



Full wwPDB EM Validation Report ⓘ

Jul 9, 2025 – 12:53 PM JST

PDB ID : 8K21 / pdb_00008k21
EMDB ID : EMD-36824
Title : Cas1-Cas2-dsDNA subregion in ICP1 Csy-DNA-Cas1-2/3 complex
Authors : Zhang, L.X.; Feng, Y.
Deposited on : 2023-07-12
Resolution : 3.80 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

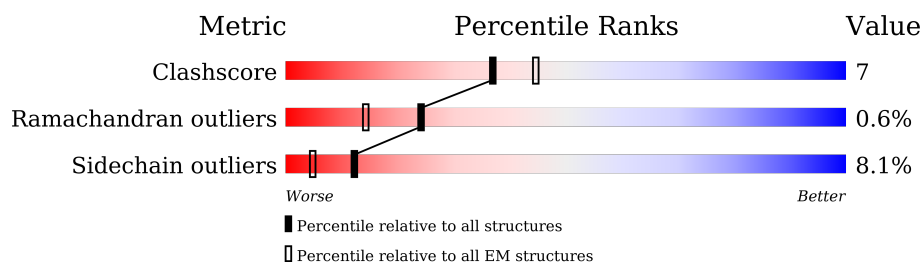
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



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

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	U	21	
2	V	21	
3	A	75	
3	a	75	
4	D	295	
4	E	295	
4	d	295	
4	e	295	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 11389 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 DNA chain called DNA (5'-D(P*AP*GP*CP*AP*AP*TP*TP*TP*AP*AP*AP*TP*AP*GP*GP*GP*AP*AP*GP*AP*T)-3').

Mol	Chain	Residues	Atoms					AltConf	Trace
1	U	21	Total	C	N	O	P	0	0
			439	209	88	121	21		

- Molecule 2 is a DNA chain called DNA (5'-D(*AP*TP*CP*TP*TP*CP*CP*CP*TP*AP*TP*TP*TP*AP*AP*AP*TP*TP*GP*CP*T)-3').

Mol	Chain	Residues	Atoms					AltConf	Trace
2	V	21	Total	C	N	O	P	0	0
			419	205	65	129	20		

- Molecule 3 is a protein called HD Cas3-type domain-containing protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	A	75	Total	C	N	O	S	0	0
			583	373	102	104	4		
3	a	75	Total	C	N	O	S	0	0
			571	365	99	103	4		

- Molecule 4 is a protein called Cas1.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	295	Total	C	N	O	S	2	0
			2327	1485	399	430	13		
4	E	295	Total	C	N	O	S	0	0
			2353	1505	400	434	14		
4	d	295	Total	C	N	O	S	2	0
			2360	1510	401	435	14		
4	e	295	Total	C	N	O	S	0	0
			2337	1496	393	434	14		

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: DNA (5'-D(P*AP*GP*CP*AP*AP*TP*TP*TP*AP*AP*AP*TP*AP*GP*GP*GP*AP*AP*GP*AP*T)-3')

Chain U:  90% 10%



- Molecule 2: DNA (5'-D(*AP*TP*CP*TP*TP*CP*CP*CP*TP*AP*TP*TP*TP*AP*AP*AP*TP*TP*GP*CP*T)-3')

Chain V:  86% 14%



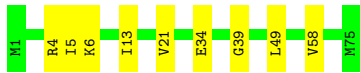
- Molecule 3: HD Cas3-type domain-containing protein

Chain A:  84% 15%



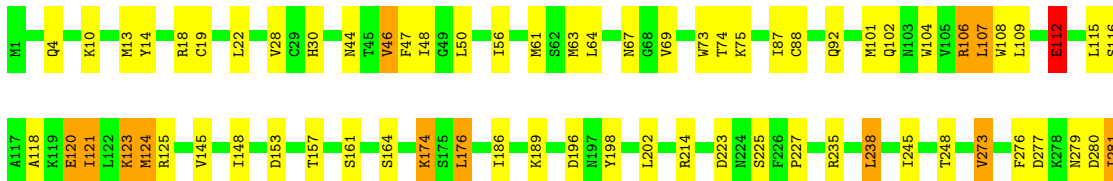
- Molecule 3: HD Cas3-type domain-containing protein

