



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:17 PM UTC

PDB ID : 6H5X / pdb_00006h5x
Title : Crystal structure of human Angiotensin-1 converting enzyme N-domain in complex with Omapatrilat.
Authors : Cozier, G.E.; Acharya, K.R.
Deposited on : 2018-07-25
Resolution : 1.80 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

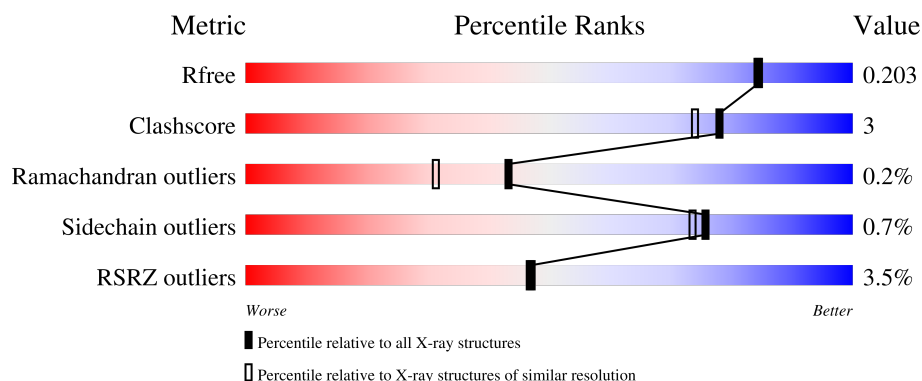
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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	629	3% 90% 7% .
1	B	629	4% 90% 6% .
2	C	2	50% 50%
2	F	2	100%
3	D	3	67% 33%

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Mol	Chain	Length	Quality of chain
3	H	3	 33% 67%
4	E	2	 50% 50%
5	G	4	 75% 25%

2 Entry composition [i](#)

There are 14 unique types of molecules in this entry. The entry contains 21160 atoms, of which 9966 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 Angiotensin-converting enzyme.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	608	Total	C	H	N	O	S	0	21	0
			9876	3235	4831	869	922	19			
1	B	606	Total	C	H	N	O	S	0	19	0
			9835	3224	4806	863	923	19			

There are 16 discrepancies between the modelled and reference sequences:

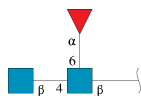
Chain	Residue	Modelled	Actual	Comment	Reference
A	9	GLN	ASN	conflict	UNP P12821
A	25	GLN	ASN	conflict	UNP P12821
A	82	GLN	ASN	conflict	UNP P12821
A	117	GLN	ASN	conflict	UNP P12821
A	289	GLN	ASN	conflict	UNP P12821
A	545	ARG	GLN	conflict	UNP P12821
A	576	LEU	PRO	conflict	UNP P12821
A	629	LEU	-	expression tag	UNP P12821
B	9	GLN	ASN	conflict	UNP P12821
B	25	GLN	ASN	conflict	UNP P12821
B	82	GLN	ASN	conflict	UNP P12821
B	117	GLN	ASN	conflict	UNP P12821
B	289	GLN	ASN	conflict	UNP P12821
B	545	ARG	GLN	conflict	UNP P12821
B	576	LEU	PRO	conflict	UNP P12821
B	629	LEU	-	expression tag	UNP P12821

- Molecule 2 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
2	C	2	Total	C	H	N	O	0	0	0
			53	16	25	2	10			
2	F	2	Total	C	H	N	O	0	0	0
			53	16	25	2	10			

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



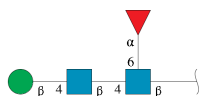
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	D	3	Total	C	H	N	O	0	0	0
			72	22	34	2	14			
3	H	3	Total	C	H	N	O	0	0	0
			72	22	34	2	14			

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



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	E	2	Total	C	H	N	O	0	0	0
			46	14	22	1	9			

- Molecule 5 is an oligosaccharide called 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.

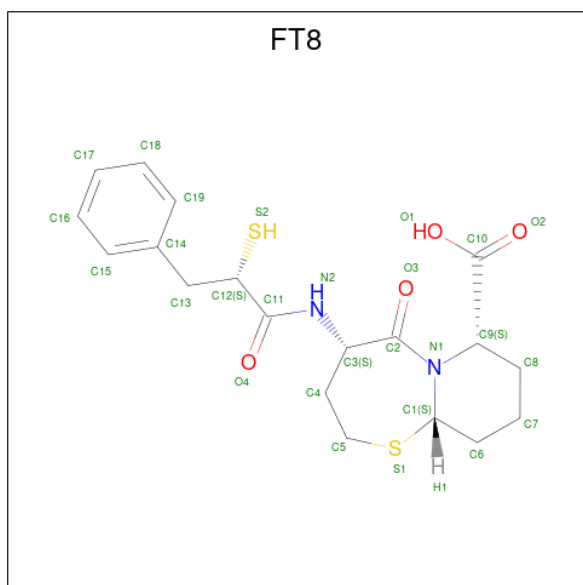


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	G	4	Total	C	H	N	O	0	0	0
			92	28	43	2	19			

- Molecule 6 is ZINC ION (CCD ID: ZN) (formula: Zn).

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

- Molecule 7 is Omapatrilat (CCD ID: FT8) (formula: $C_{19}H_{24}N_2O_4S_2$) (labeled as "Ligand of Interest" by depositor).

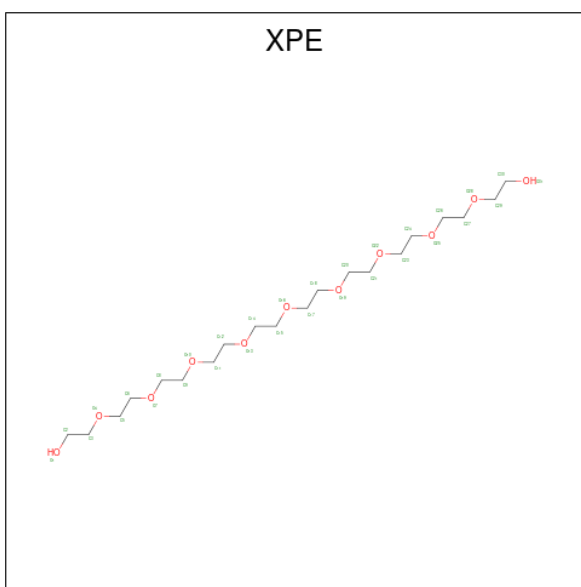


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total C N O S 27 19 2 4 2	0	0
7	B	1	Total C N O S 27 19 2 4 2	0	0

- Molecule 8 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

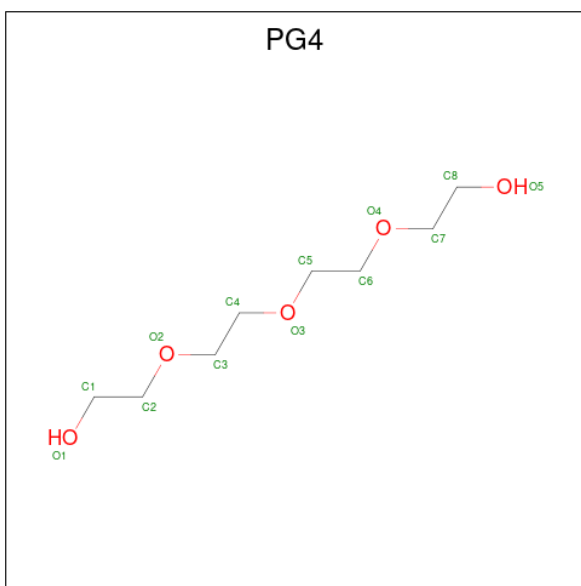
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total Cl 1 1	0	0
8	B	1	Total Cl 1 1	0	0

- Molecule 9 is 3,6,9,12,15,18,21,24,27-NONAOXANONACOSANE-1,29-DIOL (CCD ID: XPE) (formula: $C_{20}H_{42}O_{11}$).



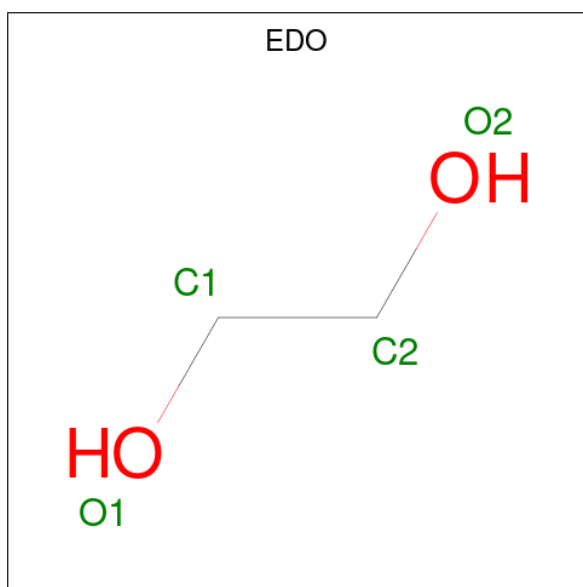
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
9	A	1	Total	C	H	O	0	0
			73	20	42	11		

- Molecule 10 is TETRAETHYLENE GLYCOL (CCD ID: PG4) (formula: $C_8H_{18}O_5$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
10	A	1	Total	C	H	O	0	0
			31	8	18	5		

- Molecule 11 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).

