Full wwPDB X-ray Structure Validation Report (i)

Oct 30, 2023 – 09:08 PM JST

PDB ID	:	4ZRI
Title	:	Crystal structure of Merlin-FERM and Lats2
Authors	:	Li, F.; Zhou, H.; Long, J.; Shen, Y.
Deposited on	:	2015-05-12
Resolution	:	2.70 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 (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 (1)) were used in the production of this report:

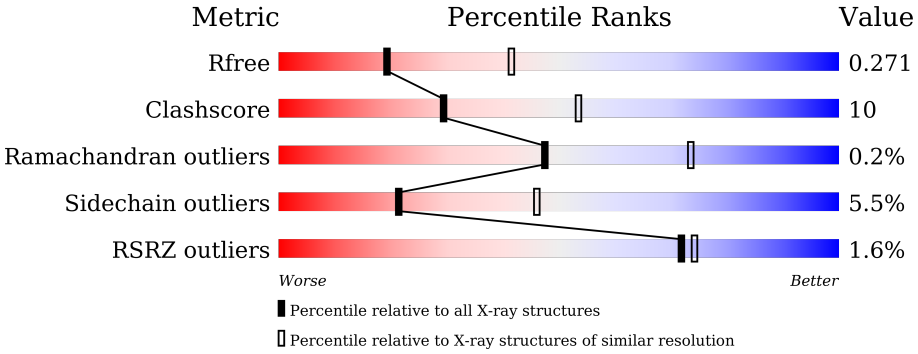
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.70 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	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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	A	324	77% 12% • 10%
1	B	324	3% 68% 18% • 10%
2	C	32	59% • 38%
2	D	32	53% 6% 41%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 4975 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 Merlin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	293	2380	1540	393	434	13	0	0	0
1	B	291	2278	1474	369	422	13	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP P35240
A	-2	PRO	-	expression tag	UNP P35240
A	-1	GLY	-	expression tag	UNP P35240
A	0	SER	-	expression tag	UNP P35240
B	-3	GLY	-	expression tag	UNP P35240
B	-2	PRO	-	expression tag	UNP P35240
B	-1	GLY	-	expression tag	UNP P35240
B	0	SER	-	expression tag	UNP P35240

- Molecule 2 is a protein called Serine/threonine-protein kinase LATS2.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	C	20	163	107	29	27	0	0	0
2	D	19	151	100	26	25	0	0	0

- Molecule 3 is water.

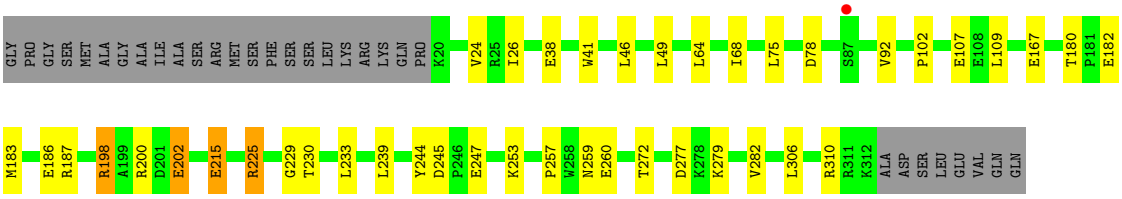
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	2	2	2	0	0
3	B	1	1	1	0	0

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.

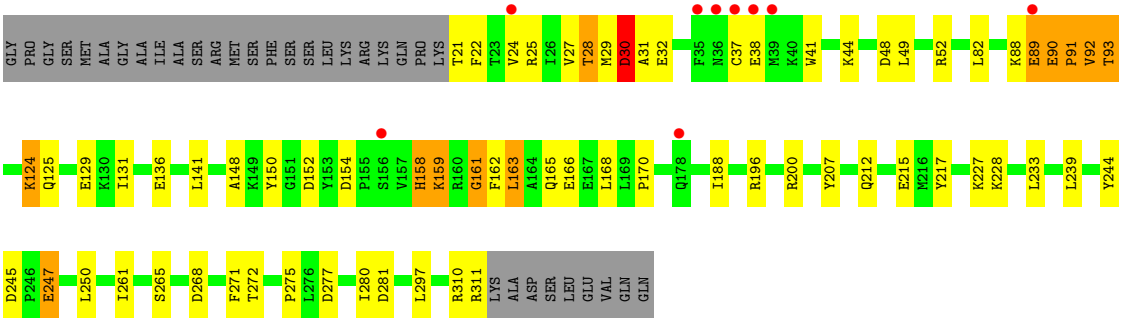
- Molecule 1: Merlin

Chain A:



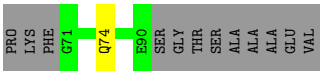
- Molecule 1: Merlin

Chain B:



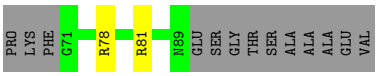
- Molecule 2: Serine/threonine-protein kinase LATS2

Chain C:



- Molecule 2: Serine/threonine-protein kinase LATS2

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	62.96Å 100.55Å 65.03Å 90.00° 105.85° 90.00°	Depositor
Resolution (Å)	36.01 – 2.70 36.01 – 2.70	Depositor EDS
% Data completeness (in resolution range)	99.0 (36.01-2.70) 94.0 (36.01-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.97 (at 2.68Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.2_1309)	Depositor
R, R_{free}	0.227 , 0.270 0.226 , 0.271	Depositor DCC
R_{free} test set	1100 reflections (5.14%)	wwPDB-VP
Wilson B-factor (Å^2)	53.9	Xtriage
Anisotropy	0.684	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 40.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.025 for l,-k,h	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	4975	wwPDB-VP
Average B, all atoms (Å^2)	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.91% 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 (i)

5.1 Standard geometry (i)

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	0.48	0/2439	0.61	0/3306
1	B	0.55	1/2334 (0.0%)	0.63	3/3179 (0.1%)
2	C	0.47	0/167	0.61	0/225
2	D	0.44	0/155	0.66	0/210
All	All	0.51	1/5095 (0.0%)	0.62	3/6920 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	91	PRO	N-CD	5.12	1.55	1.47

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	88	LYS	N-CA-C	-6.60	93.17	111.00
1	B	92	VAL	CB-CA-C	-5.58	100.81	111.40
1	B	90	GLU	C-N-CD	5.10	139.11	128.40

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	159	LYS	Peptide
1	B	30	ASP	Peptide

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Mol	Chain	Res	Type	Group
1	B	89	GLU	Peptide

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	A	2380	0	2291	29	0
1	B	2278	0	2114	62	0
2	C	163	0	163	0	0
2	D	151	0	146	2	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
All	All	4975	0	4714	92	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 10.

All (92) 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:B:25:ARG:O	1:B:93:THR:CG2	1.76	1.31
1:B:25:ARG:O	1:B:93:THR:HG22	1.14	1.25
1:B:154:ASP:H	1:B:158:HIS:CE1	1.60	1.18
1:B:277:ASP:O	1:B:280:ILE:HG22	1.42	1.16
1:B:154:ASP:N	1:B:158:HIS:CE1	2.30	0.98
1:B:154:ASP:N	1:B:158:HIS:HE1	1.63	0.95
1:B:25:ARG:HG2	1:B:93:THR:HG21	1.52	0.89
1:A:24:VAL:HG11	1:A:46:LEU:HD21	1.58	0.86
1:B:25:ARG:HG2	1:B:93:THR:CG2	2.05	0.86
1:B:25:ARG:O	1:B:93:THR:HG23	1.75	0.84
1:B:277:ASP:O	1:B:280:ILE:CG2	2.27	0.78
1:B:25:ARG:CB	1:B:93:THR:HG23	2.14	0.77
1:B:90:GLU:CB	1:B:91:PRO:HA	2.17	0.75
1:B:25:ARG:HB3	1:B:93:THR:HG23	1.68	0.74
1:B:163:LEU:HD12	1:B:163:LEU:N	2.03	0.73
1:B:275:PRO:HB2	1:B:280:ILE:HG21	1.69	0.73

