



wwPDB X-ray Structure Validation Summary Report

Feb 28, 2014 – 12:36 AM GMT

PDB ID : 2P1B
Title : Crystal structure of human nucleophosmin-core
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Jung, G.; Suh, S.W.
Deposited on : 2007-03-03
Resolution : 2.75 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

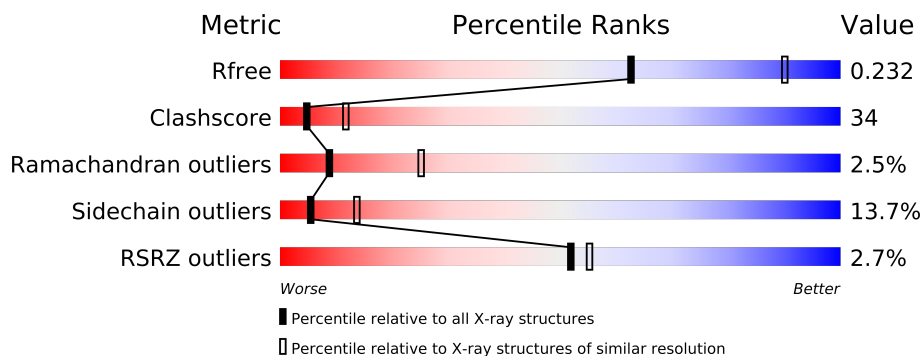
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.15 2013
Xtriage (Phenix)	:	dev-1323
EDS	:	stable22639
Percentile statistics	:	21963
Refmac	:	5.8.0049
CCP4	:	6.3.0 (Settle)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP)	:	stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.75 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}	66092	2406 (2.80-2.72)
Clashscore	79885	2995 (2.80-2.72)
Ramachandran outliers	78287	2941 (2.80-2.72)
Sidechain outliers	78261	2944 (2.80-2.72)
RSRZ outliers	66119	2409 (2.80-2.72)

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 ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	122	
1	B	122	
1	C	122	
1	D	122	
1	E	122	
1	F	122	
1	G	122	
1	H	122	
1	I	122	
1	J	122	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7686 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Nucleophosmin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	B	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	C	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	D	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	E	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	F	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	G	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	H	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	I	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			
1	J	100	Total	C	N	O	S	0	0	0
			760	484	129	143	4			

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	123	LEU	-	EXPRESSION TAG	UNP P06748
A	124	GLU	-	EXPRESSION TAG	UNP P06748
A	125	HIS	-	EXPRESSION TAG	UNP P06748
A	126	HIS	-	EXPRESSION TAG	UNP P06748
A	127	HIS	-	EXPRESSION TAG	UNP P06748
A	128	HIS	-	EXPRESSION TAG	UNP P06748
A	129	HIS	-	EXPRESSION TAG	UNP P06748
A	130	HIS	-	EXPRESSION TAG	UNP P06748
B	123	LEU	-	EXPRESSION TAG	UNP P06748

