



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 12, 2025 – 12:07 AM EST

PDB ID : 2FH8 / pdb_00002fh8
Title : Crystal Structure Analysis of Klebsiella pneumoniae pullulanase complexed with isomaltose
Authors : Mikami, B.; Iwamoto, H.; Katsuya, Y.; Yoon, H.-J.; Demirkan-Sarikaya, E.; Malle, D.
Deposited on : 2005-12-23
Resolution : 1.90 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 : 20231227.v01 (using entries in the PDB archive December 27th 2023)
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) : 2.46

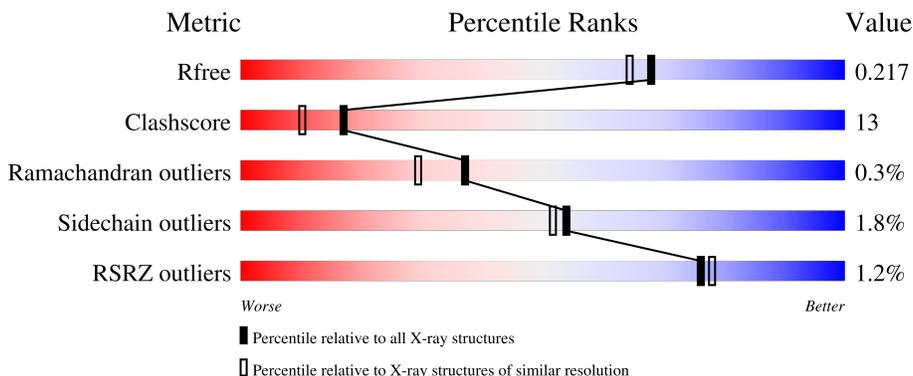
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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}	164625	7293 (1.90-1.90)
Clashscore	180529	8090 (1.90-1.90)
Ramachandran outliers	177936	8022 (1.90-1.90)
Sidechain outliers	177891	8022 (1.90-1.90)
RSRZ outliers	164620	7292 (1.90-1.90)

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	1083	 68% 16% 15%
2	B	2	 50% 50%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 8236 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 Alpha-dextrin endo-1,6-alpha-glucosidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	922	7130	4453	1218	1433	26	0	13	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	680	LEU	GLY	conflict	UNP W9BQ28

- Molecule 2 is an oligosaccharide called alpha-D-glucopyranose-(1-6)-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
			Total	C	O			
2	B	2	23	12	11	0	0	0

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	4	Total	Ca	0	0
			4	4		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1079	Total	O	0	0
			1079	1079		

BGL1
GLC2

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	149.53Å 60.32Å 134.02Å 90.00° 112.62° 90.00°	Depositor
Resolution (Å)	15.00 – 1.90 15.00 – 1.90	Depositor EDS
% Data completeness (in resolution range)	81.6 (15.00-1.90) 81.4 (15.00-1.90)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.30 (at 1.70Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.177 , 0.221 0.174 , 0.217	Depositor DCC
R_{free} test set	7158 reflections (8.60%)	wwPDB-VP
Wilson B-factor (Å ²)	17.6	Xtrriage
Anisotropy	0.523	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 51.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8236	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.96% 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: GLC, BGC, CA

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	0.35	0/7325	0.91	17/9961 (0.2%)

There are no bond length outliers.

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	644	CYS	N-CA-CB	-9.22	103.02	111.59
1	A	484	THR	N-CA-C	8.02	122.44	113.21
1	A	562	PHE	N-CA-C	-7.32	103.19	112.93
1	A	555	TYR	N-CA-C	7.13	120.86	109.24
1	A	931	LYS	N-CA-C	7.05	119.58	111.11
1	A	480	PHE	N-CA-C	-6.58	101.27	110.35
1	A	652	ARG	N-CA-C	6.56	118.98	111.11
1	A	897	TRP	N-CA-C	6.15	117.67	110.97
1	A	845	LYS	N-CA-C	6.08	120.82	113.41
1	A	297	TYR	N-CA-C	5.79	118.66	109.81
1	A	1044	LEU	N-CA-C	-5.78	105.49	112.54
1	A	426	ILE	N-CA-C	5.71	118.14	109.12
1	A	904	SER	N-CA-C	-5.66	106.14	113.16
1	A	905	LEU	N-CA-C	5.48	119.25	112.24
1	A	278	VAL	N-CA-C	5.41	115.68	108.11
1	A	891	SER	N-CA-C	5.37	118.94	112.93
1	A	644	CYS	N-CA-C	5.14	115.89	108.34

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	7130	0	6863	176	0
2	B	23	0	21	1	0
3	A	4	0	0	0	0
4	A	1079	0	0	24	0
All	All	8236	0	6884	176	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 13.

