



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 12:07 AM UTC

PDB ID : 4BQF / pdb_00004bqf
Title : Arabidopsis thaliana cytosolic alpha-1,4-glucan phosphorylase (PHS2) in complex with acarbose
Authors : O'Neill, E.C.; Rashid, A.M.; Stevenson, C.E.M.; Hetru, A.C.; Gunning, A.P.; Rejzek, M.; Nepogodiev, S.A.; Bornemann, S.; Lawson, D.M.; Field, R.A.
Deposited on : 2013-05-30
Resolution : 2.35 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

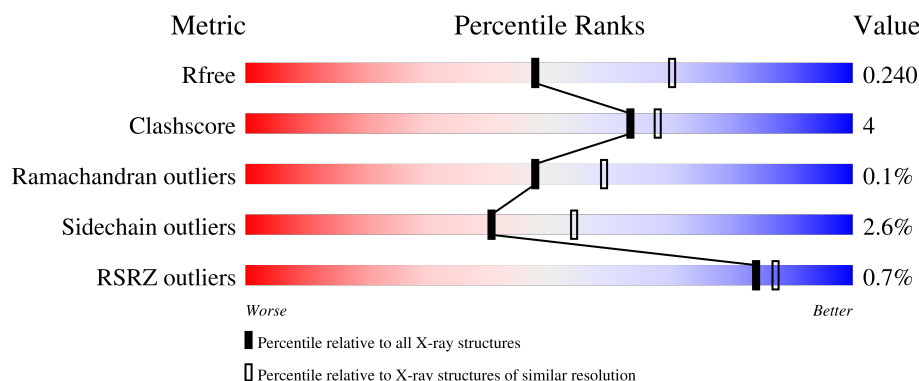
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.35 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	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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	874	84% 9% • 6%
1	B	874	84% 10% • 5%
2	C	3	33% 67%
2	D	3	100%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 13573 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-GLUCAN PHOSPHORYLASE 2, CYTOSOLIC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	824	Total	C	N	O	S	0	6	0
			6552	4180	1120	1228	24			
1	B	827	Total	C	N	O	S	0	4	0
			6539	4176	1119	1220	24			

There are 66 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-32	MET	-	expression tag	UNP Q9SD76
A	-31	HIS	-	expression tag	UNP Q9SD76
A	-30	HIS	-	expression tag	UNP Q9SD76
A	-29	HIS	-	expression tag	UNP Q9SD76
A	-28	HIS	-	expression tag	UNP Q9SD76
A	-27	HIS	-	expression tag	UNP Q9SD76
A	-26	HIS	-	expression tag	UNP Q9SD76
A	-25	GLY	-	expression tag	UNP Q9SD76
A	-24	LYS	-	expression tag	UNP Q9SD76
A	-23	PRO	-	expression tag	UNP Q9SD76
A	-22	ILE	-	expression tag	UNP Q9SD76
A	-21	PRO	-	expression tag	UNP Q9SD76
A	-20	ASN	-	expression tag	UNP Q9SD76
A	-19	PRO	-	expression tag	UNP Q9SD76
A	-18	LEU	-	expression tag	UNP Q9SD76
A	-17	LEU	-	expression tag	UNP Q9SD76
A	-16	GLY	-	expression tag	UNP Q9SD76
A	-15	LEU	-	expression tag	UNP Q9SD76
A	-14	ASP	-	expression tag	UNP Q9SD76
A	-13	SER	-	expression tag	UNP Q9SD76
A	-12	THR	-	expression tag	UNP Q9SD76
A	-11	GLU	-	expression tag	UNP Q9SD76
A	-10	ASN	-	expression tag	UNP Q9SD76
A	-9	LEU	-	expression tag	UNP Q9SD76
A	-8	TYR	-	expression tag	UNP Q9SD76

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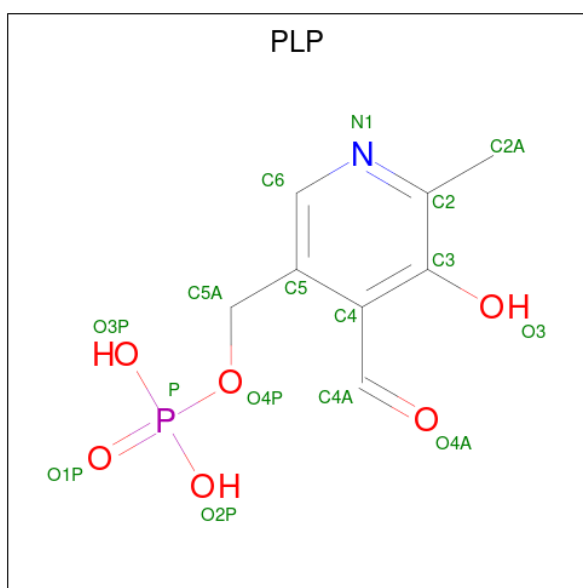
Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	PHE	-	expression tag	UNP Q9SD76
A	-6	GLN	-	expression tag	UNP Q9SD76
A	-5	GLY	-	expression tag	UNP Q9SD76
A	-4	ILE	-	expression tag	UNP Q9SD76
A	-3	ASP	-	expression tag	UNP Q9SD76
A	-2	PRO	-	expression tag	UNP Q9SD76
A	-1	PHE	-	expression tag	UNP Q9SD76
A	0	THR	-	expression tag	UNP Q9SD76
B	-32	MET	-	expression tag	UNP Q9SD76
B	-31	HIS	-	expression tag	UNP Q9SD76
B	-30	HIS	-	expression tag	UNP Q9SD76
B	-29	HIS	-	expression tag	UNP Q9SD76
B	-28	HIS	-	expression tag	UNP Q9SD76
B	-27	HIS	-	expression tag	UNP Q9SD76
B	-26	HIS	-	expression tag	UNP Q9SD76
B	-25	GLY	-	expression tag	UNP Q9SD76
B	-24	LYS	-	expression tag	UNP Q9SD76
B	-23	PRO	-	expression tag	UNP Q9SD76
B	-22	ILE	-	expression tag	UNP Q9SD76
B	-21	PRO	-	expression tag	UNP Q9SD76
B	-20	ASN	-	expression tag	UNP Q9SD76
B	-19	PRO	-	expression tag	UNP Q9SD76
B	-18	LEU	-	expression tag	UNP Q9SD76
B	-17	LEU	-	expression tag	UNP Q9SD76
B	-16	GLY	-	expression tag	UNP Q9SD76
B	-15	LEU	-	expression tag	UNP Q9SD76
B	-14	ASP	-	expression tag	UNP Q9SD76
B	-13	SER	-	expression tag	UNP Q9SD76
B	-12	THR	-	expression tag	UNP Q9SD76
B	-11	GLU	-	expression tag	UNP Q9SD76
B	-10	ASN	-	expression tag	UNP Q9SD76
B	-9	LEU	-	expression tag	UNP Q9SD76
B	-8	TYR	-	expression tag	UNP Q9SD76
B	-7	PHE	-	expression tag	UNP Q9SD76
B	-6	GLN	-	expression tag	UNP Q9SD76
B	-5	GLY	-	expression tag	UNP Q9SD76
B	-4	ILE	-	expression tag	UNP Q9SD76
B	-3	ASP	-	expression tag	UNP Q9SD76
B	-2	PRO	-	expression tag	UNP Q9SD76
B	-1	PHE	-	expression tag	UNP Q9SD76
B	0	THR	-	expression tag	UNP Q9SD76

