



Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 02:31 pm BST

PDB ID : 5NO6
Title : TEAD4-HOXB13 complex bound to DNA
Authors : Morgunova, E.; Jolma, A.; Yin, Y.; Popov, A.; Taipale, J.
Deposited on : 2017-04-11
Resolution : 2.88 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtrriage (Phenix) : 1.13
EDS : 2.11
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) : 2.11

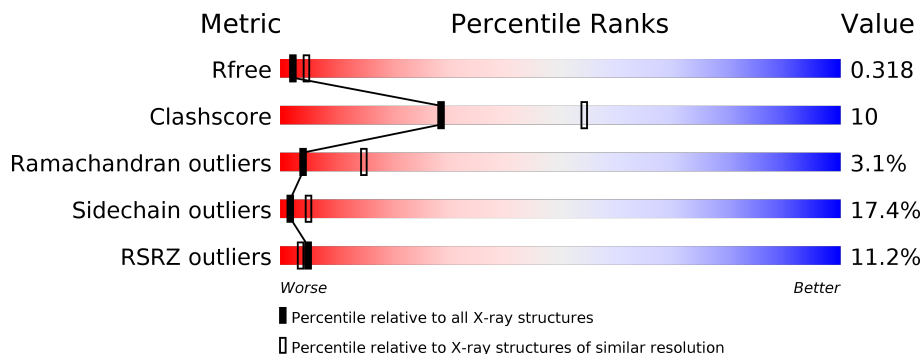
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.88 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.



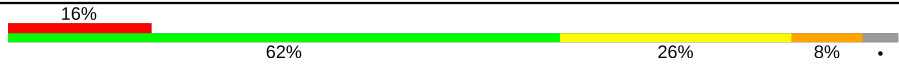

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2691 (2.90-2.86)
Clashscore	141614	2947 (2.90-2.86)
Ramachandran outliers	138981	2868 (2.90-2.86)
Sidechain outliers	138945	2871 (2.90-2.86)
RSRZ outliers	127900	2629 (2.90-2.86)

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 on 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	62	 6% 55% 39% 6%
1	B	62	 5% 69% 27% •
2	C	18	 61% 39%
2	D	18	 61% 39%
3	E	18	 94% 6%
3	F	18	 72% 28%

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Mol	Chain	Length	Quality of chain
4	I	73	
4	N	73	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3722 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 Homeobox protein Hox-B13.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
1	A	62	528	334	106	88	0	0	0
1	B	62	528	334	106	88	0	0	0

- Molecule 2 is a DNA chain called DNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	C	18	365	177	57	113	18	0	0	0
2	D	18	365	177	57	113	18	0	0	0

- Molecule 3 is a DNA chain called DNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	F	18	373	178	74	103	18	0	0	0
3	E	18	373	178	74	103	18	0	0	0

- Molecule 4 is a protein called Transcriptional enhancer factor TEF-3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	I	70	577	361	114	100	2	0	0	0
4	N	73	597	373	117	105	2	0	0	0

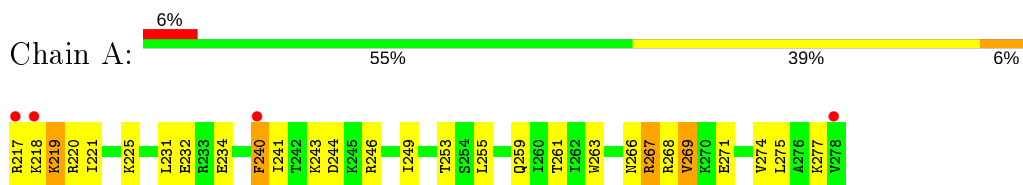
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	2	Total O 2 2	0	0
5	C	2	Total O 2 2	0	0
5	F	2	Total O 2 2	0	0
5	B	2	Total O 2 2	0	0
5	D	2	Total O 2 2	0	0
5	E	1	Total O 1 1	0	0
5	I	2	Total O 2 2	0	0
5	N	3	Total O 3 3	0	0

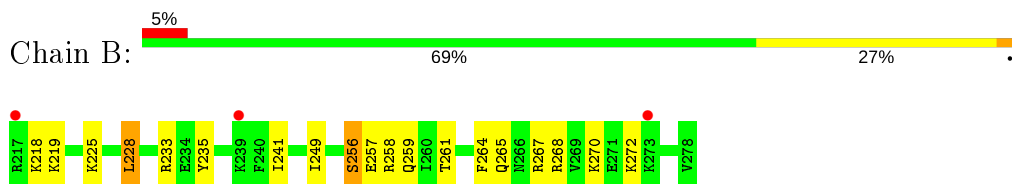
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Homeobox protein Hox-B13



