



Full wwPDB EM Validation Report ⓘ

Jul 15, 2025 – 08:21 PM JST

PDB ID : 8YH9 / pdb_00008yh9
EMDB ID : EMD-39285
Title : Type I-FHNN Cascade complex
Authors : Li, Z.
Deposited on : 2024-02-27
Resolution : 3.35 Å(reported)

This is a Full wwPDB EM 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/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

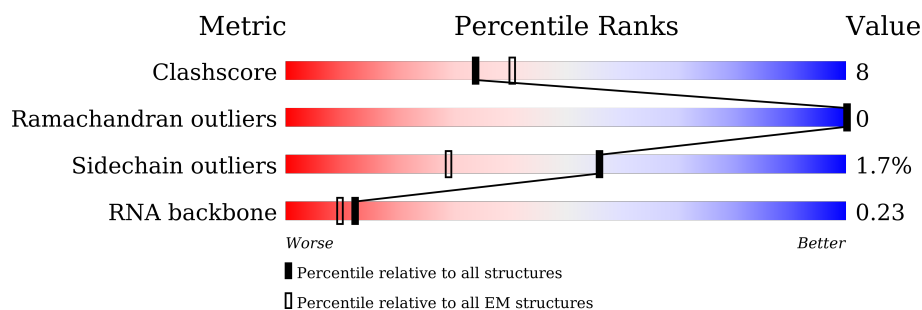
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.35 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
RNA backbone	6643	2191

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	255	74% 20% . .
2	B	181	73% 23% . .
3	C	60	42% 47% 12%
4	D	335	71% 16% . 13%
4	E	335	64% 23% . 12%
4	F	335	74% 15% 10%
4	G	335	75% 15% 10%
4	H	335	70% 18% 11%

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Mol	Chain	Length	Quality of chain
4	I	335	<div><div></div><div>68%</div><div>21%</div><div>10%</div></div>
5	J	344	<div><div></div><div>58%</div><div>13%</div><div>30%</div></div>

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 21153 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 Cas5f.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	245	Total	C	N	O	S	0	0
			1934	1235	324	361	14		

- Molecule 2 is a protein called Cas6f.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	175	Total	C	N	O	S	0	0
			1415	913	239	258	5		

- Molecule 3 is a RNA chain called 60-nt crRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	60	Total	C	N	O	P	0	0
			1287	577	240	411	59		

- Molecule 4 is a protein called Cas7f.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	I	302	Total	C	N	O	S	0	0
			2467	1581	407	466	13		
4	H	297	Total	C	N	O	S	0	0
			2423	1553	399	458	13		
4	G	302	Total	C	N	O	S	0	0
			2461	1576	407	465	13		
4	F	300	Total	C	N	O	S	0	0
			2447	1570	403	461	13		
4	E	294	Total	C	N	O	S	0	0
			2397	1539	393	452	13		
4	D	293	Total	C	N	O	S	0	0
			2393	1534	393	453	13		

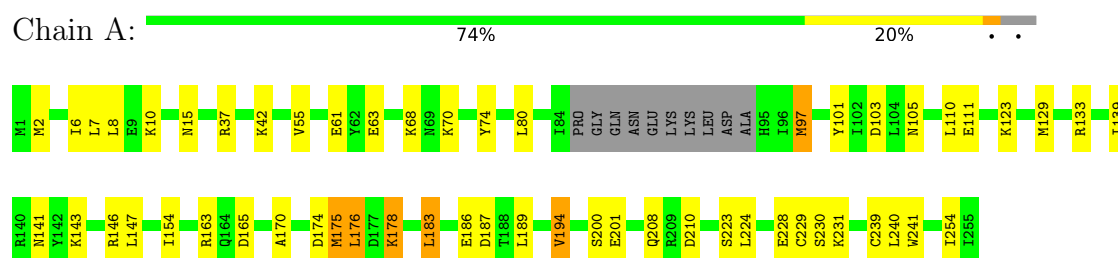
- Molecule 5 is a protein called Cas8f fusion with HNH.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	J	242	Total	C	N	O	S	0	0
			1929	1229	334	360	6		

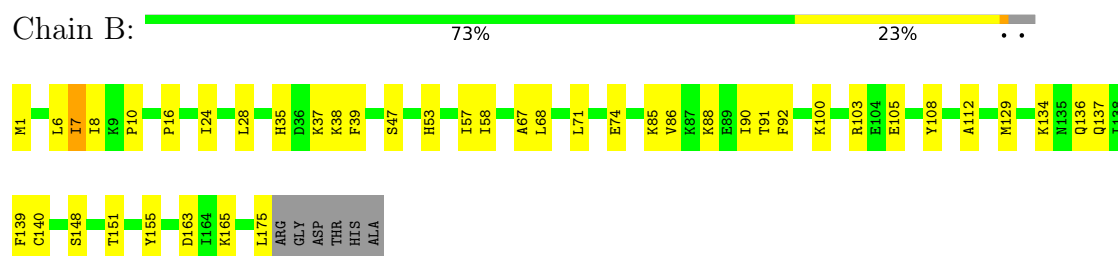
3 Residue-property plots

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.