Chain a:  88% 12%



- Molecule 4: Cas1

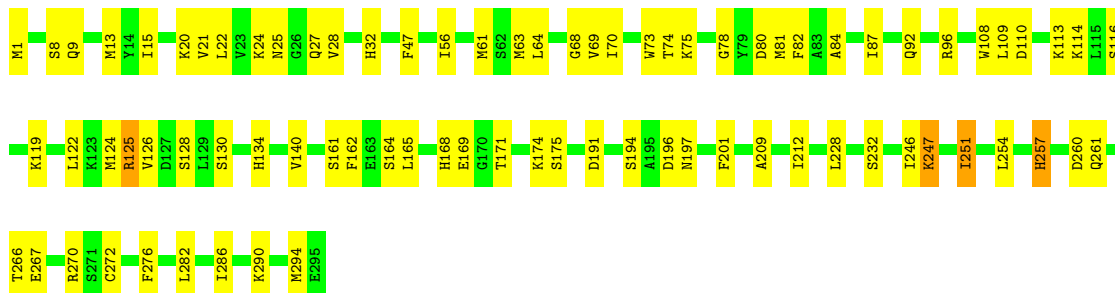
Chain D:  74% 21%





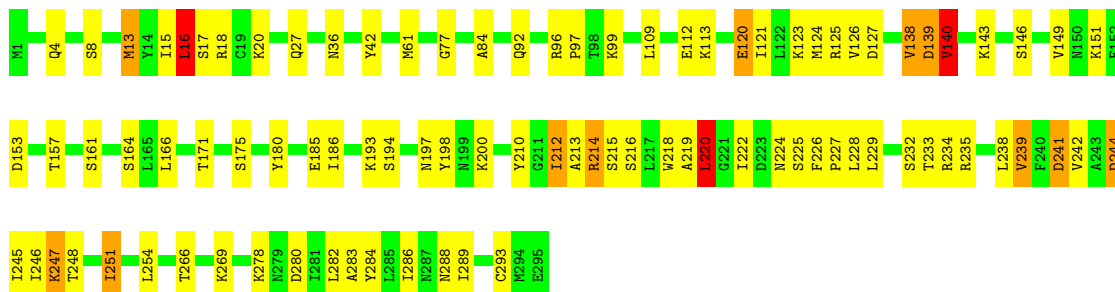
• Molecule 4: Cas1

Chain E:  73% 26%



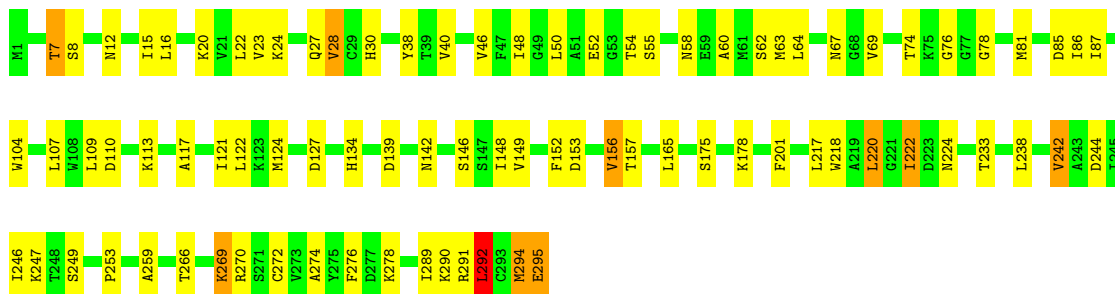
• Molecule 4: Cas1

Chain d:  69% 26%



• Molecule 4: Cas1

Chain e:  71% 25%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	30241	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	1500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

5 Model quality

5.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# $ Z > 5$	RMSZ	# $ Z > 5$
1	U	0.21	0/495	0.41	0/763
2	V	0.26	0/466	0.48	0/716
3	A	0.28	0/592	0.69	1/795 (0.1%)
3	a	0.30	0/580	0.68	0/782
4	D	0.60	5/2378 (0.2%)	0.83	5/3215 (0.2%)
4	E	0.40	0/2403	0.75	2/3244 (0.1%)
4	d	0.83	12/2416 (0.5%)	1.02	18/3262 (0.6%)
4	e	0.42	1/2387 (0.0%)	0.82	2/3226 (0.1%)
All	All	0.55	18/11717 (0.2%)	0.81	28/16003 (0.2%)

