



# Full wwPDB X-ray Structure Validation Report

Feb 27, 2014 – 11:06 PM GMT

PDB ID : 3E6F  
Title : MHC CLASS I H-2Dd Heavy chain complexed with Beta-2 Microglobulin and a variant peptide, PA9, from the Human immunodeficiency virus (BaL) envelope glycoprotein 120  
Authors : Wang, R.; Natarajan, K.; Robinson, H.; Margulies, D.H.  
Deposited on : 2008-08-15  
Resolution : 2.41 Å(reported)

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

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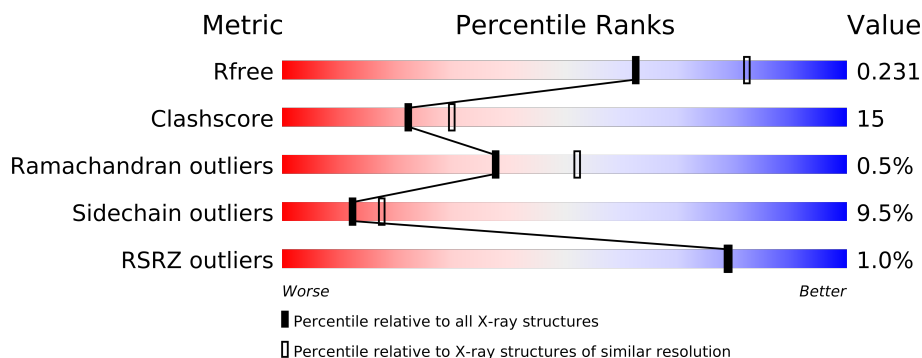
The following versions of software and data (see [references](#)) were used in the production of this report:

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 2.41 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	2496 (2.44-2.40)
Clashscore	79885	3124 (2.44-2.40)
Ramachandran outliers	78287	3067 (2.44-2.40)
Sidechain outliers	78261	3068 (2.44-2.40)
RSRZ outliers	66119	2499 (2.44-2.40)

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	A	274	
2	B	99	
3	P	9	

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3256 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 protein called H-2 class I histocompatibility antigen, D-D alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	0	0
			2245	1409	406	421	9			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	EXPRESSION TAG	UNP P01900

- Molecule 2 is a protein called BETA-2 MICROGLOBULIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	99	Total	C	N	O	S	0	0	0
			818	522	138	150	8			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	ILE	ENGINEERED	UNP Q91XJ8

- Molecule 3 is a protein called Envelope glycoprotein 9-residue peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	P	9	Total	C	N	O	0	0	0
			68	45	12	11			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	88	Total	O	0	0
			88	88		
4	B	32	Total	O	0	0
			32	32		

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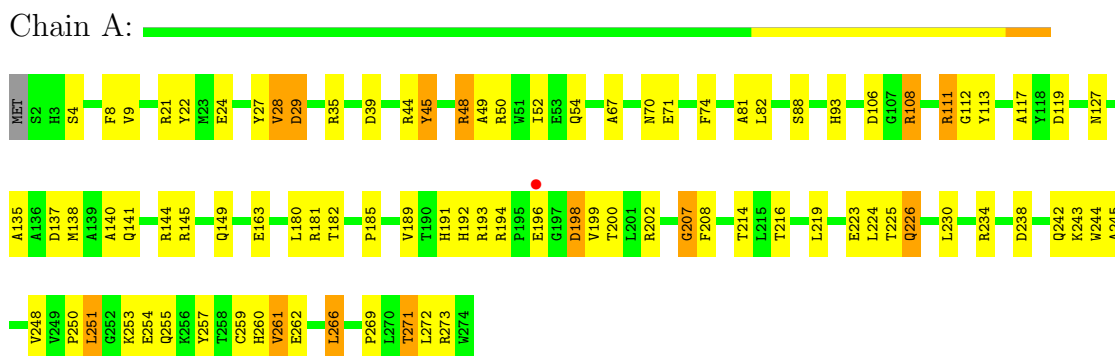
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	P	5	Total	O	0	0
			5	5		

