



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 05:27 AM GMT

PDB ID : 2QS1  
Title : Crystal structure of the GluR5 ligand binding core dimer in complex with  
UBP315 at 1.80 Angstroms resolution  
Authors : Alushin, G.M.; Jane, D.E.; Mayer, M.L.  
Deposited on : 2007-07-30  
Resolution : 1.80 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  
<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 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
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) : trunk26865

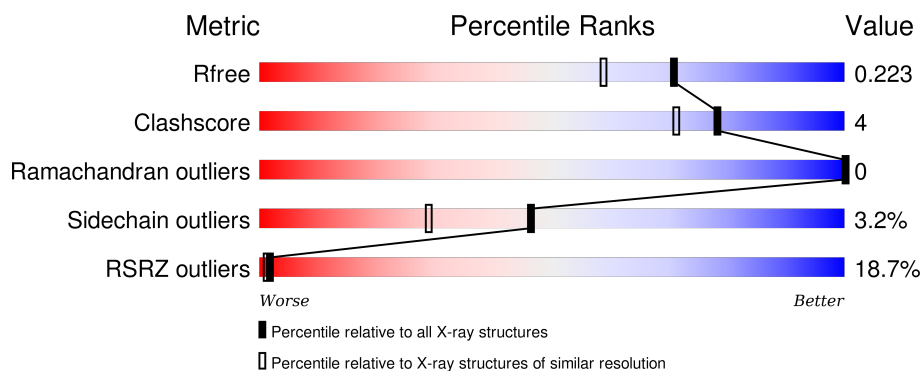
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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))
$R_{free}$	91344	4533 (1.80-1.80)
Clashscore	102246	5383 (1.80-1.80)
Ramachandran outliers	100387	5320 (1.80-1.80)
Sidechain outliers	100360	5319 (1.80-1.80)
RSRZ outliers	91569	4547 (1.80-1.80)

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	258	<div> <div>19%</div> <div>88%</div> <div>9%</div> <div>...</div> </div>
1	B	258	<div> <div>18%</div> <div>87%</div> <div>10%</div> <div>.</div> </div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 4620 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 Glutamate receptor, ionotropic kainate 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	251	Total	C	N	O	S	0	10	0
			2089	1333	347	396	13			
1	B	251	Total	C	N	O	S	0	9	0
			2079	1327	345	393	14			

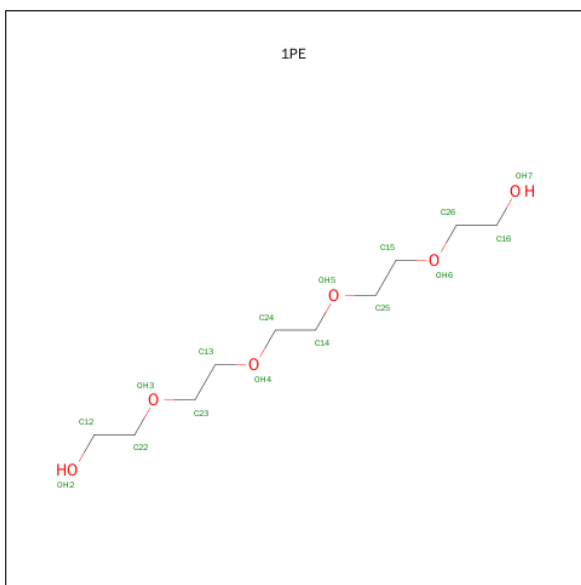
There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	EXPRESSION TAG	UNP P22756
A	2	SER	-	EXPRESSION TAG	UNP P22756
A	117	GLY	-	LINKER	UNP P22756
A	118	THR	-	LINKER	UNP P22756
A	258	SER	GLU	ENGINEERED	UNP P22756
B	1	GLY	-	EXPRESSION TAG	UNP P22756
B	2	SER	-	EXPRESSION TAG	UNP P22756
B	117	GLY	-	LINKER	UNP P22756
B	118	THR	-	LINKER	UNP P22756
B	258	SER	GLU	ENGINEERED	UNP P22756

