



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 01:28 PM UTC

PDB ID : 2ZUW / pdb_00002zuw
Title : Crystal structure of Galacto-N-biose/Lacto-N-biose I phosphorylase in complex with GlcNAc and sulfate
Authors : Hidaka, M.; Nishimoto, M.; Kitaoka, M.; Wakagi, T.; Shoun, H.; Fushinobu, S.
Deposited on : 2008-10-28
Resolution : 2.11 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

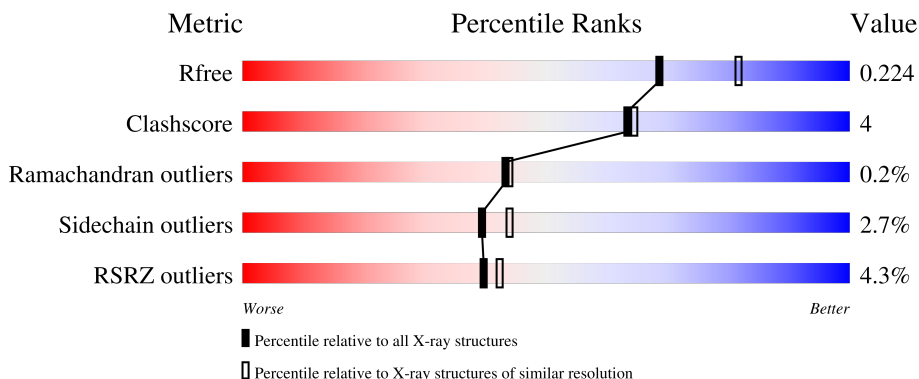
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.11 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	8290 (2.14-2.10)
Clashscore	190562	8817 (2.14-2.10)
Ramachandran outliers	187476	8738 (2.14-2.10)
Sidechain outliers	187428	8739 (2.14-2.10)
RSRZ outliers	180081	8294 (2.14-2.10)

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	759	
1	B	759	
1	C	759	
1	D	759	

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 25782 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 Lacto-N-biose phosphorylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	745	Total	C	N	O	S	0	0	0
			5926	3782	995	1133	16			
1	B	734	Total	C	N	O	S	0	0	0
			5833	3723	983	1111	16			
1	C	748	Total	C	N	O	S	0	0	0
			5950	3795	1000	1139	16			
1	D	713	Total	C	N	O	S	0	0	0
			5686	3635	957	1078	16			

There are 32 discrepancies between the modelled and reference sequences:

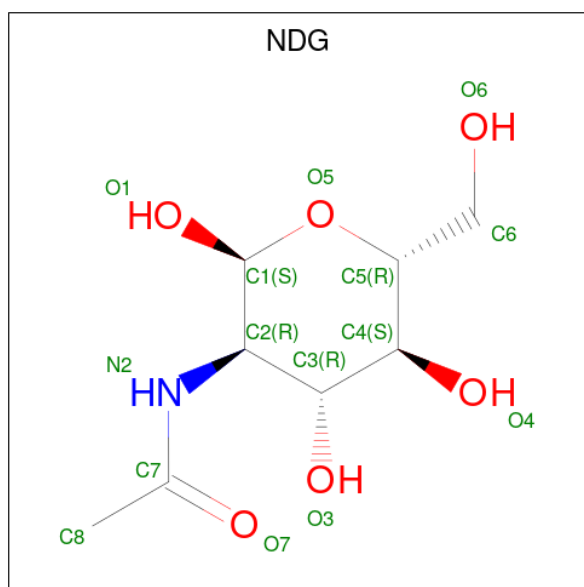
Chain	Residue	Modelled	Actual	Comment	Reference
A	752	LEU	-	expression tag	UNP Q5NU17
A	753	GLU	-	expression tag	UNP Q5NU17
A	754	HIS	-	expression tag	UNP Q5NU17
A	755	HIS	-	expression tag	UNP Q5NU17
A	756	HIS	-	expression tag	UNP Q5NU17
A	757	HIS	-	expression tag	UNP Q5NU17
A	758	HIS	-	expression tag	UNP Q5NU17
A	759	HIS	-	expression tag	UNP Q5NU17
B	752	LEU	-	expression tag	UNP Q5NU17
B	753	GLU	-	expression tag	UNP Q5NU17
B	754	HIS	-	expression tag	UNP Q5NU17
B	755	HIS	-	expression tag	UNP Q5NU17
B	756	HIS	-	expression tag	UNP Q5NU17
B	757	HIS	-	expression tag	UNP Q5NU17
B	758	HIS	-	expression tag	UNP Q5NU17
B	759	HIS	-	expression tag	UNP Q5NU17
C	752	LEU	-	expression tag	UNP Q5NU17
C	753	GLU	-	expression tag	UNP Q5NU17
C	754	HIS	-	expression tag	UNP Q5NU17
C	755	HIS	-	expression tag	UNP Q5NU17
C	756	HIS	-	expression tag	UNP Q5NU17

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Chain	Residue	Modelled	Actual	Comment	Reference
C	757	HIS	-	expression tag	UNP Q5NU17
C	758	HIS	-	expression tag	UNP Q5NU17
C	759	HIS	-	expression tag	UNP Q5NU17
D	752	LEU	-	expression tag	UNP Q5NU17
D	753	GLU	-	expression tag	UNP Q5NU17
D	754	HIS	-	expression tag	UNP Q5NU17
D	755	HIS	-	expression tag	UNP Q5NU17
D	756	HIS	-	expression tag	UNP Q5NU17
D	757	HIS	-	expression tag	UNP Q5NU17
D	758	HIS	-	expression tag	UNP Q5NU17
D	759	HIS	-	expression tag	UNP Q5NU17

- Molecule 2 is 2-acetamido-2-deoxy- α -D-glucopyranose (CCD ID: NDG) (formula: $C_8H_{15}NO_6$).



