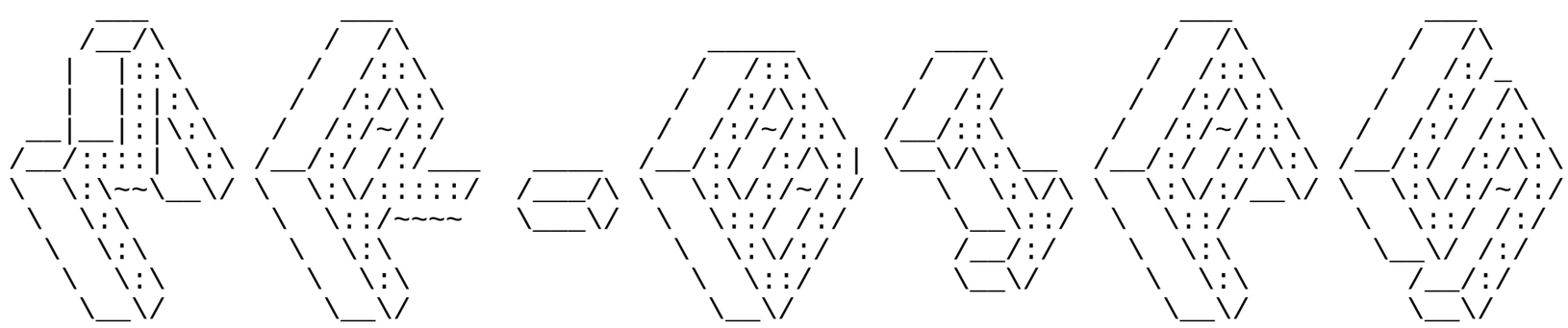

MR-BIAS v1.0.1 (released on 16th January 2023)

Source code: http://github.com/JamesCKorte/mrbias

Please cite the following publication:

TITLE: "Magnetic resonance biomarker assessment software (MR-BIAS): an automated open-source tool for the ISMRM/NIST system phantom"

AUTHORS: James C Korte, Zachary Chin, Madeline Carr, Lois Holloway, Rick Franich

JOURNAL: Physics in Medicine & Biology

YEAR: 2023

DOI: https://doi.org/10.1088/1361-6560/acbcbb

Image Sorting : Summary

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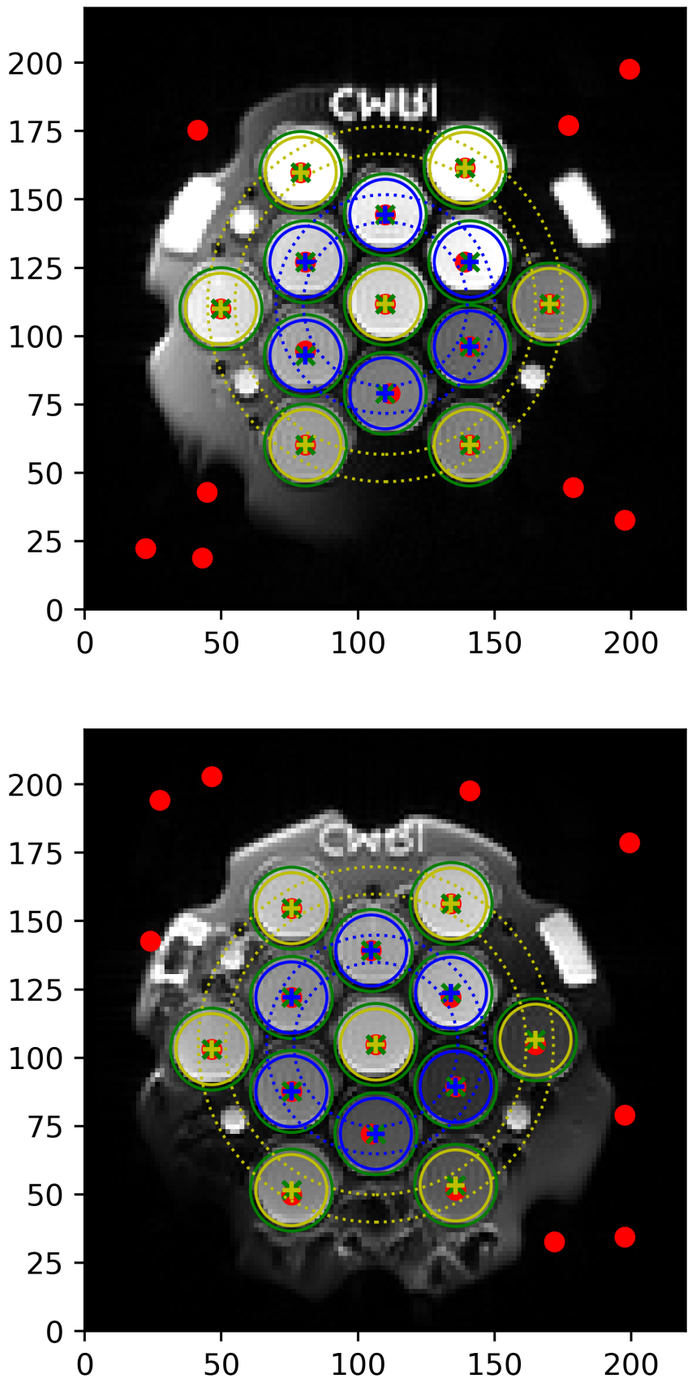

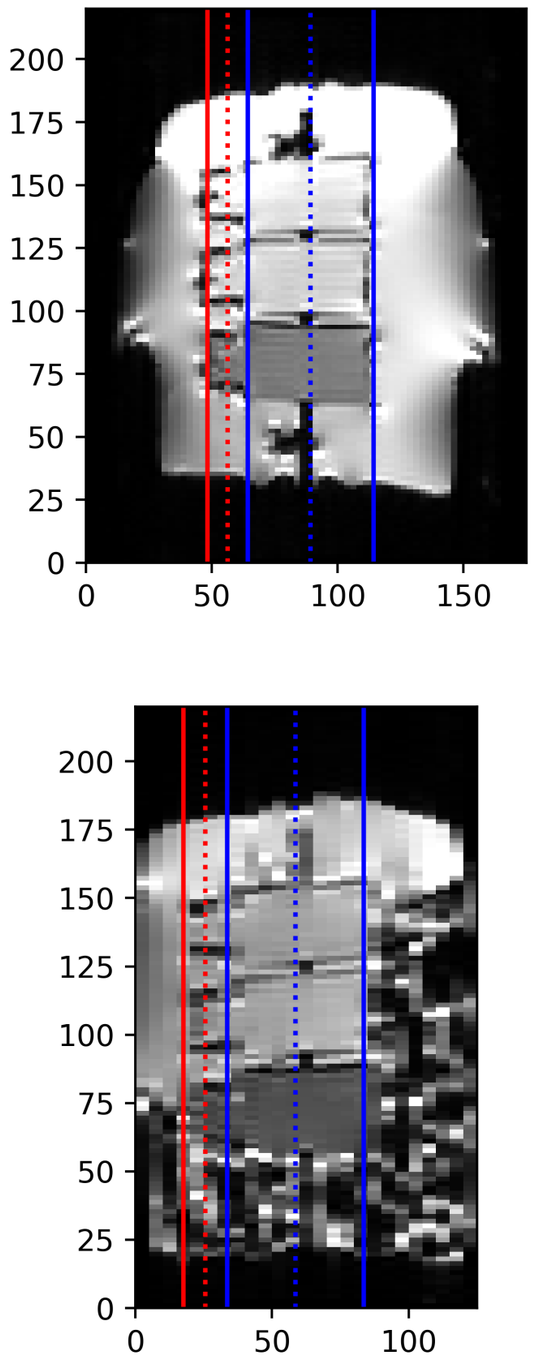

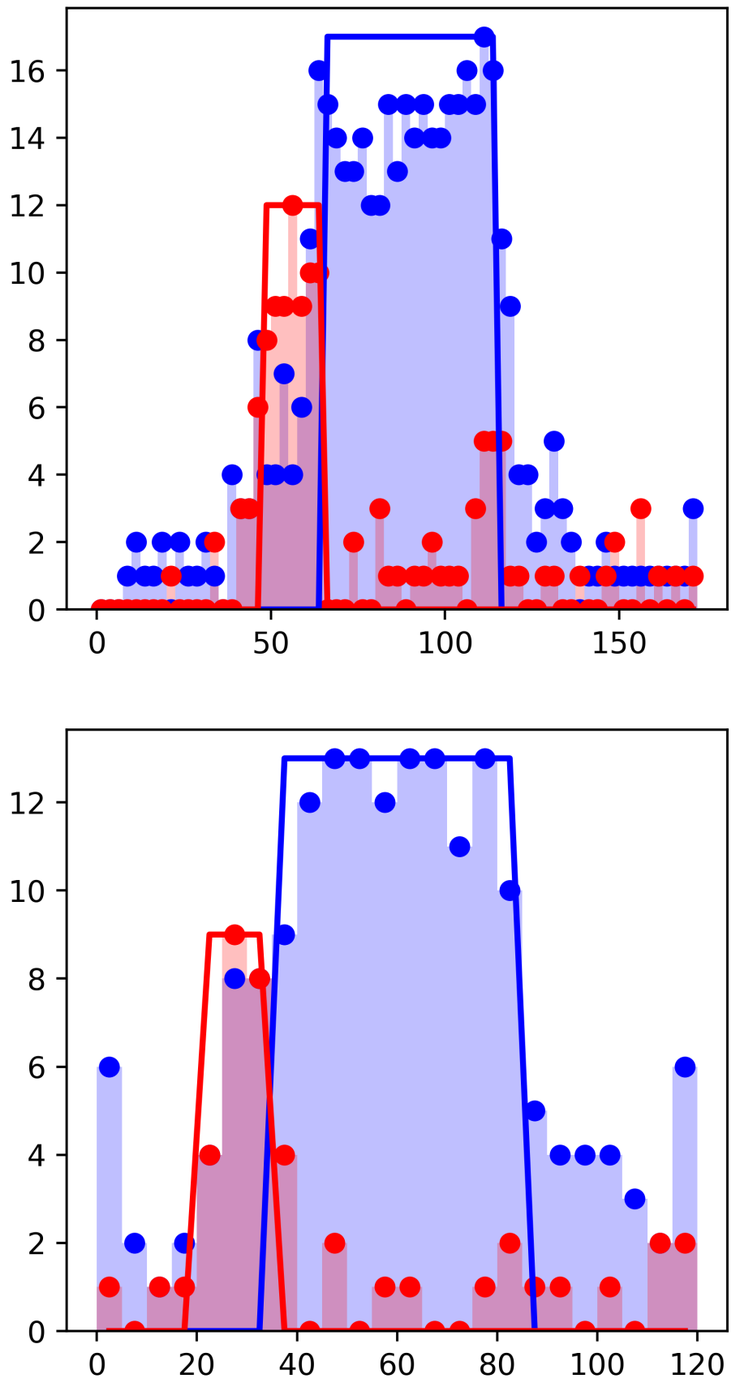

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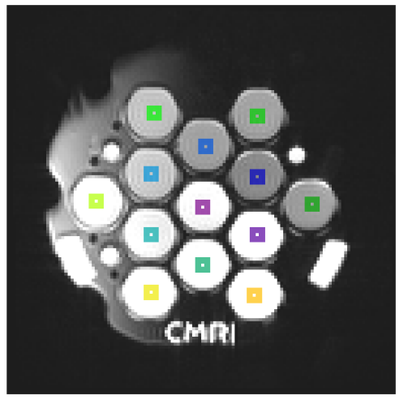

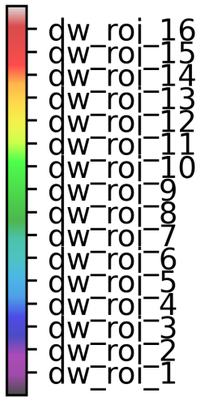

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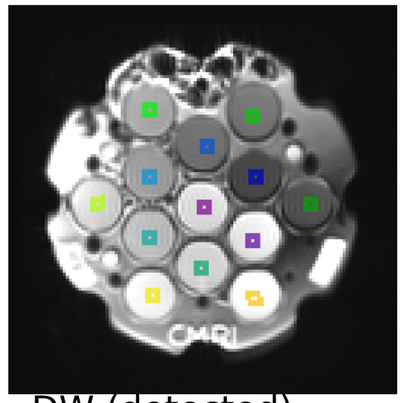

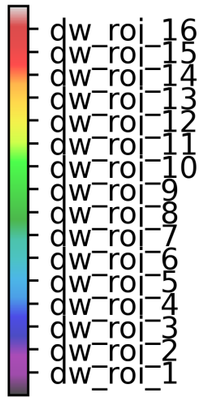

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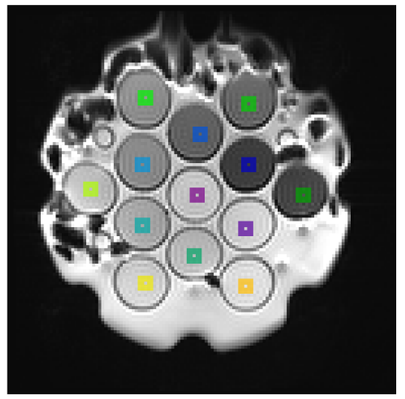

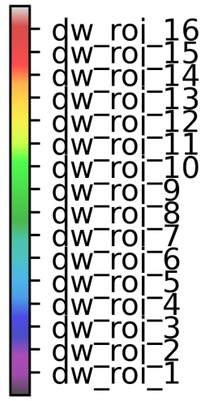

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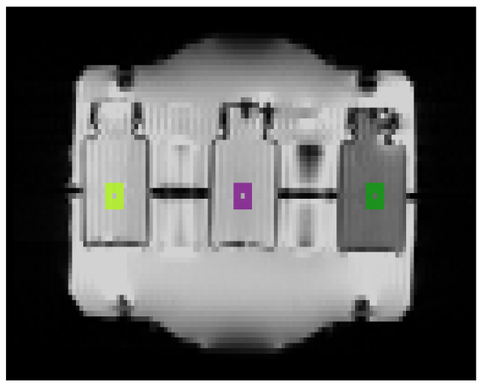