- Molecule 2 is an oligosaccharide called 4,6-dideoxy-4-[[[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hy

droxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-beta-D-glucopyranose.

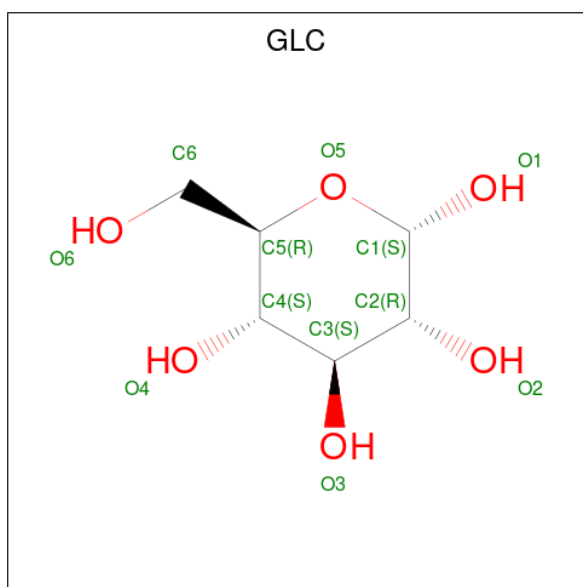
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	3	Total	C	N	O	0	0	1
			22	12	1	9			
2	D	3	Total	C	N	O	0	0	0
			44	25	1	18			

- Molecule 3 is PYRIDOXAL-5'-PHOSPHATE (CCD ID: PLP) (formula: C₈H₁₀NO₆P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
3	B	1	Total	C	N	O	P	0	0
			15	8	1	5	1		

- Molecule 4 is alpha-D-glucopyranose (CCD ID: GLC) (formula: C₆H₁₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			12	6	6		
4	A	1	Total	C	O	0	0
			12	6	6		
4	B	1	Total	C	O	0	0
			12	6	6		

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	C	O	0	0
			6	3	3		

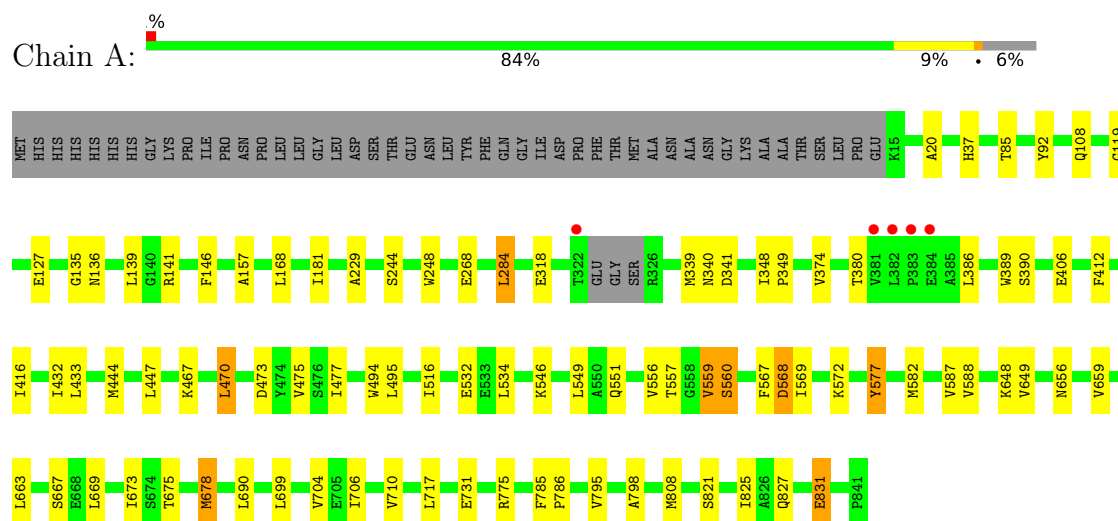
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	197	Total 197	O 197	0	0
6	B	147	Total 147	O 147	0	0

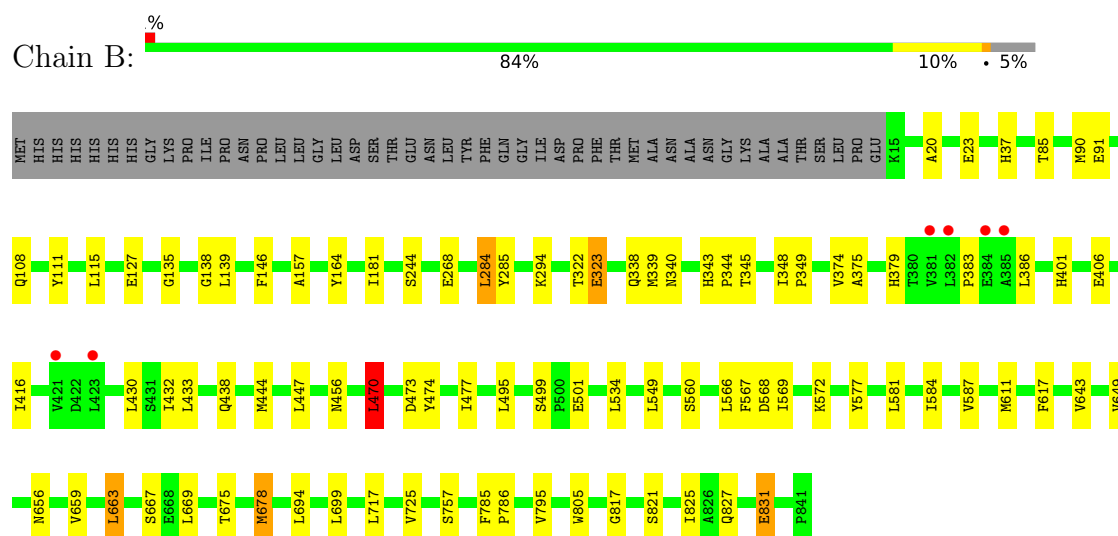
3 Residue-property plots [i](#)