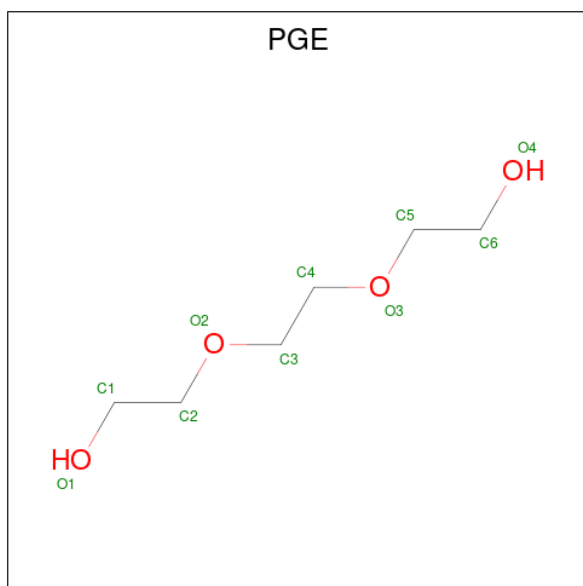


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	A	1	Total	C	H	O	0	0
			10	2	6	2		
11	A	1	Total	C	H	O	0	0
			10	2	6	2		
11	A	1	Total	C	H	O	0	0
			10	2	6	2		
11	A	1	Total	C	H	O	0	0
			10	2	6	2		
11	A	1	Total	C	H	O	0	0
			10	2	6	2		
11	A	1	Total	C	H	O	0	0
			10	2	6	2		
11	B	1	Total	C	H	O	0	0
			10	2	6	2		
11	B	1	Total	C	H	O	0	0
			10	2	6	2		
11	B	1	Total	C	H	O	0	0
			10	2	6	2		
11	B	1	Total	C	H	O	0	0
			10	2	6	2		

- Molecule 12 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	B	1	Total	Mg	0	0
			1	1		

- Molecule 13 is TRIETHYLENE GLYCOL (CCD ID: PGE) (formula: $C_6H_{14}O_4$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
13	B	1	Total	C	H	O	0	0
			24	6	14	4		

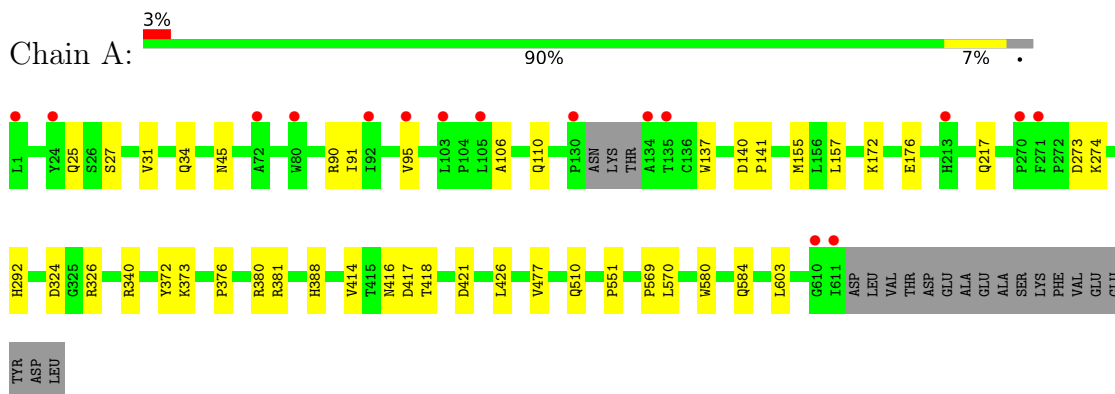
- Molecule 14 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
14	A	330	Total	O	0	4
			333	333		
14	B	418	Total	O	0	5
			421	421		

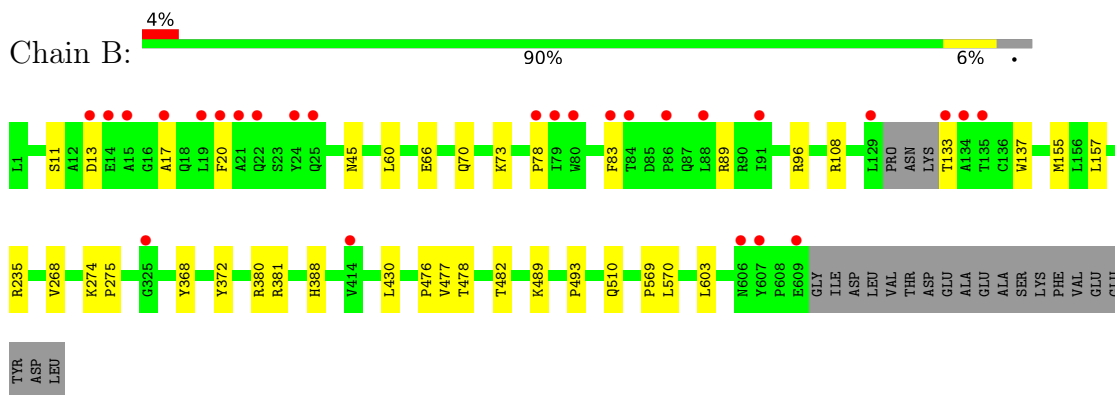
3 Residue-property plots

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



- Molecule 1: Angiotensin-converting enzyme



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



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



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



- Molecule 4: alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 5: 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



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	73.16Å 76.95Å 83.09Å 88.83° 64.22° 75.21°	Depositor
Resolution (Å)	44.60 – 1.80 44.60 – 1.80	Depositor EDS
% Data completeness (in resolution range)	96.2 (44.60-1.80) 97.4 (44.60-1.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.64 (at 1.80Å)	Xtriage
Refinement program	PHENIX (1.13_2998: ???)	Depositor
R, R_{free}	0.164 , 0.204 0.165 , 0.203	Depositor DCC
R_{free} test set	2106 reflections (1.45%)	wwPDB-VP
Wilson B-factor (Å ²)	27.6	Xtriage
Anisotropy	0.277	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 44.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.52$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	21160	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.70% 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, BMA, CL, NAG, XPE, PG4, FUC, FT8, MG, PGE, ZN

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	0.22	0/5294	0.47	0/7212
1	B	0.23	0/5252	0.50	0/7154
All	All	0.23	0/10546	0.48	0/14366

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5045	4831	4736	27	0
1	B	5029	4806	4733	23	0
2	C	28	25	25	1	0
2	F	28	25	25	0	0
3	D	38	34	34	2	0
3	H	38	34	34	10	0
4	E	24	22	22	0	0
5	G	49	43	43	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
7	A	27	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	B	27	0	0	0	0
8	A	1	0	0	0	0
8	B	1	0	0	0	0
9	A	31	42	42	1	0
10	A	13	18	18	0	0
11	A	28	42	42	1	0
11	B	20	30	30	0	0
12	B	1	0	0	0	0
13	B	10	14	14	1	0
14	A	333	0	0	4	0
14	B	421	0	0	0	0
All	All	11194	9966	9798	58	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 3.

All (58) 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)
3:H:1:NAG:H83	3:H:1:NAG:H3	1.64	0.79
1:B:157:LEU:HD11	1:B:477:VAL:HG13	1.76	0.68
1:A:157:LEU:HD11	1:A:477:VAL:HG13	1.75	0.66
3:H:2:NAG:H83	3:H:2:NAG:H3	1.82	0.61
3:H:2:NAG:C1	3:H:2:NAG:H82	2.30	0.59
1:B:83:PHE:HB2	1:B:89:ARG:HG2	1.85	0.58
1:B:478:THR:HB	3:H:3:FUC:H61	1.84	0.58
1:A:477:VAL:HG12	1:A:603:LEU:HD21	1.88	0.56
1:B:477:VAL:HG12	1:B:603:LEU:HD21	1.88	0.55
3:H:1:NAG:H3	3:H:1:NAG:C8	2.37	0.54
1:B:380:ARG:O	1:B:381:ARG:HD2	2.07	0.54
1:B:11:SER:OG	1:B:13:ASP:OD2	2.25	0.54
1:A:31:VAL:O	1:A:34:GLN:HG3	2.07	0.54
1:B:137:TRP:HH2	1:B:155:MET:HE1	1.73	0.52
1:B:482:THR:OG1	3:H:1:NAG:C8	2.59	0.51
1:A:416:ASN:ND2	3:D:1:NAG:O7	2.43	0.50
1:A:418:THR:HG23	3:D:3:FUC:H4	1.92	0.50
3:H:2:NAG:C1	3:H:2:NAG:C8	2.89	0.50
1:A:91:ILE:O	1:A:95:VAL:HG23	2.12	0.49
3:H:1:NAG:H61	3:H:3:FUC:O2	2.12	0.49
1:B:274:LYS:HB3	1:B:275:PRO:CD	2.43	0.49
1:A:137:TRP:HH2	1:A:155:MET:HE1	1.77	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:274:LYS:HB3	1:B:275:PRO:HD2	1.95	0.49
1:A:106:ALA:O	14:A:801:HOH:O	2.20	0.48
1:B:235:ARG:HH12	13:B:719:PGE:H22	1.79	0.48
1:B:66:GLU:CD	1:B:108:ARG:HH22	2.22	0.48
1:A:110[A]:GLN:HG3	14:A:801:HOH:O	2.15	0.47
1:A:172:LYS:O	1:A:176[B]:GLU:HG3	2.14	0.47
1:A:426:LEU:C	1:A:426:LEU:HD13	2.40	0.47
1:B:489:LYS:O	1:B:493:PRO:HD2	2.16	0.46
1:A:340:ARG:HG2	1:A:373:LYS:O	2.16	0.46
1:A:274:LYS:NZ	1:A:417:ASP:OD2	2.48	0.45
1:A:570:LEU:C	1:A:570:LEU:HD23	2.41	0.45
3:H:1:NAG:H83	3:H:1:NAG:C3	2.41	0.45
1:B:73:LYS:HG2	1:B:96:ARG:HG3	1.99	0.45
1:B:157:LEU:HD13	1:B:476:PRO:HB2	1.99	0.45
1:A:510:GLN:HG2	1:A:569:PRO:HG2	1.98	0.45
1:A:27:SER:OG	11:A:719:EDO:C2	2.66	0.44
1:B:66:GLU:O	1:B:70:GLN:HG3	2.18	0.44
1:A:90:ARG:NH1	1:A:551:PRO:HA	2.32	0.44
1:B:17:ALA:O	1:B:20:PHE:HB3	2.18	0.44
1:A:273:ASP:OD1	1:A:273:ASP:N	2.51	0.44
1:A:380:ARG:O	1:A:381:ARG:HD3	2.18	0.43
1:B:268:VAL:HG21	1:B:430:LEU:HD11	2.00	0.43
1:B:482:THR:OG1	3:H:1:NAG:H81	2.18	0.43
1:A:324:ASP:OD1	1:A:326:ARG:HB2	2.18	0.43
1:B:510:GLN:HG2	1:B:569:PRO:HG2	2.01	0.42
1:B:60:LEU:HD23	1:B:60:LEU:O	2.19	0.42
1:A:140:ASP:HA	1:A:141:PRO:HA	1.90	0.42
1:A:292:HIS:CD2	9:A:711:XPE:H142	2.55	0.42
1:B:133:THR:HG22	1:B:133:THR:O	2.19	0.42
1:A:25:GLN:OE1	1:A:376:PRO:HB2	2.20	0.42
1:A:217:GLN:NE2	14:A:813:HOH:O	2.44	0.41
1:A:580:TRP:O	1:A:584:GLN:HG2	2.20	0.41
14:A:1105:HOH:O	2:C:1:NAG:H5	2.20	0.41
1:B:570:LEU:HD23	1:B:570:LEU:C	2.45	0.40
1:A:137:TRP:CH2	1:A:155:MET:HE1	2.57	0.40
1:A:324:ASP:OD2	1:A:326:ARG:NH2	2.53	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	625/629 (99%)	615 (98%)	9 (1%)	1 (0%)	43	31
1	B	621/629 (99%)	611 (98%)	8 (1%)	2 (0%)	36	25
All	All	1246/1258 (99%)	1226 (98%)	17 (1%)	3 (0%)	43	31

