



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 26, 2024 – 09:40 AM EDT

PDB ID : 5KK7
Title : Crystal structure of the class I human endoplasmic reticulum 1,2-alpha-mannosidase T688A mutant and Thio-disaccharide substrate analog complex
Authors : Karaveg, K.; Xiang, Y.; Moremen, K.W.
Deposited on : 2016-06-21
Resolution : 1.73 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

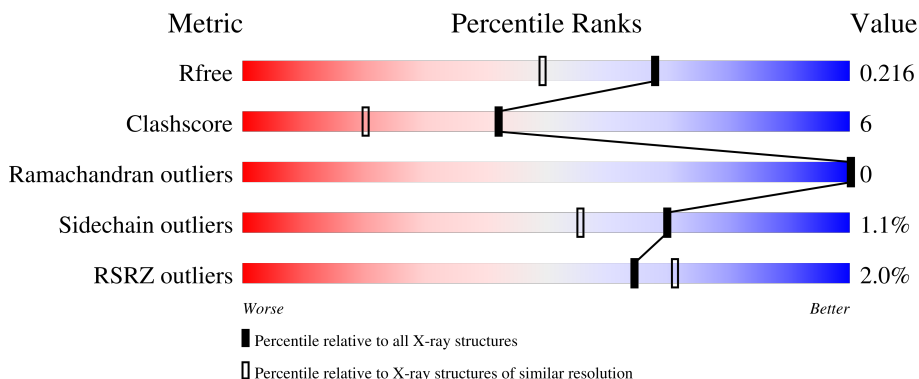
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.73 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1043 (1.74-1.74)
Clashscore	180529	1119 (1.74-1.74)
Ramachandran outliers	177936	1112 (1.74-1.74)
Sidechain outliers	177891	1112 (1.74-1.74)
RSRZ outliers	164620	1043 (1.74-1.74)

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	455	 2% 91% 9%
1	B	455	 2% 92% 8%
2	C	2	 50% 50%
2	D	2	 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 criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
5	1PS	A	709	-	-	X	-
6	BU1	B	703	-	-	X	-
7	ACT	B	704	-	-	X	-
7	ACT	B	705	-	-	X	-
7	ACT	B	707	-	-	X	-

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 8916 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 Endoplasmic reticulum mannosyl-oligosaccharide 1,2-alpha-mannosidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	455	3794	2438	653	692	11	0	13	0
1	B	455	3798	2439	656	692	11	0	13	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	688	ALA	THR	engineered mutation	UNP Q9UKM7
B	688	ALA	THR	engineered mutation	UNP Q9UKM7

- Molecule 2 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-methyl 2-thio-alpha-D-mannopyranoside.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	O	S			
2	C	2	24	13	10	1	0	0	0
2	D	2	24	13	10	1	0	0	0

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

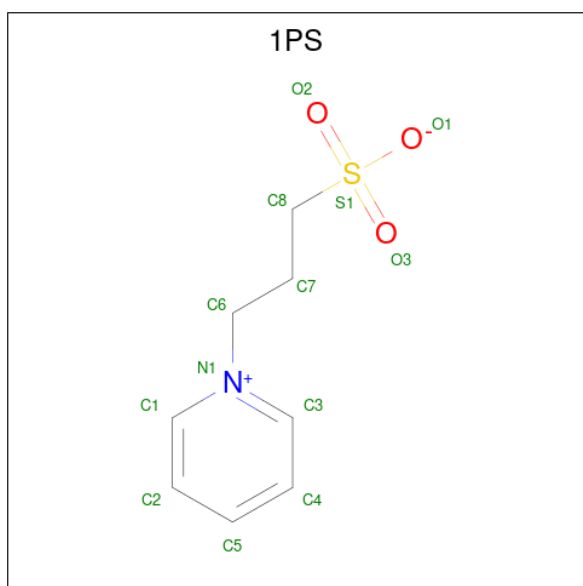
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Ca	0	0
			1	1		
3	B	1	Total	Ca	0	0
			1	1		

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



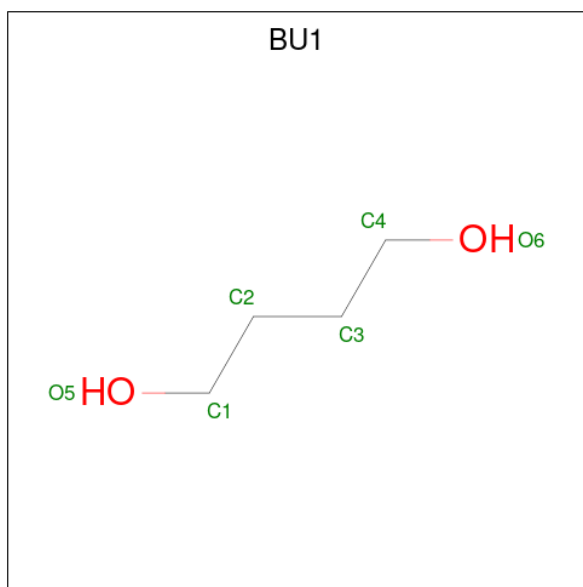
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O S 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0

- Molecule 5 is 3-PYRIDINIUM-1-YLPROPANE-1-SULFONATE (three-letter code: 1PS) (formula: C₈H₁₁NO₃S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	S	0	0
			13	8	1	3	1		
5	A	1	Total	C	N	O	S	0	0
			13	8	1	3	1		

- Molecule 6 is 1,4-BUTANEDIOL (three-letter code: BU1) (formula: C₄H₁₀O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			6	4	2		
6	A	1	Total	C	O	0	0
			6	4	2		
6	B	1	Total	C	O	0	0
			6	4	2		
6	B	1	Total	C	O	0	0
			6	4	2		

- Molecule 7 is ACETATE ION (three-letter code: ACT) (formula: C₂H₃O₂).



