



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 21, 2026 – 07:19 pm BST

PDB ID : 9SJF / pdb_00009sjf
Title : Crystal structure of GHdex dextranase (BT3087), E360A catalytic mutant with bound IMO3
Authors : Feasey, M.; Basle, A.; van den Berg, B.
Deposited on : 2025-08-31
Resolution : 2.20 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	:	1.8.4, 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

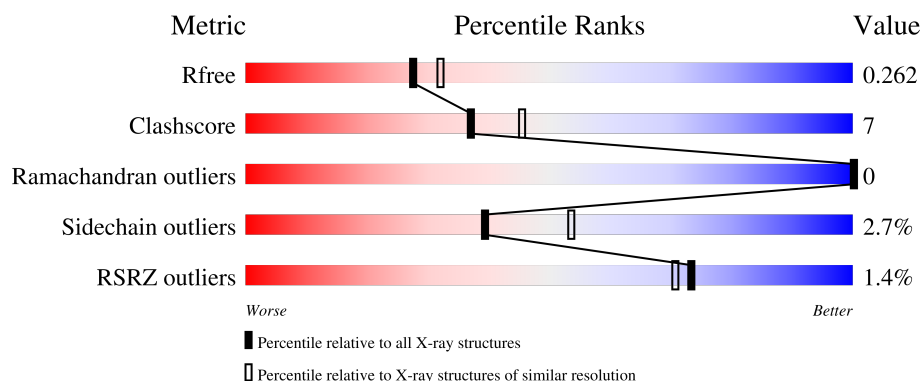
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	576	% 81% 15% ..
1	B	576	2% 81% 16% ..
2	C	3	33% 33% 33%
2	D	3	67% 33%

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 criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	SO4	A	717	-	-	X	-
4	SO4	B	713	-	-	X	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 9700 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 Cycloisomaltooligosaccharide glucanotransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	568	Total	C	N	O	S	0	0	0
			4500	2859	754	865	22			
1	B	568	Total	C	N	O	S	0	0	0
			4500	2859	754	865	22			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	25	MET	-	initiating methionine	UNP Q8A368
A	360	ALA	GLU	engineered mutation	UNP Q8A368
A	593	LEU	-	expression tag	UNP Q8A368
A	594	GLU	-	expression tag	UNP Q8A368
A	595	HIS	-	expression tag	UNP Q8A368
A	596	HIS	-	expression tag	UNP Q8A368
A	597	HIS	-	expression tag	UNP Q8A368
A	598	HIS	-	expression tag	UNP Q8A368
A	599	HIS	-	expression tag	UNP Q8A368
A	600	HIS	-	expression tag	UNP Q8A368
B	25	MET	-	initiating methionine	UNP Q8A368
B	360	ALA	GLU	engineered mutation	UNP Q8A368
B	593	LEU	-	expression tag	UNP Q8A368
B	594	GLU	-	expression tag	UNP Q8A368
B	595	HIS	-	expression tag	UNP Q8A368
B	596	HIS	-	expression tag	UNP Q8A368
B	597	HIS	-	expression tag	UNP Q8A368
B	598	HIS	-	expression tag	UNP Q8A368
B	599	HIS	-	expression tag	UNP Q8A368
B	600	HIS	-	expression tag	UNP Q8A368

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

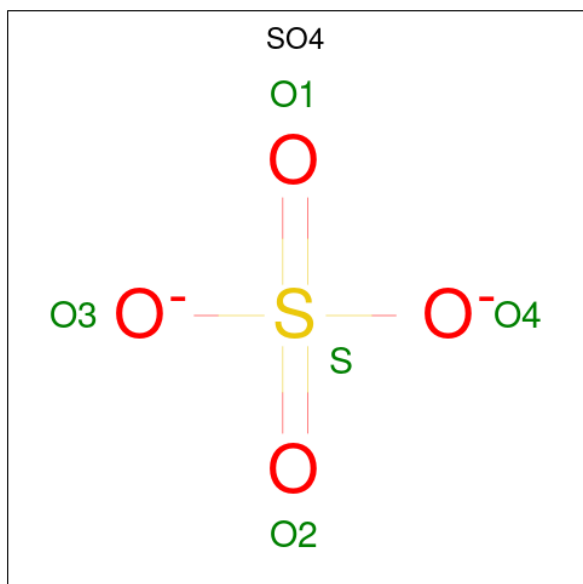


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	C	3	Total	C	O	0	0	0
			34	18	16			
2	D	3	Total	C	O	0	0	0
			34	18	16			

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Cl	0	0
			2	2		
3	B	4	Total	Cl	0	0
			4	4		

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		

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

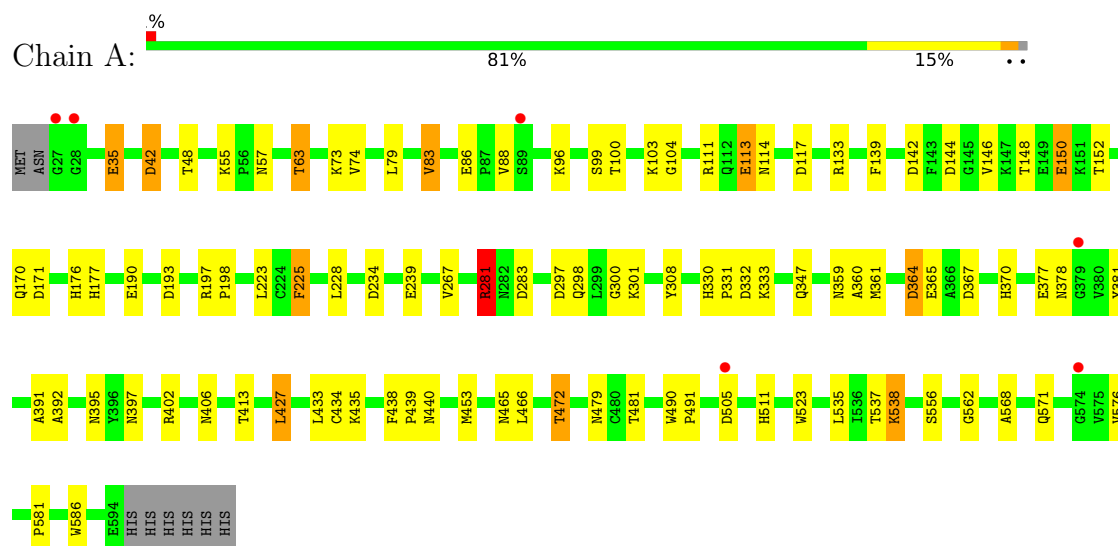
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	213	Total	O	0	0
			213	213		
5	B	253	Total	O	0	0
			253	253		

