



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 16, 2026 – 12:04 PM EDT

PDB ID : 9NW8 / pdb\_00009nw8  
Title : CA117v2v8 Fab bound to HLA-E-Mtb44  
Authors : Wrapp, D.; Hwang, J.K.; Marston, D.J.; Haynes, B.F.; Azoitei, M.L.  
Deposited on : 2025-03-21  
Resolution : 2.30 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 : 4-5-2 with Phenix2.0  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.48.1

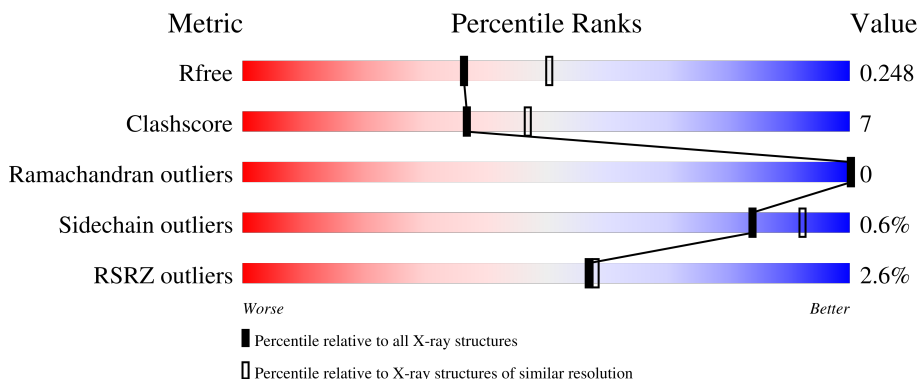
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*


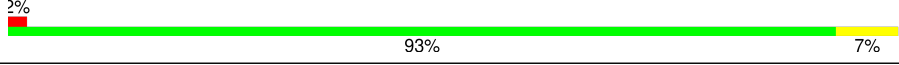
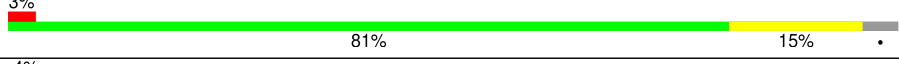

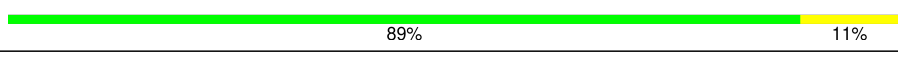
The reported resolution of this entry is 2.30 Å.

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	5963 (2.30-2.30)
Clashscore	180529	6698 (2.30-2.30)
Ramachandran outliers	177936	6640 (2.30-2.30)
Sidechain outliers	177891	6640 (2.30-2.30)
RSRZ outliers	164620	5963 (2.30-2.30)

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	A	275	 85% 12%
2	B	100	 93% 7%
3	H	233	 81% 15%
4	L	217	 82% 18%
5	P	9	 89% 11%

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6516 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 HLA class I histocompatibility antigen, alpha chain E.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	269	2199	1377	392	423	7	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	initiating methionine	UNP P13747

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	100	836	533	141	158	4	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	initiating methionine	UNP P61769

- Molecule 3 is a protein called CA117v2v8 heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	H	223	1661	1052	272	331	6	0	0	0

- Molecule 4 is a protein called CA117v2v8 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	L	217	1626	1013	271	336	6	0	0	0

- Molecule 5 is a protein called Mtb44 peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
5	P	9	68	46	13	9	0	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	55	Total	O	0	0
			55	55		
6	B	21	Total	O	0	0
			21	21		
6	H	24	Total	O	0	0
			24	24		
6	L	23	Total	O	0	0
			23	23		
6	P	3	Total	O	0	0
			3	3		





- Molecule 5: Mtb44 peptide

Chain P:   
89% 11%

A horizontal bar chart for Chain P showing 89% green and 11% yellow.



