



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 10:38 AM UTC

PDB ID : 2CE3 / pdb\_00002ce3  
Title : CRYSTAL STRUCTURE OF THE ATP-DEPENDENT CLP PROTEASE  
PROTEOLYTIC SUBUNIT 1 (CLPP1) FROM MYCOBACTERIUM TU-  
BERCULOSIS  
Authors : Segelke, B.; Kim, C.Y.; Ortiz-Lombardia, M.; Alzari, P.M.; Legin, T.  
Deposited on : 2006-02-03  
Resolution : 2.60 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>.

---

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

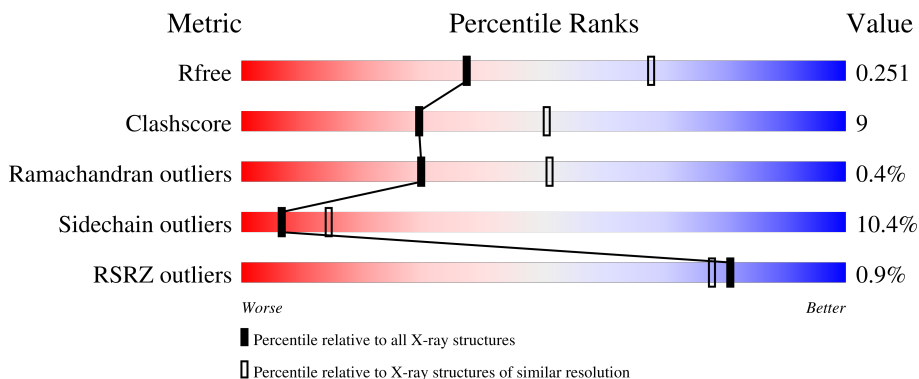
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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	4008 (2.60-2.60)
Clashscore	190562	4347 (2.60-2.60)
Ramachandran outliers	187476	4277 (2.60-2.60)
Sidechain outliers	187428	4277 (2.60-2.60)
RSRZ outliers	180081	4008 (2.60-2.60)

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	200	 2% 74% 8% 16%
1	B	200	 64% 16% 16%
1	C	200	 2% 72% 10% 16%
1	D	200	 64% 18% 16%
1	E	200	 66% 16% 16%

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Length	Quality of chain
1	F	200	 68% 12% • 16%
1	G	200	 2% 57% 24% • 16%
1	H	200	 66% 16% • 16%
1	I	200	 70% 12% • 16%
1	J	200	 62% 20% • 16%
1	K	200	 60% 20% • 16%
1	L	200	 64% 16% • 16%
1	M	200	 2% 60% 22% • 16%
1	N	200	 % 62% 18% • 16%

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 18231 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 ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUB-UNIT 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	167	1295	823	217	246	9	0	1	0
1	B	167	1303	828	220	246	9	0	2	0
1	C	167	1295	823	217	246	9	0	1	0
1	D	167	1288	818	215	246	9	0	0	0
1	E	169	1304	827	220	248	9	0	0	0
1	F	167	1295	823	217	246	9	0	1	0
1	G	167	1295	823	217	246	9	0	1	0
1	H	167	1288	818	215	246	9	0	0	0
1	I	167	1288	818	215	246	9	0	0	0
1	J	167	1288	818	215	246	9	0	0	0
1	K	167	1288	818	215	246	9	0	0	0
1	L	169	1304	827	220	248	9	0	0	0
1	M	167	1295	823	217	246	9	0	1	0
1	N	167	1288	818	215	246	9	0	0	0

