



Full wwPDB X-ray Structure Validation Report ⓘ

Sep 14, 2026 – 02:05 PM JST

PDB ID : 24AZ / pdb_000024az
Title : alpha-1,2-glucosidase from Arthrobacter humicola A8F5, kojitriose complex
Authors : Yasukochi, R.; Fushinobu, S.
Deposited on : 2026-02-26
Resolution : 1.83 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 : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.015 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.50

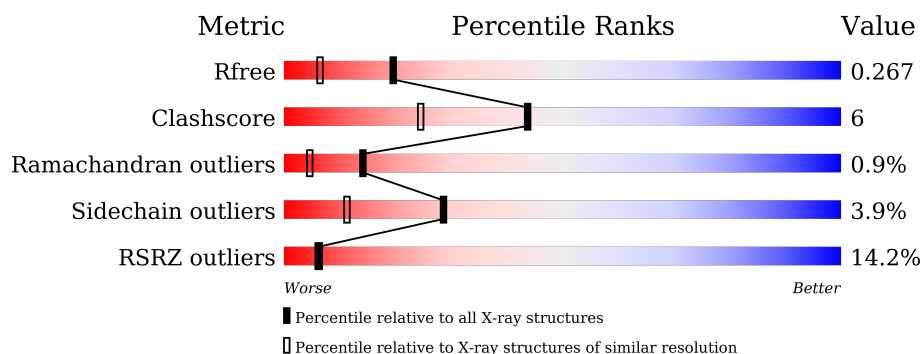
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.83 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	1296 (1.84-1.84)
Clashscore	190562	1329 (1.84-1.84)
Ramachandran outliers	187476	1318 (1.84-1.84)
Sidechain outliers	187428	1318 (1.84-1.84)
RSRZ outliers	180081	1296 (1.84-1.84)

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	639	14% 79% 13% ..
1	B	639	13% 77% 16% .. 5%
2	C	3	100%
2	D	3	100%

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

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	BGC	C	1	-	-	X	-

2 Entry composition [i](#)

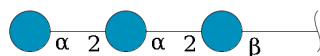
There are 6 unique types of molecules in this entry. The entry contains 9412 atoms, of which 0 are hydrogens and 0 are deuteriums.

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-1,2-glucosidase.

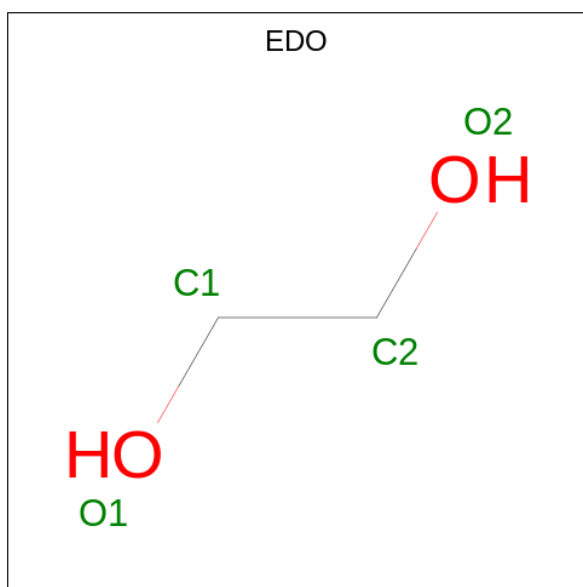
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	615	Total	C	N	O	S	0	0	0
			4607	2904	840	850	13			
1	B	607	Total	C	N	O	S	0	0	0
			4555	2874	830	838	13			

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



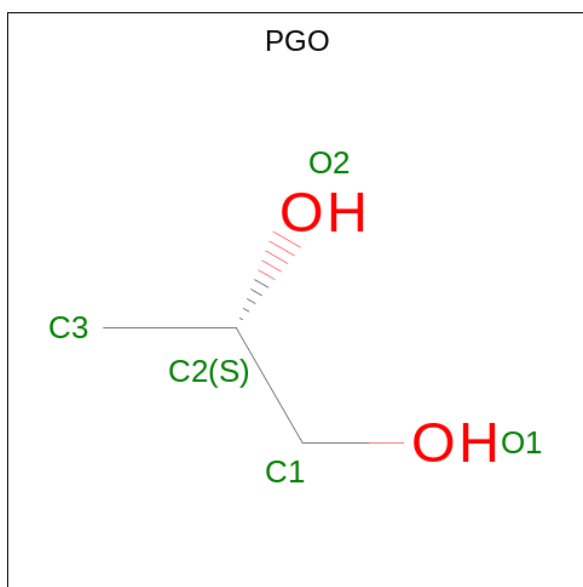
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	C	3	Total	C	O	0	0	0
			34	18	16			
2	D	3	Total	C	O	0	0	0
			34	18	16			

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



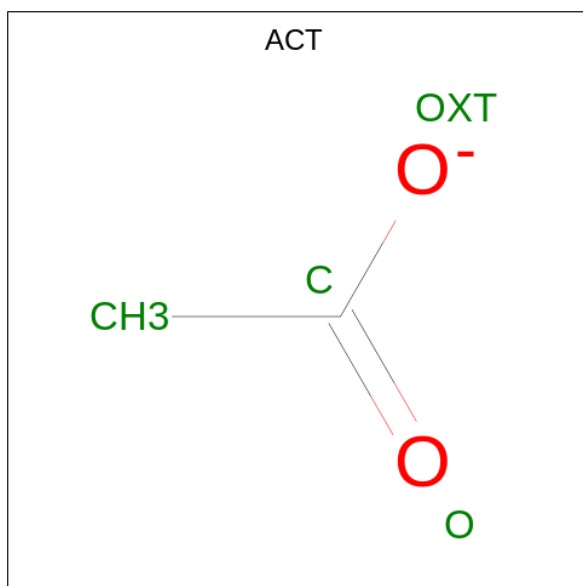
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		
3	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 4 is S-1,2-PROPANEDIOL (CCD ID: PGO) (formula: C₃H₈O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			5	3	2		

- Molecule 5 is ACETATE ION (CCD ID: ACT) (formula: $C_2H_3O_2^-$).



