



## Full wwPDB EM Validation Report ⓘ

Jan 23, 2024 – 08:08 PM JST

PDB ID : 8HWE  
EMDB ID : EMD-35055  
Title : Cryo-EM Structure of D5 ATP-ADP form  
Authors : Li, Y.N.; Zhu, J.; Guo, Y.Y.; Yan, R.H.  
Deposited on : 2022-12-29  
Resolution : 3.30 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](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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

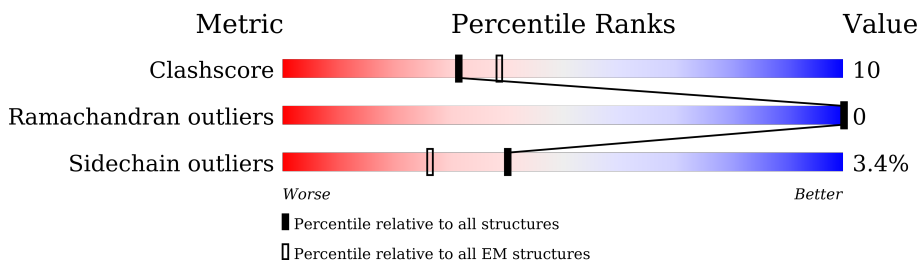
EMDB validation analysis : **FAILED**  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
MolProbity : 4.02b-467  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : **FAILED**  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

# 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 3.30 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	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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  $\geq 3$ , 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	785	
1	B	785	
1	C	785	
1	D	785	
1	E	785	
1	F	785	

## 2 Entry composition [i](#)

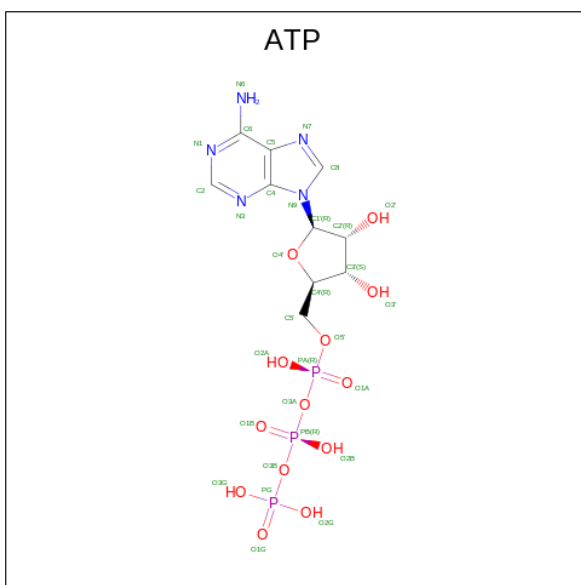
There are 4 unique types of molecules in this entry. The entry contains 17247 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Primase D5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	D	379	Total 3054	C 1945	N 520	O 573	S 16	0	0
1	C	379	Total 3054	C 1945	N 520	O 573	S 16	0	0
1	F	274	Total 2230	C 1429	N 377	O 410	S 14	0	0
1	A	329	Total 2666	C 1699	N 455	O 498	S 14	0	0
1	E	372	Total 3002	C 1915	N 508	O 564	S 15	0	0
1	B	379	Total 3054	C 1945	N 520	O 573	S 16	0	0

- Molecule 2 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula:  $C_{10}H_{16}N_5O_{13}P_3$ ) (labeled as "Ligand of Interest" by depositor).

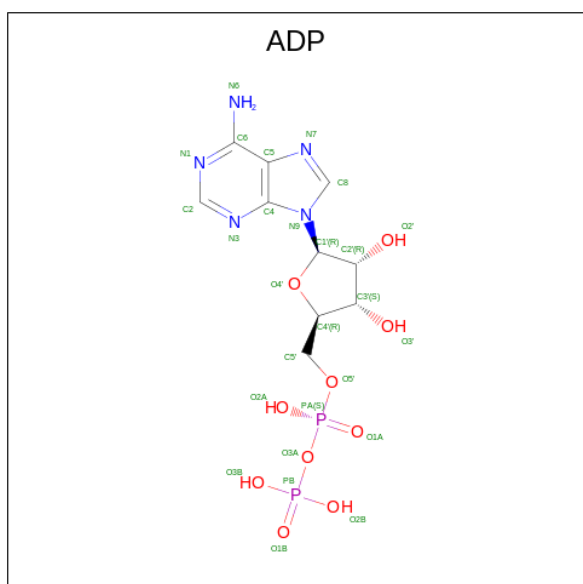


Mol	Chain	Residues	Atoms					AltConf
2	D	1	Total	C	N	O	P	0
			31	10	5	13	3	
2	C	1	Total	C	N	O	P	0
			31	10	5	13	3	
2	A	1	Total	C	N	O	P	0
			31	10	5	13	3	
2	E	1	Total	C	N	O	P	0
			31	10	5	13	3	
2	B	1	Total	C	N	O	P	0
			31	10	5	13	3	

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
3	D	1	Total	Mg	0
			1	1	
3	C	1	Total	Mg	0
			1	1	
3	A	1	Total	Mg	0
			1	1	
3	E	1	Total	Mg	0
			1	1	
3	B	1	Total	Mg	0
			1	1	

- Molecule 4 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: C<sub>10</sub>H<sub>15</sub>N<sub>5</sub>O<sub>10</sub>P<sub>2</sub>) (labeled as "Ligand of Interest" by depositor).

