



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 6, 2026 – 12:36 AM UTC

PDB ID : 5E64 / pdb\_00005e64  
Title : Hemagglutinin-esterase-fusion protein structure of influenza D virus  
Authors : Song, H.; Qi, J.; Shi, Y.; Gao, G.F.  
Deposited on : 2015-10-09  
Resolution : 2.40 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

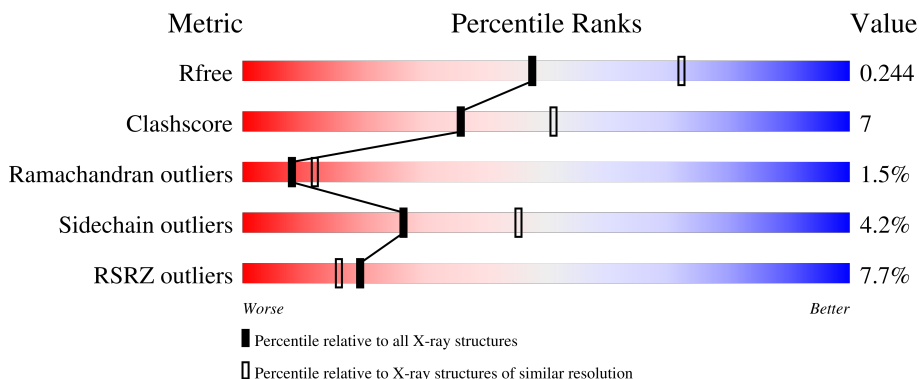
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.40 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	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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	427	 3% 85% 14% ..
1	C	427	 2% 83% 14% ..
2	B	166	 16% 67% 20% • 10%
2	D	166	 25% 70% 13% 6% • 10%
3	E	6	 67% 33%

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Mol	Chain	Length	Quality of chain
3	F	6	 33% 67%
3	I	6	 17% 50% 33%
4	G	2	 100%
4	H	2	 100%
4	J	2	 100%
4	K	2	 100%
4	L	2	 100%

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 9653 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.

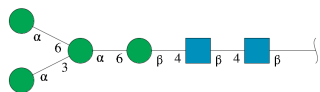
- Molecule 1 is a protein called Hemagglutinin-esterase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	424	Total 3249	C 2043	N 542	O 642	S 22	0	0	0
1	C	421	Total 3226	C 2028	N 537	O 639	S 22	0	0	0

- Molecule 2 is a protein called Hemagglutinin-esterase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	149	Total 1110	C 695	N 194	O 217	S 4	0	0	0
2	D	149	Total 1110	C 695	N 194	O 217	S 4	0	0	0

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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.



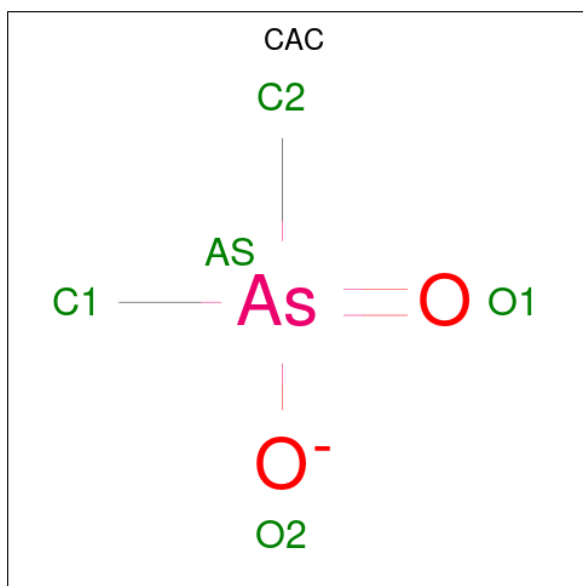
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	E	6	Total 72	C 40	N 2	O 30	0	0	0
3	F	6	Total 72	C 40	N 2	O 30	0	0	0
3	I	6	Total 72	C 40	N 2	O 30	0	0	0

- Molecule 4 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
4	G	2	Total	C	N	O	0	0	0
			28	16	2	10			
4	H	2	Total	C	N	O	0	0	0
			28	16	2	10			
4	J	2	Total	C	N	O	0	0	0
			28	16	2	10			
4	K	2	Total	C	N	O	0	0	0
			28	16	2	10			
4	L	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 5 is CACODYLATE ION (CCD ID: CAC) (formula:  $C_2H_6AsO_2$ ).



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

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula:  $C_8H_{15}NO_6$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	
6	B	1	Total	C	N	O	0	0
			14	8	1	5		
6	D	1	Total	C	N	O	0	0
			14	8	1	5		

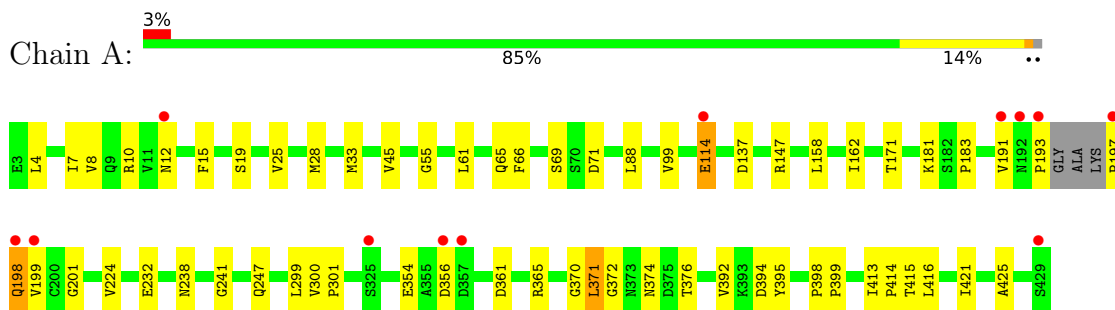
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	264	Total	O	0	0
			264	264		
7	B	58	Total	O	0	0
			58	58		
7	C	223	Total	O	0	0
			223	223		
7	D	21	Total	O	0	0
			21	21		

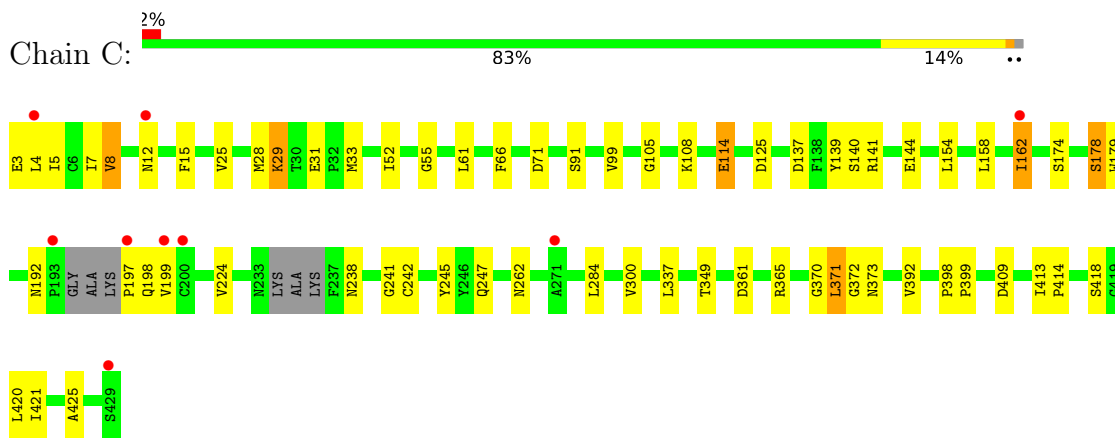
### 3 Residue-property plots [i](#)

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.

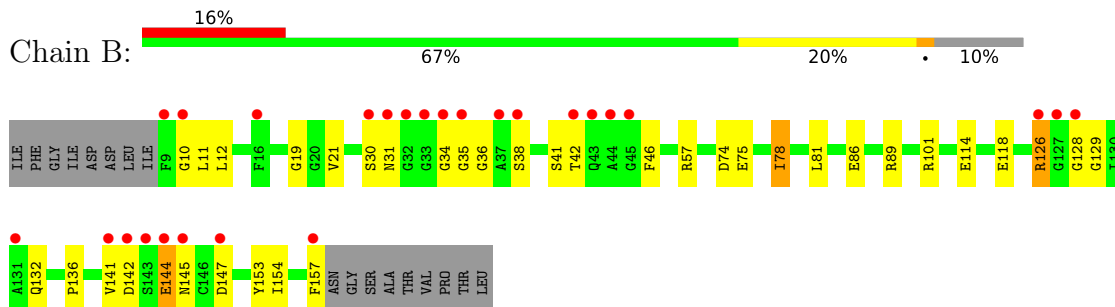
- Molecule 1: Hemagglutinin-esterase



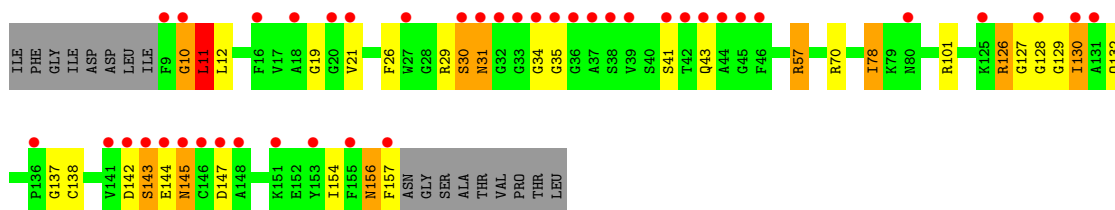
- Molecule 1: Hemagglutinin-esterase



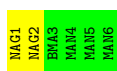
- Molecule 2: Hemagglutinin-esterase



- Molecule 2: Hemagglutinin-esterase



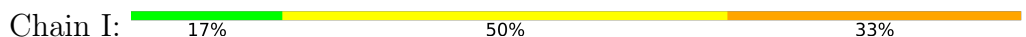
- Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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



