Full wwPDB X-ray Structure Validation Report ⓘ

Sep 26, 2023 – 10:46 AM EDT

PDB ID	:	6CZF
Title	:	The structure of E. coli PurF in complex with ppGpp-Mg
Authors	:	Wang, B.; Grant, R.A.; Laub, M.T.
Deposited on	:	2018-04-09
Resolution	:	1.95 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:

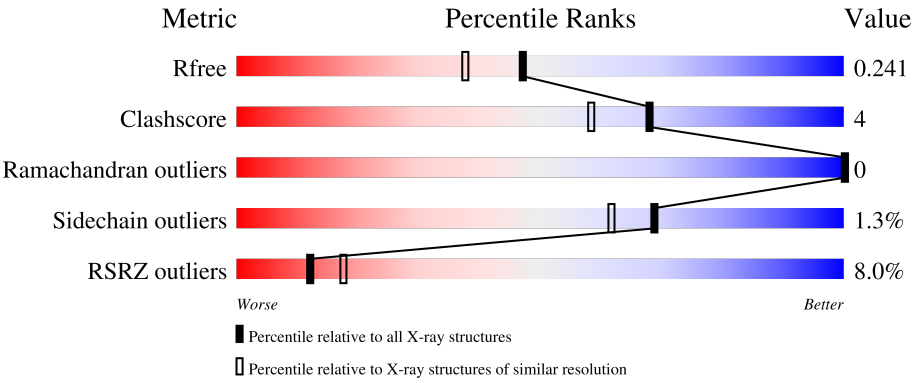
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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))
R_{free}	130704	4310 (1.96-1.92)
Clashscore	141614	1023 (1.94-1.94)
Ramachandran outliers	138981	1007 (1.94-1.94)
Sidechain outliers	138945	1007 (1.94-1.94)
RSRZ outliers	127900	4250 (1.96-1.92)

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% 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	A	498	8% 87% 12%
1	B	498	5% 92% 7%
1	C	498	11% 88% 12%
1	D	498	7% 92% 7%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 31549 atoms, of which 15444 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.

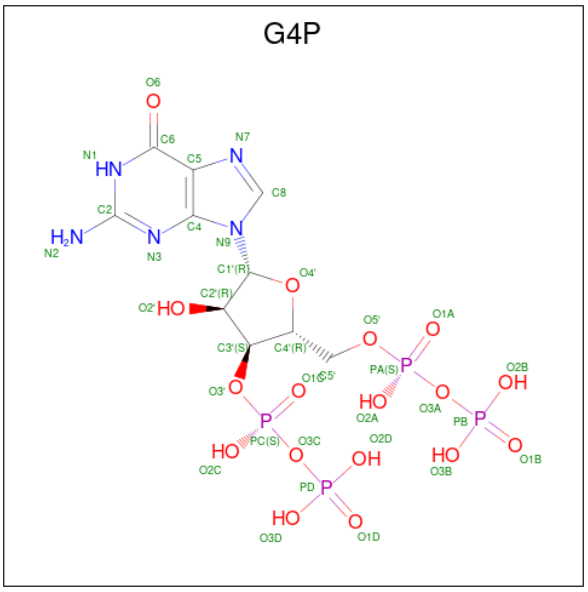
- Molecule 1 is a protein called Amidophosphoribosyltransferase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	498	Total	C	H	N	O	S	0	0	0
			7783	2453	3872	700	741	17			
1	B	495	Total	C	H	N	O	S	0	0	0
			7711	2434	3831	692	737	17			
1	C	498	Total	C	H	N	O	S	0	0	0
			7791	2455	3876	700	743	17			
1	D	494	Total	C	H	N	O	S	0	0	0
			7692	2428	3821	692	734	17			

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mg	0	1
			2	2		
2	D	1	Total	Mg	0	1
			2	2		

- Molecule 3 is GUANOSINE-5',3'-TETRAPHOSPHATE (three-letter code: G4P) (formula: $C_{10}H_{17}N_5O_{17}P_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total	C	H	N	O	P	0	1
			94	20	22	10	34	8		
3	D	1	Total	C	H	N	O	P	0	1
			94	20	22	10	34	8		

- Molecule 4 is water.

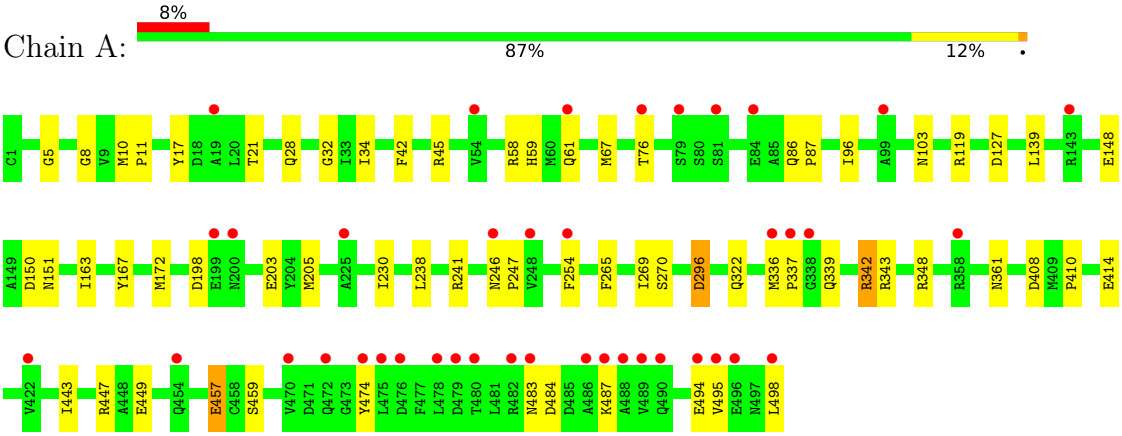
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	78	Total	O	0	0
			78	78		
4	B	113	Total	O	0	0
			113	113		
4	C	74	Total	O	0	0
			74	74		
4	D	115	Total	O	0	0
			115	115		

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.

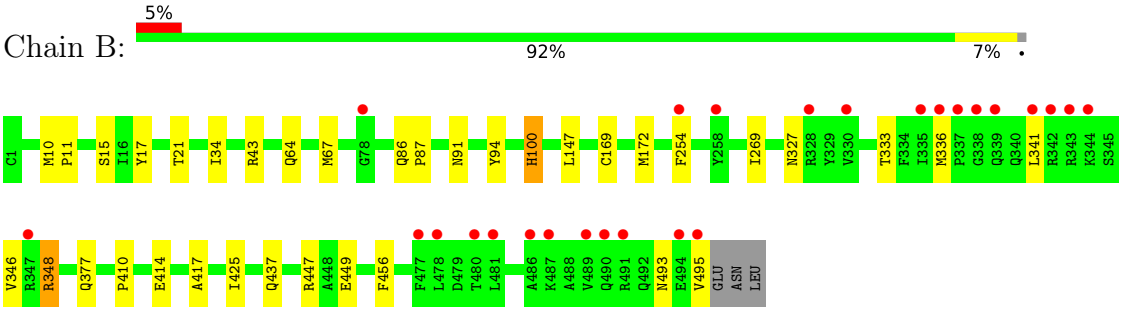
• Molecule 1: Amidophosphoribosyltransferase

Chain A:



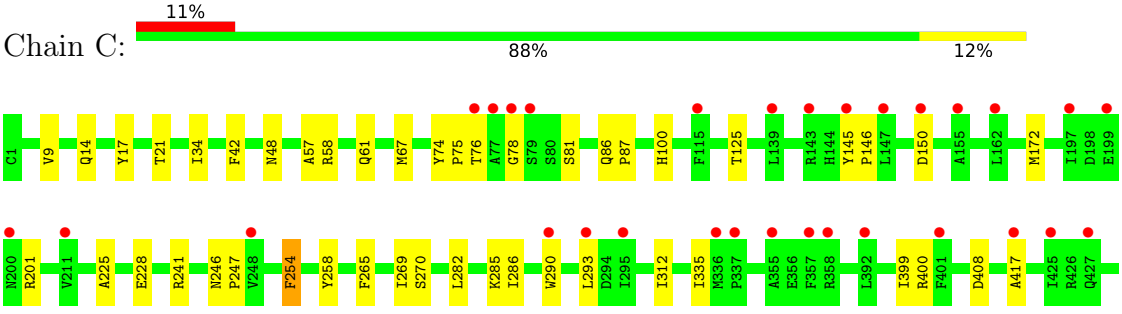
• Molecule 1: Amidophosphoribosyltransferase

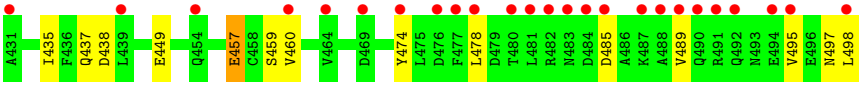
Chain B:



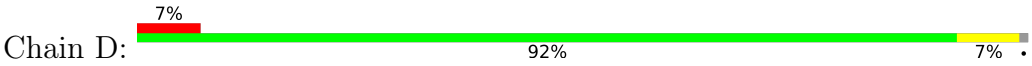
• Molecule 1: Amidophosphoribosyltransferase

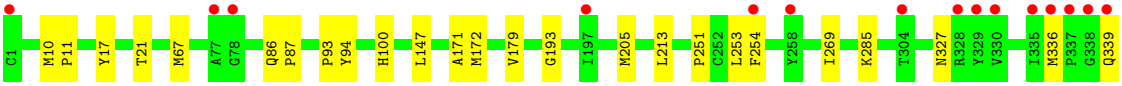
Chain C:

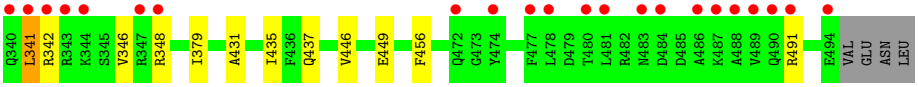




• Molecule 1: Amidophosphoribosyltransferase







4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	107.29Å 115.34Å 156.07Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.64 – 1.95 48.64 – 1.95	Depositor EDS
% Data completeness (in resolution range)	99.5 (48.64-1.95) 90.5 (48.64-1.95)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.63 (at 1.95Å)	Xtriage
Refinement program	PHENIX 1.13_2998	Depositor
R, R_{free}	0.216 , 0.241 0.216 , 0.241	Depositor DCC
R_{free} test set	1987 reflections (1.41%)	wwPDB-VP
Wilson B-factor (Å^2)	37.0	Xtriage
Anisotropy	0.252	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 36.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	31549	wwPDB-VP
Average B, all atoms (Å^2)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 86.10 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.0387e-07. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: G4P, MG

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	0.35	0/3979	0.58	0/5386
1	B	0.35	0/3948	0.59	0/5346
1	C	0.35	0/3983	0.57	0/5391
1	D	0.35	0/3939	0.60	0/5333
All	All	0.35	0/15849	0.59	0/21456

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	A	3911	3872	3872	38	0
1	B	3880	3831	3831	24	0
1	C	3915	3876	3876	42	0
1	D	3871	3821	3821	23	0
2	A	2	0	0	0	0
2	D	2	0	0	0	0
3	A	72	22	22	0	0
3	D	72	22	22	0	0
4	A	78	0	0	3	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	113	0	0	1	0
4	C	74	0	0	1	0
4	D	115	0	0	0	0
All	All	16105	15444	15444	117	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 (117) 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:495:VAL:HG21	1:C:61:GLN:HB3	1.40	1.03
1:A:495:VAL:HG21	1:C:61:GLN:CB	2.11	0.81
1:A:61:GLN:HB3	1:C:495:VAL:HG21	1.63	0.79
1:B:341:LEU:H	1:B:341:LEU:HD23	1.51	0.75
1:A:342:ARG:HD3	1:B:15:SER:OG	1.86	0.74
1:C:150:ASP:OD1	1:C:241:ARG:NH2	2.28	0.67
1:A:150:ASP:OD1	1:A:241:ARG:NH2	2.31	0.63
1:A:296:ASP:HB2	1:A:361:ASN:O	2.00	0.62
1:C:254:PHE:CE1	1:C:460:VAL:HG21	2.34	0.61
1:C:58:ARG:O	1:C:61:GLN:HG3	1.99	0.61
1:A:342:ARG:CD	1:B:15:SER:OG	2.49	0.61
1:A:45:ARG:HG2	1:A:59:HIS:HB3	1.83	0.61
1:C:254:PHE:CD1	1:C:460:VAL:HG21	2.38	0.58
1:A:103:ASN:HA	1:A:127:ASP:OD2	2.04	0.58
1:A:269:ILE:HG23	1:A:449:GLU:HB2	1.87	0.57
1:A:76:THR:HG22	1:A:408:ASP:HB2	1.86	0.56
1:C:285:LYS:NZ	1:C:438:ASP:OD1	2.37	0.56
1:C:282:LEU:O	1:C:286:ILE:HG13	2.06	0.55
1:C:254:PHE:CD2	1:C:258:TYR:HE2	2.25	0.55
1:C:282:LEU:HD23	1:C:312:ILE:HD11	1.89	0.54
1:B:493:ASN:O	1:C:498:LEU:HB2	2.07	0.54
1:A:17:TYR:O	1:A:21:THR:HG23	2.08	0.53
1:D:341:LEU:HD23	1:D:341:LEU:H	1.73	0.53
1:C:78:GLY:N	1:C:485:ASP:OD2	2.41	0.53
1:C:225:ALA:HB3	1:C:228:GLU:HB2	1.90	0.53
1:C:265:PHE:CE2	1:C:270:SER:HB2	2.44	0.52
1:D:269:ILE:HD13	1:D:446:VAL:HG12	1.91	0.52
1:A:148:GLU:O	1:A:151:ASN:N	2.43	0.52
1:B:495:VAL:O	1:C:497:ASN:HA	2.10	0.51
1:C:76:THR:HG22	1:C:408:ASP:HB2	1.92	0.51

