



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 05:45 PM EDT

PDB ID : 4BWS / pdb_00004bws
Title : Crystal structure of the heterotrimer of PQBP1, U5-15kD and U5-52kD.
Authors : Mizuguchi, M.; Obita, T.; Serita, T.; Kojima, R.; Morimoto, T.; Nabeshima, Y.; Okazawa, H.
Deposited on : 2013-07-04
Resolution : 2.50 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

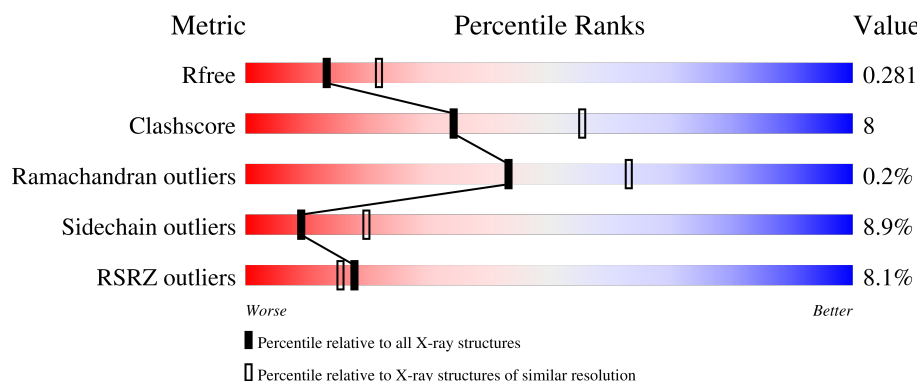
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	142	
1	D	142	
2	B	37	
2	E	37	
3	C	71	

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Mol	Chain	Length	Quality of chain
3	F	71	14% 70% 18% 6% 6%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3667 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 THIOREDOXIN-LIKE PROTEIN 4A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	133	Total	C	N	O	S	0	0	0
			1092	700	182	201	9			
1	D	133	Total	C	N	O	S	0	0	0
			1092	700	182	201	9			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	MET	-	expression tag	UNP P83876
A	-3	ALA	-	expression tag	UNP P83876
A	-2	HIS	-	expression tag	UNP P83876
A	-1	HIS	-	expression tag	UNP P83876
A	0	HIS	-	expression tag	UNP P83876
A	1	HIS	-	expression tag	UNP P83876
A	2	HIS	-	expression tag	UNP P83876
A	3	HIS	-	expression tag	UNP P83876
D	-4	MET	-	expression tag	UNP P83876
D	-3	ALA	-	expression tag	UNP P83876
D	-2	HIS	-	expression tag	UNP P83876
D	-1	HIS	-	expression tag	UNP P83876
D	0	HIS	-	expression tag	UNP P83876
D	1	HIS	-	expression tag	UNP P83876
D	2	HIS	-	expression tag	UNP P83876
D	3	HIS	-	expression tag	UNP P83876

- Molecule 2 is a protein called POLYGLUTAMINE-BINDING PROTEIN 1.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	22	Total	C	N	O	0	0	0
			167	106	31	30			
2	E	23	Total	C	N	O	0	0	0
			178	112	35	31			

- Molecule 3 is a protein called CD2 ANTIGEN CYTOPLASMIC TAIL-BINDING PROTEIN 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	66	Total	C	N	O	S	0	0	0
			556	358	89	105	4			
3	F	67	Total	C	N	O	S	0	0	0
			566	364	92	106	4			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	271	MET	-	expression tag	UNP O95400
C	272	ALA	-	expression tag	UNP O95400
C	273	HIS	-	expression tag	UNP O95400
C	274	HIS	-	expression tag	UNP O95400
C	275	HIS	-	expression tag	UNP O95400
C	276	HIS	-	expression tag	UNP O95400
C	277	HIS	-	expression tag	UNP O95400
C	278	HIS	-	expression tag	UNP O95400
C	279	MET	-	expression tag	UNP O95400
F	271	MET	-	expression tag	UNP O95400
F	272	ALA	-	expression tag	UNP O95400
F	273	HIS	-	expression tag	UNP O95400
F	274	HIS	-	expression tag	UNP O95400
F	275	HIS	-	expression tag	UNP O95400
F	276	HIS	-	expression tag	UNP O95400
F	277	HIS	-	expression tag	UNP O95400
F	278	HIS	-	expression tag	UNP O95400
F	279	MET	-	expression tag	UNP O95400

