



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 15, 2024 – 11:29 am GMT

PDB ID : 6IBM  
Title : Crystal structure of human alpha-galactosidase A in complex with alpha-galactose configured cyclosulfate ME776  
Authors : Rowland, R.J.; Wu, L.; Davies, G.J.  
Deposited on : 2018-11-30  
Resolution : 2.07 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](mailto: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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

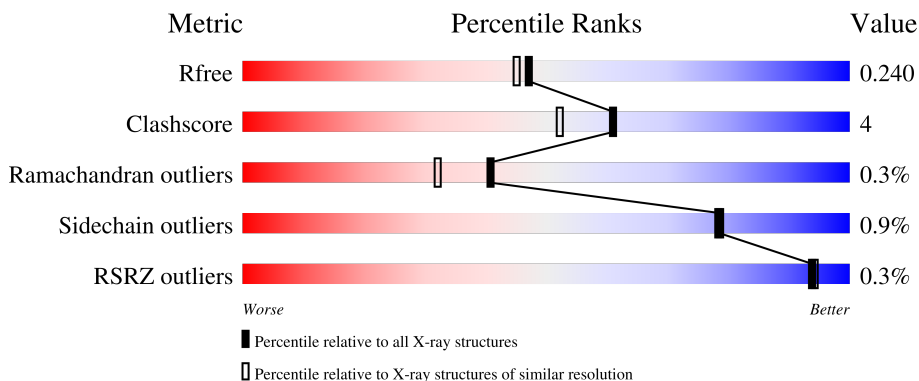
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.07 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.



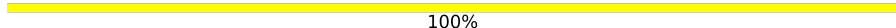
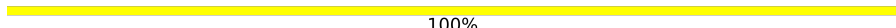

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	2684 (2.08-2.04)
Clashscore	141614	2801 (2.08-2.04)
Ramachandran outliers	138981	2768 (2.08-2.04)
Sidechain outliers	138945	2768 (2.08-2.04)
RSRZ outliers	127900	2646 (2.08-2.04)

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  $\geq 3$ , 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	398	 86% 12%
1	B	398	 89% 9%
2	C	3	 100%
2	E	3	 67% 33%
2	H	3	 100%

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Mol	Chain	Length	Quality of chain
3	D	2	 100%
3	G	2	 100%
4	F	6	 33% 67%

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	F	6	-	-	-	X
5	PEG	A	509	-	-	X	-

## 2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 6948 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 Alpha-galactosidase A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	390	Total 3139	C 1998	N 537	O 578	S 26	0	3	0
1	B	392	Total 3128	C 1992	N 532	O 577	S 27	0	0	0

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



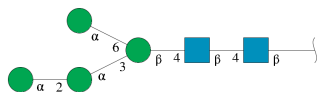
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	C	3	Total 39	C 22	N 2	O 15	0	0	0
2	E	3	Total 39	C 22	N 2	O 15	0	0	0
2	H	3	Total 39	C 22	N 2	O 15	0	0	0

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



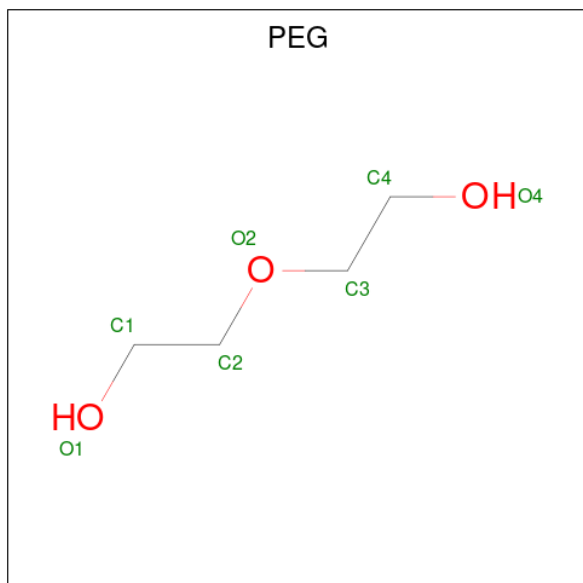
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	D	2	Total 28	C 16	N 2	O 10	0	0	0
3	G	2	Total 28	C 16	N 2	O 10	0	0	0

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	F	6	72	40	2	30	0	0	0

- Molecule 5 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C<sub>4</sub>H<sub>10</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
5	A	1	7	4	3	0	0
5	A	1	7	4	3	0	0

- Molecule 6 is ACETATE ION (three-letter code: ACT) (formula: C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>).



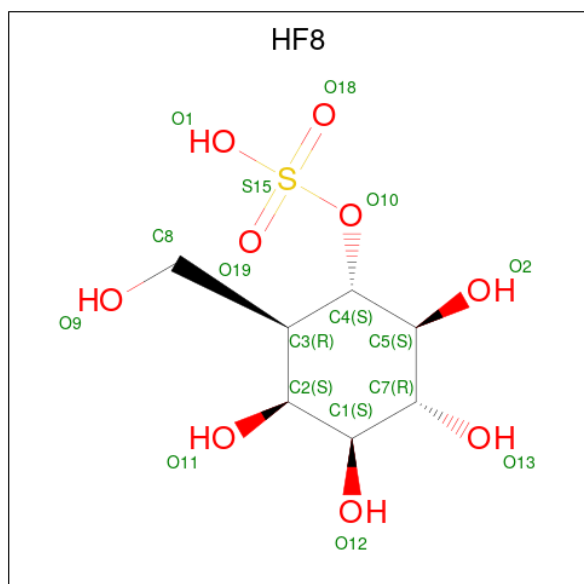
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C O 4 2 2	0	0
6	A	1	Total C O 4 2 2	0	0
6	A	1	Total C O 4 2 2	0	0
6	B	1	Total C O 4 2 2	0	0

- Molecule 7 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

- Molecule 8 is [(1 {S},2 {R},3 {S},4 {S},5 {R},6 {S})-2-(hydroxymethyl)-3,4,5,6-tetrakis(oxidanyl)cyclohexyl] hydrogen sulfate (three-letter code: HF8) (formula: C<sub>7</sub>H<sub>14</sub>O<sub>9</sub>S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total C O S 16 7 8 1	0	0
8	B	1	Total C O S 16 7 8 1	0	0

- Molecule 9 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



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

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	B	1	Total C O 4 2 2	0	0
9	B	1	Total C O 4 2 2	0	0
9	B	1	Total C O 4 2 2	0	0
9	B	1	Total C O 4 2 2	0	0

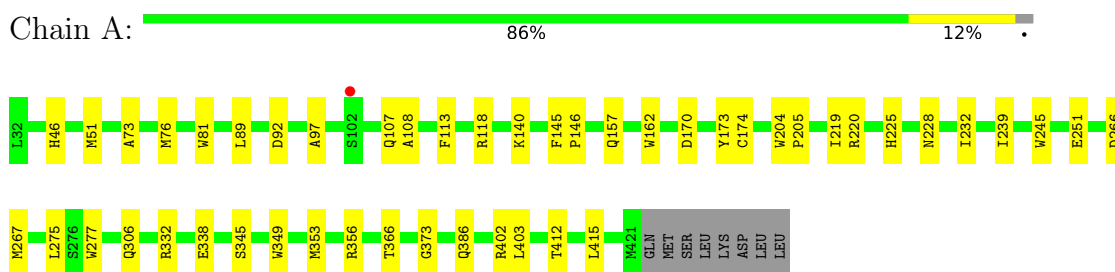
- Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	157	Total O 157 157	0	0
10	B	115	Total O 115 115	0	0

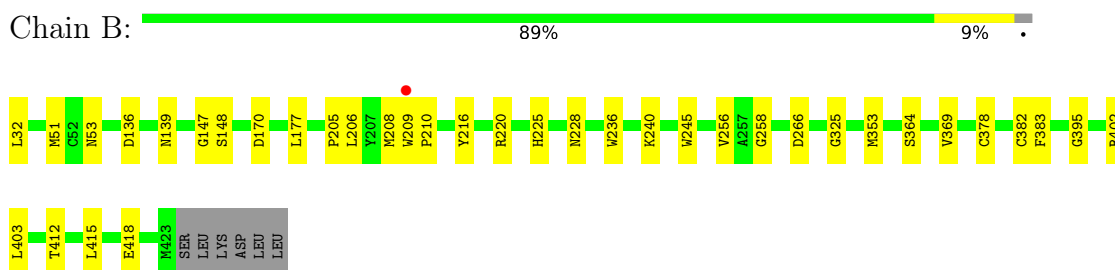
### 3 Residue-property plots [i](#)

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.

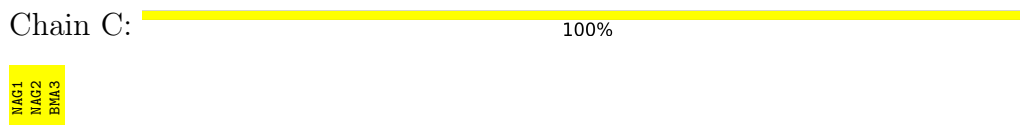
- Molecule 1: Alpha-galactosidase A



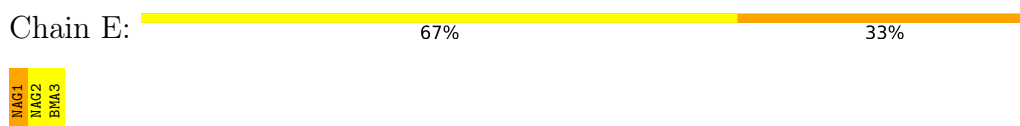
- Molecule 1: Alpha-galactosidase A



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



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




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

Chain H:  100%


MAG1  
MAG2  
BMA3

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

Chain D:  100%

MAG1  
MAG2

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

Chain G:  100%

MAG1  
MAG2

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

Chain F:  33% 67%

MAG1  
MAG2  
BMA3  
MAN4  
MAN5  
MAN6

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	90.34Å 90.34Å 216.00Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	78.36 – 2.07 78.24 – 2.07	Depositor EDS
% Data completeness (in resolution range)	99.9 (78.36-2.07) 100.0 (78.24-2.07)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.50 (at 2.07Å)	Xtrriage
Refinement program	REFMAC 5.8.0238	Depositor
R, $R_{free}$	0.180 , 0.242 0.186 , 0.240	Depositor DCC
$R_{free}$ test set	3073 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	44.1	Xtrriage
Anisotropy	0.483	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 54.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.025 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	6948	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	60.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.95% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: SO4, PEG, EDO, MAN, ACT, NAG, HF8, BMA

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	0.68	1/3226 (0.0%)	0.81	1/4382 (0.0%)
1	B	0.71	1/3215 (0.0%)	0.81	0/4368
All	All	0.70	2/6441 (0.0%)	0.81	1/8750 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	170	ASP	CG-OD2	8.73	1.45	1.25
1	A	170	ASP	CG-OD2	8.33	1.44	1.25

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	220	ARG	CG-CD-NE	-6.57	98.01	111.80

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3139	0	2979	33	0
1	B	3128	0	2971	25	0
2	C	39	0	34	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	E	39	0	34	1	0
2	H	39	0	34	0	0
3	D	28	0	25	0	0
3	G	28	0	25	0	0
4	F	72	0	61	0	0
5	A	14	0	20	5	0
6	A	12	0	9	1	0
6	B	4	0	3	0	0
7	A	15	0	0	1	0
7	B	15	0	0	1	0
8	A	16	0	0	0	0
8	B	16	0	0	0	0
9	A	36	0	54	0	0
9	B	36	0	54	0	0
10	A	157	0	0	2	0
10	B	115	0	0	0	0
All	All	6948	0	6303	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 4.

