



# wwPDB X-ray Structure Validation Summary Report

Feb 27, 2014 – 11:35 AM GMT

PDB ID : 3CVW  
Title : Drosophila melanogaster (6-4) photolyase H365N mutant bound to ds DNA with a T-T (6-4) photolesion and cofactor F0  
Authors : Maul, M.J.; Barends, T.R.M.; Glas, A.F.; Cryle, M.J.; Schlichting, I.; Carell, T.  
Deposited on : 2008-04-20  
Resolution : 3.20 Å(reported)

This is a wwPDB validation summary 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 <http://wwpdb.org/ValidationPDFNotes.html>

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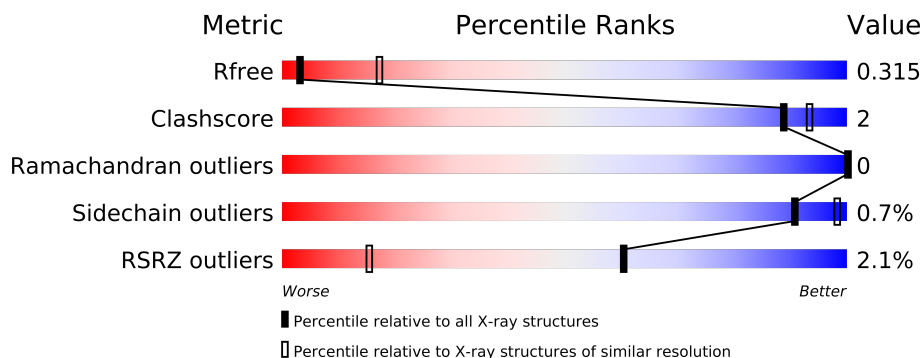
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 3.20 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))
$R_{free}$	66092	1824 (3.30-3.10)
Clashscore	79885	1078 (3.26-3.14)
Ramachandran outliers	78287	1059 (3.26-3.14)
Sidechain outliers	78261	1058 (3.26-3.14)
RSRZ outliers	66119	1825 (3.30-3.10)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	C	15	
2	D	15	
3	A	543	

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 4817 atoms, of which 0 are hydrogen and 0 are deuterium.

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 DNA chain called DNA (5'-D(\*DAP\*DCP\*DAP\*DGP\*DCP\*DGP\*DGP\*(64T)P\*(5PY)P\*DGP\*DCP\*DAP\*DGP\*DGP\*DT)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	15	Total	C	N	O	P	0	0	0
			309	147	60	88	14			

- Molecule 2 is a DNA chain called DNA (5'-D(\*DTP\*DAP\*DCP\*DCP\*DTP\*DGP\*DCP\*DAP\*DAP\*DCP\*DCP\*DGP\*DCP\*DTP\*DG)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	15	Total	C	N	O	P	0	0	0
			300	144	54	88	14			

- Molecule 3 is a protein called RE11660p.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	A	502	Total	C	N	O	S	0	0	0
			4117	2653	731	715	18			

There are 24 discrepancies between the modelled and reference sequences:

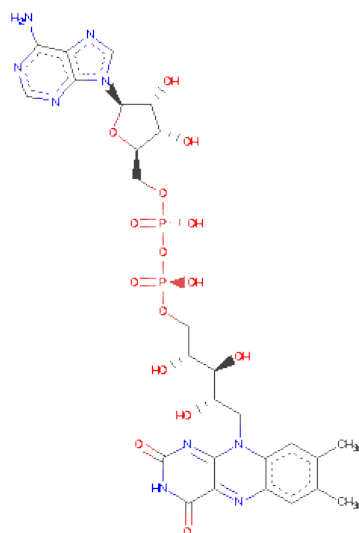
Chain	Residue	Modelled	Actual	Comment	Reference
A	-22	MET	-	EXPRESSION TAG	UNP Q8SXXK5
A	-21	ALA	-	EXPRESSION TAG	UNP Q8SXXK5
A	-20	SER	-	EXPRESSION TAG	UNP Q8SXXK5
A	-19	TRP	-	EXPRESSION TAG	UNP Q8SXXK5
A	-18	SER	-	EXPRESSION TAG	UNP Q8SXXK5
A	-17	HIS	-	EXPRESSION TAG	UNP Q8SXXK5
A	-16	PRO	-	EXPRESSION TAG	UNP Q8SXXK5
A	-15	GLN	-	EXPRESSION TAG	UNP Q8SXXK5
A	-14	PHE	-	EXPRESSION TAG	UNP Q8SXXK5
A	-13	GLU	-	EXPRESSION TAG	UNP Q8SXXK5
A	-12	LYS	-	EXPRESSION TAG	UNP Q8SXXK5
A	-11	GLY	-	EXPRESSION TAG	UNP Q8SXXK5

