



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 04:18 PM UTC

PDB ID : 3GMR / pdb_00003gmr
Title : Structure of mouse CD1d in complex with C8Ph, different space group
Authors : Schiefner, A.; Wilson, I.A.
Deposited on : 2009-03-14
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
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

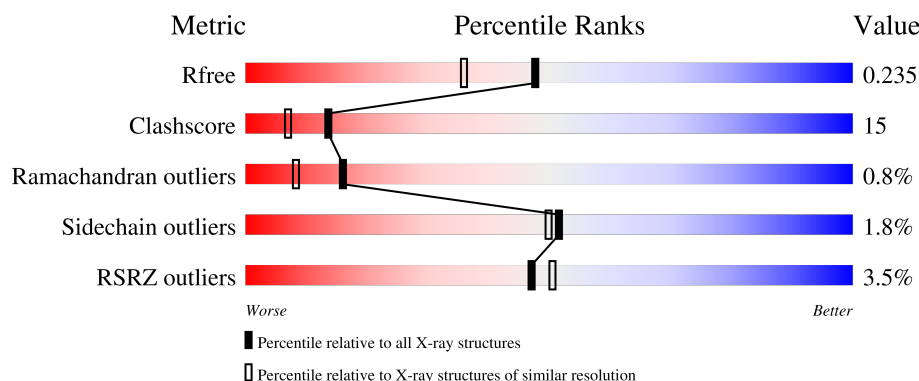
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 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	287	4% 75% 18% •• 5%
2	B	99	2% 79% 21%
3	C	2	100%
3	D	2	100%
4	E	6	50% 50%

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
4	MAN	E	5	-	-	X	-
4	FUC	E	6	-	-	X	-
8	PG4	B	100	-	-	X	-

2 Entry composition

There are 9 unique types of molecules in this entry. The entry contains 3613 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 T-cell surface glycoprotein CD1d1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	8	0
			2252	1430	390	419	13			

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	201	HIS	ASP	SEE REMARK 999	UNP P11609
A	280	GLY	-	expression tag	UNP P11609
A	281	SER	-	expression tag	UNP P11609
A	282	HIS	-	expression tag	UNP P11609
A	283	HIS	-	expression tag	UNP P11609
A	284	HIS	-	expression tag	UNP P11609
A	285	HIS	-	expression tag	UNP P11609
A	286	HIS	-	expression tag	UNP P11609
A	287	HIS	-	expression tag	UNP P11609

- Molecule 2 is a protein called Beta-2 microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	99	Total	C	N	O	S	0	1	0
			827	528	140	152	7			

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



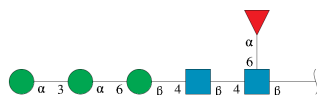
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	2	Total	C	N	O	0	0	0
			28	16	2	10			

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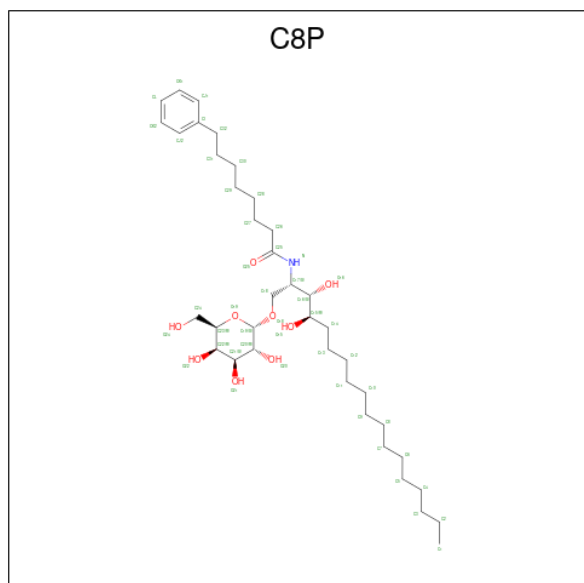
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	D	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 4 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.



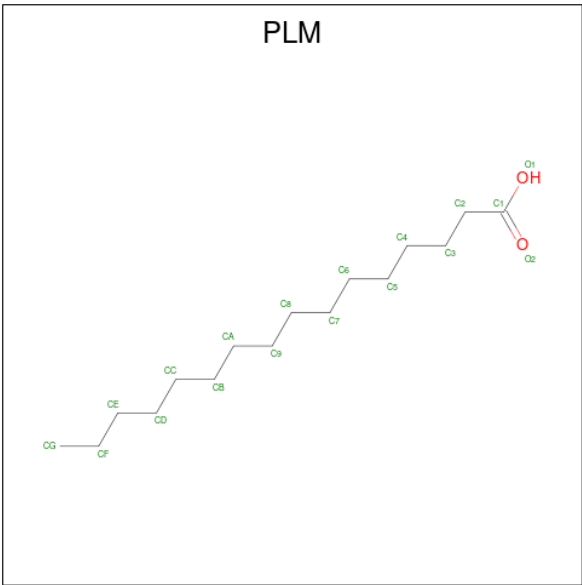
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	E	6	Total	C	N	O	0	0	0
			71	40	2	29			

- Molecule 5 is N-((1S,2S,3R)-1-[(alpha-D-galactopyranosyloxy)methyl]-2,3-dihydroxyheptadecyl)-8-phenyloctanamide (CCD ID: C8P) (formula: C₃₈H₆₇NO₉).



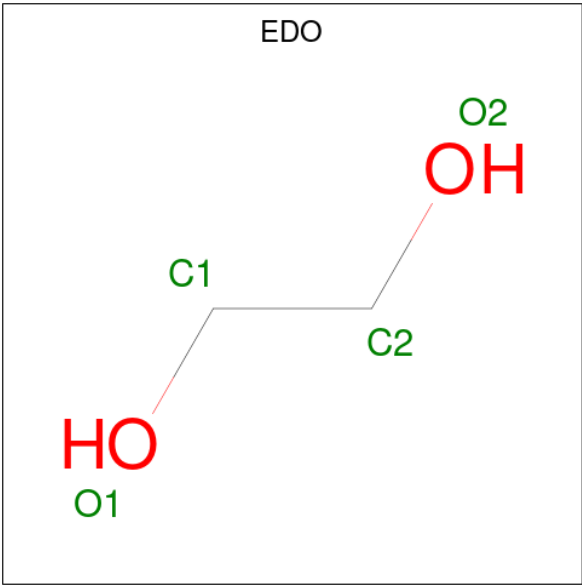
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			48	38	1	9		

- Molecule 6 is PALMITIC ACID (CCD ID: PLM) (formula: C₁₆H₃₂O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			18	16	2		

- Molecule 7 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



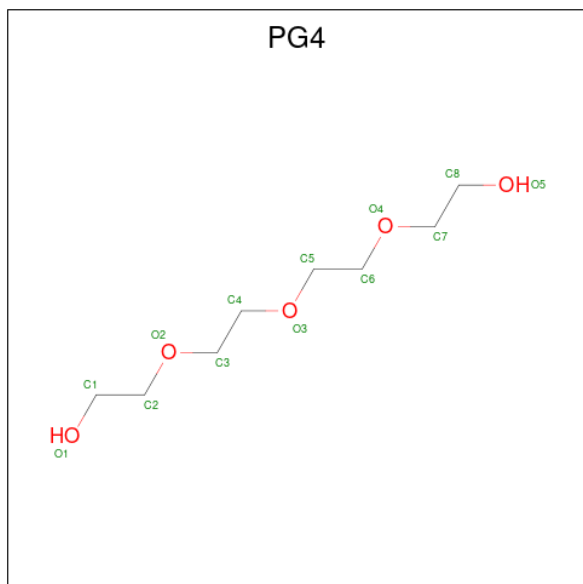
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			4	2	2		
7	A	1	Total	C	O	0	0
			4	2	2		
7	A	1	Total	C	O	0	1
			8	4	4		

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

- Molecule 8 is TETRAETHYLENE GLYCOL (CCD ID: PG4) (formula: $C_8H_{18}O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	B	1	Total	C	O	0	0
			13	8	5		

