



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 11, 2018 – 10:46 PM EST

PDB ID : 5PZL
Title : CRYSTAL STRUCTURE OF THE HEPATITIS C VIRUS NS5B RNA-DEPENDENT RNA POLYMERASE IN COMPLEX WITH 2-({3-[1-(2-CYCLOPROPYLETHYL)-6-FLUORO-4-HYDROXY-2-OXO-1,2-DIHYDROQUINOLIN-3-YL]-1,1-DIOXO-1,4-DIHYDRO-1LAMBDA 6 ,2,4-BENZOTHIAZIN-7-YL}OXY)ACETAMIDE
Authors : Sheriff, S.
Deposited on : 2017-02-27
Resolution : 2.06 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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20030736
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) : rb-20030736

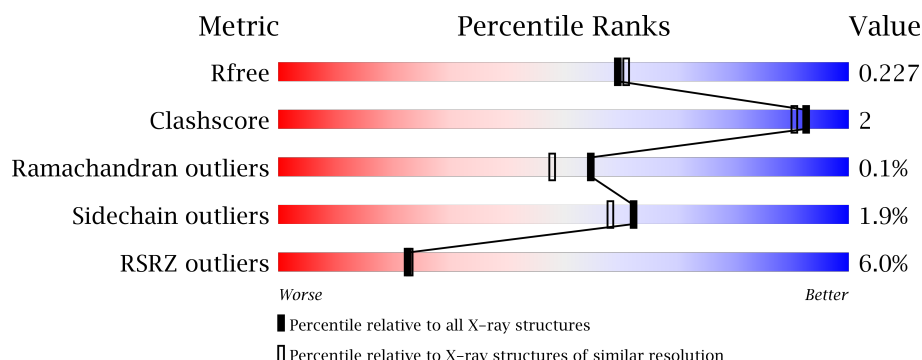
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.06 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	2028 (2.08-2.04)
Clashscore	112137	2143 (2.08-2.04)
Ramachandran outliers	110173	2126 (2.08-2.04)
Sidechain outliers	110143	2126 (2.08-2.04)
RSRZ outliers	101464	2035 (2.08-2.04)

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 ≥ 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	574	<div> <div>5%</div> <div> <div></div> <div>90%</div> <div>5% • •</div> </div> </div>
1	B	574	<div> <div>6%</div> <div> <div></div> <div>90%</div> <div>5% • 5%</div> </div> </div>

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 9492 atoms, of which 118 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.

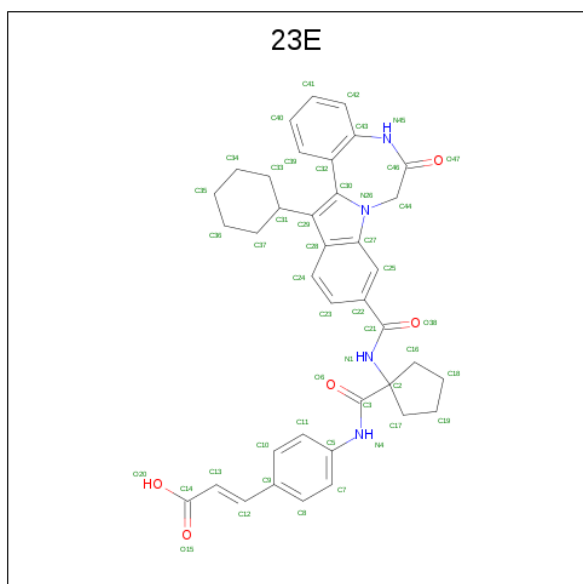
- Molecule 1 is a protein called RNA-directed RNA polymerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	551	Total	C	N	O	S	0	0	0
			4240	2675	746	786	33			
1	B	545	Total	C	N	O	S	0	0	0
			4182	2635	738	777	32			

There are 2 discrepancies between the modelled and reference sequences:

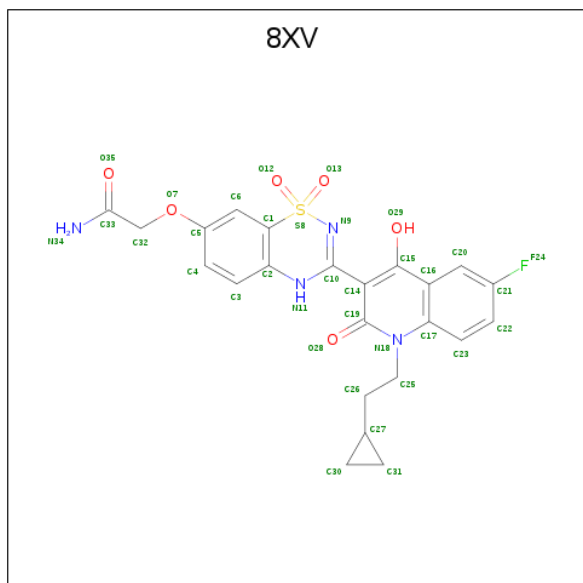
Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	expression tag	UNP Q9WMX2
B	0	MET	-	expression tag	UNP Q9WMX2

- Molecule 2 is (2E)-3-(4-{{(1-{{(13-cyclohexyl-6-oxo-6,7-dihydro-5H-indolo[1,2-d][1,4]benzodiazepin-10-yl)carbonyl}amino}cyclopentyl)carbonyl}amino}phenyl)prop-2-enoic acid (three-letter code: 23E) (formula: C₃₈H₃₈N₄O₅).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	H	N	O	38	0
			85	38	38	4	5		
2	B	1	Total	C	H	N	O	38	0
			85	38	38	4	5		

- Molecule 3 is 2-({3-[1-(2-cyclopropylethyl)-6-fluoro-4-hydroxy-2-oxo-1,2-dihydroquinolin-3-yl]-1,1-dioxo-1,4-dihydro-1 λ 6,2,4-benzothiadiazin-7-yl}oxy)acetamide (three-letter code: 8XV) (formula: C₂₃H₂₁FN₄O₆S).



Mol	Chain	Residues	Atoms							ZeroOcc	AltConf
3	A	1	Total	C	F	H	N	O	S	21	0
			56	23	1	21	4	6	1		
3	B	1	Total	C	F	H	N	O	S	21	0
			56	23	1	21	4	6	1		

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		

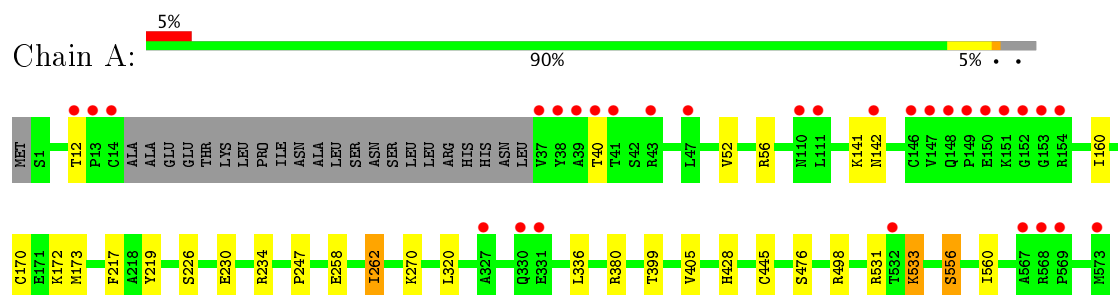
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	376	Total	O	0	0
			376	376		
5	B	377	Total	O	0	0
			377	377		

