



wwPDB EM Validation Summary Report ⓘ

Jul 16, 2025 – 12:29 PM JST

PDB ID : 8XA3 / pdb_00008xa3
EMDB ID : EMD-38193
Title : C-hexon capsomer of the VZV B-Capsid
Authors : Wang, N.; Cao, L.; Wang, X.
Deposited on : 2023-12-01
Resolution : 3.70 Å(reported)

This is a wwPDB EM Validation Summary 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/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>.

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 Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

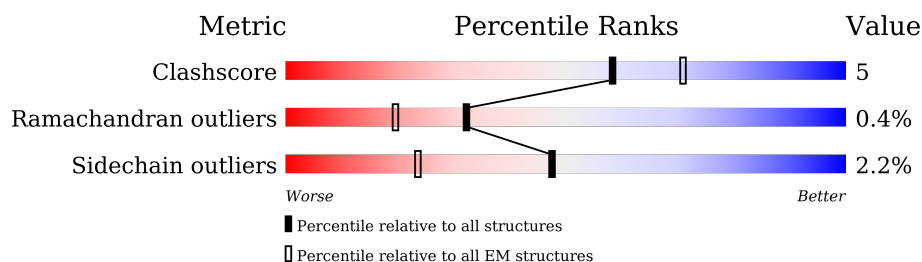
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.70 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)	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 ≥ 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	1381	87% 13%
1	C	1381	87% 13% .
1	D	1381	86% 14%
1	E	1381	88% 12%
1	F	1381	84% 15%
1	H	1381	88% 12%
2	B	94	80% 18% .
2	G	94	81% 18% .
2	L	94	80% 19% .

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Mol	Chain	Length	Quality of chain
2	Q	94	 77% 21% •
2	V	94	 77% 23%
2	g	94	 85% 13% •
3	I	256	 90% 10%
3	K	256	 92% 8%
4	N	263	 89% 11%
4	P	263	 85% 15%
5	S	392	 85% 15% •
5	U	392	 83% 17% •

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 81795 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 Major capsid protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1381	Total 10675	C 6757	N 1870	O 1981	S 67	0	0
1	C	1381	Total 10675	C 6757	N 1870	O 1981	S 67	0	0
1	D	1381	Total 10680	C 6759	N 1873	O 1981	S 67	0	0
1	E	1381	Total 10675	C 6757	N 1870	O 1981	S 67	0	0
1	F	1381	Total 10675	C 6757	N 1870	O 1981	S 67	0	0
1	H	1381	Total 10675	C 6757	N 1870	O 1981	S 67	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	22	ILE	LEU	conflict	UNP Q6QCL5
A	814	ALA	GLY	conflict	UNP Q6QCL5
C	22	ILE	LEU	conflict	UNP Q6QCL5
C	814	ALA	GLY	conflict	UNP Q6QCL5
D	22	ILE	LEU	conflict	UNP Q6QCL5
D	814	ALA	GLY	conflict	UNP Q6QCL5
E	22	ILE	LEU	conflict	UNP Q6QCL5
E	814	ALA	GLY	conflict	UNP Q6QCL5
F	22	ILE	LEU	conflict	UNP Q6QCL5
F	814	ALA	GLY	conflict	UNP Q6QCL5
H	22	ILE	LEU	conflict	UNP Q6QCL5
H	814	ALA	GLY	conflict	UNP Q6QCL5

- Molecule 2 is a protein called Small capsomere-interacting protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	L	94	Total	C	N	O	S	0	0
			699	437	135	125	2		
2	G	94	Total	C	N	O	S	0	0
			699	437	135	125	2		
2	B	94	Total	C	N	O	S	0	0
			699	437	135	125	2		
2	g	94	Total	C	N	O	S	0	0
			699	437	135	125	2		
2	V	94	Total	C	N	O	S	0	0
			699	437	135	125	2		
2	Q	94	Total	C	N	O	S	0	0
			699	437	135	125	2		

