



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 08:50 AM UTC

PDB ID : 8WWF / pdb_00008wwf
Title : Crystal structure of (R)-DHPS dehydrogenase HpsO from Ruegeria pomeroyi DSS-3
Authors : Liu, L.; Tang, K.
Deposited on : 2023-10-25
Resolution : 1.70 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

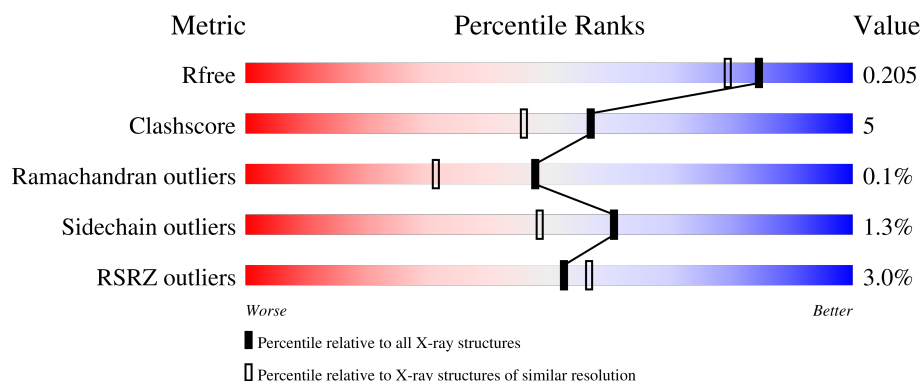
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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	5551 (1.70-1.70)
Clashscore	190562	5924 (1.70-1.70)
Ramachandran outliers	187476	5846 (1.70-1.70)
Sidechain outliers	187428	5846 (1.70-1.70)
RSRZ outliers	180081	5554 (1.70-1.70)

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	253	3% 84% 15% .
1	B	253	3% 85% 12% ..
1	C	253	4% 87% 11% ..
1	D	253	2% 87% 13%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8483 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.

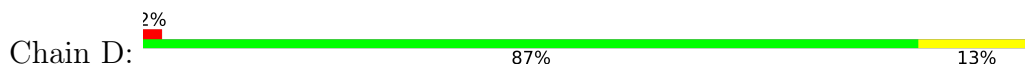
- Molecule 1 is a protein called (R)-DHPS dehydrogenase HpsO.

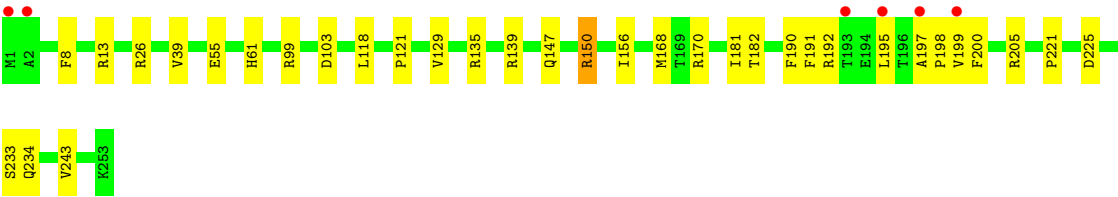
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	249	Total	C	N	O	S	0	0	0
			1834	1152	330	345	7			
1	B	249	Total	C	N	O	S	0	0	0
			1834	1152	330	345	7			
1	C	249	Total	C	N	O	S	0	0	0
			1834	1152	330	345	7			
1	D	253	Total	C	N	O	S	0	0	0
			1861	1167	334	352	8			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	270	Total	O	0	0
			270	270		
2	B	271	Total	O	0	0
			271	271		
2	C	283	Total	O	0	0
			283	283		
2	D	296	Total	O	0	0
			296	296		

- Molecule 1: (R)-DHPS dehydrogenase HpsO





4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	56.14Å 56.16Å 76.19Å 96.27° 105.96° 90.70°	Depositor
Resolution (Å)	41.95 – 1.70 41.95 – 1.70	Depositor EDS
% Data completeness (in resolution range)	95.7 (41.95-1.70) 95.7 (41.95-1.70)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.98 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.157 , 0.194 (Not available) , 0.205	Depositor DCC
R_{free} test set	4672 reflections (4.79%)	wwPDB-VP
Wilson B-factor (Å ²)	16.3	Xtriage
Anisotropy	0.036	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 41.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	8483	wwPDB-VP
Average B, all atoms (Å ²)	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.87% 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

5.1 Standard geometry

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	1.48	9/1874 (0.5%)	1.33	10/2552 (0.4%)
1	B	1.48	10/1874 (0.5%)	1.32	9/2552 (0.4%)
1	C	1.46	7/1874 (0.4%)	1.34	9/2552 (0.4%)
1	D	1.47	7/1901 (0.4%)	1.33	7/2588 (0.3%)
All	All	1.47	33/7523 (0.4%)	1.33	35/10244 (0.3%)

