



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 02:20 PM UTC

PDB ID : 3EIU / pdb_00003eiu
Title : A second transient position of ATP on its trail to the nucleotide-binding site of subunit B of the motor protein A1Ao ATP synthase
Authors : Manimekalai, S.M.S.; Kumar, A.; Balakrishna, A.M.; Gruber, G.
Deposited on : 2008-09-17
Resolution : 3.43 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

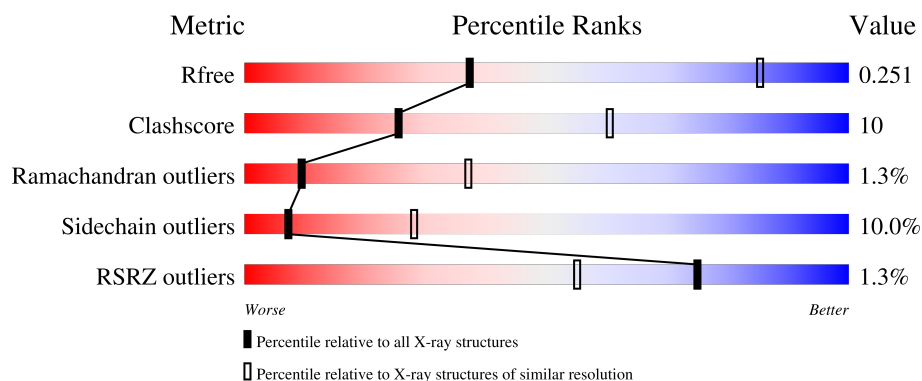
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.43 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	1736 (3.50-3.38)
Clashscore	190562	1808 (3.50-3.38)
Ramachandran outliers	187476	1776 (3.50-3.38)
Sidechain outliers	187428	1777 (3.50-3.38)
RSRZ outliers	180081	1736 (3.50-3.38)

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	469	2% 63% 23% • 11%
1	B	469	% 65% 23% • 9%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6550 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.

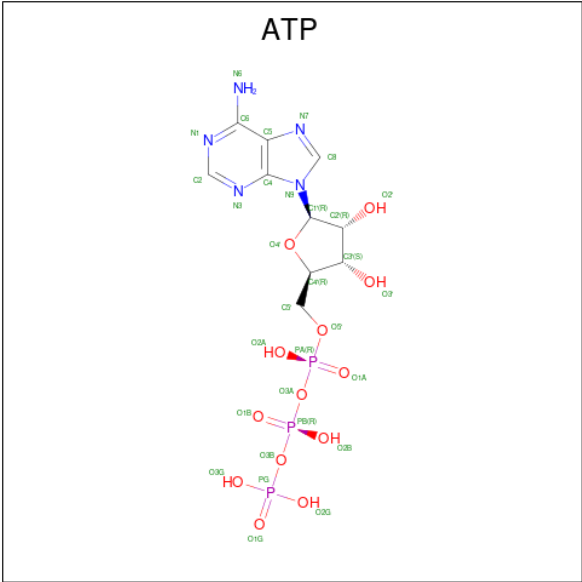
- Molecule 1 is a protein called V-type ATP synthase beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	418	Total	C	N	O	S	0	0	0
			3221	2044	552	614	11			
1	B	426	Total	C	N	O	S	0	0	0
			3285	2085	566	623	11			

There are 22 discrepancies between the modelled and reference sequences:

