



wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 24, 2024 – 12:15 am GMT

PDB ID : 8R72
Title : Polysaccharide lyase BtPL33HA (BT4410) Y291A with HA dp4 collected at 1.33 Å
Authors : Cartmell, A.
Deposited on : 2023-11-23
Resolution : 2.58 Å (reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.40

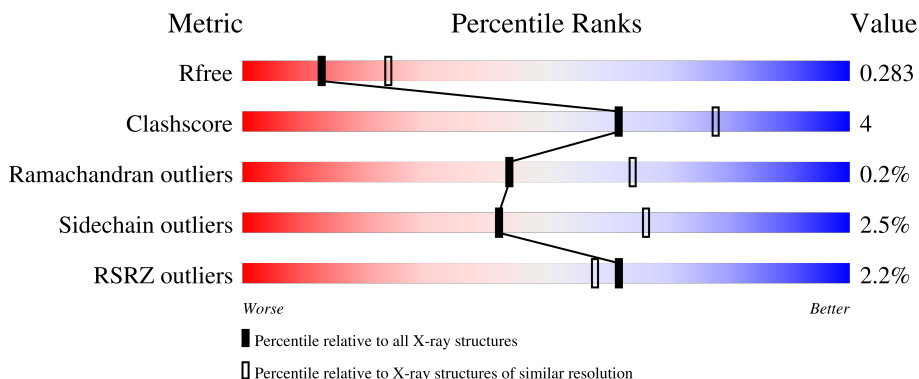
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.58 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	4456 (2.60-2.56)
Clashscore	180529	4905 (2.60-2.56)
Ramachandran outliers	177936	4847 (2.60-2.56)
Sidechain outliers	177891	4847 (2.60-2.56)
RSRZ outliers	164620	4456 (2.60-2.56)

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	644	 84% 11% .
1	B	644	 3% 80% 13% 6%
2	C	4	 100%
2	D	4	 100%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 19635 atoms, of which 9700 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 Heparinase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	616	9810	3153	4856	845	922	34	122	0	0
1	B	606	9637	3098	4770	829	906	34	119	0	0

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	MET	-	initiating methionine	UNP Q89ZG7
A	-6	GLY	-	expression tag	UNP Q89ZG7
A	-5	SER	-	expression tag	UNP Q89ZG7
A	-4	SER	-	expression tag	UNP Q89ZG7
A	-3	HIS	-	expression tag	UNP Q89ZG7
A	-2	HIS	-	expression tag	UNP Q89ZG7
A	-1	HIS	-	expression tag	UNP Q89ZG7
A	0	HIS	-	expression tag	UNP Q89ZG7
A	1	HIS	-	expression tag	UNP Q89ZG7
A	2	HIS	-	expression tag	UNP Q89ZG7
A	3	SER	-	expression tag	UNP Q89ZG7
A	4	SER	-	expression tag	UNP Q89ZG7
A	5	GLY	-	expression tag	UNP Q89ZG7
A	6	LEU	-	expression tag	UNP Q89ZG7
A	7	VAL	-	expression tag	UNP Q89ZG7
A	8	PRO	-	expression tag	UNP Q89ZG7
A	9	ARG	-	expression tag	UNP Q89ZG7
A	10	GLY	-	expression tag	UNP Q89ZG7
A	11	SER	-	expression tag	UNP Q89ZG7
A	12	HIS	-	expression tag	UNP Q89ZG7
A	13	MET	-	expression tag	UNP Q89ZG7
A	14	ALA	-	expression tag	UNP Q89ZG7
A	15	SER	-	expression tag	UNP Q89ZG7
A	283	ALA	TYR	engineered mutation	UNP Q89ZG7
B	-7	MET	-	initiating methionine	UNP Q89ZG7

