Full wwPDB X-ray Structure Validation Report ⓘ

Mar 24, 2025 – 02:18 PM JST

PDB ID	:	9L6X
Title	:	Crystal structure of the L7Ae derivative protein LS4 in complex with its co-evolved target CS1 RNA
Authors	:	Teramoto, T.; Nakashima, M.; Fukunaga, K.; Yokobayashi, Y.; Kakuta, Y.
Deposited on	:	2024-12-25
Resolution	:	1.89 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references ⓘ) were used in the production of this report:

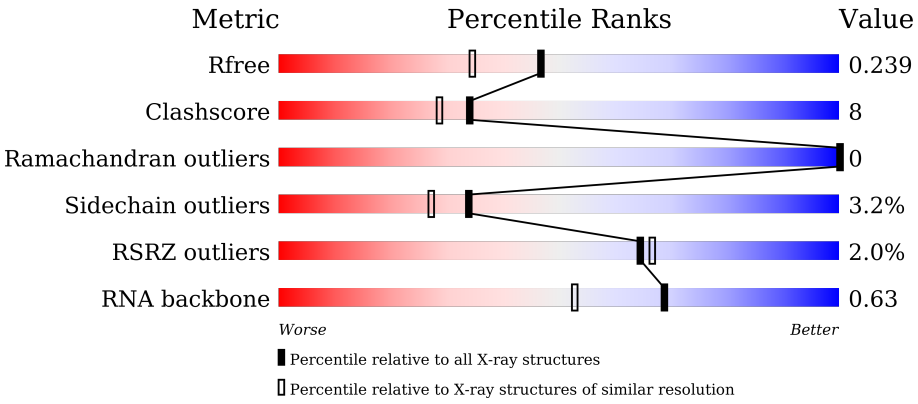
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.21
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.004 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.41.4

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.89 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	7293 (1.90-1.90)
Clashscore	180529	8090 (1.90-1.90)
Ramachandran outliers	177936	8022 (1.90-1.90)
Sidechain outliers	177891	8022 (1.90-1.90)
RSRZ outliers	164620	7292 (1.90-1.90)
RNA backbone	3690	1046 (2.30-1.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	119	2% 80% 17% • •
1	C	119	2% 82% 12% • 5%
2	B	36	3% 58% 28% 11% •
2	D	36	3% 72% 19% 6% •

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 3559 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Large ribosomal subunit protein eL8.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	116	Total	C	N	O	S	0	0	0
			900	575	156	167	2			
1	C	113	Total	C	N	O	S	0	1	0
			876	556	154	164	2			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	SER	-	expression tag	UNP O29494
A	34	ARG	GLU	engineered mutation	UNP O29494
A	37	HIS	LYS	engineered mutation	UNP O29494
A	40	TYR	GLU	engineered mutation	UNP O29494
A	88	GLY	ILE	engineered mutation	UNP O29494
A	89	TRP	GLU	engineered mutation	UNP O29494
A	90	PRO	VAL	engineered mutation	UNP O29494
A	91	ILE	PRO	engineered mutation	UNP O29494
A	92	GLY	CYS	engineered mutation	UNP O29494
C	1	SER	-	expression tag	UNP O29494
C	34	ARG	GLU	engineered mutation	UNP O29494
C	37	HIS	LYS	engineered mutation	UNP O29494
C	40	TYR	GLU	engineered mutation	UNP O29494
C	88	GLY	ILE	engineered mutation	UNP O29494
C	89	TRP	GLU	engineered mutation	UNP O29494
C	90	PRO	VAL	engineered mutation	UNP O29494
C	91	ILE	PRO	engineered mutation	UNP O29494
C	92	GLY	CYS	engineered mutation	UNP O29494

- Molecule 2 is a RNA chain called CS1 RNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	36	Total	C	N	O	P	0	0	0
			779	348	151	245	35			

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	36	Total	C	N	O	P	0	0	0
			779	348	151	245	35			

