



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 31, 2026 – 02:28 PM EDT

PDB ID : 9NHY / pdb_00009nhy
Title : Fab1502 in complex with the C-terminal alpha-TSR domain of the *P. falciparum* circumsporozoite protein
Authors : Moskovitz, R.; Wilson, I.A.
Deposited on : 2025-02-25
Resolution : 2.00 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
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
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)	:	2.50

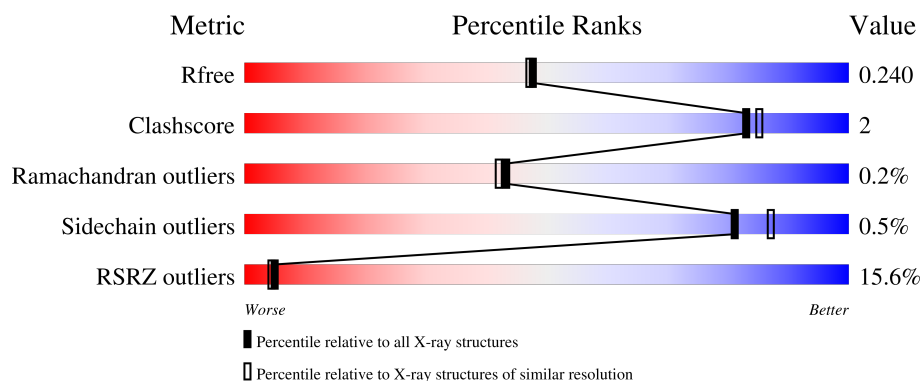
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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	H	241	15% 83% 7% 10%
2	L	212	19% 93% 6%
3	C	73	% 90% 10%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 7493 atoms, of which 3611 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 Fab1502 heavy chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	H	217	Total	C	H	N	O	S	0	2	0
			3192	1023	1573	271	320	5			

- Molecule 2 is a protein called Fab1502 light chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	L	211	Total	C	H	N	O	S	0	1	0
			3079	996	1495	265	318	5			

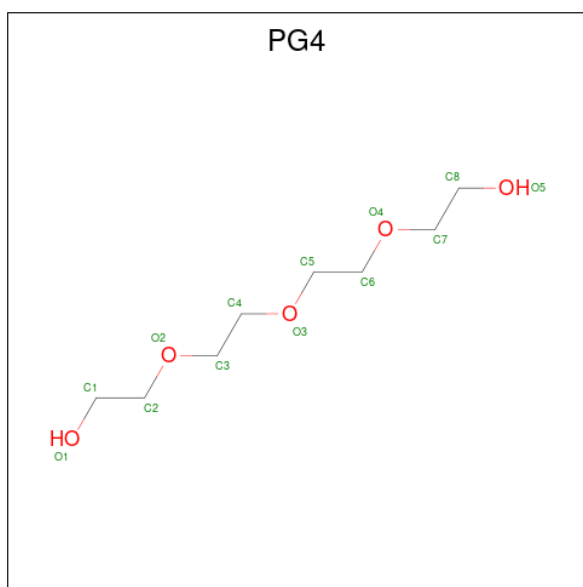
- Molecule 3 is a protein called Circumsporozoite protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	C	66	Total	C	H	N	O	S	0	0	0
			1032	319	515	89	104	5			

There are 6 discrepancies between the modelled and reference sequences:

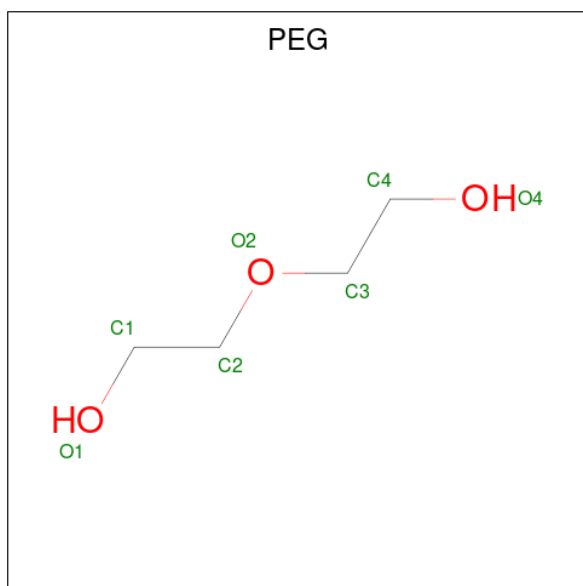
Chain	Residue	Modelled	Actual	Comment	Reference
C	376	HIS	-	expression tag	UNP Q7K740
C	377	HIS	-	expression tag	UNP Q7K740
C	378	HIS	-	expression tag	UNP Q7K740
C	379	HIS	-	expression tag	UNP Q7K740
C	380	HIS	-	expression tag	UNP Q7K740
C	381	HIS	-	expression tag	UNP Q7K740

