



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 09:34 PM EDT

PDB ID : 5X3J / pdb_00005x3j
Title : Kfla1895 D451A mutant in complex with cyclobis-(1->6)-alpha-nigerosyl
Authors : Tanaka, Y.; Chen, M.; Tagami, T.; Yao, M.; Kimura, A.
Deposited on : 2017-02-06
Resolution : 2.30 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

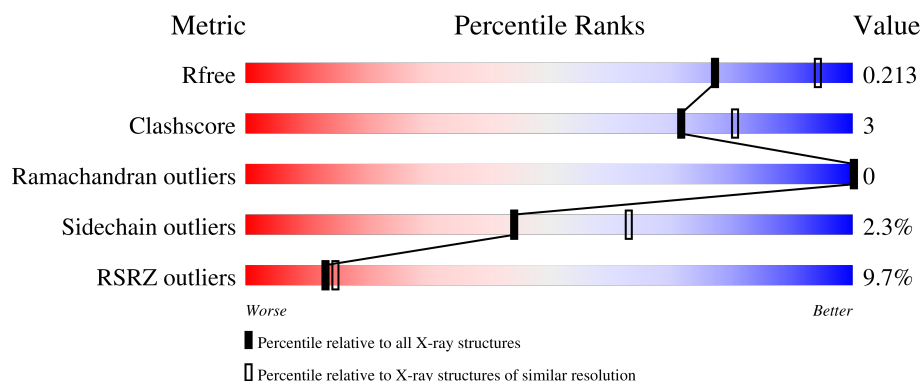
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	743	6% 86% 10% ..
1	B	743	13% 87% 9% ..
2	C	4	75% 25%
2	D	4	100%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12070 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 Glycoside hydrolase family 31.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	718	Total	C	N	O	S	0	0	0
			5641	3584	1001	1044	12			
1	B	714	Total	C	N	O	S	0	0	0
			5613	3568	996	1037	12			

There are 42 discrepancies between the modelled and reference sequences:

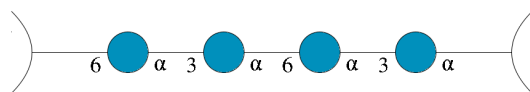
Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	expression tag	UNP D2PPM7
A	-18	GLY	-	expression tag	UNP D2PPM7
A	-17	SER	-	expression tag	UNP D2PPM7
A	-16	SER	-	expression tag	UNP D2PPM7
A	-15	HIS	-	expression tag	UNP D2PPM7
A	-14	HIS	-	expression tag	UNP D2PPM7
A	-13	HIS	-	expression tag	UNP D2PPM7
A	-12	HIS	-	expression tag	UNP D2PPM7
A	-11	HIS	-	expression tag	UNP D2PPM7
A	-10	HIS	-	expression tag	UNP D2PPM7
A	-9	SER	-	expression tag	UNP D2PPM7
A	-8	SER	-	expression tag	UNP D2PPM7
A	-7	GLY	-	expression tag	UNP D2PPM7
A	-6	LEU	-	expression tag	UNP D2PPM7
A	-5	VAL	-	expression tag	UNP D2PPM7
A	-4	PRO	-	expression tag	UNP D2PPM7
A	-3	ARG	-	expression tag	UNP D2PPM7
A	-2	GLY	-	expression tag	UNP D2PPM7
A	-1	SER	-	expression tag	UNP D2PPM7
A	0	HIS	-	expression tag	UNP D2PPM7
A	451	ALA	ASP	engineered mutation	UNP D2PPM7
B	-19	MET	-	expression tag	UNP D2PPM7
B	-18	GLY	-	expression tag	UNP D2PPM7
B	-17	SER	-	expression tag	UNP D2PPM7
B	-16	SER	-	expression tag	UNP D2PPM7

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-15	HIS	-	expression tag	UNP D2PPM7
B	-14	HIS	-	expression tag	UNP D2PPM7
B	-13	HIS	-	expression tag	UNP D2PPM7
B	-12	HIS	-	expression tag	UNP D2PPM7
B	-11	HIS	-	expression tag	UNP D2PPM7
B	-10	HIS	-	expression tag	UNP D2PPM7
B	-9	SER	-	expression tag	UNP D2PPM7
B	-8	SER	-	expression tag	UNP D2PPM7
B	-7	GLY	-	expression tag	UNP D2PPM7
B	-6	LEU	-	expression tag	UNP D2PPM7
B	-5	VAL	-	expression tag	UNP D2PPM7
B	-4	PRO	-	expression tag	UNP D2PPM7
B	-3	ARG	-	expression tag	UNP D2PPM7
B	-2	GLY	-	expression tag	UNP D2PPM7
B	-1	SER	-	expression tag	UNP D2PPM7
B	0	HIS	-	expression tag	UNP D2PPM7
B	451	ALA	ASP	engineered mutation	UNP D2PPM7

- Molecule 2 is an oligosaccharide called Cyclic alpha-D-glucopyranose-(1-3)-alpha-D-glucopyranose-(1-6)-alpha-D-glucopyranose-(1-3)-alpha-D-glucopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	C	4	Total	C	O	0	0	0
			44	24	20			
2	D	4	Total	C	O	0	0	0
			44	24	20			