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

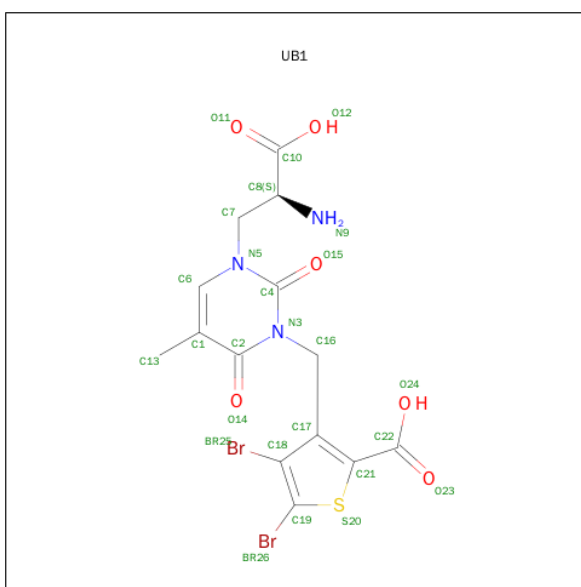
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Cl	0	0
			1	1		
2	A	1	Total	Cl	0	0
			1	1		

- Molecule 3 is PENTAETHYLENE GLYCOL (three-letter code: 1PE) (formula: C<sub>10</sub>H<sub>22</sub>O<sub>6</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			16	10	6		
3	B	1	Total	C	O	0	0
			16	10	6		

- Molecule 4 is 3-({3-[(2S)-2-AMINO-2-CARBOXYETHYL]-5-METHYL-2,6-DIOXO-3,6-DIHYDROPYRIMIDIN-1(2H)-YL} METHYL)-4,5-DIBROMOTHIOPHENE-2-CARBOXYLIC ACID (three-letter code: UB1) (formula:  $C_{14}H_{13}Br_2N_3O_6S$ ).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
4	A	1	Total	Br	C	N	O	S	0	0
			26	2	14	3	6	1		

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Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
4	B	1	Total	Br	C	N	O	S	0	0
			26	2	14	3	6	1		

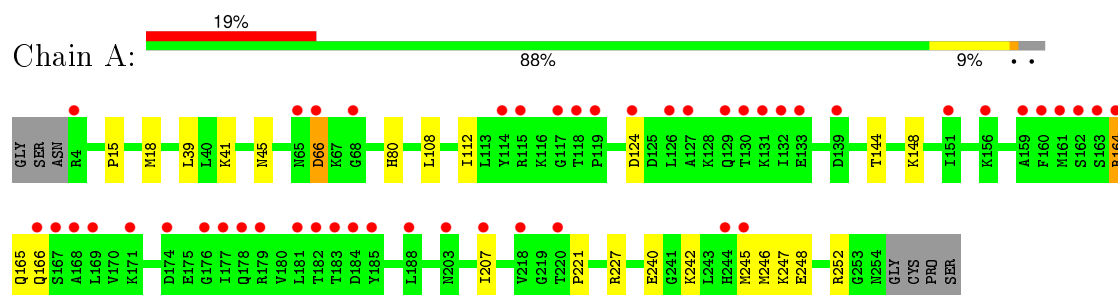
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	190	Total	O	0	0
			190	190		
5	B	176	Total	O	0	0
			176	176		

