



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:42 AM UTC

PDB ID : 3SAQ / pdb_00003saq
Title : Structure of D13, the scaffolding protein of vaccinia virus
Authors : Coulibaly, F.
Deposited on : 2011-06-03
Resolution : 3.51 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

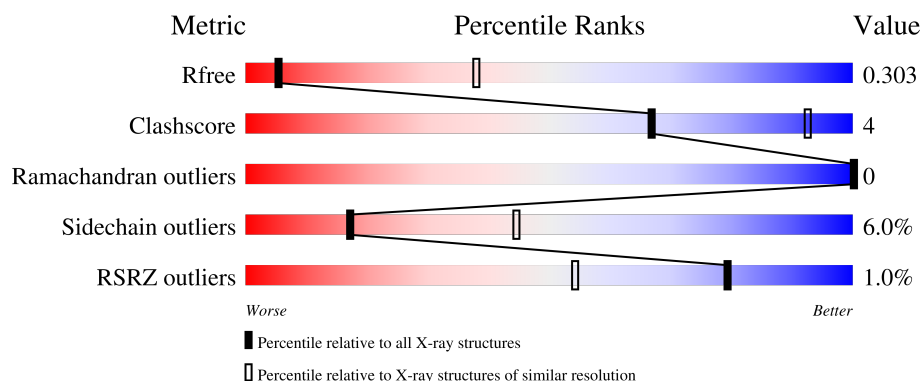
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.51 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	1025 (3.56-3.48)
Clashscore	190562	1079 (3.56-3.48)
Ramachandran outliers	187476	1052 (3.56-3.48)
Sidechain outliers	187428	1053 (3.56-3.48)
RSRZ outliers	180081	1024 (3.56-3.48)

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	576	2% 71% 9% • 19%
1	B	576	74% 10% • 15%

2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 7428 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 Rifampicin resistance protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	465	Total	C	N	O	S	0	0	0
			3612	2321	571	709	11			
1	B	492	Total	C	N	O	S	0	0	0
			3816	2446	608	751	11			

There are 50 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-24	MET	-	expression tag	UNP P68440
A	-23	SER	-	expression tag	UNP P68440
A	-22	TYR	-	expression tag	UNP P68440
A	-21	TYR	-	expression tag	UNP P68440
A	-20	HIS	-	expression tag	UNP P68440
A	-19	HIS	-	expression tag	UNP P68440
A	-18	HIS	-	expression tag	UNP P68440
A	-17	HIS	-	expression tag	UNP P68440
A	-16	HIS	-	expression tag	UNP P68440
A	-15	HIS	-	expression tag	UNP P68440
A	-14	ASP	-	expression tag	UNP P68440
A	-13	TYR	-	expression tag	UNP P68440
A	-12	ASP	-	expression tag	UNP P68440
A	-11	ILE	-	expression tag	UNP P68440
A	-10	PRO	-	expression tag	UNP P68440
A	-9	THR	-	expression tag	UNP P68440
A	-8	THR	-	expression tag	UNP P68440
A	-7	GLU	-	expression tag	UNP P68440
A	-6	ASN	-	expression tag	UNP P68440
A	-5	LEU	-	expression tag	UNP P68440
A	-4	TYR	-	expression tag	UNP P68440
A	-3	PHE	-	expression tag	UNP P68440
A	-2	GLN	-	expression tag	UNP P68440
A	-1	GLY	-	expression tag	UNP P68440
A	0	ALA	-	expression tag	UNP P68440

