



Full wwPDB EM Validation Report ⓘ

Jul 16, 2025 – 11:02 AM JST

PDB ID : 8KGY / pdb_00008kgy
EMDB ID : EMD-37235
Title : Human glutamate dehydrogenase I
Authors : Su, M.-Y.
Deposited on : 2023-08-20
Resolution : 2.59 Å(reported)
Based on initial model : 1L1F

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

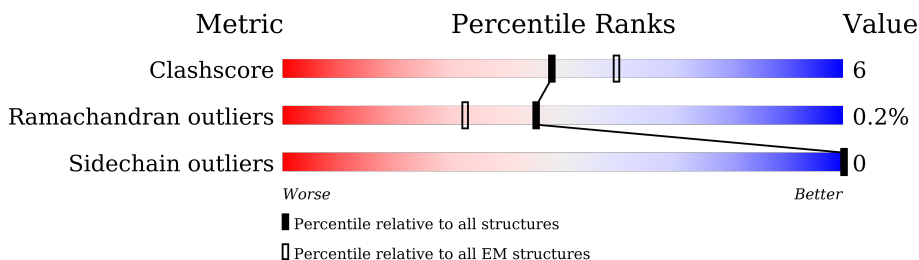
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.59 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	A	558	77% 10% 13%
1	B	558	75% 12% 12%
1	C	558	75% 13% 12%
1	D	558	73% 14% 13%
1	E	558	76% 11% 13%
1	F	558	73% 14% 13%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 21846 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.

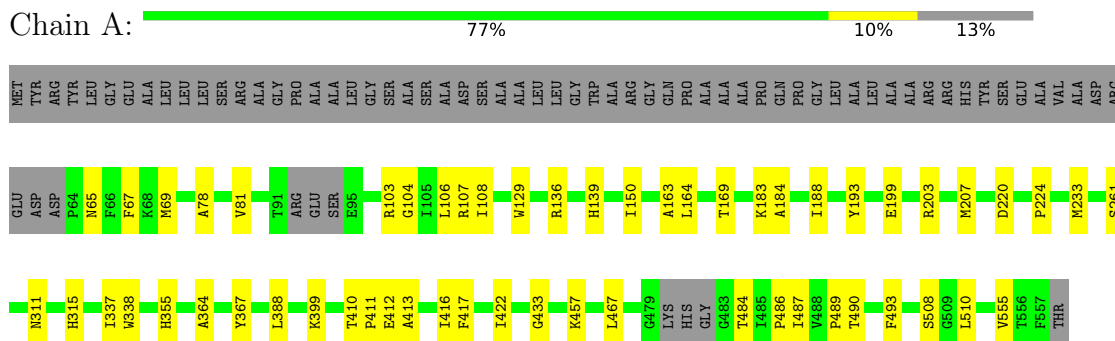
- Molecule 1 is a protein called Glutamate dehydrogenase 1, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	488	Total	C	N	O	S	0	0
			3552	2271	630	634	17		
1	B	489	Total	C	N	O	S	0	0
			3670	2332	651	669	18		
1	C	489	Total	C	N	O	S	0	0
			3658	2323	647	670	18		
1	D	485	Total	C	N	O	S	0	0
			3641	2309	639	675	18		
1	E	485	Total	C	N	O	S	0	0
			3648	2316	644	670	18		
1	F	485	Total	C	N	O	S	0	0
			3677	2329	650	680	18		

