



wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 13, 2022 – 09:16 am GMT

PDB ID : 7OS0
Title : Structure of the Rhodobacter capsulatus Cas13a-crRNA binary complex
Authors : Kick, L.M.; Schneider, S.
Deposited on : 2021-06-07
Resolution : 2.20 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/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 : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.24
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0267
CCP4 : 7.1.010 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.24

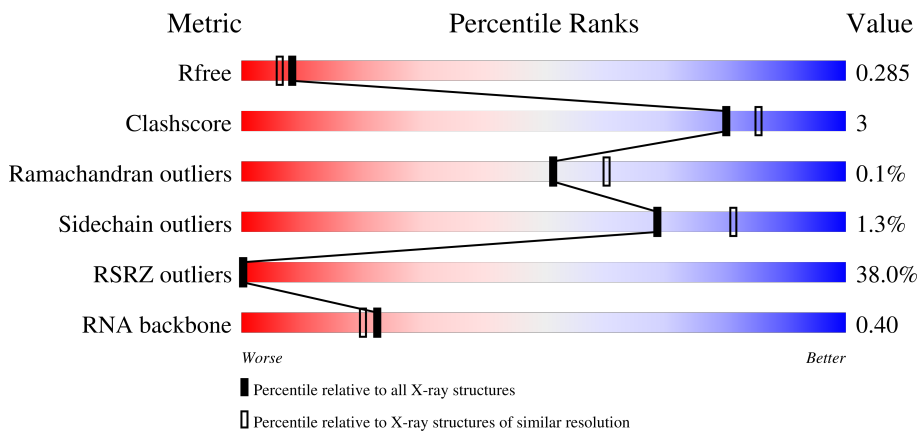
1 Overall quality at a glance

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}	130704	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)
RNA backbone	3102	1032 (2.60-1.80)

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	1304	<p>29% 81% 5% 13%</p>
1	C	1304	<p>37% 80% 6% 14%</p>
2	D	54	<p>26% 52% 31% 6% 11%</p>
2	F	54	<p>22% 48% 33% 7% 11%</p>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	EDO	A	1404	-	-	-	X
3	EDO	D	102	-	-	-	X

2 Entry composition i

There are 5 unique types of molecules in this entry. The entry contains 20467 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 Cas13a.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1130	8945	5629	1653	1633	30	0	8	0
1	C	1123	8850	5575	1634	1611	30	0	1	0

There are 38 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1286	GLU	-	expression tag	UNP D5AUW0
A	1287	ASN	-	expression tag	UNP D5AUW0
A	1288	LEU	-	expression tag	UNP D5AUW0
A	1289	TYR	-	expression tag	UNP D5AUW0
A	1290	PHE	-	expression tag	UNP D5AUW0
A	1291	GLN	-	expression tag	UNP D5AUW0
A	1292	LYS	-	expression tag	UNP D5AUW0
A	1293	LEU	-	expression tag	UNP D5AUW0
A	1294	ALA	-	expression tag	UNP D5AUW0
A	1295	ALA	-	expression tag	UNP D5AUW0
A	1296	ALA	-	expression tag	UNP D5AUW0
A	1297	LEU	-	expression tag	UNP D5AUW0
A	1298	GLU	-	expression tag	UNP D5AUW0
A	1299	HIS	-	expression tag	UNP D5AUW0
A	1300	HIS	-	expression tag	UNP D5AUW0
A	1301	HIS	-	expression tag	UNP D5AUW0
A	1302	HIS	-	expression tag	UNP D5AUW0
A	1303	HIS	-	expression tag	UNP D5AUW0
A	1304	HIS	-	expression tag	UNP D5AUW0
C	1286	GLU	-	expression tag	UNP D5AUW0
C	1287	ASN	-	expression tag	UNP D5AUW0
C	1288	LEU	-	expression tag	UNP D5AUW0
C	1289	TYR	-	expression tag	UNP D5AUW0
C	1290	PHE	-	expression tag	UNP D5AUW0
C	1291	GLN	-	expression tag	UNP D5AUW0

