



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 18, 2026 – 11:15 PM UTC

PDB ID : 5B2D / pdb_00005b2d
Title : Crystal structure of Mumps virus hemagglutinin-neuraminidase bound to 3-sialyllactose
Authors : Kubota, M.; Takeuchi, K.; Watanabe, S.; Ohno, S.; Matsuoka, R.; Kohda, D.; Hiramatsu, H.; Suzuki, Y.; Nakayama, T.; Terada, T.; Shimizu, K.; Shimizu, N.; Yanagi, Y.; Hashiguchi, T.
Deposited on : 2016-01-14
Resolution : 2.18 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

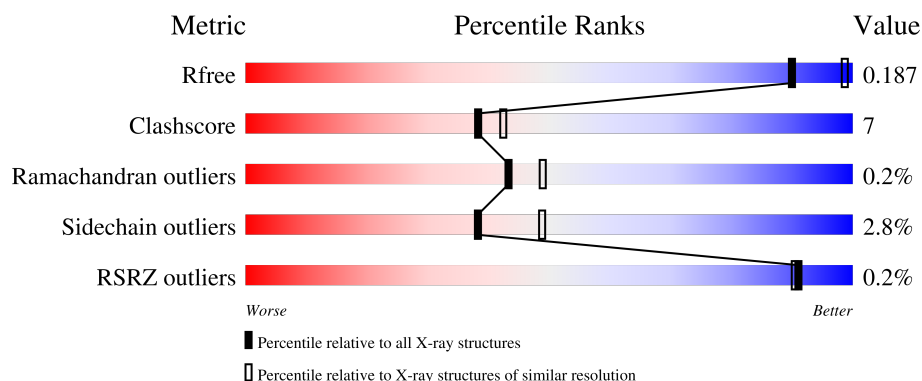
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

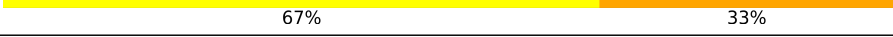
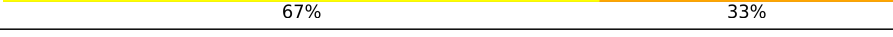
The reported resolution of this entry is 2.18 Å.

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	8975 (2.20-2.16)
Clashscore	190562	9786 (2.20-2.16)
Ramachandran outliers	187476	9664 (2.20-2.16)
Sidechain outliers	187428	9664 (2.20-2.16)
RSRZ outliers	180081	8979 (2.20-2.16)

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	489	 74% 17% • 8%
1	B	489	 76% 15% • 8%
2	C	3	 67% 33%
2	D	3	 67% 33%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 7501 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.

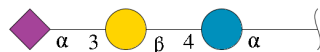
- Molecule 1 is a protein called HN protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	450	Total	C	N	O	S	0	0	0
			3518	2248	582	667	21			
1	B	450	Total	C	N	O	S	0	0	0
			3518	2248	582	667	21			

There are 24 discrepancies between the modelled and reference sequences:

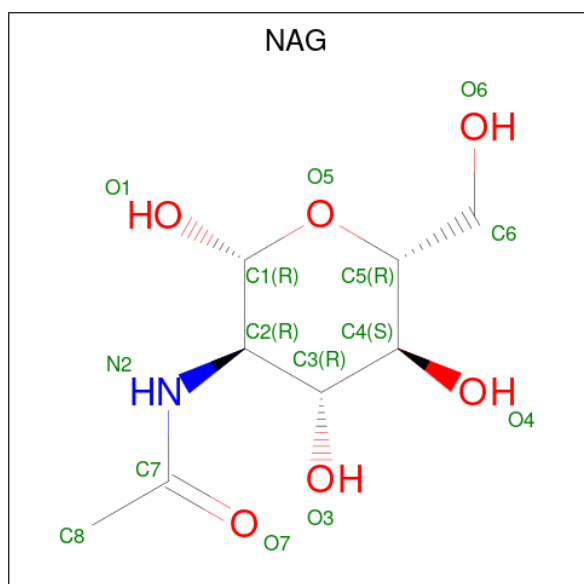
Chain	Residue	Modelled	Actual	Comment	Reference
A	103	GLU	-	expression tag	UNP Q9WAF5
A	104	THR	-	expression tag	UNP Q9WAF5
A	105	GLY	-	expression tag	UNP Q9WAF5
A	583	GLY	-	expression tag	UNP Q9WAF5
A	584	THR	-	expression tag	UNP Q9WAF5
A	585	LYS	-	expression tag	UNP Q9WAF5
A	586	HIS	-	expression tag	UNP Q9WAF5
A	587	HIS	-	expression tag	UNP Q9WAF5
A	588	HIS	-	expression tag	UNP Q9WAF5
A	589	HIS	-	expression tag	UNP Q9WAF5
A	590	HIS	-	expression tag	UNP Q9WAF5
A	591	HIS	-	expression tag	UNP Q9WAF5
B	103	GLU	-	expression tag	UNP Q9WAF5
B	104	THR	-	expression tag	UNP Q9WAF5
B	105	GLY	-	expression tag	UNP Q9WAF5
B	583	GLY	-	expression tag	UNP Q9WAF5
B	584	THR	-	expression tag	UNP Q9WAF5
B	585	LYS	-	expression tag	UNP Q9WAF5
B	586	HIS	-	expression tag	UNP Q9WAF5
B	587	HIS	-	expression tag	UNP Q9WAF5
B	588	HIS	-	expression tag	UNP Q9WAF5
B	589	HIS	-	expression tag	UNP Q9WAF5
B	590	HIS	-	expression tag	UNP Q9WAF5
B	591	HIS	-	expression tag	UNP Q9WAF5

- Molecule 2 is an oligosaccharide called N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-4)-alpha-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	3	Total	C	N	O	0	0	0
			43	23	1	19			
2	D	3	Total	C	N	O	0	0	0
			43	23	1	19			