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

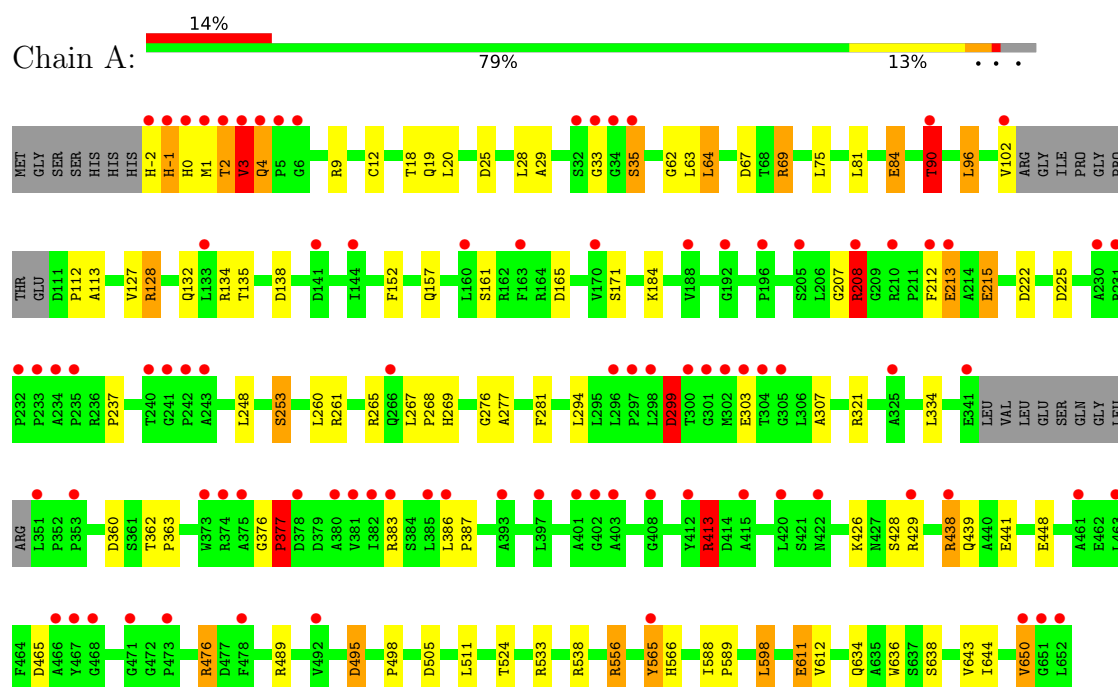
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	70	Total 70	O 70	0	0
6	B	71	Total 71	O 71	0	0

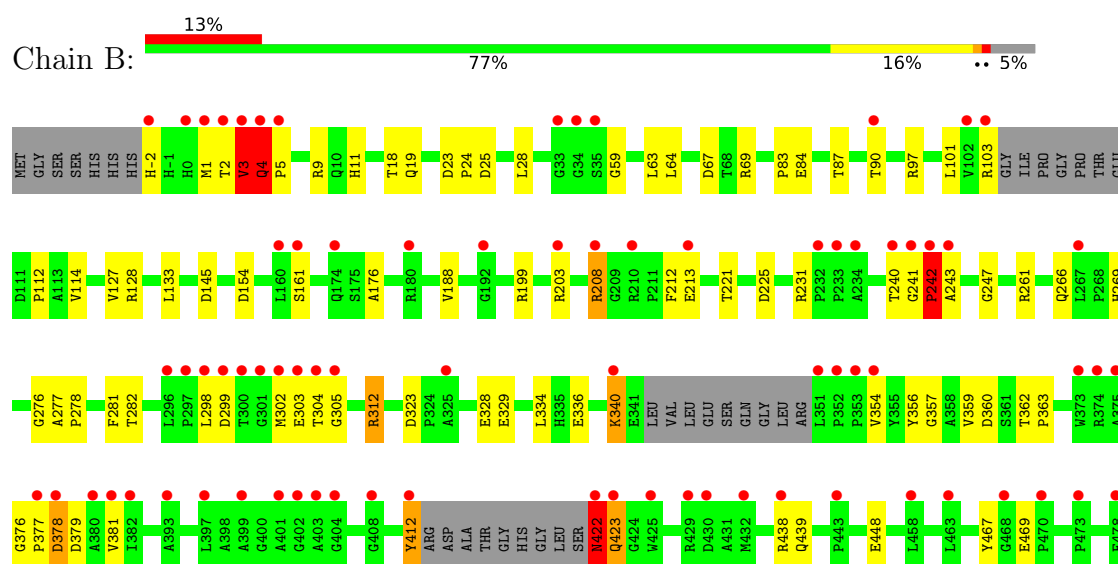
3 Residue-property plots

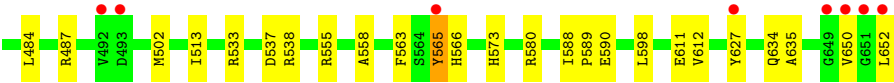
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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-1,2-glucosidase



• Molecule 1: alpha-1,2-glucosidase





● Molecule 2: alpha-D-glucopyranose-(1-2)-alpha-D-glucopyranose-(1-2)-beta-D-glucopyranose



● Molecule 2: alpha-D-glucopyranose-(1-2)-alpha-D-glucopyranose-(1-2)-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	56.38Å 107.98Å 105.52Å 90.00° 93.34° 90.00°	Depositor
Resolution (Å)	48.49 – 1.83 48.49 – 1.83	Depositor EDS
% Data completeness (in resolution range)	99.8 (48.49-1.83) 100.0 (48.49-1.83)	Depositor EDS
R_{merge}	0.27	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.84 (at 1.83Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.210 , 0.257 0.220 , 0.267	Depositor DCC
R_{free} test set	5479 reflections (4.91%)	wwPDB-VP
Wilson B-factor (Å ²)	28.3	Xtriage
Anisotropy	0.066	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 37.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	9412	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.72% 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: PGO, ACT, EDO, GLC, 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	1.02	1/4725 (0.0%)	1.47	34/6445 (0.5%)
1	B	1.02	2/4671 (0.0%)	1.52	44/6370 (0.7%)
All	All	1.02	3/9396 (0.0%)	1.49	78/12815 (0.6%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	9
1	B	0	6
All	All	0	15

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	635	ALA	CA-CB	-6.69	1.43	1.53
1	B	573	HIS	CE1-NE2	5.29	1.37	1.32
1	A	253	SER	CA-CB	5.20	1.61	1.53

All (78) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	90	THR	CA-CB-OG1	-9.93	94.71	109.60
1	A	299	ASP	CA-CB-CG	9.06	121.66	112.60
1	A	67	ASP	CA-CB-CG	8.45	121.05	112.60
1	B	225	ASP	CA-CB-CG	8.34	120.94	112.60
1	A	611	GLU	CB-CG-CD	8.19	126.52	112.60
1	B	231	ARG	CB-CA-C	8.15	122.24	110.02