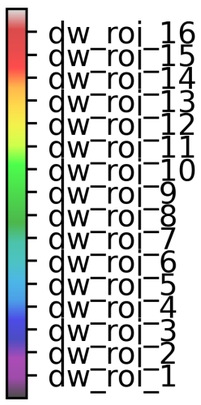

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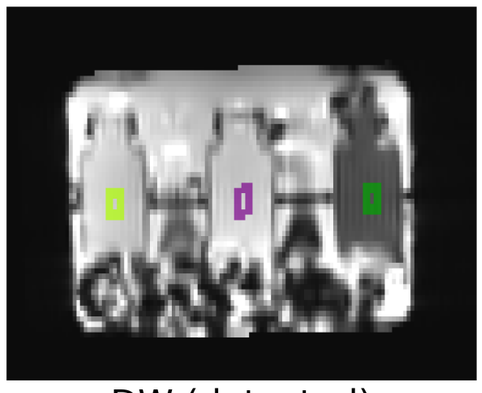

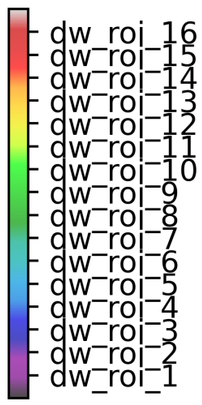

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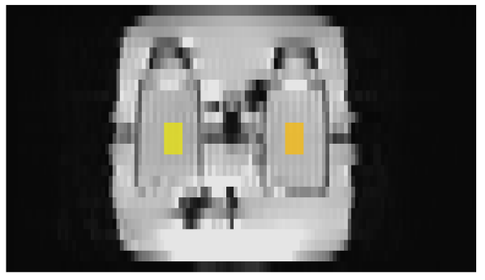

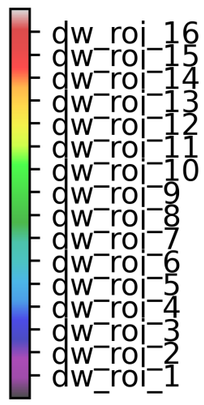

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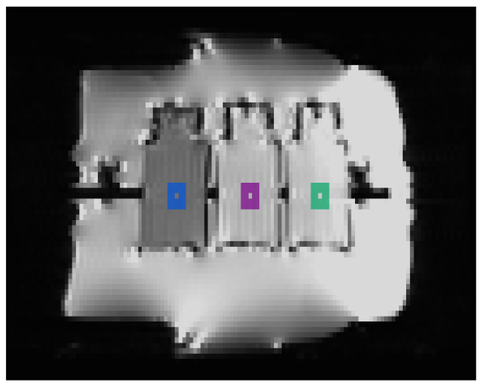

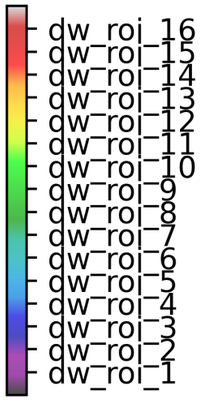

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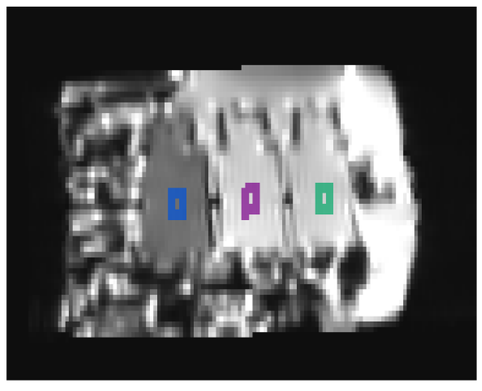

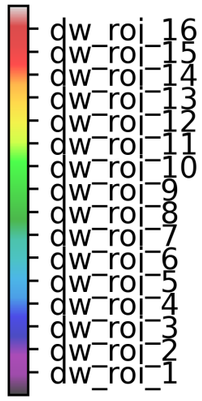

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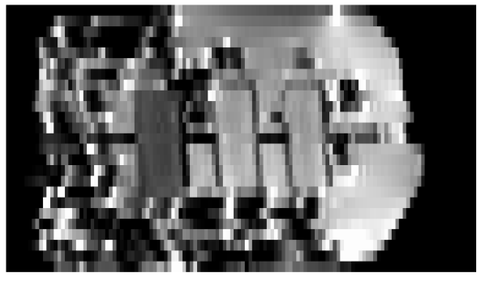

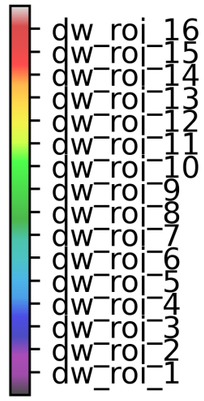

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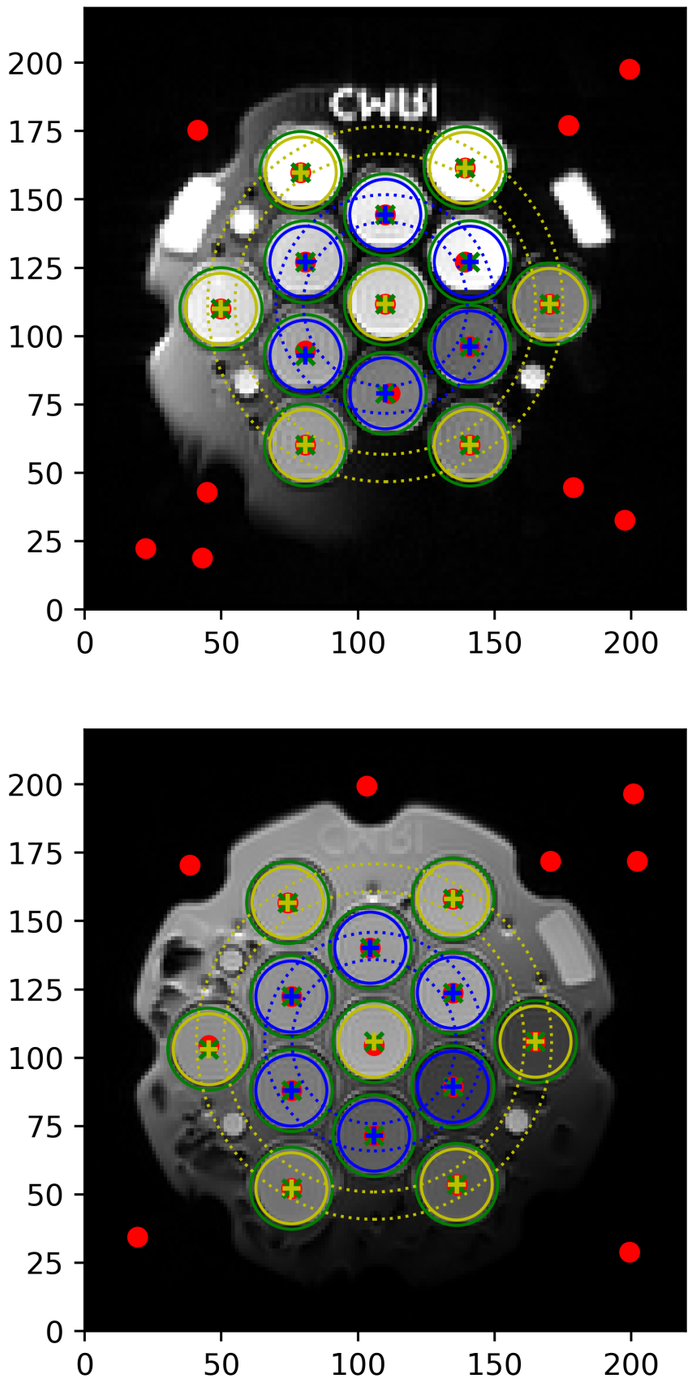

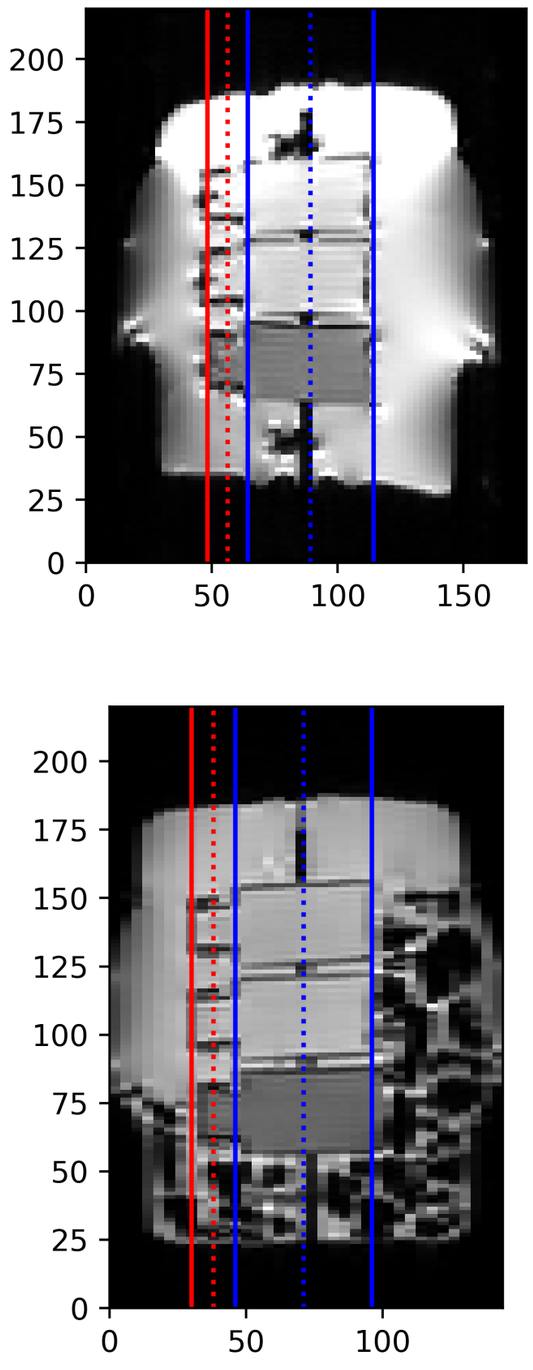

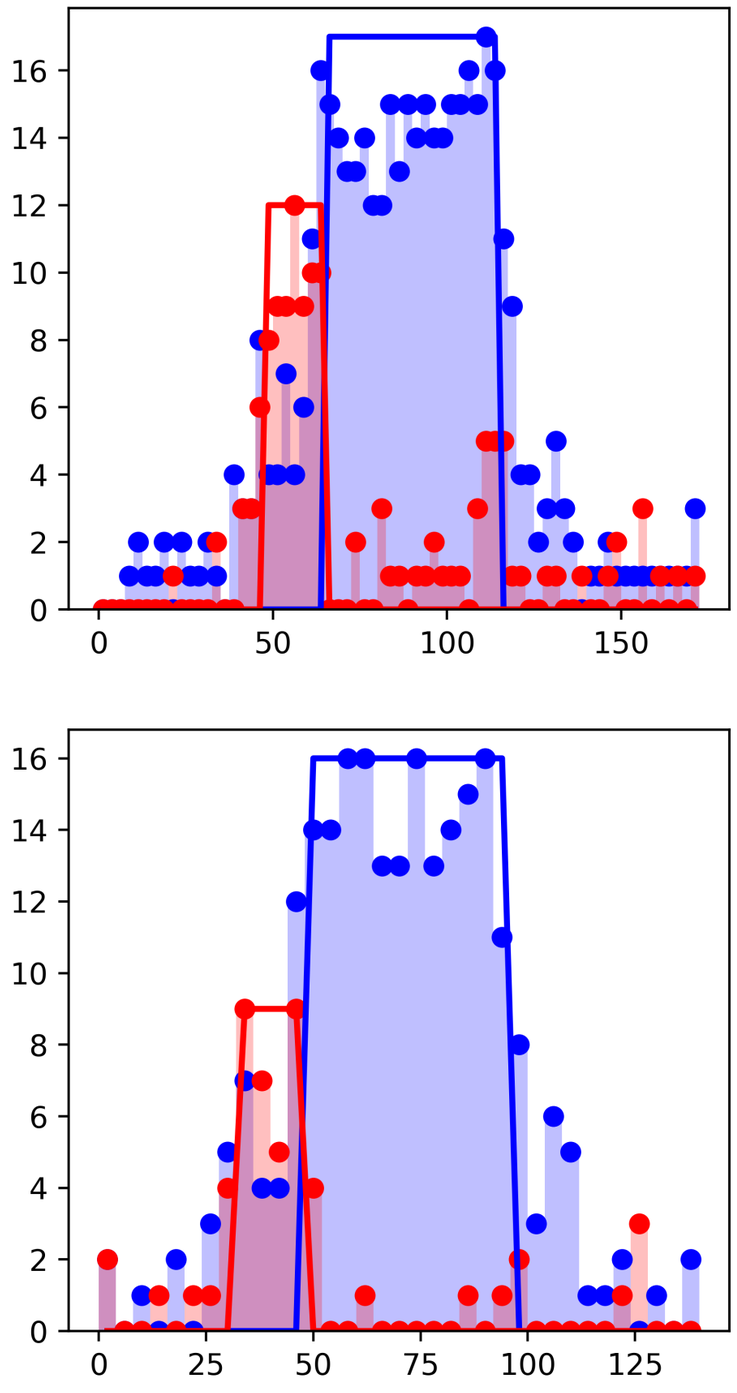

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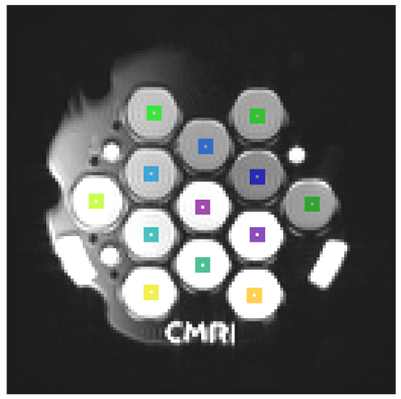

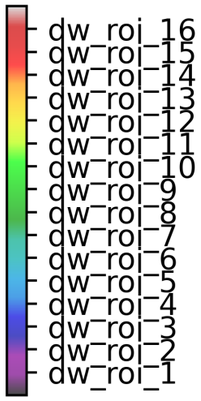

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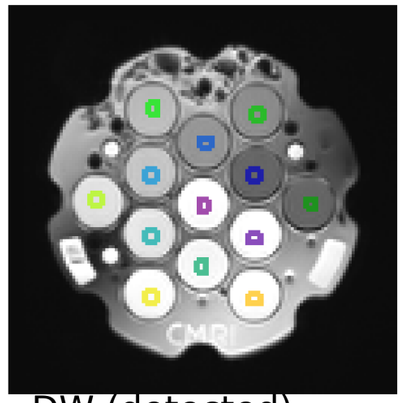