- Molecule 3 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	B	1	Total	C	N	O	0	0
			14	8	1	5		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	N	O	0	0
			14	8	1	5		
3	B	1	Total	C	N	O	0	0
			14	8	1	5		
3	B	1	Total	C	N	O	0	0
			14	8	1	5		
3	B	1	Total	C	N	O	0	0
			14	8	1	5		

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



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

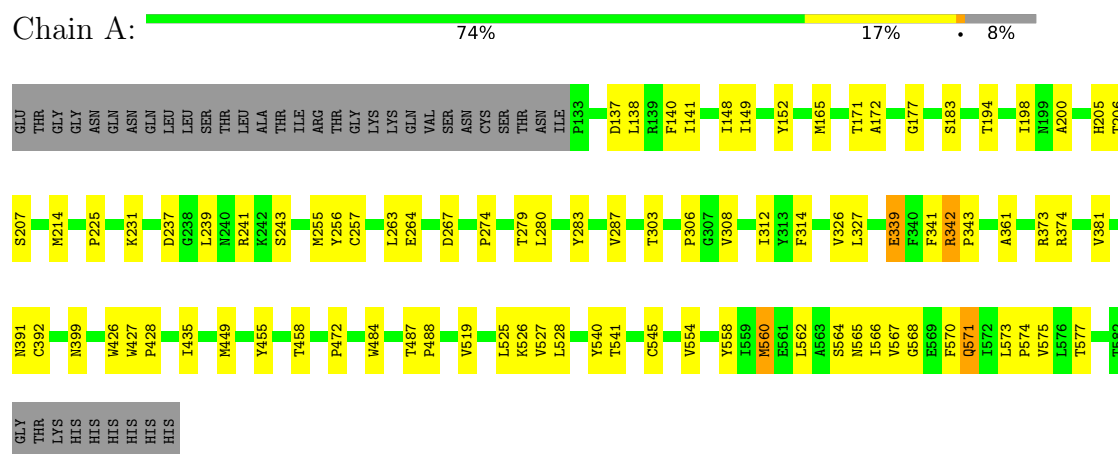
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	120	Total	O	0	0
			120	120		
5	B	114	Total	O	0	0
			114	114		

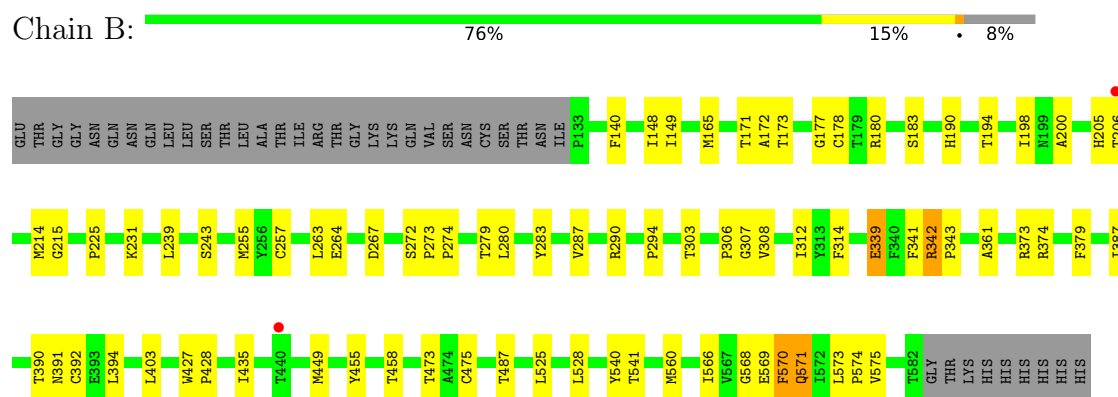
3 Residue-property plots

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.

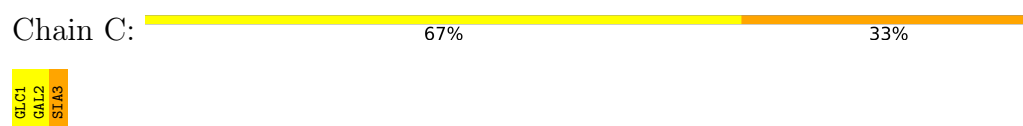
• Molecule 1: HN protein



• Molecule 1: HN protein



• Molecule 2: N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-4)-alpha-D-glucopyranose



- Molecule 2: N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-4)-alpha-D-glucopyranose

Chain D:  67% 33%

GLC1
GAL2
SIA3

4 Data and refinement statistics

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α , β , γ	136.88Å 136.88Å 177.27Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	118.54 – 2.18 118.54 – 2.18	Depositor EDS
% Data completeness (in resolution range)	100.0 (118.54-2.18) 97.3 (118.54-2.18)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.90 (at 2.18Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.176 , 0.191 0.177 , 0.187	Depositor DCC
R_{free} test set	4905 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	29.4	Xtriage
Anisotropy	0.244	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 35.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.41$, $\langle L^2 \rangle = 0.24$	Xtriage
Estimated twinning fraction	0.229 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	7501	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.66% 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: GAL, SIA, SO4, NAG, 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	0.43	0/3616	0.83	4/4945 (0.1%)
1	B	0.42	0/3616	0.82	4/4945 (0.1%)
All	All	0.43	0/7232	0.82	8/9890 (0.1%)

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	339	GLU	N-CA-C	5.76	118.59	110.23
1	B	339	GLU	N-CA-C	5.62	118.37	110.23
1	A	427	TRP	CA-C-N	5.55	126.03	120.04
1	A	427	TRP	C-N-CA	5.55	126.03	120.04
1	B	427	TRP	CA-C-N	5.29	125.75	120.04
1	B	427	TRP	C-N-CA	5.29	125.75	120.04
1	B	206	THR	N-CA-C	-5.24	105.10	112.12
1	A	571	GLN	N-CA-C	-5.08	102.12	109.59