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

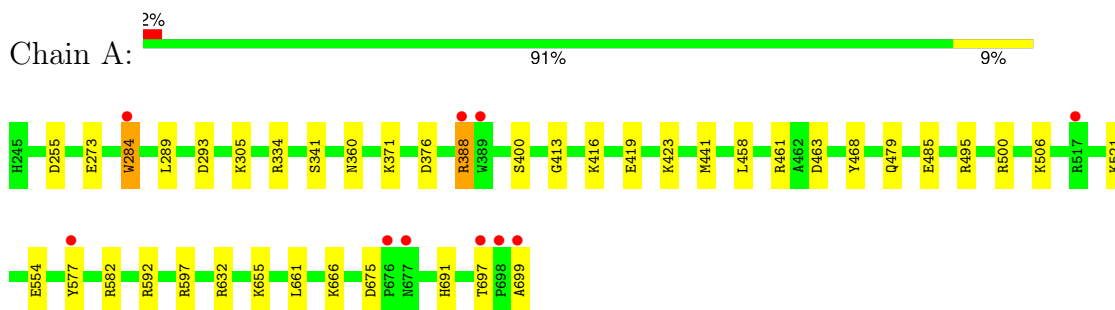
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	591	Total O 591 591	0	0
8	B	598	Total O 598 598	0	0

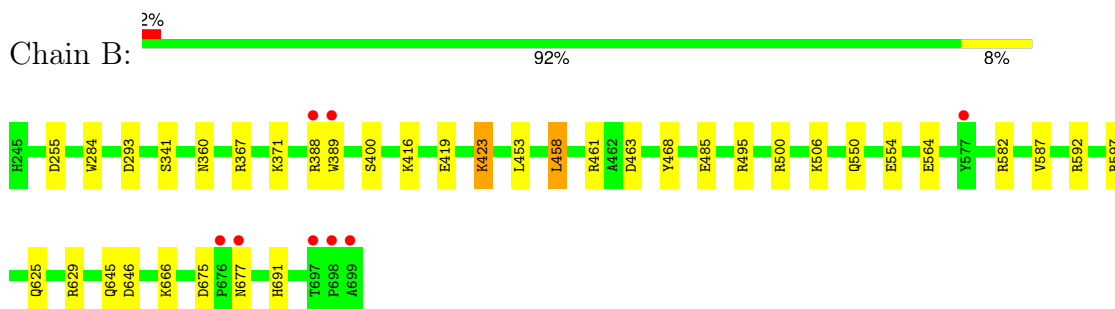
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Endoplasmic reticulum mannosyl-oligosaccharide 1,2-alpha-mannosidase



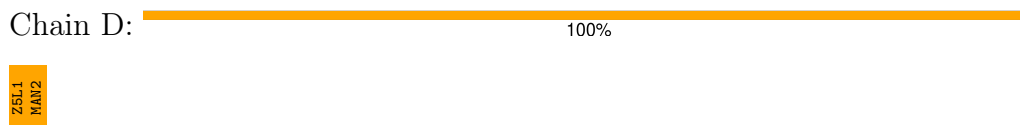
- Molecule 1: Endoplasmic reticulum mannosyl-oligosaccharide 1,2-alpha-mannosidase



- Molecule 2: alpha-D-mannopyranose-(1-2)-methyl 2-thio-alpha-D-mannopyranoside



- Molecule 2: alpha-D-mannopyranose-(1-2)-methyl 2-thio-alpha-D-mannopyranoside



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	53.89Å 56.30Å 89.56Å 105.68° 94.15° 114.25°	Depositor
Resolution (Å)	42.16 – 1.73 42.16 – 1.73	Depositor EDS
% Data completeness (in resolution range)	90.6 (42.16-1.73) 65.7 (42.16-1.73)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.51 (at 1.73Å)	Xtrriage
Refinement program	PHENIX (1.10.1_2155: ???)	Depositor
R, R_{free}	0.176 , 0.209 0.188 , 0.216	Depositor DCC
R_{free} test set	1989 reflections (2.35%)	wwPDB-VP
Wilson B-factor (Å ²)	10.2	Xtrriage
Anisotropy	0.230	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 57.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	8916	wwPDB-VP
Average B, all atoms (Å ²)	17.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 99.33 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.2507e-12. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

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

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 1PS, MAN, BU1, ACT, SO4, Z5L, CA

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.48	0/3898	0.62	0/5277
1	B	0.51	0/3902	0.66	0/5282
All	All	0.49	0/7800	0.64	0/10559

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	3794	0	3709	42	1
1	B	3798	0	3710	41	0
2	C	24	0	8	1	0
2	D	24	0	8	2	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	10	0	0	0	0
4	B	5	0	0	0	0
5	A	26	0	22	16	0
6	A	12	0	20	1	0
6	B	12	0	20	5	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	8	0	6	1	0
7	B	12	0	9	7	0
8	A	591	0	0	30	3
8	B	598	0	0	22	5
All	All	8916	0	7512	95	7