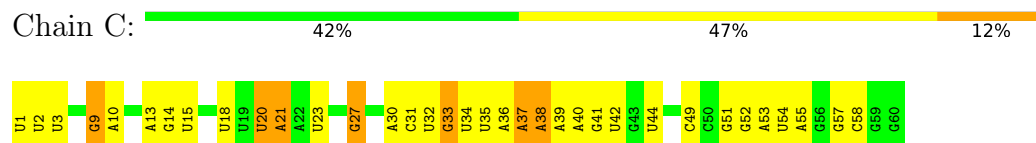
• Molecule 1: Cas5f



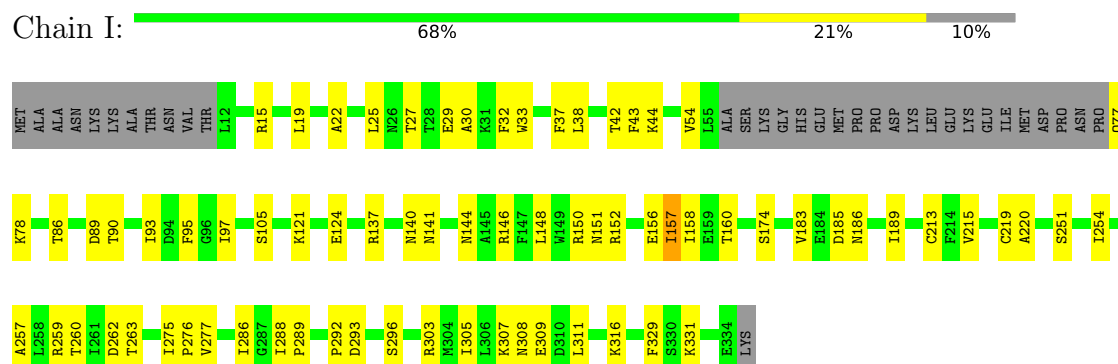
• Molecule 2: Cas6f



• Molecule 3: 60-nt crRNA

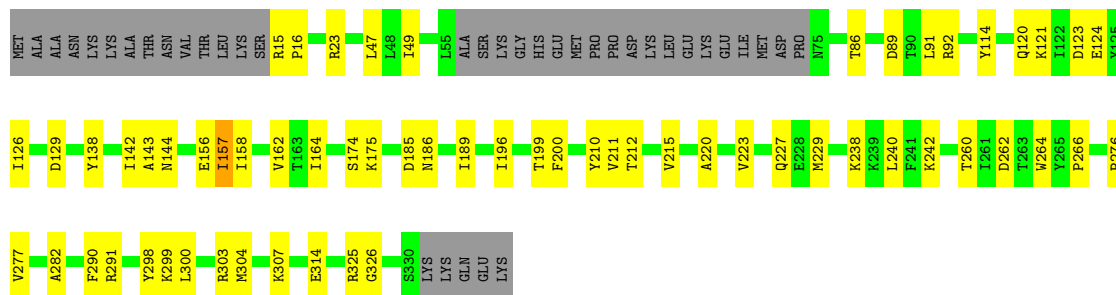


• Molecule 4: Cas7f




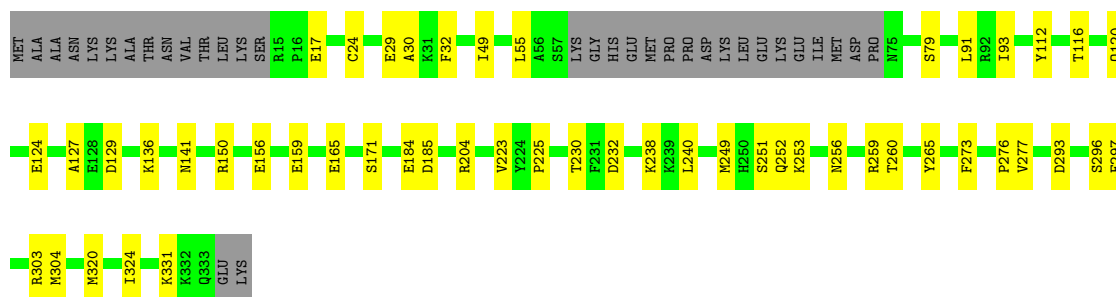
- Molecule 4: Cas7f

Chain H:  70% 18% 11%



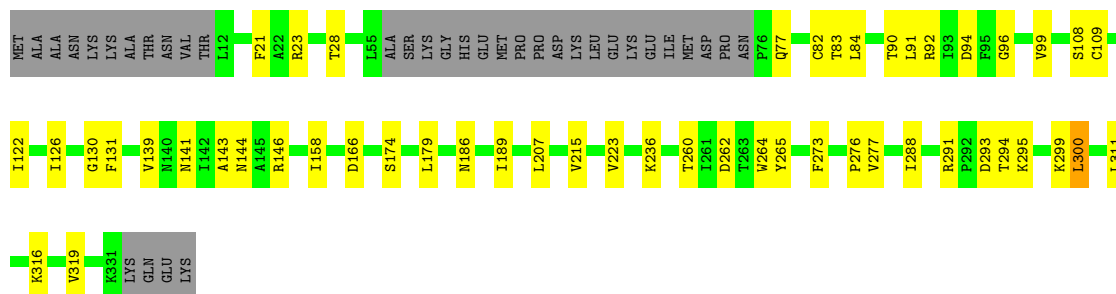
- Molecule 4: Cas7f

Chain G:  75% 15% 10%



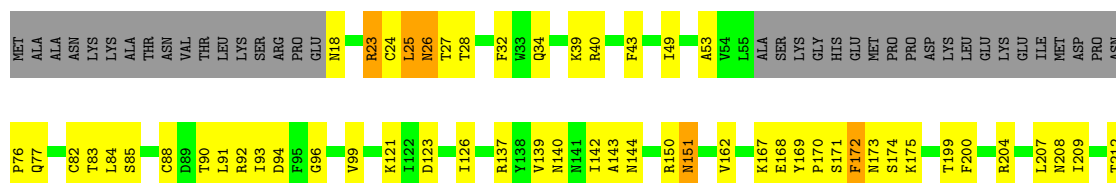
- Molecule 4: Cas7f

Chain F:  74% 15% 10%

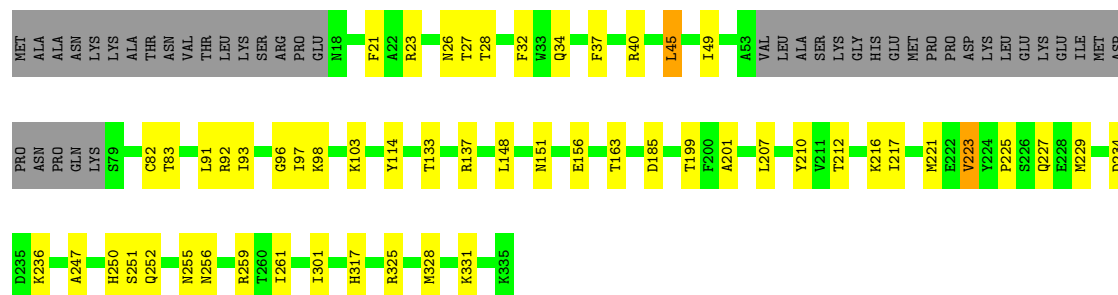


- Molecule 4: Cas7f

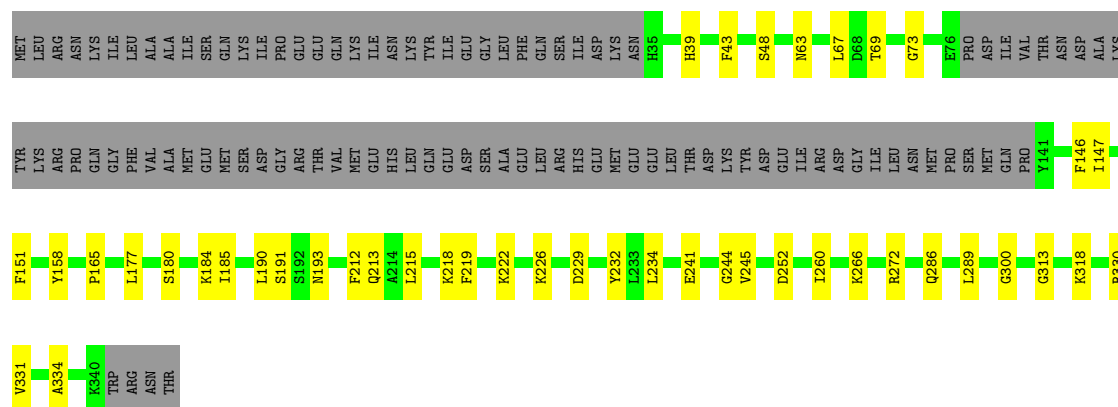
Chain E:  64% 23% 12%



- Molecule 4: Cas7f



- Molecule 5: Cas8f fusion with HNH



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	110316	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	54	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (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	0.19	0/1967	0.50	0/2650
2	B	0.16	0/1446	0.40	0/1945
3	C	0.17	0/1443	0.36	0/2250
4	D	0.17	0/2445	0.42	0/3299
4	E	0.21	0/2450	0.51	0/3308
4	F	0.19	0/2501	0.43	0/3376
4	G	0.18	0/2515	0.46	0/3396
4	H	0.18	0/2477	0.43	0/3347
4	I	0.18	0/2520	0.43	0/3400
5	J	0.18	0/1972	0.46	0/2668
All	All	0.18	0/21736	0.45	0/29639

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	1934	0	1953	43	0
2	B	1415	0	1437	27	0
3	C	1287	0	645	22	0
4	D	2393	0	2359	35	0
4	E	2397	0	2368	56	0
4	F	2447	0	2423	34	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	G	2461	0	2430	37	0
4	H	2423	0	2386	36	0
4	I	2467	0	2442	44	0
5	J	1929	0	1921	30	0
All	All	21153	0	20364	330	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 8.

