



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 09:51 PM UTC

PDB ID : 1QNR / pdb_00001qnr
Title : The 3-D structure of a Trichoderma reesei b-mannanase from glycoside hydrolase family 5
Authors : Sabini, E.; Schubert, H.; Murshudov, G.; Wilson, K.S.; Siika-Aho, M.; Penttila, M.
Deposited on : 1999-10-20
Resolution : 1.40 Å(reported)

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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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

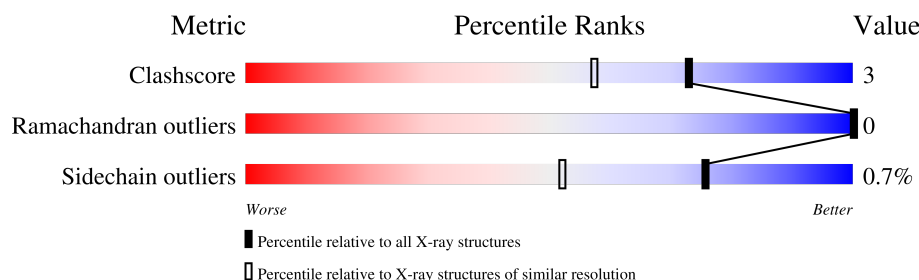
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.40 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))
Clashscore	190562	2660 (1.40-1.40)
Ramachandran outliers	187476	2611 (1.40-1.40)
Sidechain outliers	187428	2610 (1.40-1.40)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	344	
2	B	2	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	GOL	A	410	-	-	X	-

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 3293 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 ENDO-1,4-B-D-MANNANASE.

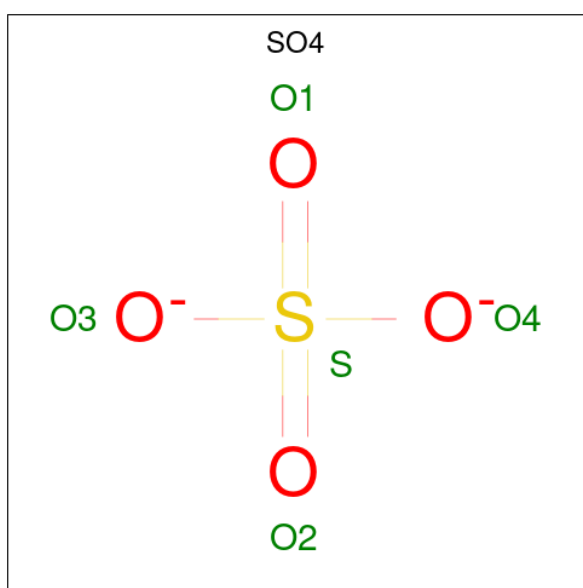
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	344	2703	1704	453	536	10	0	13	0

- Molecule 2 is an oligosaccharide called beta-D-mannopyranose-(1-4)-beta-D-mannopyranos e.



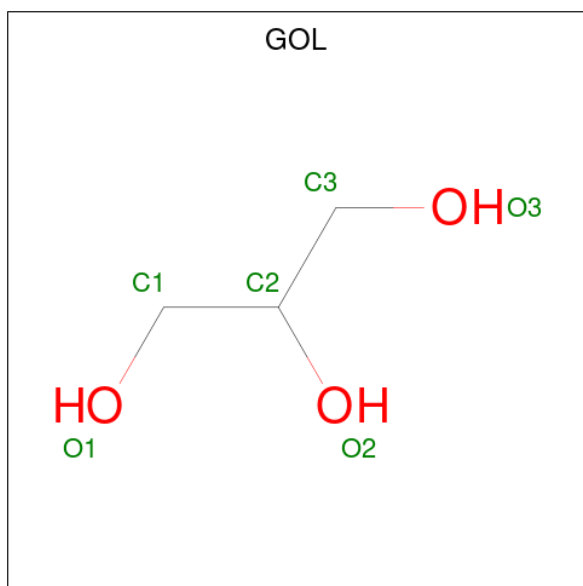
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
			Total	C	O			
2	B	2	23	12	11	0	0	0