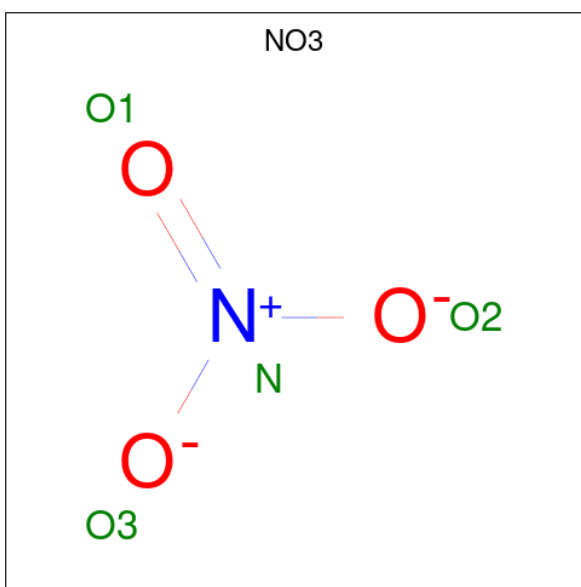
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			15	8	1	6		
2	B	1	Total	C	N	O	0	0
			15	8	1	6		
2	C	1	Total	C	N	O	0	0
			15	8	1	6		
2	D	1	Total	C	N	O	0	0
			15	8	1	6		

- 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	C	1	Total	C	O	0	0
			6	3	3		
3	D	1	Total	C	O	0	0
			6	3	3		
3	D	1	Total	C	O	0	0
			6	3	3		

- Molecule 4 is NITRATE ION (CCD ID: NO3) (formula: NO₃).

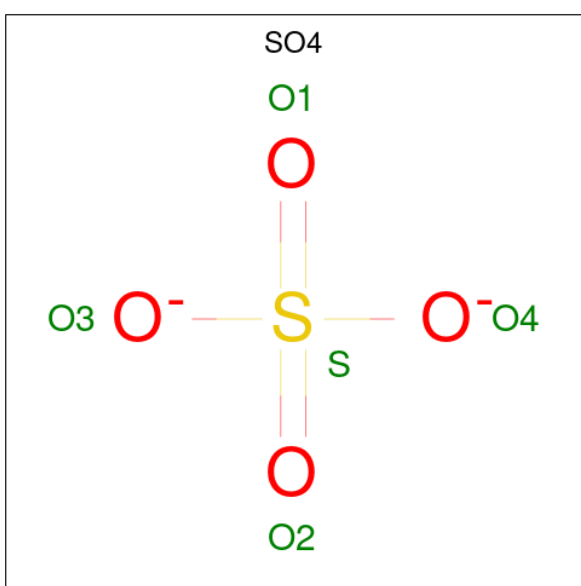


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	N	O	0	0
			4	1	3		

- Molecule 5 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	1	Total	Mg	0	0
			1	1		

- Molecule 6 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	D	1	Total	O	S	0	0
			5	4	1		

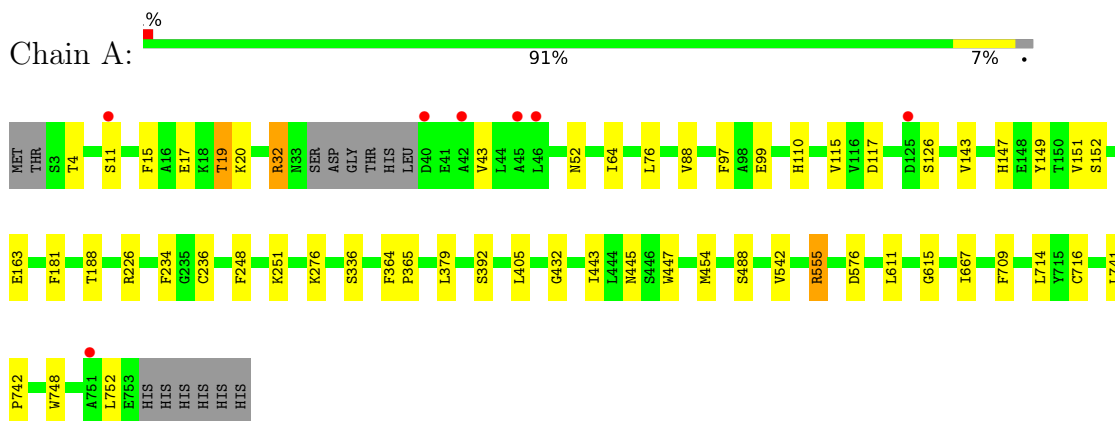
- Molecule 7 is water.

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	627	Total	O		0	0
			627	627			
7	B	533	Total	O		2	0
			533	533			
7	C	601	Total	O		1	0
			601	601			
7	D	520	Total	O		0	0
			520	520			

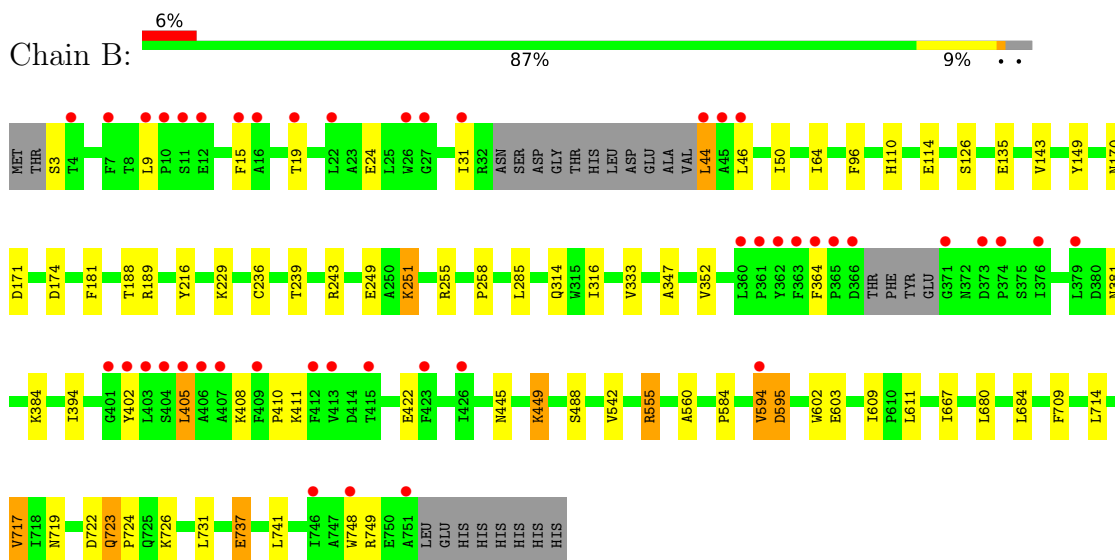
3 Residue-property plots [i](#)