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	128	ARG	CD-NE-CZ	8.05	135.68	124.40
1	B	67	ASP	CA-CB-CG	7.71	120.31	112.60
1	B	269	HIS	CA-CB-CG	-7.61	106.19	113.80
1	B	266	GLN	CB-CA-C	7.44	122.56	110.88
1	B	439	GLN	CB-CA-C	-7.43	96.94	109.65
1	A	538	ARG	NE-CZ-NH1	-7.31	114.19	121.50
1	A	90	THR	OG1-CB-CG2	-6.99	95.31	109.30
1	A	18	THR	OG1-CB-CG2	6.99	123.27	109.30
1	A	377	PRO	N-CA-CB	-6.86	96.04	103.25
1	A	128	ARG	NE-CZ-NH1	-6.80	114.70	121.50
1	B	580	ARG	CD-NE-CZ	6.77	133.88	124.40
1	A	267	LEU	N-CA-CB	6.74	121.11	111.21
1	B	627	TYR	CB-CA-C	6.65	117.73	110.08
1	A	269	HIS	CA-CB-CG	-6.55	107.25	113.80
1	B	242	PRO	N-CA-CB	-6.50	96.42	103.25
1	B	90	THR	OG1-CB-CG2	6.47	122.24	109.30
1	A	213	GLU	CB-CG-CD	6.34	123.38	112.60
1	A	360	ASP	CA-CB-CG	6.16	118.76	112.60
1	A	75	LEU	N-CA-CB	-6.15	100.40	110.43
1	B	97	ARG	CG-CD-NE	-6.13	98.51	112.00
1	B	360	ASP	CA-CB-CG	6.11	118.71	112.60
1	A	426	LYS	CA-C-O	-6.08	115.05	122.41
1	A	225	ASP	CA-CB-CG	6.03	118.63	112.60
1	A	448	GLU	N-CA-CB	6.01	118.96	110.12
1	A	438	ARG	CA-CB-CG	5.85	125.79	114.10
1	B	304	THR	CA-C-N	5.82	125.62	120.10
1	B	304	THR	C-N-CA	5.82	125.62	120.10
1	A	538	ARG	CG-CD-NE	-5.78	99.29	112.00
1	A	495	ASP	CA-CB-CG	5.74	118.34	112.60
1	B	199	ARG	CB-CG-CD	5.72	124.46	111.30
1	B	484	LEU	N-CA-CB	-5.70	101.74	110.12
1	B	438	ARG	CA-CB-CG	5.69	125.48	114.10
1	A	102	VAL	CA-C-O	-5.68	111.14	120.80
1	B	422	ASN	CA-CB-CG	5.68	118.28	112.60
1	B	203	ARG	CB-CA-C	-5.60	98.27	109.35
1	B	323	ASP	CA-CB-CG	5.56	118.16	112.60
1	B	87	THR	OG1-CB-CG2	-5.54	98.22	109.30
1	B	212	PHE	CA-CB-CG	5.54	119.34	113.80
1	B	18	THR	OG1-CB-CG2	5.51	120.32	109.30
1	B	412	TYR	CA-C-O	-5.50	111.44	120.80
1	B	537	ASP	CA-CB-CG	5.50	118.10	112.60
1	B	282	THR	CA-CB-OG1	-5.47	101.39	109.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	84	GLU	CB-CG-CD	5.44	121.85	112.60
1	B	487	ARG	CB-CA-C	5.43	119.50	110.81
1	A	524	THR	N-CA-C	-5.42	105.40	112.23
1	A	237	PRO	N-CA-C	5.41	117.30	110.70
1	A	212	PHE	CA-CB-CG	5.40	119.20	113.80
1	B	627	TYR	CA-C-O	5.40	122.80	119.29
1	A	184	LYS	CB-CA-C	-5.36	100.90	109.75
1	A	96	LEU	N-CA-CB	5.36	119.01	110.65
1	B	261	ARG	N-CA-CB	5.32	117.83	109.69
1	B	448	GLU	N-CA-CB	5.28	118.47	110.28
1	A	18	THR	CA-CB-OG1	-5.26	101.71	109.60
1	A	261	ARG	NE-CZ-NH2	5.26	123.93	119.20
1	A	64	LEU	N-CA-CB	-5.19	102.86	110.85
1	B	281	PHE	CB-CA-C	5.17	119.76	111.91
1	B	299	ASP	CB-CA-C	5.14	118.19	109.50
1	B	336	GLU	CB-CG-CD	-5.13	103.87	112.60
1	A	81	LEU	CA-C-O	-5.10	115.19	120.70
1	B	203	ARG	N-CA-CB	5.09	120.22	111.00
1	B	221	THR	CA-CB-OG1	-5.09	101.96	109.60
1	A	215	GLU	N-CA-CB	-5.07	102.52	111.39
1	B	304	THR	CA-CB-OG1	-5.07	102.00	109.60
1	B	145	ASP	CA-CB-CG	5.06	117.66	112.60
1	A	441	GLU	CB-CA-C	-5.05	101.19	109.53
1	B	422	ASN	CA-C-N	-5.04	115.26	122.67
1	B	422	ASN	C-N-CA	-5.04	115.26	122.67
1	A	598	LEU	N-CA-CB	5.03	118.07	110.28
1	B	627	TYR	O-C-N	-5.02	117.16	121.23
1	A	448	GLU	CB-CG-CD	5.01	121.12	112.60
1	B	11	HIS	CA-C-N	-5.00	114.73	122.59
1	B	11	HIS	C-N-CA	-5.00	114.73	122.59

There are no chirality outliers.

All (15) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	208	ARG	Sidechain
1	A	277	ALA	Mainchain
1	A	35	SER	Peptide
1	A	383	ARG	Sidechain
1	A	413	ARG	Sidechain
1	A	438	ARG	Sidechain
1	A	476	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	A	556	ARG	Sidechain
1	A	69	ARG	Sidechain
1	B	208	ARG	Sidechain
1	B	312	ARG	Sidechain
1	B	423	GLN	Peptide
1	B	538	ARG	Sidechain
1	B	555	ARG	Sidechain
1	B	69	ARG	Sidechain

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	4607	0	4498	57	0
1	B	4555	0	4452	52	0
2	C	34	0	29	7	0
2	D	34	0	30	6	0
3	A	16	0	24	5	0
3	B	16	0	23	2	0
4	A	5	0	8	2	0
5	A	4	0	3	0	0
6	A	70	0	0	1	0
6	B	71	0	0	2	0
All	All	9412	0	9067	111	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 6.

All (111) 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:428:SER:HB3	2:C:1:BGC:H6C1	1.54	0.87
1:B:83:PRO:HG2	3:B:703:EDO:H12	1.57	0.86
1:B:357:GLY:O	1:B:423:GLN:HG2	1.76	0.86
1:A:321:ARG:NH1	3:A:705:EDO:O1	2.10	0.85
1:A:-1:HIS:CD2	1:A:165:ASP:OD1	2.34	0.80