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	3	Total	Mg	0	0
			3	3		

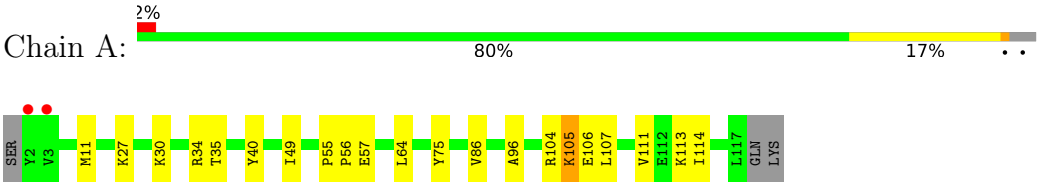
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	47	Total	O	0	0
			47	47		
4	B	72	Total	O	0	0
			72	72		
4	C	50	Total	O	0	0
			50	50		
4	D	53	Total	O	0	0
			53	53		

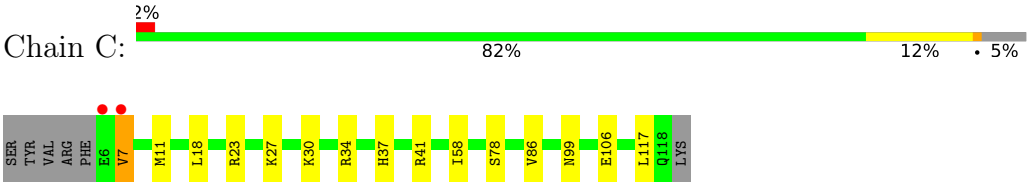
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

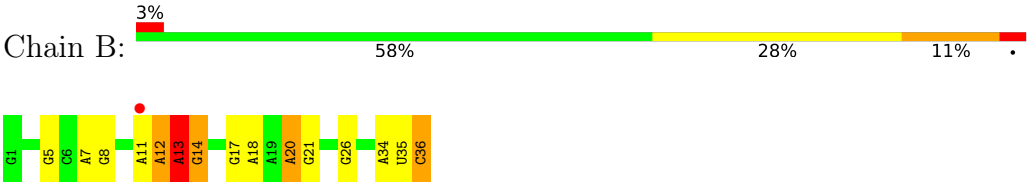
• Molecule 1: Large ribosomal subunit protein eL8



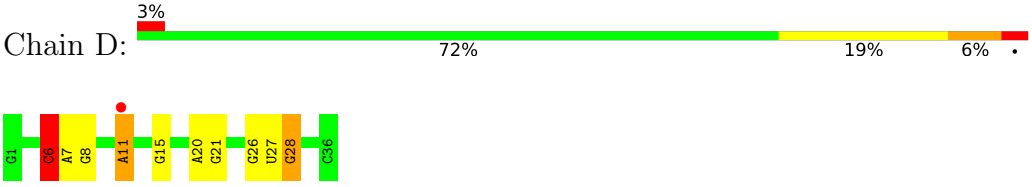
• Molecule 1: Large ribosomal subunit protein eL8



• Molecule 2: CS1 RNA



• Molecule 2: CS1 RNA



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	40.87Å 91.88Å 61.21Å 90.00° 106.11° 90.00°	Depositor
Resolution (Å)	45.94 – 1.89 45.94 – 1.89	Depositor EDS
% Data completeness (in resolution range)	99.8 (45.94-1.89) 99.8 (45.94-1.89)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.21 (at 1.89Å)	Xtriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, R_{free}	0.199 , 0.239 0.199 , 0.239	Depositor DCC
R_{free} test set	32803 reflections (5.74%)	wwPDB-VP
Wilson B-factor (Å^2)	31.8	Xtriage
Anisotropy	0.358	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 34.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	3559	wwPDB-VP
Average B, all atoms (Å^2)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.66% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$\|Z\|>5$	RMSZ	#$\|Z\|>5$
1	A	0.42	0/915	0.63	0/1236
1	C	0.42	0/892	0.67	0/1204
2	B	0.63	0/874	1.30	11/1364 (0.8%)
2	D	0.57	0/874	1.07	3/1364 (0.2%)
All	All	0.52	0/3555	0.97	14/5168 (0.3%)

