



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 12:49 PM UTC

PDB ID : 4DYS / pdb_00004dys
Title : Crystal Structure of Apo Swine Flu Influenza Nucleoprotein
Authors : Lewis, H.A.; Baldwin, E.T.; Steinbacher, S.; Maskos, K.; Mortl, M.; Kiefer-sauer, R.; Edavettal, S.; McDonnell, P.A.; Pearce, B.C.; Langley, D.R.
Deposited on : 2012-02-29
Resolution : 2.80 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

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

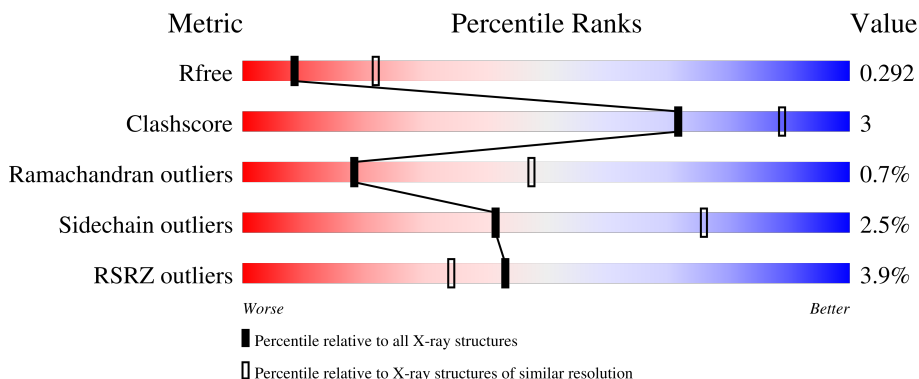
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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}	180053	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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 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	466	 3% 83% 12% 5%
1	B	466	 6% 87% 8% . .
1	C	466	 3% 87% 10% .

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 9906 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 Nucleocapsid protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	441	Total	C	N	O	S	2	0	0
			3332	2092	605	609	26			
1	B	448	Total	C	N	O	S	7	0	0
			3221	2027	574	594	26			
1	C	454	Total	C	N	O	S	1	0	0
			3314	2088	589	611	26			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	30	MET	-	expression tag	UNP G8XKZ6
A	31	GLY	-	expression tag	UNP G8XKZ6
B	30	MET	-	expression tag	UNP G8XKZ6
B	31	GLY	-	expression tag	UNP G8XKZ6
C	30	MET	-	expression tag	UNP G8XKZ6
C	31	GLY	-	expression tag	UNP G8XKZ6

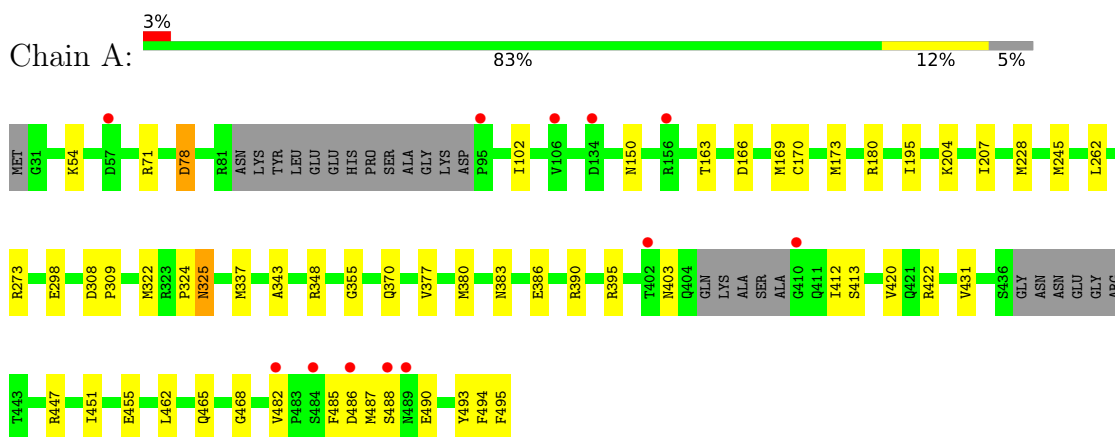
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	13	Total	O	0	0
			13	13		
2	B	17	Total	O	0	0
			17	17		
2	C	9	Total	O	0	0
			9	9		

