



wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 18, 2026 – 06:36 PM UTC

PDB ID : 8EB2 / pdb_00008eb2
Title : Structure of HLA-A*02:01 in complex with NY-ESO-1 peptide and PA2.1 Fab
Authors : Jette, C.A.; West, A.P.
Deposited on : 2022-08-30
Resolution : 2.90 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

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
Xtrriage (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

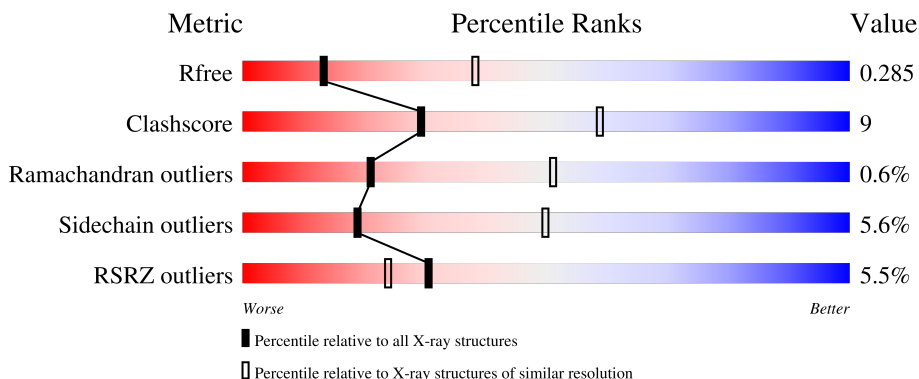
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


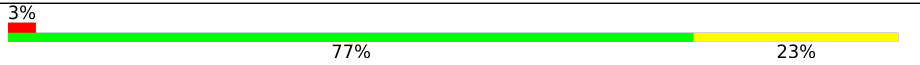
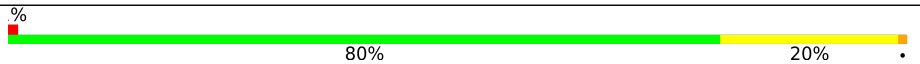
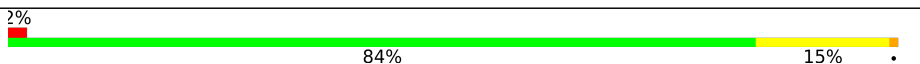
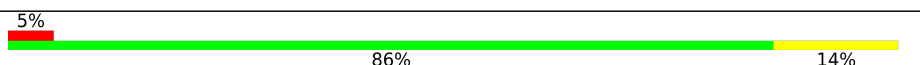
The reported resolution of this entry is 2.90 Å.

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	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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	275	
1	D	275	
1	G	275	
2	B	100	
2	E	100	

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Mol	Chain	Length	Quality of chain
2	H	100	
3	C	9	
3	F	9	
3	I	9	
4	J	221	
4	K	221	
4	N	221	
5	L	219	
5	M	219	
5	O	219	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 19374 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-A*02:01 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	275	Total 2246	C 1403	N 409	O 425	S 9	0	0	0
1	D	274	Total 2237	C 1398	N 408	O 422	S 9	0	0	0
1	G	275	Total 2246	C 1403	N 409	O 425	S 9	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	100	Total 837	C 533	N 141	O 159	S 4	0	0	0
2	E	100	Total 836	C 533	N 141	O 158	S 4	0	0	0
2	H	100	Total 836	C 533	N 141	O 158	S 4	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	initiating methionine	UNP P61769
E	0	MET	-	initiating methionine	UNP P61769
H	0	MET	-	initiating methionine	UNP P61769

- Molecule 3 is a protein called NY-ESO-1 peptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	9	Total 75	C 51	N 11	O 12	S 1	0	0	0
3	F	9	Total 75	C 51	N 11	O 12	S 1	0	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	I	9	75	51	11	12	1	0	0	0

