STAR Independent Assessment of J1 ATMS Thermal Vacuum Test CP-Mid and CP-High Data Analysis

STAR ATMS SDR Team

May 13, 2014

Introduction

Analyzing TVAC calibration data provides instrument performance assessment:

- Calibration Accuracy
- Nonlinearity
- Sensitivity (i.e., NEΔT)
- Dynamic Range
- Striping

J1 ATMS TVAC Test

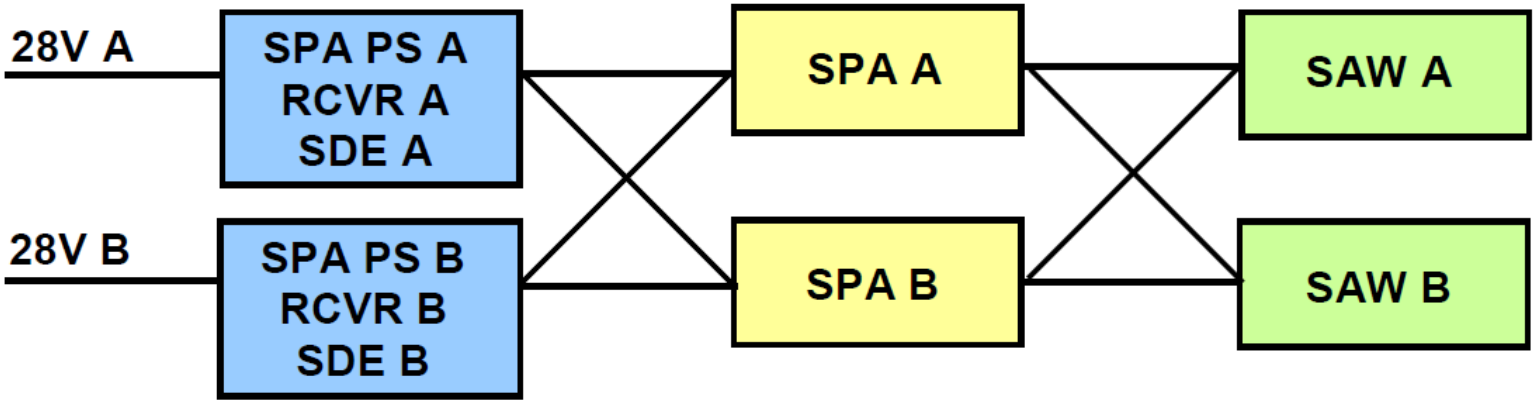
- Data is updated till May 9, 2014
- TVAC calibration: ST95, 105, 130, 155, 180, 205, 230, 255, 280, 305, 330 in CP_Mid and CP_High

Software

- Log file reader is provided by MIT-LL (version 1.7)
- Programs mainly prepared for TVAC calibration test

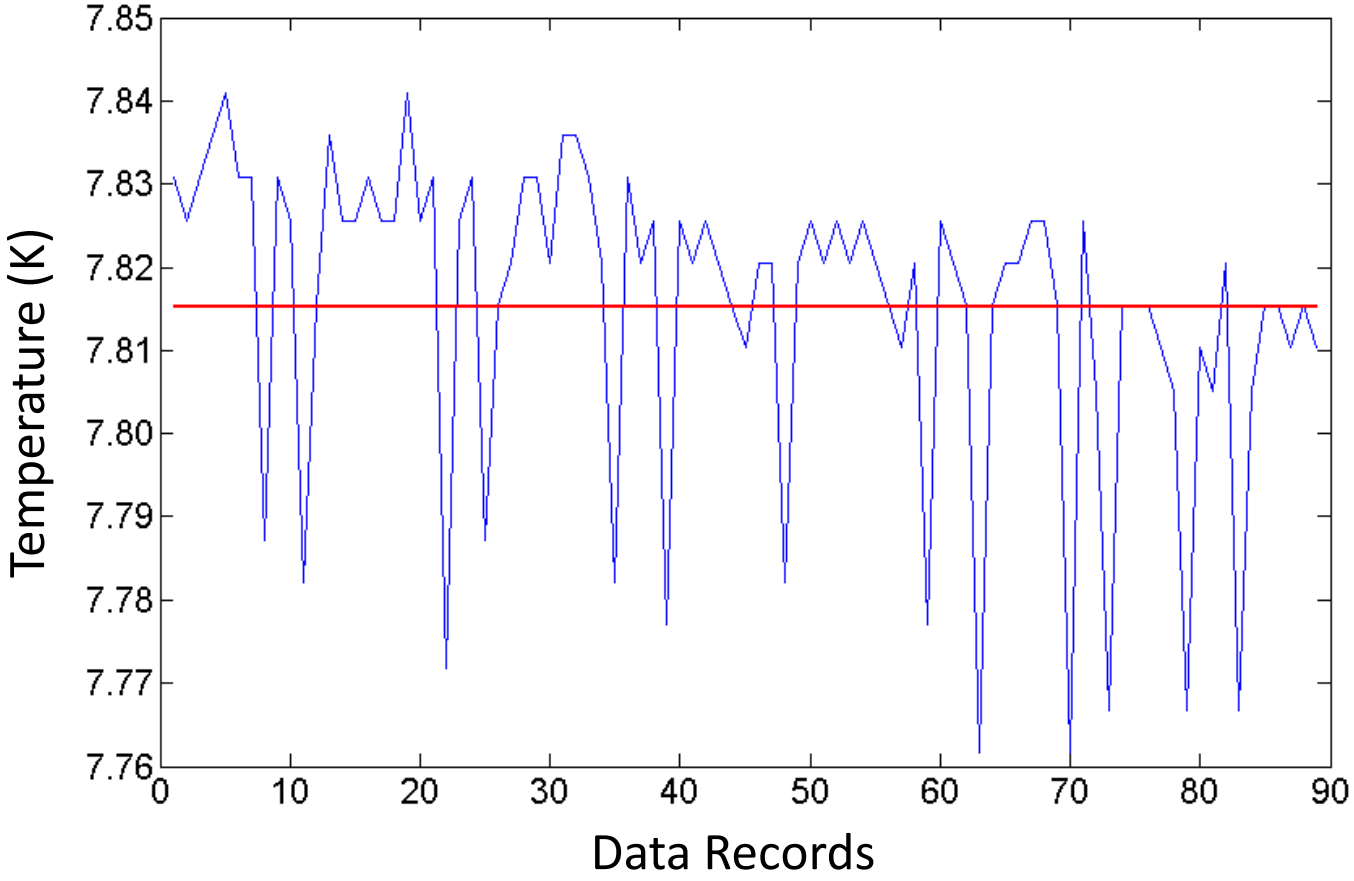
Date: May 13, 2014

J1 ATMS TVAC Redundancy Configuration



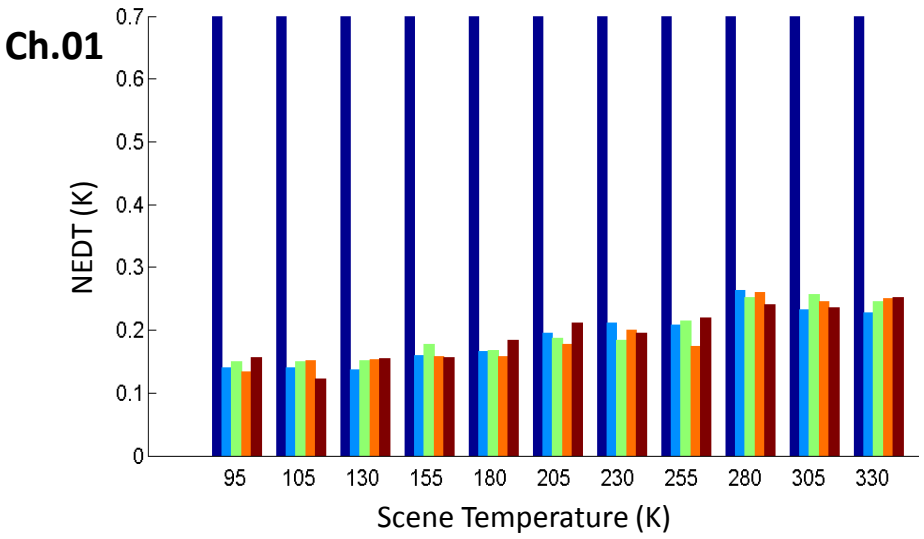
CONFIG.	SPA PS	RECEIVER SELECT	SDE SELECT	SPA CROSS	SAW CROSS
1	A	REC A - PLO, CSO, GDO, RPS	SDE A	SPA A	SAW A
2					SAW B
3				SPA B	SAW B
4					SAW A
5	B	REC B - PLO, CSO, GDO, RPS	SDE B	SPA B	SAW B
6					SAW A
7				SPA A	SAW A
8					SAW B