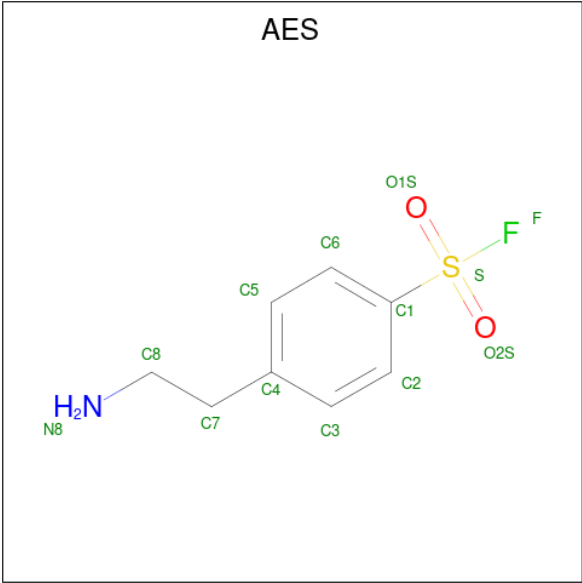
Chain	Residue	Modelled	Actual	Comment	Reference
A	-8	MET	-	expression tag	UNP Q60187
A	-7	LYS	-	expression tag	UNP Q60187
A	-6	HIS	-	expression tag	UNP Q60187
A	-5	HIS	-	expression tag	UNP Q60187
A	-4	HIS	-	expression tag	UNP Q60187
A	-3	HIS	-	expression tag	UNP Q60187
A	-2	HIS	-	expression tag	UNP Q60187
A	-1	HIS	-	expression tag	UNP Q60187
A	0	PRO	-	expression tag	UNP Q60187
A	2	VAL	ALA	SEE REMARK 999	UNP Q60187
A	416	TRP	ARG	engineered mutation	UNP Q60187
B	-8	MET	-	expression tag	UNP Q60187
B	-7	LYS	-	expression tag	UNP Q60187
B	-6	HIS	-	expression tag	UNP Q60187
B	-5	HIS	-	expression tag	UNP Q60187
B	-4	HIS	-	expression tag	UNP Q60187
B	-3	HIS	-	expression tag	UNP Q60187
B	-2	HIS	-	expression tag	UNP Q60187
B	-1	HIS	-	expression tag	UNP Q60187
B	0	PRO	-	expression tag	UNP Q60187
B	2	VAL	ALA	SEE REMARK 999	UNP Q60187
B	416	TRP	ARG	engineered mutation	UNP Q60187

- Molecule 2 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: C₁₀H₁₆N₅O₁₃P₃).



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

- Molecule 3 is 4-(2-AMINOETHYL)BENZENESULFONYL FLUORIDE (CCD ID: AES) (formula: C₈H₁₀FNO₂S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	B	1	Total	C	F	N	O	S	0
			13	8	1	1	2	1	



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	75.69Å 96.87Å 129.63Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	24.62 – 3.43 24.62 – 3.43	Depositor EDS
% Data completeness (in resolution range)	90.5 (24.62-3.43) 90.4 (24.62-3.43)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.98 (at 3.46Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.246 , 0.315 0.241 , 0.251	Depositor DCC
R_{free} test set	599 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	76.7	Xtriage
Anisotropy	0.143	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 45.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	6550	wwPDB-VP
Average B, all atoms (Å ²)	72.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.97% 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: ATP, AES

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	0.46	0/3283	0.85	1/4453 (0.0%)
1	B	0.43	0/3349	0.81	0/4542
All	All	0.44	0/6632	0.83	1/8995 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	110	ILE	N-CA-C	6.72	116.87	110.42