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	3518	0	3395	55	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	3518	0	3395	49	0
2	C	43	0	37	1	0
2	D	43	0	37	1	0
3	A	70	0	65	2	0
3	B	70	0	65	1	0
4	B	5	0	0	0	0
5	A	120	0	0	2	0
5	B	114	0	0	1	0
All	All	7501	0	6994	99	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 (99) 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:267:ASP:HB3	1:A:303:THR:HG21	1.50	0.94
1:B:267:ASP:HB3	1:B:303:THR:HG21	1.48	0.94
1:A:274:PRO:HD3	1:A:303:THR:HG22	1.63	0.80
1:A:165:MET:SD	5:A:793:HOH:O	2.45	0.74
1:A:571:GLN:NE2	1:B:171:THR:HG21	2.01	0.74
1:A:177:GLY:O	1:A:568:GLY:HA3	1.89	0.72
1:B:274:PRO:HD3	1:B:303:THR:HG22	1.73	0.69
1:A:571:GLN:HE22	1:B:171:THR:HG21	1.57	0.68
1:B:149:ILE:HB	1:B:487:THR:HG22	1.77	0.67
1:A:525:LEU:HD13	1:A:528:LEU:HD21	1.76	0.66
1:B:525:LEU:HD13	1:B:528:LEU:HD21	1.77	0.65
1:A:373:ARG:HH12	3:A:602:NAG:H4	1.62	0.65
1:B:177:GLY:O	1:B:568:GLY:HA3	1.96	0.64
1:A:198:ILE:HG22	1:A:200:ALA:H	1.62	0.64
1:B:255:MET:HE2	1:B:279:THR:HG21	1.80	0.63
1:A:526:LYS:NZ	5:A:702:HOH:O	2.32	0.62
1:B:339:GLU:O	1:B:374:ARG:NH2	2.31	0.61
1:A:562:LEU:O	1:A:570:PHE:HA	2.01	0.61
1:A:171:THR:HG23	1:A:172:ALA:O	2.01	0.60
1:B:435:ILE:HG22	1:B:449:MET:HB3	1.82	0.60
1:A:573:LEU:HD12	1:A:574:PRO:HD2	1.84	0.58
1:B:198:ILE:HG22	1:B:200:ALA:H	1.68	0.58
1:A:171:THR:HG21	1:B:571:GLN:OE1	2.02	0.58
1:B:171:THR:HG23	1:B:172:ALA:O	2.03	0.58
1:A:428:PRO:HB2	1:A:458:THR:OG1	2.04	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:327:LEU:HD22	3:A:602:NAG:H61	1.86	0.56
1:B:180:ARG:HG2	1:B:570:PHE:HD2	1.71	0.55
1:B:428:PRO:HB2	1:B:458:THR:OG1	2.06	0.55
1:A:206:THR:HG23	1:A:207:SER:H	1.72	0.55
1:A:558:TYR:HE1	1:A:577:THR:HG21	1.71	0.55
1:A:149:ILE:HB	1:A:487:THR:HG22	1.90	0.54
1:A:435:ILE:HG22	1:A:449:MET:HB3	1.90	0.54
1:A:214:MET:HG2	1:A:231:LYS:HB2	1.90	0.53
1:B:342:ARG:HG3	1:B:361:ALA:HB2	1.89	0.53
1:A:256:TYR:CD2	1:A:306:PRO:HB3	2.44	0.53
1:A:152:TYR:HE1	1:A:488:PRO:HG2	1.74	0.53
1:B:391:ASN:O	1:B:392:CYS:HB2	2.09	0.52
1:A:255:MET:HE2	1:A:279:THR:HG21	1.91	0.52
1:B:541:THR:HG22	1:B:560:MET:HB3	1.90	0.51
1:A:342:ARG:HG3	1:A:361:ALA:HB2	1.92	0.51
1:A:564:SER:HB2	1:B:566:ILE:HD11	1.92	0.51
1:B:294:PRO:HB2	1:B:394:LEU:HG	1.91	0.51
1:A:138:LEU:HD23	1:A:141:ILE:HD12	1.95	0.49
1:A:243:SER:O	1:A:306:PRO:HG2	2.12	0.49
1:A:558:TYR:HE1	1:A:577:THR:CG2	2.26	0.49
1:B:573:LEU:HD12	1:B:574:PRO:HD2	1.95	0.49
1:B:148:ILE:HG13	1:B:149:ILE:HG13	1.94	0.49
1:B:214:MET:HG2	1:B:231:LYS:HB2	1.95	0.49
1:A:264:GLU:O	1:A:267:ASP:HB2	2.12	0.48
1:A:231:LYS:HE3	1:A:283:TYR:O	2.13	0.48
1:B:341:PHE:CE2	1:B:343:PRO:HG3	2.49	0.48
1:B:569:GLU:O	1:B:570:PHE:HB2	2.13	0.48
1:B:379:PHE:CE1	1:B:449:MET:HE1	2.49	0.48
1:B:243:SER:O	1:B:306:PRO:HB2	2.13	0.47
1:A:519:VAL:HB	1:A:527:VAL:HG12	1.96	0.47
1:B:255:MET:HB3	1:B:279:THR:CG2	2.45	0.47
1:B:540:TYR:OH	2:D:3:SIA:H31	2.15	0.47
1:A:148:ILE:HD13	1:A:554:VAL:HG13	1.96	0.46
1:A:449:MET:HB3	1:A:449:MET:HE2	1.71	0.46
1:A:206:THR:HG23	1:A:207:SER:N	2.30	0.46
1:A:565:ASN:CG	1:A:566:ILE:HG23	2.41	0.46
1:B:178:CYS:HB3	1:B:198:ILE:HB	1.98	0.46
1:B:264:GLU:O	1:B:267:ASP:HB2	2.15	0.46
1:A:541:THR:HG22	1:A:560:MET:HB3	1.97	0.45
1:B:255:MET:HE2	1:B:279:THR:CG2	2.47	0.45
1:A:374:ARG:HH21	1:A:399:ASN:HB2	1.81	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:140:PHE:CZ	1:A:225:PRO:HB3	2.51	0.45
1:A:573:LEU:HD11	1:B:173:THR:HA	1.98	0.45
1:B:165:MET:HE3	5:B:787:HOH:O	2.15	0.45
1:B:290:ARG:NH2	1:B:390:THR:O	2.30	0.45
1:B:449:MET:HB3	1:B:449:MET:HE2	1.69	0.45
1:B:373:ARG:NH1	3:B:602:NAG:O7	2.51	0.45
1:A:183:SER:HB3	1:A:194:THR:HG22	2.00	0.44
1:A:484:TRP:CD1	1:A:545:CYS:HB2	2.53	0.44
1:A:540:TYR:OH	2:C:3:SIA:H31	2.18	0.44
1:A:171:THR:OG1	1:A:567:VAL:HG21	2.18	0.44
1:B:290:ARG:NH1	1:B:387:ILE:O	2.50	0.44
1:B:473:THR:HG23	1:B:475:CYS:SG	2.57	0.44
1:A:237:ASP:CG	1:A:241:ARG:HH22	2.26	0.44
1:B:272:SER:HA	1:B:273:PRO:HD3	1.92	0.44
1:A:239:LEU:HD12	1:A:239:LEU:HA	1.85	0.44
1:A:391:ASN:O	1:A:392:CYS:HB2	2.19	0.43
1:B:190:HIS:HB2	1:B:215:GLY:O	2.19	0.43
1:B:341:PHE:CD2	1:B:403:LEU:HD22	2.54	0.42
1:B:257:CYS:HA	1:B:306:PRO:HG2	2.01	0.42
1:B:341:PHE:HD2	1:B:403:LEU:HD22	1.84	0.42
1:B:183:SER:HB3	1:B:194:THR:HG22	2.02	0.42
1:A:255:MET:HB3	1:A:279:THR:CG2	2.50	0.42
1:A:255:MET:HE3	1:A:257:CYS:SG	2.60	0.42
1:A:137:ASP:HB3	1:A:140:PHE:CD1	2.55	0.42
1:A:198:ILE:HG22	1:A:200:ALA:N	2.32	0.42
1:B:307:GLY:O	1:B:308:VAL:HB	2.20	0.42
1:B:140:PHE:CZ	1:B:225:PRO:HB3	2.56	0.41
1:B:379:PHE:CZ	1:B:449:MET:HE1	2.55	0.41
1:A:339:GLU:O	1:A:374:ARG:NH2	2.45	0.41
1:A:341:PHE:CE2	1:A:343:PRO:HG3	2.55	0.41
1:A:426:TRP:CD2	1:A:472:PRO:HA	2.56	0.41
1:B:231:LYS:HE3	1:B:283:TYR:O	2.21	0.40
1:A:326:VAL:HB	1:A:374:ARG:HB3	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	448/489 (92%)	424 (95%)	23 (5%)	1 (0%)	43	49
1	B	448/489 (92%)	430 (96%)	17 (4%)	1 (0%)	43	49
All	All	896/978 (92%)	854 (95%)	40 (4%)	2 (0%)	43	49