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: ALPHA-GLUCAN PHOSPHORYLASE 2, CYTOSOLIC



• Molecule 1: ALPHA-GLUCAN PHOSPHORYLASE 2, CYTOSOLIC



• Molecule 2: 4,6-dideoxy-4-[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-beta-D-glucopyranose



BUC1
GLC2
AC13

- Molecule 2: 4,6-dideoxy-4-{[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)cyclohex-2-en-1-yl]amino}-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-beta-D-glucopyranose

Chain D:

100%

BUC1
GLC2
AC13

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	84.25Å 117.08Å 94.97Å 90.00° 106.79° 90.00°	Depositor
Resolution (Å)	60.99 – 2.35 60.99 – 2.35	Depositor EDS
% Data completeness (in resolution range)	99.8 (60.99-2.35) 99.8 (60.99-2.35)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.94 (at 2.34Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.184 , 0.240 0.186 , 0.240	Depositor DCC
R_{free} test set	3671 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	41.7	Xtriage
Anisotropy	0.430	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 36.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	13573	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 29.95 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.4207e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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, GLC, AC1, PLP, BGC

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	1.04	3/6722 (0.0%)	0.99	4/9123 (0.0%)
1	B	1.01	3/6704 (0.0%)	0.99	6/9100 (0.1%)
All	All	1.02	6/13426 (0.0%)	0.99	10/18223 (0.1%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	401	HIS	CA-C	-5.92	1.45	1.52
1	A	92	TYR	C-O	-5.69	1.17	1.23
1	B	37	HIS	CG-CD2	5.45	1.41	1.35
1	B	379	HIS	CG-ND1	-5.22	1.32	1.38
1	A	37	HIS	CG-ND1	-5.21	1.32	1.38
1	A	37	HIS	CG-CD2	5.11	1.41	1.35

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	643	VAL	CB-CA-C	-6.59	104.17	110.70
1	B	663	LEU	CA-C-N	6.50	124.34	120.24
1	B	663	LEU	C-N-CA	6.50	124.34	120.24
1	A	470	LEU	N-CA-C	6.32	118.16	111.28
1	B	294	LYS	N-CA-C	-5.48	105.31	111.28
1	B	470	LEU	N-CA-C	5.43	117.90	111.33
1	B	108	GLN	CB-CA-C	-5.42	102.36	110.88
1	A	108	GLN	CB-CA-C	-5.15	102.79	110.88
1	A	532	GLU	N-CA-C	5.14	116.88	111.28
1	A	494	TRP	N-CA-C	5.05	119.08	113.02

