



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 01:49 PM UTC

PDB ID : 6LYS / pdb_00006lys
Title : Structure of the BAM complex
Authors : Xiao, L.; Huang, Y.
Deposited on : 2020-02-15
Resolution : 3.05 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
Xtrriage (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

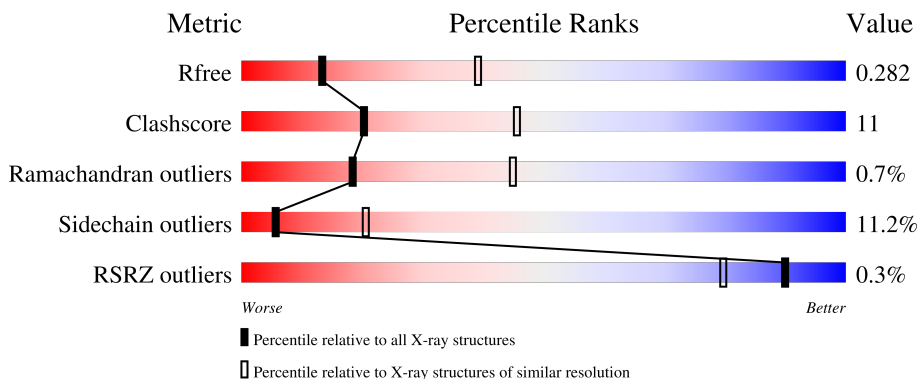
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.05 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	2469 (3.10-3.02)
Clashscore	190562	2569 (3.10-3.02)
Ramachandran outliers	187476	2424 (3.10-3.02)
Sidechain outliers	187428	2423 (3.10-3.02)
RSRZ outliers	180081	2469 (3.10-3.02)

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	810	
2	B	400	
3	D	245	
4	E	119	
5	C	344	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12196 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 Outer membrane protein assembly factor BamA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	786	6152	3882	1033	1221	16	0	0	0

- Molecule 2 is a protein called Outer membrane protein assembly factor BamB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	351	2607	1637	448	516	6	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	393	TRP	-	expression tag	UNP P77774
B	394	SER	-	expression tag	UNP P77774
B	395	HIS	-	expression tag	UNP P77774
B	396	PRO	-	expression tag	UNP P77774
B	397	GLN	-	expression tag	UNP P77774
B	398	PHE	-	expression tag	UNP P77774
B	399	GLU	-	expression tag	UNP P77774
B	400	LYS	-	expression tag	UNP P77774

- Molecule 3 is a protein called Outer membrane protein assembly factor BamD.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	D	208	1682	1057	296	322	7	0	0	0

- Molecule 4 is a protein called Outer membrane protein assembly factor BamE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	E	83	645	405	112	126	2	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	114	HIS	-	expression tag	UNP P0A937
E	115	HIS	-	expression tag	UNP P0A937
E	116	HIS	-	expression tag	UNP P0A937
E	117	HIS	-	expression tag	UNP P0A937
E	118	HIS	-	expression tag	UNP P0A937
E	119	HIS	-	expression tag	UNP P0A937