All (176) 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:978:ASN:HD21	1:A:984:GLN:H	1.19	0.90
1:A:680:LEU:HG	1:A:710:SER:HB2	1.56	0.87
1:A:606:ASN:HD21	1:A:607:HIS:HD2	1.21	0.84
1:A:680:LEU:HD13	1:A:708:TRP:H	1.42	0.83
1:A:680:LEU:HD11	1:A:709:ASP:H	1.45	0.80
1:A:606:ASN:ND2	1:A:607:HIS:HD2	1.83	0.77
1:A:680:LEU:HD11	1:A:709:ASP:N	2.01	0.76
1:A:680:LEU:HD22	1:A:707:GLY:HA3	1.67	0.76
1:A:680:LEU:CG	1:A:710:SER:HB2	2.16	0.75
1:A:1009:ILE:HG12	1:A:1067[A]:GLU:HG2	1.67	0.74
1:A:771:THR:HG23	4:A:2201:HOH:O	1.87	0.73
1:A:987:LEU:HD21	1:A:1022:LEU:HD21	1.72	0.72
1:A:229:ASN:ND2	1:A:232:VAL:H	1.88	0.71
1:A:229:ASN:HD21	1:A:232:VAL:CB	2.03	0.71
1:A:301:LEU:HD23	1:A:395:ASP:HB2	1.73	0.71
1:A:706:GLU:HG2	1:A:707:GLY:H	1.54	0.71
1:A:627:TYR:O	1:A:651:HIS:HD2	1.74	0.70
1:A:560[B]:ASP:HB3	1:A:609:ASN:ND2	2.08	0.69
1:A:996:MET:HE3	4:A:1812:HOH:O	1.93	0.69
1:A:680:LEU:CD1	1:A:710:SER:H	2.05	0.68
1:A:680:LEU:HD13	1:A:708:TRP:N	2.09	0.67
1:A:977:ARG:NH1	1:A:1024:ASP:HB3	2.09	0.66
1:A:170:ALA:HA	4:A:2124:HOH:O	1.96	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:722:ILE:HG23	4:A:1665:HOH:O	1.96	0.65
1:A:229:ASN:HD21	1:A:232:VAL:CG2	2.12	0.63
1:A:816:PRO:HG2	4:A:1995:HOH:O	1.99	0.63
1:A:208:VAL:HG21	1:A:262:VAL:HG21	1.80	0.63
1:A:560[A]:ASP:HB2	1:A:609:ASN:ND2	2.14	0.63
1:A:229:ASN:ND2	1:A:232:VAL:HB	2.14	0.63
1:A:229:ASN:HD21	1:A:232:VAL:HB	1.63	0.62
1:A:680:LEU:HD21	4:A:1543:HOH:O	1.99	0.62
1:A:229:ASN:HD21	1:A:232:VAL:H	1.48	0.62
1:A:1049:GLN:HG3	1:A:1057:THR:HB	1.80	0.62
1:A:680:LEU:HD11	1:A:710:SER:H	1.66	0.61
1:A:1012:ALA:HB1	1:A:1058[B]:LEU:HD21	1.81	0.61
1:A:229:ASN:HD21	1:A:232:VAL:HG23	1.66	0.60
1:A:322:ILE:HG22	1:A:330:ILE:HD11	1.83	0.60
1:A:977:ARG:HH11	1:A:1024:ASP:HB3	1.65	0.60
1:A:706:GLU:HG2	1:A:707:GLY:N	2.16	0.60
1:A:418:LYS:HD2	1:A:966[B]:ASP:OD1	2.01	0.60
1:A:1039:ALA:HB3	1:A:1043:SER:HB2	1.82	0.60
1:A:523:THR:OG1	1:A:526:GLU:HG3	2.02	0.60
1:A:484:THR:N	1:A:560[A]:ASP:OD2	2.32	0.59
1:A:208:VAL:CG2	1:A:262:VAL:HG21	2.32	0.59
1:A:254:ASP:HB2	4:A:2156:HOH:O	2.03	0.59
1:A:682:HIS:HD2	1:A:686:GLN:HE22	1.51	0.58
1:A:972:LYS:HG3	4:A:1135:HOH:O	2.03	0.58
1:A:258:GLN:HE22	1:A:316:GLN:HA	1.69	0.57
1:A:430:HIS:HB3	1:A:433:ASP:HB2	1.86	0.57
1:A:753:ARG:HD3	1:A:769:LEU:HD12	1.87	0.56
1:A:722:ILE:C	1:A:722:ILE:HD12	2.30	0.56
1:A:606:ASN:ND2	1:A:607:HIS:CD2	2.70	0.56
1:A:272:LEU:C	1:A:272:LEU:HD23	2.31	0.55
1:A:367:GLN:HG2	4:A:1479:HOH:O	2.05	0.55
1:A:710:SER:O	1:A:711:ASN:HB3	2.07	0.55
1:A:680:LEU:CD2	1:A:707:GLY:HA3	2.37	0.55
1:A:708:TRP:N	1:A:708:TRP:CE3	2.75	0.55