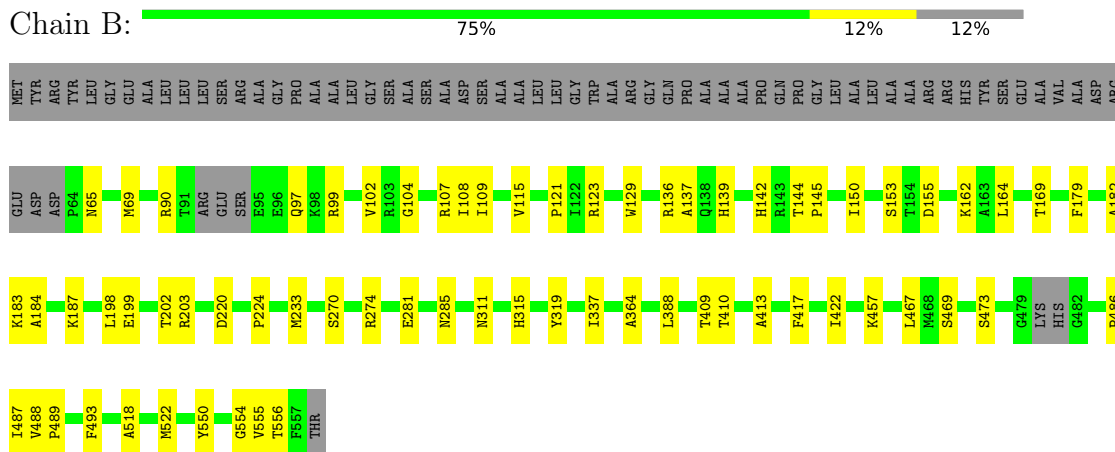
3 Residue-property plots

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.

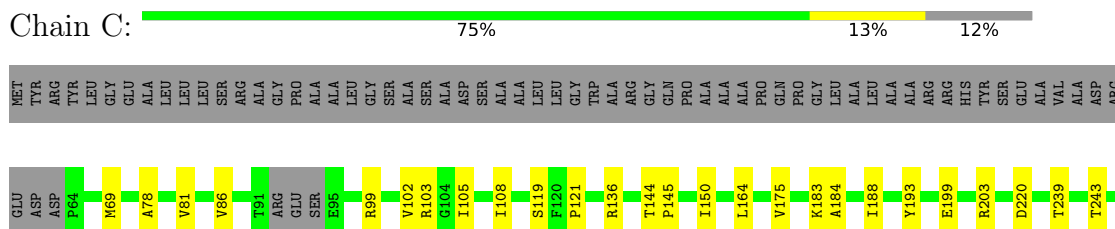
- Molecule 1: Glutamate dehydrogenase 1, mitochondrial

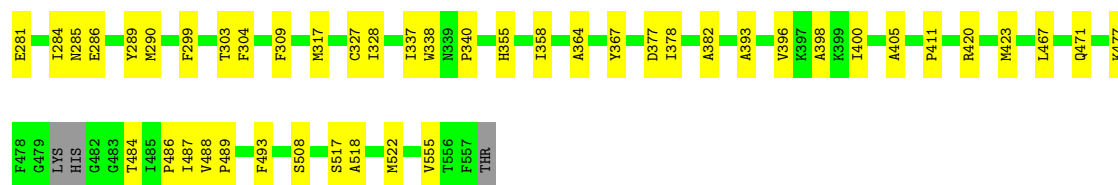


- Molecule 1: Glutamate dehydrogenase 1, mitochondrial



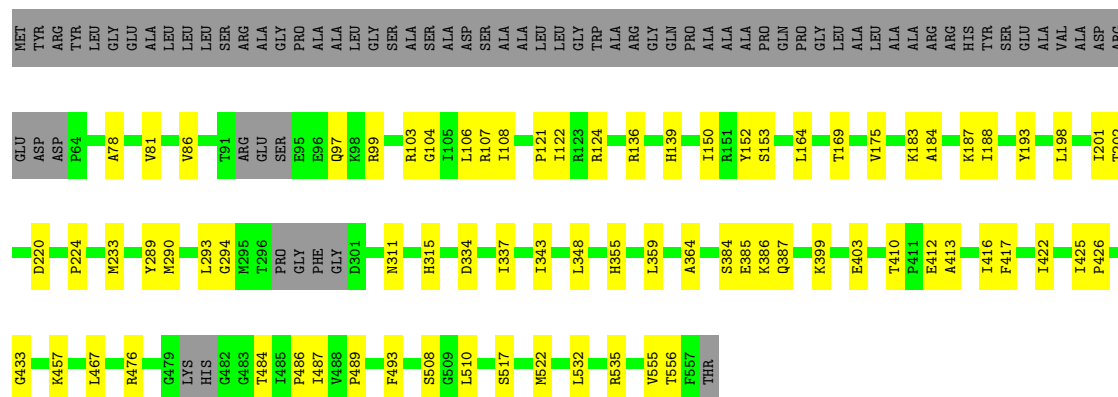
- Molecule 1: Glutamate dehydrogenase 1, mitochondrial





