



Full wwPDB EM Validation Report ⓘ

Jul 16, 2025 – 01:43 PM JST

PDB ID : 8YB6 / pdb_00008yb6
EMDB ID : EMD-39110
Title : Type I-EHNNH Cascade complex
Authors : Li, Z.
Deposited on : 2024-02-11
Resolution : 3.06 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

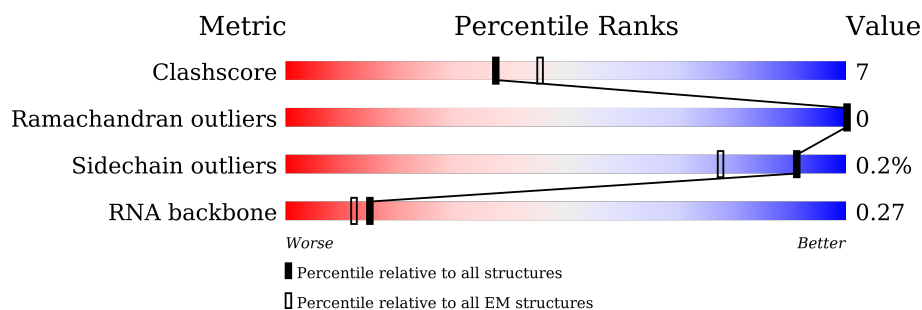
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.06 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	75% 15% 10%
2	B	272	81% 17% .
3	C	61	41% 39% 20%
4	D	378	79% 20% .
4	E	378	78% 20% .
4	F	378	83% 16% .
4	G	378	84% 16%
4	H	378	83% 17%

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Mol	Chain	Length	Quality of chain
4	I	378	<div><div></div><div>62%9%29%</div></div>
5	J	535	<div><div></div><div>68%15%17%</div></div>
6	K	174	<div><div></div><div>87%7%5%</div></div>

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 27758 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	350	Total	C	N	O	S	0	0
			2768	1746	514	490	18		

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

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	267	Total	C	N	O	S	0	0
			2166	1392	387	383	4		

- 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	372	Total	C	N	O	S	0	0
			2897	1830	506	549	12		
4	E	370	Total	C	N	O	S	0	0
			2882	1821	503	546	12		
4	F	374	Total	C	N	O	S	0	0
			2911	1839	509	551	12		
4	G	377	Total	C	N	O	S	0	0
			2935	1856	512	555	12		
4	H	377	Total	C	N	O	S	0	0
			2935	1856	512	555	12		
4	I	268	Total	C	N	O	S	0	0
			2072	1319	358	387	8		

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

Mol	Chain	Residues	Atoms					AltConf	Trace
5	J	443	Total	C	N	O	S	0	0
			3531	2266	605	641	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		

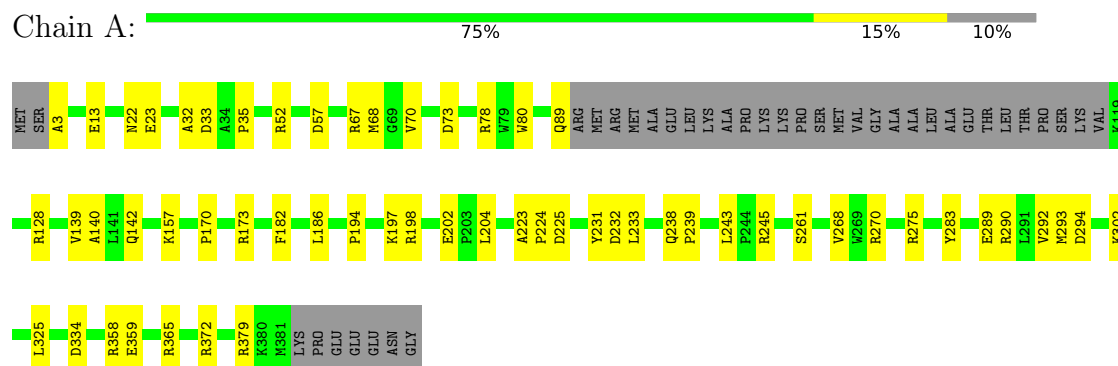
- Molecule 7 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

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

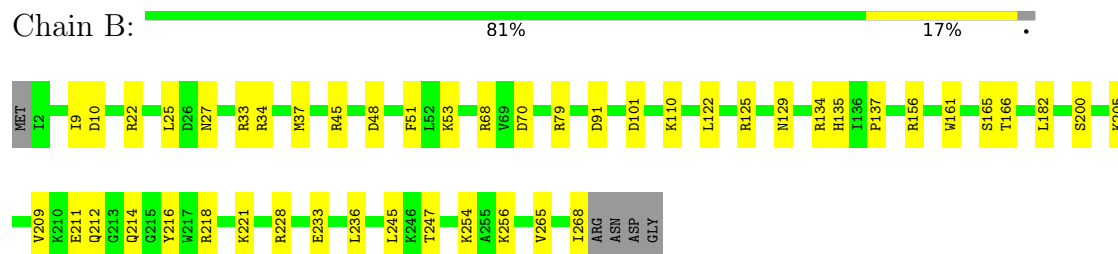
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

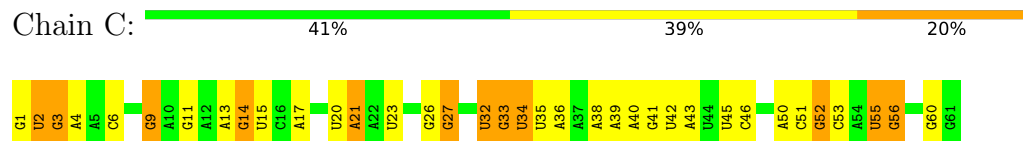
• Molecule 1: CRISPR system Cascade subunit CasD



