



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 08:34 AM UTC

PDB ID : 6B0J / pdb_00006b0j
Title : Crystal structure of Ps i-CgsB in complex with k-i-k-neocarrahexaose
Authors : Hettle, A.G.; Boraston, A.B.
Deposited on : 2017-09-14
Resolution : 2.50 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
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
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

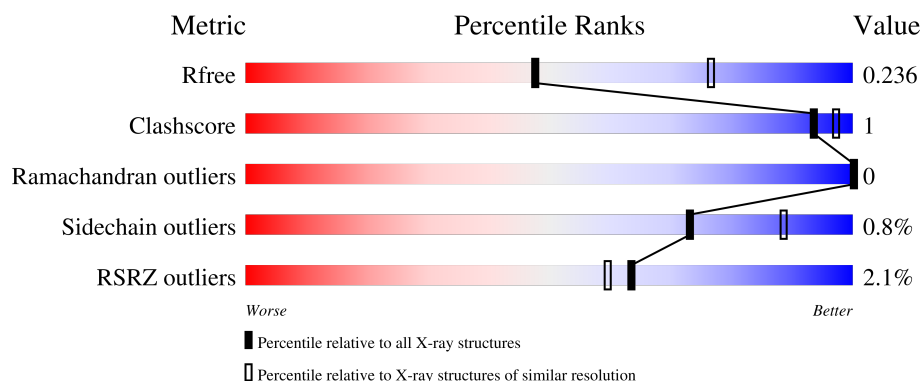
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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.



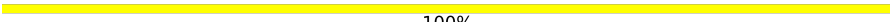
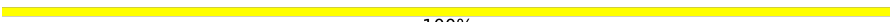
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	452	2% 95% 5%
1	B	452	3% 96% .
1	C	452	% 95% 5%
2	D	3	100%
2	F	3	100%

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Mol	Chain	Length	Quality of chain
2	G	3	 100%
2	H	3	 100%
3	E	2	 100%

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 11252 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 Iota-carrageenan sulfatase.

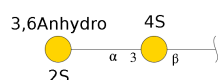
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	452	Total	C	N	O	S	0	0	0
			3529	2263	603	651	12			
1	B	451	Total	C	N	O	S	0	1	0
			3560	2285	611	652	12			
1	C	451	Total	C	N	O	S	0	1	0
			3548	2274	610	652	12			

- Molecule 2 is an oligosaccharide called 4-O-sulfo-beta-D-galactopyranose-(1-4)-3,6-anhydro-2-O-sulfo-alpha-D-galactopyranose-(1-3)-4-O-sulfo-beta-D-galactopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	D	3	Total	C	O	S	0	0	0
			44	18	23	3			
2	F	3	Total	C	O	S	0	0	0
			44	18	23	3			
2	G	3	Total	C	O	S	0	0	0
			44	18	23	3			
2	H	3	Total	C	O	S	0	0	0
			44	18	23	3			

- Molecule 3 is an oligosaccharide called 3,6-anhydro-2-O-sulfo-alpha-D-galactopyranose-(1-3)-4-O-sulfo-beta-D-galactopyranose.

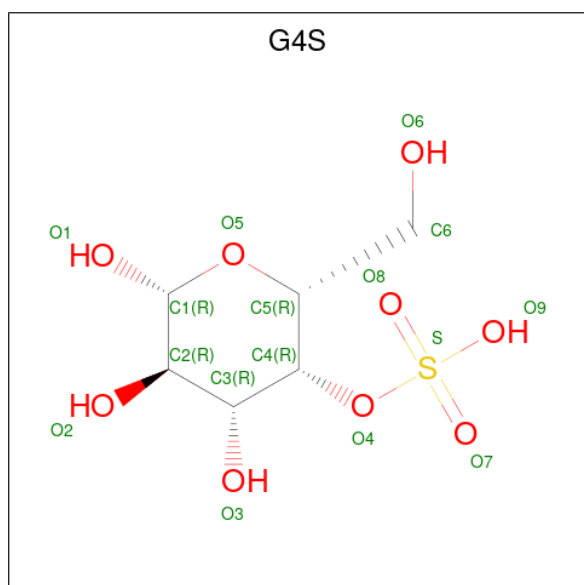


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	E	2	Total	C	O	S	0	0	0
			30	12	16	2			

- Molecule 4 is CALCIUM ION (CCD ID: CA) (formula: Ca).

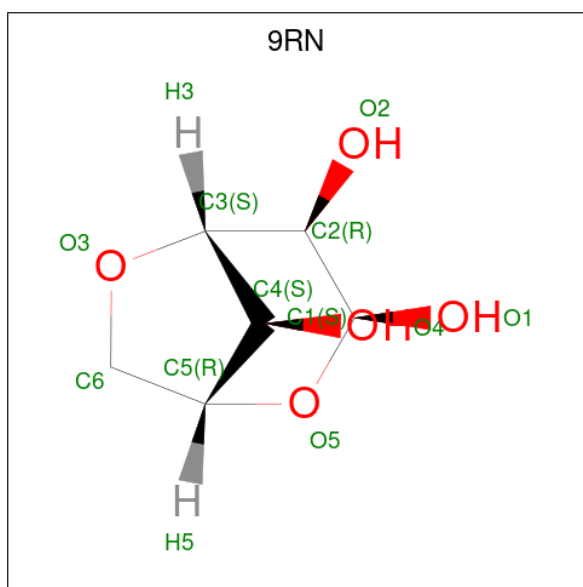
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Ca	0	0
			1	1		
4	B	1	Total	Ca	0	0
			1	1		
4	C	1	Total	Ca	0	0
			1	1		

- Molecule 5 is 4-O-sulfo-beta-D-galactopyranose (CCD ID: G4S) (formula: C₆H₁₂O₉S).



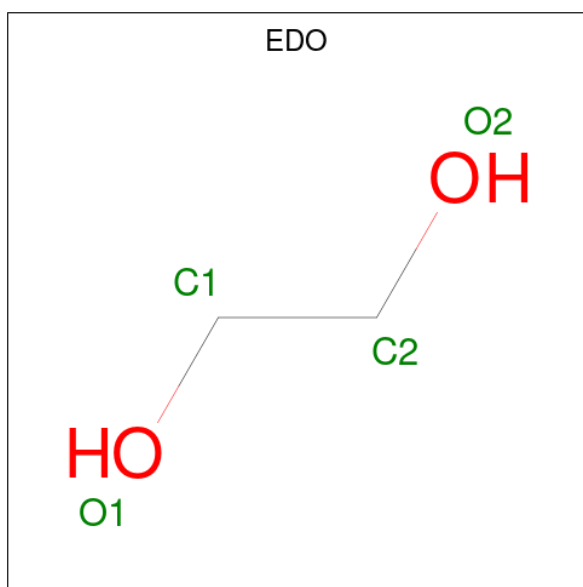
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	O	S	0	0
			16	6	9	1		
5	B	1	Total	C	O	S	0	0
			16	6	9	1		
5	C	1	Total	C	O	S	0	0
			16	6	9	1		

- Molecule 6 is 3,6-anhydro-D-galactose (CCD ID: 9RN) (formula: C₆H₁₀O₅).



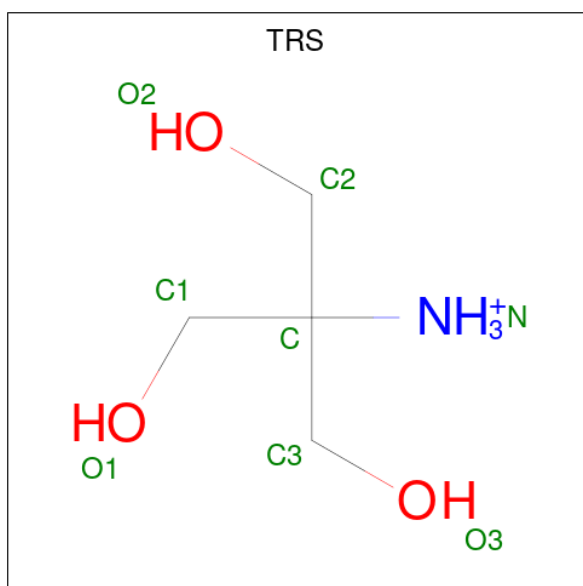
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			10	6	4		
6	A	1	Total	C	O	0	0
			10	6	4		
6	B	1	Total	C	O	0	0
			10	6	4		
6	B	1	Total	C	O	0	0
			10	6	4		
6	B	1	Total	C	O	0	0
			11	6	5		
6	C	1	Total	C	O	0	0
			10	6	4		
6	C	1	Total	C	O	0	0
			10	6	4		

- Molecule 7 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			4	2	2		
7	C	1	Total	C	O	0	0
			4	2	2		

- Molecule 8 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: $C_4H_{12}NO_3$).