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Chain	Residue	Modelled	Actual	Comment	Reference
B	124	GLU	-	EXPRESSION TAG	UNP P06748
B	125	HIS	-	EXPRESSION TAG	UNP P06748
B	126	HIS	-	EXPRESSION TAG	UNP P06748
B	127	HIS	-	EXPRESSION TAG	UNP P06748
B	128	HIS	-	EXPRESSION TAG	UNP P06748
B	129	HIS	-	EXPRESSION TAG	UNP P06748
B	130	HIS	-	EXPRESSION TAG	UNP P06748
C	123	LEU	-	EXPRESSION TAG	UNP P06748
C	124	GLU	-	EXPRESSION TAG	UNP P06748
C	125	HIS	-	EXPRESSION TAG	UNP P06748
C	126	HIS	-	EXPRESSION TAG	UNP P06748
C	127	HIS	-	EXPRESSION TAG	UNP P06748
C	128	HIS	-	EXPRESSION TAG	UNP P06748
C	129	HIS	-	EXPRESSION TAG	UNP P06748
C	130	HIS	-	EXPRESSION TAG	UNP P06748
D	123	LEU	-	EXPRESSION TAG	UNP P06748
D	124	GLU	-	EXPRESSION TAG	UNP P06748
D	125	HIS	-	EXPRESSION TAG	UNP P06748
D	126	HIS	-	EXPRESSION TAG	UNP P06748
D	127	HIS	-	EXPRESSION TAG	UNP P06748
D	128	HIS	-	EXPRESSION TAG	UNP P06748
D	129	HIS	-	EXPRESSION TAG	UNP P06748
D	130	HIS	-	EXPRESSION TAG	UNP P06748
E	123	LEU	-	EXPRESSION TAG	UNP P06748
E	124	GLU	-	EXPRESSION TAG	UNP P06748
E	125	HIS	-	EXPRESSION TAG	UNP P06748
E	126	HIS	-	EXPRESSION TAG	UNP P06748
E	127	HIS	-	EXPRESSION TAG	UNP P06748
E	128	HIS	-	EXPRESSION TAG	UNP P06748
E	129	HIS	-	EXPRESSION TAG	UNP P06748
E	130	HIS	-	EXPRESSION TAG	UNP P06748
F	123	LEU	-	EXPRESSION TAG	UNP P06748
F	124	GLU	-	EXPRESSION TAG	UNP P06748
F	125	HIS	-	EXPRESSION TAG	UNP P06748
F	126	HIS	-	EXPRESSION TAG	UNP P06748
F	127	HIS	-	EXPRESSION TAG	UNP P06748
F	128	HIS	-	EXPRESSION TAG	UNP P06748
F	129	HIS	-	EXPRESSION TAG	UNP P06748
F	130	HIS	-	EXPRESSION TAG	UNP P06748
G	123	LEU	-	EXPRESSION TAG	UNP P06748
G	124	GLU	-	EXPRESSION TAG	UNP P06748
G	125	HIS	-	EXPRESSION TAG	UNP P06748

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Chain	Residue	Modelled	Actual	Comment	Reference
G	126	HIS	-	EXPRESSION TAG	UNP P06748
G	127	HIS	-	EXPRESSION TAG	UNP P06748
G	128	HIS	-	EXPRESSION TAG	UNP P06748
G	129	HIS	-	EXPRESSION TAG	UNP P06748
G	130	HIS	-	EXPRESSION TAG	UNP P06748
H	123	LEU	-	EXPRESSION TAG	UNP P06748
H	124	GLU	-	EXPRESSION TAG	UNP P06748
H	125	HIS	-	EXPRESSION TAG	UNP P06748
H	126	HIS	-	EXPRESSION TAG	UNP P06748
H	127	HIS	-	EXPRESSION TAG	UNP P06748
H	128	HIS	-	EXPRESSION TAG	UNP P06748
H	129	HIS	-	EXPRESSION TAG	UNP P06748
H	130	HIS	-	EXPRESSION TAG	UNP P06748
I	123	LEU	-	EXPRESSION TAG	UNP P06748
I	124	GLU	-	EXPRESSION TAG	UNP P06748
I	125	HIS	-	EXPRESSION TAG	UNP P06748
I	126	HIS	-	EXPRESSION TAG	UNP P06748
I	127	HIS	-	EXPRESSION TAG	UNP P06748
I	128	HIS	-	EXPRESSION TAG	UNP P06748
I	129	HIS	-	EXPRESSION TAG	UNP P06748
I	130	HIS	-	EXPRESSION TAG	UNP P06748
J	123	LEU	-	EXPRESSION TAG	UNP P06748
J	124	GLU	-	EXPRESSION TAG	UNP P06748
J	125	HIS	-	EXPRESSION TAG	UNP P06748
J	126	HIS	-	EXPRESSION TAG	UNP P06748
J	127	HIS	-	EXPRESSION TAG	UNP P06748
J	128	HIS	-	EXPRESSION TAG	UNP P06748
J	129	HIS	-	EXPRESSION TAG	UNP P06748
J	130	HIS	-	EXPRESSION TAG	UNP P06748

- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	10	Total O 10 10	0	0
2	B	15	Total O 15 15	0	0
2	C	8	Total O 8 8	0	0
2	D	8	Total O 8 8	0	0
2	E	5	Total O 5 5	0	0

