



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:14 PM UTC

PDB ID : 3ZM8 / pdb_00003zm8
Title : Crystal structure of Podospora anserina GH26-CBM35 beta-(1,4)- mannanase
Authors : Couturier, M.; Roussel, A.; Rosengren, A.; Leone, P.; Stalbrand, H.; Berrin, J.G.
Deposited on : 2013-02-06
Resolution : 2.85 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

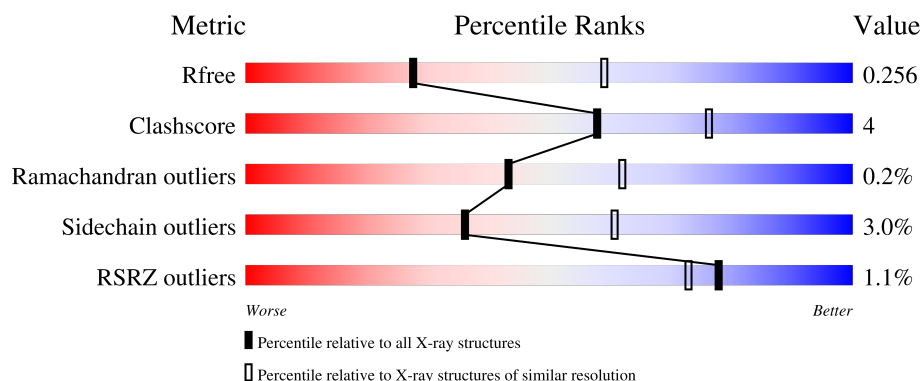
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.85 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	1407 (2.88-2.84)
Clashscore	190562	1446 (2.88-2.84)
Ramachandran outliers	187476	1406 (2.88-2.84)
Sidechain outliers	187428	1407 (2.88-2.84)
RSRZ outliers	180081	1408 (2.88-2.84)

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	475	 79% 13% 7%
2	B	2	 100%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 3676 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 GH26 ENDO-BETA-1,4-MANNANASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	444	Total	C	N	O	S	0	0	0
			3493	2233	590	667	3			

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	MET	-	expression tag	UNP E2GHW2
A	-1	SER	-	expression tag	UNP E2GHW2
A	0	ILE	-	expression tag	UNP E2GHW2
A	450	GLY	-	expression tag	UNP E2GHW2
A	451	ASP	-	expression tag	UNP E2GHW2
A	452	GLU	-	expression tag	UNP E2GHW2
A	453	GLN	-	expression tag	UNP E2GHW2
A	454	LYS	-	expression tag	UNP E2GHW2
A	455	LEU	-	expression tag	UNP E2GHW2
A	456	ILE	-	expression tag	UNP E2GHW2
A	457	SER	-	expression tag	UNP E2GHW2
A	458	GLU	-	expression tag	UNP E2GHW2
A	459	GLU	-	expression tag	UNP E2GHW2
A	460	ASP	-	expression tag	UNP E2GHW2
A	461	LEU	-	expression tag	UNP E2GHW2
A	462	ASN	-	expression tag	UNP E2GHW2
A	463	SER	-	expression tag	UNP E2GHW2
A	464	ALA	-	expression tag	UNP E2GHW2
A	465	VAL	-	expression tag	UNP E2GHW2
A	466	ASP	-	expression tag	UNP E2GHW2
A	467	HIS	-	expression tag	UNP E2GHW2
A	468	HIS	-	expression tag	UNP E2GHW2
A	469	HIS	-	expression tag	UNP E2GHW2
A	470	HIS	-	expression tag	UNP E2GHW2
A	471	HIS	-	expression tag	UNP E2GHW2
A	472	HIS	-	expression tag	UNP E2GHW2

- Molecule 2 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
2	B	2	Total	C	N	O	0	0	0
			28	16	2	10			

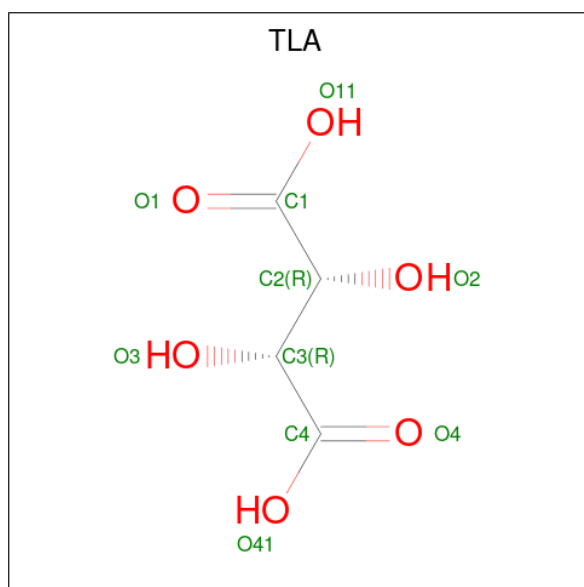
- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

