



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 3, 2024 – 07:40 PM EST

PDB ID : 1MTL  
Title : Non-productive MUG-DNA complex  
Authors : Barrett, T.E.; Savva, R.; Barlow, T.; Brown, T.; Jiricny, J.; Pearl, L.H.  
Deposited on : 2002-09-21  
Resolution : 2.80 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

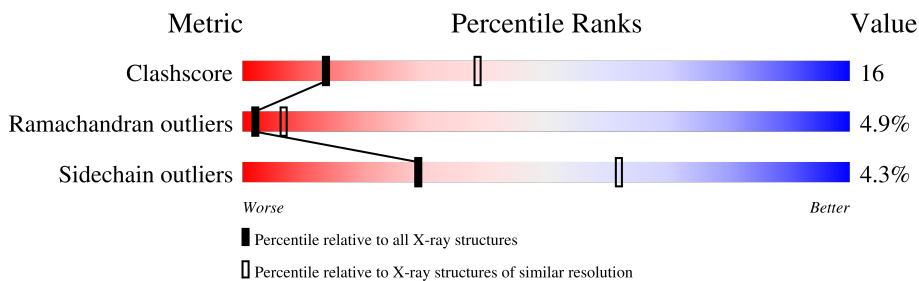
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	C	12	50% (green), 42% (yellow), 8% (orange)
1	D	12	17% (green), 33% (yellow), 42% (orange), 8% (red)
2	A	168	64% (green), 27% (yellow), 7% (orange), 2% (red), 0% (grey)
2	B	168	61% (green), 28% (yellow), 5% (orange), 5% (red), 0% (grey)

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3028 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 DNA chain called 5'-D(\*CP\*GP\*CP\*GP\*AP\*GP\*(AAB)P\*TP\*CP\*GP\*CP\*G)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	C	12	236	111	44	70	11	0	0	0
1	D	12	236	111	44	70	11	0	0	0

- Molecule 2 is a protein called G/U mismatch-specific DNA glycosylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	A	157	1218	780	213	223	2	0	0	0
2	B	160	1245	796	217	229	3	0	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	13	Total 13	O 13	0	0
3	D	10	Total 10	O 10	0	0
3	A	40	Total 40	O 40	0	0
3	B	30	Total 30	O 30	0	0

### 3 Residue-property plots

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. 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. 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.

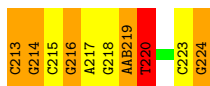
- Molecule 1: 5'-D(\*CP\*GP\*CP\*GP\*AP\*GP\*(AAB)P\*TP\*CP\*GP\*CP\*G)-3'

Chain C: 



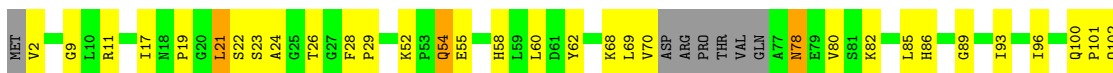
- Molecule 1: 5'-D(\*CP\*GP\*CP\*GP\*AP\*GP\*(AAB)P\*TP\*CP\*GP\*CP\*G)-3'

Chain D: 



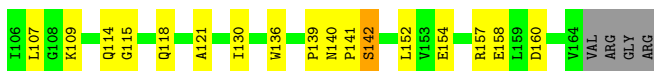
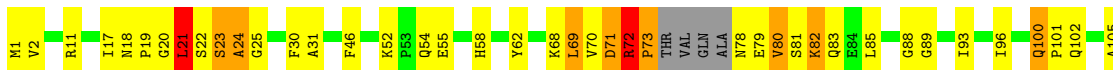
- Molecule 2: G/U mismatch-specific DNA glycosylase

Chain A: 



- Molecule 2: G/U mismatch-specific DNA glycosylase

Chain B: 



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	67.62Å 84.86Å 97.58Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	14.99 – 2.80	Depositor
% Data completeness (in resolution range)	91.9 (14.99-2.80)	Depositor
$R_{merge}$	0.06	Depositor
$R_{sym}$	0.06	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, $R_{free}$	0.206 , 0.286	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	3028	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	39.0	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:  
AAB

