



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 22, 2024 – 04:37 AM EDT

PDB ID : 4HT1  
Title : Human TWEAK in complex with the Fab fragment of a neutralizing antibody  
Authors : Lammens, A.  
Deposited on : 2012-10-31  
Resolution : 2.50 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](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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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  
Xtrriage (Phenix) : 1.20.1  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

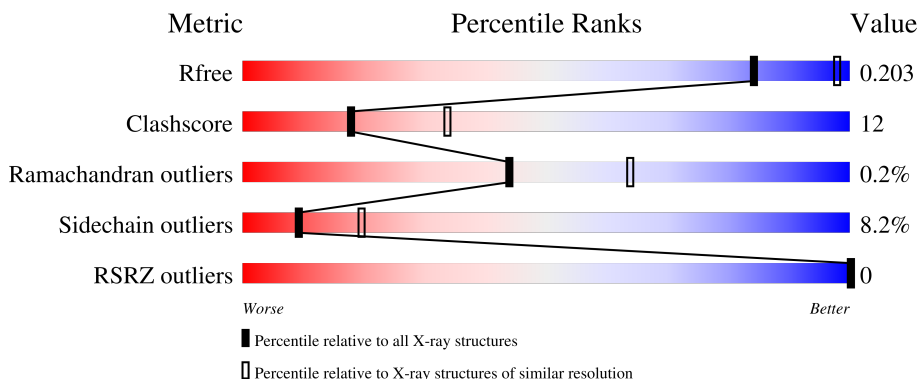
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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))
$R_{free}$	164625	5504 (2.50-2.50)
Clashscore	180529	6282 (2.50-2.50)
Ramachandran outliers	177936	6191 (2.50-2.50)
Sidechain outliers	177891	6193 (2.50-2.50)
RSRZ outliers	164620	5504 (2.50-2.50)

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  $\geq 3$ , 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	T	154	 62% 22% 15%
2	H	227	 63% 26% 7%
3	L	218	 71% 27%

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 4373 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 Tumor necrosis factor ligand superfamily member 12.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	T	131	1033	667	184	179	3	40	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
T	1	MET	-	initiating methionine	UNP O43508

- Molecule 2 is a protein called chimeric antibody Fab.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	210	1580	1009	255	310	6	19	0	0

- Molecule 3 is a protein called chimeric antibody Fab.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	217	1660	1040	279	334	7	8	1	0

- Molecule 4 is water.

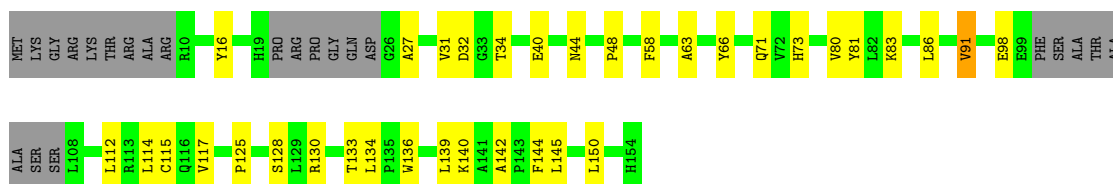
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	T	20	Total	O	0	0
			20	20		
4	H	30	Total	O	0	0
			30	30		
4	L	50	Total	O	0	0
			50	50		

### 3 Residue-property plots

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.

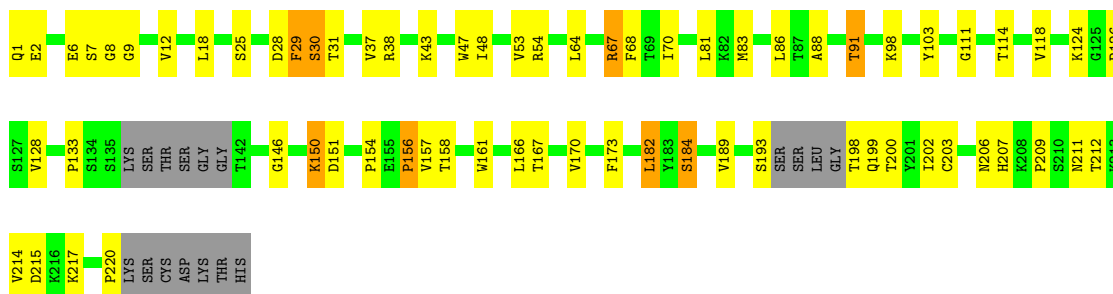
- Molecule 1: Tumor necrosis factor ligand superfamily member 12