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	20	A	O4'-C1'-N9	8.13	114.70	108.20
2	B	20	A	N7-C8-N9	7.69	117.65	113.80
2	B	20	A	C6-C5-N7	-7.68	126.92	132.30
2	B	20	A	C4-N9-C1'	6.93	138.77	126.30
2	B	20	A	C4-C5-C6	6.56	120.28	117.00
2	B	20	A	C8-N9-C4	-6.30	103.28	105.80
2	D	28	G	C5-C6-O6	-6.14	124.92	128.60
2	D	6	C	C5-C6-N1	5.84	123.92	121.00
2	B	13	A	C2'-C3'-O3'	5.62	122.69	113.70
2	B	20	A	N1-C2-N3	5.61	132.11	129.30
2	B	20	A	C8-N9-C1'	-5.45	117.90	127.70
2	D	28	G	C8-N9-C4	5.31	108.52	106.40
2	B	20	A	C5-N7-C8	-5.24	101.28	103.90
2	B	36	C	C6-N1-C2	-5.02	118.29	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	900	0	931	16	0
1	C	876	0	912	14	0
2	B	779	0	393	9	0
2	D	779	0	393	11	0
3	B	3	0	0	0	0
4	A	47	0	0	0	0
4	B	72	0	0	1	0
4	C	50	0	0	0	0
4	D	53	0	0	0	0
All	All	3559	0	2629	45	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 8.

All (45) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:34:ARG:HD3	2:D:8:G:N7	1.94	0.82
2:B:11:A:H3'	2:B:12:A:H5'	1.70	0.73
2:B:5:G:N7	4:B:202:HOH:O	2.25	0.70
1:C:23:ARG:HD2	1:C:86:VAL:O	1.94	0.67
1:A:55:PRO:HB2	1:A:57:GLU:OE1	1.94	0.66
2:D:6:C:H5"	2:D:6:C:H6	1.63	0.63
1:A:64:LEU:HD22	1:A:64:LEU:H	1.65	0.60
1:A:11:MET:CE	1:A:113:LYS:HB3	2.30	0.60
1:C:7:VAL:HG13	1:C:117:LEU:HD11	1.81	0.60
2:B:17:G:H21	2:B:20:A:H2	1.50	0.59
1:C:27:LYS:HB2	1:C:99:ASN:HB2	1.86	0.57
2:B:35:U:O2'	2:B:36:C:H5'	2.03	0.57
2:D:15:G:H5"	2:D:15:G:C8	2.39	0.57
2:D:15:G:H5"	2:D:15:G:H8	1.70	0.57
2:B:26:G:H5'	2:B:26:G:N3	2.20	0.57
1:C:37:HIS:NE2	1:C:41:ARG:HD2	2.21	0.55