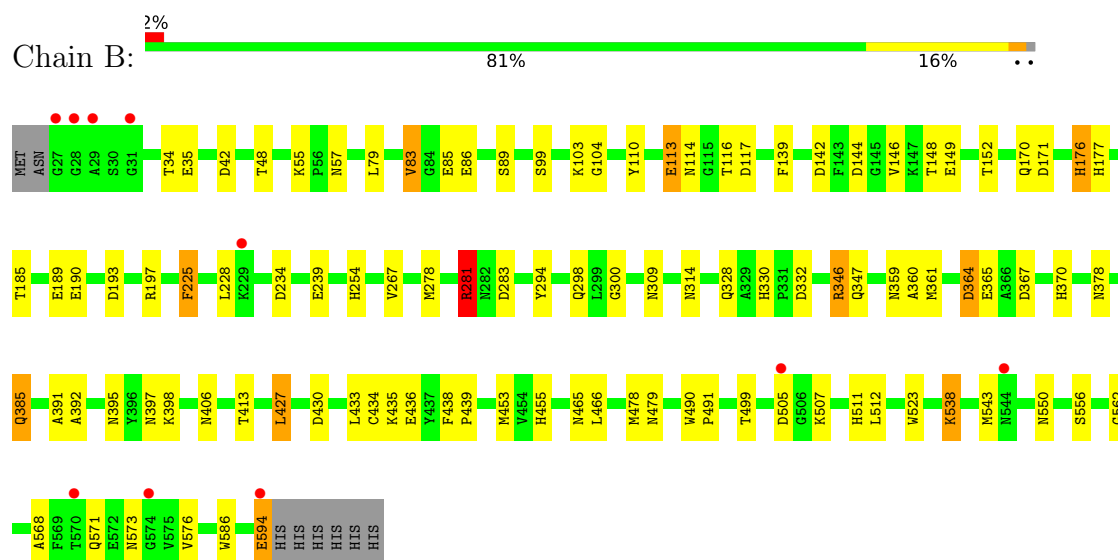
3 Residue-property plots

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: Cycloisomaltooligosaccharide glucanotransferase



- Molecule 1: Cycloisomaltooligosaccharide glucanotransferase



- Molecule 2: alpha-D-glucopyranose-(1-6)-alpha-D-glucopyranose-(1-6)-alpha-D-glucopyranos

e

Chain C:  33% 33% 33%



- Molecule 2: alpha-D-glucopyranose-(1-6)-alpha-D-glucopyranose-(1-6)-alpha-D-glucopyranose

Chain D:  67% 33%



4 Data and refinement statistics

Property	Value
Space group	P 41 21 2
Cell constants a, b, c, α , β , γ	92.22Å 92.22Å 328.03Å 90.00° 90.00° 90.00°
Resolution (Å)	46.29 – 2.20 46.29 – 2.20
% Data completeness (in resolution range)	99.9 (46.29-2.20) 99.9 (46.29-2.20)
R_{merge}	0.32
R_{sym}	(Not available)
$\langle I/\sigma(I) \rangle$ ¹	1.41 (at 2.20Å)
Refinement program	REFMAC 5.8.0430 (refmacat 0.4.88), REFMAC 5.8.0430 (refmacat 0.4.88)
R, R_{free}	0.202 , 0.262 0.202 , 0.262
R_{free} test set	3604 reflections (4.93%)
Wilson B-factor (Å ²)	34.4
Anisotropy	0.412
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 30.4
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$
Estimated twinning fraction	No twinning to report.
F_o, F_c correlation	0.95
Total number of atoms	9700
Average B, all atoms (Å ²)	38.0

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.67% 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, SO4, CL

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	0.64	0/4618	1.29	31/6276 (0.5%)
1	B	0.63	0/4618	1.28	32/6276 (0.5%)
All	All	0.63	0/9236	1.28	63/12552 (0.5%)

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	1

There are no bond length outliers.

All (63) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	35	GLU	CB-CG-CD	15.53	139.00	112.60
1	A	505	ASP	CA-CB-CG	10.21	122.81	112.60
1	B	594	GLU	CB-CG-CD	9.70	129.08	112.60
1	A	35	GLU	N-CA-CB	-9.04	97.13	110.24
1	B	505	ASP	CA-CB-CG	8.60	121.20	112.60
1	B	189	GLU	CB-CA-C	8.03	124.50	110.85
1	A	55	LYS	CB-CG-CD	7.97	129.63	111.30
1	B	35	GLU	CB-CG-CD	7.39	125.17	112.60
1	A	83	VAL	N-CA-C	-7.28	106.40	113.53
1	B	309	ASN	CB-CA-C	7.14	123.57	110.36
1	B	83	VAL	N-CA-C	-7.12	106.28	113.47
1	A	117	ASP	CA-CB-CG	7.00	119.60	112.60
1	A	113	GLU	CB-CA-C	6.95	120.38	110.24
1	B	427	LEU	CA-C-N	-6.91	116.32	122.47

