W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Aug 8, 2023 – 01:39 AM EDT

PDB ID	:	1QHA
Title	:	HUMAN HEXOKINASE TYPE I COMPLEXED WITH ATP ANALOGUE AMP-PNP
Authors	:	Rosano, C.; Sabini, E.; Deriu, D.; Magnani, M.; Bolognesi, M.
Deposited on	:	1999-05-11
Resolution	:	2.25 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

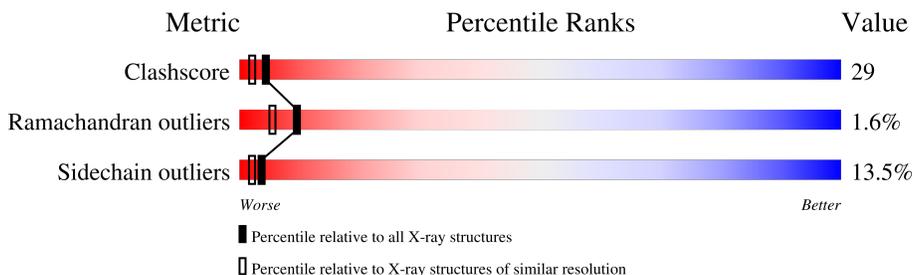|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (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 2.25 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	Percentile Ranks	Value
Clashscore		29
Ramachandran outliers		1.6%
Sidechain outliers		13.5%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)

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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	917	48% 35% 12% · ·
1	B	917	61% 26% 9% · ·

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:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	G6P	A	919	X	-	X	-
3	G6P	A	921	X	-	-	-
3	G6P	B	1916	X	-	-	-
3	G6P	B	1918	X	-	-	-

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 14737 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 (HEXOKINASE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	903	Total	C	N	O	S	67	0	0
			7065	4428	1246	1338	53			
1	B	899	Total	C	N	O	S	62	0	0
			7032	4407	1241	1331	53			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	776	LEU	MET	conflict	UNP P19367
B	776	LEU	MET	conflict	UNP P19367

- Molecule 2 is alpha-D-glucopyranose (three-letter code: GLC) (formula: $C_6H_{12}O_6$).
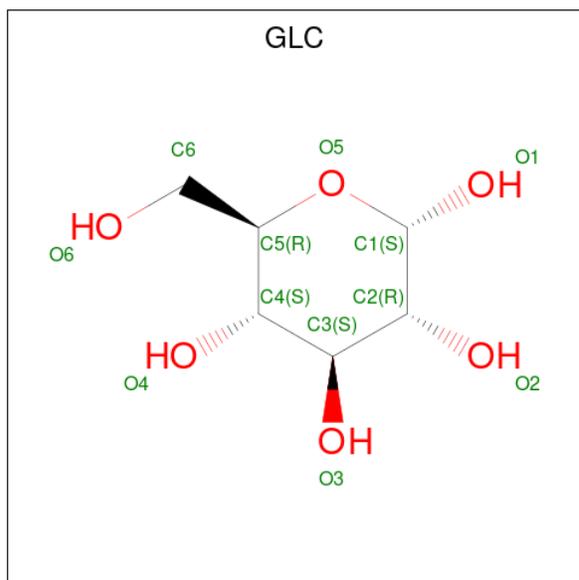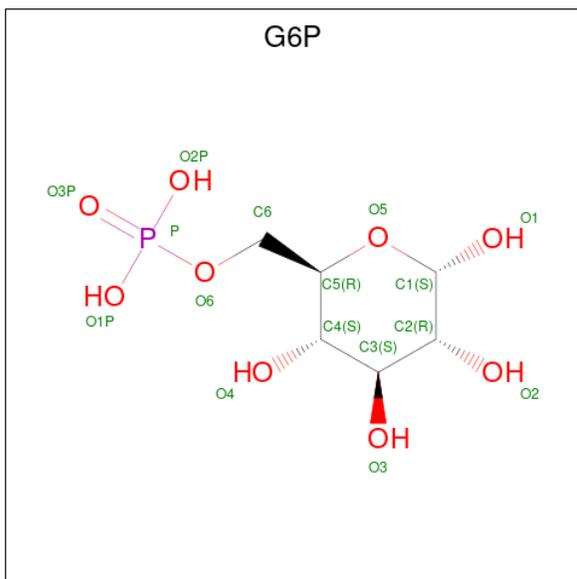

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			12	6	6		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 12	C 6	O 6	0	0
2	B	1	Total 12	C 6	O 6	0	0
2	B	1	Total 12	C 6	O 6	0	0

- Molecule 3 is 6-O-phosphono-alpha-D-glucopyranose (three-letter code: G6P) (formula: $C_6H_{13}O_9P$).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total 16	C 6	O 9	P 1	0	0
3	A	1	Total 16	C 6	O 9	P 1	0	0
3	B	1	Total 16	C 6	O 9	P 1	0	0
3	B	1	Total 16	C 6	O 9	P 1	0	0

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	3	Total 3	Mg 3	0	0
4	B	3	Total 3	Mg 3	0	0