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	6552	0	6385	53	0
1	B	6539	0	6369	53	0
2	C	22	0	10	0	0
2	D	44	0	30	0	0
3	A	15	0	7	0	0
3	B	15	0	6	1	0
4	A	24	0	24	0	0
4	B	12	0	12	2	0
5	B	6	0	8	0	0
6	A	197	0	0	5	0
6	B	147	0	0	2	0
All	All	13573	0	12851	105	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 (105) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:549:LEU:HD11	1:B:663:LEU:HD23	1.41	1.02
1:A:339:MET:HE2	1:A:374:VAL:CG1	1.89	1.02
1:A:731:GLU:HG3	6:A:2180:HOH:O	1.68	0.93
1:B:549:LEU:HD11	1:B:663:LEU:CD2	2.06	0.85
1:B:339:MET:HE2	1:B:374:VAL:CG1	2.10	0.82
1:B:549:LEU:CD1	1:B:663:LEU:HD23	2.12	0.79
1:B:656:ASN:OD1	1:B:659:VAL:HG23	1.86	0.76
1:B:569:ILE:HG12	1:B:611:MET:HE3	1.68	0.76
1:A:569:ILE:HD13	1:A:663:LEU:HD22	1.74	0.69
1:A:380:THR:HG21	1:A:386:LEU:CD2	2.23	0.68
1:B:383:PRO:HB3	1:B:470:LEU:HD11	1.76	0.67
1:A:339:MET:HE2	1:A:374:VAL:HG12	1.74	0.67
1:B:473:ASP:O	1:B:477:ILE:HD12	1.95	0.66
1:A:339:MET:HE2	1:A:374:VAL:HG11	1.77	0.64
1:B:139:LEU:HD11	1:B:340:ASN:ND2	2.13	0.64
1:A:669:LEU:HD22	1:A:795:VAL:HG11	1.79	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:675:THR:HB	1:A:678:MET:HG3	1.80	0.63
1:B:416:ILE:HG22	1:B:416:ILE:O	1.99	0.62
1:A:569:ILE:HD12	1:A:667:SER:HB3	1.83	0.60
1:B:675:THR:HB	1:B:678:MET:HG3	1.83	0.60
1:B:581:LEU:HA	1:B:584:ILE:HG22	1.84	0.59
1:A:139:LEU:HD11	1:A:340:ASN:ND2	2.20	0.57
1:A:20:ALA:HB3	1:B:20:ALA:HB3	1.86	0.56
1:B:617:PHE:CZ	4:B:952:GLC:H1	2.40	0.56
1:A:339:MET:HE1	1:A:348:ILE:HD11	1.87	0.56
1:B:339:MET:HE2	1:B:374:VAL:HG11	1.86	0.56
1:A:699:LEU:HD12	1:A:704:VAL:HG22	1.90	0.53
1:B:146:PHE:CG	1:B:825:ILE:HD11	2.44	0.53
1:B:386:LEU:HA	6:B:2082:HOH:O	2.09	0.53
1:B:322:THR:O	1:B:323:GLU:O	2.26	0.52
1:B:432:ILE:HD13	1:B:447:LEU:HD13	1.91	0.52
1:B:339:MET:HE2	1:B:374:VAL:HG12	1.89	0.52
1:B:416:ILE:O	1:B:416:ILE:CG2	2.58	0.51
1:A:473:ASP:O	1:A:477:ILE:HD12	2.12	0.50
1:B:135:GLY:CA	1:B:284:LEU:HD11	2.42	0.49
1:B:348:ILE:HB	1:B:349:PRO:HD3	1.94	0.48
1:A:135:GLY:CA	1:A:284:LEU:HD11	2.44	0.48
1:B:406:GLU:HG2	1:B:433:LEU:HD11	1.95	0.48
1:B:135:GLY:HA2	1:B:284:LEU:HD11	1.96	0.47
1:B:669:LEU:HD22	1:B:795:VAL:HG11	1.95	0.47
1:A:557:THR:O	1:A:559:VAL:HG23	2.14	0.47
1:B:348:ILE:HB	1:B:349:PRO:CD	2.45	0.47
1:B:568:ASP:OD1	1:B:568:ASP:C	2.56	0.47
1:A:568:ASP:OD1	1:A:568:ASP:C	2.57	0.47
1:A:135:GLY:HA2	1:A:284:LEU:HD11	1.96	0.47
1:A:229:ALA:HB2	1:A:248:TRP:CZ3	2.50	0.47
1:A:516:ILE:O	1:A:516:ILE:HG22	2.15	0.46
1:A:406:GLU:HG2	1:A:433:LEU:HD11	1.97	0.46
1:B:587:VAL:HG11	1:B:649:VAL:HG21	1.96	0.46
1:A:146:PHE:CG	1:A:825:ILE:HD11	2.51	0.46
1:B:138:GLY:HA2	3:B:901:PLP:H5A2	1.98	0.46
1:A:556:VAL:HG23	1:A:557:THR:HG23	1.97	0.46
1:B:566:LEU:HD12	1:B:567:PHE:N	2.31	0.46
1:A:827:GLN:O	1:A:831:GLU:HG2	2.16	0.46
1:B:827:GLN:O	1:B:831:GLU:HG2	2.16	0.46
1:B:85:THR:O	1:B:157:ALA:HA	2.15	0.46
1:A:432:ILE:HD13	1:A:447:LEU:HD13	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:560:SER:O	1:A:648:LYS:NZ	2.41	0.45
1:A:546:LYS:NZ	6:A:2142:HOH:O	2.50	0.45
1:A:380:THR:CG2	1:A:386:LEU:CD2	2.93	0.45
1:A:656:ASN:OD1	1:A:659:VAL:HG23	2.17	0.45
1:A:467:LYS:HA	1:A:475:VAL:HG21	1.98	0.45
1:B:495:LEU:HD12	1:B:499:SER:HB2	1.98	0.45
1:B:549:LEU:HD23	1:B:567:PHE:CD2	2.52	0.44
1:B:268:GLU:HG2	6:B:2072:HOH:O	2.17	0.44
1:A:699:LEU:CD1	1:A:704:VAL:HG22	2.47	0.44
1:B:694:LEU:HD12	1:B:805:TRP:CZ2	2.53	0.44
1:A:587:VAL:HG11	1:A:649:VAL:HG21	1.99	0.43
1:B:284:LEU:O	1:B:285:TYR:C	2.61	0.43
1:A:785:PHE:N	1:A:786:PRO:CD	2.81	0.43
1:B:146:PHE:CD2	1:B:825:ILE:HD11	2.53	0.43
1:A:119:GLY:HA2	6:A:2042:HOH:O	2.18	0.43
1:B:569:ILE:HD12	1:B:667:SER:HB3	2.01	0.43
1:A:136:ASN:OD1	1:A:168:LEU:HD22	2.18	0.43
1:A:268:GLU:HG2	6:A:2089:HOH:O	2.18	0.43
1:A:386:LEU:HA	6:A:2105:HOH:O	2.19	0.43
1:A:412:PHE:CZ	1:A:416:ILE:HD11	2.53	0.43
1:A:389:TRP:CD1	1:A:444:MET:HE2	2.54	0.43
1:A:582:MET:HE2	1:A:673:ILE:HD12	2.00	0.43
1:B:91:GLU:OE2	1:B:285:TYR:OH	2.36	0.43
1:A:380:THR:CG2	1:A:386:LEU:HD21	2.49	0.42
1:B:534:LEU:O	1:B:534:LEU:HD12	2.20	0.42
1:A:495:LEU:HD22	1:A:690:LEU:HD11	2.02	0.42
1:B:438:GLN:HE21	1:B:438:GLN:HB2	1.65	0.42
1:B:699:LEU:HB2	1:B:717:LEU:HD11	2.02	0.42
1:A:534:LEU:HD12	1:A:534:LEU:O	2.20	0.42
1:A:85:THR:O	1:A:157:ALA:HA	2.19	0.41
1:A:348:ILE:HB	1:A:349:PRO:CD	2.50	0.41
1:A:348:ILE:HB	1:A:349:PRO:HD3	2.01	0.41
1:A:798:ALA:HB1	1:A:808:MET:HE1	2.01	0.41
1:B:430:LEU:O	1:B:474:TYR:OH	2.35	0.41
1:B:338:GLN:OE1	1:B:375:ALA:HB3	2.20	0.41
1:A:706:ILE:O	1:A:710:VAL:HG22	2.21	0.41
1:B:345:THR:HB	1:B:444:MET:HE3	2.03	0.41
1:A:141:ARG:HD2	1:A:141:ARG:HA	1.86	0.41
1:B:111:TYR:O	1:B:115:LEU:HD23	2.20	0.41
1:A:699:LEU:HB2	1:A:717:LEU:HD11	2.03	0.41
1:B:584:ILE:HD12	1:B:584:ILE:HA	1.90	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:343:HIS:HB2	1:B:344:PRO:HD3	2.03	0.41
1:A:146:PHE:CD2	1:A:825:ILE:HD11	2.56	0.40
1:B:90:MET:HE3	1:B:164:TYR:OH	2.21	0.40
1:B:785:PHE:N	1:B:786:PRO:CD	2.84	0.40
1:A:549:LEU:HD23	1:A:567:PHE:CD2	2.57	0.40
1:A:577:TYR:CD1	1:A:577:TYR:C	3.00	0.40
1:B:617:PHE:CZ	4:B:952:GLC:C1	3.04	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	826/874 (94%)	793 (96%)	33 (4%)	0	100	100
1	B	829/874 (95%)	797 (96%)	30 (4%)	2 (0%)	43	52
All	All	1655/1748 (95%)	1590 (96%)	63 (4%)	2 (0%)	48	59

