



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 6, 2026 – 02:02 PM EST

PDB ID : 9NRV / pdb\_00009nrv  
Title : Crystal structure of the H5 influenza virus hemagglutinin from A/duck/France/161108h/2016 (H5N8) clade 2.3.4.4b in complex with avian receptor analog LSTa  
Authors : Zhu, X.; Wilson, I.A.  
Deposited on : 2025-03-14  
Resolution : 2.89 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)  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
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) : 2.47

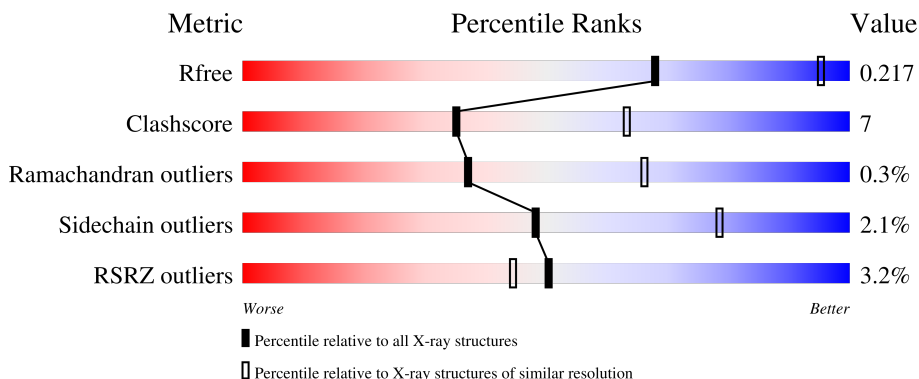
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.89 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))
$R_{free}$	164625	2335 (2.90-2.90)
Clashscore	180529	2564 (2.90-2.90)
Ramachandran outliers	177936	2514 (2.90-2.90)
Sidechain outliers	177891	2516 (2.90-2.90)
RSRZ outliers	164620	2337 (2.90-2.90)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	329	 4% 78% 19% ..
1	C	329	 3% 83% 14% ..
1	E	329	 2% 78% 20% .
2	B	181	 6% 76% 17% • 6%

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Mol	Chain	Length	Quality of chain
2	D	181	<p>4% 75% 19% • 6%</p>
2	F	181	<p>% 77% 18% • 5%</p>
3	G	5	<p>100%</p>
4	H	5	<p>20% 80%</p>
5	I	4	<p>50% 50%</p>
6	J	2	<p>50% 50%</p>
7	K	5	<p>40% 60%</p>
8	l	3	<p>33% 33% 33%</p>

## 2 Entry composition [i](#)

There are 13 unique types of molecules in this entry. The entry contains 12458 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 HA1 chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	322	Total 2548	C 1614	N 443	O 477	S 14	0	0	0
1	C	323	Total 2556	C 1618	N 444	O 480	S 14	0	0	0
1	E	323	Total 2556	C 1618	N 444	O 480	S 14	0	0	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	8	ASP	-	expression tag	UNP A0A6M2RJB8
A	9	PRO	-	expression tag	UNP A0A6M2RJB8
A	10	GLY	-	expression tag	UNP A0A6M2RJB8
C	8	ASP	-	expression tag	UNP A0A6M2RJB8
C	9	PRO	-	expression tag	UNP A0A6M2RJB8
C	10	GLY	-	expression tag	UNP A0A6M2RJB8
E	8	ASP	-	expression tag	UNP A0A6M2RJB8
E	9	PRO	-	expression tag	UNP A0A6M2RJB8
E	10	GLY	-	expression tag	UNP A0A6M2RJB8

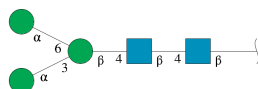
- Molecule 2 is a protein called Hemagglutinin HA2 chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	170	Total 1384	C 858	N 241	O 277	S 8	0	0	0
2	D	171	Total 1388	C 860	N 242	O 278	S 8	0	0	0
2	F	172	Total 1399	C 866	N 246	O 279	S 8	0	0	0

There are 21 discrepancies between the modelled and reference sequences:

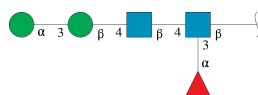
Chain	Residue	Modelled	Actual	Comment	Reference
B	175	SER	-	expression tag	UNP A0A6M2RJB8
B	176	GLY	-	expression tag	UNP A0A6M2RJB8
B	177	ARG	-	expression tag	UNP A0A6M2RJB8
B	178	LEU	-	expression tag	UNP A0A6M2RJB8
B	179	VAL	-	expression tag	UNP A0A6M2RJB8
B	180	PRO	-	expression tag	UNP A0A6M2RJB8
B	181	ARG	-	expression tag	UNP A0A6M2RJB8
D	175	SER	-	expression tag	UNP A0A6M2RJB8
D	176	GLY	-	expression tag	UNP A0A6M2RJB8
D	177	ARG	-	expression tag	UNP A0A6M2RJB8
D	178	LEU	-	expression tag	UNP A0A6M2RJB8
D	179	VAL	-	expression tag	UNP A0A6M2RJB8
D	180	PRO	-	expression tag	UNP A0A6M2RJB8
D	181	ARG	-	expression tag	UNP A0A6M2RJB8
F	175	SER	-	expression tag	UNP A0A6M2RJB8
F	176	GLY	-	expression tag	UNP A0A6M2RJB8
F	177	ARG	-	expression tag	UNP A0A6M2RJB8
F	178	LEU	-	expression tag	UNP A0A6M2RJB8
F	179	VAL	-	expression tag	UNP A0A6M2RJB8
F	180	PRO	-	expression tag	UNP A0A6M2RJB8
F	181	ARG	-	expression tag	UNP A0A6M2RJB8

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



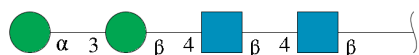
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	G	5	61	34	2	25	0	0	0

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	H	5	60	34	2	24	0	0	0

- Molecule 5 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



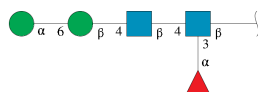
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
5	I	4	50	28	2	20	0	0	0

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



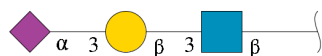
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
6	J	2	28	16	2	10	0	0	0

- Molecule 7 is an oligosaccharide called alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-3)]2-acetamido-2-deoxy-beta-D-glucopyranose.



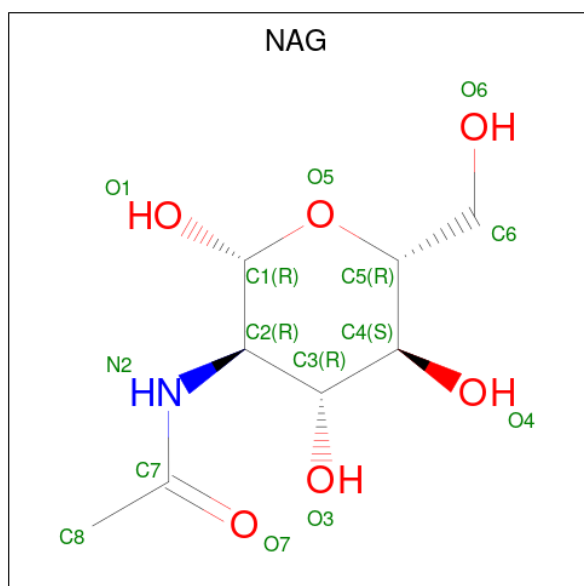
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
7	K	5	60	34	2	24	0	0	0

- Molecule 8 is an oligosaccharide called N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
8	1	3	45	25	2	18	0	0	0

- Molecule 9 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula:  $C_8H_{15}NO_6$ ) (labeled as "Ligand of Interest" by depositor).



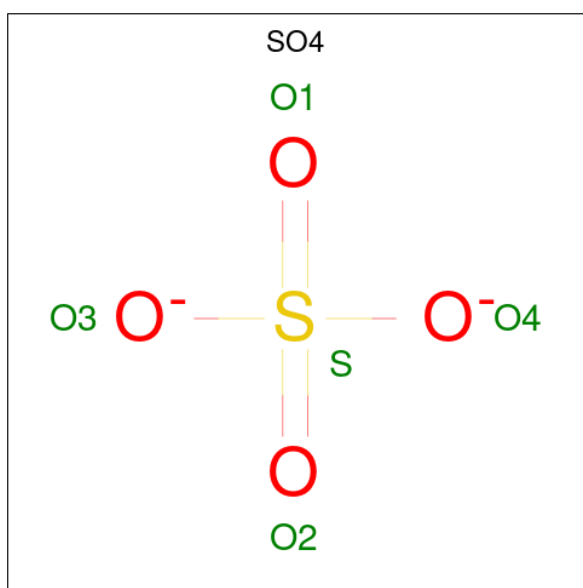
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
9	A	1	14	8	1	5	0	0
9	A	1	14	8	1	5	0	0
9	C	1	14	8	1	5	0	0
9	C	1	14	8	1	5	0	0
9	E	1	14	8	1	5	0	0

- Molecule 10 is GLYCEROL (CCD ID: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
10	A	1	Total	C	O	0	0
			6	3	3		
10	E	1	Total	C	O	0	0
			6	3	3		

- Molecule 11 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



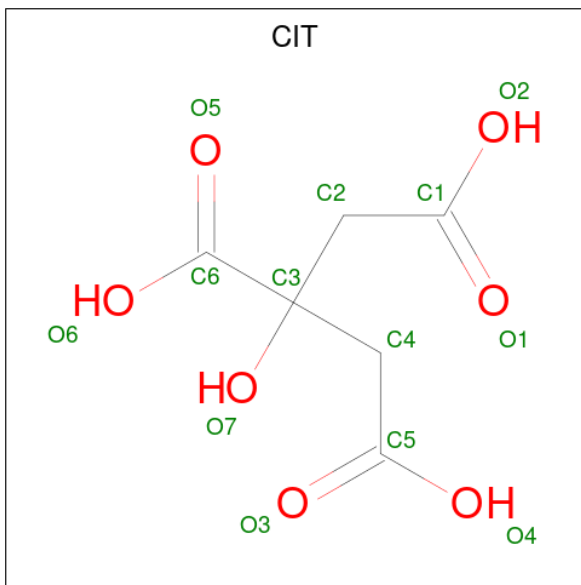
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
11	A	1	Total	O	S	0	0
			5	4	1		
11	C	1	Total	O	S	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
11	C	1	Total	O	S	0	0
			5	4	1		
11	D	1	Total	O	S	0	0
			5	4	1		
11	E	1	Total	O	S	0	0
			5	4	1		
11	E	1	Total	O	S	0	0
			5	4	1		
11	E	1	Total	O	S	0	0
			5	4	1		
11	F	1	Total	O	S	0	0
			5	4	1		
11	F	1	Total	O	S	0	0
			5	4	1		

- Molecule 12 is CITRIC ACID (CCD ID: CIT) (formula: C<sub>6</sub>H<sub>8</sub>O<sub>7</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
12	B	1	Total	C	O	0	0
			13	6	7		

- Molecule 13 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
13	A	45	Total	O	0	0
			45	45		

