



Full wwPDB EM Validation Report ⓘ

Sep 1, 2024 – 12:09 AM JST

PDB ID : 8YH9
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:

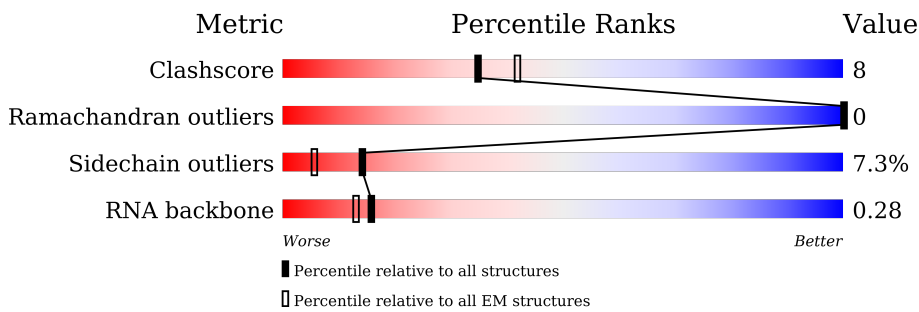
EMDB validation analysis : **FAILED**
MolProbity : 4.02b-467
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.38.2

1 Overall quality at a glance i

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	72% 22% . .
2	B	181	70% 25% . .
3	C	60	42% 47% 12%
4	D	335	70% 15% . 13%
4	E	335	59% 26% . 12%
4	F	335	71% 17% . 10%
4	G	335	71% 19% . 10%
4	H	335	67% 20% . 11%

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Mol	Chain	Length	Quality of chain
4	I	335	 65% 24% 10%
5	J	344	 56% 14% 30%

2 Entry composition [i](#)

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
			Total	C	N	O	S		
1	A	245	1934	1235	324	361	14	0	0

- Molecule 2 is a protein called Cas6f.

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

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

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

- Molecule 4 is a protein called Cas7f.

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

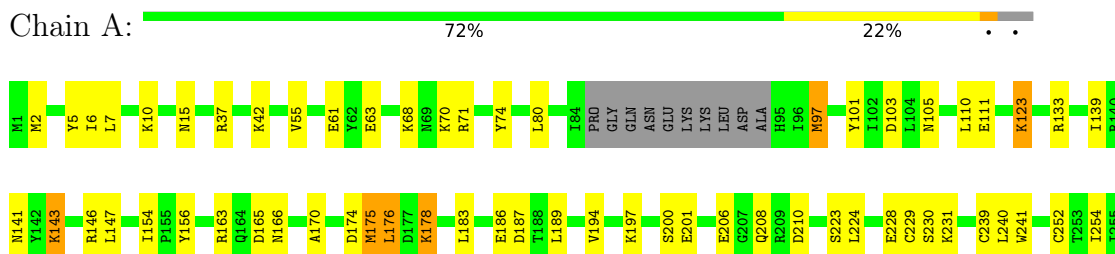
- Molecule 5 is a protein called Cas8f fusion with HNH.

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

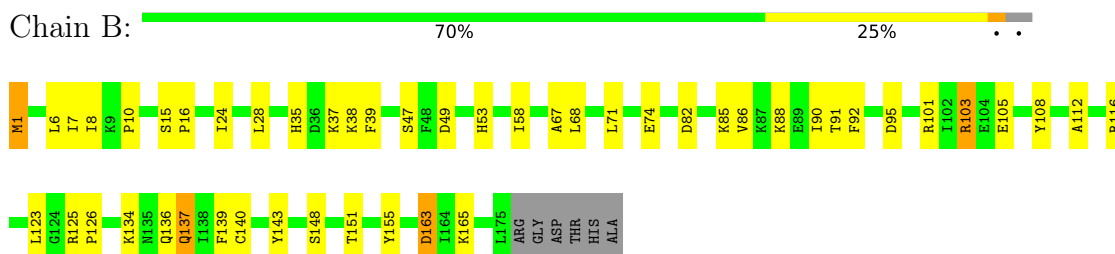
3 Residue-property plots

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.

