wwPDB X-ray Structure Validation Summary Report (i)

Sep 6, 2023 – 11:19 PM EDT

PDB ID	:	4F88
Title	:	X-ray Crystal Structure of PlyC
Authors	:	McGowan, S.; Buckle, A.M.; Fischetti, V.A.; Nelson, D.C.; Whisstock, J.C.
Deposited on	:	2012-05-17
Resolution	:	3.30 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 (i) 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 (i)) were used in the production of this report:

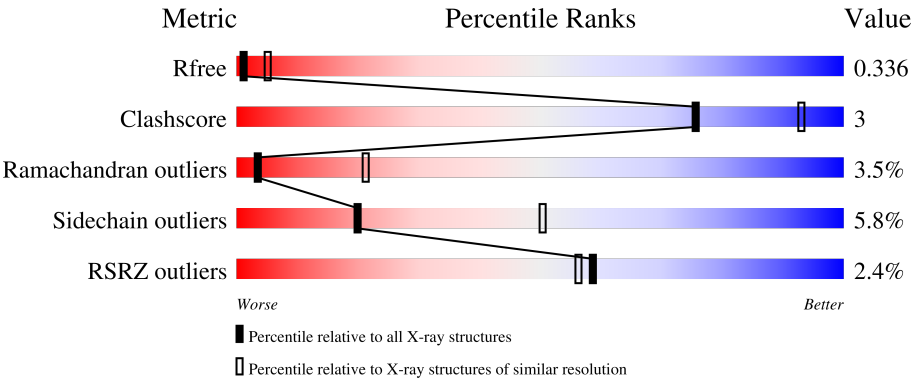
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.30 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}	130704	1149 (3.34-3.26)
Clashscore	141614	1205 (3.34-3.26)
Ramachandran outliers	138981	1183 (3.34-3.26)
Sidechain outliers	138945	1182 (3.34-3.26)
RSRZ outliers	127900	1115 (3.34-3.26)

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 <=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	1	465	2% 78% 12% • 8%
1	2	465	2% 74% 13% • 10%
2	A	72	7% 86% 8% 6%
2	B	72	12% 89% 7% •
2	C	72	% 89% 7% •

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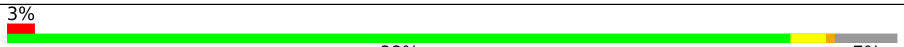
Mol	Chain	Length	Quality of chain
2	D	72	
2	E	72	
2	F	72	
2	G	72	
2	H	72	
2	I	72	
2	J	72	
2	K	72	
2	L	72	
2	M	72	
2	N	72	
2	O	72	
2	P	72	

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 12281 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 PlyCA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	1	430	Total	C	N	O	S	0	0	0
			2858	1799	497	548	14			
1	2	418	Total	C	N	O	S	0	0	0
			2781	1752	471	545	13			

- Molecule 2 is a protein called PlyCB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	68	Total	C	N	O	S	0	0	0
			490	307	82	100	1			
2	B	69	Total	C	N	O	S	0	0	0
			509	319	87	102	1			
2	C	69	Total	C	N	O	S	0	0	0
			499	310	87	101	1			
2	D	63	Total	C	N	O	S	0	0	0
			455	287	76	91	1			
2	E	65	Total	C	N	O	S	0	0	0
			463	293	78	91	1			
2	F	65	Total	C	N	O	S	0	0	0
			473	299	80	93	1			
2	G	69	Total	C	N	O	S	0	0	0
			483	307	80	95	1			
2	H	67	Total	C	N	O	S	0	0	0
			485	306	83	95	1			
2	I	52	Total	C	N	O		0	0	0
			309	189	58	62				
2	J	35	Total	C	N	O		0	0	0
			185	110	36	39				
2	K	53	Total	C	N	O		0	0	0
			283	169	58	56				
2	L	55	Total	C	N	O		0	0	0
			300	178	58	64				