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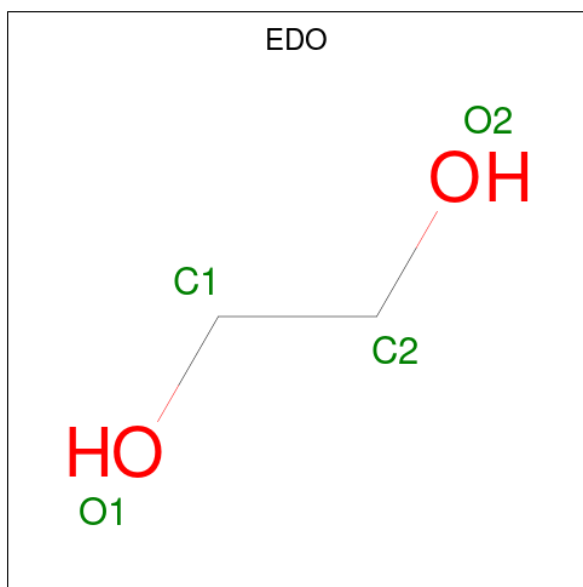
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Chain	Residue	Modelled	Actual	Comment	Reference
C	1292	LYS	-	expression tag	UNP D5AUW0
C	1293	LEU	-	expression tag	UNP D5AUW0
C	1294	ALA	-	expression tag	UNP D5AUW0
C	1295	ALA	-	expression tag	UNP D5AUW0
C	1296	ALA	-	expression tag	UNP D5AUW0
C	1297	LEU	-	expression tag	UNP D5AUW0
C	1298	GLU	-	expression tag	UNP D5AUW0
C	1299	HIS	-	expression tag	UNP D5AUW0
C	1300	HIS	-	expression tag	UNP D5AUW0
C	1301	HIS	-	expression tag	UNP D5AUW0
C	1302	HIS	-	expression tag	UNP D5AUW0
C	1303	HIS	-	expression tag	UNP D5AUW0
C	1304	HIS	-	expression tag	UNP D5AUW0

- Molecule 2 is a RNA chain called crRNA.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
2	D	48	Total	C	N	O	P	0	0	1
			993	444	172	330	47			
2	F	48	Total	C	N	O	P	0	0	1
			993	444	172	330	47			

- Molecule 3 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C₂H₆O₂).



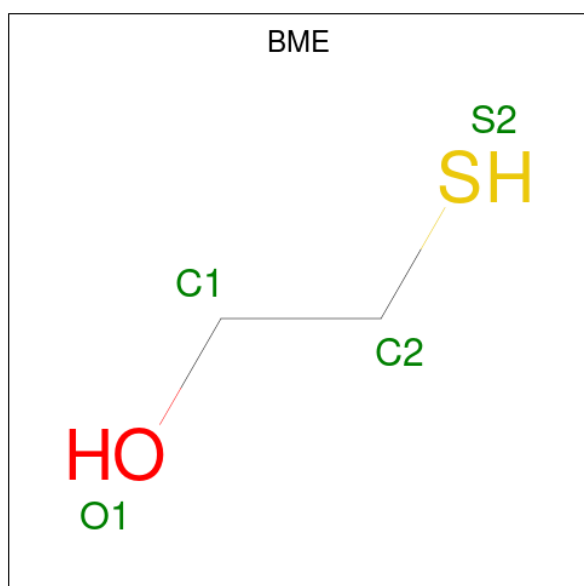
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	D	1	Total C O 4 2 2	0	0
3	D	1	Total C O 4 2 2	0	0
3	F	1	Total C O 4 2 2	0	0

- Molecule 4 is BETA-MERCAPTOETHANOL (three-letter code: BME) (formula: C₂H₆OS).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O S 4 2 1 1	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	C	1	Total	C	O	S	0	0
			4	2	1	1		
4	D	1	Total	C	O	S	0	0
			4	2	1	1		