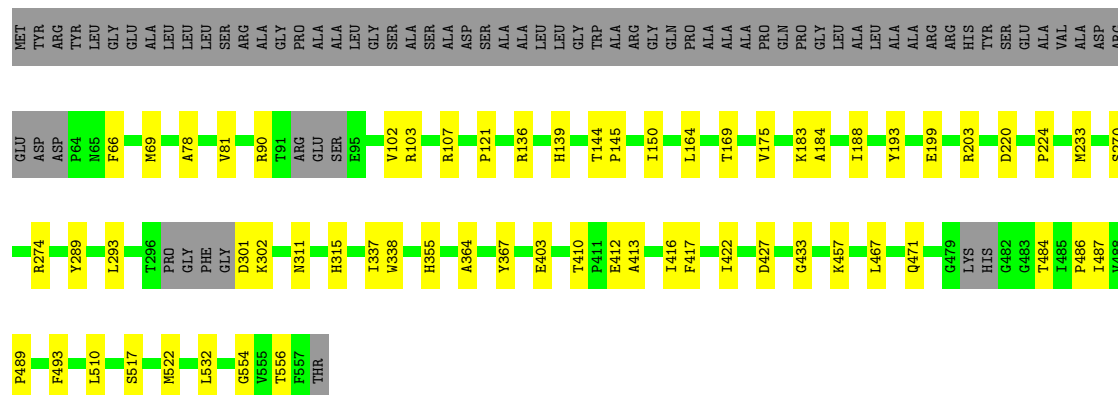
- Molecule 1: Glutamate dehydrogenase 1, mitochondrial

Chain D: 73% 14% 13%



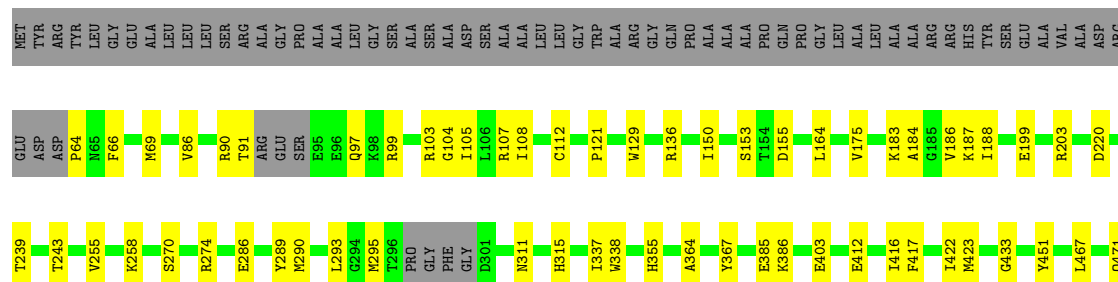
- Molecule 1: Glutamate dehydrogenase 1, mitochondrial

Chain E: 76% 11% 13%



- Molecule 1: Glutamate dehydrogenase 1, mitochondrial

Chain F: 73% 14% 13%





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, D3	Depositor
Number of particles used	79181	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 ($e^-/\text{\AA}^2$)	1.072	Depositor
Minimum defocus (nm)	1100	Depositor
Maximum defocus (nm)	1900	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	A	0.12	0/3633	0.28	0/4939
1	B	0.12	0/3751	0.30	0/5083
1	C	0.12	0/3738	0.30	0/5068
1	D	0.12	0/3718	0.29	0/5038
1	E	0.12	0/3725	0.27	0/5043
1	F	0.12	0/3754	0.28	0/5080
All	All	0.12	0/22319	0.29	0/30251

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

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	3552	0	3342	38	0
1	B	3670	0	3537	46	0
1	C	3658	0	3511	44	0
1	D	3641	0	3505	46	0
1	E	3648	0	3531	38	0
1	F	3677	0	3567	54	0
All	All	21846	0	20993	245	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 6.