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	570	PHE
1	A	308	VAL

5.3.2 Protein sidechains

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	398/432 (92%)	387 (97%)	11 (3%)	38	49
1	B	398/432 (92%)	387 (97%)	11 (3%)	38	49
All	All	796/864 (92%)	774 (97%)	22 (3%)	38	49

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	205	HIS
1	A	263	LEU
1	A	280	LEU
1	A	287	VAL

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Mol	Chain	Res	Type
1	A	312	ILE
1	A	314	PHE
1	A	342	ARG
1	A	381	VAL
1	A	455	TYR
1	A	560	MET
1	A	575	VAL
1	B	205	HIS
1	B	239	LEU
1	B	263	LEU
1	B	280	LEU
1	B	287	VAL
1	B	312	ILE
1	B	314	PHE
1	B	342	ARG
1	B	455	TYR
1	B	571	GLN
1	B	575	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	233	GLN
1	A	523	ASN
1	A	571	GLN
1	B	196	ASN
1	B	201	ASN
1	B	386	GLN
1	B	524	ASN
1	B	571	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

6 monosaccharides are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	GLC	C	1	2	12,12,12	1.61	4 (33%)	17,17,17	0.78	0
2	GAL	C	2	2	11,11,12	1.51	3 (27%)	15,15,17	0.78	0
2	SIA	C	3	2	20,20,21	2.20	5 (25%)	21,28,31	1.54	5 (23%)
2	GLC	D	1	2	12,12,12	1.61	4 (33%)	17,17,17	0.78	0
2	GAL	D	2	2	11,11,12	1.41	3 (27%)	15,15,17	0.76	0
2	SIA	D	3	2	20,20,21	2.17	6 (30%)	21,28,31	1.50	5 (23%)

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	GAL	C	2	2	-	2/2/19/22	0/1/1/1
2	SIA	C	3	2	-	0/18/34/38	0/1/1/1
2	GLC	D	1	2	-	0/2/22/22	0/1/1/1
2	GAL	D	2	2	-	2/2/19/22	0/1/1/1
2	SIA	D	3	2	-	0/18/34/38	0/1/1/1