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

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

- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		

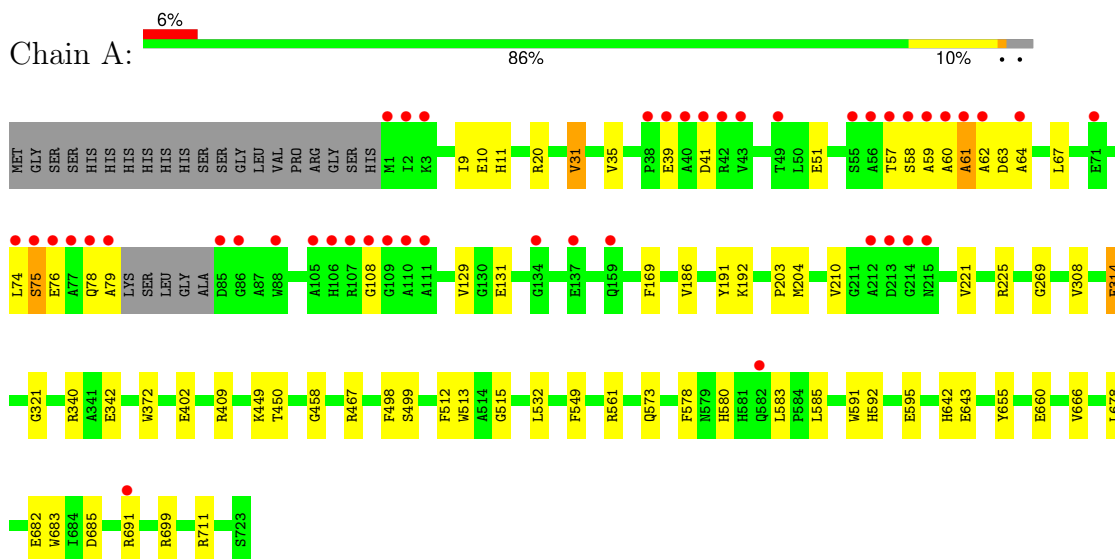
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	372	Total	O	0	0
			372	372		
5	B	220	Total	O	0	0
			220	220		

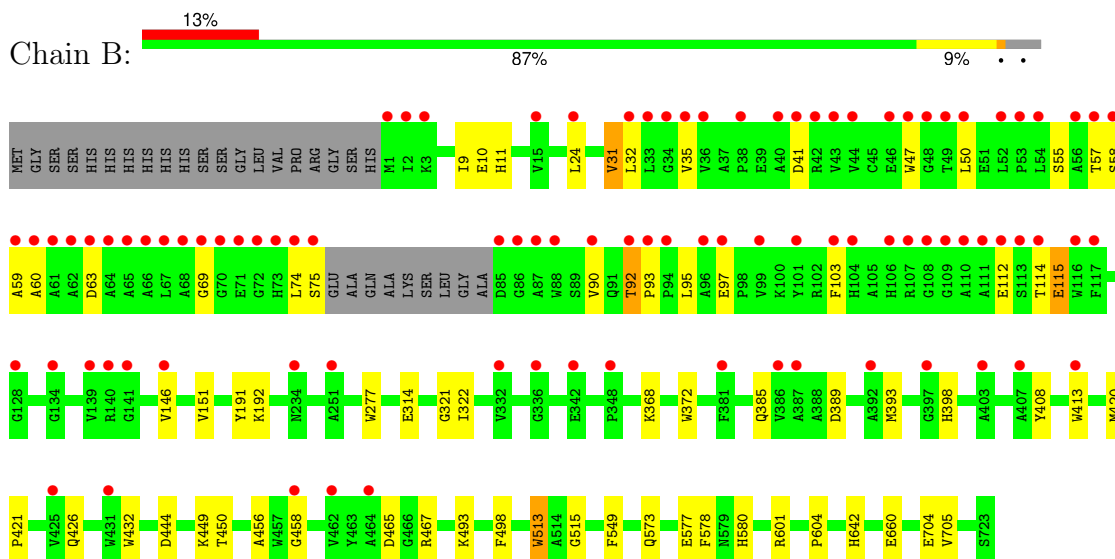
3 Residue-property plots

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: Glycoside hydrolase family 31



• Molecule 1: Glycoside hydrolase family 31



• Molecule 2: Cyclic alpha-D-glucopyranose-(1-3)-alpha-D-glucopyranose-(1-6)-alpha-D-glucopyranose-(1-3)-alpha-D-glucopyranose

Chain C:  75% 25%

GLC1
GLC2
GLC3
GLC4

- Molecule 2: Cyclic alpha-D-glucopyranose-(1-3)-alpha-D-glucopyranose-(1-6)-alpha-D-glucopyranose-(1-3)-alpha-D-glucopyranose

Chain D:  100%

GLC1
GLC2
GLC3
GLC4

4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	180.54Å 180.54Å 391.63Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	48.40 – 2.30 48.40 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.40-2.30) 99.9 (48.40-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.34 (at 2.29Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.189 , 0.208 0.192 , 0.213	Depositor DCC
R_{free} test set	2000 reflections (1.84%)	wwPDB-VP
Wilson B-factor (Å ²)	32.2	Xtriage
Anisotropy	0.375	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 37.0	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	0.95	EDS
Total number of atoms	12070	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.13% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, SO4, GLC

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	0.47	2/5815 (0.0%)	0.82	7/7948 (0.1%)
1	B	0.41	0/5787	0.77	2/7910 (0.0%)
All	All	0.44	2/11602 (0.0%)	0.79	9/15858 (0.1%)

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	2

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	321	GLY	C-O	-6.56	1.16	1.24
1	A	583	LEU	C-O	-5.06	1.17	1.24

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	62	ALA	N-CA-C	-7.24	104.05	113.17
1	A	314	GLU	CA-C-N	-6.89	112.57	122.77
1	A	314	GLU	C-N-CA	-6.89	112.57	122.77
1	A	221	VAL	CA-C-N	-6.21	113.28	122.41
1	A	221	VAL	C-N-CA	-6.21	113.28	122.41
1	A	642	HIS	N-CA-C	5.84	120.11	112.92
1	B	660	GLU	N-CA-C	5.48	120.12	113.38
1	B	642	HIS	N-CA-C	5.16	119.11	112.41
1	A	269	GLY	N-CA-C	5.07	116.77	111.95

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	61	ALA	Peptide
1	A	74	LEU	Peptide

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	5641	0	5349	39	0
1	B	5613	0	5325	35	0
2	C	44	0	36	0	0
2	D	44	0	36	0	0
3	A	60	0	0	0	0
3	B	40	0	0	1	0
4	A	36	0	48	5	0
5	A	372	0	0	3	0
5	B	220	0	0	1	0
All	All	12070	0	10794	74	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 3.

