



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 19, 2016 – 09:47 PM GMT

PDB ID : 5AWF  
Title : Crystal structure of SufB-SufC-SufD complex from Escherichia coli  
Authors : Hirabayashi, K.; Wada, K.  
Deposited on : 2015-07-03  
Resolution : 2.96 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](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : unknown  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026982  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20026982

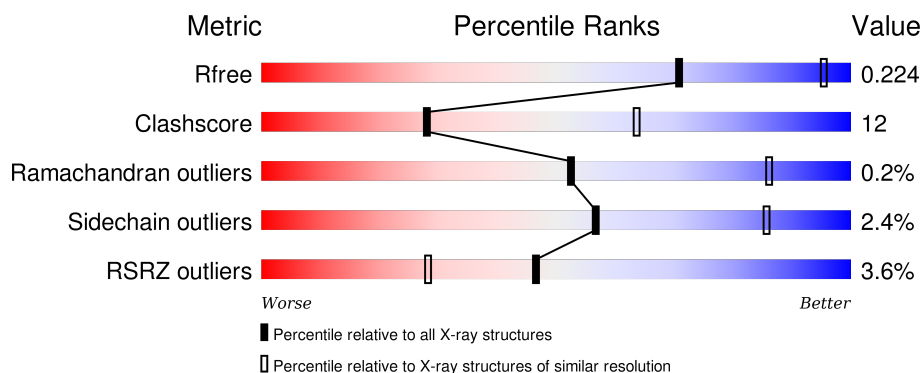
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.96 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))
$R_{free}$	91344	2184 (3.00-2.92)
Clashscore	102246	2552 (3.00-2.92)
Ramachandran outliers	100387	2468 (3.00-2.92)
Sidechain outliers	100360	2471 (3.00-2.92)
RSRZ outliers	91569	2201 (3.00-2.92)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	495	<div> <div>2%</div> <div>61% 16% • 22%</div> </div>
1	E	495	<div> <div>3%</div> <div>55% 21% • 23%</div> </div>
2	B	423	<div> <div>%</div> <div>82% 16% •</div> </div>
2	F	423	<div> <div>4%</div> <div>77% 20% ••</div> </div>
3	C	248	<div> <div>4%</div> <div>76% 21% ••</div> </div>

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Mol	Chain	Length	Quality of chain
3	D	248	<div><div></div><div>5%</div><div>64%</div><div>27%</div><div>• 5%</div></div>
3	G	248	<div><div></div><div>2%</div><div>79%</div><div>18%</div><div>•</div></div>
3	H	248	<div><div></div><div>8%</div><div>59%</div><div>33%</div><div>• 5%</div></div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 19914 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 FeS cluster assembly protein SufB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	385	Total	C	N	O	S	0	0	0
			3004	1892	517	577	18			
1	E	381	Total	C	N	O	S	0	0	0
			2972	1872	511	571	18			

- Molecule 2 is a protein called FeS cluster assembly protein SufD.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	414	Total	C	N	O	S	0	0	0
			3238	2019	599	612	8			
2	F	414	Total	C	N	O	S	0	0	0
			3238	2019	599	612	8			

- Molecule 3 is a protein called Probable ATP-dependent transporter SufC.

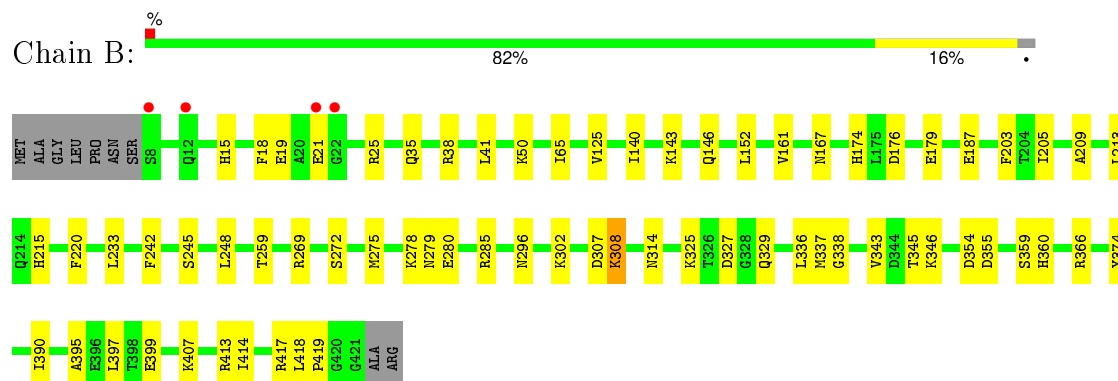
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	243	Total	C	N	O	S	0	0	0
			1898	1203	320	368	7			
3	D	235	Total	C	N	O	S	0	0	0
			1829	1158	310	354	7			
3	G	243	Total	C	N	O	S	0	0	0
			1898	1203	320	368	7			
3	H	236	Total	C	N	O	S	0	0	0
			1837	1164	311	355	7			

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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 ( $\text{RSRZ} > 2$ ). 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.