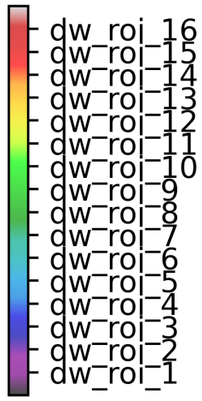

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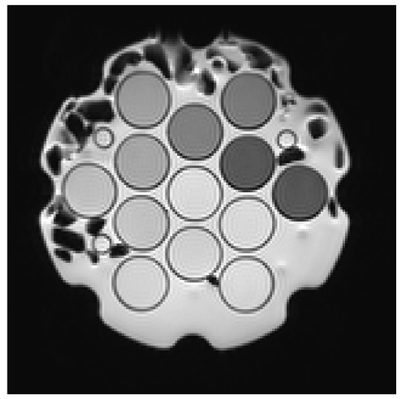

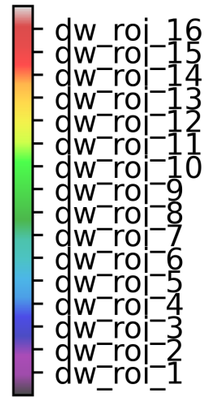

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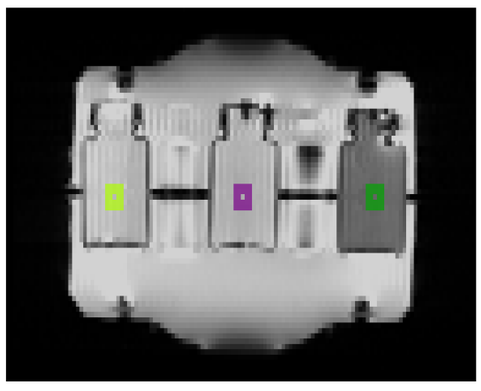

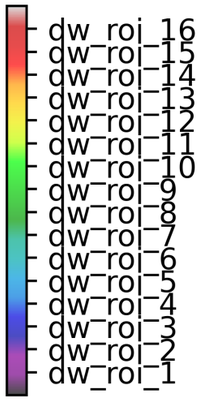

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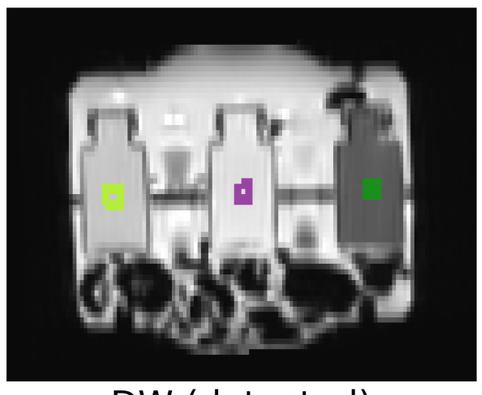

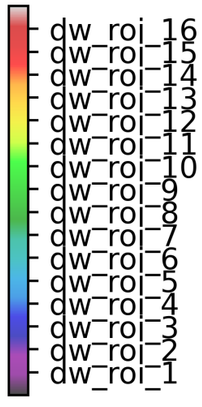

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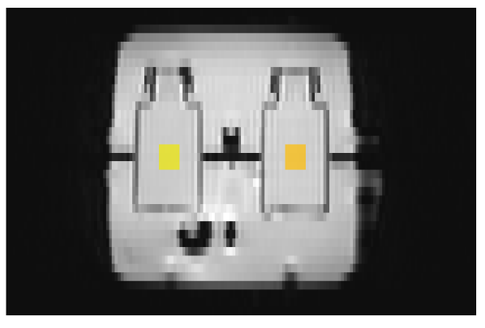

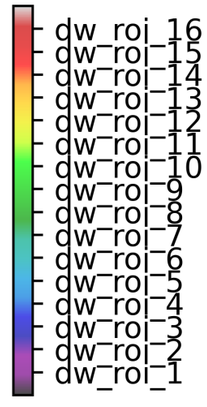

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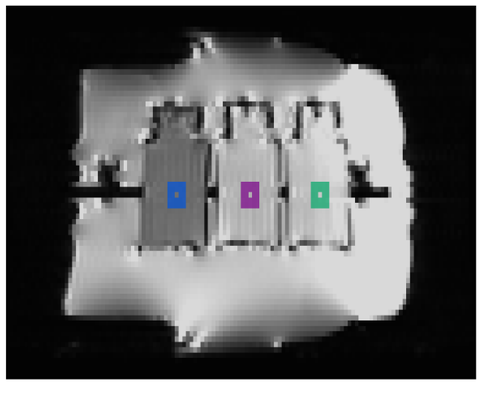

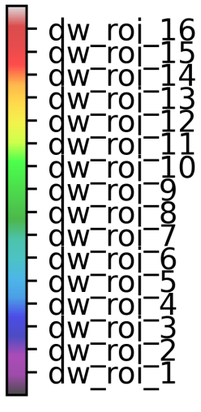

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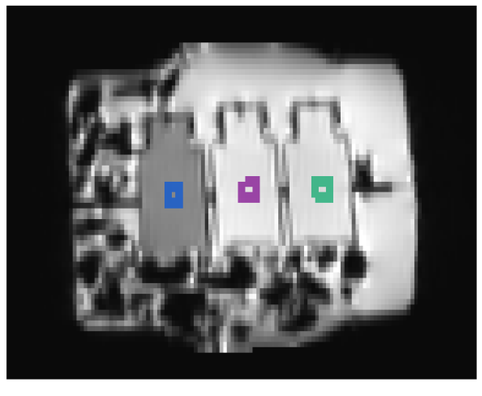

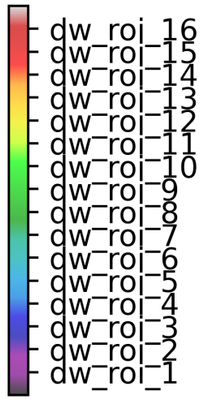

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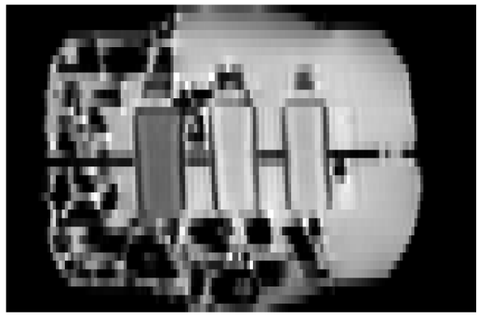

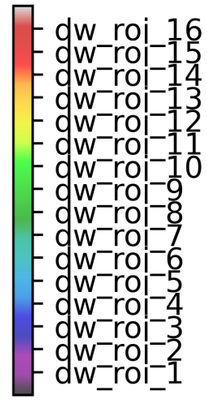

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39	dw_roi_3	122.8	1.0	12.8	11.6	110.0	2000.0	True	True	False
40	dw_roi_4	230.5	1.9	10.5	4.8	220.0	2000.0	True	True	False
41	dw_roi_5	406.2	1.0	26.2	6.9	380.0	2000.0	True	True	False
42	dw_roi_6	606.0	1.5	27.0	4.7	579.0	2000.0	True	True	False
43	dw_roi_7	845.7	1.7	28.7	3.5	817.0	2000.0	True	True	False
44	dw_roi_8	134.1	4.5	24.1	22.0	110.0	2000.0	True	True	False
45	dw_roi_9	230.3	1.7	10.3	4.7	220.0	2000.0	True	True	False
46	dw_roi_10	418.4	1.4	38.4	10.1	380.0	2000.0	True	True	False
47	dw_roi_11	615.4	1.2	36.4	6.3	579.0	2000.0	True	True	False
48	dw_roi_12	866.0	2.1	49.0	6.0	817.0	2000.0	True	True	False
49	dw_roi_13	1184.7	2.9	75.7	6.8	1109.0	2000.0	True	True	False

SIGNAL EQUATION:

$$\log(S(Bx) / S(0)) = -Bx * D$$

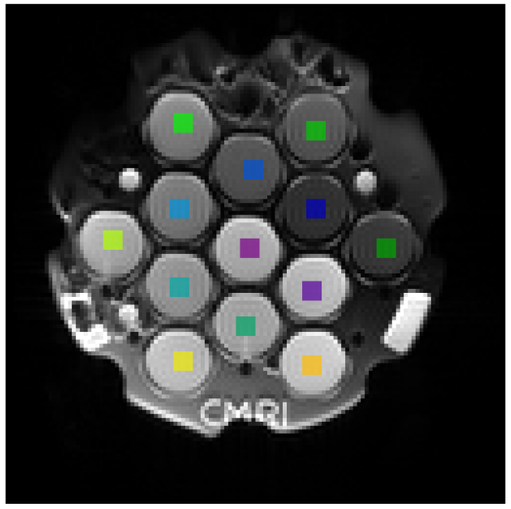
Parameter	Description	Init Val.	Min Val.	Max Val.
D	D	D	0.0	inf
Bx	b value	as measured	-	-

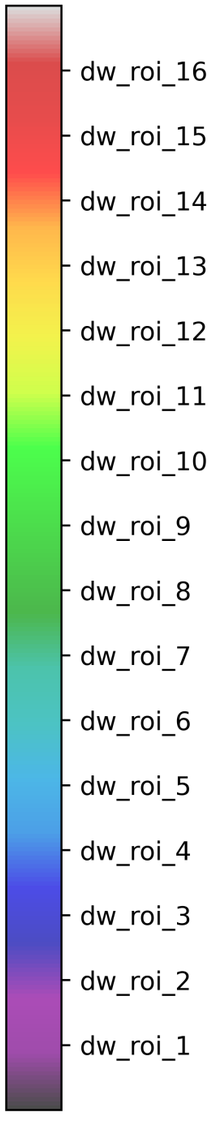
GOODNESS OF FIT:

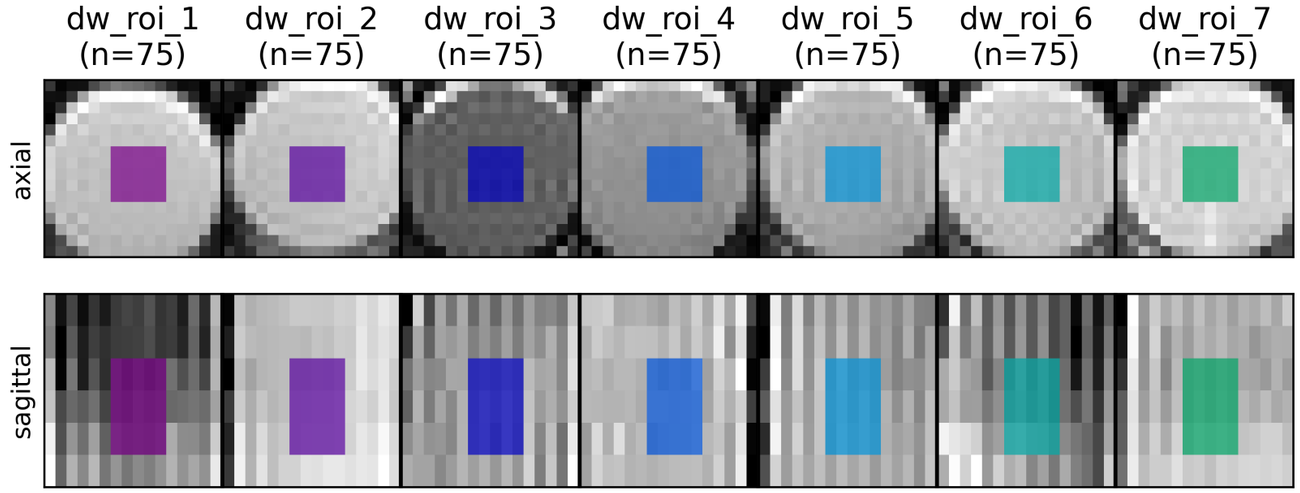
ROI_DX	ROI LABEL	chisqr	redchi	aic	bic
37	dw_roi_1	nan	nan	nan	nan
38	dw_roi_2	nan	nan	nan	nan
39	dw_roi_3	nan	nan	nan	nan
40	dw_roi_4	nan	nan	nan	nan
41	dw_roi_5	nan	nan	nan	nan
42	dw_roi_6	nan	nan	nan	nan
43	dw_roi_7	nan	nan	nan	nan
44	dw_roi_8	nan	nan	nan	nan
45	dw_roi_9	nan	nan	nan	nan
46	dw_roi_10	nan	nan	nan	nan
47	dw_roi_11	nan	nan	nan	nan
48	dw_roi_12	nan	nan	nan	nan
49	dw_roi_13	nan	nan	nan	nan

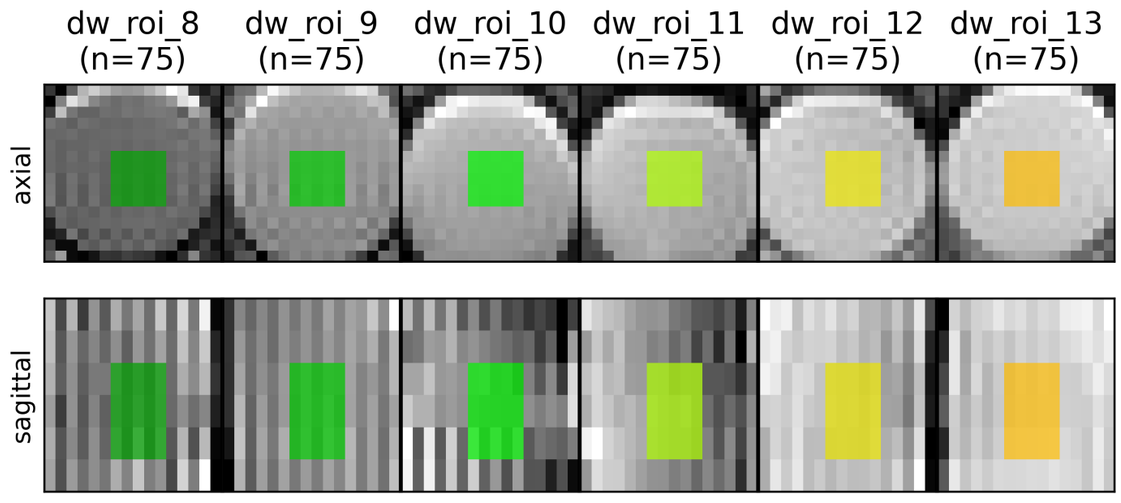
chisqr : Chi-square statistic
redchi : Reduced Chi-square statistic
aic : Akaike Information Criterion statistic
bic : Bayesian Information Criterion statistic

