



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 12, 2023 – 08:16 PM EDT

PDB ID : 4N9G  
Title : Crystal Structure of a Computationally Designed RSV-Presenting Epitope Scaffold And Its Elicited Antibody 17HD9  
Authors : Carrico, C.T.D.; Strong, R.K.  
Deposited on : 2013-10-21  
Resolution : 2.50 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.

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  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35.1

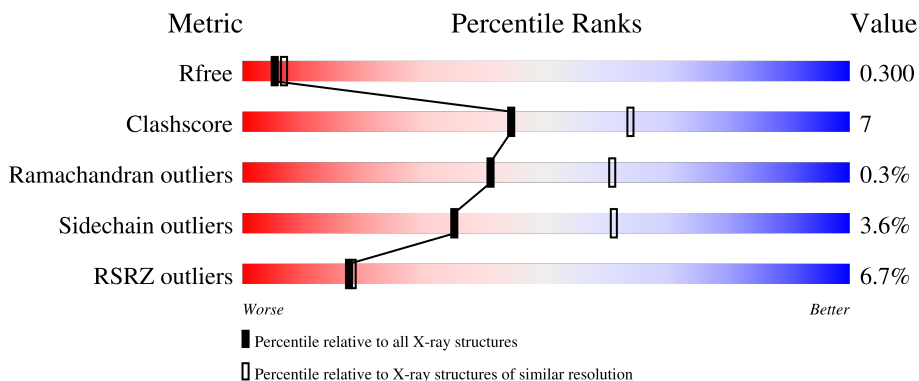
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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))
$R_{free}$	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (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	A	230	
1	E	230	
1	H	230	
1	M	230	
2	B	215	

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Mol	Chain	Length	Quality of chain
2	F	215	<p>7% 89% 10%</p>
2	L	215	<p>2% 88% 10%</p>
2	N	215	<p>5% 87% 12%</p>
3	C	123	<p>2% 22% 7% 72%</p>
3	D	123	<p>3% 23% 6% 72%</p>
3	Y	123	<p>5% 25% 6% 71%</p>
3	Z	123	<p>5% 23% 6% 71%</p>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 14304 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 Antibody 17HD9, Heavy Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	224	Total 1656	C 1047	N 273	O 328	S 8	0	1	0
1	E	223	Total 1664	C 1051	N 277	O 329	S 7	0	1	0
1	H	221	Total 1650	C 1043	N 275	O 324	S 8	0	1	0
1	M	223	Total 1653	C 1043	N 275	O 327	S 8	0	1	0

- Molecule 2 is a protein called Antibody 17HD9, Light Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	214	Total 1624	C 1013	N 271	O 334	S 6	6	0	0
2	F	214	Total 1645	C 1025	N 275	O 339	S 6	8	2	0
2	L	214	Total 1641	C 1023	N 275	O 337	S 6	9	1	0
2	N	214	Total 1632	C 1018	N 272	O 336	S 6	10	0	0

- Molecule 3 is a protein called Epitope Scaffold rsv\_lisea\_FFL\_001\_C.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	35	Total 263	C 164	N 42	O 55	S 2	0	0	0
3	D	35	Total 268	C 165	N 45	O 56	S 2	0	0	0
3	Y	36	Total 281	C 175	N 46	O 58	S 2	0	1	0
3	Z	36	Total 268	C 168	N 43	O 55	S 2	0	0	0