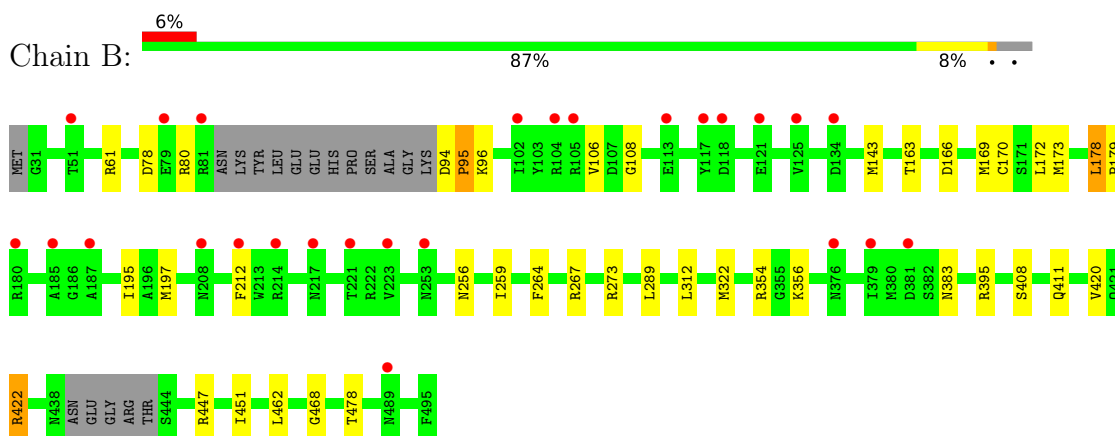
3 Residue-property plots [i](#)

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.

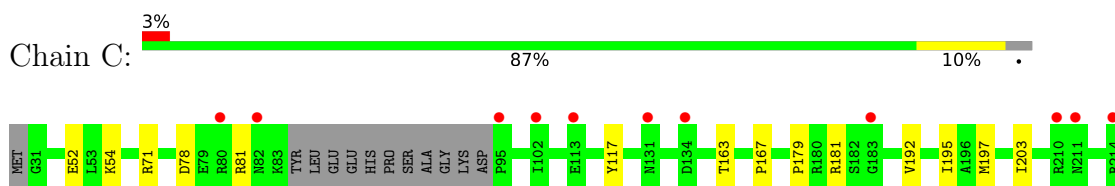
- Molecule 1: Nucleocapsid protein

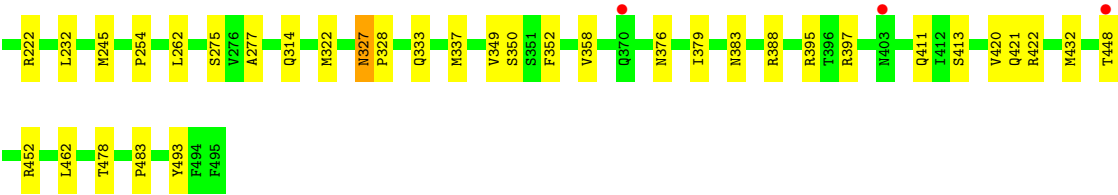


- Molecule 1: Nucleocapsid protein



- Molecule 1: Nucleocapsid protein





4 Data and refinement statistics

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, α , β , γ	94.34Å 94.34Å 603.80Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	51.85 – 2.80 51.85 – 2.80	Depositor EDS
% Data completeness (in resolution range)	98.3 (51.85-2.80) 98.3 (51.85-2.80)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.65 (at 2.81Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.241 , 0.296 0.241 , 0.292	Depositor DCC
R_{free} test set	1619 reflections (4.02%)	wwPDB-VP
Wilson B-factor (Å ²)	44.2	Xtriage
Anisotropy	0.243	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 37.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	9906	wwPDB-VP
Average B, all atoms (Å ²)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.25% 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