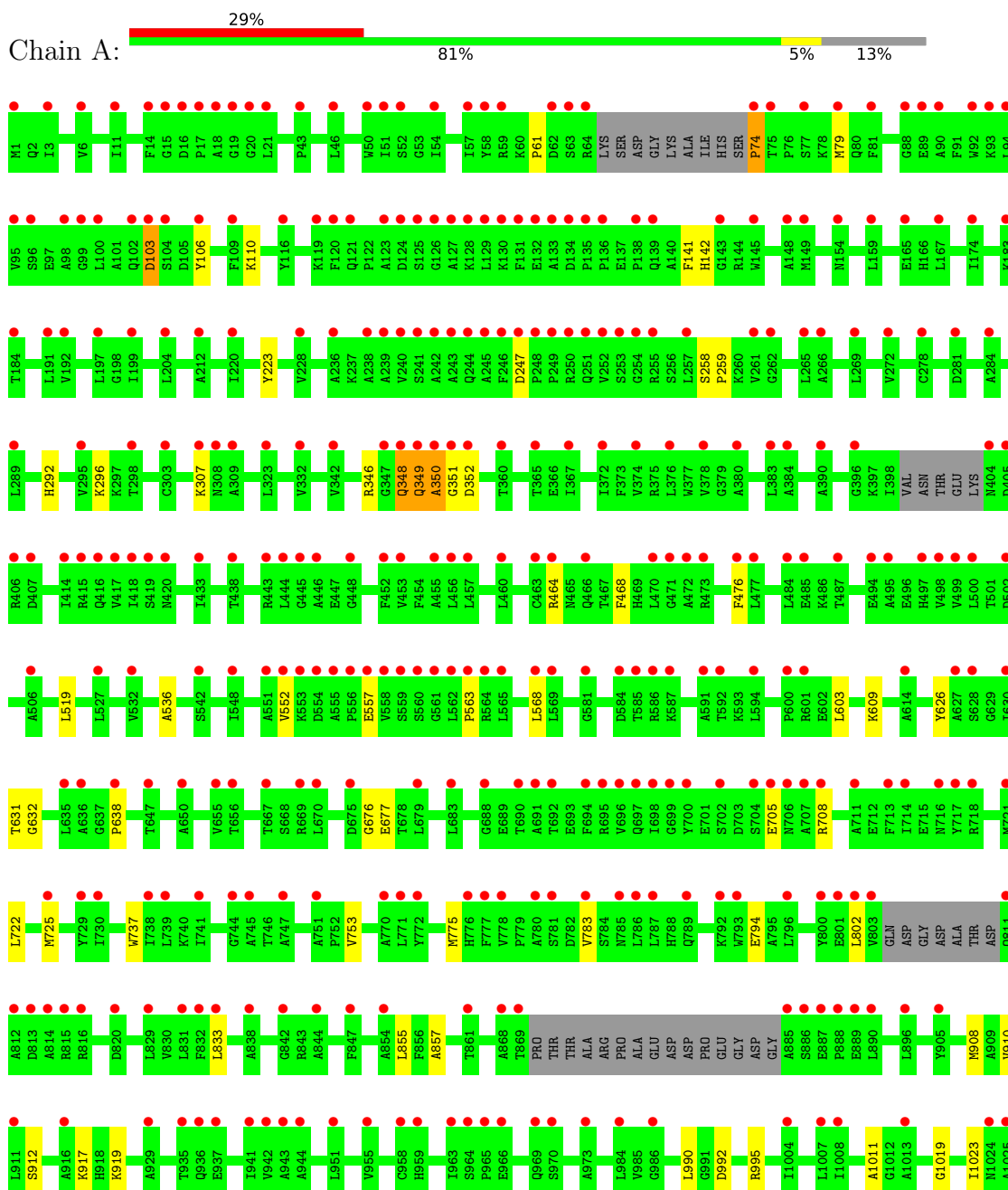
- Molecule 5 is water.

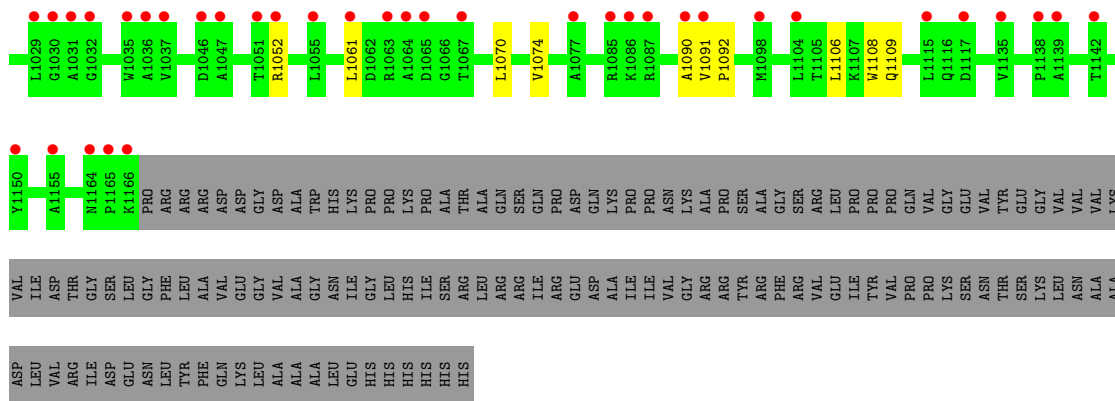
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	331	Total	O	0	0
			331	331		
5	C	177	Total	O	0	0
			177	177		
5	D	48	Total	O	0	0
			48	48		
5	F	74	Total	O	0	0
			74	74		

