



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 22, 2020 – 02:34 pm BST

PDB ID : 2NX5  
Title : Crystal structure of ELS4 TCR bound to HLA-B\*3501 presenting EBV peptide EPLPQGQLTAY at 1.7Å  
Authors : Tynan, F.E.; Reid, H.H.; Rossjohn, J.  
Deposited on : 2006-11-16  
Resolution : 2.70 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](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.

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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
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

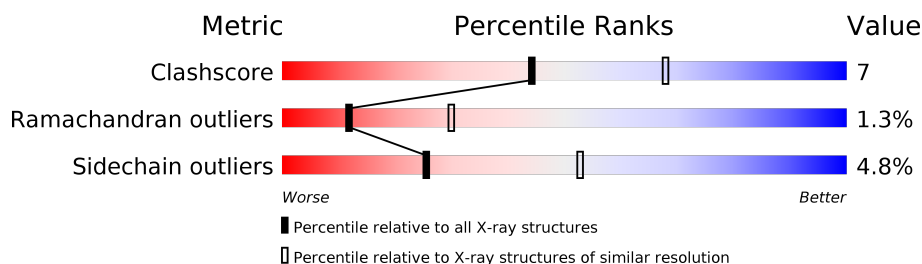
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.70 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))
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)


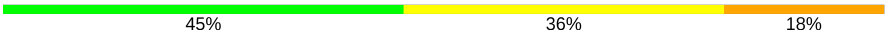
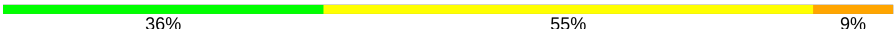








The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	276	83% 16% .
1	F	276	83% 16% .
1	K	276	85% 13% .
1	Q	276	81% 18% .
2	B	99	91% 9%
2	G	99	86% 14%
2	L	99	87% 9% .
2	R	99	80% 20%

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Mol	Chain	Length	Quality of chain
3	C	11	 55% 45%
3	H	11	 45% 27% 27%
3	M	11	 45% 36% 18%
3	S	11	 36% 55% 9%
4	D	188	 77% 20% .
4	I	188	 76% 21% ..
4	N	188	 76% 22% .
4	T	188	 76% 23% .
5	E	243	 81% 16% .
5	J	243	 84% 16% .
5	P	243	 82% 15% .
5	U	243	 81% 17% .

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 26481 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-B35.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	276	Total	C	N	O	S	0	0	0
			2254	1405	411	431	7			
1	F	276	Total	C	N	O	S	0	0	0
			2254	1405	411	431	7			
1	K	276	Total	C	N	O	S	0	0	0
			2254	1405	411	431	7			
1	Q	276	Total	C	N	O	S	0	0	0
			2254	1405	411	431	7			

- 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			
2	G	99	Total	C	N	O	S	0	0	0
			829	528	140	158	3			
2	L	99	Total	C	N	O	S	0	0	0
			829	528	140	158	3			
2	R	99	Total	C	N	O	S	0	0	0
			829	528	140	158	3			

- Molecule 3 is a protein called EBV peptide, EPLPQGQLTAY.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	11	Total	C	N	O	0	0	0
			86	55	13	18			
3	H	11	Total	C	N	O	0	0	0
			86	55	13	18			
3	M	11	Total	C	N	O	0	0	0
			86	55	13	18			
3	S	11	Total	C	N	O	0	0	0
			86	55	13	18			

- Molecule 4 is a protein called ELS4 TCR alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	188	Total	C	N	O	S	0	0	0
			1466	919	241	297	9			
4	I	188	Total	C	N	O	S	0	0	0
			1467	920	241	297	9			
4	N	188	Total	C	N	O	S	0	0	0
			1467	920	241	297	9			
4	T	188	Total	C	N	O	S	0	0	0
			1467	920	241	297	9			

- Molecule 5 is a protein called ELS4 TCR beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	243	Total	C	N	O	S	0	0	0
			1936	1208	342	380	6			
5	J	243	Total	C	N	O	S	0	0	0
			1936	1208	342	380	6			
5	P	243	Total	C	N	O	S	0	0	0
			1936	1208	342	380	6			
5	U	243	Total	C	N	O	S	0	0	0
			1936	1208	342	380	6			