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.

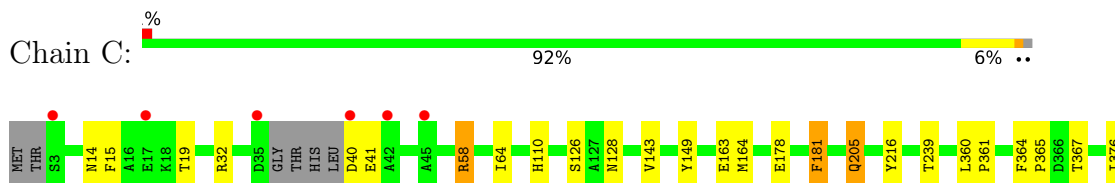
- Molecule 1: Lacto-N-biose phosphorylase



- Molecule 1: Lacto-N-biose phosphorylase

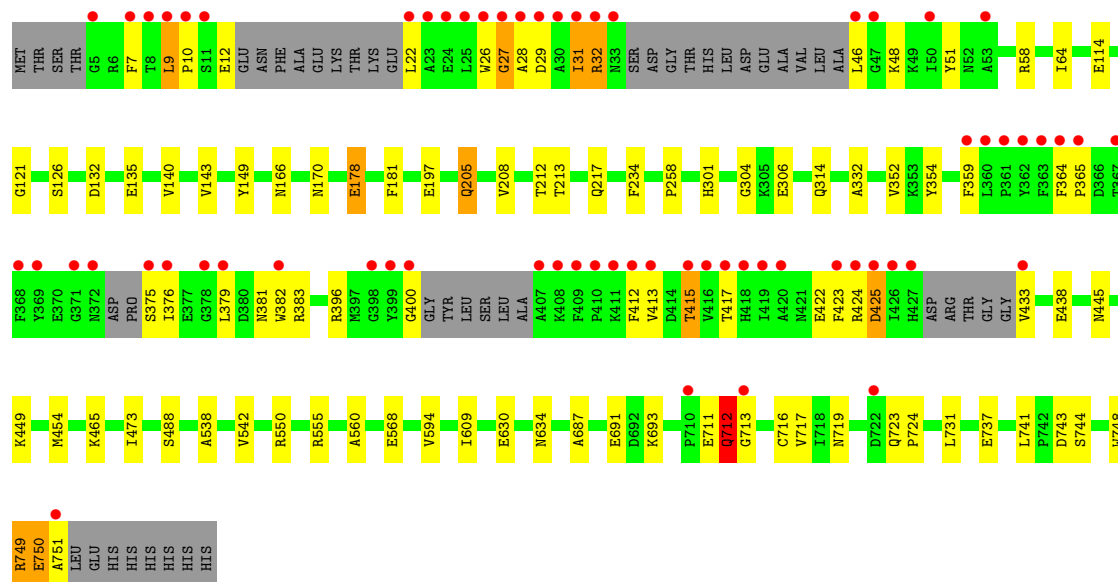
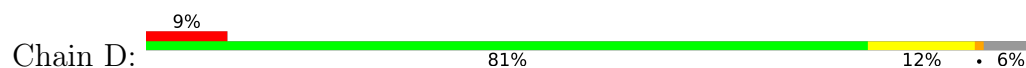


- Molecule 1: Lacto-N-biose phosphorylase





● Molecule 1: Lacto-N-biose phosphorylase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	67.91Å 112.04Å 118.66Å 105.21° 90.43° 107.32°	Depositor
Resolution (Å)	41.07 – 2.11 41.07 – 2.11	Depositor EDS
% Data completeness (in resolution range)	97.4 (41.07-2.11) 97.3 (41.07-2.11)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.66 (at 2.12Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.169 , 0.225 0.169 , 0.224	Depositor DCC
R_{free} test set	8997 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	22.2	Xtriage
Anisotropy	0.020	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 44.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.025 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	25782	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.53% 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: GOL, NDG, MG, SO4, NO3

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	0.76	1/6093 (0.0%)	0.84	2/8299 (0.0%)
1	B	0.69	0/5997	0.83	0/8166
1	C	0.75	1/6118 (0.0%)	0.84	0/8333
1	D	0.75	1/5846 (0.0%)	0.87	4/7958 (0.1%)
All	All	0.74	3/24054 (0.0%)	0.84	6/32756 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	415	THR	CA-CB	6.14	1.62	1.53
1	C	647	ALA	CA-CB	5.91	1.57	1.53
1	A	88	VAL	CA-CB	5.45	1.61	1.55

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	750	GLU	N-CA-C	7.44	120.84	111.69
1	D	32	ARG	N-CA-C	5.80	117.08	108.60
1	A	392	SER	CA-C-N	5.46	125.39	119.76
1	A	392	SER	C-N-CA	5.46	125.39	119.76
1	D	352	VAL	N-CA-C	5.39	116.66	108.80
1	D	415	THR	CB-CA-C	5.27	119.53	110.79

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	5926	0	5615	31	0
1	B	5833	0	5536	53	0
1	C	5950	0	5631	33	0
1	D	5686	0	5386	66	0
2	A	15	0	12	0	0
2	B	15	0	12	0	0
2	C	15	0	12	0	0
2	D	15	0	12	0	0
3	A	6	0	8	1	0
3	B	6	0	8	2	0
3	C	12	0	16	0	0
3	D	12	0	16	1	0
4	A	4	0	0	0	0
5	B	1	0	0	0	0
6	D	5	0	0	0	0
7	A	627	0	0	7	0
7	B	533	0	0	12	0
7	C	601	0	0	7	0
7	D	520	0	0	11	0
All	All	25782	0	22264	182	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 4.

