



wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 2, 2025 – 12:44 am BST

PDB ID : 1E4O / pdb_00001e4o
Title : Phosphorylase recognition and phosphorolysis of its oligosaccharide substrate:
answers to a long outstanding question
Authors : Watson, K.A.; McCleverty, C.; Geremia, S.; Cottaz, S.; Driguez, H.; Johnson,
L.N.
Deposited on : 2000-07-11
Resolution : 2.90 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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.42

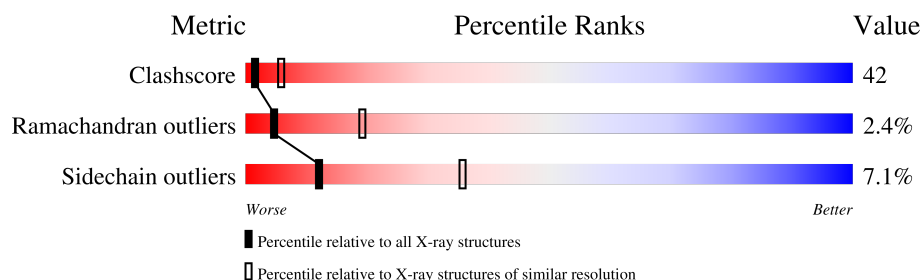
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	180529	2564 (2.90-2.90)
Ramachandran outliers	177936	2514 (2.90-2.90)
Sidechain outliers	177891	2516 (2.90-2.90)

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	796	<div> <div>38%</div> <div>57%</div> <div>6%</div> </div>
1	B	796	<div> <div>37%</div> <div>57%</div> <div>6%</div> </div>
2	C	5	<div> <div>40%</div> <div>40%</div> <div>20%</div> </div>
2	D	5	<div> <div>40%</div> <div>40%</div> <div>20%</div> </div>

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 13251 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.

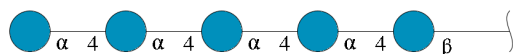
- Molecule 1 is a protein called MALTODEXTRIN PHOSPHORYLASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	796	Total	C	N	O	S	0	0	0
			6378	4068	1127	1163	20			
1	B	796	Total	C	N	O	S	0	0	0
			6378	4068	1127	1163	20			

There are 16 discrepancies between the modelled and reference sequences:

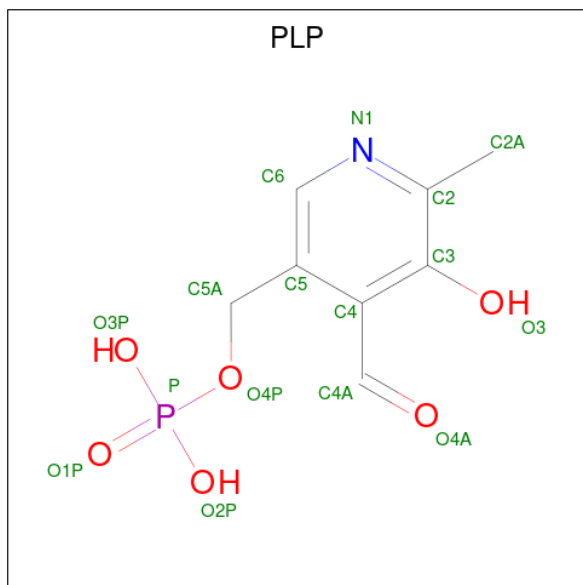
Chain	Residue	Modelled	Actual	Comment	Reference
A	293	LYS	GLU	conflict	UNP P00490
A	487	GLU	VAL	conflict	UNP P00490
A	489	PHE	LEU	conflict	UNP P00490
A	498	GLN	LEU	conflict	UNP P00490
A	501	GLU	VAL	conflict	UNP P00490
A	521	GLU	ASP	conflict	UNP P00490
A	547	HIS	ARG	conflict	UNP P00490
A	681	GLU	LYS	conflict	UNP P00490
B	293	LYS	GLU	conflict	UNP P00490
B	487	GLU	VAL	conflict	UNP P00490
B	489	PHE	LEU	conflict	UNP P00490
B	498	GLN	LEU	conflict	UNP P00490
B	501	GLU	VAL	conflict	UNP P00490
B	521	GLU	ASP	conflict	UNP P00490
B	547	HIS	ARG	conflict	UNP P00490
B	681	GLU	LYS	conflict	UNP P00490

