



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 01:04 AM UTC

PDB ID : 1A4G / pdb_00001a4g
Title : INFLUENZA VIRUS B/BEIJING/1/87 NEURAMINIDASE COMPLEXED
WITH ZANAMIVIR
Authors : Cleasby, A.; Singh, O.; Skarzynski, T.; Wonacott, A.J.
Deposited on : 1998-01-29
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

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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

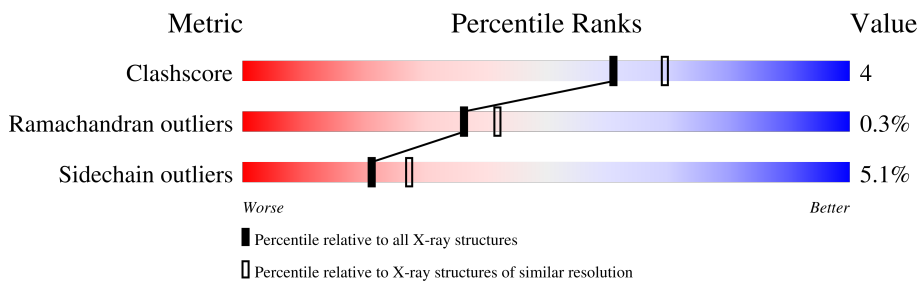
1 Overall quality at a glance

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	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (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 ≥ 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	390	
1	B	390	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 6641 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 NEURAMINIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	390	Total	C	N	O	S	0	0	0
			3036	1899	533	575	29			
1	B	390	Total	C	N	O	S	0	0	0
			3036	1899	533	575	29			

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

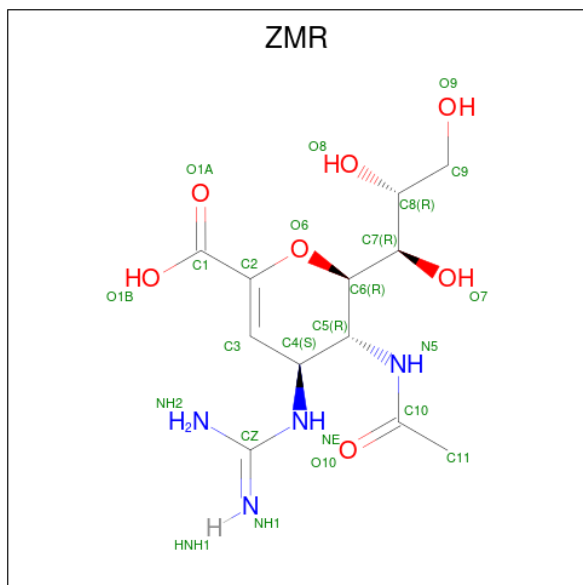


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Ca 1 1	0	0
3	B	2	Total Ca 2 2	0	0

- Molecule 4 is ZANAMIVIR (CCD ID: ZMR) (formula: $C_{12}H_{20}N_4O_7$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O 23 12 4 7	0	0
4	B	1	Total C N O 23 12 4 7	0	0

- Molecule 5 is water.

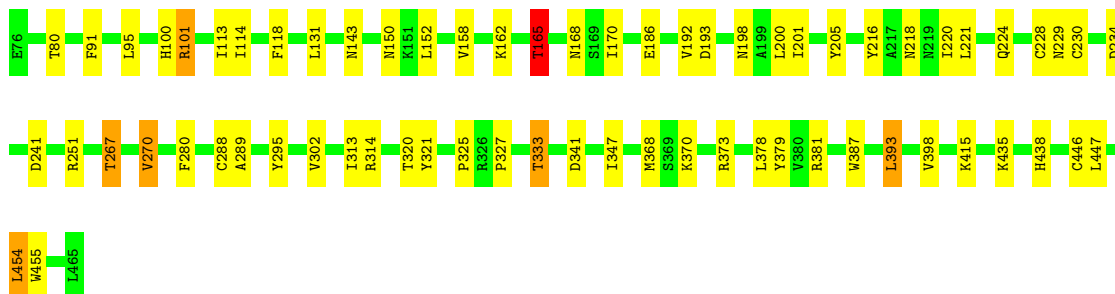
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	254	Total O 254 254	0	0
5	B	238	Total O 238 238	0	0

Note EDS was not executed.