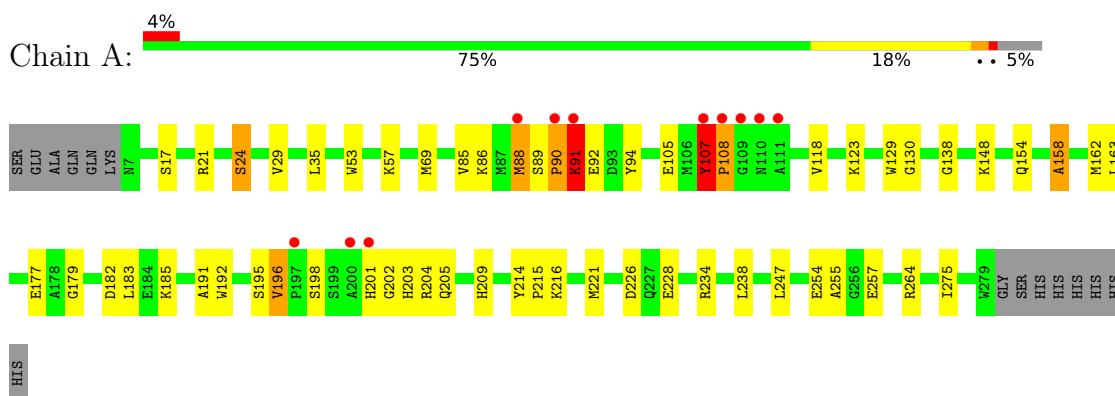
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	205	Total	O	0	0
			205	205		
9	B	103	Total	O	0	0
			103	103		

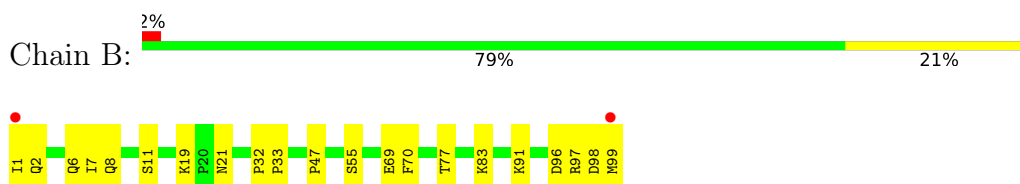
3 Residue-property plots [i](#)

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.

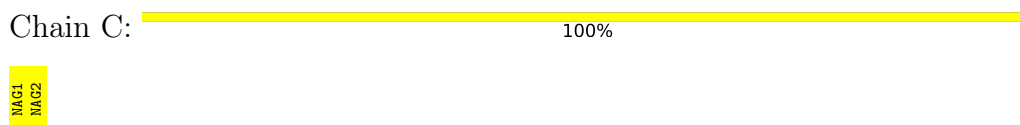
- Molecule 1: T-cell surface glycoprotein CD1d1



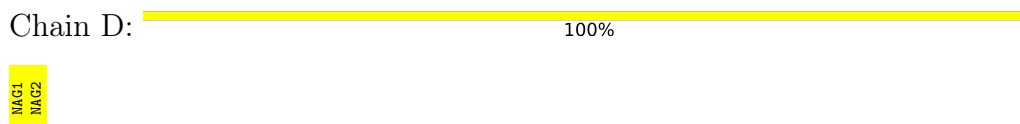
- Molecule 2: Beta-2 microglobulin



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



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



- Molecule 4: alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamid

o-2-deoxy-beta-D-glucopyranose

Chain E:

50%

50%

MAG1	MAG2	EMA3	MAN4	MAN5	FUC6
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4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	42.27Å 107.23Å 109.42Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 1.90 30.00 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.2 (30.00-1.90) 99.2 (30.00-1.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.97 (at 1.89Å)	Xtriage
Refinement program	REFMAC 5.5.0066	Depositor
R, R_{free}	0.186 , 0.230 0.194 , 0.235	Depositor DCC
R_{free} test set	1995 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	21.4	Xtriage
Anisotropy	0.086	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 42.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.018 for -h,l,k	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3613	wwPDB-VP
Average B, all atoms (Å ²)	16.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.04% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: EDO, FUC, MAN, NAG, PLM, PG4, BMA, C8P

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	1.19	1/2323 (0.0%)	1.14	11/3157 (0.3%)
2	B	1.22	0/853	1.21	2/1156 (0.2%)
All	All	1.20	1/3176 (0.0%)	1.16	13/4313 (0.3%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	158	ALA	CA-CB	7.69	1.65	1.53

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	107	TYR	CA-C-N	7.68	129.44	119.84
1	A	107	TYR	C-N-CA	7.68	129.44	119.84
2	B	47	PRO	CA-C-N	-6.82	111.63	122.95
2	B	47	PRO	C-N-CA	-6.82	111.63	122.95
1	A	216	LYS	CA-C-N	-6.11	113.23	119.83
1	A	216	LYS	C-N-CA	-6.11	113.23	119.83
1	A	238	LEU	CA-C-N	-5.94	113.85	120.14
1	A	238	LEU	C-N-CA	-5.94	113.85	120.14
1	A	257	GLU	N-CA-C	-5.87	104.67	112.94
1	A	138	GLY	N-CA-C	-5.45	108.13	115.21
1	A	275	ILE	CA-C-N	-5.33	116.16	123.14
1	A	275	ILE	C-N-CA	-5.33	116.16	123.14
1	A	264	ARG	NE-CZ-NH2	-5.19	114.53	119.20

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	2252	0	2147	61	0
2	B	827	0	804	23	0
3	C	28	0	25	0	0
3	D	28	0	25	0	0
4	E	71	0	61	13	0
5	A	48	0	67	2	0
6	A	18	0	31	3	0
7	A	20	0	30	0	0
8	B	13	0	18	15	0
9	A	205	0	0	11	0
9	B	103	0	0	6	0
All	All	3613	0	3208	95	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 15.

All (95) 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)
4:E:4:MAN:H2	4:E:5:MAN:H5	1.12	1.09
4:E:4:MAN:H2	4:E:5:MAN:C5	1.93	0.98
2:B:11:SER:OG	8:B:100:PG4:H72	1.67	0.94
1:A:196:VAL:HG11	2:B:99:MET:HG3	1.50	0.93
4:E:4:MAN:C2	4:E:5:MAN:H5	1.99	0.91
1:A:192:TRP:HE1	8:B:100:PG4:H81	1.39	0.88
1:A:107:TYR:HB3	1:A:108:PRO:HD2	1.57	0.86
1:A:195:SER:OG	1:A:204[B]:ARG:NH1	2.10	0.84
1:A:89:SER:HB2	1:A:90:PRO:O	1.76	0.84
9:A:389:HOH:O	4:E:6:FUC:C6	2.29	0.80
1:A:89:SER:HA	1:A:90:PRO:C	2.07	0.79
1:A:192:TRP:HE1	8:B:100:PG4:C8	1.96	0.78
1:A:130:GLY:H	4:E:6:FUC:H61	1.49	0.76
1:A:192:TRP:NE1	8:B:100:PG4:H81	1.99	0.76
9:A:463:HOH:O	4:E:5:MAN:O4	2.05	0.75
1:A:130:GLY:H	4:E:6:FUC:C6	2.02	0.73

