



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 11, 2023 – 06:24 PM EDT

PDB ID : 4M7D  
Title : Crystal structure of Lsm2-8 complex bound to the RNA fragment CGUUU  
Authors : Zhou, L.; Hang, J.; Zhou, Y.; Wan, R.; Lu, G.; Yan, C.; Shi, Y.  
Deposited on : 2013-08-12  
Resolution : 2.60 Å(reported)

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

We welcome your comments at [validation@mail.wwpdb.org](mailto: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>.

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

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35.1

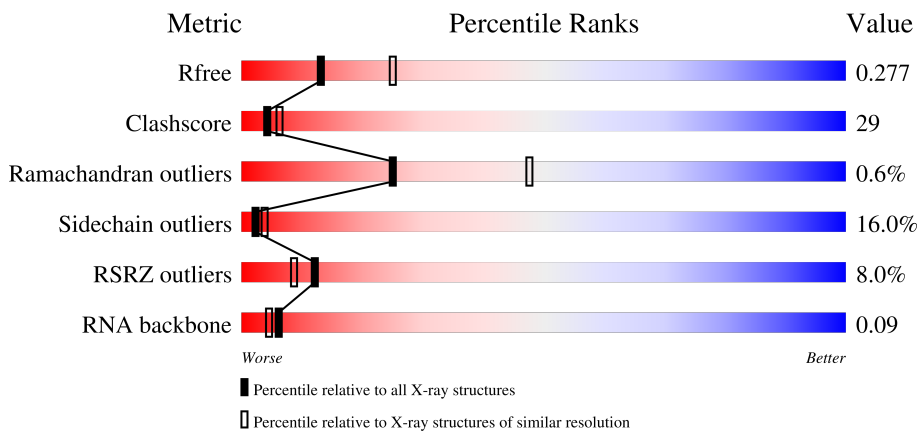
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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))
$R_{free}$	130704	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)
RNA backbone	3102	1040 (2.90-2.30)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	96	
1	H	96	
2	B	95	
2	I	95	

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Mol	Chain	Length	Quality of chain
3	C	89	<p>2% 47% 31% 8% 13%</p>
3	J	89	<p>2% 48% 31% 7% 12%</p>
4	D	86	<p>2% 47% 36% 14%</p>
4	K	86	<p>2% 59% 24% 14%</p>
5	E	93	<p>2% 56% 25% 17%</p>
5	L	93	<p>2% 46% 30% 5% 18%</p>
6	F	115	<p>3% 38% 18% 43%</p>
6	M	115	<p>10% 20% 27% 10% 43%</p>
7	G	93	<p>5% 58% 16% 8% 17%</p>
7	N	93	<p>18% 24% 33% 14% 29%</p>
8	O	8	<p>25% 38% 38%</p>
8	P	8	<p>12% 12% 25% 50%</p>

## 2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 8455 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 U6 snRNA-associated Sm-like protein LSm8.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
1	A	65	Total	C	N	O	0	0	0
			508	329	86	93			
1	H	64	Total	C	N	O	0	0	0
			494	317	85	92			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	17	LEU	LYS	engineered mutation	UNP P47093
A	22	SER	CYS	engineered mutation	UNP P47093
A	38	LEU	ILE	engineered mutation	UNP P47093
A	51	SER	CYS	engineered mutation	UNP P47093
H	17	LEU	LYS	engineered mutation	UNP P47093
H	22	SER	CYS	engineered mutation	UNP P47093
H	38	LEU	ILE	engineered mutation	UNP P47093
H	51	SER	CYS	engineered mutation	UNP P47093

- Molecule 2 is a protein called U6 snRNA-associated Sm-like protein LSm2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	92	Total	C	N	O	S	0	0	0
			750	478	126	143	3			
2	I	88	Total	C	N	O	S	0	0	0
			721	462	122	134	3			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	45	SER	CYS	engineered mutation	UNP P38203
I	45	SER	CYS	engineered mutation	UNP P38203

- Molecule 3 is a protein called U6 snRNA-associated Sm-like protein LSm3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	77	Total	C	N	O	S	0	0	0
			611	382	105	123	1			
3	J	78	Total	C	N	O	S	0	0	0
			616	385	106	124	1			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	37	SER	CYS	engineered mutation	UNP P57743
C	63	SER	CYS	engineered mutation	UNP P57743
J	37	SER	CYS	engineered mutation	UNP P57743
J	63	SER	CYS	engineered mutation	UNP P57743