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	B	45	ASN
1	B	78	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	542/541 (100%)	538 (99%)	4 (1%)	76	73
1	B	538/541 (99%)	535 (99%)	3 (1%)	78	77
All	All	1080/1082 (100%)	1073 (99%)	7 (1%)	76	77

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

Mol	Chain	Res	Type
1	A	372	TYR
1	A	388	HIS
1	A	414	VAL

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Mol	Chain	Res	Type
1	A	421	ASP
1	B	368	TYR
1	B	372	TYR
1	B	388	HIS

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	109	GLN
1	A	188	GLN
1	A	371	GLN
1	A	423	ASN
1	A	527	GLN
1	B	289	GLN
1	B	568	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

16 monosaccharides are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	NAG	C	1	2,1	14,14,15	0.32	0	17,19,21	0.56	0
2	NAG	C	2	2	14,14,15	0.25	0	17,19,21	0.53	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	NAG	D	1	3,1	14,14,15	0.71	0	17,19,21	0.78	0
3	NAG	D	2	3	14,14,15	0.68	1 (7%)	17,19,21	0.57	0
3	FUC	D	3	3	10,10,11	0.75	0	14,14,16	2.00	4 (28%)
4	NAG	E	1	1,4	14,14,15	0.36	0	17,19,21	0.74	0
4	FUC	E	2	4	10,10,11	1.05	0	14,14,16	2.00	3 (21%)
2	NAG	F	1	2,1	14,14,15	0.17	0	17,19,21	0.52	0
2	NAG	F	2	2	14,14,15	0.35	0	17,19,21	0.40	0
5	NAG	G	1	5,1	14,14,15	0.38	0	17,19,21	0.52	0
5	NAG	G	2	5	14,14,15	0.19	0	17,19,21	0.72	0
5	BMA	G	3	5	11,11,12	0.85	0	15,15,17	0.81	0
5	FUC	G	4	5	10,10,11	1.11	1 (10%)	14,14,16	0.84	0
3	NAG	H	1	3,1	14,14,15	0.43	0	17,19,21	1.43	3 (17%)
3	NAG	H	2	3	14,14,15	0.37	0	17,19,21	0.83	0
3	FUC	H	3	3	10,10,11	1.34	3 (30%)	14,14,16	1.14	1 (7%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	C	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	C	2	2	-	2/6/23/26	0/1/1/1
3	NAG	D	1	3,1	-	3/6/23/26	0/1/1/1
3	NAG	D	2	3	-	1/6/23/26	0/1/1/1
3	FUC	D	3	3	-	-	0/1/1/1
4	NAG	E	1	1,4	-	4/6/23/26	0/1/1/1
4	FUC	E	2	4	-	-	0/1/1/1
2	NAG	F	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	F	2	2	-	0/6/23/26	0/1/1/1
5	NAG	G	1	5,1	-	0/6/23/26	0/1/1/1
5	NAG	G	2	5	-	0/6/23/26	0/1/1/1
5	BMA	G	3	5	-	2/2/19/22	0/1/1/1
5	FUC	G	4	5	-	-	0/1/1/1
3	NAG	H	1	3,1	-	6/6/23/26	0/1/1/1
3	NAG	H	2	3	-	4/6/23/26	0/1/1/1
3	FUC	H	3	3	-	-	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	H	3	FUC	C2-C3	2.38	1.56	1.52
5	G	4	FUC	O5-C1	-2.32	1.39	1.43
3	D	2	NAG	C1-C2	2.22	1.55	1.52
3	H	3	FUC	O5-C5	2.03	1.47	1.43
3	H	3	FUC	C1-C2	2.02	1.57	1.52

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	E	2	FUC	C1-C2-C3	5.99	118.37	109.64
3	D	3	FUC	C1-C2-C3	5.01	116.94	109.64
3	D	3	FUC	C1-O5-C5	3.51	121.25	112.97
3	H	1	NAG	C1-O5-C5	3.48	116.85	112.19
3	H	3	FUC	O2-C2-C1	2.96	115.99	109.22
3	D	3	FUC	C3-C4-C5	-2.65	105.79	109.81
4	E	2	FUC	C1-O5-C5	2.63	119.17	112.97
3	H	1	NAG	C1-C2-N2	2.60	114.52	110.43
4	E	2	FUC	C3-C4-C5	-2.37	106.22	109.81
3	H	1	NAG	C2-N2-C7	2.35	126.06	122.90
3	D	3	FUC	O5-C1-C2	2.11	115.83	110.79

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	H	2	NAG	C1-C2-N2-C7
3	H	1	NAG	O5-C5-C6-O6
4	E	1	NAG	O5-C5-C6-O6
2	C	2	NAG	O5-C5-C6-O6
2	C	2	NAG	C4-C5-C6-O6
4	E	1	NAG	C4-C5-C6-O6
3	H	1	NAG	C4-C5-C6-O6
3	H	1	NAG	C8-C7-N2-C2
3	H	1	NAG	O7-C7-N2-C2
3	H	2	NAG	C8-C7-N2-C2
3	H	2	NAG	O7-C7-N2-C2
5	G	3	BMA	C4-C5-C6-O6
3	D	2	NAG	O5-C5-C6-O6
5	G	3	BMA	O5-C5-C6-O6
3	D	1	NAG	C4-C5-C6-O6
3	H	1	NAG	C3-C2-N2-C7
4	E	1	NAG	C3-C2-N2-C7

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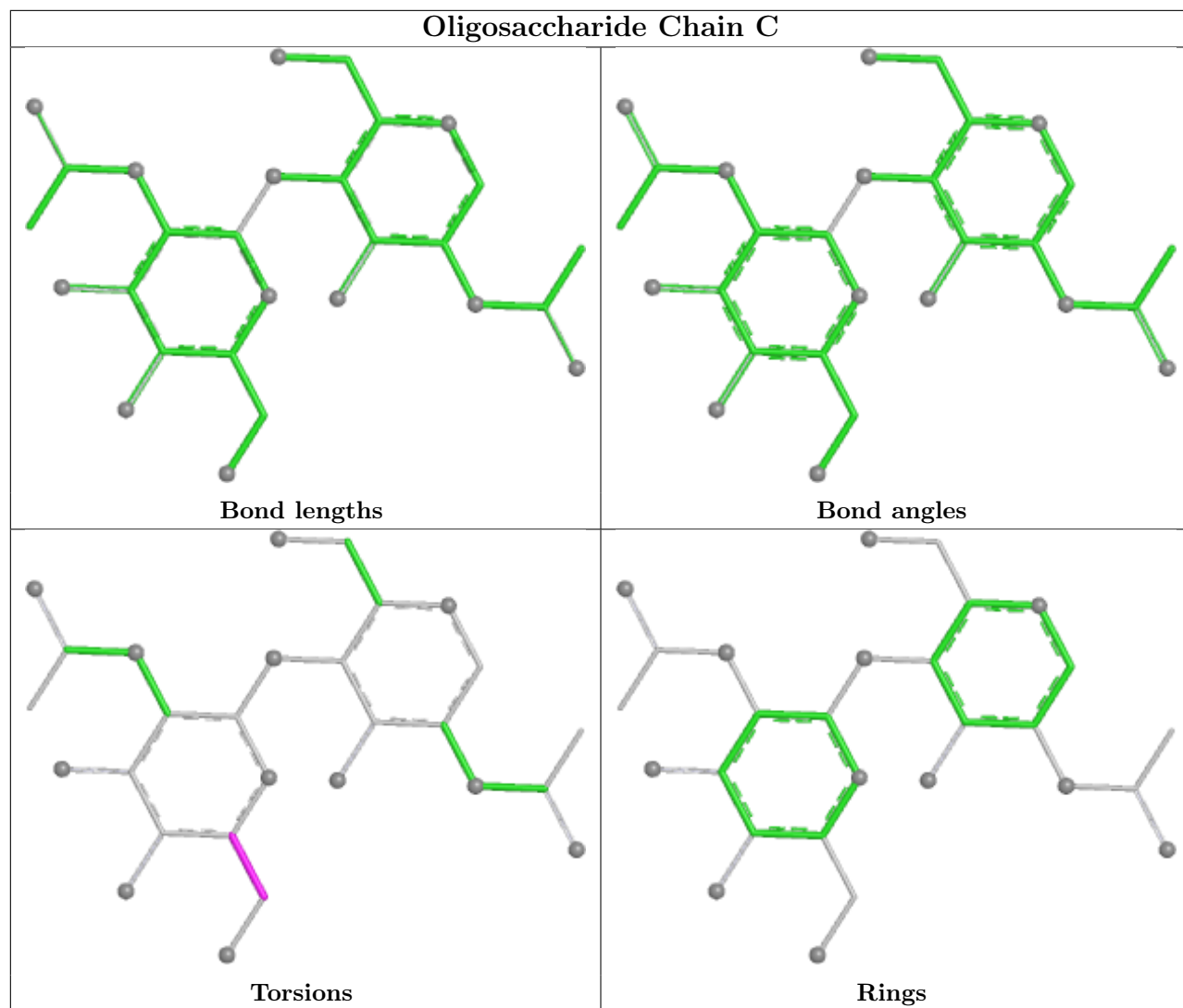
Mol	Chain	Res	Type	Atoms
3	D	1	NAG	O5-C5-C6-O6
3	D	1	NAG	C1-C2-N2-C7
3	H	1	NAG	C1-C2-N2-C7
4	E	1	NAG	C1-C2-N2-C7
3	H	2	NAG	C3-C2-N2-C7