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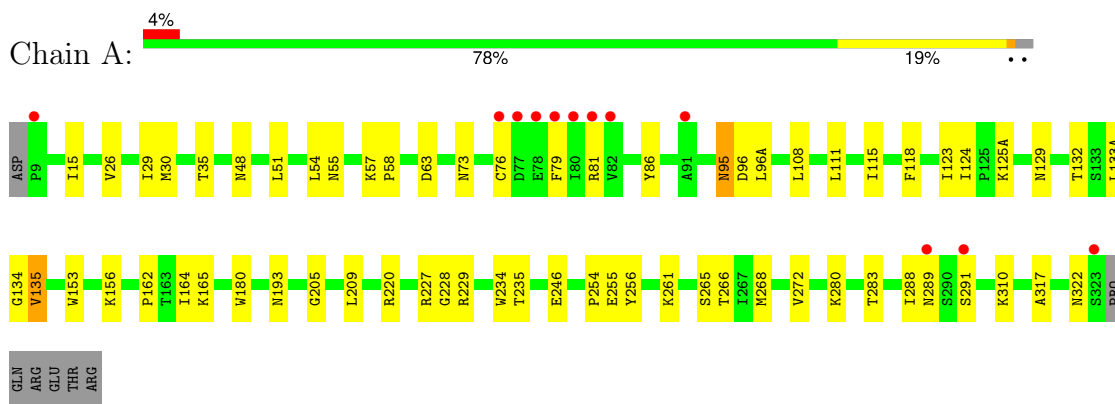
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<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>	<b>ZeroOcc</b>	<b>AltConf</b>
13	B	19	Total O 19 19	0	0
13	C	42	Total O 42 42	0	0
13	D	11	Total O 11 11	0	0
13	E	44	Total O 44 44	0	0
13	F	22	Total O 22 22	0	0

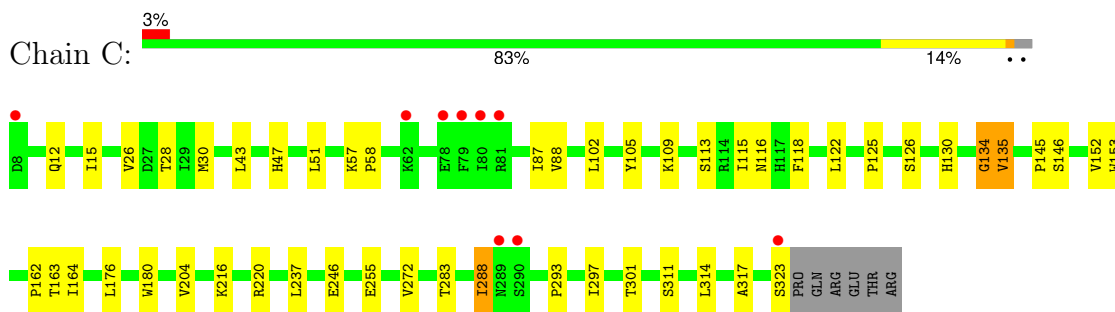
### 3 Residue-property plots [i](#)

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.

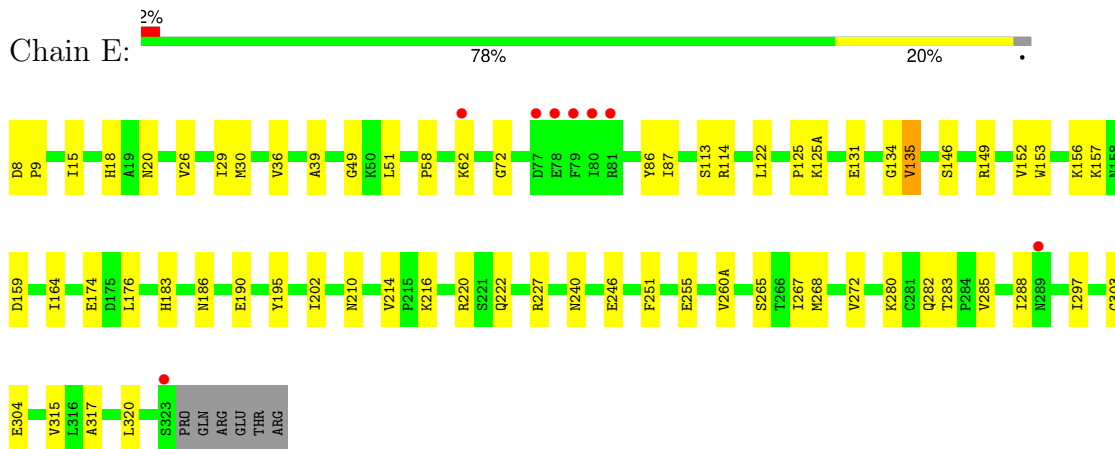
- Molecule 1: Hemagglutinin HA1 chain



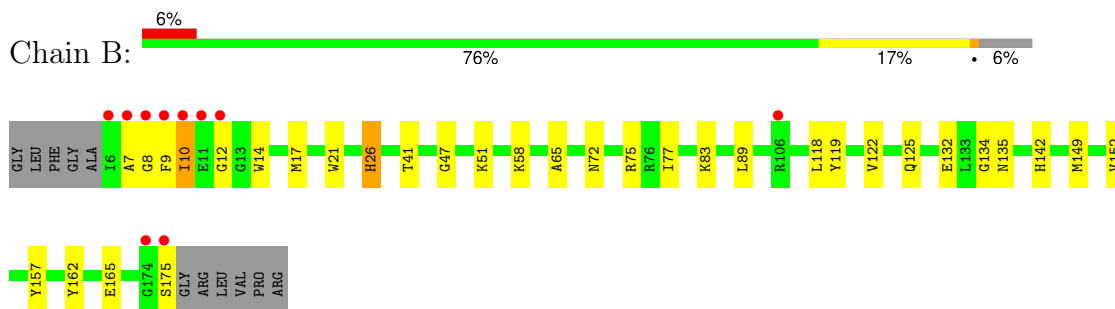
- Molecule 1: Hemagglutinin HA1 chain



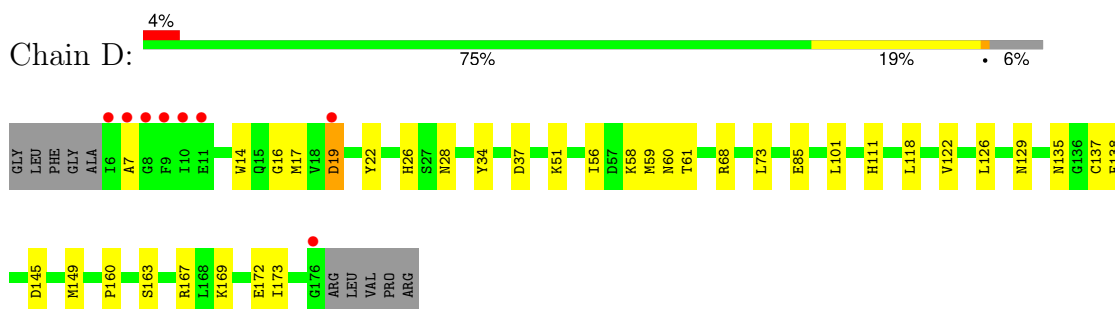
- Molecule 1: Hemagglutinin HA1 chain



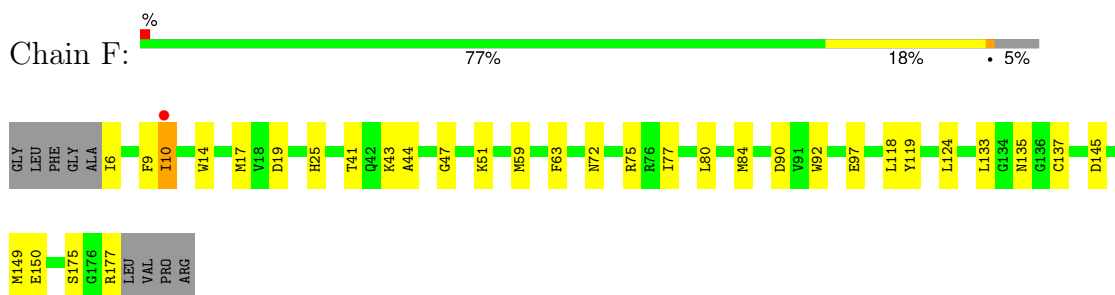
- Molecule 2: Hemagglutinin HA2 chain



- Molecule 2: Hemagglutinin HA2 chain



- Molecule 2: Hemagglutinin HA2 chain




- Molecule 3: 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



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




- Molecule 5: alpha-D-mannopyranose-(1-3)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain I: 

MAG1  
MAG2  
BMA3  
MAN4

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

Chain J: 

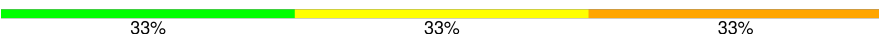
MAG1  
MAG2

- Molecule 7: alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-3)]2-acetamido-2-deoxy-beta-D-glucopyranose

Chain K: 

MAG1  
MAG2  
BMA3  
MAN4  
FUC5

- Molecule 8: N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-3)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain l: 

MAG1  
GAL2  
STA3

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	94.96Å 176.98Å 224.65Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.97 – 2.89 48.97 – 2.89	Depositor EDS
% Data completeness (in resolution range)	99.4 (48.97-2.89) 99.4 (48.97-2.89)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.27	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.29 (at 2.91Å)	Xtrriage
Refinement program	PHENIX (1.21rc1_5127: ???)	Depositor
R, $R_{free}$	0.178 , 0.218 0.177 , 0.217	Depositor DCC
$R_{free}$ test set	4228 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	50.7	Xtrriage
Anisotropy	0.515	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 64.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	12458	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 2.90% 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: FUC, GOL, SIA, BMA, MAN, SO4, GAL, CIT, NAG

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	0.37	0/2612	0.57	0/3552
1	C	0.37	0/2620	0.55	0/3564
1	E	0.40	0/2620	0.58	0/3564
2	B	0.39	0/1410	0.56	0/1895
2	D	0.32	0/1414	0.49	0/1900
2	F	0.36	0/1425	0.51	0/1914
All	All	0.37	0/12101	0.55	0/16389

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 [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	2548	0	2501	46	0
1	C	2556	0	2505	33	0
1	E	2556	0	2505	39	0
2	B	1384	0	1287	27	0
2	D	1388	0	1292	26	0
2	F	1399	0	1303	25	0
3	G	61	0	52	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	H	60	0	52	0	0
5	I	50	0	43	1	0
6	J	28	0	25	2	0
7	K	60	0	52	2	0
8	l	45	0	38	2	0
9	A	28	0	26	1	0
9	C	28	0	26	0	0
9	E	14	0	13	0	0
10	A	6	0	8	2	0
10	E	6	0	8	0	0
11	A	5	0	0	0	0
11	C	10	0	0	0	0
11	D	5	0	0	0	0
11	E	15	0	0	0	0
11	F	10	0	0	0	0
12	B	13	0	5	0	0
13	A	45	0	0	0	0
13	B	19	0	0	0	0
13	C	42	0	0	1	0
13	D	11	0	0	0	0
13	E	44	0	0	0	0
13	F	22	0	0	0	0
All	All	12458	0	11741	176	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 7.

