



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 23, 2021 – 12:32 PM EDT

PDB ID : 1CZA  
Title : MUTANT MONOMER OF RECOMBINANT HUMAN HEXOKINASE  
TYPE I COMPLEXED WITH GLUCOSE, GLUCOSE-6-PHOSPHATE,  
AND ADP  
Authors : Aleshin, A.E.; Liu, X.; Kirby, C.; Bourenkov, G.P.; Bartunik, H.D.; Fromm,  
H.J.; Honzatko, R.B.  
Deposited on : 1999-09-01  
Resolution : 1.90 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](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) : 1.13  
EDS : 2.23.2  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

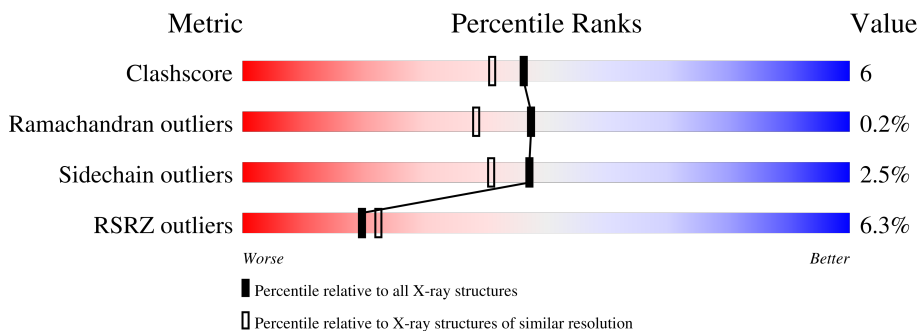
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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  $\geq 3$ , 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  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	N	917	

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	N	919	X	-	-	-
3	G6P	N	921	X	-	-	-

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 7859 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.

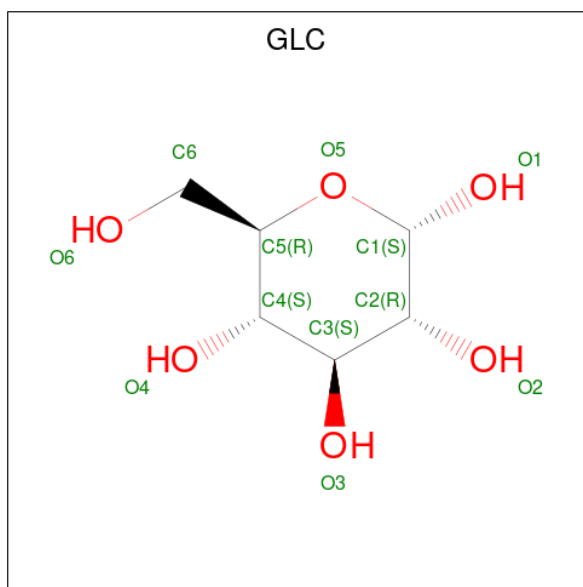
- Molecule 1 is a protein called HEXOKINASE TYPE I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	N	898	7097	4444	1258	1340	55	0	18	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
N	280	ALA	GLU	engineered mutation	UNP P19367
N	283	ALA	ARG	engineered mutation	UNP P19367
N	284	TYR	GLY	engineered mutation	UNP P19367
N	730	ASP	ASN	SEE REMARK 999	UNP P19367
N	776	LEU	MET	SEE REMARK 999	UNP P19367

- Molecule 2 is alpha-D-glucopyranose (three-letter code: GLC) (formula: C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>).



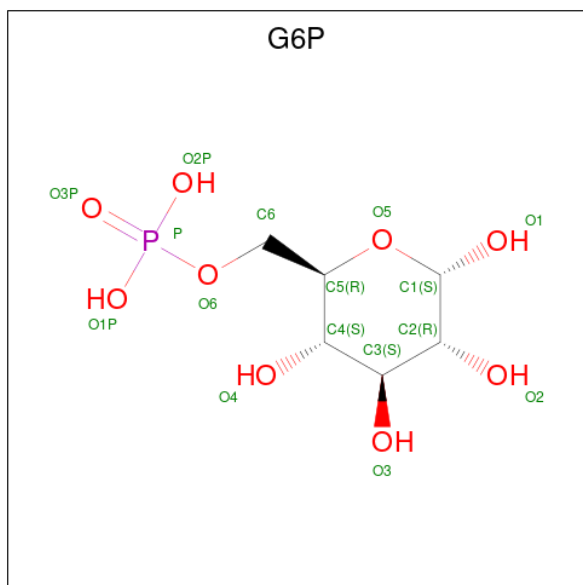
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	N	1	12	6	6	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	N	1	12	6	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
			Total	C	O	P		
3	N	1	16	6	9	1	0	0
3	N	1	16	6	9	1	0	0

- Molecule 4 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula:  $C_{10}H_{15}N_5O_{10}P_2$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
4	N	1	27	10	5	10	2	0	0

