



wwPDB/EMDataBank EM Map/Model Validation Summary Report ⓘ

Dec 9, 2019 – 03:04 AM EST

PDB ID : 6RDO
EMDB ID: : EMD-4825
Title : Cryo-EM structure of Polytomella F-ATP synthase, Rotary substate 1C, composite map
Authors : Murphy, B.J.; Klusch, N.; Yildiz, O.; Kuhlbrandt, W.
Deposited on : 2019-04-12
Resolution : 3.10 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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) : 2.4

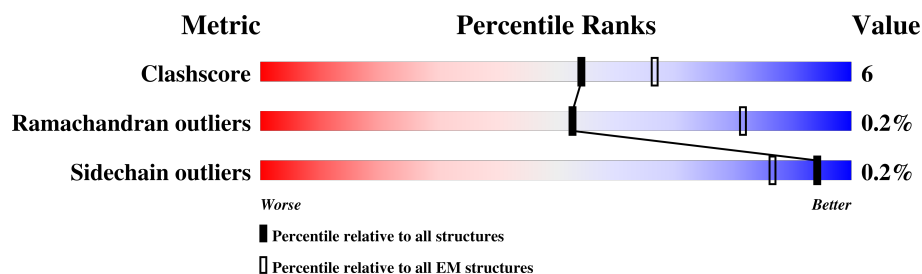
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.10 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.



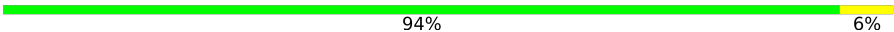
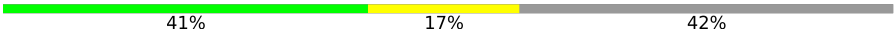
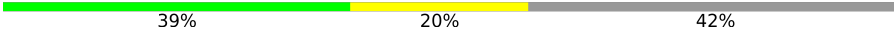
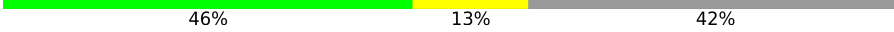


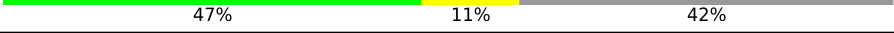
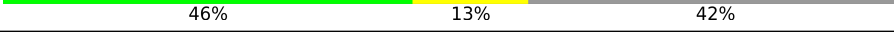
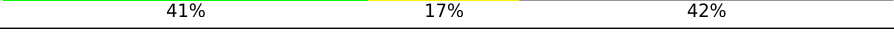
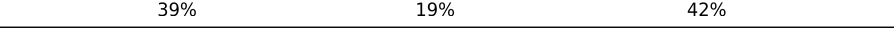
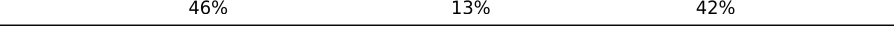
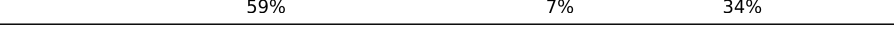
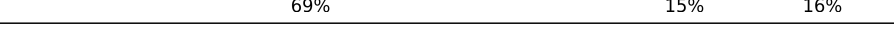


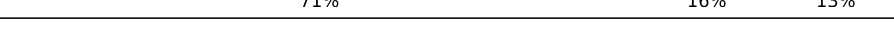






| Metric | Whole archive (#Entries) | EM structures (#Entries) |
|-----------------------|-----------------------------|-----------------------------|
| Clashscore | 136327 | 1886 |
| Ramachandran outliers | 132723 | 1663 |
| Sidechain outliers | 132532 | 1531 |

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 ≥ 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 | 0 | 82 | 98% .. |
| 2 | 1 | 618 | 85% 11% . |
| 3 | 2 | 441 | 87% 13% |
| 4 | 3 | 325 | 65% 11% 25% |
| 5 | 4 | 294 | 89% 10% . |
| 6 | 5 | 123 | 84% 15% . |
| 7 | 6 | 151 | 69% 13% 18% |
| 8 | 7 | 190 | 78% 14% 7% |
| 9 | 8 | 89 | 82% 17% . |

Continued on next page...

Continued from previous page...

| Mol | Chain | Length | Quality of chain |
|-----|-------|--------|----------------------------------------------------------------------------------------------------|
| 10 | 9 | 97 |  94% 6% |
| 11 | A | 127 |  41% 17% 42% |
| 11 | B | 127 |  39% 20% 42% |
| 11 | C | 127 |  46% 13% 42% |
| 11 | D | 127 |  53% 6% 42% |
| 11 | E | 127 |  49% 9% 42% |
| 11 | F | 127 |  47% 11% 42% |
| 11 | G | 127 |  46% 13% 42% |
| 11 | H | 127 |  41% 17% 42% |
| 11 | I | 127 |  39% 19% 42% |
| 11 | J | 127 |  46% 13% 42% |
| 12 | M | 327 |  59% 7% 34% |
| 13 | P | 229 |  69% 15% 16% |
| 14 | Q | 74 |  82% 15% . |
| 15 | R | 199 |  73% 15% . 11% |
| 16 | S | 317 |  71% 16% 13% |
| 17 | T | 562 |  80% 12% 7% |
| 17 | U | 562 |  79% 14% 7% |
| 17 | V | 562 |  80% 13% 7% |
| 18 | X | 574 |  79% 15% 6% |
| 18 | Y | 574 |  73% 17% 9% |
| 18 | Z | 574 |  83% 10% 6% |

2 Entry composition

There are 22 unique types of molecules in this entry. The entry contains 53748 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 ASA-10: Polytomella F-ATP synthase associated subunit 10.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---|---------|-------|
| 1 | 0 | 81 | Total | C | N | O | S | 0 | 0 |
| | | | 607 | 388 | 107 | 110 | 2 | | |

- Molecule 2 is a protein called ATP synthase associated protein ASA1.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|---|---------|-------|
| 2 | 1 | 595 | Total | C | N | O | S | 0 | 0 |
| | | | 4661 | 2958 | 798 | 900 | 5 | | |

- Molecule 3 is a protein called ASA-2: Polytomella F-ATP synthase associated subunit 2.

| Mol | Chain | Residues | Atoms | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|---------|-------|
| 3 | 2 | 441 | Total | C | N | O | 0 | 0 |
| | | | 3163 | 2020 | 532 | 611 | | |

- Molecule 4 is a protein called Mitochondrial F1F0 ATP synthase associated 32 kDa protein.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|---|---------|-------|
| 4 | 3 | 245 | Total | C | N | O | S | 0 | 0 |
| | | | 1874 | 1204 | 299 | 370 | 1 | | |

- Molecule 5 is a protein called Mitochondrial ATP synthase associated protein ASA4.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|---|---------|-------|
| 5 | 4 | 290 | Total | C | N | O | S | 0 | 0 |
| | | | 2177 | 1385 | 356 | 434 | 2 | | |

- Molecule 6 is a protein called Mitochondrial F1F0 ATP synthase associated 14 kDa protein.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---|---------|-------|
| 6 | 5 | 123 | Total | C | N | O | S | 0 | 0 |
| | | | 986 | 640 | 172 | 170 | 4 | | |

- Molecule 7 is a protein called Mitochondrial ATP synthase subunit ASA6.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---|---------|-------|
| 7 | 6 | 124 | Total | C | N | O | S | 0 | 0 |
| | | | 926 | 599 | 154 | 172 | 1 | | |

- Molecule 8 is a protein called Mitochondrial ATP synthase associated protein ASA7.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---|---------|-------|
| 8 | 7 | 176 | Total | C | N | O | S | 0 | 0 |
| | | | 1347 | 860 | 227 | 259 | 1 | | |

- Molecule 9 is a protein called Mitochondrial ATP synthase subunit ASA8.

| Mol | Chain | Residues | Atoms | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---------|-------|
| 9 | 8 | 88 | Total | C | N | O | 0 | 0 |
| | | | 692 | 456 | 115 | 121 | | |

- Molecule 10 is a protein called ASA-9: Polytomella F-ATP synthase associated subunit 9.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---|---------|-------|
| 10 | 9 | 97 | Total | C | N | O | S | 0 | 0 |
| | | | 776 | 514 | 124 | 132 | 6 | | |

- Molecule 11 is a protein called Mitochondrial ATP synthase subunit c.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|----|----|---|---------|-------|
| 11 | A | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | B | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | C | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | D | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | E | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | F | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | G | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | H | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |

Continued on next page...

Continued from previous page...

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|----|----|---|---------|-------|
| 11 | I | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |
| 11 | J | 74 | Total | C | N | O | S | 0 | 0 |
| | | | 514 | 340 | 83 | 88 | 3 | | |

- Molecule 12 is a protein called Mitochondrial ATP synthase subunit 6.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|---|---------|-------|
| 12 | M | 217 | Total | C | N | O | S | 0 | 0 |
| | | | 1640 | 1077 | 267 | 288 | 8 | | |

- Molecule 13 is a protein called Mitochondrial ATP synthase subunit OSCP.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---|---------|-------|
| 13 | P | 193 | Total | C | N | O | S | 0 | 0 |
| | | | 1532 | 988 | 250 | 290 | 4 | | |

- Molecule 14 is a protein called epsilon: Polytomella F-ATP synthase epsilon subunit.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|----|---|---------|-------|
| 14 | Q | 72 | Total | C | N | O | S | 0 | 0 |
| | | | 561 | 358 | 102 | 99 | 2 | | |

- Molecule 15 is a protein called Mitochondrial ATP synthase subunit delta.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|-----|-----|-----|---|---------|-------|
| 15 | R | 177 | Total | C | N | O | S | 0 | 0 |
| | | | 1303 | 833 | 213 | 256 | 1 | | |

- Molecule 16 is a protein called ATP synthase gamma chain, mitochondrial.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|----|---------|-------|
| 16 | S | 277 | Total | C | N | O | S | 0 | 0 |
| | | | 2130 | 1327 | 377 | 416 | 10 | | |

- Molecule 17 is a protein called ATP synthase subunit alpha.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|----|---------|-------|
| 17 | T | 523 | Total | C | N | O | S | 0 | 0 |
| | | | 3979 | 2537 | 703 | 728 | 11 | | |

Continued on next page...