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:400:ARG:NH1	1:C:417:ALA:O	2.43	0.51
1:A:58:ARG:O	1:A:61:GLN:HG3	2.09	0.51
1:D:205:MET:CG	1:D:213:LEU:HD22	2.41	0.51
1:C:269:ILE:HG23	1:C:449:GLU:HB2	1.93	0.51
1:A:8:GLY:HA2	1:A:203:GLU:HG2	1.91	0.50
1:A:103:ASN:ND2	1:A:474:TYR:OH	2.40	0.50
1:A:34:ILE:HD11	1:A:42:PHE:HB3	1.93	0.49
1:A:96:ILE:HD13	1:A:139:LEU:HD12	1.94	0.49
1:C:497:ASN:O	1:C:498:LEU:C	2.50	0.49
1:B:410:PRO:HB2	1:B:414:GLU:HB2	1.95	0.48
1:C:290:TRP:CG	1:C:293:LEU:HD12	2.49	0.48
1:A:483:ASN:O	1:A:487:LYS:HG3	2.13	0.48
1:C:17:TYR:O	1:C:21:THR:HG23	2.13	0.48
1:A:343:ARG:HD3	1:A:348:ARG:HG2	1.96	0.48
1:C:457:GLU:OE2	1:C:459:SER:OG	2.28	0.48
1:B:34:ILE:HA	1:B:43:ARG:O	2.14	0.47
1:D:269:ILE:HG23	1:D:449:GLU:HB2	1.96	0.47
1:C:474:TYR:CE2	1:C:478:LEU:HD11	2.49	0.47
1:C:254:PHE:CD2	1:C:258:TYR:CE2	3.02	0.47
4:A:671:HOH:O	1:B:333:THR:HG22	2.14	0.47
1:B:86:GLN:HB3	1:B:87:PRO:HA	1.95	0.47
1:D:86:GLN:HB3	1:D:87:PRO:HA	1.96	0.47
1:D:94:TYR:CE2	1:D:147:LEU:HD11	2.50	0.47
1:B:67:MET:HG2	1:B:172:MET:SD	2.55	0.46
1:D:251:PRO:HG2	1:D:456:PHE:CD1	2.50	0.46
1:B:327:ASN:HB3	4:B:682:HOH:O	2.14	0.46
1:D:171:ALA:HB3	1:D:179:VAL:HG22	1.96	0.46
1:C:78:GLY:HA2	1:C:125:THR:OG1	2.16	0.46
1:B:269:ILE:HG23	1:B:449:GLU:HB2	1.98	0.45
1:B:348:ARG:CZ	1:B:348:ARG:HA	2.46	0.45
1:C:86:GLN:HB3	1:C:87:PRO:HA	1.98	0.45
1:A:67:MET:HE3	4:A:673:HOH:O	2.16	0.45
1:C:67:MET:HG2	1:C:172:MET:SD	2.57	0.45
1:C:285:LYS:HE2	1:C:435:ILE:HD11	1.99	0.45
1:D:10:MET:HB2	1:D:11:PRO:HD2	1.99	0.45
1:C:485:ASP:O	1:C:489:VAL:HG23	2.17	0.45
1:A:336:MET:HB3	1:A:339:GLN:HB2	1.98	0.44
1:B:346:VAL:HG11	1:B:377:GLN:HB3	1.99	0.44
1:C:285:LYS:HG2	1:C:435:ILE:HD11	1.99	0.44
1:B:447:ARG:HG3	1:B:456:PHE:HE1	1.82	0.44
4:C:566:HOH:O	1:D:327:ASN:HB3	2.16	0.44

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:93:PRO:HB2	1:D:94:TYR:CD2	2.52	0.44
1:C:74:TYR:CD1	1:C:75:PRO:HD2	2.52	0.44
1:A:457:GLU:OE2	1:A:459:SER:OG	2.35	0.44
1:B:10:MET:HB2	1:B:11:PRO:HD2	2.00	0.44
1:B:100:HIS:HB2	1:B:169:CYS:SG	2.58	0.44
1:A:494:GLU:O	1:A:498:LEU:HG	2.18	0.43
1:D:67:MET:HG2	1:D:172:MET:SD	2.58	0.43
1:D:342:ARG:O	1:D:342:ARG:HG3	2.18	0.43
1:D:10:MET:HB2	1:D:11:PRO:CD	2.48	0.43
1:B:346:VAL:HG22	1:B:346:VAL:O	2.18	0.43
1:C:34:ILE:HD11	1:C:42:PHE:HB3	2.00	0.43
1:D:379:ILE:HD13	1:D:431:ALA:HB2	2.01	0.43
1:A:322:GLN:HG3	4:A:676:HOH:O	2.17	0.43
1:A:265:PHE:CE2	1:A:270:SER:HB2	2.53	0.43
1:A:32:GLY:HA3	1:A:87:PRO:HD3	2.00	0.43
1:A:246:ASN:N	1:A:247:PRO:CD	2.82	0.43
1:C:14:GLN:NE2	1:D:348:ARG:HH22	2.16	0.43
1:C:254:PHE:HD2	1:C:258:TYR:CE2	2.36	0.43
1:A:495:VAL:HG11	1:C:57:ALA:O	2.19	0.43
1:D:17:TYR:O	1:D:21:THR:HG23	2.18	0.43
1:A:230:ILE:HG23	1:A:238:LEU:CD1	2.49	0.42
1:D:336:MET:O	1:D:339:GLN:CB	2.67	0.42
1:B:341:LEU:HD23	1:B:341:LEU:N	2.28	0.42
1:C:399:ILE:O	1:C:417:ALA:HB3	2.18	0.42
1:D:285:LYS:HG2	1:D:435:ILE:HD11	2.02	0.42
1:A:410:PRO:HB2	1:A:414:GLU:HB2	2.01	0.42
1:B:64:GLN:HG2	1:D:491:ARG:NH2	2.35	0.42
1:C:246:ASN:N	1:C:247:PRO:CD	2.82	0.42
1:C:335:ILE:HD12	1:C:335:ILE:H	1.83	0.42
1:B:94:TYR:CE2	1:B:147:LEU:HD11	2.55	0.42
1:D:346:VAL:O	1:D:346:VAL:HG22	2.20	0.42
1:A:163:ILE:HD11	1:A:167:TYR:CZ	2.54	0.41
1:C:145:TYR:CD1	1:C:146:PRO:HA	2.55	0.41
1:C:48:ASN:ND2	1:C:81:SER:O	2.43	0.41
1:A:67:MET:HG2	1:A:172:MET:SD	2.60	0.41
1:B:17:TYR:O	1:B:21:THR:HG23	2.20	0.41
1:B:417:ALA:HA	1:B:425:ILE:HD11	2.01	0.41
1:A:86:GLN:HB3	1:A:87:PRO:HA	2.02	0.41
1:B:336:MET:CE	1:B:336:MET:HA	2.51	0.41
1:C:9:VAL:HG11	1:C:201:ARG:HB3	2.02	0.41
1:D:193:GLY:HA3	1:D:213:LEU:HD13	2.03	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:253:LEU:HD12	1:D:253:LEU:HA	1.94	0.41
1:A:443:ILE:O	1:A:447:ARG:HB2	2.20	0.40
1:A:5:GLY:O	1:A:205:MET:HA	2.21	0.40
1:A:10:MET:HB2	1:A:11:PRO:CD	2.51	0.40
1:A:336:MET:HA	1:A:337:PRO:HD2	1.98	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	496/498 (100%)	477 (96%)	19 (4%)	0	100	100
1	B	493/498 (99%)	478 (97%)	15 (3%)	0	100	100
1	C	496/498 (100%)	469 (95%)	27 (5%)	0	100	100
1	D	492/498 (99%)	481 (98%)	11 (2%)	0	100	100
All	All	1977/1992 (99%)	1905 (96%)	72 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	416/417 (100%)	408 (98%)	8 (2%)	57	45

