



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 28, 2026 – 10:50 PM UTC

PDB ID : 7W52 / pdb_00007w52
Title : Crystal structure of fragmin domain-1 (15-160) in complex with actin
Authors : Takeda, S.
Deposited on : 2021-11-29
Resolution : 2.00 Å(reported)

This is a Full wwPDB X-ray Structure 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/XrayValidationReportHelp>

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:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

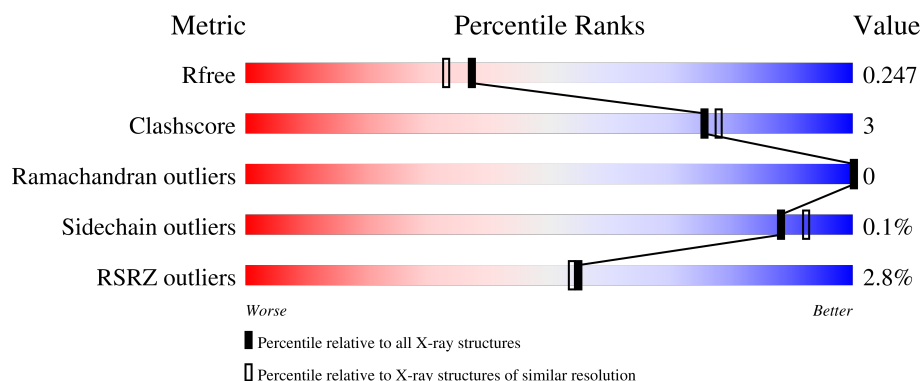
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower 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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	377	4% 82% 13% 5%
1	C	377	2% 84% 10% 7%
1	E	377	3% 86% 7% 6%
1	G	377	2% 83% 9% 8%
2	B	148	0% 93% 5%

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Mol	Chain	Length	Quality of chain
2	D	148	% 89% 5%6%
2	F	148	4% 91% •7%
2	H	148	% 93% •6%

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 17256 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 Actin, alpha skeletal muscle.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	359	Total	C	N	O	S	0	4	0
			2842	1802	477	543	20			
1	C	352	Total	C	N	O	S	8	1	0
			2764	1756	459	530	19			
1	E	353	Total	C	N	O	S	0	1	0
			2773	1759	463	532	19			
1	G	348	Total	C	N	O	S	0	1	0
			2730	1734	451	526	19			

- Molecule 2 is a protein called Actin-binding protein fragmin P.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	140	Total	C	N	O	0	0	0
			1128	728	188	212			
2	D	139	Total	C	N	O	0	0	0
			1121	724	187	210			
2	F	138	Total	C	N	O	0	0	0
			1114	721	185	208			
2	H	139	Total	C	N	O	0	0	0
			1124	726	187	211			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	13	GLY	-	expression tag	UNP Q94707
B	14	PRO	-	expression tag	UNP Q94707
D	13	GLY	-	expression tag	UNP Q94707
D	14	PRO	-	expression tag	UNP Q94707
F	13	GLY	-	expression tag	UNP Q94707
F	14	PRO	-	expression tag	UNP Q94707
H	13	GLY	-	expression tag	UNP Q94707
H	14	PRO	-	expression tag	UNP Q94707

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- The diagram illustrates the chemical structure of Adenosine Triphosphate (ATP). It consists of an adenine base (a purine ring system with an amino group at position 6) attached to a ribose sugar (a five-membered ring with hydroxyl groups at positions 2' and 3'). The ribose is linked to a chain of three phosphate groups (labeled alpha, beta, and gamma) via phosphodiester bonds. The alpha phosphate is directly attached to the 5' carbon of the ribose. The beta and gamma phosphates are linked in series. The structure is shown with various atom labels (N1, N3, N7, N9, C2, C4, C5, C6, C1', C2', C3', C4', C5') and bond types (solid, dashed, wedged) to indicate stereochemistry. The phosphate groups are labeled with their respective oxygen atoms (O1A, O1B, O1C, O2A, O2B, O2C, O3A, O3B, O3C).

- Molecule 4 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	G	1	Total	Ca	0	0
			1	1		
4	H	2	Total	Ca	0	0
			2	2		

- Molecule 5 is ACETATE ION (CCD ID: ACT) (formula: $C_2H_3O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			4	2	2		
5	B	1	Total	C	O	0	0
			4	2	2		
5	B	1	Total	C	O	0	0
			4	2	2		
5	D	1	Total	C	O	0	0
			4	2	2		

- Molecule 6 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	Na	0	0
			1	1		
6	C	1	Total	Na	0	0
			1	1		
6	E	1	Total	Na	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	G	1	Total	Na	0	0
			1	1		

- Molecule 7 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			4	2	2		
7	C	1	Total	C	O	0	0
			4	2	2		
7	E	1	Total	C	O	0	0
			4	2	2		
7	G	1	Total	C	O	0	0
			4	2	2		

- Molecule 8 is water.

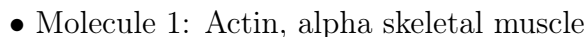
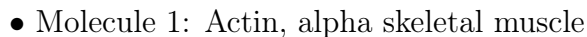
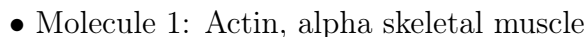
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	275	Total	O	0	0
			275	275		
8	B	156	Total	O	0	0
			156	156		
8	C	285	Total	O	0	0
			285	285		
8	D	131	Total	O	0	0
			131	131		

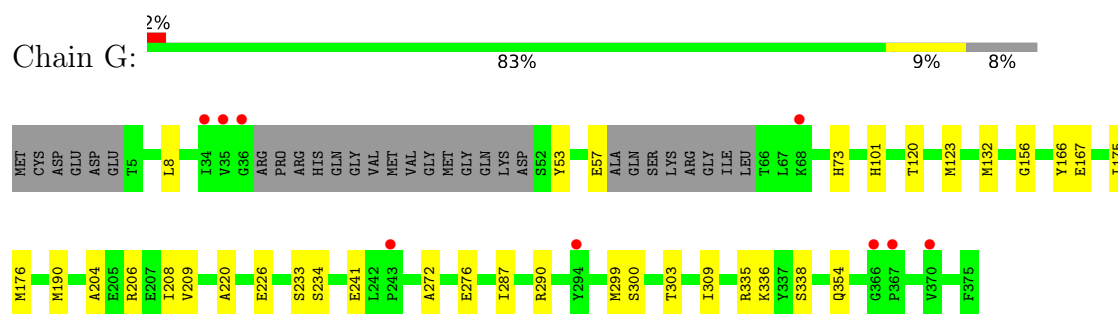
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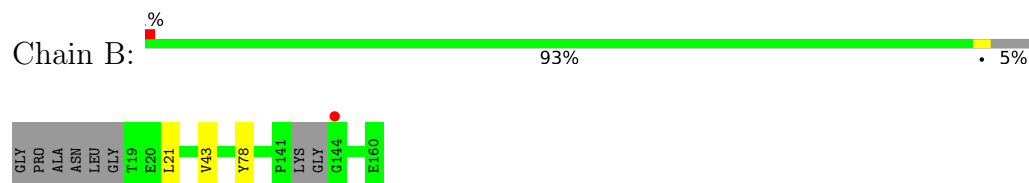
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	E	213	Total 213	O 213	0	0
8	F	101	Total 101	O 101	0	0
8	G	194	Total 194	O 194	0	0
8	H	133	Total 133	O 133	0	0