All (245) 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:C:378:ILE:HG22	1:C:400:ILE:HB	1.71	0.71
1:E:66:PHE:HA	1:E:69:MET:HG3	1.74	0.69
1:F:90:ARG:HH21	1:F:99:ARG:HB3	1.57	0.69
1:F:64:PRO:O	1:F:386:LYS:NZ	2.26	0.67
1:A:338:TRP:HB2	1:A:367:TYR:HB2	1.78	0.65
1:B:108:ILE:HD12	1:D:121:PRO:HB3	1.80	0.64
1:B:150:ILE:HG12	1:B:184:ALA:HB3	1.80	0.64
1:D:385:GLU:OE2	1:D:386:LYS:NZ	2.31	0.64
1:B:121:PRO:HB3	1:D:108:ILE:HD12	1.80	0.64
1:D:150:ILE:HG12	1:D:184:ALA:HB3	1.80	0.63
1:F:99:ARG:O	1:F:103:ARG:NH1	2.32	0.63
1:C:488:VAL:HG21	1:D:476:ARG:HH12	1.64	0.63
1:B:142:HIS:HB3	1:B:550:TYR:HE1	1.63	0.62
1:B:281:GLU:OE2	1:B:285:ASN:ND2	2.33	0.62
1:C:281:GLU:OE2	1:C:285:ASN:ND2	2.33	0.62
1:E:150:ILE:HG12	1:E:184:ALA:HB3	1.81	0.61
1:A:150:ILE:HG12	1:A:184:ALA:HB3	1.80	0.61
1:F:337:ILE:HG23	1:F:364:ALA:HB1	1.83	0.60
1:A:337:ILE:HG23	1:A:364:ALA:HB1	1.83	0.60
1:B:337:ILE:HG23	1:B:364:ALA:HB1	1.83	0.60
1:F:150:ILE:HG12	1:F:184:ALA:HB3	1.84	0.60
1:B:115:VAL:HG21	1:B:162:LYS:HE3	1.82	0.60
1:B:199:GLU:O	1:B:203:ARG:HG2	2.02	0.60
1:C:150:ILE:HG12	1:C:184:ALA:HB3	1.83	0.60
1:E:337:ILE:HG23	1:E:364:ALA:HB1	1.84	0.60
1:D:467:LEU:HB3	1:D:487:ILE:HA	1.83	0.59
1:F:338:TRP:HB2	1:F:367:TYR:HB2	1.85	0.59
1:B:467:LEU:HB3	1:B:487:ILE:HA	1.85	0.59
1:B:129:TRP:O	1:D:107:ARG:NH2	2.36	0.58
1:F:199:GLU:O	1:F:203:ARG:HG2	2.03	0.58
1:C:199:GLU:O	1:C:203:ARG:HG2	2.04	0.58
1:B:554:GLY:O	1:B:556:THR:N	2.37	0.58
1:C:393:ALA:O	1:C:420:ARG:NH2	2.36	0.58
1:D:556:THR:HA	1:E:203:ARG:HH12	1.67	0.58
1:D:399:LYS:HA	1:D:422:ILE:HD12	1.86	0.57
1:E:467:LEU:HB3	1:E:487:ILE:HA	1.86	0.57
1:D:385:GLU:HG2	1:D:386:LYS:HG2	1.86	0.57
1:D:337:ILE:HG23	1:D:364:ALA:HB1	1.85	0.57
1:A:69:MET:HE3	1:A:411:PRO:HD3	1.86	0.57
1:F:86:VAL:HA	1:F:90:ARG:HH22	1.70	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:104:GLY:O	1:B:107:ARG:HG2	2.05	0.56
1:D:484:THR:HG22	1:D:486:PRO:HD3	1.88	0.55
1:C:99:ARG:O	1:C:103:ARG:NH1	2.39	0.55
1:E:199:GLU:O	1:E:203:ARG:HG2	2.07	0.55
1:E:224:PRO:HG3	1:E:233:MET:HG3	1.89	0.55
1:B:410:THR:HG23	1:B:413:ALA:H	1.71	0.55
1:A:199:GLU:O	1:A:203:ARG:HG2	2.06	0.55
1:D:188:ILE:HD11	1:D:193:TYR:CZ	2.41	0.55
1:C:471:GLN:HB2	1:C:486:PRO:HD2	1.89	0.55
1:F:289:TYR:HB3	1:F:423:MET:HE1	1.89	0.54
1:C:289:TYR:HB3	1:C:423:MET:HE1	1.89	0.54
1:C:136:ARG:HH11	1:C:184:ALA:HB2	1.71	0.54
1:F:385:GLU:HG2	1:F:386:LYS:HG3	1.90	0.53
1:A:136:ARG:HH11	1:A:184:ALA:HB2	1.74	0.53
1:C:284:ILE:HG13	1:C:299:PHE:HE1	1.74	0.53
1:C:136:ARG:HH21	1:C:220:ASP:CG	2.17	0.53
1:A:129:TRP:O	1:E:107:ARG:NH1	2.42	0.52
1:C:355:HIS:O	1:C:355:HIS:ND1	2.42	0.52
1:D:136:ARG:HH11	1:D:184:ALA:HB2	1.73	0.52
1:A:136:ARG:HH21	1:A:220:ASP:CG	2.17	0.52
1:F:136:ARG:HH21	1:F:220:ASP:CG	2.18	0.52
1:A:188:ILE:HD11	1:A:193:TYR:CZ	2.44	0.52
1:C:69:MET:HE3	1:C:411:PRO:HD3	1.91	0.52