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	17	Total	O	0	0
			17	17		
6	B	4	Total	O	0	0
			4	4		
6	C	1	Total	O	0	0
			1	1		
6	D	18	Total	O	0	0
			18	18		
6	E	5	Total	O	0	0
			5	5		
6	F	18	Total	O	0	0
			18	18		
6	G	4	Total	O	0	0
			4	4		
6	I	21	Total	O	0	0
			21	21		
6	J	10	Total	O	0	0
			10	10		

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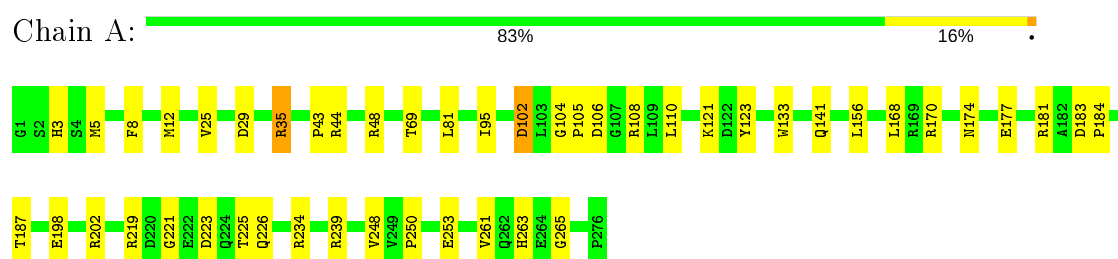
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	K	14	Total 14	O 14	0	0
6	L	6	Total 6	O 6	0	0
6	N	16	Total 16	O 16	0	0
6	P	20	Total 20	O 20	0	0
6	Q	15	Total 15	O 15	0	0
6	R	5	Total 5	O 5	0	0
6	T	10	Total 10	O 10	0	0
6	U	10	Total 10	O 10	0	0

### 3 Residue-property plots

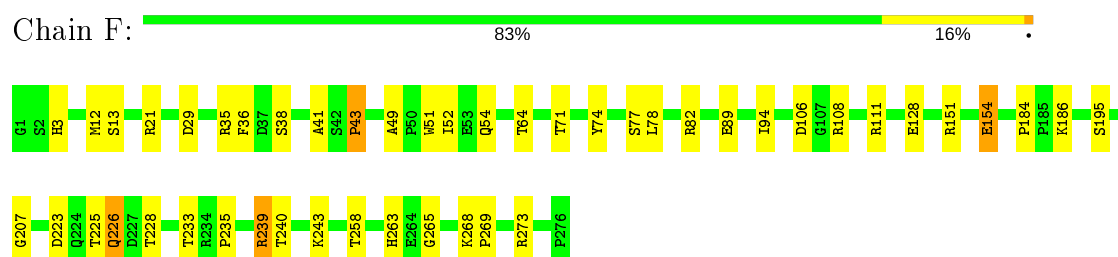
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according 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. 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.

Note EDS was not executed.