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	427	LEU	C-N-CA	-6.91	116.32	122.47
1	A	150	GLU	CB-CG-CD	6.89	124.32	112.60
1	A	42	ASP	CB-CA-C	6.83	121.86	111.95
1	A	281	ARG	CD-NE-CZ	6.74	133.84	124.40
1	B	86	GLU	CB-CG-CD	6.71	124.01	112.60
1	B	281	ARG	CD-NE-CZ	6.61	133.65	124.40
1	A	198	PRO	CB-CA-C	-6.42	103.55	111.64
1	B	83	VAL	N-CA-CB	-6.41	104.71	112.33
1	A	133	ARG	CB-CG-CD	-6.29	96.83	111.30
1	A	413	THR	CA-CB-OG1	-6.22	100.27	109.60
1	A	332	ASP	CB-CA-C	6.21	121.21	110.72
1	A	55	LYS	CB-CA-C	6.19	118.40	109.11
1	A	472	THR	OG1-CB-CG2	-6.07	97.16	109.30
1	B	171	ASP	CB-CA-C	6.05	120.32	111.73
1	A	171	ASP	CB-CA-C	6.02	120.28	111.73
1	A	63	THR	CA-CB-OG1	-5.88	100.78	109.60
1	A	190	GLU	CB-CA-C	5.88	121.31	109.38
1	B	48	THR	CA-CB-OG1	-5.83	100.85	109.60
1	B	364	ASP	CB-CA-C	5.83	122.17	109.99
1	B	278	MET	CG-SD-CE	-5.74	88.28	100.90
1	B	176	HIS	CA-CB-CG	-5.71	108.09	113.80
1	B	507	LYS	CB-CG-CD	5.64	124.27	111.30
1	B	385	GLN	CB-CG-CD	5.61	122.13	112.60
1	B	436	GLU	CB-CG-CD	5.61	122.13	112.60
1	B	113	GLU	CB-CA-C	5.60	118.58	110.79
1	A	427	LEU	CA-C-N	-5.60	117.49	122.47
1	A	427	LEU	C-N-CA	-5.60	117.49	122.47
1	B	281	ARG	CG-CD-NE	-5.54	99.80	112.00
1	B	385	GLN	CB-CA-C	5.54	119.29	109.65
1	B	346	ARG	CD-NE-CZ	5.50	132.11	124.40
1	A	42	ASP	CA-CB-CG	5.50	118.10	112.60
1	A	301	LYS	N-CA-CB	5.49	117.99	109.48
1	A	86	GLU	CB-CG-CD	5.48	121.91	112.60
1	A	35	GLU	CB-CA-C	5.45	120.26	111.05
1	A	176	HIS	CA-CB-CG	-5.43	108.37	113.80
1	B	332	ASP	CB-CA-C	5.41	119.87	110.72
1	A	74	VAL	N-CA-CB	5.40	117.47	110.99
1	A	239	GLU	CB-CG-CD	5.39	121.77	112.60
1	B	538	LYS	CB-CG-CD	5.36	123.63	111.30
1	B	42	ASP	CB-CA-C	5.27	119.59	111.95
1	B	117	ASP	CA-CB-CG	5.20	117.80	112.60
1	B	347	GLN	CB-CA-C	5.18	119.65	110.85

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	239	GLU	CB-CG-CD	5.17	121.38	112.60
1	B	185	THR	CA-CB-OG1	-5.16	101.87	109.60
1	A	332	ASP	CA-CB-CG	5.13	117.73	112.60
1	A	481	THR	OG1-CB-CG2	5.13	119.56	109.30
1	B	294	TYR	N-CA-CB	-5.09	102.77	110.77
1	B	413	THR	CA-CB-OG1	-5.07	101.99	109.60
1	A	281	ARG	CG-CD-NE	-5.03	100.94	112.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	111	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	4500	0	4289	62	0
1	B	4500	0	4289	68	0
2	C	34	0	30	3	0
2	D	34	0	30	2	0
3	A	2	0	0	0	0
3	B	4	0	0	0	0
4	A	75	0	0	7	0
4	B	85	0	0	4	0
5	A	213	0	0	4	0
5	B	253	0	0	15	0
All	All	9700	0	8638	127	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 7.

