



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 10:57 PM UTC

PDB ID : 2F5J / pdb_00002f5j
Title : Crystal structure of MRG domain from human MRG15
Authors : Zhang, P.; Du, J.; Ding, J.
Deposited on : 2005-11-26
Resolution : 2.20 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

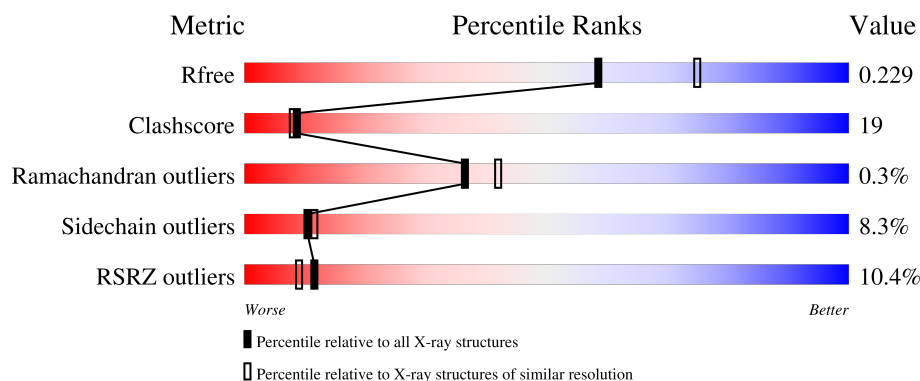
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	181	6% 56% 27% • 13%
1	B	181	12% 60% 23% 5% 12%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2836 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 Mortality factor 4-like protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	157	Total	C	N	O	S	0	0	0
			1289	848	206	232	3			
1	B	159	Total	C	N	O	S	0	0	0
			1309	860	212	234	3			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	322	ALA	-	expression tag	UNP Q9UBU8
A	323	VAL	-	expression tag	UNP Q9UBU8
A	324	LEU	-	expression tag	UNP Q9UBU8
A	325	GLU	-	expression tag	UNP Q9UBU8
A	326	HIS	-	expression tag	UNP Q9UBU8
A	327	HIS	-	expression tag	UNP Q9UBU8
A	328	HIS	-	expression tag	UNP Q9UBU8
A	329	HIS	-	expression tag	UNP Q9UBU8
A	330	HIS	-	expression tag	UNP Q9UBU8
A	331	HIS	-	expression tag	UNP Q9UBU8
B	322	ALA	-	expression tag	UNP Q9UBU8
B	323	VAL	-	expression tag	UNP Q9UBU8
B	324	LEU	-	expression tag	UNP Q9UBU8
B	325	GLU	-	expression tag	UNP Q9UBU8
B	326	HIS	-	expression tag	UNP Q9UBU8
B	327	HIS	-	expression tag	UNP Q9UBU8
B	328	HIS	-	expression tag	UNP Q9UBU8
B	329	HIS	-	expression tag	UNP Q9UBU8
B	330	HIS	-	expression tag	UNP Q9UBU8
B	331	HIS	-	expression tag	UNP Q9UBU8

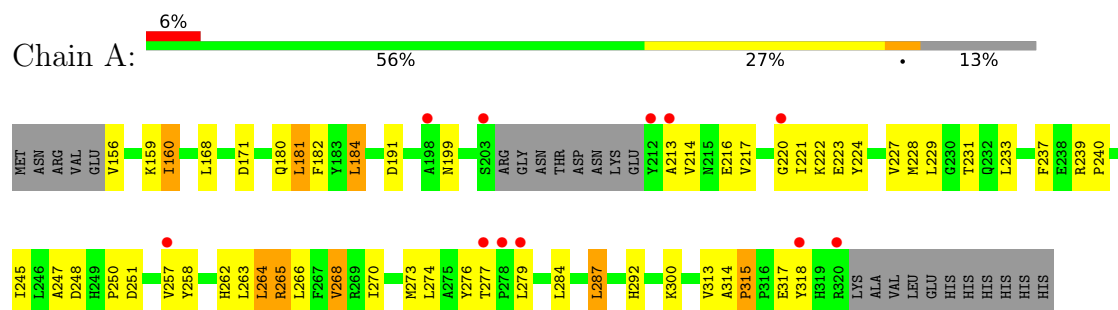
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	103	Total 103	O 103	0	0
2	B	135	Total 135	O 135	0	0