- Molecule 1: Homeobox protein Hox-B13



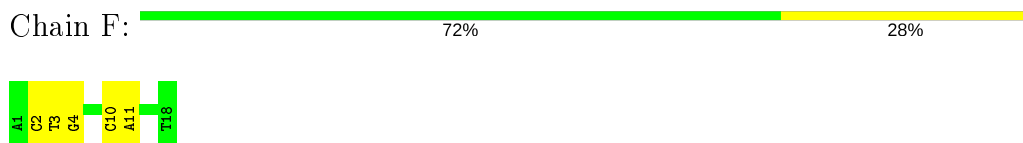
- Molecule 2: DNA



- Molecule 2: DNA

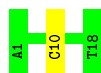


- Molecule 3: DNA

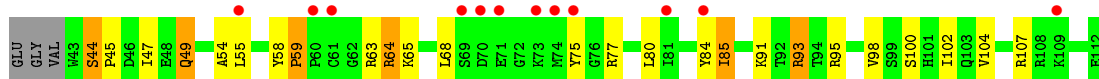


- Molecule 3: DNA

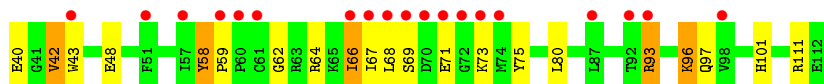




- Molecule 4: Transcriptional enhancer factor TEF-3



- Molecule 4: Transcriptional enhancer factor TEF-3



4 Data and refinement statistics

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	82.66Å 56.67Å 144.99Å 90.00° 93.81° 90.00°	Depositor
Resolution (Å)	45.00 – 2.88 40.47 – 2.88	Depositor EDS
% Data completeness (in resolution range)	95.0 (45.00-2.88) 95.1 (40.47-2.88)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.15 (at 2.90Å)	Xtrriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.240 , 0.317 0.241 , 0.318	Depositor DCC
R_{free} test set	765 reflections (5.23%)	wwPDB-VP
Wilson B-factor (Å ²)	105.3	Xtrriage
Anisotropy	0.275	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.25 , 72.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3722	wwPDB-VP
Average B, all atoms (Å ²)	125.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.22% 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	0.55	0/534	0.92	0/707
1	B	0.52	0/534	0.85	0/707
2	C	0.45	0/406	0.83	0/624
2	D	0.42	0/406	0.84	0/624
3	E	0.43	0/420	0.81	0/646
3	F	0.40	0/420	0.84	0/646
4	I	0.58	0/586	0.81	0/783
4	N	0.59	0/606	0.83	0/810
All	All	0.51	0/3912	0.84	0/5547

There are no bond length outliers.