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	1.89	5/250 (2.0%)	1.53	1/382 (0.3%)
1	D	1.91	6/250 (2.4%)	1.63	3/382 (0.8%)
2	A	0.62	0/1244	0.80	0/1685
2	B	0.68	0/1272	0.92	3/1723 (0.2%)
All	All	0.98	11/3016 (0.4%)	1.03	7/4172 (0.2%)

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	D	0	1

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	201	DC	C4'-C3'	-6.03	1.46	1.52
1	C	206	DG	C2'-C1'	-5.79	1.46	1.52
1	D	218	DG	C2'-C1'	-5.76	1.46	1.52
1	D	217	DA	C2'-C1'	-5.65	1.46	1.52
1	D	214	DG	C2-N3	5.57	1.37	1.32
1	D	214	DG	O3'-P	-5.45	1.54	1.61
1	C	205	DA	N9-C4	-5.39	1.34	1.37
1	C	212	DG	C2'-C1'	-5.38	1.46	1.52
1	C	201	DC	C2'-C1'	-5.36	1.46	1.52
1	D	213	DC	N1-C6	-5.29	1.33	1.37
1	D	216	DG	C5'-C4'	-5.09	1.45	1.51

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	21	LEU	CA-CB-CG	8.98	135.96	115.30
2	B	23	SER	N-CA-C	-6.57	93.28	111.00
2	B	72	ARG	C-N-CD	-5.43	108.65	120.60
1	C	208	DT	C4-C5-C6	5.25	121.15	118.00
1	D	220	DT	C6-C5-C7	-5.17	119.80	122.90
1	D	224	DG	O4'-C1'-N9	5.15	111.61	108.00
1	D	223	DC	O4'-C1'-N1	5.09	111.56	108.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	220	DT	Sidechain

## 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	C	236	0	132	3	0
1	D	236	0	132	6	0
2	A	1218	0	1216	38	0
2	B	1245	0	1242	46	0
3	A	40	0	0	2	0
3	B	30	0	0	1	0
3	C	13	0	0	0	0
3	D	10	0	0	1	0
All	All	3028	0	2722	89	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 16.

