



Full wwPDB X-ray Structure Validation Report ⓘ

May 25, 2020 – 06:03 am BST

PDB ID : 1WTD
Title : Crystal structure of type II restriction endonuclease, EcoO109I DNA-free form
Authors : Hashimoto, H.; Shimizu, T.; Imasaki, T.; Kato, M.; Shichijo, N.; Kita, K.; Sato, M.
Deposited on : 2004-11-22
Resolution : 2.40 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	GOL	A	306	-	-	-	X
2	GOL	B	308	-	-	X	-

2 Entry composition [i](#)

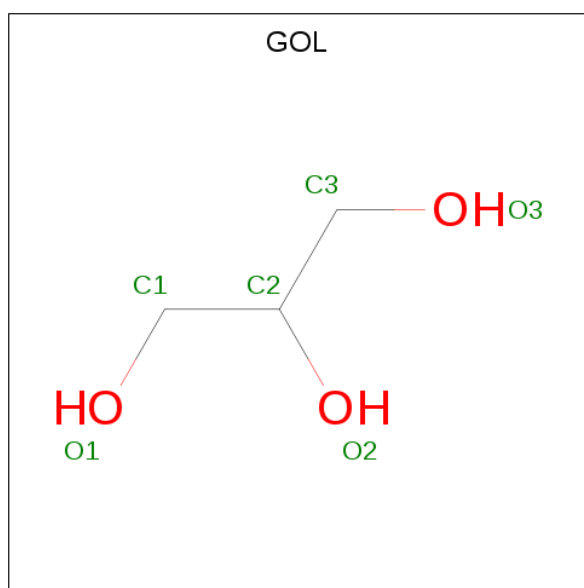
There are 3 unique types of molecules in this entry. The entry contains 4230 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 EcoO109IR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	264	Total 2038	C 1308	N 344	O 379	S 7	0	0	0
1	B	267	Total 2087	C 1337	N 354	O 388	S 8	0	0	0

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	Total 6	C 3	O 3	0	0
2	A	1	Total 6	C 3	O 3	0	0
2	A	1	Total 6	C 3	O 3	0	0
2	B	1	Total 6	C 3	O 3	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		

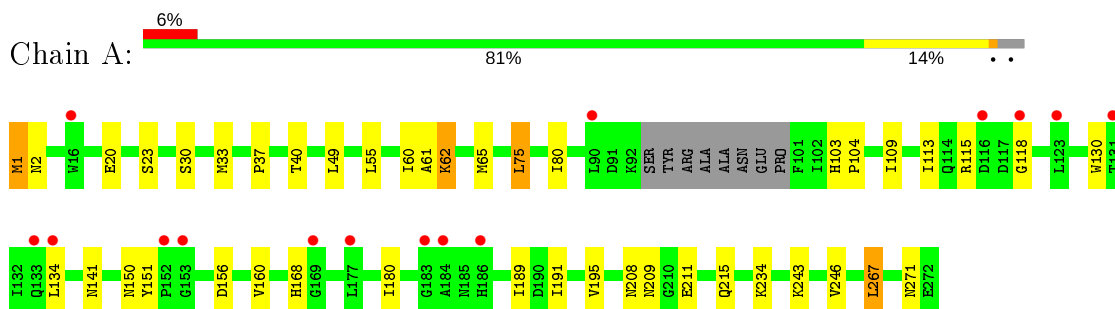
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	24	Total	O	0	0
			24	24		
3	B	21	Total	O	0	0
			21	21		

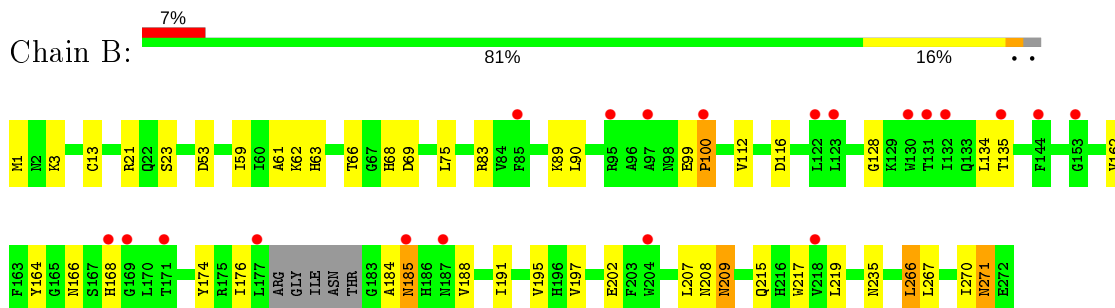
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: EcoO109IR