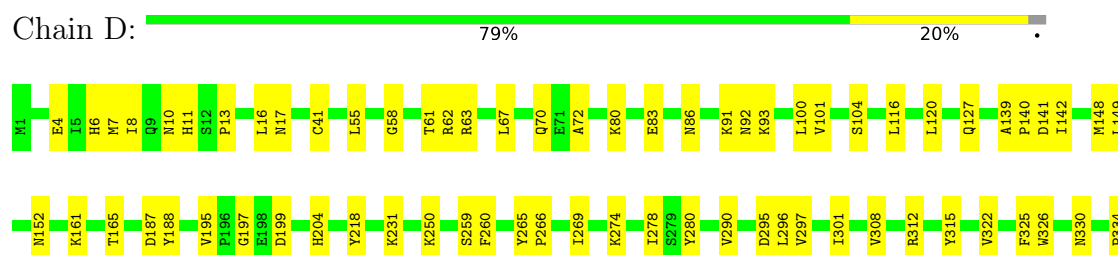
• Molecule 2: CRISPR-associated endoribonuclease Cse3



• Molecule 3: 61-nt crRNA



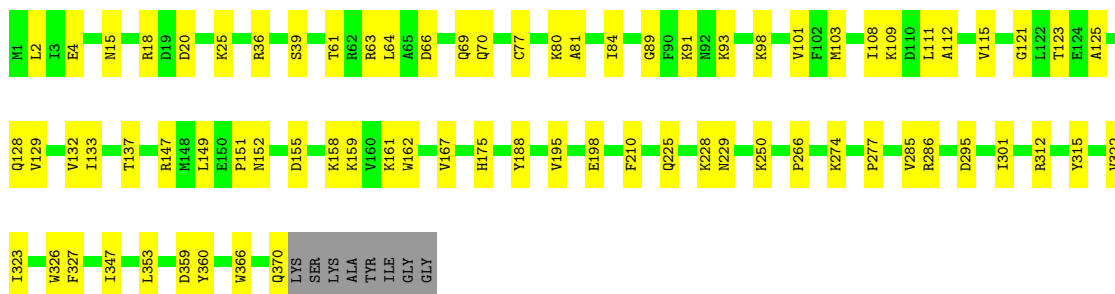
• Molecule 4: CRISPR system Cascade subunit CasC





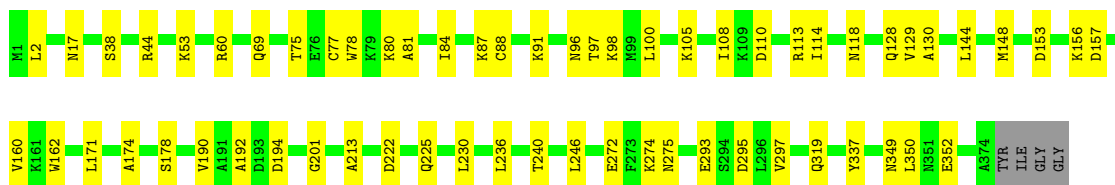
• Molecule 4: CRISPR system Cascade subunit CasC

Chain E: 78% 20% .



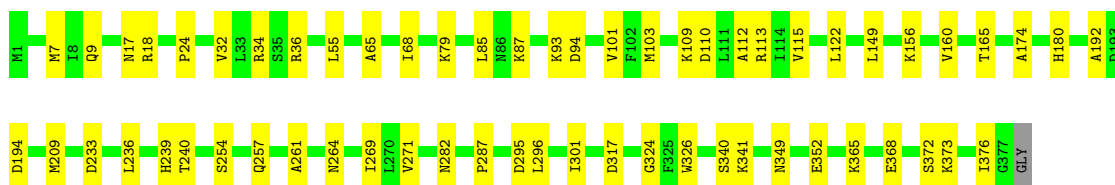
• Molecule 4: CRISPR system Cascade subunit CasC

Chain F: 83% 16% .



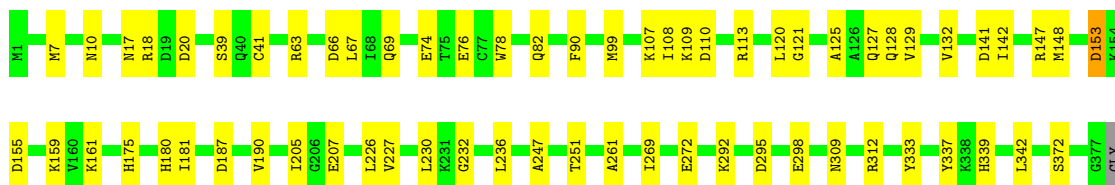
• Molecule 4: CRISPR system Cascade subunit CasC

Chain G: 84% 16%



• Molecule 4: CRISPR system Cascade subunit CasC

Chain H: 83% 17%



• Molecule 4: CRISPR system Cascade subunit CasC

Chain I: 62% 9% 29%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	291872	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	0.15	0/2837	0.35	0/3848
2	B	0.13	0/2224	0.32	0/3012
3	C	0.19	0/1459	0.35	0/2273
4	D	0.15	0/2954	0.40	0/3995
4	E	0.17	0/2939	0.38	0/3976
4	F	0.17	0/2968	0.35	0/4013
4	G	0.16	0/2993	0.36	0/4047
4	H	0.16	0/2993	0.33	0/4047
4	I	0.16	0/2118	0.35	0/2870
5	J	0.16	0/3632	0.38	0/4942
6	K	0.16	0/1386	0.34	0/1866
All	All	0.16	0/28503	0.36	0/38889