All (74) 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:31:VAL:H	1:B:92:THR:HG22	1.51	0.75
1:B:704:GLU:OE2	5:B:901:HOH:O	2.10	0.68
1:A:61:ALA:HB1	1:A:64:ALA:H	1.60	0.67
1:A:225:ARG:HH22	4:A:818:GOL:H32	1.63	0.62
1:A:685:ASP:OD2	1:A:699:ARG:NH2	2.33	0.62
1:A:60:ALA:HB3	1:A:61:ALA:HA	1.79	0.62
1:A:20:ARG:HG3	1:A:31:VAL:HG21	1.85	0.59
1:B:465:ASP:OD2	1:B:467:ARG:NH1	2.35	0.59
1:B:513:TRP:CD1	1:B:515:GLY:H	2.22	0.57
1:B:10:GLU:CD	1:B:458:GLY:HA2	2.31	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:76:GLU:HG3	1:A:78:GLN:O	2.07	0.55
1:B:314:GLU:HA	1:B:372:TRP:HB2	1.90	0.54
1:B:47:TRP:O	1:B:50:LEU:HB2	2.08	0.54
1:A:449:LYS:HA	1:A:498:PHE:HB3	1.89	0.54
1:A:61:ALA:HB1	1:A:64:ALA:N	2.23	0.53
1:A:682:GLU:CD	1:A:691:ARG:HH11	2.15	0.53
1:B:103:PHE:H	1:B:114:THR:HG22	1.74	0.53
1:B:277:TRP:CD2	1:B:368:LYS:HG3	2.45	0.53
1:A:513:TRP:CD1	1:A:515:GLY:H	2.27	0.52
1:B:92:THR:HG23	1:B:93:PRO:O	2.10	0.52
1:B:449:LYS:HA	1:B:498:PHE:HB3	1.92	0.52
1:A:10:GLU:CD	1:A:458:GLY:HA2	2.35	0.51
1:B:191:TYR:OH	1:B:577:GLU:OE2	2.22	0.51
1:A:191:TYR:O	1:A:192:LYS:HB2	2.10	0.50
1:A:314:GLU:HA	1:A:372:TRP:HB2	1.94	0.50
1:B:57:THR:HG22	1:B:58:SER:N	2.25	0.50
1:B:69:GLY:HA2	1:B:413:TRP:CD2	2.48	0.49
1:A:578:PHE:CZ	1:A:580:HIS:HA	2.48	0.49
1:A:585:LEU:O	1:A:592:HIS:NE2	2.39	0.49
1:B:426:GLN:N	3:B:805:SO4:O4	2.38	0.49
1:A:532:LEU:HD21	1:A:655:TYR:HB3	1.95	0.49
1:A:561:ARG:HD2	1:A:666:VAL:HB	1.93	0.48
1:A:41:ASP:OD2	1:A:108:GLY:N	2.45	0.48
1:A:59:ALA:HA	1:A:60:ALA:HA	1.49	0.48
1:B:59:ALA:HA	1:B:60:ALA:HA	1.62	0.48
1:A:10:GLU:OE1	1:A:458:GLY:HA2	2.14	0.47
1:A:20:ARG:HG3	1:A:31:VAL:CG2	2.44	0.47
1:A:225:ARG:NH2	4:A:818:GOL:H32	2.28	0.47
1:B:74:LEU:HG	1:B:75:SER:H	1.80	0.46
1:A:643:GLU:OE2	5:A:901:HOH:O	2.21	0.46
1:B:420:MET:HE1	1:B:456:ALA:HB2	1.97	0.46
1:B:578:PHE:CZ	1:B:580:HIS:HA	2.51	0.46
1:A:499:SER:O	1:A:512:PHE:HA	2.16	0.46
1:B:191:TYR:O	1:B:192:LYS:HB2	2.15	0.46
1:A:75:SER:HA	1:A:76:GLU:C	2.42	0.45
1:A:591:TRP:HE1	4:A:814:GOL:C1	2.29	0.45
1:A:467:ARG:HH12	4:A:817:GOL:H2	1.81	0.45
1:B:393:MET:HA	1:B:398:HIS:HB2	1.99	0.44
1:A:169:PHE:HA	1:A:204:MET:O	2.18	0.44
1:B:601:ARG:C	1:B:604:PRO:HD2	2.43	0.44
1:A:63:ASP:O	1:A:67:LEU:HG	2.18	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:385:GLN:NE2	1:B:389:ASP:OD1	2.45	0.44
1:B:60:ALA:HB3	1:B:63:ASP:HB2	2.00	0.43
1:B:57:THR:CG2	1:B:58:SER:N	2.81	0.43
1:A:340:ARG:HD3	1:A:342:GLU:OE2	2.19	0.43
1:B:47:TRP:HZ2	1:B:95:LEU:HD13	1.83	0.43
1:B:32:LEU:HD12	1:B:90:VAL:O	2.19	0.43
1:B:408:TYR:CD2	1:B:420:MET:HE2	2.54	0.42
1:B:444:ASP:OD1	1:B:493:LYS:NZ	2.52	0.42
1:B:321:GLY:C	1:B:322:ILE:HG12	2.44	0.42
1:B:9:ILE:HG23	1:B:11:HIS:H	1.85	0.42
1:A:678:LEU:HB3	1:A:683:TRP:CD1	2.54	0.42
1:A:409:ARG:HG2	5:A:902:HOH:O	2.21	0.41
1:B:146:VAL:HG12	1:B:151:VAL:HG22	2.01	0.41
1:A:9:ILE:HG23	1:A:11:HIS:H	1.85	0.41
1:B:421:PRO:HG3	1:B:432:TRP:CZ3	2.56	0.41
1:A:591:TRP:HE1	4:A:814:GOL:H11	1.86	0.41
1:B:704:GLU:HG2	1:B:705:VAL:HG23	2.03	0.41
1:A:78:GLN:O	1:A:79:ALA:HB3	2.21	0.41
1:A:57:THR:HG22	1:A:58:SER:H	1.86	0.40
1:A:186:VAL:C	1:A:203:PRO:HG3	2.46	0.40
1:A:660:GLU:OE1	1:A:711:ARG:NH1	2.46	0.40
1:B:114:THR:OG1	1:B:115:GLU:N	2.53	0.40
1:A:402:GLU:OE2	5:A:902:HOH:O	2.22	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	714/743 (96%)	703 (98%)	11 (2%)	0	100	100
1	B	710/743 (96%)	703 (99%)	7 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	1424/1486 (96%)	1406 (99%)	18 (1%)	0	100	100

There are no Ramachandran outliers to report.