5.1 Standard geometry

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	0.46	2/3388 (0.1%)	0.81	3/4566 (0.1%)
1	B	0.50	3/3278 (0.1%)	0.87	5/4435 (0.1%)
1	C	0.41	0/3372	0.79	2/4557 (0.0%)
All	All	0.46	5/10038 (0.0%)	0.83	10/13558 (0.1%)

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	195	ILE	CG1-CD1	-10.80	1.09	1.51
1	A	54	LYS	CG-CD	8.90	1.79	1.52
1	B	212	PHE	CD1-CE1	-7.78	1.15	1.38
1	A	102	ILE	CG1-CD1	-6.93	1.24	1.51
1	B	212	PHE	CD2-CE2	6.51	1.58	1.38

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	195	ILE	CB-CG1-CD1	14.67	144.62	113.80
1	B	212	PHE	CG-CD1-CE1	9.49	136.83	120.70
1	B	212	PHE	CG-CD2-CE2	-7.14	108.56	120.70
1	A	54	LYS	CB-CG-CD	-6.25	96.92	111.30
1	C	327	ASN	CA-C-N	5.51	126.73	119.84
1	C	327	ASN	C-N-CA	5.51	126.73	119.84
1	B	178	LEU	CA-C-N	5.20	126.34	119.84
1	B	178	LEU	C-N-CA	5.20	126.34	119.84
1	A	482	VAL	CA-C-N	5.17	126.31	119.84
1	A	482	VAL	C-N-CA	5.17	126.31	119.84

