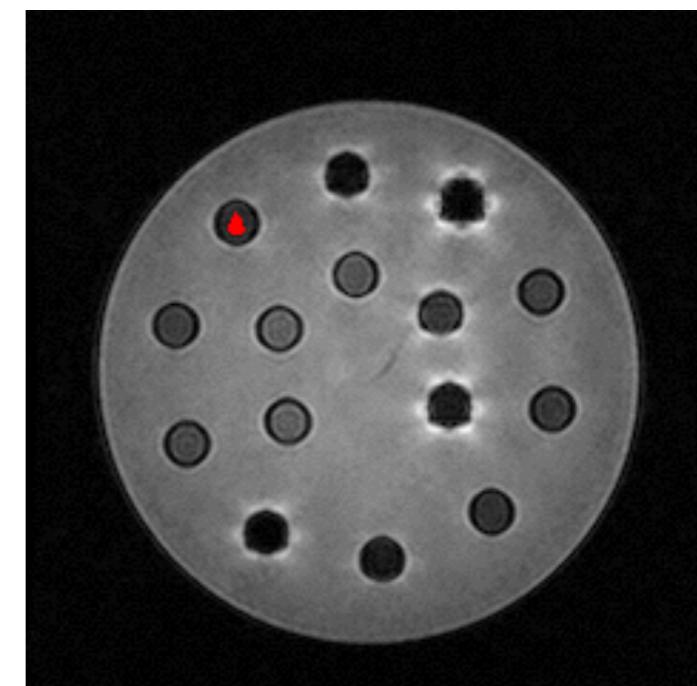
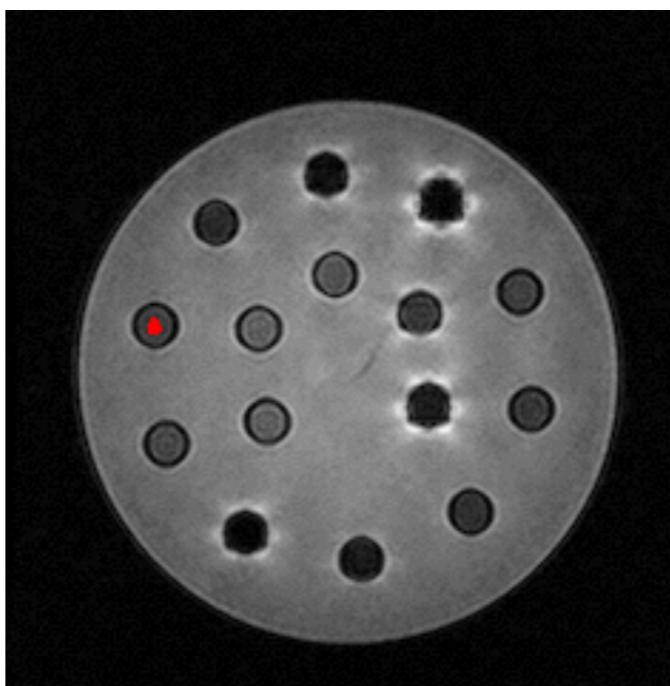
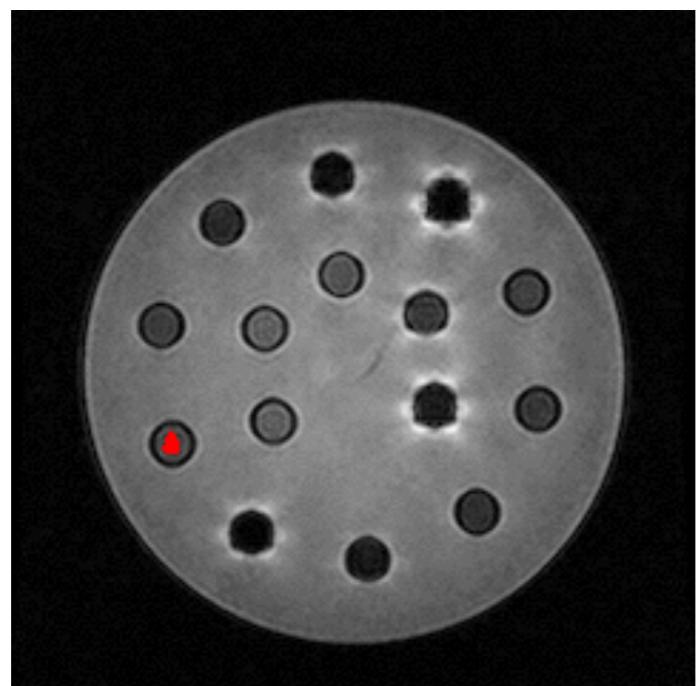
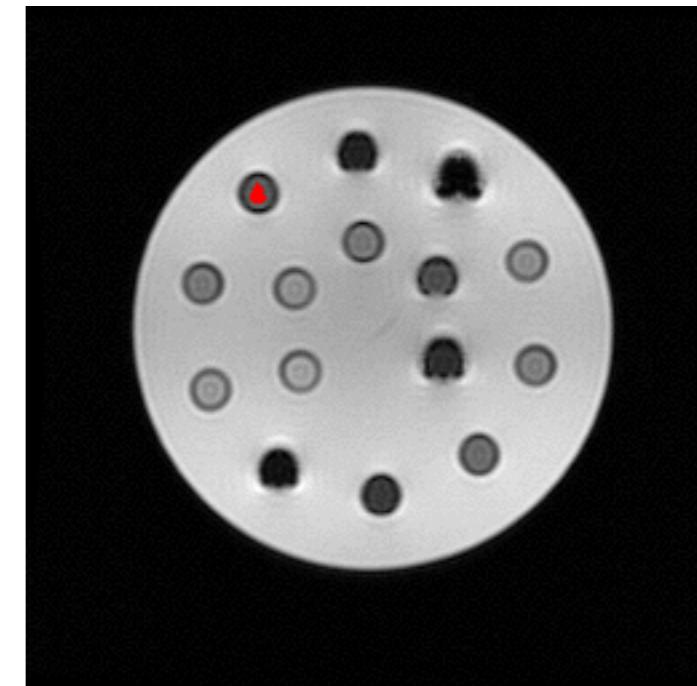
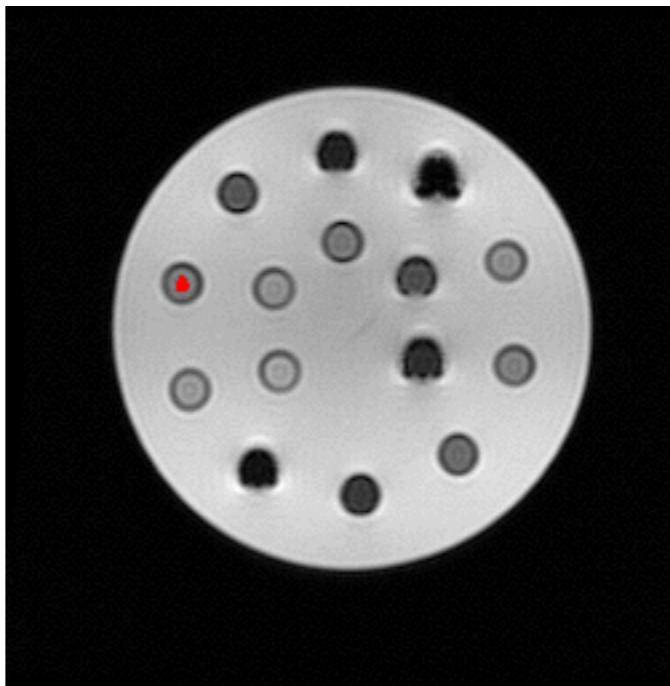
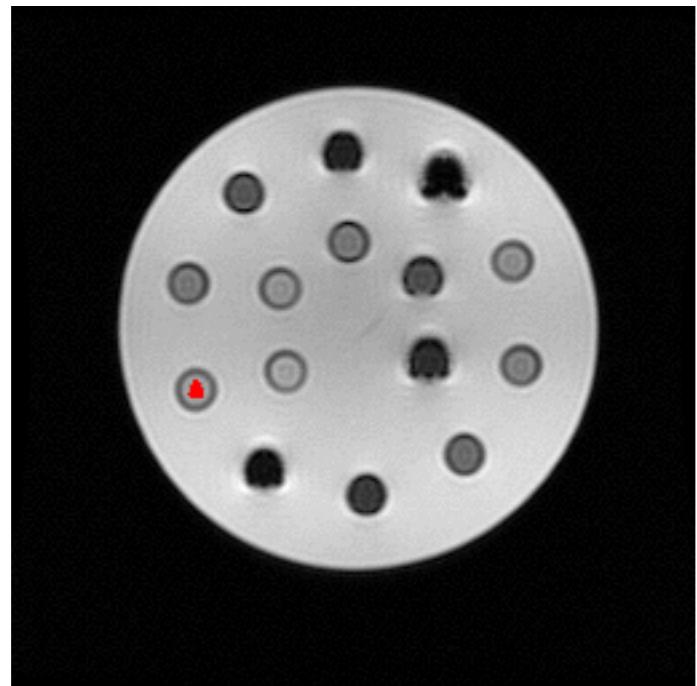


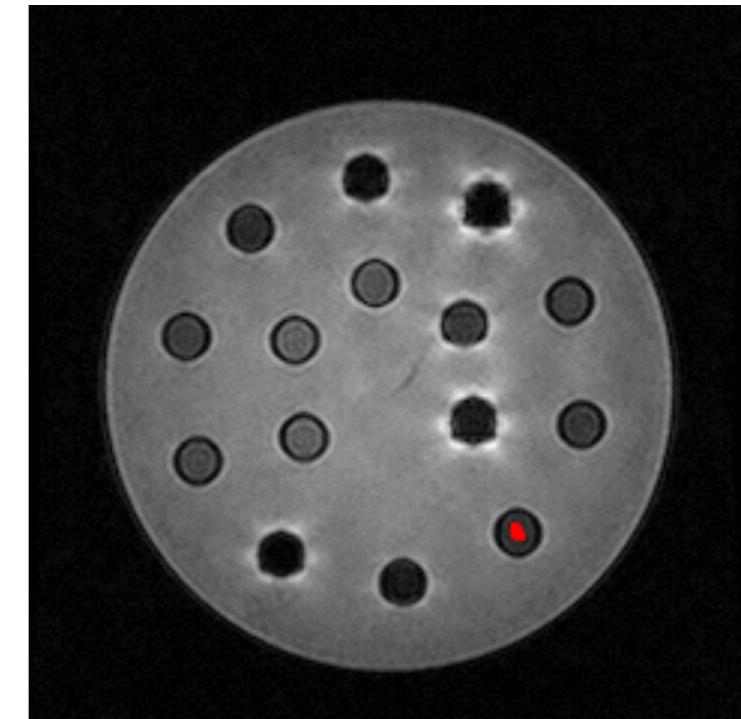
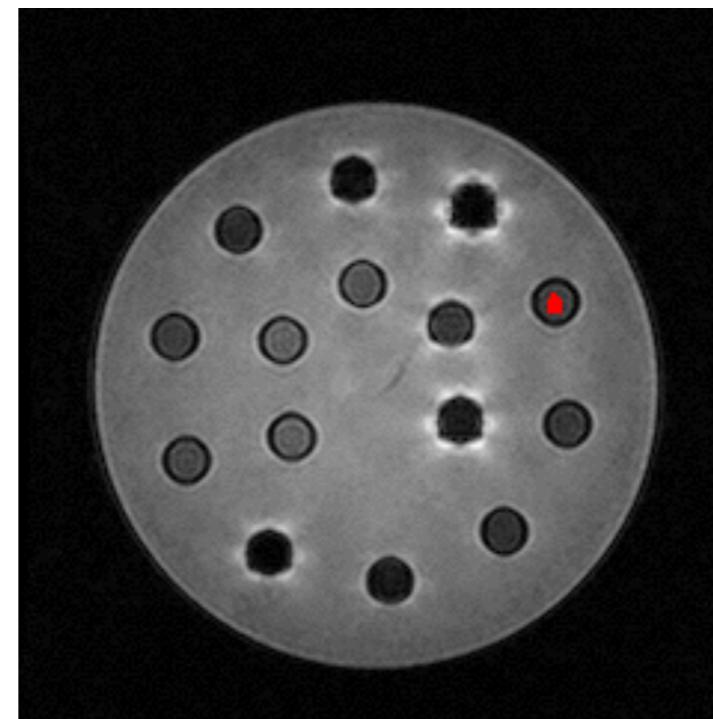
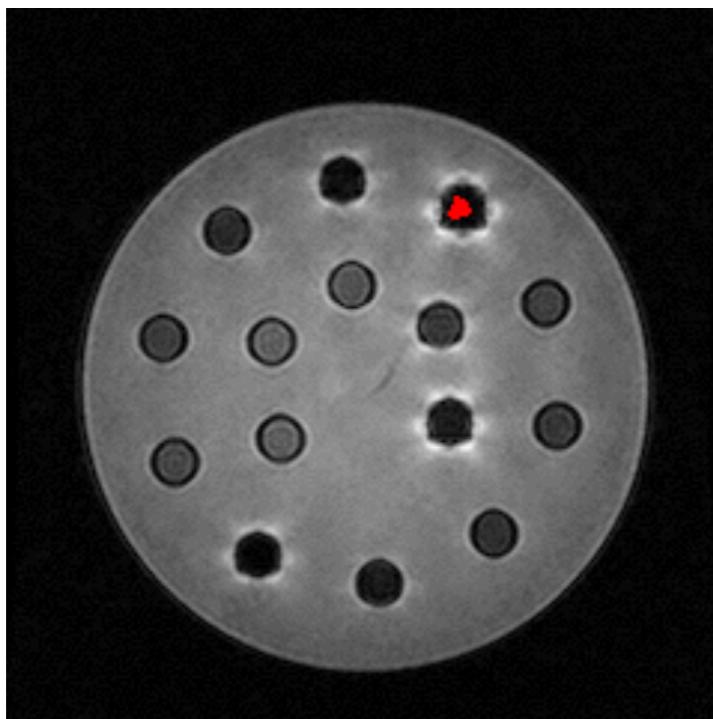
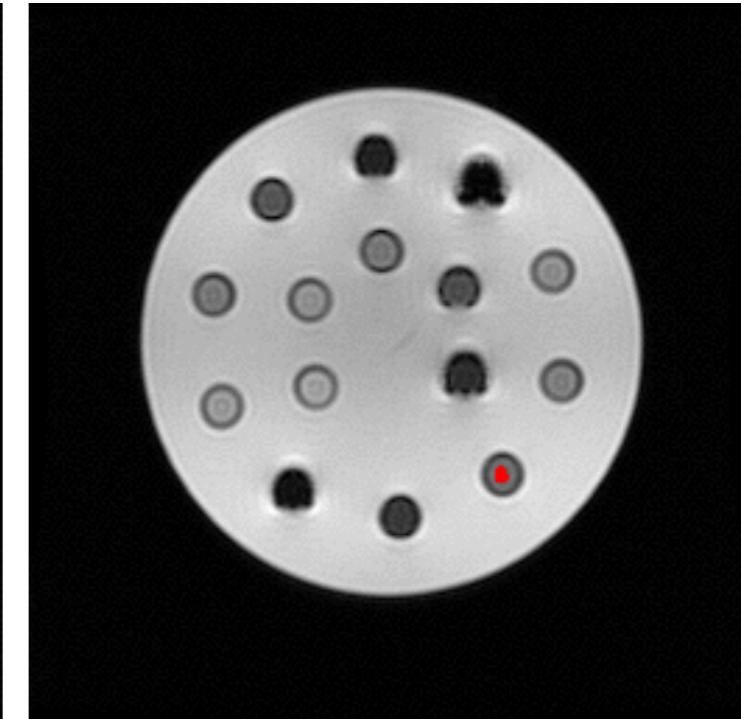
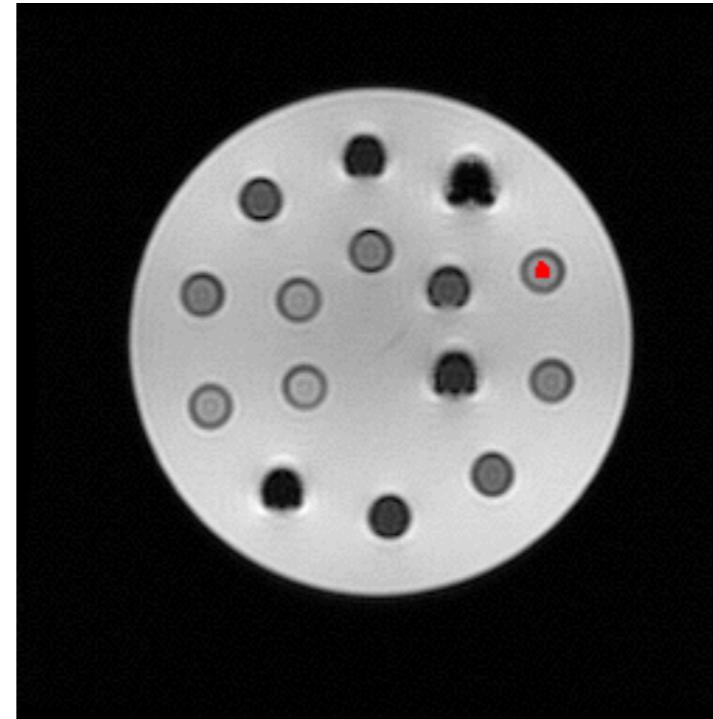
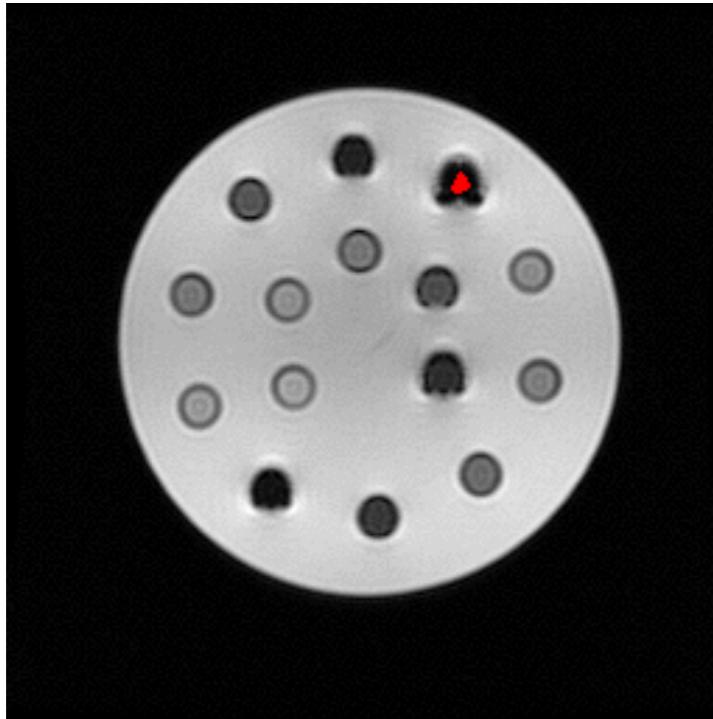
# Phantom

