



## Full wwPDB EM Validation Report ⓘ

Sep 30, 2025 – 10:32 AM EDT

PDB ID : 8UAW / pdb\_00008uaw  
EMDB ID : EMD-42073  
Title : Cryo-EM Structure of Brucella Abortus Lumazine Synthase (BLS) Engineered with Shiga Toxin II subunit B (Stx2B)  
Authors : Cristofalo, A.E.; Sharma, A.; Cerutti, M.L.; Sharma, K.; Zylberman, V.; Goldbaum, F.A.; Borgnia, M.J.; Otero, L.H.  
Deposited on : 2023-09-22  
Resolution : 2.97 Å (reported)  
Based on initial models : 1XN1, 3MXG

This is a Full wwPDB EM Validation 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

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

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>.

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

EMDB validation analysis : **FAILED**  
MolProbity : 4-5-2 with Phenix2.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
EM percentile statistics : **NOT EXECUTED**  
MapQ : **FAILED**  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.46

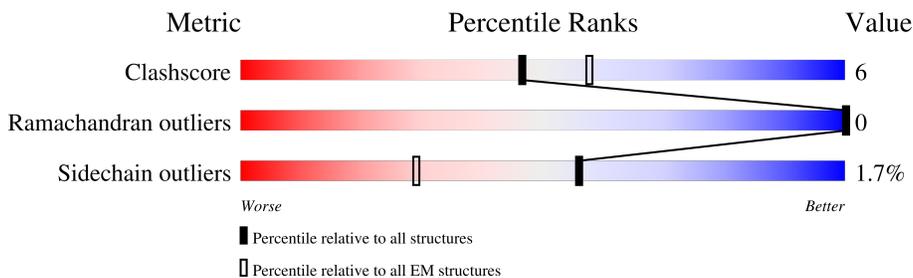
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 2.97 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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  $\leq 5\%$ .

Mol	Chain	Length	Quality of chain
1	A	234	85% 14% ..
1	B	234	80% 19% .
1	C	234	85% 15% .
1	D	234	84% 15% .
1	E	234	84% 15% .
1	F	234	84% 15% .
1	G	234	84% 15% .
1	H	234	80% 19% .
1	I	234	83% 15% ..

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Mol	Chain	Length	Quality of chain
1	J	234	 86% 13%

## 2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 17830 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	232	1783	1130	310	337	6	0	0
1	B	232	1783	1130	310	337	6	0	0
1	C	232	1783	1130	310	337	6	0	0
1	D	232	1783	1130	310	337	6	0	0
1	E	232	1783	1130	310	337	6	0	0
1	F	232	1783	1130	310	337	6	0	0
1	G	232	1783	1130	310	337	6	0	0
1	H	232	1783	1130	310	337	6	0	0
1	I	232	1783	1130	310	337	6	0	0
1	J	232	1783	1130	310	337	6	0	0

There are 130 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP A7UQX3
A	2	HIS	-	expression tag	UNP A7UQX3
A	73	GLY	-	linker	UNP A7UQX3
A	74	SER	-	linker	UNP A7UQX3
A	75	GLY	-	linker	UNP A7UQX3
A	76	SER	-	linker	UNP A7UQX3
A	77	GLY	-	linker	UNP A7UQX3
A	78	SER	-	linker	UNP A7UQX3
A	79	GLY	-	linker	UNP A7UQX3