1:E:410:THR:HG23	1:E:413:ALA:H	1.74	0.52
1:B:489:PRO:HB3	1:B:493:PHE:HD2	1.74	0.52
1:F:136:ARG:HH11	1:F:184:ALA:HB2	1.73	0.52
1:F:355:HIS:O	1:F:355:HIS:ND1	2.43	0.52
1:B:224:PRO:HG3	1:B:233:MET:HG3	1.92	0.52
1:C:489:PRO:HB3	1:C:493:PHE:HD2	1.75	0.52
1:E:136:ARG:HH21	1:E:220:ASP:CG	2.18	0.52
1:D:410:THR:HG23	1:D:413:ALA:H	1.75	0.52
1:E:338:TRP:HB2	1:E:367:TYR:HB2	1.91	0.52
1:B:109:ILE:HG12	1:B:550:TYR:HE2	1.75	0.51
1:D:224:PRO:HG3	1:D:233:MET:HG3	1.93	0.51
1:F:105:ILE:HA	1:F:108:ILE:HD12	1.92	0.51
1:D:136:ARG:HH21	1:D:220:ASP:CG	2.18	0.51
1:F:484:THR:HG22	1:F:486:PRO:HD3	1.92	0.51
1:B:136:ARG:HH21	1:B:220:ASP:CG	2.18	0.51
1:D:86:VAL:HG22	1:D:103:ARG:HH11	1.76	0.51
1:F:290:MET:HE3	1:F:295:MET:HB2	1.93	0.51
1:C:484:THR:HG22	1:C:486:PRO:HD3	1.93	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:136:ARG:HH11	1:B:184:ALA:HB2	1.76	0.50
1:C:119:SER:OG	1:F:112:CYS:O	2.29	0.50
1:C:309:PHE:HE2	1:C:317:MET:HE1	1.77	0.49
1:A:467:LEU:HB3	1:A:487:ILE:HA	1.94	0.49
1:A:410:THR:HG23	1:A:413:ALA:H	1.77	0.49
1:E:403:GLU:HB3	1:E:427:ASP:HB3	1.95	0.49
1:F:164:LEU:HD13	1:F:183:LYS:HE3	1.95	0.49
1:F:104:GLY:O	1:F:107:ARG:HG2	2.13	0.49
1:A:67:PHE:HD1	1:A:163:ALA:HB2	1.78	0.48
1:B:518:ALA:O	1:B:522:MET:HG3	2.13	0.48
1:C:303:THR:HG23	1:C:377:ASP:H	1.78	0.48
1:B:144:THR:HG23	1:B:145:PRO:HD3	1.94	0.48
1:D:433:GLY:HA2	1:D:510:LEU:HD11	1.94	0.48
1:E:293:LEU:HD21	1:E:532:LEU:HD21	1.95	0.48
1:F:66:PHE:HA	1:F:69:MET:HG3	1.95	0.48
1:E:136:ARG:HH11	1:E:184:ALA:HB2	1.78	0.48
1:A:355:HIS:O	1:A:355:HIS:ND1	2.47	0.48
1:A:484:THR:HG22	1:A:486:PRO:HD3	1.96	0.48
1:B:90:ARG:HH12	1:B:102:VAL:HG21	1.79	0.48
1:B:109:ILE:HG12	1:B:550:TYR:CE2	2.47	0.48
1:A:104:GLY:O	1:A:107:ARG:HG2	2.13	0.48
1:C:164:LEU:HD13	1:C:183:LYS:HE3	1.95	0.48
1:D:403:GLU:OE2	1:D:535:ARG:NH2	2.42	0.48
1:A:65:ASN:ND2	1:A:67:PHE:HB3	2.29	0.48
1:C:188:ILE:HD11	1:C:193:TYR:CZ	2.49	0.48
1:C:337:ILE:HD12	1:C:358:ILE:HD12	1.96	0.48
1:E:417:PHE:HB3	1:E:422:ILE:HB	1.93	0.48
1:E:433:GLY:HA2	1:E:510:LEU:HD11	1.96	0.48
1:D:343:ILE:HG21	1:D:348:LEU:HD22	1.95	0.47
1:B:142:HIS:HB3	1:B:550:TYR:CE1	2.45	0.47
1:B:311:ASN:O	1:B:315:HIS:ND1	2.48	0.47
1:C:121:PRO:HB3	1:F:108:ILE:HG12	1.97	0.47
1:C:518:ALA:O	1:C:522:MET:HG3	2.14	0.47
1:F:91:THR:O	1:F:99:ARG:NH2	2.38	0.47
1:C:108:ILE:HG12	1:F:121:PRO:HB3	1.96	0.47
1:F:467:LEU:HB3	1:F:487:ILE:HA	1.97	0.47
1:A:139:HIS:HD2	1:A:169:THR:HG21	1.80	0.47
1:F:153:SER:OG	1:F:155:ASP:OD1	2.25	0.47
1:A:433:GLY:HA2	1:A:510:LEU:HD11	1.97	0.46
1:D:164:LEU:HD13	1:D:183:LYS:HE3	1.97	0.46
1:A:224:PRO:HG3	1:A:233:MET:HG3	1.97	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:139:HIS:ND1	1:B:169:THR:HG21	2.29	0.46
1:C:105:ILE:HA	1:C:108:ILE:HD12	1.96	0.46
1:D:122:ILE:HG21	1:D:201:ILE:HG12	1.98	0.46
