



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 15, 2023 – 04:56 PM EDT

PDB ID : 1XHG
Title : Crystal structure of a 40 kDa signalling protein from Porcine (SPP-40) at 2.89Å resolution
Authors : Srivastava, D.B.; Ethayathulla, A.S.; Singh, N.; Kaur, P.; Sharma, S.; Singh, T.P.
Deposited on : 2004-09-19
Resolution : 2.90 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

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>.

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) : 2.35

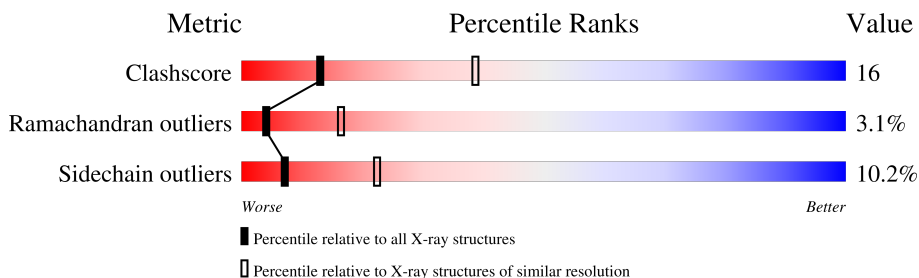
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (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 ≥ 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	361	
2	B	2	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2982 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 SPP-40.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	361	2875	1835	502	529	9	0	0	0

- Molecule 2 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			
2	B	2	28	16	2	10	0	0	0

- Molecule 3 is water.

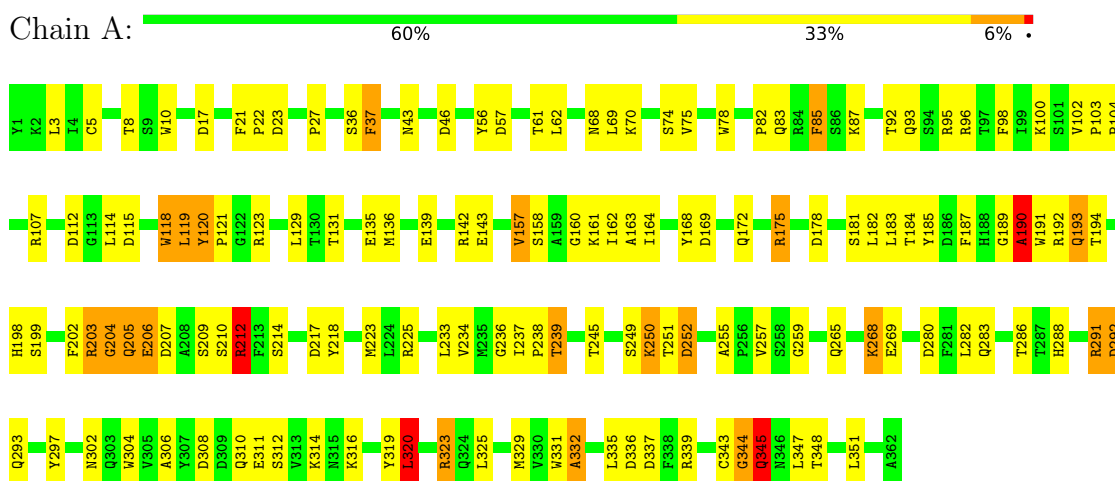
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	79	Total	O	0	0
			79	79		

3 Residue-property plots

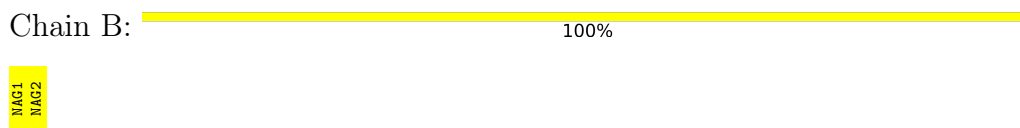
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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: SPP-40



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



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 21	Depositor
Cell constants a, b, c, α , β , γ	62.75Å 66.45Å 107.65Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	56.00 – 2.90	Depositor
% Data completeness (in resolution range)	90.2 (56.00-2.90)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.13	Depositor
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.177 , 0.218	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2982	wwPDB-VP
Average B, all atoms (Å ²)	30.0	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