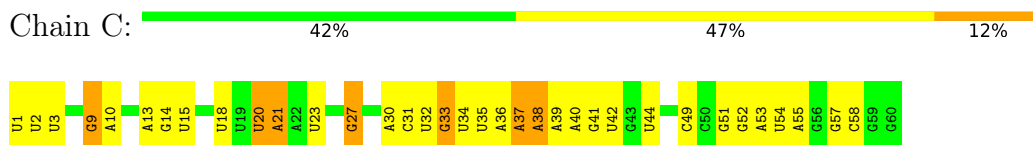
- Molecule 1: Cas5f



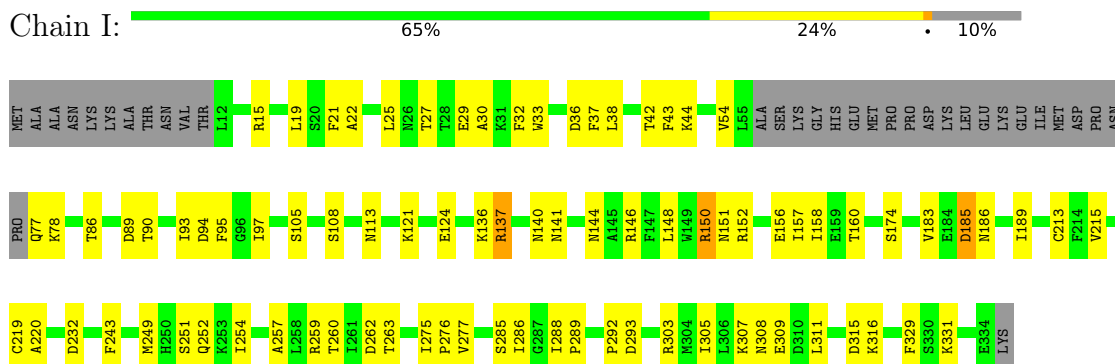
- Molecule 2: Cas6f



- Molecule 3: 60-nt crRNA

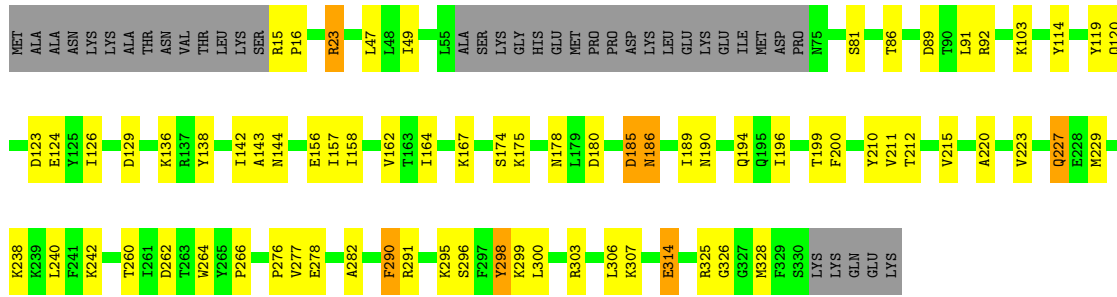


- Molecule 4: Cas7f



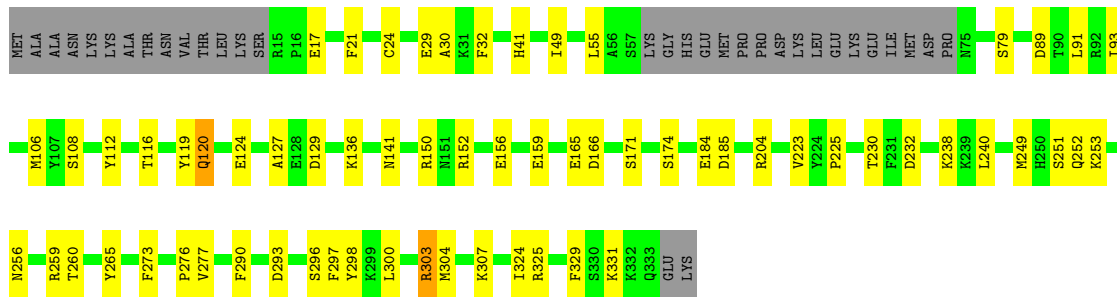
• Molecule 4: Cas7f

Chain H:  67% 20% 11%



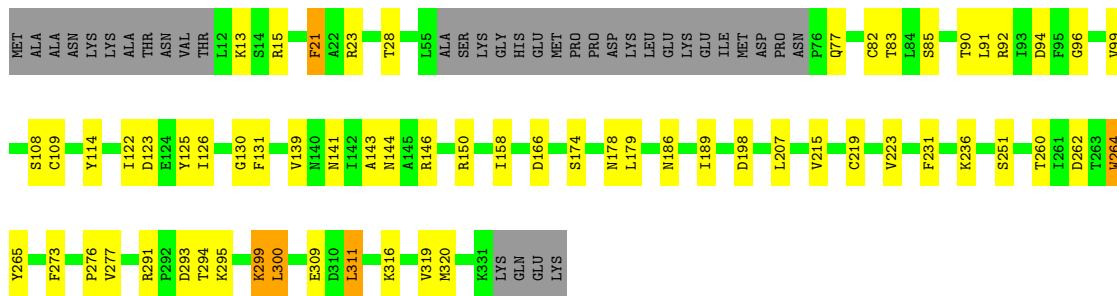
• Molecule 4: Cas7f

Chain G:  71% 19% 10%



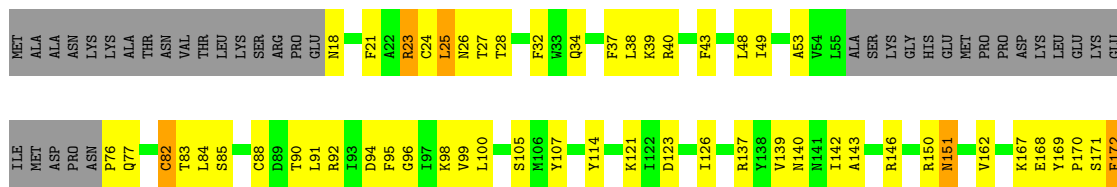
• Molecule 4: Cas7f

Chain F:  71% 17% 10%



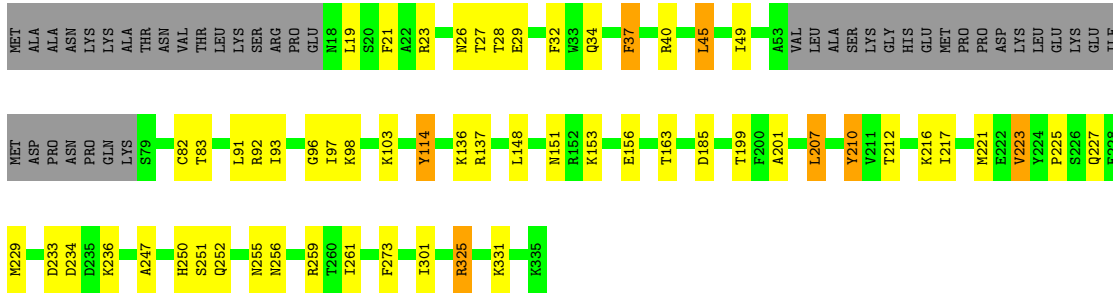
• Molecule 4: Cas7f

Chain E:  59% 26% 12%

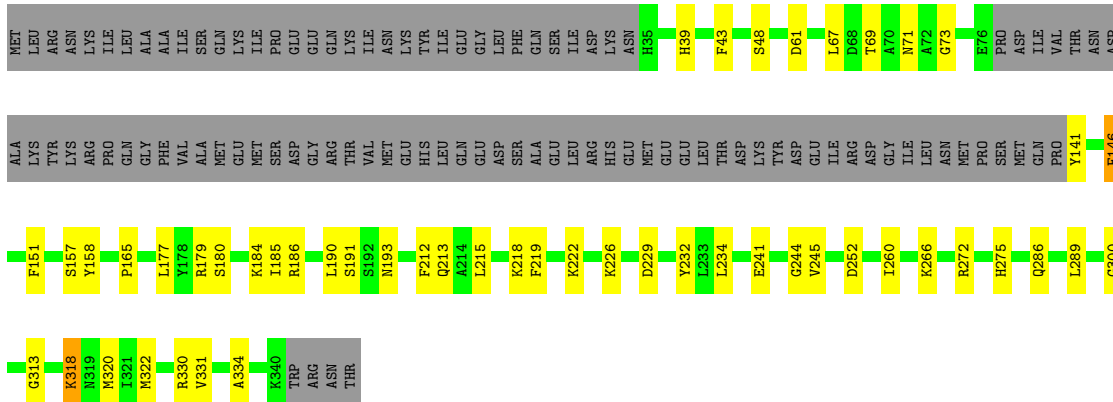




• Molecule 4: Cas7f



• 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	0.28	0/1967	0.58	0/2650
2	B	0.26	0/1446	0.51	0/1945
3	C	0.30	0/1443	0.89	0/2250
4	D	0.26	0/2445	0.52	0/3299
4	E	0.29	0/2450	0.55	0/3308
4	F	0.30	0/2501	0.54	0/3376
4	G	0.28	0/2515	0.56	0/3396
4	H	0.27	0/2477	0.55	0/3347
4	I	0.28	0/2520	0.54	0/3400
5	J	0.26	0/1972	0.59	0/2668
All	All	0.28	0/21736	0.58	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	39	0
2	B	1415	0	1437	25	0
3	C	1287	0	645	23	0
4	D	2393	0	2359	33	0
4	E	2397	0	2368	59	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	36	0
4	H	2423	0	2386	35	0
4	I	2467	0	2442	42	0
5	J	1929	0	1921	29	0
All	All	21153	0	20364	322	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 (322) 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
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: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
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
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

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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