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	2768	0	2765	44	0
2	B	2166	0	2177	42	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	1303	0	659	36	0
4	D	2897	0	2878	49	0
4	E	2882	0	2860	53	0
4	F	2911	0	2896	50	0
4	G	2935	0	2919	38	0
4	H	2935	0	2919	52	0
4	I	2072	0	2036	27	0
5	J	3531	0	3460	55	0
6	K	1356	0	1398	10	0
7	A	1	0	0	0	0
7	J	1	0	0	0	0
All	All	27758	0	26967	397	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 (397) 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:H:247:ALA:O	4:H:251:THR:HG22	1.33	1.23
2:B:182:LEU:HD23	2:B:247:THR:HG23	1.40	1.02
4:F:114:ILE:HG21	4:F:129:VAL:HG23	1.52	0.91
4:F:105:LYS:O	4:F:108:ILE:HB	1.77	0.83
4:H:247:ALA:O	4:H:251:THR:CG2	2.24	0.82
4:H:337:TYR:CE1	4:H:339:HIS:HB3	2.18	0.79
4:I:226:LEU:O	4:I:230:LEU:HD22	1.85	0.76
4:E:4:GLU:OE2	4:E:277:PRO:HA	1.86	0.74
4:F:114:ILE:CG2	4:F:129:VAL:HG23	2.16	0.74
4:E:137:THR:HG21	4:E:167:VAL:HG21	1.72	0.71
3:C:26:G:H2'	3:C:26:G:N3	2.06	0.71
2:B:135:HIS:ND1	3:C:55:U:OP1	2.23	0.70
4:D:326:TRP:HE1	4:D:334:PRO:HB3	1.56	0.70
4:H:78:TRP:CE2	4:H:82:GLN:NE2	2.59	0.70
4:F:69:GLN:HB2	4:F:78:TRP:HB2	1.76	0.68
4:F:114:ILE:CD1	4:F:128:GLN:HB3	2.23	0.68
4:E:159:LYS:HE3	4:E:161:LYS:HD3	1.76	0.67
4:D:55:LEU:HB3	4:D:140:PRO:HG2	1.76	0.66
4:E:66:ASP:O	4:E:70:GLN:HB2	1.95	0.66
4:F:2:LEU:HB2	4:F:274:LYS:O	1.95	0.65
4:I:292:LYS:HE3	6:K:148:GLU:HB2	1.77	0.65
4:D:195:VAL:HG22	4:D:197:GLY:H	1.62	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:G:340:SER:OG	4:G:341:LYS:N	2.31	0.63
4:F:174:ALA:HB2	4:G:261:ALA:HB3	1.81	0.63
4:D:312:ARG:NH2	4:D:322:VAL:O	2.29	0.62
4:E:327:PHE:HB2	4:E:353:LEU:HD13	1.81	0.62
4:E:103:MET:HE2	4:E:108:ILE:HG13	1.82	0.62
1:A:379:ARG:NH1	4:E:20:ASP:OD1	2.33	0.61
4:F:114:ILE:HD13	4:F:128:GLN:CB	2.30	0.61
5:J:186:ARG:NH2	5:J:327:ILE:O	2.33	0.61
4:H:128:GLN:O	4:H:132:VAL:HG12	2.00	0.61
1:A:334:ASP:OD2	1:A:372:ARG:NH2	2.34	0.61
5:J:354:SER:HB3	5:J:396:ALA:HB2	1.83	0.61
4:E:2:LEU:HB2	4:E:274:LYS:O	2.01	0.60
3:C:35:U:OP2	4:E:18:ARG:NH2	2.33	0.60
4:F:130:ALA:HB1	4:F:162:TRP:CZ3	2.37	0.60
2:B:135:HIS:CE1	3:C:55:U:OP2	2.54	0.60
4:F:114:ILE:HD13	4:F:128:GLN:HB3	1.81	0.60
1:A:52:ARG:HG3	3:C:1:G:H1'	1.83	0.60
4:G:295:ASP:OD1	4:G:295:ASP:N	2.35	0.60
3:C:11:G:OP2	4:I:18:ARG:NH2	2.35	0.60
4:G:156:LYS:NZ	4:G:160:VAL:O	2.35	0.60
4:H:337:TYR:HE1	4:H:339:HIS:HB3	1.63	0.60
3:C:33:G:OP1	4:E:25:LYS:NZ	2.35	0.59
4:H:74:GLU:HG2	4:H:76:GLU:H	1.66	0.59
5:J:445:LYS:CG	5:J:446:LYS:N	2.64	0.59
1:A:32:ALA:O	1:A:78:ARG:NH2	2.36	0.59
3:C:6:C:N3	5:J:203:HIS:NE2	2.47	0.59
1:A:68:MET:HA	1:A:140:ALA:O	2.01	0.59
4:F:44:ARG:NH1	4:G:194:ASP:OD1	2.36	0.59
4:H:17:ASN:ND2	4:H:41:CYS:SG	2.76	0.59
4:E:64:LEU:HD22	4:E:101:VAL:HG11	1.84	0.58
4:I:226:LEU:O	4:I:230:LEU:CD2	2.51	0.58
4:E:225:GLN:NE2	4:E:229:ASN:OD1	2.36	0.58
2:B:182:LEU:HD23	2:B:247:THR:CG2	2.24	0.58
4:H:142:ILE:HD11	4:H:147:ARG:HD3	1.86	0.58
4:D:13:PRO:HA	4:D:16:LEU:HD12	1.85	0.58
1:A:57:ASP:OD1	1:A:57:ASP:N	2.33	0.57
4:D:297:VAL:O	4:D:301:ILE:HG12	2.03	0.57
4:D:312:ARG:HE	4:D:342:LEU:HD21	1.69	0.57
3:C:17:A:OP2	4:H:18:ARG:NH2	2.38	0.57
4:F:295:ASP:OD1	4:F:295:ASP:N	2.38	0.57
4:G:9:GLN:NE2	4:G:264:ASN:O	2.38	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:135:HIS:NE2	3:C:56:G:O4'	2.37	0.57
2:B:122:LEU:HD22	2:B:265:VAL:HB	1.86	0.56
1:A:365:ARG:NH2	2:B:101:ASP:OD1	2.38	0.56
4:D:91:LYS:HG3	4:D:152:ASN:HB2	1.87	0.56
4:I:295:ASP:OD1	4:I:295:ASP:N	2.37	0.56
2:B:45:ARG:NH2	2:B:91:ASP:OD2	2.37	0.56
4:D:127:GLN:NE2	4:D:161:LYS:O	2.37	0.56
4:F:114:ILE:HD11	4:F:128:GLN:HB3	1.88	0.56
4:F:110:ASP:HA	4:F:113:ARG:HD3	1.88	0.56
4:D:58:GLY:HA2	4:D:104:SER:HA	1.88	0.56
4:G:7:MET:HG2	4:G:269:ILE:HG12	1.87	0.56
4:D:141:ASP:OD1	4:D:141:ASP:N	2.39	0.55