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	B	412/417 (99%)	407 (99%)	5 (1%)	71 64
1	C	417/417 (100%)	413 (99%)	4 (1%)	76 71
1	D	410/417 (98%)	406 (99%)	4 (1%)	76 71
All	All	1655/1668 (99%)	1634 (99%)	21 (1%)	69 62

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	28	GLN
1	A	119	ARG
1	A	198	ASP
1	A	254	PHE
1	A	296	ASP
1	A	342	ARG
1	A	457	GLU
1	A	484	ASP
1	B	91	ASN
1	B	100	HIS
1	B	254	PHE
1	B	348	ARG
1	B	437	GLN
1	C	100	HIS
1	C	254	PHE
1	C	437	GLN
1	C	457	GLU
1	D	100	HIS
1	D	254	PHE
1	D	341	LEU
1	D	437	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	103	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)

Of 8 ligands modelled in this entry, 4 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	$\#\|Z\| > 2$
3	G4P	A	502[A]	2	30,38,38	1.04	2 (6%)	42,61,61	1.19	6 (14%)
3	G4P	D	502[A]	2	30,38,38	0.99	2 (6%)	42,61,61	1.23	5 (11%)
3	G4P	A	502[B]	2	30,38,38	1.01	1 (3%)	42,61,61	1.11	5 (11%)
3	G4P	D	502[B]	2	30,38,38	0.95	2 (6%)	42,61,61	1.24	6 (14%)

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	G4P	A	502[A]	2	-	6/23/43/43	0/3/3/3
3	G4P	D	502[A]	2	-	7/23/43/43	0/3/3/3
3	G4P	A	502[B]	2	-	4/23/43/43	0/3/3/3
3	G4P	D	502[B]	2	-	7/23/43/43	0/3/3/3

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	502[A]	G4P	O4'-C1'	3.09	1.45	1.41

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	502[B]	G4P	C6-N1	-2.80	1.33	1.37
3	D	502[A]	G4P	C6-N1	-2.52	1.34	1.37
3	D	502[A]	G4P	O4'-C1'	2.40	1.44	1.41
3	D	502[B]	G4P	C6-N1	-2.31	1.34	1.37
3	A	502[A]	G4P	C6-N1	-2.11	1.34	1.37
3	D	502[B]	G4P	O4'-C1'	2.07	1.44	1.41

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	D	502[A]	G4P	O4'-C4'-C5'	-3.12	99.12	109.37
3	A	502[B]	G4P	C8-N7-C5	2.94	108.60	102.99
3	D	502[B]	G4P	O4'-C4'-C5'	-2.81	100.12	109.37
3	D	502[A]	G4P	C8-N7-C5	2.77	108.27	102.99
3	D	502[A]	G4P	C5-C6-N1	2.74	118.79	113.95
3	D	502[B]	G4P	C5-C6-N1	2.72	118.76	113.95
3	A	502[A]	G4P	C5-C6-N1	2.64	118.61	113.95
3	D	502[B]	G4P	C8-N7-C5	2.57	107.89	102.99
3	A	502[A]	G4P	C8-N7-C5	2.55	107.84	102.99
3	D	502[A]	G4P	PA-O3A-PB	-2.47	124.33	132.83
3	A	502[A]	G4P	O4'-C4'-C5'	-2.44	101.34	109.37
3	D	502[B]	G4P	PA-O3A-PB	-2.42	124.54	132.83
3	A	502[B]	G4P	O4'-C4'-C5'	-2.39	101.52	109.37
3	D	502[B]	G4P	O3B-PB-O2B	2.23	116.16	107.64
3	A	502[A]	G4P	C2-N1-C6	-2.16	121.13	125.10
3	A	502[B]	G4P	O3B-PB-O2B	2.15	115.85	107.64
3	D	502[A]	G4P	PC-O3C-PD	-2.13	125.50	132.83
3	A	502[B]	G4P	PA-O3A-PB	-2.11	125.58	132.83
3	A	502[A]	G4P	PA-O3A-PB	-2.10	125.62	132.83
3	D	502[B]	G4P	O4'-C1'-C2'	2.07	109.94	106.93
3	A	502[B]	G4P	C5-C6-N1	2.06	117.59	113.95
3	A	502[A]	G4P	PC-O3C-PD	-2.02	125.90	132.83

There are no chirality outliers.

All (24) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	502[A]	G4P	PC-O3C-PD-O2D
3	A	502[B]	G4P	O4'-C4'-C5'-O5'
3	D	502[A]	G4P	PA-O3A-PB-O2B
3	D	502[B]	G4P	O4'-C4'-C5'-O5'
3	A	502[A]	G4P	O4'-C4'-C5'-O5'

Continued on next page...

Continued from previous page...

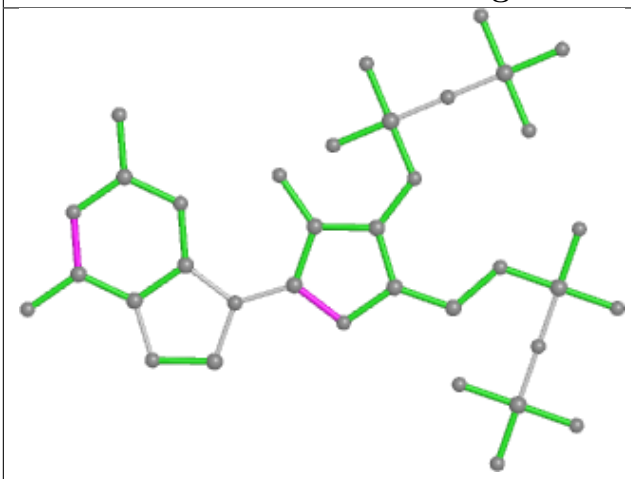
Mol	Chain	Res	Type	Atoms
3	A	502[A]	G4P	C3'-C4'-C5'-O5'
3	D	502[A]	G4P	O4'-C4'-C5'-O5'
3	D	502[A]	G4P	C3'-C4'-C5'-O5'
3	D	502[B]	G4P	C3'-C4'-C5'-O5'
3	A	502[B]	G4P	C3'-C4'-C5'-O5'
3	A	502[B]	G4P	PC-O3C-PD-O2D
3	D	502[A]	G4P	C3'-O3'-PC-O3C
3	A	502[A]	G4P	C4'-C5'-O5'-PA
3	A	502[B]	G4P	C4'-C5'-O5'-PA
3	D	502[B]	G4P	C3'-O3'-PC-O3C
3	D	502[A]	G4P	C4'-C5'-O5'-PA
3	D	502[B]	G4P	C4'-C5'-O5'-PA
3	D	502[A]	G4P	C3'-O3'-PC-O1C
3	D	502[A]	G4P	C3'-O3'-PC-O2C
3	D	502[B]	G4P	C3'-O3'-PC-O2C
3	A	502[A]	G4P	PA-O3A-PB-O2B
3	D	502[B]	G4P	PA-O3A-PB-O2B
3	A	502[A]	G4P	C3'-O3'-PC-O3C
3	D	502[B]	G4P	C5'-O5'-PA-O1A

There are no ring outliers.