- Molecule 3: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]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




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



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



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

Chain J:  100%

MAG1  
MAG2

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

Chain K:  100%

MAG1  
MAG2

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

Chain L:  100%

MAG1  
MAG2

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 3	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	165.22Å 165.22Å 165.22Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.70 – 2.40 47.70 – 2.40	Depositor EDS
% Data completeness (in resolution range)	100.0 (47.70-2.40) 100.0 (47.70-2.40)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	0.11	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.55 (at 2.39Å)	Xtrriage
Refinement program	PHENIX 1.9_1692	Depositor
R, $R_{free}$	0.201 , 0.245 0.203 , 0.244	Depositor DCC
$R_{free}$ test set	2966 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	30.3	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 42.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.031 for l,-k,h	Xtrriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	9653	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 12.91% 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: NAG, MAN, CAC, 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	0.44	0/3325	0.76	2/4507 (0.0%)
1	C	0.41	0/3301	0.76	3/4475 (0.1%)
2	B	0.43	0/1127	0.78	0/1515
2	D	0.44	0/1127	0.85	3/1515 (0.2%)
All	All	0.43	0/8880	0.78	8/12012 (0.1%)

There are no bond length outliers.

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	371	LEU	N-CA-C	8.58	123.56	113.18
1	C	371	LEU	N-CA-C	8.09	122.96	113.18
1	A	199	VAL	N-CA-C	6.08	116.37	107.37
2	D	30	SER	N-CA-C	5.59	122.71	110.80
2	D	156	ASN	CB-CA-C	-5.22	104.05	112.09

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	3249	0	3114	45	1
1	C	3226	0	3082	52	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	1110	0	1067	24	0
2	D	1110	0	1067	21	0
3	E	72	0	61	0	0
3	F	72	0	61	0	0
3	I	72	0	61	2	0
4	G	28	0	25	2	0
4	H	28	0	25	0	0
4	J	28	0	25	2	0
4	K	28	0	25	0	0
4	L	28	0	25	1	0
5	A	4	0	0	0	0
5	C	4	0	0	0	0
6	B	14	0	13	0	0
6	D	14	0	13	0	0
7	A	264	0	0	12	1
7	B	58	0	0	6	1
7	C	223	0	0	11	1
7	D	21	0	0	1	0
All	All	9653	0	8664	129	2

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 7.

The worst 5 of 129 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:A:193:PRO:C	1:A:197:PRO:HD2	1.48	1.35
1:C:192:ASN:H	1:C:199:VAL:HG23	1.19	1.07
1:C:192:ASN:CB	1:C:199:VAL:HG21	1.78	1.07
1:C:192:ASN:HB3	1:C:199:VAL:HG21	1.06	1.04
1:C:192:ASN:N	1:C:199:VAL:HG23	1.71	1.02

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:425:ALA:O	7:B:802:HOH:O[5_555]	2.12	0.08
7:A:1005:HOH:O	7:C:1000:HOH:O[3_544]	2.12	0.08

## 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	420/427 (98%)	401 (96%)	19 (4%)	0	100	100
1	C	415/427 (97%)	398 (96%)	17 (4%)	0	100	100
2	B	147/166 (89%)	120 (82%)	20 (14%)	7 (5%)	2	1
2	D	147/166 (89%)	123 (84%)	14 (10%)	10 (7%)	1	0
All	All	1129/1186 (95%)	1042 (92%)	70 (6%)	17 (2%)	8	12

5 of 17 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	11	LEU
2	D	43	GLN
2	B	147	ASP
2	D	31	ASN
2	D	41	SER

### 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	360/361 (100%)	349 (97%)	11 (3%)	35	57
1	C	358/361 (99%)	346 (97%)	12 (3%)	32	54
2	B	109/123 (89%)	101 (93%)	8 (7%)	13	22
2	D	109/123 (89%)	101 (93%)	8 (7%)	13	22
All	All	936/968 (97%)	897 (96%)	39 (4%)	26	45

5 of 39 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	247	GLN
2	D	130	ILE
1	C	337	LEU
2	D	57	ARG
2	D	145	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	366	GLN
2	D	31	ASN
2	B	43	GLN
1	C	104	GLN
1	C	204	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](#)

28 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	E	1	1,3	14,14,15	0.38	0	17,19,21	1.10	2 (11%)
3	NAG	E	2	3	14,14,15	0.40	0	17,19,21	1.16	2 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	BMA	E	3	3	11,11,12	0.44	0	15,15,17	0.72	0
3	MAN	E	4	3	11,11,12	0.29	0	15,15,17	0.84	0
3	MAN	E	5	3	11,11,12	0.33	0	15,15,17	0.84	0
3	MAN	E	6	3	11,11,12	0.35	0	15,15,17	0.63	0
3	NAG	F	1	1,3	14,14,15	0.38	0	17,19,21	0.88	0
3	NAG	F	2	3	14,14,15	0.42	0	17,19,21	1.56	4 (23%)
3	BMA	F	3	3	11,11,12	0.44	0	15,15,17	2.30	6 (40%)
3	MAN	F	4	3	11,11,12	0.37	0	15,15,17	1.77	2 (13%)
3	MAN	F	5	3	11,11,12	0.29	0	15,15,17	0.69	0
3	MAN	F	6	3	11,11,12	0.50	0	15,15,17	1.14	2 (13%)
4	NAG	G	1	1,4	14,14,15	0.35	0	17,19,21	1.19	1 (5%)
4	NAG	G	2	4	14,14,15	0.29	0	17,19,21	1.05	1 (5%)
4	NAG	H	1	4,2	14,14,15	0.38	0	17,19,21	1.03	1 (5%)
4	NAG	H	2	4	14,14,15	0.30	0	17,19,21	1.22	1 (5%)
3	NAG	I	1	1,3	14,14,15	0.32	0	17,19,21	0.91	1 (5%)
3	NAG	I	2	3	14,14,15	0.65	0	17,19,21	2.79	2 (11%)
3	BMA	I	3	3	11,11,12	0.77	0	15,15,17	2.24	3 (20%)
3	MAN	I	4	3	11,11,12	0.30	0	15,15,17	1.16	1 (6%)
3	MAN	I	5	3	11,11,12	0.41	0	15,15,17	0.83	1 (6%)
3	MAN	I	6	3	11,11,12	0.28	0	15,15,17	0.65	0
4	NAG	J	1	1,4	14,14,15	0.40	0	17,19,21	0.99	1 (5%)
4	NAG	J	2	4	14,14,15	0.37	0	17,19,21	0.73	0
4	NAG	K	1	1,4	14,14,15	0.37	0	17,19,21	1.45	1 (5%)
4	NAG	K	2	4	14,14,15	0.31	0	17,19,21	1.04	1 (5%)
4	NAG	L	1	4,2	14,14,15	0.30	0	17,19,21	0.77	1 (5%)
4	NAG	L	2	4	14,14,15	0.31	0	17,19,21	1.00	1 (5%)

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. '2' means no outliers of that kind were identified.

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

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

There are no bond length outliers.

The worst 5 of 35 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	I	2	NAG	O4-C4-C3	-10.28	86.14	110.38
3	I	3	BMA	O5-C1-C2	-6.87	94.39	110.79
3	F	4	MAN	C1-O5-C5	5.29	119.28	112.19
4	K	1	NAG	C1-O5-C5	5.23	119.19	112.19
3	F	3	BMA	C1-C2-C3	5.22	117.25	109.64

There are no chirality outliers.

5 of 15 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	G	1	NAG	O5-C5-C6-O6
4	H	2	NAG	O5-C5-C6-O6