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-6	GLY	-	expression tag	UNP Q89ZG7
B	-5	SER	-	expression tag	UNP Q89ZG7
B	-4	SER	-	expression tag	UNP Q89ZG7
B	-3	HIS	-	expression tag	UNP Q89ZG7
B	-2	HIS	-	expression tag	UNP Q89ZG7
B	-1	HIS	-	expression tag	UNP Q89ZG7
B	0	HIS	-	expression tag	UNP Q89ZG7
B	1	HIS	-	expression tag	UNP Q89ZG7
B	2	HIS	-	expression tag	UNP Q89ZG7
B	3	SER	-	expression tag	UNP Q89ZG7
B	4	SER	-	expression tag	UNP Q89ZG7
B	5	GLY	-	expression tag	UNP Q89ZG7
B	6	LEU	-	expression tag	UNP Q89ZG7
B	7	VAL	-	expression tag	UNP Q89ZG7
B	8	PRO	-	expression tag	UNP Q89ZG7
B	9	ARG	-	expression tag	UNP Q89ZG7
B	10	GLY	-	expression tag	UNP Q89ZG7
B	11	SER	-	expression tag	UNP Q89ZG7
B	12	HIS	-	expression tag	UNP Q89ZG7
B	13	MET	-	expression tag	UNP Q89ZG7
B	14	ALA	-	expression tag	UNP Q89ZG7
B	15	SER	-	expression tag	UNP Q89ZG7
B	283	ALA	TYR	engineered mutation	UNP Q89ZG7

- Molecule 2 is an oligosaccharide called beta-D-glucopyranuronic acid-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-beta-D-glucopyranuronic acid-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
2	C	4	Total	C	H	N	O	8	0	0
			90	28	37	2	23			
2	D	4	Total	C	H	N	O	8	0	0
			90	28	37	2	23			

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

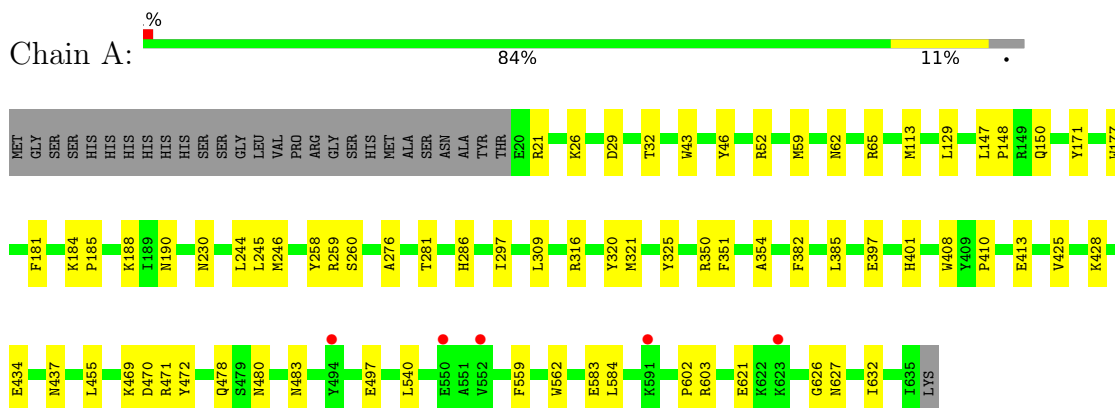
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	3	Total 3	O 3	0	0
4	B	3	Total 3	O 3	0	0

