



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 15, 2017 – 03:48 am GMT

PDB ID : 5CBQ  
Title : Crystal structure of a T1-like thiolase from Mycobacterium smegmatis  
Authors : Janardan, N.; Murthy, M.R.N.  
Deposited on : 2015-07-01  
Resolution : 2.45 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

<http://wwpdb.org/validation/2016/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)	:	1.9-1692
EDS	:	trunk28620
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	recalc28949

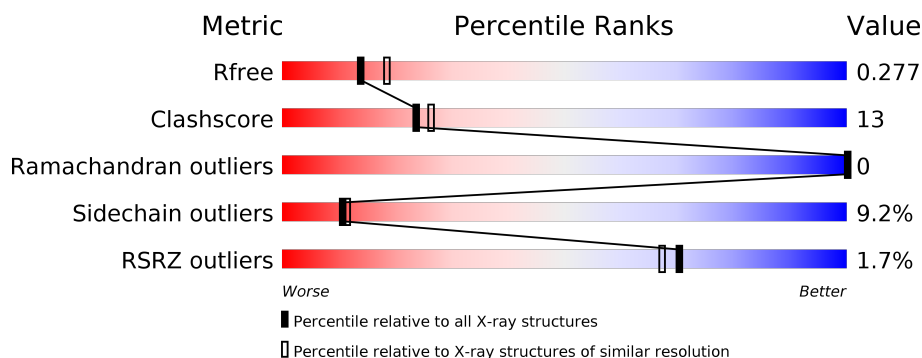
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.45 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))
$R_{free}$	100719	1119 (2.48-2.44)
Clashscore	112137	1193 (2.48-2.44)
Ramachandran outliers	110173	1185 (2.48-2.44)
Sidechain outliers	110143	1185 (2.48-2.44)
RSRZ outliers	101464	1126 (2.48-2.44)

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. 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	413	<div> <div>3%</div> <div> <div></div> <div>71%</div> <div>23%</div> <div>• •</div> </div> </div>
1	B	413	<div> <div></div> <div> <div>71%</div> <div>21%</div> <div>• • •</div> </div> </div>
1	C	413	<div> <div>%</div> <div> <div></div> <div>71%</div> <div>22%</div> <div>• •</div> </div> </div>
1	D	413	<div> <div></div> <div> <div>72%</div> <div>23%</div> <div>• •</div> </div> </div>
1	E	413	<div> <div>%</div> <div> <div></div> <div>75%</div> <div>20%</div> <div>• •</div> </div> </div>
1	F	413	<div> <div>5%</div> <div> <div></div> <div>68%</div> <div>23%</div> <div>• 5%</div> </div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 17727 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 Beta-ketothiolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	399	Total	C	N	O	S	0	0	0
			2868	1770	525	557	16			
1	B	398	Total	C	N	O	S	0	2	0
			2943	1823	538	566	16			
1	C	397	Total	C	N	O	S	0	0	0
			2882	1786	522	558	16			
1	D	398	Total	C	N	O	S	0	1	0
			2927	1813	535	563	16			
1	E	400	Total	C	N	O	S	0	0	0
			2925	1811	538	560	16			
1	F	393	Total	C	N	O	S	0	0	0
			2846	1763	523	544	16			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	HIS	-	expression tag	UNP A0QUH3
A	-4	HIS	-	expression tag	UNP A0QUH3
A	-3	HIS	-	expression tag	UNP A0QUH3
A	-2	HIS	-	expression tag	UNP A0QUH3
A	-1	HIS	-	expression tag	UNP A0QUH3
A	0	HIS	-	expression tag	UNP A0QUH3
B	-5	HIS	-	expression tag	UNP A0QUH3
B	-4	HIS	-	expression tag	UNP A0QUH3
B	-3	HIS	-	expression tag	UNP A0QUH3
B	-2	HIS	-	expression tag	UNP A0QUH3
B	-1	HIS	-	expression tag	UNP A0QUH3
B	0	HIS	-	expression tag	UNP A0QUH3
C	-5	HIS	-	expression tag	UNP A0QUH3
C	-4	HIS	-	expression tag	UNP A0QUH3
C	-3	HIS	-	expression tag	UNP A0QUH3
C	-2	HIS	-	expression tag	UNP A0QUH3
C	-1	HIS	-	expression tag	UNP A0QUH3