- Molecule 1: Actin, alpha skeletal muscle

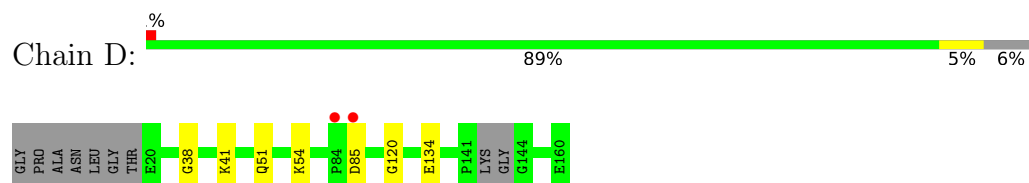




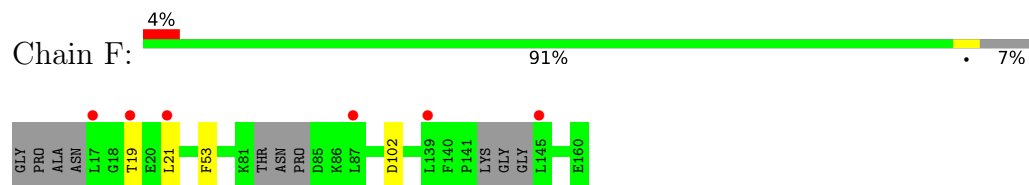
- Molecule 2: Actin-binding protein fragmin P



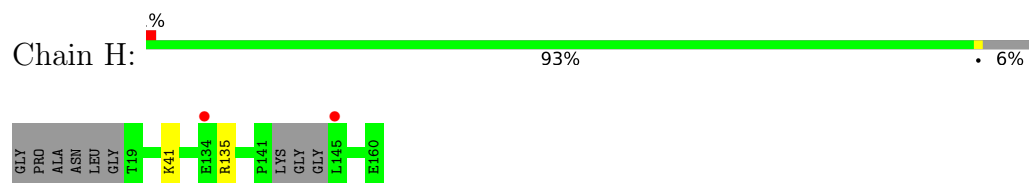
- Molecule 2: Actin-binding protein fragmin P



- Molecule 2: Actin-binding protein fragmin P



- Molecule 2: Actin-binding protein fragmin P



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	56.99Å 96.26Å 426.92Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.67 – 2.00 46.67 – 2.00	Depositor EDS
% Data completeness (in resolution range)	98.1 (46.67-2.00) 98.2 (46.67-2.00)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.21 (at 2.00Å)	Xtriage
Refinement program	PHENIX 1.18	Depositor
R, R_{free}	0.209 , 0.246 0.210 , 0.247	Depositor DCC
R_{free} test set	7853 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	35.2	Xtriage
Anisotropy	0.209	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 47.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.26$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	17256	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.86% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: ACT, EDO, HIC, NA, ATP, CA

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	0.19	0/2890	0.34	0/3912
1	C	0.13	0/2811	0.32	0/3809
1	E	0.13	0/2820	0.32	0/3820
1	G	0.14	0/2776	0.32	0/3761
2	B	0.19	0/1160	0.38	0/1570
2	D	0.26	0/1153	0.39	0/1560
2	F	0.20	0/1144	0.40	0/1545
2	H	0.27	0/1156	0.37	0/1565
All	All	0.18	0/15910	0.34	0/21542

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	2842	0	2814	29	0
1	C	2764	0	2726	19	1
1	E	2773	0	2733	16	0
1	G	2730	0	2687	21	0
2	B	1128	0	1083	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	1121	0	1076	4	1
2	F	1114	0	1073	5	0
2	H	1124	0	1080	1	0
3	A	31	0	12	1	0
3	C	31	0	12	0	0
3	E	31	0	12	0	0
3	G	31	0	12	1	0
4	A	1	0	0	0	0
4	B	2	0	0	0	0
4	C	1	0	0	0	0
4	D	2	0	0	0	0
4	E	1	0	0	0	0
4	F	2	0	0	0	0
4	G	1	0	0	0	0
4	H	2	0	0	0	0
5	A	4	0	3	0	0
5	B	8	0	6	0	0
5	D	4	0	3	0	0
6	A	1	0	0	0	0
6	C	1	0	0	0	0
6	E	1	0	0	0	0
6	G	1	0	0	0	0
7	A	4	0	6	2	0
7	C	4	0	6	0	0
7	E	4	0	6	0	0
7	G	4	0	6	0	0
8	A	275	0	0	1	0
8	B	156	0	0	0	0
8	C	285	0	0	2	0
8	D	131	0	0	2	0
8	E	213	0	0	1	0
8	F	101	0	0	0	0
8	G	194	0	0	1	0
8	H	133	0	0	1	0
All	All	17256	0	15356	94	1

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 3.