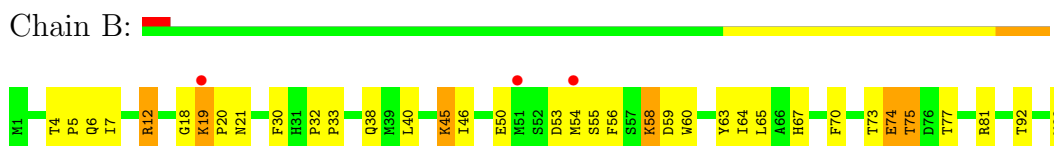
### 3 Residue-property plots

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: H-2 class I histocompatibility antigen, D-D alpha chain



- Molecule 2: BETA-2 MICROGLOBULIN



- Molecule 3: Envelope glycoprotein 9-residue peptide



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	67.81Å 109.52Å 53.76Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.83 – 2.41 28.83 – 2.41	Depositor EDS
% Data completeness (in resolution range)	90.7 (28.83-2.41) 93.7 (28.83-2.41)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.46 (at 2.42Å)	Xtriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.223 , 0.271 0.230 , 0.231	Depositor DCC
$R_{free}$ test set	737 reflections (4.91%)	DCC
Wilson B-factor (Å <sup>2</sup> )	27.0	Xtriage
Anisotropy	0.214	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 16.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 15010 reflections	Xtriage
$F_o, F_c$ correlation	0.91	EDS
Total number of atoms	3256	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.71% of the height of the origin peak. No significant pseudotranslation is detected.*

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

## 5 Model quality

### 5.1 Standard geometry

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	0.39	0/2308	0.63	1/3133 (0.0%)
2	B	0.66	2/844 (0.2%)	0.69	1/1143 (0.1%)
3	P	0.41	0/70	0.45	0/92
All	All	0.48	2/3222 (0.1%)	0.65	2/4368 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	19	LYS	C-N	-13.26	1.09	1.34
2	B	18	GLY	C-N	-6.62	1.18	1.34

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	18	GLY	O-C-N	-5.74	113.51	122.70
1	A	28	VAL	N-CA-C	-5.23	96.88	111.00

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 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	A	2245	0	2111	71	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	818	0	794	26	0
3	P	68	0	67	3	0
4	A	88	0	0	4	0
4	B	32	0	0	0	0
4	P	5	0	0	0	0
All	All	3256	0	2972	91	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 15.

All (91) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:9:VAL:HG22	1:A:24:GLU:HG2	1.49	0.95
1:A:163:GLU:HB3	3:P:1:ILE:HD11	1.53	0.91
1:A:243:LYS:HG2	1:A:244:TRP:N	1.96	0.80
1:A:141:GLN:NE2	1:A:144:ARG:HH21	1.80	0.78
1:A:200:THR:HG22	1:A:248:VAL:HG22	1.65	0.78
1:A:111:ARG:HD2	1:A:113:TYR:CZ	2.27	0.68
2:B:73:THR:HG22	2:B:75:THR:H	1.60	0.66
1:A:194:ARG:HD3	1:A:198:ASP:OD1	1.95	0.66
1:A:234:ARG:HH11	1:A:242:GLN:NE2	1.92	0.65
1:A:28:VAL:O	1:A:29:ASP:HB2	1.96	0.65
1:A:35:ARG:HD3	2:B:53:ASP:OD2	1.97	0.65
2:B:5:PRO:HG3	2:B:30:PHE:HB3	1.78	0.65
1:A:194:ARG:HD2	1:A:200:THR:HG23	1.78	0.64
1:A:21:ARG:HH11	1:A:21:ARG:HG2	1.62	0.64
1:A:111:ARG:HD3	1:A:112:GLY:N	2.13	0.64
1:A:163:GLU:CB	3:P:1:ILE:HD11	2.26	0.63
1:A:145:ARG:HG3	4:A:314:HOH:O	1.99	0.62
1:A:260:HIS:CE1	1:A:262:GLU:HG3	2.34	0.62
1:A:106:ASP:OD2	1:A:108:ARG:HB3	1.98	0.62
1:A:196:GLU:H	1:A:196:GLU:CD	2.03	0.62
1:A:255:GLN:O	1:A:273:ARG:NH1	2.32	0.61
1:A:108:ARG:O	1:A:108:ARG:HG3	2.00	0.60
2:B:6:GLN:C	2:B:7:ILE:HD12	2.22	0.60
1:A:141:GLN:HE22	1:A:144:ARG:HH21	1.46	0.59
2:B:5:PRO:HG3	2:B:30:PHE:CB	2.33	0.58
2:B:7:ILE:HD12	2:B:7:ILE:N	2.18	0.58
1:A:194:ARG:CD	1:A:200:THR:HG23	2.34	0.58
1:A:93:HIS:HD2	1:A:119:ASP:OD2	1.87	0.57
1:A:243:LYS:HG2	1:A:244:TRP:H	1.69	0.56
1:A:238:ASP:OD2	2:B:12:ARG:NH1	2.38	0.55

