# W O R L D W I D E

# wwPDB

## P R O T E I N   D A T A   B A N K

# wwPDB EM Validation Summary Report ⓘ

Nov 16, 2022 – 01:07 PM EST

| | | |
|---|---|---|
| PDB ID | : | 7L1R |
| EMDB ID | : | EMD-23116 |
| Title | : | PS3 F1-ATPase Hydrolysis Dwell |
| Authors | : | Sobti, M.; Ueno, H.; Noji, H.; Stewart, A.G. |
| Deposited on | : | 2020-12-15 |
| Resolution | : | 3.10 Å(reported) |

This is a wwPDB EM Validation Summary 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/EMValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

| | | |
|---|---|---|
| EMDB validation analysis | : | 0.0.1.dev43 |
| Mogul | : | 1.8.5 (274361), CSD as541be (2020) |
| MolProbity | : | 4.02b-467 |
| buster-report | : | 1.1.7 (2018) |
| Percentile statistics | : | 20191225.v01 (using entries in the PDB archive December 25th 2019) |
| MapQ | : | 1.9.9 |
| Ideal geometry (proteins) | : | Engh & Huber (2001) |
| Ideal geometry (DNA, RNA) | : | Parkinson et al. (1996) |
| Validation Pipeline (wwPDB-VP) | : | 2.31.2 |

# 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 | Percentile Ranks | Value |
|---|---|---|
| Clashscore | | 4 |
| Ramachandran outliers | | 0.0% |
| Sidechain outliers | | 2.6% |

*Worse*          *Better*

▌ Percentile relative to all structures

▯ Percentile relative to all EM structures
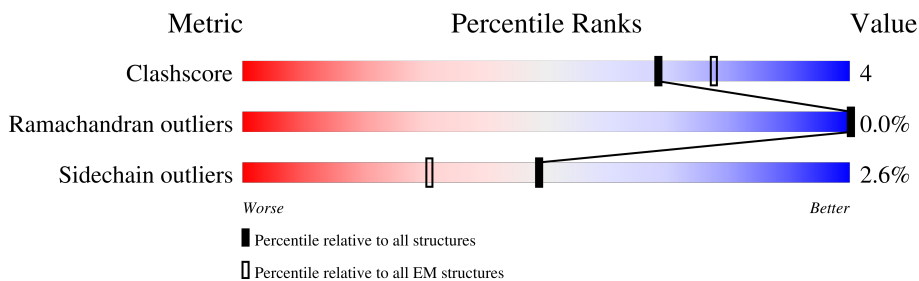
| Metric | Whole archive (#Entries) | EM structures (#Entries) |
|---|---|---|
| Clashscore | 158937 | 4297 |
| Ramachandran outliers | 154571 | 4023 |
| Sidechain outliers | 154315 | 3826 |

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for >=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 <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion < 40%). The numeric value is given above the bar.

| Mol | Chain | Length | Quality of chain |
|---|---|---|---|
| 1 | A | 510 | 8% · 80% · 12% · 7% |
| 1 | B | 510 | 6% · 83% · 10% · 7% |
| 1 | C | 510 | · 85% · 7% · 7% |
| 2 | D | 484 | · 91% · 6% · |
| 2 | E | 484 | 7% · 91% · 5% ·· |
| 2 | F | 484 | 5% · 94% ·· |
| 3 | G | 285 | 29% · 88% · 10% ·· |

# 2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 24199 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 ATP synthase subunit alpha.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|:---:|:---:|:---:|:---|:---|:---|:---|:---|:---:|:---:|
| 1 | A | 474 | Total<br>3636 | C<br>2303 | N<br>637 | O<br>687 | S<br>9 | 0 | 0 |
| 1 | B | 475 | Total<br>3643 | C<br>2308 | N<br>638 | O<br>688 | S<br>9 | 0 | 0 |
| 1 | C | 476 | Total<br>3649 | C<br>2311 | N<br>639 | O<br>690 | S<br>9 | 0 | 0 |

There are 33 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|:---:|:---:|:---:|:---:|:---:|:---:|
| A | -7 | MET | - | expression tag | UNP A0A0M3VGF9 |
| A | -6 | SER | - | expression tag | UNP A0A0M3VGF9 |
| A | -5 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| A | -4 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| A | -3 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| A | -2 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| A | -1 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| A | 0 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| A | 1 | GLY | - | expression tag | UNP A0A0M3VGF9 |
| A | 193 | SER | CYS | conflict | UNP A0A0M3VGF9 |
| A | 463 | PHE | TRP | conflict | UNP A0A0M3VGF9 |
| B | -7 | MET | - | expression tag | UNP A0A0M3VGF9 |
| B | -6 | SER | - | expression tag | UNP A0A0M3VGF9 |
| B | -5 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| B | -4 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| B | -3 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| B | -2 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| B | -1 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| B | 0 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| B | 1 | GLY | - | expression tag | UNP A0A0M3VGF9 |
| B | 193 | SER | CYS | conflict | UNP A0A0M3VGF9 |
| B | 463 | PHE | TRP | conflict | UNP A0A0M3VGF9 |
| C | -7 | MET | - | expression tag | UNP A0A0M3VGF9 |
| C | -6 | SER | - | expression tag | UNP A0A0M3VGF9 |

W O R L D W I D E
wwPDB
PROTEIN DATA BANK

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| Chain | Residue | Modelled | Actual | Comment | Reference |
|:---:|:---:|:---:|:---:|:---:|:---:|
| C | -5 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| C | -4 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| C | -3 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| C | -2 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| C | -1 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| C | 0 | HIS | - | expression tag | UNP A0A0M3VGF9 |
| C | 1 | GLY | - | expression tag | UNP A0A0M3VGF9 |
| C | 193 | SER | CYS | conflict | UNP A0A0M3VGF9 |
| C | 463 | PHE | TRP | conflict | UNP A0A0M3VGF9 |

- Molecule 2 is a protein called ATP synthase subunit beta.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|:---:|:---:|:---:|:---:|:---:|:---:|:---:|:---:|:---:|:---:|
| 2 | D | 470 | Total<br>3621 | C<br>2285 | N<br>627 | O<br>696 | S<br>13 | 0 | 0 |
| 2 | E | 470 | Total<br>3622 | C<br>2285 | N<br>627 | O<br>696 | S<br>14 | 0 | 0 |
| 2 | F | 471 | Total<br>3629 | C<br>2290 | N<br>628 | O<br>697 | S<br>14 | 0 | 0 |

There are 36 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|:---:|:---:|:---:|:---:|:---:|:---:|
| D | -10 | MET | - | expression tag | UNP A0A0M4U1P9 |
| D | -9 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -8 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -7 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -6 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -5 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -4 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -3 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -2 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | -1 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | 0 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| D | 190 | ASP | GLU | conflict | UNP A0A0M4U1P9 |
| E | -10 | MET | - | expression tag | UNP A0A0M4U1P9 |
| E | -9 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | -8 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | -7 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | -6 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | -5 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | -4 | HIS | - | expression tag | UNP A0A0M4U1P9 |

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| Chain | Residue | Modelled | Actual | Comment | Reference |
|:-----:|:-------:|:--------:|:------:|:-------:|:----------|
| E | -3 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | -2 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | -1 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | 0 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| E | 190 | ASP | GLU | conflict | UNP A0A0M4U1P9 |
| F | -10 | MET | - | expression tag | UNP A0A0M4U1P9 |
| F | -9 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -8 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -7 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -6 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -5 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -4 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -3 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -2 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | -1 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | 0 | HIS | - | expression tag | UNP A0A0M4U1P9 |
| F | 190 | ASP | GLU | conflict | UNP A0A0M4U1P9 |

- Molecule 3 is a protein called ATP synthase gamma chain.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|:---:|:-----:|:--------:|:-----:|:---:|:---:|:---:|:---:|:-------:|:-----:|
| | | | Total | C | N | O | S | | |
| 3 | G | 282 | 2211 | 1393 | 388 | 420 | 10 | 0 | 0 |

There are 2 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|:-----:|:-------:|:--------:|:------:|:-------:|:----------|
| G | 112 | CYS | SER | conflict | UNP A0A0M4TPJ7 |
| G | 215 | CYS | ILE | conflict | UNP A0A0M4TPJ7 |

- Molecule 4 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).