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
L	95	ARG	LYS	conflict	UNP U5NQG6
G	95	ARG	LYS	conflict	UNP U5NQG6
B	95	ARG	LYS	conflict	UNP U5NQG6
g	95	ARG	LYS	conflict	UNP U5NQG6
V	95	ARG	LYS	conflict	UNP U5NQG6
Q	95	ARG	LYS	conflict	UNP U5NQG6

- Molecule 3 is a protein called Tri2A.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	I	256	Total	C	N	O	S	0	0
			1847	1191	315	333	8		
3	K	256	Total	C	N	O	S	0	0
			1847	1191	315	333	8		

- Molecule 4 is a protein called Tri2B.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	N	263	Total	C	N	O	S	0	0
			1975	1269	339	358	9		
4	P	263	Total	C	N	O	S	0	0
			1975	1269	339	358	9		

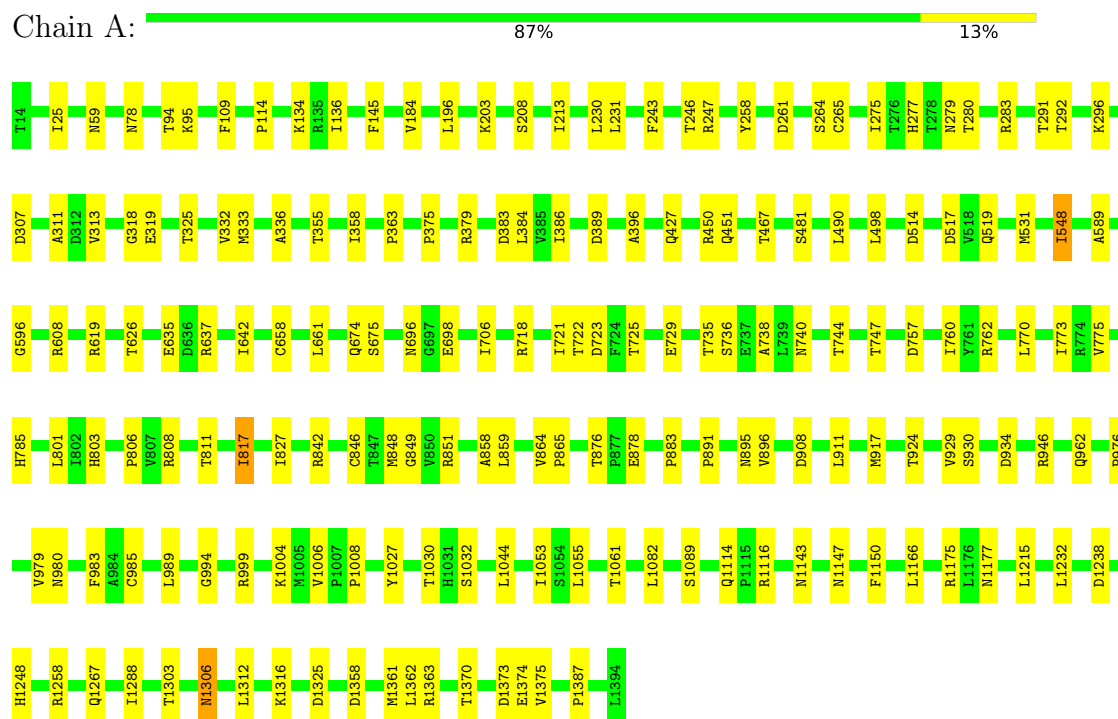
- Molecule 5 is a protein called Tri1.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	S	392	Total 2951	C 1854	N 552	O 529	S 16	0	0
5	U	392	Total 2951	C 1854	N 552	O 529	S 16	0	0