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	1.10	2/2950 (0.1%)	1.08	19/3999 (0.5%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	56	TYR	CE2-CZ	-5.10	1.31	1.38
1	A	157	VAL	CB-CG1	-5.10	1.42	1.52

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	207	ASP	CB-CG-OD2	8.24	125.72	118.30
1	A	119	LEU	CA-CB-CG	-8.16	96.53	115.30
1	A	178	ASP	CB-CG-OD2	8.09	125.58	118.30
1	A	337	ASP	CB-CG-OD2	7.98	125.48	118.30
1	A	320	LEU	CA-CB-CG	7.41	132.34	115.30
1	A	123	ARG	NE-CZ-NH2	7.11	123.86	120.30
1	A	212	ARG	CD-NE-CZ	6.89	133.25	123.60
1	A	212	ARG	CB-CA-C	-6.44	97.52	110.40
1	A	209	SER	N-CA-C	-6.43	93.65	111.00
1	A	336	ASP	CB-CG-OD2	6.42	124.08	118.30
1	A	190	ALA	N-CA-C	5.80	126.66	111.00
1	A	178	ASP	CB-CG-OD1	-5.78	113.09	118.30
1	A	308	ASP	CB-CG-OD2	5.61	123.35	118.30
1	A	292	ASP	CB-CG-OD2	5.55	123.29	118.30
1	A	112	ASP	CB-CG-OD2	5.43	123.19	118.30
1	A	280	ASP	CB-CG-OD2	5.43	123.18	118.30
1	A	217	ASP	CB-CG-OD2	5.29	123.06	118.30
1	A	46	ASP	CB-CG-OD2	5.16	122.95	118.30
1	A	252	ASP	CB-CG-OD2	5.07	122.86	118.30

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	2875	0	2808	94	0
2	B	28	0	25	0	0
3	A	79	0	0	6	0
All	All	2982	0	2833	94	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 16.