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	568/588 (97%)	555 (98%)	13 (2%)	44	63
1	B	566/588 (96%)	553 (98%)	13 (2%)	44	63
All	All	1134/1176 (96%)	1108 (98%)	26 (2%)	44	63

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

Mol	Chain	Res	Type
1	A	31	VAL
1	A	35	VAL
1	A	39	GLU
1	A	51	GLU
1	A	75	SER
1	A	129	VAL
1	A	131	GLU
1	A	210	VAL
1	A	308	VAL
1	A	450	THR
1	A	549	PHE
1	A	573	GLN
1	A	595	GLU
1	B	24	LEU
1	B	31	VAL
1	B	35	VAL
1	B	41	ASP
1	B	55	SER
1	B	92	THR
1	B	97	GLU

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Mol	Chain	Res	Type
1	B	112	GLU
1	B	115	GLU
1	B	450	THR
1	B	513	TRP
1	B	549	PHE
1	B	573	GLN

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	106	HIS
1	A	234	ASN
1	B	190	GLN
1	B	479	HIS
1	B	580	HIS
1	B	582	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

8 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	11,11,12	0.74	0	15,15,17	0.91	1 (6%)

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	0.64	0	15,15,17	0.73	0
2	GLC	C	3	2	11,11,12	0.76	0	15,15,17	0.61	0
2	GLC	C	4	2	11,11,12	0.63	0	15,15,17	0.73	0
2	GLC	D	1	2	11,11,12	0.63	0	15,15,17	0.72	0
2	GLC	D	2	2	11,11,12	0.74	0	15,15,17	0.66	0
2	GLC	D	3	2	11,11,12	0.70	0	15,15,17	0.36	0
2	GLC	D	4	2	11,11,12	0.65	0	15,15,17	0.62	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GLC	C	1	2	-	0/2/19/22	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	GLC	C	4	2	-	0/2/19/22	0/1/1/1
2	GLC	D	1	2	-	0/2/19/22	0/1/1/1
2	GLC	D	2	2	-	0/2/19/22	0/1/1/1
2	GLC	D	3	2	-	2/2/19/22	0/1/1/1
2	GLC	D	4	2	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1	GLC	C1-O5-C5	2.12	115.02	112.19

There are no chirality outliers.

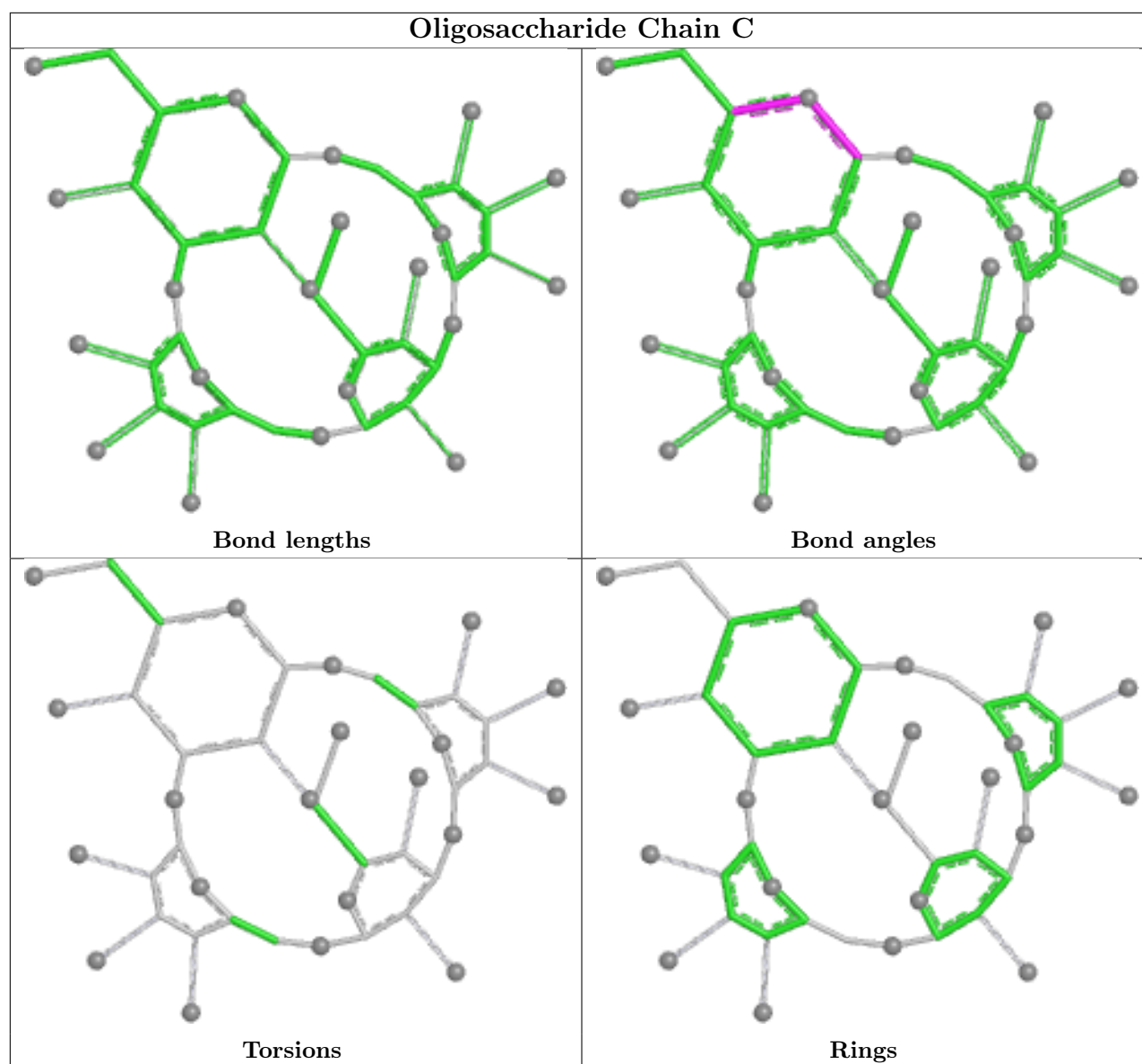
All (2) torsion outliers are listed below:

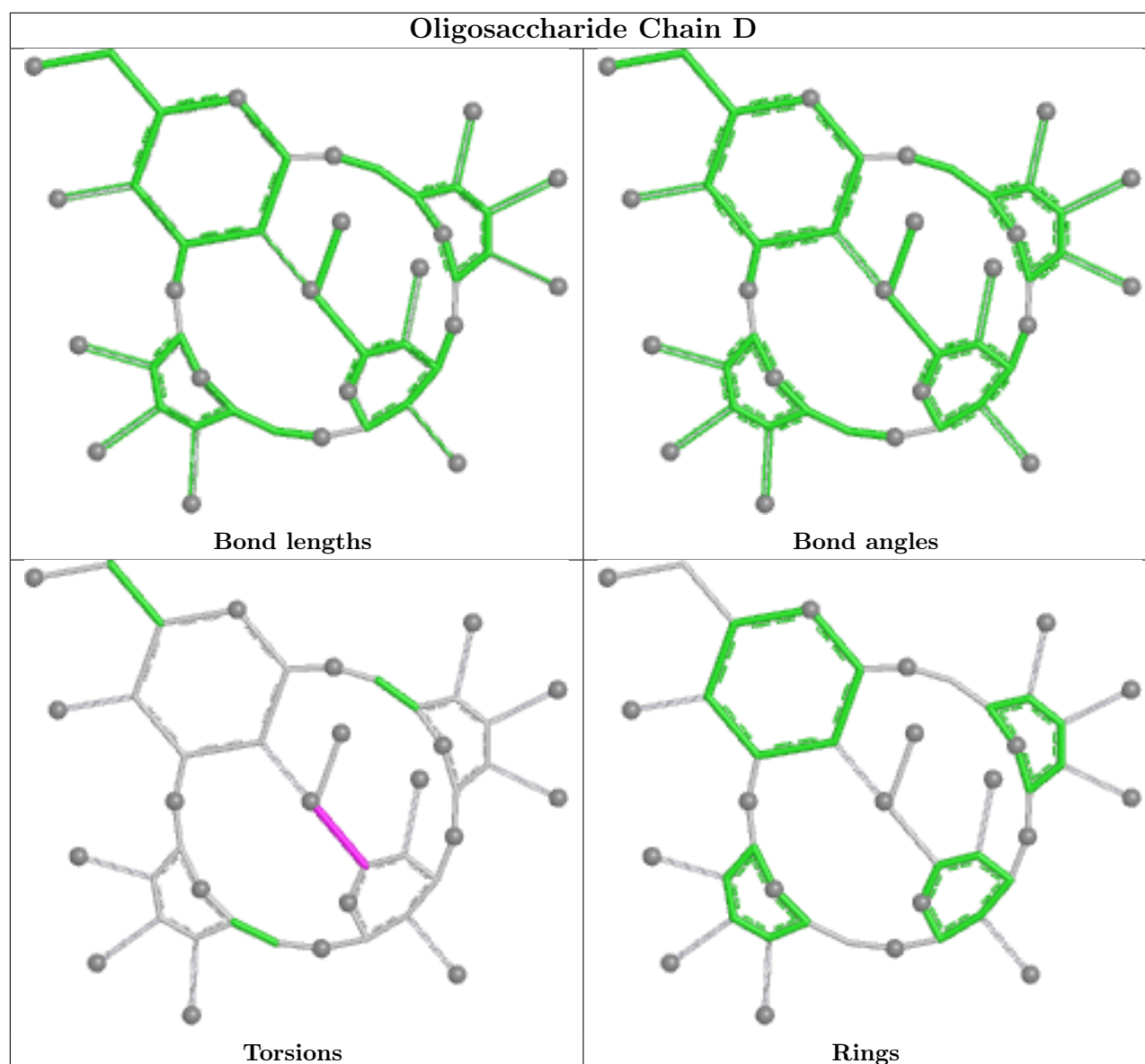
Mol	Chain	Res	Type	Atoms
2	D	3	GLC	C4-C5-C6-O6
2	D	3	GLC	O5-C5-C6-O6

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 [i](#)