4:H:20:ASP:OD1	5:J:441:ARG:NH1	2.38	0.55
4:H:90:PHE:HA	4:H:99:MET:HE3	1.88	0.55
1:A:358:ARG:NH1	1:A:359:GLU:OE2	2.40	0.55
4:E:295:ASP:OD1	4:E:295:ASP:N	2.38	0.55
4:E:128:GLN:O	4:E:132:VAL:HG23	2.06	0.55
4:F:194:ASP:N	4:F:194:ASP:OD1	2.40	0.55
4:F:153:ASP:O	4:F:156:LYS:NZ	2.40	0.54
4:H:292:LYS:NZ	6:K:32:ASP:OD2	2.39	0.54
5:J:445:LYS:HG3	5:J:446:LYS:N	2.21	0.54
4:E:89:GLY:HA2	4:E:155:ASP:HB3	1.89	0.54
4:D:101:VAL:HG13	4:D:149:LEU:HD22	1.90	0.54
4:F:75:THR:O	4:F:78:TRP:HB3	2.08	0.54
4:E:286:ARG:NH1	4:F:293:GLU:O	2.40	0.54
4:F:144:LEU:HD22	4:F:171:LEU:HB2	1.90	0.54
4:H:309:ASN:HB2	4:H:342:LEU:HD11	1.90	0.54
2:B:22:ARG:NH1	4:E:188:TYR:OH	2.41	0.54
6:K:90:ARG:NH1	6:K:166:ILE:O	2.42	0.53
5:J:445:LYS:CG	5:J:446:LYS:H	2.21	0.53
4:E:93:LYS:HD3	4:E:98:LYS:HB2	1.90	0.53
4:F:77:CYS:HA	4:F:80:LYS:HE3	1.91	0.53
4:F:91:LYS:HD2	4:F:98:LYS:HB3	1.91	0.53
5:J:339:LYS:HE2	5:J:345:TYR:HE2	1.74	0.53
4:D:83:GLU:OE1	4:D:86:ASN:ND2	2.40	0.53
5:J:325:CYS:SG	5:J:326:SER:N	2.81	0.53
3:C:36:A:H5'	4:D:148:MET:HB3	1.91	0.53
1:A:302:LYS:O	2:B:34:ARG:NH2	2.42	0.53
4:F:77:CYS:O	4:F:81:ALA:N	2.42	0.53
4:E:36:ARG:HD2	4:E:175:HIS:HD2	1.74	0.52
5:J:385:SER:OG	5:J:386:ARG:N	2.43	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:G:32:VAL:HG21	4:G:287:PRO:HG3	1.92	0.52
4:G:87:LYS:HG3	4:G:122:LEU:HD21	1.90	0.52
3:C:26:G:C2	4:G:192:ALA:HB2	2.44	0.52
4:H:78:TRP:NE1	4:H:82:GLN:HE21	2.07	0.52
2:B:134:ARG:HB2	2:B:137:PRO:HB3	1.91	0.52
2:B:33:ARG:O	2:B:37:MET:HG3	2.09	0.52
5:J:226:LEU:O	5:J:230:THR:OG1	2.27	0.52
5:J:272:ILE:HG13	5:J:273:PRO:HD2	1.92	0.52
2:B:68:ARG:NH1	2:B:70:ASP:OD2	2.43	0.52
4:F:17:ASN:HD22	4:F:38:SER:H	1.58	0.52
1:A:197:LYS:HD2	1:A:202:GLU:HB3	1.91	0.51
1:A:35:PRO:HD2	1:A:70:VAL:HG11	1.93	0.51
4:E:39:SER:OG	4:E:175:HIS:ND1	2.40	0.51
4:G:109:LYS:O	4:G:112:ALA:HB3	2.10	0.51
4:E:91:LYS:HB3	4:E:93:LYS:HG3	1.91	0.51
1:A:23:GLU:OE1	5:J:369:ARG:NH2	2.43	0.51
4:I:166:THR:OG1	4:I:167:VAL:N	2.36	0.51
1:A:290:ARG:NE	1:A:294:ASP:OD1	2.44	0.51
1:A:275:ARG:NH2	6:K:55:ALA:O	2.42	0.51
3:C:32:U:H5'	4:F:190:VAL:O	2.11	0.51
4:G:317:ASP:N	4:G:317:ASP:OD1	2.42	0.51
4:I:143:ALA:HB1	4:I:229:ASN:HB3	1.92	0.51
5:J:118:TYR:HB2	5:J:124:ARG:HB3	1.93	0.50
5:J:503:VAL:HG21	6:K:160:PHE:HD2	1.76	0.50
6:K:60:VAL:O	6:K:64:ILE:HG12	2.11	0.50
1:A:67:ARG:HG3	1:A:142:GLN:HB3	1.94	0.50
6:K:137:TRP:O	6:K:141:THR:OG1	2.28	0.50
5:J:197:THR:HG22	5:J:198:ALA:H	1.77	0.50
3:C:20:U:H6	3:C:21:A:H4'	1.75	0.50
4:D:80:LYS:HA	4:D:83:GLU:HB2	1.93	0.50
4:H:155:ASP:OD1	4:H:155:ASP:N	2.45	0.50
4:G:373:LYS:HD3	4:G:376:ILE:HD13	1.94	0.50
4:F:87:LYS:NZ	4:F:157:ASP:OD2	2.45	0.50
4:F:272:GLU:OE1	4:F:274:LYS:NZ	2.42	0.50
4:H:120:LEU:CD1	4:H:125:ALA:HB2	2.41	0.50
5:J:167:PHE:HE1	5:J:275:TRP:HE1	1.59	0.50
4:D:315:TYR:OH	4:E:266:PRO:O	2.29	0.49
4:H:110:ASP:HA	4:H:113:ARG:HD3	1.94	0.49
1:A:70:VAL:HG22	1:A:139:VAL:HG22	1.95	0.49
2:B:212:GLN:NE2	2:B:214:GLN:OE1	2.44	0.49
4:F:130:ALA:HB1	4:F:162:TRP:CH2	2.47	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:209:VAL:HG22	2:B:216:TYR:HA	1.93	0.49
4:F:84:ILE:O	4:F:88:CYS:N	2.45	0.49
4:F:97:THR:OG1	4:F:98:LYS:N	2.45	0.49
4:G:349:ASN:HB3	4:G:352:GLU:HB2	1.95	0.49
4:H:337:TYR:CE1	4:H:339:HIS:CB	2.92	0.49
4:E:61:THR:HG22	4:E:63:ARG:H	1.77	0.49
4:E:301:ILE:HD12	4:E:326:TRP:HH2	1.77	0.49
4:E:315:TYR:HD2	4:F:350:LEU:HD22	1.76	0.49
4:I:238:ALA:HB1	4:I:358:LEU:HD22	1.93	0.49
4:H:69:GLN:HA	4:H:76:GLU:HG3	1.94	0.49
4:H:295:ASP:HB2	4:H:298:GLU:HB3	1.95	0.49
4:I:172:GLN:HB3	4:I:220:SER:HB2	1.93	0.49
1:A:292:VAL:HG11	2:B:218:ARG:HB3	1.94	0.48
3:C:23:U:C2	4:F:148:MET:HE1	2.49	0.48
4:D:250:LYS:HD2	4:D:265:TYR:HE1	1.77	0.48
4:I:56:LEU:HD12	4:I:140:PRO:HG2	1.95	0.48
1:A:3:ALA:HB1	1:A:182:PHE:HD2	1.77	0.48
