



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 6, 2026 – 02:44 PM UTC

PDB ID : 6PPN / pdb_00006ppn
Title : Structure of *S. pombe* Lsm2-8 with unprocessed U6 snRNA
Authors : Montemayor, E.J.; Butcher, S.E.
Deposited on : 2019-07-08
Resolution : 1.91 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

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 : 4-5-2 with Phenix2.0
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

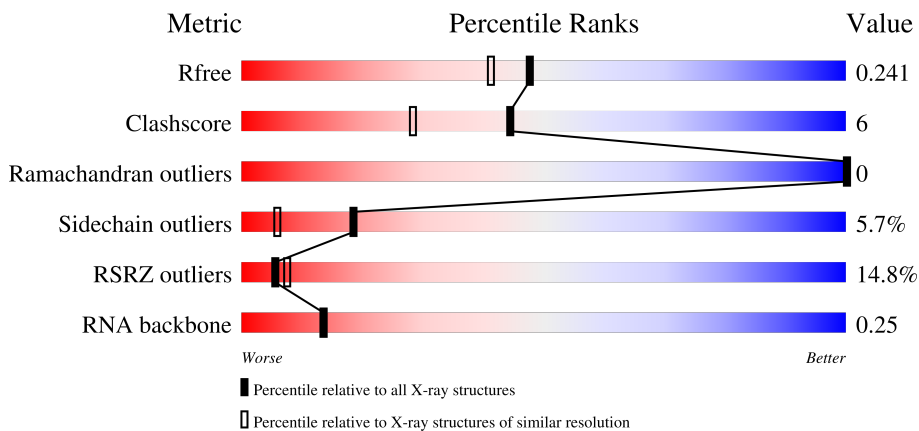
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.91 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}	180053	1188 (1.92-1.92)
Clashscore	190562	1209 (1.92-1.92)
Ramachandran outliers	187476	1195 (1.92-1.92)
Sidechain outliers	187428	1195 (1.92-1.92)
RSRZ outliers	180081	1188 (1.92-1.92)
RNA backbone	3983	1041 (2.30-1.54)

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 $\leq 5\%$. 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	6	
1	I	6	
2	B	96	
2	J	96	

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Mol	Chain	Length	Quality of chain
3	C	95	<p>3% 73% 5% 21%</p>
3	K	95	<p>5% 68% 11% 21%</p>
4	D	129	<p>4% 56% 9% 32%</p>
4	L	129	<p>16% 52% 16% 32%</p>
5	E	80	<p>6% 71% 14% 15%</p>
5	M	80	<p>52% 66% 15% 15%</p>
6	F	77	<p>8% 73% 14% 12%</p>
6	N	77	<p>18% 79% 6% 12%</p>
7	G	119	<p>8% 50% 11% 37%</p>
7	O	119	<p>27% 44% 13% 41%</p>
8	H	94	<p>11% 83% 15%</p>
8	P	94	<p>9% 85% 15%</p>

2 Entry composition

There are 9 unique types of molecules in this entry. The entry contains 8877 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 RNA chain called Mimic of unprocessed U6 snRNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	A	5	84	36	8	35	5	0	0	0
1	I	5	84	36	8	35	5	0	0	0

- 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	94	739	474	123	137	5	0	0	0
2	J	89	711	458	118	130	5	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	75	605	389	104	110	2	0	0	0
3	K	75	605	389	104	110	2	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-1	GLY	-	expression tag	UNP Q9Y7M4
C	0	SER	-	expression tag	UNP Q9Y7M4
K	-1	GLY	-	expression tag	UNP Q9Y7M4
K	0	SER	-	expression tag	UNP Q9Y7M4

- Molecule 4 is a protein called Probable U6 snRNA-associated Sm-like protein LSm4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	88	Total	C	N	O	S	0	0	0
			702	441	127	129	5			
4	L	88	Total	C	N	O	S	0	0	0
			685	432	121	127	5			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	122	TRP	-	expression tag	UNP O14352
D	123	SER	-	expression tag	UNP O14352
D	124	HIS	-	expression tag	UNP O14352
D	125	PRO	-	expression tag	UNP O14352
D	126	GLN	-	expression tag	UNP O14352
D	127	PHE	-	expression tag	UNP O14352
D	128	GLU	-	expression tag	UNP O14352
D	129	LYS	-	expression tag	UNP O14352
L	122	TRP	-	expression tag	UNP O14352
L	123	SER	-	expression tag	UNP O14352
L	124	HIS	-	expression tag	UNP O14352
L	125	PRO	-	expression tag	UNP O14352
L	126	GLN	-	expression tag	UNP O14352
L	127	PHE	-	expression tag	UNP O14352
L	128	GLU	-	expression tag	UNP O14352
L	129	LYS	-	expression tag	UNP O14352