Continued from previous page...

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|----|---------|-------|
| 17 | U | 523 | Total | C | N | O | S | 0 | 0 |
| | | | 3980 | 2537 | 703 | 729 | 11 | | |
| 17 | V | 520 | Total | C | N | O | S | 0 | 0 |
| | | | 3962 | 2527 | 700 | 724 | 11 | | |

There are 3 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|-------|---------|----------|--------|----------|------------|
| T | 266 | ARG | LYS | conflict | UNP A0ZW40 |
| U | 266 | ARG | LYS | conflict | UNP A0ZW40 |
| V | 266 | ARG | LYS | conflict | UNP A0ZW40 |

- Molecule 18 is a protein called ATP synthase subunit beta.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|----|---------|-------|
| 18 | X | 542 | Total | C | N | O | S | 0 | 0 |
| | | | 4115 | 2586 | 696 | 820 | 13 | | |
| 18 | Y | 521 | Total | C | N | O | S | 0 | 0 |
| | | | 3957 | 2485 | 670 | 789 | 13 | | |
| 18 | Z | 538 | Total | C | N | O | S | 0 | 0 |
| | | | 4087 | 2568 | 692 | 814 | 13 | | |

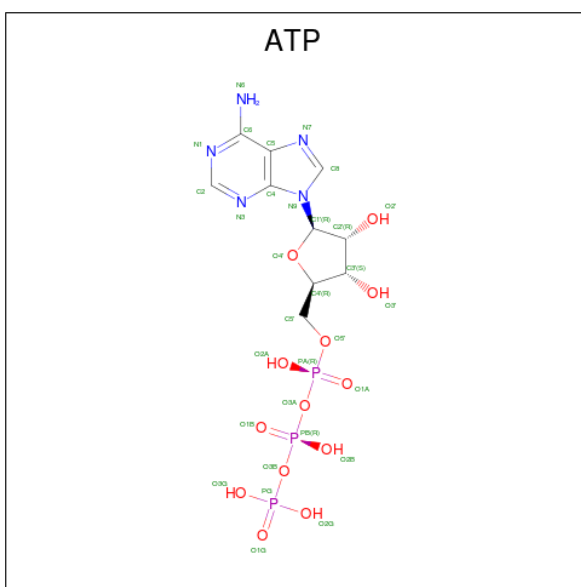
There are 6 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|-------|---------|----------|--------|----------|------------|
| X | 350 | ALA | GLY | conflict | UNP A0ZW41 |
| X | 387 | LEU | ARG | conflict | UNP A0ZW41 |
| Y | 350 | ALA | GLY | conflict | UNP A0ZW41 |
| Y | 387 | LEU | ARG | conflict | UNP A0ZW41 |
| Z | 350 | ALA | GLY | conflict | UNP A0ZW41 |
| Z | 387 | LEU | ARG | conflict | UNP A0ZW41 |

- Molecule 19 is ZINC ION (three-letter code: ZN) (formula: Zn).

| Mol | Chain | Residues | Atoms | | AltConf |
|-----|-------|----------|-------|----|---------|
| 19 | M | 1 | Total | Zn | 0 |
| | | | 1 | 1 | |

- Molecule 20 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: C₁₀H₁₆N₅O₁₃P₃).

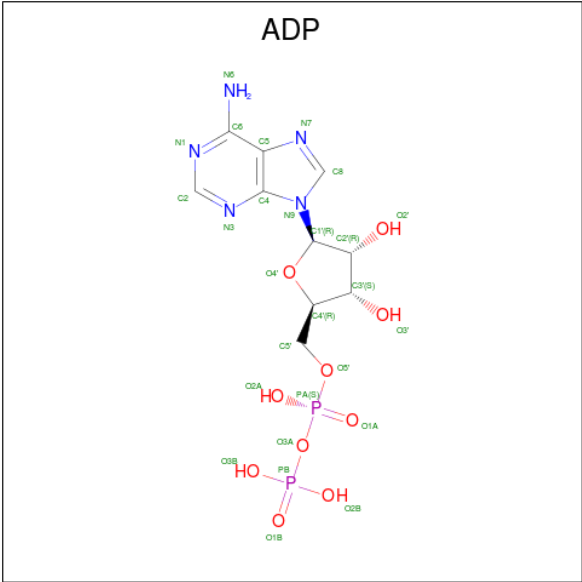


| Mol | Chain | Residues | Atoms | | | | | AltConf |
|-----|-------|----------|-------------|---------|--------|---------|--------|---------|
| 20 | T | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |
| 20 | U | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |
| 20 | V | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |

- Molecule 21 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

| Mol | Chain | Residues | Atoms | AltConf |
|-----|-------|----------|-----------------|---------|
| 21 | X | 1 | Total Mg 1 1 | 0 |
| 21 | Y | 1 | Total Mg 1 1 | 0 |
| 21 | T | 1 | Total Mg 1 1 | 0 |
| 21 | V | 1 | Total Mg 1 1 | 0 |
| 21 | U | 1 | Total Mg 1 1 | 0 |

- Molecule 22 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $\text{C}_{10}\text{H}_{15}\text{N}_5\text{O}_{10}\text{P}_2$).



| Mol | Chain | Residues | Atoms | | | | | AltConf |
|-----|-------|----------|-------|----|---|----|---|---------|
| 22 | X | 1 | Total | C | N | O | P | 0 |
| | | | 27 | 10 | 5 | 10 | 2 | |
| 22 | Y | 1 | Total | C | N | O | P | 0 |
| | | | 27 | 10 | 5 | 10 | 2 | |

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.

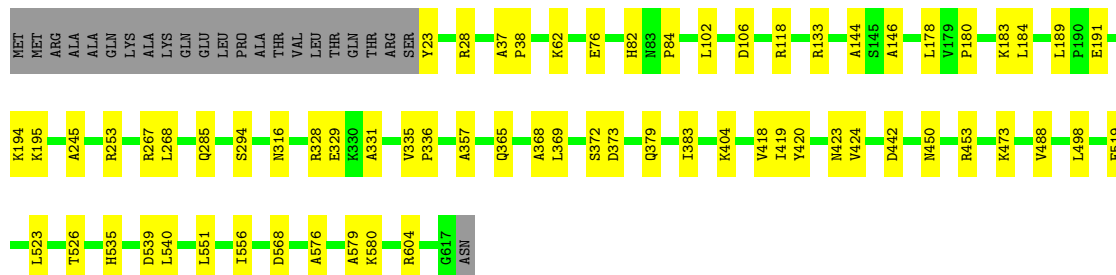
- Molecule 1: ASA-10: Polytomella F-ATP synthase associated subunit 10

Chain 0: 



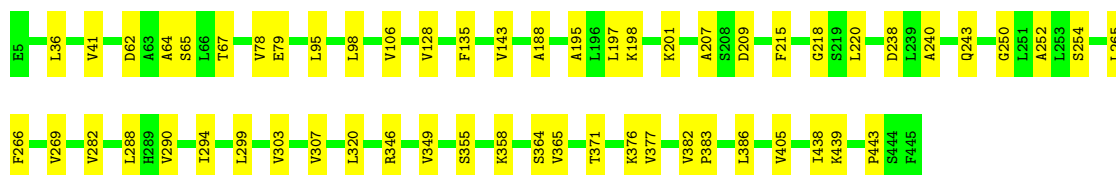
- Molecule 2: ATP synthase associated protein ASA1

Chain 1: 



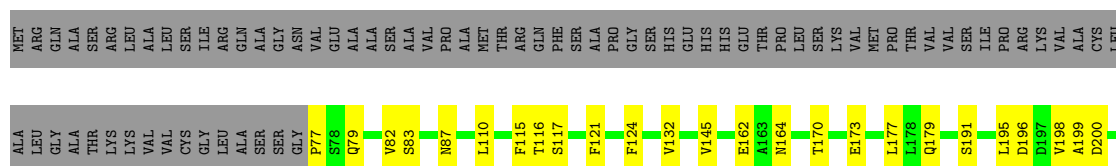
- Molecule 3: ASA-2: Polytomella F-ATP synthase associated subunit 2

Chain 2: 



- Molecule 4: Mitochondrial F1F0 ATP synthase associated 32 kDa protein

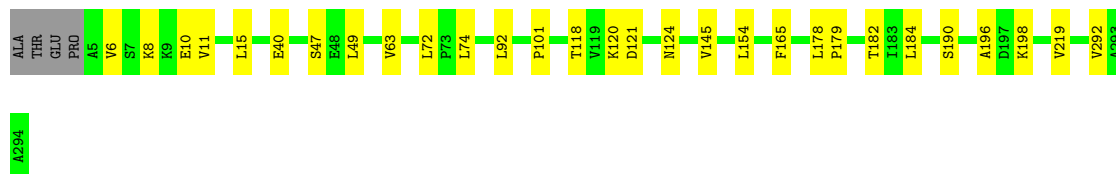
Chain 3: 