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:2:GLC:H2	2:D:3:GLC:H5	1.65	0.80
1:A:-1:HIS:NE2	1:A:165:ASP:OD1	2.19	0.75
1:B:611:GLU:OE2	6:B:801:HOH:O	2.04	0.73
1:B:3:VAL:HG22	1:B:5:PRO:HD3	1.72	0.71
1:A:428:SER:CB	2:C:1:BGC:H6C1	2.21	0.70
1:A:25:ASP:OD1	1:B:9:ARG:NH2	2.26	0.69
2:D:1:BGC:O1	2:D:3:GLC:C1	2.44	0.66
1:B:84:GLU:OE1	1:B:103:ARG:NH1	2.30	0.65
2:D:2:GLC:H2	2:D:3:GLC:C5	2.28	0.63
2:D:2:GLC:C2	2:D:3:GLC:H5	2.28	0.63
1:B:412:TYR:CE1	1:B:422:ASN:HA	2.34	0.62
1:B:357:GLY:O	1:B:423:GLN:CG	2.45	0.62
1:A:90:THR:HG21	3:A:701:EDO:O1	1.99	0.61
1:B:328:GLU:C	1:B:329:GLU:HG3	2.25	0.61
1:B:241:GLY:O	1:B:243:ALA:N	2.35	0.59
1:A:428:SER:CA	2:C:1:BGC:H6C1	2.32	0.59
1:B:533:ARG:NH2	1:B:590:GLU:OE1	2.37	0.58
1:A:428:SER:HB3	2:C:1:BGC:C6	2.31	0.57
1:A:495:ASP:OD1	1:A:556:ARG:NH1	2.33	0.57
1:B:63:LEU:HD11	1:B:127:VAL:HG21	1.86	0.57
1:A:90:THR:CG2	3:A:701:EDO:O1	2.54	0.56
1:B:241:GLY:O	1:B:242:PRO:C	2.49	0.55
1:B:357:GLY:O	1:B:423:GLN:HB3	2.06	0.55
1:B:378:ASP:HB3	1:B:381:VAL:HG23	1.88	0.55
1:B:242:PRO:O	1:B:247:GLY:HA3	2.06	0.55
1:B:362:THR:N	1:B:363:PRO:HD2	2.22	0.55
1:A:9:ARG:NH2	1:B:25:ASP:OD1	2.39	0.54
1:A:222:ASP:OD2	6:A:801:HOH:O	2.18	0.54
1:A:63:LEU:HD11	1:A:127:VAL:HG21	1.89	0.54
1:A:489:ARG:HH11	4:A:704:PGO:H11	1.73	0.54
1:A:19:GLN:HG3	1:A:64:LEU:HB2	1.89	0.54
1:A:276:GLY:HA3	1:A:634:GLN:NE2	2.23	0.54
1:A:208:ARG:CD	1:B:558:ALA:O	2.56	0.53
1:B:334:LEU:HD12	1:B:334:LEU:C	2.33	0.53
1:A:362:THR:N	1:A:363:PRO:HD2	2.23	0.53
1:A:321:ARG:NH1	3:A:705:EDO:HO1	2.06	0.53
1:A:650:VAL:O	1:A:650:VAL:HG12	2.09	0.52
1:A:128:ARG:HE	1:A:215:GLU:CD	2.18	0.52
1:B:23:ASP:HB2	1:B:24:PRO:CD	2.40	0.51
1:A:321:ARG:HH11	3:A:705:EDO:HO1	1.52	0.51
1:B:377:PRO:C	1:B:378:ASP:O	2.54	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:650:VAL:HG12	1:B:650:VAL:O	2.10	0.50
1:B:114:VAL:CG1	1:B:133:LEU:HD22	2.41	0.50
1:A:84:GLU:OE2	1:B:5:PRO:HB3	2.12	0.50
1:B:154:ASP:OD1	1:B:340:LYS:NZ	2.45	0.50
1:A:113:ALA:O	1:A:135:THR:HA	2.13	0.49
1:B:357:GLY:O	1:B:423:GLN:CB	2.61	0.49
1:A:132:GLN:NE2	1:A:213:GLU:OE1	2.46	0.48
1:A:112:PRO:HG2	1:B:563:PHE:HB3	1.94	0.48
1:A:413:ARG:HH21	1:A:413:ARG:HB3	1.79	0.48
1:A:2:THR:HB	1:A:161:SER:HB3	1.95	0.48
1:A:376:GLY:H	1:A:377:PRO:HD3	1.79	0.48
1:A:489:ARG:NH1	4:A:704:PGO:H11	2.29	0.48
2:D:1:BGC:O1	2:D:2:GLC:O2	2.32	0.47
1:B:101:LEU:HD13	1:B:112:PRO:HG3	1.97	0.47
1:A:90:THR:HG23	1:A:96:LEU:CD2	2.45	0.47
1:B:305:GLY:HA3	6:B:865:HOH:O	2.14	0.47
1:B:502:MET:HE2	1:B:513:ILE:CG2	2.45	0.47
1:B:650:VAL:O	1:B:652:LEU:HG	2.15	0.46
1:A:294:LEU:HD22	1:A:643:VAL:HG21	1.96	0.46
1:A:465:ASP:OD2	1:A:476:ARG:NH2	2.49	0.46
1:B:467:TYR:O	1:B:469:GLU:HG2	2.15	0.46
1:B:303:GLU:O	1:B:312:ARG:NH2	2.48	0.46
1:B:354:VAL:HG12	1:B:356:TYR:CE1	2.51	0.46
1:B:377:PRO:O	1:B:378:ASP:C	2.57	0.46
1:A:428:SER:HA	2:C:1:BGC:H6C1	1.97	0.46
1:B:5:PRO:HG2	1:B:59:GLY:HA2	1.98	0.45
1:A:334:LEU:C	1:A:334:LEU:HD12	2.41	0.45
1:A:533:ARG:O	1:A:533:ARG:HD3	2.16	0.45
1:A:611:GLU:HG3	1:A:634:GLN:HG2	1.98	0.45
1:B:176:ALA:HA	1:B:188:VAL:O	2.17	0.45
1:A:90:THR:HG23	1:A:96:LEU:HD23	1.99	0.45
1:B:565:TYR:CD2	1:B:566:HIS:CE1	3.05	0.44
1:A:12:CYS:HA	1:A:20:LEU:O	2.17	0.44
1:B:378:ASP:OD1	1:B:379:ASP:N	2.51	0.44
1:A:29:ALA:HB1	1:A:33:GLY:HA3	1.99	0.44
1:A:428:SER:HA	2:C:1:BGC:C6	2.48	0.43
1:B:276:GLY:HA3	1:B:634:GLN:NE2	2.33	0.43
1:A:265:ARG:O	1:A:268:PRO:HD3	2.19	0.43
2:C:2:GLC:H2	2:C:3:GLC:C5	2.49	0.43
2:D:2:GLC:C2	2:D:3:GLC:C5	2.95	0.43
1:B:376:GLY:H	1:B:377:PRO:HD3	1.83	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:588:ILE:N	1:A:589:PRO:CD	2.82	0.42
1:A:253:SER:HB3	1:A:638:SER:O	2.19	0.42
1:A:28:LEU:HD21	1:A:62:GLY:HA2	2.02	0.42
1:A:138:ASP:O	1:A:207:GLY:HA3	2.19	0.42
1:A:260:LEU:HA	1:A:260:LEU:HD23	1.89	0.42
1:B:357:GLY:C	1:B:423:GLN:HG2	2.42	0.42
1:A:505:ASP:OD1	1:A:505:ASP:C	2.63	0.41
1:B:377:PRO:O	1:B:378:ASP:O	2.38	0.41
1:B:588:ILE:HB	1:B:589:PRO:HD3	2.02	0.41
1:A:132:GLN:OE1	1:A:134:ARG:CZ	2.69	0.41
1:B:83:PRO:CG	3:B:703:EDO:H12	2.40	0.41
1:A:-2:HIS:CE1	1:A:157:GLN:HG3	2.56	0.41
1:A:386:LEU:N	1:A:387:PRO:CD	2.84	0.41
1:B:359:VAL:HG12	1:B:423:GLN:O	2.21	0.41
1:B:598:LEU:HD23	1:B:598:LEU:HA	1.92	0.41
1:A:69:ARG:O	1:A:152:PHE:HA	2.21	0.41
1:A:299:ASP:OD2	1:A:307:ALA:N	2.40	0.41
1:B:303:GLU:HG3	1:B:381:VAL:HG22	2.02	0.40
1:B:19:GLN:HG3	1:B:64:LEU:HB2	2.03	0.40
1:A:598:LEU:HD13	1:A:644:ILE:HD11	2.02	0.40
1:B:4:GLN:H	1:B:5:PRO:HD3	1.87	0.40
1:A:3:VAL:HB	1:A:4:GLN:H	1.68	0.40
1:A:565:TYR:CD2	1:A:566:HIS:CE1	3.10	0.40
1:B:277:ALA:HA	1:B:278:PRO:HA	1.88	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	609/639 (95%)	583 (96%)	21 (3%)	5 (1%)	16 5