All (182) 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:D:359:PHE:HD1	7:D:831:HOH:O	1.37	1.04
1:B:251:LYS:HE2	7:B:961:HOH:O	1.58	1.00
1:C:691:GLU:HG2	7:C:964:HOH:O	1.67	0.93
1:D:412:PHE:HA	1:D:415:THR:HG22	1.52	0.92
1:D:121:GLY:O	3:D:4010:GOL:H12	1.69	0.91
1:B:449:LYS:HB3	3:B:4006:GOL:H32	1.56	0.86
1:A:110:HIS:HD2	1:A:126:SER:HB2	1.41	0.83
1:A:20:LYS:HE2	7:A:2060:HOH:O	1.77	0.83

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:110:HIS:HD2	1:B:126:SER:HB2	1.42	0.82
1:D:412:PHE:HA	1:D:415:THR:CG2	2.10	0.81
1:C:15:PHE:O	1:C:19:THR:HG23	1.83	0.77
1:D:7:PHE:HB2	7:D:1375:HOH:O	1.83	0.77
1:C:163:GLU:HG2	7:C:1001:HOH:O	1.86	0.73
1:B:46:LEU:HD12	7:B:1962:HOH:O	1.88	0.73
1:B:737:GLU:HG2	7:B:2233:HOH:O	1.89	0.71
1:B:381:ASN:HA	1:B:384:LYS:CE	2.20	0.71
1:D:26:TRP:O	1:D:28:ALA:N	2.24	0.70
1:D:32:ARG:HB3	1:D:51:TYR:HB2	1.74	0.70
1:D:711:GLU:C	1:D:713:GLY:H	1.99	0.70
1:B:44:LEU:N	7:B:1962:HOH:O	2.25	0.69
1:B:722:ASP:OD1	1:B:723:GLN:NE2	2.26	0.69
1:C:110:HIS:HD2	1:C:126:SER:HB2	1.56	0.69
1:D:375:SER:CB	1:D:415:THR:HG21	2.22	0.68
1:A:110:HIS:CD2	1:A:126:SER:HB2	2.27	0.66
1:B:594:VAL:HG23	1:B:595:ASP:H	1.60	0.66
1:D:691:GLU:HG2	7:D:1234:HOH:O	1.98	0.64
1:B:249:GLU:OE1	1:B:255:ARG:NH1	2.31	0.63
1:B:64:ILE:HD13	1:B:181:PHE:HB3	1.78	0.63
1:B:236:CYS:HB3	1:B:316:ILE:HG21	1.79	0.63
1:B:555:ARG:HD2	7:B:1757:HOH:O	1.98	0.63
1:D:400:GLY:C	7:D:894:HOH:O	2.40	0.63
1:B:110:HIS:CD2	1:B:126:SER:HB2	2.30	0.63
1:A:709:PHE:HB2	1:A:714:LEU:HD12	1.82	0.62
1:D:412:PHE:CA	1:D:415:THR:HG22	2.27	0.62
1:D:724:PRO:HA	1:D:741:LEU:O	2.00	0.61
1:B:717:VAL:HG22	1:B:741:LEU:HD11	1.83	0.61
1:A:17:GLU:HA	1:A:17:GLU:OE2	2.01	0.61
1:D:731:LEU:HD11	1:D:737:GLU:HG3	1.82	0.61
1:B:381:ASN:HA	1:B:384:LYS:HE2	1.82	0.60
1:D:140:VAL:HG12	1:D:143:VAL:CG1	2.31	0.60
1:D:375:SER:HB3	1:D:415:THR:HG21	1.82	0.60
1:C:110:HIS:CD2	1:C:126:SER:HB2	2.37	0.60
1:B:381:ASN:HA	1:B:384:LYS:HE3	1.83	0.59
1:D:29:ASP:HB3	1:D:396:ARG:HH22	1.66	0.59
1:D:26:TRP:O	1:D:27:GLY:C	2.45	0.58
1:C:376:ILE:HD12	7:C:1002:HOH:O	2.02	0.58
1:D:48:LYS:HB2	7:D:811:HOH:O	2.03	0.58
1:D:750:GLU:O	1:D:751:ALA:C	2.44	0.58
1:C:380:ASP:HB3	1:C:383:ARG:NH2	2.19	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:609:ILE:HD12	1:B:609:ILE:N	2.18	0.57
1:A:15:PHE:O	1:A:19:THR:HG23	2.04	0.57
1:C:205:GLN:H	1:C:205:GLN:CD	2.11	0.57
1:A:64:ILE:HD13	1:A:181:PHE:HB3	1.87	0.57
1:D:413:VAL:CG2	7:D:2109:HOH:O	2.53	0.57
1:D:413:VAL:HG23	7:D:2109:HOH:O	2.05	0.57
1:B:449:LYS:CB	3:B:4006:GOL:H32	2.32	0.56
1:C:364:PHE:CD2	1:C:365:PRO:HD2	2.40	0.56
1:D:205:GLN:H	1:D:205:GLN:CD	2.13	0.56
1:B:251:LYS:CE	7:B:961:HOH:O	2.34	0.56
1:D:64:ILE:HD13	1:D:181:PHE:HB3	1.88	0.56
1:A:143:VAL:HB	1:A:149:TYR:OH	2.06	0.55
1:A:447:TRP:O	3:A:4005:GOL:H31	2.07	0.55