26 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	SO4	B	808	-	4,4,4	0.24	0	6,6,6	0.12	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	SO4	A	808	-	4,4,4	0.23	0	6,6,6	0.07	0
3	SO4	A	804	-	4,4,4	0.25	0	6,6,6	0.08	0
3	SO4	A	811	-	4,4,4	0.24	0	6,6,6	0.08	0
4	GOL	A	818	-	5,5,5	0.39	0	5,5,5	0.34	0
3	SO4	A	806	-	4,4,4	0.24	0	6,6,6	0.12	0
3	SO4	B	804	-	4,4,4	0.24	0	6,6,6	0.10	0
3	SO4	B	806	-	4,4,4	0.25	0	6,6,6	0.11	0
3	SO4	A	809	-	4,4,4	0.25	0	6,6,6	0.26	0
4	GOL	A	816	-	5,5,5	0.34	0	5,5,5	0.45	0
4	GOL	A	815	-	5,5,5	0.31	0	5,5,5	0.40	0
3	SO4	B	803	-	4,4,4	0.25	0	6,6,6	0.12	0
3	SO4	A	801	-	4,4,4	0.26	0	6,6,6	0.07	0
3	SO4	A	802	-	4,4,4	0.22	0	6,6,6	0.10	0
3	SO4	B	802	-	4,4,4	0.24	0	6,6,6	0.11	0
3	SO4	B	807	-	4,4,4	0.24	0	6,6,6	0.04	0
3	SO4	A	812	-	4,4,4	0.24	0	6,6,6	0.18	0
3	SO4	A	805	-	4,4,4	0.23	0	6,6,6	0.10	0
3	SO4	B	805	-	4,4,4	0.25	0	6,6,6	0.11	0
4	GOL	A	814	-	5,5,5	0.36	0	5,5,5	0.38	0
4	GOL	A	813	-	5,5,5	0.36	0	5,5,5	0.46	0
3	SO4	A	803	-	4,4,4	0.25	0	6,6,6	0.12	0
4	GOL	A	817	-	5,5,5	0.39	0	5,5,5	0.29	0
3	SO4	B	801	-	4,4,4	0.24	0	6,6,6	0.17	0
3	SO4	A	810	-	4,4,4	0.23	0	6,6,6	0.15	0
3	SO4	A	807	-	4,4,4	0.22	0	6,6,6	0.12	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
4	GOL	A	816	-	-	2/4/4/4	-
4	GOL	A	815	-	-	2/4/4/4	-
4	GOL	A	818	-	-	3/4/4/4	-
4	GOL	A	817	-	-	2/4/4/4	-
4	GOL	A	814	-	-	2/4/4/4	-
4	GOL	A	813	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	813	GOL	O1-C1-C2-C3
4	A	814	GOL	O1-C1-C2-O2
4	A	814	GOL	O1-C1-C2-C3
4	A	816	GOL	O1-C1-C2-C3
4	A	817	GOL	O1-C1-C2-O2
4	A	818	GOL	C1-C2-C3-O3
4	A	817	GOL	O1-C1-C2-C3
4	A	818	GOL	O1-C1-C2-C3
4	A	816	GOL	O1-C1-C2-O2
4	A	818	GOL	O2-C2-C3-O3
4	A	813	GOL	O1-C1-C2-O2
4	A	815	GOL	O1-C1-C2-O2
4	A	815	GOL	O1-C1-C2-C3

There are no ring outliers.

4 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	818	GOL	2	0
3	B	805	SO4	1	0
4	A	814	GOL	2	0
4	A	817	GOL	1	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	718/743 (96%)	0.01	45 (6%) 26 28	12, 24, 63, 98	0
1	B	714/743 (96%)	0.64	94 (13%) 7 8	16, 34, 83, 105	0
All	All	1432/1486 (96%)	0.32	139 (9%) 13 15	12, 29, 75, 105	0

All (139) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	62	ALA	9.1
1	B	74	LEU	8.9
1	B	64	ALA	8.5
1	B	59	ALA	8.1
1	B	61	ALA	7.7
1	B	67	LEU	7.5
1	B	66	ALA	7.0
1	B	75	SER	6.6
1	B	60	ALA	6.5
1	B	69	GLY	6.4
1	A	75	SER	6.4
1	A	60	ALA	6.2
1	B	70	GLY	6.2
1	A	110	ALA	6.2
1	B	68	ALA	6.2
1	B	110	ALA	5.8
1	B	58	SER	5.7
1	A	62	ALA	5.6
1	A	59	ALA	5.6
1	A	77	ALA	5.6
1	A	79	ALA	5.4
1	B	65	ALA	5.0
1	B	49	THR	5.0
1	B	71	GLU	5.0

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Mol	Chain	Res	Type	RSRZ
1	B	111	ALA	5.0
1	A	111	ALA	4.9
1	B	72	GLY	4.7
1	A	1	MET	4.7
1	B	50	LEU	4.6
1	B	1	MET	4.5
1	A	58	SER	4.4
1	B	57	THR	4.4
1	B	114	THR	4.4
1	A	109	GLY	4.2
1	B	48	GLY	4.0
1	A	106	HIS	3.9
1	B	109	GLY	3.9
1	B	413	TRP	3.9
1	B	116	TRP	3.9
1	A	108	GLY	3.8
1	B	63	ASP	3.8
1	B	113	SER	3.8
1	B	86	GLY	3.7
1	B	41	ASP	3.7
1	A	76	GLU	3.7
1	A	57	THR	3.6
1	B	38	PRO	3.6
1	B	56	ALA	3.6
1	B	106	HIS	3.6
1	B	87	ALA	3.6
1	B	2	ILE	3.5
1	A	213	ASP	3.4
1	B	117	PHE	3.4
1	A	40	ALA	3.4
1	B	104	HIS	3.4
1	A	42	ARG	3.3
1	B	44	VAL	3.3
1	B	53	PRO	3.3
1	B	42	ARG	3.3
1	B	3	LYS	3.3
1	B	128	GLY	3.2
1	A	85	ASP	3.2
1	B	43	VAL	3.2
1	A	214	GLY	3.1
1	B	85	ASP	3.1
1	B	234	ASN	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	39	GLU	3.0
1	B	96	ALA	3.0
1	B	54	LEU	3.0
1	B	47	TRP	3.0
1	B	107	ARG	2.9
1	B	24	LEU	2.9
1	B	15	VAL	2.9
1	B	397	GLY	2.8
1	B	94	PRO	2.8
1	A	691	ARG	2.8
1	B	464	ALA	2.8
1	B	35	VAL	2.8
1	B	99	VAL	2.8
1	A	55	SER	2.7
1	B	342	GLU	2.7
1	A	61	ALA	2.7
1	A	78	GLN	2.7
1	B	92	THR	2.7
1	B	103	PHE	2.7
1	B	93	PRO	2.6
1	A	38	PRO	2.6
1	A	107	ARG	2.5
1	B	40	ALA	2.5
1	A	43	VAL	2.5
1	A	64	ALA	2.5
1	B	403	ALA	2.5
1	A	86	GLY	2.5
1	B	108	GLY	2.5
1	B	458	GLY	2.5
1	B	88	TRP	2.5
1	A	212	ALA	2.5
1	B	46	GLU	2.4
1	A	74	LEU	2.4
1	B	431	TRP	2.4
1	A	215	ASN	2.4
1	B	332	VAL	2.4
1	A	56	ALA	2.3
1	B	90	VAL	2.3
1	A	88	TRP	2.3
1	B	101	TYR	2.3
1	A	105	ALA	2.3
1	B	140	ARG	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	159	GLN	2.3
1	B	97	GLU	2.3
1	B	146	VAL	2.3
1	B	33	LEU	2.3
1	B	36	VAL	2.3
1	B	381	PHE	2.3
1	B	336	GLY	2.3
1	B	407	ALA	2.3
1	A	49	THR	2.3
1	B	112	GLU	2.3
1	B	141	GLY	2.2
1	A	71	GLU	2.2
1	B	251	ALA	2.2
1	B	32	LEU	2.2
1	A	134	GLY	2.2
1	B	386	VAL	2.2
1	B	425	VAL	2.1
1	A	582	GLN	2.1
1	B	34	GLY	2.1
1	A	41	ASP	2.1
1	A	137	GLU	2.1
1	B	134	GLY	2.1
1	A	3	LYS	2.1
1	A	2	ILE	2.1
1	B	52	LEU	2.1
1	B	392	ALA	2.1
1	B	73	HIS	2.1
1	B	462	VAL	2.1
1	B	387	ALA	2.0
1	B	139	VAL	2.0
1	B	348	PRO	2.0

