



# Full wwPDB X-ray Structure Validation Report ⓘ

May 23, 2020 – 02:53 am BST

PDB ID : 5B56  
Title : Crystal structure of HIV-1 VPR C-Terminal domain and DIBB-M-Importin-Alpha2 complex  
Authors : Miyatake, H.; Sanjoh, A.; Matusda, G.; Murakami, T.; Murakami, H.; Hagiwara, K.; Yokoyama, M.; Sato, H.; Miyamoto, Y.; Dohmae, N.; Aida, Y.  
Deposited on : 2016-04-25  
Resolution : 2.30 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

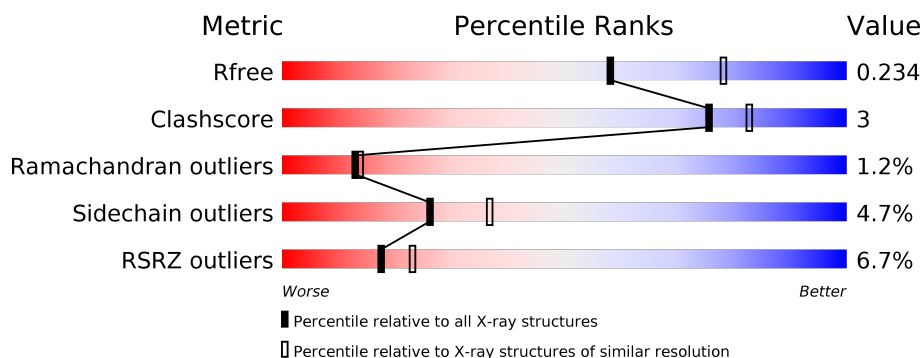
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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))
$R_{free}$	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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 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  $\leq 5\%$ . 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	460	<div> <div>3%</div> <div>84%</div> <div>9%</div> <div>7%</div> </div>
1	B	460	<div> <div>6%</div> <div>83%</div> <div>10%</div> <div>6%</div> </div>
2	C	12	<div> <div>33%</div> <div>83%</div> <div>17%</div> </div>
2	D	12	<div> <div>25%</div> <div>58%</div> <div>42%</div> </div>
2	E	12	<div> <div>58%</div> <div>33%</div> <div>8%</div> </div>
2	F	12	<div> <div>42%</div> <div>75%</div> <div>17%</div> <div>8%</div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 14559 atoms, of which 7096 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 Importin subunit alpha-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	429	Total	C	H	N	O	S	0	0	0
			6611	2080	3343	555	623	10			
1	B	432	Total	C	H	N	O	S	0	0	0
			6657	2096	3361	557	633	10			

- Molecule 2 is a protein called Protein Vpr.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	12	Total	C	H	N	O	0	0	0
			195	53	98	25	19			
2	D	12	Total	C	H	N	O	0	0	0
			195	53	98	25	19			
2	E	12	Total	C	H	N	O	0	0	0
			194	53	98	25	18			
2	F	12	Total	C	H	N	O	0	0	0
			195	53	98	25	19			

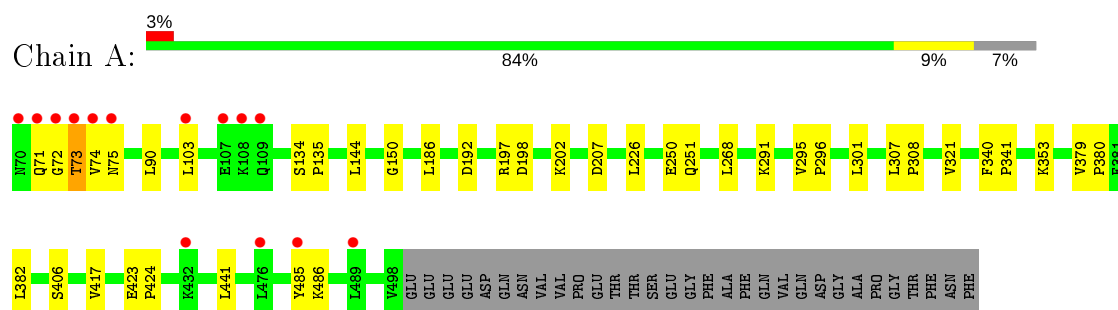
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	275	Total	O	0	0
			275	275		
3	B	213	Total	O	0	0
			213	213		
3	C	9	Total	O	0	0
			9	9		
3	D	5	Total	O	0	0
			5	5		
3	E	5	Total	O	0	0
			5	5		
3	F	5	Total	O	0	0
			5	5		