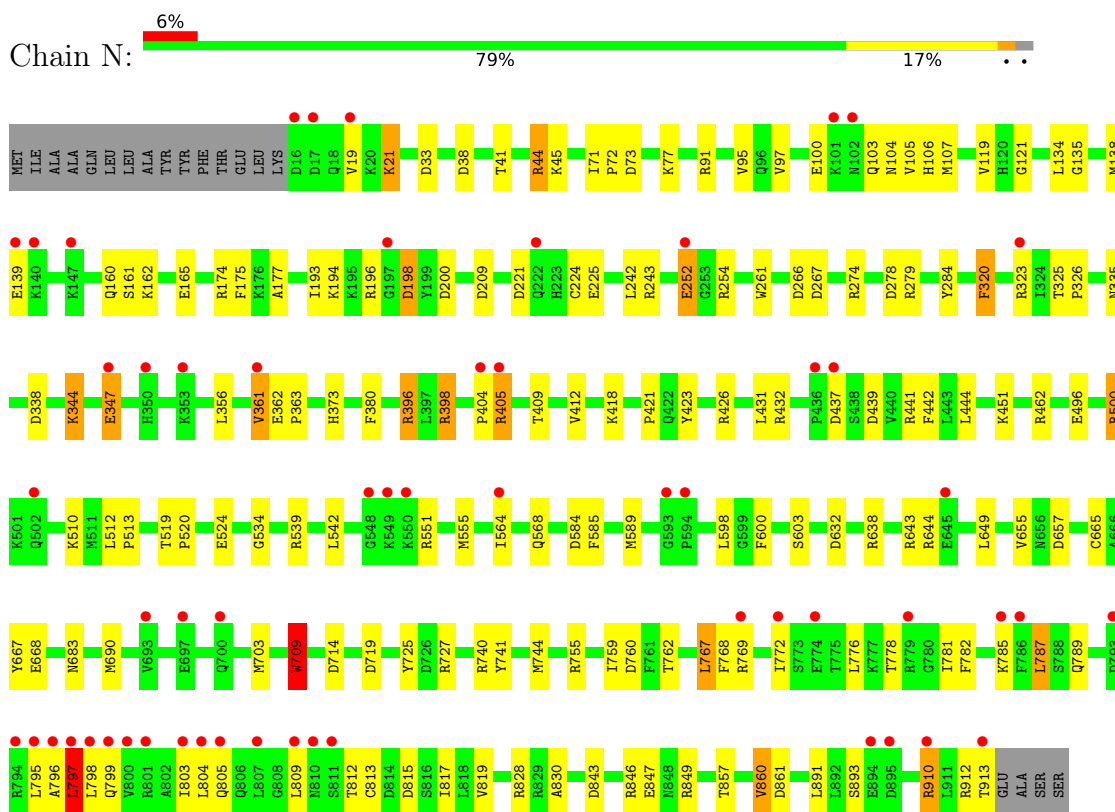
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	N	672	Total	O	0	7
			679	679		

### 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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). 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.

- Molecule 1: HEXOKINASE TYPE I



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	145.66Å 145.80Å 58.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 1.90 14.93 – 1.90	Depositor EDS
% Data completeness (in resolution range)	100.0 (8.00-1.90) 98.2 (14.93-1.90)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.41 (at 1.89Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.211 , 0.258 0.198 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	29.6	Xtrriage
Anisotropy	0.490	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 58.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	0.007 for k,h,-l	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7859	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	35.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.99% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 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, GLC, ADP

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	N	0.70	0/7288	1.51	91/9806 (0.9%)

There are no bond length outliers.

All (91) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	N	828	ARG	NE-CZ-NH2	-22.45	109.08	120.30
1	N	828	ARG	NE-CZ-NH1	14.43	127.52	120.30
1	N	727	ARG	NE-CZ-NH1	-12.53	114.03	120.30
1	N	462	ARG	NE-CZ-NH1	11.61	126.10	120.30
1	N	441	ARG	NE-CZ-NH2	-11.55	114.52	120.30
1	N	432	ARG	NE-CZ-NH1	11.13	125.86	120.30
1	N	741	TYR	CB-CG-CD1	10.96	127.58	121.00
1	N	643	ARG	NE-CZ-NH1	-10.52	115.04	120.30
1	N	174	ARG	NE-CZ-NH2	-10.38	115.11	120.30
1	N	912	ARG	NE-CZ-NH2	-10.25	115.17	120.30
1	N	741	TYR	CB-CG-CD2	-9.99	115.00	121.00
1	N	174	ARG	NE-CZ-NH1	9.78	125.19	120.30
1	N	279[A]	ARG	NE-CZ-NH2	-9.48	115.56	120.30
1	N	279[B]	ARG	NE-CZ-NH2	-9.48	115.56	120.30
1	N	644	ARG	CD-NE-CZ	9.45	136.82	123.60
1	N	462	ARG	NE-CZ-NH2	-9.23	115.68	120.30
1	N	510	LYS	CD-CE-NZ	9.14	132.73	111.70
1	N	396	ARG	NE-CZ-NH2	-9.12	115.74	120.30
1	N	910	ARG	NE-CZ-NH1	-8.99	115.80	120.30
1	N	740	ARG	NE-CZ-NH2	-8.79	115.91	120.30
1	N	44[A]	ARG	CD-NE-CZ	8.52	135.53	123.60
1	N	44[B]	ARG	CD-NE-CZ	8.52	135.53	123.60
1	N	254	ARG	NE-CZ-NH2	-8.48	116.06	120.30
1	N	38	ASP	CB-CG-OD1	8.26	125.73	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	N	638	ARG	NE-CZ-NH2	-8.22	116.19	120.30
1	N	912	ARG	NE-CZ-NH1	8.08	124.34	120.30
1	N	441	ARG	NE-CZ-NH1	7.72	124.16	120.30
1	N	849	ARG	NE-CZ-NH2	-7.66	116.47	120.30
1	N	727	ARG	NE-CZ-NH2	7.63	124.12	120.30
1	N	709	TRP	CA-CB-CG	7.61	128.16	113.70
1	N	644	ARG	NE-CZ-NH2	-7.55	116.53	120.30
1	N	396	ARG	NE-CZ-NH1	7.48	124.04	120.30
1	N	221	ASP	CB-CG-OD1	7.41	124.97	118.30
1	N	44[A]	ARG	NE-CZ-NH1	7.39	124.00	120.30
1	N	44[B]	ARG	NE-CZ-NH1	7.39	124.00	120.30
1	N	462	ARG	CD-NE-CZ	7.36	133.91	123.60
1	N	254	ARG	NE-CZ-NH1	7.27	123.94	120.30
1	N	396	ARG	CD-NE-CZ	7.24	133.73	123.60
1	N	719	ASP	CB-CG-OD1	-7.21	111.81	118.30
1	N	347	GLU	OE1-CD-OE2	-7.12	114.76	123.30
1	N	91	ARG	NE-CZ-NH1	6.86	123.73	120.30
1	N	655	VAL	CA-CB-CG1	6.82	121.13	110.90
1	N	644	ARG	NE-CZ-NH1	6.68	123.64	120.30
1	N	266	ASP	CB-CG-OD2	6.59	124.23	118.30
1	N	426	ARG	NE-CZ-NH1	6.55	123.58	120.30
1	N	200	ASP	CB-CG-OD1	6.51	124.16	118.30
1	N	267	ASP	CB-CG-OD2	6.40	124.06	118.30
1	N	714	ASP	CB-CG-OD2	6.39	124.06	118.30
1	N	274	ARG	NE-CZ-NH1	-6.36	117.12	120.30
1	N	426	ARG	NE-CZ-NH2	-6.28	117.16	120.30
1	N	174	ARG	CD-NE-CZ	6.25	132.36	123.60
1	N	719	ASP	CB-CG-OD2	6.23	123.91	118.30
1	N	500	ARG	NE-CZ-NH2	6.22	123.41	120.30
1	N	657	ASP	CB-CG-OD2	6.06	123.75	118.30
1	N	643	ARG	NE-CZ-NH2	6.05	123.32	120.30
1	N	667	TYR	CB-CG-CD2	-5.95	117.43	121.00
1	N	243	ARG	NE-CZ-NH2	-5.94	117.33	120.30
1	N	44[A]	ARG	CG-CD-NE	5.93	124.26	111.80
1	N	44[B]	ARG	CG-CD-NE	5.93	124.26	111.80
1	N	539	ARG	NE-CZ-NH1	5.82	123.21	120.30
1	N	274	ARG	NE-CZ-NH2	5.80	123.20	120.30
1	N	412	VAL	CG1-CB-CG2	-5.80	101.62	110.90
1	N	361	VAL	CA-C-O	5.79	132.26	120.10
1	N	423	TYR	CB-CG-CD1	-5.78	117.53	121.00
1	N	846	ARG	NE-CZ-NH2	5.70	123.15	120.30
1	N	830	ALA	N-CA-CB	-5.67	102.16	110.10