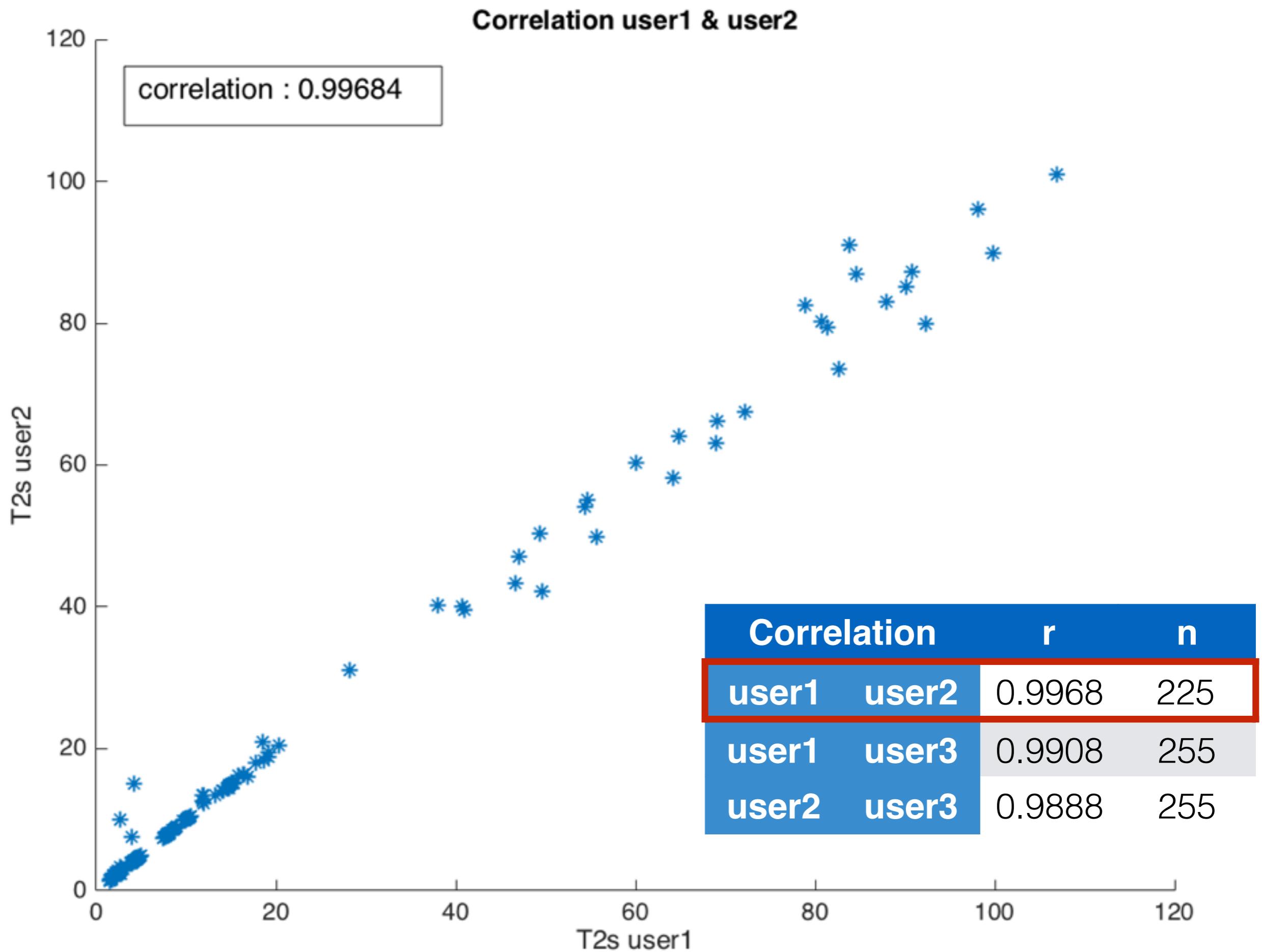
## transfer function

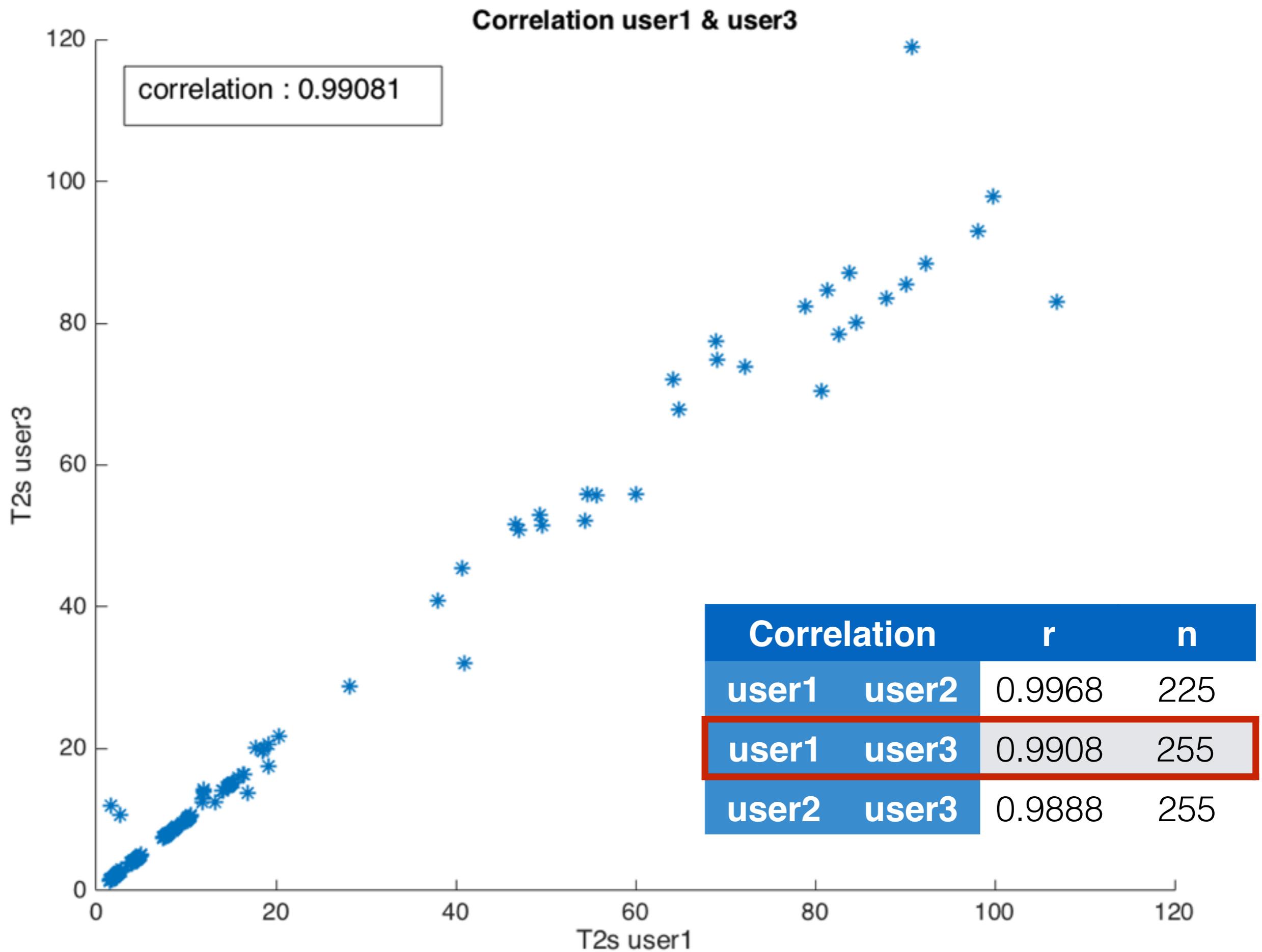
transfer roi from 1.5 to 3 Tesla

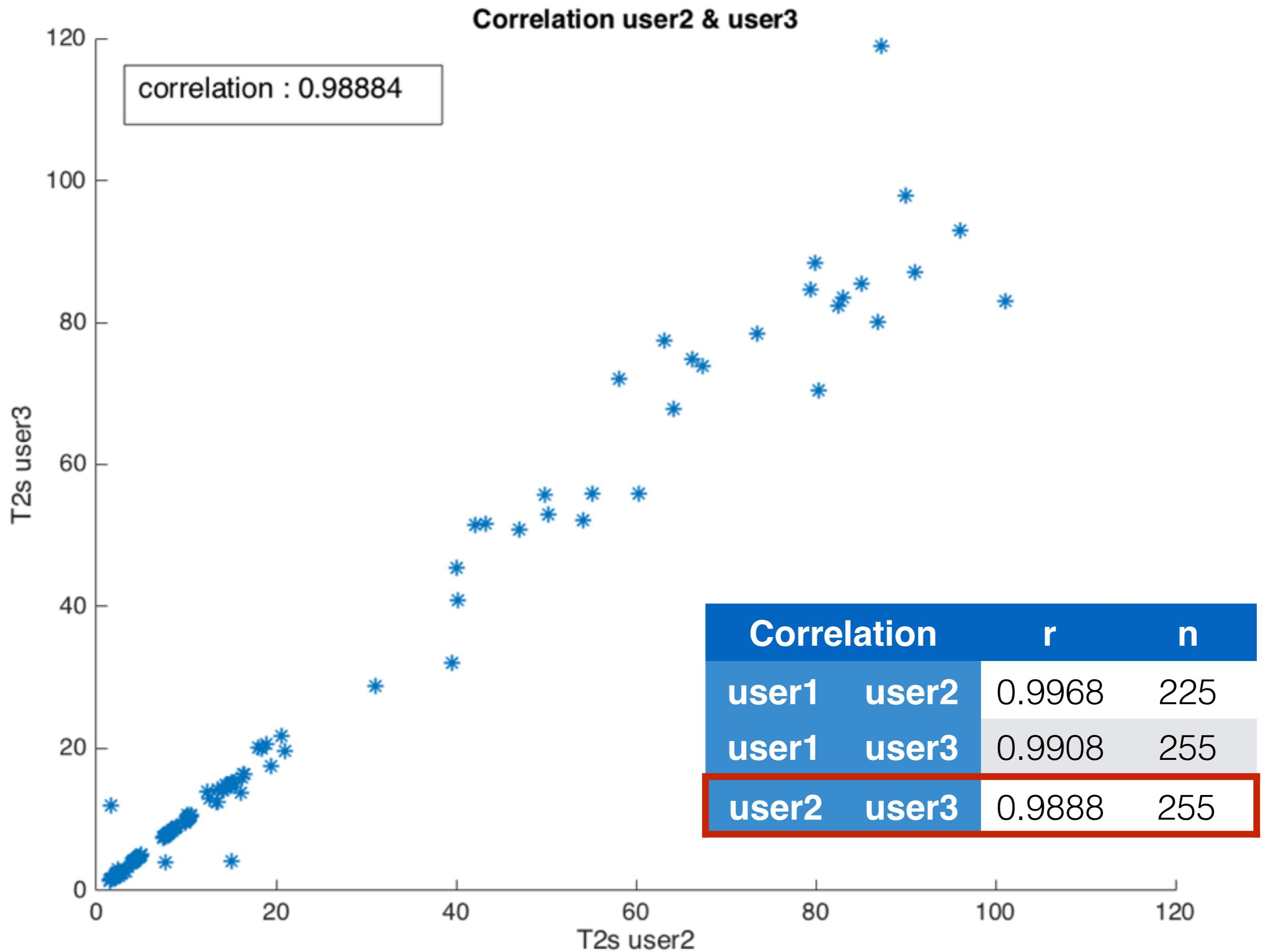


transfer roi from 1.5 to 3 Tesla

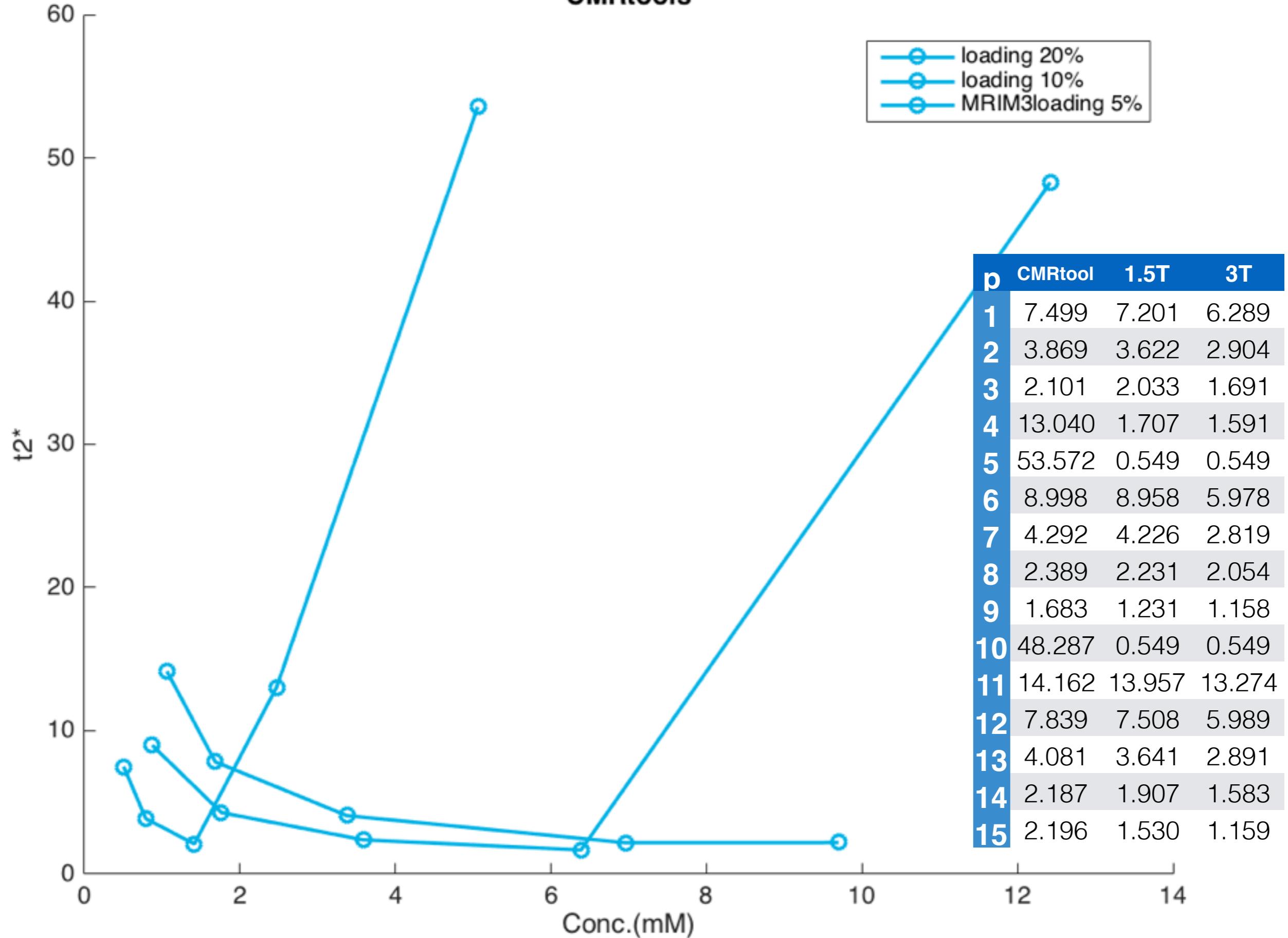




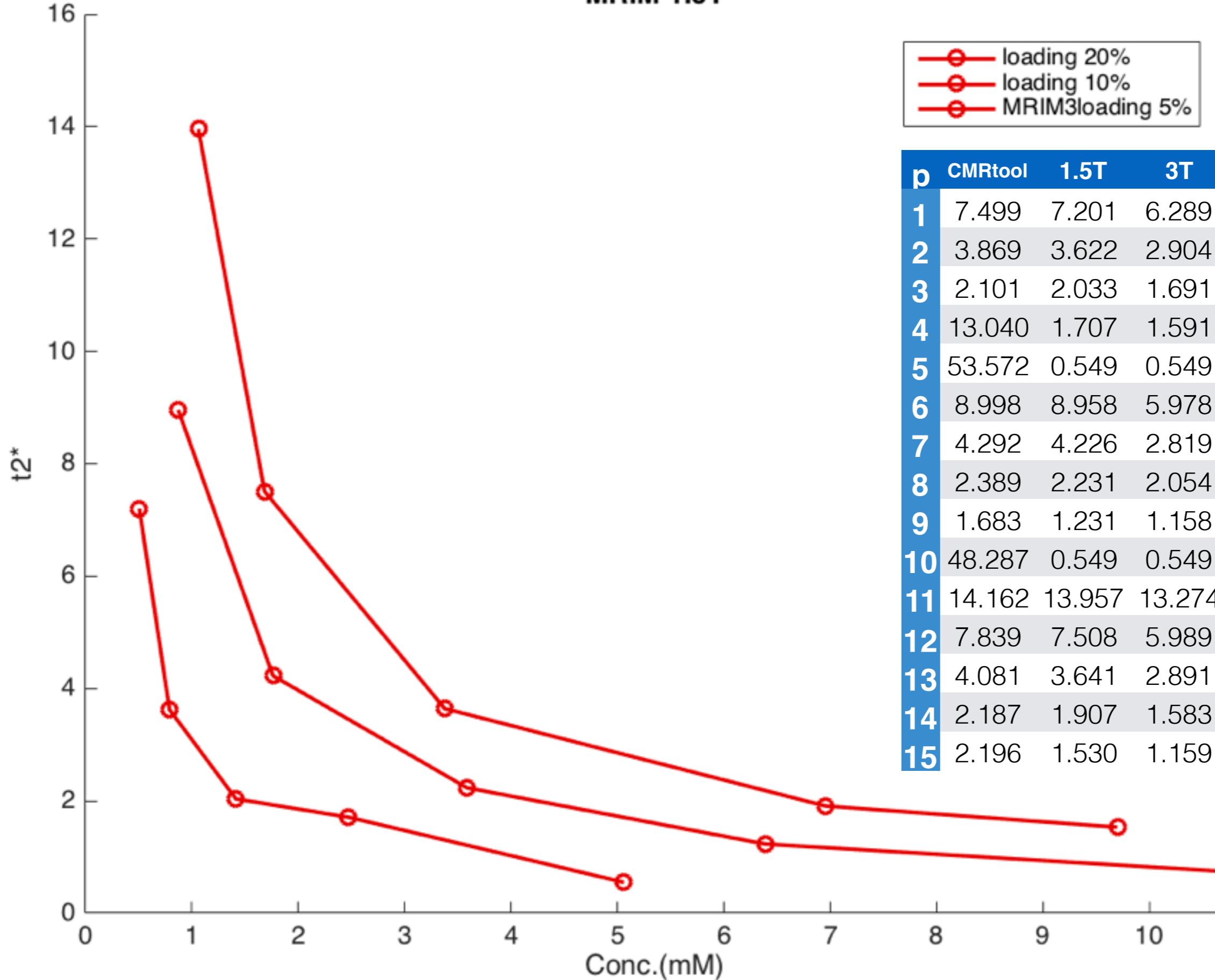




# CMRtools

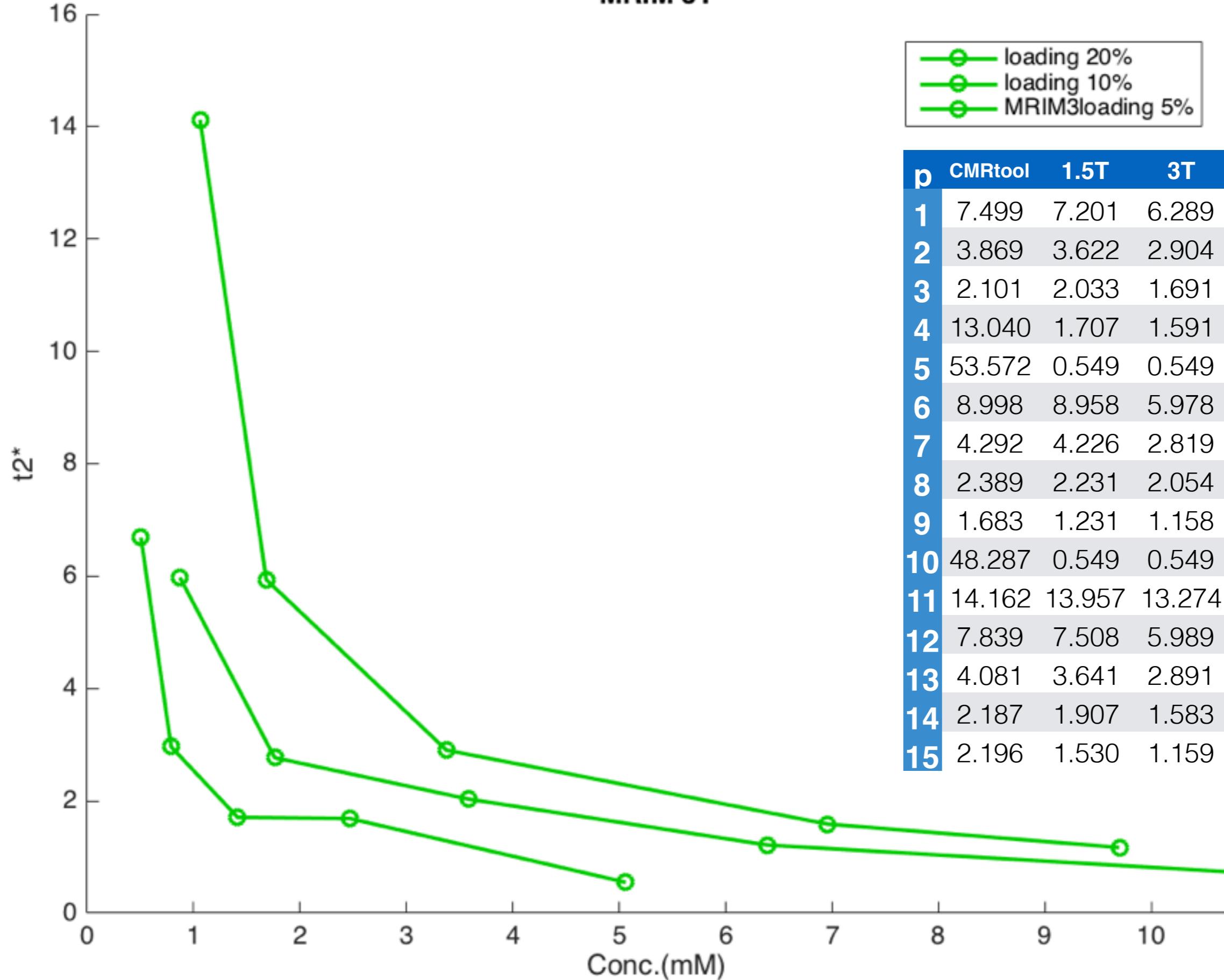


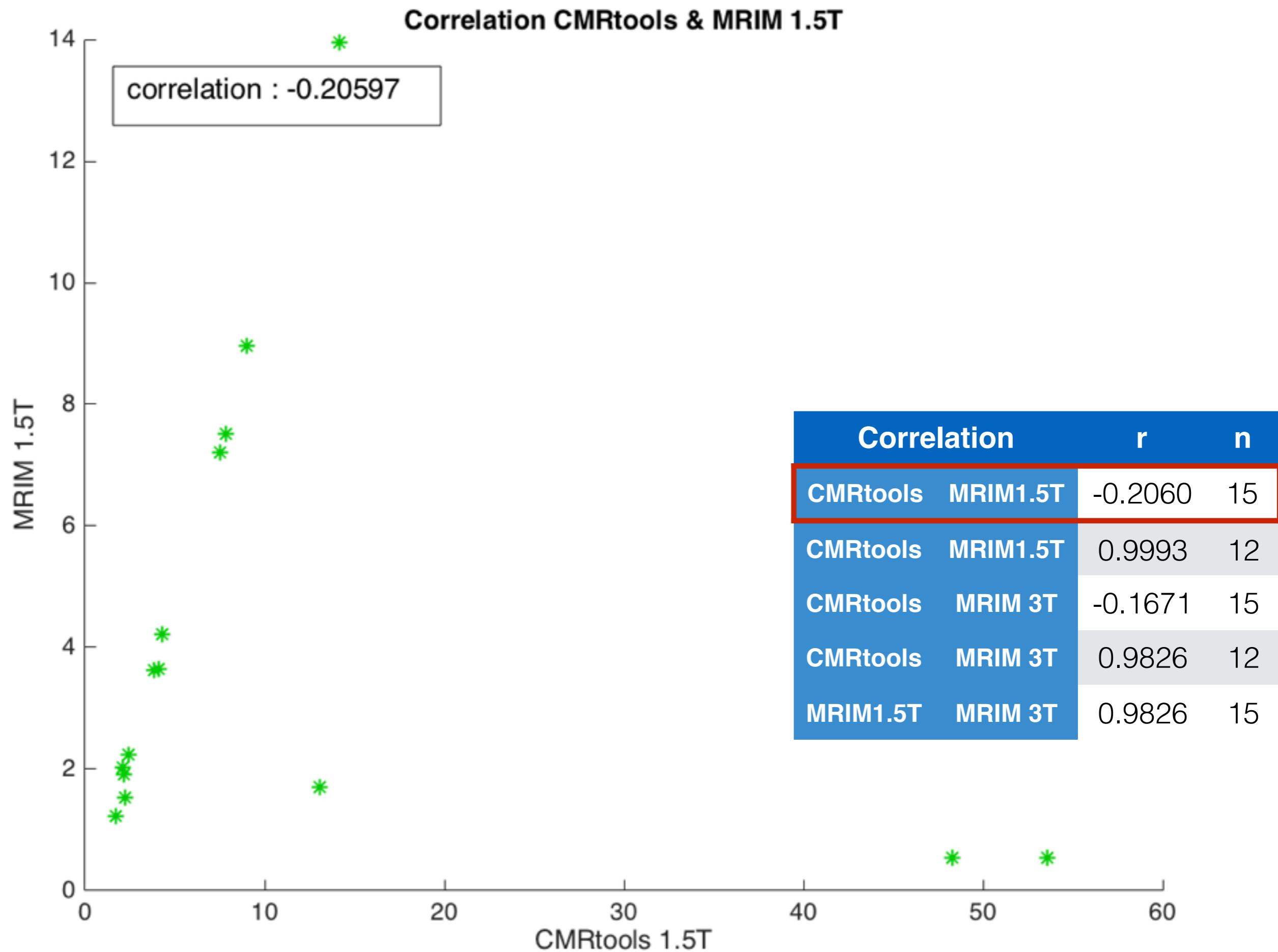
# MRIM 1.5T



p	CMRtool	1.5T	3T
1	7.499	7.201	6.289
2	3.869	3.622	2.904
3	2.101	2.033	1.691
4	13.040	1.707	1.591
5	53.572	0.549	0.549
6	8.998	8.958	5.978
7	4.292	4.226	2.819
8	2.389	2.231	2.054
9	1.683	1.231	1.158
10	48.287	0.549	0.549
11	14.162	13.957	13.274
12	7.839	7.508	5.989
13	4.081	3.641	2.891
14	2.187	1.907	1.583
15	2.196	1.530	1.159

# MRIM 3T

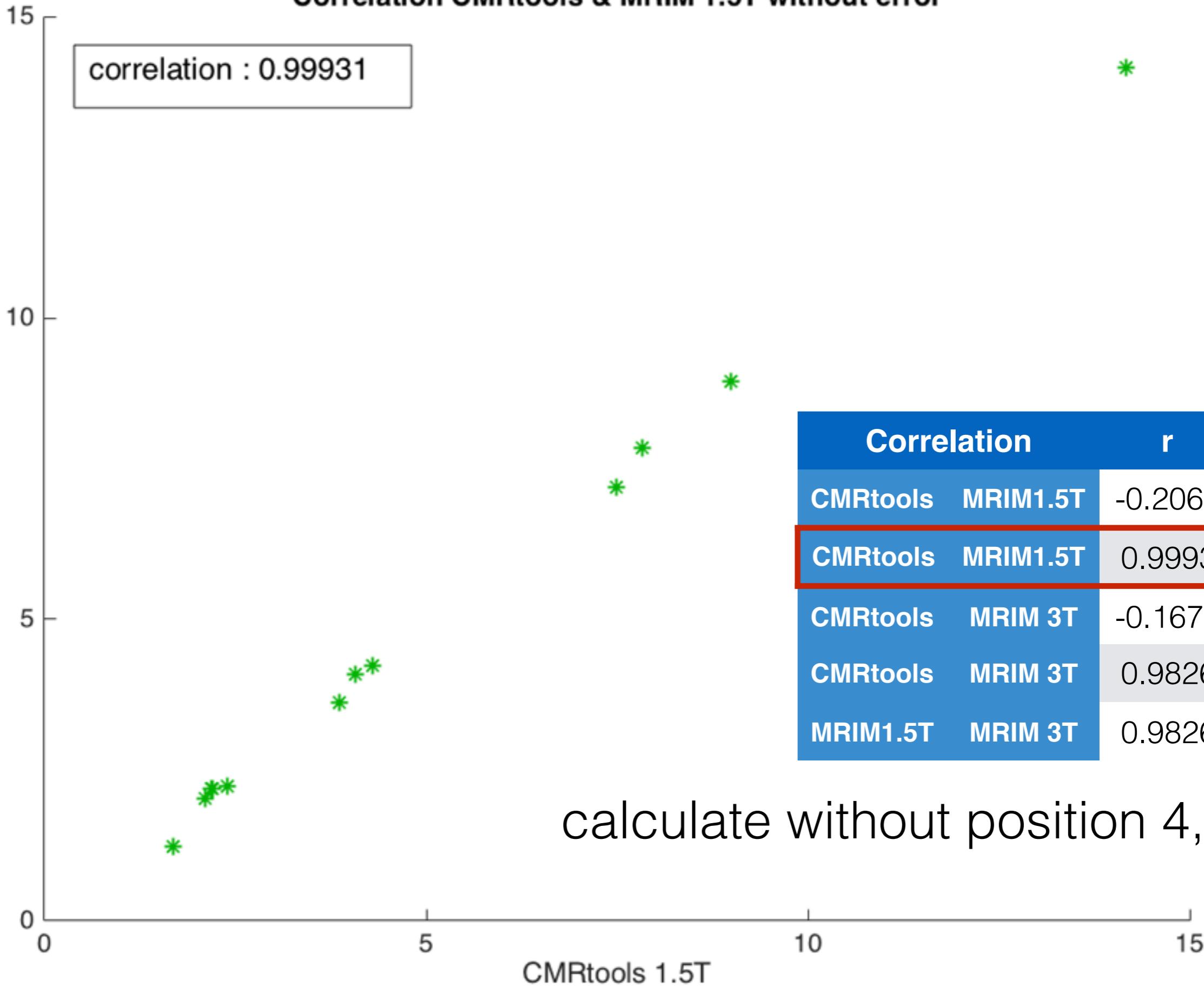




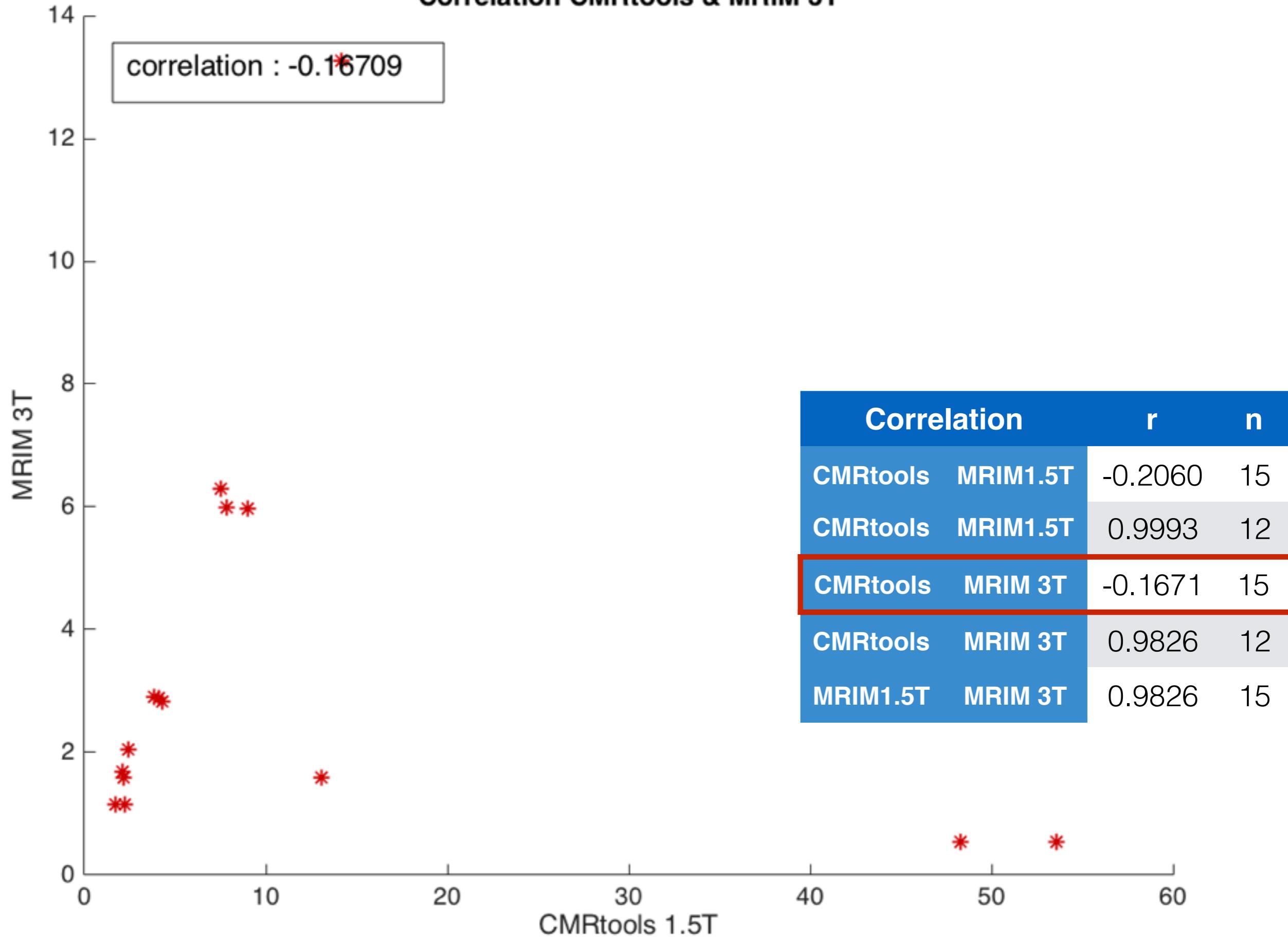
### Correlation CMRtools & MRIM 1.5T without error