All (33) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	170	ARG	CZ-NH2	-8.55	1.22	1.33
1	A	170	ARG	CZ-NH1	8.30	1.44	1.32
1	A	170	ARG	CZ-NH2	-8.19	1.22	1.33
1	C	33	ALA	N-CA	8.02	1.55	1.46
1	C	170	ARG	CZ-NH1	7.41	1.43	1.32
1	C	170	ARG	CZ-NH2	-7.25	1.24	1.33
1	D	170	ARG	CZ-NH1	6.96	1.42	1.32
1	B	170	ARG	CZ-NH2	-6.68	1.24	1.33
1	B	170	ARG	CD-NE	-6.18	1.37	1.46
1	B	205	ARG	C-O	6.16	1.31	1.24
1	C	138	GLY	C-O	-5.92	1.18	1.23
1	B	33	ALA	C-O	5.91	1.31	1.24
1	C	7	LEU	N-CA	5.85	1.53	1.46
1	D	150	ARG	CZ-NH2	-5.67	1.26	1.33
1	D	8	PHE	N-CA	5.39	1.52	1.46
1	B	127	TYR	C-O	5.38	1.30	1.24
1	C	173	ALA	C-O	-5.37	1.17	1.24
1	A	23	GLY	C-O	5.36	1.31	1.23
1	C	222	GLU	C-O	-5.36	1.17	1.24
1	D	39	VAL	N-CA	5.26	1.52	1.46
1	A	107	PRO	C-O	5.18	1.30	1.24
1	B	170	ARG	CZ-NH1	5.17	1.40	1.32
1	A	213	THR	N-CA	-5.17	1.39	1.45
1	B	22	SER	C-O	-5.16	1.18	1.23

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	163	GLY	N-CA	-5.12	1.39	1.45
1	A	74	GLU	C-O	-5.11	1.18	1.24
1	D	205	ARG	C-O	5.11	1.30	1.24
1	D	243	VAL	CA-CB	-5.09	1.48	1.54
1	A	124	LEU	C-O	-5.07	1.18	1.24
1	A	247	ASP	N-CA	-5.06	1.40	1.46
1	A	73	LEU	C-O	5.01	1.30	1.24
1	B	171	ALA	C-O	5.01	1.30	1.24
1	B	107	PRO	C-O	5.00	1.30	1.24

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	170	ARG	NE-CZ-NH2	-17.68	103.29	119.20
1	A	170	ARG	NE-CZ-NH2	-17.57	103.38	119.20
1	B	170	ARG	NE-CZ-NH2	-17.36	103.58	119.20
1	C	170	ARG	NE-CZ-NH2	-17.32	103.62	119.20
1	D	170	ARG	NE-CZ-NH1	14.52	136.02	121.50
1	C	170	ARG	NE-CZ-NH1	14.20	135.70	121.50
1	A	170	ARG	NE-CZ-NH1	13.59	135.09	121.50
1	B	170	ARG	NE-CZ-NH1	13.08	134.58	121.50
1	D	170	ARG	CD-NE-CZ	7.92	135.49	124.40
1	B	156	ILE	N-CA-C	7.80	117.91	110.42
1	C	170	ARG	CD-NE-CZ	7.74	135.24	124.40
1	D	225	ASP	N-CA-C	6.98	118.54	111.07
1	A	156	ILE	N-CA-C	6.91	117.05	110.42
1	B	253	LYS	CA-C-O	-6.59	109.59	120.80
1	C	156	ILE	N-CA-C	6.54	117.29	110.62
1	C	233	SER	N-CA-C	6.49	118.39	109.18
1	A	170	ARG	CD-NE-CZ	6.45	133.43	124.40
1	B	170	ARG	CD-NE-CZ	6.42	133.38	124.40
1	D	156	ILE	N-CA-C	6.30	117.04	110.62
1	B	191	PHE	N-CA-C	-6.07	99.91	109.50
1	A	234	GLN	CB-CG-CD	6.00	122.80	112.60
1	C	73	LEU	N-CA-C	5.99	117.81	111.28
1	B	234	GLN	CB-CG-CD	5.52	121.98	112.60
1	A	6	TYR	CB-CA-C	-5.49	101.35	110.68
1	A	5	GLY	CA-C-N	5.31	127.66	120.38
1	A	5	GLY	C-N-CA	5.31	127.66	120.38
1	B	32	LEU	N-CA-C	-5.31	105.57	111.36
1	A	253	LYS	CA-C-O	-5.29	111.81	120.80
1	B	11	ARG	CG-CD-NE	-5.26	100.44	112.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	177	SER	CA-C-N	-5.25	114.41	119.87
1	C	177	SER	C-N-CA	-5.25	114.41	119.87
1	D	233	SER	N-CA-C	5.23	116.24	108.86
1	A	6	TYR	CA-C-O	5.23	126.28	120.63
1	C	253	LYS	CA-C-O	-5.09	112.15	120.80
1	D	234	GLN	CB-CG-CD	5.02	121.13	112.60