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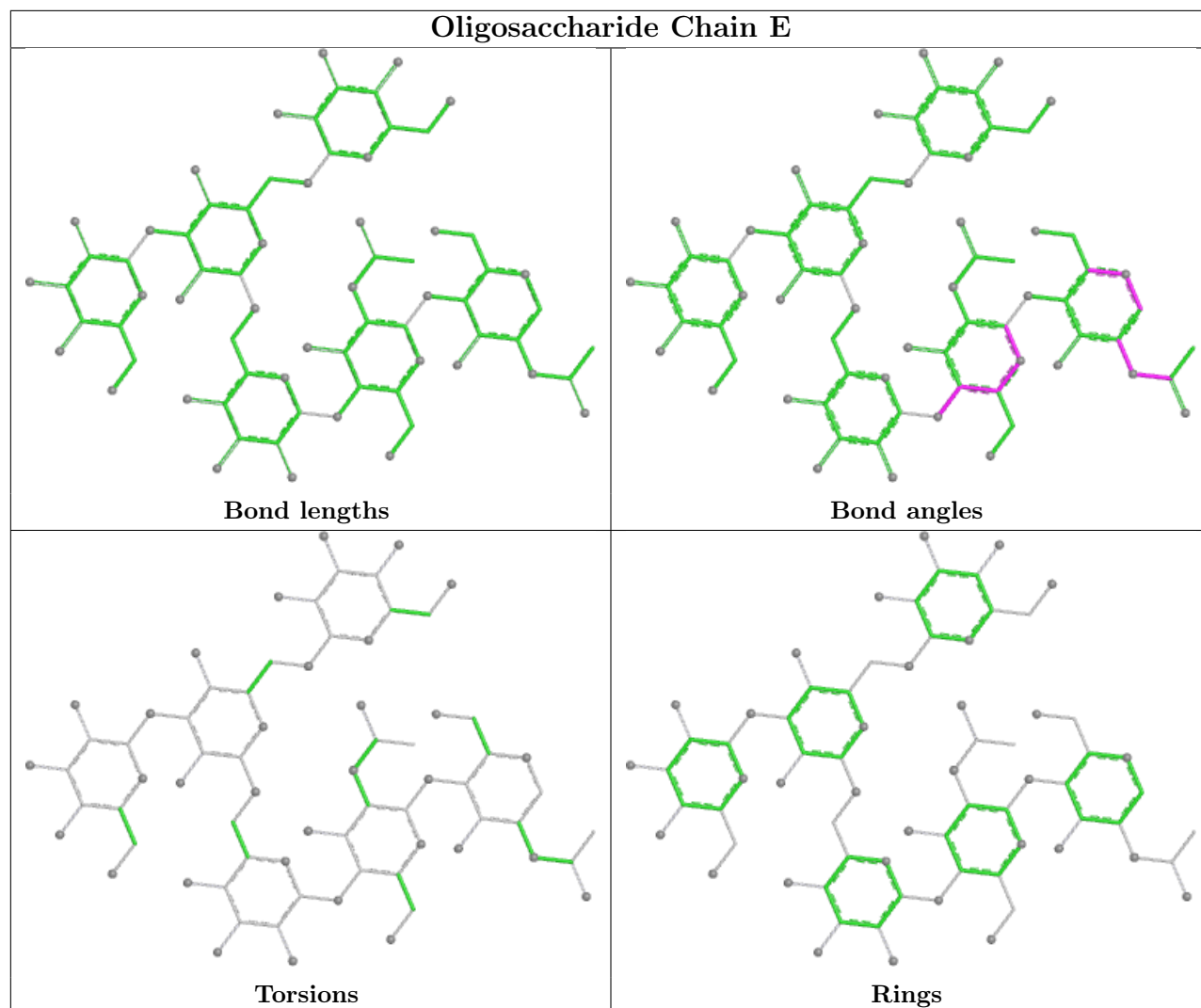
Mol	Chain	Res	Type	Atoms
4	H	2	NAG	C4-C5-C6-O6
4	G	2	NAG	O5-C5-C6-O6
4	G	1	NAG	C4-C5-C6-O6

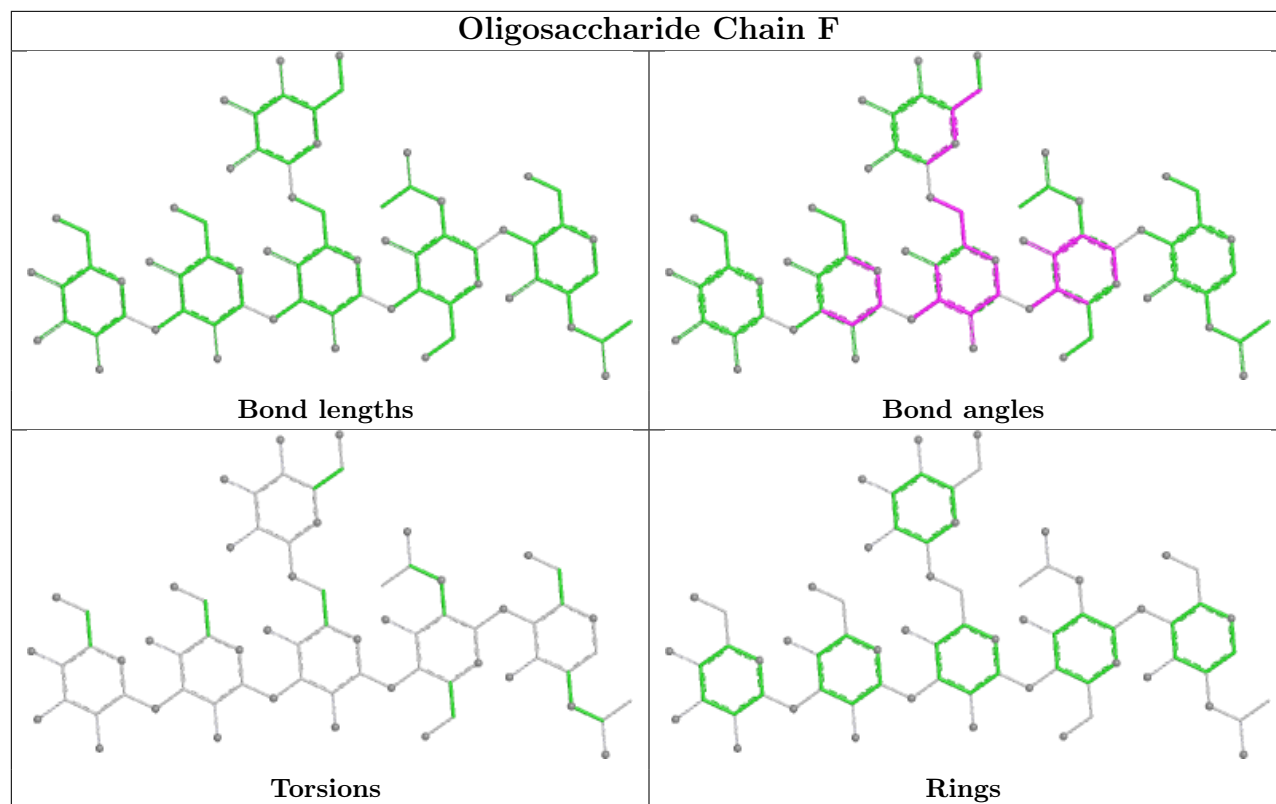
There are no ring outliers.

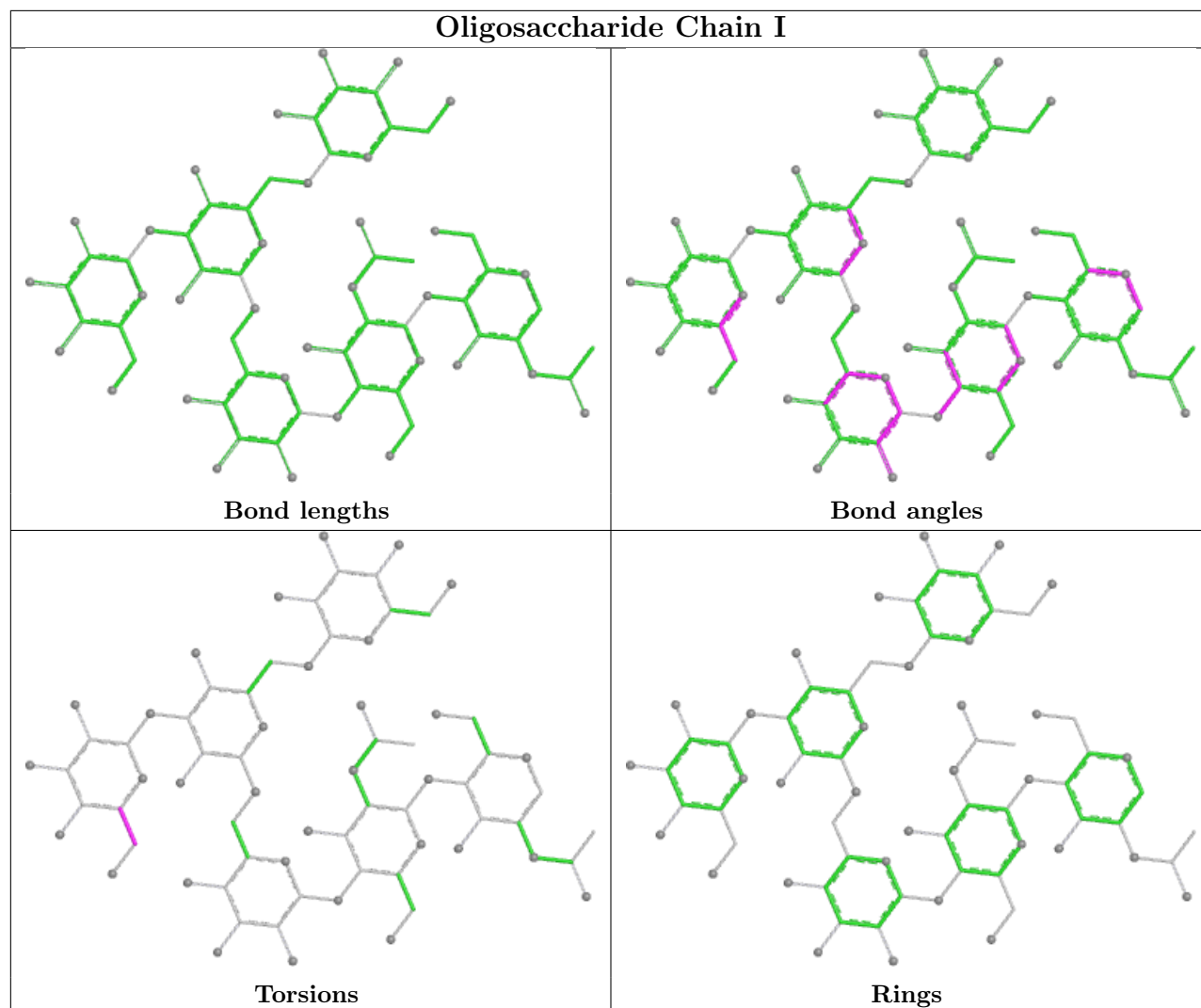
7 monomers are involved in 6 short contacts:

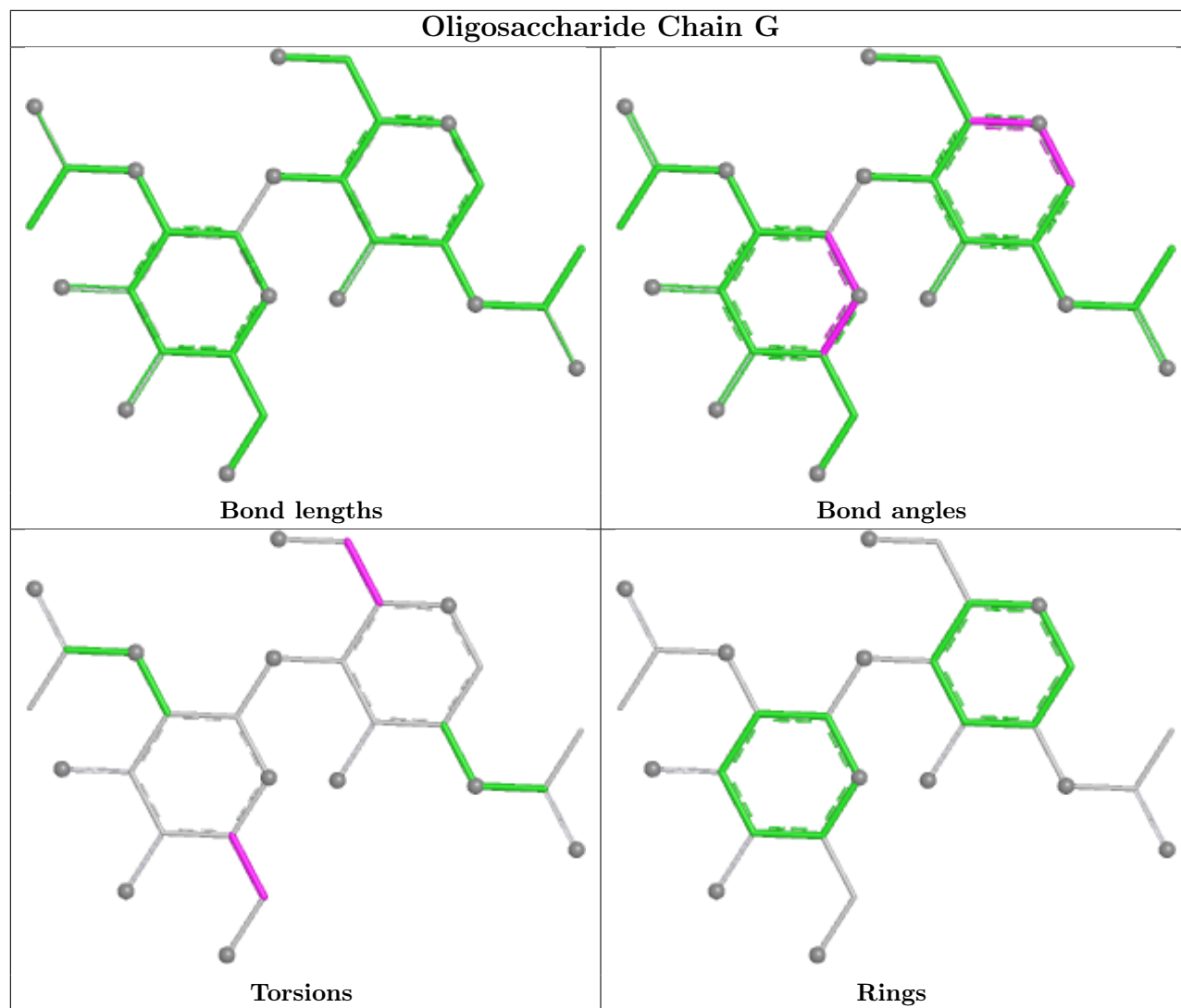
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	J	2	NAG	2	0
4	G	2	NAG	1	0
3	I	3	BMA	1	0
4	L	1	NAG	1	0
4	L	2	NAG	1	0
4	G	1	NAG	1	0
3	I	2	NAG	1	0

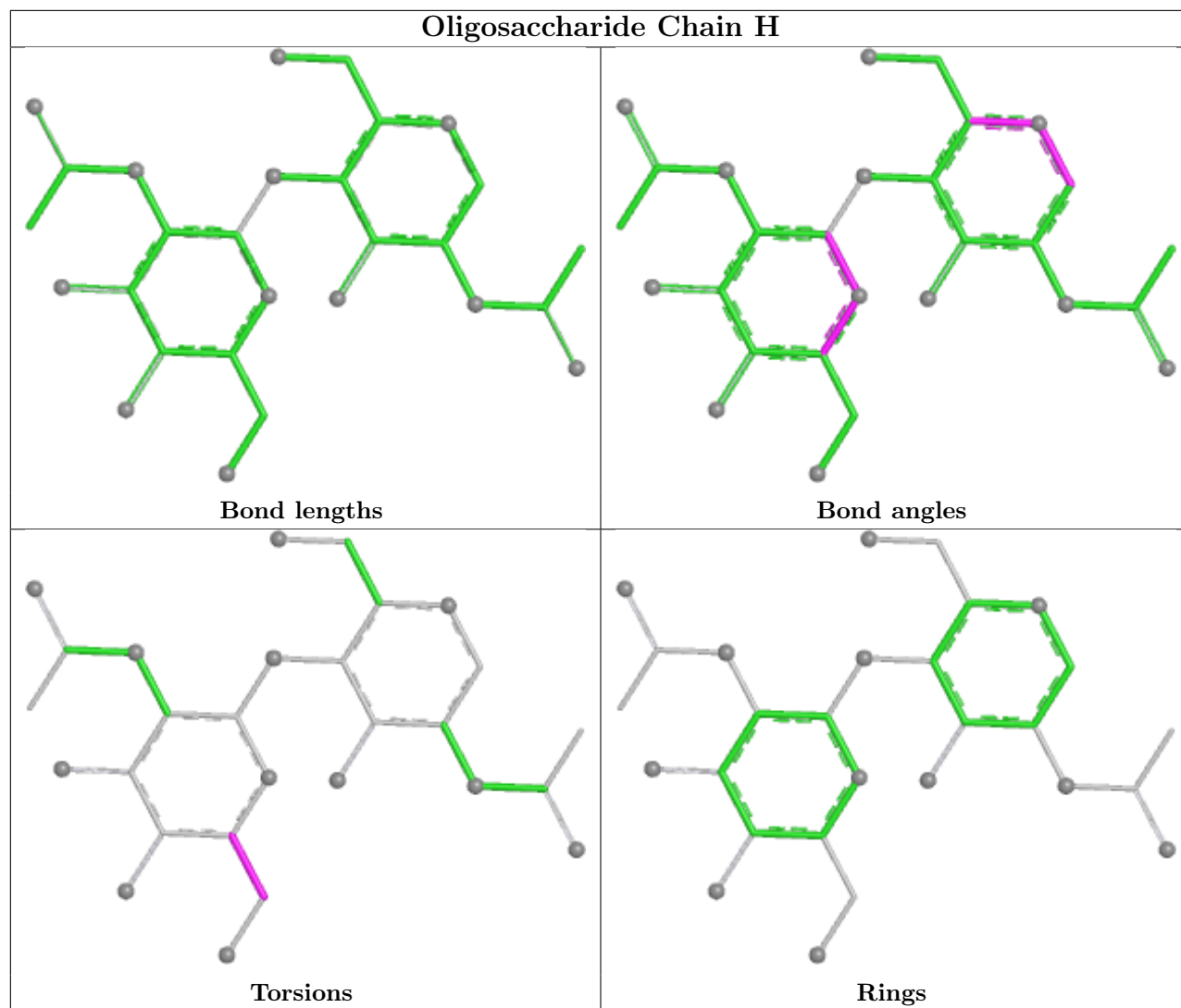
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