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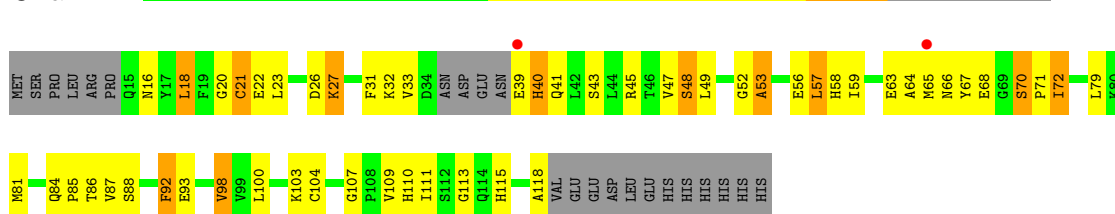
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	F	8	Total 8	O 8	0	0
2	G	5	Total 5	O 5	0	0
2	H	11	Total 11	O 11	0	0
2	I	5	Total 5	O 5	0	0
2	J	11	Total 11	O 11	0	0

3 Residue-property plots

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 ($RSRZ > 2$). 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.

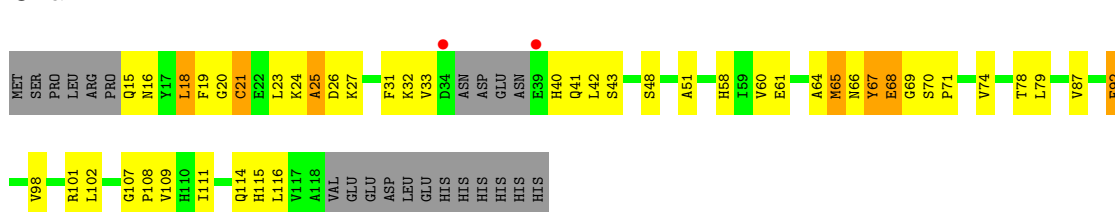
- Molecule 1: Nucleophosmin

Chain A:



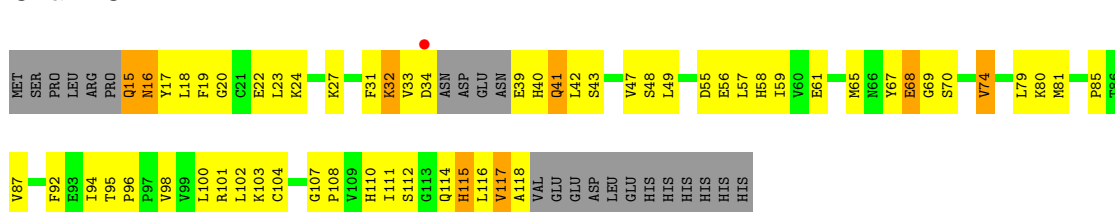
- Molecule 1: Nucleophosmin

Chain B:



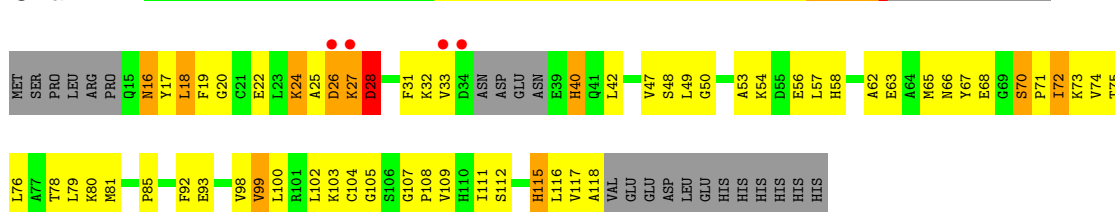
- Molecule 1: Nucleophosmin

Chain C:



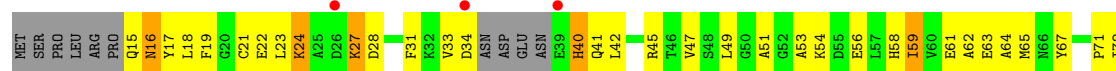
- Molecule 1: Nucleophosmin

Chain D:



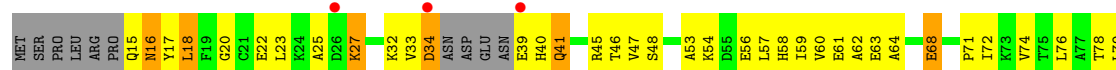
- Molecule 1: Nucleophosmin

Chain E: 



