



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 04:14 PM UTC

PDB ID : 4XBZ / pdb_00004xbz
Title : Crystal Structure of EvdO1 from *Micromonospora carbonacea* var. *aurantiaca*
Authors : McCulloch, K.M.; McCranie, E.K.; Sarwar, M.; Mathieu, J.L.; Gitschlag, B.L.;
Du, Y.; Bachmann, B.O.; Iverson, T.M.
Deposited on : 2014-12-17
Resolution : 2.30 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 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

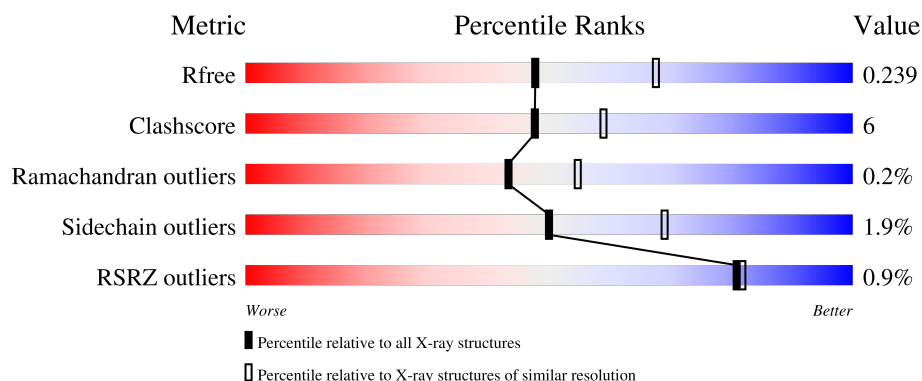
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	334	2% 78% 14% 7%
1	B	334	2% 74% 11% 14%
1	C	334	81% 14% 5%
1	D	334	2% 78% 9% 13%
1	E	334	2% 70% 14% 15%

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Mol	Chain	Length	Quality of chain
1	F	334	83%9%7%
1	G	334	% 73%14%13%
1	H	334	% 81%12%7%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 20394 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 EvdO1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	312	Total	C	N	O	S	0	0	0
			2467	1560	442	454	11			
1	B	286	Total	C	N	O	S	0	0	0
			2270	1436	406	418	10			
1	C	317	Total	C	N	O	S	8	0	0
			2495	1573	451	460	11			
1	D	290	Total	C	N	O	S	0	0	0
			2320	1470	414	426	10			
1	E	283	Total	C	N	O	S	1	0	0
			2254	1428	405	411	10			
1	F	309	Total	C	N	O	S	2	0	0
			2449	1549	439	450	11			
1	G	292	Total	C	N	O	S	1	0	0
			2313	1462	414	427	10			
1	H	312	Total	C	N	O	S	0	0	0
			2449	1549	438	451	11			

- Molecule 2 is NICKEL (II) ION (CCD ID: NI) (formula: Ni).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Ni	0	0
			1	1		
2	B	1	Total	Ni	0	0
			1	1		
2	C	1	Total	Ni	0	0
			1	1		
2	D	1	Total	Ni	0	0
			1	1		
2	E	1	Total	Ni	0	0
			1	1		
2	F	1	Total	Ni	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	G	1	Total	Ni	0	0
			1	1		
2	H	1	Total	Ni	0	0
			1	1		

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		
3	E	1	Total	C	O	0	0
			6	3	3		
3	G	1	Total	C	O	0	0
			6	3	3		
3	H	1	Total	C	O	0	0
			6	3	3		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	163	Total	O	0	0
			163	163		

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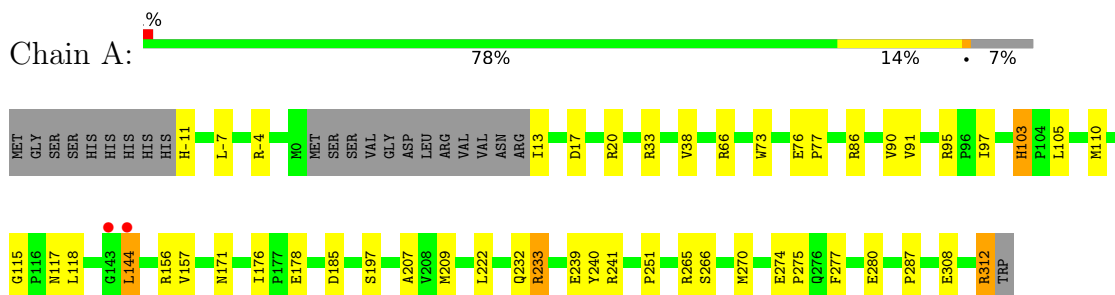
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	134	Total 134	O 134	0	0
4	C	209	Total 209	O 209	0	0
4	D	165	Total 165	O 165	0	0
4	E	168	Total 168	O 168	0	0
4	F	178	Total 178	O 178	0	0
4	G	168	Total 168	O 168	0	0
4	H	148	Total 148	O 148	0	0