All (94) 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)
2:F:19:THR:HG22	2:F:21:LEU:H	1.53	0.72
1:A:299:MET:HE1	1:A:309:ILE:HG23	1.75	0.68
1:G:190:MET:HE1	1:G:206:ARG:HH21	1.56	0.68
1:E:375:PHE:HZ	2:F:21:LEU:HD12	1.59	0.66
1:A:62:ARG:HG2	1:A:67:LEU:HD11	1.78	0.66
1:A:220:ALA:HB1	1:A:226:GLU:HG3	1.78	0.65
1:G:53:TYR:HB3	1:G:57:GLU:HB3	1.78	0.64
1:E:272:ALA:HB1	1:E:276:GLU:HB2	1.82	0.61
1:A:252:ASN:HA	1:A:255:PHE:CE1	2.36	0.61
1:E:375:PHE:CZ	2:F:21:LEU:HD12	2.35	0.61
2:D:120:GLY:HA2	8:D:384:HOH:O	1.99	0.60
1:A:183:ARG:HG3	1:A:206:ARG:HH22	1.67	0.60
1:A:35:VAL:HG21	1:A:81:ASP:HB3	1.84	0.59
1:C:238:LYS:NZ	8:C:508:HOH:O	2.31	0.59
1:C:183:ARG:HG3	1:C:206:ARG:HH22	1.69	0.57
1:C:299:MET:HE1	1:C:309:ILE:HG23	1.86	0.56
1:G:287:ILE:H	1:G:287:ILE:HD12	1.71	0.56
2:D:38:GLY:HA2	2:D:41:LYS:HE2	1.87	0.55
1:C:190:MET:HG3	1:C:209:VAL:HG11	1.89	0.55
1:G:272:ALA:HB1	1:G:276:GLU:HB2	1.90	0.53
1:A:153:LEU:HD22	1:A:313:MET:HE3	1.92	0.52
1:A:38:PRO:HA	1:A:65:LEU:HD23	1.91	0.52
1:E:205:GLU:HA	1:E:208:ILE:HD12	1.92	0.52
1:E:114:ALA:O	1:E:118:LYS:HG3	2.11	0.51
1:C:53:TYR:HA	8:C:610:HOH:O	2.11	0.50
1:G:299:MET:HE1	1:G:309:ILE:HG23	1.93	0.50
1:G:287:ILE:HG13	1:G:290:ARG:CZ	2.42	0.50
1:A:372:ARG:HA	2:B:21:LEU:HD21	1.95	0.49
1:G:123:MET:HG3	1:G:132:MET:HE2	1.94	0.49
1:G:354:GLN:HG3	8:H:502:HOH:O	2.13	0.49
1:A:35:VAL:HG12	1:A:54:VAL:HG22	1.95	0.48
1:A:10:CYS:HB3	1:A:105:LEU:HD23	1.95	0.48
1:C:10:CYS:HB3	1:C:105:LEU:HD23	1.94	0.48
2:F:21:LEU:O	2:F:21:LEU:HD13	2.13	0.48
1:E:233:SER:OG	1:E:234:SER:N	2.46	0.48
1:A:52:SER:N	8:A:518:HOH:O	2.46	0.48
1:A:216:LEU:HD11	1:A:240:TYR:HB2	1.96	0.48
1:C:113:LYS:O	1:C:117:GLU:HG3	2.14	0.48
1:C:190:MET:HG2	1:C:209:VAL:HG21	1.96	0.48
1:G:204:ALA:O	1:G:208:ILE:HD12	2.14	0.48
1:E:299:MET:HE1	1:E:309:ILE:HG23	1.95	0.47
1:G:220:ALA:HB1	1:G:226:GLU:HG3	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:335:ARG:HA	1:A:338[A]:SER:OG	2.14	0.47
1:G:300:SER:HA	1:G:335:ARG:HB2	1.96	0.47
1:G:233:SER:OG	1:G:234:SER:N	2.48	0.46
1:G:241:GLU:OE2	8:G:501:HOH:O	2.20	0.46
1:A:205:GLU:HA	1:A:208:ILE:HD12	1.98	0.46
1:G:190:MET:HG3	1:G:209:VAL:HG11	1.96	0.46
1:A:375:PHE:OXT	7:A:405:EDO:O1	2.27	0.46
1:A:59:GLN:HA	1:A:62:ARG:HG3	1.96	0.46
1:E:335:ARG:HA	1:E:338:SER:OG	2.16	0.46
2:H:41:LYS:HA	2:H:41:LYS:HD3	1.60	0.46
1:A:135:ALA:HB1	7:A:405:EDO:H12	1.98	0.45
1:G:335:ARG:HA	1:G:338[A]:SER:OG	2.17	0.45
1:E:5:THR:HG22	1:E:6:THR:H	1.81	0.45
1:C:228:ALA:O	1:C:232:SER:OG	2.31	0.45
1:A:302:GLY:HA2	1:A:336[A]:LYS:HG2	1.98	0.45
1:C:272:ALA:HB1	1:C:276:GLU:HB2	1.99	0.44
1:C:17:VAL:O	1:C:30:VAL:HA	2.18	0.44
1:E:118:LYS:HD3	8:E:570:HOH:O	2.17	0.44
1:C:151:ILE:HA	1:C:164:PRO:HA	2.00	0.44
2:D:85:ASP:O	8:D:301:HOH:O	2.21	0.44
1:E:8:LEU:HG	1:E:101:HIS:HB3	1.98	0.44
1:C:176:MET:HG2	1:C:281:SER:HB2	1.99	0.43
1:G:175:ILE:O	1:G:176:MET:HE2	2.19	0.43
1:A:272:ALA:HB1	1:A:276:GLU:HB2	1.99	0.43
1:C:31:PHE:CE1	1:C:93:GLU:HG3	2.54	0.43
1:C:335:ARG:HA	1:C:338:SER:OG	2.18	0.43
1:G:156:GLY:O	1:G:303:THR:OG1	2.28	0.43
1:A:214:GLU:HG2	3:A:401:ATP:C4	2.54	0.43
1:E:227:MET:HE1	1:E:256[B]:ARG:HD2	2.00	0.42
1:A:156:GLY:O	1:A:303:THR:OG1	2.35	0.42
2:F:53:PHE:CE1	2:F:102:ASP:HB2	2.54	0.42
2:B:43:VAL:HG22	2:B:78:TYR:HA	2.00	0.42
1:A:219:VAL:HG22	1:A:258:PRO:HB2	2.01	0.42
1:C:35:VAL:HG21	1:C:81:ASP:CG	2.45	0.42
1:C:153:LEU:HD22	1:C:313:MET:HE2	2.02	0.42
1:G:166:TYR:CE2	1:G:167:GLU:HG3	2.55	0.42
1:G:336:LYS:HE2	3:G:401:ATP:N7	2.35	0.42
1:E:97:ALA:O	1:E:100:GLU:HG2	2.20	0.41
1:A:222:ASP:HB3	1:A:225:ASN:HB2	2.03	0.41
1:E:105:LEU:HD12	1:E:132:MET:HE2	2.02	0.41
2:D:51:GLN:O	2:D:54:LYS:HE3	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:53:TYR:CZ	1:A:61:LYS:HE2	2.56	0.41
1:E:252:ASN:HA	1:E:255:PHE:CE1	2.56	0.41
1:G:8:LEU:HG	1:G:101:HIS:HB3	2.03	0.41
1:C:106:THR:HB	1:C:137:GLN:HG3	2.03	0.40
1:A:285:CYS:HB3	1:A:289:ILE:HD11	2.03	0.40
1:A:218:TYR:O	1:A:255:PHE:HA	2.21	0.40
1:C:273:GLY:O	1:C:277:THR:HG23	2.21	0.40
1:E:79:TRP:CE2	1:E:118:LYS:HD2	2.56	0.40
1:A:38:PRO:O	1:A:39:ARG:HB2	2.22	0.40
1:A:151:ILE:HA	1:A:164:PRO:HA	2.04	0.40
1:G:120:THR:HA	1:G:132:MET:CE	2.52	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:128:ASN:ND2	2:D:134:GLU:OE1[1_455]	2.02	0.18

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 X-ray entries followed by that with respect to entries of similar resolution.

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	358/377 (95%)	350 (98%)	8 (2%)	0	100	100
1	C	346/377 (92%)	340 (98%)	6 (2%)	0	100	100
1	E	347/377 (92%)	342 (99%)	5 (1%)	0	100	100
1	G	342/377 (91%)	336 (98%)	6 (2%)	0	100	100
2	B	136/148 (92%)	135 (99%)	1 (1%)	0	100	100
2	D	135/148 (91%)	133 (98%)	2 (2%)	0	100	100
2	F	132/148 (89%)	131 (99%)	1 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	H	135/148 (91%)	133 (98%)	2 (2%)	0	100	100
All	All	1931/2100 (92%)	1900 (98%)	31 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

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	308/319 (97%)	308 (100%)	0	100	100
1	C	299/319 (94%)	299 (100%)	0	100	100
1	E	300/319 (94%)	300 (100%)	0	100	100
1	G	296/319 (93%)	296 (100%)	0	100	100
2	B	118/122 (97%)	118 (100%)	0	100	100
2	D	117/122 (96%)	117 (100%)	0	100	100
2	F	116/122 (95%)	116 (100%)	0	100	100
2	H	118/122 (97%)	117 (99%)	1 (1%)	73	80
All	All	1672/1764 (95%)	1671 (100%)	1 (0%)	88	92

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	H	135	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	121	GLN
1	A	161	HIS
1	G	162	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

4 non-standard protein/DNA/RNA residues 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
1	HIC	E	73	1	10,11,12	1.60	2 (20%)	9,14,16	1.21	1 (11%)
1	HIC	G	73	1	10,11,12	1.55	2 (20%)	9,14,16	1.41	1 (11%)
1	HIC	C	73	1	10,11,12	1.54	2 (20%)	9,14,16	1.24	1 (11%)
1	HIC	A	73	1	10,11,12	1.55	1 (10%)	9,14,16	1.47	1 (11%)

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
1	HIC	E	73	1	-	0/5/6/8	0/1/1/1
1	HIC	G	73	1	-	0/5/6/8	0/1/1/1
1	HIC	C	73	1	-	0/5/6/8	0/1/1/1
1	HIC	A	73	1	-	0/5/6/8	0/1/1/1

