

# Full wwPDB/EMDataBank EM Map/Model Validation Report ⓘ

Jun 6, 2019 – 09:35 AM EDT

PDB ID : 6MLR  
EMDB ID: : EMD-9141  
Title : Cryo-EM structure of microtubule-bound Kif7 in the AMPPNP state  
Authors : Mani, N.; Jiang, S.; Wilson-Kubalek, E.M.; Ku, P.; Milligan, R.A.; Subramanian, R.  
Deposited on : 2018-09-27  
Resolution : 4.20 Å(reported)  
Based on PDB ID : 4A14, 3J6G

This is a Full wwPDB/EMDataBank EM Map/Model Validation Report  
for a publicly released PDB/EMDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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.

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MolProbity : 4.02b-467  
Mogul : 1.8.0 (224370), CSD as540be (2019)  
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20031633

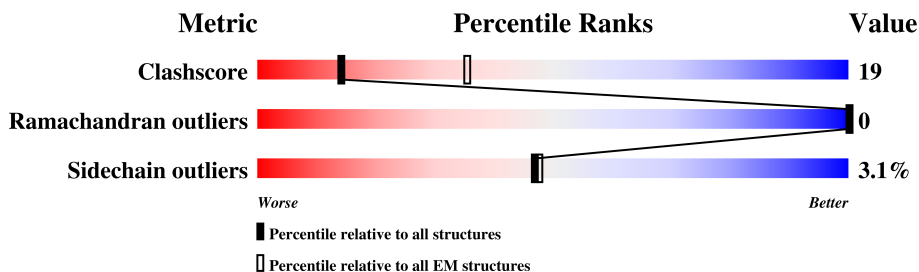
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 4.20 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	136327	1886
Ramachandran outliers	132723	1663
Sidechain outliers	132532	1531

The table below summarises the geometric issues observed across the polymeric chains. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	451	63% (green), 27% (yellow), 9% (grey)
2	B	445	63% (green), 31% (yellow), 6% (grey)
3	C	399	57% (green), 24% (yellow), 19% (grey)

## 2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 9177 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 Tubulin alpha-1A chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	411	3224	2042	550	612	20	0	0

- Molecule 2 is a protein called Tubulin beta chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	426	3351	2105	575	646	25	0	0

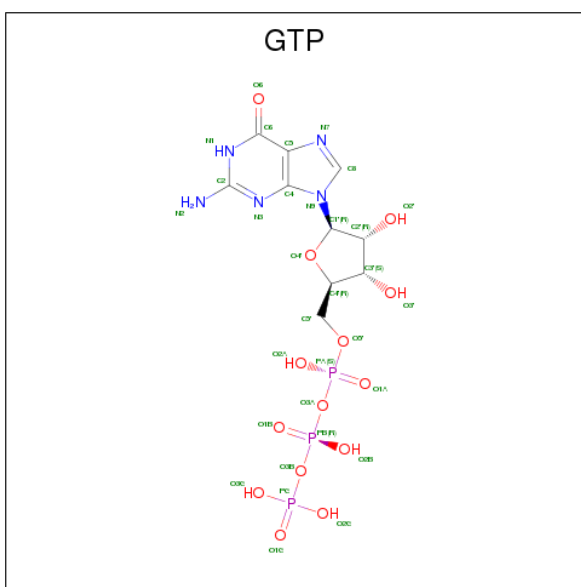
- Molecule 3 is a protein called Kinesin-like protein KIF7.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	C	323	2449	1534	432	474	9	0	0

There is a discrepancy between the modelled and reference sequences:

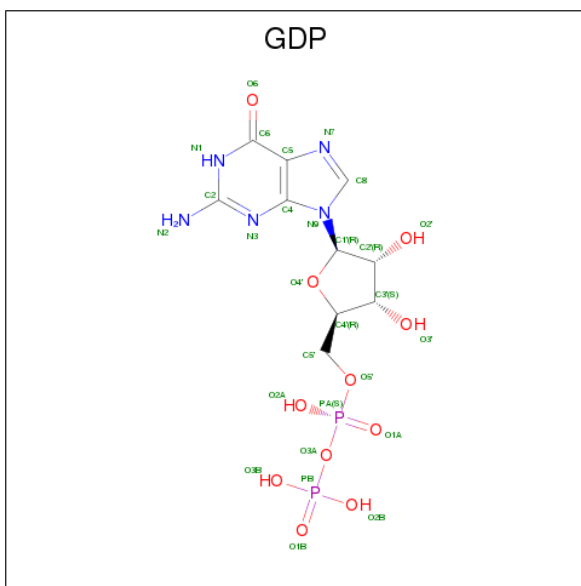
Chain	Residue	Modelled	Actual	Comment	Reference
C	0	GLY	-	expression tag	UNP Q2M1P5

- Molecule 4 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula: C<sub>10</sub>H<sub>16</sub>N<sub>5</sub>O<sub>14</sub>P<sub>3</sub>).



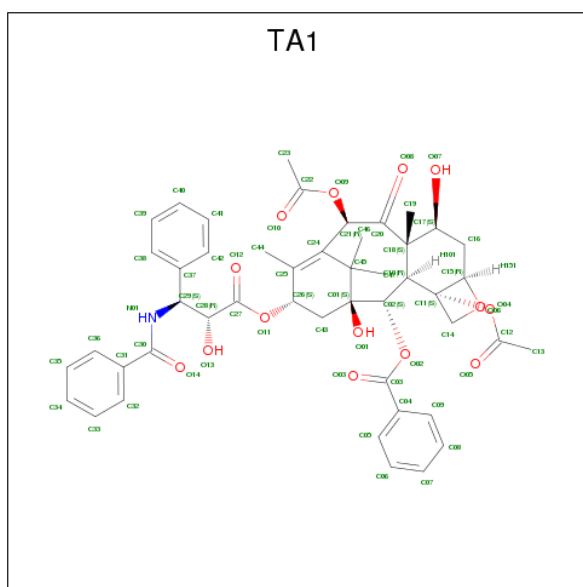
Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
4	A	1	32	10	5	14	3	0

- Molecule 5 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula:  $C_{10}H_{15}N_5O_{11}P_2$ ).