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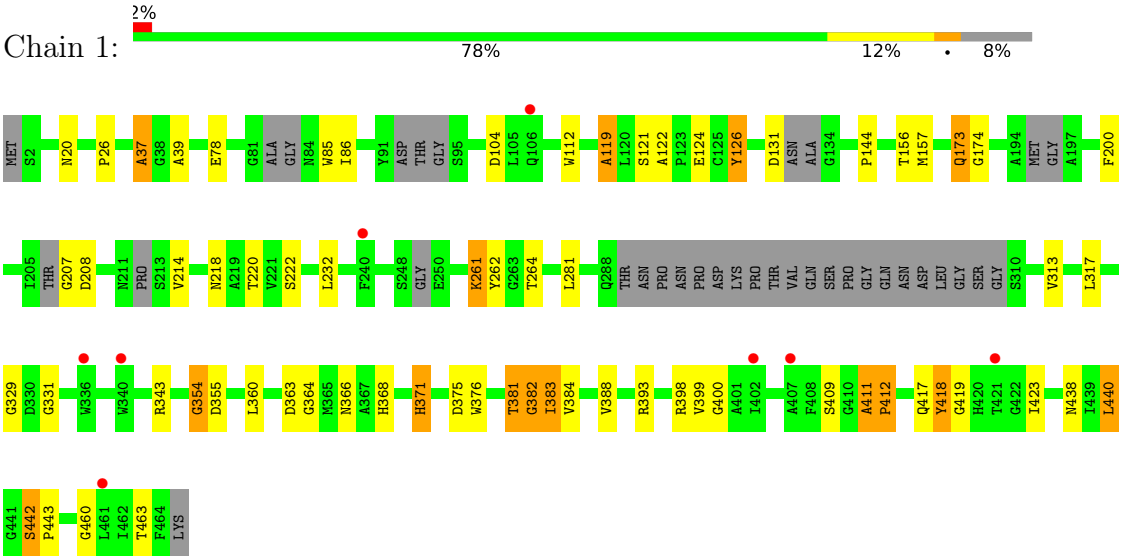
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
2	M	65	Total C N O 447 283 77 87	0	0	0
2	N	59	Total C N O 435 277 73 85	0	0	0
2	O	65	Total C N O S 439 276 76 86 1	0	0	0
2	P	60	Total C N O S 387 237 70 79 1	0	0	0

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.

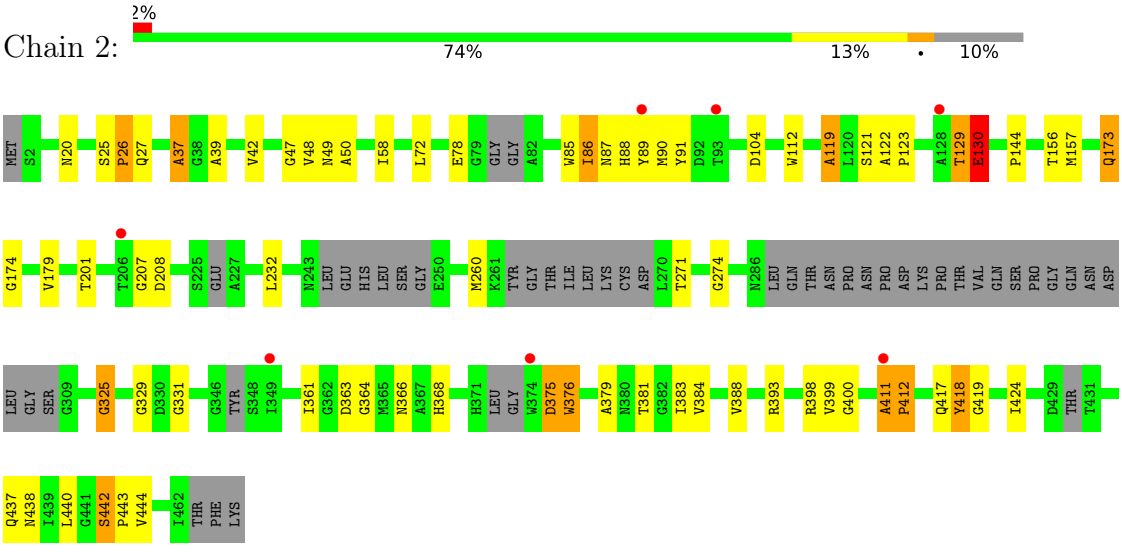
• Molecule 1: PlyCA

Chain 1:



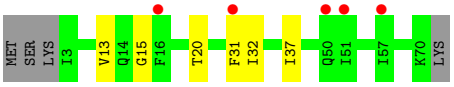
• Molecule 1: PlyCA

Chain 2:



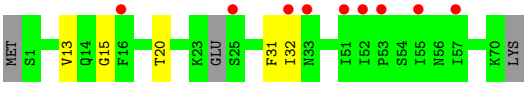
• Molecule 2: PlyCB

Chain A:



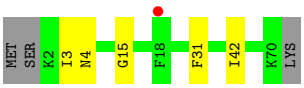
• Molecule 2: PlyCB

Chain B:



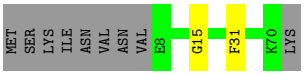
• Molecule 2: PlyCB

Chain C:



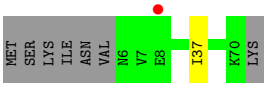
• Molecule 2: PlyCB

Chain D:



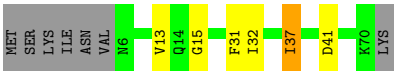
• Molecule 2: PlyCB

Chain E:



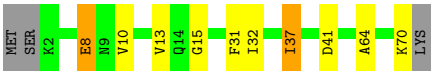
• Molecule 2: PlyCB

Chain F:



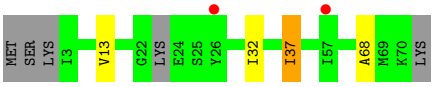
• Molecule 2: PlyCB

Chain G:



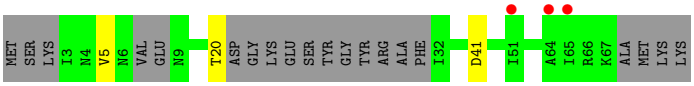
• Molecule 2: PlyCB

Chain H:



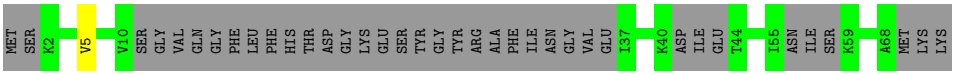
• Molecule 2: PlyCB

Chain I:



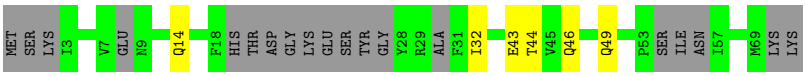
• Molecule 2: PlyCB

Chain J:



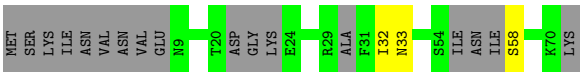
• Molecule 2: PlyCB

Chain K:



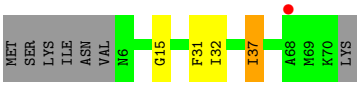
• Molecule 2: PlyCB

Chain L:



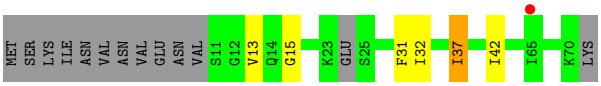
• Molecule 2: PlyCB

Chain M:



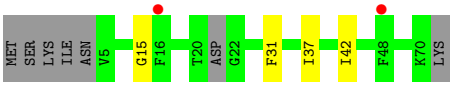
• Molecule 2: PlyCB

Chain N:



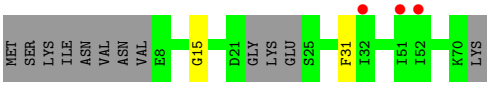
• Molecule 2: PlyCB

Chain O:



• Molecule 2: PlyCB

Chain P:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	93.85Å 117.42Å 222.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.72 – 3.30 86.46 – 3.30	Depositor EDS
% Data completeness (in resolution range)	99.0 (46.72-3.30) 98.8 (86.46-3.30)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.94 (at 3.33Å)	Xtriage
Refinement program	BUSTER 2.8.0	Depositor
R, R_{free}	0.266 , 0.297 0.297 , 0.336	Depositor DCC
R_{free} test set	1870 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	106.2	Xtriage
Anisotropy	0.168	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 79.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.44$, $< L^2 > = 0.27$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.86	EDS
Total number of atoms	12281	wwPDB-VP
Average B, all atoms (Å^2)	98.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.57% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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	1	0.42	0/2926	0.72	3/4021 (0.1%)
1	2	0.42	0/2850	0.70	1/3923 (0.0%)
2	A	0.39	0/496	0.60	0/675
2	B	0.44	0/515	0.57	0/696
2	C	0.36	0/506	0.57	0/686
2	D	0.38	0/462	0.57	0/626
2	E	0.36	0/470	0.56	0/638
2	F	0.38	0/480	0.61	0/651
2	G	0.39	0/490	0.67	1/666 (0.2%)
2	H	0.37	0/491	0.56	0/663
2	I	0.39	0/310	0.58	0/421
2	J	0.38	0/182	0.51	0/247
2	K	0.42	0/279	0.76	1/378 (0.3%)
2	L	0.37	0/299	0.58	0/406
2	M	0.39	0/453	0.58	0/616
2	N	0.45	0/441	0.58	0/595
2	O	0.37	0/444	0.55	0/603
2	P	0.37	0/390	0.55	0/530
All	All	0.40	0/12484	0.65	6/17041 (0.0%)

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	2	376	TRP	C-N-CA	6.02	136.75	121.70
1	1	371	HIS	C-N-CA	5.56	135.59	121.70
2	K	43	GLU	C-N-CA	5.47	135.38	121.70
1	1	354	GLY	C-N-CA	5.24	134.79	121.70
1	1	382	GLY	C-N-CA	5.17	134.62	121.70

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

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	1	2858	0	2235	20	0
1	2	2781	0	2169	24	0
2	A	490	0	444	2	0
2	B	509	0	471	2	0
2	C	499	0	439	1	0
2	D	455	0	408	1	0
2	E	463	0	411	0	0
2	F	473	0	430	3	0
2	G	483	0	426	6	0
2	H	485	0	437	3	0
2	I	309	0	213	1	0
2	J	185	0	97	1	0
2	K	283	0	164	2	0
2	L	300	0	171	1	0
2	M	447	0	394	2	0
2	N	435	0	404	3	0
2	O	439	0	372	1	0
2	P	387	0	307	1	0
All	All	12281	0	9992	70	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.

The worst 5 of 70 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)
1:2:442:SER:HB3	1:2:443:PRO:HA	1.55	0.88
2:N:32:ILE:HD12	2:N:37:ILE:HD11	1.72	0.71
2:H:32:ILE:HD12	2:H:37:ILE:HD11	1.74	0.69
2:M:32:ILE:HD12	2:M:37:ILE:HD11	1.73	0.69
2:G:8:GLU:HA	2:G:10:VAL:H	1.61	0.65

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	1	412/465 (89%)	327 (79%)	59 (14%)	26 (6%)	1 9
1	2	400/465 (86%)	315 (79%)	55 (14%)	30 (8%)	1 7
2	A	66/72 (92%)	65 (98%)	1 (2%)	0	100 100
2	B	65/72 (90%)	64 (98%)	1 (2%)	0	100 100
2	C	67/72 (93%)	66 (98%)	1 (2%)	0	100 100
2	D	61/72 (85%)	60 (98%)	1 (2%)	0	100 100
2	E	63/72 (88%)	62 (98%)	1 (2%)	0	100 100
2	F	63/72 (88%)	59 (94%)	4 (6%)	0	100 100
2	G	67/72 (93%)	62 (92%)	5 (8%)	0	100 100
2	H	63/72 (88%)	62 (98%)	1 (2%)	0	100 100
2	I	46/72 (64%)	44 (96%)	2 (4%)	0	100 100
2	J	27/72 (38%)	26 (96%)	1 (4%)	0	100 100
2	K	43/72 (60%)	34 (79%)	7 (16%)	2 (5%)	2 14
2	L	47/72 (65%)	45 (96%)	0	2 (4%)	2 16
2	M	63/72 (88%)	60 (95%)	3 (5%)	0	100 100
2	N	55/72 (76%)	55 (100%)	0	0	100 100
2	O	61/72 (85%)	59 (97%)	2 (3%)	0	100 100
2	P	56/72 (78%)	54 (96%)	2 (4%)	0	100 100
All	All	1725/2082 (83%)	1519 (88%)	146 (8%)	60 (4%)	3 21