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



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	C	5	Total	C	O	0	0	0
			56	30	26			
2	D	5	Total	C	O	0	0	0
			56	30	26			

- Molecule 3 is PYRIDOXAL-5'-PHOSPHATE (CCD ID: PLP) (formula: $C_8H_{10}NO_6P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
3	B	1	Total	C	N	O	P	0	0
			15	8	1	5	1		

- Molecule 4 is water.

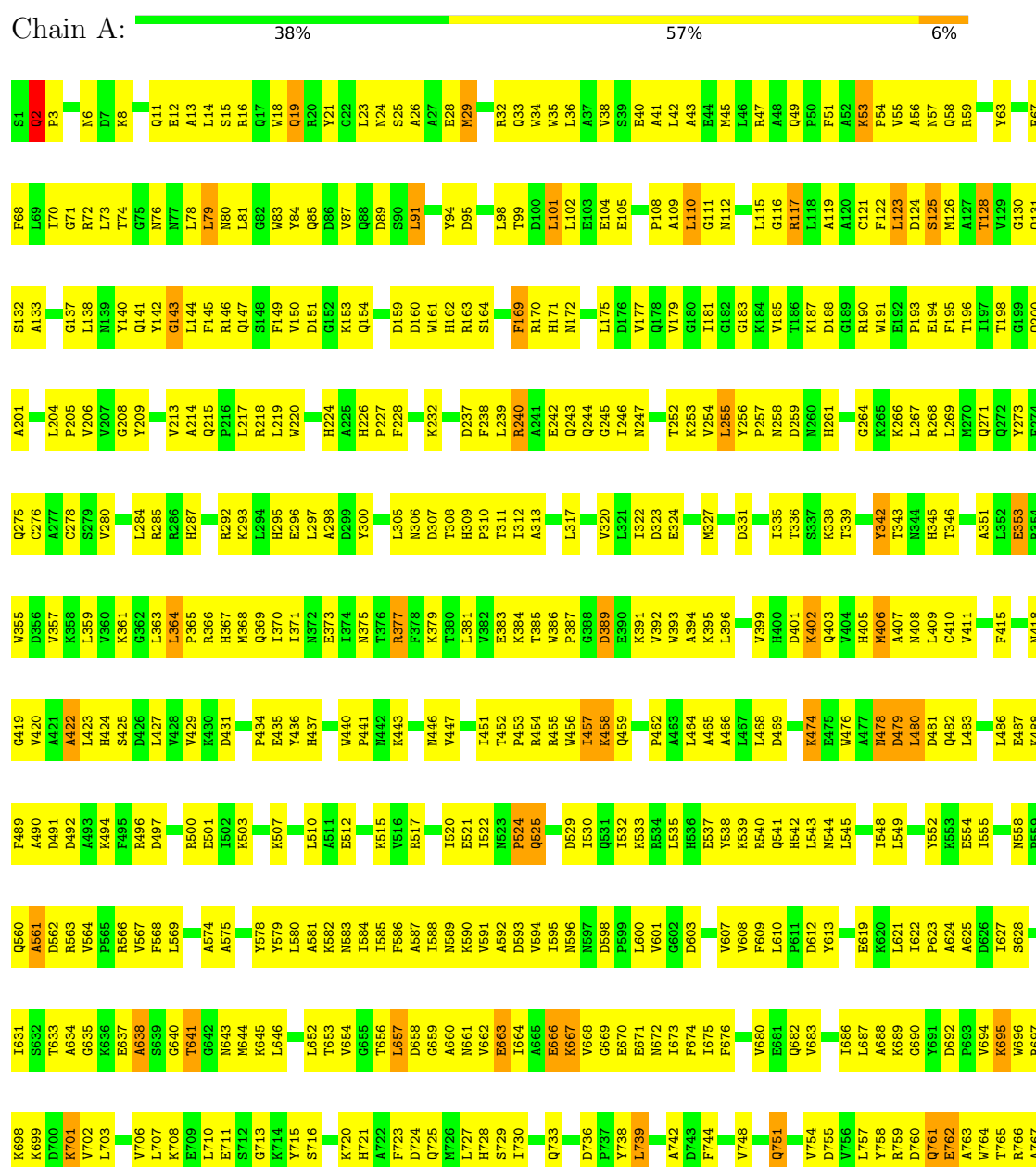
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	167	Total	O	0	0
			167	167		
4	B	186	Total	O	0	0
			186	186		