The worst 5 of 176 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)
2:B:77:ILE:HD11	2:F:77:ILE:HD13	1.48	0.95
2:B:125:GLN:NE2	2:B:157:TYR:H	1.78	0.81
2:D:51:LYS:HE3	1:E:30:MET:HE3	1.64	0.79
2:B:9:PHE:CE2	2:B:10:ILE:HD13	2.23	0.73
1:E:26:VAL:HG21	1:E:317:ALA:HB2	1.71	0.73

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	320/329 (97%)	298 (93%)	22 (7%)	0	100	100
1	C	321/329 (98%)	303 (94%)	17 (5%)	1 (0%)	37	66
1	E	321/329 (98%)	301 (94%)	19 (6%)	1 (0%)	37	66
2	B	168/181 (93%)	160 (95%)	6 (4%)	2 (1%)	11	35
2	D	169/181 (93%)	157 (93%)	12 (7%)	0	100	100
2	F	170/181 (94%)	163 (96%)	7 (4%)	0	100	100
All	All	1469/1530 (96%)	1382 (94%)	83 (6%)	4 (0%)	37	66

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	12	GLY
1	C	134	GLY
2	B	8	GLY
1	E	62	LYS

### 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	287/294 (98%)	282 (98%)	5 (2%)	56	83
1	C	288/294 (98%)	281 (98%)	7 (2%)	44	76
1	E	288/294 (98%)	282 (98%)	6 (2%)	48	78

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	147/154 (96%)	143 (97%)	4 (3%)	40	73
2	D	147/154 (96%)	144 (98%)	3 (2%)	50	79
2	F	148/154 (96%)	145 (98%)	3 (2%)	50	79
All	All	1305/1344 (97%)	1277 (98%)	28 (2%)	48	78

5 of 28 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	288	ILE
2	F	80	LEU
2	D	61	THR
1	E	304	GLU
2	D	19	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
2	D	62	GLN
1	E	129	ASN
2	F	25	HIS
1	E	172	ASN
2	B	72	ASN

### 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](#)

24 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	G	1	3,1	14,14,15	0.85	1 (7%)	17,19,21	1.38	3 (17%)
3	NAG	G	2	3	14,14,15	0.80	0	17,19,21	1.45	2 (11%)
3	BMA	G	3	3	11,11,12	0.86	1 (9%)	15,15,17	1.87	5 (33%)
3	MAN	G	4	3	11,11,12	0.67	0	15,15,17	1.46	1 (6%)
3	MAN	G	5	3	11,11,12	0.66	0	15,15,17	1.87	1 (6%)
4	NAG	H	1	2,4	14,14,15	0.80	0	17,19,21	1.37	1 (5%)
4	NAG	H	2	4	14,14,15	0.79	0	17,19,21	0.89	0
4	BMA	H	3	4	11,11,12	0.89	0	15,15,17	1.83	2 (13%)
4	MAN	H	4	4	11,11,12	0.62	0	15,15,17	1.57	1 (6%)
4	FUC	H	5	4	10,10,11	0.74	0	14,14,16	1.07	1 (7%)
5	NAG	I	1	5,1	14,14,15	0.81	1 (7%)	17,19,21	1.15	2 (11%)
5	NAG	I	2	5	14,14,15	0.74	0	17,19,21	1.37	2 (11%)
5	BMA	I	3	5	11,11,12	1.01	0	15,15,17	1.87	4 (26%)
5	MAN	I	4	5	11,11,12	0.62	0	15,15,17	1.51	2 (13%)
6	NAG	J	1	6,1	14,14,15	0.81	0	17,19,21	1.69	3 (17%)
6	NAG	J	2	6	14,14,15	0.72	0	17,19,21	1.49	3 (17%)
7	NAG	K	1	2,7	14,14,15	0.69	0	17,19,21	0.94	1 (5%)
7	NAG	K	2	7	14,14,15	0.80	0	17,19,21	1.14	2 (11%)
7	BMA	K	3	7	11,11,12	0.88	0	15,15,17	2.09	2 (13%)
7	MAN	K	4	7	11,11,12	0.74	0	15,15,17	1.00	1 (6%)
7	FUC	K	5	7	10,10,11	0.63	0	14,14,16	1.31	2 (14%)
8	NAG	l	1	8	14,14,15	0.75	0	17,19,21	1.77	5 (29%)
8	GAL	l	2	8	11,11,12	0.74	0	15,15,17	1.08	0
8	SIA	l	3	8	20,20,21	1.93	3 (15%)	21,28,31	1.97	4 (19%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	G	1	3,1	-	1/6/23/26	0/1/1/1
3	NAG	G	2	3	-	2/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	BMA	G	3	3	-	1/2/19/22	0/1/1/1
3	MAN	G	4	3	-	2/2/19/22	0/1/1/1
3	MAN	G	5	3	-	2/2/19/22	0/1/1/1
4	NAG	H	1	2,4	-	0/6/23/26	0/1/1/1
4	NAG	H	2	4	-	0/6/23/26	0/1/1/1
4	BMA	H	3	4	-	2/2/19/22	0/1/1/1
4	MAN	H	4	4	-	0/2/19/22	0/1/1/1
4	FUC	H	5	4	-	-	0/1/1/1
5	NAG	I	1	5,1	-	0/6/23/26	0/1/1/1
5	NAG	I	2	5	-	0/6/23/26	0/1/1/1
5	BMA	I	3	5	-	1/2/19/22	0/1/1/1
5	MAN	I	4	5	-	0/2/19/22	0/1/1/1
6	NAG	J	1	6,1	-	0/6/23/26	0/1/1/1
6	NAG	J	2	6	-	3/6/23/26	0/1/1/1
7	NAG	K	1	2,7	-	2/6/23/26	0/1/1/1
7	NAG	K	2	7	-	2/6/23/26	0/1/1/1
7	BMA	K	3	7	-	2/2/19/22	0/1/1/1
7	MAN	K	4	7	-	0/2/19/22	0/1/1/1
7	FUC	K	5	7	-	-	0/1/1/1
8	NAG	l	1	8	-	0/6/23/26	0/1/1/1
8	GAL	l	2	8	-	2/2/19/22	0/1/1/1
8	SIA	l	3	8	-	0/18/34/38	0/1/1/1

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	l	3	SIA	C2-C1	7.04	1.60	1.52
8	l	3	SIA	C7-C6	3.11	1.56	1.52
8	l	3	SIA	O6-C2	2.49	1.48	1.43
5	I	1	NAG	O5-C1	-2.11	1.40	1.43
3	G	3	BMA	C2-C3	2.08	1.55	1.52

The worst 5 of 50 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	G	5	MAN	C1-O5-C5	6.24	120.55	112.19
7	K	3	BMA	C1-O5-C5	6.23	120.53	112.19
4	H	3	BMA	C1-O5-C5	5.22	119.18	112.19
4	H	4	MAN	C1-O5-C5	5.16	119.11	112.19
5	I	3	BMA	C1-O5-C5	5.11	119.03	112.19

There are no chirality outliers.

5 of 22 torsion outliers are listed below:

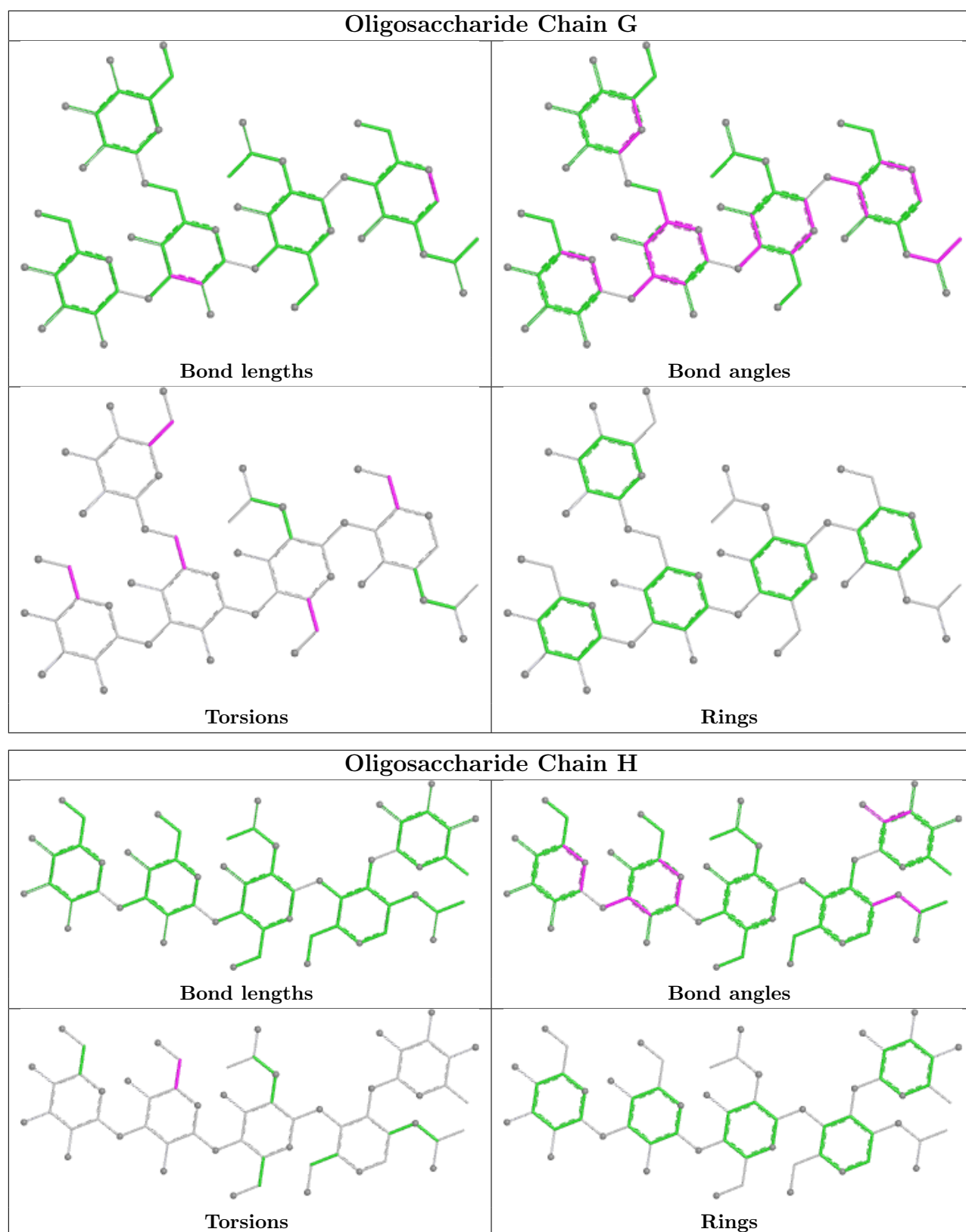
Mol	Chain	Res	Type	Atoms
6	J	2	NAG	O5-C5-C6-O6
3	G	2	NAG	O5-C5-C6-O6
3	G	4	MAN	O5-C5-C6-O6
7	K	3	BMA	O5-C5-C6-O6
6	J	2	NAG	C4-C5-C6-O6