ATP

| Mol | Chain | Residues | Atoms | | | | | AltConf |
|---|---|---|---|---|---|---|---|---|
| 4 | A | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |
| 4 | B | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |
| 4 | C | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |
| 4 | D | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |
| 4 | F | 1 | Total 31 | C 10 | N 5 | O 13 | P 3 | 0 |

- Molecule 5 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

| Mol | Chain | Residues | Atoms | | AltConf |
|---|---|---|---|---|---|
| 5 | A | 1 | Total 1 | Mg 1 | 0 |
| 5 | B | 1 | Total 1 | Mg 1 | 0 |
| 5 | C | 1 | Total 1 | Mg 1 | 0 |
| 5 | D | 1 | Total 1 | Mg 1 | 0 |
| 5 | E | 1 | Total 1 | Mg 1 | 0 |
| 5 | F | 1 | Total 1 | Mg 1 | 0 |

- Molecule 6 is A D E N O S I N E - 5 ' - D I P H O S P H A T E (three-letter code: ADP) (formula:

$C_{10}H_{15}N_5O_{10}P_2$).
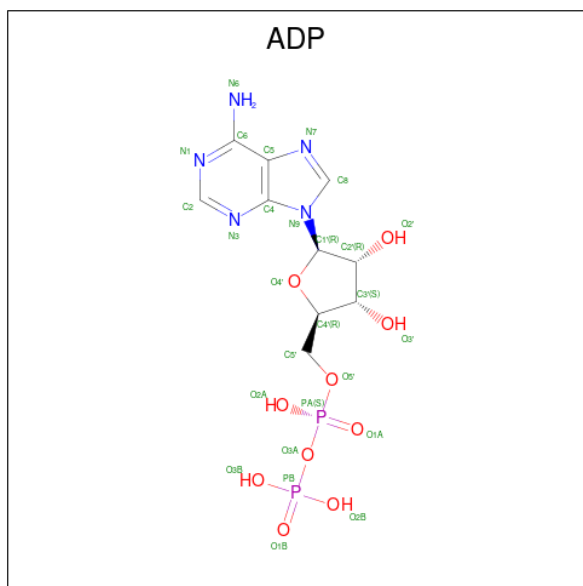


| Mol | Chain | Residues | Atoms | | | | | AltConf |
|---|---|---|---|---|---|---|---|---|
| | | | Total | C | N | O | P | |
| 6 | E | 1 | 27 | 10 | 5 | 10 | 2 | 0 |

# 3   Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. 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. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). 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: ATP synthase subunit alpha



Chain A:

- Molecule 1: ATP synthase subunit alpha



Chain B:

- Molecule 1: ATP synthase subunit alpha



Chain C:

MET SER HIS HIS HIS HIS HIS GLY SER ILE ARG ALA GLU GLU ILE SER ALA LEU ILE LYS GLN GLN ILE GLU GLU ASN TYR GLU SER GLN ILE ILE VAL S26 D27 G37 D45 M48 E51 E67 E68 N69 N70 R93 I104 V136 M137 R140 S141 D170

T173 A179 Q189 S193 L218 T221 I222 D289 T314 F318 G324 D325 S336 L344 D347 R365 V366 L382 R383 L384 R390 E391 A394 F395 A396 Q397 F398 G399 S400 D401 L402 D403 K409 R415 D446 D447 I448 D452

R455 Q469 D486 L487 N488 E492 V499 V500 S501 GLN

• Molecule 2: ATP synthase subunit beta

Chain D:

91%   6% •

MET HIS HIS HIS HIS HIS HIS HIS HIS HIS MET T2 R5 E19 N20 G21 H22 R37 N38 E39 D45 L46 E49 D56 R60 R72 D78 I83 L105 D112 D116 P117 I118 E126 D143 I149 T165 V166 H179 R191

T192 R193 E194 M226 N253 R256 T283 Q287 A317 P318 T350 A353 D382 D390 D396 R404 Q423 P424 D451 V456 V462 G470 V471 GLU VAL

• Molecule 2: ATP synthase subunit beta

Chain E:

7%

91%   5% • •

MET HIS HIS HIS HIS HIS HIS HIS HIS HIS M1 T2 Q8 E19 N20 Q33 R37 N38 E39 D56 D68 E75 D78 A111 F125 E126 E131 I154 A160 G161 T192 R193 E194 K210 E220 R225 V228 R240 L248

D252 L268 V275 V308 P309 A310 D311 D312 D315 D326 E332 R333 K334 L335 I340 E357 R368 L380 D390 E391 D394 E395 D396 R435 K444 E450 R454 L455 V456 E460 E464 K467 A468 M469 G470 VAL GLU VAL

• Molecule 2: ATP synthase subunit beta

Chain F:

5%

94%   • •

MET HIS HIS HIS HIS HIS HIS HIS HIS HIS M1 Q8 D15 E19 N20 G21 H22 N28 R37 E41 D56 D57 D112 E131 V162 G163 K164 Q177 E178 D190 R191 T192 R193 E194 D204 Q217 D252 D311 D315 P316 A317 P318

M338 Q365 E391 E395 H447 D451 G470 V471 GLU VAL

• Molecule 3: ATP synthase gamma chain

Chain G:

29%

88%   10% ••
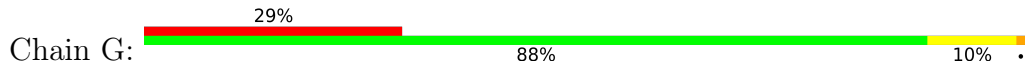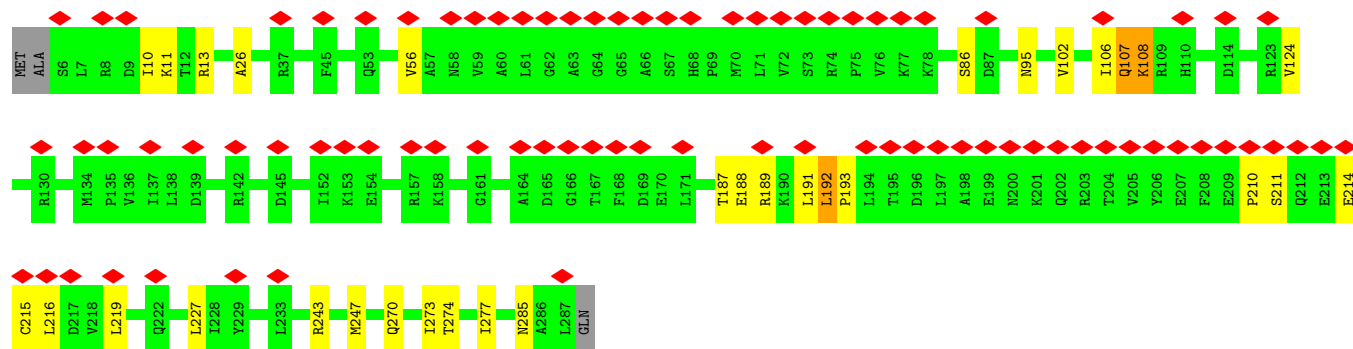
# 4 Experimental information ⓘ

| Property | Value | Source |
|---|---|---|
| EM reconstruction method | SINGLE PARTICLE | Depositor |
| Imposed symmetry | POINT, Not provided | |
| Number of particles used | 340916 | 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 $(e^-/\text{Å}^2)$ | 50 | Depositor |
| Minimum defocus (nm) | Not provided | |
| Maximum defocus (nm) | Not provided | |
| Magnification | Not provided | |
| Image detector | GATAN K2 QUANTUM (4k x 4k) | Depositor |
| Maximum map value | 2.095 | Depositor |
| Minimum map value | -0.028 | Depositor |
| Average map value | 0.005 | Depositor |
| Map value standard deviation | 0.050 | Depositor |
| Recommended contour level | 0.15 | Depositor |
| Map size (Å) | 215.04, 215.04, 215.04 | wwPDB |
| Map dimensions | 256, 256, 256 | wwPDB |
| Map angles (°) | 90.0, 90.0, 90.0 | wwPDB |
| Pixel spacing (Å) | 0.84, 0.84, 0.84 | Depositor |

# 5   Model quality ⓘ

## 5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MG, ATP, ADP

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

| Mol | Chain | Bond lengths | | Bond angles | |
|-----|-------|------|--------|------|--------|
| | | RMSZ | #$|Z|$ >5 | RMSZ | #$|Z|$ >5 |
| 1 | A | 0.57 | 0/3695 | 0.93 | 0/5004 |
| 1 | B | 0.58 | 0/3702 | 0.93 | 0/5014 |
| 1 | C | 0.56 | 0/3708 | 0.85 | 0/5022 |
| 2 | D | 0.54 | 0/3684 | 0.83 | 0/4991 |
| 2 | E | 0.53 | 0/3685 | 0.81 | 0/4991 |
| 2 | F | 0.53 | 0/3692 | 0.82 | 0/5001 |
| 3 | G | 0.54 | 0/2244 | 0.80 | 0/3036 |
| All | All | 0.55 | 0/24410 | 0.86 | 0/33059 |

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 ⓘ

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 | 3636 | 0 | 3710 | 49 | 0 |
| 1 | B | 3643 | 0 | 3718 | 40 | 0 |
| 1 | C | 3649 | 0 | 3724 | 37 | 0 |
| 2 | D | 3621 | 0 | 3631 | 24 | 0 |
| 2 | E | 3622 | 0 | 3634 | 20 | 0 |
| 2 | F | 3629 | 0 | 3643 | 8 | 0 |

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| Mol | Chain | Non-H | H(model) | H(added) | Clashes | Symm-Clashes |
|-----|-------|-------|----------|----------|---------|--------------|
| 3 | G | 2211 | 0 | 2257 | 20 | 0 |
| 4 | A | 31 | 0 | 12 | 2 | 0 |
| 4 | B | 31 | 0 | 12 | 0 | 0 |
| 4 | C | 31 | 0 | 12 | 0 | 0 |
| 4 | D | 31 | 0 | 12 | 1 | 0 |
| 4 | F | 31 | 0 | 12 | 4 | 0 |
| 5 | A | 1 | 0 | 0 | 0 | 0 |
| 5 | B | 1 | 0 | 0 | 0 | 0 |
| 5 | C | 1 | 0 | 0 | 0 | 0 |
| 5 | D | 1 | 0 | 0 | 0 | 0 |
| 5 | E | 1 | 0 | 0 | 0 | 0 |
| 5 | F | 1 | 0 | 0 | 0 | 0 |
| 6 | E | 27 | 0 | 12 | 0 | 0 |
| All | All | 24199 | 0 | 24389 | 186 | 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 4.

