



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:04 AM UTC

PDB ID : 5OYE / pdb_00005oye
Title : GH5 endo-xyloglucanase from *Cellvibrio japonicus*
Authors : Attia, M.; Nelson, C.E.; Offen, W.A.; Jain, N.; Gardner, J.G.; Davies, G.J.; Brumer, H.
Deposited on : 2017-09-08
Resolution : 1.90 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

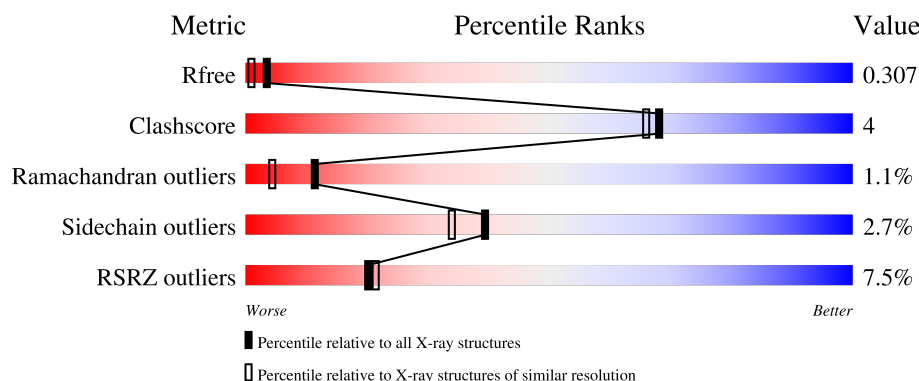
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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))
R_{free}	180053	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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 $\leq 5\%$. 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	396	2% 85% 8% 6%
1	B	396	12% 74% 18% 7%
2	C	7	14% 71% 14%
3	D	6	67% 33%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	XYS	D	5	X	-	-	-

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6109 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 Cellulase, putative, cel5D.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	372	Total	C	N	O	S	0	2	0
			2953	1871	501	571	10			
1	B	370	Total	C	N	O	S	0	0	0
			2890	1834	493	553	10			

There are 46 discrepancies between the modelled and reference sequences:

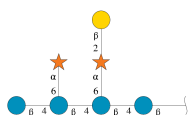
Chain	Residue	Modelled	Actual	Comment	Reference
A	73	MET	-	initiating methionine	UNP B3PD52
A	74	GLY	-	expression tag	UNP B3PD52
A	75	SER	-	expression tag	UNP B3PD52
A	76	SER	-	expression tag	UNP B3PD52
A	77	HIS	-	expression tag	UNP B3PD52
A	78	HIS	-	expression tag	UNP B3PD52
A	79	HIS	-	expression tag	UNP B3PD52
A	80	HIS	-	expression tag	UNP B3PD52
A	81	HIS	-	expression tag	UNP B3PD52
A	82	HIS	-	expression tag	UNP B3PD52
A	83	SER	-	expression tag	UNP B3PD52
A	84	SER	-	expression tag	UNP B3PD52
A	85	GLY	-	expression tag	UNP B3PD52
A	86	LEU	-	expression tag	UNP B3PD52
A	87	VAL	-	expression tag	UNP B3PD52
A	88	PRO	-	expression tag	UNP B3PD52
A	89	ARG	-	expression tag	UNP B3PD52
A	90	GLY	-	expression tag	UNP B3PD52
A	91	SER	-	expression tag	UNP B3PD52
A	92	HIS	-	expression tag	UNP B3PD52
A	93	MET	-	expression tag	UNP B3PD52
A	94	ALA	-	expression tag	UNP B3PD52
A	95	SER	-	expression tag	UNP B3PD52
B	73	MET	-	initiating methionine	UNP B3PD52
B	74	GLY	-	expression tag	UNP B3PD52

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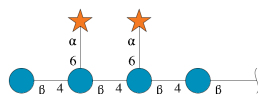
Chain	Residue	Modelled	Actual	Comment	Reference
B	75	SER	-	expression tag	UNP B3PD52
B	76	SER	-	expression tag	UNP B3PD52
B	77	HIS	-	expression tag	UNP B3PD52
B	78	HIS	-	expression tag	UNP B3PD52
B	79	HIS	-	expression tag	UNP B3PD52
B	80	HIS	-	expression tag	UNP B3PD52
B	81	HIS	-	expression tag	UNP B3PD52
B	82	HIS	-	expression tag	UNP B3PD52
B	83	SER	-	expression tag	UNP B3PD52
B	84	SER	-	expression tag	UNP B3PD52
B	85	GLY	-	expression tag	UNP B3PD52
B	86	LEU	-	expression tag	UNP B3PD52
B	87	VAL	-	expression tag	UNP B3PD52
B	88	PRO	-	expression tag	UNP B3PD52
B	89	ARG	-	expression tag	UNP B3PD52
B	90	GLY	-	expression tag	UNP B3PD52
B	91	SER	-	expression tag	UNP B3PD52
B	92	HIS	-	expression tag	UNP B3PD52
B	93	MET	-	expression tag	UNP B3PD52
B	94	ALA	-	expression tag	UNP B3PD52
B	95	SER	-	expression tag	UNP B3PD52

- Molecule 2 is an oligosaccharide called beta-D-glucopyranose-(1-4)-[alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-[beta-D-galactopyranose-(1-2)-alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	C	7	Total	C	O	0	0	0
			74	40	34			

- Molecule 3 is an oligosaccharide called beta-D-glucopyranose-(1-4)-[alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-[alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
3	D	6	Total	C	O	0	0	0
			63	34	29			

