



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 13, 2017 – 06:37 am GMT

PDB ID : 1JBW
Title : FPGS-AMPPCP-folate complex
Authors : Sun, X.; Cross, J.A.; Bognar, A.L.; Baker, E.N.; Smith, C.A.
Deposited on : 2001-06-06
Resolution : 1.85 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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : recalc28949

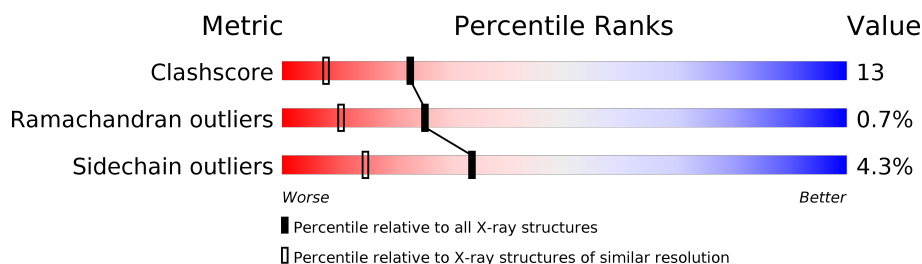
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.85 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	112137	2083 (1.86-1.86)
Ramachandran outliers	110173	2060 (1.86-1.86)
Sidechain outliers	110143	2060 (1.86-1.86)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	428	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3592 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 FOLYLPOLYGLUTAMATE SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	410	Total	C	N	O	S	0	0	0
			3143	2007	552	579	5			

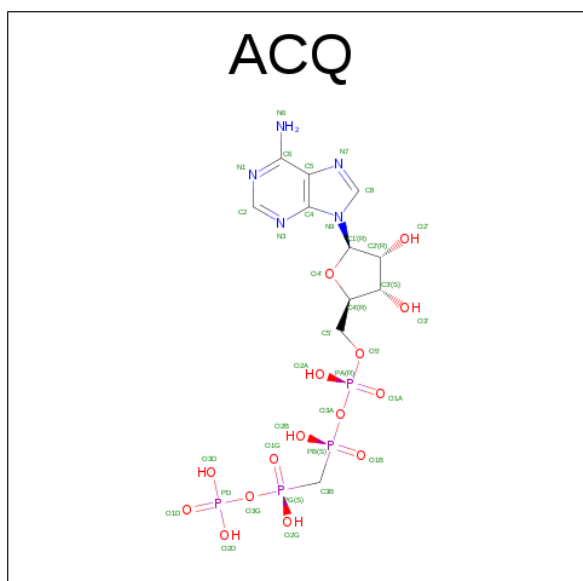
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	128	ALA	GLY	SEE REMARK 999	UNP P15925
A	185	KCX	LYS	MODIFIED RESIDUE	UNP P15925

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

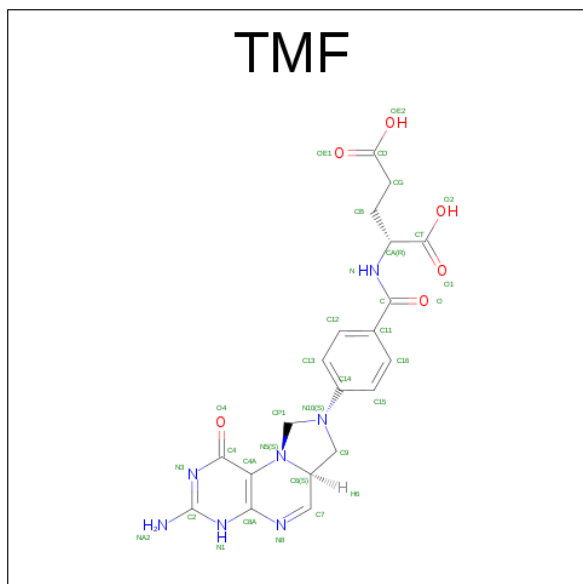
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Mg	0	0
			2	2		

- Molecule 3 is DIPHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (three-letter code: ACQ) (formula: C₁₁H₁₉N₅O₁₅P₄).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			35	11	5	15	4		

- Molecule 4 is 5,10-METHYLENE-6-HYDROFOLIC ACID (three-letter code: TMF) (formula: $C_{20}H_{21}N_7O_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			24	15	7	2		

- Molecule 5 is water.