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	3221	0	3222	62	0
1	B	3285	0	3287	68	0
2	A	31	0	12	0	0
3	B	13	0	10	1	0
All	All	6550	0	6531	126	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 (126) 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:B:388:VAL:O	1:B:392:ALA:HB3	1.49	1.12
1:A:327:VAL:HG21	1:A:345:PRO:HB2	1.67	0.76
1:B:248:ASP:H	1:B:302:ILE:HB	1.51	0.74
1:A:248:ASP:H	1:A:302:ILE:HB	1.54	0.73
1:A:385:VAL:HG22	1:A:393:LEU:HD11	1.73	0.71
1:A:197:PHE:HB3	1:A:203:LEU:HD22	1.72	0.71
1:B:452:TYR:HA	1:B:457:ARG:HD3	1.76	0.68
1:A:347:LEU:HB3	1:B:349:ARG:HH22	1.59	0.67
1:A:132:SER:HB2	1:A:425:THR:HG23	1.76	0.67
1:A:128:GLN:HE22	1:A:421:THR:HA	1.58	0.66
1:A:127:ILE:HG13	1:A:142:ARG:HG2	1.79	0.65
1:B:139:THR:HB	1:B:351:MET:HG3	1.81	0.62
1:B:129:THR:HG23	1:B:131:ILE:H	1.64	0.62
1:A:366:ALA:HB1	1:A:444:ILE:HG22	1.80	0.61
1:A:128:GLN:NE2	1:A:421:THR:HA	2.16	0.61
1:A:438:GLU:HA	1:A:441:LEU:HD13	1.82	0.60
1:A:197:PHE:HB3	1:A:203:LEU:CD2	2.32	0.58
1:A:19:GLU:HG3	1:A:76:LEU:HA	1.86	0.58
1:B:323:GLU:HG2	1:B:350:LEU:HD21	1.86	0.57
1:A:281:ALA:HA	1:A:284:TYR:CZ	2.40	0.57
1:B:88:ILE:HD13	1:B:194:MET:HG3	1.86	0.57
1:B:158:GLU:HB3	1:B:416:TRP:CZ2	2.39	0.57
1:A:347:LEU:HD21	1:B:347:LEU:HD22	1.87	0.57
1:B:211:ASN:HD21	1:B:220:ARG:CD	2.18	0.56
1:A:344:LEU:HB2	1:A:345:PRO:HD3	1.87	0.56
1:B:344:LEU:HD11	1:B:379:ARG:HG3	1.87	0.56
1:A:381:LEU:O	1:A:385:VAL:HG23	2.06	0.55
1:A:367:VAL:HG12	1:A:371:MET:HE2	1.89	0.55
1:A:144:GLN:HG3	1:A:350:LEU:HD12	1.90	0.53
1:B:306:PRO:HD2	1:B:314:ILE:HG22	1.90	0.53
1:A:125:ASP:HB3	1:A:142:ARG:NH1	2.25	0.52
1:A:144:GLN:H	1:A:298:THR:HG23	1.74	0.52
1:B:87:ARG:HH11	1:B:100:PRO:HG2	1.74	0.51
1:A:247:THR:HA	1:A:302:ILE:HD13	1.91	0.51
1:A:273:PRO:HB3	1:A:275:TYR:CE2	2.46	0.51
1:B:129:THR:HG21	1:B:134:ILE:HB	1.92	0.51
1:B:388:VAL:O	1:B:392:ALA:CB	2.41	0.51
1:A:183:MET:HA	1:A:211:ASN:HB3	1.92	0.51
1:A:40:ARG:HD2	1:A:56:VAL:HG21	1.92	0.50