- Molecule 4 is MERCURY (II) ION (CCD ID: HG) (formula: Hg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Hg	0	0
			1	1		

- Molecule 5 is L(+)-TARTARIC ACID (CCD ID: TLA) (formula: C₄H₆O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			10	4	6		

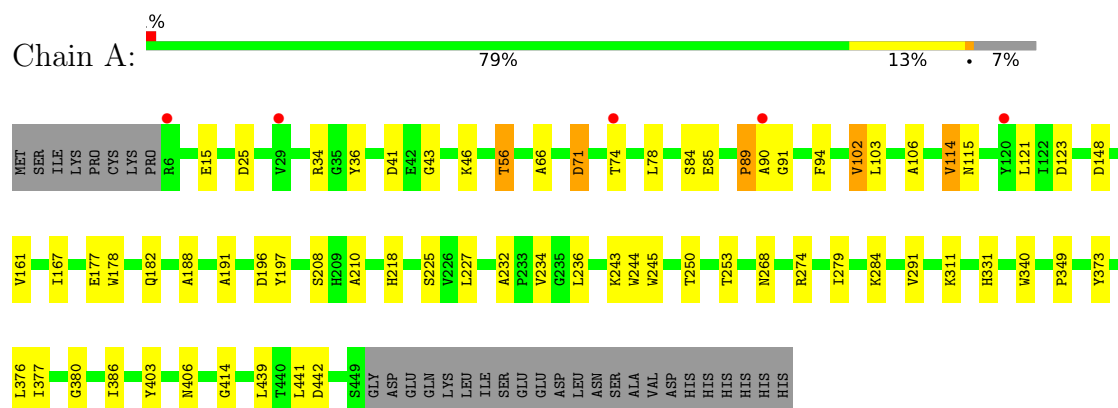
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	143	Total 143	O 143	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: GH26 ENDO-BETA-1,4-MANNANASE



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



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	97.49Å 97.49Å 268.72Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	28.30 – 2.85 28.30 – 2.85	Depositor EDS
% Data completeness (in resolution range)	100.0 (28.30-2.85) 99.8 (28.30-2.85)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.86 (at 2.69Å)	Xtriage
Refinement program	BUSTER 2.11.4	Depositor
R, R_{free}	0.206 , 0.257 0.203 , 0.256	Depositor DCC
R_{free} test set	1110 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å ²)	68.2	Xtriage
Anisotropy	0.148	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 52.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3676	wwPDB-VP
Average B, all atoms (Å ²)	68.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.97% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: TLA, CA, NAG, HG

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	0.77	0/3594	1.28	14/4930 (0.3%)

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	268	ASN	CA-CB-CG	7.35	119.95	112.60
1	A	148	ASP	CA-CB-CG	7.09	119.69	112.60
1	A	71	ASP	CA-CB-CG	6.91	119.51	112.60
1	A	89	PRO	N-CA-C	6.27	121.80	113.40
1	A	250	THR	CA-C-N	6.03	128.96	120.28
1	A	250	THR	C-N-CA	6.03	128.96	120.28
1	A	274	ARG	CA-C-N	5.88	128.09	120.44
1	A	274	ARG	C-N-CA	5.88	128.09	120.44
1	A	441	LEU	CA-C-N	5.28	129.59	121.19
1	A	441	LEU	C-N-CA	5.28	129.59	121.19
1	A	442	ASP	CA-C-N	5.24	127.83	120.28
1	A	442	ASP	C-N-CA	5.24	127.83	120.28
1	A	380	GLY	CA-C-N	5.22	129.54	122.07
1	A	380	GLY	C-N-CA	5.22	129.54	122.07

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	3493	0	3327	31	0
2	B	28	0	25	0	0
3	A	1	0	0	0	0
4	A	1	0	0	0	0
5	A	10	0	4	0	0
6	A	143	0	0	0	0
All	All	3676	0	3356	31	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 4.

