Full wwPDB X-ray Structure Validation Report ⓘ

Nov 16, 2026 – 05:04 pm GMT

PDB ID	:	9T7W / pdb_00009t7w
Title	:	Crystal structure of RamR with Tyr92 replaced with para-boronophenylalanine
Authors	:	Thunnissen, A.M.W.H.; Da Settimo Passetti, C.; Roelfes, G.
Deposited on	:	2025-11-12
Resolution	:	1.75 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:

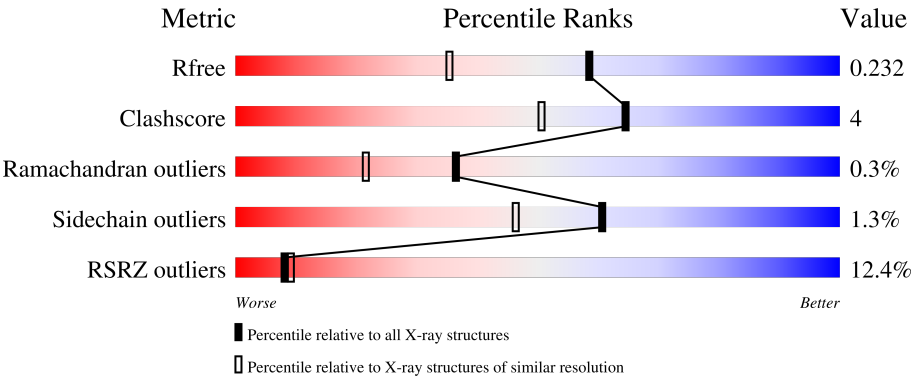
MolProbity	:	4-5-2 with Phenix2.2
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

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 1.75 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	3183 (1.76-1.76)
Clashscore	190562	3299 (1.76-1.76)
Ramachandran outliers	187476	3274 (1.76-1.76)
Sidechain outliers	187428	3274 (1.76-1.76)
RSRZ outliers	180081	3183 (1.76-1.76)

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 <=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	203	6% 85% 8% 6%
1	B	203	16% 79% 10% 10%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 6088 atoms, of which 2961 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 Transcriptional regulator RamR.

Mol	Chain	Residues	Atoms							ZeroOcc	AltConf	Trace
1	A	190	Total	B	C	H	N	O	S	0	2	0
			3029	1	957	1506	268	288	9			
1	B	183	Total	B	C	H	N	O	S	0	1	0
			2906	1	921	1447	255	273	9			

There are 28 discrepancies between the modelled and reference sequences:

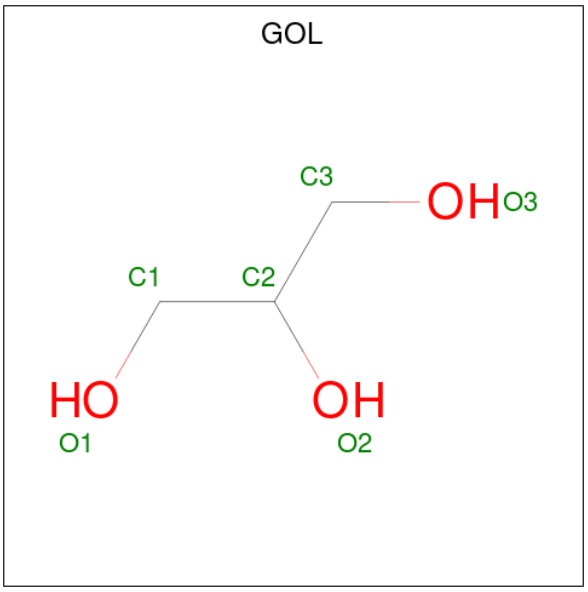
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	VAL	-	expression tag	UNP Q8ZR43
A	67	SER	CYS	engineered mutation	UNP Q8ZR43
A	92	7N8	TYR	engineered mutation	UNP Q8ZR43
A	134	SER	CYS	engineered mutation	UNP Q8ZR43
A	194	ALA	-	expression tag	UNP Q8ZR43
A	195	ALA	-	expression tag	UNP Q8ZR43
A	196	TRP	-	expression tag	UNP Q8ZR43
A	197	SER	-	expression tag	UNP Q8ZR43
A	198	HIS	-	expression tag	UNP Q8ZR43
A	199	PRO	-	expression tag	UNP Q8ZR43
A	200	GLN	-	expression tag	UNP Q8ZR43
A	201	PHE	-	expression tag	UNP Q8ZR43
A	202	GLU	-	expression tag	UNP Q8ZR43
A	203	LYS	-	expression tag	UNP Q8ZR43
B	1	VAL	-	expression tag	UNP Q8ZR43
B	67	SER	CYS	engineered mutation	UNP Q8ZR43
B	92	7N8	TYR	engineered mutation	UNP Q8ZR43
B	134	SER	CYS	engineered mutation	UNP Q8ZR43
B	194	ALA	-	expression tag	UNP Q8ZR43
B	195	ALA	-	expression tag	UNP Q8ZR43
B	196	TRP	-	expression tag	UNP Q8ZR43
B	197	SER	-	expression tag	UNP Q8ZR43
B	198	HIS	-	expression tag	UNP Q8ZR43
B	199	PRO	-	expression tag	UNP Q8ZR43
B	200	GLN	-	expression tag	UNP Q8ZR43

