



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 23, 2021 – 11:26 AM EDT

PDB ID : 1KBG  
Title : MHC Class I H-2KB Presented Glycopeptide RGY8-6H-GAL2  
Authors : Speir, J.A.; Abdel-Motal, U.M.; Jondal, M.; Wilson, I.A.  
Deposited on : 1998-08-28  
Resolution : 2.20 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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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)  
Xtriage (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) : 2.23.2

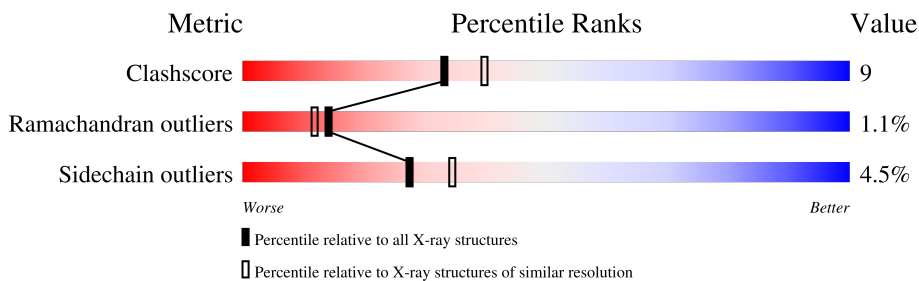
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	H	274	
2	L	99	
3	P	8	
4	A	3	
5	B	2	

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 3304 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 PROTEIN (MAJOR HISTOCOMPATIBILITY COMPLEX CLASS I ANTIGEN H-2KB).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	H	274	Total	C	N	O	S	0	0	0
			2232	1408	393	422	9			

- Molecule 2 is a protein called PROTEIN (BETA-2-MICROGLOBULIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	99	Total	C	N	O	S	0	0	0
			821	524	138	152	7			

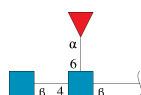
- Molecule 3 is a protein called PROTEIN (SYNTHETIC GLYCOPEPTIDE RGY8-6H-GAL2).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	P	8	Total	C	N	O	S	0	0	0
			68	45	11	11	1			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
P	6	ESC	GLN	engineered mutation	UNP P11212

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



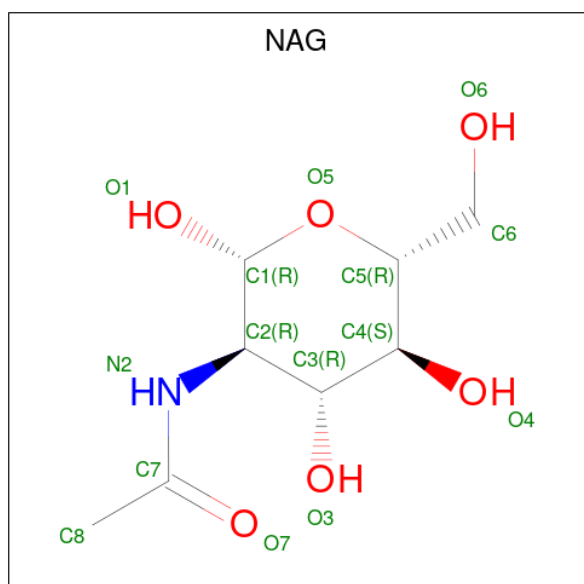
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	A	3	Total	C	N	O	0	0	0
			38	22	2	14			

- Molecule 5 is an oligosaccharide called alpha-D-galactopyranose-(1-4)-beta-D-galactopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
5	B	2	Total	C	O	0	0	0
			23	12	11			

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



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

- Molecule 7 is water.