All (94) 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:203:ARG:HB3	1:A:212:ARG:NH2	1.65	1.11
1:A:203:ARG:HB3	1:A:212:ARG:HH21	0.84	0.99
1:A:203:ARG:CB	1:A:212:ARG:HH21	1.77	0.96
1:A:8:THR:HA	1:A:36:SER:HB2	1.61	0.83
1:A:185:TYR:HB3	1:A:238:PRO:HG3	1.66	0.77
1:A:310:GLN:O	1:A:314:LYS:HG3	1.84	0.77
1:A:95:ARG:CZ	1:A:131:THR:HG21	2.18	0.73
1:A:319:TYR:CZ	1:A:323:ARG:HD2	2.25	0.71
1:A:189:GLY:O	1:A:191:TRP:CD1	2.43	0.70
1:A:69:LEU:HD13	1:A:70:LYS:N	2.06	0.70
1:A:185:TYR:CB	1:A:238:PRO:HG3	2.24	0.68
1:A:199:SER:HB2	3:A:435:HOH:O	1.92	0.67
1:A:332:ALA:HB1	1:A:335:LEU:HG	1.75	0.67
1:A:210:SER:HB3	1:A:214:SER:HB2	1.76	0.66
1:A:102:VAL:HB	1:A:103:PRO:HD3	1.80	0.63
1:A:239:THR:HG22	1:A:335:LEU:HB2	1.80	0.63
1:A:57:ASP:O	1:A:61:THR:HG23	1.99	0.62
1:A:198:HIS:CE1	3:A:415:HOH:O	2.51	0.62
1:A:75:VAL:CG2	1:A:114:LEU:HD11	2.30	0.62
1:A:239:THR:HG23	1:A:239:THR:O	1.98	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:345:GLN:HA	3:A:402:HOH:O	1.98	0.62
1:A:169:ASP:OD2	1:A:172:GLN:HG3	2.00	0.62
1:A:103:PRO:HB2	1:A:104:PRO:CD	2.31	0.60
1:A:192:ARG:O	1:A:194:THR:N	2.34	0.60
1:A:192:ARG:C	1:A:194:THR:H	2.07	0.58
1:A:3:LEU:HD22	1:A:5:CYS:SG	2.44	0.58
1:A:343:CYS:O	1:A:344:GLY:C	2.42	0.57
1:A:239:THR:CG2	1:A:335:LEU:HB2	2.35	0.57
1:A:187:PHE:O	1:A:192:ARG:NH1	2.37	0.57
1:A:78:TRP:NE1	1:A:119:LEU:HD13	2.20	0.56
1:A:43:ASN:O	1:A:98:PHE:HA	2.06	0.56
1:A:204:GLY:O	1:A:206:GLU:N	2.39	0.55
1:A:251:THR:HG22	3:A:423:HOH:O	2.06	0.55
1:A:239:THR:O	1:A:239:THR:CG2	2.54	0.54
1:A:157:VAL:O	1:A:183:LEU:HG	2.09	0.52
1:A:190:ALA:C	1:A:192:ARG:H	2.12	0.52
1:A:312:SER:O	1:A:316:LYS:HG3	2.09	0.52
1:A:78:TRP:CD1	1:A:119:LEU:HD13	2.46	0.51
1:A:172:GLN:O	1:A:175:ARG:HG2	2.11	0.51
1:A:75:VAL:HG21	1:A:114:LEU:HD11	1.92	0.50
1:A:320:LEU:HB2	1:A:325:LEU:HD12	1.92	0.50
1:A:344:GLY:O	1:A:345:GLN:C	2.49	0.50
1:A:210:SER:HB3	1:A:214:SER:CB	2.42	0.50
1:A:304:TRP:CZ3	1:A:306:ALA:HB2	2.46	0.49
1:A:37:PHE:CD1	1:A:37:PHE:N	2.75	0.49
1:A:164:ILE:HA	1:A:168:TYR:HD2	1.76	0.49
1:A:192:ARG:C	1:A:194:THR:N	2.67	0.48
1:A:286:THR:HG22	1:A:288:HIS:CE1	2.48	0.48
1:A:103:PRO:HB2	1:A:104:PRO:HD3	1.96	0.48
1:A:239:THR:HG21	1:A:332:ALA:O	2.14	0.48
1:A:189:GLY:O	1:A:191:TRP:N	2.39	0.47
1:A:74:SER:HA	1:A:115:ASP:HB3	1.96	0.47
1:A:268:LYS:O	1:A:269:GLU:HB2	2.14	0.47
1:A:10:TRP:HB3	3:A:391:HOH:O	2.14	0.47
1:A:120:TYR:CE2	1:A:158:SER:HB3	2.50	0.47
1:A:347:LEU:HD23	1:A:348:THR:N	2.30	0.47
1:A:120:TYR:CD2	1:A:120:TYR:N	2.77	0.46
1:A:157:VAL:HG12	1:A:158:SER:N	2.30	0.46
1:A:236:GLY:HA2	1:A:329:MET:HB3	1.97	0.46
1:A:120:TYR:HA	1:A:121:PRO:HD2	1.78	0.46
1:A:27:PRO:HG3	1:A:62:LEU:HD22	1.96	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:234:VAL:HG12	1:A:329:MET:HB2	1.98	0.46
1:A:160:GLY:O	1:A:163:ALA:N	2.49	0.45
1:A:202:PHE:O	1:A:293:GLN:HG2	2.16	0.45
1:A:237:ILE:N	1:A:329:MET:O	2.38	0.45
1:A:257:VAL:CG1	1:A:259:GLY:H	2.30	0.45
1:A:182:LEU:HD21	1:A:223:MET:HG3	1.98	0.45
1:A:161:LYS:HD3	1:A:218:TYR:OH	2.17	0.44
1:A:17:ASP:HB3	1:A:339:ARG:HE	1.82	0.44
1:A:85:PHE:HB3	1:A:118:TRP:CE2	2.53	0.44
1:A:331:TRP:O	1:A:332:ALA:HB3	2.18	0.43
1:A:78:TRP:HZ3	1:A:331:TRP:CZ2	2.36	0.43
1:A:139:GLU:OE1	1:A:142:ARG:NH2	2.51	0.43
1:A:21:PHE:HB2	1:A:23:ASP:HB3	2.00	0.43
1:A:92:THR:HG22	1:A:95:ARG:NH2	2.33	0.43
1:A:21:PHE:HB3	1:A:22:PRO:HD2	2.01	0.43
1:A:257:VAL:HG12	1:A:259:GLY:H	1.84	0.43
1:A:21:PHE:C	1:A:23:ASP:N	2.67	0.42
1:A:291:ARG:HE	1:A:291:ARG:HB2	1.52	0.42
1:A:345:GLN:HE21	1:A:345:GLN:HB3	1.50	0.42
1:A:193:GLN:H	1:A:193:GLN:HG2	1.60	0.41
1:A:92:THR:HG22	1:A:95:ARG:HH22	1.85	0.41
1:A:82:PRO:O	1:A:83:GLN:C	2.57	0.41
1:A:344:GLY:O	1:A:345:GLN:O	2.38	0.41
1:A:237:ILE:HA	1:A:238:PRO:HD3	1.78	0.41
1:A:250:LYS:HG2	1:A:255:ALA:HA	2.03	0.41
1:A:311:GLU:O	1:A:312:SER:C	2.58	0.41
1:A:135:GLU:O	1:A:136:MET:C	2.58	0.41
1:A:245:THR:HG23	1:A:302:ASN:ND2	2.35	0.41
1:A:297:TYR:CD2	1:A:304:TRP:NE1	2.89	0.41
1:A:316:LYS:O	1:A:319:TYR:HB3	2.20	0.41
1:A:332:ALA:HB1	1:A:335:LEU:CG	2.48	0.41
1:A:297:TYR:CD2	1:A:304:TRP:CE2	3.08	0.40
1:A:181:SER:CB	3:A:437:HOH:O	2.69	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	359/361 (99%)	315 (88%)	33 (9%)	11 (3%)	4 16