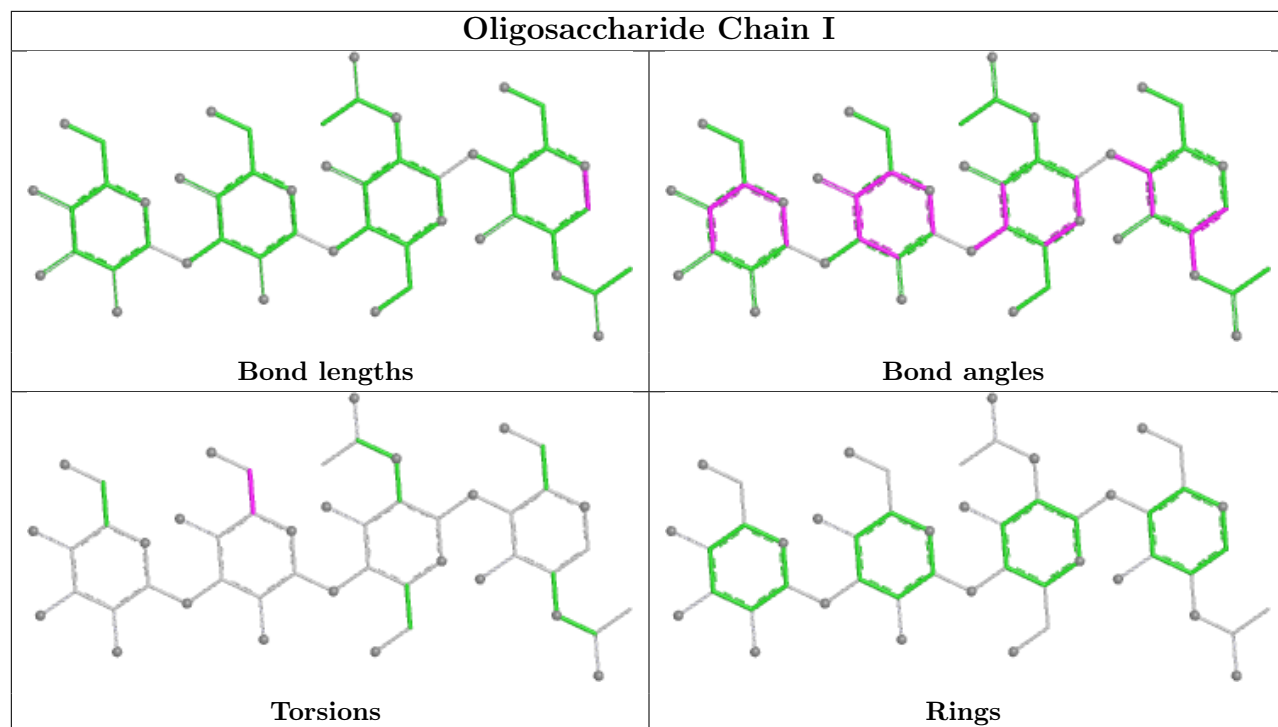
There are no ring outliers.

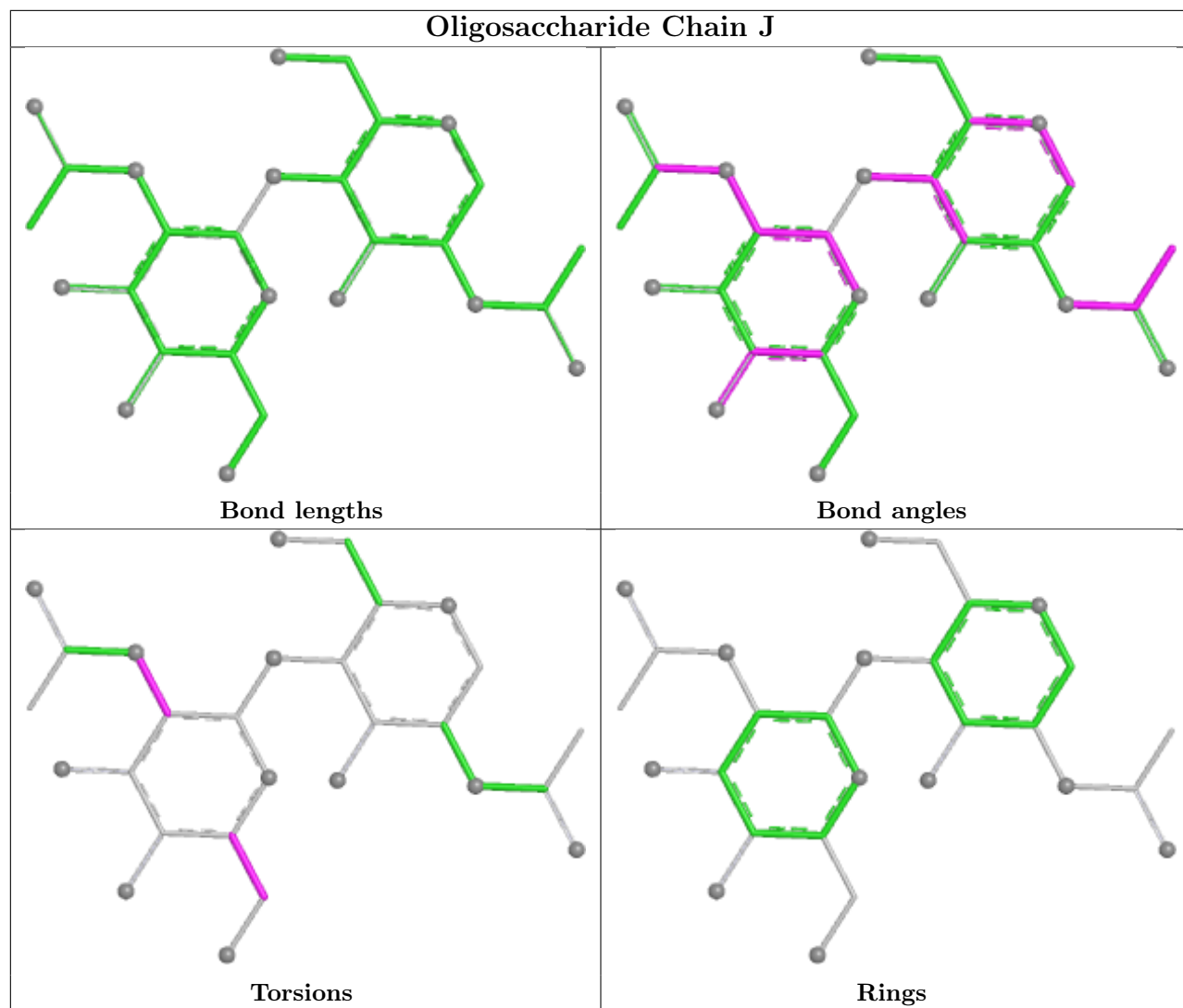
7 monomers are involved in 7 short contacts:

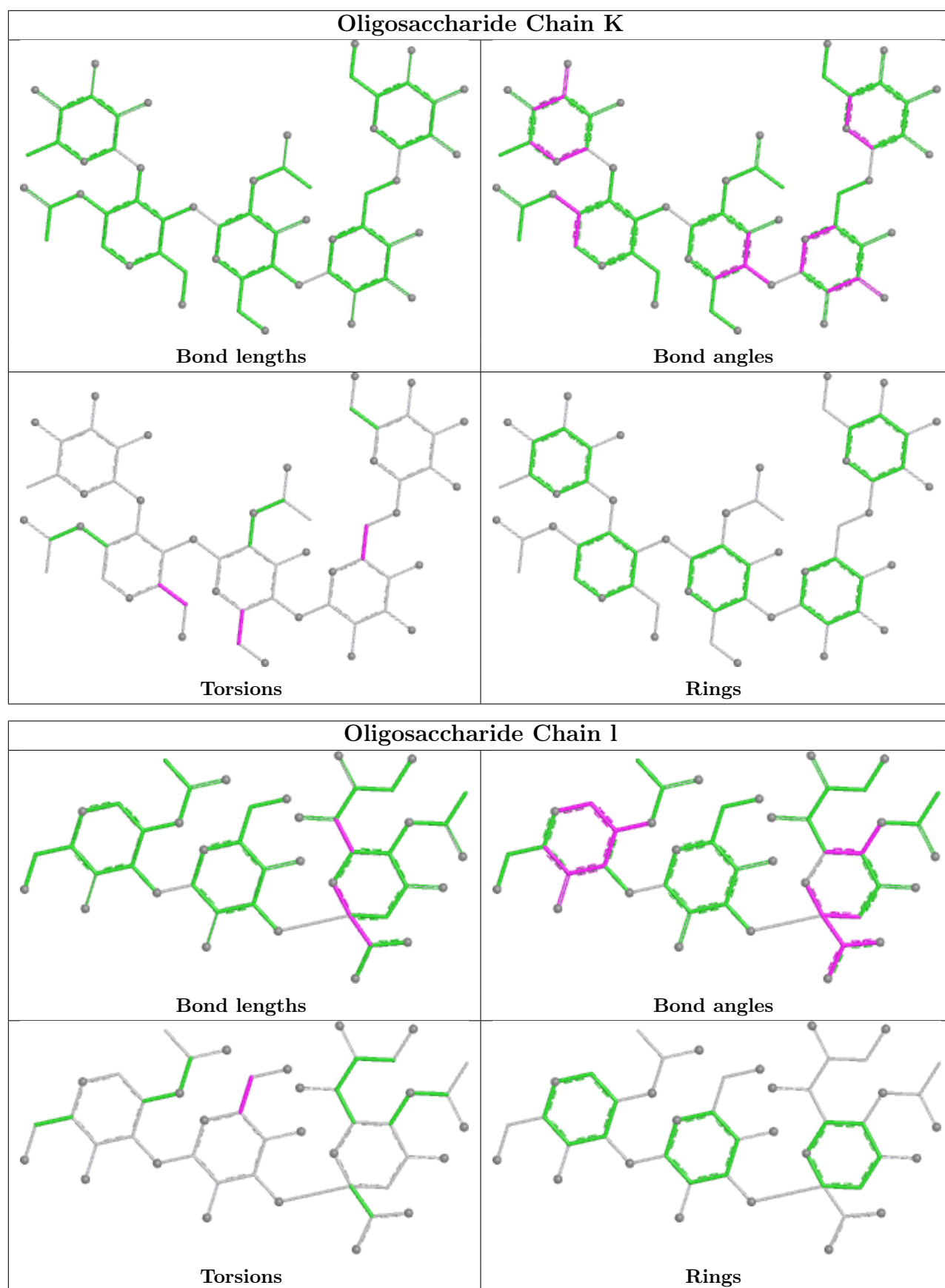
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	I	1	NAG	1	0
6	J	1	NAG	2	0
7	K	5	FUC	1	0
8	l	3	SIA	2	0
7	K	2	NAG	1	0
7	K	1	NAG	1	0
5	I	2	NAG	1	0