4:E:18:ASN:N	4:E:330:SER:HG	2.04	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: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
2:B:1:MET:SD	2:B:1:MET:N	2.76	0.54
4:I:54:VAL:O	4:I:77:GLN:N	2.40	0.54
4:G:296:SER:OG	4:G:297:PHE:N	2.41	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:H:227:GLN:HG3	4:H:238:LYS:HZ2	1.74	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
4:G:32:PHE:HD2	4:G:91:LEU:HD11	1.73	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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: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
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
4:E:226:SER:HG	4:E:250:HIS:CE1	2.30	0.49
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

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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:143:ALA:O	4:F:174:SER:OG	2.27	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: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
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

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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
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:N	4:G:129:ASP:OD1	2.49	0.45
4:D:103:LYS:NZ	4:D:201:ALA:O	2.42	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
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

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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: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
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
4:E:105:SER:O	4:E:105:SER:OG	2.34	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
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
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: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: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
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

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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
3:C:23:U:O2'	4:F:21:PHE:O	2.32	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
4:E:172:PHE:O	4:E:173:ASN:HB2	2.20	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
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

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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: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
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:E:212:THR:O	4:E:212:THR:OG1	2.30	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
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
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:H:136:LYS:HZ1	4:H:190:ASN:HA	1.86	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

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
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:E:234:ASP:N	4:E:234:ASP:OD1	2.54	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
All	All	2416/2790 (87%)	2215 (92%)	201 (8%)	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	211/219 (96%)	197 (93%)	14 (7%)	14	39
2	B	156/160 (98%)	142 (91%)	14 (9%)	8	28
4	D	262/299 (88%)	248 (95%)	14 (5%)	19	45
4	E	263/299 (88%)	238 (90%)	25 (10%)	7	25
4	F	269/299 (90%)	248 (92%)	21 (8%)	10	33
4	G	270/299 (90%)	253 (94%)	17 (6%)	15	40
4	H	266/299 (89%)	243 (91%)	23 (9%)	8	30
4	I	271/299 (91%)	253 (93%)	18 (7%)	14	39
5	J	211/304 (69%)	199 (94%)	12 (6%)	17	44
All	All	2179/2477 (88%)	2021 (93%)	158 (7%)	14	36