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	57.73Å 72.33Å 121.27Å 90.00° 101.36° 90.00°	Depositor
Resolution (Å)	59.45 – 2.30 59.45 – 2.30	Depositor EDS
% Data completeness (in resolution range)	93.7 (59.45-2.30) 93.7 (59.45-2.30)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.65 (at 2.29Å)	Xtrriage
Refinement program	PHENIX dev_3758	Depositor
R, $R_{free}$	0.196 , 0.246 0.199 , 0.248	Depositor DCC
$R_{free}$ test set	2061 reflections (4.71%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	48.7	Xtrriage
Anisotropy	0.200	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 45.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.034 for h,-k,-h-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6516	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	65.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.49% 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	A	0.71	10/2263 (0.4%)	0.51	0/3078
2	B	0.24	0/859	0.45	0/1162
3	H	0.54	4/1703 (0.2%)	0.54	0/2324
4	L	0.41	0/1662	0.54	2/2260 (0.1%)
5	P	0.75	0/69	0.65	0/93
All	All	0.55	14/6556 (0.2%)	0.52	2/8917 (0.0%)

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	94	THR	C-O	-5.95	1.17	1.24
1	A	117	ALA	C-O	-5.76	1.17	1.23
1	A	124	LEU	C-O	-5.74	1.17	1.24
3	H	22	CYS	C-O	-5.66	1.17	1.24
1	A	77	ASN	C-O	-5.65	1.17	1.24
1	A	95	LEU	C-O	-5.58	1.17	1.24
3	H	23	THR	C-O	-5.55	1.17	1.24
3	H	24	VAL	C-O	-5.43	1.17	1.24
1	A	96	GLN	C-O	-5.42	1.16	1.23
1	A	78	LEU	C-O	-5.18	1.18	1.24
1	A	81	LEU	C-O	-5.17	1.18	1.24
1	A	123	TYR	C-O	-5.10	1.17	1.24
3	H	6	GLU	C-O	-5.06	1.17	1.23
1	A	87	GLN	C-O	-5.01	1.18	1.23

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	L	201	THR	N-CA-C	5.65	118.75	109.76
4	L	200	THR	N-CA-C	5.11	116.93	111.36

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	2199	0	2042	26	0
2	B	836	0	803	5	0
3	H	1661	0	1639	21	0
4	L	1626	0	1569	42	0
5	P	68	0	85	1	0
6	A	55	0	0	8	0
6	B	21	0	0	5	0
6	H	24	0	0	6	0
6	L	23	0	0	6	0
6	P	3	0	0	0	0
All	All	6516	0	6138	88	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.

