Full wwPDB X-ray Structure Validation Report (i)

Jun 24, 2024 – 04:16 PM EDT

PDB ID	:	5TE6
Title	:	Crystal Structure of Broadly Neutralizing VRC01-class Antibody N6 in Complex with HIV-1 Clade AE Strain 93TH057 gp120 Core
Authors	:	Zhou, T.; Kwong, P.D.
Deposited on	:	2016-09-20
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 (i) 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 (i)) were used in the production of this report:

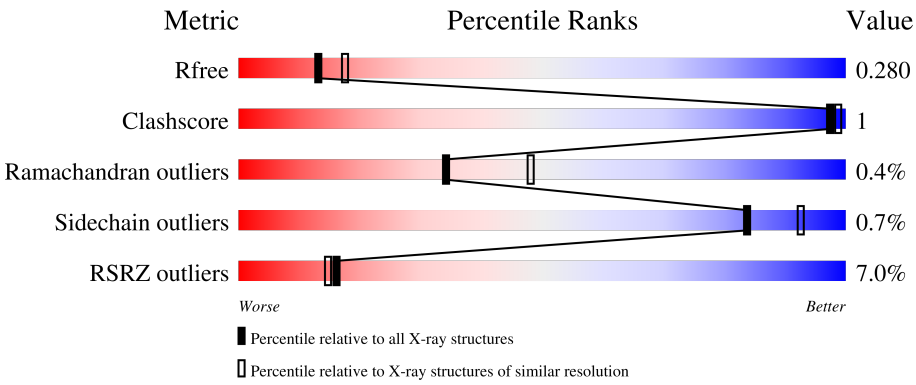
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.40 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}	130704	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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	G	353	5% 92%
2	H	225	8% 97%
3	L	210	9% 96%

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 12232 atoms, of which 5985 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 clade A/E 93TH057 HIV-1 gp120 core.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	G	341	5271	1673	2606	463	507	22	0	0	0

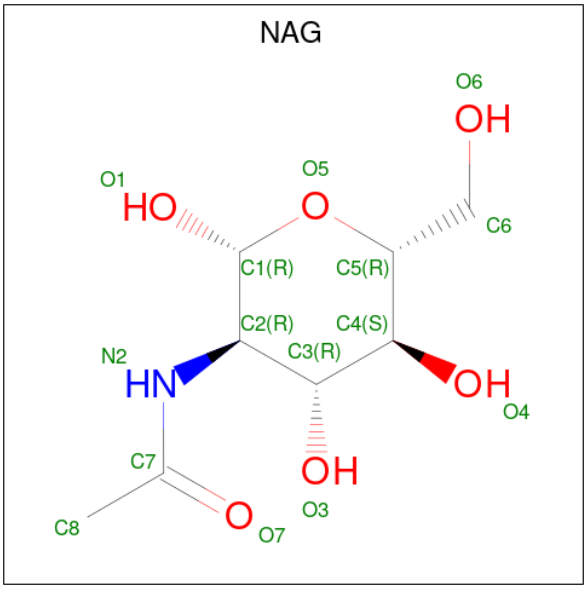
- Molecule 2 is a protein called Heavy chain of N6.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
2	H	223	3347	1073	1656	294	318	6	0	0	0

- Molecule 3 is a protein called Light chain of N6.

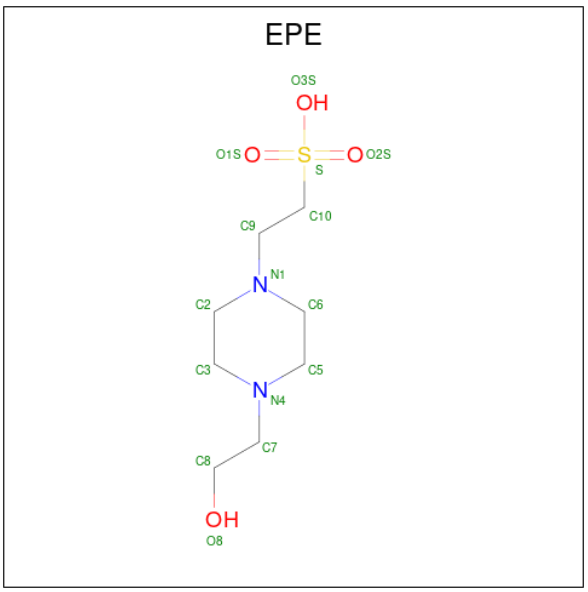
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
3	L	210	3193	1018	1562	285	323	5	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	G	1	27	8	13	1	5	0	0
			Total	C	H	N	O		
4	L	1	28	8	14	1	5	0	0

- Molecule 5 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: $C_8H_{18}N_2O_4S$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	H	N	O	S		
5	G	1	32	8	17	2	4	1	0	0

- Molecule 6 is water.