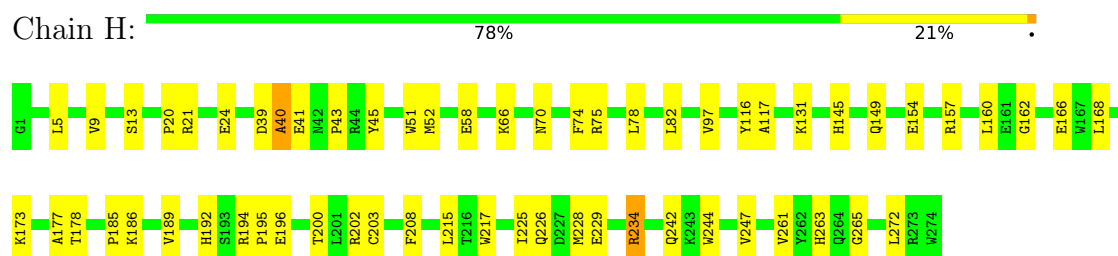
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	H	81	Total	O	0	0
			81	81		
7	L	24	Total	O	0	0
			24	24		
7	P	3	Total	O	0	0
			3	3		

### 3 Residue-property plots

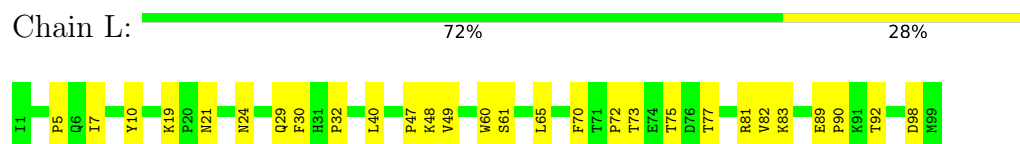
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded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

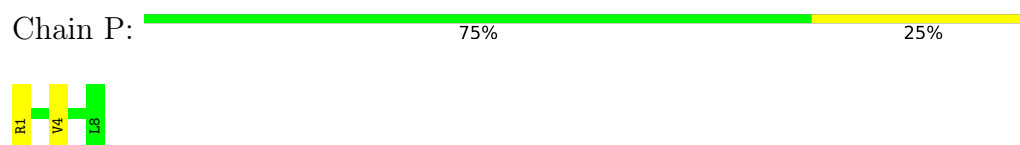
- Molecule 1: PROTEIN (MAJOR HISTOCOMPATIBILITY COMPLEX CLASS I ANTIGEN H-2KB)



- Molecule 2: PROTEIN (BETA-2-MICROGLOBULIN)



- Molecule 3: PROTEIN (SYNTHETIC GLYCOPEPTIDE RGY8-6H-GAL2)



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



- Molecule 5: alpha-D-galactopyranose-(1-4)-beta-D-galactopyranose



GAL1  
GLA2

## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	135.87Å 86.84Å 44.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	18.00 – 2.20	Depositor
% Data completeness (in resolution range)	94.0 (18.00-2.20)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.08	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, $R_{free}$	0.224 , 0.279	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3304	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	30.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NAG, FUC, GLA, GAL, ESC

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	H	0.41	0/2293	0.67	0/3113
2	L	0.42	0/847	0.65	0/1148
3	P	0.44	0/59	0.75	0/75
All	All	0.41	0/3199	0.66	0/4336

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	H	2232	0	2121	38	0
2	L	821	0	796	17	0
3	P	68	0	67	1	0
4	A	38	0	34	4	0
5	B	23	0	20	2	0
6	H	14	0	13	0	0
7	H	81	0	0	0	0
7	L	24	0	0	2	0
7	P	3	0	0	0	0
All	All	3304	0	3051	54	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 9.