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)
1:B:369:VAL:HG13	1:B:378:CYS:SG	2.25	0.77
1:A:403:LEU:HD21	1:A:415:LEU:CD1	2.22	0.69
1:B:209:TRP:N	1:B:210:PRO:HD2	2.15	0.62
1:A:277:TRP:H	5:A:509:PEG:C3	2.13	0.62
1:A:403:LEU:HD21	1:A:415:LEU:HD11	1.84	0.60
1:A:402:ARG:NH2	7:A:514:SO4:O1	2.31	0.59
1:A:338:GLU:OE2	1:A:356:ARG:NH1	2.37	0.58
1:B:403:LEU:HD21	1:B:415:LEU:CD1	2.35	0.57
1:B:403:LEU:HD21	1:B:415:LEU:HD13	1.86	0.57
1:B:177:LEU:H	1:B:177:LEU:HD12	1.69	0.57
1:B:353:MET:HE1	1:B:415:LEU:HD11	1.87	0.56
1:A:46:HIS:CD2	1:A:92:ASP:H	2.25	0.54
1:A:228:ASN:HB3	1:A:245:TRP:CH2	2.41	0.54
1:A:277:TRP:H	5:A:509:PEG:H31	1.72	0.54
1:A:251:GLU:H	1:A:251:GLU:CD	2.11	0.54
1:B:32:LEU:N	1:B:220:ARG:O	2.42	0.53
1:A:204:TRP:HB3	1:A:205:PRO:HD3	1.90	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:239:ILE:HD11	1:A:275:LEU:HD11	1.90	0.53
1:A:345:SER:HA	6:A:512:ACT:H2	1.91	0.52
1:A:332:ARG:HD2	10:A:724:HOH:O	2.10	0.51
1:B:369:VAL:CG1	1:B:378:CYS:CB	2.88	0.51
1:A:277:TRP:CZ3	1:A:306:GLN:HG2	2.47	0.49
1:B:216:TYR:HB3	1:B:256:VAL:HG11	1.94	0.49
1:B:208:MET:C	1:B:210:PRO:HD2	2.33	0.49
1:A:97:ALA:HB3	1:A:107:GLN:HG3	1.94	0.49
1:B:228:ASN:HB3	1:B:245:TRP:CH2	2.47	0.49
1:B:353:MET:O	1:B:412:THR:HA	2.14	0.47
1:B:369:VAL:CG1	1:B:378:CYS:SG	2.98	0.47
1:A:157:GLN:NE2	10:A:607:HOH:O	2.48	0.46
1:A:366:THR:HA	1:A:403:LEU:O	2.16	0.46
1:A:205:PRO:HG3	1:A:219:ILE:HD13	1.97	0.46
1:A:73:ALA:HB2	1:A:89:LEU:CD2	2.46	0.46
1:A:76:MET:HA	1:A:81:TRP:HB2	1.98	0.45
1:A:118:ARG:H	5:A:510:PEG:H21	1.82	0.45
1:B:136:ASP:O	1:B:148:SER:HB2	2.17	0.45
1:A:386:GLN:HA	1:A:415:LEU:HD23	1.98	0.44
1:B:383:PHE:CE1	1:B:395:GLY:HA2	2.52	0.44
1:A:174:CYS:HA	2:E:1:NAG:H81	1.99	0.44
1:A:277:TRP:CB	5:A:509:PEG:H31	2.48	0.44
1:B:177:LEU:HD12	1:B:177:LEU:N	2.30	0.44
1:A:108:ALA:HB1	1:A:113:PHE:HB2	1.98	0.43
1:B:139:ASN:C	1:B:147:GLY:HA3	2.38	0.43
1:A:145:PHE:HB3	1:A:146:PRO:HD2	2.00	0.43
1:A:239:ILE:CD1	1:A:275:LEU:HD11	2.48	0.43
1:B:177:LEU:H	1:B:177:LEU:CD1	2.30	0.42
1:A:232:ILE:HD13	1:A:267:MET:O	2.19	0.42
1:A:349:TRP:CZ3	1:A:373:GLY:HA2	2.54	0.42
1:B:205:PRO:O	1:B:209:TRP:CD1	2.73	0.42
1:B:382:CYS:HA	1:B:418:GLU:O	2.20	0.42
1:B:236:TRP:NE1	1:B:240:LYS:HD2	2.36	0.41
1:B:209:TRP:N	1:B:210:PRO:CD	2.82	0.41
1:A:277:TRP:HB3	5:A:509:PEG:H31	2.02	0.41
1:A:140:LYS:HB2	1:A:173:TYR:CD2	2.56	0.40
1:A:353:MET:O	1:A:412:THR:HA	2.21	0.40
1:A:118:ARG:HA	1:A:162:TRP:O	2.21	0.40
1:B:258:GLY:HA2	1:B:325:GLY:O	2.21	0.40
1:B:402:ARG:NH2	7:B:513:SO4:O3	2.55	0.40
1:B:206:LEU:HA	1:B:209:TRP:HD1	1.87	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	391/398 (98%)	378 (97%)	12 (3%)	1 (0%)	41	32
1	B	390/398 (98%)	372 (95%)	17 (4%)	1 (0%)	41	32
All	All	781/796 (98%)	750 (96%)	29 (4%)	2 (0%)	41	32

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	266	ASP
1	A	266	ASP

### 5.3.2 Protein sidechains [i](#)

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	330/339 (97%)	327 (99%)	3 (1%)	78	78
1	B	330/339 (97%)	326 (99%)	4 (1%)	71	69
All	All	660/678 (97%)	653 (99%)	7 (1%)	78	72

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

Mol	Chain	Res	Type
1	A	51[A]	MET

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Mol	Chain	Res	Type
1	A	51[B]	MET
1	A	225	HIS
1	B	51	MET
1	B	53	ASN
1	B	225	HIS
1	B	364	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	46	HIS

### 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](#)

19 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	0.66	0	17,19,21	1.05	1 (5%)
2	NAG	C	2	2	14,14,15	0.54	0	17,19,21	1.39	4 (23%)
2	BMA	C	3	2	11,11,12	0.47	0	15,15,17	1.33	1 (6%)
3	NAG	D	1	3,1	14,14,15	0.43	0	17,19,21	1.28	2 (11%)
3	NAG	D	2	3	14,14,15	0.40	0	17,19,21	1.60	6 (35%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	NAG	E	1	2,1	14,14,15	0.56	0	17,19,21	1.21	2 (11%)
2	NAG	E	2	2	14,14,15	0.39	0	17,19,21	1.08	1 (5%)
2	BMA	E	3	2	11,11,12	0.46	0	15,15,17	1.24	1 (6%)
4	NAG	F	1	4,1	14,14,15	0.45	0	17,19,21	1.21	1 (5%)
4	NAG	F	2	4	14,14,15	0.54	0	17,19,21	0.92	0
4	BMA	F	3	4	11,11,12	0.44	0	15,15,17	0.74	0
4	MAN	F	4	4	11,11,12	0.47	0	15,15,17	1.14	1 (6%)
4	MAN	F	5	4	11,11,12	0.28	0	15,15,17	0.78	1 (6%)
4	MAN	F	6	4	11,11,12	0.71	0	15,15,17	1.13	2 (13%)
3	NAG	G	1	3,1	14,14,15	0.46	0	17,19,21	1.06	2 (11%)
3	NAG	G	2	3	14,14,15	0.30	0	17,19,21	1.36	2 (11%)
2	NAG	H	1	2,1	14,14,15	0.49	0	17,19,21	1.25	2 (11%)
2	NAG	H	2	2	14,14,15	0.64	0	17,19,21	1.47	1 (5%)
2	BMA	H	3	2	11,11,12	0.45	0	15,15,17	1.17	1 (6%)

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

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

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	BMA	H	3	2	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	H	2	NAG	C2-N2-C7	4.39	129.15	122.90
2	C	3	BMA	O5-C5-C6	3.64	112.91	107.20
2	E	3	BMA	C1-O5-C5	3.54	116.99	112.19
3	G	2	NAG	O5-C5-C6	3.53	112.74	107.20
4	F	4	MAN	O2-C2-C1	3.13	115.55	109.15
2	C	2	NAG	O4-C4-C5	3.08	116.95	109.30
3	G	1	NAG	C1-C2-N2	2.75	115.19	110.49
2	E	1	NAG	C1-O5-C5	2.75	115.91	112.19
2	C	2	NAG	C3-C4-C5	-2.63	105.55	110.24
2	H	1	NAG	O7-C7-N2	2.58	126.69	121.95
3	D	2	NAG	O4-C4-C3	-2.56	104.43	110.35
3	D	2	NAG	C1-O5-C5	2.54	115.63	112.19
2	E	1	NAG	O5-C5-C6	2.52	111.16	107.20
2	E	2	NAG	O4-C4-C3	-2.51	104.55	110.35
4	F	6	MAN	O5-C5-C6	2.46	111.07	107.20
4	F	1	NAG	C6-C5-C4	-2.44	107.29	113.00
2	H	3	BMA	O5-C5-C6	2.42	111.00	107.20
3	D	2	NAG	O3-C3-C4	-2.40	104.80	110.35
2	C	2	NAG	O4-C4-C3	-2.38	104.85	110.35
3	D	2	NAG	C3-C4-C5	2.37	114.47	110.24
3	D	1	NAG	O5-C5-C6	2.33	110.86	107.20
2	C	1	NAG	C4-C3-C2	-2.27	107.69	111.02
4	F	6	MAN	O2-C2-C1	2.26	113.78	109.15
2	H	1	NAG	C2-N2-C7	2.26	126.11	122.90
3	D	2	NAG	C2-N2-C7	-2.22	119.75	122.90
3	G	2	NAG	C1-O5-C5	2.16	115.12	112.19
3	D	2	NAG	C1-C2-N2	2.12	114.10	110.49
2	C	2	NAG	C6-C5-C4	2.05	117.82	113.00
3	G	1	NAG	O5-C5-C6	2.05	110.41	107.20
4	F	5	MAN	O5-C1-C2	-2.04	107.62	110.77
3	D	1	NAG	O4-C4-C3	-2.04	105.64	110.35

There are no chirality outliers.