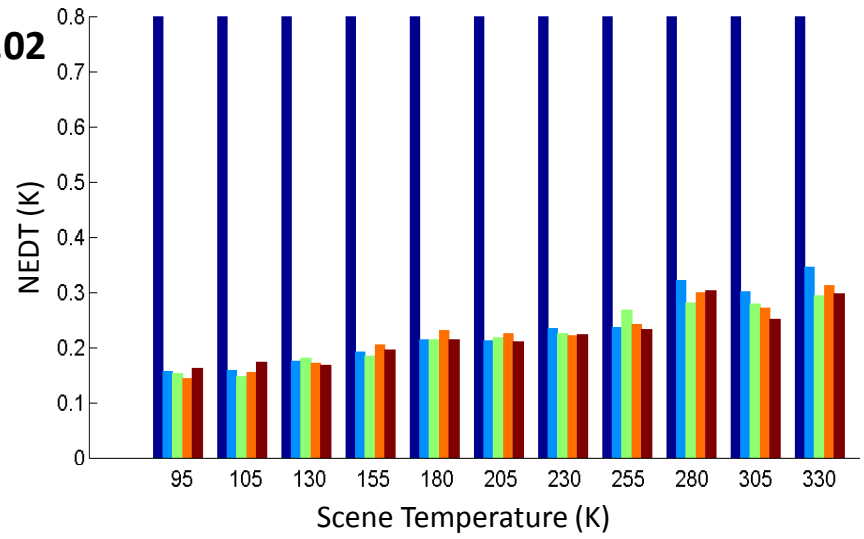
Cold Plate Temperature at CP_Mid ST-330

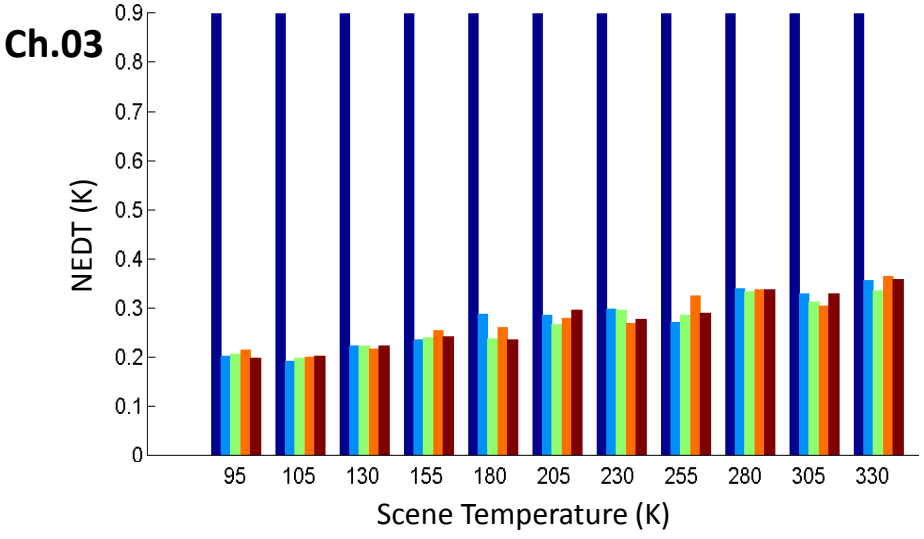


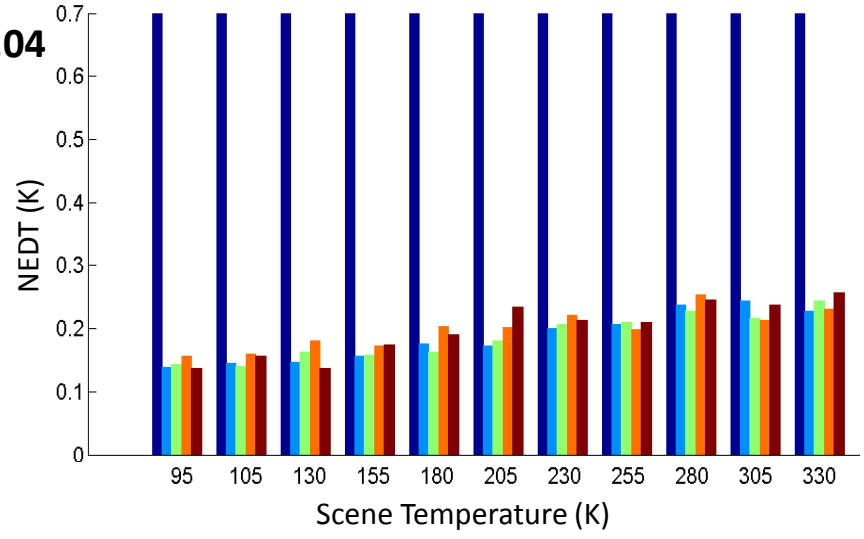
Mean: 7.8152K ; Std. Dev: 0.0189K

NEΔT at CP_Mid

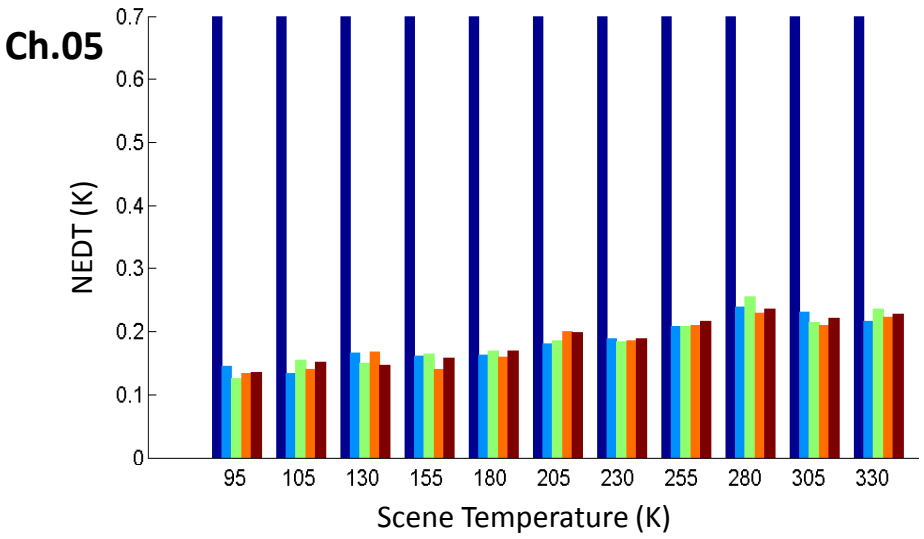


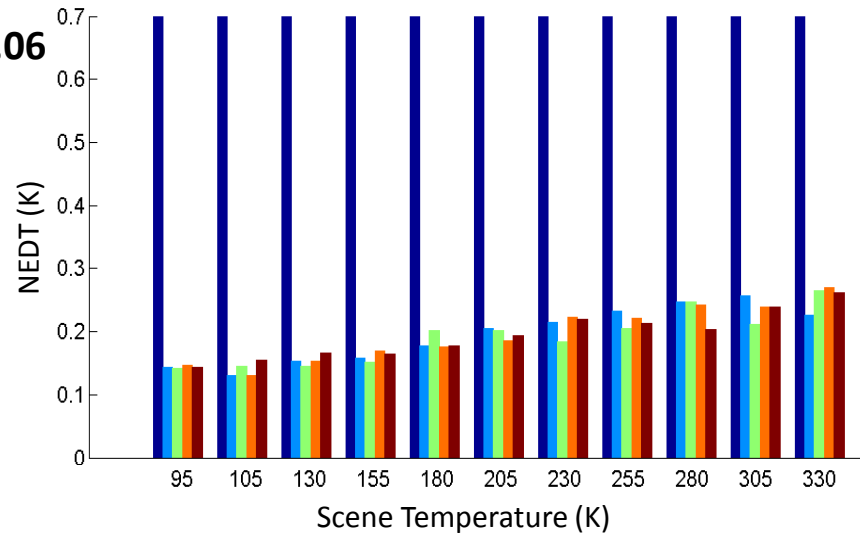


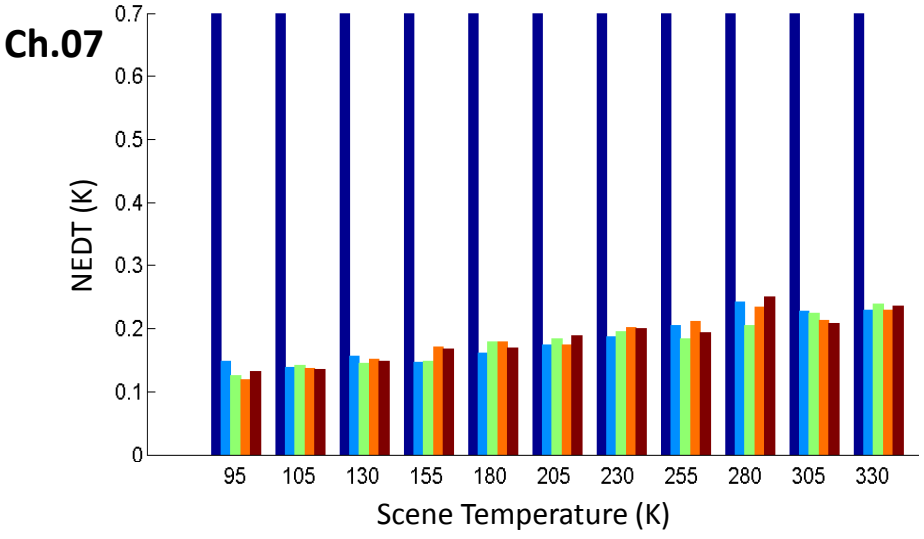


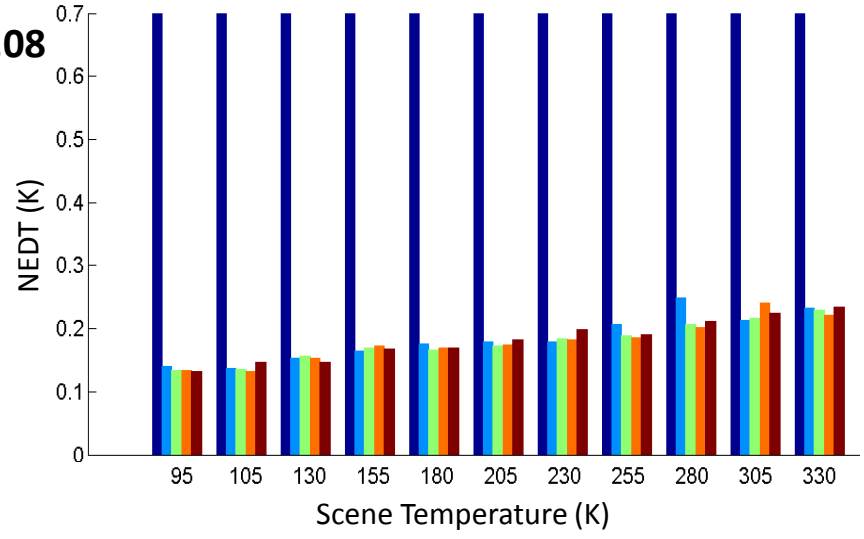


NEΔT at CP_Mid



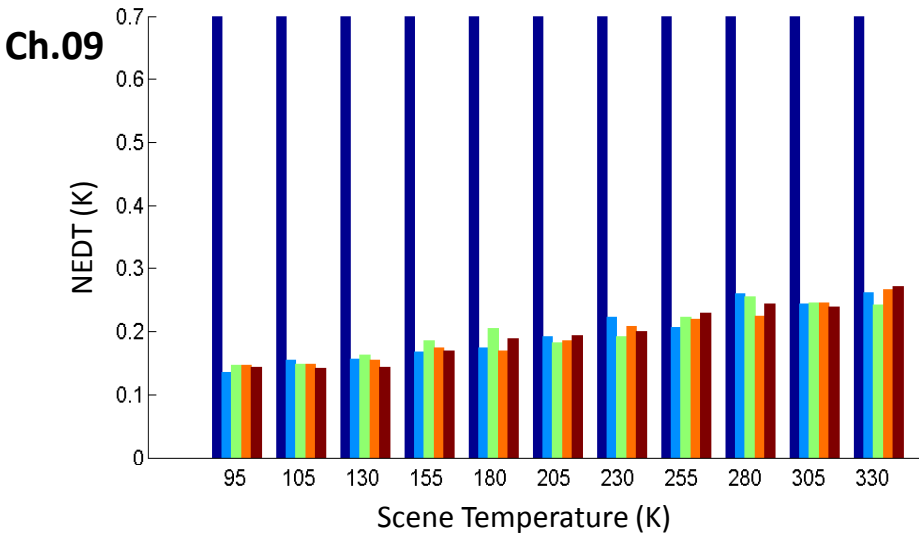


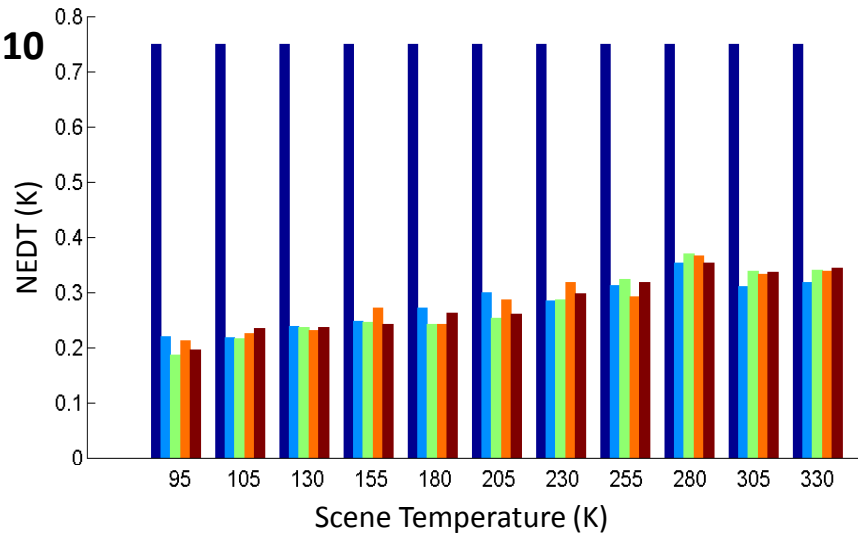


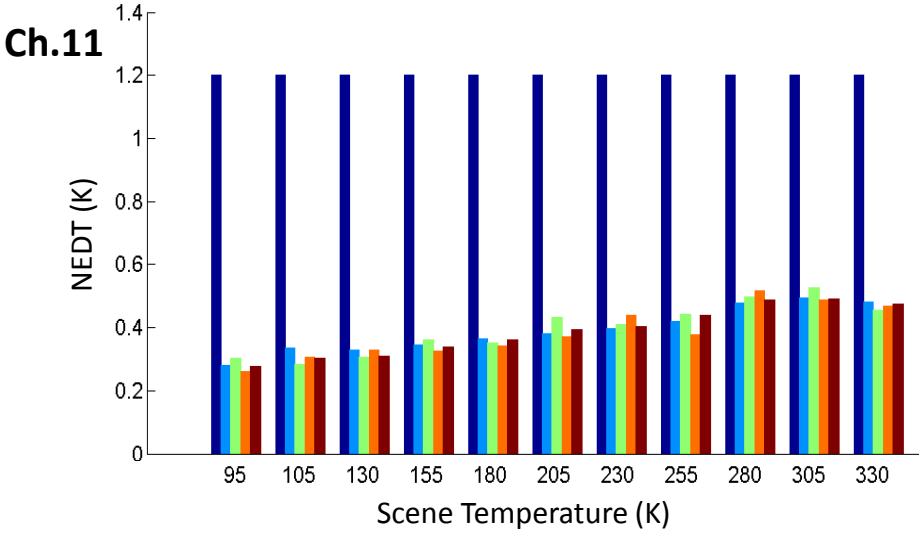


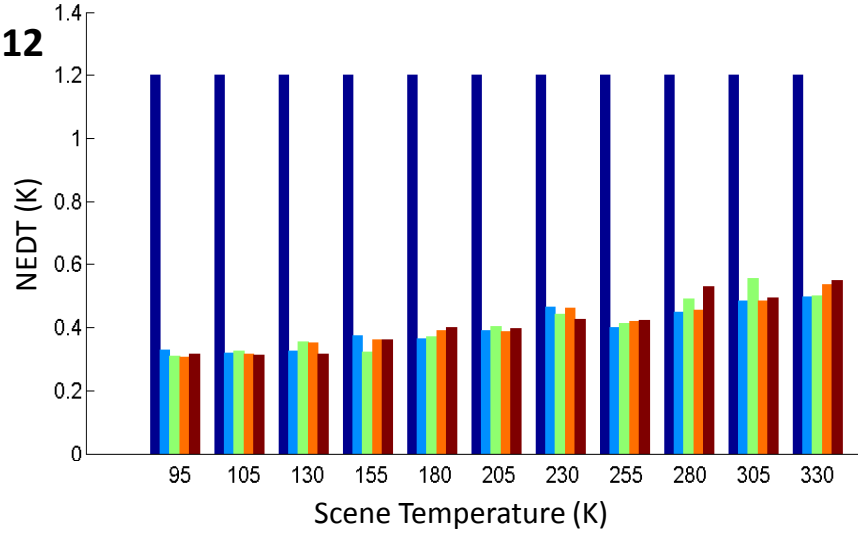
Spec. RC01 RC02 RC05 RC06

NEΔT at CP_Mid

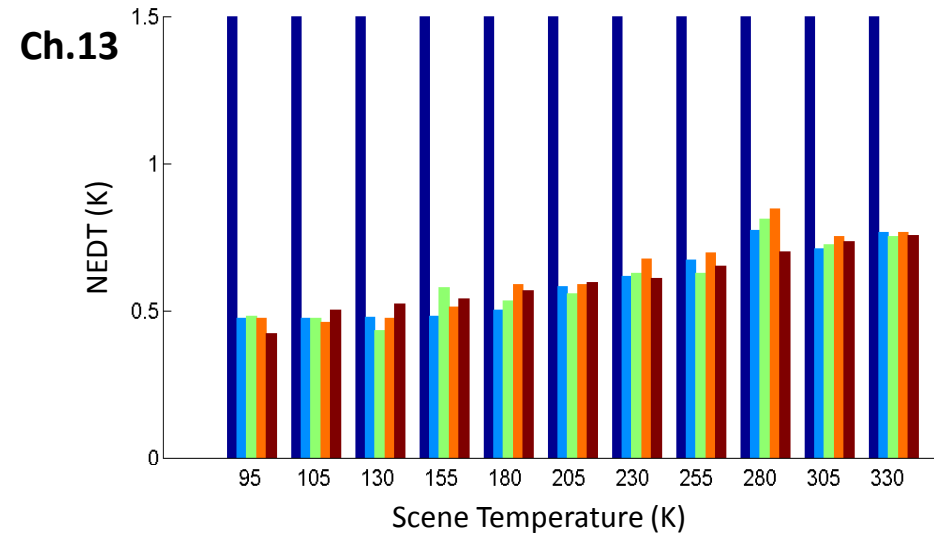


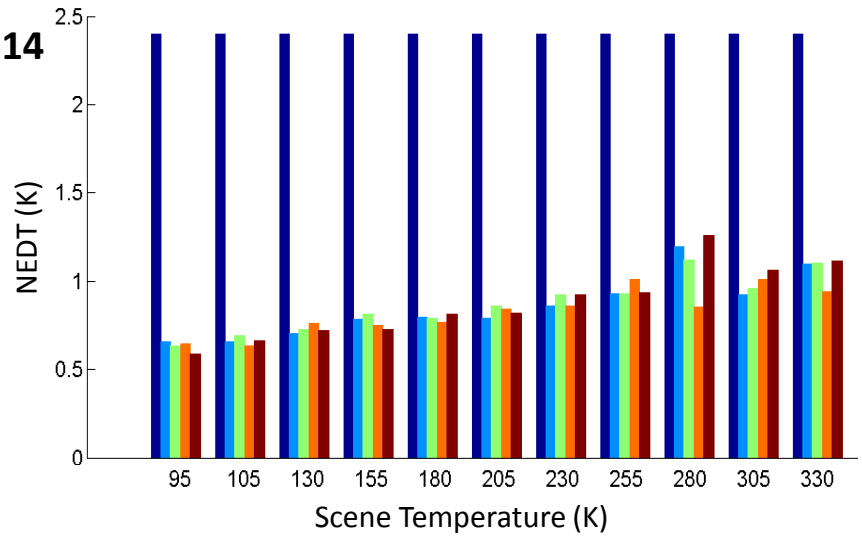


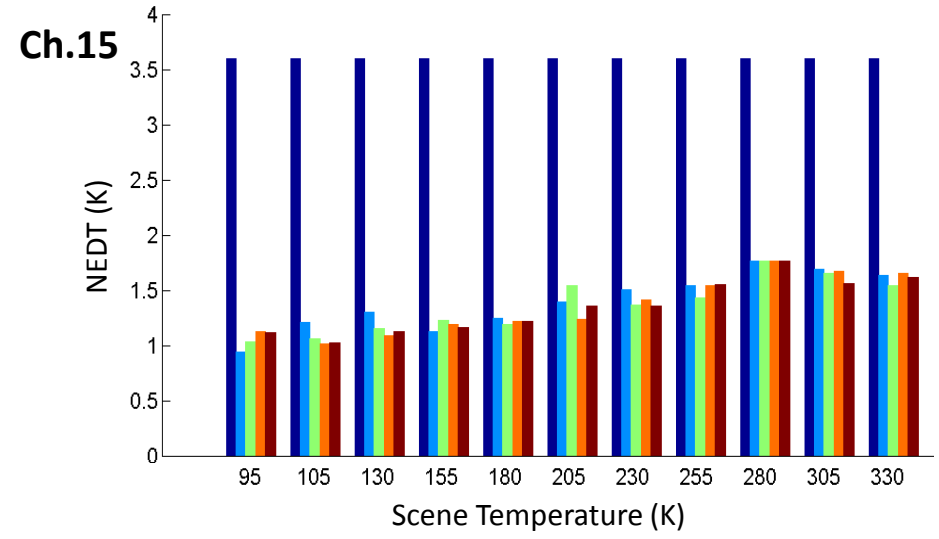


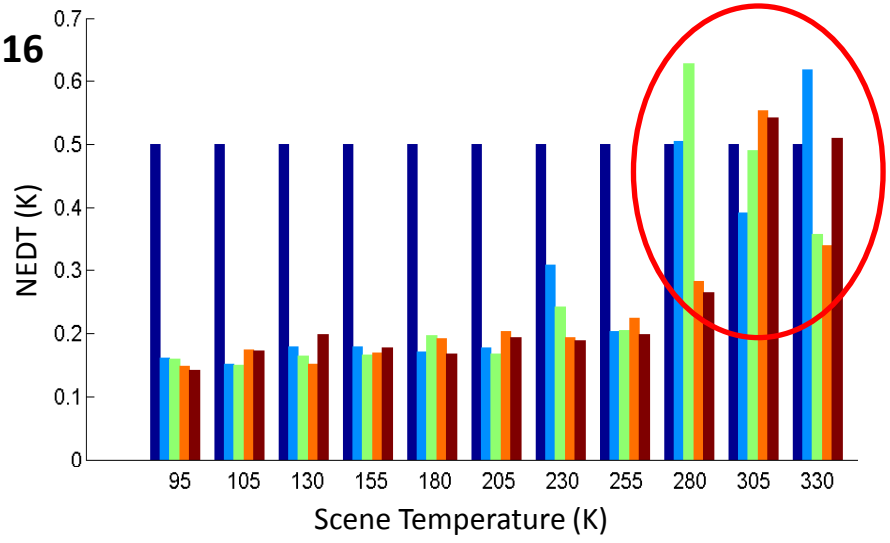


NEΔT at CP_Mid



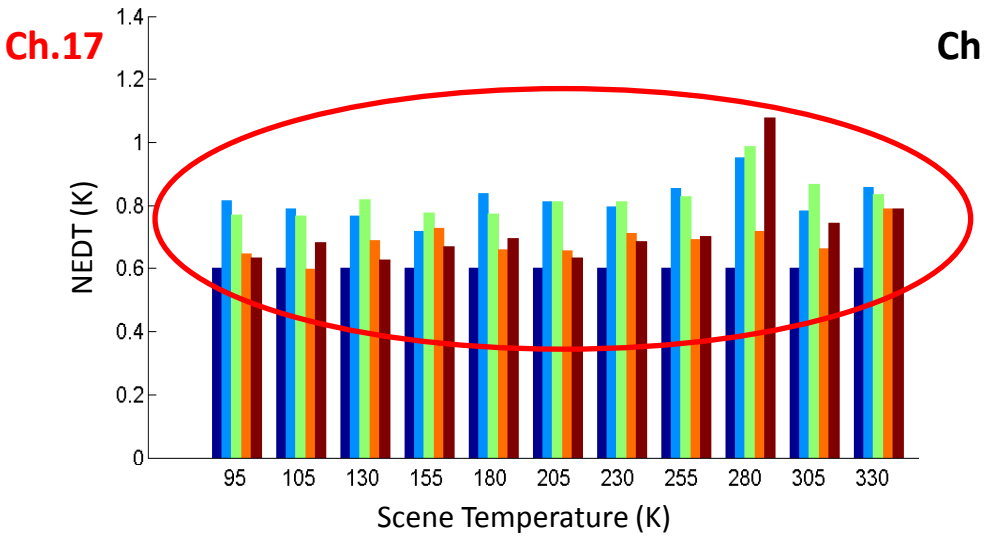


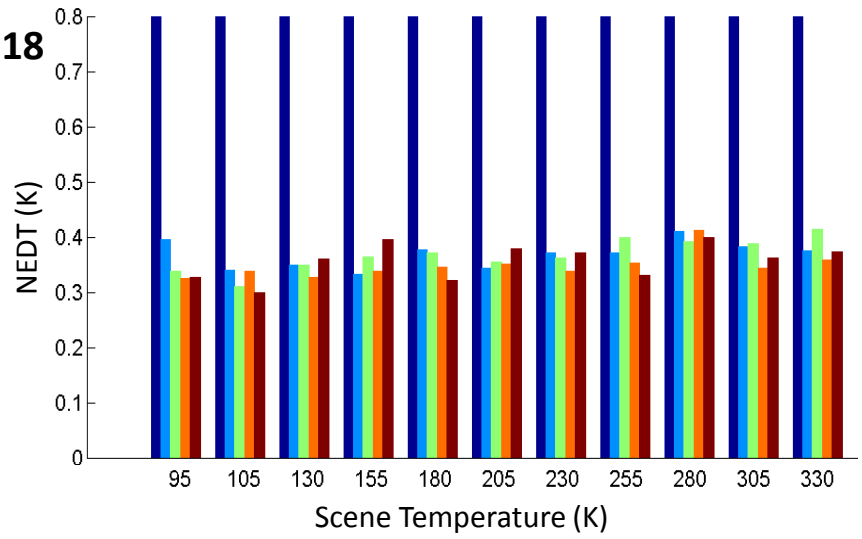


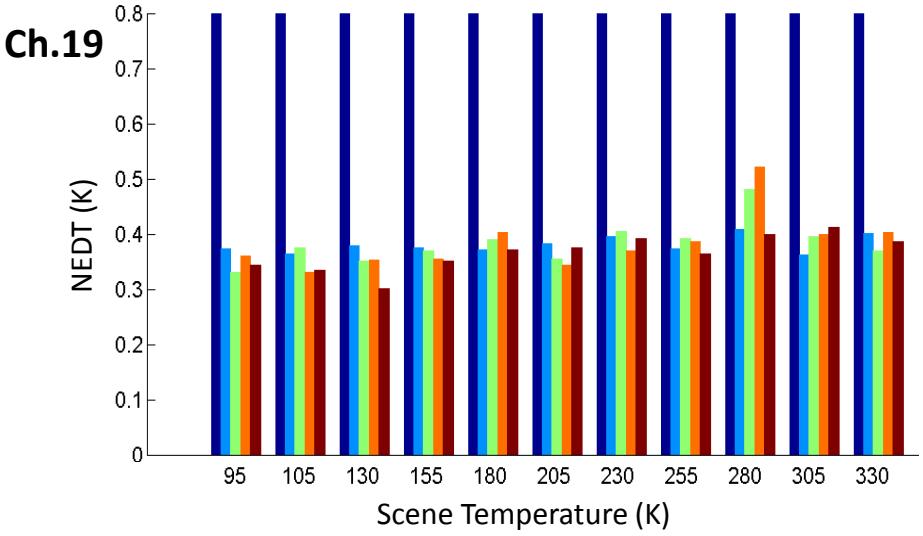


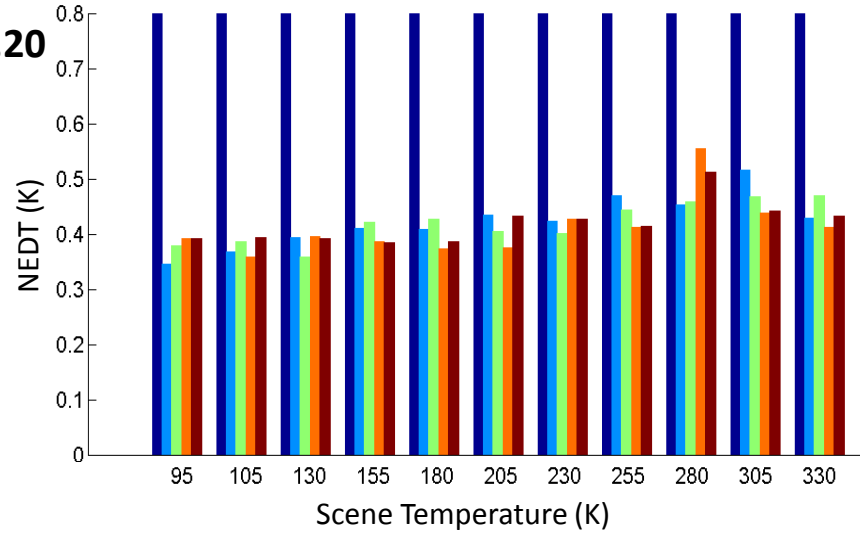
Spec. RC01 RC02 RC05 RC06

NEΔT at CP_Mid





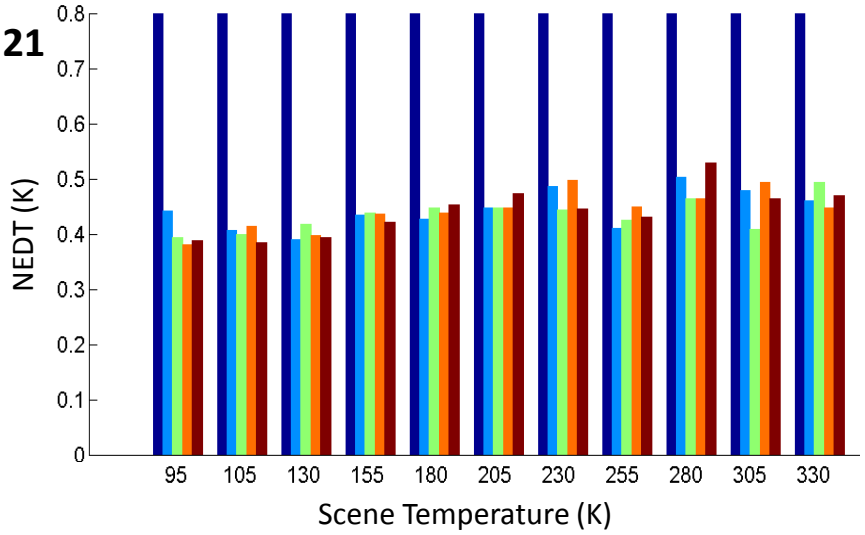




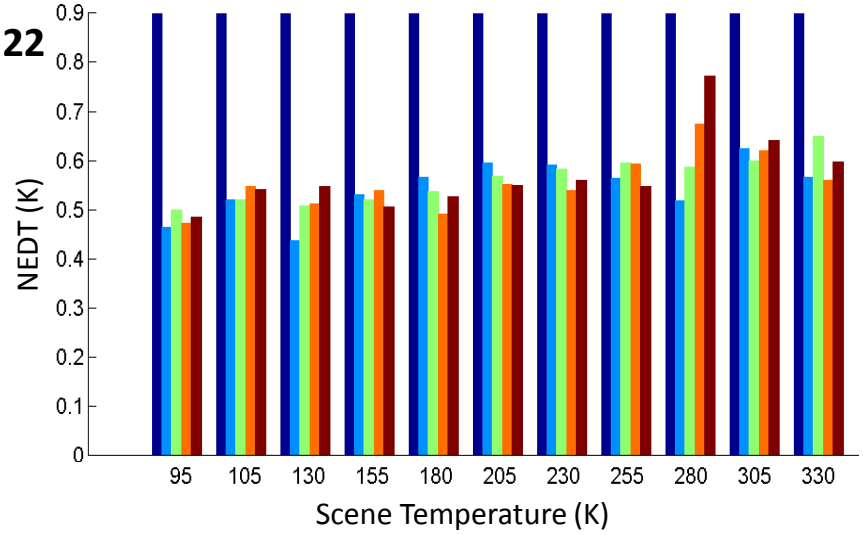
Spec. RC01 RC02 RC05 RC06

NEΔT at CP_Mid

Ch.21



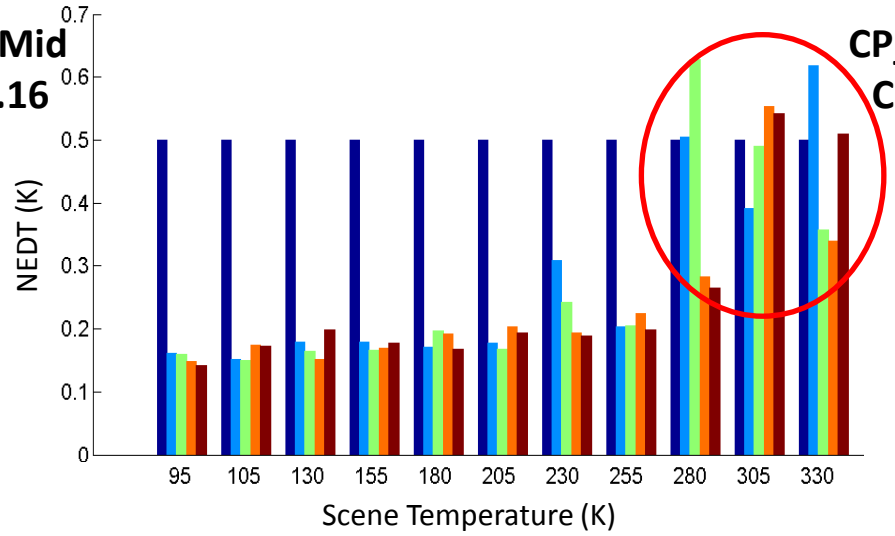
Ch.22



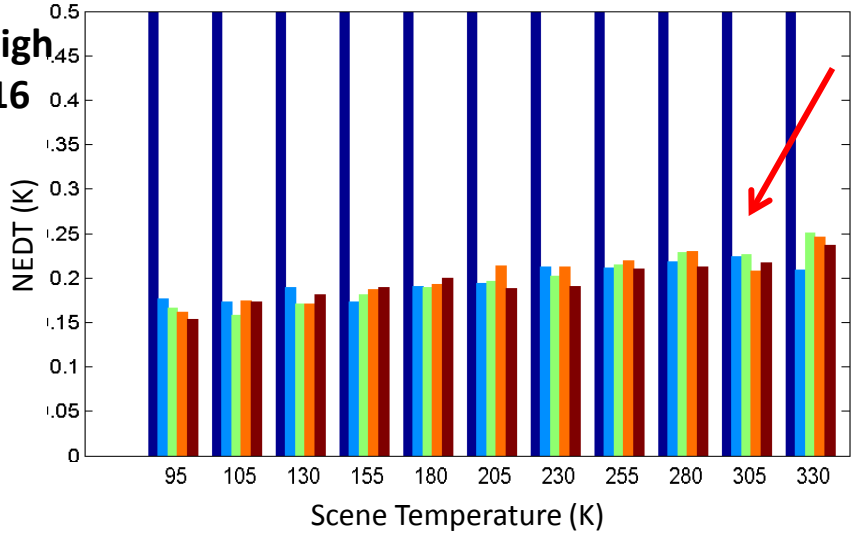
Spec. RC01 RC02 RC05 RC06

Ch.16 and 17 NEΔT at CP_Mid&CP_High

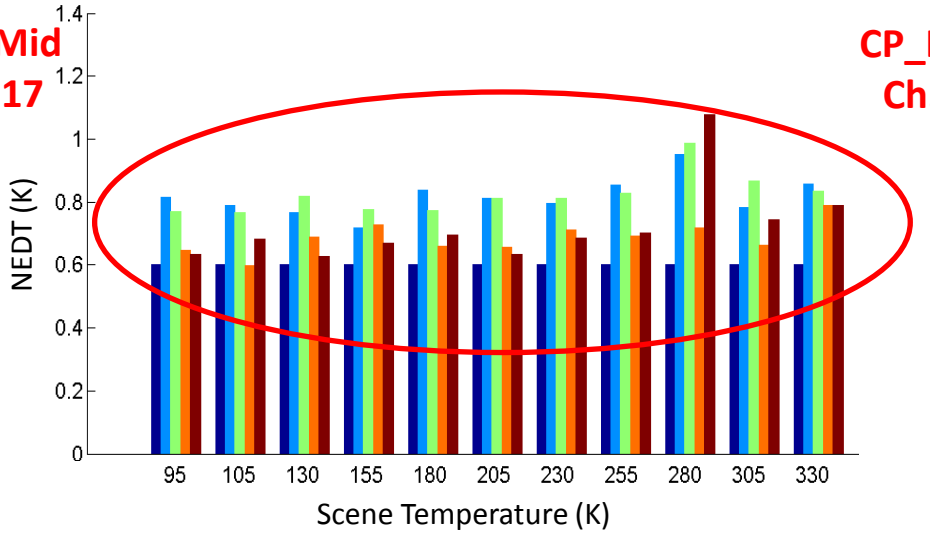
CP_Mid Ch.16



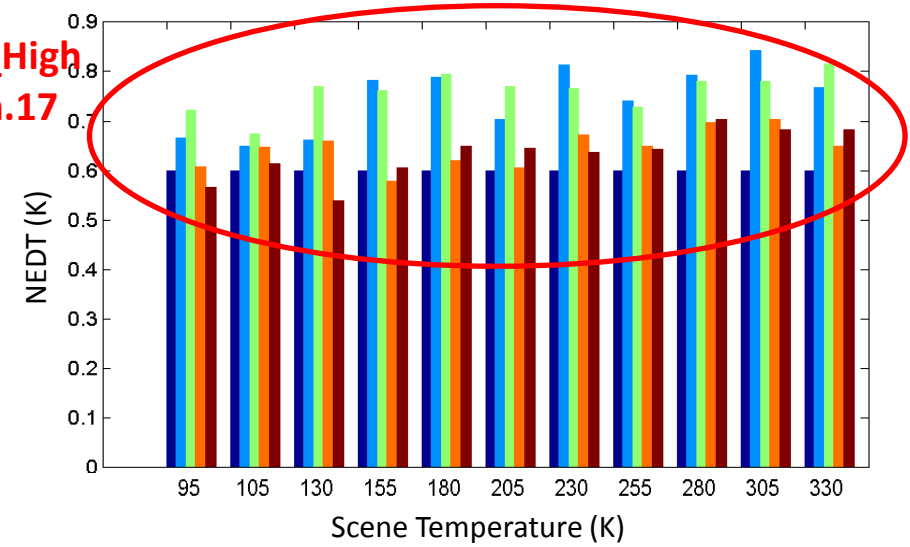
CP_High Ch.16



CP_Mid Ch.17

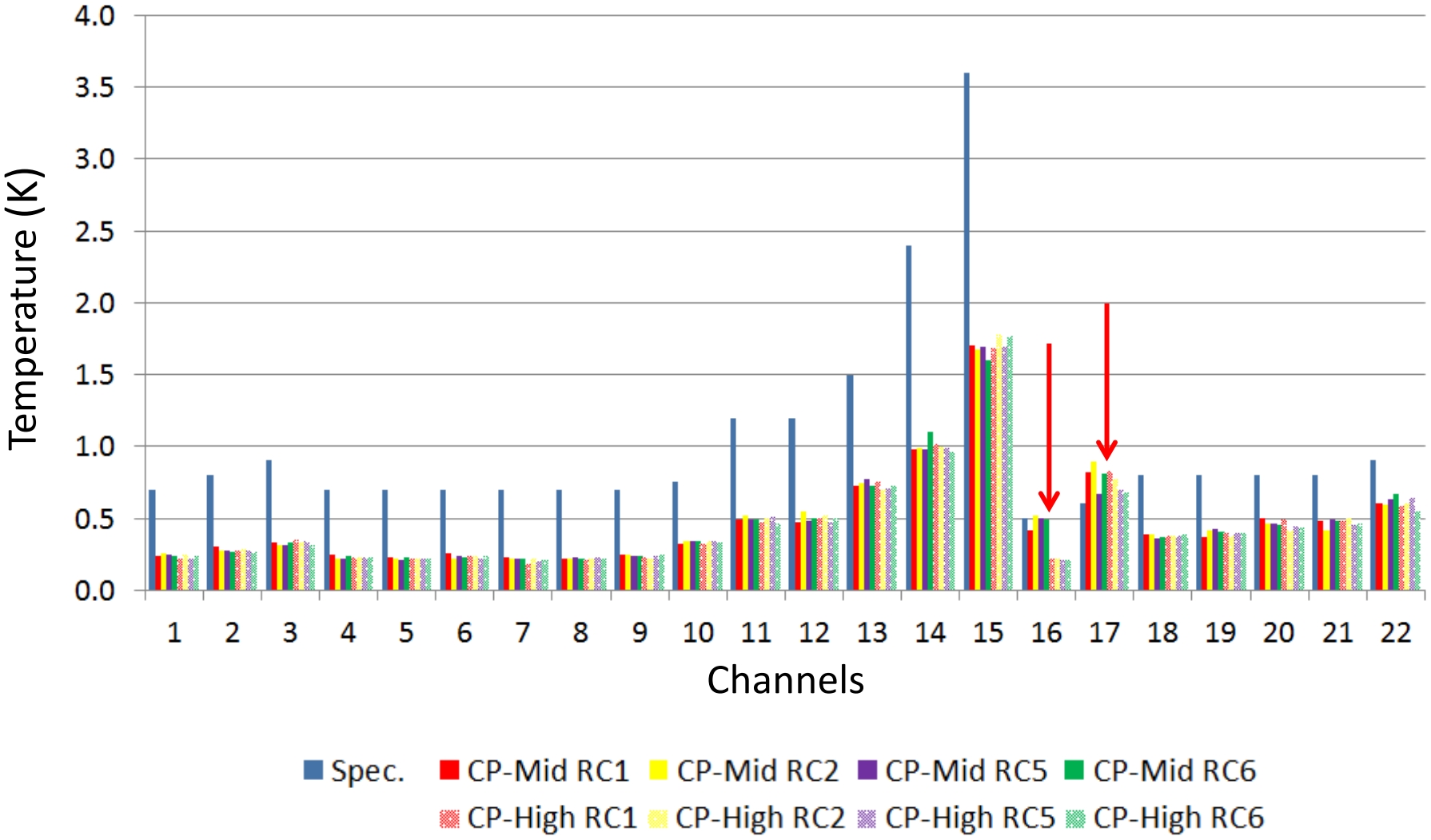


CP_High Ch.17



Spec. RC01 RC02 RC05 RC06

NEΔT at 300K CP_Mid vs. CP_High

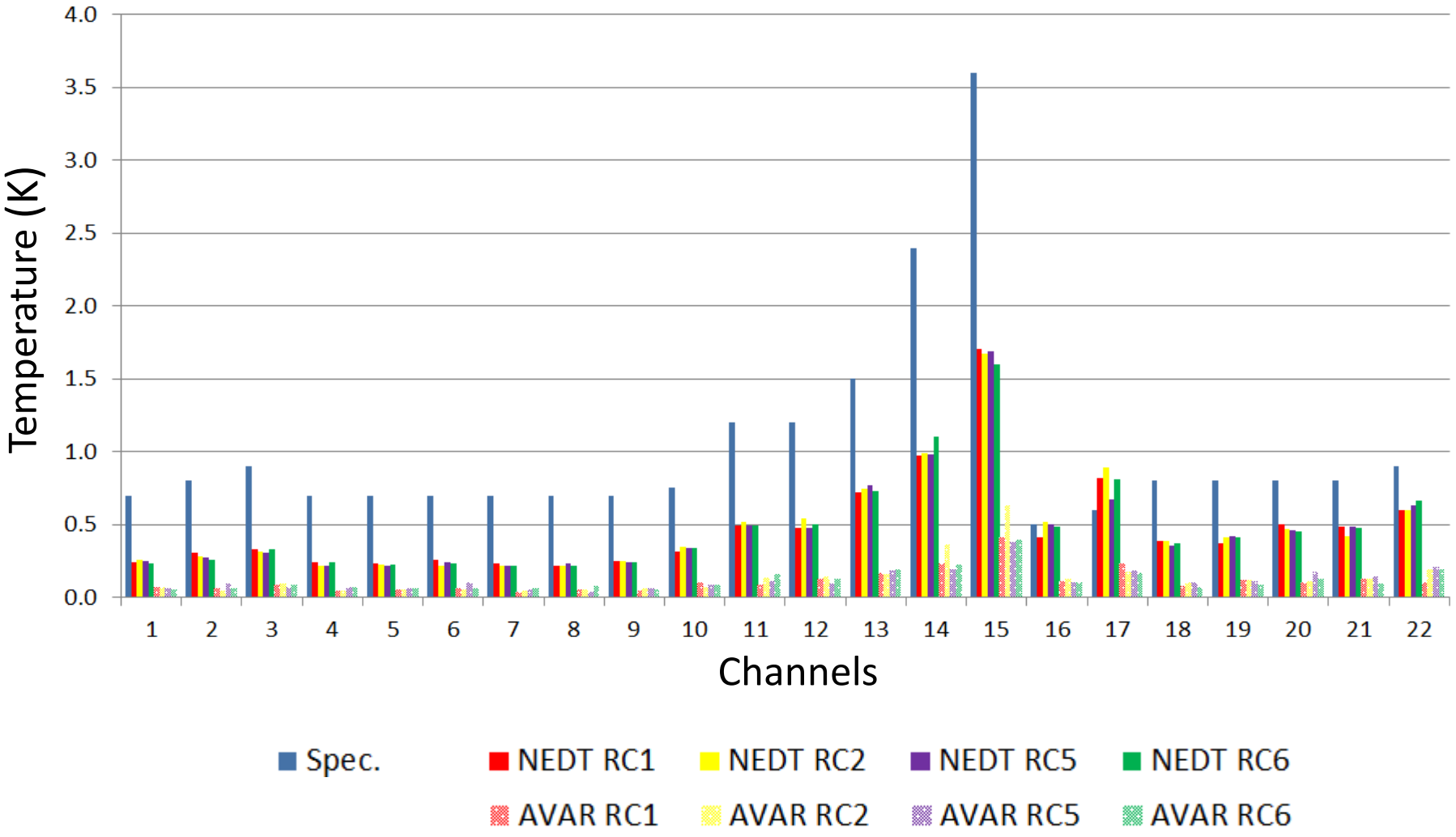


NEΔT at 300K S-NPP vs. J1

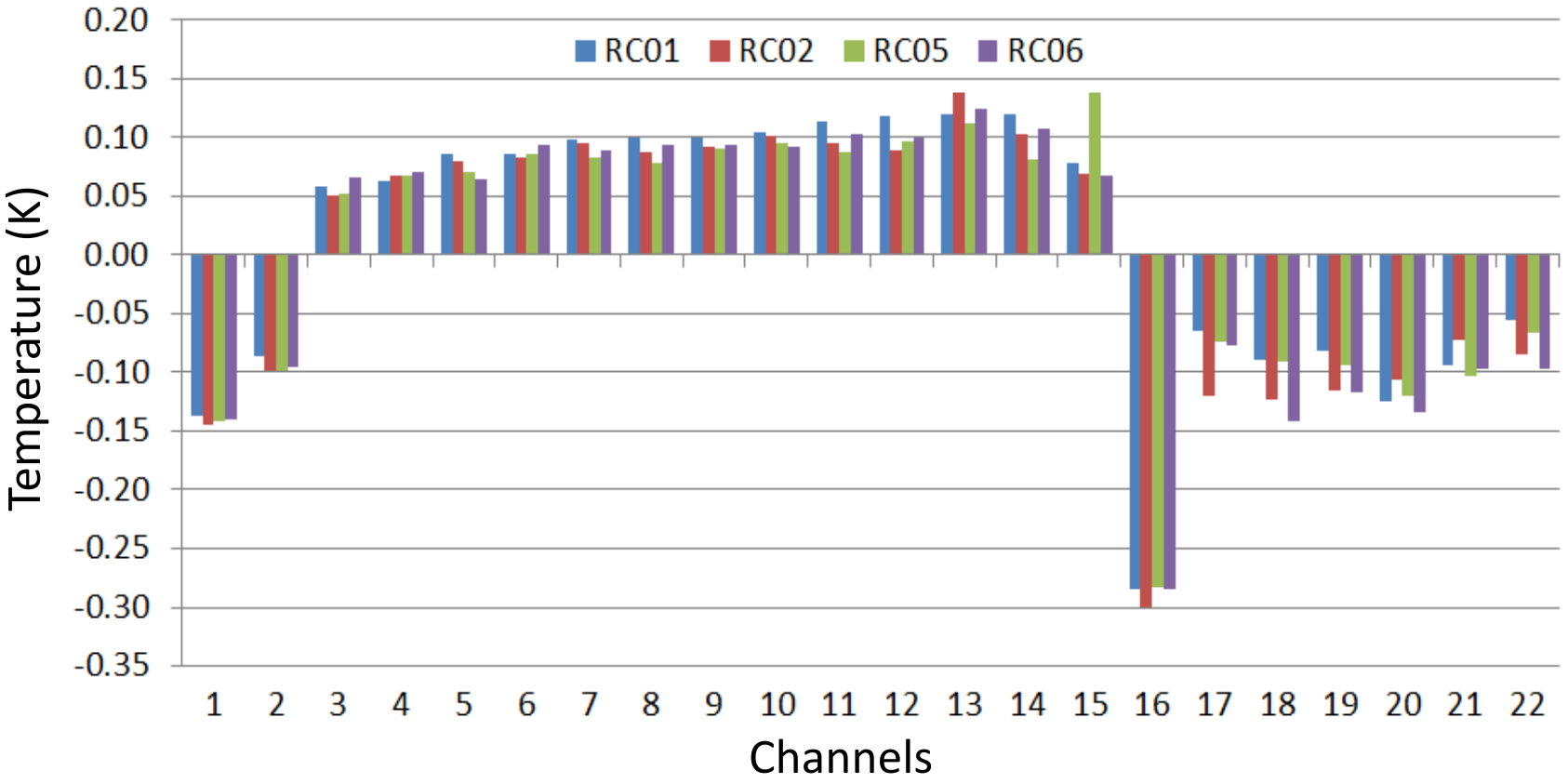
NPP	Req.	RC 01	RC 02	RC 05	RC 06
Ch. 01	0.7	0.2472	0.2487	0.2523	0.2465
Ch. 02	0.8	0.3113	0.3104	0.3138	0.3123
Ch. 03	0.9	0.3654	0.3653	0.3647	0.3619
Ch. 04	0.7	0.2789	0.2763	0.2810	0.2784
Ch. 05	0.7	0.2783	0.2688	0.2791	0.2805
Ch. 06	0.7	0.2885	0.2743	0.2847	0.2849
Ch. 07	0.7	0.2712	0.2625	0.2723	0.2680
Ch. 08	0.7	0.2667	0.2584	0.2708	0.2642
Ch. 09	0.7	0.2907	0.2877	0.2869	0.2896
Ch. 10	0.75	0.4179	0.4168	0.4192	0.416
Ch. 11	1.2	0.5547	0.5493	0.5508	0.556
Ch. 12	1.2	0.5744	0.5846	0.5892	0.5819