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	3332	0	3224	28	0
1	B	3221	0	2968	21	0
1	C	3314	0	3108	27	0
2	A	13	0	0	1	0
2	B	17	0	0	1	0
2	C	9	0	0	0	0
All	All	9906	0	9300	64	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 (64) 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:163:THR:HG21	1:C:197:MET:HG3	1.78	0.66
1:A:78:ASP:HB3	2:A:506:HOH:O	1.94	0.65
1:C:245:MET:HE1	1:C:262:LEU:HD21	1.80	0.64
1:A:71:ARG:HH11	1:A:370:GLN:HE22	1.48	0.61
1:C:333:GLN:O	1:C:337:MET:HG3	2.03	0.58
1:A:495:PHE:HB2	1:C:411:GLN:HG3	1.87	0.56
1:A:324:PRO:O	1:A:325:ASN:HB2	2.06	0.56
1:C:376:ASN:HD22	1:C:379:ILE:HG12	1.72	0.55
1:A:412:ILE:HD12	1:A:431:VAL:HG22	1.89	0.55
1:C:448:THR:O	1:C:452:ARG:HB2	2.07	0.55
1:C:78:ASP:O	1:C:81:ARG:HG2	2.09	0.53
1:A:348:ARG:HH12	1:A:487:MET:HA	1.73	0.52
1:B:143:MET:HE3	1:B:179:PRO:HD2	1.92	0.52
1:B:170:CYS:HA	1:B:173:MET:HG2	1.91	0.52
1:A:245:MET:HE1	1:A:262:LEU:HD21	1.93	0.51
1:A:377:VAL:HA	1:A:380:MET:HG3	1.92	0.51
1:B:411:GLN:HB3	1:C:493:TYR:HB3	1.91	0.51
1:B:264:PHE:HE1	1:B:451:ILE:HD11	1.76	0.51
1:B:322:MET:HG3	1:B:383:ASN:HD22	1.76	0.50
1:A:468:GLY:HA2	1:C:420:VAL:HG13	1.95	0.48
1:A:166:ASP:HB3	1:A:169:MET:HG3	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:78:ASP:C	1:B:80:ARG:H	2.22	0.47
1:B:166:ASP:HB3	1:B:169:MET:HG3	1.96	0.47
1:C:192:VAL:HG13	1:C:232:LEU:HD11	1.96	0.47
1:C:203:ILE:HG12	1:C:254:PRO:HB2	1.97	0.47
1:C:314:GLN:HA	1:C:388:ARG:HG3	1.97	0.47
1:A:337:MET:HE2	1:A:343:ALA:HA	1.97	0.46
1:A:324:PRO:O	1:A:325:ASN:CB	2.64	0.46
1:A:447:ARG:O	1:A:451:ILE:HG12	2.16	0.46
1:B:408:SER:O	1:C:167:PRO:HG2	2.16	0.45
1:A:465:GLN:HA	1:C:421:GLN:HG3	1.97	0.45
1:A:204:LYS:HA	1:A:207:ILE:HD12	1.99	0.45
1:B:422:ARG:NH1	1:C:349:VAL:HG21	2.33	0.44
1:C:195:ILE:HB	1:C:232:LEU:HD13	2.00	0.44
1:B:94:ASP:HA	1:B:95:PRO:HD3	1.90	0.44
1:B:169:MET:HB3	1:B:172:LEU:HD12	1.99	0.44
1:A:273:ARG:NH1	1:C:413:SER:OG	2.50	0.44
1:A:493:TYR:HB3	1:C:411:GLN:HB2	1.99	0.43
1:C:352:PHE:CZ	1:C:483:PRO:HB3	2.52	0.43
1:A:337:MET:HE1	1:A:494:PHE:CG	2.53	0.43
1:A:455:GLU:CG	1:C:432:MET:HE2	2.49	0.43
1:C:327:ASN:HA	1:C:328:PRO:HD2	1.89	0.43
1:B:95:PRO:HB2	1:B:96:LYS:H	1.62	0.42
1:B:267:ARG:NH2	2:B:515:HOH:O	2.51	0.42
1:C:52:GLU:C	1:C:54:LYS:H	2.27	0.42
1:A:355:GLY:HA3	1:A:390:ARG:HD3	2.01	0.42
1:B:61:ARG:HD3	1:B:289:LEU:HD22	2.01	0.42
1:B:354:ARG:HG2	1:B:356:LYS:HB3	2.02	0.42
1:C:350:SER:HB3	1:C:358:VAL:HG21	2.01	0.42
1:B:447:ARG:O	1:B:451:ILE:HG12	2.20	0.42
1:A:455:GLU:HG3	1:C:432:MET:HE2	2.01	0.42
1:A:413:SER:OG	1:B:273:ARG:NH1	2.53	0.42
1:C:179:PRO:C	1:C:181:ARG:H	2.28	0.42
1:A:420:VAL:HG13	1:B:468:GLY:HA2	2.02	0.41
1:A:308:ASP:HB2	1:A:309:PRO:HD3	2.01	0.41
1:C:277:ALA:HA	1:C:397:ARG:HA	2.03	0.41
1:A:195:ILE:HG23	1:A:228:MET:HE2	2.03	0.41
1:B:178:LEU:HA	1:B:179:PRO:HD3	1.82	0.41
1:B:163:THR:HG21	1:B:197:MET:HG3	2.02	0.40
1:A:355:GLY:HA2	1:A:390:ARG:HH11	1.86	0.40
1:B:256:ASN:HA	1:B:259:ILE:HD12	2.04	0.40
1:A:322:MET:HG3	1:A:383:ASN:HD22	1.87	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:322:MET:HE3	1:C:383:ASN:HB2	2.04	0.40
1:A:170:CYS:HA	1:A:173:MET:HG2	2.04	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	433/466 (93%)	407 (94%)	20 (5%)	6 (1%)	9	30
1	B	442/466 (95%)	417 (94%)	22 (5%)	3 (1%)	18	47
1	C	450/466 (97%)	427 (95%)	23 (5%)	0	100	100
All	All	1325/1398 (95%)	1251 (94%)	65 (5%)	9 (1%)	18	47

