



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 24, 2025 – 03:21 am BST

PDB ID : 5ANN / pdb\_00005ann  
Title : Structure of fructofuranosidase from Xanthophyllomyces dendrorhous  
Authors : Ramirez-Escudero, M.; Sanz-Aparicio, J.  
Deposited on : 2015-09-07  
Resolution : 2.14 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](mailto: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>.

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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 : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
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) : 2.46

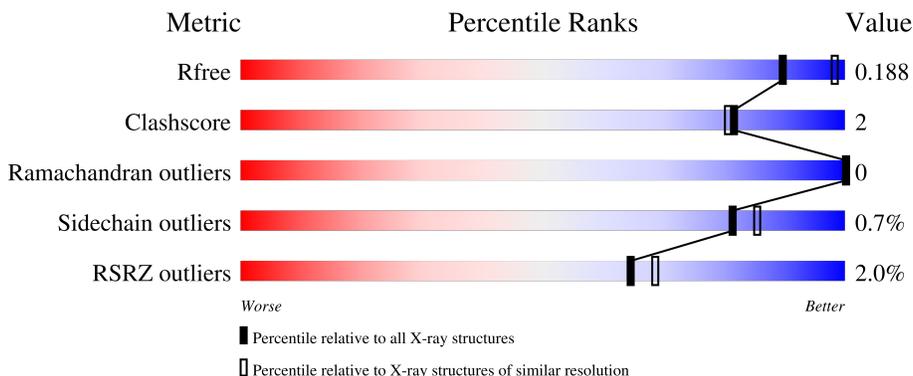
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

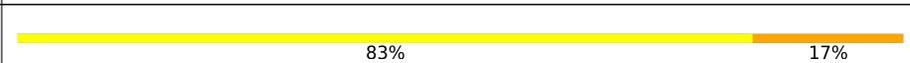
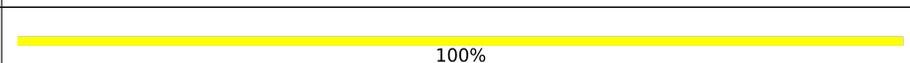
The reported resolution of this entry is 2.14 Å.

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.



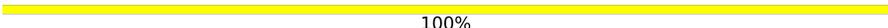
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	164625	3336 (2.16-2.12)
Clashscore	180529	3585 (2.16-2.12)
Ramachandran outliers	177936	3554 (2.16-2.12)
Sidechain outliers	177891	3553 (2.16-2.12)
RSRZ outliers	164620	3337 (2.16-2.12)

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  $\geq 3$ , 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	665	 2% 88% 6% 6%
1	B	665	 2% 87% 6% 6%
2	C	6	 83% 17%
2	F	6	 100%
3	D	10	 20% 80%

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Mol	Chain	Length	Quality of chain
3	G	10	 30% 70%
4	E	2	 50% 50%
4	H	2	 100%

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 11653 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.

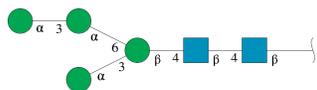
- Molecule 1 is a protein called BETA-FRUCTOFURANOSIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	624	4808	3064	784	953	7	0	1	0
1	B	624	4808	3064	784	953	7	0	1	0

There are 4 discrepancies between the modelled and reference sequences:

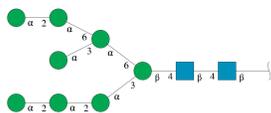
Chain	Residue	Modelled	Actual	Comment	Reference
A	663	ALA	SER	conflict	UNP J7HDY4
A	665	TYR	ARG	conflict	UNP J7HDY4
B	663	ALA	SER	conflict	UNP J7HDY4
B	665	TYR	ARG	conflict	UNP J7HDY4

- Molecule 2 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	C	6	72	40	2	30	0	0	0
2	F	6	72	40	2	30	0	0	0

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



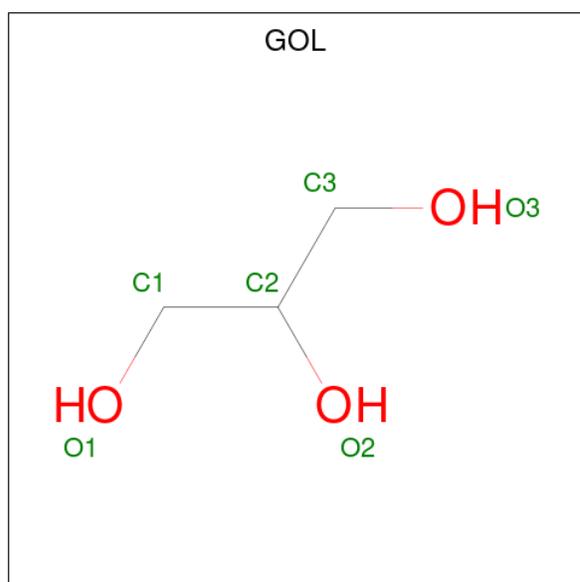
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	D	10	116	64	2	50	0	0	0
3	G	10	116	64	2	50	0	0	0

- Molecule 4 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



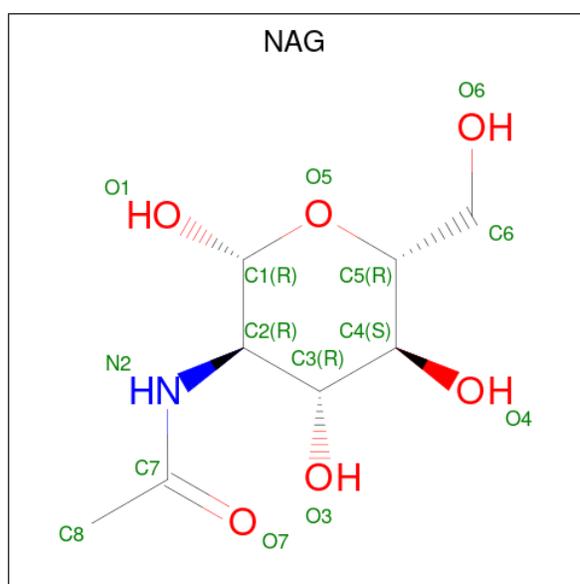
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	E	2	28	16	2	10	0	0	0
4	H	2	28	16	2	10	0	0	0

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



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

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula:  $C_8H_{15}NO_6$ ).



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

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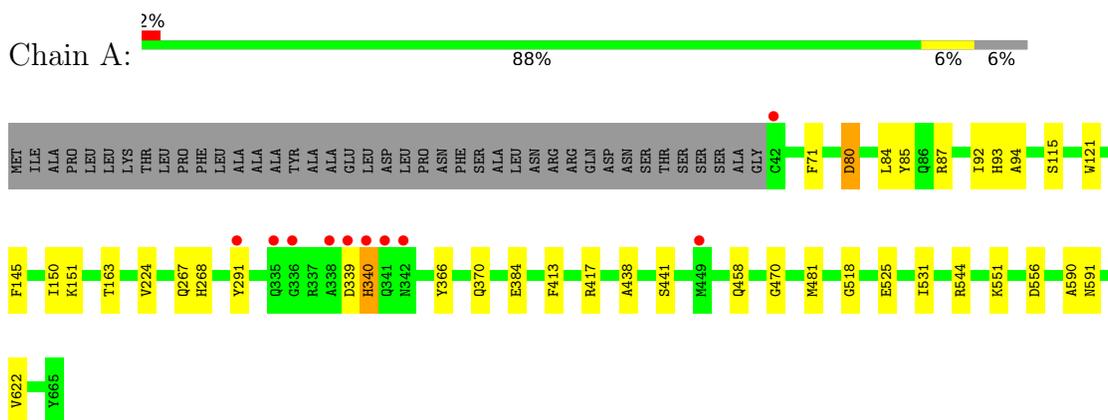


<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
7	A	648	Total 648	O 648	0	0
7	B	569	Total 569	O 569	0	0

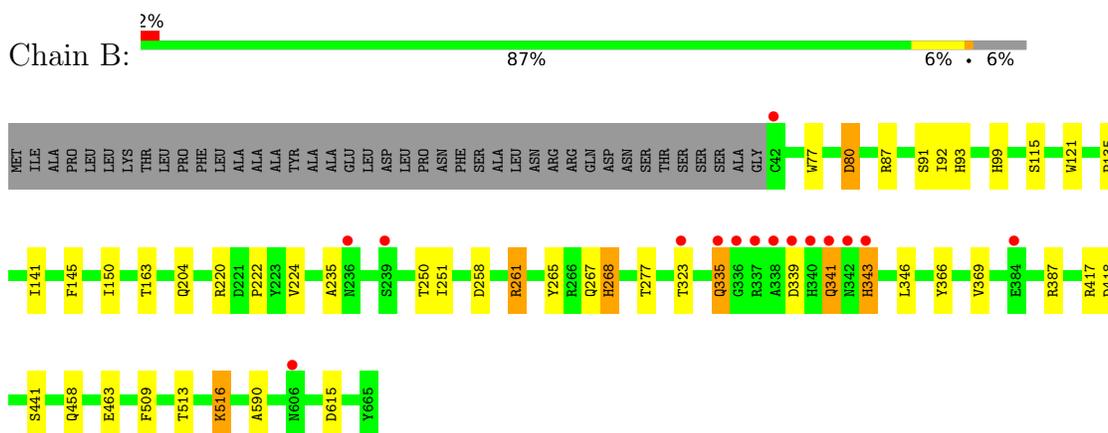
### 3 Residue-property plots [i](#)

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.