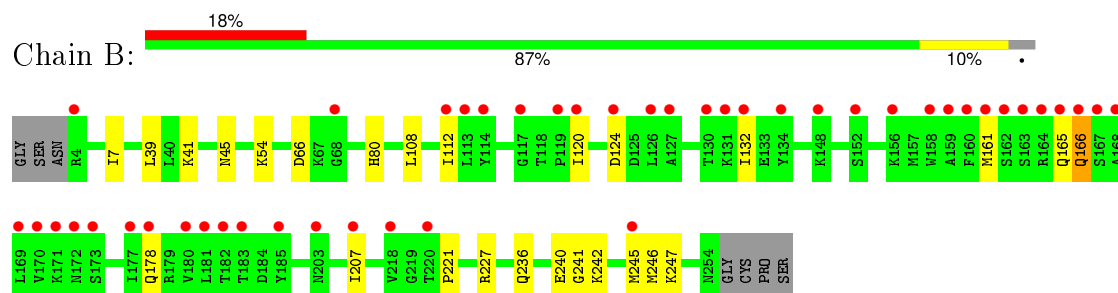
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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 ( $\text{RSRZ} > 2$ ). 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: Glutamate receptor, ionotropic kainate 1



- Molecule 1: Glutamate receptor, ionotropic kainate 1



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	97.82Å 97.82Å 129.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	21.57 – 1.80 21.57 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.9 (21.57-1.80) 99.9 (21.57-1.80)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.16 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.198 , 0.219 0.206 , 0.223	Depositor DCC
$R_{free}$ test set	2884 reflections (5.30%)	DCC
Wilson B-factor (Å <sup>2</sup> )	25.3	Xtriage
Anisotropy	0.105	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 45.2	EDS
Estimated twinning fraction	0.486 for -k,-h,-l	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtriage
Outliers	1 of 57347 reflections (0.002%)	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	4620	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.71% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 5 Model quality ⓘ

### 5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CL, UB1, 1PE

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	0.42	0/2128	0.55	0/2865
1	B	0.42	0/2118	0.55	0/2852
All	All	0.42	0/4246	0.55	0/5717

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 ⓘ

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	2089	0	2108	14	0
1	B	2079	0	2100	16	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	16	0	22	0	0
3	B	16	0	22	1	0
4	A	26	0	11	0	0
4	B	26	0	11	0	0
5	A	190	0	0	3	0
5	B	176	0	0	6	0
All	All	4620	0	4274	31	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 4.

All (31) 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:221[A]:PRO:HG3	5:A:671:HOH:O	1.74	0.87
1:B:221[A]:PRO:HG3	5:B:705:HOH:O	1.76	0.86
1:A:248:GLU:O	1:A:252:ARG:HG3	1.93	0.68
1:B:240[A]:GLU:HG3	1:B:242:LYS:HG3	1.76	0.67
1:B:120:ILE:HD11	1:B:132:ILE:HD13	1.78	0.66
1:B:80:HIS:HA	5:B:705:HOH:O	1.95	0.65
1:A:80:HIS:HA	5:A:671:HOH:O	1.96	0.65
3:B:601:1PE:OH7	5:B:761:HOH:O	2.16	0.63
1:B:245[B]:MET:HG3	5:B:764:HOH:O	2.01	0.60
1:B:166:GLN:CD	1:B:166:GLN:H	2.05	0.59
1:A:242:LYS:HA	1:A:245[B]:MET:HG2	1.84	0.58
1:A:112:ILE:HB	1:A:207:ILE:HB	1.87	0.57
1:A:240[A]:GLU:HG3	1:A:242:LYS:HG3	1.91	0.53
1:A:66:ASP:OD2	1:A:66:ASP:N	2.43	0.51
1:B:112:ILE:HB	1:B:207:ILE:HB	1.92	0.51
1:A:144:THR:O	1:A:148:LYS:HG2	2.11	0.51
1:A:41:LYS:HE2	1:A:45:ASN:HD21	1.75	0.50
1:B:39:LEU:N	1:B:246[B]:MET:HE1	2.26	0.49
1:B:161:MET:O	1:B:165:GLN:HA	2.13	0.48
1:B:41:LYS:HE2	1:B:45:ASN:HD21	1.77	0.48
1:B:242:LYS:HA	1:B:245[B]:MET:HG2	1.97	0.46
1:A:248:GLU:O	1:A:252:ARG:CG	2.63	0.45
1:A:164:ARG:HH21	1:A:166:GLN:HB3	1.82	0.45
1:A:80:HIS:CE1	5:A:769:HOH:O	2.70	0.45
1:B:236:GLN:OE1	5:B:774:HOH:O	2.21	0.44
1:A:15:PRO:HA	1:A:18[A]:MET:SD	2.57	0.44
1:B:7[B]:ILE:CG2	1:B:54[B]:LYS:HD2	2.48	0.43
1:A:39:LEU:HB2	1:A:246:MET:HE1	2.01	0.42
1:B:7[B]:ILE:HG23	1:B:54[B]:LYS:HD2	2.01	0.42
1:B:80:HIS:CE1	5:B:775:HOH:O	2.72	0.41
1:B:241:GLY:O	1:B:245[B]:MET:HG2	2.21	0.41