Chain T: 



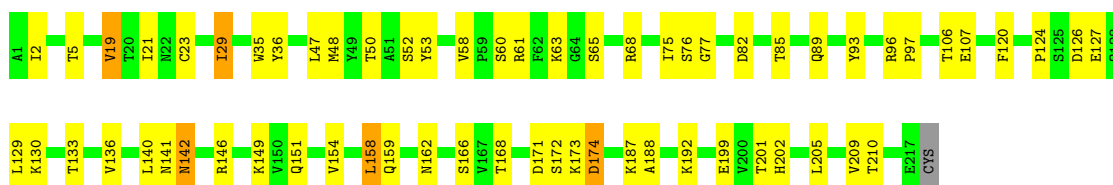
- Molecule 2: chimeric antibody Fab

Chain H: 



- Molecule 3: chimeric antibody Fab

Chain L: 



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 3	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	101.63Å 101.63Å 57.58Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.34 – 2.50 29.34 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.5 (29.34-2.50) 99.4 (29.34-2.50)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.27 (at 2.51Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.6.1_357)	Depositor
R, $R_{free}$	0.183 , 0.211 0.184 , 0.203	Depositor DCC
$R_{free}$ test set	2294 reflections (10.26%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	24.4	Xtrriage
Anisotropy	0.067	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 10.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.40$ , $\langle L^2 \rangle = 0.23$	Xtrriage
Estimated twinning fraction	0.087 for -h,-k,l 0.097 for h,-h-k,-l 0.379 for -k,-h,-l	Xtrriage
Reported twinning fraction	0.400 for -k,-h,-l	Depositor
Outliers	0 of 22932 reflections	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	4373	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	21.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.21% 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 [i](#)

### 5.1 Standard geometry [i](#)

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	T	0.63	0/1056	0.83	0/1430
2	H	0.60	0/1621	0.76	0/2214
3	L	0.62	0/1699	0.75	1/2312 (0.0%)
All	All	0.62	0/4376	0.77	1/5956 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	L	77	GLY	N-CA-C	-5.17	100.19	113.10

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	T	1033	0	1035	22	0
2	H	1580	0	1527	45	0
3	L	1660	0	1614	37	0
4	H	30	0	0	1	0
4	L	50	0	0	1	0
4	T	20	0	0	1	0
All	All	4373	0	4176	100	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 12.

