



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 07:42 AM UTC

PDB ID : 1S4F / pdb_00001s4f
Title : Crystal Structure of RNA-dependent RNA polymerase construct 2 from bovine viral diarrhea virus (BVDV)
Authors : Choi, K.H.; Groarke, J.M.; Young, D.C.; Kuhn, R.J.; Smith, J.L.; Pevear, D.C.; Rossmann, M.G.
Deposited on : 2004-01-16
Resolution : 3.00 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
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

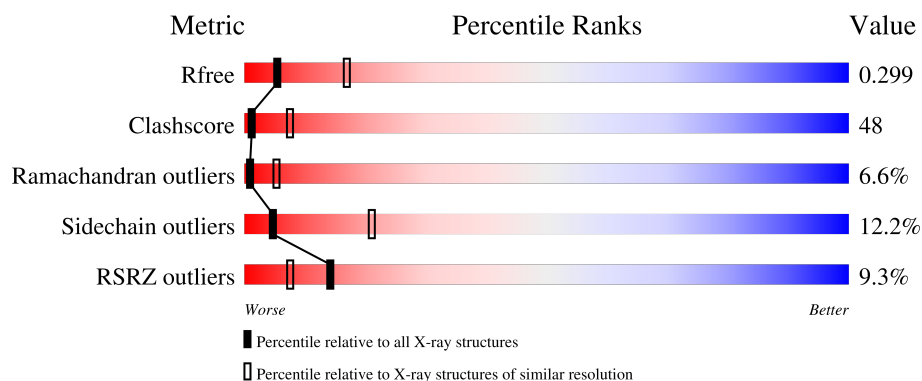
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 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	2672 (3.00-3.00)
Clashscore	190562	2977 (3.00-3.00)
Ramachandran outliers	187476	2877 (3.00-3.00)
Sidechain outliers	187428	2880 (3.00-3.00)
RSRZ outliers	180081	2671 (3.00-3.00)

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	601	4% 37% 48% 11% ..
1	B	601	4% 41% 45% 10% ..
1	C	601	15% 28% 49% 16% ..
1	D	601	12% 26% 51% 15% ..

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 18714 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.

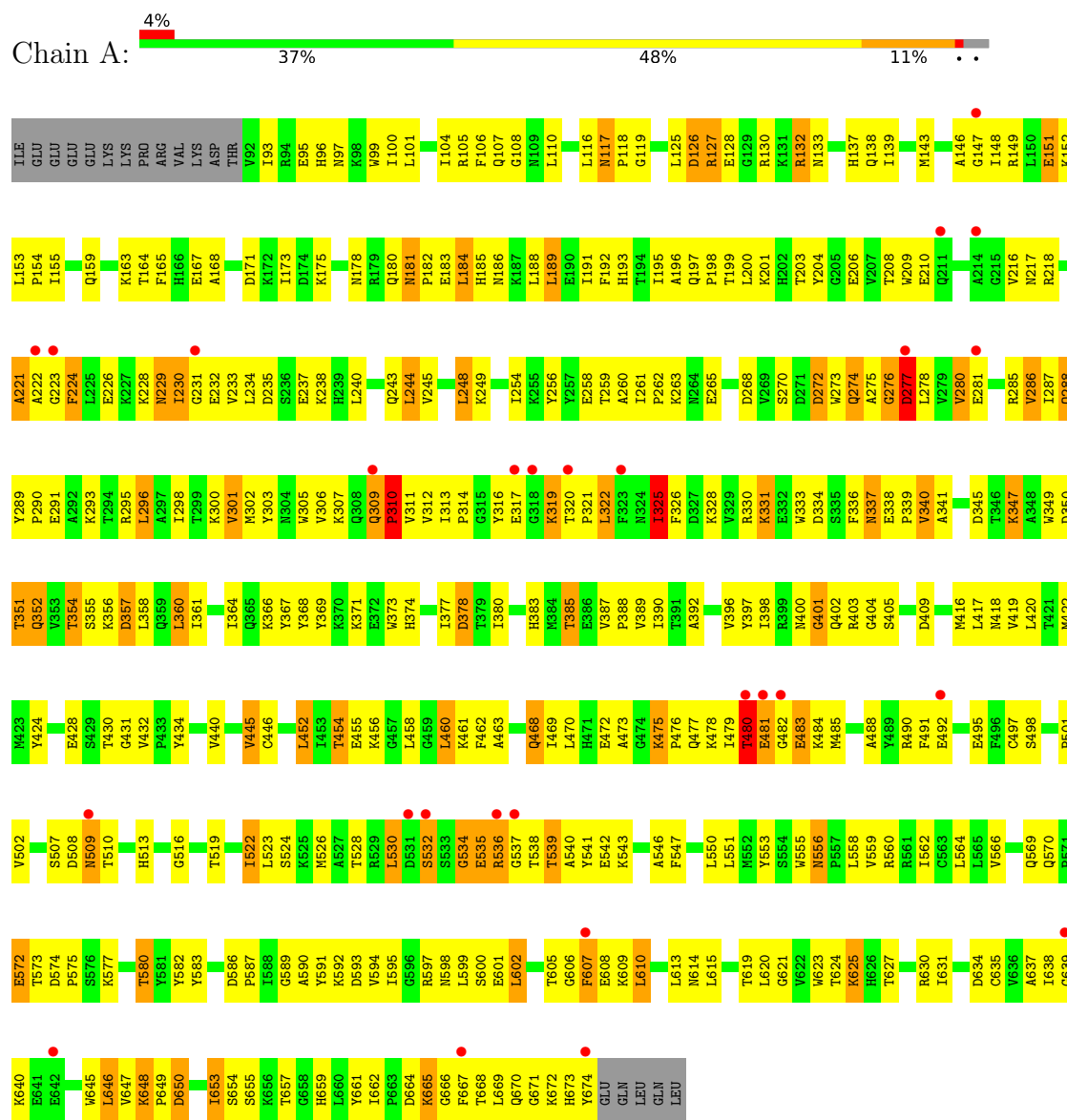
- Molecule 1 is a protein called RNA-dependent RNA polymerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	583	Total	C	N	O	S	0	0	0
			4697	2984	830	866	17			
1	B	583	Total	C	N	O	S	0	0	0
			4697	2984	830	866	17			
1	C	581	Total	C	N	O	S	0	0	0
			4684	2977	828	862	17			
1	D	575	Total	C	N	O	S	0	0	0
			4636	2945	821	853	17			

