



Full wwPDB EM Validation Report ⓘ

Jul 7, 2025 – 07:11 PM JST

PDB ID : 8YHA / pdb_00008yha
EMDB ID : EMD-39286
Title : Type I-EHNNH Cascade-ssDNA complex
Authors : Li, Z.
Deposited on : 2024-02-27
Resolution : 3.40 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

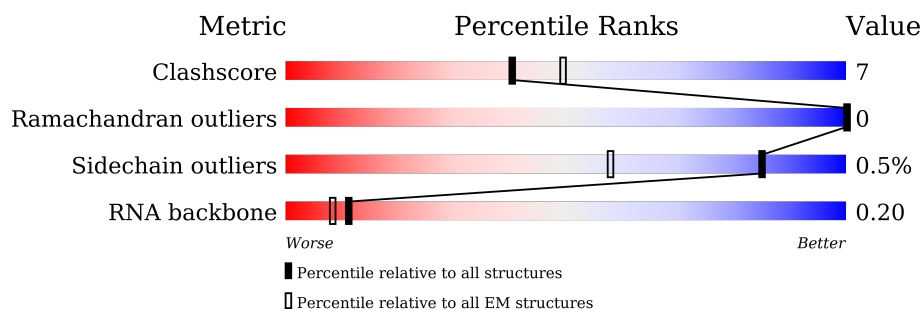
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.40 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.






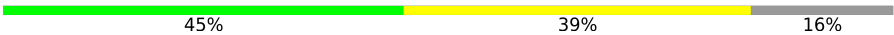
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415
RNA backbone	6643	2191

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	388	72% 18% 10%
2	B	272	79% 19% .
3	C	61	44% 41% 15%
4	D	378	74% 19% 6%
4	E	378	85% 14% .
4	F	378	87% 12% .
4	G	378	81% 16% .
4	H	378	83% 15% .

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Mol	Chain	Length	Quality of chain
4	I	378	 61% 9% 30%
5	J	535	 68% 15% 17%
6	K	174	 83% 11% 5%
7	T	56	 45% 39% 16%

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 28503 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 CRISPR system Cascade subunit CasD.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	349	Total	C	N	O	S	0	0
			2756	1736	512	489	19		

- Molecule 2 is a protein called CRISPR-associated endoribonuclease Cse3.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	268	Total	C	N	O	S	0	0
			2174	1397	388	384	5		

- Molecule 3 is a RNA chain called 61-nt crRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	61	Total	C	N	O	P	0	0
			1303	584	239	420	60		

- Molecule 4 is a protein called CRISPR system Cascade subunit CasC.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	355	Total	C	N	O	S	0	0
			2792	1771	488	522	11		
4	E	375	Total	C	N	O	S	0	0
			2923	1848	510	553	12		
4	F	372	Total	C	N	O	S	0	0
			2897	1830	506	549	12		
4	G	370	Total	C	N	O	S	0	0
			2882	1821	503	546	12		
4	H	371	Total	C	N	O	S	0	0
			2891	1827	505	547	12		
4	I	266	Total	C	N	O	S	0	0
			2056	1308	356	385	7		

- Molecule 5 is a protein called CRISPR-associated protein Cse1 (CRISPR_cse1).

Mol	Chain	Residues	Atoms					AltConf	Trace
5	J	442	Total	C	N	O	S	0	0
			3521	2260	602	640	19		

- Molecule 6 is a protein called CRISPR-associated protein Cse2 (CRISPR_cse2).

Mol	Chain	Residues	Atoms					AltConf	Trace
6	K	165	Total	C	N	O	S	0	0
			1356	878	239	233	6		

- Molecule 7 is DNA/RNA hybrid called DNA/RNA (47-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
7	T	47	Total	C	N	O	P	0	0
			950	457	158	288	47		

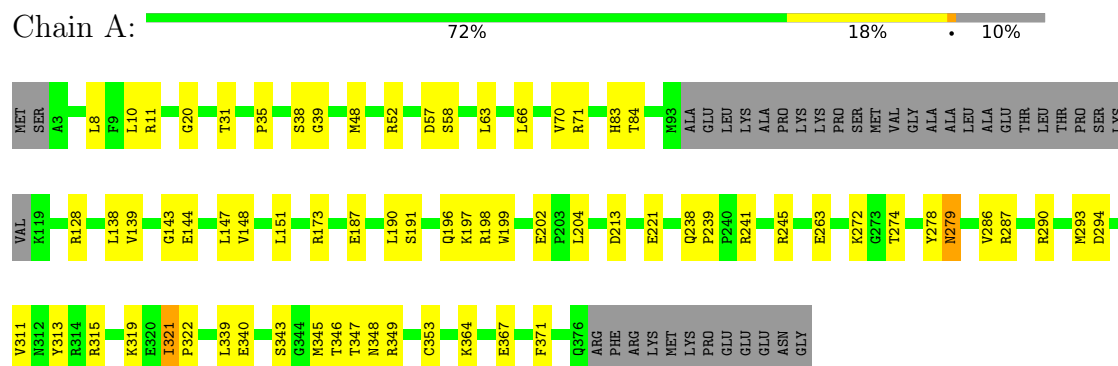
- Molecule 8 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
8	A	1	Total	Zn	0
			1	1	
8	J	1	Total	Zn	0
			1	1	

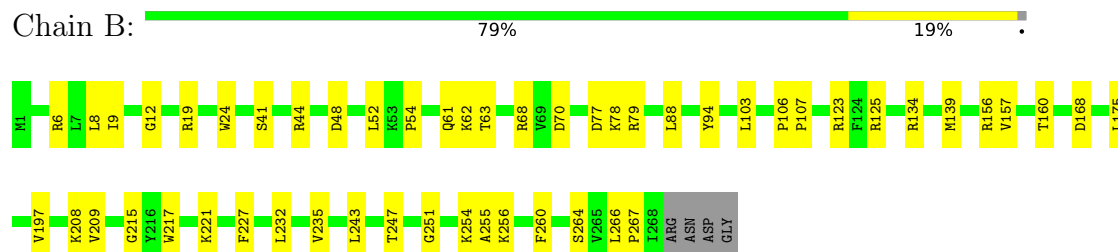
3 Residue-property plots

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.