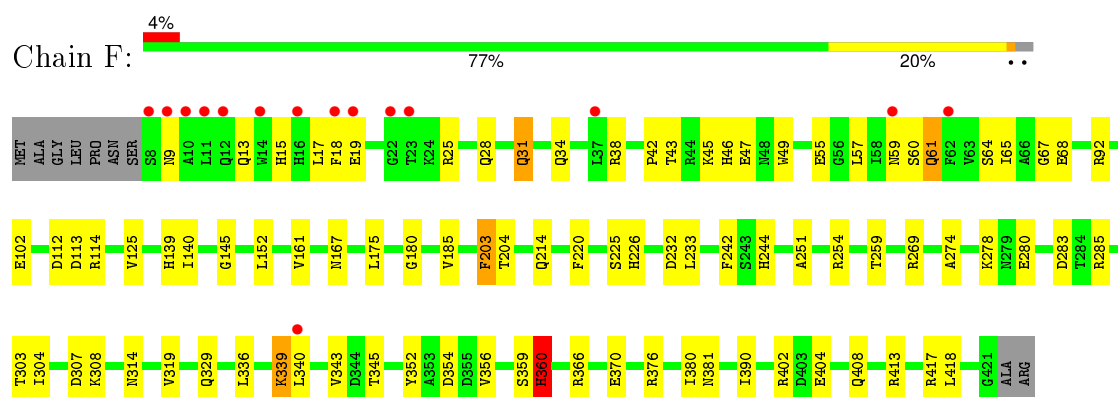
- Chain A:

- [illegible]

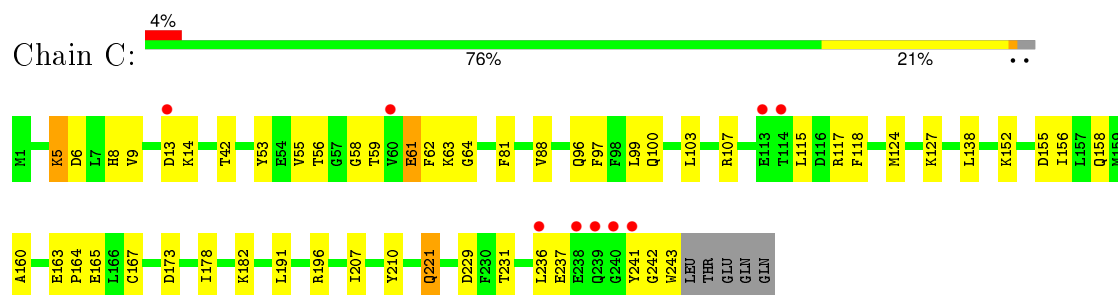
- Molecule 2: FeS cluster assembly protein SufD



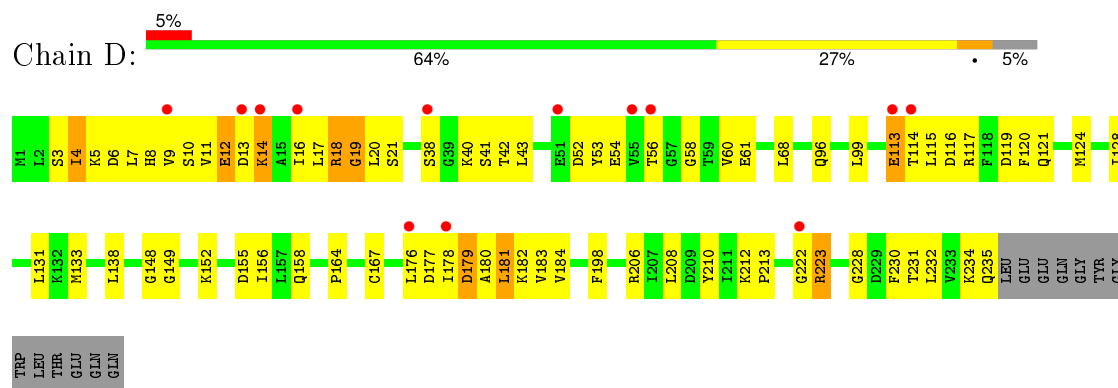
- Molecule 2: FeS cluster assembly protein SufD