4:D:4:GLU:OE1	4:D:218:TYR:OH	2.30	0.48
4:H:236:LEU:HD12	4:H:372:SER:HB3	1.94	0.48
4:E:77:CYS:HA	4:E:80:LYS:HB3	1.95	0.48
1:A:232:ASP:OD1	1:A:245:ARG:NE	2.40	0.48
4:D:347:ILE:HG22	4:D:349:ASN:H	1.78	0.48
4:H:63:ARG:NH2	4:I:199:ASP:O	2.46	0.48
4:I:7:MET:HG2	4:I:269:ILE:HG12	1.95	0.48
5:J:428:ARG:NH1	5:J:461:GLU:OE2	2.46	0.48
3:C:32:U:O4	3:C:34:U:H1'	2.13	0.48
4:E:129:VAL:O	4:E:133:ILE:HG12	2.13	0.48
4:E:133:ILE:O	4:E:147:ARG:NH2	2.43	0.48
4:E:285:VAL:HG12	4:F:295:ASP:HB2	1.96	0.48
4:G:24:PRO:HD3	4:G:209:MET:HB3	1.95	0.48
1:A:22:ASN:HD22	1:A:231:TYR:HB2	1.79	0.48
4:H:230:LEU:HD22	4:H:236:LEU:HD23	1.95	0.48
4:I:20:ASP:N	4:I:20:ASP:OD1	2.38	0.48
2:B:48:ASP:OD2	2:B:53:LYS:HB2	2.13	0.48
4:F:78:TRP:O	4:F:81:ALA:HB3	2.13	0.48
2:B:256:LYS:NZ	3:C:60:G:OP2	2.41	0.48
4:I:43:LYS:NZ	4:I:145:CYS:O	2.45	0.48
5:J:123:ASP:OD1	5:J:225:ARG:NH2	2.42	0.48
6:K:27:ARG:HD3	6:K:70:GLU:OE1	2.14	0.47
1:A:170:PRO:HB3	4:I:172:GLN:HE21	1.79	0.47
2:B:236:LEU:HD12	2:B:236:LEU:O	2.15	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:26:G:C8	4:F:44:ARG:HG2	2.50	0.47
4:E:123:THR:OG1	4:E:158:LYS:NZ	2.38	0.47
4:F:275:ASN:ND2	4:F:319:GLN:OE1	2.47	0.47
4:G:79:LYS:HB3	4:G:79:LYS:HE3	1.75	0.47
4:G:149:LEU:O	4:G:165:THR:OG1	2.32	0.47
4:D:61:THR:HG22	4:E:195:VAL:HG22	1.96	0.47
4:H:125:ALA:O	4:H:129:VAL:HG12	2.14	0.47
5:J:84:LEU:HB3	5:J:104:LEU:HD12	1.96	0.47
5:J:85:LEU:HB3	5:J:105:VAL:HG13	1.96	0.47
5:J:249:LEU:HD11	5:J:392:LEU:HD23	1.96	0.47
4:F:118:ASN:OD1	4:F:118:ASN:N	2.47	0.47
1:A:33:ASP:OD1	1:A:78:ARG:NH2	2.38	0.47
1:A:233:LEU:HB3	1:A:243:LEU:HB2	1.95	0.47
4:D:139:ALA:HB3	4:D:142:ILE:HB	1.96	0.47
5:J:445:LYS:HE2	5:J:446:LYS:HG2	1.95	0.47
5:J:178:GLN:NE2	5:J:223:LEU:HD11	2.29	0.47
4:E:112:ALA:O	4:E:115:VAL:HB	2.14	0.47
4:F:17:ASN:ND2	4:F:38:SER:H	2.12	0.47
4:I:17:ASN:HB3	4:I:25:LYS:HD2	1.97	0.47
5:J:246:PRO:HB3	5:J:351:SER:HB3	1.96	0.47
4:G:365:LYS:HB2	4:G:368:GLU:HG3	1.95	0.47
2:B:70:ASP:OD1	2:B:70:ASP:N	2.47	0.46
2:B:161:TRP:O	3:C:43:A:N6	2.48	0.46
4:D:8:ILE:HD12	4:D:301:ILE:HD13	1.97	0.46
4:E:285:VAL:HG11	4:F:297:VAL:HG23	1.97	0.46
4:H:120:LEU:HD11	4:H:125:ALA:HB2	1.96	0.46
2:B:125:ARG:HG3	2:B:233:GLU:HG2	1.97	0.46
3:C:51:C:H2'	3:C:52:G:C5	2.50	0.46
4:G:36:ARG:NH1	4:H:187:ASP:OD1	2.39	0.46
5:J:152:LEU:HD22	5:J:153:PRO:HD2	1.97	0.46
4:E:225:GLN:HA	4:E:228:LYS:HB3	1.96	0.46
4:G:65:ALA:HB2	4:G:85:LEU:HD21	1.96	0.46
4:H:207:GLU:OE2	4:H:207:GLU:HA	2.16	0.46
5:J:376:PHE:HA	5:J:422:LEU:HD21	1.97	0.46
6:K:141:THR:O	6:K:145:SER:OG	2.30	0.46
4:H:78:TRP:NE1	4:H:82:GLN:NE2	2.62	0.46
4:I:292:LYS:HB3	6:K:148:GLU:HG3	1.97	0.46
5:J:138:CYS:O	5:J:142:THR:OG1	2.27	0.46
4:D:149:LEU:O	4:D:165:THR:OG1	2.26	0.46
4:F:60:ARG:HG2	4:F:100:LEU:HD22	1.96	0.46
4:E:323:ILE:HG21	4:E:360:TYR:CE2	2.51	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:7:MET:HE3	4:D:266:PRO:CG	2.46	0.46
4:D:338:LYS:HZ2	4:D:342:LEU:H	1.62	0.46
4:G:282:ASN:OD1	4:H:10:ASN:ND2	2.44	0.46
1:A:197:LYS:HD3	1:A:204:LEU:HD21	1.98	0.46
1:A:223:ALA:HB3	5:J:95:LEU:HD12	1.98	0.46
4:E:109:LYS:O	4:E:112:ALA:HB3	2.16	0.46
2:B:37:MET:HE3	2:B:51:PHE:HE2	1.81	0.46
3:C:51:C:H2'	3:C:52:G:C4	2.51	0.46
5:J:289:LEU:O	5:J:293:THR:OG1	2.34	0.46
2:B:48:ASP:OD2	2:B:53:LYS:N	2.28	0.45
3:C:3:G:H4'	3:C:4:A:C8	2.51	0.45
1:A:194:PRO:HB2	1:A:261:SER:HB2	1.98	0.45
4:D:4:GLU:OE2	4:D:6:HIS:NE2	2.49	0.45
4:E:111:LEU:HD22	4:E:129:VAL:HG22	1.98	0.45
4:F:53:LYS:HD3	4:F:53:LYS:HA	1.64	0.45
5:J:255:ASP:O	5:J:259:MET:N	2.48	0.45
4:G:301:ILE:HD12	4:G:326:TRP:HH2	1.81	0.45
1:A:186:LEU:HD12	1:A:186:LEU:H	1.82	0.45
1:A:238:GLN:HB3	1:A:239:PRO:HD3	1.98	0.45
4:D:349:ASN:HB3	4:D:352:GLU:HB3	1.98	0.45
4:E:360:TYR:CD1	4:E:360:TYR:C	2.95	0.45
1:A:128:ARG:NH2	4:I:20:ASP:OD2	2.50	0.45