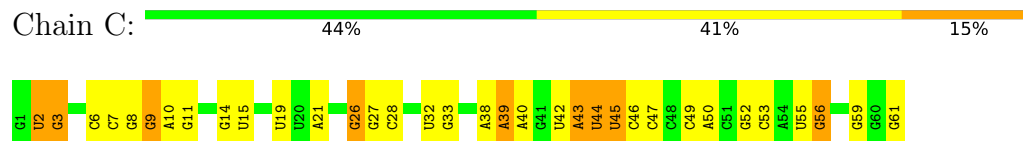
• Molecule 1: CRISPR system Cascade subunit CasD



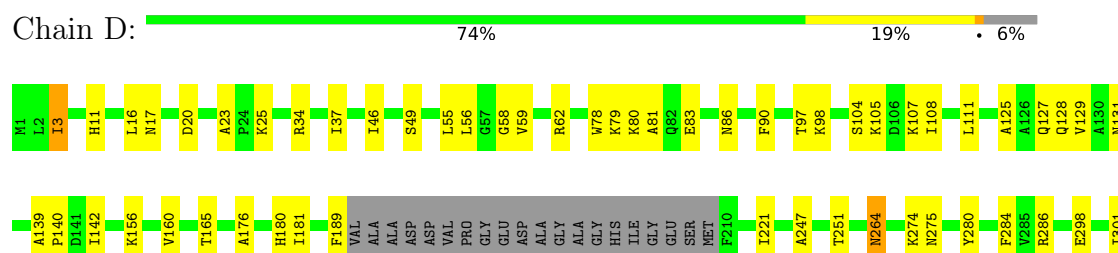
• Molecule 2: CRISPR-associated endoribonuclease Cse3



• Molecule 3: 61-nt crRNA



• Molecule 4: CRISPR system Cascade subunit CasC





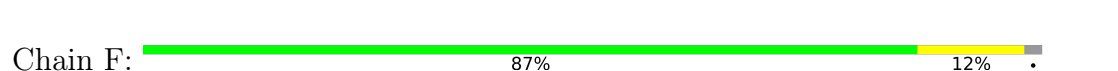
• Molecule 4: CRISPR system Cascade subunit CasC

Chain E: 85% 14%



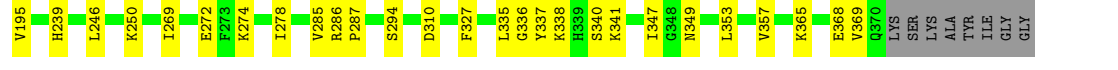
• Molecule 4: CRISPR system Cascade subunit CasC

Chain F: 87% 12%



• Molecule 4: CRISPR system Cascade subunit CasC

Chain G: 81% 16%



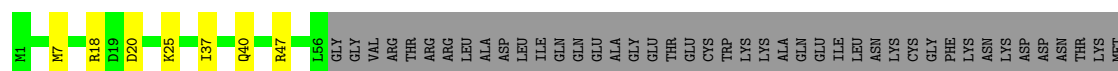
• Molecule 4: CRISPR system Cascade subunit CasC

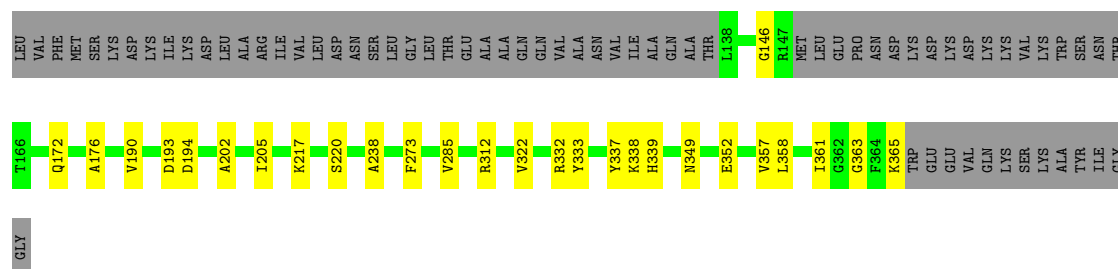
Chain H: 83% 15%



• Molecule 4: CRISPR system Cascade subunit CasC

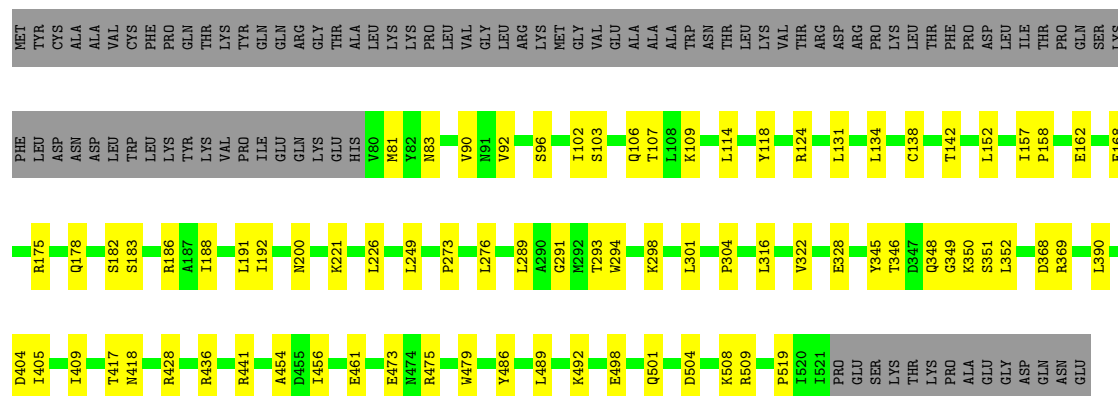
Chain I: 61% 9% 30%





- Molecule 5: CRISPR-associated protein Cse1 (CRISPR_cse1)

Chain J: 68% 15% 17%



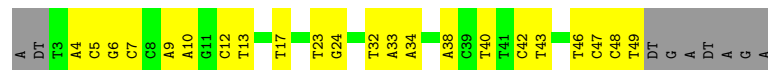
- Molecule 6: CRISPR-associated protein Cse2 (CRISPR_cse2)

Chain K: 83% 11% 5%



- Molecule 7: DNA/RNA (47-MER)

Chain T: 45% 39% 16%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	63162	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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN

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	0.14	0/2824	0.36	0/3831
2	B	0.13	0/2232	0.35	0/3022
3	C	0.18	0/1459	0.39	0/2273
4	D	0.15	0/2847	0.40	0/3847
4	E	0.12	0/2981	0.29	0/4031
4	F	0.13	0/2954	0.33	0/3995
4	G	0.12	0/2939	0.31	0/3976
4	H	0.13	0/2948	0.34	0/3987
4	I	0.13	0/2102	0.32	0/2849
5	J	0.13	0/3621	0.36	0/4927
6	K	0.15	0/1386	0.37	0/1866
7	T	0.22	0/1060	0.46	0/1631
All	All	0.14	0/29353	0.35	0/40235

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	2756	0	2752	69	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	2174	0	2189	35	0
3	C	1303	0	659	25	0
4	D	2792	0	2791	49	0
4	E	2923	0	2905	39	0
4	F	2897	0	2878	30	0
4	G	2882	0	2860	43	0
4	H	2891	0	2873	40	0
4	I	2056	0	2016	25	0
5	J	3521	0	3453	50	0
6	K	1356	0	1398	18	0
7	T	950	0	535	44	0
8	A	1	0	0	0	0
8	J	1	0	0	0	0
All	All	28503	0	27309	377	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 7.