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_000>

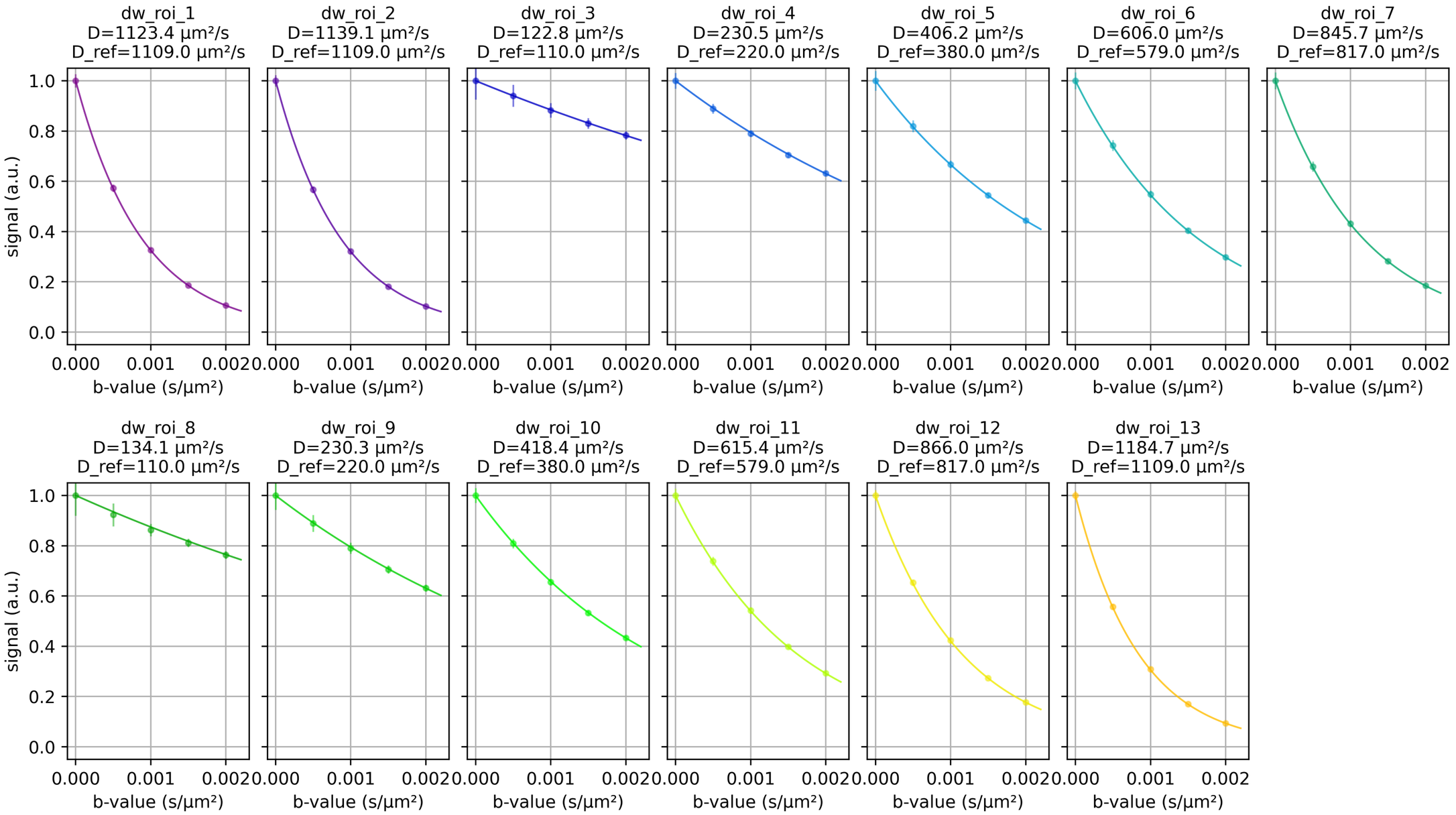






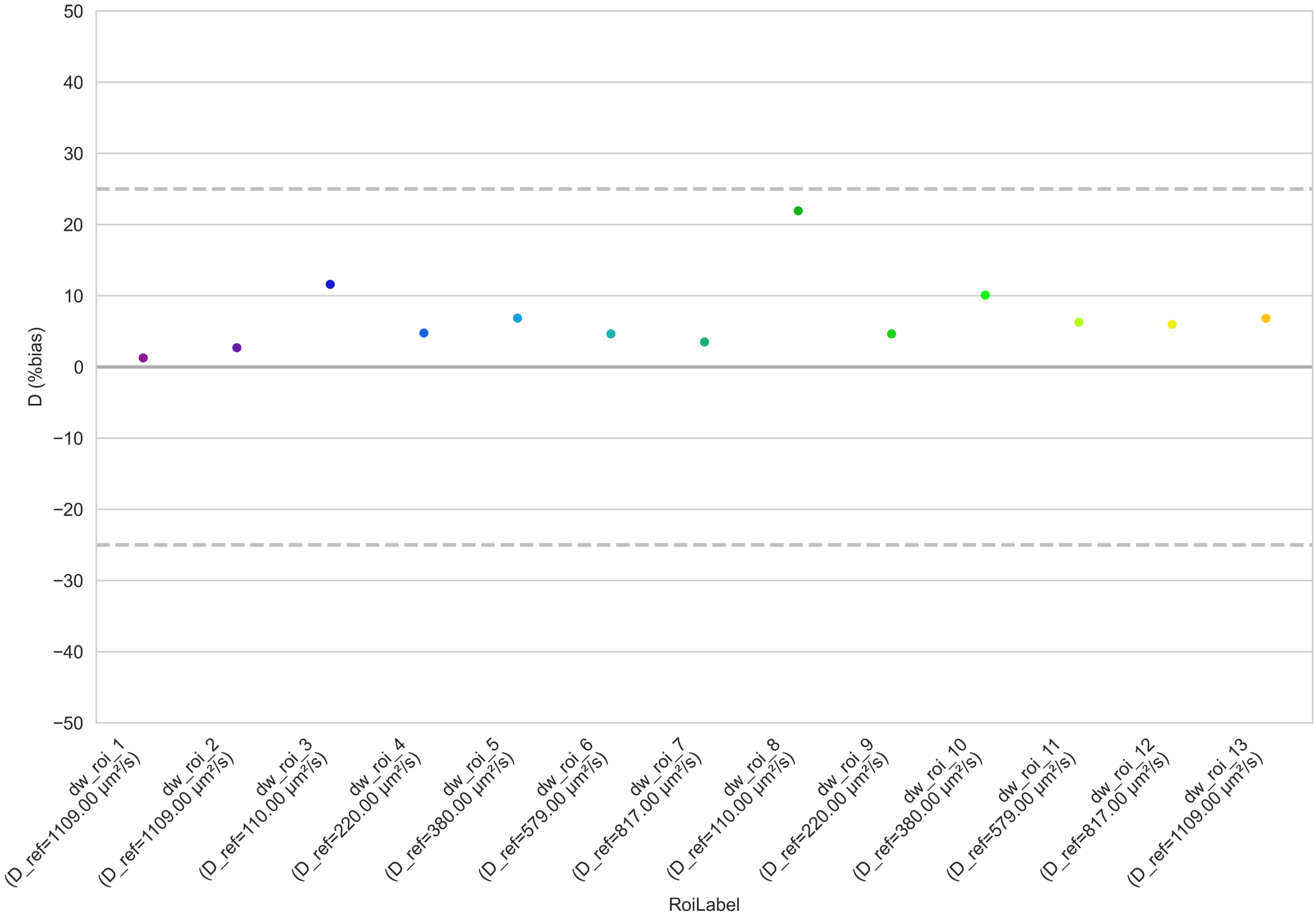


CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_000>



Included measurements are denoted with colour markers. Excluded measurements are denoted with black markers for (crosses) clipped or (circles) user excluded measurements.

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_000>



CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_001>

ROI_DX	ROI LABEL	D	D_var	D_err	D_pct.err	D_ref	D_init	AVRGD	NORMLD	CLIPD
37	dw_roi_1	1121.5	0.9	12.5	1.1	1109.0	2000.0	True	True	False
38	dw_roi_2	1139.6	0.6	30.6	2.8	1109.0	2000.0	True	True	False
39	dw_roi_3	121.1	1.4	11.1	10.0	110.0	2000.0	True	True	False
40	dw_roi_4	229.9	1.7	9.9	4.5	220.0	2000.0	True	True	False
41	dw_roi_5	404.9	1.2	24.9	6.6	380.0	2000.0	True	True	False
42	dw_roi_6	604.9	1.1	25.9	4.5	579.0	2000.0	True	True	False
43	dw_roi_7	845.9	1.7	28.9	3.5	817.0	2000.0	True	True	False
44	dw_roi_8	134.5	5.8	24.5	22.3	110.0	2000.0	True	True	False
45	dw_roi_9	231.1	2.3	11.1	5.0	220.0	2000.0	True	True	False
46	dw_roi_10	418.7	1.0	38.7	10.2	380.0	2000.0	True	True	False
47	dw_roi_11	614.9	1.2	35.9	6.2	579.0	2000.0	True	True	False
48	dw_roi_12	872.8	1.9	55.8	6.8	817.0	2000.0	True	True	False
49	dw_roi_13	1192.6	2.4	83.6	7.5	1109.0	2000.0	True	True	False

SIGNAL EQUATION:

log(S(Bx) / S(0)) = -Bx * D

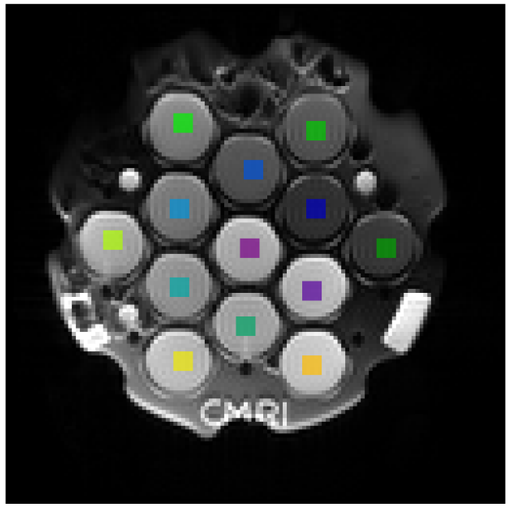
Parameter	Description	Init Val.	Min Val.	Max Val.
D	D	D	0.0	inf
Bx	b value	as measured	-	-

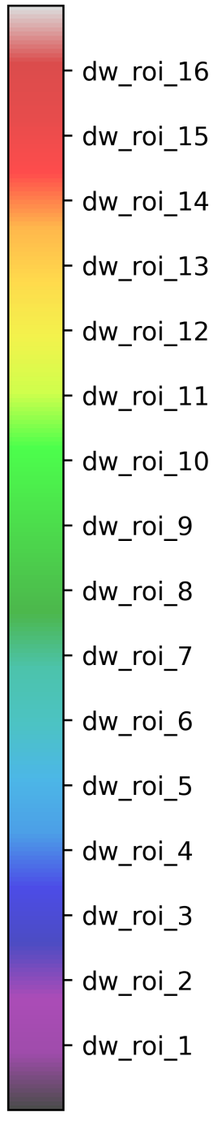
GOODNESS OF FIT:

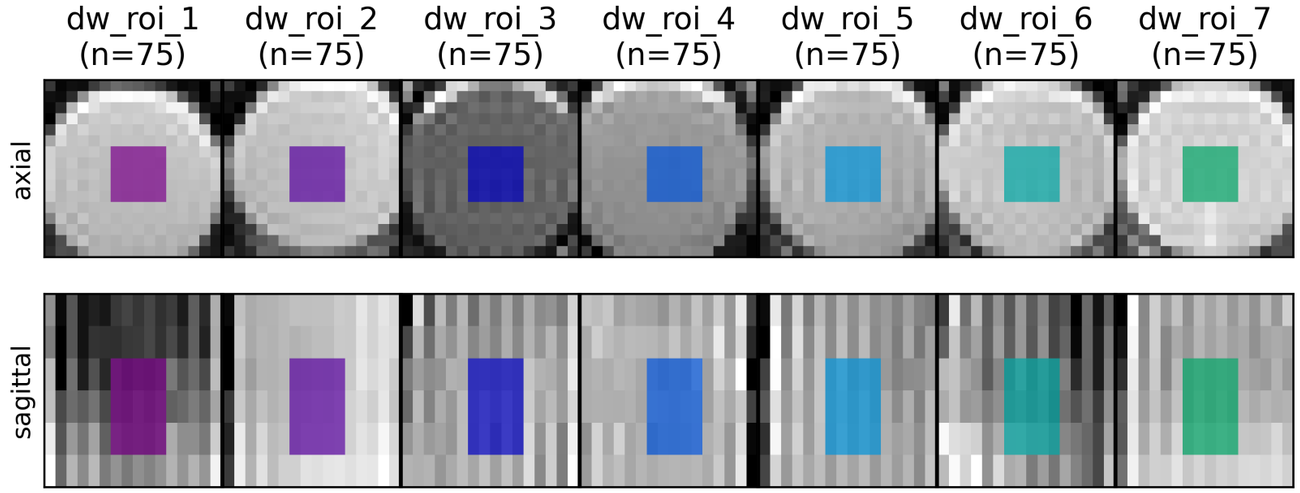
ROI_DX	ROI LABEL	chisqr	redchi	aic	bic
37	dw_roi_1	nan	nan	nan	nan
38	dw_roi_2	nan	nan	nan	nan
39	dw_roi_3	nan	nan	nan	nan
40	dw_roi_4	nan	nan	nan	nan
41	dw_roi_5	nan	nan	nan	nan
42	dw_roi_6	nan	nan	nan	nan
43	dw_roi_7	nan	nan	nan	nan
44	dw_roi_8	nan	nan	nan	nan
45	dw_roi_9	nan	nan	nan	nan
46	dw_roi_10	nan	nan	nan	nan
47	dw_roi_11	nan	nan	nan	nan
48	dw_roi_12	nan	nan	nan	nan
49	dw_roi_13	nan	nan	nan	nan