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:130:GLY:N	4:E:6:FUC:H61	2.04	0.72
1:A:201:HIS:CD2	1:A:202:GLY:N	2.59	0.71
1:A:107:TYR:CB	1:A:108:PRO:HD2	2.24	0.67
9:A:389:HOH:O	4:E:6:FUC:H5	1.94	0.66
1:A:89:SER:CA	1:A:90:PRO:C	2.69	0.66
2:B:8:GLN:HB3	8:B:100:PG4:H11	1.76	0.65
1:A:196:VAL:HG11	2:B:99:MET:CG	2.24	0.65
9:A:389:HOH:O	4:E:6:FUC:C5	2.44	0.65
1:A:158:ALA:O	1:A:162:MET:HG3	1.96	0.64
9:A:389:HOH:O	4:E:6:FUC:H62	1.95	0.63
1:A:105:GLU:HG2	1:A:107:TYR:CE1	2.34	0.62
2:B:99:MET:OXT	8:B:100:PG4:H42	1.98	0.62
8:B:100:PG4:H82	8:B:100:PG4:C5	2.25	0.61
1:A:234[B]:ARG:HD2	9:A:383:HOH:O	2.02	0.60
1:A:107:TYR:HB3	1:A:108:PRO:CD	2.31	0.59
2:B:69:GLU:HG3	9:B:140:HOH:O	2.01	0.59
1:A:88:MET:O	1:A:91:LYS:HB2	2.03	0.59
1:A:107:TYR:CB	1:A:108:PRO:CD	2.81	0.58
2:B:1:ILE:CG1	2:B:2:GLN:H	2.17	0.58
1:A:88:MET:HE1	1:A:92:GLU:HG2	1.89	0.55
1:A:201:HIS:CD2	1:A:202:GLY:H	2.24	0.54
2:B:32:PRO:HB2	2:B:33:PRO:HD2	1.89	0.54
1:A:234[A]:ARG:HB2	9:A:383:HOH:O	2.08	0.53
1:A:57:LYS:HD2	1:A:177:GLU:OE1	2.09	0.52
2:B:1:ILE:HG12	2:B:2:GLN:H	1.74	0.52
2:B:77:THR:HG22	9:B:198:HOH:O	2.10	0.52
1:A:192:TRP:CE2	8:B:100:PG4:H81	2.45	0.51
1:A:85:VAL:HG11	1:A:94:TYR:CZ	2.45	0.51
1:A:195:SER:OG	1:A:204[B]:ARG:CZ	2.59	0.51
1:A:88:MET:CE	1:A:92:GLU:HG2	2.41	0.51
8:B:100:PG4:H22	9:B:104:HOH:O	2.11	0.51
1:A:148:LYS:HG3	9:A:376:HOH:O	2.11	0.51
1:A:196:VAL:HG23	1:A:205:GLN:HB3	1.93	0.51
1:A:209:HIS:HE1	2:B:99:MET:OXT	1.95	0.50
1:A:21:ARG:HH11	1:A:21:ARG:HG3	1.77	0.50
1:A:89:SER:HB2	1:A:90:PRO:C	2.35	0.50
1:A:254:GLU:HG2	1:A:255:ALA:N	2.26	0.49
1:A:86:LYS:HG3	9:A:388:HOH:O	2.13	0.48
1:A:118:VAL:HG11	5:A:298:C8P:H6	1.94	0.48
8:B:100:PG4:C8	8:B:100:PG4:C5	2.90	0.48
1:A:209:HIS:CE1	8:B:100:PG4:H51	2.49	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:53:TRP:CG	1:A:179:GLY:HA2	2.49	0.47
1:A:234[A]:ARG:HG2	1:A:247:LEU:HD11	1.96	0.47
1:A:21:ARG:HG3	1:A:21:ARG:NH1	2.30	0.47
1:A:182:ASP:O	1:A:185:LYS:HG2	2.14	0.47
2:B:1:ILE:CG1	2:B:2:GLN:N	2.76	0.47
1:A:29[A]:VAL:HG21	2:B:55:SER:OG	2.15	0.47
1:A:154:GLN:OE1	9:A:379:HOH:O	2.21	0.47
2:B:11:SER:HG	8:B:100:PG4:H72	1.75	0.47
1:A:195:SER:O	2:B:98:ASP:HB3	2.15	0.46
2:B:97:ARG:O	8:B:100:PG4:O5	2.32	0.46
1:A:192:TRP:CZ2	8:B:100:PG4:H81	2.51	0.46
2:B:6[A]:GLN:HG2	9:B:101:HOH:O	2.16	0.45
8:B:100:PG4:C8	8:B:100:PG4:H52	2.47	0.45
2:B:21:ASN:HB3	2:B:70:PHE:CE1	2.53	0.44
1:A:17:SER:O	1:A:24:SER:HA	2.16	0.44
1:A:89:SER:HA	1:A:91:LYS:N	2.32	0.44
5:A:298:C8P:H31A	6:A:299:PLM:HG3	2.00	0.44
1:A:89:SER:CB	1:A:90:PRO:O	2.59	0.43
1:A:35:LEU:HD12	1:A:183:LEU:HD23	2.01	0.43
2:B:1:ILE:HG12	2:B:2:GLN:N	2.34	0.43
2:B:19:LYS:HD3	9:B:237:HOH:O	2.18	0.43
1:A:201:HIS:HD2	1:A:202:GLY:H	1.66	0.43
6:A:299:PLM:HC2	6:A:299:PLM:HF2	1.76	0.43
6:A:299:PLM:HA1	6:A:299:PLM:HD1	1.80	0.42
1:A:191:ALA:HA	1:A:209:HIS:O	2.19	0.42
1:A:129:TRP:CD1	4:E:5:MAN:H2	2.54	0.42
4:E:4:MAN:H2	4:E:5:MAN:O5	2.17	0.42
1:A:214:TYR:CG	1:A:215:PRO:HA	2.55	0.42
1:A:89:SER:CB	1:A:90:PRO:C	2.93	0.41
2:B:7:ILE:HD12	2:B:91:LYS:HD3	2.01	0.41
1:A:123:LYS:HD3	9:A:408:HOH:O	2.20	0.41
1:A:221:MET:HE3	1:A:228:GLU:OE1	2.19	0.41
1:A:53:TRP:CD1	1:A:179:GLY:HA2	2.55	0.41
2:B:83:LYS:HG3	9:B:201:HOH:O	2.21	0.41
1:A:198:SER:HB3	1:A:203:HIS:C	2.46	0.40
1:A:88:MET:HE1	1:A:92:GLU:CG	2.51	0.40
1:A:69:MET:SD	1:A:163:LEU:HD11	2.62	0.40
2:B:96:ASP:C	2:B:96:ASP:OD2	2.63	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	279/287 (97%)	272 (98%)	4 (1%)	3 (1%)	11	4
2	B	98/99 (99%)	96 (98%)	2 (2%)	0	100	100
All	All	377/386 (98%)	368 (98%)	6 (2%)	3 (1%)	16	8

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	90	PRO
1	A	91	LYS
1	A	108	PRO

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	246/250 (98%)	239 (97%)	7 (3%)	38	32
2	B	94/93 (101%)	94 (100%)	0	100	100
All	All	340/343 (99%)	333 (98%)	7 (2%)	51	44

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	SER
1	A	88	MET
1	A	91	LYS

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Mol	Chain	Res	Type
1	A	107	TYR
1	A	196	VAL
1	A	226[A]	ASP
1	A	226[B]	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	154	GLN
1	A	186	GLN
1	A	201	HIS
2	B	31	HIS
2	B	34	HIS

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	$\# Z > 2$
3	NAG	C	1	3,1	14,14,15	0.83	1 (7%)	17,19,21	1.35	4 (23%)
3	NAG	C	2	3	14,14,15	0.36	0	17,19,21	1.77	4 (23%)
3	NAG	D	1	3,1	14,14,15	0.65	0	17,19,21	1.27	1 (5%)
3	NAG	D	2	3	14,14,15	0.64	0	17,19,21	1.27	2 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	NAG	E	1	4,1	14,14,15	1.43	2 (14%)	17,19,21	1.55	2 (11%)
4	NAG	E	2	4	14,14,15	0.82	0	17,19,21	1.29	2 (11%)
4	BMA	E	3	4	11,11,12	0.67	0	15,15,17	1.49	1 (6%)
4	MAN	E	4	4	11,11,12	0.65	0	15,15,17	1.68	4 (26%)
4	MAN	E	5	4	11,11,12	0.66	0	15,15,17	1.92	5 (33%)
4	FUC	E	6	4	10,10,11	1.04	1 (10%)	14,14,16	2.55	7 (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
3	NAG	C	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	C	2	3	-	2/6/23/26	0/1/1/1
3	NAG	D	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	D	2	3	-	4/6/23/26	0/1/1/1
4	NAG	E	1	4,1	-	1/6/23/26	0/1/1/1
4	NAG	E	2	4	-	0/6/23/26	0/1/1/1
4	BMA	E	3	4	-	0/2/19/22	0/1/1/1
4	MAN	E	4	4	-	2/2/19/22	0/1/1/1
4	MAN	E	5	4	-	0/2/19/22	0/1/1/1
4	FUC	E	6	4	-	-	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	E	1	NAG	C1-C2	4.07	1.57	1.52
4	E	1	NAG	O5-C5	-2.61	1.38	1.43
3	C	1	NAG	C1-C2	2.49	1.55	1.52
4	E	6	FUC	C2-C3	2.29	1.56	1.52