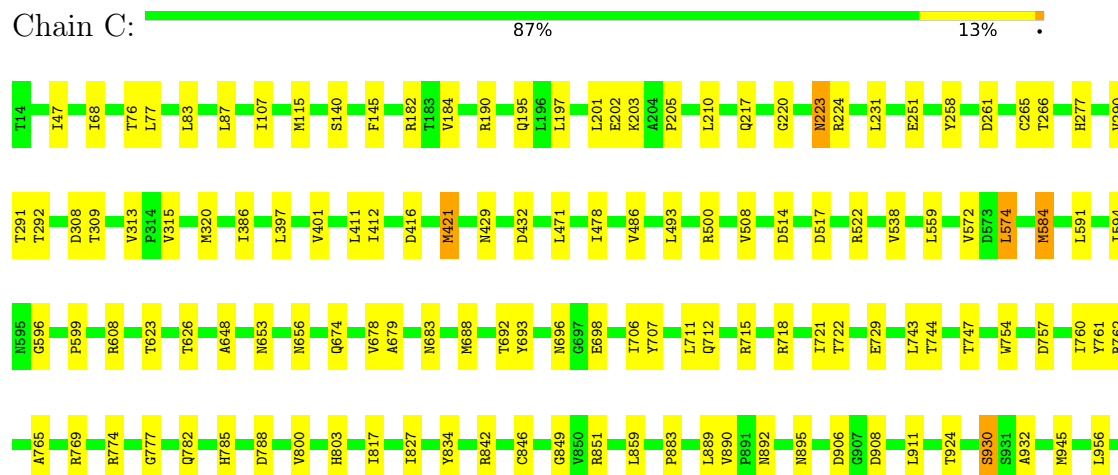
3 Residue-property plots

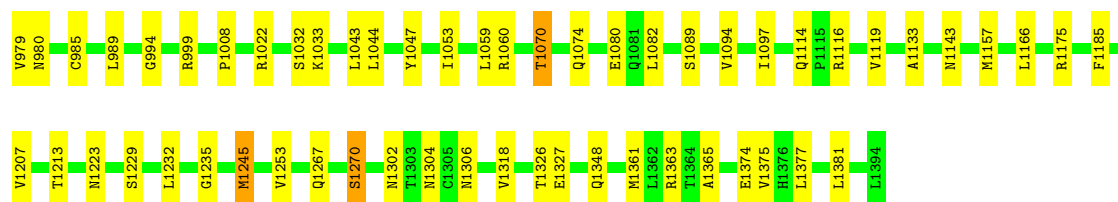
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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: Major capsid protein