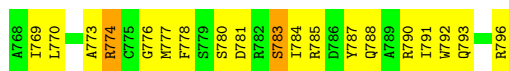
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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.

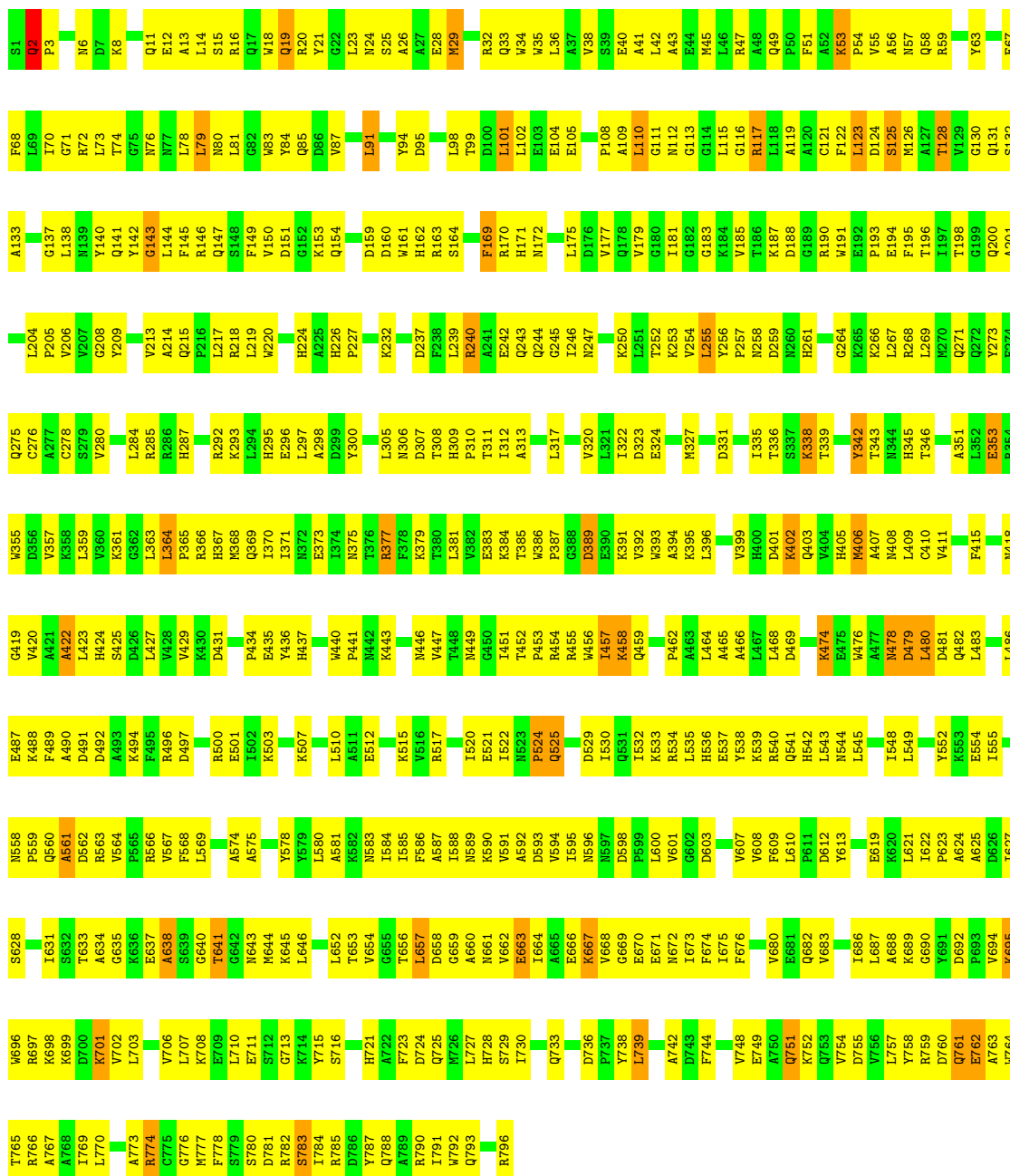
• Molecule 1: MALTODEXTRIN PHOSPHORYLASE