All (330) 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)
4:F:300:LEU:HD11	4:F:319:VAL:HG11	1.55	0.88
4:E:139:VAL:HG22	4:E:172:PHE:HZ	1.42	0.85
4:D:91:LEU:HD22	4:D:223:VAL:HG21	1.63	0.80
1:A:175:MET:HE1	5:J:63:ASN:HA	1.72	0.72
4:F:300:LEU:HD21	4:F:319:VAL:HG12	1.74	0.69
4:I:150:ARG:HH22	4:H:23:ARG:HH21	1.44	0.66
4:H:156:GLU:HG3	4:H:157:ILE:HG12	1.79	0.65
1:A:63:GLU:HB2	1:A:103:ASP:HB2	1.77	0.65
4:E:23:ARG:HD2	4:E:255:ASN:HD21	1.62	0.65
4:E:49:ILE:HG12	4:E:82:CYS:HB2	1.80	0.64
4:I:156:GLU:HG2	4:I:157:ILE:HG12	1.79	0.63
4:G:116:THR:O	4:G:120:GLN:NE2	2.32	0.63
4:H:227:GLN:HG3	4:H:238:LYS:HZ2	1.63	0.62
4:G:303:ARG:NH1	4:G:304:MET:SD	2.73	0.62
1:A:176:LEU:HD12	5:J:73:GLY:HA3	1.81	0.61
3:C:21:A:N6	4:G:230:THR:O	2.35	0.60
4:I:141:ASN:HD21	4:I:260:THR:H	1.49	0.60
4:D:156:GLU:H	4:D:217:ILE:HG21	1.67	0.60
4:E:34:GLN:NE2	4:E:88:CYS:SG	2.75	0.60
2:B:137:GLN:HG2	5:J:300:GLY:HA3	1.84	0.59
4:I:77:GLN:N	4:H:229:MET:SD	2.76	0.59
4:I:260:THR:HA	4:I:276:PRO:HA	1.83	0.59
4:E:28:THR:HB	4:E:96:GLY:H	1.68	0.59
4:I:286:ILE:HG22	4:I:288:ILE:H	1.68	0.59
3:C:38:A:OP2	4:D:256:ASN:ND2	2.36	0.59
4:G:30:ALA:HB3	4:G:249:MET:HB3	1.84	0.58
2:B:1:MET:SD	2:B:1:MET:N	2.76	0.58
3:C:20:U:O2	4:G:253:LYS:NZ	2.35	0.58
4:I:160:THR:HG1	4:I:213:CYS:HG	1.50	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:G:260:THR:HG22	4:G:276:PRO:HG3	1.86	0.58
1:A:229:CYS:SG	1:A:230:SER:N	2.78	0.57
4:I:148:LEU:HB3	4:I:151:ASN:HB3	1.84	0.57
3:C:23:U:OP1	4:G:150:ARG:NH1	2.38	0.57
5:J:222:LYS:HA	5:J:226:LYS:HD2	1.85	0.57
4:E:83:THR:HG23	4:E:222:GLU:HA	1.86	0.57
4:I:186:ASN:HB3	4:I:189:ILE:HB	1.87	0.57
4:E:121:LYS:NZ	4:E:304:MET:SD	2.79	0.56
4:G:17:GLU:HA	4:G:331:LYS:HG2	1.88	0.56
4:I:32:PHE:HE1	4:I:93:ILE:HD12	1.70	0.56
4:E:23:ARG:HG2	4:E:25:LEU:O	2.05	0.56
1:A:6:ILE:HG22	1:A:110:LEU:HB2	1.88	0.56
4:I:19:LEU:HD22	4:I:329:PHE:HB2	1.88	0.56
4:D:185:ASP:OD1	4:D:185:ASP:N	2.39	0.55
4:I:140:ASN:ND2	4:I:183:VAL:O	2.38	0.55
4:G:293:ASP:HA	4:G:296:SER:HB3	1.89	0.55
4:F:300:LEU:HD21	4:F:319:VAL:CG1	2.37	0.55
4:H:185:ASP:OD1	4:H:185:ASP:N	2.37	0.55
4:I:185:ASP:N	4:I:185:ASP:OD1	2.37	0.55
4:G:259:ARG:NH1	4:G:277:VAL:O	2.39	0.55
4:D:225:PRO:HG3	4:D:247:ALA:HB1	1.88	0.55
4:I:137:ARG:HA	4:I:140:ASN:HB2	1.87	0.54
4:D:236:LYS:NZ	5:J:330:ARG:O	2.40	0.54
1:A:175:MET:HG2	5:J:67:LEU:HB3	1.87	0.54
1:A:7:LEU:HD23	1:A:146:ARG:HB2	1.89	0.54
4:F:264:TRP:O	4:F:291:ARG:NH2	2.40	0.54
3:C:20:U:OP2	4:G:259:ARG:NH2	2.41	0.54
4:E:18:ASN:N	4:E:330:SER:HG	2.04	0.54
4:H:49:ILE:HD13	4:H:240:LEU:HB2	1.90	0.54
4:E:23:ARG:HD2	4:E:255:ASN:ND2	2.22	0.54
4:I:54:VAL:O	4:I:77:GLN:N	2.40	0.54
4:E:25:LEU:HD11	4:E:200:PHE:HE1	1.73	0.54
4:D:82:CYS:SG	4:D:83:THR:N	2.80	0.54
1:A:97:MET:HA	5:J:190:LEU:HD13	1.90	0.53
4:I:262:ASP:HB3	4:I:275:ILE:HG13	1.89	0.53
4:G:232:ASP:OD1	4:G:232:ASP:N	2.41	0.53
4:E:90:THR:OG1	4:E:91:LEU:N	2.42	0.53
4:G:296:SER:OG	4:G:297:PHE:N	2.41	0.53
1:A:80:LEU:HD13	3:C:9:G:H5''	1.90	0.53