The worst 5 of 186 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) |
|--------|--------|--------------------------|-------------------|
| 4:F:500:ATP:H8 | 4:F:500:ATP:H5'1 | 1.38 | 0.89 |
| 1:B:55:PHE:HA | 1:B:88:VAL:HA | 1.57 | 0.86 |
| 2:E:275:VAL:H | 3:G:274:THR:HG22 | 1.41 | 0.86 |
| 4:F:500:ATP:H5'1 | 4:F:500:ATP:C8 | 2.11 | 0.85 |
| 2:D:191:ARG:CG | 2:D:191:ARG:HH21 | 1.91 | 0.84 |

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 PDB entries followed by that with respect to all EM entries.

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

| Mol | Chain | Analysed | Favoured | Allowed | Outliers | Percentiles | |
|-----|-------|----------|----------|---------|----------|------|------|
| 1 | A | 472/510 (92%) | 453 (96%) | 19 (4%) | 0 | 100 | 100 |
| 1 | B | 473/510 (93%) | 456 (96%) | 16 (3%) | 1 (0%) | 47 | 79 |
| 1 | C | 474/510 (93%) | 461 (97%) | 13 (3%) | 0 | 100 | 100 |
| 2 | D | 468/484 (97%) | 451 (96%) | 17 (4%) | 0 | 100 | 100 |
| 2 | E | 468/484 (97%) | 455 (97%) | 13 (3%) | 0 | 100 | 100 |
| 2 | F | 469/484 (97%) | 453 (97%) | 16 (3%) | 0 | 100 | 100 |
| 3 | G | 280/285 (98%) | 273 (98%) | 7 (2%) | 0 | 100 | 100 |
| All | All | 3104/3267 (95%) | 3002 (97%) | 101 (3%) | 1 (0%) | 100 | 100 |

All (1) Ramachandran outliers are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 1 | B | 281 | 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 PDB entries followed by that with respect to all EM entries.

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

| Mol | Chain | Analysed | Rotameric | Outliers | Percentiles | |
|-----|-------|----------|-----------|----------|------|------|
| 1 | A | 386/419 (92%) | 375 (97%) | 11 (3%) | 43 | 73 |
| 1 | B | 387/419 (92%) | 375 (97%) | 12 (3%) | 40 | 70 |
| 1 | C | 388/419 (93%) | 379 (98%) | 9 (2%) | 50 | 77 |
| 2 | D | 386/400 (96%) | 377 (98%) | 9 (2%) | 50 | 77 |
| 2 | E | 386/400 (96%) | 376 (97%) | 10 (3%) | 46 | 74 |
| 2 | F | 387/400 (97%) | 383 (99%) | 4 (1%) | 76 | 90 |
| 3 | G | 238/240 (99%) | 227 (95%) | 11 (5%) | 27 | 59 |
| All | All | 2558/2697 (95%) | 2492 (97%) | 66 (3%) | 49 | 74 |

5 of 66 residues with a non-rotameric sidechain are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 3 | G | 102 | VAL |
| 3 | G | 108 | LYS |

*Continued on next page...*

*Continued from previous page...*

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 3 | G | 285 | ASN |
| 1 | C | 173 | THR |
| 1 | C | 70 | ASN |

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 23 such sidechains are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 2 | D | 33 | GLN |
| 2 | F | 8 | GLN |
| 2 | E | 33 | GLN |
| 2 | F | 217 | GLN |
| 1 | B | 397 | GLN |

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

## 5.6 Ligand geometry ⓘ

Of 12 ligands modelled in this entry, 6 are monoatomic - leaving 6 for Mogul analysis.

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

| Mol | Type | Chain | Res | Link | Bond lengths | | | Bond angles | | |
|-----|------|-------|-----|------|--------|------|--------|--------|------|--------|
| | | | | | Counts | RMSZ | $\#|Z| > 2$ | Counts | RMSZ | $\#|Z| > 2$ |
| 4 | ATP | D | 500 | 5 | 26,33,33 | 0.74 | 0 | 31,52,52 | 1.07 | 3 (9%) |

| Mol | Type | Chain | Res | Link | Bond lengths | | | Bond angles | | |
|-----|------|-------|-----|------|--------|------|-----------|--------|------|-----------|
| | | | | | Counts | RMSZ | $\#|Z| > 2$ | Counts | RMSZ | $\#|Z| > 2$ |
| 6 | ADP | E | 501 | 5 | 24,29,29 | 0.70 | 0 | 29,45,45 | 0.84 | 1 (3%) |
| 4 | ATP | B | 600 | 5 | 26,33,33 | 0.71 | 0 | 31,52,52 | 0.85 | 1 (3%) |
| 4 | ATP | C | 600 | 5 | 26,33,33 | 0.74 | 0 | 31,52,52 | 0.98 | 2 (6%) |
| 4 | ATP | A | 600 | 5 | 26,33,33 | 0.72 | 0 | 31,52,52 | 0.97 | 1 (3%) |
| 4 | ATP | F | 500 | 5 | 26,33,33 | 0.71 | 0 | 31,52,52 | 0.95 | 1 (3%) |

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

| Mol | Type | Chain | Res | Link | Chirals | Torsions | Rings |
|-----|------|-------|-----|------|---------|----------|-------|
| 4 | ATP | D | 500 | 5 | - | 1/18/38/38 | 0/3/3/3 |
| 6 | ADP | E | 501 | 5 | - | 1/12/32/32 | 0/3/3/3 |
| 4 | ATP | B | 600 | 5 | - | 1/18/38/38 | 0/3/3/3 |
| 4 | ATP | C | 600 | 5 | - | 1/18/38/38 | 0/3/3/3 |
| 4 | ATP | A | 600 | 5 | - | 1/18/38/38 | 0/3/3/3 |
| 4 | ATP | F | 500 | 5 | - | 3/18/38/38 | 0/3/3/3 |

There are no bond length outliers.

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

| Mol | Chain | Res | Type | Atoms | Z | Observed($^o$) | Ideal($^o$) |
|-----|-------|-----|------|-------|---|-------------|----------|
| 4 | D | 500 | ATP | PB-O3B-PG | -2.77 | 123.33 | 132.83 |
| 4 | D | 500 | ATP | PA-O3A-PB | -2.66 | 123.69 | 132.83 |
| 4 | C | 600 | ATP | C5-C6-N6 | 2.32 | 123.87 | 120.35 |
| 4 | B | 600 | ATP | C5-C6-N6 | 2.31 | 123.86 | 120.35 |
| 4 | A | 600 | ATP | C5-C6-N6 | 2.28 | 123.81 | 120.35 |

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

| Mol | Chain | Res | Type | Atoms |
|-----|-------|-----|------|-------|
| 4 | D | 500 | ATP | O4'-C4'-C5'-O5' |
| 4 | B | 600 | ATP | O4'-C4'-C5'-O5' |
| 4 | C | 600 | ATP | O4'-C4'-C5'-O5' |
| 4 | F | 500 | ATP | PA-O3A-PB-O1B |
| 4 | F | 500 | ATP | PA-O3A-PB-O2B |

There are no ring outliers.

3 monomers are involved in 7 short contacts:

| Mol | Chain | Res | Type | Clashes | Symm-Clashes |
| --- | --- | --- | --- | --- | --- |
| 4 | D | 500 | ATP | 1 | 0 |
| 4 | A | 600 | ATP | 2 | 0 |
| 4 | F | 500 | ATP | 4 | 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 then 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.