All (377) 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:349:ARG:HH22	7:T:6:DG:H1'	1.13	1.11
1:A:287:ARG:NH2	7:T:10:DA:OP1	1.87	1.06
6:K:49:ARG:NH2	7:T:7:DC:H5	1.57	1.02
6:K:49:ARG:HH22	7:T:7:DC:H5	1.01	0.96
1:A:313:TYR:CD2	7:T:6:DG:C4	2.57	0.93
1:A:349:ARG:HH22	7:T:6:DG:C1'	1.82	0.92
6:K:49:ARG:NH2	7:T:7:DC:C5	2.40	0.89
1:A:349:ARG:NH2	7:T:6:DG:H1'	1.86	0.88
1:A:313:TYR:CE2	7:T:6:DG:C4	2.66	0.83
1:A:313:TYR:CD2	7:T:6:DG:C5	2.67	0.83
1:A:313:TYR:HD2	7:T:6:DG:C5	1.99	0.78
2:B:157:VAL:HG12	3:C:45:U:H5''	1.66	0.78
4:E:144:LEU:HB3	4:E:171:LEU:HB2	1.68	0.76
6:K:54:ARG:NH2	7:T:4:DA:H62	1.86	0.72
1:A:287:ARG:HH22	7:T:9:DA:H3'	1.55	0.70
4:D:127:GLN:HE21	4:D:131:ASN:HD22	1.40	0.69
4:F:69:GLN:HG3	4:F:78:TRP:HB2	1.75	0.69
1:A:287:ARG:NH2	7:T:9:DA:H3'	2.09	0.68
5:J:81:MET:SD	5:J:81:MET:N	2.64	0.68
5:J:102:ILE:HD12	5:J:106:GLN:HB3	1.74	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:K:30:ARG:HH12	6:K:114:MET:HE1	1.62	0.65
4:I:202:ALA:H	7:T:38:A:H1'	1.61	0.65
4:H:62:ARG:HG2	4:H:96:ASN:HB2	1.77	0.64
5:J:390:LEU:O	5:J:409:ILE:HA	1.97	0.64
1:A:345:MET:HG3	6:K:58:ARG:HH22	1.62	0.64
1:A:315:ARG:HB3	1:A:319:LYS:HB3	1.80	0.64
1:A:313:TYR:CE2	7:T:6:DG:N3	2.66	0.63
1:A:287:ARG:HH12	7:T:9:DA:H5''	1.63	0.63
1:A:71:ARG:HB2	1:A:190:LEU:HD13	1.79	0.63
2:B:209:VAL:HA	2:B:215:GLY:HA2	1.80	0.63
4:G:100:LEU:HD21	4:H:203:GLY:HA3	1.80	0.63
4:I:190:VAL:HG22	4:I:205:ILE:HG12	1.80	0.63
4:F:365:LYS:HB2	4:F:368:GLU:HG2	1.81	0.62
3:C:11:G:OP2	4:I:18:ARG:NH2	2.33	0.62
1:A:198:ARG:HD2	4:I:285:VAL:HG11	1.82	0.61
4:G:337:TYR:HB3	4:G:340:SER:H	1.66	0.61
4:D:78:TRP:O	4:D:81:ALA:N	2.31	0.61
5:J:200:ASN:ND2	7:T:46:DT:OP1	2.33	0.61
4:D:98:LYS:NZ	7:T:17:DT:OP1	2.34	0.60
4:H:204:HIS:NE2	7:T:34:A:OP2	2.35	0.60
4:I:349:ASN:HB3	4:I:352:GLU:HG2	1.83	0.60
1:A:66:LEU:HD22	1:A:143:GLY:HA3	1.84	0.59
5:J:152:LEU:HD21	5:J:157:ILE:HD11	1.83	0.59
1:A:287:ARG:NH1	7:T:9:DA:OP1	2.35	0.59
4:I:312:ARG:HH12	4:I:322:VAL:HB	1.67	0.58
4:F:272:GLU:OE2	4:F:312:ARG:NH2	2.35	0.58
4:F:199:ASP:OD1	4:F:199:ASP:N	2.36	0.58
4:D:59:VAL:HG23	4:E:194:ASP:HB2	1.85	0.58
4:F:47:ARG:NH2	4:G:194:ASP:OD2	2.36	0.58
4:E:87:LYS:HE2	4:E:122:LEU:HB3	1.86	0.58
2:B:160:THR:HG23	3:C:42:U:C5	2.39	0.58
4:D:367:GLU:O	4:D:371:LYS:NZ	2.35	0.58
4:H:68:ILE:HD11	4:H:111:LEU:HB3	1.86	0.57
1:A:8:LEU:HB2	1:A:148:VAL:HG13	1.86	0.57
4:D:274:LYS:NZ	4:D:280:TYR:OH	2.38	0.57
5:J:182:SER:OG	5:J:183:SER:N	2.36	0.57
4:G:20:ASP:OD1	6:K:104:ARG:NH2	2.38	0.57
2:B:139:MET:SD	2:B:139:MET:N	2.75	0.57
4:D:315:TYR:OH	4:E:266:PRO:O	2.22	0.57
2:B:77:ASP:OD1	2:B:77:ASP:N	2.37	0.57
2:B:197:VAL:HG22	2:B:227:PHE:HB2	1.87	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:G:80:LYS:NZ	4:G:115:VAL:O	2.38	0.57
4:D:83:GLU:HA	4:D:86:ASN:HB3	1.87	0.57
4:E:306:ASN:OD1	4:E:339:HIS:NE2	2.33	0.57
1:A:286:VAL:HG13	1:A:322:PRO:HB3	1.86	0.56
4:G:2:LEU:HB2	4:G:274:LYS:O	2.04	0.56
2:B:44:ARG:NH2	2:B:54:PRO:O	2.38	0.56
2:B:63:THR:HG21	2:B:88:LEU:HB2	1.87	0.56
4:G:310:ASP:OD2	4:H:332:ARG:NH1	2.37	0.56
5:J:428:ARG:NH2	5:J:461:GLU:OE2	2.38	0.56
2:B:168:ASP:OD1	2:B:168:ASP:N	2.35	0.55
2:B:160:THR:HG23	3:C:42:U:H5	1.72	0.55
4:F:47:ARG:NH1	4:F:141:ASP:OD2	2.39	0.55
2:B:41:SER:HB3	2:B:61:GLN:HG2	1.89	0.55
4:D:17:ASN:HD22	4:D:25:LYS:HD2	1.72	0.55
1:A:241:ARG:HH21	5:J:316:LEU:HB2	1.72	0.55
4:E:7:MET:HB2	4:E:217:LYS:HB2	1.88	0.55
7:T:48:C:H1'	7:T:49:DT:H4'	1.88	0.55
4:D:56:LEU:O	4:D:105:LYS:NZ	2.40	0.54
4:G:62:ARG:NH2	7:T:33:A:OP1	2.40	0.54
4:H:47:ARG:NH2	4:I:194:ASP:OD2	2.41	0.54
4:E:317:ASP:N	4:E:317:ASP:OD1	2.40	0.54
5:J:103:SER:O	5:J:107:THR:OG1	2.25	0.54
3:C:6:C:H4'	4:I:146:GLY:HA3	1.88	0.54
4:F:3:ILE:HG13	4:F:221:ILE:HB	1.89	0.54
4:E:47:ARG:NH2	4:F:194:ASP:OD2	2.34	0.54
4:E:332:ARG:NH1	4:E:333:TYR:OH	2.39	0.54
4:F:312:ARG:HD2	4:F:342:LEU:HD12	1.90	0.54
4:F:68:ILE:HD11	4:F:111:LEU:HD12	1.89	0.54
4:G:62:ARG:O	4:G:97:THR:OG1	2.26	0.54
1:A:10:LEU:HB2	1:A:139:VAL:HB	1.89	0.54
1:A:287:ARG:HH12	7:T:9:DA:C5'	2.20	0.54
4:H:18:ARG:HD2	4:H:22:GLY:HA2	1.90	0.53
4:E:305:SER:HB2	4:E:335:LEU:HD12	1.90	0.53
4:H:114:ILE:HD13	4:H:128:GLN:HG2	1.91	0.53
4:H:90:PHE:O	4:H:97:THR:OG1	2.24	0.53
1:A:287:ARG:NH1	7:T:9:DA:H3'	2.23	0.53
4:D:20:ASP:N	4:D:20:ASP:OD1	2.42	0.53
7:T:13:DT:H5'	7:T:13:DT:C6	2.44	0.53
4:F:163:SER:OG	4:F:164:ASN:N	2.41	0.53
