



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 03:59 AM UTC

PDB ID : 3U8Z / pdb_00003u8z
Title : human merlin FERM domain
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Deposited on : 2011-10-17
Resolution : 2.64 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	:	4-5-2 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

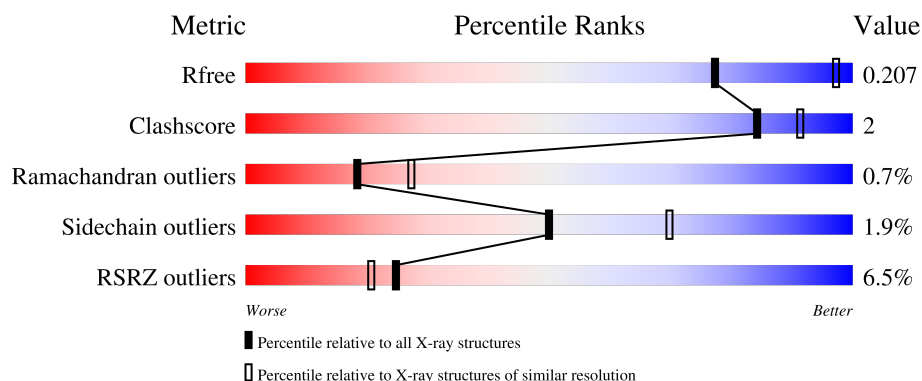
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

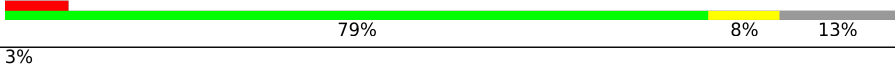
The reported resolution of this entry is 2.64 Å.

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	2053 (2.66-2.62)
Clashscore	190562	2097 (2.66-2.62)
Ramachandran outliers	187476	2066 (2.66-2.62)
Sidechain outliers	187428	2066 (2.66-2.62)
RSRZ outliers	180081	2052 (2.66-2.62)

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	300	
1	B	300	
1	C	300	
1	D	300	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 9077 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 Merlin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	260	Total	C	N	O	S	0	0	0
			2173	1411	362	387	13			
1	B	260	Total	C	N	O	S	0	0	0
			2172	1411	361	387	13			
1	C	266	Total	C	N	O	S	0	0	0
			2222	1443	369	397	13			
1	D	237	Total	C	N	O	S	0	0	0
			1973	1288	324	350	11			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	13	GLY	-	expression tag	UNP P35240
A	14	PRO	-	expression tag	UNP P35240
A	15	LEU	-	expression tag	UNP P35240
A	16	GLY	-	expression tag	UNP P35240
A	17	SER	-	expression tag	UNP P35240
B	13	GLY	-	expression tag	UNP P35240
B	14	PRO	-	expression tag	UNP P35240
B	15	LEU	-	expression tag	UNP P35240
B	16	GLY	-	expression tag	UNP P35240
B	17	SER	-	expression tag	UNP P35240
C	13	GLY	-	expression tag	UNP P35240
C	14	PRO	-	expression tag	UNP P35240
C	15	LEU	-	expression tag	UNP P35240
C	16	GLY	-	expression tag	UNP P35240
C	17	SER	-	expression tag	UNP P35240
D	13	GLY	-	expression tag	UNP P35240
D	14	PRO	-	expression tag	UNP P35240
D	15	LEU	-	expression tag	UNP P35240
D	16	GLY	-	expression tag	UNP P35240
D	17	SER	-	expression tag	UNP P35240

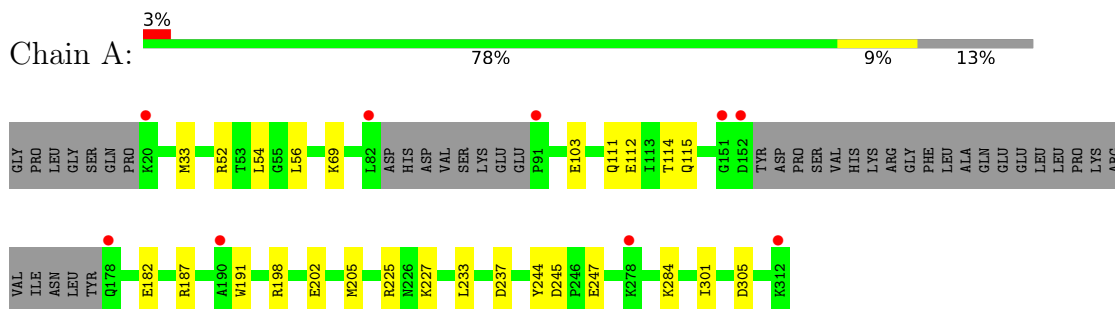
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	164	Total 164	O 164	0	0
2	B	141	Total 141	O 141	0	0
2	C	162	Total 162	O 162	0	0
2	D	70	Total 70	O 70	0	0