Ligand ATP D 500

Bond lengths

Bond angles

Torsions

Rings

**Ligand ADP E 501**

Bond lengths

Bond angles

Torsions

Rings

**Ligand ATP B 600**

Bond lengths

Bond angles

Torsions

Rings

## Ligand ATP C 600



Bond lengths



Bond angles



Torsions



Rings

## Ligand ATP A 600


Bond lengths


Bond angles


Torsions


Rings

**Ligand ATP F 500**



Bond lengths



Bond angles



Torsions



Rings
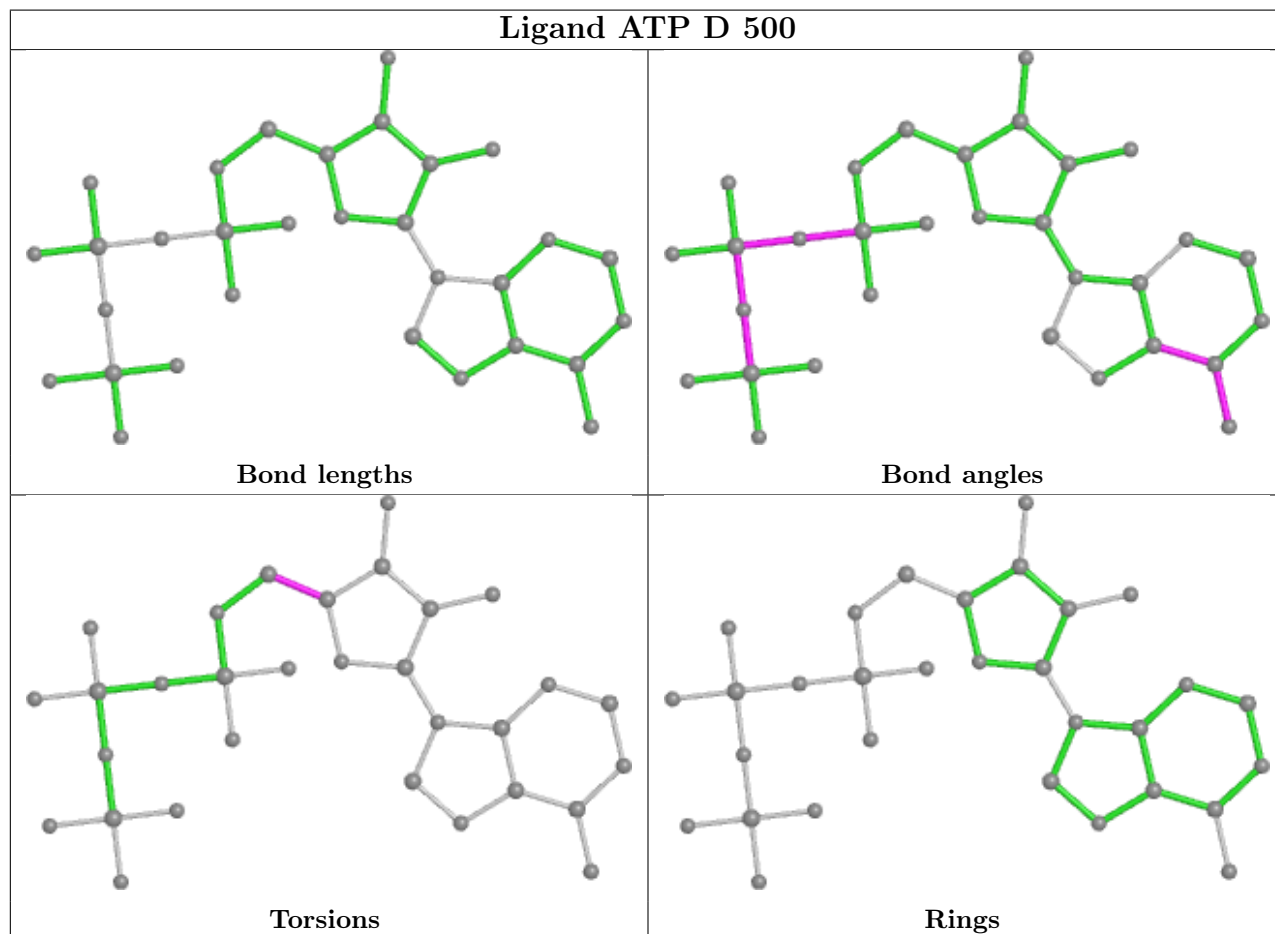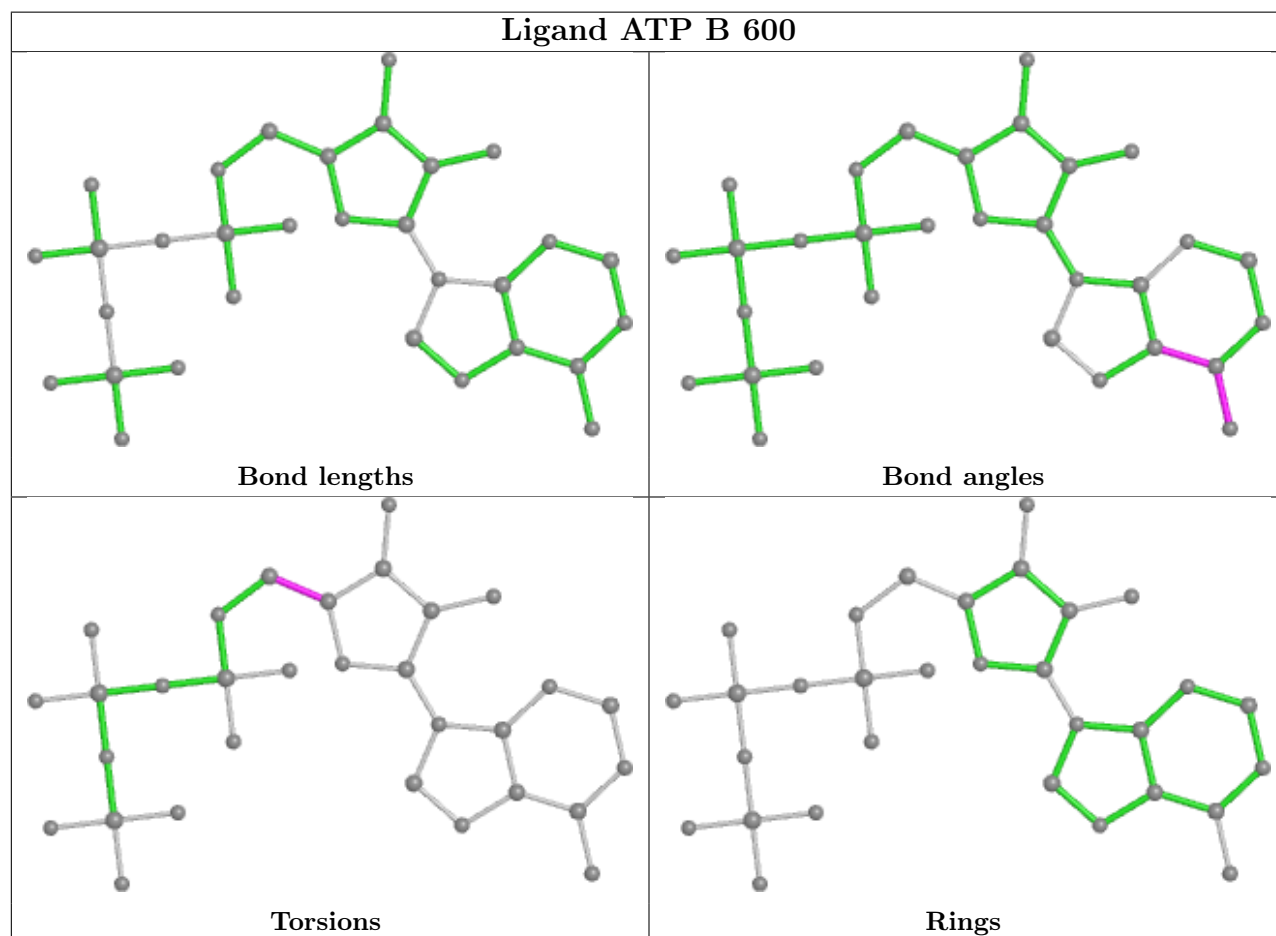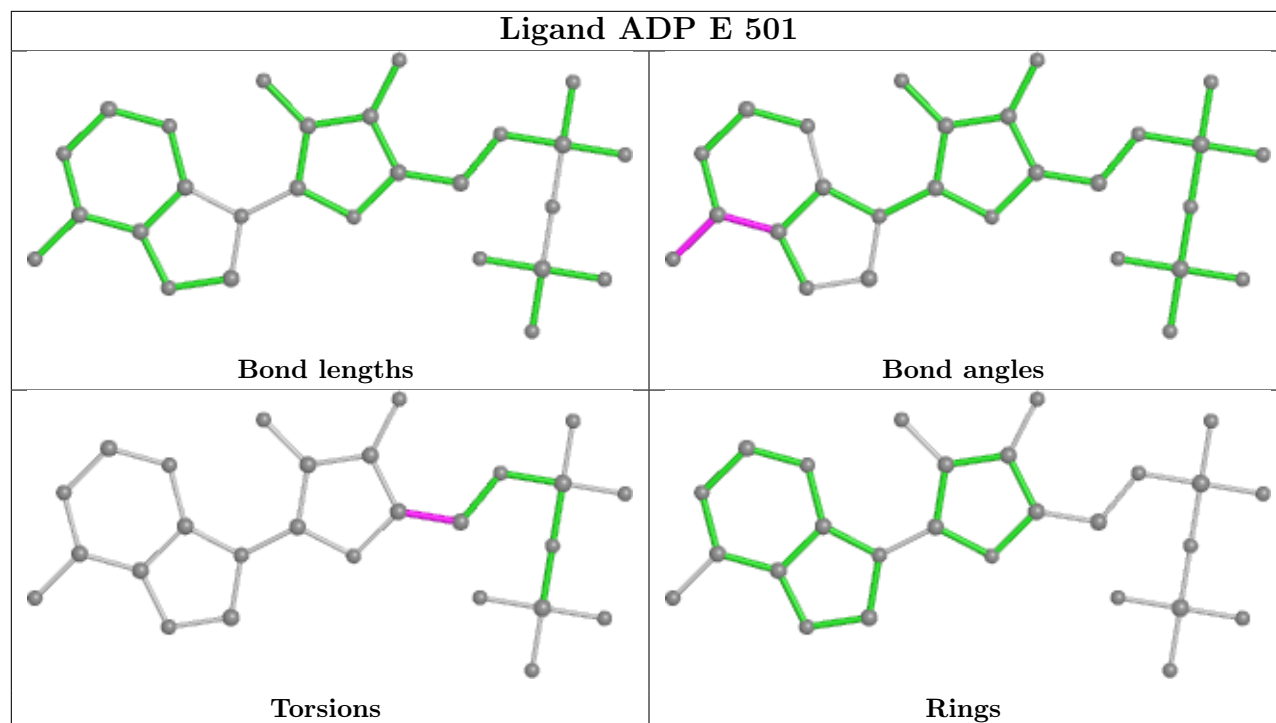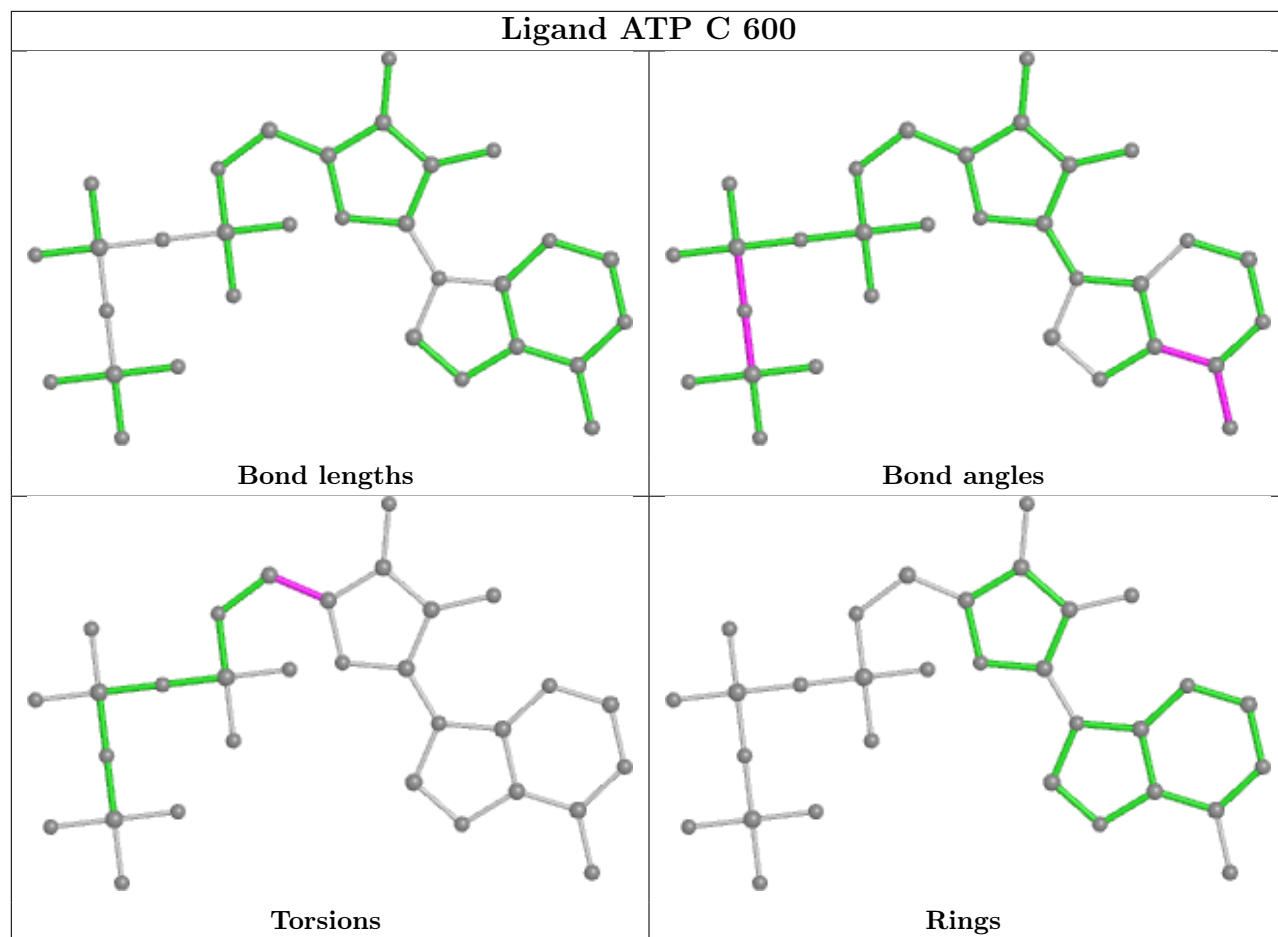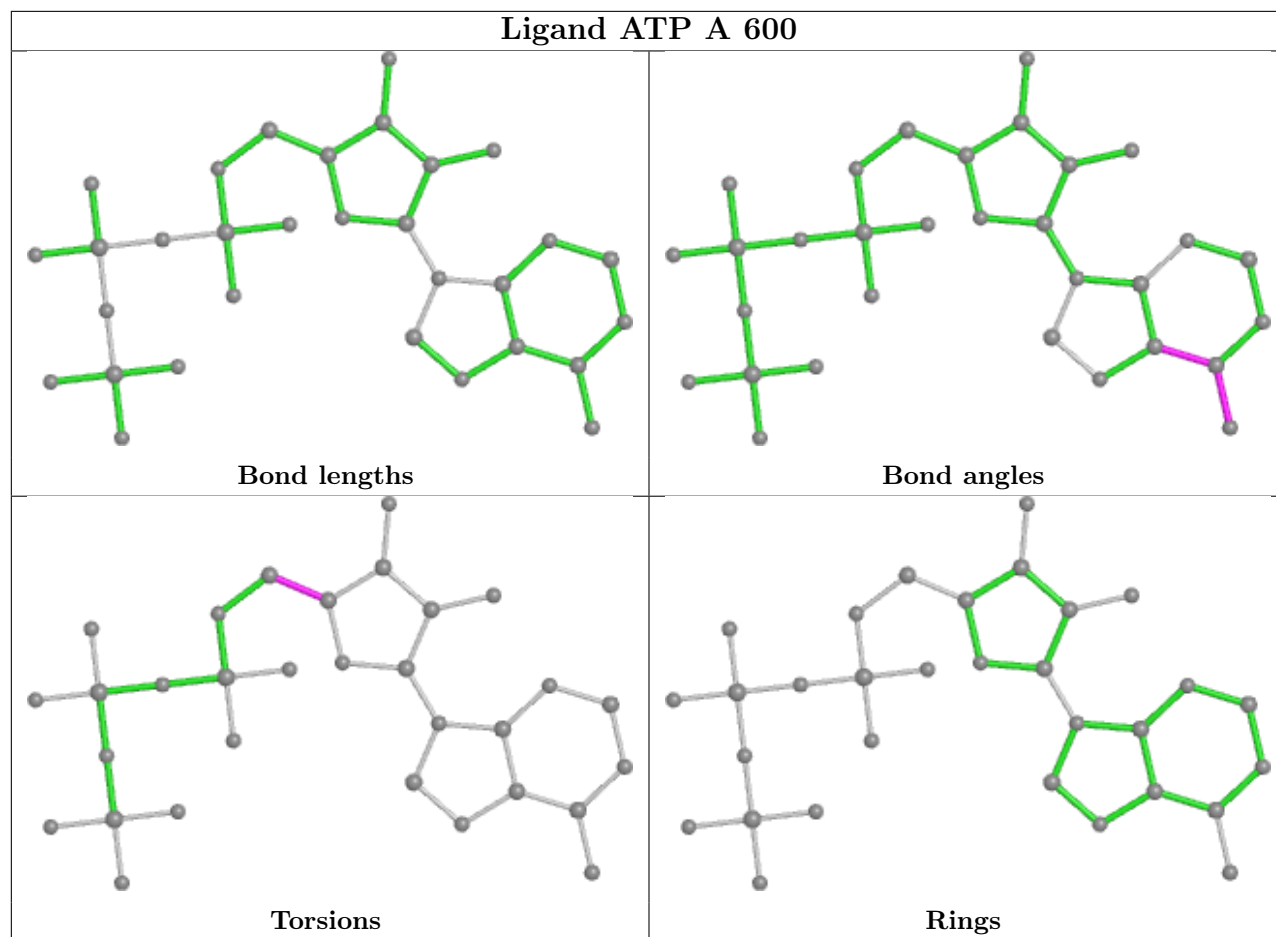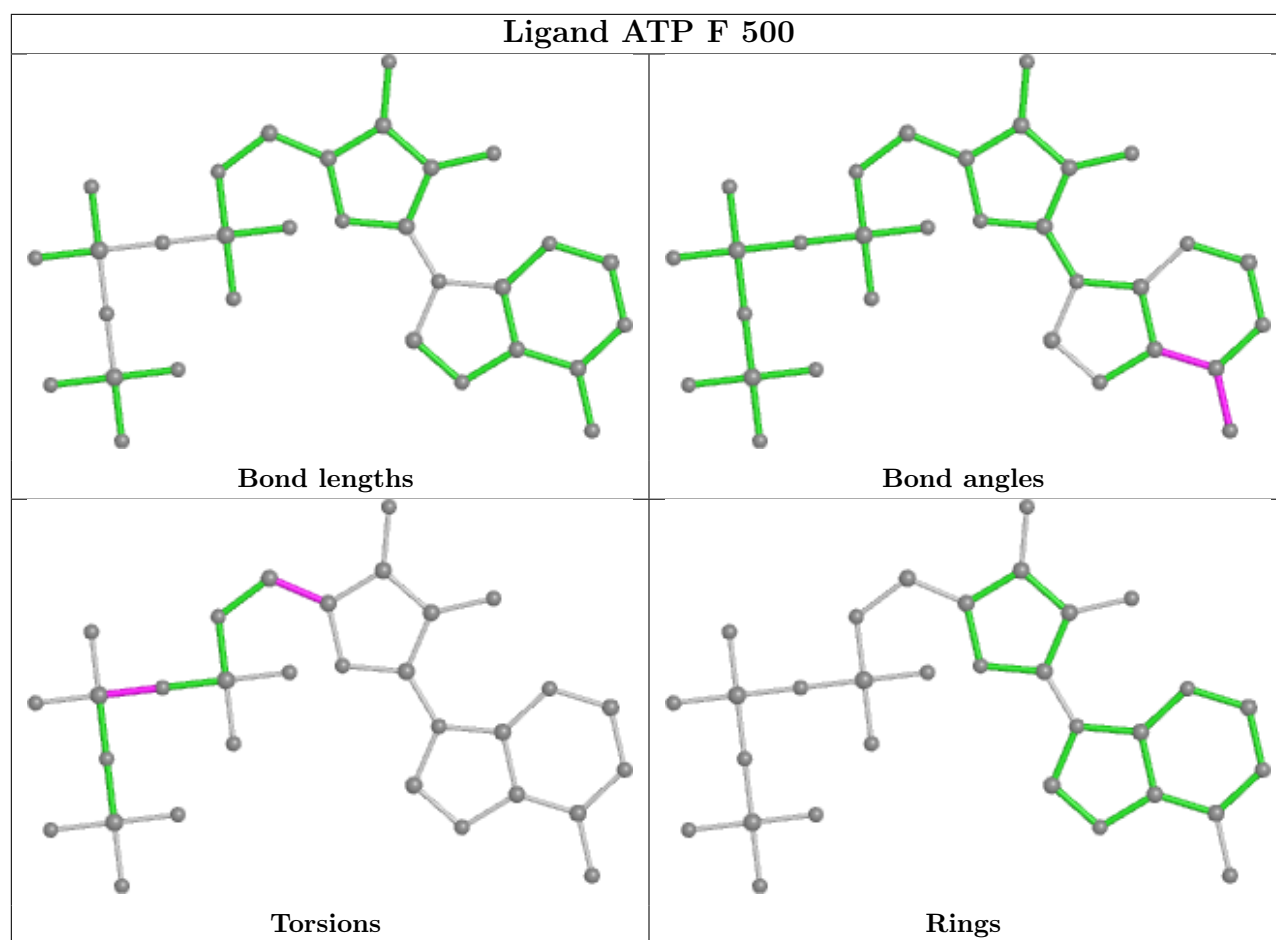
## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