4:G:274:LYS:HE2	4:G:278:ILE:HD11	1.91	0.53
4:F:108:ILE:O	4:F:111:LEU:HB2	2.09	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:H:190:VAL:HG23	4:H:205:ILE:HG12	1.90	0.52
4:H:254:SER:HA	4:H:257:GLN:HG3	1.91	0.52
5:J:501:GLN:NE2	6:K:150:GLU:OE1	2.42	0.52
4:F:67:LEU:HD21	4:G:195:VAL:HG11	1.91	0.52
5:J:109:LYS:HA	5:J:152:LEU:HD22	1.92	0.52
5:J:436:ARG:HG3	5:J:454:ALA:HB2	1.91	0.52
1:A:84:THR:HG21	3:C:8:G:H21	1.72	0.52
4:D:62:ARG:O	4:D:97:THR:OG1	2.27	0.52
4:D:37:ILE:HB	4:D:176:ALA:HB3	1.92	0.52
4:I:238:ALA:HB1	4:I:358:LEU:HD22	1.90	0.52
1:A:213:ASP:OD2	1:A:245:ARG:NH1	2.42	0.52
4:E:153:ASP:HA	4:E:156:LYS:HG2	1.92	0.52
4:I:172:GLN:HB3	4:I:220:SER:HB3	1.91	0.52
1:A:313:TYR:CD2	7:T:6:DG:N9	2.77	0.52
1:A:313:TYR:CD2	7:T:6:DG:C8	2.98	0.52
4:F:109:LYS:NZ	4:F:110:ASP:OD1	2.42	0.52
4:G:47:ARG:NH2	4:H:194:ASP:OD2	2.43	0.52
2:B:254:LYS:NZ	3:C:59:G:OP2	2.39	0.52
1:A:346:THR:OG1	1:A:348:ASN:OD1	2.24	0.52
4:G:239:HIS:HB2	4:G:369:VAL:HB	1.92	0.52
2:B:68:ARG:NH2	2:B:264:SER:OG	2.42	0.52
4:H:50:ASN:HA	4:H:53:LYS:HG2	1.92	0.52
1:A:287:ARG:HH12	7:T:9:DA:H3'	1.74	0.51
2:B:77:ASP:OD2	2:B:79:ARG:NH2	2.43	0.51
4:I:7:MET:HB2	4:I:217:LYS:HB2	1.92	0.51
4:I:20:ASP:N	4:I:20:ASP:OD1	2.43	0.51
5:J:504:ASP:O	5:J:508:LYS:HG2	2.09	0.51
1:A:52:ARG:NE	3:C:2:U:OP1	2.42	0.51
1:A:173:ARG:HH22	1:A:196:GLN:HG2	1.75	0.51
4:D:3:ILE:HG13	4:D:221:ILE:HB	1.92	0.51
2:B:208:LYS:HG3	2:B:217:TRP:HD1	1.75	0.51
4:F:91:LYS:HD3	4:F:98:LYS:HZ3	1.76	0.51
4:G:29:PHE:HB3	4:G:34:ARG:HG3	1.92	0.51
5:J:175:ARG:HB3	5:J:178:GLN:HB2	1.93	0.51
1:A:353:CYS:HA	2:B:52:LEU:HB3	1.92	0.51
4:H:110:ASP:O	4:H:114:ILE:HG13	2.11	0.51
3:C:7:C:OP1	4:I:47:ARG:NH1	2.43	0.51
4:G:269:ILE:HB	4:G:327:PHE:HD2	1.76	0.51
4:H:74:GLU:OE2	4:H:74:GLU:N	2.44	0.51
4:H:80:LYS:O	4:H:84:ILE:HG13	2.11	0.51
4:G:80:LYS:O	4:G:84:ILE:HG12	2.11	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:H:275:ASN:OD1	4:H:275:ASN:N	2.44	0.50
4:E:301:ILE:HD12	4:E:326:TRP:HH2	1.77	0.50
4:D:336:GLY:HA2	4:D:342:LEU:HD12	1.93	0.50
4:I:47:ARG:NH2	4:I:146:GLY:O	2.43	0.50
1:A:196:GLN:HE22	1:A:263:GLU:HA	1.77	0.50
1:A:238:GLN:HB3	1:A:239:PRO:HD3	1.93	0.50
2:B:134:ARG:NE	3:C:56:G:OP2	2.45	0.50
4:D:55:LEU:HB3	4:D:140:PRO:HG2	1.92	0.50
1:A:144:GLU:HG3	1:A:147:LEU:H	1.77	0.50
2:B:12:GLY:HA3	2:B:19:ARG:HD2	1.93	0.50
2:B:251:GLY:O	2:B:256:LYS:NZ	2.44	0.50
2:B:6:ARG:NH1	4:D:189:PHE:O	2.44	0.50
2:B:156:ARG:NH2	3:C:59:G:O6	2.42	0.50
4:I:332:ARG:NH1	4:I:333:TYR:OH	2.43	0.50
5:J:157:ILE:HD12	5:J:157:ILE:H	1.77	0.50
1:A:290:ARG:NE	1:A:294:ASP:OD1	2.42	0.49
4:G:120:LEU:HD11	4:G:124:GLU:HB2	1.94	0.49
1:A:70:VAL:HG22	1:A:139:VAL:HG22	1.94	0.49
4:D:180:HIS:ND1	4:D:181:ILE:O	2.44	0.49
5:J:417:THR:OG1	5:J:418:ASN:N	2.45	0.49
4:H:20:ASP:OD1	4:H:20:ASP:N	2.40	0.49
5:J:461:GLU:OE2	5:J:486:TYR:OH	2.30	0.49
7:T:42:C:H2''	7:T:43:DT:C5	2.47	0.49
1:A:287:ARG:CZ	7:T:9:DA:H3'	2.43	0.49
4:E:62:ARG:NH1	4:F:203:GLY:O	2.42	0.49
1:A:321:ILE:HD12	1:A:322:PRO:HD2	1.95	0.49
1:A:38:SER:OG	3:C:3:G:OP1	2.26	0.49
1:A:367:GLU:O	1:A:371:PHE:HB2	2.12	0.49
4:D:310:ASP:O	4:D:314:GLY:N	2.46	0.49
4:H:64:LEU:HB3	4:H:85:LEU:HD11	1.95	0.49
5:J:273:PRO:HG2	5:J:276:LEU:HD23	1.95	0.49
4:E:174:ALA:HB3	4:E:218:TYR:HB3	1.95	0.48
4:F:286:ARG:HH21	4:G:294:SER:HA	1.78	0.48
4:H:4:GLU:OE2	4:H:274:LYS:NZ	2.46	0.48
2:B:175:LEU:HD22	2:B:232:LEU:HD11	1.96	0.48
1:A:340:GLU:OE2	1:A:349:ARG:NH1	2.36	0.48
4:G:86:ASN:ND2	4:G:92:ASN:OD1	2.47	0.48
5:J:456:ILE:HB	5:J:489:LEU:HD23	1.95	0.48
1:A:20:GLY:HA3	3:C:3:G:H3'	1.95	0.48
4:E:142:ILE:O	4:E:143:ALA:C	2.56	0.48
4:G:68:ILE:HD11	4:G:111:LEU:HD13	1.94	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:9:G:P	4:I:40:GLN:HE21	2.36	0.48
4:F:114:ILE:HG21	4:F:129:VAL:HG23	1.95	0.48
4:G:63:ARG:NH1	4:H:195:VAL:O	2.47	0.48
1:A:313:TYR:CZ	7:T:6:DG:O4'	2.67	0.48
4:D:156:LYS:HD2	4:D:160:VAL:HB	1.96	0.48
4:E:174:ALA:HB2	4:F:261:ALA:HB3	1.96	0.48
4:E:171:LEU:HG	4:E:173:VAL:HG23	1.95	0.47
6:K:9:ILE:O	6:K:13:GLU:HG2	2.13	0.47
4:E:267:ASP:OD1	4:E:267:ASP:N	2.45	0.47
4:E:359:ASP:HA	4:E:363:GLY:HA2	1.95	0.47
4:I:363:GLY:O	4:I:365:LYS:NZ	2.38	0.47
5:J:178:GLN:HE21	5:J:301:LEU:HD13	1.79	0.47
1:A:84:THR:O	3:C:8:G:H5'	2.15	0.47
2:B:48:ASP:OD2	2:B:94:TYR:OH	2.32	0.47
4:D:286:ARG:NH1	4:E:293:GLU:O	2.48	0.47
4:D:58:GLY:HA2	4:D:104:SER:HA	1.96	0.47
1:A:313:TYR:HE2	7:T:6:DG:N3	2.11	0.47
