



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jul 20, 2021 – 04:08 PM JST

PDB ID : 7DFA  
Title : Crystal of Arrestin2-V2Rpp-4-Fab30 complex  
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Deposited on : 2020-11-06  
Resolution : 2.54 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

<https://www.wwpdb.org/validation/2017/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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.22  
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) : 2.22

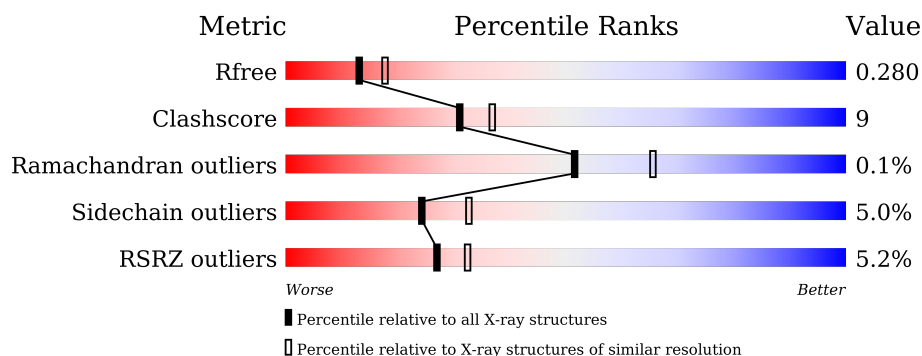
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.54 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	1284 (2.56-2.52)
Clashscore	141614	1332 (2.56-2.52)
Ramachandran outliers	138981	1315 (2.56-2.52)
Sidechain outliers	138945	1315 (2.56-2.52)
RSRZ outliers	127900	1272 (2.56-2.52)

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  $\leq 5\%$ . 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	426	<div> <div style="width: 100%; height: 10px; background-color: red; position: relative;"> <span style="position: absolute; top: -10px; left: 0;">%</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>68%</span> <span>15%</span> <span>•</span> <span>15%</span> </div> </div>
2	H	249	<div> <div style="width: 100%; height: 10px; background-color: red; position: relative;"> <span style="position: absolute; top: -10px; left: 0;">8%</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>62%</span> <span>22%</span> <span>•</span> <span>13%</span> </div> </div>
3	L	227	<div> <div style="width: 100%; height: 10px; background-color: red; position: relative;"> <span style="position: absolute; top: -10px; left: 0;">7%</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>76%</span> <span>15%</span> <span>•</span> <span>7%</span> </div> </div>
4	V	23	<div> <div style="width: 100%; height: 10px; background-color: red; position: relative;"> <span style="position: absolute; top: -10px; left: 0;">4%</span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>65%</span> <span>26%</span> <span>9%</span> </div> </div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 6015 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 Beta-arrestin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	363	Total	C	N	O	S	0	0	0
			2746	1755	467	514	10			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	419	LEU	-	expression tag	UNP P17870
A	420	GLU	-	expression tag	UNP P17870
A	421	HIS	-	expression tag	UNP P17870
A	422	HIS	-	expression tag	UNP P17870
A	423	HIS	-	expression tag	UNP P17870
A	424	HIS	-	expression tag	UNP P17870
A	425	HIS	-	expression tag	UNP P17870
A	426	HIS	-	expression tag	UNP P17870

- Molecule 2 is a protein called FAB30 HEAVY CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	216	Total	C	N	O	S	0	0	0
			1551	984	261	301	5			

- Molecule 3 is a protein called FAB30 LIGHT CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	210	Total	C	N	O	S	0	0	0
			1533	957	252	319	5			

- Molecule 4 is a protein called VaRpp-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	V	23	Total	C	N	O	P	S	0	0
			177	88	24	57	7	1		

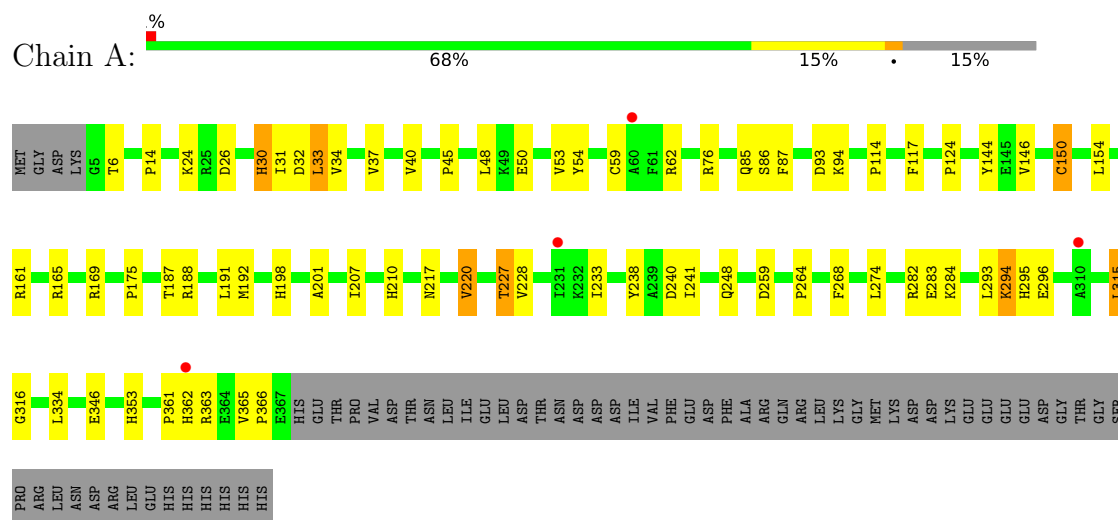
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	2	Total 2	O 2	0	0
5	H	4	Total 4	O 4	0	0
5	L	1	Total 1	O 1	0	0
5	V	1	Total 1	O 1	0	0