# 6 Map visualisation ⓘ

This section contains visualisations of the EMDB entry EMD-23116. These allow visual inspection of the internal detail of the map and identification of artifacts.

No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

## 6.1 Orthogonal projections ⓘ

### 6.1.1 Primary map



| X | Y | Z |
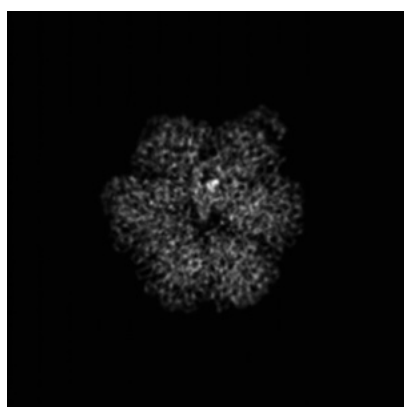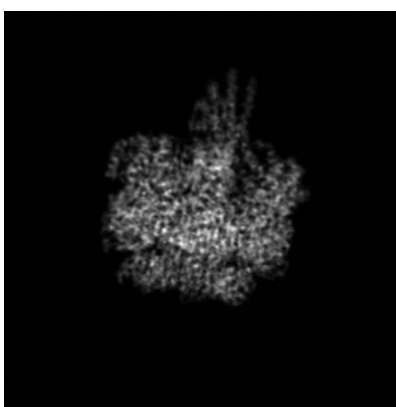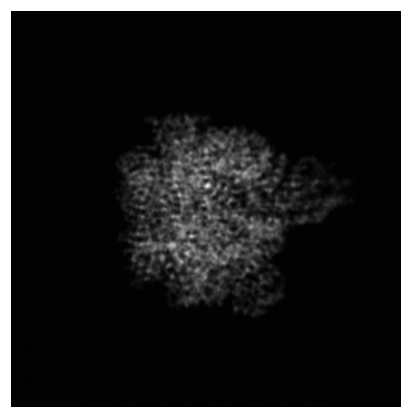
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices ⓘ

### 6.2.1 Primary map



| X Index: 128 | Y Index: 128 | Z Index: 128 |

The images above show central slices of the map in three orthogonal directions.

## 6.3    Largest variance slices ⓘ

### 6.3.1    Primary map



| X Index: 125 | Y Index: 149 | Z Index: 136 |

The images above show the largest variance slices of the map in three orthogonal directions.

## 6.4    Orthogonal surface views ⓘ
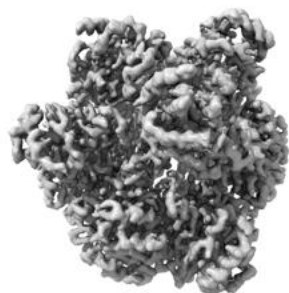
### 6.4.1    Primary map



| X | Y | Z |

The images above show the 3D surface view of the map at the recommended contour level 0.15. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

## 6.5 Mask visualisation (i)

This section was not generated. No masks/segmentation were deposited.

# 7   Map analysis ⓘ

This section contains the results of statistical analysis of the map.