3 Residue-property plots [i](#)

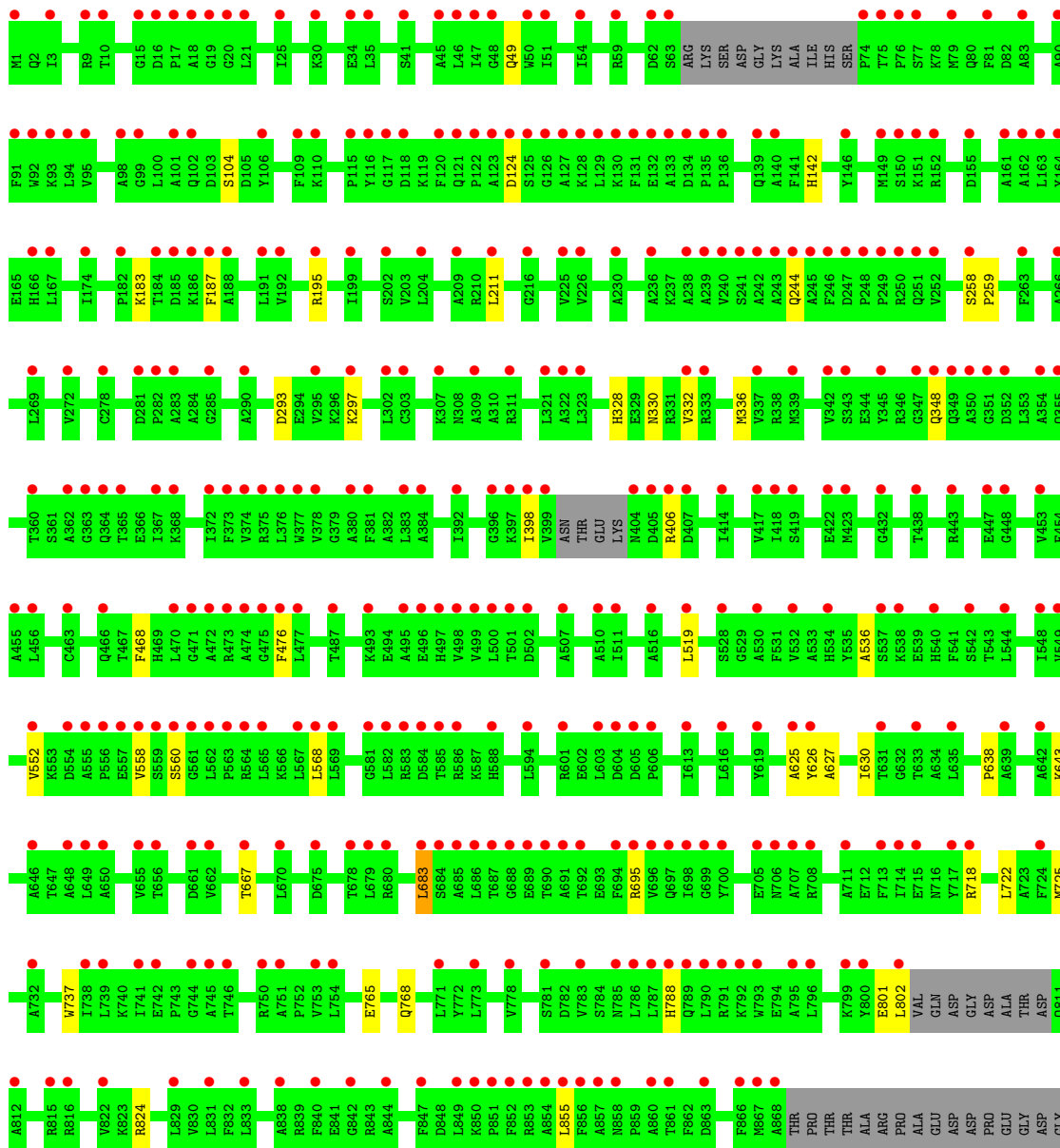
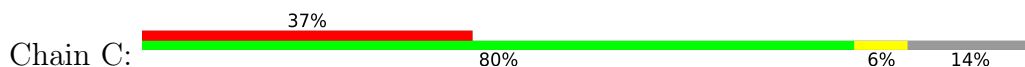
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Cas13a





