



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 7, 2020 – 05:23 AM BST

PDB ID : 1EO8  
Title : INFLUENZA VIRUS HEMAGGLUTININ COMPLEXED WITH A NEUTRALIZING ANTIBODY  
Authors : Fleury, D.; Gigant, B.; Daniels, R.S.; Skehel, J.J.; Knossow, M.; Bizebard, T.  
Deposited on : 2000-03-22  
Resolution : 2.80 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.

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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 : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.13.1

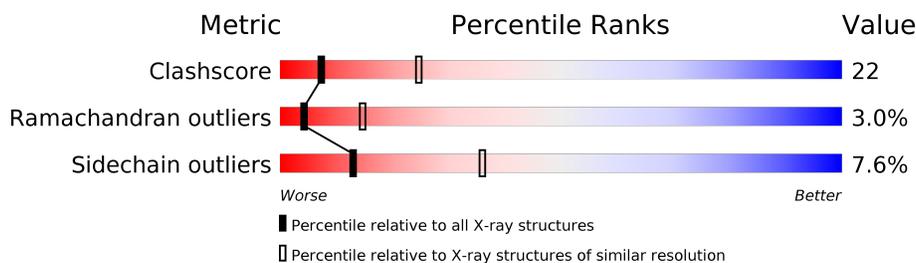
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	328	
2	B	175	
3	L	210	
4	H	217	
5	C	3	
6	D	2	

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:

<b>Mol</b>	<b>Type</b>	<b>Chain</b>	<b>Res</b>	<b>Chirality</b>	<b>Geometry</b>	<b>Clashes</b>	<b>Electron density</b>
5	MAN	C	3	X	-	-	-
7	NAG	B	410	X	-	-	-

## 2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 7357 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	319	2464	1543	433	475	13	0	0	0

- Molecule 2 is a protein called HEMAGGLUTININ (HA2 CHAIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	175	1421	882	250	283	6	0	0	0

- Molecule 3 is a protein called ANTIBODY (LIGHT CHAIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	210	1620	1009	270	332	9	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
L	40	SER	PRO	conflict	GB 7159941

- Molecule 4 is a protein called ANTIBODY (HEAVY CHAIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	H	217	1648	1046	272	323	7	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
H	64	LYS	ARG	conflict	GB 7159939
H	187	PRO	THR	conflict	GB 7159939

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Chain	Residue	Modelled	Actual	Comment	Reference
H	188	ARG	TRP	conflict	GB 7159939

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



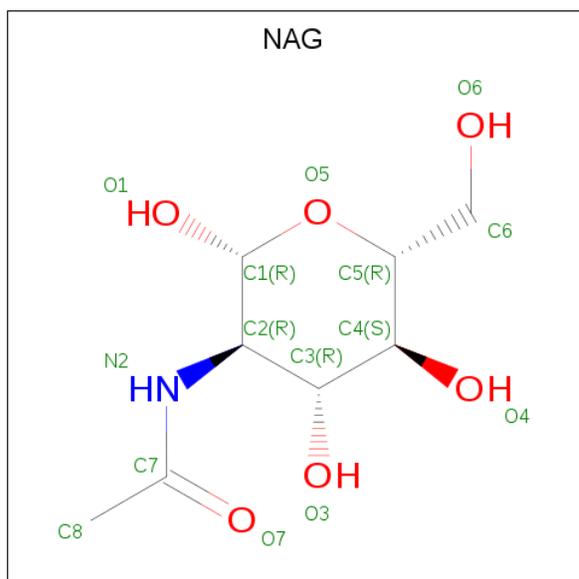
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
5	C	3	39	22	2	15	0	0	0

- 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	D	2	28	16	2	10	0	0	0

- Molecule 7 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



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

- Molecule 8 is water.