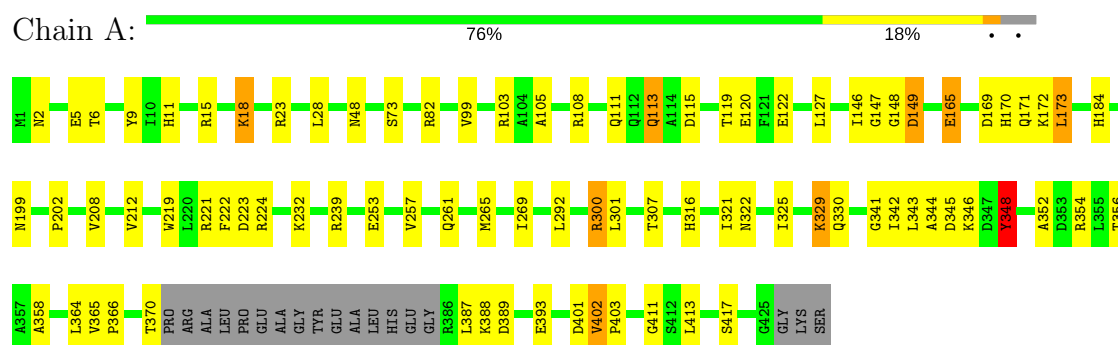
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	388	Total	O	0	0
			388	388		

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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.

Note EDS was not executed.

• Molecule 1: FOLYLPOLYGLUTAMATE SYNTHASE



4 Data and refinement statistics

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	53.10Å 45.60Å 82.70Å 90.00° 104.60° 90.00°	Depositor
Resolution (Å)	100.00 – 1.85	Depositor
% Data completeness (in resolution range)	(Not available) (100.00-1.85)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.195 , 0.225	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3592	wwPDB-VP
Average B, all atoms (Å ²)	21.0	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: MG, ACQ, TMF, KCX

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	0.53	0/3196	0.74	1/4362 (0.0%)

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	1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	348	TYR	O-C-N	-8.79	108.64	122.70

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	348	TYR	Mainchain

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	3143	0	3161	81	0
2	A	2	0	0	0	0
3	A	35	0	14	2	0
4	A	24	0	13	1	0
5	A	388	0	0	14	0
All	All	3592	0	3188	82	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 13.