1:A:107:LEU:O	1:A:111:VAL:HG13	2.07	0.54
1:A:34:ARG:NH1	2:B:8:G:N7	2.55	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:11:A:H3'	2:D:11:A:N3	2.26	0.51
1:A:11:MET:HE3	1:A:113:LYS:HB3	1.92	0.50
1:A:57:GLU:H	1:A:57:GLU:CD	2.14	0.50
1:A:30:LYS:HB2	1:A:86:VAL:HG11	1.93	0.50
1:A:11:MET:HE2	1:A:113:LYS:HB3	1.93	0.49
1:A:35:THR:HG23	1:A:96:ALA:HB2	1.93	0.49
2:D:26:G:H5"	2:D:28:G:O4'	2.13	0.49
1:C:58:ILE:HD13	2:D:27:U:O4'	2.14	0.48
2:D:6:C:H2'	2:D:7:A:O4'	2.14	0.48
1:A:64:LEU:HD22	1:A:64:LEU:N	2.29	0.46
1:C:106:GLU:H	1:C:106:GLU:CD	2.17	0.45
1:C:23:ARG:HD2	1:C:86:VAL:C	2.37	0.44
2:D:26:G:H5'	2:D:26:G:N3	2.32	0.44
1:A:105:LYS:HG3	1:A:106:GLU:N	2.33	0.43
1:A:40:TYR:CE1	1:C:11:MET:HG3	2.54	0.43
2:B:7:A:O2'	2:B:8:G:H5'	2.19	0.43
2:D:20:A:H2'	2:D:21:G:O4'	2.18	0.43
1:A:40:TYR:HE1	1:C:11:MET:HG3	1.84	0.43
1:A:111:VAL:HA	1:A:114:ILE:HD12	2.01	0.42
1:C:37:HIS:CE1	1:C:41:ARG:HD2	2.54	0.42
1:C:18:LEU:HD11	1:C:106:GLU:HB2	2.01	0.42
2:B:34:A:H2'	2:B:35:U:O4'	2.20	0.41
2:B:13:A:H2'	2:B:14:G:C8	2.55	0.41
1:C:30:LYS:HB3	1:C:30:LYS:HE2	1.67	0.41
1:A:49:ILE:O	1:A:75:TYR:HA	2.21	0.40
1:C:27:LYS:HD3	1:C:27:LYS:HA	1.72	0.40
2:D:6:C:H5"	2:D:6:C:C6	2.50	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	114/119 (96%)	113 (99%)	1 (1%)	0	100	100
1	C	112/119 (94%)	110 (98%)	2 (2%)	0	100	100
All	All	226/238 (95%)	223 (99%)	3 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	96/100 (96%)	92 (96%)	4 (4%)	25	18
1	C	94/100 (94%)	92 (98%)	2 (2%)	48	45
All	All	190/200 (95%)	184 (97%)	6 (3%)	34	27