All (100) 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)
3:L:149:LYS:HB3	3:L:201:THR:HB	1.58	0.85
2:H:67:ARG:HG2	2:H:68:PHE:CD1	2.13	0.84
2:H:67:ARG:HG2	2:H:68:PHE:HD1	1.38	0.84
1:T:133:THR:HG22	1:T:134:LEU:H	1.44	0.81
1:T:91:VAL:HG21	3:L:96:ARG:NH2	2.00	0.77
2:H:202:ILE:HG22	2:H:217:LYS:HB3	1.69	0.75
3:L:2:ILE:HD13	3:L:29:ILE:HD11	1.69	0.75
2:H:158:THR:HG22	2:H:206:ASN:HB3	1.69	0.73
2:H:128:VAL:HG21	2:H:214:VAL:HG11	1.72	0.72
2:H:67:ARG:HD2	2:H:68:PHE:HE1	1.56	0.70
2:H:200:THR:HG23	4:H:302:HOH:O	1.92	0.69
2:H:150:LYS:HG3	2:H:184:SER:OG	1.93	0.68
3:L:21:ILE:HG12	3:L:106:THR:HG21	1.77	0.67
3:L:151:GLN:HG3	3:L:199:GLU:HB3	1.80	0.63
3:L:126:ASP:O	3:L:130:LYS:HG3	1.99	0.62
2:H:133:PRO:HG2	2:H:220:PRO:HA	1.80	0.62
2:H:37:VAL:HG22	2:H:47:TRP:HA	1.82	0.62
1:T:83:LYS:O	1:T:133:THR:HG23	1.99	0.62
2:H:170:VAL:HG22	2:H:189:VAL:HG22	1.84	0.60
1:T:73:HIS:CE1	1:T:114:LEU:HD13	2.36	0.60
2:H:81:LEU:CD2	2:H:83:MET:HG2	2.32	0.60
2:H:157:VAL:HG22	2:H:207:HIS:HB2	1.83	0.59
2:H:68:PHE:CD2	2:H:81:LEU:HD21	2.36	0.59
3:L:61:ARG:HB2	3:L:76:SER:O	2.02	0.59
3:L:61:ARG:NH1	3:L:82:ASP:OD2	2.33	0.58
2:H:48:ILE:HG23	2:H:64:LEU:HD11	1.85	0.57
1:T:91:VAL:HG21	3:L:96:ARG:HH22	1.68	0.57
3:L:159:GLN:HG3	3:L:162:ASN:HD21	1.71	0.56
2:H:31:THR:HG22	2:H:54:ARG:NH1	2.21	0.55
1:T:63:ALA:HB2	1:T:125:PRO:HG3	1.88	0.55
1:T:32:ASP:OD1	1:T:34:THR:OG1	2.24	0.54
2:H:9:GLY:H	2:H:114:THR:HG21	1.74	0.53
2:H:202:ILE:HG22	2:H:217:LYS:CB	2.38	0.52
1:T:16:TYR:CE1	1:T:40:GLU:HG3	2.45	0.52
2:H:64:LEU:O	2:H:67:ARG:HB3	2.10	0.52
2:H:31:THR:HG22	2:H:54:ARG:HH11	1.75	0.52
2:H:154:PRO:HD2	2:H:209:PRO:HD2	1.89	0.52
3:L:199:GLU:OE1	3:L:210:THR:OG1	2.28	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:H:81:LEU:HD23	2:H:83:MET:HG2	1.91	0.51
2:H:67:ARG:HD2	2:H:68:PHE:CE1	2.43	0.51
3:L:154:VAL:HG12	3:L:159:GLN:OE1	2.10	0.51
3:L:171:ASP:HB3	3:L:174:ASP:OD2	2.11	0.51
1:T:31:VAL:HG22	1:T:136:TRP:CH2	2.47	0.50
2:H:103:TYR:CZ	3:L:97:PRO:HB3	2.47	0.50
3:L:61:ARG:HH22	3:L:82:ASP:CG	2.14	0.50
3:L:205:LEU:HD22	3:L:209:VAL:HG21	1.94	0.50
2:H:88:ALA:O	2:H:91:THR:HB	2.11	0.50
3:L:202:HIS:HB3	3:L:205:LEU:HD12	1.94	0.50
2:H:126:PRO:HG2	2:H:212:THR:HG21	1.94	0.49
3:L:142:ASN:OD1	3:L:142:ASN:N	2.45	0.49
2:H:173:PHE:HB3	3:L:166:SER:OG	2.13	0.49
3:L:36:TYR:HE2	3:L:89:GLN:HB3	1.77	0.49
2:H:38:ARG:HB3	2:H:48:ILE:HD11	1.94	0.48
3:L:93:TYR:CD1	3:L:97:PRO:HA	2.49	0.48
3:L:129:LEU:HB3	3:L:187:LYS:HE3	1.96	0.48
3:L:47:LEU:HA	3:L:58:VAL:HG21	1.94	0.48
1:T:142:ALA:HB3	1:T:145:LEU:HB2	1.96	0.47
2:H:166:LEU:HD21	2:H:189:VAL:HG11	1.95	0.47
2:H:2:GLU:OE1	2:H:98:LYS:NZ	2.48	0.47
2:H:29:PHE:O	2:H:53:VAL:HG21	2.15	0.47
2:H:83:MET:HB2	2:H:86:LEU:HD21	1.97	0.47
3:L:188:ALA:O	3:L:192:LYS:HG3	2.15	0.47
2:H:30:SER:O	2:H:53:VAL:HG23	2.16	0.46
3:L:124:PRO:HD3	3:L:136:VAL:HG22	1.97	0.46
3:L:85:THR:HG22	3:L:107:GLU:HG2	1.98	0.46
3:L:48:MET:HB2	3:L:53:TYR:O	2.15	0.46
2:H:28:ASP:OD1	2:H:30:SER:OG	2.33	0.45
3:L:154:VAL:HG13	3:L:154:VAL:O	2.16	0.45
1:T:130:ARG:HD3	4:T:209:HOH:O	2.15	0.45
3:L:23:CYS:HB2	3:L:35:TRP:CH2	2.52	0.45
1:T:73:HIS:CD2	1:T:112:LEU:HD11	2.51	0.45
3:L:60:SER:O	3:L:63:LYS:HE3	2.17	0.45
1:T:71:GLN:HG3	1:T:114:LEU:HD11	1.98	0.45
1:T:73:HIS:HD2	1:T:112:LEU:HD11	1.82	0.44
2:H:124:LYS:HD2	2:H:151:ASP:O	2.18	0.44
3:L:158:LEU:HD22	3:L:158:LEU:HA	1.85	0.44
1:T:58:PHE:O	1:T:128:SER:HA	2.17	0.44
1:T:80:VAL:HG13	1:T:81:TYR:HD2	1.82	0.44
2:H:6:GLU:OE2	2:H:111:GLY:HA3	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:T:81:TYR:OH	1:T:134:LEU:HD21	2.19	0.43
3:L:120:PHE:HE1	3:L:141:ASN:OD1	2.01	0.43
3:L:140:LEU:N	3:L:140:LEU:HD12	2.34	0.43
1:T:27:ALA:HB3	1:T:139:LEU:HD11	2.01	0.43
3:L:146[A]:ARG:NH1	4:L:315:HOH:O	2.52	0.43
2:H:83:MET:CB	2:H:86:LEU:HD21	2.49	0.42
1:T:48:PRO:HG3	1:T:66:TYR:CE1	2.53	0.42
3:L:19:VAL:HG12	3:L:75:ILE:HB	2.01	0.42
3:L:48:MET:HE2	3:L:48:MET:HB3	1.83	0.42
2:H:156:PRO:O	2:H:207:HIS:CD2	2.73	0.42
2:H:70:ILE:HG12	2:H:81:LEU:HD12	2.01	0.42
2:H:146:GLY:HA2	2:H:161:TRP:CH2	2.55	0.41
1:T:144:PHE:CD2	1:T:145:LEU:HD13	2.55	0.41
2:H:198:THR:HG23	2:H:199:GLN:N	2.35	0.41
3:L:127:GLU:O	3:L:130:LYS:HB2	2.19	0.41
2:H:12:VAL:O	2:H:118:VAL:HA	2.21	0.41
1:T:31:VAL:H	1:T:31:VAL:HG23	1.64	0.41
2:H:182:LEU:HD12	2:H:182:LEU:HA	1.81	0.41
2:H:156:PRO:O	2:H:207:HIS:HD2	2.04	0.40
1:T:144:PHE:CE2	1:T:145:LEU:HD13	2.56	0.40
2:H:8:GLY:O	2:H:18:LEU:HD21	2.21	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	T	125/154 (81%)	118 (94%)	7 (6%)	0	100	100
2	H	204/227 (90%)	197 (97%)	6 (3%)	1 (0%)	25	44
3	L	216/218 (99%)	207 (96%)	9 (4%)	0	100	100
All	All	545/599 (91%)	522 (96%)	22 (4%)	1 (0%)	44	64