1:A:175:MET:HB3	5:J:67:LEU:HD22	1.90	0.53
1:A:37:ARG:NH2	5:J:158:TYR:OH	2.41	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:G:32:PHE:HD2	4:G:91:LEU:HD11	1.73	0.53
4:F:158:ILE:HG23	4:F:215:VAL:HG12	1.90	0.53
4:I:86:THR:HA	4:I:220:ALA:HB2	1.89	0.53
4:F:291:ARG:HG2	4:F:295:LYS:HB2	1.91	0.53
1:A:15:ASN:HA	1:A:101:TYR:HB3	1.90	0.53
4:H:49:ILE:HD12	4:H:242:LYS:HG3	1.91	0.53
4:F:265:TYR:OH	4:F:273:PHE:O	2.27	0.53
4:E:151:ASN:HB3	4:E:217:ILE:HD11	1.91	0.53
4:F:77:GLN:HG2	4:F:236:LYS:HB2	1.90	0.52
4:E:76:PRO:O	4:E:77:GLN:NE2	2.41	0.52
1:A:194:VAL:HG21	1:A:223:SER:HB2	1.91	0.52
4:D:103:LYS:NZ	4:D:201:ALA:O	2.42	0.52
2:B:148:SER:OG	2:B:151:THR:O	2.27	0.52
4:I:158:ILE:HD12	4:I:215:VAL:HG22	1.92	0.52
4:E:91:LEU:HB3	4:E:215:VAL:O	2.10	0.52
4:G:165:GLU:OE2	4:G:204:ARG:NH2	2.43	0.52
4:G:223:VAL:HG23	4:G:225:PRO:HD3	1.91	0.52
4:F:291:ARG:NH1	4:F:295:LYS:O	2.42	0.52
4:I:140:ASN:O	4:I:144:ASN:ND2	2.43	0.52
4:E:170:PRO:O	4:E:174:SER:HB3	2.10	0.52
4:H:129:ASP:OD1	4:H:129:ASP:N	2.43	0.51
1:A:174:ASP:O	1:A:178:LYS:HB3	2.09	0.51
4:F:262:ASP:HB2	4:F:277:VAL:HG22	1.92	0.51
1:A:133:ARG:O	3:C:2:U:N3	2.42	0.51
1:A:74:TYR:HB2	5:J:185:ILE:HD12	1.93	0.51
4:I:303:ARG:HE	4:I:311:LEU:HD21	1.75	0.51
4:F:90:THR:HA	4:F:215:VAL:O	2.11	0.51
3:C:27:G:H5'	4:G:55:LEU:HB2	1.92	0.51
4:H:282:ALA:HB2	4:H:290:PHE:HB2	1.93	0.51
3:C:37:A:OP1	4:D:255:ASN:ND2	2.44	0.50
4:F:300:LEU:HD11	4:F:319:VAL:CG1	2.33	0.50
4:E:27:THR:OG1	4:E:28:THR:N	2.44	0.50
4:G:185:ASP:N	4:G:185:ASP:OD1	2.44	0.50
4:G:141:ASN:ND2	4:G:260:THR:OG1	2.44	0.50
4:E:311:LEU:HB3	4:E:315:ASP:HB3	1.93	0.50
1:A:165:ASP:OD1	1:A:165:ASP:N	2.39	0.49
2:B:47:SER:O	2:B:53:HIS:ND1	2.45	0.49
4:G:136:LYS:NZ	4:G:184:GLU:O	2.45	0.49
3:C:34:U:O3'	4:E:150:ARG:NH1	2.40	0.49
4:E:139:VAL:HG22	4:E:172:PHE:CZ	2.33	0.49
4:I:146:ARG:HB3	4:I:257:ALA:HB1	1.93	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:7:ILE:HG22	2:B:85:LYS:HB3	1.93	0.49
1:A:163:ARG:NH2	1:A:228:GLU:OE1	2.44	0.49
1:A:239:CYS:HA	1:A:254:ILE:HD13	1.95	0.49
3:C:21:A:H62	4:G:230:THR:H	1.61	0.49
4:G:24:CYS:HB3	4:G:324:ILE:HG23	1.93	0.49
4:D:93:ILE:O	4:D:212:THR:HA	2.13	0.49
5:J:39:HIS:HE1	5:J:69:THR:HG21	1.76	0.49
1:A:111:GLU:HB2	1:A:240:LEU:HD23	1.95	0.49
4:F:82:CYS:SG	4:F:83:THR:N	2.86	0.49
3:C:33:G:OP1	4:E:226:SER:OG	2.31	0.49
4:D:259:ARG:HD2	4:D:325:ARG:HG3	1.95	0.49
4:I:22:ALA:HB3	4:I:105:SER:HB3	1.95	0.49
4:D:28:THR:O	4:D:251:SER:OG	2.28	0.49
3:C:20:U:H5'	4:G:256:ASN:HB2	1.95	0.48
4:F:311:LEU:HD21	4:F:316:LYS:HB2	1.95	0.48
4:I:305:ILE:O	4:I:308:ASN:ND2	2.45	0.48
4:F:146:ARG:NH2	4:F:179:LEU:O	2.44	0.48
4:D:26:ASN:HB2	4:D:98:LYS:HB3	1.96	0.48
3:C:1:U:H2'	5:J:151:PHE:HD2	1.78	0.48
4:H:92:ARG:HH21	4:H:212:THR:HG21	1.77	0.48
1:A:6:ILE:HD12	1:A:147:LEU:HD13	1.96	0.48
4:I:137:ARG:HH12	4:I:263:THR:HG23	1.78	0.48
4:H:262:ASP:HB2	4:H:277:VAL:HG22	1.96	0.48
2:B:24:ILE:O	2:B:28:LEU:HB2	2.13	0.48
2:B:136:GLN:O	2:B:139:PHE:HB3	2.14	0.48
4:D:49:ILE:HD11	4:D:247:ALA:HB2	1.95	0.48