All (31) 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:90:ALA:CB	1:A:91:GLY:HA2	2.12	0.78
1:A:90:ALA:HB3	1:A:91:GLY:HA2	1.79	0.64
1:A:161:VAL:HG21	1:A:439:LEU:HD11	1.80	0.62
1:A:90:ALA:HB1	1:A:91:GLY:HA2	1.81	0.62
1:A:90:ALA:CB	1:A:91:GLY:CA	2.80	0.59
1:A:178:TRP:O	1:A:182:GLN:HG2	2.05	0.57
1:A:78:LEU:HD22	1:A:102:VAL:HG22	1.87	0.56
1:A:56:THR:HG22	1:A:106:ALA:H	1.70	0.56
1:A:232:ALA:HB3	1:A:253:THR:HG21	1.89	0.55
1:A:161:VAL:HG21	1:A:439:LEU:CD1	2.38	0.52
1:A:90:ALA:HB3	1:A:91:GLY:CA	2.38	0.52
1:A:71:ASP:HB3	1:A:89:PRO:O	2.10	0.51
1:A:66:ALA:HB3	1:A:121:LEU:HB2	1.97	0.47
1:A:373:TYR:OH	1:A:406:ASN:HB2	2.15	0.47
1:A:74:THR:O	1:A:85:GLU:HA	2.16	0.46
1:A:167:ILE:HG23	1:A:188:ALA:HB3	1.97	0.46
1:A:15:GLU:HG3	1:A:34:ARG:HB3	2.00	0.44
1:A:196:ASP:HB2	1:A:208:SER:HB2	1.99	0.44
1:A:25:ASP:HB3	1:A:36:TYR:CE1	2.54	0.43
1:A:284:LYS:HE3	1:A:331:HIS:HB3	2.01	0.43
1:A:43:GLY:HA2	1:A:115:ASN:HD22	1.84	0.42
1:A:94:PHE:CE1	1:A:123:ASP:HB2	2.54	0.42
1:A:191:ALA:HA	1:A:225:SER:O	2.19	0.42
1:A:376:LEU:HB3	1:A:386:ILE:HD12	2.01	0.42
1:A:236:LEU:HD23	1:A:244:TRP:HB2	2.01	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:46:LYS:HB3	1:A:114:VAL:HG13	2.02	0.41
1:A:218:HIS:CG	1:A:291:VAL:HG22	2.55	0.41
1:A:340:TRP:CE2	1:A:349:PRO:HD3	2.55	0.41
1:A:197:TYR:HE2	1:A:210:ALA:HB3	1.85	0.40
1:A:103:LEU:HD13	1:A:403:TYR:CE2	2.56	0.40
1:A:243:LYS:HD3	1:A:245:TRP:CZ2	2.57	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	442/475 (93%)	419 (95%)	22 (5%)	1 (0%)	43 62

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	414	GLY

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	362/391 (93%)	351 (97%)	11 (3%)	36 61

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	ASP
1	A	56	THR
1	A	84	SER
1	A	102	VAL
1	A	114	VAL
1	A	177	GLU
1	A	227	LEU
1	A	234	VAL
1	A	279	ILE
1	A	311	LYS
1	A	377	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	28	GLN
1	A	150	ASN
1	A	174	HIS
1	A	231	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	NAG	B	1	2,1	14,14,15	0.36	0	17,19,21	1.36	3 (17%)
2	NAG	B	2	2	14,14,15	0.31	0	17,19,21	0.74	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	B	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	NAG	O5-C1-C2	-4.14	104.88	111.29
2	B	1	NAG	C1-C2-N2	2.84	114.90	110.43
2	B	2	NAG	C1-O5-C5	2.12	115.02	112.19
2	B	1	NAG	C1-O5-C5	2.03	114.91	112.19