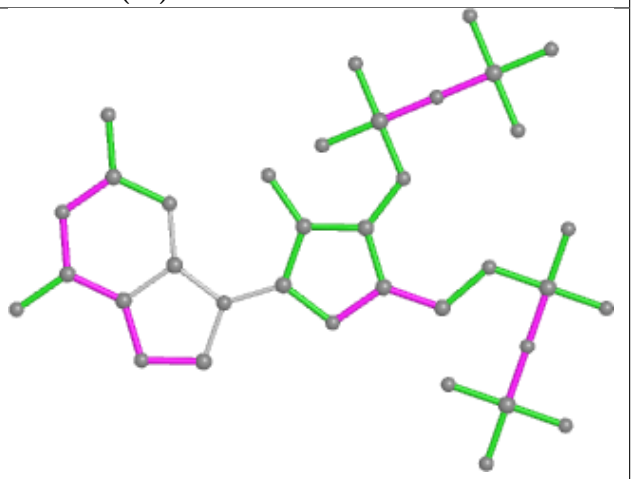
No monomer is involved in short contacts.

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 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.

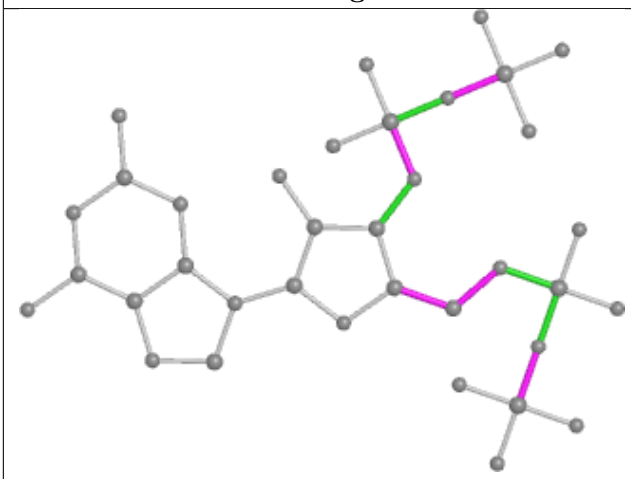
Ligand G4P A 502 (A)



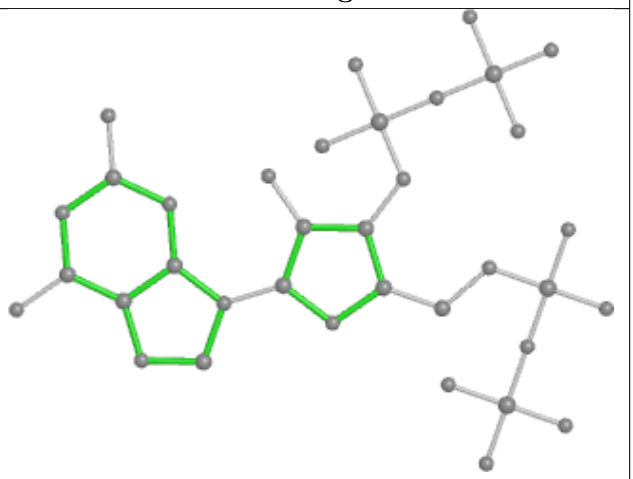
Bond lengths



Bond angles

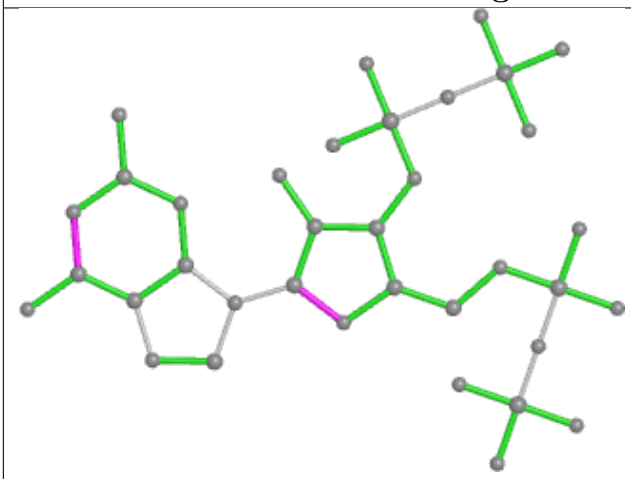


Torsions

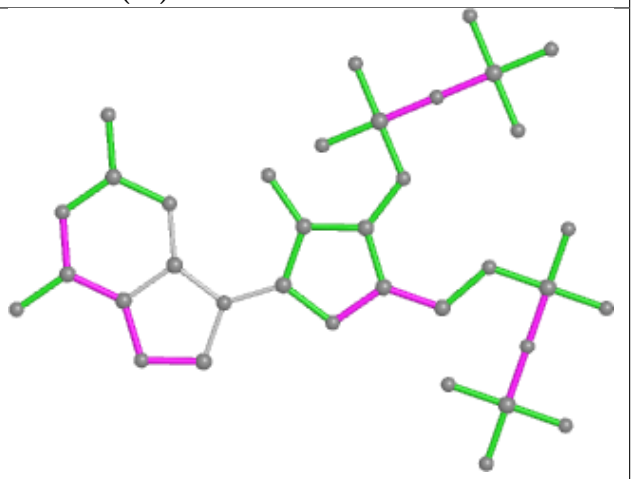


Rings

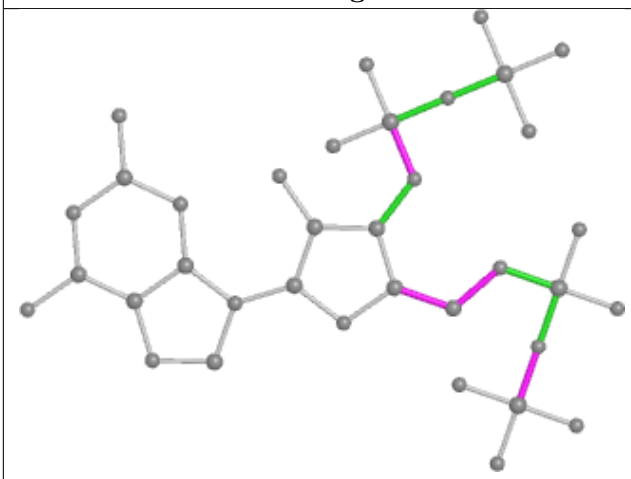
Ligand G4P D 502 (A)