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	156	PRO

### 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	T	106/123 (86%)	98 (92%)	8 (8%)	11	23
2	H	175/189 (93%)	159 (91%)	16 (9%)	7	16
3	L	185/185 (100%)	171 (92%)	14 (8%)	11	22
All	All	466/497 (94%)	428 (92%)	38 (8%)	9	19

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	T	44	ASN
1	T	86	LEU
1	T	91	VAL
1	T	98	GLU
1	T	115	CYS
1	T	117	VAL
1	T	140	LYS
1	T	150	LEU
2	H	1	GLN
2	H	7	SER
2	H	25	SER
2	H	29	PHE
2	H	30	SER
2	H	43	LYS
2	H	67	ARG
2	H	91	THR
2	H	150	LYS
2	H	167	THR
2	H	182	LEU
2	H	184	SER

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Mol	Chain	Res	Type
2	H	193	SER
2	H	203	CYS
2	H	211	ASN
2	H	215	ASP
3	L	5	THR
3	L	19	VAL
3	L	29	ILE
3	L	50	THR
3	L	52	SER
3	L	65	SER
3	L	68	ARG
3	L	133	THR
3	L	142	ASN
3	L	158	LEU
3	L	168	THR
3	L	172	SER
3	L	173	LYS
3	L	174	ASP

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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 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	T	131/154 (85%)	-1.57	0 <a href="#">100</a> <a href="#">100</a>	7, 14, 35, 49	10 (7%)
2	H	210/227 (92%)	-1.46	0 <a href="#">100</a> <a href="#">100</a>	11, 24, 40, 67	6 (2%)
3	L	217/218 (99%)	-1.52	0 <a href="#">100</a> <a href="#">100</a>	11, 21, 34, 43	4 (1%)
All	All	558/599 (93%)	-1.51	0 <a href="#">100</a> <a href="#">100</a>	7, 21, 38, 67	20 (3%)

There are no RSRZ outliers to report.

### 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](#)

There are no ligands in this entry.

### 6.5 Other polymers [i](#)

There are no such residues in this entry.