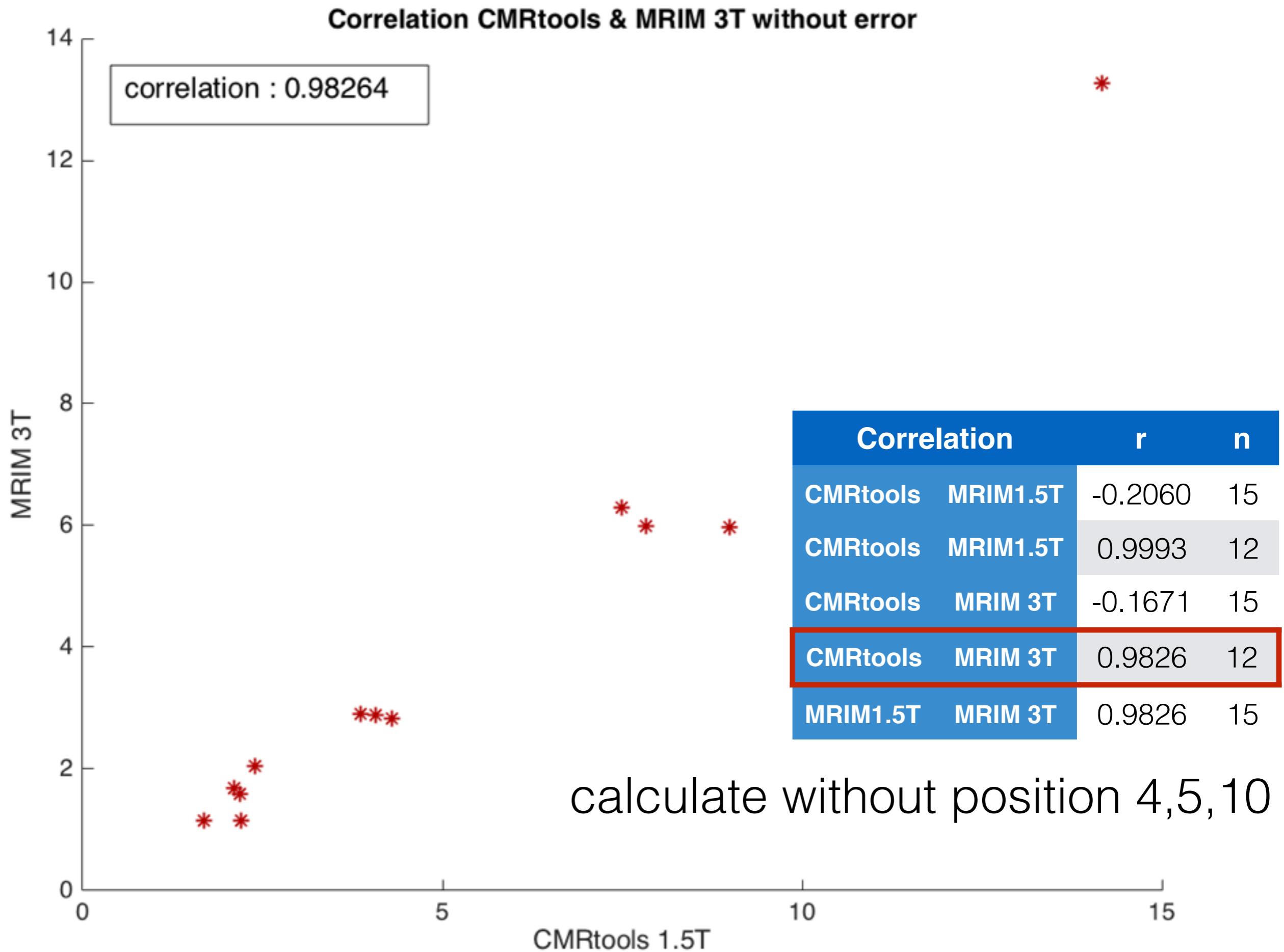
correlation : 0.99931

MRIM 1.5T

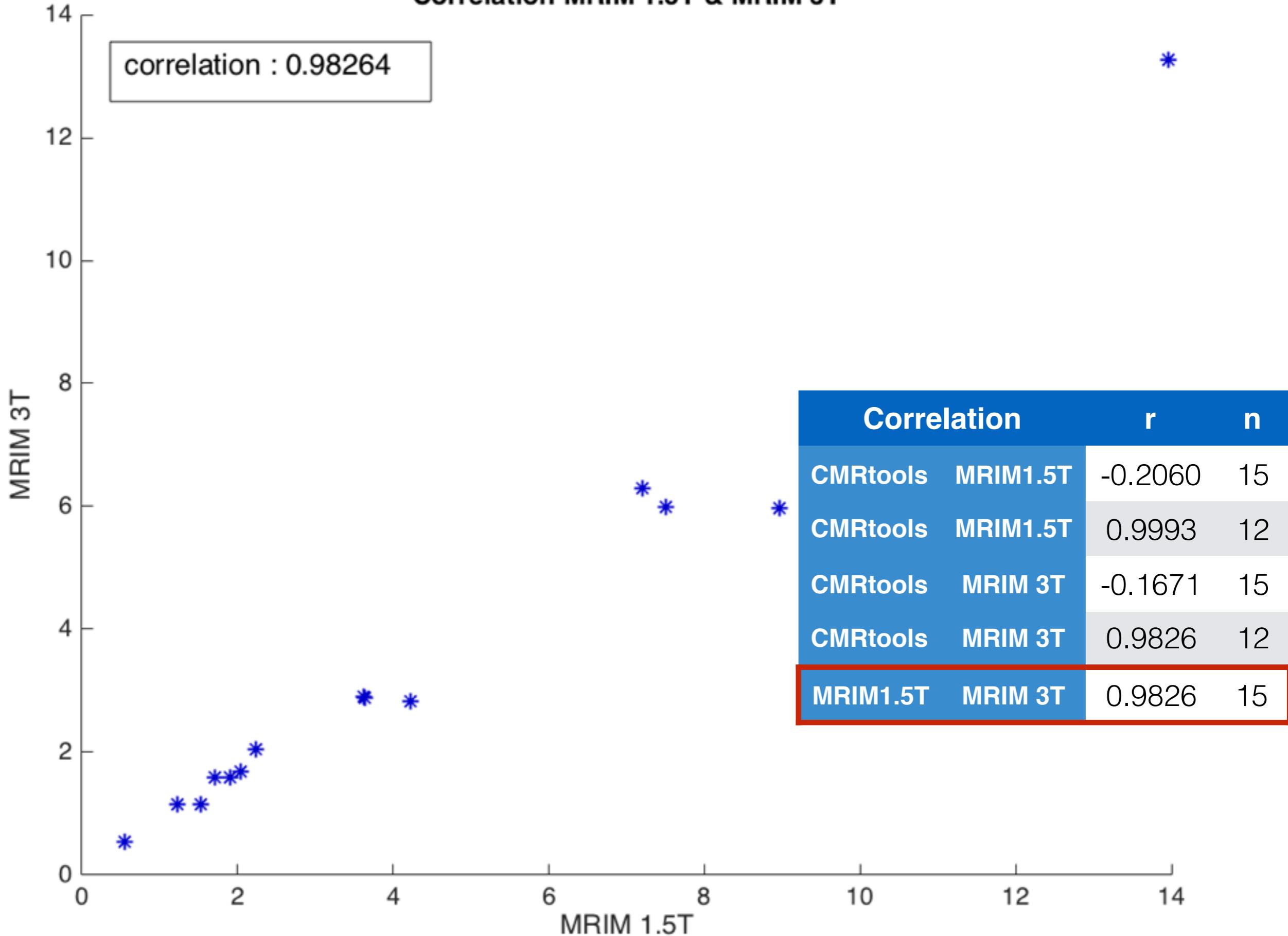


### Correlation CMRtools & MRIM 3T





### Correlation MRIM 1.5T & MRIM 3T









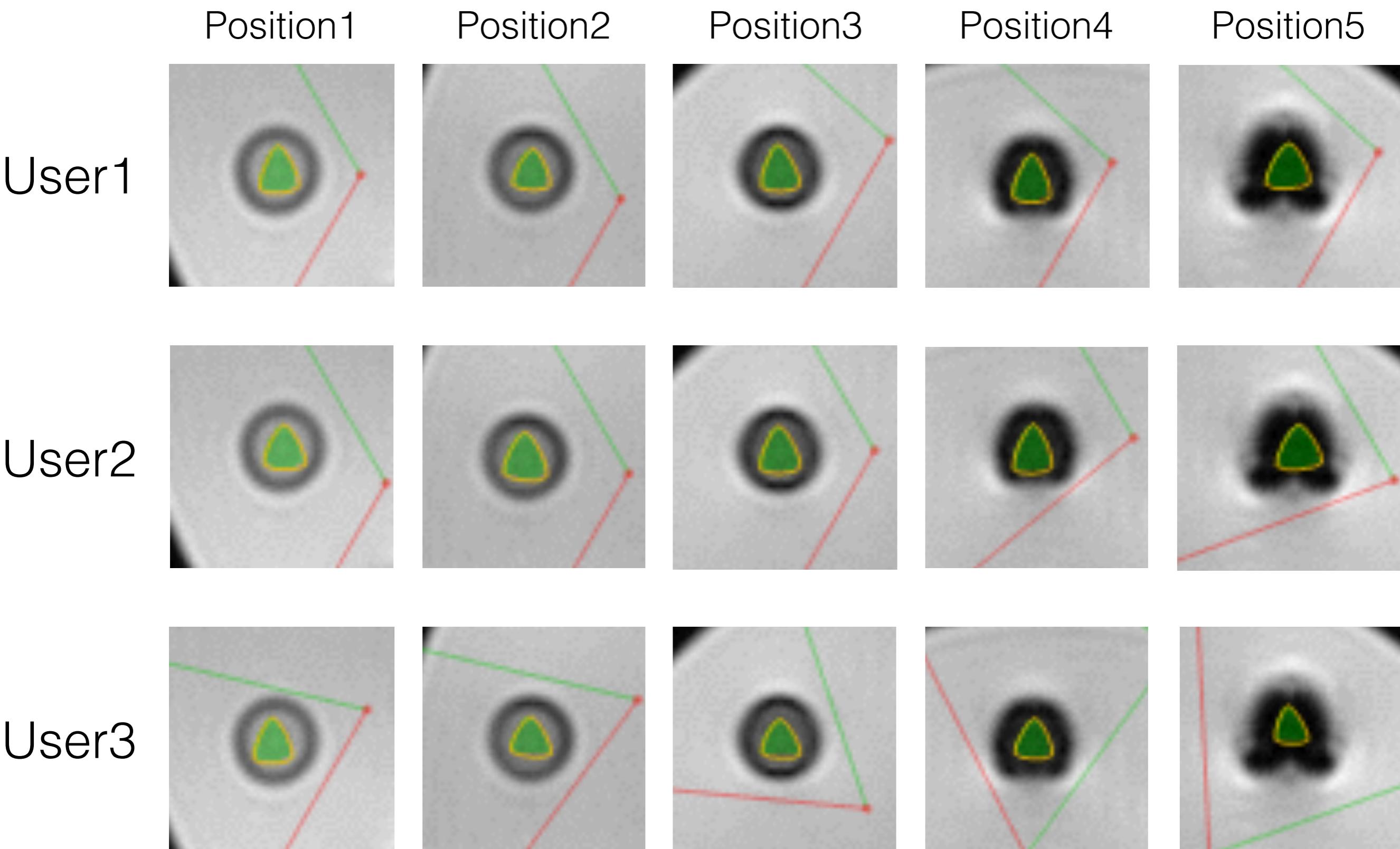








# ตัวอย่างการวัดด้วยโปรแกรม CMRtools ของทั้ง 3 คน



# T2\* CMRtools User1

position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
week1	7.47	3.86	2.11	13.25	54.44	8.99	4.29	2.39	1.69	47.03	14.16	7.83	4.08	2.18	2.20
week2	7.60	3.92	1.96	19.14	92.33	9.66	4.53	2.33	1.76	64.82	14.76	7.59	4.01	2.22	2.22
week3	7.99	3.99	2.07	18.61	80.75	10.20	4.76	2.39	1.70	54.69	15.15	7.95	4.17	2.28	2.80
week4	7.76	3.96	2.11	17.79	99.77	10.26	4.68	2.36	1.63	69.01	14.63	7.84	4.10	2.30	2.37
week5	7.71	3.96	2.23	18.55	90.83	9.99	4.62	2.39	1.67	64.20	14.95	7.92	4.15	2.45	2.43
week6	7.65	3.87	2.12	20.31	98.07	9.83	4.61	2.41	1.57	72.22	14.53	7.56	3.87	2.31	2.72
week7	8.03	4.10	2.20	15.74	83.79	10.18	4.77	2.45	1.64	69.06	15.18	8.23	4.26	2.42	2.10
week8	8.45	4.39	2.43	14.75	84.56	10.51	4.87	2.51	1.71	49.39	16.39	8.73	4.49	2.57	2.10
week9	8.53	4.44	2.44	11.79	87.89	10.27	4.99	2.55	1.61	55.73	16.39	8.84	4.60	2.61	1.97
week10	8.12	4.15	2.23	11.76	82.64	10.18	4.81	2.46	1.48	46.62	14.80	8.08	4.24	2.32	1.92
week11	7.98	4.05	2.18	2.67	78.90	10.08	4.63	2.42	1.45	40.70	14.82	8.00	4.20	2.34	1.95
week12	8.15	4.17	2.22	11.90	81.42	10.27	4.73	2.43	1.51	38.04	15.24	8.16	4.30	2.33	1.93
week13	7.87	4.14	2.24	11.95	60.04	10.41	4.78	2.63	1.56	28.21	15.07	8.07	4.26	2.37	2.08
week14	7.97	4.18	2.29	16.89	106.90	10.57	4.99	2.66	1.66	41.03	15.33	8.20	4.30	2.53	2.31
week15	7.42	3.86	2.16	19.12	90.14	10.17	4.66	2.57	1.48	49.62	14.01	7.41	3.85	2.30	2.60

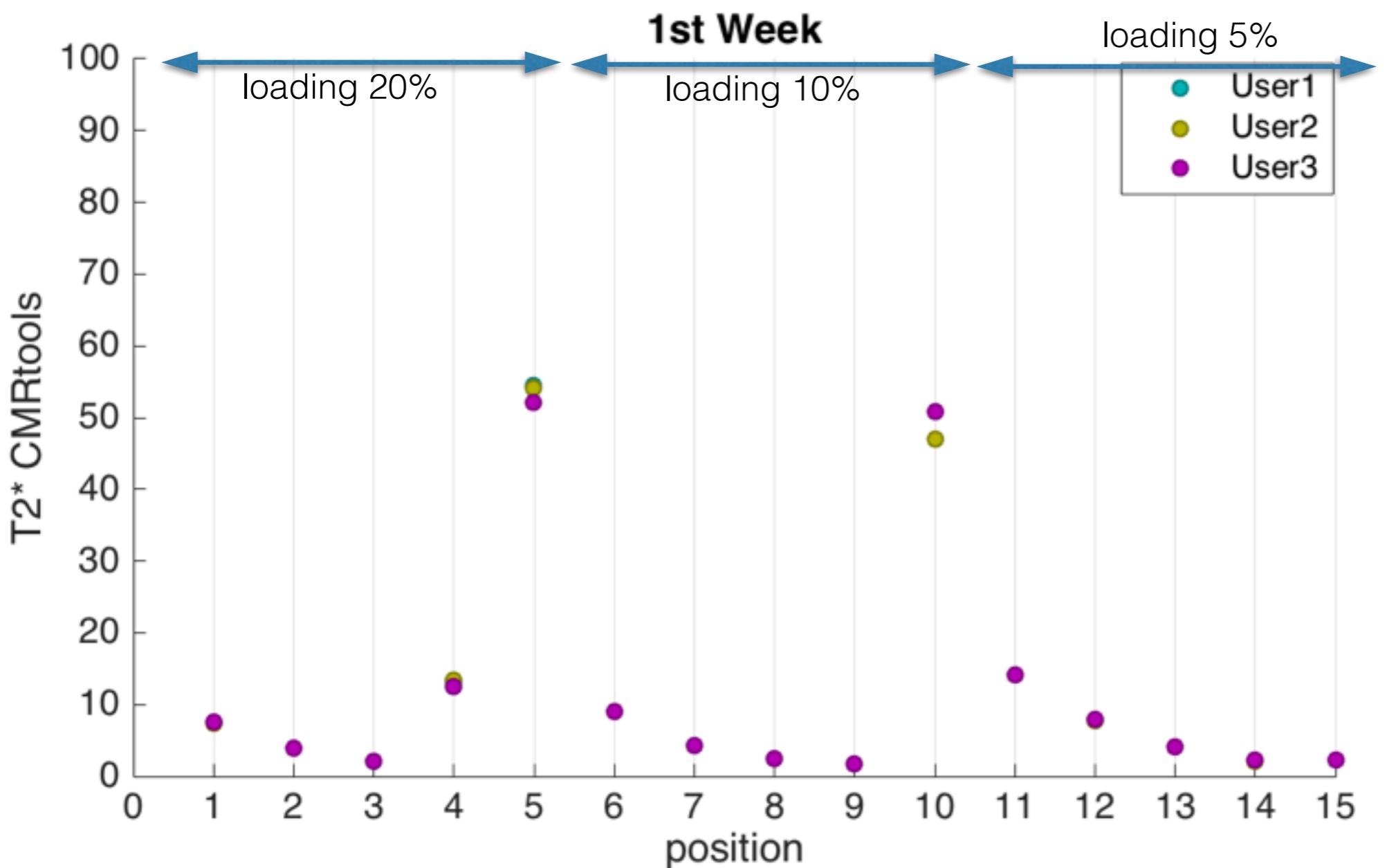
# T2\* CMRtools User2

position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
week1	7.47	3.88	2.11	13.39	54.14	9.00	4.29	2.40	1.68	47.03	14.15	7.83	4.09	2.18	2.19
week2	7.58	3.95	1.96	18.88	79.90	9.81	4.50	2.33	1.76	64.15	14.91	7.61	7.61	2.18	2.78
week3	8.02	4.01	2.06	18.39	18.39	10.23	4.78	2.41	1.63	55.17	15.08	15.08	15.08	2.28	2.37
week4	7.73	3.95	2.10	17.99	89.95	10.31	4.67	2.34	1.67	63.10	14.56	7.78	4.07	2.32	2.89
week5	7.62	7.62	2.19	21.03	87.26	9.95	4.56	2.37	1.62	58.12	14.86	7.94	4.19	2.48	2.77
week6	7.62	3.94	2.13	20.54	96.02	9.85	4.55	2.42	1.51	67.46	14.49	7.50	3.89	2.46	3.19
week7	7.97	4.10	2.19	16.17	91.10	10.21	4.69	2.41	1.70	66.28	15.13	8.15	4.28	2.53	2.54
week8	8.47	4.34	2.35	14.43	86.91	10.56	4.81	2.49	1.59	50.29	16.33	8.65	4.49	2.60	2.17
week9	8.50	4.43	2.40	13.42	83.01	10.32	4.93	2.55	1.57	49.85	16.44	8.88	4.61	2.67	2.05
week10	8.05	4.12	2.21	12.63	73.54	10.16	4.76	2.44	1.47	43.27	14.75	8.04	4.27	2.40	2.05
week11	7.99	4.07	2.16	10.07	82.51	10.15	4.66	2.44	1.45	40.07	14.82	8.03	4.25	2.32	2.19
week12	8.12	4.17	2.17	13.54	79.36	10.29	4.65	2.41	1.45	40.25	15.16	8.17	4.32	2.39	2.13
week13	7.85	4.14	2.25	12.36	60.31	10.37	4.76	2.62	1.57	31.02	15.05	8.08	4.24	2.32	2.19
week14	7.97	4.16	2.28	16.03	101.04	10.57	4.99	2.64	1.62	39.54	15.33	8.21	4.29	2.55	2.32
week15	7.39	3.87	2.17	19.44	85.09	10.14	4.72	2.57	1.51	42.12	14.05	7.41	3.82	2.37	3.33