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

- Molecule 5 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Cl	0	0
			1	1		

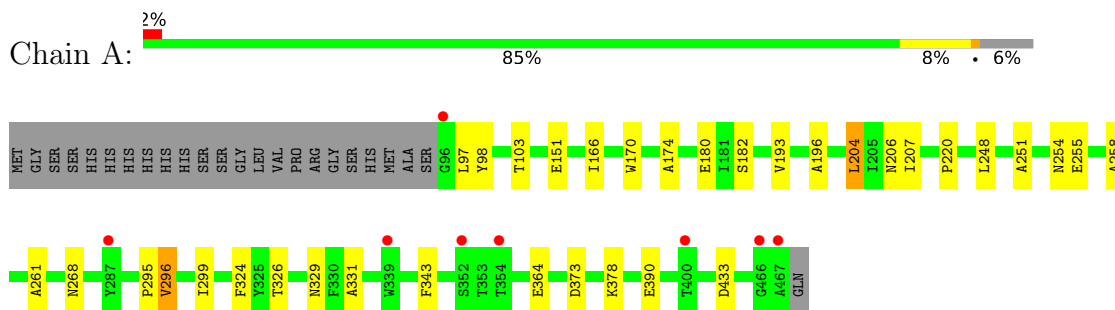
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	47	Total 47	O 47	0	0
6	B	51	Total 51	O 51	0	0

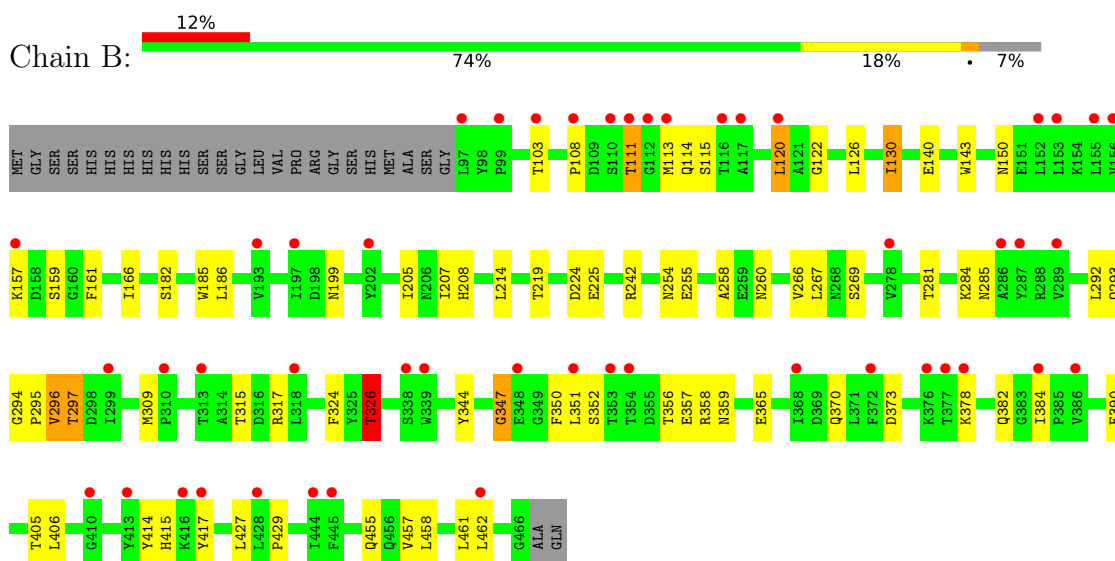
3 Residue-property plots [i](#)

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.

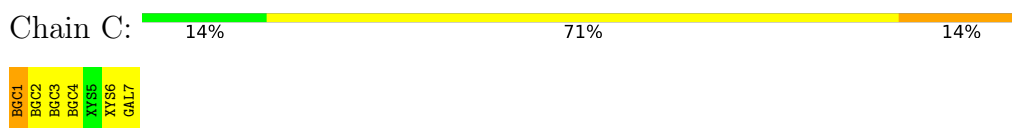
- Molecule 1: Cellulase, putative, cel5D



- Molecule 1: Cellulase, putative, cel5D



- Molecule 2: beta-D-glucopyranose-(1-4)-[alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-[beta-D-galactopyranose-(1-2)-alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-beta-D-glucopyranose



- Molecule 3: beta-D-glucopyranose-(1-4)-[alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-[alpha-D-xylopyranose-(1-6)]beta-D-glucopyranose-(1-4)-beta-D-glucopyranose

Chain D:



BGC1
BGC2
BGC3
BGC4
XY55
XY56

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	55.34Å 95.83Å 157.21Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	81.83 – 1.90 81.83 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.9 (81.83-1.90) 99.9 (81.83-1.90)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.94 (at 1.90Å)	Xtriage
Refinement program	REFMAC 5.8.0158	Depositor
R, R_{free}	0.234 , 0.300 0.246 , 0.307	Depositor DCC
R_{free} test set	3299 reflections (2.80%)	wwPDB-VP
Wilson B-factor (Å ²)	38.5	Xtriage
Anisotropy	0.951	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 48.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	6109	wwPDB-VP
Average B, all atoms (Å ²)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.88% 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: CL, GAL, YYS, BGC, SO4

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	1.24	6/3025 (0.2%)	1.18	7/4120 (0.2%)
1	B	1.27	10/2962 (0.3%)	1.21	12/4040 (0.3%)
All	All	1.25	16/5987 (0.3%)	1.19	19/8160 (0.2%)

