



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 17, 2017 – 12:13 PM EDT

PDB ID : 5JJ4  
Title : Crystal Structure of a Variant Human Activation-induced Deoxycytidine Deaminase as an MBP fusion protein  
Authors : Pedersen, L.C.; Goodman, M.F.; Pham, P.; Affif, S.A.  
Deposited on : unknown  
Resolution : 2.81 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](mailto: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.

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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 : 1.7.2 (RC1), CSD as538be (2017)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20029824  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
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) : rb-20029824

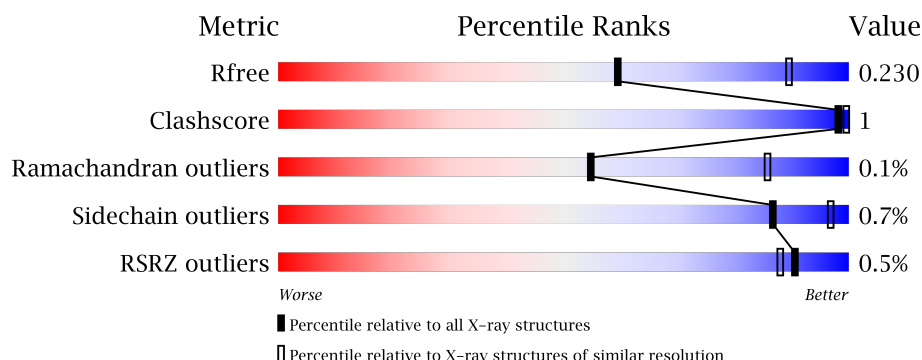
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

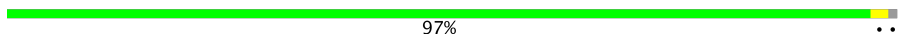
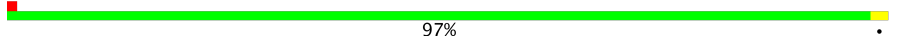
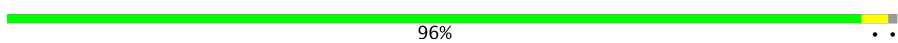
The reported resolution of this entry is 2.81 Å.

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))
$R_{free}$	100719	2583 (2.80-2.80)
Clashscore	112137	3033 (2.80-2.80)
Ramachandran outliers	110173	2983 (2.80-2.80)
Sidechain outliers	110143	2985 (2.80-2.80)
RSRZ outliers	101464	2610 (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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	546	
1	B	546	
1	C	546	

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12734 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 Maltose-binding periplasmic protein, Single-stranded DNA cytosine deaminase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	541	Total	C	N	O	S	0	1	0
			4221	2722	700	784	15			
1	A	542	Total	C	N	O	S	0	0	0
			4187	2696	692	784	15			
1	B	545	Total	C	N	O	S	0	0	0
			4149	2681	680	773	15			

There are 81 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	359	ALA	GLU	conflict	UNP P0AEY0
C	362	ALA	LYS	conflict	UNP P0AEY0
C	363	ALA	ASP	conflict	UNP P0AEY0
C	367	ASN	ARG	conflict	UNP P0AEY0
C	368	ALA	-	linker	UNP P0AEY0
C	369	ALA	-	linker	UNP P0AEY0
C	370	ALA	-	linker	UNP P0AEY0
C	1005	LEU	-	linker	UNP P0AEY0
C	1006	MET	-	linker	UNP P0AEY0
C	1007	ASP	-	linker	UNP P0AEY0
C	1008	PRO	-	linker	UNP P0AEY0
C	1009	HIS	-	linker	UNP P0AEY0
C	1010	ILE	-	linker	UNP P0AEY0
C	1011	PHE	-	linker	UNP P0AEY0
C	1012	THR	-	linker	UNP P0AEY0
C	1013	SER	-	linker	UNP P0AEY0
C	1014	ASN	-	linker	UNP P0AEY0
C	1015	PHE	-	linker	UNP P0AEY0
C	1016	ASN	-	linker	UNP P0AEY0
C	1017	ASN	-	linker	UNP P0AEY0
C	1018	GLY	-	linker	UNP P0AEY0
C	1019	ILE	-	linker	UNP P0AEY0