# T2\* CMRtools User3

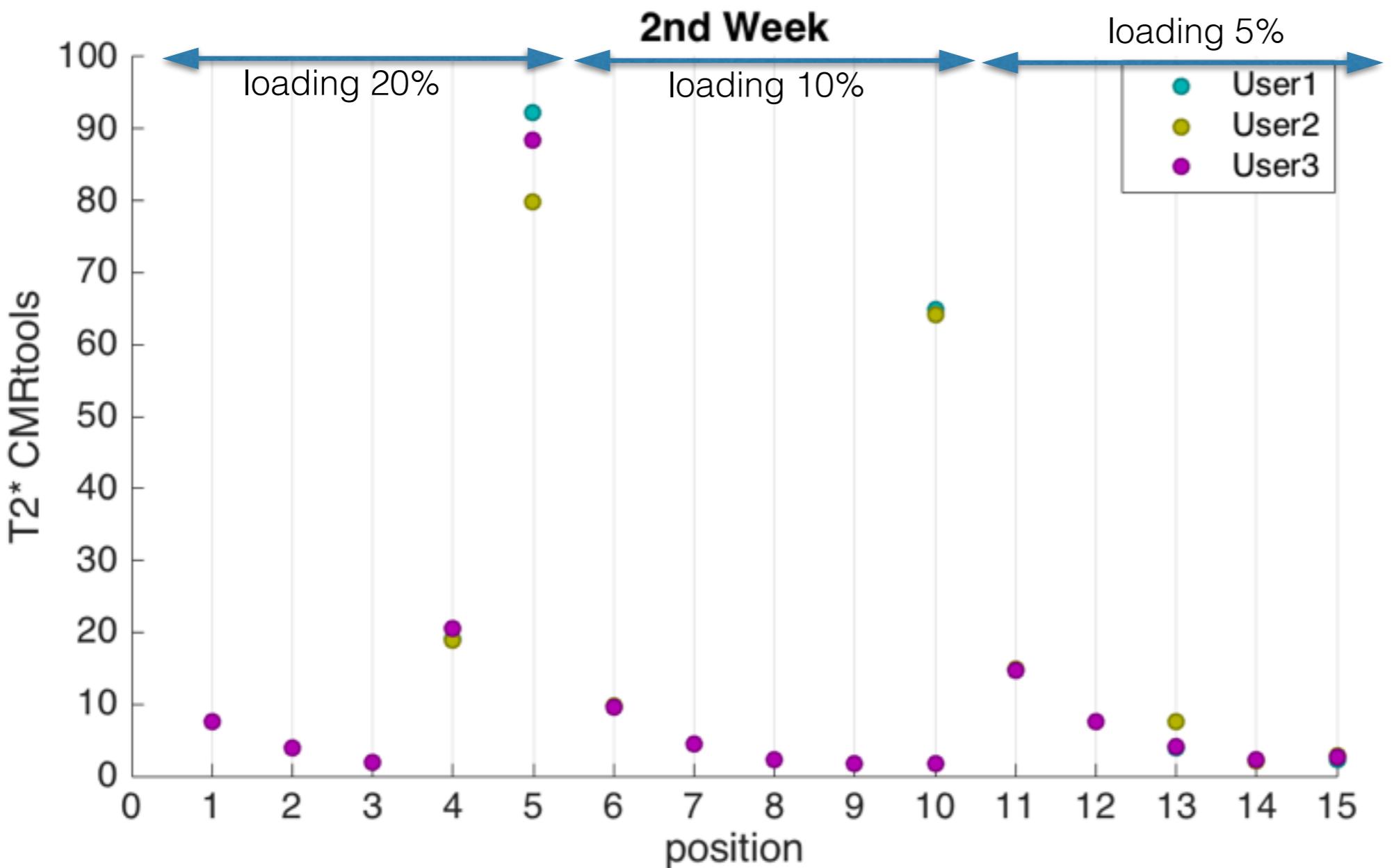
position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
week1	7.55	3.87	2.09	12.48	52.14	9.00	4.29	2.38	1.67	50.80	14.17	7.85	4.06	2.20	2.20
week2	7.58	3.95	1.95	20.56	88.36	9.62	4.52	2.31	1.76	1.76	14.78	7.65	4.05	2.27	2.72
week3	8.04	4.00	2.07	19.96	70.49	10.21	4.77	2.40	1.61	55.99	15.23	8.00	4.21	2.29	3.08
week4	7.81	3.97	2.16	20.23	97.95	10.26	4.67	2.36	1.70	77.48	14.67	7.87	4.16	2.33	2.58
week5	7.72	3.94	2.24	19.66	118.88	9.93	4.59	2.38	11.97	72.10	14.97	7.97	4.16	2.48	2.30
week6	7.66	3.93	2.15	21.79	93.00	9.77	4.56	2.41	1.57	73.80	14.60	7.60	3.89	2.38	2.61
week7	8.04	4.14	2.20	15.91	87.09	10.15	4.76	2.43	1.74	74.78	15.31	8.24	4.29	2.49	2.10
week8	8.46	4.38	2.45	14.87	80.09	10.51	4.85	2.49	1.69	52.99	16.42	8.76	4.52	2.63	2.10
week9	8.55	4.46	2.46	12.41	83.58	10.29	5.03	2.56	1.59	55.75	16.42	8.93	4.61	2.64	1.80
week10	8.07	4.14	2.23	12.99	78.41	10.14	4.81	2.44	1.49	51.64	14.87	8.07	4.23	2.40	1.90
week11	8.01	4.06	2.19	10.69	82.37	10.05	4.63	2.41	1.43	45.44	14.86	8.02	4.26	2.42	1.81
week12	8.15	4.17	2.16	14.27	84.62	10.25	4.70	2.41	1.43	40.96	15.29	8.20	4.33	2.43	1.91
week13	7.86	4.15	2.27	13.94	55.89	10.34	4.74	2.61	1.55	28.80	15.14	8.07	4.26	2.49	2.10
week14	8.05	4.20	2.23	13.75	83.00	10.74	5.07	2.66	1.61	32.09	15.20	8.23	4.29	2.50	2.12
week15	7.40	3.89	2.16	17.49	85.42	10.07	4.67	2.57	1.53	51.52	14.12	7.48	3.90	2.29	2.60

# T2<sup>\*</sup> Value



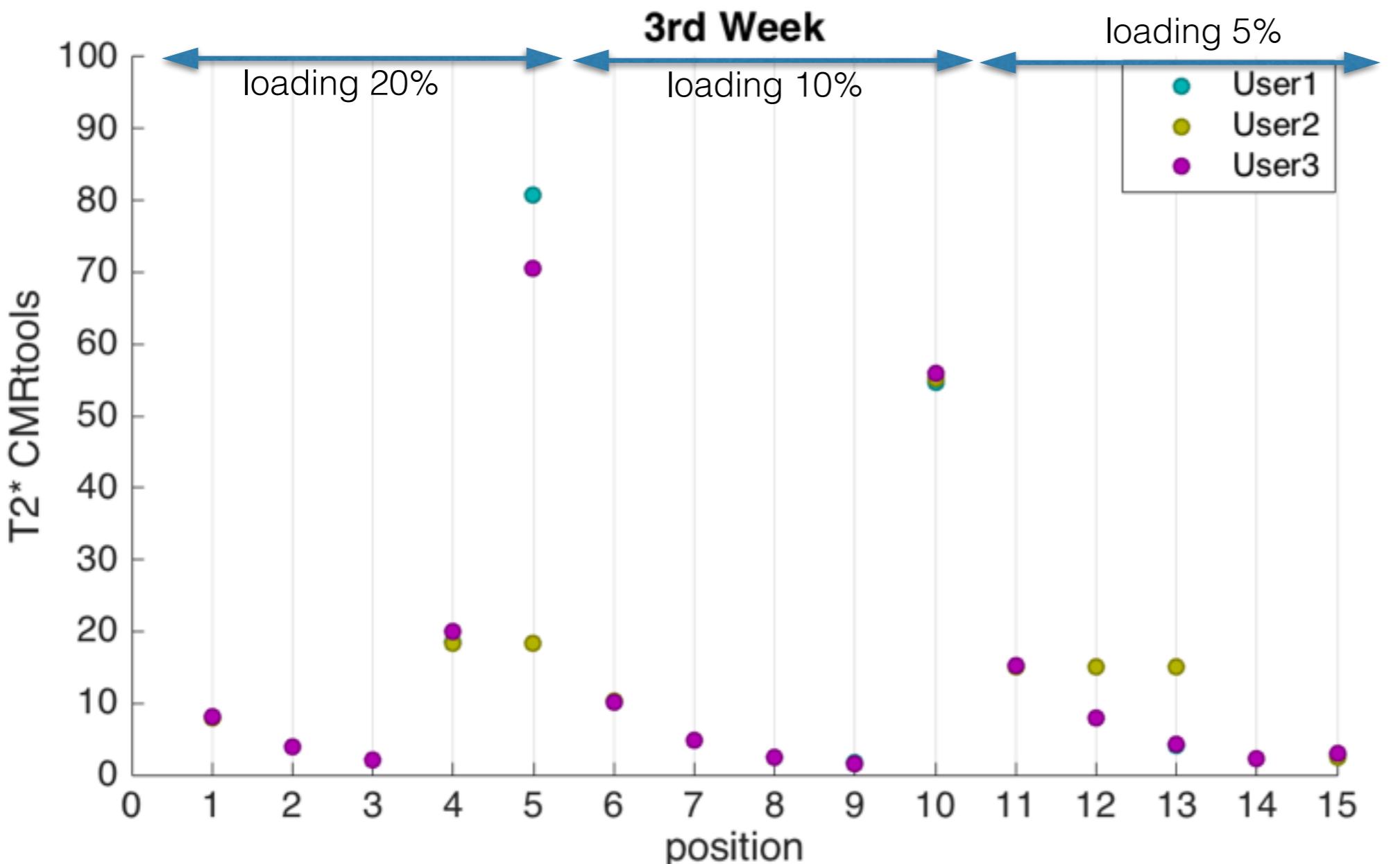
position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
mean	7.50	3.87	2.10	13.04	53.57	9.00	4.29	2.39	1.68	48.29	14.16	7.84	4.08	2.19	2.20
SD	0.47	0.08	0.11	4.94	12.53	0.10	0.03	0.10	0.11	21.75	0.06	0.13	0.15	0.14	0.05

# T2\* Value



position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
mean	7.59	3.94	1.96	19.53	86.87	9.70	4.52	2.32	1.76	43.57	14.81	7.62	5.22	2.22	2.57
SD	0.11	0.14	0.06	9.04	63.46	1.01	0.14	0.11	0.03	362.16	0.81	0.34	20.64	0.49	3.08

# T2<sup>\*</sup> Value



position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
mean	8.02	4.00	2.06	18.99	56.54	10.21	14.77	2.40	1.65	55.28	15.15	10.34	7.82	2.28	2.75
SD	0.23	0.09	0.06	8.50	334.36	0.14	0.10	0.11	0.45	6.60	0.74	41.05	2.87	0.09	3.57

# เพิ่มเงื่อนไขตรวจสอบค่า $T2^*$

- การตรวจสอบว่าค่า  $T2^*$  ที่ได้ถูกต้องหรือไม่
  - 1. ค่า ratio ต้องมีค่าต่ำกว่า 0.317
  - 2. ค่า  $T2^*$  ต้องไม่ติดลบ
- ถ้าไม่ถูกต้องจะกำหนดให้ค่า  $T2^*$  มีค่าต่ำกว่า 1.097 โดยกำหนดให้มีค่าเท่ากับ 0.549 เพื่อง่ายแก่การ plot chart

# Result

1.5Tesla CMRtools Result

date	T2* value														
	position1	position2	position3	position4	position5	position6	position7	position8	position9	position10	position11	position12	position13	position14	position15
2014-09-30'	7.472	3.860	2.094	12.325	55.463	8.954	4.320	2.377	1.683	51.289	14.185	7.781	4.056	2.160	2.079
2014-10-08'	7.617	3.926	1.958	17.812	88.170	9.677	4.505	2.350	1.802	63.018	14.653	7.503	3.959	2.077	2.714
2014-10-15'	8.033	4.015	2.069	17.659	82.364	10.235	4.758	2.418	1.638	55.377	15.233	7.933	4.152	2.170	2.612
2014-10-22'	7.733	3.981	2.103	16.333	99.779	10.323	4.708	2.386	1.673	64.793	14.631	7.857	4.067	2.199	2.391
2014-11-05'	7.672	3.933	2.198	19.128	98.721	10.082	4.626	2.408	1.727	58.036	14.813	7.833	4.088	2.328	2.294
2014-11-12'	7.579	3.885	2.129	19.123	104.508	9.946	4.633	2.417	1.575	69.908	14.425	7.528	3.844	2.228	2.726
2014-11-19'	7.957	4.128	2.162	14.417	90.513	10.242	4.753	2.462	1.727	62.562	15.178	8.150	4.178	2.299	2.309
2014-11-26'	8.363	4.320	2.316	13.467	89.903	10.683	4.893	2.554	1.668	49.213	16.303	8.689	4.442	2.444	2.114
2014-12-03'	8.453	4.375	2.384	11.064	83.863	10.372	5.004	2.571	1.617	49.300	16.338	8.792	4.517	2.456	1.910
2014-12-10'	8.037	4.180	2.196	8.043	79.613	10.233	4.773	2.530	1.490	42.714	14.799	8.030	4.195	2.248	1.818
2014-12-17'	7.981	4.110	2.192	2.392	88.821	10.259	4.673	2.466	1.487	40.002	14.936	8.020	4.148	2.187	1.769
2014-12-24'	8.146	4.167	2.197	12.296	70.749	10.327	4.750	2.466	1.527	36.942	15.194	8.184	4.206	2.260	1.919
2015-01-21'	7.914	4.166	2.260	9.619	60.496	10.507	4.804	2.636	1.609	27.603	15.063	8.042	4.184	2.257	1.819
2015-01-28'	7.981	4.216	2.304	14.208	112.086	10.664	4.980	2.663	1.671	40.998	15.403	8.218	4.290	2.334	2.053
2015-02-04'	7.421	3.892	2.169	18.980	101.124	10.182	4.718	2.596	1.597	46.076	14.100	7.394	3.805	2.185	2.540
mean	7.891	4.077	2.182	13.791	87.078	10.179	4.727	2.487	1.633	50.522	15.017	7.997	4.142	2.256	2.205

# Result

## 1.5Tesla MRIM Result

date	T2* value														
	position1	position2	position3	position4	position5	position6	position7	position8	position9	position10	position11	position12	position13	position14	position15
2014-09-30'	7.207	3.644	2.031	1.807	0.549	8.906	4.248	2.207	1.316	0.549	13.905	7.425	3.701	1.891	1.487
2014-10-08'	7.440	3.686	1.868	1.494	0.549	9.271	4.253	2.245	1.242	0.549	14.382	7.053	3.633	2.431	1.636
2014-10-15'	7.741	3.705	1.826	1.620	0.549	10.015	4.431	2.333	1.209	0.549	15.131	7.572	3.778	2.394	1.628
2014-10-22'	7.449	3.685	2.054	1.691	0.549	9.890	4.370	2.294	1.110	0.549	14.322	7.463	3.910	1.869	1.514
2014-11-05'	7.494	3.679	1.936	1.637	0.549	9.629	4.454	2.337	1.158	0.549	14.522	7.408	3.651	1.896	1.580
2014-11-12'	7.420	3.680	2.020	1.773	0.549	9.539	4.556	2.339	1.136	0.549	14.363	7.281	3.583	2.443	1.600
2014-11-19'	7.795	3.904	1.906	1.564	0.549	9.954	4.456	2.297	1.212	0.549	14.953	7.803	3.924	1.975	1.536
2014-11-26'	8.149	4.043	2.040	1.434	0.549	10.152	4.545	2.374	1.247	0.549	15.928	8.268	4.098	2.402	1.507
2014-12-03'	8.297	4.070	2.028	1.422	0.549	10.086	4.861	2.437	1.205	0.549	16.331	8.506	4.224	2.376	1.407
2014-12-10'	7.919	3.933	1.910	1.312	0.549	9.950	4.529	2.388	1.174	0.549	14.711	7.678	3.809	2.144	1.370
2014-12-17'	7.670	3.858	1.889	1.332	0.549	9.997	4.486	2.430	1.184	0.549	14.873	7.730	3.954	2.128	1.395
2014-12-24'	7.901	3.911	1.907	1.264	0.549	9.937	4.445	2.397	1.206	2.037	14.909	7.770	4.026	2.163	1.448
2015-01-21'	7.647	3.970	2.091	1.286	0.549	10.280	4.693	2.647	1.332	1.867	14.823	7.585	3.968	2.198	1.396
2015-01-28'	7.934	3.952	2.072	1.489	0.549	10.348	4.700	2.542	1.353	0.549	15.234	7.839	3.932	1.935	1.503
2015-02-04'	7.360	3.680	2.011	1.643	0.549	9.854	4.478	2.440	1.258	0.549	14.090	7.040	3.472	1.807	1.568
mean	7.695	3.827	1.973	1.518	0.549	9.854	4.500	2.380	1.223	0.736	14.832	7.628	3.844	2.137	1.505

T2\* value on table = 0.549 mean T2\* value less than 1.097

# Result

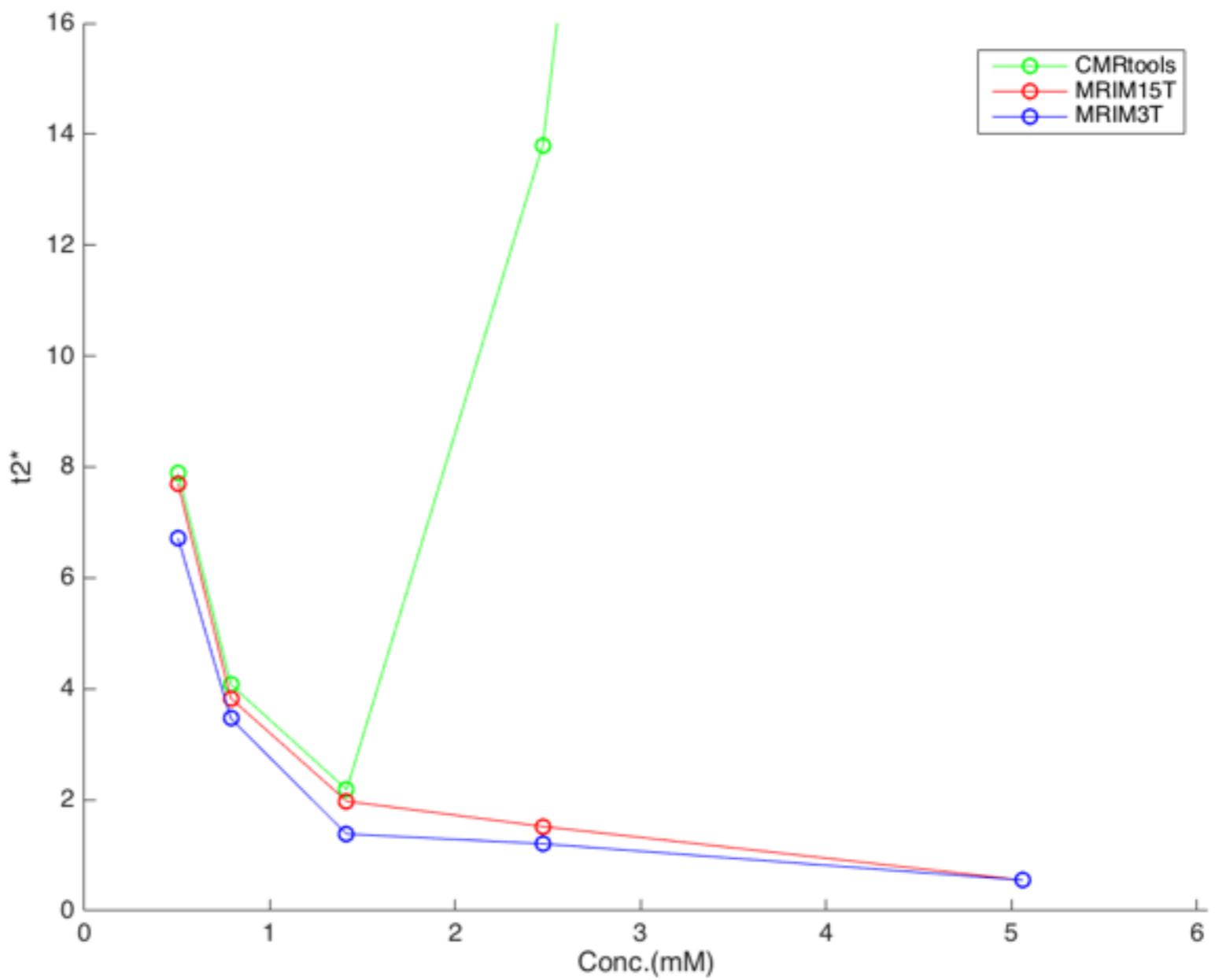
3Tesla MRIM Result

date	T2* value														
	position1	position2	position3	position4	position5	position6	position7	position8	position9	position10	position11	position12	position13	position14	position15
2014-09-30'	5.459	2.864	1.771	1.565	0.549	6.624	2.949	2.036	1.094	0.549	17.389	5.914	2.998	1.643	1.146
2014-10-08'	6.507	3.523	1.473	1.668	0.549	9.287	3.907	2.196	0.549	0.549	11.171	6.314	3.987	1.089	1.140
2014-10-15'	6.835	3.586	1.500	1.635	0.549	8.497	4.231	2.183	1.175	0.549	15.874	6.909	3.780	1.196	1.184
2014-10-22'	6.872	3.590	1.692	1.606	0.549	8.660	3.623	2.074	1.128	0.549	12.666	6.640	3.965	1.421	0.967
2014-11-05'	7.808	3.479	1.372	0.549	0.549	10.816	4.965	1.849	1.210	0.549	13.094	6.346	3.833	1.617	1.606
2014-11-12'	6.508	3.240	0.992	0.549	0.549	8.857	5.048	1.926	1.262	0.549	9.919	5.560	3.227	1.476	1.542
2014-11-19'	7.081	3.449	1.341	1.388	0.549	8.231	3.930	2.170	0.921	0.549	10.281	6.108	3.762	1.428	1.488
2014-11-26'	8.647	3.762	1.487	1.051	0.549	11.591	4.985	1.600	1.139	0.549	17.732	6.961	3.986	1.752	1.064
2014-12-03'	7.376	3.595	1.374	1.054	0.549	6.210	3.464	1.662	0.927	0.549	9.666	6.228	3.389	1.631	1.049
2014-12-10'	5.453	3.291	1.083	2.139	0.549	8.525	3.233	1.549	1.175	0.549	7.174	5.065	2.655	1.741	1.792
2014-12-17'	6.116	3.445	1.362	0.916	0.549	12.673	3.281	1.619	0.856	0.549	10.074	6.209	3.380	1.407	1.129
2014-12-24'	6.615	3.417	1.217	1.280	0.549	10.846	4.021	1.917	1.173	0.549	10.913	6.507	3.741	1.446	1.434
2015-01-21'	7.199	3.438	1.342	1.338	0.549	11.279	4.105	1.766	1.018	0.549	12.445	6.544	3.459	1.589	1.121
2015-01-28'	6.797	3.418	1.250	0.801	0.549	8.200	3.441	1.702	1.065	0.868	12.581	6.258	3.443	1.745	0.913
2015-02-04'	5.430	3.816	1.472	0.549	0.549	11.056	3.157	2.054	1.183	0.549	10.160	6.081	3.768	1.334	1.297
mean	6.714	3.461	1.382	1.206	0.549	9.423	3.889	1.887	1.058	0.570	12.076	6.243	3.558	1.501	1.258