All (127) 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:440:ASN:HD22	2:C:3:GLC:H61	1.24	1.03
1:B:385:GLN:HG3	5:B:996:HOH:O	1.58	1.01
1:B:346:ARG:HD3	5:B:1020:HOH:O	1.69	0.92
1:A:331:PRO:HD2	4:A:717:SO4:O1	1.71	0.90
1:A:440:ASN:HD22	2:C:3:GLC:C6	1.90	0.85
1:B:367:ASP:H	1:B:370:HIS:HD2	1.25	0.85
1:A:367:ASP:H	1:A:370:HIS:HD2	1.26	0.83
1:B:594:GLU:HG2	5:B:815:HOH:O	1.79	0.81
1:B:511:HIS:HD2	1:B:586:TRP:HE1	1.30	0.79
1:A:511:HIS:HD2	1:A:586:TRP:HE1	1.33	0.76
1:B:395:ASN:HD21	1:B:406:ASN:H	1.31	0.76
1:B:254:HIS:NE2	2:D:1:GLC:H62	2.01	0.76
1:B:573:ASN:CB	5:B:982:HOH:O	2.33	0.75
1:B:455:HIS:HD2	5:B:841:HOH:O	1.69	0.75
1:A:440:ASN:ND2	2:C:3:GLC:H61	2.01	0.74
1:B:511:HIS:CD2	1:B:586:TRP:HE1	2.06	0.73
5:B:931:HOH:O	2:D:1:GLC:H1	1.87	0.73
1:A:347:GLN:OE1	4:A:708:SO4:O4	2.04	0.73
1:A:511:HIS:CD2	1:A:586:TRP:HE1	2.06	0.73
1:B:190:GLU:HG2	5:B:989:HOH:O	1.87	0.73
1:B:594:GLU:OE1	5:B:801:HOH:O	2.08	0.72
1:A:395:ASN:HD21	1:A:406:ASN:H	1.36	0.71
1:A:104:GLY:H	1:A:465:ASN:HD21	1.37	0.70
1:A:364:ASP:HB2	5:A:980:HOH:O	1.92	0.69
1:A:538:LYS:NZ	1:B:113:GLU:OE2	2.25	0.69
1:B:359:ASN:HD21	1:B:378:ASN:HD21	1.40	0.69
1:A:427:LEU:HD21	1:A:453:MET:HE2	1.75	0.68
1:B:573:ASN:HB2	5:B:982:HOH:O	1.92	0.68
1:B:427:LEU:HD21	1:B:453:MET:HE2	1.74	0.68
1:A:104:GLY:H	1:A:465:ASN:ND2	1.93	0.67
1:A:359:ASN:HD21	1:A:378:ASN:HD21	1.42	0.66
1:B:104:GLY:H	1:B:465:ASN:ND2	1.94	0.66
1:B:359:ASN:ND2	1:B:378:ASN:HD21	1.95	0.65
1:B:104:GLY:H	1:B:465:ASN:HD21	1.44	0.64
1:B:149:GLU:N	4:B:713:SO4:O1	2.28	0.64
1:A:568:ALA:H	1:B:114:ASN:HD22	1.44	0.63
1:A:359:ASN:ND2	1:A:378:ASN:HD21	1.97	0.63
1:B:283:ASP:OD1	1:B:330:HIS:HE1	1.81	0.63
1:A:283:ASP:OD1	1:A:330:HIS:HE1	1.82	0.62
1:B:594:GLU:CG	5:B:815:HOH:O	2.44	0.62
1:A:57:ASN:HD21	1:A:99:SER:HB3	1.63	0.62
1:B:34:THR:N	4:B:709:SO4:O3	2.26	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:594:GLU:CB	5:B:815:HOH:O	2.47	0.61
1:B:103:LYS:HA	1:B:465:ASN:HD21	1.65	0.61
1:A:395:ASN:ND2	1:A:406:ASN:H	1.97	0.61
1:A:427:LEU:HD21	1:A:453:MET:CE	2.31	0.61
1:B:395:ASN:ND2	1:B:406:ASN:H	1.97	0.60
1:B:427:LEU:HD21	1:B:453:MET:CE	2.32	0.59
1:B:573:ASN:HB3	5:B:982:HOH:O	2.03	0.57
1:A:571:GLN:HG3	1:A:576:VAL:HG22	1.87	0.56
1:A:377:GLU:HB3	1:A:381:TYR:CE2	2.41	0.56
1:A:35:GLU:HG2	5:A:954:HOH:O	2.04	0.56
1:B:177:HIS:CD2	1:B:228:LEU:H	2.25	0.55
1:B:490:TRP:CG	1:B:491:PRO:HA	2.42	0.55
1:A:193:ASP:OD2	1:A:197:ARG:NH1	2.40	0.54
1:B:142:ASP:OD1	1:B:197:ARG:NH2	2.40	0.54
1:B:367:ASP:H	1:B:370:HIS:CD2	2.16	0.54
1:A:177:HIS:CD2	1:A:228:LEU:H	2.25	0.53
1:A:333:LYS:HG2	4:A:717:SO4:O3	2.08	0.53
1:A:139:PHE:CE1	1:A:433:LEU:HG	2.43	0.53
1:A:142:ASP:OD1	1:A:197:ARG:NH2	2.41	0.53
1:B:298:GLN:HE21	1:B:300:GLY:H	1.55	0.53
1:A:367:ASP:H	1:A:370:HIS:CD2	2.16	0.53
1:B:139:PHE:CE1	1:B:433:LEU:HG	2.44	0.52
1:B:57:ASN:HD21	1:B:99:SER:HB3	1.74	0.52
1:A:331:PRO:CD	4:A:717:SO4:O1	2.53	0.52
1:A:177:HIS:HD2	1:A:228:LEU:H	1.58	0.51
1:A:490:TRP:CG	1:A:491:PRO:HA	2.45	0.51
1:B:193:ASP:OD2	1:B:197:ARG:NH1	2.41	0.51
1:B:398:LYS:NZ	4:B:711:SO4:O2	2.43	0.51
1:A:361:MET:HB2	1:A:523:TRP:CZ2	2.46	0.50
1:A:35:GLU:CG	5:A:954:HOH:O	2.60	0.50
1:B:170:GLN:HE22	1:B:438:PHE:H	1.59	0.49
1:B:361:MET:HB2	1:B:523:TRP:CZ2	2.47	0.49
1:A:298:GLN:HE21	1:A:300:GLY:H	1.61	0.49
1:A:144:ASP:OD2	1:A:146:VAL:HG12	2.12	0.49
1:B:225:PHE:HB2	1:B:267:VAL:O	2.13	0.49
1:A:170:GLN:HE22	1:A:438:PHE:H	1.60	0.49
1:A:103:LYS:HA	1:A:465:ASN:HD21	1.78	0.49
1:B:430:ASP:HB2	5:B:942:HOH:O	2.13	0.49
1:A:402:ARG:HB2	4:A:705:SO4:O1	2.13	0.48
1:B:177:HIS:HE1	1:B:234:ASP:OD2	1.96	0.48
1:A:79:LEU:HD22	1:A:466:LEU:HG	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:434:CYS:O	1:B:435:LYS:HG3	2.14	0.47
1:A:434:CYS:O	1:A:435:LYS:HG3	2.14	0.47
1:B:79:LEU:HD22	1:B:466:LEU:HG	1.96	0.47
1:A:281:ARG:HA	1:A:281:ARG:HD3	1.53	0.47
1:B:438:PHE:N	1:B:439:PRO:CD	2.78	0.47
1:B:594:GLU:HB3	5:B:815:HOH:O	2.10	0.47
1:A:57:ASN:HD22	1:A:96:LYS:NZ	2.13	0.47
1:B:556:SER:O	1:B:562:GLY:HA2	2.16	0.46
1:A:438:PHE:N	1:A:439:PRO:CD	2.79	0.46
1:B:392:ALA:HB1	1:B:523:TRP:CZ3	2.51	0.46
1:A:114:ASN:HD22	1:B:568:ALA:H	1.62	0.46
1:B:499:THR:HA	1:B:511:HIS:O	2.16	0.46
1:A:177:HIS:HE1	1:A:234:ASP:OD2	1.99	0.46
1:A:392:ALA:HB1	1:A:523:TRP:CZ3	2.51	0.46
1:B:144:ASP:OD2	1:B:146:VAL:HG12	2.16	0.46
1:B:177:HIS:HD2	1:B:228:LEU:H	1.62	0.46
1:B:225:PHE:CD1	1:B:225:PHE:C	2.93	0.45
1:B:314:ASN:HB3	5:B:812:HOH:O	2.16	0.45
1:B:360:ALA:HA	1:B:391:ALA:O	2.17	0.45
1:A:225:PHE:HB2	1:A:267:VAL:O	2.16	0.45
1:A:308:TYR:N	4:A:710:SO4:O4	2.50	0.45
1:B:85:GLU:OE2	1:B:110:TYR:OH	2.26	0.44
1:B:281:ARG:HD3	1:B:281:ARG:HA	1.65	0.44
1:A:556:SER:O	1:A:562:GLY:HA2	2.17	0.44
1:B:571:GLN:HG3	1:B:576:VAL:HG22	1.99	0.44
1:A:223:LEU:HD23	1:A:297:ASP:HB3	2.00	0.44
1:A:360:ALA:HA	1:A:391:ALA:O	2.17	0.44
1:A:225:PHE:CD1	1:A:225:PHE:C	2.96	0.44
1:B:148:THR:O	1:B:152:THR:HG23	2.17	0.43
1:A:104:GLY:N	1:A:465:ASN:HD21	2.11	0.43
1:A:535:LEU:N	4:A:706:SO4:O1	2.36	0.43
1:B:225:PHE:C	1:B:225:PHE:HD1	2.27	0.43
1:A:113:GLU:OE2	1:B:538:LYS:HE2	2.17	0.43
1:A:48:THR:HG22	1:A:63:THR:HB	2.01	0.42
1:A:148:THR:O	1:A:152:THR:HG23	2.19	0.42
1:B:478:MET:HE3	1:B:543:MET:HG3	2.01	0.42
1:A:330:HIS:HD2	5:A:959:HOH:O	2.02	0.41
1:B:490:TRP:CD2	1:B:491:PRO:HA	2.55	0.41
1:B:148:THR:HB	4:B:713:SO4:O1	2.21	0.41
1:B:104:GLY:N	1:B:465:ASN:HD21	2.15	0.40
1:A:537:THR:HA	1:A:581:PRO:O	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:298:GLN:NE2	1:A:300:GLY:H	2.18	0.40
1:B:512:LEU:O	1:B:586:TRP:HA	2.22	0.40
1:B:176:HIS:HD2	1:B:228:LEU:HD21	1.85	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	566/576 (98%)	553 (98%)	13 (2%)	0	100	100
1	B	566/576 (98%)	548 (97%)	18 (3%)	0	100	100
All	All	1132/1152 (98%)	1101 (97%)	31 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	477/485 (98%)	463 (97%)	14 (3%)	37	51
1	B	477/485 (98%)	465 (98%)	12 (2%)	42	56
All	All	954/970 (98%)	928 (97%)	26 (3%)	39	53