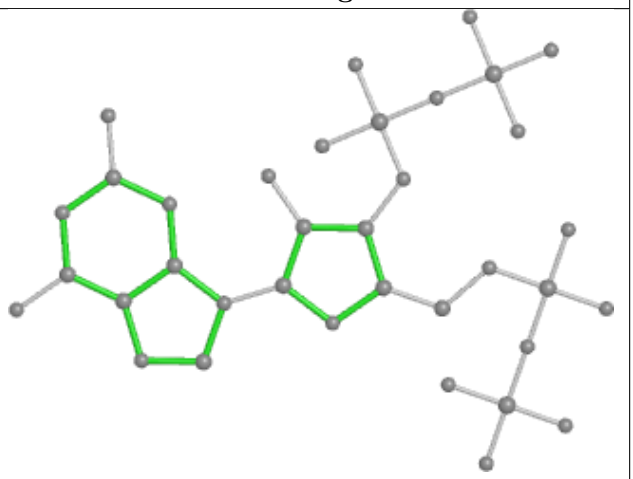
Bond lengths



Bond angles

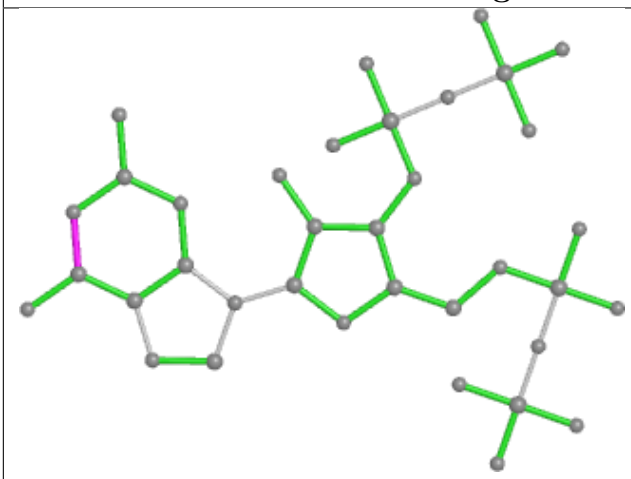


Torsions

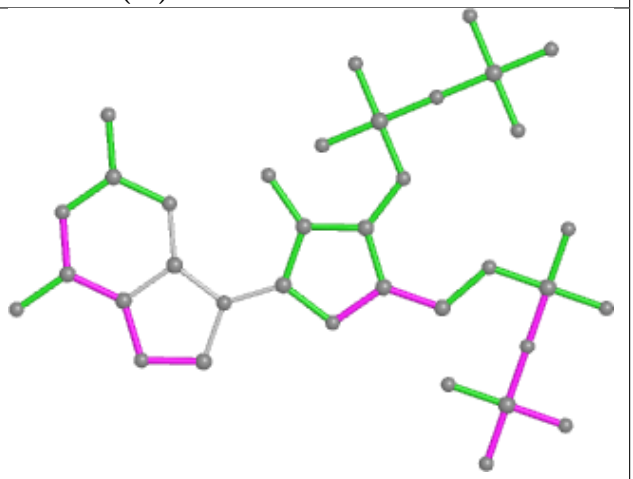


Rings

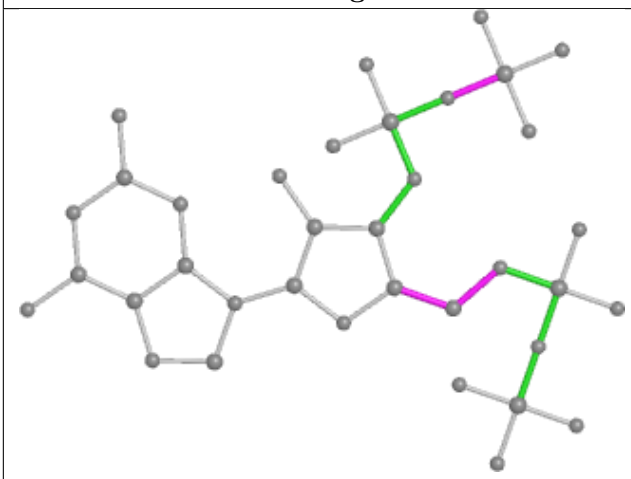
Ligand G4P A 502 (B)



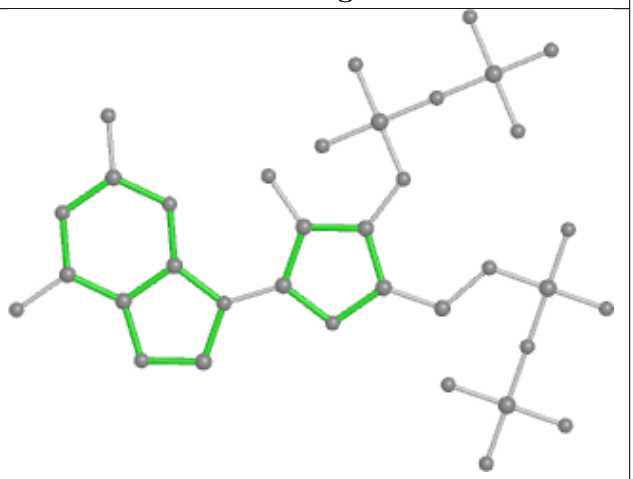
Bond lengths



Bond angles

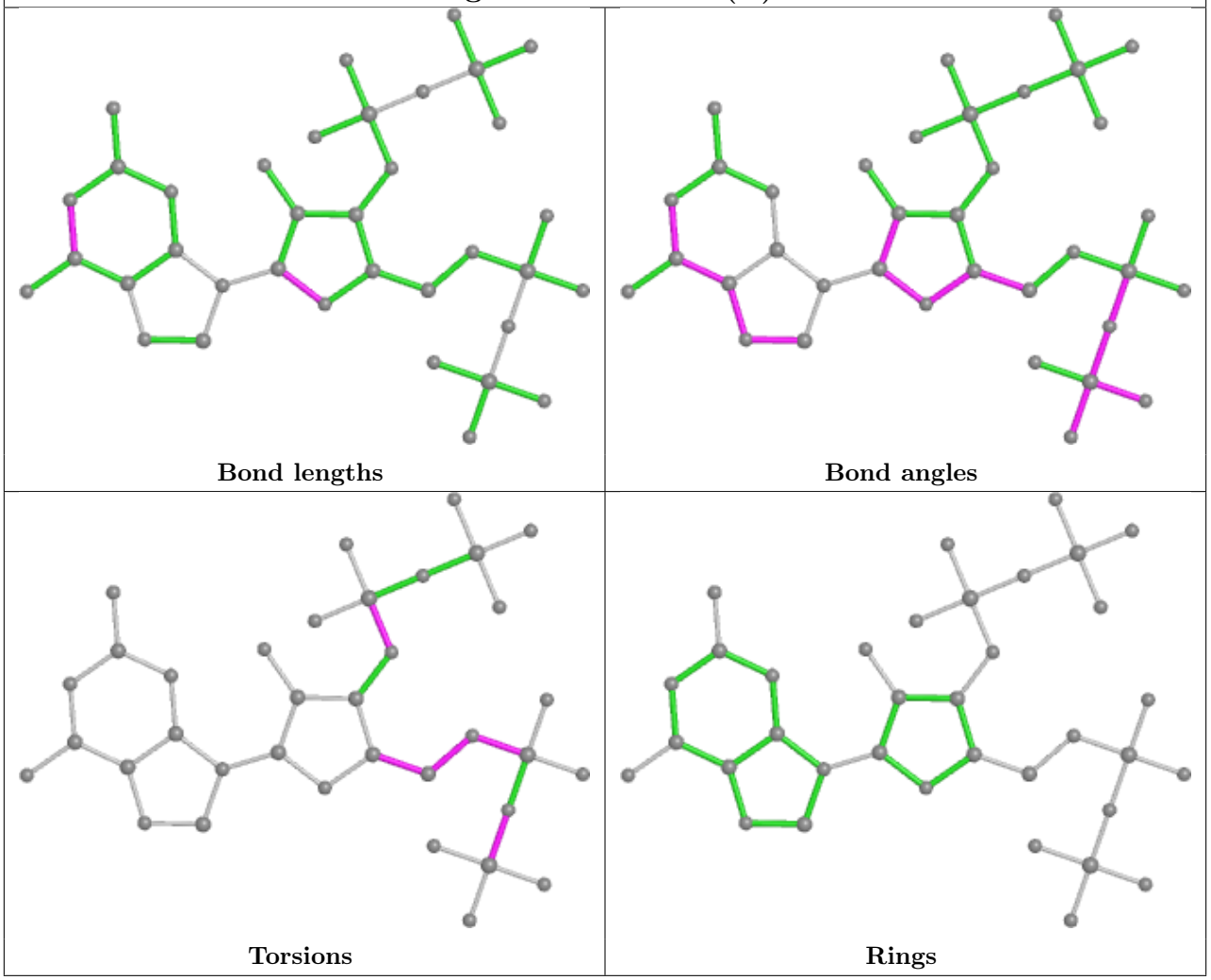


Torsions



Rings

Ligand G4P D 502 (B)