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	323	GLU
1	B	817	GLY

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	690/752 (92%)	671 (97%)	19 (3%)	38	51
1	B	684/752 (91%)	668 (98%)	16 (2%)	44	58
All	All	1374/1504 (91%)	1339 (98%)	35 (2%)	40	55

All (35) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	127	GLU
1	A	181	ILE
1	A	244	SER
1	A	284	LEU
1	A	318	GLU
1	A	341	ASP
1	A	390	SER
1	A	470	LEU
1	A	551	GLN
1	A	559	VAL
1	A	560	SER
1	A	568	ASP
1	A	572	LYS
1	A	577	TYR
1	A	588	VAL
1	A	678	MET
1	A	775	ARG
1	A	821	SER
1	A	831	GLU
1	B	23	GLU
1	B	127	GLU
1	B	181	ILE
1	B	244	SER
1	B	284	LEU
1	B	456	ASN
1	B	470	LEU
1	B	501	GLU
1	B	560	SER
1	B	572	LYS
1	B	577	TYR
1	B	678	MET
1	B	725	VAL
1	B	757	SER
1	B	821	SER
1	B	831	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	76	HIS
1	A	210	GLN
1	A	226	GLN
1	A	261	GLN
1	A	278	GLN
1	A	480	ASN
1	A	484	ASN
1	A	583	ASN
1	A	631	ASN
1	A	748	GLN
1	A	827	GLN
1	B	76	HIS
1	B	78	ASN
1	B	94	GLN
1	B	210	GLN
1	B	226	GLN
1	B	359	ASN
1	B	438	GLN
1	B	480	ASN
1	B	484	ASN
1	B	631	ASN

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](#)

Of 6 monosaccharides modelled in this entry, 5 were used 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	GLC	C	2	2	11,11,12	1.32	1 (9%)	15,15,17	2.76	4 (26%)
2	AC1	C	3	2	10,10,23	1.38	2 (20%)	12,14,34	1.80	3 (25%)
2	BGC	D	1	2	12,12,12	0.86	0	17,17,17	1.60	3 (17%)
2	GLC	D	2	2	11,11,12	0.54	0	15,15,17	1.31	2 (13%)
2	AC1	D	3	2	21,22,23	0.87	0	22,32,34	1.01	1 (4%)

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	GLC	C	2	2	-	2/2/19/22	0/1/1/1
2	AC1	C	3	2	-	-	0/1/1/2
2	BGC	D	1	2	-	0/2/22/22	0/1/1/1
2	GLC	D	2	2	-	2/2/19/22	0/1/1/1
2	AC1	D	3	2	-	2/6/43/46	0/2/2/2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	2	GLC	C2-C3	2.63	1.56	1.52
2	C	3	AC1	O5-C5	2.19	1.47	1.43
2	C	3	AC1	O5-C1	2.14	1.47	1.43

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	2	GLC	C1-O5-C5	8.52	123.60	112.19
2	D	1	BGC	O4-C4-C3	-4.37	100.08	110.38
2	C	3	AC1	C1-O5-C5	4.24	122.96	112.97
2	C	2	GLC	O2-C2-C3	3.90	118.23	110.15
2	D	2	GLC	O5-C5-C6	3.41	114.30	107.66
2	C	2	GLC	O2-C2-C1	-2.73	102.97	109.22
2	D	2	GLC	O2-C2-C3	-2.58	104.82	110.15
2	C	2	GLC	O4-C4-C3	2.50	116.27	110.38
2	D	3	AC1	O2-C2-C1	2.48	114.89	109.22

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	BGC	O5-C5-C4	2.43	114.08	109.70
2	C	3	AC1	C3-C4-N4A	2.37	115.90	111.05
2	C	3	AC1	C1-C2-C3	2.26	112.93	109.64
2	D	1	BGC	C4-C3-C2	-2.04	107.25	110.83

There are no chirality outliers.