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	27	LYS
1	A	56	PRO
1	A	104	ARG
1	A	105	LYS
1	C	7	VAL
1	C	78	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	B	35/36 (97%)	5 (14%)	2 (5%)
2	D	35/36 (97%)	2 (5%)	0
All	All	70/72 (97%)	7 (10%)	2 (2%)

All (7) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	B	12	A
2	B	13	A
2	B	14	G
2	B	18	A
2	B	21	G
2	D	6	C
2	D	11	A

All (2) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
2	B	12	A
2	B	13	A

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	116/119 (97%)	0.10	2 (1%)	69	71	21, 33, 47, 52	0
1	C	113/119 (94%)	0.07	2 (1%)	67	70	18, 31, 43, 67	1 (0%)
2	B	36/36 (100%)	0.15	1 (2%)	55	57	26, 38, 52, 79	0
2	D	36/36 (100%)	-0.06	1 (2%)	55	57	24, 42, 52, 94	0
All	All	301/310 (97%)	0.07	6 (1%)	64	67	18, 33, 51, 94	1 (0%)

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	7	VAL	4.1
1	A	2	TYR	3.6
2	D	11	A	2.7
1	C	6	GLU	2.4
2	B	11	A	2.3
1	A	3	VAL	2.2

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

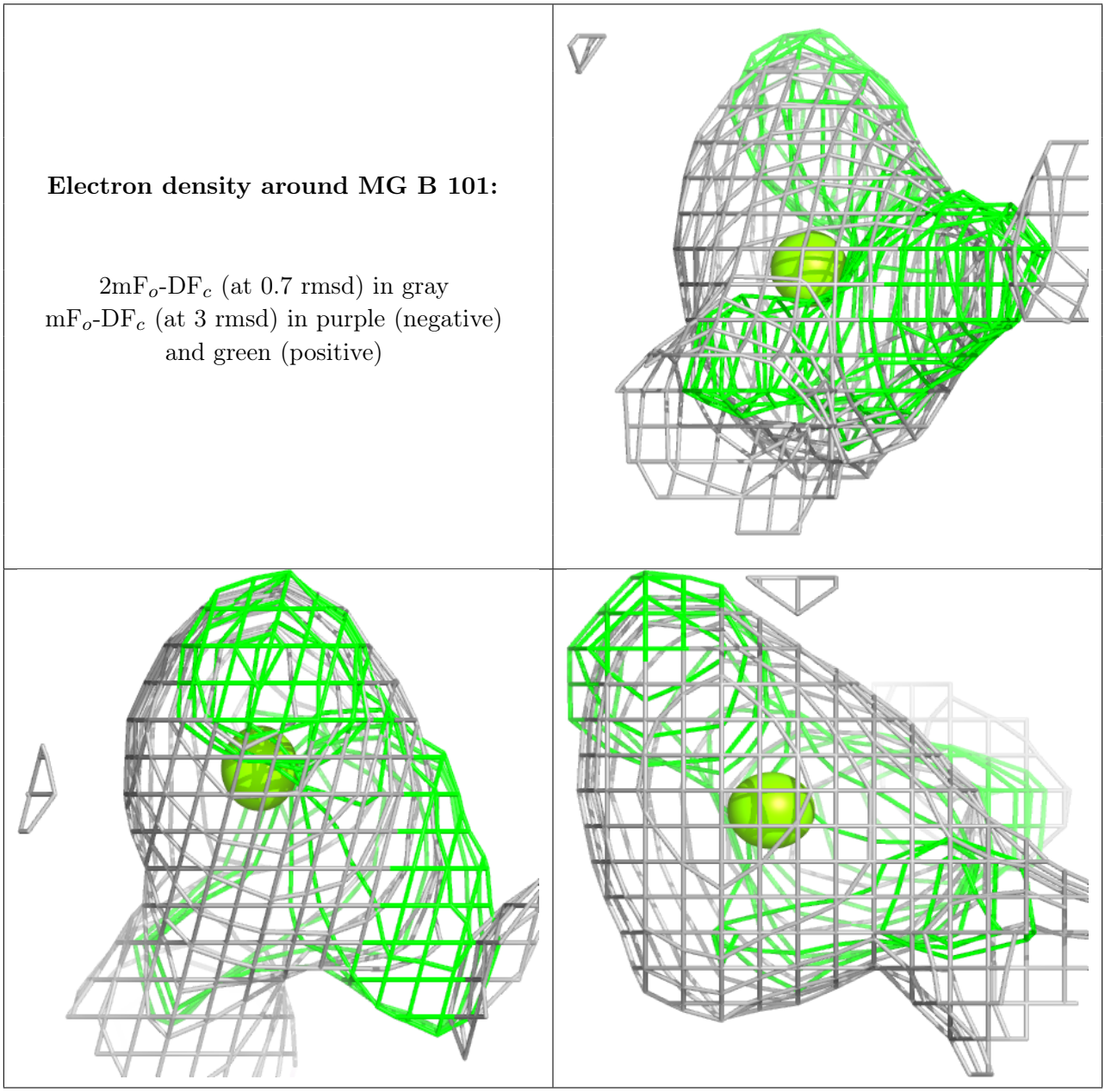
median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	MG	B	101	1/1	0.91	0.24	41,41,41,41	0
3	MG	B	102	1/1	0.93	0.09	46,46,46,46	0
3	MG	B	103	1/1	0.96	0.05	42,42,42,42	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

