



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 06:12 AM UTC

PDB ID : 6MTM / pdb_00006mtm
Title : Crystal Structure of EM2 TCR in complex with HLA-B*37:01-NP338
Authors : Gras, S.
Deposited on : 2018-10-19
Resolution : 3.00 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
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
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)	:	2.49

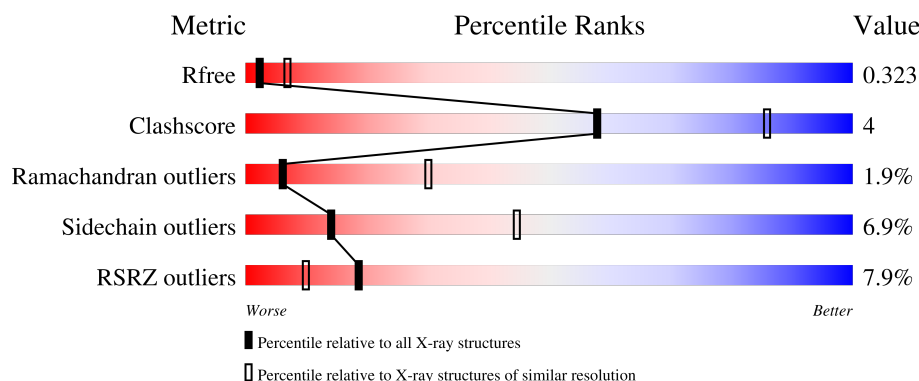
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 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	2672 (3.00-3.00)
Clashscore	190562	2977 (3.00-3.00)
Ramachandran outliers	187476	2877 (3.00-3.00)
Sidechain outliers	187428	2880 (3.00-3.00)
RSRZ outliers	180081	2671 (3.00-3.00)

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	A	276	7% 85% 14% .
2	B	99	82% 17% .
3	C	9	78% 22%
4	D	193	16% 77% 19% .
5	E	237	7% 81% 17% .

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 6562 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, B-37 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	276	Total	C	N	O	S	0	0	0
			2253	1399	410	438	6			

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	99	Total	C	N	O	S	0	0	0
			829	528	140	158	3			

- Molecule 3 is a protein called NP338 influenza peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	9	Total	C	N	O	0	0	0
			80	53	12	15			

- Molecule 4 is a protein called EM2 TCR alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	193	Total	C	N	O	S	0	0	0
			1505	948	253	296	8			

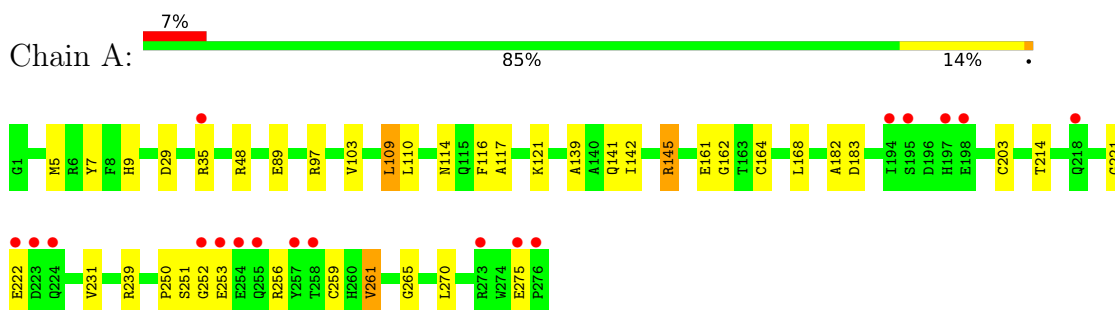
- Molecule 5 is a protein called EM2 TCR beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	237	Total	C	N	O	S	0	0	0
			1895	1198	325	364	8			

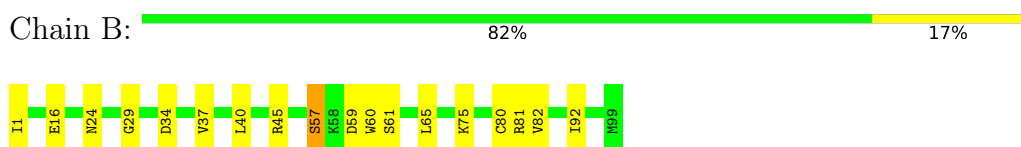
3 Residue-property plots [i](#)

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.