4:D:127:GLN:O	4:D:131:ASN:ND2	2.47	0.47
4:E:4:GLU:OE2	4:E:218:TYR:OH	2.33	0.47
5:J:83:ASN:ND2	5:J:168:GLU:OE1	2.47	0.47
5:J:158:PRO:O	5:J:162:GLU:HG2	2.15	0.47
4:H:11:HIS:O	4:H:212:SER:OG	2.32	0.47
4:G:46:ILE:O	4:G:49:SER:OG	2.29	0.47
4:F:295:ASP:OD1	4:F:295:ASP:N	2.47	0.47
1:A:347:THR:HA	7:T:6:DG:N7	2.30	0.46
3:C:43:A:H4'	3:C:44:U:H5'	1.97	0.46
4:E:68:ILE:HD11	4:E:111:LEU:HG	1.97	0.46
2:B:70:ASP:OD2	2:B:125:ARG:NH1	2.37	0.46
2:B:8:LEU:HD23	2:B:8:LEU:HA	1.82	0.46
4:G:250:LYS:HE3	4:G:250:LYS:HB2	1.74	0.46
6:K:8:PHE:HB2	6:K:48:LEU:HD11	1.97	0.46
7:T:5:DC:H2''	7:T:6:DG:H21	1.81	0.46
1:A:57:ASP:OD1	1:A:58:SER:N	2.48	0.46
1:A:128:ARG:NH2	4:I:20:ASP:OD2	2.46	0.46
7:T:12:DC:O3'	7:T:13:DT:H3'	2.15	0.46
1:A:197:LYS:HD2	1:A:204:LEU:HD21	1.98	0.46
2:B:78:LYS:HD2	4:D:23:ALA:HB1	1.96	0.46
4:H:87:LYS:HD3	4:H:87:LYS:HA	1.71	0.46
4:E:172:GLN:OE1	4:F:263:HIS:NE2	2.36	0.46
4:H:112:ALA:HA	4:H:115:VAL:HG12	1.98	0.46
5:J:221:LYS:HB3	5:J:221:LYS:HE2	1.66	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:20:GLY:HA2	1:A:31:THR:HA	1.97	0.46
4:E:159:LYS:HB3	4:E:159:LYS:HE3	1.65	0.46
5:J:92:VAL:HB	5:J:114:LEU:HD13	1.98	0.46
5:J:345:TYR:HB3	5:J:349:GLY:HA2	1.98	0.46
1:A:272:LYS:HG3	1:A:274:THR:H	1.81	0.46
4:F:156:LYS:HE2	4:F:156:LYS:HB3	1.58	0.46
4:D:139:ALA:HB3	4:D:142:ILE:HB	1.98	0.46
2:B:9:ILE:HD12	2:B:24:TRP:HZ3	1.81	0.45
4:G:32:VAL:HG21	4:G:287:PRO:HG3	1.98	0.45
5:J:298:LYS:HB2	5:J:328:GLU:HB3	1.99	0.45
5:J:304:PRO:HA	5:J:322:VAL:HG12	1.97	0.45
4:D:350:LEU:O	4:D:354:VAL:HG23	2.16	0.45
1:A:364:LYS:HA	1:A:364:LYS:HD3	1.74	0.45
1:A:349:ARG:NH2	7:T:6:DG:C1'	2.61	0.45
2:B:255:ALA:HB3	2:B:260:PHE:HD2	1.82	0.45
5:J:473:GLU:OE2	5:J:475:ARG:NH1	2.49	0.45
4:D:325:PHE:HD1	4:D:345:ARG:HG3	1.82	0.45
4:D:165:THR:O	4:D:165:THR:OG1	2.30	0.44
4:G:341:LYS:HA	4:G:341:LYS:HD3	1.63	0.44
4:G:180:HIS:ND1	4:G:181:ILE:O	2.43	0.44
4:H:8:ILE:HD11	4:H:304:LEU:HD22	1.98	0.44
5:J:188:ILE:HD11	5:J:301:LEU:HD23	1.99	0.44
4:E:252:ASN:ND2	4:E:262:ALA:O	2.50	0.44
4:F:184:PRO:HG2	6:K:25:LYS:NZ	2.32	0.44
4:G:347:ILE:HG22	4:G:349:ASN:H	1.82	0.44
2:B:266:LEU:HD22	2:B:267:PRO:HD2	2.00	0.44
4:D:128:GLN:HA	4:D:131:ASN:HD21	1.81	0.44
4:D:275:ASN:OD1	4:D:275:ASN:N	2.43	0.44
4:E:208:SER:OG	4:E:209:MET:N	2.50	0.44
5:J:118:TYR:HB2	5:J:124:ARG:HG3	1.98	0.44
5:J:351:SER:O	5:J:351:SER:OG	2.32	0.44
4:D:46:ILE:O	4:D:49:SER:OG	2.30	0.44
4:E:79:LYS:HB3	4:E:79:LYS:HE3	1.77	0.44
4:D:107:LYS:HA	4:D:107:LYS:HD2	1.81	0.44
5:J:390:LEU:HD23	5:J:390:LEU:HA	1.88	0.44
3:C:26:G:C8	4:G:192:ALA:HB2	2.52	0.44
4:E:1:MET:HE2	4:E:1:MET:HB3	1.84	0.44
4:E:110:ASP:OD1	4:E:110:ASP:N	2.51	0.44
2:B:221:LYS:HA	2:B:221:LYS:HD3	1.74	0.44
5:J:368:ASP:OD1	5:J:369:ARG:N	2.50	0.44
5:J:498:GLU:HB2	5:J:509:ARG:HG3	2.00	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:83:HIS:HA	3:C:9:G:OP2	2.18	0.43
5:J:289:LEU:O	5:J:293:THR:OG1	2.27	0.43
7:T:23:DT:H2''	7:T:24:G:H5''	2.01	0.43
2:B:157:VAL:HA	3:C:45:U:H5''	2.01	0.43
4:E:285:VAL:HG12	4:F:295:ASP:HB2	2.00	0.43
4:F:32:VAL:HG23	4:F:34:ARG:HE	1.82	0.43
4:F:312:ARG:HH22	4:F:324:GLY:HA3	1.84	0.43
4:H:325:PHE:HD1	4:H:345:ARG:HB2	1.84	0.43
4:D:247:ALA:O	4:D:251:THR:OG1	2.24	0.43
4:F:9:GLN:OE1	4:F:11:HIS:NE2	2.51	0.43
4:D:316:TYR:HB3	4:E:349:ASN:HD21	1.84	0.43
4:G:114:ILE:HD13	4:G:129:VAL:HG23	2.01	0.43
4:H:205:ILE:HD11	7:T:32:DT:C2	2.54	0.43
6:K:116:MET:O	6:K:120:LEU:HB2	2.19	0.43
4:E:236:LEU:HD12	4:E:236:LEU:HA	1.90	0.43
4:G:285:VAL:HG11	4:H:297:VAL:HG23	2.00	0.43
1:A:63:LEU:HD21	1:A:151:LEU:HD11	2.01	0.43
1:A:221:GLU:OE1	5:J:96:SER:OG	2.36	0.43
3:C:9:G:OP1	4:I:25:LYS:NZ	2.52	0.42
4:E:20:ASP:OD1	4:E:20:ASP:N	2.51	0.42
4:D:298:GLU:O	4:D:301:ILE:HB	2.20	0.42
4:G:353:LEU:O	4:G:357:VAL:HG22	2.19	0.42
5:J:138:CYS:O	5:J:142:THR:OG1	2.25	0.42
6:K:34:LYS:HD3	6:K:34:LYS:HA	1.72	0.42
4:D:17:ASN:ND2	4:D:25:LYS:HD2	2.35	0.42
5:J:291:GLY:HA2	5:J:294:TRP:HB2	2.02	0.42
6:K:19:ASP:OD1	6:K:19:ASP:N	2.52	0.42
1:A:349:ARG:CZ	7:T:6:DG:H1''	2.46	0.42
5:J:191:LEU:HD12	5:J:192:ILE:HG12	2.00	0.42
1:A:343:SER:HA	4:H:292:LYS:HD3	2.02	0.42
4:G:246:LEU:HD23	4:G:246:LEU:HA	1.88	0.42
4:G:286:ARG:HB2	4:H:295:ASP:HB3	2.02	0.42
4:I:273:PHE:HZ	4:I:357:VAL:HG13	1.85	0.42
4:D:125:ALA:O	4:D:129:VAL:HG12	2.19	0.42
5:J:346:THR:HG22	5:J:352:LEU:HB2	2.01	0.42
5:J:404:ASP:OD1	5:J:405:ILE:N	2.52	0.42
