



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 11:46 AM GMT

PDB ID : 3PW7
Title : Ternary complex of Aflatoxin B1 Adduct modified DNA (AFB1-N7-Gua) with DNA Polymerase IV and incoming dCTP
Authors : Banerjee, S.
Deposited on : 2010-12-07
Resolution : 2.90 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

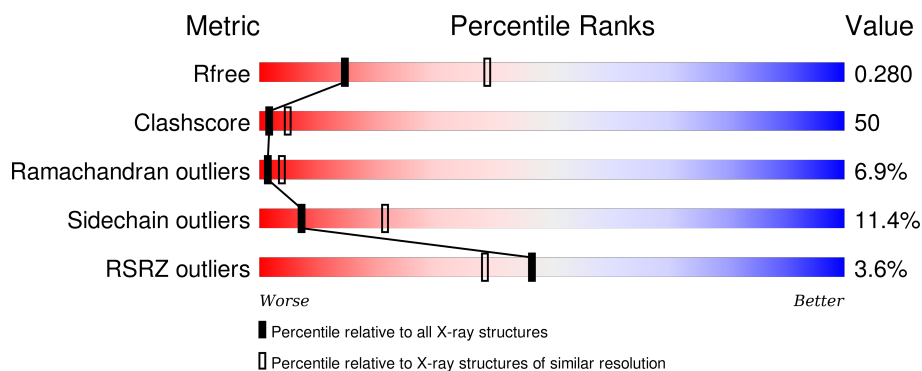
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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))
R_{free}	91344	1451 (2.90-2.90)
Clashscore	102246	1668 (2.90-2.90)
Ramachandran outliers	100387	1630 (2.90-2.90)
Sidechain outliers	100360	1632 (2.90-2.90)
RSRZ outliers	91569	1456 (2.90-2.90)

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 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.

Mol	Chain	Length	Quality of chain
1	A	347	<div> <div>2%</div> <div>31%</div> <div>56%</div> <div>11%</div> <div>.</div> </div>
1	E	347	<div> <div>%</div> <div>33%</div> <div>53%</div> <div>12%</div> <div>..</div> </div>
2	B	16	<div> <div>25%</div> <div>31%</div> <div>69%</div> </div>
2	F	16	<div> <div>25%</div> <div>6%</div> <div>94%</div> </div>
3	C	12	<div> <div>25%</div> <div>25%</div> <div>75%</div> </div>

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Mol	Chain	Length	Quality of chain
3	G	12	

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
2	X	B	374	X	-	-	-
2	X	F	374	X	-	-	-
4	DCP	A	400	-	-	X	-

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6857 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 DNA polymerase IV.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	343	Total	C	N	O	S	0	0	0
			2764	1772	478	507	7			
1	E	343	Total	C	N	O	S	0	0	0
			2764	1772	478	507	7			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	HIS	-	EXPRESSION TAG	UNP Q97W02
A	-1	HIS	-	EXPRESSION TAG	UNP Q97W02
A	0	HIS	-	EXPRESSION TAG	UNP Q97W02
A	1	HIS	-	EXPRESSION TAG	UNP Q97W02
A	2	HIS	-	EXPRESSION TAG	UNP Q97W02
A	3	HIS	-	EXPRESSION TAG	UNP Q97W02
E	-2	HIS	-	EXPRESSION TAG	UNP Q97W02
E	-1	HIS	-	EXPRESSION TAG	UNP Q97W02
E	0	HIS	-	EXPRESSION TAG	UNP Q97W02
E	1	HIS	-	EXPRESSION TAG	UNP Q97W02
E	2	HIS	-	EXPRESSION TAG	UNP Q97W02
E	3	HIS	-	EXPRESSION TAG	UNP Q97W02

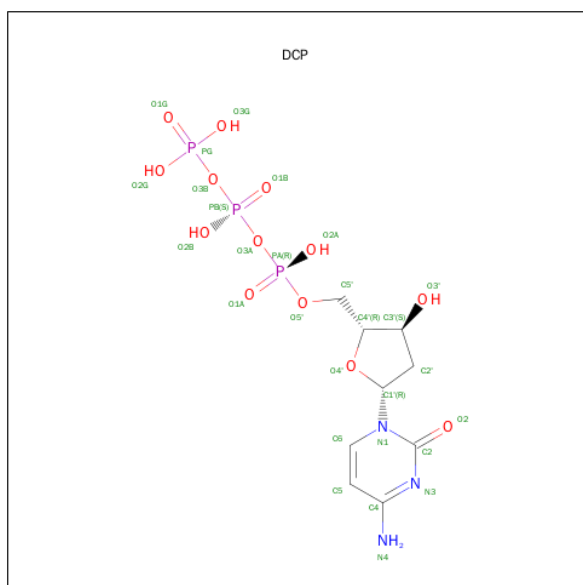
- Molecule 2 is a DNA chain called DNA (5'-D(*AP*TP*TP*(X)P*AP*AP*TP*CP*CP*TP*TP*CP*CP*CP*CP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	16	Total	C	N	O	P	0	0	0
			339	170	51	103	15			
2	F	16	Total	C	N	O	P	0	0	0
			339	170	51	103	15			