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:141:GLN:NE2	1:A:144:ARG:NH2	2.54	0.55
1:A:117:ALA:HB2	2:B:60:TRP:CE2	2.41	0.55
1:A:111:ARG:HD2	1:A:113:TYR:CE1	2.42	0.54
1:A:214:THR:O	1:A:261:VAL:HA	2.08	0.52
2:B:50:GLU:HB2	2:B:67:HIS:CE1	2.44	0.52
2:B:64:ILE:HG12	2:B:65:LEU:N	2.25	0.52
2:B:21:ASN:HB3	2:B:70:PHE:CE1	2.44	0.52
1:A:191:HIS:CE1	1:A:199:VAL:HG11	2.46	0.51
1:A:137:ASP:O	1:A:141:GLN:HG2	2.11	0.51
1:A:262:GLU:HG2	1:A:269:PRO:HG3	1.92	0.51
1:A:4:SER:O	1:A:28:VAL:HA	2.11	0.50
1:A:21:ARG:HD3	1:A:39:ASP:OD2	2.10	0.50
1:A:21:ARG:NH1	1:A:21:ARG:HG2	2.27	0.49
1:A:27:TYR:HB3	1:A:29:ASP:O	2.12	0.49
1:A:138:MET:HG2	4:A:362:HOH:O	2.13	0.49
1:A:194:ARG:HD2	1:A:200:THR:CG2	2.43	0.48
2:B:59:ASP:O	2:B:60:TRP:HB2	2.14	0.48
1:A:196:GLU:CD	1:A:196:GLU:N	2.67	0.48
1:A:141:GLN:HA	1:A:141:GLN:HE21	1.78	0.47
1:A:191:HIS:HE1	1:A:254:GLU:OE2	1.97	0.47
1:A:111:ARG:HD3	1:A:111:ARG:C	2.34	0.47
1:A:127:ASN:HB3	4:A:304:HOH:O	2.13	0.47
1:A:219:LEU:HD22	1:A:257:TYR:CE1	2.50	0.47
1:A:185:PRO:HD2	1:A:266:LEU:HD13	1.96	0.47
3:P:1:ILE:O	3:P:1:ILE:HD12	2.15	0.46
1:A:185:PRO:HB3	1:A:208:PHE:HB3	1.97	0.46
1:A:230:LEU:HD23	1:A:245:ALA:HB2	1.97	0.46
1:A:207:GLY:HA3	2:B:12:ARG:HH21	1.81	0.45
1:A:45:TYR:HE1	1:A:67:ALA:HB2	1.81	0.45
1:A:35:ARG:HH12	1:A:48:ARG:CZ	2.29	0.45
2:B:54:MET:SD	2:B:64:ILE:HD12	2.56	0.45
2:B:55:SER:OG	2:B:63:TYR:CE1	2.63	0.45
1:A:70:ASN:O	1:A:74:PHE:HD2	2.00	0.44
1:A:8:PHE:HB3	2:B:56:PHE:CE1	2.53	0.44
2:B:40:LEU:HD23	2:B:45:LYS:HA	2.00	0.44
1:A:216:THR:HG21	1:A:223:GLU:HG3	1.99	0.44
1:A:194:ARG:CG	1:A:200:THR:HG23	2.48	0.44
1:A:196:GLU:OE1	1:A:196:GLU:N	2.34	0.43
1:A:193:ARG:NH1	1:A:251:LEU:HD21	2.33	0.43
2:B:4:THR:HA	2:B:5:PRO:HD3	1.91	0.43
1:A:45:TYR:CE1	1:A:67:ALA:HB2	2.54	0.43
1:A:192:HIS:CE1	2:B:99:MET:HA	2.54	0.42