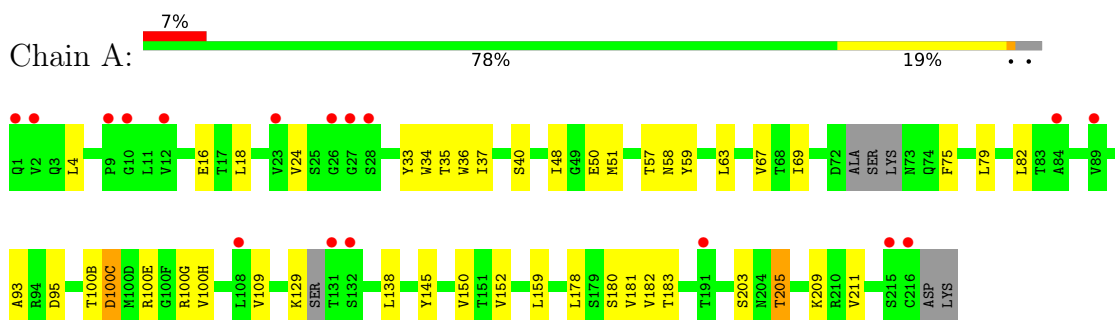
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	9	Total O 9 9	0	0
4	B	7	Total O 7 7	0	0
4	E	5	Total O 5 5	0	0
4	F	5	Total O 5 5	0	0
4	H	6	Total O 6 6	0	0
4	L	12	Total O 12 12	0	0
4	M	6	Total O 6 6	0	0
4	N	8	Total O 8 8	0	0
4	Z	1	Total O 1 1	0	0

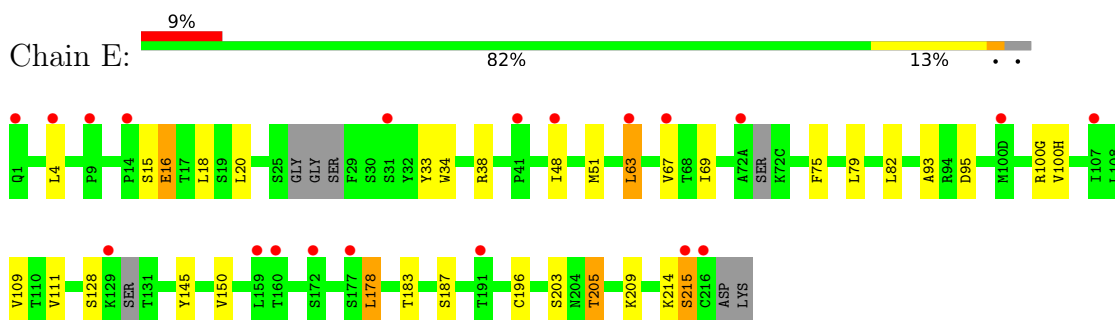
### 3 Residue-property plots [i](#)

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.

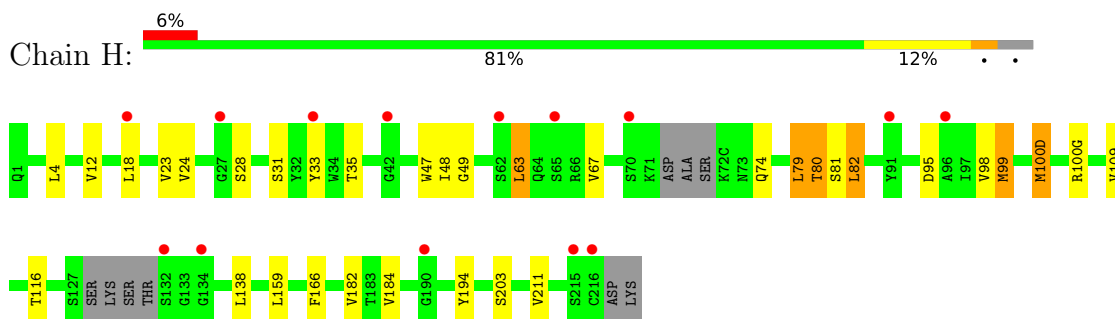
- Molecule 1: Antibody 17HD9, Heavy Chain



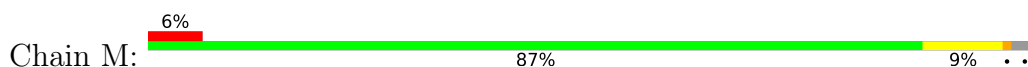
- Molecule 1: Antibody 17HD9, Heavy Chain