1:A:417:PHE:HB3	1:A:422:ILE:HB	1.97	0.46
1:F:417:PHE:HB3	1:F:422:ILE:HB	1.97	0.46
1:F:239:THR:O	1:F:243:THR:OG1	2.26	0.46
1:B:97:GLN:O	1:B:97:GLN:HG3	2.15	0.46
1:B:270:SER:O	1:B:274:ARG:HG3	2.16	0.46
1:D:99:ARG:O	1:D:103:ARG:NH1	2.49	0.46
1:E:136:ARG:HD3	1:E:184:ALA:HB2	1.97	0.46
1:C:337:ILE:HG23	1:C:364:ALA:HB1	1.98	0.46
1:D:384:SER:OG	1:D:387:GLN:OE1	2.33	0.46
1:C:382:ALA:HA	1:C:405:ALA:HB2	1.98	0.45
1:F:412:GLU:O	1:F:416:ILE:HG12	2.16	0.45
1:B:486:PRO:HA	1:F:473:SER:HB3	1.99	0.45
1:F:91:THR:C	1:F:99:ARG:HH22	2.23	0.45
1:F:186:VAL:HG12	1:F:188:ILE:HG12	1.97	0.45
1:F:518:ALA:O	1:F:522:MET:HG3	2.16	0.45
1:E:188:ILE:HD11	1:E:193:TYR:CZ	2.51	0.45
1:F:153:SER:O	1:F:187:LYS:HA	2.17	0.45
1:C:239:THR:O	1:C:243:THR:OG1	2.26	0.45
1:C:467:LEU:HB3	1:C:487:ILE:HA	1.99	0.45
1:A:311:ASN:O	1:A:315:HIS:ND1	2.49	0.45
1:B:274:ARG:HG2	1:B:319:TYR:CE2	2.51	0.45
1:D:139:HIS:HD2	1:D:169:THR:HG21	1.81	0.45
1:A:164:LEU:HD13	1:A:183:LYS:HE3	1.99	0.45
1:B:489:PRO:HB3	1:B:493:PHE:CD2	2.51	0.45
1:F:104:GLY:HA2	1:F:107:ARG:HE	1.82	0.45
1:F:286:GLU:O	1:F:290:MET:HG2	2.16	0.45
1:D:175:VAL:HA	1:D:517:SER:OG	2.17	0.44
1:B:488:VAL:HG11	1:F:476:ARG:HH12	1.83	0.44
1:C:86:VAL:HG22	1:C:103:ARG:HH11	1.81	0.44
1:C:489:PRO:HB3	1:C:493:PHE:CD2	2.53	0.44
1:D:153:SER:O	1:D:187:LYS:HA	2.17	0.44
1:D:355:HIS:O	1:D:355:HIS:ND1	2.49	0.44
1:C:144:THR:OG1	1:C:145:PRO:HD3	2.17	0.44
1:A:508:SER:OG	1:B:457:LYS:HB3	2.18	0.44
1:B:153:SER:O	1:B:187:LYS:HA	2.17	0.44
1:E:337:ILE:HD12	1:E:364:ALA:HB1	1.98	0.44
1:C:286:GLU:O	1:C:290:MET:HG2	2.17	0.44
1:C:477:LYS:HE2	1:E:484:THR:HG22	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:102:VAL:HG23	1:F:129:TRP:CH2	2.53	0.44
1:D:289:TYR:CE1	1:D:522:MET:HE2	2.53	0.44
1:D:311:ASN:OD1	1:D:315:HIS:ND1	2.50	0.44
1:B:198:LEU:O	1:B:202:THR:HG23	2.18	0.43
1:E:90:ARG:HH12	1:E:102:VAL:HG11	1.83	0.43
1:F:97:GLN:O	1:F:97:GLN:HG3	2.18	0.43
1:F:403:GLU:OE2	1:F:535:ARG:NH2	2.45	0.43
1:C:328:ILE:HG13	1:C:340:PRO:HA	1.99	0.43
1:F:86:VAL:HA	1:F:90:ARG:NH2	2.33	0.43
1:A:108:ILE:HG12	1:E:121:PRO:HB3	1.99	0.43
1:F:270:SER:O	1:F:274:ARG:HG3	2.19	0.43
1:B:144:THR:CG2	1:B:145:PRO:HD3	2.48	0.43
1:E:139:HIS:ND1	1:E:169:THR:HG21	2.34	0.43
1:E:270:SER:O	1:E:274:ARG:HG3	2.18	0.43
1:E:311:ASN:O	1:E:315:HIS:ND1	2.51	0.43
1:F:433:GLY:HA2	1:F:510:LEU:HD11	1.99	0.43
1:F:293:LEU:HD21	1:F:532:LEU:HD21	2.01	0.43
1:B:137:ALA:O	1:B:182:ALA:HA	2.19	0.43
1:B:388:LEU:HB2	1:B:409:THR:HG22	2.01	0.43
1:F:311:ASN:O	1:F:315:HIS:ND1	2.51	0.43
1:D:417:PHE:HB3	1:D:422:ILE:HB	2.01	0.43
1:A:103:ARG:HD3	1:A:103:ARG:HA	1.79	0.43
1:C:338:TRP:HB2	1:C:367:TYR:HB2	2.01	0.43
1:D:104:GLY:HA2	1:D:107:ARG:HG3	2.01	0.43
1:B:164:LEU:HD13	1:B:183:LYS:HE3	2.01	0.42
1:B:417:PHE:HB3	1:B:422:ILE:HB	2.00	0.42
1:E:355:HIS:ND1	1:E:355:HIS:O	2.52	0.42