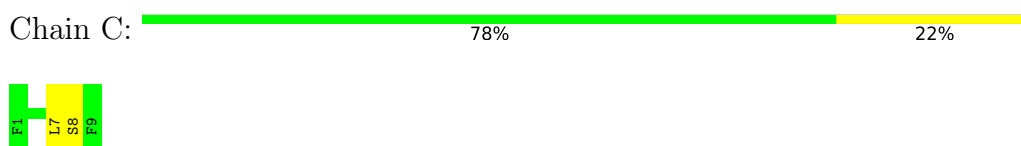
- Molecule 1: HLA class I histocompatibility antigen, B-37 alpha chain



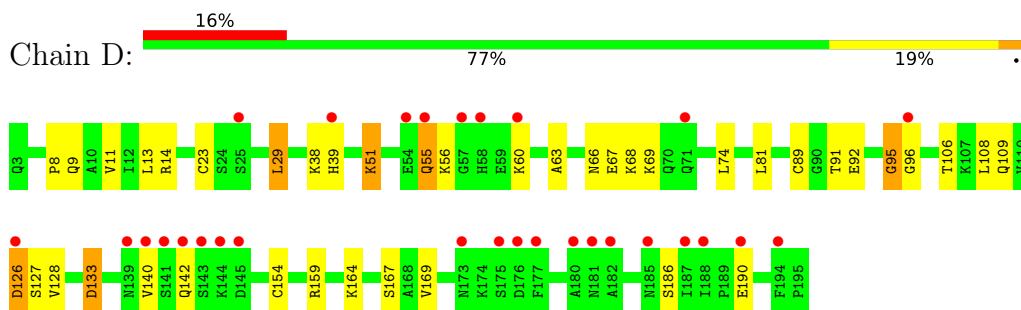
- Molecule 2: Beta-2-microglobulin



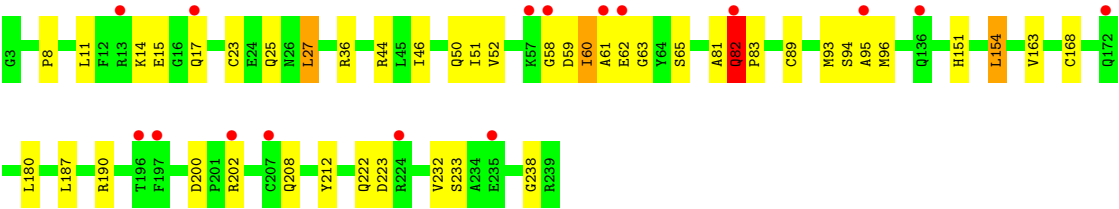
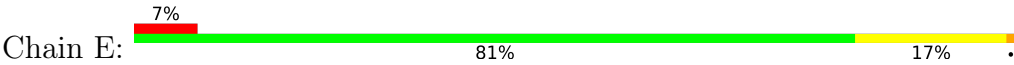
- Molecule 3: NP338 influenza peptide



- Molecule 4: EM2 TCR alpha chain



- Molecule 5: EM2 TCR beta chain



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	46.81Å 97.92Å 189.59Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.44 – 3.00 45.44 – 3.00	Depositor EDS
% Data completeness (in resolution range)	100.0 (45.44-3.00) 100.0 (45.44-3.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.08 (at 3.01Å)	Xtriage
Refinement program	BUSTER	Depositor
R, R_{free}	0.218 , 0.301 0.236 , 0.323	Depositor DCC
R_{free} test set	959 reflections (5.26%)	wwPDB-VP
Wilson B-factor (Å ²)	28.2	Xtriage
Anisotropy	0.319	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 41.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.26$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.84	EDS
Total number of atoms	6562	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.97% 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](#)

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	0.72	0/2315	1.26	4/3149 (0.1%)
2	B	0.75	0/852	1.17	0/1152
3	C	0.60	0/81	1.22	0/106
4	D	0.79	0/1538	1.28	12/2081 (0.6%)
5	E	0.72	0/1946	1.19	5/2646 (0.2%)
All	All	0.74	0/6732	1.23	21/9134 (0.2%)

There are no bond length outliers.