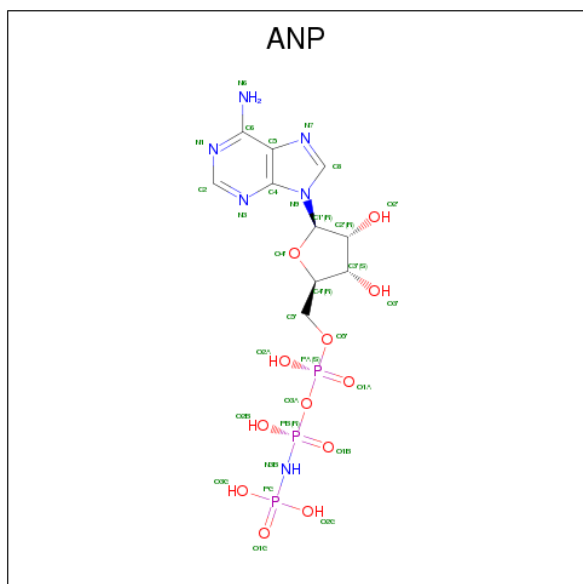
Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
5	B	1	28	10	5	11	2	0

- Molecule 6 is TAXOL (three-letter code: TA1) (formula:  $C_{47}H_{51}NO_{14}$ ).



Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
6	B	1	62	47	1	14	0

- Molecule 7 is PHOSPHOAMINOPHOSPHONIC ACID-ADENYLATE ESTER (three-letter code: ANP) (formula:  $C_{10}H_{17}N_6O_{12}P_3$ ).

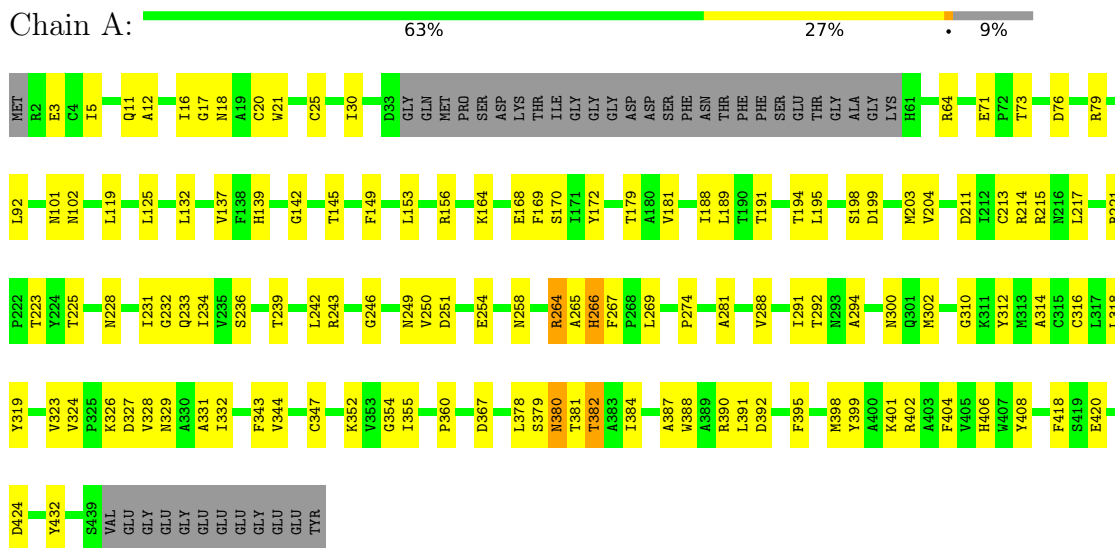


Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
7	C	1	31	10	6	12	3	0

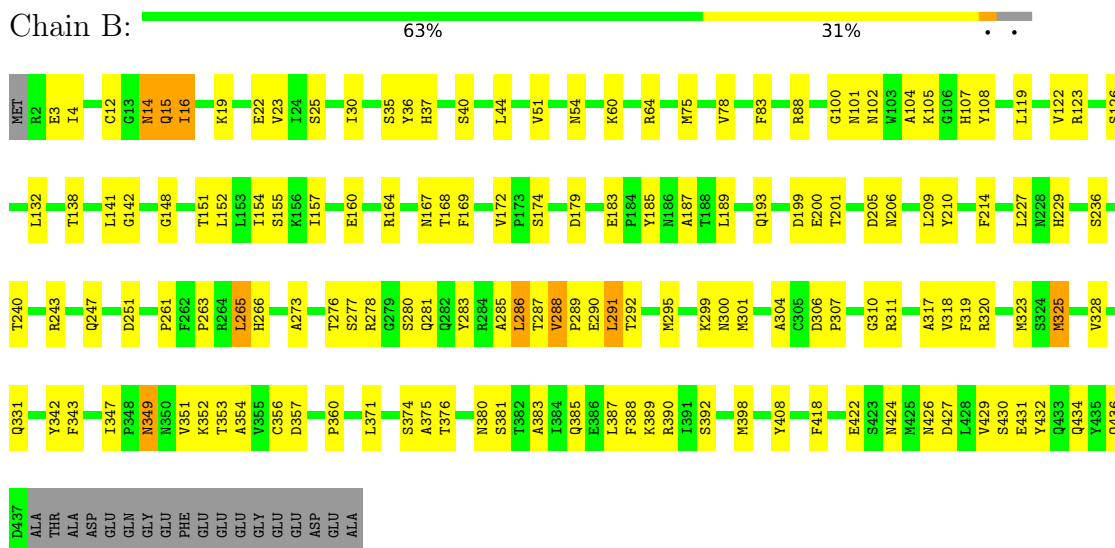
### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: Tubulin alpha-1A chain



- Molecule 2: Tubulin beta chain



- Molecule 3: Kinesin-like protein KIF7





## 4 Experimental information

Property	Value	Source
Reconstruction method	HELICAL	Depositor
Imposed symmetry	HELICAL, twist=-25.76°, rise=8.83 Å, axial sym=C1	Depositor
Number of segments used	37220	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING ONLY; CTF correction using CTFFIND4	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{Å}^2$ )	37	Depositor
Minimum defocus (nm)	Not provided	Depositor
Maximum defocus (nm)	Not provided	Depositor
Magnification	Not provided	Depositor
Image detector	GATAN K2 SUMMIT (4k 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: GDP, GTP, ANP, TA1