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	1

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	214	LEU	C-O	7.71	1.33	1.23
1	A	204	LEU	C-O	-7.25	1.15	1.24
1	B	384	ILE	CA-C	6.75	1.58	1.53
1	A	220	PRO	C-O	-6.37	1.16	1.24
1	B	255	GLU	CA-CB	6.28	1.59	1.53
1	B	326	THR	CA-C	6.17	1.61	1.52
1	B	297	THR	CA-C	5.92	1.60	1.52
1	B	429	PRO	CA-C	5.92	1.58	1.52
1	B	347	GLY	N-CA	5.80	1.50	1.45
1	A	373	ASP	N-CA	5.72	1.53	1.46
1	B	269	SER	C-O	5.69	1.30	1.24
1	B	224	ASP	N-CA	5.44	1.52	1.46
1	A	254	ASN	C-O	-5.38	1.17	1.24
1	A	268	ASN	N-CA	5.25	1.52	1.46
1	A	433	ASP	C-O	-5.21	1.18	1.24
1	B	293	GLN	N-CA	-5.14	1.39	1.46

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	384	ILE	N-CA-C	6.95	114.42	107.55
1	A	331	ALA	N-CA-C	6.76	118.73	111.36
1	A	166	ILE	N-CA-C	-6.32	101.89	108.15
1	B	309	MET	CA-C-N	-5.83	113.68	119.92
1	B	309	MET	C-N-CA	-5.83	113.68	119.92
1	A	166	ILE	CA-C-N	-5.83	113.93	119.76
1	A	166	ILE	C-N-CA	-5.83	113.93	119.76
1	B	378	LYS	N-CA-C	5.82	117.70	111.36
1	B	266	VAL	CB-CA-C	-5.61	104.78	111.97
1	B	266	VAL	N-CA-C	5.61	115.81	110.42
1	B	120	LEU	N-CA-C	-5.52	104.89	111.69
1	B	103	THR	CB-CA-C	5.49	118.25	109.02
1	B	140	GLU	N-CA-C	5.38	118.64	111.75
1	B	115	SER	N-CA-C	5.38	118.87	110.32
1	B	267	LEU	N-CA-C	-5.35	105.45	111.28
1	A	261	ALA	N-CA-C	5.22	117.65	111.33
1	A	299	ILE	N-CA-C	5.17	115.79	110.36
1	B	294	GLY	N-CA-C	-5.14	105.78	112.10
1	A	196	ALA	N-CA-C	-5.10	105.80	111.36

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	206	ASN	Peptide

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	2953	0	2793	12	0
1	B	2890	0	2705	30	0
2	C	74	0	61	2	0
3	D	63	0	53	2	0
4	A	15	0	0	0	0
4	B	15	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	1	0	0	1	0
6	A	47	0	0	2	0
6	B	51	0	0	1	0
All	All	6109	0	5612	42	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 (42) 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:B:242:ARG:NH2	1:B:281:THR:O	2.19	0.74
1:A:204:LEU:HD11	1:A:251:ALA:HB2	1.73	0.70
1:B:225:GLU:OE1	6:B:601:HOH:O	2.15	0.64
1:B:258:ALA:O	1:B:295:PRO:HB2	2.01	0.61
1:B:347:GLY:O	1:B:351:LEU:HD13	2.02	0.59
1:B:113:MET:O	1:B:317:ARG:NH1	2.36	0.57
1:B:390:GLU:OE1	3:D:1:BGC:H1	2.05	0.55
1:B:126:LEU:HG	1:B:161:PHE:CD1	2.41	0.55
1:A:170:TRP:CD1	1:A:207:ILE:HG12	2.43	0.53
1:B:324:PHE:CE1	1:B:326:THR:HB	2.44	0.52
1:B:208:HIS:HA	1:B:254:ASN:HB2	1.92	0.52
1:B:427:LEU:HD12	1:B:427:LEU:N	2.27	0.50
1:B:324:PHE:CZ	1:B:326:THR:HB	2.48	0.48
1:A:324:PHE:CZ	1:A:326:THR:HB	2.48	0.48
1:A:390:GLU:OE1	2:C:1:BGC:H1	2.13	0.48
1:B:344:TYR:CE2	1:B:358:ARG:HD2	2.48	0.48
1:B:415:HIS:HB3	1:B:461:LEU:HD23	1.96	0.47
1:A:174:ALA:HA	1:A:180:GLU:O	2.16	0.46
1:A:97:LEU:HD23	1:A:98:TYR:CE2	2.51	0.46
1:B:185:TRP:O	1:B:186:LEU:C	2.59	0.44
1:B:350:PHE:C	1:B:406:LEU:HD11	2.42	0.44
1:B:143:TRP:CG	3:D:3:BGC:H5	2.53	0.44
1:B:356:THR:HA	1:B:359:ASN:ND2	2.33	0.44
1:B:130:ILE:HD12	1:B:166:ILE:HG12	2.00	0.43
1:B:365:GLU:HG2	1:B:417:TYR:CE1	2.53	0.43
1:B:260:ASN:OD1	1:B:260:ASN:C	2.61	0.43
1:B:326:THR:O	1:B:414:TYR:OH	2.23	0.43
1:B:281:THR:OG1	1:B:285:ASN:ND2	2.37	0.43
1:B:370:GLN:O	1:B:373:ASP:HB2	2.19	0.42
1:B:457:VAL:O	1:B:458:LEU:C	2.60	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:151:GLU:HG2	6:A:647:HOH:O	2.19	0.42
1:A:255:GLU:OE2	2:C:1:BGC:O1	2.38	0.41
1:A:193:VAL:HG11	1:A:248:LEU:HD22	2.02	0.41
1:B:120:LEU:HD12	1:B:120:LEU:HA	1.89	0.41
1:A:329:ASN:HB2	1:A:343:PHE:CD2	2.57	0.40
6:A:633:HOH:O	1:B:219:THR:HB	2.20	0.40
1:B:150:ASN:OD1	1:B:199:ASN:ND2	2.49	0.40
1:B:159:SER:O	1:B:462:LEU:HD11	2.22	0.40
1:A:258:ALA:HB3	1:A:295:PRO:HB3	2.03	0.40
1:A:364:GLU:HB2	5:A:511:CL:CL	2.59	0.40
1:B:111:THR:O	1:B:284:LYS:HE2	2.21	0.40
1:B:207:ILE:HD13	1:B:207:ILE:HG21	1.84	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	372/396 (94%)	349 (94%)	22 (6%)	1 (0%)	36	29
1	B	368/396 (93%)	340 (92%)	21 (6%)	7 (2%)	6	1
All	All	740/792 (93%)	689 (93%)	43 (6%)	8 (1%)	11	4

