



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 04:22 PM UTC

PDB ID : 3DRF / pdb_00003drf
Title : Lactococcal OppA complexed with an endogenous peptide in the closed conformation
Authors : Berntsson, R.P.-A.; Doeven, M.K.; Duurkens, R.H.; Sengupta, D.; Marrink, S.-J.; Thunnissen, A.-M.; Poolman, B.; Slotboom, D.-J.
Deposited on : 2008-07-11
Resolution : 1.30 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

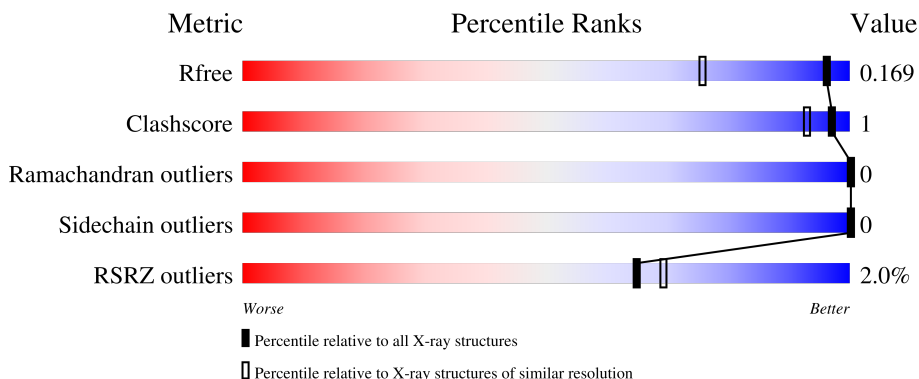
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.30 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	1553 (1.30-1.30)
Clashscore	190562	1595 (1.30-1.30)
Ramachandran outliers	187476	1551 (1.30-1.30)
Sidechain outliers	187428	1551 (1.30-1.30)
RSRZ outliers	180081	1549 (1.30-1.30)

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 ≥ 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	590	
2	B	8	

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 5516 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 Oligopeptide-binding protein oppA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	539	4349	2749	715	872	13	0	20	0

There are 13 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP A2RJ53
A	579	GLY	-	expression tag	UNP A2RJ53
A	580	SER	-	expression tag	UNP A2RJ53
A	581	ILE	-	expression tag	UNP A2RJ53
A	582	GLU	-	expression tag	UNP A2RJ53
A	583	GLY	-	expression tag	UNP A2RJ53
A	584	ARG	-	expression tag	UNP A2RJ53
A	585	HIS	-	expression tag	UNP A2RJ53
A	586	HIS	-	expression tag	UNP A2RJ53
A	587	HIS	-	expression tag	UNP A2RJ53
A	588	HIS	-	expression tag	UNP A2RJ53
A	589	HIS	-	expression tag	UNP A2RJ53
A	590	HIS	-	expression tag	UNP A2RJ53

- Molecule 2 is a protein called endogenous peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	B	8	48	27	9	12	0	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1111	Total	O	0	0
			1111	1111		