1:B:86:GLY:HA2	1:B:203:LEU:HG	1.92	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:344:LEU:HB2	1:B:345:PRO:HD3	1.92	0.50
1:A:254:GLU:HA	1:A:257:ARG:HB3	1.93	0.50
1:B:178:VAL:O	1:B:206:ALA:HA	2.11	0.50
1:B:442:GLY:C	1:B:444:ILE:H	2.19	0.50
1:B:429:GLY:O	1:B:432:ILE:HG22	2.12	0.50
1:B:85:LEU:H	1:B:207:VAL:HG22	1.77	0.49
1:B:236:TYR:HD2	1:B:237:GLU:HG3	1.76	0.49
1:A:193:PHE:CD2	1:A:193:PHE:N	2.81	0.49
1:A:165:ARG:HD2	1:A:200:THR:HG21	1.95	0.48
1:A:235:ALA:HA	1:A:240:MET:O	2.13	0.48
1:A:338:TYR:HH	1:A:416:TRP:CD1	2.31	0.48
1:B:129:THR:HG22	1:B:135:ASP:CG	2.38	0.48
1:B:344:LEU:HA	1:B:372:TYR:CE1	2.49	0.48
1:A:284:TYR:HB3	1:A:320:TYR:CE2	2.47	0.48
1:A:379:ARG:HH21	1:B:319:GLY:HA2	1.78	0.48
1:B:234:LEU:HD22	1:B:240:MET:HE2	1.96	0.48
1:A:193:PHE:N	1:A:193:PHE:HD2	2.11	0.48
1:B:211:ASN:HD21	1:B:220:ARG:HD2	1.78	0.47
1:B:225:ARG:NH1	1:B:252:TYR:OH	2.46	0.47
1:A:178:VAL:O	1:A:206:ALA:HA	2.15	0.47
1:A:103:VAL:HA	1:A:104:PRO:HD3	1.85	0.46
1:B:366:ALA:HB1	1:B:444:ILE:HG13	1.97	0.46
1:A:160:ALA:HB1	1:A:245:ILE:HG21	1.96	0.45
1:B:186:THR:HG23	1:B:189:GLU:H	1.81	0.45
1:A:125:ASP:C	1:A:142:ARG:HG3	2.42	0.45
1:B:384:LEU:HA	1:B:387:ILE:HD12	1.98	0.45
1:A:173:GLU:H	1:A:173:GLU:HG2	1.55	0.45
1:A:145:LYS:HD3	1:A:284:TYR:O	2.15	0.45
1:B:87:ARG:NH1	1:B:100:PRO:HG2	2.32	0.45
1:A:379:ARG:O	1:A:382:ARG:HB2	2.17	0.45
1:B:182:ALA:HA	1:B:247:THR:CG2	2.46	0.44
1:B:339:PRO:HA	1:B:340:PRO:HD3	1.80	0.44
1:A:316:ASP:OD2	1:B:330:ARG:HB2	2.16	0.44
1:B:256:LEU:HD13	1:B:276:MET:HG2	1.99	0.44
1:B:162:GLN:CA	1:B:165:ARG:HH21	2.31	0.44
1:B:165:ARG:HD3	1:B:200:THR:HG21	1.98	0.44
1:B:165:ARG:HH22	1:B:416:TRP:CD1	2.36	0.44
1:B:367:VAL:HG12	1:B:371:MET:HE2	1.99	0.44
1:A:78:LEU:HB2	1:A:226:MET:SD	2.58	0.43
1:B:396:ARG:HD3	1:B:396:ARG:C	2.43	0.43
1:A:228:LEU:HD13	1:A:286:ARG:HG3	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:355:ILE:HG13	1:B:364:HIS:CG	2.53	0.43
1:A:236:TYR:HE1	1:A:291:LYS:HB2	1.84	0.43
1:B:378:GLY:HA3	1:B:404:ALA:HB2	1.99	0.43
1:B:181:ALA:O	1:B:247:THR:HG22	2.19	0.43
