



wwPDB X-ray Structure Validation Summary Report

Mar 5, 2026 – 07:35 PM UTC

PDB ID : 4B76 / pdb_00004b76
Title : Discovery of an allosteric mechanism for the regulation of HCV NS3 protein function
Authors : Saalau-Bethell, S.M.; Woodhead, A.J.; Chessari, G.; Carr, M.G.; Coyle, J.; Graham, B.; Hiscock, S.D.; Murray, C.W.; Pathuri, P.; Rich, S.J.; Richardson, C.J.; Williams, P.A.; Jhoti, H.
Deposited on : 2012-08-16
Resolution : 2.14 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the  symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

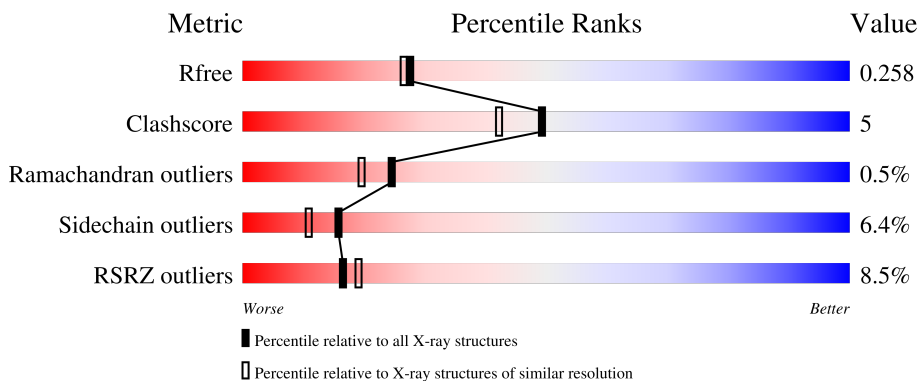
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.14 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}	180053	3689 (2.16-2.12)
Clashscore	190562	3812 (2.16-2.12)
Ramachandran outliers	187476	3773 (2.16-2.12)
Sidechain outliers	187428	3772 (2.16-2.12)
RSRZ outliers	180081	3691 (2.16-2.12)

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 ≥ 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	666	 11% 83% 12% ..
1	B	666	 5% 82% 12% ..

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 10215 atoms, of which 24 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 NON-STRUCTURAL PROTEIN 4A, SERINE PROTEASE NS3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	645	4808	3026	834	918	30	0	0	0
1	B	642	4794	3019	831	914	30	0	0	0

There are 56 discrepancies between the modelled and reference sequences:

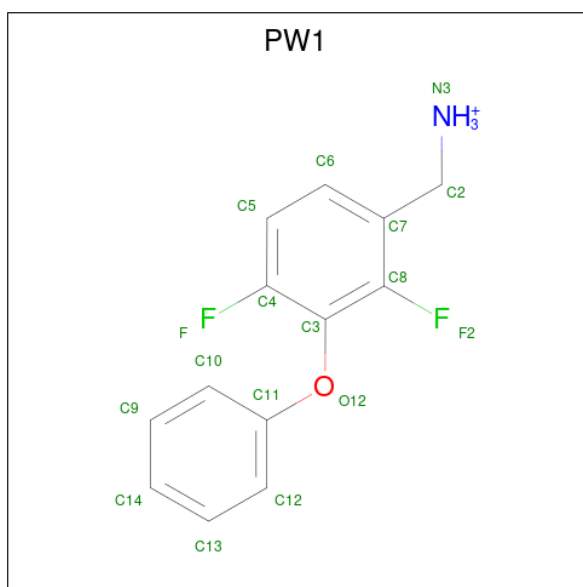
Chain	Residue	Modelled	Actual	Comment	Reference
A	684	MET	-	expression tag	UNP P26663
A	685	GLY	-	expression tag	UNP P26663
A	686	SER	-	expression tag	UNP P26663
A	687	SER	-	expression tag	UNP P26663
A	688	HIS	-	expression tag	UNP P26663
A	689	HIS	-	expression tag	UNP P26663
A	690	HIS	-	expression tag	UNP P26663
A	691	HIS	-	expression tag	UNP P26663
A	692	HIS	-	expression tag	UNP P26663
A	693	HIS	-	expression tag	UNP P26663
A	694	SER	-	expression tag	UNP P26663
A	695	SER	-	expression tag	UNP P26663
A	696	GLY	-	expression tag	UNP P26663
A	697	LEU	-	expression tag	UNP P26663
A	698	VAL	-	expression tag	UNP P26663
A	699	PRO	-	expression tag	UNP P26663
A	700	ARG	-	expression tag	UNP P26663
A	701	GLY	-	expression tag	UNP P26663
A	702	SER	-	expression tag	UNP P26663
A	703	HIS	-	expression tag	UNP P26663
A	704	MET	-	expression tag	UNP P26663
A	66	GLY	ALA	conflict	UNP P26663
A	86	GLN	PRO	conflict	UNP P26663
A	87	ALA	LYS	conflict	UNP P26663