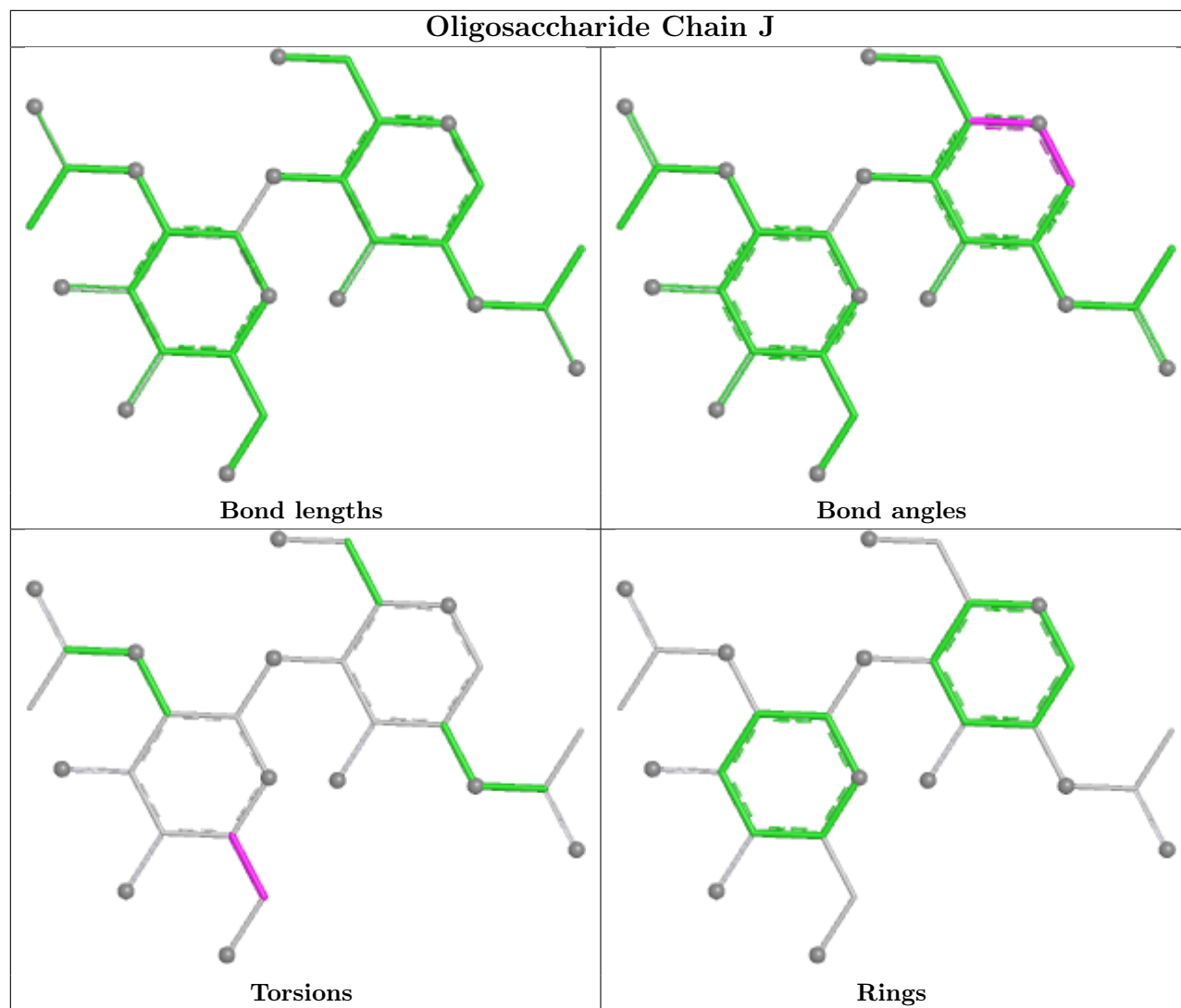


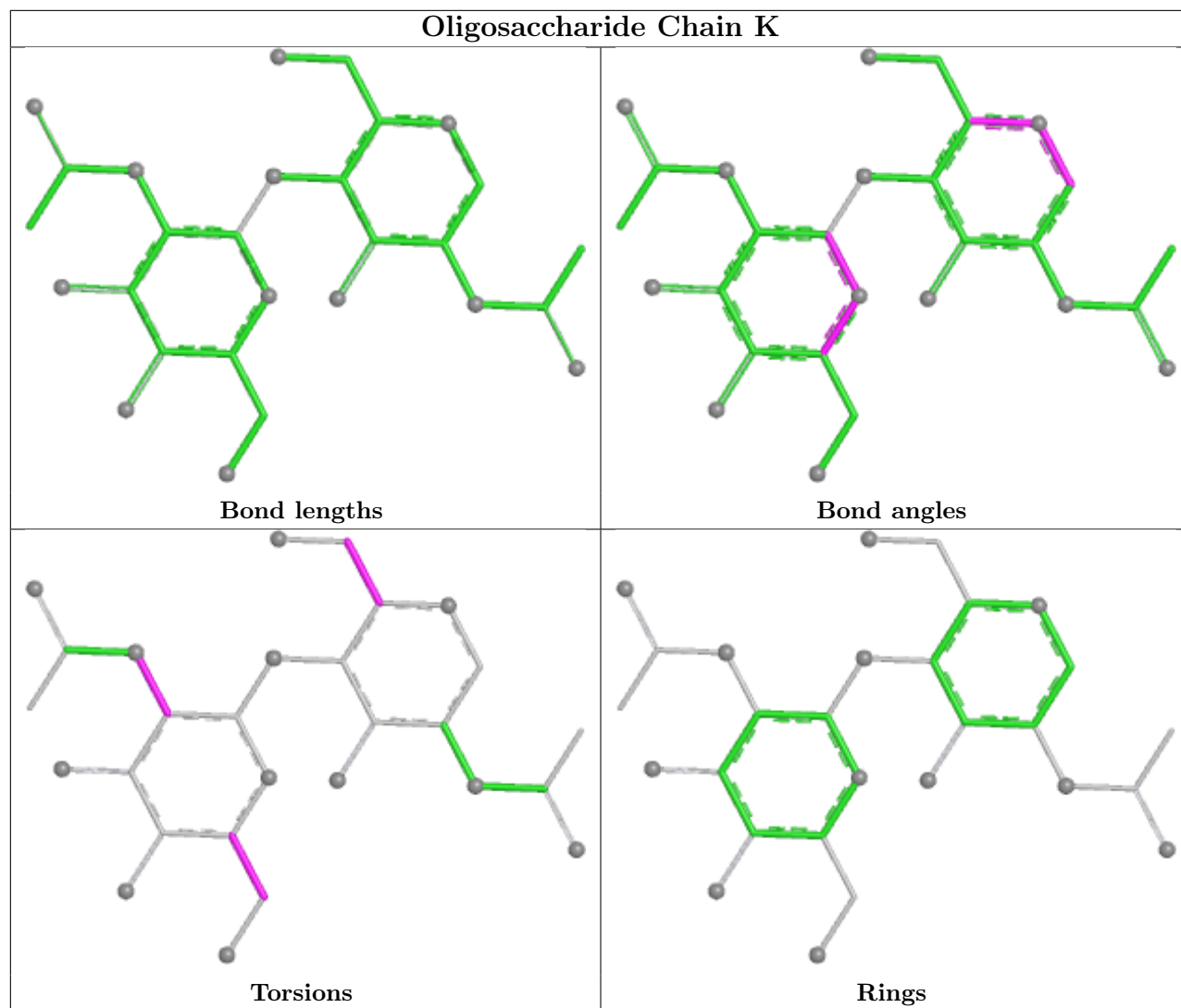


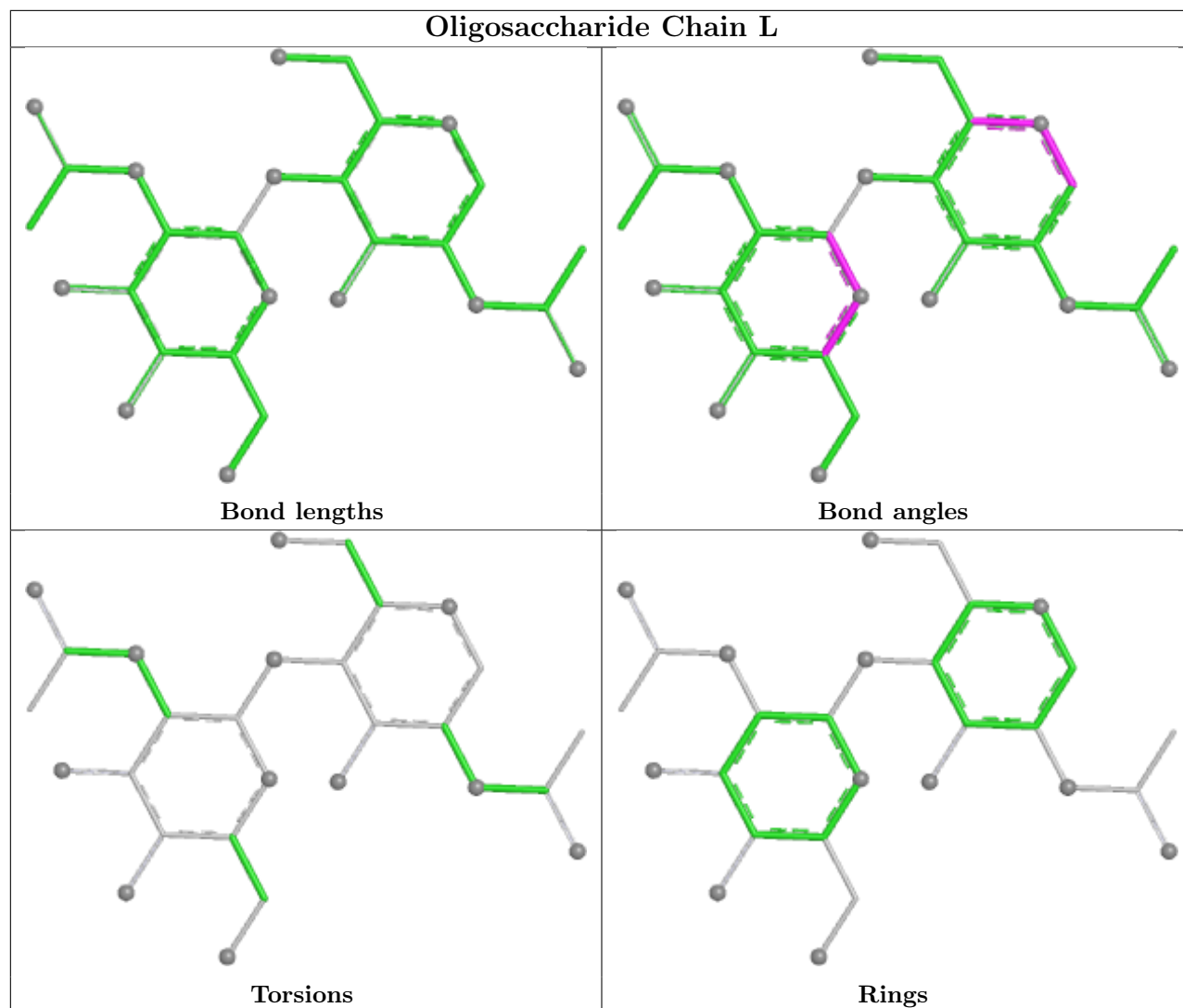












## 5.6 Ligand geometry [i](#)

4 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	CAC	C	711	-	0,3,4	-	-	1,3,6	10.02	1 (100%)
5	CAC	A	715	-	0,3,4	-	-	1,3,6	9.08	1 (100%)
6	NAG	D	703	2	14,14,15	0.33	0	17,19,21	1.02	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
6	NAG	B	703	2	14,14,15	0.30	0	17,19,21	1.08	1 (5%)

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
6	NAG	B	703	2	-	1/6/23/26	0/1/1/1
6	NAG	D	703	2	-	4/6/23/26	0/1/1/1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	C	711	CAC	C1-AS-C2	10.02	111.43	97.34
5	A	715	CAC	C1-AS-C2	9.08	110.11	97.34
6	D	703	NAG	C1-O5-C5	3.36	116.69	112.19
6	B	703	NAG	C1-O5-C5	3.30	116.61	112.19

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	D	703	NAG	O5-C5-C6-O6
6	D	703	NAG	C4-C5-C6-O6
6	D	703	NAG	C8-C7-N2-C2
6	D	703	NAG	O7-C7-N2-C2
6	B	703	NAG	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

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	424/427 (99%)	-0.20	12 (2%) 55 51	14, 25, 48, 95	0
1	C	421/427 (98%)	-0.02	9 (2%) 63 59	13, 27, 55, 83	0
2	B	149/166 (89%)	0.66	26 (17%) 4 3	10, 33, 98, 123	0
2	D	149/166 (89%)	1.16	41 (27%) 1 1	22, 47, 122, 148	0
All	All	1143/1186 (96%)	0.15	88 (7%) 19 16	10, 29, 77, 148	0

The worst 5 of 88 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	9	PHE	7.1
2	D	9	PHE	6.5
1	C	197	PRO	6.4
2	B	131	ALA	5.3