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	E	222	GLN	N-CA-C	6.04	118.12	110.33
4	D	68	LYS	CA-C-N	5.66	131.88	121.70
4	D	68	LYS	C-N-CA	5.66	131.88	121.70
4	D	159	ARG	CA-C-N	5.61	128.06	120.38
4	D	159	ARG	C-N-CA	5.61	128.06	120.38
4	D	125	ARG	CA-C-N	5.51	132.07	121.54
4	D	125	ARG	C-N-CA	5.51	132.07	121.54
4	D	126	ASP	CA-C-N	5.43	131.91	121.54
4	D	126	ASP	C-N-CA	5.43	131.91	121.54
4	D	51	LYS	CA-C-N	5.40	131.42	121.70
4	D	51	LYS	C-N-CA	5.40	131.42	121.70
1	A	221	GLY	CA-C-N	5.36	129.72	121.19
1	A	221	GLY	C-N-CA	5.36	129.72	121.19
1	A	162	GLY	CA-C-N	5.23	128.67	120.82
1	A	162	GLY	C-N-CA	5.23	128.67	120.82
4	D	38	LYS	CA-C-N	5.21	131.49	121.54
4	D	38	LYS	C-N-CA	5.21	131.49	121.54
5	E	95	ALA	CA-C-N	5.05	130.78	121.70
5	E	95	ALA	C-N-CA	5.05	130.78	121.70
5	E	61	ALA	CA-C-N	5.03	130.75	121.70
5	E	61	ALA	C-N-CA	5.03	130.75	121.70

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	2253	0	2112	15	0
2	B	829	0	796	7	0
3	C	80	0	79	3	0
4	D	1505	0	1452	15	0
5	E	1895	0	1804	23	0
All	All	6562	0	6243	55	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 4.

All (55) 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)
5:E:23:CYS:HG	5:E:89:CYS:HG	0.79	0.77
4:D:154:CYS:HB3	5:E:190:ARG:HH12	1.59	0.67
4:D:23:CYS:HG	4:D:89:CYS:HG	1.36	0.66
4:D:29:LEU:HD22	4:D:91:THR:HB	1.82	0.59
3:C:7:LEU:HD13	5:E:94:SER:HB3	1.84	0.59
5:E:81:ALA:O	5:E:82:GLN:HB2	2.02	0.59
4:D:154:CYS:HB3	5:E:190:ARG:NH1	2.19	0.57
1:A:5:MET:HB2	1:A:168:LEU:HD13	1.88	0.55
5:E:14:LYS:HB3	5:E:17:GLN:HG3	1.88	0.55
5:E:62:GLU:HG3	5:E:63:GLY:H	1.71	0.54
1:A:35:ARG:HD2	1:A:48:ARG:HH21	1.71	0.54
5:E:36:ARG:HB2	5:E:46:ILE:HD11	1.90	0.54
3:C:7:LEU:HD11	5:E:93:MET:HE2	1.90	0.53
5:E:154:LEU:HD23	5:E:187:LEU:HD23	1.91	0.53
5:E:51:ILE:HG13	5:E:52:VAL:H	1.74	0.52
4:D:118:ASP:O	4:D:133:ASP:HB2	2.10	0.51
1:A:117:ALA:HB2	2:B:60:TRP:CE2	2.46	0.50
2:B:24:ASN:HB3	2:B:65:LEU:HD11	1.94	0.50