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Chain	Residue	Modelled	Actual	Comment	Reference
B	201	PHE	-	expression tag	UNP Q8ZR43
B	202	GLU	-	expression tag	UNP Q8ZR43
B	203	LYS	-	expression tag	UNP Q8ZR43

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C H O 14 3 8 3	0	0

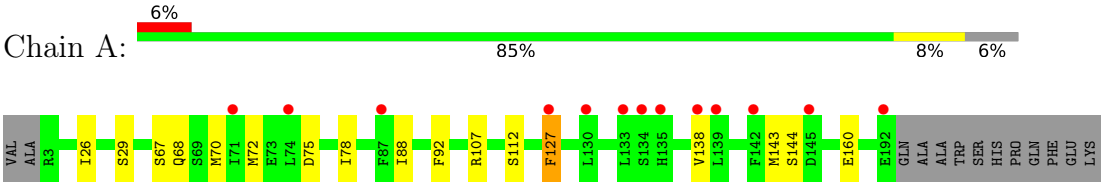
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	98	Total O 98 98	0	0
3	B	41	Total O 41 41	0	0

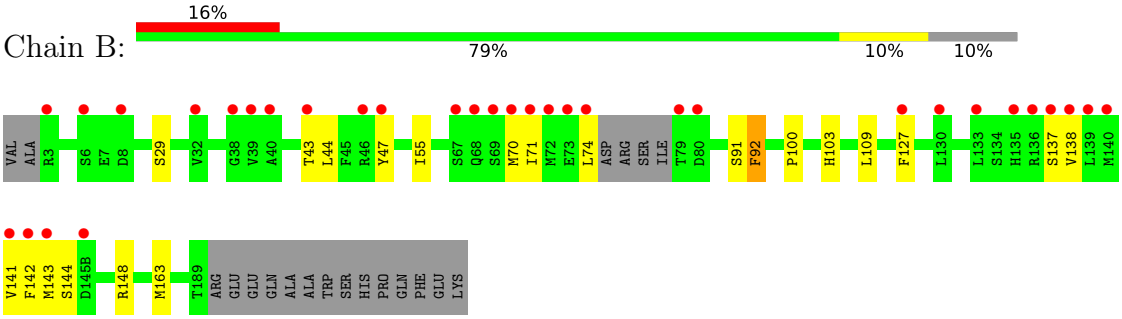
3 Residue-property plots (i)

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: Transcriptional regulator RamR