2	D	145	ASN	5.1

### 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
4	NAG	K	2	14/15	0.71	0.17	55,61,78,80	0
4	NAG	L	2	14/15	0.84	0.12	33,45,51,54	0

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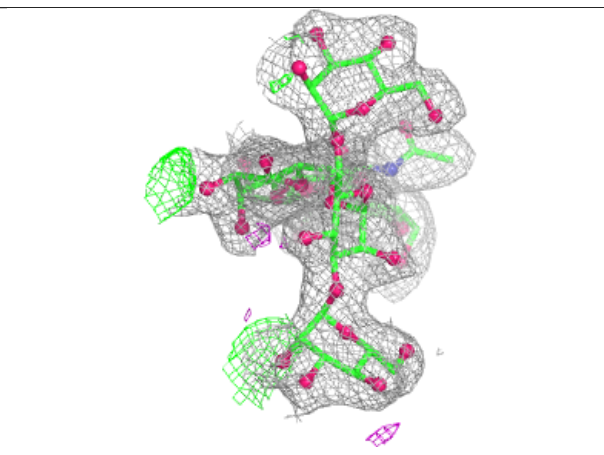
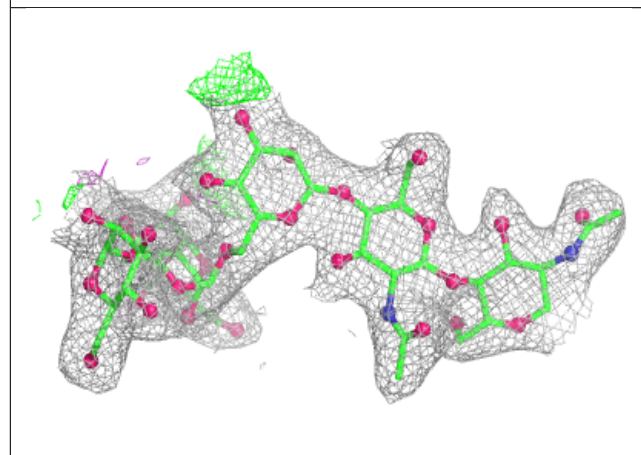
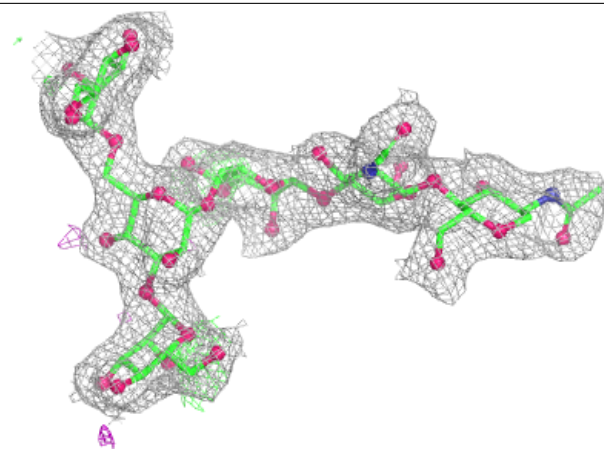
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	BMA	F	3	11/12	0.85	0.13	34,39,47,49	0
3	MAN	I	5	11/12	0.85	0.10	27,31,33,34	0
4	NAG	G	2	14/15	0.86	0.11	51,54,59,60	0
3	MAN	F	5	11/12	0.87	0.13	46,54,59,65	0
3	NAG	I	2	14/15	0.87	0.12	24,29,34,35	0
3	MAN	F	6	11/12	0.88	0.08	29,33,36,42	0
4	NAG	J	2	14/15	0.88	0.10	30,37,41,43	0
3	MAN	I	6	11/12	0.90	0.09	34,39,46,53	0
4	NAG	G	1	14/15	0.90	0.09	41,46,48,49	0
3	MAN	F	4	11/12	0.90	0.08	36,37,46,47	0
3	MAN	E	5	11/12	0.91	0.08	21,25,29,34	0
4	NAG	H	2	14/15	0.92	0.10	29,33,43,44	0
3	NAG	F	2	14/15	0.92	0.08	21,27,33,33	0
3	MAN	E	6	11/12	0.93	0.07	20,26,28,28	0
4	NAG	K	1	14/15	0.93	0.09	38,44,53,54	0
3	BMA	E	3	11/12	0.93	0.08	20,23,26,31	0
4	NAG	J	1	14/15	0.93	0.07	21,24,29,36	0
3	NAG	I	1	14/15	0.95	0.07	22,26,30,31	0
4	NAG	H	1	14/15	0.95	0.07	16,20,22,23	0
3	MAN	E	4	11/12	0.95	0.07	19,21,22,23	0
4	NAG	L	1	14/15	0.95	0.07	23,27,29,30	0
3	BMA	I	3	11/12	0.95	0.07	31,32,38,40	0
3	NAG	E	1	14/15	0.96	0.07	19,24,31,36	0
3	NAG	E	2	14/15	0.96	0.06	20,25,27,29	0
3	NAG	F	1	14/15	0.97	0.06	19,25,28,32	0
3	MAN	I	4	11/12	0.97	0.05	19,25,33,35	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.

