



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:43 PM UTC

PDB ID : 6QKJ / pdb_00006qkj
Title : EgtB from *Chloracidobacterium thermophilum*, a type II sulfoxide synthase
in complex with N,N,N-trimethyl-histidine
Authors : Stampfli, A.R.; Badri, B.N.; Schirmer, T.; Seebeck, F.P.
Deposited on : 2019-01-29
Resolution : 2.20 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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
Mogul	:	2022.3.0, CSD as543be (2022)
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

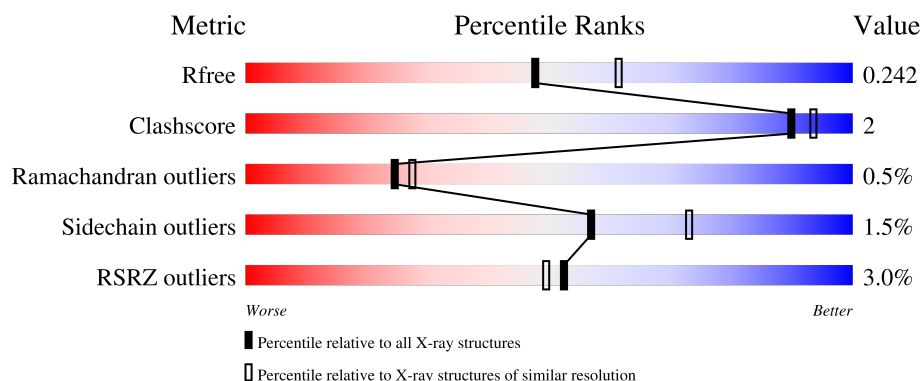
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

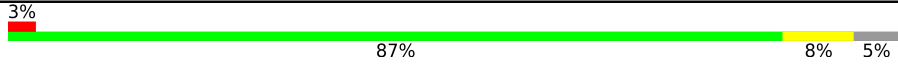
The reported resolution of this entry is 2.20 Å.

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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	437	
1	B	437	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6992 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 Uncharacterized protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	417	Total	C	N	O	S	0	2	0
			3364	2158	599	596	11			
1	B	407	Total	C	N	O	S	0	4	0
			3307	2122	591	582	12			

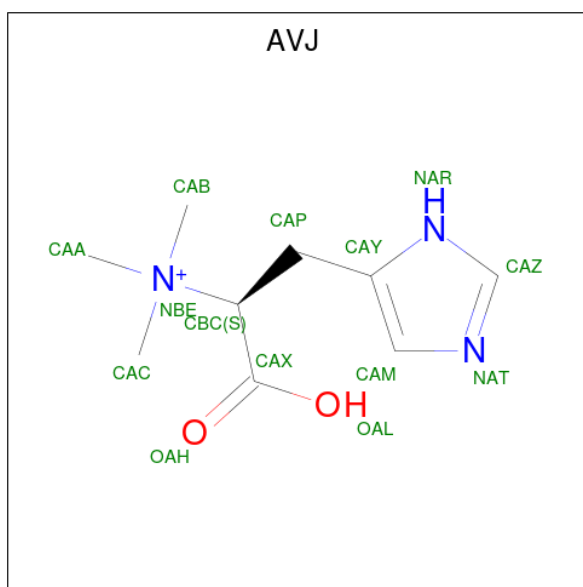
There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP G2LET6
A	-1	SER	-	expression tag	UNP G2LET6
A	0	HIS	-	expression tag	UNP G2LET6
B	-2	GLY	-	expression tag	UNP G2LET6
B	-1	SER	-	expression tag	UNP G2LET6
B	0	HIS	-	expression tag	UNP G2LET6

- Molecule 2 is FE (III) ION (CCD ID: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Fe	0	0
			2	2		
2	B	2	Total	Fe	0	0
			2	2		

- Molecule 3 is N,N,N-trimethyl-histidine (CCD ID: AVJ) (formula: C₉H₁₆N₃O₂).