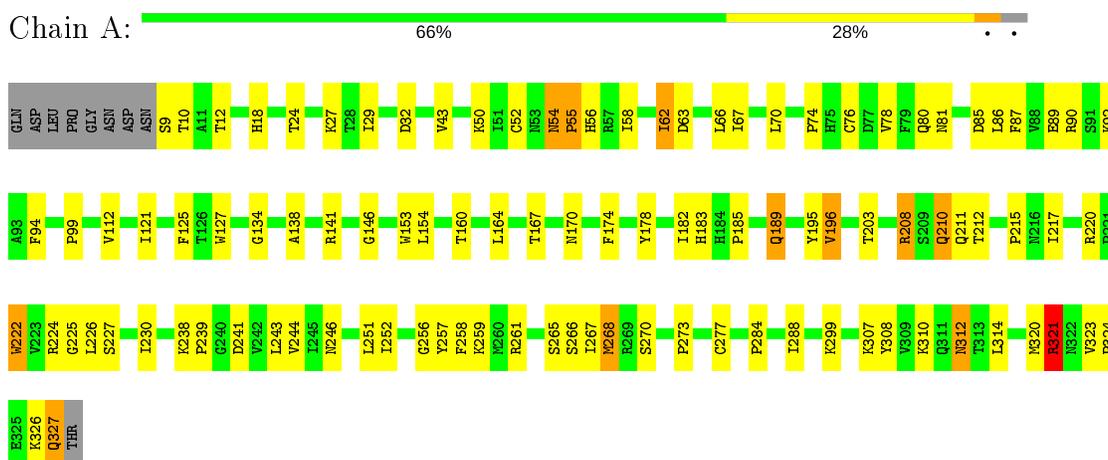
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	43	Total	O	0	0
			43	43		
8	B	44	Total	O	0	0
			44	44		
8	L	5	Total	O	0	0
			5	5		
8	H	17	Total	O	0	0
			17	17		

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

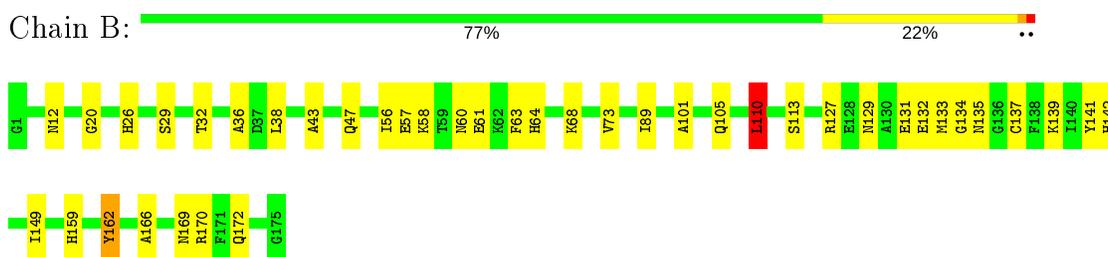
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded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

Note EDS was not executed.

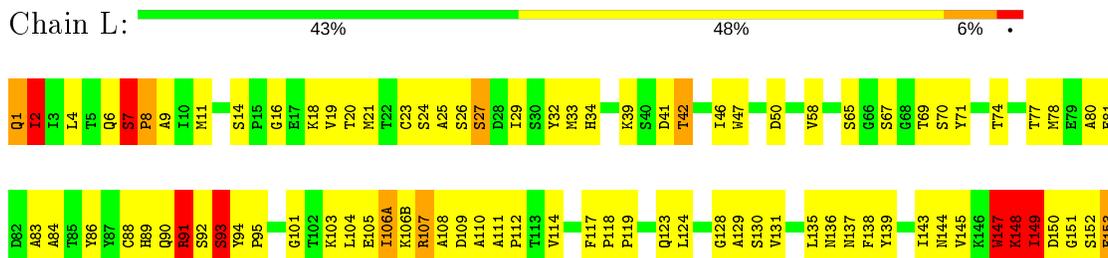
- Molecule 1: HEMAGGLUTININ (HA1 CHAIN)

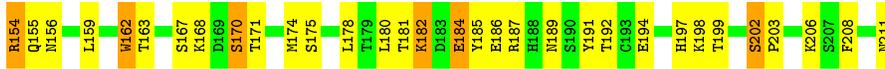


- Molecule 2: HEMAGGLUTININ (HA2 CHAIN)



