



wwPDB EM Validation Summary Report ⓘ

Oct 14, 2024 – 06:15 PM JST

PDB ID : 7VH2
EMDB ID : EMD-31984
Title : Cryo-EM structure of Machupo virus dimeric polymerase L
Authors : Zhang, X.; Ma, J.; Zhang, S.
Deposited on : 2021-09-20
Resolution : 5.10 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>.

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

EMDB validation analysis : 0.0.1.dev113
MolProbity : 4.02b-467
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

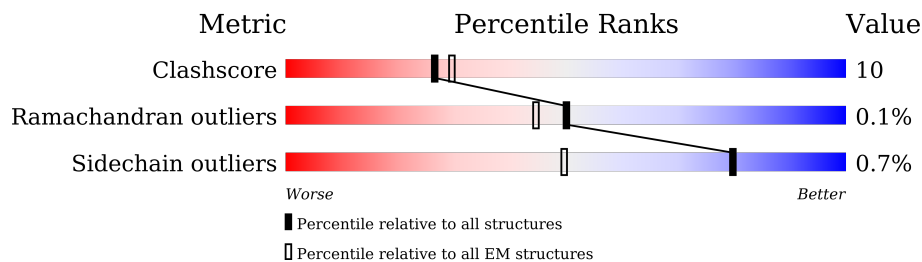
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 5.10 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 | 210492 | 15764 |
| Ramachandran outliers | 207382 | 16835 |
| Sidechain outliers | 206894 | 16415 |

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 $\leq 5\%$. 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 | 2238 | |

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 12749 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 RNA-directed RNA polymerase L.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|-----|-------|----------|-------|------|------|------|----|---------|-------|
| | | | Total | C | N | O | S | | |
| 1 | A | 1612 | 12749 | 8144 | 2129 | 2389 | 87 | 0 | 0 |

There are 29 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|-------|---------|----------|--------|----------------|------------|
| A | 2210 | TRP | - | expression tag | UNP Q6IUF8 |
| A | 2211 | SER | - | expression tag | UNP Q6IUF8 |
| A | 2212 | HIS | - | expression tag | UNP Q6IUF8 |
| A | 2213 | PRO | - | expression tag | UNP Q6IUF8 |
| A | 2214 | GLN | - | expression tag | UNP Q6IUF8 |
| A | 2215 | PHE | - | expression tag | UNP Q6IUF8 |
| A | 2216 | GLU | - | expression tag | UNP Q6IUF8 |
| A | 2217 | LYS | - | expression tag | UNP Q6IUF8 |
| A | 2218 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2219 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2220 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2221 | SER | - | expression tag | UNP Q6IUF8 |
| A | 2222 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2223 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2224 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2225 | SER | - | expression tag | UNP Q6IUF8 |
| A | 2226 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2227 | GLY | - | expression tag | UNP Q6IUF8 |
| A | 2228 | SER | - | expression tag | UNP Q6IUF8 |
| A | 2229 | SER | - | expression tag | UNP Q6IUF8 |
| A | 2230 | ALA | - | expression tag | UNP Q6IUF8 |
| A | 2231 | TRP | - | expression tag | UNP Q6IUF8 |
| A | 2232 | SER | - | expression tag | UNP Q6IUF8 |
| A | 2233 | HIS | - | expression tag | UNP Q6IUF8 |
| A | 2234 | PRO | - | expression tag | UNP Q6IUF8 |
| A | 2235 | GLN | - | expression tag | UNP Q6IUF8 |
| A | 2236 | PHE | - | expression tag | UNP Q6IUF8 |
| A | 2237 | GLU | - | expression tag | UNP Q6IUF8 |