T2\* value on table = 0.549 mean T2\* value less than 1.097

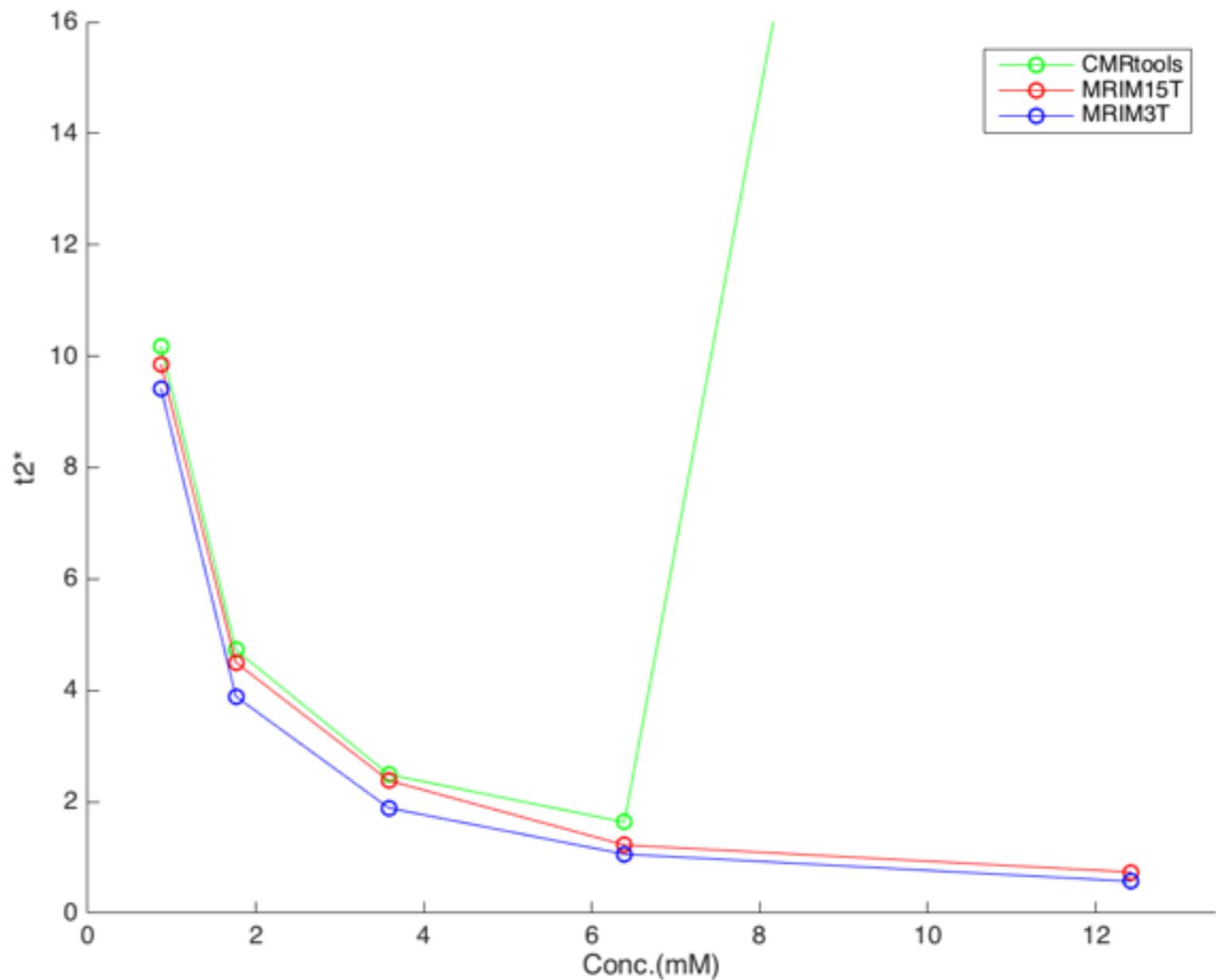
position	T2* mean value			Conc.
	CMRtools	1.5T	3T	
1	7.891	7.695	6.714	0.505
2	4.077	3.827	3.461	0.789
3	2.182	1.973	1.382	1.413
4	13.791	1.518	1.206	2.470
5	87.078	0.549	0.549	5.059
6	10.179	9.854	9.423	0.871
7	4.727	4.500	3.889	1.761
8	2.487	2.380	1.887	3.584
9	1.633	1.223	1.058	6.387
10	50.522	0.736	0.570	12.421
11	15.017	14.832	12.076	1.060
12	7.997	7.628	6.243	1.682
13	4.142	3.844	3.558	3.375
14	2.256	2.137	1.501	6.956
15	2.205	1.505	1.258	9.698

set1 loading 20%



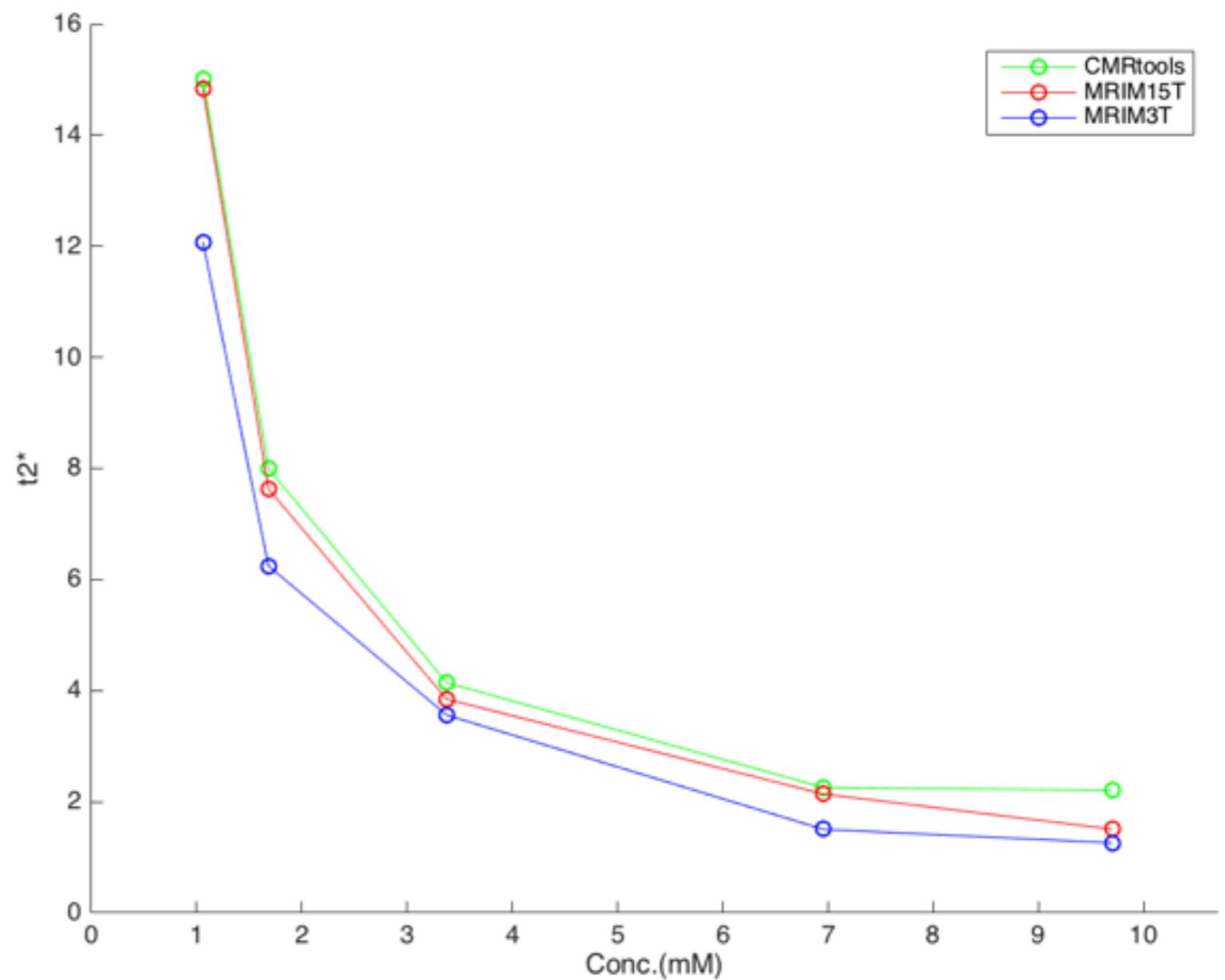
position	T2* mean value			Conc.
	CMRtools	1.5T	3T	
1	7.891	7.695	6.714	0.505
2	4.077	3.827	3.461	0.789
3	2.182	1.973	1.382	1.413
4	13.791	1.518	1.206	2.470
5	87.078	0.549	0.549	5.059
6	10.179	9.854	9.423	0.871
7	4.727	4.500	3.889	1.761
8	2.487	2.380	1.887	3.584
9	1.633	1.223	1.058	6.387
10	50.522	0.736	0.570	12.421
11	15.017	14.832	12.076	1.060
12	7.997	7.628	6.243	1.682
13	4.142	3.844	3.558	3.375
14	2.256	2.137	1.501	6.956
15	2.205	1.505	1.258	9.698

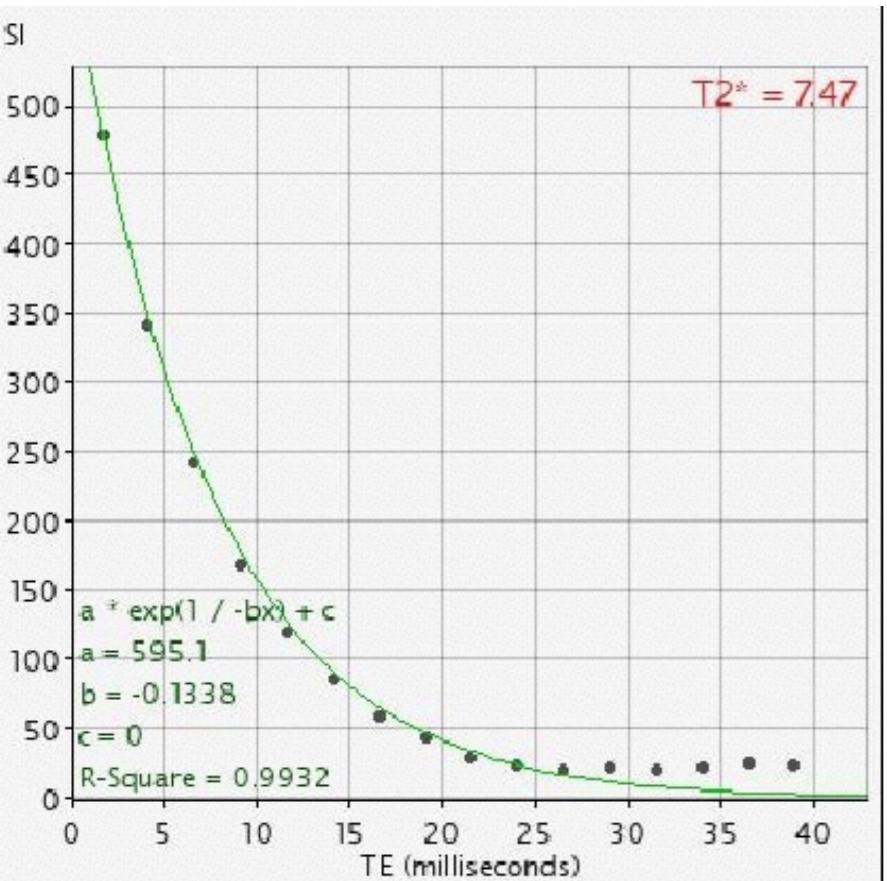
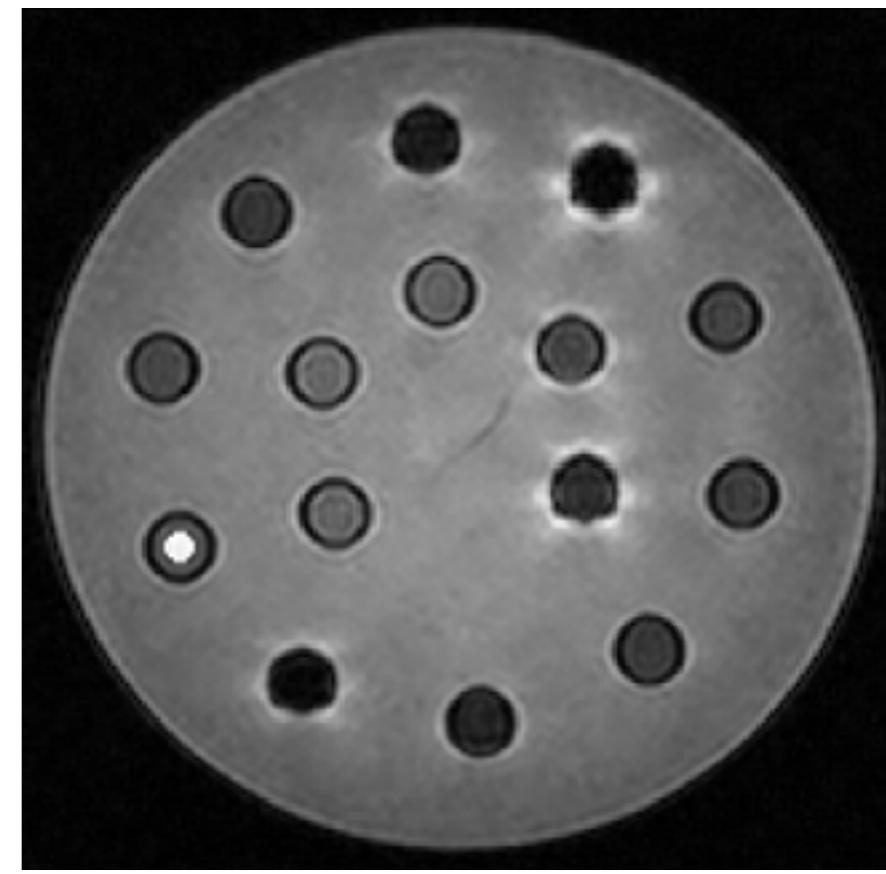
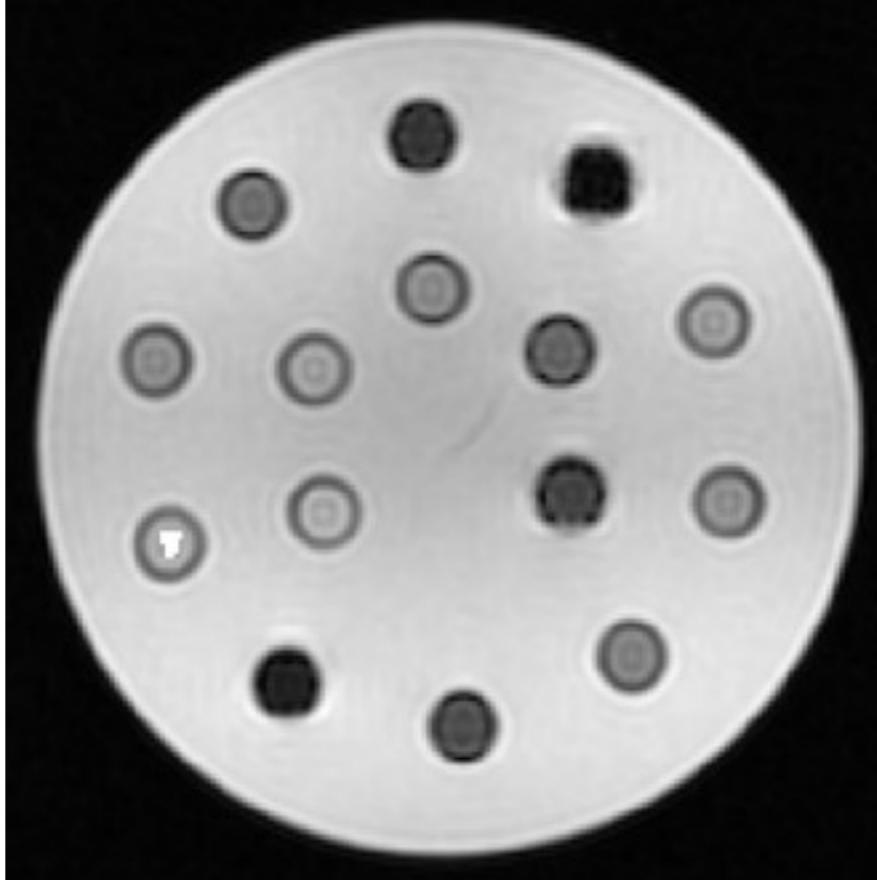
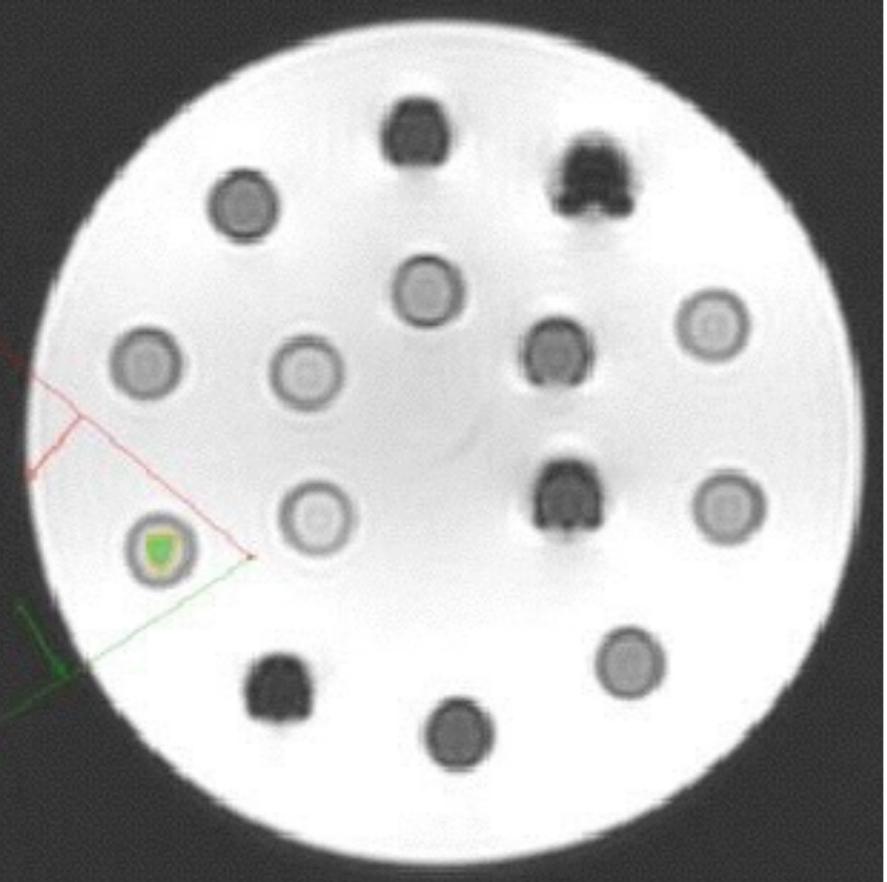
set2 loading 10%



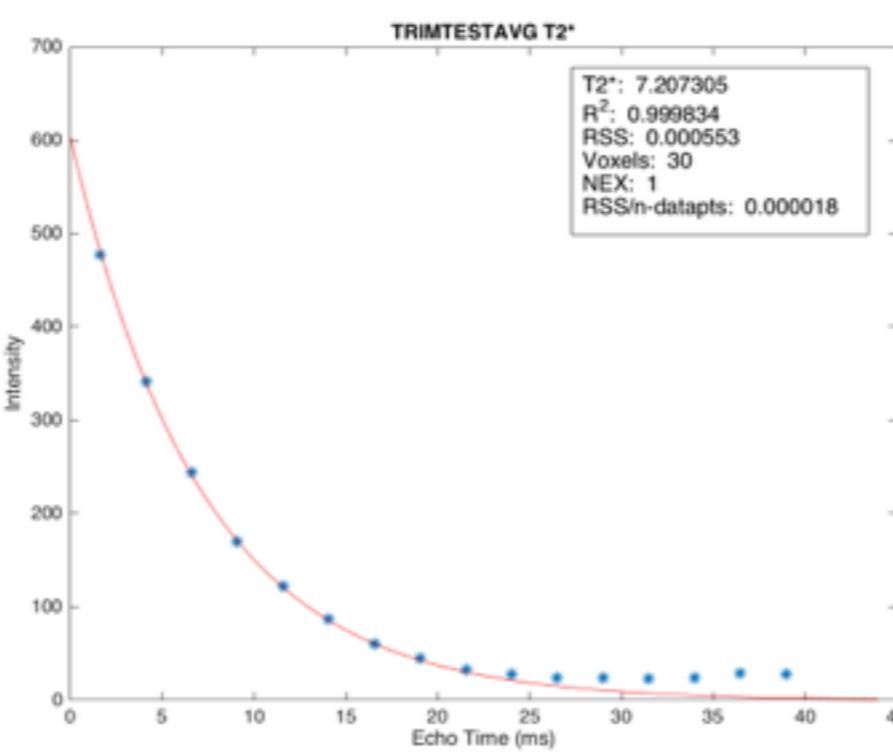
position	T2* mean value			Conc.
	CMRtools	1.5T	3T	
1	7.891	7.695	6.714	0.505
2	4.077	3.827	3.461	0.789
3	2.182	1.973	1.382	1.413
4	13.791	1.518	1.206	2.470
5	87.078	0.549	0.549	5.059
6	10.179	9.854	9.423	0.871
7	4.727	4.500	3.889	1.761
8	2.487	2.380	1.887	3.584
9	1.633	1.223	1.058	6.387
10	50.522	0.736	0.570	12.421
11	15.017	14.832	12.076	1.060
12	7.997	7.628	6.243	1.682
13	4.142	3.844	3.558	3.375
14	2.256	2.137	1.501	6.956
15	2.205	1.505	1.258	9.698