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	1834	0	1796	16	0
1	B	1834	0	1796	17	0
1	C	1834	0	1796	16	0
1	D	1861	0	1822	21	0
2	A	270	0	0	6	1
2	B	271	0	0	9	1
2	C	283	0	0	4	0
2	D	296	0	0	9	0
All	All	8483	0	7210	67	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 5.

All (67) 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:B:222:GLU:OE1	2:B:301:HOH:O	1.63	1.14
1:A:222:GLU:OE1	2:A:301:HOH:O	1.88	0.92
1:B:192:ARG:NH2	2:B:304:HOH:O	2.08	0.85
1:B:194:GLU:OE2	2:B:302:HOH:O	1.95	0.85
1:C:99:ARG:NH1	1:C:195:LEU:O	2.12	0.82
1:B:74:GLU:OE1	2:B:303:HOH:O	2.04	0.75

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:220:GLU:HG3	2:C:533:HOH:O	1.87	0.74
1:C:6:TYR:O	1:C:8:PHE:N	2.13	0.73
1:D:135:ARG:NH1	2:D:304:HOH:O	2.21	0.73
1:B:26:ARG:HH21	1:B:55:GLU:CD	1.98	0.71
1:B:99:ARG:NH1	1:B:195:LEU:O	2.26	0.69
1:A:198:PRO:O	2:A:302:HOH:O	2.11	0.69
1:B:47:ASP:O	1:B:51:GLU:HG3	1.93	0.68
1:D:26:ARG:HH21	1:D:55:GLU:CD	2.01	0.68
1:C:6:TYR:C	1:C:8:PHE:H	2.02	0.66
1:A:26:ARG:HH21	1:A:55:GLU:CD	2.02	0.66
1:A:99:ARG:NH1	1:A:195:LEU:O	2.28	0.66
1:D:192:ARG:NH2	2:D:306:HOH:O	2.32	0.61
1:A:192:ARG:NH2	2:A:305:HOH:O	2.33	0.60
1:C:6:TYR:CD2	1:C:7:LEU:N	2.67	0.60
1:B:135:ARG:NH1	2:B:309:HOH:O	2.35	0.59
1:B:135:ARG:NH1	2:B:308:HOH:O	2.30	0.58
1:A:103:ASP:OD2	1:C:133:LYS:NZ	2.40	0.54
1:D:13:ARG:NH2	2:D:303:HOH:O	2.11	0.54
1:D:191:PHE:HB3	2:D:434:HOH:O	2.08	0.53
1:D:26:ARG:NH2	1:D:55:GLU:OE2	2.42	0.50
1:D:139:ARG:HD3	1:D:182:THR:OG1	2.11	0.50
1:A:45:ARG:NH2	1:A:47:ASP:OD2	2.44	0.50
1:C:192:ARG:HG2	1:C:200:PHE:CE1	2.47	0.50
1:B:47:ASP:OD2	2:B:305:HOH:O	2.18	0.49
1:D:190:PHE:CE1	1:D:199:VAL:HG21	2.47	0.49
1:A:190:PHE:CE1	1:A:199:VAL:HG21	2.48	0.48
1:B:73:LEU:HB3	1:B:127:TYR:HE2	1.78	0.48
1:B:78:ARG:NH2	2:B:306:HOH:O	2.29	0.48
1:B:133:LYS:NZ	1:D:103:ASP:OD2	2.47	0.47
1:D:192:ARG:NH1	2:D:306:HOH:O	2.46	0.47
1:A:135:ARG:HD2	2:A:422:HOH:O	2.14	0.47
1:D:197:ALA:HB3	1:D:198:PRO:HD3	1.95	0.47
1:A:34:GLN:NE2	2:A:306:HOH:O	2.38	0.46
1:D:129:VAL:HG13	1:D:181:ILE:HD13	1.97	0.46
1:A:11:ARG:NH2	2:A:309:HOH:O	2.46	0.46
1:D:13:ARG:NE	2:D:303:HOH:O	2.46	0.45
1:D:129:VAL:HG13	1:D:181:ILE:CD1	2.47	0.45
1:C:44:ARG:HD3	2:C:303:HOH:O	2.17	0.45
1:C:44:ARG:CD	2:C:303:HOH:O	2.65	0.45
1:C:139:ARG:HD3	1:C:182:THR:OG1	2.17	0.45
1:D:121:PRO:HB2	1:D:168:MET:HE1	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:147:GLN:HA	1:D:150:ARG:O	2.17	0.44
1:D:99:ARG:NH1	1:D:195:LEU:O	2.52	0.43
1:D:61:HIS:HD2	2:D:516:HOH:O	2.01	0.43
1:D:26:ARG:HD3	2:D:463:HOH:O	2.18	0.42
1:C:121:PRO:HB2	1:C:168:MET:HE1	2.00	0.42
1:B:135:ARG:NH2	2:B:308:HOH:O	2.52	0.42
1:A:21:SER:HB2	1:A:48:ALA:HB1	2.01	0.42
1:A:129:VAL:N	1:A:130:PRO:CD	2.82	0.42
1:B:139:ARG:HD3	1:B:182:THR:OG1	2.18	0.42
1:B:177:SER:N	1:B:178:PRO:CD	2.83	0.41
1:C:6:TYR:C	1:C:8:PHE:N	2.72	0.41
1:D:192:ARG:HG2	1:D:200:PHE:CE1	2.56	0.41
1:A:112:ILE:HD12	1:A:112:ILE:HA	1.89	0.41
1:B:177:SER:HA	1:B:181:ILE:O	2.21	0.41
1:A:212:GLN:HG2	1:A:250:TYR:CZ	2.56	0.41
1:C:26:ARG:HH21	1:C:55:GLU:CD	2.29	0.41
1:C:73:LEU:HB3	1:C:127:TYR:HE2	1.86	0.41
1:A:133:LYS:NZ	1:C:103:ASP:OD2	2.54	0.40
1:C:135:ARG:NH1	2:C:316:HOH:O	2.53	0.40
1:D:99:ARG:NH2	2:D:325:HOH:O	2.53	0.40