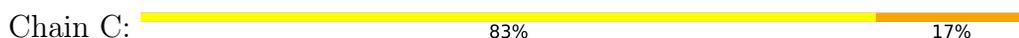
- Molecule 1: BETA-FRUCTOFURANOSIDASE



- Molecule 1: BETA-FRUCTOFURANOSIDASE



- Molecule 2: alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 2: alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyran

ose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain F:  100%

MAG1  
MAG2  
BMA3  
MAN4  
MAN5  
MAN6

- Molecule 3: alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D:  20% 80%

MAG1  
MAG2  
BMA3  
MAN4  
MAN5  
MAN6  
MAN7  
MAN8  
MAN9  
MAN10

- Molecule 3: alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-3)]alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain G:  30% 70%

MAG1  
MAG2  
BMA3  
MAN4  
MAN5  
MAN6  
MAN7  
MAN8  
MAN9  
MAN10

- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain E:  50% 50%

MAG1  
MAG2

- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain H:  100%

MAG1  
MAG2

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	74.62Å 205.18Å 145.77Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	145.77 – 2.14 145.77 – 2.14	Depositor EDS
% Data completeness (in resolution range)	99.9 (145.77-2.14) 99.9 (145.77-2.14)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.96 (at 2.14Å)	Xtrriage
Refinement program	REFMAC 5.8.0103	Depositor
R, $R_{free}$	0.169 , 0.188 0.170 , 0.188	Depositor DCC
$R_{free}$ test set	6195 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	19.1	Xtrriage
Anisotropy	0.019	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 38.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	11653	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	20.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.40% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: BMA, NAG, MAN, GOL

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	0.78	7/4943 (0.1%)	0.85	8/6758 (0.1%)
1	B	0.90	5/4943 (0.1%)	0.92	15/6758 (0.2%)
All	All	0.84	12/9886 (0.1%)	0.89	23/13516 (0.2%)

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	590	ALA	C-N	-27.68	0.95	1.33
1	A	590	ALA	C-N	-23.55	1.01	1.33
1	B	339	ASP	C-N	22.34	1.64	1.33
1	B	267	GLN	C-N	-18.29	1.07	1.33
1	A	267	GLN	C-N	-16.39	1.10	1.33
1	A	339	ASP	C-N	14.71	1.53	1.33
1	B	369	VAL	C-N	-14.05	1.13	1.33
1	A	340	HIS	C-N	8.49	1.45	1.33
1	A	591	ASN	C-N	-7.62	1.23	1.33
1	A	268	HIS	C-N	-5.41	1.26	1.33
1	A	370	GLN	C-N	-5.38	1.26	1.33
1	B	268	HIS	C-N	-5.16	1.26	1.33

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	92	ILE	CA-C-N	14.46	141.82	122.30
1	B	92	ILE	C-N-CA	14.46	141.82	122.30
1	B	93	HIS	O-C-N	12.48	137.48	123.13
1	A	93	HIS	O-C-N	11.99	136.92	123.13
1	A	92	ILE	CA-C-N	11.55	137.90	122.30
1	A	92	ILE	C-N-CA	11.55	137.90	122.30
1	B	343	HIS	N-CA-C	10.72	126.87	109.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	92	ILE	O-C-N	-10.29	112.38	123.18
1	B	590	ALA	CA-C-N	7.74	133.62	122.40
1	B	590	ALA	C-N-CA	7.74	133.62	122.40
1	B	93	HIS	CA-C-N	-7.25	112.78	123.00
1	B	93	HIS	C-N-CA	-7.25	112.78	123.00
1	A	93	HIS	CA-C-N	-6.87	113.31	123.00
1	A	93	HIS	C-N-CA	-6.87	113.31	123.00
1	A	92	ILE	O-C-N	-6.64	115.66	123.03
1	A	340	HIS	O-C-N	6.18	130.22	122.55
1	B	369	VAL	O-C-N	5.60	129.25	123.20
1	B	346	LEU	N-CA-C	5.57	118.33	110.14
1	B	80	ASP	N-CA-C	5.25	115.64	109.60
1	A	80	ASP	N-CA-C	5.21	115.59	109.60
1	B	235	ALA	CA-C-N	5.17	127.94	120.38
1	B	235	ALA	C-N-CA	5.17	127.94	120.38
1	B	220	ARG	N-CA-C	5.17	115.88	108.74

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	4808	0	4498	20	0
1	B	4808	0	4501	26	0
2	C	72	0	61	1	0
2	F	72	0	61	0	0
3	D	116	0	97	0	0
3	G	116	0	97	0	0
4	E	28	0	25	0	0
4	H	28	0	25	0	0
5	A	12	0	16	0	0
5	B	12	0	16	0	0
6	A	210	0	195	4	0
6	B	154	0	143	0	0
7	A	648	0	0	4	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	B	569	0	0	1	0
All	All	11653	0	9735	48	1

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 2.

All (48) 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:341:GLN:CG	1:B:343:HIS:CD2	2.51	0.94
1:A:525:GLU:H	6:A:715:NAG:H81	1.33	0.93
1:B:341:GLN:CG	1:B:343:HIS:HD2	1.89	0.83
1:B:341:GLN:HG3	1:B:343:HIS:CD2	2.16	0.78
1:B:341:GLN:HG2	1:B:343:HIS:CD2	2.18	0.77
1:B:204:GLN:HG3	7:B:1313:HOH:O	1.88	0.72
1:B:387:ARG:HD2	1:B:418:ASP:OD1	2.03	0.58
1:B:516:LYS:HG3	1:B:615:ASP:HB3	1.86	0.58
1:B:268:HIS:HD2	1:B:277:THR:OG1	1.87	0.58
1:B:341:GLN:HG2	1:B:343:HIS:HD2	1.57	0.57
1:B:417:ARG:HH11	1:B:458:GLN:HE22	1.52	0.57
1:A:481:MET:HE3	1:A:622:VAL:CG1	2.36	0.56
1:A:151:LYS:HE2	7:A:846:HOH:O	2.07	0.55
1:B:341:GLN:HG3	1:B:341:GLN:O	2.06	0.55
6:A:715:NAG:H83	6:A:715:NAG:H3	1.88	0.55
1:A:291:TYR:HE2	1:A:438:ALA:O	1.92	0.53
1:A:481:MET:HE3	1:A:622:VAL:HG11	1.91	0.52
1:B:341:GLN:CD	1:B:343:HIS:HD2	2.18	0.52
1:A:470:GLY:HA3	6:A:710:NAG:C8	2.40	0.52
1:B:251:ILE:HD12	1:B:265:TYR:CE1	2.45	0.52
1:B:150:ILE:HG12	1:B:224:VAL:HG11	1.94	0.49
1:B:87:ARG:HD3	1:B:91:SER:OG	2.13	0.48
1:A:417:ARG:HH11	1:A:458:GLN:HE22	1.61	0.47
1:A:384:GLU:HG2	7:A:1397:HOH:O	2.15	0.47
1:A:145:PHE:HB2	1:A:163:THR:HB	1.97	0.46
1:B:145:PHE:HB2	1:B:163:THR:HB	1.98	0.45
7:A:1086:HOH:O	2:C:2:NAG:H83	2.18	0.44
1:A:340:HIS:HE1	7:A:1218:HOH:O	1.99	0.44
1:B:335:GLN:HE21	1:B:335:GLN:HA	1.82	0.44
1:B:115:SER:HB2	1:B:121:TRP:CD2	2.53	0.44
1:A:84:LEU:HD23	1:A:94:ALA:HA	1.98	0.44
1:B:387:ARG:NH2	1:B:463:GLU:OE2	2.45	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:544:ARG:HD3	1:A:556:ASP:O	2.17	0.43
1:A:85:TYR:CE2	1:A:87:ARG:HG2	2.54	0.43
1:B:258:ASP:O	1:B:261:ARG:NH2	2.51	0.43
1:B:341:GLN:NE2	1:B:343:HIS:HD2	2.17	0.43
1:A:551:LYS:HA	1:A:551:LYS:HD3	1.71	0.43
1:A:71:PHE:HB3	1:A:413:PHE:HB2	2.01	0.42
1:B:366:TYR:CE1	1:B:441:SER:HB2	2.55	0.42
1:A:115:SER:HB2	1:A:121:TRP:CD2	2.55	0.42
1:B:509:PHE:HB3	1:B:513:THR:HG21	2.02	0.41
1:A:518:GLY:HA3	1:A:531:ILE:O	2.20	0.41
1:B:135:PRO:HB3	1:B:141:ILE:HA	2.02	0.41
1:B:77:TRP:HB3	1:B:99:HIS:HB3	2.03	0.40
1:B:222:PRO:HA	1:B:250:THR:O	2.21	0.40
1:A:366:TYR:CE1	1:A:441:SER:HB2	2.57	0.40
1:A:150:ILE:HG12	1:A:224:VAL:HG11	2.02	0.40
1:A:470:GLY:HA3	6:A:710:NAG:H81	2.04	0.40

All (1) 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)
7:A:1443:HOH:O	7:A:1443:HOH:O[2_655]	0.92	1.28

## 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	623/665 (94%)	596 (96%)	27 (4%)	0	100	100
1	B	623/665 (94%)	593 (95%)	30 (5%)	0	100	100
All	All	1246/1330 (94%)	1189 (95%)	57 (5%)	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	499/530 (94%)	498 (100%)	1 (0%)	92	95
1	B	499/530 (94%)	493 (99%)	6 (1%)	67	72
All	All	998/1060 (94%)	991 (99%)	7 (1%)	81	85

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	80	ASP
1	B	80	ASP
1	B	261	ARG
1	B	323	THR
1	B	335	GLN
1	B	341	GLN
1	B	516	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	46	GLN
1	A	268	HIS
1	A	341	GLN
1	A	342	ASN
1	A	343	HIS
1	A	458	GLN
1	B	46	GLN
1	B	204	GLN
1	B	268	HIS
1	B	335	GLN
1	B	343	HIS
1	B	458	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](#)

36 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	NAG	C	1	2,1	14,14,15	0.57	0	17,19,21	1.07	1 (5%)
2	NAG	C	2	2	14,14,15	0.55	0	17,19,21	1.00	1 (5%)
2	BMA	C	3	2	11,11,12	0.53	0	15,15,17	1.46	1 (6%)
2	MAN	C	4	2	11,11,12	0.88	0	15,15,17	1.16	3 (20%)
2	MAN	C	5	2	11,11,12	0.57	0	15,15,17	1.04	1 (6%)
2	MAN	C	6	2	11,11,12	0.71	0	15,15,17	2.54	6 (40%)
3	NAG	D	1	3,1	14,14,15	0.83	1 (7%)	17,19,21	0.74	0
3	MAN	D	10	3	11,11,12	0.66	0	15,15,17	1.00	1 (6%)
3	NAG	D	2	3	14,14,15	0.52	0	17,19,21	1.00	0
3	BMA	D	3	3	11,11,12	0.55	0	15,15,17	0.90	0
3	MAN	D	4	3	11,11,12	0.57	0	15,15,17	1.32	1 (6%)
3	MAN	D	5	3	11,11,12	0.61	0	15,15,17	1.14	1 (6%)
3	MAN	D	6	3	11,11,12	0.73	0	15,15,17	1.08	1 (6%)
3	MAN	D	7	3	11,11,12	0.62	0	15,15,17	1.10	1 (6%)
3	MAN	D	8	3	11,11,12	0.66	0	15,15,17	0.94	1 (6%)
3	MAN	D	9	3	11,11,12	0.77	0	15,15,17	1.35	2 (13%)
4	NAG	E	1	4,1	14,14,15	0.43	0	17,19,21	0.80	0
4	NAG	E	2	4	14,14,15	0.52	0	17,19,21	1.32	3 (17%)
2	NAG	F	1	2,1	14,14,15	0.55	0	17,19,21	1.24	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	NAG	F	2	2	14,14,15	0.48	0	17,19,21	0.84	1 (5%)
2	BMA	F	3	2	11,11,12	0.60	0	15,15,17	1.52	1 (6%)
2	MAN	F	4	2	11,11,12	0.85	0	15,15,17	1.26	2 (13%)
2	MAN	F	5	2	11,11,12	0.68	0	15,15,17	1.09	1 (6%)
2	MAN	F	6	2	11,11,12	0.68	0	15,15,17	1.05	1 (6%)
3	NAG	G	1	3,1	14,14,15	0.85	1 (7%)	17,19,21	0.73	0
3	MAN	G	10	3	11,11,12	0.54	0	15,15,17	0.79	1 (6%)
3	NAG	G	2	3	14,14,15	0.55	0	17,19,21	0.87	0
3	BMA	G	3	3	11,11,12	0.47	0	15,15,17	0.94	0
3	MAN	G	4	3	11,11,12	0.56	0	15,15,17	1.18	2 (13%)
3	MAN	G	5	3	11,11,12	0.60	0	15,15,17	1.01	1 (6%)
3	MAN	G	6	3	11,11,12	0.75	0	15,15,17	1.62	3 (20%)
3	MAN	G	7	3	11,11,12	0.57	0	15,15,17	1.10	1 (6%)
3	MAN	G	8	3	11,11,12	0.68	0	15,15,17	0.94	0
3	MAN	G	9	3	11,11,12	0.78	0	15,15,17	1.13	1 (6%)
4	NAG	H	1	4,1	14,14,15	0.51	0	17,19,21	1.35	1 (5%)
4	NAG	H	2	4	14,14,15	0.50	0	17,19,21	1.09	1 (5%)