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Chain	Residue	Modelled	Actual	Comment	Reference
C	1025	HIS	ARG	conflict	UNP Q9GZX7
C	1026	LYS	GLU	conflict	UNP Q9GZX7
C	1032	GLU	VAL	conflict	UNP Q9GZX7
C	1034	GLU	LYS	conflict	UNP Q9GZX7
C	1036	LEU	ARG	conflict	UNP Q9GZX7
A	359	ALA	GLU	conflict	UNP P0AEY0
A	362	ALA	LYS	conflict	UNP P0AEY0
A	363	ALA	ASP	conflict	UNP P0AEY0
A	367	ASN	ARG	conflict	UNP P0AEY0
A	368	ALA	-	linker	UNP P0AEY0
A	369	ALA	-	linker	UNP P0AEY0
A	370	ALA	-	linker	UNP P0AEY0
A	1005	LEU	-	linker	UNP P0AEY0
A	1006	MET	-	linker	UNP P0AEY0
A	1007	ASP	-	linker	UNP P0AEY0
A	1008	PRO	-	linker	UNP P0AEY0
A	1009	HIS	-	linker	UNP P0AEY0
A	1010	ILE	-	linker	UNP P0AEY0
A	1011	PHE	-	linker	UNP P0AEY0
A	1012	THR	-	linker	UNP P0AEY0
A	1013	SER	-	linker	UNP P0AEY0
A	1014	ASN	-	linker	UNP P0AEY0
A	1015	PHE	-	linker	UNP P0AEY0
A	1016	ASN	-	linker	UNP P0AEY0
A	1017	ASN	-	linker	UNP P0AEY0
A	1018	GLY	-	linker	UNP P0AEY0
A	1019	ILE	-	linker	UNP P0AEY0
A	1025	HIS	ARG	conflict	UNP Q9GZX7
A	1026	LYS	GLU	conflict	UNP Q9GZX7
A	1032	GLU	VAL	conflict	UNP Q9GZX7
A	1034	GLU	LYS	conflict	UNP Q9GZX7
A	1036	LEU	ARG	conflict	UNP Q9GZX7
B	359	ALA	GLU	conflict	UNP P0AEY0
B	362	ALA	LYS	conflict	UNP P0AEY0
B	363	ALA	ASP	conflict	UNP P0AEY0
B	367	ASN	ARG	conflict	UNP P0AEY0
B	368	ALA	-	linker	UNP P0AEY0
B	369	ALA	-	linker	UNP P0AEY0
B	370	ALA	-	linker	UNP P0AEY0
B	1005	LEU	-	linker	UNP P0AEY0
B	1006	MET	-	linker	UNP P0AEY0
B	1007	ASP	-	linker	UNP P0AEY0

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Chain	Residue	Modelled	Actual	Comment	Reference
B	1008	PRO	-	linker	UNP P0AEY0
B	1009	HIS	-	linker	UNP P0AEY0
B	1010	ILE	-	linker	UNP P0AEY0
B	1011	PHE	-	linker	UNP P0AEY0
B	1012	THR	-	linker	UNP P0AEY0
B	1013	SER	-	linker	UNP P0AEY0
B	1014	ASN	-	linker	UNP P0AEY0
B	1015	PHE	-	linker	UNP P0AEY0
B	1016	ASN	-	linker	UNP P0AEY0
B	1017	ASN	-	linker	UNP P0AEY0
B	1018	GLY	-	linker	UNP P0AEY0
B	1019	ILE	-	linker	UNP P0AEY0
B	1025	HIS	ARG	conflict	UNP Q9GZX7
B	1026	LYS	GLU	conflict	UNP Q9GZX7
B	1032	GLU	VAL	conflict	UNP Q9GZX7
B	1034	GLU	LYS	conflict	UNP Q9GZX7
B	1036	LEU	ARG	conflict	UNP Q9GZX7