All (16) torsion outliers are listed below:

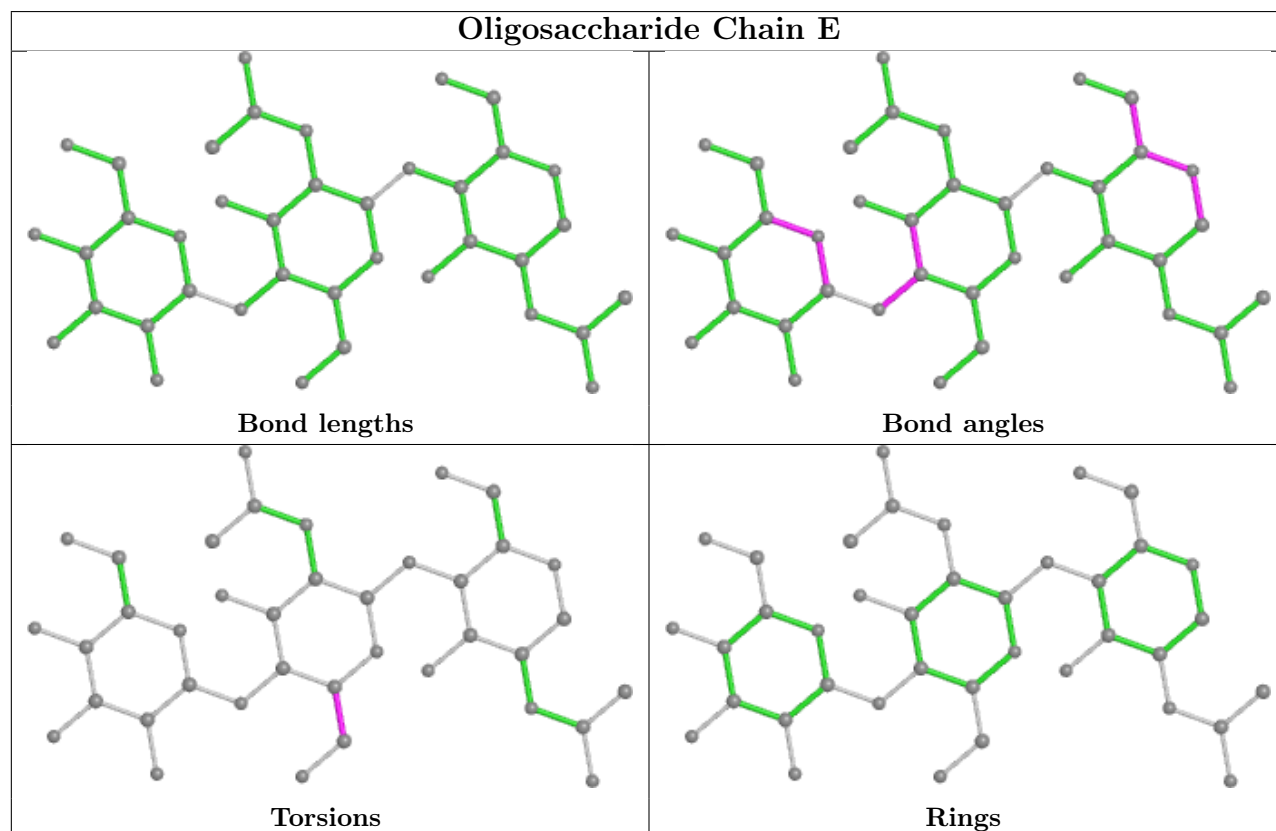
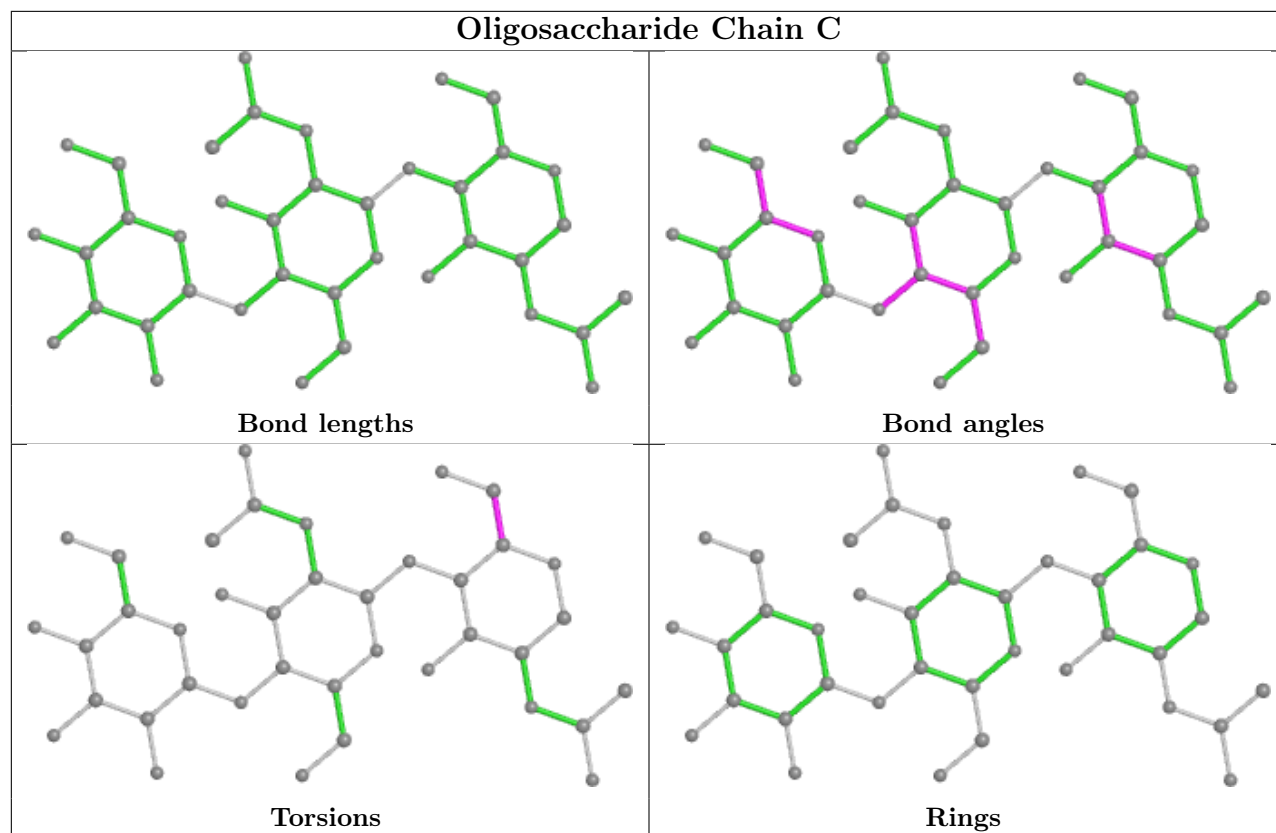
Mol	Chain	Res	Type	Atoms
2	H	2	NAG	C3-C2-N2-C7
4	F	6	MAN	O5-C5-C6-O6
2	E	2	NAG	C4-C5-C6-O6
2	H	2	NAG	C4-C5-C6-O6
2	C	1	NAG	C4-C5-C6-O6
2	E	2	NAG	O5-C5-C6-O6
4	F	1	NAG	O5-C5-C6-O6
2	H	2	NAG	O5-C5-C6-O6
3	G	1	NAG	C4-C5-C6-O6
4	F	6	MAN	C4-C5-C6-O6
2	C	1	NAG	O5-C5-C6-O6
3	G	1	NAG	O5-C5-C6-O6
4	F	5	MAN	O5-C5-C6-O6
4	F	1	NAG	C4-C5-C6-O6
3	G	2	NAG	C3-C2-N2-C7
4	F	4	MAN	C4-C5-C6-O6

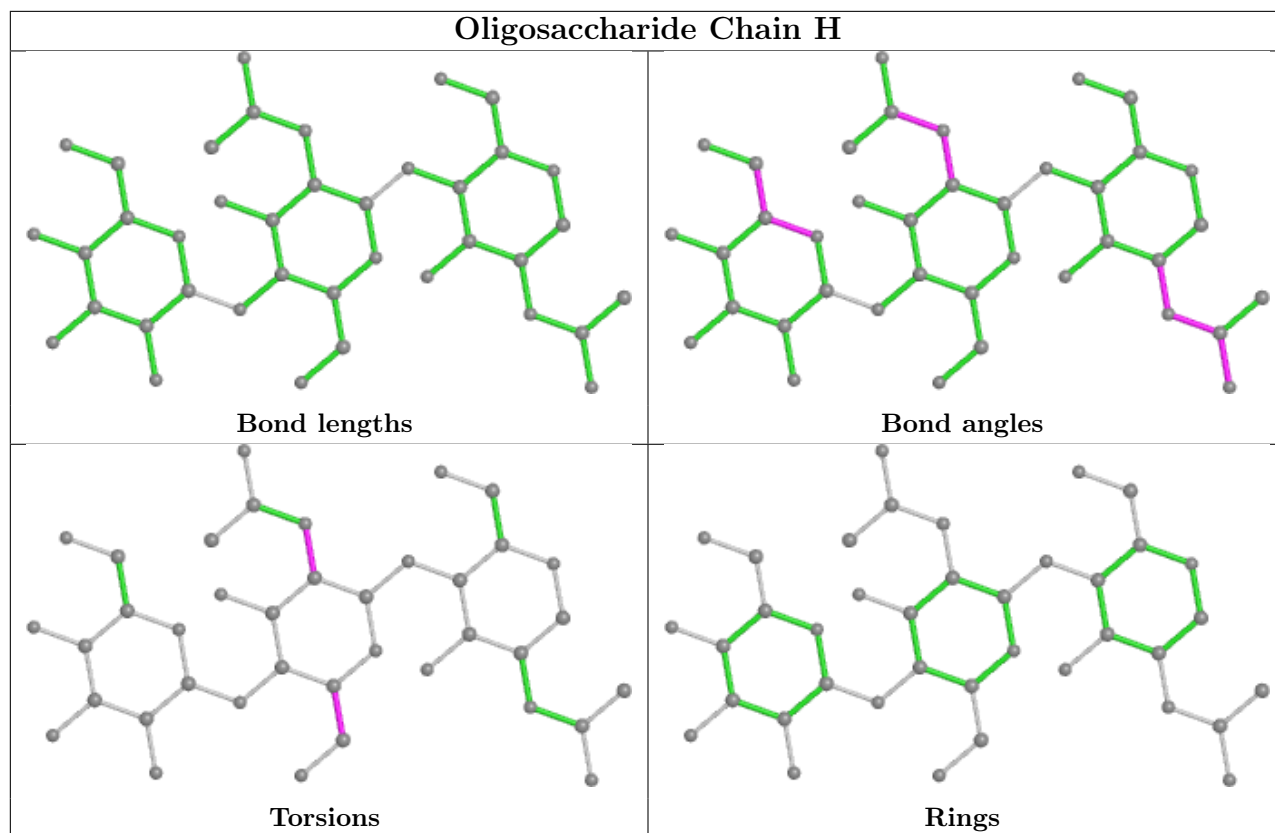
There are no ring outliers.