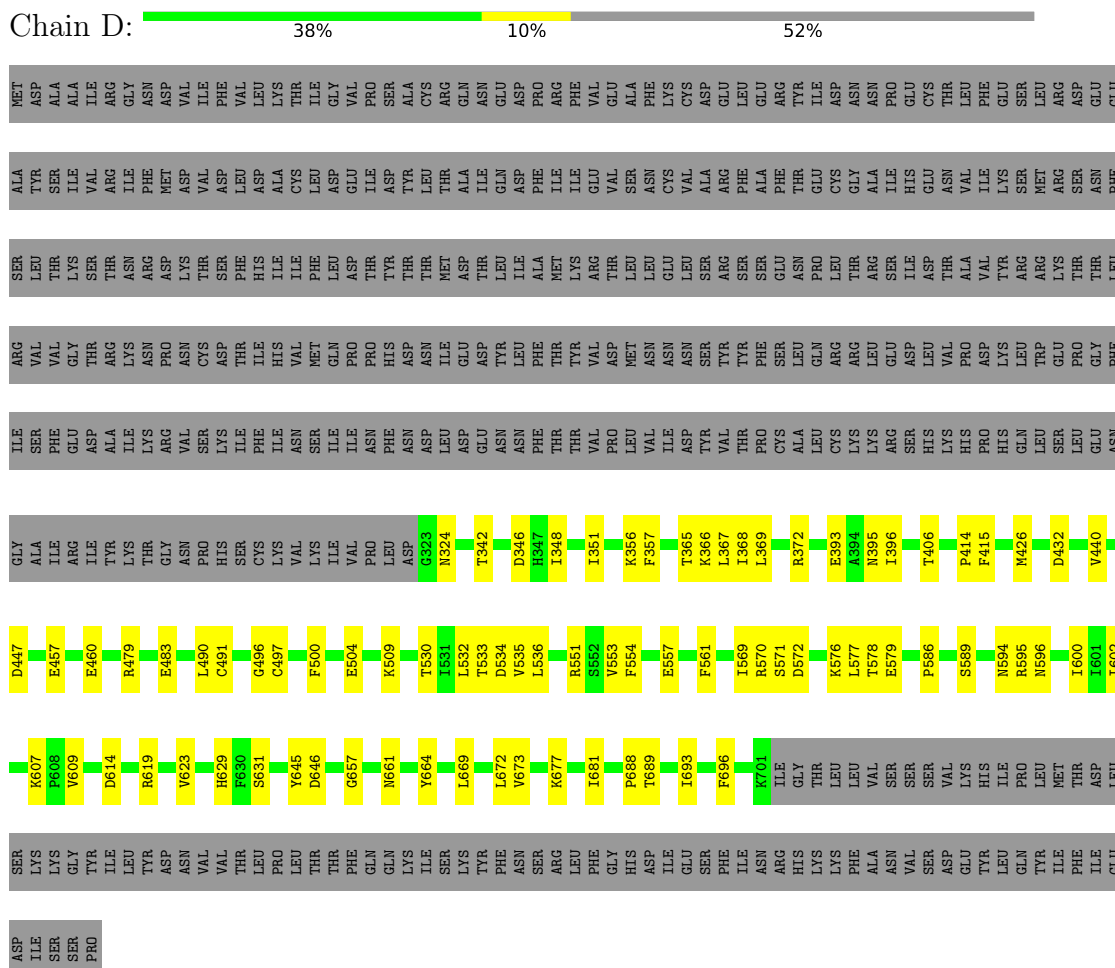


Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
4	F	1	27	10	5	10	2	0

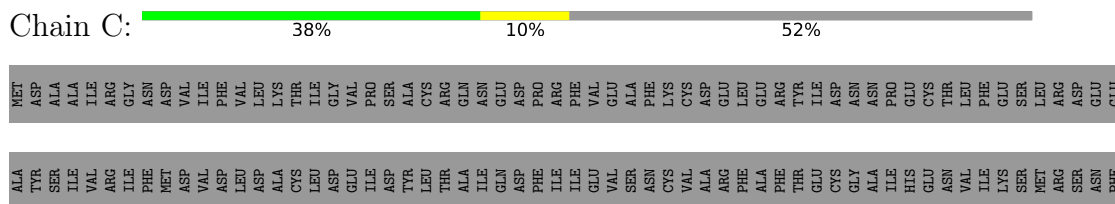
### 3 Residue-property plots

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: Primase D5



- Molecule 1: Primase D5











## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	321782	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)	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: MG, ATP, ADP

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	0.26	0/2716	0.51	0/3660
1	B	0.26	0/3117	0.51	0/4209
1	C	0.26	0/3117	0.49	0/4209
1	D	0.25	0/3117	0.49	0/4209
1	E	0.26	0/3063	0.50	0/4135
1	F	0.25	0/2270	0.52	0/3055
All	All	0.25	0/17400	0.50	0/23477

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	2666	0	2687	74	0
1	B	3054	0	3067	62	0
1	C	3054	0	3067	47	0
1	D	3054	0	3068	51	0
1	E	3002	0	3015	64	0
1	F	2230	0	2263	50	0
2	A	31	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	31	0	12	1	0
2	C	31	0	12	1	0
2	D	31	0	12	0	0
2	E	31	0	12	2	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
3	E	1	0	0	0	0
4	F	27	0	12	2	0
All	All	17247	0	17239	330	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 10.