Ch. 13	1.5	0.8454	0.8473	0.8562	0.8522
Ch. 14	2.4	1.1819	1.2050	1.2334	1.1977
Ch. 15	3.6	1.9266	1.9452	1.9216	1.915
Ch. 16	0.5	0.2848	0.2813	0.2887	0.2771
Ch. 17	0.6	0.4323	0.4507	0.4441	0.4393
Ch. 18	0.8	0.3711	0.3772	0.3546	0.3511
Ch. 19	0.8	0.4318	0.4521	0.4291	0.4179
Ch. 20	0.8	0.5014	0.5346	0.4990	0.4865
Ch. 21	0.8	0.5596	0.5734	0.5362	0.5180
Ch. 22	0.9	0.7119	0.7255	0.6838	0.6817

J1	RC 01	RC 02	RC 05	RC 06	RC 01	RC 02	RC 05	RC 06
Ch. 01	0.2390	0.2562	0.2482	0.2371	0.2298	0.2512	0.2252	0.2441
Ch. 02	0.3047	0.2797	0.2765	0.2620	0.2832	0.2900	0.2857	0.2706
Ch. 03	0.3301	0.3149	0.3106	0.3303	0.3580	0.3360	0.3474	0.3212
Ch. 04	0.2428	0.2188	0.2210	0.2386	0.2305	0.2333	0.2301	0.2363
Ch. 05	0.2323	0.2232	0.2137	0.2242	0.2206	0.2281	0.2265	0.2212
Ch. 06	0.2548	0.2193	0.2402	0.2325	0.2414	0.2440	0.2246	0.2393
Ch. 07	0.2307	0.2201	0.2169	0.2168	0.1916	0.2262	0.2080	0.2151
Ch. 08	0.2207	0.2146	0.2324	0.2215	0.2130	0.2248	0.2346	0.2253
Ch. 09	0.2472	0.2469	0.2407	0.2398	0.2367	0.2284	0.2477	0.2492
Ch. 10	0.3190	0.3440	0.3392	0.3400	0.3294	0.3509	0.3506	0.3407
Ch. 11	0.4910	0.5199	0.4942	0.4899	0.4816	0.5063	0.5139	0.4685
Ch. 12	0.4765	0.5431	0.4794	0.5023	0.5066	0.5233	0.4743	0.5068
Ch. 13	0.7241	0.7426	0.7703	0.7282	0.7581	0.6994	0.7180	0.7299
Ch. 14	0.9773	0.9877	0.9789	1.1020	1.0217	1.0030	0.9990	0.9653
Ch. 15	1.7068	1.6756	1.6909	1.6007	1.6940	1.7809	1.7025	1.7734
Ch. 16	0.4142	0.5182	0.4987	0.4865	0.2225	0.2270	0.2124	0.2159
Ch. 17	0.8167	0.8902	0.6734	0.8094	0.8328	0.7797	0.7014	0.6857
Ch. 18	0.3881	0.3885	0.3569	0.3697	0.3837	0.3862	0.3835	0.3903
Ch. 19	0.3711	0.4120	0.4235	0.4101	0.4032	0.3894	0.3989	0.4058
Ch. 20	0.5035	0.4660	0.4611	0.4555	0.4948	0.4225	0.4482	0.4404
Ch. 21	0.4833	0.4194	0.4868	0.4776	0.4882	0.5108	0.4600	0.4727
Ch. 22	0.6022	0.5970	0.6311	0.6674	0.5940	0.6081	0.6469	0.5506

NEΔT vs. Allan Variance at 300K (CP_Mid)

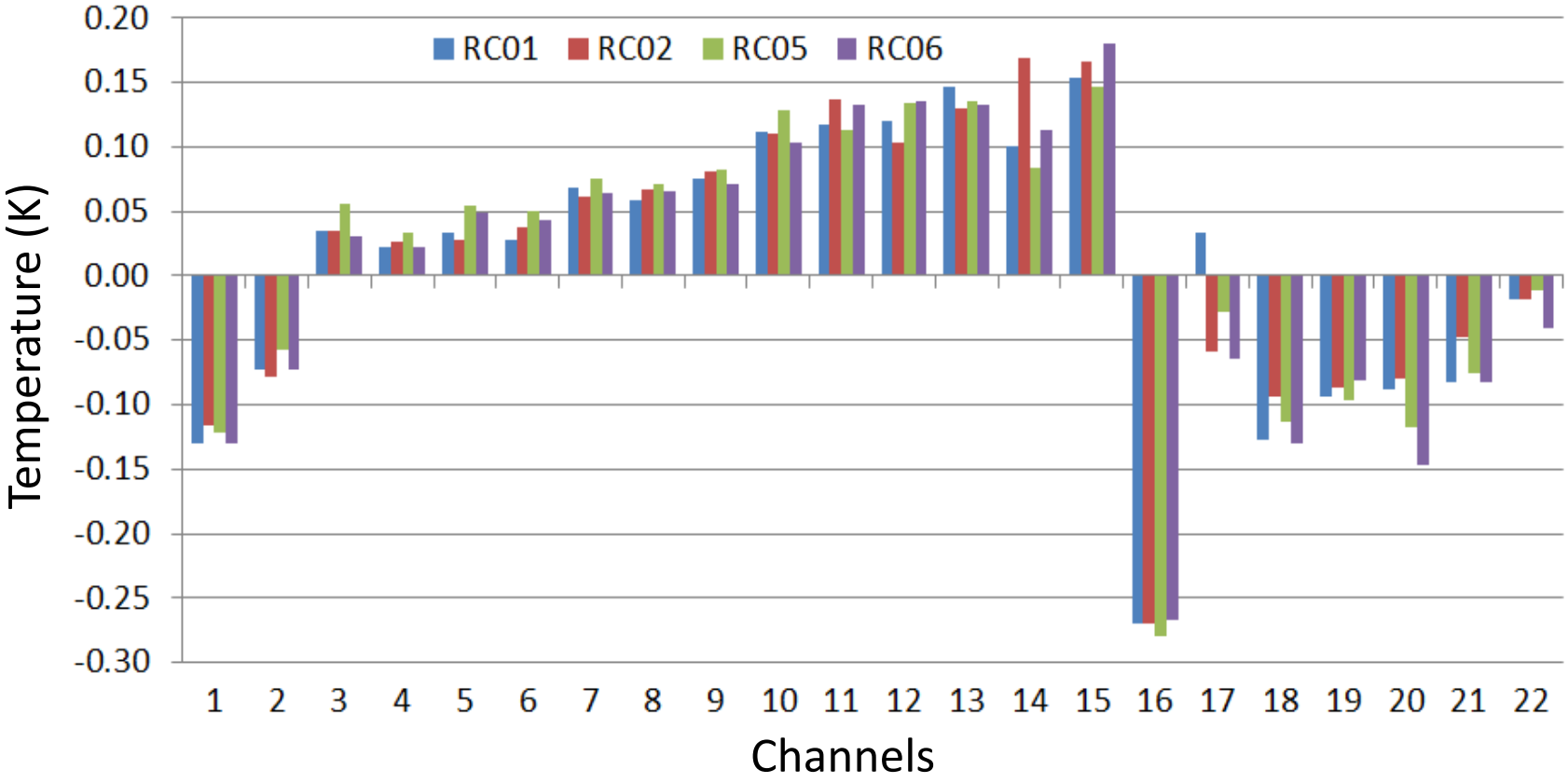


Radiometric Accuracy at CP_Mid ST-95

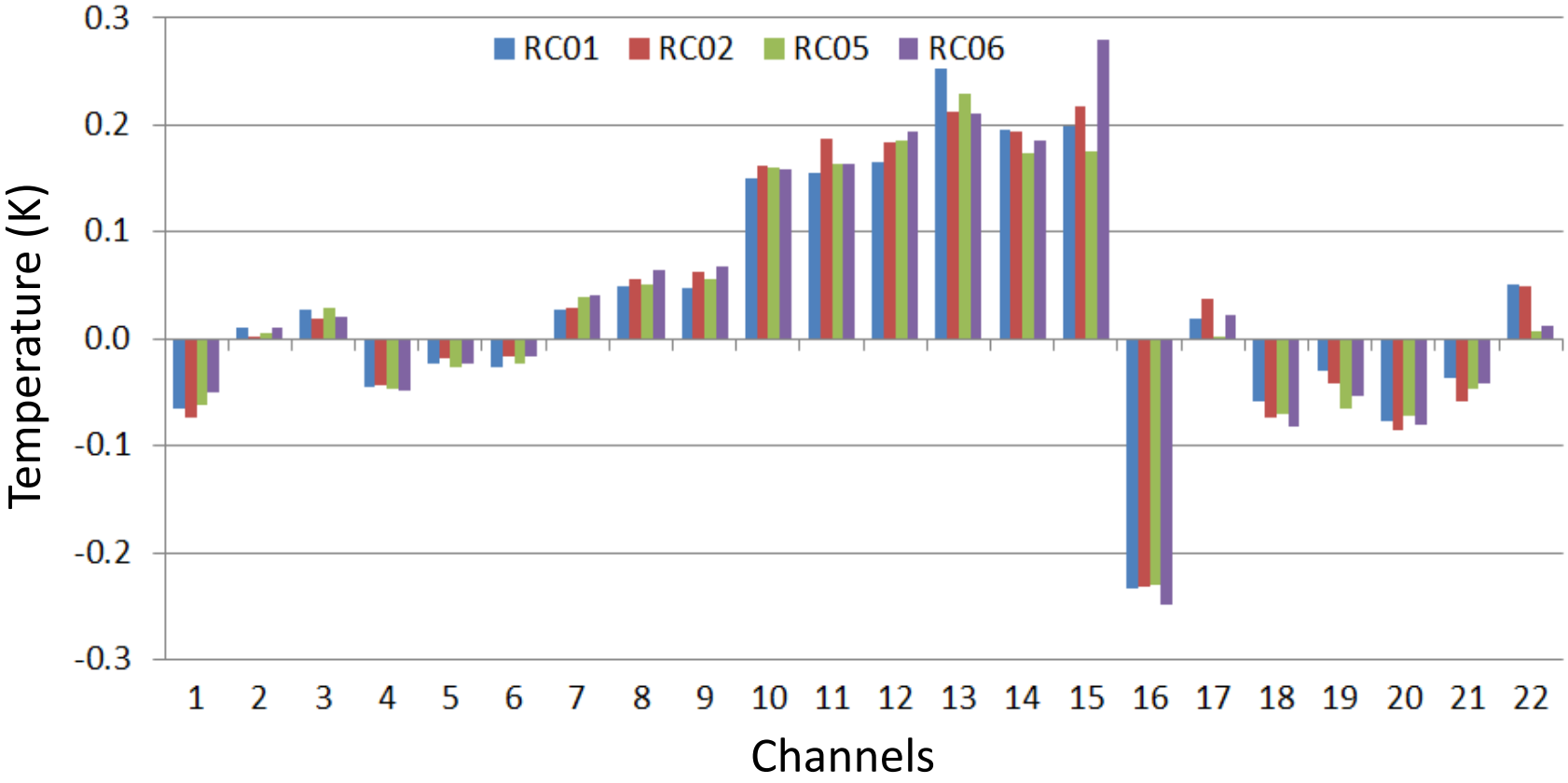


Note: Accuracy is computed by subtracting the inferred scene brightness temperature using two-point linear calibration equation with corresponding measured scene brightness temperature. FOV# 9 to 22 are used.