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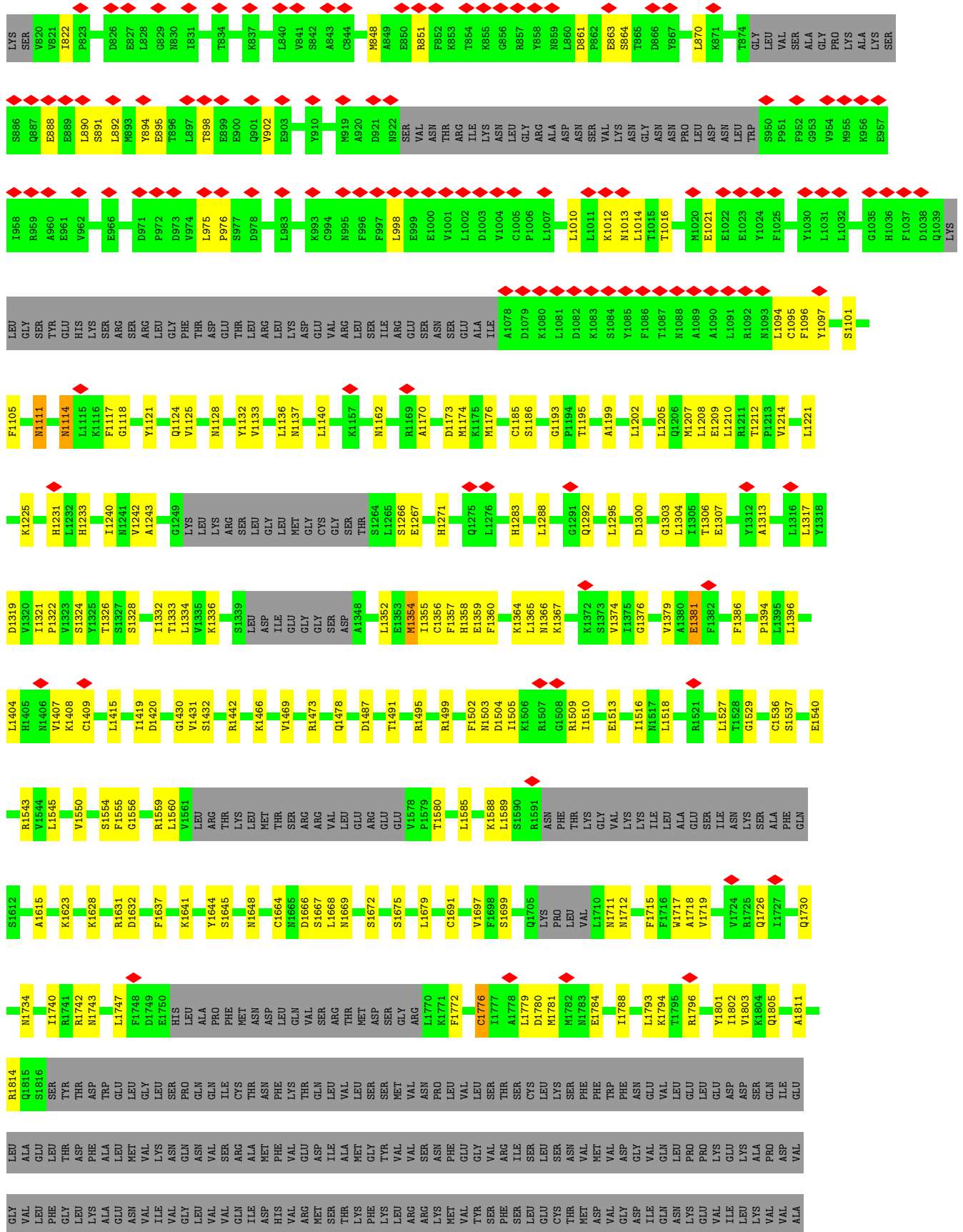
| Chain | Residue | Modelled | Actual | Comment | Reference |
|-------|---------|----------|--------|----------------|------------|
| A | 2238 | LYS | - | expression tag | UNP Q6IUF8 |

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: RNA-directed RNA polymerase L





VAL ASP
GLY GLN
SER SER
VAL VAL
SER SER
GLY GLY
SER ASP
GLY GLY
TYR ASN
HIS
MET
LEU
LEU
ASP
GLY
VAL
PRO
GLY
PRO
VAL
ASN
VAL
ILE
ALA
SER
SER
PHE
ASP
GLY
GLN
ALA
ALA
SER
PHE
TYR
ASP
VAL
GLY
GLY
ALA
MET
LEU
LEU
ILE
GLU
THR
SER
TYR
ASN
LEU
ALA
GLY
SER
SER
MET
LEU
ASN
VAL
THR
GLY
ALA
ASP
LEU

GLY PHE
SER SER
PRO VAL
GLY MET
SER LEU
ASP ASP
LYS TYR
SER SER
TYR MET
ARG ARG
LEU LEU
SER ASP
GLY GLY
PRO VAL
ASN ASN
ILE ILE
GLU GLU
SER SER
ASP ASP
PRO LEU
LEU VAL
PHE LEU
LEU LEU
LYS ASP
GLY ASP
ALA ALA
SER ARG
LEU VAL
GLN GLN
ASN ASP
PHE PHE
LEU THR
THR THR
ILE ILE
VAL VAL
HIS HIS
ASP ASP
VAL VAL
GLY TYR
LYS LYS
ILE ILE
LEU LEU
GLN THR
SER SER
HIS HIS
PRO PRO
GLN PHE
LYS LYS
GLY GLY
GLY GLY
GLY GLY
GLY GLY
SER SER
SER SER
PHE PHE
LYS LYS
VAL VAL
TRP TRP
ALA ALA
SER SER
HIS HIS

ASP GLU
GLY GLY
VAL VAL
SER VAL
MET MET
LEU LEU
HIS HIS
GLN GLN
ASP ASP
LEU LEU
TRP TRP
PRO PRO
TYR TYR
LEU LEU
LYS LYS
ALA ALA
THR THR
SER SER
GLN GLN
VAL VAL
MET MET
ILE ILE
PHE PHE
GLU GLU
GLN GLN
PRO PRO
LEU LEU
ALA ALA
ASN ASN
THR THR
LEU LEU
GLN GLN
VAL VAL
GLU GLU
ASP ASP
ILE ILE
GLU GLU
TRP TRP
SER SER
HIS HIS
PRO PRO
GLN GLN
PHE PHE
GLU GLU
LYS LYS
GLY GLY
GLY GLY
PHE PHE
SER SER
ILE ILE
GLU GLU
PHE PHE
GLY GLY
SER SER
GLY GLY
TRP TRP
ILE ILE
SER SER
GLY GLY
THR THR
PHE PHE
ASN ASN
SER SER
PHE PHE
LYS LYS
VAL VAL
ALA ALA
TRP TRP
ALA ALA
TYR TYR