4:F:126:ILE:HA	4:F:130:GLY:HA2	1.95	0.48
4:D:234:ASP:N	4:D:234:ASP:OD1	2.46	0.48
4:F:141:ASN:ND2	4:F:260:THR:OG1	2.40	0.48
3:C:51:G:N2	3:C:55:A:OP1	2.47	0.47
3:C:51:G:O2'	3:C:55:A:N6	2.47	0.47
4:F:99:VAL:HG22	4:F:207:LEU:HB3	1.95	0.47
4:E:94:ASP:HA	4:E:212:THR:HA	1.96	0.47
5:J:244:GLY:HA2	5:J:252:ASP:HB2	1.97	0.47
4:I:219:CYS:O	4:H:210:TYR:OH	2.28	0.47
4:I:307:LYS:HG3	4:I:309:GLU:HB2	1.96	0.47
4:G:124:GLU:O	4:G:127:ALA:HB3	2.14	0.47
3:C:31:C:H5''	4:E:252:GLN:HG2	1.95	0.47
4:H:325:ARG:NH1	4:H:326:GLY:O	2.48	0.47
4:F:91:LEU:HD13	4:F:223:VAL:HG11	1.95	0.47
4:F:139:VAL:HG13	4:F:189:ILE:HG13	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:30:A:H5''	4:E:23:ARG:HD3	1.96	0.47
4:H:303:ARG:HA	4:H:307:LYS:HE2	1.96	0.47
4:E:199:THR:HA	4:E:204:ARG:HB2	1.97	0.47
1:A:2:MET:SD	1:A:2:MET:N	2.88	0.47
1:A:208:GLN:NE2	1:A:210:ASP:O	2.47	0.47
2:B:148:SER:HB3	2:B:155:TYR:HE1	1.80	0.47
4:E:235:ASP:O	4:E:239:LYS:NZ	2.48	0.47
5:J:48:SER:HB3	5:J:146:PHE:HB3	1.96	0.47
5:J:177:LEU:HD12	5:J:184:LYS:HD3	1.97	0.47
1:A:200:SER:OG	1:A:201:GLU:N	2.47	0.47
4:I:121:LYS:HA	4:I:121:LYS:HD2	1.75	0.47
4:E:25:LEU:HG	4:E:99:VAL:HA	1.97	0.47
2:B:39:PHE:HE1	2:B:67:ALA:HB1	1.80	0.46
2:B:91:THR:OG1	2:B:92:PHE:N	2.47	0.46
4:I:124:GLU:OE2	4:I:316:LYS:NZ	2.48	0.46
4:I:152:ARG:NH1	4:I:174:SER:OG	2.48	0.46
2:B:74:GLU:HA	2:B:86:VAL:HG11	1.98	0.46
4:H:164:ILE:HB	4:H:210:TYR:H	1.81	0.46
4:D:28:THR:OG1	4:D:96:GLY:N	2.46	0.46
4:G:91:LEU:HD13	4:G:223:VAL:HG11	1.97	0.46
4:E:39:LYS:HB3	4:E:43:PHE:HB2	1.97	0.46
4:E:174:SER:OG	4:E:175:LYS:N	2.48	0.46
2:B:35:HIS:O	2:B:38:LYS:NZ	2.49	0.46
3:C:31:C:OP1	4:E:255:ASN:ND2	2.41	0.46
4:G:265:TYR:OH	4:G:273:PHE:O	2.33	0.46
4:E:25:LEU:HD11	4:E:99:VAL:HG13	1.98	0.46
4:E:325:ARG:NH1	4:E:326:GLY:O	2.49	0.46
4:G:156:GLU:N	4:G:156:GLU:OE2	2.49	0.46
4:E:169:TYR:HD2	4:E:171:SER:HB3	1.79	0.46
5:J:43:PHE:HB3	5:J:165:PRO:HG3	1.98	0.46
1:A:230:SER:OG	1:A:231:LYS:NZ	2.49	0.46
4:D:199:THR:HG21	4:D:207:LEU:HB2	1.98	0.46
2:B:108:TYR:O	2:B:112:ALA:HB2	2.16	0.46
4:D:40:ARG:O	4:D:92:ARG:NH1	2.49	0.46
1:A:170:ALA:HB3	1:A:178:LYS:HE2	1.97	0.45
4:D:133:THR:OG1	4:D:317:HIS:NE2	2.47	0.45
5:J:229:ASP:HB2	5:J:272:ARG:HD3	1.97	0.45
4:F:260:THR:HG22	4:F:276:PRO:HG3	1.98	0.45
4:G:129:ASP:OD1	4:G:129:ASP:N	2.49	0.45
1:A:186:GLU:HG3	1:A:189:LEU:HB2	1.99	0.45
1:A:10:LYS:HB2	1:A:143:LYS:HB3	1.97	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:26:ASN:O	4:D:97:ILE:HA	2.17	0.45
4:D:27:THR:HB	4:D:251:SER:HB3	1.99	0.45
4:D:328:MET:HE2	4:D:328:MET:HB3	1.80	0.45
4:E:23:ARG:HB3	4:E:26:ASN:ND2	2.31	0.45
4:E:303:ARG:HH12	4:E:311:LEU:HD11	1.81	0.45
4:F:92:ARG:NE	4:F:94:ASP:OD1	2.45	0.45
4:F:143:ALA:O	4:F:174:SER:OG	2.27	0.45
4:F:265:TYR:HB3	4:F:291:ARG:HE	1.82	0.45
4:E:171:SER:HA	4:E:174:SER:OG	2.16	0.45
5:J:213:GLN:HE22	5:J:215:LEU:HG	1.82	0.45
1:A:187:ASP:OD1	1:A:187:ASP:N	2.49	0.45
4:E:236:LYS:HB2	4:E:236:LYS:HE2	1.78	0.45
5:J:177:LEU:HD13	5:J:180:SER:HB3	1.98	0.45