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  >2	RMSZ	# Z  >2
1	A	0.40	0/3297	0.61	0/4479
2	B	0.42	0/3426	0.62	0/4642
3	C	0.27	0/2485	0.52	0/3360
All	All	0.38	0/9208	0.59	0/12481

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	4
2	B	0	2
3	C	0	1
All	All	0	7

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	281	ALA	Peptide
1	A	3	GLU	Peptide
1	A	329	ASN	Peptide
1	A	382	THR	Peptide
2	B	183	GLU	Peptide
2	B	343	PHE	Peptide
3	C	259	VAL	Peptide

## 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	3224	0	3142	99	0
2	B	3351	0	3229	164	0
3	C	2449	0	2407	84	0
4	A	32	0	12	3	0
5	B	28	0	12	2	0
6	B	62	0	51	14	0
7	C	31	0	12	0	0
All	All	9177	0	8865	339	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 19.

All (339) 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:266:HIS:CE1	1:A:432:TYR:CD1	2.03	1.45
1:A:266:HIS:CE1	1:A:432:TYR:CE1	2.05	1.43
1:A:266:HIS:ND1	1:A:432:TYR:HE1	1.28	1.29
3:C:113:LEU:HD13	3:C:114:GLU:N	1.48	1.28
1:A:266:HIS:HE1	1:A:432:TYR:CD1	1.50	1.20
2:B:288:VAL:HB	2:B:323:MET:HE1	1.19	1.19
3:C:113:LEU:HD22	3:C:115:ASP:H	1.08	1.17
3:C:113:LEU:CD2	3:C:115:ASP:CB	2.24	1.16
1:A:266:HIS:ND1	1:A:432:TYR:CE1	2.07	1.15
2:B:287:THR:O	2:B:291:LEU:CD1	1.92	1.15
2:B:14:ASN:OD1	2:B:78:VAL:HG21	1.47	1.12
2:B:288:VAL:HA	2:B:291:LEU:HD13	1.26	1.11
3:C:113:LEU:HD21	3:C:115:ASP:CB	1.79	1.11
2:B:291:LEU:O	2:B:295:MET:HG3	1.50	1.10
3:C:113:LEU:CD2	3:C:115:ASP:HB3	1.79	1.10
2:B:288:VAL:CA	2:B:291:LEU:HD13	1.80	1.10
2:B:287:THR:OG1	2:B:289:PRO:HD2	1.50	1.08
3:C:113:LEU:HD21	3:C:115:ASP:HB3	1.14	1.08
2:B:14:ASN:CG	2:B:78:VAL:HG21	1.72	1.08
2:B:288:VAL:CB	2:B:323:MET:HE1	1.83	1.08