● Molecule 1: Cas13a



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	61.39Å 91.08Å 136.51Å 89.99° 103.69° 97.65°	Depositor
Resolution (Å)	47.12 – 2.20 47.08 – 2.20	Depositor EDS
% Data completeness (in resolution range)	97.8 (47.12-2.20) 97.8 (47.08-2.20)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.49 (at 2.20Å)	Xtrriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.218 , 0.256 0.258 , 0.285	Depositor DCC
R_{free} test set	7063 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	41.1	Xtrriage
Anisotropy	0.541	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	(Not available) , (Not available)	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.000 for -h,-k,h+1	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	20467	wwPDB-VP
Average B, all atoms (Å ²)	91.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.98% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: BME, EDO

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	0.39	0/9130	0.57	0/12313
1	C	0.40	2/9028 (0.0%)	0.58	4/12174 (0.0%)
2	D	0.34	0/1107	0.77	0/1722
2	F	0.33	0/1107	0.76	0/1722
All	All	0.39	2/20372 (0.0%)	0.60	4/27931 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	718[A]	ARG	C-O	6.43	1.35	1.23
1	C	718[B]	ARG	C-O	6.43	1.35	1.23

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	718[A]	ARG	CA-C-O	5.99	132.67	120.10
1	C	718[B]	ARG	CA-C-O	5.99	132.67	120.10
1	C	718[A]	ARG	O-C-N	-5.04	114.63	122.70
1	C	718[B]	ARG	O-C-N	-5.04	114.63	122.70

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	8945	0	8995	44	0
1	C	8850	0	8909	54	0
2	D	993	0	507	5	0
2	F	993	0	507	5	0
3	A	16	0	24	0	0
3	C	16	0	24	0	0
3	D	8	0	12	0	0
3	F	4	0	6	0	0
4	A	4	0	6	0	0
4	C	4	0	6	0	0
4	D	4	0	6	0	0
5	A	331	0	0	1	0
5	C	177	0	0	0	0
5	D	48	0	0	0	0
5	F	74	0	0	0	0
All	All	20467	0	19002	104	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 3.

The worst 5 of 104 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:C:1060:VAL:HG11	1:C:1073:LEU:HD21	1.49	0.93
1:C:626:TYR:CE2	1:C:630:ILE:HD11	2.23	0.72
1:C:348:GLN:O	1:C:348:GLN:HG2	1.89	0.71
1:A:351[A]:GLY:O	1:A:352[A]:ASP:HB2	1.92	0.68
1:C:1014:TYR:HB2	1:C:1081:MET:HE1	1.77	0.67

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	1128/1304 (86%)	1106 (98%)	18 (2%)	4 (0%)	34	37
1	C	1112/1304 (85%)	1092 (98%)	20 (2%)	0	100	100
All	All	2240/2608 (86%)	2198 (98%)	38 (2%)	4 (0%)	51	55

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	350[A]	ALA
1	A	350[B]	ALA
1	A	349[A]	GLN
1	A	349[B]	GLN

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	910/1049 (87%)	897 (99%)	13 (1%)	67	80
1	C	901/1049 (86%)	888 (99%)	13 (1%)	67	80
All	All	1811/2098 (86%)	1785 (99%)	26 (1%)	69	80

5 of 26 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	124	ASP
1	C	187	PHE
1	C	1141	VAL
1	C	183	LYS
1	C	244	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	330	ASN
1	C	768	GLN

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Mol	Chain	Res	Type
1	C	1127	HIS
1	C	997	HIS
1	C	1075	ASN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	D	46/54 (85%)	14 (30%)	7 (15%)
2	F	46/54 (85%)	17 (36%)	8 (17%)
All	All	92/108 (85%)	31 (33%)	15 (16%)

5 of 31 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	D	10	C
2	D	11	A
2	D	17	A
2	D	21	C
2	D	22	G

5 of 15 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
2	F	17	A
2	F	44	A
2	F	18	A
2	F	50	G
2	F	38	U