- Molecule 5: Mitochondrial ATP synthase associated protein ASA4

Chain 4: 89% 10%



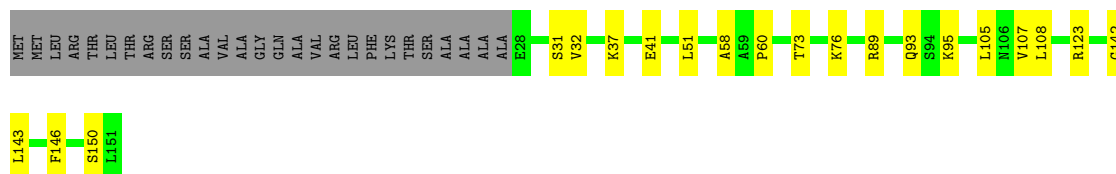
- Molecule 6: Mitochondrial F1F0 ATP synthase associated 14 kDa protein

Chain 5: 84% 15%



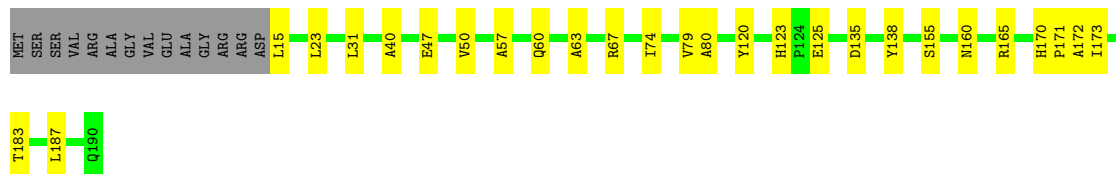
- Molecule 7: Mitochondrial ATP synthase subunit ASA6

Chain 6: 69% 13% 18%



- Molecule 8: Mitochondrial ATP synthase associated protein ASA7

Chain 7: 78% 14% 7%



- Molecule 9: Mitochondrial ATP synthase subunit ASA8

Chain 8: 82% 17%



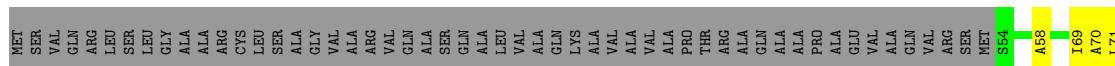
- Molecule 10: ASA-9: Polytomella F-ATP synthase associated subunit 9

Chain 9: 94% 6%



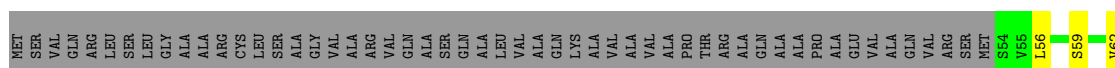
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain A: 41% 17% 42%



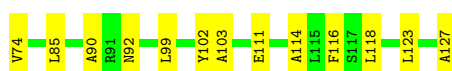
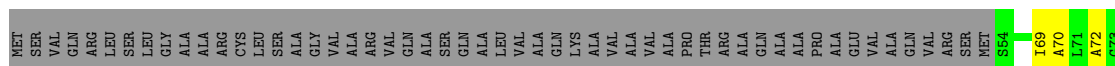
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain B: 39% 20% 42%



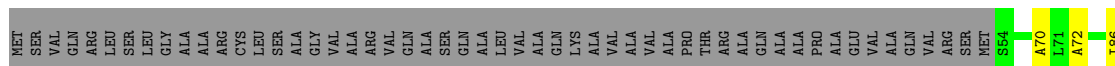
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain C: 46% 13% 42%



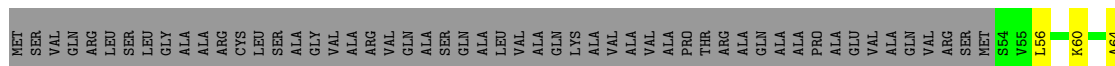
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain D: 53% 6% 42%



- Molecule 11: Mitochondrial ATP synthase subunit c

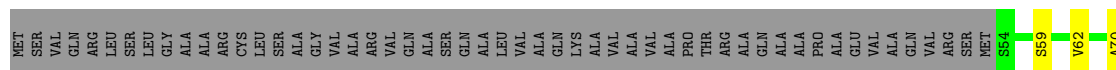
Chain E: 49% 9% 42%





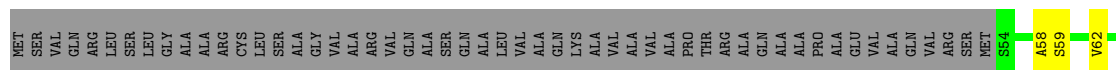
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain F: 47% 11% 42%



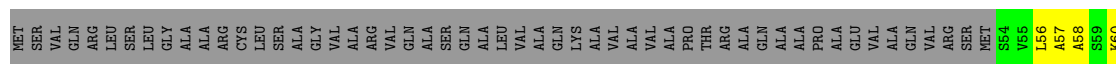
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain G: 46% 13% 42%



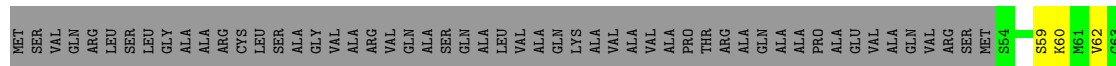
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain H: 41% 17% 42%



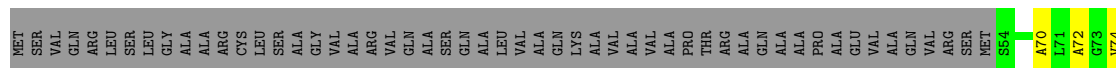
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain I: 39% 19% 42%



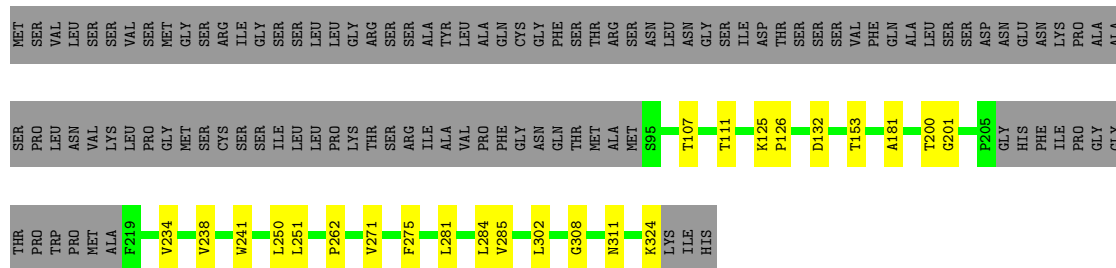
- Molecule 11: Mitochondrial ATP synthase subunit c

Chain J: 46% 13% 42%



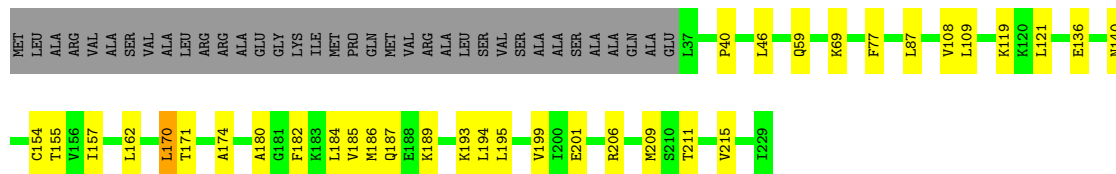
- Molecule 12: Mitochondrial ATP synthase subunit 6

Chain M:  59% 7% 34%




- Molecule 13: Mitochondrial ATP synthase subunit OSCP

Chain P:  69% 15% 16%



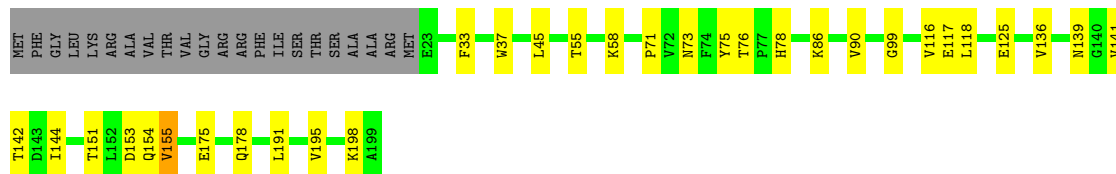
- Molecule 14: epsilon: Polytomella F-ATP synthase epsilon subunit

Chain Q:  82% 15% .