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	73	HIC	CD2-CG	3.27	1.41	1.36
1	A	73	HIC	CD2-CG	3.18	1.41	1.36
1	C	73	HIC	CD2-CG	3.09	1.41	1.36
1	G	73	HIC	CD2-CG	3.07	1.41	1.36
1	E	73	HIC	CD2-NE2	2.06	1.40	1.37
1	G	73	HIC	CD2-NE2	2.05	1.40	1.37
1	C	73	HIC	CD2-NE2	2.03	1.40	1.37

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	73	HIC	NE2-CE1-ND1	-3.89	111.17	112.66
1	G	73	HIC	NE2-CE1-ND1	-3.54	111.31	112.66
1	C	73	HIC	NE2-CE1-ND1	-3.05	111.50	112.66
1	E	73	HIC	NE2-CE1-ND1	-2.99	111.52	112.66

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 28 ligands modelled in this entry, 16 are monoatomic - leaving 12 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
7	EDO	E	404	-	3,3,3	0.43	0	2,2,2	0.39	0
5	ACT	B	204	-	3,3,3	1.23	0	3,3,3	1.60	0
3	ATP	G	401	4	32,33,33	1.40	5 (15%)	48,52,52	1.79	10 (20%)
5	ACT	B	203	-	3,3,3	1.46	1 (33%)	3,3,3	1.52	0
3	ATP	A	401	4	32,33,33	1.40	5 (15%)	48,52,52	1.78	9 (18%)
3	ATP	C	401	4	32,33,33	1.45	7 (21%)	48,52,52	1.73	8 (16%)
7	EDO	A	405	-	3,3,3	0.43	0	2,2,2	0.40	0
3	ATP	E	401	4	32,33,33	1.49	7 (21%)	48,52,52	1.77	10 (20%)
5	ACT	D	203	-	3,3,3	1.50	1 (33%)	3,3,3	1.44	0
7	EDO	C	404	-	3,3,3	0.44	0	2,2,2	0.34	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	ACT	A	403	-	3,3,3	1.37	0	3,3,3	1.40	0
7	EDO	G	404	-	3,3,3	0.44	0	2,2,2	0.37	0

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
7	EDO	E	404	-	-	0/1/1/1	-
3	ATP	G	401	4	-	2/22/38/38	0/3/3/3
3	ATP	A	401	4	-	3/22/38/38	0/3/3/3
3	ATP	C	401	4	-	2/22/38/38	0/3/3/3
7	EDO	A	405	-	-	0/1/1/1	-
3	ATP	E	401	4	-	4/22/38/38	0/3/3/3
7	EDO	C	404	-	-	1/1/1/1	-
7	EDO	G	404	-	-	0/1/1/1	-

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	401	ATP	C5-C4	4.62	1.47	1.39
3	G	401	ATP	C5-C4	4.61	1.47	1.39
3	A	401	ATP	C5-C4	4.61	1.47	1.39
3	C	401	ATP	C5-C4	4.57	1.47	1.39
3	G	401	ATP	C5-C6	2.82	1.48	1.41
3	A	401	ATP	C5-C6	2.80	1.48	1.41
3	E	401	ATP	C5-C6	2.67	1.48	1.41
3	E	401	ATP	PB-O3B	2.65	1.62	1.59
3	C	401	ATP	C5-C6	2.63	1.48	1.41
3	E	401	ATP	PB-O3A	2.62	1.62	1.59
3	C	401	ATP	PB-O3B	2.61	1.62	1.59
3	G	401	ATP	PB-O3B	2.55	1.62	1.59
3	E	401	ATP	C8-N7	2.48	1.36	1.31
3	G	401	ATP	C8-N7	2.42	1.36	1.31
3	C	401	ATP	C8-N7	2.38	1.36	1.31
3	A	401	ATP	C8-N7	2.32	1.36	1.31
3	C	401	ATP	PA-O3A	2.21	1.61	1.59
5	D	203	ACT	CH3-C	2.20	1.57	1.49
3	A	401	ATP	PB-O3A	2.20	1.61	1.59
3	C	401	ATP	C5-N7	-2.17	1.35	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	G	401	ATP	C5-N7	-2.14	1.35	1.39
5	B	203	ACT	CH3-C	2.14	1.57	1.49
3	E	401	ATP	C5-N7	-2.13	1.35	1.39
3	C	401	ATP	PB-O3A	2.13	1.61	1.59
3	E	401	ATP	PA-O3A	2.08	1.61	1.59
3	A	401	ATP	C5-N7	-2.05	1.35	1.39

All (37) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	G	401	ATP	C5-C4-N3	-5.89	118.61	126.72
3	E	401	ATP	C5-C4-N3	-5.63	118.96	126.72
3	C	401	ATP	C5-C4-N3	-5.58	119.03	126.72
3	A	401	ATP	C5-C4-N3	-5.51	119.13	126.72
3	C	401	ATP	N3-C4-N9	4.61	135.02	127.17
3	G	401	ATP	N3-C4-N9	4.60	134.99	127.17
3	E	401	ATP	N3-C4-N9	4.54	134.88	127.17
3	A	401	ATP	N3-C4-N9	4.34	134.55	127.17
3	G	401	ATP	C2-N3-C4	3.74	120.97	111.83
3	A	401	ATP	C4-C5-N7	-3.72	106.32	110.58
3	G	401	ATP	C4-C5-N7	-3.72	106.32	110.58
3	E	401	ATP	C2-N3-C4	3.72	120.93	111.83
3	A	401	ATP	C2-N3-C4	3.66	120.77	111.83
3	E	401	ATP	N3-C2-N1	-3.47	123.33	128.58
3	C	401	ATP	C2-N3-C4	3.45	120.26	111.83
3	E	401	ATP	C4-C5-N7	-3.32	106.78	110.58
3	C	401	ATP	C4-C5-N7	-3.32	106.79	110.58
3	A	401	ATP	N3-C2-N1	-3.31	123.58	128.58
3	G	401	ATP	N3-C2-N1	-3.21	123.73	128.58
3	C	401	ATP	N3-C2-N1	-3.11	123.87	128.58
3	C	401	ATP	C4-N9-C8	3.06	108.96	105.74
3	A	401	ATP	C4-N9-C8	3.06	108.95	105.74
3	E	401	ATP	C4-N9-C8	2.95	108.83	105.74
3	G	401	ATP	C5-N7-C8	2.87	107.96	103.45
3	A	401	ATP	C5-N7-C8	2.85	107.94	103.45
3	G	401	ATP	C4-N9-C8	2.84	108.72	105.74
3	E	401	ATP	O4'-C1'-N9	2.73	113.34	108.09
3	C	401	ATP	C5-N7-C8	2.59	107.53	103.45
3	E	401	ATP	C5-N7-C8	2.49	107.37	103.45
3	A	401	ATP	N9-C8-N7	-2.44	110.47	113.94
3	A	401	ATP	C6-C5-N7	2.38	136.69	132.09
3	G	401	ATP	N9-C8-N7	-2.36	110.59	113.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	G	401	ATP	C6-C5-N7	2.25	136.42	132.09
3	C	401	ATP	N9-C8-N7	-2.23	110.77	113.94
3	G	401	ATP	O4'-C1'-N9	2.19	112.30	108.09
3	E	401	ATP	N9-C8-N7	-2.17	110.86	113.94
3	E	401	ATP	C6-C5-N7	2.16	136.25	132.09