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)
2:A:476:HOH:O	2:B:533:HOH:O[1_565]	2.10	0.10

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	247/253 (98%)	240 (97%)	7 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	247/253 (98%)	242 (98%)	5 (2%)	0	100	100
1	C	247/253 (98%)	238 (96%)	8 (3%)	1 (0%)	30	16
1	D	251/253 (99%)	244 (97%)	7 (3%)	0	100	100
All	All	992/1012 (98%)	964 (97%)	27 (3%)	1 (0%)	48	31

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	7	LEU

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	179/182 (98%)	178 (99%)	1 (1%)	78	72
1	B	179/182 (98%)	176 (98%)	3 (2%)	53	38
1	C	179/182 (98%)	176 (98%)	3 (2%)	53	38
1	D	182/182 (100%)	180 (99%)	2 (1%)	65	54
All	All	719/728 (99%)	710 (99%)	9 (1%)	61	48

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	118	LEU
1	B	7	LEU
1	B	73	LEU
1	B	192	ARG
1	C	6	TYR
1	C	73	LEU
1	C	118	LEU
1	D	118	LEU
1	D	221	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	38	GLN
1	A	53	GLN
1	C	38	GLN
1	D	38	GLN
1	D	61	HIS

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

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	249/253 (98%)	0.04	7 (2%) 55 59	9, 16, 35, 49	0
1	B	249/253 (98%)	-0.01	8 (3%) 50 54	9, 15, 35, 49	0
1	C	249/253 (98%)	0.01	9 (3%) 46 50	9, 15, 35, 53	0
1	D	253/253 (100%)	-0.02	6 (2%) 59 64	9, 15, 34, 44	0
All	All	1000/1012 (98%)	0.00	30 (3%) 52 56	9, 15, 35, 53	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	199	VAL	6.2
1	C	6	TYR	5.6
1	B	6	TYR	5.0
1	C	199	VAL	4.9
1	A	195	LEU	4.9
1	C	5	GLY	4.5
1	A	199	VAL	4.4
1	A	11	ARG	4.4
1	B	195	LEU	4.4
1	A	6	TYR	4.2
1	D	195	LEU	3.9
1	B	197	ALA	3.4
1	C	195	LEU	3.2
1	A	197	ALA	3.2
1	D	199	VAL	3.2
1	D	2	ALA	3.0
1	C	192	ARG	2.8
1	B	198	PRO	2.6
1	A	192	ARG	2.6
1	A	194	GLU	2.6
1	B	194	GLU	2.5

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Mol	Chain	Res	Type	RSRZ
1	C	194	GLU	2.4
1	C	11	ARG	2.4
1	B	5	GLY	2.3
1	C	197	ALA	2.2
1	D	1	MET	2.2
1	D	197	ALA	2.2
1	B	192	ARG	2.1
1	D	193	THR	2.1
1	C	54	ALA	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.