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	297	THR
1	B	382	GLN
1	B	357	GLU
1	B	122	GLY
1	B	108	PRO
1	A	296	VAL

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Mol	Chain	Res	Type
1	B	296	VAL
1	B	130	ILE

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	304/327 (93%)	300 (99%)	4 (1%)	61	61
1	B	291/327 (89%)	279 (96%)	12 (4%)	27	19
All	All	595/654 (91%)	579 (97%)	16 (3%)	39	34

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	103	THR
1	A	182	SER
1	A	296	VAL
1	A	378	LYS
1	B	111	THR
1	B	114	GLN
1	B	157	LYS
1	B	182	SER
1	B	205	ILE
1	B	292	LEU
1	B	296	VAL
1	B	315	THR
1	B	326	THR
1	B	352	SER
1	B	405	THR
1	B	455	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	150	ASN
1	A	199	ASN
1	A	217	ASN
1	A	450	ASN
1	B	191	GLN
1	B	194	GLN
1	B	217	ASN

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 ⓘ

13 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	0.88	0	17,17,17	1.74	3 (17%)
2	BGC	C	2	2	11,11,12	0.58	0	15,15,17	1.59	4 (26%)
2	BGC	C	3	2	11,11,12	0.93	0	15,15,17	1.61	4 (26%)
2	BGC	C	4	2	11,11,12	0.56	0	15,15,17	2.13	6 (40%)
2	XYS	C	5	2	9,9,10	0.53	0	10,12,14	0.72	0
2	XYS	C	6	2	9,9,10	0.47	0	10,12,14	1.34	2 (20%)
2	GAL	C	7	2	11,11,12	1.14	0	15,15,17	2.03	5 (33%)
3	BGC	D	1	3	12,12,12	0.79	0	17,17,17	1.67	3 (17%)
3	BGC	D	2	3	11,11,12	1.39	3 (27%)	15,15,17	1.27	2 (13%)
3	BGC	D	3	3	11,11,12	0.70	0	15,15,17	1.67	2 (13%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	BGC	D	4	3	11,11,12	1.12	1 (9%)	15,15,17	1.23	2 (13%)
3	XYS	D	5	3	9,9,10	0.57	0	10,12,14	1.18	2 (20%)
3	XYS	D	6	3	9,9,10	0.99	0	10,12,14	1.89	5 (50%)

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	-	2/2/22/22	0/1/1/1
2	BGC	C	2	2	-	0/2/19/22	0/1/1/1
2	BGC	C	3	2	-	0/2/19/22	0/1/1/1
2	BGC	C	4	2	-	1/2/19/22	0/1/1/1
2	XYS	C	5	2	-	-	0/1/1/1
2	XYS	C	6	2	-	-	0/1/1/1
2	GAL	C	7	2	-	2/2/19/22	0/1/1/1
3	BGC	D	1	3	-	0/2/22/22	0/1/1/1
3	BGC	D	2	3	-	2/2/19/22	0/1/1/1
3	BGC	D	3	3	-	0/2/19/22	0/1/1/1
3	BGC	D	4	3	-	2/2/19/22	0/1/1/1
3	XYS	D	5	3	1/1/3/4	-	0/1/1/1
3	XYS	D	6	3	-	-	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	2	BGC	C2-C3	2.49	1.56	1.52
3	D	2	BGC	O2-C2	2.27	1.48	1.43
3	D	4	BGC	O5-C1	2.14	1.47	1.43
3	D	2	BGC	C1-C2	2.04	1.57	1.52