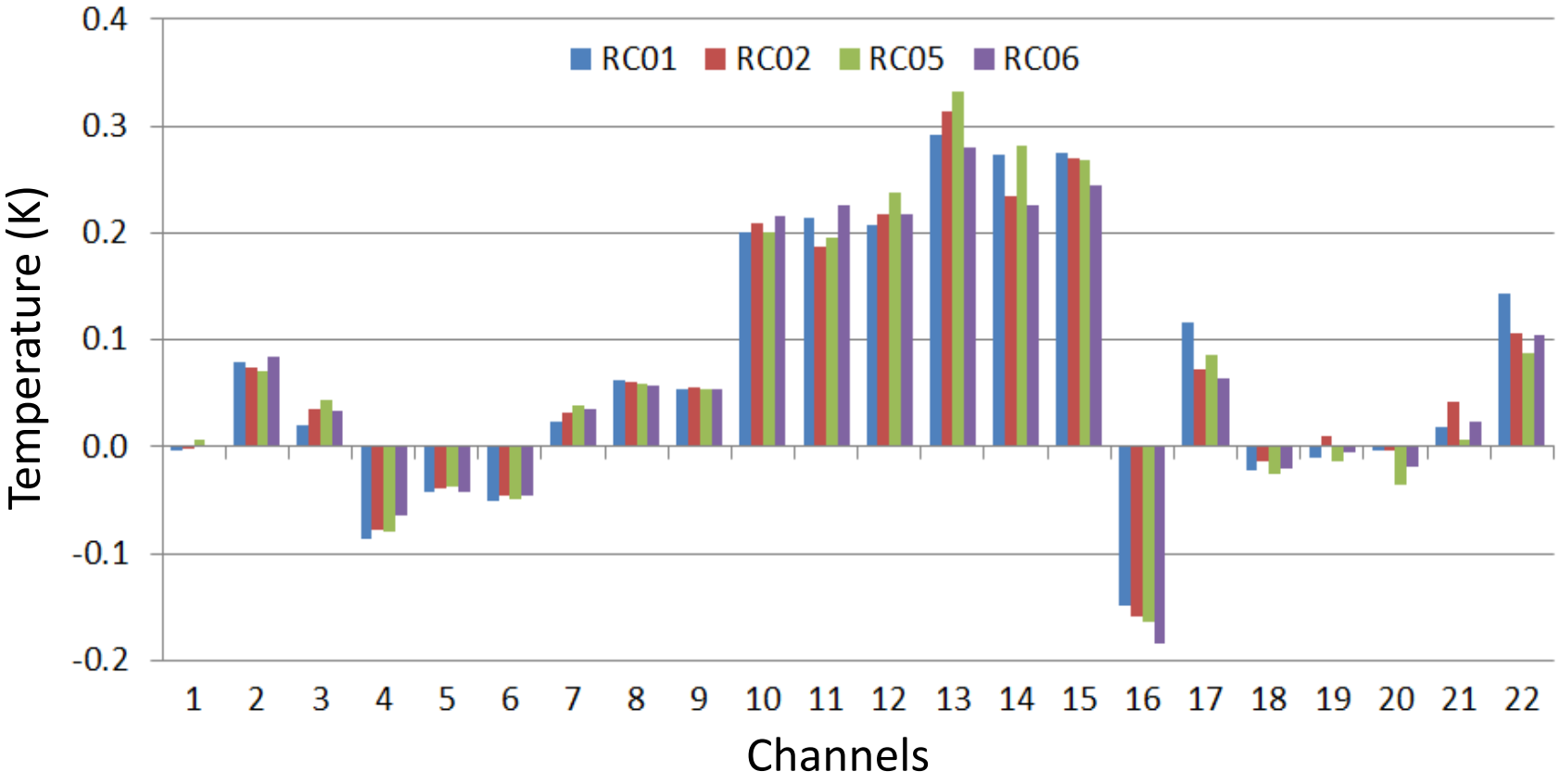
Radiometric Accuracy at CP_Mid ST-105



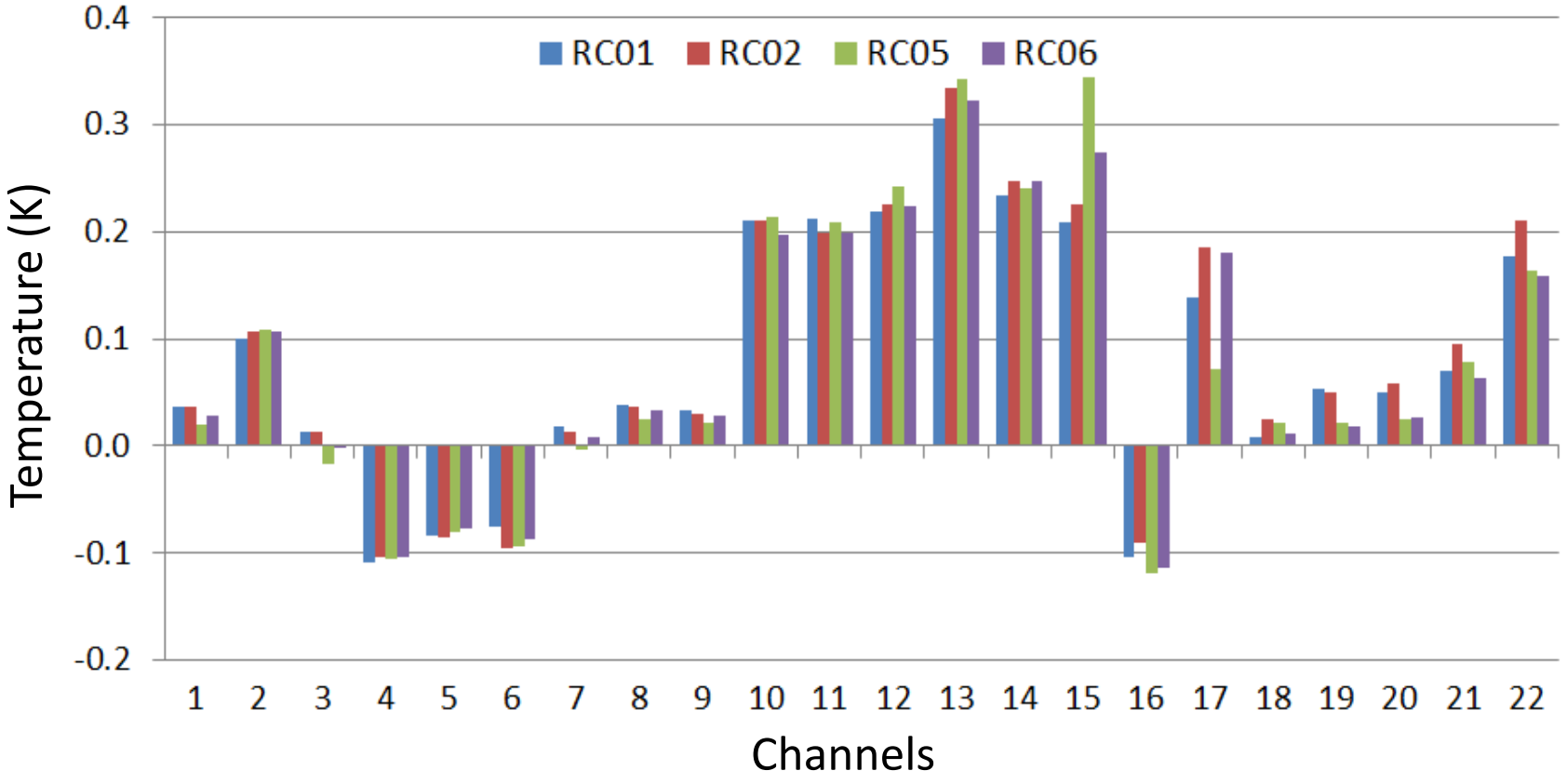
Radiometric Accuracy at CP_Mid ST-130



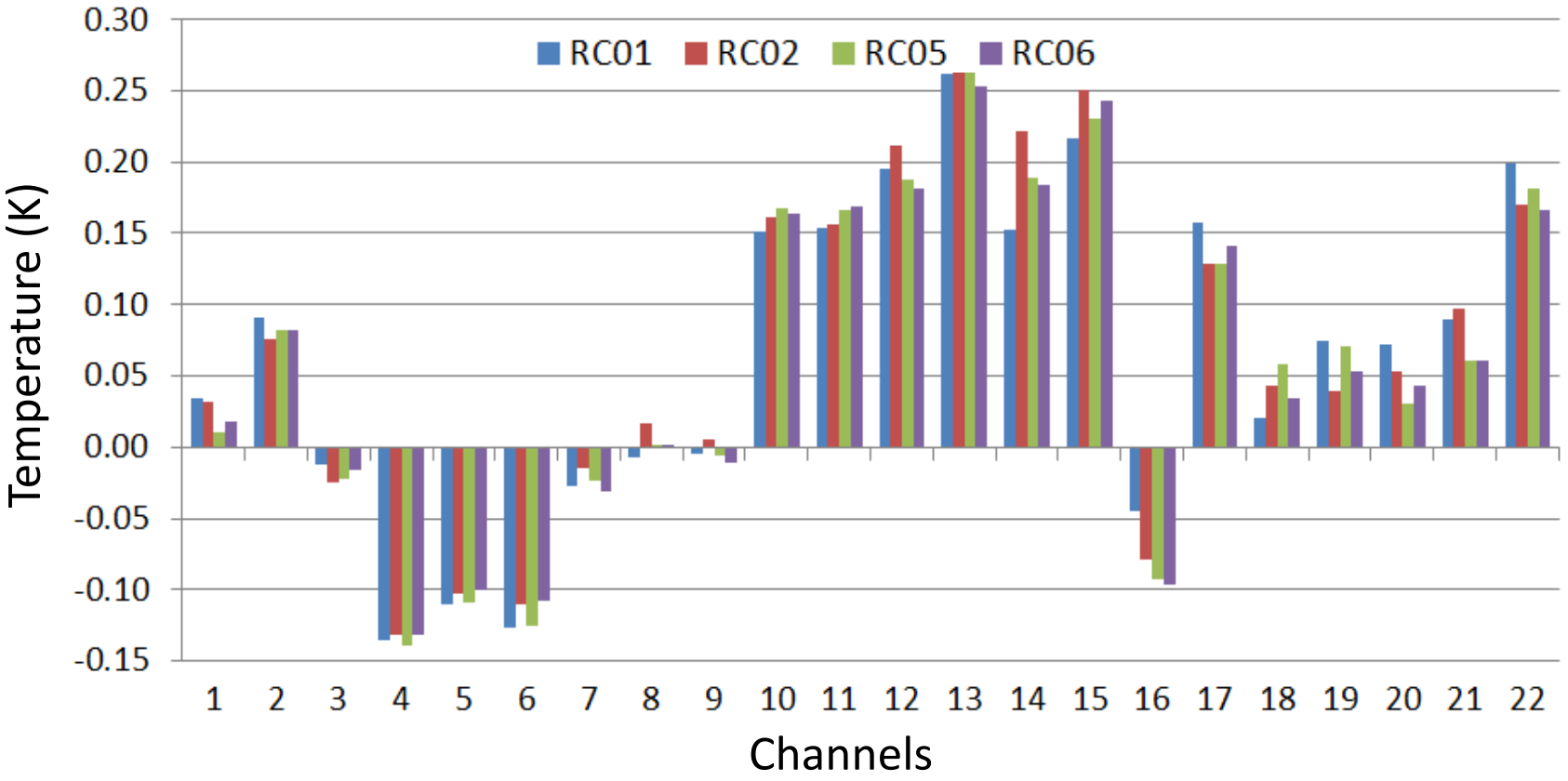
Radiometric Accuracy at CP_Mid ST-155



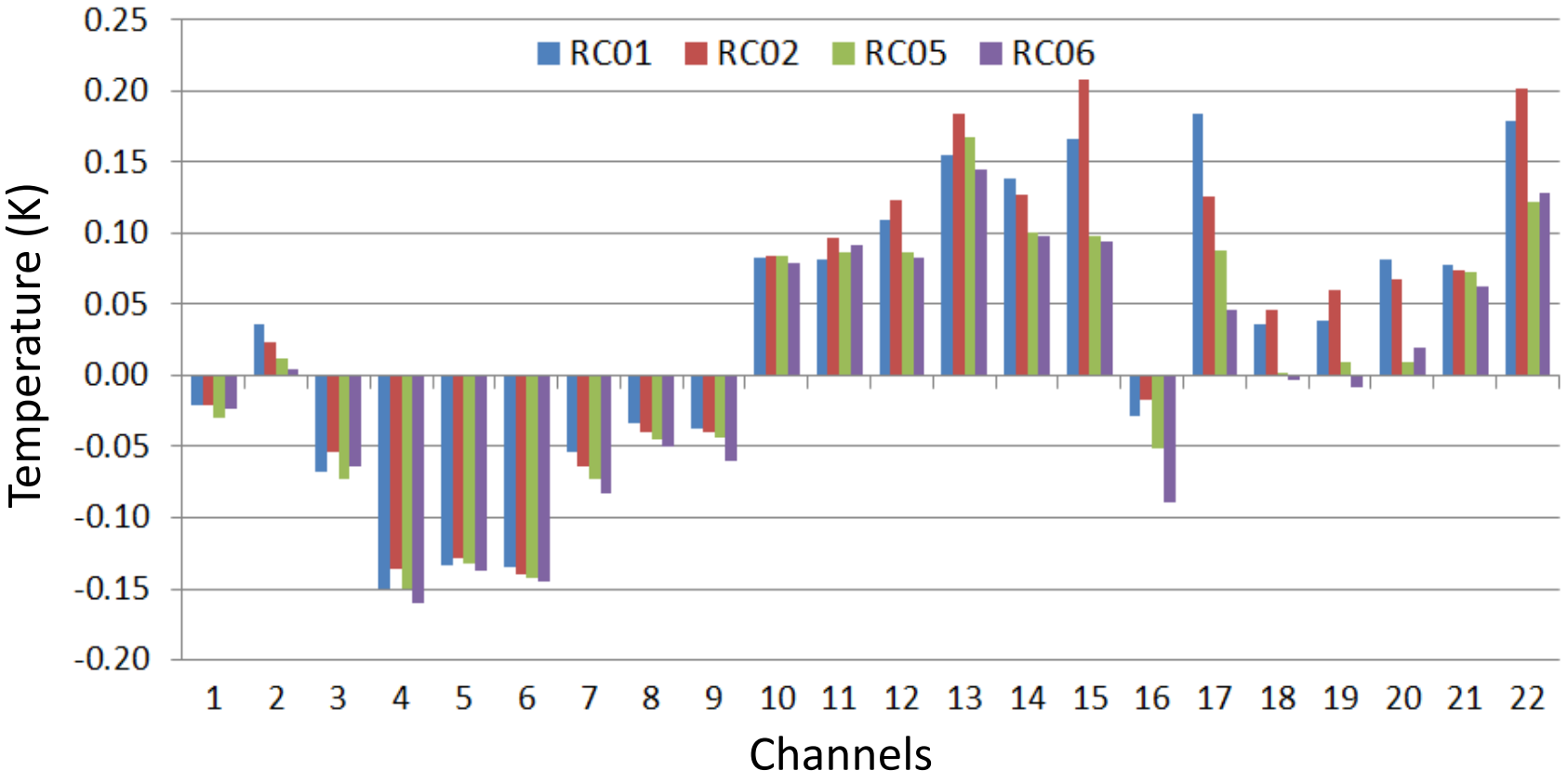
Radiometric Accuracy at CP_Mid ST-180



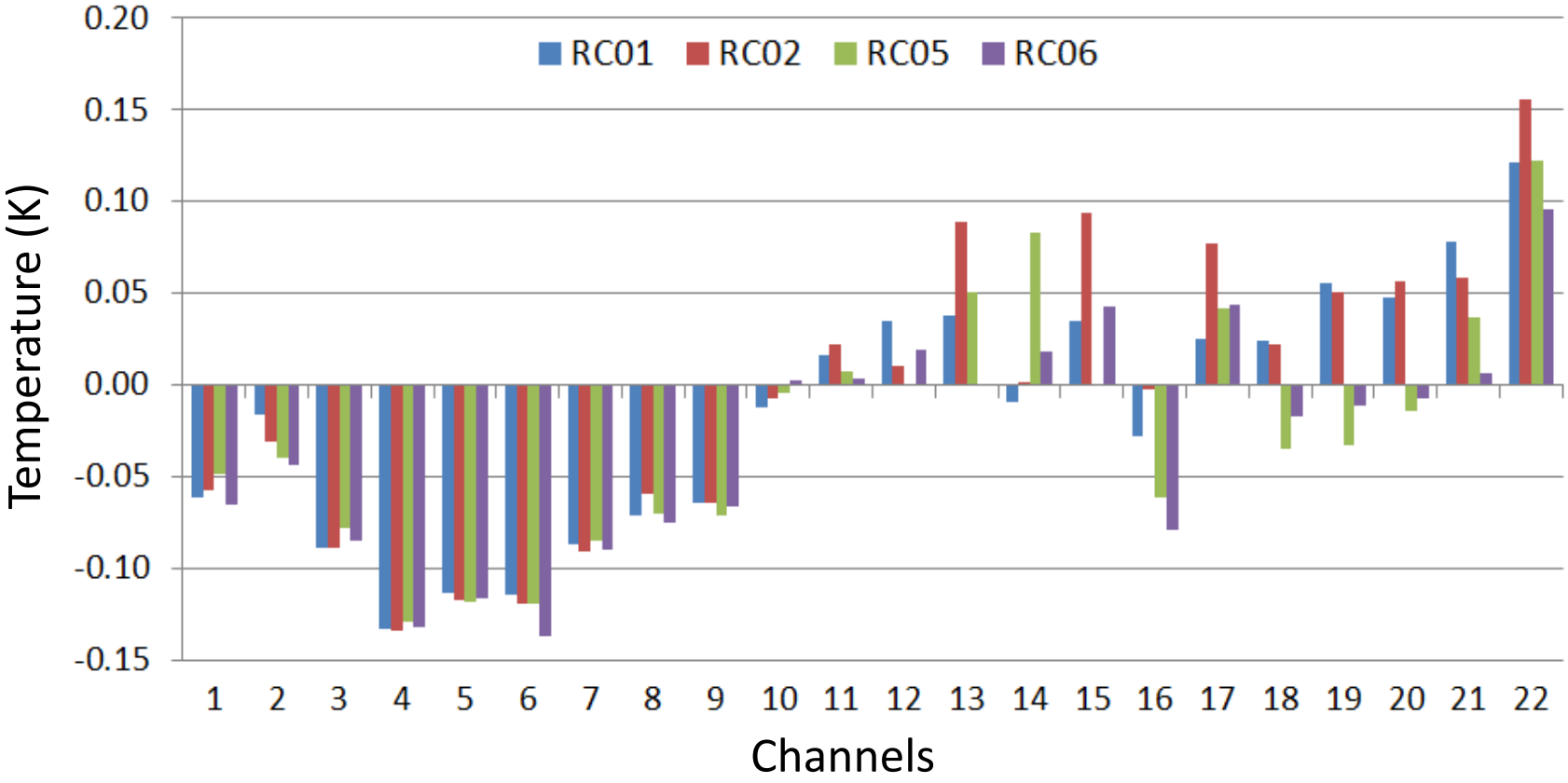
Radiometric Accuracy at CP_Mid ST-205



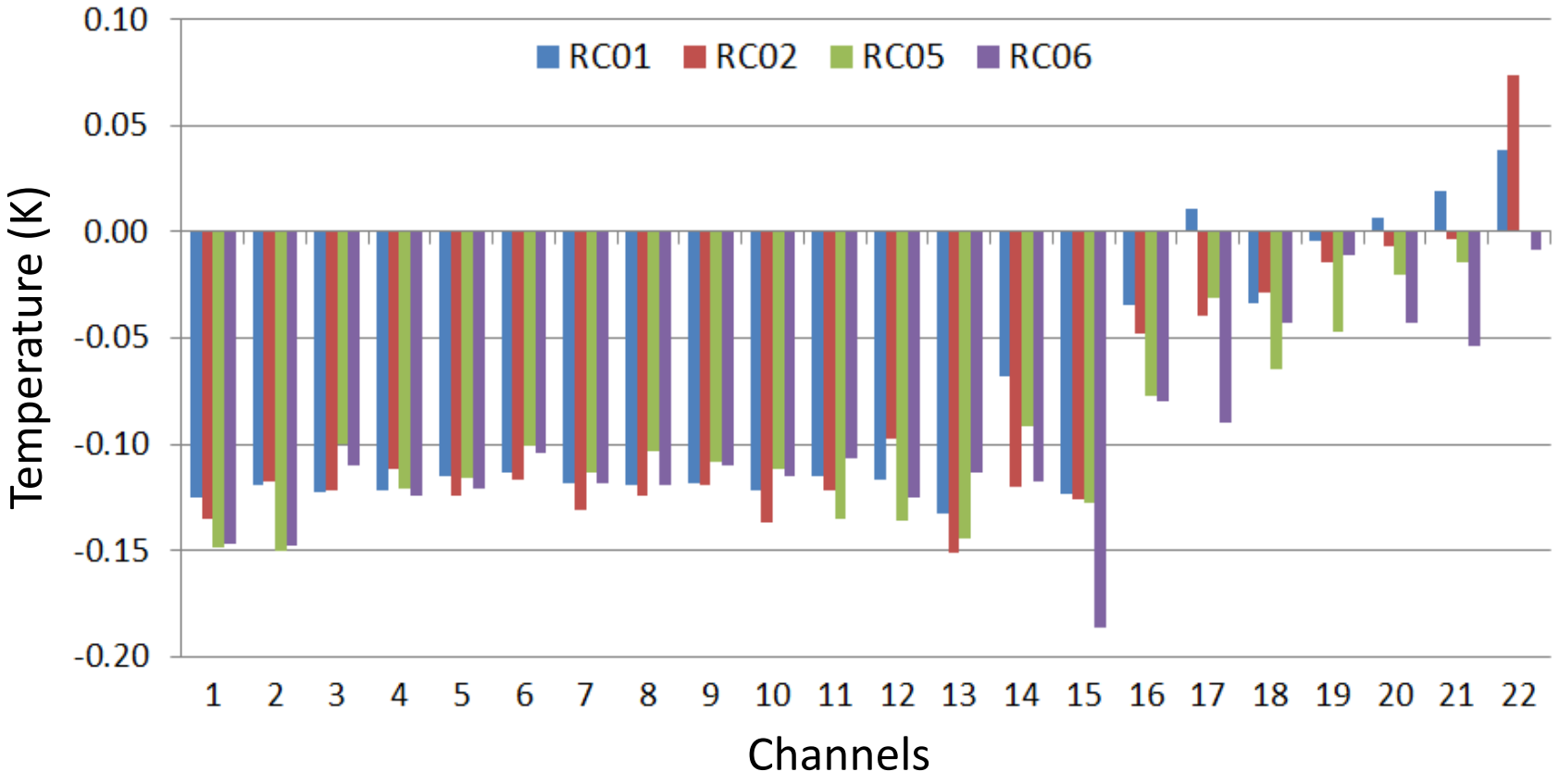
Radiometric Accuracy at CP_Mid ST-230



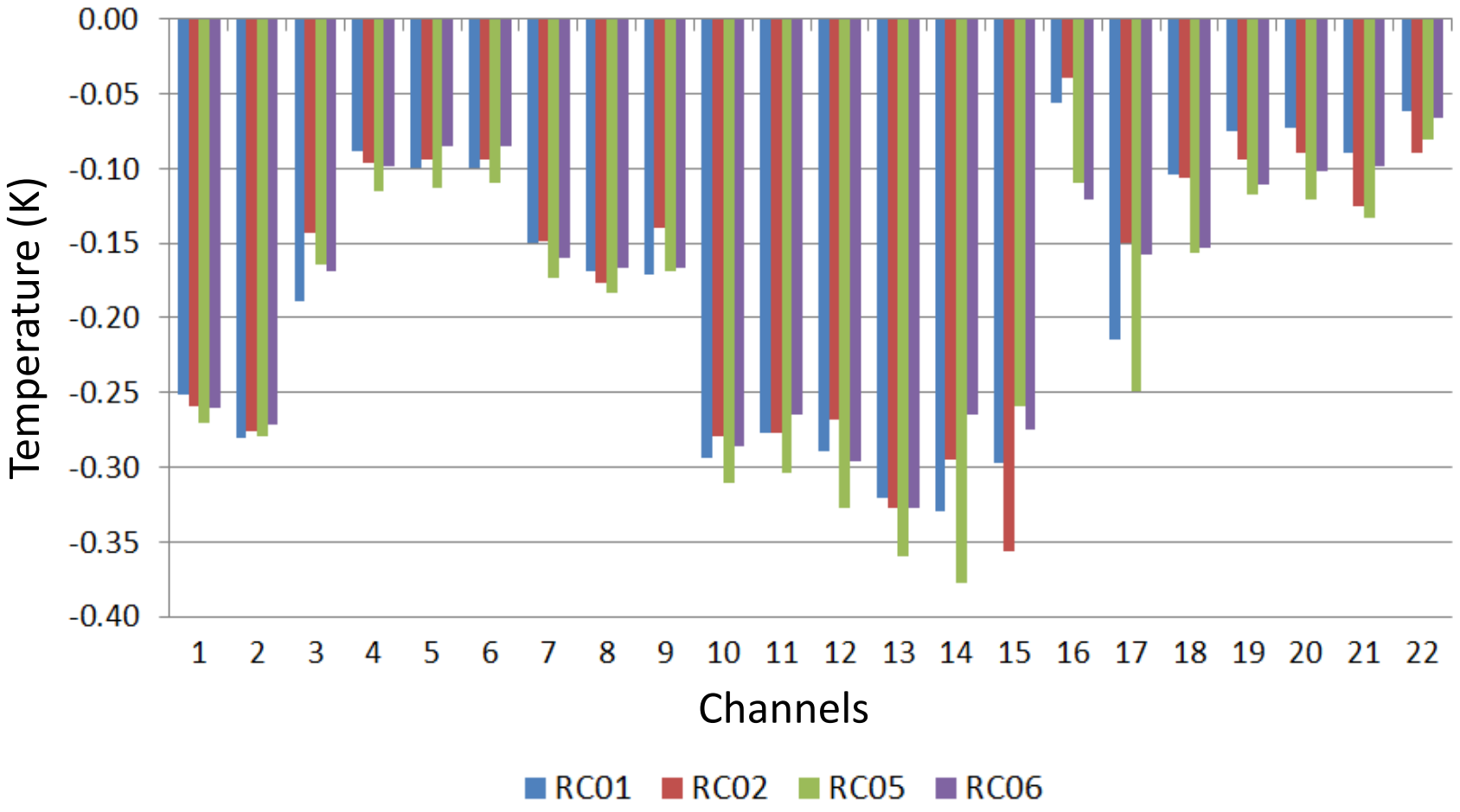