1:A:181:PHE:HB2	1:A:188:THR:HG21	1.89	0.55
1:B:719:ASN:ND2	1:B:723:GLN:O	2.36	0.55
1:C:511:ASP:OD2	1:D:550:ARG:HD3	2.07	0.54
1:C:19:THR:HG22	1:C:403:LEU:HD23	1.90	0.53
1:C:64:ILE:HD13	1:C:181:PHE:HB3	1.91	0.53
1:D:473:ILE:HD11	1:D:542:VAL:HG11	1.89	0.53
1:C:542:VAL:HA	1:C:667:ILE:O	2.09	0.53
1:D:58:ARG:HD2	1:D:178:GLU:HG2	1.90	0.53
1:D:140:VAL:HG12	1:D:143:VAL:HG11	1.90	0.53
1:D:379:LEU:HG	1:D:383:ARG:HH12	1.74	0.52
1:B:15:PHE:O	1:B:19:THR:HG23	2.08	0.52
1:B:9:LEU:O	1:B:31:ILE:HA	2.09	0.52
1:C:32:ARG:HD3	7:C:1575:HOH:O	2.10	0.52
1:C:364:PHE:CG	1:C:365:PRO:HD2	2.45	0.52
1:D:445:ASN:O	1:D:488:SER:HA	2.10	0.52
1:D:438:GLU:HB3	1:D:693:LYS:NZ	2.24	0.51
1:A:234:PHE:CZ	1:A:454:MET:HB3	2.46	0.51
1:B:555:ARG:HD3	1:B:560:ALA:HB3	1.93	0.51
1:B:609:ILE:HD11	7:B:1404:HOH:O	2.11	0.51
1:A:32:ARG:HD3	7:A:887:HOH:O	2.10	0.50
1:D:422:GLU:HA	1:D:425:ASP:OD2	2.11	0.50
1:A:110:HIS:HE1	7:A:807:HOH:O	1.95	0.49
1:B:709:PHE:HB2	1:B:714:LEU:HD12	1.94	0.49
1:A:445:ASN:O	1:A:488:SER:HA	2.11	0.49
1:C:205:GLN:HB3	7:C:919:HOH:O	2.13	0.49
1:D:9:LEU:HA	7:D:1809:HOH:O	2.12	0.49
1:D:31:ILE:HG13	1:D:32:ARG:N	2.27	0.49
1:C:584:PRO:HD2	7:C:901:HOH:O	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:711:GLU:C	1:D:713:GLY:N	2.65	0.48
1:B:402:TYR:HB2	1:B:405:LEU:HD13	1.95	0.48
1:A:97:PHE:CE1	1:A:226:ARG:HD2	2.49	0.48
1:B:181:PHE:HB2	1:B:188:THR:HG21	1.96	0.48
1:D:711:GLU:O	1:D:713:GLY:N	2.47	0.48
1:D:383:ARG:NH1	1:D:744:SER:OG	2.47	0.48
1:C:602:TRP:CE3	1:C:603:GLU:HG3	2.49	0.47
1:D:749:ARG:NH2	7:D:2064:HOH:O	2.47	0.47
1:B:410:PRO:HA	7:B:1449:HOH:O	2.13	0.47
1:D:170:ASN:ND2	1:D:365:PRO:HD3	2.30	0.47
1:D:140:VAL:CG1	1:D:143:VAL:HG11	2.45	0.47
1:D:413:VAL:O	1:D:417:THR:HG23	2.15	0.47
1:C:143:VAL:HB	1:C:149:TYR:CZ	2.50	0.47
1:C:393:PRO:HB3	7:C:992:HOH:O	2.15	0.47
1:D:234:PHE:CZ	1:D:454:MET:HB3	2.49	0.46
1:D:379:LEU:HG	1:D:383:ARG:NH1	2.30	0.46
1:C:380:ASP:HB3	1:C:383:ARG:HH22	1.79	0.46
1:D:359:PHE:CD1	7:D:831:HOH:O	2.27	0.46
1:C:216:TYR:HB3	1:C:239:THR:HG22	1.98	0.46
1:C:555:ARG:HA	1:C:555:ARG:HE	1.80	0.46
1:D:132:ASP:HB3	1:D:135:GLU:O	2.16	0.46
1:B:114:GLU:HB2	1:B:258:PRO:HG2	1.98	0.46
1:D:555:ARG:HD2	1:D:560:ALA:HB3	1.97	0.46
1:B:555:ARG:HA	1:B:555:ARG:HE	1.80	0.46
1:C:445:ASN:O	1:C:488:SER:HA	2.16	0.46
1:D:10:PRO:HA	1:D:32:ARG:O	2.16	0.45
1:D:716:CYS:HB3	1:D:748:TRP:CE3	2.50	0.45
1:D:719:ASN:ND2	1:D:723:GLN:O	2.38	0.45
1:C:731:LEU:HD23	1:C:731:LEU:N	2.31	0.45
1:D:375:SER:HB2	1:D:415:THR:HG21	1.99	0.45
1:B:724:PRO:HA	1:B:741:LEU:O	2.17	0.45
1:A:716:CYS:HB3	1:A:748:TRP:CE3	2.52	0.45
1:B:243:ARG:HA	1:B:243:ARG:HD2	1.44	0.44
1:B:408:LYS:O	1:B:410:PRO:HD3	2.18	0.44
1:B:609:ILE:CD1	7:B:1404:HOH:O	2.64	0.44
1:B:555:ARG:CD	7:B:1757:HOH:O	2.61	0.44