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	NAG	C	1	2,1	-	1/6/23/26	0/1/1/1
2	NAG	C	2	2	-	2/6/23/26	0/1/1/1
2	BMA	C	3	2	-	0/2/19/22	0/1/1/1
2	MAN	C	4	2	-	1/2/19/22	0/1/1/1
2	MAN	C	5	2	-	0/2/19/22	0/1/1/1
2	MAN	C	6	2	-	0/2/19/22	0/1/1/1
3	NAG	D	1	3,1	-	0/6/23/26	0/1/1/1
3	MAN	D	10	3	-	0/2/19/22	0/1/1/1
3	NAG	D	2	3	-	0/6/23/26	0/1/1/1
3	BMA	D	3	3	-	0/2/19/22	0/1/1/1
3	MAN	D	4	3	-	0/2/19/22	0/1/1/1
3	MAN	D	5	3	-	2/2/19/22	0/1/1/1
3	MAN	D	6	3	-	0/2/19/22	0/1/1/1
3	MAN	D	7	3	-	0/2/19/22	0/1/1/1
3	MAN	D	8	3	-	0/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	MAN	D	9	3	-	0/2/19/22	0/1/1/1
4	NAG	E	1	4,1	-	0/6/23/26	0/1/1/1
4	NAG	E	2	4	-	3/6/23/26	0/1/1/1
2	NAG	F	1	2,1	-	2/6/23/26	0/1/1/1
2	NAG	F	2	2	-	0/6/23/26	0/1/1/1
2	BMA	F	3	2	-	0/2/19/22	0/1/1/1
2	MAN	F	4	2	-	0/2/19/22	0/1/1/1
2	MAN	F	5	2	-	1/2/19/22	0/1/1/1
2	MAN	F	6	2	-	1/2/19/22	0/1/1/1
3	NAG	G	1	3,1	-	0/6/23/26	0/1/1/1
3	MAN	G	10	3	-	0/2/19/22	0/1/1/1
3	NAG	G	2	3	-	0/6/23/26	0/1/1/1
3	BMA	G	3	3	-	0/2/19/22	0/1/1/1
3	MAN	G	4	3	-	1/2/19/22	0/1/1/1
3	MAN	G	5	3	-	2/2/19/22	0/1/1/1
3	MAN	G	6	3	-	2/2/19/22	0/1/1/1
3	MAN	G	7	3	-	0/2/19/22	0/1/1/1
3	MAN	G	8	3	-	0/2/19/22	0/1/1/1
3	MAN	G	9	3	-	0/2/19/22	0/1/1/1
4	NAG	H	1	4,1	-	0/6/23/26	0/1/1/1
4	NAG	H	2	4	-	2/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	G	1	NAG	C1-C2	2.61	1.56	1.52
3	D	1	NAG	C1-C2	2.50	1.56	1.52

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	6	MAN	C1-O5-C5	7.02	121.70	112.19
2	F	3	BMA	C1-O5-C5	4.68	118.53	112.19
3	G	6	MAN	C1-O5-C5	4.50	118.29	112.19
3	D	4	MAN	C1-O5-C5	4.42	118.17	112.19
2	C	3	BMA	C1-O5-C5	3.79	117.33	112.19
2	C	6	MAN	C3-C4-C5	3.77	116.96	110.24
2	F	1	NAG	C1-O5-C5	3.65	117.13	112.19
3	G	4	MAN	C1-O5-C5	3.63	117.11	112.19
3	D	5	MAN	C1-O5-C5	3.53	116.98	112.19
2	F	4	MAN	C1-O5-C5	3.47	116.90	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	H	1	NAG	C1-O5-C5	3.27	116.62	112.19
2	C	6	MAN	O5-C5-C4	3.19	118.59	110.83
2	C	1	NAG	C1-O5-C5	3.17	116.49	112.19
4	H	2	NAG	C1-O5-C5	3.14	116.45	112.19
2	F	5	MAN	C1-O5-C5	3.13	116.44	112.19
3	D	9	MAN	C1-O5-C5	3.10	116.39	112.19
3	G	5	MAN	C1-O5-C5	3.08	116.36	112.19
3	D	10	MAN	C1-O5-C5	2.95	116.19	112.19
3	G	9	MAN	C1-O5-C5	2.92	116.15	112.19
3	G	6	MAN	C3-C4-C5	2.84	115.31	110.24
4	E	2	NAG	C2-N2-C7	2.79	126.88	122.90
2	F	6	MAN	O5-C5-C6	2.73	111.48	107.20
2	C	5	MAN	C1-O5-C5	2.70	115.85	112.19
3	D	9	MAN	C2-C3-C4	2.61	115.42	110.89
2	F	2	NAG	C1-O5-C5	2.61	115.72	112.19
2	C	6	MAN	C6-C5-C4	-2.60	106.91	113.00
3	D	6	MAN	O5-C5-C6	2.59	111.27	107.20
4	E	2	NAG	C8-C7-N2	2.59	120.49	116.10
3	D	8	MAN	C1-O5-C5	2.55	115.65	112.19
2	C	2	NAG	C1-O5-C5	2.55	115.64	112.19
3	D	7	MAN	C1-O5-C5	2.51	115.60	112.19
3	G	7	MAN	C1-O5-C5	2.39	115.43	112.19
4	E	2	NAG	C1-O5-C5	2.35	115.38	112.19
2	C	4	MAN	C1-C2-C3	2.24	112.42	109.67
3	G	10	MAN	C1-O5-C5	2.24	115.22	112.19
2	C	4	MAN	C1-O5-C5	2.24	115.22	112.19
2	C	4	MAN	O5-C5-C6	2.24	110.71	107.20
2	C	6	MAN	C2-C3-C4	2.24	114.76	110.89
2	C	6	MAN	O5-C1-C2	2.15	114.09	110.77
3	G	6	MAN	C2-C3-C4	2.11	114.55	110.89
3	G	4	MAN	O5-C5-C6	2.11	110.51	107.20
2	F	4	MAN	O5-C5-C6	2.02	110.38	107.20

There are no chirality outliers.

All (20) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	H	2	NAG	O5-C5-C6-O6
3	G	6	MAN	O5-C5-C6-O6
4	H	2	NAG	C4-C5-C6-O6
3	D	5	MAN	O5-C5-C6-O6
3	D	5	MAN	C4-C5-C6-O6

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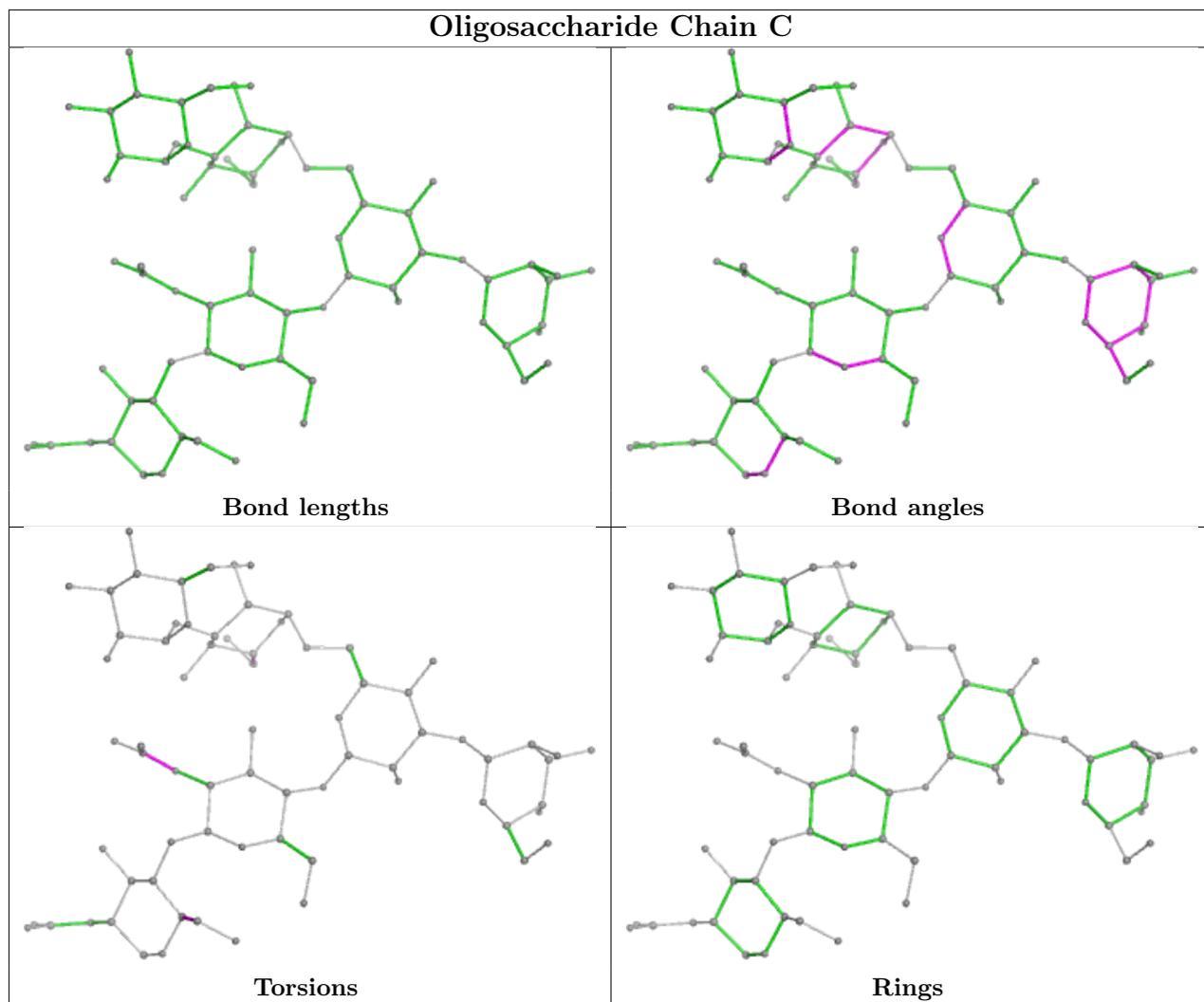
Mol	Chain	Res	Type	Atoms
2	C	2	NAG	C8-C7-N2-C2
2	C	2	NAG	O7-C7-N2-C2
4	E	2	NAG	C8-C7-N2-C2
4	E	2	NAG	O7-C7-N2-C2
3	G	6	MAN	C4-C5-C6-O6
3	G	5	MAN	C4-C5-C6-O6
3	G	5	MAN	O5-C5-C6-O6
2	F	1	NAG	C4-C5-C6-O6
4	E	2	NAG	C4-C5-C6-O6
3	G	4	MAN	O5-C5-C6-O6
2	F	5	MAN	C4-C5-C6-O6
2	F	6	MAN	C4-C5-C6-O6
2	C	1	NAG	C4-C5-C6-O6
2	F	1	NAG	O5-C5-C6-O6
2	C	4	MAN	O5-C5-C6-O6