1:A:143:LYS:O	1:A:143:LYS:NZ	2.48	0.45
5:J:331:VAL:HA	5:J:334:ALA:HB3	1.99	0.45
4:E:123:ASP:HA	4:E:126:ILE:HD12	1.98	0.44
5:J:234:LEU:O	5:J:266:LYS:NZ	2.43	0.44
2:B:129:MET:HE2	2:B:129:MET:HB2	1.80	0.44
5:J:232:TYR:HB3	5:J:313:GLY:H	1.82	0.44
3:C:20:U:H5''	4:G:252:GLN:HB2	1.98	0.44
4:I:293:ASP:O	4:I:296:SER:OG	2.34	0.44
5:J:260:ILE:HD11	5:J:334:ALA:HB1	2.00	0.44
3:C:35:U:O2'	4:D:21:PHE:O	2.33	0.44
5:J:241:GLU:OE1	5:J:245:VAL:HG22	2.16	0.44
3:C:37:A:H2'	4:D:252:GLN:HE21	1.82	0.44
2:B:7:ILE:HD12	2:B:7:ILE:HA	1.82	0.44
4:H:143:ALA:O	4:H:174:SER:OG	2.29	0.44
4:E:144:ASN:C	4:E:173:ASN:HD21	2.25	0.44
1:A:154:ILE:HB	1:A:230:SER:HB2	1.99	0.44
2:B:37:LYS:HB2	2:B:37:LYS:HE3	1.80	0.44
4:H:121:LYS:HD3	4:H:304:MET:HE3	2.00	0.43
4:F:294:THR:OG1	4:F:295:LYS:N	2.51	0.43
2:B:103:ARG:HH11	2:B:105:GLU:HG3	1.84	0.43
4:G:320:MET:HE3	4:G:320:MET:HB3	1.77	0.43
4:E:258:LEU:HD23	4:E:258:LEU:HA	1.85	0.43
4:H:120:GLN:O	4:H:124:GLU:HG2	2.18	0.43
4:F:122:ILE:HG23	4:F:131:PHE:HE2	1.83	0.43
4:F:186:ASN:HB2	4:F:189:ILE:HG22	1.98	0.43
4:E:24:CYS:HB2	4:E:324:ILE:HA	2.00	0.43
4:D:37:PHE:O	4:D:216:LYS:NZ	2.46	0.43
1:A:42:LYS:HD3	1:A:42:LYS:HA	1.77	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:175:MET:SD	1:A:175:MET:N	2.92	0.43
4:D:301:ILE:HD12	4:D:301:ILE:HA	1.86	0.43
5:J:191:SER:OG	5:J:193:ASN:OD1	2.35	0.43
4:E:199:THR:HG21	4:E:207:LEU:HB2	2.00	0.43
4:G:49:ILE:HD13	4:G:240:LEU:HB2	2.00	0.43
1:A:55:VAL:O	1:A:241:TRP:N	2.52	0.43
2:B:163:ASP:OD1	2:B:165:LYS:NZ	2.45	0.43
4:F:293:ASP:O	4:F:299:LYS:NZ	2.52	0.43
1:A:139:ILE:HD13	1:A:139:ILE:HA	1.89	0.43
4:H:260:THR:HA	4:H:276:PRO:HA	2.01	0.43
4:I:42:THR:OG1	4:I:43:PHE:N	2.52	0.42
4:H:175:LYS:HD2	4:H:175:LYS:HA	1.81	0.42
4:G:159:GLU:OE1	4:G:171:SER:OG	2.36	0.42
4:E:32:PHE:N	4:E:247:ALA:O	2.52	0.42
4:I:25:LEU:HD12	4:I:25:LEU:HA	1.90	0.42
5:J:218:LYS:HA	5:J:218:LYS:HD2	1.80	0.42
1:A:37:ARG:HA	1:A:37:ARG:HD2	1.82	0.42
5:J:219:PHE:O	5:J:226:LYS:NZ	2.39	0.42
1:A:141:ASN:OD1	1:A:141:ASN:N	2.51	0.42
2:B:68:LEU:HB3	2:B:90:ILE:HG21	2.02	0.42
4:I:38:LEU:HD23	4:I:38:LEU:HA	1.90	0.42
4:H:15:ARG:HH22	4:H:298:TYR:HA	1.84	0.42
4:G:30:ALA:HB1	4:G:93:ILE:HG23	2.01	0.42
4:D:114:TYR:HE2	4:D:331:LYS:HZ1	1.66	0.42
4:D:163:THR:HG23	4:D:210:TYR:HD2	1.85	0.42
5:J:286:GLN:HA	5:J:289:LEU:HB2	2.01	0.42
4:I:27:THR:HG22	4:I:97:ILE:HG12	2.01	0.42
4:H:91:LEU:HD13	4:H:223:VAL:HG11	2.01	0.42
4:H:266:PRO:HD2	4:H:291:ARG:HD3	2.01	0.42
4:H:123:ASP:HA	4:H:126:ILE:HG12	2.02	0.42
4:H:196:ILE:HA	4:H:199:THR:HG22	2.01	0.42
4:E:40:ARG:HG3	4:E:214:PHE:CE2	2.55	0.42
2:B:68:LEU:HA	2:B:71:LEU:HD12	2.01	0.42
4:H:314:GLU:H	4:H:314:GLU:HG3	1.68	0.42
4:H:162:VAL:HG22	4:H:211:VAL:HG22	2.02	0.42
1:A:61:GLU:OE1	1:A:105:ASN:ND2	2.43	0.42
2:B:134:LYS:HE3	2:B:134:LYS:HB2	1.78	0.42
4:H:86:THR:HA	4:H:220:ALA:HB2	2.02	0.42
4:G:29:GLU:OE1	4:G:251:SER:N	2.53	0.42
4:F:166:ASP:OD1	4:F:166:ASP:N	2.51	0.42