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:288:VAL:HB	2:B:323:MET:CE	1.85	1.07
2:B:287:THR:OG1	2:B:289:PRO:CD	2.03	1.05
2:B:291:LEU:HD12	2:B:291:LEU:H	1.18	1.05
2:B:287:THR:O	2:B:291:LEU:HD12	1.57	1.04
2:B:288:VAL:HG13	2:B:289:PRO:HD3	1.35	1.04
3:C:290:GLY:CA	3:C:347:GLN:OE1	2.06	1.02
3:C:290:GLY:HA3	3:C:347:GLN:OE1	1.60	1.01
3:C:113:LEU:CD2	3:C:115:ASP:H	1.74	1.00
2:B:287:THR:OG1	2:B:289:PRO:CG	2.10	0.99
2:B:288:VAL:CG2	2:B:323:MET:CE	2.41	0.98
2:B:291:LEU:HD23	2:B:375:ALA:HB2	1.45	0.96
3:C:110:ALA:O	3:C:112:LEU:CD2	2.15	0.95
1:A:199:ASP:HA	1:A:265:ALA:CB	1.97	0.93
3:C:110:ALA:O	3:C:112:LEU:HD23	1.68	0.93
2:B:288:VAL:CG2	2:B:323:MET:HE1	1.98	0.92
3:C:113:LEU:HD13	3:C:114:GLU:H	1.17	0.92
1:A:266:HIS:CE1	1:A:432:TYR:HD1	1.62	0.92
3:C:113:LEU:HD22	3:C:115:ASP:N	1.84	0.91
2:B:288:VAL:N	2:B:289:PRO:HD2	1.82	0.91
2:B:288:VAL:CB	2:B:323:MET:CE	2.46	0.91
2:B:291:LEU:HD23	2:B:375:ALA:CB	2.01	0.90
2:B:291:LEU:CD2	2:B:375:ALA:HB2	2.01	0.90
1:A:195:LEU:HD11	1:A:265:ALA:O	1.72	0.89
2:B:288:VAL:HG21	2:B:323:MET:CE	2.03	0.89
2:B:288:VAL:HG13	2:B:289:PRO:CD	2.04	0.87
2:B:422:GLU:O	2:B:426:ASN:HB2	1.75	0.87
2:B:14:ASN:OD1	2:B:78:VAL:CG2	2.23	0.87
2:B:360:PRO:HB2	6:B:601:TA1:O13	1.75	0.85
3:C:113:LEU:CD2	3:C:115:ASP:HB2	2.07	0.85
2:B:236:SER:OG	6:B:601:TA1:C40	2.24	0.84
1:A:199:ASP:HA	1:A:265:ALA:HB1	1.62	0.81
1:A:195:LEU:CD2	1:A:264:ARG:NH1	2.45	0.80
2:B:14:ASN:HD21	2:B:78:VAL:HG11	1.47	0.80
1:A:195:LEU:HD21	1:A:264:ARG:NH1	1.97	0.79
1:A:195:LEU:HD21	1:A:264:ARG:HH11	1.46	0.79
3:C:290:GLY:HA2	3:C:347:GLN:OE1	1.81	0.78
1:A:199:ASP:HA	1:A:265:ALA:HB2	1.64	0.77
2:B:387:LEU:O	2:B:390:ARG:HB3	1.84	0.77
2:B:12:CYS:O	2:B:16:ILE:HG12	1.84	0.76
1:A:266:HIS:CG	1:A:432:TYR:HE1	2.05	0.75
3:C:113:LEU:CD2	3:C:115:ASP:N	2.45	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:287:THR:O	2:B:291:LEU:HD11	1.84	0.74
2:B:290:GLU:HG2	2:B:291:LEU:HD12	1.68	0.74
1:A:269:LEU:O	1:A:378:LEU:HA	1.88	0.73
3:C:112:LEU:N	3:C:112:LEU:HD23	2.03	0.73
1:A:137:VAL:O	1:A:169:PHE:HB3	1.87	0.73
2:B:288:VAL:C	2:B:291:LEU:HD13	2.09	0.73
2:B:291:LEU:HD12	2:B:291:LEU:N	2.02	0.72
1:A:327:ASP:O	1:A:331:ALA:HB3	1.89	0.72
2:B:292:THR:HG21	2:B:331:GLN:HB3	1.70	0.72
3:C:113:LEU:CD1	3:C:114:GLU:N	2.43	0.70
2:B:287:THR:C	2:B:289:PRO:HD2	2.11	0.70
2:B:291:LEU:CD1	2:B:291:LEU:H	1.99	0.69
2:B:290:GLU:HG2	2:B:291:LEU:H	1.57	0.69
1:A:195:LEU:CD1	1:A:265:ALA:O	2.41	0.69
2:B:288:VAL:HA	2:B:291:LEU:CD1	2.14	0.68
2:B:317:ALA:O	2:B:354:ALA:HB3	1.93	0.68
3:C:113:LEU:HD13	3:C:113:LEU:C	2.14	0.68
1:A:316:CYS:HA	1:A:352:LYS:O	1.94	0.68
3:C:110:ALA:O	3:C:112:LEU:HD21	1.94	0.68
1:A:266:HIS:CE1	1:A:432:TYR:HE1	1.65	0.68
2:B:287:THR:C	2:B:291:LEU:CD1	2.62	0.68
3:C:83:PHE:HA	3:C:227:GLN:HE22	1.59	0.67
1:A:149:PHE:O	1:A:153:LEU:HB2	1.94	0.67
1:A:12:ALA:O	1:A:16:ILE:HB	1.96	0.66
2:B:288:VAL:N	2:B:289:PRO:CD	2.57	0.66
2:B:356:CYS:SG	2:B:357:ASP:N	2.69	0.66
2:B:14:ASN:ND2	2:B:78:VAL:HG11	2.10	0.66
3:C:113:LEU:HD12	3:C:113:LEU:H	1.62	0.65
3:C:113:LEU:HD21	3:C:115:ASP:CA	2.25	0.65
3:C:339:THR:O	3:C:342:TYR:HB3	1.96	0.65
1:A:266:HIS:HE1	1:A:432:TYR:HD1	0.78	0.65
2:B:287:THR:HG1	2:B:289:PRO:CD	2.09	0.65
2:B:236:SER:OG	6:B:601:TA1:H401	1.96	0.65
3:C:113:LEU:CD1	3:C:114:GLU:H	2.03	0.64
3:C:330:SER:O	3:C:333:PHE:HB2	1.95	0.64
3:C:148:VAL:HB	3:C:218:HIS:HB2	1.80	0.64
1:A:76:ASP:HA	1:A:79:ARG:HB2	1.79	0.63
3:C:113:LEU:HD11	3:C:116:GLU:HG2	1.79	0.63
1:A:101:ASN:ND2	4:A:500:GTP:O2B	2.31	0.63
2:B:132:LEU:HB3	2:B:164:ARG:HE	1.63	0.63
6:B:601:TA1:H463	6:B:601:TA1:H261	1.80	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:105:GLY:HA3	3:C:118:GLY:H	1.63	0.62
1:A:191:THR:HA	1:A:194:THR:HG22	1.82	0.62
2:B:288:VAL:CB	2:B:323:MET:HE3	2.30	0.62
2:B:288:VAL:HG21	2:B:323:MET:HE3	1.80	0.62
3:C:113:LEU:HD22	3:C:115:ASP:CB	2.22	0.62
2:B:290:GLU:CG	2:B:291:LEU:N	2.62	0.61
2:B:434:GLN:HE21	3:C:297:SER:HA	1.65	0.61
3:C:122:ARG:O	3:C:126:GLU:HB2	2.00	0.61
2:B:210:TYR:O	2:B:214:PHE:HB3	2.00	0.61
3:C:113:LEU:HD11	3:C:116:GLU:H	1.65	0.61
1:A:195:LEU:HD23	1:A:264:ARG:NH1	2.15	0.61
2:B:286:LEU:O	2:B:287:THR:HG22	1.99	0.61
3:C:113:LEU:CD2	3:C:115:ASP:CA	2.78	0.61
2:B:287:THR:OG1	2:B:289:PRO:HG2	1.97	0.60
3:C:113:LEU:HD22	3:C:115:ASP:HB2	1.81	0.60
2:B:286:LEU:C	2:B:286:LEU:HD22	2.22	0.60
1:A:233:GLN:HE22	1:A:360:PRO:HB3	1.67	0.60
1:A:251:ASP:HB3	1:A:254:GLU:HG2	1.83	0.60
1:A:213:CYS:HA	1:A:217:LEU:HB3	1.83	0.59
1:A:254:GLU:O	1:A:258:ASN:HB2	2.02	0.59
2:B:360:PRO:HB2	6:B:601:TA1:C28	2.33	0.59
2:B:172:VAL:HG11	2:B:387:LEU:HD21	1.83	0.59
1:A:79:ARG:NH2	1:A:92:LEU:O	2.36	0.59
2:B:431:GLU:HG2	3:C:302:ARG:HH22	1.66	0.59
2:B:290:GLU:HG2	2:B:291:LEU:N	2.18	0.59
2:B:209:LEU:HB3	2:B:227:LEU:HD22	1.84	0.59
2:B:318:VAL:HB	2:B:376:THR:HB	1.85	0.58