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	3	SIA	C4-C5	-6.46	1.47	1.53
2	D	3	SIA	C4-C5	-5.97	1.47	1.53
2	C	3	SIA	C10-N5	3.79	1.46	1.34
2	D	3	SIA	C10-N5	3.64	1.46	1.34
2	C	1	GLC	O3-C3	3.28	1.51	1.43
2	D	3	SIA	C2-C1	-3.19	1.48	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	1	GLC	O3-C3	3.16	1.50	1.43
2	C	2	GAL	O5-C1	2.88	1.48	1.43
2	C	3	SIA	C2-C1	-2.83	1.48	1.52
2	D	1	GLC	O4-C4	2.65	1.49	1.43
2	C	1	GLC	O4-C4	2.56	1.49	1.43
2	D	3	SIA	O6-C6	2.56	1.47	1.44
2	C	3	SIA	O6-C6	2.53	1.47	1.44
2	D	2	GAL	O5-C1	2.53	1.47	1.43
2	D	1	GLC	C4-C3	-2.38	1.46	1.52
2	D	2	GAL	O3-C3	2.36	1.48	1.43
2	C	2	GAL	O3-C3	2.35	1.48	1.43
2	D	3	SIA	C3-C4	-2.28	1.48	1.52
2	C	1	GLC	C4-C3	-2.26	1.46	1.52
2	D	1	GLC	C3-C2	-2.18	1.46	1.52
2	C	2	GAL	O5-C5	2.15	1.47	1.43
2	D	2	GAL	O5-C5	2.13	1.47	1.43
2	D	3	SIA	C3-C2	-2.13	1.49	1.52
2	C	3	SIA	C3-C4	-2.12	1.48	1.52
2	C	1	GLC	C3-C2	-2.06	1.47	1.52

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	3	SIA	O6-C2-C3	3.13	114.77	110.56
2	D	3	SIA	O6-C2-C3	2.81	114.34	110.56
2	C	3	SIA	O1B-C1-C2	2.78	119.94	112.71
2	D	3	SIA	O1B-C1-C2	2.70	119.73	112.71
2	C	3	SIA	O6-C2-C1	2.51	112.46	107.72
2	D	3	SIA	O6-C2-C1	2.41	112.27	107.72
2	D	3	SIA	C11-C10-N5	2.23	119.82	116.12
2	C	3	SIA	C8-C7-C6	-2.20	108.92	113.05
2	C	3	SIA	C11-C10-N5	2.18	119.73	116.12
2	D	3	SIA	C8-C7-C6	-2.06	109.18	113.05

There are no chirality outliers.

All (4) torsion outliers are listed below:

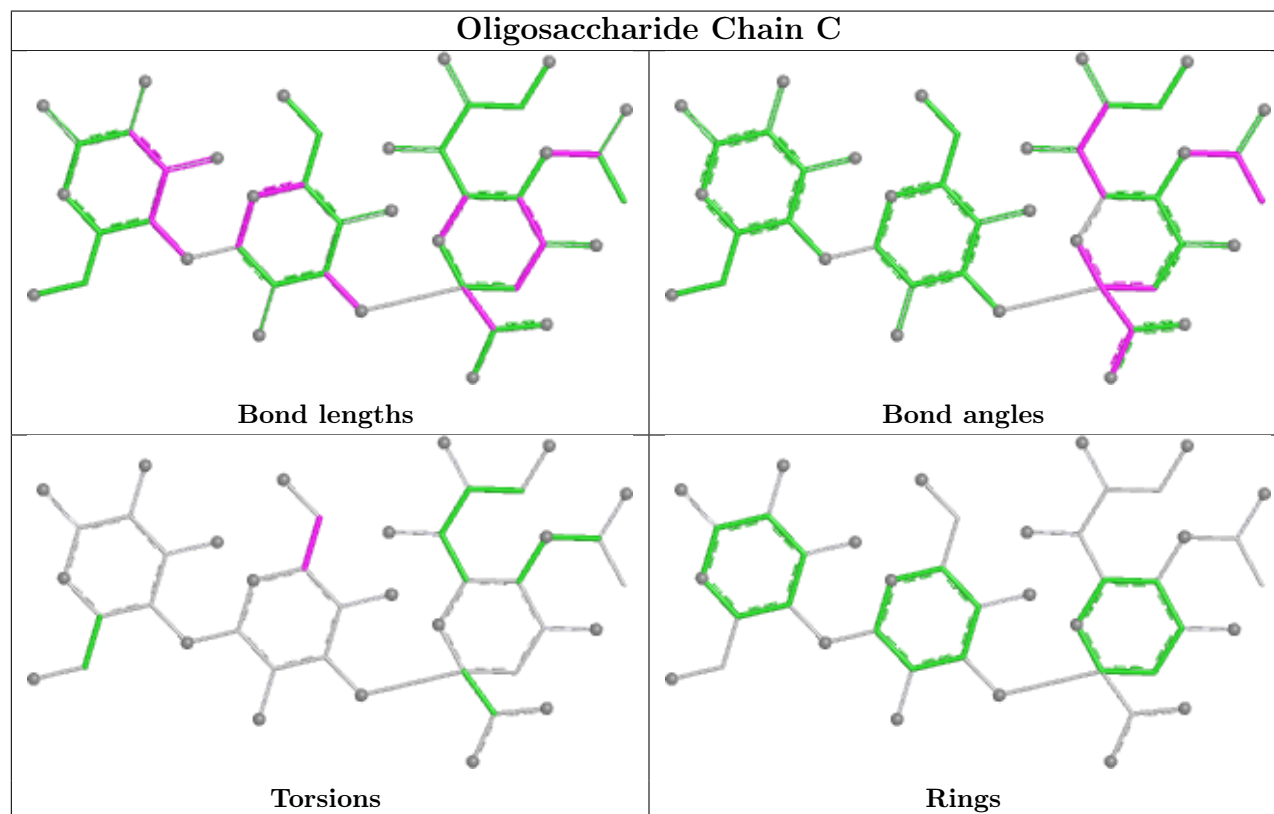
Mol	Chain	Res	Type	Atoms
2	D	2	GAL	C4-C5-C6-O6
2	C	2	GAL	C4-C5-C6-O6
2	D	2	GAL	O5-C5-C6-O6
2	C	2	GAL	O5-C5-C6-O6

