



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 7, 2020 – 07:05 AM BST

PDB ID : 5WB9  
Title : Crystal structure of CD4 binding site antibody N60P23 in complex with HIV-1  
clade A/E strain 93TH057 gp120 core  
Authors : Gohain, N.; Tolbert, W.; Pazgier, M.  
Deposited on : 2017-06-28  
Resolution : 2.40 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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.

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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	:	2.13.1
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)	:	2.13.1

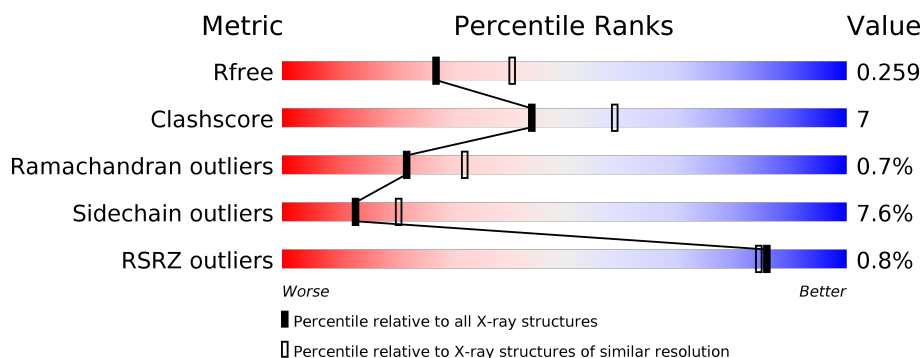
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	G	353	<div> <div style="width: 100%; height: 10px; background-color: red;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>%</span> <div style="width: 100%; height: 10px; background-color: green;"></div> <span>80%</span> <span>13%</span> <span>• •</span> </div> </div>
2	H	227	<div> <div style="width: 100%; height: 10px; background-color: red;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>%</span> <div style="width: 100%; height: 10px; background-color: green;"></div> <span>75%</span> <span>18%</span> <span>• • •</span> </div> </div>
3	L	208	<div> <div style="width: 100%; height: 10px; background-color: green;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>77%</span> <span>16%</span> <span>• •</span> </div> </div>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	NAG	G	508	-	-	-	X

## 2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 6260 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 clade A/E 93TH057 HIV-1 gp120 core.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	G	340	Total	C	N	O	S	0	1	0
			2672	1676	463	510	23			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	375	SER	HIS	engineered mutation	UNP A0A0M3KKW9

- Molecule 2 is a protein called N60P23 Fab heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	220	Total	C	N	O	S	0	0	0
			1672	1053	292	319	8			

- Molecule 3 is a protein called N60P23 Fab light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	200	Total	C	N	O	S	0	1	0
			1561	982	263	312	4			

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



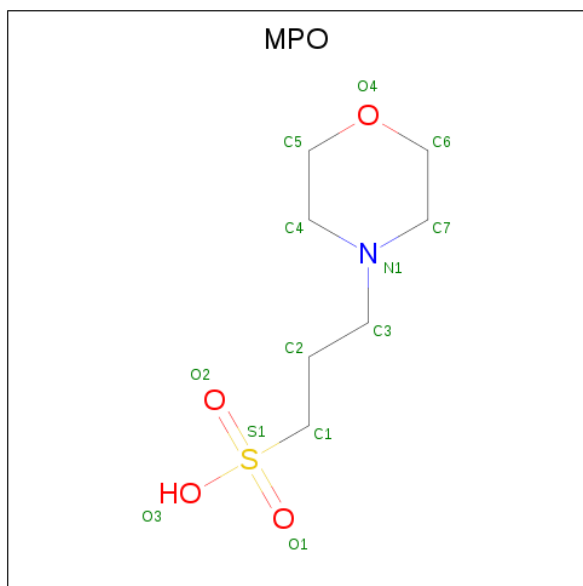
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 5 is (4S)-2-METHYL-2,4-PENTANEDIOL (three-letter code: MPD) (formula:  $C_6H_{14}O_2$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	G	1	Total	C	O	0	0
			8	6	2		

- Molecule 6 is 3[N-MORPHOLINO]PROPANE SULFONIC ACID (three-letter code: MPO) (formula:  $C_7H_{15}NO_4S$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	G	1	Total	C	N	O	S	0	0
			13	7	1	4	1		