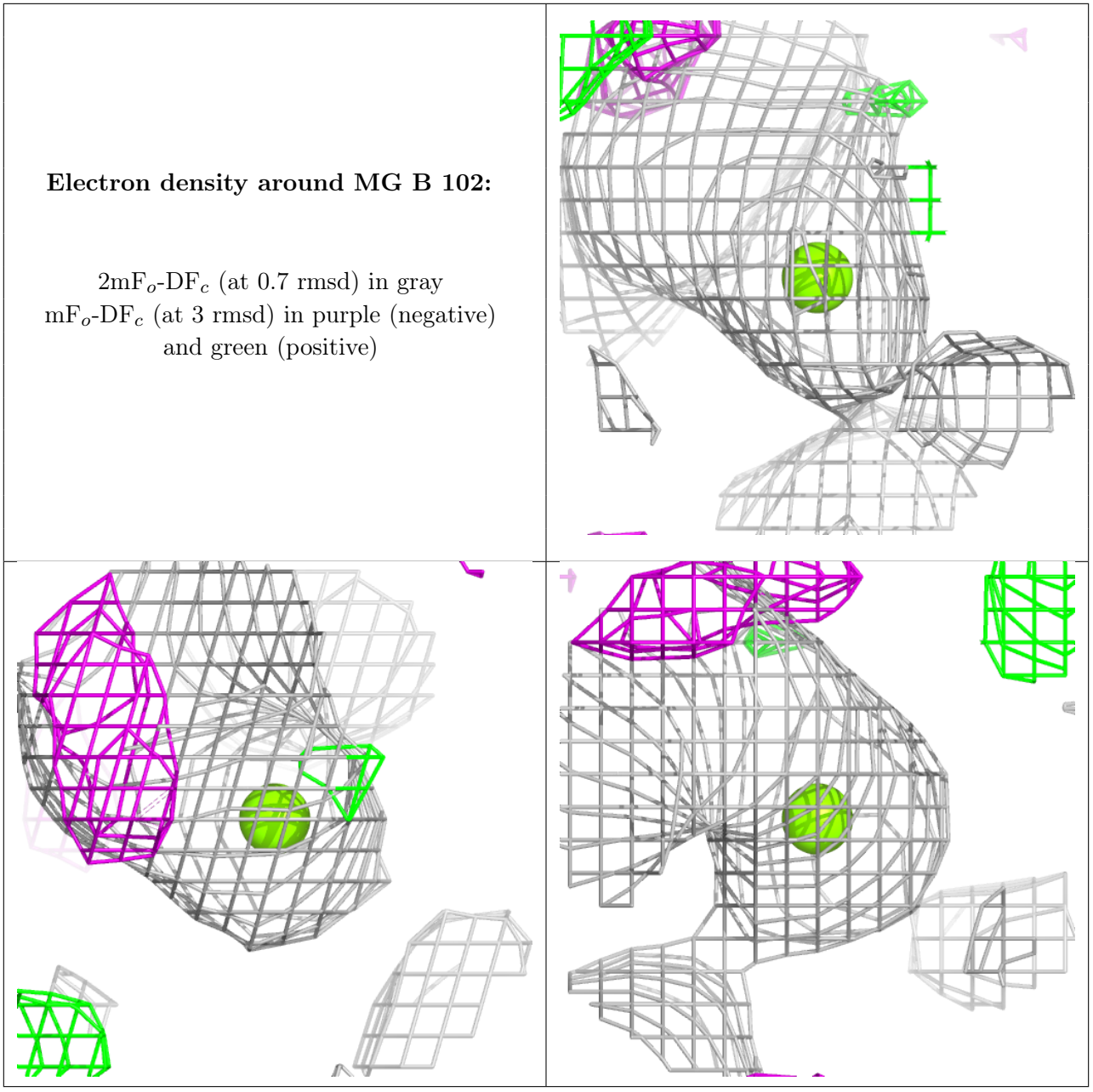
Electron density around MG B 101:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