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	3	BGC	C1-O5-C5	5.06	118.97	112.19
2	C	4	BGC	C1-C2-C3	-4.62	102.91	109.64
3	D	1	BGC	O1-C1-O5	-3.88	98.89	110.41
3	D	1	BGC	O5-C1-C2	3.68	116.78	110.30
2	C	7	GAL	C1-O5-C5	3.68	117.12	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1	BGC	O1-C1-O5	-3.65	99.56	110.41
2	C	7	GAL	C1-C2-C3	3.58	114.86	109.64
2	C	3	BGC	C1-O5-C5	3.29	116.60	112.19
2	C	7	GAL	O4-C4-C3	3.26	118.06	110.38
2	C	4	BGC	C3-C4-C5	3.13	115.91	110.23
2	C	7	GAL	O3-C3-C4	3.03	117.52	110.38
3	D	6	XYS	C1-C2-C3	-3.00	105.27	109.64
2	C	4	BGC	O2-C2-C3	2.99	116.34	110.15
2	C	4	BGC	O4-C4-C5	-2.96	102.04	109.32
2	C	2	BGC	O6-C6-C5	-2.86	101.59	111.33
3	D	4	BGC	O2-C2-C3	2.76	115.87	110.15
2	C	2	BGC	O2-C2-C1	2.73	115.46	109.22
3	D	4	BGC	O5-C5-C6	2.59	112.69	107.66
3	D	2	BGC	O2-C2-C3	2.51	115.36	110.15
3	D	5	XYS	C5-O5-C1	-2.51	107.37	111.42
2	C	4	BGC	O3-C3-C4	-2.49	104.52	110.38
2	C	7	GAL	O2-C2-C3	-2.45	105.08	110.15
2	C	3	BGC	O2-C2-C3	-2.44	105.09	110.15
3	D	1	BGC	O1-C1-C2	-2.44	101.91	108.98
2	C	1	BGC	O6-C6-C5	-2.42	103.10	111.33
3	D	6	XYS	C5-C4-C3	2.35	113.07	109.64
3	D	6	XYS	O4-C4-C3	-2.34	105.30	110.15
2	C	2	BGC	C1-C2-C3	-2.20	106.45	109.64
2	C	2	BGC	O3-C3-C4	-2.20	105.20	110.38
3	D	2	BGC	O6-C6-C5	-2.14	104.04	111.33
2	C	3	BGC	O6-C6-C5	2.13	118.60	111.33
2	C	6	XYS	O2-C2-C1	2.13	114.10	109.22
2	C	4	BGC	C1-O5-C5	-2.11	109.35	112.19
3	D	5	XYS	C5-C4-C3	2.11	112.72	109.64
3	D	6	XYS	O3-C3-C2	2.10	114.34	110.05
3	D	6	XYS	C5-O5-C1	2.09	114.79	111.42
3	D	3	BGC	O5-C5-C6	2.07	111.69	107.66
2	C	1	BGC	C1-O5-C5	-2.07	109.65	113.65
2	C	3	BGC	O3-C3-C2	-2.01	105.96	110.05
2	C	6	XYS	C4-C3-C2	-2.00	108.54	110.92

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	D	5	XYS	C1

All (9) torsion outliers are listed below:

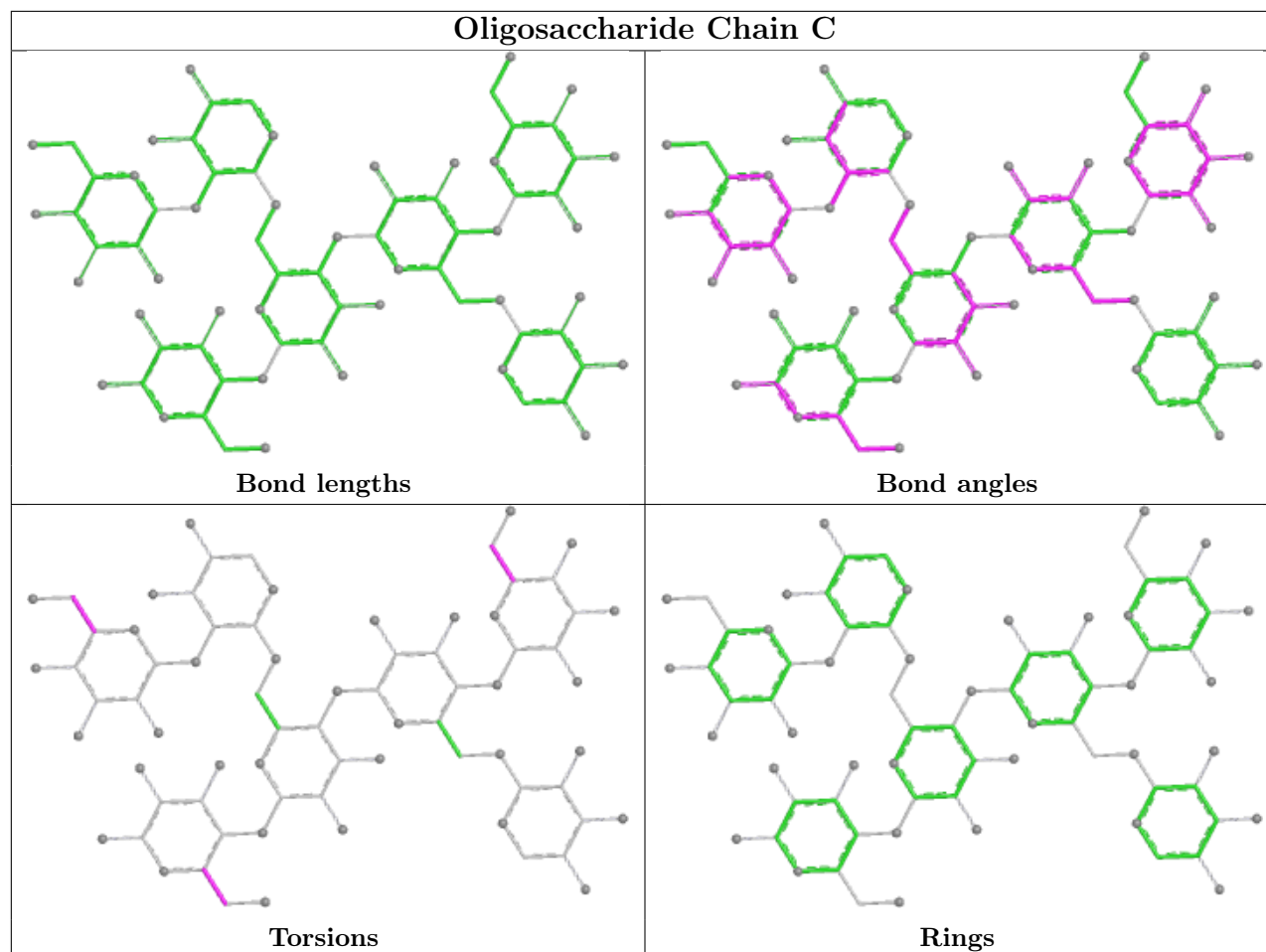
Mol	Chain	Res	Type	Atoms
2	C	7	GAL	C4-C5-C6-O6
2	C	1	BGC	O5-C5-C6-O6
2	C	7	GAL	O5-C5-C6-O6
2	C	1	BGC	C4-C5-C6-O6
2	C	4	BGC	O5-C5-C6-O6
3	D	2	BGC	C4-C5-C6-O6
3	D	2	BGC	O5-C5-C6-O6
3	D	4	BGC	C4-C5-C6-O6
3	D	4	BGC	O5-C5-C6-O6