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	190	ALA
1	A	205	GLN
1	A	193	GLN
1	A	204	GLY
1	A	344	GLY
1	A	345	GLN
1	A	268	LYS
1	A	118	TRP
1	A	332	ALA
1	A	37	PHE
1	A	120	TYR

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	303/303 (100%)	272 (90%)	31 (10%)	7 22

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	68	ASN
1	A	85	PHE
1	A	87	LYS
1	A	93	GLN
1	A	96	ARG
1	A	100	LYS
1	A	107	ARG
1	A	129	LEU
1	A	143	GLU
1	A	162	ILE
1	A	175	ARG
1	A	184	THR
1	A	203	ARG
1	A	205	GLN
1	A	206	GLU
1	A	212	ARG
1	A	225	ARG
1	A	233	LEU
1	A	239	THR
1	A	249	SER
1	A	250	LYS
1	A	252	ASP
1	A	265	GLN
1	A	282	LEU
1	A	283	GLN
1	A	291	ARG
1	A	292	ASP
1	A	320	LEU
1	A	323	ARG
1	A	345	GLN
1	A	351	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	60	ASN
1	A	68	ASN
1	A	193	GLN
1	A	265	GLN
1	A	288	HIS
1	A	294	GLN
1	A	303	GLN
1	A	310	GLN

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Mol	Chain	Res	Type
1	A	315	ASN
1	A	345	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](#)

2 monosaccharides are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	NAG	B	1	2,1	14,14,15	0.99	0	17,19,21	1.44	1 (5%)
2	NAG	B	2	2	14,14,15	1.02	1 (7%)	17,19,21	4.24	7 (41%)

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

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

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2	NAG	O5-C1	-3.06	1.38	1.43

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2	NAG	O5-C1-C2	-12.62	91.36	111.29
2	B	2	NAG	O5-C5-C4	-7.07	93.62	110.83
2	B	2	NAG	C1-O5-C5	-7.07	102.61	112.19
2	B	1	NAG	O5-C1-C2	-4.20	104.66	111.29
2	B	2	NAG	O5-C5-C6	3.44	112.60	107.20
2	B	2	NAG	C2-N2-C7	-3.24	118.28	122.90
2	B	2	NAG	C3-C4-C5	-2.68	105.46	110.24
2	B	2	NAG	O4-C4-C5	2.03	114.33	109.30

There are no chirality outliers.