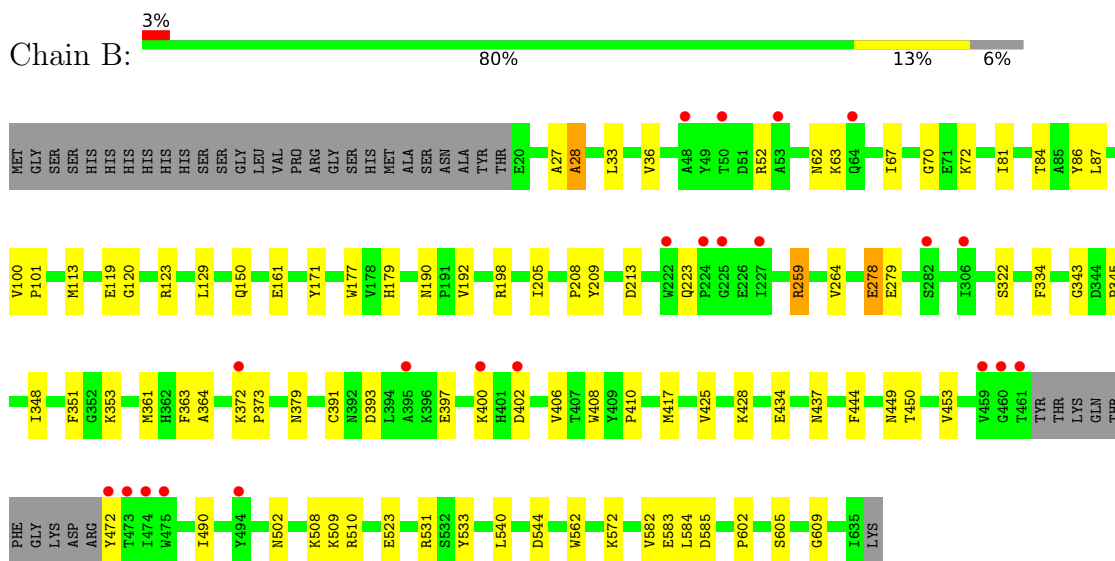
3 Residue-property plots [i](#)

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.

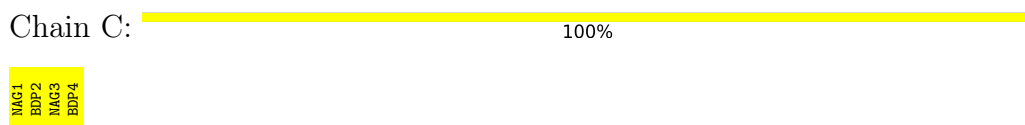
- Molecule 1: Heparinase



- Molecule 1: Heparinase



- Molecule 2: beta-D-glucopyranuronic acid-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-beta-D-glucopyranuronic acid-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 2: beta-D-glucopyranuronic acid-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-beta-D-glucopyranuronic acid-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D:

100%

NAG1
BDF2
NAG3
BDF4

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	53.87Å 137.40Å 203.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	52.13 – 2.58 52.13 – 2.58	Depositor EDS
% Data completeness (in resolution range)	99.9 (52.13-2.58) 99.9 (52.13-2.58)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.71 (at 2.58Å)	Xtrriage
Refinement program	REFMAC 5.8.0415	Depositor
R, R_{free}	0.219 , 0.281 0.220 , 0.283	Depositor DCC
R_{free} test set	2537 reflections (5.22%)	wwPDB-VP
Wilson B-factor (Å ²)	45.8	Xtrriage
Anisotropy	0.519	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 20.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	19635	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.05% 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: NAG, ZN, BDP

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	0.41	0/5075	0.77	0/6869
1	B	0.37	0/4985	0.74	1/6748 (0.0%)
All	All	0.39	0/10060	0.76	1/13617 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	6

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	B	259	ARG	NE-CZ-NH1	5.40	123.00	120.30

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	259	ARG	Sidechain
1	A	316	ARG	Sidechain
1	A	350	ARG	Sidechain
1	A	52	ARG	Sidechain
1	A	65	ARG	Sidechain

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	4954	4856	4847	34	0
1	B	4867	4770	4760	45	0
2	C	53	37	39	0	0
2	D	53	37	39	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	3	0	0	0	0
4	B	3	0	0	0	0
All	All	9935	9700	9685	79	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.