- Molecule 4 is a protein called PA2.1 Fab Heavy Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	J	215	1628	1032	267	323	6	0	0	0
4	K	215	1628	1032	267	323	6	0	0	0
4	N	215	1628	1032	267	323	6	0	0	0

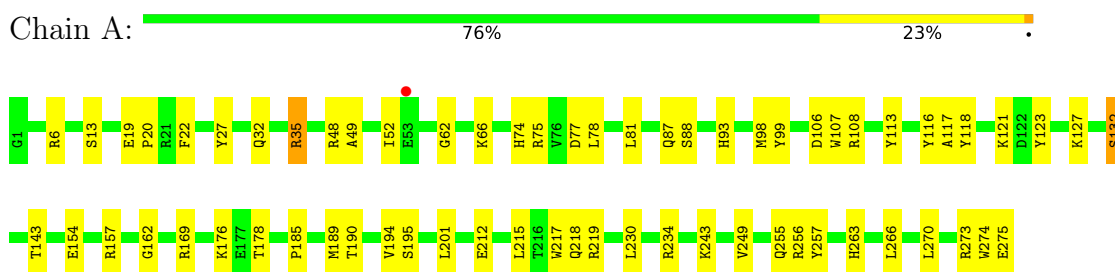
- Molecule 5 is a protein called PA2.1 Fab Light Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	L	218	1683	1052	288	338	5	0	0	0
5	M	217	1671	1044	287	335	5	0	0	0
5	O	217	1673	1046	287	335	5	0	0	0

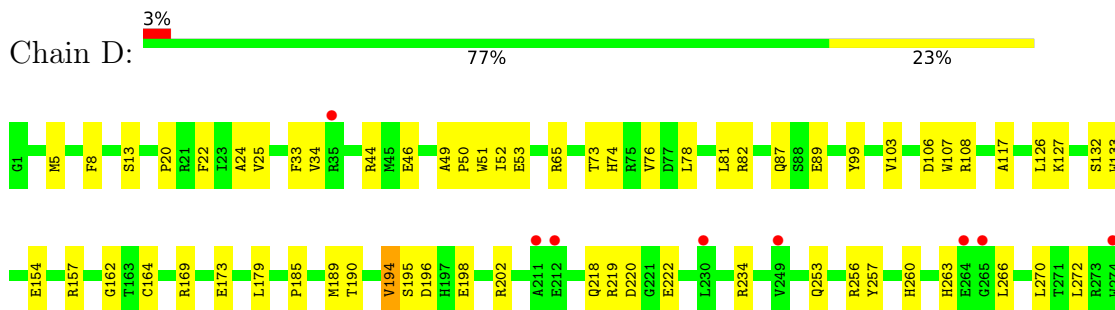
3 Residue-property plots [i](#)

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.