All (330) 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:E:461:LEU:HD12	1:E:664:TYR:HB3	1.64	0.79
1:E:511:THR:HG21	2:E:1001:ATP:H8	1.50	0.76
1:B:623:VAL:HG21	1:B:693:ILE:HD11	1.66	0.75
1:A:369:LEU:O	1:A:372:ARG:HB3	1.87	0.73
1:A:554:PHE:HE2	1:A:601:ILE:HD12	1.54	0.72
1:E:500:PHE:HB2	1:E:623:VAL:HG23	1.72	0.71
1:A:384:LEU:O	1:B:324:ASN:ND2	2.24	0.71
1:D:586:PRO:HG2	1:D:589:SER:HB3	1.73	0.70
1:F:462:MET:SD	1:F:466:ASN:ND2	2.64	0.70
1:D:532:LEU:HD11	1:D:602:ILE:HD12	1.75	0.69
1:E:349:VAL:HG21	1:E:363:LEU:HB3	1.73	0.69
1:E:490:LEU:HD11	1:E:672:LEU:HB3	1.74	0.69
1:F:369:LEU:O	1:F:372:ARG:HB3	1.93	0.68
1:B:586:PRO:HG2	1:B:589:SER:HB3	1.75	0.68
1:D:366:LYS:HE3	1:E:398:ASP:HA	1.75	0.67
1:E:369:LEU:O	1:E:372:ARG:HB3	1.94	0.67
1:B:536:LEU:HD12	1:B:544:ILE:HD11	1.74	0.67
1:B:369:LEU:O	1:B:372:ARG:HB3	1.95	0.66
1:E:426:MET:SD	1:E:426:MET:N	2.69	0.66
1:F:385:CYS:SG	1:F:387:ARG:NH1	2.69	0.66
1:C:532:LEU:HD11	1:C:602:ILE:HD12	1.78	0.65
1:A:661:ASN:O	1:A:661:ASN:ND2	2.27	0.64
1:E:412:LYS:O	1:E:551:ARG:NH1	2.31	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:495:LYS:NZ	1:E:597:HIS:O	2.32	0.63
1:C:479:ARG:NH1	1:C:483:GLU:OE2	2.31	0.63
1:B:693:ILE:HB	1:B:696:PHE:HB2	1.81	0.63
1:D:395:ASN:OD1	1:C:389:ARG:NH2	2.31	0.63
1:A:531:ILE:O	1:A:573:ASN:ND2	2.29	0.62
1:D:369:LEU:O	1:D:372:ARG:HB3	1.99	0.62
1:B:358:ASN:HB3	1:B:363:LEU:HD11	1.81	0.62
1:A:507:THR:OG1	1:A:509:LYS:NZ	2.33	0.62
1:E:531:ILE:HA	1:E:536:LEU:HD21	1.82	0.61
1:A:554:PHE:CE2	1:A:601:ILE:HD12	2.36	0.61
1:C:353:ASN:HD22	1:C:430:GLY:H	1.49	0.61
1:F:450:LYS:HG2	1:F:666:PHE:HB2	1.82	0.60
1:E:495:LYS:HE3	1:E:684:MET:HE2	1.83	0.60
1:C:365:THR:OG1	1:C:393:GLU:OE1	2.20	0.60
1:C:496:GLY:HA2	1:C:578:THR:HB	1.84	0.60
1:D:576:LYS:HD2	1:C:557:GLU:HB2	1.83	0.60
1:A:517:LYS:HB2	1:A:524:PHE:CE2	2.36	0.60
1:F:548:HIS:O	1:F:550:LYS:NZ	2.32	0.59
1:D:365:THR:OG1	1:D:393:GLU:OE1	2.21	0.59
1:A:351:ILE:O	1:A:356:LYS:NZ	2.36	0.59
1:B:365:THR:OG1	1:B:393:GLU:OE1	2.20	0.59
1:A:546:ASN:HD22	1:B:592:ILE:HD11	1.68	0.58
1:E:658:LYS:HB2	1:E:663:ARG:HD3	1.85	0.58
1:E:693:ILE:HB	1:E:696:PHE:HB2	1.84	0.58
1:B:498:LEU:HG	1:B:600:ILE:HB	1.85	0.58
1:A:344:ARG:NH2	1:A:594:ASN:OD1	2.36	0.58
1:E:498:LEU:HD12	1:E:574:ILE:HG13	1.85	0.57
1:D:324:ASN:ND2	1:C:384:LEU:O	2.37	0.57
1:D:351:ILE:O	1:D:356:LYS:NZ	2.37	0.57
1:F:495:LYS:NZ	1:F:597:HIS:O	2.34	0.57
1:C:586:PRO:HG2	1:C:589:SER:HB2	1.87	0.57
1:E:504:GLU:O	1:E:509:LYS:NZ	2.25	0.57
1:C:495:LYS:HE3	1:C:684:MET:HE2	1.87	0.57
1:A:555:CYS:HB3	1:A:602:ILE:HD12	1.87	0.57
1:A:554:PHE:HD2	1:A:601:ILE:HB	1.70	0.56
1:A:577:LEU:O	1:A:596:ASN:ND2	2.38	0.56
1:A:606:TYR:OH	1:B:614:ASP:OD2	2.23	0.56
1:A:500:PHE:HD2	1:A:602:ILE:HB	1.71	0.56
1:A:366:LYS:HD3	1:B:401:VAL:HG12	1.88	0.56
1:D:457:GLU:OE2	1:D:457:GLU:N	2.39	0.56
1:E:346:ASP:OD2	1:E:359:SER:OG	2.23	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:424:ASP:OD1	1:E:424:ASP:N	2.39	0.56
1:C:490:LEU:O	1:C:551:ARG:NH1	2.38	0.56
1:B:485:THR:HG21	1:B:499:THR:HG21	1.88	0.56
1:D:619:ARG:HA	1:D:688:PRO:HG3	1.88	0.56
1:D:614:ASP:OD1	1:D:614:ASP:N	2.39	0.55
1:D:657:GLY:O	1:D:661:ASN:ND2	2.38	0.55
1:B:495:LYS:NZ	1:B:597:HIS:O	2.38	0.55
1:A:349:VAL:HG13	1:A:367:LEU:HD12	1.88	0.55
1:A:483:GLU:HA	1:A:675:TRP:CZ3	2.41	0.55
1:A:367:LEU:O	1:A:371:ILE:HG22	2.05	0.55
1:D:570:ARG:NH2	1:D:572:ASP:OD1	2.32	0.55
1:B:533:THR:HB	1:B:569:ILE:HA	1.89	0.55
1:B:643:ASP:OD2	1:B:644:ALA:N	2.39	0.55
1:F:519:ALA:HB2	1:F:668:PHE:HD2	1.71	0.55
1:F:677:LYS:O	1:F:678:LYS:HD3	2.07	0.55
1:F:398:ASP:HA	1:E:366:LYS:HE3	1.89	0.55
1:A:661:ASN:C	1:A:661:ASN:HD22	2.04	0.55
1:E:546:ASN:OD1	1:E:547:MET:N	2.40	0.55
1:F:324:ASN:ND2	1:E:384:LEU:O	2.39	0.54
1:A:525:VAL:HG23	1:A:553:VAL:HG22	1.89	0.54
1:D:479:ARG:NH1	1:D:483:GLU:OE2	2.39	0.54
1:F:670:TYR:O	1:F:674:LYS:HG2	2.08	0.54
1:D:577:LEU:O	1:D:596:ASN:ND2	2.41	0.54
1:C:395:ASN:OD1	1:B:389:ARG:NH2	2.40	0.54
1:E:450:LYS:HB2	1:E:666:PHE:HD2	1.71	0.54
1:D:490:LEU:HD11	1:D:672:LEU:HB3	1.89	0.54
1:B:514:ARG:NH2	1:B:656:ASP:OD1	2.41	0.54
1:D:614:ASP:OD2	1:C:606:TYR:OH	2.26	0.53
1:E:655:LEU:HA	1:E:658:LYS:HE2	1.91	0.53
1:B:385:CYS:SG	1:B:387:ARG:NE	2.81	0.53
1:D:553:VAL:HB	1:D:600:ILE:HD13	1.90	0.53
1:C:500:PHE:HB2	1:C:623:VAL:HG22	1.91	0.53
1:F:509:LYS:N	4:F:1001:ADP:O1B	2.42	0.53
1:A:346:ASP:OD1	1:A:346:ASP:N	2.39	0.53
1:D:536:LEU:HD23	1:D:536:LEU:H	1.74	0.53
1:B:346:ASP:OD1	1:B:359:SER:OG	2.27	0.53
1:E:553:VAL:HB	1:E:600:ILE:HD13	1.90	0.52
1:D:535:VAL:HG22	1:D:570:ARG:HH12	1.75	0.52
1:E:614:ASP:N	1:E:614:ASP:OD1	2.42	0.52
1:E:615:ASN:OD1	1:E:615:ASN:N	2.41	0.52
1:B:509:LYS:NZ	2:B:1001:ATP:O1B	2.33	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:529:GLN:HB2	1:B:557:GLU:HB3	1.92	0.52
1:B:537:ASP:N	1:B:537:ASP:OD1	2.43	0.52
1:D:689:THR:O	1:D:689:THR:OG1	2.26	0.52
1:A:556:SER:HA	1:A:603:ASP:HB3	1.91	0.52
1:A:412:LYS:O	1:A:551:ARG:NH1	2.42	0.52
1:E:658:LYS:HA	1:E:661:ASN:HD21	1.75	0.51
1:C:505:THR:OG1	2:C:1001:ATP:O1G	2.24	0.51
1:A:338:SER:HB3	1:A:367:LEU:HD11	1.92	0.51
1:D:496:GLY:HA2	1:D:578:THR:HB	1.91	0.51
1:C:485:THR:HG21	1:C:499:THR:HG21	1.93	0.51
1:A:514:ARG:HB3	1:A:659:ILE:HG21	1.91	0.51
1:B:395:ASN:O	1:B:399:MET:HG3	2.10	0.51
1:E:326:LEU:HD12	1:E:392:VAL:HG23	1.93	0.51
1:E:533:THR:HA	1:E:570:ARG:HG3	1.93	0.51
1:D:557:GLU:HG3	1:E:572:ASP:HB2	1.93	0.51
1:C:577:LEU:O	1:C:596:ASN:ND2	2.44	0.51
1:F:575:LYS:HZ1	1:F:616:ALA:HB1	1.76	0.51
1:B:364:ILE:O	1:B:368:ILE:HG12	2.11	0.51
1:D:490:LEU:O	1:D:551:ARG:NH1	2.41	0.50
1:E:526:GLU:N	1:E:526:GLU:OE1	2.45	0.50
1:D:432:ASP:OD2	1:D:432:ASP:N	2.44	0.50
1:C:547:MET:O	1:C:547:MET:HG3	2.10	0.50
1:D:342:THR:OG1	1:D:346:ASP:O	2.29	0.50
1:D:460:GLU:HG3	1:D:664:TYR:HE1	1.76	0.50
1:F:504:GLU:O	1:F:509:LYS:NZ	2.43	0.50
1:B:553:VAL:HB	1:B:600:ILE:HD13	1.92	0.50
1:B:616:ALA:O	1:B:620:ARG:NH1	2.42	0.50
1:A:532:LEU:HD13	1:A:558:LEU:HD11	1.93	0.50
1:E:338:SER:HB3	1:E:367:LEU:HD11	1.93	0.50
1:D:533:THR:HB	1:D:569:ILE:HA	1.94	0.50
1:B:490:LEU:HD11	1:B:672:LEU:HB3	1.94	0.50
1:B:525:VAL:HG23	1:B:553:VAL:HG22	1.93	0.50
1:C:693:ILE:HB	1:C:696:PHE:HB2	1.94	0.50
1:D:561:PHE:HD2	1:D:609:VAL:HG22	1.76	0.49
1:C:582:VAL:HG12	1:C:594:ASN:HB2	1.94	0.49
1:C:504:GLU:O	1:C:509:LYS:NZ	2.39	0.49
1:F:547:MET:SD	1:F:547:MET:N	2.85	0.49
1:A:505:THR:OG1	2:A:1001:ATP:O3G	2.26	0.49
1:A:490:LEU:HD11	1:A:672:LEU:HB3	1.94	0.49
1:A:339:VAL:HG22	1:A:367:LEU:HD13	1.94	0.49
1:E:365:THR:HA	1:E:368:ILE:HD12	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:367:LEU:O	1:E:371:ILE:HG22	2.13	0.49
1:F:483:GLU:HG2	1:F:675:TRP:CD2	2.48	0.49
1:D:406:THR:O	1:D:595:ARG:NH1	2.32	0.49
1:E:533:THR:HG22	1:E:569:ILE:HA	1.95	0.49
1:F:369:LEU:O	1:F:372:ARG:CB	2.60	0.49
1:E:460:GLU:OE2	1:E:663:ARG:NH2	2.42	0.49
1:E:689:THR:O	1:E:689:THR:OG1	2.29	0.49
1:B:525:VAL:O	1:B:553:VAL:HA	2.13	0.49
1:D:629:HIS:HB2	1:D:645:TYR:CD1	2.47	0.48
1:F:424:ASP:O	1:F:677:LYS:NZ	2.46	0.48
1:F:441:SER:OG	1:F:442:THR:N	2.46	0.48
1:F:673:VAL:O	1:F:677:LYS:HG2	2.13	0.48
1:E:616:ALA:O	1:E:620:ARG:NH1	2.47	0.48
1:F:432:ASP:O	1:F:435:LYS:NZ	2.40	0.48
1:A:457:GLU:HG2	1:A:458:MET:N	2.28	0.48
1:F:440:VAL:HG21	1:F:549:LEU:HB3	1.95	0.48
1:B:474:GLU:OE1	1:B:474:GLU:N	2.41	0.48
1:D:576:LYS:O	1:D:579:GLU:HG2	2.13	0.48
1:A:547:MET:O	1:A:547:MET:HG3	2.13	0.48
1:E:498:LEU:HD22	1:E:600:ILE:HB	1.95	0.48
1:C:570:ARG:NH2	1:C:572:ASP:OD2	2.46	0.48
1:F:366:LYS:HD3	1:A:401:VAL:HG22	1.94	0.48
1:E:570:ARG:NH1	1:E:572:ASP:OD1	2.46	0.48
1:B:343:GLU:HG2	1:B:403:SER:HB3	1.95	0.48
1:A:364:ILE:O	1:A:368:ILE:HG13	2.14	0.48
1:A:545:ALA:HA	1:A:594:ASN:HD21	1.77	0.48
1:B:607:LYS:HA	1:B:607:LYS:HD3	1.55	0.48
1:A:482:TYR:HB2	1:A:624:VAL:HG21	1.96	0.48