Radiometric Accuracy at CP_Mid ST-255



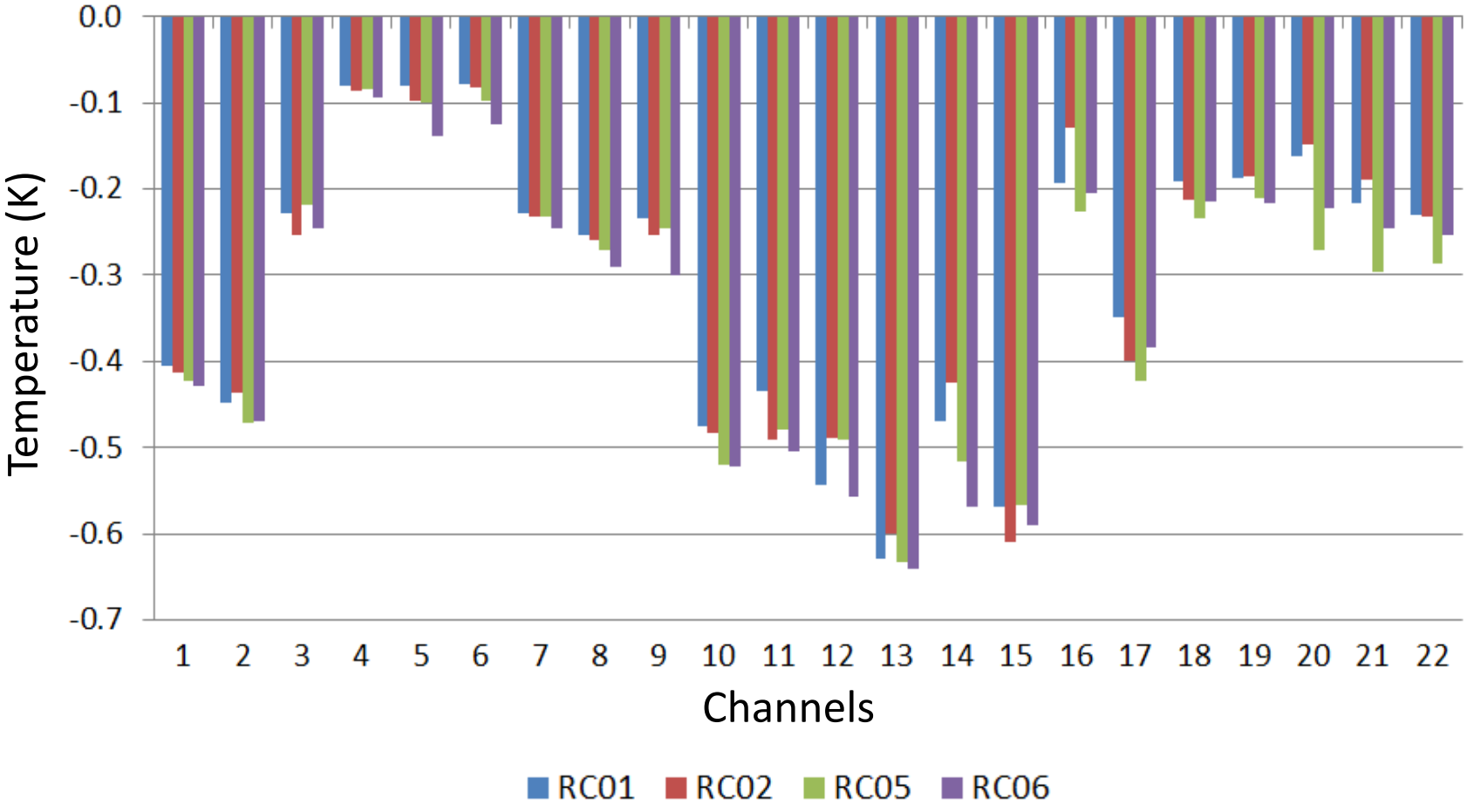
Radiometric Accuracy at CP_Mid ST-280



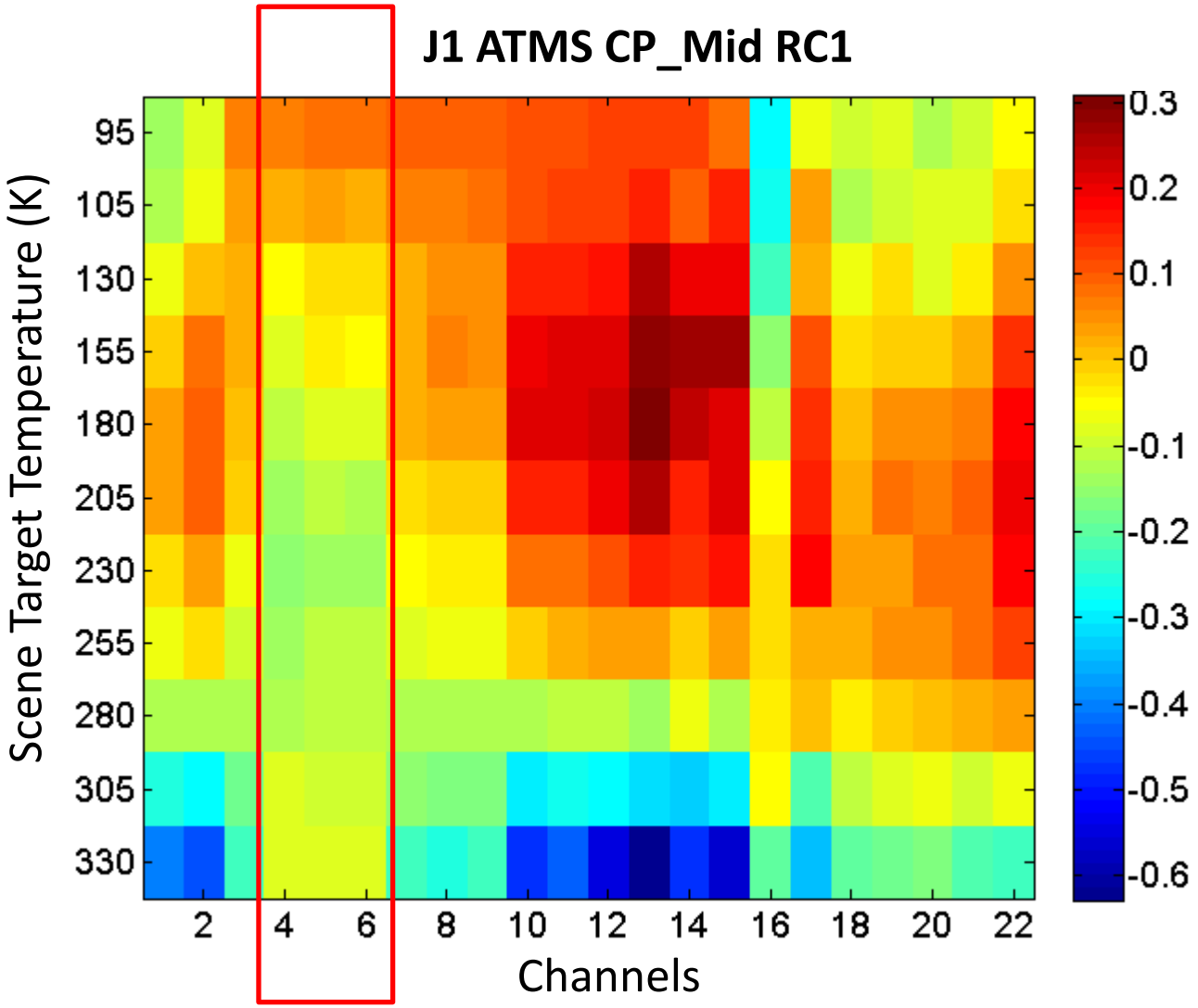
Radiometric Accuracy at CP_Mid ST-305



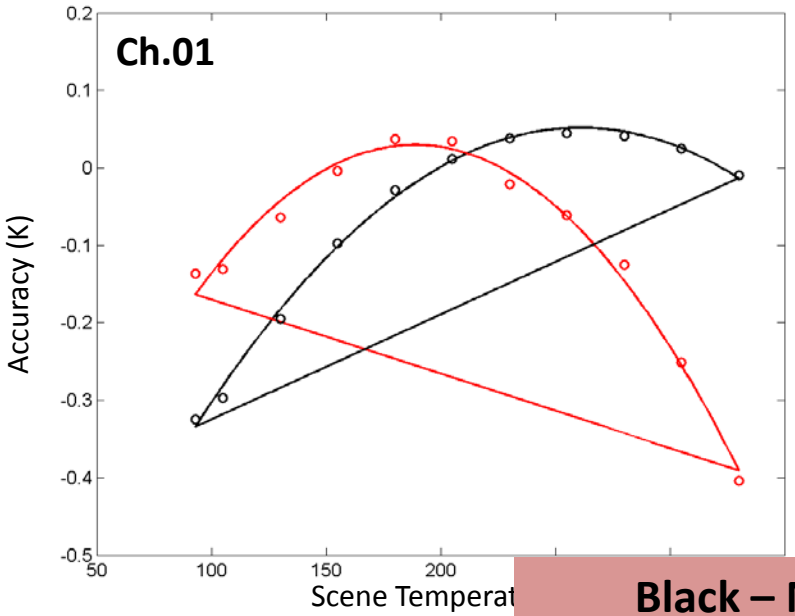
Radiometric Accuracy at CP_Mid ST-330

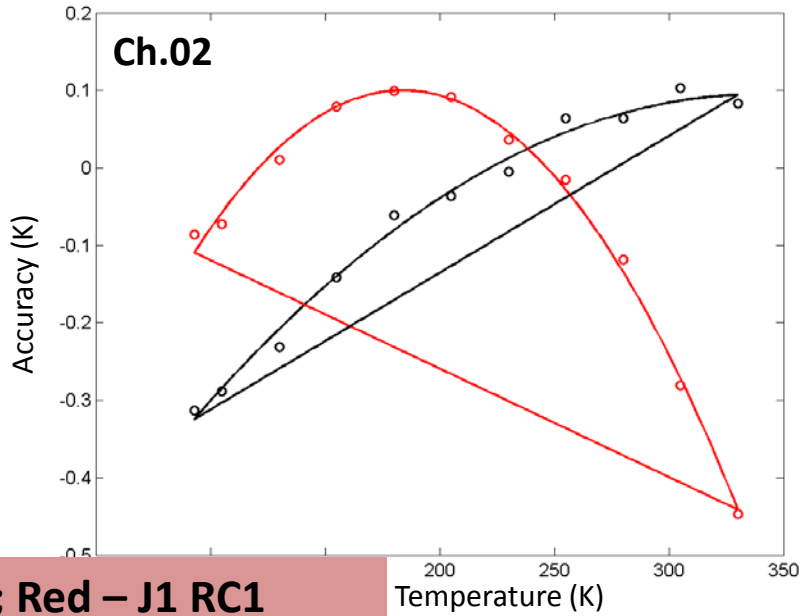


Radiometric Accuracy at CP_Mid RC1

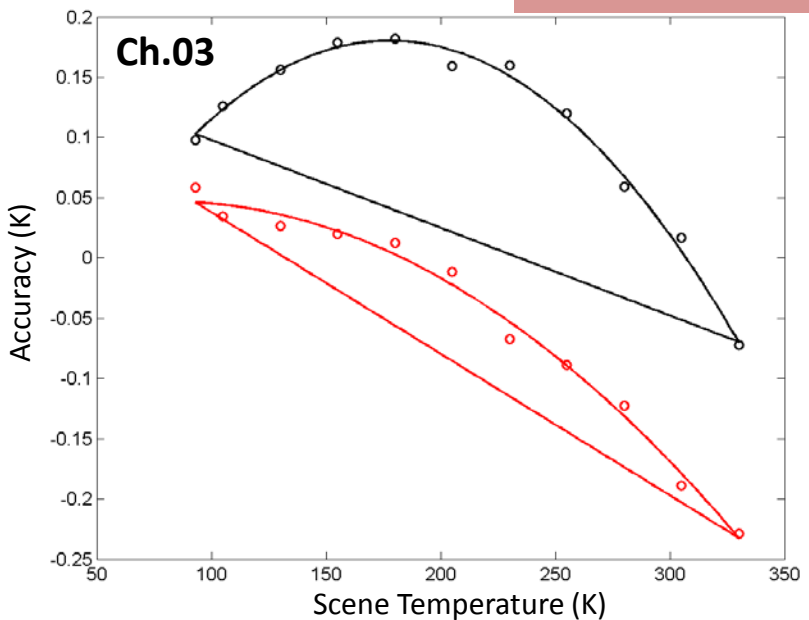


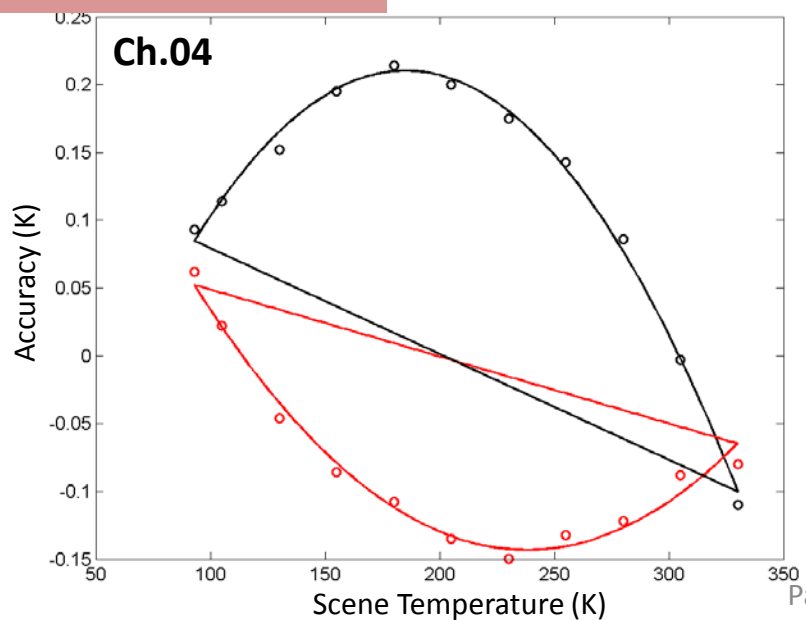
Nonlinearity Fitting for CP_Mid RC1 vs. S-NPP