• Molecule 1: MALTODEXTRIN PHOSPHORYLASE

Chain B: 37% 57% 6%



• Molecule 2: alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-beta-D-glucopyranose

Chain C: 40% 40% 20%



- Molecule 2: alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-alpha-D-glucopyranose-(1-4)-beta-D-glucopyranose

Chain D: 40% 40% 20%



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	74.45Å 105.69Å 214.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.90	Depositor
% Data completeness (in resolution range)	77.2 (50.00-2.90)	Depositor
R_{merge}	0.18	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.5	Depositor
R, R_{free}	0.245 , 0.306	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	13251	wwPDB-VP
Average B, all atoms (Å ²)	47.0	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: BGC, PLP, GLC

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.41	0/6528	0.63	0/8853
1	B	0.41	0/6528	0.63	0/8853
All	All	0.41	0/13056	0.63	0/17706

There are no bond length outliers.

There are no bond angle outliers.

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	6378	0	6306	531	6
1	B	6378	0	6306	541	5
2	C	56	0	48	6	0
2	D	56	0	48	7	0
3	A	15	0	7	1	0
3	B	15	0	7	1	0
4	A	167	0	0	33	0
4	B	186	0	0	35	0
All	All	13251	0	12722	1064	6

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 42.

The worst 5 of 1064 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:715:TYR:N	4:A:2151:HOH:O	1.70	1.23
1:B:715:TYR:N	4:B:2164:HOH:O	1.70	1.23
1:B:338:LYS:HD3	4:B:2106:HOH:O	1.08	1.21
1:B:300:TYR:CE1	4:B:2096:HOH:O	1.99	1.14
1:A:300:TYR:CE1	4:A:2088:HOH:O	1.99	1.13

The worst 5 of 6 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:774:ARG:NH1	1:B:701:LYS:CE[2_555]	1.71	0.49
1:A:95:ASP:OD2	1:B:261:HIS:CB[3_555]	1.73	0.47
1:A:774:ARG:NH2	1:B:701:LYS:NZ[2_555]	1.79	0.41
1:A:774:ARG:CZ	1:B:701:LYS:NZ[2_555]	1.87	0.33
1:A:331:ASP:OD2	1:A:720:LYS:NZ[1_655]	2.09	0.11

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	794/796 (100%)	654 (82%)	121 (15%)	19 (2%)	5	19
1	B	794/796 (100%)	654 (82%)	121 (15%)	19 (2%)	5	19
All	All	1588/1592 (100%)	1308 (82%)	242 (15%)	38 (2%)	5	19

5 of 38 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	2	GLN
1	A	389	ASP

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Mol	Chain	Res	Type
1	A	402	LYS
1	A	457	ILE
1	A	479	ASP

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	665/667 (100%)	618 (93%)	47 (7%)	12	36
1	B	665/667 (100%)	618 (93%)	47 (7%)	12	36
All	All	1330/1334 (100%)	1236 (93%)	94 (7%)	12	36