- Molecule 4 is TETRAETHYLENE GLYCOL (CCD ID: PG4) (formula: C₈H₁₈O₅).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	H	1	Total	C	H	O	0	0
			31	8	18	5		

- Molecule 5 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	L	1	Total	C	H	O	0	0
			17	4	10	3		

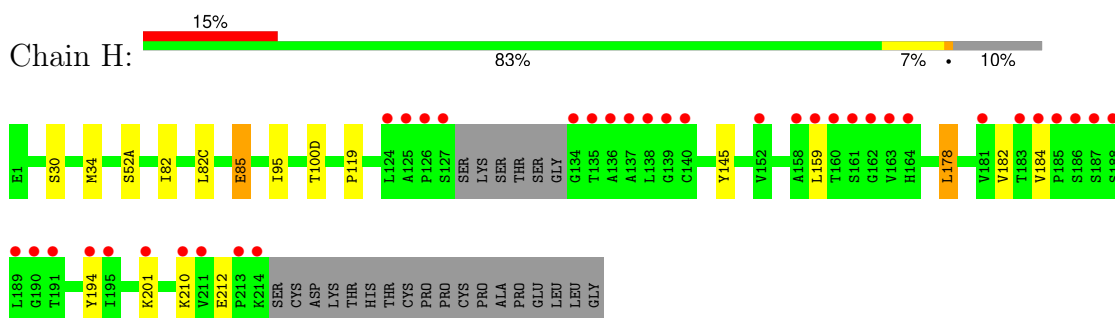
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	H	68	Total 68	O 68	0	0
6	L	60	Total 60	O 60	0	0
6	C	14	Total 14	O 14	0	0

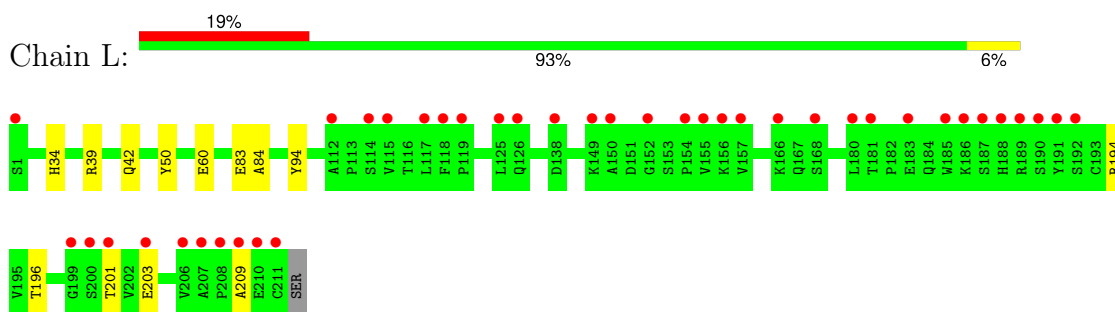
3 Residue-property plots [i](#)

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.