1:A:387:ASN:ND2	1:A:487:GLU:H	2.05	0.55
1:A:560[B]:ASP:HB3	1:A:609:ASN:HD22	1.72	0.54
1:A:682:HIS:HD2	1:A:686:GLN:NE2	2.05	0.54
1:A:682:HIS:CD2	1:A:686:GLN:HE22	2.25	0.54
1:A:525:GLU:HG2	4:A:2213:HOH:O	2.07	0.54
1:A:642:THR:O	1:A:643:CYS:HB3	2.06	0.53
1:A:643:CYS:SG	1:A:644:CYS:N	2.81	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:198:VAL:HG12	1:A:223:LEU:HD12	1.89	0.53
1:A:839:TRP:HA	1:A:842[A]:ILE:HG22	1.89	0.53
1:A:946:THR:O	1:A:950:GLN:HG3	2.09	0.53
1:A:997:GLN:HG2	4:A:2004:HOH:O	2.09	0.53
1:A:1066:LEU:HD22	1:A:1066:LEU:N	2.24	0.53
1:A:253:VAL:HG23	1:A:254:ASP:N	2.24	0.52
1:A:854:THR:O	1:A:858:MET:HG3	2.09	0.52
1:A:543:GLN:NE2	1:A:917:SER:H	2.08	0.52
1:A:229:ASN:C	1:A:229:ASN:HD22	2.17	0.52
1:A:223:LEU:CD2	1:A:247:LEU:HD23	2.40	0.52
1:A:200:LEU:HB3	1:A:221:VAL:CG2	2.41	0.51
1:A:690:ALA:O	1:A:694:ILE:HG12	2.11	0.51
1:A:680:LEU:CD2	1:A:680:LEU:H	2.24	0.51
1:A:706:GLU:HB2	1:A:732:PHE:CD2	2.46	0.50
1:A:384:LEU:HD23	1:A:391:SER:HA	1.92	0.50
1:A:657:LEU:C	1:A:657:LEU:HD23	2.37	0.50
1:A:680:LEU:H	1:A:680:LEU:HD23	1.77	0.49
1:A:606:ASN:HD21	1:A:607:HIS:CD2	2.14	0.49
1:A:238:HIS:HE1	4:A:1434:HOH:O	1.95	0.49
1:A:543:GLN:HE21	1:A:916:ARG:HA	1.78	0.49
1:A:680:LEU:CD1	1:A:708:TRP:N	2.75	0.49
1:A:296:SER:O	1:A:309:ARG:HD2	2.14	0.48
1:A:750:ASP:O	1:A:754:GLN:HG3	2.14	0.48
1:A:211:ASP:OD1	1:A:213:ASN:HB2	2.13	0.48
1:A:771:THR:HG22	4:A:1664:HOH:O	2.13	0.48
1:A:1014:ASN:HD21	1:A:1020:ARG:HH11	1.60	0.48
1:A:875:ASP:OD1	1:A:879:SER:HB2	2.13	0.48
1:A:229:ASN:ND2	1:A:229:ASN:C	2.72	0.48
1:A:495:ILE:HA	1:A:524:VAL:HB	1.96	0.47
1:A:496:GLN:NE2	1:A:496:GLN:H	2.12	0.47
1:A:834:ASP:O	1:A:835:ASN:HB2	2.12	0.47
1:A:839:TRP:HA	1:A:842[A]:ILE:CG2	2.44	0.47
1:A:210:ALA:HB2	1:A:216:PHE:CE1	2.50	0.47
1:A:194:ASN:C	1:A:195:LYS:HE3	2.40	0.47
1:A:170:ALA:C	1:A:172:PHE:H	2.23	0.46
1:A:710:SER:O	1:A:711:ASN:CB	2.63	0.46
1:A:176:LEU:HA	4:A:1721:HOH:O	2.15	0.46
1:A:449:TYR:CZ	1:A:571:TYR:HB2	2.50	0.46
1:A:182:VAL:HG21	1:A:232:VAL:HG11	1.97	0.46
1:A:484:THR:HG23	1:A:560[A]:ASP:OD2	2.16	0.46
1:A:678:LEU:HD21	2:B:1:BGC:H3	1.97	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:465:GLN:HG3	1:A:950:GLN:HE22	1.80	0.46
1:A:195:LYS:HG2	1:A:265:ALA:HB1	1.98	0.46
1:A:430:HIS:HD2	1:A:433:ASP:H	1.62	0.46
1:A:642:THR:O	1:A:643:CYS:CB	2.64	0.46
1:A:1003:ASP:OD2	1:A:1005:ARG:HD3	2.16	0.46
1:A:886:SER:O	1:A:887:PHE:HB2	2.16	0.46
1:A:228:VAL:HG12	4:A:2055:HOH:O	2.14	0.45
1:A:510:LYS:HD3	4:A:1500:HOH:O	2.16	0.45
1:A:680:LEU:CD1	1:A:708:TRP:H	2.19	0.45
1:A:473:HIS:CD2	1:A:598:ASN:HB2	2.52	0.45