- Molecule 4 is a protein called U6 snRNA-associated Sm-like protein LSm6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	74	Total	C	N	O	S	0	0	0
			577	364	95	116	2			
4	K	74	Total	C	N	O	S	0	0	0
			556	351	93	110	2			

- Molecule 5 is a protein called U6 snRNA-associated Sm-like protein LSm5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	77	Total	C	N	O	S	0	0	0
			603	387	100	114	2			
5	L	76	Total	C	N	O	S	0	0	0
			594	382	99	111	2			

- Molecule 6 is a protein called U6 snRNA-associated Sm-like protein LSm7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	66	Total	C	N	O	S	0	0	0
			504	325	85	91	3			
6	M	65	Total	C	N	O	S	0	0	0
			496	321	83	89	3			

- Molecule 7 is a protein called U6 snRNA-associated Sm-like protein LSm4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	G	77	Total	C	N	O	S	0	0	0
			613	394	99	117	3			

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	N	66	Total	C	N	O	S	0	0	0
			536	349	87	97	3			

- Molecule 8 is a RNA chain called U6 snRNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
8	O	5	Total	C	N	O	P	0	0	0
			103	46	14	38	5			
8	P	4	Total	C	N	O	P	0	0	0
			83	37	11	31	4			

- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	2	Total	O	0	0
			2	2		
9	B	7	Total	O	0	0
			7	7		
9	C	13	Total	O	0	0
			13	13		
9	D	10	Total	O	0	0
			10	10		
9	E	8	Total	O	0	0
			8	8		
9	F	6	Total	O	0	0
			6	6		
9	G	6	Total	O	0	0
			6	6		
9	H	4	Total	O	0	0
			4	4		
9	I	5	Total	O	0	0
			5	5		
9	J	5	Total	O	0	0
			5	5		
9	K	9	Total	O	0	0
			9	9		
9	L	5	Total	O	0	0
			5	5		
9	M	5	Total	O	0	0
			5	5		
9	N	3	Total	O	0	0
			3	3		

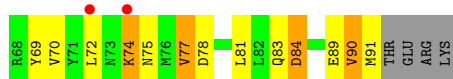
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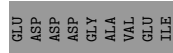
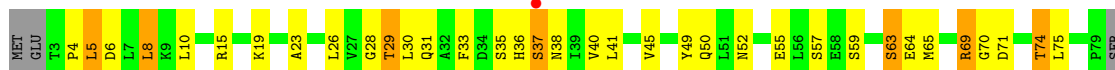
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
9	O	2	Total	O	0	0
			2	2		



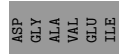
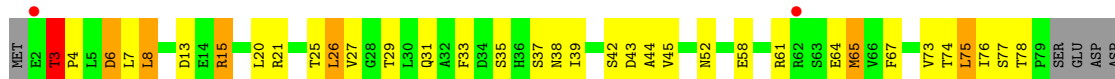




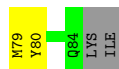
- Molecule 3: U6 snRNA-associated Sm-like protein LSm3



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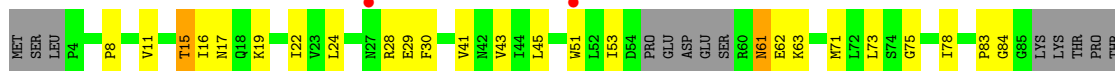
- Molecule 4: U6 snRNA-associated Sm-like protein LSm6



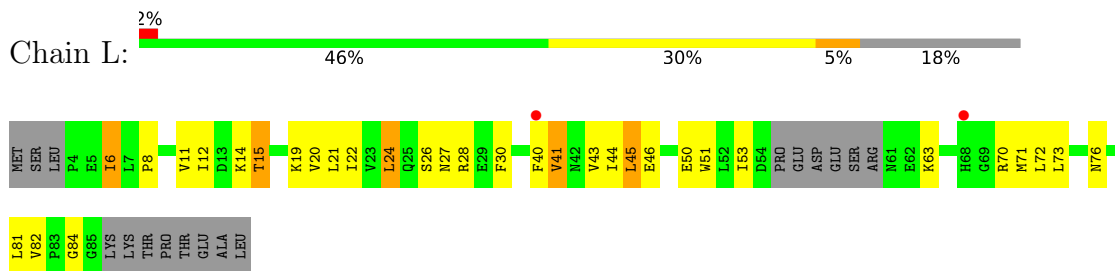
- Molecule 4: U6 snRNA-associated Sm-like protein LSm6