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

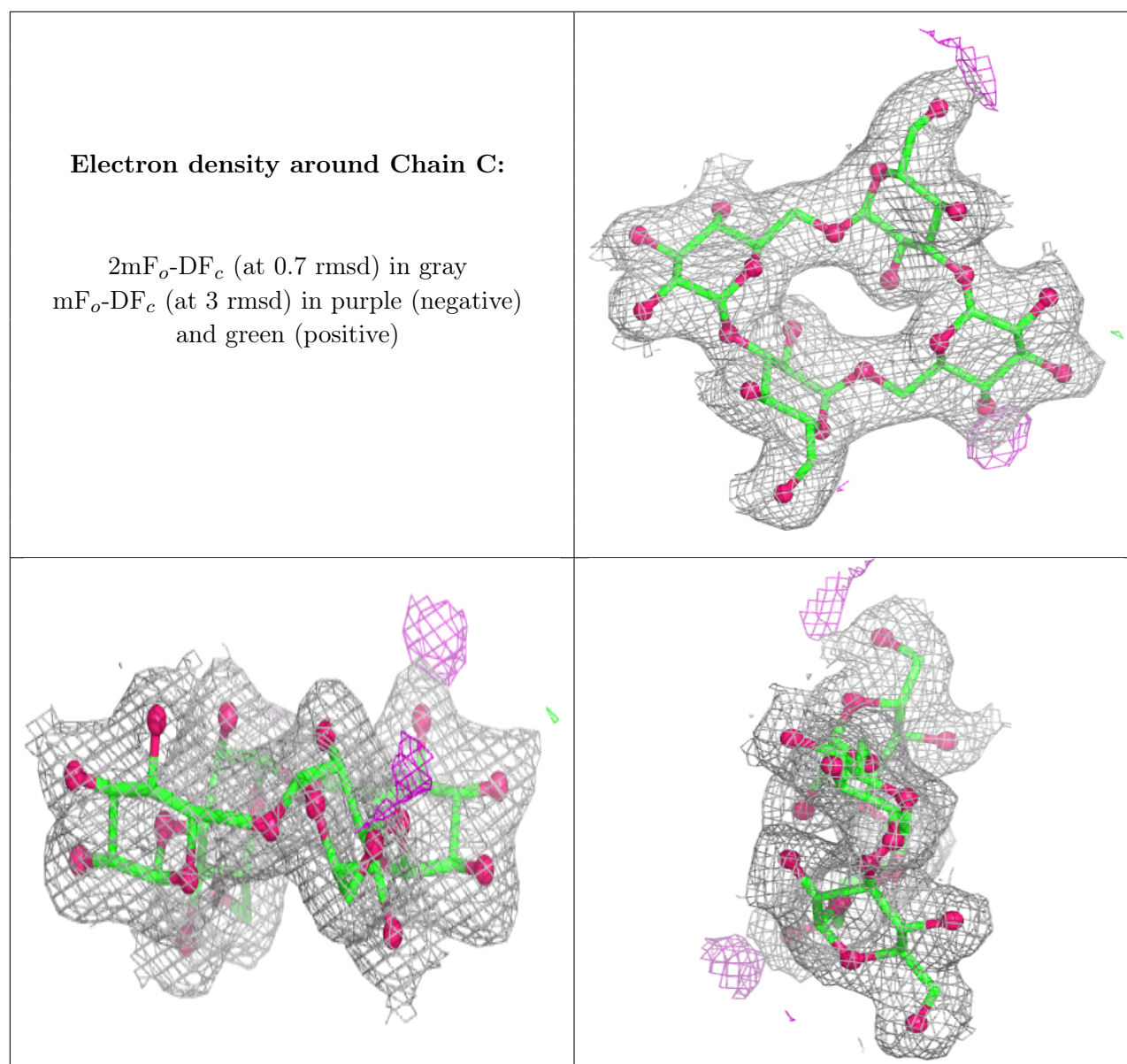
There are no non-standard protein/DNA/RNA residues in this entry.