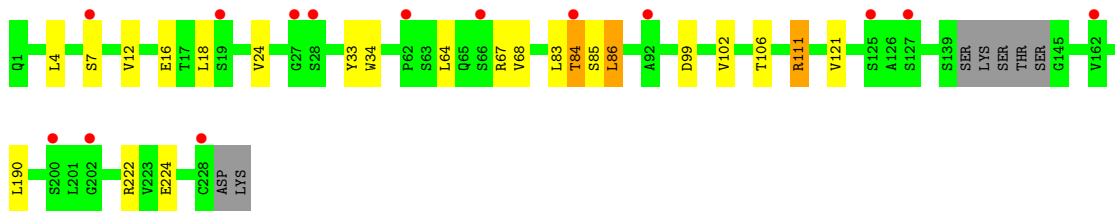


- Molecule 1: Antibody 17HD9, Heavy Chain

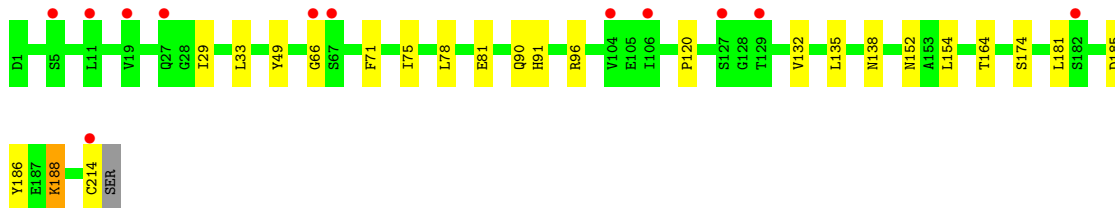
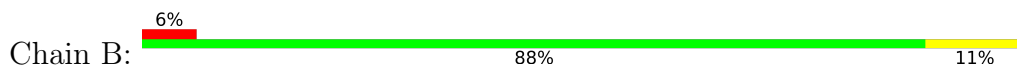


- Molecule 1: Antibody 17HD9, Heavy Chain

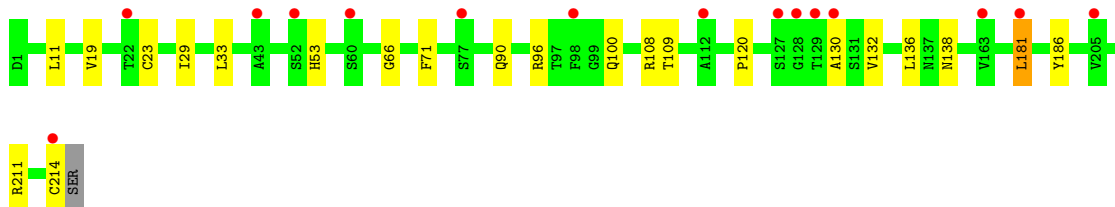
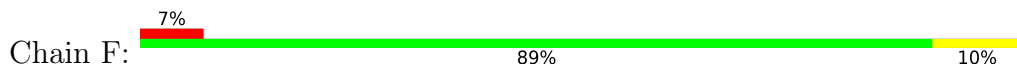




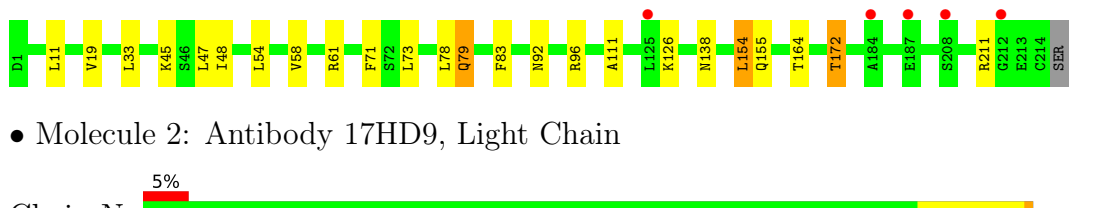
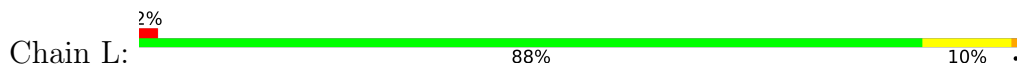
• Molecule 2: Antibody 17HD9, Light Chain