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	488	SER
1	B	95	PRO
1	B	106	VAL
1	A	325	ASN
1	A	403	ASN
1	A	485	PHE
1	B	108	GLY
1	A	180	ARG
1	A	490	GLU

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	327/390 (84%)	318 (97%)	9 (3%)	38	73
1	B	291/390 (75%)	285 (98%)	6 (2%)	47	79
1	C	307/390 (79%)	299 (97%)	8 (3%)	40	75
All	All	925/1170 (79%)	902 (98%)	23 (2%)	42	76

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	78	ASP
1	A	150	ASN
1	A	163	THR
1	A	298	GLU
1	A	386	GLU
1	A	395	ARG
1	A	422	ARG
1	A	462	LEU
1	A	486	ASP
1	B	312	LEU
1	B	395	ARG
1	B	420	VAL
1	B	422	ARG
1	B	462	LEU
1	B	478	THR
1	C	71	ARG
1	C	117	TYR
1	C	222	ARG
1	C	275	SER
1	C	395	ARG
1	C	422	ARG
1	C	462	LEU
1	C	478	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	48	GLN
1	A	155	GLN

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Mol	Chain	Res	Type
1	A	217	ASN
1	A	370	GLN
1	A	376	ASN
1	A	383	ASN
1	B	48	GLN
1	B	146	HIS
1	B	315	ASN
1	B	383	ASN
1	B	438	ASN
1	C	150	ASN
1	C	295	HIS
1	C	376	ASN
1	C	383	ASN
1	C	415	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 [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, 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	441/466 (94%)	0.05	12 (2%) 56 46	18, 33, 48, 55	2 (0%)
1	B	448/466 (96%)	0.41	26 (5%) 29 22	20, 41, 72, 75	4 (0%)
1	C	454/466 (97%)	0.23	14 (3%) 51 41	19, 38, 56, 63	1 (0%)
All	All	1343/1398 (96%)	0.23	52 (3%) 43 34	18, 37, 59, 75	7 (0%)

All (52) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	105	ARG	4.0
1	C	82	ASN	3.7
1	C	403	ASN	3.1
1	C	95	PRO	3.0
1	A	482	VAL	3.0
1	C	102	ILE	3.0
1	B	253	ASN	2.8
1	B	379	ILE	2.8
1	C	183	GLY	2.8
1	A	106	VAL	2.8
1	B	217	ASN	2.8
1	A	95	PRO	2.8
1	B	121	GLU	2.7
1	B	376	ASN	2.7
1	A	484	SER	2.7
1	A	410	GLY	2.7
1	B	212	PHE	2.6
1	A	57	ASP	2.5
1	B	125	VAL	2.4
1	B	117	TYR	2.4
1	B	113	GLU	2.4
1	B	187	ALA	2.4
1	B	104	ARG	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	208	ASN	2.3
1	C	370	GLN	2.3
1	A	402	THR	2.3
1	C	80	ARG	2.3
1	C	214	ARG	2.3
1	B	489	ASN	2.3
1	B	223	VAL	2.3
1	A	489	ASN	2.3
1	B	79	GLU	2.3
1	B	381	ASP	2.3
1	C	210	ARG	2.3
1	A	486	ASP	2.2
1	B	118	ASP	2.2
1	C	113	GLU	2.2
1	B	102	ILE	2.1
1	C	131	ASN	2.1
1	A	134	ASP	2.1
1	B	221	THR	2.1
1	A	488	SER	2.1
1	B	214	ARG	2.1
1	C	134	ASP	2.1
1	C	211	ASN	2.0
1	B	81	ARG	2.0
1	B	180	ARG	2.0
1	B	134	ASP	2.0
1	A	156	ARG	2.0
1	B	51	THR	2.0
1	B	185	ALA	2.0
1	C	448	THR	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.