All (82) 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:322:ASN:OD1	1:A:354:ARG:NH1	2.10	0.84
1:A:18:LYS:H	1:A:18:LYS:HD2	1.41	0.83
1:A:221:ARG:HH11	1:A:221:ARG:HG2	1.42	0.82
1:A:344:ALA:CB	5:A:741:HOH:O	2.36	0.73
1:A:344:ALA:HB2	5:A:741:HOH:O	1.89	0.72
1:A:232:LYS:NZ	1:A:239:ARG:HH21	1.89	0.70
1:A:232:LYS:HZ1	1:A:239:ARG:HH21	1.38	0.70
1:A:2:ASN:OD1	1:A:5:GLU:HG3	1.91	0.69
1:A:300:ARG:NH1	1:A:413:LEU:HD11	2.09	0.68
1:A:365:VAL:HB	1:A:366:PRO:HD2	1.75	0.67
1:A:221:ARG:HG2	1:A:221:ARG:NH1	2.09	0.67
1:A:6:THR:CG2	1:A:99:VAL:HG21	2.24	0.67
1:A:402:VAL:N	1:A:403:PRO:HD3	2.10	0.66
1:A:9:TYR:CZ	1:A:103:ARG:HD2	2.29	0.66
1:A:239:ARG:HD3	1:A:253:GLU:OE1	1.96	0.65
1:A:199:ASN:HA	1:A:221:ARG:NH1	2.11	0.65
1:A:269:ILE:HD11	1:A:292:LEU:HD11	1.80	0.63
1:A:146:ILE:HD11	1:A:170:HIS:CE1	2.32	0.63
1:A:18:LYS:H	1:A:18:LYS:CD	2.11	0.63
1:A:113:GLN:NE2	1:A:115:ASP:OD1	2.33	0.62
1:A:149:ASP:OD2	1:A:184:HIS:HA	1.99	0.61
1:A:199:ASN:HA	1:A:221:ARG:HH12	1.65	0.61
1:A:389:ASP:HB2	1:A:393:GLU:OE1	2.00	0.61
1:A:6:THR:HG23	1:A:99:VAL:HG21	1.83	0.61
1:A:6:THR:HG23	1:A:99:VAL:HG11	1.82	0.61
1:A:341:GLY:HA2	1:A:365:VAL:O	2.01	0.60
1:A:11:HIS:HE1	5:A:595:HOH:O	1.84	0.60
1:A:147:GLY:HA3	5:A:462:HOH:O	2.01	0.59
1:A:172:LYS:N	1:A:172:LYS:HD2	2.18	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:342:ILE:C	1:A:344:ALA:H	2.07	0.58
1:A:345:ASP:O	1:A:348:TYR:HB3	2.05	0.56
1:A:11:HIS:HD2	1:A:120:GLU:OE2	1.88	0.56
1:A:222:PHE:O	1:A:223:ASP:HB2	2.07	0.54
1:A:18:LYS:HD2	1:A:18:LYS:N	2.19	0.53
1:A:387:LEU:HD22	1:A:387:LEU:H	1.74	0.53
1:A:184:HIS:CE1	5:A:575:HOH:O	2.63	0.52
1:A:348:TYR:HE1	1:A:364:LEU:HD13	1.75	0.51
1:A:108:ARG:HD3	5:A:788:HOH:O	2.11	0.51
1:A:345:ASP:O	1:A:348:TYR:CB	2.58	0.51
1:A:111:GLN:HG2	5:A:710:HOH:O	2.11	0.51
1:A:232:LYS:HZ3	1:A:239:ARG:HE	1.58	0.50
1:A:48:ASN:HB2	1:A:165:GLU:OE2	2.11	0.50
3:A:999:ACQ:H3B2	5:A:431:HOH:O	2.12	0.49
1:A:18:LYS:N	1:A:18:LYS:CD	2.76	0.49
1:A:221:ARG:CG	1:A:221:ARG:NH1	2.75	0.48
1:A:321:ILE:O	1:A:325:ILE:HG13	2.12	0.48
1:A:257:VAL:HG23	1:A:301:LEU:HD13	1.96	0.47
1:A:329:LYS:HE3	1:A:358:ALA:HB1	1.97	0.47
1:A:261:GLN:O	1:A:265:MET:HG2	2.15	0.46
1:A:172:LYS:HD2	1:A:172:LYS:H	1.81	0.46
1:A:316:HIS:HB3	1:A:411:GLY:C	2.36	0.45
1:A:170:HIS:HD2	5:A:758:HOH:O	1.98	0.45
1:A:402:VAL:N	1:A:403:PRO:CD	2.78	0.45
1:A:113:GLN:HB2	5:A:797:HOH:O	2.16	0.45
1:A:208:VAL:O	1:A:212:VAL:HG22	2.16	0.45
1:A:344:ALA:HB3	5:A:741:HOH:O	2.10	0.45
1:A:221:ARG:HD3	1:A:224:ARG:NH1	2.31	0.45
1:A:127:LEU:C	1:A:127:LEU:HD23	2.38	0.44
1:A:300:ARG:HH12	1:A:413:LEU:HD11	1.78	0.43
1:A:342:ILE:C	1:A:344:ALA:N	2.71	0.43
1:A:346:LYS:C	1:A:348:TYR:N	2.71	0.43
1:A:171:GLN:C	1:A:173:LEU:H	2.20	0.43
1:A:300:ARG:HD2	3:A:999:ACQ:H5'2	2.00	0.43
1:A:169:ASP:OD1	1:A:170:HIS:CD2	2.71	0.43
1:A:219:TRP:O	1:A:224:ARG:NH2	2.52	0.43
1:A:105:ALA:HA	1:A:108:ARG:CZ	2.48	0.43
1:A:387:LEU:HD22	1:A:387:LEU:N	2.34	0.43
1:A:73:SER:HB3	1:A:82:ARG:NH2	2.34	0.42
1:A:352:ALA:O	1:A:356:THR:HG23	2.19	0.42
1:A:417:SER:OG	4:A:996:TMF:NA2	2.53	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:342:ILE:O	1:A:344:ALA:N	2.52	0.42
1:A:365:VAL:HG12	1:A:388:LYS:HB2	2.02	0.42
1:A:232:LYS:NZ	1:A:239:ARG:NH2	2.64	0.41
1:A:232:LYS:HZ3	1:A:239:ARG:NE	2.19	0.41
1:A:388:LYS:HA	1:A:388:LYS:HD3	1.82	0.41
1:A:265:MET:O	1:A:269:ILE:HG13	2.20	0.41
1:A:301:LEU:HD23	1:A:301:LEU:HA	1.95	0.41
1:A:119:THR:OG1	1:A:122:GLU:HG3	2.21	0.40
1:A:169:ASP:CG	5:A:771:HOH:O	2.59	0.40
1:A:330:GLN:NE2	5:A:503:HOH:O	2.53	0.40
1:A:401:ASP:C	1:A:403:PRO:HD3	2.40	0.40
1:A:413:LEU:CD1	5:A:431:HOH:O	2.69	0.40

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	405/428 (95%)	384 (95%)	18 (4%)	3 (1%)	25	10

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	343	LEU
1	A	348	TYR
1	A	148	GLY