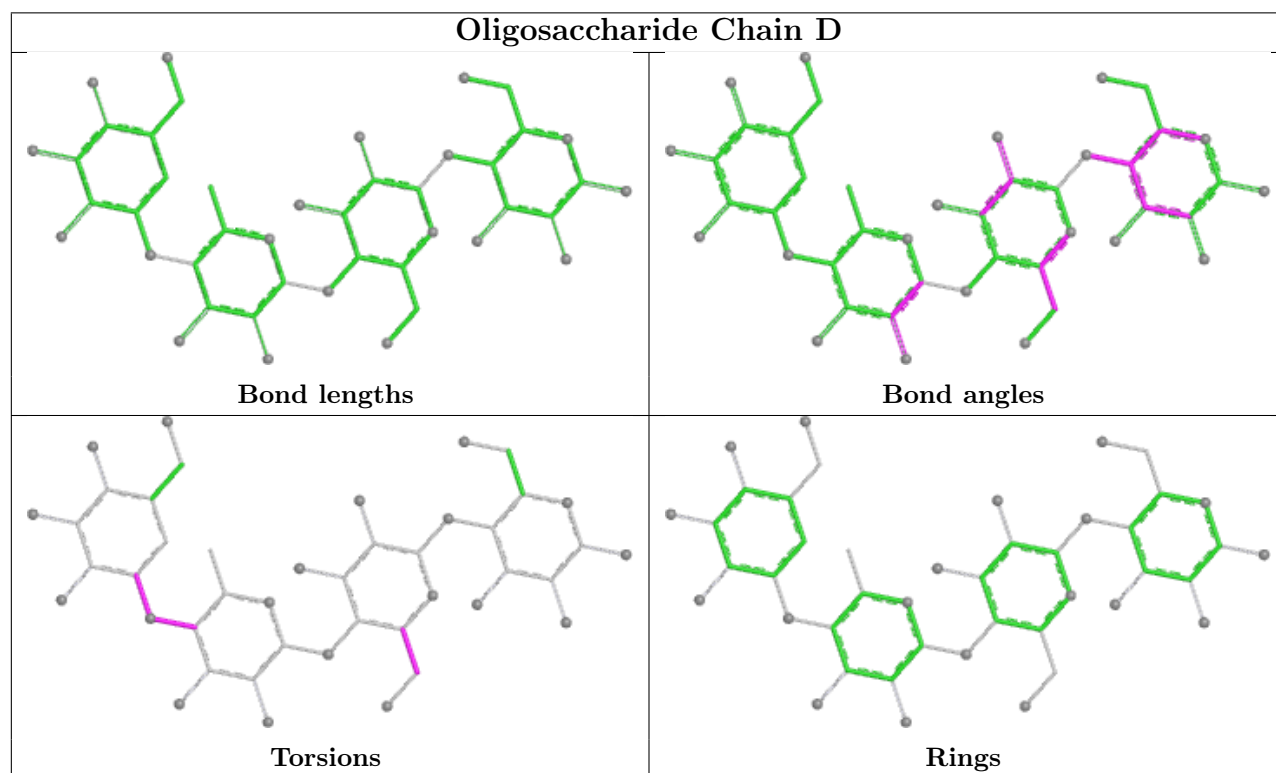
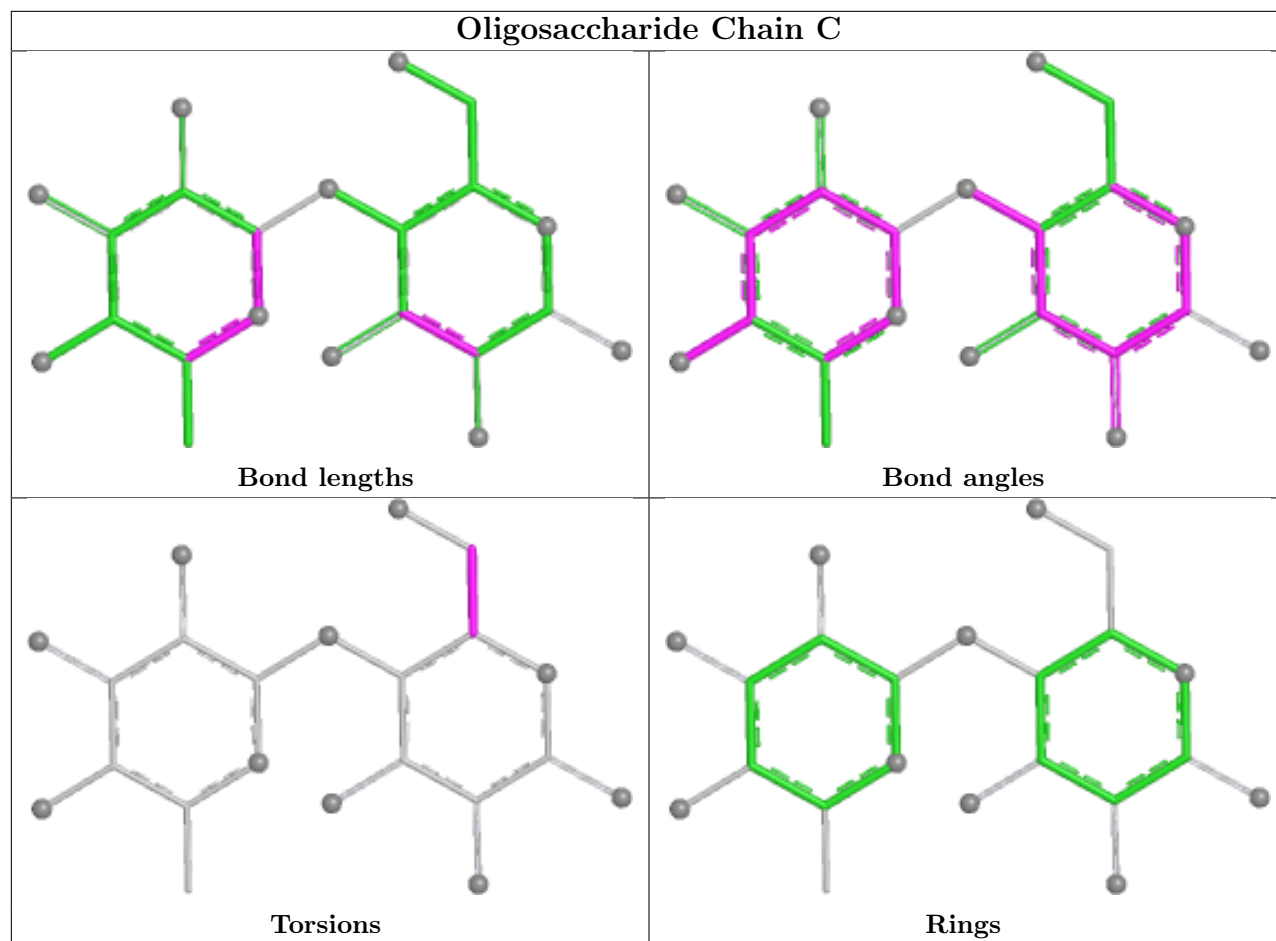
All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	2	GLC	O5-C5-C6-O6
2	D	2	GLC	C4-C5-C6-O6
2	C	2	GLC	C4-C5-C6-O6
2	C	2	GLC	O5-C5-C6-O6
2	D	3	AC1	C2B-C1B-N4A-C4
2	D	3	AC1	C3-C4-N4A-C1B

There are no ring outliers.

No monomer is involved in short contacts.