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	401	ATP	PG-O3B-PB-O1B
3	E	401	ATP	PG-O3B-PB-O1B
3	G	401	ATP	PG-O3B-PB-O1B
3	C	401	ATP	PG-O3B-PB-O2B
3	E	401	ATP	PG-O3B-PB-O2B
3	G	401	ATP	PG-O3B-PB-O2B
3	E	401	ATP	C3'-C4'-C5'-O5'
3	A	401	ATP	PG-O3B-PB-O1B
3	E	401	ATP	O4'-C4'-C5'-O5'
7	C	404	EDO	O1-C1-C2-O2
3	A	401	ATP	PG-O3B-PB-O2B
3	A	401	ATP	C3'-C4'-C5'-O5'

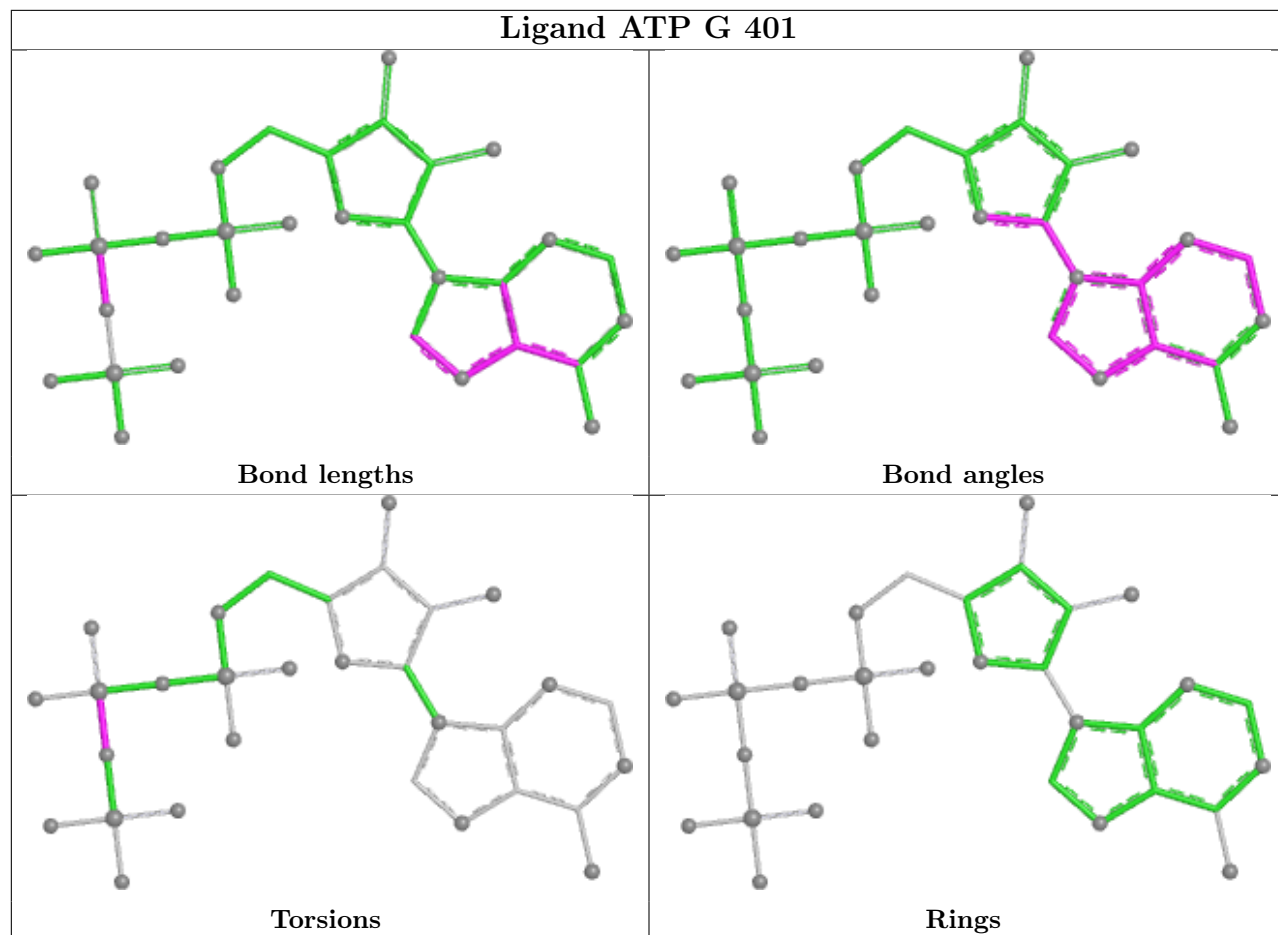
There are no ring outliers.

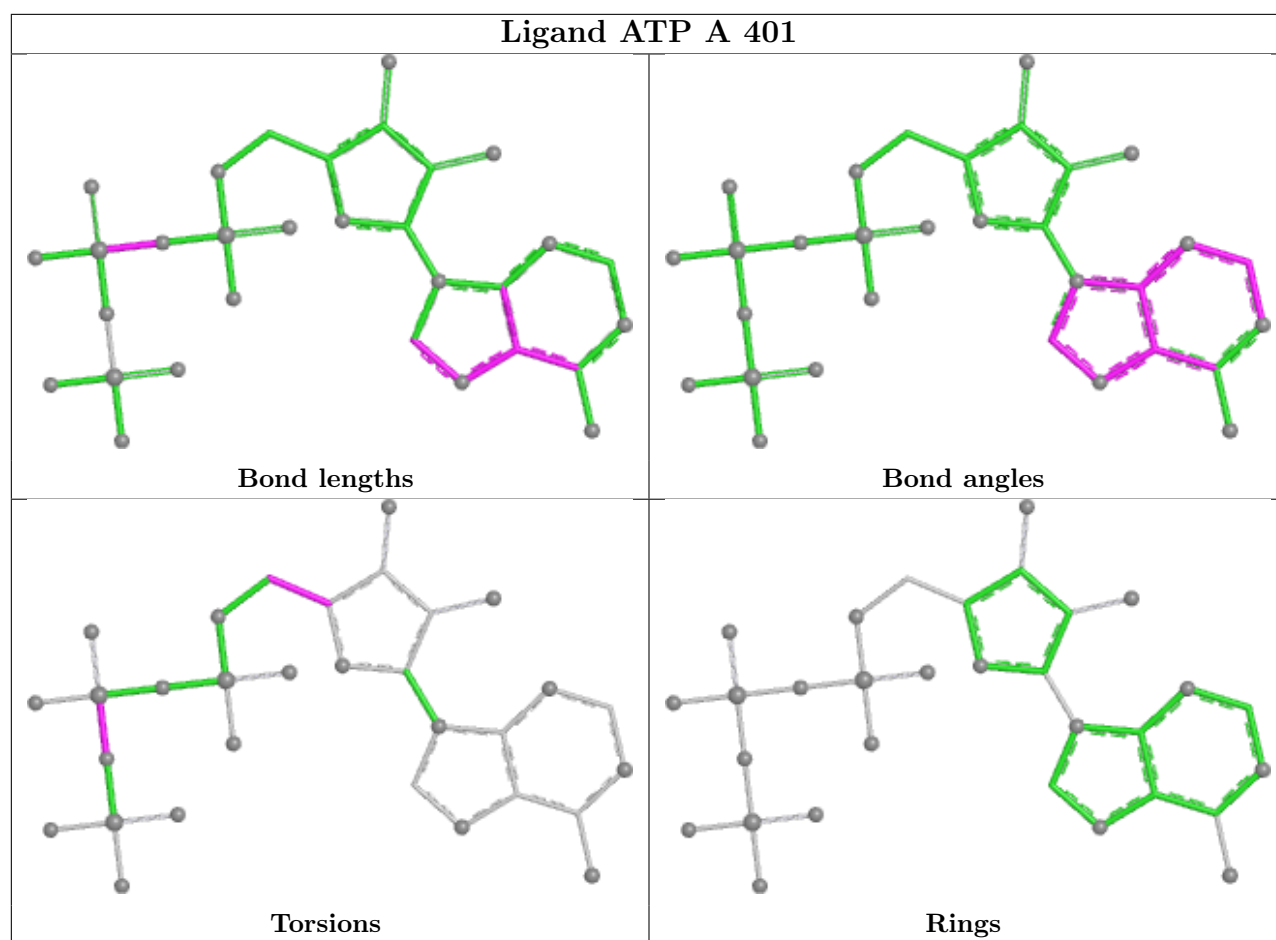
3 monomers are involved in 4 short contacts:

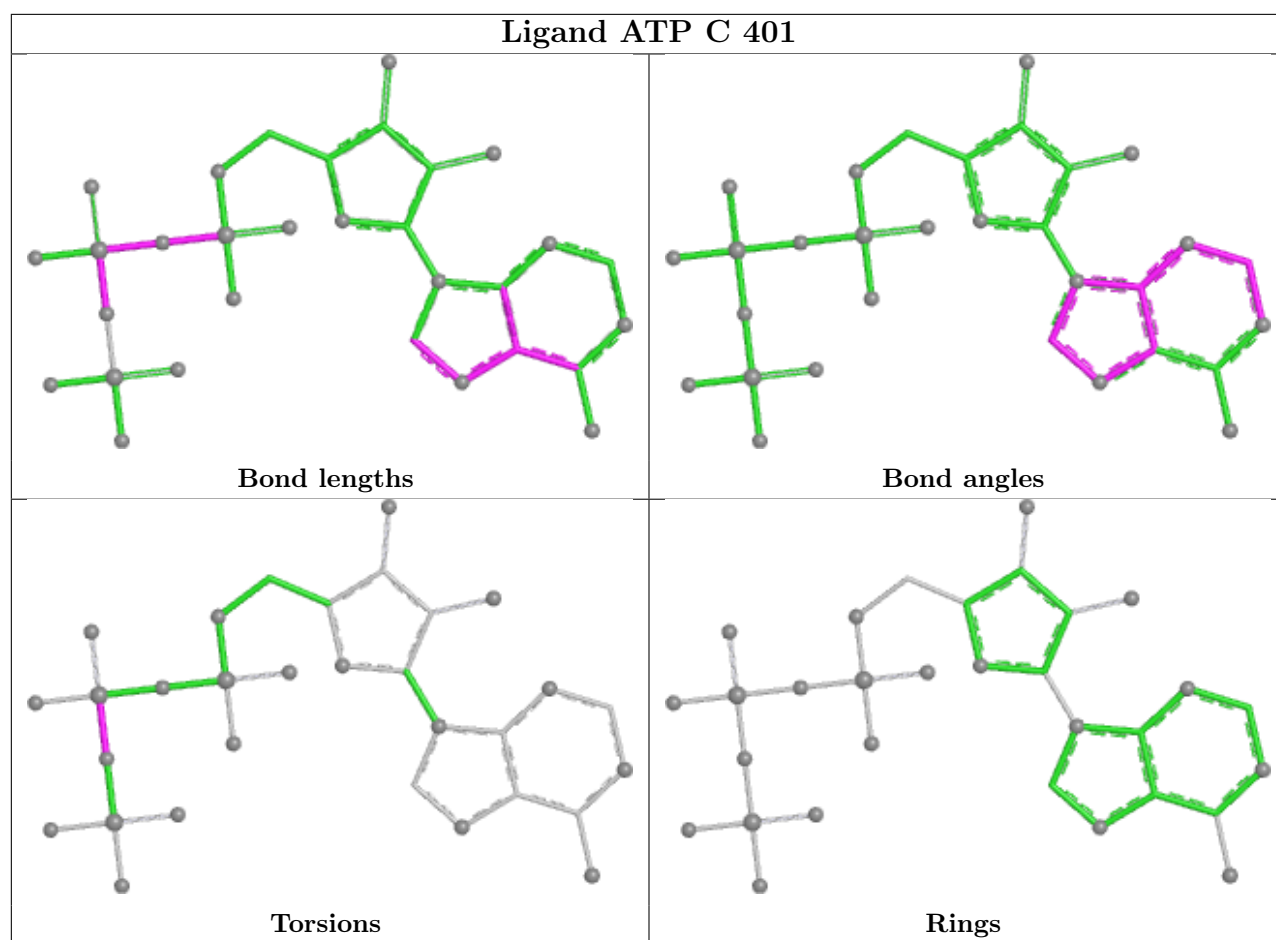
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	G	401	ATP	1	0
3	A	401	ATP	1	0
7	A	405	EDO	2	0

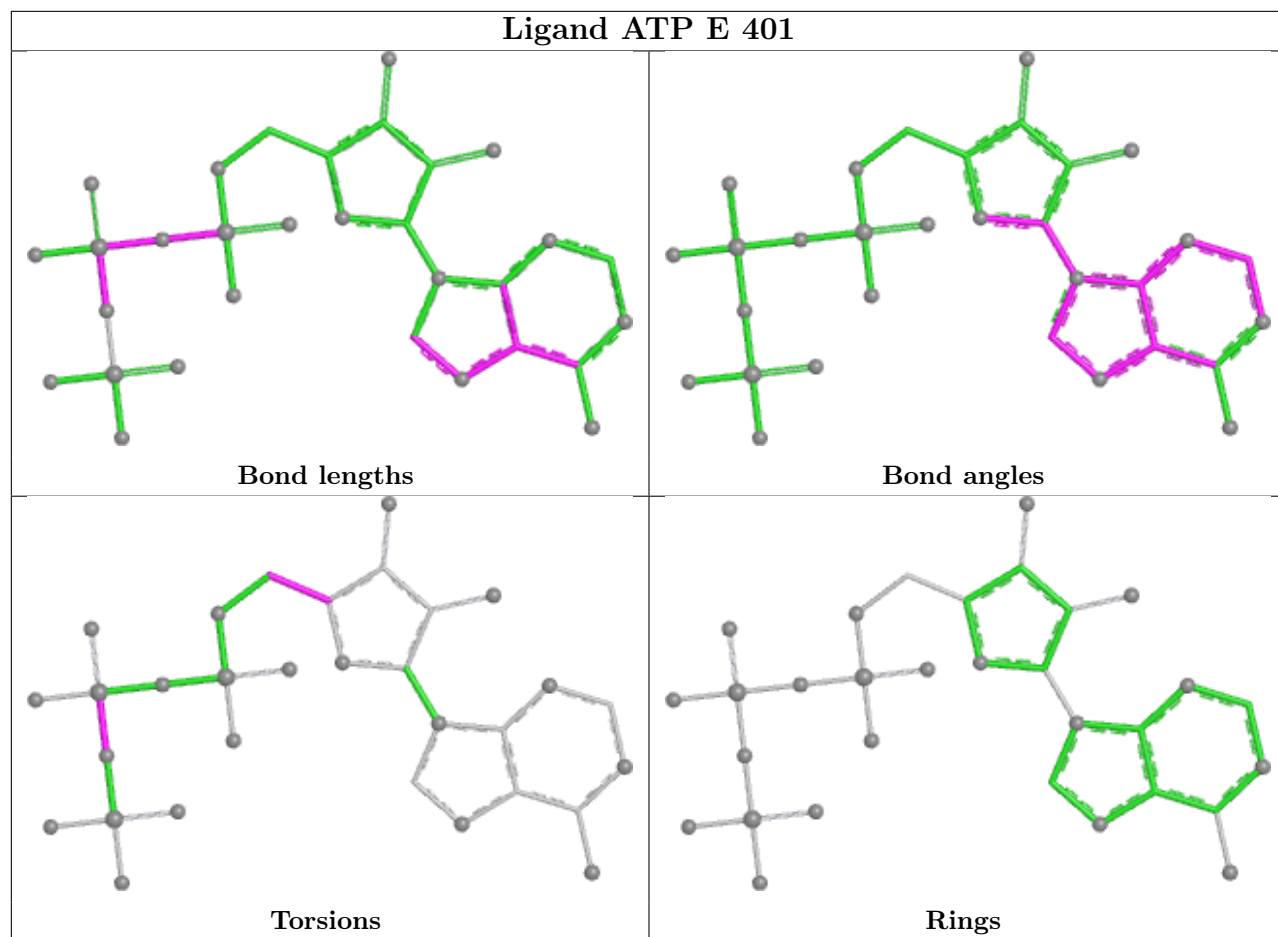
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	358/377 (94%)	0.27	14 (3%) 43 42	13, 38, 59, 81	4 (1%)
1	C	350/377 (92%)	0.24	7 (2%) 65 64	23, 38, 62, 73	0
1	E	352/377 (93%)	0.42	13 (3%) 45 44	19, 41, 68, 88	1 (0%)
1	G	347/377 (92%)	0.46	9 (2%) 57 56	16, 43, 68, 76	1 (0%)
2	B	140/148 (94%)	-0.05	1 (0%) 84 84	22, 33, 52, 66	0
2	D	139/148 (93%)	0.21	2 (1%) 73 73	23, 37, 66, 75	0
2	F	138/148 (93%)	0.46	6 (4%) 40 39	27, 43, 70, 91	0
2	H	139/148 (93%)	0.18	2 (1%) 73 73	28, 39, 57, 74	0
All	All	1963/2100 (93%)	0.30	54 (2%) 55 54	13, 39, 65, 91	6 (0%)