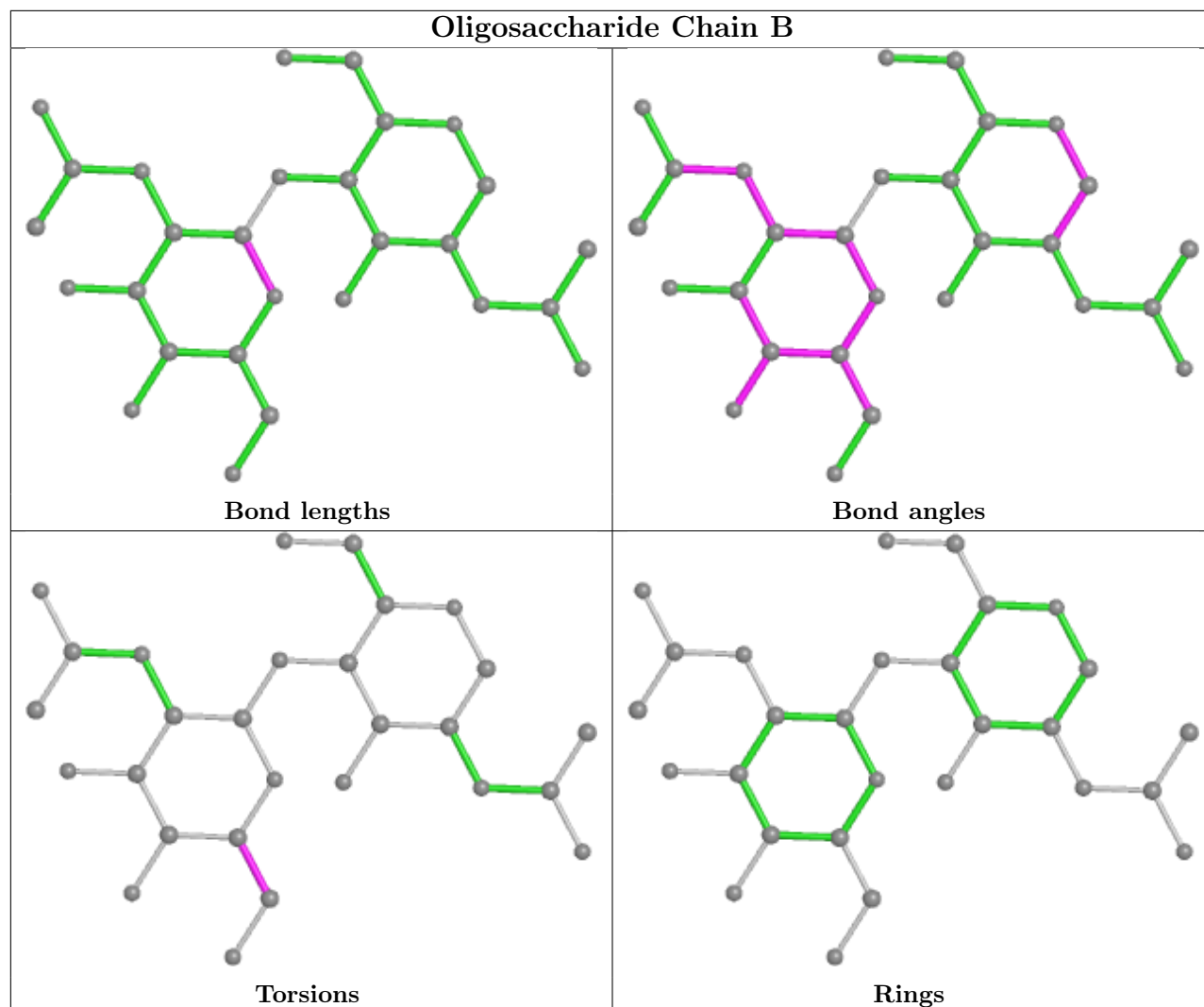
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	2	NAG	O5-C5-C6-O6
2	B	2	NAG	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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](#)

There are no ligands in this entry.

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](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.