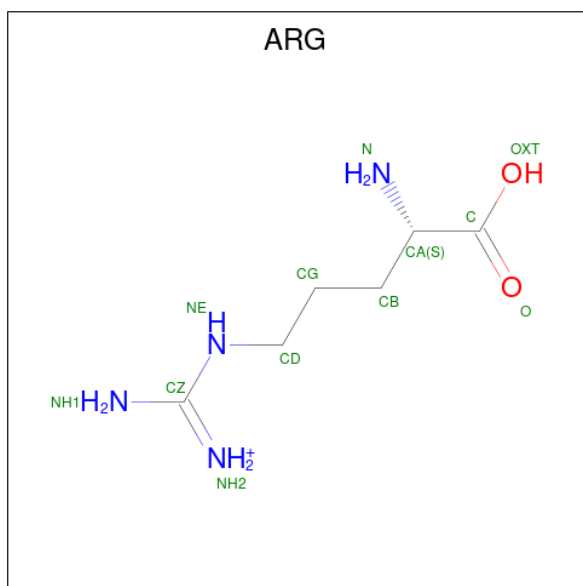
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	A	1	Total	C	N	O	0	0
			8	4	1	3		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	B	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 9 is ARGinine (CCD ID: ARG) (formula: $C_6H_{15}N_4O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
9	A	1	Total	C	N	O	0	0
			12	6	4	2		
9	C	1	Total	C	N	O	0	0
			12	6	4	2		

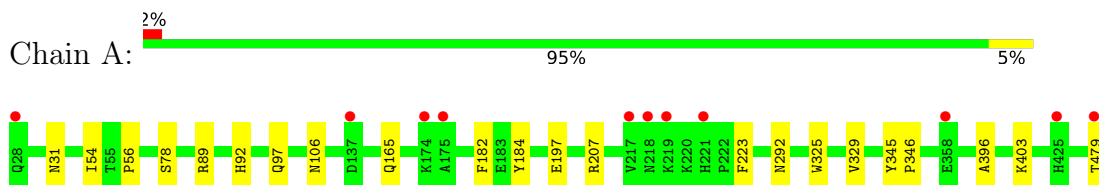
- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	69	Total	O	0	0
			69	69		
10	B	76	Total	O	0	0
			76	76		
10	C	94	Total	O	0	0
			94	94		

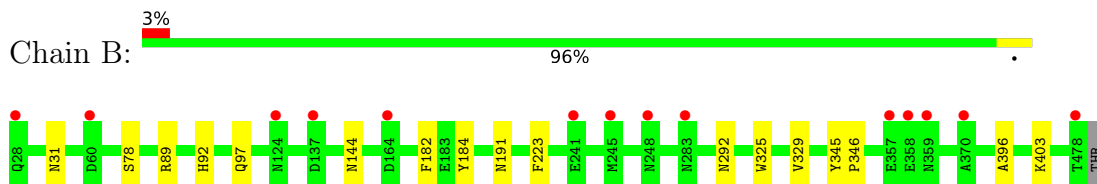
3 Residue-property plots [i](#)

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.

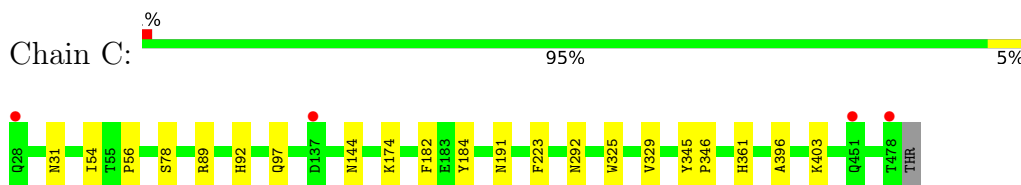
- Molecule 1: Iota-carrageenan sulfatase



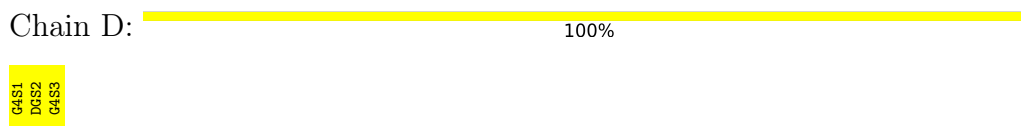
- Molecule 1: Iota-carrageenan sulfatase



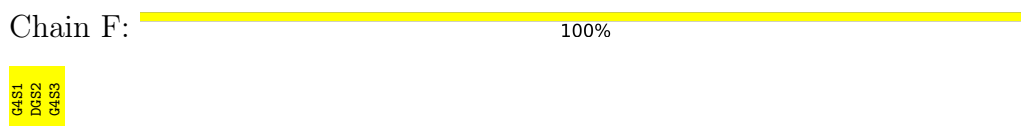
- Molecule 1: Iota-carrageenan sulfatase



- Molecule 2: 4-O-sulfo-beta-D-galactopyranose-(1-4)-3,6-anhydro-2-O-sulfo-alpha-D-galactopyranose-(1-3)-4-O-sulfo-beta-D-galactopyranose



- Molecule 2: 4-O-sulfo-beta-D-galactopyranose-(1-4)-3,6-anhydro-2-O-sulfo-alpha-D-galactopyranose-(1-3)-4-O-sulfo-beta-D-galactopyranose



- Molecule 2: 4-O-sulfo-beta-D-galactopyranose-(1-4)-3,6-anhydro-2-O-sulfo-alpha-D-galactopyranose-(1-3)-4-O-sulfo-beta-D-galactopyranose

Chain G:  100%

G4S1
D6S2
G4S3

- Molecule 2: 4-O-sulfo-beta-D-galactopyranose-(1-4)-3,6-anhydro-2-O-sulfo-alpha-D-galactopyranose-(1-3)-4-O-sulfo-beta-D-galactopyranose

Chain H:  100%

G4S1
D6S2
G4S3

- Molecule 3: 3,6-anhydro-2-O-sulfo-alpha-D-galactopyranose-(1-3)-4-O-sulfo-beta-D-galactopyranose

Chain E:  100%

G4S1
D6S2

4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	123.39Å 123.39Å 240.11Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	109.75 – 2.50 109.75 – 2.50	Depositor EDS
% Data completeness (in resolution range)	97.2 (109.75-2.50) 97.2 (109.75-2.50)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.26 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.8.0158	Depositor
R, R_{free}	0.214 , 0.234 0.219 , 0.236	Depositor DCC
R_{free} test set	3136 reflections (4.83%)	wwPDB-VP
Wilson B-factor (Å ²)	29.4	Xtriage
Anisotropy	0.042	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 30.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	11252	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.74% 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: CA, TRS, EDO, 9RN, G4S, DGS

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	0.58	0/3635	0.78	1/4942 (0.0%)
1	B	0.58	0/3669	0.79	1/4979 (0.0%)
1	C	0.59	0/3657	0.79	1/4964 (0.0%)
All	All	0.59	0/10961	0.79	3/14885 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	78	SER	N-CA-C	8.00	119.69	110.97
1	C	78	SER	N-CA-C	7.79	119.46	110.97
1	B	78	SER	N-CA-C	7.75	119.42	110.97

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	3529	0	3277	10	0
1	B	3560	0	3350	8	0
1	C	3548	0	3335	11	0
2	D	44	0	22	0	0
2	F	44	0	23	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	G	44	0	24	0	0
2	H	44	0	24	0	0
3	E	30	0	18	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
5	A	16	0	11	0	0
5	B	16	0	10	0	0
5	C	16	0	10	0	0
6	A	20	0	0	0	0
6	B	31	0	0	0	0
6	C	20	0	0	0	0
7	A	4	0	6	0	0
7	C	4	0	6	0	0
8	A	8	0	12	0	0
8	B	8	0	12	0	0
9	A	12	0	12	0	0
9	C	12	0	12	0	0
10	A	69	0	0	0	0
10	B	76	0	0	0	0
10	C	94	0	0	1	0
All	All	11252	0	10164	29	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 1.

All (29) 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:C:144:ASN:HD21	1:C:191:ASN:HA	1.68	0.59
1:B:144:ASN:HD21	1:B:191:ASN:HA	1.67	0.59
1:C:174:LYS:CD	10:C:690:HOH:O	2.51	0.59
1:B:396:ALA:HB1	1:B:403:LYS:HE3	1.89	0.54
1:A:396:ALA:HB1	1:A:403:LYS:HE3	1.89	0.52
1:C:54:ILE:HG22	1:C:56:PRO:HD3	1.91	0.52
1:C:396:ALA:HB1	1:C:403:LYS:HE3	1.91	0.51
1:A:54:ILE:HG22	1:A:56:PRO:HD3	1.92	0.51
1:A:31:ASN:HD22	1:A:223:PHE:H	1.62	0.47
1:C:92:HIS:HA	1:C:97:GLN:HG3	1.96	0.47
1:B:31:ASN:HD22	1:B:223:PHE:H	1.61	0.47
1:A:197:GLU:OE2	1:A:207:ARG:NH2	2.46	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:31:ASN:HD22	1:C:223:PHE:H	1.62	0.46
1:B:92:HIS:HA	1:B:97:GLN:HG3	1.97	0.46
1:A:197:GLU:CD	1:A:207:ARG:HH22	2.24	0.45
1:C:182:PHE:CE2	1:C:184:TYR:HB2	2.51	0.45
1:B:182:PHE:CE2	1:B:184:TYR:HB2	2.51	0.45
1:A:92:HIS:HA	1:A:97:GLN:HG3	1.99	0.45
1:A:182:PHE:CE2	1:A:184:TYR:HB2	2.51	0.44
1:C:345:TYR:HB3	1:C:346:PRO:HD3	2.00	0.44
1:C:325:TRP:HB3	1:C:329:VAL:HG23	2.00	0.44
1:B:325:TRP:HB3	1:B:329:VAL:HG23	2.00	0.43
1:A:325:TRP:HB3	1:A:329:VAL:HG23	2.00	0.42
1:A:345:TYR:HB3	1:A:346:PRO:HD3	2.01	0.42
1:B:345:TYR:HB3	1:B:346:PRO:HD3	2.00	0.42
1:B:345:TYR:HB3	1:B:346:PRO:CD	2.50	0.42
1:C:345:TYR:HB3	1:C:346:PRO:CD	2.49	0.42
1:A:345:TYR:HB3	1:A:346:PRO:CD	2.50	0.42
1:C:89:ARG:HD3	1:C:361:HIS:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	450/452 (100%)	435 (97%)	15 (3%)	0	100	100
1	B	450/452 (100%)	434 (96%)	16 (4%)	0	100	100
1	C	450/452 (100%)	434 (96%)	16 (4%)	0	100	100
All	All	1350/1356 (100%)	1303 (96%)	47 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	349/383 (91%)	344 (99%)	5 (1%)	59	81
1	B	356/383 (93%)	354 (99%)	2 (1%)	78	91
1	C	356/383 (93%)	355 (100%)	1 (0%)	86	94
All	All	1061/1149 (92%)	1053 (99%)	8 (1%)	73	88