All (54) 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:H:177:ALA:HA	4:A:1:NAG:H82	1.43	0.99
1:H:263:HIS:CD2	1:H:265:GLY:H	1.91	0.87
1:H:173:LYS:NZ	4:A:3:FUC:H63	1.93	0.84
1:H:173:LYS:HZ2	4:A:3:FUC:H63	1.41	0.82
2:L:73:THR:HG22	2:L:75:THR:H	1.50	0.75
1:H:263:HIS:HD2	1:H:265:GLY:H	1.32	0.75
1:H:185:PRO:HG3	1:H:208:PHE:HB3	1.76	0.67
1:H:234:ARG:HD3	2:L:10:TYR:CZ	2.31	0.65
1:H:217:TRP:H	1:H:228:MET:HE1	1.63	0.62
5:B:1:GAL:H62	5:B:2:GLA:O2	1.99	0.61
1:H:215:LEU:CD2	1:H:261:VAL:HG22	2.30	0.60
2:L:29:GLN:HA	2:L:61:SER:HB3	1.83	0.60
2:L:83:LYS:HG2	2:L:90:PRO:HB3	1.82	0.59
1:H:194:ARG:HD2	1:H:200:THR:OG1	2.04	0.58
1:H:131:LYS:HZ1	1:H:154:GLU:HG3	1.70	0.57
1:H:217:TRP:HB2	1:H:228:MET:HE2	1.85	0.56
2:L:5:PRO:HB3	2:L:30:PHE:HB3	1.87	0.56
2:L:24:ASN:HB3	2:L:65:LEU:HD11	1.88	0.55
1:H:13:SER:HB3	1:H:78:LEU:HD13	1.89	0.55
2:L:73:THR:HG22	2:L:75:THR:N	2.19	0.55
1:H:66:LYS:HG3	3:P:4:VAL:HG22	1.90	0.54
2:L:32:PRO:HB2	7:L:112:HOH:O	2.10	0.52
2:L:81:ARG:HG3	2:L:92:THR:OG1	2.11	0.51
1:H:5:LEU:HB2	1:H:168:LEU:HD13	1.93	0.50
1:H:145:HIS:O	1:H:149:GLN:HG2	2.12	0.50
1:H:234:ARG:HD3	2:L:10:TYR:CE1	2.48	0.49
1:H:162:GLY:O	1:H:166:GLU:HG3	2.14	0.47
1:H:21:ARG:HH11	1:H:21:ARG:HG2	1.80	0.47
1:H:9:VAL:HG22	1:H:24:GLU:HG2	1.96	0.47
1:H:40:ALA:O	1:H:43:PRO:HD3	2.15	0.47
2:L:21:ASN:HB3	2:L:70:PHE:CE1	2.50	0.46
1:H:234:ARG:NH1	1:H:242:GLN:OE1	2.45	0.46
1:H:234:ARG:HD2	1:H:242:GLN:HG3	1.98	0.45
1:H:202:ARG:HD3	1:H:244:TRP:CE3	2.52	0.45
4:A:1:NAG:H62	4:A:2:NAG:C1	2.46	0.45
1:H:185:PRO:HG3	1:H:208:PHE:CB	2.46	0.45
1:H:70:ASN:O	1:H:74:PHE:HD1	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:117:ALA:HB2	2:L:60:TRP:CE2	2.52	0.45
1:H:192:HIS:HE1	2:L:98:ASP:O	2.01	0.44
1:H:51:TRP:CZ3	1:H:52:MET:SD	3.11	0.44
2:L:19:LYS:O	2:L:72:PRO:HD2	2.18	0.43
1:H:13:SER:HA	1:H:20:PRO:HB3	2.00	0.43
1:H:39:ASP:O	1:H:40:ALA:HB2	2.18	0.43
2:L:7:ILE:HG12	2:L:82:VAL:HG21	2.01	0.42
1:H:97:VAL:HG22	1:H:116:TYR:CD2	2.55	0.42
5:B:1:GAL:H62	5:B:2:GLA:C1	2.50	0.42
1:H:58:GLU:H	1:H:58:GLU:CD	2.22	0.41
2:L:49:VAL:HG21	7:L:123:HOH:O	2.18	0.41
2:L:89:GLU:HA	2:L:90:PRO:HD2	1.94	0.41
1:H:189:VAL:HG23	1:H:272:LEU:HD22	2.02	0.41
1:H:21:ARG:HG2	1:H:21:ARG:NH1	2.36	0.41
1:H:78:LEU:O	1:H:82:LEU:HD13	2.21	0.41
1:H:131:LYS:NZ	1:H:157:ARG:HD2	2.36	0.40
1:H:203:CYS:O	1:H:244:TRP:HA	2.22	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles ⓘ