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

17 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
11	SO4	E	604	-	4,4,4	0.74	0	6,6,6	0.32	0
9	NAG	A	602	1	14,14,15	0.78	0	17,19,21	2.44	3 (17%)
9	NAG	C	602	1	14,14,15	0.77	1 (7%)	17,19,21	1.58	2 (11%)
9	NAG	A	601	1	14,14,15	0.82	1 (7%)	17,19,21	1.04	1 (5%)
10	GOL	A	603	-	5,5,5	0.45	0	5,5,5	0.72	0
9	NAG	C	601	1	14,14,15	0.72	0	17,19,21	1.35	1 (5%)
11	SO4	C	603	-	4,4,4	1.00	0	6,6,6	0.62	0
11	SO4	C	604	-	4,4,4	0.92	0	6,6,6	0.42	0
11	SO4	D	201	-	4,4,4	0.75	0	6,6,6	0.54	0
11	SO4	E	603	-	4,4,4	0.96	0	6,6,6	0.67	0
9	NAG	E	601	1	14,14,15	0.66	0	17,19,21	1.84	2 (11%)
11	SO4	E	605	-	4,4,4	0.80	0	6,6,6	0.35	0
11	SO4	F	202	-	4,4,4	0.77	0	6,6,6	0.17	0
12	CIT	B	201	-	12,12,12	1.84	1 (8%)	17,17,17	1.76	5 (29%)
11	SO4	F	201	-	4,4,4	0.86	0	6,6,6	0.53	0
10	GOL	E	602	-	5,5,5	0.40	0	5,5,5	0.86	0
11	SO4	A	604	-	4,4,4	0.74	0	6,6,6	0.31	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	NAG	A	602	1	-	5/6/23/26	0/1/1/1
9	NAG	C	602	1	-	0/6/23/26	0/1/1/1
9	NAG	A	601	1	-	2/6/23/26	0/1/1/1
10	GOL	A	603	-	-	4/4/4/4	-
9	NAG	C	601	1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
9	NAG	E	601	1	-	0/6/23/26	0/1/1/1
12	CIT	B	201	-	-	10/16/16/16	-
10	GOL	E	602	-	-	2/4/4/4	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
12	B	201	CIT	C3-C6	4.74	1.58	1.53
9	A	601	NAG	C1-C2	2.30	1.55	1.52
9	C	602	NAG	C1-C2	2.14	1.55	1.52

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	A	602	NAG	C2-N2-C7	8.30	134.02	122.90
9	E	601	NAG	C1-O5-C5	6.32	120.66	112.19
9	C	601	NAG	C1-O5-C5	4.26	117.89	112.19
9	C	602	NAG	C1-O5-C5	3.99	117.53	112.19
12	B	201	CIT	O6-C6-C3	3.50	119.86	113.14

There are no chirality outliers.

5 of 23 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
10	A	603	GOL	C1-C2-C3-O3
10	E	602	GOL	C1-C2-C3-O3
10	E	602	GOL	O2-C2-C3-O3
12	B	201	CIT	C1-C2-C3-O7
12	B	201	CIT	C1-C2-C3-C6

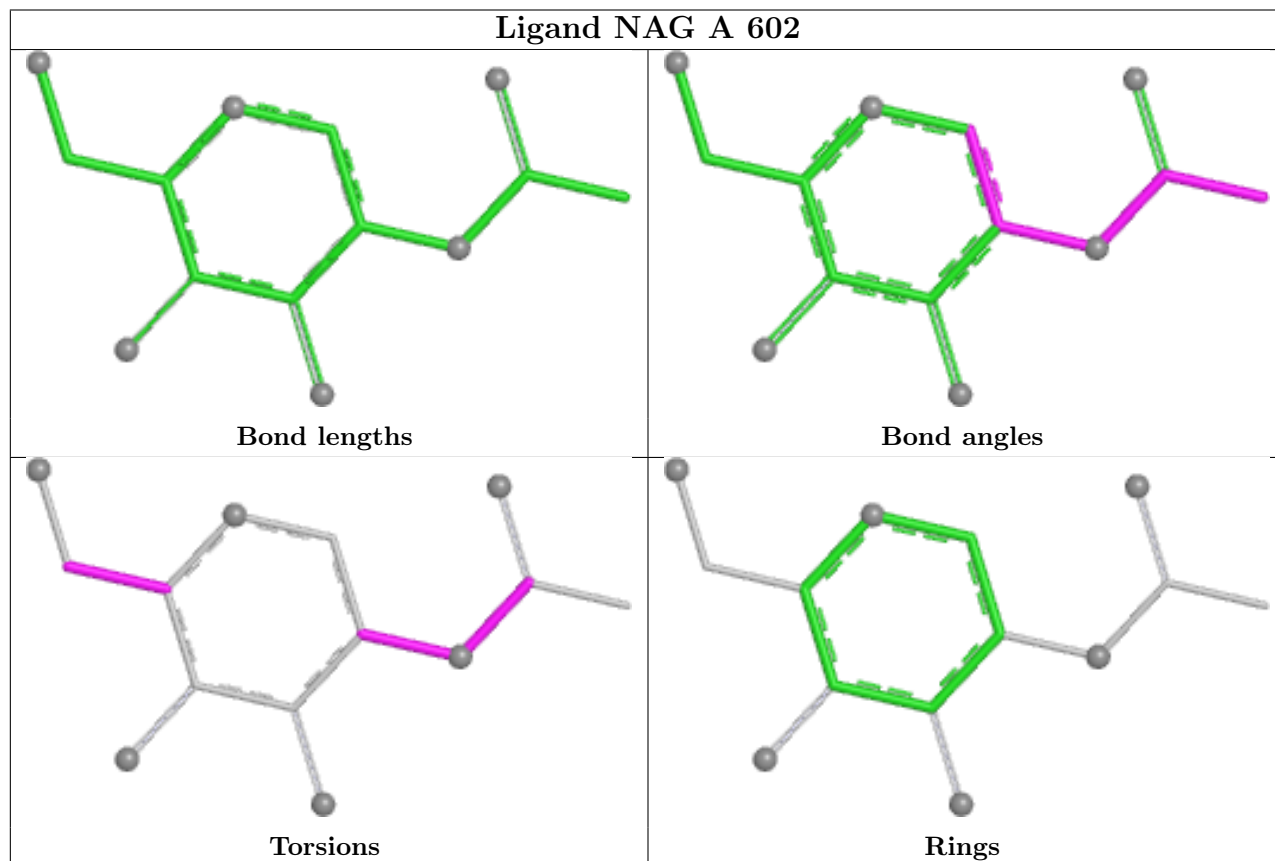
There are no ring outliers.

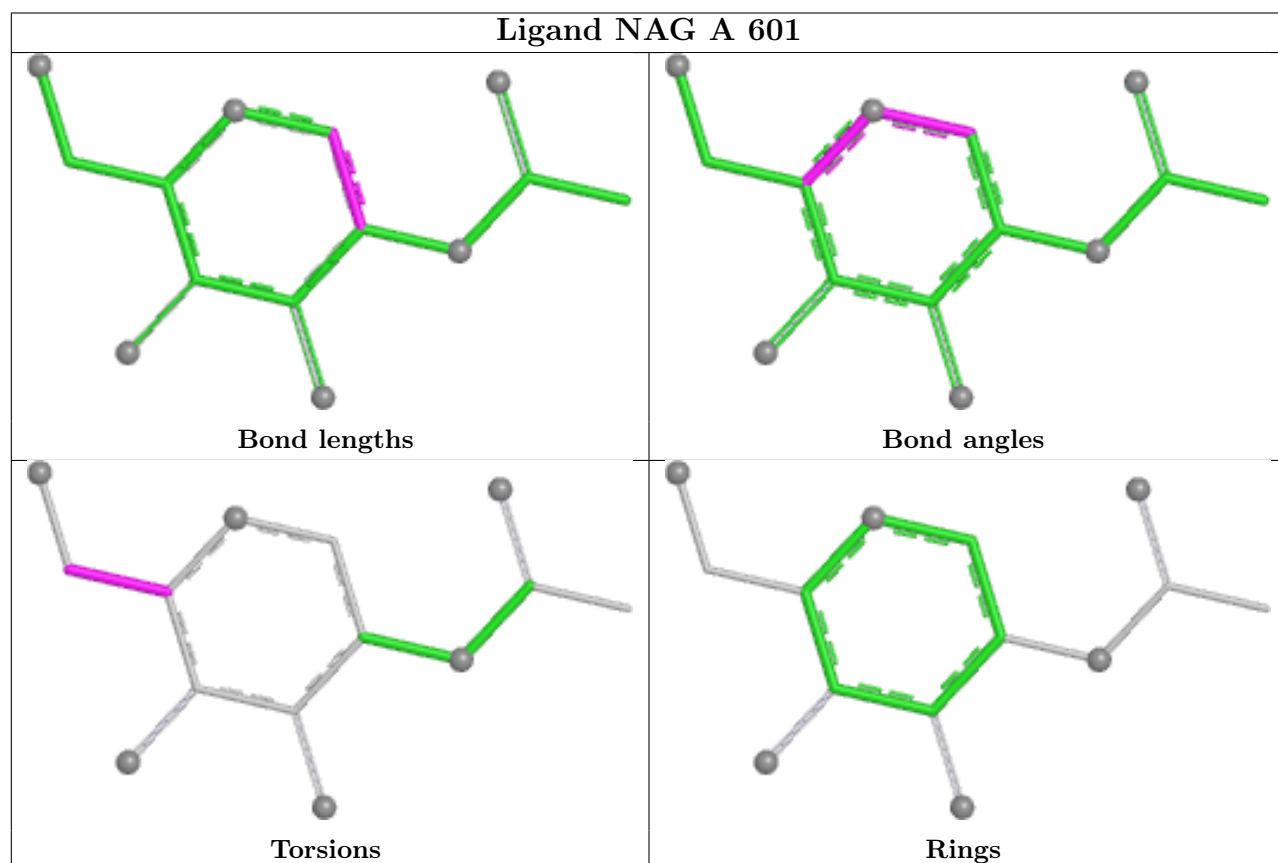
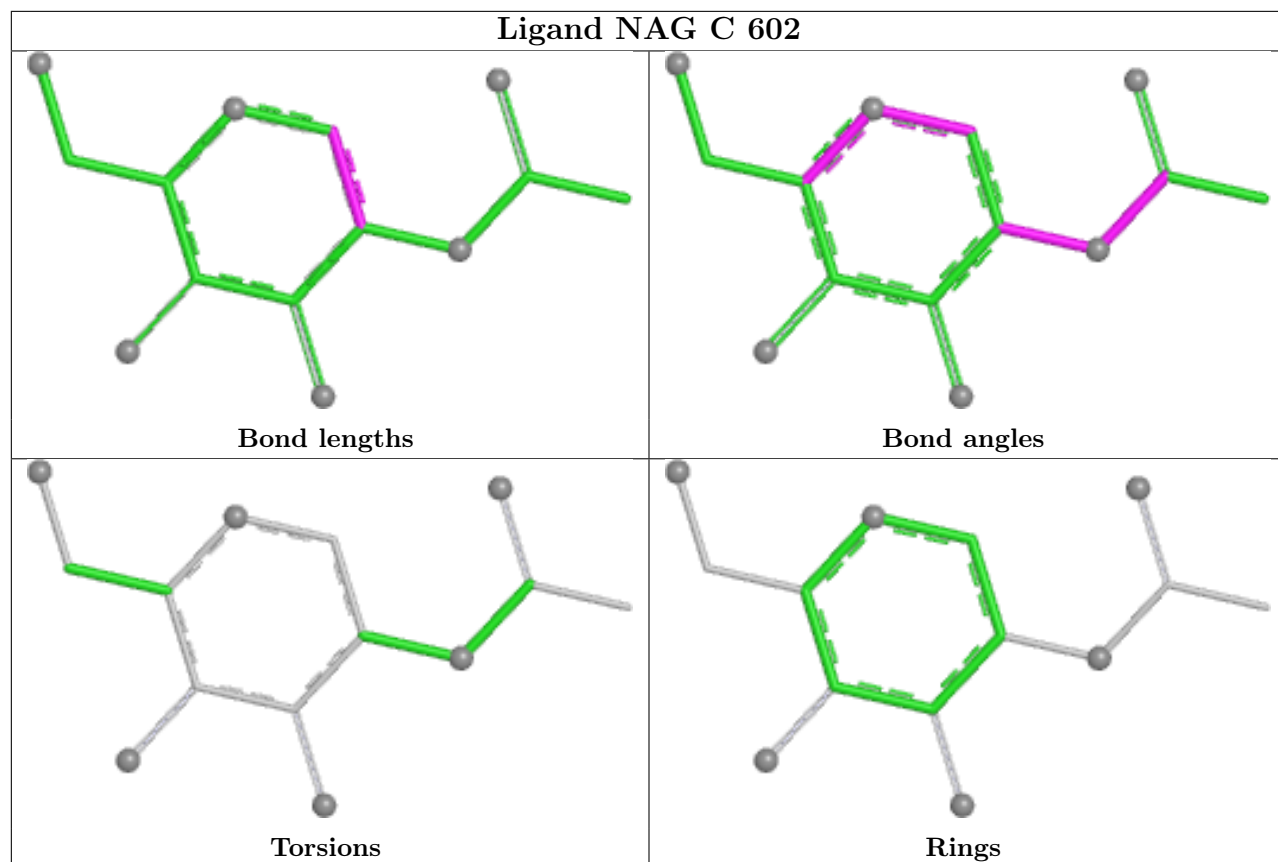
2 monomers are involved in 3 short contacts:

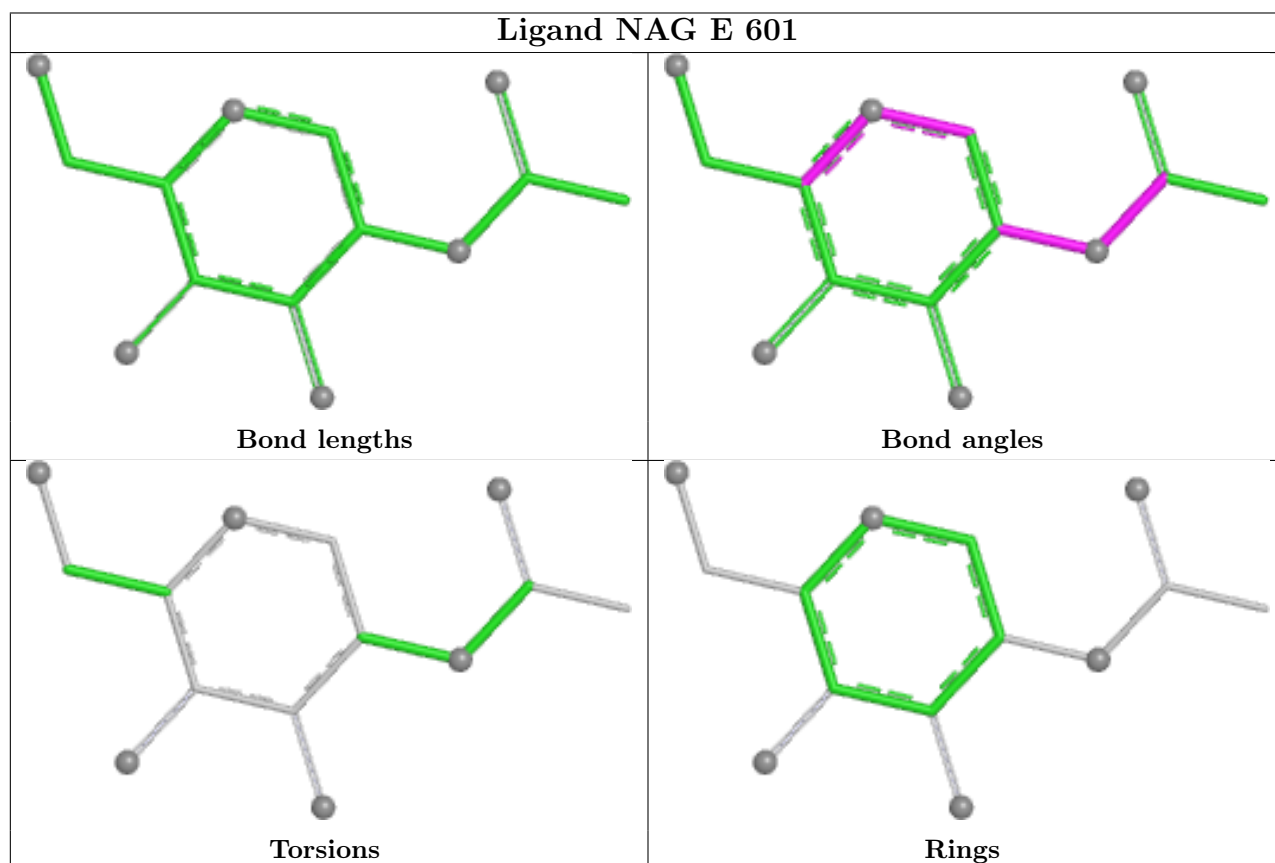
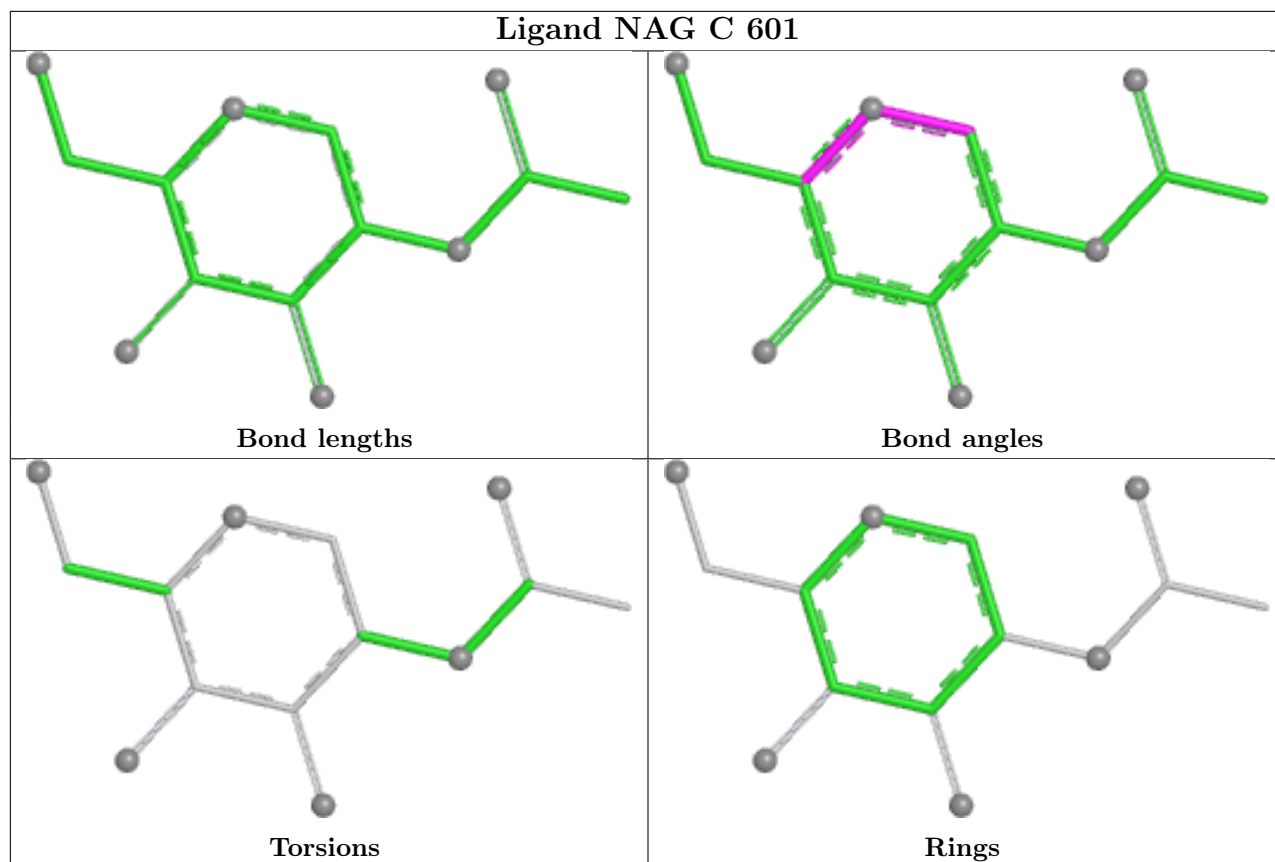
Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	A	602	NAG	1	0
10	A	603	GOL	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for 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	322/329 (97%)	-0.46	12 (3%) 45 39	32, 51, 85, 170	0
1	C	323/329 (98%)	-0.52	9 (2%) 55 49	30, 50, 89, 152	0
1	E	323/329 (98%)	-0.60	8 (2%) 58 52	27, 47, 78, 165	0
2	B	170/181 (93%)	-0.26	10 (5%) 29 25	38, 60, 96, 169	0
2	D	171/181 (94%)	0.04	8 (4%) 37 31	41, 79, 109, 122	0
2	F	172/181 (95%)	-0.45	1 (0%) 85 82	40, 59, 81, 110	0
All	All	1481/1530 (96%)	-0.42	48 (3%) 50 44	27, 54, 96, 170	0

The worst 5 of 48 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	6	ILE	6.9
2	B	9	PHE	6.8
1	A	9	PRO	6.6
1	A	78	GLU	6.4
1	E	80	ILE	5.9