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	d	226	PHE	N-CA	-7.81	1.38	1.46
4	d	224	ASN	CA-C	-7.65	1.42	1.52
4	d	219	ALA	CA-C	-7.29	1.42	1.52
4	D	118	ALA	CA-C	-7.27	1.43	1.52
4	d	239	VAL	CA-C	-7.12	1.44	1.52
4	d	210	TYR	CA-C	-7.01	1.43	1.52
4	d	225	SER	CA-C	-6.37	1.42	1.52
4	D	281	ILE	N-CA	-6.37	1.38	1.46
4	D	121	ILE	CA-C	-6.01	1.45	1.52
4	d	238	LEU	CA-C	-5.99	1.44	1.52
4	d	239	VAL	CA-CB	-5.66	1.47	1.54
4	d	212	ILE	N-CA	-5.59	1.39	1.46
4	D	107	LEU	CA-C	-5.48	1.46	1.52
4	e	292	LEU	CA-C	-5.46	1.45	1.52
4	D	108	TRP	CA-C	-5.36	1.45	1.52
4	d	214	ARG	N-CA	-5.33	1.39	1.46
4	d	218	TRP	CA-C	-5.19	1.45	1.52
4	d	229	LEU	CA-C	-5.06	1.46	1.52

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	D	118	ALA	N-CA-C	-10.62	99.78	111.36
4	d	224	ASN	N-CA-C	-9.92	101.30	113.50
4	d	238	LEU	N-CA-C	-8.63	102.53	113.23
4	D	273	VAL	N-CA-C	-8.22	105.24	111.90
4	E	257	HIS	N-CA-C	-8.03	102.12	112.23
4	D	121	ILE	N-CA-C	-8.00	101.25	113.16
4	D	112	GLU	N-CA-C	-7.77	102.89	111.36
4	d	214	ARG	N-CA-C	-7.69	102.90	111.82
4	d	245	ILE	N-CA-C	-7.13	103.83	110.53
4	d	251	ILE	N-CA-C	7.03	117.03	110.42
4	d	212	ILE	N-CA-C	-6.83	103.66	110.62
4	d	293	CYS	CA-C-N	-6.64	112.11	122.67
4	d	293	CYS	C-N-CA	-6.64	112.11	122.67
4	d	139	ASP	N-CA-C	-6.53	99.75	109.15
4	e	7	THR	N-CA-C	-6.43	99.90	108.19
4	d	216	SER	N-CA-C	-6.31	104.28	112.23
4	d	225	SER	CA-C-N	-5.86	116.53	122.74
4	d	225	SER	C-N-CA	-5.86	116.53	122.74
3	A	13	ILE	N-CA-C	-5.81	106.65	112.17
4	D	106	ARG	N-CA-C	-5.61	105.31	111.82
4	d	16	LEU	N-CA-C	5.57	122.66	110.80
4	E	124	MET	N-CA-C	-5.52	106.54	113.28
4	e	292	LEU	N-CA-C	-5.34	106.76	113.28
4	d	241	ASP	N-CA-C	-5.27	99.58	110.80
4	d	227	PRO	N-CA-C	5.26	118.97	111.13
4	d	220	LEU	N-CA-C	-5.14	106.41	113.30
4	d	222	ILE	N-CA-C	5.09	115.97	109.30
4	d	210	TYR	N-CA-C	-5.04	105.86	111.36