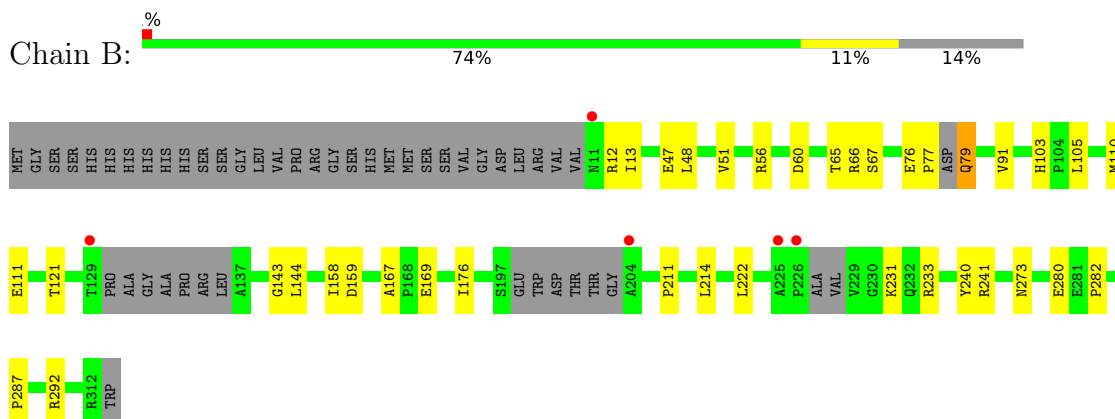
3 Residue-property plots [i](#)

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.