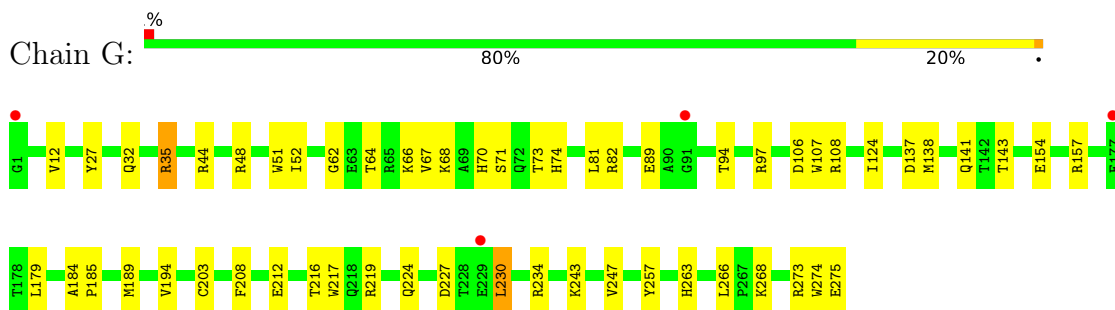
- Molecule 1: HLA-A*02:01 alpha chain



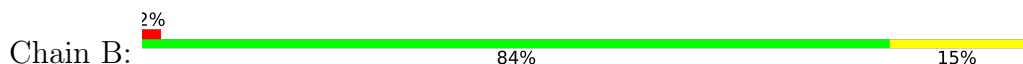
- Molecule 1: HLA-A*02:01 alpha chain

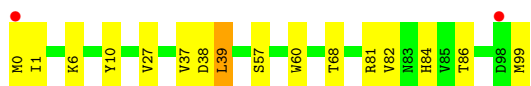


- Molecule 1: HLA-A*02:01 alpha chain

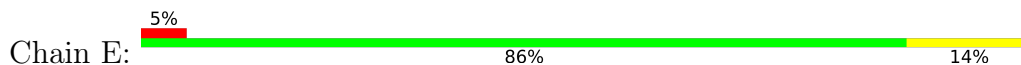


- Molecule 2: Beta-2-microglobulin

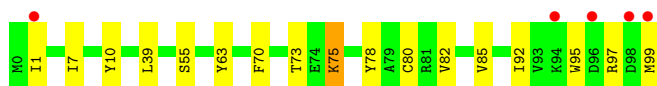
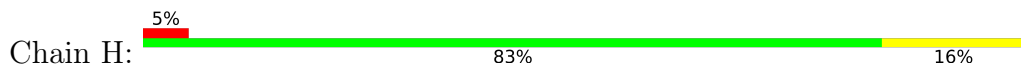




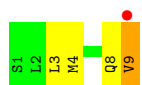
• Molecule 2: Beta-2-microglobulin



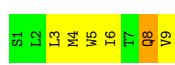
• Molecule 2: Beta-2-microglobulin



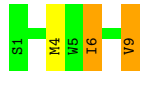
• Molecule 3: NY-ESO-1 peptide



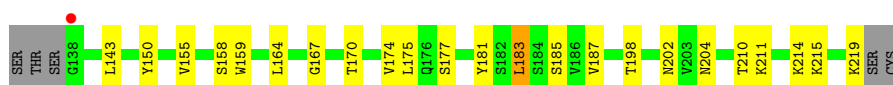
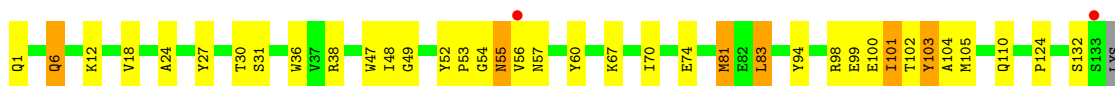
• Molecule 3: NY-ESO-1 peptide