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



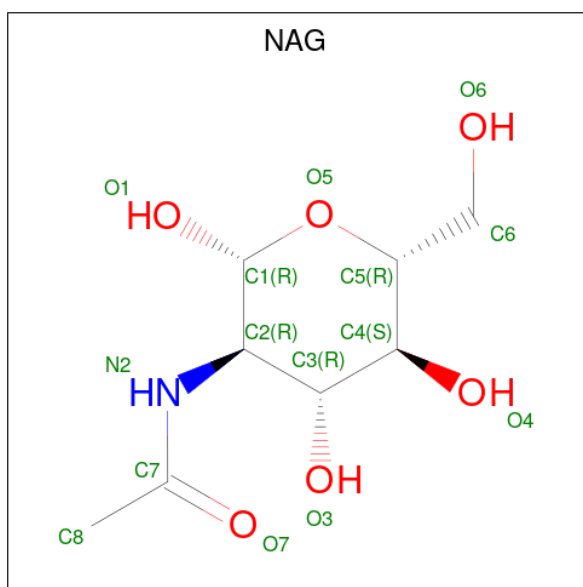
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		

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



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

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



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

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	494	Total	O	0	0
			494	494		

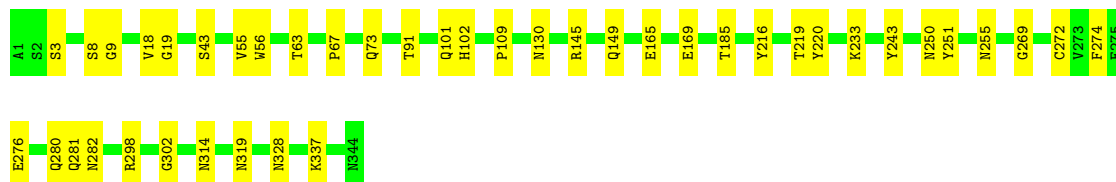
3 Residue-property plots [i](#)

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. 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. 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.

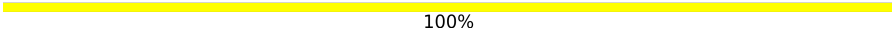
Note EDS was not executed.

- Molecule 1: ENDO-1,4-B-D-MANNANASE

Chain A:  88% 12%



- Molecule 2: beta-D-mannopyranose-(1-4)-beta-D-mannopyranose

Chain B:  100%



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	50.75Å 54.92Å 61.36Å 90.00° 111.73° 90.00°	Depositor
Resolution (Å)	19.80 – 1.40	Depositor
% Data completeness (in resolution range)	91.2 (19.80-1.40)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
Refinement program	REFMAC	Depositor
R, R_{free}	0.124 , 0.171	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3293	wwPDB-VP
Average B, all atoms (Å ²)	16.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	1.41	4/2848 (0.1%)	1.58	33/3896 (0.8%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	55	VAL	N-CA	6.36	1.53	1.46
1	A	302	GLY	N-CA	6.21	1.52	1.45
1	A	185	THR	C-O	5.76	1.30	1.24
1	A	19	GLY	CA-C	5.54	1.57	1.51

All (33) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	101	GLN	OE1-CD-NE2	10.10	132.69	122.60
1	A	130	ASN	OD1-CG-ND2	-9.33	113.27	122.60
1	A	337	LYS	CA-C-O	-8.81	111.21	120.55
1	A	282	ASN	OD1-CG-ND2	8.46	131.06	122.60
1	A	3[A]	SER	CA-C-O	-8.38	112.09	121.40
1	A	3[B]	SER	CA-C-O	-8.38	112.09	121.40
1	A	274	PHE	CA-CB-CG	7.74	121.54	113.80
1	A	91	THR	N-CA-CB	7.10	120.67	110.16
1	A	73	GLN	OE1-CD-NE2	-6.61	115.99	122.60
1	A	67	PRO	O-C-N	-6.60	114.80	122.85
1	A	251	TYR	O-C-N	-6.37	114.89	122.15
1	A	281	GLN	CG-CD-NE2	-6.18	107.12	116.40
1	A	281	GLN	CG-CD-OE1	5.99	132.78	120.80
1	A	250	ASN	OD1-CG-ND2	-5.99	116.61	122.60
1	A	328	ASN	OD1-CG-ND2	-5.97	116.63	122.60
1	A	63	THR	OG1-CB-CG2	-5.80	97.69	109.30
1	A	8[A]	SER	O-C-N	-5.78	116.50	123.27