1:A:143:VAL:HB	1:A:149:TYR:CZ	2.52	0.44
1:B:542:VAL:HA	1:B:667:ILE:O	2.17	0.44
1:B:748:TRP:O	1:B:749:ARG:NH1	2.50	0.44
1:A:248:PHE:CD2	1:A:248:PHE:C	2.95	0.44
1:C:128:ASN:N	1:C:128:ASN:HD22	2.15	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:143:VAL:HG12	7:A:2021:HOH:O	2.16	0.44
1:A:576:ASP:HB3	1:A:615:GLY:HA2	2.00	0.44
1:C:58:ARG:HD2	1:C:178:GLU:OE1	2.18	0.44
1:D:465:LYS:NZ	1:D:630:GLU:OE1	2.49	0.44
1:A:432:GLY:HA2	7:A:1535:HOH:O	2.17	0.44
1:B:584:PRO:HD2	7:B:815:HOH:O	2.17	0.44
1:C:716:CYS:HB3	1:C:748:TRP:CE3	2.53	0.43
1:D:712:GLN:H	1:D:712:GLN:CD	2.25	0.43
1:D:166:ASN:ND2	1:D:364:PHE:HE2	2.16	0.43
1:B:44:LEU:C	1:B:46:LEU:H	2.27	0.43
1:C:713:GLY:HA3	1:C:753:GLU:CD	2.43	0.43
1:D:217:GLN:HA	1:D:314:GLN:HA	2.00	0.43
1:D:197:GLU:HG3	7:D:1792:HOH:O	2.18	0.43
1:D:301:HIS:O	1:D:304:GLY:N	2.39	0.43
1:A:276:LYS:HE2	7:A:1055:HOH:O	2.18	0.43
1:B:445:ASN:O	1:B:488:SER:HA	2.18	0.43
1:B:189:ARG:HD2	7:B:1674:HOH:O	2.18	0.43
1:B:333:VAL:HG23	1:B:352:VAL:HG11	2.01	0.43
1:A:555:ARG:HD3	7:A:1008:HOH:O	2.19	0.43
1:D:538:ALA:HB1	1:D:687:ALA:HB1	2.00	0.42
1:B:216:TYR:O	1:B:314:GLN:HA	2.19	0.42
1:B:402:TYR:CB	1:B:405:LEU:HD13	2.49	0.42
1:B:143:VAL:HB	1:B:149:TYR:OH	2.20	0.42
1:B:680:LEU:O	1:B:684:LEU:HG	2.19	0.42
1:A:234:PHE:CE1	1:A:454:MET:HB3	2.55	0.42
1:A:117:ASP:OD2	1:A:147:HIS:ND1	2.53	0.42
1:A:741:LEU:HA	1:A:742:PRO:HD3	1.93	0.42
1:C:164:MET:HE2	1:C:164:MET:HB3	1.96	0.42
1:D:114:GLU:HB2	1:D:258:PRO:HG2	2.01	0.42
1:A:542:VAL:HA	1:A:667:ILE:O	2.20	0.41
1:B:170:ASN:HD21	1:B:364:PHE:HZ	1.64	0.41
1:C:602:TRP:CZ3	1:C:603:GLU:HG3	2.55	0.41
1:D:332:ALA:HA	1:D:354:TYR:O	2.19	0.41
1:D:438:GLU:HB3	1:D:693:LYS:HZ3	1.85	0.41
1:A:115:VAL:HG22	1:A:151:VAL:HG22	2.02	0.41
1:C:753:GLU:H	1:C:753:GLU:HG2	1.71	0.41
1:D:212:THR:N	1:D:213:THR:HA	2.35	0.41
1:B:143:VAL:HB	1:B:149:TYR:CZ	2.55	0.41
1:A:364:PHE:CD2	1:A:365:PRO:HD2	2.56	0.41
1:C:360:LEU:HB3	1:C:361:PRO:HA	2.03	0.41
1:B:96:PHE:CE1	1:B:229:LYS:HE2	2.56	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:602:TRP:CE3	1:B:603:GLU:HG3	2.55	0.41
1:D:22:LEU:O	1:D:26:TRP:HB2	2.20	0.41
1:D:143:VAL:HB	1:D:149:TYR:CZ	2.56	0.41
1:D:9:LEU:O	1:D:31:ILE:HD12	2.21	0.41
1:A:97:PHE:CZ	1:A:226:ARG:HD2	2.56	0.40
1:B:239:THR:HG21	1:B:285:LEU:HD21	2.02	0.40
1:B:347:ALA:HB2	1:B:394:ILE:CG2	2.51	0.40
1:D:568:GLU:HB3	1:D:634:ASN:HB3	2.02	0.40
1:A:76:LEU:O	1:A:152:SER:HA	2.21	0.40
1:D:208:VAL:HG22	1:D:306:GLU:HB2	2.04	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	741/759 (98%)	711 (96%)	30 (4%)	0	100	100
1	B	728/759 (96%)	694 (95%)	32 (4%)	2 (0%)	36	36
1	C	744/759 (98%)	718 (96%)	25 (3%)	1 (0%)	48	49
1	D	701/759 (92%)	663 (95%)	34 (5%)	4 (1%)	21	18
All	All	2914/3036 (96%)	2786 (96%)	121 (4%)	7 (0%)	43	44