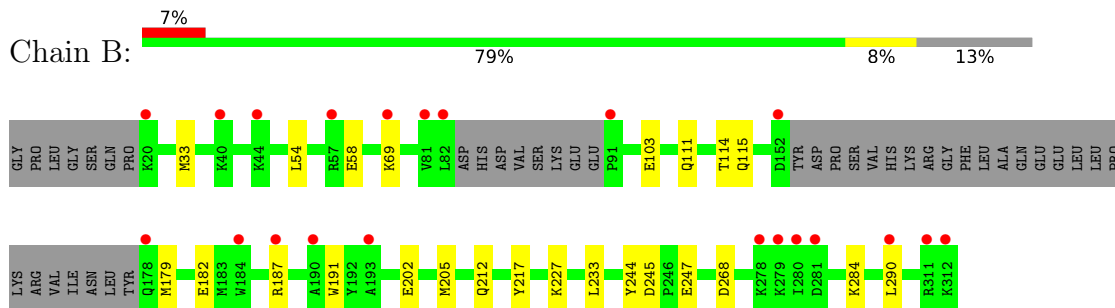
3 Residue-property plots [i](#)

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.

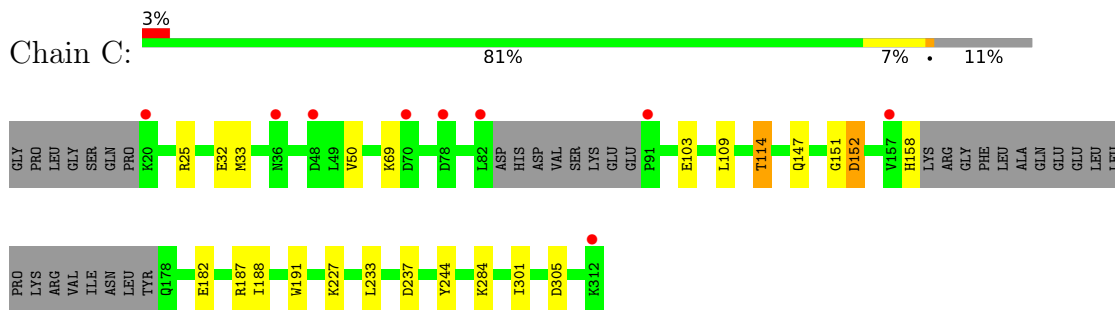
• Molecule 1: Merlin



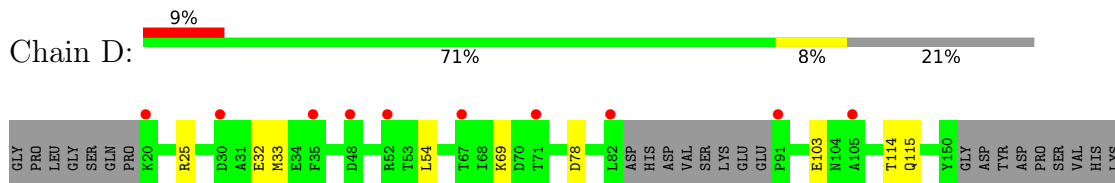
• Molecule 1: Merlin

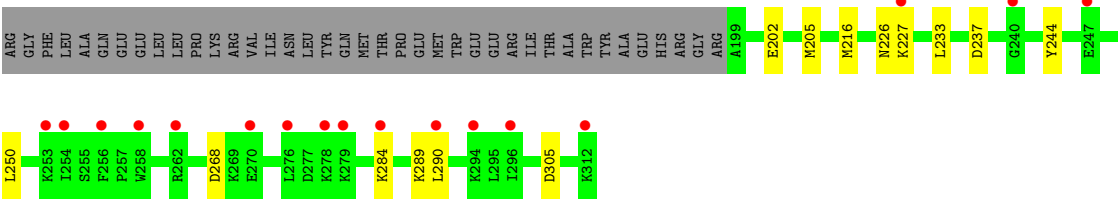


• Molecule 1: Merlin



• Molecule 1: Merlin





4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	105.45Å 105.45Å 330.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	26.36 – 2.64 26.36 – 2.64	Depositor EDS
% Data completeness (in resolution range)	94.1 (26.36-2.64) 94.1 (26.36-2.64)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.69 (at 2.64Å)	Xtriage
Refinement program	BUSTER 2.13.0	Depositor
R, R_{free}	0.200 , 0.229 (Not available) , 0.207	Depositor DCC
R_{free} test set	2666 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	47.9	Xtriage
Anisotropy	0.114	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 70.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	9077	wwPDB-VP
Average B, all atoms (Å ²)	64.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 25.44 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 3.1713e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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	0.75	0/2223	1.14	1/2992 (0.0%)
1	B	0.72	0/2222	1.13	0/2990
1	C	0.76	0/2275	1.17	3/3064 (0.1%)
1	D	0.70	0/2016	1.16	4/2711 (0.1%)
All	All	0.73	0/8736	1.15	8/11757 (0.1%)