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	N	703	MET	CG-SD-CE	5.63	109.21	100.20
1	N	279[A]	ARG	CG-CD-NE	-5.57	100.10	111.80
1	N	279[B]	ARG	CG-CD-NE	-5.57	100.10	111.80
1	N	225	GLU	OE1-CD-OE2	5.56	129.97	123.30
1	N	278	ASP	CB-CG-OD1	-5.50	113.35	118.30
1	N	655	VAL	N-CA-CB	-5.49	99.42	111.50
1	N	423	TYR	CB-CG-CD2	5.45	124.27	121.00
1	N	398	ARG	NE-CZ-NH2	-5.45	117.58	120.30
1	N	744	MET	CG-SD-CE	-5.41	91.54	100.20
1	N	209	ASP	CB-CG-OD2	5.38	123.14	118.30
1	N	709	TRP	CD2-CE3-CZ3	-5.36	111.84	118.80
1	N	893	SER	CB-CA-C	-5.35	99.93	110.10
1	N	584	ASP	CB-CG-OD2	-5.35	113.48	118.30
1	N	33	ASP	CB-CG-OD2	5.34	123.11	118.30
1	N	73	ASP	CB-CG-OD1	5.33	123.09	118.30
1	N	632	ASP	CB-CG-OD1	5.26	123.03	118.30
1	N	860	VAL	CB-CA-C	-5.23	101.45	111.40
1	N	284	TYR	CB-CG-CD2	-5.17	117.90	121.00
1	N	584	ASP	CB-CG-OD1	5.14	122.92	118.30
1	N	767	LEU	CB-CA-C	-5.09	100.53	110.20
1	N	849	ARG	NH1-CZ-NH2	5.08	124.99	119.40
1	N	755	ARG	NE-CZ-NH2	-5.05	117.78	120.30
1	N	405[A]	ARG	NE-CZ-NH2	-5.03	117.78	120.30
1	N	405[B]	ARG	NE-CZ-NH2	-5.03	117.78	120.30
1	N	690	MET	CA-CB-CG	-5.03	104.75	113.30

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	N	7097	0	7150	90	0
2	N	24	0	23	0	0
3	N	32	0	22	0	0
4	N	27	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	N	679	0	0	7	0
All	All	7859	0	7207	90	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 6.