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	2	NAG	C1-O5-C5	5.12	119.04	112.19
4	E	6	FUC	O4-C4-C5	-4.40	100.04	109.74
4	E	6	FUC	O5-C1-C2	-4.20	100.78	110.79
4	E	3	BMA	C1-C2-C3	3.64	114.95	109.64
4	E	1	NAG	C1-O5-C5	3.56	116.96	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	E	6	FUC	O2-C2-C3	3.39	117.18	110.15
4	E	5	MAN	C1-O5-C5	3.27	116.57	112.19
4	E	6	FUC	C6-C5-C4	-3.22	107.19	113.08
4	E	4	MAN	C1-C2-C3	-3.13	105.09	109.64
4	E	6	FUC	C1-C2-C3	-3.07	105.17	109.64
4	E	5	MAN	O5-C5-C6	3.06	113.62	107.66
3	D	1	NAG	O5-C5-C6	2.83	113.17	107.66
4	E	6	FUC	O3-C3-C2	2.74	115.64	110.05
4	E	6	FUC	O4-C4-C3	2.69	116.72	110.38
4	E	1	NAG	C8-C7-N2	2.66	120.53	116.12
4	E	2	NAG	C1-O5-C5	2.50	115.54	112.19
4	E	5	MAN	C1-C2-C3	-2.46	106.06	109.64
4	E	5	MAN	C3-C4-C5	2.43	114.64	110.23
3	D	2	NAG	C1-C2-N2	-2.40	106.66	110.43
3	D	2	NAG	O5-C5-C6	2.38	112.29	107.66
4	E	4	MAN	C2-C3-C4	2.36	115.02	110.86
3	C	2	NAG	C2-N2-C7	-2.30	119.82	122.90
3	C	1	NAG	O3-C3-C4	-2.26	105.05	110.38
3	C	1	NAG	O5-C5-C6	2.22	111.98	107.66
4	E	2	NAG	O3-C3-C4	-2.21	105.16	110.38
3	C	1	NAG	C1-O5-C5	2.20	115.14	112.19
4	E	4	MAN	O5-C5-C6	2.19	111.93	107.66
4	E	4	MAN	O2-C2-C3	2.15	114.61	110.15
4	E	5	MAN	C6-C5-C4	-2.14	107.75	113.02
3	C	2	NAG	C1-C2-N2	2.14	113.80	110.43
3	C	2	NAG	C4-C3-C2	-2.13	107.89	111.02
3	C	1	NAG	C1-C2-N2	2.06	113.69	110.43

There are no chirality outliers.

All (9) torsion outliers are listed below:

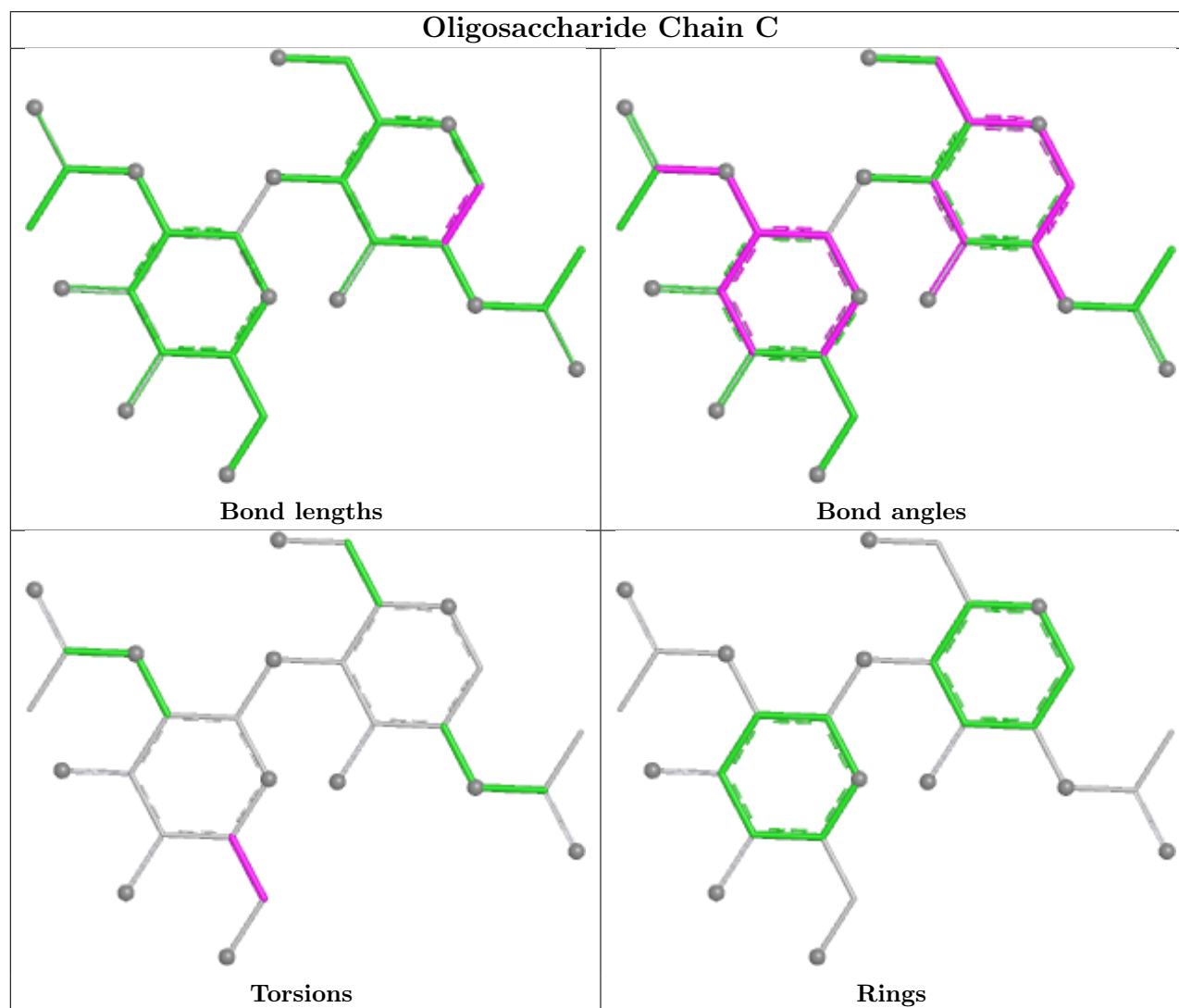
Mol	Chain	Res	Type	Atoms
3	D	2	NAG	O5-C5-C6-O6
3	D	2	NAG	C4-C5-C6-O6
3	D	2	NAG	C8-C7-N2-C2
3	D	2	NAG	O7-C7-N2-C2
4	E	4	MAN	O5-C5-C6-O6
3	C	2	NAG	O5-C5-C6-O6
3	C	2	NAG	C4-C5-C6-O6
4	E	4	MAN	C4-C5-C6-O6
4	E	1	NAG	C1-C2-N2-C7