1:A:680:LEU:HD12	1:A:710:SER:H	1.80	0.45
1:A:377:THR:OG1	1:A:563:HIS:HE1	2.00	0.45
1:A:297:TYR:CD1	1:A:309:ARG:HG2	2.52	0.45
1:A:839:TRP:O	1:A:842[A]:ILE:CG2	2.65	0.45
1:A:706:GLU:HA	1:A:708:TRP:CZ2	2.52	0.44
1:A:1012:ALA:CB	1:A:1058[B]:LEU:HD21	2.45	0.44
1:A:32:ASP:CG	1:A:222:LYS:HZ1	2.25	0.44
1:A:183:ASP:OD2	1:A:183:ASP:C	2.61	0.44
1:A:504:GLU:HG2	4:A:1917:HOH:O	2.16	0.44
1:A:260:GLU:HB2	1:A:364:TYR:CE1	2.52	0.44
1:A:706:GLU:HB2	1:A:732:PHE:HD2	1.82	0.44
1:A:842[A]:ILE:HD12	1:A:858:MET:HB2	1.99	0.44
1:A:968:ALA:HA	1:A:971[A]:MET:CE	2.47	0.44
1:A:680:LEU:HD11	1:A:710:SER:N	2.31	0.44
1:A:706:GLU:CG	1:A:707:GLY:H	2.27	0.44
1:A:199:ARG:HB2	1:A:201:TYR:HE1	1.83	0.44
1:A:680:LEU:HD23	1:A:680:LEU:N	2.32	0.44
1:A:1023:GLN:NE2	1:A:1055:SER:HB3	2.33	0.44
1:A:1049:GLN:CG	1:A:1057:THR:HB	2.45	0.44
1:A:797:LEU:HD12	1:A:797:LEU:C	2.42	0.43
1:A:200:LEU:HB3	1:A:221:VAL:HG22	1.99	0.43
1:A:971[A]:MET:HE1	4:A:1866:HOH:O	2.18	0.43
1:A:36:ARG:HG2	1:A:36:ARG:HH11	1.82	0.43
1:A:797:LEU:HD12	1:A:797:LEU:O	2.19	0.43
1:A:208:VAL:HG21	1:A:262:VAL:CG2	2.48	0.43
1:A:183:ASP:OD2	1:A:186:THR:N	2.52	0.43
1:A:195:LYS:HA	1:A:196:PRO:HD3	1.87	0.42
1:A:592:LYS:HE2	1:A:672:ASP:OD2	2.19	0.42
1:A:923:ASN:O	1:A:927:ILE:HG13	2.19	0.42
1:A:199:ARG:HD3	1:A:220:TYR:CD2	2.54	0.42
1:A:229:ASN:HD22	1:A:229:ASN:N	2.18	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:470:GLY:HA2	1:A:957:LYS:HD3	2.01	0.42
1:A:483:ALA:HB1	1:A:617:THR:HG21	2.02	0.42
1:A:430:HIS:CD2	1:A:432:ARG:H	2.37	0.42
1:A:841:MET:HE1	4:A:2075:HOH:O	2.20	0.42
1:A:465:GLN:NE2	4:A:1600:HOH:O	2.53	0.42
1:A:231:GLN:OE1	1:A:231:GLN:N	2.53	0.42
1:A:246:LYS:HE2	4:A:1651:HOH:O	2.18	0.41
1:A:252:ASN:OD1	1:A:255:GLU:HB2	2.20	0.41
1:A:680:LEU:HG	1:A:710:SER:CB	2.39	0.41
1:A:411:MET:HG2	1:A:672:ASP:OD1	2.21	0.41
1:A:424:MET:HB3	1:A:872:ILE:HG23	2.02	0.41
1:A:651:HIS:HE1	4:A:1186:HOH:O	2.02	0.41
1:A:258:GLN:NE2	1:A:316:GLN:HA	2.35	0.41
1:A:560[A]:ASP:HB2	1:A:609:ASN:HD22	1.82	0.41
1:A:189:TRP:CE2	1:A:191:GLY:HA3	2.56	0.41
1:A:370:LYS:HG3	4:A:1967:HOH:O	2.20	0.41
1:A:413:HIS:HD2	4:A:1172:HOH:O	2.04	0.41
1:A:465:GLN:HG3	1:A:950:GLN:NE2	2.35	0.41
1:A:252:ASN:C	1:A:252:ASN:HD22	2.28	0.40
1:A:708:TRP:N	1:A:708:TRP:CD2	2.89	0.40
1:A:792:LEU:HB2	1:A:795:PHE:HB2	2.03	0.40
1:A:993:ASP:HB2	1:A:1078:LEU:O	2.21	0.40
1:A:1023:GLN:HE22	1:A:1055:SER:HB3	1.86	0.40
1:A:36:ARG:HG2	1:A:36:ARG:NH1	2.36	0.40
1:A:680:LEU:HD13	1:A:708:TRP:CA	2.51	0.40
1:A:874:PHE:CD1	1:A:874:PHE:C	2.99	0.40
1:A:466:LEU:HD23	1:A:950:GLN:HE21	1.87	0.40
1:A:195:LYS:HE3	1:A:195:LYS:HA	2.03	0.40