2:B:23:VAL:HG22	6:B:601:TA1:C32	2.33	0.58
2:B:167:ASN:ND2	2:B:200:GLU:OE1	2.36	0.58
1:A:242:LEU:HD21	1:A:250:VAL:HB	1.85	0.58
2:B:288:VAL:CG1	2:B:289:PRO:CD	2.80	0.58
3:C:110:ALA:C	3:C:112:LEU:HD23	2.22	0.58
2:B:388:PHE:O	2:B:392:SER:N	2.34	0.58
2:B:311:ARG:HD3	2:B:342:TYR:HA	1.85	0.58
3:C:337:LEU:O	3:C:341:ASN:N	2.36	0.58
1:A:217:LEU:HD11	1:A:367:ASP:HB3	1.86	0.57
2:B:288:VAL:CA	2:B:291:LEU:CD1	2.70	0.57
2:B:287:THR:HG1	2:B:289:PRO:CG	2.14	0.57
2:B:276:THR:OG1	6:B:601:TA1:H162	2.04	0.57
2:B:54:ASN:HD21	2:B:64:ARG:HD3	1.68	0.57
3:C:21:ARG:HA	3:C:61:LEU:HB2	1.87	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:257:GLU:HB2	3:C:260:LEU:HD13	1.87	0.56
1:A:198:SER:O	1:A:265:ALA:CB	2.54	0.56
2:B:286:LEU:O	2:B:286:LEU:HD13	2.06	0.56
3:C:110:ALA:C	3:C:112:LEU:CD2	2.73	0.56
1:A:11:GLN:NE2	2:B:247:GLN:O	2.38	0.56
1:A:16:ILE:O	1:A:20:CYS:HB2	2.06	0.56
2:B:209:LEU:HD23	2:B:227:LEU:HB3	1.88	0.56
1:A:189:LEU:HD11	1:A:418:PHE:HE1	1.70	0.56
2:B:277:SER:OG	2:B:280:SER:OG	2.24	0.56
3:C:95:GLN:HA	3:C:256:SER:H	1.70	0.56
2:B:189:LEU:HD11	2:B:418:PHE:HE1	1.71	0.55
1:A:16:ILE:O	1:A:20:CYS:CB	2.54	0.55
1:A:401:LYS:HZ1	3:C:295:ARG:HE	1.54	0.55
1:A:420:GLU:O	1:A:424:ASP:HB2	2.07	0.55
2:B:310:GLY:HA2	2:B:436:GLN:HE21	1.72	0.55
1:A:137:VAL:HB	1:A:168:GLU:HA	1.89	0.55
1:A:102:ASN:HB2	1:A:408:TYR:HE1	1.71	0.55
2:B:287:THR:CB	2:B:289:PRO:HD2	2.36	0.55
3:C:169:ARG:HB2	3:C:177:VAL:HB	1.89	0.55
1:A:137:VAL:O	1:A:169:PHE:CB	2.54	0.55
3:C:28:LYS:O	3:C:32:HIS:ND1	2.40	0.55
1:A:132:LEU:O	1:A:164:LYS:NZ	2.39	0.54
1:A:17:GLY:O	1:A:21:TRP:CB	2.56	0.54
1:A:211:ASP:OD1	1:A:214:ARG:NH2	2.40	0.54
3:C:113:LEU:O	3:C:114:GLU:HB2	2.07	0.54
3:C:210:LEU:HB2	3:C:213:LEU:HA	1.88	0.54
2:B:320:ARG:HA	2:B:356:CYS:HB3	1.90	0.54
2:B:151:THR:OG1	2:B:193:GLN:O	2.26	0.53
1:A:101:ASN:ND2	1:A:145:THR:OG1	2.41	0.53
3:C:113:LEU:CD1	3:C:113:LEU:H	2.21	0.53
3:C:25:LEU:HD13	3:C:328:PRO:HG2	1.90	0.53
3:C:158:GLU:HG3	3:C:160:GLY:H	1.74	0.53
1:A:221:ARG:NH1	1:A:223:THR:OG1	2.42	0.53
1:A:269:LEU:HD11	1:A:384:ILE:HD11	1.91	0.53
1:A:319:TYR:HB3	1:A:323:VAL:HG21	1.91	0.53
2:B:290:GLU:O	2:B:291:LEU:C	2.46	0.53
2:B:229:HIS:NE2	6:B:601:TA1:H361	2.24	0.53
1:A:71:GLU:HG2	1:A:73:THR:H	1.74	0.53
2:B:289:PRO:O	2:B:292:THR:CB	2.57	0.52
2:B:25:SER:HA	2:B:30:ILE:HD12	1.90	0.52
3:C:340:LEU:O	3:C:344:SER:N	2.43	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:168:THR:HB	2:B:201:THR:HA	1.90	0.52
3:C:49:LEU:HB3	3:C:53:ARG:HB2	1.92	0.52
1:A:387:ALA:O	1:A:390:ARG:HB2	2.09	0.52
3:C:68:GLU:OE1	3:C:122:ARG:NH1	2.41	0.52
1:A:239:THR:O	1:A:243:ARG:N	2.43	0.52
2:B:287:THR:C	2:B:291:LEU:HD11	2.28	0.52
3:C:143:VAL:HG12	3:C:223:VAL:HA	1.91	0.52
1:A:392:ASP:O	1:A:395:PHE:HB3	2.10	0.52
2:B:104:ALA:O	2:B:108:TYR:N	2.39	0.52
1:A:404:PHE:HE1	2:B:261:PRO:HA	1.75	0.52
3:C:334:ASP:O	3:C:338:ASN:N	2.40	0.51
3:C:17:ARG:HB3	3:C:321:VAL:HG22	1.91	0.51
1:A:319:TYR:HB2	1:A:355:ILE:HG12	1.92	0.51
2:B:4:ILE:H	2:B:64:ARG:HH21	1.58	0.51
3:C:113:LEU:CD1	3:C:113:LEU:N	2.73	0.51
2:B:100:GLY:HA3	2:B:105:LYS:HD3	1.93	0.51
2:B:138:THR:HG22	2:B:169:PHE:HD2	1.76	0.51
2:B:301:MET:HG3	2:B:307:PRO:HG2	1.93	0.51
2:B:36:TYR:OH	2:B:40:SER:O	2.27	0.50
1:A:172:TYR:HB2	1:A:203:MET:HB3	1.93	0.50
2:B:14:ASN:OD1	2:B:75:MET:HA	2.12	0.50
1:A:142:GLY:HA3	4:A:500:GTP:H4'	1.92	0.50
1:A:318:LEU:HA	1:A:354:GLY:O	2.12	0.50
2:B:286:LEU:C	2:B:287:THR:CG2	2.81	0.50
2:B:306:ASP:OD1	2:B:306:ASP:N	2.42	0.50
3:C:23:ARG:NH2	3:C:327:SER:OG	2.45	0.50
2:B:154:ILE:HA	2:B:157:ILE:HB	1.93	0.49
1:A:149:PHE:O	1:A:153:LEU:CB	2.60	0.49
2:B:205:ASP:OD2	2:B:304:ALA:N	2.45	0.49
1:A:168:GLU:OE1	1:A:194:THR:OG1	2.29	0.49
1:A:232:GLY:O	1:A:236:SER:HB2	2.12	0.49
2:B:371:LEU:HD23	2:B:374:SER:HB3	1.94	0.49
3:C:346:ALA:O	3:C:347:GLN:C	2.50	0.49
2:B:229:HIS:HD1	6:B:601:TA1:C07	2.25	0.49
3:C:141:VAL:HG22	3:C:225:LEU:HB2	1.95	0.49
3:C:85:GLY:HA2	3:C:246:SER:HB3	1.95	0.49
2:B:141:LEU:HD23	2:B:187:ALA:HA	1.94	0.48
2:B:210:TYR:O	2:B:214:PHE:CB	2.61	0.48
2:B:229:HIS:NE2	6:B:601:TA1:C36	2.75	0.48
2:B:276:THR:HB	2:B:281:GLN:HG3	1.94	0.48
2:B:289:PRO:O	2:B:292:THR:HB	2.13	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:111:SER:C	3:C:112:LEU:HD23	2.33	0.48
1:A:5:ILE:HG12	1:A:64:ARG:HB3	1.95	0.48
1:A:199:ASP:CA	1:A:265:ALA:HB1	2.39	0.48
2:B:199:ASP:HA	2:B:265:LEU:HD22	1.95	0.48
2:B:288:VAL:HG23	2:B:323:MET:HE1	1.92	0.48
1:A:25:CYS:HA	1:A:30:ILE:HD12	1.96	0.48
1:A:204:VAL:HG13	1:A:302:MET:HB3	1.95	0.48
1:A:324:VAL:HG12	1:A:326:LYS:H	1.79	0.48
1:A:231:ILE:HA	1:A:234:ILE:HG22	1.96	0.47
2:B:291:LEU:HD22	2:B:375:ALA:HB2	1.89	0.47
3:C:117:GLN:HG3	3:C:121:PRO:HG2	1.96	0.47
3:C:13:GLU:OE2	3:C:316:GLY:N	2.48	0.47
1:A:246:GLY:H	1:A:249:ASN:HD21	1.63	0.47
1:A:17:GLY:O	1:A:21:TRP:HB3	2.14	0.47