2:B:106:PRO:HA	2:B:107:PRO:HD3	1.87	0.42
3:C:11:G:C4	4:H:148:MET:HE2	2.55	0.42
4:D:34:ARG:NH1	4:D:284:PHE:O	2.49	0.42
4:D:86:ASN:HA	4:D:90:PHE:O	2.19	0.42
4:I:37:ILE:HB	4:I:176:ALA:HB3	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:I:358:LEU:HA	4:I:361:ILE:HG22	2.02	0.42
4:E:86:ASN:ND2	4:E:92:ASN:OD1	2.52	0.42
4:G:79:LYS:HE2	4:G:79:LYS:HB2	1.93	0.42
4:D:326:TRP:CD2	4:D:335:LEU:HB2	2.54	0.42
4:D:337:TYR:O	4:D:339:HIS:N	2.53	0.42
4:E:66:ASP:OD1	4:E:66:ASP:N	2.52	0.42
4:G:365:LYS:HB2	4:G:368:GLU:HG2	2.01	0.42
4:H:62:ARG:N	4:I:193:ASP:OD2	2.50	0.42
4:H:98:LYS:HE3	4:H:98:LYS:HB3	1.87	0.42
4:I:337:TYR:O	4:I:339:HIS:ND1	2.52	0.42
4:I:338:LYS:HB3	4:I:339:HIS:H	1.69	0.42
5:J:348:GLN:HB2	5:J:350:LYS:HG2	2.02	0.42
4:H:151:PRO:HG2	4:H:162:TRP:CE2	2.55	0.42
5:J:226:LEU:H	5:J:226:LEU:HG	1.68	0.42
5:J:249:LEU:HD22	5:J:390:LEU:HD22	2.02	0.42
7:T:5:DC:H6	7:T:5:DC:H2'	1.65	0.42
1:A:35:PRO:HD2	1:A:70:VAL:HG11	2.02	0.41
6:K:54:ARG:NH1	7:T:4:DA:N7	2.68	0.41
1:A:290:ARG:CZ	1:A:293:MET:HE2	2.50	0.41
4:G:1:MET:HE3	4:G:1:MET:HB2	1.93	0.41
4:H:93:LYS:HA	4:H:93:LYS:HD3	1.85	0.41
4:H:141:ASP:OD1	4:H:142:ILE:N	2.54	0.41
4:D:108:ILE:O	4:D:111:LEU:HB3	2.20	0.41
4:F:58:GLY:HA2	4:F:104:SER:HA	2.02	0.41
4:G:120:LEU:HD12	4:G:121:GLY:N	2.35	0.41
4:H:84:ILE:HD12	4:H:115:VAL:HG23	2.01	0.41
1:A:278:TYR:O	1:A:279:ASN:C	2.62	0.41
4:D:79:LYS:HE2	4:D:79:LYS:HB3	1.94	0.41
5:J:492:LYS:H	5:J:492:LYS:HG2	1.58	0.41
1:A:199:TRP:CE2	1:A:202:GLU:HB2	2.55	0.41
4:D:78:TRP:O	4:D:80:LYS:N	2.53	0.41
7:T:40:DT:H6	7:T:40:DT:H2'	1.72	0.41
1:A:11:ARG:HH21	1:A:138:LEU:HD13	1.85	0.41
4:G:178:SER:OG	4:G:180:HIS:O	2.38	0.41
4:H:42:ILE:HD13	4:H:217:LYS:HD3	2.01	0.41
4:H:103:MET:HE2	4:H:103:MET:HB3	1.88	0.41
2:B:62:LYS:HA	2:B:62:LYS:HD3	1.77	0.41
4:H:83:GLU:HG2	4:H:122:LEU:HD11	2.02	0.41
5:J:441:ARG:HA	5:J:441:ARG:HD3	1.95	0.41
4:G:69:GLN:NE2	4:G:74:GLU:O	2.46	0.41
6:K:46:TRP:CD1	6:K:49:ARG:HH21	2.38	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:26:G:O2'	4:G:190:VAL:HG22	2.21	0.41
4:D:78:TRP:CD1	4:D:79:LYS:HG2	2.56	0.41
4:D:264:ASN:OD1	4:D:264:ASN:N	2.54	0.41
4:E:236:LEU:HD13	4:E:372:SER:HB3	2.02	0.41
4:E:239:HIS:ND1	4:E:372:SER:O	2.54	0.41
5:J:186:ARG:NH2	7:T:47:C:OP1	2.54	0.41
2:B:123:ARG:HA	2:B:235:VAL:HA	2.03	0.41
3:C:39:A:H1'	3:C:40:A:C8	2.56	0.40
3:C:47:C:C2	3:C:61:G:C2	3.08	0.40
4:D:78:TRP:HA	4:D:78:TRP:CE3	2.56	0.40
4:D:349:ASN:HB3	4:D:352:GLU:HB3	2.01	0.40
6:K:3:ARG:HD2	6:K:3:ARG:HA	1.81	0.40
1:A:48:MET:HE1	1:A:151:LEU:HD12	2.02	0.40
1:A:311:VAL:HG13	1:A:349:ARG:HB2	2.03	0.40
2:B:243:LEU:O	2:B:247:THR:HG23	2.21	0.40
4:E:111:LEU:HD11	4:E:129:VAL:HG13	2.03	0.40
4:G:338:LYS:HA	4:G:338:LYS:HD2	1.85	0.40
5:J:106:GLN:HA	5:J:109:LYS:HE2	2.03	0.40
1:A:187:GLU:O	1:A:191:SER:OG	2.27	0.40
4:F:2:LEU:HB2	4:F:274:LYS:O	2.20	0.40
4:G:272:GLU:OE1	4:G:274:LYS:NZ	2.50	0.40
4:G:335:LEU:HD23	4:G:336:GLY:HA2	2.02	0.40
5:J:134:LEU:HD23	5:J:134:LEU:HA	1.93	0.40
5:J:479:TRP:CD2	5:J:519:PRO:HG3	2.56	0.40
4:E:295:ASP:OD1	4:E:295:ASP:N	2.54	0.40
4:F:311:ILE:HD13	4:F:311:ILE:HA	1.90	0.40
1:A:39:GLY:HA2	3:C:2:U:H1'	2.04	0.40
4:D:11:HIS:HB3	4:D:16:LEU:HD11	2.02	0.40
6:K:108:LEU:HD23	6:K:108:LEU:HA	1.94	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	345/388 (89%)	321 (93%)	24 (7%)	0	100	100
2	B	266/272 (98%)	240 (90%)	26 (10%)	0	100	100
4	D	351/378 (93%)	322 (92%)	29 (8%)	0	100	100
4	E	373/378 (99%)	357 (96%)	16 (4%)	0	100	100
4	F	370/378 (98%)	352 (95%)	18 (5%)	0	100	100
4	G	368/378 (97%)	359 (98%)	9 (2%)	0	100	100
4	H	369/378 (98%)	355 (96%)	14 (4%)	0	100	100
4	I	260/378 (69%)	249 (96%)	11 (4%)	0	100	100
5	J	440/535 (82%)	396 (90%)	44 (10%)	0	100	100
6	K	163/174 (94%)	152 (93%)	11 (7%)	0	100	100
All	All	3305/3637 (91%)	3103 (94%)	202 (6%)	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	289/322 (90%)	286 (99%)	3 (1%)	73	83
2	B	235/238 (99%)	234 (100%)	1 (0%)	89	93
4	D	300/313 (96%)	298 (99%)	2 (1%)	81	88
4	E	312/313 (100%)	310 (99%)	2 (1%)	84	90
4	F	310/313 (99%)	308 (99%)	2 (1%)	84	90
4	G	308/313 (98%)	307 (100%)	1 (0%)	91	95
4	H	309/313 (99%)	308 (100%)	1 (0%)	91	95
4	I	218/313 (70%)	218 (100%)	0	100	100
5	J	377/459 (82%)	375 (100%)	2 (0%)	86	91
6	K	144/153 (94%)	143 (99%)	1 (1%)	81	88
All	All	2802/3050 (92%)	2787 (100%)	15 (0%)	85	91