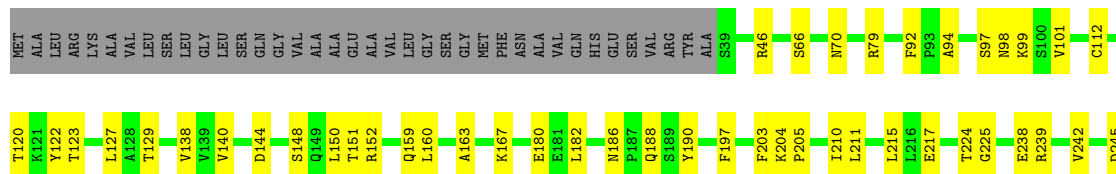
- Molecule 15: Mitochondrial ATP synthase subunit delta

Chain R:  73% 15% . 11%



- Molecule 16: ATP synthase gamma chain, mitochondrial

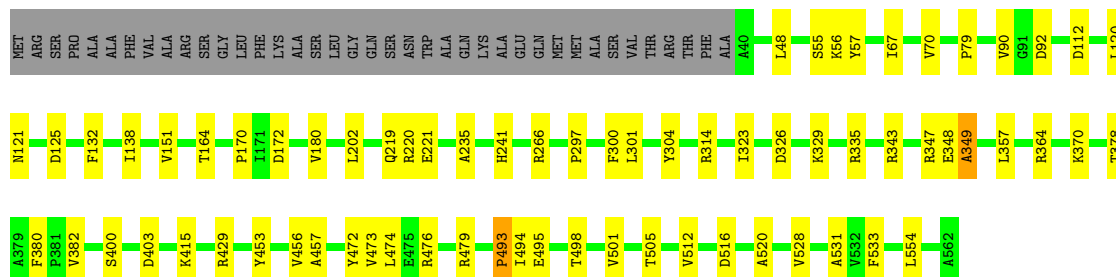
Chain S:  71% 16% 13%





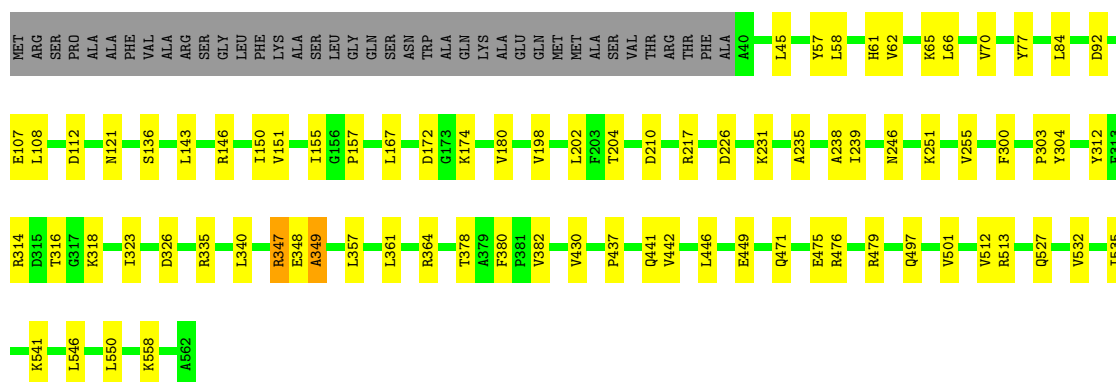
• Molecule 17: ATP synthase subunit alpha

Chain T: 80% 12% 7%



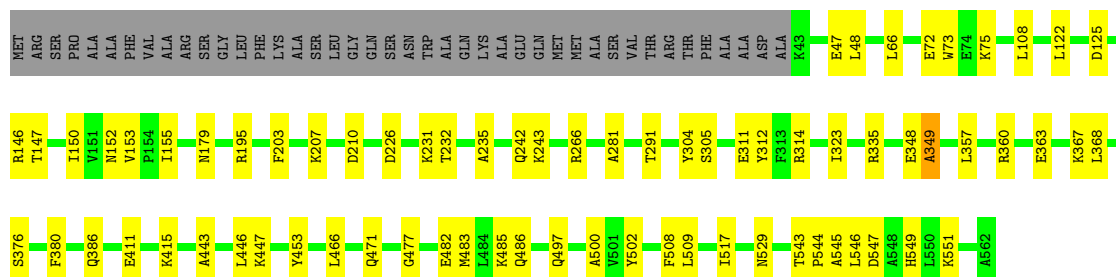
• Molecule 17: ATP synthase subunit alpha

Chain U: 79% 14% 7%



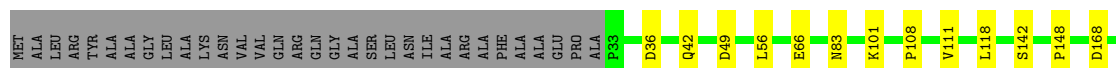
• Molecule 17: ATP synthase subunit alpha

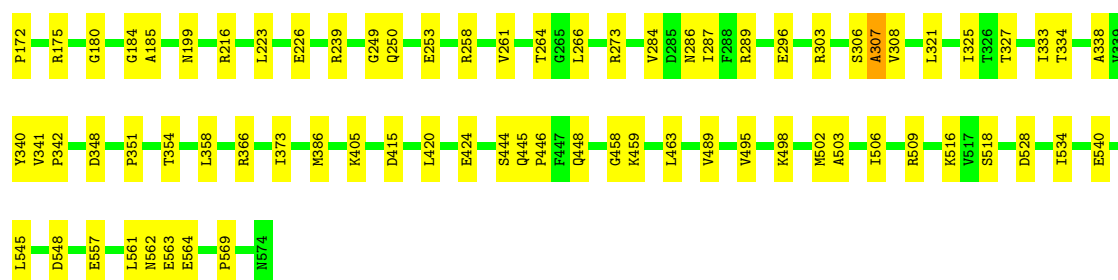
Chain V: 80% 13% 7%



• Molecule 18: ATP synthase subunit beta

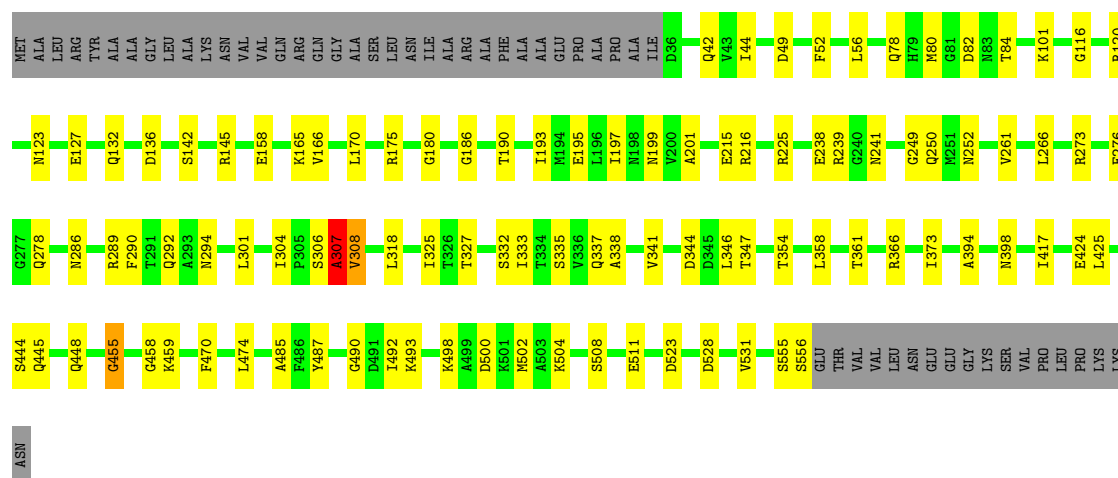
Chain X: 79% 15% 6%





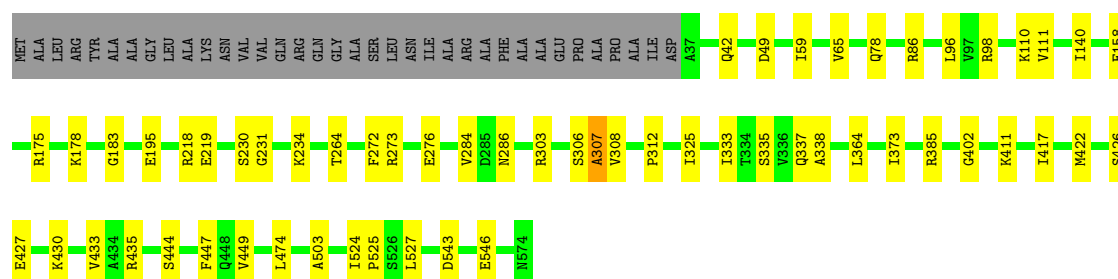
• Molecule 18: ATP synthase subunit beta

Chain Y: 73% 17% 9%



• Molecule 18: ATP synthase subunit beta

Chain Z: 83% 10% 6%



4 Experimental information

| Property | Value | Source |
|--------------------------------------|-----------------------------------------|-----------|
| Reconstruction method | SINGLE PARTICLE | Depositor |
| Imposed symmetry | POINT, C1 | Depositor |
| Number of particles used | 112810 | 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 ($e^-/\text{\AA}^2$) | 35 | Depositor |
| Minimum defocus (nm) | -400 | Depositor |
| Maximum defocus (nm) | -5000 | Depositor |
| Magnification | 75000 | Depositor |
| Image detector | FEI FALCON III (4k x 4k) | Depositor |