All (54) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	84	PRO	3.5
1	A	366	GLY	3.3
1	G	243	PRO	3.2
1	E	53	TYR	3.1
1	A	203	THR	3.1
2	F	145	LEU	3.1
1	C	324	THR	3.0
1	E	5	THR	3.0
1	C	38	PRO	2.8
1	E	368	SER	2.7
1	E	230	ALA	2.7
1	A	63	GLY	2.6
1	E	38	PRO	2.6
1	C	131	ALA	2.5
1	G	34	ILE	2.5
1	G	370	VAL	2.5

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Mol	Chain	Res	Type	RSRZ
1	G	367	PRO	2.5
2	F	21	LEU	2.5
1	A	169	TYR	2.4
1	G	36	GLY	2.4
1	E	228	ALA	2.4
2	D	85	ASP	2.4
1	A	370	VAL	2.4
1	E	367	PRO	2.4
2	F	17	LEU	2.4
1	A	176[A]	MET	2.4
1	C	114	ALA	2.3
2	F	87	LEU	2.3
1	A	62	ARG	2.3
1	A	64	ILE	2.3
2	F	139	LEU	2.3
1	E	369	ILE	2.3
1	A	57	GLU	2.2
1	E	250	ILE	2.2
1	A	38	PRO	2.2
2	B	144	GLY	2.2
1	C	110	LEU	2.2
2	H	145	LEU	2.2
1	A	65	LEU	2.2
1	A	52	SER	2.2
1	E	34	ILE	2.2
1	E	366	GLY	2.2
1	G	294	TYR	2.2
1	C	322	PRO	2.1
2	F	19	THR	2.1
1	G	35	VAL	2.1
1	C	319	ALA	2.1
1	A	367	PRO	2.1
1	E	372	ARG	2.1
2	H	134	GLU	2.1
1	G	366	GLY	2.1
1	G	68	LYS	2.0
1	A	365	ALA	2.0
1	E	66	THR	2.0

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	HIC	G	73	11/12	0.90	0.10	41,46,55,59	0
1	HIC	A	73	11/12	0.92	0.10	37,42,51,65	0
1	HIC	E	73	11/12	0.93	0.08	28,33,40,47	0
1	HIC	C	73	11/12	0.94	0.08	31,38,42,43	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
7	EDO	E	404	4/4	0.85	0.15	41,46,47,50	0
5	ACT	B	204	4/4	0.87	0.13	35,41,51,58	0
7	EDO	C	404	4/4	0.88	0.14	45,47,53,60	0
6	NA	G	403	1/1	0.89	0.08	58,58,58,58	0
5	ACT	A	403	4/4	0.90	0.10	27,37,41,43	0
7	EDO	G	404	4/4	0.91	0.12	41,45,45,53	0
6	NA	C	403	1/1	0.93	0.07	46,46,46,46	0
7	EDO	A	405	4/4	0.94	0.09	38,44,45,53	0
6	NA	A	404	1/1	0.94	0.06	50,50,50,50	0
5	ACT	D	203	4/4	0.95	0.07	28,38,40,40	0
5	ACT	B	203	4/4	0.96	0.07	29,33,33,33	0
4	CA	D	201	1/1	0.97	0.04	37,37,37,37	0
4	CA	F	400	1/1	0.97	0.04	36,36,36,36	0
3	ATP	A	401	31/31	0.97	0.06	24,30,36,37	0
3	ATP	G	401	31/31	0.97	0.06	29,36,41,44	0
6	NA	E	403	1/1	0.97	0.06	35,35,35,35	0
3	ATP	E	401	31/31	0.98	0.06	24,30,35,36	0
3	ATP	C	401	31/31	0.98	0.06	22,27,31,32	0

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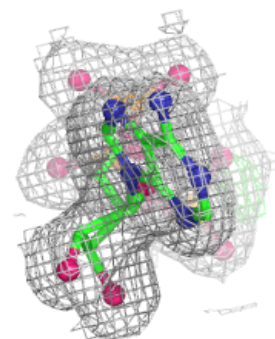
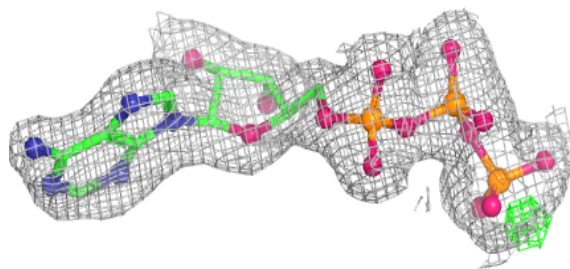
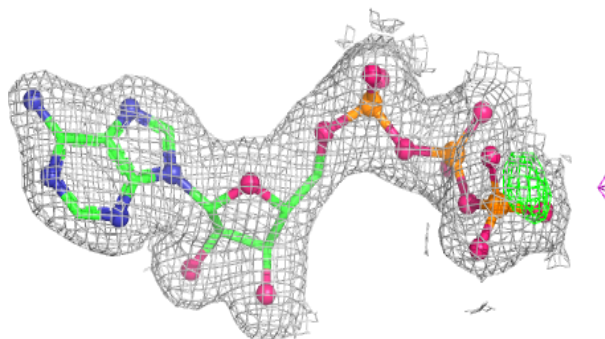
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	CA	H	400	1/1	0.98	0.03	38,38,38,38	0
4	CA	A	402	1/1	0.98	0.03	29,29,29,29	0
4	CA	B	201	1/1	0.98	0.03	33,33,33,33	0
4	CA	B	202	1/1	0.99	0.02	26,26,26,26	0
4	CA	H	401	1/1	0.99	0.03	32,32,32,32	0
4	CA	D	202	1/1	0.99	0.02	28,28,28,28	0
4	CA	E	402	1/1	0.99	0.02	26,26,26,26	0
4	CA	C	402	1/1	0.99	0.02	28,28,28,28	0
4	CA	F	401	1/1	0.99	0.02	34,34,34,34	0
4	CA	G	402	1/1	0.99	0.02	34,34,34,34	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