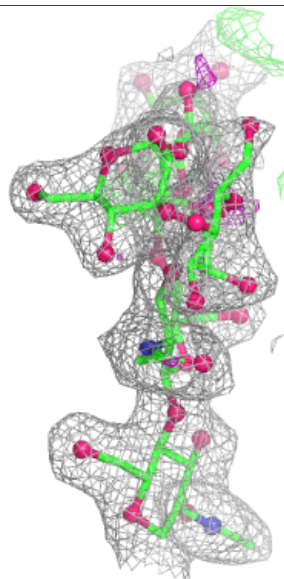
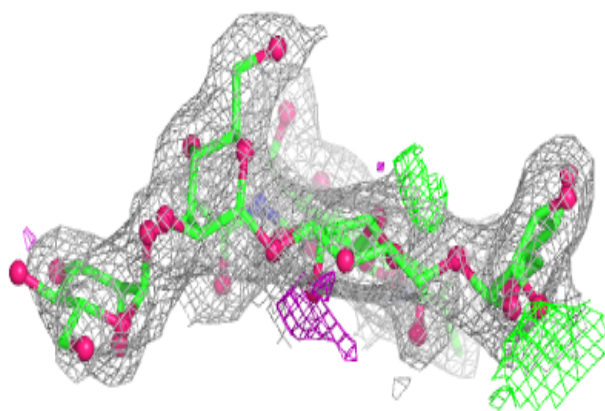
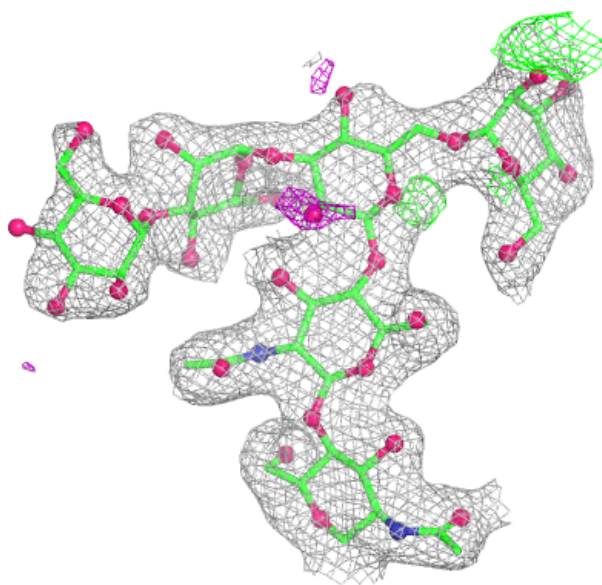
**Electron density around Chain E:**

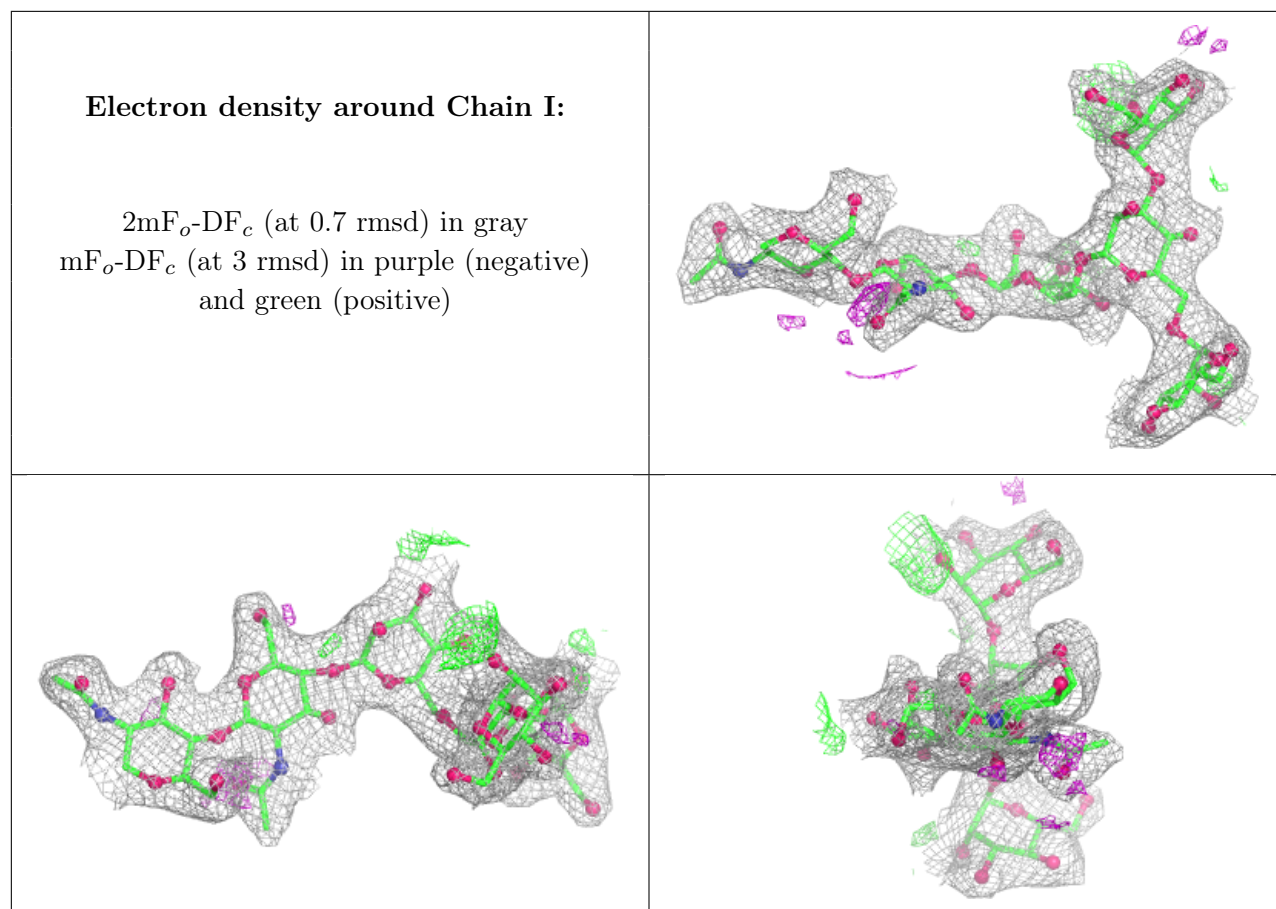
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around Chain F:**

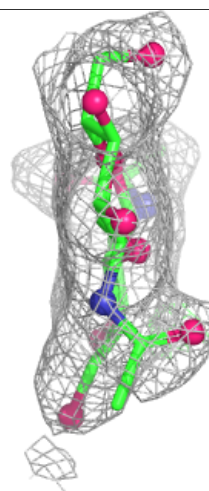
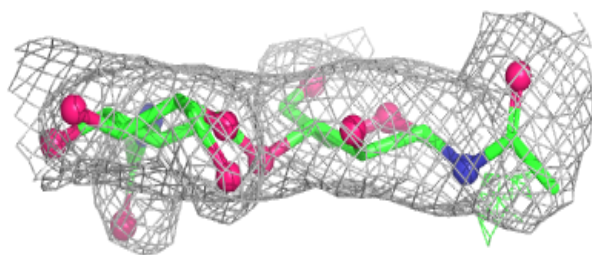
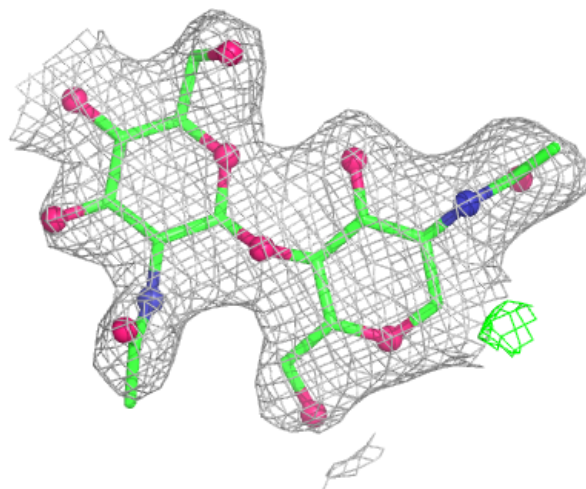
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





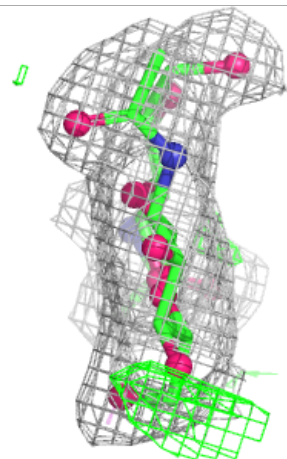
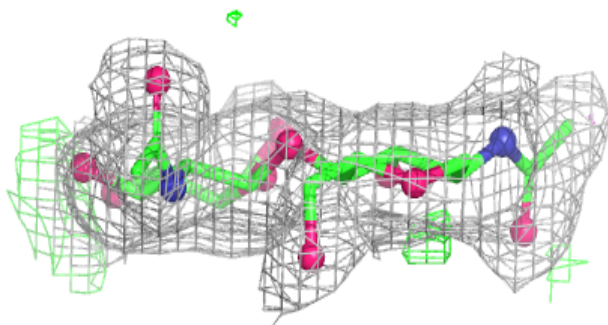
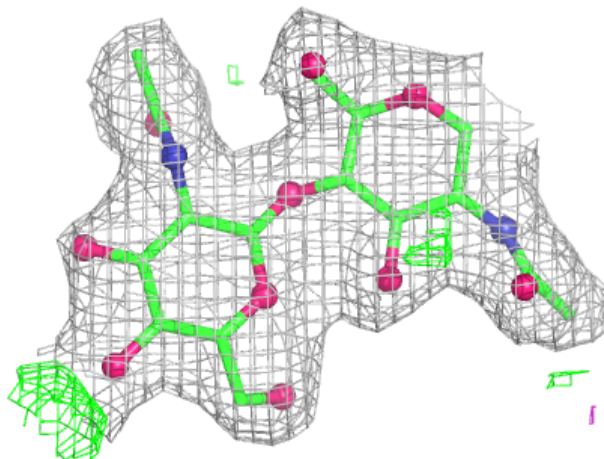
**Electron density around Chain G:**