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	259/258 (100%)	249 (96%)	10 (4%)	0	100	100
1	B	258/258 (100%)	253 (98%)	5 (2%)	0	100	100
All	All	517/516 (100%)	502 (97%)	15 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	230/225 (102%)	223 (97%)	7 (3%)	48	31
1	B	229/225 (102%)	222 (97%)	7 (3%)	47	30
All	All	459/450 (102%)	445 (97%)	14 (3%)	46	30

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	66	ASP
1	A	108	LEU
1	A	124	ASP
1	A	164	ARG
1	A	165	GLN
1	A	227	ARG
1	A	247	LYS
1	B	66	ASP

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Mol	Chain	Res	Type
1	B	108	LEU
1	B	124	ASP
1	B	166	GLN
1	B	178	GLN
1	B	227	ARG
1	B	247	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	B	45	ASN
1	B	178	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 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
3	1PE	A	602	-	15,15,15	0.48	0	14,14,14	0.34	0
4	UB1	A	603	-	13,27,27	1.75	2 (15%)	8,40,40	3.20	3 (37%)
3	1PE	B	601	-	15,15,15	0.48	0	14,14,14	0.36	0
4	UB1	B	602	-	13,27,27	1.77	2 (15%)	8,40,40	3.18	3 (37%)

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
3	1PE	A	602	-	-	0/13/13/13	0/0/0/0
4	UB1	A	603	-	-	0/6/16/16	0/2/2/2
3	1PE	B	601	-	-	0/13/13/13	0/0/0/0
4	UB1	B	602	-	-	0/6/16/16	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	603	UB1	BR25-C18	3.76	1.97	1.89
4	B	602	UB1	BR25-C18	3.79	1.98	1.89
4	B	602	UB1	C19-C18	4.38	1.47	1.38
4	A	603	UB1	C19-C18	4.38	1.47	1.38

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	603	UB1	BR25-C18-C19	-6.16	121.13	127.67
4	B	602	UB1	BR25-C18-C19	-6.00	121.30	127.67
4	B	602	UB1	C17-C16-N3	-4.11	109.53	114.29
4	A	603	UB1	C17-C16-N3	-3.99	109.67	114.29
4	A	603	UB1	C16-N3-C4	4.35	123.20	118.05
4	B	602	UB1	C16-N3-C4	4.42	123.29	118.05

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
3	B	601	1PE	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

### 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	251/258 (97%)	0.86	48 (19%) <b>2</b> <b>1</b>	14, 35, 56, 60	0
1	B	251/258 (97%)	0.89	46 (18%) <b>2</b> <b>1</b>	14, 34, 55, 60	0
All	All	502/516 (97%)	0.88	94 (18%) <b>2</b> <b>1</b>	14, 35, 56, 60	0