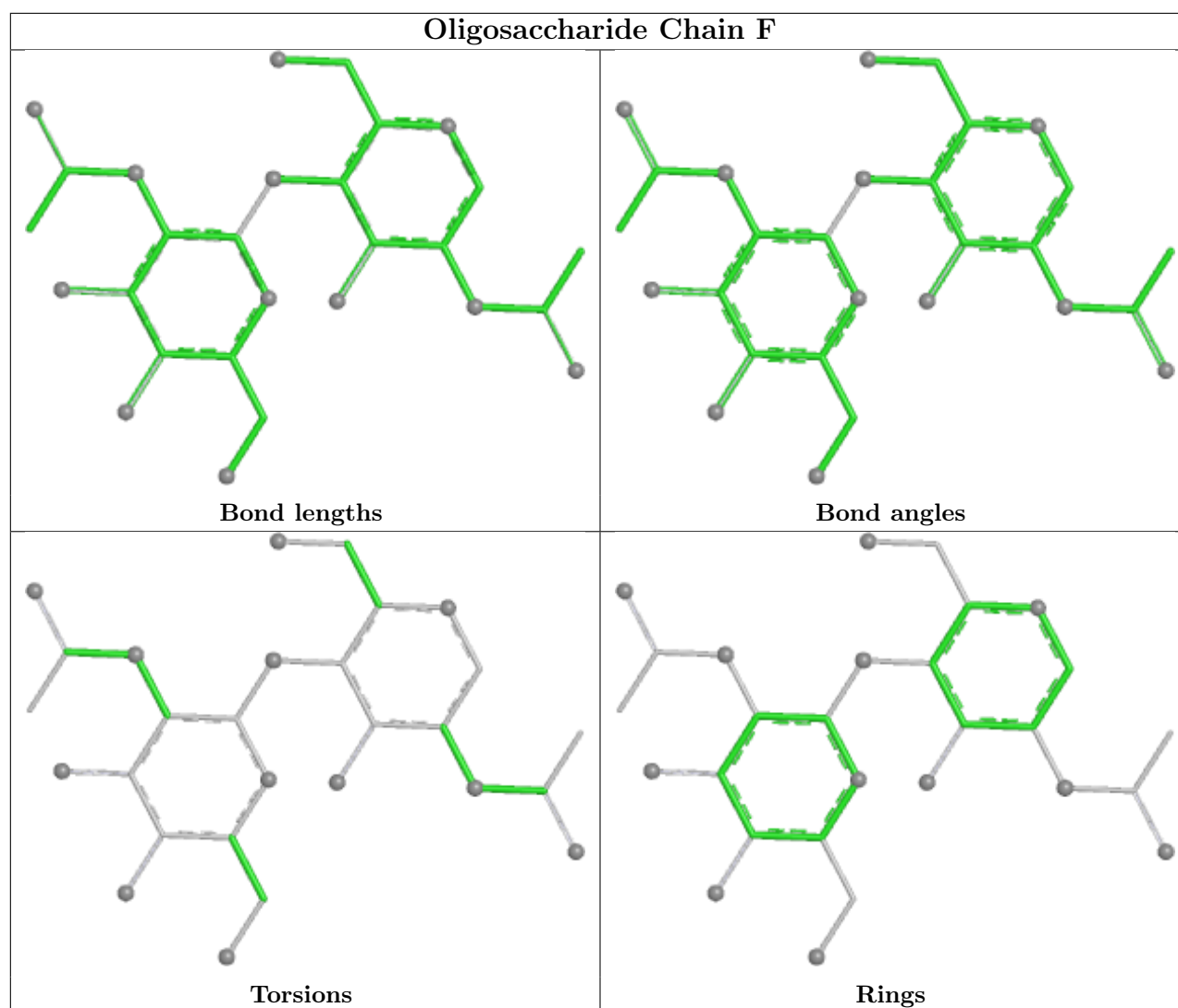
There are no ring outliers.

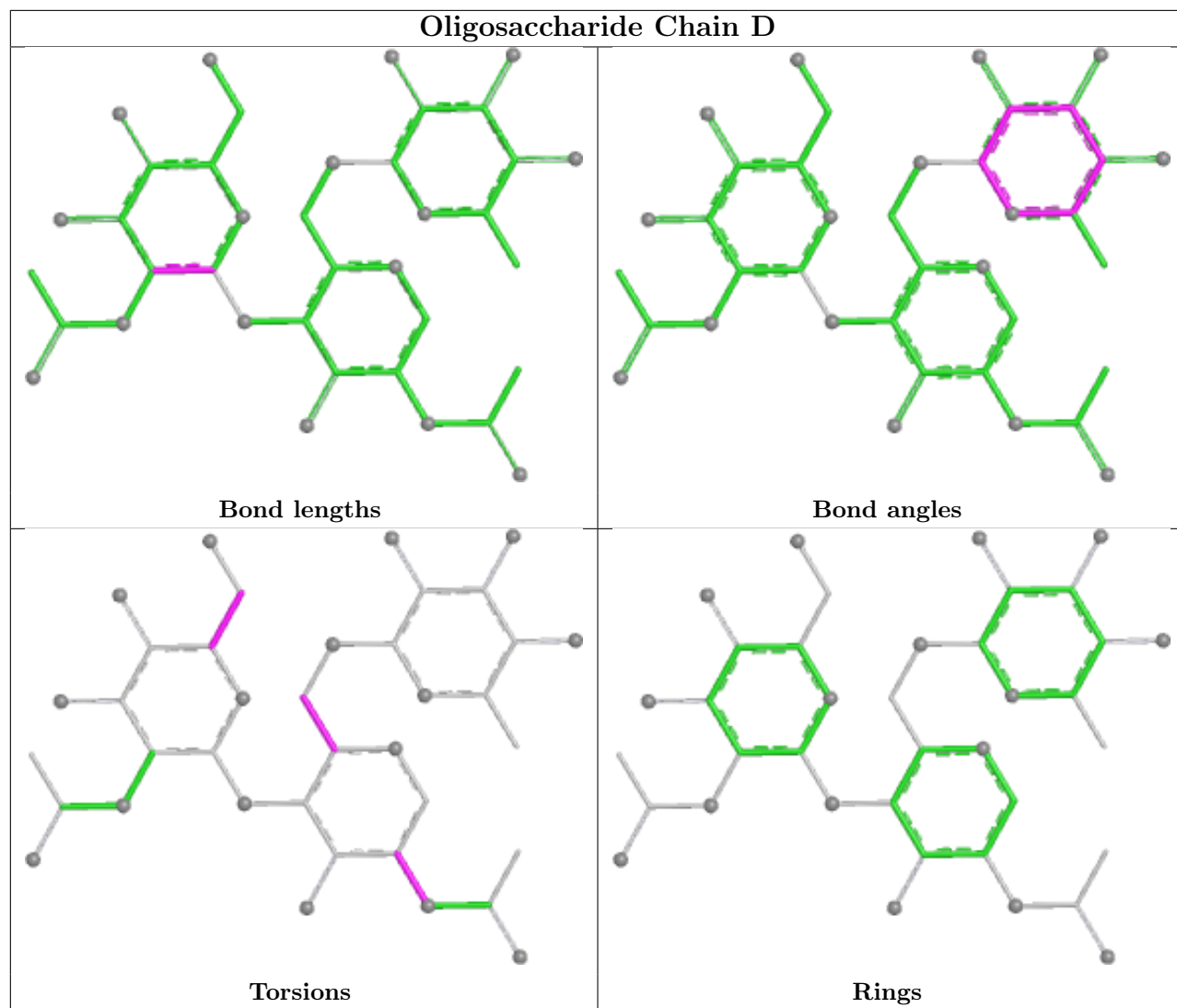
6 monomers are involved in 13 short contacts:

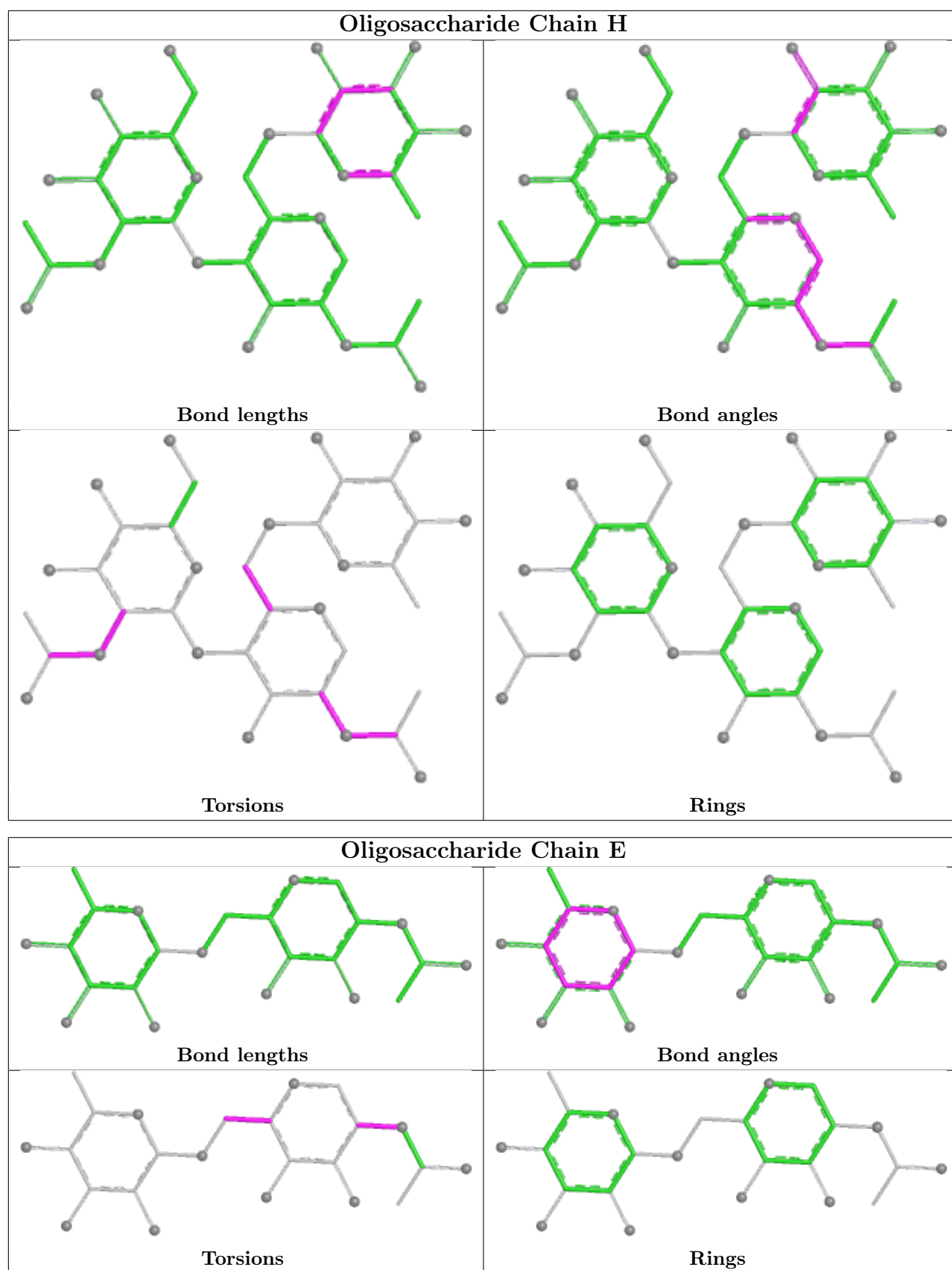
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	H	2	NAG	3	0
2	C	1	NAG	1	0
3	D	3	FUC	1	0
3	H	3	FUC	2	0
3	D	1	NAG	1	0
3	H	1	NAG	6	0