1:B:26:TYR:OH	3:B:461:AES:H72	2.17	0.43
1:B:154:LEU:HD21	1:B:330:ARG:HG2	2.01	0.43
1:A:141:VAL:HG21	1:A:350:LEU:O	2.19	0.43
1:B:124:LYS:HG3	1:B:125:ASP:H	1.83	0.43
1:B:391:GLU:OE1	1:B:391:GLU:HA	2.17	0.43
1:B:430:TRP:O	1:B:434:THR:HG23	2.19	0.43
1:A:175:ALA:O	1:A:240:MET:HB2	2.19	0.43
1:A:445:ASP:HB3	1:A:448:TYR:CD1	2.54	0.43
1:B:131:ILE:HB	1:B:134:ILE:HD12	2.01	0.43
1:B:356:GLY:O	1:B:359:LYS:HB2	2.18	0.43
1:A:33:LYS:HB2	1:A:74:GLU:HB3	2.00	0.42
1:B:162:GLN:HA	1:B:165:ARG:HE	1.84	0.42
1:B:363:ASP:O	1:B:364:HIS:C	2.62	0.42
1:A:449:ILE:O	1:A:453:HIS:HB2	2.20	0.42
1:B:182:ALA:HA	1:B:247:THR:HG22	2.00	0.42
1:A:127:ILE:CG1	1:A:142:ARG:HG2	2.48	0.42
1:B:78:LEU:O	1:B:107:LEU:HA	2.19	0.42
1:A:132:SER:H	1:A:414:GLN:HE22	1.67	0.42
1:A:301:PRO:HG3	1:A:320:TYR:CE2	2.54	0.42
1:B:128:GLN:O	1:B:167:ALA:HA	2.20	0.42
1:B:90:SER:C	1:B:92:SER:H	2.25	0.42
1:B:335:LYS:O	1:B:335:LYS:HG3	2.20	0.41
1:A:286:ARG:H	1:A:286:ARG:HG2	1.72	0.41
1:B:91:GLY:O	1:B:226:MET:HG3	2.21	0.41
1:B:147:PRO:HB3	1:B:301:PRO:HG2	2.02	0.41
1:B:203:LEU:C	1:B:205:ARG:H	2.28	0.41
1:A:18:VAL:HA	1:A:75:THR:HA	2.02	0.41
1:A:167:ALA:O	1:A:205:ARG:NH1	2.53	0.41
1:A:203:LEU:C	1:A:205:ARG:H	2.29	0.41
1:A:318:SER:HA	1:A:321:ILE:HD12	2.03	0.41
1:B:102:ILE:H	1:B:102:ILE:HG13	1.66	0.41
1:B:159:ILE:HD12	1:B:339:PRO:HB3	2.03	0.41
1:A:110:ILE:HD12	1:A:111:ASN:H	1.86	0.40
1:B:17:PHE:HB2	1:B:110:ILE:HD11	2.02	0.40
1:A:339:PRO:HA	1:A:340:PRO:HD3	2.00	0.40
1:A:384:LEU:O	1:A:388:VAL:HG22	2.22	0.40
1:B:15:LEU:HA	1:B:54:VAL:O	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:119:ALA:HB2	1:B:291:LYS:HA	2.03	0.40
1:A:37:GLY:O	1:A:38:THR:C	2.65	0.40
1:A:344:LEU:HA	1:A:372:TYR:CE2	2.56	0.40
1:B:217:ALA:HA	1:B:220:ARG:HG3	2.04	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all 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	412/469 (88%)	367 (89%)	40 (10%)	5 (1%)	10	38
1	B	420/469 (90%)	371 (88%)	43 (10%)	6 (1%)	9	35
All	All	832/938 (89%)	738 (89%)	83 (10%)	11 (1%)	9	37