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:198:ARG:HG3	1:A:202:GLU:HB3	1.69	0.73
1:A:272:THR:HG23	1:A:282:VAL:CG1	2.22	0.68
1:A:38:GLU:HB2	1:A:41:TRP:CD1	2.29	0.67
1:B:159:LYS:O	1:B:161:GLY:N	2.29	0.65
1:B:280:ILE:HG23	1:B:280:ILE:O	1.94	0.65
1:A:245:ASP:HB2	1:A:253:LYS:HE3	1.77	0.65
1:B:233:LEU:HB2	1:B:244:TYR:HB2	1.85	0.59
1:B:28:THR:HG23	1:B:31:ALA:H	1.69	0.58
1:B:25:ARG:C	1:B:93:THR:CG2	2.68	0.57
1:B:92:VAL:HG12	1:B:93:THR:N	2.20	0.57
1:B:25:ARG:CG	1:B:93:THR:CG2	2.81	0.56
1:B:154:ASP:O	1:B:158:HIS:ND1	2.36	0.56
1:A:38:GLU:HB2	1:A:41:TRP:NE1	2.20	0.56
1:A:180:THR:H	1:A:183:MET:HE3	1.71	0.56
1:A:225:ARG:HG3	1:A:229:GLY:HA2	1.87	0.56
1:A:180:THR:H	1:A:183:MET:CE	2.20	0.55
1:B:44:LYS:HG2	1:B:48:ASP:OD2	2.07	0.54
1:B:90:GLU:CB	1:B:91:PRO:CA	2.86	0.53
1:B:245:ASP:OD1	1:B:247:GLU:HG2	2.09	0.53
1:B:148:ALA:HA	1:B:200:ARG:HA	1.91	0.53
1:A:24:VAL:HG22	1:A:92:VAL:HB	1.90	0.52
1:B:28:THR:CG2	1:B:31:ALA:HB3	2.41	0.51
1:B:159:LYS:O	1:B:162:PHE:HB3	2.11	0.50
1:A:78:ASP:OD1	1:A:78:ASP:N	2.42	0.50
1:B:162:PHE:CE1	1:B:163:LEU:HD11	2.47	0.50
1:B:215:GLU:HG3	1:B:250:LEU:HB3	1.93	0.50
1:B:21:THR:N	1:B:37:CYS:O	2.45	0.50
1:A:272:THR:HG23	1:A:282:VAL:HG11	1.91	0.50
1:A:26:ILE:HD12	1:A:64:LEU:HD22	1.94	0.49
1:A:233:LEU:HB2	1:A:244:TYR:HB2	1.95	0.49
1:A:245:ASP:CB	1:A:253:LYS:HE3	2.43	0.49
1:A:257:PRO:HB2	1:A:259:ASN:OD1	2.12	0.48
1:B:261:ILE:HA	1:B:275:PRO:HA	1.95	0.48
1:A:257:PRO:HG2	1:A:260:GLU:HB2	1.95	0.48
1:B:141:LEU:HB3	1:B:207:TYR:CE2	2.49	0.47
1:A:277:ASP:C	1:A:279:LYS:N	2.66	0.47
1:B:25:ARG:CA	1:B:93:THR:HG23	2.45	0.47
1:A:46:LEU:HA	1:A:46:LEU:HD12	1.73	0.46
1:B:25:ARG:CB	1:B:93:THR:CG2	2.90	0.46
1:B:150:TYR:OH	1:B:166:GLU:OE1	2.18	0.46
1:B:30:ASP:HB3	1:B:31:ALA:HB2	1.96	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:272:THR:HG23	1:A:282:VAL:HG13	1.97	0.45
1:B:27:VAL:HG22	1:B:32:GLU:HG3	1.96	0.45
1:B:22:PHE:O	1:B:37:CYS:N	2.37	0.45
1:A:180:THR:N	1:A:183:MET:HE3	2.32	0.44
1:A:306:LEU:O	1:A:310:ARG:HG3	2.17	0.44
1:B:89:GLU:N	1:B:90:GLU:HA	2.32	0.44
1:B:25:ARG:C	1:B:93:THR:HG23	2.32	0.44
1:B:28:THR:HG21	1:B:31:ALA:HB3	2.00	0.44
1:A:68:ILE:HD12	1:A:68:ILE:HA	1.93	0.44
1:B:265:SER:OG	1:B:272:THR:HB	2.17	0.43
1:B:168:LEU:HD13	1:B:188:ILE:HD12	2.00	0.43
1:A:102:PRO:HG3	1:A:109:LEU:HD21	2.00	0.43
1:B:271:PHE:HE2	1:B:297:LEU:HD13	1.83	0.43
2:D:78:ARG:HA	2:D:81:ARG:NH1	2.34	0.43
1:A:277:ASP:C	1:A:279:LYS:H	2.21	0.42
1:B:310:ARG:HB2	1:B:311:ARG:NH1	2.34	0.42
1:A:215:GLU:H	1:A:215:GLU:HG2	1.51	0.42
1:B:212:GLN:HA	1:B:217:TYR:CG	2.54	0.42
1:A:180:THR:OG1	1:A:183:MET:HG3	2.19	0.42
1:B:29:MET:HE2	1:B:29:MET:HB3	1.85	0.42
1:B:162:PHE:CD1	1:B:163:LEU:HD11	2.55	0.42
1:B:152:ASP:OD1	1:B:196:ARG:HA	2.20	0.42
1:B:136:GLU:OE2	2:D:81:ARG:NE	2.51	0.41
1:B:49:LEU:HD12	1:B:52:ARG:HH12	1.85	0.41
1:B:129:GLU:HG2	1:B:170:PRO:HB3	2.03	0.41
1:B:28:THR:HG23	1:B:31:ALA:N	2.33	0.41
1:B:29:MET:HE1	1:B:124:LYS:HG3	2.03	0.41
1:A:182:GLU:O	1:A:186:GLU:HG3	2.21	0.41
1:B:24:VAL:HA	1:B:92:VAL:HB	2.02	0.41
1:B:125:GLN:HB3	1:B:131:ILE:HG13	2.02	0.41
1:B:280:ILE:CG2	1:B:280:ILE:O	2.63	0.41
1:A:180:THR:HG23	1:A:183:MET:HE2	2.02	0.41
1:B:38:GLU:HB3	1:B:41:TRP:CB	2.50	0.40
1:B:163:LEU:HD12	1:B:163:LEU:H	1.82	0.40
1:B:89:GLU:CB	1:B:90:GLU:CA	2.99	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	291/324 (90%)	276 (95%)	15 (5%)	0	100	100
1	B	289/324 (89%)	269 (93%)	19 (7%)	1 (0%)	41	66
2	C	18/32 (56%)	17 (94%)	1 (6%)	0	100	100
2	D	17/32 (53%)	15 (88%)	2 (12%)	0	100	100
All	All	615/712 (86%)	577 (94%)	37 (6%)	1 (0%)	47	73