1:A:288:VAL:O	1:A:292:THR:OG1	2.26	0.47
2:B:286:LEU:O	2:B:287:THR:CG2	2.62	0.47
2:B:51:VAL:O	2:B:64:ARG:NH2	2.47	0.47
2:B:15:GLN:HG2	2:B:15:GLN:H	1.36	0.47
3:C:193:LEU:HD23	3:C:196:LEU:HD12	1.96	0.46
2:B:266:HIS:NE2	2:B:431:GLU:OE2	2.49	0.46
3:C:302:ARG:HD3	3:C:302:ARG:H	1.81	0.46
2:B:19:LYS:O	2:B:22:GLU:HB2	2.15	0.46
2:B:408:TYR:HD2	2:B:418:PHE:HZ	1.62	0.46
3:C:71:TYR:HD1	3:C:119:ILE:HG23	1.81	0.46
2:B:179:ASP:OD2	5:B:600:GDP:O3'	2.28	0.46
3:C:220:VAL:HG13	3:C:251:VAL:HG22	1.97	0.46
2:B:240:THR:HA	2:B:243:ARG:HB2	1.98	0.46
2:B:102:ASN:OD1	2:B:104:ALA:N	2.45	0.46
2:B:151:THR:O	2:B:155:SER:CB	2.64	0.46
3:C:78:LEU:HD13	3:C:88:ALA:HB1	1.98	0.46
1:A:274:PRO:HB3	1:A:291:ILE:HG21	1.98	0.46
1:A:179:THR:HG23	2:B:353:THR:HB	1.97	0.46
2:B:60:LYS:HZ2	2:B:88:ARG:HH12	1.64	0.46
3:C:27:PRO:HA	3:C:30:LEU:HB3	1.98	0.46
1:A:327:ASP:O	1:A:331:ALA:CB	2.61	0.46
2:B:36:TYR:CZ	2:B:44:LEU:HB2	2.51	0.46
2:B:35:SER:H	2:B:37:HIS:CE1	2.34	0.45
3:C:104:MET:O	3:C:119:ILE:N	2.49	0.45
2:B:148:GLY:O	2:B:152:LEU:HB2	2.17	0.45
2:B:185:TYR:OH	2:B:398:MET:O	2.29	0.45
6:B:601:TA1:H463	6:B:601:TA1:C26	2.46	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:23:VAL:HG13	6:B:601:TA1:H321	1.99	0.45
3:C:332:ASP:O	3:C:336:THR:N	2.39	0.45
2:B:199:ASP:N	2:B:199:ASP:OD1	2.48	0.45
2:B:288:VAL:CG2	2:B:323:MET:HE3	2.36	0.45
1:A:181:VAL:HG23	2:B:352:LYS:HD3	1.98	0.45
2:B:385:GLN:HB2	2:B:432:TYR:HB3	1.97	0.45
1:A:225:THR:HA	1:A:228:ASN:HD22	1.80	0.45
2:B:288:VAL:O	2:B:291:LEU:HD13	2.15	0.45
1:A:232:GLY:O	1:A:236:SER:CB	2.66	0.44
2:B:273:ALA:HB1	2:B:291:LEU:HA	1.99	0.44
2:B:3:GLU:HA	2:B:51:VAL:HA	1.99	0.44
3:C:40:VAL:HG12	3:C:42:PRO:HD3	2.00	0.44
1:A:310:GLY:HA2	1:A:382:THR:HB	2.00	0.44
2:B:287:THR:O	2:B:290:GLU:HG2	2.17	0.44
1:A:399:TYR:OH	1:A:402:ARG:NH1	2.51	0.44
2:B:16:ILE:H	2:B:16:ILE:HG12	1.50	0.44
2:B:174:SER:HB3	2:B:206:ASN:HB2	1.98	0.44
3:C:78:LEU:O	3:C:82:PHE:N	2.51	0.44
1:A:102:ASN:OD1	1:A:102:ASN:N	2.51	0.44
2:B:236:SER:HB2	6:B:601:TA1:H411	2.00	0.44
3:C:330:SER:O	3:C:333:PHE:CB	2.64	0.43
1:A:314:ALA:O	1:A:379:SER:HA	2.18	0.43
2:B:151:THR:HA	2:B:154:ILE:HG13	1.99	0.43
3:C:96:THR:OG1	3:C:257:GLU:OE1	2.32	0.43
2:B:142:GLY:HA3	5:B:600:GDP:H4'	2.01	0.43
1:A:119:LEU:HD11	1:A:156:ARG:HG2	2.00	0.43
1:A:266:HIS:O	1:A:267:PHE:CG	2.72	0.43
3:C:75:VAL:HG21	3:C:119:ILE:HD13	2.01	0.43
2:B:360:PRO:HB2	6:B:601:TA1:H281	2.01	0.43
3:C:256:SER:HA	3:C:279:LEU:HD13	2.01	0.43
1:A:398:MET:HG2	2:B:347:ILE:HG12	2.01	0.42
1:A:344:VAL:HG12	1:A:347:CYS:H	1.84	0.42
1:A:11:GLN:N	4:A:500:GTP:O1A	2.52	0.42
2:B:434:GLN:HG3	3:C:298:HIS:H	1.83	0.42
2:B:122:VAL:O	2:B:126:SER:HB3	2.18	0.42
1:A:17:GLY:O	1:A:21:TRP:HB2	2.19	0.42
1:A:406:HIS:CG	2:B:263:PRO:HD3	2.55	0.42
2:B:318:VAL:HA	2:B:354:ALA:HB3	2.01	0.42
2:B:360:PRO:HG2	2:B:371:LEU:HB3	2.02	0.42
2:B:119:LEU:HA	2:B:122:VAL:HG22	2.00	0.42
2:B:247:GLN:NE2	2:B:357:ASP:OD1	2.52	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:104:ALA:HA	2:B:107:HIS:HB3	2.02	0.42
2:B:290:GLU:O	2:B:292:THR:N	2.53	0.42
1:A:319:TYR:HE2	1:A:328:VAL:HG22	1.84	0.42
1:A:328:VAL:HG13	1:A:332:ILE:HD12	2.02	0.42
1:A:380:ASN:HD22	1:A:381:THR:H	1.68	0.42
2:B:325:MET:SD	2:B:325:MET:N	2.93	0.42
2:B:22:GLU:HA	2:B:83:PHE:CE2	2.55	0.42
1:A:211:ASP:O	1:A:215:ARG:HB2	2.20	0.41
2:B:151:THR:O	2:B:155:SER:OG	2.32	0.41
2:B:427:ASP:HA	2:B:430:SER:HB3	2.02	0.41
2:B:325:MET:HA	2:B:328:VAL:HB	2.02	0.41
2:B:389:LYS:HB2	2:B:429:VAL:HG11	2.01	0.41
3:C:49:LEU:HD23	3:C:53:ARG:HD2	2.02	0.41
3:C:225:LEU:O	3:C:246:SER:OG	2.35	0.41
2:B:243:ARG:HH21	2:B:251:ASP:HB2	1.85	0.41
3:C:142:HIS:ND1	3:C:183:GLU:OE1	2.43	0.41
2:B:349:ASN:ND2	2:B:351:VAL:O	2.53	0.41
1:A:312:TYR:HB2	1:A:343:PHE:CD1	2.55	0.41
2:B:287:THR:HG1	2:B:289:PRO:HG3	1.84	0.41
3:C:121:PRO:O	3:C:125:ALA:CB	2.68	0.41
1:A:291:ILE:HA	1:A:294:ALA:HB3	2.03	0.41
2:B:319:PHE:HE2	2:B:328:VAL:HG13	1.86	0.41
1:A:188:ILE:HD11	1:A:391:LEU:HG	2.03	0.41
1:A:125:LEU:HD23	1:A:125:LEU:HA	1.88	0.40
1:A:388:TRP:O	1:A:392:ASP:N	2.53	0.40
2:B:123:ARG:NH2	2:B:160:GLU:OE1	2.50	0.40
2:B:35:SER:H	2:B:37:HIS:HE1	1.69	0.40
3:C:16:VAL:CG2	3:C:348:ASN:C	2.90	0.40
1:A:139:HIS:NE2	1:A:170:SER:HB3	2.36	0.40
2:B:381:SER:OG	2:B:383:ALA:N	2.50	0.40
2:B:283:TYR:CD2	2:B:285:ALA:HB3	2.56	0.40
2:B:290:GLU:C	2:B:292:THR:N	2.73	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	407/451 (90%)	348 (86%)	59 (14%)	0	100	100
2	B	424/445 (95%)	370 (87%)	54 (13%)	0	100	100
3	C	317/399 (79%)	290 (92%)	27 (8%)	0	100	100
All	All	1148/1295 (89%)	1008 (88%)	140 (12%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	347/377 (92%)	342 (99%)	5 (1%)	69	85
2	B	367/381 (96%)	352 (96%)	15 (4%)	33	63
3	C	260/328 (79%)	250 (96%)	10 (4%)	36	65
All	All	974/1086 (90%)	944 (97%)	30 (3%)	47	69