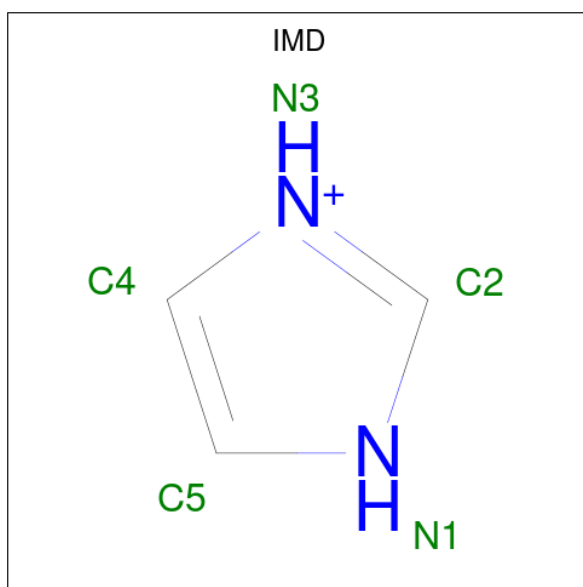


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			14	9	3	2		
3	B	1	Total	C	N	O	0	0
			14	9	3	2		

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Cl	0	0
			2	2		
4	B	2	Total	Cl	0	0
			2	2		

- Molecule 5 is IMIDAZOLE (CCD ID: IMD) (formula: C₃H₅N₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	N	0	0
			5	3	2		
5	B	1	Total	C	N	0	0
			5	3	2		

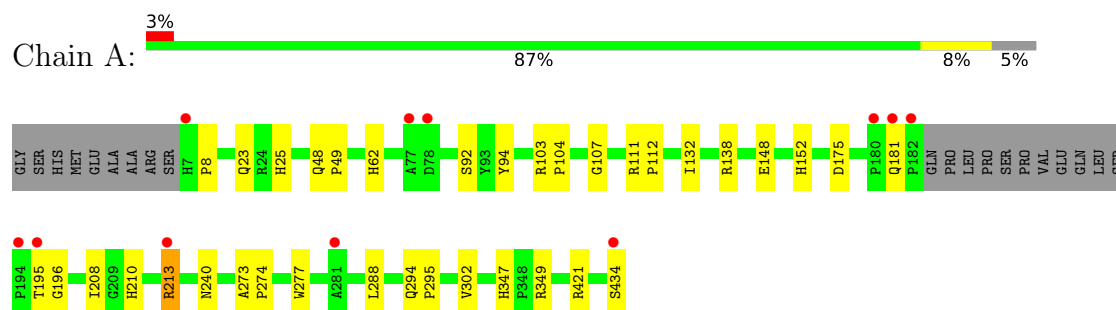
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	158	Total	O	0	0
			158	158		
6	B	117	Total	O	0	0
			117	117		

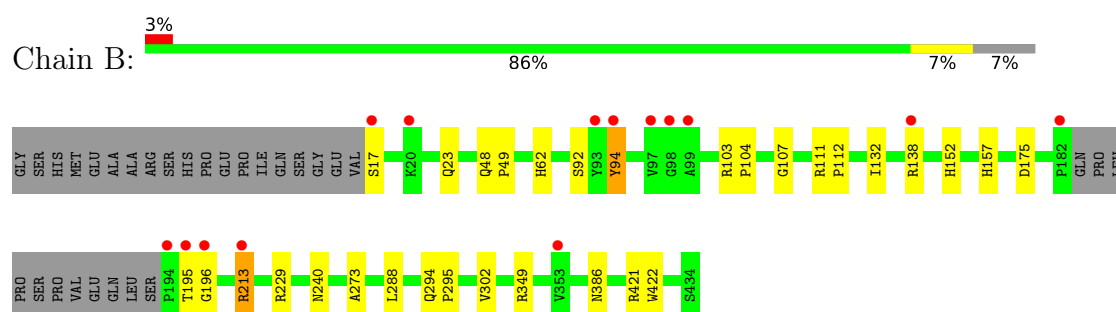
3 Residue-property plots [i](#)

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: Uncharacterized protein



- Molecule 1: Uncharacterized protein



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	108.14Å 201.29Å 108.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.68 – 2.20 29.68 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.9 (29.68-2.20) 99.9 (29.68-2.20)	Depositor EDS
R_{merge}	0.27	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.59 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.8.0232	Depositor
R, R_{free}	0.195 , 0.237 0.201 , 0.242	Depositor DCC
R_{free} test set	2932 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å ²)	31.1	Xtriage
Anisotropy	0.282	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 17.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6992	wwPDB-VP
Average B, all atoms (Å ²)	35.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.97% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: IMD, CL, AVJ, FE

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	1.17	6/3488 (0.2%)	1.34	5/4768 (0.1%)
1	B	1.12	2/3428 (0.1%)	1.35	5/4684 (0.1%)
All	All	1.14	8/6916 (0.1%)	1.34	10/9452 (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