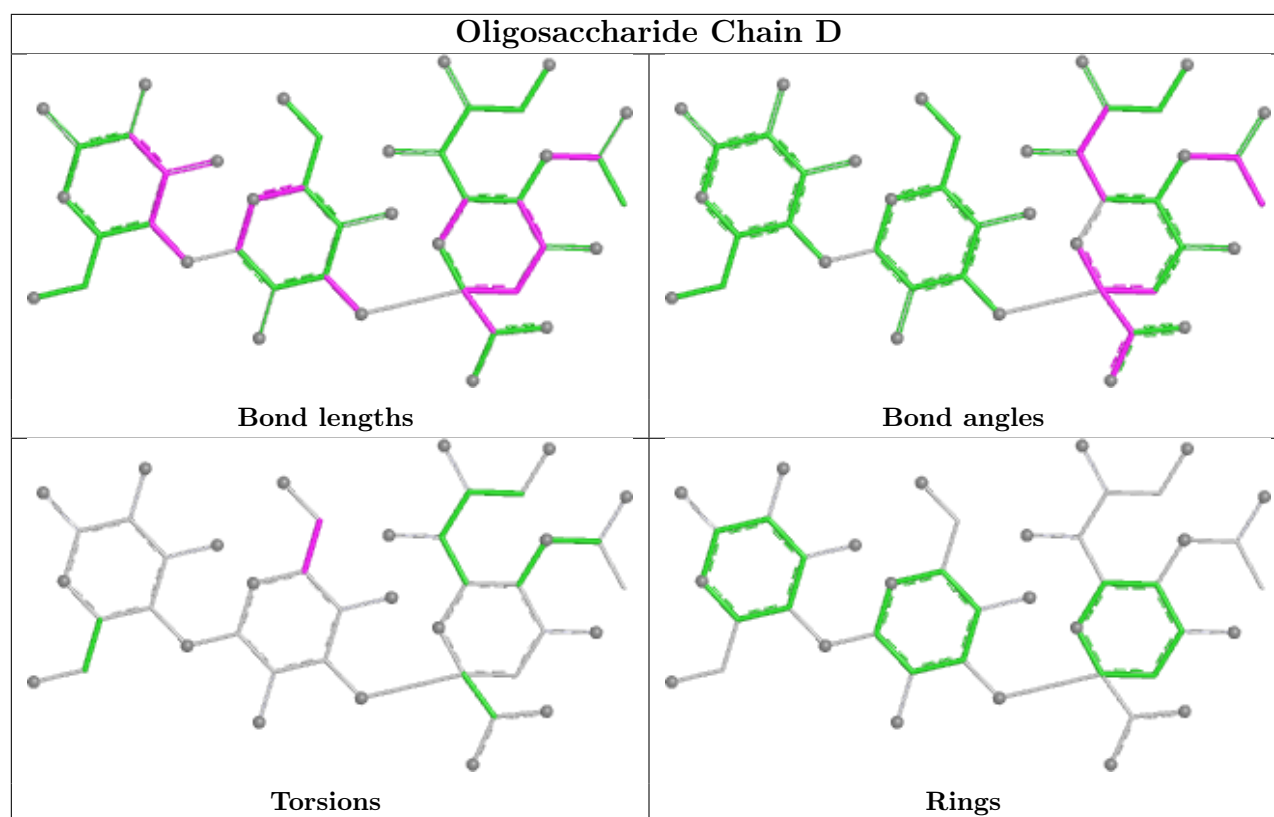
There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	3	SIA	1	0
2	D	3	SIA	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](#)

11 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	NAG	A	603	1	14,14,15	1.16	1 (7%)	17,19,21	1.15	2 (11%)
3	NAG	B	604	1	14,14,15	1.13	2 (14%)	17,19,21	1.47	2 (11%)
3	NAG	A	604	1	14,14,15	1.07	2 (14%)	17,19,21	1.08	1 (5%)
3	NAG	B	601	1	14,14,15	1.06	2 (14%)	17,19,21	1.44	4 (23%)
4	SO4	B	607	-	4,4,4	0.25	0	6,6,6	0.26	0
3	NAG	A	601	1	14,14,15	1.14	2 (14%)	17,19,21	1.52	3 (17%)
3	NAG	B	605	1	14,14,15	1.04	1 (7%)	17,19,21	1.53	3 (17%)
3	NAG	A	605	1	14,14,15	1.08	2 (14%)	17,19,21	1.30	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	NAG	B	603	1	14,14,15	1.15	2 (14%)	17,19,21	1.08	1 (5%)
3	NAG	B	602	1	14,14,15	1.12	2 (14%)	17,19,21	1.19	1 (5%)
3	NAG	A	602	1	14,14,15	1.02	2 (14%)	17,19,21	1.43	4 (23%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	A	603	1	-	0/6/23/26	0/1/1/1
3	NAG	B	604	1	-	0/6/23/26	0/1/1/1
3	NAG	A	604	1	-	0/6/23/26	0/1/1/1
3	NAG	B	601	1	-	2/6/23/26	0/1/1/1
3	NAG	A	601	1	-	1/6/23/26	0/1/1/1
3	NAG	B	605	1	-	0/6/23/26	0/1/1/1
3	NAG	A	605	1	-	2/6/23/26	0/1/1/1
3	NAG	B	603	1	-	0/6/23/26	0/1/1/1
3	NAG	B	602	1	-	0/6/23/26	0/1/1/1
3	NAG	A	602	1	-	2/6/23/26	0/1/1/1

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	603	NAG	C7-N2	2.75	1.43	1.34
3	A	605	NAG	C7-N2	2.62	1.42	1.34
3	B	603	NAG	C7-N2	2.61	1.42	1.34
3	B	605	NAG	C7-N2	2.61	1.42	1.34
3	B	602	NAG	C7-N2	2.58	1.42	1.34
3	A	602	NAG	C7-N2	2.56	1.42	1.34
3	B	601	NAG	C7-N2	2.53	1.42	1.34
3	B	604	NAG	C7-N2	2.45	1.42	1.34
3	A	604	NAG	C7-N2	2.41	1.42	1.34
3	A	601	NAG	C7-N2	2.41	1.42	1.34
3	A	601	NAG	C2-N2	-2.32	1.42	1.46
3	A	602	NAG	C2-N2	-2.11	1.42	1.46
3	B	603	NAG	C2-N2	-2.11	1.42	1.46
3	A	604	NAG	C2-N2	-2.07	1.42	1.46
3	B	601	NAG	C2-N2	-2.07	1.42	1.46
3	A	605	NAG	C2-N2	-2.03	1.42	1.46
3	B	602	NAG	C2-N2	-2.01	1.42	1.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	604	NAG	O5-C1	-2.01	1.40	1.43