All (94) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	166	GLN	8.4
1	B	163	SER	7.3
1	B	160	PHE	7.0
1	A	127	ALA	7.0
1	A	163	SER	6.6
1	A	160	PHE	6.3
1	B	161	MET	6.2
1	A	119	PRO	6.1
1	B	114	TYR	5.8
1	B	131	LYS	5.8
1	A	161	MET	5.7
1	B	124	ASP	5.4
1	B	127	ALA	5.3
1	B	171	LYS	4.9
1	B	119	PRO	4.9
1	B	178	GLN	4.7
1	B	167	SER	4.6
1	A	131	LYS	4.5
1	B	117	GLY	4.5
1	A	124	ASP	4.4
1	A	114	TYR	4.4
1	B	148	LYS	4.3
1	A	167	SER	4.3
1	A	178	GLN	4.1

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Mol	Chain	Res	Type	RSRZ
1	B	173	SER	4.1
1	A	159	ALA	4.0
1	B	168	ALA	4.0
1	A	126	LEU	3.9
1	B	159	ALA	3.9
1	A	183	THR	3.8
1	B	166	GLN	3.8
1	B	162	SER	3.8
1	B	207	ILE	3.6
1	B	164	ARG	3.5
1	B	68	GLY	3.5
1	B	130	THR	3.5
1	B	181	LEU	3.5
1	A	171	LYS	3.4
1	A	130	THR	3.4
1	A	162	SER	3.3
1	B	177	ILE	3.3
1	A	133	GLU	3.2
1	A	132	ILE	3.2
1	B	182	THR	3.1
1	A	66	ASP	3.0
1	A	68	GLY	3.0
1	B	112	ILE	3.0
1	B	203	ASN	3.0
1	A	181	LEU	3.0
1	B	126	LEU	3.0
1	A	245[A]	MET	2.9
1	A	168	ALA	2.9
1	A	207	ILE	2.9
1	B	132	ILE	2.9
1	B	134	TYR	2.9
1	A	117	GLY	2.9
1	B	169	LEU	2.8
1	A	129	GLN	2.8
1	B	156	LYS	2.8
1	A	185	TYR	2.7
1	A	182	THR	2.7
1	A	156	LYS	2.6
1	A	203	ASN	2.6
1	A	218	VAL	2.6
1	B	180	VAL	2.6
1	A	169	LEU	2.6

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Mol	Chain	Res	Type	RSRZ
1	B	170	VAL	2.6
1	A	177	ILE	2.6
1	B	220	THR	2.4
1	B	245[A]	MET	2.4
1	B	113	LEU	2.4
1	B	120	ILE	2.4
1	B	185	TYR	2.4
1	B	158	TRP	2.3
1	A	220	THR	2.3
1	B	218	VAL	2.3
1	A	179	ARG	2.2
1	A	151	ILE	2.2
1	A	4	ARG	2.2
1	A	174	ASP	2.2
1	A	164	ARG	2.2
1	B	4	ARG	2.2
1	A	115	ARG	2.1
1	A	65	ASN	2.1
1	A	176	GLY	2.1
1	A	118	THR	2.1
1	B	152	SER	2.1
1	A	139	ASP	2.1
1	B	165	GLN	2.1
1	A	244	HIS	2.1
1	A	184	ASP	2.1
1	B	172	ASN	2.0
1	B	183	THR	2.0
1	A	188	LEU	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](#)

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(Å <sup>2</sup> )	Q<0.9
4	UB1	B	602	26/26	0.94	0.10	-0.56	30,38,43,45	2
4	UB1	A	603	26/26	0.92	0.10	-0.74	30,37,43,45	2
3	1PE	B	601	16/16	0.95	0.11	-	18,24,31,31	16
2	CL	B	502	1/1	0.99	0.06	-	24,24,24,24	1
2	CL	A	501	1/1	0.99	0.06	-	24,24,24,24	1
3	1PE	A	602	16/16	0.93	0.13	-	20,24,29,31	16

## 6.5 Other polymers

There are no such residues in this entry.