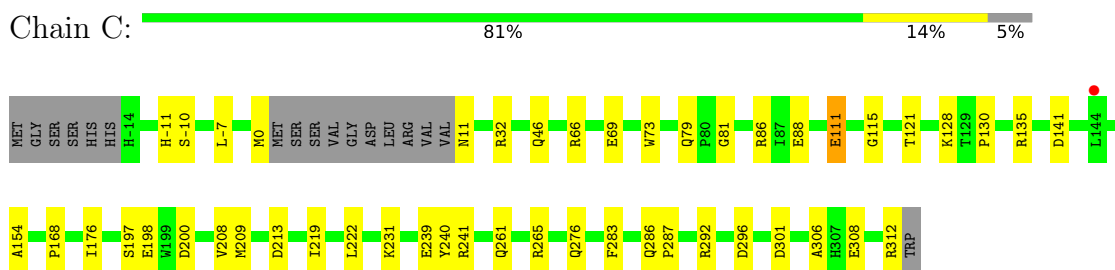
• Molecule 1: EvdO1



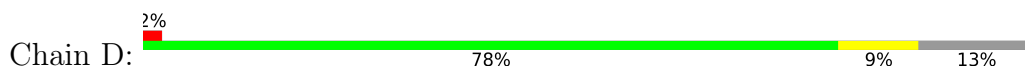
• Molecule 1: EvdO1

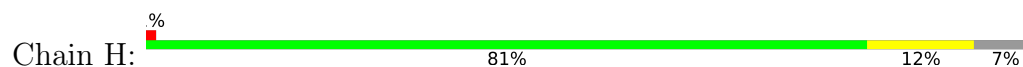


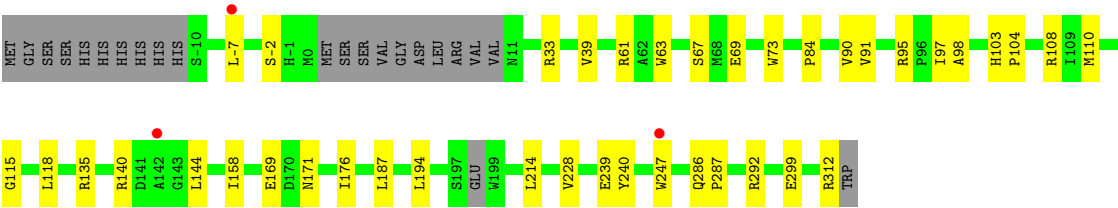
• Molecule 1: EvdO1



• Molecule 1: EvdO1







4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	91.61Å 109.43Å 146.05Å 90.00° 108.27° 90.00°	Depositor
Resolution (Å)	46.32 – 2.30 46.32 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.4 (46.32-2.30) 99.5 (46.32-2.30)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.49 (at 2.29Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.183 , 0.237 0.185 , 0.239	Depositor DCC
R_{free} test set	6081 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	31.5	Xtriage
Anisotropy	0.608	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 39.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.017 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	20394	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 17.22% 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: GOL, NI

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	0.51	0/2534	0.88	6/3461 (0.2%)
1	B	0.48	0/2327	0.80	0/3171
1	C	0.55	0/2564	0.86	2/3500 (0.1%)
1	D	0.51	0/2379	0.83	2/3244 (0.1%)
1	E	0.52	0/2311	0.82	2/3149 (0.1%)
1	F	0.51	0/2514	0.83	3/3431 (0.1%)
1	G	0.54	0/2370	0.85	6/3232 (0.2%)
1	H	0.52	0/2514	0.86	6/3432 (0.2%)
All	All	0.52	0/19513	0.84	27/26620 (0.1%)

There are no bond length outliers.

The worst 5 of 27 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	95	ARG	CA-C-N	-8.45	111.03	119.56
1	G	95	ARG	C-N-CA	-8.45	111.03	119.56
1	C	115	GLY	CA-C-N	8.17	127.90	119.56
1	C	115	GLY	C-N-CA	8.17	127.90	119.56
1	H	95	ARG	CA-C-N	-7.06	112.43	119.56

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	2467	0	2399	35	0
1	B	2270	0	2193	21	0
1	C	2495	0	2395	31	0
1	D	2320	0	2250	25	0
1	E	2254	0	2189	35	0
1	F	2449	0	2379	17	0
1	G	2313	0	2242	28	0
1	H	2449	0	2374	23	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
2	G	1	0	0	0	0
2	H	1	0	0	0	0
3	A	6	0	8	0	0
3	B	6	0	8	0	0
3	C	6	0	7	0	0
3	E	6	0	8	0	0
3	G	6	0	8	0	0
3	H	6	0	8	0	0
4	A	163	0	0	12	0
4	B	134	0	0	6	0
4	C	209	0	0	7	0
4	D	165	0	0	14	1
4	E	168	0	0	12	1
4	F	178	0	0	8	1
4	G	168	0	0	7	1
4	H	148	0	0	5	0
All	All	20394	0	18468	209	2

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 6.

The worst 5 of 209 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:280:GLU:O	4:A:501:HOH:O	1.84	0.96
1:B:169:GLU:OE2	4:B:501:HOH:O	1.85	0.94
1:E:255:GLU:OE1	4:E:501:HOH:O	1.86	0.92
1:F:312:ARG:O	4:F:501:HOH:O	1.87	0.91

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:86:ARG:NH1	4:A:503:HOH:O	2.09	0.84

All (2) 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)
4:E:667:HOH:O	4:F:673:HOH:O[2_655]	1.92	0.28
4:D:655:HOH:O	4:G:668:HOH:O[1_545]	2.17	0.03

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	308/334 (92%)	298 (97%)	10 (3%)	0	100	100
1	B	276/334 (83%)	263 (95%)	12 (4%)	1 (0%)	30	38
1	C	313/334 (94%)	301 (96%)	12 (4%)	0	100	100
1	D	280/334 (84%)	270 (96%)	10 (4%)	0	100	100
1	E	273/334 (82%)	264 (97%)	9 (3%)	0	100	100
1	F	301/334 (90%)	290 (96%)	10 (3%)	1 (0%)	36	46
1	G	284/334 (85%)	271 (95%)	11 (4%)	2 (1%)	18	23
1	H	306/334 (92%)	292 (95%)	14 (5%)	0	100	100
All	All	2341/2672 (88%)	2249 (96%)	88 (4%)	4 (0%)	43	55

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	66	ARG
1	G	198	GLU
1	G	199	TRP

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Mol	Chain	Res	Type
1	F	-10	SER