- Molecule 1: EcoO109IR



4 Data and refinement statistics

Property	Value	Source
Space group	I 4	Depositor
Cell constants a, b, c, α , β , γ	175.55Å 175.55Å 44.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.40 19.88 – 2.40	Depositor EDS
% Data completeness (in resolution range)	98.8 (20.00-2.40) 99.1 (19.88-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	7.61 (at 2.41Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.255 , 0.297 0.264 , 0.302	Depositor DCC
R_{free} test set	1343 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	47.2	Xtrriage
Anisotropy	0.047	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 40.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.019 for -k,-h,-l	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	4230	wwPDB-VP
Average B, all atoms (Å ²)	56.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.77% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL

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	0.71	1/2083 (0.0%)	0.70	2/2828 (0.1%)
1	B	0.63	0/2135	0.61	0/2894
All	All	0.67	1/4218 (0.0%)	0.66	2/5722 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	20	GLU	CD-OE1	5.06	1.31	1.25

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1	MET	N-CA-C	-11.28	80.56	111.00
1	A	1	MET	CB-CA-C	6.52	123.44	110.40

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	2038	0	1909	26	0
1	B	2087	0	1963	24	0
2	A	18	0	24	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	42	0	55	11	0
3	A	24	0	0	0	0
3	B	21	0	0	0	0
All	All	4230	0	3951	45	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.

All (45) 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:1:MET:N	1:B:208:ASN:OD1	2.20	0.74
1:A:61:ALA:HB1	2:B:308:GOL:H12	1.72	0.70
1:A:1:MET:N	1:A:208:ASN:HD21	1.91	0.69
1:A:62:LYS:NZ	1:B:69:ASP:OD2	2.30	0.64
1:A:61:ALA:HB1	2:B:308:GOL:C1	2.28	0.62
1:B:13:CYS:SG	1:B:83:ARG:NH1	2.74	0.61
1:B:184:ALA:O	1:B:185:ASN:CB	2.49	0.60
1:A:65:MET:HE2	2:B:308:GOL:O1	2.04	0.58
1:A:1:MET:H1	1:A:208:ASN:ND2	2.05	0.54
1:A:1:MET:N	1:A:208:ASN:ND2	2.56	0.53
1:B:63:HIS:CE1	2:B:310:GOL:H2	2.44	0.53
1:A:141:ASN:HD21	1:A:189:ILE:H	1.55	0.52
1:A:1:MET:H1	1:A:208:ASN:HD21	1.57	0.52
1:A:75:LEU:HD22	1:A:80:ILE:HG12	1.93	0.51
1:B:59:ILE:HG12	2:B:307:GOL:O1	2.11	0.51
1:A:215:GLN:HE22	1:B:271:ASN:HB3	1.76	0.51
1:A:130:TRP:CZ3	1:A:160:VAL:HG11	2.45	0.50
1:B:208:ASN:O	1:B:209:ASN:ND2	2.45	0.50
1:B:61:ALA:HB3	2:B:308:GOL:H32	1.93	0.49
1:B:21:ARG:HD3	1:B:68:HIS:ND1	2.28	0.49
1:A:215:GLN:HE22	1:B:271:ASN:CB	2.25	0.49
1:A:65:MET:CE	2:B:308:GOL:O1	2.60	0.49
1:A:61:ALA:HB1	2:B:308:GOL:H31	1.94	0.49
1:B:191:ILE:HD12	1:B:195:VAL:HG21	1.94	0.49
1:B:128:GLY:HA2	1:B:164:TYR:CE2	2.48	0.48
1:B:62:LYS:HZ3	2:B:307:GOL:C1	2.27	0.47
1:A:1:MET:H1	1:A:208:ASN:CG	2.16	0.47
1:A:49:LEU:HD13	1:A:55:LEU:HA	1.96	0.47
1:B:3:LYS:HA	1:B:217:TRP:CE3	2.49	0.46
1:B:90:LEU:HD11	1:B:112:VAL:HG23	1.97	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:271:ASN:CB	1:B:215:GLN:HE22	2.28	0.45
1:A:191:ILE:HD12	1:A:195:VAL:HG21	1.98	0.45
1:B:266:LEU:HD22	1:B:270:ILE:HD12	1.98	0.45
1:A:30:SER:HB2	1:A:246:VAL:HG22	1.99	0.43
1:B:174:TYR:CD1	1:B:197:VAL:HG11	2.53	0.43
1:A:61:ALA:O	1:A:65:MET:HB2	2.20	0.42
1:A:37:PRO:HB2	1:A:267:LEU:HA	2.02	0.41
1:B:23:SER:O	2:B:302:GOL:H2	2.20	0.41
1:B:61:ALA:CB	2:B:308:GOL:H32	2.50	0.41
1:A:40:THR:HG22	1:A:55:LEU:HD21	2.03	0.41
1:A:60:ILE:CD1	1:A:243:LYS:HA	2.51	0.41
1:B:99:GLU:CB	1:B:100:PRO:HD2	2.51	0.41
1:A:23:SER:O	2:A:306:GOL:H2	2.21	0.40
1:B:128:GLY:O	1:B:162:VAL:CG1	2.70	0.40
1:A:271:ASN:HB3	1:B:215:GLN:HE22	1.86	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	260/272 (96%)	236 (91%)	18 (7%)	6 (2%)	6 7
1	B	263/272 (97%)	245 (93%)	13 (5%)	5 (2%)	8 10
All	All	523/544 (96%)	481 (92%)	31 (6%)	11 (2%)	7 8