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:37:VAL:HG22	2:B:82:VAL:HG13	1.93	0.50
5:E:51:ILE:HG13	5:E:52:VAL:N	2.27	0.49
1:A:103:VAL:HG12	1:A:109:LEU:HA	1.94	0.49
2:B:40:LEU:HD11	2:B:81:ARG:HB2	1.95	0.48
1:A:9:HIS:HB2	1:A:97:ARG:HB3	1.95	0.47
4:D:14:ARG:HG2	4:D:111:ILE:HD11	1.95	0.47
5:E:8:PRO:HG2	5:E:11:LEU:HB2	1.97	0.47
5:E:44:ARG:CB	5:E:60:ILE:HD11	2.44	0.47
4:D:55:GLN:HA	4:D:56:LYS:HA	1.73	0.47
2:B:29:GLY:HA2	2:B:61:SER:HB2	1.96	0.47
4:D:95:GLY:HA2	4:D:96:GLY:HA2	1.62	0.46
1:A:141:GLN:HG2	1:A:145:ARG:HH11	1.79	0.46
2:B:80:CYS:O	2:B:92:ILE:HA	2.15	0.46
5:E:25:GLN:HB2	5:E:27:LEU:HD12	1.97	0.46
5:E:151:HIS:HB3	5:E:212:TYR:HB2	1.98	0.46
4:D:140:VAL:HA	4:D:186:SER:HB3	1.97	0.46
1:A:203:CYS:SG	1:A:259:CYS:SG	3.12	0.46
5:E:208:GLN:HA	5:E:233:SER:HB3	1.98	0.45
4:D:8:PRO:HD2	4:D:106:THR:HG21	1.99	0.45
4:D:63:ALA:HB2	4:D:74:LEU:HD12	2.00	0.44
5:E:44:ARG:HB2	5:E:60:ILE:HD11	2.00	0.44
1:A:203:CYS:HG	1:A:259:CYS:HG	1.58	0.44
1:A:261:VAL:HG13	1:A:270:LEU:HB3	1.99	0.44
4:D:92:GLU:HB3	5:E:96:MET:HB2	1.99	0.43
3:C:7:LEU:HD12	3:C:8:SER:H	1.84	0.43
1:A:139:ALA:HA	1:A:142:ILE:HD12	2.01	0.42
4:D:55:GLN:HB2	4:D:56:LYS:HD2	2.01	0.42
5:E:58:GLY:HA2	5:E:59:ASP:HA	1.75	0.42
1:A:109:LEU:HD22	1:A:161:GLU:HG2	2.02	0.41
1:A:5:MET:HE2	1:A:164:CYS:SG	2.60	0.41
1:A:97:ARG:HG3	1:A:116:PHE:CZ	2.54	0.41
1:A:5:MET:HE3	1:A:7:TYR:HE2	1.86	0.41
1:A:182:ALA:HB1	1:A:265:GLY:HA2	2.03	0.41
5:E:200:ASP:O	5:E:238:GLY:HA3	2.21	0.40
2:B:57:SER:HB2	2:B:59:ASP:OD1	2.21	0.40
4:D:154:CYS:CB	5:E:190:ARG:HH12	2.29	0.40
4:D:154:CYS:SG	5:E:168:CYS:SG	3.17	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	274/276 (99%)	252 (92%)	18 (7%)	4 (2%)	8	35
2	B	97/99 (98%)	93 (96%)	3 (3%)	1 (1%)	12	45
3	C	7/9 (78%)	7 (100%)	0	0	100	100
4	D	191/193 (99%)	165 (86%)	18 (9%)	8 (4%)	2	13
5	E	235/237 (99%)	219 (93%)	14 (6%)	2 (1%)	14	48
All	All	804/814 (99%)	736 (92%)	53 (7%)	15 (2%)	6	30

All (15) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	250	PRO
4	D	39	HIS
4	D	127	SER
5	E	82	GLN
5	E	83	PRO
4	D	126	ASP
1	A	239	ARG
1	A	252	GLY
4	D	67	GLU
4	D	9	GLN
2	B	34	ASP
4	D	69	LYS
1	A	29	ASP
4	D	60	LYS
4	D	95	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	A	237/237 (100%)	222 (94%)	15 (6%)	16	48
2	B	94/94 (100%)	89 (95%)	5 (5%)	20	54
3	C	9/9 (100%)	9 (100%)	0	100	100
4	D	169/170 (99%)	152 (90%)	17 (10%)	7	29
5	E	206/206 (100%)	194 (94%)	12 (6%)	18	51
All	All	715/716 (100%)	666 (93%)	49 (7%)	14	45