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	237	ASP	CA-CB-CG	6.28	118.88	112.60
1	C	151	GLY	CA-C-N	6.07	133.14	121.54
1	C	151	GLY	C-N-CA	6.07	133.14	121.54
1	C	237	ASP	CA-CB-CG	5.78	118.38	112.60
1	D	226	ASN	CA-CB-CG	5.38	117.98	112.60
1	D	289	LYS	CA-C-N	5.32	127.41	120.28
1	D	289	LYS	C-N-CA	5.32	127.41	120.28
1	D	237	ASP	CA-CB-CG	5.29	117.89	112.60

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	2173	0	2185	18	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2172	0	2184	11	0
1	C	2222	0	2225	12	0
1	D	1973	0	2007	8	0
2	A	164	0	0	2	0
2	B	141	0	0	1	0
2	C	162	0	0	0	0
2	D	70	0	0	0	0
All	All	9077	0	8601	40	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 2.

All (40) 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:A:56:LEU:CD1	1:A:114:THR:HG22	2.02	0.90
1:A:52:ARG:HD3	1:C:152:ASP:OD2	1.81	0.80
1:B:58:GLU:OE1	1:B:114:THR:HG21	1.89	0.72
1:C:25:ARG:HE	1:C:32:GLU:HG3	1.57	0.69
1:A:56:LEU:HD12	1:A:114:THR:HG22	1.74	0.67
1:D:227:LYS:HE3	1:D:284:LYS:H	1.61	0.66
1:D:25:ARG:HH11	1:D:32:GLU:CD	2.09	0.60
1:D:33:MET:HE1	1:D:54:LEU:HD21	1.84	0.59
1:A:227:LYS:HE3	1:A:284:LYS:HD3	1.85	0.58
1:B:115:GLN:HG3	1:B:205:MET:HE2	1.85	0.57
1:B:33:MET:HE1	1:B:54:LEU:HD21	1.87	0.56
1:B:227:LYS:HE3	1:B:284:LYS:HD3	1.87	0.56
1:B:233:LEU:HB2	1:B:244:TYR:HB2	1.90	0.54
1:C:227:LYS:HE3	1:C:284:LYS:HD3	1.89	0.53
1:A:233:LEU:HB2	1:A:244:TYR:HB2	1.91	0.52
1:C:233:LEU:HB2	1:C:244:TYR:HB2	1.92	0.52
1:D:233:LEU:HB2	1:D:244:TYR:HB2	1.92	0.51
1:A:33:MET:HE1	1:A:54:LEU:HD21	1.92	0.50
1:A:301:ILE:HD11	1:C:187:ARG:HE	1.76	0.50
1:A:247:GLU:O	1:B:247:GLU:O	2.30	0.50
1:A:111:GLN:HB2	1:A:114:THR:HG23	1.94	0.49
1:A:187:ARG:HE	1:C:301:ILE:HD11	1.78	0.49
1:B:191:TRP:HB3	1:D:305:ASP:OD2	2.12	0.49
1:D:227:LYS:H	1:D:227:LYS:HD2	1.78	0.48
1:B:111:GLN:O	1:B:114:THR:HG22	2.13	0.47
1:A:191:TRP:HB3	1:C:305:ASP:OD2	2.15	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:115:GLN:HE21	1:A:205:MET:HE2	1.80	0.47
1:B:245:ASP:HB3	2:B:357:HOH:O	2.16	0.45
1:B:179:MET:HE2	1:B:187:ARG:NE	2.32	0.45
1:D:115:GLN:HE21	1:D:205:MET:HE2	1.82	0.44
1:A:245:ASP:HB3	2:A:362:HOH:O	2.18	0.43
1:A:305:ASP:OD2	1:C:191:TRP:HB3	2.19	0.43
1:B:212:GLN:HA	1:B:217:TYR:CD1	2.56	0.41
1:A:112:GLU:CD	1:A:198:ARG:HH22	2.29	0.41
1:C:33:MET:HE3	1:C:50:VAL:HG13	2.02	0.41
1:D:216:MET:HG3	1:D:250:LEU:HD23	2.02	0.41
1:A:187:ARG:HE	1:C:301:ILE:CD1	2.33	0.41
1:A:33:MET:HG2	1:C:33:MET:HB3	2.02	0.41
1:C:109:LEU:HD22	1:C:114:THR:HG22	2.02	0.41
1:A:225:ARG:HD3	2:A:343:HOH:O	2.21	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	254/300 (85%)	249 (98%)	4 (2%)	1 (0%)	30	42
1	B	254/300 (85%)	249 (98%)	3 (1%)	2 (1%)	16	24
1	C	260/300 (87%)	250 (96%)	8 (3%)	2 (1%)	16	24
1	D	231/300 (77%)	228 (99%)	1 (0%)	2 (1%)	14	21
All	All	999/1200 (83%)	976 (98%)	16 (2%)	7 (1%)	18	27