set3 loading 5%

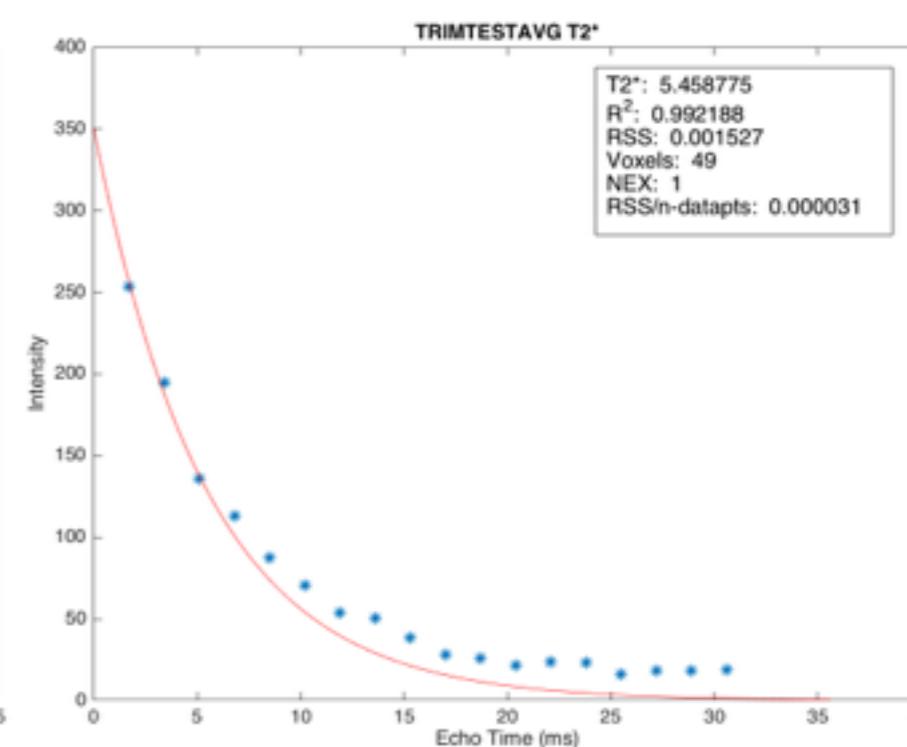




$T2^* = 7.47$   
CMRtools 1.5T

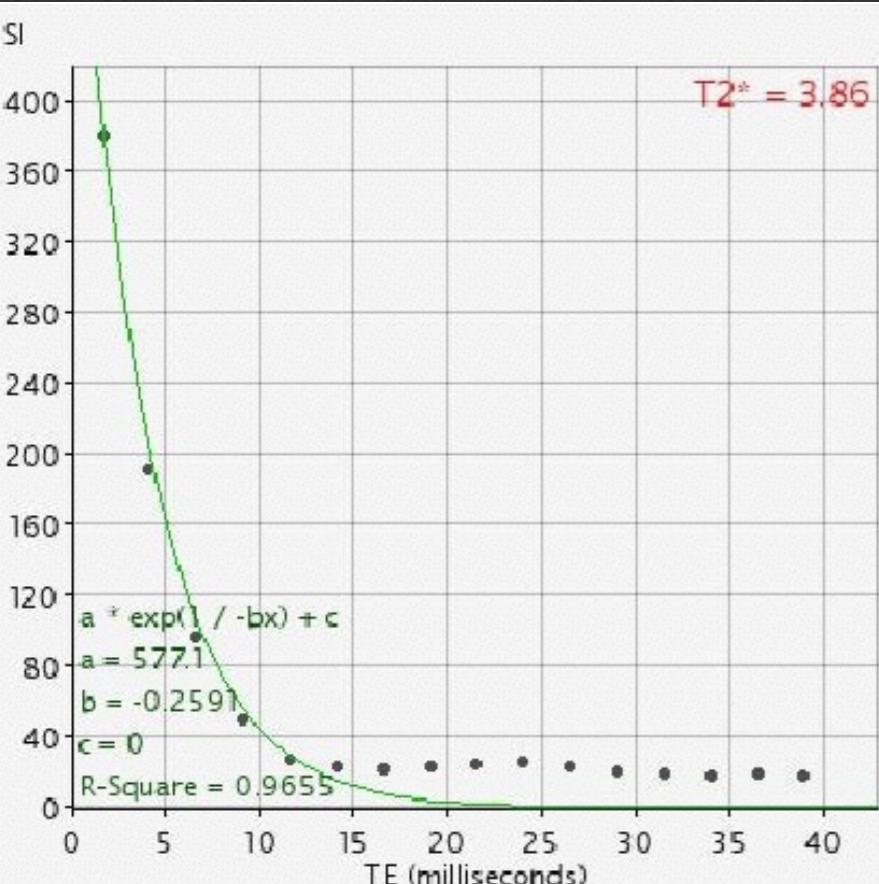
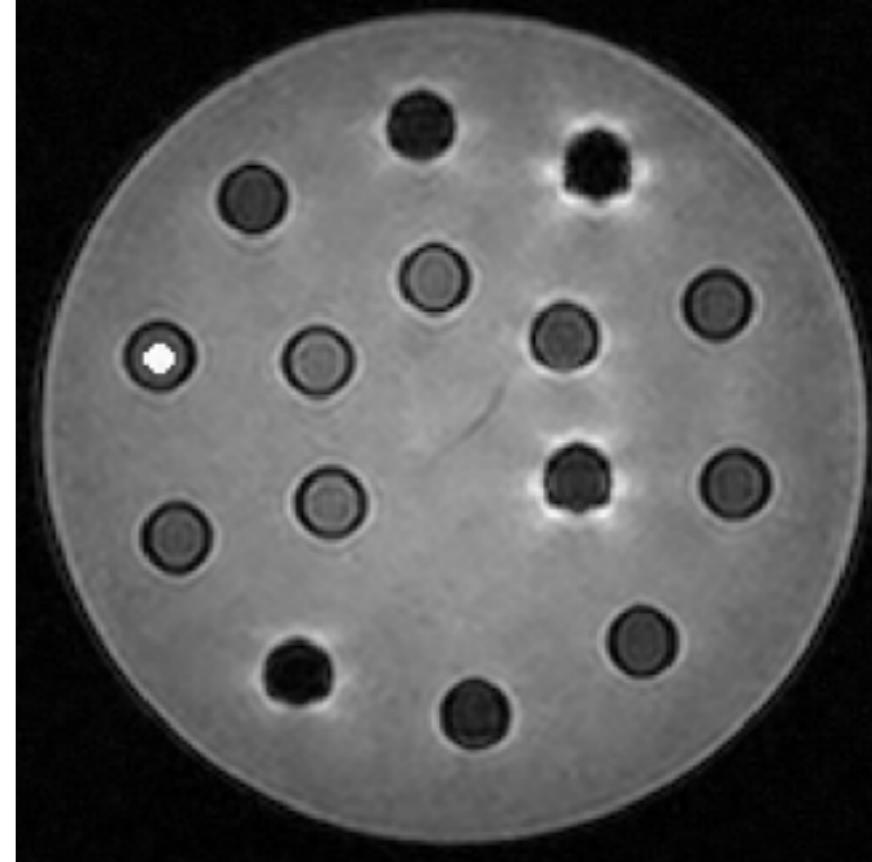
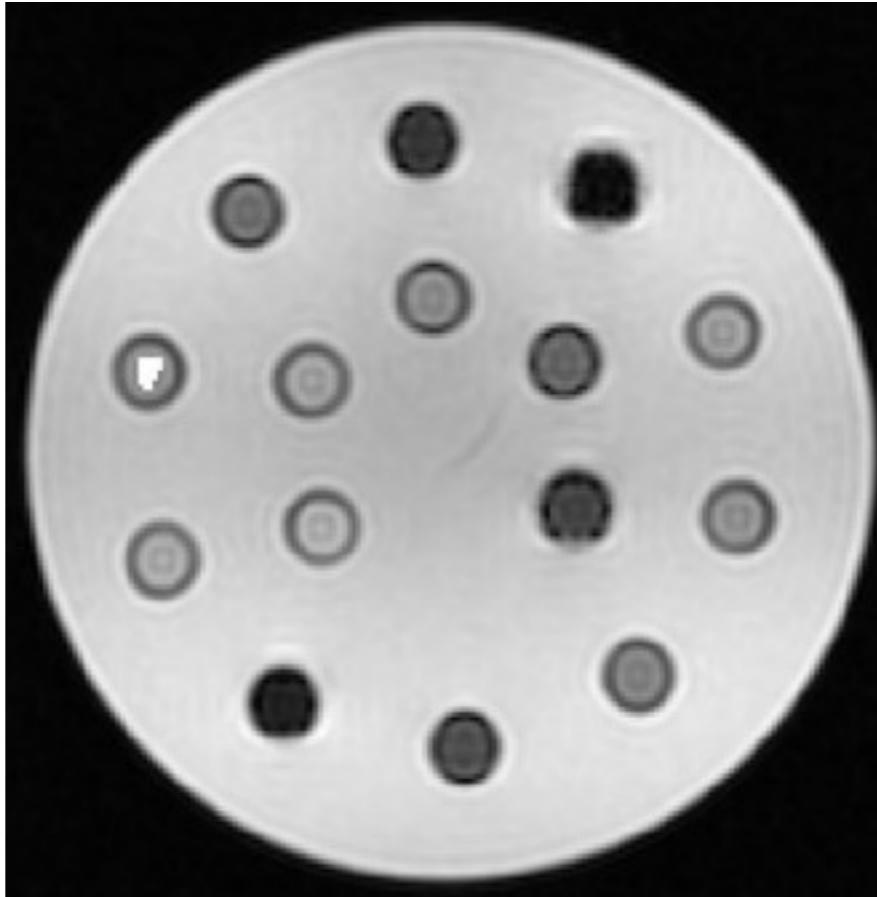
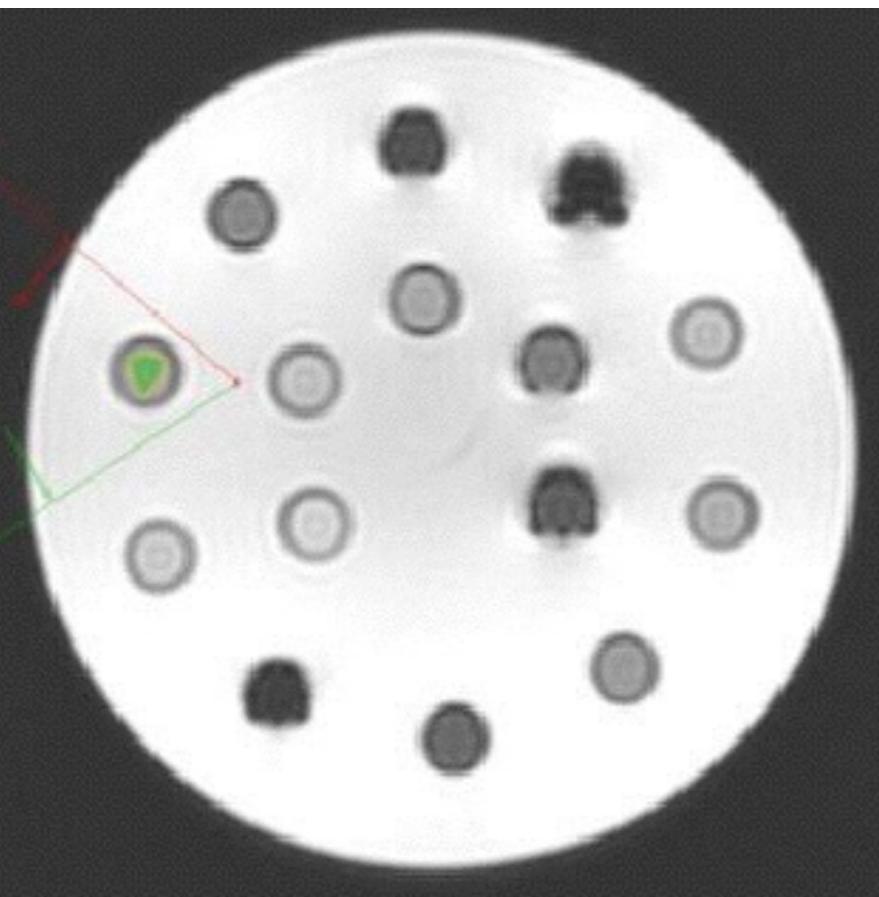


$T2^* = 7.207$   
MRIM 1.5T

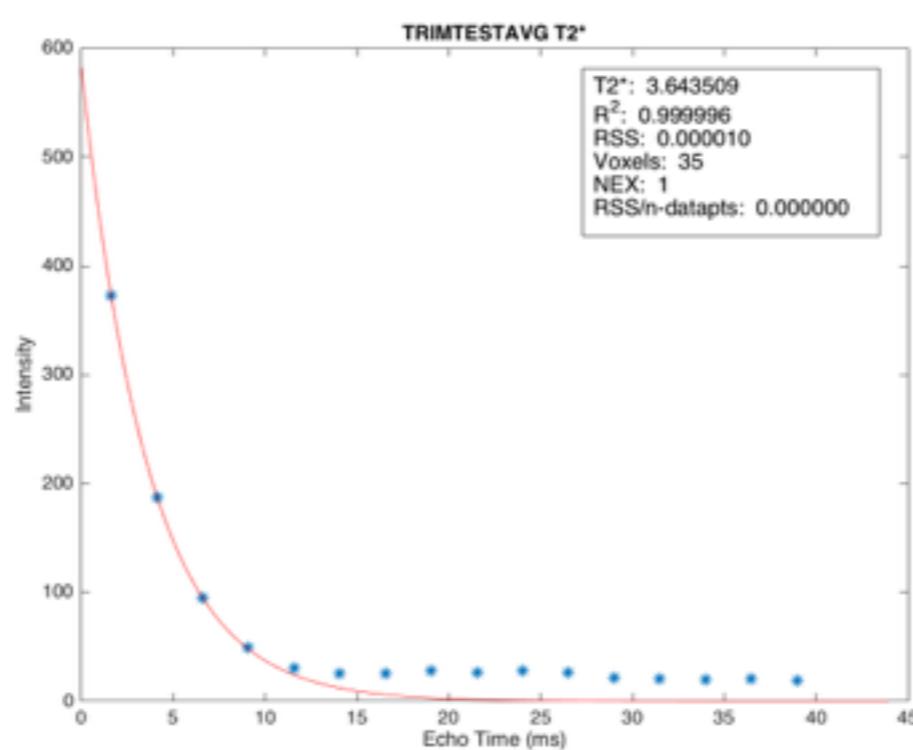


$T2^* = 5.459$   
MRIM 3T

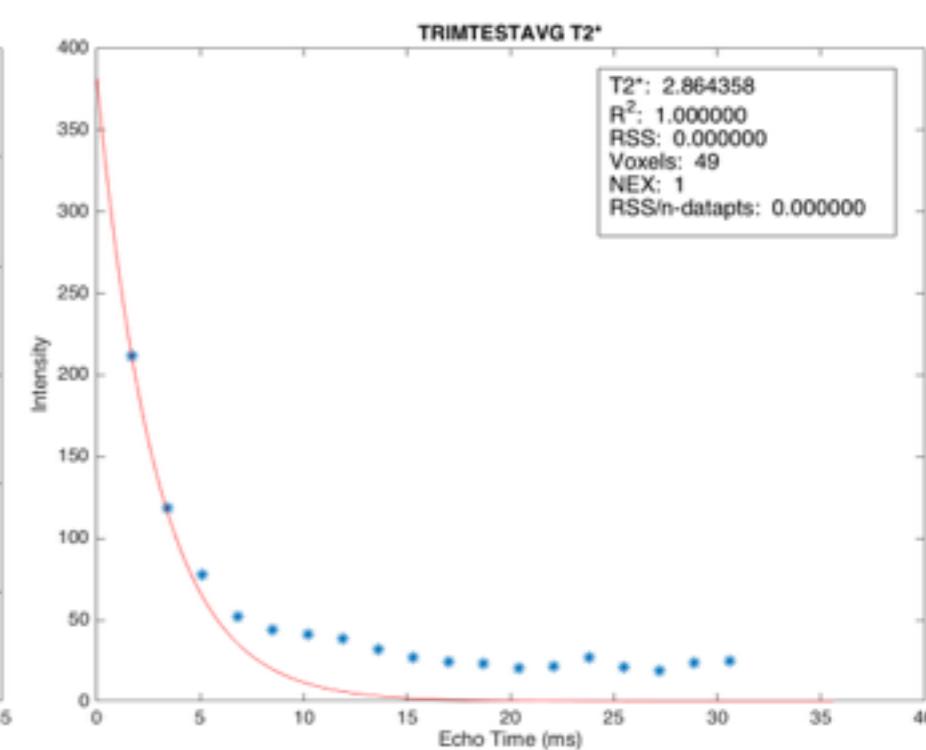
position 1 Conc. 0.505



$T2^* = 3.86$   
CMRtools 1.5T

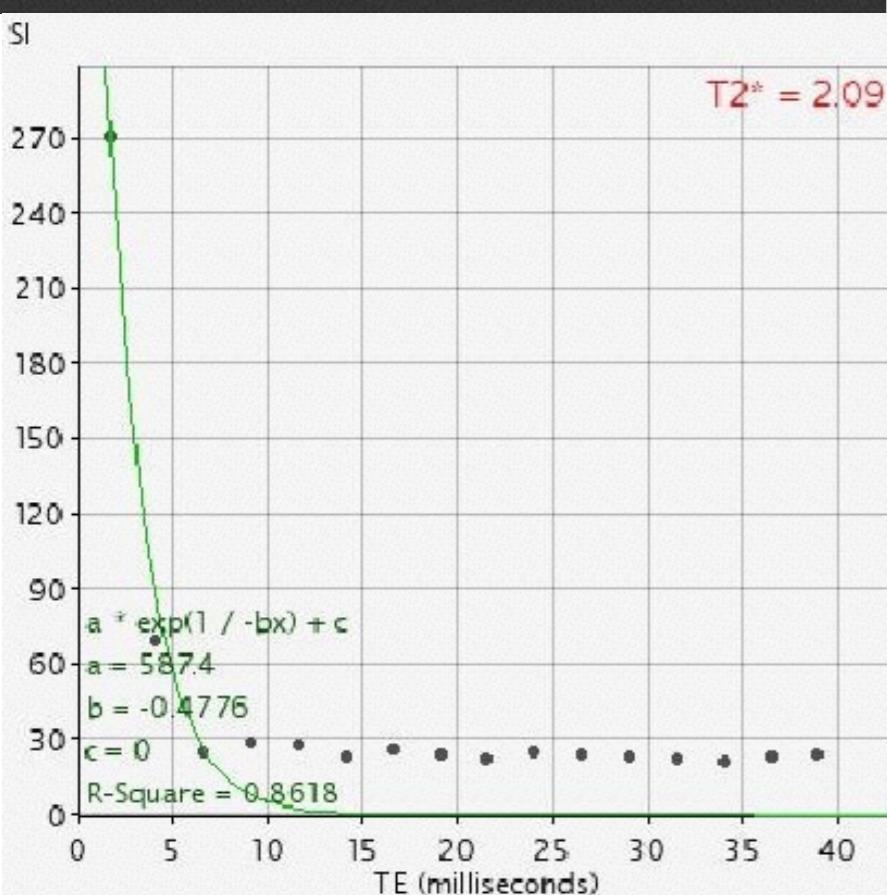
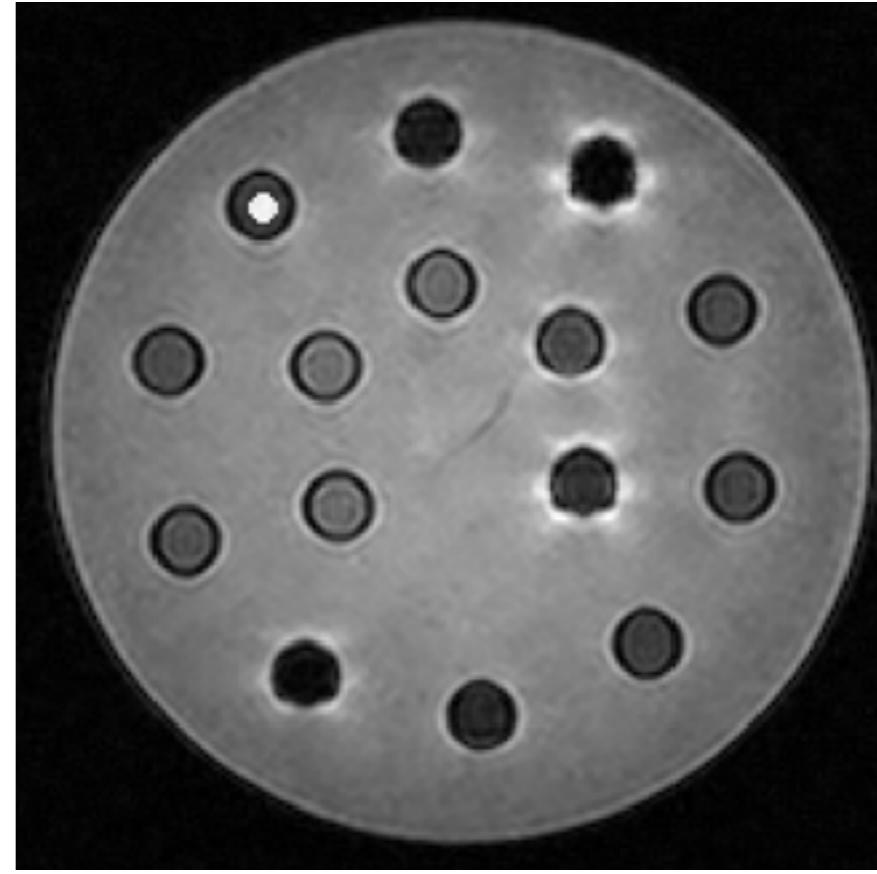
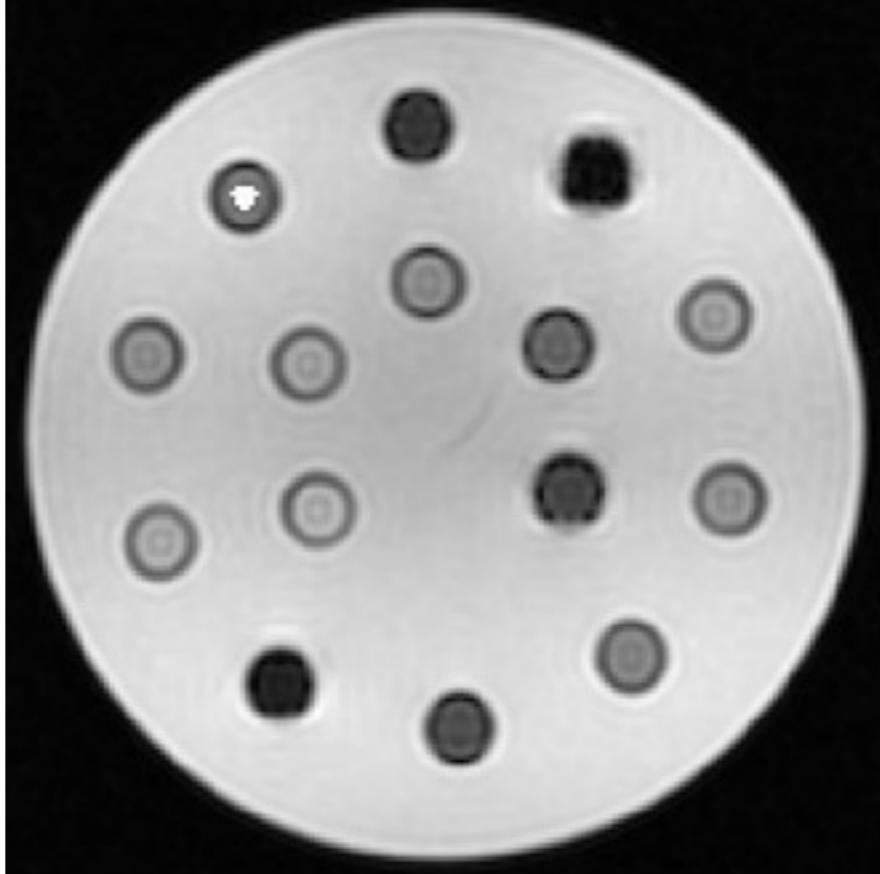
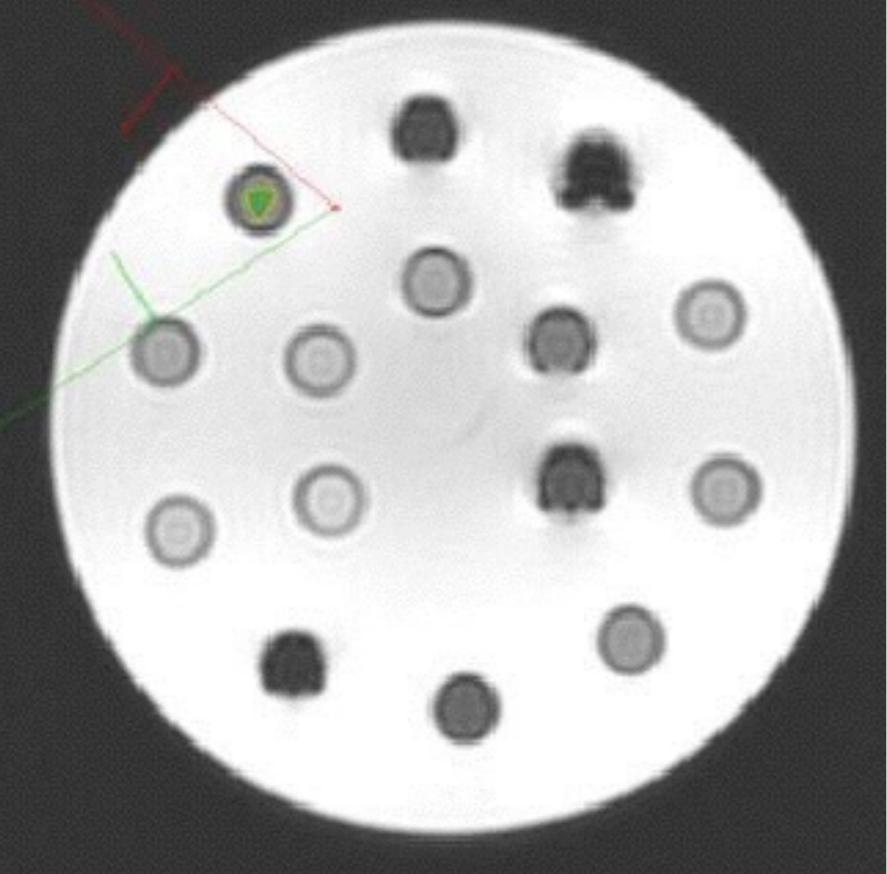