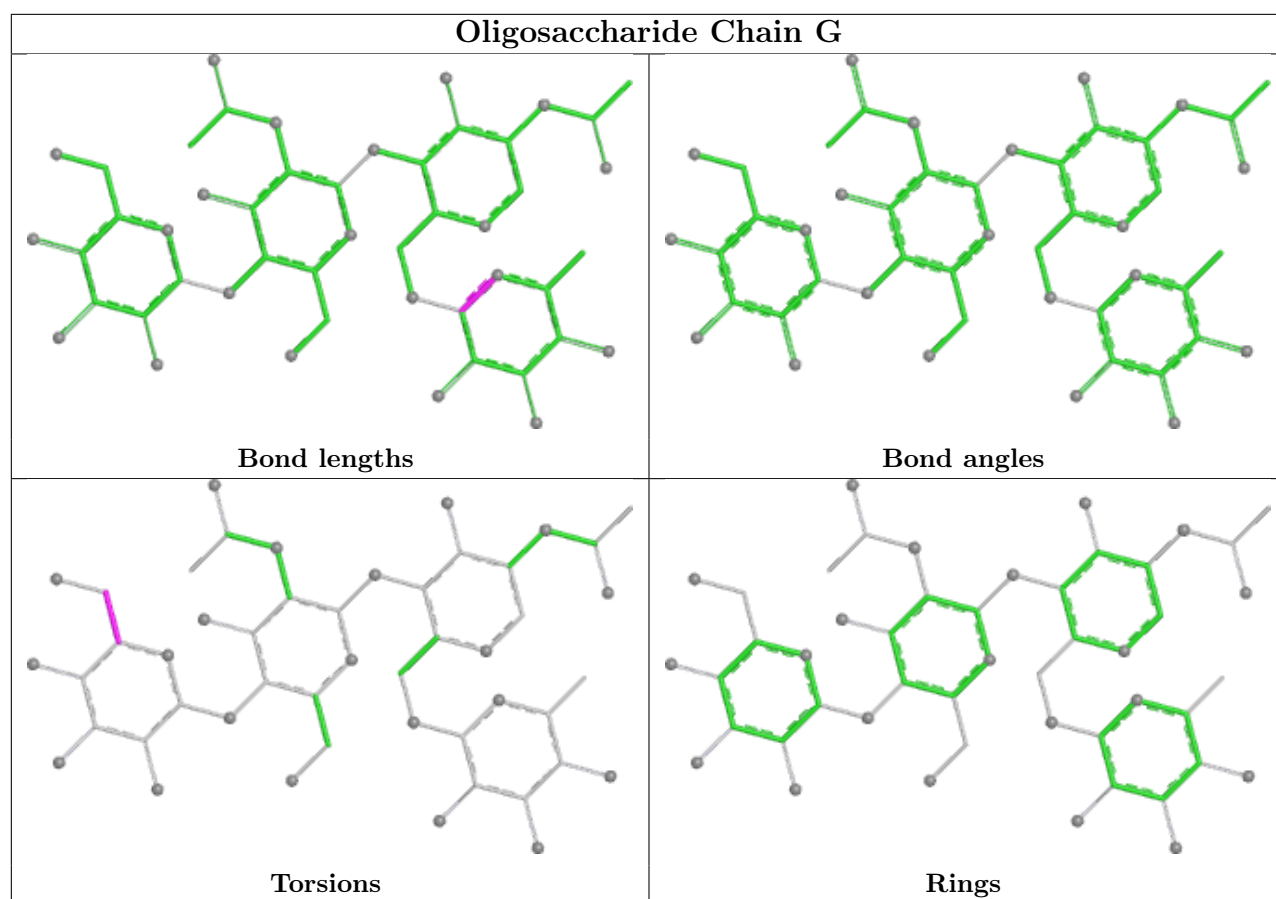
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.











5.6 Ligand geometry [i](#)

Of 22 ligands modelled in this entry, 5 are monoatomic - leaving 17 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	$\# Z > 2$
7	FT8	B	711	6	25,29,29	2.27	6 (24%)	26,40,40	1.40	3 (11%)
11	EDO	A	719	-	3,3,3	0.44	0	2,2,2	0.29	0
11	EDO	A	716	-	3,3,3	0.43	0	2,2,2	0.43	0
11	EDO	A	718	-	3,3,3	0.44	0	2,2,2	0.44	0
11	EDO	B	718	-	3,3,3	0.43	0	2,2,2	0.65	0
11	EDO	B	716	-	3,3,3	0.43	0	2,2,2	0.40	0
13	PGE	B	719	-	9,9,9	0.34	0	8,8,8	0.40	0
7	FT8	A	709	6	25,29,29	2.18	7 (28%)	26,40,40	1.38	5 (19%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
11	EDO	A	714	-	3,3,3	0.44	0	2,2,2	0.28	0
11	EDO	B	714	-	3,3,3	0.44	0	2,2,2	0.34	0
11	EDO	A	713	-	3,3,3	0.47	0	2,2,2	0.35	0
9	XPE	A	711	-	30,30,30	0.57	0	29,29,29	0.38	0
11	EDO	B	717	-	3,3,3	0.44	0	2,2,2	0.36	0
11	EDO	A	717	-	3,3,3	0.45	0	2,2,2	0.40	0
10	PG4	A	712	-	12,12,12	0.54	0	11,11,11	0.38	0
11	EDO	A	715	-	3,3,3	0.45	0	2,2,2	0.26	0
11	EDO	B	715	-	3,3,3	0.44	0	2,2,2	0.24	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
7	FT8	B	711	6	-	2/14/44/44	0/2/3/3
11	EDO	A	719	-	-	0/1/1/1	-
11	EDO	A	716	-	-	1/1/1/1	-
11	EDO	A	718	-	-	1/1/1/1	-
11	EDO	B	718	-	-	0/1/1/1	-
11	EDO	B	716	-	-	0/1/1/1	-
13	PGE	B	719	-	-	1/7/7/7	-
7	FT8	A	709	6	-	2/14/44/44	0/2/3/3
11	EDO	A	714	-	-	0/1/1/1	-
11	EDO	B	714	-	-	0/1/1/1	-
11	EDO	A	713	-	-	0/1/1/1	-
9	XPE	A	711	-	-	16/28/28/28	-
11	EDO	B	717	-	-	1/1/1/1	-
11	EDO	A	717	-	-	0/1/1/1	-
10	PG4	A	712	-	-	5/10/10/10	-
11	EDO	A	715	-	-	1/1/1/1	-
11	EDO	B	715	-	-	1/1/1/1	-

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	B	711	FT8	C2-N1	8.88	1.45	1.35
7	A	709	FT8	C2-N1	8.18	1.44	1.35
7	A	709	FT8	C11-N2	4.48	1.43	1.34
7	B	711	FT8	C11-N2	4.33	1.43	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	B	711	FT8	C9-N1	2.41	1.51	1.47
7	A	709	FT8	C7-C6	-2.40	1.47	1.53
7	A	709	FT8	O4-C11	-2.33	1.18	1.23
7	B	711	FT8	C7-C6	-2.31	1.47	1.53
7	A	709	FT8	O3-C2	-2.29	1.18	1.22
7	B	711	FT8	C7-C8	-2.19	1.47	1.53
7	A	709	FT8	C9-N1	2.17	1.50	1.47
7	A	709	FT8	C7-C8	-2.10	1.47	1.53
7	B	711	FT8	O3-C2	-2.09	1.18	1.22

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	711	FT8	C8-C9-N1	5.01	117.83	110.26
7	A	709	FT8	C8-C9-N1	4.11	116.47	110.26
7	A	709	FT8	C4-C3-C2	2.38	114.69	111.65
7	A	709	FT8	O1-C10-C9	2.31	120.88	113.34
7	B	711	FT8	O1-C10-C9	2.16	120.39	113.34
7	B	711	FT8	C3-N2-C11	-2.14	117.06	121.65
7	A	709	FT8	O1-C10-O2	-2.12	119.27	124.08
7	A	709	FT8	C3-N2-C11	-2.11	117.11	121.65

There are no chirality outliers.

All (31) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	A	711	XPE	O13-C14-C15-O16
9	A	711	XPE	O4-C5-C6-O7
9	A	711	XPE	O16-C17-C18-O19
9	A	711	XPE	O7-C8-C9-O10
10	A	712	PG4	O4-C7-C8-O5
9	A	711	XPE	O10-C11-C12-O13
9	A	711	XPE	O22-C23-C24-O25
10	A	712	PG4	C5-C6-O4-C7
9	A	711	XPE	C8-C9-O10-C11
9	A	711	XPE	C12-C11-O10-C9
9	A	711	XPE	O1-C2-C3-O4
9	A	711	XPE	C27-C26-O25-C24
13	B	719	PGE	C1-C2-O2-C3
10	A	712	PG4	C1-C2-O2-C3
9	A	711	XPE	O28-C29-C30-O31
11	A	715	EDO	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
9	A	711	XPE	C26-C27-O28-C29
10	A	712	PG4	C3-C4-O3-C5
9	A	711	XPE	C14-C15-O16-C17
11	A	716	EDO	O1-C1-C2-O2
11	A	718	EDO	O1-C1-C2-O2
9	A	711	XPE	C17-C18-O19-C20
11	B	717	EDO	O1-C1-C2-O2
7	A	709	FT8	O2-C10-C9-N1
7	B	711	FT8	O2-C10-C9-N1
11	B	715	EDO	O1-C1-C2-O2
10	A	712	PG4	O2-C3-C4-O3
7	A	709	FT8	S2-C12-C13-C14
7	B	711	FT8	S2-C12-C13-C14
9	A	711	XPE	C20-C21-O22-C23
9	A	711	XPE	C11-C12-O13-C14