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 (95) 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)
5:A:709:1PS:O3	8:A:801:HOH:O	1.73	1.02
1:A:423[A]:LYS:NZ	8:A:803:HOH:O	2.00	0.95
7:B:705:ACT:OXT	8:B:801:HOH:O	1.85	0.94
1:B:629[B]:ARG:NH1	8:B:805:HOH:O	2.04	0.89
1:A:255:ASP:CG	5:A:709:1PS:H81	1.94	0.88
1:A:675:ASP:OD2	8:A:802:HOH:O	1.94	0.85
1:A:521[B]:LYS:NZ	8:A:806:HOH:O	2.11	0.82
1:B:461:ARG:NE	8:B:809:HOH:O	2.11	0.82
1:B:675:ASP:OD2	8:B:802:HOH:O	1.96	0.82
7:B:705:ACT:O	8:B:803:HOH:O	1.98	0.80
1:A:376:ASP:OD2	8:A:804:HOH:O	2.00	0.79
1:A:255:ASP:HB3	5:A:709:1PS:H62	1.65	0.77
1:B:255:ASP:OD1	8:B:804:HOH:O	2.01	0.77
1:B:419:GLU:O	1:B:423[A]:LYS:HG2	1.84	0.77
1:B:646:ASP:OD2	8:B:806:HOH:O	2.05	0.75
1:B:550[A]:GLN:OE1	8:B:807:HOH:O	2.05	0.74
5:A:709:1PS:H1	8:A:1149:HOH:O	1.87	0.73
1:B:255:ASP:OD2	8:B:808:HOH:O	2.08	0.71
1:A:597:ARG:HH22	6:A:705:BU1:H22	1.60	0.67
1:B:485:GLU:OE2	8:B:810:HOH:O	2.14	0.65
1:A:500[A]:ARG:NH2	8:A:814:HOH:O	2.29	0.65
1:B:625[A]:GLN:OE1	8:B:811:HOH:O	2.15	0.65
1:A:388:ARG:NH1	8:A:804:HOH:O	2.13	0.64
1:A:255:ASP:HB3	5:A:709:1PS:C6	2.28	0.64
1:A:495:ARG:NH1	8:A:815:HOH:O	2.29	0.64
1:A:485:GLU:OE1	8:A:807:HOH:O	2.15	0.64
1:A:441:MET:HE1	8:A:1056:HOH:O	1.98	0.63
5:A:709:1PS:C1	8:A:1149:HOH:O	2.47	0.61
1:B:423[A]:LYS:HE2	8:B:1251:HOH:O	2.02	0.59

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:632:ARG:NH1	5:A:709:1PS:H2	2.17	0.59
1:A:697:THR:O	8:A:810:HOH:O	2.17	0.59
1:B:500[A]:ARG:NH2	8:B:823:HOH:O	2.36	0.58
1:B:506:LYS:NZ	8:B:822:HOH:O	2.35	0.57
1:B:582:ARG:NH1	8:B:817:HOH:O	2.28	0.56
1:A:592:ARG:NH1	8:A:820:HOH:O	2.37	0.56
1:A:441:MET:HE2	1:A:461:ARG:HD2	1.87	0.55
1:A:255:ASP:OD2	5:A:709:1PS:H81	2.07	0.55
1:B:675:ASP:OD1	1:B:677:ASN:HB3	2.07	0.55
2:D:2:MAN:H61	2:D:2:MAN:O3	2.06	0.54
5:A:709:1PS:O2	8:A:809:HOH:O	2.17	0.54
1:B:423[A]:LYS:CE	8:B:1251:HOH:O	2.57	0.53
1:B:388:ARG:CZ	1:B:389:TRP:HB3	2.39	0.52
1:A:441:MET:CE	8:A:1056:HOH:O	2.54	0.52
1:A:582:ARG:NH2	8:A:816:HOH:O	2.31	0.51
1:B:564[B]:GLU:N	1:B:564[B]:GLU:OE2	2.44	0.51
1:A:506:LYS:NZ	8:A:813:HOH:O	2.26	0.50
1:A:419:GLU:O	1:A:423[A]:LYS:HG2	2.10	0.50
1:B:597:ARG:HH22	7:B:704:ACT:H3	1.77	0.49
1:A:371:LYS:HD2	8:A:975:HOH:O	2.12	0.49
1:A:255:ASP:CB	5:A:709:1PS:H81	2.41	0.49
1:A:423[B]:LYS:NZ	8:A:827:HOH:O	2.45	0.48
1:A:632:ARG:CZ	5:A:709:1PS:H2	2.44	0.48
1:A:632:ARG:HH11	5:A:709:1PS:H2	1.78	0.48
1:A:305:LYS:NZ	8:A:818:HOH:O	2.34	0.47
1:B:367:ARG:HG3	7:B:707:ACT:H1	1.95	0.47
1:B:423[A]:LYS:N	1:B:423[A]:LYS:HE3	2.30	0.47
1:B:485:GLU:OE1	8:B:812:HOH:O	2.20	0.47
1:B:400:SER:HA	1:B:468:TYR:CD2	2.49	0.46
1:B:371:LYS:HD2	8:B:967:HOH:O	2.15	0.46
1:A:416:LYS:NZ	8:A:833:HOH:O	2.48	0.46
1:B:367:ARG:CG	7:B:707:ACT:H1	2.45	0.45
1:B:360:ASN:OD1	1:B:416:LYS:CE	2.65	0.45
1:A:632:ARG:NE	5:A:709:1PS:H2	2.31	0.45
1:B:341[B]:SER:OG	1:B:691:HIS:HB3	2.15	0.45
1:A:341[B]:SER:OG	1:A:691:HIS:HB3	2.16	0.45
1:A:360:ASN:OD1	1:A:416:LYS:CE	2.64	0.45
1:B:645[A]:GLN:HA	1:B:645[A]:GLN:OE1	2.16	0.45
2:C:2:MAN:H61	2:C:2:MAN:O3	2.16	0.45
1:B:495:ARG:NH2	8:B:829:HOH:O	2.41	0.45
1:B:388:ARG:HG3	1:B:389:TRP:HE3	1.82	0.44