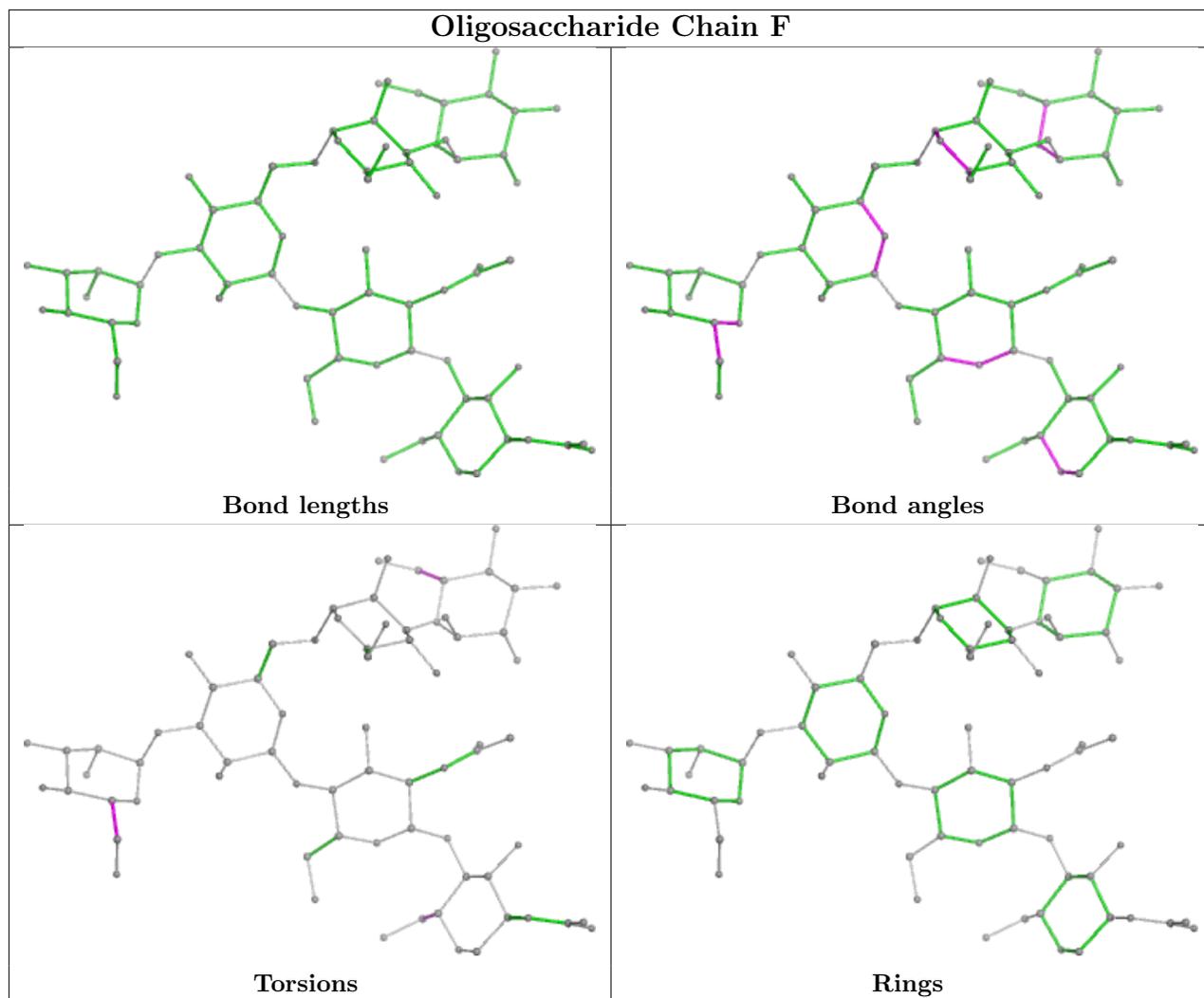
There are no ring outliers.

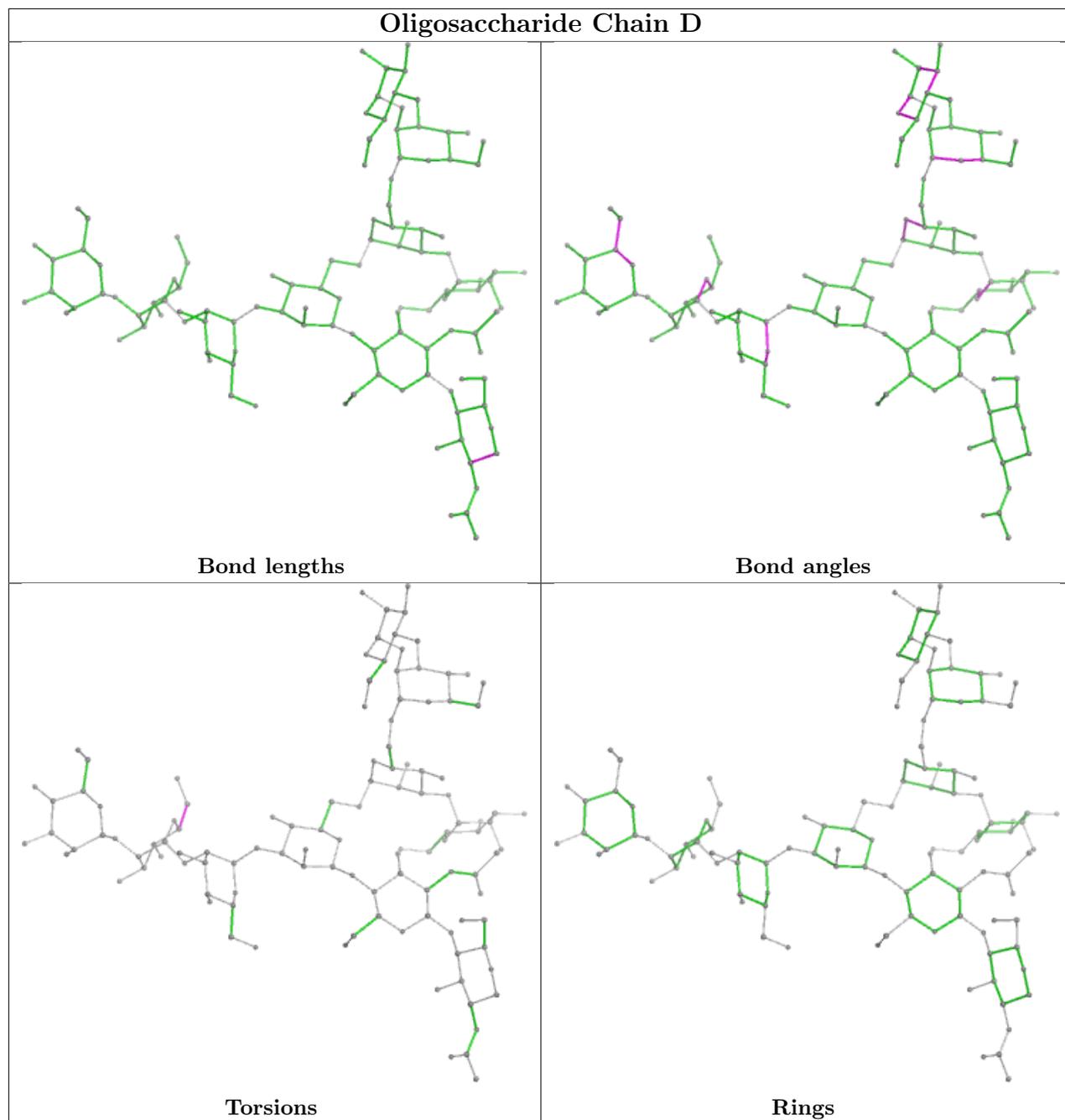
1 monomer is involved in 1 short contact:

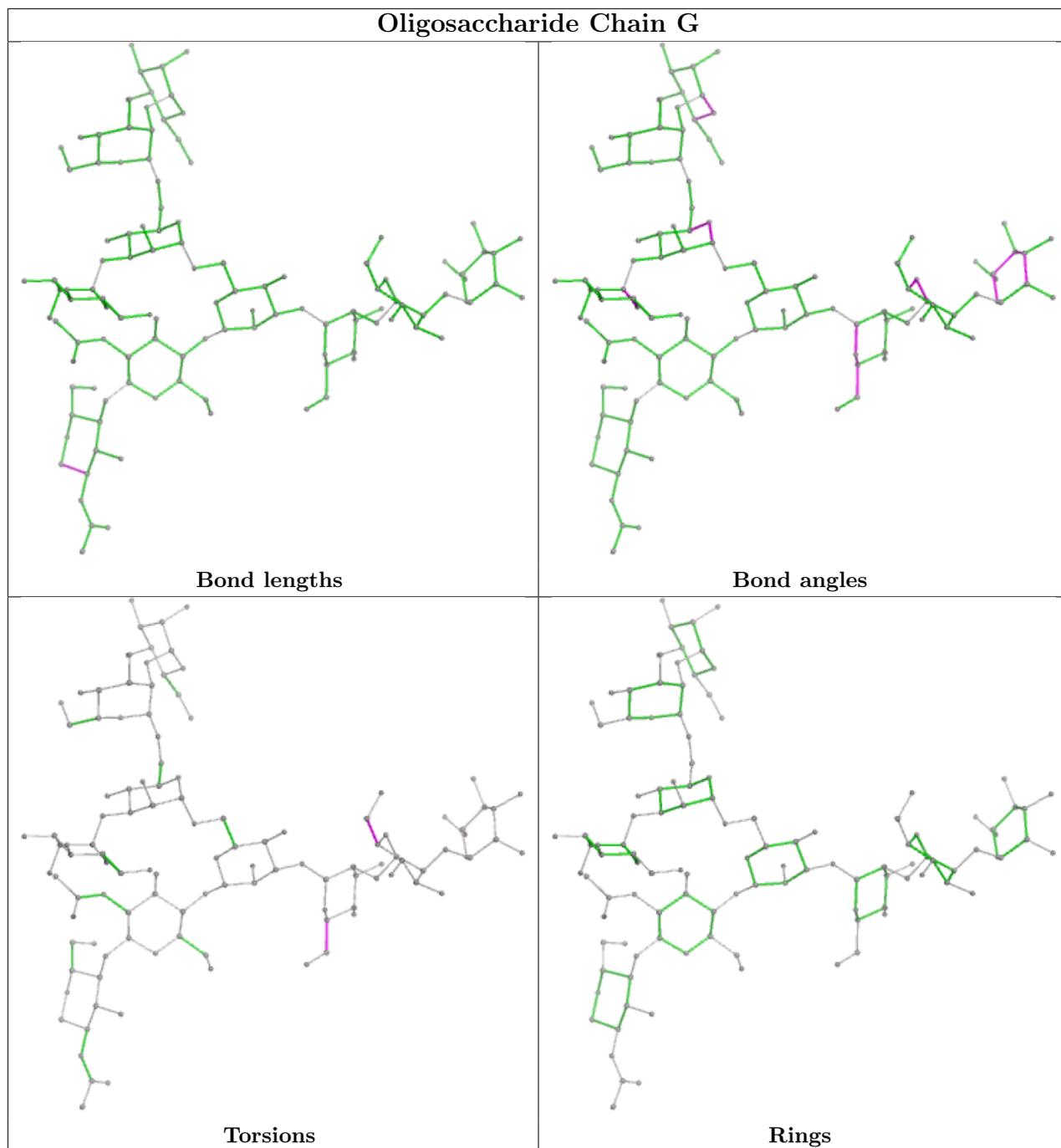
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	2	NAG	1	0