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	68	Total	C	N	O	S	0	0	0
			518	333	82	97	6			
5	M	68	Total	C	N	O	S	0	0	0
			514	330	81	97	6			

- Molecule 6 is a protein called U6 snRNA-associated Sm-like protein LSm6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	68	Total	C	N	O	S	0	0	0
			505	324	84	95	2			
6	N	68	Total	C	N	O	S	0	0	0
			499	321	81	95	2			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	-1	GLY	-	expression tag	UNP Q9UUI1
F	0	SER	-	expression tag	UNP Q9UUI1
N	-1	GLY	-	expression tag	UNP Q9UUI1
N	0	SER	-	expression tag	UNP Q9UUI1

- Molecule 7 is a protein called U6 snRNA-associated Sm-like protein LSm7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	G	75	Total	C	N	O	S	0	0	0
			572	365	98	107	2			
7	O	70	Total	C	N	O	S	0	0	0
			534	339	92	101	2			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	114	HIS	-	expression tag	UNP O74499
G	115	HIS	-	expression tag	UNP O74499
G	116	HIS	-	expression tag	UNP O74499
G	117	HIS	-	expression tag	UNP O74499
G	118	HIS	-	expression tag	UNP O74499
G	119	HIS	-	expression tag	UNP O74499
O	114	HIS	-	expression tag	UNP O74499
O	115	HIS	-	expression tag	UNP O74499
O	116	HIS	-	expression tag	UNP O74499
O	117	HIS	-	expression tag	UNP O74499
O	118	HIS	-	expression tag	UNP O74499
O	119	HIS	-	expression tag	UNP O74499

- Molecule 8 is a protein called U6 snRNA-associated Sm-like protein LSm8.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
8	H	94	Total	C	N	O	S	0	0	0
			713	450	121	138	4			
8	P	94	Total	C	N	O	S	0	0	0
			713	450	121	138	4			

- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	2	Total	O	0	0
			2	2		

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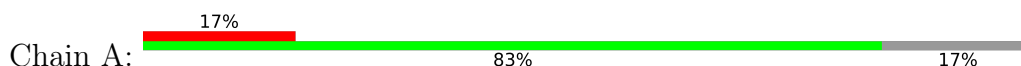
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	B	24	Total 24	O 24	0	0
9	C	11	Total 11	O 11	0	0
9	D	5	Total 5	O 5	0	0
9	E	1	Total 1	O 1	0	0
9	F	6	Total 6	O 6	0	0
9	G	3	Total 3	O 3	0	0
9	H	12	Total 12	O 12	0	0
9	I	2	Total 2	O 2	0	0
9	J	21	Total 21	O 21	0	0
9	K	7	Total 7	O 7	0	0

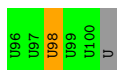
3 Residue-property plots [i](#)

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.

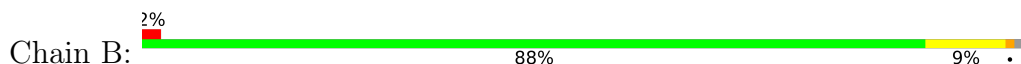
- Molecule 1: Mimic of unprocessed U6 snRNA



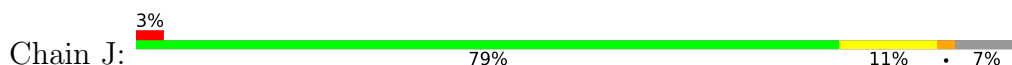
- Molecule 1: Mimic of unprocessed U6 snRNA