Chain A: 84% 14%



Chain B: 83% 15%



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	88.20Å 88.20Å 221.10Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	34.00 – 2.20	Depositor
% Data completeness (in resolution range)	(Not available) (34.00-2.20)	Depositor
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.8	Depositor
R, R_{free}	0.198 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	6641	wwPDB-VP
Average B, all atoms (Å ²)	13.0	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, ZMR, CA

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	0.72	0/3109	1.39	14/4197 (0.3%)
1	B	0.73	0/3109	1.45	21/4197 (0.5%)
All	All	0.72	0/6218	1.42	35/8394 (0.4%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

There are no bond length outliers.

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	270	VAL	N-CA-CB	-11.33	97.65	112.26
1	B	224	GLN	N-CA-C	10.92	122.76	111.07
1	A	224	GLN	N-CA-C	10.44	122.24	111.07
1	A	295	TYR	N-CA-C	8.31	124.10	113.88
1	B	341	ASP	CA-CB-CG	7.77	120.37	112.60
1	A	92	GLN	OE1-CD-NE2	-7.59	115.01	122.60
1	B	165	THR	N-CA-CB	-7.22	99.94	110.70
1	B	295	TYR	N-CA-C	6.75	121.64	113.41
1	B	150	ASN	CA-CB-CG	6.65	119.25	112.60
1	A	170	ILE	CB-CA-C	-6.57	101.04	110.83
1	B	170	ILE	CB-CA-C	-6.57	100.83	110.81
1	B	193	ASP	CA-CB-CG	6.48	119.08	112.60
1	A	193	ASP	CA-CB-CG	6.44	119.04	112.60
1	B	333	THR	N-CA-CB	-6.36	101.26	110.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	270	VAL	CB-CA-C	6.35	119.07	111.20
1	B	100	HIS	CA-CB-CG	-6.30	107.50	113.80
1	B	241	ASP	CA-CB-CG	6.25	118.85	112.60
1	B	267	THR	N-CA-CB	-5.87	101.69	111.20
1	B	454	LEU	N-CA-C	5.82	120.39	113.12
1	A	209	TYR	N-CA-C	-5.76	101.12	109.59
1	A	92	GLN	CG-CD-NE2	5.58	124.77	116.40
1	B	221	LEU	N-CA-C	-5.58	102.14	110.23
1	B	118	PHE	CA-CB-CG	5.43	119.23	113.80
1	A	221	LEU	N-CA-C	-5.34	102.49	110.23
1	A	289	ALA	N-CA-C	-5.33	100.49	109.07
1	A	454	LEU	N-CA-CB	-5.28	103.57	110.59
1	B	170	ILE	N-CA-C	-5.23	100.94	108.53
1	A	241	ASP	CA-CB-CG	5.14	117.74	112.60
1	B	143	ASN	OD1-CG-ND2	-5.11	117.49	122.60
1	B	218	ASN	N-CA-C	5.10	118.24	111.30
1	B	447	LEU	N-CA-C	-5.07	102.54	110.10
1	A	267	THR	N-CA-CB	-5.06	103.00	111.20
1	A	416	ASP	CA-CB-CG	5.04	117.64	112.60
1	A	254	LYS	N-CA-C	-5.04	100.31	108.52
1	B	289	ALA	N-CA-C	-5.00	100.36	108.52

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	321	TYR	Sidechain

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	3036	0	2923	30	0
1	B	3036	0	2923	20	0
2	A	14	0	13	0	0
2	B	14	0	13	0	0
3	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	2	0	0	0	0
4	A	23	0	17	0	0
4	B	23	0	19	1	0
5	A	254	0	0	5	0
5	B	238	0	0	2	0
All	All	6641	0	5908	50	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 4.