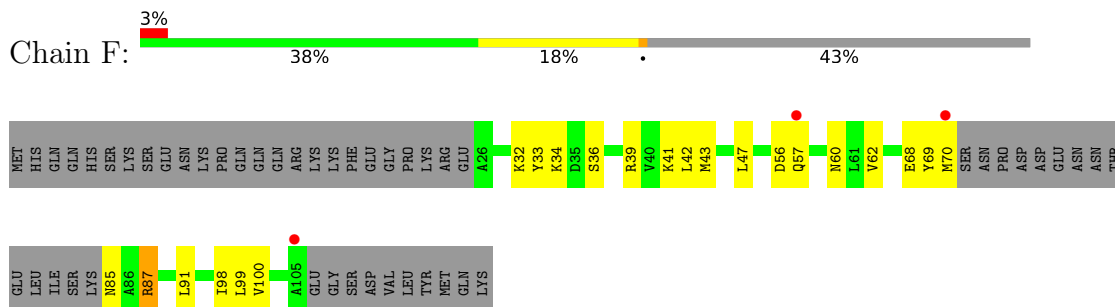
- Molecule 5: U6 snRNA-associated Sm-like protein LSm5



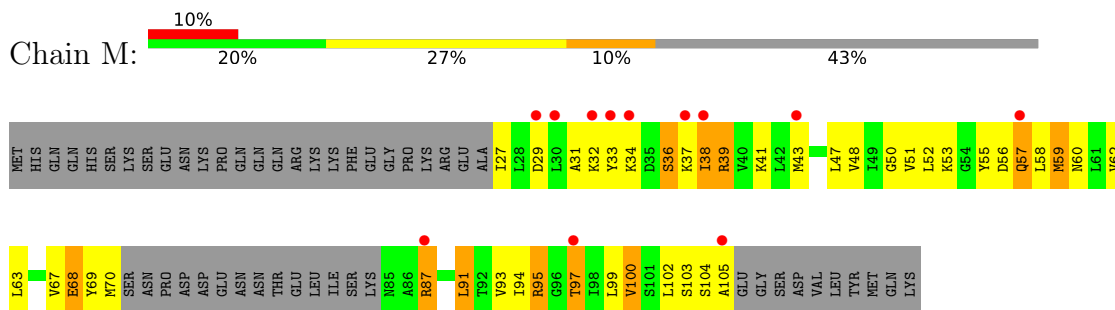
- Molecule 5: U6 snRNA-associated Sm-like protein LSm5



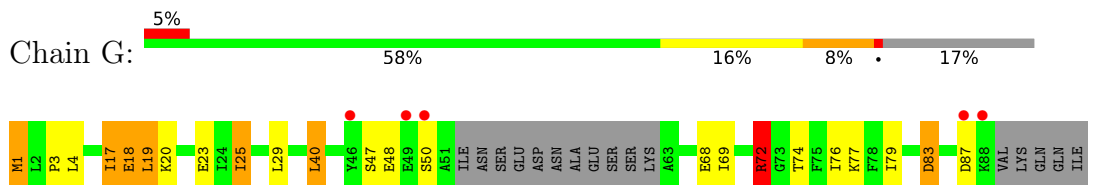
- Molecule 6: U6 snRNA-associated Sm-like protein LSm7



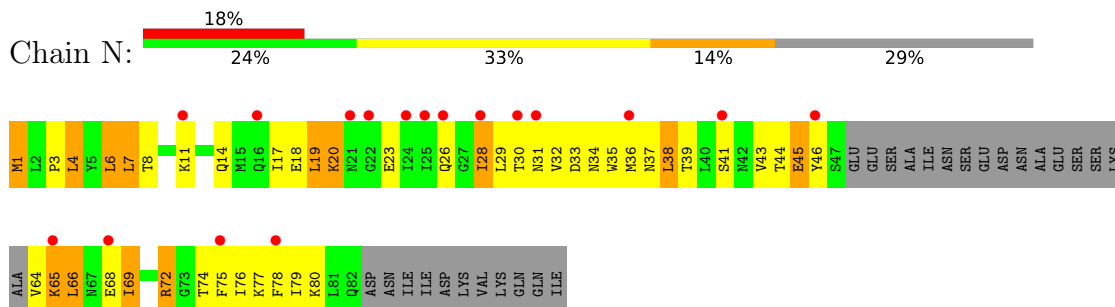
- Molecule 6: U6 snRNA-associated Sm-like protein LSm7