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	210	HIS	CE1-NE2	7.17	1.39	1.32
1	B	175	ASP	N-CA	6.55	1.51	1.46
1	A	25	HIS	CE1-NE2	6.25	1.38	1.32
1	A	49	PRO	C-O	-5.68	1.17	1.24
1	A	8	PRO	C-O	-5.65	1.17	1.23
1	A	175	ASP	N-CA	5.46	1.50	1.46
1	B	49	PRO	C-O	-5.13	1.17	1.24
1	A	208	ILE	C-O	5.04	1.28	1.24

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	94	TYR	CA-C-N	6.05	128.38	120.28
1	A	94	TYR	C-N-CA	6.05	128.38	120.28
1	A	349	ARG	CB-CA-C	5.74	117.70	108.91

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	349	ARG	CB-CA-C	5.70	117.63	108.91
1	B	386	ASN	CA-C-N	5.58	126.17	119.98
1	B	386	ASN	C-N-CA	5.58	126.17	119.98
1	B	94	TYR	CA-C-N	5.40	127.51	120.28
1	B	94	TYR	C-N-CA	5.40	127.51	120.28
1	A	138	ARG	CA-C-N	5.38	127.76	120.44
1	A	138	ARG	C-N-CA	5.38	127.76	120.44

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	17	SER	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	3364	0	3193	12	0
1	B	3307	0	3145	11	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	14	0	15	0	0
3	B	14	0	15	0	0
4	A	2	0	0	0	0
4	B	2	0	0	1	0
5	A	5	0	4	0	0
5	B	5	0	5	1	0
6	A	158	0	0	2	1
6	B	117	0	0	0	0
All	All	6992	0	6377	23	1

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 2.

All (23) 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:B:152:HIS:CE1	5:B:506:IMD:C4	2.83	0.61
1:A:48:GLN:NE2	1:A:107:GLY:H	2.03	0.55
1:B:62:HIS:CE1	1:B:92[B]:SER:HB2	2.42	0.53
1:A:213:ARG:NH1	6:A:605:HOH:O	2.43	0.52
1:A:294:GLN:HG3	1:A:295:PRO:O	2.08	0.52
1:B:294:GLN:HG3	1:B:295:PRO:O	2.09	0.50
1:A:62:HIS:CE1	1:A:92[B]:SER:HB2	2.48	0.49
1:B:48:GLN:NE2	1:B:107:GLY:H	2.11	0.48
1:B:273:ALA:O	1:B:421:ARG:NH2	2.46	0.48
1:A:111:ARG:HA	1:A:112:PRO:C	2.40	0.46
1:B:111:ARG:HA	1:B:112:PRO:C	2.41	0.45
1:A:273:ALA:O	1:A:421:ARG:NH2	2.49	0.45
1:B:103:ARG:HB3	1:B:104:PRO:HD3	1.98	0.44
1:A:240:ASN:ND2	1:A:302:VAL:HA	2.33	0.44
1:A:347:HIS:HD2	6:A:713:HOH:O	1.99	0.44
1:A:23:GLN:HG3	1:A:132:ILE:HG21	2.00	0.43
1:A:148:GLU:OE1	1:A:152:HIS:HE1	2.02	0.43
1:B:62:HIS:CD2	1:B:157:HIS:CE1	3.07	0.42
1:A:274:PRO:HD2	1:A:277:TRP:CD2	2.55	0.41
1:B:94:TYR:HE2	4:B:504:CL:CL	2.41	0.41
1:B:240:ASN:ND2	1:B:302:VAL:HA	2.36	0.41
1:A:103:ARG:N	1:A:104:PRO:CD	2.83	0.41
1:B:23:GLN:HG3	1:B:132:ILE:HG21	2.03	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:A:705:HOH:O	6:A:705:HOH:O[3_554]	2.03	0.17

5.3 Torsion angles

5.3.1 Protein backbone

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	415/437 (95%)	404 (97%)	9 (2%)	2 (0%)	24	27
1	B	407/437 (93%)	392 (96%)	13 (3%)	2 (0%)	24	27
All	All	822/874 (94%)	796 (97%)	22 (3%)	4 (0%)	24	27

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	213	ARG
1	B	213	ARG
1	B	196	GLY
1	A	196	GLY

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	343/358 (96%)	339 (99%)	4 (1%)	63	78
1	B	336/358 (94%)	330 (98%)	6 (2%)	51	68
All	All	679/716 (95%)	669 (98%)	10 (2%)	57	73