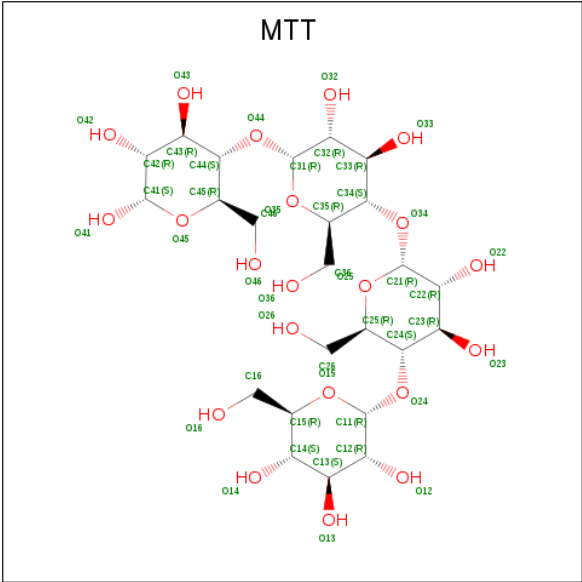
- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total Zn 1 1	0	0
2	A	1	Total Zn 1 1	0	0
2	C	1	Total Zn 1 1	0	0

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total Ca 1 1	0	0
3	A	1	Total Ca 1 1	0	0
3	C	1	Total Ca 1 1	0	0

- Molecule 4 is MALTOTETRAOSE (three-letter code: MTT) (formula: C<sub>24</sub>H<sub>42</sub>O<sub>21</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	C	1	Total	C	O	0	0
			45	24	21		
4	A	1	Total	C	O	0	0
			45	24	21		
4	B	1	Total	C	O	0	0
			45	24	21		

- Molecule 5 is water.

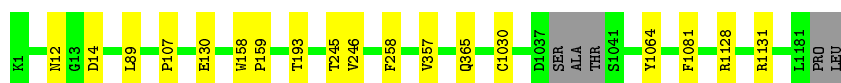
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	12	Total	O	0	0
			12	12		
5	A	13	Total	O	0	0
			13	13		
5	B	11	Total	O	0	0
			11	11		

### 3 Residue-property plots [i](#)

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.

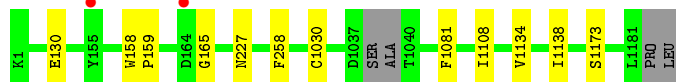
- Molecule 1: Maltose-binding periplasmic protein,Single-stranded DNA cytosine deaminase

Chain C:  96%



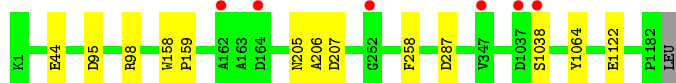
- Molecule 1: Maltose-binding periplasmic protein,Single-stranded DNA cytosine deaminase

Chain A:  97%



- Molecule 1: Maltose-binding periplasmic protein,Single-stranded DNA cytosine deaminase

Chain B:  97%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	106.79 Å 96.81 Å 108.69 Å 90.00° 102.86° 90.00°	Depositor
Resolution (Å)	35.48 – 2.81 35.47 – 2.81	Depositor EDS
% Data completeness (in resolution range)	99.4 (35.48-2.81) 93.1 (35.47-2.81)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.08 (at 2.81 Å)	Xtriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, $R_{free}$	0.183 , 0.232 0.180 , 0.230	Depositor DCC
$R_{free}$ test set	1858 reflections (3.77%)	DCC
Wilson B-factor (Å <sup>2</sup> )	68.4	Xtriage
Anisotropy	0.689	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 33.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.016 for l,-k,h	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	12734	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	74.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.56% of the height of the origin peak. No significant pseudotranslation is detected.*

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

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.



## 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: ZN, CA, MTT

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	0.24	0/4299	0.41	0/5863
1	B	0.23	0/4263	0.40	0/5824
1	C	0.26	0/4333	0.41	0/5898
All	All	0.24	0/12895	0.41	0/17585

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 [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	4187	0	3936	5	0
1	B	4149	0	3860	6	0
1	C	4221	0	4017	8	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
4	A	45	0	42	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	45	0	42	1	0
4	C	45	0	42	0	0
5	A	13	0	0	0	0
5	B	11	0	0	0	0
5	C	12	0	0	0	0
All	All	12734	0	11939	19	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 1.