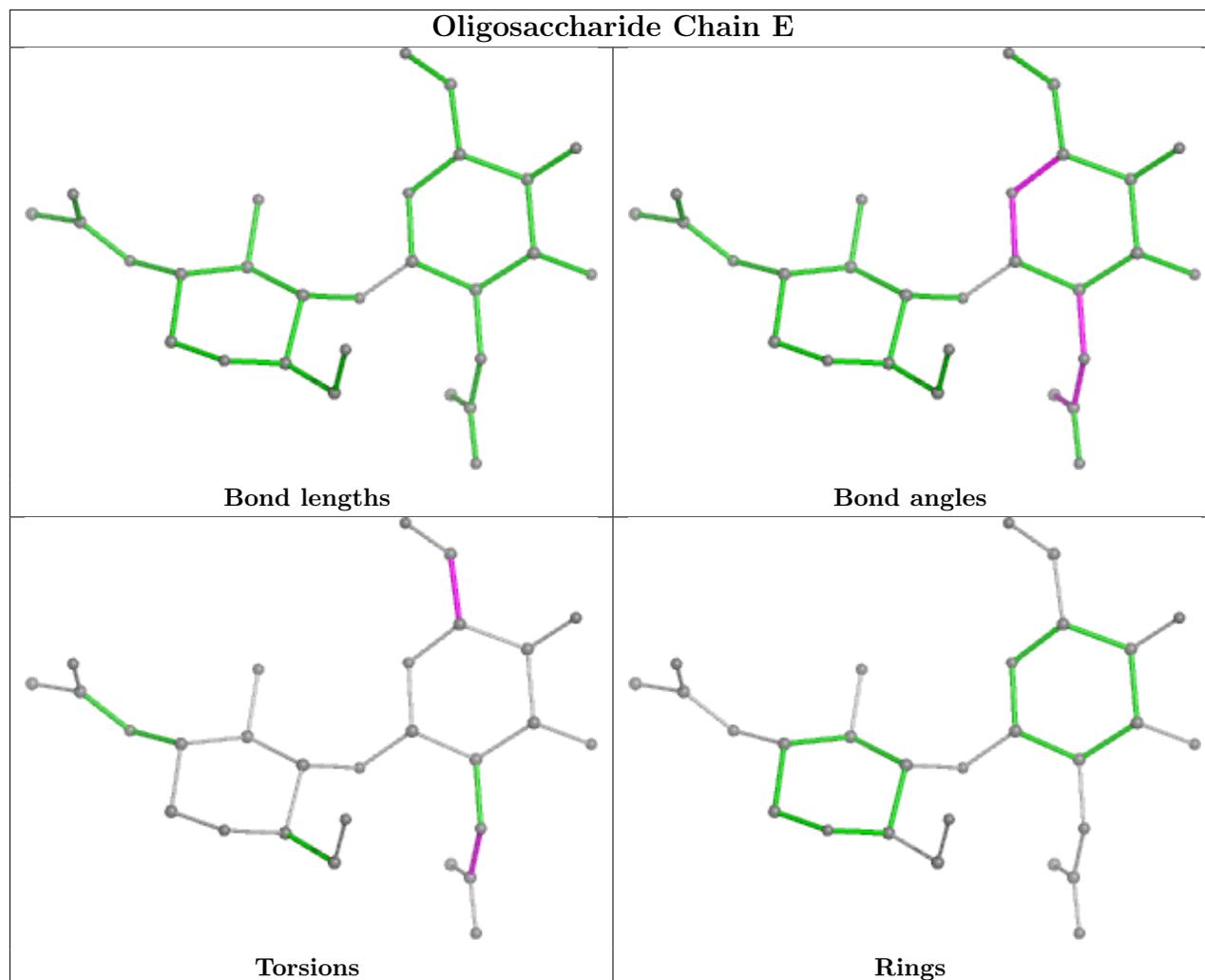
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

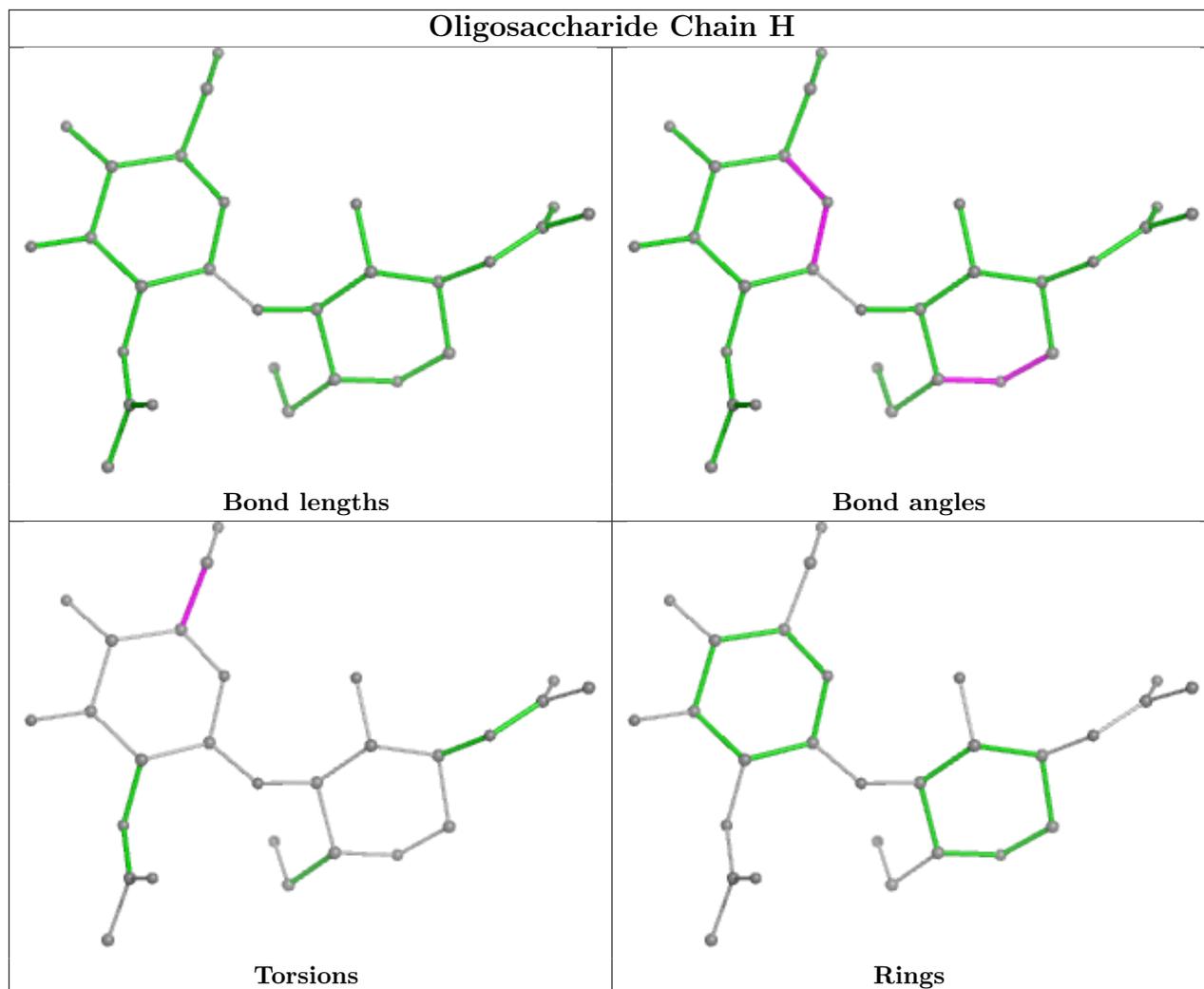












## 5.6 Ligand geometry [i](#)

30 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$
6	NAG	A	703	1	14,14,15	0.61	0	17,19,21	1.89	3 (17%)
6	NAG	B	712	1	14,14,15	0.52	0	17,19,21	0.76	0
6	NAG	B	704	1	14,14,15	0.57	0	17,19,21	1.54	3 (17%)
6	NAG	A	709	1	14,14,15	0.52	0	17,19,21	0.98	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
5	GOL	B	701	-	5,5,5	0.34	0	5,5,5	0.46	0
6	NAG	A	707	1	14,14,15	0.55	0	17,19,21	1.34	2 (11%)
6	NAG	B	710	1	14,14,15	0.59	0	17,19,21	0.94	1 (5%)
6	NAG	A	702	1	14,14,15	0.41	0	17,19,21	1.03	2 (11%)
6	NAG	A	705	1	14,14,15	0.58	0	17,19,21	0.79	0
6	NAG	B	706	1	14,14,15	0.52	0	17,19,21	1.05	1 (5%)
6	NAG	A	713	1	14,14,15	0.53	0	17,19,21	1.15	2 (11%)
6	NAG	B	707	1	14,14,15	0.47	0	17,19,21	1.08	1 (5%)
6	NAG	B	711	1	14,14,15	0.60	0	17,19,21	1.20	1 (5%)
5	GOL	A	701	-	5,5,5	0.37	0	5,5,5	0.34	0
6	NAG	A	716	1	14,14,15	0.58	0	17,19,21	0.86	1 (5%)
6	NAG	A	711	1	14,14,15	0.51	0	17,19,21	1.34	1 (5%)
6	NAG	B	705	1	14,14,15	0.85	0	17,19,21	2.07	4 (23%)
6	NAG	B	702	1	14,14,15	0.53	0	17,19,21	0.92	1 (5%)
6	NAG	A	704	-	14,14,15	0.62	0	17,19,21	1.51	2 (11%)
5	GOL	A	717	-	5,5,5	0.22	0	5,5,5	0.76	0
5	GOL	B	713	-	5,5,5	0.31	0	5,5,5	0.38	0
6	NAG	A	712	1	14,14,15	0.46	0	17,19,21	1.34	3 (17%)
6	NAG	B	709	1	14,14,15	0.53	0	17,19,21	1.21	2 (11%)
6	NAG	A	715	1	14,14,15	0.75	0	17,19,21	1.84	5 (29%)
6	NAG	B	703	1	14,14,15	0.66	0	17,19,21	1.45	2 (11%)
6	NAG	A	714	1	14,14,15	0.47	0	17,19,21	1.31	2 (11%)
6	NAG	A	708	1	14,14,15	0.47	0	17,19,21	1.61	3 (17%)
6	NAG	A	706	1	14,14,15	0.47	0	17,19,21	1.24	1 (5%)
6	NAG	A	710	1	14,14,15	0.44	0	17,19,21	1.15	1 (5%)
6	NAG	B	708	1	14,14,15	0.56	0	17,19,21	0.97	1 (5%)