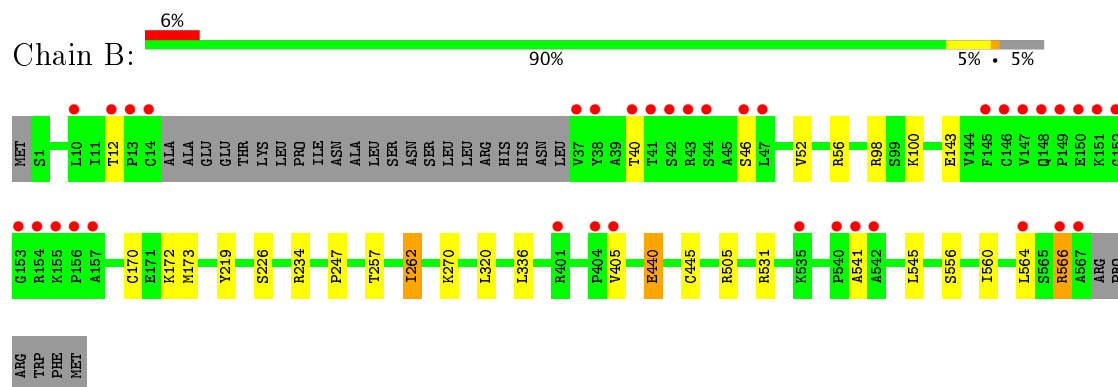
3 Residue-property plots [i](#)

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: RNA-directed RNA polymerase



• Molecule 1: RNA-directed RNA polymerase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	66.20 Å 91.30 Å 232.50 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.44 – 2.06 41.44 – 2.06	Depositor EDS
% Data completeness (in resolution range)	96.2 (41.44-2.06) 96.2 (41.44-2.06)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.00 (at 2.06 Å)	Xtriage
Refinement program	BUSTER 2.11.7	Depositor
R, R_{free}	0.197 , 0.228 0.198 , 0.227	Depositor DCC
R_{free} test set	1769 reflections (2.13%)	DCC
Wilson B-factor (Å ²)	20.8	Xtriage
Anisotropy	0.633	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 52.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	9492	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.15% of the height of the origin peak. No significant pseudotranslation is detected.*

¹ Intensities estimated from amplitudes.

² 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 23E, 8XV, SO4

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	0.46	0/4335	0.60	0/5889
1	B	0.46	0/4272	0.61	0/5804
All	All	0.46	0/8607	0.60	0/11693

There are no bond length outliers.

There are no bond angle outliers.

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	4240	0	4185	16	0
1	B	4182	0	4137	17	0
2	A	47	38	37	0	0
2	B	47	38	37	0	0
3	A	35	21	0	0	0
3	B	35	21	0	0	0
4	A	15	0	0	0	0
4	B	20	0	0	0	0
5	A	376	0	0	1	0
5	B	377	0	0	0	0
All	All	9374	118	8396	30	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 2.

All (30) 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:545:LEU:HD22	1:B:564:LEU:HD11	1.73	0.69
1:B:505:ARG:HH12	1:B:531:ARG:HG3	1.58	0.67
1:A:141:LYS:HD2	1:A:160:ILE:HD11	1.83	0.60
1:A:247:PRO:HG3	1:B:234:ARG:HE	1.67	0.60
1:A:230:GLU:HG3	1:A:262:ILE:HG12	1.87	0.56
1:B:170:CYS:HA	1:B:173:MET:HE2	1.88	0.56
1:B:505:ARG:NH1	1:B:531:ARG:HG3	2.21	0.55
1:B:40:THR:HG22	1:B:143:GLU:H	1.71	0.54
1:A:219:TYR:HB3	1:A:320:LEU:HD23	1.91	0.53
1:A:12:THR:HG21	1:A:270:LYS:HG3	1.90	0.53
1:A:247:PRO:HG3	1:B:234:ARG:NE	2.23	0.52
1:B:12:THR:HG21	1:B:270:LYS:HG3	1.92	0.52
1:B:219:TYR:HB3	1:B:320:LEU:HD23	1.93	0.50
1:B:541:ALA:HB1	1:B:566:ARG:NH2	2.31	0.46
1:A:170:CYS:HA	1:A:173:MET:HE2	1.97	0.46
1:B:405:VAL:HG13	1:B:445:CYS:HA	1.99	0.44
1:B:172:LYS:HE3	1:B:560:ILE:HD13	1.99	0.44
1:A:556:SER:HB2	5:A:743:HOH:O	2.16	0.44
1:B:440:GLU:CD	1:B:440:GLU:H	2.21	0.44
1:A:234:ARG:NH1	1:B:247:PRO:HG3	2.33	0.43
1:B:234:ARG:HG3	1:B:262:ILE:HD11	2.01	0.43
1:B:52:VAL:HB	1:B:226:SER:OG	2.19	0.42
1:A:405:VAL:HG13	1:A:445:CYS:HA	2.01	0.42
1:A:399:THR:HG21	1:A:428:HIS:NE2	2.35	0.42
1:A:234:ARG:NH1	1:A:258:GLU:OE2	2.53	0.42
1:A:52:VAL:HB	1:A:226:SER:OG	2.19	0.41
1:A:172:LYS:HE3	1:A:560:ILE:HD13	2.01	0.41
1:B:257:THR:O	1:B:262:ILE:HB	2.21	0.41
1:A:40:THR:O	1:A:142:ASN:HA	2.21	0.41
1:A:217:PHE:CD2	1:A:336:LEU:HD21	2.56	0.40