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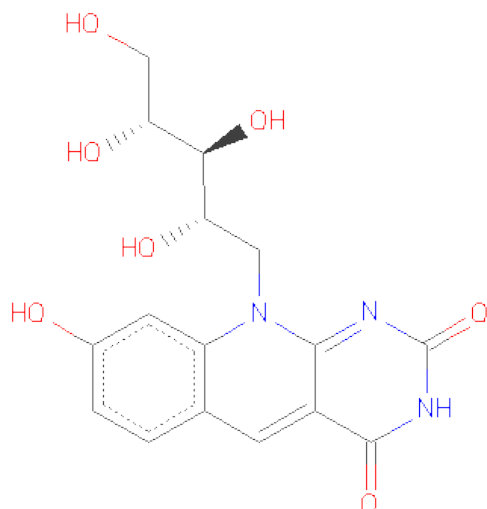
Chain	Residue	Modelled	Actual	Comment	Reference
A	-10	ALA	-	EXPRESSION TAG	UNP Q8SXX5
A	-9	SER	-	EXPRESSION TAG	UNP Q8SXX5
A	-8	THR	-	EXPRESSION TAG	UNP Q8SXX5
A	-7	SER	-	EXPRESSION TAG	UNP Q8SXX5
A	-6	LEU	-	EXPRESSION TAG	UNP Q8SXX5
A	-5	TYR	-	EXPRESSION TAG	UNP Q8SXX5
A	-4	LYS	-	EXPRESSION TAG	UNP Q8SXX5
A	-3	LYS	-	EXPRESSION TAG	UNP Q8SXX5
A	-2	ALA	-	EXPRESSION TAG	UNP Q8SXX5
A	-1	GLY	-	EXPRESSION TAG	UNP Q8SXX5
A	0	LEU	-	EXPRESSION TAG	UNP Q8SXX5
A	365	ASN	HIS	ENGINEERED	UNP Q8SXX5

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula:  $C_{27}H_{33}N_9O_{15}P_2$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 5 is 1-DEOXY-1-(8-HYDROXY-2,4-DIOXO-3,4-DIHYDROPYRIMIDO[4,5-B]QUINOLIN-10(2H)-YL)-D-RIBITOL (three-letter code: FO1) (formula:  $C_{16}H_{17}N_3O_7$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			26	16	3	7		

- Molecule 6 is water.

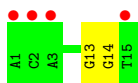
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	11	Total	O	0	0
			11	11		
6	C	1	Total	O	0	0
			1	1		

### 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 errors 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.

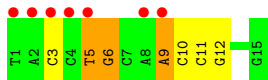
- Molecule 1: DNA (5'-D(\*DAP\*DCP\*DAP\*DGP\*DCP\*DGP\*DGP\*(64T)P\*(5PY)P\*DGP\*DCP\*DAP\*DGP\*DGP\*DT)-3')

Chain C: 



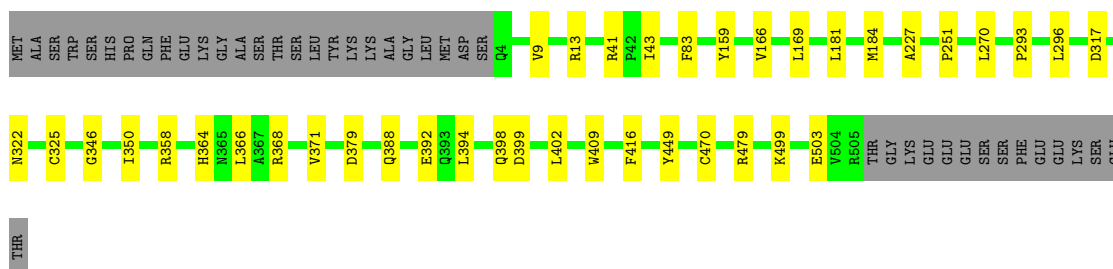
- Molecule 2: DNA (5'-D(\*DTP\*DAP\*DCP\*DCP\*DTP\*DGP\*DCP\*DAP\*DAP\*DCP\*DCP\*DCP\*DCP\*DCP\*DTP\*DG)-3')

Chain D: 



- Molecule 3: RE11660p

Chain A: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	86.47Å 89.51Å 89.34Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.87 – 3.20 19.87 – 3.20	Depositor EDS
% Data completeness (in resolution range)	93.0 (19.87-3.20) 93.0 (19.87-3.20)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.52 (at 3.22Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.272 , 0.329 0.261 , 0.315	Depositor DCC
$R_{free}$ test set	549 reflections (5.25%)	DCC
Wilson B-factor (Å <sup>2</sup> )	61.7	Xtriage
Anisotropy	0.352	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , -6.1	EDS
Estimated twinning fraction	0.016 for -h,l,k 0.022 for -k,-h,l 0.021 for l,-k,h 0.002 for l,h,k 0.002 for k,l,h	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	1 of 11014 reflections (0.009%)	Xtriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	4817	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.83% of the height of the origin peak. No significant pseudotranslation is detected.*

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

## 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: FO1, 64T, FAD, 5PY

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	C	0.64	0/302	1.14	2/463 (0.4%)
2	D	0.71	0/335	1.34	5/514 (1.0%)
3	A	0.30	0/4239	0.44	0/5752
All	All	0.37	0/4876	0.63	7/6729 (0.1%)

There are no bond length outliers.