- Molecule 3 is a DNA chain called DNA (5'-D(*GP*GP*GP*GP*GP*AP*AP*GP*GP*AP*TP*T)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	12	Total	C	N	O	P	0	0	0
			254	120	54	69	11			
3	G	12	Total	C	N	O	P	0	0	0
			254	120	54	69	11			

- Molecule 4 is 2'-DEOXYCYTIDINE-5'-TRIPHOSPHATE (three-letter code: DCP) (formula: $C_9H_{16}N_3O_{13}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			28	9	3	13	3		
4	E	1	Total	C	N	O	P	0	0
			28	9	3	13	3		

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Ca	0	0
			1	1		
5	E	1	Total	Ca	0	0
			1	1		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	41	Total	O	0	0
			41	41		

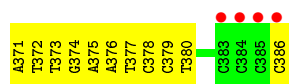
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	3	Total 3	O 3	0	0
6	C	3	Total 3	O 3	0	0
6	E	34	Total 34	O 34	0	0
6	F	3	Total 3	O 3	0	0
6	G	1	Total 1	O 1	0	0

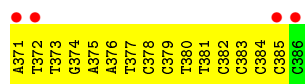
- Molecule 2: DNA (5'-D(*AP*TP*TP*(X)P*AP*AP*TP*CP*CP*TP*TP*CP*CP*CP*CP*C)-3')

Chain B: 



- Molecule 2: DNA (5'-D(*AP*TP*TP*(X)P*AP*AP*TP*CP*CP*TP*TP*CP*CP*CP*CP*C)-3')

Chain F: 

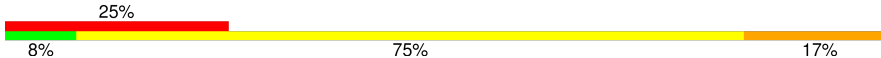


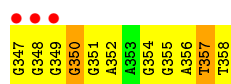
- Molecule 3: DNA (5'-D(*GP*GP*GP*GP*GP*AP*AP*GP*GP*AP*TP*T)-3')

Chain C: 



- Molecule 3: DNA (5'-D(*GP*GP*GP*GP*GP*AP*AP*GP*GP*AP*TP*T)-3')

Chain G: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	52.15Å 99.79Å 52.12Å 75.02° 70.95° 80.91°	Depositor
Resolution (Å)	29.52 – 2.90 29.52 – 2.88	Depositor EDS
% Data completeness (in resolution range)	88.7 (29.52-2.90) 83.1 (29.52-2.88)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.42 (at 2.90Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.239 , 0.284 0.234 , 0.280	Depositor DCC
R_{free} test set	880 reflections (4.69%)	DCC
Wilson B-factor (Å ²)	60.5	Xtriage
Anisotropy	0.180	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 52.3	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 19512 reflections	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	6857	wwPDB-VP
Average B, all atoms (Å ²)	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.96% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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: X, CA, DCP

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	0.44	0/2805	0.68	0/3766
1	E	0.42	0/2805	0.68	0/3766
2	B	0.81	0/324	0.91	0/493
2	F	0.71	0/324	0.96	0/493
3	C	0.72	0/287	0.90	0/444
3	G	0.75	0/287	0.95	2/444 (0.5%)
All	All	0.50	0/6832	0.73	2/9406 (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
2	B	1	0
2	F	1	0
All	All	2	0

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	G	350	DG	O4'-C4'-C3'	-5.96	102.11	104.50
3	G	357	DT	C4'-C3'-C2'	5.87	108.38	103.10

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	B	374	X	C4'
2	F	374	X	C4'

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	2764	0	2900	300	0
1	E	2764	0	2900	257	0
2	B	339	0	196	51	0
2	F	339	0	196	57	0
3	C	254	0	136	18	0
3	G	254	0	136	28	0
4	A	28	0	11	13	0
4	E	28	0	11	5	0
5	A	1	0	0	0	0
5	E	1	0	0	0	0
6	A	41	0	0	13	0
6	B	3	0	0	3	0
6	C	3	0	0	3	0
6	E	34	0	0	5	0
6	F	3	0	0	4	0
6	G	1	0	0	0	0
All	All	6857	0	6486	657	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 50.