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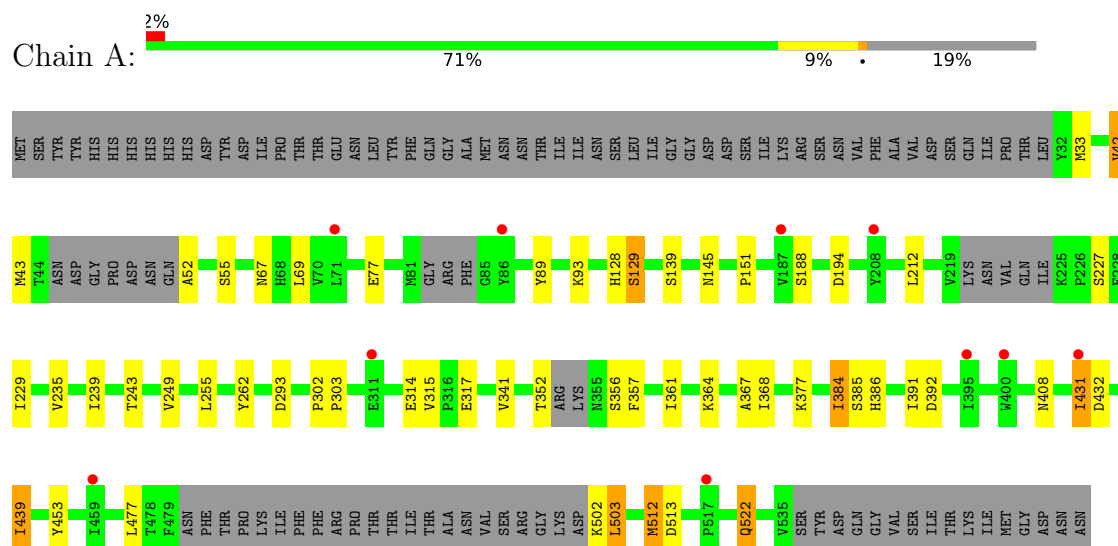
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Chain	Residue	Modelled	Actual	Comment	Reference
B	-24	MET	-	expression tag	UNP P68440
B	-23	SER	-	expression tag	UNP P68440
B	-22	TYR	-	expression tag	UNP P68440
B	-21	TYR	-	expression tag	UNP P68440
B	-20	HIS	-	expression tag	UNP P68440
B	-19	HIS	-	expression tag	UNP P68440
B	-18	HIS	-	expression tag	UNP P68440
B	-17	HIS	-	expression tag	UNP P68440
B	-16	HIS	-	expression tag	UNP P68440
B	-15	HIS	-	expression tag	UNP P68440
B	-14	ASP	-	expression tag	UNP P68440
B	-13	TYR	-	expression tag	UNP P68440
B	-12	ASP	-	expression tag	UNP P68440
B	-11	ILE	-	expression tag	UNP P68440
B	-10	PRO	-	expression tag	UNP P68440
B	-9	THR	-	expression tag	UNP P68440
B	-8	THR	-	expression tag	UNP P68440
B	-7	GLU	-	expression tag	UNP P68440
B	-6	ASN	-	expression tag	UNP P68440
B	-5	LEU	-	expression tag	UNP P68440
B	-4	TYR	-	expression tag	UNP P68440
B	-3	PHE	-	expression tag	UNP P68440
B	-2	GLN	-	expression tag	UNP P68440
B	-1	GLY	-	expression tag	UNP P68440
B	0	ALA	-	expression tag	UNP P68440

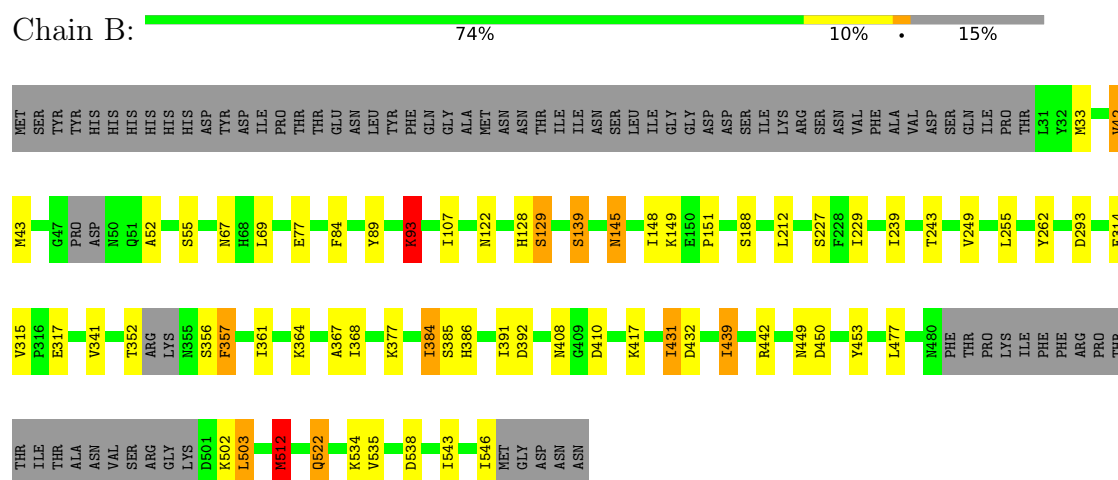
3 Residue-property plots [i](#)