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	594	VAL
1	D	27	GLY
1	D	712	GLN
1	B	595	ASP
1	C	41	GLU

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Mol	Chain	Res	Type
1	D	382	TRP
1	D	423	PHE

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	621/634 (98%)	604 (97%)	17 (3%)	39	44
1	B	611/634 (96%)	592 (97%)	19 (3%)	35	38
1	C	624/634 (98%)	613 (98%)	11 (2%)	51	59
1	D	596/634 (94%)	577 (97%)	19 (3%)	34	37
All	All	2452/2536 (97%)	2386 (97%)	66 (3%)	39	44

All (66) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	THR
1	A	11	SER
1	A	19	THR
1	A	32	ARG
1	A	43	VAL
1	A	52	ASN
1	A	99	GLU
1	A	163	GLU
1	A	236	CYS
1	A	251	LYS
1	A	336	SER
1	A	379	LEU
1	A	405	LEU
1	A	443	ILE
1	A	555	ARG
1	A	611	LEU
1	A	752	LEU
1	B	3	SER
1	B	24	GLU

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Mol	Chain	Res	Type
1	B	44	LEU
1	B	50	ILE
1	B	135	GLU
1	B	171	ASP
1	B	174	ASP
1	B	251	LYS
1	B	405	LEU
1	B	411	LYS
1	B	422	GLU
1	B	449	LYS
1	B	555	ARG
1	B	611	LEU
1	B	717	VAL
1	B	723	GLN
1	B	726	LYS
1	B	731	LEU
1	B	737	GLU
1	C	14	ASN
1	C	40	ASP
1	C	58	ARG
1	C	181	PHE
1	C	205	GLN
1	C	367	THR
1	C	443	ILE
1	C	611	LEU
1	C	683	VAL
1	C	731	LEU
1	C	753	GLU
1	D	9	LEU
1	D	12	GLU
1	D	31	ILE
1	D	46	LEU
1	D	126	SER
1	D	178	GLU
1	D	205	GLN
1	D	376	ILE
1	D	381	ASN
1	D	424	ARG
1	D	425	ASP
1	D	433	VAL
1	D	449	LYS
1	D	594	VAL

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Mol	Chain	Res	Type
1	D	609	ILE
1	D	712	GLN
1	D	717	VAL
1	D	743	ASP
1	D	749	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (26) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	110	HIS
1	A	128	ASN
1	A	166	ASN
1	A	690	ASN
1	A	720	ASN
1	B	52	ASN
1	B	128	ASN
1	B	166	ASN
1	B	483	ASN
1	B	641	ASN
1	B	689	HIS
1	B	690	ASN
1	B	720	ASN
1	C	110	HIS
1	C	128	ASN
1	C	170	ASN
1	C	483	ASN
1	C	641	ASN
1	C	690	ASN
1	C	720	ASN
1	D	52	ASN
1	D	128	ASN
1	D	166	ASN
1	D	170	ASN
1	D	381	ASN
1	D	690	ASN

5.3.3 RNA ⓘ

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 13 ligands modelled in this entry, 1 is monoatomic - leaving 12 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	$\# Z > 2$
2	NDG	A	4001	-	15,15,15	0.59	0	21,21,21	1.08	1 (4%)
6	SO4	D	4011	-	4,4,4	0.27	0	6,6,6	0.24	0
2	NDG	B	4002	-	15,15,15	0.63	0	21,21,21	1.27	3 (14%)
3	GOL	A	4005	-	5,5,5	0.34	0	5,5,5	0.79	0
2	NDG	C	4003	-	15,15,15	0.62	0	21,21,21	1.04	1 (4%)
3	GOL	B	4006	-	5,5,5	0.29	0	5,5,5	0.81	0
3	GOL	D	4009	-	5,5,5	0.30	0	5,5,5	0.86	0
4	NO3	A	4012	-	1,3,3	3.49	1 (100%)	0,3,3	-	-
3	GOL	D	4010	-	5,5,5	0.38	0	5,5,5	0.59	0
3	GOL	C	4008	-	5,5,5	0.31	0	5,5,5	0.57	0
3	GOL	C	4007	-	5,5,5	0.27	0	5,5,5	0.70	0
2	NDG	D	4004	-	15,15,15	0.63	0	21,21,21	1.28	3 (14%)

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	NDG	A	4001	-	-	0/6/26/26	0/1/1/1
2	NDG	B	4002	-	-	0/6/26/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	A	4005	-	-	2/4/4/4	-
2	NDG	C	4003	-	-	0/6/26/26	0/1/1/1
3	GOL	B	4006	-	-	2/4/4/4	-
3	GOL	D	4009	-	-	0/4/4/4	-
3	GOL	D	4010	-	-	1/4/4/4	-
3	GOL	C	4008	-	-	4/4/4/4	-
3	GOL	C	4007	-	-	0/4/4/4	-
2	NDG	D	4004	-	-	0/6/26/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	4012	NO3	O1-N	3.49	1.41	1.24

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	4002	NDG	C1-C2-N2	-4.54	105.47	110.73
2	A	4001	NDG	C1-C2-N2	-3.58	106.59	110.73
2	D	4004	NDG	C1-C2-N2	-3.54	106.62	110.73
2	C	4003	NDG	C1-C2-N2	-3.51	106.66	110.73
2	D	4004	NDG	O5-C1-C2	2.45	111.98	109.52
2	D	4004	NDG	C3-C2-N2	2.21	114.69	110.62
2	B	4002	NDG	O5-C1-C2	2.04	111.56	109.52
2	B	4002	NDG	C3-C2-N2	2.01	114.33	110.62

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	4005	GOL	O1-C1-C2-C3
3	B	4006	GOL	C1-C2-C3-O3
3	C	4008	GOL	O1-C1-C2-C3
3	B	4006	GOL	O2-C2-C3-O3
3	C	4008	GOL	C1-C2-C3-O3
3	C	4008	GOL	O1-C1-C2-O2
3	A	4005	GOL	O1-C1-C2-O2
3	C	4008	GOL	O2-C2-C3-O3
3	D	4010	GOL	O1-C1-C2-O2

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	4005	GOL	1	0
3	B	4006	GOL	2	0
3	D	4010	GOL	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	745/759 (98%)	-0.36	7 (0%) 81 83	12, 21, 35, 66	0
1	B	734/759 (96%)	0.09	45 (6%) 27 29	13, 24, 55, 69	0
1	C	748/759 (98%)	-0.33	8 (1%) 78 80	11, 21, 38, 64	0
1	D	713/759 (93%)	0.09	65 (9%) 15 16	12, 23, 53, 64	0
All	All	2940/3036 (96%)	-0.13	125 (4%) 40 42	11, 22, 49, 69	0