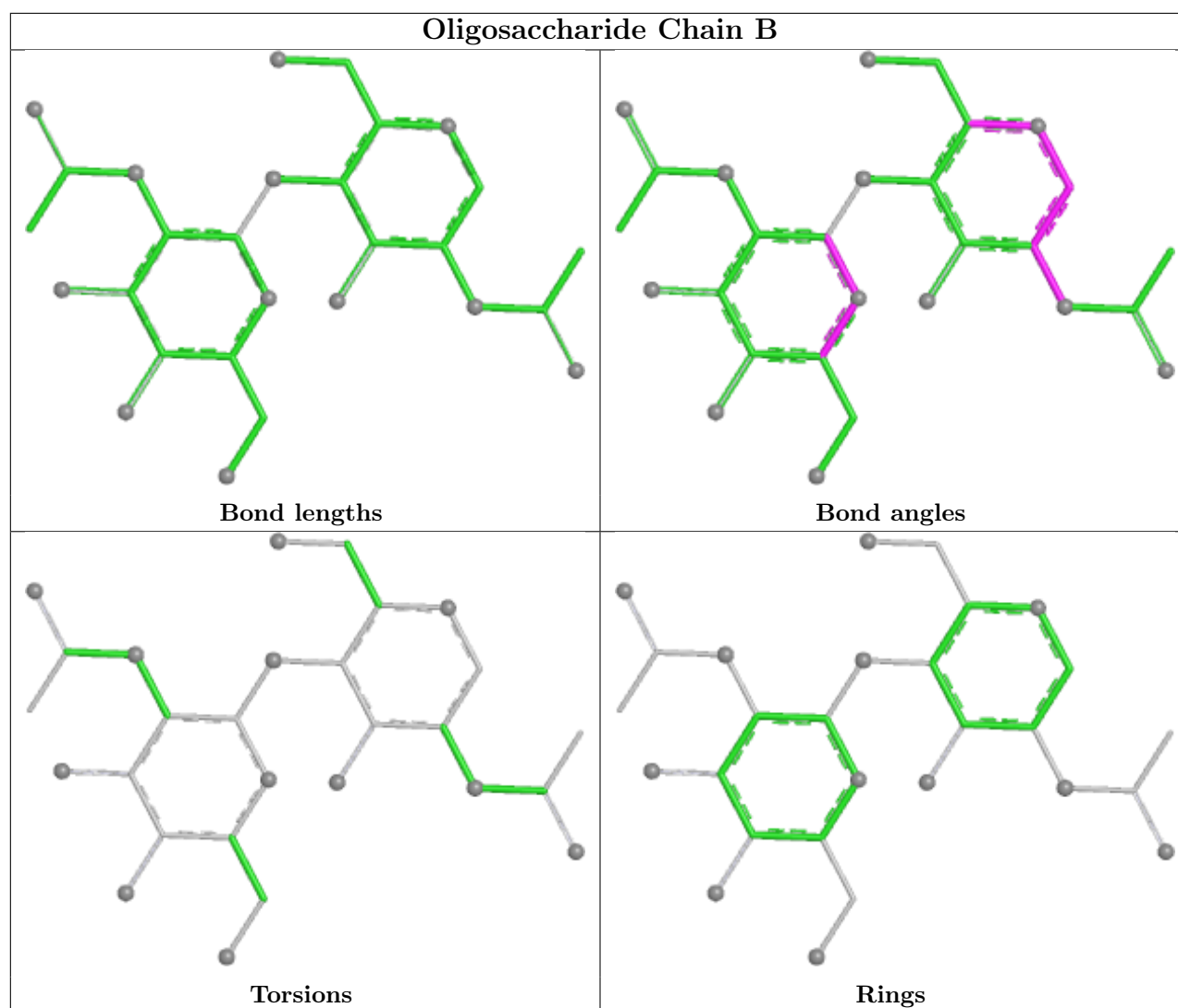
There are no chirality outliers.

There are no torsion outliers.

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](#)

Of 3 ligands modelled in this entry, 2 are monoatomic - leaving 1 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
5	TLA	A	1452	-	9,9,9	1.18	0	12,12,12	1.89	3 (25%)

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
5	TLA	A	1452	-	-	10/12/12/12	-

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	1452	TLA	C2-C3-C4	4.14	119.00	109.82
5	A	1452	TLA	O11-C1-C2	2.66	120.69	113.31
5	A	1452	TLA	O2-C2-C3	2.46	115.18	110.17

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	1452	TLA	O3-C3-C4-O4
5	A	1452	TLA	O3-C3-C4-O41
5	A	1452	TLA	O11-C1-C2-O2
5	A	1452	TLA	O1-C1-C2-O2
5	A	1452	TLA	C2-C3-C4-O4
5	A	1452	TLA	C2-C3-C4-O41
5	A	1452	TLA	C1-C2-C3-C4
5	A	1452	TLA	O11-C1-C2-C3
5	A	1452	TLA	O1-C1-C2-C3
5	A	1452	TLA	O2-C2-C3-O3

There are no ring outliers.

No monomer is involved in short contacts.