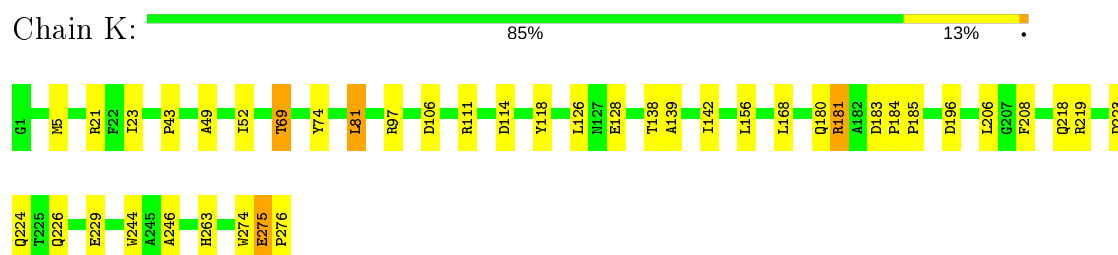
#### • Molecule 1: HLA-B35



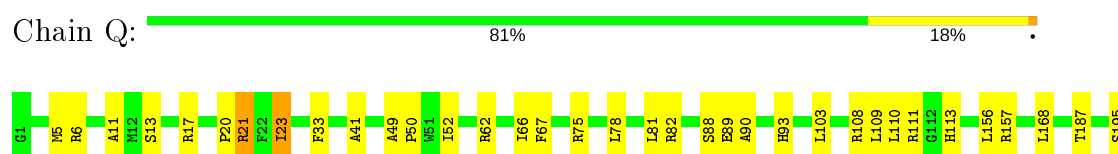
#### • Molecule 1: HLA-B35

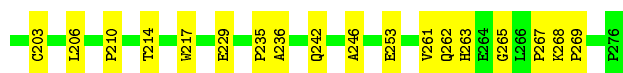


#### • Molecule 1: HLA-B35

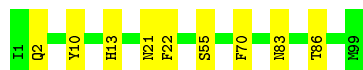


#### • Molecule 1: HLA-B35

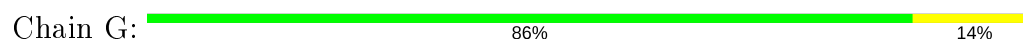




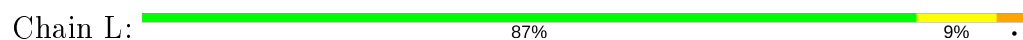
- Molecule 2: Beta-2-microglobulin



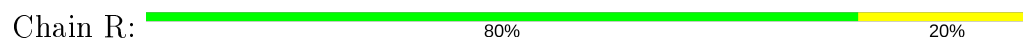
- Molecule 2: Beta-2-microglobulin



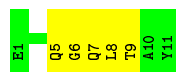
- Molecule 2: Beta-2-microglobulin



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- Molecule 3: EBV peptide, EPLPQGQLTAY



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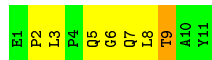






- Molecule 3: EBV peptide, EPLPQQQLTAY

Chain S: 36% 55% 9%



- Molecule 4: ELS4 TCR alpha chain

Chain D: 77% 20% .



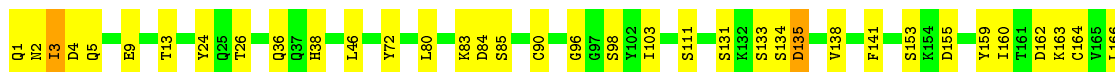
- Molecule 4: ELS4 TCR alpha chain

Chain I: 76% 21% . .



- Molecule 4: ELS4 TCR alpha chain

Chain N: 76% 22% .




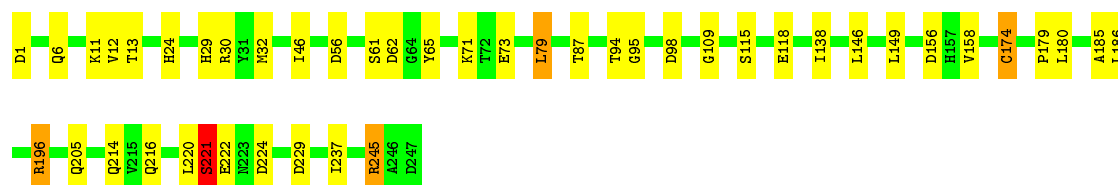
- Molecule 4: ELS4 TCR alpha chain

Chain T: 76% 23% .