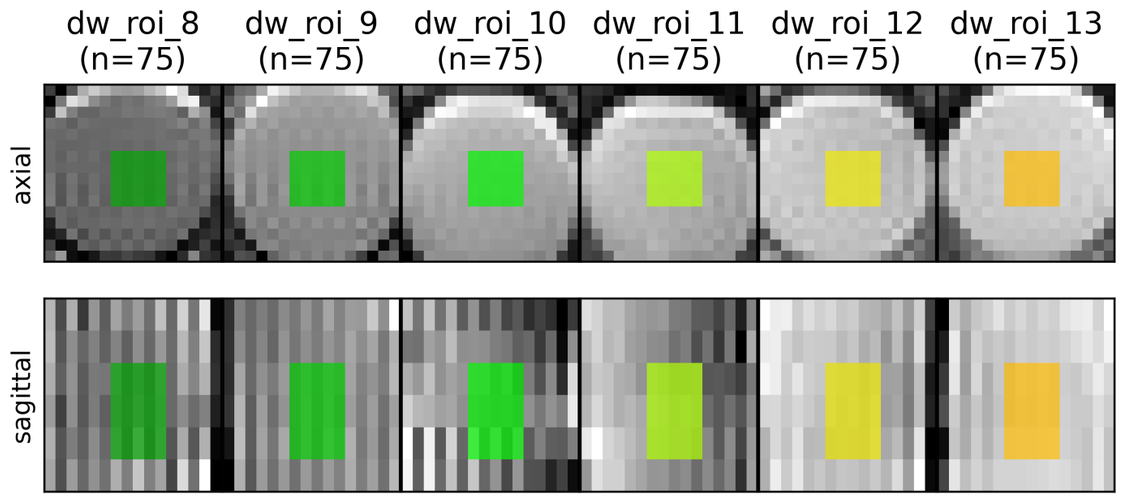
chisqr : Chi-square statistic
redchi : Reduced Chi-square statistic
aic : Akaike Information Criterion statistic
bic : Bayesian Information Criterion statistic

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_001>

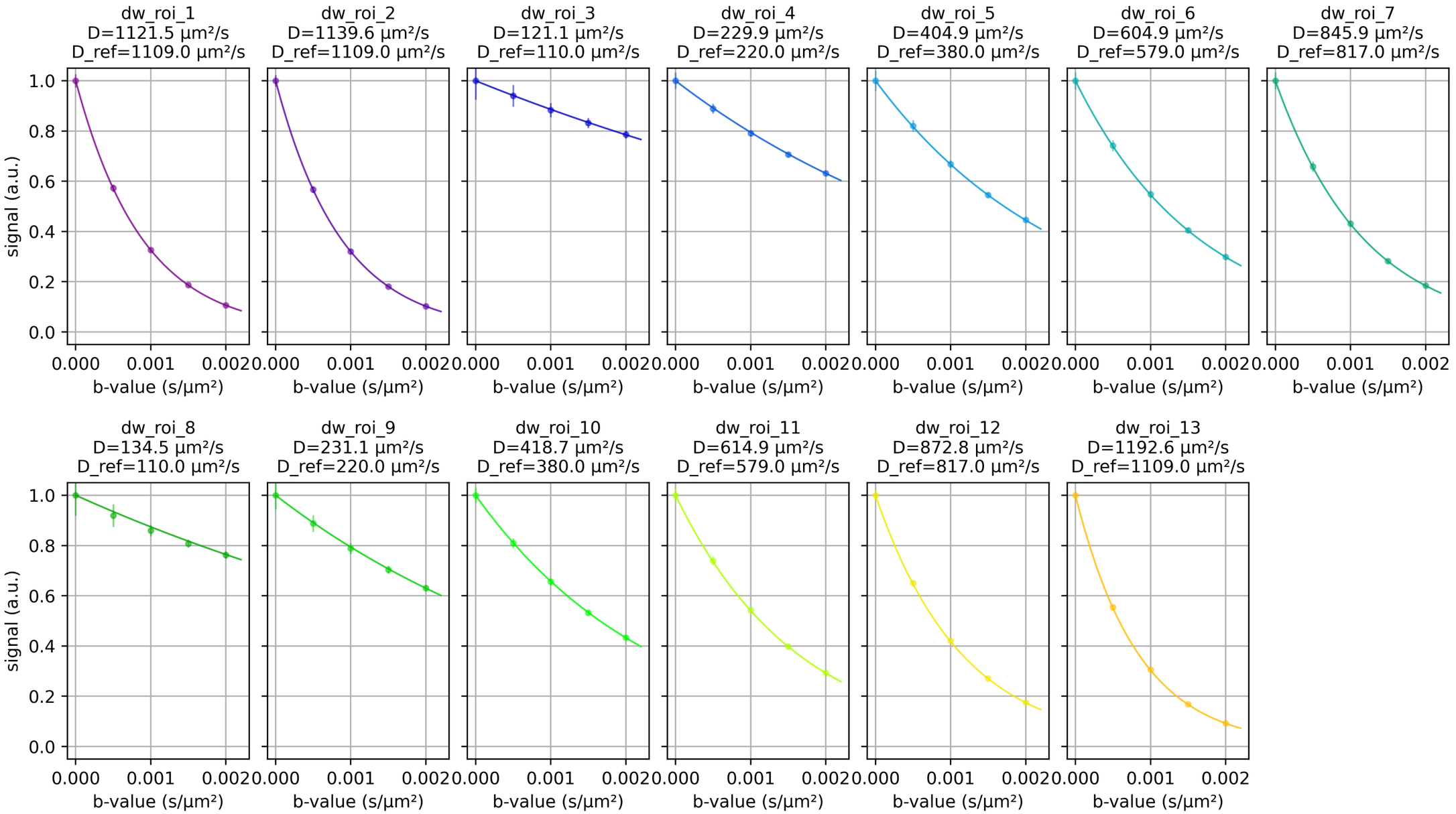






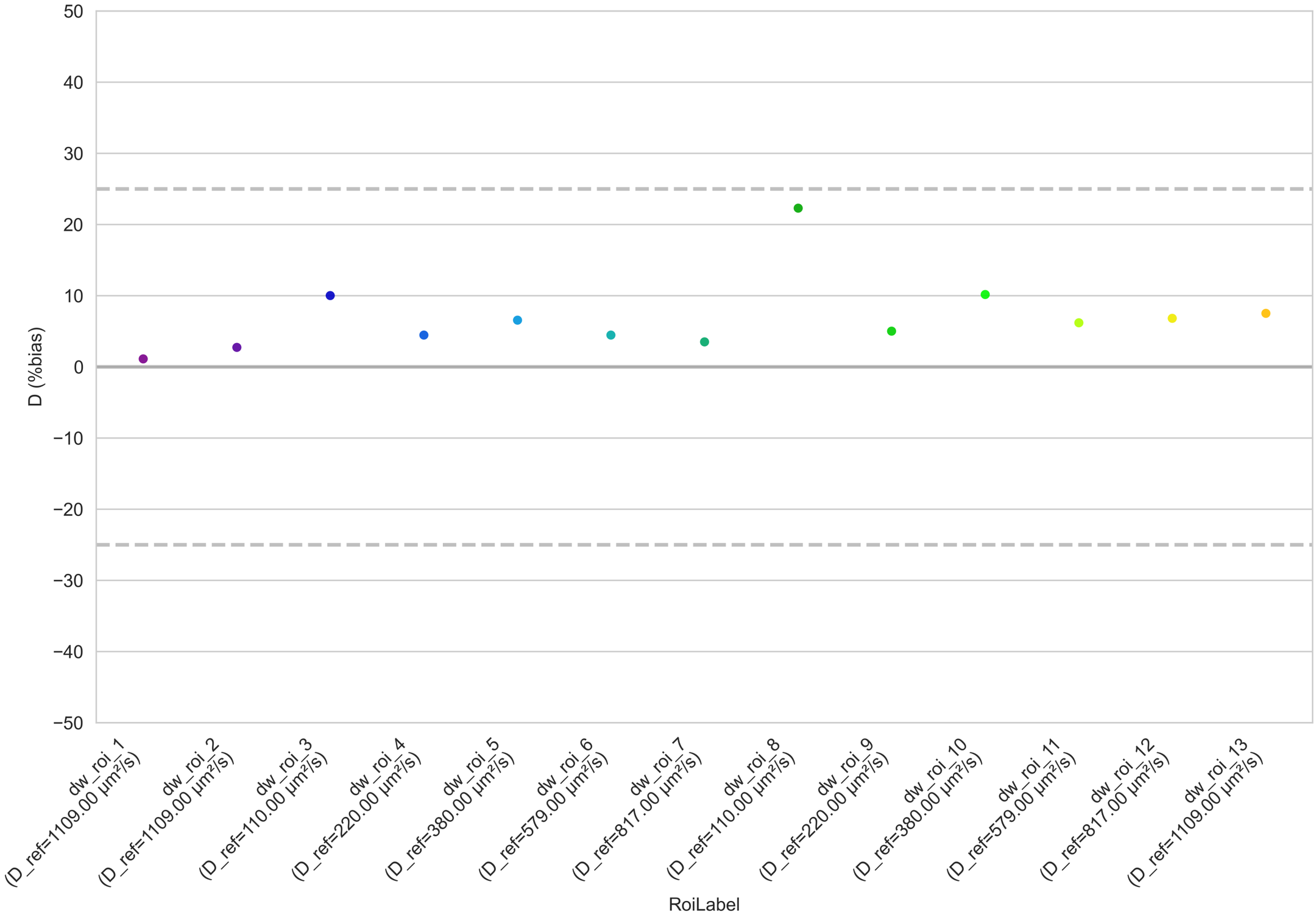


CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_001>



Included measurements are denoted with colour markers. Excluded measurements are denoted with black markers for (crosses) clipped or (circles) user excluded measurements.

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_001>



CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_002>

ROI_DX	ROI LABEL	D	D_var	D_err	D_pct.err	D_ref	D_init	AVRGD	NORMLD	CLIPD
37	dw_roi_1	1123.4	1.3	14.4	1.3	1109.0	2000.0	True	True	False
38	dw_roi_2	1140.8	0.7	31.8	2.9	1109.0	2000.0	True	True	False
39	dw_roi_3	120.9	1.7	10.9	9.9	110.0	2000.0	True	True	False
40	dw_roi_4	229.2	2.1	9.2	4.2	220.0	2000.0	True	True	False
41	dw_roi_5	405.1	0.8	25.1	6.6	380.0	2000.0	True	True	False
42	dw_roi_6	606.5	1.1	27.5	4.7	579.0	2000.0	True	True	False
43	dw_roi_7	849.3	1.4	32.3	3.9	817.0	2000.0	True	True	False
44	dw_roi_8	135.4	5.8	25.4	23.1	110.0	2000.0	True	True	False
45	dw_roi_9	229.9	2.3	9.9	4.5	220.0	2000.0	True	True	False
46	dw_roi_10	418.5	1.0	38.5	10.1	380.0	2000.0	True	True	False
47	dw_roi_11	615.7	1.0	36.7	6.3	579.0	2000.0	True	True	False
48	dw_roi_12	878.7	1.7	61.7	7.5	817.0	2000.0	True	True	False
49	dw_roi_13	1200.2	2.1	91.2	8.2	1109.0	2000.0	True	True	False

SIGNAL EQUATION:

log(S(Bx) / S(0)) = -Bx * D

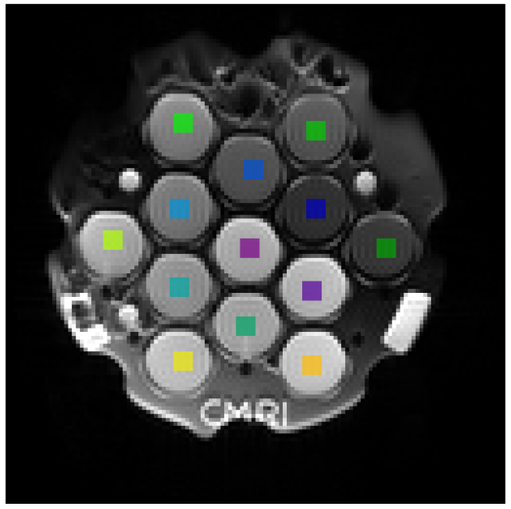
Parameter	Description	Init Val.	Min Val.	Max Val.
D	D	D	0.0	inf
Bx	b value	as measured	-	-

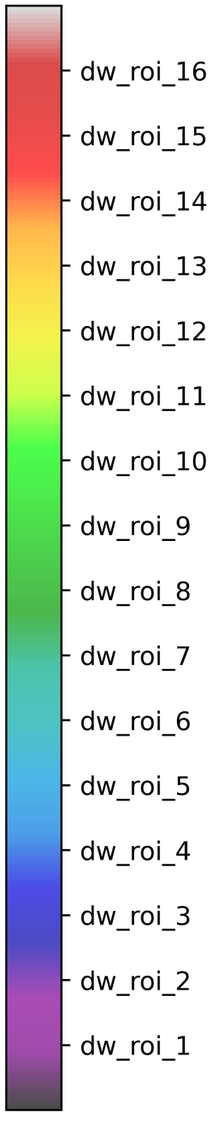
GOODNESS OF FIT:

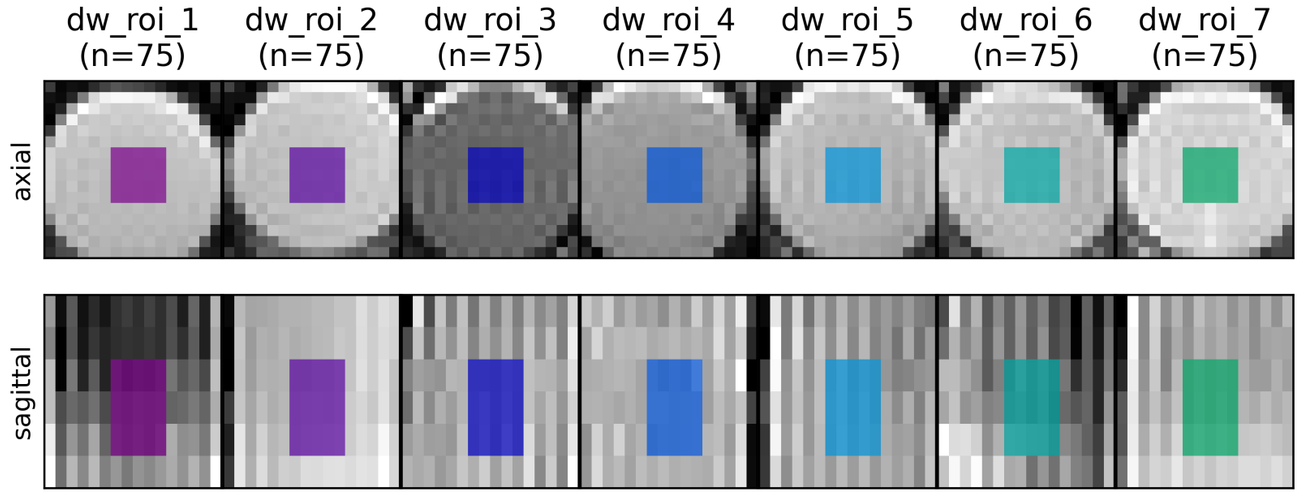
ROI_DX	ROI LABEL	chisqr	redchi	aic	bic
37	dw_roi_1	nan	nan	nan	nan
38	dw_roi_2	nan	nan	nan	nan
39	dw_roi_3	nan	nan	nan	nan
40	dw_roi_4	nan	nan	nan	nan
41	dw_roi_5	nan	nan	nan	nan
42	dw_roi_6	nan	nan	nan	nan
43	dw_roi_7	nan	nan	nan	nan
44	dw_roi_8	nan	nan	nan	nan
45	dw_roi_9	nan	nan	nan	nan
46	dw_roi_10	nan	nan	nan	nan
47	dw_roi_11	nan	nan	nan	nan
48	dw_roi_12	nan	nan	nan	nan
49	dw_roi_13	nan	nan	nan	nan