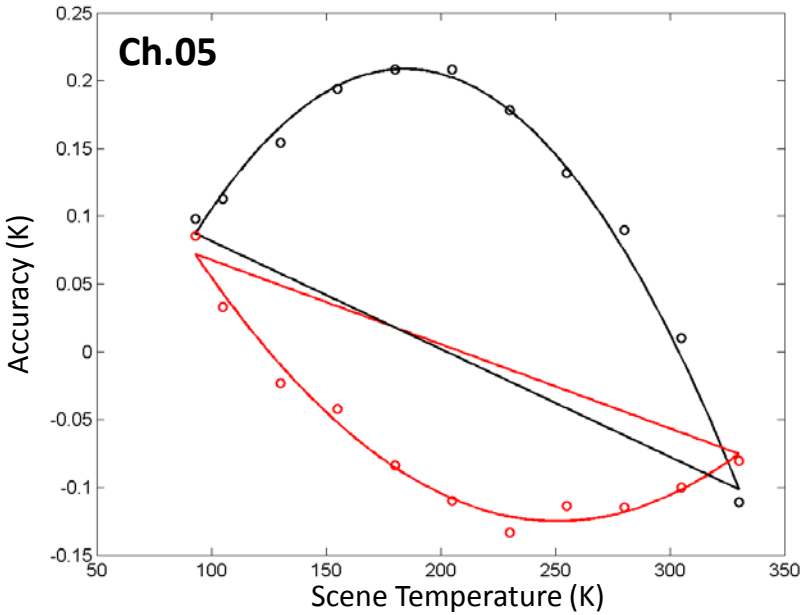


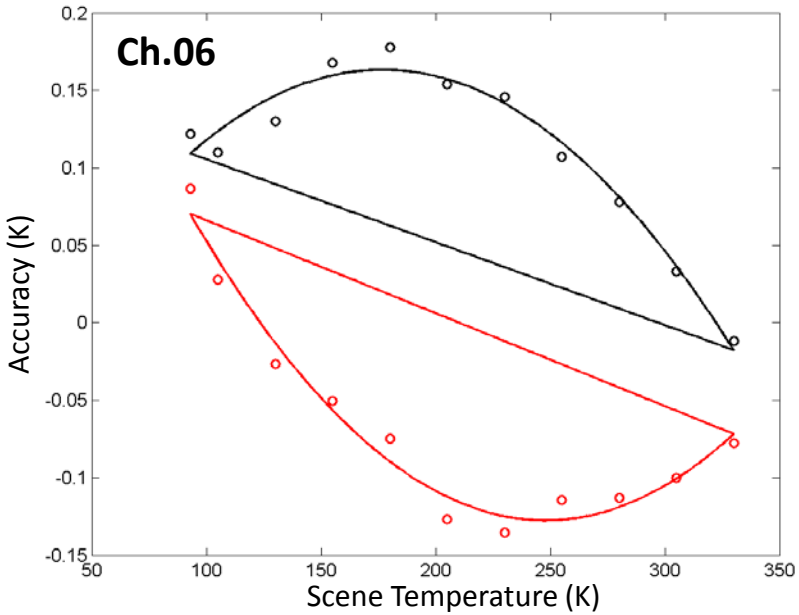
Black – NPP; Red – J1 RC1

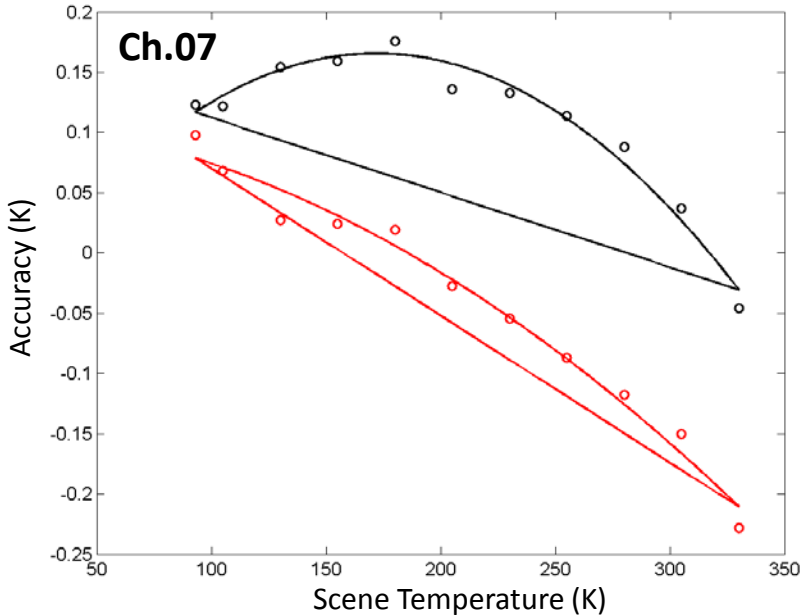


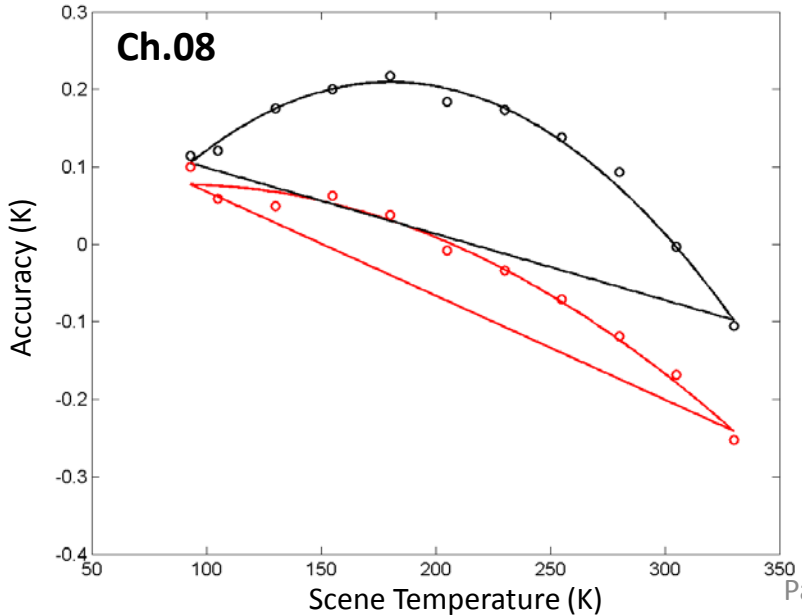


Nonlinearity Fitting for CP_Mid RC1 vs. S-NPP

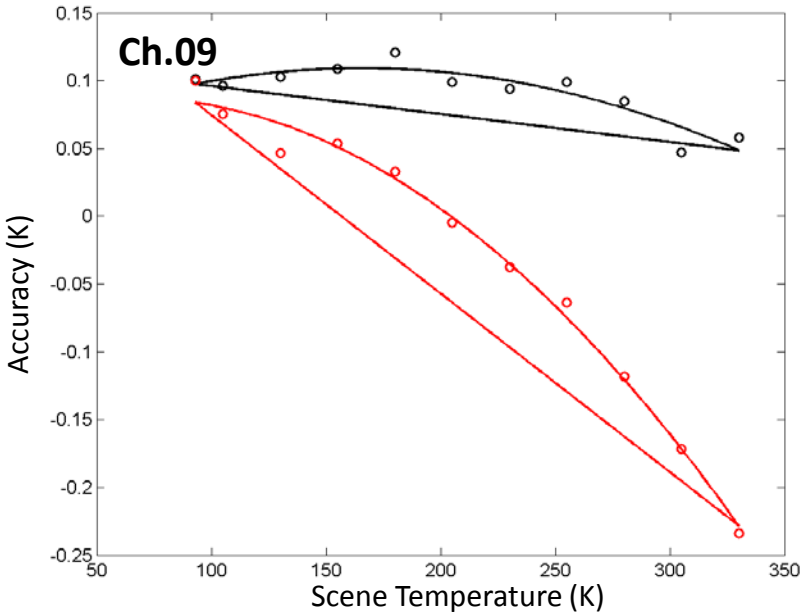


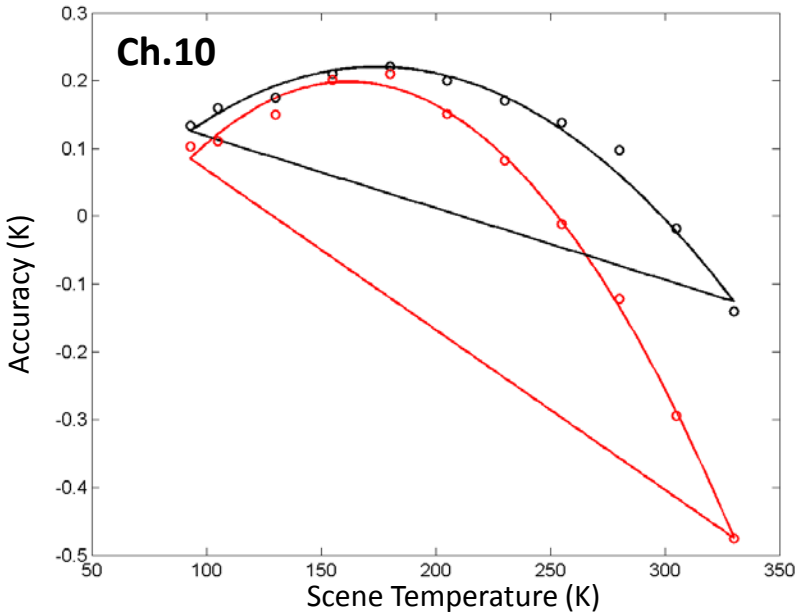


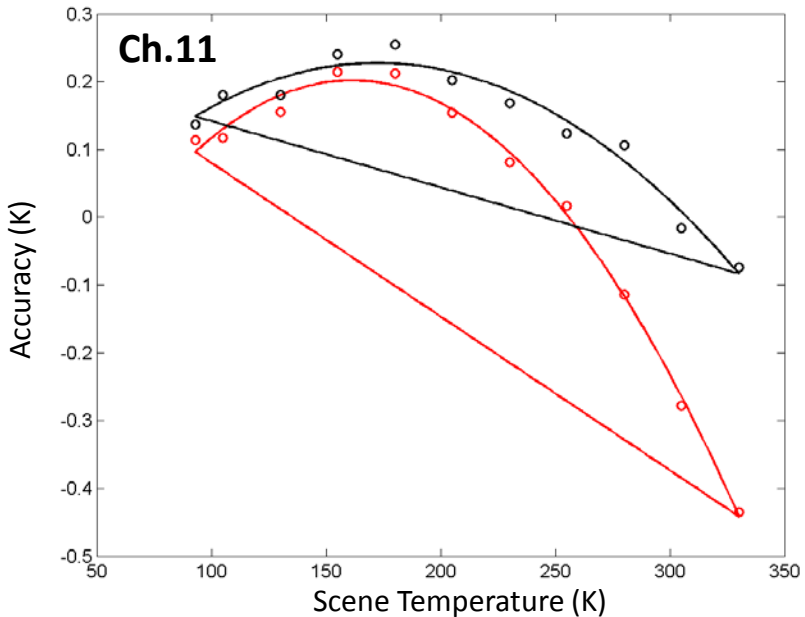


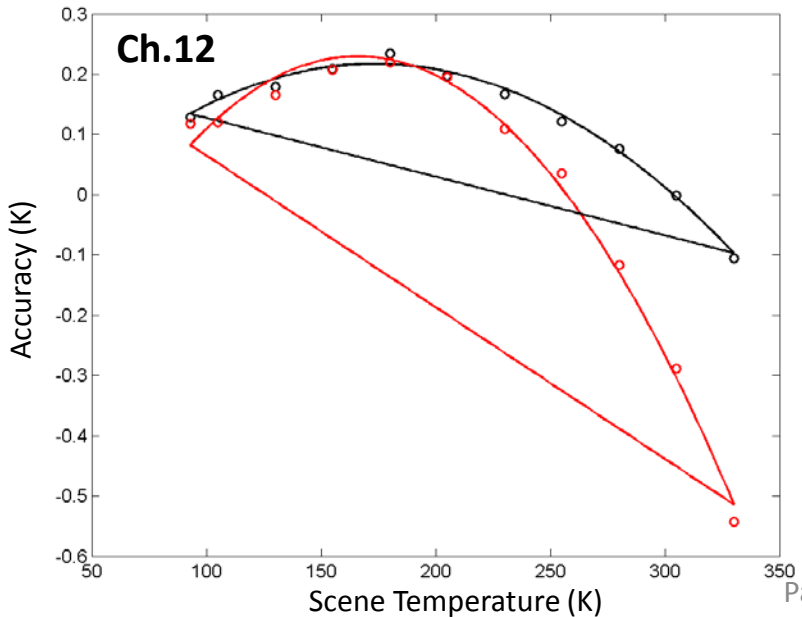


Nonlinearity Fitting for CP_Mid RC1 vs. S-NPP

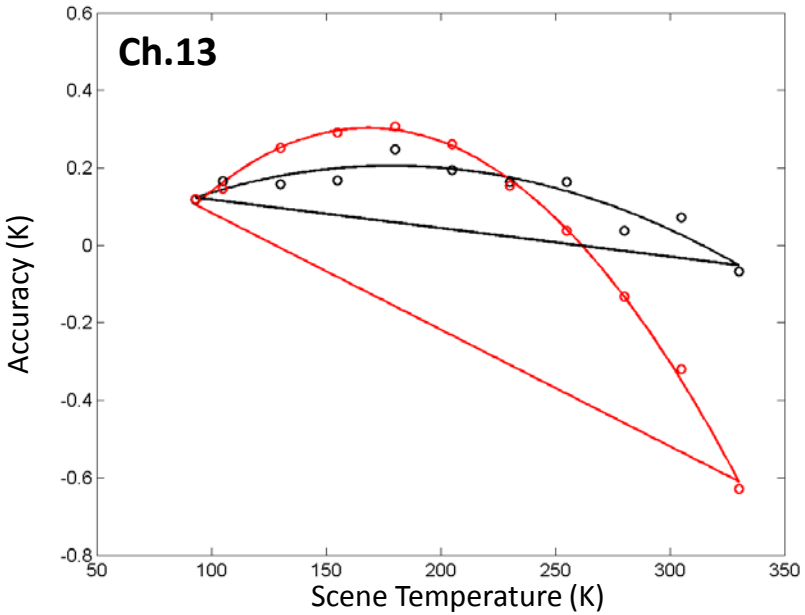


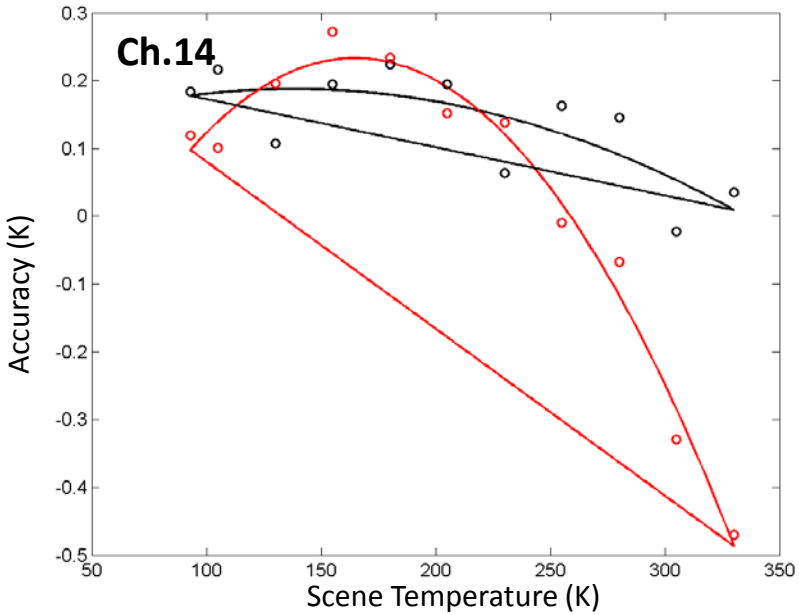


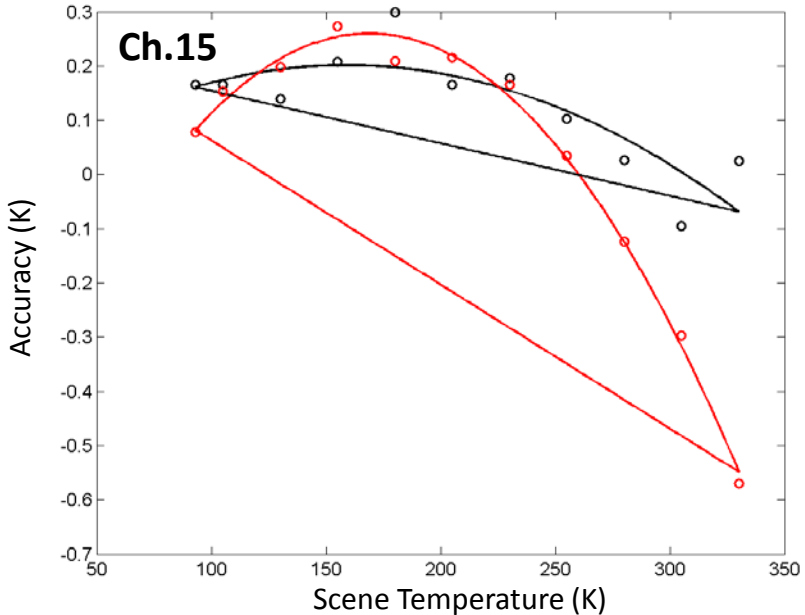


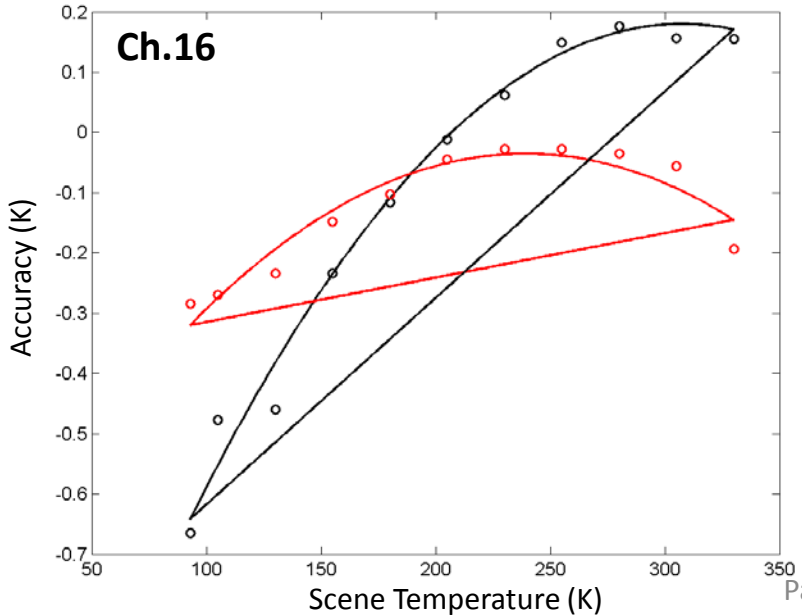


Nonlinearity Fitting for CP_Mid RC1 vs. S-NPP

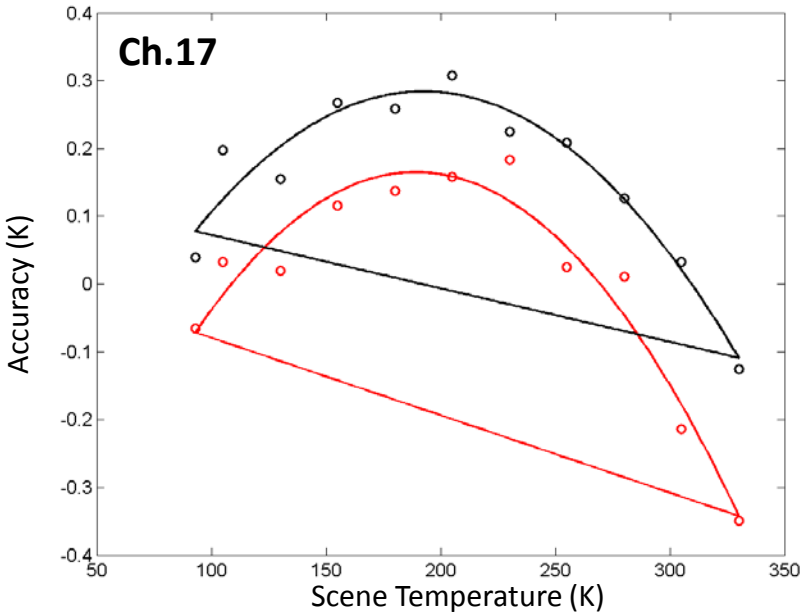


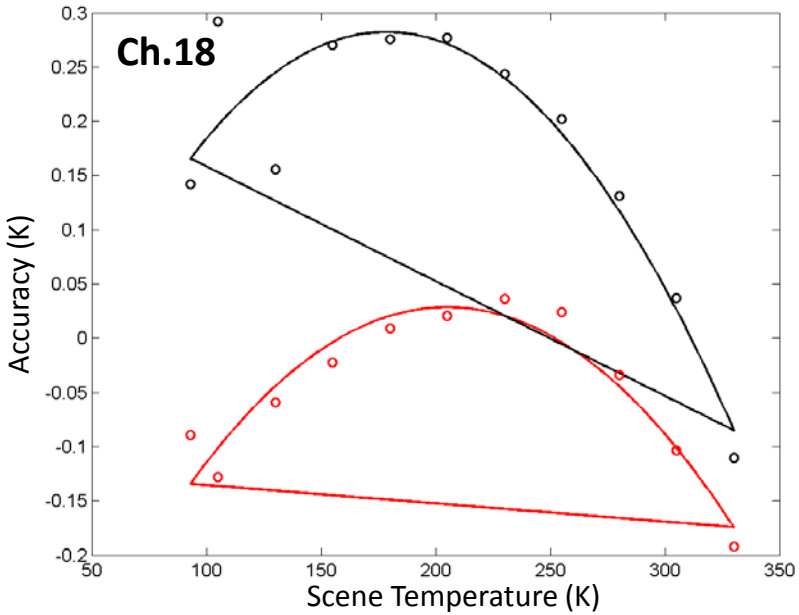


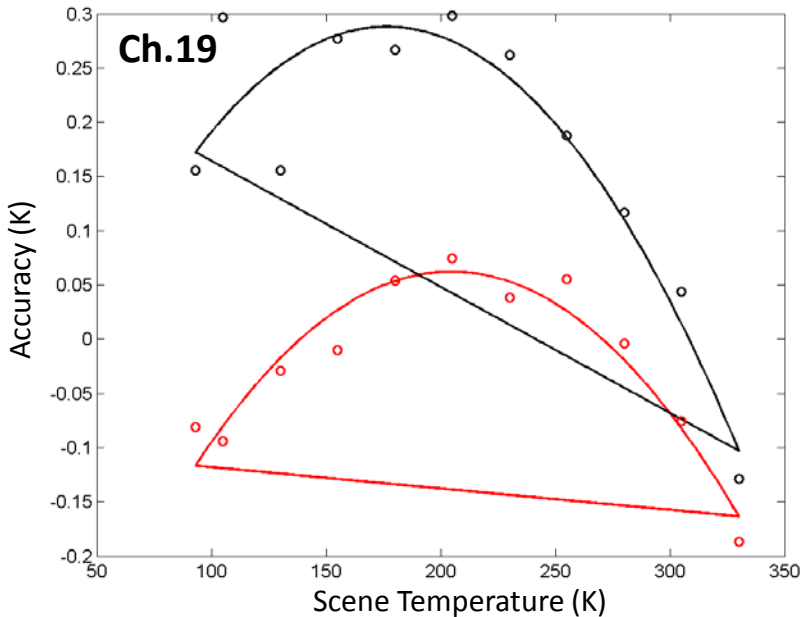


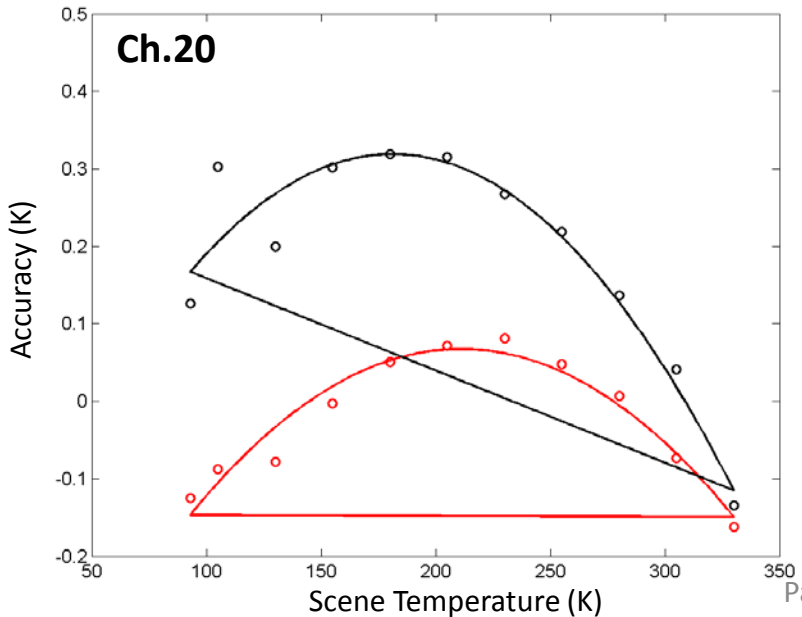


Nonlinearity Fitting for CP_Mid RC1 vs. S-NPP

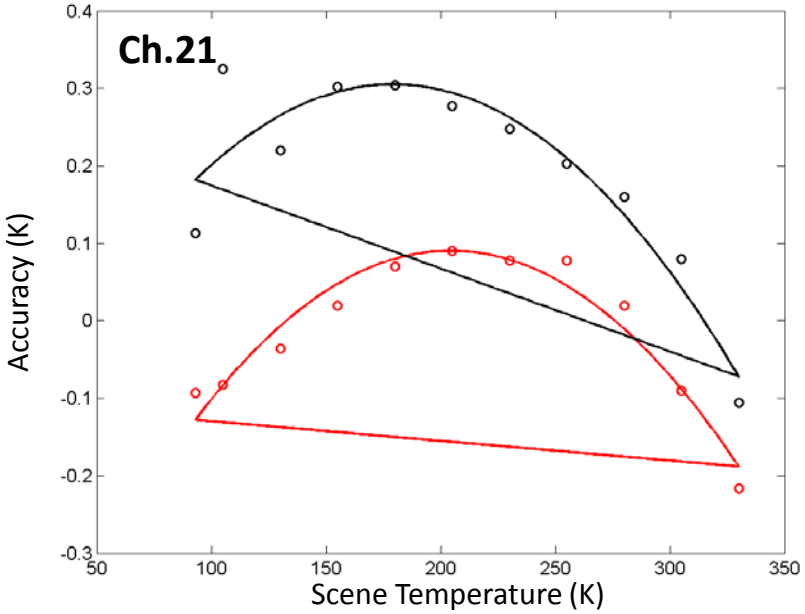


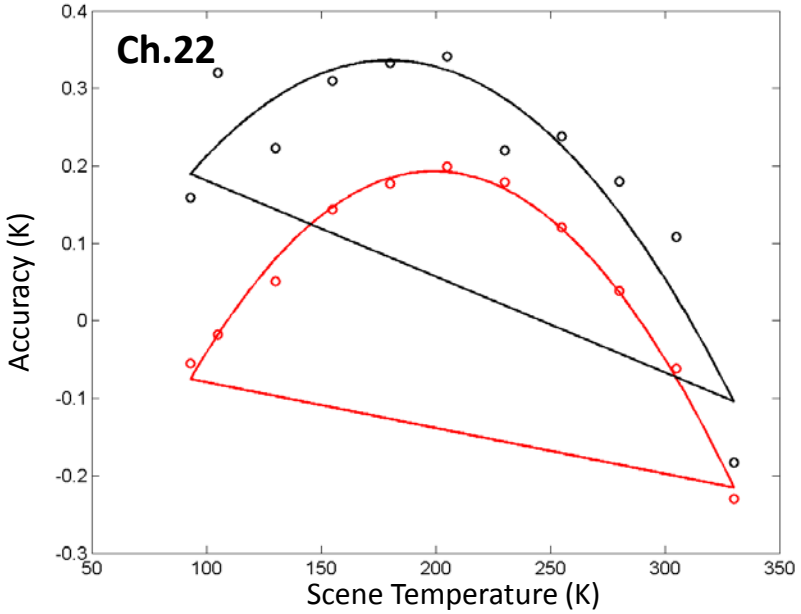




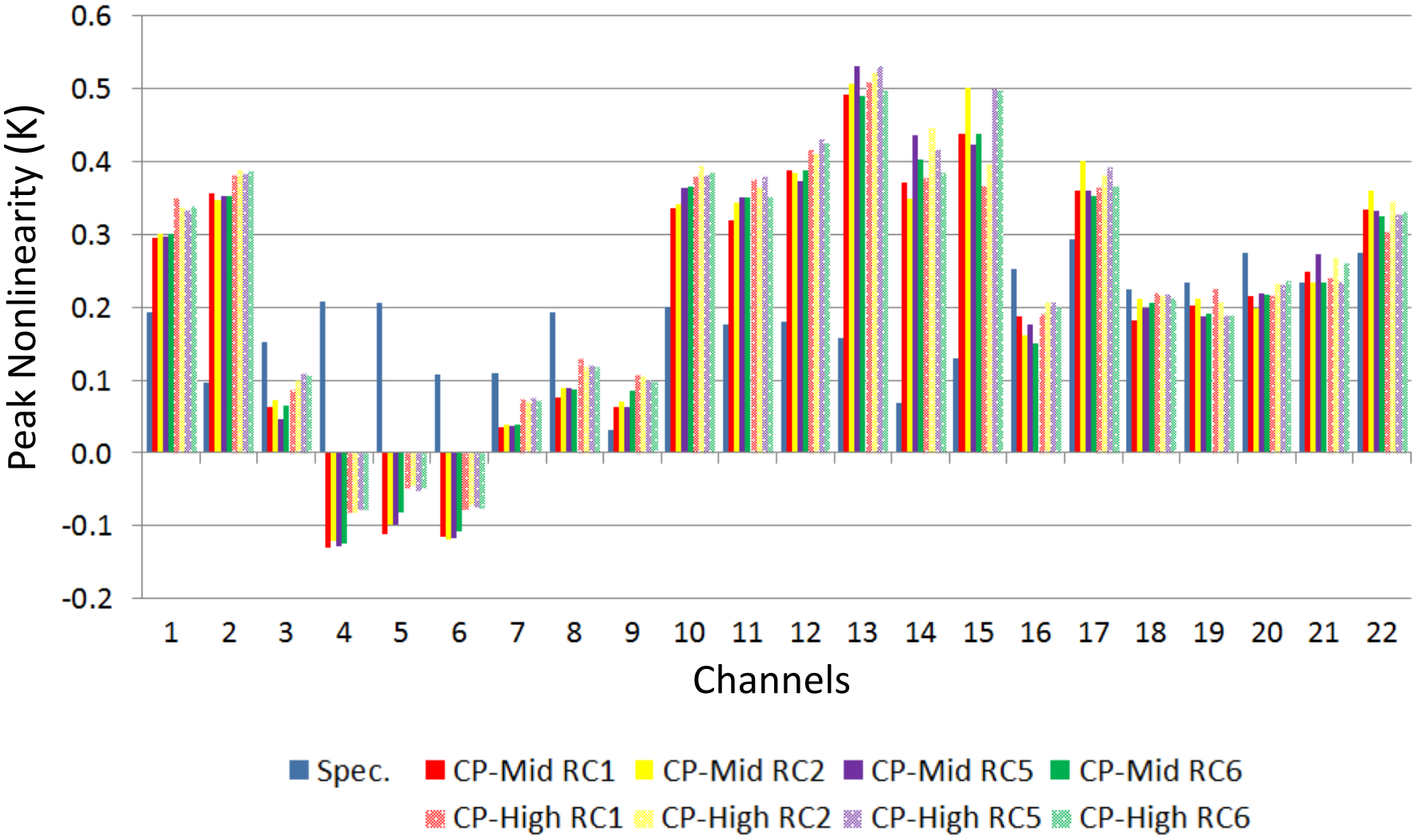


Nonlinearity Fitting for CP_Mid RC1 vs. S-NPP





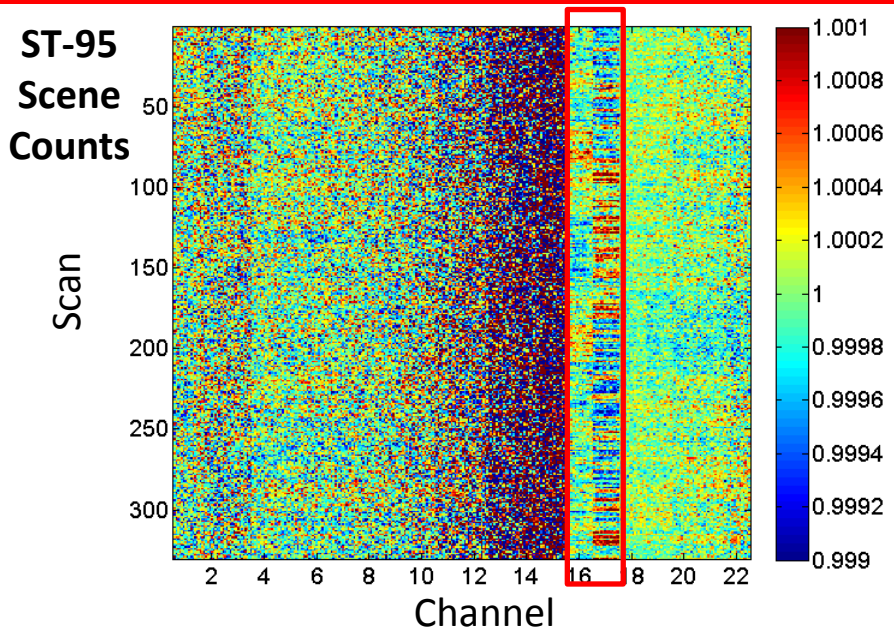
Peak Nonlinearity CP_Mid vs. CP_High vs. S-NPP