- Molecule 5 is PHOSPHOAMINOPHOSPHONIC ACID-ADENYLATE ESTER (three-letter code: ANP) (formula: $C_{10}H_{17}N_6O_{12}P_3$).
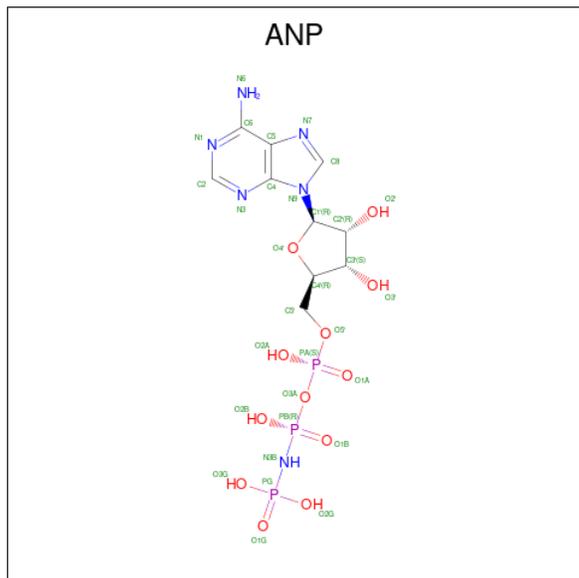
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	P	0	0
			31	10	6	12	3		
5	B	1	Total	C	N	O	P	0	0
			31	10	6	12	3		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	188	Total	O	0	0
			188	188		
6	B	272	Total	O	0	0
			272	272		

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 (HEXOKINASE)

E894 D895 G896 K899 A902 V907 G908 V909 R910 L911 R912 T913 E914 ALA SER SER

● Molecule 1: PROTEIN (HEXOKINASE)

Chain B:

61%   26%   9%

MET ILE ALA ALA GLN LEU LEU ALA TYR TYR PHE THR GLU LEU LYS D16 D17 Q18 V19 K20 K21 I22 D23 K24 Y25 R30 D38 R42 F43 R44 K48 N49 S52 R53 D54 F55 N56 P57 K62 R69 S70 I71 P72 E76 D79 F80 I81 A82 L83 D84

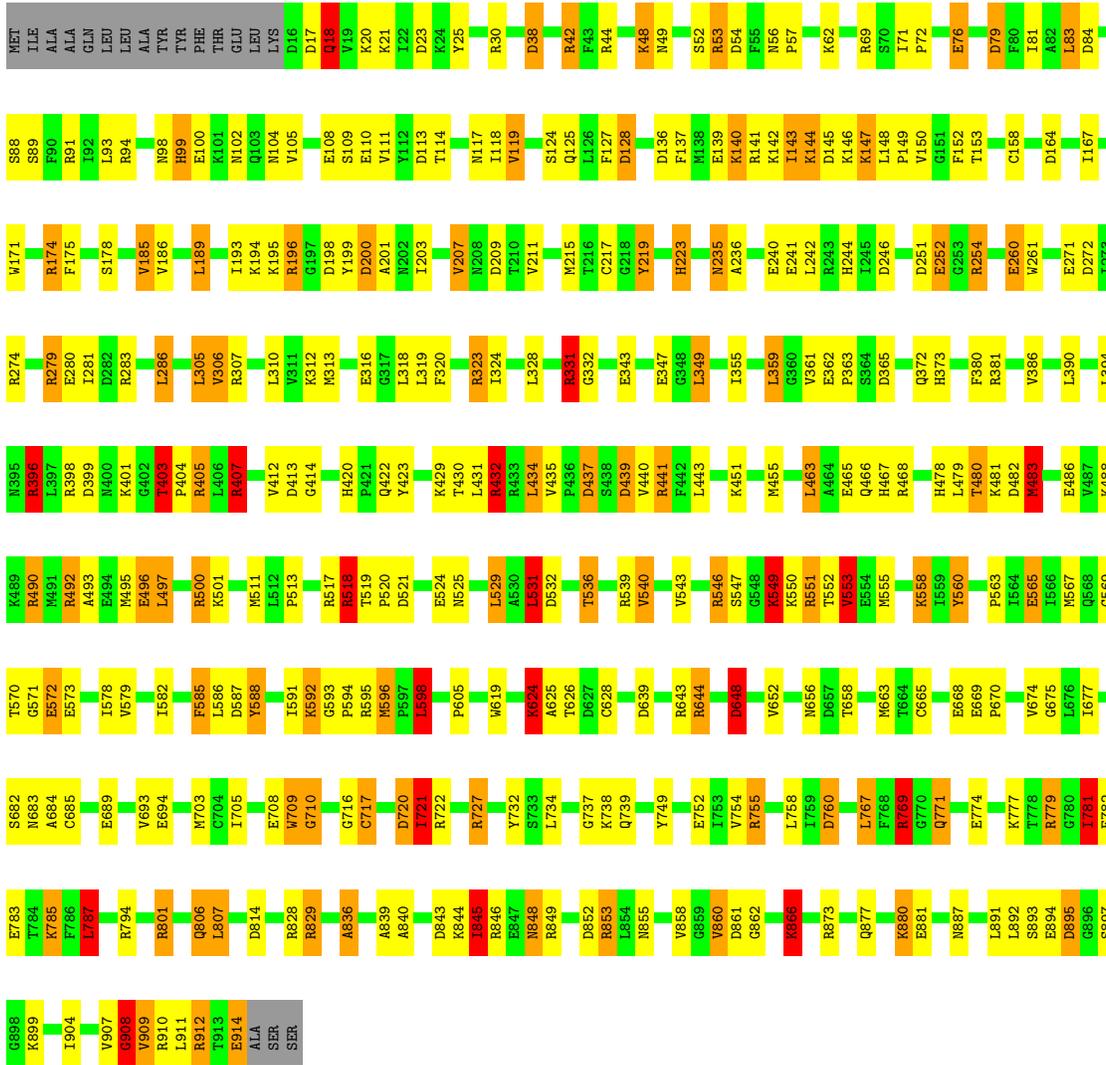S88 S89 F90 R91 I92 L93 R94 N98 H99 E100 K101 N102 Q103 N104 V105 E108 S109 E110 V111 Y112 D113 T114 N117 I118 V119 S124 Q125 L126 F127 D128 D136 F137 M138 E139 K140 R141 K142 I143 K144 D145 K146 K147 L148 P149 V150 G151 F152 T153 C158 D164 I167