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	181	GLN
1	A	195	THR
1	A	288	LEU
1	A	434	SER
1	B	138	ARG
1	B	195	THR
1	B	213	ARG
1	B	229	ARG
1	B	288	LEU
1	B	422	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19)

such sidechains are listed below:

Mol	Chain	Res	Type
1	A	23	GLN
1	A	38	GLN
1	A	48	GLN
1	A	152	HIS
1	A	155	GLN
1	A	181	GLN
1	A	240	ASN
1	A	279	GLN
1	A	347	HIS
1	A	393	GLN
1	B	38	GLN
1	B	48	GLN
1	B	152	HIS
1	B	155	GLN
1	B	181	GLN
1	B	240	ASN
1	B	279	GLN
1	B	347	HIS
1	B	393	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](#)

Of 12 ligands modelled in this entry, 8 are monoatomic - leaving 4 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
5	IMD	B	506	2	5,5,5	0.34	0	5,5,5	0.61	0
5	IMD	A	506	2	5,5,5	0.20	0	5,5,5	0.60	0
3	AVJ	B	502	2	14,14,14	1.86	3 (21%)	16,20,20	1.37	2 (12%)
3	AVJ	A	502	2	14,14,14	1.31	1 (7%)	16,20,20	1.44	1 (6%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	IMD	B	506	2	-	-	0/1/1/1
5	IMD	A	506	2	-	-	0/1/1/1
3	AVJ	B	502	2	-	1/14/14/14	0/1/1/1
3	AVJ	A	502	2	-	1/14/14/14	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	502	AVJ	CAY-NAR	-4.29	1.30	1.37
3	B	502	AVJ	CAP-CAY	4.12	1.55	1.49
3	A	502	AVJ	CAY-NAR	-2.44	1.33	1.37
3	B	502	AVJ	CBC-CAX	2.17	1.56	1.53

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	502	AVJ	OAL-CAX-CBC	3.86	120.82	111.88
3	A	502	AVJ	CAM-CAY-NAR	2.75	108.90	105.65
3	B	502	AVJ	OAH-CAX-CBC	-2.59	114.29	122.95

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	502	AVJ	OAL-CAX-CBC-NBE
3	A	502	AVJ	CBC-CAP-CAY-NAR

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	506	IMD	1	0

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, 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	417/437 (95%)	-0.26	11 (2%) 57 54	15, 30, 61, 93	2 (0%)
1	B	407/437 (93%)	-0.04	14 (3%) 48 45	13, 35, 62, 112	4 (0%)
All	All	824/874 (94%)	-0.15	25 (3%) 52 49	13, 32, 62, 112	6 (0%)

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	194	PRO	5.1
1	A	7	HIS	4.7
1	A	213	ARG	4.4
1	B	97	VAL	4.1
1	A	434	SER	3.9
1	A	194	PRO	3.8
1	B	195	THR	3.7
1	A	182	PRO	3.7
1	B	98	GLY	3.6
1	B	17	SER	3.6
1	B	93	TYR	3.4
1	B	182	PRO	3.4
1	B	94	TYR	3.3
1	B	196	GLY	3.1
1	A	78	ASP	2.7
1	A	195	THR	2.7
1	B	213	ARG	2.6
1	A	281	ALA	2.6
1	A	181	GLN	2.5
1	B	99	ALA	2.5
1	B	353	VAL	2.5
1	A	180	PRO	2.2
1	A	77	ALA	2.1
1	B	138	ARG	2.0

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Mol	Chain	Res	Type	RSRZ
1	B	20	LYS	2.0

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 oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	CL	B	503	1/1	0.91	0.16	62,62,62,62	0
5	IMD	B	506	5/5	0.94	0.12	50,52,54,55	0
4	CL	A	504	1/1	0.95	0.08	44,44,44,44	0
3	AVJ	B	502	14/14	0.95	0.08	28,29,31,31	0
4	CL	A	503	1/1	0.95	0.12	57,57,57,57	0
3	AVJ	A	502	14/14	0.96	0.07	24,25,27,27	0
4	CL	B	504	1/1	0.97	0.07	56,56,56,56	0
5	IMD	A	506	5/5	0.98	0.04	26,26,26,26	0
2	FE	B	505	1/1	0.99	0.04	47,47,47,47	0
2	FE	A	501	1/1	1.00	0.01	21,21,21,21	0
2	FE	A	505	1/1	1.00	0.01	23,23,23,23	0
2	FE	B	501	1/1	1.00	0.01	24,24,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.