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	89	ARG
1	A	106	ASN
1	A	165	GLN
1	A	292	ASN
1	A	479	THR
1	B	89	ARG
1	B	292	ASN
1	C	292	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	ASN
1	A	160	ASN
1	A	278	ASN
1	A	360	GLN
1	B	31	ASN
1	B	121	ASN
1	B	144	ASN
1	B	278	ASN
1	B	337	HIS
1	B	360	GLN
1	C	31	ASN
1	C	144	ASN
1	C	278	ASN

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Mol	Chain	Res	Type
1	C	337	HIS
1	C	360	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 ⓘ

14 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	G4S	D	1	6,2,4	15,15,16	1.23	1 (6%)	19,22,24	0.86	0
2	DGS	D	2	2	15,15,16	1.36	2 (13%)	16,23,25	1.79	2 (12%)
2	G4S	D	3	6,2	15,15,16	1.25	1 (6%)	19,22,24	1.18	3 (15%)
3	G4S	E	1	3	16,16,16	0.82	1 (6%)	21,24,24	1.01	2 (9%)
3	DGS	E	2	3	15,15,16	1.49	3 (20%)	16,23,25	1.83	5 (31%)
2	G4S	F	1	6,2,4	15,15,16	1.22	1 (6%)	19,22,24	1.01	1 (5%)
2	DGS	F	2	2	15,15,16	1.12	1 (6%)	16,23,25	1.25	2 (12%)
2	G4S	F	3	6,2	15,15,16	1.28	1 (6%)	19,22,24	0.90	1 (5%)
2	G4S	G	1	6,2	15,15,16	0.81	1 (6%)	19,22,24	0.75	0
2	DGS	G	2	2	15,15,16	1.52	2 (13%)	16,23,25	1.45	3 (18%)
2	G4S	G	3	2	15,15,16	1.27	1 (6%)	19,22,24	1.07	2 (10%)
2	G4S	H	1	6,2,4	15,15,16	0.77	1 (6%)	19,22,24	0.78	0
2	DGS	H	2	2	15,15,16	1.02	1 (6%)	16,23,25	1.19	1 (6%)
2	G4S	H	3	6,2	15,15,16	1.32	1 (6%)	19,22,24	1.69	5 (26%)

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	G4S	D	1	6,2,4	-	0/7/24/27	0/1/1/1
2	DGS	D	2	2	-	2/5/27/30	0/3/2/2
2	G4S	D	3	6,2	-	3/7/24/27	0/1/1/1
3	G4S	E	1	3	-	0/7/27/27	0/1/1/1
3	DGS	E	2	3	-	2/5/27/30	0/3/2/2
2	G4S	F	1	6,2,4	-	0/7/24/27	0/1/1/1
2	DGS	F	2	2	-	2/5/27/30	0/3/2/2
2	G4S	F	3	6,2	-	1/7/24/27	0/1/1/1
2	G4S	G	1	6,2	-	0/7/24/27	0/1/1/1
2	DGS	G	2	2	-	0/5/27/30	0/3/2/2
2	G4S	G	3	2	-	2/7/24/27	0/1/1/1
2	G4S	H	1	6,2,4	-	0/7/24/27	0/1/1/1
2	DGS	H	2	2	-	2/5/27/30	0/3/2/2
2	G4S	H	3	6,2	-	0/7/24/27	0/1/1/1

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	3	G4S	O7-S	4.44	1.64	1.45
2	G	2	DGS	O9-S	4.39	1.64	1.45
2	F	3	G4S	O8-S	4.36	1.64	1.45
3	E	2	DGS	O9-S	4.29	1.63	1.45
2	G	3	G4S	O8-S	4.28	1.63	1.45
2	D	3	G4S	O7-S	4.21	1.63	1.45
2	D	1	G4S	O7-S	4.07	1.63	1.45
2	F	1	G4S	O8-S	4.02	1.62	1.45
2	D	2	DGS	O9-S	3.82	1.61	1.45
2	F	2	DGS	O2-C2	-3.18	1.42	1.47
2	D	2	DGS	O2-C2	-2.80	1.43	1.47
2	H	2	DGS	O2-C2	-2.78	1.43	1.47
2	G	2	DGS	O2-C2	-2.73	1.43	1.47
3	E	2	DGS	C1-C2	2.54	1.55	1.51
3	E	1	G4S	O9-S	2.16	1.64	1.50
2	G	1	G4S	O9-S	2.10	1.63	1.50
3	E	2	DGS	O2-C2	-2.07	1.44	1.47
2	H	1	G4S	O9-S	2.00	1.62	1.50

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	2	DGS	O2-C2-C3	5.75	113.02	106.65
2	H	3	G4S	O5-C5-C6	4.16	115.77	107.66
3	E	2	DGS	C1-O5-C5	3.52	116.90	112.19
3	E	2	DGS	O2-C2-C3	3.37	110.38	106.65
2	G	2	DGS	O2-C2-C3	3.25	110.25	106.65
2	F	2	DGS	O2-C2-C3	3.22	110.22	106.65
2	H	3	G4S	O5-C5-C4	-3.21	104.30	110.06
2	H	2	DGS	O2-C2-C3	3.10	110.09	106.65
2	G	2	DGS	C1-O5-C5	3.03	116.24	112.19
3	E	1	G4S	O9-S-O4	2.85	112.93	106.37
2	G	3	G4S	C1-C2-C3	2.79	113.71	109.64
2	G	2	DGS	C3-C4-C5	-2.76	96.06	101.99
2	H	3	G4S	O3-C3-C2	-2.74	104.47	110.05
3	E	1	G4S	C4-O4-S	2.73	125.59	119.04
3	E	2	DGS	C3-C4-C5	-2.62	96.36	101.99
2	F	1	G4S	O9-S-O4	2.55	112.24	106.37
2	D	2	DGS	C1-O5-C5	2.39	115.38	112.19
2	G	3	G4S	C1-O5-C5	2.37	115.36	112.19
3	E	2	DGS	C2-C3-C4	-2.37	108.09	113.84
2	H	3	G4S	C3-C4-C5	-2.33	105.76	110.93
3	E	2	DGS	O5-C1-C2	2.32	114.20	109.51
2	D	3	G4S	C1-O5-C5	2.31	115.28	112.19
2	F	3	G4S	C1-O5-C5	2.26	115.22	112.19
2	H	3	G4S	C4-O4-S	2.21	124.35	119.04
2	F	2	DGS	C2-C3-C4	-2.15	108.62	113.84
2	D	3	G4S	C4-O4-S	2.14	124.17	119.04
2	D	3	G4S	O9-S-O4	2.13	111.27	106.37

There are no chirality outliers.

All (14) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	2	DGS	C1-C2-O2-S
2	D	2	DGS	C3-C2-O2-S
2	F	2	DGS	C1-C2-O2-S
2	F	2	DGS	C3-C2-O2-S
2	G	3	G4S	C3-C4-O4-S
2	H	2	DGS	C1-C2-O2-S
2	H	2	DGS	C3-C2-O2-S
3	E	2	DGS	C1-C2-O2-S
3	E	2	DGS	C3-C2-O2-S

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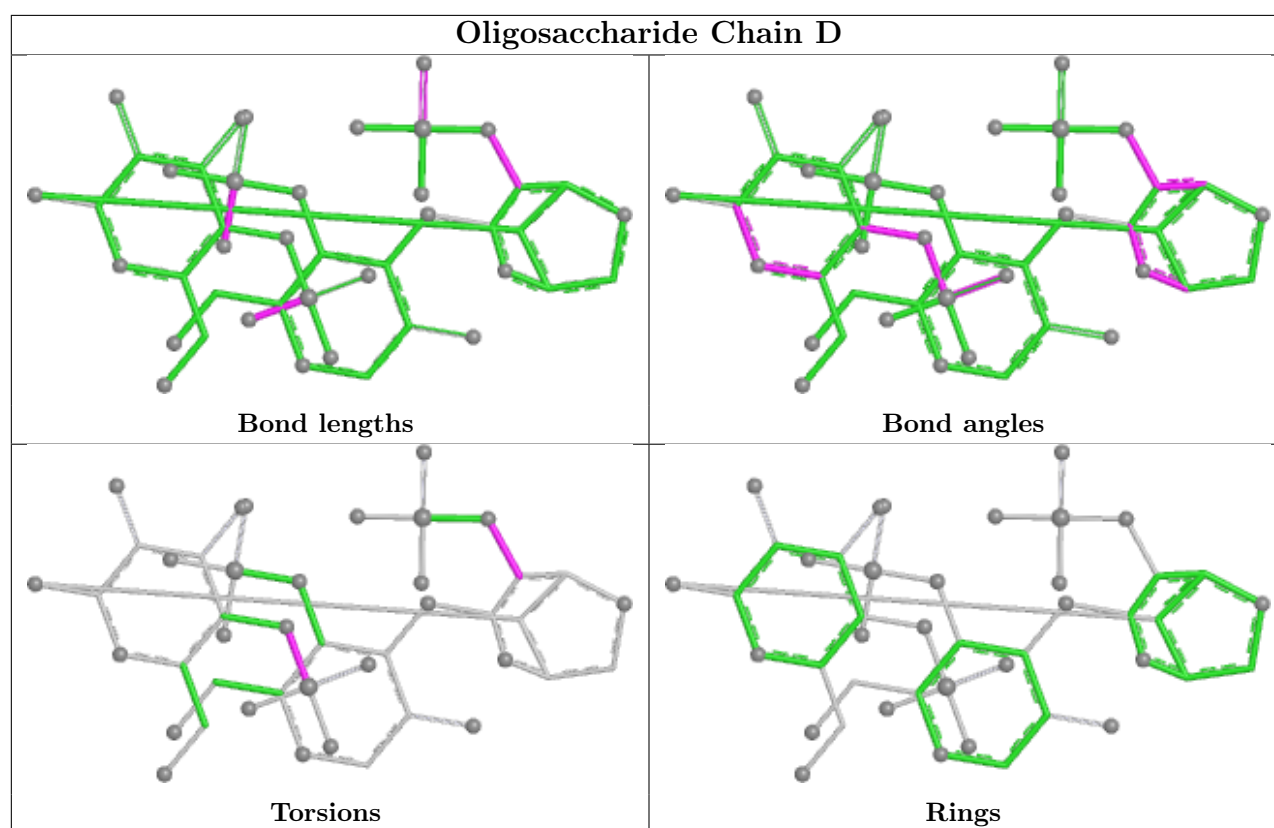
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Mol	Chain	Res	Type	Atoms
2	D	3	G4S	C4-O4-S-O9
2	F	3	G4S	C4-C5-C6-O6
2	G	3	G4S	C5-C4-O4-S
2	D	3	G4S	C4-O4-S-O7
2	D	3	G4S	C4-O4-S-O8