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

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	U	439	0	237	2	0
2	V	419	0	243	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	583	0	606	9	0
3	a	571	0	578	5	0
4	D	2327	0	2299	41	0
4	E	2353	0	2342	41	0
4	d	2360	0	2350	35	0
4	e	2337	0	2309	43	0
All	All	11389	0	10964	165	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 (165) 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:E:272:CYS:O	4:E:276:PHE:HB2	1.88	0.73
4:e:15:ILE:HG13	4:e:78:GLY:HA3	1.72	0.72
4:d:242:VAL:HG21	4:d:289:ILE:HD11	1.72	0.71
4:e:50:LEU:HB3	4:e:54:THR:HG21	1.75	0.67
3:a:4:ARG:HG3	3:a:34:GLU:HB2	1.77	0.66
4:e:121:ILE:HA	4:e:124:MET:HE2	1.78	0.65
4:D:13:MET:HB2	4:D:273:VAL:HG22	1.80	0.64
4:E:164:SER:O	4:E:168:HIS:ND1	2.30	0.62
4:d:138:VAL:HB	4:d:180:TYR:HE1	1.64	0.62
4:d:96:ARG:HE	4:d:97:PRO:HD3	1.64	0.62
4:E:75:LYS:HB2	4:E:80:ASP:HB3	1.82	0.61
4:E:212:ILE:HG21	4:E:276:PHE:HE2	1.64	0.61
4:D:124:MET:HB3	4:D:245:ILE:HD12	1.83	0.60
4:d:244:ASP:HA	4:d:247:LYS:HB3	1.83	0.59
4:D:280:ASP:C	4:D:282:LEU:H	2.10	0.59
4:d:121:ILE:HA	4:d:124:MET:HG2	1.85	0.59
4:e:85:ASP:OD1	4:e:86:ILE:N	2.35	0.59
4:e:63:MET:O	4:e:67:ASN:ND2	2.37	0.58
4:D:280:ASP:C	4:D:282:LEU:N	2.59	0.58
4:e:156:VAL:HG23	4:e:165:LEU:HD21	1.86	0.56
4:d:112:GLU:OE2	4:d:113:LYS:NZ	2.35	0.56
4:D:28:VAL:HG23	4:D:63:MET:HE2	1.88	0.56
4:d:280:ASP:HB3	4:d:283:ALA:HB3	1.88	0.55
4:d:171:THR:O	4:d:175:SER:OG	2.23	0.55
4:e:28:VAL:HG21	4:e:64:LEU:HD12	1.89	0.55
4:D:196:ASP:OD1	4:D:196:ASP:N	2.40	0.54
3:A:25:LEU:HB3	3:A:33:TRP:HB3	1.89	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:E:13:MET:HG2	4:E:47:PHE:HB2	1.90	0.54
4:d:109:LEU:HD13	4:e:109:LEU:HD11	1.90	0.54
4:d:120:GLU:HA	4:d:123:LYS:HD2	1.89	0.54
4:d:214:ARG:HD2	4:d:239:VAL:HG21	1.89	0.54
4:d:127:ASP:OD1	4:d:284:TYR:OH	2.25	0.53
4:E:209:ALA:HB2	4:E:251:ILE:HG13	1.90	0.53
4:d:99:LYS:HE3	4:e:233:THR:HA	1.90	0.53
3:A:64:ASP:OD1	3:A:64:ASP:N	2.40	0.53
4:d:266:THR:HA	4:d:269:LYS:HD2	1.91	0.53
4:D:227:PRO:HA	4:D:238:LEU:HB3	1.89	0.52
4:d:220:LEU:HG	4:d:286:ILE:HG23	1.90	0.52
4:E:267:GLU:OE1	4:E:270:ARG:NH1	2.39	0.52
4:d:213:ALA:HB1	4:d:242:VAL:HG13	1.92	0.52
4:e:139:ASP:O	4:e:142:ASN:ND2	2.43	0.52
4:E:74:THR:HA	4:E:81:MET:HA	1.90	0.51
3:a:21:VAL:HG23	3:a:49:LEU:HD21	1.91	0.51
4:e:294:MET:O	4:e:295:GLU:C	2.53	0.51
4:E:196:ASP:OD1	4:E:196:ASP:N	2.34	0.51
4:e:272:CYS:O	4:e:276:PHE:HB2	2.11	0.51
4:D:120:GLU:HB3	4:D:292:LEU:HD11	1.93	0.51
4:D:283:ALA:HA	4:D:286:ILE:HB	1.93	0.51
4:e:12:ASN:HD22	4:e:46:VAL:HG22	1.76	0.51
4:E:108:TRP:HA	4:E:114:LYS:HG3	1.93	0.51
4:d:153:ASP:O	4:d:157:THR:OG1	2.26	0.51