• Molecule 1: Nucleophosmin

Chain F: 



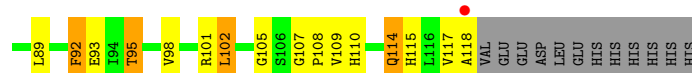
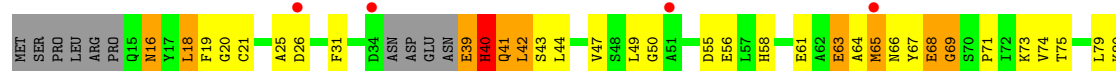
• Molecule 1: Nucleophosmin

Chain G: 



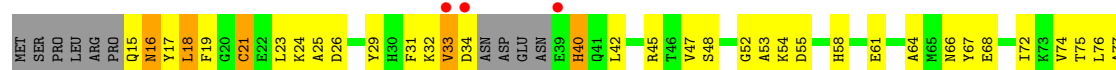
• Molecule 1: Nucleophosmin

Chain H: 



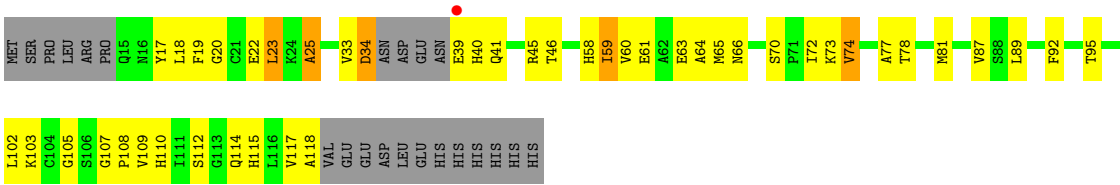
• Molecule 1: Nucleophosmin

Chain I: 



• Molecule 1: Nucleophosmin

Chain J: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	99.26Å 107.84Å 108.69Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.91 – 2.75 19.91 – 2.75	Depositor EDS
% Data completeness (in resolution range)	94.8 (19.91-2.75) 94.6 (19.91-2.75)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.66 (at 2.75Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.213 , 0.232 0.211 , 0.232	Depositor DCC
R_{free} test set	2915 reflections (9.96%)	DCC
Wilson B-factor (Å ²)	31.5	Xtriage
Anisotropy	0.147	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 20.2	EDS
Estimated twinning fraction	0.000 for -h,l,k	Xtriage
L-test for twinning	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.26$	Xtriage
Outliers	3 of 29318 reflections (0.010%)	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	7686	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 38.05 % of the origin peak, indicating pseudo translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo translational symmetry is equal to 3.9082e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

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	0.39	0/774	0.74	0/1046
1	B	0.44	0/774	0.75	0/1046
1	C	0.42	0/774	0.75	0/1046
1	D	0.42	0/774	0.76	0/1046
1	E	0.42	0/774	0.79	0/1046
1	F	0.39	0/774	0.72	0/1046
1	G	0.40	0/774	0.75	0/1046
1	H	0.44	0/774	0.88	2/1046 (0.2%)
1	I	0.40	0/774	0.75	0/1046
1	J	0.42	0/774	0.79	1/1046 (0.1%)
All	All	0.41	0/7740	0.77	3/10460 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	H	40	HIS	N-CA-C	8.06	132.76	111.00
1	J	25	ALA	N-CA-C	6.24	127.86	111.00
1	H	39	GLU	CB-CA-C	5.30	121.00	110.40

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	760	0	767	52	0
1	B	760	0	767	51	0
1	C	760	0	767	71	0
1	D	760	0	767	76	0
1	E	760	0	767	80	0
1	F	760	0	767	58	0
1	G	760	0	767	50	0
1	H	760	0	767	61	0
1	I	760	0	767	63	0
1	J	760	0	767	47	0
2	A	10	0	0	0	0
2	B	15	0	0	0	0
2	C	8	0	0	0	0
2	D	8	0	0	0	0
2	E	5	0	0	0	0
2	F	8	0	0	0	0
2	G	5	0	0	0	0
2	H	11	0	0	1	0
2	I	5	0	0	0	0
2	J	11	0	0	0	0
All	All	7686	0	7670	526	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 34.