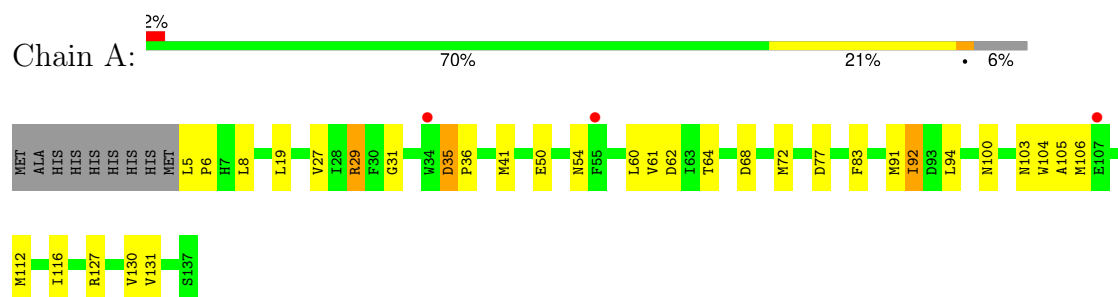
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	7	Total	O	0	0
			7	7		
4	C	1	Total	O	0	0
			1	1		
4	D	7	Total	O	0	0
			7	7		
4	F	1	Total	O	0	0
			1	1		

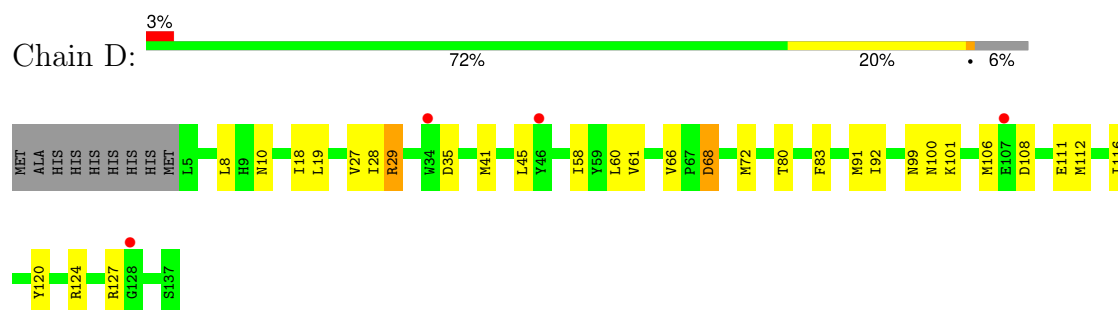
3 Residue-property plots [i](#)

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.

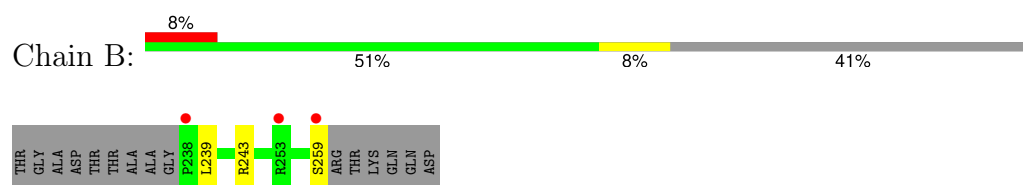
- Molecule 1: THIOREDOXIN-LIKE PROTEIN 4A



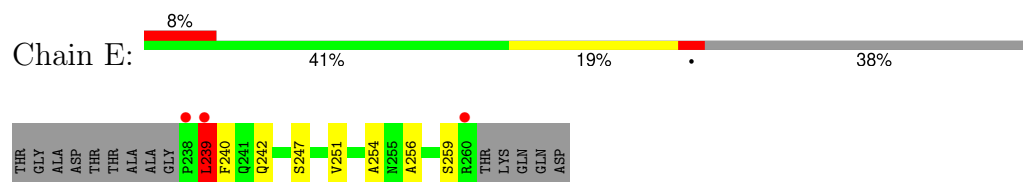
- Molecule 1: THIOREDOXIN-LIKE PROTEIN 4A