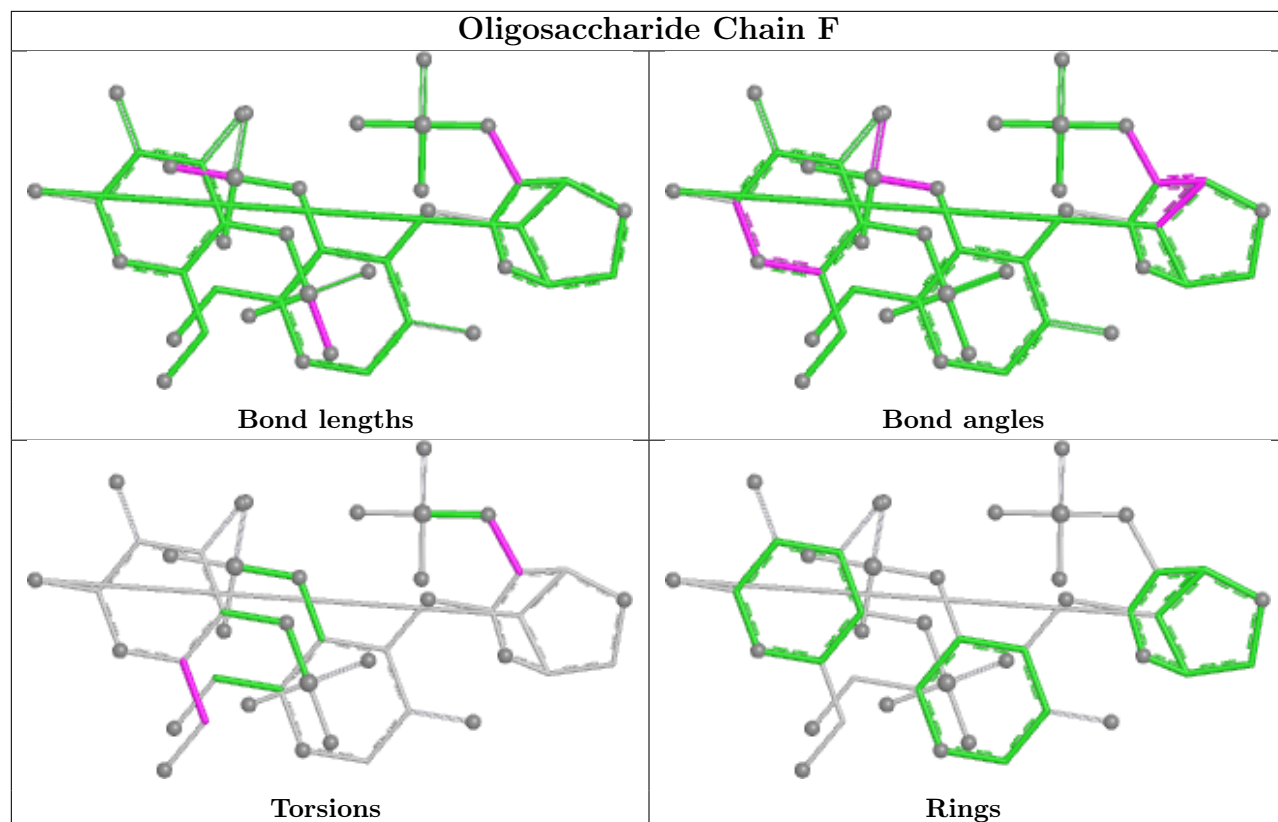
There are no ring outliers.

No monomer is involved in short contacts.

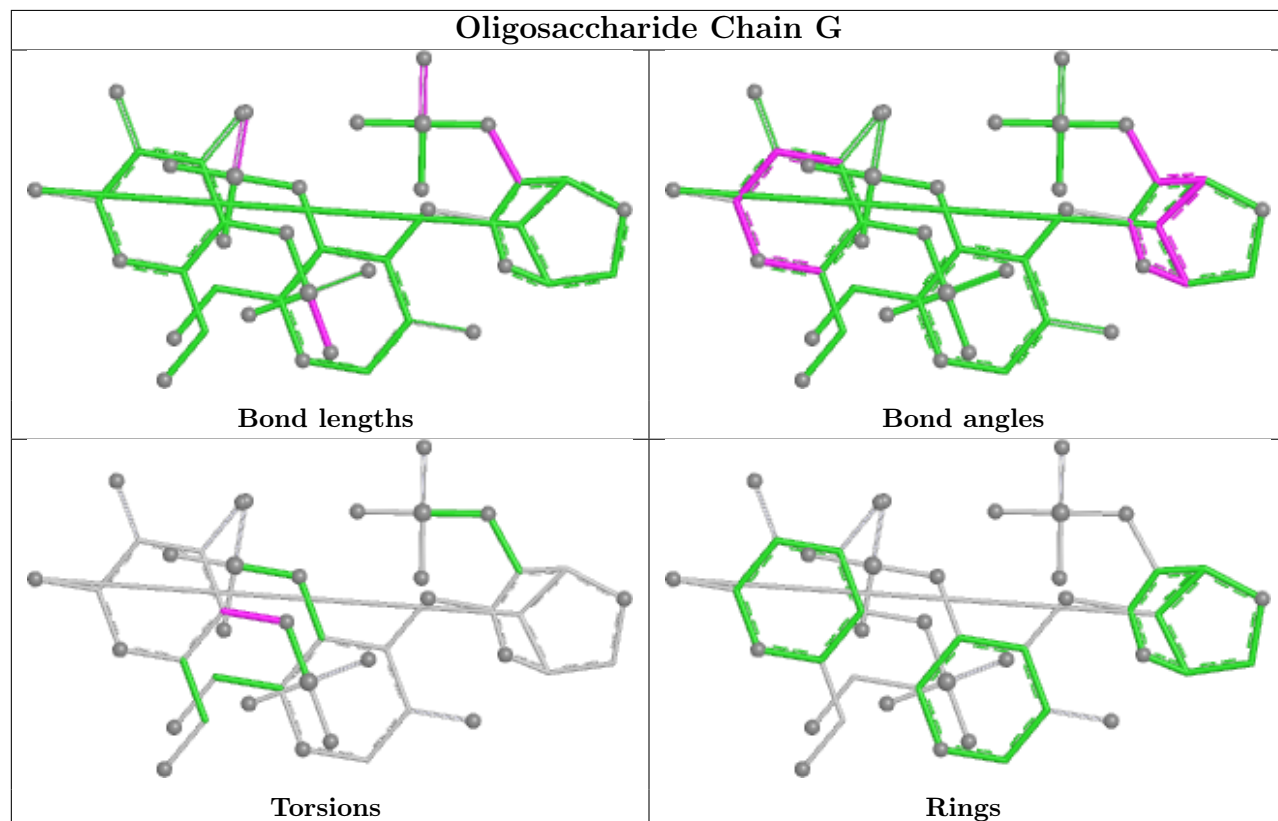
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