- Molecule 1: Major capsid protein





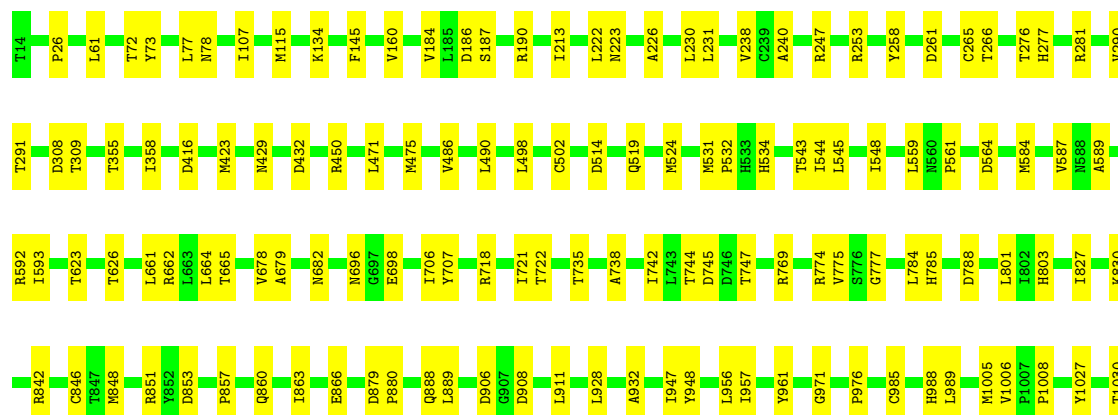
• Molecule 1: Major capsid protein

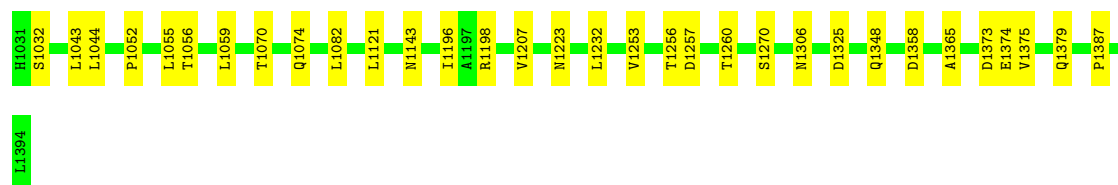
Chain D: 86% 14%



• Molecule 1: Major capsid protein

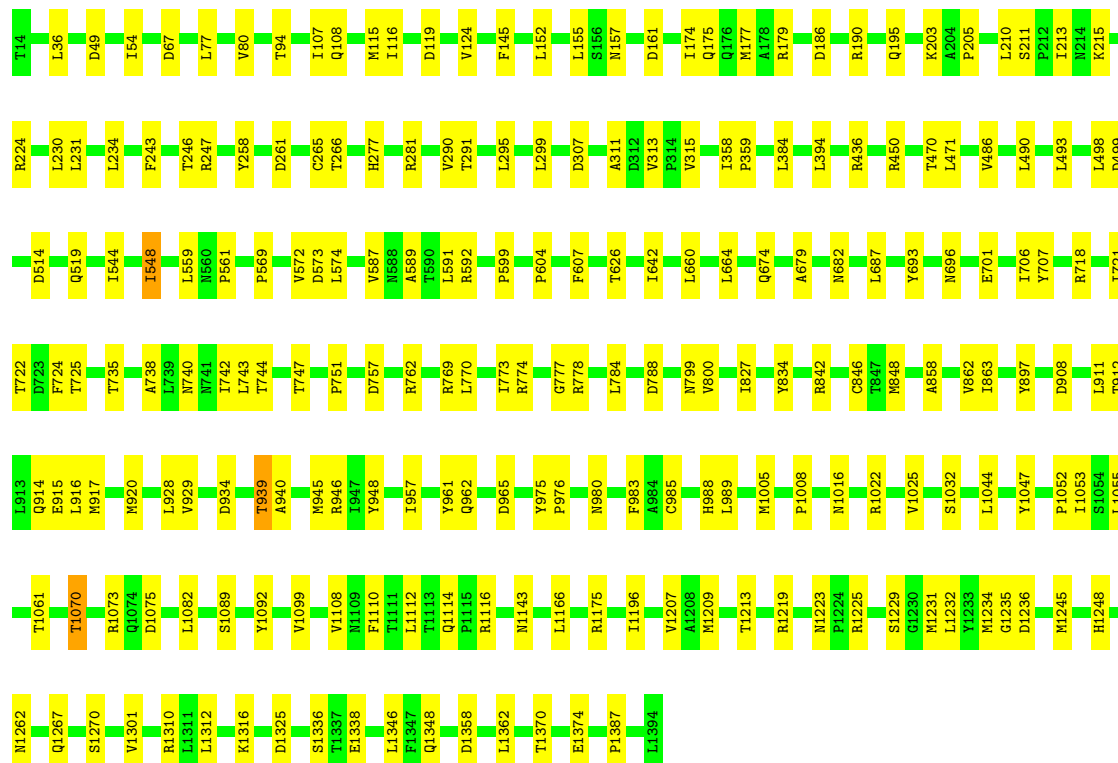
Chain E: 88% 12%





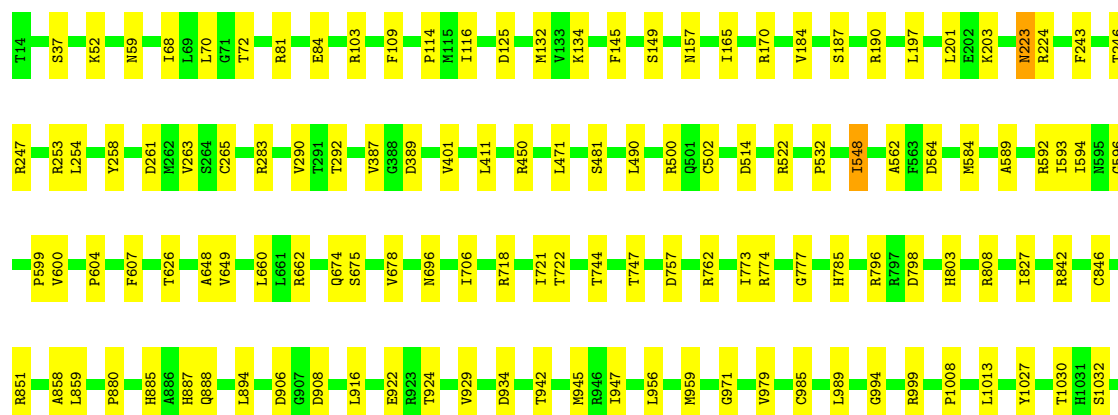
- Molecule 1: Major capsid protein

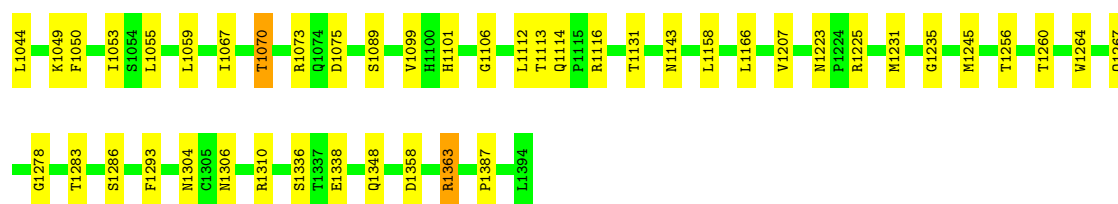
Chain F: 84% 15%



- Molecule 1: Major capsid protein

Chain H: 88% 12%





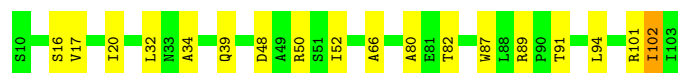
- Molecule 2: Small capsomere-interacting protein

Chain L: 80% 19%



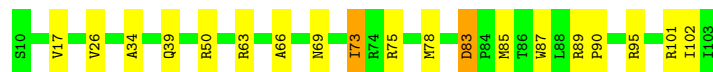
- Molecule 2: Small capsomere-interacting protein

Chain G: 81% 18%



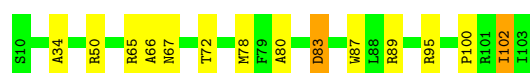
- Molecule 2: Small capsomere-interacting protein