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Chain	Residue	Modelled	Actual	Comment	Reference
C	0	HIS	-	expression tag	UNP A0QUH3
D	-5	HIS	-	expression tag	UNP A0QUH3
D	-4	HIS	-	expression tag	UNP A0QUH3
D	-3	HIS	-	expression tag	UNP A0QUH3
D	-2	HIS	-	expression tag	UNP A0QUH3
D	-1	HIS	-	expression tag	UNP A0QUH3
D	0	HIS	-	expression tag	UNP A0QUH3
E	-5	HIS	-	expression tag	UNP A0QUH3
E	-4	HIS	-	expression tag	UNP A0QUH3
E	-3	HIS	-	expression tag	UNP A0QUH3
E	-2	HIS	-	expression tag	UNP A0QUH3
E	-1	HIS	-	expression tag	UNP A0QUH3
E	0	HIS	-	expression tag	UNP A0QUH3
F	-5	HIS	-	expression tag	UNP A0QUH3
F	-4	HIS	-	expression tag	UNP A0QUH3
F	-3	HIS	-	expression tag	UNP A0QUH3
F	-2	HIS	-	expression tag	UNP A0QUH3
F	-1	HIS	-	expression tag	UNP A0QUH3
F	0	HIS	-	expression tag	UNP A0QUH3

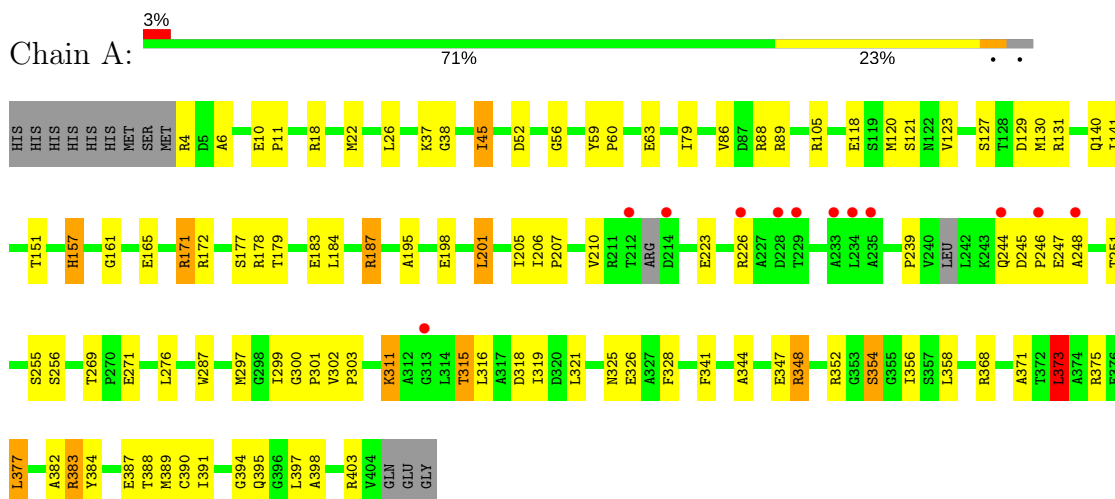
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	51	Total O 51 51	0	0
2	B	66	Total O 66 66	0	0
2	C	55	Total O 55 55	0	0
2	D	69	Total O 69 69	0	0
2	E	49	Total O 49 49	0	0
2	F	46	Total O 46 46	0	0