All (50) 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:192:VAL:HG22	1:A:201:ILE:HD13	1.66	0.77
1:A:116:GLU:HB2	1:A:131:LEU:HD23	1.74	0.67
1:B:192:VAL:HG22	1:B:201:ILE:HD13	1.78	0.66
1:B:165:THR:HG22	1:B:168:ASN:HB2	1.79	0.63
1:B:302:VAL:HG22	1:B:313:ILE:HG12	1.81	0.62
4:B:466:ZMR:H113	5:B:694:HOH:O	1.98	0.62
1:A:272:HIS:HB2	5:A:674:HOH:O	2.02	0.60
1:A:201:ILE:HG12	1:A:221:LEU:HD21	1.86	0.56
1:A:284:LYS:HE3	1:A:305:ASN:HD21	1.73	0.54
1:A:284:LYS:HE3	1:A:305:ASN:ND2	2.23	0.53
1:A:347:ILE:HD12	1:A:373:ARG:HG2	1.92	0.51
1:B:113:ILE:HG23	1:B:438:HIS:O	2.11	0.51
1:A:295:TYR:HE2	5:A:674:HOH:O	1.97	0.48
1:A:269:ARG:HH21	1:A:339:ASN:HD21	1.63	0.47
1:A:102:PHE:O	1:A:109:SER:HB2	2.16	0.46
1:A:356:MET:HE1	1:A:382:TYR:CE1	2.51	0.45
1:A:351:PHE:HA	1:A:363:TRP:O	2.16	0.45
1:A:356:MET:HE1	1:A:382:TYR:HE1	1.81	0.45
1:A:379:TYR:HB3	1:A:393:LEU:HB3	1.99	0.45
1:B:379:TYR:HB3	1:B:393:LEU:HB3	1.98	0.45
1:B:314:ARG:HB2	1:B:387:TRP:CD1	2.51	0.44
1:A:134:TYR:O	1:B:101:ARG:HD3	2.17	0.44
1:B:192:VAL:HA	1:B:200:LEU:O	2.18	0.44
1:B:288:CYS:HB2	1:B:302:VAL:HB	1.98	0.44
1:A:302:VAL:HG22	1:A:313:ILE:HG12	2.00	0.44
1:B:320:THR:HB	1:B:393:LEU:HD22	2.00	0.43
1:A:131:LEU:HD22	1:A:131:LEU:N	2.32	0.43
1:A:247:ILE:HA	5:A:674:HOH:O	2.19	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:92:GLN:HE22	1:A:454:LEU:HB2	1.84	0.42
1:A:116:GLU:HB2	1:A:131:LEU:CD2	2.45	0.42
1:A:201:ILE:HB	1:A:213:TYR:HB3	2.01	0.42
1:A:133:HIS:HE1	5:A:702:HOH:O	2.02	0.42
1:A:121:CYS:HA	1:A:126:CYS:HA	2.02	0.42
1:A:125:GLU:HB2	5:A:606:HOH:O	2.20	0.42
1:A:248:SER:O	1:A:272:HIS:HA	2.20	0.42
1:B:325:PRO:HA	1:B:370:LYS:O	2.20	0.42
1:A:229:ASN:HB3	1:A:280:PHE:CE2	2.55	0.42
1:B:186:GLU:HB3	1:B:205:TYR:CZ	2.54	0.41
1:B:216:TYR:CZ	1:B:251:ARG:HD3	2.55	0.41
1:B:91:PHE:HA	1:B:446:CYS:O	2.21	0.41
1:B:158:VAL:HB	1:B:162:LYS:HB2	2.02	0.40
1:A:92:GLN:HE22	1:A:454:LEU:H	1.68	0.40
1:B:230:CYS:HA	1:B:234:ASP:O	2.21	0.40
1:A:325:PRO:HA	1:A:370:LYS:O	2.21	0.40
1:B:347:ILE:HD12	1:B:373:ARG:HG2	2.02	0.40
1:B:368:MET:HE1	1:B:398:VAL:HG13	2.04	0.40
1:B:415:LYS:HE3	5:B:620:HOH:O	2.21	0.40
1:A:277:THR:O	1:A:288:CYS:HA	2.22	0.40
1:A:368:MET:HE1	1:A:398:VAL:HG13	2.02	0.40
1:B:229:ASN:HB3	1:B:280:PHE:CE2	2.56	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	388/390 (100%)	374 (96%)	13 (3%)	1 (0%)	36	42
1	B	388/390 (100%)	370 (95%)	17 (4%)	1 (0%)	36	42
All	All	776/780 (100%)	744 (96%)	30 (4%)	2 (0%)	36	42