1:C:629:HIS:NE2	1:C:631:SER:HB3	2.29	0.48
1:E:339:VAL:O	1:E:340:LEU:HD23	2.14	0.48
1:E:464:ILE:HG23	2:E:1001:ATP:HN61	1.78	0.48
1:E:520:ILE:HD11	1:E:524:PHE:HD2	1.78	0.47
1:B:536:LEU:HD23	1:B:536:LEU:H	1.79	0.47
1:D:504:GLU:O	1:D:509:LYS:NZ	2.46	0.47
1:F:395:ASN:OD1	1:E:389:ARG:NH2	2.48	0.47
1:A:554:PHE:CD2	1:A:601:ILE:HB	2.50	0.47
1:B:520:ILE:HD11	1:B:524:PHE:HD2	1.80	0.47
1:C:466:ASN:OD1	1:C:479:ARG:NH2	2.48	0.47
1:B:501:PHE:HB2	1:B:603:ASP:HA	1.97	0.47
1:E:479:ARG:NH1	1:E:483:GLU:OE1	2.48	0.47
1:B:421:ASP:HB2	1:B:428:TYR:HE2	1.80	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:334:LEU:HD21	1:F:396:ILE:HG23	1.96	0.47
1:A:557:GLU:HG2	1:B:576:LYS:HE2	1.97	0.47
1:C:361:GLU:O	1:C:363:LEU:N	2.46	0.46
1:B:478:ASN:OD1	1:B:624:VAL:HG23	2.15	0.46
1:B:513:LYS:HE2	1:B:554:PHE:CD2	2.50	0.46
1:C:495:LYS:NZ	1:C:597:HIS:O	2.45	0.46
1:B:424:ASP:OD1	1:B:426:MET:HG2	2.16	0.46
1:F:415:PHE:HA	1:F:442:THR:HG22	1.96	0.46
1:F:555:CYS:HB3	1:F:602:ILE:HD13	1.97	0.46
1:C:533:THR:HA	1:C:570:ARG:HG3	1.97	0.46
1:C:414:PRO:HG2	1:C:440:VAL:O	2.16	0.46
1:C:689:THR:O	1:C:689:THR:OG1	2.26	0.46
1:F:428:TYR:HB3	1:F:432:ASP:OD1	2.16	0.46
1:F:674:LYS:O	1:F:678:LYS:HG2	2.16	0.45
1:E:593:ASN:OD1	1:E:593:ASN:N	2.45	0.45
1:C:673:VAL:O	1:C:677:LYS:HG2	2.16	0.45
1:C:368:ILE:HD13	1:C:392:VAL:HB	1.97	0.45
1:C:583:ILE:HA	1:C:592:ILE:O	2.17	0.45
1:E:416:LYS:HB3	1:E:445:LYS:HD3	1.97	0.45
1:E:629:HIS:NE2	1:E:631:SER:HB3	2.31	0.45
1:B:493:ALA:HB3	1:B:684:MET:HE3	1.98	0.45
1:B:611:ASP:OD1	1:B:612:ARG:N	2.49	0.45
1:A:495:LYS:HD3	1:A:599:THR:HB	1.97	0.45
1:A:513:LYS:HE2	1:A:513:LYS:HB3	1.72	0.45
1:B:353:ASN:HD22	1:B:430:GLY:H	1.63	0.45
1:B:414:PRO:HG2	1:B:440:VAL:O	2.16	0.45
1:A:485:THR:HG21	1:A:499:THR:HG21	1.97	0.45
1:B:495:LYS:HE3	1:B:684:MET:HE2	1.99	0.45
1:E:534:ASP:OD1	1:E:535:VAL:N	2.48	0.45
1:D:681:ILE:HD13	1:D:681:ILE:HA	1.87	0.45
1:F:507:THR:HG21	1:F:626:PHE:HB3	1.99	0.45
1:A:661:ASN:ND2	1:A:661:ASN:C	2.69	0.45
1:D:673:VAL:O	1:D:677:LYS:HG3	2.17	0.45
1:C:369:LEU:O	1:C:372:ARG:HB3	2.15	0.45
1:F:524:PHE:CE1	1:F:554:PHE:HD2	2.35	0.45
1:A:504:GLU:O	1:A:509:LYS:NZ	2.39	0.45
1:D:500:PHE:HB2	1:D:623:VAL:HG23	1.99	0.44
1:B:375:LEU:HD23	1:B:379:TYR:HB3	1.98	0.44
1:F:338:SER:HB3	1:F:367:LEU:HD11	1.99	0.44
1:F:484:LYS:HE2	1:F:484:LYS:HB3	1.76	0.44
1:A:413:LEU:HD23	1:A:415:PHE:CZ	2.52	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:532:LEU:HD11	1:A:602:ILE:HG13	1.99	0.44
1:B:350:TRP:CZ2	1:B:353:ASN:HA	2.52	0.44
1:B:629:HIS:NE2	1:B:631:SER:HB2	2.31	0.44
1:F:415:PHE:CD2	1:F:442:THR:HG21	2.53	0.44
1:B:677:LYS:HA	1:B:681:ILE:HG12	1.98	0.44
1:C:533:THR:OG1	1:C:568:LYS:O	2.28	0.44
1:B:368:ILE:HG21	1:B:392:VAL:HG11	1.98	0.44
1:C:557:GLU:O	1:C:557:GLU:HG2	2.18	0.44
1:C:415:PHE:HD1	1:C:442:THR:HG1	1.62	0.44
1:B:334:LEU:HD21	1:B:396:ILE:HG23	2.00	0.44
1:C:671:LEU:HD12	1:C:671:LEU:HA	1.83	0.44
1:A:483:GLU:HG3	1:A:675:TRP:CE2	2.53	0.44
1:A:483:GLU:OE1	1:A:679:TYR:OH	2.32	0.44
1:A:524:PHE:HD1	1:A:525:VAL:N	2.16	0.44
1:A:647:LYS:HE2	1:A:647:LYS:HB2	1.78	0.44
1:B:690:PRO:C	1:B:692:GLU:H	2.20	0.44
1:C:629:HIS:HB2	1:C:645:TYR:CD1	2.53	0.43
1:F:455:SER:O	1:F:459:GLU:HG2	2.18	0.43
1:A:671:LEU:O	1:A:675:TRP:HB2	2.17	0.43
1:E:419:VAL:HG23	1:E:433:ALA:HB1	1.99	0.43
1:E:514:ARG:HB3	1:E:659:ILE:HG21	1.99	0.43
1:F:364:ILE:O	1:F:368:ILE:HG12	2.18	0.43
1:A:544:ILE:HA	1:A:547:MET:HE2	1.99	0.43
1:D:460:GLU:HG3	1:D:664:TYR:CE1	2.53	0.43
1:D:530:THR:O	1:D:534:ASP:HB2	2.19	0.43
1:F:470:PRO:HB2	1:F:472:THR:HG23	2.00	0.43
1:E:500:PHE:CD1	1:E:602:ILE:HB	2.53	0.43
1:C:575:LYS:HB3	1:C:575:LYS:HE2	1.71	0.43
1:B:377:LYS:N	1:B:377:LYS:HD3	2.34	0.43
1:F:516:LEU:O	1:F:520:ILE:HG12	2.18	0.43
1:B:477:LYS:HB3	1:B:477:LYS:HE2	1.81	0.43
1:F:417:ASN:HB3	1:F:445:LYS:HE3	1.99	0.42
1:E:627:ARG:HB3	1:E:646:ASP:HB2	2.01	0.42
1:B:476:LYS:NZ	1:B:480:GLU:HB3	2.34	0.42
1:D:535:VAL:HG22	1:D:570:ARG:NH1	2.34	0.42
1:D:607:LYS:HA	1:D:607:LYS:HD3	1.85	0.42
1:C:390:LYS:HA	1:C:393:GLU:HG2	2.00	0.42
1:C:507:THR:HG22	1:C:626:PHE:HB3	2.00	0.42
1:F:511:THR:HG22	1:F:514:ARG:HH21	1.85	0.42
1:F:517:LYS:HA	1:F:524:PHE:HD2	1.83	0.42
1:E:665:ARG:HG2	1:E:666:PHE:HD1	1.85	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:465:ILE:HD11	1:F:668:PHE:HE1	1.83	0.42
1:F:576:LYS:HD2	1:F:576:LYS:HA	1.91	0.42
1:E:555:CYS:HB3	1:E:602:ILE:HD12	2.00	0.42
1:D:677:LYS:HA	1:D:681:ILE:HG12	2.01	0.42
1:A:389:ARG:NH2	1:B:395:ASN:OD1	2.53	0.42
1:A:483:GLU:HG3	1:A:675:TRP:CD2	2.55	0.42
1:B:547:MET:O	1:B:547:MET:SD	2.78	0.42
1:D:693:ILE:HB	1:D:696:PHE:HB2	2.01	0.42
1:F:442:THR:HG23	1:F:444:PHE:H	1.84	0.42
1:A:453:GLU:HG2	1:A:670:TYR:CE1	2.55	0.42
1:A:573:ASN:O	1:A:576:LYS:HG2	2.19	0.42
1:D:351:ILE:HG13	1:D:356:LYS:NZ	2.34	0.42
1:A:556:SER:OG	1:A:557:GLU:N	2.51	0.42
1:D:368:ILE:HD11	1:D:396:ILE:HD12	2.02	0.42
1:C:350:TRP:CZ2	1:C:353:ASN:HA	2.55	0.42
1:C:533:THR:O	1:C:533:THR:HG23	2.20	0.42
1:A:529:GLN:O	1:A:529:GLN:HG2	2.20	0.42
1:D:414:PRO:HG2	1:D:440:VAL:O	2.20	0.41
1:A:529:GLN:NE2	1:A:559:PRO:HD2	2.35	0.41
1:E:493:ALA:HB3	1:E:684:MET:HE3	2.02	0.41
1:A:486:LEU:HD23	1:A:486:LEU:HA	1.82	0.41
1:A:486:LEU:HD13	1:A:668:PHE:HZ	1.85	0.41
1:D:351:ILE:HG23	1:D:367:LEU:HD23	2.03	0.41
1:E:550:LYS:HD3	1:E:550:LYS:HA	1.90	0.41
1:D:629:HIS:NE2	1:D:631:SER:HB3	2.35	0.41
1:A:378:GLU:HG2	1:A:379:TYR:CD1	2.55	0.41
1:E:470:PRO:HB2	1:E:472:THR:HG23	2.02	0.41
1:D:415:PHE:CZ	1:D:669:LEU:HD21	2.56	0.41
1:A:356:LYS:HB2	1:A:356:LYS:HE2	1.80	0.41
1:E:692:GLU:N	1:E:692:GLU:OE1	2.54	0.41
1:F:507:THR:N	4:F:1001:ADP:O2B	2.50	0.41
1:E:415:PHE:HA	1:E:442:THR:OG1	2.21	0.41
1:C:576:LYS:HE2	1:B:557:GLU:OE2	2.21	0.41
1:A:422:LEU:HD11	1:A:490:LEU:HB3	2.02	0.41
1:F:410:PRO:HB3	1:F:493:ALA:N	2.36	0.41
1:F:414:PRO:HG2	1:F:440:VAL:O	2.21	0.41
1:A:351:ILE:HG13	1:A:356:LYS:NZ	2.36	0.41
1:A:383:LEU:HD23	1:A:383:LEU:HA	1.88	0.41
1:E:486:LEU:HD23	1:E:486:LEU:HA	1.92	0.41
1:B:582:VAL:HG12	1:B:594:ASN:HB2	2.01	0.41
1:D:348:ILE:HG22	1:D:357:PHE:HB3	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:460:GLU:O	1:F:464:ILE:HG12	2.21	0.41
1:B:407:ASP:O	1:B:595:ARG:NH2	2.54	0.41
1:B:536:LEU:HD22	1:B:573:ASN:ND2	2.36	0.41
1:C:516:LEU:O	1:C:520:ILE:HG12	2.21	0.40
1:F:356:LYS:HE2	1:F:363:LEU:HD21	2.03	0.40
1:A:473:ASP:O	1:A:476:LYS:HG2	2.21	0.40
1:E:499:THR:HA	1:E:622:ALA:O	2.20	0.40
1:C:349:VAL:HG13	1:C:367:LEU:HB2	2.03	0.40
1:A:378:GLU:HG2	1:A:379:TYR:HD1	1.85	0.40
1:A:400:LEU:HD23	1:A:400:LEU:HA	1.87	0.40
1:A:524:PHE:C	1:A:524:PHE:CD1	2.94	0.40
1:E:501:PHE:HD1	1:E:501:PHE:HA	1.73	0.40
1:A:677:LYS:HA	1:A:681:ILE:HG12	2.03	0.40
1:E:640:GLU:H	1:E:640:GLU:HG3	1.75	0.40
1:C:351:ILE:HG23	1:C:367:LEU:HD23	2.03	0.40
1:F:350:TRP:CZ2	1:F:353:ASN:HA	2.56	0.40
1:A:554:PHE:HA	1:A:601:ILE:O	2.22	0.40
1:D:426:MET:HE2	1:D:426:MET:HB3	1.96	0.40
1:A:363:LEU:HD23	1:A:366:LYS:HD2	2.03	0.40
1:A:658:LYS:HE3	1:A:658:LYS:HB2	1.68	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	319/785 (41%)	291 (91%)	28 (9%)	0	100   100
1	B	377/785 (48%)	343 (91%)	34 (9%)	0	100   100
1	C	377/785 (48%)	348 (92%)	29 (8%)	0	100   100
1	D	377/785 (48%)	343 (91%)	34 (9%)	0	100   100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	E	368/785 (47%)	338 (92%)	30 (8%)	0	100	100
1	F	262/785 (33%)	241 (92%)	21 (8%)	0	100	100
All	All	2080/4710 (44%)	1904 (92%)	176 (8%)	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	301/725 (42%)	286 (95%)	15 (5%)	24	55
1	B	344/725 (47%)	331 (96%)	13 (4%)	33	62
1	C	344/725 (47%)	332 (96%)	12 (4%)	36	64
1	D	344/725 (47%)	337 (98%)	7 (2%)	55	76
1	E	338/725 (47%)	330 (98%)	8 (2%)	49	73
1	F	253/725 (35%)	243 (96%)	10 (4%)	31	61
All	All	1924/4350 (44%)	1859 (97%)	65 (3%)	40	65