### 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](#)

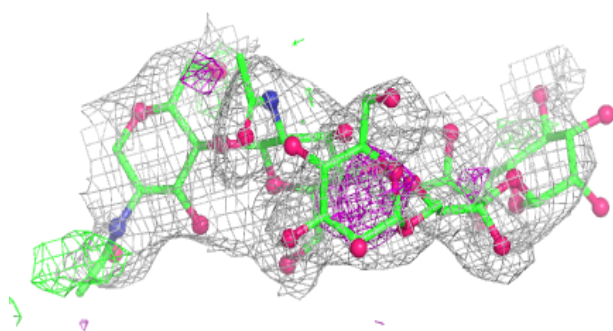
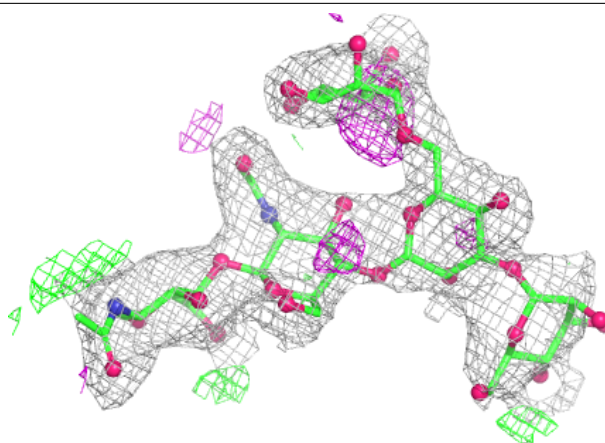
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
7	MAN	K	4	11/12	0.26	0.18	139,173,177,178	0
4	MAN	H	4	11/12	0.31	0.20	152,177,188,190	0
4	BMA	H	3	11/12	0.45	0.16	138,167,180,189	0
7	BMA	K	3	11/12	0.51	0.18	110,141,154,161	0
3	MAN	G	4	11/12	0.71	0.18	109,139,149,161	0
7	FUC	K	5	10/11	0.73	0.19	111,125,141,142	0
7	NAG	K	2	14/15	0.76	0.20	103,113,126,129	0
6	NAG	J	2	14/15	0.76	0.14	63,104,112,116	0
4	NAG	H	2	14/15	0.80	0.17	103,125,148,149	0
3	MAN	G	5	11/12	0.82	0.21	85,99,115,129	0
5	BMA	I	3	11/12	0.85	0.14	63,70,92,100	0
7	NAG	K	1	14/15	0.85	0.15	80,98,113,125	0
3	BMA	G	3	11/12	0.86	0.16	83,117,136,140	0
4	NAG	H	1	14/15	0.86	0.14	64,107,117,123	0
3	NAG	G	2	14/15	0.87	0.18	73,100,124,129	0
4	FUC	H	5	10/11	0.88	0.17	87,112,116,119	0
3	NAG	G	1	14/15	0.88	0.16	69,84,94,102	0
5	NAG	I	2	14/15	0.93	0.10	50,58,74,84	0
5	NAG	I	1	14/15	0.93	0.11	46,64,71,89	0
5	MAN	I	4	11/12	0.94	0.08	51,58,74,77	0
6	NAG	J	1	14/15	0.96	0.07	49,71,83,101	0
8	NAG	l	1	14/15	-	-	59,86,102,112	0
8	GAL	l	2	11/12	-	-	40,48,60,63	0
8	SIA	l	3	20/21	-	-	35,44,51,57	0

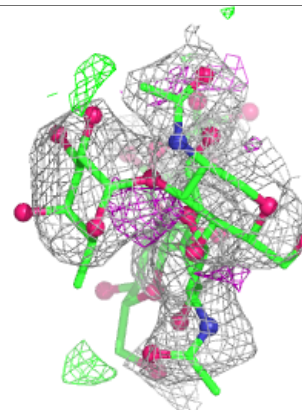
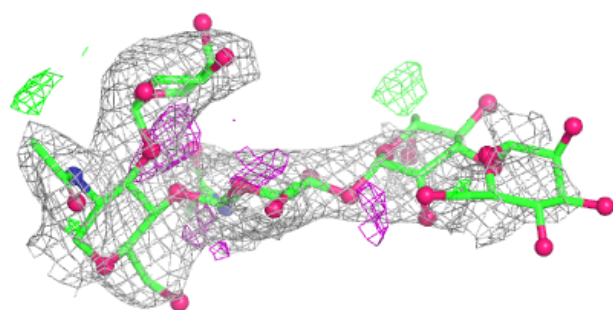
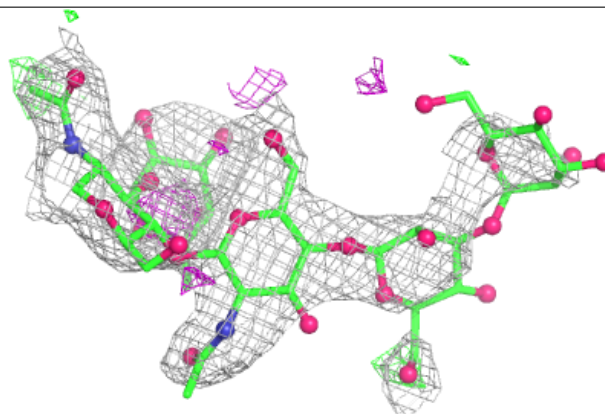
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

**Electron density around Chain G:**

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

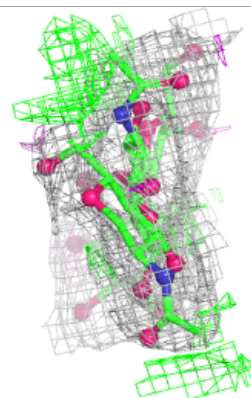
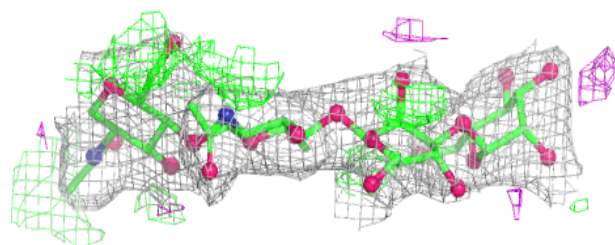
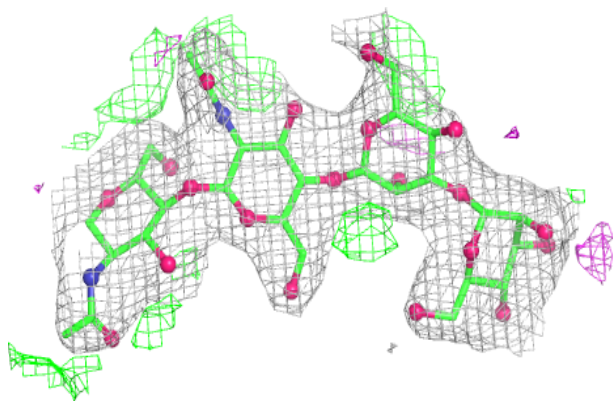
**Electron density around Chain H:**

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

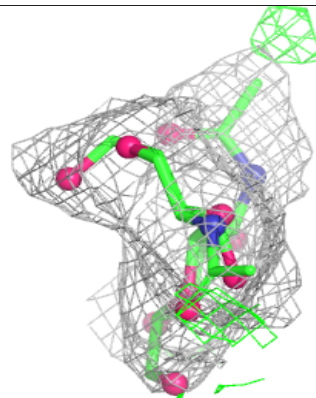
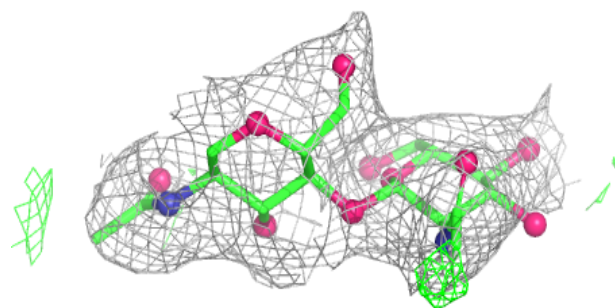
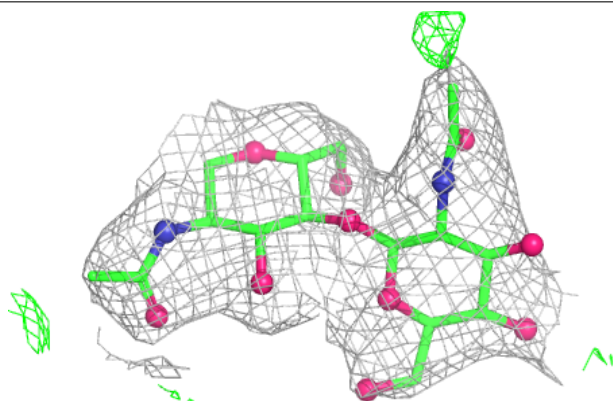


**Electron density around Chain I:**

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

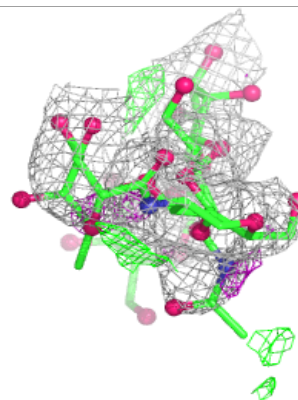
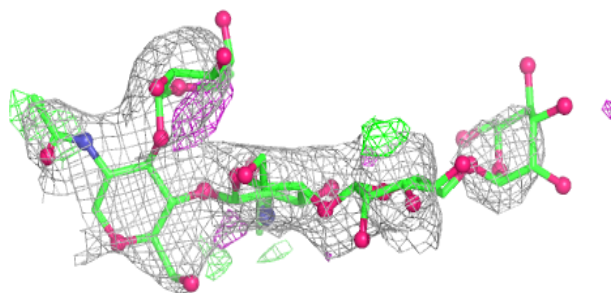
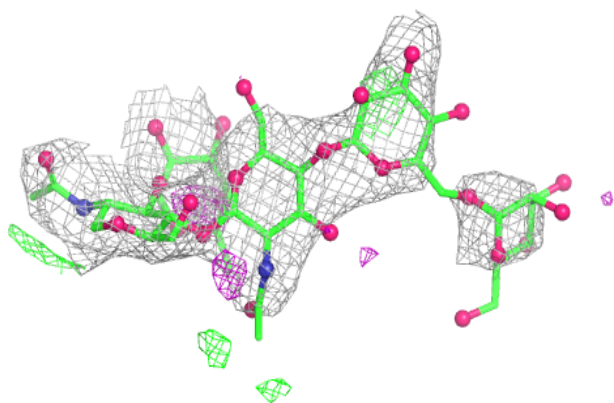
**Electron density around Chain J:**

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

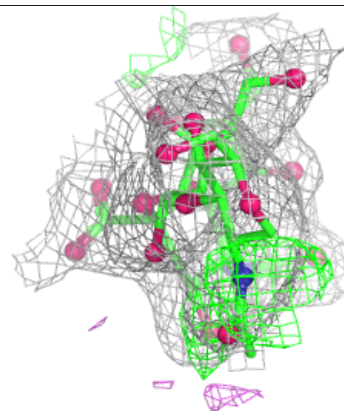
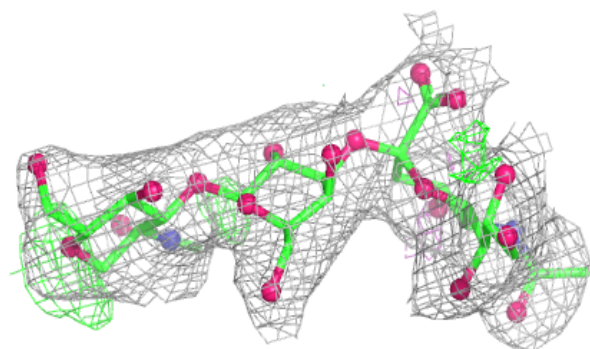
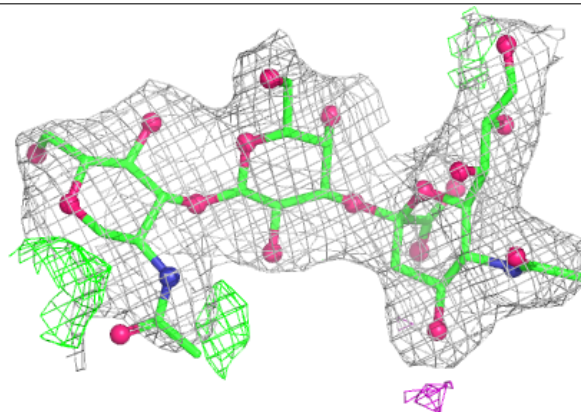