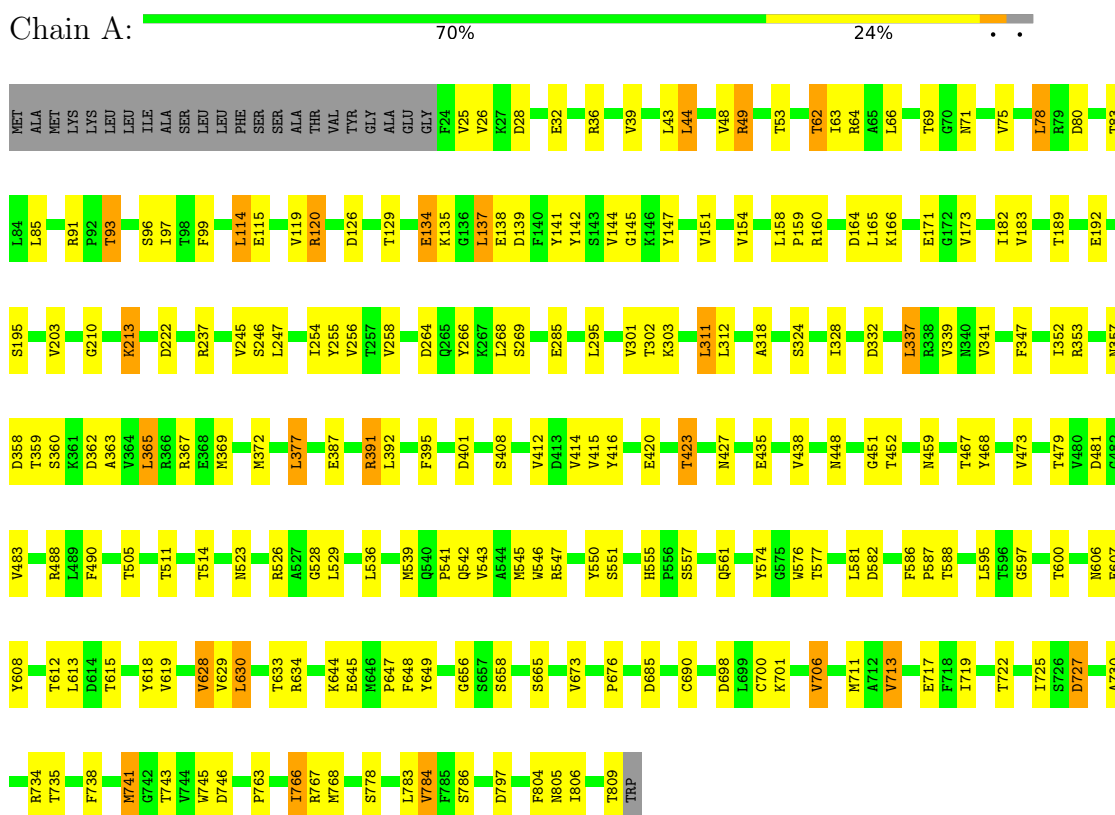
- Molecule 5 is a protein called Outer membrane protein assembly factor BamC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	C	154	1110	694	194	219	3	1	0	0

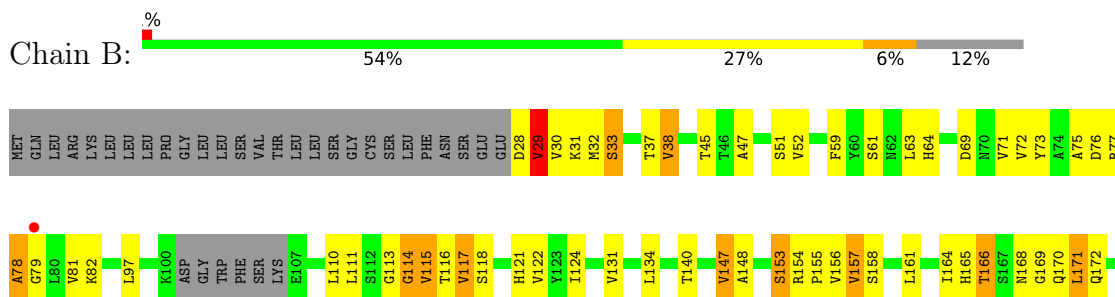
3 Residue-property plots i

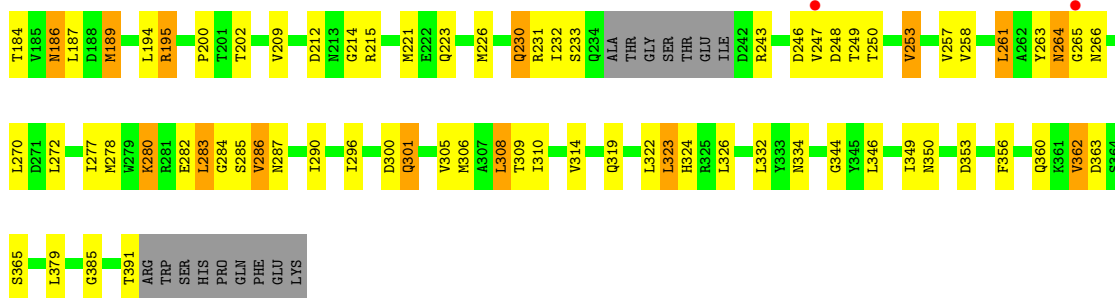
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Outer membrane protein assembly factor BamA