4:e:134:HIS:NE2	4:e:249:SER:O	2.44	0.51
4:D:225:SER:O	4:D:225:SER:OG	2.26	0.50
4:E:161:SER:OG	4:E:162:PHE:N	2.44	0.50
4:D:19:CYS:HB2	4:D:30:HIS:HB2	1.92	0.50
4:d:8:SER:HB2	4:d:286:ILE:HD12	1.92	0.50
4:D:13:MET:HG2	4:D:47:PHE:CE2	2.47	0.50
4:d:186:ILE:HD13	4:d:198:TYR:CE1	2.47	0.50
4:E:74:THR:HG21	4:E:78:GLY:HA2	1.93	0.49
3:A:28:THR:OG1	3:a:6:LYS:NZ	2.42	0.49
4:D:102:GLN:HE22	4:E:232:SER:HB2	1.78	0.49
4:E:191:ASP:O	4:E:194:SER:OG	2.30	0.49
4:e:146:SER:HA	4:e:149:VAL:HG22	1.94	0.49
4:E:64:LEU:HD22	4:E:69:VAL:HG11	1.95	0.48
4:E:56:ILE:HG12	4:E:61:MET:HG2	1.96	0.48
4:E:162:PHE:HA	4:E:165:LEU:HD12	1.95	0.48
4:e:54:THR:OG1	4:e:55:SER:N	2.46	0.48
4:d:284:TYR:O	4:d:288:ASN:HB2	2.14	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:e:30:HIS:HD2	4:e:38:TYR:HB2	1.78	0.47
4:e:153:ASP:O	4:e:157:THR:OG1	2.25	0.47
1:U:21:DT:OP1	4:E:266:THR:OG1	2.28	0.47
4:D:10:LYS:NZ	4:D:67:ASN:O	2.34	0.47
4:D:64:LEU:HB3	4:D:69:VAL:HB	1.97	0.47
4:e:274:ALA:O	4:e:278:LYS:HG3	2.15	0.47
4:D:10:LYS:HB2	4:D:46:VAL:HG13	1.95	0.47
4:e:7:THR:HG22	4:e:8:SER:H	1.79	0.47
4:D:56:ILE:HG22	4:D:73:TRP:HZ2	1.79	0.47
4:e:104:TRP:HA	4:e:107:LEU:HD12	1.97	0.47
4:e:110:ASP:HB3	4:e:113:LYS:HG3	1.97	0.46
4:e:148:ILE:HD13	4:e:175:SER:HB3	1.96	0.46
4:e:81:MET:HE1	4:e:218:TRP:CD2	2.50	0.46
4:e:122:LEU:HB3	4:e:152:PHE:CE1	2.50	0.46
4:e:269:LYS:HA	4:e:269:LYS:HD2	1.41	0.46
4:e:60:ALA:O	4:e:64:LEU:HB2	2.16	0.46
4:E:8:SER:OG	4:E:9:GLN:N	2.49	0.46
4:D:174:LYS:HD3	4:D:174:LYS:HA	1.61	0.46
4:E:122:LEU:HD11	4:E:169:GLU:HB2	1.98	0.45
4:E:81:MET:HE3	4:E:81:MET:HB2	1.80	0.45
3:A:59:VAL:HG23	3:A:73:VAL:HG21	1.98	0.45
3:A:74:ALA:O	4:d:36:ASN:ND2	2.49	0.45
4:e:244:ASP:OD1	4:e:247:LYS:NZ	2.50	0.45
4:e:201:PHE:HD2	4:e:259:ALA:HB2	1.82	0.45
4:D:176:LEU:HD12	4:D:176:LEU:HA	1.68	0.45
4:E:282:LEU:O	4:E:286:ILE:HD12	2.17	0.45
4:d:125:ARG:H	4:d:125:ARG:HG2	1.48	0.45
4:E:125:ARG:HD3	4:E:125:ARG:HA	1.73	0.44
4:d:151:LYS:HE2	4:d:151:LYS:HB3	1.87	0.44
4:E:70:ILE:HD13	4:E:87:ILE:HD13	1.98	0.44
4:E:81:MET:HE1	4:E:84:ALA:HB2	2.00	0.44
4:d:146:SER:HA	4:d:149:VAL:HG22	2.00	0.44
4:e:107:LEU:HD22	4:e:117:ALA:HB2	1.99	0.44
4:D:50:LEU:HD23	4:D:50:LEU:HA	1.68	0.44
4:D:176:LEU:HD23	4:D:248:THR:HB	2.00	0.44
4:E:174:LYS:HE2	4:E:174:LYS:HB3	1.79	0.44
3:A:28:THR:O	3:a:6:LYS:NZ	2.44	0.44
4:D:202:LEU:HD23	4:D:202:LEU:HA	1.84	0.44
4:E:197:ASN:O	4:E:201:PHE:HB2	2.18	0.44
4:e:222:ILE:H	4:e:222:ILE:HG12	1.51	0.44
4:d:139:ASP:O	4:d:140:VAL:C	2.61	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:d:77:GLY:HA2	4:d:84:ALA:HB3	1.99	0.43
2:V:5:DT:H1'	2:V:6:DC:H5'	2.00	0.43
4:D:101:MET:HE2	4:D:223:ASP:H	1.83	0.43