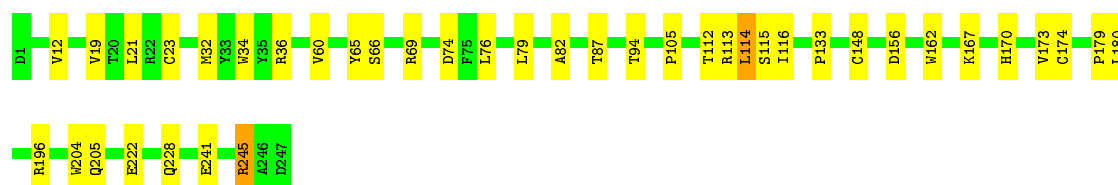
- Molecule 5: ELS4 TCR beta chain

Chain E:  81% 16%




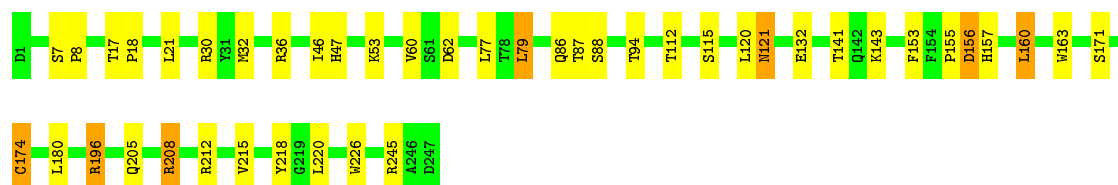
- Molecule 5: ELS4 TCR beta chain

Chain J:  84% 16%




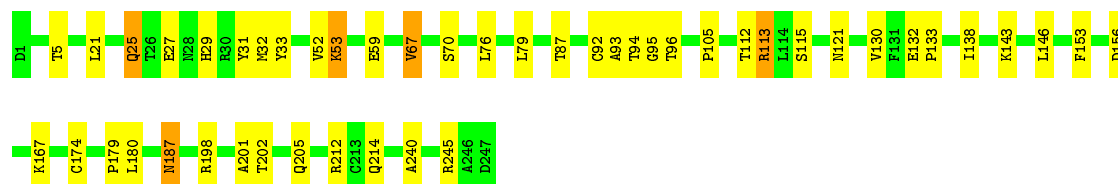
- Molecule 5: ELS4 TCR beta chain

Chain P:  82% 15%



- Molecule 5: ELS4 TCR beta chain

Chain U:  81% 17%



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	118.48Å 118.07Å 131.47Å 90.00° 96.04° 90.00°	Depositor
Resolution (Å)	30.00 – 2.70	Depositor
% Data completeness (in resolution range)	93.5 (30.00-2.70)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.269 , 0.327	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	26481	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

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	0.33	0/2317	0.52	0/3150
1	F	0.33	0/2317	0.50	0/3150
1	K	0.33	0/2317	0.50	0/3150
1	Q	0.34	0/2317	0.51	0/3150
2	B	0.34	0/852	0.45	0/1152
2	G	0.34	0/852	0.47	0/1152
2	L	0.35	0/852	0.48	0/1152
2	R	0.35	0/852	0.47	0/1152
3	C	0.43	0/88	0.60	0/119
3	H	0.44	0/88	0.70	0/119
3	M	0.37	0/88	0.56	0/119
3	S	0.38	0/88	0.52	0/119
4	D	0.35	0/1498	0.58	0/2027
4	I	0.36	0/1499	0.54	0/2028
4	N	0.36	0/1499	0.55	0/2028
4	T	0.37	0/1499	0.55	0/2028
5	E	0.35	0/1989	0.50	0/2707
5	J	0.33	0/1989	0.50	0/2707
5	P	0.35	0/1989	0.52	0/2707
5	U	0.35	0/1989	0.49	0/2707
All	All	0.34	0/26979	0.51	0/36623

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
4	D	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
4	D	136	LYS	Peptide

## 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	2254	0	2117	23	0
1	F	2254	0	2117	28	0
1	K	2254	0	2117	24	0
1	Q	2254	0	2117	32	0
2	B	829	0	794	4	0
2	G	829	0	794	6	0
2	L	829	0	794	7	0
2	R	829	0	794	14	0
3	C	86	0	84	5	0
3	H	86	0	84	7	0
3	M	86	0	84	5	0
3	S	86	0	84	6	0
4	D	1466	0	1382	26	0
4	I	1467	0	1387	26	0
4	N	1467	0	1387	23	0
4	T	1467	0	1387	36	0
5	E	1936	0	1817	25	0
5	J	1936	0	1817	21	0
5	P	1936	0	1817	33	0
5	U	1936	0	1817	29	0
6	A	17	0	0	0	0
6	B	4	0	0	1	0
6	C	1	0	0	0	0
6	D	18	0	0	0	0
6	E	5	0	0	0	0
6	F	18	0	0	0	0
6	G	4	0	0	0	0
6	I	21	0	0	0	0
6	J	10	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	K	14	0	0	0	0
6	L	6	0	0	1	0
6	N	16	0	0	0	0
6	P	20	0	0	1	0
6	Q	15	0	0	0	0
6	R	5	0	0	0	0
6	T	10	0	0	0	0
6	U	10	0	0	0	0
All	All	26481	0	24791	335	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.