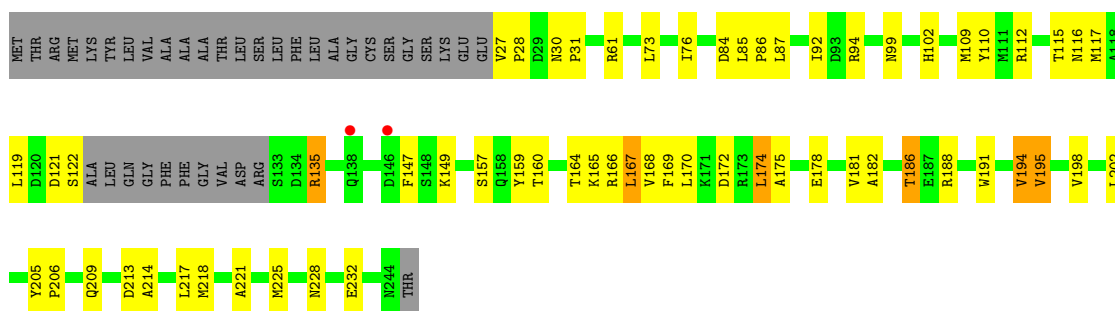


- Molecule 2: Outer membrane protein assembly factor BamB

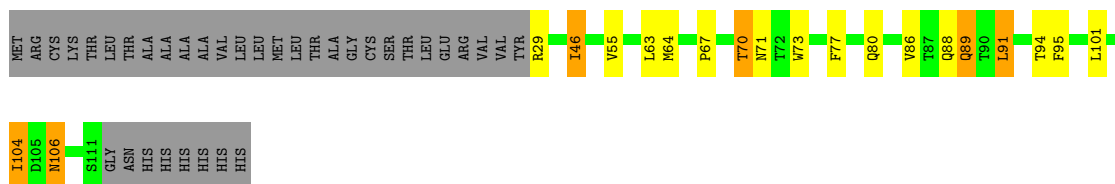




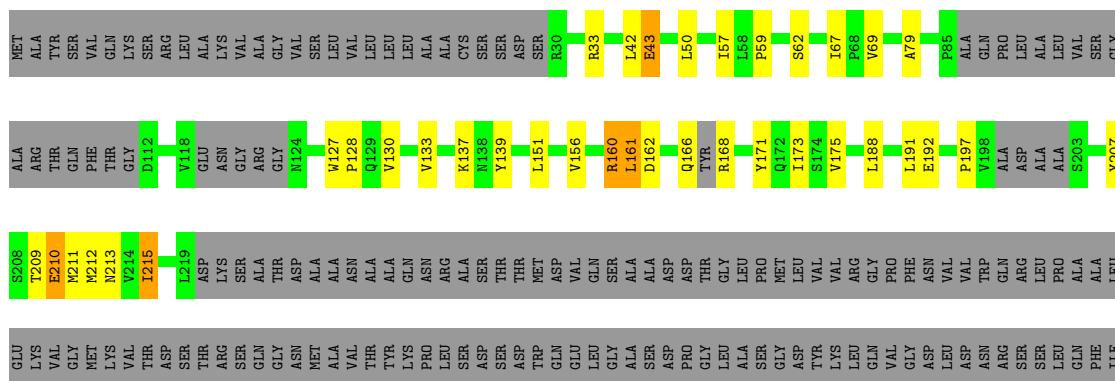
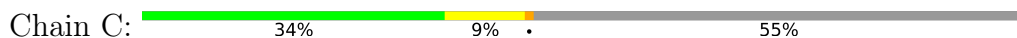
- Molecule 3: Outer membrane protein assembly factor BamD