4:E:68:GLY:H	4:E:92:GLN:HE22	1.65	0.43
4:d:126:VAL:HG23	4:d:149:VAL:HB	2.00	0.43
4:e:87:ILE:HD11	4:e:218:TRP:CZ2	2.53	0.43
4:D:120:GLU:HA	4:D:123:LYS:HB2	2.00	0.43
4:e:220:LEU:HB3	4:e:222:ILE:HG12	2.00	0.43
3:A:3:ILE:HD11	3:A:25:LEU:HD21	2.01	0.43
3:A:24:TYR:HA	4:D:44:ASN:HB2	2.01	0.43
4:e:124:MET:HA	4:e:127:ASP:HB2	2.00	0.43
4:D:153:ASP:O	4:D:157:THR:OG1	2.35	0.42
4:E:1:MET:HE2	4:E:32:HIS:HD1	1.84	0.42
4:D:284:TYR:O	4:D:288:ASN:HB2	2.19	0.42
4:d:13:MET:HE2	4:d:13:MET:HB2	1.55	0.42
4:D:104:TRP:O	4:D:107:LEU:HB2	2.20	0.42
4:e:58:ASN:O	4:e:62:SER:OG	2.30	0.42
4:e:178:LYS:HA	4:e:178:LYS:HD2	1.73	0.42
4:D:145:VAL:HA	4:D:148:ILE:HG22	2.01	0.42
4:D:189:LYS:HD2	4:D:189:LYS:HA	1.75	0.42
4:E:110:ASP:OD1	4:E:113:LYS:N	2.42	0.42
3:A:1:MET:HE2	3:A:42:VAL:HG21	2.02	0.42
4:D:92:GLN:N	4:E:82:PHE:O	2.49	0.42
4:D:106:ARG:HG2	4:E:109:LEU:HD11	2.01	0.42
4:d:166:LEU:HD11	4:d:234:ARG:HG3	2.02	0.42
4:D:161:SER:O	4:D:164:SER:OG	2.31	0.42
4:D:61:MET:HG3	4:E:73:TRP:CE2	2.55	0.42
4:E:130:SER:HA	4:E:140:VAL:HG21	2.02	0.42
4:e:134:HIS:CE1	4:e:253:PRO:HG2	2.55	0.42
4:e:294:MET:HE2	4:e:294:MET:HB2	1.72	0.42
4:E:13:MET:HE3	4:E:15:ILE:HD11	2.02	0.41
4:e:30:HIS:CE1	4:e:40:VAL:HG22	2.55	0.41
4:D:112:GLU:H	4:D:112:GLU:HG3	1.33	0.41
4:d:27:GLN:HA	4:d:42:TYR:HE2	1.85	0.41
1:U:19:DG:N2	2:V:4:DT:O2	2.54	0.41
4:e:16:LEU:HD11	4:e:48:ILE:HD11	2.03	0.41
4:D:186:ILE:HG12	4:D:198:TYR:CE2	2.55	0.41
4:d:161:SER:O	4:d:164:SER:OG	2.32	0.41
4:D:74:THR:OG1	4:D:75:LYS:N	2.53	0.41
4:D:235:ARG:HH22	4:E:96:ARG:HH12	1.68	0.41
4:D:87:ILE:H	4:D:87:ILE:HD12	1.86	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:E:171:THR:O	4:E:175:SER:CB	2.68	0.41
4:E:247:LYS:HB3	4:E:247:LYS:HE3	1.89	0.41
4:e:217:LEU:HD21	4:e:242:VAL:HG11	2.02	0.41
4:e:289:ILE:HA	4:e:292:LEU:HD12	2.03	0.41
4:D:88:CYS:SG	4:D:214:ARG:HG2	2.61	0.41
4:E:28:VAL:HG21	4:E:64:LEU:HD21	2.03	0.40
4:d:214:ARG:CD	4:d:239:VAL:HG21	2.50	0.40
4:e:64:LEU:HD23	4:e:69:VAL:HB	2.03	0.40
4:D:14:TYR:HB2	4:D:48:ILE:HD13	2.02	0.40
4:E:290:LYS:O	4:E:294:MET:HB2	2.22	0.40
3:a:5:ILE:HG23	3:a:58:VAL:HG13	2.03	0.40
4:d:212:ILE:HG23	4:d:282:LEU:HD13	2.02	0.40
4:d:247:LYS:HA	4:d:251:ILE:HB	2.03	0.40
4:d:254:LEU:HD12	4:d:254:LEU:HA	1.93	0.40
4:E:116:SER:HA	4:E:119:LYS:HG3	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	
3	A	73/75 (97%)	66 (90%)	7 (10%)	0	100	100
3	a	73/75 (97%)	66 (90%)	6 (8%)	1 (1%)	9	37
4	D	294/295 (100%)	274 (93%)	18 (6%)	2 (1%)	19	52
4	E	293/295 (99%)	275 (94%)	18 (6%)	0	100	100
4	d	295/295 (100%)	269 (91%)	22 (8%)	4 (1%)	9	37
4	e	293/295 (99%)	272 (93%)	20 (7%)	1 (0%)	37	69
All	All	1321/1330 (99%)	1222 (92%)	91 (7%)	8 (1%)	24	55