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	NAG	A	703	1	-	2/6/23/26	0/1/1/1
6	NAG	B	712	1	-	0/6/23/26	0/1/1/1
6	NAG	B	704	1	-	2/6/23/26	0/1/1/1
6	NAG	A	709	1	-	1/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	GOL	B	701	-	-	2/4/4/4	-
6	NAG	A	707	1	-	2/6/23/26	0/1/1/1
6	NAG	B	710	1	-	0/6/23/26	0/1/1/1
6	NAG	A	702	1	-	3/6/23/26	0/1/1/1
6	NAG	A	705	1	-	0/6/23/26	0/1/1/1
6	NAG	B	706	1	-	0/6/23/26	0/1/1/1
6	NAG	A	713	1	-	0/6/23/26	0/1/1/1
6	NAG	B	707	1	-	2/6/23/26	0/1/1/1
6	NAG	B	711	1	-	0/6/23/26	0/1/1/1
5	GOL	A	701	-	-	1/4/4/4	-
6	NAG	A	716	1	-	0/6/23/26	0/1/1/1
6	NAG	A	711	1	-	0/6/23/26	0/1/1/1
6	NAG	B	705	1	-	0/6/23/26	0/1/1/1
6	NAG	B	702	1	-	1/6/23/26	0/1/1/1
6	NAG	A	704	-	-	3/6/23/26	0/1/1/1
5	GOL	A	717	-	-	4/4/4/4	-
5	GOL	B	713	-	-	4/4/4/4	-
6	NAG	A	712	1	-	3/6/23/26	0/1/1/1
6	NAG	B	709	1	-	0/6/23/26	0/1/1/1
6	NAG	A	715	1	-	3/6/23/26	0/1/1/1
6	NAG	B	703	1	-	0/6/23/26	0/1/1/1
6	NAG	A	714	1	-	4/6/23/26	0/1/1/1
6	NAG	A	708	1	-	2/6/23/26	0/1/1/1
6	NAG	A	706	1	-	0/6/23/26	0/1/1/1
6	NAG	A	710	1	-	2/6/23/26	0/1/1/1
6	NAG	B	708	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (46) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	715	NAG	C2-N2-C7	5.66	130.96	122.90
6	A	711	NAG	C1-O5-C5	5.14	119.15	112.19
6	B	703	NAG	C1-O5-C5	4.67	118.52	112.19
6	A	703	NAG	C1-O5-C5	4.53	118.32	112.19
6	B	711	NAG	C1-O5-C5	4.42	118.18	112.19
6	B	705	NAG	C1-O5-C5	4.36	118.10	112.19
6	A	708	NAG	C2-N2-C7	4.21	128.90	122.90
6	A	706	NAG	C1-O5-C5	4.07	117.70	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	705	NAG	C3-C4-C5	-4.03	103.06	110.24
6	B	707	NAG	C1-O5-C5	3.88	117.45	112.19
6	B	704	NAG	C1-O5-C5	3.88	117.45	112.19
6	A	704	NAG	C2-N2-C7	3.79	128.30	122.90
6	A	704	NAG	C1-O5-C5	3.76	117.29	112.19
6	A	714	NAG	C2-N2-C7	3.71	128.19	122.90
6	A	703	NAG	O5-C1-C2	-3.70	105.45	111.29
6	B	705	NAG	C1-C2-N2	-3.69	104.18	110.49
6	A	709	NAG	C1-O5-C5	3.44	116.85	112.19
6	A	708	NAG	C1-O5-C5	3.40	116.80	112.19
6	B	705	NAG	O4-C4-C5	3.37	117.67	109.30
6	A	710	NAG	C1-O5-C5	3.35	116.72	112.19
6	A	713	NAG	C1-O5-C5	3.34	116.72	112.19
6	B	706	NAG	C1-O5-C5	3.22	116.55	112.19
6	A	707	NAG	O5-C5-C6	3.13	112.11	107.20
6	A	703	NAG	C1-C2-N2	3.01	115.63	110.49
6	A	707	NAG	C4-C3-C2	2.91	115.28	111.02
6	B	710	NAG	C1-O5-C5	2.89	116.10	112.19
6	B	703	NAG	C4-C3-C2	2.86	115.21	111.02
6	A	716	NAG	C1-O5-C5	2.78	115.97	112.19
6	B	708	NAG	C1-O5-C5	2.73	115.89	112.19
6	A	712	NAG	C2-N2-C7	2.66	126.69	122.90
6	A	712	NAG	C1-O5-C5	2.62	115.74	112.19
6	A	708	NAG	C8-C7-N2	2.56	120.44	116.10
6	A	714	NAG	C8-C7-N2	2.56	120.43	116.10
6	B	709	NAG	C4-C3-C2	2.53	114.72	111.02
6	A	715	NAG	O5-C1-C2	2.43	115.12	111.29
6	B	704	NAG	C8-C7-N2	2.34	120.07	116.10
6	A	713	NAG	C1-C2-N2	2.31	114.44	110.49
6	A	715	NAG	C8-C7-N2	2.30	120.00	116.10
6	A	712	NAG	C8-C7-N2	2.30	120.00	116.10
6	A	702	NAG	C8-C7-N2	2.27	119.94	116.10
6	B	702	NAG	C4-C3-C2	2.23	114.28	111.02
6	B	709	NAG	C1-O5-C5	2.18	115.15	112.19
6	A	715	NAG	O7-C7-C8	-2.16	118.05	122.06
6	B	704	NAG	C2-N2-C7	2.09	125.87	122.90
6	A	715	NAG	C1-O5-C5	2.04	114.96	112.19
6	A	702	NAG	O5-C1-C2	-2.02	108.10	111.29

There are no chirality outliers.

All (41) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	717	GOL	O1-C1-C2-C3
5	A	717	GOL	C1-C2-C3-O3
5	B	713	GOL	C1-C2-C3-O3
6	A	707	NAG	O5-C5-C6-O6
6	A	704	NAG	C8-C7-N2-C2
6	A	714	NAG	C4-C5-C6-O6
6	A	704	NAG	O7-C7-N2-C2
6	A	707	NAG	C4-C5-C6-O6
6	A	702	NAG	C8-C7-N2-C2
6	A	702	NAG	O7-C7-N2-C2
6	A	708	NAG	C8-C7-N2-C2
6	A	708	NAG	O7-C7-N2-C2
6	A	710	NAG	C8-C7-N2-C2
6	A	710	NAG	O7-C7-N2-C2
6	A	712	NAG	C8-C7-N2-C2
6	A	712	NAG	O7-C7-N2-C2
6	A	714	NAG	C8-C7-N2-C2
6	A	714	NAG	O7-C7-N2-C2
6	A	715	NAG	C8-C7-N2-C2
6	A	715	NAG	O7-C7-N2-C2
6	B	704	NAG	C8-C7-N2-C2
6	B	704	NAG	O7-C7-N2-C2
6	A	714	NAG	O5-C5-C6-O6
5	A	717	GOL	O2-C2-C3-O3
6	A	703	NAG	C4-C5-C6-O6
5	B	701	GOL	C1-C2-C3-O3
5	B	713	GOL	O1-C1-C2-C3
5	B	713	GOL	O2-C2-C3-O3
5	A	717	GOL	O1-C1-C2-O2
6	A	704	NAG	C3-C2-N2-C7
6	B	707	NAG	C4-C5-C6-O6
6	B	702	NAG	C4-C5-C6-O6
6	A	702	NAG	C4-C5-C6-O6
5	B	713	GOL	O1-C1-C2-O2
6	A	703	NAG	O5-C5-C6-O6
6	A	712	NAG	C4-C5-C6-O6
6	B	707	NAG	O5-C5-C6-O6
6	A	715	NAG	C3-C2-N2-C7
5	B	701	GOL	O2-C2-C3-O3
5	A	701	GOL	O1-C1-C2-C3
6	A	709	NAG	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	715	NAG	2	0
6	A	710	NAG	2	0

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	4
1	A	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	339:ASP	C	340:HIS	N	1.64
1	B	369:VAL	C	370:GLN	N	1.13
1	A	267:GLN	C	268:HIS	N	1.10
1	B	267:GLN	C	268:HIS	N	1.07
1	A	590:ALA	C	591:ASN	N	1.01
1	B	590:ALA	C	591:ASN	N	0.95

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	624/665 (93%)	-0.50	10 (1%) 70 73	7, 16, 28, 54	1 (0%)
1	B	624/665 (93%)	-0.27	15 (2%) 59 64	9, 20, 35, 62	1 (0%)
All	All	1248/1330 (93%)	-0.39	25 (2%) 64 68	7, 17, 32, 62	2 (0%)

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	338	ALA	6.2
1	B	342	ASN	5.8
1	B	341	GLN	5.6
1	B	338	ALA	5.6
1	B	336	GLY	5.0
1	A	342	ASN	4.7
1	A	291	TYR	4.2
1	B	340	HIS	4.0
1	B	339	ASP	3.9
1	A	336	GLY	3.7
1	B	236	ASN	3.4
1	B	337	ARG	3.1
1	A	340	HIS	3.0
1	A	339	ASP	3.0
1	A	42	CYS	2.9
1	A	341	GLN	2.8
1	B	343	HIS	2.8
1	B	323	THR	2.6
1	B	42	CYS	2.5
1	B	335	GLN	2.5
1	B	239	SER	2.3
1	B	384	GLU	2.3
1	B	606	ASN	2.3
1	A	449	MET	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	335	GLN	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, 95<sup>th</sup> 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.