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

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	D	3	DC	O4'-C1'-N1	6.84	112.79	108.00
1	C	14	DG	O4'-C4'-C3'	-6.36	101.96	104.50
2	D	9	DA	O4'-C4'-C3'	-6.30	101.98	104.50
2	D	5	DT	P-O3'-C3'	5.83	126.69	119.70
1	C	13	DG	O4'-C1'-N9	5.59	111.91	108.00

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	309	0	170	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	300	0	170	3	0
3	A	4117	0	4098	18	0
4	A	53	0	31	0	0
5	A	26	0	16	0	0
6	A	11	0	0	0	0
6	C	1	0	0	0	0
All	All	4817	0	4485	21	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 2.

The worst 5 of 21 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
3:A:399:ASP:HB3	3:A:402:LEU:HB2	1.88	0.54
3:A:392:GLU:HA	3:A:398:GLN:HG3	1.89	0.54
3:A:181:LEU:HD13	3:A:184:MET:HG2	1.90	0.52
2:D:11:DC:H2'	2:D:12:DG:C8	2.46	0.50
3:A:317:ASP:HB2	3:A:388:GLN:HE22	1.77	0.50

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
3	A	500/543 (92%)	477 (95%)	23 (5%)	0	100 100

There are no Ramachandran outliers to report.

### 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	
3	A	438/473 (93%)	435 (99%)	3 (1%)	91	98

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	A	13	ARG
3	A	296	LEU
3	A	379	ASP

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

Mol	Chain	Res	Type
3	A	10	HIS
3	A	123	GLN
3	A	286	GLN
3	A	388	GLN
3	A	398	GLN

### 5.3.3 RNA ⓘ

There are no RNA chains 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	$\# Z  > 2$
1	64T	C	8	1	20,22,23	1.63	3 (15%)	30,33,36	1.14	3 (10%)
1	5PY	C	9	1	18,20,21	0.84	0	23,28,31	1.52	4 (17%)

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	64T	C	8	1	-	0/8/40/41	0/2/2/2
1	5PY	C	9	1	-	0/5/21/22	0/2/2/2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	8	64T	C1'-N1	5.69	1.53	1.45
1	C	8	64T	C2-N1	-2.44	1.31	1.35
1	C	8	64T	C6-N1	2.21	1.48	1.46

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	9	5PY	C6-N1-C2	3.79	120.49	118.62
1	C	8	64T	C2'-C1'-N1	3.28	119.76	115.66
1	C	9	5PY	N3-C2-N1	-3.21	117.86	121.50
1	C	9	5PY	C5M-C5-C4	3.14	126.05	121.14
1	C	8	64T	N3-C2-N1	2.66	119.31	116.71

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

2 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	$\# Z  > 2$
5	FO1	A	1422	-	28,28,28	1.76	5 (17%)	37,41,41	2.86	13 (35%)
4	FAD	A	521	-	58,58,58	1.03	5 (8%)	85,89,89	1.81	12 (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
5	FO1	A	1422	-	-	0/14/14/14	0/0/3/3
4	FAD	A	521	-	-	0/34/50/50	0/1/6/6

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	1422	FO1	C11-C12	-5.47	1.30	1.40
5	A	1422	FO1	C5-C12	4.08	1.49	1.42
5	A	1422	FO1	C11-C9	-3.67	1.29	1.37
4	A	521	FAD	C2A-N3A	3.31	1.38	1.32
4	A	521	FAD	C1'-N10	2.80	1.51	1.48

The worst 5 of 25 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	521	FAD	N3A-C2A-N1A	-10.24	120.15	128.71
5	A	1422	FO1	C1-N1-C13	7.92	122.96	114.98
5	A	1422	FO1	C14-N3-C12	-7.08	111.98	118.87
5	A	1422	FO1	C12-N3-C13	-6.55	115.34	121.77
4	A	521	FAD	C2-N1-C10	5.85	120.88	114.98

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues

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<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	C	15/15 (100%)	1.43	4 (26%) 1 1	50, 50, 50, 50	0
2	D	15/15 (100%)	1.25	7 (46%) 1 0	50, 50, 50, 50	0
3	A	502/543 (92%)	0.01	0 100 100	50, 50, 50, 50	0
All	All	532/573 (92%)	0.09	11 (2%) 60 15	50, 50, 50, 50	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	1	DA	4.7
1	C	2	DC	2.9
2	D	1	DT	2.9
1	C	15	DT	2.8
2	D	3	DC	2.7

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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, 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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
1	5PY	C	9	19/20	0.19	-1.30	49,49,49,49	0
1	64T	C	8	21/22	0.17	-1.92	49,49,49,49	0

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands

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, 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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
5	FO1	A	1422	26/26	0.25	0.02	49,49,49,49	0
4	FAD	A	521	53/53	0.20	-1.13	49,49,49,49	0

## 6.5 Other polymers

There are no such residues in this entry.