W171 R174 F175 S178 V185 V186 L189 I193 K194 K195 R196 G197 D198 Y199 D200 A201 N202 I203 V207 N208 D209 T210 V211 M215 T216 C217 G218 Y219 H223 N235 A236 E240 E241 L242 R243 H244 I245 D246 D251 E252 G253 R254 E260 W261 E271 D272 I273

R274 R279 E280 I281 D282 R283 L286 L305 V306 R307 L310 V311 K312 M313 E316 G317 L318 L319 F320 R323 I324 L328 R331 G332 E343 E347 G348 L349 I355 L359 G360 V361 E362 P363 S364 D365 Q372 H373 F380 R381 V386 L390 L394

N395 H396 L397 R398 D399 N400 K401 G402 T403 P404 R405 L406 R407 V412 D413 G414 H420 P421 Q422 Y423 K429 T430 L431 R432 R433 L434 V435 P436 D437 S438 D439 V440 R441 F442 L443 K451 M455 L463 A464 E465 Q466 H467 R468 H478 L479 T480 K481 D482 M483 E486 V487 K488

K489 R490 M491 R492 A493 E494 M495 E496 L497 R500 K501 M511 L512 P513 R517 R518 T519 P520 D521 E524 N525 L529 A530 L531 D532 T536 R539 V540 V543 R546 S547 G548 K549 K550 R551 T552 V553 E554 M555 K558 I559 Y560 P563 I564 E565 I566 M567 Q568 G569

T570 G571 E572 E573 I578 V579 I582 F585 L586 D587 Y588 I591 K592 G593 P594 R595 M596 P597 L598 P605 W619 K624 A625 T626 D627 C628 D639 R643 R644 D648 V652 N656 D657 T658 M663 T664 C665 E668 E669 P670 V674 G675 L676 I677

S682 N683 A684 C685 E689 V693 E694 M703 C704 I705 E708 W709 G710 G716 C717 D720 I721 R722 R727 Y732 S733 L734 G737 K738 Q739 Y749 E752 I753 V754 R755 L758 I759 D760 L767 F768 R769 G770 Q771 E774 K777 T778 R779 G780 I781 F782

E783 T784 K785 F786 L787 R794 R801 Q806 L807 D814 R828 R829 A836 A839 A840 D843 K844 I845 R846 E847 N848 R849 D852 R853 L854 N855 V858 G859 V860 D861 G862 K866 R873 Q877 K880 E881 N887 L891 L892 S893 E894 D895 G896 S897

G898 K899 I904 V907 G908 V909 R910 L911 R912 T913 E914 ALA SER SER

4   Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	83.59Å 176.17Å 86.76Å 90.00° 90.53° 90.00°	Depositor
Resolution (Å)	12.00 – 2.25	Depositor
% Data completeness (in resolution range)	85.0 (12.00-2.25)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	0.10	Depositor
Refinement program	REFMAC	Depositor
R, R_{free}	0.208 , 0.279	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	14737	wwPDB-VP
Average B, all atoms (Å^2)	41.0	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: G6P, ANP, MG, GLC

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	8/7170 (0.1%)	1.75	146/9647 (1.5%)
1	B	0.83	6/7134 (0.1%)	1.89	162/9594 (1.7%)
All	All	0.78	14/14304 (0.1%)	1.82	308/19241 (1.6%)

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	A	0	28
1	B	0	16
All	All	0	44

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	914	GLU	CB-CG	-32.64	0.90	1.52
1	A	144	LYS	CG-CD	-17.85	0.91	1.52
1	A	147	LYS	CG-CD	16.68	2.09	1.52
1	B	99	HIS	C-N	14.83	1.68	1.34
1	B	62	LYS	CG-CD	-13.55	1.06	1.52

The worst 5 of 308 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	102	ASN	N-CA-CB	-39.95	38.70	110.60
1	B	829	ARG	NE-CZ-NH2	-27.14	106.73	120.30
1	B	829	ARG	CD-NE-CZ	25.57	159.40	123.60
1	B	100	GLU	CB-CA-C	-25.01	60.37	110.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	755	ARG	NE-CZ-NH1	-24.72	107.94	120.30

There are no chirality outliers.

5 of 44 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	100	GLU	Mainchain
1	A	101	LYS	Mainchain
1	A	68	VAL	Mainchain
1	A	79	ASP	Mainchain
1	A	99	HIS	Mainchain

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	A	7065	0	7124	483	0
1	B	7032	0	7087	334	0
2	A	24	0	24	0	0
2	B	24	0	24	0	0
3	A	32	0	22	7	0
3	B	32	0	21	8	0
4	A	3	0	0	0	0
4	B	3	0	0	0	0
5	A	31	0	13	1	0
5	B	31	0	13	1	0
6	A	188	0	0	33	0
6	B	272	0	0	37	0
All	All	14737	0	14328	823	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 29.