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	ASP
1	A	73	LYS
1	A	83	VAL
1	A	88	VAL
1	A	100	THR
1	A	150	GLU
1	A	225	PHE
1	A	281	ARG
1	A	364	ASP
1	A	365	GLU
1	A	397	ASN
1	A	472	THR
1	A	479	ASN
1	A	538	LYS
1	B	55	LYS
1	B	83	VAL
1	B	89	SER
1	B	116	THR
1	B	225	PHE
1	B	281	ARG
1	B	328	GLN
1	B	364	ASP
1	B	365	GLU
1	B	397	ASN
1	B	479	ASN
1	B	550	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (37) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	57	ASN
1	A	114	ASN
1	A	130	HIS
1	A	170	GLN
1	A	176	HIS
1	A	177	HIS
1	A	298	GLN
1	A	330	HIS
1	A	359	ASN
1	A	370	HIS
1	A	383	ASN
1	A	385	GLN
1	A	395	ASN

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Mol	Chain	Res	Type
1	A	465	ASN
1	A	488	ASN
1	A	511	HIS
1	B	57	ASN
1	B	92	ASN
1	B	112	GLN
1	B	114	ASN
1	B	170	GLN
1	B	176	HIS
1	B	177	HIS
1	B	298	GLN
1	B	309	ASN
1	B	330	HIS
1	B	359	ASN
1	B	370	HIS
1	B	383	ASN
1	B	395	ASN
1	B	455	HIS
1	B	465	ASN
1	B	474	ASN
1	B	488	ASN
1	B	508	GLN
1	B	511	HIS
1	B	573	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](#)

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	GLC	C	1	2	12,12,12	0.69	0	17,17,17	0.89	0
2	GLC	C	2	2	11,11,12	0.78	0	15,15,17	2.23	4 (26%)
2	GLC	C	3	2	11,11,12	1.26	1 (9%)	15,15,17	2.82	6 (40%)
2	GLC	D	1	2	12,12,12	0.82	0	17,17,17	3.07	9 (52%)
2	GLC	D	2	2	11,11,12	0.54	0	15,15,17	1.33	1 (6%)
2	GLC	D	3	2	11,11,12	1.21	1 (9%)	15,15,17	1.95	4 (26%)

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

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	3	GLC	C2-C3	2.73	1.56	1.52
2	D	3	GLC	O5-C5	2.48	1.48	1.43

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	GLC	C4-C3-C2	-7.37	97.96	110.82
2	C	3	GLC	C1-C2-C3	-7.16	100.86	109.67
2	C	2	GLC	O5-C5-C6	-5.91	97.94	107.20
2	C	3	GLC	O2-C2-C1	4.79	118.95	109.15
2	C	2	GLC	C1-O5-C5	4.54	118.34	112.19
2	D	1	GLC	O4-C4-C5	4.22	119.78	109.30
2	D	3	GLC	C1-O5-C5	4.13	117.79	112.19
2	D	1	GLC	O5-C1-C2	4.13	117.66	110.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	GLC	O5-C5-C4	-3.55	103.25	109.69
2	D	3	GLC	O2-C2-C1	3.49	116.29	109.15
2	C	3	GLC	O2-C2-C3	3.40	116.95	110.14
2	D	1	GLC	O2-C2-C1	3.37	116.98	109.16
2	D	1	GLC	C3-C4-C5	-3.29	104.37	110.24
2	D	2	GLC	O2-C2-C1	3.11	115.52	109.15
2	C	3	GLC	C1-O5-C5	-3.08	108.01	112.19
2	D	1	GLC	O4-C4-C3	2.94	117.14	110.35
2	D	1	GLC	O3-C3-C4	2.83	116.89	110.35
2	D	3	GLC	O2-C2-C3	2.72	115.59	110.14
2	C	2	GLC	O3-C3-C2	-2.72	104.79	109.99
2	C	3	GLC	O4-C4-C3	2.59	116.35	110.35
2	D	3	GLC	C2-C3-C4	-2.54	106.49	110.89
2	C	3	GLC	O5-C5-C4	-2.26	105.32	110.83
2	C	2	GLC	C1-C2-C3	2.17	112.33	109.67
2	D	1	GLC	C6-C5-C4	2.10	117.93	113.00

There are no chirality outliers.