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	38	THR
1	A	442	GLY
1	B	84	LEU
1	B	457	ARG
1	B	85	LEU
1	B	248	ASP
1	B	357	ALA
1	A	293	ALA
1	A	204	GLU
1	A	37	GLY
1	B	216	PRO

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	343/384 (89%)	304 (89%)	39 (11%)	5	23
1	B	348/384 (91%)	318 (91%)	30 (9%)	10	33
All	All	691/768 (90%)	622 (90%)	69 (10%)	7	28

All (69) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	THR
1	A	39	VAL
1	A	52	VAL
1	A	57	PHE
1	A	74	GLU
1	A	78	LEU
1	A	82	VAL
1	A	89	LEU
1	A	102	ILE
1	A	110	ILE
1	A	158	GLU
1	A	161	LEU
1	A	163	ILE
1	A	172	SER
1	A	173	GLU
1	A	189	GLU
1	A	191	GLN
1	A	193	PHE
1	A	199	LYS
1	A	203	LEU
1	A	214	ASP
1	A	246	LEU
1	A	248	ASP
1	A	257	ARG
1	A	276	MET
1	A	286	ARG
1	A	312	HIS

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Mol	Chain	Res	Type
1	A	314	ILE
1	A	320	TYR
1	A	362	GLU
1	A	368	SER
1	A	390	LYS
1	A	395	GLU
1	A	399	LYS
1	A	413	ARG
1	A	435	HIS
1	A	436	LEU
1	A	439	ASN
1	A	444	ILE
1	B	15	LEU
1	B	20	LYS
1	B	32	ILE
1	B	34	MET
1	B	57	PHE
1	B	75	THR
1	B	82	VAL
1	B	87	ARG
1	B	102	ILE
1	B	107	LEU
1	B	108	LEU
1	B	128	GLN
1	B	199	LYS
1	B	211	ASN
1	B	212	LEU
1	B	244	VAL
1	B	250	THR
1	B	259	MET
1	B	278	THR
1	B	305	MET
1	B	310	ILE
1	B	347	LEU
1	B	350	LEU
1	B	355	ILE
1	B	391	GLU
1	B	394	SER
1	B	396	ARG
1	B	406	LEU
1	B	422	ILE
1	B	447	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	27	ASN
1	A	128	GLN
1	A	211	ASN
1	A	238	HIS
1	A	299	GLN
1	A	312	HIS
1	A	333	HIS
1	A	414	GLN
1	A	439	ASN
1	B	106	GLN
1	B	116	ASN
1	B	138	ASN
1	B	162	GLN
1	B	166	GLN
1	B	211	ASN
1	B	299	GLN
1	B	333	HIS
1	B	352	ASN
1	B	414	GLN
1	B	417	ASN
1	B	450	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 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$
3	AES	B	461	-	12,13,13	0.66	0	17,18,18	1.15	1 (5%)
2	ATP	A	461	-	32,33,33	1.52	7 (21%)	48,52,52	1.77	9 (18%)

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
3	AES	B	461	-	-	5/9/9/9	0/1/1/1
2	ATP	A	461	-	-	2/22/38/38	0/3/3/3

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	461	ATP	C5-C4	4.83	1.47	1.39
2	A	461	ATP	C5-C6	2.87	1.49	1.41
2	A	461	ATP	PA-O3A	2.77	1.62	1.59
2	A	461	ATP	PB-O3A	2.46	1.62	1.59
2	A	461	ATP	C8-N7	2.28	1.36	1.31
2	A	461	ATP	C5-N7	-2.24	1.35	1.39
2	A	461	ATP	PB-O3B	2.15	1.61	1.59

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	461	ATP	C5-C4-N3	-5.83	118.68	126.72
2	A	461	ATP	N3-C4-N9	4.69	135.15	127.17
2	A	461	ATP	C2-N3-C4	3.81	121.14	111.83
2	A	461	ATP	N3-C2-N1	-3.46	123.35	128.58
2	A	461	ATP	C4-C5-N7	-3.41	106.69	110.58
3	B	461	AES	O2S-S-O1S	-3.06	109.98	119.18
2	A	461	ATP	C4-N9-C8	2.57	108.44	105.74

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	461	ATP	C5-N7-C8	2.57	107.48	103.45
2	A	461	ATP	C3'-C2'-C1'	2.22	105.66	101.46
2	A	461	ATP	C6-C5-N7	2.14	136.21	132.09

There are no chirality outliers.

All (7) torsion outliers are listed below:

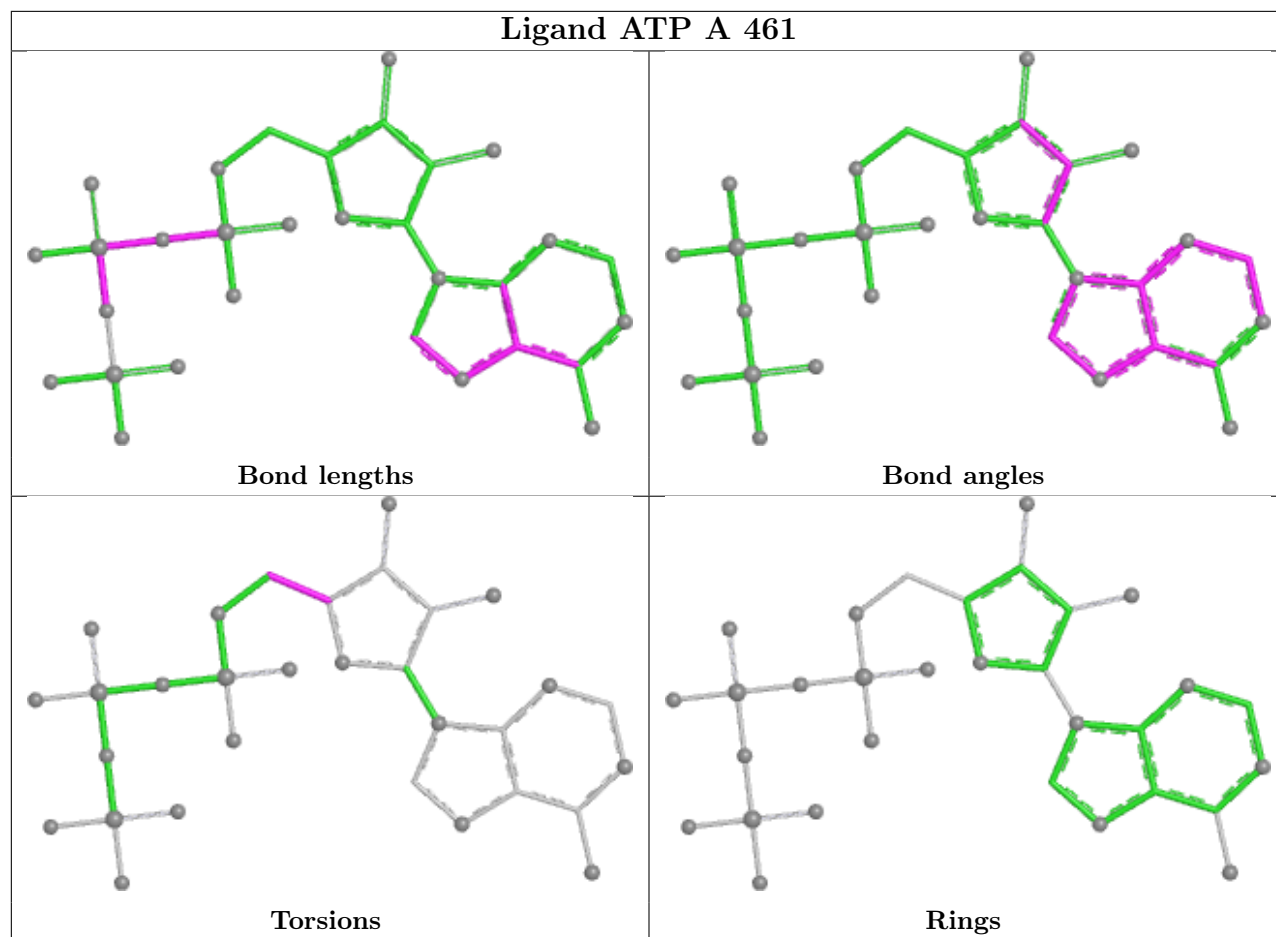
Mol	Chain	Res	Type	Atoms
3	B	461	AES	C4-C7-C8-N8
2	A	461	ATP	O4'-C4'-C5'-O5'
2	A	461	ATP	C3'-C4'-C5'-O5'
3	B	461	AES	C5-C4-C7-C8
3	B	461	AES	C3-C4-C7-C8
3	B	461	AES	C2-C1-S-O2S
3	B	461	AES	C6-C1-S-O2S

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	461	AES	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.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	418/469 (89%)	0.02	8 (1%) 66 45	55, 70, 89, 104	0
1	B	426/469 (90%)	-0.08	3 (0%) 84 67	26, 70, 89, 93	0
All	All	844/938 (89%)	-0.03	11 (1%) 75 55	26, 70, 89, 104	0

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	311	THR	3.3
1	A	442	GLY	3.3
1	A	14	PRO	2.8
1	A	315	PRO	2.5
1	A	445	ASP	2.4
1	A	310	ILE	2.3
1	A	308	ASP	2.3
1	B	311	THR	2.3
1	A	56	VAL	2.3
1	B	455	ALA	2.3
1	B	273	PRO	2.1