The worst 5 of 823 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:505:ASN:O	1:A:507:ALA:N	1.57	1.31
1:A:521:ASP:HB3	6:A:1169:HOH:O	1.34	1.24
1:A:29:MET:HB2	1:A:377:ILE:HD11	1.27	1.17
1:B:441:ARG:HH11	1:B:441:ARG:HG3	1.13	1.11
1:A:62:LYS:CE	6:A:1057:HOH:O	1.89	1.11

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	A	899/917 (98%)	825 (92%)	51 (6%)	23 (3%)	5	2
1	B	891/917 (97%)	861 (97%)	24 (3%)	6 (1%)	22	21
All	All	1790/1834 (98%)	1686 (94%)	75 (4%)	29 (2%)	9	5

5 of 29 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	82	ALA
1	A	100	GLU
1	A	111	VAL
1	A	504	HIS
1	A	506	ASN

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	778/788 (99%)	657 (84%)	121 (16%)	2 1
1	B	774/788 (98%)	686 (89%)	88 (11%)	5 3
All	All	1552/1576 (98%)	1343 (86%)	209 (14%)	4 2

5 of 209 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	891	LEU
1	B	207	VAL
1	B	845	ILE
1	A	912	ARG
1	B	117	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 39 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	372	GLN
1	B	656	ASN
1	B	373	HIS
1	B	420	HIS
1	B	855	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 16 ligands modelled in this entry, 6 are monoatomic - leaving 10 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	GLC	A	918	-	12,12,12	0.86	1 (8%)	17,17,17	1.75	4 (23%)
2	GLC	B	1915	-	12,12,12	0.54	0	17,17,17	1.45	2 (11%)
2	GLC	A	920	-	12,12,12	0.96	1 (8%)	17,17,17	2.02	4 (23%)
2	GLC	B	1917	-	12,12,12	1.14	1 (8%)	17,17,17	2.02	6 (35%)
3	G6P	B	1918	-	16,16,16	1.40	3 (18%)	24,24,24	2.68	10 (41%)
5	ANP	A	999	-	29,33,33	1.54	6 (20%)	31,52,52	1.56	6 (19%)
3	G6P	A	921	-	16,16,16	1.00	0	24,24,24	2.20	6 (25%)
3	G6P	B	1916	-	16,16,16	0.98	1 (6%)	24,24,24	2.17	10 (41%)
5	ANP	B	1999	4	29,33,33	1.54	5 (17%)	31,52,52	1.45	4 (12%)
3	G6P	A	919	-	16,16,16	1.30	3 (18%)	24,24,24	2.46	11 (45%)

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	GLC	A	918	-	-	0/2/22/22	0/1/1/1
2	GLC	A	920	-	-	0/2/22/22	0/1/1/1
2	GLC	B	1915	-	-	0/2/22/22	0/1/1/1
2	GLC	B	1917	-	-	0/2/22/22	0/1/1/1
3	G6P	B	1918	-	1/1/6/6	3/6/26/26	0/1/1/1
5	ANP	A	999	-	-	5/14/38/38	0/3/3/3
3	G6P	A	921	-	1/1/6/6	5/6/26/26	0/1/1/1
3	G6P	B	1916	-	1/1/6/6	2/6/26/26	0/1/1/1
5	ANP	B	1999	4	-	7/14/38/38	0/3/3/3
3	G6P	A	919	-	1/1/6/6	4/6/26/26	0/1/1/1

The worst 5 of 21 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	999	ANP	C8-N7	-3.44	1.28	1.34
5	B	1999	ANP	C8-N7	-3.30	1.28	1.34
5	A	999	ANP	PG-O3G	-3.03	1.48	1.56
5	A	999	ANP	PG-O2G	-3.01	1.48	1.56
5	B	1999	ANP	PG-O3G	-2.98	1.48	1.56

The worst 5 of 63 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	B	1918	G6P	O5-C5-C6	-6.82	92.91	106.67
3	A	919	G6P	C6-C5-C4	5.38	123.32	112.09
3	B	1918	G6P	C6-C5-C4	5.07	122.68	112.09
3	A	921	G6P	O5-C5-C4	5.01	118.79	109.69
3	A	921	G6P	O5-C1-C2	4.84	118.93	110.28

All (4) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	A	919	G6P	C1
3	A	921	G6P	C1
3	B	1916	G6P	C1
3	B	1918	G6P	C1

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	919	G6P	C4-C5-C6-O6
3	A	919	G6P	O5-C5-C6-O6
3	A	921	G6P	C4-C5-C6-O6
3	A	921	G6P	O5-C5-C6-O6
3	A	921	G6P	C6-O6-P-O1P

There are no ring outliers.

6 monomers are involved in 17 short contacts:

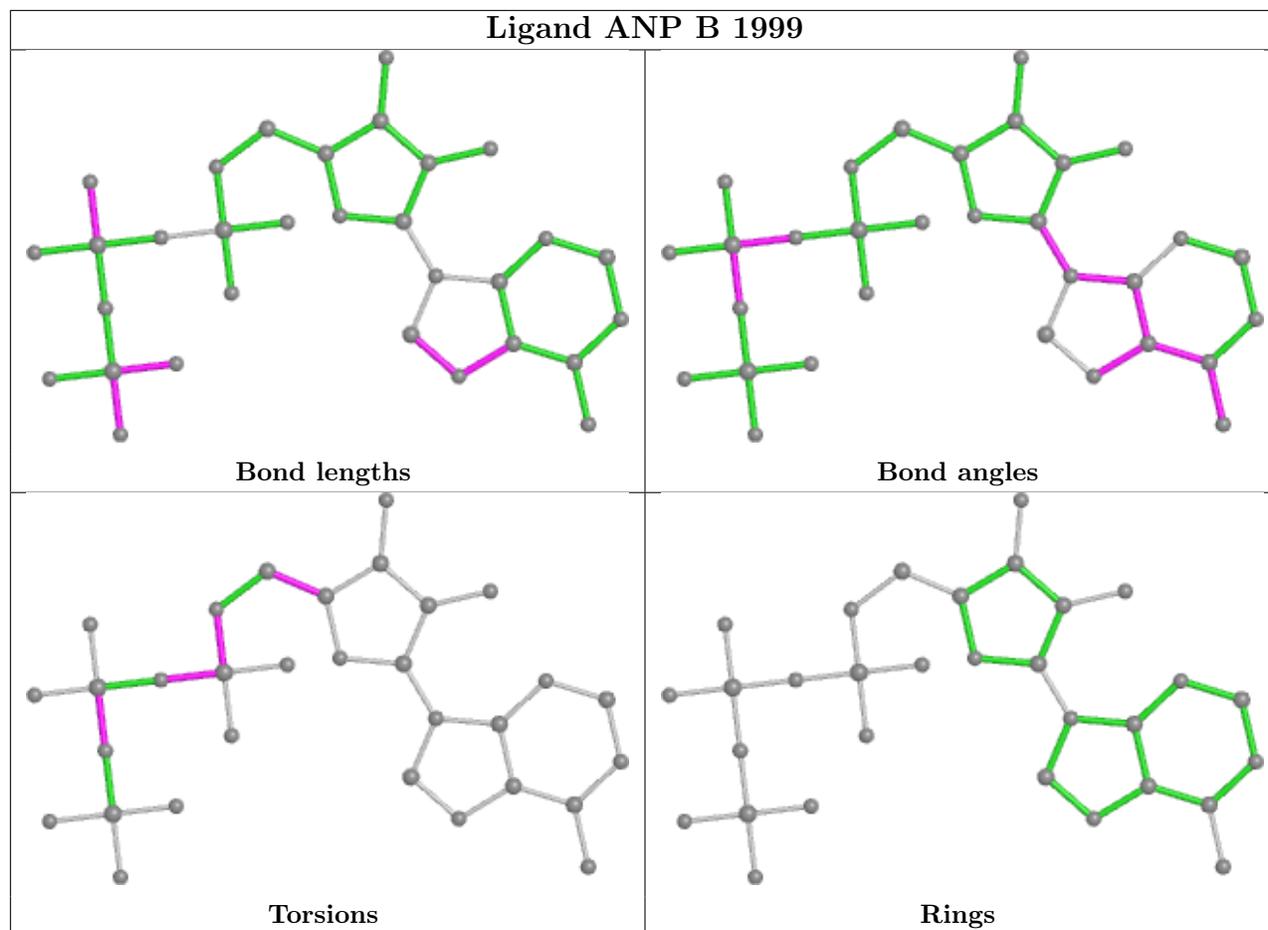| Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	1918	G6P	5	0
5	A	999	ANP	1	0
3	A	921	G6P	1	0
3	B	1916	G6P	3	0
5	B	1999	ANP	1	0
3	A	919	G6P	6	0

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 then 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.
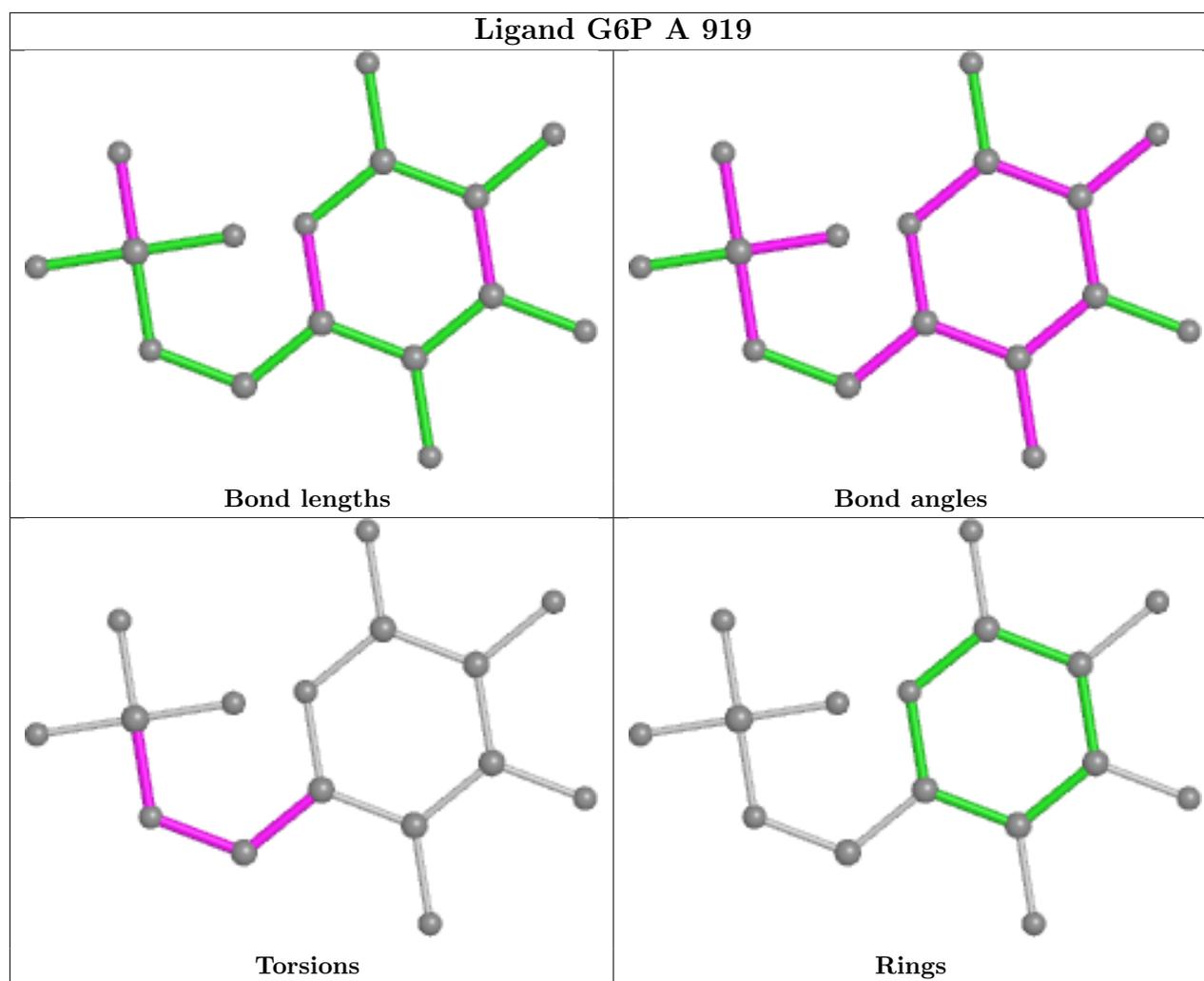