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	18	ASN
1	A	264	ARG
1	A	266	HIS
1	A	300	ASN
1	A	380	ASN
2	B	14	ASN
2	B	15	GLN
2	B	16	ILE
2	B	101	ASN
2	B	265	LEU
2	B	278	ARG

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Mol	Chain	Res	Type
2	B	286	LEU
2	B	288	VAL
2	B	291	LEU
2	B	299	LYS
2	B	300	ASN
2	B	325	MET
2	B	349	ASN
2	B	380	ASN
2	B	424	ASN
3	C	47	VAL
3	C	90	VAL
3	C	112	LEU
3	C	113	LEU
3	C	132	ASP
3	C	154	ARG
3	C	178	LEU
3	C	268	ARG
3	C	302	ARG
3	C	304	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	18	ASN
1	A	28	HIS
1	A	233	GLN
1	A	266	HIS
1	A	300	ASN
1	A	380	ASN
2	B	6	HIS
2	B	101	ASN
2	B	136	GLN
2	B	337	ASN
2	B	349	ASN
2	B	424	ASN
2	B	434	GLN
2	B	436	GLN
3	C	227	GLN
3	C	338	ASN
3	C	341	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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

4 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	GTP	A	500	-	26,34,34	1.07	2 (7%)	29,54,54	1.76	6 (20%)
5	GDP	B	600	-	24,30,30	0.99	2 (8%)	27,47,47	1.96	8 (29%)
6	TA1	B	601	-	68,68,68	1.93	18 (26%)	105,105,105	1.31	8 (7%)
7	ANP	C	1401	-	28,33,33	3.78	13 (46%)	29,52,52	2.80	4 (13%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	GTP	A	500	-	-	0/18/38/38	0/3/3/3
5	GDP	B	600	-	-	0/12/32/32	0/3/3/3
6	TA1	B	601	-	-	0/41/127/127	0/7/7/7
7	ANP	C	1401	-	-	1/13/38/38	0/3/3/3