## 7.1   Map-value distribution ⓘ
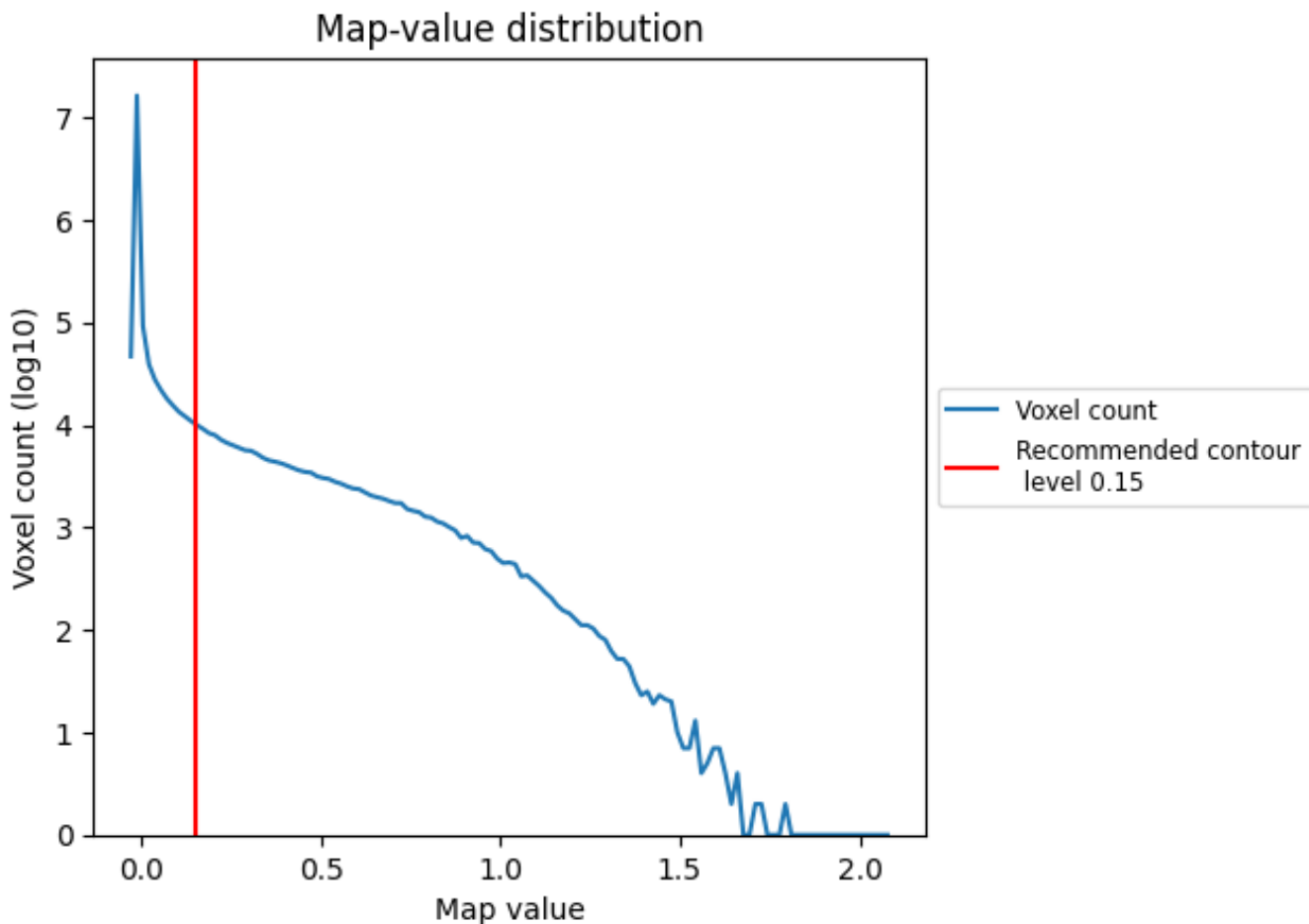


The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

## 7.2    Volume estimate ⓘ
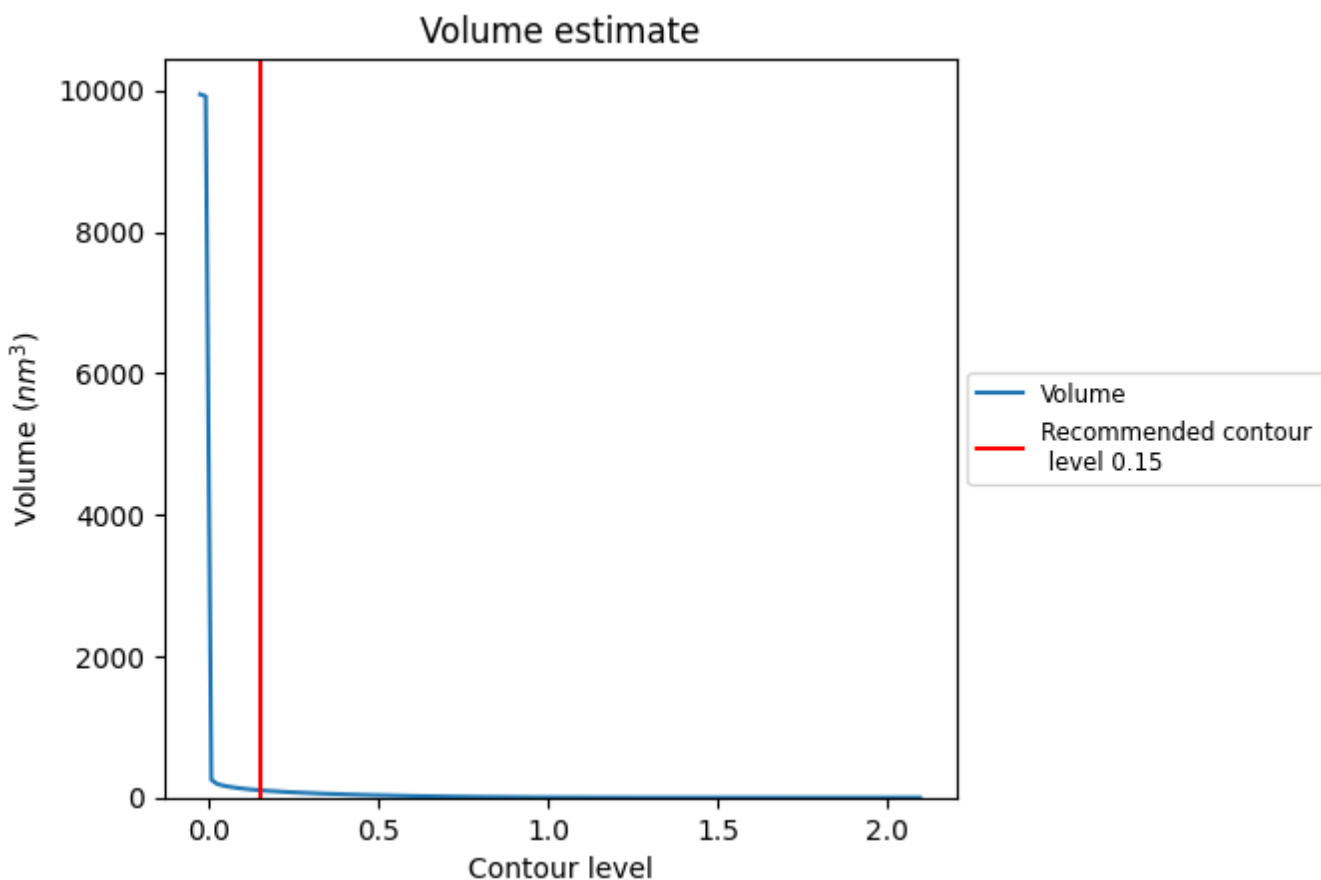
**Volume estimate**



The volume at the recommended contour level is 103 nm$^3$; this corresponds to an approximate mass of 93 kDa.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.

## 7.3 Rotationally averaged power spectrum (i)
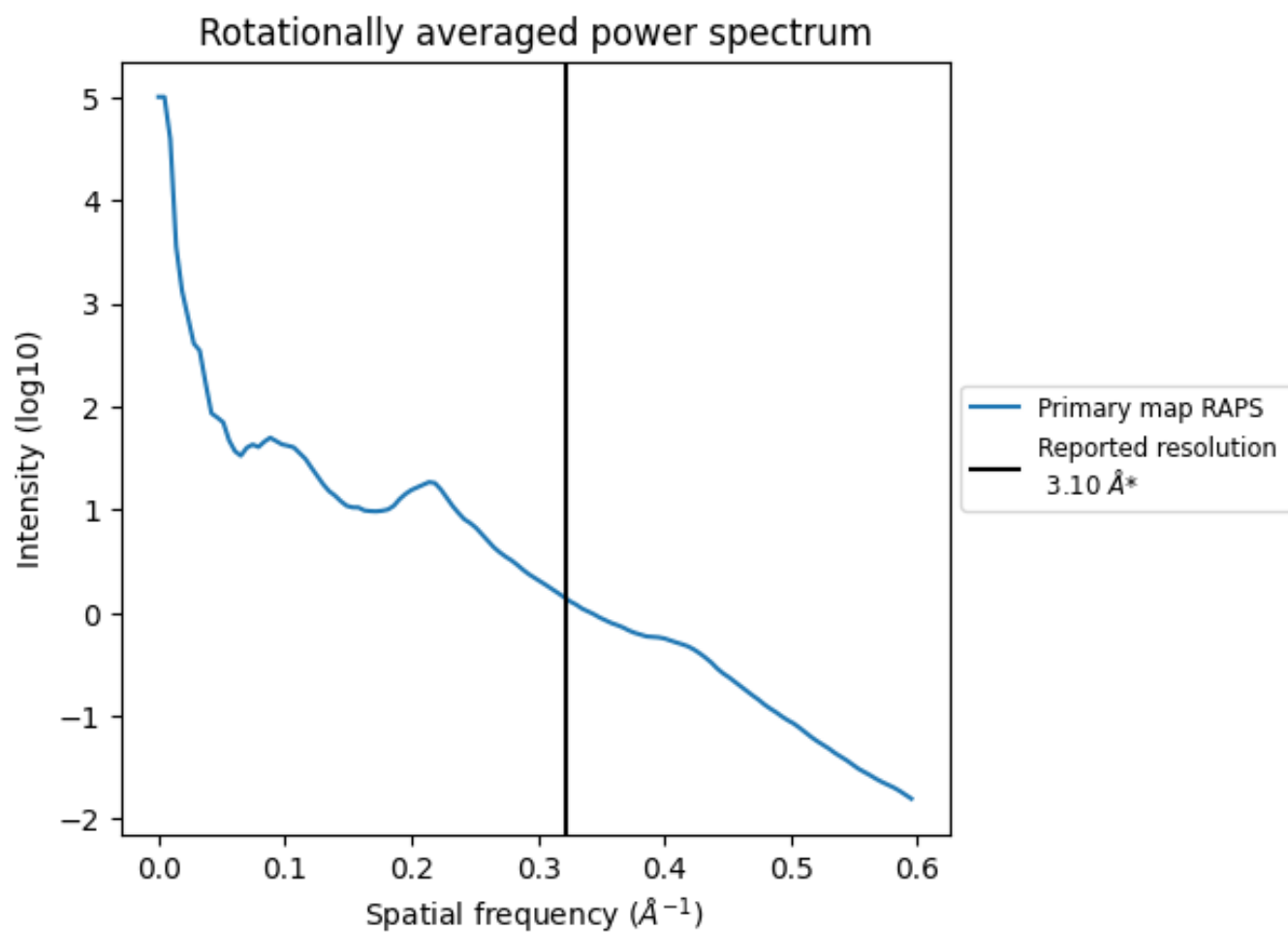


*Reported resolution corresponds to spatial frequency of 0.323 Å$^{-1}$

# 8 Fourier-Shell correlation (i)

This section was not generated. No FSC curve or half-maps provided.

# 9　Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-23116 and PDB model 7L1R. Per-residue inclusion information can be found in section 3 on page 8.