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Chain	Residue	Modelled	Actual	Comment	Reference
A	80	SER	-	linker	UNP A7UQX3
A	81	GLY	-	linker	UNP A7UQX3
A	82	SER	-	linker	UNP A7UQX3
A	83	LEU	-	linker	UNP A7UQX3
B	1	MET	-	expression tag	UNP A7UQX3
B	2	HIS	-	expression tag	UNP A7UQX3
B	73	GLY	-	linker	UNP A7UQX3
B	74	SER	-	linker	UNP A7UQX3
B	75	GLY	-	linker	UNP A7UQX3
B	76	SER	-	linker	UNP A7UQX3
B	77	GLY	-	linker	UNP A7UQX3
B	78	SER	-	linker	UNP A7UQX3
B	79	GLY	-	linker	UNP A7UQX3
B	80	SER	-	linker	UNP A7UQX3
B	81	GLY	-	linker	UNP A7UQX3
B	82	SER	-	linker	UNP A7UQX3
B	83	LEU	-	linker	UNP A7UQX3
C	1	MET	-	expression tag	UNP A7UQX3
C	2	HIS	-	expression tag	UNP A7UQX3
C	73	GLY	-	linker	UNP A7UQX3
C	74	SER	-	linker	UNP A7UQX3
C	75	GLY	-	linker	UNP A7UQX3
C	76	SER	-	linker	UNP A7UQX3
C	77	GLY	-	linker	UNP A7UQX3
C	78	SER	-	linker	UNP A7UQX3
C	79	GLY	-	linker	UNP A7UQX3
C	80	SER	-	linker	UNP A7UQX3
C	81	GLY	-	linker	UNP A7UQX3
C	82	SER	-	linker	UNP A7UQX3
C	83	LEU	-	linker	UNP A7UQX3
D	1	MET	-	expression tag	UNP A7UQX3
D	2	HIS	-	expression tag	UNP A7UQX3
D	73	GLY	-	linker	UNP A7UQX3
D	74	SER	-	linker	UNP A7UQX3
D	75	GLY	-	linker	UNP A7UQX3
D	76	SER	-	linker	UNP A7UQX3
D	77	GLY	-	linker	UNP A7UQX3
D	78	SER	-	linker	UNP A7UQX3
D	79	GLY	-	linker	UNP A7UQX3
D	80	SER	-	linker	UNP A7UQX3
D	81	GLY	-	linker	UNP A7UQX3
D	82	SER	-	linker	UNP A7UQX3

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Chain	Residue	Modelled	Actual	Comment	Reference
D	83	LEU	-	linker	UNP A7UQX3
E	1	MET	-	expression tag	UNP A7UQX3
E	2	HIS	-	expression tag	UNP A7UQX3
E	73	GLY	-	linker	UNP A7UQX3
E	74	SER	-	linker	UNP A7UQX3
E	75	GLY	-	linker	UNP A7UQX3
E	76	SER	-	linker	UNP A7UQX3
E	77	GLY	-	linker	UNP A7UQX3
E	78	SER	-	linker	UNP A7UQX3
E	79	GLY	-	linker	UNP A7UQX3
E	80	SER	-	linker	UNP A7UQX3
E	81	GLY	-	linker	UNP A7UQX3
E	82	SER	-	linker	UNP A7UQX3
E	83	LEU	-	linker	UNP A7UQX3
F	1	MET	-	expression tag	UNP A7UQX3
F	2	HIS	-	expression tag	UNP A7UQX3
F	73	GLY	-	linker	UNP A7UQX3
F	74	SER	-	linker	UNP A7UQX3
F	75	GLY	-	linker	UNP A7UQX3
F	76	SER	-	linker	UNP A7UQX3
F	77	GLY	-	linker	UNP A7UQX3
F	78	SER	-	linker	UNP A7UQX3
F	79	GLY	-	linker	UNP A7UQX3
F	80	SER	-	linker	UNP A7UQX3
F	81	GLY	-	linker	UNP A7UQX3
F	82	SER	-	linker	UNP A7UQX3
F	83	LEU	-	linker	UNP A7UQX3
G	1	MET	-	expression tag	UNP A7UQX3
G	2	HIS	-	expression tag	UNP A7UQX3
G	73	GLY	-	linker	UNP A7UQX3
G	74	SER	-	linker	UNP A7UQX3
G	75	GLY	-	linker	UNP A7UQX3
G	76	SER	-	linker	UNP A7UQX3
G	77	GLY	-	linker	UNP A7UQX3
G	78	SER	-	linker	UNP A7UQX3
G	79	GLY	-	linker	UNP A7UQX3
G	80	SER	-	linker	UNP A7UQX3
G	81	GLY	-	linker	UNP A7UQX3
G	82	SER	-	linker	UNP A7UQX3
G	83	LEU	-	linker	UNP A7UQX3
H	1	MET	-	expression tag	UNP A7UQX3
H	2	HIS	-	expression tag	UNP A7UQX3