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	8[B]	SER	O-C-N	-5.78	116.50	123.27
1	A	298	ARG	NE-CZ-NH2	5.78	124.40	119.20
1	A	130	ASN	CB-CG-OD1	5.68	132.15	120.80
1	A	8[A]	SER	CA-C-O	5.62	126.19	120.24
1	A	8[B]	SER	CA-C-O	5.62	126.19	120.24
1	A	18	VAL	CA-C-O	5.57	126.67	120.59
1	A	43	SER	O-C-N	-5.52	116.27	122.12
1	A	102	HIS	CE1-NE2-CD2	5.40	114.40	109.00
1	A	255	ASN	CA-CB-CG	-5.40	107.20	112.60
1	A	314	ASN	OD1-CG-ND2	-5.33	117.27	122.60
1	A	145[A]	ARG	CD-NE-CZ	5.32	131.84	124.40
1	A	145[B]	ARG	CD-NE-CZ	5.32	131.84	124.40
1	A	319	ASN	O-C-N	-5.15	116.47	122.81
1	A	149	GLN	OE1-CD-NE2	-5.13	117.47	122.60
1	A	9	GLY	CA-C-O	-5.12	114.75	121.51
1	A	63	THR	CA-CB-CG2	5.11	119.19	110.50

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2703	0	2484	13	1
2	B	23	0	21	0	0
3	A	5	0	0	0	0
4	A	12	0	15	6	0
5	A	56	0	52	0	0
6	A	494	0	0	10	1
All	All	3293	0	2572	17	2

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (17) 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:169[A]:GLU:OE2	6:A:2293:HOH:O	1.87	0.91
4:A:410:GOL:H11	6:A:2481:HOH:O	1.74	0.88
1:A:276:GLU:OE1	6:A:2293:HOH:O	1.93	0.84
1:A:219[A]:THR:HG22	1:A:220:TYR:H	1.43	0.83
4:A:410:GOL:O1	6:A:2293:HOH:O	2.06	0.73
1:A:219[A]:THR:HG22	1:A:220:TYR:N	2.10	0.61
1:A:219[A]:THR:CG2	1:A:220:TYR:H	2.12	0.60
1:A:216:TYR:CE1	6:A:2348:HOH:O	2.59	0.55
1:A:243:TYR:CE1	4:A:410:GOL:H32	2.43	0.54
4:A:410:GOL:C1	6:A:2293:HOH:O	2.56	0.52
4:A:410:GOL:H12	6:A:2293:HOH:O	2.11	0.49
1:A:233:LYS:HG3	6:A:2364:HOH:O	2.12	0.48
1:A:216:TYR:CZ	6:A:2348:HOH:O	2.55	0.46
1:A:219[A]:THR:CG2	1:A:220:TYR:N	2.76	0.44
1:A:243:TYR:CZ	4:A:410:GOL:H32	2.52	0.44
1:A:109:PRO:HA	1:A:165:GLU:O	2.20	0.42
1:A:280[A]:GLN:NE2	6:A:2400:HOH:O	2.53	0.42

All (2) 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:219[A]:THR:CG2	1:A:269:GLY:O[2_646]	1.85	0.35
6:A:2080:HOH:O	6:A:2228:HOH:O[2_555]	1.97	0.23

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	355/344 (103%)	345 (97%)	10 (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	295/282 (105%)	293 (99%)	2 (1%)	76	52

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	TRP
1	A	272	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	143	GLN
1	A	229	ASN
1	A	281	GLN
1	A	307	GLN
1	A	331	ASN
1	A	338	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

2 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	BMA	B	1	2	12,12,12	1.14	1 (8%)	17,17,17	1.44	3 (17%)
2	BMA	B	2	2	11,11,12	1.22	1 (9%)	15,15,17	1.67	3 (20%)