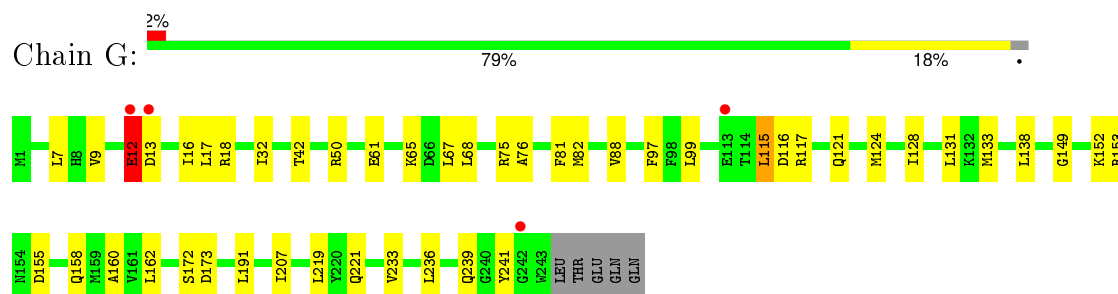
- Molecule 3: Probable ATP-dependent transporter SufC



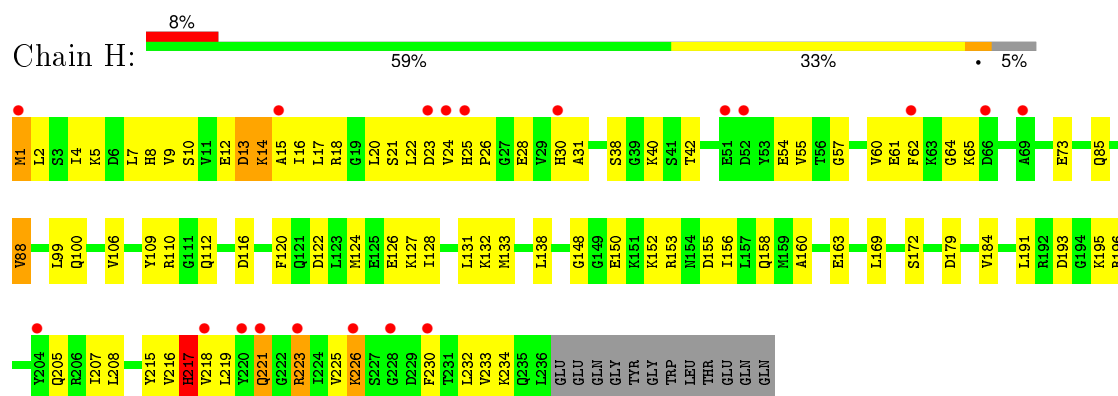
- Molecule 3: Probable ATP-dependent transporter SufC



- Molecule 3: Probable ATP-dependent transporter SufC



- Molecule 3: Probable ATP-dependent transporter SufC



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	119.47Å 139.56Å 124.68Å 90.00° 113.10° 90.00°	Depositor
Resolution (Å)	41.11 – 2.96 43.37 – 2.96	Depositor EDS
% Data completeness (in resolution range)	98.2 (41.11-2.96) 94.7 (43.37-2.96)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.62 (at 2.95Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1692)	Depositor
R, $R_{free}$	0.187 , 0.226 0.187 , 0.224	Depositor DCC
$R_{free}$ test set	1928 reflections (2.59%)	DCC
Wilson B-factor (Å <sup>2</sup> )	64.7	Xtriage
Anisotropy	0.547	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 71.7	EDS
Estimated twinning fraction	0.013 for l,-k,h	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 77308 reflections	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	19914	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	83.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.88% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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	0.32	0/3068	0.58	1/4153 (0.0%)
1	E	0.31	0/3035	0.57	0/4108
2	B	0.27	0/3300	0.50	0/4473
2	F	0.30	0/3300	0.55	1/4473 (0.0%)
3	C	0.31	0/1930	0.56	0/2604
3	D	0.35	0/1858	0.65	2/2506 (0.1%)
3	G	0.30	0/1930	0.54	0/2604
3	H	0.44	0/1866	0.79	2/2517 (0.1%)
All	All	0.32	0/20287	0.59	6/27438 (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	A	0	2
1	E	0	3
3	D	0	3
3	G	0	1
3	H	0	2
All	All	0	11

There are no bond length outliers.