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ATP, ZN, MG, 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 >2 | RMSZ | # Z >2 |
| 1 | 0 | 0.47 | 0/628 | 0.49 | 0/856 |
| 10 | 9 | 0.38 | 0/802 | 0.52 | 0/1084 |
| 11 | A | 0.37 | 0/520 | 0.56 | 0/704 |
| 11 | B | 0.39 | 0/520 | 0.64 | 2/704 (0.3%) |
| 11 | C | 0.35 | 0/519 | 0.61 | 0/701 |
| 11 | D | 0.32 | 0/520 | 0.58 | 0/704 |
| 11 | E | 0.32 | 0/520 | 0.63 | 0/704 |
| 11 | F | 0.34 | 0/520 | 0.55 | 0/704 |
| 11 | G | 0.35 | 0/520 | 0.56 | 0/704 |
| 11 | H | 0.35 | 0/520 | 0.66 | 0/704 |
| 11 | I | 0.33 | 0/520 | 0.60 | 0/704 |
| 11 | J | 0.35 | 0/520 | 0.56 | 1/704 (0.1%) |
| 12 | M | 0.52 | 0/1683 | 0.62 | 0/2295 |
| 13 | P | 0.42 | 0/1553 | 0.60 | 1/2093 (0.0%) |
| 14 | Q | 0.36 | 0/574 | 0.58 | 0/774 |
| 15 | R | 0.42 | 0/1336 | 0.57 | 1/1827 (0.1%) |
| 16 | S | 0.42 | 0/2153 | 0.59 | 0/2901 |
| 17 | T | 0.55 | 0/4048 | 0.61 | 0/5481 |
| 17 | U | 0.59 | 0/4049 | 0.63 | 2/5481 (0.0%) |
| 17 | V | 0.53 | 0/4031 | 0.61 | 0/5456 |
| 18 | X | 0.57 | 0/4176 | 0.61 | 1/5659 (0.0%) |
| 18 | Y | 0.49 | 0/4015 | 0.58 | 0/5440 |
| 18 | Z | 0.53 | 0/4147 | 0.59 | 0/5619 |
| 2 | 1 | 0.47 | 0/4750 | 0.54 | 0/6434 |
| 3 | 2 | 0.38 | 0/3212 | 0.56 | 0/4371 |
| 4 | 3 | 0.44 | 0/1911 | 0.55 | 1/2601 (0.0%) |
| 5 | 4 | 0.43 | 0/2216 | 0.52 | 0/3000 |
| 6 | 5 | 0.57 | 0/1011 | 0.62 | 0/1376 |
| 7 | 6 | 0.49 | 0/946 | 0.56 | 0/1287 |
| 8 | 7 | 0.52 | 0/1374 | 0.57 | 0/1865 |
| 9 | 8 | 0.52 | 0/715 | 0.60 | 0/974 |
| All | All | 0.49 | 0/54529 | 0.59 | 9/73911 (0.0%) |

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 |
|-----|-------|---------------------|---------------------|
| 17 | T | 0 | 1 |
| 17 | U | 0 | 1 |
| 17 | V | 0 | 2 |
| 18 | X | 0 | 1 |
| 18 | Y | 0 | 4 |
| 18 | Z | 0 | 2 |
| 5 | 4 | 0 | 1 |
| 6 | 5 | 0 | 1 |
| All | All | 0 | 13 |

There are no bond length outliers.

The worst 5 of 9 bond angle outliers are listed below:

| Mol | Chain | Res | Type | Atoms | Z | Observed(°) | Ideal(°) |
|-----|-------|-----|------|------------|-------|-------------|----------|
| 18 | X | 36 | ASP | CB-CG-OD1 | 6.59 | 124.24 | 118.30 |
| 11 | B | 95 | ILE | CG1-CB-CG2 | -6.06 | 98.07 | 111.40 |
| 4 | 3 | 77 | PRO | N-CA-CB | 5.89 | 110.36 | 103.30 |
| 13 | P | 170 | LEU | CA-CB-CG | 5.49 | 127.92 | 115.30 |
| 11 | J | 123 | LEU | CA-CB-CG | 5.35 | 127.60 | 115.30 |

There are no chirality outliers.

5 of 13 planarity outliers are listed below:

| Mol | Chain | Res | Type | Group |
|-----|-------|-----|------|---------|
| 5 | 4 | 47 | SER | Peptide |
| 6 | 5 | 119 | LYS | Peptide |
| 17 | T | 348 | GLU | Peptide |
| 17 | U | 348 | GLU | Peptide |
| 17 | V | 75 | LYS | Peptide |

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

| Mol | Chain | Non-H | H(model) | H(added) | Clashes | Symm-Clashes |
|-----|-------|-------|----------|----------|---------|--------------|
| 1 | 0 | 607 | 0 | 584 | 1 | 0 |
| 2 | 1 | 4661 | 0 | 4695 | 45 | 0 |
| 3 | 2 | 3163 | 0 | 3262 | 33 | 0 |
| 4 | 3 | 1874 | 0 | 1826 | 20 | 0 |
| 5 | 4 | 2177 | 0 | 2169 | 18 | 0 |
| 6 | 5 | 986 | 0 | 1021 | 18 | 0 |
| 7 | 6 | 926 | 0 | 941 | 17 | 0 |
| 8 | 7 | 1347 | 0 | 1345 | 24 | 0 |
| 9 | 8 | 692 | 0 | 694 | 11 | 0 |
| 10 | 9 | 776 | 0 | 757 | 5 | 0 |
| 11 | A | 514 | 0 | 554 | 23 | 0 |
| 11 | B | 514 | 0 | 554 | 22 | 0 |
| 11 | C | 514 | 0 | 553 | 17 | 0 |
| 11 | D | 514 | 0 | 554 | 11 | 0 |
| 11 | E | 514 | 0 | 554 | 9 | 0 |
| 11 | F | 514 | 0 | 554 | 12 | 0 |
| 11 | G | 514 | 0 | 554 | 15 | 0 |
| 11 | H | 514 | 0 | 554 | 20 | 0 |
| 11 | I | 514 | 0 | 554 | 24 | 0 |
| 11 | J | 514 | 0 | 554 | 19 | 0 |
| 12 | M | 1640 | 0 | 1665 | 17 | 0 |
| 13 | P | 1532 | 0 | 1603 | 38 | 0 |
| 14 | Q | 561 | 0 | 565 | 13 | 0 |
| 15 | R | 1303 | 0 | 1266 | 21 | 0 |
| 16 | S | 2130 | 0 | 2180 | 39 | 0 |
| 17 | T | 3979 | 0 | 4119 | 52 | 0 |
| 17 | U | 3980 | 0 | 4119 | 53 | 0 |
| 17 | V | 3962 | 0 | 4105 | 45 | 0 |
| 18 | X | 4115 | 0 | 4137 | 54 | 0 |
| 18 | Y | 3957 | 0 | 3966 | 62 | 0 |
| 18 | Z | 4087 | 0 | 4110 | 35 | 0 |
| 19 | M | 1 | 0 | 0 | 0 | 0 |
| 20 | T | 31 | 0 | 12 | 0 | 0 |
| 20 | U | 31 | 0 | 12 | 1 | 0 |
| 20 | V | 31 | 0 | 12 | 1 | 0 |
| 21 | T | 1 | 0 | 0 | 0 | 0 |
| 21 | U | 1 | 0 | 0 | 0 | 0 |
| 21 | V | 1 | 0 | 0 | 0 | 0 |
| 21 | X | 1 | 0 | 0 | 0 | 0 |
| 21 | Y | 1 | 0 | 0 | 0 | 0 |
| 22 | X | 27 | 0 | 12 | 0 | 0 |
| 22 | Y | 27 | 0 | 12 | 2 | 0 |
| All | All | 53748 | 0 | 54728 | 643 | 0 |

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 6.

The worst 5 of 643 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) |
|------------------|-------------------|--------------------------|-------------------|
| 13:P:180:ALA:HB3 | 13:P:182:PHE:CD2 | 1.59 | 1.35 |
| 17:T:453:TYR:CE1 | 17:T:474:LEU:HD12 | 1.63 | 1.32 |
| 13:P:171:THR:HA | 13:P:186:MET:HE1 | 1.23 | 1.17 |
| 13:P:180:ALA:CB | 13:P:182:PHE:CE2 | 2.35 | 1.10 |
| 18:X:498:LYS:O | 18:X:502:MET:HG3 | 1.52 | 1.09 |

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 | 0 | 79/82 (96%) | 73 (92%) | 6 (8%) | 0 | 100 | 100 |
| 2 | 1 | 593/618 (96%) | 574 (97%) | 19 (3%) | 0 | 100 | 100 |
| 3 | 2 | 439/441 (100%) | 420 (96%) | 18 (4%) | 1 (0%) | 49 | 81 |
| 4 | 3 | 243/325 (75%) | 236 (97%) | 7 (3%) | 0 | 100 | 100 |
| 5 | 4 | 288/294 (98%) | 281 (98%) | 7 (2%) | 0 | 100 | 100 |
| 6 | 5 | 121/123 (98%) | 113 (93%) | 7 (6%) | 1 (1%) | 21 | 59 |
| 7 | 6 | 122/151 (81%) | 109 (89%) | 13 (11%) | 0 | 100 | 100 |
| 8 | 7 | 174/190 (92%) | 169 (97%) | 5 (3%) | 0 | 100 | 100 |
| 9 | 8 | 86/89 (97%) | 77 (90%) | 9 (10%) | 0 | 100 | 100 |
| 10 | 9 | 95/97 (98%) | 82 (86%) | 13 (14%) | 0 | 100 | 100 |
| 11 | A | 72/127 (57%) | 70 (97%) | 2 (3%) | 0 | 100 | 100 |
| 11 | B | 72/127 (57%) | 69 (96%) | 3 (4%) | 0 | 100 | 100 |

Continued on next page...

