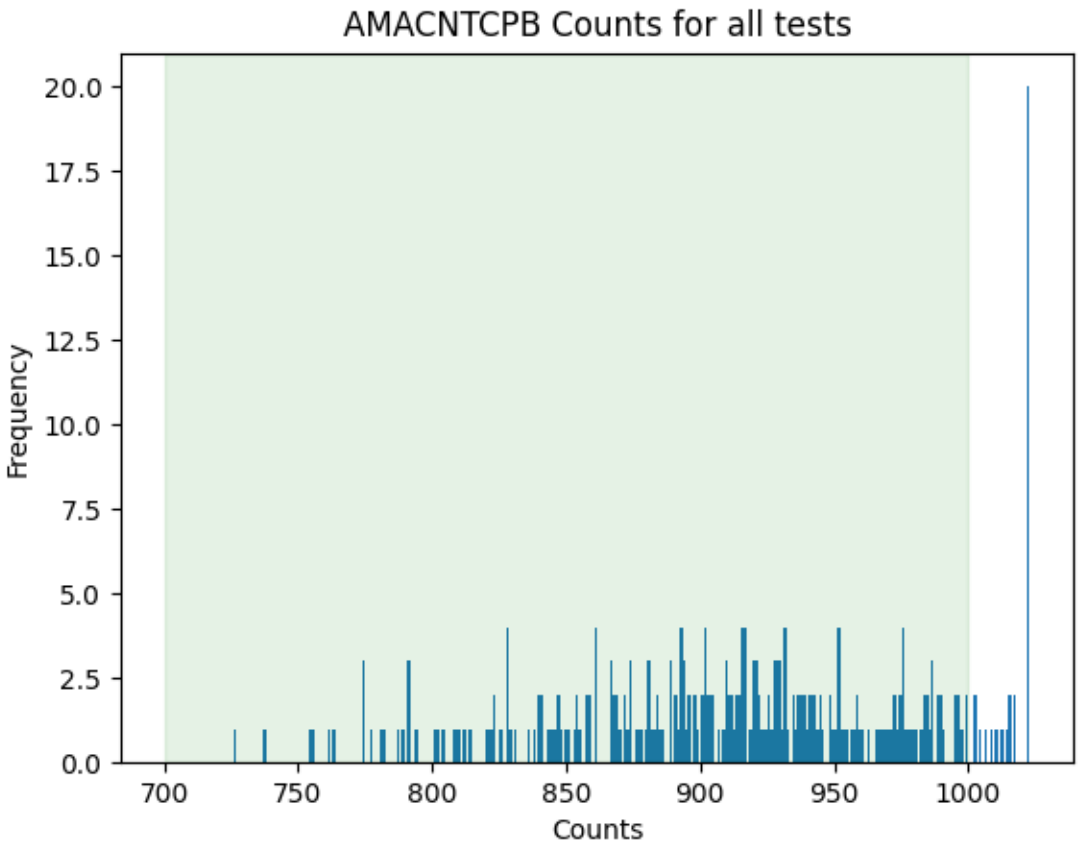


NTCX and NTCY

- Temp test that failed the least
- Under inspection, this is due to our cuts being too lax
- Follows same pattern of Gaussian with outliers
- I investigated all of the outlier tests and crosschecked them with the other temp tests
- NTCX has 26 tests not in 600-750, NTCY has 31 (with 4 duplicates).
- Of theses tests, 21 of each are from the same boards, and 11 are unique (not including duplicate)
- Of the 31 PTAT tests, 19 were the same boards that failed both NTCX and Y, 5 failed one, and 4 failed neither. (3 duplicates)
- Of the 19 CTAT, 18 failed both, 1 failed one.
- Of 34 NTCPB 16 failed both, 16 failed neither, 1 failed one.