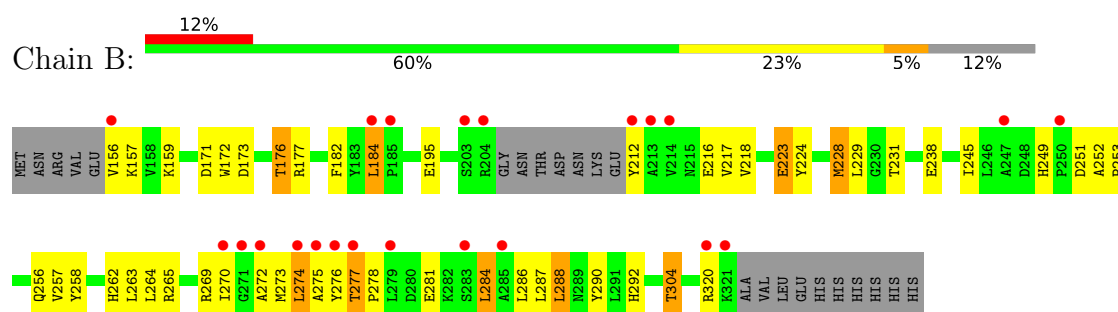
3 Residue-property plots [i](#)

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: Mortality factor 4-like protein 1



- Molecule 1: Mortality factor 4-like protein 1



4 Data and refinement statistics

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α , β , γ	111.15Å 111.15Å 86.99Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 2.20 50.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.2 (50.00-2.20) 99.2 (50.00-2.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.14 (at 2.00Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.205 , 0.243 (Not available) , 0.229	Depositor DCC
R_{free} test set	1337 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	33.8	Xtriage
Anisotropy	0.474	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 52.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.033 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	2836	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.26% 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 [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	0.93	2/1324 (0.2%)	1.05	0/1799
1	B	0.94	1/1344 (0.1%)	1.00	0/1824
All	All	0.93	3/2668 (0.1%)	1.03	0/3623

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	160	ILE	CA-C	6.18	1.58	1.53
1	A	315	PRO	CA-C	5.98	1.55	1.51
1	B	228	MET	SD-CE	-5.71	1.65	1.79

There are no bond angle outliers.

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	A	1289	0	1292	57	0
1	B	1309	0	1318	49	0
2	A	103	0	0	10	0
2	B	135	0	0	14	0
All	All	2836	0	2610	98	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 19.