SER LYS
LEU LEU
GLY GLY
LEU LEU
VAL VAL
ILE ILE
SER SER
ASP ASP
THR THR
GLN GLN
GLY GLY
SER SER
PHE PHE
ARG ARG
LEU LEU
LYS LYS
GLY GLY
VAL VAL
MET MET
CYS CYS
ARG ARG
PRO PRO
LEU LEU
ALA ALA
ASN ASN
THR THR
LEU LEU
GLN GLN
VAL VAL
GLU GLU
ASP ASP
ILE ILE
GLU GLU
TRP TRP
SER SER
HIS HIS
PRO PRO
GLN GLN
PHE PHE
GLU GLU
LYS LYS
GLY GLY
GLY GLY
GLY GLY
SER SER
SER SER
GLY GLY
THR THR
PHE PHE
ASN ASN
SER SER
PHE PHE
LYS LYS
VAL VAL
TRP TRP
ALA ALA
SER SER
HIS HIS

PRO
GLN
PHE
GLU
LYS

4 Experimental information

| Property | Value | Source |
|--------------------------------------|---|-----------|
| EM reconstruction method | SINGLE PARTICLE | Depositor |
| Imposed symmetry | POINT, Not provided | |
| Number of particles used | 52947 | 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 ($e^-/\text{\AA}^2$) | 60 | Depositor |
| Minimum defocus (nm) | Not provided | |
| Maximum defocus (nm) | Not provided | |
| Magnification | Not provided | |
| Image detector | GATAN K2 SUMMIT (4k x 4k) | Depositor |
| Maximum map value | 0.137 | Depositor |
| Minimum map value | -0.073 | Depositor |
| Average map value | 0.000 | Depositor |
| Map value standard deviation | 0.005 | Depositor |
| Recommended contour level | 0.0225 | Depositor |
| Map size (\AA) | 262.4, 262.4, 262.4 | wwPDB |
| Map dimensions | 160, 160, 160 | wwPDB |
| Map angles ($^\circ$) | 90.0, 90.0, 90.0 | wwPDB |
| Pixel spacing (\AA) | 1.64, 1.64, 1.64 | Depositor |

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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 | 0.39 | 0/12967 | 0.67 | 6/17487 (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 |
|-----|-------|---------------------|---------------------|
| 1 | A | 0 | 10 |

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

| Mol | Chain | Res | Type | Atoms | Z | Observed(°) | Ideal(°) |
|-----|-------|------|------|-----------|------|-------------|----------|
| 1 | A | 388 | LEU | CA-CB-CG | 5.54 | 128.04 | 115.30 |
| 1 | A | 1319 | ASP | CB-CG-OD1 | 5.52 | 123.27 | 118.30 |
| 1 | A | 1288 | LEU | CA-CB-CG | 5.37 | 127.64 | 115.30 |
| 1 | A | 678 | LEU | CA-CB-CG | 5.18 | 127.22 | 115.30 |
| 1 | A | 539 | LEU | CA-CB-CG | 5.16 | 127.17 | 115.30 |

There are no chirality outliers.

5 of 10 planarity outliers are listed below:

| Mol | Chain | Res | Type | Group |
|-----|-------|-----|------|---------|
| 1 | A | 388 | LEU | Peptide |
| 1 | A | 390 | ASN | Peptide |
| 1 | A | 392 | ARG | Peptide |
| 1 | A | 395 | ASP | Peptide |
| 1 | A | 710 | THR | Peptide |

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 | 12749 | 0 | 12784 | 249 | 0 |
| All | All | 12749 | 0 | 12784 | 249 | 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.

The worst 5 of 249 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:A:218:LEU:O | 1:A:222:LEU:HB2 | 1.66 | 0.95 |
| 1:A:1322:PRO:HA | 1:A:1334:LEU:O | 1.68 | 0.91 |
| 1:A:1354:MET:O | 1:A:1357:PHE:HB3 | 1.73 | 0.89 |
| 1:A:1118:GLY:H | 1:A:1133:VAL:H | 1.37 | 0.72 |
| 1:A:245:TRP:O | 1:A:249:GLU:HB2 | 1.89 | 0.71 |

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

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

| Mol | Chain | Analysed | Favoured | Allowed | Outliers | Percentiles |
|-----|-------|-----------------|------------|-----------|----------|-------------|
| 1 | A | 1582/2238 (71%) | 1363 (86%) | 217 (14%) | 2 (0%) | 48 83 |

All (2) Ramachandran outliers are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 1 | A | 475 | PHE |
| 1 | A | 711 | PRO |

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

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

| Mol | Chain | Analysed | Rotameric | Outliers | Percentiles |
|-----|-------|-----------------|------------|----------|---------------------------------------|
| 1 | A | 1441/2026 (71%) | 1431 (99%) | 10 (1%) | 81 87 |