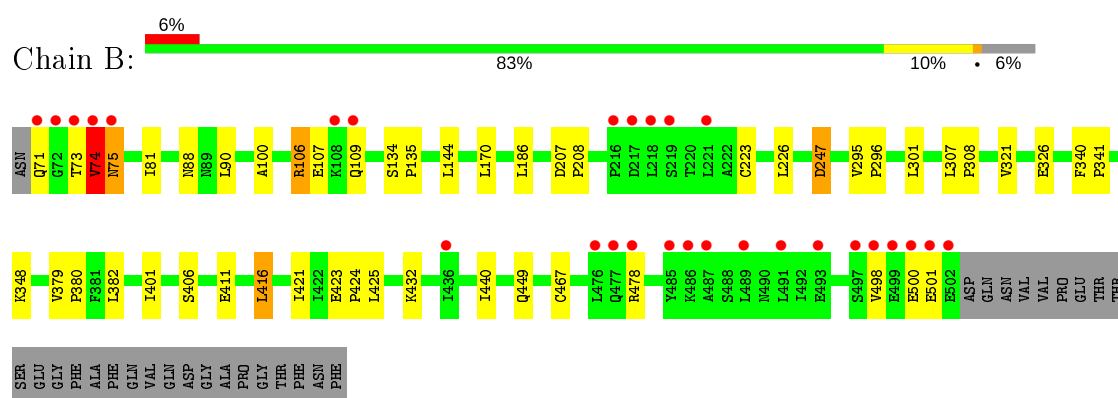
### 3 Residue-property plots [i](#)

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.

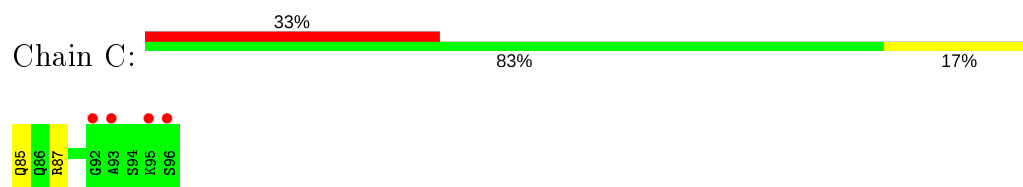
#### • Molecule 1: Importin subunit alpha-1



#### • Molecule 1: Importin subunit alpha-1



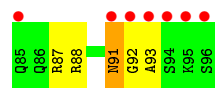
#### • Molecule 2: Protein Vpr



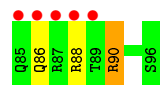
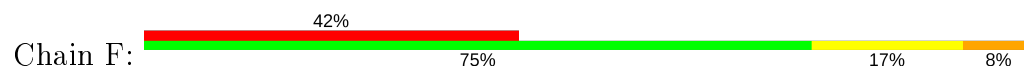
#### • Molecule 2: Protein Vpr



## ● Molecule 2: Protein Vpr



## ● Molecule 2: Protein Vpr



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	91.02Å 81.56Å 101.55Å 90.00° 97.78° 90.00°	Depositor
Resolution (Å)	31.52 – 2.30 43.40 – 2.30	Depositor EDS
% Data completeness (in resolution range)	87.0 (31.52-2.30) 87.2 (43.40-2.30)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.60 (at 2.29Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, $R_{free}$	0.182 , 0.226 0.191 , 0.234	Depositor DCC
$R_{free}$ test set	2912 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	39.9	Xtriage
Anisotropy	0.357	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 57.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	14559	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	71.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.37% 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](#)

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	0.23	0/3326	0.39	0/4533
1	B	0.23	0/3354	0.39	0/4570
2	C	0.23	0/96	0.53	0/123
2	D	0.23	0/96	0.50	0/123
2	E	0.25	0/95	0.58	0/123
2	F	0.23	0/96	0.47	0/123
All	All	0.23	0/7063	0.40	0/9595

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	3268	3343	3343	18	0
1	B	3296	3361	3361	23	0
2	C	97	98	98	2	0
2	D	97	98	98	3	0
2	E	96	98	98	4	0
2	F	97	98	98	0	0
3	A	275	0	0	4	0
3	B	213	0	0	2	0
3	C	9	0	0	0	0
3	D	5	0	0	1	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	5	0	0	1	0
3	F	5	0	0	0	0
All	All	7463	7096	7096	44	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 3.