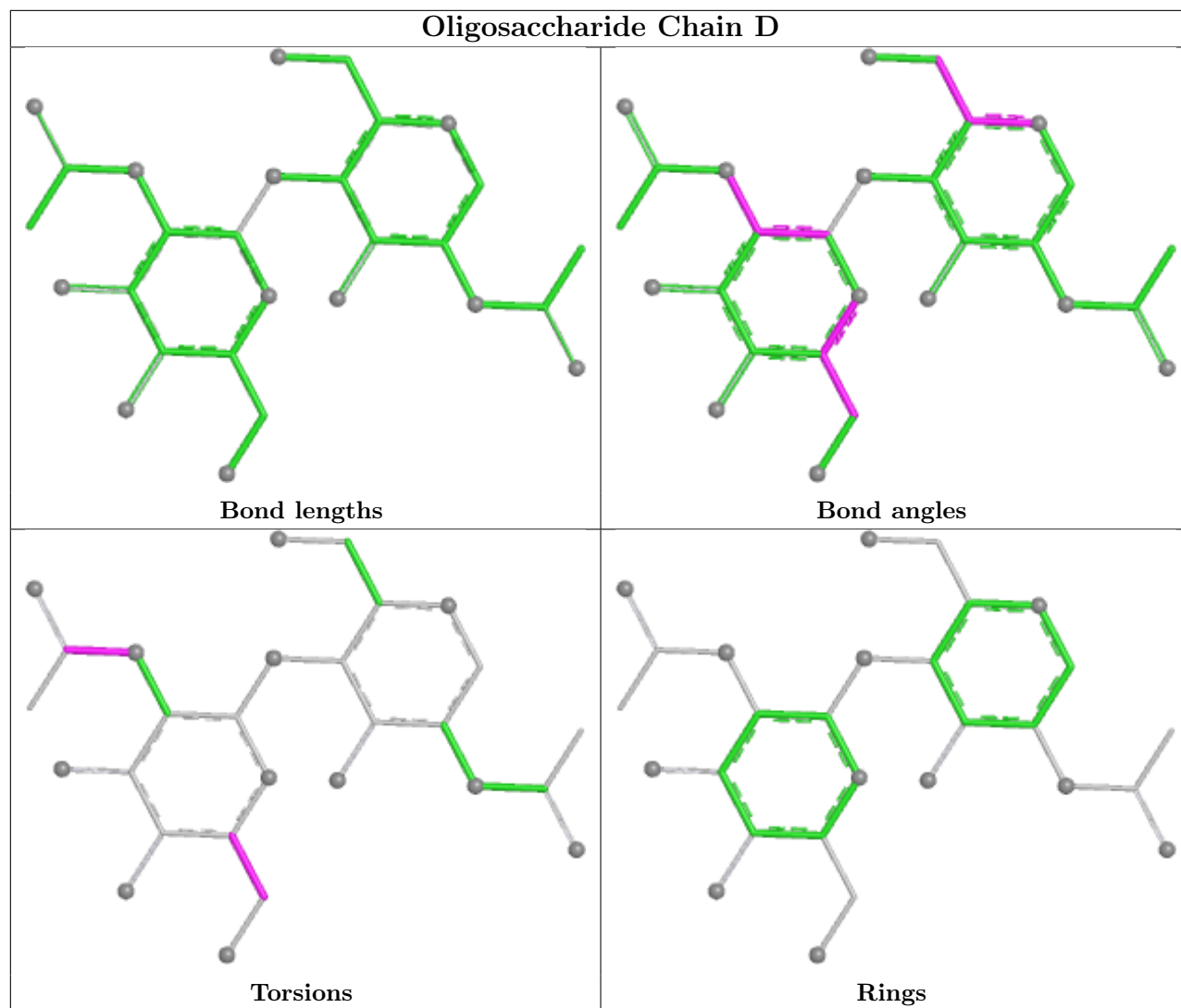
There are no ring outliers.

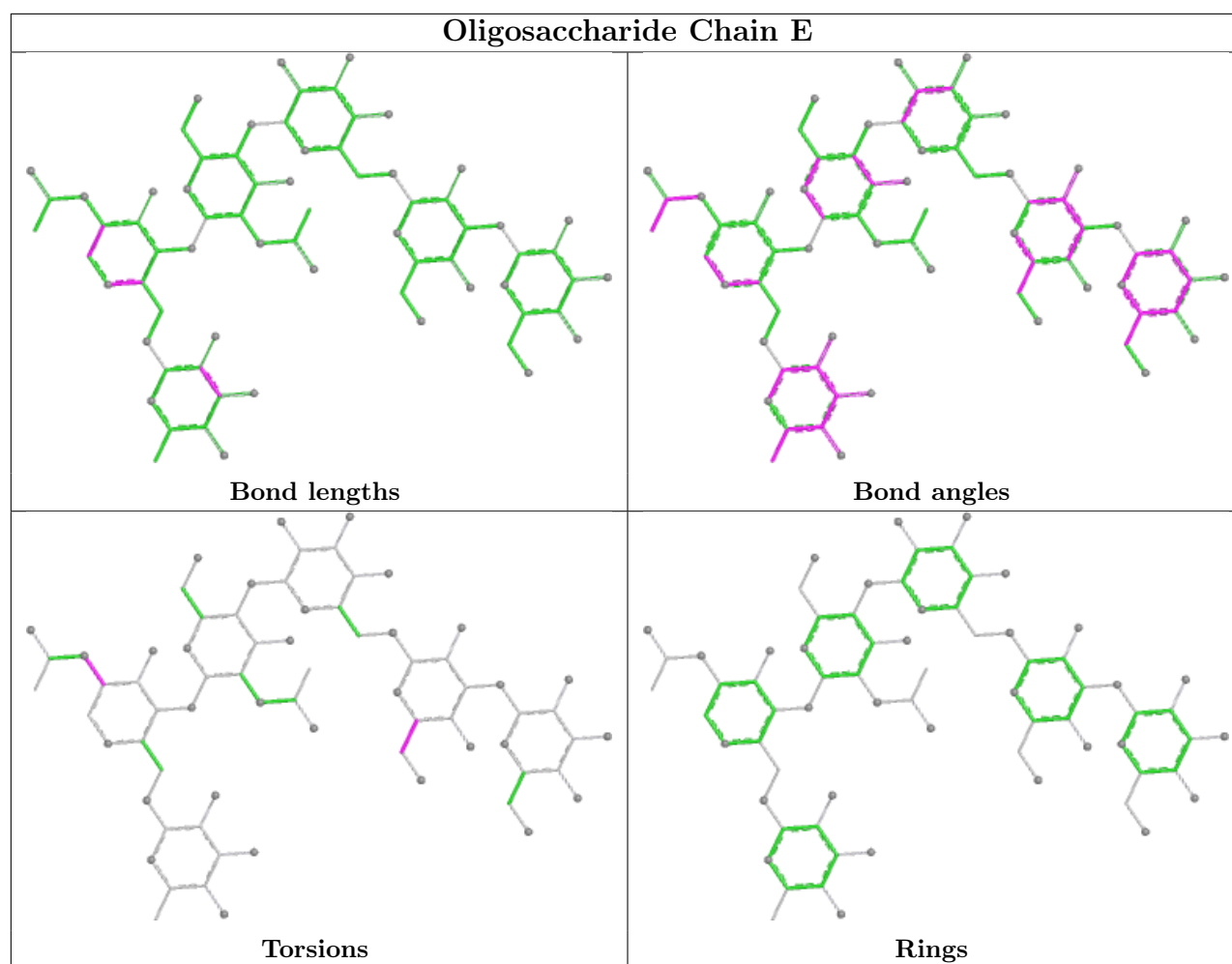
3 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	E	5	MAN	6	0
4	E	6	FUC	7	0
4	E	4	MAN	4	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](#)