4:E:137:ARG:HB3	4:E:261:ILE:HG21	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:23:ARG:NH1	4:D:26:ASN:OD1	2.53	0.42
4:H:186:ASN:HB2	4:H:189:ILE:HB	2.01	0.41
4:D:32:PHE:CG	4:D:91:LEU:HD11	2.54	0.41
4:I:289:PRO:HB2	4:I:292:PRO:HG3	2.02	0.41
1:A:70:LYS:HE2	1:A:70:LYS:HB2	1.85	0.41
4:H:299:LYS:HD3	4:H:299:LYS:HA	1.87	0.41
4:D:148:LEU:HB3	4:D:151:ASN:HB2	2.01	0.41
4:I:259:ARG:NH1	4:I:277:VAL:O	2.53	0.41
4:H:47:LEU:HD12	4:H:47:LEU:HA	1.89	0.41
4:E:172:PHE:O	4:E:173:ASN:HB2	2.20	0.41
4:H:16:PRO:HG3	4:H:114:TYR:CZ	2.56	0.41
4:F:108:SER:OG	4:F:109:CYS:N	2.53	0.41
4:E:53:ALA:H	4:D:250:HIS:CE1	2.39	0.41
2:B:100:LYS:HZ2	2:B:175:LEU:HB3	1.86	0.41
4:I:15:ARG:H	4:I:331:LYS:HE2	1.85	0.41
4:I:251:SER:HA	4:I:254:ILE:HG22	2.03	0.41
4:I:307:LYS:HA	4:I:307:LYS:HD2	1.85	0.41
4:F:28:THR:HB	4:F:96:GLY:H	1.84	0.41
4:E:34:GLN:HE22	4:E:85:SER:HB2	1.84	0.41
4:I:37:PHE:HD1	4:I:90:THR:HG21	1.86	0.41
4:H:138:TYR:O	4:H:142:ILE:HD12	2.20	0.41
2:B:6:LEU:HB3	2:B:58:ILE:HG23	2.03	0.41
4:I:29:GLU:HG3	4:I:251:SER:HB3	2.03	0.41
4:E:208:ASN:OD1	4:E:208:ASN:N	2.51	0.41
1:A:183:LEU:HD21	1:A:224:LEU:HD11	2.02	0.41
1:A:241:TRP:H	1:A:241:TRP:CD1	2.38	0.41
2:B:8:ILE:HG23	2:B:10:PRO:HD3	2.02	0.41
2:B:88:LYS:HA	2:B:88:LYS:HD2	1.79	0.41
2:B:140:CYS:HB3	5:J:300:GLY:HA2	2.03	0.41
4:I:78:LYS:HD2	4:I:78:LYS:HA	1.75	0.41
4:H:158:ILE:HG12	4:H:215:VAL:HG13	2.03	0.41
4:H:242:LYS:HB2	4:H:242:LYS:HE2	1.90	0.41
4:G:79:SER:HB2	4:G:238:LYS:H	1.86	0.41
4:F:260:THR:HA	4:F:276:PRO:HA	2.02	0.41
4:E:162:VAL:HB	4:E:209:ILE:HD12	2.03	0.41
4:E:243:PHE:N	4:E:246:SER:O	2.52	0.41
4:D:137:ARG:HB3	4:D:261:ILE:HG21	2.02	0.41
4:I:30:ALA:HB2	4:I:95:PHE:HB3	2.03	0.41
4:G:112:TYR:O	4:G:116:THR:OG1	2.30	0.40
4:F:236:LYS:HA	4:F:236:LYS:HD3	1.85	0.40
4:E:140:ASN:HA	4:E:143:ALA:HB3	2.02	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:8:LEU:HD13	1:A:129:MET:HE1	2.02	0.40
4:H:264:TRP:HB3	4:H:314:GLU:HB2	2.03	0.40
4:E:304:MET:O	4:E:306:LEU:N	2.54	0.40
4:D:34:GLN:O	4:D:45:LEU:HD12	2.20	0.40
2:B:8:ILE:HG21	2:B:16:PRO:HG3	2.03	0.40
4:F:144:ASN:HA	4:F:174:SER:HA	2.04	0.40
4:E:142:ILE:HG22	4:E:172:PHE:CE2	2.56	0.40
4:E:217:ILE:HD12	4:E:223:VAL:HG22	2.03	0.40
5:J:318:LYS:HA	5:J:318:LYS:HD3	1.86	0.40
1:A:123:LYS:HE2	1:A:123:LYS:HB2	1.81	0.40
4:I:33:TRP:CD2	4:I:44:LYS:HE2	2.56	0.40
4:G:252:GLN:H	4:G:252:GLN:HG2	1.66	0.40
4:D:227:GLN:HG3	4:D:229:MET:H	1.87	0.40
4:E:311:LEU:HD13	4:E:311:LEU:HA	1.95	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	241/255 (94%)	206 (86%)	35 (14%)	0	100	100
2	B	173/181 (96%)	155 (90%)	18 (10%)	0	100	100
4	D	289/335 (86%)	271 (94%)	18 (6%)	0	100	100
4	E	290/335 (87%)	261 (90%)	29 (10%)	0	100	100
4	F	296/335 (88%)	278 (94%)	18 (6%)	0	100	100
4	G	298/335 (89%)	276 (93%)	22 (7%)	0	100	100
4	H	293/335 (88%)	275 (94%)	18 (6%)	0	100	100
4	I	298/335 (89%)	281 (94%)	17 (6%)	0	100	100
5	J	238/344 (69%)	212 (89%)	26 (11%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	2416/2790 (87%)	2215 (92%)	201 (8%)	0	100	100