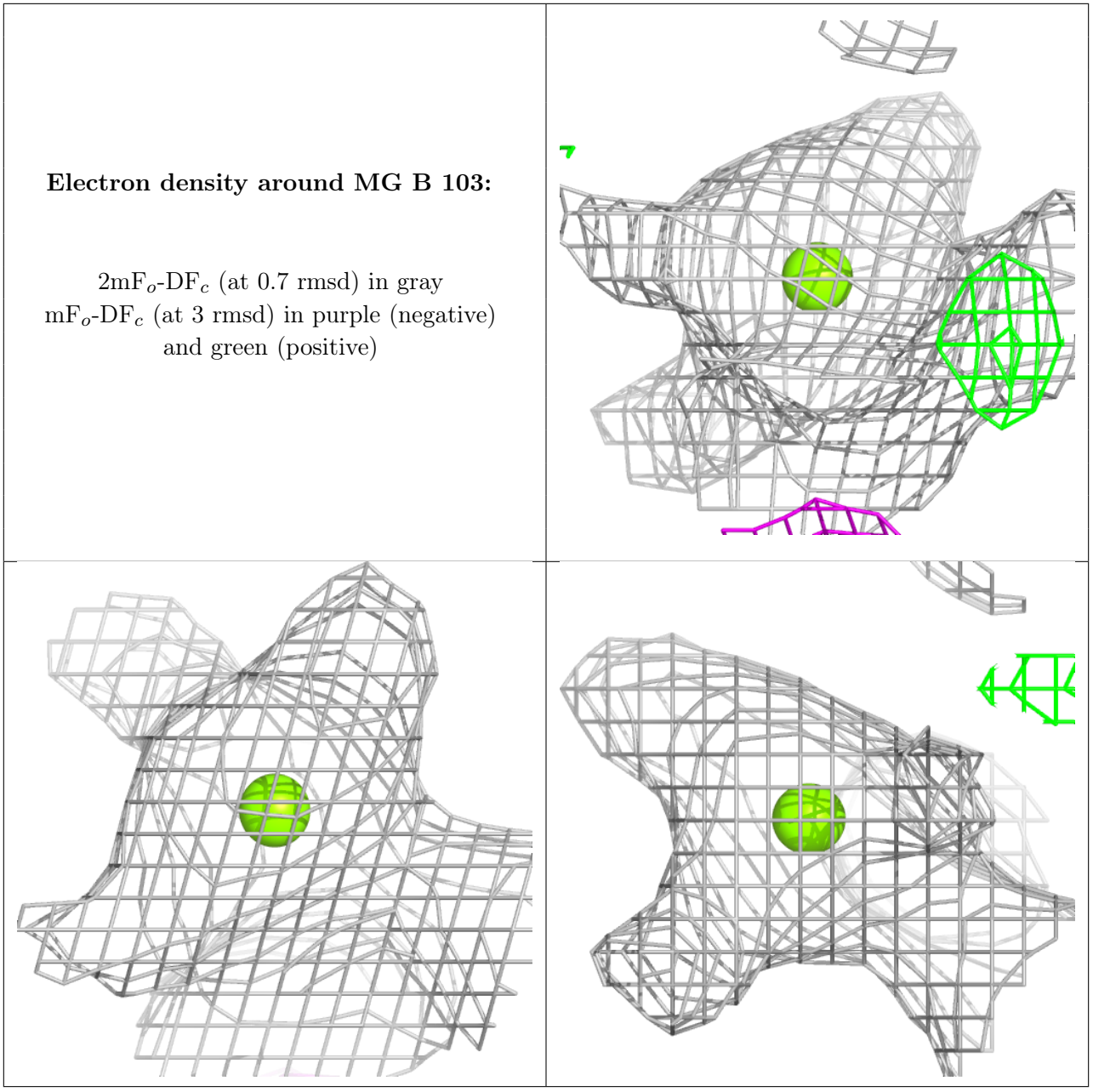
Electron density around MG B 102:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



Electron density around MG B 103:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



6.5 Other polymers (i)

There are no such residues in this entry.