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	605	NAG	C1-O5-C5	4.66	118.43	112.19
3	A	601	NAG	C1-O5-C5	4.57	118.31	112.19
3	B	601	NAG	C1-O5-C5	3.88	117.38	112.19
3	A	605	NAG	C1-O5-C5	3.83	117.31	112.19
3	B	604	NAG	C4-C3-C2	3.69	116.43	111.02
3	A	602	NAG	C2-N2-C7	-2.87	119.05	122.90
3	B	605	NAG	C6-C5-C4	-2.55	106.77	113.02
3	A	603	NAG	C8-C7-N2	2.54	120.33	116.12
3	A	602	NAG	C8-C7-N2	2.52	120.30	116.12
3	B	603	NAG	C8-C7-N2	2.34	119.99	116.12
3	B	604	NAG	C1-C2-N2	-2.30	106.81	110.43
3	B	601	NAG	C8-C7-N2	2.27	119.88	116.12
3	A	601	NAG	C2-N2-C7	-2.26	119.88	122.90
3	A	601	NAG	C8-C7-N2	2.17	119.72	116.12
3	B	602	NAG	C8-C7-N2	2.16	119.69	116.12
3	A	602	NAG	C4-C3-C2	-2.12	107.91	111.02
3	B	605	NAG	C8-C7-N2	2.09	119.59	116.12
3	A	604	NAG	C8-C7-N2	2.07	119.56	116.12
3	B	601	NAG	C2-N2-C7	-2.07	120.12	122.90
3	A	603	NAG	C2-N2-C7	-2.05	120.16	122.90
3	B	601	NAG	C6-C5-C4	-2.05	108.00	113.02
3	A	602	NAG	O5-C1-C2	-2.01	108.19	111.29

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	601	NAG	O5-C5-C6-O6
3	B	601	NAG	C4-C5-C6-O6
3	A	602	NAG	C4-C5-C6-O6
3	A	602	NAG	O5-C5-C6-O6
3	A	601	NAG	O5-C5-C6-O6
3	A	605	NAG	O5-C5-C6-O6
3	A	605	NAG	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	602	NAG	1	0
3	A	602	NAG	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	450/489 (92%)	-1.16	0	100 100	17, 29, 50, 93	0
1	B	450/489 (92%)	-1.15	2 (0%)	88 88	17, 29, 50, 95	0
All	All	900/978 (92%)	-1.16	2 (0%)	91 90	17, 29, 51, 95	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	206	THR	2.2
1	B	440	THR	2.2

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

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

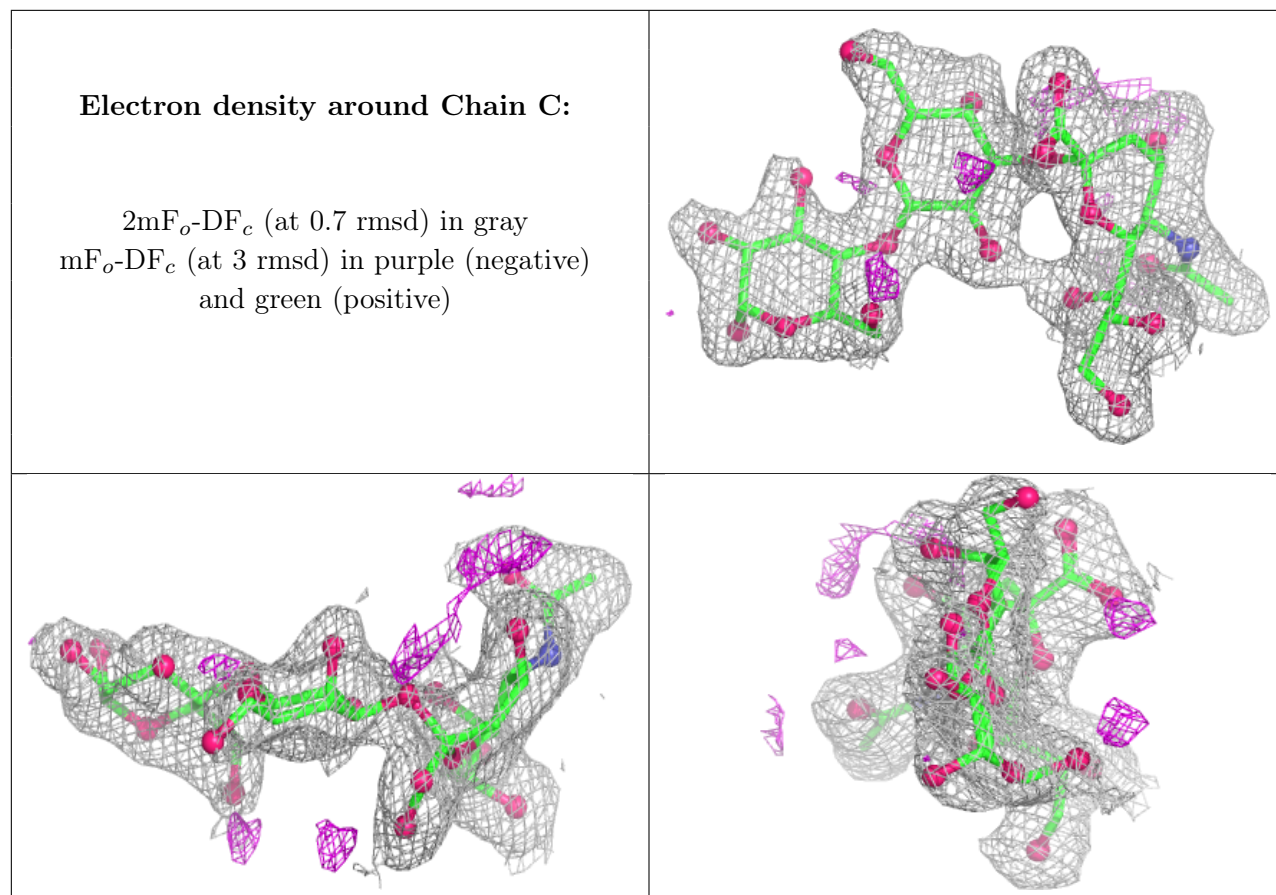
6.3 Carbohydrates [i](#)