$T2^* = 3.644$   
MRIM 1.5T

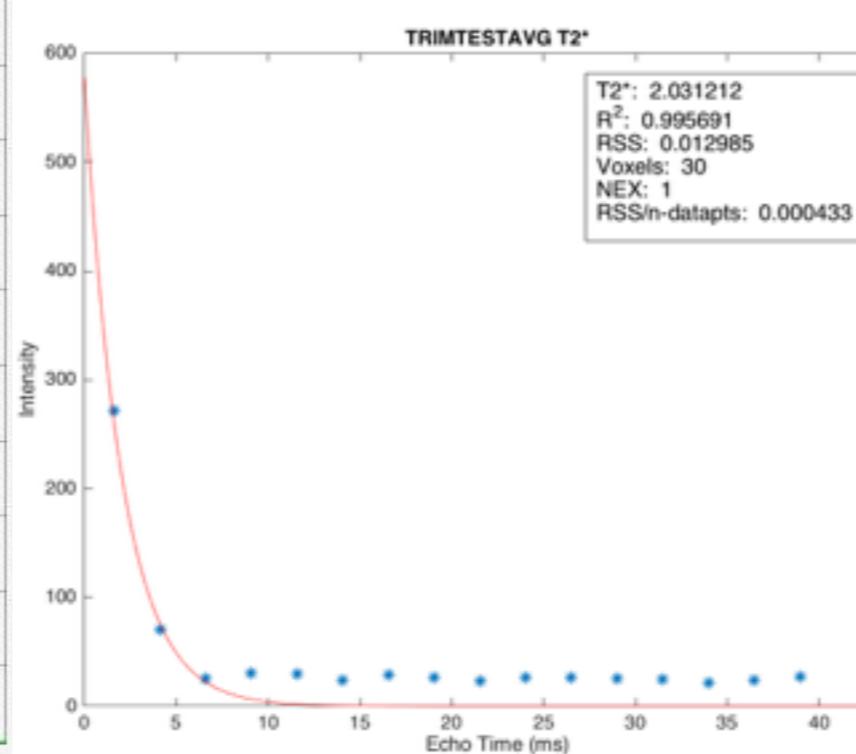


$T2^* = 2.864$   
MRIM 3T

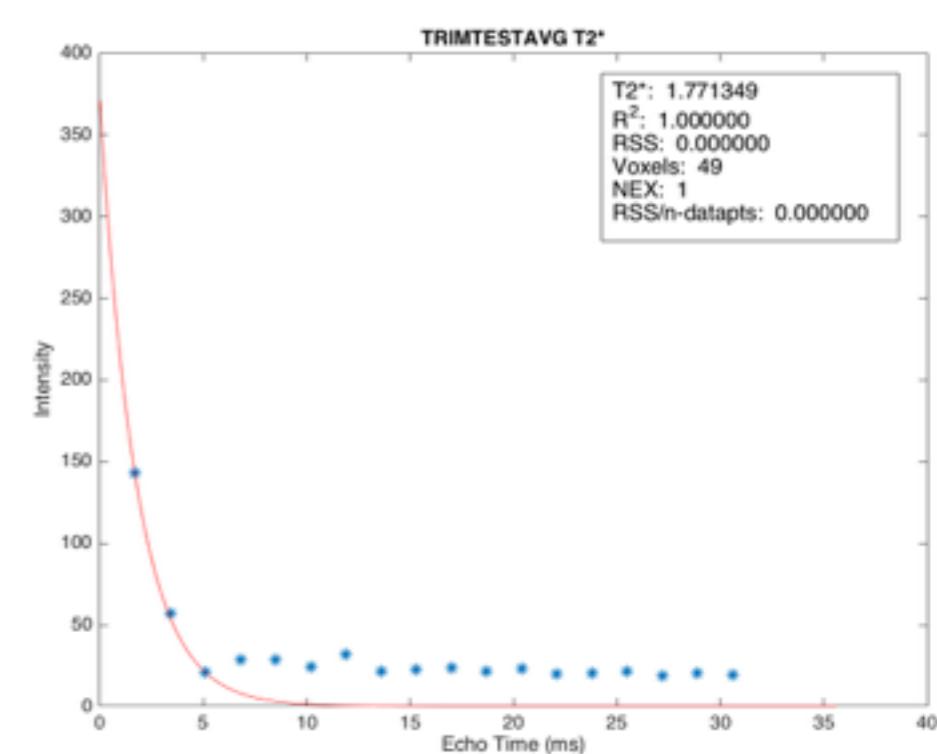
position 2 Conc. 0.789



$T2^* = 2.09$   
CMRtools 1.5T

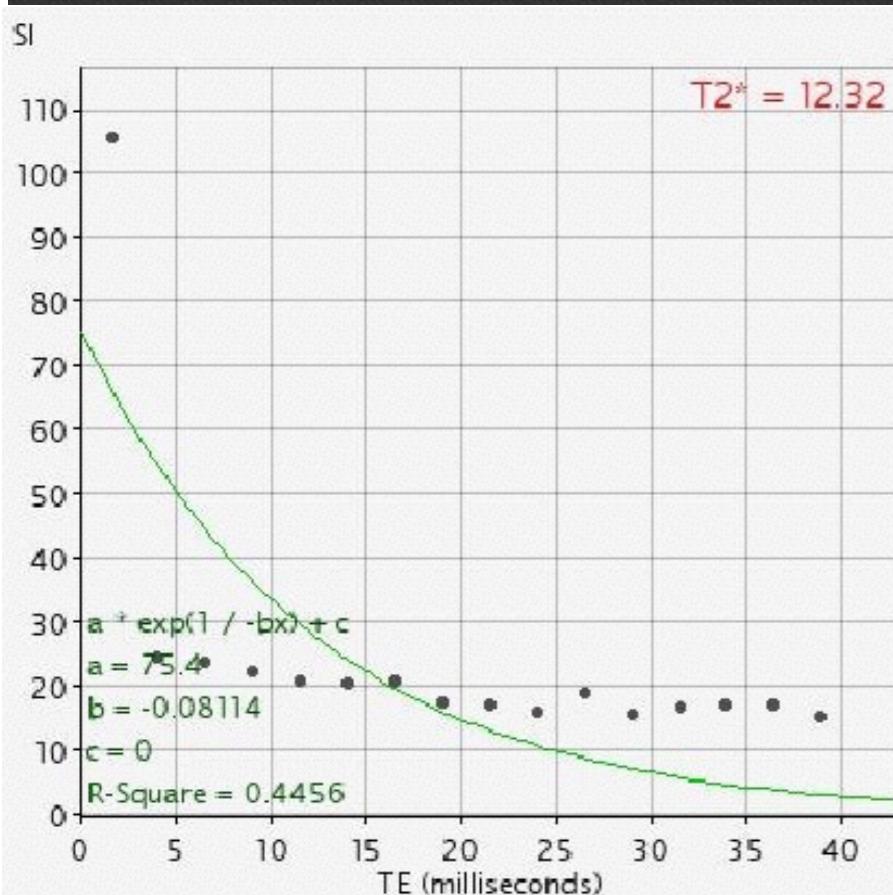
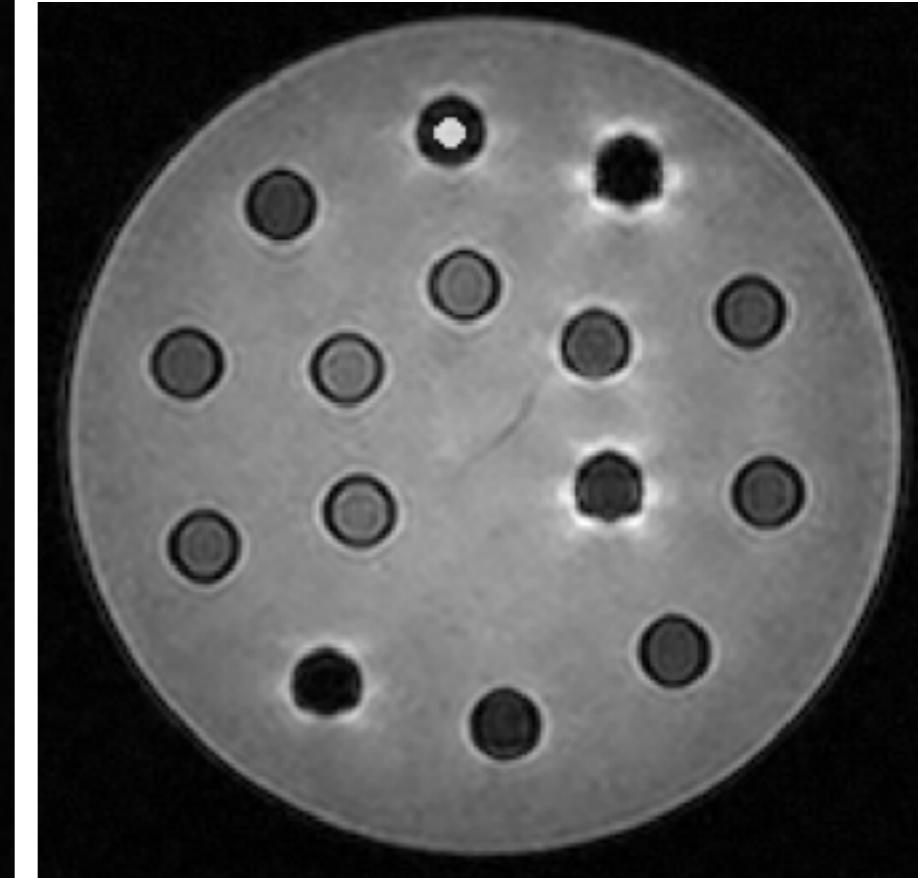
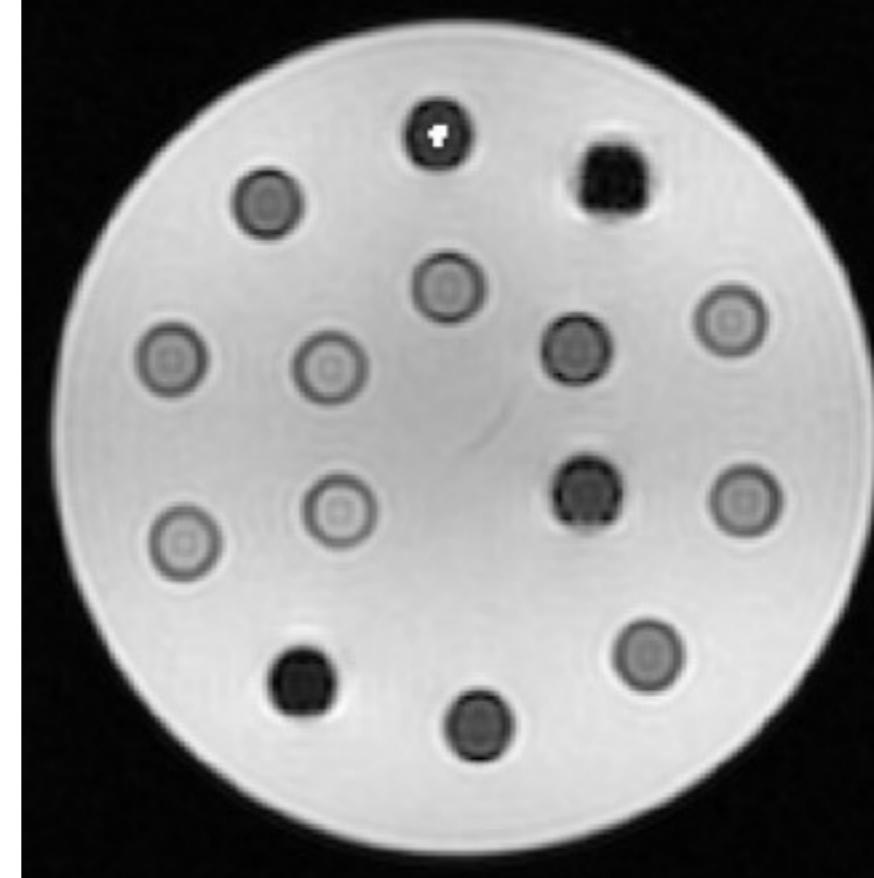
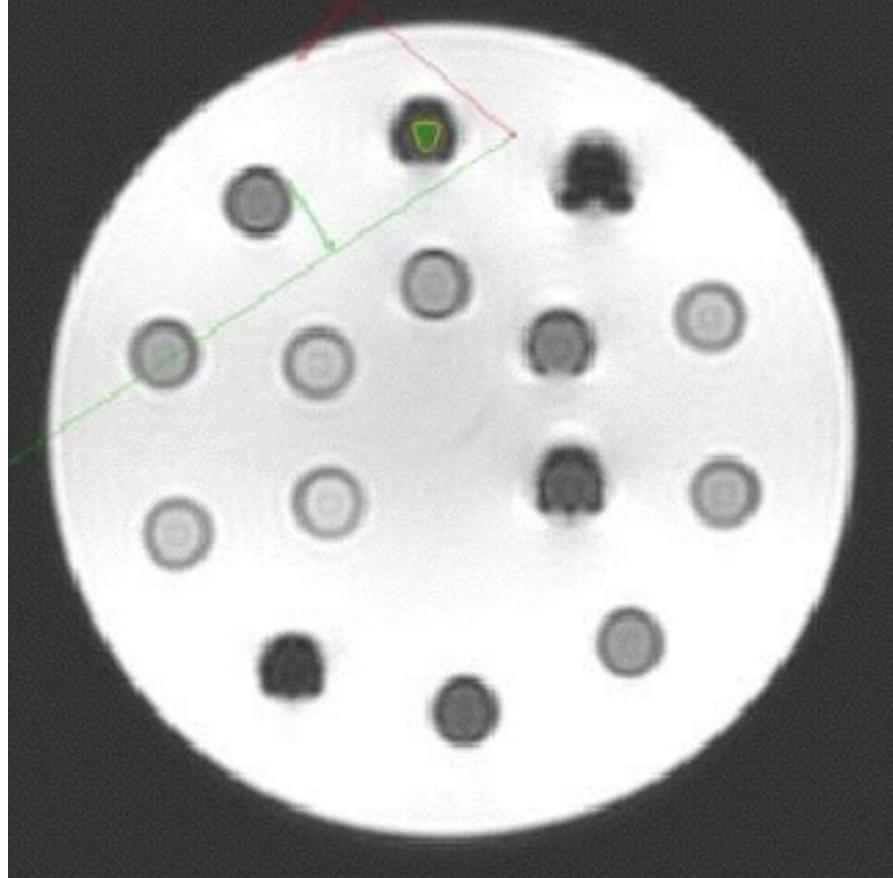


$T2^* = 2.031$   
MRIM 1.5T

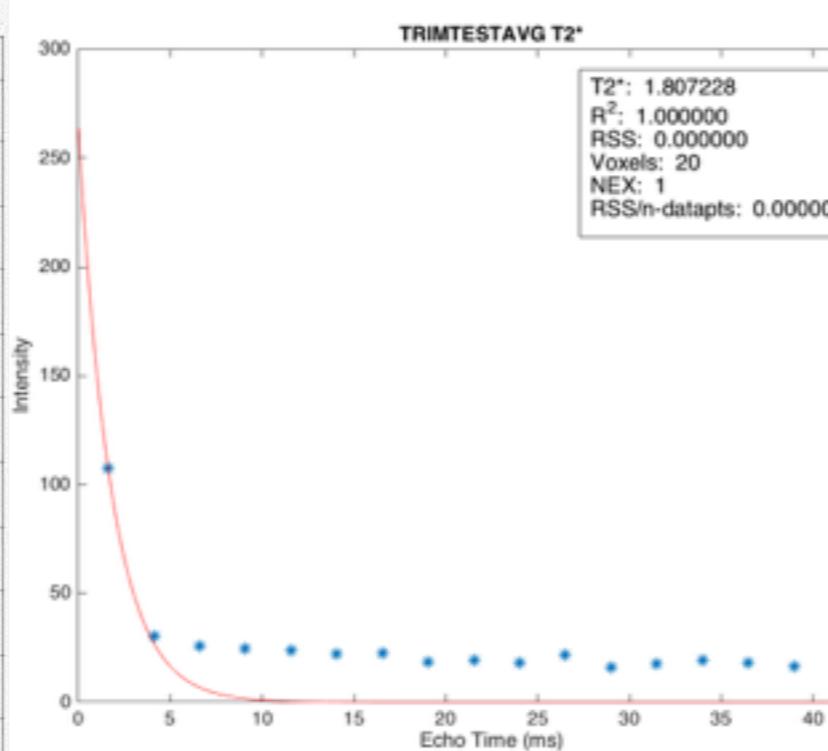


$T2^* = 1.771$   
MRIM 3T

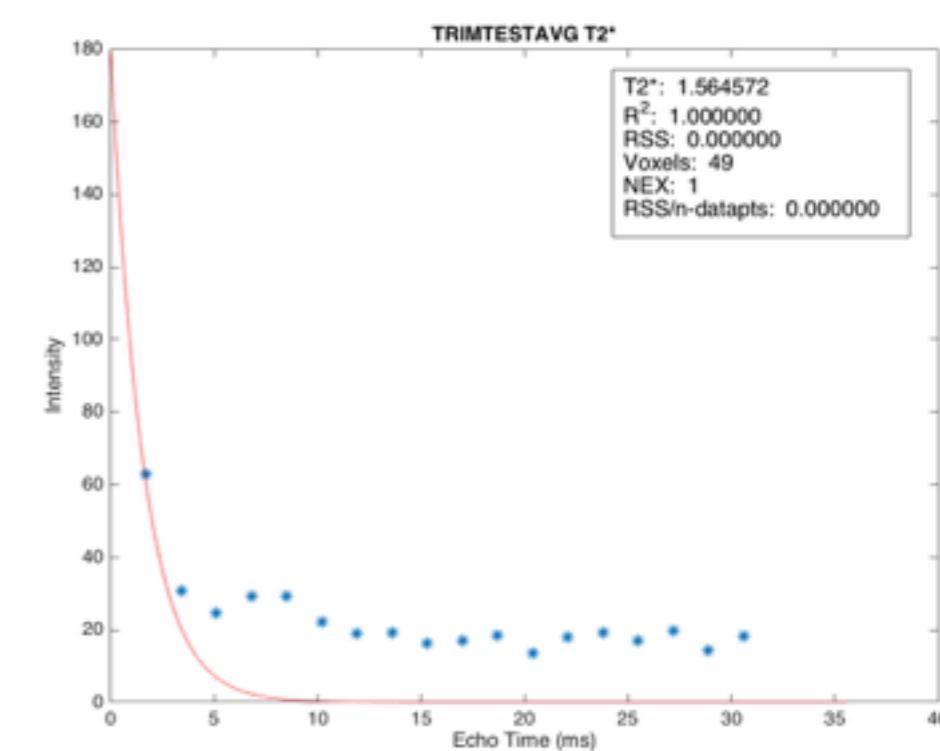
position 3 Conc. 1.413



$T2^* = 12.32$   
CMRtools 1.5T

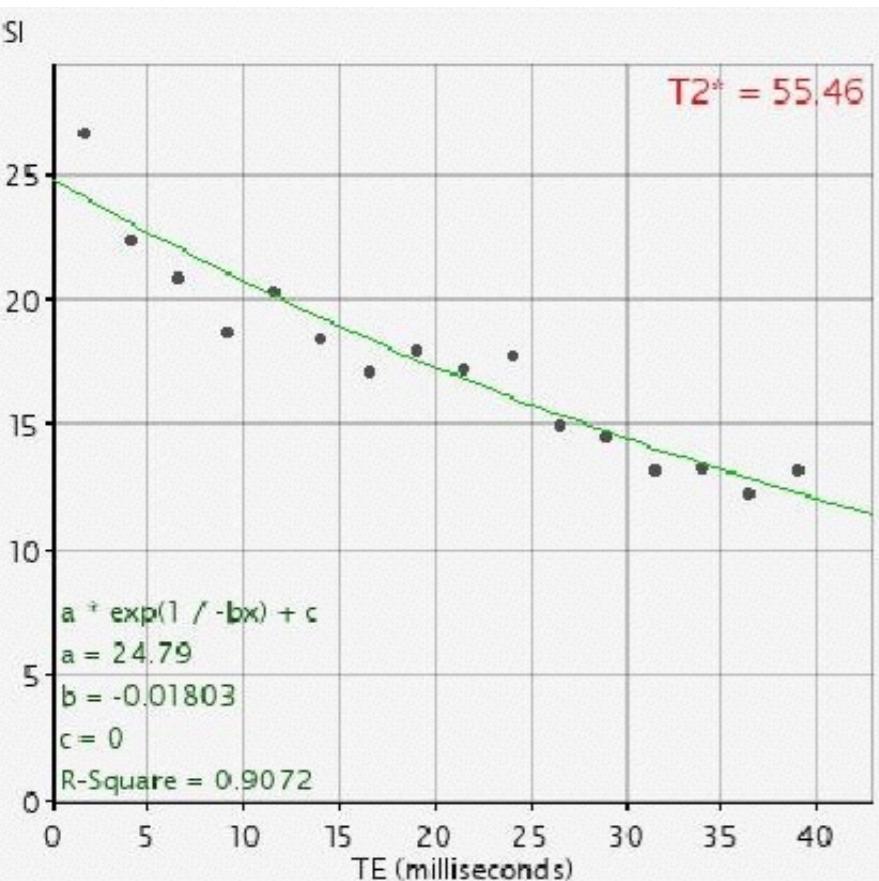
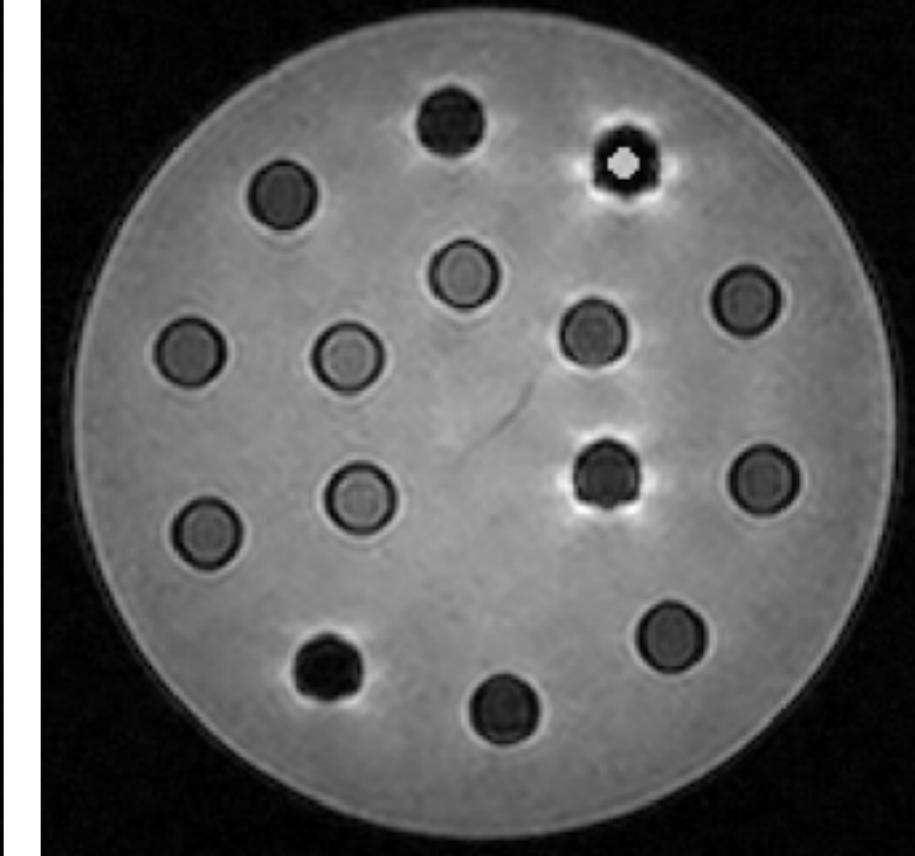
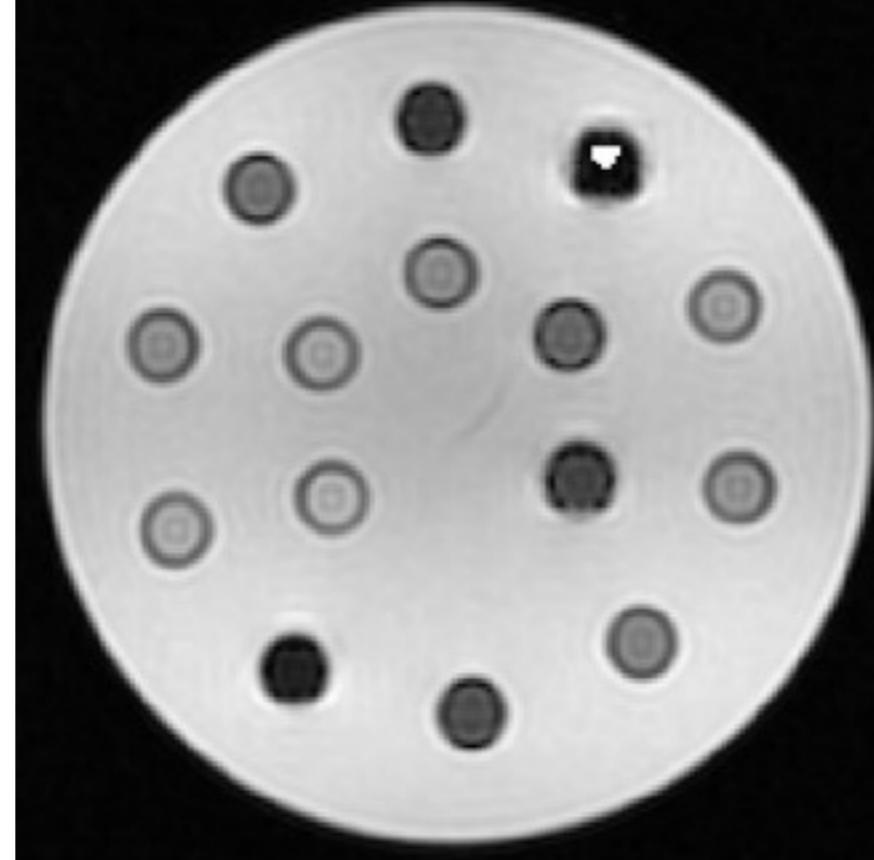
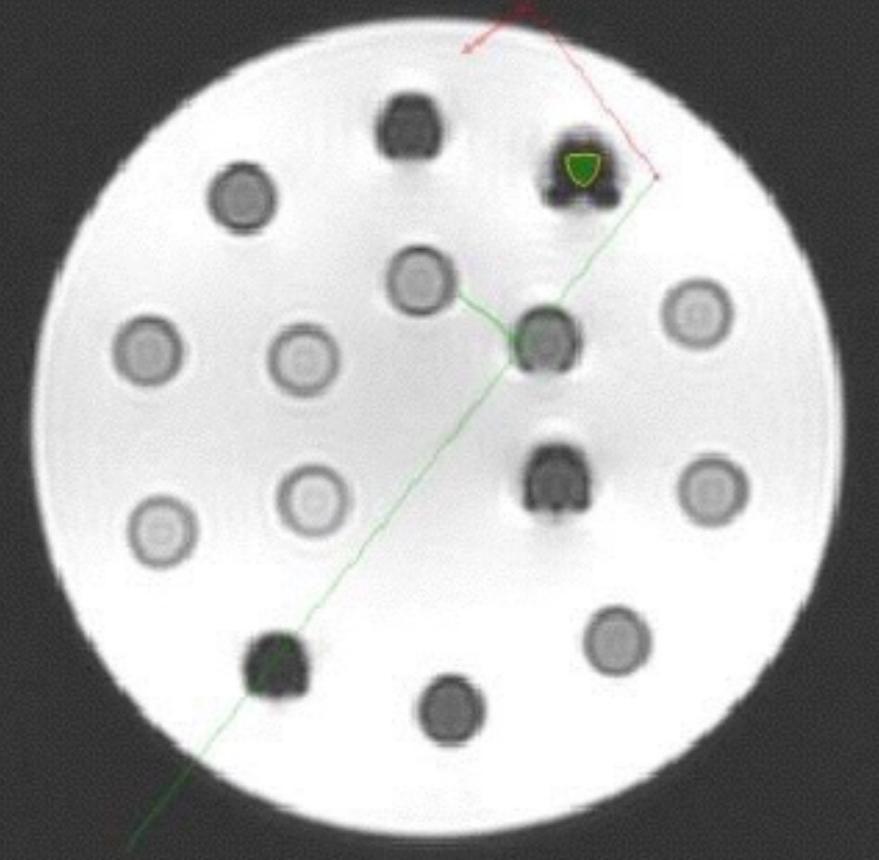