There are no symmetry-related clashes.

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	547/574 (95%)	538 (98%)	8 (2%)	1 (0%)	51	42
1	B	541/574 (94%)	530 (98%)	11 (2%)	0	100	100
All	All	1088/1148 (95%)	1068 (98%)	19 (2%)	1 (0%)	55	48

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	533	LYS

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	450/486 (93%)	442 (98%)	8 (2%)	64	60
1	B	444/486 (91%)	435 (98%)	9 (2%)	60	56
All	All	894/972 (92%)	877 (98%)	17 (2%)	62	58

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	ARG
1	A	262	ILE
1	A	380	ARG
1	A	476	SER
1	A	498	ARG

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Mol	Chain	Res	Type
1	A	531	ARG
1	A	533	LYS
1	A	556	SER
1	B	46	SER
1	B	56	ARG
1	B	98	ARG
1	B	100	LYS
1	B	262	ILE
1	B	336	LEU
1	B	440	GLU
1	B	556	SER
1	B	566	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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](#)

11 ligands are modelled in this entry.

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
2	23E	A	601	-	49,53,53	0.78	1 (2%)	59,77,77	0.70	1 (1%)
3	8XV	A	602	-	36,39,39	0.76	2 (5%)	43,59,59	0.52	0
4	SO4	A	603	-	4,4,4	0.14	0	6,6,6	0.15	0
4	SO4	A	604	-	4,4,4	0.27	0	6,6,6	0.18	0
4	SO4	A	605	-	4,4,4	0.14	0	6,6,6	0.20	0
2	23E	B	601	-	49,53,53	0.78	1 (2%)	59,77,77	0.74	1 (1%)
3	8XV	B	602	-	36,39,39	0.77	2 (5%)	43,59,59	0.49	0
4	SO4	B	603	-	4,4,4	0.18	0	6,6,6	0.13	0
4	SO4	B	604	-	4,4,4	0.17	0	6,6,6	0.07	0
4	SO4	B	605	-	4,4,4	0.19	0	6,6,6	0.15	0
4	SO4	B	606	-	4,4,4	0.17	0	6,6,6	0.06	0

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
2	23E	A	601	-	-	0/24/57/57	0/6/7/7
3	8XV	A	602	-	-	0/13/31/31	0/4/5/5
4	SO4	A	603	-	-	0/0/0/0	0/0/0/0
4	SO4	A	604	-	-	0/0/0/0	0/0/0/0
4	SO4	A	605	-	-	0/0/0/0	0/0/0/0
2	23E	B	601	-	-	0/24/57/57	0/6/7/7
3	8XV	B	602	-	-	0/13/31/31	0/4/5/5
4	SO4	B	603	-	-	0/0/0/0	0/0/0/0
4	SO4	B	604	-	-	0/0/0/0	0/0/0/0
4	SO4	B	605	-	-	0/0/0/0	0/0/0/0
4	SO4	B	606	-	-	0/0/0/0	0/0/0/0

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	602	8XV	C19-N18	2.01	1.41	1.38
3	A	602	8XV	C19-N18	2.07	1.41	1.38
3	B	602	8XV	C17-N18	2.36	1.43	1.40
3	A	602	8XV	C17-N18	2.43	1.43	1.40
2	A	601	23E	C29-C28	3.78	1.44	1.40
2	B	601	23E	C29-C28	3.81	1.44	1.40