Continued from previous page...

| Mol | Chain | Analysed | Favoured | Allowed | Outliers | Percentiles | |
|-----|-------|-----------------|------------|----------|----------|-------------|-----|
| 11 | C | 71/127 (56%) | 69 (97%) | 2 (3%) | 0 | 100 | 100 |
| 11 | D | 72/127 (57%) | 70 (97%) | 2 (3%) | 0 | 100 | 100 |
| 11 | E | 72/127 (57%) | 70 (97%) | 2 (3%) | 0 | 100 | 100 |
| 11 | F | 72/127 (57%) | 70 (97%) | 2 (3%) | 0 | 100 | 100 |
| 11 | G | 72/127 (57%) | 70 (97%) | 2 (3%) | 0 | 100 | 100 |
| 11 | H | 72/127 (57%) | 72 (100%) | 0 | 0 | 100 | 100 |
| 11 | I | 72/127 (57%) | 66 (92%) | 6 (8%) | 0 | 100 | 100 |
| 11 | J | 72/127 (57%) | 71 (99%) | 1 (1%) | 0 | 100 | 100 |
| 12 | M | 213/327 (65%) | 205 (96%) | 8 (4%) | 0 | 100 | 100 |
| 13 | P | 191/229 (83%) | 174 (91%) | 17 (9%) | 0 | 100 | 100 |
| 14 | Q | 70/74 (95%) | 67 (96%) | 3 (4%) | 0 | 100 | 100 |
| 15 | R | 175/199 (88%) | 160 (91%) | 15 (9%) | 0 | 100 | 100 |
| 16 | S | 275/317 (87%) | 262 (95%) | 13 (5%) | 0 | 100 | 100 |
| 17 | T | 521/562 (93%) | 490 (94%) | 27 (5%) | 4 (1%) | 21 | 59 |
| 17 | U | 521/562 (93%) | 489 (94%) | 31 (6%) | 1 (0%) | 49 | 81 |
| 17 | V | 518/562 (92%) | 496 (96%) | 21 (4%) | 1 (0%) | 49 | 81 |
| 18 | X | 540/574 (94%) | 504 (93%) | 35 (6%) | 1 (0%) | 49 | 81 |
| 18 | Y | 519/574 (90%) | 478 (92%) | 38 (7%) | 3 (1%) | 27 | 64 |
| 18 | Z | 536/574 (93%) | 503 (94%) | 31 (6%) | 2 (0%) | 36 | 72 |
| All | All | 7038/8234 (86%) | 6659 (95%) | 365 (5%) | 14 (0%) | 53 | 81 |

5 of 14 Ramachandran outliers are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 18 | X | 308 | VAL |
| 18 | Z | 308 | VAL |
| 3 | 2 | 383 | PRO |
| 17 | T | 493 | PRO |
| 17 | U | 349 | ALA |

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 | 0 | 63/64 (98%) | 63 (100%) | 0 | 100 | 100 |
| 2 | 1 | 493/512 (96%) | 493 (100%) | 0 | 100 | 100 |
| 3 | 2 | 312/312 (100%) | 312 (100%) | 0 | 100 | 100 |
| 4 | 3 | 195/258 (76%) | 195 (100%) | 0 | 100 | 100 |
| 5 | 4 | 220/223 (99%) | 219 (100%) | 1 (0%) | 90 | 95 |
| 6 | 5 | 107/107 (100%) | 107 (100%) | 0 | 100 | 100 |
| 7 | 6 | 96/115 (84%) | 96 (100%) | 0 | 100 | 100 |
| 8 | 7 | 140/150 (93%) | 140 (100%) | 0 | 100 | 100 |
| 9 | 8 | 71/72 (99%) | 71 (100%) | 0 | 100 | 100 |
| 10 | 9 | 79/79 (100%) | 79 (100%) | 0 | 100 | 100 |
| 11 | A | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 11 | B | 50/86 (58%) | 49 (98%) | 1 (2%) | 58 | 83 |
| 11 | C | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 11 | D | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 11 | E | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 11 | F | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 11 | G | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 11 | H | 50/86 (58%) | 49 (98%) | 1 (2%) | 58 | 83 |
| 11 | I | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 11 | J | 50/86 (58%) | 50 (100%) | 0 | 100 | 100 |
| 12 | M | 178/272 (65%) | 178 (100%) | 0 | 100 | 100 |
| 13 | P | 171/196 (87%) | 171 (100%) | 0 | 100 | 100 |
| 14 | Q | 56/58 (97%) | 56 (100%) | 0 | 100 | 100 |
| 15 | R | 134/151 (89%) | 134 (100%) | 0 | 100 | 100 |
| 16 | S | 235/265 (89%) | 234 (100%) | 1 (0%) | 92 | 96 |
| 17 | T | 419/448 (94%) | 417 (100%) | 2 (0%) | 90 | 95 |
| 17 | U | 419/448 (94%) | 417 (100%) | 2 (0%) | 90 | 95 |
| 17 | V | 418/448 (93%) | 417 (100%) | 1 (0%) | 94 | 97 |
| 18 | X | 449/469 (96%) | 449 (100%) | 0 | 100 | 100 |
| 18 | Y | 430/469 (92%) | 428 (100%) | 2 (0%) | 90 | 95 |

Continued on next page...

Continued from previous page...

| Mol | Chain | Analysed | Rotameric | Outliers | Percentiles | |
|-----|-------|-----------------|-------------|----------|-------------|----|
| 18 | Z | 446/469 (95%) | 445 (100%) | 1 (0%) | 94 | 97 |
| All | All | 5631/6445 (87%) | 5619 (100%) | 12 (0%) | 94 | 97 |

5 of 12 residues with a non-rotameric sidechain are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 17 | T | 300 | PHE |
| 17 | U | 180 | VAL |
| 18 | Y | 82 | ASP |
| 17 | T | 180 | VAL |
| 17 | V | 146 | ARG |

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 94 such sidechains are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 12 | M | 163 | ASN |
| 16 | S | 188 | GLN |
| 18 | Y | 398 | ASN |
| 13 | P | 220 | ASN |
| 15 | R | 85 | 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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 6 are monoatomic - leaving 5 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 |
| 20 | ATP | T | 1001 | 21 | 26,33,33 | 0.93 | 1 (3%) | 27,52,52 | 1.61 | 5 (18%) |
| 20 | ATP | U | 1001 | 21 | 26,33,33 | 0.95 | 1 (3%) | 27,52,52 | 1.52 | 5 (18%) |
| 20 | ATP | V | 1001 | 21 | 26,33,33 | 0.94 | 1 (3%) | 27,52,52 | 1.43 | 3 (11%) |
| 22 | ADP | X | 601 | 21 | 24,29,29 | 0.96 | 1 (4%) | 25,45,45 | 1.30 | 3 (12%) |
| 22 | ADP | Y | 601 | 21 | 24,29,29 | 0.97 | 1 (4%) | 25,45,45 | 1.36 | 3 (12%) |

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 |
|-----|------|-------|------|------|---------|------------|---------|
| 20 | ATP | T | 1001 | 21 | - | 4/18/38/38 | 0/3/3/3 |
| 20 | ATP | U | 1001 | 21 | - | 2/18/38/38 | 0/3/3/3 |
| 20 | ATP | V | 1001 | 21 | - | 2/18/38/38 | 0/3/3/3 |
| 22 | ADP | X | 601 | 21 | - | 0/12/32/32 | 0/3/3/3 |
| 22 | ADP | Y | 601 | 21 | - | 5/12/32/32 | 0/3/3/3 |

All (5) bond length outliers are listed below:

| Mol | Chain | Res | Type | Atoms | Z | Observed(Å) | Ideal(Å) |
|-----|-------|------|------|-------|------|-------------|----------|
| 22 | Y | 601 | ADP | C5-C4 | 2.84 | 1.46 | 1.40 |
| 20 | V | 1001 | ATP | C5-C4 | 2.57 | 1.46 | 1.40 |
| 20 | U | 1001 | ATP | C5-C4 | 2.51 | 1.46 | 1.40 |
| 22 | X | 601 | ADP | C5-C4 | 2.41 | 1.45 | 1.40 |
| 20 | T | 1001 | ATP | C5-C4 | 2.28 | 1.45 | 1.40 |

The worst 5 of 19 bond angle outliers are listed below:

| Mol | Chain | Res | Type | Atoms | Z | Observed(°) | Ideal(°) |
|-----|-------|------|------|-----------|-------|-------------|----------|
| 20 | U | 1001 | ATP | PB-O3B-PG | -3.70 | 120.81 | 132.57 |
| 20 | V | 1001 | ATP | PB-O3B-PG | -3.68 | 120.86 | 132.57 |
| 20 | T | 1001 | ATP | PA-O3A-PB | -3.42 | 121.70 | 132.57 |
| 20 | T | 1001 | ATP | N3-C2-N1 | -3.37 | 123.25 | 128.68 |

Continued on next page...

Continued from previous page...

| Mol | Chain | Res | Type | Atoms | Z | Observed($^{\circ}$) | Ideal($^{\circ}$) |
|-----|-------|------|------|-----------|-------|------------------------|---------------------|
| 20 | T | 1001 | ATP | PB-O3B-PG | -3.32 | 122.01 | 132.57 |

There are no chirality outliers.