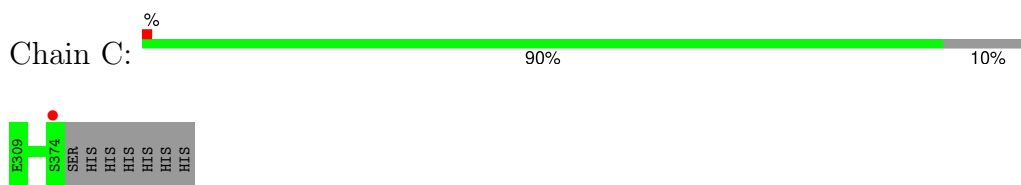
- Molecule 1: Fab1502 heavy chain



- Molecule 2: Fab1502 light chain



- Molecule 3: Circumsporozoite protein



4 Data and refinement statistics

Property	Value	Source
Space group	I 41	Depositor
Cell constants a, b, c, α , β , γ	102.99Å 102.99Å 172.40Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.50 – 2.00 44.50 – 2.00	Depositor EDS
% Data completeness (in resolution range)	98.2 (44.50-2.00) 98.9 (44.50-2.00)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.32 (at 2.00Å)	Xtriage
Refinement program	PHENIX (1.21.2_5419: ???)	Depositor
R, R_{free}	0.212 , 0.242 0.210 , 0.240	Depositor DCC
R_{free} test set	2998 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	33.9	Xtriage
Anisotropy	0.277	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.44 , 44.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.026 for h,-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7493	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.16% 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: PG4, PEG

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	H	0.69	1/1663 (0.1%)	0.67	1/2265 (0.0%)
2	L	0.62	0/1626	0.62	0/2228
3	C	0.71	0/525	0.68	0/704
All	All	0.66	1/3814 (0.0%)	0.65	1/5197 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	H	34	MET	SD-CE	5.19	1.92	1.79

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	H	34	MET	CB-CG-SD	5.32	128.67	112.70

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	H	1619	1573	1582	11	0
2	L	1584	1495	1531	7	0
3	C	517	515	513	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	H	13	18	18	1	0
5	L	7	10	10	0	0
6	C	14	0	0	0	0
6	H	68	0	0	0	0
6	L	60	0	0	1	0
All	All	3882	3611	3654	18	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 2.

All (18) 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:H:159:LEU:HD21	1:H:182:VAL:HG21	1.75	0.67
2:L:196:THR:OG1	2:L:201:THR:HG22	1.97	0.65
1:H:159:LEU:HD23	1:H:159:LEU:C	2.31	0.55
1:H:85:GLU:CD	1:H:85:GLU:H	2.17	0.52
2:L:39:ARG:HB2	2:L:42:GLN:HG3	1.93	0.51
1:H:201:LYS:HD2	1:H:201:LYS:H	1.76	0.51
1:H:210:LYS:HE2	1:H:212:GLU:CG	2.42	0.49
2:L:60:GLU:HG3	6:L:439:HOH:O	2.15	0.46
2:L:34:HIS:CE1	2:L:50:TYR:H	2.34	0.45
1:H:178:LEU:C	1:H:178:LEU:HD12	2.42	0.44
1:H:184:VAL:HG11	1:H:194:TYR:CE1	2.53	0.43
1:H:82:ILE:HB	1:H:82(C):LEU:HD21	2.01	0.42
2:L:194:ARG:HG2	2:L:203:GLU:OE1	2.20	0.42
2:L:83:GLU:O	2:L:84:ALA:HB2	2.20	0.41
1:H:119:PRO:HB3	1:H:145:TYR:HB3	2.03	0.41
4:H:301:PG4:H21	2:L:94:TYR:HB3	2.02	0.41
1:H:95:ILE:HA	1:H:100(D):THR:O	2.21	0.40
1:H:30:SER:O	1:H:52(A):SER:HB2	2.22	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	H	215/241 (89%)	211 (98%)	4 (2%)	0	100	100
2	L	209/212 (99%)	198 (95%)	10 (5%)	1 (0%)	24	21
3	C	64/73 (88%)	64 (100%)	0	0	100	100
All	All	488/526 (93%)	473 (97%)	14 (3%)	1 (0%)	43	42

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	L	209	ALA

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	H	183/202 (91%)	181 (99%)	2 (1%)	65	73
2	L	176/177 (99%)	176 (100%)	0	100	100
3	C	61/68 (90%)	61 (100%)	0	100	100
All	All	420/447 (94%)	418 (100%)	2 (0%)	81	87

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	85	GLU
1	H	178	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
2	L	53	ASN
2	L	184	GLN