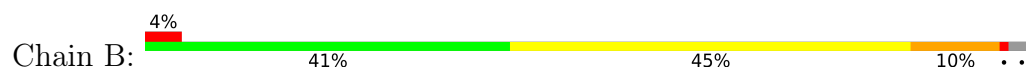
3 Residue-property plots

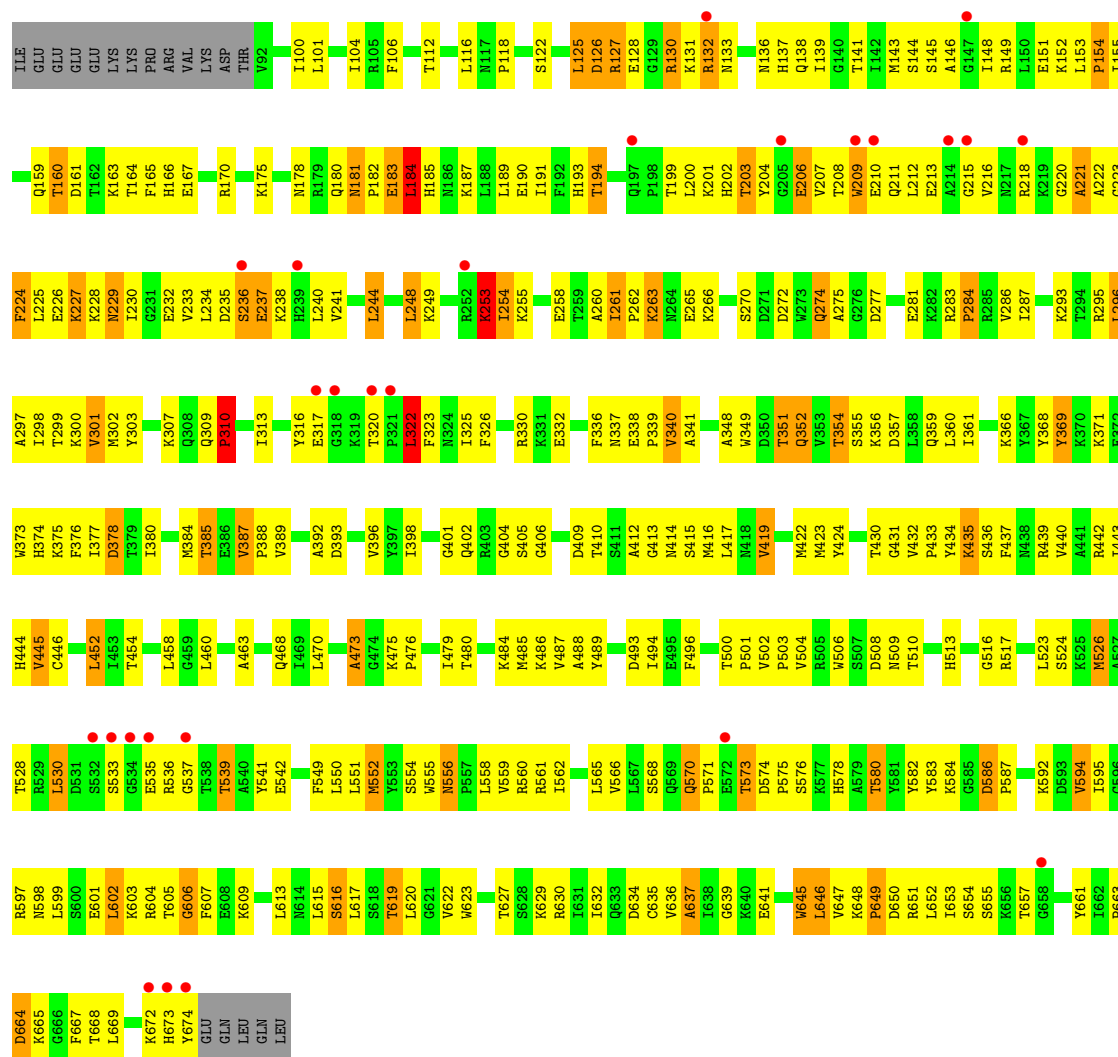
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: RNA-dependent RNA polymerase