All (88) 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)
4:L:108:ARG:HH22	4:L:166:GLN:NE2	1.53	1.06
1:A:82:ARG:NH1	1:A:89:GLU:HG3	1.78	0.99
1:A:55:GLU:O	6:A:301:HOH:O	1.81	0.98
2:B:75:LYS:NZ	6:B:101:HOH:O	1.97	0.98
4:L:108:ARG:NH2	4:L:166:GLN:HE22	1.63	0.96
3:H:58:TYR:OH	6:H:302:HOH:O	1.85	0.94
4:L:108:ARG:HD2	4:L:140:TYR:OH	1.67	0.94
4:L:108:ARG:HH22	4:L:166:GLN:HE22	1.02	0.92
1:A:93:HIS:NE2	6:A:303:HOH:O	2.02	0.92
4:L:124:GLN:OE1	6:L:301:HOH:O	1.89	0.91
1:A:232:GLU:HG3	6:B:103:HOH:O	1.72	0.88
3:H:1:GLN:OE1	3:H:1:GLN:N	2.06	0.87
4:L:108:ARG:NH2	4:L:166:GLN:NE2	2.23	0.86
4:L:181:LEU:HD12	4:L:182:SER:O	1.76	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:L:181:LEU:HD11	4:L:186:TYR:HB2	1.60	0.84
4:L:108:ARG:HH22	4:L:166:GLN:CD	1.87	0.83
1:A:82:ARG:HH12	1:A:89:GLU:HG3	1.42	0.81
1:A:211:ALA:O	6:A:302:HOH:O	1.98	0.80
1:A:232:GLU:CD	6:B:103:HOH:O	2.24	0.80
3:H:148:GLU:OE1	6:H:303:HOH:O	2.02	0.78
1:A:232:GLU:CG	6:B:103:HOH:O	2.28	0.77
4:L:127:SER:OG	6:L:303:HOH:O	2.01	0.77
3:H:83:THR:HG22	3:H:85:ALA:H	1.51	0.74
3:H:100(A):PHE:HE1	4:L:95(A):SER:HA	1.53	0.72
1:A:216:THR:OG1	6:A:304:HOH:O	2.08	0.72
3:H:101:ASP:OD1	6:H:304:HOH:O	2.07	0.71
3:H:44:GLY:O	6:H:305:HOH:O	2.08	0.69
4:L:108:ARG:NH2	4:L:166:GLN:OE1	2.25	0.69
4:L:108:ARG:HD2	4:L:140:TYR:CZ	2.26	0.69
4:L:27(B):ASP:CG	4:L:27(C):VAL:H	2.00	0.69
2:B:38:ASP:OD1	2:B:45:ARG:NH2	2.28	0.65
4:L:181:LEU:CD1	4:L:182:SER:O	2.44	0.65
4:L:187:GLU:OE1	6:L:304:HOH:O	2.14	0.65
3:H:183:THR:OG1	6:H:306:HOH:O	2.15	0.64
4:L:108:ARG:NH2	4:L:166:GLN:CD	2.52	0.63
4:L:27(B):ASP:OD1	4:L:27(C):VAL:N	2.29	0.61
4:L:108:ARG:HD2	4:L:140:TYR:HH	1.66	0.60
3:H:61:PRO:HG2	4:L:1:LEU:HD22	1.85	0.58
4:L:206:SER:OG	6:L:305:HOH:O	2.16	0.57
1:A:72:GLN:OE1	6:A:306:HOH:O	2.18	0.57
4:L:45:LYS:HA	6:L:302:HOH:O	2.05	0.57
1:A:194:ILE:HG13	1:A:195:SER:N	2.19	0.56
4:L:91:TYR:HE1	4:L:95(A):SER:H	1.54	0.56
4:L:123:GLU:HA	4:L:126:LYS:HE2	1.86	0.56
3:H:100(A):PHE:CE1	4:L:95(A):SER:HA	2.38	0.55
4:L:181:LEU:HD11	4:L:186:TYR:CB	2.33	0.55
3:H:87:THR:HG23	3:H:110:THR:HA	1.88	0.54
3:H:8:GLY:HA3	3:H:20:LEU:HD23	1.89	0.54
1:A:194:ILE:HG13	1:A:195:SER:H	1.72	0.53
1:A:82:ARG:NH1	1:A:89:GLU:HA	2.24	0.53
1:A:117:ALA:HB2	2:B:60:TRP:CE2	2.44	0.53
1:A:56:GLY:C	6:A:301:HOH:O	2.51	0.53
4:L:47:MET:HA	4:L:58:VAL:HG21	1.90	0.52
4:L:112:ALA:HA	4:L:198:GLN:OE1	2.11	0.50
4:L:181:LEU:HD12	4:L:181:LEU:C	2.36	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:L:30:TYR:O	4:L:66:LYS:NZ	2.45	0.50
4:L:27(B):ASP:CG	4:L:27(C):VAL:N	2.66	0.50
1:A:121:LYS:HZ2	1:A:122:ASP:HB2	1.76	0.50
3:H:38:ARG:HB3	3:H:48:ILE:HD11	1.94	0.50
3:H:46:GLU:OE2	6:H:307:HOH:O	2.20	0.49
2:B:71:THR:O	6:B:102:HOH:O	2.20	0.49
4:L:46:LEU:N	6:L:302:HOH:O	2.01	0.48
4:L:181:LEU:CD1	4:L:186:TYR:HB2	2.37	0.48
1:A:188:HIS:ND1	6:A:312:HOH:O	2.35	0.46
1:A:33:PHE:CD2	1:A:34:VAL:HG13	2.51	0.46
3:H:66:ARG:HH12	3:H:86:ASP:CG	2.23	0.46
4:L:77:GLY:O	4:L:79:GLN:NE2	2.50	0.45
4:L:4:LEU:HD21	4:L:27(B):ASP:OD2	2.16	0.45
1:A:121:LYS:NZ	1:A:122:ASP:HB2	2.32	0.45
3:H:4:LEU:HD11	3:H:94:ILE:HD11	1.99	0.44
1:A:115:GLN:HG2	1:A:125:THR:HG23	1.99	0.44
1:A:237:GLY:N	6:A:305:HOH:O	2.17	0.44
3:H:38:ARG:NH1	3:H:63:LEU:HD11	2.33	0.44
1:A:7:TYR:HB2	1:A:99:HIS:CE1	2.53	0.43
1:A:142:ILE:HG22	1:A:146:LYS:HE3	1.99	0.43
4:L:120:PRO:HD3	4:L:132:VAL:HG22	2.00	0.43
3:H:16:GLU:O	3:H:82(C):VAL:HG22	2.19	0.43
4:L:60:ASP:N	4:L:60:ASP:OD1	2.51	0.43
4:L:83:GLU:OE2	4:L:108:ARG:NH1	2.52	0.43
3:H:47:TRP:CH2	4:L:95(B):LYS:HA	2.55	0.42
3:H:59:TYR:HB2	3:H:64:LYS:HG3	2.01	0.42
1:A:196:ASP:OD1	1:A:196:ASP:N	2.48	0.41
4:L:196:VAL:O	4:L:196:VAL:HG12	2.19	0.41
1:A:117:ALA:HB2	2:B:60:TRP:CZ2	2.55	0.41
4:L:181:LEU:HD11	4:L:186:TYR:CA	2.51	0.41
4:L:83:GLU:HG3	4:L:104:LEU:O	2.21	0.41
1:A:116:PHE:HZ	5:P:7:PRO:HD2	1.86	0.40
3:H:139:GLY:HA2	3:H:154:TRP:CH2	2.56	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	A	265/275 (96%)	258 (97%)	7 (3%)	0	100	100
2	B	98/100 (98%)	95 (97%)	3 (3%)	0	100	100
3	H	221/233 (95%)	214 (97%)	7 (3%)	0	100	100
4	L	215/217 (99%)	205 (95%)	10 (5%)	0	100	100
5	P	7/9 (78%)	7 (100%)	0	0	100	100
All	All	806/834 (97%)	779 (97%)	27 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	233/236 (99%)	233 (100%)	0	100	100
2	B	95/95 (100%)	93 (98%)	2 (2%)	48	66
3	H	192/201 (96%)	191 (100%)	1 (0%)	86	93
4	L	185/185 (100%)	184 (100%)	1 (0%)	86	93
5	P	7/7 (100%)	7 (100%)	0	100	100
All	All	712/724 (98%)	708 (99%)	4 (1%)	84	92