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: Rifampicin resistance protein



• Molecule 1: Rifampicin resistance protein



4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	125.13Å 125.13Å 370.83Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	26.81 – 3.51 26.81 – 3.51	Depositor EDS
% Data completeness (in resolution range)	97.8 (26.81-3.51) 97.0 (26.81-3.51)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.73 (at 3.55Å)	Xtriage
Refinement program	BUSTER 2.8.0	Depositor
R, R_{free}	0.245 , 0.257 (Not available) , 0.303	Depositor DCC
R_{free} test set	699 reflections (4.86%)	wwPDB-VP
Wilson B-factor (Å ²)	83.3	Xtriage
Anisotropy	0.600	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 91.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.40$, $\langle L^2 \rangle = 0.22$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.86	EDS
Total number of atoms	7428	wwPDB-VP
Average B, all atoms (Å ²)	99.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.46% 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 ⓘ

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	0.81	1/3691 (0.0%)	1.18	12/5038 (0.2%)
1	B	0.82	1/3899 (0.0%)	1.19	18/5322 (0.3%)
All	All	0.82	2/7590 (0.0%)	1.19	30/10360 (0.3%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	128	HIS	ND1-CE1	5.45	1.38	1.32
1	B	145	ASN	CG-OD1	5.20	1.33	1.23

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	128	HIS	CB-CG-CD2	-7.88	120.95	131.20
1	A	128	HIS	CB-CG-CD2	-7.82	121.03	131.20
1	B	512	MET	N-CA-C	-6.49	99.72	110.17
1	A	317	GLU	CA-C-N	6.40	129.50	120.28
1	A	317	GLU	C-N-CA	6.40	129.50	120.28
1	B	317	GLU	CA-C-N	6.37	129.45	120.28
1	B	317	GLU	C-N-CA	6.37	129.45	120.28
1	A	129	SER	CA-C-N	6.32	133.80	121.41
1	A	129	SER	C-N-CA	6.32	133.80	121.41
1	A	512	MET	N-CA-C	-6.21	100.17	110.17
1	B	93	LYS	CA-C-N	6.05	128.39	120.28
1	B	93	LYS	C-N-CA	6.05	128.39	120.28
1	B	129	SER	CA-C-N	6.03	133.24	121.41
1	B	129	SER	C-N-CA	6.03	133.24	121.41
1	B	67	ASN	CA-CB-CG	6.01	118.61	112.60
1	B	129	SER	O-C-N	5.76	129.36	122.27
1	B	128	HIS	CA-C-N	5.69	128.96	120.31
1	B	128	HIS	C-N-CA	5.69	128.96	120.31
1	A	128	HIS	CA-C-N	5.55	128.75	120.31
1	A	128	HIS	C-N-CA	5.55	128.75	120.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	67	ASN	CA-CB-CG	5.42	118.02	112.60
1	A	408	ASN	O-C-N	5.38	127.69	122.09
1	B	408	ASN	O-C-N	5.36	127.66	122.09
1	B	107	ILE	N-CA-C	-5.33	107.23	111.81
1	A	194	ASP	CA-CB-CG	5.30	117.90	112.60
1	B	449	ASN	CA-CB-CG	5.18	117.78	112.60
1	B	122	ASN	CA-C-N	5.07	127.33	120.38
1	B	122	ASN	C-N-CA	5.07	127.33	120.38
1	A	128	HIS	CB-CG-ND1	5.07	130.30	122.70
1	B	357	PHE	CA-CB-CG	5.04	118.83	113.80