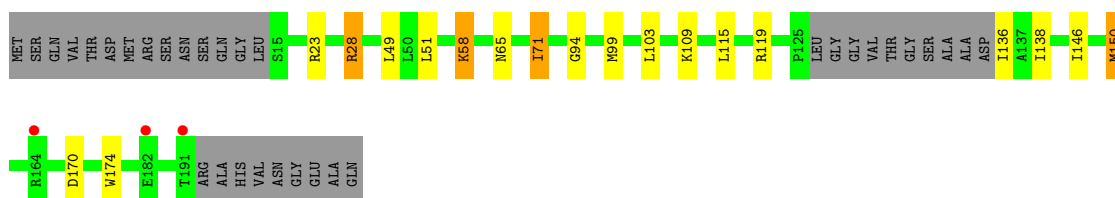
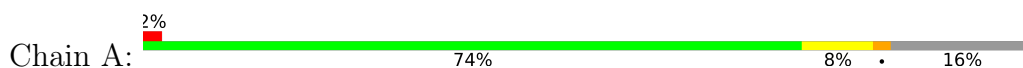
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	5	Total O 5 5	0	0
2	B	21	Total O 21 21	0	0
2	C	11	Total O 11 11	0	0
2	D	3	Total O 3 3	0	0
2	E	4	Total O 4 4	0	0
2	F	12	Total O 12 12	0	0
2	G	17	Total O 17 17	0	0
2	H	3	Total O 3 3	0	0
2	I	8	Total O 8 8	0	0
2	J	7	Total O 7 7	0	0
2	K	7	Total O 7 7	0	0
2	L	10	Total O 10 10	0	0
2	M	6	Total O 6 6	0	0
2	N	3	Total O 3 3	0	0

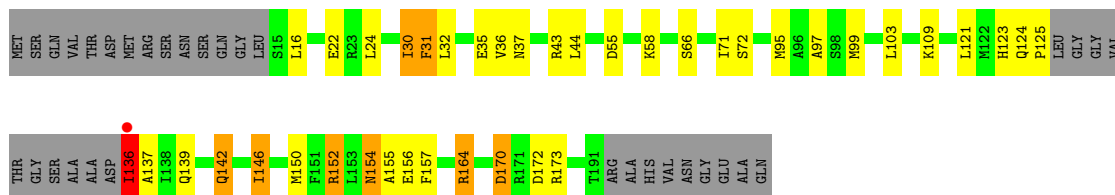
### 3 Residue-property plots [i](#)

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.

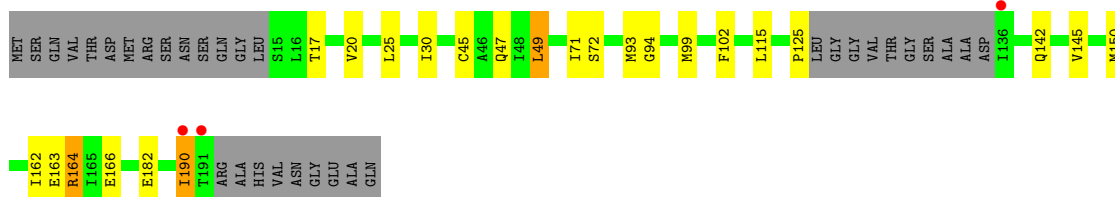
- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1



- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1



- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

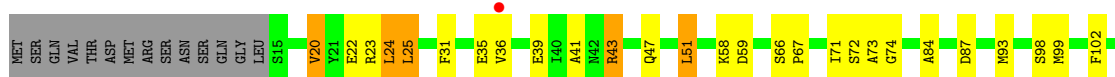


- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

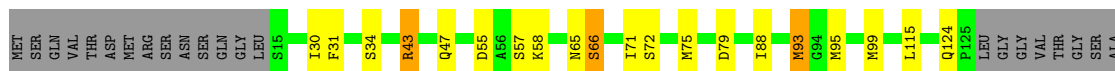




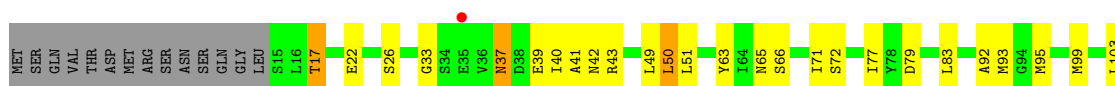
- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1



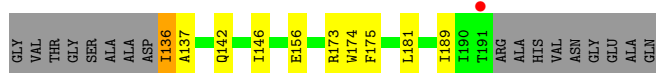
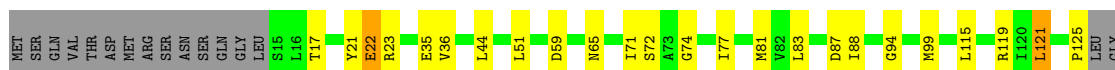
- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1



- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

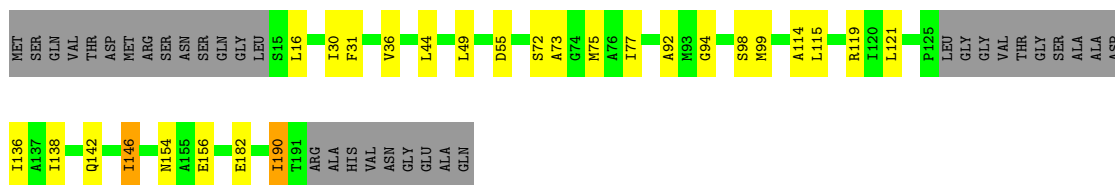


- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1



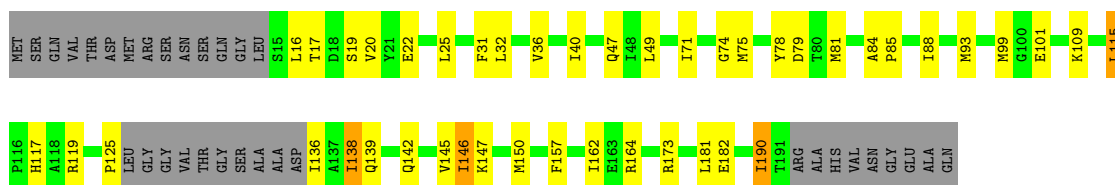
- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

Chain I:  70% 12% 16%



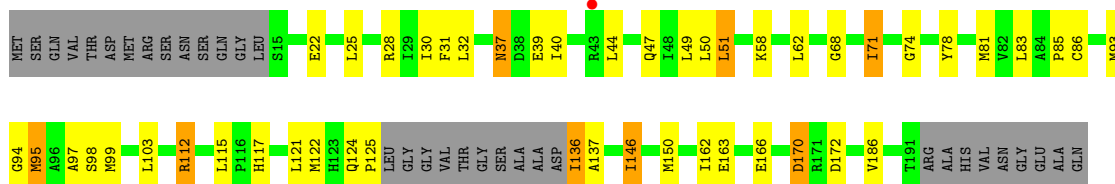
• Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

Chain J:  62% 20% 16%



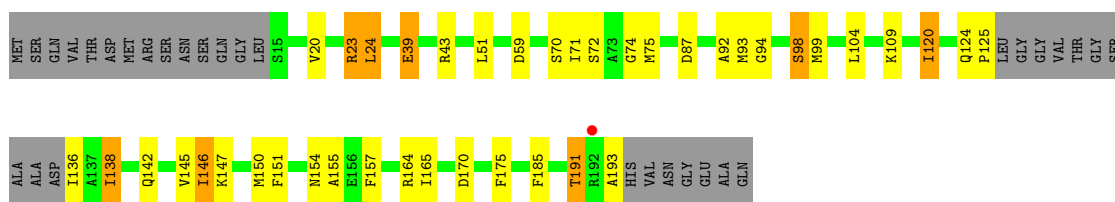
• Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

Chain K:  60% 20% 16%



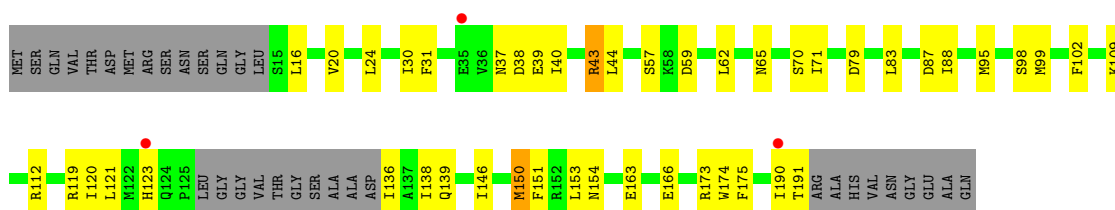
• Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

Chain L:  64% 16% 16%



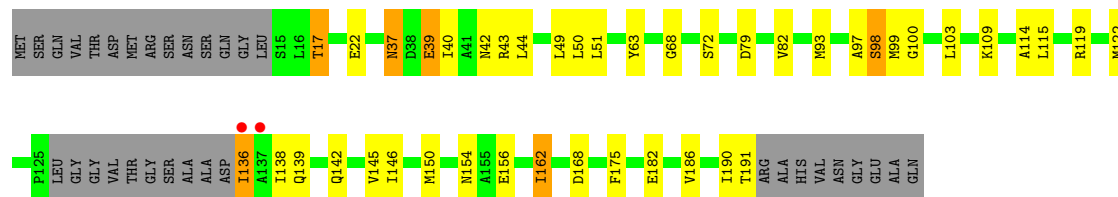
• Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