All (49) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	89	GLU
1	A	109	LEU
1	A	110	LEU
1	A	114	ASN
1	A	121	LYS
1	A	145	ARG
1	A	183	ASP
1	A	214	THR
1	A	222	GLU
1	A	231	VAL
1	A	251	SER
1	A	253	GLU
1	A	256	ARG
1	A	261	VAL
1	A	275	GLU
2	B	1	ILE
2	B	16	GLU
2	B	45	ARG
2	B	57	SER
2	B	75	LYS
4	D	11	VAL
4	D	13	LEU
4	D	29	LEU
4	D	51	LYS
4	D	55	GLN
4	D	66	ASN
4	D	81	LEU
4	D	108	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
4	D	109	GLN
4	D	125	ARG
4	D	128	VAL
4	D	133	ASP
4	D	142	GLN
4	D	164	LYS
4	D	167	SER
4	D	169	VAL
4	D	190	GLU
5	E	15	GLU
5	E	27	LEU
5	E	50	GLN
5	E	60	ILE
5	E	65	SER
5	E	82	GLN
5	E	154	LEU
5	E	163	VAL
5	E	180	LEU
5	E	202	ARG
5	E	223	ASP
5	E	232	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (22) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	114	ASN
1	A	155	GLN
1	A	180	GLN
1	A	191	HIS
1	A	224	GLN
1	A	242	GLN
1	A	260	HIS
2	B	17	ASN
2	B	24	ASN
4	D	55	GLN
4	D	58	HIS
4	D	66	ASN
4	D	70	GLN
4	D	109	GLN
4	D	115	GLN
4	D	123	GLN
5	E	50	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
5	E	56	GLN
5	E	172	GLN
5	E	199	GLN
5	E	208	GLN
5	E	217	ASN

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

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	A	276/276 (100%)	0.32	18 (6%) 25 13	4, 17, 55, 74	9 (3%)
2	B	99/99 (100%)	0.30	0 100 100	6, 24, 47, 56	2 (2%)
3	C	9/9 (100%)	-0.10	0 100 100	5, 7, 12, 18	0
4	D	193/193 (100%)	0.97	30 (15%) 5 3	7, 31, 62, 71	32 (16%)
5	E	237/237 (100%)	0.52	16 (6%) 23 12	5, 25, 48, 70	17 (7%)
All	All	814/814 (100%)	0.53	64 (7%) 18 10	4, 25, 55, 74	60 (7%)

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	222	GLU	5.6
1	A	253	GLU	5.5
4	D	60	LYS	5.2
4	D	176	ASP	4.9
4	D	144	LYS	4.8
4	D	141	SER	4.7
1	A	252	GLY	4.7
1	A	257	TYR	4.7
4	D	187	ILE	4.6
5	E	17	GLN	4.4
4	D	188	ILE	4.1
1	A	275	GLU	3.9
1	A	223	ASP	3.9
4	D	175	SER	3.5
4	D	126	ASP	3.2
4	D	142	GLN	3.2
5	E	62	GLU	3.2
1	A	258	THR	3.2
4	D	185	ASN	3.1
4	D	194	PHE	3.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
4	D	173	ASN	3.1
4	D	143	SER	3.0
5	E	197	PHE	3.0
4	D	39	HIS	2.9
5	E	95	ALA	2.8
5	E	207	CYS	2.7
1	A	273	ARG	2.7
1	A	197	HIS	2.6
4	D	139	ASN	2.6
1	A	198	GLU	2.6
5	E	172	GLN	2.6
4	D	180	ALA	2.6
4	D	177	PHE	2.5
4	D	190	GLU	2.5
5	E	136	GLN	2.5
1	A	254	GLU	2.5
4	D	145	ASP	2.5
5	E	202	ARG	2.5
1	A	218	GLN	2.5
1	A	35	ARG	2.4
5	E	224	ARG	2.4
1	A	276	PRO	2.4
4	D	57	GLY	2.4
4	D	71	GLN	2.4
4	D	25	SER	2.4
4	D	55	GLN	2.4
4	D	140	VAL	2.4
4	D	181	ASN	2.3
1	A	224	GLN	2.3
5	E	61	ALA	2.3
5	E	196	THR	2.3
4	D	182	ALA	2.2
4	D	58	HIS	2.2
5	E	57	LYS	2.2
4	D	54	GLU	2.2
5	E	58	GLY	2.2
1	A	255	GLN	2.2
4	D	125	ARG	2.1
1	A	195	SER	2.1
5	E	235	GLU	2.1
4	D	96	GLY	2.1
5	E	13	ARG	2.0

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
5	E	82	GLN	2.0
1	A	194	ILE	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.