All (89) 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)
2:A:26:THR:HG1	2:A:28:PHE:HD1	1.07	0.96
1:D:216:DG:P	3:D:91:HOH:O	2.34	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:19:PRO:HG3	2:B:70:VAL:O	1.79	0.81
2:B:85:LEU:HD12	2:B:114:GLN:OE1	1.81	0.78
2:B:58:HIS:HD2	2:B:62:TYR:HE1	1.38	0.71
2:A:58:HIS:HD2	2:A:62:TYR:HE1	1.40	0.67
1:D:215:DC:H2''	1:D:216:DG:O5'	1.93	0.67
2:A:82:LYS:O	2:A:86:HIS:HD2	1.78	0.66
2:A:69:LEU:HD23	2:A:85:LEU:HD22	1.80	0.64
2:A:89:GLY:O	2:A:93:ILE:HG13	1.98	0.64
2:A:139:PRO:HG2	2:A:152:LEU:HD12	1.80	0.63
2:B:23:SER:HA	2:B:31:ALA:H	1.63	0.63
2:B:78:ASN:CG	2:B:79:GLU:H	2.02	0.63
2:A:85:LEU:HD12	2:A:114:GLN:OE1	1.99	0.62
2:B:23:SER:HB2	2:B:30:PHE:HA	1.80	0.62
2:B:69:LEU:O	2:B:88:GLY:HA3	2.01	0.61
2:B:139:PRO:HG2	2:B:152:LEU:HD12	1.82	0.61
2:B:89:GLY:O	2:B:93:ILE:HG13	2.00	0.61
2:B:118:GLN:HB3	3:B:187:HOH:O	2.01	0.61
2:A:28:PHE:CE2	2:A:54:GLN:HA	2.36	0.60
2:B:58:HIS:CD2	2:B:62:TYR:HE1	2.20	0.59
2:A:140:ASN:ND2	2:A:142:SER:H	1.99	0.59
2:A:9:GLY:HA2	3:A:206:HOH:O	2.03	0.59
2:B:140:ASN:ND2	2:B:142:SER:H	2.00	0.59
2:A:21:LEU:O	2:A:23:SER:N	2.36	0.59
2:B:58:HIS:HD2	2:B:62:TYR:CE1	2.21	0.57
2:B:52:LYS:HB2	2:B:55:GLU:HG3	1.86	0.57
2:B:22:SER:C	2:B:24:ALA:N	2.58	0.56
2:A:52:LYS:HB2	2:A:55:GLU:HG3	1.86	0.56
2:A:58:HIS:CD2	2:A:62:TYR:HE1	2.21	0.56
2:B:154:GLU:O	2:B:158:GLU:HG3	2.06	0.55
2:A:154:GLU:O	2:A:158:GLU:HG3	2.07	0.55
2:A:58:HIS:HD2	2:A:62:TYR:CE1	2.22	0.55
2:B:22:SER:C	2:B:24:ALA:H	2.10	0.54
2:B:80:VAL:O	2:B:80:VAL:HG13	2.09	0.53
2:B:22:SER:C	2:B:25:GLY:H	2.12	0.52
2:B:72:ARG:CB	2:B:73:PRO:HD2	2.38	0.52
2:A:109:LYS:HD2	2:A:121:ALA:O	2.11	0.51
1:C:201:DC:C5'	2:A:78:ASN:O	2.58	0.51
2:B:58:HIS:CD2	2:B:62:TYR:CE1	2.98	0.51
2:B:2:VAL:HG23	2:B:24:ALA:HB1	1.93	0.50
2:B:81:SER:O	2:B:83:GLN:N	2.45	0.50
2:B:82:LYS:O	2:B:83:GLN:C	2.50	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:58:HIS:CD2	2:A:62:TYR:CE1	2.99	0.50
1:C:201:DC:H4'	2:A:21:LEU:CD2	2.42	0.49
2:B:23:SER:O	2:B:24:ALA:HB2	2.11	0.49
2:B:109:LYS:HD2	2:B:121:ALA:O	2.12	0.49
1:D:214:DG:H2''	1:D:215:DC:O5'	2.14	0.48
1:D:219:AAB:H5'2	1:D:220:DT:OP2	2.14	0.48
2:B:2:VAL:CG2	2:B:24:ALA:HA	2.44	0.48
2:B:71:ASP:N	2:B:71:ASP:OD1	2.45	0.48
1:D:224:DG:O4'	2:A:146:ARG:NH1	2.43	0.48
2:A:24:ALA:HA	2:A:28:PHE:O	2.14	0.47
2:B:157:ARG:HG2	2:B:157:ARG:HH11	1.78	0.47
1:D:213:DC:H6	1:D:213:DC:O5'	1.97	0.47
2:B:96:ILE:O	2:B:100:GLN:HA	2.16	0.46
2:A:96:ILE:O	2:A:100:GLN:HA	2.16	0.45
2:A:21:LEU:C	2:A:23:SER:H	2.20	0.45
2:A:157:ARG:HH11	2:A:157:ARG:HG2	1.81	0.45
2:B:46:PHE:CZ	2:B:160:ASP:HB2	2.51	0.45
2:B:93:ILE:HG23	2:B:130:ILE:HD13	1.97	0.45
2:A:17:ILE:HD11	2:A:108:GLY:HA3	1.99	0.45
2:B:20:GLY:O	2:B:21:LEU:HD13	2.16	0.45
2:B:157:ARG:HG2	2:B:157:ARG:NH1	2.32	0.44
2:A:93:ILE:HG23	2:A:130:ILE:HD13	1.98	0.44
2:A:2:VAL:HB	2:A:24:ALA:HB1	1.99	0.44
2:A:100:GLN:O	2:A:100:GLN:HG3	2.18	0.44
2:B:78:ASN:CG	2:B:79:GLU:N	2.70	0.43
1:C:201:DC:H5'	2:A:78:ASN:O	2.18	0.43
2:A:100:GLN:HA	2:A:101:PRO:HD2	1.84	0.43
2:B:100:GLN:O	2:B:100:GLN:HG3	2.17	0.43
2:B:100:GLN:HA	2:B:101:PRO:HD2	1.83	0.43
2:B:23:SER:O	2:B:23:SER:OG	2.33	0.43
2:A:157:ARG:HG2	2:A:157:ARG:NH1	2.35	0.42
2:A:58:HIS:HB2	3:A:202:HOH:O	2.19	0.42
2:B:85:LEU:HA	2:B:85:LEU:HD23	1.74	0.42
2:A:28:PHE:HA	2:A:29:PRO:HD3	1.84	0.42
2:B:2:VAL:HG22	2:B:24:ALA:HA	2.02	0.42
2:A:11:ARG:O	2:A:102:GLN:HB2	2.20	0.41
2:A:60:LEU:HA	2:A:60:LEU:HD23	1.76	0.41
2:B:107:LEU:O	2:B:140:ASN:HB2	2.21	0.41
2:B:140:ASN:HA	2:B:141:PRO:HD3	1.86	0.41
2:B:140:ASN:HD22	2:B:142:SER:H	1.68	0.41
2:B:105:ALA:HA	2:B:136:TRP:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:11:ARG:O	2:B:102:GLN:HB2	2.21	0.41
2:A:140:ASN:HD22	2:A:142:SER:H	1.66	0.41
2:A:156:TYR:N	2:A:156:TYR:CD1	2.89	0.41
2:B:79:GLU:O	2:B:80:VAL:HB	2.20	0.41
2:A:105:ALA:HA	2:A:136:TRP:O	2.21	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	
2	A	153/168 (91%)	133 (87%)	14 (9%)	6 (4%)	3	10
2	B	156/168 (93%)	131 (84%)	16 (10%)	9 (6%)	1	4
All	All	309/336 (92%)	264 (85%)	30 (10%)	15 (5%)	2	7