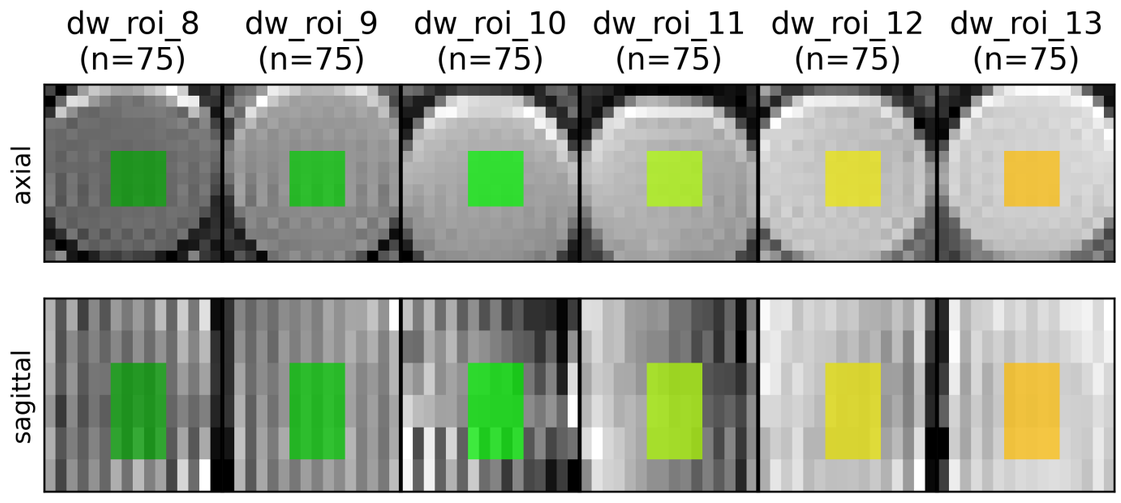
chisqr : Chi-square statistic
redchi : Reduced Chi-square statistic
aic : Akaike Information Criterion statistic
bic : Bayesian Information Criterion statistic

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_002>

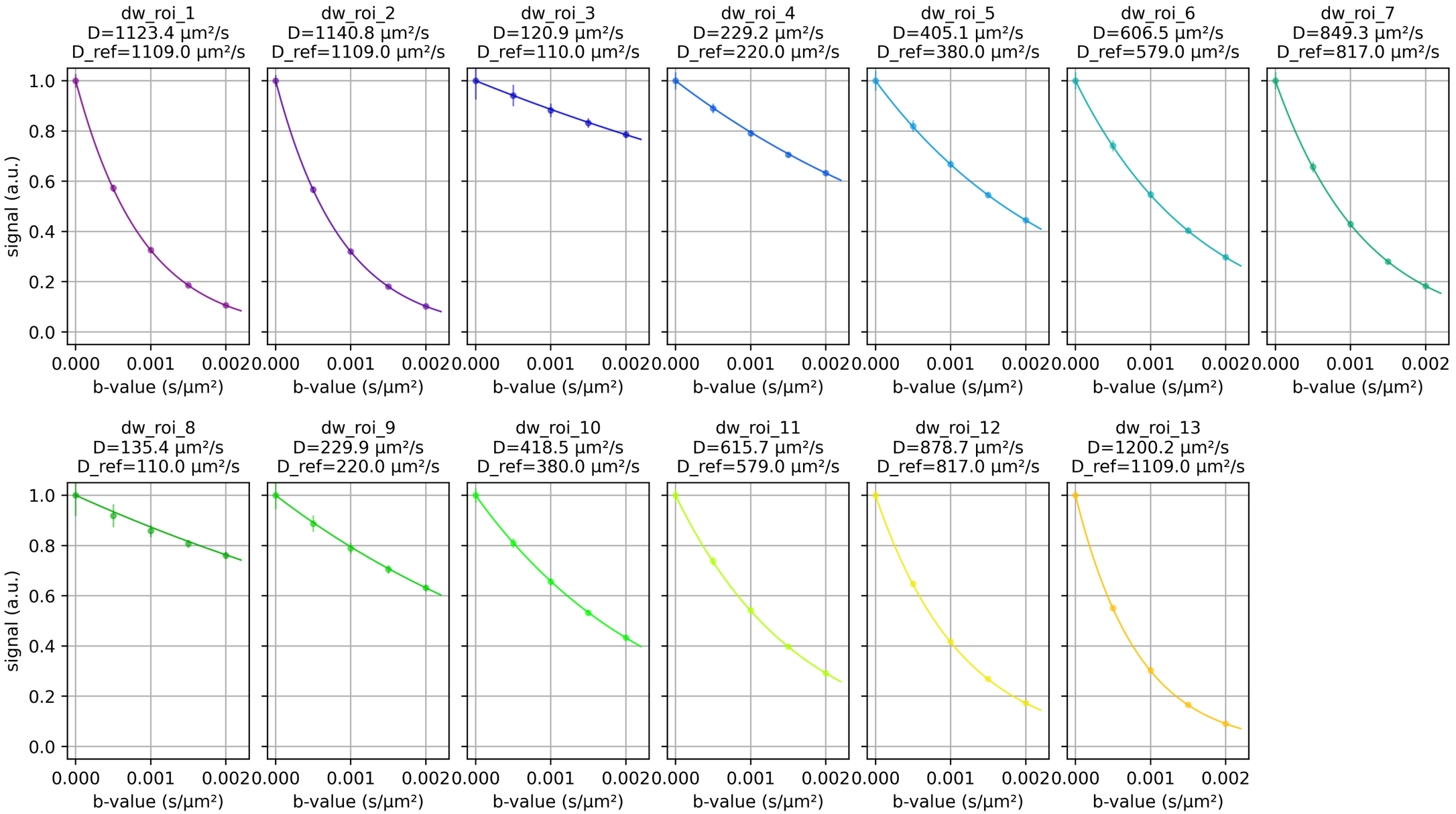






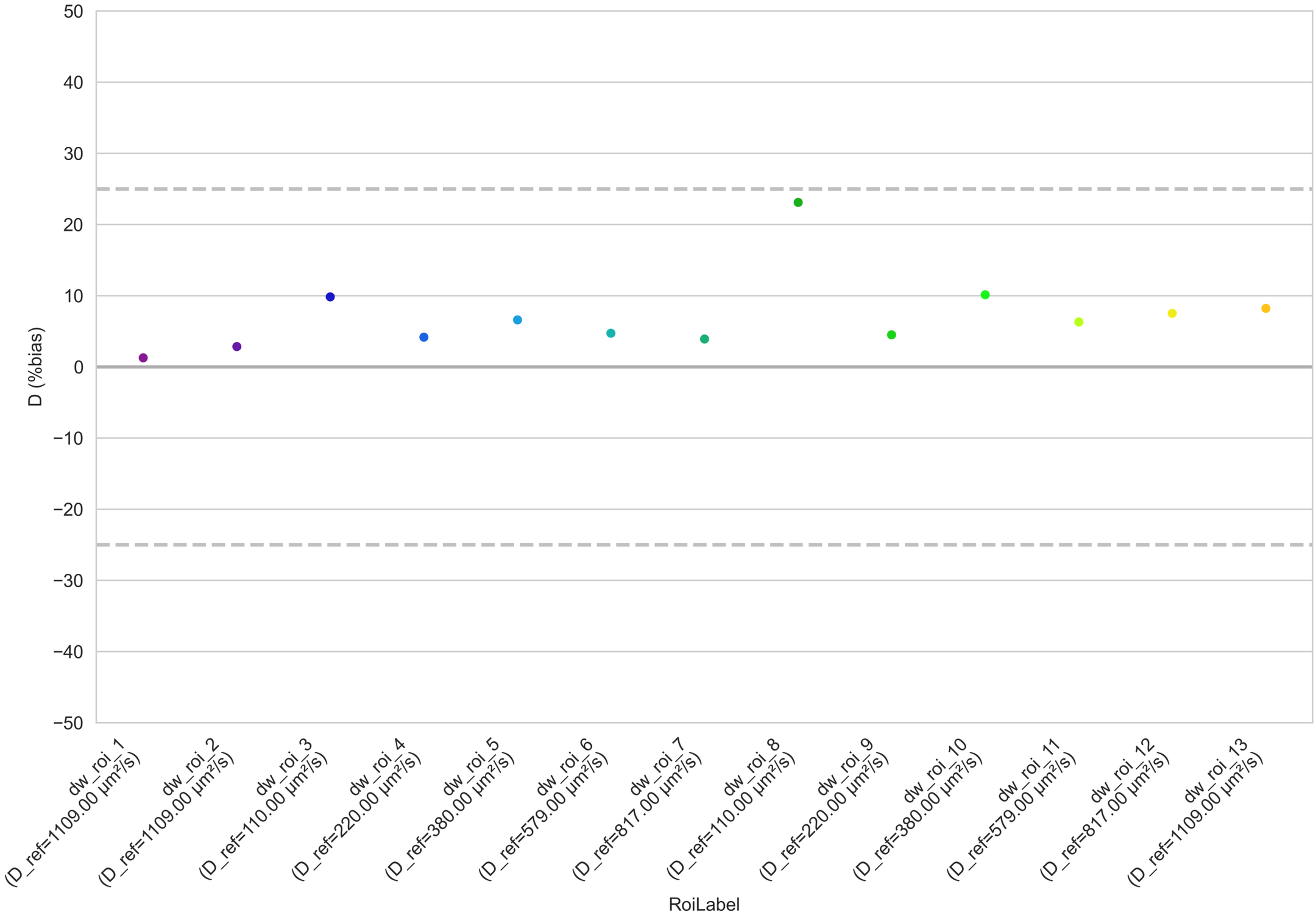


CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_002>



Included measurements are denoted with colour markers. Excluded measurements are denoted with black markers for (crosses) clipped or (circles) user excluded measurements.

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_002>



CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_003>

ROI_DX	ROI LABEL	D	D_var	D_err	D_pct.err	D_ref	D_init	AVRGD	NORMLD	CLIPD
37	dw_roi_1	1123.1	1.1	14.1	1.3	1109.0	2000.0	True	True	False
38	dw_roi_2	1143.5	1.0	34.5	3.1	1109.0	2000.0	True	True	False
39	dw_roi_3	123.5	2.4	13.5	12.3	110.0	2000.0	True	True	False
40	dw_roi_4	230.1	2.5	10.1	4.6	220.0	2000.0	True	True	False
41	dw_roi_5	405.1	1.0	25.1	6.6	380.0	2000.0	True	True	False
42	dw_roi_6	607.3	1.1	28.3	4.9	579.0	2000.0	True	True	False
43	dw_roi_7	851.2	1.4	34.2	4.2	817.0	2000.0	True	True	False
44	dw_roi_8	137.2	5.9	27.2	24.7	110.0	2000.0	True	True	False
45	dw_roi_9	231.4	2.5	11.4	5.2	220.0	2000.0	True	True	False
46	dw_roi_10	419.8	1.0	39.8	10.5	380.0	2000.0	True	True	False
47	dw_roi_11	616.5	1.1	37.5	6.5	579.0	2000.0	True	True	False
48	dw_roi_12	885.3	1.9	68.3	8.4	817.0	2000.0	True	True	False
49	dw_roi_13	1210.8	2.3	101.8	9.2	1109.0	2000.0	True	True	False

SIGNAL EQUATION:

log(S(Bx) / S(0)) = -Bx * D

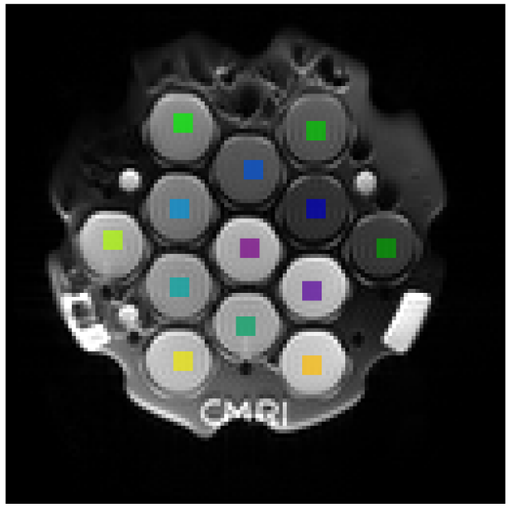
Parameter	Description	Init Val.	Min Val.	Max Val.
D	D	D	0.0	inf
Bx	b value	as measured	-	-

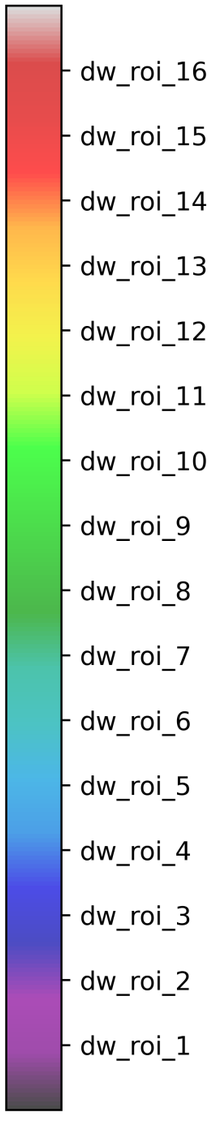
GOODNESS OF FIT:

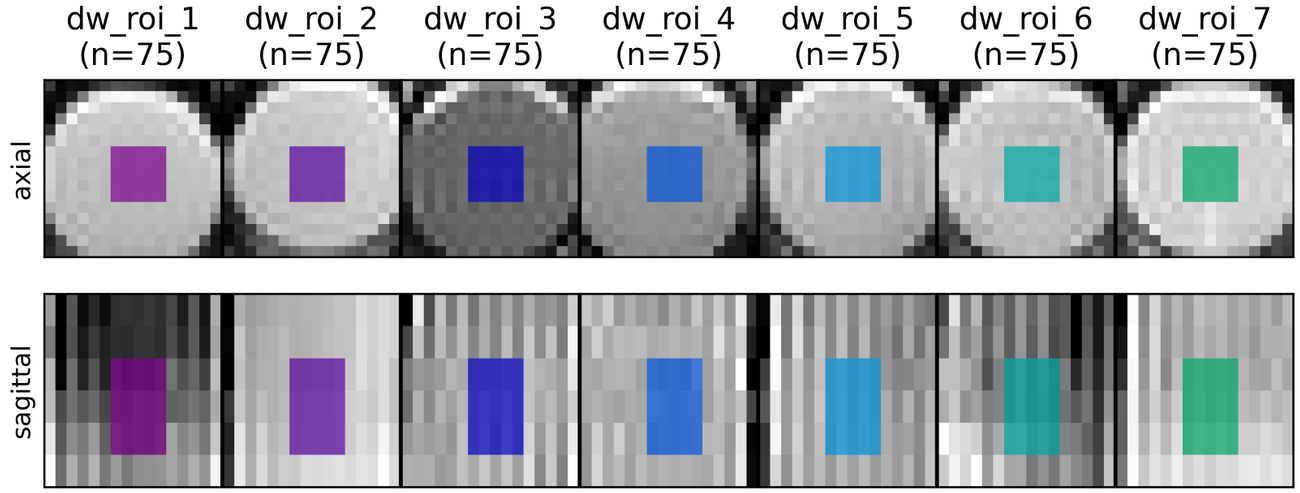
ROI_DX	ROI LABEL	chisqr	redchi	aic	bic
37	dw_roi_1	nan	nan	nan	nan
38	dw_roi_2	nan	nan	nan	nan
39	dw_roi_3	nan	nan	nan	nan
40	dw_roi_4	nan	nan	nan	nan
41	dw_roi_5	nan	nan	nan	nan
42	dw_roi_6	nan	nan	nan	nan
43	dw_roi_7	nan	nan	nan	nan
44	dw_roi_8	nan	nan	nan	nan
45	dw_roi_9	nan	nan	nan	nan
46	dw_roi_10	nan	nan	nan	nan
47	dw_roi_11	nan	nan	nan	nan
48	dw_roi_12	nan	nan	nan	nan
49	dw_roi_13	nan	nan	nan	nan

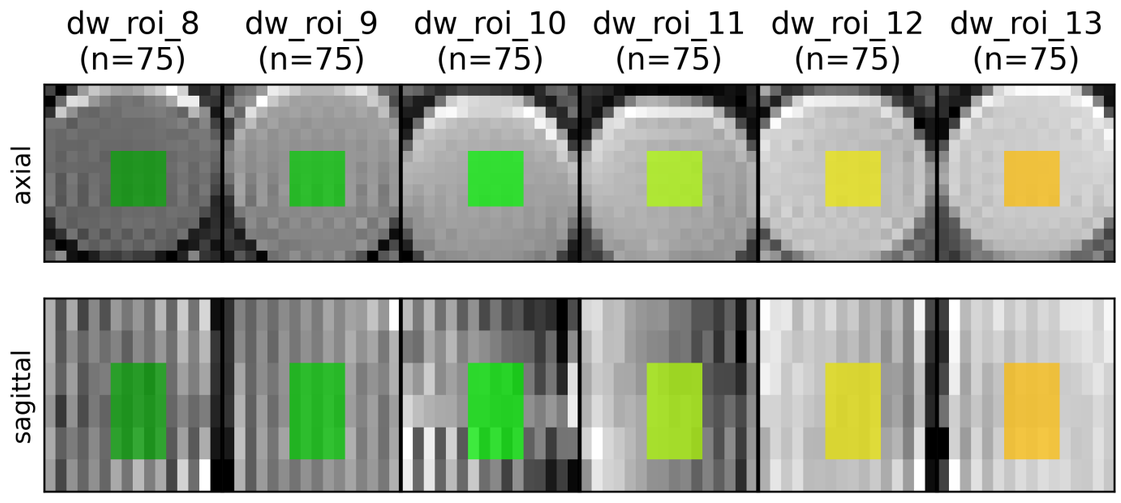
chisqr : Chi-square statistic
redchi : Reduced Chi-square statistic
aic : Akaike Information Criterion statistic
bic : Bayesian Information Criterion statistic

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_003>

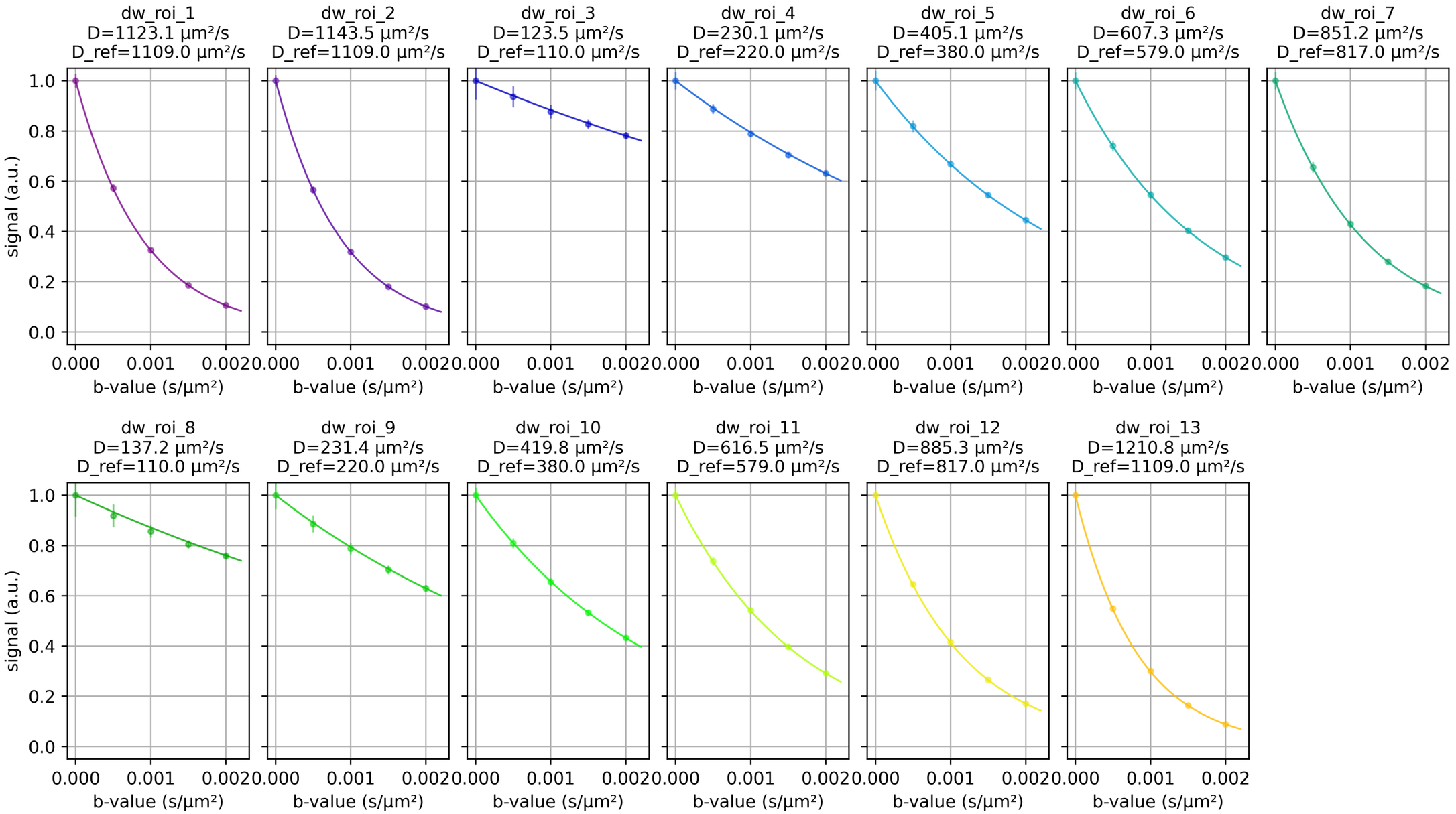








CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_003>



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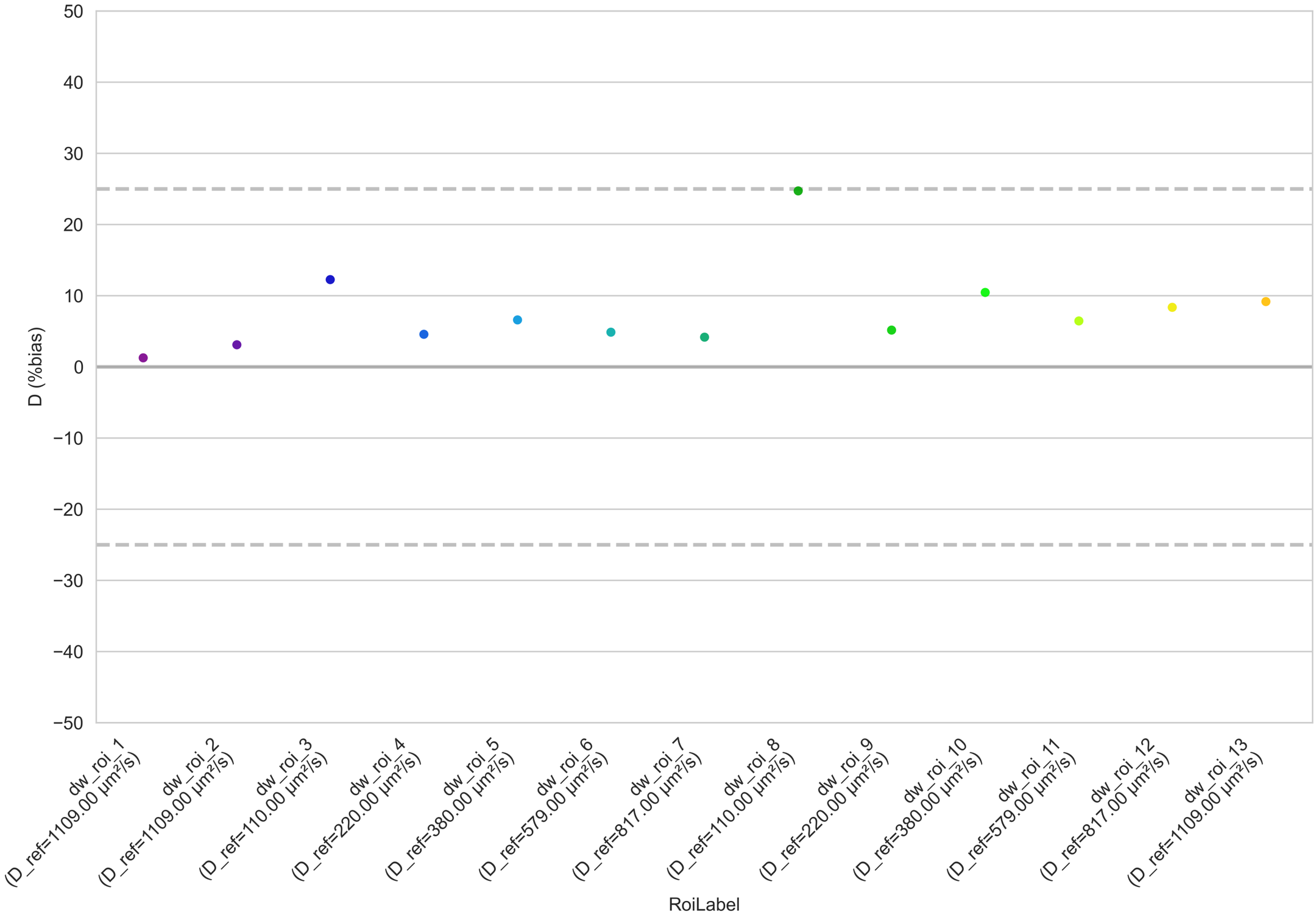
CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_003>



CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_004>

ROI_DX	ROI LABEL	D	D_var	D_err	D_pct.err	D_ref	D_init	AVRGD	NORMLD	CLIPD
37	dw_roi_1	1125.5	0.0	16.5	1.5	1109.0	2000.0	True	True	False
38	dw_roi_2	1140.0	0.0	31.0	2.8	1109.0	2000.0	True	True	False
39	dw_roi_3	115.5	0.0	5.5	5.0	110.0	2000.0	True	True	False
40	dw_roi_4	227.7	0.0	7.7	3.5	220.0	2000.0	True	True	False
41	dw_roi_5	413.0	0.0	33.0	8.7	380.0	2000.0	True	True	False
42	dw_roi_6	614.5	0.0	35.5	6.1	579.0	2000.0	True	True	False
43	dw_roi_7	859.7	0.0	42.7	5.2	817.0	2000.0	True	True	False
44	dw_roi_8	117.3	0.0	7.3	6.6	110.0	2000.0	True	True	False
45	dw_roi_9	226.1	0.0	6.1	2.8	220.0	2000.0	True	True	False
46	dw_roi_10	415.5	0.0	35.5	9.4	380.0	2000.0	True	True	False
47	dw_roi_11	618.7	0.0	39.7	6.9	579.0	2000.0	True	True	False
48	dw_roi_12	889.2	0.0	72.2	8.8	817.0	2000.0	True	True	False
49	dw_roi_13	1205.5	0.0	96.5	8.7	1109.0	2000.0	True	True	False

SIGNAL EQUATION:

log(S(Bx) / S(0)) = -Bx * D

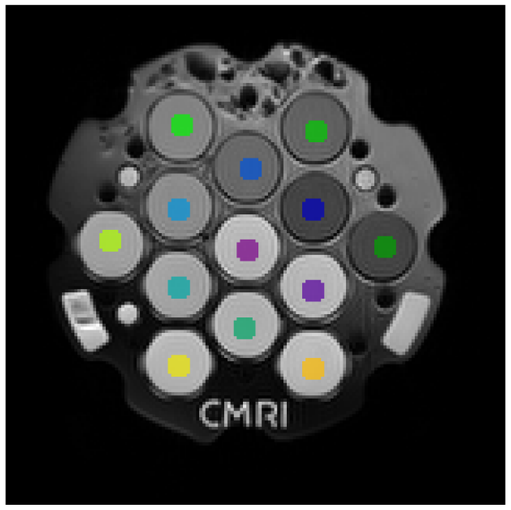
Parameter	Description	Init Val.	Min Val.	Max Val.
D	D	D	0.0	inf
Bx	b value	as measured	-	-

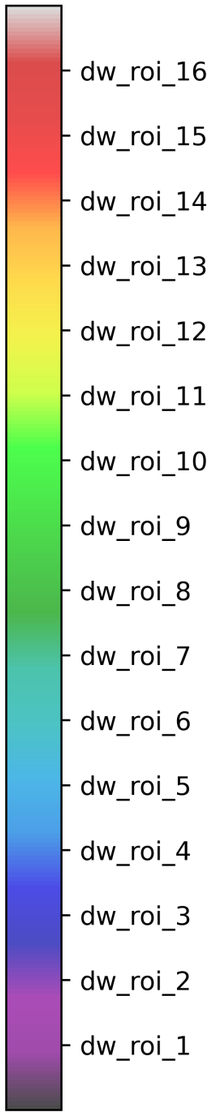
GOODNESS OF FIT:

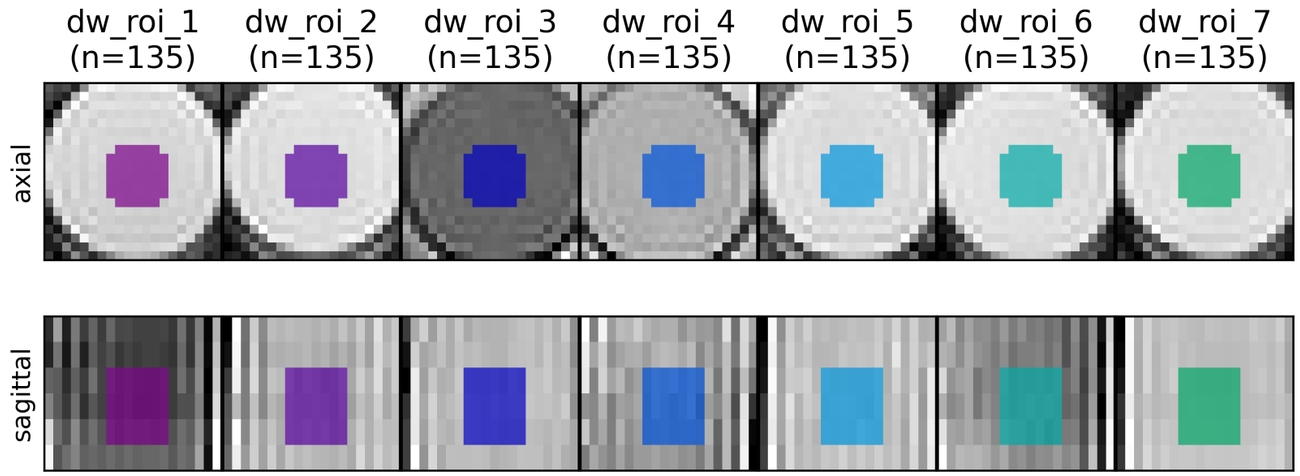
ROI_DX	ROI LABEL	chisqr	redchi	aic	bic
37	dw_roi_1	nan	nan	nan	nan
38	dw_roi_2	nan	nan	nan	nan
39	dw_roi_3	nan	nan	nan	nan
40	dw_roi_4	nan	nan	nan	nan
41	dw_roi_5	nan	nan	nan	nan
42	dw_roi_6	nan	nan	nan	nan
43	dw_roi_7	nan	nan	nan	nan
44	dw_roi_8	nan	nan	nan	nan
45	dw_roi_9	nan	nan	nan	nan
46	dw_roi_10	nan	nan	nan	nan
47	dw_roi_11	nan	nan	nan	nan
48	dw_roi_12	nan	nan	nan	nan
49	dw_roi_13	nan	nan	nan	nan

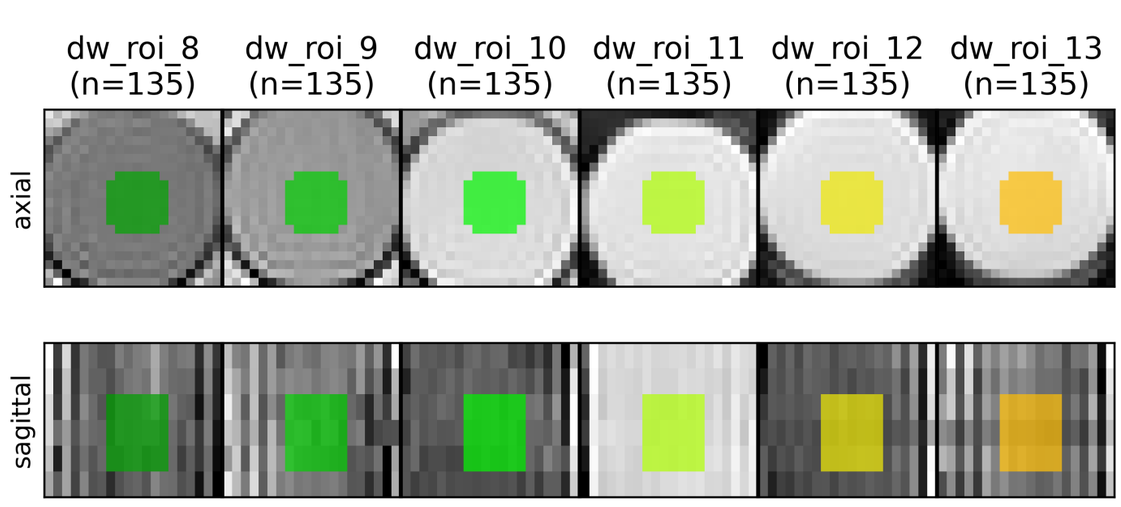
chisqr : Chi-square statistic
redchi : Reduced Chi-square statistic
aic : Akaike Information Criterion statistic
bic : Bayesian Information Criterion statistic

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_004>

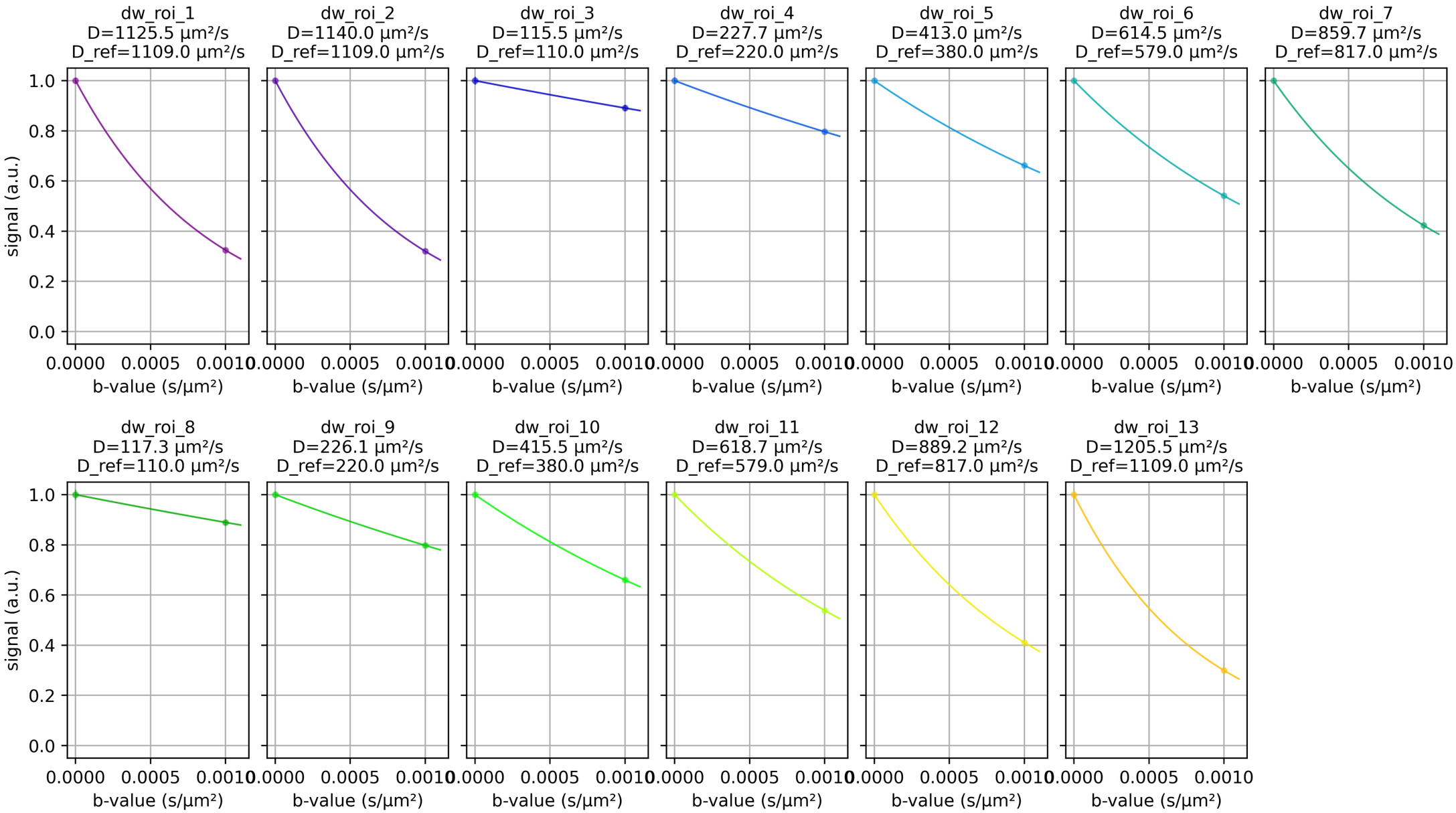






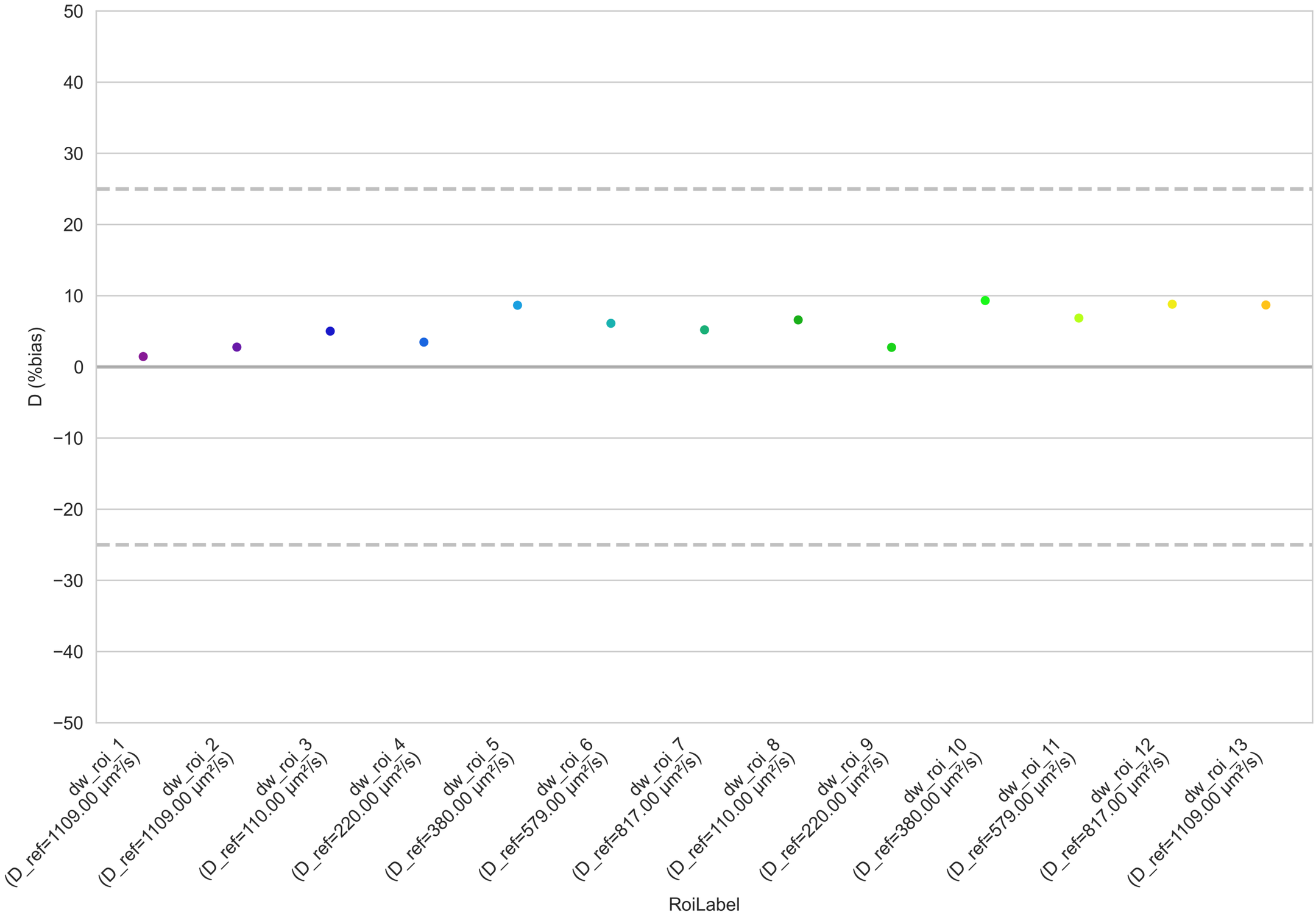


CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_004>



Included measurements are denoted with colour markers. Excluded measurements are denoted with black markers for (crosses) clipped or (circles) user excluded measurements.

CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_004>



Repeatability metrics across 4 short-term scan repeats:

- CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_000>
- CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_001>
- CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_002>
- CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_003>
- CurveFit [DWCurveFit2param - AvROI_NrmROIMax] <dw_004>

ROI LABEL	ref	mean	std	RC_st	CV_st	bias (%)
dw_roi_1	1109.00	1123.40	1.42	3.94	0.13	1.30
dw_roi_2	1109.00	1140.61	1.73	4.80	0.15	2.85
dw_roi_3	110.00	120.74	3.12	8.65	2.59	9.76
dw_roi_4	220.00	229.47	1.12	3.10	0.49	4.31
dw_roi_5	380.00	406.87	3.45	9.55	0.85	7.07
dw_roi_6	579.00	607.85	3.83	10.61	0.63	4.98
dw_roi_7	817.00	850.36	5.71	15.81	0.67	4.08
dw_roi_8	110.00	131.72	8.17	22.63	6.20	19.75
dw_roi_9	220.00	229.75	2.15	5.94	0.93	4.43
dw_roi_10	380.00	418.20	1.59	4.40	0.38	10.05
dw_roi_11	579.00	616.26	1.50	4.15	0.24	6.44
dw_roi_12	817.00	878.40	9.36	25.91	1.07	7.51
dw_roi_13	1109.00	1198.74	10.32	28.60	0.86	8.09

SUMMARY METRICS:

Metric	Description	Symbol
ref	Reference ADC value as measured by NIST	ADC_ref
mean	Mean ADC value across 4 short-term repeats	ADC_mean
std	Standard deviation of ADC values across 4 short-term repeats	SD
RC_st	Repeatability coefficient	RC_st = 2.77 * SD
CV_st	Coefficient of variation	CV_st = 100% * (SD/ADC_mean)
bias (%)	%Bias	bias(%) = 100% * (ADC_mean - ADC_ref)/ADC_ref