The worst 5 of 19 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:C:130:GLU:N	1:C:130:GLU:OE1	2.38	0.56
1:B:205:ASN:ND2	1:B:207:ASP:OD1	2.39	0.55
1:B:95:ASP:OD1	1:B:98:ARG:NH1	2.36	0.55
1:B:44:GLU:OE2	4:B:1203:MTT:O12	2.19	0.51
1:A:1138:ILE:HG13	1:A:1173:SER:HA	1.93	0.51

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	538/546 (98%)	518 (96%)	19 (4%)	1 (0%)	51	83
1	B	543/546 (100%)	520 (96%)	22 (4%)	1 (0%)	51	83
1	C	538/546 (98%)	524 (97%)	14 (3%)	0	100	100
All	All	1619/1638 (99%)	1562 (96%)	55 (3%)	2 (0%)	55	86

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	1038	SER
1	A	165	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	412/450 (92%)	410 (100%)	2 (0%)	91	97
1	B	398/450 (88%)	395 (99%)	3 (1%)	85	96
1	C	419/450 (93%)	416 (99%)	3 (1%)	87	97
All	All	1229/1350 (91%)	1221 (99%)	8 (1%)	87	97

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	227	ASN
1	B	1064	TYR
1	B	258	PHE
1	C	1064	TYR
1	A	258	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 6 are monoatomic - leaving 3 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	MTT	A	1203	-	48,48,48	0.78	0	71,71,71	1.20	5 (7%)
4	MTT	B	1203	-	48,48,48	0.85	1 (2%)	71,71,71	1.14	6 (8%)
4	MTT	C	1203	-	48,48,48	0.89	3 (6%)	71,71,71	1.17	5 (7%)

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	MTT	A	1203	-	-	0/20/100/100	0/4/4/4
4	MTT	B	1203	-	-	0/20/100/100	0/4/4/4
4	MTT	C	1203	-	-	0/20/100/100	0/4/4/4

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	C	1203	MTT	O32-C32	-2.08	1.38	1.43
4	C	1203	MTT	C34-C35	-2.05	1.47	1.52
4	C	1203	MTT	O34-C21	2.06	1.47	1.41
4	B	1203	MTT	O34-C21	2.09	1.47	1.41

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	1203	MTT	C16-C15-C14	-2.88	106.27	113.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	1203	MTT	C36-C35-C34	-2.42	106.64	113.24
4	C	1203	MTT	O32-C32-C31	-2.34	105.13	110.03
4	A	1203	MTT	C23-C24-C25	-2.31	105.97	110.88
4	B	1203	MTT	O35-C31-C32	-2.29	105.89	110.30

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
4	B	1203	MTT	1	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, 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	A	542/546 (99%)	-0.36	2 (0%) 92 90	39, 73, 108, 129	0
1	B	545/546 (99%)	-0.28	6 (1%) 80 74	48, 81, 117, 133	0
1	C	541/546 (99%)	-0.41	0 100 100	38, 64, 91, 121	0
All	All	1628/1638 (99%)	-0.35	8 (0%) 90 88	38, 72, 110, 133	0

The worst 5 of 8 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1037	ASP	4.0
1	B	164	ASP	3.3
1	B	347	VAL	2.9
1	A	164	ASP	2.5
1	B	1038	SER	2.4

### 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 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, 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	RSCC	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
4	MTT	B	1203	45/45	0.93	0.21	1.23	49,61,66,76	11
4	MTT	C	1203	45/45	0.95	0.25	0.98	30,52,60,62	11
4	MTT	A	1203	45/45	0.95	0.23	0.22	44,57,66,67	11
3	CA	C	1202	1/1	0.87	0.15	-	100,100,100,100	0
3	CA	A	1202	1/1	0.93	0.13	-	101,101,101,101	0
2	ZN	B	1201	1/1	0.99	0.13	-	71,71,71,71	0
2	ZN	A	1201	1/1	0.99	0.14	-	67,67,67,67	0
3	CA	B	1202	1/1	0.91	0.23	-	131,131,131,131	0
2	ZN	C	1201	1/1	1.00	0.12	-	68,68,68,68	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.