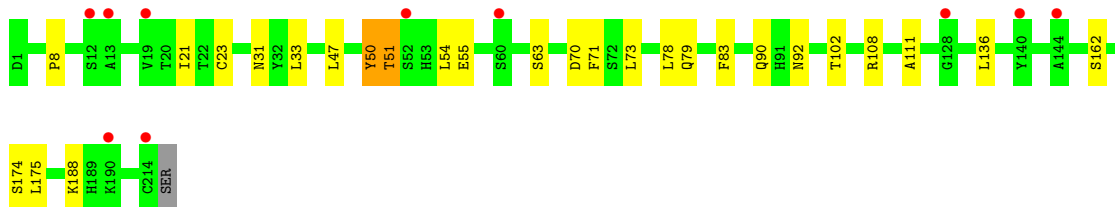
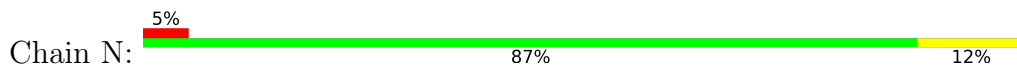
• Molecule 2: Antibody 17HD9, Light Chain



• Molecule 2: Antibody 17HD9, Light Chain

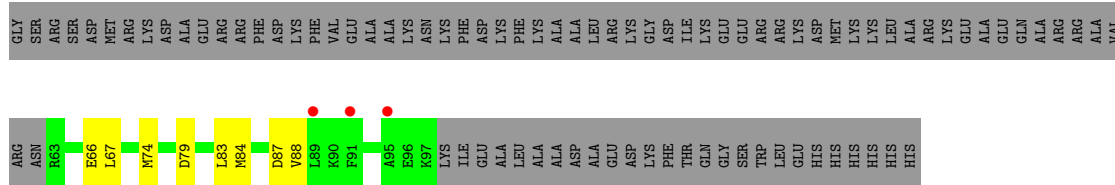


• Molecule 2: Antibody 17HD9, Light Chain

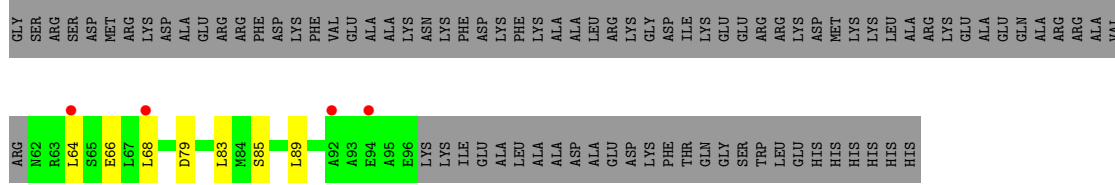


• Molecule 3: Epitope Scaffold rsv\_1isea\_FFL\_001\_C

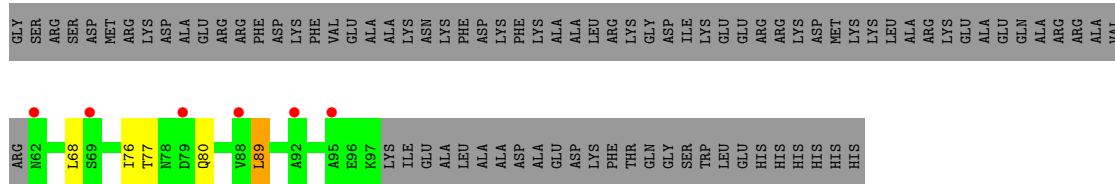




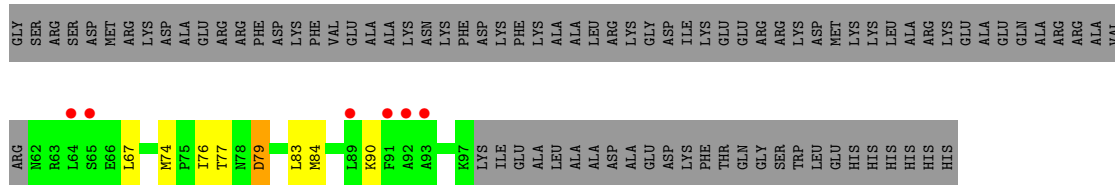
• Molecule 3: Epitope Scaffold rsv\_1isea\_FFL\_001\_C