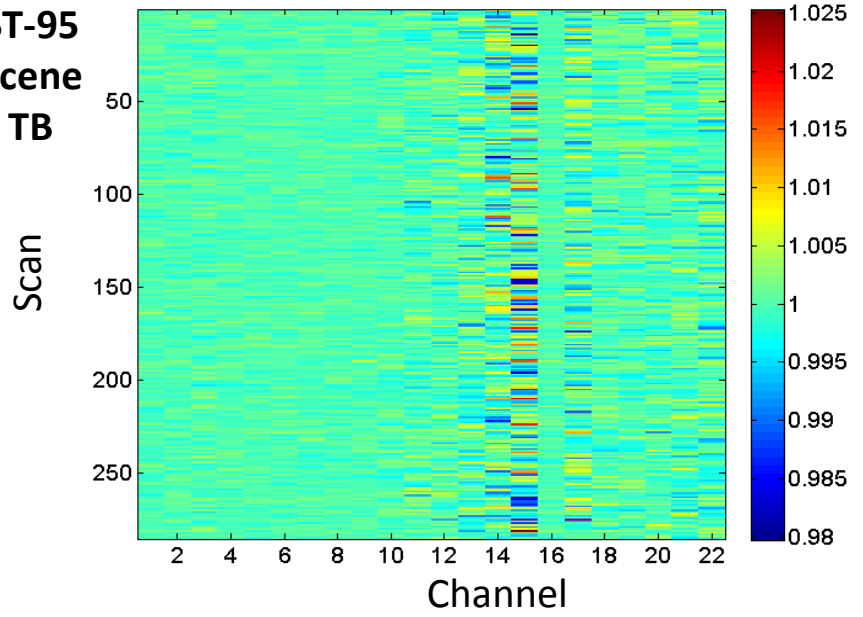


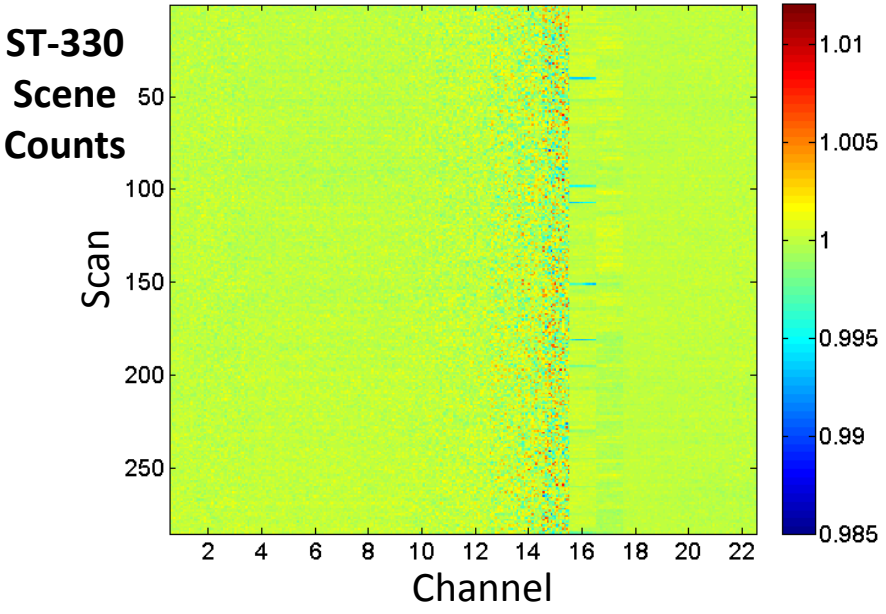
Peak Nonlinearity CP_Mid vs. CP_High vs. S-NPP

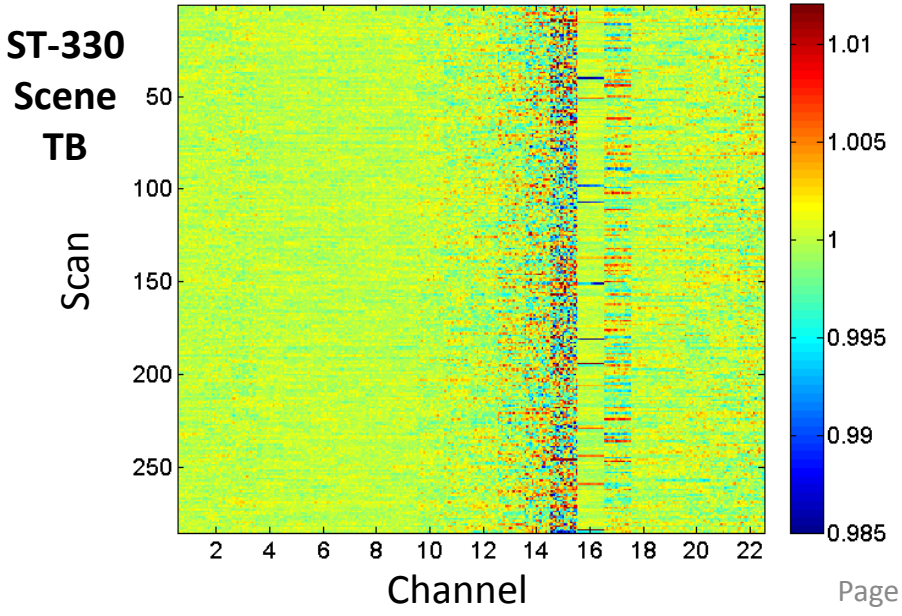
	Req.	NPP	RC 01	RC 02	RC 05	RC 06	RC 01	RC 02	RC 05	RC 06
Ch. 01	0.3	0.192375	0.295533	0.300354	0.295683	0.300126	0.350545	0.335861	0.332529	0.338800
Ch. 02	0.4	0.097030	0.356295	0.347214	0.352813	0.352103	0.381823	0.388844	0.382640	0.386258
Ch. 03	0.4	0.151654	0.063326	0.071473	0.046543	0.065086	0.087422	0.100421	0.107853	0.107398
Ch. 04	0.4	0.207822	-0.13045	-0.12117	-0.12731	-0.12330	-0.081500	-0.082200	-0.078464	-0.079056
Ch. 05	0.4	0.205013	-0.11092	-0.09897	-0.09844	-0.08080	-0.049000	-0.045700	-0.052999	-0.048141
Ch. 06	0.4	0.108404	-0.11574	-0.11833	-0.11686	-0.10726	-0.077700	-0.073500	-0.073962	-0.076087
Ch. 07	0.4	0.110230	0.036040	0.039193	0.037443	0.038843	0.072957	0.069023	0.076008	0.071417
Ch. 08	0.4	0.192375	0.076095	0.089287	0.088286	0.087903	0.128727	0.118902	0.120489	0.117619
Ch. 09	0.4	0.031454	0.063095	0.069742	0.063940	0.084724	0.107218	0.104286	0.100277	0.096756
Ch. 10	0.4	0.200801	0.334665	0.341480	0.363272	0.364838	0.379554	0.393401	0.381613	0.385252
Ch. 11	0.4	0.175525	0.317945	0.342248	0.350390	0.349432	0.376068	0.364571	0.380200	0.351793
Ch. 12	0.4	0.179738	0.388312	0.383448	0.371666	0.386639	0.416540	0.410095	0.432229	0.425297
Ch. 13	0.4	0.157270	0.490847	0.505495	0.530009	0.489683	0.509692	0.522424	0.532068	0.497168
Ch. 14	0.4	0.068104	0.369805	0.348896	0.436279	0.401462	0.378473	0.445803	0.415863	0.384177
Ch. 15	0.4	0.129748	0.436805	0.500044	0.422272	0.437745	0.366713	0.396972	0.499259	0.497620
Ch. 16	0.4	0.251352	0.187002	0.160974	0.176309	0.149825	0.189948	0.206867	0.206306	0.199304
Ch. 17	0.4	0.292074	0.359176	0.400952	0.359268	0.351730	0.364226	0.381516	0.393170	0.366368
Ch. 18	0.4	0.224672	0.182350	0.210731	0.198731	0.206451	0.220616	0.216834	0.218325	0.211934
Ch. 19	0.4	0.233097	0.201559	0.211713	0.187876	0.190328	0.225926	0.206616	0.187707	0.188110
Ch. 20	0.4	0.275223	0.215399	0.198030	0.219165	0.216822	0.215823	0.232860	0.231878	0.237326
Ch. 21	0.4	0.233097	0.247567	0.232987	0.272747	0.232993	0.239922	0.267539	0.235167	0.261524
Ch. 22	0.4	0.273819	0.334551	0.359397	0.330968	0.325268	0.303348	0.345271	0.327134	0.331810

Striping in RC1 at CP_Mid ST-95 vs. ST-330

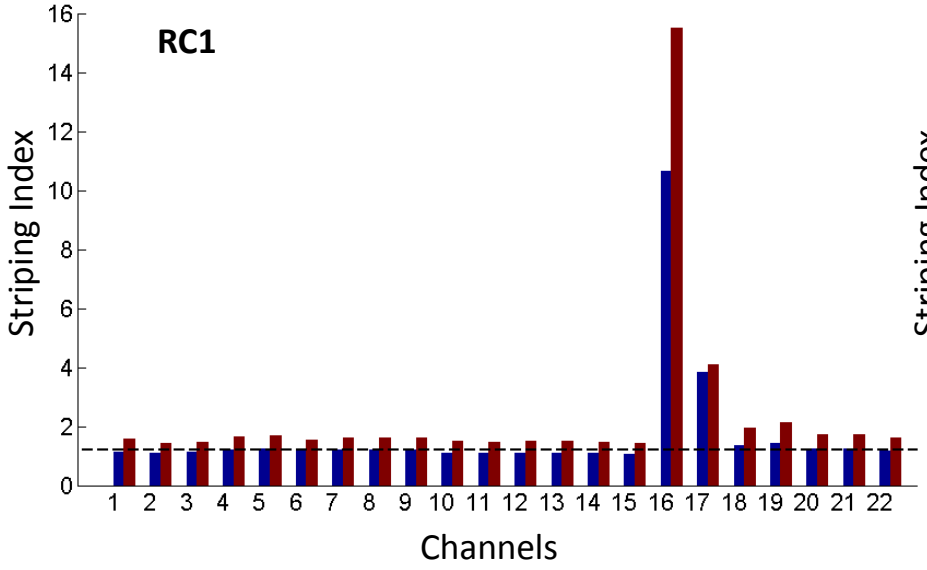


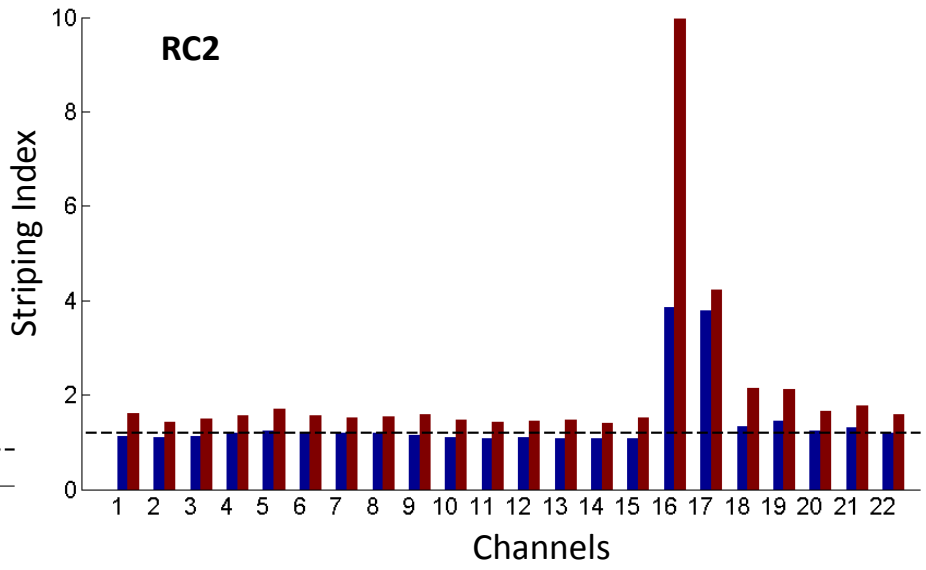


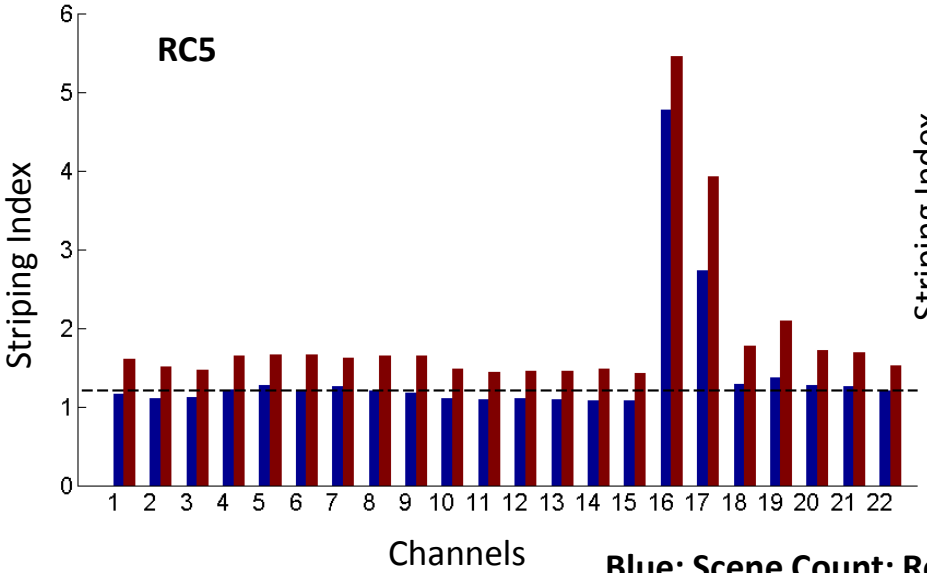


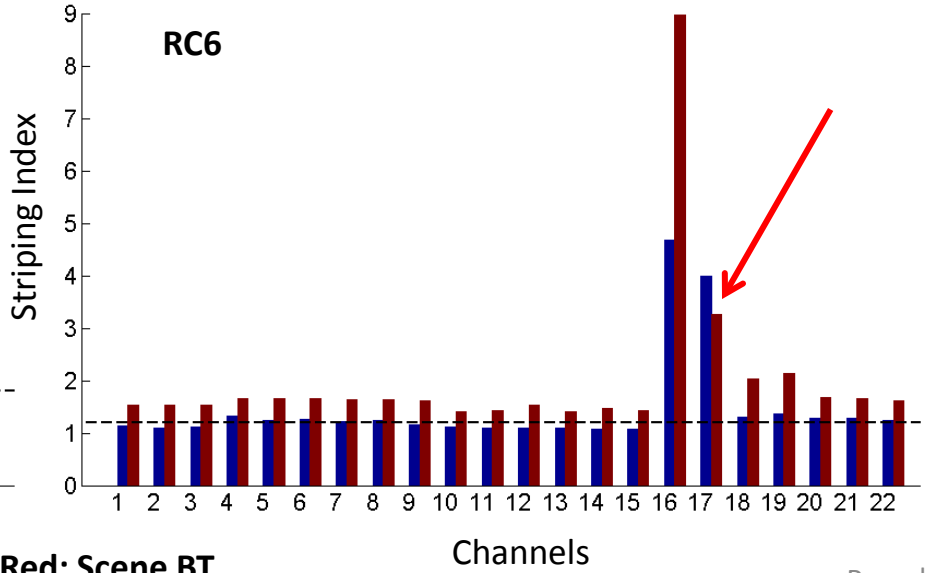


Striping Index at CP_Mid ST-330



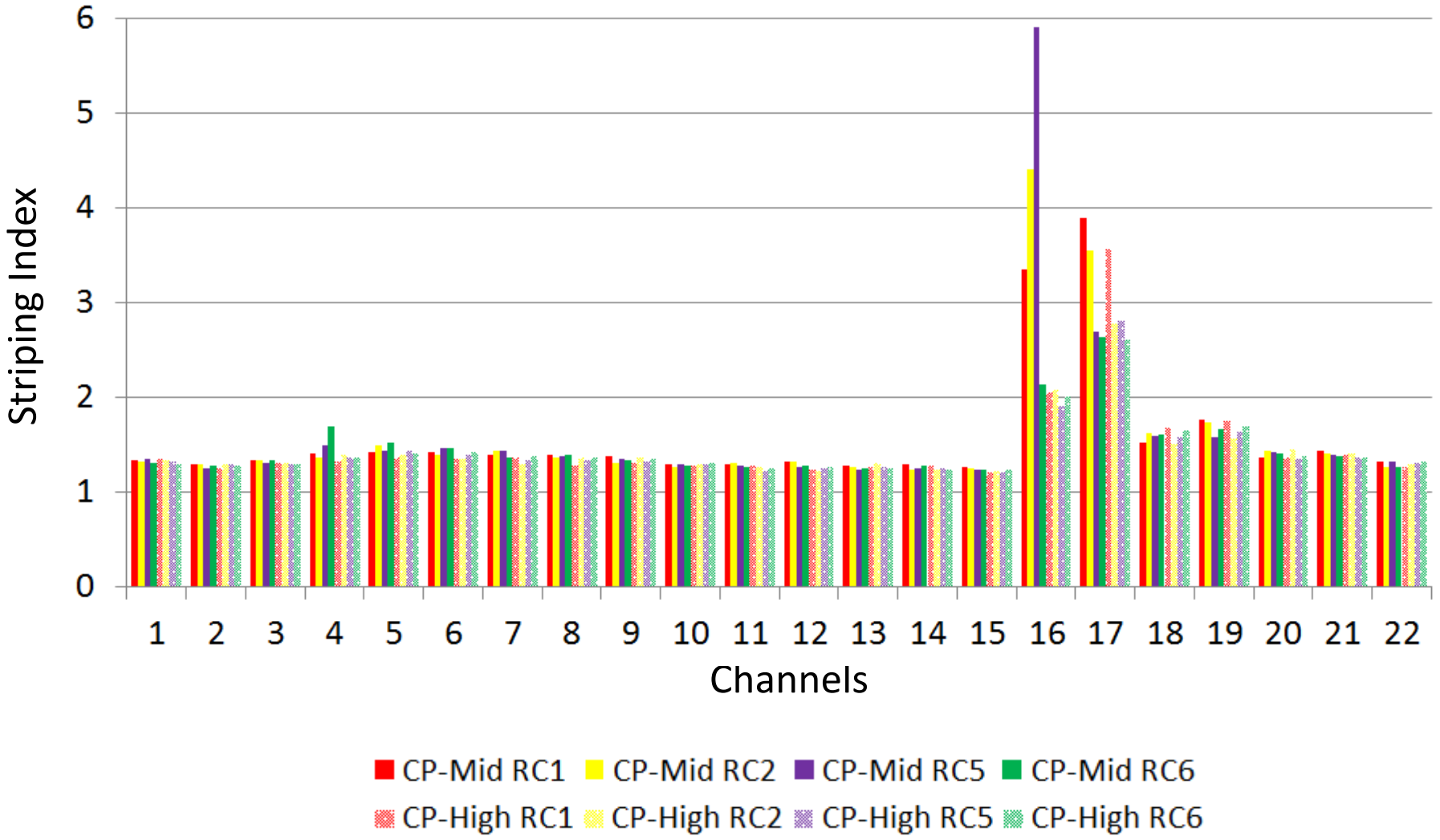




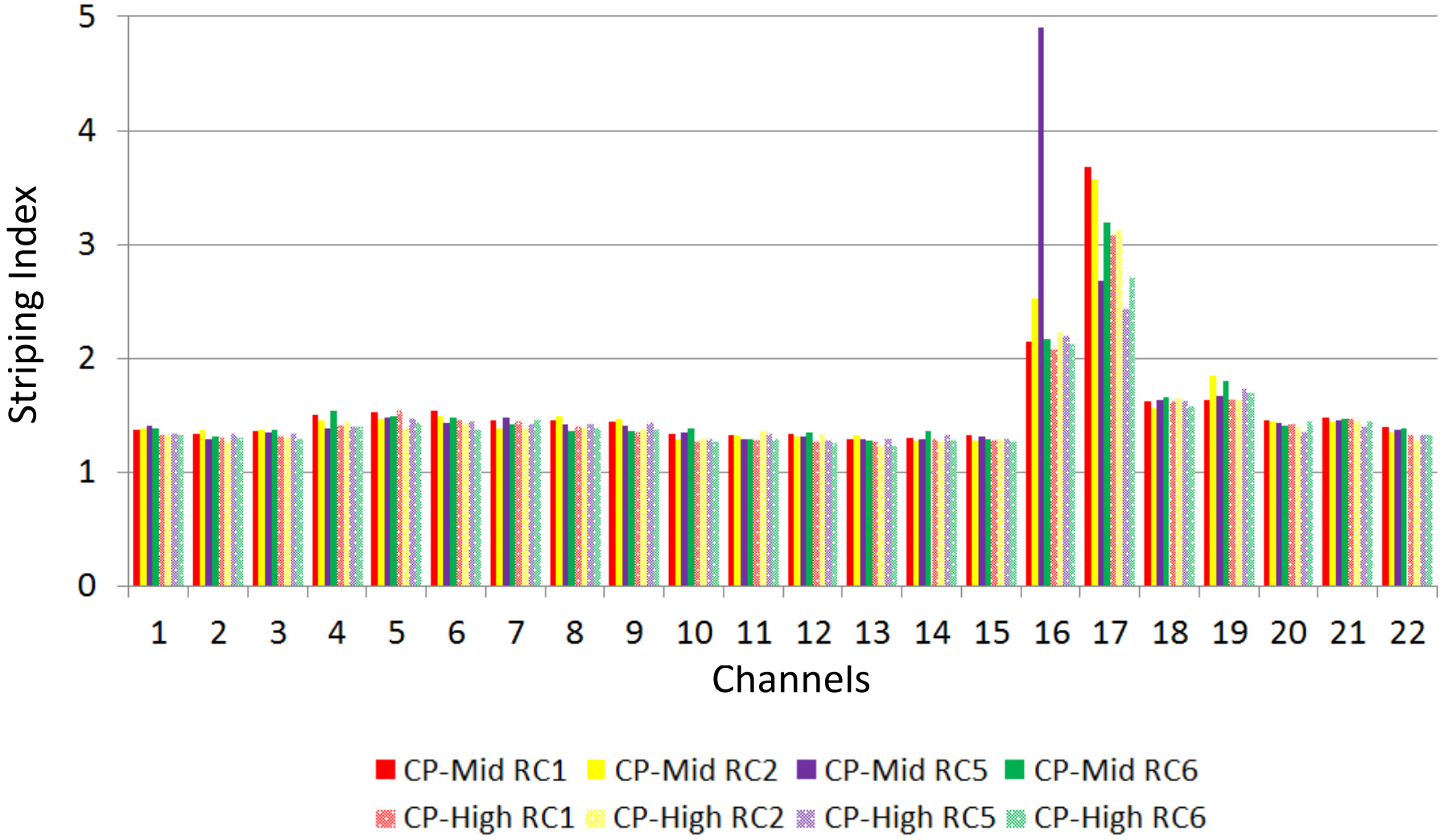


Blue: Scene Count; Red: Scene BT

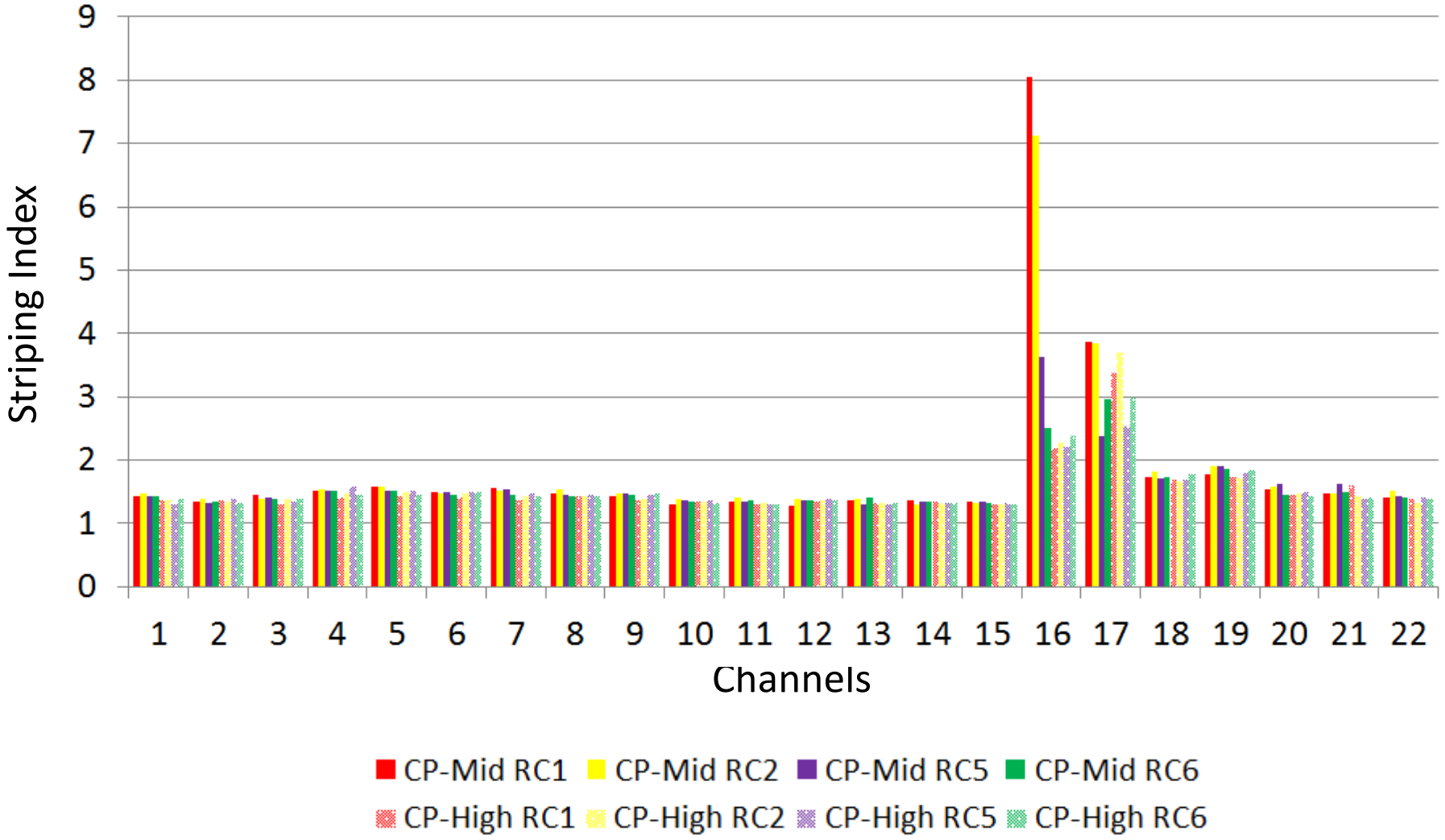
Striping Index at ST-230 CP_Mid vs. CP_High