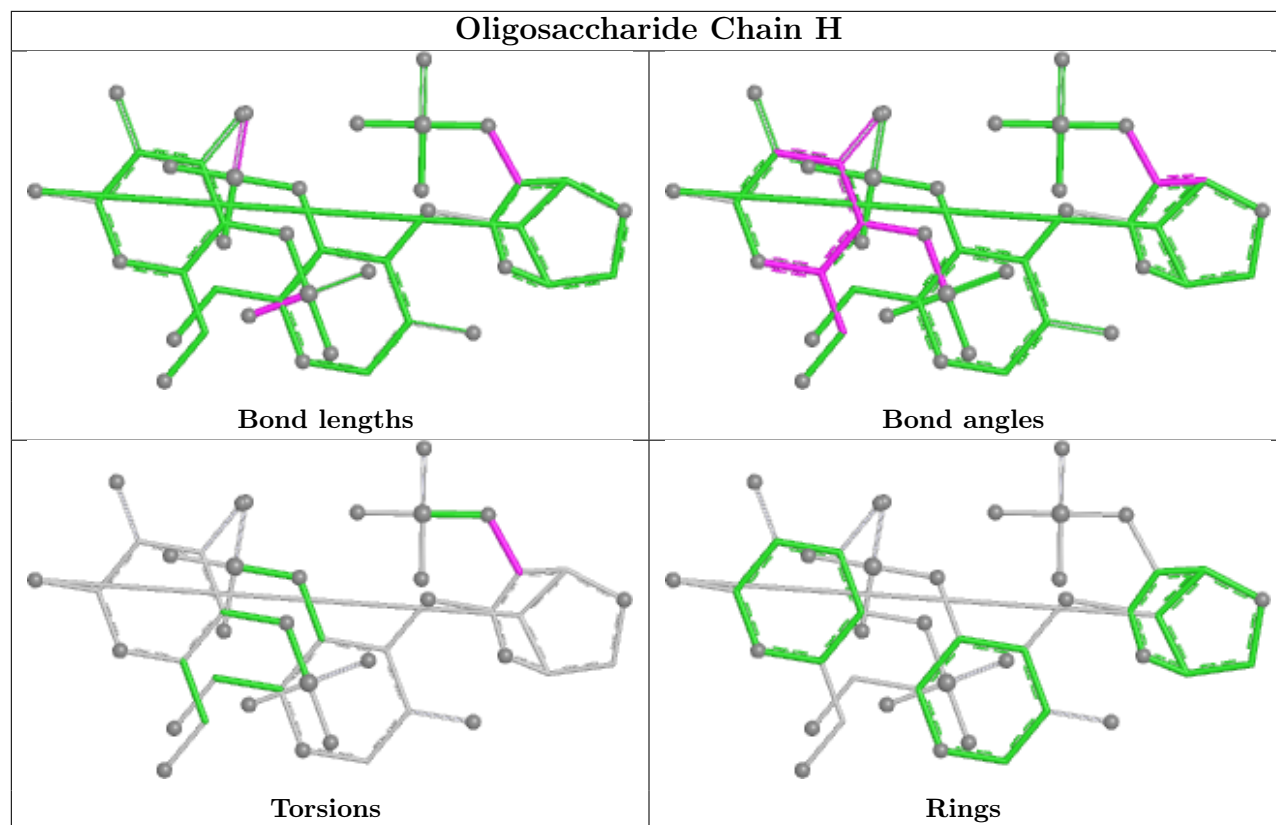


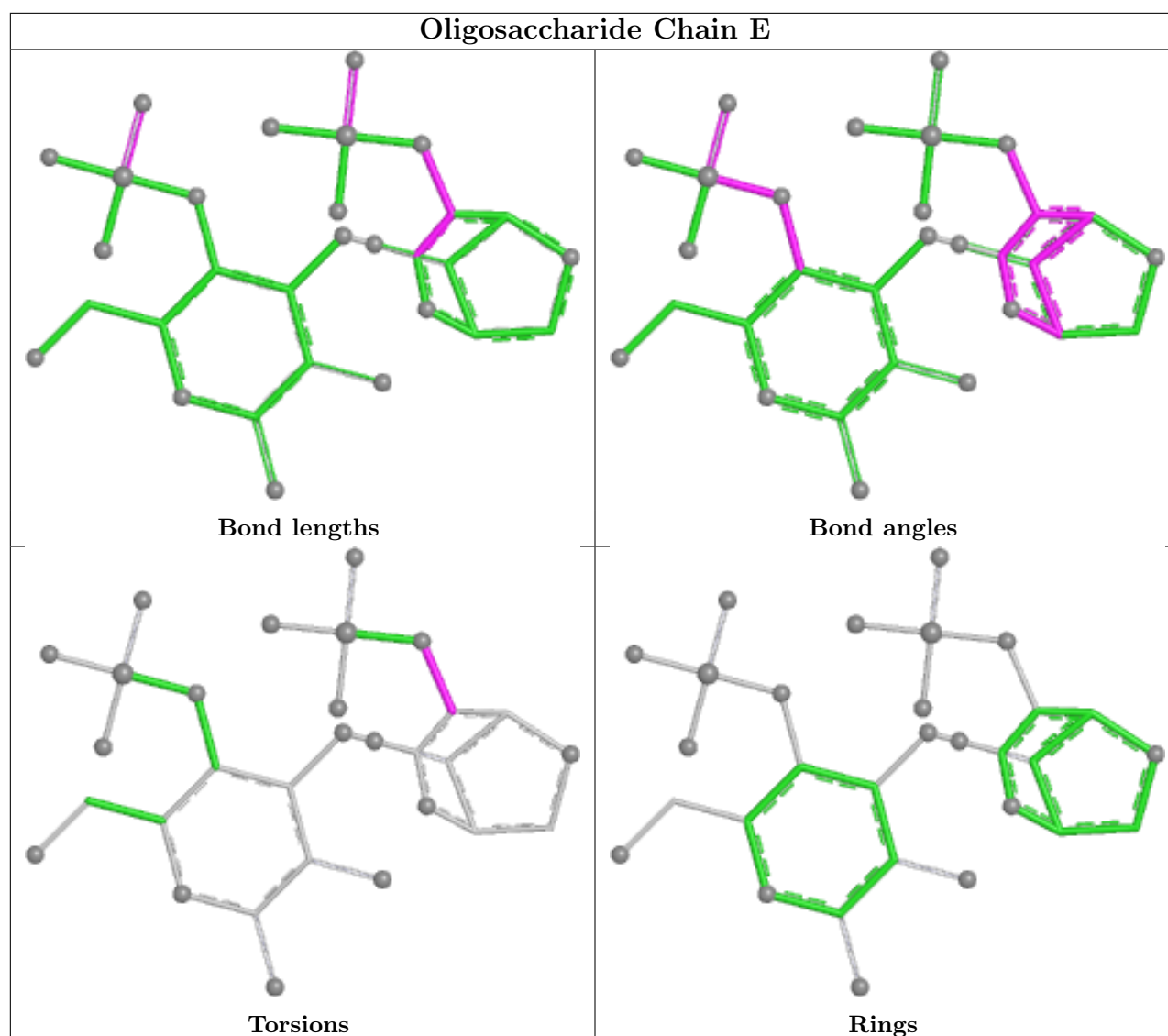
Oligosaccharide Chain F



Oligosaccharide Chain G







5.6 Ligand geometry [i](#)

Of 19 ligands modelled in this entry, 3 are monoatomic - leaving 16 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	$\# Z > 2$
8	TRS	B	512	-	7,7,7	0.61	0	9,9,9	0.96	0
9	ARG	C	509	-	10,11,11	0.82	1 (10%)	9,13,13	0.99	1 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	G4S	A	502	6	16,16,16	0.81	0	21,24,24	0.82	0
6	9RN	A	503	2,5	11,11,12	0.49	0	13,16,18	1.51	3 (23%)
6	9RN	B	503	2,5	11,11,12	0.60	0	13,16,18	1.49	3 (23%)
5	G4S	B	502	6	16,16,16	1.23	1 (6%)	21,24,24	0.74	0
6	9RN	B	507	2	11,11,12	0.64	0	13,16,18	1.42	1 (7%)
7	EDO	A	510	-	3,3,3	0.45	0	2,2,2	0.26	0
5	G4S	C	502	6	16,16,16	1.33	1 (6%)	21,24,24	1.04	1 (4%)
6	9RN	C	503	2,5	11,11,12	0.53	0	13,16,18	1.36	2 (15%)
8	TRS	A	511	-	7,7,7	0.67	0	9,9,9	0.91	0
7	EDO	C	508	-	3,3,3	0.46	0	2,2,2	0.29	0
9	ARG	A	512	-	10,11,11	0.76	0	9,13,13	1.30	1 (11%)
6	9RN	C	507	2	11,11,12	0.79	0	13,16,18	1.26	2 (15%)
6	9RN	A	507	2	11,11,12	0.72	0	13,16,18	1.18	2 (15%)
6	9RN	B	508	2	12,12,12	0.75	0	16,18,18	1.08	1 (6%)

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
8	TRS	B	512	-	-	6/9/9/9	-
9	ARG	C	509	-	-	2/11/11/11	-
5	G4S	A	502	6	-	0/7/27/27	0/1/1/1
9	ARG	A	512	-	-	7/11/11/11	-
6	9RN	A	503	2,5	-	-	0/3/2/2
5	G4S	B	502	6	-	0/7/27/27	0/1/1/1
7	EDO	A	510	-	-	1/1/1/1	-
8	TRS	A	511	-	-	9/9/9/9	-
5	G4S	C	502	6	-	0/7/27/27	0/1/1/1
6	9RN	B	503	2,5	-	-	0/3/2/2
6	9RN	B	507	2	-	-	0/3/2/2
7	EDO	C	508	-	-	1/1/1/1	-
6	9RN	C	503	2,5	-	-	0/3/2/2
6	9RN	C	507	2	-	-	0/3/2/2
6	9RN	A	507	2	-	-	0/3/2/2
6	9RN	B	508	2	-	-	0/3/2/2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	C	502	G4S	O7-S	4.35	1.64	1.45
5	B	502	G4S	O8-S	3.97	1.62	1.45
9	C	509	ARG	OXT-C	-2.25	1.23	1.30

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	507	9RN	C1-O5-C5	3.91	117.42	112.19
9	A	512	ARG	OXT-C-O	-3.75	115.56	124.08
6	A	503	9RN	C1-O5-C5	3.27	116.57	112.19
5	C	502	G4S	O9-S-O4	3.18	113.68	106.37
6	C	503	9RN	C1-O5-C5	3.05	116.28	112.19
6	C	507	9RN	C2-C3-C4	-2.88	106.73	113.85
6	A	503	9RN	C1-C2-C3	2.80	113.13	109.29
6	B	503	9RN	C2-C3-C4	-2.68	107.22	113.85
6	A	507	9RN	C1-O5-C5	2.58	115.64	112.19
6	B	503	9RN	C1-C2-C3	2.56	112.79	109.29
9	C	509	ARG	OXT-C-O	-2.50	118.42	124.08
6	C	507	9RN	O5-C1-C2	2.43	116.58	110.79
6	B	503	9RN	C1-O5-C5	2.37	115.36	112.19
6	B	508	9RN	C3-C4-C5	-2.30	97.05	101.99
6	C	503	9RN	C1-C2-C3	2.27	112.39	109.29
6	A	503	9RN	C3-C4-C5	-2.08	97.53	101.99
6	A	507	9RN	C3-C4-C5	-2.03	97.63	101.99

There are no chirality outliers.