Chain B: 80% 18%



- Molecule 2: Small capsomere-interacting protein

Chain g: 85% 13%



- Molecule 2: Small capsomere-interacting protein

Chain V: 77% 23%



- Molecule 2: Small capsomere-interacting protein

Chain Q: 77% 21%



- Molecule 3: Tri2A

Chain I:  90% 10%



• Molecule 3: Tri2A

Chain K:  92% 8%



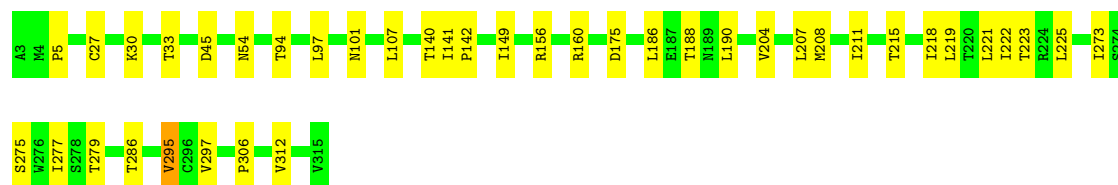
• Molecule 4: Tri2B

Chain N:  89% 11%



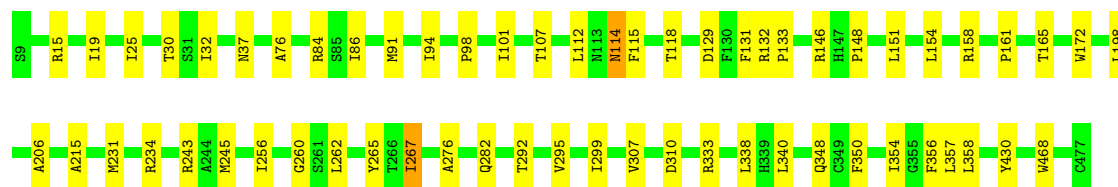
• Molecule 4: Tri2B

Chain P:  85% 15%



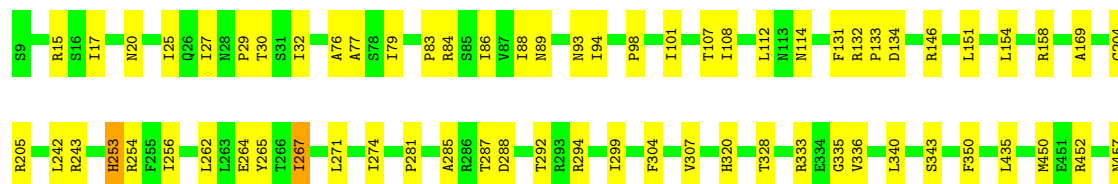
• Molecule 5: Tri1

Chain S:  85% 15%



• Molecule 5: Tri1

Chain U:  83% 17%





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	1442742	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI POLARA 300	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K2 BASE (4k x 4k)	Depositor

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	0.19	0/10933	0.47	0/14911
1	C	0.18	0/10933	0.47	4/14911 (0.0%)
1	D	0.19	0/10938	0.49	2/14917 (0.0%)
1	E	0.19	0/10933	0.47	1/14911 (0.0%)
1	F	0.19	0/10933	0.47	2/14911 (0.0%)
1	H	0.19	0/10933	0.49	3/14911 (0.0%)
2	B	0.31	0/714	0.84	3/978 (0.3%)
2	G	0.33	0/714	0.93	5/978 (0.5%)
2	L	0.35	0/714	0.86	3/978 (0.3%)
2	Q	0.32	0/714	0.85	3/978 (0.3%)
2	V	0.35	0/714	0.85	1/978 (0.1%)
2	g	0.32	0/714	0.77	0/978
3	I	0.17	0/1878	0.45	0/2568
3	K	0.19	0/1878	0.52	0/2568
4	N	0.18	0/2010	0.43	0/2743
4	P	0.17	0/2010	0.45	0/2743
5	S	0.24	0/3008	0.59	0/4097
5	U	0.25	0/3008	0.60	2/4097 (0.0%)
All	All	0.20	0/83679	0.51	29/114156 (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	1
1	F	0	1
2	B	0	1
2	G	0	1
2	Q	0	1
All	All	0	5

There are no bond length outliers.

The worst 5 of 29 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	599	PRO	CA-C-N	9.23	126.05	120.24
1	C	599	PRO	C-N-CA	9.23	126.05	120.24
1	F	599	PRO	CA-C-N	8.98	125.90	120.24
1	F	599	PRO	C-N-CA	8.98	125.90	120.24
1	H	599	PRO	CA-C-N	8.95	125.88	120.24

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	25	ILE	Peptide
2	B	39	GLN	Peptide
1	F	573	ASP	Peptide
2	G	39	GLN	Peptide
2	Q	39	GLN	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	10675	0	10419	97	0
1	C	10675	0	10419	102	0
1	D	10680	0	10428	111	0
1	E	10675	0	10419	95	0
1	F	10675	0	10419	117	0
1	H	10675	0	10419	96	0
2	B	699	0	696	12	0
2	G	699	0	696	8	0
2	L	699	0	696	11	0
2	Q	699	0	696	12	0
2	V	699	0	696	13	0
2	g	699	0	696	9	0
3	I	1847	0	1851	13	0
3	K	1847	0	1851	13	0
4	N	1975	0	2031	15	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	P	1975	0	2031	21	0
5	S	2951	0	2928	34	0
5	U	2951	0	2928	43	0
All	All	81795	0	80319	733	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 5.