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	444/475 (93%)	0.05	5 (1%) 78 73	40, 67, 98, 118	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	90	ALA	2.8
1	A	120	TYR	2.4
1	A	6	ARG	2.2
1	A	29	VAL	2.2
1	A	74	THR	2.0

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

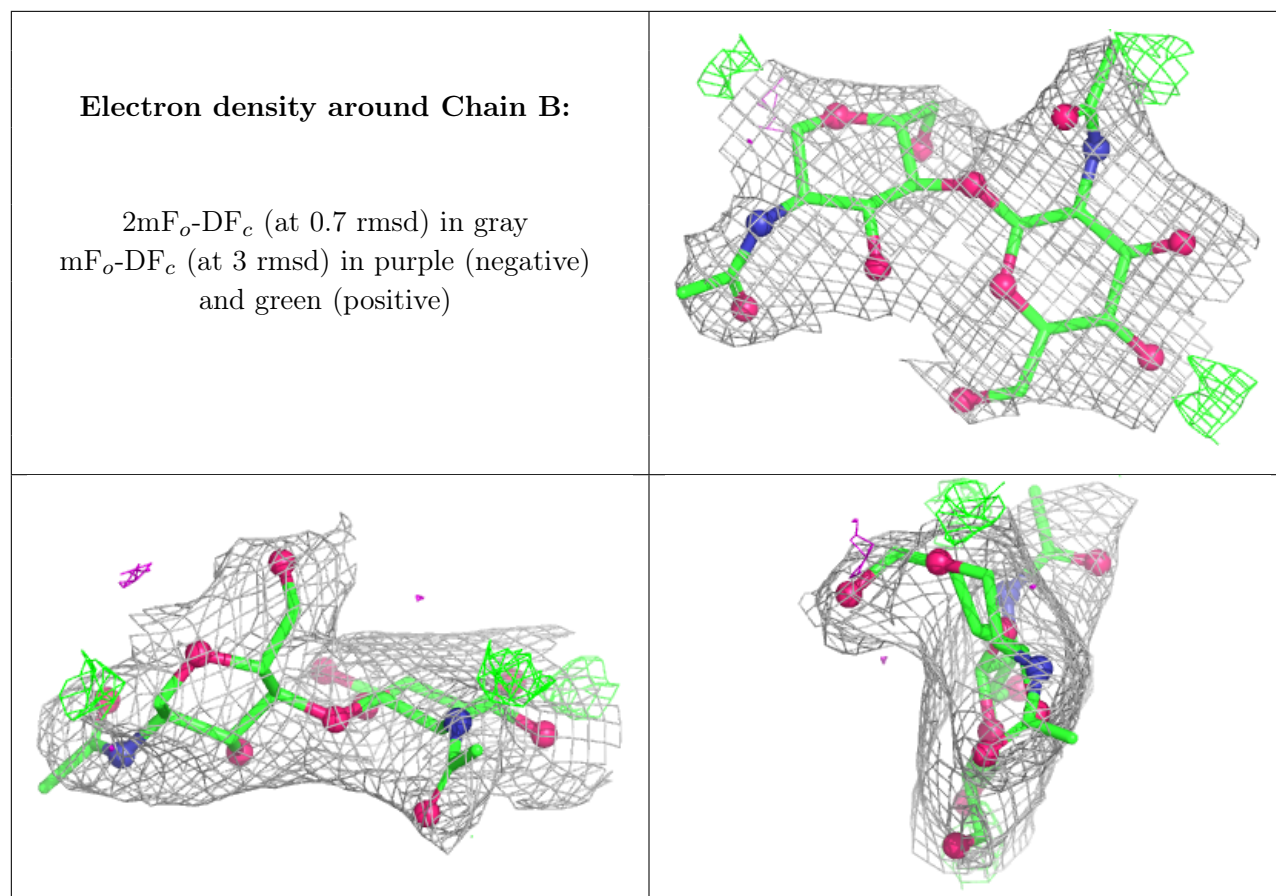
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NAG	B	2	14/15	0.82	0.12	82,86,91,92	0
2	NAG	B	1	14/15	0.93	0.10	85,89,94,94	0

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



6.4 Ligands [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	TLA	A	1452	10/10	0.75	0.19	82,84,87,88	0
4	HG	A	1451	1/1	0.82	0.29	93,93,93,93	1
3	CA	A	1450	1/1	0.98	0.10	90,90,90,90	0

6.5 Other polymers [i](#)

There are no such residues in this entry.