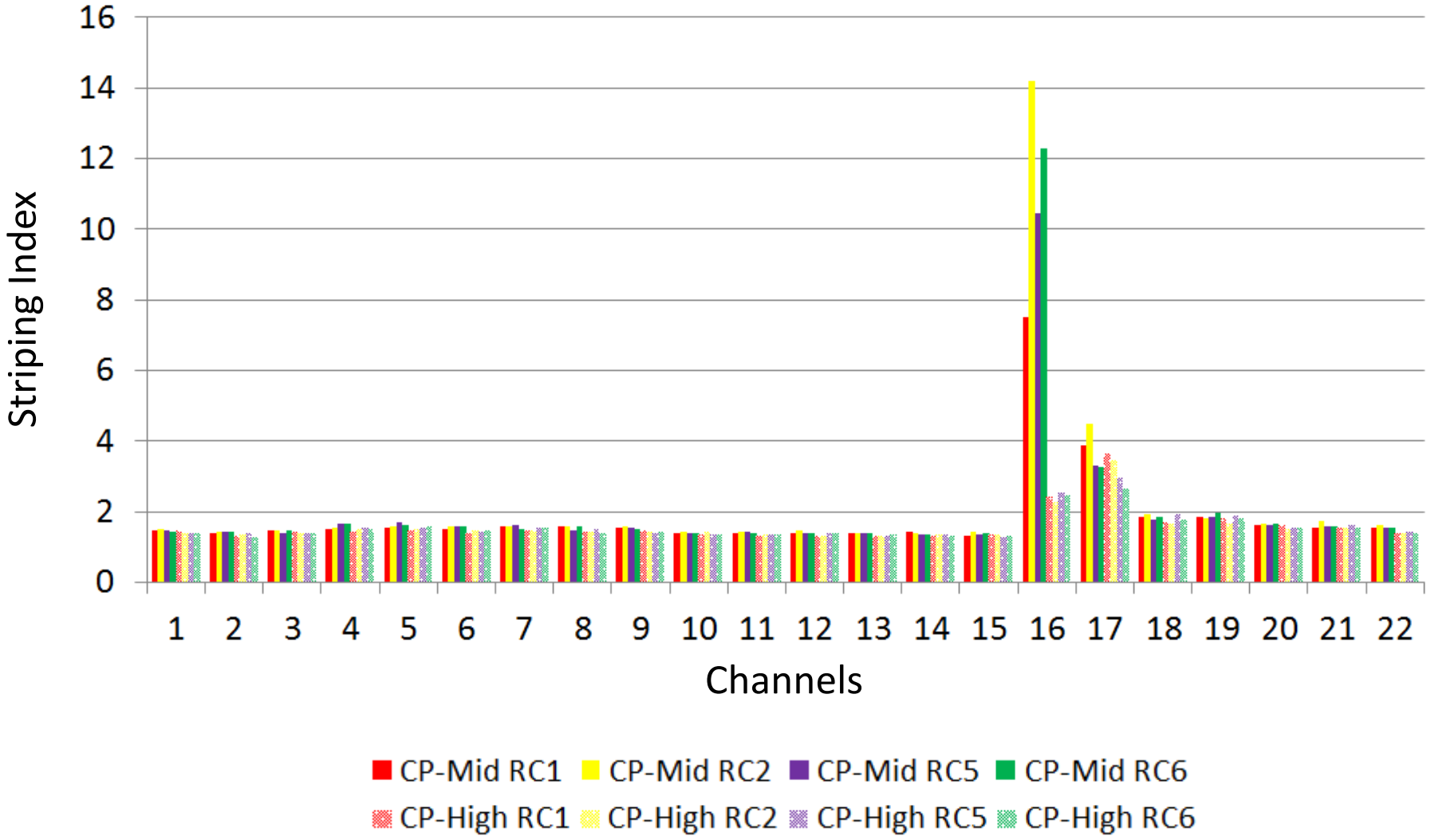
Striping Index at ST-255 CP_Mid vs. CP_High



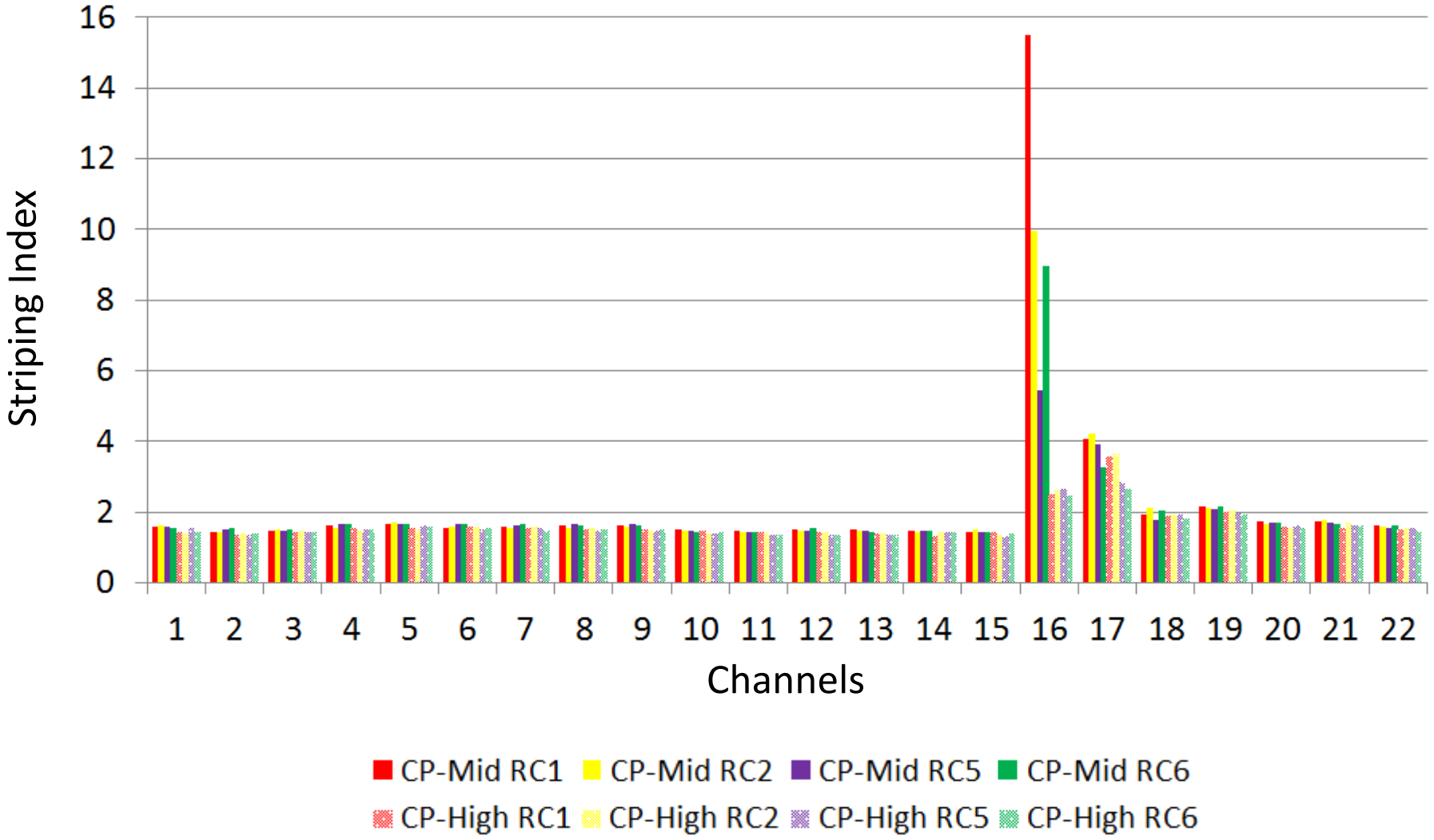
Striping Index at ST-280 CP_Mid vs. CP_High



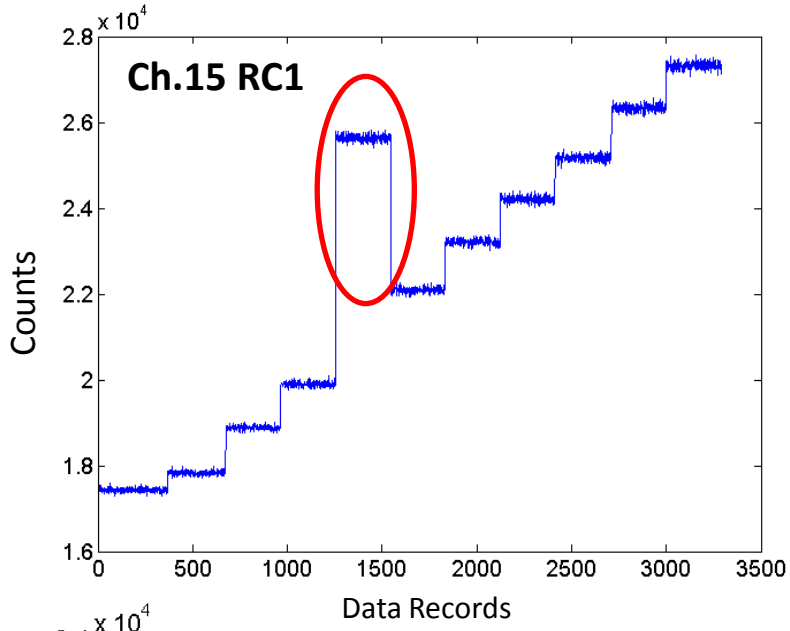
Striping Index at ST-305 CP_Mid vs. CP_High

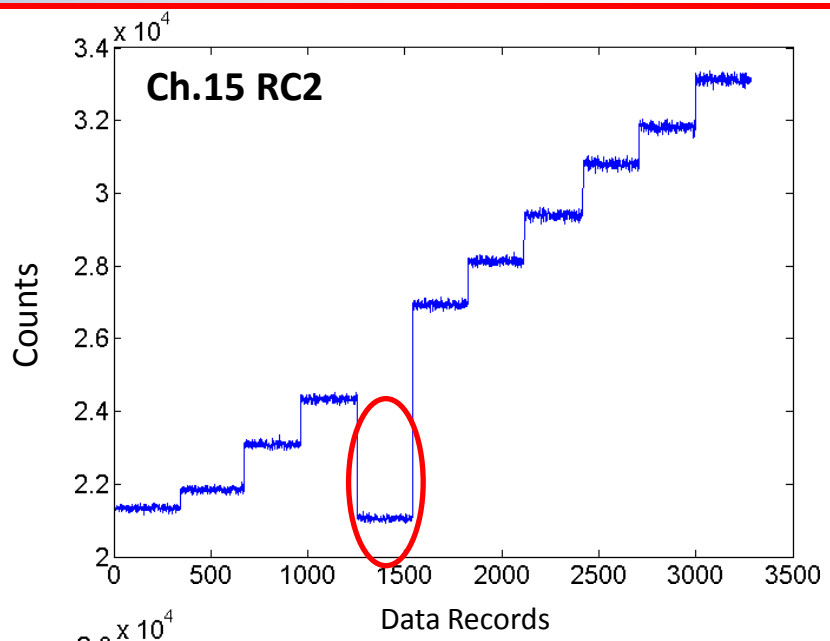


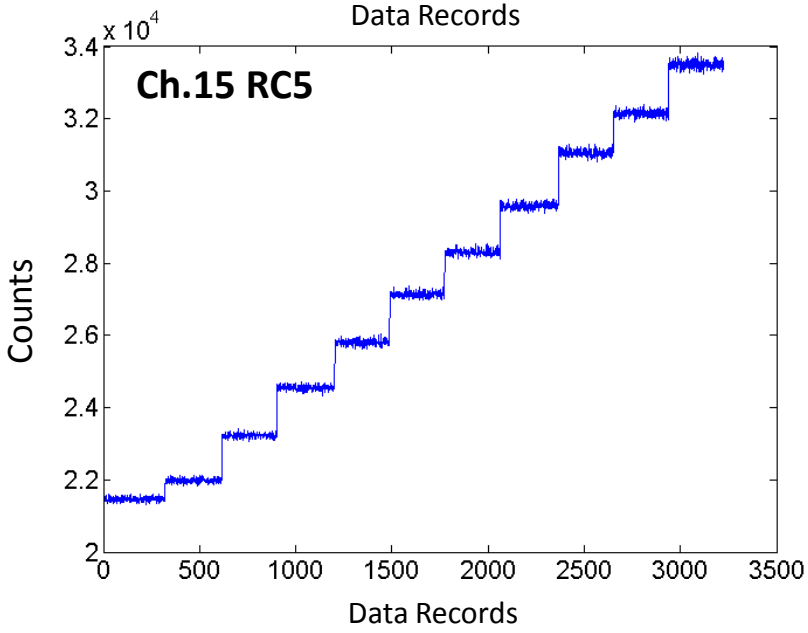
Striping Index at ST-330 CP_Mid vs. CP_High

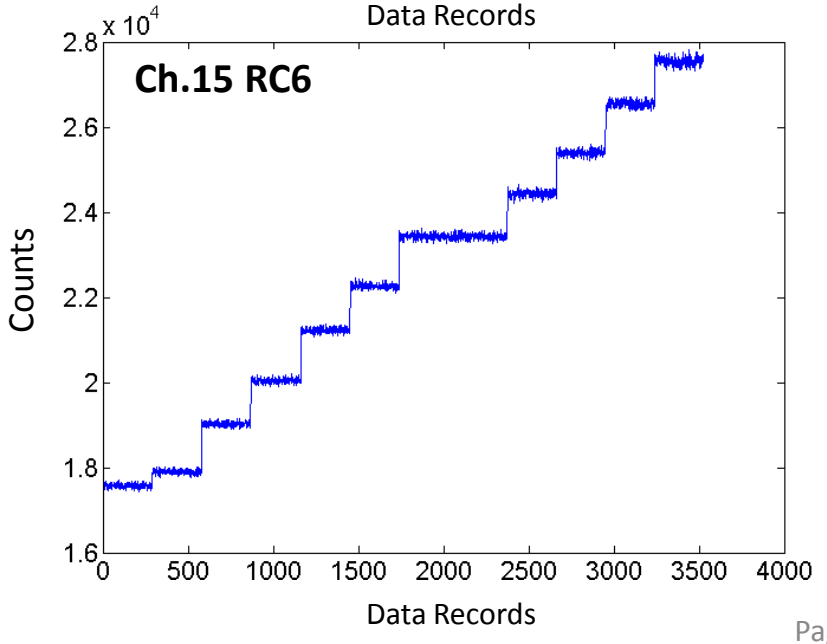


Ch.15 Counts Anomaly at CP_Mid ST-180



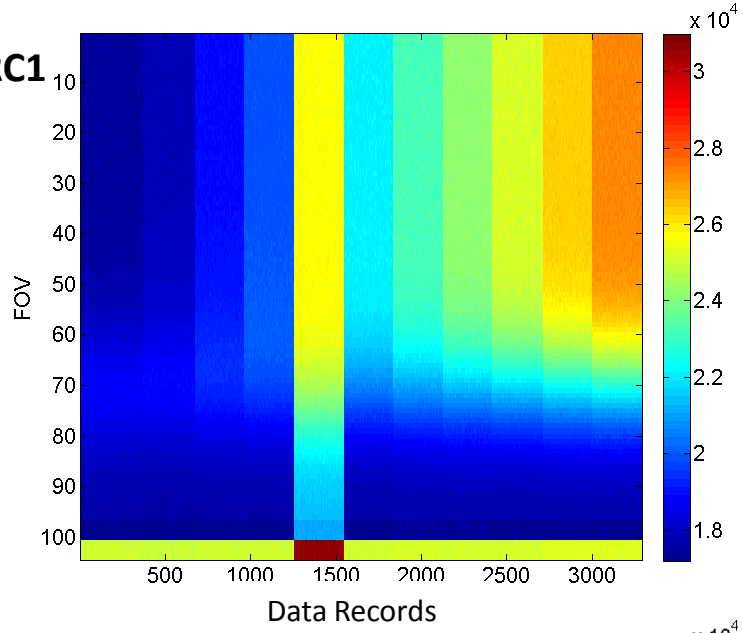




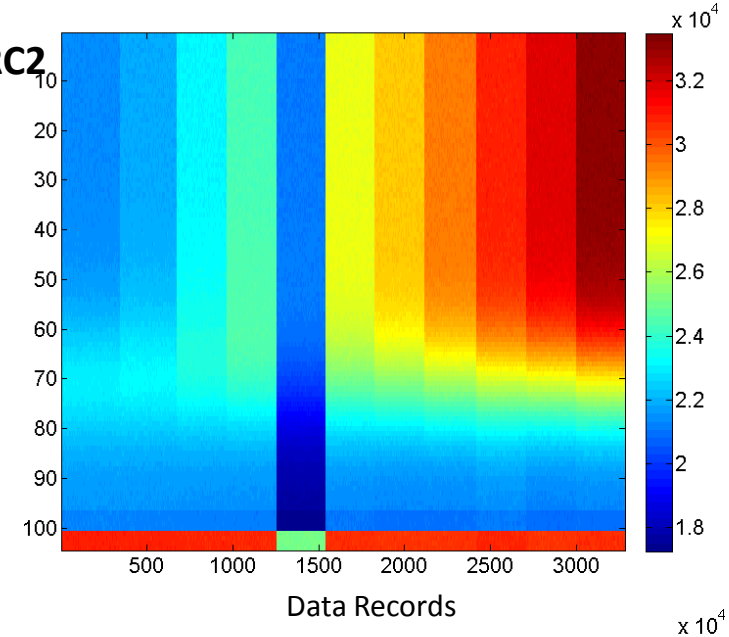


Ch.15 Counts Anomaly at CP_Mid ST-180

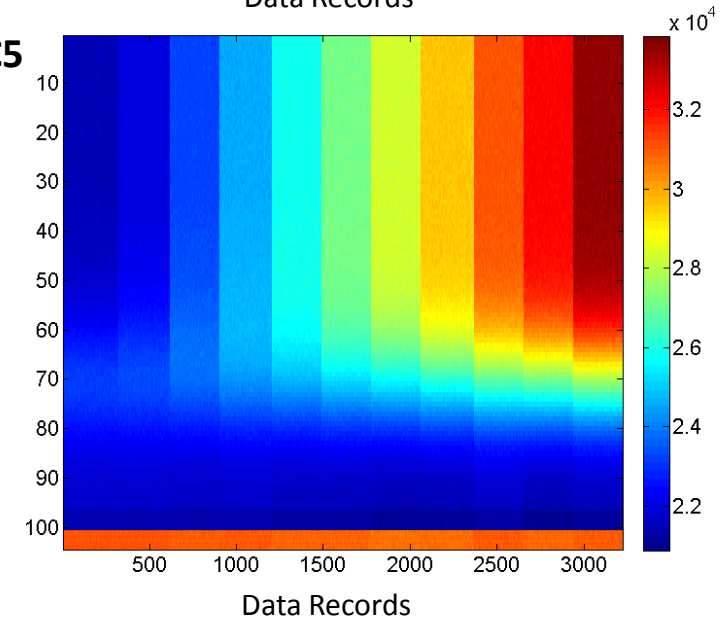
Ch.15 RC1



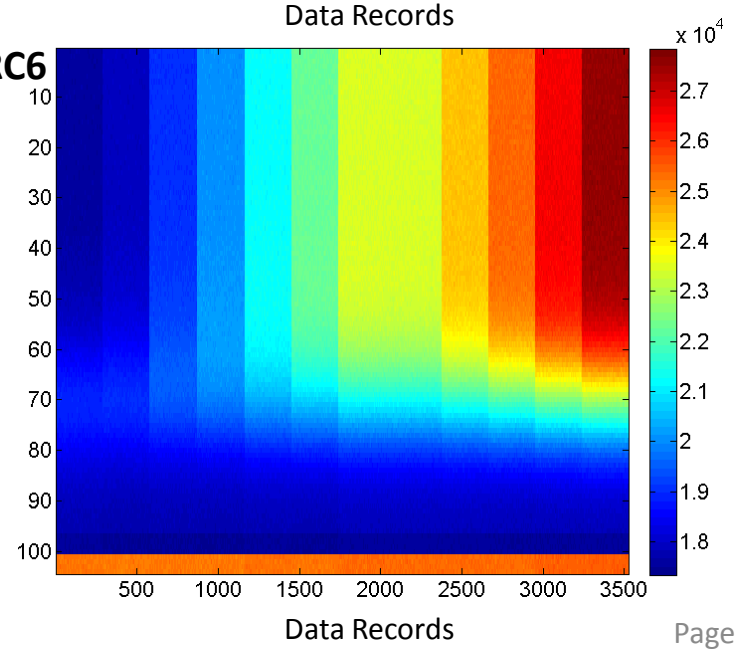
Ch.15 RC2



Ch.15 RC5



Ch.15 RC6



Summary

- J1 ATMS all channels' NEΔT, except channel 17, meet the mission requirements
- Channel 16 demonstrates large temperature dependent noise
- Radiometric accuracy at channel 4 to 6 present reversed pattern compared to S-NPP
- Radiometric accuracy residuals exist at ST-95 and large difference is found between S-NPP and J1
- Several V-band channels' peak nonlinearity are out of specifications
- SDR algorithm introduces additional striping affects