All (98) 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:184:LEU:HD23	1:B:245:ILE:HD11	1.44	0.98
1:B:159:LYS:H	1:B:292:HIS:CE1	1.86	0.94
1:A:159:LYS:H	1:A:292:HIS:HE1	1.05	0.94
1:B:159:LYS:H	1:B:292:HIS:HE1	0.93	0.88
1:A:227:VAL:HG13	1:B:228:MET:HG2	1.54	0.88
1:A:159:LYS:H	1:A:292:HIS:CE1	1.94	0.85
1:B:171:ASP:OD2	1:B:265:ARG:HD2	1.81	0.81
1:B:184:LEU:CD2	1:B:245:ILE:HD11	2.13	0.79
1:A:213:ALA:O	1:A:217:VAL:HG23	1.84	0.77
1:A:217:VAL:O	1:A:221:ILE:HG12	1.86	0.76
1:B:278:PRO:HD3	2:B:436:HOH:O	1.87	0.74
1:A:171:ASP:OD1	2:A:348:HOH:O	2.06	0.73
1:A:223:GLU:CD	1:B:272:ALA:HB1	2.15	0.72
1:A:262:HIS:HA	1:A:265:ARG:HG3	1.72	0.72
1:A:159:LYS:N	1:A:292:HIS:HE1	1.84	0.71
1:A:300:LYS:NZ	2:A:420:HOH:O	2.23	0.71
1:A:276:TYR:CE1	1:B:223:GLU:HG3	2.26	0.70
1:A:264:LEU:HB3	2:A:347:HOH:O	1.94	0.68
1:B:172:TRP:O	1:B:176:THR:HB	1.96	0.66
1:A:199:ASN:ND2	2:A:340:HOH:O	2.27	0.66
1:A:227:VAL:CG1	1:B:228:MET:HG2	2.25	0.66
1:A:180:GLN:O	1:A:181:LEU:HD12	1.96	0.65
1:B:159:LYS:N	1:B:292:HIS:HE1	1.79	0.64
1:B:270:ILE:CD1	2:B:447:HOH:O	2.46	0.64
1:B:277:THR:HB	2:B:436:HOH:O	1.98	0.63
1:A:181:LEU:HD11	1:A:237:PHE:CE2	2.34	0.63
1:B:224:TYR:HB3	1:B:228:MET:HE3	1.82	0.61
1:B:195:GLU:HG3	2:B:368:HOH:O	1.99	0.61
1:B:270:ILE:HD11	2:B:447:HOH:O	2.00	0.61
1:B:173:ASP:OD2	1:B:177:ARG:NE	2.35	0.59
1:B:277:THR:N	1:B:278:PRO:HD2	2.17	0.59
1:B:212:TYR:HA	1:B:216:GLU:CD	2.28	0.59
1:A:248:ASP:OD1	2:A:417:HOH:O	2.16	0.58
1:A:220:GLY:HA3	1:B:276:TYR:CE2	2.39	0.57
1:B:284:LEU:HD22	1:B:288:LEU:HD22	1.86	0.57
1:B:182:PHE:HD2	1:B:184:LEU:HD13	1.70	0.56
1:A:191:ASP:OD1	1:A:222:LYS:HE2	2.07	0.55
1:A:276:TYR:CZ	1:B:223:GLU:HG3	2.43	0.53
1:A:184:LEU:HD21	1:A:258:TYR:CE2	2.44	0.52
1:B:274:LEU:C	2:B:442:HOH:O	2.52	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:216:GLU:OE1	1:B:278:PRO:HG2	2.10	0.52
1:A:156:VAL:HG22	1:A:284:LEU:HD21	1.92	0.51
1:A:181:LEU:CD1	1:A:237:PHE:CE2	2.93	0.50
1:A:240:PRO:HB2	1:A:318:TYR:CE1	2.46	0.49
1:A:229:LEU:C	1:A:229:LEU:HD13	2.38	0.49
1:B:262:HIS:HD2	2:B:377:HOH:O	1.94	0.49
1:B:156:VAL:O	1:B:157:LYS:HB2	2.13	0.48
1:B:273:MET:O	1:B:275:ALA:N	2.36	0.48
1:A:274:LEU:HD13	1:A:287:LEU:HD11	1.95	0.48
1:A:257:VAL:HG13	1:A:258:TYR:CD1	2.48	0.48
1:A:270:ILE:HG12	1:A:274:LEU:HG	1.96	0.47
1:A:171:ASP:OD1	1:A:265:ARG:HD3	2.14	0.47
1:B:253:PRO:HD2	1:B:256:GLN:NE2	2.30	0.47
1:B:156:VAL:O	1:B:156:VAL:HG12	2.15	0.47
1:B:212:TYR:HA	1:B:216:GLU:OE1	2.14	0.47
1:A:168:LEU:HD21	1:A:264:LEU:HD13	1.97	0.47
1:A:239:ARG:N	1:A:240:PRO:CD	2.77	0.47
1:B:224:TYR:HD2	1:B:228:MET:HE2	1.80	0.47
1:A:182:PHE:HD2	1:A:184:LEU:HD13	1.78	0.47
1:A:224:TYR:HE2	1:A:273:MET:HG2	1.79	0.47
1:A:247:ALA:CA	2:A:334:HOH:O	2.62	0.47
1:B:238:GLU:OE2	1:B:262:HIS:HE1	1.98	0.46
1:A:181:LEU:HD13	1:A:314:ALA:HB2	1.99	0.45
1:A:257:VAL:HG13	1:A:258:TYR:HD1	1.81	0.45
1:A:292:HIS:HD2	2:A:335:HOH:O	2.00	0.45
1:B:217:VAL:HG21	1:B:290:TYR:CG	2.50	0.45
1:A:224:TYR:O	1:A:228:MET:HG3	2.16	0.45
1:B:304:THR:HG22	2:B:451:HOH:O	2.16	0.45
1:B:278:PRO:CD	2:B:436:HOH:O	2.57	0.44
1:A:279:LEU:HD13	1:A:284:LEU:HD23	1.99	0.44
1:A:279:LEU:CD1	1:A:284:LEU:HD23	2.47	0.44
1:A:220:GLY:O	1:A:224:TYR:HD1	2.00	0.44
1:A:245:ILE:HD12	1:A:257:VAL:HG21	1.99	0.44
1:B:269:ARG:NH1	2:B:361:HOH:O	2.51	0.43
1:A:214:VAL:HG23	2:A:429:HOH:O	2.17	0.43
1:A:228:MET:O	1:A:229:LEU:C	2.61	0.43
1:B:270:ILE:HD13	2:B:447:HOH:O	2.12	0.43
1:A:181:LEU:CD1	1:A:237:PHE:HE2	2.31	0.43
1:A:160:ILE:CD1	1:A:268:VAL:HG23	2.48	0.43
1:A:247:ALA:HA	2:A:334:HOH:O	2.18	0.42
1:A:250:PRO:O	1:A:251:ASP:HB2	2.18	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:184:LEU:HG	1:B:257:VAL:HG12	2.01	0.42
1:A:160:ILE:HD11	1:A:268:VAL:HG23	2.00	0.42
1:A:229:LEU:HD22	1:A:233:LEU:HB2	2.02	0.42
1:B:277:THR:CB	2:B:436:HOH:O	2.64	0.42
1:A:279:LEU:HB3	1:A:284:LEU:HB2	2.01	0.42
1:B:249:HIS:O	1:B:252:ALA:HB3	2.20	0.42
1:B:229:LEU:C	1:B:229:LEU:HD13	2.44	0.42
1:B:252:ALA:HA	2:B:334:HOH:O	2.20	0.42
1:B:273:MET:N	1:B:273:MET:HE2	2.34	0.42
1:A:180:GLN:HG2	1:A:313:VAL:HA	2.02	0.41
1:A:315:PRO:HB2	1:A:317:GLU:HG2	2.00	0.41
1:A:180:GLN:C	1:A:181:LEU:HD12	2.46	0.41
1:A:247:ALA:HB2	2:A:334:HOH:O	2.21	0.41
1:B:184:LEU:HD21	1:B:258:TYR:CE2	2.55	0.41
1:B:270:ILE:C	1:B:272:ALA:H	2.29	0.41
1:A:231:THR:HG23	1:B:231:THR:HG23	2.04	0.40
1:B:281:GLU:HG2	2:B:374:HOH:O	2.20	0.40