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	D	294	MET
4	d	16	LEU
4	d	140	VAL
4	d	241	ASP
4	D	4	GLN
4	d	4	GLN
4	e	76	GLY
3	a	39	GLY

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	
3	A	64/64 (100%)	63 (98%)	1 (2%)	58	73
3	a	61/64 (95%)	60 (98%)	1 (2%)	58	73
4	D	248/254 (98%)	229 (92%)	19 (8%)	10	34
4	E	254/254 (100%)	235 (92%)	19 (8%)	11	35
4	d	255/254 (100%)	227 (89%)	28 (11%)	5	22
4	e	251/254 (99%)	228 (91%)	23 (9%)	7	28
All	All	1133/1144 (99%)	1042 (92%)	91 (8%)	12	33

All (91) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	A	59	VAL
4	D	18	ARG
4	D	22	LEU
4	D	46	VAL
4	D	109	LEU
4	D	112	GLU
4	D	115	LEU
4	D	116	SER
4	D	120	GLU
4	D	121	ILE
4	D	123	LYS

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Mol	Chain	Res	Type
4	D	124	MET
4	D	125	ARG
4	D	174	LYS
4	D	176	LEU
4	D	238	LEU
4	D	276	PHE
4	D	277	ASP
4	D	279	ASN
4	D	281	ILE
4	E	20	LYS
4	E	21	VAL
4	E	22	LEU
4	E	24	LYS
4	E	25	ASN
4	E	27	GLN
4	E	63	MET
4	E	125	ARG
4	E	126	VAL
4	E	128	SER
4	E	134	HIS
4	E	228	LEU
4	E	246	ILE
4	E	247	LYS
4	E	251	ILE
4	E	254	LEU
4	E	257	HIS
4	E	260	ASP
4	E	261	GLN
3	a	13	ILE
4	d	13	MET
4	d	15	ILE
4	d	16	LEU
4	d	17	SER
4	d	18	ARG
4	d	20	LYS
4	d	61	MET
4	d	92	GLN
4	d	120	GLU
4	d	138	VAL
4	d	140	VAL
4	d	143	LYS
4	d	185	GLU

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Mol	Chain	Res	Type
4	d	193	LYS
4	d	194	SER
4	d	197	ASN
4	d	200	LYS
4	d	215	SER
4	d	220	LEU
4	d	228	LEU
4	d	232	SER
4	d	233	THR
4	d	235	ARG
4	d	244	ASP
4	d	246	ILE
4	d	247	LYS
4	d	248	THR
4	d	278	LYS
4	e	20	LYS
4	e	22	LEU
4	e	23	VAL
4	e	24	LYS
4	e	27	GLN
4	e	28	VAL
4	e	52	GLU
4	e	74	THR
4	e	156	VAL
4	e	220	LEU
4	e	222	ILE
4	e	224	ASN
4	e	238	LEU
4	e	242	VAL
4	e	246	ILE
4	e	266	THR
4	e	269	LYS
4	e	270	ARG
4	e	290	LYS
4	e	291	ARG
4	e	292	LEU
4	e	294	MET
4	e	295	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
3	A	11	GLN
4	D	32	HIS
4	D	287[B]	ASN
4	E	30	HIS
4	E	224	ASN
3	a	40	GLN
3	a	44	ASN
3	a	51	ASN
4	d	12	ASN
4	e	25	ASN
4	e	30	HIS
4	e	67	ASN
4	e	158	GLN
4	e	279	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.