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

14 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
3	EDO	C	1403	-	3,3,3	0.06	0	2,2,2	0.18	0
3	EDO	A	1403	-	3,3,3	0.05	0	2,2,2	0.19	0
3	EDO	C	1404	-	3,3,3	0.06	0	2,2,2	0.19	0
3	EDO	F	101	-	3,3,3	0.05	0	2,2,2	0.24	0
4	BME	D	103	-	3,3,3	0.15	0	1,2,2	0.08	0
3	EDO	D	102	-	3,3,3	0.06	0	2,2,2	0.18	0
4	BME	C	1405	-	3,3,3	0.14	0	1,2,2	0.12	0
3	EDO	D	101	-	3,3,3	0.05	0	2,2,2	0.18	0
4	BME	A	1405	-	3,3,3	0.14	0	1,2,2	0.00	0
3	EDO	A	1404	-	3,3,3	0.06	0	2,2,2	0.19	0
3	EDO	C	1402	-	3,3,3	0.07	0	2,2,2	0.19	0
3	EDO	A	1401	-	3,3,3	0.07	0	2,2,2	0.19	0
3	EDO	C	1401	-	3,3,3	0.07	0	2,2,2	0.28	0
3	EDO	A	1402	-	3,3,3	0.05	0	2,2,2	0.14	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
3	EDO	C	1403	-	-	1/1/1/1	-
3	EDO	A	1403	-	-	1/1/1/1	-
3	EDO	C	1404	-	-	0/1/1/1	-
3	EDO	F	101	-	-	1/1/1/1	-
4	BME	D	103	-	-	1/1/1/1	-
3	EDO	D	102	-	-	0/1/1/1	-
4	BME	C	1405	-	-	0/1/1/1	-
3	EDO	D	101	-	-	1/1/1/1	-
4	BME	A	1405	-	-	0/1/1/1	-
3	EDO	A	1404	-	-	1/1/1/1	-
3	EDO	C	1402	-	-	1/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	EDO	A	1401	-	-	0/1/1/1	-
3	EDO	C	1401	-	-	1/1/1/1	-
3	EDO	A	1402	-	-	0/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	D	103	BME	O1-C1-C2-S2
3	F	101	EDO	O1-C1-C2-O2
3	A	1404	EDO	O1-C1-C2-O2
3	C	1403	EDO	O1-C1-C2-O2
3	C	1401	EDO	O1-C1-C2-O2

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 [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, 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	1130/1304 (86%)	1.88	379 (33%) 0 0	54, 81, 132, 211	0
1	C	1123/1304 (86%)	2.18	487 (43%) 0 0	64, 95, 149, 206	0
2	D	48/54 (88%)	1.89	14 (29%) 0 0	54, 83, 178, 252	0
2	F	48/54 (88%)	1.48	12 (25%) 0 0	33, 48, 125, 164	0
All	All	2349/2716 (86%)	2.01	892 (37%) 0 0	33, 88, 146, 252	0

The worst 5 of 892 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	399	VAL	15.6
1	A	74	PRO	14.2
1	A	243	ALA	11.8
1	A	802	LEU	10.8
1	A	125	SER	10.8

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](#)

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(\AA^2)	Q<0.9
3	EDO	C	1403	4/4	0.47	0.33	78,78,80,82	0
3	EDO	D	102	4/4	0.56	0.50	67,74,77,80	0
3	EDO	A	1404	4/4	0.61	0.41	85,85,89,92	0
3	EDO	A	1402	4/4	0.69	0.24	63,64,69,70	0
3	EDO	C	1401	4/4	0.76	0.31	51,52,56,59	0
3	EDO	C	1402	4/4	0.80	0.19	61,66,68,69	0
4	BME	C	1405	4/4	0.80	0.24	95,96,96,96	0
3	EDO	A	1401	4/4	0.82	0.22	52,52,53,55	0
3	EDO	A	1403	4/4	0.90	0.18	64,70,71,75	0
3	EDO	F	101	4/4	0.91	0.26	43,45,45,46	0
3	EDO	D	101	4/4	0.91	0.29	49,50,52,52	0
4	BME	D	103	4/4	0.91	0.23	68,68,73,74	0
3	EDO	C	1404	4/4	0.93	0.24	68,68,70,71	0
4	BME	A	1405	4/4	0.94	0.17	74,76,76,81	0

6.5 Other polymers [i](#)

There are no such residues in this entry.