8 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	$\# Z > 2$
5	C8P	A	298	-	49,49,49	0.84	2 (4%)	57,60,60	1.30	5 (8%)
8	PG4	B	100	-	12,12,12	1.04	0	11,11,11	1.29	2 (18%)
7	EDO	A	303	-	3,3,3	0.32	0	2,2,2	0.55	0
6	PLM	A	299	-	17,17,17	0.70	0	17,17,17	1.32	2 (11%)
7	EDO	A	301	-	3,3,3	0.78	0	2,2,2	0.55	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
7	EDO	A	302[B]	-	3,3,3	0.38	0	2,2,2	1.02	0
7	EDO	A	302[A]	-	3,3,3	0.56	0	2,2,2	1.56	0
7	EDO	A	300	-	3,3,3	0.29	0	2,2,2	0.67	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	C8P	A	298	-	-	9/43/63/63	0/2/2/2
8	PG4	B	100	-	-	7/10/10/10	-
7	EDO	A	303	-	-	1/1/1/1	-
6	PLM	A	299	-	-	8/15/15/15	-
7	EDO	A	301	-	-	0/1/1/1	-
7	EDO	A	302[B]	-	-	1/1/1/1	-
7	EDO	A	302[A]	-	-	1/1/1/1	-
7	EDO	A	300	-	-	0/1/1/1	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	298	C8P	O18-C19	2.98	1.45	1.40
5	A	298	C8P	C27-C26	2.03	1.59	1.52

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	298	C8P	C26-C25-N	3.94	122.81	115.86
6	A	299	PLM	O1-C1-C2	3.78	125.93	114.00
5	A	298	C8P	C18-C17-C16	-3.29	106.24	112.71
5	A	298	C8P	O25-C25-N	-3.20	117.53	122.95
6	A	299	PLM	O1-C1-O2	-3.03	115.53	123.33
8	B	100	PG4	O4-C6-C5	-2.88	97.23	110.35
5	A	298	C8P	CL-CK2-CJ2	-2.48	117.18	120.24
5	A	298	C8P	C14-C15-C16	-2.47	110.06	113.97
8	B	100	PG4	O3-C5-C6	2.03	119.59	110.35

There are no chirality outliers.

All (27) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	B	100	PG4	C8-C7-O4-C6
6	A	299	PLM	C4-C5-C6-C7
8	B	100	PG4	O4-C7-C8-O5
5	A	298	C8P	O19-C23-C24-O24
8	B	100	PG4	O2-C3-C4-O3
8	B	100	PG4	O1-C1-C2-O2
6	A	299	PLM	C5-C6-C7-C8
5	A	298	C8P	C4-C5-C6-C7
6	A	299	PLM	C1-C2-C3-C4
6	A	299	PLM	C7-C8-C9-CA
6	A	299	PLM	CB-CC-CD-CE
5	A	298	C8P	C7-C8-C9-C10
8	B	100	PG4	O3-C5-C6-O4
5	A	298	C8P	C5-C6-C7-C8
5	A	298	C8P	C22-C23-C24-O24
6	A	299	PLM	CC-CD-CE-CF
5	A	298	C8P	C6-C7-C8-C9
5	A	298	C8P	C12-C13-C14-C15
6	A	299	PLM	CA-CB-CC-CD
8	B	100	PG4	C6-C5-O3-C4
7	A	302[B]	EDO	O1-C1-C2-O2
5	A	298	C8P	C10-C11-C12-C13
5	A	298	C8P	C2-C3-C4-C5
7	A	303	EDO	O1-C1-C2-O2
6	A	299	PLM	C2-C3-C4-C5
7	A	302[A]	EDO	O1-C1-C2-O2
8	B	100	PG4	C1-C2-O2-C3

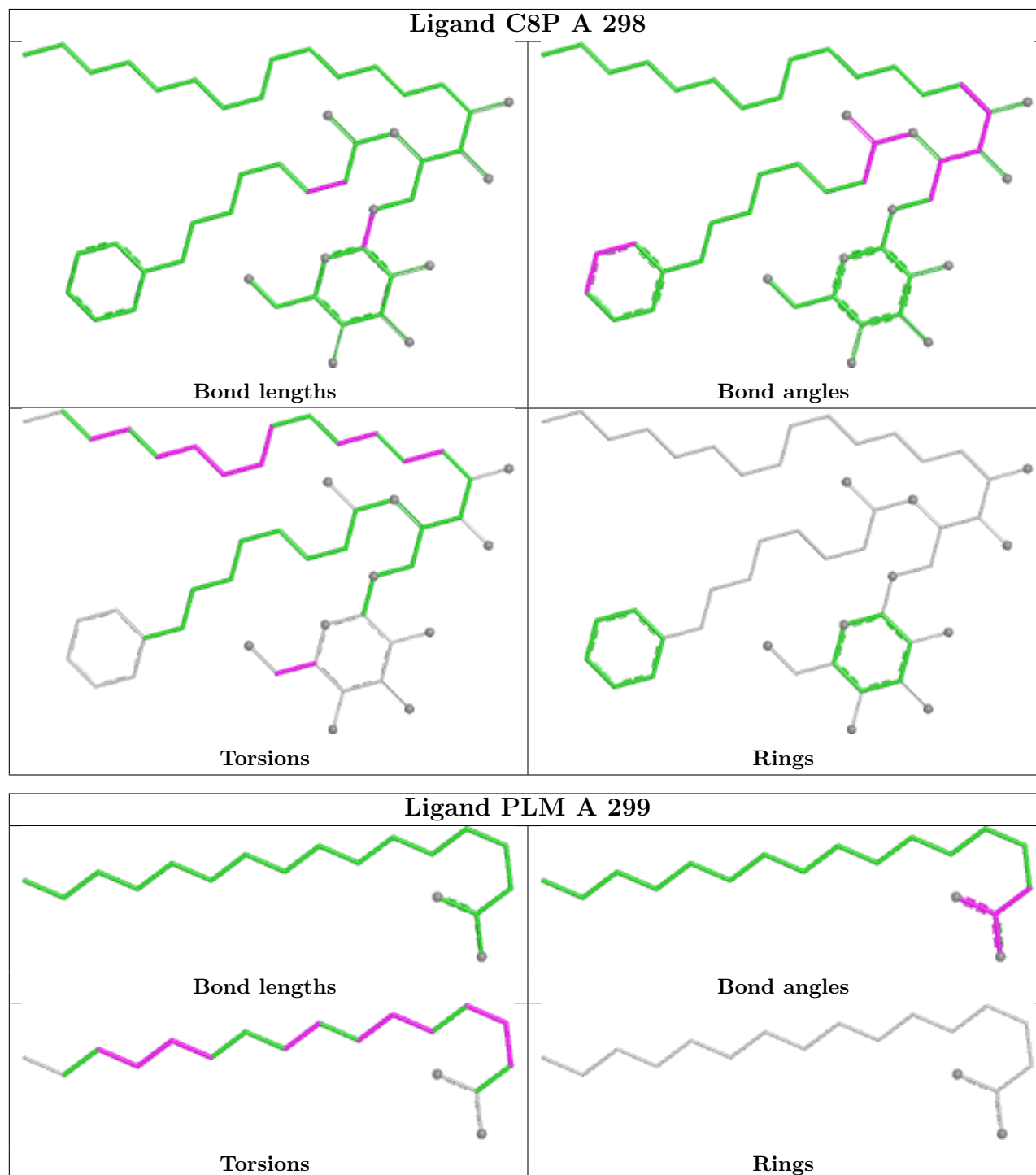
There are no ring outliers.

3 monomers are involved in 19 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	298	C8P	2	0
8	B	100	PG4	15	0
6	A	299	PLM	3	0

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.



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	273/287 (95%)	-0.02	11 (4%) 42 45	3, 12, 32, 48	8 (2%)
2	B	99/99 (100%)	-0.19	2 (2%) 65 69	5, 12, 26, 36	1 (1%)
All	All	372/386 (96%)	-0.06	13 (3%) 47 50	3, 12, 30, 48	9 (2%)

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	90	PRO	3.7
1	A	109	GLY	3.7
1	A	200	ALA	3.3
1	A	111	ALA	3.0
1	A	110	ASN	3.0
2	B	1	ILE	2.8
1	A	197	PRO	2.6
1	A	88	MET	2.5
2	B	99	MET	2.5
1	A	108	PRO	2.2
1	A	107	TYR	2.2
1	A	201	HIS	2.1
1	A	91	LYS	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.