5 of 10 residues with a non-rotameric sidechain are listed below:

| Mol | Chain | Res | Type |
|-----|-------|------|------|
| 1 | A | 1111 | ASN |
| 1 | A | 1114 | ASN |
| 1 | A | 1560 | LEU |
| 1 | A | 449 | GLN |
| 1 | A | 580 | LEU |

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 18 such sidechains are listed below:

| Mol | Chain | Res | Type |
|-----|-------|------|------|
| 1 | A | 1478 | GLN |
| 1 | A | 1785 | ASN |
| 1 | A | 1734 | ASN |
| 1 | A | 647 | HIS |
| 1 | A | 1292 | 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](#)

There are no ligands in this entry.

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.

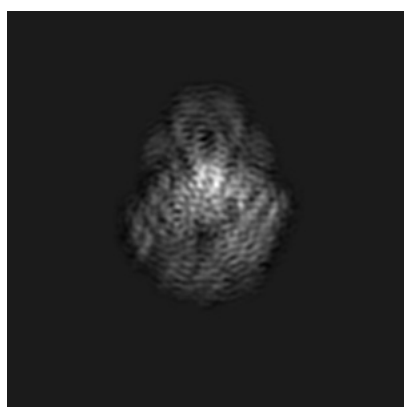
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-31984. These allow visual inspection of the internal detail of the map and identification of artifacts.

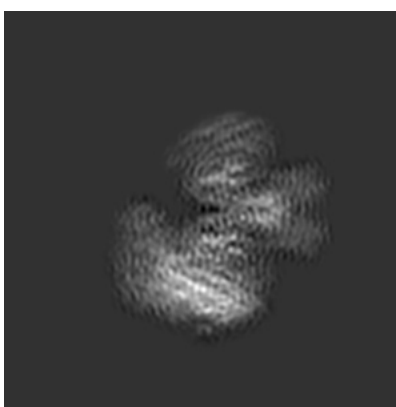
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

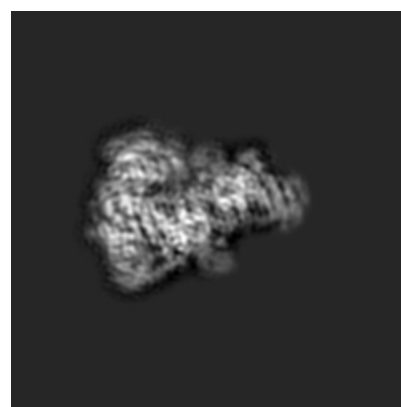
6.1.1 Primary map



X



Y



Z

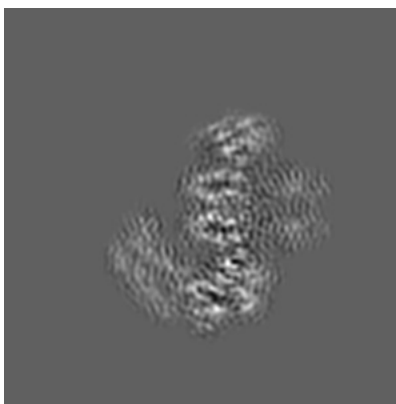
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

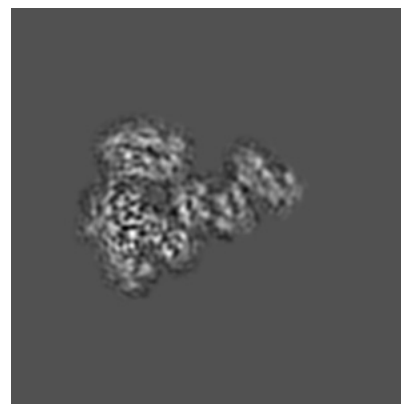
6.2.1 Primary map



X Index: 80



Y Index: 80

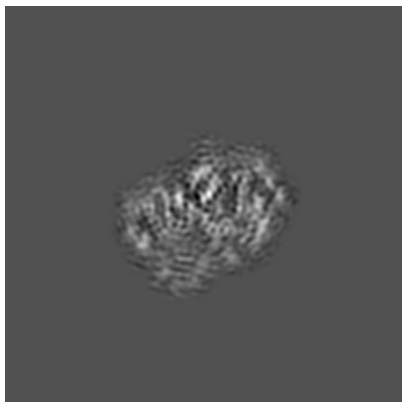


Z Index: 80

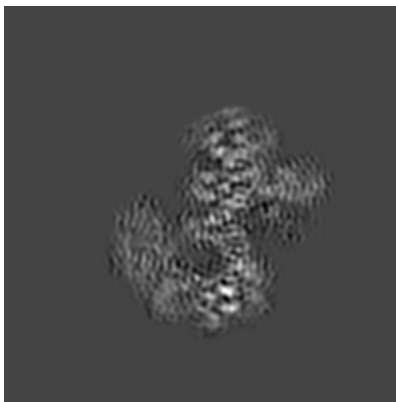
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [\(i\)](#)