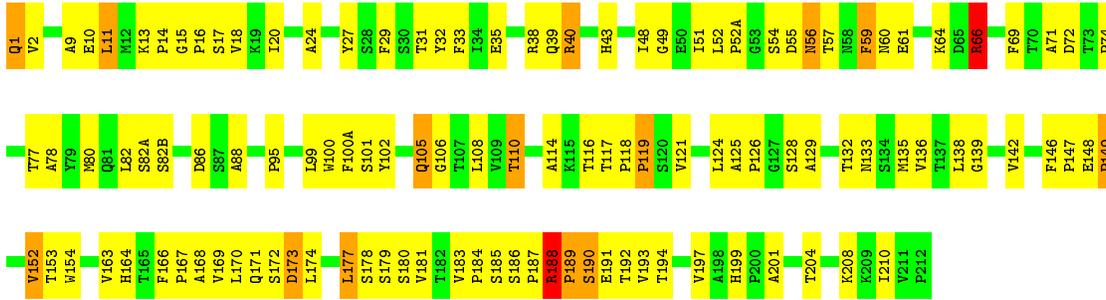
- Molecule 3: ANTIBODY (LIGHT CHAIN)





- Molecule 4: ANTIBODY (HEAVY CHAIN)

Chain H: 46% 47% 6%



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

Chain C: 67% 33%



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

Chain D: 100%



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 3 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	138.15Å 138.15Å 129.50Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	7.00 – 2.80	Depositor
% Data completeness (in resolution range)	(Not available) (7.00-2.80)	Depositor
$R_{merge}$	0.07	Depositor
$R_{sym}$	0.07	Depositor
Refinement program	X-PLOR 3.843	Depositor
R, $R_{free}$	0.196 , 0.298	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	7357	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	38.0	wwPDB-VP

## 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

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	0.60	0/2520	0.86	2/3433 (0.1%)
2	B	0.67	0/1445	0.84	2/1939 (0.1%)
3	L	0.59	0/1658	0.94	5/2249 (0.2%)
4	H	0.60	0/1695	0.87	3/2319 (0.1%)
All	All	0.61	0/7318	0.88	12/9940 (0.1%)

There are no bond length outliers.

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	L	7	SER	N-CA-C	9.20	135.84	111.00
3	L	91	ARG	NE-CZ-NH2	7.17	123.89	120.30
3	L	8	PRO	N-CA-C	-7.07	93.73	112.10
2	B	110	LEU	CA-CB-CG	6.81	130.97	115.30
1	A	321	ARG	NE-CZ-NH1	5.78	123.19	120.30

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	2464	0	2415	93	0
2	B	1421	0	1344	32	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	L	1620	0	1557	109	0
4	H	1648	0	1608	105	0
5	C	39	0	34	1	0
6	D	28	0	25	0	0
7	A	14	0	13	0	0
7	B	14	0	13	0	0
8	A	43	0	0	3	0
8	B	44	0	0	2	0
8	H	17	0	0	0	0
8	L	5	0	0	0	0
All	All	7357	0	7009	319	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 22.

The worst 5 of 319 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:L:184:GLU:HA	3:L:187:ARG:HD2	1.34	1.06
1:A:321:ARG:HH11	1:A:321:ARG:HG2	1.23	1.02
3:L:6:GLN:HB2	3:L:88:CYS:SG	2.09	0.93
3:L:148:LYS:HB3	3:L:153:GLU:HA	1.52	0.89
4:H:17:SER:HB3	4:H:82(A):SER:HA	1.53	0.88

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	317/328 (97%)	292 (92%)	23 (7%)	2 (1%)	25 56
2	B	173/175 (99%)	159 (92%)	13 (8%)	1 (1%)	25 56