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	103	HIS
1	A	104	PRO
1	B	100	PRO

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Mol	Chain	Res	Type
1	B	176	ILE
1	B	185	ASN
1	A	180	ILE
1	B	188	VAL
1	A	33	MET
1	A	211	GLU
1	A	118	GLY
1	B	134	LEU

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	200/237 (84%)	186 (93%)	14 (7%)	15	24
1	B	208/237 (88%)	192 (92%)	16 (8%)	13	20
All	All	408/474 (86%)	378 (93%)	30 (7%)	13	22

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	ASN
1	A	62	LYS
1	A	75	LEU
1	A	109	ILE
1	A	113	ILE
1	A	115	ARG
1	A	134	LEU
1	A	150	ASN
1	A	151	TYR
1	A	156	ASP
1	A	168	HIS
1	A	209	ASN
1	A	234	LYS
1	A	267	LEU
1	B	53	ASP

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Mol	Chain	Res	Type
1	B	66	THR
1	B	75	LEU
1	B	89	LYS
1	B	116	ASP
1	B	135	THR
1	B	166	ASN
1	B	168	HIS
1	B	202	GLU
1	B	207	LEU
1	B	209	ASN
1	B	219	LEU
1	B	235	ASN
1	B	266	LEU
1	B	267	LEU
1	B	271	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	141	ASN
1	A	157	ASN
1	A	196	HIS
1	A	209	ASN
1	A	215	GLN
1	B	22	GLN
1	B	114	GLN
1	B	133	GLN
1	B	141	ASN
1	B	166	ASN
1	B	209	ASN
1	B	215	GLN
1	B	235	ASN
1	B	271	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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

10 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	GOL	A	304	-	5,5,5	0.49	0	5,5,5	0.63	0
2	GOL	B	303	-	5,5,5	0.39	0	5,5,5	0.34	0
2	GOL	A	306	-	5,5,5	0.66	0	5,5,5	1.20	1 (20%)
2	GOL	B	307	-	5,5,5	0.62	0	5,5,5	0.99	0
2	GOL	A	309	-	5,5,5	0.63	0	5,5,5	0.74	0
2	GOL	B	310	-	5,5,5	0.29	0	5,5,5	0.38	0
2	GOL	B	308	-	5,5,5	1.25	1 (20%)	5,5,5	1.94	2 (40%)
2	GOL	B	301	-	5,5,5	0.43	0	5,5,5	0.40	0
2	GOL	B	302	-	5,5,5	0.75	0	5,5,5	1.74	2 (40%)
2	GOL	B	305	-	5,5,5	0.49	0	5,5,5	1.71	1 (20%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	A	304	-	-	2/4/4/4	-
2	GOL	B	303	-	-	2/4/4/4	-
2	GOL	A	306	-	-	3/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	B	307	-	-	0/4/4/4	-
2	GOL	A	309	-	-	2/4/4/4	-
2	GOL	B	310	-	-	2/4/4/4	-
2	GOL	B	308	-	-	2/4/4/4	-
2	GOL	B	301	-	-	4/4/4/4	-
2	GOL	B	302	-	-	2/4/4/4	-
2	GOL	B	305	-	-	4/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	308	GOL	O2-C2	-2.34	1.36	1.43

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	305	GOL	O3-C3-C2	2.57	122.53	110.20
2	B	302	GOL	O3-C3-C2	2.43	121.86	110.20
2	B	308	GOL	C3-C2-C1	2.38	120.95	111.70
2	B	302	GOL	C3-C2-C1	2.36	120.86	111.70
2	B	308	GOL	O3-C3-C2	2.26	121.02	110.20
2	A	306	GOL	O3-C3-C2	2.14	120.46	110.20

There are no chirality outliers.