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

Mol	Chain	Res	Type
2	B	34	ASP
2	B	70	PHE
3	H	187	SER
4	L	202	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	38	ASN
1	A	127	ASN
1	A	188	HIS
1	A	191	HIS
2	B	13	HIS
2	B	31	HIS
3	H	192	GLN
4	L	37	GLN
4	L	189	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](#)

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

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<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	A	269/275 (97%)	0.02	4 (1%) 71 72	36, 58, 97, 137	0
2	B	100/100 (100%)	0.02	2 (2%) 64 66	34, 58, 93, 110	0
3	H	223/233 (95%)	0.18	6 (2%) 56 57	39, 63, 94, 149	0
4	L	217/217 (100%)	0.28	9 (4%) 42 43	44, 72, 102, 128	0
5	P	9/9 (100%)	0.24	0 100 100	40, 50, 66, 78	0
All	All	818/834 (98%)	0.13	21 (2%) 57 58	34, 64, 98, 149	0

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	L	1	LEU	4.9
4	L	2	PRO	3.8
1	A	225	THR	3.7
3	H	131	THR	3.3
1	A	154	GLU	3.0
4	L	107	GLY	3.0
4	L	212	CYS	2.9
4	L	3	VAL	2.8
3	H	130	SER	2.6
4	L	168	SER	2.6
3	H	127	SER	2.5
3	H	132	SER	2.4
4	L	95(A)	SER	2.4
1	A	82	ARG	2.4
4	L	154	LEU	2.2
1	A	273	ARG	2.2
4	L	56	SER	2.1
2	B	1(A)	ILE	2.1
3	H	194	TYR	2.1
3	H	210	LYS	2.1

*Continued on next page...*

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Mol	Chain	Res	Type	RSRZ
2	B	77	GLU	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 oligosaccharides 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.