The worst 5 of 335 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:H:5:GLN:HB2	3:H:9:THR:HG21	1.17	1.13
5:P:208:ARG:HH11	5:P:208:ARG:HG3	1.16	1.07
4:T:129:ARG:HG2	4:T:129:ARG:HH21	1.27	0.97
1:Q:20:PRO:HB2	1:Q:75:ARG:HG2	1.47	0.96
1:Q:20:PRO:HB3	1:Q:78:LEU:HD13	1.49	0.95

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%)	263 (96%)	9 (3%)	2 (1%)	22	46
1	F	274/276 (99%)	254 (93%)	18 (7%)	2 (1%)	22	46
1	K	274/276 (99%)	258 (94%)	14 (5%)	2 (1%)	22	46

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	Q	274/276 (99%)	255 (93%)	15 (6%)	4 (2%)	10	26
2	B	97/99 (98%)	94 (97%)	3 (3%)	0	100	100
2	G	97/99 (98%)	92 (95%)	5 (5%)	0	100	100
2	L	97/99 (98%)	93 (96%)	3 (3%)	1 (1%)	15	37
2	R	97/99 (98%)	94 (97%)	3 (3%)	0	100	100
3	C	9/11 (82%)	6 (67%)	3 (33%)	0	100	100
3	H	9/11 (82%)	6 (67%)	1 (11%)	2 (22%)	0	0
3	M	9/11 (82%)	6 (67%)	2 (22%)	1 (11%)	0	0
3	S	9/11 (82%)	7 (78%)	2 (22%)	0	100	100
4	D	186/188 (99%)	170 (91%)	12 (6%)	4 (2%)	6	17
4	I	186/188 (99%)	167 (90%)	13 (7%)	6 (3%)	4	9
4	N	186/188 (99%)	160 (86%)	19 (10%)	7 (4%)	3	7
4	T	186/188 (99%)	168 (90%)	13 (7%)	5 (3%)	5	12
5	E	241/243 (99%)	229 (95%)	10 (4%)	2 (1%)	19	43
5	J	241/243 (99%)	233 (97%)	8 (3%)	0	100	100
5	P	241/243 (99%)	227 (94%)	12 (5%)	2 (1%)	19	43
5	U	241/243 (99%)	227 (94%)	12 (5%)	2 (1%)	19	43
All	All	3228/3268 (99%)	3009 (93%)	177 (6%)	42 (1%)	12	30

5 of 42 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	I	102	TYR
4	N	135	ASP
4	N	191	ASN
4	T	135	ASP
4	D	2	ASN

### 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	A	234/234 (100%)	224 (96%)	10 (4%)	29	57
1	F	234/234 (100%)	228 (97%)	6 (3%)	46	75
1	K	234/234 (100%)	225 (96%)	9 (4%)	33	62
1	Q	234/234 (100%)	226 (97%)	8 (3%)	37	66
2	B	94/94 (100%)	91 (97%)	3 (3%)	39	68
2	G	94/94 (100%)	91 (97%)	3 (3%)	39	68
2	L	94/94 (100%)	88 (94%)	6 (6%)	17	39
2	R	94/94 (100%)	91 (97%)	3 (3%)	39	68
3	C	9/9 (100%)	9 (100%)	0	100	100
3	H	9/9 (100%)	7 (78%)	2 (22%)	1	2
3	M	9/9 (100%)	7 (78%)	2 (22%)	1	2
3	S	9/9 (100%)	7 (78%)	2 (22%)	1	2
4	D	163/164 (99%)	155 (95%)	8 (5%)	25	52
4	I	164/164 (100%)	154 (94%)	10 (6%)	18	41
4	N	164/164 (100%)	158 (96%)	6 (4%)	34	63
4	T	164/164 (100%)	154 (94%)	10 (6%)	18	41
5	E	213/213 (100%)	198 (93%)	15 (7%)	15	35
5	J	213/213 (100%)	201 (94%)	12 (6%)	21	45
5	P	213/213 (100%)	204 (96%)	9 (4%)	30	58
5	U	213/213 (100%)	199 (93%)	14 (7%)	16	38
All	All	2855/2856 (100%)	2717 (95%)	138 (5%)	25	53

5 of 138 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
5	J	113	ARG
1	K	275	GLU
5	U	59	GLU
5	J	167	LYS
1	K	81	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 81 such sidechains are listed below:

Mol	Chain	Res	Type
4	I	38	HIS

*Continued on next page...*



*Continued from previous page...*

Mol	Chain	Res	Type
5	J	157	HIS
4	T	21	ASN
4	I	81	GLN
5	J	6	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 carbohydrates 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

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.