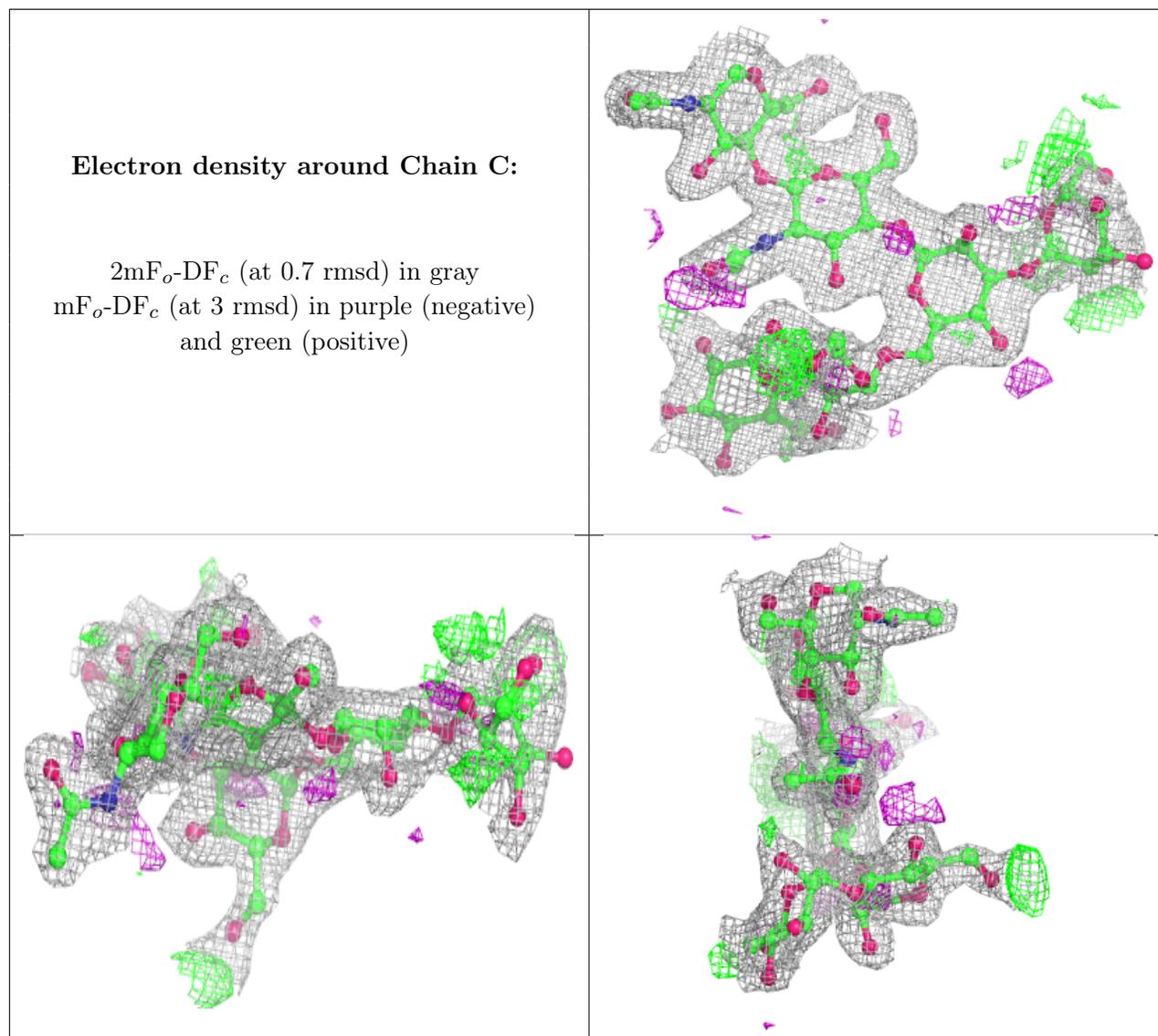
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
4	NAG	H	2	14/15	0.48	0.26	73,79,82,82	0
2	MAN	C	6	11/12	0.50	0.24	54,62,68,72	0
4	NAG	E	2	14/15	0.54	0.24	70,74,80,80	0
2	MAN	F	6	11/12	0.55	0.22	57,63,65,67	0
3	MAN	D	6	11/12	0.57	0.23	67,73,75,77	0
3	MAN	G	6	11/12	0.59	0.23	74,79,82,84	0
3	MAN	D	9	11/12	0.82	0.14	38,41,45,46	0
2	MAN	C	4	11/12	0.83	0.15	41,43,46,48	0
2	MAN	F	4	11/12	0.84	0.14	46,49,51,51	0
3	MAN	G	9	11/12	0.84	0.13	35,37,39,40	0
3	MAN	D	5	11/12	0.86	0.13	44,47,49,57	0
2	MAN	F	5	11/12	0.87	0.14	50,52,52,53	0
4	NAG	H	1	14/15	0.87	0.13	43,49,56,65	0
3	MAN	G	5	11/12	0.87	0.13	50,53,55,64	0
4	NAG	E	1	14/15	0.88	0.12	38,45,51,61	0
2	MAN	C	5	11/12	0.88	0.12	43,44,45,47	0
3	MAN	G	4	11/12	0.90	0.12	30,35,39,41	0
3	MAN	D	4	11/12	0.91	0.10	27,31,36,37	0
2	BMA	F	3	11/12	0.92	0.11	33,38,42,48	0
2	BMA	C	3	11/12	0.93	0.10	28,32,38,44	0
2	NAG	C	2	14/15	0.95	0.08	18,19,21,23	0
2	NAG	F	2	14/15	0.95	0.08	22,24,25,29	0
2	NAG	C	1	14/15	0.95	0.07	14,17,20,20	0
3	MAN	D	8	11/12	0.95	0.07	23,25,28,32	0
3	MAN	G	8	11/12	0.95	0.07	24,26,29,31	0
3	BMA	D	3	11/12	0.96	0.06	14,15,17,21	0
3	MAN	G	7	11/12	0.97	0.06	13,15,18,22	0

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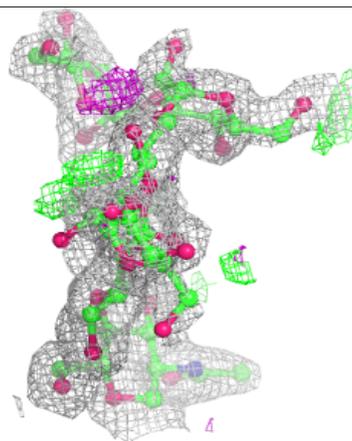
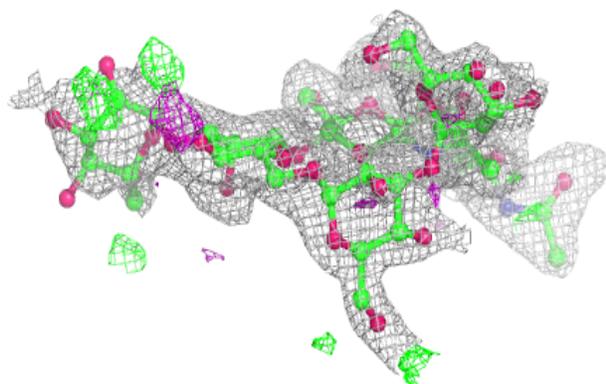
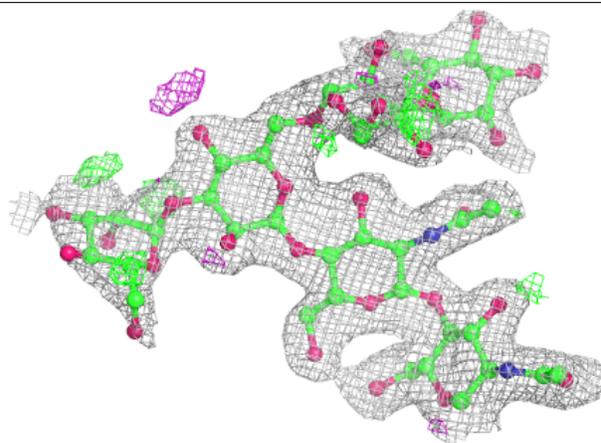
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	NAG	D	2	14/15	0.97	0.06	9,10,11,12	0
3	NAG	G	2	14/15	0.97	0.05	12,13,14,15	0
3	BMA	G	3	11/12	0.97	0.05	16,17,20,25	0
2	NAG	F	1	14/15	0.97	0.06	17,20,23,23	0
3	MAN	D	7	11/12	0.97	0.06	12,14,17,21	0
3	NAG	D	1	14/15	0.97	0.05	9,9,10,10	0
3	NAG	G	1	14/15	0.98	0.05	12,13,13,14	0
3	MAN	G	10	11/12	0.98	0.05	11,11,12,12	0
3	MAN	D	10	11/12	0.98	0.05	9,10,10,11	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



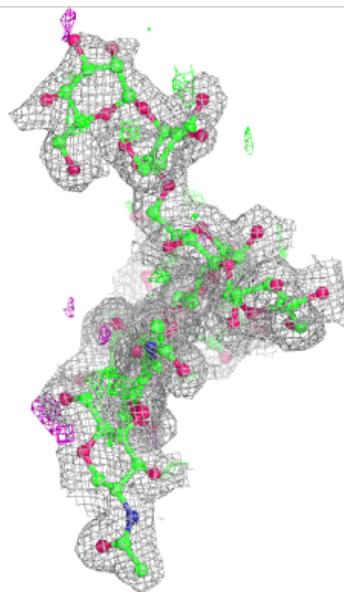
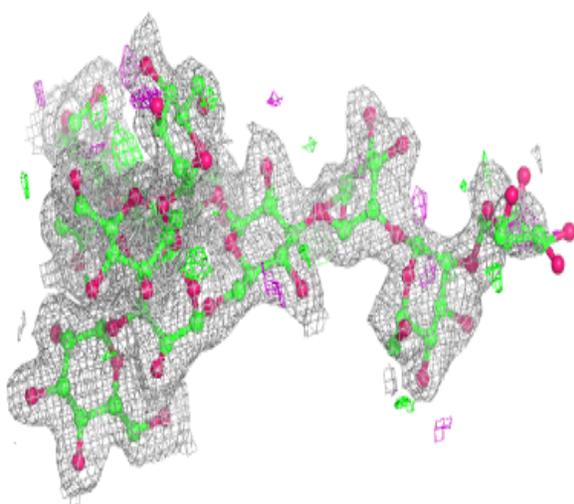
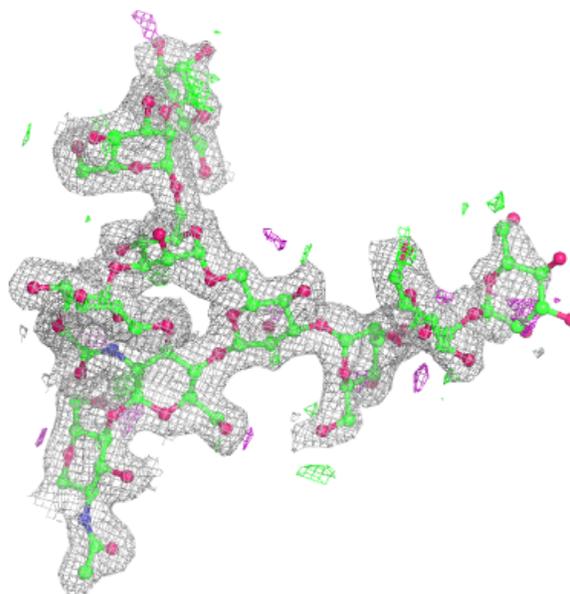
**Electron density around Chain F:**