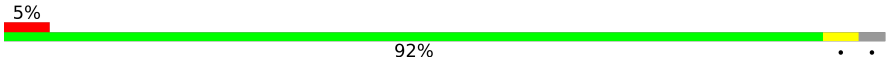
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	G	59	59	59	0	0
			Total	O		
6	H	20	20	20	0	0
			Total	O		
6	L	12	12	12	0	0

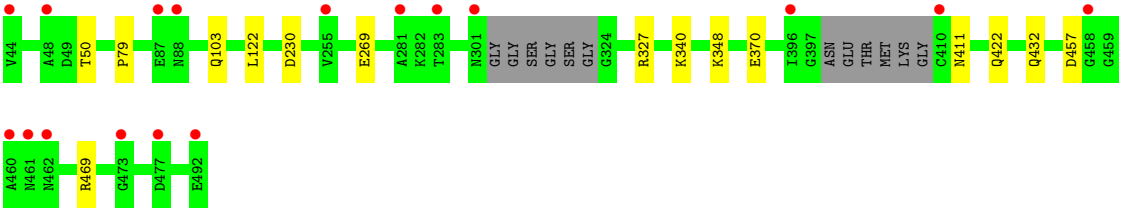
3 Residue-property plots (i)

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: clade A/E 93TH057 HIV-1 gp120 core

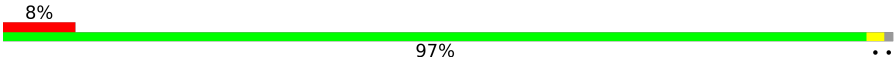
Chain G:

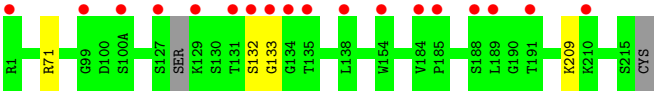




- Molecule 2: Heavy chain of N6

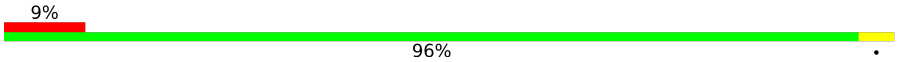
Chain H:

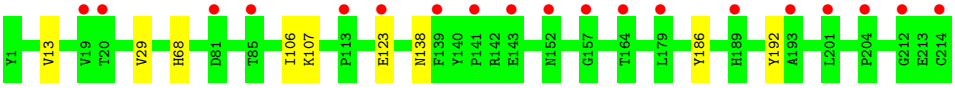




- Molecule 3: Light chain of N6

Chain L:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	64.69Å 65.82Å 238.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.14 – 2.40 44.14 – 2.36	Depositor EDS
% Data completeness (in resolution range)	97.6 (44.14-2.40) 95.5 (44.14-2.36)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.21 (at 2.37Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.227 , 0.278 0.228 , 0.280	Depositor DCC
R_{free} test set	2012 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å^2)	50.0	Xtriage
Anisotropy	0.660	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 42.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.018 for k,h,-l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	12232	wwPDB-VP
Average B, all atoms (Å^2)	79.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.72% 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 (i)

5.1 Standard geometry (i)

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

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	G	0.26	0/2721	0.43	0/3694
2	H	0.27	0/1736	0.47	0/2364
3	L	0.26	0/1669	0.46	0/2264
All	All	0.26	0/6126	0.45	0/8322