All (90) 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:N:196[A]:ARG:HG2	1:N:198:ASP:HB2	1.27	1.14
1:N:361:VAL:HG12	1:N:362:GLU:H	1.29	0.97
1:N:323[A]:ARG:HD3	1:N:361:VAL:HG13	1.49	0.93
1:N:41:THR:HG23	1:N:44[B]:ARG:HH21	1.32	0.90
1:N:431:LEU:HD22	1:N:442:PHE:HZ	1.45	0.81
1:N:785:LYS:HE2	1:N:789:GLN:HE22	1.51	0.77
1:N:320:PHE:HB3	1:N:361:VAL:HG11	1.66	0.76
1:N:196[B]:ARG:HD3	5:N:1507:HOH:O	1.87	0.73
1:N:785:LYS:HE2	1:N:789:GLN:NE2	2.02	0.73
1:N:105:VAL:HG21	1:N:451:LYS:HE3	1.69	0.73
1:N:323[B]:ARG:NH1	1:N:362:GLU:HB2	2.03	0.73
1:N:103:GLN:HE21	1:N:106:HIS:HB2	1.55	0.70
1:N:797:LEU:HG	1:N:798:LEU:H	1.56	0.70
1:N:323[A]:ARG:CD	1:N:361:VAL:HG13	2.22	0.69
1:N:524:GLU:HA	1:N:910:ARG:HH22	1.58	0.68
1:N:344:LYS:HE3	1:N:421:PRO:HB3	1.79	0.65
1:N:665:CYS:HB2	5:N:1591:HOH:O	1.98	0.63
1:N:323[B]:ARG:HH12	1:N:362:GLU:HB2	1.63	0.63
1:N:551:ARG:HB2	5:N:1183:HOH:O	2.00	0.62
1:N:242:LEU:HG	1:N:252:GLU:OE1	2.01	0.61
1:N:162:LYS:HG2	1:N:165[A]:GLU:HG2	1.83	0.60
1:N:431:LEU:HD22	1:N:442:PHE:CZ	2.32	0.60
1:N:325:THR:HB	1:N:326:PRO:HD2	1.82	0.60
1:N:534:GLY:HA3	1:N:603:SER:OG	2.01	0.60
1:N:404:PRO:HD2	5:N:1481:HOH:O	2.08	0.53
1:N:782:PHE:HB3	1:N:787:LEU:HD23	1.90	0.53
1:N:762:THR:HB	1:N:772:ILE:HD13	1.91	0.52
1:N:405[A]:ARG:NH1	1:N:439:ASP:OD1	2.42	0.52
1:N:119:VAL:HG13	1:N:175:PHE:HA	1.92	0.51
1:N:564:ILE:HD11	1:N:568:GLN:NE2	2.25	0.51
1:N:782:PHE:HB3	1:N:787:LEU:CD2	2.41	0.51
1:N:107:MET:HE3	1:N:451:LYS:HB2	1.93	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:N:812:THR:H	1:N:815:ASP:HB2	1.76	0.51
1:N:496:GLU:OE2	1:N:500:ARG:NH1	2.43	0.50
1:N:796:ALA:HB1	1:N:797:LEU:HD23	1.92	0.50
1:N:161:SER:N	1:N:165[A]:GLU:OE1	2.42	0.50
1:N:795:LEU:HD22	1:N:799:GLN:HG3	1.94	0.50
1:N:134:LEU:HD11	1:N:138:MET:HE2	1.94	0.50
1:N:103:GLN:NE2	1:N:106:HIS:HB2	2.26	0.50
1:N:804:LEU:HD21	1:N:819:VAL:HG11	1.93	0.50
1:N:356:LEU:HB2	1:N:363:PRO:HG3	1.93	0.49
1:N:519:THR:HB	1:N:520:PRO:HD2	1.95	0.49
1:N:598:LEU:HD13	1:N:649:LEU:HD13	1.95	0.49
1:N:45:LYS:NZ	5:N:1419:HOH:O	2.44	0.49
1:N:361:VAL:CG1	1:N:362:GLU:H	2.06	0.49
1:N:555:MET:HE2	5:N:1533[A]:HOH:O	2.13	0.48
1:N:398:ARG:NH2	1:N:437:ASP:HB2	2.29	0.48
1:N:759:ILE:HG23	1:N:772:ILE:HD12	1.95	0.48
1:N:19:VAL:HG13	1:N:373:HIS:CE1	2.49	0.47
1:N:551:ARG:HH21	1:N:668:GLU:CD	2.18	0.46
1:N:224:CYS:HA	1:N:409:THR:HB	1.97	0.46
1:N:860:VAL:HG12	1:N:861:ASP:N	2.32	0.45
1:N:119:VAL:CG1	1:N:175:PHE:HA	2.47	0.45
1:N:524:GLU:HA	1:N:910:ARG:NH2	2.27	0.44
1:N:768:PHE:O	1:N:769:ARG:HB2	2.17	0.44
1:N:335[B]:ASN:ND2	1:N:338:ASP:H	2.15	0.44
1:N:335[B]:ASN:HD22	1:N:338:ASP:H	1.66	0.44
1:N:398:ARG:HH21	1:N:437:ASP:HB2	1.82	0.44
1:N:512:LEU:HA	1:N:513:PRO:HD3	1.79	0.44
1:N:107:MET:CE	1:N:451:LYS:HB2	2.48	0.44
1:N:519:THR:HB	1:N:520:PRO:CD	2.48	0.44
1:N:418:LYS:HE3	1:N:444:LEU:HD11	2.00	0.44
1:N:683:ASN:HA	1:N:709:TRP:CD1	2.53	0.44
1:N:767:LEU:HD13	1:N:768:PHE:CE2	2.53	0.44
1:N:95:VAL:HG22	1:N:107:MET:HE2	2.00	0.43
1:N:71:ILE:HB	1:N:72:PRO:CD	2.49	0.43
1:N:19:VAL:HG13	1:N:373:HIS:NE2	2.33	0.43
1:N:431:LEU:O	1:N:431:LEU:HG	2.19	0.43
1:N:21:LYS:HA	1:N:21:LYS:HE3	2.02	0.42
1:N:857:THR:HG21	1:N:891:LEU:HD22	2.01	0.42
1:N:725:TYR:OH	1:N:760[A]:ASP:OD1	2.35	0.42
1:N:135:GLY:O	1:N:139:GLU:HB2	2.19	0.42
1:N:193:ILE:O	1:N:196[B]:ARG:HB2	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:N:121:GLY:O	1:N:177:ALA:HA	2.19	0.42
1:N:778:THR:O	1:N:781:ILE:HG12	2.20	0.42
1:N:795:LEU:HD23	1:N:795:LEU:HA	1.87	0.42
1:N:649:LEU:HA	1:N:649:LEU:HD23	1.77	0.41
1:N:843:ASP:O	1:N:847:GLU:HG3	2.20	0.41
1:N:805:GLN:HA	1:N:809:LEU:O	2.20	0.41
1:N:361:VAL:CG1	1:N:362:GLU:N	2.81	0.41
1:N:776:LEU:HB2	1:N:809:LEU:HD21	2.03	0.41
1:N:585:PHE:CZ	1:N:589:MET:HG3	2.56	0.40
1:N:797:LEU:HG	1:N:798:LEU:N	2.29	0.40
1:N:95:VAL:HG13	1:N:107:MET:HE2	2.02	0.40
1:N:347:GLU:HG3	5:N:1212:HOH:O	2.21	0.40
1:N:361:VAL:HG12	1:N:362:GLU:N	2.14	0.40
1:N:799:GLN:O	1:N:803:ILE:HG13	2.22	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	N	914/917 (100%)	891 (98%)	21 (2%)	2 (0%)	47 38