1:D:97:GLN:HG3	1:D:97:GLN:O	2.19	0.42
1:F:66:PHE:HE2	1:F:385:GLU:CD	2.27	0.42
1:F:175:VAL:HA	1:F:517:SER:OG	2.18	0.42
1:A:412:GLU:O	1:A:416:ILE:HG12	2.19	0.42
1:C:78:ALA:HA	1:C:81:VAL:HG12	2.00	0.42
1:C:396:VAL:HG12	1:C:398:ALA:H	1.85	0.42
1:E:289:TYR:HE2	1:E:522:MET:HE3	1.84	0.42
1:F:489:PRO:HB3	1:F:493:PHE:CD2	2.55	0.42
1:A:457:LYS:HB3	1:F:508:SER:OG	2.20	0.42
1:C:99:ARG:O	1:C:102:VAL:HG12	2.19	0.42
1:A:207:MET:HE3	1:A:207:MET:HB3	1.88	0.42
1:D:489:PRO:HB3	1:D:493:PHE:CD2	2.54	0.42
1:E:78:ALA:HA	1:E:81:VAL:HG12	2.01	0.42
1:F:471:GLN:HG2	1:F:475:GLU:OE2	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:78:ALA:HB1	1:A:106:LEU:HD13	2.02	0.42
1:D:293:LEU:HD21	1:D:532:LEU:HD21	2.02	0.42
1:F:555:VAL:HG12	1:F:555:VAL:O	2.20	0.42
1:A:388:LEU:HD23	1:A:388:LEU:HA	1.94	0.42
1:C:175:VAL:HA	1:C:517:SER:OG	2.19	0.42
1:E:175:VAL:HA	1:E:517:SER:OG	2.19	0.42
1:B:65:ASN:O	1:B:69:MET:HG3	2.19	0.42
1:B:99:ARG:O	1:B:102:VAL:HG12	2.20	0.42
1:D:198:LEU:O	1:D:202:THR:HG23	2.20	0.42
1:E:144:THR:OG1	1:E:145:PRO:HD3	2.20	0.42
1:F:255:VAL:O	1:F:258:LYS:NZ	2.52	0.42
1:F:451:TYR:HB2	1:F:502:GLU:HG3	2.02	0.42
1:F:86:VAL:HG22	1:F:103:ARG:HH11	1.85	0.41
1:C:508:SER:OG	1:D:457:LYS:HB3	2.20	0.41
1:A:486:PRO:HA	1:B:473:SER:HB3	2.03	0.41
1:D:78:ALA:HA	1:D:81:VAL:HG12	2.01	0.41
1:A:136:ARG:HD3	1:A:184:ALA:HB2	2.02	0.41
1:D:508:SER:HB3	1:E:457:LYS:HB3	2.03	0.41
1:A:78:ALA:HA	1:A:81:VAL:HG12	2.03	0.41
1:E:489:PRO:HB3	1:E:493:PHE:CD2	2.56	0.41
1:A:399:LYS:HA	1:A:422:ILE:HD12	2.02	0.41
1:D:334:ASP:HB2	1:D:359:LEU:HD21	2.03	0.41
1:E:164:LEU:HD13	1:E:183:LYS:HE3	2.03	0.41
1:E:412:GLU:O	1:E:416:ILE:HG12	2.21	0.41
1:E:471:GLN:HB2	1:E:486:PRO:HD2	2.03	0.41
1:B:153:SER:OG	1:B:155:ASP:OD2	2.36	0.41
1:D:78:ALA:HB1	1:D:106:LEU:HD13	2.02	0.41
1:D:152:TYR:OH	1:D:202:THR:HG22	2.21	0.41
1:E:301:ASP:OD2	1:E:302:LYS:HG3	2.21	0.41
1:B:123:ARG:HD3	1:B:129:TRP:CZ2	2.55	0.41
1:B:145:PRO:HB2	1:B:179:PHE:CD1	2.55	0.41
1:C:304:PHE:CZ	1:C:327:CYS:HB2	2.56	0.41
1:A:490:THR:HG23	1:B:469:SER:HA	2.03	0.40
1:E:103:ARG:HA	1:E:103:ARG:HD3	1.83	0.40
1:A:139:HIS:CD2	1:A:169:THR:HG21	2.56	0.40
1:A:489:PRO:HB3	1:A:493:PHE:CD2	2.56	0.40
1:A:261:SER:OG	1:F:552:GLU:OE1	2.34	0.40
1:D:290:MET:O	1:D:294:GLY:N	2.55	0.40
1:D:412:GLU:O	1:D:416:ILE:HG12	2.21	0.40
1:D:425:ILE:HA	1:D:426:PRO:HD3	1.99	0.40
1:E:554:GLY:C	1:E:556:THR:H	2.29	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	482/558 (86%)	468 (97%)	13 (3%)	1 (0%)	44	66
1	B	483/558 (87%)	467 (97%)	15 (3%)	1 (0%)	44	66
1	C	483/558 (87%)	464 (96%)	18 (4%)	1 (0%)	44	66
1	D	477/558 (86%)	463 (97%)	12 (2%)	2 (0%)	30	52
1	E	477/558 (86%)	461 (97%)	16 (3%)	0	100	100
1	F	477/558 (86%)	458 (96%)	18 (4%)	1 (0%)	44	66
All	All	2879/3348 (86%)	2781 (97%)	92 (3%)	6 (0%)	45	66