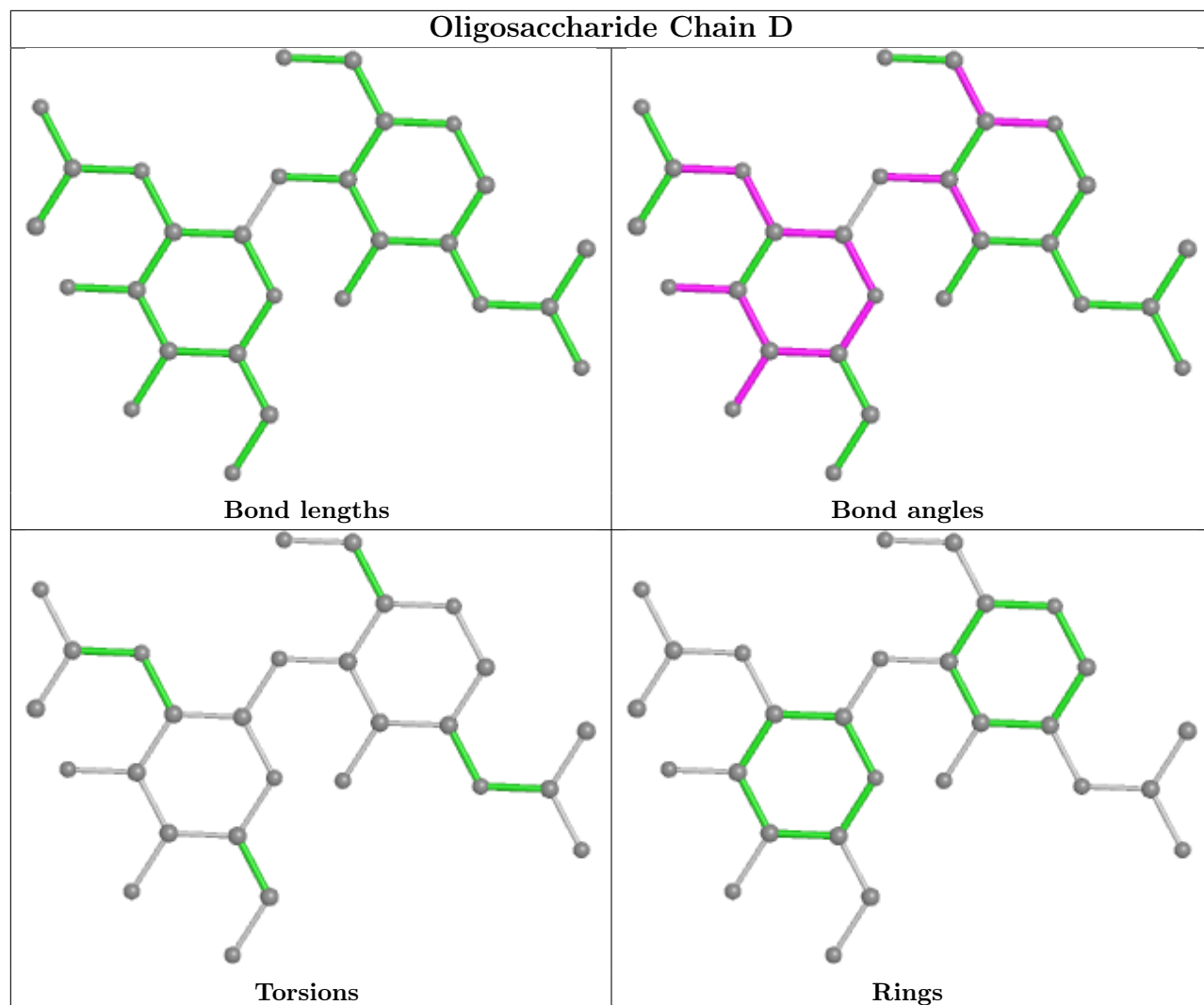
1 monomer is involved in 1 short contact:

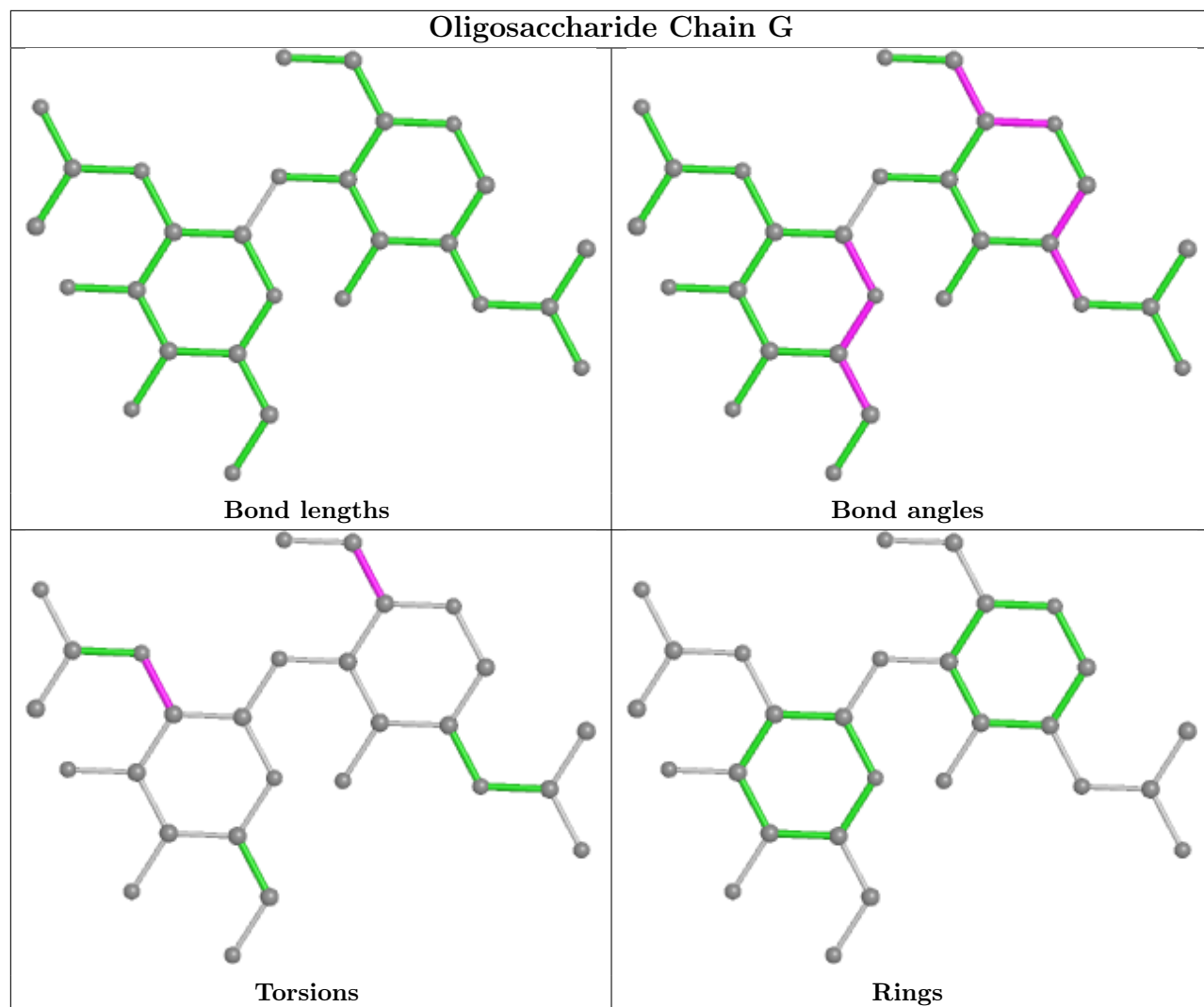
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	1	NAG	1	0