5 of 60 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	1	119	ALA
1	1	354	GLY
1	1	383	ILE
1	1	388	VAL

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Mol	Chain	Res	Type
1	1	411	ALA

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	1	205/375 (55%)	186 (91%)	19 (9%)	9 30
1	2	204/375 (54%)	187 (92%)	17 (8%)	11 36
2	A	49/62 (79%)	47 (96%)	2 (4%)	30 61
2	B	52/62 (84%)	51 (98%)	1 (2%)	57 77
2	C	48/62 (77%)	45 (94%)	3 (6%)	18 47
2	D	44/62 (71%)	44 (100%)	0	100 100
2	E	43/62 (69%)	42 (98%)	1 (2%)	50 73
2	F	46/62 (74%)	44 (96%)	2 (4%)	29 59
2	G	44/62 (71%)	41 (93%)	3 (7%)	16 44
2	H	46/62 (74%)	45 (98%)	1 (2%)	52 74
2	I	18/62 (29%)	16 (89%)	2 (11%)	6 23
2	J	5/62 (8%)	5 (100%)	0	100 100
2	K	8/62 (13%)	8 (100%)	0	100 100
2	L	11/62 (18%)	11 (100%)	0	100 100
2	M	39/62 (63%)	38 (97%)	1 (3%)	46 71
2	N	43/62 (69%)	41 (95%)	2 (5%)	26 57
2	O	37/62 (60%)	35 (95%)	2 (5%)	22 53
2	P	30/62 (48%)	30 (100%)	0	100 100
All	All	972/1742 (56%)	916 (94%)	56 (6%)	20 50

5 of 56 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	2	130	GLU

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Mol	Chain	Res	Type
2	O	42	ILE
1	2	440	LEU
2	O	37	ILE
2	I	20	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	1	103	HIS

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 monosaccharides 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, 95^{th} 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	1	430/465 (92%)	0.17	8 (1%) 66 65	61, 97, 138, 172	0
1	2	418/465 (89%)	0.21	7 (1%) 70 68	69, 98, 156, 184	0
2	A	68/72 (94%)	0.29	5 (7%) 14 14	65, 94, 110, 122	0
2	B	69/72 (95%)	0.63	9 (13%) 3 3	73, 92, 112, 142	0
2	C	69/72 (95%)	-0.08	1 (1%) 75 75	74, 86, 100, 108	0
2	D	63/72 (87%)	0.18	0 100 100	73, 84, 100, 114	0
2	E	65/72 (90%)	0.31	1 (1%) 73 72	66, 80, 114, 123	0
2	F	65/72 (90%)	0.21	0 100 100	62, 78, 112, 123	0
2	G	69/72 (95%)	0.15	0 100 100	72, 88, 106, 137	0
2	H	67/72 (93%)	0.27	2 (2%) 50 49	76, 89, 105, 132	0
2	I	52/72 (72%)	0.43	3 (5%) 23 22	99, 122, 138, 149	0
2	J	35/72 (48%)	-0.18	0 100 100	103, 122, 142, 161	0
2	K	53/72 (73%)	-0.10	0 100 100	103, 118, 145, 161	0
2	L	55/72 (76%)	-0.34	0 100 100	98, 111, 140, 158	0
2	M	65/72 (90%)	0.15	1 (1%) 73 72	78, 98, 117, 125	0
2	N	59/72 (81%)	0.28	1 (1%) 70 68	81, 96, 107, 139	0
2	O	65/72 (90%)	0.19	2 (3%) 49 48	94, 104, 119, 129	0
2	P	60/72 (83%)	0.50	3 (5%) 28 27	105, 116, 129, 140	0
All	All	1827/2082 (87%)	0.19	43 (2%) 59 56	61, 97, 138, 184	0

The worst 5 of 43 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	I	64	ALA	4.6
1	2	93	THR	4.1
2	B	16	PHE	4.0

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Mol	Chain	Res	Type	RSRZ
1	1	106	GLN	3.4
2	O	48	PHE	3.3

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 monosaccharides 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.