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	BMA	B	1	2	-	2/2/22/22	0/1/1/1
2	BMA	B	2	2	-	0/2/19/22	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2	BMA	O5-C5	2.61	1.48	1.43
2	B	1	BMA	O5-C1	2.16	1.48	1.42

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2	BMA	O5-C5-C6	-3.98	99.92	107.66
2	B	2	BMA	O6-C6-C5	-3.21	100.41	111.33
2	B	1	BMA	O5-C5-C6	2.72	113.17	106.44
2	B	1	BMA	O5-C1-C2	-2.37	106.12	110.30
2	B	2	BMA	C1-O5-C5	-2.24	109.19	112.19
2	B	1	BMA	O5-C5-C4	-2.17	105.79	109.70

There are no chirality outliers.

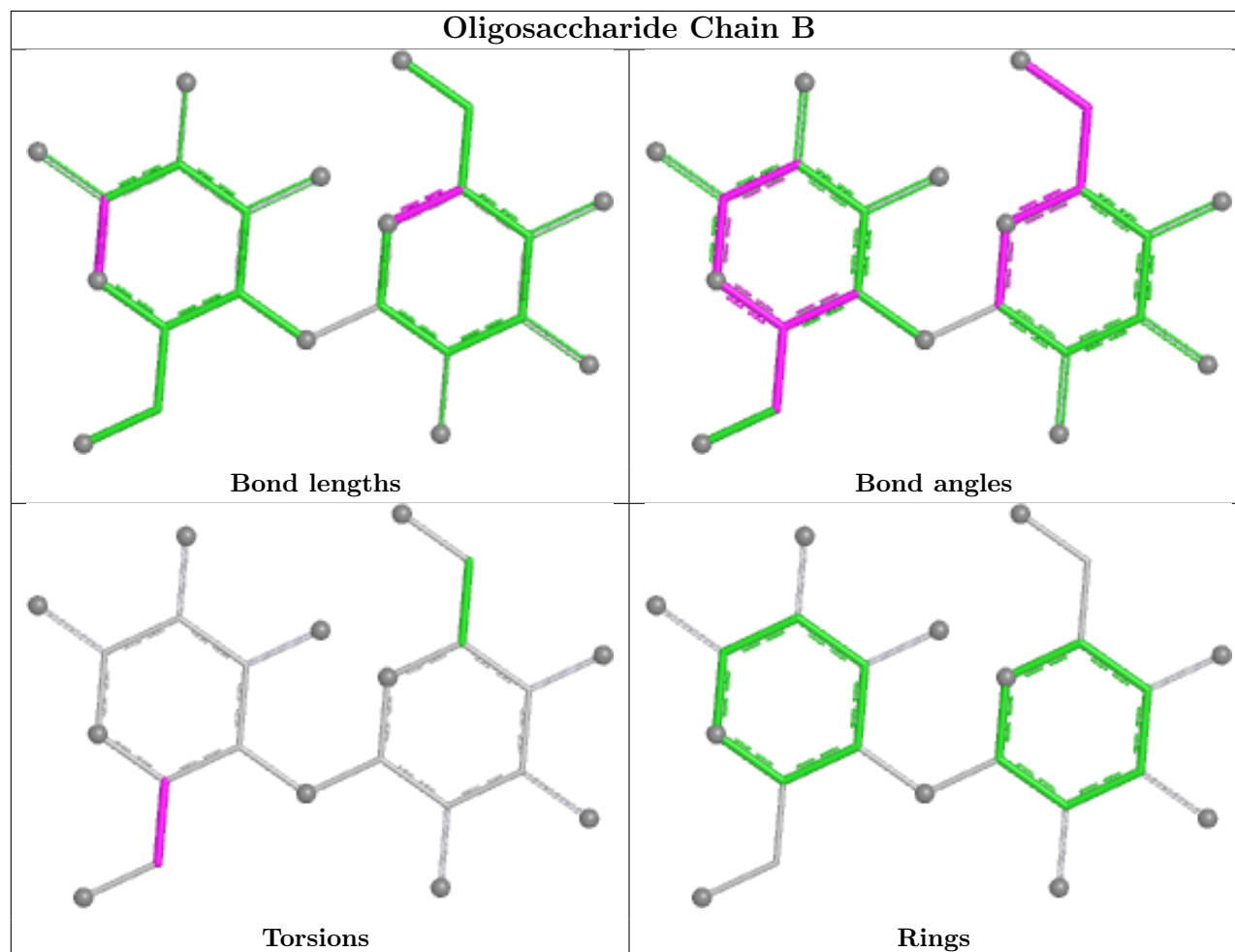
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1	BMA	C4-C5-C6-O6
2	B	1	BMA	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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