Chain M:  2% 60% 22% 16%



- Molecule 1: ATP-DEPENDENT CLP PROTEASE PROTEOLYTIC SUBUNIT 1

Chain N:  %



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	97.72Å 168.95Å 104.36Å 90.00° 114.83° 90.00°	Depositor
Resolution (Å)	169.03 – 2.60 94.72 – 2.60	Depositor EDS
% Data completeness (in resolution range)	95.7 (169.03-2.60) 95.9 (94.72-2.60)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.53 (at 2.61Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.202 , 0.261 0.195 , 0.251	Depositor DCC
$R_{free}$ test set	4541 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	51.8	Xtrriage
Anisotropy	0.773	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 63.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	18231	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.44% 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	0.66	0/1320	0.92	1/1783 (0.1%)
1	B	0.84	1/1331 (0.1%)	1.03	4/1797 (0.2%)
1	C	0.65	0/1320	0.91	0/1783
1	D	0.62	0/1309	0.91	0/1768
1	E	0.68	0/1325	0.97	2/1789 (0.1%)
1	F	0.74	0/1320	0.96	0/1783
1	G	0.74	0/1320	1.04	3/1783 (0.2%)
1	H	0.66	0/1309	0.90	0/1768
1	I	0.81	0/1309	0.98	0/1768
1	J	0.66	0/1309	0.94	1/1768 (0.1%)
1	K	0.74	0/1309	0.99	0/1768
1	L	0.85	1/1325 (0.1%)	1.03	1/1789 (0.1%)
1	M	0.73	0/1320	0.97	0/1783
1	N	0.61	0/1309	0.92	0/1768
All	All	0.72	2/18435 (0.0%)	0.96	12/24898 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	L	120	ILE	CA-CB	-5.34	1.48	1.54
1	B	136	ILE	CG1-CD1	5.14	1.71	1.51

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	66	SER	CA-C-N	6.80	128.34	119.84
1	G	66	SER	C-N-CA	6.80	128.34	119.84
1	E	84	ALA	CA-C-N	6.46	125.69	118.97
1	E	84	ALA	C-N-CA	6.46	125.69	118.97
1	B	30	ILE	CB-CA-C	-6.04	102.21	110.90

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	1295	0	1287	11	0
1	B	1303	0	1300	36	0
1	C	1295	0	1287	13	0
1	D	1288	0	1280	28	0
1	E	1304	0	1298	18	0
1	F	1295	0	1287	17	0
1	G	1295	0	1287	37	0
1	H	1288	0	1280	21	0
1	I	1288	0	1280	20	0
1	J	1288	0	1280	24	0
1	K	1288	0	1280	36	0
1	L	1304	0	1298	30	0
1	M	1295	0	1287	26	0
1	N	1288	0	1280	30	0
2	A	5	0	0	0	0
2	B	21	0	0	0	0
2	C	11	0	0	1	0
2	D	3	0	0	0	0
2	E	4	0	0	0	0
2	F	12	0	0	0	0
2	G	17	0	0	0	0
2	H	3	0	0	0	0
2	I	8	0	0	0	0
2	J	7	0	0	0	0
2	K	7	0	0	0	0
2	L	10	0	0	0	0
2	M	6	0	0	0	0
2	N	3	0	0	0	0
All	All	18231	0	18011	310	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 310 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:I:115:LEU:HD23	1:I:190:ILE:HD12	1.25	1.13
1:G:122:MET:HE1	1:G:168:ASP:HB3	1.34	1.10
1:G:122:MET:CE	1:G:168:ASP:HB3	1.83	1.08
1:A:65:ASN:HD22	1:G:42:ASN:HD21	1.19	0.90
1:N:99:MET:HE1	1:N:150:MET:SD	2.13	0.88