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Chain	Residue	Modelled	Actual	Comment	Reference
A	147	SER	PHE	conflict	UNP P26663
A	718	SER	-	linker	UNP P26663
A	719	GLY	-	linker	UNP P26663
A	720	SER	-	linker	UNP P26663
B	684	MET	-	expression tag	UNP P26663
B	685	GLY	-	expression tag	UNP P26663
B	686	SER	-	expression tag	UNP P26663
B	687	SER	-	expression tag	UNP P26663
B	688	HIS	-	expression tag	UNP P26663
B	689	HIS	-	expression tag	UNP P26663
B	690	HIS	-	expression tag	UNP P26663
B	691	HIS	-	expression tag	UNP P26663
B	692	HIS	-	expression tag	UNP P26663
B	693	HIS	-	expression tag	UNP P26663
B	694	SER	-	expression tag	UNP P26663
B	695	SER	-	expression tag	UNP P26663
B	696	GLY	-	expression tag	UNP P26663
B	697	LEU	-	expression tag	UNP P26663
B	698	VAL	-	expression tag	UNP P26663
B	699	PRO	-	expression tag	UNP P26663
B	700	ARG	-	expression tag	UNP P26663
B	701	GLY	-	expression tag	UNP P26663
B	702	SER	-	expression tag	UNP P26663
B	703	HIS	-	expression tag	UNP P26663
B	704	MET	-	expression tag	UNP P26663
B	718	SER	-	linker	UNP P26663
B	719	GLY	-	linker	UNP P26663
B	720	SER	-	linker	UNP P26663
B	66	GLY	ALA	conflict	UNP P26663
B	86	GLN	PRO	conflict	UNP P26663
B	87	ALA	LYS	conflict	UNP P26663
B	147	SER	PHE	conflict	UNP P26663

- Molecule 2 is [2,4-bis(fluoranyl)-3-phenoxy-phenyl]methylazanium (CCD ID: PW1) (formula: C₁₃H₁₂F₂NO).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	F	H	N			O
2	A	1	29	13	2	12	1	1	0	0
2	B	1	29	13	2	12	1	1	0	0