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 (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	G	2665	2606	2594	6	1
2	H	1691	1656	1660	2	0
3	L	1631	1562	1572	3	0
4	G	140	130	130	0	0
4	L	14	14	13	0	0
5	G	15	17	17	0	0
6	G	59	0	0	1	0
6	H	20	0	0	0	0
6	L	12	0	0	0	0
All	All	6247	5985	5986	10	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 (10) 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:G:122:LEU:O	6:G:601:HOH:O	2.07	0.72
1:G:50:THR:O	1:G:103:GLN:NE2	2.38	0.54
3:L:186:TYR:O	3:L:192:TYR:OH	2.24	0.52
1:G:457:ASP:OD1	1:G:469:ARG:NH1	2.44	0.51
3:L:13:VAL:O	3:L:107:LYS:N	2.45	0.45
1:G:327:ARG:NH1	1:G:422:GLN:OE1	2.43	0.43
1:G:269:GLU:OE1	1:G:348:LYS:NZ	2.52	0.43
1:G:370:GLU:OE1	1:G:370:GLU:N	2.50	0.42
2:H:209:LYS:NZ	3:L:123:GLU:OE1	2.52	0.41
2:H:132:SER:OG	2:H:133:GLY:N	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)
1:G:79:PRO:O	1:G:340:LYS:NZ[3_444]	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	G	335/353 (95%)	316 (94%)	18 (5%)	1 (0%)	41	55
2	H	219/225 (97%)	212 (97%)	7 (3%)	0	100	100
3	L	208/210 (99%)	198 (95%)	8 (4%)	2 (1%)	15	23
All	All	762/788 (97%)	726 (95%)	33 (4%)	3 (0%)	34	48

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	L	138	ASN
1	G	411	ASN
3	L	68	HIS

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	G	303/311 (97%)	301 (99%)	2 (1%)	84 92
2	H	183/185 (99%)	182 (100%)	1 (0%)	88 95
3	L	187/187 (100%)	185 (99%)	2 (1%)	73 87
All	All	673/683 (98%)	668 (99%)	5 (1%)	84 92

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	230	ASP
1	G	432	GLN
2	H	71	ARG
3	L	29	VAL
3	L	106	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

12 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	$\#\|Z\| > 2$
4	NAG	G	507	1	14,14,15	0.21	0	17,19,21	0.55	0
4	NAG	L	301	3	14,14,15	0.23	0	17,19,21	0.53	0
4	NAG	G	510	1	14,14,15	0.22	0	17,19,21	0.43	0
4	NAG	G	503	1	14,14,15	0.38	0	17,19,21	0.39	0
4	NAG	G	506	1	14,14,15	0.24	0	17,19,21	0.46	0
5	EPE	G	511	-	15,15,15	0.75	1 (6%)	18,20,20	2.05	5 (27%)
4	NAG	G	508	1	14,14,15	0.30	0	17,19,21	0.48	0
4	NAG	G	504	1	14,14,15	0.24	0	17,19,21	0.36	0
4	NAG	G	505	1	14,14,15	0.21	0	17,19,21	0.52	0
4	NAG	G	502	1	14,14,15	0.23	0	17,19,21	0.39	0
4	NAG	G	509	1	14,14,15	0.25	0	17,19,21	0.58	0
4	NAG	G	501	1	14,14,15	0.19	0	17,19,21	0.40	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
4	NAG	G	507	1	-	2/6/23/26	0/1/1/1
4	NAG	L	301	3	-	3/6/23/26	0/1/1/1
4	NAG	G	510	1	-	1/6/23/26	0/1/1/1
4	NAG	G	503	1	-	0/6/23/26	0/1/1/1
4	NAG	G	506	1	-	2/6/23/26	0/1/1/1
5	EPE	G	511	-	-	2/9/19/19	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	G	508	1	-	2/6/23/26	0/1/1/1
4	NAG	G	504	1	-	0/6/23/26	0/1/1/1
4	NAG	G	505	1	-	0/6/23/26	0/1/1/1
4	NAG	G	502	1	-	3/6/23/26	0/1/1/1
4	NAG	G	509	1	-	4/6/23/26	0/1/1/1
4	NAG	G	501	1	-	0/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	G	511	EPE	C10-S	2.26	1.80	1.77

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	G	511	EPE	C5-N4-C3	4.77	119.56	108.83
5	G	511	EPE	C7-N4-C3	3.79	120.93	111.23
5	G	511	EPE	C7-N4-C5	3.20	119.42	111.23
5	G	511	EPE	O1S-S-C10	3.13	110.68	106.92
5	G	511	EPE	C6-N1-C2	2.45	114.33	108.83

There are no chirality outliers.