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	164/200 (82%)	159 (97%)	4 (2%)	1 (1%)	21	42
1	B	165/200 (82%)	159 (96%)	5 (3%)	1 (1%)	21	42
1	C	164/200 (82%)	158 (96%)	5 (3%)	1 (1%)	21	42
1	D	163/200 (82%)	157 (96%)	6 (4%)	0	100	100
1	E	165/200 (82%)	156 (94%)	9 (6%)	0	100	100
1	F	164/200 (82%)	159 (97%)	5 (3%)	0	100	100
1	G	164/200 (82%)	157 (96%)	7 (4%)	0	100	100
1	H	163/200 (82%)	152 (93%)	9 (6%)	2 (1%)	10	23
1	I	163/200 (82%)	156 (96%)	6 (4%)	1 (1%)	21	42
1	J	163/200 (82%)	157 (96%)	6 (4%)	0	100	100
1	K	163/200 (82%)	156 (96%)	6 (4%)	1 (1%)	21	42
1	L	165/200 (82%)	159 (96%)	5 (3%)	1 (1%)	21	42
1	M	164/200 (82%)	154 (94%)	10 (6%)	0	100	100
1	N	163/200 (82%)	155 (95%)	7 (4%)	1 (1%)	21	42
All	All	2293/2800 (82%)	2194 (96%)	90 (4%)	9 (0%)	30	51

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	K	94	GLY
1	C	94	GLY
1	H	94	GLY
1	I	94	GLY
1	L	94	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	134/157 (85%)	126 (94%)	8 (6%)	17 37
1	B	135/157 (86%)	123 (91%)	12 (9%)	9 20
1	C	134/157 (85%)	124 (92%)	10 (8%)	12 28
1	D	133/157 (85%)	118 (89%)	15 (11%)	5 12
1	E	134/157 (85%)	116 (87%)	18 (13%)	4 7
1	F	134/157 (85%)	118 (88%)	16 (12%)	5 10
1	G	134/157 (85%)	116 (87%)	18 (13%)	4 7
1	H	133/157 (85%)	126 (95%)	7 (5%)	20 43
1	I	133/157 (85%)	124 (93%)	9 (7%)	14 32
1	J	133/157 (85%)	118 (89%)	15 (11%)	5 12
1	K	133/157 (85%)	119 (90%)	14 (10%)	6 14
1	L	134/157 (85%)	117 (87%)	17 (13%)	4 9
1	M	134/157 (85%)	118 (88%)	16 (12%)	5 10
1	N	133/157 (85%)	113 (85%)	20 (15%)	3 5
All	All	1871/2198 (85%)	1676 (90%)	195 (10%)	7 14

5 of 195 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	J	49	LEU
1	L	23	ARG
1	J	138	ILE

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	K	37	ASN
1	L	136	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 37 such sidechains are listed below:

Mol	Chain	Res	Type
1	M	142	GLN
1	N	154	ASN
1	M	154	ASN
1	N	65	ASN
1	G	124	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

### 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	167/200 (83%)	-0.31	3 (1%) 67 63	13, 29, 37, 42	3 (1%)
1	B	167/200 (83%)	-0.50	1 (0%) 85 83	16, 28, 37, 47	2 (1%)
1	C	167/200 (83%)	-0.35	3 (1%) 67 63	19, 29, 37, 39	1 (0%)
1	D	167/200 (83%)	-0.43	1 (0%) 85 83	20, 29, 37, 45	0
1	E	169/200 (84%)	-0.50	2 (1%) 76 73	14, 28, 39, 46	0
1	F	167/200 (83%)	-0.57	0 100 100	20, 29, 38, 42	1 (0%)
1	G	167/200 (83%)	-0.40	3 (1%) 67 63	19, 29, 37, 42	2 (1%)
1	H	167/200 (83%)	-0.36	1 (0%) 85 83	18, 29, 38, 46	0
1	I	167/200 (83%)	-0.45	0 100 100	17, 28, 38, 46	1 (0%)
1	J	167/200 (83%)	-0.53	0 100 100	19, 29, 37, 41	0
1	K	167/200 (83%)	-0.43	1 (0%) 85 83	13, 29, 37, 45	1 (0%)
1	L	169/200 (84%)	-0.44	1 (0%) 85 83	18, 29, 36, 45	1 (0%)
1	M	167/200 (83%)	-0.45	3 (1%) 67 63	20, 29, 38, 45	2 (1%)
1	N	167/200 (83%)	-0.26	2 (1%) 76 73	22, 29, 35, 41	0
All	All	2342/2800 (83%)	-0.43	21 (0%) 81 78	13, 29, 37, 47	14 (0%)

The worst 5 of 21 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	L	192	ARG	7.1
1	M	35	GLU	6.3
1	K	43	ARG	5.4
1	N	136	ILE	5.2
1	A	182	GLU	4.2

## 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.