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:B:54:MET:SD	2:B:64:ILE:HB	2.59	0.42
1:A:271:THR:HG22	4:A:284:HOH:O	2.19	0.42
1:A:35:ARG:NH1	1:A:48:ARG:CZ	2.83	0.42
1:A:135:ALA:HB1	1:A:140:ALA:HB3	2.01	0.42
2:B:19:LYS:O	2:B:20:PRO:C	2.57	0.42
1:A:202:ARG:HD3	1:A:244:TRP:CE3	2.55	0.42
2:B:73:THR:HG22	2:B:74:GLU:N	2.34	0.42
2:B:45:LYS:HG3	2:B:46:ILE:N	2.34	0.42
1:A:192:HIS:HE1	2:B:99:MET:HA	1.84	0.42
1:A:250:PRO:HB2	1:A:253:LYS:HD2	2.01	0.42
1:A:49:ALA:O	1:A:52:ILE:HG22	2.20	0.42
1:A:81:ALA:O	1:A:82:LEU:C	2.58	0.42
1:A:259:CYS:O	1:A:271:THR:HA	2.20	0.41
1:A:145:ARG:O	1:A:149:GLN:HG2	2.19	0.41
1:A:9:VAL:CG2	1:A:24:GLU:HG2	2.36	0.41
2:B:7:ILE:CD1	2:B:7:ILE:N	2.83	0.41
1:A:22:TYR:CD2	1:A:71:GLU:HB2	2.57	0.40
2:B:32:PRO:HB2	2:B:33:PRO:HD2	2.02	0.40
1:A:226:GLN:HB3	1:A:226:GLN:HE21	1.67	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	271/274 (99%)	257 (95%)	13 (5%)	1 (0%)	43	60
2	B	97/99 (98%)	91 (94%)	5 (5%)	1 (1%)	22	31
3	P	7/9 (78%)	7 (100%)	0	0	100	100
All	All	375/382 (98%)	355 (95%)	18 (5%)	2 (0%)	38	52

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	58	LYS
1	A	207	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	229/230 (100%)	207 (90%)	22 (10%)	12	17
2	B	93/93 (100%)	84 (90%)	9 (10%)	12	17
3	P	5/5 (100%)	5 (100%)	0	100	100
All	All	327/328 (100%)	296 (90%)	31 (10%)	12	17

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	29	ASP
1	A	44	ARG
1	A	45	TYR
1	A	48	ARG
1	A	50	ARG
1	A	54	GLN
1	A	88	SER
1	A	108	ARG
1	A	111	ARG
1	A	180	LEU
1	A	181	ARG
1	A	182	THR
1	A	189	VAL
1	A	198	ASP
1	A	224	LEU
1	A	225	THR
1	A	226	GLN
1	A	251	LEU
1	A	261	VAL
1	A	266	LEU
1	A	271	THR
1	A	272	LEU

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Mol	Chain	Res	Type
2	B	12	ARG
2	B	38	GLN
2	B	45	LYS
2	B	58	LYS
2	B	74	GLU
2	B	75	THR
2	B	77	THR
2	B	81	ARG
2	B	92	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	87	GLN
1	A	93	HIS
1	A	115	GLN
1	A	127	ASN
1	A	141	GLN
1	A	191	HIS
1	A	220	ASN
1	A	226	GLN
1	A	242	GLN
1	A	260	HIS
2	B	38	GLN
2	B	67	HIS

### 5.3.3 RNA ⓘ

There are no RNA chains 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 ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

There are no ligands in this entry.

## 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	A	273/274 (99%)	-0.32	1 (0%) 90 90	5, 25, 48, 67	0
2	B	99/99 (100%)	-0.18	3 (3%) 48 45	8, 27, 53, 63	0
3	P	9/9 (100%)	-0.32	0 100 100	17, 22, 29, 43	0
All	All	381/382 (99%)	-0.28	4 (1%) 79 79	5, 26, 50, 67	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	54	MET	3.1
1	A	196	GLU	2.7
2	B	19	LYS	2.6
2	B	51	MET	2.1

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

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

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

### 6.4 Ligands ⓘ

There are no ligands in this entry.

### 6.5 Other polymers ⓘ

There are no such residues in this entry.