All (158) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	5	TYR
1	A	68	LYS
1	A	71	ARG
1	A	97	MET
1	A	123	LYS
1	A	143	LYS
1	A	156	TYR
1	A	166	ASN
1	A	175	MET
1	A	176	LEU
1	A	178	LYS
1	A	197	LYS
1	A	206	GLU
1	A	252	CYS
2	B	1	MET
2	B	15	SER
2	B	49	ASP
2	B	82	ASP

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Mol	Chain	Res	Type
2	B	95	ASP
2	B	101	ARG
2	B	103	ARG
2	B	116	ARG
2	B	123	LEU
2	B	125	ARG
2	B	126	PRO
2	B	137	GLN
2	B	143	TYR
2	B	163	ASP
4	I	21	PHE
4	I	36	ASP
4	I	89	ASP
4	I	94	ASP
4	I	108	SER
4	I	113	ASN
4	I	136	LYS
4	I	137	ARG
4	I	150	ARG
4	I	185	ASP
4	I	219	CYS
4	I	232	ASP
4	I	243	PHE
4	I	249	MET
4	I	252	GLN
4	I	285	SER
4	I	293	ASP
4	I	315	ASP
4	H	23	ARG
4	H	81	SER
4	H	89	ASP
4	H	103	LYS
4	H	119	TYR
4	H	144	ASN
4	H	167	LYS
4	H	178	ASN
4	H	180	ASP
4	H	185	ASP
4	H	186	ASN
4	H	194	GLN
4	H	200	PHE
4	H	227	GLN

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Mol	Chain	Res	Type
4	H	278	GLU
4	H	290	PHE
4	H	295	LYS
4	H	296	SER
4	H	298	TYR
4	H	300	LEU
4	H	306	LEU
4	H	314	GLU
4	H	328	MET
4	G	21	PHE
4	G	41	HIS
4	G	89	ASP
4	G	106	MET
4	G	108	SER
4	G	119	TYR
4	G	120	GLN
4	G	152	ARG
4	G	166	ASP
4	G	174	SER
4	G	290	PHE
4	G	298	TYR
4	G	300	LEU
4	G	303	ARG
4	G	307	LYS
4	G	325	ARG
4	G	329	PHE
4	F	13	LYS
4	F	15	ARG
4	F	21	PHE
4	F	23	ARG
4	F	85	SER
4	F	114	TYR
4	F	123	ASP
4	F	125	TYR
4	F	150	ARG
4	F	178	ASN
4	F	198	ASP
4	F	219	CYS
4	F	231	PHE
4	F	251	SER
4	F	264	TRP
4	F	273	PHE

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Mol	Chain	Res	Type
4	F	299	LYS
4	F	300	LEU
4	F	309	GLU
4	F	311	LEU
4	F	320	MET
4	E	21	PHE
4	E	23	ARG
4	E	25	LEU
4	E	37	PHE
4	E	38	LEU
4	E	48	LEU
4	E	82	CYS
4	E	84	LEU
4	E	92	ARG
4	E	95	PHE
4	E	98	LYS
4	E	100	LEU
4	E	107	TYR
4	E	114	TYR
4	E	146	ARG
4	E	151	ASN
4	E	167	LYS
4	E	168	GLU
4	E	172	PHE
4	E	175	LYS
4	E	180	ASP
4	E	226	SER
4	E	233	ASP
4	E	243	PHE
4	E	293	ASP
4	D	19	LEU
4	D	29	GLU
4	D	37	PHE
4	D	45	LEU
4	D	114	TYR
4	D	136	LYS
4	D	153	LYS
4	D	207	LEU
4	D	210	TYR
4	D	221	MET
4	D	223	VAL
4	D	233	ASP

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Mol	Chain	Res	Type
4	D	273	PHE
4	D	325	ARG
5	J	61	ASP
5	J	71	ASN
5	J	141	TYR
5	J	146	PHE
5	J	157	SER
5	J	179	ARG
5	J	186	ARG
5	J	212	PHE
5	J	275	HIS
5	J	318	LYS
5	J	320	MET
5	J	322	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
4	I	141	ASN
4	G	120	GLN
4	E	26	ASN
4	E	141	ASN
5	J	328	HIS

5.3.3 RNA [i](#)

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

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Mol	Chain	Res	Type
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
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

There are no chain breaks in this entry.