• Molecule 3: NY-ESO-1 peptide

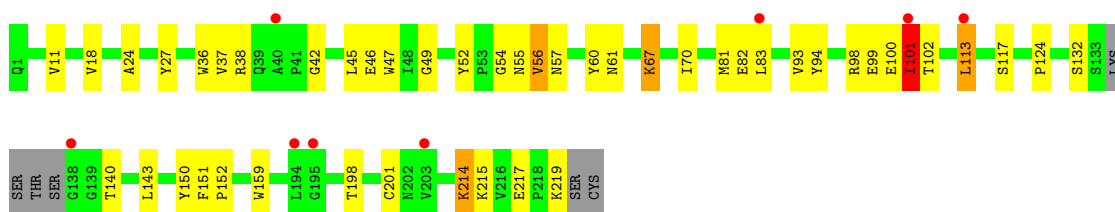


• Molecule 4: PA2.1 Fab Heavy Chain




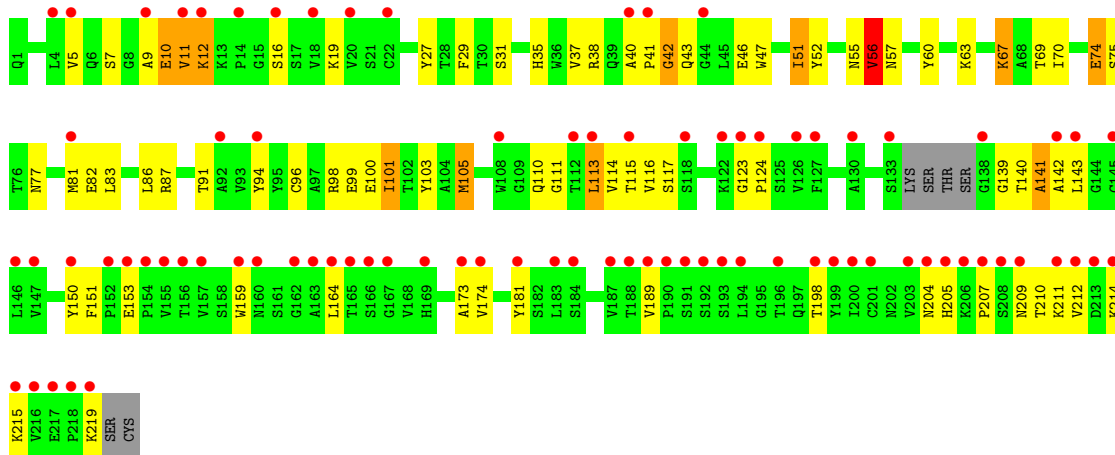
- Molecule 4: PA2.1 Fab Heavy Chain

Chain K:  4% 76% 19% ..



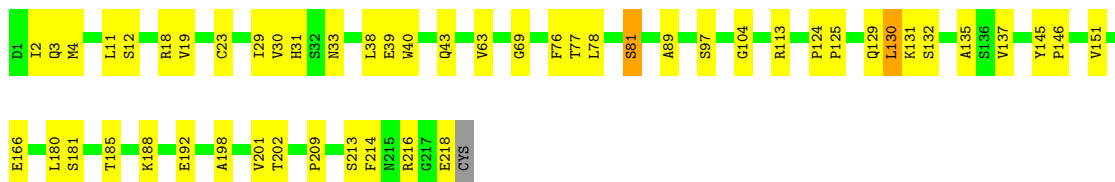
- Molecule 4: PA2.1 Fab Heavy Chain

Chain N:  38% 61% 31% 5% .




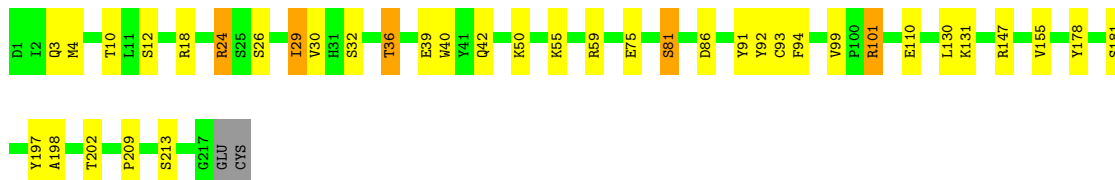
- Molecule 5: PA2.1 Fab Light Chain

Chain L:  76% 22% .



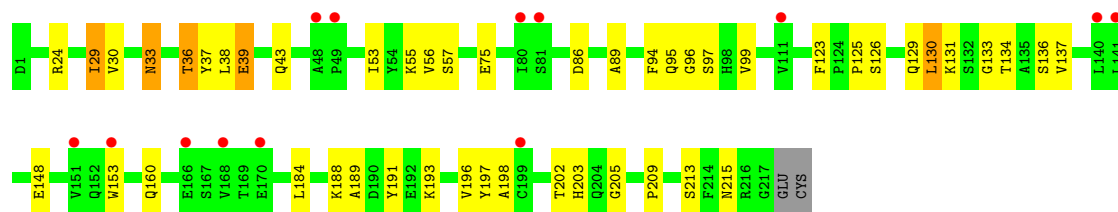
- Molecule 5: PA2.1 Fab Light Chain

Chain M:  82% 15% ..