4:D:17:ASN:ND2	4:D:41:CYS:SG	2.90	0.45
4:H:180:HIS:ND1	4:H:181:ILE:O	2.50	0.45
2:B:48:ASP:CG	2:B:53:LYS:HG3	2.42	0.44
4:H:120:LEU:HD12	4:H:121:GLY:O	2.16	0.44
5:J:391:TRP:HE1	5:J:407:ASP:HB2	1.82	0.44
4:D:338:LYS:HZ1	4:D:342:LEU:HD13	1.83	0.44
4:E:250:LYS:HE3	4:E:250:LYS:HB2	1.81	0.44
4:E:312:ARG:HD2	4:E:322:VAL:HG11	1.99	0.44
4:G:174:ALA:HB2	4:H:261:ALA:HB3	1.99	0.44
5:J:221:LYS:HB3	5:J:221:LYS:HE2	1.67	0.44
4:E:366:TRP:O	4:E:370:GLN:NE2	2.50	0.44
4:G:32:VAL:HG23	4:G:34:ARG:HE	1.82	0.44
5:J:122:MET:O	5:J:126:THR:HG23	2.18	0.44
5:J:272:ILE:HG22	5:J:290:ALA:HB2	1.99	0.44
5:J:412:LEU:HD23	5:J:412:LEU:HA	1.89	0.44
1:A:22:ASN:HA	3:C:3:G:N7	2.33	0.44
3:C:14:G:O2'	4:H:41:CYS:SG	2.70	0.44
4:F:96:ASN:HB3	4:F:97:THR:H	1.65	0.44
1:A:73:ASP:N	1:A:73:ASP:OD1	2.51	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:48:ASP:OD1	2:B:53:LYS:HG3	2.18	0.44
2:B:165:SER:OG	2:B:166:THR:N	2.51	0.44
4:G:68:ILE:HD11	4:G:112:ALA:HB2	1.98	0.44
4:D:274:LYS:HE2	4:D:278:ILE:HD12	2.00	0.44
4:G:372:SER:O	4:G:372:SER:OG	2.31	0.44
5:J:304:PRO:HB3	5:J:320:ALA:HB1	1.99	0.44
4:H:127:GLN:HE21	4:H:161:LYS:HB3	1.83	0.44
2:B:268:ILE:HD13	4:D:204:HIS:HB2	1.99	0.43
4:D:312:ARG:HG3	4:D:342:LEU:HD21	1.99	0.43
4:E:91:LYS:HD2	4:E:152:ASN:HB3	1.99	0.43
4:E:121:GLY:HA2	4:E:125:ALA:HB2	1.99	0.43
4:H:148:MET:HE3	4:H:148:MET:HB3	1.89	0.43
5:J:153:PRO:HB2	5:J:156:TRP:NE1	2.32	0.43
4:H:107:LYS:HD2	4:H:107:LYS:HA	1.83	0.43
4:H:226:LEU:HD12	4:H:226:LEU:HA	1.88	0.43
5:J:205:LYS:HA	5:J:205:LYS:HD2	1.75	0.43
2:B:9:ILE:HD12	2:B:25:LEU:HD11	2.00	0.43
4:F:349:ASN:HB3	4:F:352:GLU:HG3	2.00	0.43
4:E:347:ILE:HG21	4:E:353:LEU:HB2	2.01	0.43
4:F:178:SER:HB2	4:F:213:ALA:HB1	2.00	0.43
5:J:164:LYS:HE2	5:J:164:LYS:HB2	1.79	0.43
5:J:249:LEU:HD23	5:J:390:LEU:HD21	2.00	0.43
3:C:1:G:H4'	3:C:2:U:OP2	2.18	0.43
4:E:15:ASN:HB2	4:E:210:PHE:HA	2.01	0.43
4:G:236:LEU:O	4:G:240:THR:OG1	2.31	0.43
5:J:355:LYS:H	5:J:355:LYS:HG2	1.62	0.43
5:J:369:ARG:HA	5:J:369:ARG:HD3	1.87	0.43
2:B:245:LEU:HD23	2:B:245:LEU:HA	1.88	0.43
3:C:26:G:N3	3:C:26:G:C2'	2.79	0.43
3:C:32:U:C2	4:F:192:ALA:HB2	2.54	0.43
4:E:225:GLN:HA	4:E:228:LYS:HE2	1.99	0.43
3:C:3:G:H4'	3:C:4:A:H8	1.83	0.43
5:J:214:LEU:HA	5:J:311:CYS:HB2	2.01	0.43
5:J:316:LEU:HD12	5:J:316:LEU:HA	1.92	0.43
4:H:295:ASP:OD2	4:H:333:TYR:OH	2.33	0.43
4:I:180:HIS:CD2	4:I:296:LEU:HD21	2.54	0.43
4:E:39:SER:H	4:E:175:HIS:CE1	2.36	0.43
4:H:153:ASP:C	4:H:155:ASP:N	2.75	0.43
4:H:109:LYS:H	4:H:109:LYS:HG2	1.55	0.43
1:A:157:LYS:HE2	4:I:275:ASN:HB3	2.01	0.42
4:D:63:ARG:HD2	4:E:198:GLU:HA	2.00	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:268:VAL:HB	1:A:270:ARG:NH2	2.34	0.42
2:B:135:HIS:ND1	3:C:55:U:P	2.92	0.42
4:D:93:LYS:HD2	4:D:93:LYS:HA	1.73	0.42
4:D:295:ASP:OD1	4:D:295:ASP:N	2.46	0.42
4:H:67:LEU:HD23	4:H:108:ILE:HD13	2.02	0.42
4:E:147:ARG:HH21	4:E:149:LEU:HD23	1.84	0.42
4:I:339:HIS:HB2	4:I:342:LEU:HD22	2.00	0.42
2:B:135:HIS:CD2	3:C:56:G:H8	2.37	0.42
2:B:156:ARG:HE	2:B:254:LYS:HD2	1.85	0.42
4:D:290:VAL:HG11	4:D:296:LEU:HB2	2.02	0.42
4:D:325:PHE:HZ	4:D:360:TYR:HD2	1.68	0.42
4:H:272:GLU:OE2	4:H:312:ARG:NH2	2.42	0.42
2:B:110:LYS:HA	2:B:110:LYS:HD3	1.74	0.42
4:G:17:ASN:HD22	4:G:17:ASN:HA	1.66	0.42
4:H:7:MET:HG2	4:H:269:ILE:HG12	2.02	0.42
5:J:218:CYS:HA	5:J:221:LYS:HB2	2.01	0.42
5:J:163:ASN:HB2	5:J:166:TYR:HD2	1.84	0.42
1:A:283:TYR:HE1	1:A:325:LEU:HD21	1.85	0.42
2:B:129:ASN:ND2	2:B:228:ARG:O	2.48	0.42
4:G:68:ILE:HD12	4:G:68:ILE:HA	1.87	0.42
4:G:180:HIS:CD2	4:G:296:LEU:HD21	2.55	0.42
5:J:141:ASN:HB3	5:J:159:TRP:CH2	2.55	0.42
4:E:147:ARG:HE	4:E:149:LEU:HD23	1.85	0.42
4:F:246:LEU:HD23	4:F:246:LEU:HA	1.88	0.42
4:H:78:TRP:CZ2	4:H:82:GLN:NE2	2.88	0.42
1:A:89:GLN:H	1:A:89:GLN:HG3	1.62	0.42
5:J:84:LEU:HD12	5:J:167:PHE:HB3	2.00	0.42