All (65) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	447	ASP
1	D	491	CYS
1	D	497	CYS
1	D	554	PHE
1	D	571	SER
1	D	594	ASN
1	D	646	ASP
1	C	324	ASN
1	C	326	LEU
1	C	407	ASP
1	C	411	ASP
1	C	479	ARG

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	C	497	CYS
1	C	534	ASP
1	C	585	ARG
1	C	594	ASN
1	C	632	GLN
1	C	634	SER
1	C	646	ASP
1	F	324	ASN
1	F	365	THR
1	F	377	LYS
1	F	479	ARG
1	F	500	PHE
1	F	501	PHE
1	F	572	ASP
1	F	664	TYR
1	F	679	TYR
1	F	685	LYS
1	A	354	SER
1	A	361	GLU
1	A	380	SER
1	A	407	ASP
1	A	411	ASP
1	A	431	ASP
1	A	477	LYS
1	A	479	ARG
1	A	502	PHE
1	A	524	PHE
1	A	549	LEU
1	A	572	ASP
1	A	646	ASP
1	A	661	ASN
1	A	675	TRP
1	E	365	THR
1	E	387	ARG
1	E	407	ASP
1	E	501	PHE
1	E	502	PHE
1	E	554	PHE
1	E	646	ASP
1	E	662	ASN
1	B	346	ASP
1	B	380	SER

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Mol	Chain	Res	Type
1	B	407	ASP
1	B	411	ASP
1	B	429	SER
1	B	436	TYR
1	B	479	ARG
1	B	554	PHE
1	B	585	ARG
1	B	634	SER
1	B	646	ASP
1	B	689	THR
1	B	691	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	661	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 5 are monoatomic - leaving 6 for Mogul analysis.