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Mol	Chain	Res	Type
2	L	197	HIS
3	C	361	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

2 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	PG4	H	301	-	12,12,12	0.50	0	11,11,11	0.40	0
5	PEG	L	301	-	6,6,6	0.21	0	5,5,5	0.34	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	PG4	H	301	-	-	3/10/10/10	-
5	PEG	L	301	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	L	301	PEG	O2-C3-C4-O4
4	H	301	PG4	C3-C4-O3-C5
4	H	301	PG4	O2-C3-C4-O3
4	H	301	PG4	C8-C7-O4-C6
5	L	301	PEG	C4-C3-O2-C2

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	H	301	PG4	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	H	217/241 (90%)	0.67	36 (16%) 4 4	30, 44, 94, 182	1 (0%)
2	L	211/212 (99%)	0.73	40 (18%) 3 3	28, 50, 91, 152	0
3	C	66/73 (90%)	0.09	1 (1%) 72 71	33, 41, 66, 79	0
All	All	494/526 (93%)	0.62	77 (15%) 5 4	28, 46, 91, 182	1 (0%)

All (77) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	214	LYS	12.1
2	L	211	CYS	8.0
1	H	184	VAL	5.2
2	L	209	ALA	5.2
2	L	201	THR	4.8
1	H	136	ALA	4.1
2	L	150	ALA	4.0
2	L	206	VAL	4.0
1	H	125	ALA	3.9
2	L	156	LYS	3.9
1	H	194	TYR	3.8
1	H	213	PRO	3.8
1	H	183	THR	3.8
1	H	127	SER	3.7
2	L	191	TYR	3.7
2	L	180	LEU	3.6
1	H	188	SER	3.6
2	L	186	LYS	3.6
2	L	115	VAL	3.6
3	C	374	SER	3.6
1	H	135	THR	3.5
1	H	185	PRO	3.4
1	H	134	GLY	3.4

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Mol	Chain	Res	Type	RSRZ
2	L	207	ALA	3.4
1	H	159	LEU	3.3
2	L	152	GLY	3.2
2	L	189	ARG	3.2
2	L	190	SER	3.1
2	L	208	PRO	3.1
1	H	158	ALA	3.1
1	H	201	LYS	3.1
2	L	1	SER	3.0
1	H	139	GLY	3.0
2	L	119	PRO	3.0
1	H	189	LEU	2.9
2	L	154	PRO	2.9
2	L	188	HIS	2.9
2	L	117	LEU	2.9
2	L	138	ASP	2.9
2	L	187	SER	2.8
2	L	126	GLN	2.8
2	L	210	GLU	2.8
1	H	124	LEU	2.8
1	H	138	LEU	2.7
1	H	164	HIS	2.7
1	H	211	VAL	2.7
1	H	181	VAL	2.7
2	L	200	SER	2.7
2	L	183	GLU	2.6
2	L	149	LYS	2.6
2	L	192	SER	2.6
1	H	195	ILE	2.6
1	H	137	ALA	2.6
1	H	186[A]	SER	2.6
2	L	185	TRP	2.6
1	H	126	PRO	2.5
1	H	163	VAL	2.5
1	H	190	GLY	2.5
2	L	199	GLY	2.5
2	L	157	VAL	2.5
2	L	155	VAL	2.4
1	H	187[A]	SER	2.4
2	L	166	LYS	2.4
2	L	118	PHE	2.4
1	H	191	THR	2.4

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Mol	Chain	Res	Type	RSRZ
2	L	112	ALA	2.3
1	H	162	GLY	2.3
2	L	203	GLU	2.2
1	H	140	CYS	2.2
1	H	210	LYS	2.2
1	H	160	THR	2.1
1	H	161	SER	2.1
2	L	181	THR	2.1
2	L	125	LEU	2.1
2	L	168	SER	2.1
1	H	152	VAL	2.1
2	L	114	SER	2.1

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](#)

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	PG4	H	301	13/13	0.87	0.19	42,67,82,89	0
5	PEG	L	301	7/7	0.90	0.17	54,68,85,94	0

6.5 Other polymers [i](#)

There are no such residues in this entry.