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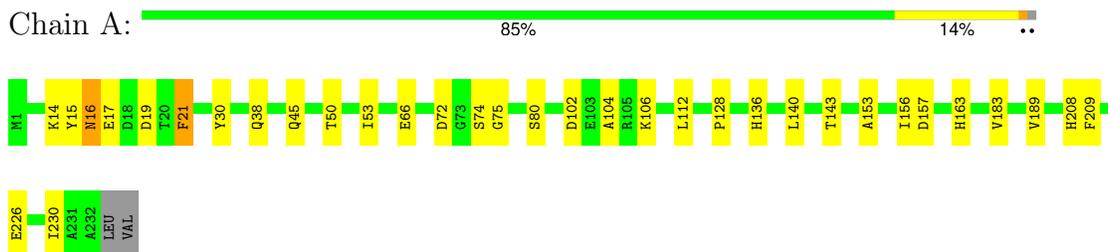
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Chain	Residue	Modelled	Actual	Comment	Reference
H	73	GLY	-	linker	UNP A7UQX3
H	74	SER	-	linker	UNP A7UQX3
H	75	GLY	-	linker	UNP A7UQX3
H	76	SER	-	linker	UNP A7UQX3
H	77	GLY	-	linker	UNP A7UQX3
H	78	SER	-	linker	UNP A7UQX3
H	79	GLY	-	linker	UNP A7UQX3
H	80	SER	-	linker	UNP A7UQX3
H	81	GLY	-	linker	UNP A7UQX3
H	82	SER	-	linker	UNP A7UQX3
H	83	LEU	-	linker	UNP A7UQX3
I	1	MET	-	expression tag	UNP A7UQX3
I	2	HIS	-	expression tag	UNP A7UQX3
I	73	GLY	-	linker	UNP A7UQX3
I	74	SER	-	linker	UNP A7UQX3
I	75	GLY	-	linker	UNP A7UQX3
I	76	SER	-	linker	UNP A7UQX3
I	77	GLY	-	linker	UNP A7UQX3
I	78	SER	-	linker	UNP A7UQX3
I	79	GLY	-	linker	UNP A7UQX3
I	80	SER	-	linker	UNP A7UQX3
I	81	GLY	-	linker	UNP A7UQX3
I	82	SER	-	linker	UNP A7UQX3
I	83	LEU	-	linker	UNP A7UQX3
J	1	MET	-	expression tag	UNP A7UQX3
J	2	HIS	-	expression tag	UNP A7UQX3
J	73	GLY	-	linker	UNP A7UQX3
J	74	SER	-	linker	UNP A7UQX3
J	75	GLY	-	linker	UNP A7UQX3
J	76	SER	-	linker	UNP A7UQX3
J	77	GLY	-	linker	UNP A7UQX3
J	78	SER	-	linker	UNP A7UQX3
J	79	GLY	-	linker	UNP A7UQX3
J	80	SER	-	linker	UNP A7UQX3
J	81	GLY	-	linker	UNP A7UQX3
J	82	SER	-	linker	UNP A7UQX3
J	83	LEU	-	linker	UNP A7UQX3

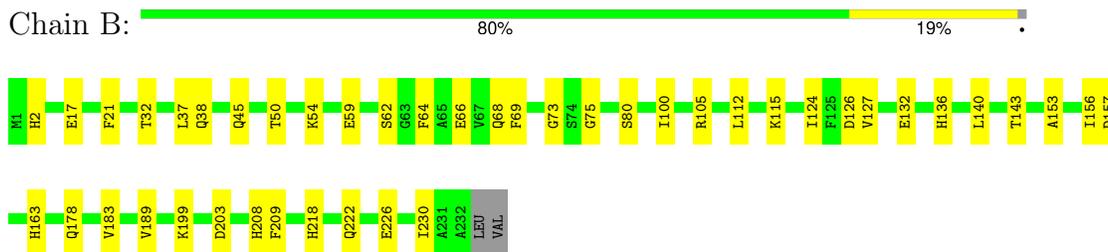
### 3 Residue-property plots [i](#)

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. 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. 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.

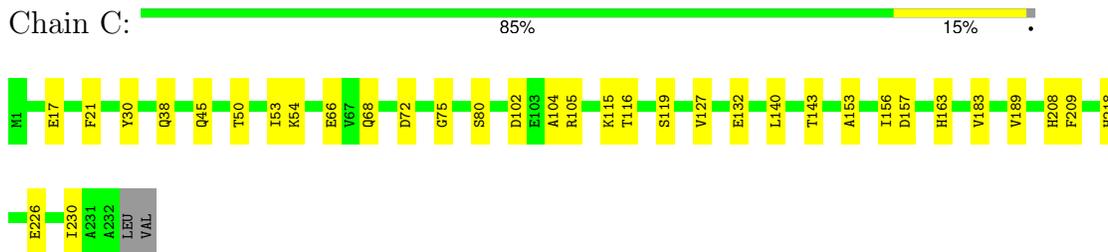
- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2



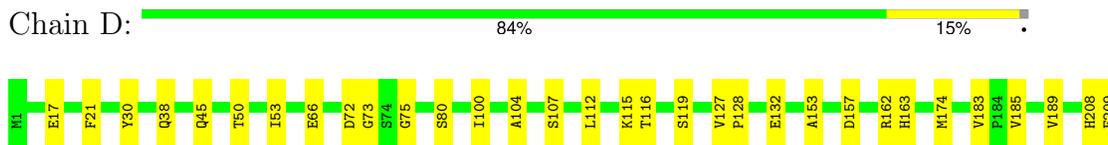
- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2



- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2



- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2





- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2

Chain E: 84% 15%



- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2

Chain F: 84% 15%



- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2

Chain G: 84% 15%



- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2

Chain H: 80% 19%



- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2

Chain I: 83% 15%





- Molecule 1: Shiga toxin II subunit B,6,7-dimethyl-8-ribityllumazine synthase 2

Chain J: 86% 13%



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, D5	Depositor
Number of particles used	96992	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	42.7	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	130000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor

## 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	0.22	0/1824	0.36	0/2467
1	B	0.13	0/1824	0.30	0/2467
1	C	0.12	0/1824	0.28	0/2467
1	D	0.12	0/1824	0.29	0/2467
1	E	0.13	0/1824	0.29	0/2467
1	F	0.12	0/1824	0.27	0/2467
1	G	0.16	0/1824	0.31	0/2467
1	H	0.13	0/1824	0.29	0/2467
1	I	0.22	0/1824	0.37	0/2467
1	J	0.13	0/1824	0.29	0/2467
All	All	0.16	0/18240	0.31	0/24670

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	1783	0	1735	25	0
1	B	1783	0	1735	30	0
1	C	1783	0	1735	22	0
1	D	1783	0	1735	24	0
1	E	1783	0	1735	23	0
1	F	1783	0	1735	22	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	G	1783	0	1735	21	0
1	H	1783	0	1735	30	0
1	I	1783	0	1735	28	0
1	J	1783	0	1735	18	0
All	All	17830	0	17350	206	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 6.