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	528	0	577	18	0
1	B	528	0	577	10	0
2	C	365	0	208	14	0
2	D	365	0	208	4	0
3	E	373	0	203	1	0
3	F	373	0	203	3	0
4	I	577	0	604	13	0
4	N	597	0	622	16	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	2	0	0	0	0
5	B	2	0	0	0	0
5	C	2	0	0	0	0
5	D	2	0	0	0	0
5	E	1	0	0	0	0
5	F	2	0	0	0	0
5	I	2	0	0	1	0
5	N	3	0	0	0	0
All	All	3722	0	3202	67	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 (67) 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)
2:C:29:DC:OP1	4:N:42:VAL:CG2	1.80	1.29
2:C:29:DC:H5'	4:N:42:VAL:HG21	1.16	1.09
2:C:29:DC:OP1	4:N:42:VAL:HG22	1.61	0.99
2:C:29:DC:OP1	4:N:42:VAL:HG23	1.66	0.94
2:C:29:DC:C5'	4:N:42:VAL:HG21	2.05	0.86
1:A:253:THR:HB	1:A:255:LEU:HD12	1.71	0.72
4:I:58:TYR:CE1	4:I:80:LEU:HD22	2.31	0.65
2:C:29:DC:OP1	4:N:42:VAL:HG21	1.93	0.65
1:B:270:LYS:NZ	2:D:23:DT:OP2	2.29	0.63
2:C:29:DC:H5'	4:N:42:VAL:CG2	2.10	0.63
1:B:241:ILE:HD11	1:B:249:ILE:CD1	2.30	0.61
4:N:58:TYR:CE1	4:N:80:LEU:HD13	2.36	0.61
4:I:58:TYR:CD1	4:I:80:LEU:HD13	2.38	0.59
1:A:249:ILE:O	1:A:253:THR:HG23	2.03	0.58
1:A:249:ILE:HG22	1:A:253:THR:HG21	1.87	0.56
4:I:100:SER:O	4:I:104:VAL:HG23	2.05	0.56
4:I:98:VAL:O	4:I:102:ILE:HG13	2.06	0.56
2:C:37:DT:H4'	4:N:66:ILE:HG21	1.88	0.55
1:B:241:ILE:HD11	1:B:249:ILE:HD13	1.88	0.55
1:A:240:PHE:CE1	1:A:268:ARG:HD3	2.42	0.54
1:A:234:GLU:HG2	1:A:249:ILE:HD11	1.90	0.54
1:A:241:ILE:HD11	1:A:249:ILE:CD1	2.37	0.54
4:N:43:TRP:CZ2	4:N:101:HIS:HB2	2.42	0.54
4:I:49:GLN:NE2	5:I:201:HOH:O	2.40	0.54
4:I:44:SER:HB2	4:I:47:ILE:HD12	1.92	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:N:93:ARG:HA	4:N:97:GLN:OE1	2.09	0.52
1:A:249:ILE:HG22	1:A:253:THR:CG2	2.39	0.51
4:I:47:ILE:HG23	4:I:85:ILE:HG21	1.93	0.51
4:I:54:ALA:HB2	4:I:84:TYR:CD1	2.47	0.50
4:N:64:ARG:HD2	4:N:67:ILE:HG22	1.95	0.49
4:N:48:GLU:OE2	4:N:101:HIS:NE2	2.41	0.49
1:A:274:VAL:O	1:A:274:VAL:HG12	2.14	0.48
1:A:218:LYS:HB2	1:A:219:LYS:HA	1.95	0.48
1:A:253:THR:CB	1:A:255:LEU:HD12	2.40	0.47
1:B:241:ILE:HD12	1:B:264:PHE:CE1	2.49	0.47
1:B:256:SER:N	1:B:259:GLN:OE1	2.48	0.47
4:I:95:ARG:O	4:I:98:VAL:HG22	2.14	0.46
1:A:255:LEU:HB3	1:A:259:GLN:OE1	2.16	0.46
1:A:232:GLU:OE2	1:A:267:ARG:NH2	2.49	0.46
4:I:58:TYR:HB3	4:I:59:PRO:CD	2.46	0.46
1:B:261:THR:O	1:B:265:GLN:HG3	2.17	0.45
2:C:32:DT:H73	4:N:96:LYS:HE3	1.99	0.45
2:D:29:DC:H2'	2:D:30:DA:C8	2.52	0.45
4:N:67:ILE:O	4:N:67:ILE:HG23	2.17	0.44
4:N:68:LEU:HD12	4:N:75:TYR:HB2	2.00	0.44
1:A:253:THR:HB	1:A:255:LEU:CD1	2.43	0.44
2:C:34:DC:H5	3:F:4:DG:H1	1.65	0.44
1:A:217:ARG:HA	1:A:218:LYS:HA	1.81	0.43
2:C:29:DC:H2''	2:C:30:DA:H5'	1.99	0.43
4:I:58:TYR:CZ	4:I:80:LEU:HD22	2.54	0.42
1:A:231:LEU:HB3	1:A:263:TRP:CZ3	2.55	0.42
3:F:10:DC:H2''	3:F:11:DA:C8	2.54	0.42
2:D:27:DT:H2''	2:D:28:DG:C8	2.55	0.42
4:I:95:ARG:HA	4:I:98:VAL:HG22	2.02	0.42
1:B:256:SER:O	1:B:259:GLN:HB2	2.20	0.41
2:D:34:DC:H2''	2:D:35:DA:C8	2.54	0.41
1:B:235:TYR:CE2	1:B:267:ARG:HG3	2.55	0.41
1:B:268:ARG:NH1	3:E:10:DC:OP2	2.54	0.41
4:I:44:SER:O	4:I:47:ILE:HB	2.21	0.41
1:A:240:PHE:CD1	1:A:240:PHE:N	2.87	0.41
1:A:246:ARG:NH1	1:A:261:THR:OG1	2.53	0.41
2:C:30:DA:C8	2:C:31:DT:H72	2.55	0.41
3:F:2:DC:H2'	3:F:3:DT:O4'	2.20	0.41
2:C:34:DC:H2''	2:C:35:DA:O4'	2.21	0.41
1:A:266:ASN:O	1:A:269:VAL:HG12	2.21	0.40
1:B:225:LYS:HA	1:B:228:LEU:HD21	2.03	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:34:DC:H2''	2:C:35:DA:H5''	2.03	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	60/62 (97%)	55 (92%)	5 (8%)	0	100	100
1	B	60/62 (97%)	55 (92%)	5 (8%)	0	100	100
4	I	68/73 (93%)	54 (79%)	10 (15%)	4 (6%)	1	4
4	N	71/73 (97%)	55 (78%)	12 (17%)	4 (6%)	2	5
All	All	259/270 (96%)	219 (85%)	32 (12%)	8 (3%)	4	15