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	152	ASP

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Mol	Chain	Res	Type
1	D	69	LYS
1	A	69	LYS
1	B	69	LYS
1	C	69	LYS
1	B	268	ASP
1	D	268	ASP

5.3.2 Protein sidechains ⓘ

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	235/271 (87%)	232 (99%)	3 (1%)	61	76
1	B	234/271 (86%)	230 (98%)	4 (2%)	53	72
1	C	240/271 (89%)	234 (98%)	6 (2%)	42	63
1	D	215/271 (79%)	210 (98%)	5 (2%)	44	65
All	All	924/1084 (85%)	906 (98%)	18 (2%)	50	70

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	103	GLU
1	A	182	GLU
1	A	202	GLU
1	B	103	GLU
1	B	182	GLU
1	B	202	GLU
1	B	290	LEU
1	C	103	GLU
1	C	114	THR
1	C	147	GLN
1	C	158	HIS
1	C	182	GLU
1	C	188	ILE
1	D	78	ASP
1	D	103	GLU

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Mol	Chain	Res	Type
1	D	114	THR
1	D	202	GLU
1	D	290	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	65	GLN
1	A	115	GLN
1	B	65	GLN
1	B	115	GLN
1	B	303	ASN
1	C	65	GLN
1	C	303	ASN
1	D	65	GLN
1	D	115	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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 ⓘ

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, 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	260/300 (86%)	-0.12	9 (3%) 47 41	28, 43, 85, 110	0
1	B	260/300 (86%)	0.43	21 (8%) 18 14	28, 61, 125, 156	0
1	C	266/300 (88%)	0.03	9 (3%) 48 42	29, 51, 97, 122	0
1	D	237/300 (79%)	0.85	27 (11%) 10 8	48, 80, 138, 169	0
All	All	1023/1200 (85%)	0.28	66 (6%) 25 21	28, 58, 122, 169	0

All (66) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	82	LEU	5.1
1	B	20	LYS	5.0
1	D	82	LEU	4.9
1	C	82	LEU	4.7
1	A	82	LEU	4.4
1	D	91	PRO	4.3
1	C	20	LYS	4.0
1	D	258	TRP	3.9
1	B	280	ILE	3.9
1	D	290	LEU	3.9
1	D	20	LYS	3.9
1	B	178	GLN	3.7
1	B	312	LYS	3.6
1	C	91	PRO	3.6
1	D	279	LYS	3.5
1	B	278	LYS	3.3
1	B	91	PRO	3.2
1	B	190	ALA	3.2
1	D	240	GLY	3.1
1	D	278	LYS	3.1
1	A	312	LYS	3.0

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Mol	Chain	Res	Type	RSRZ
1	B	152	ASP	3.0
1	D	247	GLU	2.9
1	D	256	PHE	2.9
1	B	81	VAL	2.9
1	D	253	LYS	2.9
1	D	71	THR	2.8
1	B	184	TRP	2.8
1	C	48	ASP	2.8
1	D	105	ALA	2.8
1	B	44	LYS	2.7
1	A	152	ASP	2.7
1	A	151	GLY	2.7
1	D	262	ARG	2.7
1	D	284	LYS	2.6
1	D	294	LYS	2.5
1	D	227	LYS	2.4
1	D	312	LYS	2.4
1	D	276	LEU	2.4
1	A	278	LYS	2.4
1	B	279	LYS	2.4
1	C	312	LYS	2.4
1	D	52	ARG	2.4
1	C	157	VAL	2.3
1	A	91	PRO	2.3
1	C	78	ASP	2.3
1	B	290	LEU	2.3
1	B	40	LYS	2.2
1	A	20	LYS	2.2
1	D	35	PHE	2.2
1	B	57	ARG	2.2
1	B	193	ALA	2.1
1	B	311	ARG	2.1
1	C	70	ASP	2.1
1	D	30	ASP	2.1
1	D	296	ILE	2.1
1	D	270	GLU	2.1
1	D	67	THR	2.1
1	D	48	ASP	2.1
1	D	254	ILE	2.1
1	B	281	ASP	2.1
1	A	190	ALA	2.1
1	A	178	GLN	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	187	ARG	2.0
1	B	69	LYS	2.0
1	C	36	ASN	2.0

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.