## 9.1　Map-model overlay ⓘ



|  |  |  |
|:---:|:---:|:---:|
| X | Y | Z |
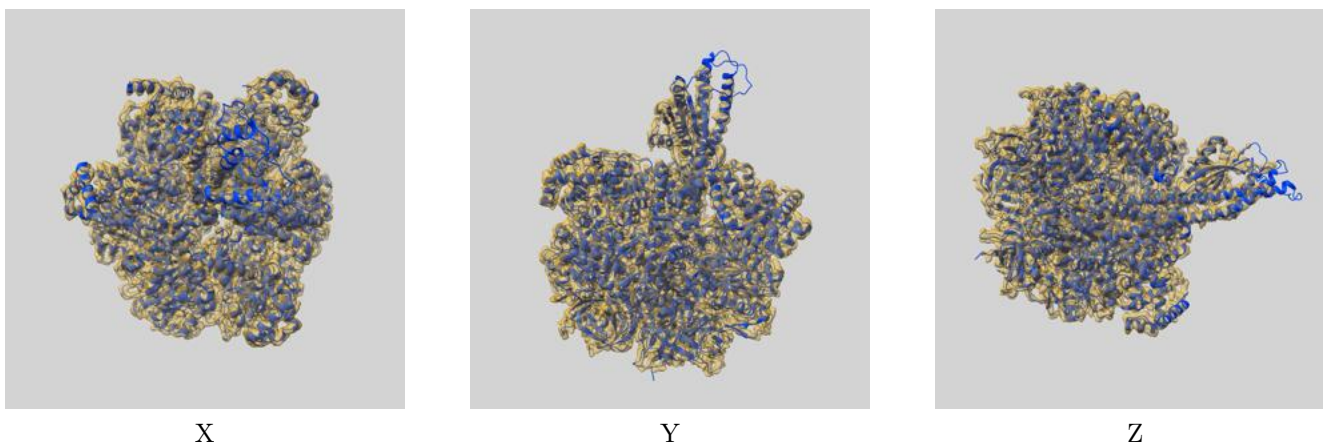
The images above show the 3D surface view of the map at the recommended contour level 0.15 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

## 9.2    Q-score mapped to coordinate model ⓘ
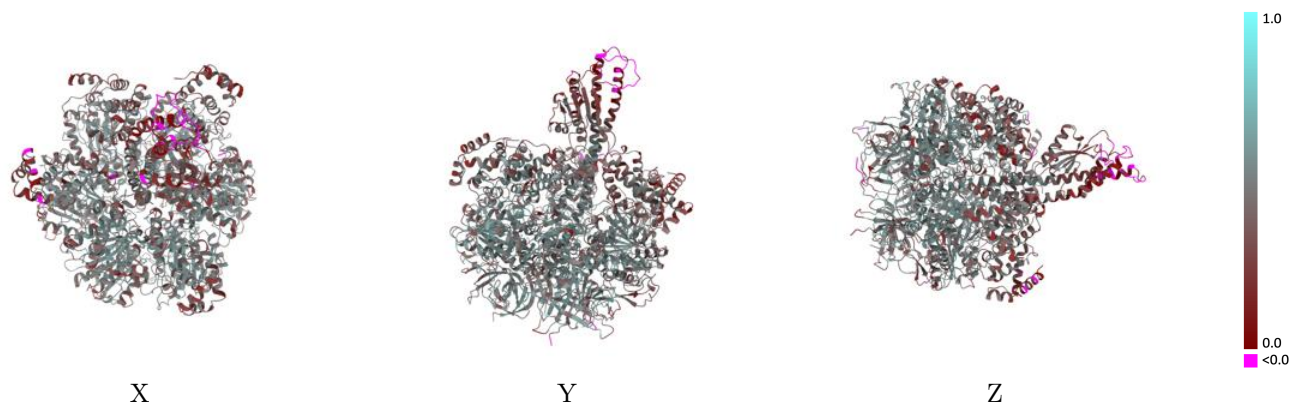


The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

## 9.3    Atom inclusion mapped to coordinate model ⓘ
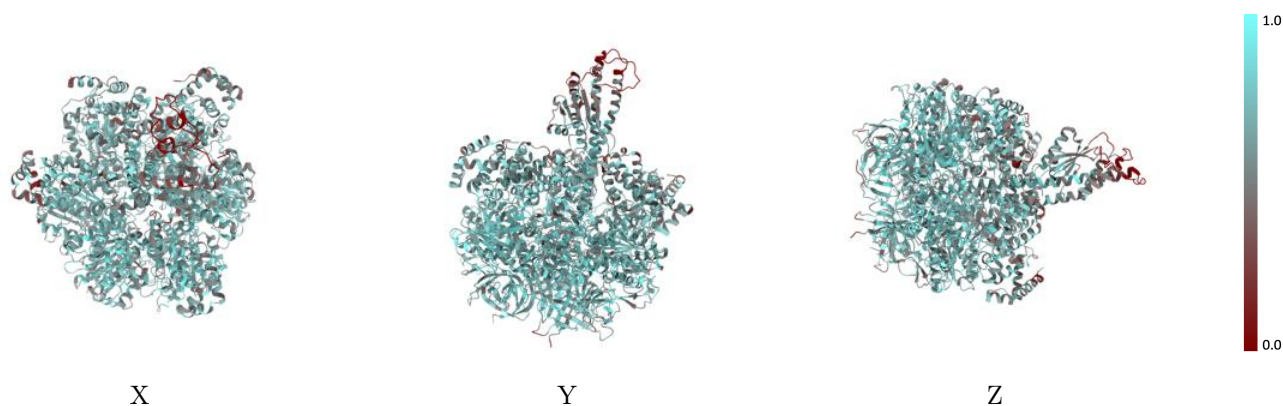


The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.15).

## 9.4 Atom inclusion (i)
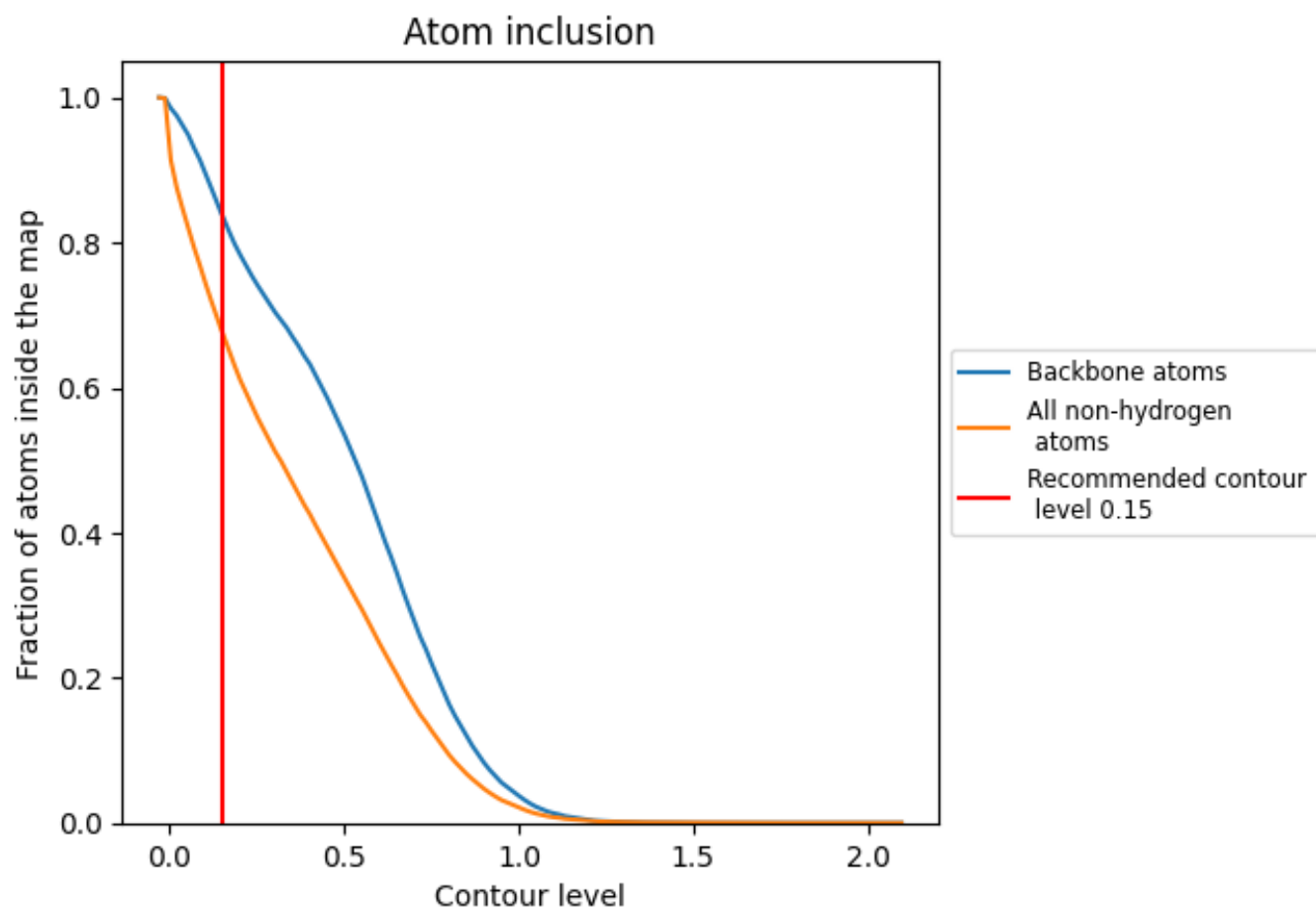


At the recommended contour level, 84% of all backbone atoms, 68% of all non-hydrogen atoms, are inside the map.

## 9.5    Map-model fit summary (i)

The table lists the average atom inclusion at the recommended contour level (0.15) and Q-score for the entire model and for each chain.

| Chain | Atom inclusion | Q-score |
|:-----:|:--------------:|:-------:|
| All | 0.6795 | 0.4440 |
| A | 0.6733 | 0.4170 |
| B | 0.6812 | 0.4290 |
| C | 0.7228 | 0.4780 |
| D | 0.7156 | 0.4820 |
| E | 0.6805 | 0.4590 |
| F | 0.7010 | 0.4840 |
| G | 0.5176 | 0.3030 |

1.0

0.0
<0.0