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

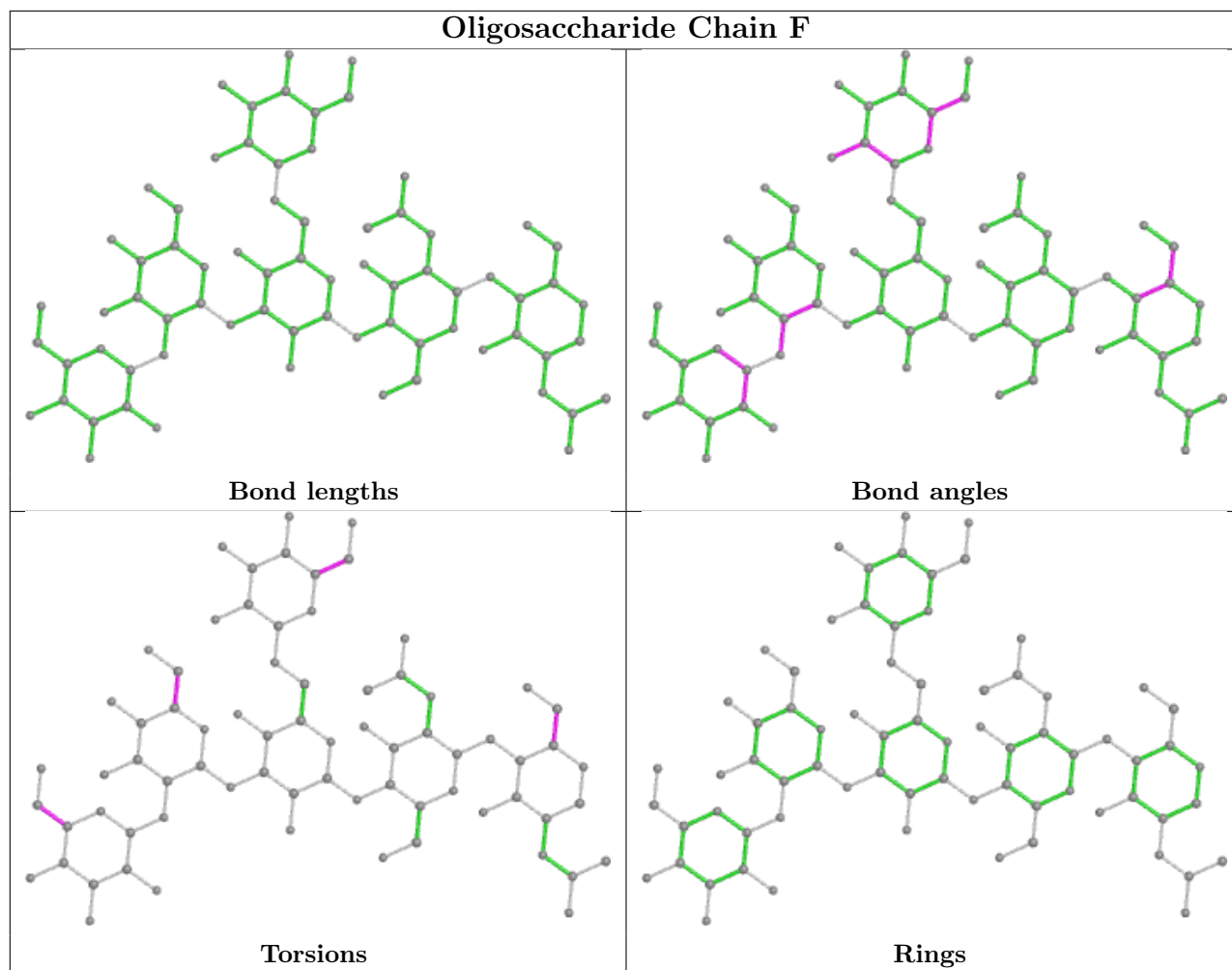












## 5.6 Ligand geometry [i](#)

32 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
9	EDO	B	524	-	3,3,3	0.12	0	2,2,2	0.19	0
7	SO4	A	514	-	4,4,4	0.50	0	6,6,6	0.14	0
5	PEG	A	509	-	6,6,6	0.16	0	5,5,5	0.30	0
9	EDO	B	523	-	3,3,3	0.41	0	2,2,2	0.64	0
9	EDO	A	526	-	3,3,3	0.30	0	2,2,2	0.28	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
9	EDO	B	522	-	3,3,3	0.06	0	2,2,2	0.09	0
9	EDO	B	521	-	3,3,3	0.14	0	2,2,2	0.33	0
8	HF8	A	517	1	16,16,17	1.11	1 (6%)	18,24,26	1.28	2 (11%)
8	HF8	B	516	1	16,16,17	0.89	1 (6%)	18,24,26	1.36	3 (16%)
9	EDO	A	524	-	3,3,3	0.16	0	2,2,2	0.31	0
9	EDO	A	519	-	3,3,3	0.11	0	2,2,2	0.54	0
6	ACT	A	513	-	3,3,3	1.24	0	3,3,3	0.65	0
9	EDO	B	517	-	3,3,3	0.03	0	2,2,2	0.20	0
7	SO4	B	513	-	4,4,4	0.50	0	6,6,6	0.16	0
9	EDO	B	519	-	3,3,3	0.13	0	2,2,2	0.17	0
6	ACT	B	512	-	3,3,3	0.93	0	3,3,3	0.87	0
9	EDO	B	518	-	3,3,3	0.17	0	2,2,2	0.29	0
9	EDO	B	520	-	3,3,3	0.10	0	2,2,2	0.03	0
5	PEG	A	510	-	6,6,6	0.52	0	5,5,5	0.41	0
9	EDO	A	520	-	3,3,3	0.14	0	2,2,2	0.15	0
7	SO4	B	515	-	4,4,4	0.36	0	6,6,6	0.07	0
9	EDO	A	518	-	3,3,3	0.39	0	2,2,2	0.29	0
9	EDO	A	525	-	3,3,3	0.14	0	2,2,2	0.34	0
9	EDO	B	525	-	3,3,3	0.14	0	2,2,2	0.35	0
9	EDO	A	522	-	3,3,3	0.21	0	2,2,2	0.42	0
6	ACT	A	512	-	3,3,3	1.12	0	3,3,3	0.46	0
6	ACT	A	511	-	3,3,3	1.01	0	3,3,3	0.83	0
7	SO4	A	515	-	4,4,4	0.28	0	6,6,6	0.16	0
7	SO4	B	514	-	4,4,4	0.47	0	6,6,6	0.15	0
7	SO4	A	516	-	4,4,4	0.33	0	6,6,6	0.08	0
9	EDO	A	523	-	3,3,3	0.04	0	2,2,2	0.23	0
9	EDO	A	521	-	3,3,3	0.24	0	2,2,2	0.27	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
9	EDO	B	524	-	-	1/1/1/1	-
5	PEG	A	509	-	-	2/4/4/4	-
9	EDO	B	523	-	-	0/1/1/1	-
9	EDO	A	526	-	-	1/1/1/1	-
9	EDO	B	522	-	-	1/1/1/1	-
9	EDO	B	521	-	-	1/1/1/1	-
8	HF8	A	517	1	-	0/7/27/31	0/1/1/1
8	HF8	B	516	1	-	1/7/27/31	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
9	EDO	A	524	-	-	1/1/1/1	-
9	EDO	A	519	-	-	0/1/1/1	-
9	EDO	B	517	-	-	1/1/1/1	-
9	EDO	B	519	-	-	1/1/1/1	-
9	EDO	B	518	-	-	0/1/1/1	-
9	EDO	B	520	-	-	0/1/1/1	-
5	PEG	A	510	-	-	2/4/4/4	-
9	EDO	A	520	-	-	1/1/1/1	-
9	EDO	A	518	-	-	1/1/1/1	-
9	EDO	A	525	-	-	0/1/1/1	-
9	EDO	B	525	-	-	1/1/1/1	-
9	EDO	A	522	-	-	1/1/1/1	-
9	EDO	A	523	-	-	0/1/1/1	-
9	EDO	A	521	-	-	1/1/1/1	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	A	517	HF8	O10-C4	-3.82	1.41	1.47
8	B	516	HF8	O10-C4	-2.25	1.43	1.47

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	517	HF8	C4-O10-S15	3.02	121.85	117.91
8	A	517	HF8	O10-C4-C5	-2.83	102.53	108.54
8	B	516	HF8	O10-C4-C5	-2.80	102.59	108.54
8	B	516	HF8	O11-C2-C3	2.68	115.59	110.05
8	B	516	HF8	O11-C2-C1	-2.25	105.16	110.35

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	A	526	EDO	O1-C1-C2-O2
5	A	510	PEG	C1-C2-O2-C3
9	A	520	EDO	O1-C1-C2-O2
9	A	524	EDO	O1-C1-C2-O2
5	A	510	PEG	O1-C1-C2-O2
9	A	522	EDO	O1-C1-C2-O2
9	B	517	EDO	O1-C1-C2-O2

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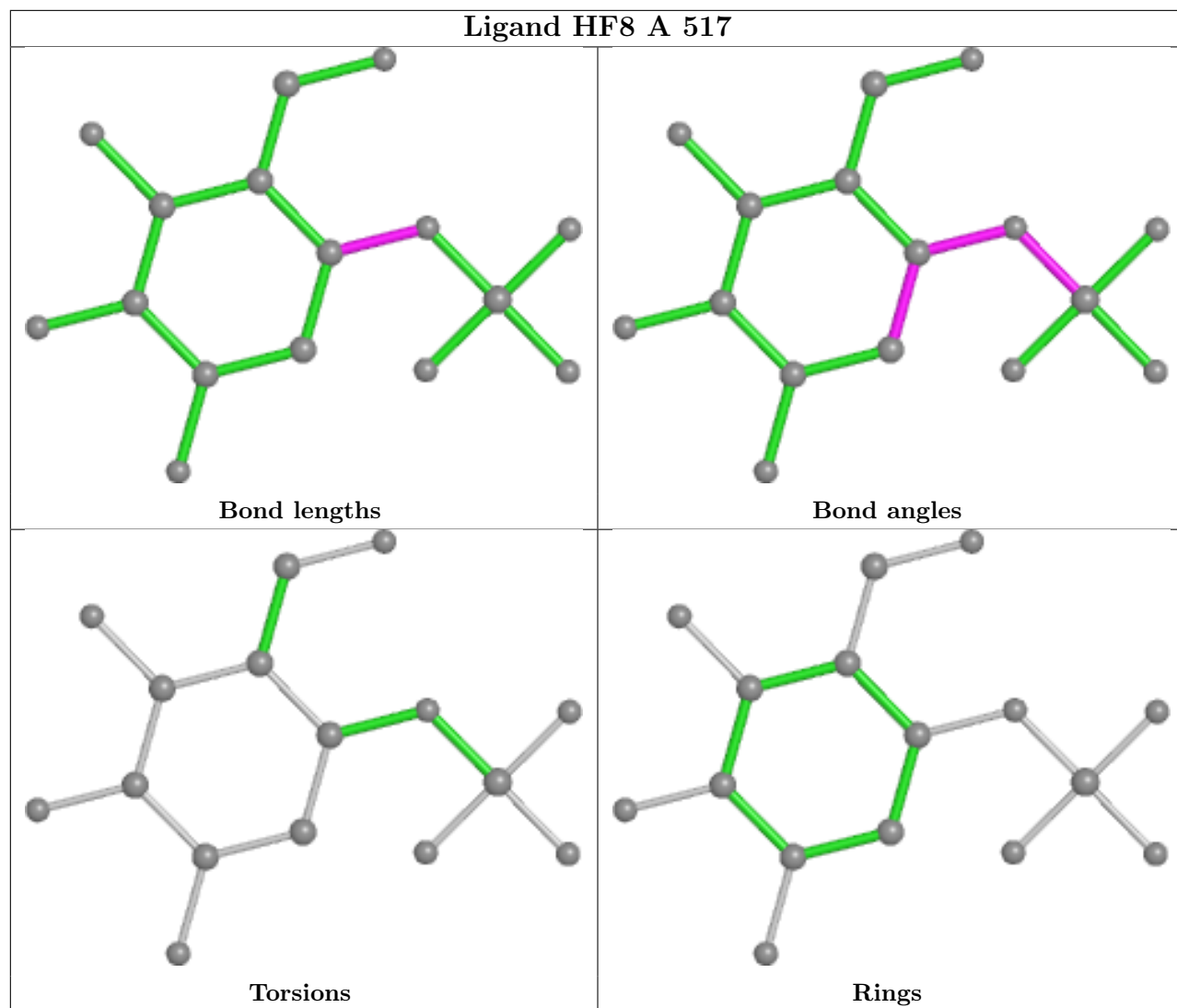
Mol	Chain	Res	Type	Atoms
9	B	524	EDO	O1-C1-C2-O2
9	A	518	EDO	O1-C1-C2-O2
5	A	509	PEG	O2-C3-C4-O4
9	B	519	EDO	O1-C1-C2-O2
9	B	522	EDO	O1-C1-C2-O2
9	B	525	EDO	O1-C1-C2-O2
5	A	509	PEG	C4-C3-O2-C2
9	A	521	EDO	O1-C1-C2-O2
9	B	521	EDO	O1-C1-C2-O2
8	B	516	HF8	C3-C4-O10-S15