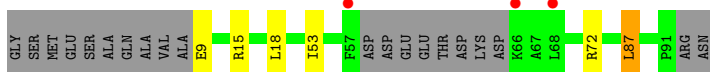
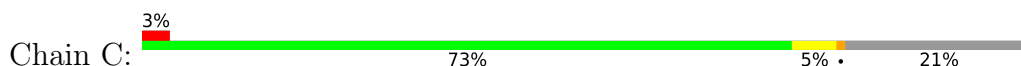
- Molecule 2: U6 snRNA-associated Sm-like protein LSm2



- Molecule 2: U6 snRNA-associated Sm-like protein LSm2



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



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

4 Data and refinement statistics

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, α , β , γ	70.28Å 135.39Å 168.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	67.70 – 1.91 67.70 – 1.91	Depositor EDS
% Data completeness (in resolution range)	63.3 (67.70-1.91) 64.0 (67.70-1.91)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.52 (at 1.91Å)	Xtrriage
Refinement program	PHENIX	Depositor
R, R_{free}	(Not available) , (Not available) 0.216 , 0.241	Depositor DCC
R_{free} test set	2000 reflections (1.60%)	wwPDB-VP
Wilson B-factor (Å ²)	42.3	Xtrriage
Anisotropy	0.051	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 49.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8877	wwPDB-VP
Average B, all atoms (Å ²)	66.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.72% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	0.61	0/91	0.92	0/139
1	I	0.41	0/91	0.90	0/139
2	B	0.51	0/750	0.76	0/1014
2	J	0.47	0/722	0.76	0/974
3	C	0.50	0/614	0.74	0/829
3	K	0.45	0/614	0.78	0/829
4	D	0.48	0/712	0.76	0/962
4	L	0.26	0/695	0.60	0/942
5	E	0.38	0/524	0.68	0/707
5	M	0.28	0/520	0.67	0/703
6	F	0.41	0/511	0.74	0/691
6	N	0.38	0/505	0.79	0/684
7	G	0.37	0/576	0.62	0/778
7	O	0.25	0/536	0.60	0/722
8	H	0.47	0/722	0.72	0/979
8	P	0.34	0/722	0.60	0/979
All	All	0.41	0/8905	0.71	0/12071

There are no bond length outliers.

There are no bond angle outliers.

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	84	0	40	0	0
1	I	84	0	40	1	0
2	B	739	0	747	8	0
2	J	711	0	729	7	0
3	C	605	0	617	5	0
3	K	605	0	617	11	0
4	D	702	0	698	12	0
4	L	685	0	666	13	0
5	E	518	0	529	5	0
5	M	514	0	518	10	0
6	F	505	0	489	9	0
6	N	499	0	478	5	0
7	G	572	0	580	11	0
7	O	534	0	547	13	0
8	H	713	0	690	9	0
8	P	713	0	690	6	0
9	A	2	0	0	0	0
9	B	24	0	0	1	0
9	C	11	0	0	0	0
9	D	5	0	0	1	0
9	E	1	0	0	0	0
9	F	6	0	0	0	0
9	G	3	0	0	0	0
9	H	12	0	0	0	0
9	I	2	0	0	1	0
9	J	21	0	0	1	0
9	K	7	0	0	0	0
All	All	8877	0	8675	104	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 6.

The worst 5 of 104 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)
4:L:10:THR:HG22	4:L:75:VAL:HG11	1.64	0.80
4:L:20:LYS:HA	4:L:67:LYS:HD3	1.64	0.79
4:D:20:LYS:HA	4:D:67:LYS:HD3	1.66	0.76
3:K:12:ASP:OD1	3:K:15:ARG:NH1	2.23	0.72
3:K:9:GLU:HG2	6:N:33:CYS:SG	2.29	0.72