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	931/1083 (86%)	898 (96%)	30 (3%)	3 (0%)	37 29

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	643	CYS
1	A	478	PRO
1	A	710	SER

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	771/891 (86%)	756 (98%)	15 (2%)	52 49

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	195	LYS
1	A	229	ASN
1	A	374	TYR
1	A	387	ASN
1	A	391	SER
1	A	478	PRO
1	A	482	LEU
1	A	496	GLN
1	A	543	GLN
1	A	593	GLN
1	A	722	ILE
1	A	859	GLN
1	A	1058[A]	LEU
1	A	1058[B]	LEU
1	A	1066	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (44) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	194	ASN
1	A	204	HIS
1	A	229	ASN
1	A	230	GLN
1	A	238	HIS
1	A	258	GLN
1	A	279	GLN
1	A	316	GLN
1	A	317	GLN
1	A	387	ASN
1	A	392	GLN
1	A	413	HIS
1	A	430	HIS
1	A	439	GLN
1	A	455	GLN
1	A	458	ASN
1	A	465	GLN
1	A	496	GLN
1	A	533	GLN
1	A	534	ASN
1	A	541	GLN
1	A	543	GLN
1	A	551	GLN
1	A	563	HIS
1	A	606	ASN
1	A	607	HIS
1	A	609	ASN
1	A	629	GLN
1	A	651	HIS
1	A	682	HIS
1	A	686	GLN
1	A	711	ASN
1	A	859	GLN
1	A	899	ASN
1	A	906	GLN
1	A	911	ASN
1	A	950	GLN
1	A	978	ASN
1	A	984	GLN
1	A	1014	ASN
1	A	1023	GLN
1	A	1037	GLN
1	A	1049	GLN