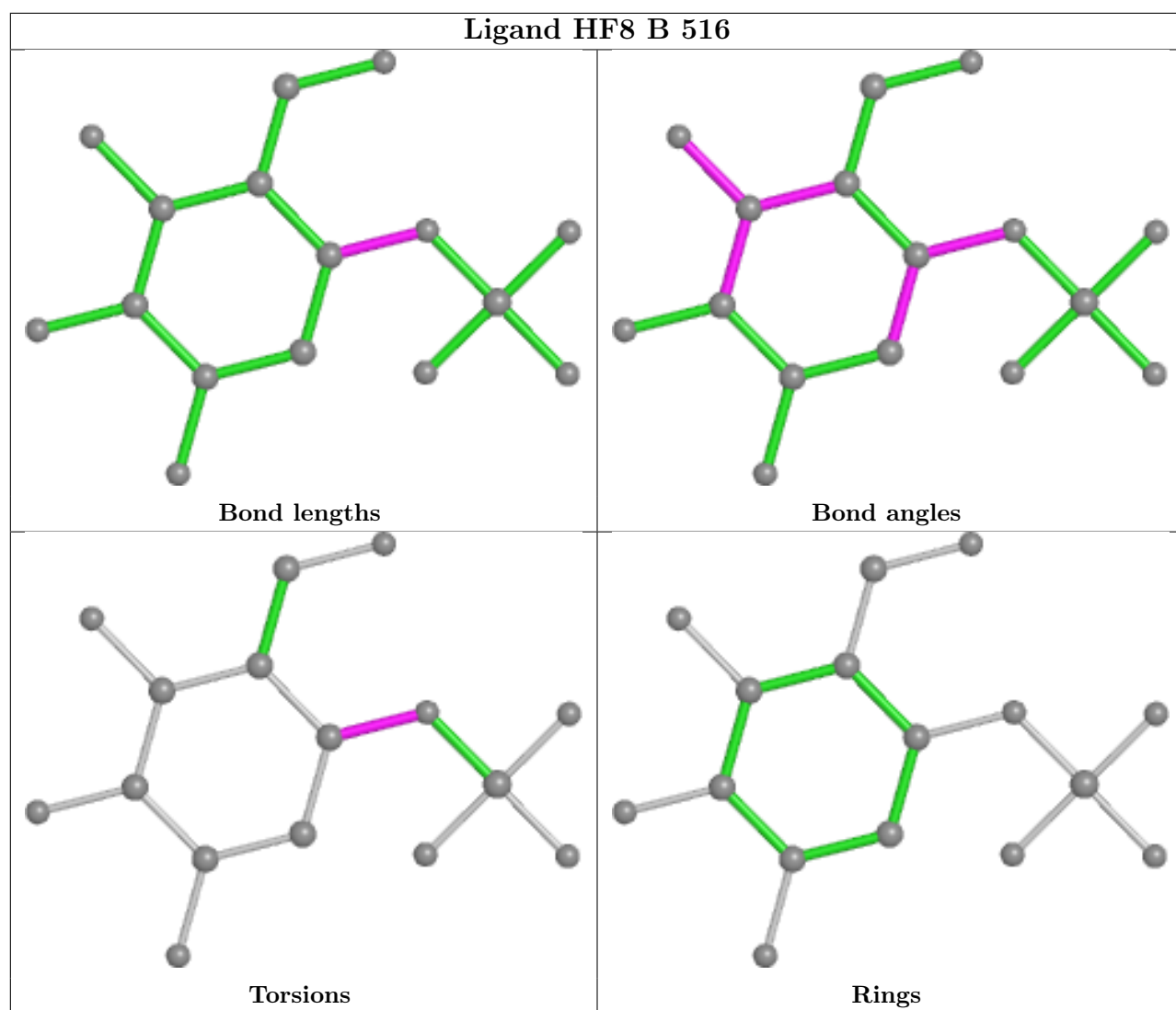
There are no ring outliers.

5 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	A	514	SO4	1	0
5	A	509	PEG	4	0
7	B	513	SO4	1	0
5	A	510	PEG	1	0
6	A	512	ACT	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.





## 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 [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	390/398 (97%)	-0.12	1 (0%) 94 94	40, 53, 70, 100	7 (1%)
1	B	392/398 (98%)	-0.09	1 (0%) 94 94	42, 59, 86, 116	4 (1%)
All	All	782/796 (98%)	-0.11	2 (0%) 94 94	40, 55, 81, 116	11 (1%)

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	209	TRP	2.2
1	A	102	SER	2.1

### 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, 95<sup>th</sup> 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.

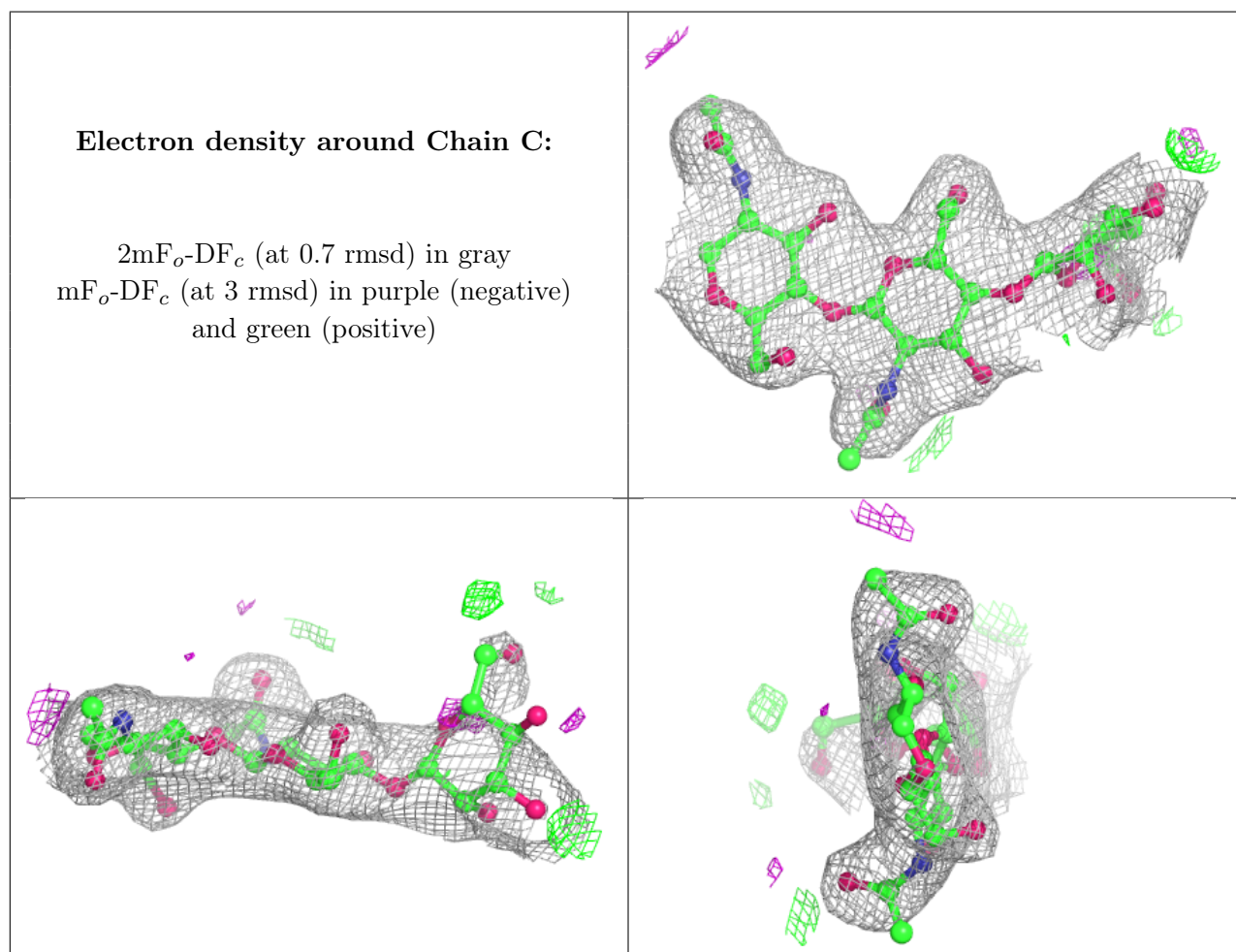
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	BMA	H	3	11/12	0.33	0.26	122,136,146,150	0
2	BMA	E	3	11/12	0.61	0.18	114,124,137,137	0
2	BMA	C	3	11/12	0.64	0.24	94,106,119,128	0
2	NAG	H	1	14/15	0.75	0.16	78,102,112,120	0
4	MAN	F	6	11/12	0.75	0.46	95,111,121,121	0
4	MAN	F	5	11/12	0.79	0.30	125,134,139,150	0
2	NAG	H	2	14/15	0.81	0.23	112,124,137,140	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	NAG	D	2	14/15	0.84	0.18	91,100,106,109	0
3	NAG	G	2	14/15	0.84	0.20	130,139,143,155	0
2	NAG	E	1	14/15	0.88	0.09	71,81,87,91	0
2	NAG	E	2	14/15	0.89	0.15	91,104,119,130	0
4	BMA	F	3	11/12	0.89	0.13	75,95,105,106	0
4	MAN	F	4	11/12	0.90	0.12	82,100,112,117	0
4	NAG	F	1	14/15	0.92	0.11	64,74,83,83	0
4	NAG	F	2	14/15	0.92	0.11	79,85,89,89	0
3	NAG	G	1	14/15	0.92	0.09	83,107,117,126	0
3	NAG	D	1	14/15	0.93	0.09	72,76,94,96	0
2	NAG	C	2	14/15	0.95	0.10	62,79,91,96	0
2	NAG	C	1	14/15	0.98	0.11	57,61,66,68	0

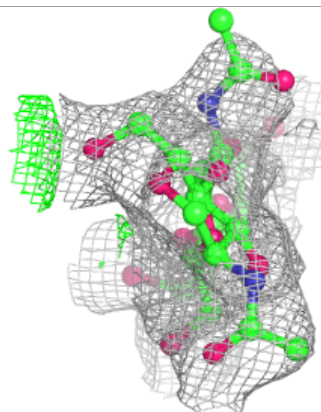
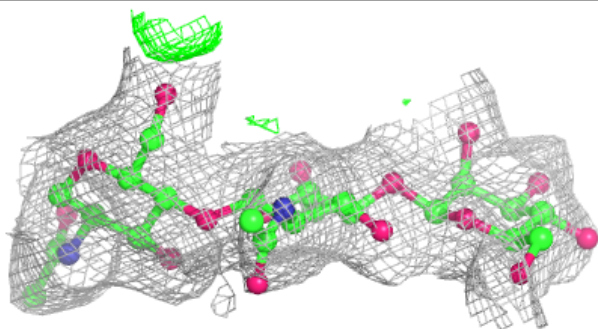
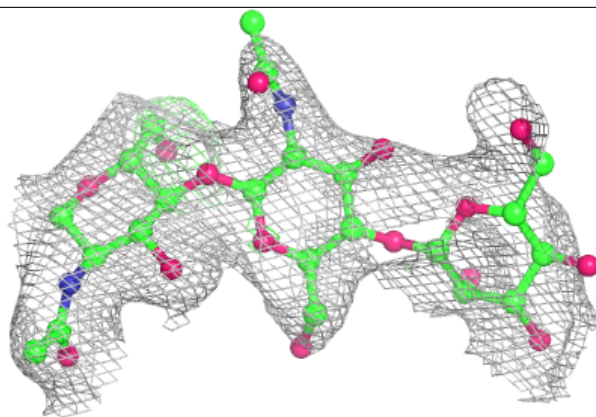
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.