5 of 94 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	110	LEU
1	B	364	LEU
1	B	117	ARG
1	B	198	THR
1	B	517	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 69 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	478	ASN
1	B	525	GLN
1	B	728	HIS
1	A	525	GLN
1	A	504	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

10 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	BGC	C	1	2	12,12,12	0.46	0	17,17,17	0.65	0
2	GLC	C	2	2	11,11,12	0.52	0	15,15,17	0.56	0
2	GLC	C	3	2	11,11,12	0.49	0	15,15,17	0.58	0
2	GLC	C	4	2	11,11,12	0.67	0	15,15,17	0.74	0
2	GLC	C	5	2	11,11,12	0.50	0	15,15,17	1.02	2 (13%)
2	BGC	D	1	2	12,12,12	0.46	0	17,17,17	0.65	0
2	GLC	D	2	2	11,11,12	0.51	0	15,15,17	0.56	0
2	GLC	D	3	2	11,11,12	0.50	0	15,15,17	0.57	0
2	GLC	D	4	2	11,11,12	0.67	0	15,15,17	0.74	0
2	GLC	D	5	2	11,11,12	0.49	0	15,15,17	1.02	2 (13%)

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	BGC	C	1	2	-	1/2/22/22	0/1/1/1
2	GLC	C	2	2	-	0/2/19/22	0/1/1/1
2	GLC	C	3	2	-	0/2/19/22	0/1/1/1
2	GLC	C	4	2	-	0/2/19/22	0/1/1/1
2	GLC	C	5	2	-	0/2/19/22	0/1/1/1
2	BGC	D	1	2	-	1/2/22/22	0/1/1/1
2	GLC	D	2	2	-	0/2/19/22	0/1/1/1
2	GLC	D	3	2	-	0/2/19/22	0/1/1/1
2	GLC	D	4	2	-	0/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GLC	D	5	2	-	0/2/19/22	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	D	5	GLC	C1-C2-C3	2.68	112.96	109.67
2	C	5	GLC	C1-C2-C3	2.66	112.94	109.67
2	C	5	GLC	C1-O5-C5	2.43	115.49	112.19
2	D	5	GLC	C1-O5-C5	2.41	115.46	112.19

There are no chirality outliers.

All (2) torsion outliers are listed below:

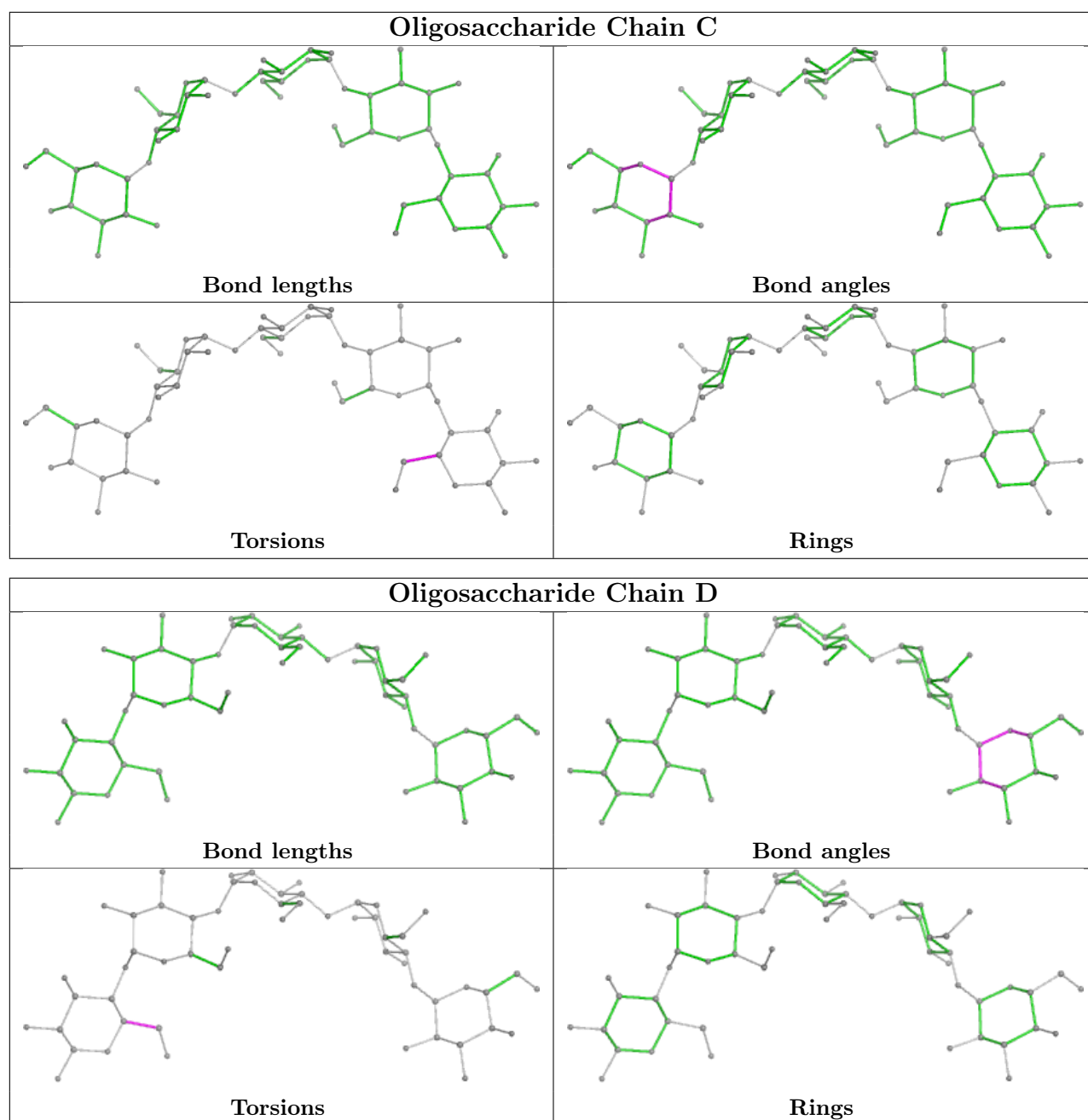
Mol	Chain	Res	Type	Atoms
2	C	1	BGC	O5-C5-C6-O6
2	D	1	BGC	O5-C5-C6-O6

There are no ring outliers.

6 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	3	GLC	1	0
2	C	4	GLC	2	0
2	D	5	GLC	4	0
2	C	5	GLC	3	0
2	D	3	GLC	1	0
2	D	4	GLC	2	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](#)

2 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	PLP	B	999	1	15,15,16	2.66	6 (40%)	20,22,23	2.03	9 (45%)
3	PLP	A	999	1	15,15,16	2.66	6 (40%)	20,22,23	2.03	9 (45%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	PLP	B	999	1	-	1/6/6/8	0/1/1/1
3	PLP	A	999	1	-	1/6/6/8	0/1/1/1

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	999	PLP	P-O1P	5.49	1.68	1.50
3	A	999	PLP	P-O1P	5.49	1.68	1.50
3	A	999	PLP	P-O4P	-4.17	1.46	1.60
3	B	999	PLP	P-O4P	-4.16	1.46	1.60
3	B	999	PLP	C2-N1	3.97	1.41	1.33

The worst 5 of 18 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	999	PLP	C5-C6-N1	-3.61	117.80	123.82
3	A	999	PLP	C5-C6-N1	-3.60	117.82	123.82
3	A	999	PLP	C4A-C4-C3	-3.37	114.79	120.50
3	B	999	PLP	C4A-C4-C3	-3.37	114.79	120.50
3	A	999	PLP	C5A-C5-C6	-3.24	114.05	119.37

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	999	PLP	C4-C5-C5A-O4P
3	B	999	PLP	C4-C5-C5A-O4P

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	999	PLP	1	0
3	A	999	PLP	1	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.