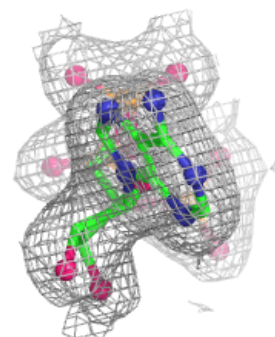
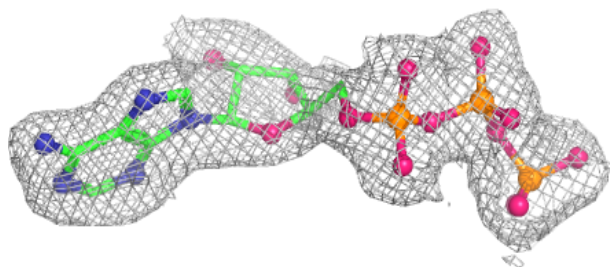
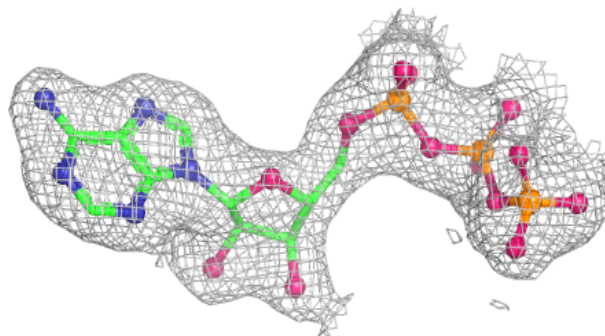
Electron density around ATP A 401:

2mF_o-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

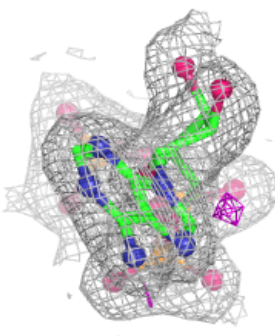
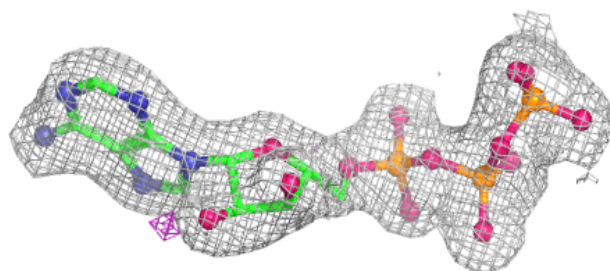
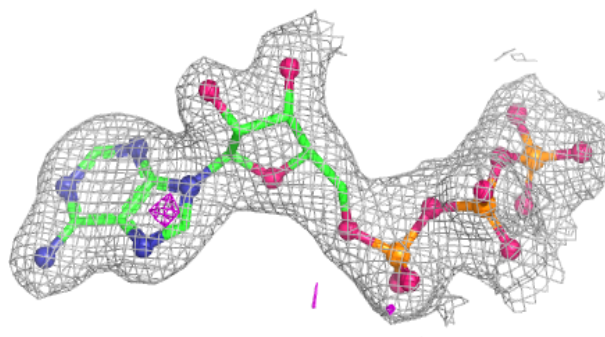


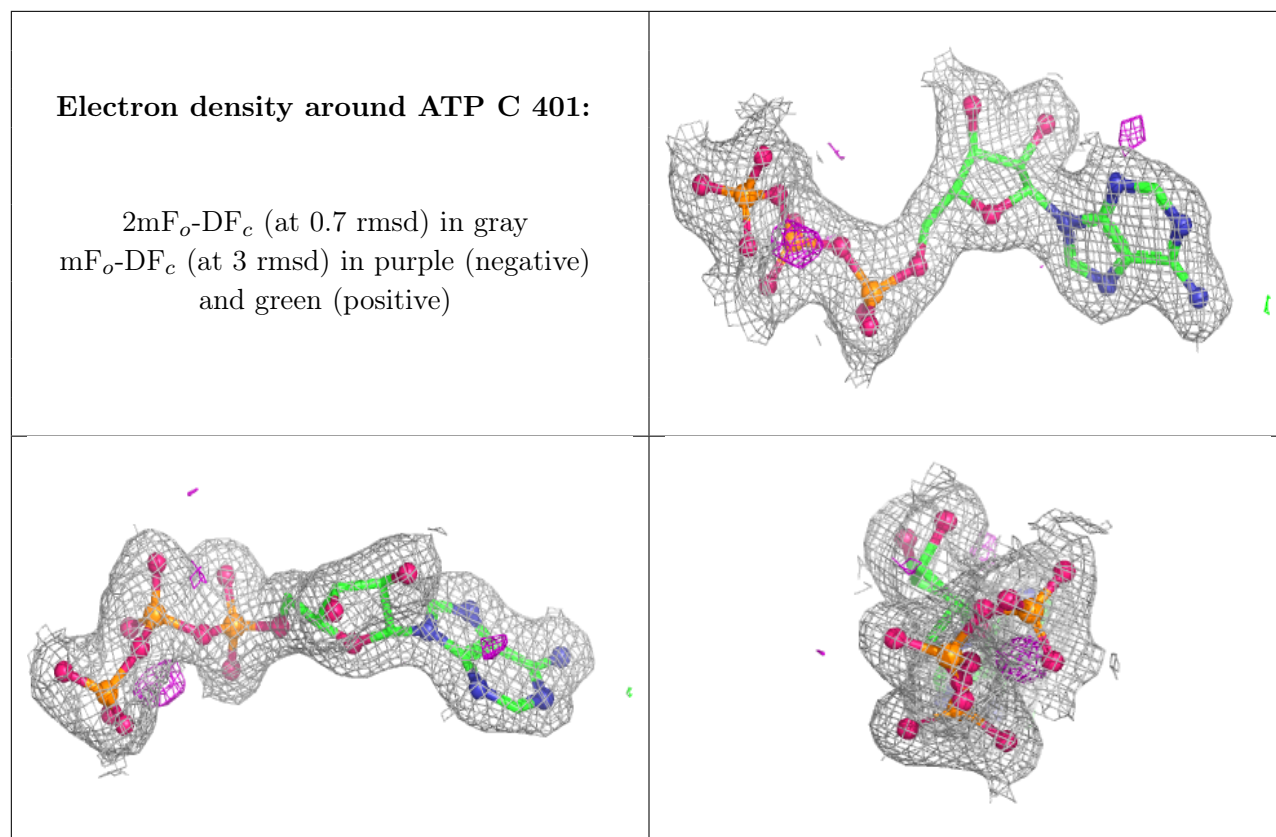
Electron density around ATP G 401:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

**Electron density around ATP E 401:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers [i](#)

There are no such residues in this entry.