- Molecule 5: PA2.1 Fab Light Chain

Chain O: 6% 77% 20% ..



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	116.80Å 148.79Å 199.57Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.59 – 2.90 49.59 – 2.90	Depositor EDS
% Data completeness (in resolution range)	98.2 (49.59-2.90) 84.6 (49.59-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.48 (at 2.91Å)	Xtrriage
Refinement program	PHENIX 1.19.1_4122	Depositor
R, R_{free}	0.239 , 0.284 0.239 , 0.285	Depositor DCC
R_{free} test set	2101 reflections (2.70%)	wwPDB-VP
Wilson B-factor (Å ²)	57.4	Xtrriage
Anisotropy	0.494	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 50.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	19374	wwPDB-VP
Average B, all atoms (Å ²)	91.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.42% 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	0.47	0/2311	0.69	0/3137
1	D	0.45	0/2302	0.65	0/3125
1	G	0.42	0/2311	0.62	0/3137
2	B	0.50	0/860	0.70	0/1162
2	E	0.38	0/859	0.59	0/1162
2	H	0.38	0/859	0.62	0/1162
3	C	0.42	0/76	0.67	0/103
3	F	0.55	0/76	0.77	0/103
3	I	0.65	0/76	0.79	0/103
4	J	0.47	0/1669	0.73	0/2276
4	K	0.37	0/1669	0.65	0/2276
4	N	0.41	0/1669	0.72	0/2276
5	L	0.55	1/1720 (0.1%)	0.78	2/2333 (0.1%)
5	M	0.41	0/1708	0.65	0/2317
5	O	0.35	0/1710	0.64	0/2319
All	All	0.44	1/19875 (0.0%)	0.68	2/26991 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	L	63	VAL	CA-C	5.78	1.58	1.53

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	L	81	SER	CA-C-N	-5.06	115.45	123.24
5	L	81	SER	C-N-CA	-5.06	115.45	123.24

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	2246	0	2096	50	0
1	D	2237	0	2090	49	0
1	G	2246	0	2096	39	0
2	B	837	0	803	8	0
2	E	836	0	803	12	0
2	H	836	0	803	8	0
3	C	75	0	83	4	0
3	F	75	0	83	7	0
3	I	75	0	83	7	0
4	J	1628	0	1585	39	0
4	K	1628	0	1585	32	0
4	N	1628	0	1585	46	0
5	L	1683	0	1637	25	0
5	M	1671	0	1622	16	0
5	O	1673	0	1627	27	0
All	All	19374	0	18581	328	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 9.

The worst 5 of 328 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:G:70:HIS:HA	3:I:6:ILE:HD11	1.50	0.94
1:A:35:ARG:HD2	1:A:48:ARG:HE	1.35	0.91
1:G:154:GLU:HG3	1:G:157:ARG:HH22	1.36	0.90
1:A:108:ARG:NH1	4:K:99:GLU:OE2	2.11	0.84
4:K:100:GLU:O	4:K:102:THR:N	2.11	0.84

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	273/275 (99%)	264 (97%)	9 (3%)	0	100	100
1	D	272/275 (99%)	261 (96%)	11 (4%)	0	100	100
1	G	273/275 (99%)	260 (95%)	13 (5%)	0	100	100
2	B	98/100 (98%)	97 (99%)	1 (1%)	0	100	100
2	E	98/100 (98%)	90 (92%)	8 (8%)	0	100	100
2	H	98/100 (98%)	93 (95%)	5 (5%)	0	100	100
3	C	7/9 (78%)	7 (100%)	0	0	100	100
3	F	7/9 (78%)	7 (100%)	0	0	100	100
3	I	7/9 (78%)	7 (100%)	0	0	100	100
4	J	211/221 (96%)	197 (93%)	12 (6%)	2 (1%)	14	41
4	K	211/221 (96%)	193 (92%)	14 (7%)	4 (2%)	6	23
4	N	211/221 (96%)	192 (91%)	11 (5%)	8 (4%)	2	10
5	L	216/219 (99%)	208 (96%)	8 (4%)	0	100	100
5	M	215/219 (98%)	204 (95%)	11 (5%)	0	100	100
5	O	215/219 (98%)	204 (95%)	10 (5%)	1 (0%)	24	54
All	All	2412/2472 (98%)	2284 (95%)	113 (5%)	15 (1%)	21	51