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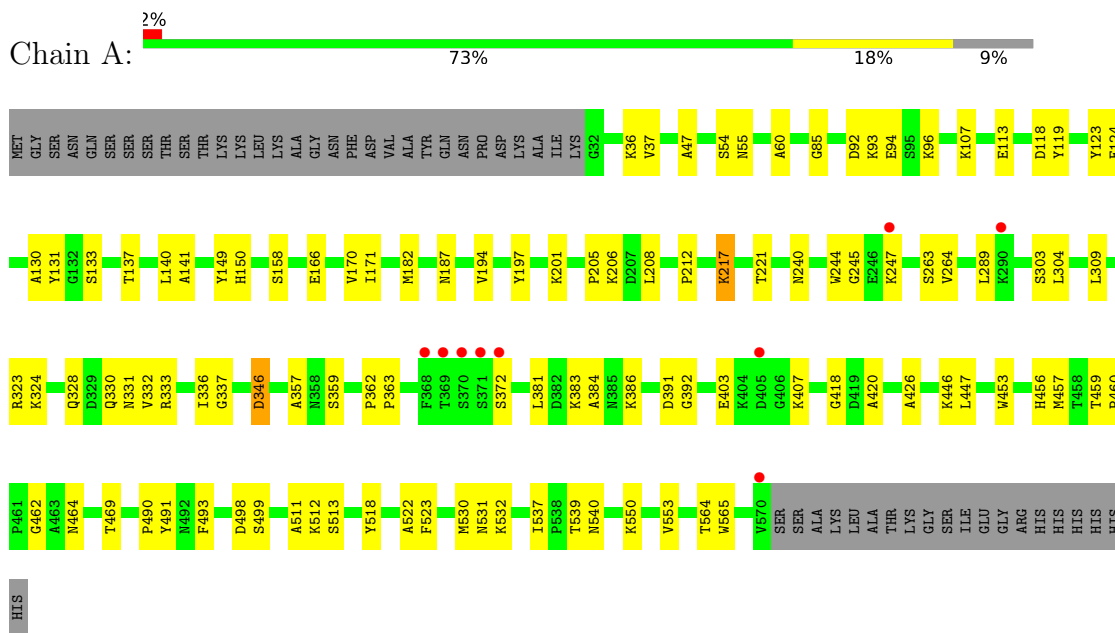
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	8	Total	O	0	0
			8	8		

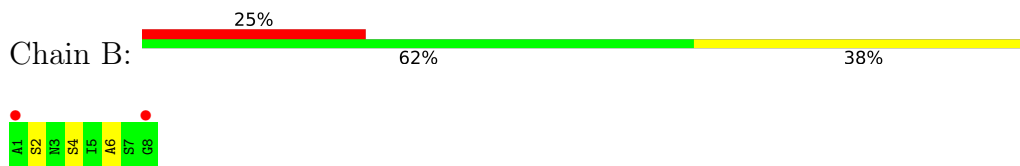
3 Residue-property plots

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: Oligopeptide-binding protein oppA



- Molecule 2: endogenous peptide



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	59.11Å 74.65Å 115.44Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	62.75 – 1.30 62.69 – 1.30	Depositor EDS
% Data completeness (in resolution range)	99.6 (62.75-1.30) 99.6 (62.69-1.30)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.67 (at 1.30Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.131 , 0.161 0.141 , 0.169	Depositor DCC
R_{free} test set	6300 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	8.5	Xtrriage
Anisotropy	0.039	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 45.0	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	0.97	EDS
Total number of atoms	5516	wwPDB-VP
Average B, all atoms (Å ²)	12.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.86% 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	1.81	103/4446 (2.3%)	0.92	1/6021 (0.0%)
2	B	2.17	3/47 (6.4%)	1.06	0/62
All	All	1.81	106/4493 (2.4%)	0.93	1/6083 (0.0%)