### 5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	H	272/274 (99%)	259 (95%)	10 (4%)	3 (1%)	14	12
2	L	97/99 (98%)	93 (96%)	3 (3%)	1 (1%)	15	14
3	P	5/8 (62%)	5 (100%)	0	0	100	100
All	All	374/381 (98%)	357 (96%)	13 (4%)	4 (1%)	14	12

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	40	ALA
1	H	195	PRO
1	H	225	ILE
2	L	47	PRO

### 5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	H	232/232 (100%)	221 (95%)	11 (5%)	26	33
2	L	94/94 (100%)	91 (97%)	3 (3%)	39	50
3	P	5/5 (100%)	4 (80%)	1 (20%)	1	1
All	All	331/331 (100%)	316 (96%)	15 (4%)	27	34

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	41	GLU
1	H	45	TYR
1	H	75	ARG
1	H	160	LEU
1	H	178	THR
1	H	186	LYS
1	H	196	GLU
1	H	226	GLN
1	H	229	GLU
1	H	234	ARG
1	H	247	VAL
2	L	40	LEU
2	L	48	LYS
2	L	77	THR
3	P	1	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	H	87	GLN
1	H	115	GLN
1	H	218	GLN
1	H	263	HIS

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	ESC	P	6	3,5	7,8,9	0.64	0	3,8,10	0.55	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
3	ESC	P	6	3,5	-	4/6/7/9	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	P	6	ESC	N-CA-CB-CG
3	P	6	ESC	C-CA-CB-CG

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Mol	Chain	Res	Type	Atoms
3	P	6	ESC	CB-CG-SD-CD
3	P	6	ESC	CA-CB-CG-SD

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates ⓘ

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	$\# Z  > 2$
4	NAG	A	1	1,4	14,14,15	0.59	0	17,19,21	0.73	1 (5%)
4	NAG	A	2	4	14,14,15	0.56	0	17,19,21	0.65	0
4	FUC	A	3	4	10,10,11	0.63	0	14,14,16	0.74	1 (7%)
5	GAL	B	1	3,5	12,12,12	0.66	0	17,17,17	0.59	0
5	GLA	B	2	5	11,11,12	0.63	0	15,15,17	0.36	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
4	NAG	A	1	1,4	-	2/6/23/26	0/1/1/1
4	NAG	A	2	4	-	2/6/23/26	0/1/1/1
4	FUC	A	3	4	-	-	0/1/1/1
5	GAL	B	1	3,5	-	2/2/22/22	0/1/1/1
5	GLA	B	2	5	-	2/2/19/22	0/1/1/1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	3	FUC	C1-C2-C3	2.23	112.41	109.67
4	A	1	NAG	C2-N2-C7	-2.07	119.96	122.90

There are no chirality outliers.

All (8) torsion outliers are listed below:

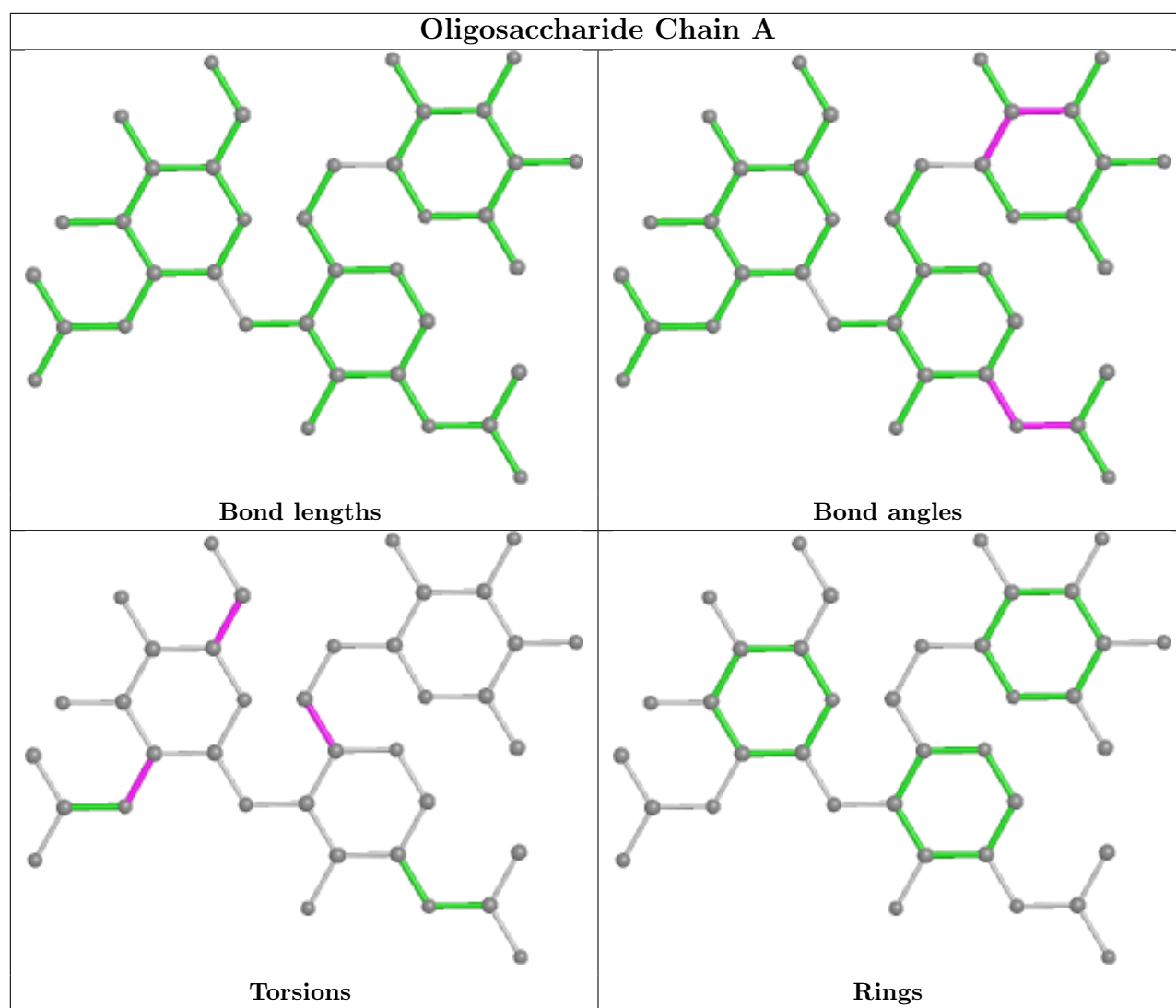
Mol	Chain	Res	Type	Atoms
5	B	1	GAL	O5-C5-C6-O6
5	B	2	GLA	O5-C5-C6-O6
5	B	2	GLA	C4-C5-C6-O6
5	B	1	GAL	C4-C5-C6-O6
4	A	1	NAG	C4-C5-C6-O6
4	A	2	NAG	C4-C5-C6-O6
4	A	1	NAG	O5-C5-C6-O6
4	A	2	NAG	C3-C2-N2-C7