5.6 Ligand geometry [i](#)

7 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
4	GOL	A	410	-	5,5,5	1.39	1 (20%)	5,5,5	2.16	2 (40%)
5	NAG	A	433	1	14,14,15	1.46	2 (14%)	17,19,21	2.14	7 (41%)
4	GOL	A	411	-	5,5,5	0.49	0	5,5,5	1.24	0
5	NAG	A	430	1	14,14,15	1.03	1 (7%)	17,19,21	1.58	5 (29%)
3	SO4	A	402	-	4,4,4	1.16	1 (25%)	6,6,6	0.29	0
5	NAG	A	431	1	14,14,15	1.19	1 (7%)	17,19,21	1.47	3 (17%)
5	NAG	A	432	1	14,14,15	1.36	1 (7%)	17,19,21	2.48	2 (11%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	GOL	A	410	-	-	2/4/4/4	-
5	NAG	A	433	1	-	0/6/23/26	0/1/1/1
4	GOL	A	411	-	-	2/4/4/4	-
5	NAG	A	430	1	-	0/6/23/26	0/1/1/1
5	NAG	A	431	1	-	0/6/23/26	0/1/1/1
5	NAG	A	432	1	-	0/6/23/26	0/1/1/1

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	433	NAG	O7-C7	-3.53	1.15	1.23
5	A	432	NAG	O7-C7	-3.47	1.15	1.23
5	A	430	NAG	O7-C7	-2.83	1.16	1.23
5	A	433	NAG	C2-N2	2.75	1.50	1.46
4	A	410	GOL	O1-C1	-2.37	1.32	1.42
3	A	402	SO4	O1-S	2.16	1.57	1.44
5	A	431	NAG	C2-N2	2.14	1.49	1.46

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	432	NAG	O5-C1-C2	9.08	125.33	111.29
4	A	410	GOL	O1-C1-C2	4.09	128.79	110.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	430	NAG	C4-C3-C2	-3.82	105.42	111.02
5	A	433	NAG	C2-N2-C7	-3.69	117.95	122.90
5	A	433	NAG	O3-C3-C2	-3.63	101.86	109.40
5	A	433	NAG	C3-C4-C5	3.63	116.81	110.23
5	A	431	NAG	C2-N2-C7	-3.27	118.52	122.90
5	A	431	NAG	C1-C2-N2	-3.07	105.60	110.43
5	A	433	NAG	C1-O5-C5	-2.87	108.34	112.19
5	A	432	NAG	C1-O5-C5	2.85	116.00	112.19
5	A	433	NAG	C4-C3-C2	-2.53	107.30	111.02
5	A	433	NAG	O5-C1-C2	2.44	115.06	111.29
5	A	430	NAG	C1-C2-N2	-2.41	106.64	110.43
5	A	430	NAG	O5-C5-C4	-2.39	105.02	110.83
5	A	430	NAG	C1-O5-C5	-2.36	109.03	112.19
5	A	433	NAG	O5-C5-C6	-2.29	103.20	107.66
5	A	430	NAG	O5-C1-C2	2.28	114.81	111.29
5	A	431	NAG	O7-C7-C8	2.01	125.64	122.05
4	A	410	GOL	O2-C2-C1	-2.01	100.88	109.18

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	410	GOL	O1-C1-C2-O2
4	A	410	GOL	O1-C1-C2-C3
4	A	411	GOL	O1-C1-C2-C3
4	A	411	GOL	O1-C1-C2-O2

There are no ring outliers.

1 monomer is involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	410	GOL	6	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.