All (3) torsion outliers are listed below:

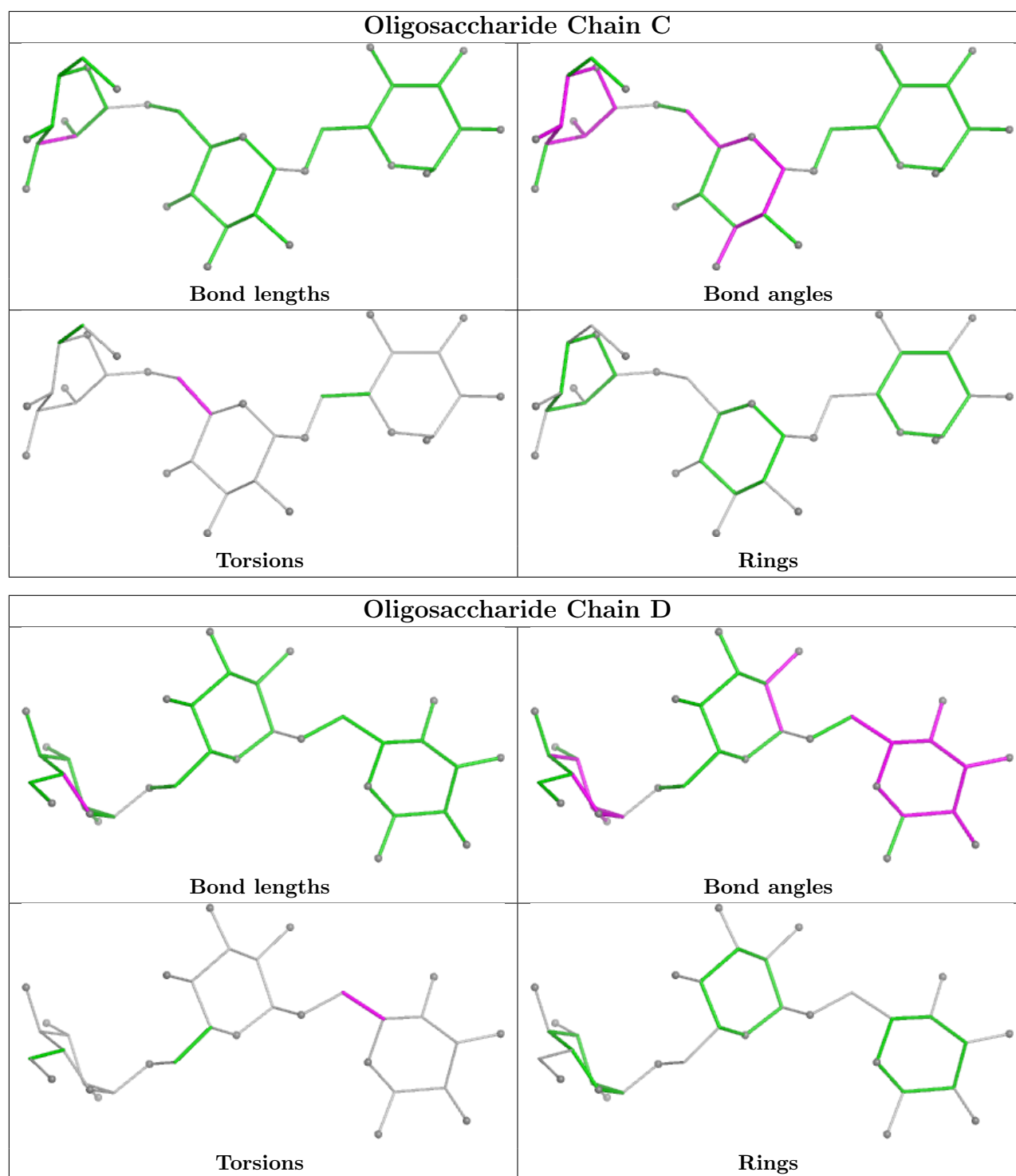
Mol	Chain	Res	Type	Atoms
2	D	1	GLC	C4-C5-C6-O6
2	D	1	GLC	O5-C5-C6-O6
2	C	2	GLC	O5-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	1	GLC	2	0
2	C	3	GLC	3	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 38 ligands modelled in this entry, 6 are monoatomic - leaving 32 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	$\# Z > 2$
4	SO4	A	707	-	4,4,4	0.30	0	6,6,6	0.43	0
4	SO4	A	713	-	4,4,4	0.33	0	6,6,6	0.12	0
4	SO4	B	715	-	4,4,4	0.31	0	6,6,6	0.10	0
4	SO4	A	705	-	4,4,4	0.39	0	6,6,6	0.17	0
4	SO4	B	707	-	4,4,4	0.25	0	6,6,6	0.26	0
4	SO4	B	721	-	4,4,4	0.31	0	6,6,6	0.08	0
4	SO4	A	714	-	4,4,4	0.29	0	6,6,6	0.11	0
4	SO4	B	718	-	4,4,4	0.32	0	6,6,6	0.08	0
4	SO4	B	712	-	4,4,4	0.22	0	6,6,6	0.13	0
4	SO4	B	708	-	4,4,4	0.21	0	6,6,6	0.14	0
4	SO4	B	717	-	4,4,4	0.33	0	6,6,6	0.14	0
4	SO4	A	703	-	4,4,4	0.32	0	6,6,6	0.22	0
4	SO4	A	706	-	4,4,4	0.28	0	6,6,6	0.12	0
4	SO4	A	709	-	4,4,4	0.21	0	6,6,6	0.18	0
4	SO4	A	717	-	4,4,4	0.28	0	6,6,6	0.19	0
4	SO4	B	713	-	4,4,4	0.30	0	6,6,6	0.21	0
4	SO4	B	719	-	4,4,4	0.29	0	6,6,6	0.14	0
4	SO4	A	716	-	4,4,4	0.27	0	6,6,6	0.25	0
4	SO4	B	711	-	4,4,4	0.32	0	6,6,6	0.19	0
4	SO4	A	710	-	4,4,4	0.36	0	6,6,6	0.07	0
4	SO4	A	711	-	4,4,4	0.32	0	6,6,6	0.14	0
4	SO4	A	715	-	4,4,4	0.39	0	6,6,6	0.06	0
4	SO4	A	704	-	4,4,4	0.33	0	6,6,6	0.25	0
4	SO4	B	720	-	4,4,4	0.28	0	6,6,6	0.14	0
4	SO4	A	708	-	4,4,4	0.32	0	6,6,6	0.12	0
4	SO4	B	706	-	4,4,4	0.28	0	6,6,6	0.15	0
4	SO4	B	716	-	4,4,4	0.33	0	6,6,6	0.07	0
4	SO4	B	705	-	4,4,4	0.32	0	6,6,6	0.33	0
4	SO4	B	714	-	4,4,4	0.34	0	6,6,6	0.06	0
4	SO4	B	709	-	4,4,4	0.37	0	6,6,6	0.11	0
4	SO4	B	710	-	4,4,4	0.34	0	6,6,6	0.15	0
4	SO4	A	712	-	4,4,4	0.32	0	6,6,6	0.12	0

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.