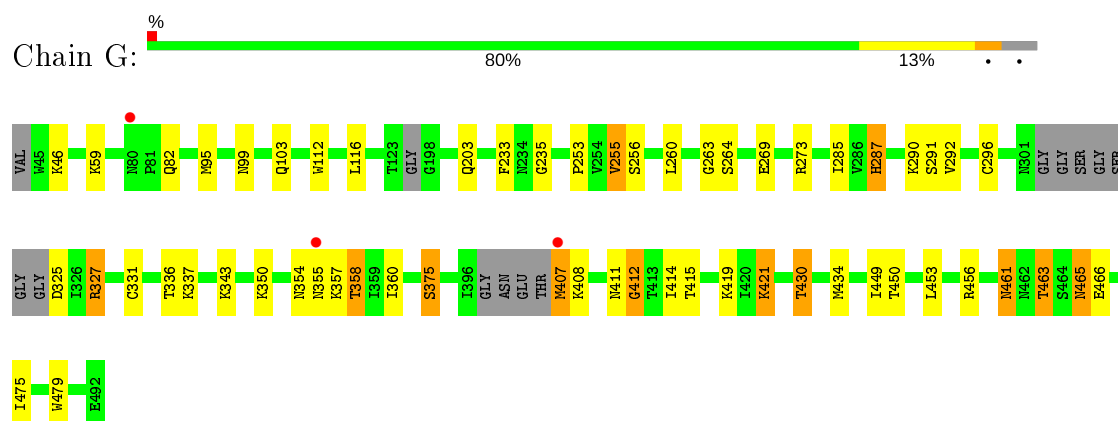
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	G	77	Total 77	O 77	0	0
7	H	78	Total 78	O 78	0	0
7	L	67	Total 67	O 67	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





## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	127.56Å 68.57Å 119.36Å 90.00° 111.36° 90.00°	Depositor
Resolution (Å)	37.33 – 2.40 38.32 – 2.40	Depositor EDS
% Data completeness (in resolution range)	99.7 (37.33-2.40) 99.7 (38.32-2.40)	Depositor EDS
$R_{merge}$	0.16	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.66 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.8.0158	Depositor
R, $R_{free}$	0.213 , 0.258 0.217 , 0.259	Depositor DCC
$R_{free}$ test set	1882 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	36.4	Xtriage
Anisotropy	0.263	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 29.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6260	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.43% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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 ⓘ

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

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	0.68	0/2726	0.85	3/3697 (0.1%)
2	H	0.84	1/1717 (0.1%)	1.09	10/2338 (0.4%)
3	L	0.80	0/1597	0.90	3/2167 (0.1%)
All	All	0.76	1/6040 (0.0%)	0.94	16/8202 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	G	0	1
2	H	0	3
3	L	0	1
All	All	0	5

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	106	GLY	N-CA	5.10	1.53	1.46

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	67	ARG	NE-CZ-NH1	10.63	125.62	120.30
2	H	72	ARG	NE-CZ-NH2	-9.42	115.59	120.30
2	H	72	ARG	NE-CZ-NH1	8.85	124.72	120.30
2	H	67	ARG	NE-CZ-NH2	-7.89	116.35	120.30
2	H	106	GLY	N-CA-C	-6.74	96.25	113.10

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	G	355	ASN	Mainchain
2	H	101	ASP	Peptide
2	H	105	ASP	Peptide
2	H	64	PHE	Peptide
3	L	28	SER	Peptide

## 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	G	2672	0	2608	29	0
2	H	1672	0	1621	31	0
3	L	1561	0	1518	21	0
4	G	112	0	104	0	0
5	G	8	0	14	1	0
6	G	13	0	15	2	0
7	G	77	0	0	2	0
7	H	78	0	0	1	0
7	L	67	0	0	2	0
All	All	6260	0	5880	79	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 7.

The worst 5 of 79 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)
2:H:112:GLN:HE21	2:H:112:GLN:H	1.18	0.92
3:L:102:ARG:NH1	3:L:103:THR:O	2.09	0.84
2:H:6:GLN:H	2:H:112:GLN:HE22	1.23	0.81
3:L:22:THR:HG22	3:L:70:THR:HG22	1.69	0.75
1:G:358:THR:HG21	7:G:602:HOH:O	1.92	0.69

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	G	333/353 (94%)	313 (94%)	18 (5%)	2 (1%)	25	36
2	H	218/227 (96%)	204 (94%)	13 (6%)	1 (0%)	29	41
3	L	199/208 (96%)	183 (92%)	14 (7%)	2 (1%)	15	23
All	All	750/788 (95%)	700 (93%)	45 (6%)	5 (1%)	22	32

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	89	ASP
1	G	430	THR
3	L	200	GLY
3	L	201	LEU
1	G	412	GLY

### 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	306/311 (98%)	282 (92%)	24 (8%)	12	19
2	H	185/192 (96%)	169 (91%)	16 (9%)	10	16
3	L	178/185 (96%)	167 (94%)	11 (6%)	18	29
All	All	669/688 (97%)	618 (92%)	51 (8%)	13	20