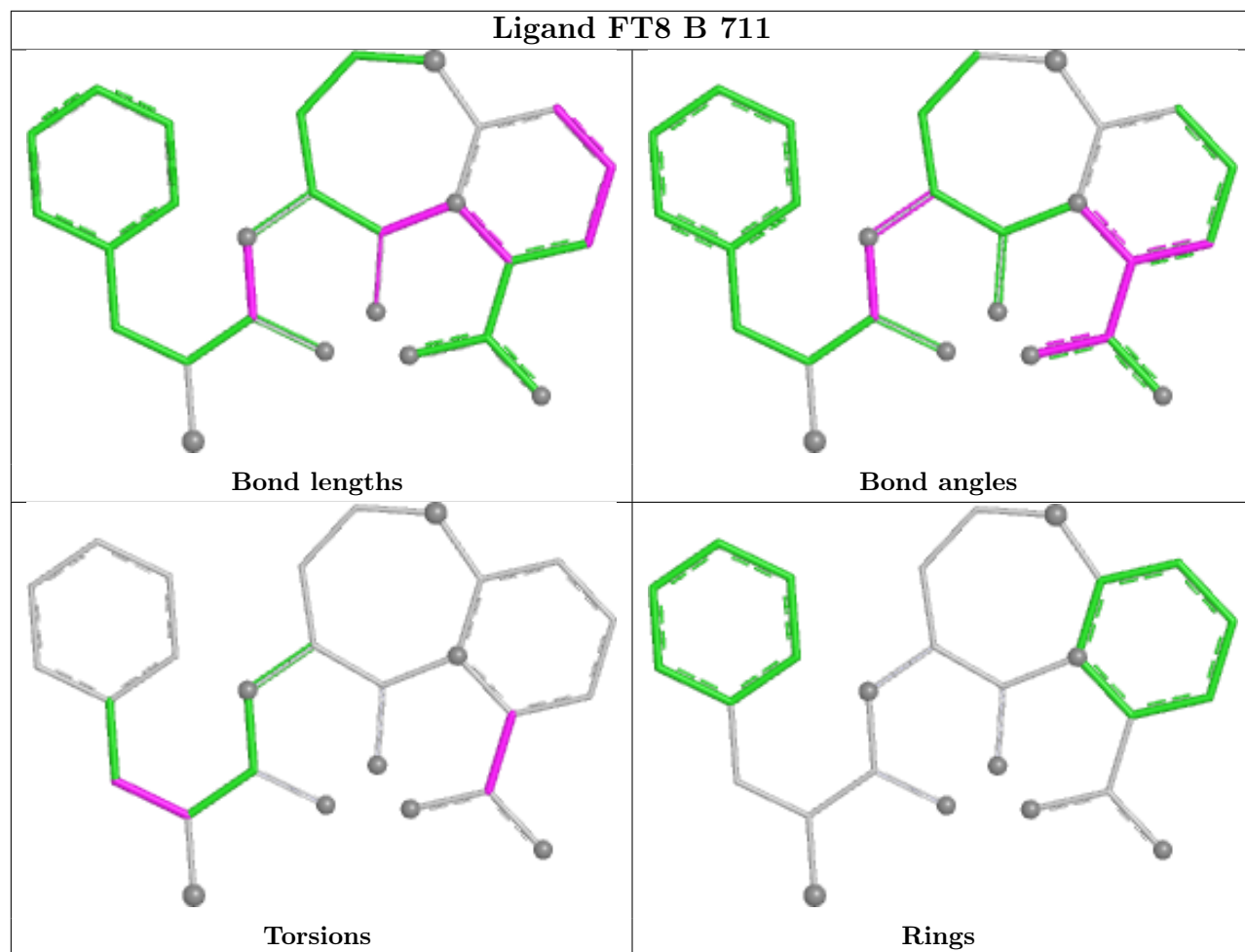
There are no ring outliers.

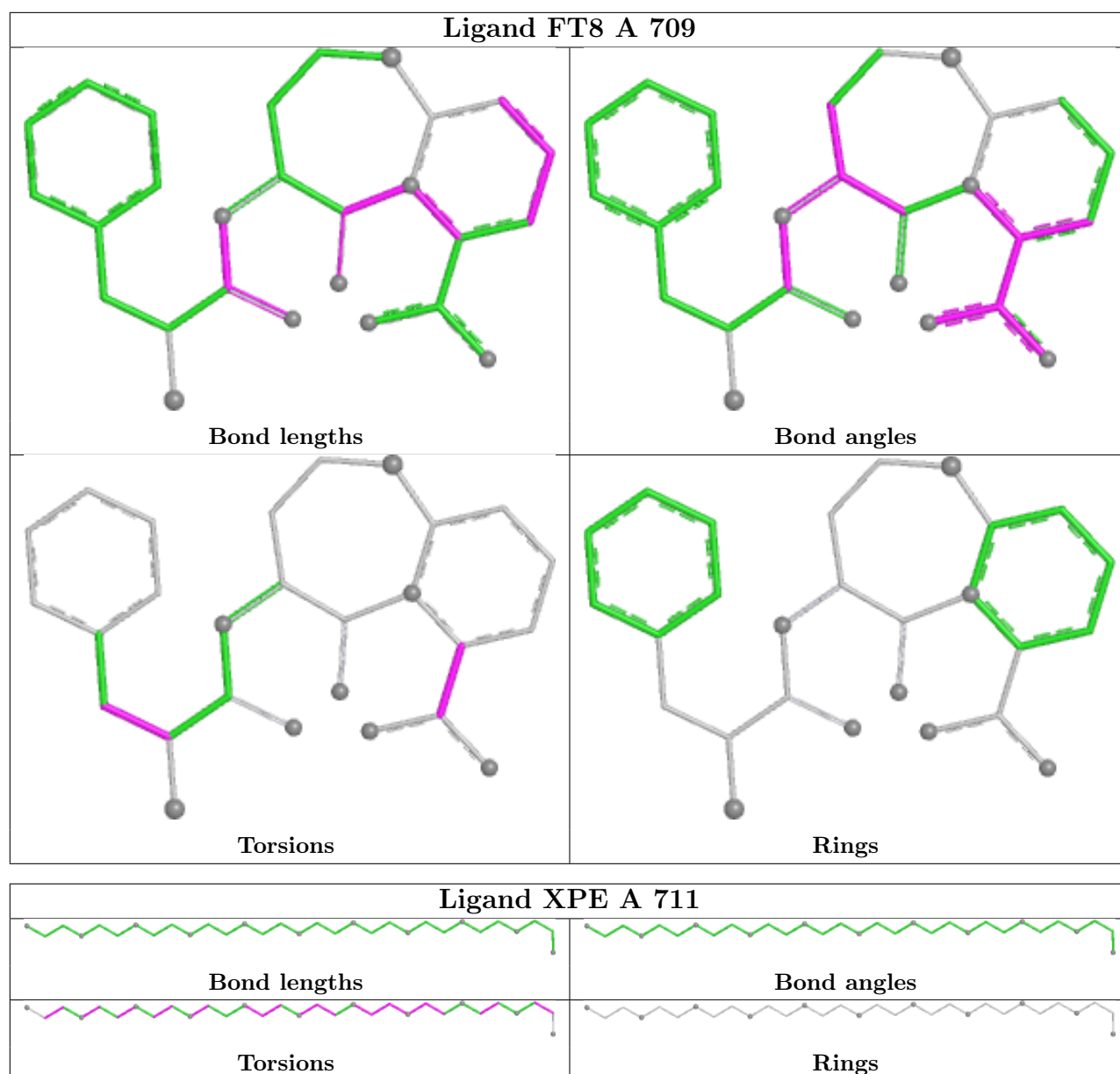
3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
11	A	719	EDO	1	0
13	B	719	PGE	1	0
9	A	711	XPE	1	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.

Ligand FT8 B 711





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	608/629 (96%)	-0.09	16 (2%) 57 57	14, 40, 65, 93	10 (1%)
1	B	606/629 (96%)	-0.36	27 (4%) 38 37	12, 34, 57, 87	10 (1%)
All	All	1214/1258 (96%)	-0.23	43 (3%) 47 47	12, 37, 62, 93	20 (1%)

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	134	ALA	5.5
1	A	611	ILE	4.9
1	B	79	ILE	4.8
1	B	607	TYR	4.7
1	A	130	PRO	4.7
1	B	80	TRP	4.6
1	B	133	THR	3.9
1	B	83	PHE	3.9
1	B	129	LEU	3.6
1	B	325	GLY	3.4
1	B	15	ALA	3.4
1	A	135	THR	3.3
1	B	21	ALA	3.1
1	B	134	ALA	3.0
1	B	91	ILE	2.9
1	A	105	LEU	2.9
1	B	135	THR	2.9
1	B	78	PRO	2.9
1	B	88	LEU	2.8
1	B	414	VAL	2.8
1	B	19	LEU	2.6
1	A	271	PHE	2.6
1	B	17	ALA	2.6
1	B	609	GLU	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	84	THR	2.5
1	B	606	ASN	2.4
1	A	92	ILE	2.4
1	B	24	TYR	2.4
1	A	270	PRO	2.4
1	B	13	ASP	2.3
1	B	25	GLN	2.3
1	A	95	VAL	2.2
1	A	1	LEU	2.2
1	B	86	PRO	2.2
1	A	24	TYR	2.1
1	B	14	GLU	2.1
1	A	72	ALA	2.1
1	B	22	GLN	2.1
1	B	20	PHE	2.1
1	A	213[A]	HIS	2.0
1	A	80	TRP	2.0
1	A	103	LEU	2.0
1	A	610	GLY	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.

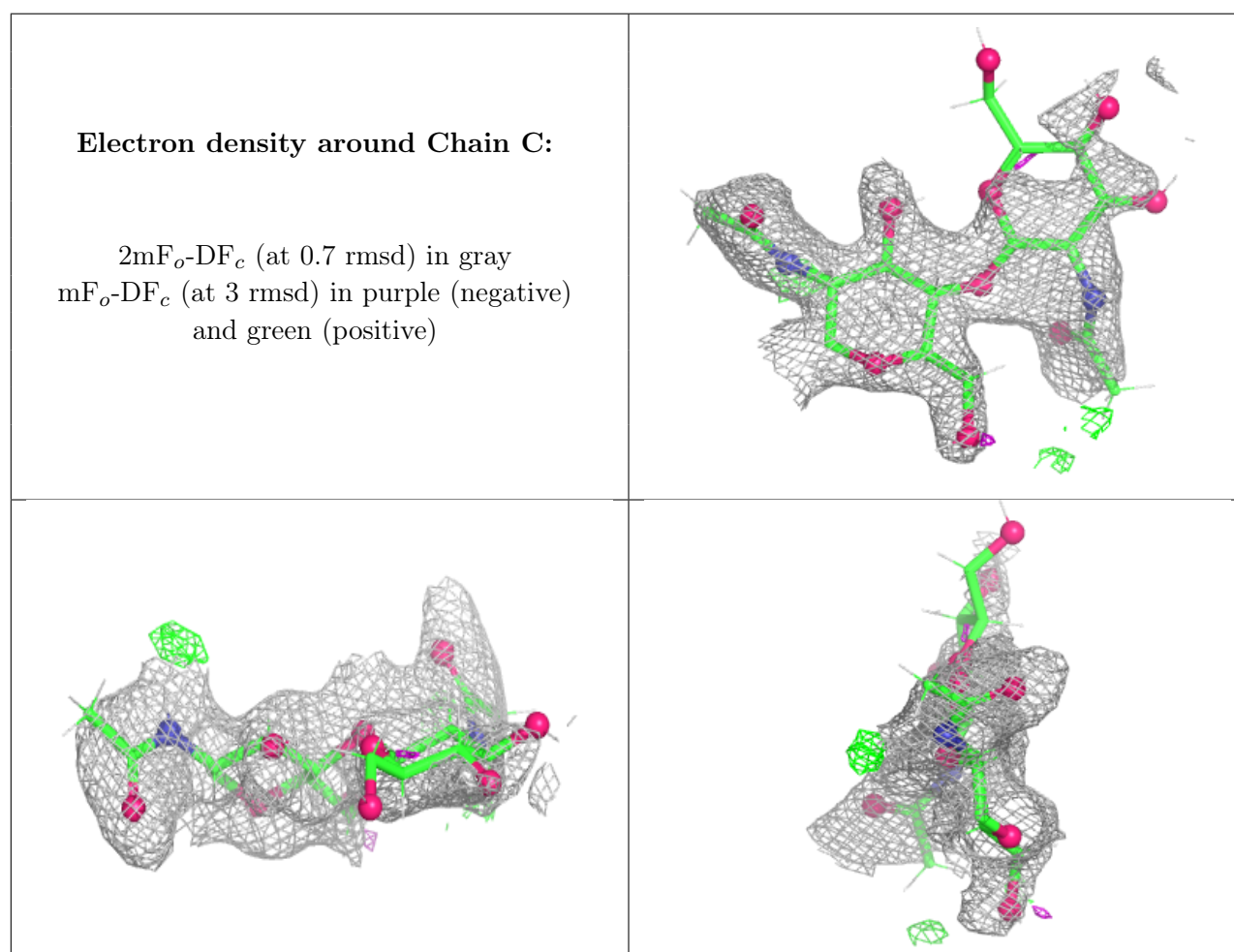
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	FUC	E	2	10/11	0.68	0.20	63,67,80,81	20
3	NAG	H	2	14/15	0.70	0.17	65,72,87,88	0
3	FUC	H	3	10/11	0.72	0.14	68,72,86,86	0
2	NAG	C	2	14/15	0.77	0.14	69,77,93,94	27
3	FUC	D	3	10/11	0.78	0.14	72,74,88,89	0
3	NAG	D	2	14/15	0.79	0.14	68,71,84,85	0
3	NAG	D	1	14/15	0.81	0.12	63,68,79,82	0
5	BMA	G	3	11/12	0.82	0.11	62,65,78,80	0
2	NAG	F	2	14/15	0.83	0.13	64,71,86,87	0