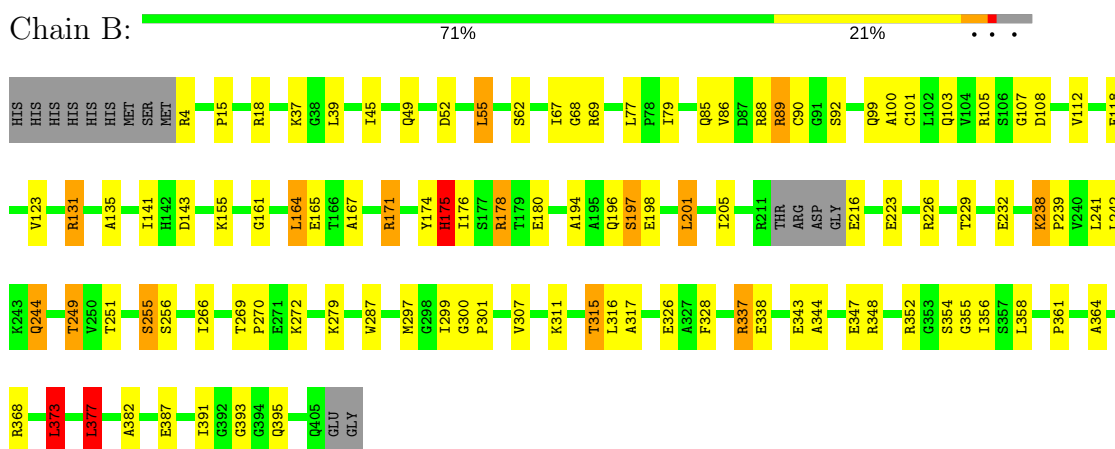
### 3 Residue-property plots

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 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.