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



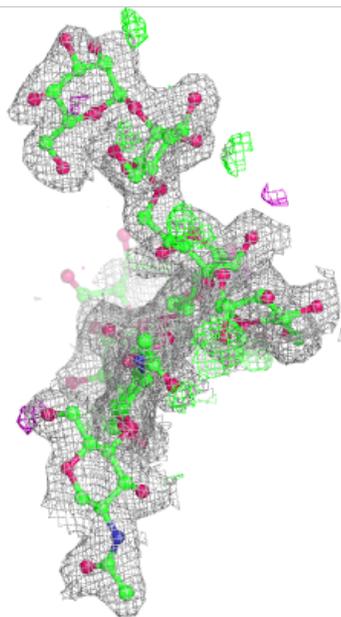
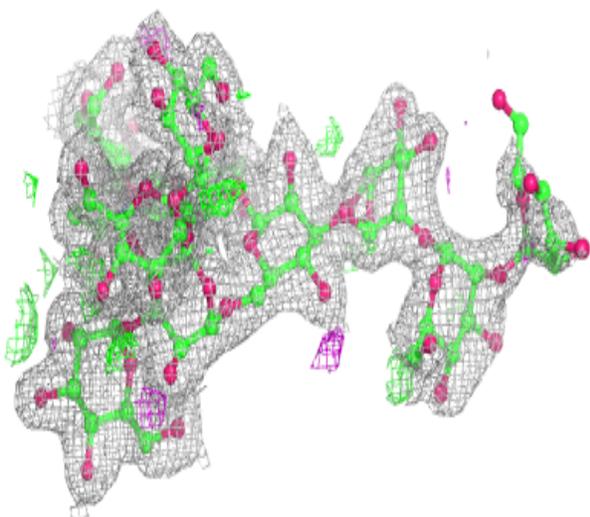
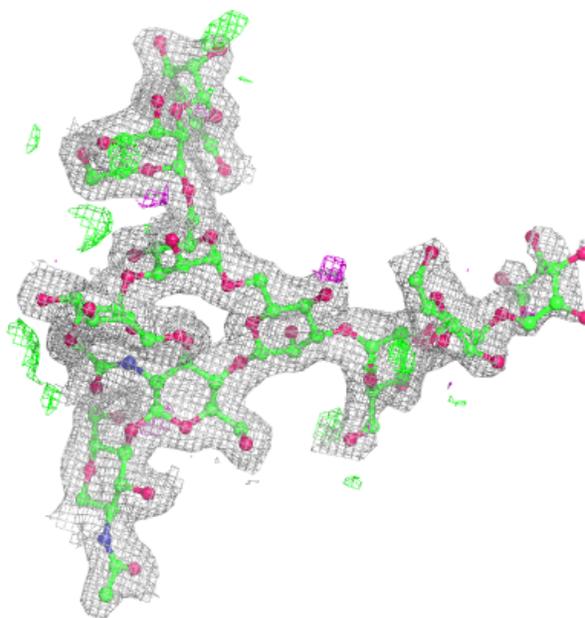
**Electron density around Chain D:**

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



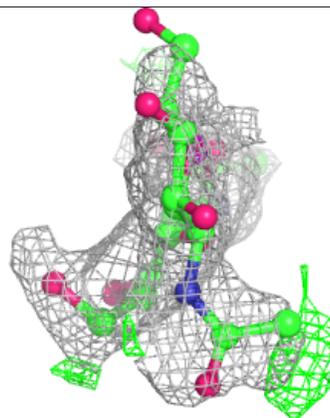
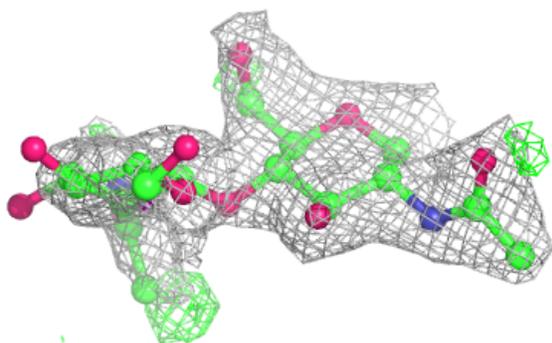
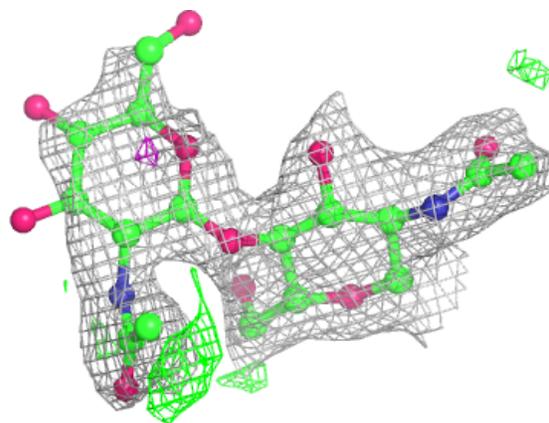
**Electron density around Chain G:**

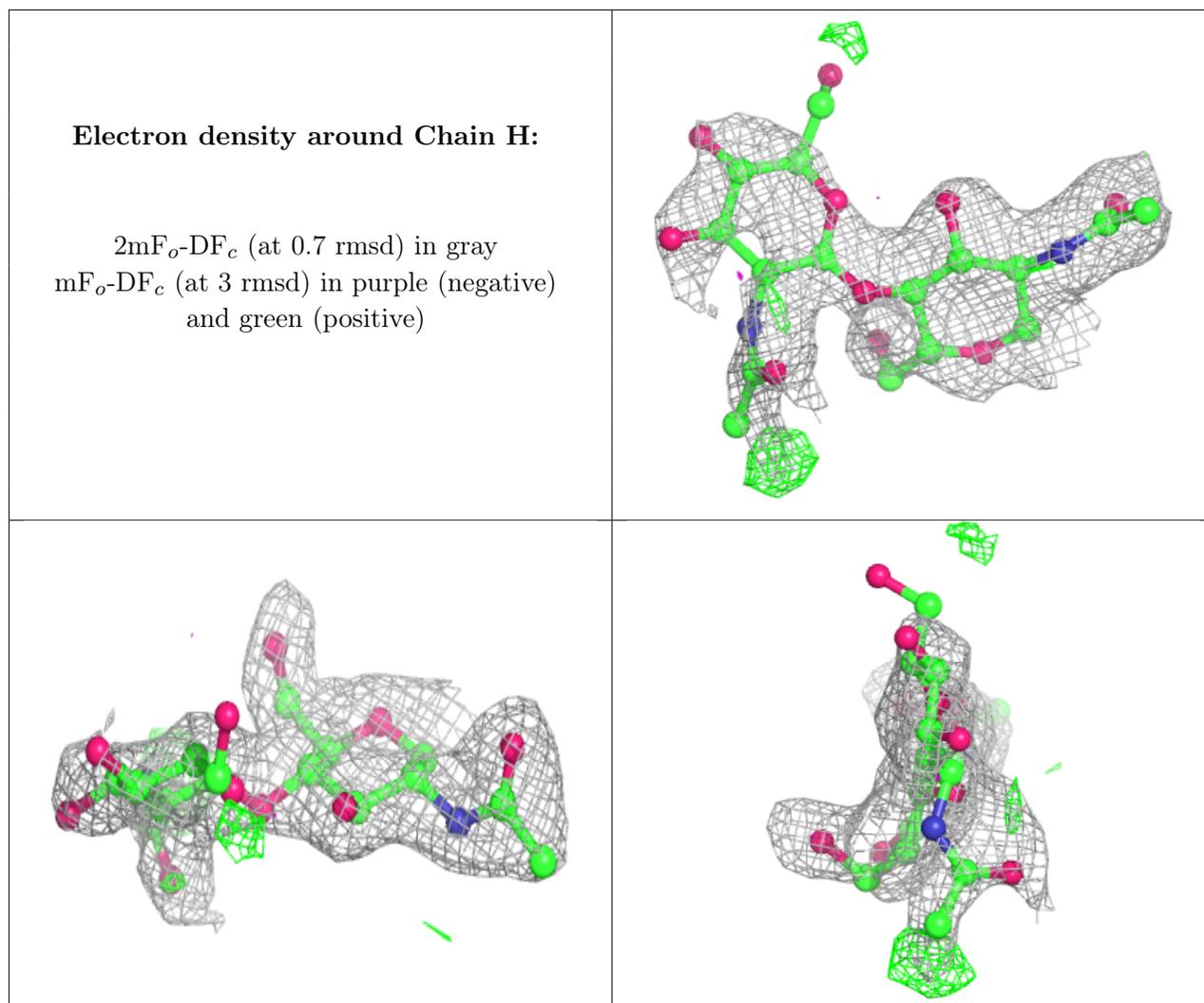
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around Chain E:**

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





## 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
6	NAG	A	704	14/15	0.53	0.27	71,81,84,85	0
6	NAG	B	702	14/15	0.65	0.23	53,59,62,64	0
6	NAG	A	712	14/15	0.70	0.21	49,60,69,69	0
6	NAG	B	704	14/15	0.70	0.20	64,69,74,75	0
6	NAG	A	714	14/15	0.73	0.19	46,53,56,58	0
6	NAG	A	706	14/15	0.76	0.18	49,54,56,57	0
6	NAG	A	702	14/15	0.78	0.18	43,50,52,53	0
6	NAG	A	703	14/15	0.78	0.17	39,45,47,49	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
6	NAG	B	705	14/15	0.78	0.17	53,59,60,60	0
5	GOL	A	717	6/6	0.79	0.17	31,32,33,33	0
6	NAG	B	703	14/15	0.79	0.16	39,45,47,48	0
6	NAG	A	707	14/15	0.81	0.16	46,52,56,56	0
6	NAG	A	711	14/15	0.83	0.14	38,42,44,44	0
6	NAG	A	715	14/15	0.83	0.13	36,39,42,43	0
6	NAG	B	709	14/15	0.83	0.16	46,51,55,56	0
5	GOL	B	713	6/6	0.86	0.15	30,32,34,34	0
6	NAG	A	705	14/15	0.88	0.10	25,28,30,30	0
6	NAG	B	711	14/15	0.88	0.11	32,35,36,36	0
5	GOL	B	701	6/6	0.89	0.11	19,21,22,25	0
6	NAG	B	710	14/15	0.91	0.10	27,30,33,34	0
5	GOL	A	701	6/6	0.91	0.09	15,16,17,18	0
6	NAG	A	713	14/15	0.92	0.09	26,28,31,34	0
6	NAG	A	716	14/15	0.93	0.08	18,19,23,25	0
6	NAG	A	708	14/15	0.93	0.09	26,27,29,30	0
6	NAG	B	712	14/15	0.93	0.09	21,22,27,29	0
6	NAG	B	706	14/15	0.95	0.08	31,32,35,37	0
6	NAG	B	707	14/15	0.95	0.08	24,26,27,28	0
6	NAG	A	710	14/15	0.95	0.07	16,19,23,26	0
6	NAG	A	709	14/15	0.96	0.07	21,22,24,26	0
6	NAG	B	708	14/15	0.96	0.07	20,21,25,25	0

## 6.5 Other polymers

There are no such residues in this entry.