• Molecule 3: Epitope Scaffold rsv\_1isea\_FFL\_001\_C



• Molecule 3: Epitope Scaffold rsv\_1isea\_FFL\_001\_C





## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	64.21Å 89.27Å 104.30Å 89.99° 102.73° 89.91°	Depositor
Resolution (Å)	48.75 – 2.50 48.76 – 2.50	Depositor EDS
% Data completeness (in resolution range)	97.7 (48.75-2.50) 97.3 (48.76-2.50)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.59 (at 2.51Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, $R_{free}$	0.263 , 0.295 0.271 , 0.300	Depositor DCC
$R_{free}$ test set	3829 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	25.5	Xtrriage
Anisotropy	0.072	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 7.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.53$ , $\langle L^2 \rangle = 0.37$	Xtrriage
Estimated twinning fraction	0.430 for -h,k,-l	Xtrriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	14304	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	40.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.45% 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	0.31	0/1697	0.49	0/2319
1	E	0.30	0/1701	0.48	0/2323
1	H	0.30	0/1691	0.50	0/2308
1	M	0.31	0/1695	0.49	0/2317
2	B	0.37	1/1661 (0.1%)	0.60	1/2259 (0.0%)
2	F	0.35	0/1688	0.51	0/2294
2	L	0.68	1/1681 (0.1%)	0.60	3/2284 (0.1%)
2	N	0.37	0/1669	0.55	2/2268 (0.1%)
3	C	0.29	0/264	0.43	0/355
3	D	0.29	0/269	0.44	0/362
3	Y	0.33	0/285	0.42	0/382
3	Z	0.32	0/269	0.39	0/361
All	All	0.39	2/14570 (0.0%)	0.52	6/19832 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	L	211	ARG	CZ-NH2	-23.78	1.02	1.33
2	B	154	LEU	CG-CD1	-6.52	1.27	1.51

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	154	LEU	CB-CG-CD1	13.57	134.08	111.00
2	L	45	LYS	CD-CE-NZ	10.82	136.58	111.70
2	L	211	ARG	NE-CZ-NH2	8.87	124.73	120.30
2	N	79	GLN	OE1-CD-NE2	6.58	137.04	121.90
2	N	79	GLN	CG-CD-NE2	-6.15	101.94	116.70

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	1656	0	1616	41	0
1	E	1664	0	1619	25	0
1	H	1650	0	1620	27	0
1	M	1653	0	1606	15	0
2	B	1624	0	1535	12	0
2	F	1645	0	1566	13	0
2	L	1641	0	1570	18	0
2	N	1632	0	1554	20	0
3	C	263	0	257	7	0
3	D	268	0	261	4	0
3	Y	281	0	282	5	0
3	Z	268	0	264	11	0
4	A	9	0	0	0	0
4	B	7	0	0	0	0
4	E	5	0	0	0	0
4	F	5	0	0	0	0
4	H	6	0	0	0	0
4	L	12	0	0	0	0
4	M	6	0	0	0	0
4	N	8	0	0	0	0
4	Z	1	0	0	0	0
All	All	14304	0	13750	184	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 184 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:A:57[A]:THR:HG21	1:A:59:TYR:CE1	1.96	0.99
2:F:11:LEU:HD21	2:F:19:VAL:CG1	1.98	0.93
1:E:67:VAL:HG22	1:E:79:LEU:HD13	1.49	0.92
1:A:181:VAL:HG21	2:B:135:LEU:HD22	1.60	0.84
1:A:51:MET:HE2	1:A:69:ILE:HG22	1.58	0.83