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:479:GLN:HG3	8:A:1277:HOH:O	2.18	0.44
1:B:506:LYS:NZ	8:B:838:HOH:O	2.51	0.44
1:B:645[B]:GLN:OE1	6:B:703:BU1:H22	2.18	0.43
1:A:699:ALA:HB2	8:A:1306:HOH:O	2.17	0.43
1:A:655:LYS:HD3	7:A:707:ACT:O	2.18	0.43
1:B:423[A]:LYS:HE3	1:B:423[A]:LYS:CA	2.49	0.43
1:A:458:LEU:O	1:A:463:ASP:HB3	2.19	0.43
1:A:577:TYR:OH	8:A:808:HOH:O	2.16	0.43
1:B:587[A]:VAL:HG13	6:B:703:BU1:O5	2.18	0.43
1:B:592:ARG:HH21	6:B:703:BU1:H12	1.84	0.43
1:A:400:SER:HA	1:A:468:TYR:CD2	2.54	0.42
1:A:554:GLU:CG	8:A:811:HOH:O	2.68	0.42
1:B:582:ARG:HH21	7:B:705:ACT:H2	1.83	0.42
5:A:709:1PS:H61	8:A:819:HOH:O	2.18	0.42
1:A:273:GLU:OE2	1:A:284:TRP:NE1	2.50	0.41
5:A:709:1PS:C1	8:A:1092:HOH:O	2.68	0.41
1:B:453:LEU:HD13	8:B:1337:HOH:O	2.21	0.41
1:B:458:LEU:O	1:B:463:ASP:HB3	2.20	0.41
5:A:709:1PS:C1	8:A:805:HOH:O	2.62	0.41
1:B:645[B]:GLN:OE1	6:B:703:BU1:C2	2.69	0.41
1:A:289:LEU:HD11	1:A:334:ARG:HD2	2.03	0.41
1:A:661:LEU:HG	8:A:939:HOH:O	2.20	0.41
1:B:625[B]:GLN:OE1	6:B:706:BU1:H12	2.22	0.40
1:B:554:GLU:CG	8:B:818:HOH:O	2.69	0.40
7:B:704:ACT:H2	2:D:1:Z5L:C1M	2.51	0.40

All (7) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:413:GLY:O	8:B:801:HOH:O[1_444]	1.93	0.27
8:B:1331:HOH:O	8:B:1365:HOH:O[1_565]	1.95	0.25
8:B:840:HOH:O	8:B:1274:HOH:O[1_455]	1.98	0.22
8:A:831:HOH:O	8:A:1282:HOH:O[1_455]	2.02	0.18
8:A:1253:HOH:O	8:A:1258:HOH:O[1_455]	2.07	0.13
8:B:1286:HOH:O	8:B:1337:HOH:O[1_655]	2.07	0.13
8:A:990:HOH:O	8:B:974:HOH:O[1_454]	2.12	0.08

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	466/455 (102%)	453 (97%)	13 (3%)	0	100	100
1	B	466/455 (102%)	455 (98%)	11 (2%)	0	100	100
All	All	932/910 (102%)	908 (97%)	24 (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	409/398 (103%)	405 (99%)	4 (1%)	73	61
1	B	409/398 (103%)	403 (98%)	6 (2%)	60	42
All	All	818/796 (103%)	808 (99%)	10 (1%)	70	52

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	284	TRP
1	A	293	ASP
1	A	388	ARG
1	A	666	LYS
1	B	284	TRP
1	B	293	ASP
1	B	423[A]	LYS
1	B	423[B]	LYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	458	LEU
1	B	666	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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](#)

4 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	Z5L	C	1	2	12,13,13	1.99	1 (8%)	14,18,18	1.08	0
2	MAN	C	2	2,3	11,11,12	1.43	2 (18%)	15,15,17	2.33	3 (20%)
2	Z5L	D	1	2	12,13,13	2.10	1 (8%)	14,18,18	0.97	0
2	MAN	D	2	2,3	11,11,12	1.74	3 (27%)	15,15,17	2.21	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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	Z5L	C	1	2	-	0/4/24/24	0/1/1/1

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	MAN	C	2	2,3	-	0/2/19/22	0/1/1/1
2	Z5L	D	1	2	-	0/4/24/24	0/1/1/1
2	MAN	D	2	2,3	-	0/2/19/22	0/1/1/1

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	1	Z5L	C3-C2	-6.53	1.48	1.53
2	C	1	Z5L	C3-C2	-6.07	1.48	1.53
2	D	2	MAN	C2-C3	-3.50	1.47	1.52
2	D	2	MAN	O3-C3	2.80	1.49	1.43
2	C	2	MAN	O5-C1	2.60	1.48	1.43
2	C	2	MAN	C2-C3	-2.51	1.48	1.52
2	D	2	MAN	O5-C1	2.31	1.47	1.43

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	2	MAN	C1-O5-C5	7.62	122.40	112.19
2	D	2	MAN	C1-O5-C5	6.16	120.44	112.19
2	D	2	MAN	C1-C2-C3	2.99	114.00	109.64
2	D	2	MAN	O3-C3-C4	-2.43	104.65	110.38
2	C	2	MAN	O5-C1-C2	2.31	116.29	110.79
2	D	2	MAN	O5-C1-C2	2.18	115.98	110.79
2	C	2	MAN	C1-C2-C3	2.13	112.75	109.64

There are no chirality outliers.