The worst 5 of 526 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:D:27:LYS:HG2	1:D:28:ASP:N	1.56	1.12
1:D:27:LYS:CG	1:D:28:ASP:H	1.68	1.04
1:D:27:LYS:HG2	1:D:28:ASP:H	0.87	1.02
1:E:16:ASN:HD22	1:E:16:ASN:H	1.10	0.97
1:I:58:HIS:HE1	1:I:107:GLY:H	0.97	0.97

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	96/122 (79%)	80 (83%)	12 (12%)	4 (4%)	4	11
1	B	96/122 (79%)	85 (88%)	9 (9%)	2 (2%)	11	30
1	C	96/122 (79%)	84 (88%)	11 (12%)	1 (1%)	22	56
1	D	96/122 (79%)	86 (90%)	7 (7%)	3 (3%)	7	18
1	E	96/122 (79%)	86 (90%)	9 (9%)	1 (1%)	22	56
1	F	96/122 (79%)	86 (90%)	8 (8%)	2 (2%)	11	30
1	G	96/122 (79%)	83 (86%)	11 (12%)	2 (2%)	11	30
1	H	96/122 (79%)	82 (85%)	11 (12%)	3 (3%)	7	18
1	I	96/122 (79%)	83 (86%)	9 (9%)	4 (4%)	4	11
1	J	96/122 (79%)	83 (86%)	11 (12%)	2 (2%)	11	30
All	All	960/1220 (79%)	838 (87%)	98 (10%)	24 (2%)	9	25

5 of 24 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	21	CYS
1	B	25	ALA
1	D	26	ASP
1	D	40	HIS
1	E	51	ALA

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	84/106 (79%)	72 (86%)	12 (14%)	5	12
1	B	84/106 (79%)	76 (90%)	8 (10%)	12	31
1	C	84/106 (79%)	68 (81%)	16 (19%)	2	6
1	D	84/106 (79%)	71 (84%)	13 (16%)	4	10
1	E	84/106 (79%)	72 (86%)	12 (14%)	5	12

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	F	84/106 (79%)	74 (88%)	10 (12%)	8	20
1	G	84/106 (79%)	66 (79%)	18 (21%)	1	4
1	H	84/106 (79%)	73 (87%)	11 (13%)	6	15
1	I	84/106 (79%)	76 (90%)	8 (10%)	12	31
1	J	84/106 (79%)	77 (92%)	7 (8%)	16	39
All	All	840/1060 (79%)	725 (86%)	115 (14%)	5	14

5 of 115 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	40	HIS
1	F	32	LYS
1	I	92	PHE
1	E	41	GLN
1	E	102	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 47 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	114	GLN
1	F	58	HIS
1	I	115	HIS
1	F	15	GLN
1	F	114	GLN

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

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 ⓘ

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	100/122 (81%)	-0.31	2 (2%) 62 65	7, 29, 65, 70	0
1	B	100/122 (81%)	-0.33	2 (2%) 62 65	3, 20, 57, 81	0
1	C	100/122 (81%)	-0.52	1 (1%) 79 81	3, 20, 54, 73	0
1	D	100/122 (81%)	-0.22	4 (4%) 36 39	6, 27, 63, 87	0
1	E	100/122 (81%)	-0.06	4 (4%) 36 39	9, 32, 73, 99	0
1	F	100/122 (81%)	-0.29	3 (3%) 48 52	6, 25, 64, 95	0
1	G	100/122 (81%)	-0.39	2 (2%) 62 65	6, 23, 55, 91	0
1	H	100/122 (81%)	-0.06	5 (5%) 28 29	8, 36, 71, 85	0
1	I	100/122 (81%)	-0.04	3 (3%) 48 52	11, 34, 67, 95	0
1	J	100/122 (81%)	-0.26	1 (1%) 79 81	8, 30, 61, 83	0
All	All	1000/1220 (81%)	-0.25	27 (2%) 52 55	3, 28, 65, 99	0

The worst 5 of 27 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	39	GLU	7.4
1	J	39	GLU	4.9
1	E	26	ASP	4.7
1	I	39	GLU	4.7
1	F	39	GLU	4.3

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 carbohydrates in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.