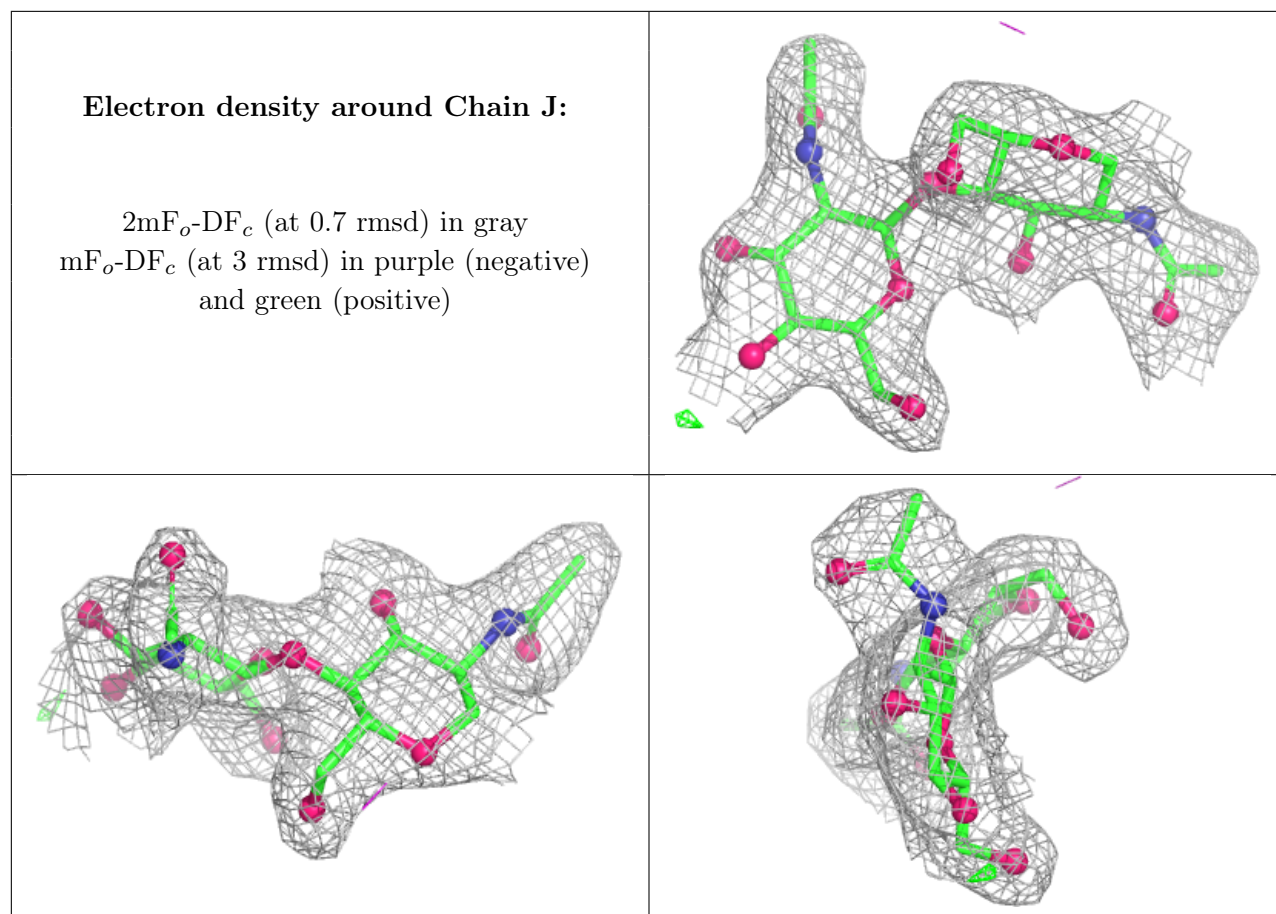
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around Chain H:**

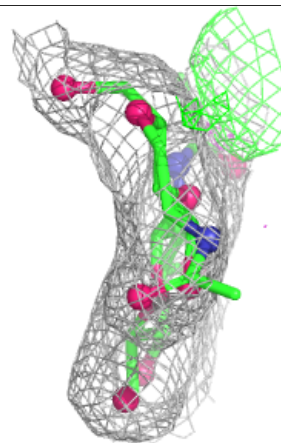
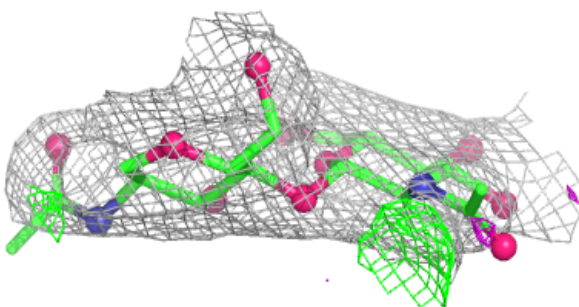
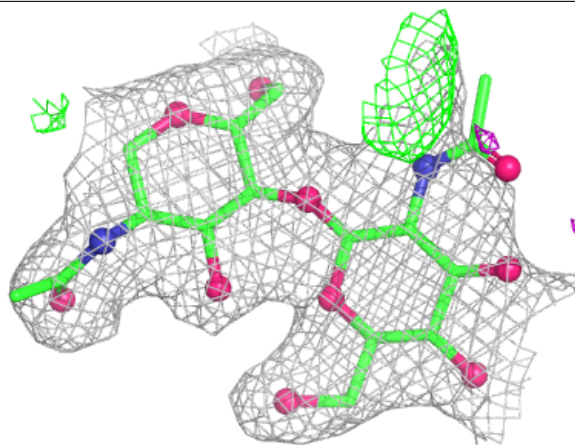
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

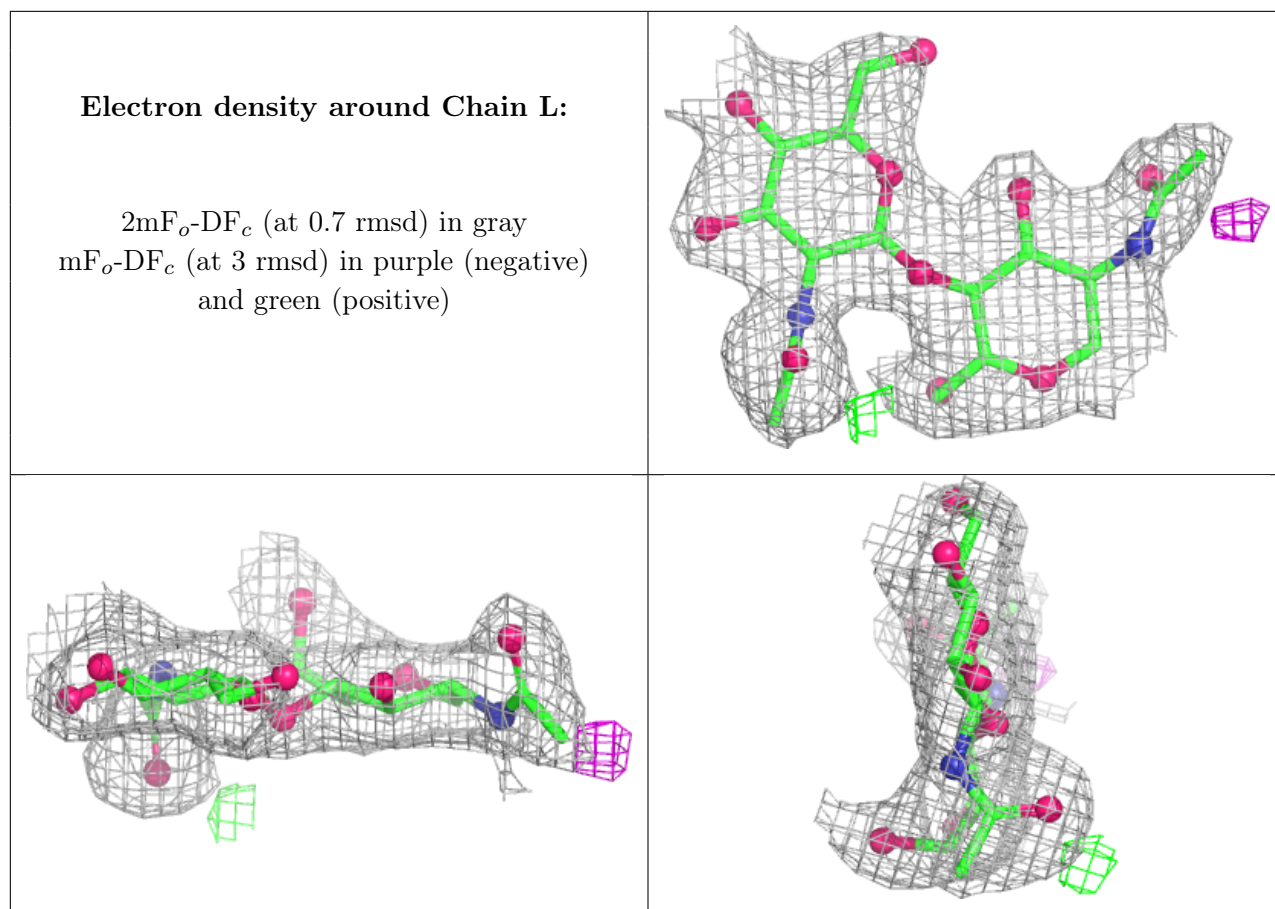




**Electron density around Chain K:**

$2mF_o-DF_c$  (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(Å <sup>2</sup> )	Q<0.9
6	NAG	D	703	14/15	0.64	0.16	86,91,97,101	0
6	NAG	B	703	14/15	0.80	0.13	45,58,64,65	0
5	CAC	A	715	4/5	0.98	0.10	35,37,40,54	0
5	CAC	C	711	4/5	0.99	0.09	26,30,38,49	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.