All (23) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	304	GOL	O1-C1-C2-C3
2	B	303	GOL	O1-C1-C2-C3
2	B	310	GOL	O1-C1-C2-C3
2	B	308	GOL	C1-C2-C3-O3
2	B	308	GOL	O2-C2-C3-O3
2	B	301	GOL	O1-C1-C2-C3
2	B	302	GOL	C1-C2-C3-O3
2	B	302	GOL	O2-C2-C3-O3
2	B	305	GOL	O1-C1-C2-C3
2	B	305	GOL	C1-C2-C3-O3
2	B	301	GOL	O1-C1-C2-O2
2	A	309	GOL	C1-C2-C3-O3
2	B	301	GOL	C1-C2-C3-O3

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Mol	Chain	Res	Type	Atoms
2	B	303	GOL	O1-C1-C2-O2
2	B	310	GOL	O1-C1-C2-O2
2	B	305	GOL	O2-C2-C3-O3
2	A	304	GOL	O1-C1-C2-O2
2	B	305	GOL	O1-C1-C2-O2
2	B	301	GOL	O2-C2-C3-O3
2	A	306	GOL	O1-C1-C2-O2
2	A	309	GOL	O2-C2-C3-O3
2	A	306	GOL	C1-C2-C3-O3
2	A	306	GOL	O1-C1-C2-C3

There are no ring outliers.

5 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	306	GOL	1	0
2	B	307	GOL	2	0
2	B	310	GOL	1	0
2	B	308	GOL	7	0
2	B	302	GOL	1	0

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	264/272 (97%)	0.38	15 (5%) 23 22	33, 49, 89, 96	0
1	B	267/272 (98%)	0.47	20 (7%) 14 13	30, 53, 91, 95	0
All	All	531/544 (97%)	0.43	35 (6%) 18 17	30, 51, 91, 96	0

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	183	GLY	4.7
1	B	185	ASN	4.0
1	B	97	ALA	4.0
1	A	184	ALA	3.8
1	B	131	THR	3.6
1	B	177	LEU	3.6
1	B	171	THR	3.5
1	A	152	PRO	3.4
1	B	122	LEU	3.3
1	A	116	ASP	3.1
1	A	118	GLY	2.8
1	A	169	GLY	2.8
1	B	123	LEU	2.7
1	A	131	THR	2.6
1	A	123	LEU	2.6
1	A	133	GLN	2.5
1	A	186	HIS	2.4
1	B	130	TRP	2.4
1	A	177	LEU	2.4
1	B	135	THR	2.3
1	B	169	GLY	2.3
1	B	218	VAL	2.3
1	B	187	ASN	2.3
1	B	144	PHE	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	153	GLY	2.2
1	A	16	TRP	2.2
1	B	168	HIS	2.1
1	A	90	LEU	2.1
1	B	95	ARG	2.1
1	B	85	PHE	2.1
1	A	134	LEU	2.1
1	B	204	TRP	2.1
1	A	153	GLY	2.0
1	B	132	ILE	2.0
1	B	100	PRO	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 carbohydrates in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	GOL	A	304	6/6	0.56	0.32	76,78,78,79	0
2	GOL	B	303	6/6	0.67	0.33	82,83,83,83	0
2	GOL	A	306	6/6	0.67	0.40	47,50,53,54	0
2	GOL	B	301	6/6	0.76	0.27	73,74,75,75	0
2	GOL	A	309	6/6	0.81	0.32	48,53,54,54	0
2	GOL	B	305	6/6	0.82	0.30	46,50,51,51	0
2	GOL	B	302	6/6	0.83	0.35	38,40,41,44	0
2	GOL	B	307	6/6	0.84	0.30	37,41,42,44	0
2	GOL	B	308	6/6	0.86	0.32	43,45,47,49	0
2	GOL	B	310	6/6	0.87	0.34	63,65,66,67	0

6.5 Other polymers

There are no such residues in this entry.