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	
2	B	92/96 (96%)	91 (99%)	1 (1%)	0	100	100
2	J	87/96 (91%)	86 (99%)	1 (1%)	0	100	100
3	C	71/95 (75%)	71 (100%)	0	0	100	100
3	K	71/95 (75%)	71 (100%)	0	0	100	100
4	D	86/129 (67%)	85 (99%)	1 (1%)	0	100	100
4	L	86/129 (67%)	85 (99%)	1 (1%)	0	100	100
5	E	64/80 (80%)	62 (97%)	2 (3%)	0	100	100
5	M	64/80 (80%)	62 (97%)	2 (3%)	0	100	100
6	F	66/77 (86%)	62 (94%)	4 (6%)	0	100	100
6	N	66/77 (86%)	61 (92%)	5 (8%)	0	100	100
7	G	69/119 (58%)	68 (99%)	1 (1%)	0	100	100
7	O	64/119 (54%)	64 (100%)	0	0	100	100
8	H	92/94 (98%)	90 (98%)	2 (2%)	0	100	100
8	P	92/94 (98%)	90 (98%)	2 (2%)	0	100	100
All	All	1070/1380 (78%)	1048 (98%)	22 (2%)	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	
2	B	82/87 (94%)	79 (96%)	3 (4%)	30	15
2	J	80/87 (92%)	73 (91%)	7 (9%)	9	1
3	C	66/83 (80%)	63 (96%)	3 (4%)	24	9
3	K	66/83 (80%)	64 (97%)	2 (3%)	36	20
4	D	75/110 (68%)	71 (95%)	4 (5%)	20	7
4	L	71/110 (64%)	67 (94%)	4 (6%)	19	6
5	E	59/71 (83%)	56 (95%)	3 (5%)	21	8
5	M	58/71 (82%)	52 (90%)	6 (10%)	7	1
6	F	50/66 (76%)	49 (98%)	1 (2%)	48	35
6	N	49/66 (74%)	47 (96%)	2 (4%)	27	12
7	G	61/104 (59%)	58 (95%)	3 (5%)	22	8
7	O	57/104 (55%)	52 (91%)	5 (9%)	9	1
8	H	75/84 (89%)	69 (92%)	6 (8%)	11	2
8	P	75/84 (89%)	71 (95%)	4 (5%)	20	7
All	All	924/1210 (76%)	871 (94%)	53 (6%)	18	6

5 of 53 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	J	66	VAL
4	L	69	LEU
8	P	11	VAL
2	J	81	LEU
4	L	6	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
4	L	64	ASN
4	L	83	GLN
7	O	67	GLN
5	M	60	HIS
4	D	64	ASN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	3/6 (50%)	0	0
1	I	3/6 (50%)	0	1 (33%)
All	All	6/12 (50%)	0	1 (16%)

There are no RNA backbone outliers to report.

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	I	98	U

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](#)

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, 95th 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	5/6 (83%)	0.26	1 (20%) 3 3	37, 39, 72, 76	0
1	I	5/6 (83%)	-0.07	0 100 100	46, 51, 68, 112	0
2	B	94/96 (97%)	0.12	2 (2%) 63 70	29, 39, 67, 88	0
2	J	89/96 (92%)	0.09	3 (3%) 48 53	32, 43, 60, 73	0
3	C	75/95 (78%)	0.08	3 (4%) 42 47	30, 43, 71, 89	0
3	K	75/95 (78%)	0.32	5 (6%) 24 28	35, 45, 76, 99	0
4	D	88/129 (68%)	0.36	5 (5%) 29 34	35, 48, 87, 124	0
4	L	88/129 (68%)	1.40	20 (22%) 2 2	64, 96, 132, 141	0
5	E	68/80 (85%)	0.84	5 (7%) 20 24	49, 73, 90, 92	0
5	M	68/80 (85%)	2.43	42 (61%) 0 0	79, 121, 145, 166	0
6	F	68/77 (88%)	0.77	6 (8%) 15 19	35, 66, 97, 107	0
6	N	68/77 (88%)	1.37	14 (20%) 2 3	46, 69, 110, 127	0
7	G	75/119 (63%)	0.67	10 (13%) 7 9	39, 58, 80, 94	0
7	O	70/119 (58%)	2.21	32 (45%) 0 0	85, 123, 147, 150	0
8	H	94/94 (100%)	0.49	10 (10%) 11 14	32, 48, 81, 91	0
8	P	94/94 (100%)	0.79	8 (8%) 16 20	40, 66, 89, 95	0
All	All	1124/1392 (80%)	0.80	166 (14%) 5 7	29, 61, 129, 166	0

The worst 5 of 166 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
6	N	6	ASN	6.6
8	P	1	MET	6.5
5	M	5	ILE	5.4
5	M	11	ILE	5.4
7	O	79	ALA	5.3

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 oligosaccharides 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.