The worst 5 of 79 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:113:MET:CE	1:A:177:TRP:HB3	2.14	0.77
1:A:113:MET:HE3	1:A:177:TRP:HB3	1.69	0.73
1:B:113:MET:HE1	1:B:177:TRP:HB3	1.76	0.68
1:B:113:MET:CE	1:B:177:TRP:HB3	2.25	0.67
1:A:230:ASN:HB2	1:A:286:HIS:O	2.01	0.61

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	614/644 (95%)	584 (95%)	29 (5%)	1 (0%)	44 64
1	B	602/644 (94%)	567 (94%)	34 (6%)	1 (0%)	44 64
All	All	1216/1288 (94%)	1151 (95%)	63 (5%)	2 (0%)	44 64

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	621	GLU
1	B	28	ALA

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	528/551 (96%)	516 (98%)	12 (2%)	45 69
1	B	519/551 (94%)	505 (97%)	14 (3%)	40 64
All	All	1047/1102 (95%)	1021 (98%)	26 (2%)	42 66

5 of 26 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	171	TYR
1	B	279	GLU
1	B	562	TRP
1	B	278	GLU
1	B	351	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	574	GLN
1	A	627	ASN
1	B	436	HIS
1	B	328	ASN

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Mol	Chain	Res	Type
1	A	502	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](#)

8 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	15,15,15	0.80	0	21,21,21	1.41	2 (9%)
2	BDP	C	2	2	12,12,13	1.04	0	14,17,19	1.57	2 (14%)
2	NAG	C	3	2	14,14,15	2.53	2 (14%)	17,19,21	2.46	8 (47%)
2	BDP	C	4	2	12,12,13	0.77	0	14,17,19	1.45	1 (7%)
2	NAG	D	1	2	15,15,15	0.67	0	21,21,21	1.34	2 (9%)
2	BDP	D	2	2	12,12,13	1.03	0	14,17,19	1.52	3 (21%)
2	NAG	D	3	2	14,14,15	2.59	3 (21%)	17,19,21	3.07	8 (47%)
2	BDP	D	4	2	12,12,13	1.31	1 (8%)	14,17,19	2.27	6 (42%)

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	-	2/6/26/26	0/1/1/1
2	BDP	C	2	2	-	0/4/21/24	0/1/1/1
2	NAG	C	3	2	-	4/6/23/26	0/1/1/1
2	BDP	C	4	2	-	2/4/21/24	0/1/1/1
2	NAG	D	1	2	-	2/6/26/26	0/1/1/1
2	BDP	D	2	2	-	2/4/21/24	0/1/1/1
2	NAG	D	3	2	-	4/6/23/26	0/1/1/1
2	BDP	D	4	2	-	0/4/21/24	0/1/1/1

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	3	NAG	C8-C7	-7.63	1.34	1.50
2	C	3	NAG	C8-C7	-7.52	1.34	1.50
2	C	3	NAG	O7-C7	4.61	1.33	1.23
2	D	3	NAG	O7-C7	4.17	1.32	1.23
2	D	4	BDP	C4-C5	2.35	1.57	1.53

The worst 5 of 32 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	4	BDP	O5-C1-C2	-5.26	102.65	110.77
2	D	3	NAG	C1-C2-N2	-5.21	101.58	110.49
2	D	3	NAG	C3-C4-C5	5.20	119.52	110.24
2	D	3	NAG	C8-C7-N2	5.12	124.76	116.10
2	D	3	NAG	O7-C7-N2	-4.82	113.08	121.95

There are no chirality outliers.

5 of 16 torsion outliers are listed below:

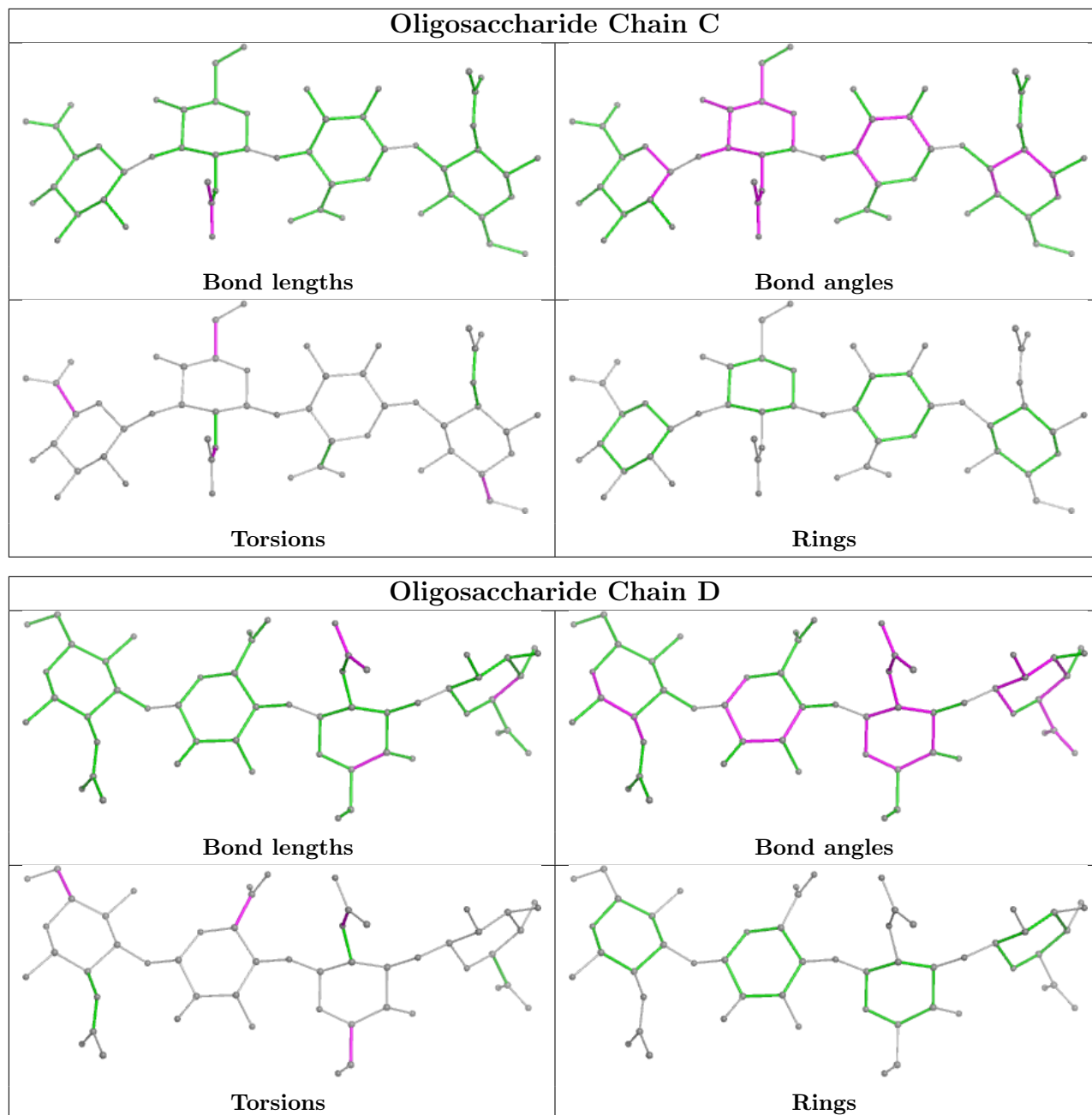
Mol	Chain	Res	Type	Atoms
2	C	4	BDP	C4-C5-C6-O6A
2	C	4	BDP	C4-C5-C6-O6B
2	C	3	NAG	O5-C5-C6-O6
2	D	1	NAG	O5-C5-C6-O6
2	C	3	NAG	C4-C5-C6-O6

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](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	616/644 (95%)	-0.19	5 (0%) 82 80	23, 39, 67, 98	0
1	B	606/644 (94%)	0.32	22 (3%) 46 42	29, 51, 78, 128	0
All	All	1222/1288 (94%)	0.06	27 (2%) 62 58	23, 45, 75, 128	0

The worst 5 of 27 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	222	TRP	4.2
1	B	473	THR	3.9
1	B	459	VAL	3.5
1	B	472	TYR	3.5
1	B	372	LYS	3.2

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.