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	599/639 (94%)	568 (95%)	25 (4%)	6 (1%)	12	4
All	All	1208/1278 (94%)	1151 (95%)	46 (4%)	11 (1%)	14	4

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	35	SER
1	B	3	VAL
1	B	4	GLN
1	B	242	PRO
1	B	378	ASP
1	B	302	MET
1	A	1	MET
1	B	340	LYS
1	A	-1	HIS
1	A	650	VAL
1	A	3	VAL

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	454/474 (96%)	434 (96%)	20 (4%)	25	8
1	B	449/474 (95%)	434 (97%)	15 (3%)	33	15
All	All	903/948 (95%)	868 (96%)	35 (4%)	28	11

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

Mol	Chain	Res	Type
1	A	0	HIS
1	A	2	THR
1	A	3	VAL
1	A	4	GLN
1	A	90	THR

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Mol	Chain	Res	Type
1	A	171	SER
1	A	208	ARG
1	A	248	LEU
1	A	281	PHE
1	A	299	ASP
1	A	303	GLU
1	A	377	PRO
1	A	413	ARG
1	A	429	ARG
1	A	439	GLN
1	A	498	PRO
1	A	511	LEU
1	A	565	TYR
1	A	612	VAL
1	A	636	TRP
1	B	-2	HIS
1	B	1	MET
1	B	2	THR
1	B	3	VAL
1	B	4	GLN
1	B	28	LEU
1	B	161	SER
1	B	208	ARG
1	B	213	GLU
1	B	240	THR
1	B	242	PRO
1	B	298	LEU
1	B	422	ASN
1	B	565	TYR
1	B	612	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	10	GLN
1	A	439	GLN
1	A	634	GLN
1	B	422	ASN
1	B	439	GLN
1	B	634	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

6 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	C	1	2	12,12,12	0.92	1 (8%)	17,17,17	1.99	3 (17%)
2	GLC	C	2	2	11,11,12	1.25	1 (9%)	15,15,17	1.04	1 (6%)
2	GLC	C	3	2	11,11,12	0.91	1 (9%)	15,15,17	1.70	2 (13%)
2	BGC	D	1	2	12,12,12	0.85	0	17,17,17	1.35	2 (11%)
2	GLC	D	2	2	11,11,12	1.64	2 (18%)	15,15,17	2.08	4 (26%)
2	GLC	D	3	2	11,11,12	1.19	1 (9%)	15,15,17	1.54	2 (13%)

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	C	1	2	-	2/2/22/22	0/1/1/1
2	GLC	C	2	2	-	0/2/19/22	0/1/1/1
2	GLC	C	3	2	-	0/2/19/22	0/1/1/1
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	GLC	D	3	2	-	0/2/19/22	0/1/1/1

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	2	GLC	C2-C3	4.14	1.58	1.52
2	C	2	GLC	O5-C5	3.16	1.49	1.43
2	D	3	GLC	C4-C5	2.93	1.59	1.53
2	D	2	GLC	O2-C2	2.80	1.49	1.43
2	C	3	GLC	C4-C3	2.30	1.58	1.52
2	C	1	BGC	O5-C5	-2.24	1.38	1.44

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1	BGC	O2-C2-C3	-6.75	94.75	110.35
2	D	2	GLC	O2-C2-C3	4.93	120.02	110.14
2	D	3	GLC	O5-C1-C2	-4.40	103.97	110.77
2	C	3	GLC	C1-O5-C5	4.32	118.04	112.19
2	D	2	GLC	C1-C2-C3	-3.45	105.42	109.67
2	C	3	GLC	O5-C5-C6	-3.40	101.88	107.20
2	D	1	BGC	O1-C1-O5	3.32	120.35	110.38
2	D	2	GLC	O3-C3-C2	3.05	115.83	109.99
2	C	2	GLC	O2-C2-C3	2.91	115.96	110.14
2	D	1	BGC	O5-C1-C2	-2.77	105.34	110.28
2	C	1	BGC	O4-C4-C3	-2.75	103.98	110.35
2	D	2	GLC	O5-C1-C2	2.69	114.92	110.77
2	D	3	GLC	O6-C6-C5	-2.36	103.21	111.29
2	C	1	BGC	C4-C3-C2	2.14	114.57	110.82

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	1	BGC	C4-C5-C6-O6
2	D	2	GLC	C4-C5-C6-O6
2	C	1	BGC	O5-C5-C6-O6
2	D	2	GLC	O5-C5-C6-O6

There are no ring outliers.

6 monomers are involved in 13 short contacts:

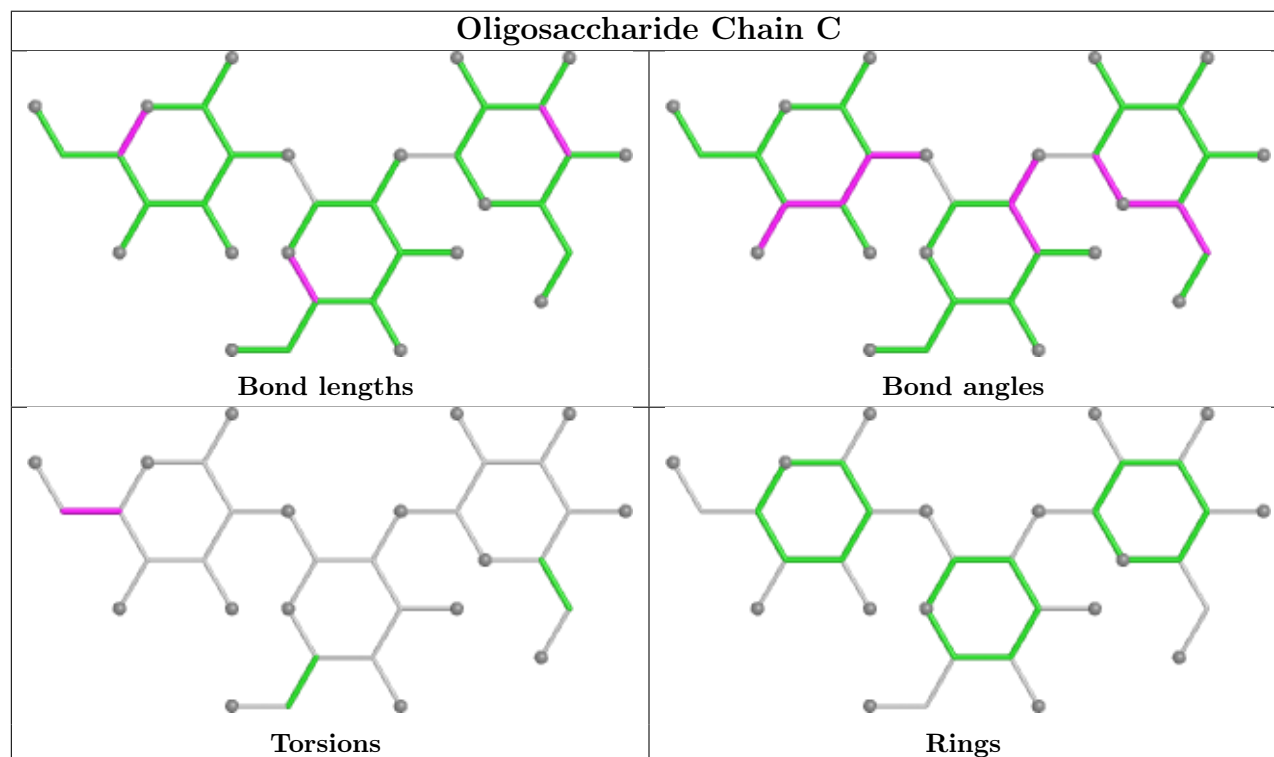
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	2	GLC	5	0
2	C	3	GLC	1	0

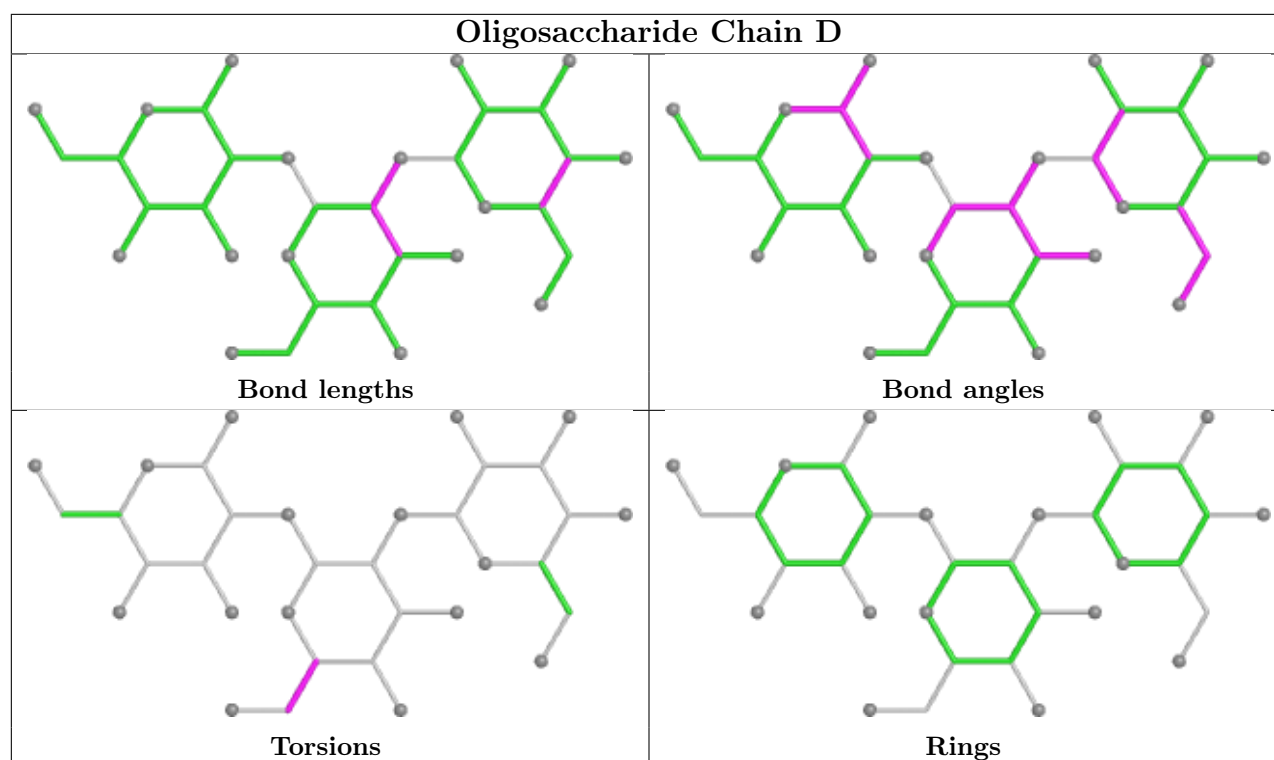
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	3	GLC	5	0
2	D	1	BGC	2	0
2	C	1	BGC	6	0
2	C	2	GLC	1	0

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](#)

10 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	EDO	A	705	-	3,3,3	0.28	0	2,2,2	0.20	0
3	EDO	A	702	-	3,3,3	0.28	0	2,2,2	0.24	0
3	EDO	B	701	-	3,3,3	0.26	0	2,2,2	0.71	0
3	EDO	A	703	-	3,3,3	0.35	0	2,2,2	0.86	0
3	EDO	B	702	-	3,3,3	0.83	0	2,2,2	0.69	0
3	EDO	B	704	-	3,3,3	0.31	0	2,2,2	0.14	0
3	EDO	A	701	-	3,3,3	1.24	0	2,2,2	0.78	0
3	EDO	B	703	-	3,3,3	1.13	0	2,2,2	0.22	0
5	ACT	A	706	-	3,3,3	1.85	2 (66%)	3,3,3	0.38	0
4	PGO	A	704	-	3,4,4	0.50	0	1,4,4	0.26	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	EDO	A	705	-	-	0/1/1/1	-
3	EDO	A	702	-	-	1/1/1/1	-
3	EDO	B	701	-	-	1/1/1/1	-
3	EDO	A	703	-	-	1/1/1/1	-
3	EDO	B	702	-	-	0/1/1/1	-
3	EDO	B	704	-	-	1/1/1/1	-
3	EDO	A	701	-	-	0/1/1/1	-
3	EDO	B	703	-	-	0/1/1/1	-
4	PGO	A	704	-	-	0/2/2/2	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	706	ACT	CH3-C	2.28	1.58	1.49
5	A	706	ACT	O-C	2.16	1.32	1.22

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	703	EDO	O1-C1-C2-O2
3	B	701	EDO	O1-C1-C2-O2
3	A	702	EDO	O1-C1-C2-O2
3	B	704	EDO	O1-C1-C2-O2

There are no ring outliers.