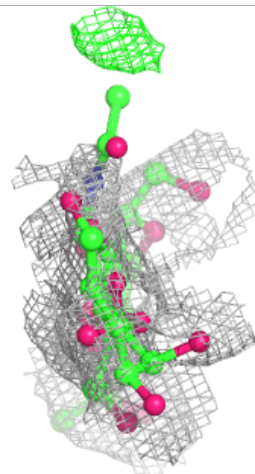
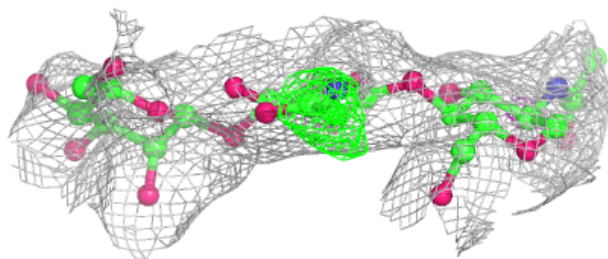
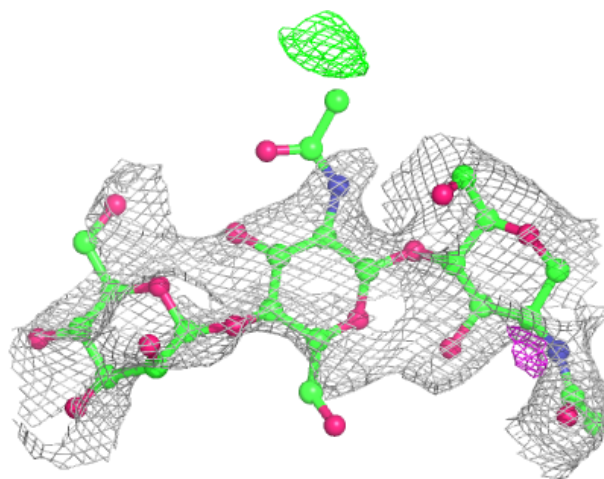
**Electron density around Chain E:**

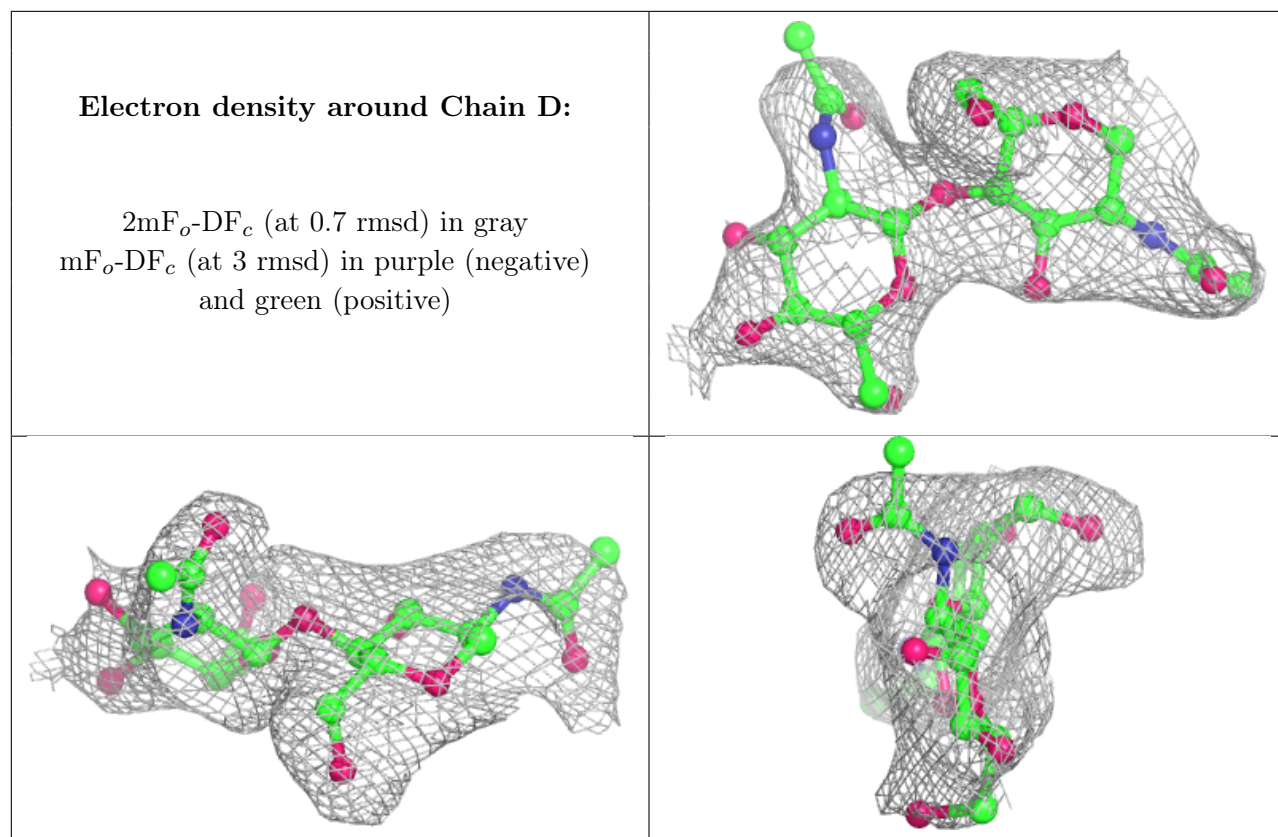
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around Chain H:**

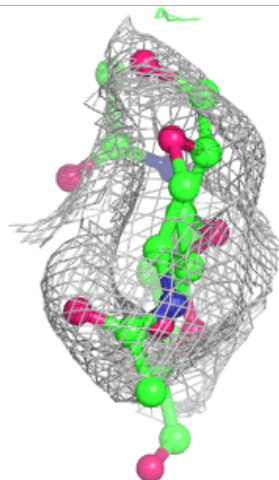
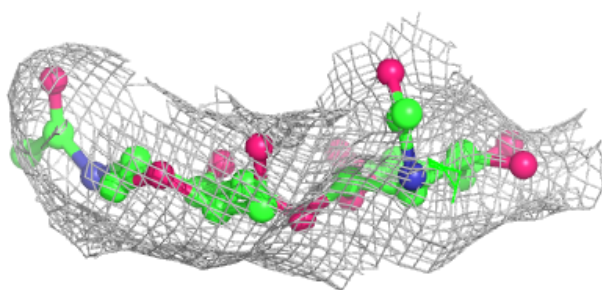
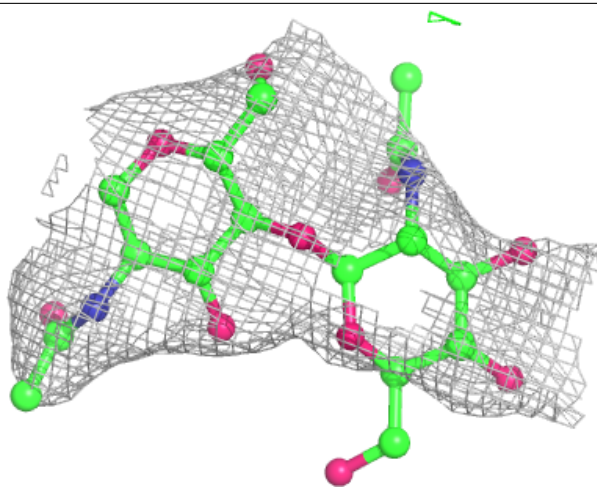
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