5 of 13 torsion outliers are listed below:

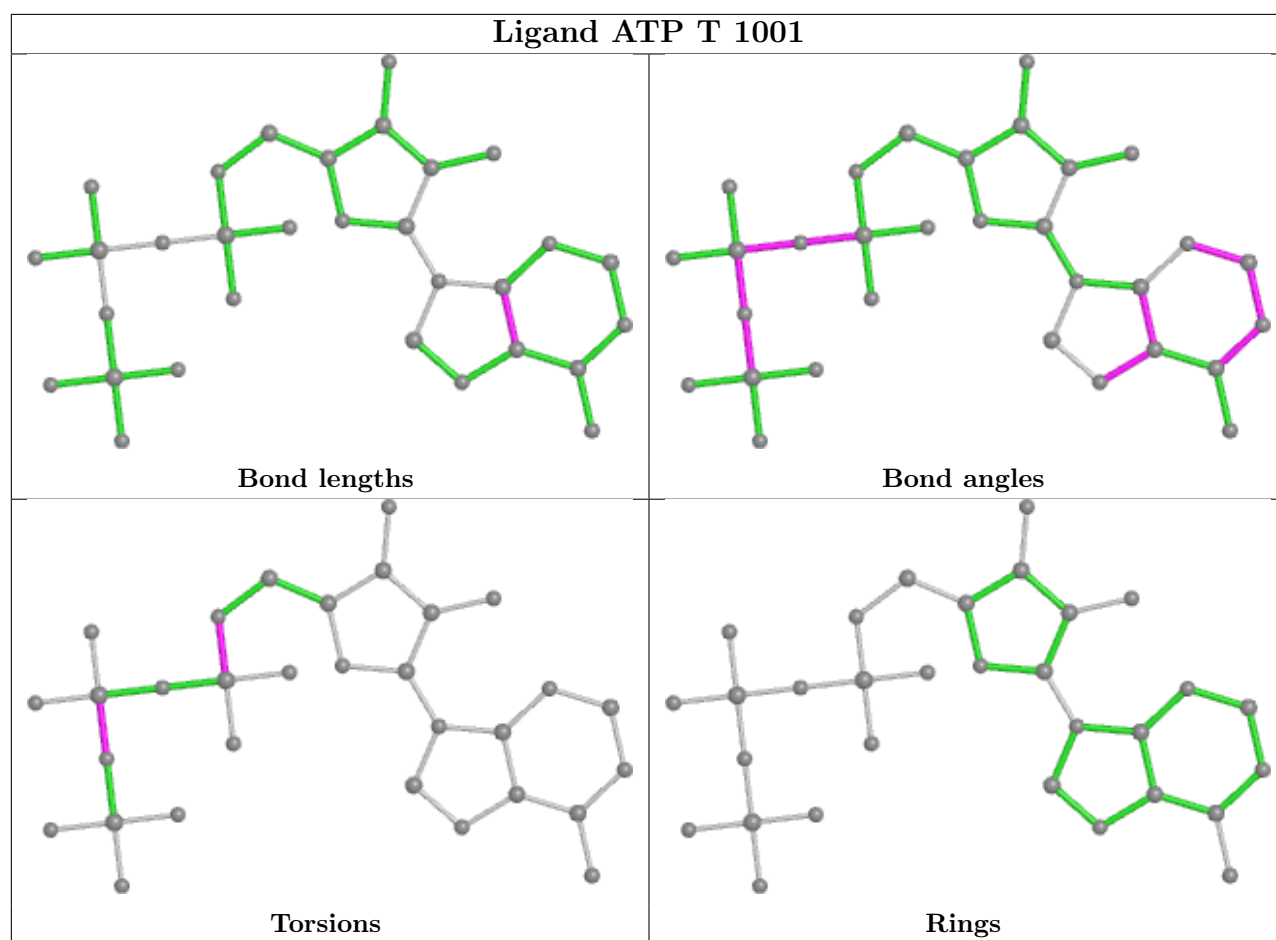
| Mol | Chain | Res | Type | Atoms |
|-----|-------|------|------|----------------|
| 22 | Y | 601 | ADP | C5'-O5'-PA-O1A |
| 22 | Y | 601 | ADP | C5'-O5'-PA-O2A |
| 20 | U | 1001 | ATP | PA-O3A-PB-O1B |
| 20 | T | 1001 | ATP | C5'-O5'-PA-O3A |
| 22 | Y | 601 | ADP | C5'-O5'-PA-O3A |

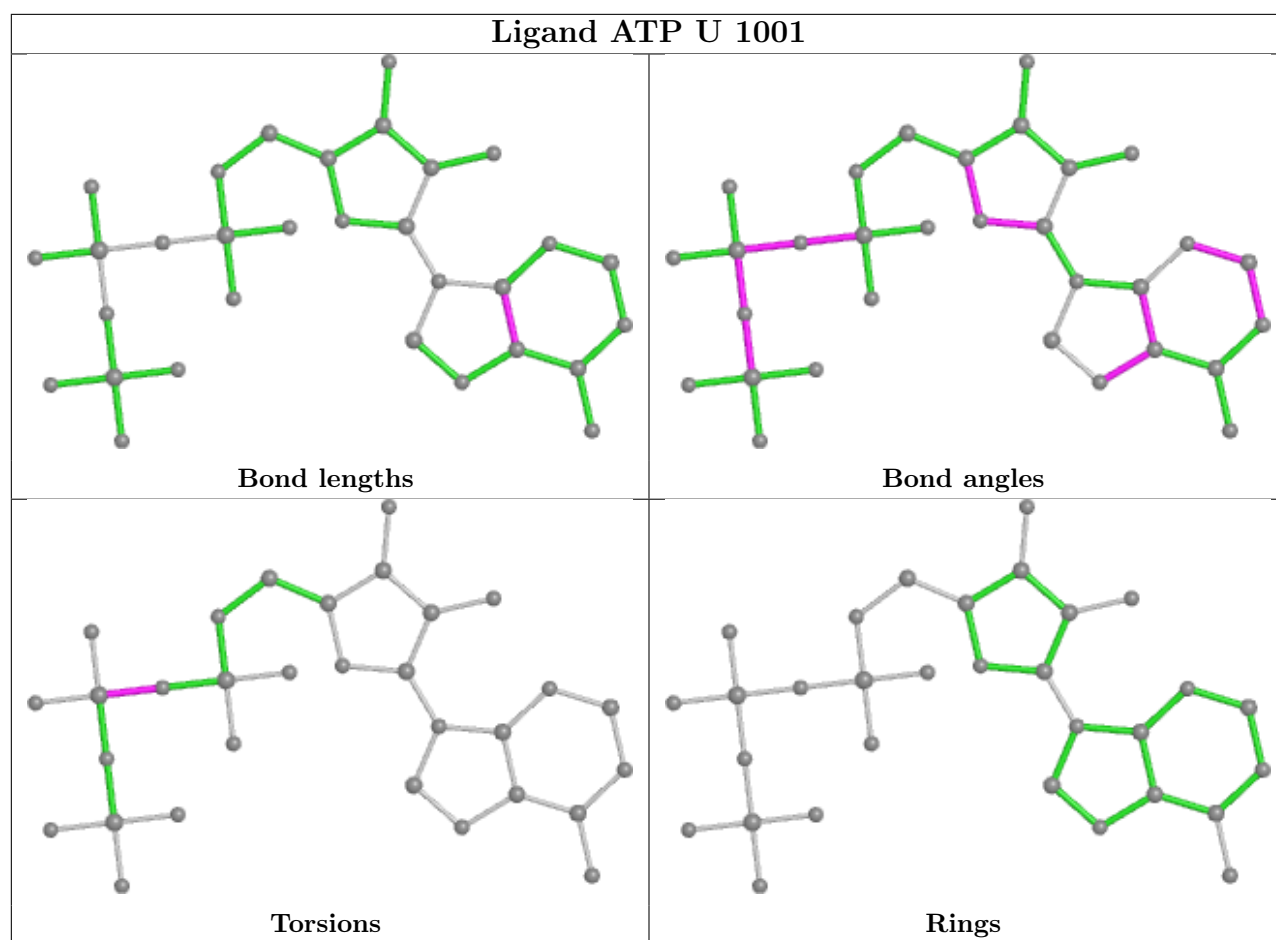
There are no ring outliers.