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

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

6.3 Carbohydrates [i](#)

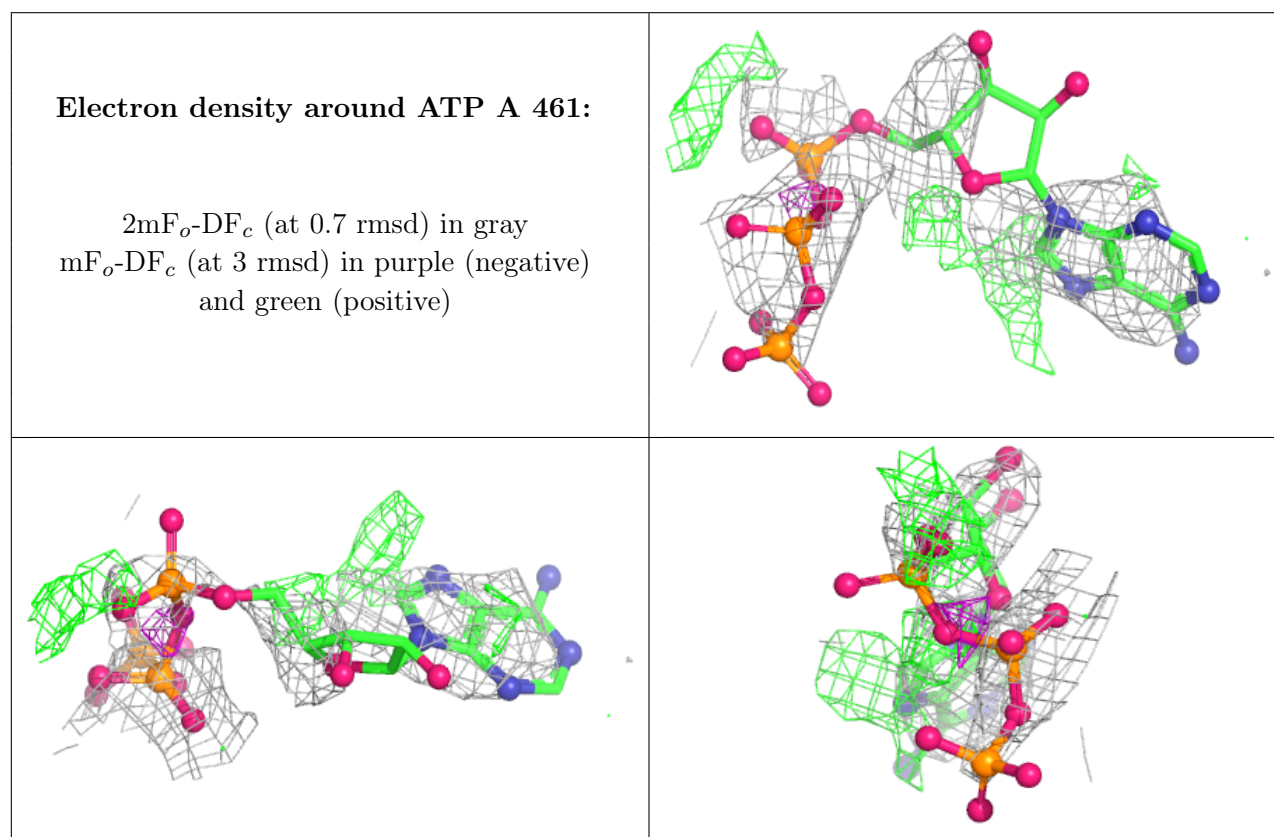
There are no oligosaccharides in this entry.

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
2	ATP	A	461	31/31	0.75	0.26	78,78,80,80	31
3	AES	B	461	13/13	0.89	0.18	72,73,74,74	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.



6.5 Other polymers [i](#)

There are no such residues in this entry.