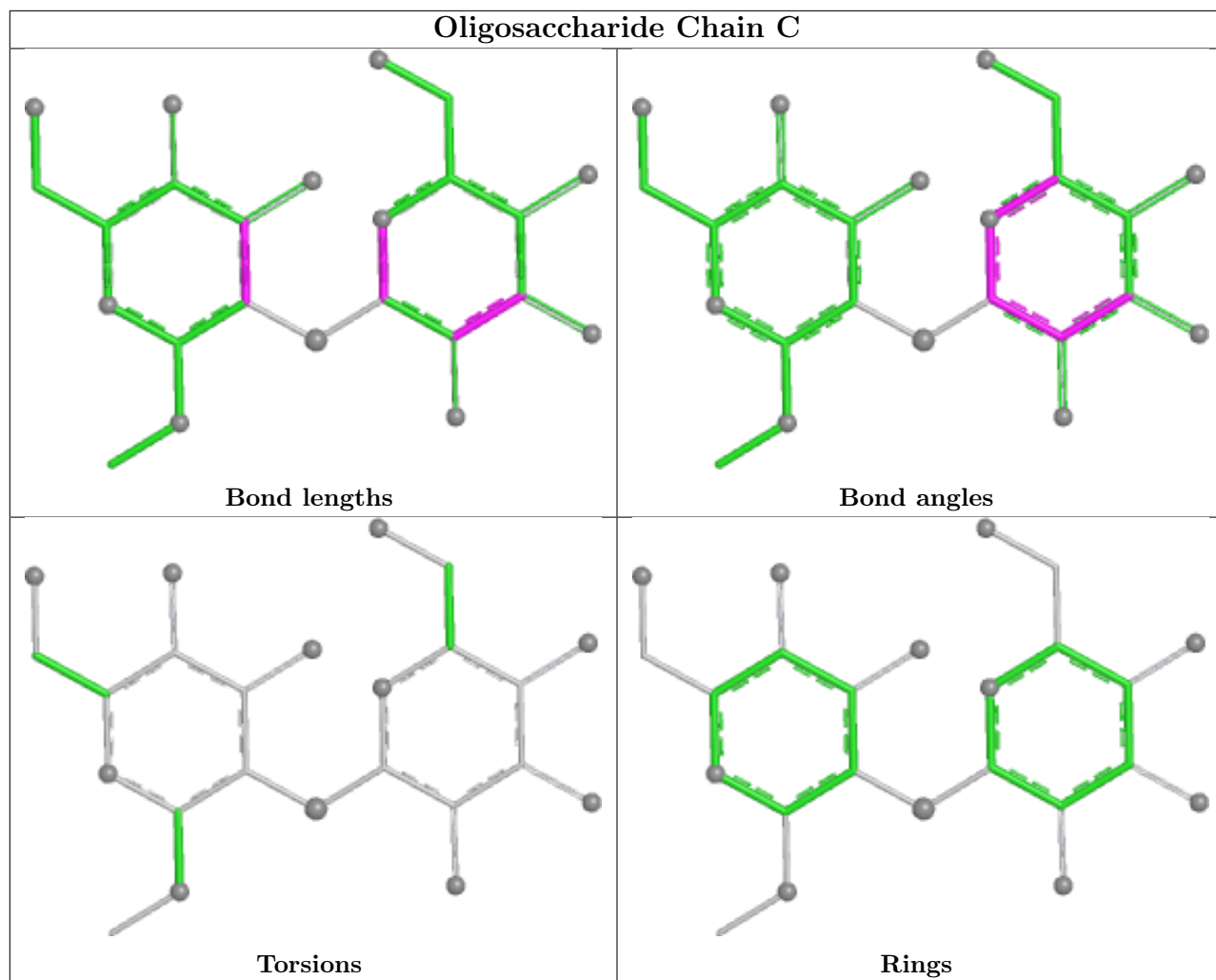
There are no torsion outliers.