5 of 51 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	465	ASN
2	H	69	THR
3	L	154	LEU
2	H	18	VAL
2	H	72	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
2	H	6	GLN
2	H	31	ASN
2	H	171	HIS
2	H	1	GLN
2	H	112	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

## 5.6 Ligand geometry ⓘ

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
5	MPD	G	509	-	7,7,7	0.37	0	9,10,10	0.60	0
6	MPO	G	510	-	13,13,13	2.70	2 (15%)	17,17,17	2.62	5 (29%)
4	NAG	G	504	1	14,14,15	0.65	1 (7%)	17,19,21	0.80	0
4	NAG	G	505	1	14,14,15	0.45	0	17,19,21	2.22	3 (17%)
4	NAG	G	508	1	14,14,15	1.01	1 (7%)	17,19,21	1.87	5 (29%)
4	NAG	G	502	1	14,14,15	0.68	0	17,19,21	1.44	2 (11%)
4	NAG	G	506	1	14,14,15	0.53	0	17,19,21	1.63	4 (23%)
4	NAG	G	501	1	14,14,15	0.45	0	17,19,21	0.93	1 (5%)
4	NAG	G	503	1	14,14,15	0.42	0	17,19,21	1.00	1 (5%)
4	NAG	G	507	1	14,14,15	0.68	0	17,19,21	2.27	4 (23%)

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
5	MPD	G	509	-	-	1/5/5/5	-
6	MPO	G	510	-	-	1/7/15/15	0/1/1/1
4	NAG	G	504	1	-	0/6/23/26	0/1/1/1
4	NAG	G	505	1	-	2/6/23/26	0/1/1/1
4	NAG	G	508	1	-	4/6/23/26	0/1/1/1
4	NAG	G	502	1	-	2/6/23/26	0/1/1/1
4	NAG	G	506	1	-	4/6/23/26	0/1/1/1
4	NAG	G	501	1	-	2/6/23/26	0/1/1/1
4	NAG	G	503	1	-	0/6/23/26	0/1/1/1
4	NAG	G	507	1	-	4/6/23/26	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	G	510	MPO	C1-S1	-8.05	1.66	1.77
6	G	510	MPO	O3-S1	5.08	1.65	1.47
4	G	504	NAG	C1-C2	2.05	1.55	1.52
4	G	508	NAG	C1-C2	2.03	1.55	1.52

The worst 5 of 25 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	G	510	MPO	C5-C4-N1	6.88	120.53	110.10
4	G	505	NAG	C1-O5-C5	6.47	120.96	112.19
4	G	507	NAG	C1-O5-C5	6.11	120.47	112.19
4	G	508	NAG	C1-O5-C5	5.37	119.47	112.19
6	G	510	MPO	O4-C6-C7	-4.38	102.14	111.80

There are no chirality outliers.

5 of 20 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	G	506	NAG	C4-C5-C6-O6
4	G	506	NAG	O5-C5-C6-O6
4	G	505	NAG	C4-C5-C6-O6
4	G	508	NAG	O5-C5-C6-O6
4	G	508	NAG	C8-C7-N2-C2

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	G	509	MPD	1	0
6	G	510	MPO	2	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 [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	G	340/353 (96%)	-0.13	3 (0%) 84 82	26, 52, 86, 123	0
2	H	220/227 (96%)	-0.44	3 (1%) 75 73	22, 34, 52, 94	0
3	L	200/208 (96%)	-0.46	0 100 100	22, 35, 68, 83	0
All	All	760/788 (96%)	-0.31	6 (0%) 86 84	22, 41, 77, 123	0

The worst 5 of 6 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	139	SER	4.5
2	H	140	GLY	3.7
1	G	407	MET	2.8
2	H	138	THR	2.3
1	G	355	ASN	2.2

### 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
4	NAG	G	508	14/15	0.55	0.41	67,76,79,80	0
4	NAG	G	507	14/15	0.73	0.27	86,92,95,95	0
6	MPO	G	510	13/13	0.74	0.30	44,54,86,89	0
4	NAG	G	502	14/15	0.77	0.36	77,83,103,107	0
4	NAG	G	505	14/15	0.87	0.19	50,54,60,62	0
5	MPD	G	509	8/8	0.87	0.26	43,45,46,47	0
4	NAG	G	501	14/15	0.90	0.14	44,47,48,51	0
4	NAG	G	506	14/15	0.91	0.14	40,46,51,55	0
4	NAG	G	504	14/15	0.92	0.16	44,51,55,55	0
4	NAG	G	503	14/15	0.93	0.11	38,43,46,46	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.