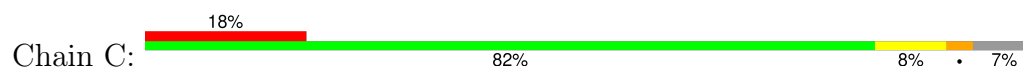
- Molecule 2: POLYGLUTAMINE-BINDING PROTEIN 1

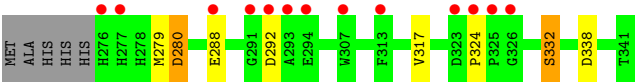


- Molecule 2: POLYGLUTAMINE-BINDING PROTEIN 1

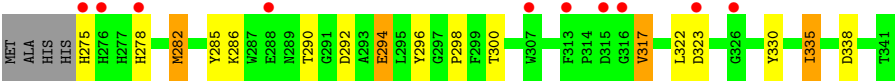


- Molecule 3: CD2 ANTIGEN CYTOPLASMIC TAIL-BINDING PROTEIN 2





● Molecule 3: CD2 ANTIGEN CYTOPLASMIC TAIL-BINDING PROTEIN 2



4 Data and refinement statistics

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	144.18Å 40.47Å 168.17Å 90.00° 95.92° 90.00°	Depositor
Resolution (Å)	41.82 – 2.50 41.82 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.9 (41.82-2.50) 99.9 (41.82-2.50)	Depositor EDS
R_{merge}	0.24	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.02 (at 2.51Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, R_{free}	0.238 , 0.277 0.242 , 0.281	Depositor DCC
R_{free} test set	1732 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	25.5	Xtriage
Anisotropy	1.120	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 36.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.25$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	3667	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.49% 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	0.54	0/1118	0.88	2/1513 (0.1%)
1	D	0.54	0/1118	0.89	2/1513 (0.1%)
2	B	0.59	0/172	0.89	0/234
2	E	0.57	0/183	1.05	1/248 (0.4%)
3	C	0.43	0/578	0.81	2/784 (0.3%)
3	F	0.42	0/589	0.81	1/799 (0.1%)
All	All	0.51	0/3758	0.87	8/5091 (0.2%)

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	324	PRO	CA-C-N	6.40	126.09	119.82
3	C	324	PRO	C-N-CA	6.40	126.09	119.82
2	E	239	LEU	N-CA-C	-5.73	94.95	111.00
1	A	35	ASP	CA-C-N	5.44	124.89	119.24
1	A	35	ASP	C-N-CA	5.44	124.89	119.24
1	D	35	ASP	CA-C-N	5.37	124.55	118.97
1	D	35	ASP	C-N-CA	5.37	124.55	118.97
3	F	292	ASP	N-CA-C	-5.23	107.92	114.56

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	1092	0	1067	17	0
1	D	1092	0	1067	23	0
2	B	167	0	164	0	0
2	E	178	0	177	6	0
3	C	556	0	491	2	0
3	F	566	0	498	9	0
4	A	7	0	0	0	0
4	C	1	0	0	0	0
4	D	7	0	0	0	0
4	F	1	0	0	1	0
All	All	3667	0	3464	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 8.