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	A	511	TRS	C3-C-C1-O1
8	A	511	TRS	N-C-C1-O1
8	A	511	TRS	N-C-C2-O2
8	A	511	TRS	C2-C-C3-O3
8	A	511	TRS	N-C-C3-O3
8	B	512	TRS	C2-C-C1-O1
8	B	512	TRS	C3-C-C1-O1
8	B	512	TRS	N-C-C1-O1
8	B	512	TRS	C1-C-C2-O2
8	B	512	TRS	C3-C-C2-O2
9	A	512	ARG	C-CA-CB-CG
9	A	512	ARG	OXT-C-CA-CB
9	A	512	ARG	OXT-C-CA-N

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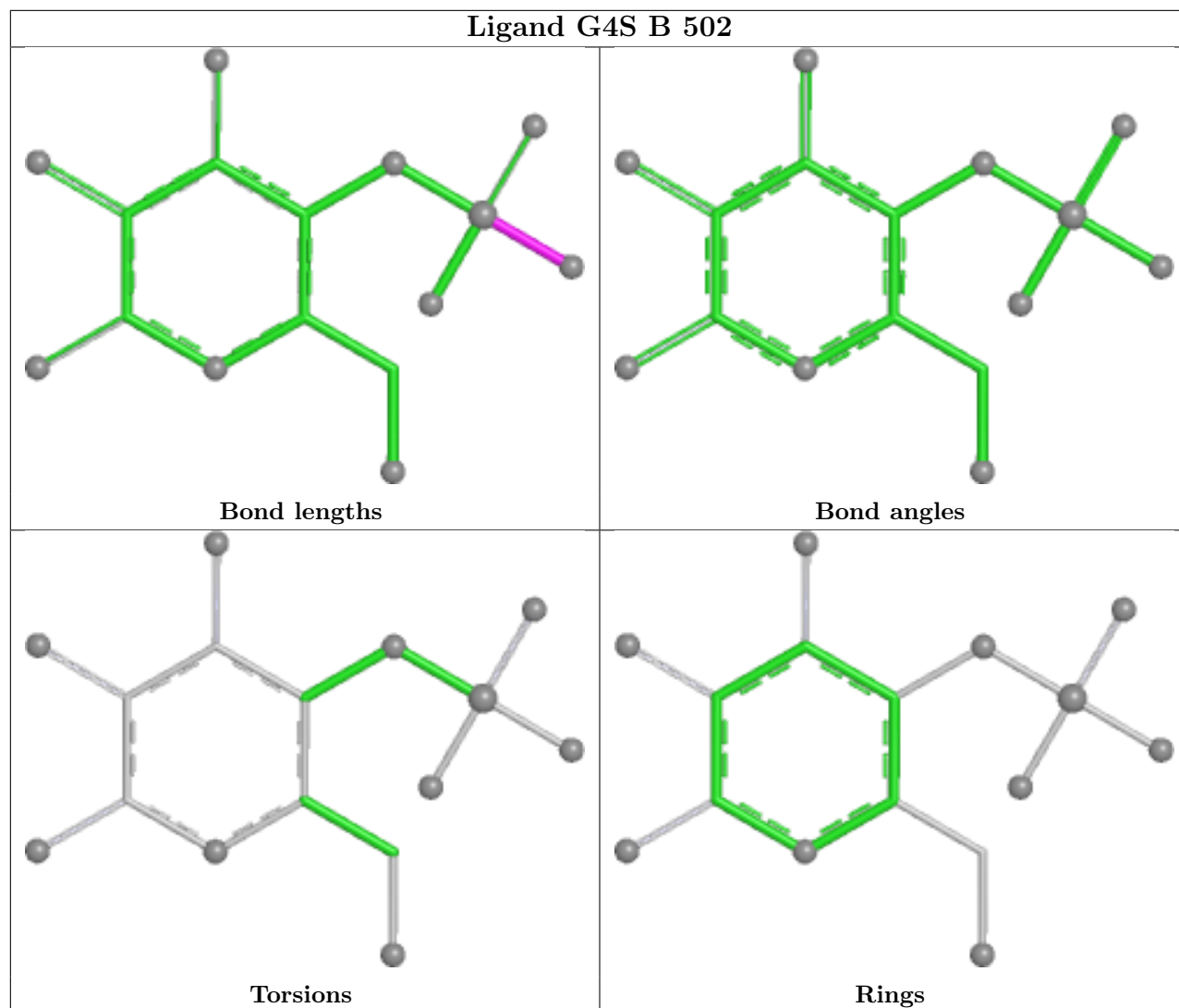
Mol	Chain	Res	Type	Atoms
8	A	511	TRS	C1-C-C2-O2
7	A	510	EDO	O1-C1-C2-O2
7	C	508	EDO	O1-C1-C2-O2
9	A	512	ARG	NE-CD-CG-CB
9	A	512	ARG	O-C-CA-CB
8	A	511	TRS	C2-C-C1-O1
8	A	511	TRS	C1-C-C3-O3
8	B	512	TRS	N-C-C2-O2
9	A	512	ARG	O-C-CA-N
9	A	512	ARG	N-CA-CB-CG
9	C	509	ARG	N-CA-CB-CG
8	A	511	TRS	C3-C-C2-O2
9	C	509	ARG	C-CA-CB-CG

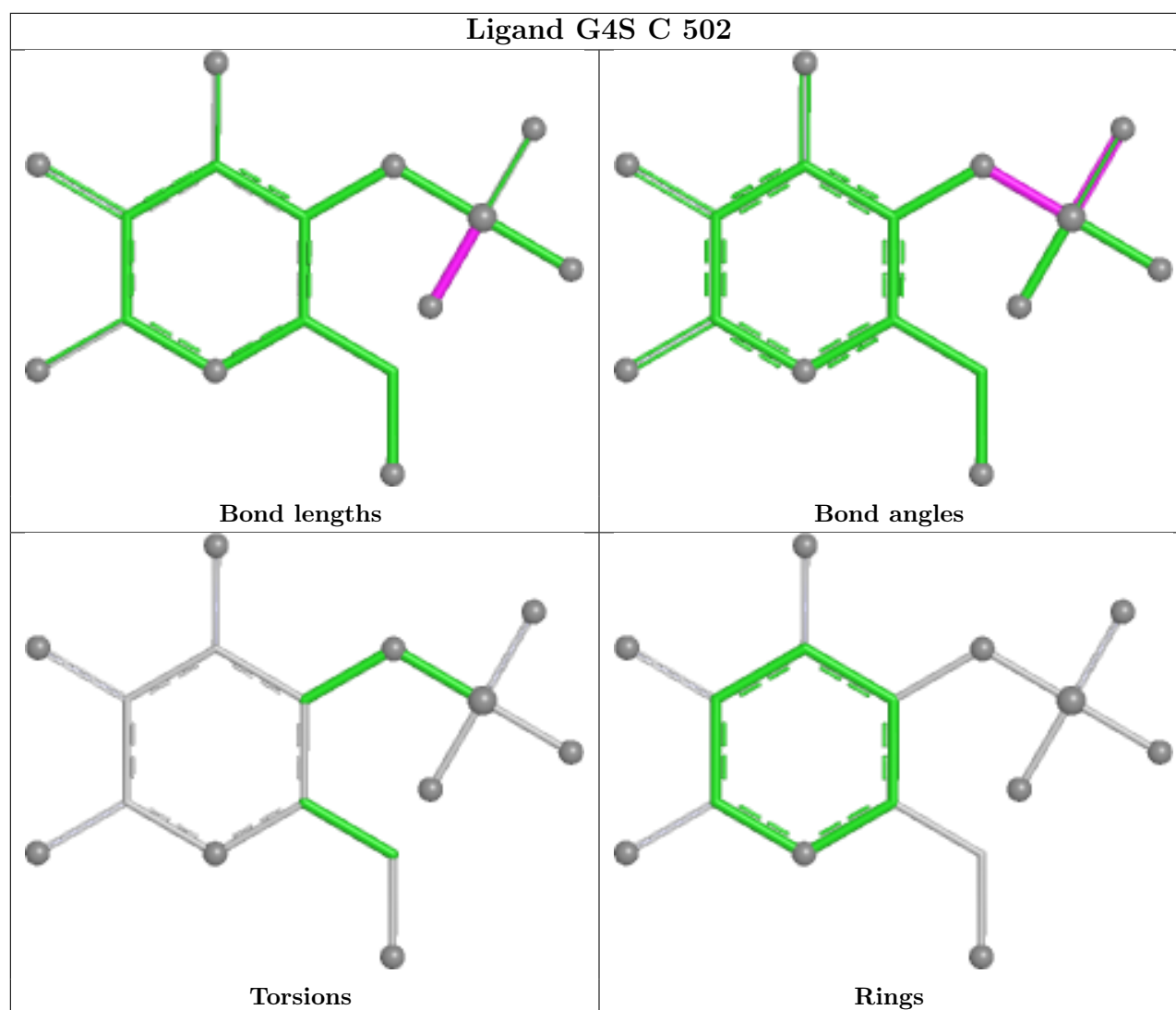
There are no ring outliers.