The worst 5 of 733 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:F:261:ASP:O	1:F:265:CYS:HB2	1.79	0.82
1:E:261:ASP:O	1:E:265:CYS:HB2	1.88	0.74
1:A:261:ASP:O	1:A:265:CYS:HB2	1.89	0.73
1:C:261:ASP:O	1:C:265:CYS:HB2	1.88	0.73
1:D:261:ASP:O	1:D:265:CYS:HB2	1.89	0.72

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	1379/1381 (100%)	1278 (93%)	101 (7%)	0	100	100
1	C	1379/1381 (100%)	1271 (92%)	108 (8%)	0	100	100
1	D	1379/1381 (100%)	1281 (93%)	97 (7%)	1 (0%)	48	78
1	E	1379/1381 (100%)	1276 (92%)	103 (8%)	0	100	100
1	F	1379/1381 (100%)	1261 (91%)	118 (9%)	0	100	100
1	H	1379/1381 (100%)	1268 (92%)	111 (8%)	0	100	100
2	B	92/94 (98%)	72 (78%)	17 (18%)	3 (3%)	3	26

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	G	92/94 (98%)	72 (78%)	18 (20%)	2 (2%)	5	32
2	L	92/94 (98%)	69 (75%)	19 (21%)	4 (4%)	2	20
2	Q	92/94 (98%)	70 (76%)	19 (21%)	3 (3%)	3	26
2	V	92/94 (98%)	72 (78%)	17 (18%)	3 (3%)	3	26
2	g	92/94 (98%)	71 (77%)	18 (20%)	3 (3%)	3	26
3	I	248/256 (97%)	234 (94%)	13 (5%)	1 (0%)	30	62
3	K	248/256 (97%)	232 (94%)	15 (6%)	1 (0%)	30	62
4	N	257/263 (98%)	238 (93%)	19 (7%)	0	100	100
4	P	257/263 (98%)	241 (94%)	16 (6%)	0	100	100
5	S	386/392 (98%)	322 (83%)	55 (14%)	9 (2%)	5	31
5	U	386/392 (98%)	320 (83%)	58 (15%)	8 (2%)	5	33
All	All	10608/10672 (99%)	9648 (91%)	922 (9%)	38 (0%)	32	62

5 of 38 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	L	46	ILE
2	L	66	ALA
2	L	102	ILE
5	S	267	ILE
5	U	267	ILE

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 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	1141/1168 (98%)	1123 (98%)	18 (2%)	58	74
1	C	1141/1168 (98%)	1107 (97%)	34 (3%)	36	58
1	D	1142/1168 (98%)	1114 (98%)	28 (2%)	42	62
1	E	1141/1168 (98%)	1123 (98%)	18 (2%)	58	74
1	F	1141/1168 (98%)	1116 (98%)	25 (2%)	47	65

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	H	1141/1168 (98%)	1124 (98%)	17 (2%)	60	75
2	B	69/73 (94%)	67 (97%)	2 (3%)	37	59
2	G	69/73 (94%)	65 (94%)	4 (6%)	17	44
2	L	69/73 (94%)	66 (96%)	3 (4%)	25	50
2	Q	69/73 (94%)	65 (94%)	4 (6%)	17	44
2	V	69/73 (94%)	66 (96%)	3 (4%)	25	50
2	g	69/73 (94%)	67 (97%)	2 (3%)	37	59
3	I	188/218 (86%)	184 (98%)	4 (2%)	48	67
3	K	188/218 (86%)	185 (98%)	3 (2%)	58	74
4	N	214/224 (96%)	207 (97%)	7 (3%)	33	57
4	P	214/224 (96%)	204 (95%)	10 (5%)	22	48
5	S	295/309 (96%)	291 (99%)	4 (1%)	62	76
5	U	295/309 (96%)	292 (99%)	3 (1%)	73	82
All	All	8655/8948 (97%)	8466 (98%)	189 (2%)	47	65

5 of 189 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	863	ILE
3	I	64	LEU
1	F	1016	ASN
1	H	481	SER
4	N	176	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 80 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	1329	GLN
4	N	143	GLN
1	F	1348	GLN
1	H	1037	ASN
4	P	143	GLN

5.3.3 RNA ⓘ

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
3	K	3
3	I	3
4	N	2
4	P	2
5	U	2
5	S	2

The worst 5 of 14 chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	N	226:LEU	C	266:ARG	N	28.83
1	P	226:LEU	C	266:ARG	N	28.15
1	K	236:LEU	C	244:VAL	N	20.36
1	I	236:LEU	C	244:VAL	N	20.15
1	K	260:MET	C	267:LEU	N	18.69