All (125) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	406	ALA	6.2
1	D	415	THR	6.2
1	D	28	ALA	5.0
1	D	407	ALA	4.8
1	D	9	LEU	4.7
1	D	412	PHE	4.6
1	D	10	PRO	4.6
1	D	23	ALA	4.4
1	D	25	LEU	4.2
1	D	413	VAL	4.2
1	D	27	GLY	4.1
1	D	26	TRP	4.0
1	D	418	HIS	3.9
1	B	405	LEU	3.9
1	B	46	LEU	3.9
1	D	416	VAL	3.9
1	D	30	ALA	3.8
1	D	22	LEU	3.8
1	D	424	ARG	3.8
1	B	379	LEU	3.8
1	D	419	ILE	3.8

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Mol	Chain	Res	Type	RSRZ
1	D	426	ILE	3.8
1	D	362	TYR	3.8
1	C	42	ALA	3.8
1	D	710	PRO	3.7
1	D	31	ILE	3.7
1	D	420	ALA	3.7
1	D	46	LEU	3.6
1	D	29	ASP	3.6
1	A	40	ASP	3.6
1	B	360	LEU	3.5
1	B	594	VAL	3.5
1	D	376	ILE	3.5
1	D	8	THR	3.5
1	B	412	PHE	3.4
1	B	44	LEU	3.4
1	C	40	ASP	3.4
1	D	713	GLY	3.4
1	B	15	PHE	3.4
1	D	24	GLU	3.4
1	B	31	ILE	3.4
1	B	374	PRO	3.4
1	D	50	ILE	3.4
1	B	373	ASP	3.3
1	B	401	GLY	3.3
1	B	45	ALA	3.3
1	D	409	PHE	3.3
1	B	366	ASP	3.3
1	D	433	VAL	3.2
1	B	363	PHE	3.2
1	B	407	ALA	3.2
1	D	365	PRO	3.2
1	D	399	TYR	3.2
1	D	425	ASP	3.1
1	D	375	SER	3.1
1	D	751	ALA	3.1
1	B	22	LEU	3.1
1	D	368	PHE	3.1
1	D	423	PHE	3.1
1	D	408	LYS	3.0
1	D	47	GLY	3.0
1	B	19	THR	3.0
1	B	364	PHE	3.0

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Mol	Chain	Res	Type	RSRZ
1	D	359	PHE	3.0
1	B	371	GLY	2.9
1	D	400	GLY	2.9
1	D	363	PHE	2.9
1	D	11	SER	2.9
1	D	417	THR	2.8
1	D	53	ALA	2.8
1	B	403	LEU	2.8
1	D	7	PHE	2.7
1	B	423	PHE	2.7
1	B	362	TYR	2.7
1	B	409	PHE	2.7
1	D	360	LEU	2.7
1	B	11	SER	2.7
1	D	410	PRO	2.6
1	D	427	HIS	2.6
1	B	16	ALA	2.6
1	D	378	GLY	2.6
1	B	10	PRO	2.6
1	D	379	LEU	2.6
1	B	402	TYR	2.5
1	C	753	GLU	2.5
1	B	376	ILE	2.5
1	B	426	ILE	2.5
1	C	17	GLU	2.4
1	B	9	LEU	2.4
1	B	27	GLY	2.4
1	D	372	ASN	2.4
1	D	371	GLY	2.4
1	B	7	PHE	2.3
1	B	361	PRO	2.3
1	B	12	GLU	2.2
1	B	4	THR	2.2
1	D	411	LYS	2.2
1	D	398	GLY	2.2
1	B	26	TRP	2.2
1	D	33	ASN	2.2
1	A	42	ALA	2.2
1	A	11	SER	2.2
1	B	365	PRO	2.2
1	D	367	THR	2.2
1	C	35	ASP	2.2

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Mol	Chain	Res	Type	RSRZ
1	C	45	ALA	2.2
1	D	364	PHE	2.1
1	B	413	VAL	2.1
1	D	5	GLY	2.1
1	A	125	ASP	2.1
1	D	722	ASP	2.1
1	B	746	ILE	2.1
1	D	32	ARG	2.1
1	B	751	ALA	2.1
1	A	45	ALA	2.1
1	D	361	PRO	2.1
1	B	748	TRP	2.1
1	C	3	SER	2.1
1	A	46	LEU	2.0
1	B	415	THR	2.0
1	D	369	TYR	2.0
1	B	404	SER	2.0
1	A	751	ALA	2.0
1	D	382	TRP	2.0
1	C	754	HIS	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($\text{\AA}^2$)	Q<0.9
4	NO3	A	4012	4/4	0.82	0.15	41,41,42,43	0
3	GOL	D	4010	6/6	0.84	0.16	50,51,52,52	0
6	SO4	D	4011	5/5	0.86	0.14	70,71,71,71	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	GOL	B	4006	6/6	0.89	0.11	31,35,37,39	0
3	GOL	C	4007	6/6	0.90	0.09	19,22,24,26	0
3	GOL	D	4009	6/6	0.92	0.10	26,30,31,36	0
3	GOL	A	4005	6/6	0.92	0.09	26,28,30,33	0
3	GOL	C	4008	6/6	0.93	0.09	35,39,40,42	0
2	NDG	B	4002	15/15	0.95	0.06	17,22,25,25	0
2	NDG	C	4003	15/15	0.96	0.06	18,19,22,25	0
2	NDG	D	4004	15/15	0.96	0.05	18,22,23,25	0
2	NDG	A	4001	15/15	0.97	0.05	13,18,21,23	0
5	MG	B	4013	1/1	0.99	0.02	30,30,30,30	0

6.5 Other polymers [i](#)

There are no such residues in this entry.