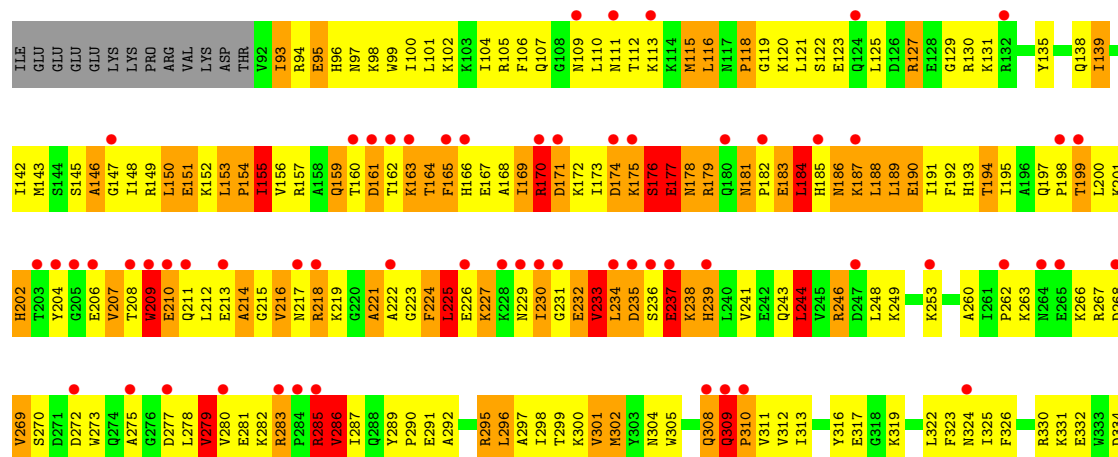


• Molecule 1: RNA-dependent RNA polymerase

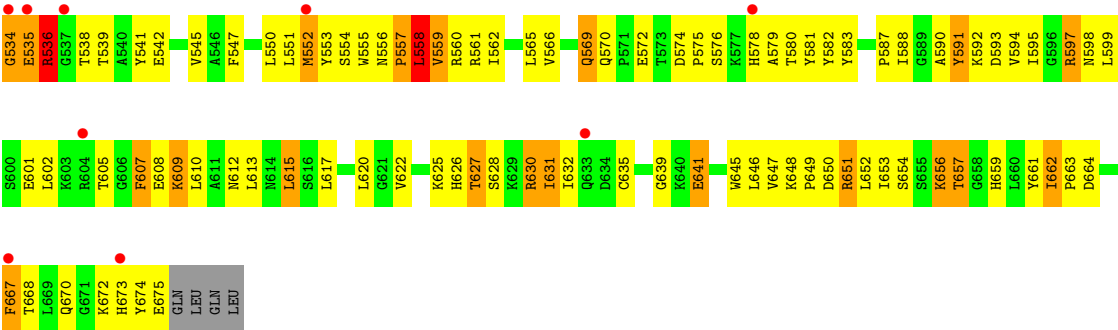




● Molecule 1: RNA-dependent RNA polymerase







4 Data and refinement statistics

Property	Value	Source
Space group	P 6 ₂ 2 2	Depositor
Cell constants a, b, c, α , β , γ	412.27Å 412.27Å 95.57Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.69 – 3.00 29.69 – 3.00	Depositor EDS
% Data completeness (in resolution range)	91.2 (29.69-3.00) 91.0 (29.69-3.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.41 (at 2.91Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.254 , 0.303 0.251 , 0.299	Depositor DCC
R_{free} test set	10559 reflections (10.03%)	wwPDB-VP
Wilson B-factor (Å ²)	52.0	Xtriage
Anisotropy	0.376	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 58.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	18714	wwPDB-VP
Average B, all atoms (Å ²)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.46% 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

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	0.56	0/4799	1.14	36/6475 (0.6%)
1	B	0.53	0/4799	1.06	27/6475 (0.4%)
1	C	0.50	0/4785	1.18	53/6455 (0.8%)
1	D	0.54	0/4736	1.18	41/6386 (0.6%)
All	All	0.53	0/19119	1.14	157/25791 (0.6%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1
1	C	0	1
1	D	0	1
All	All	0	3

There are no bond length outliers.

The worst 5 of 157 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	309	GLN	N-CA-C	-16.92	85.11	109.48
1	C	233	VAL	N-CA-C	-14.21	98.76	112.83
1	D	309	GLN	CA-C-N	-12.96	106.30	119.90
1	D	309	GLN	C-N-CA	-12.96	106.30	119.90
1	C	232	GLU	N-CA-C	-12.89	96.21	114.12

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	369	TYR	Sidechain

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Mol	Chain	Res	Type	Group
1	C	369	TYR	Sidechain
1	D	591	TYR	Sidechain

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	4697	0	4737	367	0
1	B	4697	0	4735	326	0
1	C	4684	0	4725	584	1
1	D	4636	0	4667	577	0
All	All	18714	0	18864	1808	1

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 48.