All (206) 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:A:16:ASN:HA	1:B:66:GLU:HG3	1.45	0.97
1:H:66:GLU:HG3	1:I:16:ASN:HA	1.45	0.95
1:D:127:VAL:CG1	1:D:132:GLU:HB2	2.17	0.74
1:F:127:VAL:CG1	1:F:132:GLU:HB2	2.17	0.74
1:C:45:GLN:HE21	1:D:72:ASP:H	1.33	0.74
1:B:45:GLN:HE21	1:C:72:ASP:H	1.37	0.72
1:B:127:VAL:CG1	1:B:132:GLU:HB2	2.19	0.72
1:H:68:GLN:HB2	1:I:14:LYS:HG3	1.72	0.71
1:G:72:ASP:H	1:H:45:GLN:HE21	1.38	0.71
1:F:45:GLN:HE21	1:J:72:ASP:H	1.36	0.71
1:A:128:PRO:HG3	1:B:222:GLN:HG2	1.75	0.69
1:C:127:VAL:CG1	1:C:132:GLU:HB2	2.23	0.68
1:H:222:GLN:HG2	1:I:128:PRO:HG3	1.75	0.68
1:G:127:VAL:CG1	1:G:132:GLU:HB2	2.24	0.68
1:H:37:LEU:HD21	1:I:15:TYR:CE2	2.29	0.67
1:H:127:VAL:CG1	1:H:132:GLU:HB2	2.26	0.66
1:H:105:ARG:HD2	1:H:124:ILE:HD13	1.77	0.66
1:B:105:ARG:HD2	1:B:124:ILE:HD13	1.77	0.66
1:A:15:TYR:CE2	1:B:37:LEU:HD21	2.31	0.66
1:F:80:SER:HA	1:F:183:VAL:HG22	1.80	0.64
1:D:80:SER:HA	1:D:183:VAL:HG22	1.80	0.63
1:D:45:GLN:HE22	1:E:69:PHE:HB2	1.63	0.63
1:A:14:LYS:HE3	1:B:54:LYS:HE2	1.81	0.63
1:D:127:VAL:HG13	1:D:132:GLU:HB2	1.83	0.61
1:E:100:ILE:HG22	1:E:209:PHE:CD2	2.36	0.60
1:F:127:VAL:HG13	1:F:132:GLU:HB2	1.83	0.59
1:G:50:THR:HG23	1:G:75:GLY:H	1.67	0.59
1:A:15:TYR:CE1	1:A:19:ASP:HA	2.38	0.58
1:I:15:TYR:CE1	1:I:19:ASP:HA	2.38	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:50:THR:HG23	1:E:75:GLY:H	1.69	0.58
1:B:45:GLN:NE2	1:C:72:ASP:H	2.01	0.58
1:G:72:ASP:H	1:H:45:GLN:NE2	2.01	0.57
1:B:50:THR:HG23	1:B:75:GLY:H	1.68	0.57
1:H:115:LYS:HZ1	1:H:218:HIS:CD2	2.23	0.57
1:J:50:THR:HG23	1:J:75:GLY:H	1.69	0.57
1:C:50:THR:HG23	1:C:75:GLY:H	1.69	0.57
1:H:80:SER:HA	1:H:183:VAL:HG22	1.87	0.56
1:B:127:VAL:HG13	1:B:132:GLU:HB2	1.86	0.56
1:F:153:ALA:HB3	1:F:189:VAL:HG12	1.87	0.56
1:A:72:ASP:H	1:E:45:GLN:HE21	1.53	0.56
1:D:50:THR:HG23	1:D:75:GLY:H	1.70	0.56
1:C:45:GLN:NE2	1:D:72:ASP:H	2.04	0.55
1:F:50:THR:HG23	1:F:75:GLY:H	1.70	0.55
1:B:80:SER:HA	1:B:183:VAL:HG22	1.87	0.55
1:G:102:ASP:OD1	1:G:105:ARG:NH2	2.24	0.55
1:G:66:GLU:HB2	1:H:17:GLU:HG3	1.87	0.55
1:I:72:ASP:H	1:J:45:GLN:HE21	1.54	0.55
1:B:17:GLU:HG3	1:C:66:GLU:HB2	1.88	0.55
1:D:153:ALA:HB3	1:D:189:VAL:HG12	1.87	0.55
1:H:66:GLU:HB2	1:I:17:GLU:HG3	1.89	0.55
1:H:54:LYS:HE2	1:I:14:LYS:HE3	1.88	0.54
1:F:17:GLU:HG3	1:J:66:GLU:HB2	1.87	0.54
1:B:115:LYS:HZ1	1:B:218:HIS:CD2	2.24	0.54
1:C:17:GLU:HG3	1:D:66:GLU:HB2	1.89	0.54
1:A:17:GLU:HG3	1:B:66:GLU:HB2	1.89	0.54
1:A:66:GLU:HB2	1:E:17:GLU:HG3	1.89	0.53
1:A:80:SER:HA	1:A:183:VAL:HG22	1.90	0.53
1:I:66:GLU:HB2	1:J:17:GLU:HG3	1.91	0.52
1:A:50:THR:HG23	1:A:75:GLY:H	1.74	0.52
1:I:50:THR:HG23	1:I:75:GLY:H	1.74	0.52
1:D:17:GLU:HG3	1:E:66:GLU:HB2	1.90	0.52
1:F:66:GLU:HB2	1:G:17:GLU:HG3	1.91	0.52
1:G:153:ALA:HB3	1:G:189:VAL:HG12	1.91	0.52
1:H:50:THR:HG23	1:H:75:GLY:H	1.75	0.52
1:H:1:MET:HA	1:I:14:LYS:HZ2	1.74	0.51
1:G:127:VAL:HG13	1:G:132:GLU:HB2	1.93	0.51
1:I:80:SER:HA	1:I:183:VAL:HG22	1.91	0.51
1:C:153:ALA:HB3	1:C:189:VAL:HG12	1.91	0.51
1:B:153:ALA:HB3	1:B:189:VAL:HG12	1.93	0.51