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	N	59	PRO
4	I	93	ARG
4	N	62	GLY
4	I	45	PRO
4	N	93	ARG
4	I	64	ARG
4	I	59	PRO
4	N	58	TYR

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	56/56 (100%)	44 (79%)	12 (21%)	1	2
1	B	56/56 (100%)	48 (86%)	8 (14%)	3	9
4	I	61/63 (97%)	48 (79%)	13 (21%)	1	2
4	N	63/63 (100%)	55 (87%)	8 (13%)	4	12
All	All	236/238 (99%)	195 (83%)	41 (17%)	2	5

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	219	LYS
1	A	220	ARG
1	A	221	ILE
1	A	225	LYS
1	A	240	PHE
1	A	243	LYS
1	A	244	ASP
1	A	267	ARG
1	A	269	VAL
1	A	271	GLU
1	A	275	LEU
1	A	277	LYS
1	B	218	LYS
1	B	219	LYS
1	B	228	LEU
1	B	233	ARG
1	B	256	SER
1	B	257	GLU
1	B	258	ARG
1	B	272	LYS
4	I	44	SER
4	I	49	GLN
4	I	55	LEU
4	I	63	ARG
4	I	64	ARG
4	I	65	LYS
4	I	68	LEU
4	I	75	TYR
4	I	77	ARG
4	I	85	ILE

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Mol	Chain	Res	Type
4	I	91	LYS
4	I	93	ARG
4	I	107	ARG
4	N	40	GLU
4	N	42	VAL
4	N	66	ILE
4	N	69	SER
4	N	71	GLU
4	N	73	LYS
4	N	96	LYS
4	N	111	ARG

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

Mol	Chain	Res	Type
1	A	265	GLN
4	N	78	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 carbohydrates 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

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	62/62 (100%)	0.44	4 (6%) 18 14	77, 109, 144, 188	0
1	B	62/62 (100%)	0.18	3 (4%) 30 26	92, 137, 173, 212	0
2	C	18/18 (100%)	-0.58	0 100 100	87, 94, 112, 134	0
2	D	18/18 (100%)	-0.59	0 100 100	100, 116, 130, 145	0
3	E	18/18 (100%)	-0.78	0 100 100	89, 117, 157, 169	0
3	F	18/18 (100%)	-0.56	0 100 100	75, 100, 121, 155	0
4	I	70/73 (95%)	0.94	12 (17%) 1 1	91, 145, 221, 232	0
4	N	73/73 (100%)	1.77	19 (26%) 0 0	79, 124, 248, 255	0
All	All	339/342 (99%)	0.56	38 (11%) 5 3	75, 122, 216, 255	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	N	60	PRO	28.9
4	N	61	CYS	15.2
4	I	75	TYR	13.5
1	B	217	ARG	11.8
4	N	74	MET	9.8
4	I	61	CYS	9.4
1	A	278	VAL	8.8
4	N	71	GLU	8.4
4	N	72	GLY	7.6
4	N	69	SER	7.6
4	I	60	PRO	6.4
4	I	69	SER	5.7
4	N	70	ASP	5.1
4	I	70	ASP	4.7
4	N	51	PHE	4.6
4	I	71	GLU	3.9

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Mol	Chain	Res	Type	RSRZ
4	I	81	ILE	3.7
4	N	43	TRP	3.6
4	N	67	ILE	3.4
4	N	92	THR	3.4
4	I	55	LEU	3.1
1	A	217	ARG	3.1
4	N	73	LYS	2.9
1	A	218	LYS	2.8
1	B	273	LYS	2.6
4	I	73	LYS	2.6
4	N	66	ILE	2.5
4	N	59	PRO	2.5
4	N	68	LEU	2.5
4	N	93	ARG	2.4
1	A	240	PHE	2.3
4	I	74	MET	2.3
1	B	239	LYS	2.2
4	N	98	VAL	2.1
4	N	87	LEU	2.1
4	I	84	TYR	2.0
4	N	57	ILE	2.0
4	I	109	LYS	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 carbohydrates 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.