• Molecule 1: Transcriptional regulator RamR



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	40.08Å 100.83Å 49.88Å 90.00° 111.04° 90.00°	Depositor
Resolution (Å)	50.41 – 1.75 50.41 – 1.75	Depositor EDS
% Data completeness (in resolution range)	99.9 (50.41-1.75) 99.9 (50.41-1.75)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.43 (at 1.75Å)	Xtriage
Refinement program	PHENIX (1.21.2_5419: ???)	Depositor
R, R_{free}	0.188 , 0.228 0.195 , 0.232	Depositor DCC
R_{free} test set	1874 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	24.0	Xtriage
Anisotropy	0.323	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.43 , 42.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.028 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	6088	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.93% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, 7N8

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	0.66	0/1539	0.82	0/2070
1	B	0.54	0/1472	0.71	0/1981
All	All	0.61	0/3011	0.77	0/4051

There are no bond length outliers.

There are no bond angle outliers.

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	1523	1506	1500	9	0
1	B	1459	1447	1438	14	0
2	A	6	8	8	0	0
3	A	98	0	0	0	0
3	B	41	0	0	0	0
All	All	3127	2961	2946	23	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 4.

All (23) 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:138:VAL:HG21	1:B:148:ARG:HA	1.46	0.95
1:A:70:MET:HE1	1:A:88:ILE:HG23	1.75	0.68
1:A:26:ILE:HD13	1:A:112:SER:HB2	1.74	0.68
1:A:75:ASP:HB3	1:A:78:ILE:HD12	1.79	0.65
1:B:100:PRO:HA	1:B:103:HIS:CD2	2.34	0.62
1:B:71:ILE:CD1	1:B:74:LEU:HD22	2.35	0.56
1:A:70:MET:CE	1:A:88:ILE:HG23	2.36	0.56
1:B:92:7N8:CE1	1:B:163:MET:CE	2.85	0.54
1:A:127:PHE:N	1:A:127:PHE:CD1	2.75	0.54
1:A:107:ARG:NE	1:A:160:GLU:OE2	2.42	0.53
1:B:70:MET:HE2	1:B:127:PHE:CZ	2.44	0.52
1:A:68:GLN:OE1	1:A:72:MET:HE3	2.11	0.50
1:A:67:SER:OG	1:A:127:PHE:CZ	2.66	0.48
1:B:44:LEU:HD23	1:B:44:LEU:C	2.41	0.46
1:B:55:ILE:HG23	1:B:109:LEU:HD22	1.96	0.46
1:B:137:SER:O	1:B:141:VAL:HG22	2.16	0.45
1:B:141:VAL:HG23	1:B:142:PHE:CD2	2.52	0.45
1:B:70:MET:HG2	1:B:91:SER:HB3	2.00	0.44
1:B:143:MET:HG2	1:B:143:MET:O	2.17	0.43
1:A:138:VAL:HG22	1:A:144:SER:CB	2.48	0.43
1:B:71:ILE:HD12	1:B:74:LEU:HD22	2.01	0.43
1:B:71:ILE:HD13	1:B:74:LEU:HD22	2.00	0.42
1:B:43:THR:O	1:B:47:TYR:HD1	2.04	0.41

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	189/203 (93%)	187 (99%)	2 (1%)	0	100 100
1	B	179/203 (88%)	177 (99%)	1 (1%)	1 (1%)	21 8
All	All	368/406 (91%)	364 (99%)	3 (1%)	1 (0%)	36 21

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	144	SER

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	156/164 (95%)	153 (98%)	3 (2%)	50 31
1	B	148/164 (90%)	147 (99%)	1 (1%)	76 67
All	All	304/328 (93%)	300 (99%)	4 (1%)	61 46

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	29	SER
1	A	127	PHE
1	A	143	MET
1	B	29	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	11	GLN
1	A	19	GLN
1	A	99	HIS
1	A	108	GLN
1	A	135	HIS
1	B	135	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)