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	N	797	LEU
1	N	104	ASN

### 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	N	790/787 (100%)	770 (98%)	20 (2%)	47 41

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	N	21	LYS
1	N	77	LYS
1	N	97	VAL
1	N	100	GLU
1	N	194	LYS
1	N	198	ASP
1	N	252	GLU
1	N	261	TRP
1	N	320	PHE
1	N	344	LYS
1	N	380	PHE
1	N	396	ARG
1	N	542	LEU
1	N	600	PHE
1	N	709	TRP
1	N	787	LEU
1	N	797	LEU
1	N	813[A]	CYS
1	N	813[B]	CYS
1	N	913	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	N	18	GLN
1	N	98	ASN
1	N	159	GLN
1	N	384	ASN
1	N	506	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](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

5 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	$\# Z  > 2$
2	GLC	N	918	-	12,12,12	0.84	0	17,17,17	0.86	1 (5%)
4	ADP	N	922	-	24,29,29	1.27	3 (12%)	29,45,45	1.33	6 (20%)
2	GLC	N	920	-	12,12,12	0.70	0	17,17,17	1.21	3 (17%)
3	G6P	N	919	-	16,16,16	1.21	2 (12%)	24,24,24	1.28	2 (8%)
3	G6P	N	921	-	16,16,16	1.40	2 (12%)	24,24,24	1.35	3 (12%)

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	N	918	-	-	0/2/22/22	0/1/1/1
4	ADP	N	922	-	-	3/12/32/32	0/3/3/3
2	GLC	N	920	-	-	0/2/22/22	0/1/1/1
3	G6P	N	919	-	1/1/6/6	1/6/26/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	G6P	N	921	-	1/1/6/6	1/6/26/26	0/1/1/1

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	N	921	G6P	O1-C1	4.22	1.53	1.39
3	N	919	G6P	O1-C1	3.60	1.51	1.39
4	N	922	ADP	C8-N7	-2.86	1.29	1.34
3	N	921	G6P	P-O2P	-2.27	1.46	1.54
4	N	922	ADP	PA-O2A	-2.21	1.44	1.55
4	N	922	ADP	C5-N7	-2.16	1.31	1.39
3	N	919	G6P	P-O1P	-2.13	1.46	1.54

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	N	922	ADP	C4-C5-N7	3.22	112.75	109.40
2	N	920	GLC	O1-C1-C2	2.81	116.94	109.03
3	N	919	G6P	C1-O5-C5	-2.63	108.70	113.66
3	N	921	G6P	O1-C1-O5	-2.52	102.81	110.38
4	N	922	ADP	O2A-PA-O5'	2.38	118.80	107.75
2	N	920	GLC	O5-C1-C2	-2.35	106.09	110.28
4	N	922	ADP	O3B-PB-O3A	2.30	112.35	104.64
4	N	922	ADP	PA-O3A-PB	-2.24	125.14	132.83
3	N	921	G6P	O6-P-O3P	2.16	112.55	106.47
2	N	920	GLC	O4-C4-C5	-2.16	103.93	109.30
4	N	922	ADP	C5-C6-N6	2.11	123.56	120.35
4	N	922	ADP	N3-C2-N1	-2.09	125.42	128.68
3	N	921	G6P	O2-C2-C3	2.08	115.16	110.35
3	N	919	G6P	O1-C1-O5	-2.07	104.18	110.38
2	N	918	GLC	O1-C1-C2	2.04	114.77	109.03

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	N	919	G6P	C1
3	N	921	G6P	C1

All (5) torsion outliers are listed below:

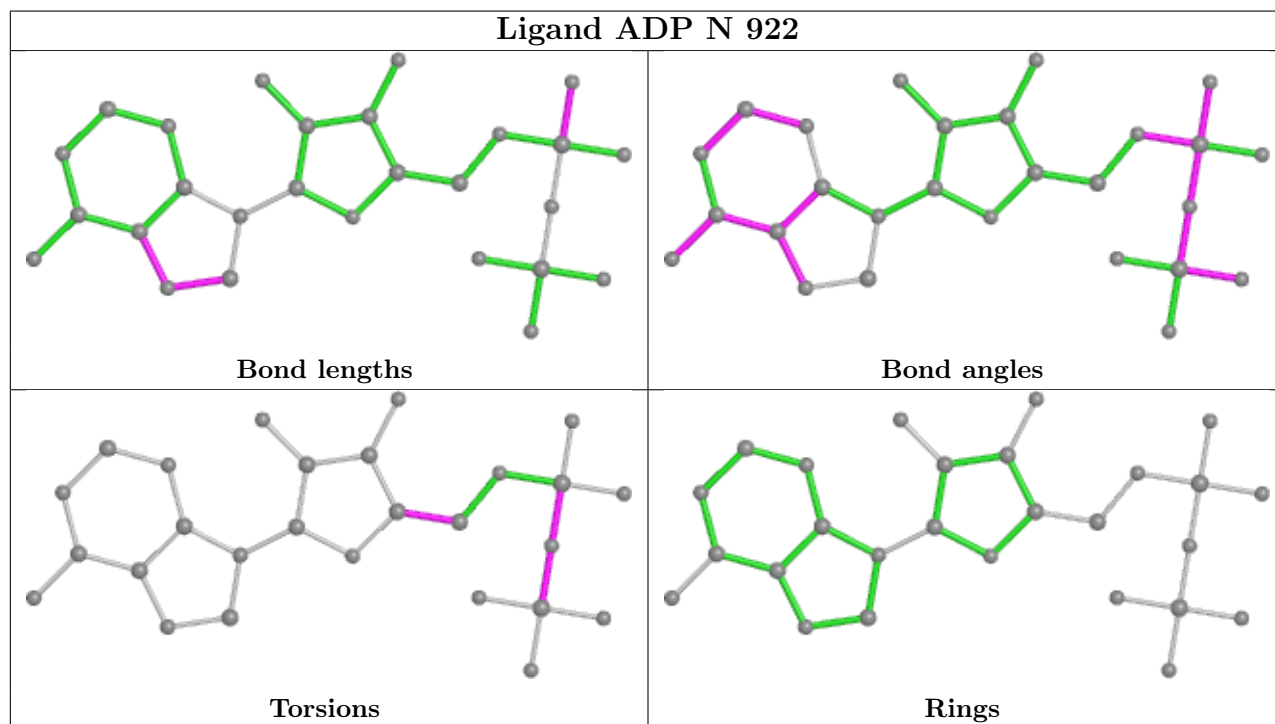


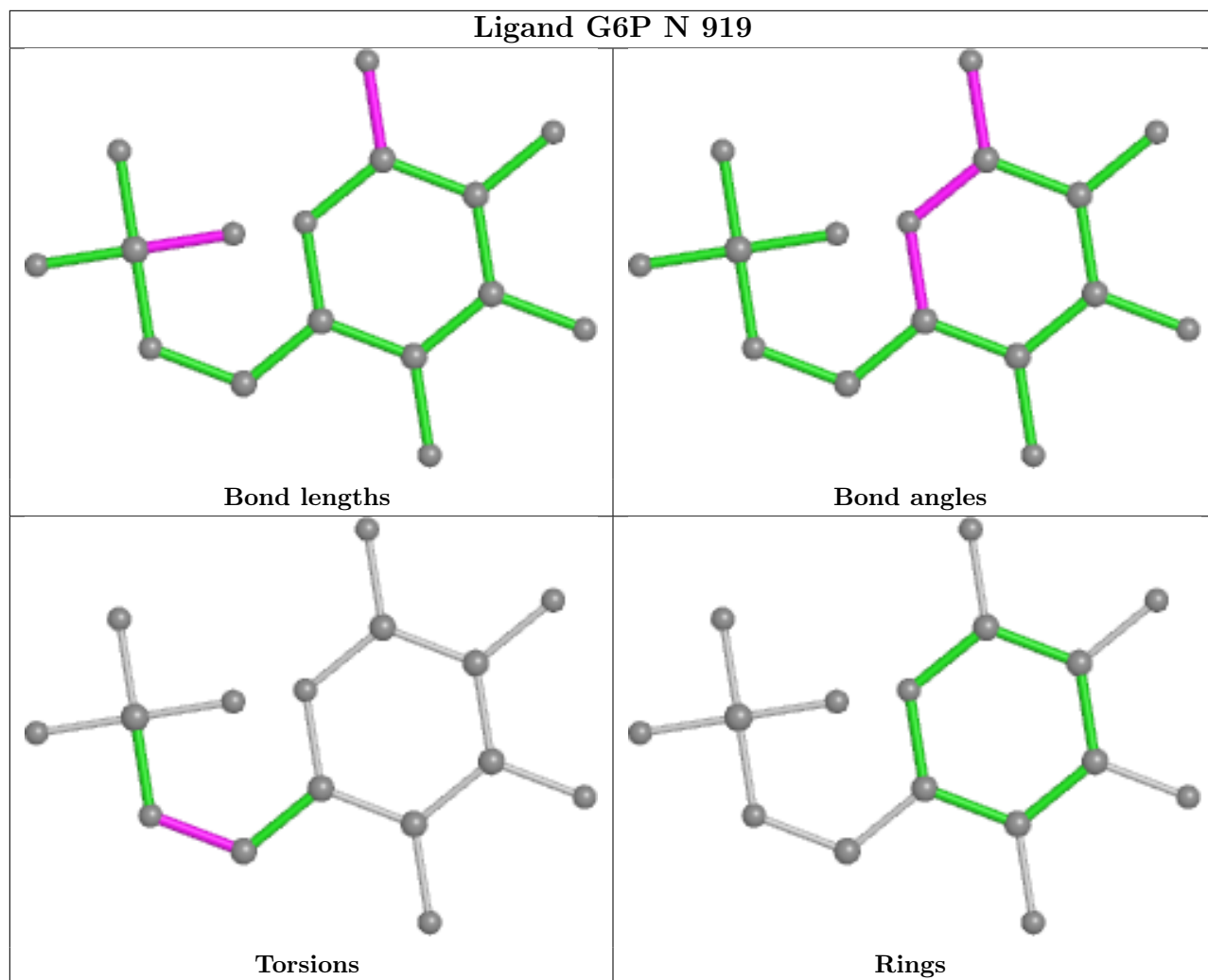
Mol	Chain	Res	Type	Atoms
4	N	922	ADP	PB-O3A-PA-O5'
3	N	919	G6P	C5-C6-O6-P
3	N	921	G6P	C5-C6-O6-P
4	N	922	ADP	PA-O3A-PB-O2B
4	N	922	ADP	C3'-C4'-C5'-O5'