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

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^{th} 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^2)	Q<0.9
1	A	498/498 (100%)	0.69	40 (8%) 12 17	32, 47, 71, 85	0
1	B	495/498 (99%)	0.46	26 (5%) 26 33	26, 39, 70, 91	0
1	C	498/498 (100%)	0.88	55 (11%) 5 8	32, 51, 76, 85	0
1	D	494/498 (99%)	0.52	37 (7%) 14 20	27, 41, 74, 94	0
All	All	1985/1992 (99%)	0.64	158 (7%) 12 17	26, 45, 74, 94	0

All (158) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	336	MET	8.9
1	D	343	ARG	8.9
1	D	341	LEU	7.6
1	B	495	VAL	7.3
1	A	482	ARG	6.6
1	D	342	ARG	6.4
1	A	495	VAL	6.4
1	C	337	PRO	6.0
1	B	344	LYS	5.8
1	A	498	LEU	5.5
1	C	480	THR	5.5
1	B	339	GLN	5.3
1	C	477	PHE	5.3
1	D	337	PRO	5.2
1	B	343	ARG	5.2
1	B	337	PRO	5.1
1	D	480	THR	5.0
1	A	199	GLU	4.9
1	C	478	LEU	4.9
1	B	338	GLY	4.9
1	C	417	ALA	4.9

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	D	477	PHE	4.8
1	A	470	VAL	4.8
1	C	487	LYS	4.7
1	B	341	LEU	4.7
1	A	486	ALA	4.7
1	D	487	LYS	4.6
1	C	482	ARG	4.5
1	C	489	VAL	4.2
1	B	490	GLN	4.2
1	D	491	ARG	4.2
1	A	338	GLY	4.1
1	A	483	ASN	4.0
1	C	490	GLN	3.9
1	A	494	GLU	3.9
1	C	491	ARG	3.9
1	D	478	LEU	3.8
1	D	1	CYS	3.8
1	D	484	ASP	3.8
1	C	495	VAL	3.8
1	B	335	ILE	3.8
1	B	342	ARG	3.7
1	B	480	THR	3.7
1	A	358	ARG	3.7
1	C	78	GLY	3.6
1	C	77	ALA	3.6
1	C	488	ALA	3.6
1	D	489	VAL	3.6
1	D	344	LYS	3.6
1	B	494	GLU	3.6
1	B	491	ARG	3.6
1	A	478	LEU	3.6
1	C	145	TYR	3.5
1	C	484	ASP	3.5
1	A	489	VAL	3.4
1	D	335	ILE	3.4
1	D	348	ARG	3.3
1	B	258	TYR	3.3
1	C	143	ARG	3.3
1	C	483	ASN	3.3
1	A	79	SER	3.3
1	A	496	GLU	3.2
1	A	490	GLN	3.2

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	486	ALA	3.1
1	C	431	ALA	3.1
1	A	476	ASP	3.1
1	C	200	ASN	3.1
1	B	481	LEU	3.1
1	C	469	ASP	3.1
1	C	494	GLU	3.0
1	D	258	TYR	3.0
1	A	248	VAL	3.0
1	B	489	VAL	3.0
1	C	481	LEU	3.0
1	D	481	LEU	3.0
1	D	488	ALA	3.0
1	A	487	LYS	3.0
1	A	474	TYR	3.0
1	A	143	ARG	2.9
1	B	328	ARG	2.9
1	D	340	GLN	2.9
1	A	246	ASN	2.9
1	C	425	ILE	2.9
1	C	79	SER	2.8
1	A	337	PRO	2.8
1	C	427	GLN	2.8
1	D	490	GLN	2.8
1	C	476	ASP	2.8
1	C	290	TRP	2.8
1	B	254	PHE	2.8
1	B	477	PHE	2.8
1	D	197	ILE	2.8
1	D	347	ARG	2.7
1	A	479	ASP	2.7
1	B	478	LEU	2.7
1	D	339	GLN	2.7
1	D	336	MET	2.7
1	D	254	PHE	2.7
1	A	76	THR	2.7
1	C	115	PHE	2.6
1	C	211	VAL	2.6
1	C	197	ILE	2.6
1	C	454	GLN	2.6
1	C	139	LEU	2.6
1	A	54	VAL	2.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	475	LEU	2.6
1	C	474	TYR	2.6
1	B	347	ARG	2.5
1	C	293	LEU	2.5
1	C	358	ARG	2.5
1	C	150	ASP	2.5
1	D	483	ASN	2.5
1	A	488	ALA	2.5
1	C	199	GLU	2.5
1	D	494	GLU	2.5
1	C	162	LEU	2.5
1	C	439	LEU	2.5
1	C	498	LEU	2.5
1	A	480	THR	2.5
1	A	19	ALA	2.5
1	D	474	TYR	2.5
1	A	422	VAL	2.4
1	D	77	ALA	2.4
1	A	61	GLN	2.4
1	A	454	GLN	2.4
1	D	472	GLN	2.4
1	C	401	PHE	2.4
1	D	330	VAL	2.3
1	A	336	MET	2.3
1	C	155	ALA	2.3
1	D	328	ARG	2.3
1	C	76	THR	2.3
1	C	357	PHE	2.3
1	D	329	TYR	2.2
1	C	336	MET	2.2
1	D	486	ALA	2.2
1	D	304	THR	2.2
1	C	492	GLN	2.2
1	D	338	GLY	2.2
1	A	225	ALA	2.2
1	D	78	GLY	2.2
1	B	330	VAL	2.2
1	A	472	GLN	2.1
1	B	78	GLY	2.1
1	C	147	LEU	2.1
1	C	392	LEU	2.1
1	C	248	VAL	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	99	ALA	2.1
1	A	254	PHE	2.1
1	A	84	GLU	2.1
1	A	200	ASN	2.1
1	C	355	ALA	2.1
1	C	460	VAL	2.0
1	B	487	LYS	2.0
1	A	81	SER	2.0
1	C	464	VAL	2.0
1	C	485	ASP	2.0
1	C	295	ILE	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)

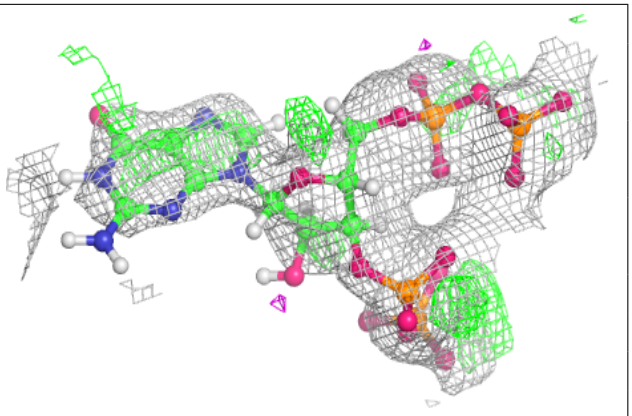
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