2 non-standard protein/DNA/RNA residues 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	$\#\|Z\| > 2$
1	7N8	A	92	1	13,14,15	3.30	6 (46%)	15,18,20	1.96	5 (33%)
1	7N8	B	92	1	13,14,15	0.88	0	15,18,20	1.61	3 (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
1	7N8	A	92	1	-	0/9/10/12	0/1/1/1
1	7N8	B	92	1	-	0/9/10/12	0/1/1/1

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	92	7N8	BZ-OB1	7.66	1.49	1.36
1	A	92	7N8	BZ-CZ	5.88	1.69	1.57
1	A	92	7N8	BZ-OB2	4.26	1.43	1.36
1	A	92	7N8	O-C	3.03	1.32	1.19
1	A	92	7N8	CE2-CZ	2.48	1.43	1.40
1	A	92	7N8	CD1-CG	2.36	1.43	1.38

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	92	7N8	OB2-BZ-CZ	-4.15	107.56	119.95
1	B	92	7N8	CG-CB-CA	-4.02	105.97	114.10
1	A	92	7N8	OB1-BZ-CZ	-3.72	108.83	119.95
1	A	92	7N8	OB2-BZ-OB1	-3.07	109.35	119.67
1	B	92	7N8	CD2-CE2-CZ	-2.29	119.67	121.81

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	92	7N8	CE1-CZ-CE2	2.28	119.42	116.88
1	A	92	7N8	CE1-CZ-CE2	-2.15	114.47	116.88
1	A	92	7N8	CD1-CE1-CZ	2.07	123.75	121.81

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	92	7N8	1	0

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

1 ligand is 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	301	-	5,5,5	0.48	0	5,5,5	0.95	0

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	301	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	GOL	C1-C2-C3-O3
2	A	301	GOL	O2-C2-C3-O3

There are no ring outliers.

No monomer is involved in short contacts.

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, 95^{th} 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	189/203 (93%)	0.17	13 (6%) 23 26	15, 27, 56, 103	2 (1%)
1	B	182/203 (89%)	0.79	33 (18%) 3 4	14, 39, 81, 102	1 (0%)
All	All	371/406 (91%)	0.47	46 (12%) 8 9	14, 32, 73, 103	3 (0%)

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	74	LEU	5.5
1	B	141	VAL	4.9
1	B	139	LEU	4.8
1	B	79	THR	4.5
1	B	71	ILE	4.1
1	B	138	VAL	3.9
1	A	74	LEU	3.9
1	A	134	SER	3.8
1	A	135	HIS	3.8
1	B	72	MET	3.7
1	B	68	GLN	3.6
1	B	140	MET	3.3
1	B	67	SER	3.3
1	B	127	PHE	3.3
1	B	38	GLY	3.2
1	B	133	LEU	3.2
1	A	138	VAL	3.1
1	A	192	GLU	3.1
1	A	130	LEU	3.0
1	B	143	MET	2.9
1	A	133	LEU	2.9
1	B	73	GLU	2.9
1	B	46	ARG	2.8
1	B	40	ALA	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	3	ARG	2.7
1	A	71	ILE	2.7
1	A	127	PHE	2.6
1	A	142	PHE	2.6
1	A	145	ASP	2.6
1	B	136	ARG	2.6
1	B	142	PHE	2.4
1	B	43	THR	2.4
1	B	70	MET	2.4
1	B	47	TYR	2.4
1	B	135	HIS	2.4
1	B	137	SER	2.3
1	A	139	LEU	2.3
1	B	32	VAL	2.3
1	B	130	LEU	2.2
1	B	69	SER	2.2
1	B	145(B)	ASP	2.1
1	B	39	VAL	2.1
1	A	87	PHE	2.1
1	B	6	SER	2.1
1	B	8	ASP	2.0
1	B	80	ASP	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (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, 95^{th} 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
1	7N8	B	92	14/15	0.89	0.14	22,35,45,50	0
1	7N8	A	92	14/15	0.95	0.06	16,22,29,35	0

6.3 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.4 Ligands

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, 95^{th} 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	301	6/6	0.84	0.14	30,40,49,49	0

6.5 Other polymers

There are no such residues in this entry.