All (44) 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:A:150:GLY:O	2:E:87:ARG:NH1	2.08	0.86
1:B:467:CYS:SG	3:B:666:HOH:O	2.40	0.79
1:A:192:ASP:OD1	2:E:87:ARG:NH2	2.24	0.70
1:B:74:VAL:HG13	1:B:75:ASN:N	2.07	0.69
1:A:207:ASP:OD1	1:A:251:GLN:NE2	2.29	0.66
1:A:291:LYS:NZ	3:A:604:HOH:O	2.27	0.65
1:B:73:THR:O	1:B:74:VAL:HG12	1.97	0.65
1:A:321:VAL:O	2:C:87:ARG:NH2	2.32	0.63
1:A:71:GLN:O	1:A:73:THR:N	2.33	0.61
1:B:449:GLN:NE2	3:B:601:HOH:O	2.36	0.59
2:E:87:ARG:NH2	3:E:101:HOH:O	2.37	0.57
2:E:91:ASN:CB	2:E:92:GLY:HA3	2.36	0.55
1:A:250:GLU:OE1	3:A:601:HOH:O	2.19	0.53
1:B:326:GLU:N	1:B:326:GLU:OE1	2.41	0.53
1:A:74:VAL:HG12	1:A:75:ASN:H	1.75	0.52
1:A:197:ARG:NH1	1:A:198:ASP:OD1	2.45	0.49
1:B:74:VAL:CG1	1:B:75:ASN:N	2.76	0.48
1:B:321:VAL:O	2:D:87:ARG:NH2	2.46	0.48
1:B:406:SER:HG	2:D:85:GLN:N	2.12	0.48
1:B:106:ARG:NH2	1:B:109:GLN:O	2.48	0.47
1:B:207:ASP:HB2	1:B:208:PRO:HD3	1.95	0.47
1:A:307:LEU:N	1:A:308:PRO:CD	2.78	0.47
1:A:406:SER:HG	2:C:85:GLN:N	2.13	0.46
1:B:74:VAL:HG13	1:B:75:ASN:H	1.80	0.45
1:A:353:LYS:NZ	3:A:614:HOH:O	2.40	0.45
1:B:379:VAL:HB	1:B:380:PRO:HD3	1.97	0.45
1:B:307:LEU:N	1:B:308:PRO:CD	2.80	0.44
2:D:86:GLN:NE2	3:D:101:HOH:O	2.51	0.44
1:B:425:LEU:HG	1:B:440:ILE:HG23	1.99	0.44
1:B:295:VAL:HB	1:B:296:PRO:HD3	2.00	0.44
1:A:134:SER:N	1:A:135:PRO:CD	2.81	0.43

*Continued on next page...*



Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:379:VAL:HB	1:A:380:PRO:HD3	1.99	0.43
1:B:73:THR:OG1	1:B:74:VAL:N	2.48	0.43
1:A:423:GLU:HB3	1:A:424:PRO:HD3	2.01	0.43
1:B:340:PHE:N	1:B:341:PRO:CD	2.82	0.43
1:A:340:PHE:N	1:A:341:PRO:CD	2.81	0.43
1:B:247:ASP:N	1:B:247:ASP:OD2	2.51	0.43
1:A:417:VAL:O	3:A:602:HOH:O	2.22	0.42
1:B:81:ILE:CD1	1:B:100:ALA:HB2	2.50	0.41
1:A:295:VAL:HB	1:A:296:PRO:HD3	2.03	0.41
1:B:423:GLU:HB3	1:B:424:PRO:HD3	2.03	0.41
1:B:401:ILE:HD13	1:B:421:ILE:HD11	2.02	0.40
1:B:134:SER:N	1:B:135:PRO:CD	2.85	0.40
1:B:416:LEU:HD22	1:B:421:ILE:HB	2.03	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	
1	A	427/460 (93%)	416 (97%)	10 (2%)	1 (0%)	47	58
1	B	430/460 (94%)	409 (95%)	16 (4%)	5 (1%)	13	14
2	C	10/12 (83%)	7 (70%)	3 (30%)	0	100	100
2	D	10/12 (83%)	7 (70%)	2 (20%)	1 (10%)	0	0
2	E	10/12 (83%)	6 (60%)	3 (30%)	1 (10%)	0	0
2	F	10/12 (83%)	6 (60%)	1 (10%)	3 (30%)	0	0
All	All	897/968 (93%)	851 (95%)	35 (4%)	11 (1%)	13	14