- Molecule 4: Outer membrane protein assembly factor BamE



- Molecule 5: Outer membrane protein assembly factor BamC



ASP
PRO
LYS
GLY
HIS
THR
LEU
THR
GLN
SER
GLN
ASN
ASP
ALA
LEU
VAL
ALA
VAL
PHE
GLN
ALA
ALA
PHE
SER
LYS

4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	117.07Å 117.07Å 429.09Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 3.05 10.00 – 3.05	Depositor EDS
% Data completeness (in resolution range)	96.4 (10.00-3.05) 96.4 (10.00-3.05)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.04 (at 3.04Å)	Xtrriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.243 , 0.284 0.247 , 0.282	Depositor DCC
R_{free} test set	2790 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	96.7	Xtrriage
Anisotropy	0.010	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 43.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	12196	wwPDB-VP
Average B, all atoms (Å ²)	100.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.32% 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	0.98	0/6295	1.33	5/8554 (0.1%)
2	B	1.03	0/2652	1.49	7/3622 (0.2%)
3	D	0.96	0/1719	1.50	0/2336
4	E	0.98	0/659	1.31	0/899
5	C	1.06	0/1127	1.41	4/1541 (0.3%)
All	All	0.99	0/12452	1.40	16/16952 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
2	B	0	1

There are no bond length outliers.

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	78	ALA	N-CA-C	-29.54	74.08	110.41
2	B	79	GLY	N-CA-C	17.43	133.85	114.67
2	B	264	ASN	CB-CA-C	-9.99	94.94	111.23
2	B	265	GLY	N-CA-C	-8.53	101.04	112.81
2	B	249	THR	N-CA-C	6.73	120.50	109.06

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	248	ASP	Peptide

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	6152	0	5804	121	0
2	B	2607	0	2541	85	0
3	D	1682	0	1624	45	0
4	E	645	0	625	14	0
5	C	1110	0	1031	23	0
All	All	12196	0	11625	270	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 11.

The worst 5 of 270 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)
2:B:64:HIS:O	2:B:115:VAL:HG22	1.72	0.89
2:B:77:ARG:C	2:B:78:ALA:O	2.01	0.85
2:B:76:ASP:O	2:B:78:ALA:O	1.94	0.85
2:B:243:ARG:O	2:B:243:ARG:NE	2.08	0.85
1:A:547:ARG:NH2	1:A:746:ASP:OD1	2.12	0.81

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	784/810 (97%)	735 (94%)	48 (6%)	1 (0%)	48 75

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	B	345/400 (86%)	311 (90%)	26 (8%)	8 (2%)	5	19
3	D	204/245 (83%)	197 (97%)	6 (3%)	1 (0%)	24	52
4	E	81/119 (68%)	75 (93%)	5 (6%)	1 (1%)	10	32
5	C	144/344 (42%)	126 (88%)	18 (12%)	0	100	100
All	All	1558/1918 (81%)	1444 (93%)	103 (7%)	11 (1%)	18	45

5 of 11 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	29	VAL
2	B	114	GLY
2	B	300	ASP
1	A	80	ASP
2	B	69	ASP

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	654/688 (95%)	581 (89%)	73 (11%)	6	20
2	B	278/329 (84%)	236 (85%)	42 (15%)	3	11
3	D	176/204 (86%)	166 (94%)	10 (6%)	18	45
4	E	72/101 (71%)	62 (86%)	10 (14%)	3	13
5	C	108/276 (39%)	99 (92%)	9 (8%)	10	32
All	All	1288/1598 (81%)	1144 (89%)	144 (11%)	6	20

5 of 144 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	D	94	ARG
5	C	215	ILE
3	D	167	LEU
4	E	89	GLN

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Mol	Chain	Res	Type
1	A	438	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 26 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	186	ASN
3	D	47	ASN
5	C	182	GLN
3	D	41	GLN
3	D	69	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 [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	786/810 (97%)	-0.55	0 100 100	69, 93, 122, 149	0
2	B	351/400 (87%)	-0.50	3 (0%) 81 61	72, 96, 117, 140	0
3	D	208/245 (84%)	-0.51	2 (0%) 79 59	73, 94, 139, 157	0
4	E	83/119 (69%)	-0.44	0 100 100	74, 99, 131, 155	0
5	C	154/344 (44%)	-0.12	0 100 100	85, 140, 177, 199	1 (0%)
All	All	1582/1918 (82%)	-0.49	5 (0%) 90 80	69, 96, 144, 199	1 (0%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	247	VAL	4.9
3	D	146	ASP	3.2
2	B	265	GLY	2.3
2	B	79	GLY	2.1
3	D	138	GLN	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.