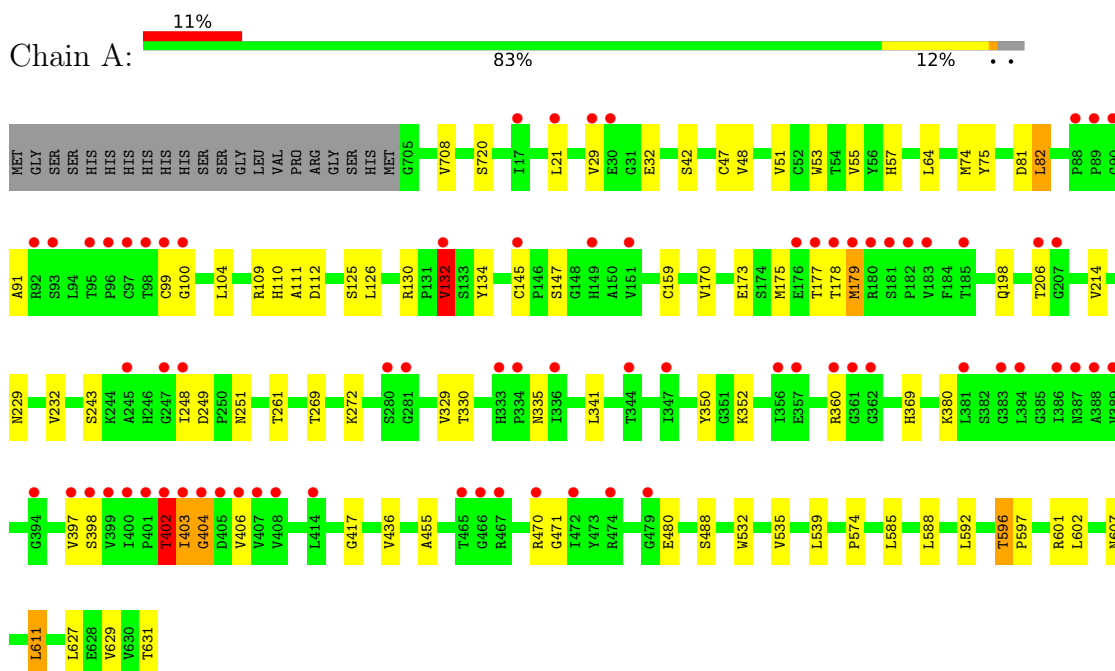
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	308	Total	O	0	0
			308	308		
3	B	247	Total	O	0	0
			247	247		

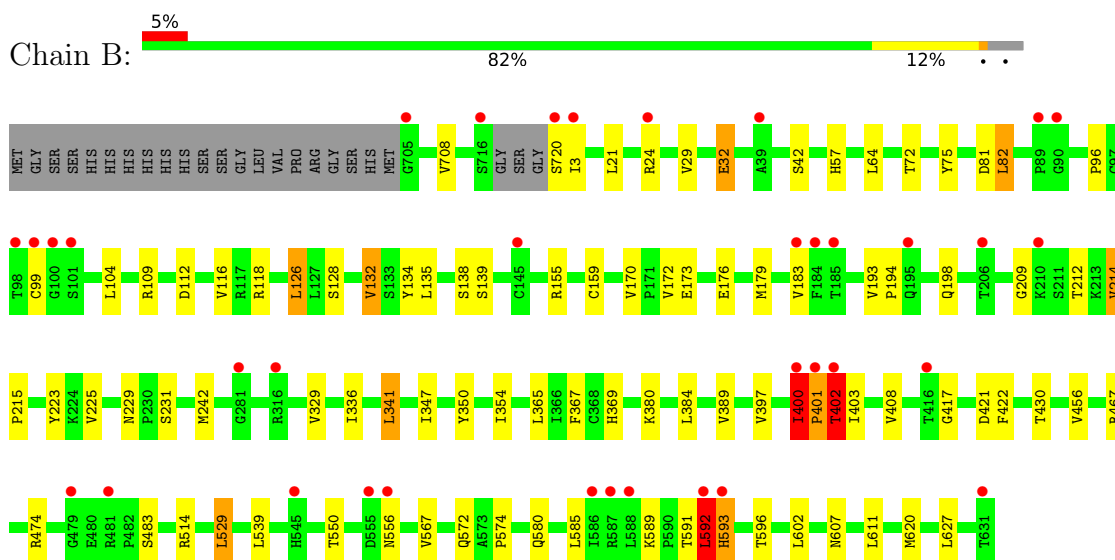
3 Residue-property plots [i](#)

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: NON-STRUCTURAL PROTEIN 4A, SERINE PROTEASE NS3



- Molecule 1: NON-STRUCTURAL PROTEIN 4A, SERINE PROTEASE NS3



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	91.35Å 110.31Å 142.15Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	87.15 – 2.14 87.15 – 2.14	Depositor EDS
% Data completeness (in resolution range)	99.2 (87.15-2.14) 99.2 (87.15-2.14)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.07 (at 2.14Å)	Xtrriage
Refinement program	REFMAC 5.7.0025	Depositor
R, R_{free}	0.194 , 0.253 0.200 , 0.258	Depositor DCC
R_{free} test set	4034 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	29.0	Xtrriage
Anisotropy	0.063	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 35.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	10215	wwPDB-VP
Average B, all atoms (Å ²)	35.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.15% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: PW1