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	220	ILE
1	A	220	ILE

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	A	324/324 (100%)	310 (96%)	14 (4%)	26	35
1	B	324/324 (100%)	305 (94%)	19 (6%)	18	22
All	All	648/648 (100%)	615 (95%)	33 (5%)	21	27

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	77	PRO
1	A	78	GLU
1	A	80	THR
1	A	101	ARG
1	A	245	SER
1	A	267	THR
1	A	294	SER
1	A	306	VAL
1	A	333	THR
1	A	393	LEU
1	A	402	MET
1	A	434	LYS
1	A	454	LEU
1	A	455	TRP
1	B	80	THR
1	B	95	LEU
1	B	101	ARG
1	B	114	ILE
1	B	131	LEU
1	B	152	LEU
1	B	165	THR

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Mol	Chain	Res	Type
1	B	198	ASN
1	B	228	CYS
1	B	267	THR
1	B	270	VAL
1	B	327	PRO
1	B	333	THR
1	B	378	LEU
1	B	381	ARG
1	B	393	LEU
1	B	435	LYS
1	B	454	LEU
1	B	455	TRP

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	92	GLN
1	A	168	ASN
1	A	218	ASN
1	A	229	ASN
1	A	339	ASN
1	B	108	ASN
1	B	133	HIS
1	B	168	ASN
1	B	198	ASN
1	B	229	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 7 ligands modelled in this entry, 3 are monoatomic - leaving 4 for Mogul analysis.

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	A	1	1	14,14,15	0.86	0	17,19,21	1.33	2 (11%)
4	ZMR	B	466	-	22,23,23	1.56	3 (13%)	24,32,32	1.67	5 (20%)
2	NAG	B	1	1	14,14,15	0.77	0	17,19,21	0.89	0
4	ZMR	A	466	-	22,23,23	3.35	5 (22%)	24,32,32	3.07	6 (25%)

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	A	1	1	-	2/6/23/26	0/1/1/1
4	ZMR	B	466	-	-	0/22/38/38	0/1/1/1
2	NAG	B	1	1	-	0/6/23/26	0/1/1/1
4	ZMR	A	466	-	-	0/22/38/38	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	466	ZMR	O7-C7	-12.96	1.10	1.43
4	A	466	ZMR	C8-C7	-5.18	1.44	1.53
4	A	466	ZMR	O1A-C1	4.63	1.34	1.22
4	B	466	ZMR	O1A-C1	4.47	1.33	1.22
4	B	466	ZMR	O1B-C1	-4.14	1.19	1.30
4	A	466	ZMR	O1B-C1	-4.08	1.19	1.30
4	B	466	ZMR	O6-C6	-3.12	1.40	1.46
4	A	466	ZMR	C6-C5	2.03	1.56	1.53

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	466	ZMR	O7-C7-C6	-11.05	85.54	109.44
4	A	466	ZMR	O7-C7-C8	7.54	126.06	108.93
4	B	466	ZMR	C3-C4-NE	5.44	118.56	110.98
2	A	1	NAG	C2-N2-C7	3.38	127.43	122.90
4	A	466	ZMR	O8-C8-C7	-3.16	101.85	109.25
4	A	466	ZMR	O6-C6-C7	3.06	111.36	105.98
4	B	466	ZMR	O6-C2-C1	2.91	117.82	112.02
4	B	466	ZMR	O1B-C1-C2	2.63	120.03	114.06
2	A	1	NAG	C1-C2-N2	-2.61	106.32	110.43
4	B	466	ZMR	O6-C6-C7	2.54	110.44	105.98
4	A	466	ZMR	O6-C2-C1	2.27	116.55	112.02
4	B	466	ZMR	C3-C2-C1	-2.04	119.13	123.56
4	A	466	ZMR	O1B-C1-C2	2.02	118.63	114.06

There are no chirality outliers.