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	555	VAL
1	A	555	VAL
1	D	124	ARG
1	C	555	VAL
1	D	555	VAL
1	F	556	THR

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	334/452 (74%)	334 (100%)	0	100	100
1	B	367/452 (81%)	367 (100%)	0	100	100
1	C	364/452 (80%)	364 (100%)	0	100	100
1	D	368/452 (81%)	368 (100%)	0	100	100
1	E	368/452 (81%)	368 (100%)	0	100	100
1	F	375/452 (83%)	375 (100%)	0	100	100
All	All	2176/2712 (80%)	2176 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (28) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	262	GLN
1	A	282	ASN
1	A	285	ASN
1	A	321	HIS
1	A	494	GLN
1	B	139	HIS
1	B	189	ASN
1	B	192	ASN
1	B	266	HIS
1	B	321	HIS
1	C	196	ASN
1	C	387	GLN
1	C	541	ASN
1	D	262	GLN
1	D	282	ASN
1	D	285	ASN
1	D	321	HIS
1	D	494	GLN
1	E	196	ASN
1	E	262	GLN
1	E	285	ASN
1	E	321	HIS
1	F	196	ASN
1	F	282	ASN
1	F	285	ASN
1	F	321	HIS
1	F	387	GLN
1	F	494	GLN

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.