**Electron density around Chain K:**

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

**Electron density around Chain I:**

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



## 6.4 Ligands

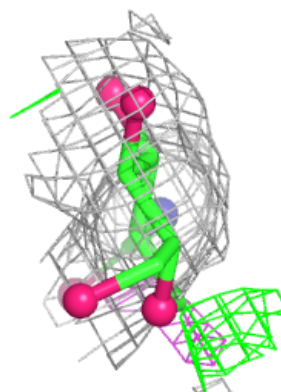
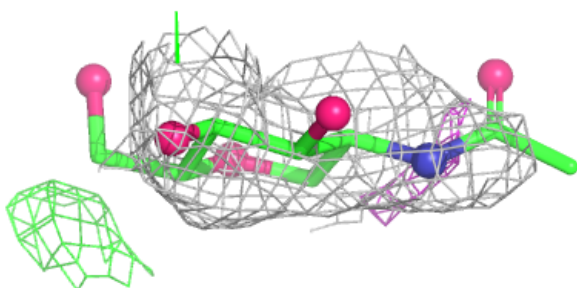
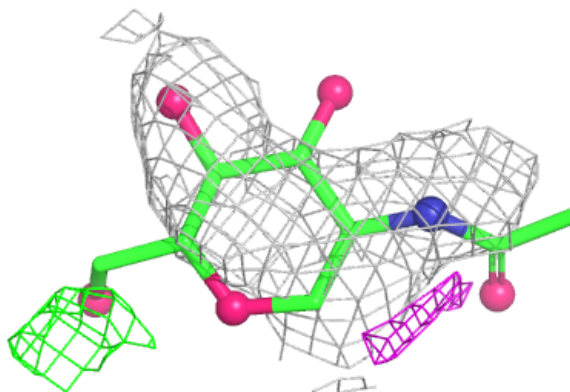
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 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
9	NAG	C	602	14/15	0.60	0.22	96,139,149,154	0
9	NAG	A	602	14/15	0.64	0.24	114,144,148,150	0
10	GOL	A	603	6/6	0.71	0.24	62,90,92,94	0
9	NAG	C	601	14/15	0.82	0.16	87,113,130,131	0
12	CIT	B	201	13/13	0.83	0.16	64,102,118,120	0
9	NAG	A	601	14/15	0.84	0.16	89,116,128,138	0
11	SO4	D	201	5/5	0.84	0.22	97,109,128,150	0
9	NAG	E	601	14/15	0.84	0.14	94,117,123,133	0
11	SO4	F	201	5/5	0.85	0.23	72,90,107,124	0
11	SO4	A	604	5/5	0.90	0.23	72,81,122,131	0
11	SO4	C	604	5/5	0.92	0.22	73,74,83,124	0
11	SO4	F	202	5/5	0.92	0.19	91,106,121,142	0
11	SO4	E	603	5/5	0.92	0.26	64,68,109,126	0
10	GOL	E	602	6/6	0.93	0.14	51,57,63,65	0
11	SO4	C	603	5/5	0.93	0.29	57,64,95,125	0
11	SO4	E	604	5/5	0.94	0.20	61,66,102,114	0
11	SO4	E	605	5/5	0.95	0.21	82,88,105,132	0

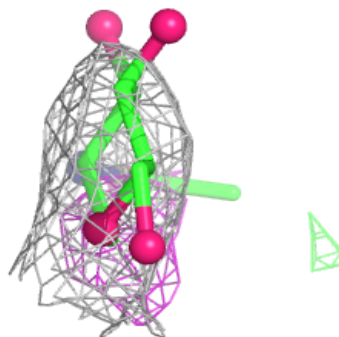
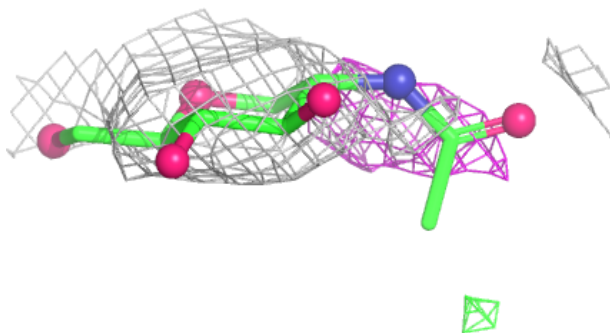
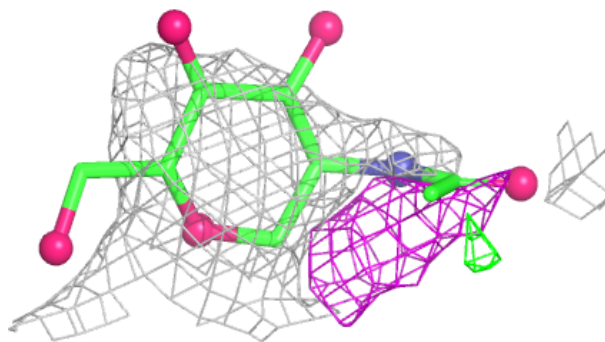
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

**Electron density around NAG C 602:**

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

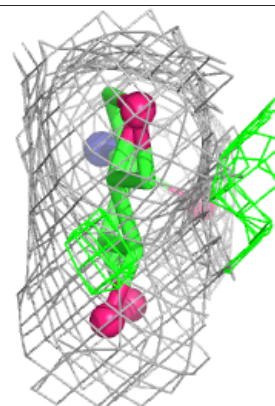
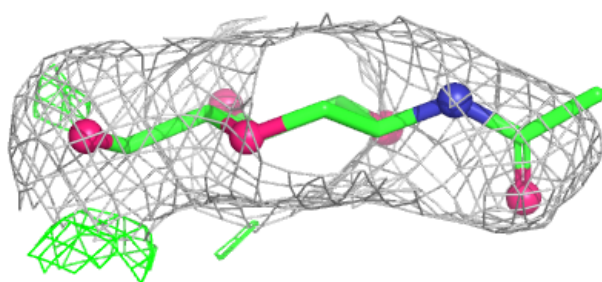
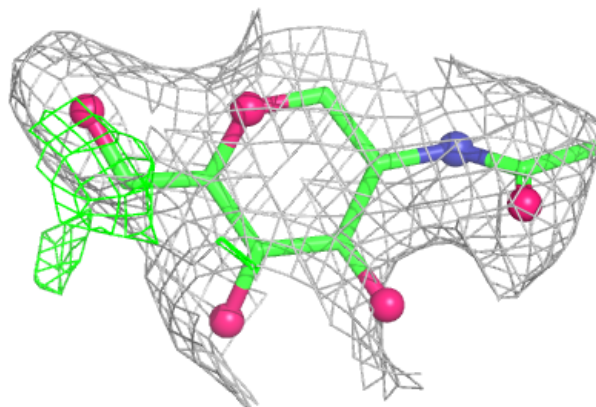
**Electron density around NAG A 602:**

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

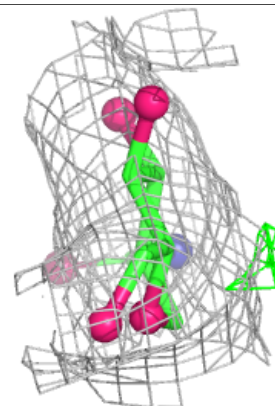
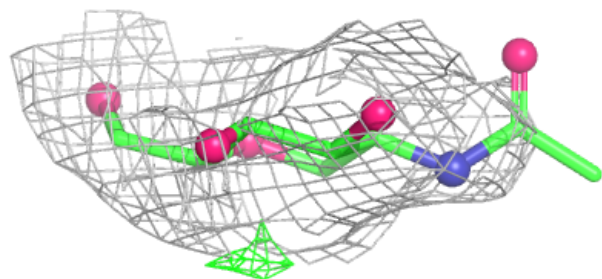


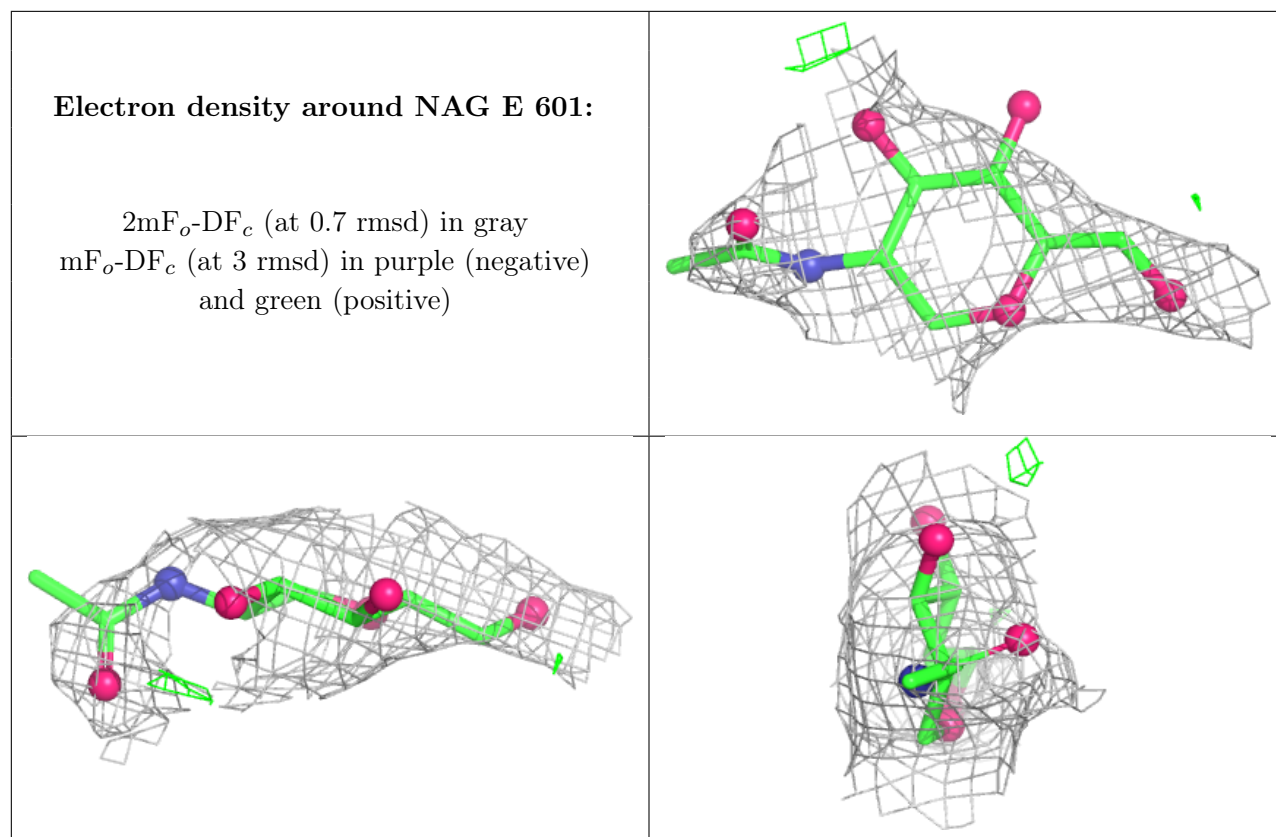
**Electron density around NAG C 601:**

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

**Electron density around NAG A 601:**

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





## 6.5 Other polymers [i](#)

There are no such residues in this entry.