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:D:120:TYR:CZ	1:D:124:ARG:HD2	2.26	0.70
1:D:72:MET:HE1	2:E:254:ALA:HB3	1.76	0.68
1:D:41:MET:HE1	1:D:112:MET:HE3	1.79	0.64
1:D:91:MET:HE3	1:D:100:ASN:ND2	2.14	0.63
1:A:83:PHE:CE2	1:A:92:ILE:HD11	2.33	0.63
1:A:41:MET:HE1	1:A:112:MET:HE3	1.83	0.60
1:D:72:MET:HE3	2:E:251:VAL:HG13	1.82	0.60
3:C:280:ASP:OD1	3:C:280:ASP:N	2.35	0.58
3:F:282:MET:HB3	3:F:322:LEU:HD12	1.84	0.58
1:D:41:MET:HE2	1:D:45:LEU:HG	1.85	0.58
1:D:8:LEU:HB2	1:D:61:VAL:HG22	1.85	0.57
1:A:29:ARG:O	1:A:29:ARG:NH1	2.38	0.56
1:A:91:MET:HE3	1:A:100:ASN:OD1	2.05	0.55
2:E:256:ALA:O	2:E:259:SER:OG	2.24	0.55
1:A:27:VAL:HG22	1:A:83:PHE:CD1	2.44	0.53
3:F:285:TYR:HB2	3:F:317:VAL:CG1	2.40	0.52
1:D:91:MET:HE1	2:E:242:GLN:HB3	1.93	0.51
1:D:68:ASP:OD1	1:D:68:ASP:N	2.37	0.50
1:D:29:ARG:HD2	1:D:29:ARG:C	2.37	0.49
1:D:29:ARG:NH2	1:D:60:LEU:HD13	2.28	0.48
1:D:80:THR:HG23	1:D:101:LYS:HD3	1.96	0.48
1:D:91:MET:HE3	1:D:100:ASN:HD21	1.79	0.47
1:A:8:LEU:HB2	1:A:61:VAL:HG22	1.97	0.46
1:A:112:MET:O	1:A:116:ILE:HG13	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:108:ASP:HB3	1:D:111:GLU:HB2	1.98	0.46
1:D:10:ASN:HA	1:D:66:VAL:HG22	1.98	0.46
3:F:330:TYR:HB2	3:F:335:ILE:HD11	1.96	0.46
2:E:239:LEU:HD22	2:E:240:PHE:H	1.82	0.45
3:F:286:LYS:O	3:F:317:VAL:HG13	2.17	0.44
3:F:294:GLU:HB3	3:F:296:TYR:CE1	2.52	0.44
3:F:294:GLU:HB3	3:F:296:TYR:HE1	1.83	0.43
1:A:31:GLY:O	1:A:62:ASP:HA	2.18	0.43
3:F:323:ASP:HB3	4:F:2001:HOH:O	2.17	0.43
3:F:282:MET:HG3	3:F:298:PRO:HB2	2.00	0.43
1:A:92:ILE:HG23	1:A:130:VAL:HG23	2.00	0.43
1:A:29:ARG:NH2	1:A:60:LEU:HD13	2.34	0.43
1:A:68:ASP:OD1	1:A:68:ASP:N	2.51	0.43
1:D:45:LEU:HD22	1:D:58:ILE:HD13	2.00	0.43
1:D:112:MET:O	1:D:116:ILE:HG13	2.19	0.43
1:D:127:ARG:H	1:D:127:ARG:HG2	1.68	0.42
2:E:247:SER:O	2:E:251:VAL:HG23	2.19	0.42
1:A:35:ASP:HA	1:A:36:PRO:HD3	1.89	0.42
1:A:94:LEU:HD13	1:A:104:TRP:CH2	2.54	0.42
1:A:77:ASP:CG	1:A:103:ASN:HD22	2.27	0.42
1:D:91:MET:HE2	1:D:99:ASN:HB2	2.02	0.42
1:D:120:TYR:CE2	1:D:124:ARG:HD2	2.55	0.41
1:A:5:LEU:HA	1:A:6:PRO:HD3	1.89	0.41
3:F:282:MET:HE1	3:F:300:THR:HG22	2.02	0.41
1:A:29:ARG:HD2	1:A:29:ARG:C	2.46	0.41
1:A:83:PHE:HE2	1:A:92:ILE:HD11	1.83	0.41
3:C:317:VAL:H	3:C:332:SER:HG	1.65	0.41
1:D:27:VAL:HG22	1:D:83:PHE:HD1	1.87	0.41
1:D:29:ARG:O	1:D:29:ARG:NH1	2.51	0.40
1:D:27:VAL:HG22	1:D:83:PHE:CD1	2.56	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	131/142 (92%)	128 (98%)	2 (2%)	1 (1%)	16	31
1	D	131/142 (92%)	129 (98%)	2 (2%)	0	100	100
2	B	20/37 (54%)	19 (95%)	1 (5%)	0	100	100
2	E	21/37 (57%)	21 (100%)	0	0	100	100
3	C	64/71 (90%)	61 (95%)	3 (5%)	0	100	100
3	F	65/71 (92%)	62 (95%)	3 (5%)	0	100	100
All	All	432/500 (86%)	420 (97%)	11 (2%)	1 (0%)	43	63