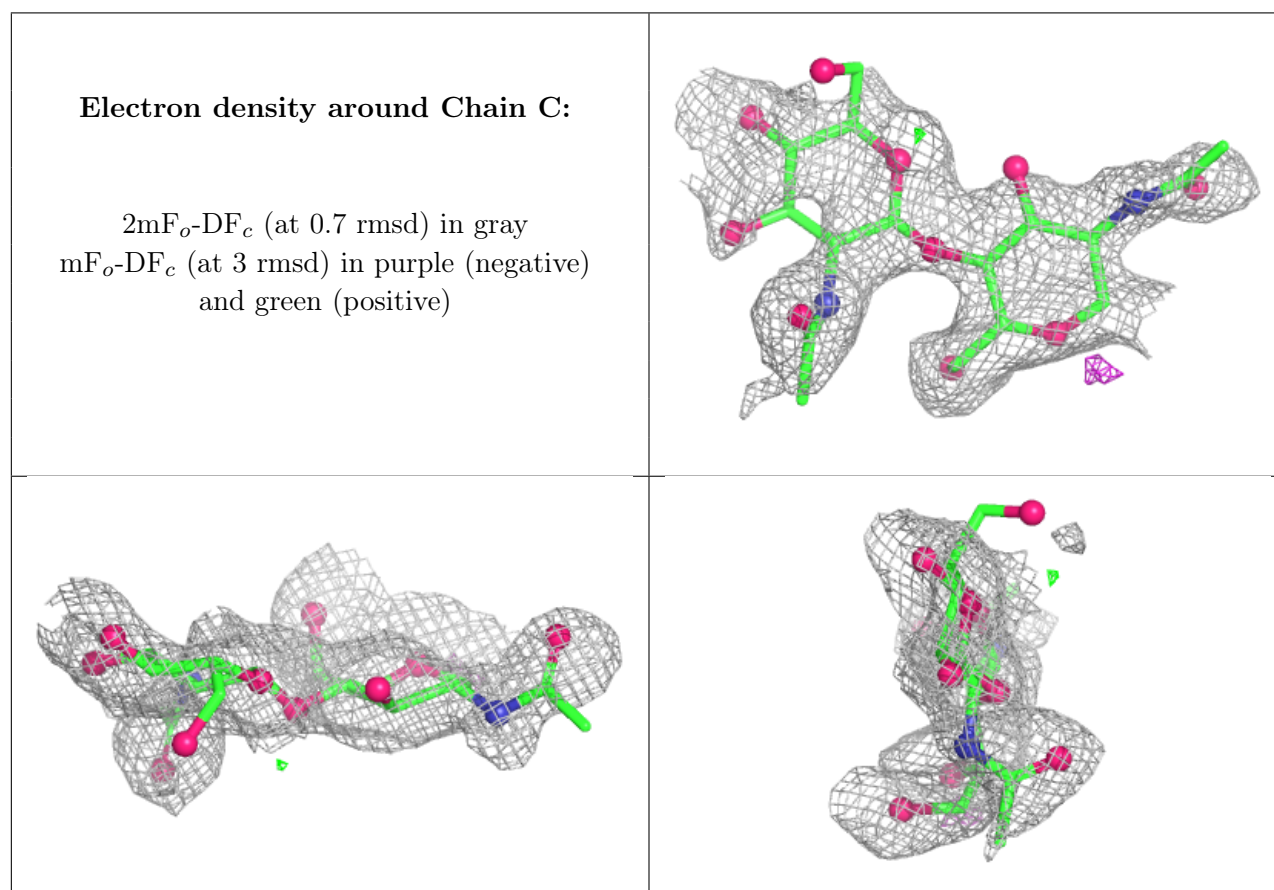
6.3 Carbohydrates [i](#)

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.

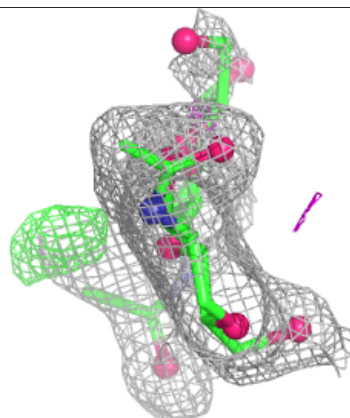
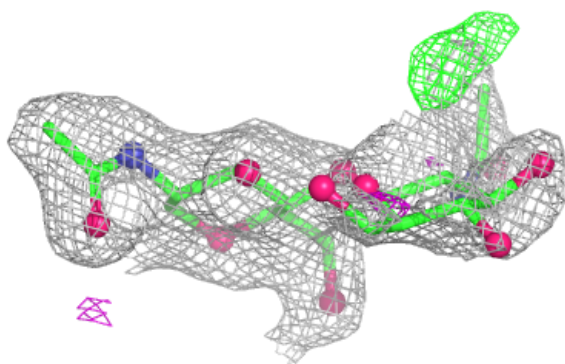
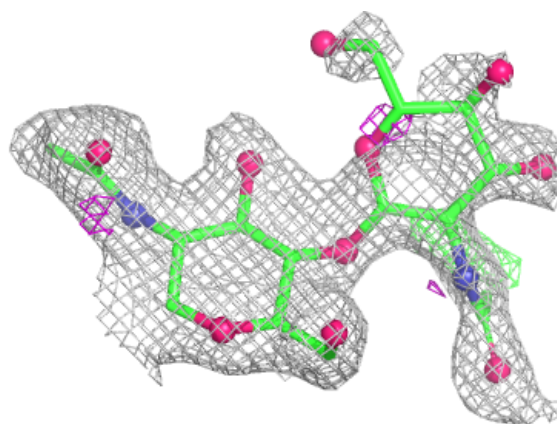
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	NAG	D	2	14/15	0.53	0.18	56,59,63,66	0
4	BMA	E	3	11/12	0.56	0.17	53,56,58,58	0
4	FUC	E	6	10/11	0.60	0.22	45,51,52,53	0
3	NAG	C	2	14/15	0.67	0.15	61,65,68,68	0
4	MAN	E	5	11/12	0.73	0.18	44,48,51,53	0
4	NAG	E	2	14/15	0.74	0.15	39,45,51,55	0
3	NAG	C	1	14/15	0.74	0.15	45,56,62,63	0
4	MAN	E	4	11/12	0.75	0.13	51,56,60,62	0
4	NAG	E	1	14/15	0.91	0.12	21,26,36,44	0
3	NAG	D	1	14/15	0.91	0.09	28,35,42,51	0