There are no Ramachandran outliers to report.

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	211/219 (96%)	204 (97%)	7 (3%)	33	59
2	B	156/160 (98%)	154 (99%)	2 (1%)	65	79
4	D	262/299 (88%)	259 (99%)	3 (1%)	70	82
4	E	263/299 (88%)	253 (96%)	10 (4%)	28	54
4	F	269/299 (90%)	264 (98%)	5 (2%)	52	72
4	G	270/299 (90%)	270 (100%)	0	100	100
4	H	266/299 (89%)	261 (98%)	5 (2%)	52	72
4	I	271/299 (91%)	269 (99%)	2 (1%)	81	89
5	J	211/304 (69%)	209 (99%)	2 (1%)	75	87
All	All	2179/2477 (88%)	2143 (98%)	36 (2%)	56	74

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	68	LYS
1	A	97	MET
1	A	175	MET
1	A	176	LEU
1	A	178	LYS
1	A	183	LEU
1	A	194	VAL
2	B	7	ILE
2	B	57	ILE
4	I	89	ASP

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Mol	Chain	Res	Type
4	I	157	ILE
4	H	89	ASP
4	H	144	ASN
4	H	157	ILE
4	H	200	PHE
4	H	300	LEU
4	F	21	PHE
4	F	23	ARG
4	F	84	LEU
4	F	288	ILE
4	F	300	LEU
4	E	23	ARG
4	E	25	LEU
4	E	26	ASN
4	E	84	LEU
4	E	92	ARG
4	E	93	ILE
4	E	151	ASN
4	E	167	LYS
4	E	168	GLU
4	E	172	PHE
4	D	45	LEU
4	D	221	MET
4	D	223	VAL
5	J	147	ILE
5	J	212	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	164	GLN
1	A	208	GLN
2	B	107	GLN
2	B	137	GLN
4	I	141	ASN
4	I	256	ASN
4	H	173	ASN
4	H	279	ASN
4	G	77	GLN
4	G	279	ASN
4	G	308	ASN
4	F	256	ASN

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Mol	Chain	Res	Type
4	E	26	ASN
4	E	144	ASN
4	E	151	ASN
4	D	186	ASN
4	D	256	ASN
5	J	71	ASN
5	J	145	GLN
5	J	213	GLN
5	J	328	HIS

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
3	C	59/60 (98%)	26 (44%)	0

All (26) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
3	C	3	U
3	C	9	G
3	C	10	A
3	C	13	A
3	C	14	G
3	C	15	U
3	C	18	U
3	C	20	U
3	C	21	A
3	C	27	G
3	C	32	U
3	C	33	G
3	C	36	A
3	C	37	A
3	C	38	A
3	C	39	A
3	C	40	A
3	C	41	G
3	C	42	U
3	C	44	U
3	C	49	C
3	C	52	G
3	C	53	A

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Mol	Chain	Res	Type
3	C	54	U
3	C	57	G
3	C	58	C

There are no RNA pucker outliers to report.

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.