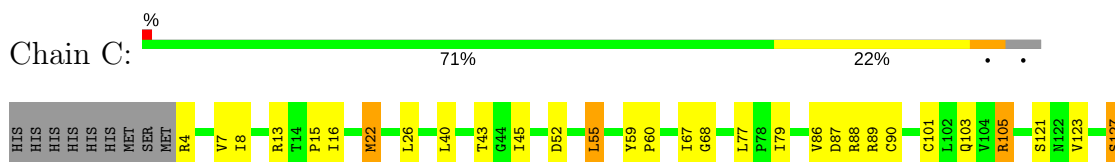
#### • Molecule 1: Beta-ketothiolase

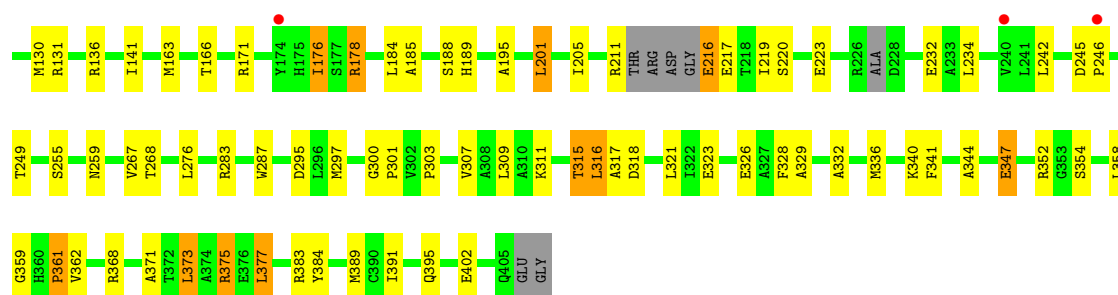


#### • Molecule 1: Beta-ketothiolase



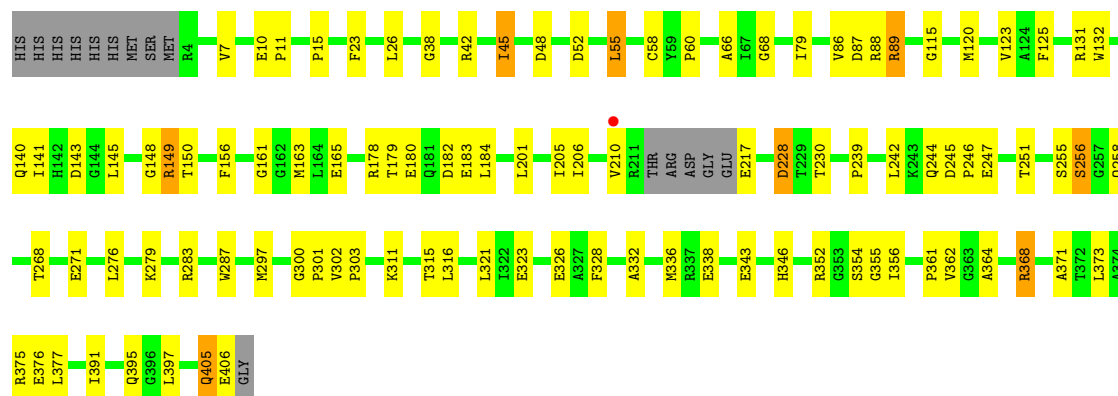
#### • Molecule 1: Beta-ketothiolase





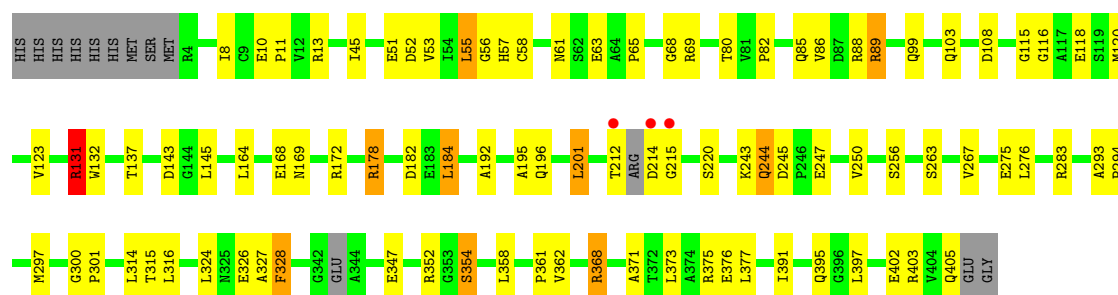
• Molecule 1: Beta-ketothiolase

Chain D: 72% 23% . .



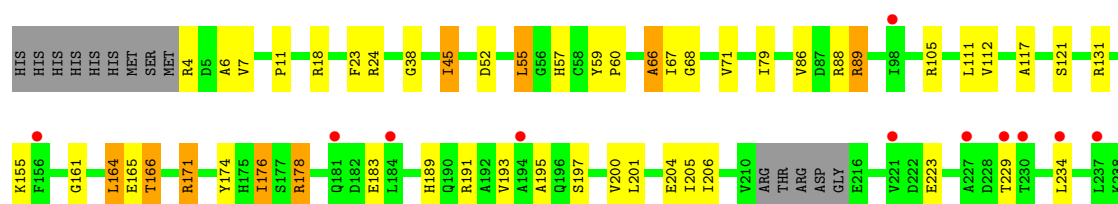
• Molecule 1: Beta-ketothiolase

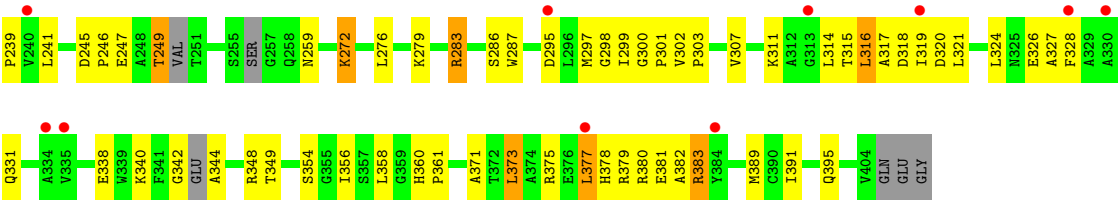
Chain E: 75% 20% . .



• Molecule 1: Beta-ketothiolase

Chain F: 5% 68% 23% 5%





## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	113.46Å 181.47Å 271.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	135.87 – 2.45 52.35 – 2.45	Depositor EDS
% Data completeness (in resolution range)	89.1 (135.87-2.45) 89.1 (52.35-2.45)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.72 (at 2.45Å)	Xtriage
Refinement program	REFMAC 5.8.0049	Depositor
R, $R_{free}$	0.226 , 0.268 0.225 , 0.277	Depositor DCC
$R_{free}$ test set	4603 reflections (5.31%)	DCC
Wilson B-factor (Å <sup>2</sup> )	38.3	Xtriage
Anisotropy	0.117	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 46.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	17727	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.73% 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	1.39	3/2911 (0.1%)	0.89	2/3957 (0.1%)
1	B	1.54	7/2991 (0.2%)	0.96	6/4058 (0.1%)
1	C	1.38	0/2925	0.88	4/3974 (0.1%)
1	D	1.48	3/2971 (0.1%)	0.94	6/4033 (0.1%)
1	E	1.34	4/2968 (0.1%)	0.89	2/4028 (0.0%)
1	F	1.22	0/2886	0.86	1/3915 (0.0%)
All	All	1.40	17/17652 (0.1%)	0.91	21/23965 (0.1%)