1:H:21:PHE:HB2	1:H:38:GLN:HG2	1.92	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:127:VAL:HG13	1:C:132:GLU:HB2	1.92	0.50
1:B:59:GLU:HG2	1:B:62:SER:HB3	1.92	0.50
1:H:59:GLU:HG2	1:H:62:SER:HB3	1.93	0.50
1:E:199:LYS:HD2	1:E:199:LYS:O	2.12	0.50
1:H:153:ALA:HB3	1:H:189:VAL:HG12	1.93	0.49
1:H:127:VAL:HG13	1:H:132:GLU:HB2	1.95	0.49
1:A:30:TYR:CG	1:A:53:ILE:HG21	2.47	0.49
1:J:199:LYS:HD2	1:J:199:LYS:O	2.12	0.49
1:A:17:GLU:CD	1:B:66:GLU:HB2	2.37	0.49
1:I:30:TYR:CG	1:I:53:ILE:HG21	2.48	0.49
1:F:30:TYR:CG	1:F:53:ILE:HG21	2.48	0.49
1:C:102:ASP:OD1	1:C:105:ARG:NH2	2.24	0.48
1:B:21:PHE:HB2	1:B:38:GLN:HG2	1.95	0.48
1:D:30:TYR:CG	1:D:53:ILE:HG21	2.48	0.48
1:G:54:LYS:NZ	1:G:68:GLN:HB3	2.29	0.48
1:E:30:TYR:CG	1:E:53:ILE:HG21	2.48	0.48
1:C:30:TYR:CG	1:C:53:ILE:HG21	2.49	0.48
1:C:104:ALA:HB2	1:C:209:PHE:HD2	1.79	0.48
1:G:80:SER:HA	1:G:183:VAL:HG22	1.96	0.48
1:J:80:SER:HA	1:J:183:VAL:HG22	1.96	0.47
1:C:80:SER:HA	1:C:183:VAL:HG22	1.96	0.47
1:G:104:ALA:HB2	1:G:209:PHE:HD2	1.79	0.47
1:E:80:SER:HA	1:E:183:VAL:HG22	1.96	0.47
1:D:115:LYS:HZ2	1:D:218:HIS:CD2	2.32	0.47
1:G:30:TYR:CG	1:G:53:ILE:HG21	2.48	0.47
1:H:66:GLU:HB2	1:I:17:GLU:CD	2.39	0.47
1:F:174:MET:HG2	1:F:185:VAL:HG11	1.95	0.47
1:C:54:LYS:NZ	1:C:68:GLN:HB3	2.29	0.47
1:E:142:ARG:HG3	1:E:142:ARG:HH11	1.80	0.47
1:A:19:ASP:O	1:A:38:GLN:NE2	2.49	0.46
1:B:199:LYS:NZ	1:B:203:ASP:OD2	2.49	0.46
1:J:30:TYR:CG	1:J:53:ILE:HG21	2.50	0.46
1:J:226:GLU:O	1:J:230:ILE:HG23	2.15	0.46
1:D:174:MET:HG2	1:D:185:VAL:HG11	1.96	0.46
1:F:115:LYS:HZ2	1:F:218:HIS:CD2	2.33	0.46
1:H:226:GLU:O	1:H:230:ILE:HG23	2.16	0.46
1:E:226:GLU:O	1:E:230:ILE:HG23	2.15	0.46
1:B:226:GLU:O	1:B:230:ILE:HG23	2.16	0.46
1:H:69:PHE:HB2	1:I:45:GLN:HE22	1.80	0.46
1:J:50:THR:H	1:J:73:GLY:HA3	1.80	0.46
1:J:100:ILE:HG22	1:J:209:PHE:CG	2.50	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:J:142:ARG:HG3	1:J:142:ARG:HH11	1.80	0.46
1:H:164:ASP:OD2	1:I:162:ARG:NH1	2.42	0.45
1:A:157:ASP:HB2	1:A:163:HIS:CE1	2.51	0.45
1:C:140:LEU:O	1:C:143:THR:HG22	2.17	0.45
1:E:112:LEU:HD13	1:E:112:LEU:HA	1.84	0.45
1:G:226:GLU:O	1:G:230:ILE:HG23	2.16	0.45
1:I:140:LEU:O	1:I:143:THR:HG22	2.17	0.45
1:A:226:GLU:O	1:A:230:ILE:HG23	2.17	0.45
1:F:226:GLU:O	1:F:230:ILE:HG23	2.17	0.45
1:D:226:GLU:O	1:D:230:ILE:HG23	2.17	0.45
1:G:140:LEU:O	1:G:143:THR:HG22	2.17	0.45
1:C:226:GLU:O	1:C:230:ILE:HG23	2.16	0.45
1:I:157:ASP:HB2	1:I:163:HIS:CE1	2.51	0.45
1:D:162:ARG:NH1	1:E:164:ASP:OD2	2.45	0.45
1:I:226:GLU:O	1:I:230:ILE:HG23	2.17	0.45
1:D:112:LEU:O	1:D:116:THR:OG1	2.32	0.45
1:D:157:ASP:HB2	1:D:163:HIS:CE1	2.52	0.45
1:I:19:ASP:O	1:I:38:GLN:NE2	2.50	0.45
1:A:140:LEU:O	1:A:143:THR:HG22	2.17	0.44
1:H:32:THR:HG22	1:H:64:PHE:O	2.17	0.44
1:D:107:SER:OG	1:D:210:LYS:HG2	2.17	0.44
1:B:157:ASP:HB2	1:B:163:HIS:CE1	2.52	0.44
1:C:157:ASP:HB2	1:C:163:HIS:CE1	2.52	0.44
1:F:107:SER:OG	1:F:210:LYS:HG2	2.17	0.44
1:E:100:ILE:HG22	1:E:209:PHE:CG	2.52	0.44
1:A:17:GLU:C	1:A:19:ASP:H	2.26	0.44
1:F:157:ASP:HB2	1:F:163:HIS:CE1	2.52	0.44
1:G:157:ASP:HB2	1:G:163:HIS:CE1	2.52	0.44