4 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	705	EDO	3	0
3	A	701	EDO	2	0
3	B	703	EDO	2	0
4	A	704	PGO	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 ⓘ

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	615/639 (96%)	0.93	88 (14%) 6 6	19, 31, 65, 105	0
1	B	607/639 (94%)	0.98	85 (14%) 6 6	17, 32, 69, 127	0
All	All	1222/1278 (95%)	0.95	173 (14%) 6 6	17, 31, 65, 127	0

All (173) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	242	PRO	7.1
1	B	301	GLY	6.7
1	A	3	VAL	6.5
1	A	651	GLY	6.0
1	A	652	LEU	5.9
1	B	3	VAL	5.7
1	A	304	THR	5.5
1	A	301	GLY	5.4
1	A	300	THR	5.3
1	B	302	MET	5.3
1	B	650	VAL	5.2
1	B	353	PRO	5.2
1	B	300	THR	5.2
1	B	304	THR	4.9
1	B	351	LEU	4.8
1	B	240	THR	4.8
1	A	34	GLY	4.7
1	B	651	GLY	4.7
1	B	652	LEU	4.7
1	B	243	ALA	4.7
1	A	351	LEU	4.7
1	A	1	MET	4.6
1	B	241	GLY	4.4
1	B	-2	HIS	4.4

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Mol	Chain	Res	Type	RSRZ
1	A	5	PRO	4.4
1	B	34	GLY	4.4
1	A	241	GLY	4.3
1	B	33	GLY	4.1
1	A	401	ALA	4.1
1	B	565	TYR	4.1
1	A	4	GLN	4.1
1	A	0	HIS	4.0
1	B	401	ALA	4.0
1	B	403	ALA	4.0
1	A	420	LEU	3.9
1	B	5	PRO	3.9
1	A	650	VAL	3.8
1	B	404	GLY	3.8
1	B	303	GLU	3.7
1	A	242	PRO	3.7
1	A	240	THR	3.7
1	A	415	ALA	3.6
1	B	1	MET	3.6
1	B	2	THR	3.6
1	A	305	GLY	3.5
1	A	-2	HIS	3.5
1	B	375	ALA	3.5
1	A	297	PRO	3.4
1	B	103	ARG	3.4
1	B	0	HIS	3.4
1	B	298	LEU	3.4
1	A	243	ALA	3.4
1	B	297	PRO	3.4
1	A	325	ALA	3.3
1	A	303	GLU	3.3
1	B	102	VAL	3.3
1	A	353	PRO	3.3
1	B	382	ILE	3.2
1	A	298	LEU	3.1
1	B	438	ARG	3.1
1	B	160	LEU	3.0
1	A	102	VAL	3.0
1	B	423	GLN	3.0
1	B	373	TRP	3.0
1	A	382	ILE	3.0
1	A	205	SER	3.0

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Mol	Chain	Res	Type	RSRZ
1	A	90	THR	3.0
1	A	473	PRO	2.9
1	B	352	PRO	2.9
1	A	160	LEU	2.9
1	B	458	LEU	2.9
1	A	302	MET	2.9
1	B	233	PRO	2.9
1	A	375	ALA	2.9
1	B	381	VAL	2.9
1	B	412	TYR	2.9
1	A	233	PRO	2.9
1	B	492	VAL	2.8
1	B	234	ALA	2.8
1	B	408	GLY	2.8
1	A	-1	HIS	2.8
1	A	170	VAL	2.8
1	B	299	ASP	2.8
1	A	35	SER	2.7
1	B	340	LYS	2.7
1	A	213	GLU	2.7
1	A	408	GLY	2.7
1	B	4	GLN	2.7
1	B	380	ALA	2.7
1	A	33	GLY	2.7
1	B	478	PHE	2.7
1	A	232	PRO	2.7
1	A	381	VAL	2.7
1	B	210	ARG	2.6
1	A	438	ARG	2.6
1	B	305	GLY	2.6
1	A	403	ALA	2.6
1	A	461	ALA	2.6
1	A	466	ALA	2.6
1	A	373	TRP	2.6
1	A	210	ARG	2.6
1	B	267	LEU	2.6
1	A	2	THR	2.6
1	B	232	PRO	2.5
1	B	429	ARG	2.5
1	A	266	GLN	2.5
1	B	377	PRO	2.5
1	A	386	LEU	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	397	LEU	2.5
1	B	203	ARG	2.5
1	A	163	PHE	2.5
1	B	393	ALA	2.4
1	B	425	TRP	2.4
1	A	492	VAL	2.4
1	B	296	LEU	2.4
1	B	325	ALA	2.4
1	A	192	GLY	2.4
1	B	468	GLY	2.4
1	A	565	TYR	2.4
1	A	468	GLY	2.4
1	A	32	SER	2.4
1	A	374	ARG	2.3
1	B	374	ARG	2.3
1	A	230	ALA	2.3
1	B	432	MET	2.3
1	B	35	SER	2.3
1	A	412	TYR	2.3
1	B	422	ASN	2.3
1	B	397	LEU	2.3
1	B	473	PRO	2.3
1	A	296	LEU	2.3
1	B	208	ARG	2.2
1	A	467	TYR	2.2
1	B	192	GLY	2.2
1	B	213	GLU	2.2
1	B	649	GLY	2.2
1	A	463	LEU	2.2
1	B	470	PRO	2.2
1	A	208	ARG	2.2
1	A	341	GLU	2.2
1	A	196	PRO	2.2
1	A	380	ALA	2.2
1	A	429	ARG	2.2
1	B	90	THR	2.2
1	A	6	GLY	2.2
1	A	422	ASN	2.1
1	A	378	ASP	2.1
1	A	188	VAL	2.1
1	B	399	ALA	2.1
1	A	478	PHE	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	231	ARG	2.1
1	A	383	ARG	2.1
1	A	402	GLY	2.1
1	B	443	PRO	2.1
1	B	174	GLN	2.1
1	B	430	ASP	2.1
1	B	493	ASP	2.1
1	B	627	TYR	2.1
1	B	161	SER	2.1
1	B	180	ARG	2.1
1	A	471	GLY	2.1
1	A	235	PRO	2.1
1	A	133	LEU	2.1
1	A	141	ASP	2.1
1	B	378	ASP	2.1
1	A	212	PHE	2.0
1	A	385	LEU	2.0
1	B	463	LEU	2.0
1	A	234	ALA	2.0
1	A	393	ALA	2.0
1	A	144	ILE	2.0
1	B	402	GLY	2.0
1	B	354	VAL	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	D	1	12/12	0.73	0.18	50,67,97,101	0
2	BGC	C	1	12/12	0.79	0.18	42,57,78,100	0
2	GLC	D	2	11/12	0.83	0.14	39,45,57,63	0
2	GLC	C	2	11/12	0.90	0.11	31,34,43,51	0
2	GLC	D	3	11/12	0.90	0.11	24,37,44,45	0