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
1	B	0	1
1	C	0	1
1	D	0	2
1	E	0	1
1	F	0	2
All	All	0	7

The worst 5 of 17 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	387	GLU	CD-OE1	-6.23	1.18	1.25
1	B	175[A]	HIS	N-CA	6.12	1.58	1.46
1	B	175[B]	HIS	N-CA	6.12	1.58	1.46
1	E	118	GLU	CD-OE2	-5.71	1.19	1.25
1	A	118	GLU	CD-OE2	-5.64	1.19	1.25

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	197[A]	SER	C-N-CA	12.34	152.56	121.70
1	B	197[B]	SER	C-N-CA	12.34	152.56	121.70
1	D	149[A]	ARG	C-N-CA	7.74	141.05	121.70
1	D	149[B]	ARG	C-N-CA	7.74	141.05	121.70
1	D	148	GLY	CA-C-N	7.16	132.96	117.20

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	361	PRO	Peptide
1	C	361	PRO	Peptide
1	D	361	PRO	Peptide
1	D	66	ALA	Peptide
1	E	361	PRO	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	2868	0	2782	89	0
1	B	2943	0	2941	83	0
1	C	2882	0	2840	89	0
1	D	2927	0	2917	73	0
1	E	2925	0	2912	72	0
1	F	2846	0	2799	76	0
2	A	51	0	0	3	0
2	B	66	0	0	6	0
2	C	55	0	0	2	0
2	D	69	0	0	4	0
2	E	49	0	0	1	0
2	F	46	0	0	2	0
All	All	17727	0	17191	437	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 13.

The worst 5 of 437 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:131:ARG:NH2	1:B:143:ASP:OD1	1.60	1.35
1:E:108:ASP:OD1	1:F:311:LYS:NZ	1.75	1.18
1:A:131:ARG:NH1	1:B:123:VAL:O	1.78	1.15
1:A:141:ILE:HD11	1:D:141:ILE:HD11	1.27	1.08
1:B:326:GLU:OE1	1:B:354:SER:HB3	1.56	1.05

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	393/413 (95%)	388 (99%)	5 (1%)	0	100	100
1	B	396/413 (96%)	391 (99%)	5 (1%)	0	100	100
1	C	391/413 (95%)	385 (98%)	6 (2%)	0	100	100
1	D	395/413 (96%)	393 (100%)	2 (0%)	0	100	100
1	E	394/413 (95%)	392 (100%)	2 (0%)	0	100	100
1	F	383/413 (93%)	380 (99%)	3 (1%)	0	100	100
All	All	2352/2478 (95%)	2329 (99%)	23 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	282/315 (90%)	253 (90%)	29 (10%)	8	9
1	B	302/315 (96%)	272 (90%)	30 (10%)	9	9
1	C	290/315 (92%)	265 (91%)	25 (9%)	12	14
1	D	298/315 (95%)	276 (93%)	22 (7%)	16	20
1	E	296/315 (94%)	271 (92%)	25 (8%)	13	15
1	F	281/315 (89%)	249 (89%)	32 (11%)	7	6
All	All	1749/1890 (92%)	1586 (91%)	163 (9%)	11	11

5 of 163 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	217	GLU
1	D	201	LEU
1	F	272	LYS
1	C	297	MET
1	C	377	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	157	HIS
1	A	244	GLN
1	C	189	HIS
1	D	157	HIS
1	D	405	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

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 [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	399/413 (96%)	0.07	12 (3%) 51 47	17, 37, 69, 89	0
1	B	398/413 (96%)	-0.20	0 100 100	16, 31, 52, 75	0
1	C	397/413 (96%)	0.00	3 (0%) 86 87	17, 38, 67, 84	0
1	D	398/413 (96%)	-0.21	1 (0%) 93 95	17, 32, 51, 74	0
1	E	400/413 (96%)	0.01	3 (0%) 86 87	22, 36, 61, 78	0
1	F	393/413 (95%)	0.36	21 (5%) 27 25	24, 43, 68, 84	0
All	All	2385/2478 (96%)	0.01	40 (1%) 70 67	16, 36, 65, 89	0

The worst 5 of 40 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	248	ALA	3.9
1	C	240	VAL	3.8
1	A	229	THR	3.6
1	E	214	ASP	3.4
1	F	334	ALA	3.2

### 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 carbohydrates 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.