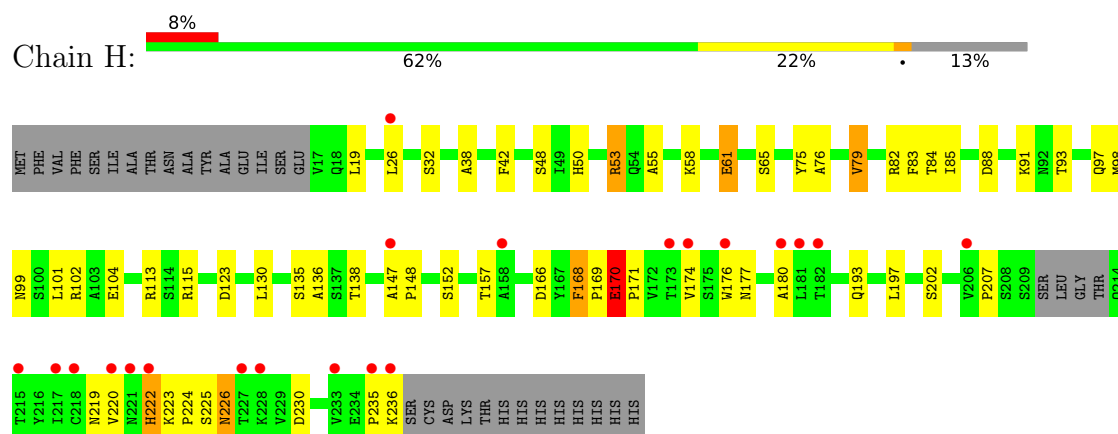
### 3 Residue-property plots [i](#)

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 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.

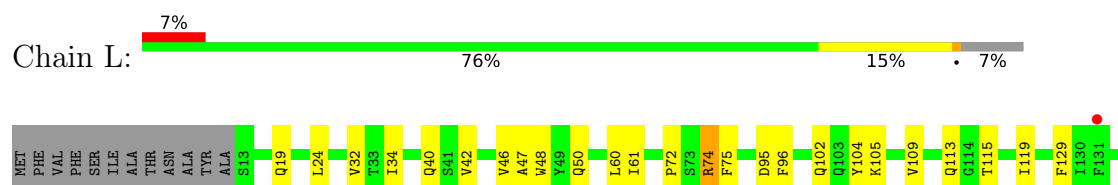
#### • Molecule 1: Beta-arrestin-1



#### • Molecule 2: FAB30 HEAVY CHAIN

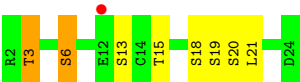


#### • Molecule 3: FAB30 LIGHT CHAIN





● Molecule 4: VaRpp-4



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	116.90Å 121.14Å 144.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.42 – 2.54 46.42 – 2.54	Depositor EDS
% Data completeness (in resolution range)	99.8 (46.42-2.54) 99.8 (46.42-2.54)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.26 (at 2.54Å)	Xtriage
Refinement program	PHENIX 1.14 _3260	Depositor
R, $R_{free}$	0.234 , 0.280 0.234 , 0.280	Depositor DCC
$R_{free}$ test set	1734 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	75.3	Xtriage
Anisotropy	0.397	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 64.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.010 for -k,-h,-l	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6015	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	83.0	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: SEP, TPO

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	0.47	0/2806	0.62	0/3829
2	H	0.55	2/1592 (0.1%)	0.69	1/2181 (0.0%)
3	L	0.47	0/1565	0.62	0/2137
4	V	0.50	0/102	0.61	0/132
All	All	0.49	2/6065 (0.0%)	0.64	1/8279 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	223	LYS	C-N	8.40	1.50	1.34
2	H	170	GLU	C-N	8.18	1.49	1.34

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	222	HIS	CA-CB-CG	-5.54	104.17	113.60

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	2746	0	2710	45	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	H	1551	0	1414	35	0
3	L	1533	0	1409	28	0
4	V	177	0	119	3	0
5	A	2	0	0	0	0
5	H	4	0	0	0	0
5	L	1	0	0	0	0
5	V	1	0	0	0	0
All	All	6015	0	5652	106	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 9.