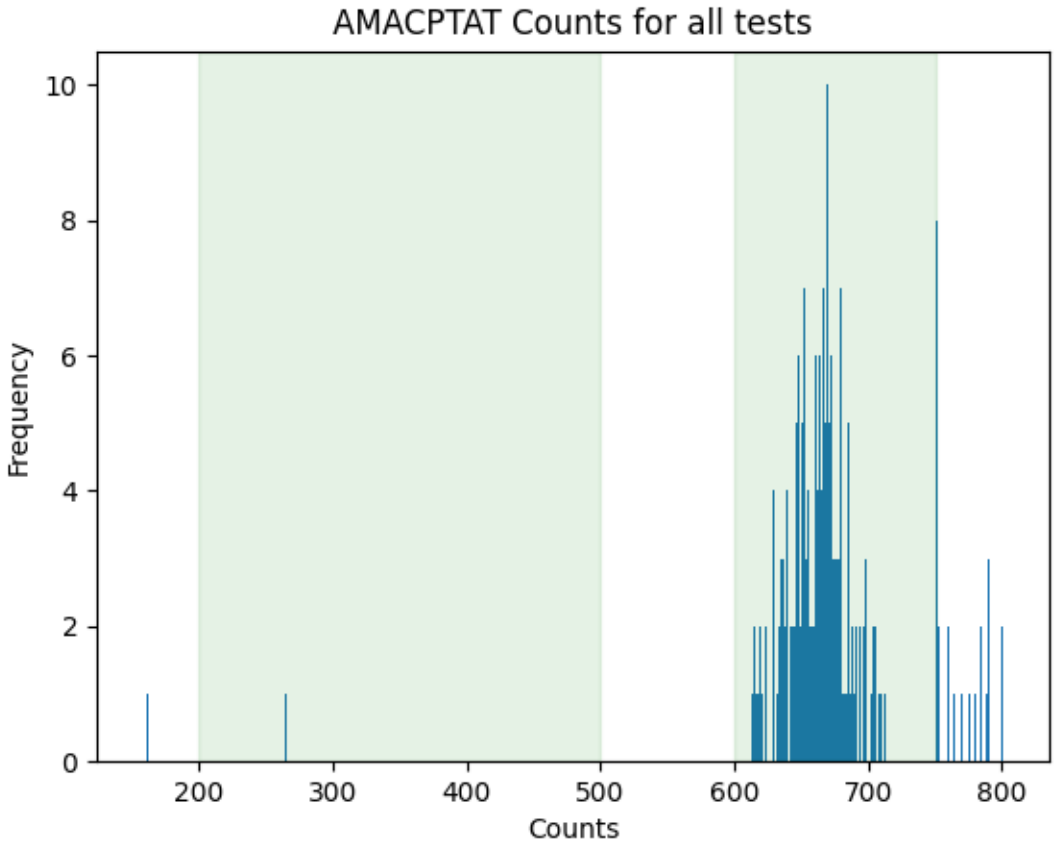






NTCPB

- Doesn’t seem to follow same Gaussian/outlier pattern as the others
- Seems range doesn't capture full Gaussian spread so hard to analyze

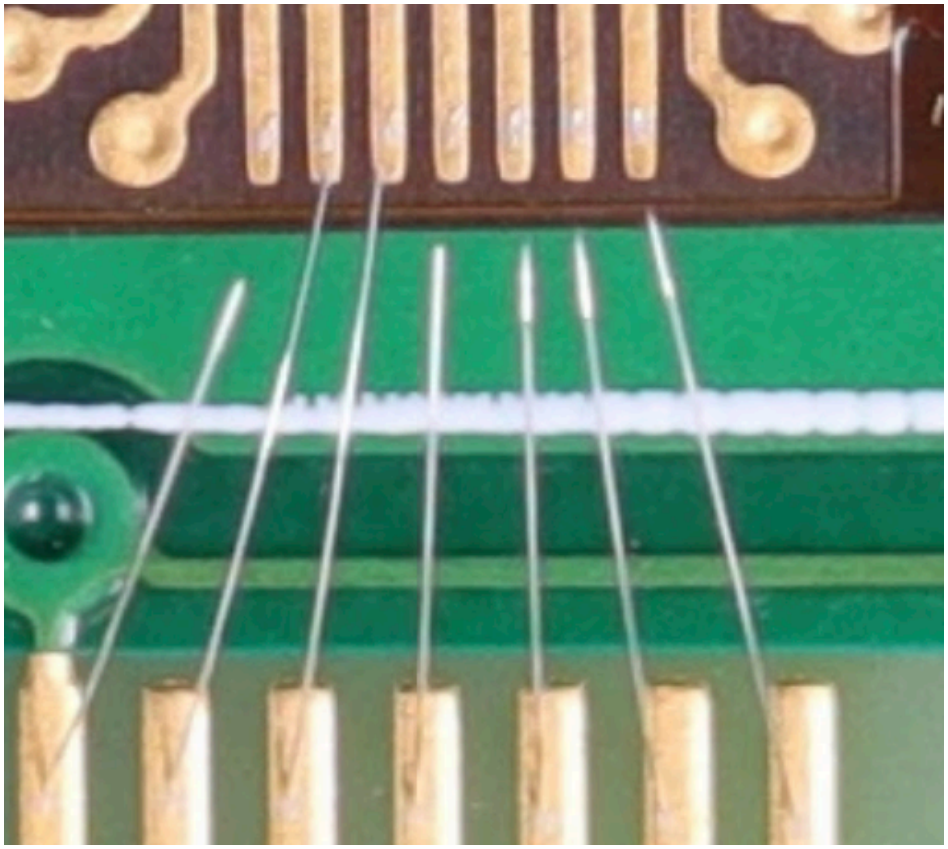


NTCPTAT

- Similar pattern as CTAT and NTCX/NTCY
- Still unsure as to what causes low outliers

Non Temp Tests

- Of 16 boards, 3 failed OF test, 10 failed ToggleOutput, 2 failed HV Enable, 1 failed DCDC Enable/Adjust, 2 failed Scan PADID
- One board has a bad LinPol so whole panel won't test due to high startup current.
- Found 5 boards with popped wirebonds
- 4 of them failed ToggleOutput, 1 failed OF, and one failed HV Enable
- Also found a broken solder connection on an SMD resistor
- Wasn't able to find a strong pattern with the broken wirebonds
- Need to investigate AMAC probing data for all failed tests



Thank You

Questions?