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

6 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
4	GLC	A	953	-	12,12,12	0.79	0	17,17,17	1.89	4 (23%)
3	PLP	B	901	1	15,15,16	1.86	5 (33%)	21,22,23	2.71	12 (57%)
4	GLC	B	952	-	12,12,12	0.81	0	17,17,17	1.71	2 (11%)
4	GLC	A	952	-	12,12,12	0.67	0	17,17,17	2.15	3 (17%)
5	GOL	B	1842	-	5,5,5	0.45	0	5,5,5	0.31	0
3	PLP	A	901	1	15,15,16	1.63	1 (6%)	21,22,23	1.91	4 (19%)

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
4	GLC	A	953	-	-	2/2/22/22	0/1/1/1
3	PLP	B	901	1	-	0/6/6/8	0/1/1/1
4	GLC	B	952	-	-	2/2/22/22	0/1/1/1
4	GLC	A	952	-	-	2/2/22/22	0/1/1/1
5	GOL	B	1842	-	-	4/4/4/4	-
3	PLP	A	901	1	-	3/6/6/8	0/1/1/1

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	901	PLP	P-O1P	4.78	1.65	1.50
3	B	901	PLP	P-O1P	4.69	1.65	1.50
3	B	901	PLP	C2A-C2	3.09	1.55	1.50
3	B	901	PLP	P-O4P	2.47	1.68	1.60
3	B	901	PLP	P-O3P	-2.22	1.46	1.54
3	B	901	PLP	C5A-C5	2.14	1.56	1.50

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	952	GLC	C1-O5-C5	5.86	125.00	113.65
3	B	901	PLP	O4P-C5A-C5	5.73	120.09	109.36
4	A	953	GLC	C1-O5-C5	4.90	123.13	113.65
3	A	901	PLP	O2P-P-O1P	-4.83	92.01	110.83
3	A	901	PLP	O3P-P-O4P	4.64	118.76	106.67
4	B	952	GLC	C1-O5-C5	4.60	122.56	113.65
3	B	901	PLP	O3-C3-C2	4.03	125.93	117.58
3	B	901	PLP	C3-C4-C5	3.79	123.13	118.59
3	B	901	PLP	O2P-P-O1P	-3.71	96.39	110.83
4	A	952	GLC	C1-C2-C3	3.61	117.71	110.36
3	B	901	PLP	O2P-P-O4P	3.54	115.90	106.67
3	B	901	PLP	C6-C5-C4	-3.42	115.29	118.10
3	B	901	PLP	C5A-C5-C6	3.22	124.61	119.36
4	B	952	GLC	O2-C2-C3	2.92	117.27	110.38
4	A	953	GLC	C4-C3-C2	-2.91	105.73	110.83
3	B	901	PLP	C6-N1-C2	2.88	124.41	119.20
3	B	901	PLP	C3-C2-N1	-2.70	117.55	120.96
3	A	901	PLP	O3P-P-O1P	2.63	121.07	110.83
3	B	901	PLP	C2A-C2-C3	2.57	123.80	120.80
4	A	953	GLC	O3-C3-C2	2.44	116.12	110.38
4	A	953	GLC	O4-C4-C5	2.32	115.03	109.32
3	B	901	PLP	C4A-C4-C5	-2.31	118.56	120.94
3	B	901	PLP	O3P-P-O2P	2.27	116.30	107.80
4	A	952	GLC	O2-C2-C1	2.17	114.26	109.25
3	A	901	PLP	O3-C3-C2	2.15	122.04	117.58

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	901	PLP	C5A-O4P-P-O2P
3	A	901	PLP	C5A-O4P-P-O3P
5	B	1842	GOL	C1-C2-C3-O3
5	B	1842	GOL	O2-C2-C3-O3
4	B	952	GLC	O5-C5-C6-O6
4	B	952	GLC	C4-C5-C6-O6
4	A	953	GLC	O5-C5-C6-O6
4	A	953	GLC	C4-C5-C6-O6
5	B	1842	GOL	O1-C1-C2-C3
5	B	1842	GOL	O1-C1-C2-O2
4	A	952	GLC	C4-C5-C6-O6

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Mol	Chain	Res	Type	Atoms
3	A	901	PLP	C5A-O4P-P-O1P
4	A	952	GLC	O5-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	901	PLP	1	0
4	B	952	GLC	2	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 [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	824/874 (94%)	-0.27	5 (0%) 85 89	17, 42, 65, 96	6 (0%)
1	B	827/874 (94%)	-0.14	6 (0%) 84 87	17, 46, 75, 110	4 (0%)
All	All	1651/1748 (94%)	-0.20	11 (0%) 84 87	17, 44, 70, 110	10 (0%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	382	LEU	3.9
1	A	381	VAL	3.2
1	B	381	VAL	2.9
1	A	382	LEU	2.9
1	A	383	PRO	2.6
1	B	423	LEU	2.5
1	A	322	THR	2.4
1	A	384	GLU	2.3
1	B	385	ALA	2.3
1	B	421	VAL	2.2
1	B	384	GLU	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

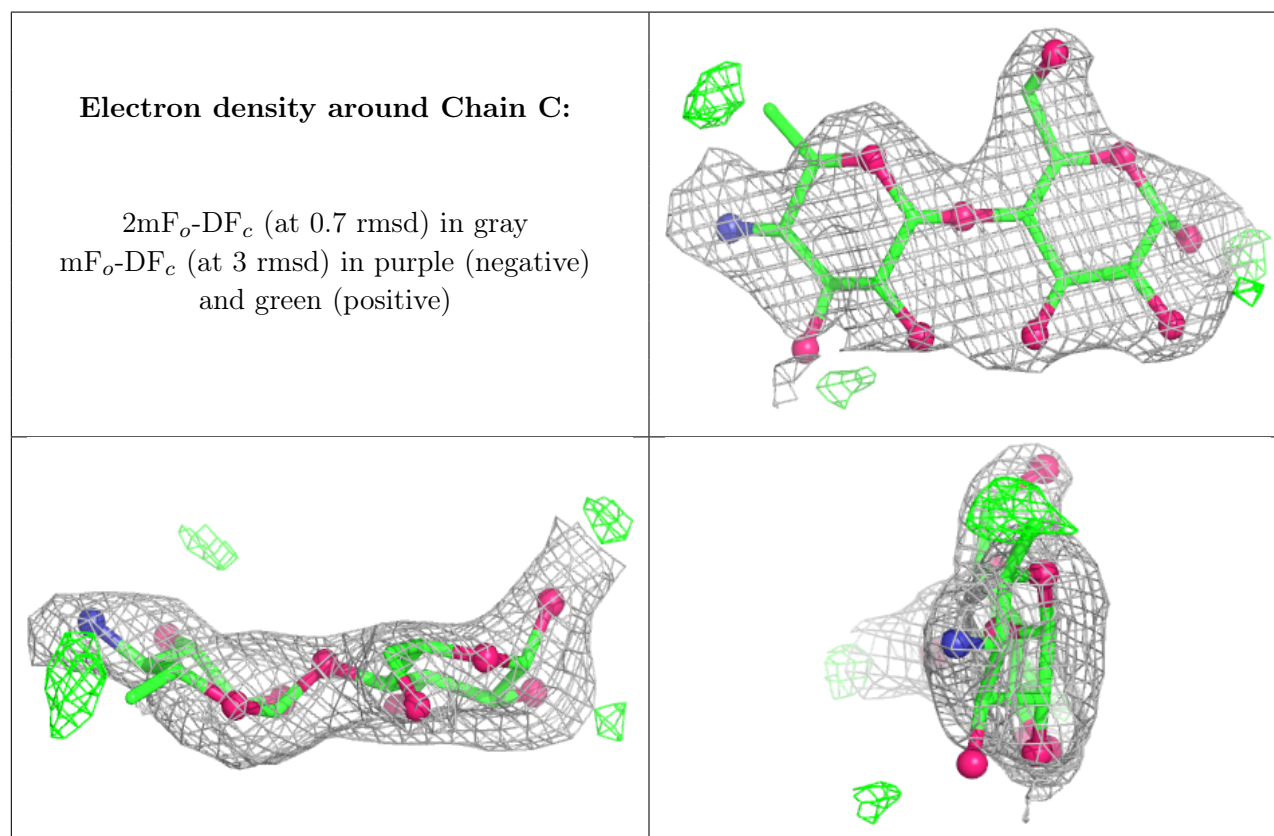
There are no non-standard protein/DNA/RNA residues in this entry.