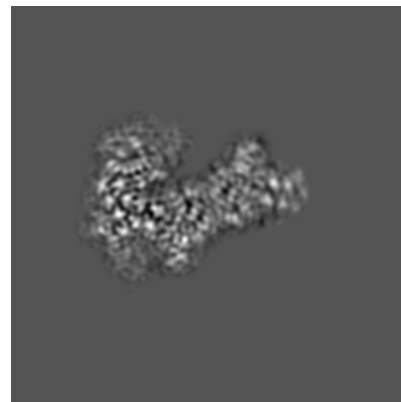
6.3.1 Primary map



X Index: 47



Y Index: 83

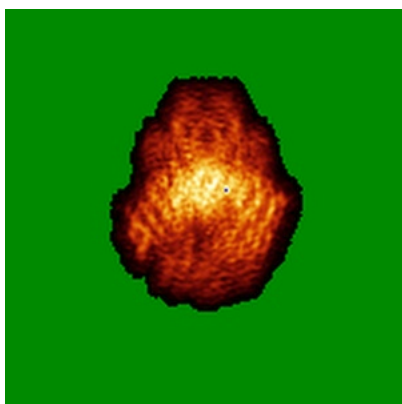


Z Index: 87

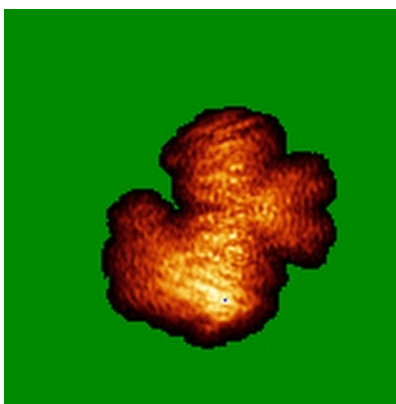
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) [\(i\)](#)

6.4.1 Primary map



X



Y

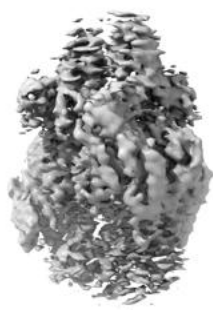


Z

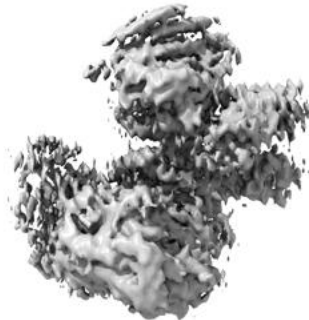
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

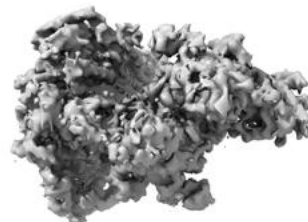
6.5.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.0225. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

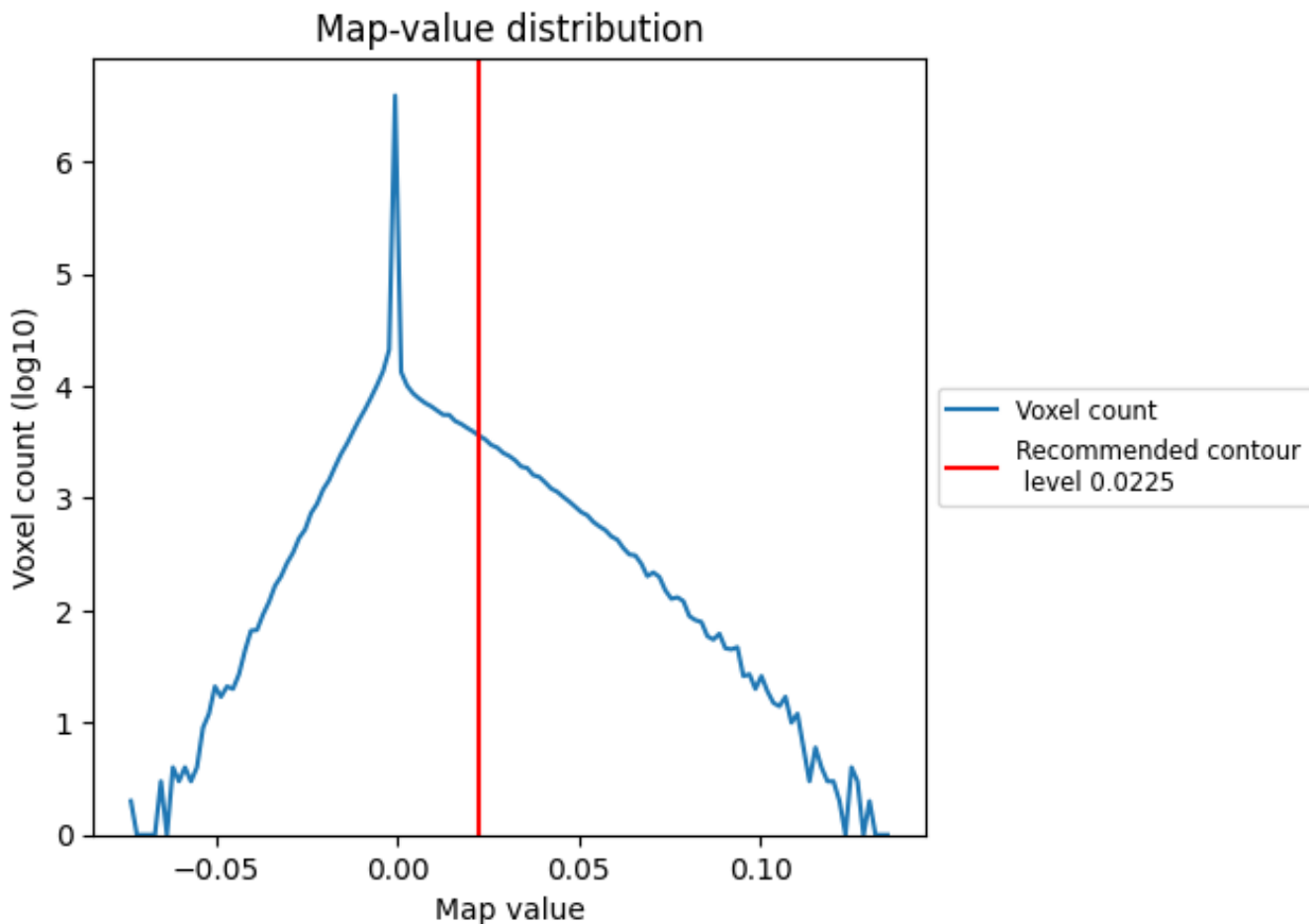
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