Ligand G6P B 1918

Bond lengths

Bond angles

Torsions

Rings

Ligand ANP A 999

Bond lengths

Bond angles

Torsions

Rings

Ligand G6P A 921

Bond lengths

Bond angles

Torsions

Rings

Ligand G6P B 1916

Bond lengths

Bond angles

Torsions

Rings

Ligand ANP B 1999

Bond lengths

Bond angles

Torsions

Rings

Ligand G6P A 919

Bond lengths

Bond angles

Torsions

Rings
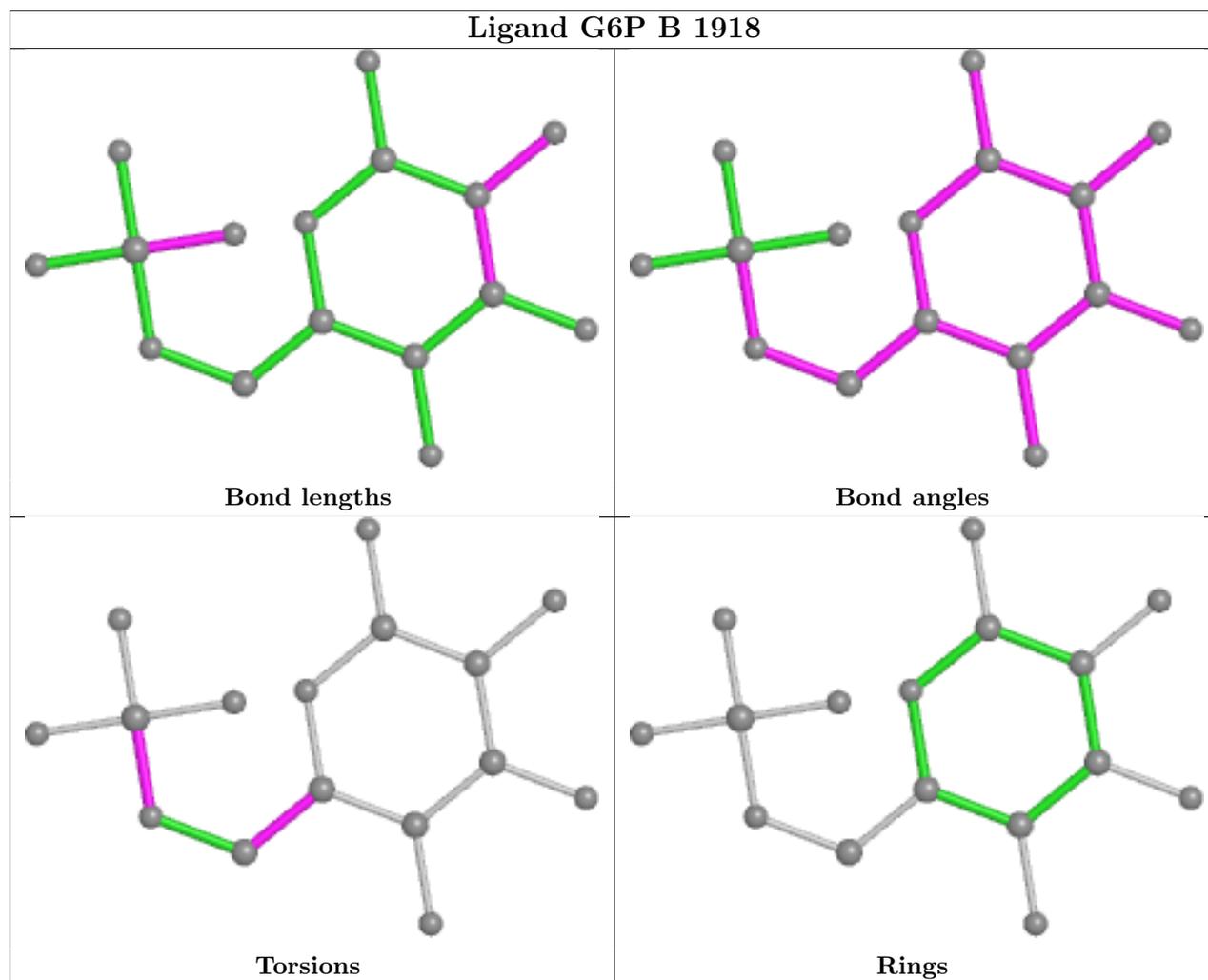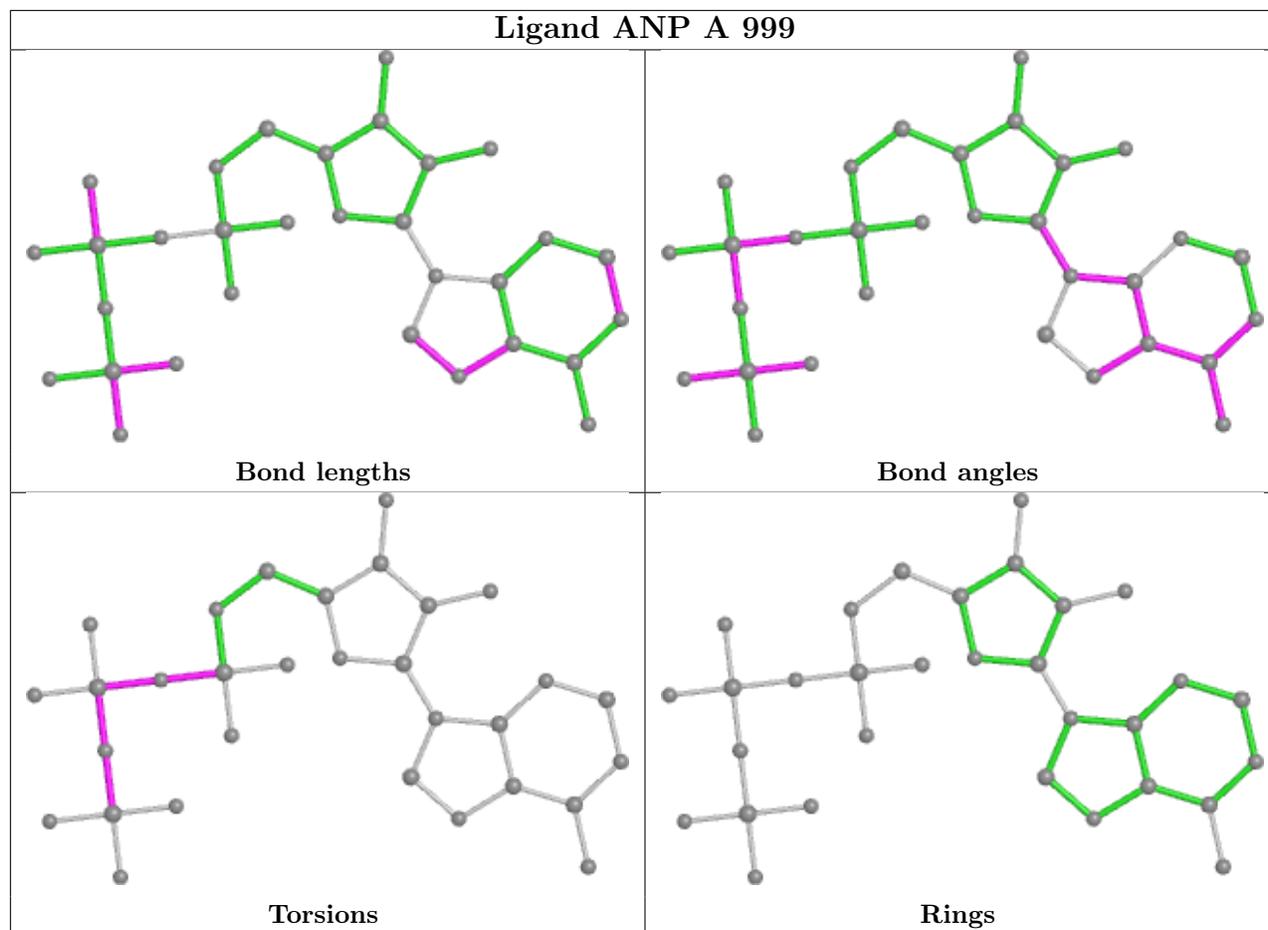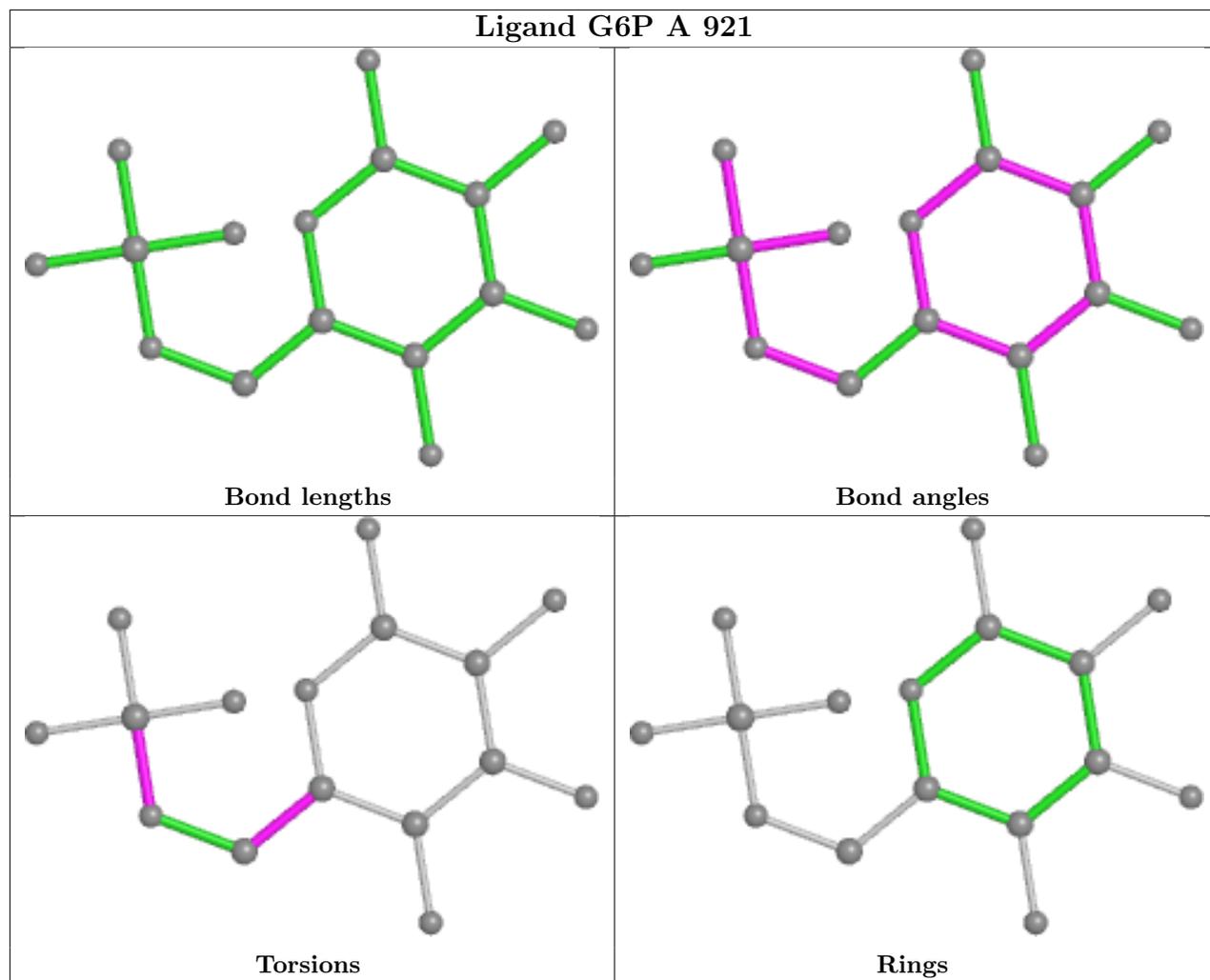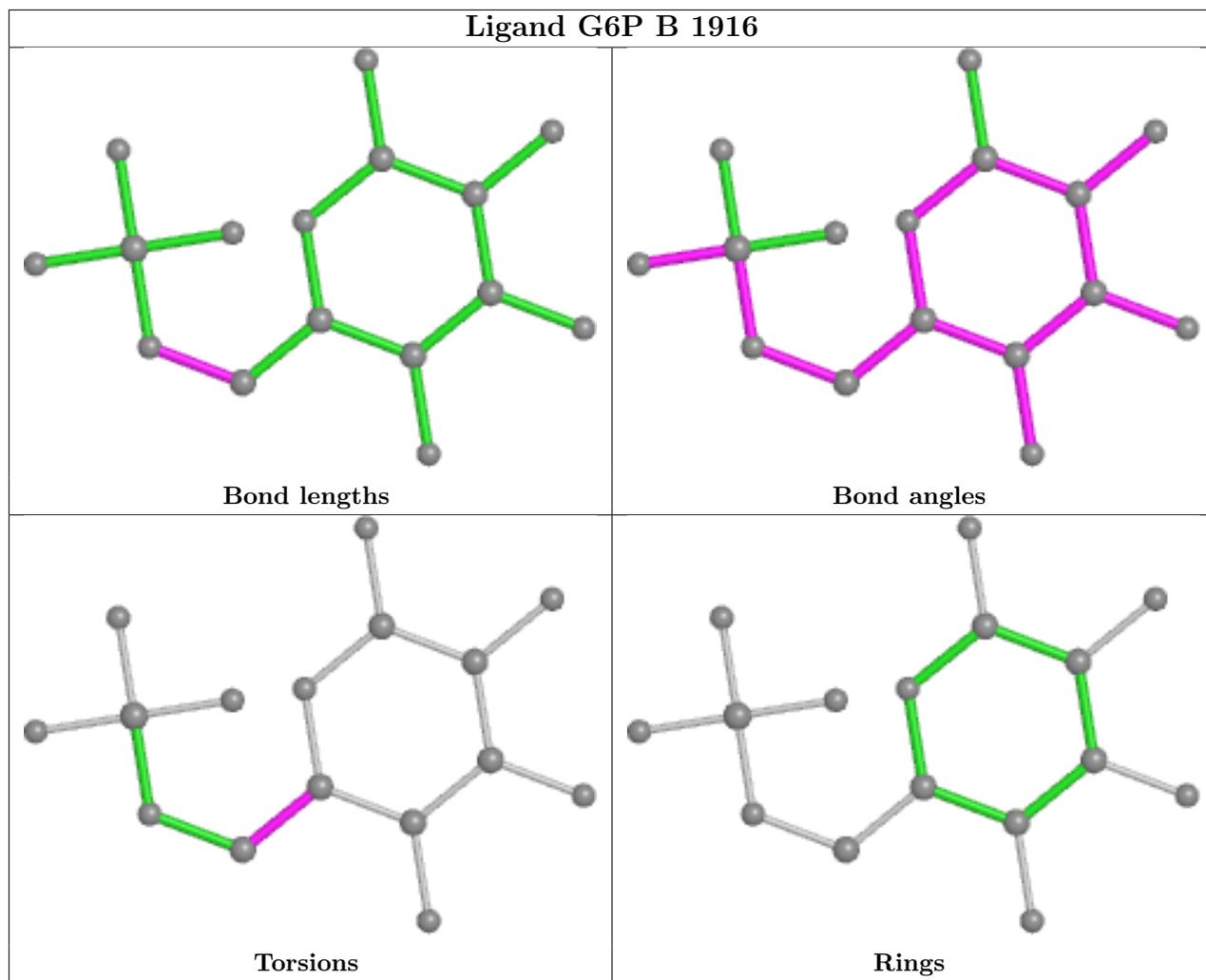
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	5
1	A	2

The worst 5 of 7 chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	101:LYS	C	102:ASN	N	2.86

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Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	100:GLU	C	101:LYS	N	2.68
1	B	16:ASP	C	17:ASP	N	2.25
1	B	103:GLN	C	104:ASN	N	2.23
1	A	912:ARG	C	913:THR	N	2.03

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.