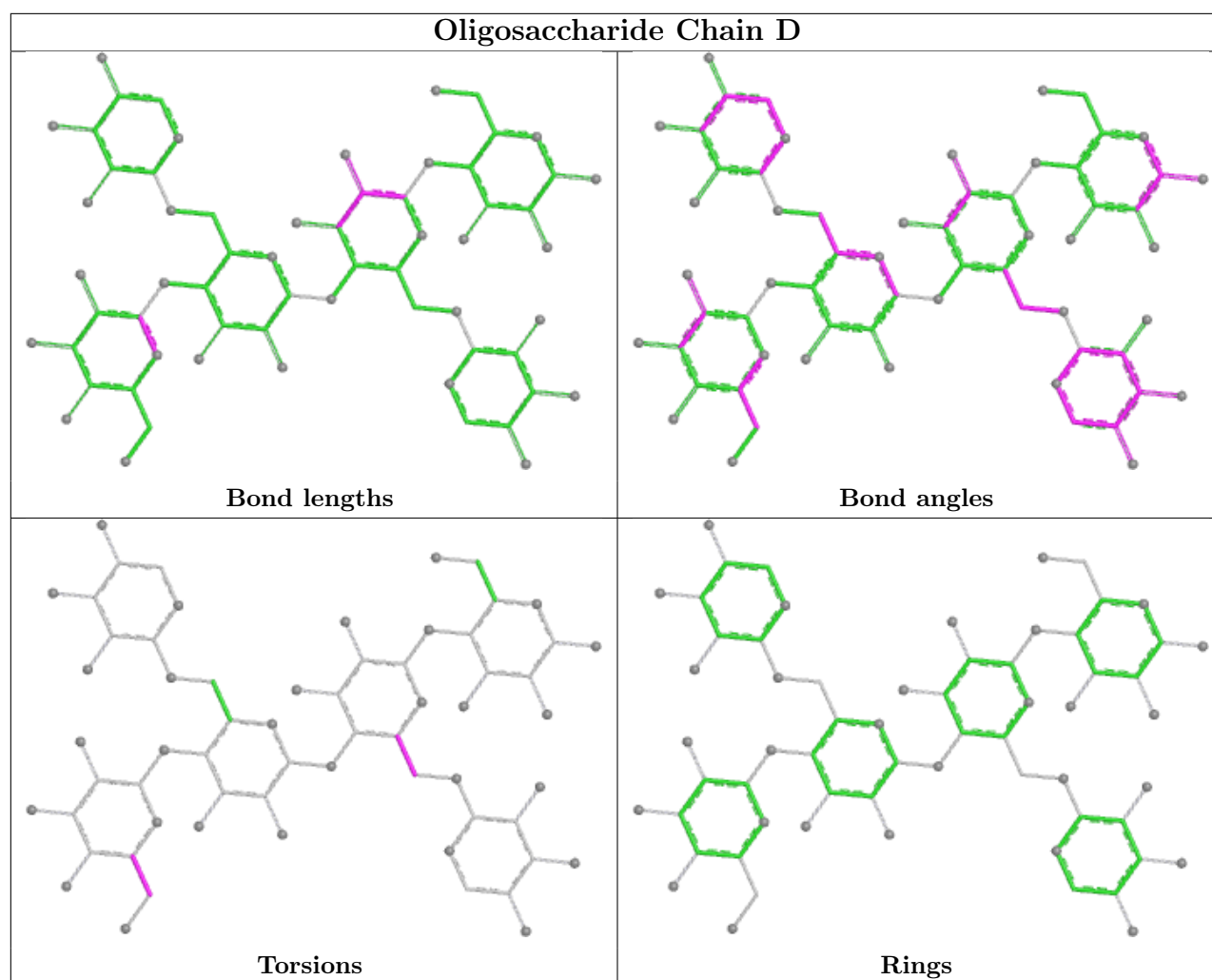
There are no ring outliers.

3 monomers are involved in 4 short contacts:

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

Of 7 ligands modelled in this entry, 1 is monoatomic - leaving 6 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	$\# Z > 2$
4	SO4	B	502	-	4,4,4	0.33	0	6,6,6	0.58	0
4	SO4	B	501	-	4,4,4	0.46	0	6,6,6	0.51	0
4	SO4	A	503	-	4,4,4	0.33	0	6,6,6	0.31	0
4	SO4	B	503	-	4,4,4	0.43	0	6,6,6	0.53	0
4	SO4	A	502	-	4,4,4	0.37	0	6,6,6	0.49	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	SO4	A	501	-	4,4,4	0.43	0	6,6,6	0.27	0