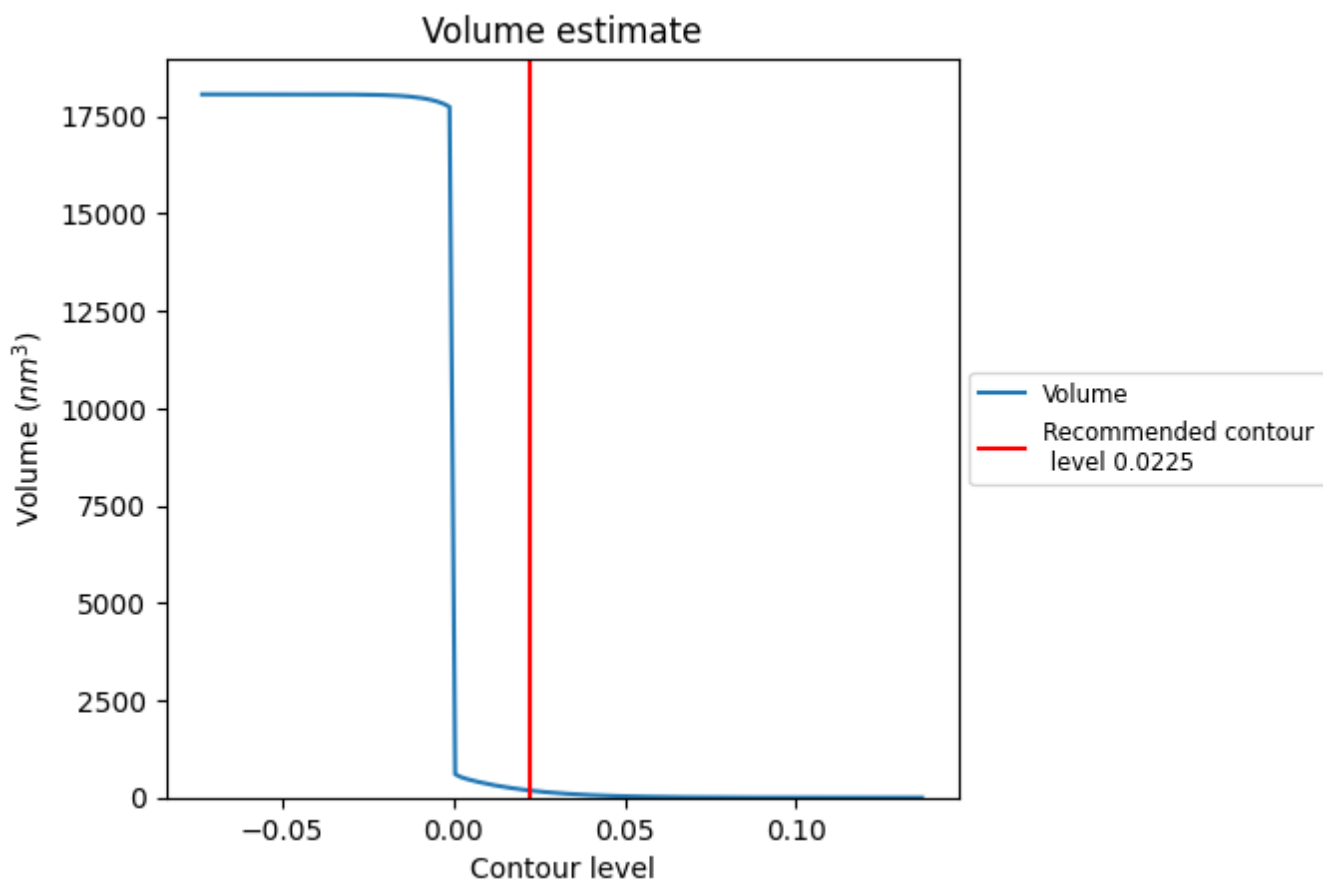
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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.