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Mol	Chain	Res	Type
1	A	1074	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](#)

2 monosaccharides 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	BGC	B	1	2	12,12,12	0.40	0	17,17,17	0.43	0
2	GLC	B	2	2	11,11,12	0.46	0	15,15,17	0.51	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	BGC	B	1	2	-	0/2/22/22	0/1/1/1
2	GLC	B	2	2	-	2/2/19/22	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

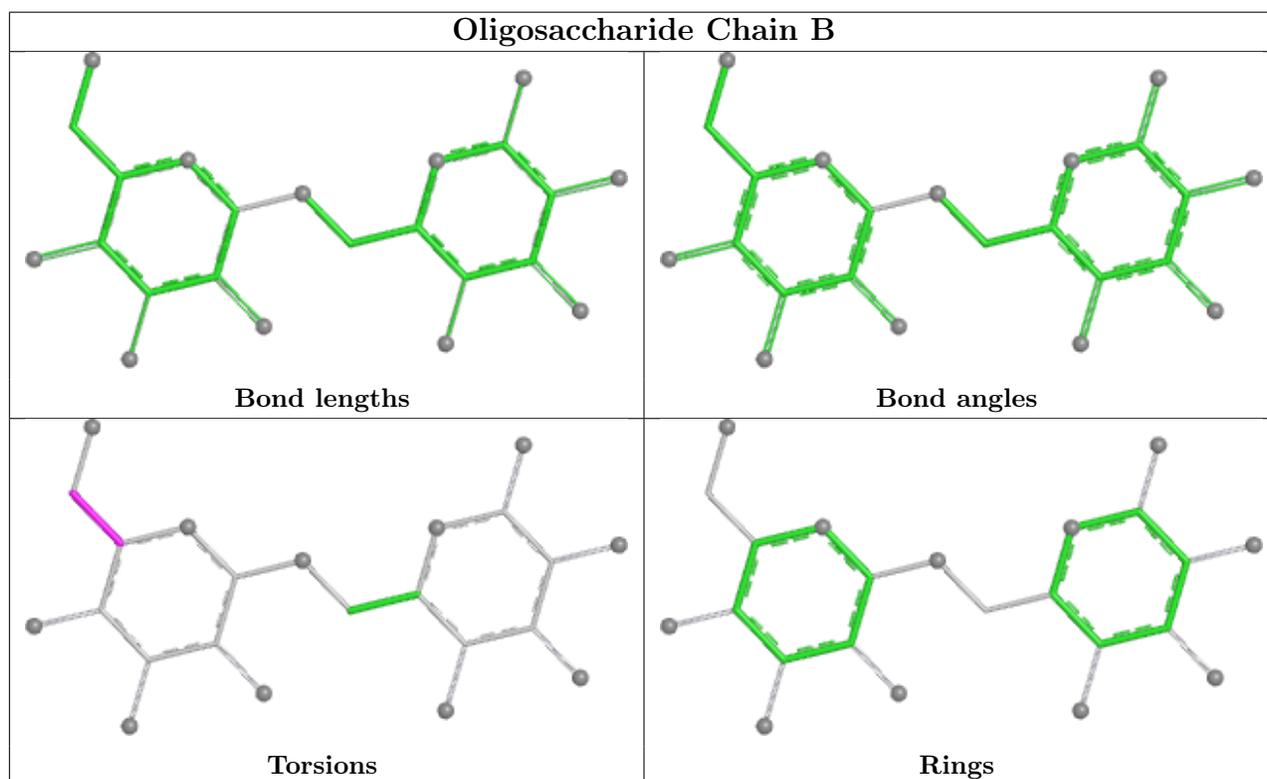
Mol	Chain	Res	Type	Atoms
2	B	2	GLC	C4-C5-C6-O6
2	B	2	GLC	O5-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1	BGC	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

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

There are no such residues in this entry.

5.8 Polymer linkage issues

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	922/1083 (85%)	-0.16	11 (1%) 76 78	12, 23, 51, 69	13 (1%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	708	TRP	3.2
1	A	302	THR	3.1
1	A	33	VAL	2.8
1	A	270	GLY	2.7
1	A	172	PHE	2.3
1	A	1028	THR	2.2
1	A	746	PHE	2.2
1	A	251	VAL	2.2
1	A	214	GLY	2.2
1	A	38	PRO	2.1
1	A	170	ALA	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](#)

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.