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	3612	0	3479	28	0
1	B	3816	0	3674	34	0
All	All	7428	0	7153	54	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 (54) 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:262:TYR:HE1	1:B:450:ASP:HB3	1.20	1.05
1:A:262:TYR:CE1	1:B:450:ASP:HB3	1.98	0.98
1:A:262:TYR:HE1	1:B:450:ASP:CB	1.84	0.91
1:B:535:VAL:HG12	1:B:543:ILE:HG22	1.66	0.77
1:A:262:TYR:HE1	1:B:450:ASP:CG	1.98	0.70
1:A:89:TYR:HA	1:A:129:SER:OG	1.92	0.69
1:B:89:TYR:HA	1:B:129:SER:OG	1.93	0.68
1:B:391:ILE:HD13	1:B:432:ASP:HB3	1.76	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:391:ILE:HD13	1:A:432:ASP:HB3	1.75	0.67
1:B:249:VAL:HG11	1:B:503:LEU:HD13	1.80	0.63
1:B:384:ILE:HG22	1:B:386:HIS:HD2	1.65	0.62
1:A:384:ILE:HG22	1:A:386:HIS:HD2	1.65	0.61
1:A:262:TYR:CE1	1:B:450:ASP:CG	2.78	0.60
1:A:249:VAL:HG11	1:A:503:LEU:HD13	1.82	0.60
1:A:262:TYR:CE1	1:B:450:ASP:CB	2.72	0.57
1:A:255:LEU:HD22	1:A:503:LEU:HD23	1.90	0.53
1:B:255:LEU:HD22	1:B:503:LEU:HD23	1.90	0.53
1:A:391:ILE:CD1	1:A:431:ILE:HD12	2.39	0.52
1:B:384:ILE:CG2	1:B:386:HIS:HD2	2.23	0.52
1:A:384:ILE:CG2	1:A:386:HIS:HD2	2.22	0.52
1:B:391:ILE:CD1	1:B:431:ILE:HD12	2.40	0.51
1:A:391:ILE:HD12	1:A:431:ILE:HD12	1.91	0.51
1:B:84:PHE:HB3	1:B:148:ILE:HG21	1.92	0.51
1:B:391:ILE:HD12	1:B:431:ILE:HD12	1.93	0.49
1:B:315:VAL:HG22	1:B:341:VAL:HB	1.95	0.48
1:B:439:ILE:HD13	1:B:439:ILE:H	1.78	0.48
1:A:315:VAL:HG22	1:A:341:VAL:HB	1.96	0.48
1:A:439:ILE:H	1:A:439:ILE:HD13	1.78	0.47
1:B:43:MET:HE1	1:B:52:ALA:HB1	1.97	0.47
1:A:43:MET:HE1	1:A:52:ALA:HB1	1.98	0.46
1:B:367:ALA:HB3	1:B:385:SER:HB2	1.98	0.45
1:B:77:GLU:HB2	1:B:151:PRO:HD3	1.98	0.45
1:A:262:TYR:HB3	1:A:522:GLN:HB2	1.98	0.45
1:B:368:ILE:HG23	1:B:384:ILE:HD11	1.97	0.45
1:A:77:GLU:HB2	1:A:151:PRO:HD3	1.97	0.45
1:A:367:ALA:HB3	1:A:385:SER:HB2	1.98	0.45
1:A:368:ILE:HG23	1:A:384:ILE:HD11	1.97	0.44
1:B:364:LYS:HE3	1:B:392:ASP:OD1	2.18	0.44
1:B:512:MET:H	1:B:512:MET:HG2	1.57	0.44
1:A:364:LYS:HE3	1:A:392:ASP:OD1	2.18	0.43
1:B:453:TYR:CD2	1:B:477:LEU:HD21	2.53	0.43
1:B:139:SER:OG	1:B:149:LYS:HE2	2.18	0.43
1:B:262:TYR:HB3	1:B:522:GLN:HB2	2.00	0.43
1:A:42:VAL:HG23	1:A:55:SER:HB2	2.00	0.42
1:A:69:LEU:CD2	1:A:212:LEU:HD11	2.50	0.42
1:B:42:VAL:HG23	1:B:55:SER:HB2	2.02	0.42
1:A:235:VAL:HG13	1:B:442:ARG:CZ	2.50	0.41
1:B:89:TYR:O	1:B:93:LYS:HD2	2.20	0.41
1:A:453:TYR:CD2	1:A:477:LEU:HD21	2.56	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:69:LEU:CD2	1:B:212:LEU:HD11	2.51	0.40
1:A:262:TYR:CE1	1:B:450:ASP:OD1	2.74	0.40
1:B:534:LYS:HB2	1:B:546:ILE:HD11	2.03	0.40
1:A:302:PRO:HA	1:A:303:PRO:HD3	2.01	0.40
1:B:410:ASP:CG	1:B:417:LYS:HE2	2.46	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	453/576 (79%)	437 (96%)	16 (4%)	0	100	100
1	B	484/576 (84%)	466 (96%)	18 (4%)	0	100	100
All	All	937/1152 (81%)	903 (96%)	34 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	407/528 (77%)	382 (94%)	25 (6%)	17	44
1	B	429/528 (81%)	404 (94%)	25 (6%)	18	45
All	All	836/1056 (79%)	786 (94%)	50 (6%)	17	44