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	L	208/210 (99%)	178 (86%)	17 (8%)	13 (6%)	1	3
4	H	215/217 (99%)	181 (84%)	23 (11%)	11 (5%)	2	6
All	All	913/930 (98%)	810 (89%)	76 (8%)	27 (3%)	4	15

5 of 27 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	L	27	SER
3	L	93	SER
3	L	148	LYS
3	L	153	GLU
3	L	182	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	281/289 (97%)	265 (94%)	16 (6%)	20	50
2	B	149/149 (100%)	144 (97%)	5 (3%)	37	71
3	L	185/185 (100%)	161 (87%)	24 (13%)	4	13
4	H	187/187 (100%)	171 (91%)	16 (9%)	10	30
All	All	802/810 (99%)	741 (92%)	61 (8%)	13	36

5 of 61 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	L	81	GLU
3	L	148	LYS
4	H	152	VAL
3	L	91	ARG
3	L	106(A)	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	60	ASN
3	L	38	GLN
4	H	105	GLN
2	B	53	ASN
4	H	56	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](#)

5 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$
5	NAG	C	1	1,5	14,14,15	1.87	5 (35%)	17,19,21	2.37	4 (23%)
5	NAG	C	2	5	14,14,15	1.23	1 (7%)	17,19,21	2.26	4 (23%)
5	MAN	C	3	5	11,11,12	1.59	2 (18%)	15,15,17	1.88	3 (20%)
6	NAG	D	1	1,6	14,14,15	1.18	2 (14%)	17,19,21	2.10	8 (47%)
6	NAG	D	2	6	14,14,15	2.19	4 (28%)	17,19,21	2.48	4 (23%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	NAG	C	1	1,5	-	0/6/23/26	0/1/1/1

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

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	D	2	NAG	C4-C5	6.09	1.65	1.53
5	C	3	MAN	C2-C3	4.43	1.59	1.52
5	C	1	NAG	C1-C2	-3.21	1.47	1.52
5	C	1	NAG	C4-C5	-2.94	1.46	1.53
5	C	2	NAG	C4-C5	-2.86	1.47	1.53

The worst 5 of 23 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	D	2	NAG	C1-O5-C5	7.19	121.93	112.19
5	C	1	NAG	C2-N2-C7	-6.27	113.97	122.90
5	C	2	NAG	C2-N2-C7	-5.84	114.59	122.90
5	C	3	MAN	C2-C3-C4	4.56	118.79	110.89
5	C	1	NAG	O3-C3-C2	-4.12	100.94	109.47

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	C	3	MAN	C1

5 of 7 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	C	2	NAG	O5-C5-C6-O6
5	C	2	NAG	C4-C5-C6-O6
5	C	3	MAN	O5-C5-C6-O6
6	D	2	NAG	C4-C5-C6-O6
5	C	3	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
5	C	1	NAG	1	0

## 5.6 Ligand geometry [i](#)

2 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
7	NAG	A	440	1	14,14,15	1.81	4 (28%)	17,19,21	2.15	6 (35%)
7	NAG	B	410	2	14,14,15	2.47	6 (42%)	17,19,21	3.63	8 (47%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
7	NAG	A	440	1	-	0/6/23/26	0/1/1/1
7	NAG	B	410	2	1/1/5/7	1/6/23/26	0/1/1/1

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	B	410	NAG	O5-C5	5.10	1.53	1.43
7	B	410	NAG	C1-C2	4.21	1.58	1.52
7	B	410	NAG	O5-C1	3.94	1.50	1.43
7	A	440	NAG	O5-C5	3.55	1.50	1.43
7	A	440	NAG	O5-C1	3.41	1.49	1.43

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	410	NAG	C1-O5-C5	7.08	121.79	112.19
7	B	410	NAG	C1-C2-N2	6.05	120.83	110.49

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	410	NAG	C4-C3-C2	-5.81	102.50	111.02
7	B	410	NAG	O3-C3-C2	5.44	120.73	109.47
7	B	410	NAG	O5-C1-C2	-5.30	102.93	111.29

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
7	B	410	NAG	C1

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	B	410	NAG	O5-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 [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.