- Molecule 7: U6 snRNA-associated Sm-like protein LSm4



- Molecule 7: U6 snRNA-associated Sm-like protein LSm4



- Molecule 8: U6 snRNA

Chain O:  25% 38% 38%



- Molecule 8: U6 snRNA

Chain P:  12% 12% 25% 50%



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	125.54Å 78.48Å 142.99Å 90.00° 103.17° 90.00°	Depositor
Resolution (Å)	34.18 – 2.60 34.18 – 2.59	Depositor EDS
% Data completeness (in resolution range)	98.3 (34.18-2.60) 98.4 (34.18-2.59)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.18 (at 2.61Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.7.3_928)	Depositor
R, $R_{free}$	0.240 , 0.283 0.238 , 0.277	Depositor DCC
$R_{free}$ test set	2098 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	66.8	Xtrriage
Anisotropy	0.293	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 62.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	8455	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	82.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.76% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

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	0.56	0/512	0.86	2/689 (0.3%)
1	H	0.39	0/496	0.57	0/666
2	B	0.60	0/760	0.76	0/1025
2	I	0.34	0/730	0.53	0/982
3	C	0.69	0/617	0.89	0/836
3	J	0.64	1/622 (0.2%)	0.86	1/843 (0.1%)
4	D	0.64	0/584	0.78	0/787
4	K	0.67	0/563	0.82	0/760
5	E	0.58	0/611	0.76	0/827
5	L	0.53	0/602	0.74	0/815
6	F	0.58	0/505	0.76	0/675
6	M	0.35	0/497	0.55	0/664
7	G	0.57	0/619	0.86	2/835 (0.2%)
7	N	0.34	0/542	0.56	0/730
8	O	0.22	0/113	0.63	0/173
8	P	0.28	0/91	0.67	0/139
All	All	0.55	1/8464 (0.0%)	0.75	5/11446 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	J	4	PRO	N-CD	5.31	1.55	1.47

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	57	ARG	NE-CZ-NH1	-6.24	117.18	120.30
7	G	72	ARG	NE-CZ-NH1	-5.82	117.39	120.30
1	A	63	LEU	CB-CG-CD2	-5.74	101.25	111.00
3	J	3	THR	C-N-CD	5.56	140.07	128.40
7	G	40	LEU	CA-CB-CG	5.02	126.85	115.30

There are no chirality outliers.

There are no planarity outliers.

## 5.2 Too-close contacts

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	508	0	543	19	0
1	H	494	0	524	103	0
2	B	750	0	760	20	0
2	I	721	0	740	89	0
3	C	611	0	620	22	0
3	J	616	0	622	29	0
4	D	577	0	572	22	0
4	K	556	0	524	20	0
5	E	603	0	609	19	0
5	L	594	0	603	34	0
6	F	504	0	557	18	0
6	M	496	0	548	72	0
7	G	613	0	628	20	0
7	N	536	0	562	81	0
8	O	103	0	53	16	0
8	P	83	0	42	8	0
9	A	2	0	0	0	0
9	B	7	0	0	0	0
9	C	13	0	0	4	0
9	D	10	0	0	2	0
9	E	8	0	0	1	0
9	F	6	0	0	1	0
9	G	6	0	0	3	0
9	H	4	0	0	3	0
9	I	5	0	0	2	0
9	J	5	0	0	0	0
9	K	9	0	0	3	0
9	L	5	0	0	0	0
9	M	5	0	0	0	0
9	N	3	0	0	1	0
9	O	2	0	0	0	0
All	All	8455	0	8507	494	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 29.

The worst 5 of 494 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)
6:M:37:LYS:HG2	6:M:105:ALA:CB	1.25	1.59
6:M:37:LYS:CG	6:M:105:ALA:HB3	1.30	1.55
6:M:67:VAL:CG2	6:M:69:TYR:HE1	1.25	1.48
6:M:67:VAL:CG2	6:M:69:TYR:CE1	2.16	1.27
2:I:43:ILE:CD1	2:I:60:ILE:HG23	1.66	1.25