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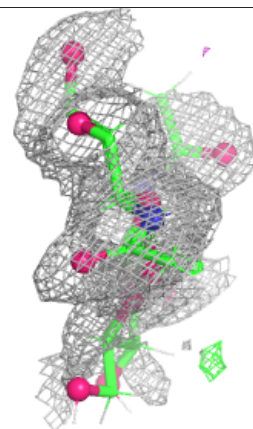
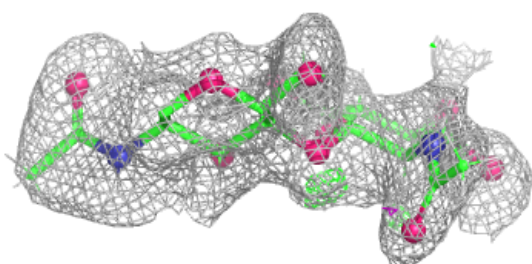
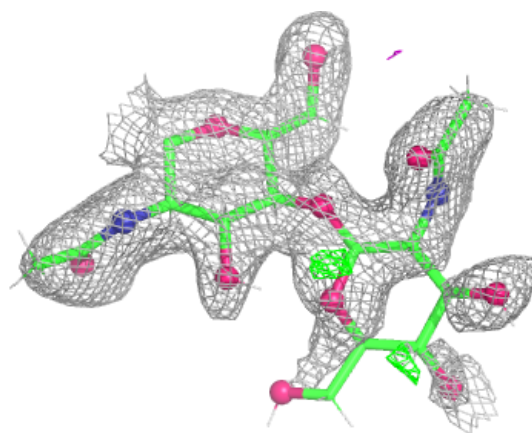
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	FUC	G	4	10/11	0.84	0.13	57,61,72,73	0
5	NAG	G	2	14/15	0.90	0.10	49,60,72,72	0
4	NAG	E	1	14/15	0.90	0.09	47,57,67,68	0
2	NAG	C	1	14/15	0.90	0.10	49,58,67,69	0
3	NAG	H	1	14/15	0.92	0.11	47,58,67,71	0
2	NAG	F	1	14/15	0.93	0.08	49,55,66,67	0
5	NAG	G	1	14/15	0.94	0.07	44,47,57,62	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.



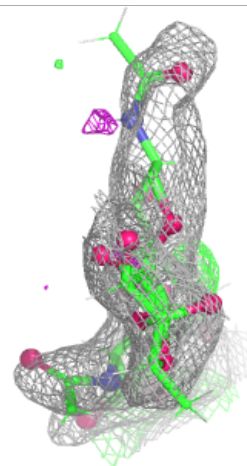
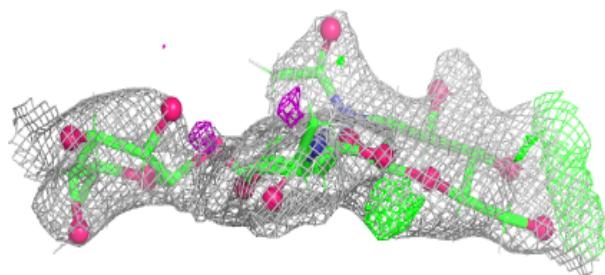
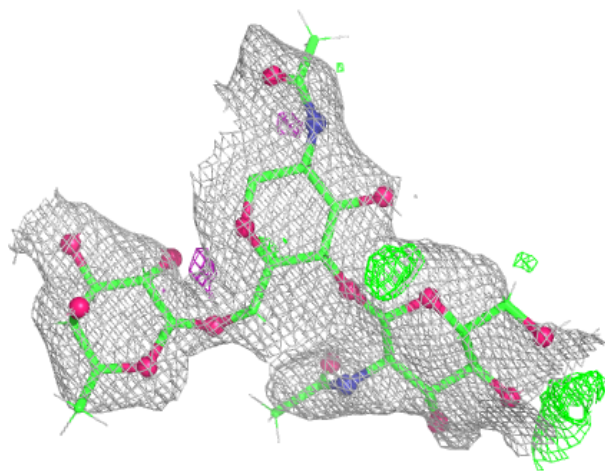
Electron density around Chain F:

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



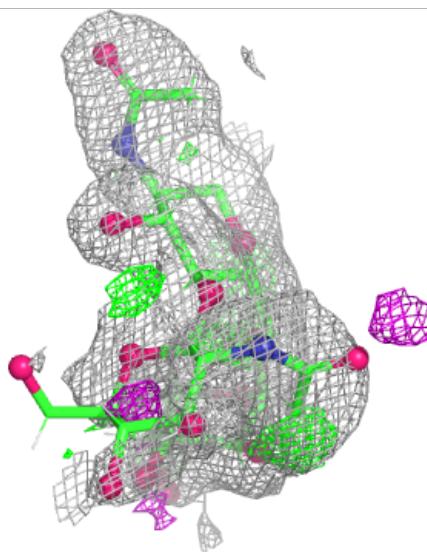
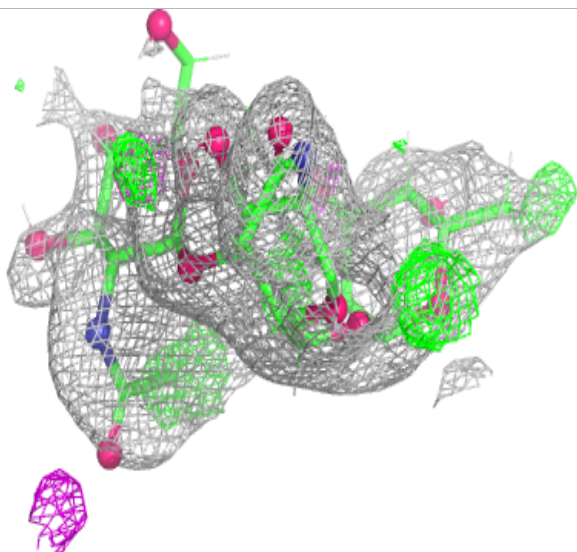
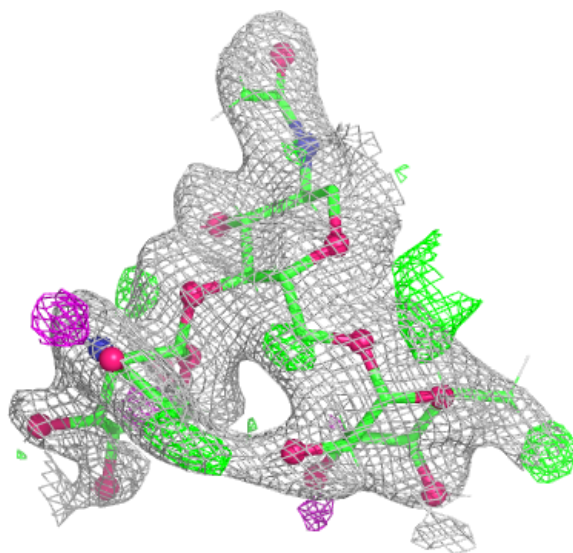
Electron density around Chain D:

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



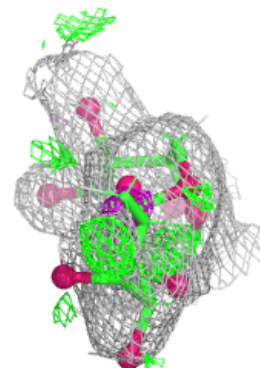
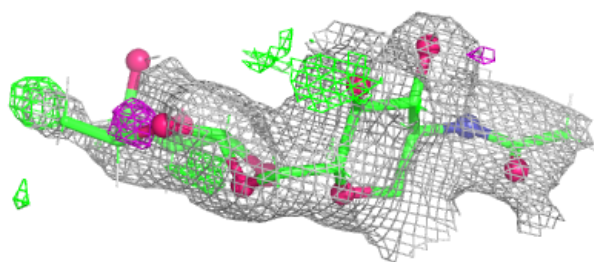
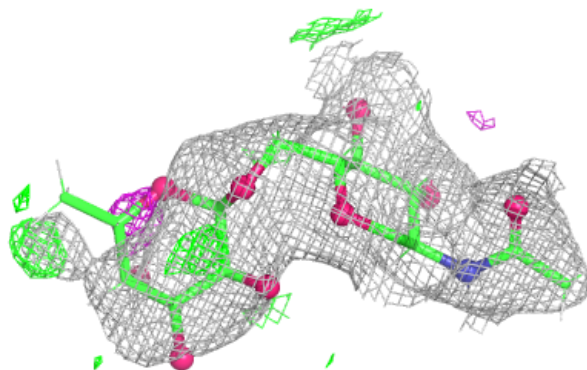
Electron density around Chain H:

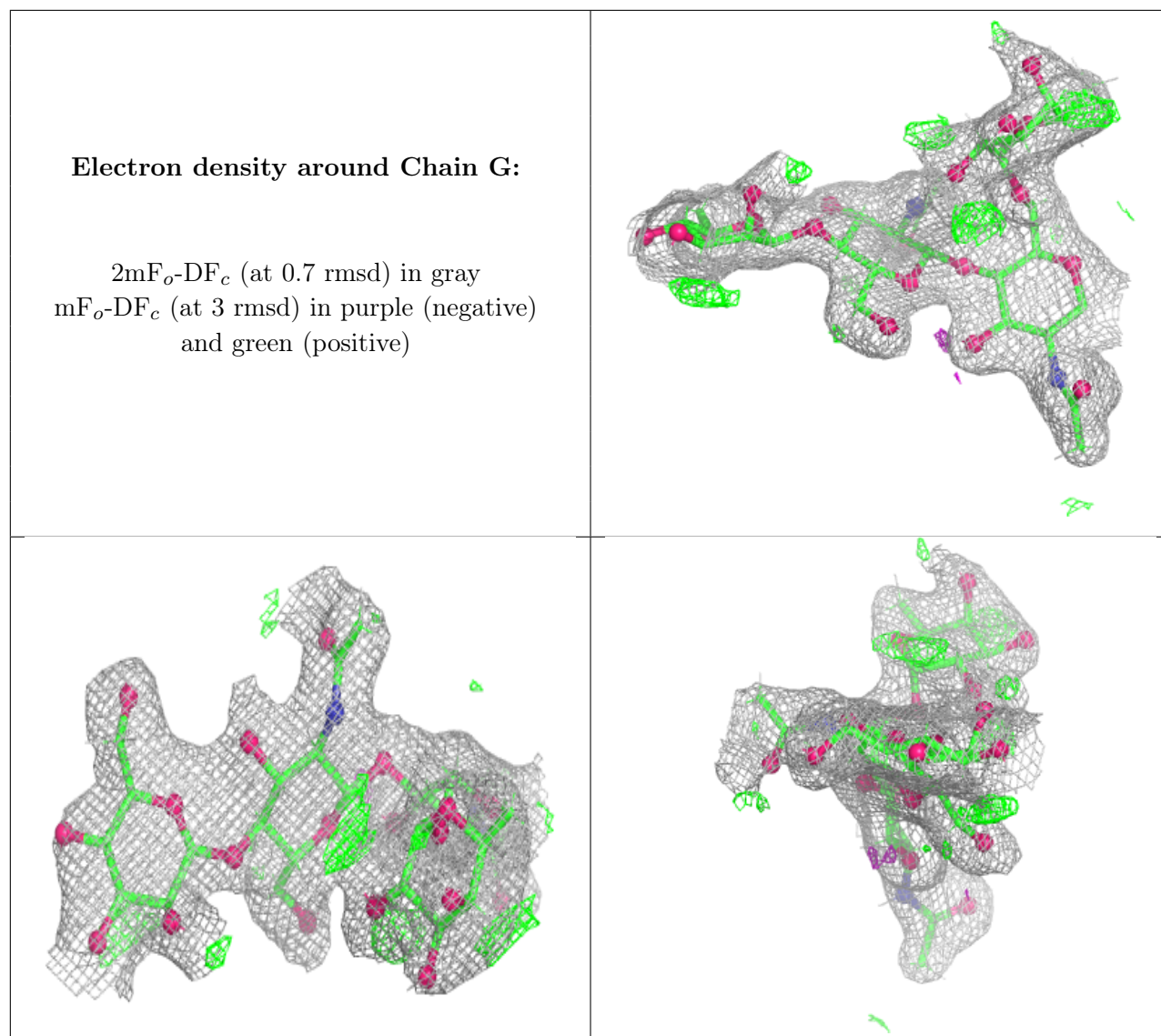
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain E:

$2mF_o - DF_c$ (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
11	EDO	B	714	4/4	0.78	0.18	63,76,77,77	0
11	EDO	B	715	4/4	0.80	0.14	57,69,70,70	10
13	PGE	B	719	10/10	0.81	0.14	51,61,72,72	0
11	EDO	A	716	4/4	0.83	0.13	59,71,72,72	0
11	EDO	A	717	4/4	0.86	0.21	63,76,76,77	0
10	PG4	A	712	13/13	0.87	0.14	57,70,79,80	0
11	EDO	B	718	4/4	0.88	0.20	64,77,78,78	0

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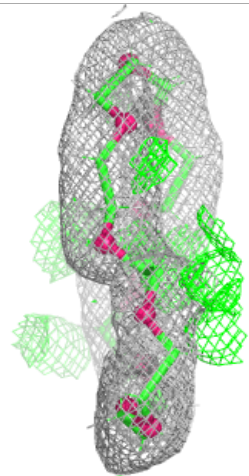
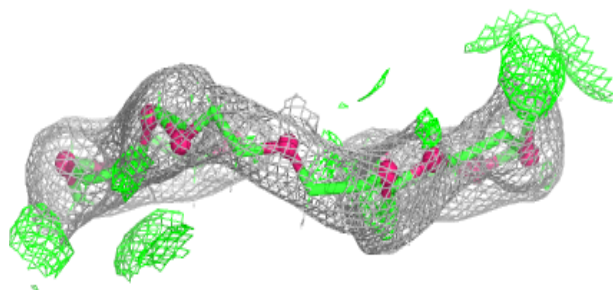
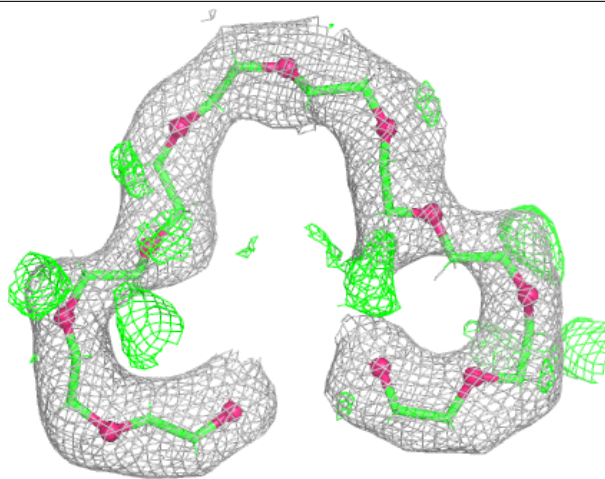
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
11	EDO	B	717	4/4	0.89	0.15	64,77,79,79	0
9	XPE	A	711	31/31	0.89	0.12	52,64,74,75	0
11	EDO	A	715	4/4	0.89	0.11	59,71,72,72	0
11	EDO	A	718	4/4	0.90	0.12	64,77,79,80	0
11	EDO	A	719	4/4	0.91	0.16	58,69,72,72	0
11	EDO	A	714	4/4	0.93	0.10	64,77,79,79	0
11	EDO	A	713	4/4	0.93	0.14	44,53,59,60	0
11	EDO	B	716	4/4	0.93	0.12	49,59,61,62	0
7	FT8	B	711	27/27	0.97	0.08	24,28,40,41	0
12	MG	B	713	1/1	0.98	0.06	49,49,49,49	0
7	FT8	A	709	27/27	0.98	0.06	23,28,39,40	0
6	ZN	A	708	1/1	1.00	0.02	25,25,25,25	0
6	ZN	B	710	1/1	1.00	0.01	25,25,25,25	0
8	CL	A	710	1/1	1.00	0.02	28,28,28,28	0
8	CL	B	712	1/1	1.00	0.02	25,25,25,25	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.

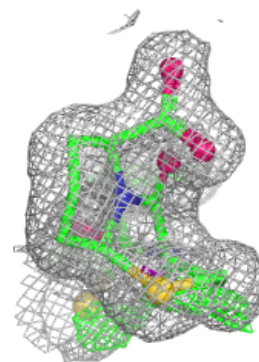
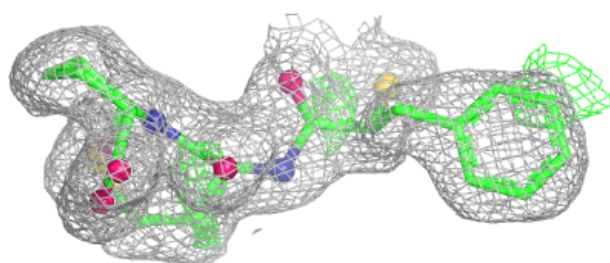
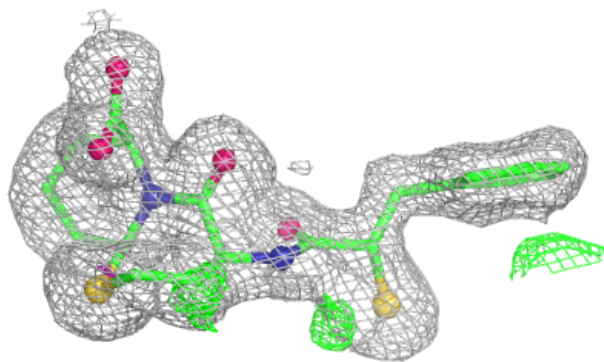
Electron density around XPE A 711:

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

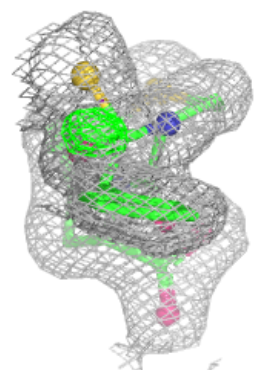
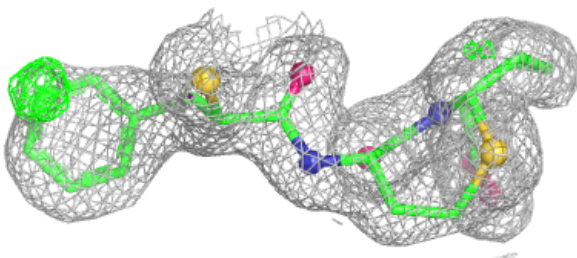
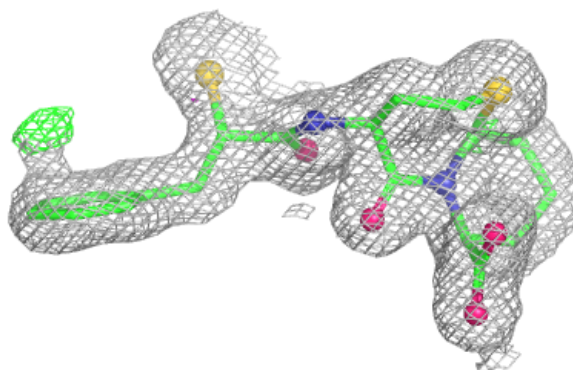


Electron density around FT8 B 711:

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

**Electron density around FT8 A 709:**

$2mF_o-DF_c$ (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.