8 monomers are involved in 11 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	705	SO4	1	0
4	A	706	SO4	1	0
4	A	717	SO4	3	0
4	B	713	SO4	2	0
4	B	711	SO4	1	0
4	A	710	SO4	1	0
4	A	708	SO4	1	0
4	B	709	SO4	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 [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	568/576 (98%)	-0.24	6 (1%) 78 76	24, 35, 58, 96	0
1	B	568/576 (98%)	-0.23	10 (1%) 67 64	24, 34, 58, 116	0
All	All	1136/1152 (98%)	-0.23	16 (1%) 73 71	24, 34, 58, 116	0

All (16) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	27	GLY	6.1
1	B	27	GLY	3.5
1	B	31	GLY	3.3
1	A	28	GLY	3.2
1	B	505	ASP	2.9
1	A	505	ASP	2.9
1	B	594	GLU	2.7
1	B	28	GLY	2.7
1	A	379	GLY	2.4
1	B	229	LYS	2.4
1	B	570	THR	2.3
1	B	29	ALA	2.3
1	B	544	ASN	2.3
1	A	89	SER	2.3
1	B	574	GLY	2.1
1	A	574	GLY	2.1

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

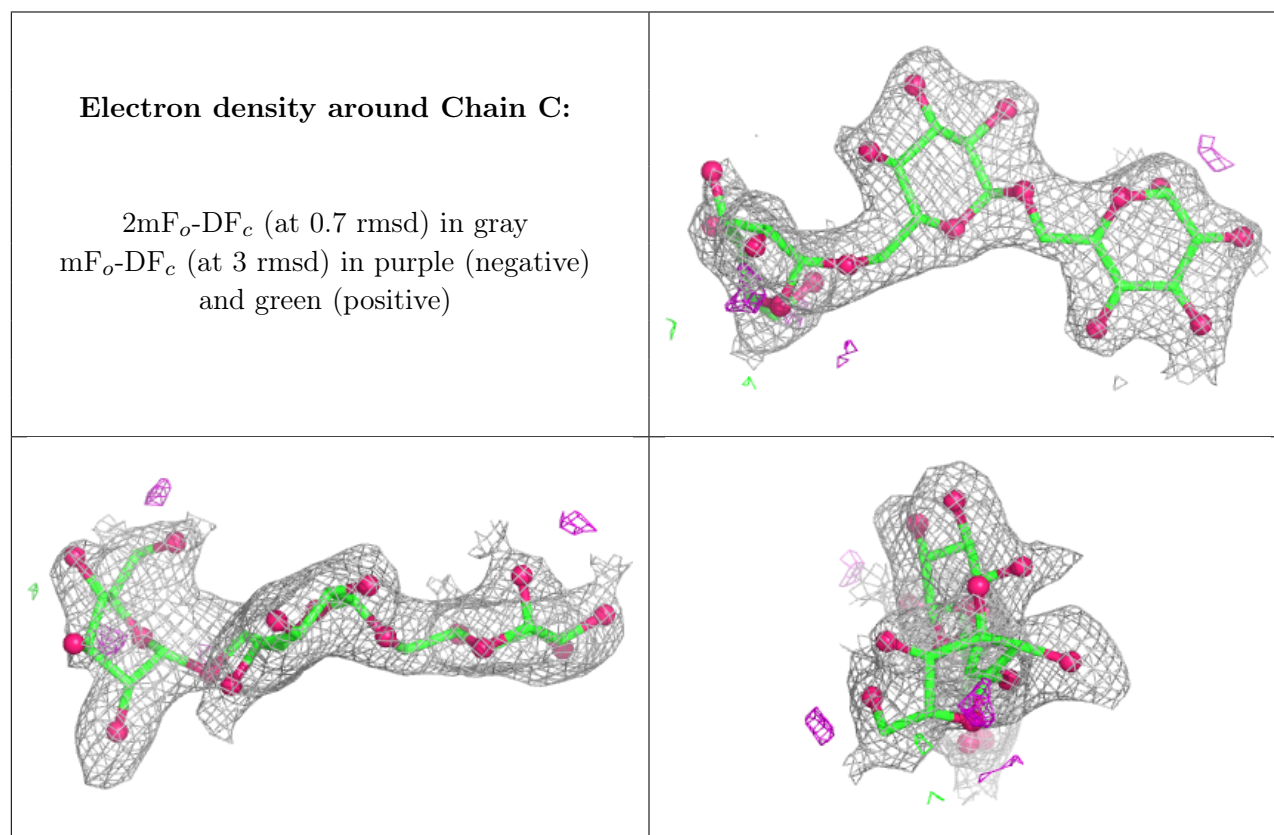
There are no non-standard protein/DNA/RNA residues in this entry.