2:B:165:SER:O	3:C:41:G:N2	2.51	0.41
3:C:23:U:OP2	4:G:18:ARG:NH1	2.53	0.41
4:D:67:LEU:O	4:D:70:GLN:NE2	2.53	0.41
4:F:222:ASP:HB3	4:F:225:GLN:HB3	2.02	0.41
4:I:273:PHE:HZ	4:I:357:VAL:HG13	1.85	0.41
4:D:10:ASN:O	4:D:11:HIS:ND1	2.53	0.41
4:D:62:ARG:HG3	4:D:100:LEU:HG	2.02	0.41
4:D:187:ASP:OD1	4:D:188:TYR:N	2.53	0.41
4:D:330:ASN:HA	4:D:334:PRO:HG2	2.02	0.41
2:B:27:ASN:HD21	2:B:200:SER:HB2	1.85	0.41
4:F:160:VAL:HG22	4:F:162:TRP:HB2	2.03	0.41
4:G:271:VAL:O	4:G:324:GLY:HA2	2.20	0.41
4:H:66:ASP:OD1	4:H:66:ASP:N	2.53	0.41
1:A:289:GLU:OE1	2:B:218:ARG:NH2	2.53	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:290:ARG:HA	1:A:290:ARG:HD2	1.85	0.41
3:C:33:G:N1	4:F:201:GLY:O	2.37	0.41
4:E:151:PRO:HG3	4:E:162:TRP:CD1	2.55	0.41
4:F:236:LEU:O	4:F:240:THR:OG1	2.28	0.41
4:G:55:LEU:HD21	4:G:239:HIS:CE1	2.55	0.41
2:B:10:ASP:OD1	2:B:79:ARG:NE	2.53	0.41
3:C:26:G:O2'	3:C:27:G:H4'	2.21	0.41
4:G:254:SER:HA	4:G:257:GLN:HG3	2.03	0.41
4:I:171:LEU:HD23	4:I:171:LEU:HA	1.83	0.41
4:E:66:ASP:HA	4:E:69:GLN:HE21	1.85	0.41
4:F:230:LEU:HD13	4:F:236:LEU:HB3	2.03	0.41
1:A:223:ALA:HA	1:A:224:PRO:HD3	1.95	0.41
4:G:101:VAL:HG11	4:G:103:MET:HE3	2.02	0.41
2:B:135:HIS:CD2	3:C:56:G:H5''	2.55	0.41
4:D:72:ALA:HB1	4:D:116:LEU:HD21	2.03	0.41
4:D:280:TYR:CZ	4:D:308:VAL:HG23	2.56	0.41
4:H:159:LYS:HA	4:H:159:LYS:HD3	1.93	0.41
5:J:150:LYS:HD2	5:J:150:LYS:HA	1.67	0.41
5:J:390:LEU:HB2	5:J:412:LEU:HD12	2.03	0.41
5:J:418:ASN:OD1	5:J:418:ASN:N	2.52	0.41
1:A:225:ASP:OD1	1:A:225:ASP:N	2.54	0.41
2:B:205:LYS:HE2	2:B:221:LYS:HG3	2.02	0.41
3:C:9:G:OP2	4:I:40:GLN:NE2	2.54	0.41
4:D:92:ASN:OD1	4:D:92:ASN:N	2.52	0.41
4:D:259:SER:OG	4:D:260:PHE:N	2.53	0.41
4:D:266:PRO:HG2	4:D:269:ILE:HD11	2.03	0.41
4:E:81:ALA:O	4:E:84:ILE:HB	2.21	0.41
4:H:39:SER:HB3	4:H:175:HIS:CD2	2.56	0.41
4:H:141:ASP:OD1	4:H:141:ASP:N	2.54	0.41
4:H:190:VAL:HG23	4:H:205:ILE:HD13	2.03	0.41
5:J:79:HIS:HB2	5:J:80:VAL:H	1.73	0.41
1:A:13:GLU:OE1	1:A:173:ARG:NE	2.48	0.41
4:H:67:LEU:HD11	4:I:195:VAL:HG21	2.03	0.41
1:A:198:ARG:HE	1:A:198:ARG:HB2	1.67	0.40
2:B:211:GLU:H	2:B:211:GLU:HG3	1.68	0.40
4:H:227:VAL:HG13	4:H:232:GLY:HA2	2.03	0.40
5:J:298:LYS:NZ	5:J:330:GLU:HG3	2.36	0.40
4:G:93:LYS:NZ	4:G:94:ASP:OD2	2.48	0.40
4:I:149:LEU:HD12	4:I:149:LEU:HA	1.87	0.40
1:A:52:ARG:NH2	4:I:168:GLU:OE2	2.45	0.40
4:G:110:ASP:HA	4:G:113:ARG:HG2	2.03	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:G:112:ALA:HA	4:G:115:VAL:HG22	2.03	0.40
1:A:80:TRP:CE3	1:A:128:ARG:HB3	2.55	0.40
1:A:293:MET:HE2	1:A:293:MET:HB3	1.87	0.40
4:D:199:ASP:HA	4:D:204:HIS:HB3	2.03	0.40
4:D:231:LYS:HE2	4:D:231:LYS:HB3	1.73	0.40
5:J:445:LYS:HG2	5:J:446:LYS:H	1.86	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	346/388 (89%)	314 (91%)	32 (9%)	0	100	100
2	B	265/272 (97%)	250 (94%)	15 (6%)	0	100	100
4	D	370/378 (98%)	334 (90%)	36 (10%)	0	100	100
4	E	368/378 (97%)	331 (90%)	37 (10%)	0	100	100
4	F	372/378 (98%)	341 (92%)	31 (8%)	0	100	100
4	G	375/378 (99%)	340 (91%)	35 (9%)	0	100	100
4	H	375/378 (99%)	352 (94%)	23 (6%)	0	100	100
4	I	262/378 (69%)	236 (90%)	26 (10%)	0	100	100
5	J	441/535 (82%)	397 (90%)	44 (10%)	0	100	100
6	K	163/174 (94%)	153 (94%)	10 (6%)	0	100	100
All	All	3337/3637 (92%)	3048 (91%)	289 (9%)	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	290/322 (90%)	290 (100%)	0	100	100
2	B	234/238 (98%)	234 (100%)	0	100	100
4	D	310/313 (99%)	309 (100%)	1 (0%)	91	94
4	E	308/313 (98%)	307 (100%)	1 (0%)	91	94
4	F	311/313 (99%)	310 (100%)	1 (0%)	91	94
4	G	313/313 (100%)	312 (100%)	1 (0%)	91	94
4	H	313/313 (100%)	312 (100%)	1 (0%)	91	94
4	I	220/313 (70%)	220 (100%)	0	100	100
5	J	378/459 (82%)	378 (100%)	0	100	100
6	K	144/153 (94%)	144 (100%)	0	100	100
All	All	2821/3050 (92%)	2816 (100%)	5 (0%)	91	95