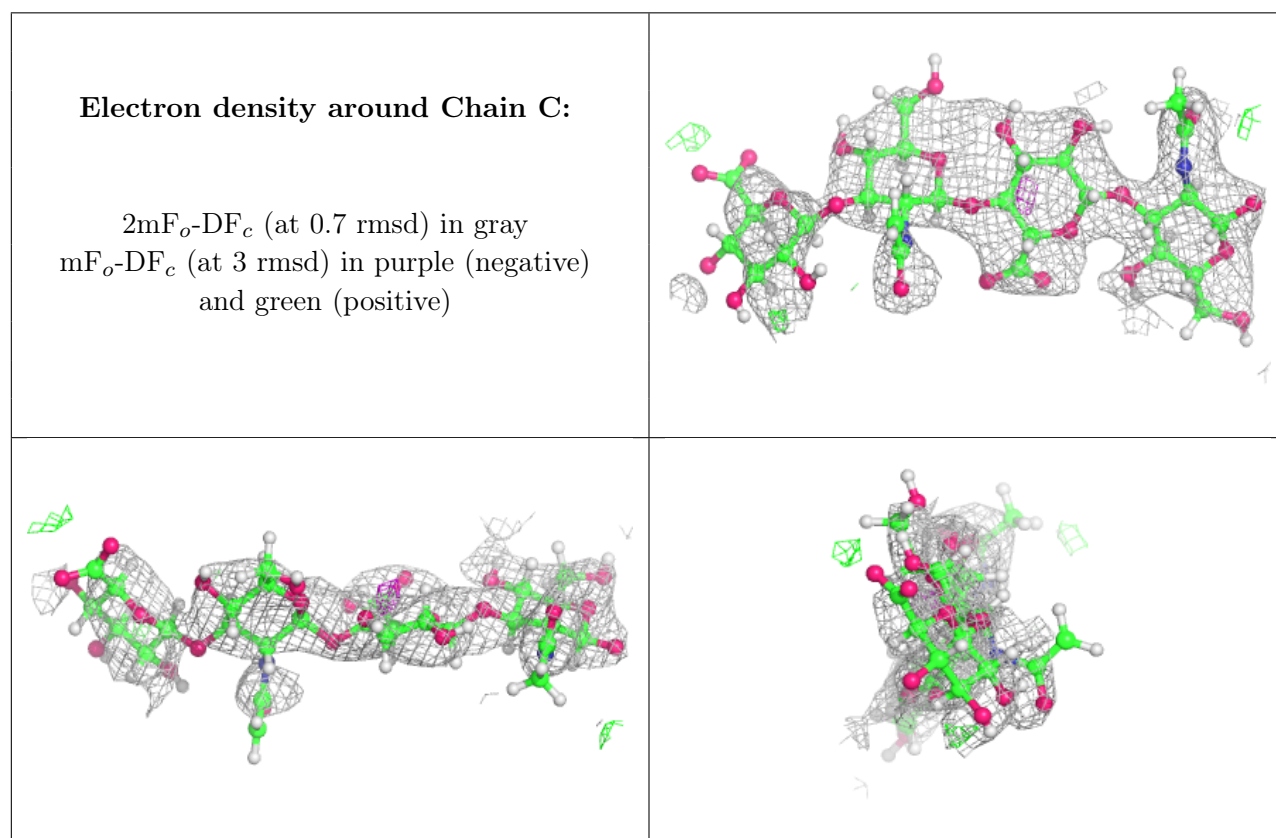
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	BDP	C	4	12/13	0.50	0.19	90,108,116,118	2
2	BDP	D	4	12/13	0.64	0.21	70,92,100,100	2
2	NAG	C	3	14/15	0.72	0.18	64,79,99,108	2
2	NAG	D	3	14/15	0.75	0.17	58,68,82,85	2
2	BDP	C	2	12/13	0.84	0.13	53,67,82,83	2