All (106) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	6	ALA	C-O	-7.80	1.14	1.23
1	A	60	ALA	C-O	-7.79	1.15	1.24
1	A	332	VAL	C-O	-7.30	1.15	1.24
1	A	518	TYR	C-O	-7.14	1.15	1.24
1	A	391	ASP	C-O	-7.03	1.14	1.24
1	A	158	SER	C-O	-7.02	1.15	1.24
1	A	47	ALA	C-O	-6.97	1.15	1.24
1	A	166	GLU	C-O	-6.84	1.15	1.24
1	A	420	ALA	C-O	-6.82	1.15	1.24
1	A	205	PRO	N-CD	-6.81	1.38	1.47
1	A	553	VAL	C-O	-6.79	1.17	1.24
1	A	149	TYR	C-O	-6.74	1.16	1.24
1	A	362	PRO	C-O	-6.63	1.17	1.24
1	A	330	GLN	C-O	-6.61	1.16	1.24
1	A	381	LEU	C-O	-6.56	1.16	1.24
1	A	333	ARG	C-O	-6.56	1.16	1.24
1	A	150	HIS	C-O	-6.52	1.16	1.24
1	A	93	LYS	C-O	-6.49	1.15	1.24
1	A	118	ASP	C-O	-6.42	1.16	1.24
1	A	171	ILE	C-O	-6.42	1.17	1.24
1	A	245	GLY	C-O	-6.41	1.17	1.24
1	A	264	VAL	C-O	-6.38	1.16	1.24
1	A	383	LYS	C-O	-6.33	1.16	1.24
1	A	530	MET	C-O	-6.30	1.16	1.24
1	A	346	ASP	C-O	-6.28	1.16	1.24
1	A	94	GLU	C-O	-6.24	1.16	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	328	GLN	C-O	-6.17	1.16	1.24
1	A	511	ALA	C-O	-6.16	1.16	1.24
1	A	357	ALA	C-O	-6.14	1.16	1.23
1	A	289	LEU	C-O	-6.13	1.16	1.23
1	A	240	ASN	C-O	-6.09	1.16	1.24
1	A	372	SER	C-O	-6.08	1.17	1.24
1	A	550	LYS	C-O	-6.02	1.16	1.24
1	A	197	TYR	C-O	-5.97	1.17	1.24
1	A	92	ASP	C-O	-5.97	1.17	1.24
1	A	336	ILE	C-O	-5.97	1.17	1.24
1	A	170	VAL	C-O	-5.96	1.17	1.24
1	A	85	GLY	C-O	-5.91	1.18	1.23
1	A	331	ASN	C-O	-5.88	1.17	1.24
1	A	359	SER	C-O	-5.88	1.17	1.23
1	A	130	ALA	C-O	-5.87	1.16	1.24
1	A	217	LYS	C-O	-5.85	1.17	1.23
1	A	194	VAL	C-O	-5.81	1.17	1.24
1	A	337	GLY	C-O	-5.77	1.17	1.23
1	A	123	TYR	C-O	-5.76	1.17	1.24
1	A	498	ASP	C-O	-5.74	1.17	1.24
1	A	469	THR	C-O	-5.69	1.16	1.23
1	A	460	PRO	CA-C	5.69	1.55	1.52
1	A	456	HIS	C-O	-5.67	1.17	1.24
1	A	565	TRP	C-O	-5.65	1.16	1.24
1	A	324	LYS	C-O	-5.62	1.17	1.24
1	A	464	ASN	C-O	-5.62	1.16	1.24
2	B	2	SER	C-O	-5.61	1.17	1.23
1	A	459	THR	C-O	-5.61	1.17	1.24
1	A	54	SER	C-O	-5.57	1.17	1.24
1	A	208	LEU	C-O	-5.54	1.17	1.24
1	A	453	TRP	C-O	-5.50	1.17	1.24
1	A	187	ASN	C-O	-5.49	1.17	1.24
1	A	384	ALA	C-O	-5.48	1.17	1.24
1	A	513	SER	C-O	-5.48	1.16	1.24
1	A	499	SER	C-O	-5.48	1.17	1.24
1	A	426	ALA	C-O	-5.48	1.17	1.24
1	A	386	LYS	C-O	-5.48	1.17	1.24
1	A	201	LYS	C-O	-5.47	1.17	1.24
2	B	4	SER	C-O	-5.47	1.17	1.23
1	A	141	ALA	C-O	-5.47	1.17	1.24
1	A	491	TYR	C-O	-5.47	1.17	1.24
1	A	537	ILE	C-O	-5.46	1.17	1.23