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 [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	372/396 (93%)	0.47	8 (2%) 62 66	26, 51, 64, 85	26 (6%)
1	B	370/396 (93%)	1.02	48 (12%) 7 7	38, 56, 73, 86	62 (16%)
All	All	742/792 (93%)	0.74	56 (7%) 20 21	26, 53, 71, 86	88 (11%)

All (56) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	467	ALA	7.8
1	B	108	PRO	5.0
1	A	287	TYR	4.6
1	B	338	SER	4.4
1	B	111	THR	4.2
1	B	445	PHE	3.7
1	B	428	LEU	3.7
1	B	120	LEU	3.7
1	B	462	LEU	3.6
1	B	417	TYR	3.6
1	B	353	THR	3.5
1	A	96	GLY	3.3
1	B	103	THR	3.2
1	B	202	TYR	3.2
1	B	197	ILE	3.1
1	B	116	THR	3.1
1	A	466	GLY	3.1
1	B	299	ILE	3.1
1	B	193	VAL	3.0
1	B	310	PRO	3.0
1	B	376	LYS	3.0
1	A	339	TRP	2.9
1	B	155	LEU	2.9
1	A	352	SER	2.9

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Mol	Chain	Res	Type	RSRZ
1	B	354	THR	2.8
1	B	110	SER	2.8
1	B	97	LEU	2.8
1	B	153	LEU	2.8
1	B	384	ILE	2.8
1	B	152	LEU	2.7
1	B	287	TYR	2.7
1	B	348	GLU	2.7
1	B	368	ILE	2.7
1	B	444	ILE	2.6
1	B	416	LYS	2.6
1	B	313	THR	2.6
1	B	157	LYS	2.5
1	B	386	VAL	2.4
1	A	400	THR	2.4
1	B	377	THR	2.4
1	B	99	PRO	2.4
1	B	113	MET	2.4
1	B	117	ALA	2.3
1	B	378	LYS	2.3
1	B	278	VAL	2.2
1	B	286	ALA	2.2
1	B	156	VAL	2.1
1	B	318	LEU	2.1
1	B	112	GLY	2.1
1	B	410	GLY	2.1
1	A	354	THR	2.1
1	B	339	TRP	2.1
1	B	413	TYR	2.0
1	B	351	LEU	2.0
1	B	372	PHE	2.0
1	B	289	VAL	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.

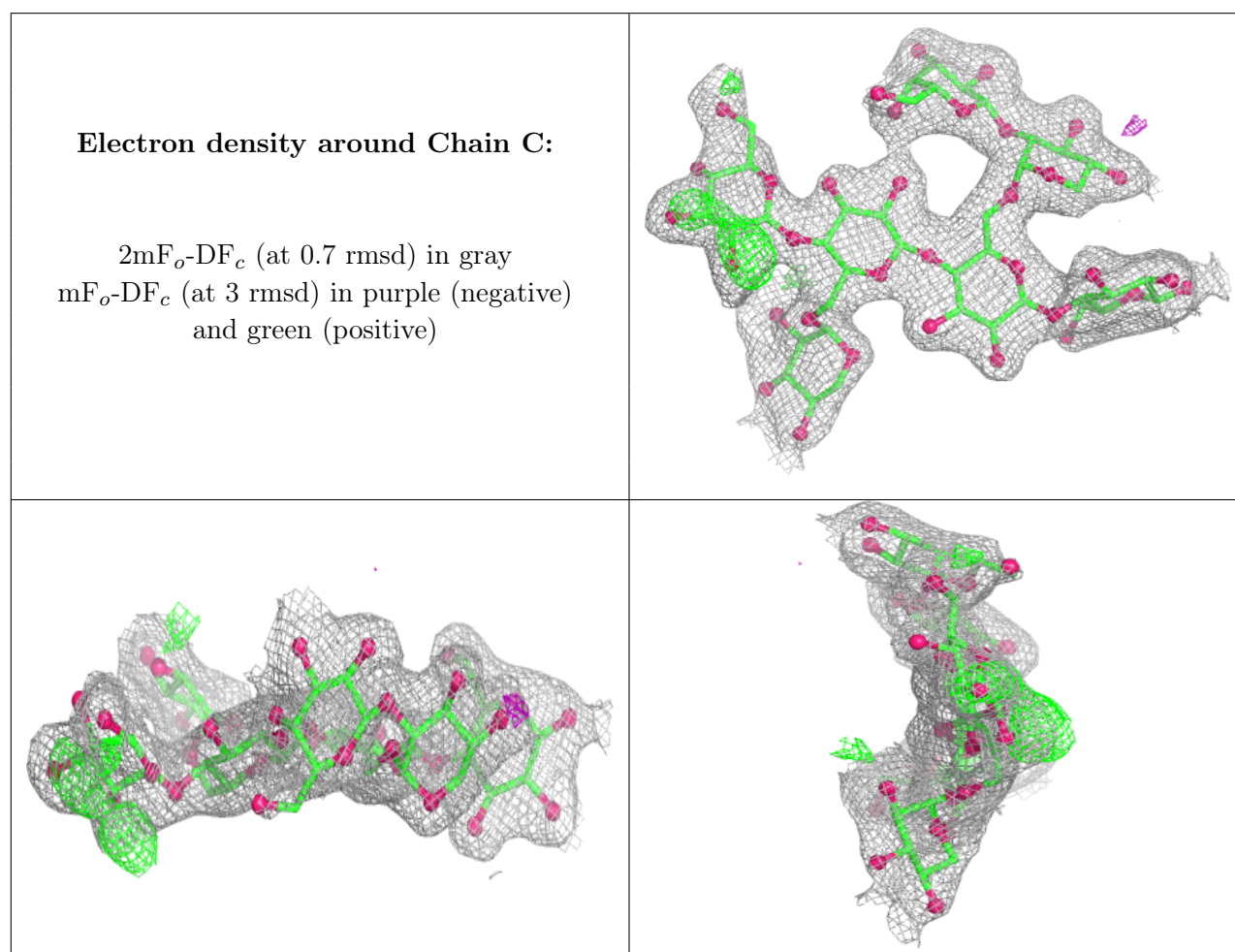
6.3 Carbohydrates [i](#)