All (2) torsion outliers are listed below:

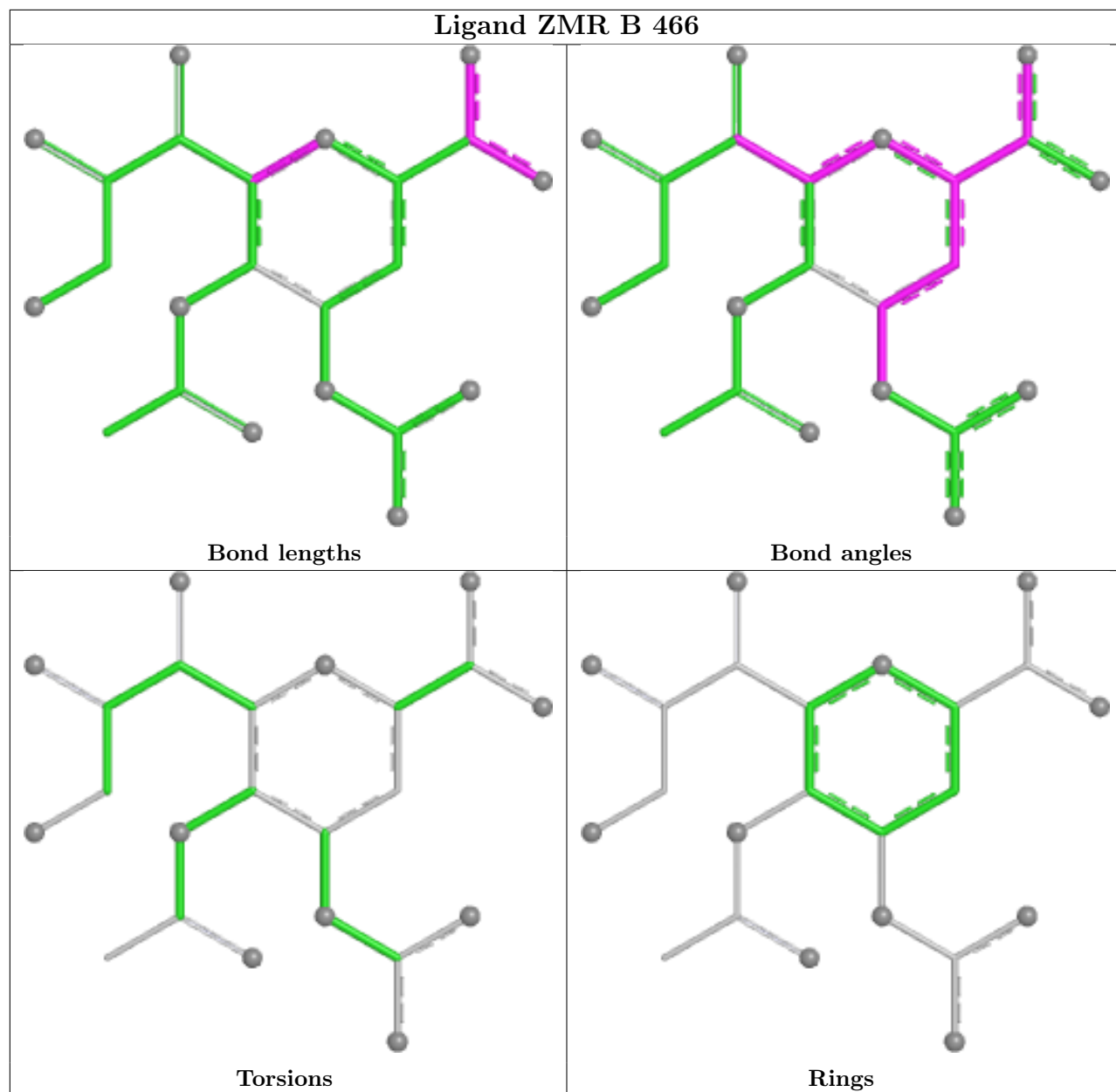
Mol	Chain	Res	Type	Atoms
2	A	1	NAG	C8-C7-N2-C2
2	A	1	NAG	O7-C7-N2-C2