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	219/230 (95%)	212 (97%)	6 (3%)	1 (0%)	29	48
1	E	216/230 (94%)	206 (95%)	8 (4%)	2 (1%)	17	31
1	H	216/230 (94%)	209 (97%)	7 (3%)	0	100	100
1	M	220/230 (96%)	214 (97%)	6 (3%)	0	100	100
2	B	212/215 (99%)	203 (96%)	8 (4%)	1 (0%)	29	48
2	F	214/215 (100%)	204 (95%)	9 (4%)	1 (0%)	29	48
2	L	213/215 (99%)	209 (98%)	4 (2%)	0	100	100
2	N	212/215 (99%)	207 (98%)	5 (2%)	0	100	100
3	C	33/123 (27%)	32 (97%)	1 (3%)	0	100	100
3	D	33/123 (27%)	33 (100%)	0	0	100	100
3	Y	35/123 (28%)	34 (97%)	1 (3%)	0	100	100
3	Z	34/123 (28%)	34 (100%)	0	0	100	100
All	All	1857/2272 (82%)	1797 (97%)	55 (3%)	5 (0%)	41	61

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	16	GLU
1	E	215	SER
1	A	100(C)	ASP
2	F	138	ASN
2	B	138	ASN

### 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	189/198 (96%)	182 (96%)	7 (4%)	34	60
1	E	189/198 (96%)	184 (97%)	5 (3%)	46	72
1	H	189/198 (96%)	181 (96%)	8 (4%)	30	54
1	M	187/198 (94%)	180 (96%)	7 (4%)	34	60
2	B	183/190 (96%)	178 (97%)	5 (3%)	44	71
2	F	188/190 (99%)	183 (97%)	5 (3%)	44	71
2	L	188/190 (99%)	184 (98%)	4 (2%)	53	78
2	N	186/190 (98%)	178 (96%)	8 (4%)	29	53
3	C	29/104 (28%)	26 (90%)	3 (10%)	7	14
3	D	30/104 (29%)	27 (90%)	3 (10%)	7	15
3	Y	32/104 (31%)	31 (97%)	1 (3%)	40	67
3	Z	29/104 (28%)	27 (93%)	2 (7%)	15	30
All	All	1619/1968 (82%)	1561 (96%)	58 (4%)	35	61

5 of 58 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	28	SER
3	Y	89	LEU
1	H	100(G)	ARG
2	N	188	LYS
2	N	51	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	164	HIS
2	F	53	HIS
2	F	137	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 monosaccharides 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	A	224/230 (97%)	0.78	17 (7%) 13 14	30, 44, 62, 78	0
1	E	223/230 (96%)	0.82	20 (8%) 9 9	29, 43, 59, 66	0
1	H	221/230 (96%)	0.69	14 (6%) 20 21	28, 38, 57, 70	0
1	M	223/230 (96%)	0.67	14 (6%) 20 21	28, 39, 57, 67	0
2	B	214/215 (99%)	0.59	12 (5%) 24 25	29, 39, 49, 61	4 (1%)
2	F	214/215 (99%)	0.70	15 (7%) 16 16	29, 40, 48, 59	5 (2%)
2	L	214/215 (99%)	0.49	5 (2%) 60 63	29, 37, 46, 61	6 (2%)
2	N	214/215 (99%)	0.60	10 (4%) 31 33	28, 37, 47, 59	7 (3%)
3	C	35/123 (28%)	0.64	3 (8%) 10 10	40, 49, 67, 75	0
3	D	35/123 (28%)	0.94	4 (11%) 5 4	39, 51, 73, 81	0
3	Y	36/123 (29%)	1.16	6 (16%) 1 1	39, 49, 69, 75	0
3	Z	36/123 (29%)	0.91	6 (16%) 1 1	35, 45, 60, 72	0
All	All	1889/2272 (83%)	0.69	126 (6%) 17 18	28, 40, 58, 81	22 (1%)

The worst 5 of 126 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	216	CYS	6.4
1	E	216	CYS	6.2
1	A	191	THR	6.2
3	Y	88	VAL	5.2
3	Y	92	ALA	5.0

### 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 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.