The worst 5 of 657 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:E:335:ARG:NH1	2:F:373:DT:H2''	1.62	1.15
2:B:372:DT:H2''	2:B:373:DT:H5''	1.32	1.10
1:E:297:ASP:HB3	1:E:331:ARG:HH12	1.08	1.08
1:A:260:ASN:HD22	1:A:263:GLU:HB2	1.18	1.08
3:G:347:DG:H2''	3:G:348:DG:O5'	1.55	1.06

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	341/347 (98%)	265 (78%)	54 (16%)	22 (6%)	1	4
1	E	341/347 (98%)	265 (78%)	51 (15%)	25 (7%)	1	3
All	All	682/694 (98%)	530 (78%)	105 (15%)	47 (7%)	1	4

5 of 47 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	3	HIS
1	A	13	TYR
1	A	41	GLU
1	A	104	ILE
1	A	198	LYS

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	302/306 (99%)	271 (90%)	31 (10%)	9	26
1	E	302/306 (99%)	264 (87%)	38 (13%)	5	16
All	All	604/612 (99%)	535 (89%)	69 (11%)	7	21

5 of 69 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	3	HIS

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Mol	Chain	Res	Type
1	E	94	LEU
1	E	299	VAL
1	E	27	LYS
1	E	71	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	164	ASN
1	A	260	ASN
1	E	237	ASN
1	A	86	GLN
1	E	164	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues 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	X	B	374	2	40,53,54	1.65	10 (25%)	44,83,86	2.60	16 (36%)
2	X	F	374	2	40,53,54	1.92	10 (25%)	44,83,86	2.58	13 (29%)

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	X	B	374	2	1/1/9/9	0/5/60/61	0/8/8/8
2	X	F	374	2	1/1/9/9	0/5/60/61	0/8/8/8

The worst 5 of 20 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	374	X	C3-C2A	-2.61	1.50	1.54
2	B	374	X	C4-N3	2.00	1.38	1.35
2	F	374	X	C8-N9	2.11	1.37	1.33
2	B	374	X	C5B-C5M	2.19	1.42	1.38
2	B	374	X	C4B-C4A	2.27	1.47	1.42

The worst 5 of 29 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	374	X	C5-C6-N1	-7.74	113.01	123.59
2	F	374	X	C5-C6-N1	-7.64	113.14	123.59
2	F	374	X	O1-C1-C2A	-4.89	121.58	125.83
2	B	374	X	O1-C1-C2A	-4.29	122.10	125.83
2	B	374	X	C5B-C5M-C9B	-4.26	120.39	124.26

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	B	374	X	C4'
2	F	374	X	C4'

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 19 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	374	X	12	0
2	F	374	X	7	0

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	DCP	A	400	5	21,29,29	2.56	4 (19%)	33,45,45	2.33	10 (30%)
4	DCP	E	400	-	21,29,29	2.65	3 (14%)	33,45,45	2.33	9 (27%)

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	DCP	A	400	5	-	0/18/34/34	0/2/2/2
4	DCP	E	400	-	-	0/18/34/34	0/2/2/2

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	400	DCP	O3'-C3'	-9.26	1.22	1.43
4	E	400	DCP	O3'-C3'	-8.95	1.23	1.43
4	E	400	DCP	O5'-C5'	-6.12	1.19	1.44
4	A	400	DCP	O5'-C5'	-4.95	1.24	1.44
4	A	400	DCP	C2'-C3'	-2.25	1.46	1.52

The worst 5 of 19 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	E	400	DCP	O4'-C4'-C5'	-4.97	91.54	109.32
4	A	400	DCP	C2'-C1'-N1	-4.82	102.44	114.16
4	E	400	DCP	C2'-C1'-N1	-4.62	102.92	114.16
4	A	400	DCP	C4'-O4'-C1'	-3.41	100.84	109.47
4	A	400	DCP	O4'-C4'-C5'	-2.68	99.74	109.32

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 18 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	400	DCP	13	0
4	E	400	DCP	5	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 [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, 95th 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	343/347 (98%)	-0.14	8 (2%) 64 59	23, 52, 85, 106	0
1	E	343/347 (98%)	-0.19	5 (1%) 76 74	23, 49, 84, 103	0
2	B	15/16 (93%)	1.51	4 (26%) 1 0	42, 93, 158, 160	0
2	F	15/16 (93%)	1.68	4 (26%) 1 0	49, 104, 164, 167	0
3	C	12/12 (100%)	0.98	3 (25%) 1 0	73, 80, 162, 167	0
3	G	12/12 (100%)	0.99	3 (25%) 1 0	75, 88, 162, 167	0
All	All	740/750 (98%)	-0.05	27 (3%) 46 38	23, 52, 98, 167	0

The worst 5 of 27 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	386	DC	7.7
2	F	385	DC	6.9
2	F	386	DC	6.0
3	C	348	DG	5.3
3	C	347	DG	5.1

6.2 Non-standard residues in protein, DNA, RNA chains [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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95th 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	LLDF	B-factors(Å ²)	Q<0.9
2	X	B	374	46/47	0.84	0.23	-	60,68,84,88	0
2	X	F	374	46/47	0.85	0.25	-	43,66,79,82	0

6.3 Carbohydrates [i](#)

There are no carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95th 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	LLDF	B-factors(\AA^2)	Q<0.9
4	DCP	E	400	28/28	0.75	0.27	1.78	76,89,100,100	0
5	CA	E	345	1/1	0.75	0.24	1.39	84,84,84,84	0
4	DCP	A	400	28/28	0.88	0.18	0.25	74,88,94,95	0
5	CA	A	345	1/1	0.87	0.12	-	78,78,78,78	0

6.5 Other polymers [i](#)

There are no such residues in this entry.