All (19) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	L	301	NAG	O5-C5-C6-O6
4	G	507	NAG	C8-C7-N2-C2
4	G	507	NAG	O7-C7-N2-C2
4	G	509	NAG	C8-C7-N2-C2
4	G	509	NAG	O7-C7-N2-C2
4	G	509	NAG	C4-C5-C6-O6
4	G	506	NAG	O5-C5-C6-O6
4	G	508	NAG	O5-C5-C6-O6
4	L	301	NAG	C4-C5-C6-O6
4	G	509	NAG	O5-C5-C6-O6
5	G	511	EPE	N4-C7-C8-O8
4	G	508	NAG	C4-C5-C6-O6
4	G	506	NAG	C4-C5-C6-O6
4	G	510	NAG	C4-C5-C6-O6
4	G	502	NAG	C1-C2-N2-C7

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Mol	Chain	Res	Type	Atoms
4	L	301	NAG	C3-C2-N2-C7
4	G	502	NAG	C4-C5-C6-O6
4	G	502	NAG	C3-C2-N2-C7
5	G	511	EPE	C8-C7-N4-C3

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 (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	G	341/353 (96%)	0.55	17 (4%)	28	27	39, 59, 100, 164	0
2	H	223/225 (99%)	0.50	18 (8%)	12	11	39, 70, 111, 160	0
3	L	210/210 (100%)	0.69	19 (9%)	9	8	51, 88, 110, 171	0
All	All	774/788 (98%)	0.57	54 (6%)	16	15	39, 69, 110, 171	0

All (54) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	133	GLY	5.7
1	G	461	ASN	5.7
3	L	214	CYS	5.6
1	G	88	ASN	5.5
1	G	44	VAL	5.1
2	H	132	SER	5.0
1	G	460	ALA	4.7
1	G	492	GLU	4.3
2	H	189	LEU	4.0
2	H	131	THR	3.8
2	H	191	THR	3.7
2	H	129	LYS	3.6
1	G	283	THR	3.4
3	L	152	ASN	3.2
2	H	184	VAL	3.2
1	G	462	ASN	3.2
2	H	138	LEU	3.1
2	H	127	SER	3.1
3	L	81	ASP	3.0
2	H	99	GLY	2.9
1	G	410	CYS	2.9
1	G	48	ALA	2.8
2	H	1	ARG	2.8

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Mol	Chain	Res	Type	RSRZ
2	H	185	PRO	2.7
3	L	141	PRO	2.7
1	G	301	ASN	2.7
1	G	87	GLU	2.6
3	L	143	GLU	2.6
2	H	134	GLY	2.6
1	G	458	GLY	2.6
3	L	113	PRO	2.6
1	G	281	ALA	2.5
3	L	212	GLY	2.5
2	H	210	LYS	2.5
1	G	473	GLY	2.5
3	L	157	GLY	2.4
3	L	189	HIS	2.4
3	L	179	LEU	2.3
3	L	204	PRO	2.3
3	L	123	GLU	2.3
1	G	255	VAL	2.3
3	L	20	THR	2.3
1	G	477	ASP	2.2
3	L	19	VAL	2.2
3	L	164	THR	2.2
2	H	188	SER	2.1
3	L	193	ALA	2.1
2	H	154	TRP	2.1
3	L	85	THR	2.1
3	L	139	PHE	2.1
2	H	135	THR	2.1
2	H	100(A)	SER	2.1
1	G	396	ILE	2.0
3	L	201	LEU	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 monosaccharides 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
4	NAG	G	509	14/15	0.74	0.39	88,104,125,127	0
4	NAG	G	510	14/15	0.74	0.29	70,88,105,108	0
4	NAG	G	501	14/15	0.78	0.21	65,84,102,102	0
4	NAG	L	301	14/15	0.79	0.27	76,91,108,110	0
4	NAG	G	502	14/15	0.82	0.34	71,87,104,104	0
4	NAG	G	505	14/15	0.86	0.21	64,75,90,90	0
4	NAG	G	507	14/15	0.89	0.19	67,79,94,95	0
4	NAG	G	506	14/15	0.90	0.17	56,68,82,83	0
4	NAG	G	508	14/15	0.91	0.13	65,78,93,94	0
4	NAG	G	504	14/15	0.91	0.14	53,68,81,82	0
5	EPE	G	511	15/15	0.93	0.27	59,71,81,84	0
4	NAG	G	503	14/15	0.97	0.15	35,51,61,64	0

6.5 Other polymers (i)

There are no such residues in this entry.