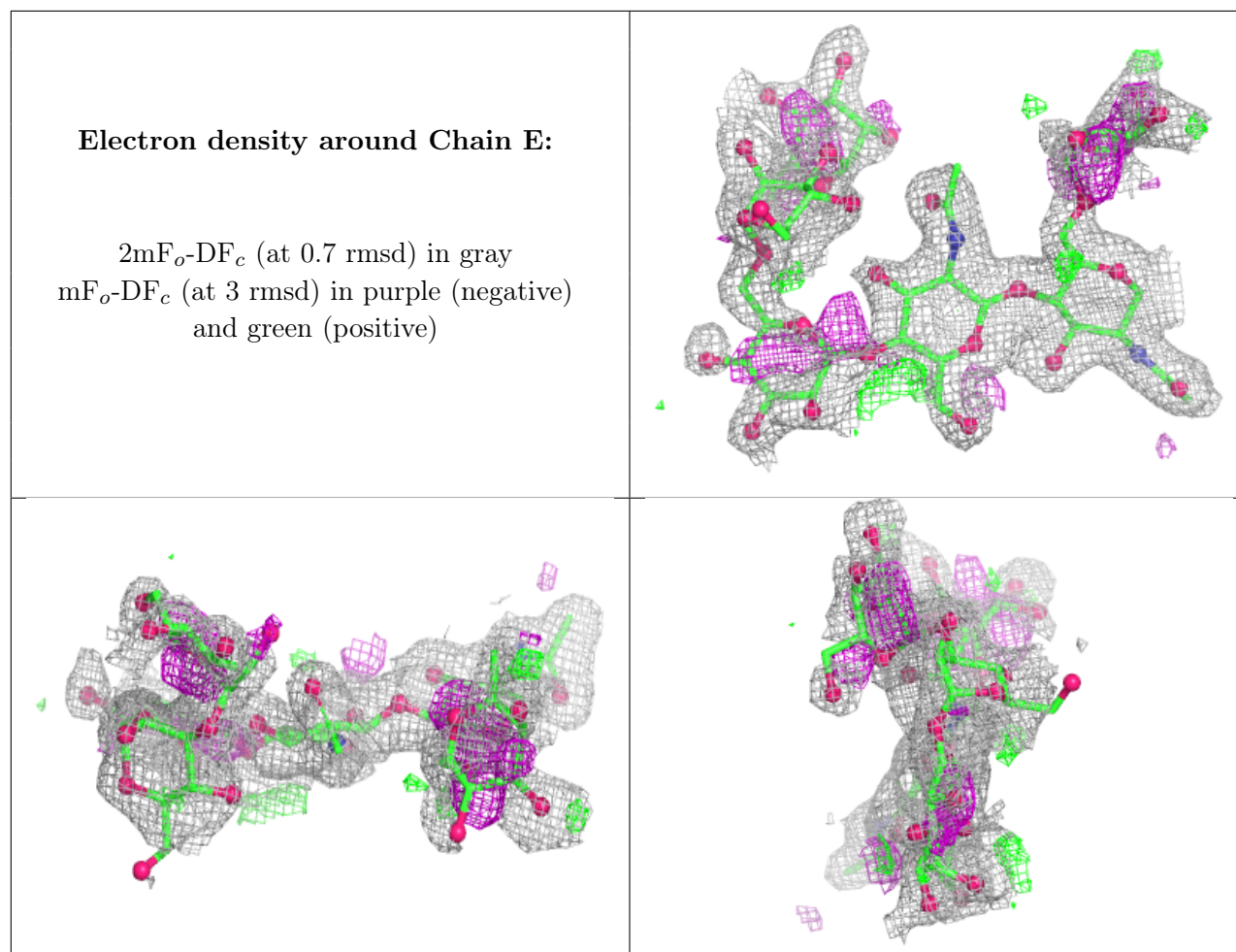
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



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)





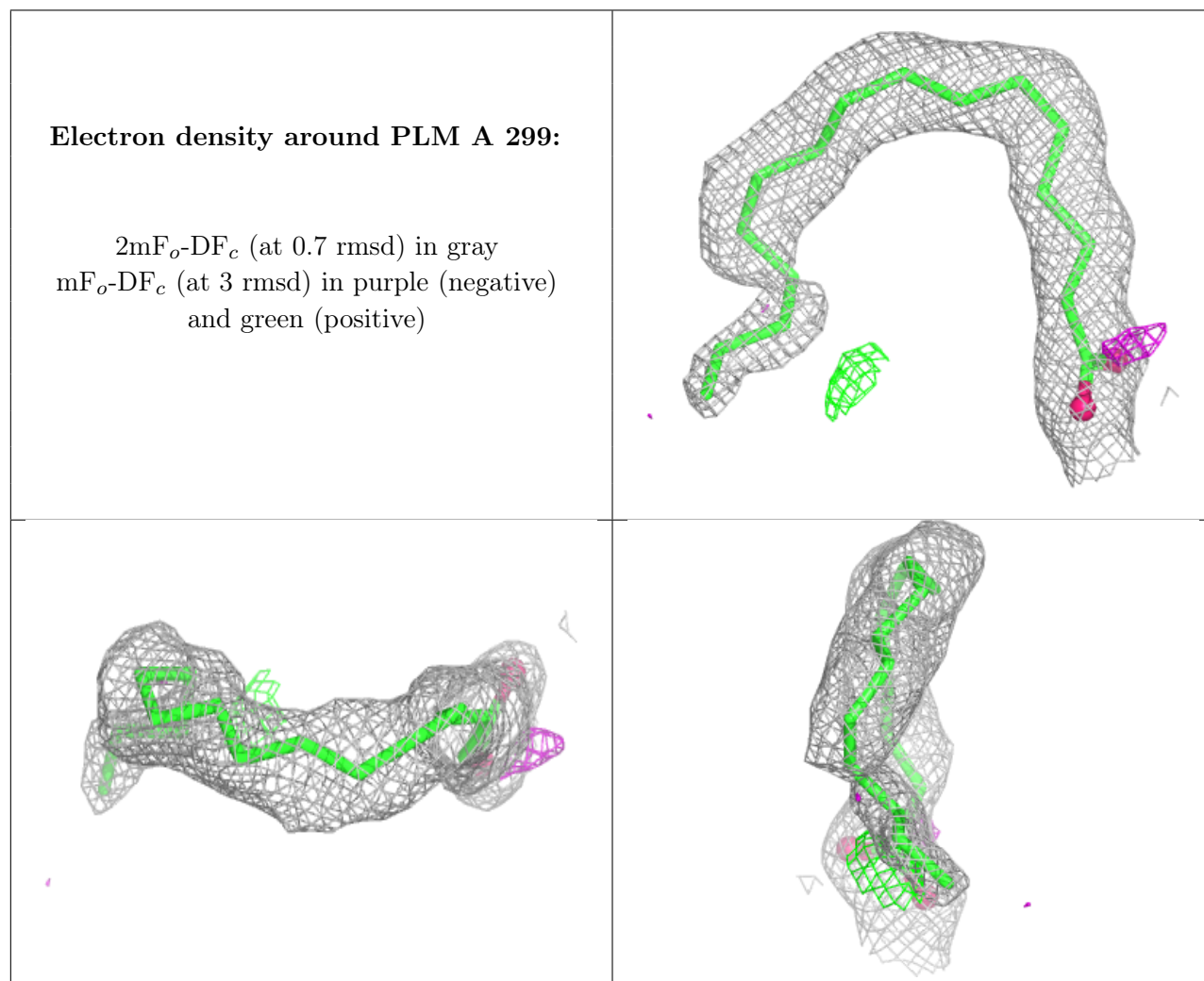
6.4 Ligands [i](#)

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	PG4	B	100	13/13	0.83	0.13	18,32,38,38	0
6	PLM	A	299	18/18	0.84	0.16	31,36,40,43	0
7	EDO	A	303	4/4	0.89	0.12	26,34,36,38	0
7	EDO	A	302[B]	4/4	0.91	0.10	20,27,28,33	4
7	EDO	A	301	4/4	0.91	0.10	20,23,25,27	0
7	EDO	A	302[A]	4/4	0.91	0.10	20,22,22,23	4
5	C8P	A	298	48/48	0.92	0.10	18,28,39,43	0
7	EDO	A	300	4/4	0.94	0.08	16,19,26,30	0

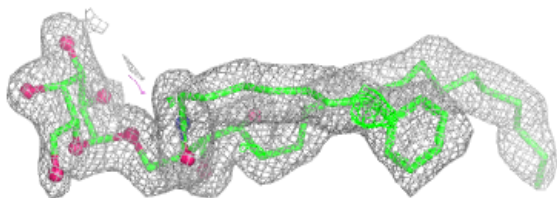
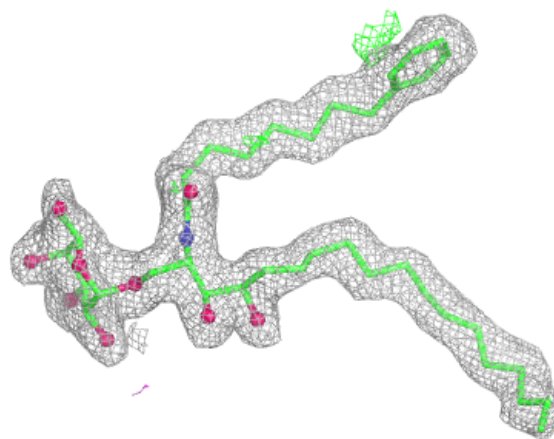
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers

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 C8P A 298:

$2mF_o-DF_c$ (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.