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	325/343 (95%)	311 (96%)	14 (4%)	33	15

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	ARG
1	A	18	LYS
1	A	23	ARG
1	A	28	LEU
1	A	113	GLN
1	A	149	ASP
1	A	165	GLU
1	A	173	LEU
1	A	202	PRO
1	A	300	ARG
1	A	307	THR
1	A	329	LYS
1	A	370	THR
1	A	402	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	11	HIS
1	A	37	GLN
1	A	111	GLN
1	A	113	GLN
1	A	170	HIS
1	A	184	HIS
1	A	238	GLN
1	A	261	GLN
1	A	262	GLN
1	A	264	ASN
1	A	405	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	$\# Z > 2$
1	KCX	A	185	1	8,11,12	0.62	0	6,12,14	1.24	0

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
1	KCX	A	185	1	-	0/6/10/12	0/0/0/0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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
4	TMF	A	996	-	24,27,36	5.27	18 (75%)	23,40,52	2.93	14 (60%)
3	ACQ	A	999	1,2	31,37,37	1.71	8 (25%)	32,59,59	1.22	4 (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
4	TMF	A	996	-	-	0/8/29/42	0/3/4/4
3	ACQ	A	999	1,2	-	0/18/44/44	0/3/3/3

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	999	ACQ	PB-O3A	-3.92	1.54	1.58
3	A	999	ACQ	PB-O2B	-2.19	1.51	1.56
3	A	999	ACQ	PG-O2G	-2.03	1.51	1.56
3	A	999	ACQ	PD-O3G	2.08	1.63	1.60
3	A	999	ACQ	C2-N3	2.35	1.36	1.32
4	A	996	TMF	O-C	2.47	1.29	1.24
4	A	996	TMF	C2-N1	2.53	1.40	1.35
3	A	999	ACQ	C4-N3	2.66	1.39	1.35
4	A	996	TMF	C2-N3	2.68	1.40	1.35
4	A	996	TMF	C14-N10	2.84	1.46	1.38
4	A	996	TMF	C13-C14	2.94	1.45	1.39
4	A	996	TMF	C-N	3.21	1.39	1.33
4	A	996	TMF	C15-C14	3.52	1.46	1.39
4	A	996	TMF	C16-C11	3.64	1.45	1.39
4	A	996	TMF	C12-C11	3.74	1.45	1.39
4	A	996	TMF	C16-C15	3.74	1.45	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	999	ACQ	O4'-C1'	3.84	1.46	1.41
4	A	996	TMF	CP1-N5	4.06	1.51	1.45
4	A	996	TMF	C13-C12	4.06	1.46	1.38
3	A	999	ACQ	PG-O3G	4.42	1.63	1.58
4	A	996	TMF	C4-N3	4.76	1.41	1.33
4	A	996	TMF	C4A-C8A	4.92	1.47	1.41
4	A	996	TMF	C6-C7	6.51	1.65	1.49
4	A	996	TMF	C4-C4A	7.22	1.49	1.41
4	A	996	TMF	O4-C4	9.52	1.48	1.24
4	A	996	TMF	C7-N8	17.13	1.48	1.28

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	996	TMF	C4A-C4-N3	-4.42	116.43	123.37
4	A	996	TMF	N3-C2-N1	-4.07	118.85	125.45
4	A	996	TMF	C15-C16-C11	-3.87	116.46	120.79
4	A	996	TMF	C12-C13-C14	-3.59	115.45	120.34
4	A	996	TMF	C9-N10-C14	-3.06	119.48	122.84
4	A	996	TMF	C11-C-N	-3.05	114.29	117.77
4	A	996	TMF	C13-C14-N10	-2.65	117.67	121.39
4	A	996	TMF	CP1-N5-C4A	-2.33	115.02	122.61
3	A	999	ACQ	O2'-C2'-C1'	-2.16	104.86	111.61
4	A	996	TMF	NA2-C2-N3	-2.06	113.95	117.24
4	A	996	TMF	C16-C15-C14	2.14	123.25	120.34
3	A	999	ACQ	C4-C5-N7	2.53	111.85	109.41
3	A	999	ACQ	O2B-PB-O1B	2.95	119.95	110.09
3	A	999	ACQ	PD-O3G-PG	2.99	142.95	132.38
4	A	996	TMF	C13-C12-C11	3.12	124.28	120.79
4	A	996	TMF	C4-C4A-C8A	3.75	118.52	114.55
4	A	996	TMF	C4-N3-C2	4.61	122.69	116.06
4	A	996	TMF	NA2-C2-N1	6.23	127.20	117.24

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	996	TMF	1	0
3	A	999	ACQ	2	0

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.