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	161	GLY

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	248/290 (86%)	235 (95%)	13 (5%)	23	49
1	B	228/290 (79%)	214 (94%)	14 (6%)	18	41
2	C	16/25 (64%)	15 (94%)	1 (6%)	18	40
2	D	14/25 (56%)	14 (100%)	0	100	100
All	All	506/630 (80%)	478 (94%)	28 (6%)	21	46

All (28) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	49	LEU
1	A	75	LEU
1	A	107	GLU
1	A	167	GLU
1	A	187	ARG
1	A	198	ARG
1	A	200	ARG
1	A	202	GLU
1	A	215	GLU
1	A	225	ARG
1	A	230	THR
1	A	239	LEU
1	A	247	GLU
1	B	28	THR
1	B	30	ASP
1	B	82	LEU
1	B	93	THR
1	B	124	LYS
1	B	158	HIS
1	B	163	LEU
1	B	165	GLN
1	B	227	LYS
1	B	228	LYS
1	B	239	LEU
1	B	247	GLU
1	B	268	ASP
1	B	281	ASP
2	C	74	GLN

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

Mol	Chain	Res	Type
2	D	74	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 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 (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	293/324 (90%)	-0.19	1 (0%) 94 95	47, 56, 68, 74	0
1	B	291/324 (89%)	0.08	9 (3%) 49 49	52, 63, 76, 82	0
2	C	20/32 (62%)	0.06	0 100 100	50, 58, 62, 68	0
2	D	19/32 (59%)	-0.11	0 100 100	57, 63, 69, 72	0
All	All	623/712 (87%)	-0.05	10 (1%) 72 74	47, 59, 74, 82	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	36	ASN	3.1
1	B	37	CYS	3.0
1	B	35	PHE	2.9
1	B	24	VAL	2.9
1	B	156	SER	2.7
1	B	39	MET	2.3
1	B	38	GLU	2.2
1	B	89	GLU	2.1
1	B	178	GLN	2.1
1	A	87	SER	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 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.