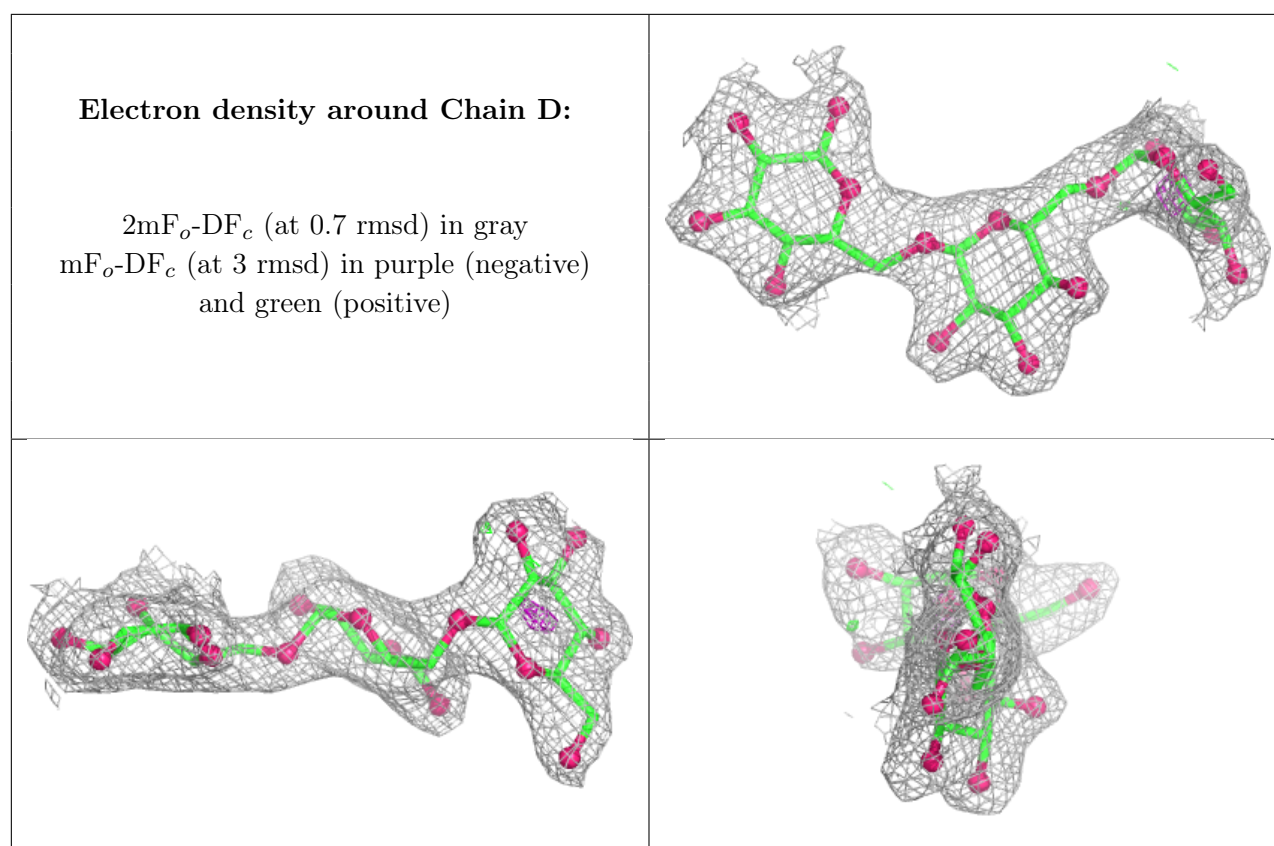
6.3 Carbohydrates ⓘ

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	GLC	C	3	11/12	0.77	0.16	58,75,84,91	0
2	GLC	C	2	11/12	0.89	0.10	46,53,61,70	0
2	GLC	D	3	11/12	0.90	0.10	34,55,60,60	0
2	GLC	D	1	12/12	0.93	0.09	31,42,47,54	0
2	GLC	D	2	11/12	0.95	0.07	39,44,49,50	0
2	GLC	C	1	12/12	0.95	0.08	41,45,48,49	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	SO4	B	720	5/5	0.07	0.15	102,110,121,129	0
4	SO4	B	716	5/5	0.30	0.11	118,138,145,152	0
4	SO4	A	715	5/5	0.43	0.17	195,198,202,202	0
4	SO4	A	710	5/5	0.49	0.19	108,117,124,142	0
4	SO4	B	712	5/5	0.50	0.14	75,89,102,106	0
4	SO4	B	714	5/5	0.62	0.22	139,178,181,182	0
4	SO4	A	712	5/5	0.64	0.13	93,111,121,126	0
4	SO4	A	708	5/5	0.64	0.16	82,86,117,117	0
4	SO4	B	718	5/5	0.67	0.14	96,100,104,118	0
4	SO4	B	721	5/5	0.68	0.12	93,98,107,110	0
4	SO4	B	719	5/5	0.72	0.14	74,106,107,127	0
4	SO4	A	711	5/5	0.73	0.14	59,108,113,117	0
4	SO4	A	709	5/5	0.73	0.14	54,79,85,102	0
4	SO4	B	711	5/5	0.75	0.11	71,73,79,86	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	SO4	A	716	5/5	0.75	0.13	71,72,85,89	0
4	SO4	A	713	5/5	0.77	0.11	89,89,93,94	0
4	SO4	B	715	5/5	0.78	0.10	64,94,100,104	0
4	SO4	B	713	5/5	0.80	0.13	47,82,91,94	0
4	SO4	B	717	5/5	0.80	0.11	80,93,98,106	0
4	SO4	A	706	5/5	0.82	0.12	61,65,77,80	0
4	SO4	A	717	5/5	0.83	0.15	60,83,97,118	0
4	SO4	A	714	5/5	0.84	0.10	80,80,84,89	0
4	SO4	A	705	5/5	0.88	0.10	68,72,82,84	0
4	SO4	B	709	5/5	0.90	0.08	64,72,75,82	0
3	CL	A	701	1/1	0.91	0.09	59,59,59,59	0
4	SO4	B	708	5/5	0.92	0.15	57,62,64,70	0
4	SO4	B	710	5/5	0.93	0.07	56,66,73,80	0
4	SO4	A	707	5/5	0.95	0.07	37,38,47,55	0
4	SO4	B	707	5/5	0.95	0.15	43,44,58,61	0
4	SO4	A	704	5/5	0.96	0.13	38,42,55,59	0
4	SO4	B	705	5/5	0.96	0.06	38,44,48,49	0
4	SO4	B	706	5/5	0.96	0.08	39,42,56,57	0
4	SO4	A	703	5/5	0.97	0.06	36,39,47,50	0
3	CL	B	702	1/1	0.97	0.08	43,43,43,43	0
3	CL	B	704	1/1	0.98	0.06	54,54,54,54	0
3	CL	B	701	1/1	0.98	0.04	40,40,40,40	0
3	CL	B	703	1/1	0.98	0.03	48,48,48,48	0
3	CL	A	702	1/1	0.99	0.06	40,40,40,40	0

6.5 Other polymers [i](#)

There are no such residues in this entry.