5 of 15 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	J	55	ASN
4	J	56	VAL
4	K	101	ILE
4	N	56	VAL
4	N	103	TYR

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	231/231 (100%)	226 (98%)	5 (2%)	45 77
1	D	230/231 (100%)	228 (99%)	2 (1%)	70 90
1	G	231/231 (100%)	223 (96%)	8 (4%)	32 66
2	B	95/95 (100%)	92 (97%)	3 (3%)	34 68
2	E	95/95 (100%)	94 (99%)	1 (1%)	65 88
2	H	95/95 (100%)	90 (95%)	5 (5%)	20 52
3	C	9/9 (100%)	7 (78%)	2 (22%)	1 3
3	F	9/9 (100%)	7 (78%)	2 (22%)	1 3
3	I	9/9 (100%)	7 (78%)	2 (22%)	1 3
4	J	182/188 (97%)	166 (91%)	16 (9%)	9 29
4	K	182/188 (97%)	173 (95%)	9 (5%)	22 54
4	N	182/188 (97%)	159 (87%)	23 (13%)	4 14
5	L	193/194 (100%)	182 (94%)	11 (6%)	18 49
5	M	191/194 (98%)	173 (91%)	18 (9%)	8 26
5	O	192/194 (99%)	180 (94%)	12 (6%)	16 45
All	All	2126/2151 (99%)	2007 (94%)	119 (6%)	19 50

5 of 119 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	K	56	VAL
5	O	36	THR
5	M	36	THR
5	O	33	ASN
5	O	131	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 21 such sidechains are listed below:

Mol	Chain	Res	Type
5	M	58	ASN
4	N	204	ASN
5	O	142	ASN
5	O	58	ASN
4	N	197	GLN

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, 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	275/275 (100%)	0.18	1 (0%) 88 85	46, 64, 87, 123	0
1	D	274/275 (99%)	0.37	8 (2%) 53 45	45, 66, 163, 202	0
1	G	275/275 (100%)	0.39	4 (1%) 72 64	50, 83, 116, 169	0
2	B	100/100 (100%)	0.13	2 (2%) 65 56	42, 58, 92, 125	0
2	E	100/100 (100%)	0.53	5 (5%) 34 27	54, 93, 139, 158	0
2	H	100/100 (100%)	0.48	5 (5%) 34 27	61, 82, 120, 132	0
3	C	9/9 (100%)	0.69	1 (11%) 10 9	57, 61, 72, 75	0
3	F	9/9 (100%)	0.10	0 100 100	46, 51, 58, 60	0
3	I	9/9 (100%)	0.62	0 100 100	73, 88, 97, 100	0
4	J	215/221 (97%)	0.13	3 (1%) 73 65	46, 68, 106, 127	0
4	K	215/221 (97%)	0.64	8 (3%) 45 37	62, 107, 153, 183	0
4	N	215/221 (97%)	1.81	84 (39%) 1 0	80, 167, 239, 299	0
5	L	218/219 (99%)	-0.04	0 100 100	42, 55, 82, 110	0
5	M	217/219 (99%)	0.34	0 100 100	61, 80, 130, 147	0
5	O	217/219 (99%)	0.84	13 (5%) 27 21	74, 130, 192, 239	0
All	All	2448/2472 (99%)	0.49	134 (5%) 30 24	42, 79, 176, 299	0

The worst 5 of 134 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	N	198	THR	5.0
4	N	203	VAL	4.9
4	N	152	PRO	4.8
2	B	98	ASP	4.7
4	N	155	VAL	4.7

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.