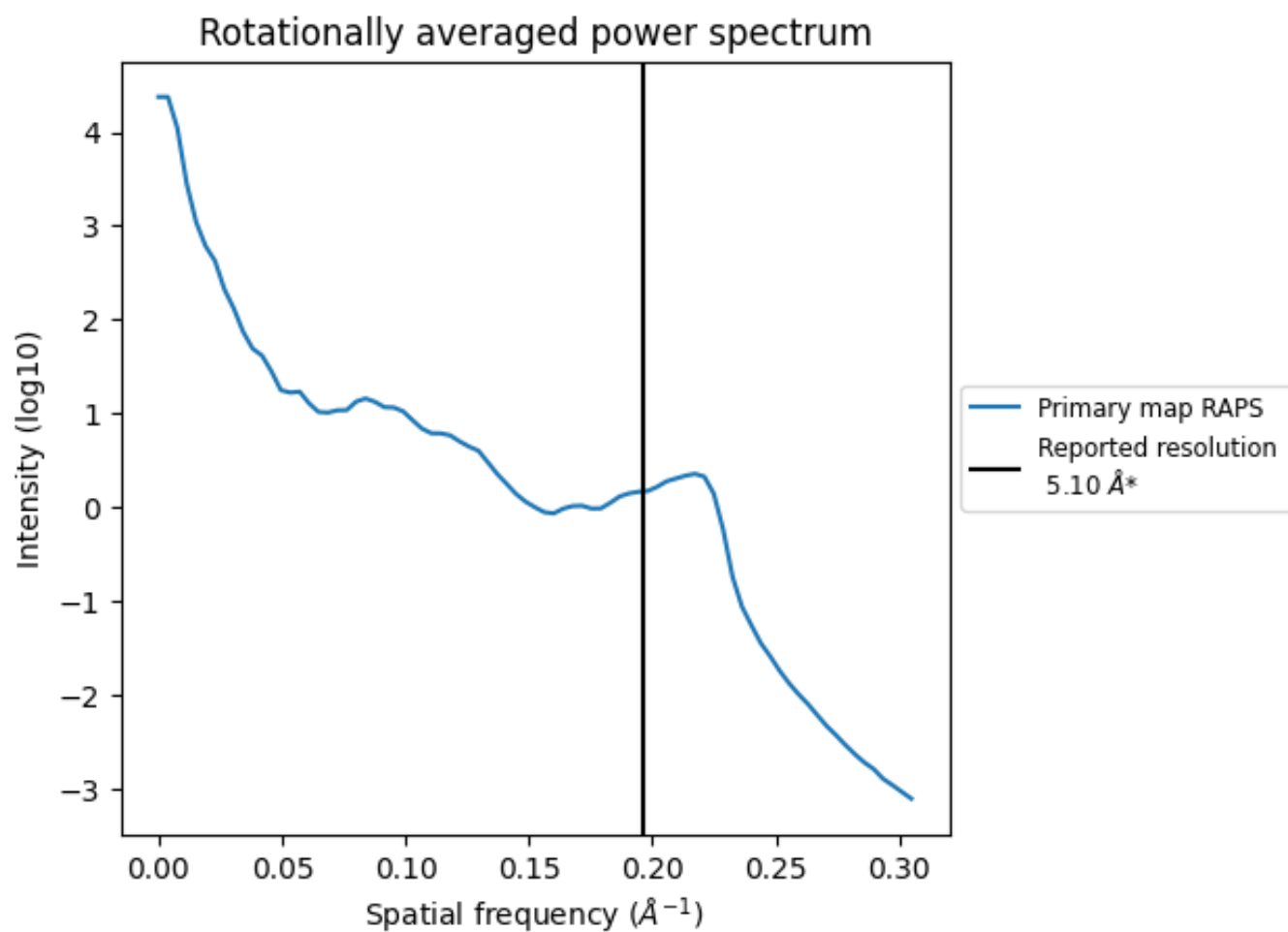
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 180 nm³; this corresponds to an approximate mass of 162 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 0.196\AA^{-1}