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	72	GLY
1	B	74	VAL
1	B	75	ASN
2	E	93	ALA
2	F	86	GLN
1	B	498	VAL
1	B	500	GLU
1	B	501	GLU
2	D	93	ALA
2	F	90	ARG
2	F	88	ARG

### 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	360/386 (93%)	347 (96%)	13 (4%)	35	49
1	B	363/386 (94%)	344 (95%)	19 (5%)	23	32
2	C	10/10 (100%)	10 (100%)	0	100	100
2	D	10/10 (100%)	9 (90%)	1 (10%)	7	9
2	E	10/10 (100%)	8 (80%)	2 (20%)	1	1
2	F	10/10 (100%)	9 (90%)	1 (10%)	7	9
All	All	763/812 (94%)	727 (95%)	36 (5%)	26	37

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	73	THR
1	A	90	LEU
1	A	103	LEU
1	A	144	LEU
1	A	186	LEU
1	A	202	LYS
1	A	226	LEU
1	A	268	LEU

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	A	301	LEU
1	A	382	LEU
1	A	441	LEU
1	A	485	TYR
1	A	486	LYS
1	B	71	GLN
1	B	74	VAL
1	B	88	ASN
1	B	90	LEU
1	B	106	ARG
1	B	107	GLU
1	B	144	LEU
1	B	170	LEU
1	B	186	LEU
1	B	223	CYS
1	B	226	LEU
1	B	247	ASP
1	B	301	LEU
1	B	348	LYS
1	B	382	LEU
1	B	411	GLU
1	B	416	LEU
1	B	432	LYS
1	B	478	ARG
2	D	90	ARG
2	E	88	ARG
2	E	91	ASN
2	F	90	ARG

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](#)

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 ⓘ

### 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	429/460 (93%)	0.36	14 (3%) 46 53	29, 52, 103, 188	0
1	B	432/460 (93%)	0.49	28 (6%) 18 24	37, 58, 117, 202	0
2	C	12/12 (100%)	1.45	4 (33%) 0 0	57, 79, 105, 144	0
2	D	12/12 (100%)	1.12	3 (25%) 0 0	66, 88, 119, 141	0
2	E	12/12 (100%)	4.58	7 (58%) 0 0	94, 113, 162, 172	0
2	F	12/12 (100%)	2.69	5 (41%) 0 0	79, 119, 183, 201	0
All	All	909/968 (93%)	0.53	61 (6%) 17 23	29, 57, 122, 202	0

All (61) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	E	96	SER	13.8
2	E	94	SER	13.2
1	B	72	GLY	11.0
1	B	74	VAL	10.7
1	B	73	THR	10.2
2	F	85	GLN	8.9
1	B	502	GLU	7.7
2	C	96	SER	7.0
1	B	71	GLN	6.5
1	A	73	THR	6.3
2	E	93	ALA	6.3
1	B	498	VAL	6.3
1	B	500	GLU	5.8
2	E	95	LYS	5.8
1	A	70	ASN	5.8
1	B	501	GLU	5.6
2	E	92	GLY	5.5
1	B	476	LEU	5.5
1	A	74	VAL	5.4

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
2	F	88	ARG	5.3
1	A	108	LYS	4.9
1	B	499	GLU	4.6
1	A	71	GLN	4.4
2	F	89	THR	4.4
1	B	75	ASN	4.4
1	B	485	TYR	4.2
1	A	476	LEU	4.1
1	B	486	LYS	4.1
2	F	87	ARG	3.8
2	D	95	LYS	3.6
1	B	216	PRO	3.5
1	A	72	GLY	3.5
1	B	497	SER	3.3
2	C	95	LYS	3.3
2	E	91	ASN	3.3
1	B	477	GLN	3.1
1	A	109	GLN	3.1
1	B	478	ARG	2.9
1	A	107	GLU	2.9
1	B	218	LEU	2.8
1	A	485	TYR	2.8
1	A	103	LEU	2.7
1	A	75	ASN	2.7
1	B	217	ASP	2.7
1	B	436	ILE	2.7
2	D	93	ALA	2.6
1	A	489	LEU	2.6
1	A	432	LYS	2.6
1	B	109	GLN	2.6
1	B	221	LEU	2.5
1	B	219	SER	2.4
2	F	86	GLN	2.4
1	B	491	LEU	2.4
2	C	93	ALA	2.3
2	C	92	GLY	2.3
2	D	96	SER	2.3
1	B	487	ALA	2.2
1	B	489	LEU	2.2
1	B	108	LYS	2.2
2	E	85	GLN	2.0
1	B	493	GLU	2.0

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.