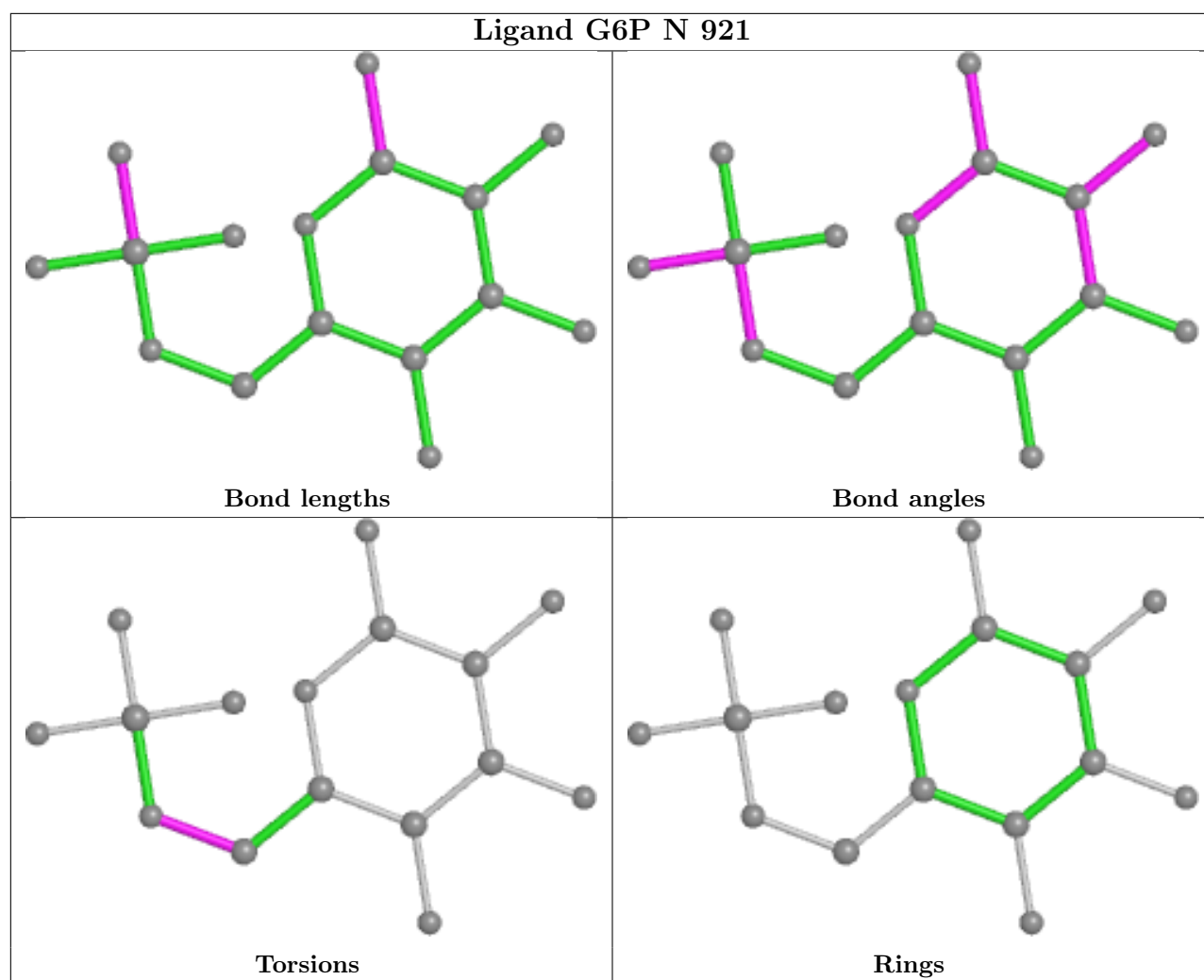
There are no ring outliers.

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 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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	N	898/917 (97%)	0.19	57 (6%) <b>20</b> <b>22</b>	17, 30, 64, 98	11 (1%)

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	N	794	ARG	6.7
1	N	798	LEU	6.0
1	N	797	LEU	5.1
1	N	550	LYS	5.1
1	N	549	LYS	4.9
1	N	807	LEU	4.9
1	N	17	ASP	4.6
1	N	502	GLN	4.5
1	N	102	ASN	4.5
1	N	548	GLY	4.4
1	N	769	ARG	4.4
1	N	564	ILE	4.3
1	N	804	LEU	4.2
1	N	800	VAL	4.2
1	N	801	ARG	4.2
1	N	913	THR	4.2
1	N	16	ASP	4.1
1	N	810	ASN	4.0
1	N	323[A]	ARG	4.0
1	N	700	GLN	3.9
1	N	809	LEU	3.8
1	N	793	ASP	3.8
1	N	799	GLN	3.7
1	N	786	PHE	3.7
1	N	772	ILE	3.7
1	N	645	GLU	3.6
1	N	795	LEU	3.5

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Mol	Chain	Res	Type	RSRZ
1	N	894	GLU	3.5
1	N	796	ALA	3.4
1	N	895	ASP	3.4
1	N	593	GLY	3.4
1	N	101	LYS	3.3
1	N	361	VAL	3.3
1	N	350	HIS	3.2
1	N	805	GLN	3.0
1	N	252	GLU	2.9
1	N	910	ARG	2.9
1	N	697	GLU	2.9
1	N	222	GLN	2.8
1	N	594	PRO	2.6
1	N	140	LYS	2.6
1	N	774	GLU	2.5
1	N	693	VAL	2.4
1	N	353	LYS	2.3
1	N	811	SER	2.3
1	N	404	PRO	2.2
1	N	19	VAL	2.2
1	N	147	LYS	2.2
1	N	197	GLY	2.2
1	N	405[A]	ARG	2.1
1	N	779	ARG	2.1
1	N	785	LYS	2.1
1	N	139	GLU	2.1
1	N	803	ILE	2.1
1	N	436	PRO	2.1
1	N	437	ASP	2.0
1	N	347	GLU	2.0