All (15) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	22	SER
2	A	78	ASN
2	B	21	LEU
2	B	24	ALA
2	B	72	ARG
2	B	80	VAL
2	B	82	LYS
2	B	17	ILE
2	A	115	GLY
2	B	115	GLY
2	A	19	PRO
2	A	142	SER
2	B	142	SER

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Mol	Chain	Res	Type
2	A	80	VAL
2	B	100	GLN

### 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
2	A	126/138 (91%)	122 (97%)	4 (3%)	39 73
2	B	130/138 (94%)	123 (95%)	7 (5%)	22 53
All	All	256/276 (93%)	245 (96%)	11 (4%)	29 62

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	21	LEU
2	A	54	GLN
2	A	68	LYS
2	A	70	VAL
2	B	1	MET
2	B	18	ASN
2	B	54	GLN
2	B	68	LYS
2	B	69	LEU
2	B	71	ASP
2	B	73	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	18	ASN
2	A	86	HIS
2	A	102	GLN
2	A	140	ASN
2	B	58	HIS

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Mol	Chain	Res	Type
2	B	78	ASN
2	B	86	HIS
2	B	102	GLN
2	B	140	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](#)

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	AAB	D	219	1	9,12,13	1.13	2 (22%)	8,16,19	1.21	1 (12%)
1	AAB	C	207	1	9,12,13	1.20	2 (22%)	8,16,19	1.30	1 (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
1	AAB	D	219	1	-	0/3/17/18	0/1/1/1
1	AAB	C	207	1	-	0/3/17/18	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	219	AAB	O1'-C1'	2.09	1.45	1.39
1	C	207	AAB	O1'-C1'	2.06	1.44	1.39
1	D	219	AAB	O4'-C1'	2.05	1.45	1.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	207	AAB	O4'-C1'	2.00	1.45	1.41

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	207	AAB	C1'-C2'-C3'	2.98	108.00	103.93
1	D	219	AAB	C1'-C2'-C3'	2.64	107.53	103.93

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	D	219	AAB	1	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 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](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.