1:H:140:LEU:O	1:H:143:THR:HG22	2.17	0.44
1:G:112:LEU:HD23	1:G:112:LEU:HA	1.80	0.44
1:B:140:LEU:O	1:B:143:THR:HG22	2.17	0.44
1:H:157:ASP:HB2	1:H:163:HIS:CE1	2.52	0.44
1:F:128:PRO:HD2	1:F:132:GLU:HG3	2.00	0.43
1:D:128:PRO:HD2	1:D:132:GLU:HG3	2.00	0.43
1:F:116:THR:HB	1:F:119:SER:HB2	2.01	0.43
1:J:115:LYS:HZ1	1:J:218:HIS:CE1	2.37	0.43
1:B:2:HIS:HB3	1:B:54:LYS:HD3	2.00	0.43
1:J:54:LYS:NZ	1:J:68:GLN:HB3	2.34	0.43
1:A:14:LYS:HG3	1:B:68:GLN:HB2	2.00	0.43
1:D:104:ALA:HB2	1:D:209:PHE:HD2	1.84	0.43
1:B:50:THR:H	1:B:73:GLY:HA3	1.83	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:100:ILE:HG22	1:B:209:PHE:CG	2.54	0.43
1:I:12:PHE:CE2	1:I:14:LYS:HB2	2.54	0.43
1:I:17:GLU:C	1:I:19:ASP:H	2.26	0.43
1:E:100:ILE:CG2	1:E:209:PHE:CG	3.02	0.43
1:E:157:ASP:HB2	1:E:163:HIS:CE1	2.54	0.43
1:H:100:ILE:HG22	1:H:209:PHE:CG	2.54	0.43
1:H:43:SER:O	1:H:47:THR:HG23	2.19	0.42
1:D:21:PHE:HB2	1:D:38:GLN:HG2	2.00	0.42
1:F:112:LEU:O	1:F:116:THR:OG1	2.32	0.42
1:F:18:ASP:OD1	1:F:20:THR:OG1	2.31	0.42
1:J:153:ALA:HB3	1:J:189:VAL:HG12	2.02	0.42
1:D:116:THR:HB	1:D:119:SER:HB2	2.00	0.42
1:I:104:ALA:HB2	1:I:209:PHE:HD2	1.84	0.42
1:C:115:LYS:HZ2	1:C:218:HIS:CD2	2.38	0.42
1:D:100:ILE:HG22	1:D:209:PHE:CG	2.55	0.42
1:E:115:LYS:HZ2	1:E:218:HIS:CD2	2.38	0.42
1:F:104:ALA:HB2	1:F:209:PHE:HD2	1.84	0.42
1:B:32:THR:HG22	1:B:64:PHE:O	2.20	0.42
1:C:156:ILE:HD13	1:C:156:ILE:HA	1.91	0.42
1:A:50:THR:OG1	1:A:74:SER:N	2.51	0.42
1:G:52:THR:HB	1:G:54:LYS:HZ2	1.85	0.42
1:J:157:ASP:HB2	1:J:163:HIS:CE1	2.54	0.42
1:B:156:ILE:HD13	1:B:156:ILE:HA	1.84	0.42
1:F:100:ILE:HG22	1:F:209:PHE:CG	2.55	0.42
1:H:156:ILE:HD13	1:H:156:ILE:HA	1.84	0.42
1:A:45:GLN:HE22	1:B:69:PHE:HB2	1.84	0.41
1:B:126:ASP:C	1:B:127:VAL:HG23	2.45	0.41
1:F:50:THR:H	1:F:73:GLY:HA3	1.85	0.41
1:C:21:PHE:HB2	1:C:38:GLN:HG2	2.01	0.41
1:E:18:ASP:OD1	1:E:20:THR:OG1	2.31	0.41
1:I:49:MET:HG3	1:I:73:GLY:HA3	2.02	0.41
1:A:102:ASP:O	1:A:106:LYS:HG3	2.21	0.41
1:E:21:PHE:HB2	1:E:38:GLN:HG2	2.02	0.41
1:J:21:PHE:HB2	1:J:38:GLN:HG2	2.01	0.41
1:A:104:ALA:HB2	1:A:209:PHE:HD2	1.85	0.41
1:G:21:PHE:HB2	1:G:38:GLN:HG2	2.02	0.41
1:I:15:TYR:HB2	1:I:21:PHE:CE1	2.55	0.41
1:D:50:THR:H	1:D:73:GLY:HA3	1.85	0.41
1:G:59:GLU:HG2	1:G:62:SER:HB3	2.02	0.41
1:E:153:ALA:HB3	1:E:189:VAL:HG12	2.02	0.41
1:H:2:HIS:HB3	1:H:54:LYS:HD3	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:I:43:SER:O	1:I:47:THR:HG23	2.20	0.41
1:A:15:TYR:HB2	1:A:21:PHE:CE1	2.56	0.41
1:A:153:ALA:HB3	1:A:189:VAL:HG12	2.03	0.40
1:E:198:SER:C	1:E:200:GLU:H	2.30	0.40
1:G:116:THR:HB	1:G:119:SER:HB2	2.04	0.40
1:I:54:LYS:HB2	1:I:66:GLU:HB3	2.03	0.40
1:A:156:ILE:HD13	1:A:156:ILE:HA	1.92	0.40
1:C:116:THR:HB	1:C:119:SER:HB2	2.03	0.40
1:E:156:ILE:HD13	1:E:156:ILE:HA	1.96	0.40
1:I:153:ALA:HB3	1:I:189:VAL:HG12	2.03	0.40
1:E:50:THR:H	1:E:73:GLY:HA3	1.87	0.40
1:F:2:HIS:CE1	1:F:54:LYS:HB3	2.57	0.40
1:J:54:LYS:HZ1	1:J:68:GLN:HB3	1.86	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 PDB entries followed by that with respect to all EM entries.