All (50) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	33	MET
1	A	42	VAL
1	A	93	LYS
1	A	139	SER
1	A	145	ASN
1	A	188	SER
1	A	227	SER
1	A	229	ILE
1	A	239	ILE
1	A	243	THR
1	A	293	ASP
1	A	314	GLU
1	A	352	THR
1	A	356	SER
1	A	357	PHE
1	A	361	ILE
1	A	377	LYS
1	A	384	ILE
1	A	431	ILE
1	A	439	ILE
1	A	502	LYS
1	A	503	LEU
1	A	512	MET
1	A	513	ASP
1	A	522	GLN
1	B	33	MET
1	B	42	VAL
1	B	93	LYS
1	B	139	SER
1	B	145	ASN
1	B	188	SER
1	B	227	SER
1	B	229	ILE
1	B	239	ILE
1	B	243	THR
1	B	293	ASP
1	B	314	GLU
1	B	352	THR
1	B	356	SER
1	B	357	PHE
1	B	361	ILE
1	B	377	LYS

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Mol	Chain	Res	Type
1	B	384	ILE
1	B	431	ILE
1	B	439	ILE
1	B	502	LYS
1	B	503	LEU
1	B	512	MET
1	B	522	GLN
1	B	538	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	96	ASN
1	A	268	ASN
1	A	408	ASN
1	A	411	ASN
1	A	449	ASN
1	B	45	ASN
1	B	96	ASN
1	B	238	GLN
1	B	268	ASN
1	B	408	ASN
1	B	411	ASN
1	B	449	ASN

5.3.3 RNA ⓘ

There are no RNA molecules 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 oligosaccharides 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 [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	465/576 (80%)	0.33	10 (2%) 62 35	64, 110, 162, 201	0
1	B	492/576 (85%)	0.06	0 100 100	34, 84, 145, 192	0
All	All	957/1152 (83%)	0.20	10 (1%) 79 54	34, 99, 154, 201	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	517	PRO	3.6
1	A	86	TYR	2.9
1	A	400	TRP	2.9
1	A	459	ILE	2.9
1	A	208	TYR	2.4
1	A	311	GLU	2.3
1	A	187	VAL	2.3
1	A	395	ILE	2.2
1	A	71	LEU	2.1
1	A	431	ILE	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 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.