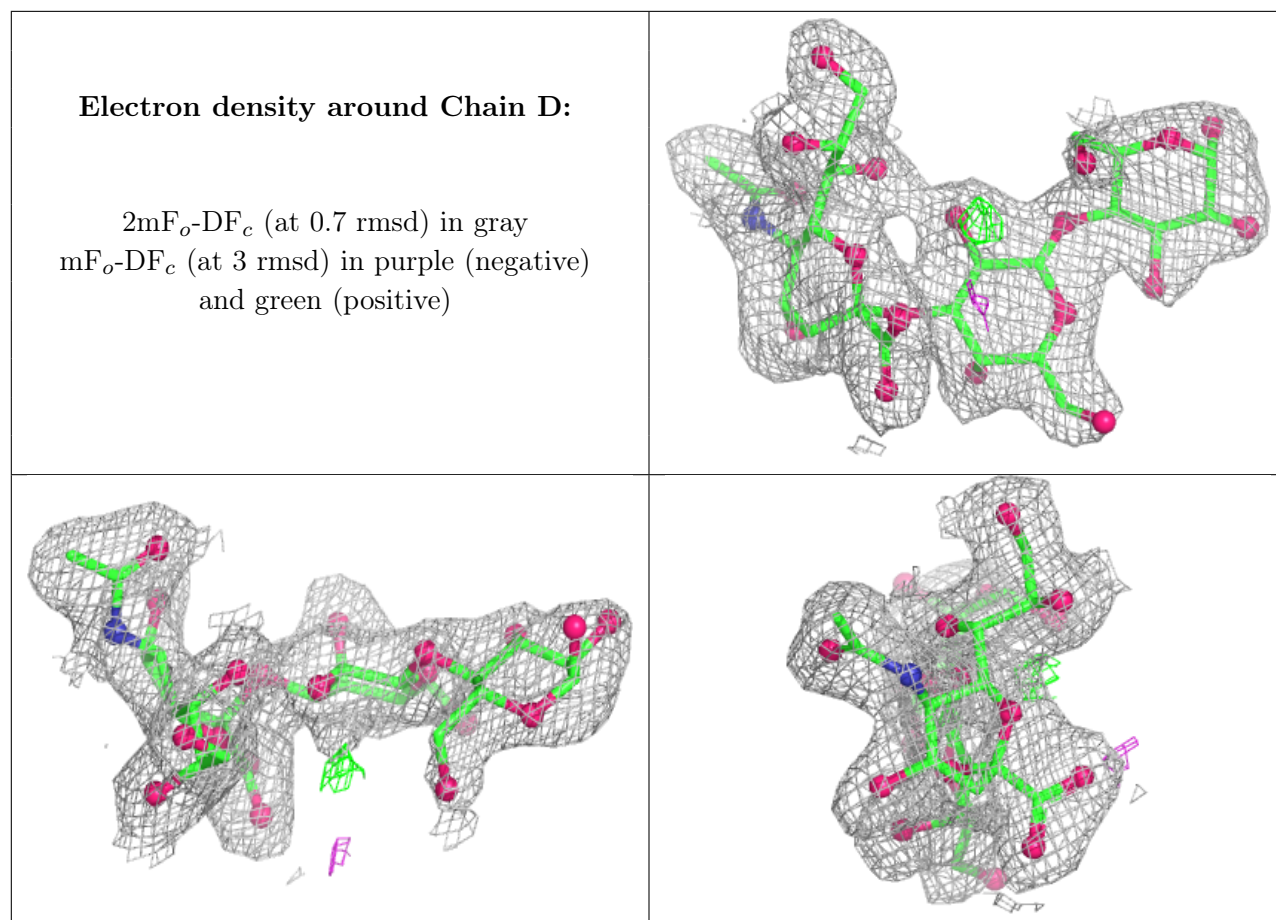
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q < 0.9’ lists 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	GLC	C	1	12/12	0.97	0.06	41,46,49,50	0
2	GAL	C	2	11/12	0.98	0.05	32,38,44,56	0
2	GLC	D	1	12/12	0.98	0.07	44,49,53,58	0
2	GAL	D	2	11/12	0.98	0.04	35,42,47,56	0
2	SIA	C	3	20/21	0.99	0.03	22,25,29,29	0
2	SIA	D	3	20/21	0.99	0.03	22,30,31,32	0

The following is a graphical depiction of the model fit to experimental electron density for oligosac-

charide. 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($\text{\AA}^2$)	Q<0.9
3	NAG	A	604	14/15	0.95	0.07	48,58,61,65	0
3	NAG	B	603	14/15	0.96	0.06	52,55,59,63	0
3	NAG	B	604	14/15	0.96	0.06	40,52,59,59	0
3	NAG	A	602	14/15	0.97	0.10	62,71,74,77	0
3	NAG	B	605	14/15	0.97	0.06	36,45,57,64	0
3	NAG	B	601	14/15	0.98	0.05	37,43,50,52	0
3	NAG	B	602	14/15	0.98	0.10	69,72,76,77	0
3	NAG	A	603	14/15	0.98	0.05	47,53,60,61	0
3	NAG	A	601	14/15	0.98	0.05	40,47,54,56	0
3	NAG	A	605	14/15	0.98	0.05	27,42,53,54	0
4	SO4	B	607	5/5	0.99	0.05	36,39,40,40	0

6.5 Other polymers [i](#)

There are no such residues in this entry.