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	303	SER	C-O	-5.45	1.17	1.23
1	A	522	ALA	C-O	-5.41	1.17	1.24
1	A	564	THR	C-O	-5.40	1.17	1.24
1	A	244	TRP	C-O	-5.39	1.17	1.24
1	A	523	PHE	C-O	-5.39	1.17	1.24
1	A	490	PRO	C-O	-5.35	1.17	1.24
1	A	372	SER	N-CA	-5.34	1.39	1.46
1	A	206	LYS	C-O	-5.34	1.17	1.24
1	A	309	LEU	C-O	-5.32	1.17	1.24
1	A	392	GLY	C-O	-5.32	1.17	1.24
1	A	418	GLY	C-O	-5.30	1.19	1.24
1	A	532	LYS	C-O	-5.28	1.17	1.24
1	A	304	LEU	C-O	-5.26	1.17	1.23
1	A	531	ASN	C-O	-5.25	1.17	1.24
1	A	124	GLU	C-O	-5.25	1.17	1.24
1	A	446	LYS	C-O	-5.20	1.17	1.23
1	A	131	TYR	C-O	-5.20	1.17	1.24
1	A	323	ARG	C-O	-5.19	1.17	1.24
1	A	140	LEU	C-O	-5.18	1.17	1.24
1	A	457	MET	C-O	-5.17	1.17	1.24
1	A	363	PRO	C-O	-5.15	1.17	1.24
1	A	96	LYS	C-O	-5.14	1.16	1.23
1	A	263	SER	C-O	-5.14	1.18	1.24
1	A	133	SER	C-O	-5.12	1.17	1.23
1	A	512	LYS	C-O	-5.12	1.17	1.24
1	A	447	LEU	C-O	-5.10	1.17	1.23
1	A	539	THR	C-O	-5.10	1.17	1.24
1	A	119	TYR	C-O	-5.09	1.18	1.24
1	A	407	LYS	C-O	-5.09	1.17	1.24
1	A	212	PRO	C-O	-5.09	1.17	1.24
1	A	37	VAL	C-O	-5.09	1.18	1.24
1	A	182	MET	C-O	-5.07	1.17	1.24
1	A	221	THR	C-O	-5.07	1.17	1.24
1	A	462	GLY	C-O	-5.06	1.17	1.23
1	A	55	ASN	C-O	-5.06	1.17	1.23
1	A	137	THR	C-O	-5.05	1.17	1.23
1	A	403	GLU	C-O	-5.03	1.17	1.23
1	A	493	PHE	C-O	-5.00	1.17	1.24

All (1) bond angle outliers are listed below:

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	205	PRO	CA-N-CD	-7.55	101.44	112.00

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	4349	0	4208	8	0
2	B	48	0	47	0	0
3	A	1111	0	0	6	1
3	B	8	0	0	0	0
All	All	5516	0	4255	8	1

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 1.

All (8) 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:247:LYS:HE2	3:A:1377:HOH:O	1.59	1.02
1:A:36:LYS:NZ	3:A:1328:HOH:O	1.88	1.02
1:A:217:LYS:HE3	3:A:1086:HOH:O	1.77	0.81
1:A:107:LYS:NZ	3:A:980:HOH:O	2.22	0.73
1:A:247:LYS:CE	3:A:1377:HOH:O	2.29	0.67
1:A:107:LYS:NZ	1:A:113[B]:GLU:OE2	2.28	0.65
1:A:107:LYS:HE3	3:A:1476:HOH:O	2.09	0.52
1:A:346:ASP:OD2	1:A:540:ASN:ND2	2.53	0.41

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:965:HOH:O	3:A:1640:HOH:O[1_455]	2.17	0.03

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	556/590 (94%)	547 (98%)	9 (2%)	0	100	100
2	B	6/8 (75%)	6 (100%)	0	0	100	100
All	All	562/598 (94%)	553 (98%)	9 (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	
1	A	474/496 (96%)	474 (100%)	0	100	100
2	B	5/5 (100%)	5 (100%)	0	100	100
All	All	479/501 (96%)	479 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	34	ASN

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Mol	Chain	Res	Type
1	A	69	GLN
1	A	228	ASN
1	A	251	ASN
1	A	276	ASN
1	A	316	ASN
1	A	379	GLN
1	A	421	ASN

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	539/590 (91%)	-0.20	9 (1%) 69 73	3, 9, 16, 25	20 (3%)
2	B	8/8 (100%)	1.13	2 (25%) 2 2	7, 11, 16, 20	1 (12%)
All	All	547/598 (91%)	-0.18	11 (2%) 65 69	3, 9, 16, 25	21 (3%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	371	SER	4.7
2	B	1	ALA	3.9
1	A	370	SER	3.6
2	B	8	GLY	3.1
1	A	570[A]	VAL	2.9
1	A	290	LYS	2.7
1	A	372	SER	2.6
1	A	369	THR	2.5
1	A	405	ASP	2.1
1	A	247	LYS	2.1
1	A	368	PHE	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

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.