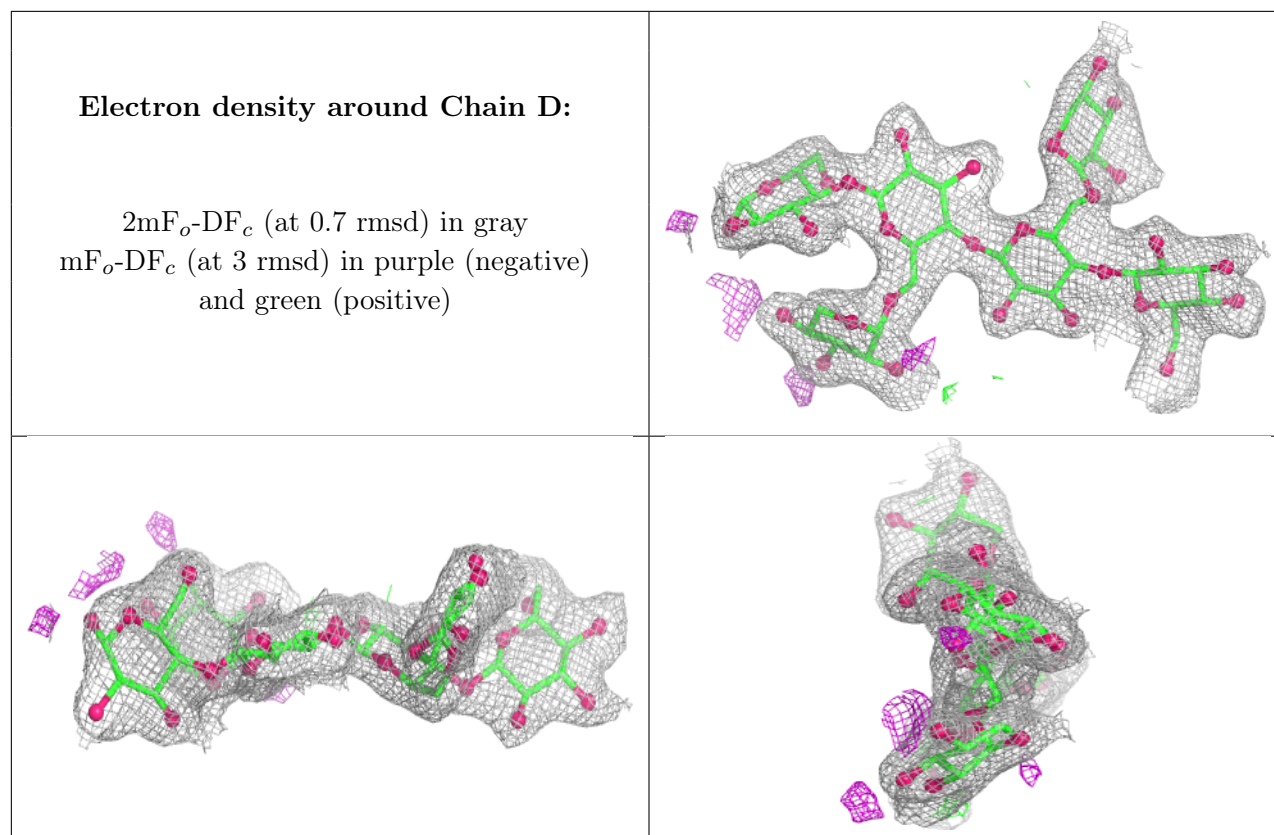
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

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	BGC	C	4	11/12	0.55	0.25	47,55,60,63	11
3	BGC	D	4	11/12	0.74	0.11	65,68,72,72	0
2	XYS	C	5	9/10	0.80	0.14	57,59,63,64	9
3	XYS	D	5	9/10	0.85	0.10	61,71,73,75	0
3	BGC	D	2	11/12	0.91	0.07	46,54,59,61	0
3	BGC	D	3	11/12	0.91	0.08	54,60,67,68	0
2	GAL	C	7	11/12	0.92	0.10	51,63,73,73	2
3	BGC	D	1	12/12	0.92	0.08	40,55,59,79	0
3	XYS	D	6	9/10	0.92	0.08	42,50,55,55	0
2	BGC	C	3	11/12	0.93	0.09	51,55,66,74	0
2	XYS	C	6	9/10	0.93	0.07	42,45,47,48	0
2	BGC	C	1	12/12	0.93	0.09	39,49,51,57	0
2	BGC	C	2	11/12	0.95	0.06	44,47,50,50	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(Å ²)	Q<0.9
4	SO4	A	503	5/5	0.76	0.13	57,61,68,70	5
4	SO4	B	502	5/5	0.81	0.11	52,59,70,71	5
4	SO4	B	503	5/5	0.81	0.11	56,56,63,65	5
5	CL	A	511	1/1	0.84	0.10	80,80,80,80	0
4	SO4	B	501	5/5	0.85	0.10	59,62,68,75	5
4	SO4	A	502	5/5	0.86	0.09	48,50,57,57	5
4	SO4	A	501	5/5	0.88	0.08	52,60,65,69	5

6.5 Other polymers [i](#)

There are no such residues in this entry.