$T2^* = 1.807$   
MRIM 1.5T

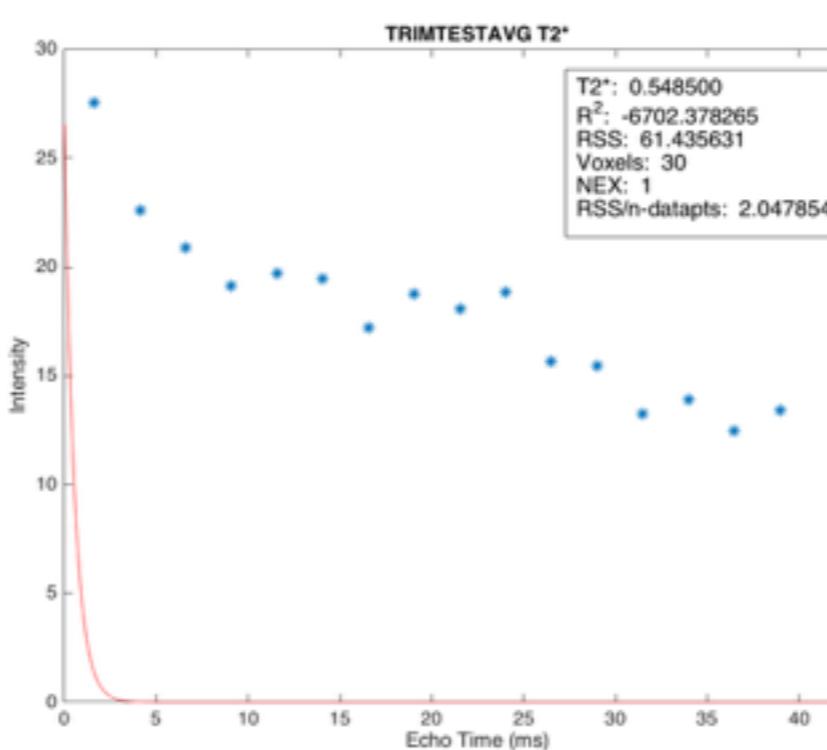


$T2^* = 1.565$   
MRIM 3T

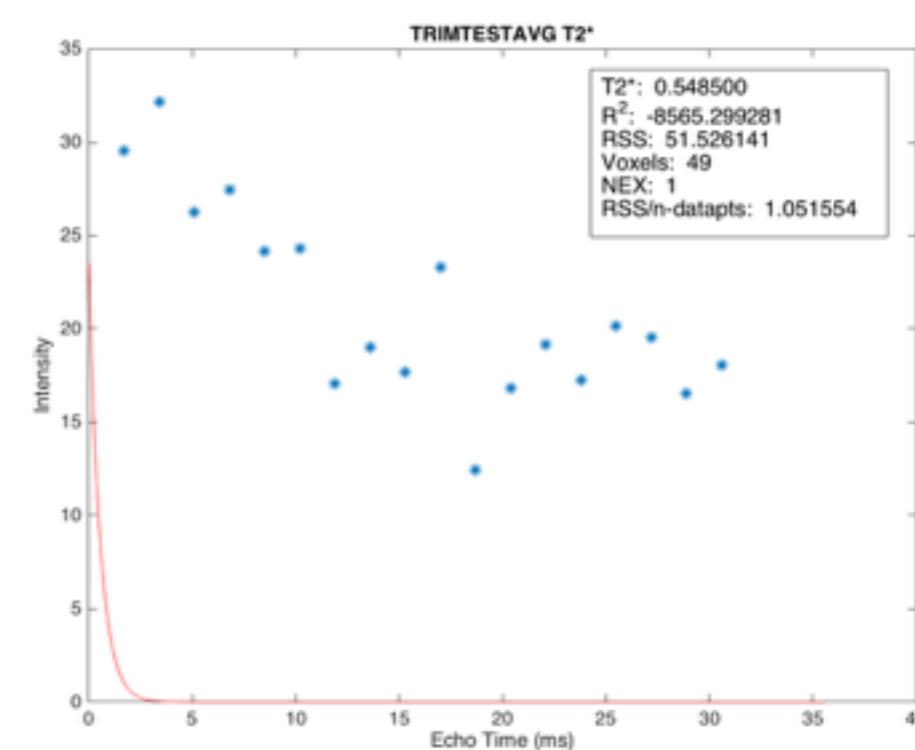
position 4 Conc. 2.470



$T2^* = 55.46$   
CMRtools 1.5T

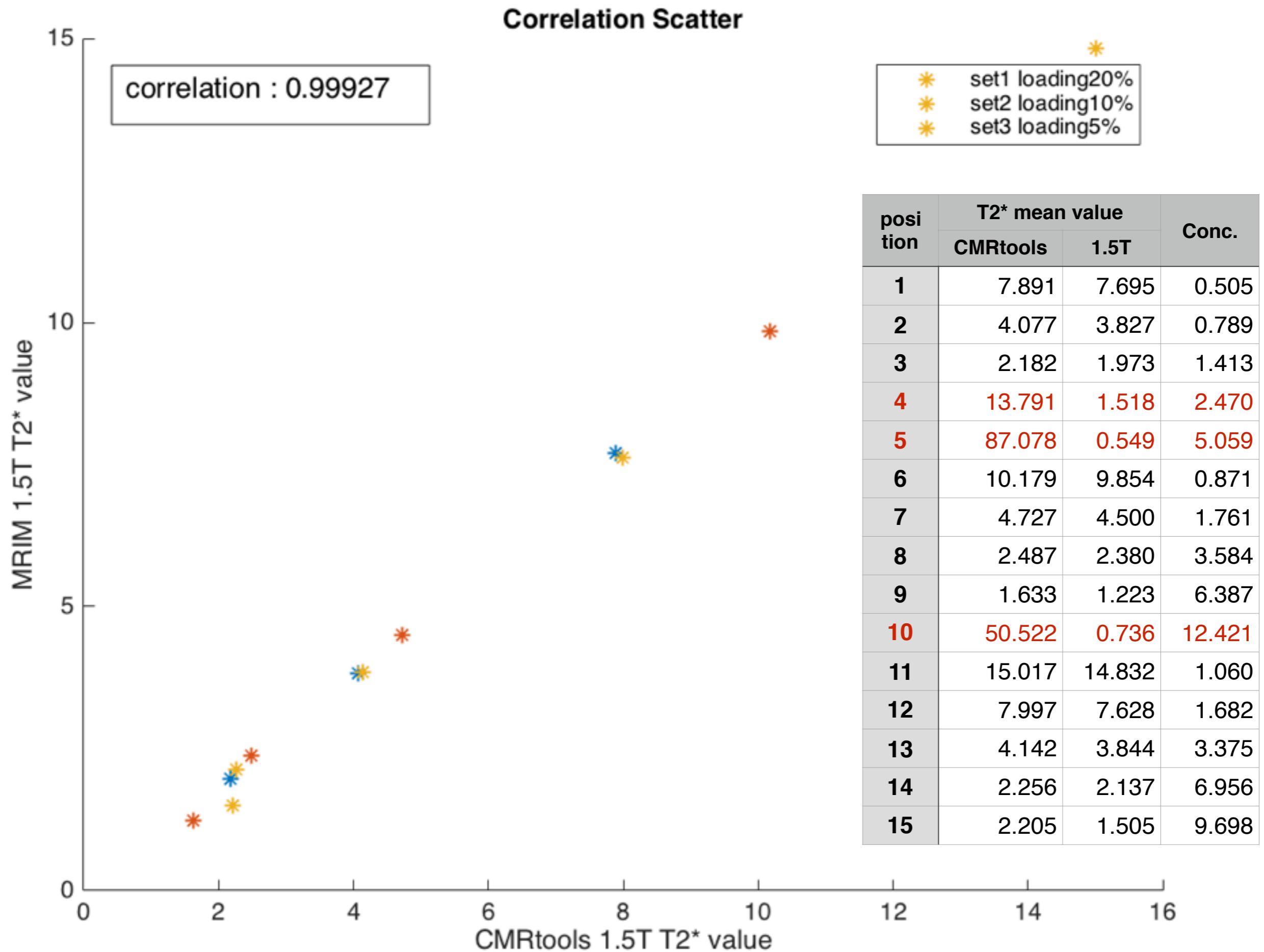


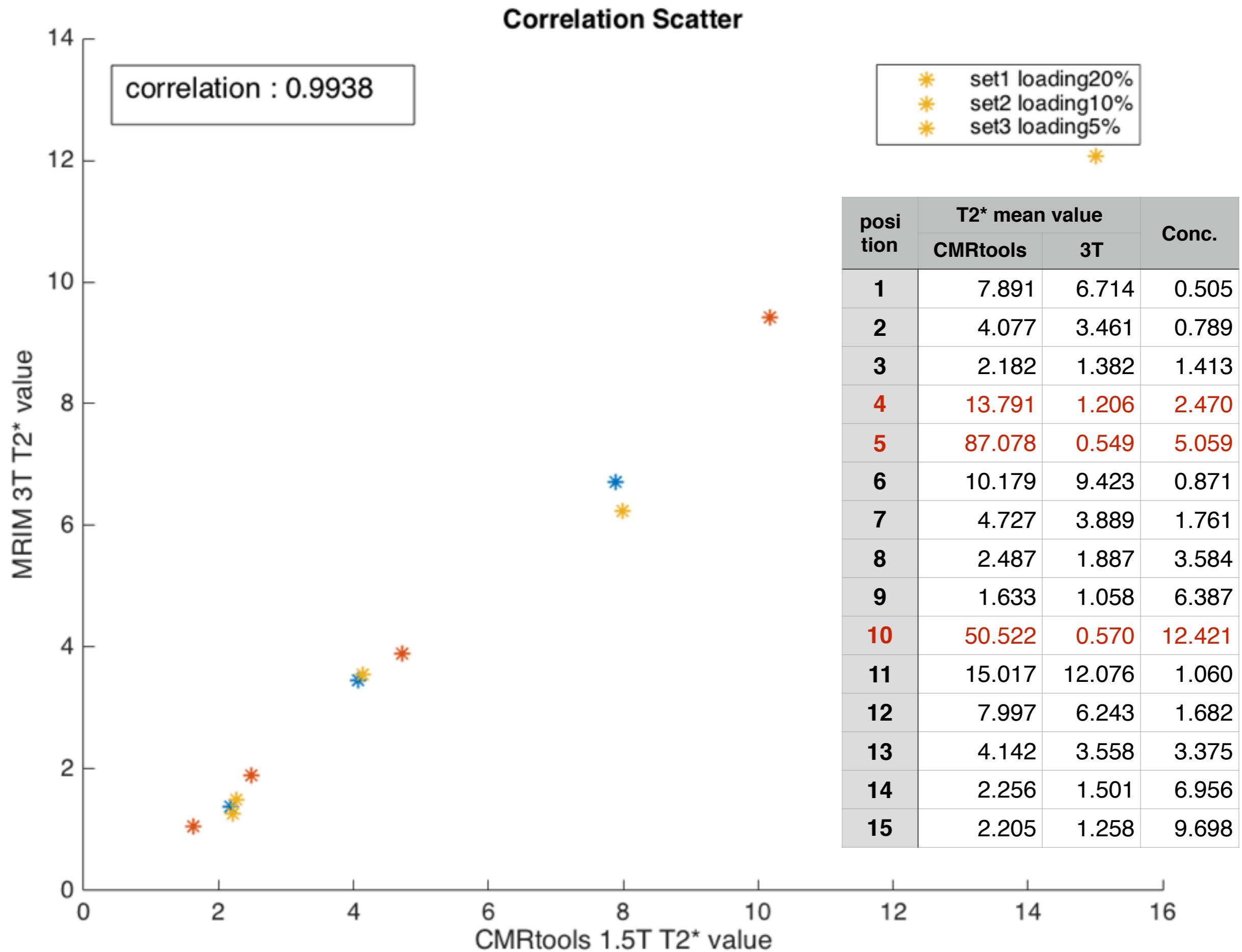
$T2^* = 0.549$   
MRIM 1.5T

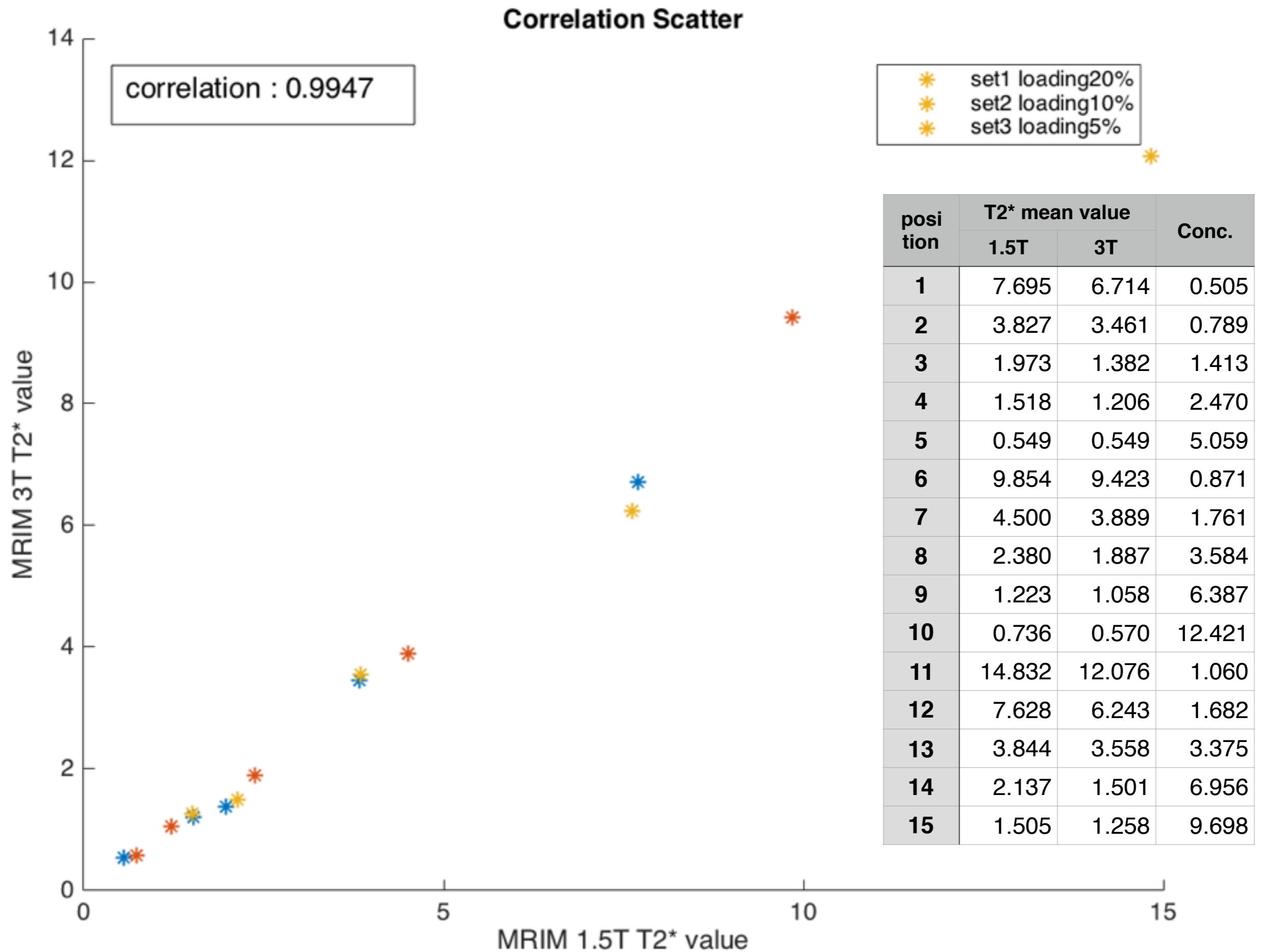


$T2^* = 0.549$   
MRIM 3T

position 5 Conc. 5.059



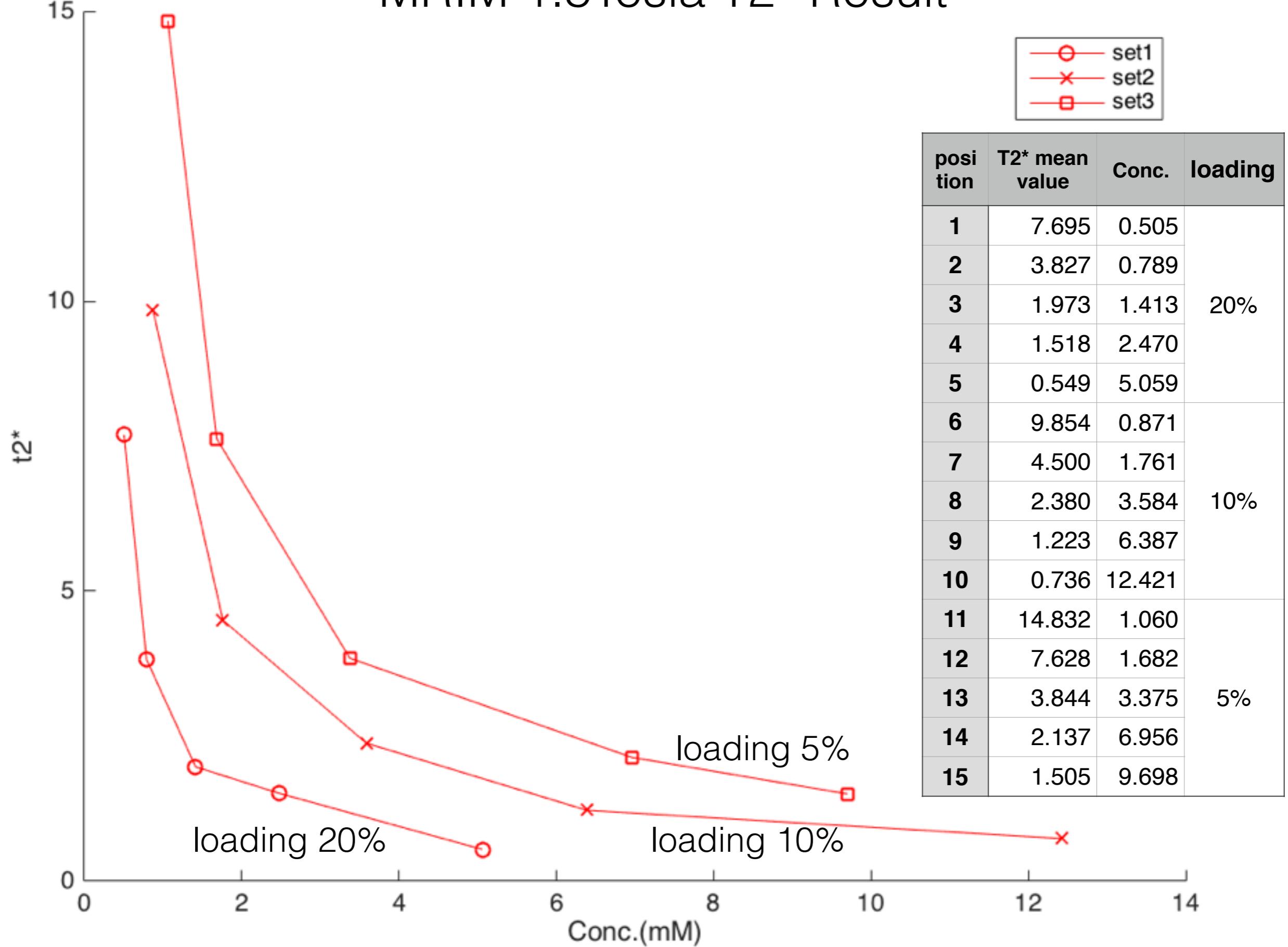




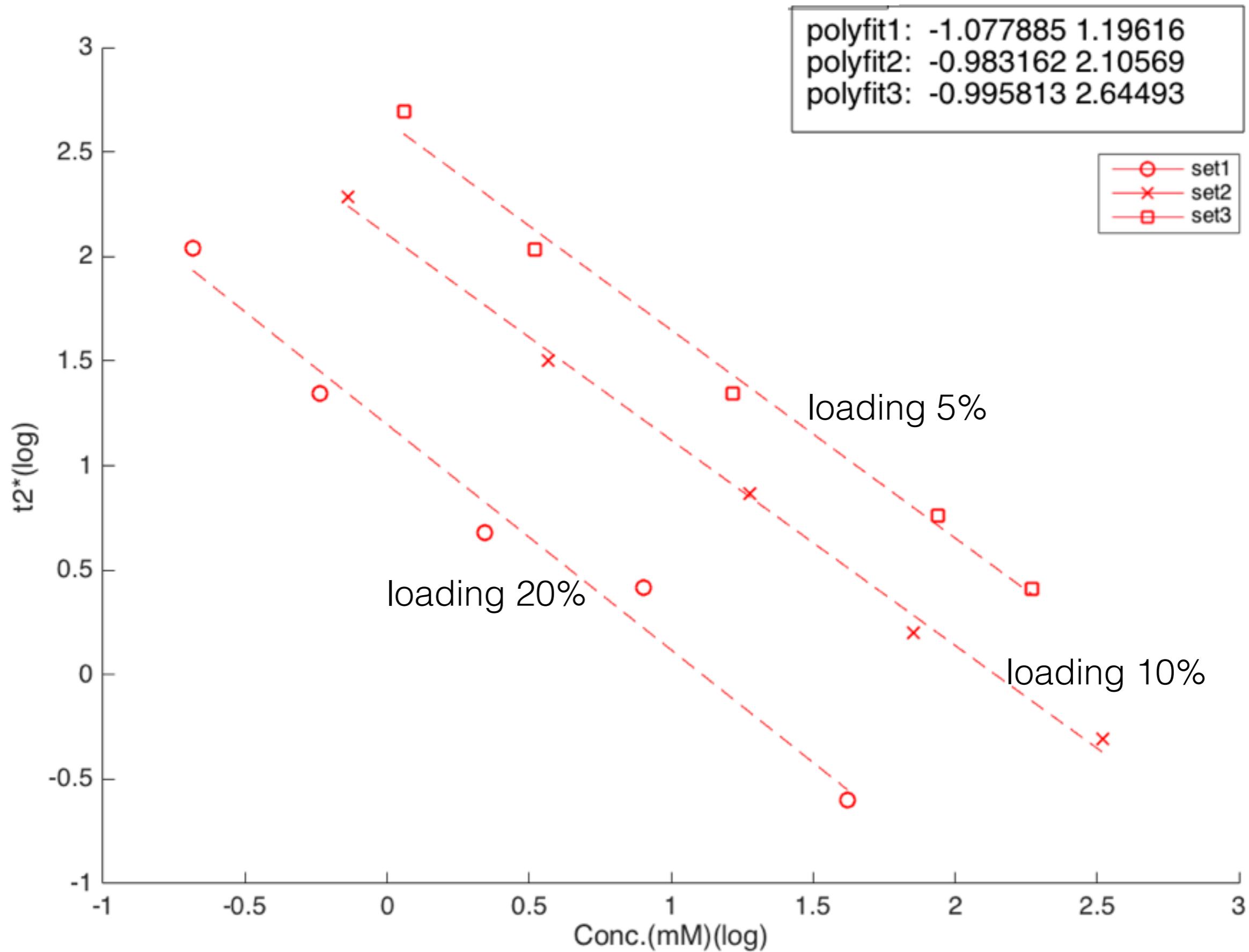
Correlation Between		r	n
CMRtools	MRIM 1.5T	0.9993	12
CMRtools	MRIM 3T	0.9938	12
MRIM 1.5T	MRIM 3T	0.9936	12*
MRIM 1.5T	MRIM 3T	0.9947	15

\*ตัด position ตาม CMRtool ที่ให้ผล error

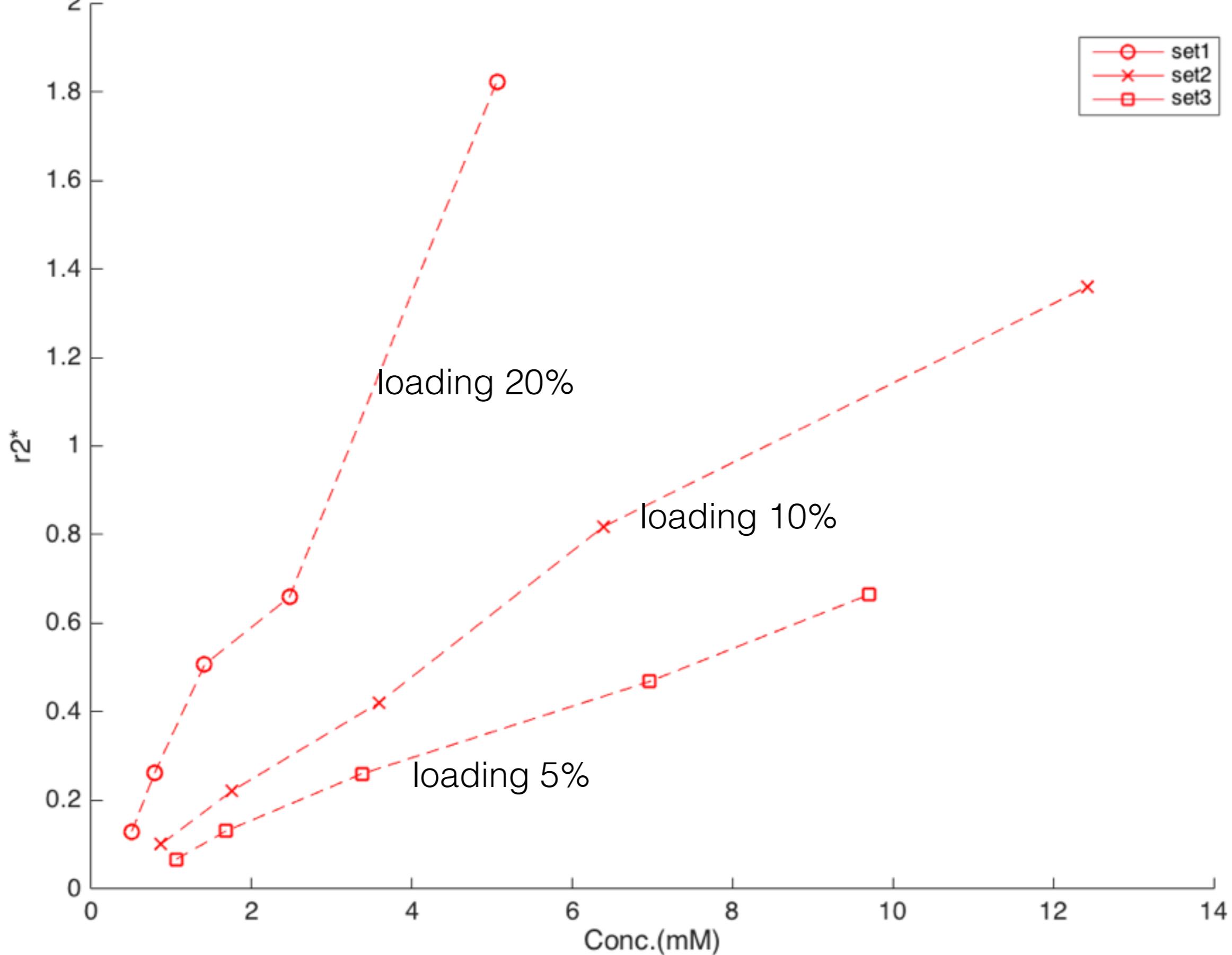
# MRIM 1.5Tesla T2\* Result



# MRIM 1.5Tesla T2\* Result



# MRIM 1.5Tesla R2\* Result



# MRIM 1.5Tesla R2\* Result