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
2	ATP	D	1001	3	26,33,33	0.62	0	31,52,52	0.75	2 (6%)
2	ATP	B	1001	3	26,33,33	0.62	0	31,52,52	0.73	2 (6%)
2	ATP	A	1001	3	26,33,33	0.61	0	31,52,52	0.78	2 (6%)
2	ATP	E	1001	3	26,33,33	0.60	0	31,52,52	0.74	2 (6%)
4	ADP	F	1001	-	24,29,29	0.95	1 (4%)	29,45,45	1.45	4 (13%)
2	ATP	C	1001	3	26,33,33	0.63	0	31,52,52	0.73	2 (6%)

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
2	ATP	D	1001	3	-	6/18/38/38	0/3/3/3
2	ATP	B	1001	3	-	4/18/38/38	0/3/3/3
2	ATP	A	1001	3	-	5/18/38/38	0/3/3/3
2	ATP	E	1001	3	-	4/18/38/38	0/3/3/3
4	ADP	F	1001	-	-	2/12/32/32	0/3/3/3
2	ATP	C	1001	3	-	8/18/38/38	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	1001	ADP	C5-C4	2.46	1.47	1.40

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	F	1001	ADP	PA-O3A-PB	-3.49	120.86	132.83
4	F	1001	ADP	C3'-C2'-C1'	3.19	105.78	100.98
4	F	1001	ADP	N3-C2-N1	-3.18	123.70	128.68
4	F	1001	ADP	C4-C5-N7	-2.72	106.57	109.40
2	E	1001	ATP	C5-C6-N6	2.33	123.89	120.35
2	C	1001	ATP	C5-C6-N6	2.30	123.84	120.35
2	A	1001	ATP	C5-C6-N6	2.28	123.81	120.35
2	B	1001	ATP	C5-C6-N6	2.27	123.80	120.35
2	D	1001	ATP	C5-C6-N6	2.27	123.80	120.35
2	D	1001	ATP	PB-O3B-PG	2.07	139.92	132.83
2	E	1001	ATP	PB-O3B-PG	2.04	139.81	132.83

*Continued on next page...*



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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1001	ATP	PB-O3B-PG	2.03	139.81	132.83
2	A	1001	ATP	PB-O3B-PG	2.03	139.78	132.83
2	B	1001	ATP	PB-O3B-PG	2.02	139.77	132.83

There are no chirality outliers.

All (29) torsion outliers are listed below:

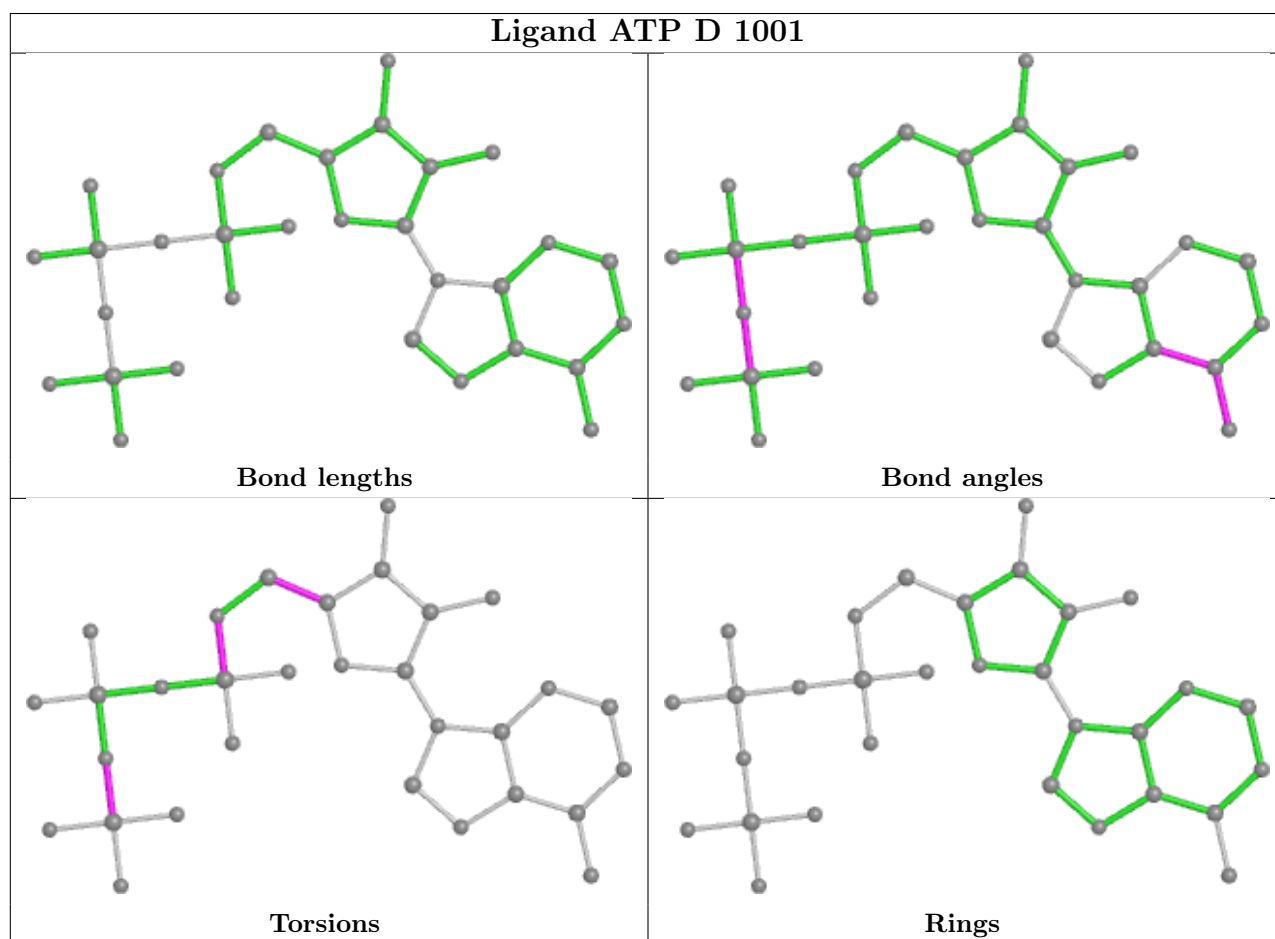
Mol	Chain	Res	Type	Atoms
2	D	1001	ATP	PB-O3B-PG-O2G
2	D	1001	ATP	C5'-O5'-PA-O2A
2	C	1001	ATP	PB-O3A-PA-O5'
2	C	1001	ATP	C5'-O5'-PA-O1A
2	C	1001	ATP	C5'-O5'-PA-O2A
2	A	1001	ATP	C5'-O5'-PA-O1A
2	A	1001	ATP	C5'-O5'-PA-O2A
2	B	1001	ATP	C5'-O5'-PA-O2A
4	F	1001	ADP	C5'-O5'-PA-O3A
2	D	1001	ATP	O4'-C4'-C5'-O5'
2	A	1001	ATP	O4'-C4'-C5'-O5'
2	A	1001	ATP	C3'-C4'-C5'-O5'
2	B	1001	ATP	O4'-C4'-C5'-O5'
2	C	1001	ATP	C5'-O5'-PA-O3A
2	B	1001	ATP	C5'-O5'-PA-O3A
2	D	1001	ATP	C3'-C4'-C5'-O5'
2	E	1001	ATP	O4'-C4'-C5'-O5'
2	E	1001	ATP	PA-O3A-PB-O2B
2	B	1001	ATP	C5'-O5'-PA-O1A
4	F	1001	ADP	C5'-O5'-PA-O1A
2	C	1001	ATP	PB-O3B-PG-O1G
2	E	1001	ATP	PG-O3B-PB-O1B
2	E	1001	ATP	PG-O3B-PB-O2B
2	C	1001	ATP	O4'-C4'-C5'-O5'
2	D	1001	ATP	C5'-O5'-PA-O3A
2	A	1001	ATP	C5'-O5'-PA-O3A
2	C	1001	ATP	C4'-C5'-O5'-PA
2	C	1001	ATP	PA-O3A-PB-O1B
2	D	1001	ATP	C5'-O5'-PA-O1A