All (35) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	C	1401	ANP	O4'-C4'	-6.22	1.31	1.45
6	B	601	TA1	C07-C06	-4.53	1.25	1.38
7	C	1401	ANP	C5-C4	-3.02	1.33	1.40
7	C	1401	ANP	O3'-C3'	-2.92	1.36	1.43
4	A	500	GTP	C6-C5	-2.54	1.36	1.41
6	B	601	TA1	C04-C03	-2.37	1.44	1.49
7	C	1401	ANP	PB-O2B	-2.00	1.51	1.56
7	C	1401	ANP	C2-N3	2.01	1.35	1.32
6	B	601	TA1	C10-C02	2.08	1.62	1.57
6	B	601	TA1	C16-C15	2.22	1.56	1.52
4	A	500	GTP	C6-N1	2.26	1.37	1.33
6	B	601	TA1	C18-C20	2.27	1.62	1.56
6	B	601	TA1	C01-C45	2.31	1.66	1.56
6	B	601	TA1	C11-C10	2.37	1.61	1.55
5	B	600	GDP	C5-C4	2.38	1.45	1.40
6	B	601	TA1	C26-C25	2.54	1.56	1.51
6	B	601	TA1	C43-C26	2.59	1.58	1.52
7	C	1401	ANP	PG-N3B	2.73	1.70	1.63
7	C	1401	ANP	PB-N3B	2.74	1.70	1.63
7	C	1401	ANP	O2'-C2'	2.92	1.49	1.43
5	B	600	GDP	C6-C5	2.93	1.46	1.41
7	C	1401	ANP	C6-N6	3.02	1.45	1.34
6	B	601	TA1	C43-C01	3.04	1.61	1.54
6	B	601	TA1	C25-C24	3.06	1.39	1.34
6	B	601	TA1	C46-C45	3.23	1.60	1.53
6	B	601	TA1	C36-C31	3.44	1.45	1.39
6	B	601	TA1	O02-C03	3.52	1.41	1.34
6	B	601	TA1	C45-C24	3.56	1.61	1.54
7	C	1401	ANP	PB-O3A	4.38	1.64	1.59
6	B	601	TA1	C09-C04	4.39	1.46	1.39
7	C	1401	ANP	PB-O1B	4.40	1.51	1.46
7	C	1401	ANP	PG-O1G	4.42	1.51	1.46
6	B	601	TA1	C18-C10	4.42	1.69	1.57
6	B	601	TA1	C08-C09	5.15	1.49	1.38
7	C	1401	ANP	O4'-C1'	14.95	1.62	1.41

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	C	1401	ANP	N6-C6-N1	-7.43	103.15	118.57
7	C	1401	ANP	N3-C2-N1	-5.59	119.67	128.68
4	A	500	GTP	PB-O3B-PG	-4.73	117.53	132.57

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	601	TA1	C08-C09-C04	-4.73	114.68	120.34
4	A	500	GTP	N3-C2-N1	-4.60	121.03	127.25
5	B	600	GDP	C5-C6-N1	-4.03	117.85	123.47
5	B	600	GDP	PA-O3A-PB	-4.01	119.82	132.57
6	B	601	TA1	C09-C04-C03	-3.96	111.44	120.40
4	A	500	GTP	PA-O3A-PB	-3.52	121.40	132.57
7	C	1401	ANP	PA-O3A-PB	-3.26	121.04	132.46
5	B	600	GDP	C6-C5-C4	-3.08	117.83	120.79
4	A	500	GTP	C5-C6-N1	-2.94	119.38	123.47
6	B	601	TA1	O04-C11-C14	-2.79	101.84	108.14
5	B	600	GDP	C5'-C4'-C3'	-2.36	106.31	115.21
5	B	600	GDP	N3-C2-N1	-2.32	124.11	127.25
5	B	600	GDP	C4-C5-N7	-2.22	107.08	109.40
4	A	500	GTP	C6-N1-C2	2.25	119.27	116.06
6	B	601	TA1	O01-C01-C43	2.42	113.35	106.96
6	B	601	TA1	C45-C01-C02	2.68	115.16	111.86
6	B	601	TA1	C17-C18-C20	2.93	109.83	102.39
4	A	500	GTP	C2-N3-C4	3.24	119.06	115.36
6	B	601	TA1	C05-C04-C03	3.57	128.49	120.40
5	B	600	GDP	C6-N1-C2	3.80	121.47	116.06
5	B	600	GDP	C2-N3-C4	3.88	119.79	115.36
6	B	601	TA1	C07-C06-C05	4.64	127.33	120.19
7	C	1401	ANP	C5-C6-N6	10.53	136.91	120.38

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	C	1401	ANP	O1B-PB-N3B-PG

There are no ring outliers.

3 monomers are involved in 19 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	500	GTP	3	0
5	B	600	GDP	2	0
6	B	601	TA1	14	0

## 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.