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 all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand G4S B 502





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

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	452/452 (100%)	0.10	11 (2%) 59 55	17, 27, 43, 63	0
1	B	451/452 (99%)	0.21	14 (3%) 51 47	18, 29, 46, 65	1 (0%)
1	C	451/452 (99%)	-0.01	4 (0%) 81 78	17, 25, 40, 62	1 (0%)
All	All	1354/1356 (99%)	0.10	29 (2%) 63 59	17, 27, 44, 65	2 (0%)

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	358	GLU	3.9
1	A	28	GLN	3.6
1	B	245	MET	3.2
1	A	218	ASN	3.0
1	C	137	ASP	3.0
1	A	358	GLU	2.9
1	B	357	GLU	2.9
1	B	28	GLN	2.8
1	A	221	HIS	2.7
1	B	241	GLU	2.7
1	B	359	ASN	2.6
1	B	478	THR	2.5
1	B	60	ASP	2.4
1	B	248	ASN	2.4
1	B	164	ASP	2.3
1	A	175	ALA	2.3
1	C	451	GLN	2.3
1	A	137	ASP	2.2
1	A	217	VAL	2.2
1	B	124	ASN	2.2
1	A	174	LYS	2.2
1	A	479	THR	2.1
1	B	283	ASN	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	137	ASP	2.1
1	A	425	HIS	2.1
1	C	28	GLN	2.0
1	B	370	ALA	2.0
1	A	219	LYS	2.0
1	C	478	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](#)

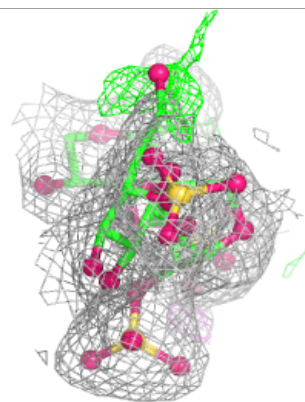
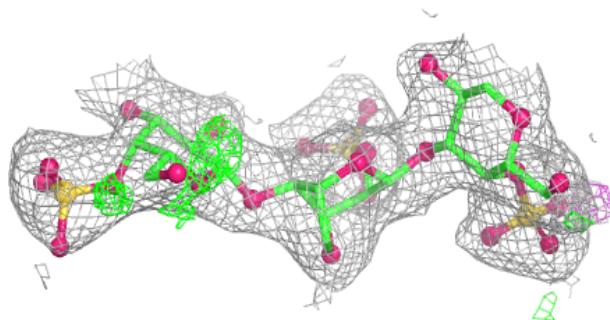
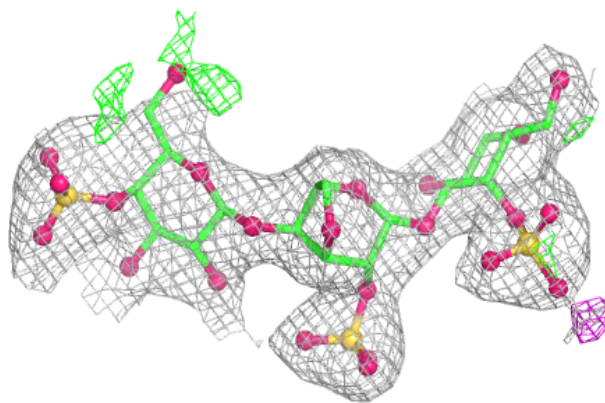
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	G4S	G	3	15/16	0.73	0.30	59,62,69,70	9
3	DGS	E	2	14/15	0.85	0.12	50,54,64,64	0
2	DGS	G	2	14/15	0.88	0.15	55,58,63,66	0
2	G4S	F	3	15/16	0.89	0.12	33,41,46,46	0
3	G4S	E	1	16/16	0.89	0.13	42,47,48,50	2
2	G4S	D	3	15/16	0.89	0.13	34,40,43,44	1
2	G4S	H	3	15/16	0.90	0.13	28,36,44,45	0
2	G4S	G	1	15/16	0.94	0.09	42,46,49,51	0
2	G4S	F	1	15/16	0.97	0.07	22,25,27,29	0
2	DGS	F	2	14/15	0.97	0.07	25,26,28,31	0
2	G4S	H	1	15/16	0.97	0.08	19,20,22,24	0
2	G4S	D	1	15/16	0.98	0.07	22,22,24,28	0
2	DGS	D	2	14/15	0.98	0.07	23,24,25,29	0
2	DGS	H	2	14/15	0.98	0.07	18,19,20,23	0

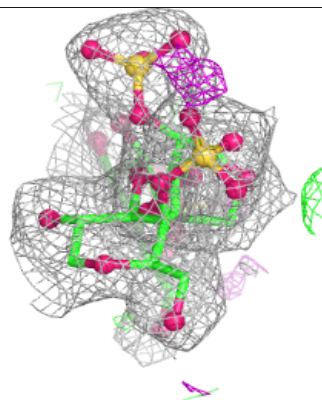
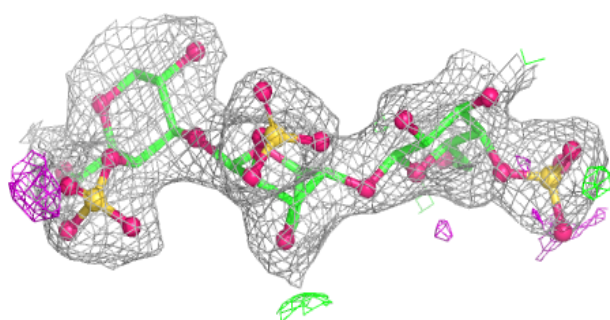
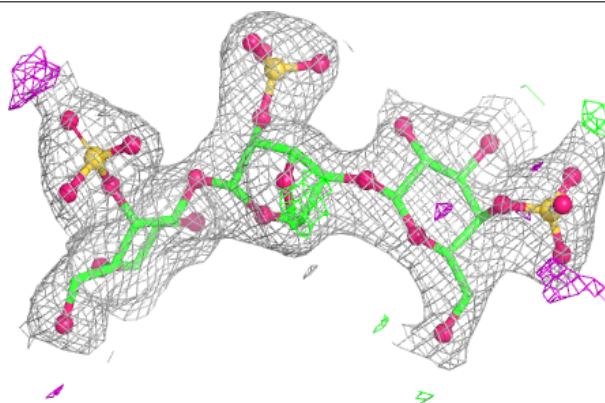
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around Chain D:

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

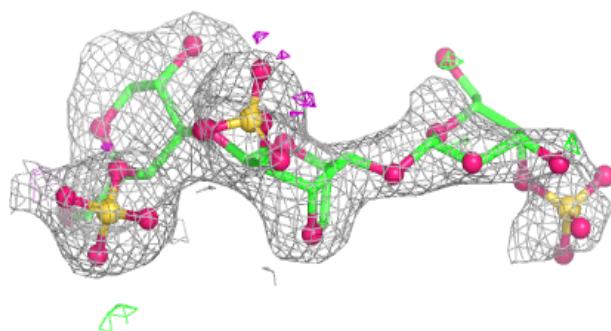
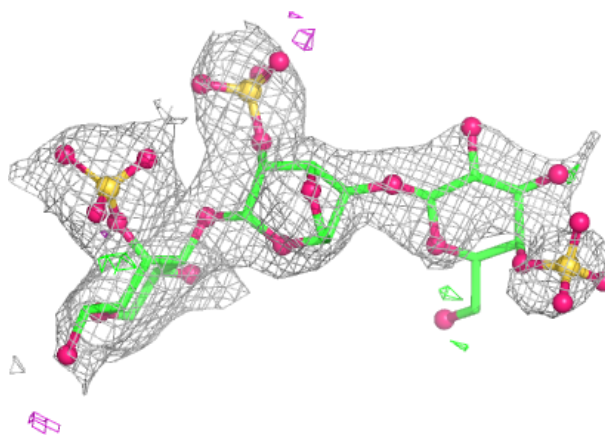
**Electron density around Chain F:**

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

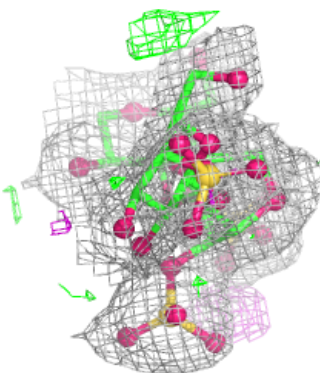
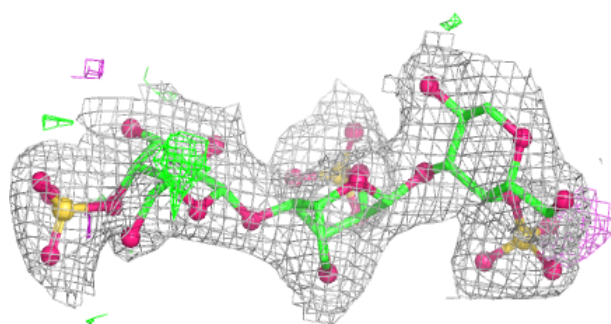
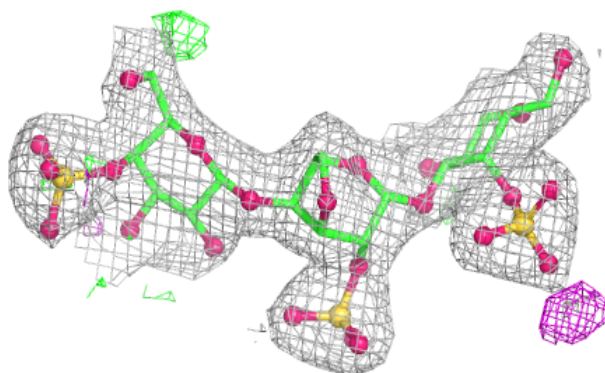