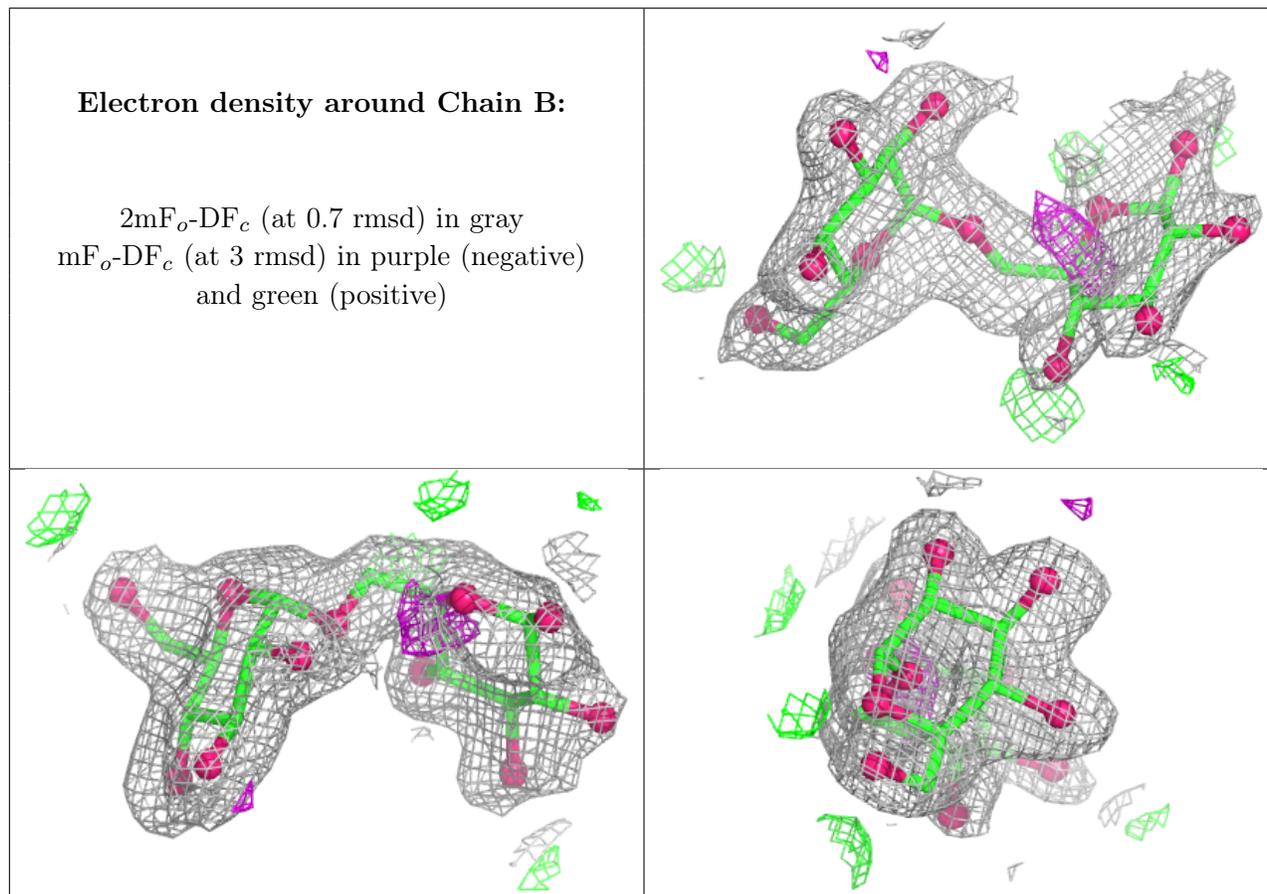
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	BGC	B	1	12/12	0.79	0.13	38,51,53,53	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	GLC	B	2	11/12	0.95	0.07	32,34,36,40	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



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	CA	A	2402	1/1	0.96	0.05	38,38,38,38	0
3	CA	A	2403	1/1	0.98	0.04	42,42,42,42	0
3	CA	A	2404	1/1	0.98	0.05	21,21,21,21	0
3	CA	A	2401	1/1	1.00	0.02	21,21,21,21	0

6.5 Other polymers [i](#)

There are no such residues in this entry.