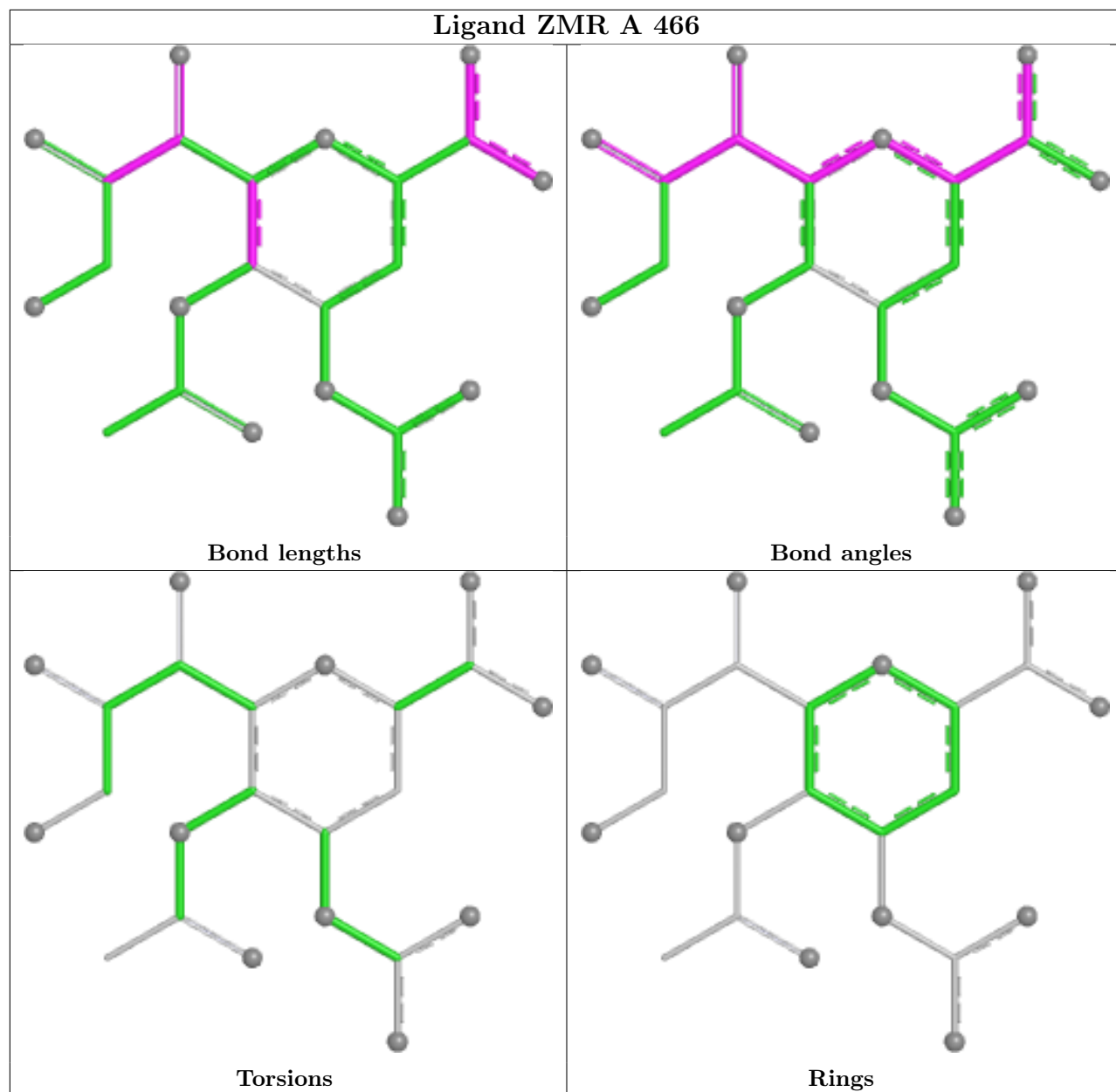
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	466	ZMR	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 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

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.