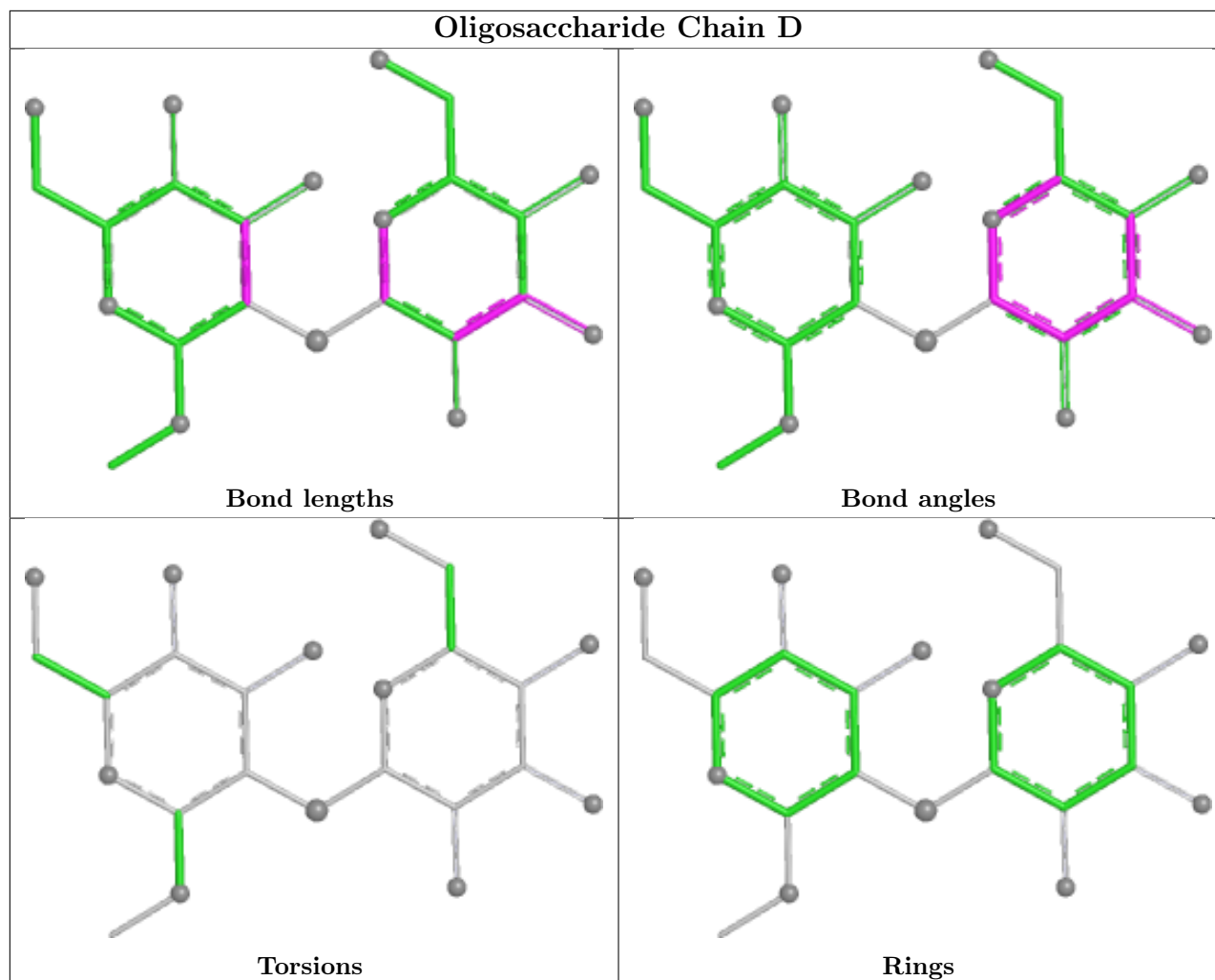
There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	1	Z5L	1	0
2	D	2	MAN	1	0
2	C	2	MAN	1	0

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





5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 2 are monoatomic - leaving 14 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	$\# Z > 2$
7	ACT	B	704	-	3,3,3	0.81	0	3,3,3	1.03	0
7	ACT	A	707	-	3,3,3	0.72	0	3,3,3	1.68	1 (33%)
7	ACT	A	708	-	3,3,3	0.80	0	3,3,3	1.46	0
6	BU1	B	706	-	5,5,5	0.36	0	4,4,4	0.33	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	1PS	A	709	-	13,13,13	1.72	3 (23%)	17,17,17	1.79	3 (17%)
7	ACT	B	705	-	3,3,3	0.81	0	3,3,3	1.15	0
6	BU1	A	706	-	5,5,5	0.39	0	4,4,4	0.43	0
4	SO4	B	702	-	4,4,4	0.22	0	6,6,6	0.15	0
6	BU1	A	705	-	5,5,5	0.40	0	4,4,4	1.27	0
6	BU1	B	703	-	5,5,5	0.44	0	4,4,4	0.48	0
4	SO4	A	703	-	4,4,4	0.30	0	6,6,6	0.17	0
5	1PS	A	704	-	13,13,13	1.64	3 (23%)	17,17,17	1.64	5 (29%)
7	ACT	B	707	-	3,3,3	0.75	0	3,3,3	1.79	2 (66%)
4	SO4	A	702	-	4,4,4	0.25	0	6,6,6	0.17	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
6	BU1	B	706	-	-	1/3/3/3	-
5	1PS	A	709	-	-	4/7/7/7	0/1/1/1
6	BU1	A	706	-	-	2/3/3/3	-
6	BU1	B	703	-	-	1/3/3/3	-
6	BU1	A	705	-	-	2/3/3/3	-
5	1PS	A	704	-	-	3/7/7/7	0/1/1/1

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	709	1PS	C8-S1	4.37	1.83	1.77
5	A	704	1PS	C8-S1	3.93	1.83	1.77
5	A	704	1PS	O3-S1	2.76	1.52	1.45
5	A	709	1PS	O3-S1	2.44	1.52	1.45
5	A	709	1PS	O2-S1	2.43	1.52	1.45
5	A	704	1PS	O2-S1	2.08	1.51	1.45

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	709	1PS	O2-S1-C8	4.24	113.13	106.73
5	A	709	1PS	O1-S1-O2	-3.68	102.20	111.40
5	A	704	1PS	O3-S1-C8	3.04	111.31	106.73

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	704	1PS	O2-S1-C8	3.02	111.29	106.73
5	A	709	1PS	O3-S1-C8	2.90	111.11	106.73
5	A	704	1PS	O1-S1-O2	-2.83	104.31	111.40
5	A	704	1PS	C7-C8-S1	-2.47	109.47	113.25
7	B	707	ACT	OXT-C-CH3	2.30	124.72	115.05
5	A	704	1PS	O3-S1-O2	-2.26	106.47	113.82
7	A	707	ACT	OXT-C-CH3	2.25	124.48	115.05
7	B	707	ACT	OXT-C-O	-2.04	114.46	122.03