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
2	A	601	23E	C32-C43-N45	2.46	123.91	120.79
2	B	601	23E	C32-C43-N45	2.51	123.98	120.79

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	551/574 (95%)	0.09	30 (5%) 26 27	12, 23, 59, 101	0
1	B	545/574 (94%)	0.22	36 (6%) 19 19	13, 26, 64, 107	0
All	All	1096/1148 (95%)	0.15	66 (6%) 23 23	12, 24, 60, 107	0

All (66) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	149	PRO	13.0
1	B	153	GLY	11.3
1	A	149	PRO	10.5
1	B	37	VAL	10.4
1	B	150	GLU	9.2
1	B	567	ALA	9.2
1	A	152	GLY	9.2
1	A	147	VAL	9.1
1	A	150	GLU	9.0
1	B	148	GLN	7.8
1	B	152	GLY	7.4
1	B	14	CYS	7.3
1	A	153	GLY	6.9
1	A	14	CYS	6.6
1	B	42	SER	6.4
1	B	151	LYS	6.2
1	A	148	GLN	5.7
1	B	38	TYR	5.7
1	B	147	VAL	5.7
1	B	146	CYS	5.6
1	A	151	LYS	5.2
1	B	154	ARG	5.1
1	B	405	VAL	5.1
1	B	41	THR	5.1

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Mol	Chain	Res	Type	RSRZ
1	B	43	ARG	4.9
1	A	41	THR	4.9
1	B	540	PRO	4.4
1	B	40	THR	4.3
1	B	541	ALA	4.1
1	A	568	ARG	3.9
1	B	401	ARG	3.8
1	B	13	PRO	3.7
1	B	44	SER	3.7
1	A	13	PRO	3.6
1	B	404	PRO	3.6
1	A	39	ALA	3.6
1	A	12	THR	3.3
1	A	327	ALA	3.2
1	A	330	GLN	3.2
1	A	532	THR	3.1
1	B	47	LEU	3.1
1	A	110	ASN	3.0
1	B	542	ALA	2.9
1	B	10	LEU	2.9
1	A	37	VAL	2.9
1	B	157	ALA	2.9
1	B	46	SER	2.9
1	A	567	ALA	2.9
1	B	155	LYS	2.8
1	A	43	ARG	2.8
1	A	573	MET	2.8
1	A	146	CYS	2.6
1	B	156	PRO	2.6
1	A	331	GLU	2.6
1	B	566	ARG	2.5
1	A	569	PRO	2.5
1	B	12	THR	2.5
1	A	142	ASN	2.5
1	B	564	LEU	2.4
1	B	535	LYS	2.4
1	B	145	PHE	2.4
1	A	38	TYR	2.4
1	A	111	LEU	2.3
1	A	40	THR	2.2
1	A	47	LEU	2.1
1	A	154	ARG	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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å ²)	Q<0.9
4	SO4	B	606	5/5	0.93	0.17	1.75	87,88,88,89	0
4	SO4	A	604	5/5	0.91	0.16	1.28	75,77,78,79	0
3	8XV	A	602	35/35	0.97	0.13	0.15	12,18,23,26	21
4	SO4	A	605	5/5	0.96	0.12	-0.01	56,57,59,61	0
2	23E	B	601	47/47	0.91	0.10	-0.32	15,21,35,42	38
2	23E	A	601	47/47	0.93	0.10	-0.32	13,17,41,46	38
3	8XV	B	602	35/35	0.98	0.11	-0.40	16,19,32,33	21
4	SO4	A	603	5/5	0.93	0.17	-	63,64,64,66	0
4	SO4	B	604	5/5	0.87	0.23	-	101,101,102,102	0
4	SO4	B	605	5/5	0.67	0.29	-	112,112,114,114	0
4	SO4	B	603	5/5	0.93	0.16	-	97,98,98,98	0

6.5 Other polymers [i](#)

There are no such residues in this entry.