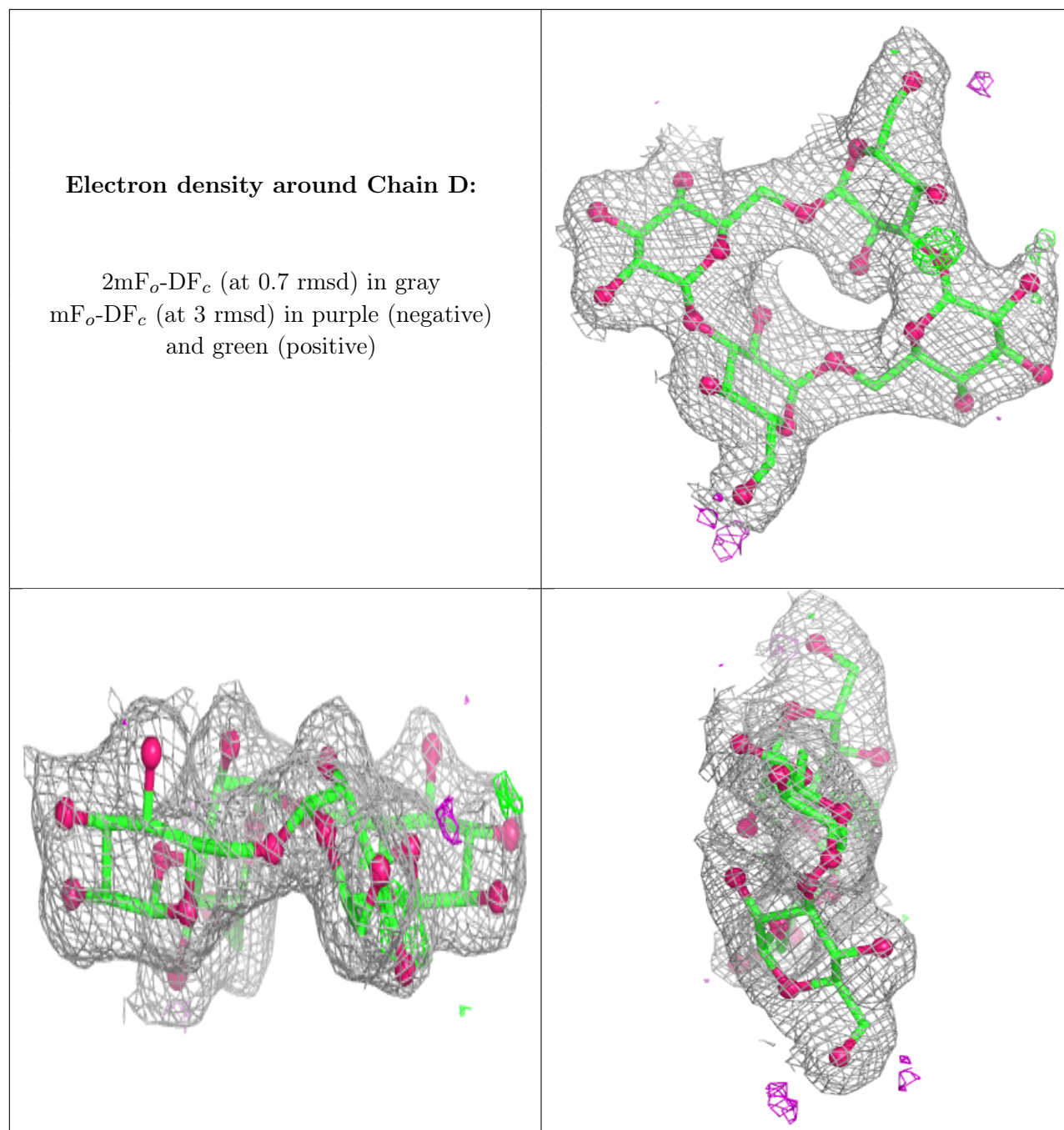
6.3 Carbohydrates [i](#)

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($\text{\AA}^2$)	Q<0.9
2	GLC	D	4	11/12	0.86	0.12	35,42,47,52	0
2	GLC	D	3	11/12	0.93	0.09	30,33,38,47	0
2	GLC	C	4	11/12	0.96	0.06	16,19,25,26	0
2	GLC	D	1	11/12	0.96	0.07	29,33,36,37	0
2	GLC	D	2	11/12	0.97	0.07	24,28,30,30	0
2	GLC	C	3	11/12	0.98	0.04	14,17,20,20	0
2	GLC	C	1	11/12	0.98	0.05	15,16,18,19	0
2	GLC	C	2	11/12	0.98	0.04	13,13,17,17	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
3	SO4	B	803	5/5	0.59	0.13	68,72,77,82	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	SO4	A	808	5/5	0.68	0.12	88,89,107,109	0
3	SO4	B	805	5/5	0.69	0.13	63,71,83,84	0
3	SO4	B	808	5/5	0.72	0.15	74,75,80,86	0
3	SO4	B	806	5/5	0.77	0.13	56,63,83,92	0
3	SO4	A	807	5/5	0.80	0.19	56,58,68,70	0
3	SO4	B	807	5/5	0.81	0.11	75,77,81,82	0
4	GOL	A	817	6/6	0.81	0.14	35,36,41,51	0
4	GOL	A	818	6/6	0.82	0.16	34,39,47,49	0
3	SO4	B	802	5/5	0.84	0.14	66,68,75,76	0
3	SO4	A	812	5/5	0.85	0.16	55,57,68,69	0
3	SO4	A	806	5/5	0.85	0.27	48,57,69,82	0
3	SO4	A	811	5/5	0.85	0.21	48,49,64,68	0
3	SO4	A	803	5/5	0.89	0.15	47,52,56,67	0
3	SO4	B	804	5/5	0.90	0.22	48,55,68,70	0
3	SO4	A	801	5/5	0.91	0.17	40,42,49,53	0
4	GOL	A	814	6/6	0.91	0.12	26,31,33,42	0
4	GOL	A	813	6/6	0.92	0.10	24,30,32,37	0
3	SO4	A	802	5/5	0.92	0.17	40,41,53,63	0
4	GOL	A	816	6/6	0.92	0.11	20,28,42,44	0
3	SO4	A	804	5/5	0.92	0.14	40,41,55,55	0
3	SO4	A	805	5/5	0.92	0.17	44,50,57,64	0
3	SO4	A	810	5/5	0.94	0.21	28,41,53,55	0
3	SO4	B	801	5/5	0.94	0.18	28,29,42,49	0
4	GOL	A	815	6/6	0.95	0.13	25,26,30,39	0
3	SO4	A	809	5/5	0.95	0.12	28,32,37,37	0

6.5 Other polymers [i](#)

There are no such residues in this entry.