The worst 5 of 1808 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:C:170:ARG:HD3	1:D:111:ASN:HD22	1.07	1.13
1:C:218:ARG:HB3	1:C:231:GLY:HA3	1.28	1.12
1:D:580:THR:HA	1:D:673:HIS:HB3	1.28	1.12
1:A:311:VAL:HG21	1:A:319:LYS:HD2	1.28	1.10
1:A:625:LYS:H	1:A:625:LYS:HD2	0.94	1.09

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:199:THR:OG1	1:C:199:THR:OG1[10_666]	2.15	0.05

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	581/601 (97%)	490 (84%)	72 (12%)	19 (3%)	3	17
1	B	581/601 (97%)	488 (84%)	67 (12%)	26 (4%)	2	12
1	C	577/601 (96%)	446 (77%)	84 (15%)	47 (8%)	1	3
1	D	569/601 (95%)	414 (73%)	95 (17%)	60 (10%)	0	2
All	All	2308/2404 (96%)	1838 (80%)	318 (14%)	152 (7%)	1	5

5 of 152 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	182	PRO
1	A	221	ALA
1	A	224	PHE
1	A	276	GLY
1	A	277	ASP

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	511/529 (97%)	447 (88%)	64 (12%)	4	20
1	B	511/529 (97%)	458 (90%)	53 (10%)	7	28
1	C	510/529 (96%)	444 (87%)	66 (13%)	4	19
1	D	503/529 (95%)	438 (87%)	65 (13%)	4	19
All	All	2035/2116 (96%)	1787 (88%)	248 (12%)	5	21

5 of 248 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	655	SER
1	D	372	GLU
1	C	233	VAL
1	D	340	VAL
1	D	562	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 76 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	124	GLN
1	D	513	HIS
1	D	159	GLN
1	D	324	ASN
1	D	633	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 oligosaccharides 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 ⓘ

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, 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	583/601 (97%)	0.11	27 (4%) 37 20	8, 36, 78, 102	0
1	B	583/601 (97%)	0.15	26 (4%) 38 20	5, 37, 77, 102	0
1	C	581/601 (96%)	0.91	90 (15%) 5 3	19, 60, 96, 102	0
1	D	575/601 (95%)	0.64	73 (12%) 8 5	15, 53, 97, 102	0
All	All	2322/2404 (96%)	0.45	216 (9%) 14 7	5, 47, 92, 102	0

The worst 5 of 216 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	199	THR	6.7
1	C	198	PRO	5.1
1	A	607	PHE	5.1
1	C	210	GLU	4.9
1	D	160	THR	4.6

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.