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	704	1PS	N1-C6-C7-C8
5	A	709	1PS	N1-C6-C7-C8
5	A	709	1PS	C7-C8-S1-O2
5	A	709	1PS	C7-C8-S1-O3
5	A	709	1PS	C7-C8-S1-O1
5	A	704	1PS	C6-C7-C8-S1
6	A	706	BU1	O5-C1-C2-C3
6	A	705	BU1	C2-C3-C4-O6
6	A	706	BU1	C2-C3-C4-O6
6	B	703	BU1	O5-C1-C2-C3
5	A	704	1PS	C7-C8-S1-O1
6	B	706	BU1	C1-C2-C3-C4
6	A	705	BU1	C1-C2-C3-C4

There are no ring outliers.

8 monomers are involved in 30 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	B	704	ACT	2	0
7	A	707	ACT	1	0
6	B	706	BU1	1	0
5	A	709	1PS	16	0
7	B	705	ACT	3	0
6	A	705	BU1	1	0
6	B	703	BU1	4	0
7	B	707	ACT	2	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	455/455 (100%)	-0.14	10 (2%) 62 68	5, 16, 27, 69	13 (2%)
1	B	455/455 (100%)	-0.35	8 (1%) 67 73	3, 12, 22, 65	13 (2%)
All	All	910/910 (100%)	-0.25	18 (1%) 64 71	3, 14, 25, 69	26 (2%)

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	389	TRP	6.3
1	B	389	TRP	5.0
1	B	699	ALA	4.4
1	A	699	ALA	4.4
1	A	577	TYR	3.7
1	A	697	THR	3.5
1	A	698	PRO	2.9
1	A	388	ARG	2.8
1	A	677	ASN	2.8
1	A	676	PRO	2.7
1	B	698	PRO	2.6
1	B	676	PRO	2.3
1	B	577	TYR	2.3
1	B	697	THR	2.3
1	A	517	ARG	2.2
1	B	388	ARG	2.2
1	B	677	ASN	2.1
1	A	284	TRP	2.1

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

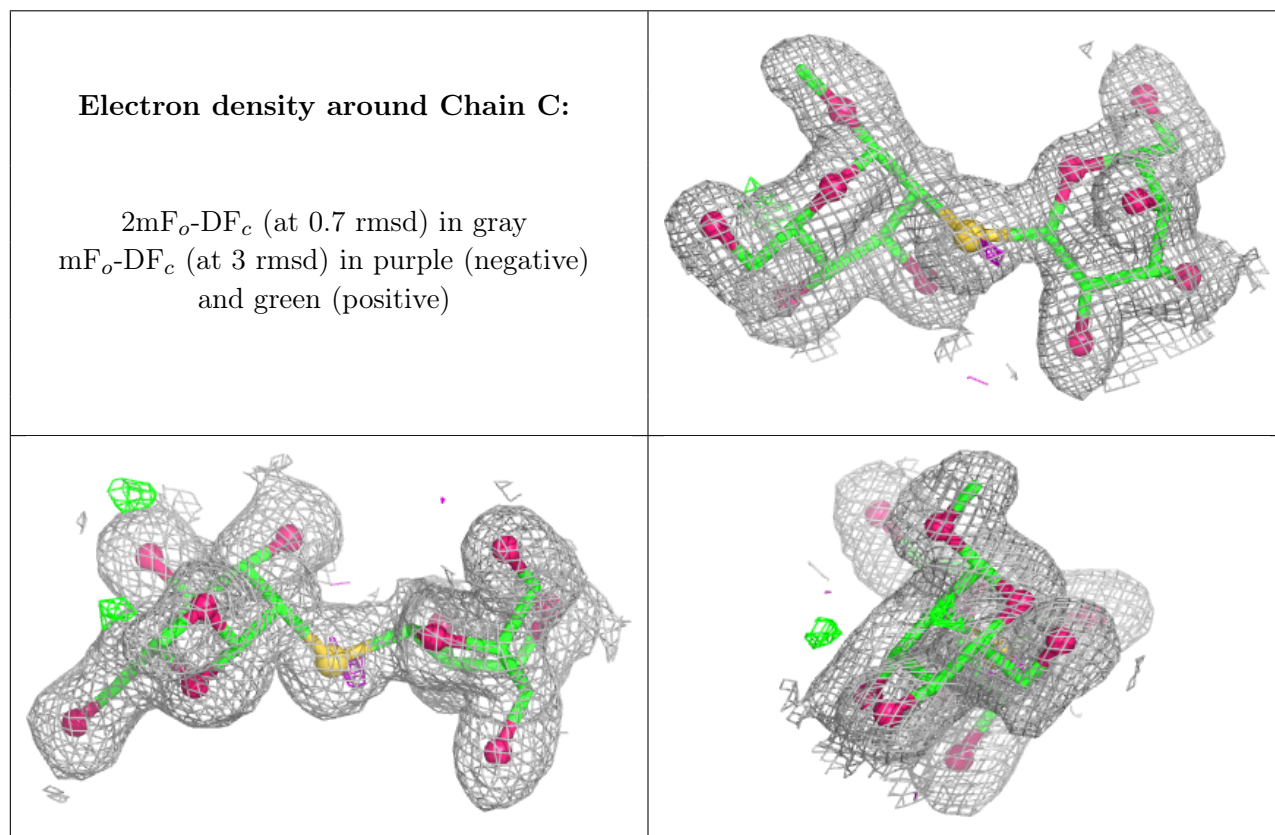
There are no non-standard protein/DNA/RNA residues in this entry.