The worst 5 of 106 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:H:50:HIS:HD1	2:H:65:SER:HG	1.18	0.89
2:H:170:GLU:CB	2:H:171:PRO:HD3	2.12	0.79
1:A:45:PRO:HA	1:A:48:LEU:HB3	1.66	0.78
1:A:53:VAL:HG22	1:A:150:CYS:HB3	1.67	0.77
2:H:169:PRO:HD2	2:H:224:PRO:HG2	1.72	0.71

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	361/426 (85%)	344 (95%)	17 (5%)	0	100	100
2	H	212/249 (85%)	192 (91%)	19 (9%)	1 (0%)	29	40
3	L	206/227 (91%)	189 (92%)	17 (8%)	0	100	100
4	V	14/23 (61%)	14 (100%)	0	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	793/925 (86%)	739 (93%)	53 (7%)	1 (0%)	51 65

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	170	GLU

### 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	294/380 (77%)	279 (95%)	15 (5%)	24 32
2	H	155/209 (74%)	144 (93%)	11 (7%)	14 19
3	L	166/199 (83%)	161 (97%)	5 (3%)	41 55
4	V	10/13 (77%)	10 (100%)	0	100 100
All	All	625/801 (78%)	594 (95%)	31 (5%)	24 33

5 of 31 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	315	LEU
3	L	40	GLN
2	H	61	GLU
3	L	113	GLN
2	H	193	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
2	H	222	HIS
2	H	226	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

7 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
4	TPO	V	15	4	8,10,11	1.72	2 (25%)	10,14,16	1.43	1 (10%)
4	SEP	V	18	4	8,9,10	1.47	1 (12%)	8,12,14	1.34	1 (12%)
4	TPO	V	3	4	8,10,11	1.79	2 (25%)	10,14,16	1.98	2 (20%)
4	SEP	V	6	4	8,9,10	1.73	1 (12%)	8,12,14	1.23	1 (12%)
4	SEP	V	20	4	8,9,10	1.50	1 (12%)	8,12,14	1.25	1 (12%)
4	SEP	V	13	4	8,9,10	1.67	2 (25%)	8,12,14	2.17	2 (25%)
4	SEP	V	19	4	8,9,10	1.62	1 (12%)	8,12,14	2.34	2 (25%)

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	TPO	V	15	4	-	5/9/11/13	-
4	SEP	V	18	4	-	0/5/8/10	-
4	TPO	V	3	4	-	0/9/11/13	-
4	SEP	V	6	4	-	4/5/8/10	-
4	SEP	V	20	4	-	0/5/8/10	-
4	SEP	V	13	4	-	1/5/8/10	-
4	SEP	V	19	4	-	2/5/8/10	-

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	V	3	TPO	P-O1P	3.81	1.62	1.50
4	V	6	SEP	P-O1P	3.77	1.62	1.50
4	V	19	SEP	P-O1P	3.71	1.62	1.50
4	V	13	SEP	P-O1P	3.50	1.61	1.50
4	V	15	TPO	P-O1P	3.29	1.61	1.50

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	V	19	SEP	OG-CB-CA	5.56	113.56	108.14
4	V	3	TPO	P-OG1-CB	-5.02	108.05	123.21
4	V	13	SEP	OG-CB-CA	4.98	112.99	108.14
4	V	15	TPO	P-OG1-CB	-3.67	112.13	123.21
4	V	18	SEP	P-OG-CB	-3.33	109.13	118.30

There are no chirality outliers.

5 of 12 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	V	15	TPO	N-CA-CB-CG2
4	V	15	TPO	N-CA-CB-OG1
4	V	15	TPO	C-CA-CB-CG2
4	V	6	SEP	CA-CB-OG-P
4	V	19	SEP	CA-CB-OG-P

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	V	3	TPO	1	0
4	V	6	SEP	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](#)

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	363/426 (85%)	0.34	4 (1%) 80 85	51, 74, 105, 130	0
2	H	216/249 (86%)	0.52	21 (9%) 7 9	55, 87, 123, 130	0
3	L	210/227 (92%)	0.55	16 (7%) 13 17	62, 94, 119, 138	0
4	V	16/23 (69%)	0.44	1 (6%) 20 23	73, 94, 112, 117	0
All	All	805/925 (87%)	0.45	42 (5%) 27 32	51, 81, 117, 138	0

The worst 5 of 42 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	L	167	LEU	5.9
3	L	166	ALA	5.2
2	H	220	VAL	4.6
2	H	235	PRO	4.5
2	H	180	ALA	4.4

### 6.2 Non-standard residues in protein, DNA, RNA chains [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. 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	B-factors(Å <sup>2</sup> )	Q<0.9
4	SEP	V	13	10/11	0.77	0.18	107,114,119,121	0
4	SEP	V	20	10/11	0.89	0.15	73,78,84,86	0
4	TPO	V	3	11/12	0.93	0.11	100,104,118,118	0
4	SEP	V	6	10/11	0.93	0.25	77,83,95,99	0
4	TPO	V	15	11/12	0.94	0.12	88,97,105,108	0
4	SEP	V	19	10/11	0.95	0.17	66,71,78,83	0
4	SEP	V	18	10/11	0.97	0.19	63,70,74,80	0

### 6.3 Carbohydrates [i](#)

There are no monosaccharides 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.