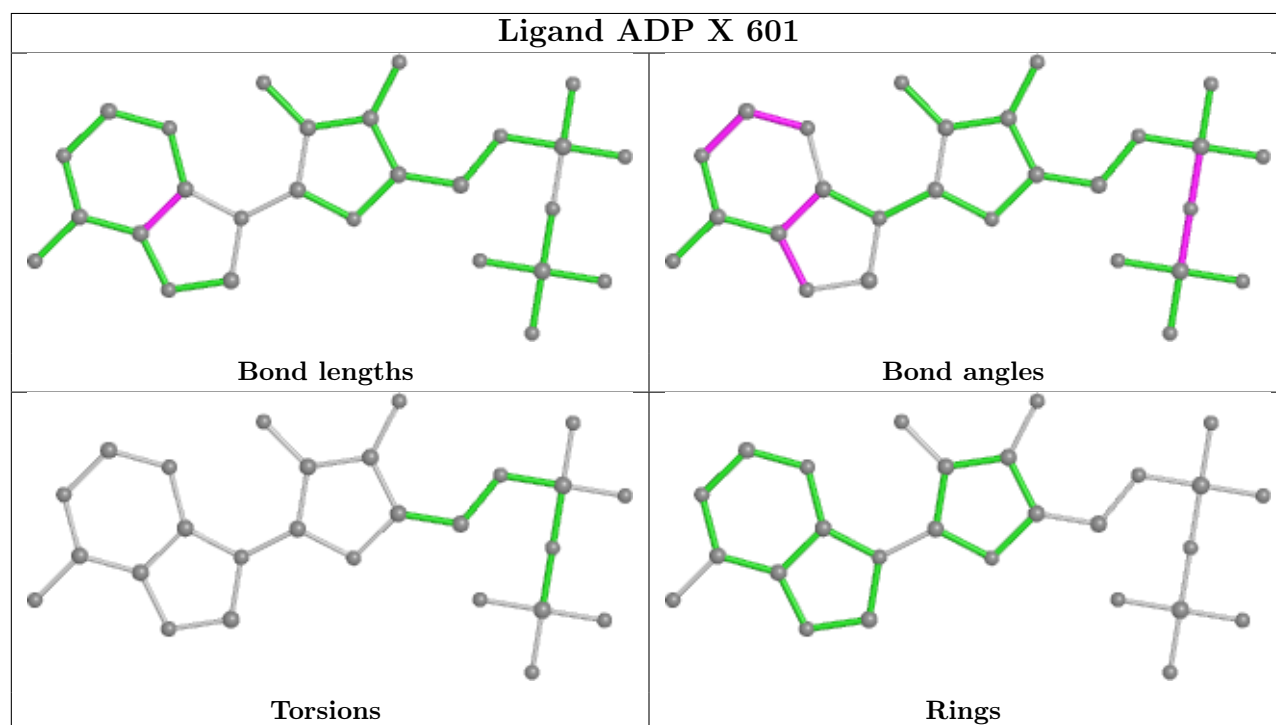
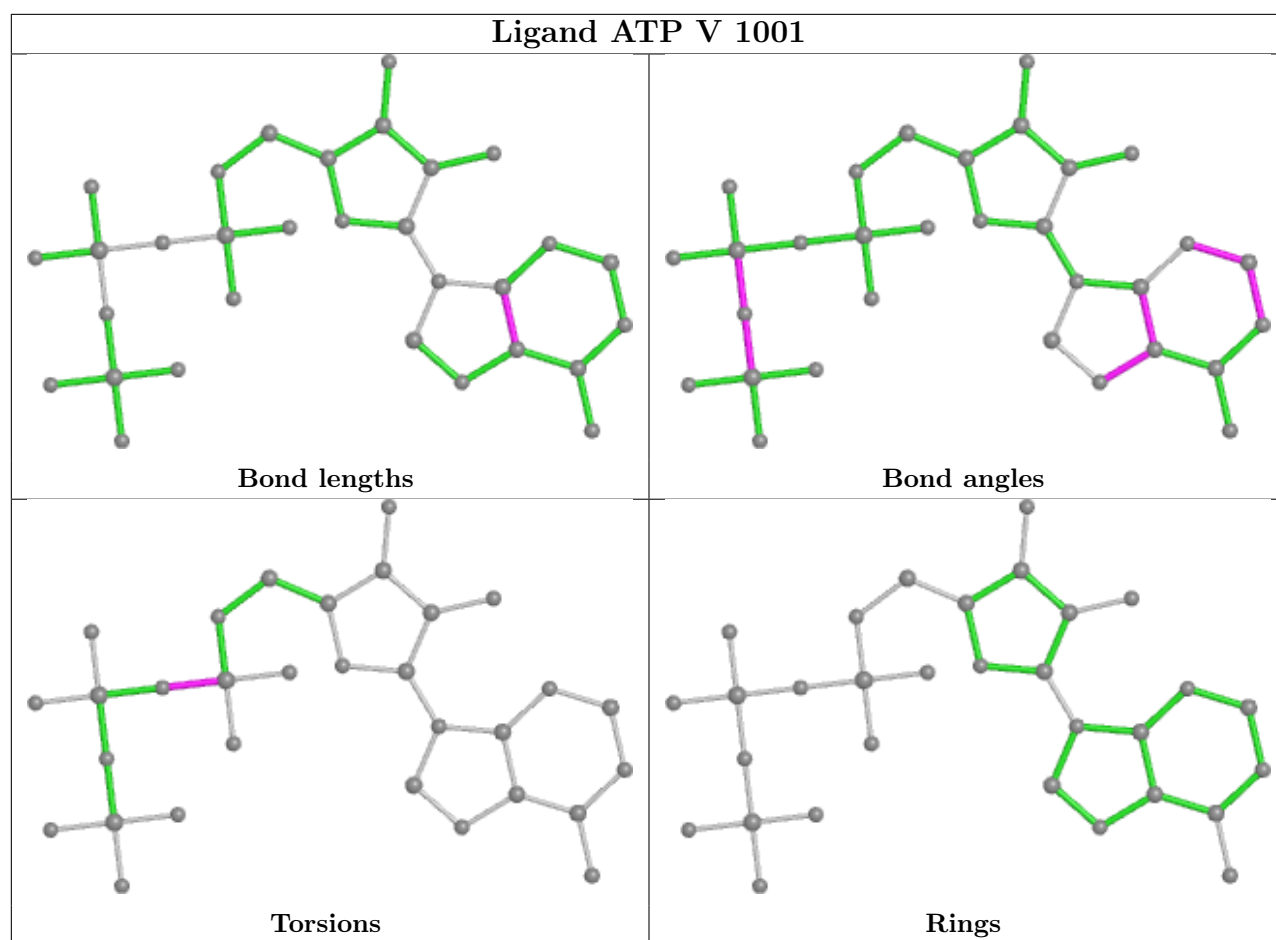
3 monomers are involved in 4 short contacts:

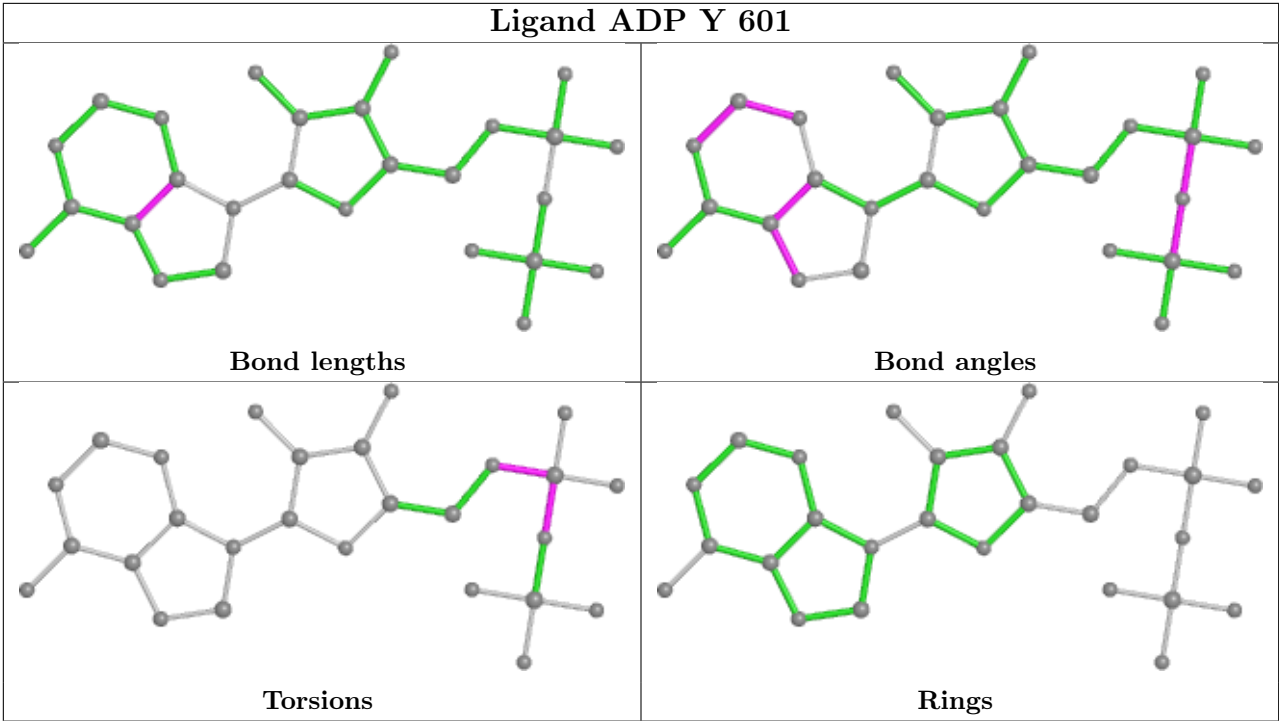
| Mol | Chain | Res | Type | Clashes | Symm-Clashes |
|-----|-------|------|------|---------|--------------|
| 20 | U | 1001 | ATP | 1 | 0 |
| 20 | V | 1001 | ATP | 1 | 0 |
| 22 | Y | 601 | ADP | 2 | 0 |

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 ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

The following chains have linkage breaks:

| Mol | Chain | Number of breaks |
|-----|-------|------------------|
| 11 | C | 1 |

All chain breaks are listed below:

| Model | Chain | Residue-1 | Atom-1 | Residue-2 | Atom-2 | Distance (Å) |
|-------|-------|-----------|--------|-----------|--------|--------------|
| 1 | C | 126:PHE | C | 127:ALA | N | 3.51 |