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	105	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	121/129 (94%)	111 (92%)	10 (8%)	10	22
1	D	121/129 (94%)	114 (94%)	7 (6%)	18	38
2	B	17/27 (63%)	14 (82%)	3 (18%)	2	3
2	E	18/27 (67%)	17 (94%)	1 (6%)	19	39
3	C	58/62 (94%)	52 (90%)	6 (10%)	7	14
3	F	59/62 (95%)	51 (86%)	8 (14%)	3	8
All	All	394/436 (90%)	359 (91%)	35 (9%)	9	20

All (35) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	19	LEU

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Mol	Chain	Res	Type
1	A	29	ARG
1	A	50	GLU
1	A	54	ASN
1	A	64	THR
1	A	72	MET
1	A	92	ILE
1	A	106	MET
1	A	127	ARG
1	A	131	VAL
2	B	239	LEU
2	B	243	ARG
2	B	259	SER
3	C	279	MET
3	C	280	ASP
3	C	288	GLU
3	C	292	ASP
3	C	332	SER
3	C	338	ASP
1	D	18	ILE
1	D	19	LEU
1	D	28	ILE
1	D	29	ARG
1	D	68	ASP
1	D	92	ILE
1	D	106	MET
2	E	239	LEU
3	F	275	HIS
3	F	278	HIS
3	F	282	MET
3	F	290	THR
3	F	294	GLU
3	F	317	VAL
3	F	335	ILE
3	F	338	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	D	89	HIS
1	D	100	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](#)

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	133/142 (93%)	0.60	3 (2%) 61 57	15, 27, 42, 53	0
1	D	133/142 (93%)	0.59	4 (3%) 52 48	14, 25, 40, 55	0
2	B	22/37 (59%)	0.84	3 (13%) 7 5	15, 22, 41, 47	0
2	E	23/37 (62%)	0.82	3 (13%) 7 6	16, 24, 44, 51	0
3	C	66/71 (92%)	1.27	13 (19%) 3 2	28, 38, 58, 71	0
3	F	67/71 (94%)	1.36	10 (14%) 5 4	27, 37, 54, 66	0
All	All	444/500 (88%)	0.83	36 (8%) 18 15	14, 30, 51, 71	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	F	275	HIS	4.4
2	E	238	PRO	4.1
3	C	276	HIS	3.7
1	A	34	TRP	3.6
3	C	326	GLY	3.6
3	F	276	HIS	3.2
3	F	278	HIS	3.1
1	D	46	TYR	3.0
3	C	291	GLY	3.0
3	F	323	ASP	2.9
2	E	260	ARG	2.8
3	F	313	PHE	2.8
2	B	259	SER	2.8
1	D	128	GLY	2.7
2	B	238	PRO	2.7
3	C	313	PHE	2.6
3	C	323	ASP	2.6
1	D	107	GLU	2.5
2	E	239	LEU	2.5

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Mol	Chain	Res	Type	RSRZ
3	C	325	PRO	2.5
3	C	277	HIS	2.5
3	F	326	GLY	2.5
3	C	307	TRP	2.4
3	F	316	GLY	2.4
2	B	253	ARG	2.3
3	C	288	GLU	2.3
1	A	107	GLU	2.2
3	F	288	GLU	2.2
3	F	315	ASP	2.2
3	C	294	GLU	2.2
3	C	293	ALA	2.1
1	A	55	PHE	2.1
3	F	307	TRP	2.1
3	C	292	ASP	2.1
1	D	34	TRP	2.0
3	C	324	PRO	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.