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	153/181 (84%)	147 (96%)	6 (4%)	0	100	100
1	B	155/181 (86%)	148 (96%)	6 (4%)	1 (1%)	21	23
All	All	308/362 (85%)	295 (96%)	12 (4%)	1 (0%)	36	42

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	274	LEU

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	138/160 (86%)	129 (94%)	9 (6%)	15	18
1	B	140/160 (88%)	126 (90%)	14 (10%)	7	7
All	All	278/320 (87%)	255 (92%)	23 (8%)	10	11

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	181	LEU
1	A	184	LEU
1	A	263	LEU
1	A	264	LEU
1	A	265	ARG
1	A	266	LEU
1	A	268	VAL
1	A	277	THR
1	A	287	LEU
1	B	176	THR
1	B	184	LEU
1	B	218	VAL
1	B	223	GLU
1	B	251	ASP
1	B	263	LEU
1	B	264	LEU
1	B	277	THR
1	B	284	LEU
1	B	286	LEU
1	B	287	LEU
1	B	288	LEU
1	B	304	THR
1	B	320	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	232	GLN
1	A	262	HIS
1	A	292	HIS
1	A	301	ASN
1	B	178	GLN
1	B	256	GLN
1	B	262	HIS
1	B	292	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 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	157/181 (86%)	0.80	11 (7%) 22 19	32, 46, 73, 127	0
1	B	159/181 (87%)	0.55	22 (13%) 6 5	26, 39, 81, 113	0
All	All	316/362 (87%)	0.67	33 (10%) 11 9	26, 43, 77, 127	0

All (33) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	277	THR	6.7
1	B	275	ALA	5.0
1	B	156	VAL	4.9
1	B	271	GLY	4.8
1	A	212	TYR	4.7
1	B	274	LEU	4.5
1	B	203	SER	4.5
1	B	321	LYS	3.8
1	B	212	TYR	3.5
1	B	213	ALA	3.5
1	A	318	TYR	3.3
1	B	283	SER	3.3
1	A	203	SER	3.2
1	B	250	PRO	3.0
1	A	278	PRO	2.9
1	B	204	ARG	2.9
1	A	213	ALA	2.8
1	B	276	TYR	2.8
1	A	279	LEU	2.7
1	A	277	THR	2.6
1	B	270	ILE	2.5
1	B	247	ALA	2.5
1	A	257	VAL	2.5
1	B	320	ARG	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	272	ALA	2.4
1	B	214	VAL	2.4
1	B	184	LEU	2.4
1	B	185	PRO	2.4
1	A	198	ALA	2.3
1	B	279	LEU	2.2
1	B	285	ALA	2.1
1	A	220	GLY	2.1
1	A	320	ARG	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.