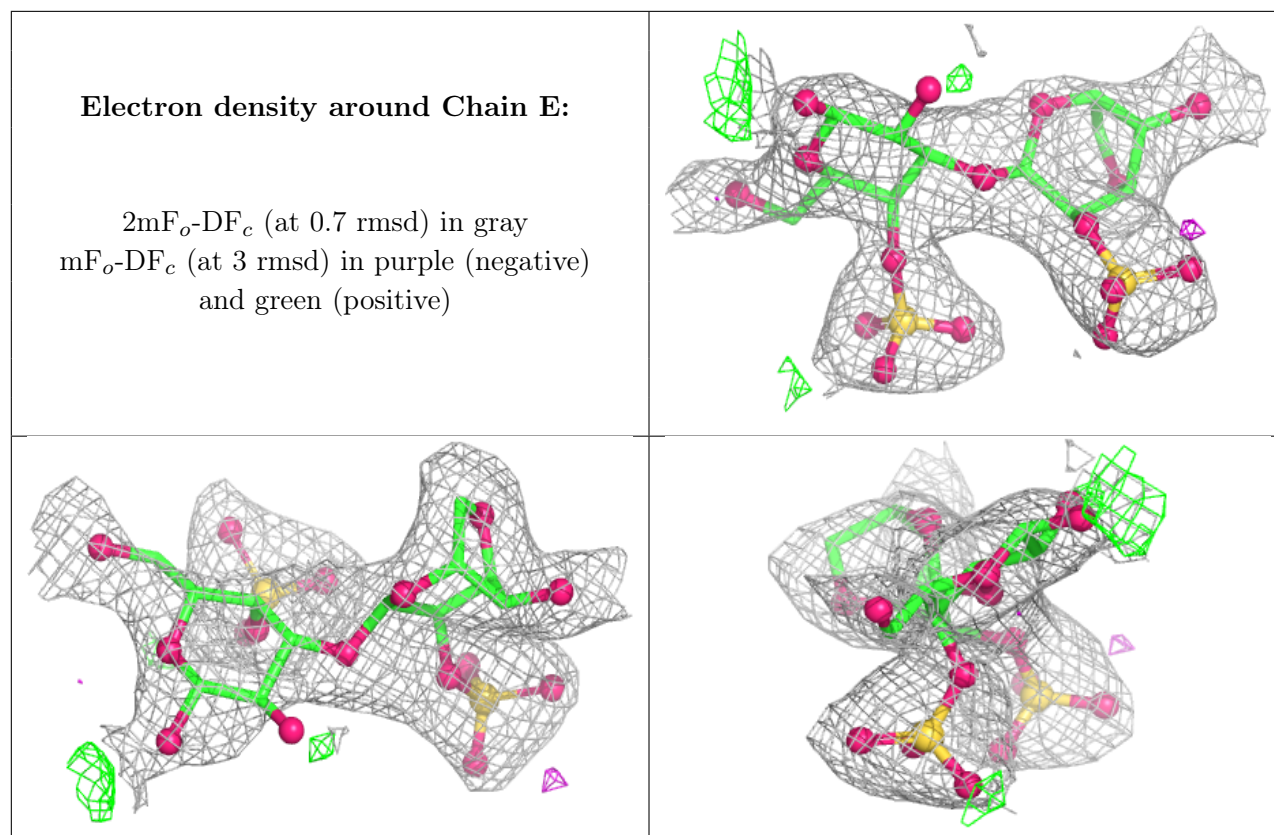
Electron density around Chain G:

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

**Electron density around Chain H:**

$2mF_o-DF_c$ (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, 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
8	TRS	B	512	8/8	0.56	0.24	56,61,63,63	0
8	TRS	A	511	8/8	0.64	0.25	54,56,57,60	0
4	CA	C	501	1/1	0.69	0.28	33,33,33,33	1
7	EDO	C	508	4/4	0.71	0.30	51,52,52,53	0
9	ARG	A	512	12/12	0.71	0.23	57,65,68,68	0
9	ARG	C	509	12/12	0.71	0.24	58,68,74,74	0
6	9RN	C	507	10/11	0.75	0.17	38,41,42,44	0
6	9RN	B	508	11/11	0.76	0.20	55,61,62,63	1
6	9RN	B	507	10/11	0.78	0.27	49,53,54,54	3
6	9RN	A	507	10/11	0.82	0.13	45,51,52,53	0
7	EDO	A	510	4/4	0.86	0.15	41,44,45,45	0
4	CA	B	501	1/1	0.87	0.18	45,45,45,45	0
4	CA	A	501	1/1	0.88	0.14	45,45,45,45	0
5	G4S	C	502	16/16	0.88	0.12	35,43,50,53	0

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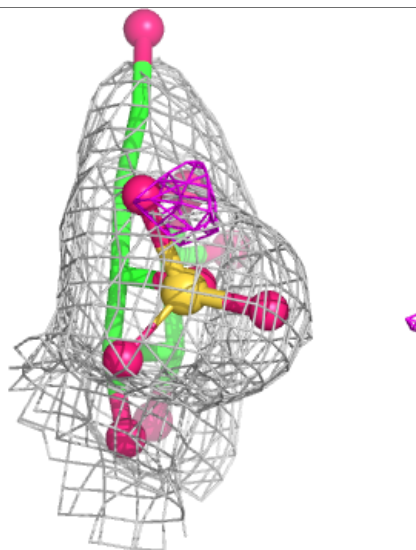
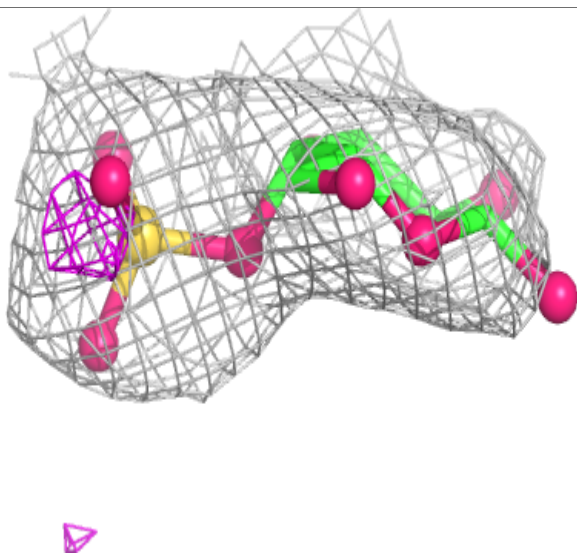
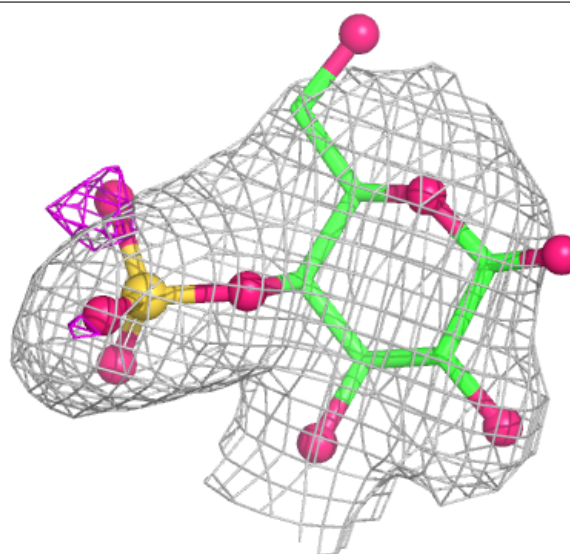
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
6	9RN	A	503	10/11	0.93	0.08	24,26,29,29	0
5	G4S	A	502	16/16	0.95	0.07	33,39,41,43	0
6	9RN	C	503	10/11	0.95	0.07	23,26,28,29	0
5	G4S	B	502	16/16	0.95	0.08	31,33,35,35	0
6	9RN	B	503	10/11	0.96	0.07	25,26,28,28	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

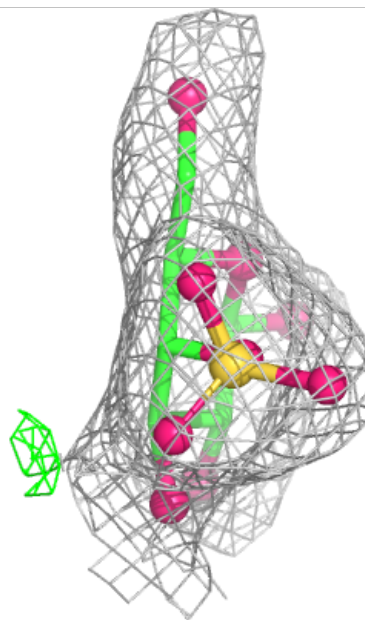
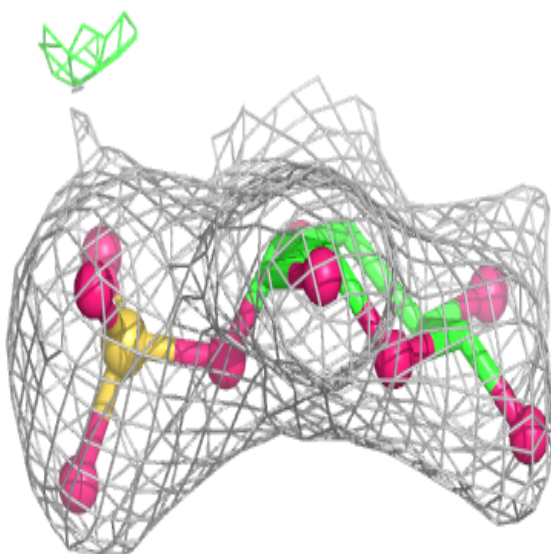
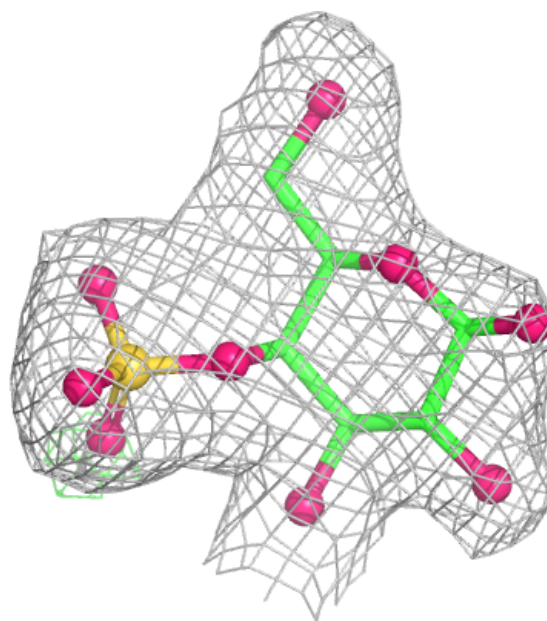
Electron density around G4S C 502:

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 G4S B 502:

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



6.5 Other polymers [i](#)

There are no such residues in this entry.