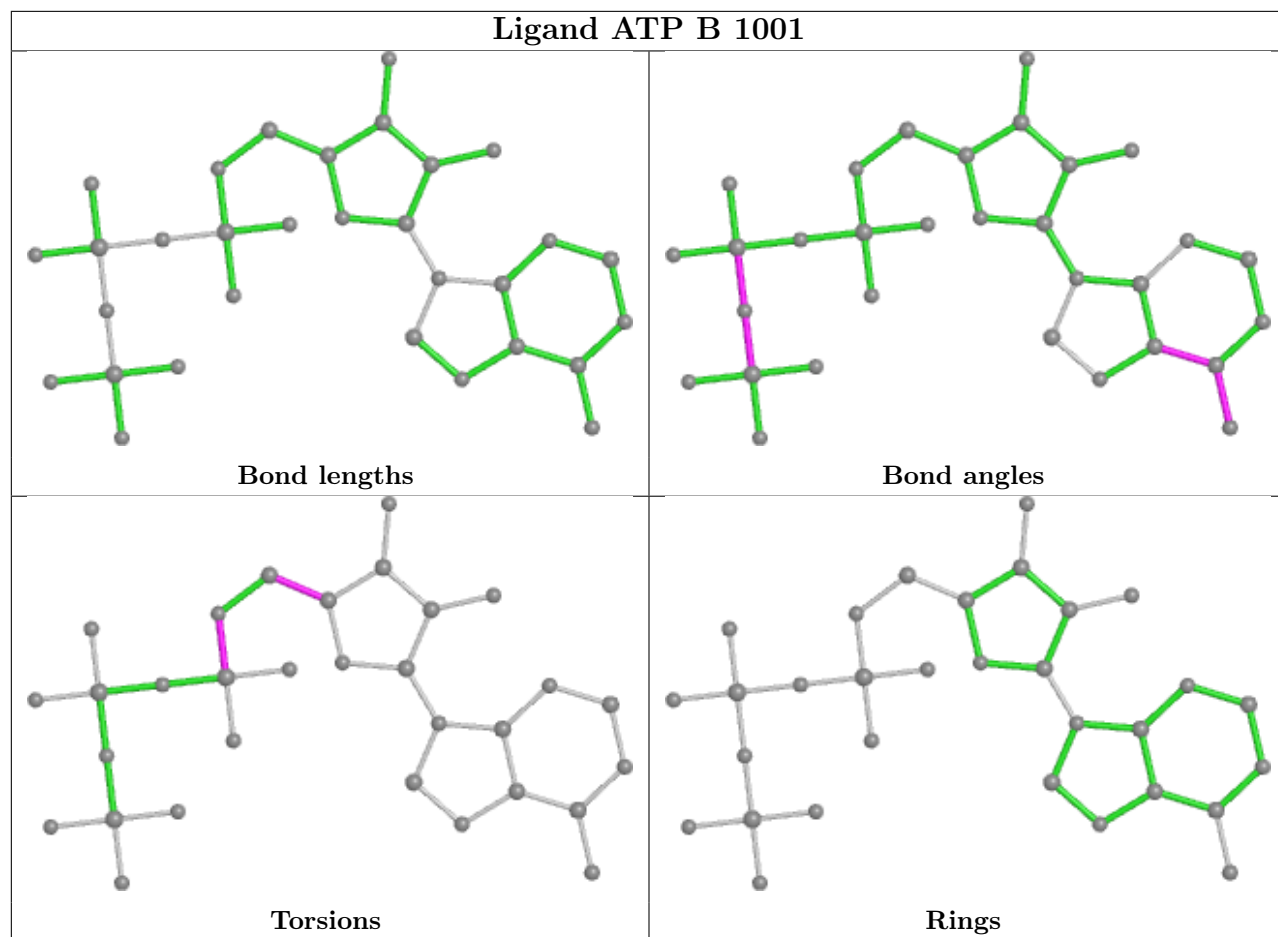
There are no ring outliers.

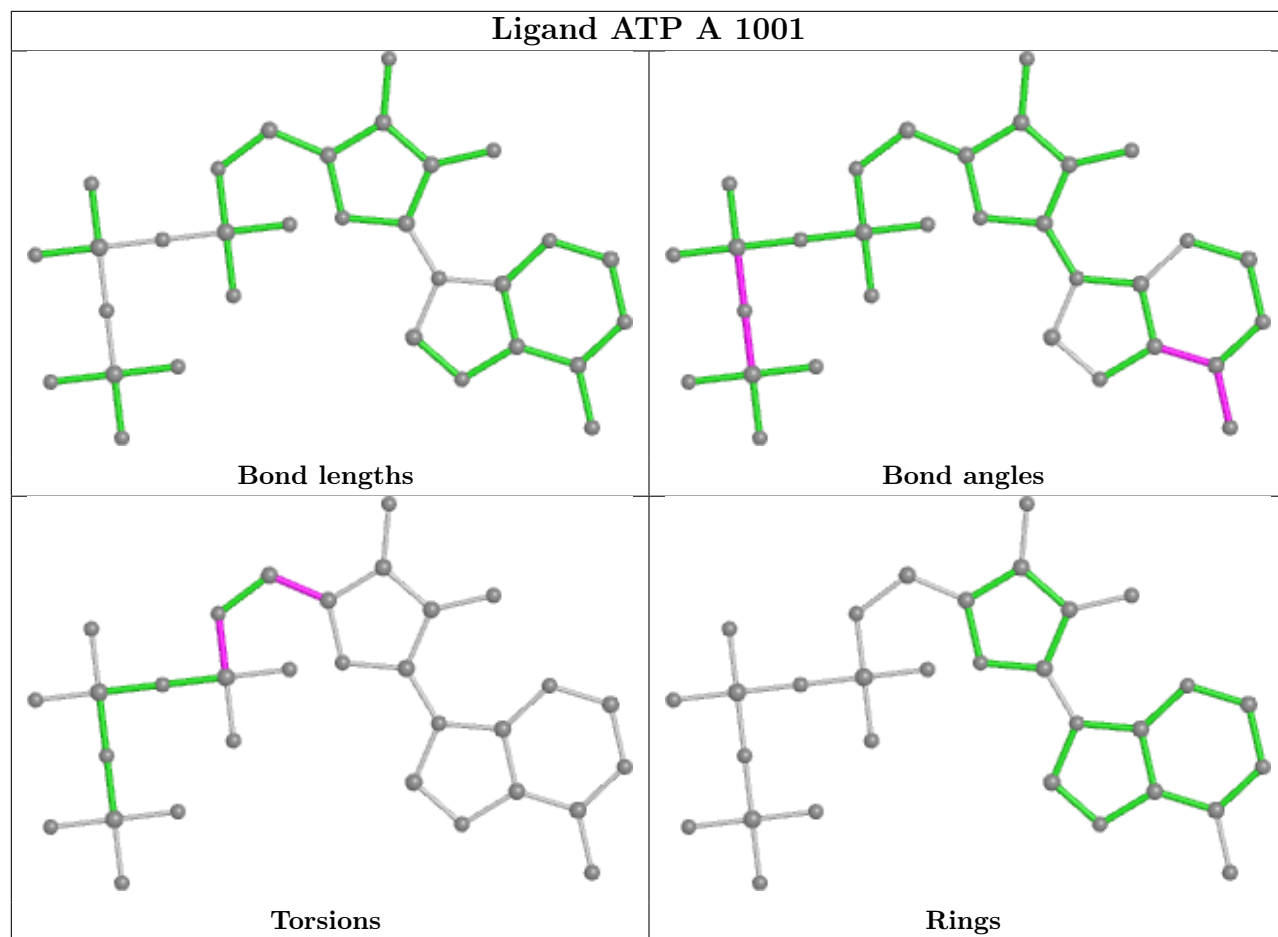
5 monomers are involved in 7 short contacts:

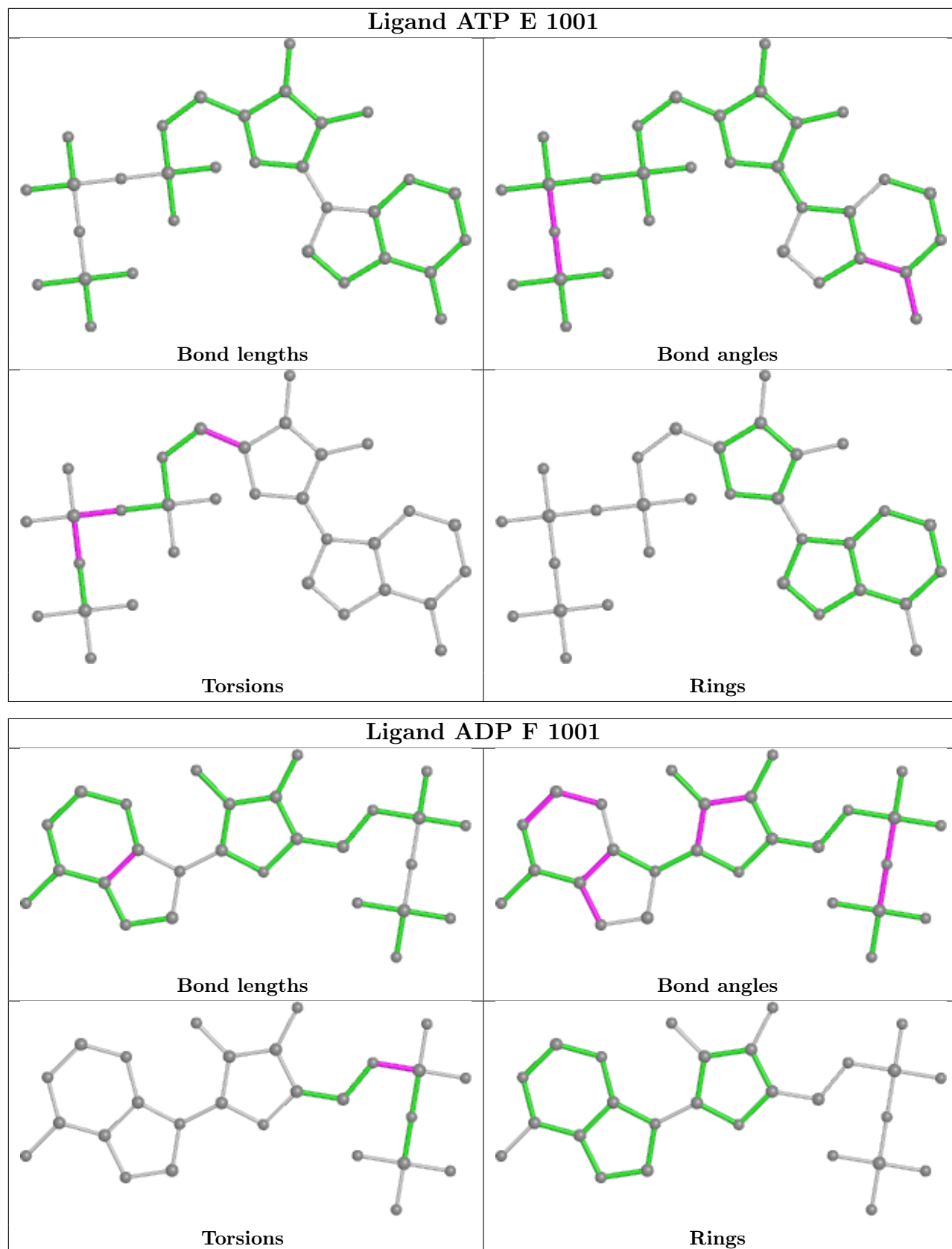
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1001	ATP	1	0
2	A	1001	ATP	1	0
2	E	1001	ATP	2	0
4	F	1001	ADP	2	0
2	C	1001	ATP	1	0

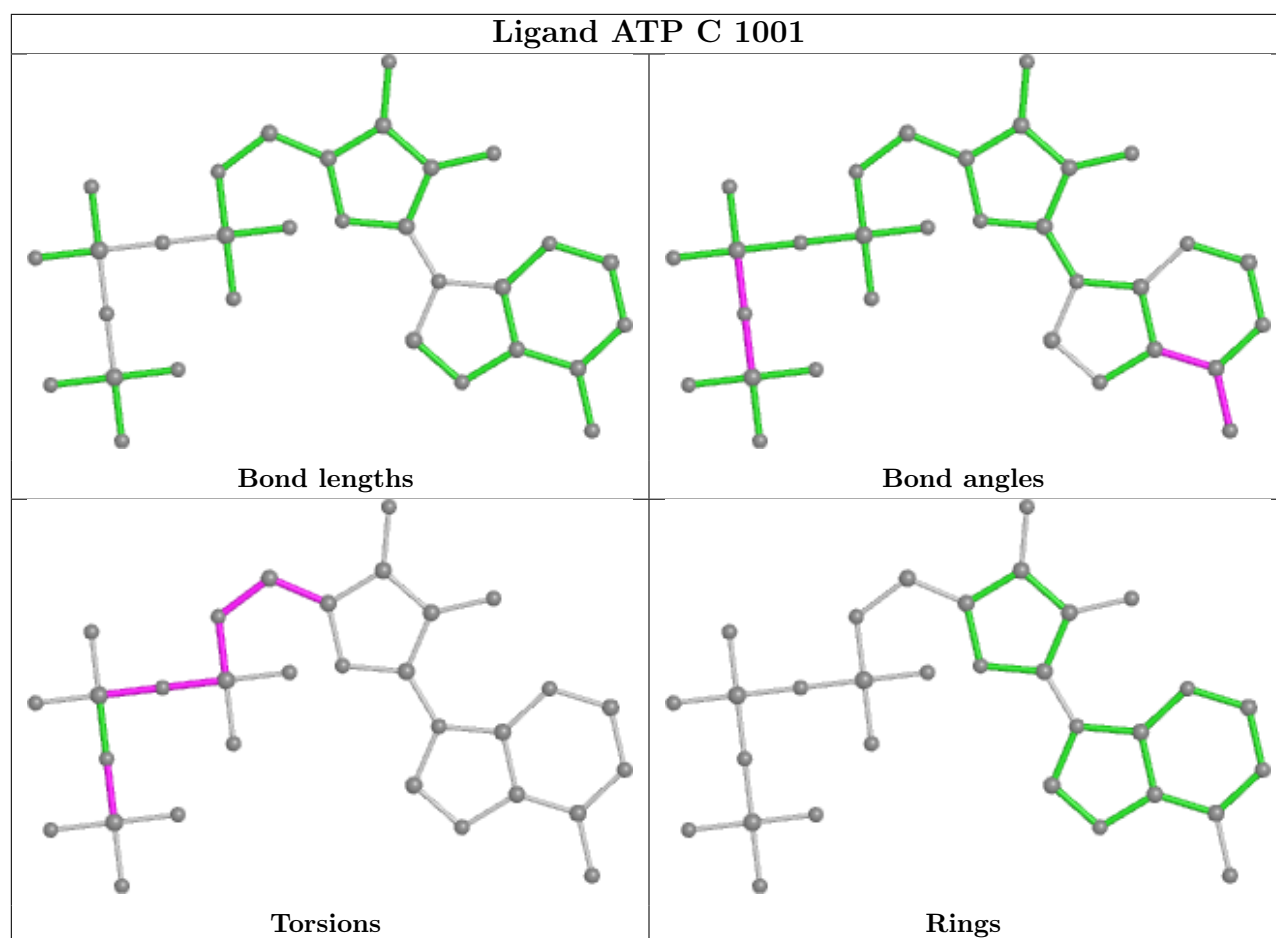
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.











## 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.