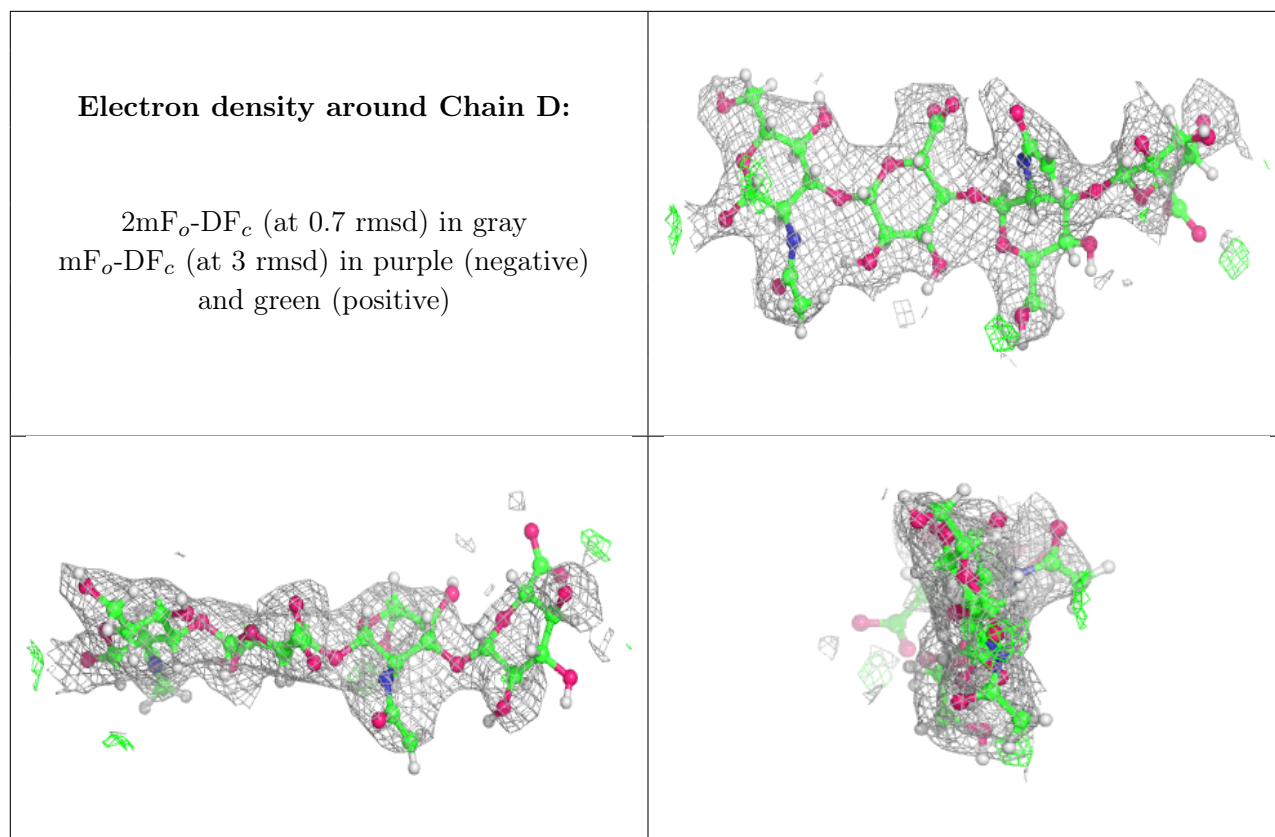
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	NAG	C	1	15/15	0.86	0.13	62,70,73,74	2
2	BDP	D	2	12/13	0.91	0.09	39,53,59,61	2
2	NAG	D	1	15/15	0.93	0.08	45,54,56,59	2

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





6.4 Ligands [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	ZN	B	701	1/1	0.99	0.02	45,45,45,45	0
3	ZN	A	701	1/1	1.00	0.02	45,45,45,45	0

6.5 Other polymers [i](#)

There are no such residues in this entry.