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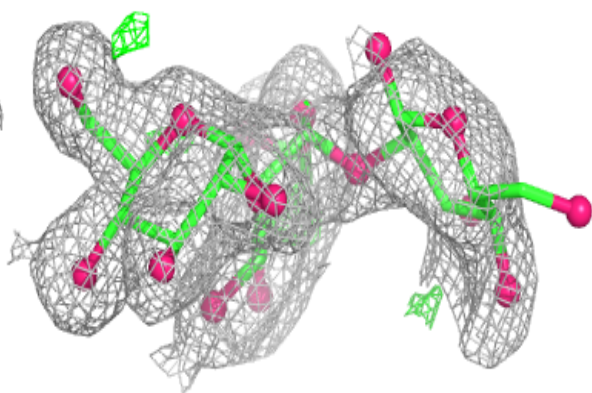
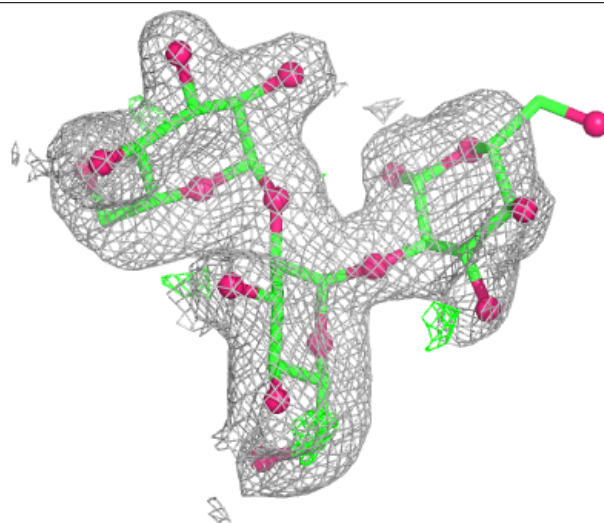
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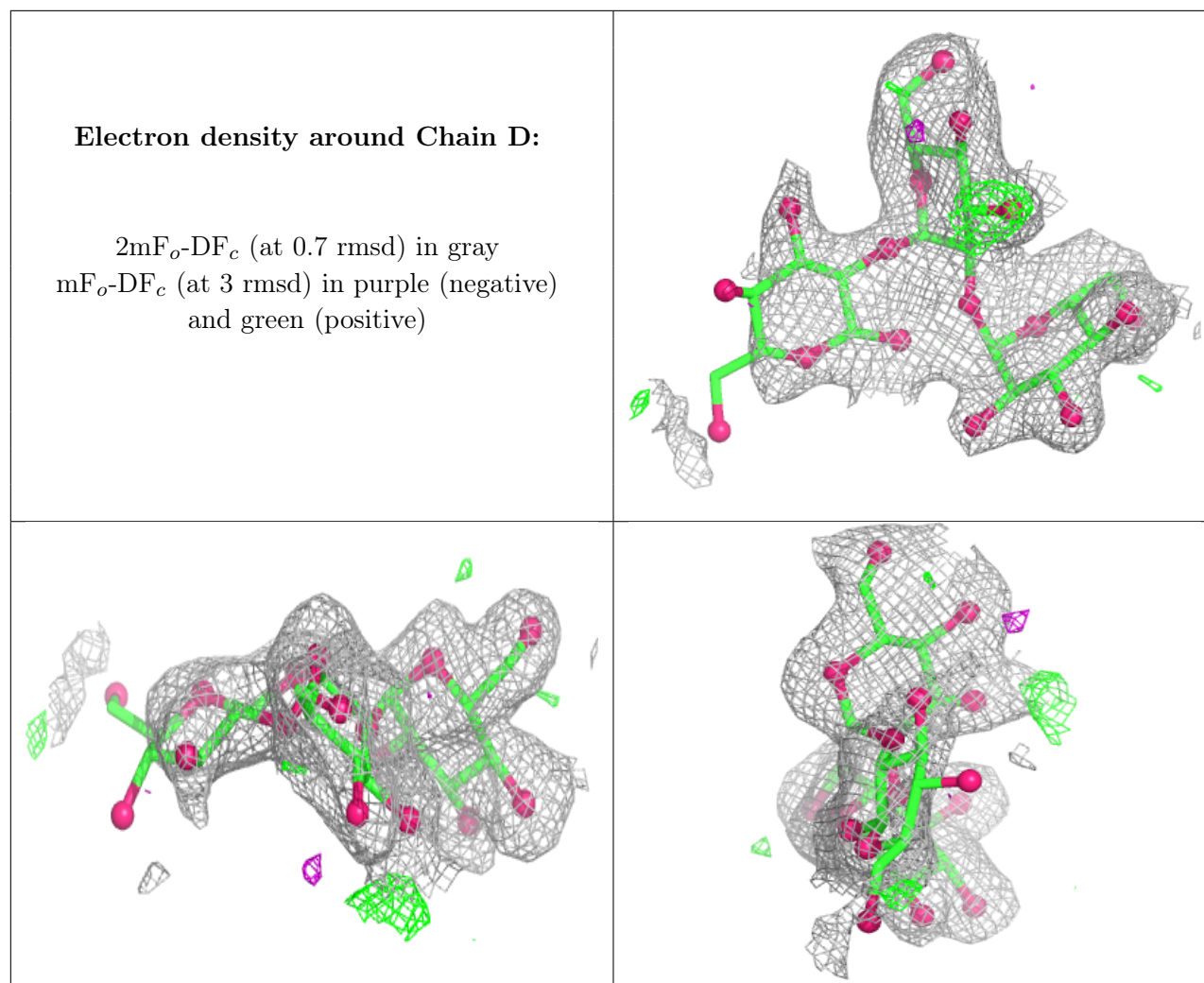
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	GLC	C	3	11/12	0.94	0.09	20,30,34,35	0

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.

Electron density around Chain C:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
 and green (positive)





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
3	EDO	A	702	4/4	0.73	0.20	59,63,63,64	0
3	EDO	A	705	4/4	0.77	0.18	57,58,58,59	0
5	ACT	A	706	4/4	0.77	0.18	31,32,39,41	0
3	EDO	B	701	4/4	0.80	0.18	44,53,55,60	0
3	EDO	A	703	4/4	0.80	0.18	45,49,49,55	0
4	PGO	A	704	5/5	0.81	0.16	26,27,34,48	0
3	EDO	A	701	4/4	0.84	0.15	24,29,35,39	0
3	EDO	B	702	4/4	0.87	0.14	23,31,34,38	0
3	EDO	B	704	4/4	0.88	0.15	39,45,49,53	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	EDO	B	703	4/4	0.94	0.13	26,32,33,44	0

6.5 Other polymers [i](#)

There are no such residues in this entry.