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

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

## 6.3 Carbohydrates [\(i\)](#)

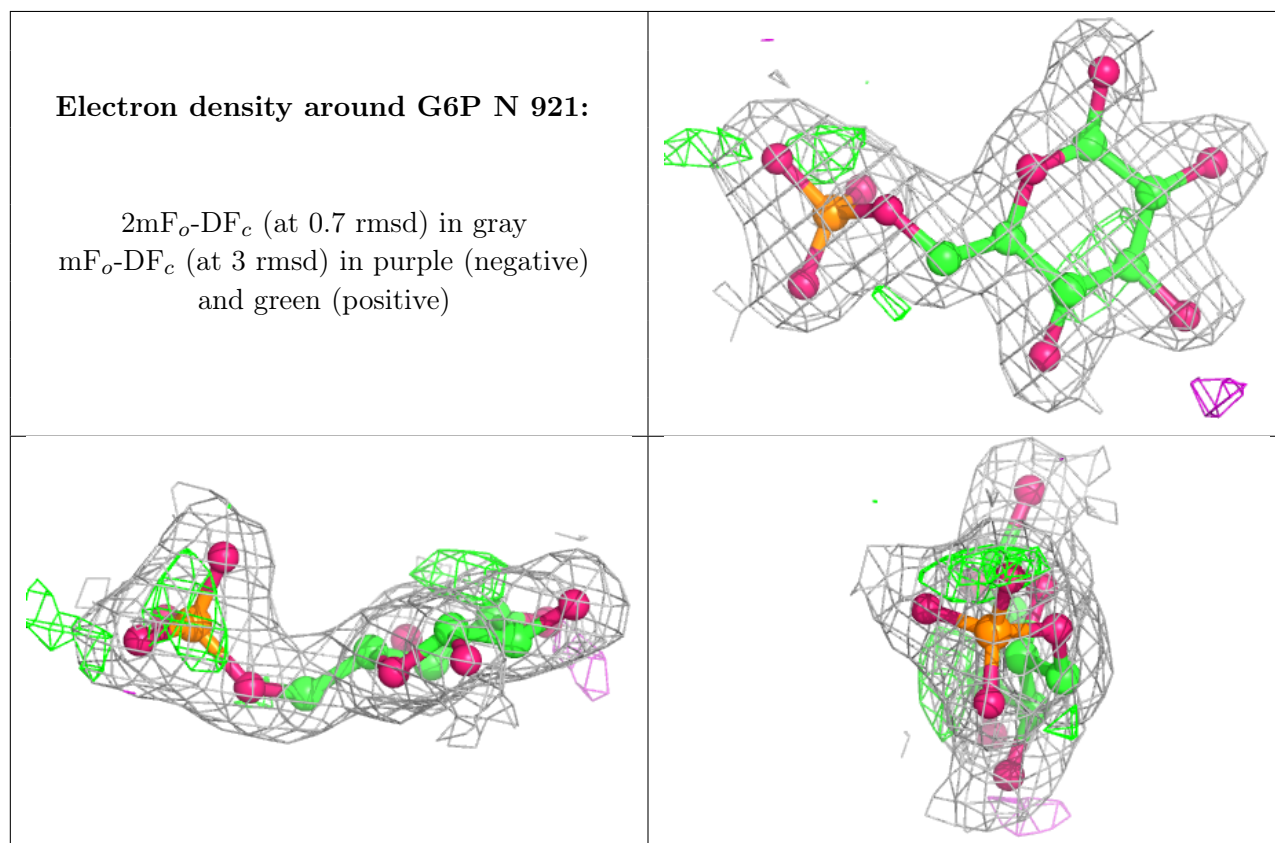
There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q < 0.9' lists the number of atoms with occupancy less than 0.9.

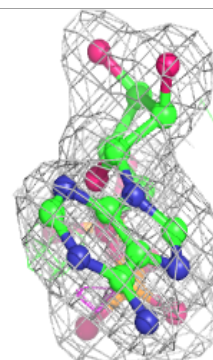
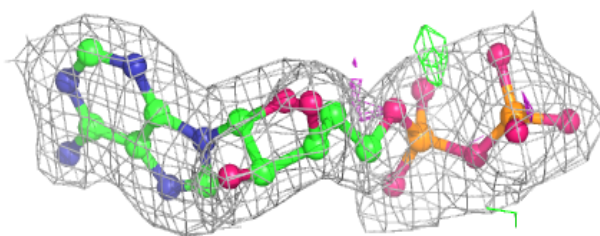
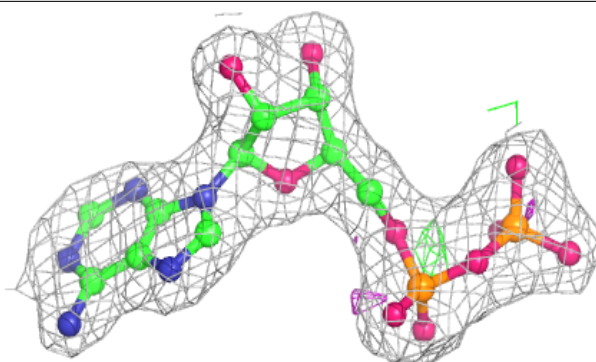
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	G6P	N	921	16/16	0.95	0.19	21,23,25,27	16
2	GLC	N	920	12/12	0.96	0.09	18,19,22,22	0
2	GLC	N	918	12/12	0.96	0.09	16,18,21,28	0
4	ADP	N	922	27/27	0.96	0.09	24,33,45,47	0
3	G6P	N	919	16/16	0.99	0.06	19,22,25,27	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

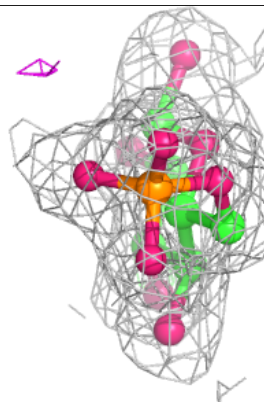
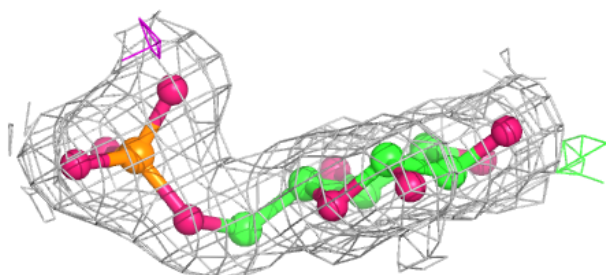
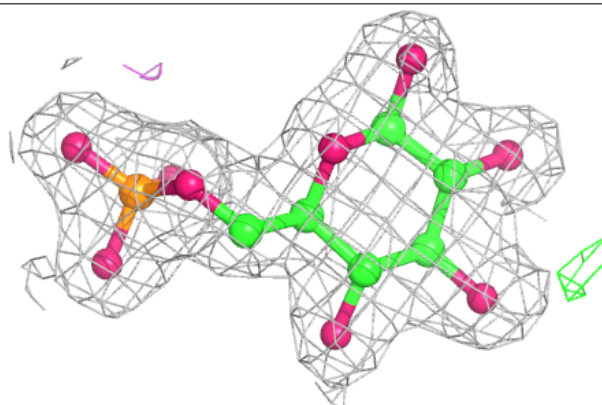


**Electron density around ADP N 922:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

**Electron density around G6P N 919:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



## 6.5 Other polymers [i](#)

There are no such residues in this entry.