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	223	ARG	NE-CZ-NH2	7.01	123.80	120.30
3	D	19	GLY	N-CA-C	6.25	128.74	113.10
1	A	295	GLY	N-CA-C	6.22	128.66	113.10
3	H	14	LYS	C-N-CA	-6.17	106.28	121.70
3	H	217	HIS	N-CA-CB	5.44	120.39	110.60

There are no chirality outliers.

5 of 11 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	294	THR	Peptide
1	A	308	GLU	Peptide
3	D	113	GLU	Peptide
3	D	12	GLU	Peptide
3	D	14	LYS	Peptide

## 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	3004	0	2916	61	0
1	E	2972	0	2887	83	0
2	B	3238	0	3184	44	0
2	F	3238	0	3184	63	0
3	C	1898	0	1896	41	0
3	D	1829	0	1840	80	0
3	G	1898	0	1896	32	0
3	H	1837	0	1851	89	0
All	All	19914	0	19654	464	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 12.

The worst 5 of 464 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:E:492:HIS:CE1	1:E:493:SER:HB3	1.82	1.13
3:H:30:HIS:HD1	3:H:215:TYR:HB2	1.22	1.03
3:H:61:GLU:OE2	3:H:64:GLY:N	1.96	0.97
3:D:12:GLU:HG3	3:D:14:LYS:HG3	1.42	0.97
2:F:381:ASN:HA	3:H:73:GLU:HG2	1.49	0.95

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	381/495 (77%)	364 (96%)	15 (4%)	2 (0%)	34	74
1	E	377/495 (76%)	367 (97%)	10 (3%)	0	100	100
2	B	412/423 (97%)	408 (99%)	4 (1%)	0	100	100
2	F	412/423 (97%)	402 (98%)	9 (2%)	1 (0%)	52	86
3	C	241/248 (97%)	235 (98%)	6 (2%)	0	100	100
3	D	233/248 (94%)	223 (96%)	10 (4%)	0	100	100
3	G	241/248 (97%)	232 (96%)	8 (3%)	1 (0%)	39	78
3	H	234/248 (94%)	226 (97%)	8 (3%)	0	100	100
All	All	2531/2828 (90%)	2457 (97%)	70 (3%)	4 (0%)	52	86

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	202	VAL
1	A	289	PRO
2	F	60	SER
3	G	12	GLU

### 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	323/413 (78%)	316 (98%)	7 (2%)	60	87

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	E	320/413 (78%)	308 (96%)	12 (4%)	40	76
2	B	344/350 (98%)	341 (99%)	3 (1%)	84	95
2	F	344/350 (98%)	339 (98%)	5 (2%)	72	91
3	C	207/212 (98%)	203 (98%)	4 (2%)	65	89
3	D	201/212 (95%)	195 (97%)	6 (3%)	48	82
3	G	207/212 (98%)	202 (98%)	5 (2%)	57	86
3	H	202/212 (95%)	193 (96%)	9 (4%)	34	72
All	All	2148/2374 (90%)	2097 (98%)	51 (2%)	57	86

5 of 51 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	164	ILE
1	E	414	CYS
3	H	217	HIS
1	E	205	ASP
1	E	450	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	199	ASN
3	H	25	HIS
2	F	214	GLN
3	C	221	GLN
1	E	417	HIS

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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 [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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	385/495 (77%)	0.05	12 (3%) 52 33	29, 63, 127, 184	0
1	E	381/495 (76%)	0.13	16 (4%) 40 23	43, 81, 140, 198	0
2	B	414/423 (97%)	-0.20	4 (0%) 84 67	28, 61, 100, 154	0
2	F	414/423 (97%)	-0.00	15 (3%) 46 28	44, 78, 123, 176	0
3	C	243/248 (97%)	0.05	9 (3%) 45 27	43, 80, 140, 174	0
3	D	235/248 (94%)	0.20	13 (5%) 29 16	44, 90, 153, 194	0
3	G	243/248 (97%)	-0.04	4 (1%) 74 55	46, 80, 128, 163	0
3	H	236/248 (95%)	0.52	19 (8%) 15 7	47, 114, 176, 266	0
All	All	2551/2828 (90%)	0.06	92 (3%) 46 28	28, 78, 143, 266	0

The worst 5 of 92 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	293	ASN	6.5
3	D	222	GLY	5.6
1	A	295	GLY	5.5
1	E	229	ALA	5.2
1	E	492	HIS	4.8

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands

There are no ligands in this entry.

## 6.5 Other polymers

There are no such residues in this entry.