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	230/234 (98%)	221 (96%)	9 (4%)	0	100	100
1	B	230/234 (98%)	222 (96%)	8 (4%)	0	100	100
1	C	230/234 (98%)	223 (97%)	7 (3%)	0	100	100
1	D	230/234 (98%)	222 (96%)	8 (4%)	0	100	100
1	E	230/234 (98%)	221 (96%)	9 (4%)	0	100	100
1	F	230/234 (98%)	221 (96%)	9 (4%)	0	100	100
1	G	230/234 (98%)	221 (96%)	9 (4%)	0	100	100
1	H	230/234 (98%)	222 (96%)	8 (4%)	0	100	100
1	I	230/234 (98%)	219 (95%)	11 (5%)	0	100	100
1	J	230/234 (98%)	222 (96%)	8 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	2300/2340 (98%)	2214 (96%)	86 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 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 PDB entries followed by that with respect to all EM entries.

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	186/188 (99%)	181 (97%)	5 (3%)	40	69
1	B	186/188 (99%)	182 (98%)	4 (2%)	47	74
1	C	186/188 (99%)	185 (100%)	1 (0%)	86	94
1	D	186/188 (99%)	185 (100%)	1 (0%)	86	94
1	E	186/188 (99%)	182 (98%)	4 (2%)	47	74
1	F	186/188 (99%)	185 (100%)	1 (0%)	86	94
1	G	186/188 (99%)	184 (99%)	2 (1%)	70	86
1	H	186/188 (99%)	182 (98%)	4 (2%)	47	74
1	I	186/188 (99%)	181 (97%)	5 (3%)	40	69
1	J	186/188 (99%)	182 (98%)	4 (2%)	47	74
All	All	1860/1880 (99%)	1829 (98%)	31 (2%)	56	80

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	16	ASN
1	A	21	PHE
1	A	112	LEU
1	A	136	HIS
1	A	208	HIS
1	B	112	LEU
1	B	136	HIS
1	B	178	GLN
1	B	208	HIS

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Mol	Chain	Res	Type
1	C	208	HIS
1	D	208	HIS
1	E	112	LEU
1	E	136	HIS
1	E	178	GLN
1	E	208	HIS
1	F	208	HIS
1	G	85	THR
1	G	208	HIS
1	H	112	LEU
1	H	136	HIS
1	H	178	GLN
1	H	208	HIS
1	I	16	ASN
1	I	21	PHE
1	I	112	LEU
1	I	136	HIS
1	I	208	HIS
1	J	112	LEU
1	J	136	HIS
1	J	178	GLN
1	J	208	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	178	GLN
1	B	163	HIS
1	C	136	HIS
1	D	178	GLN
1	F	68	GLN
1	F	178	GLN
1	G	97	HIS
1	G	136	HIS
1	H	163	HIS
1	I	68	GLN
1	I	163	HIS
1	I	178	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 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.