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	279	ASN
1	A	321	ILE
1	A	339	LEU
2	B	103	LEU
4	D	3	ILE
4	D	264	ASN
4	E	11	HIS
4	E	142	ILE
4	F	20	ASP
4	F	167	VAL
4	G	99	MET
4	H	251	THR
5	J	90	VAL
5	J	131	LEU
6	K	111	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (37) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	6	ASN
1	A	142	GLN
1	A	196	GLN
1	A	259	GLN
2	B	61	GLN
2	B	142	GLN
2	B	223	ASN
4	D	17	ASN
4	D	70	GLN
4	D	127	GLN
4	D	135	GLN
4	D	225	GLN
4	D	282	ASN
4	E	9	GLN
4	E	10	ASN
4	E	17	ASN
4	E	70	GLN
4	E	86	ASN
4	E	135	GLN
4	E	204	HIS
4	F	9	GLN
4	F	135	GLN

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Mol	Chain	Res	Type
4	F	229	ASN
4	F	257	GLN
4	G	152	ASN
4	H	69	GLN
4	H	128	GLN
4	H	306	ASN
4	H	330	ASN
4	H	346	ASN
4	I	299	GLN
5	J	163	ASN
5	J	200	ASN
5	J	203	HIS
5	J	462	ASN
5	J	474	ASN
6	K	107	GLN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
3	C	60/61 (98%)	25 (41%)	1 (1%)
7	T	0/56	-	-
All	All	60/117 (51%)	25 (41%)	1 (1%)

All (25) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
3	C	2	U
3	C	3	G
3	C	9	G
3	C	10	A
3	C	14	G
3	C	15	U
3	C	19	U
3	C	21	A
3	C	26	G
3	C	27	G
3	C	28	C
3	C	32	U
3	C	33	G
3	C	38	A
3	C	39	A

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Mol	Chain	Res	Type
3	C	43	A
3	C	44	U
3	C	45	U
3	C	46	C
3	C	49	C
3	C	50	A
3	C	52	G
3	C	53	C
3	C	55	U
3	C	56	G

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
3	C	45	U

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](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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.