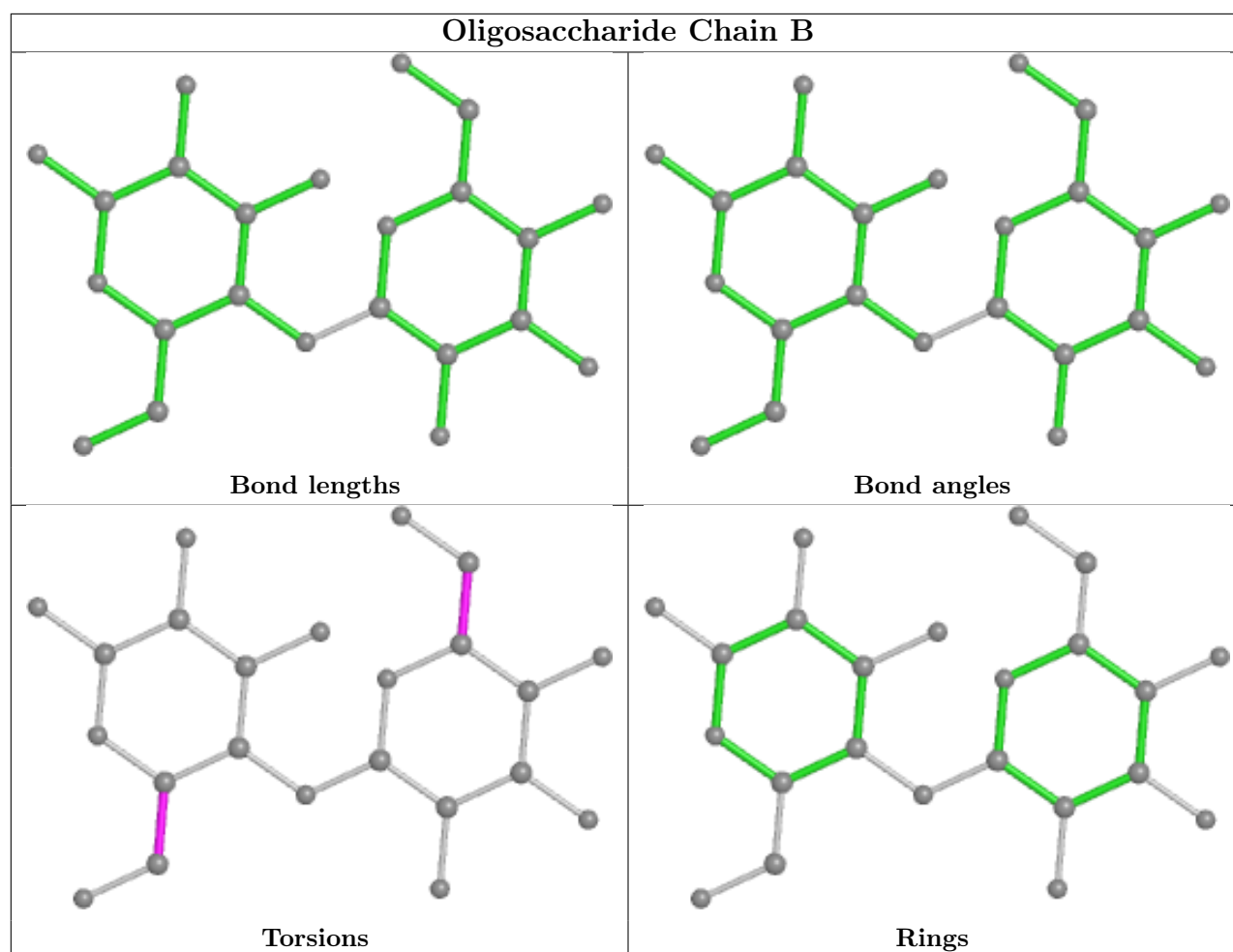
There are no ring outliers.

5 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	2	GLA	2	0
5	B	1	GAL	2	0
4	A	3	FUC	2	0
4	A	2	NAG	1	0
4	A	1	NAG	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 oligosaccharide.





## 5.6 Ligand geometry [i](#)

1 ligand is 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	$\# Z  > 2$
6	NAG	H	1001	1	14,14,15	0.50	0	17,19,21	0.62	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
6	NAG	H	1001	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	H	1001	NAG	C1-C2-N2-C7
6	H	1001	NAG	C3-C2-N2-C7

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.