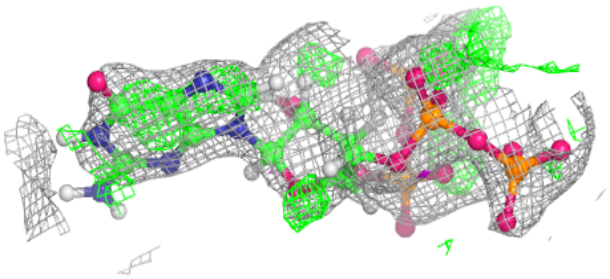
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	MG	D	501[A]	1/1	0.92	0.19	37,37,37,37	1
2	MG	D	501[B]	1/1	0.92	0.19	37,37,37,37	1
3	G4P	A	502[A]	36/36	0.92	0.27	28,37,51,62	47
3	G4P	A	502[B]	36/36	0.92	0.27	28,36,49,57	47
3	G4P	D	502[A]	36/36	0.94	0.27	26,36,51,62	47
3	G4P	D	502[B]	36/36	0.94	0.27	25,36,49,55	47
2	MG	A	501[A]	1/1	0.95	0.15	36,36,36,36	1
2	MG	A	501[B]	1/1	0.95	0.15	38,38,38,38	1

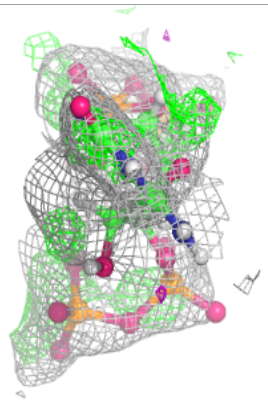
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around G4P A 502 (A):

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

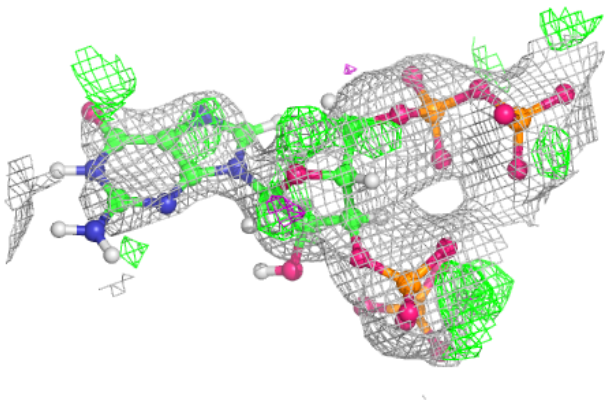


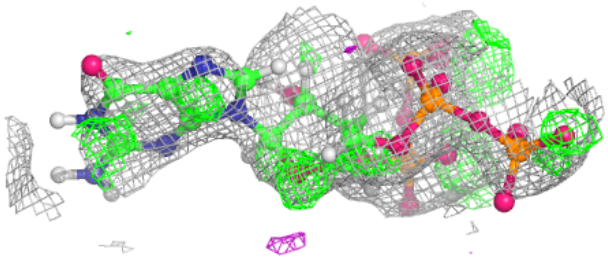


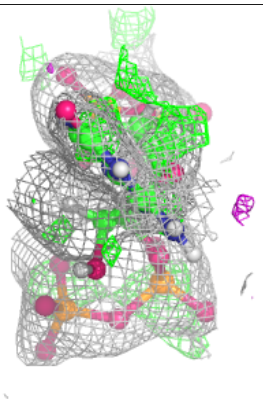


Electron density around G4P A 502 (B):

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

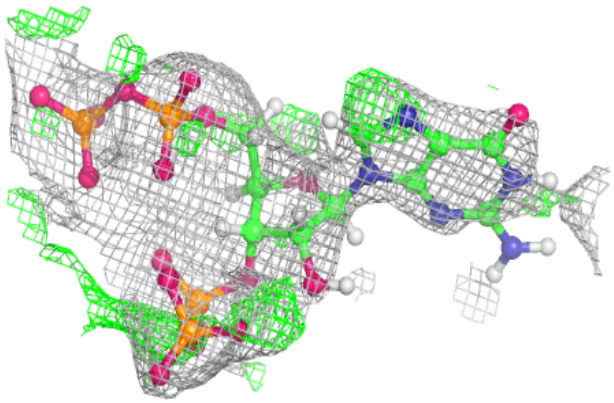


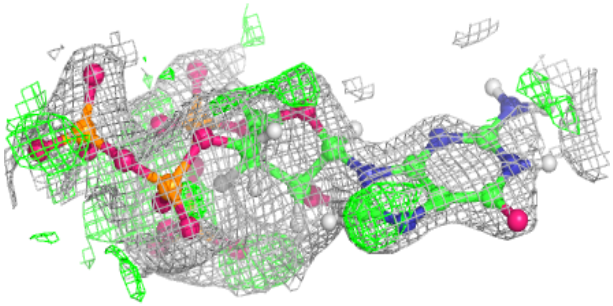


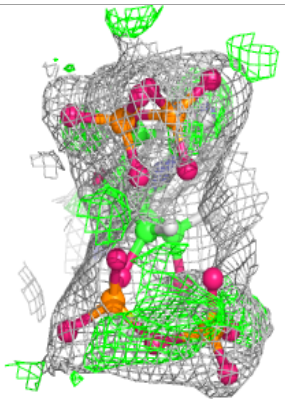


Electron density around G4P D 502 (A):

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

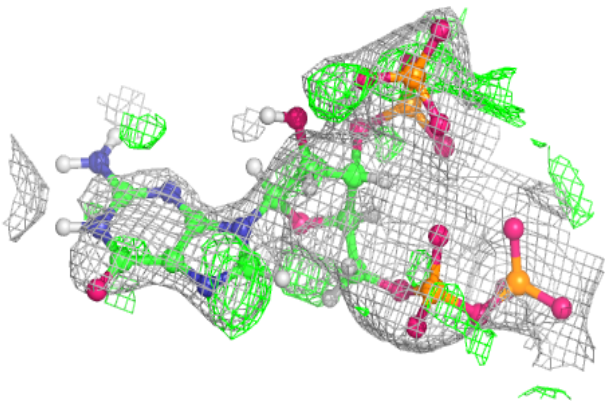


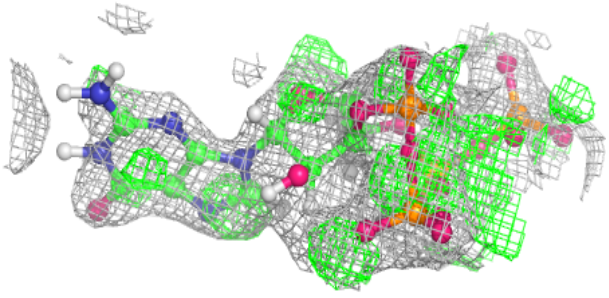


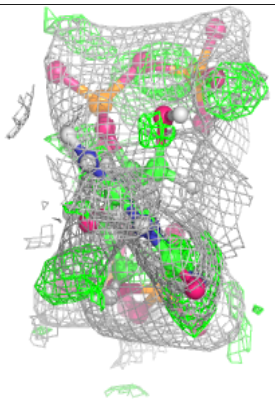


Electron density around G4P D 502 (B):

$2mF_o$-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.