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	0.87	1/4917 (0.0%)	0.92	7/6714 (0.1%)
1	B	0.75	0/4901	0.90	7/6690 (0.1%)
All	All	0.81	1/9818 (0.0%)	0.91	14/13404 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	720	SER	C-N	27.60	1.65	1.33

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	400	ILE	CA-C-N	9.15	148.96	127.00
1	B	400	ILE	C-N-CA	9.15	148.96	127.00
1	B	400	ILE	C-N-CD	-8.70	101.46	120.60
1	B	556	ASN	N-CA-C	8.37	122.77	112.23
1	A	720	SER	CA-C-N	-7.52	111.27	121.80

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	4808	0	4784	49	0
1	B	4794	0	4771	55	0
2	A	17	12	12	0	0
2	B	17	12	12	0	0
3	A	308	0	0	4	0
3	B	247	0	0	5	0
All	All	10191	24	9579	103	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 5.

The worst 5 of 103 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:B:400:ILE:HB	1:B:401:PRO:CA	2.09	0.82
1:A:596:THR:HG22	1:A:607:ASN:HD22	1.44	0.81
1:A:132:VAL:HG11	1:A:159:CYS:SG	2.22	0.80
1:B:132:VAL:CG1	1:B:159:CYS:SG	2.70	0.79
1:A:132:VAL:CG1	1:A:159:CYS:SG	2.72	0.78

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	643/666 (96%)	623 (97%)	18 (3%)	2 (0%)	36 33
1	B	637/666 (96%)	619 (97%)	14 (2%)	4 (1%)	21 15
All	All	1280/1332 (96%)	1242 (97%)	32 (2%)	6 (0%)	24 19

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	403	ILE
1	A	404	GLY
1	B	400	ILE
1	B	592	LEU
1	B	593	HIS

5.3.2 Protein sidechains [i](#)

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	526/544 (97%)	494 (94%)	32 (6%)	17	12
1	B	525/544 (96%)	490 (93%)	35 (7%)	15	10
All	All	1051/1088 (97%)	984 (94%)	67 (6%)	16	11

5 of 67 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	529	LEU
1	B	567	VAL
1	B	611	LEU
1	A	585	LEU
1	A	539	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	607	ASN
1	B	229	ASN
1	B	607	ASN
1	B	57	HIS
1	B	251	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands 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
2	PW1	B	1721	-	18,18,18	0.25	0	24,24,24	0.99	2 (8%)
2	PW1	A	1721	-	18,18,18	0.28	0	24,24,24	1.03	2 (8%)

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
2	PW1	B	1721	-	-	1/6/6/6	0/2/2/2
2	PW1	A	1721	-	-	1/6/6/6	0/2/2/2

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1721	PW1	C6-C7-C8	3.02	118.68	116.46
2	B	1721	PW1	C6-C7-C8	2.64	118.40	116.46
2	A	1721	PW1	C11-O12-C3	2.21	121.88	118.40
2	B	1721	PW1	O12-C11-C12	2.12	126.74	119.36

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1721	PW1	N3-C2-C7-C8
2	B	1721	PW1	N3-C2-C7-C8

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	1
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	720:SER	C	3:ILE	N	2.74
1	A	720:SER	C	3:ILE	N	1.65

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, 95th 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 ²)	Q<0.9
1	A	645/666 (96%)	0.53	73 (11%) 10 12	14, 32, 68, 95	0
1	B	642/666 (96%)	0.36	36 (5%) 30 34	17, 32, 58, 103	0
All	All	1287/1332 (96%)	0.44	109 (8%) 16 19	14, 32, 65, 103	0

The worst 5 of 109 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	400	ILE	7.4
1	A	98	THR	6.9
1	A	248	ILE	6.2
1	A	403	ILE	5.4
1	A	99	CYS	5.1

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 oligosaccharides 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. The B-factors column lists the minimum, median, 95th 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(\AA^2)	Q<0.9
2	PW1	B	1721	17/17	0.93	0.09	13,20,30,36	29
2	PW1	A	1721	17/17	0.94	0.10	18,23,32,47	29

6.5 Other polymers [i](#)

There are no such residues in this entry.