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	63/96 (66%)	61 (97%)	2 (3%)	0	100	100
1	H	60/96 (62%)	53 (88%)	5 (8%)	2 (3%)	4	6
2	B	90/95 (95%)	83 (92%)	7 (8%)	0	100	100
2	I	84/95 (88%)	74 (88%)	10 (12%)	0	100	100
3	C	75/89 (84%)	72 (96%)	3 (4%)	0	100	100
3	J	76/89 (85%)	73 (96%)	3 (4%)	0	100	100
4	D	72/86 (84%)	70 (97%)	2 (3%)	0	100	100
4	K	72/86 (84%)	65 (90%)	7 (10%)	0	100	100
5	E	73/93 (78%)	69 (94%)	3 (4%)	1 (1%)	11	22
5	L	72/93 (77%)	63 (88%)	8 (11%)	1 (1%)	11	22
6	F	62/115 (54%)	62 (100%)	0	0	100	100
6	M	61/115 (53%)	54 (88%)	7 (12%)	0	100	100
7	G	73/93 (78%)	72 (99%)	1 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
7	N	62/93 (67%)	53 (86%)	7 (11%)	2 (3%)	4	6
All	All	995/1334 (75%)	924 (93%)	65 (6%)	6 (1%)	25	47

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
5	L	41	VAL
1	H	7	ASP
1	H	53	ALA
7	N	34	ASN
7	N	69	ILE

### 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	57/86 (66%)	47 (82%)	10 (18%)	2	3
1	H	55/86 (64%)	39 (71%)	16 (29%)	0	0
2	B	87/91 (96%)	75 (86%)	12 (14%)	3	6
2	I	84/91 (92%)	71 (84%)	13 (16%)	2	4
3	C	71/81 (88%)	55 (78%)	16 (22%)	1	1
3	J	71/81 (88%)	58 (82%)	13 (18%)	1	2
4	D	66/75 (88%)	58 (88%)	8 (12%)	5	9
4	K	58/75 (77%)	49 (84%)	9 (16%)	2	4
5	E	68/84 (81%)	65 (96%)	3 (4%)	28	53
5	L	67/84 (80%)	58 (87%)	9 (13%)	4	6
6	F	56/103 (54%)	52 (93%)	4 (7%)	14	29
6	M	55/103 (53%)	42 (76%)	13 (24%)	1	1
7	G	68/85 (80%)	59 (87%)	9 (13%)	4	7
7	N	60/85 (71%)	47 (78%)	13 (22%)	1	1
All	All	923/1210 (76%)	775 (84%)	148 (16%)	2	4



5 of 148 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
5	L	15	THR
7	N	38	LEU
5	L	45	LEU
6	M	87	ARG
5	E	61	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	H	33	ASN
2	I	21	ASN
2	I	59	ASN

### 5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
8	O	4/8 (50%)	4 (100%)	0
8	P	3/8 (37%)	2 (66%)	0
All	All	7/16 (43%)	6 (85%)	0

5 of 6 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
8	O	108	G
8	O	109	U
8	O	110	U
8	O	111	U
8	P	109	U

There are no RNA pucker outliers to report.

## 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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	65/96 (67%)	0.27	3 (4%) 32 26	40, 68, 124, 144	0
1	H	64/96 (66%)	1.29	15 (23%) 0 0	27, 97, 152, 201	0
2	B	92/95 (96%)	0.43	7 (7%) 13 10	44, 76, 145, 193	0
2	I	88/95 (92%)	0.83	11 (12%) 3 2	50, 87, 156, 199	0
3	C	77/89 (86%)	0.08	1 (1%) 77 73	41, 66, 93, 119	0
3	J	78/89 (87%)	0.22	2 (2%) 56 50	30, 64, 100, 132	0
4	D	74/86 (86%)	0.40	2 (2%) 54 48	44, 71, 116, 157	0
4	K	74/86 (86%)	0.07	2 (2%) 54 48	36, 60, 97, 115	0
5	E	77/93 (82%)	0.21	2 (2%) 56 50	42, 61, 109, 123	0
5	L	76/93 (81%)	0.24	2 (2%) 56 50	46, 73, 117, 140	0
6	F	66/115 (57%)	0.05	3 (4%) 33 26	39, 67, 114, 144	0
6	M	65/115 (56%)	0.98	12 (18%) 1 0	60, 94, 139, 160	0
7	G	77/93 (82%)	0.28	5 (6%) 18 14	40, 65, 124, 180	0
7	N	66/93 (70%)	1.46	17 (25%) 0 0	74, 112, 149, 166	0
8	O	5/8 (62%)	0.06	0 100 100	81, 87, 154, 184	0
8	P	4/8 (50%)	0.61	0 100 100	96, 111, 117, 180	0
All	All	1048/1350 (77%)	0.47	84 (8%) 12 9	27, 75, 138, 201	0

The worst 5 of 84 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	I	53	HIS	8.1
2	B	53	HIS	7.7
1	H	24	ILE	5.3
2	I	50	LYS	5.2
6	F	105	ALA	4.9

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.