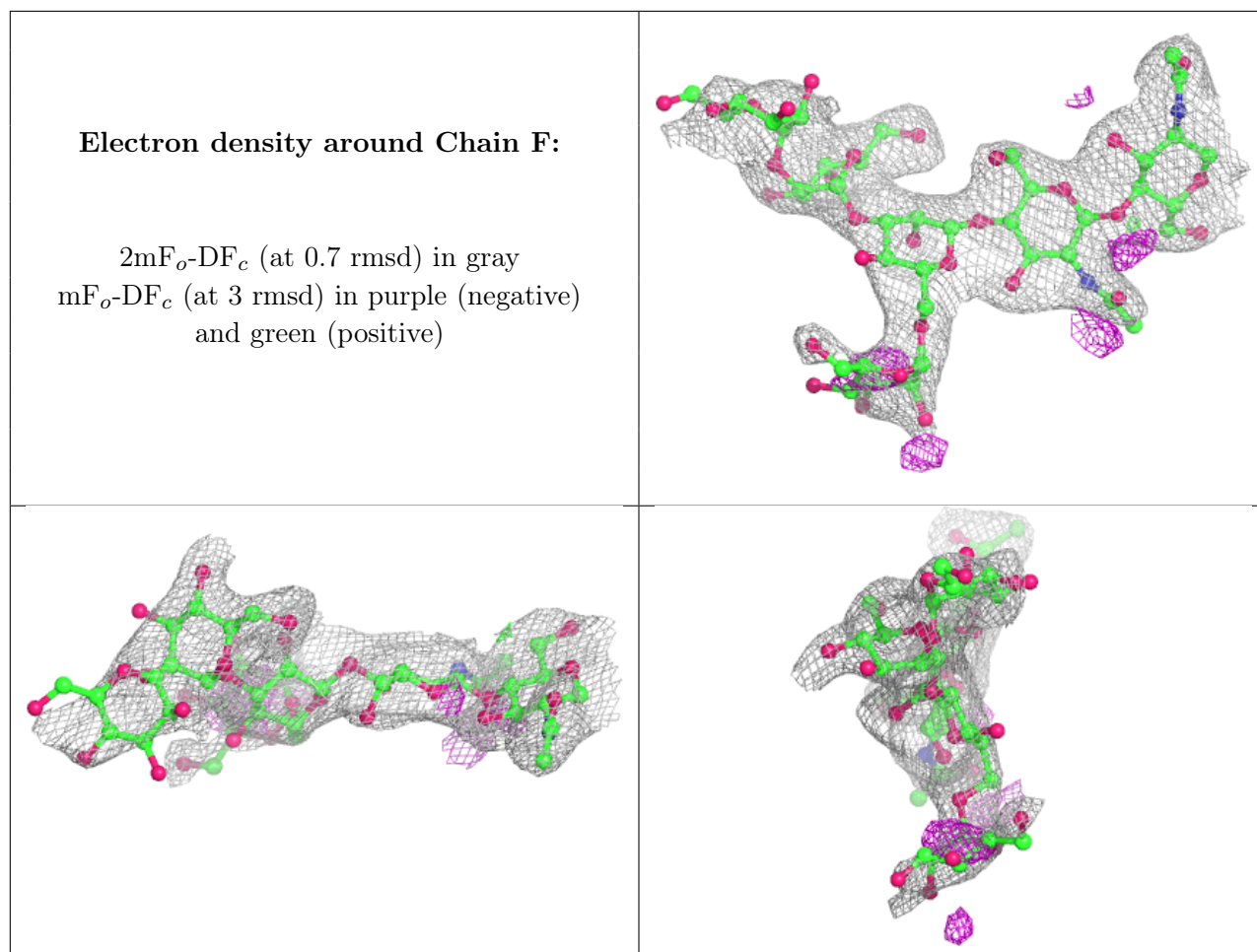




**Electron density around Chain G:**

$2mF_o-DF_c$  (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, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	PEG	A	510	7/7	0.58	0.23	65,87,91,93	0
6	ACT	A	511	4/4	0.63	0.16	82,91,92,96	0
9	EDO	A	518	4/4	0.70	0.24	64,67,70,70	0
9	EDO	B	525	4/4	0.70	0.17	85,98,102,106	0
9	EDO	B	518	4/4	0.77	0.15	91,94,95,95	0
9	EDO	B	524	4/4	0.80	0.14	74,75,77,83	0
9	EDO	A	526	4/4	0.81	0.25	74,83,84,84	0
9	EDO	A	524	4/4	0.83	0.31	64,80,81,84	0
9	EDO	A	523	4/4	0.84	0.18	74,74,75,81	0
6	ACT	A	512	4/4	0.84	0.23	57,68,72,76	0
5	PEG	A	509	7/7	0.84	0.12	63,71,75,86	0

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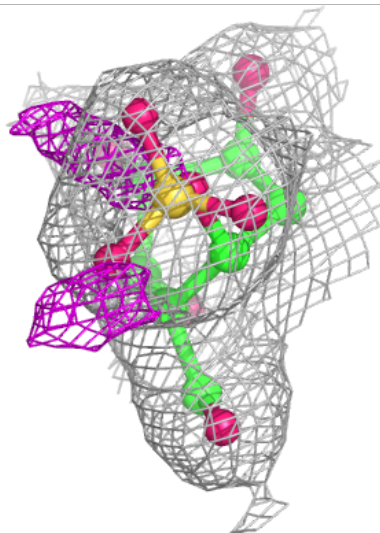
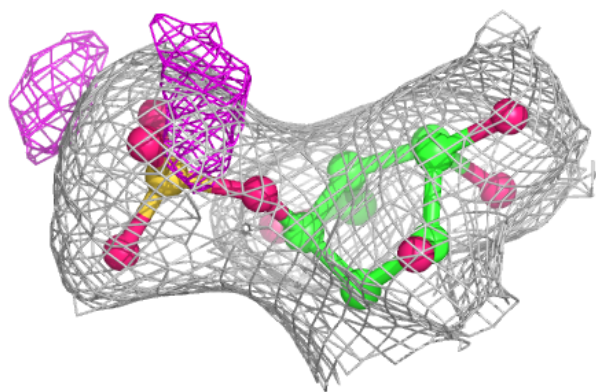
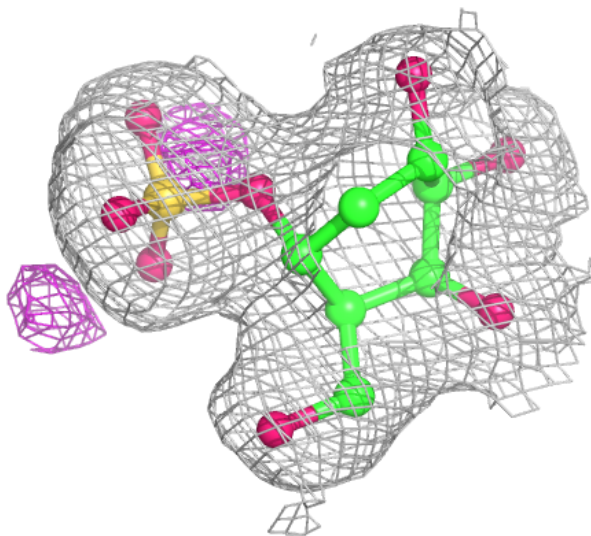
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
6	ACT	A	513	4/4	0.85	0.21	69,78,78,87	0
9	EDO	B	521	4/4	0.85	0.18	90,94,97,104	0
7	SO4	B	515	5/5	0.85	0.26	122,123,129,142	0
9	EDO	B	517	4/4	0.85	0.13	78,82,83,83	0
9	EDO	A	522	4/4	0.87	0.29	63,75,77,80	0
9	EDO	B	523	4/4	0.87	0.18	69,74,75,76	0
9	EDO	A	519	4/4	0.88	0.24	56,69,70,73	0
9	EDO	A	521	4/4	0.88	0.30	43,45,49,53	4
9	EDO	A	525	4/4	0.89	0.13	80,81,82,87	0
7	SO4	A	516	5/5	0.90	0.15	94,102,118,120	0
9	EDO	B	522	4/4	0.92	0.27	65,70,72,74	0
9	EDO	B	520	4/4	0.92	0.11	84,87,89,99	0
7	SO4	B	514	5/5	0.93	0.16	58,59,63,66	5
9	EDO	A	520	4/4	0.94	0.18	61,62,64,72	0
7	SO4	A	515	5/5	0.94	0.10	74,78,81,92	0
6	ACT	B	512	4/4	0.94	0.11	77,81,84,86	0
9	EDO	B	519	4/4	0.96	0.24	70,73,73,77	0
7	SO4	A	514	5/5	0.97	0.11	63,74,82,83	0
8	HF8	A	517	16/17	0.98	0.09	45,53,62,68	0
8	HF8	B	516	16/17	0.98	0.09	48,54,64,74	0
7	SO4	B	513	5/5	0.99	0.09	69,72,79,88	0

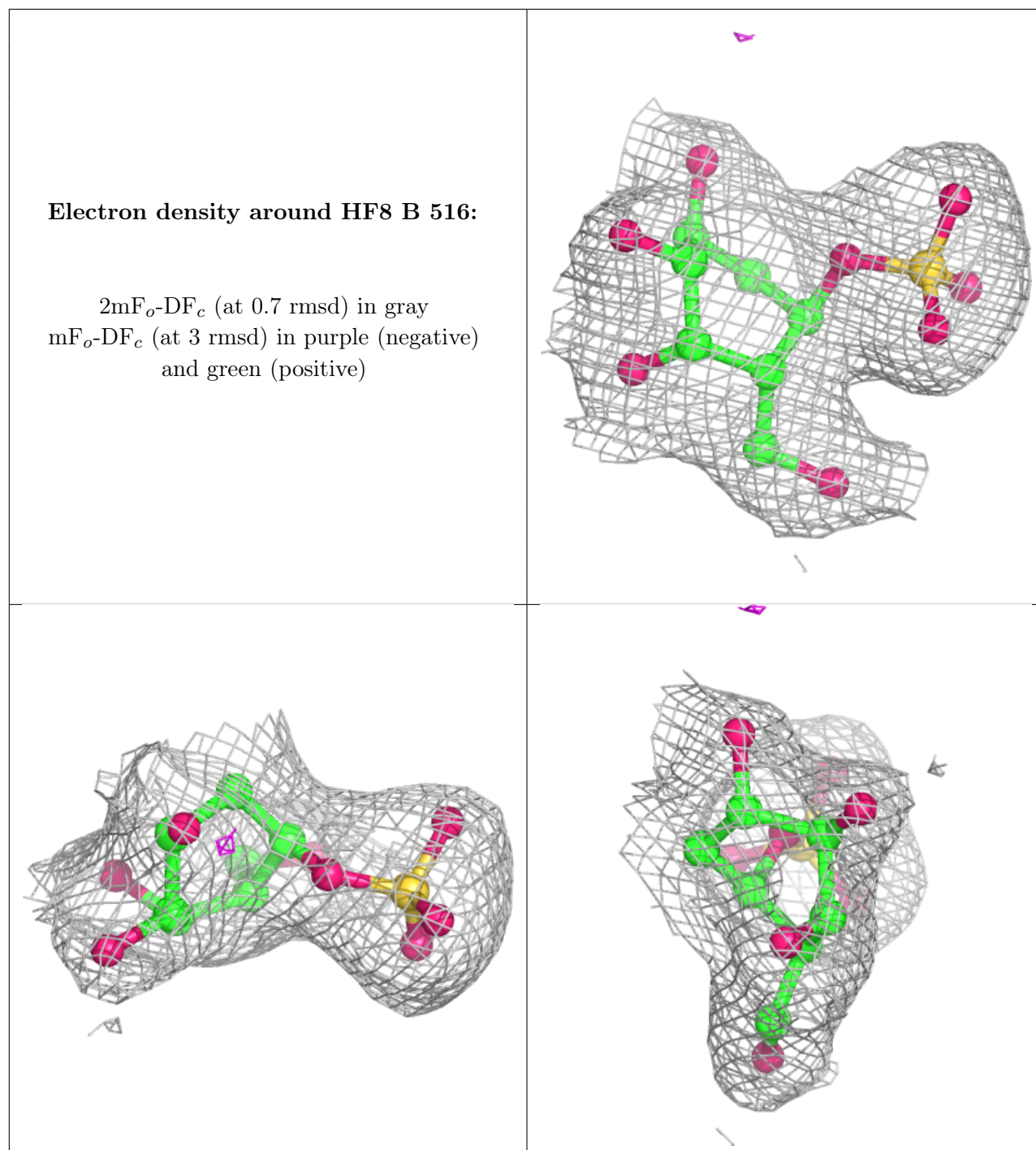
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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



**Electron density around HF8 A 517:**

$2mF_o-DF_c$  (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.