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	258/278 (93%)	250 (97%)	8 (3%)	35	52
1	B	236/278 (85%)	230 (98%)	6 (2%)	42	60
1	C	259/278 (93%)	255 (98%)	4 (2%)	57	75
1	D	243/278 (87%)	241 (99%)	2 (1%)	73	86
1	E	234/278 (84%)	230 (98%)	4 (2%)	53	72
1	F	256/278 (92%)	251 (98%)	5 (2%)	48	67
1	G	241/278 (87%)	237 (98%)	4 (2%)	53	72
1	H	255/278 (92%)	251 (98%)	4 (2%)	55	73
All	All	1982/2224 (89%)	1945 (98%)	37 (2%)	50	69

5 of 37 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	229	VAL
1	H	135	ARG
1	G	159	ASP
1	G	198	GLU
1	B	214	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	276	GLN
1	F	269	GLN
1	D	147	ASN
1	E	273	ASN

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Mol	Chain	Res	Type
1	D	112	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 14 ligands modelled in this entry, 8 are monoatomic - leaving 6 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	$\# Z > 2$
3	GOL	G	402	2	5,5,5	0.31	0	5,5,5	0.49	0
3	GOL	E	402	2	5,5,5	0.22	0	5,5,5	0.40	0
3	GOL	B	402	2	5,5,5	0.33	0	5,5,5	0.19	0
3	GOL	H	402	-	5,5,5	0.31	0	5,5,5	0.35	0
3	GOL	C	402	2	5,5,5	0.21	0	5,5,5	0.45	0
3	GOL	A	402	2	5,5,5	0.29	0	5,5,5	0.55	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	GOL	G	402	2	-	0/4/4/4	-
3	GOL	E	402	2	-	1/4/4/4	-
3	GOL	B	402	2	-	0/4/4/4	-
3	GOL	H	402	-	-	0/4/4/4	-
3	GOL	C	402	2	-	1/4/4/4	-
3	GOL	A	402	2	-	1/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	402	GOL	O2-C2-C3-O3
3	E	402	GOL	O1-C1-C2-O2
3	C	402	GOL	O2-C2-C3-O3

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	312/334 (93%)	-0.16	2 (0%) 85 86	23, 33, 50, 60	0
1	B	286/334 (85%)	0.04	5 (1%) 69 70	24, 37, 58, 74	0
1	C	315/334 (94%)	-0.18	1 (0%) 90 90	19, 30, 50, 67	0
1	D	290/334 (86%)	-0.12	6 (2%) 63 65	20, 33, 52, 62	0
1	E	283/334 (84%)	-0.14	3 (1%) 78 79	20, 32, 49, 69	1 (0%)
1	F	309/334 (92%)	-0.06	0 100 100	21, 34, 53, 70	1 (0%)
1	G	292/334 (87%)	-0.12	2 (0%) 84 85	20, 32, 50, 64	0
1	H	312/334 (93%)	-0.00	3 (0%) 79 80	23, 35, 52, 62	0
All	All	2399/2672 (89%)	-0.09	22 (0%) 81 82	19, 33, 52, 74	2 (0%)

The worst 5 of 22 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	142	ALA	8.7
1	G	228	VAL	2.9
1	C	144	LEU	2.9
1	G	199	TRP	2.7
1	A	144	LEU	2.6

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands

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
3	GOL	A	402	6/6	0.83	0.13	36,39,41,43	0
3	GOL	H	402	6/6	0.85	0.13	41,48,50,56	0
3	GOL	E	402	6/6	0.86	0.11	39,40,46,47	0
3	GOL	C	402	6/6	0.86	0.11	36,41,45,48	0
3	GOL	G	402	6/6	0.89	0.10	31,37,41,42	0
3	GOL	B	402	6/6	0.90	0.12	35,39,41,43	0
2	NI	D	401	1/1	0.96	0.05	64,64,64,64	0
2	NI	F	401	1/1	0.97	0.04	56,56,56,56	0
2	NI	G	401	1/1	0.97	0.04	51,51,51,51	0
2	NI	B	401	1/1	0.98	0.04	53,53,53,53	0
2	NI	E	401	1/1	0.98	0.04	52,52,52,52	0
2	NI	A	401	1/1	0.99	0.04	49,49,49,49	0
2	NI	C	401	1/1	0.99	0.02	49,49,49,49	0
2	NI	H	401	1/1	0.99	0.03	55,55,55,55	0

6.5 Other polymers

There are no such residues in this entry.