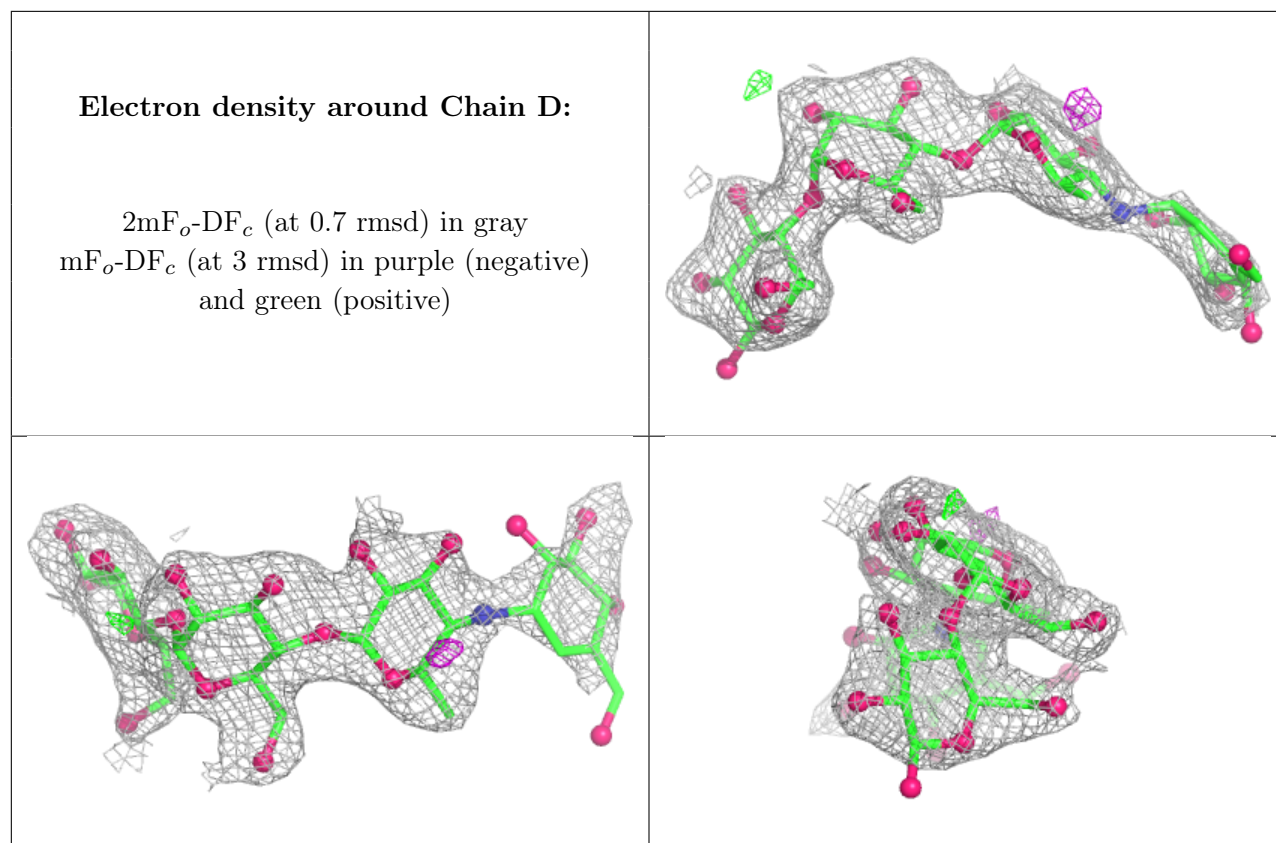
6.3 Carbohydrates [i](#)

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($\text{\AA}^2$)	Q<0.9
2	AC1	C	3	10/22	0.68	0.16	63,77,82,82	0
2	BGC	C	1	1/12	0.73	0.11	53,53,53,53	0
2	AC1	D	3	21/22	0.79	0.13	62,92,107,113	0
2	BGC	D	1	12/12	0.85	0.10	57,64,74,81	0
2	GLC	C	2	11/12	0.91	0.10	45,60,70,72	0
2	GLC	D	2	11/12	0.95	0.07	43,51,56,59	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(Å ²)	Q<0.9
4	GLC	B	952	12/12	0.66	0.15	65,70,73,76	0
4	GLC	A	952	12/12	0.71	0.14	69,76,81,82	0
4	GLC	A	953	12/12	0.77	0.12	70,84,90,90	0
5	GOL	B	1842	6/6	0.94	0.08	40,48,52,53	0
3	PLP	B	901	15/16	0.95	0.07	36,46,53,57	0
3	PLP	A	901	15/16	0.96	0.06	33,41,48,49	0

6.5 Other polymers [i](#)

There are no such residues in this entry.