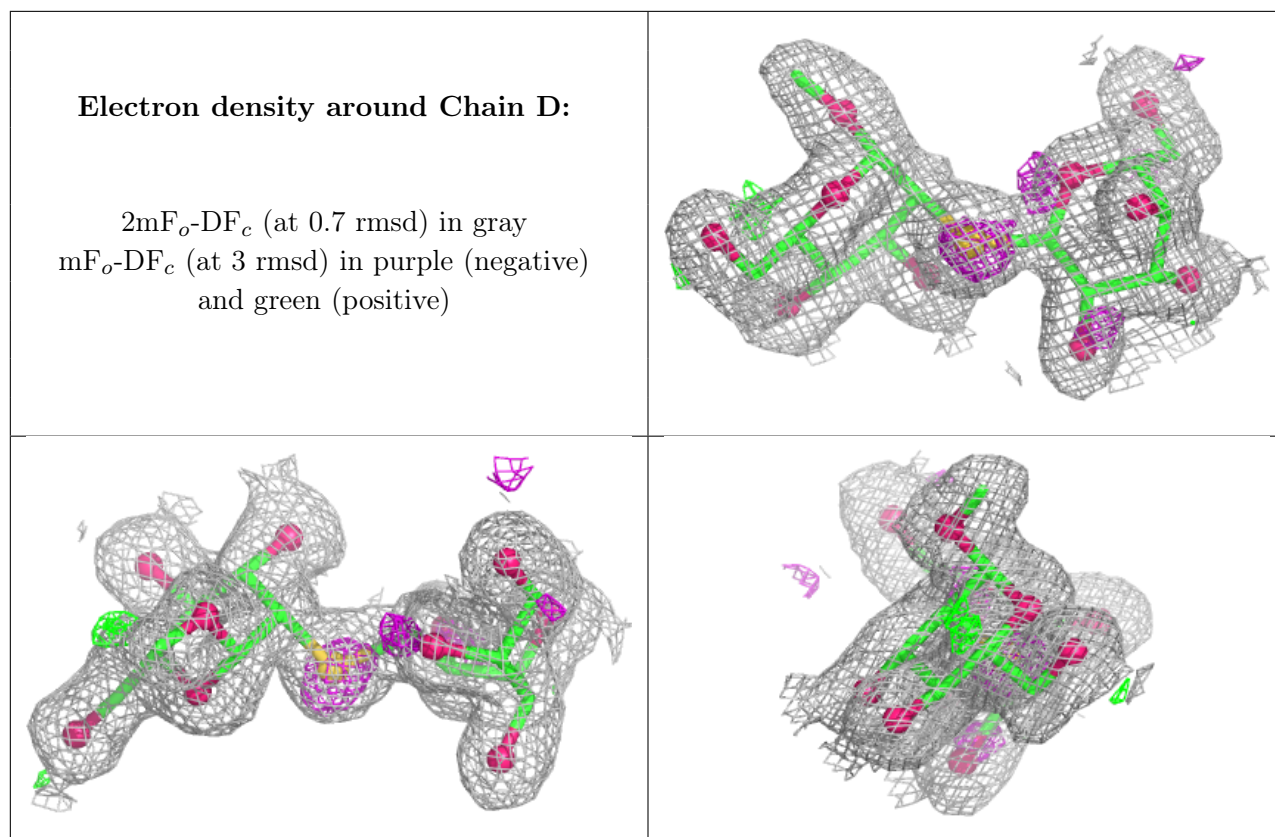
6.3 Carbohydrates [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	MAN	C	2	11/12	0.96	0.06	2,10,17,21	0
2	MAN	D	2	11/12	0.96	0.06	1,7,15,19	0
2	Z5L	D	1	13/13	0.97	0.06	9,12,15,20	0
2	Z5L	C	1	13/13	0.97	0.06	11,13,17,22	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
6	BU1	A	706	6/6	0.44	0.27	93,95,98,100	0
7	ACT	B	705	4/4	0.53	0.34	67,72,75,75	0
5	1PS	A	709	13/13	0.66	0.33	70,98,103,103	0
6	BU1	B	706	6/6	0.71	0.21	48,52,60,63	0
7	ACT	B	707	4/4	0.72	0.20	37,52,56,60	0
6	BU1	B	703	6/6	0.75	0.30	53,61,70,74	0
7	ACT	A	707	4/4	0.75	0.26	22,44,51,60	4
7	ACT	A	708	4/4	0.76	0.17	40,40,41,47	0
6	BU1	A	705	6/6	0.79	0.21	20,20,20,20	0
4	SO4	A	703	5/5	0.79	0.18	40,45,53,61	5
5	1PS	A	704	13/13	0.85	0.19	12,24,33,35	13
7	ACT	B	704	4/4	0.85	0.18	32,35,41,43	0
4	SO4	B	702	5/5	0.97	0.06	18,22,28,35	0
4	SO4	A	702	5/5	0.97	0.07	17,22,27,39	0

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	CA	A	701	1/1	1.00	0.02	8,8,8,8	0
3	CA	B	701	1/1	1.00	0.03	8,8,8,8	0

6.5 Other polymers [i](#)

There are no such residues in this entry.