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	120	LEU
4	E	359	ASP
4	F	337	TYR
4	G	233	ASP
4	H	153	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (29) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	206	GLN
2	B	141	GLN
4	D	70	GLN
4	D	128	GLN
4	D	135	GLN
4	D	164	ASN

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Mol	Chain	Res	Type
4	D	331	ASN
4	E	82	GLN
4	E	225	GLN
4	F	257	GLN
4	F	275	ASN
4	F	282	ASN
4	F	309	ASN
4	F	319	GLN
4	F	351	ASN
4	G	225	GLN
4	G	309	ASN
4	H	131	ASN
4	H	164	ASN
4	H	309	ASN
4	I	15	ASN
4	I	17	ASN
4	I	50	ASN
4	I	257	GLN
4	I	299	GLN
4	I	349	ASN
5	J	115	GLN
5	J	265	GLN
5	J	459	HIS

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
3	C	60/61 (98%)	22 (36%)	1 (1%)

All (22) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
3	C	2	U
3	C	3	G
3	C	9	G
3	C	13	A
3	C	14	G
3	C	15	U
3	C	21	A
3	C	27	G
3	C	32	U

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Mol	Chain	Res	Type
3	C	33	G
3	C	34	U
3	C	38	A
3	C	39	A
3	C	40	A
3	C	42	U
3	C	45	U
3	C	46	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	2	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

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.