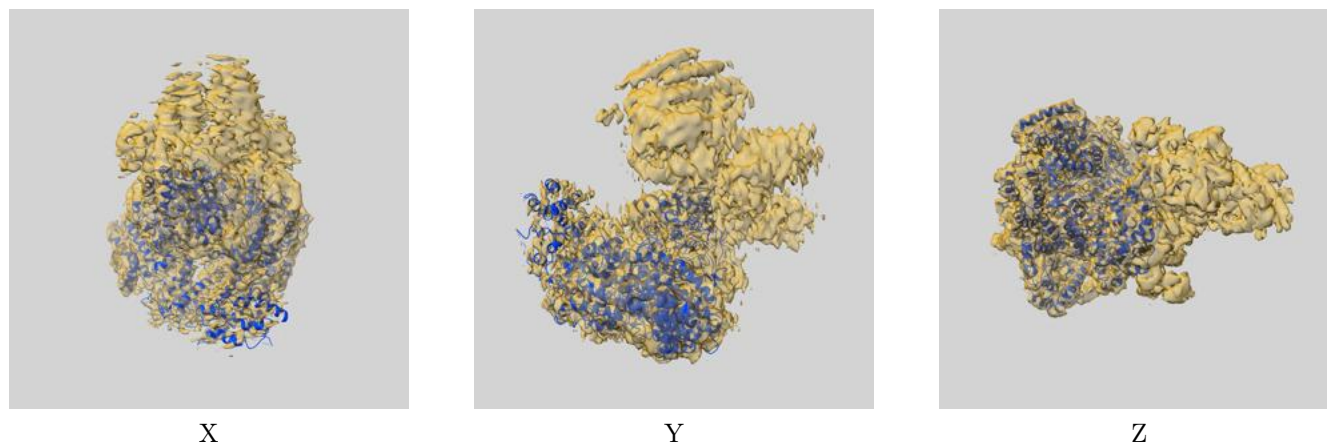
8 Fourier-Shell correlation

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

9 Map-model fit [i](#)

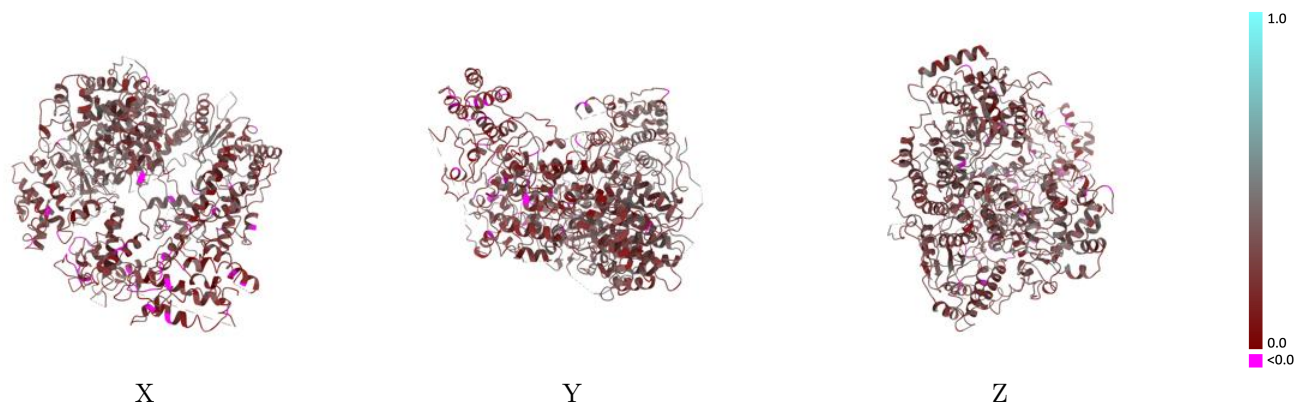
This section contains information regarding the fit between EMDB map EMD-31984 and PDB model 7VH2. Per-residue inclusion information can be found in section 3 on page 5.

9.1 Map-model overlay [i](#)



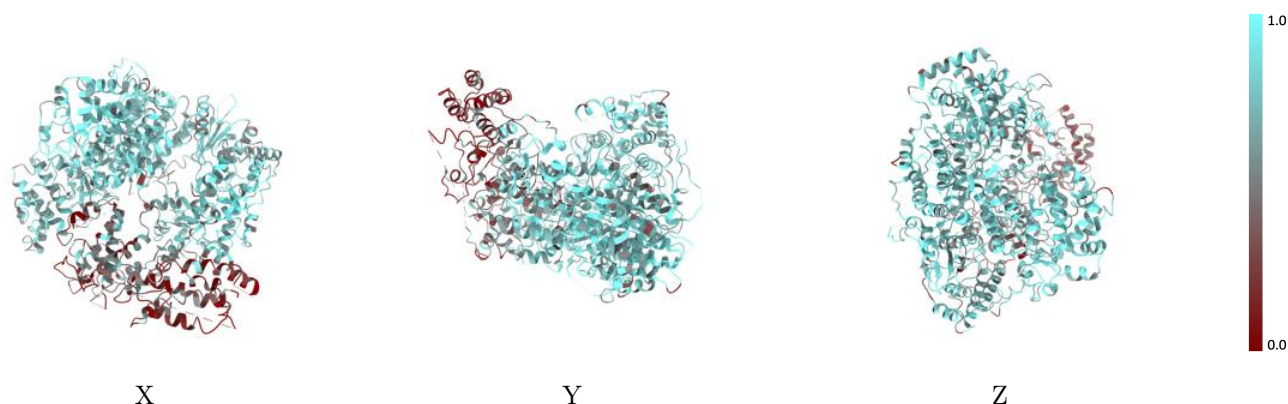
The images above show the 3D surface view of the map at the recommended contour level 0.0225 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2 Q-score mapped to coordinate model [i](#)



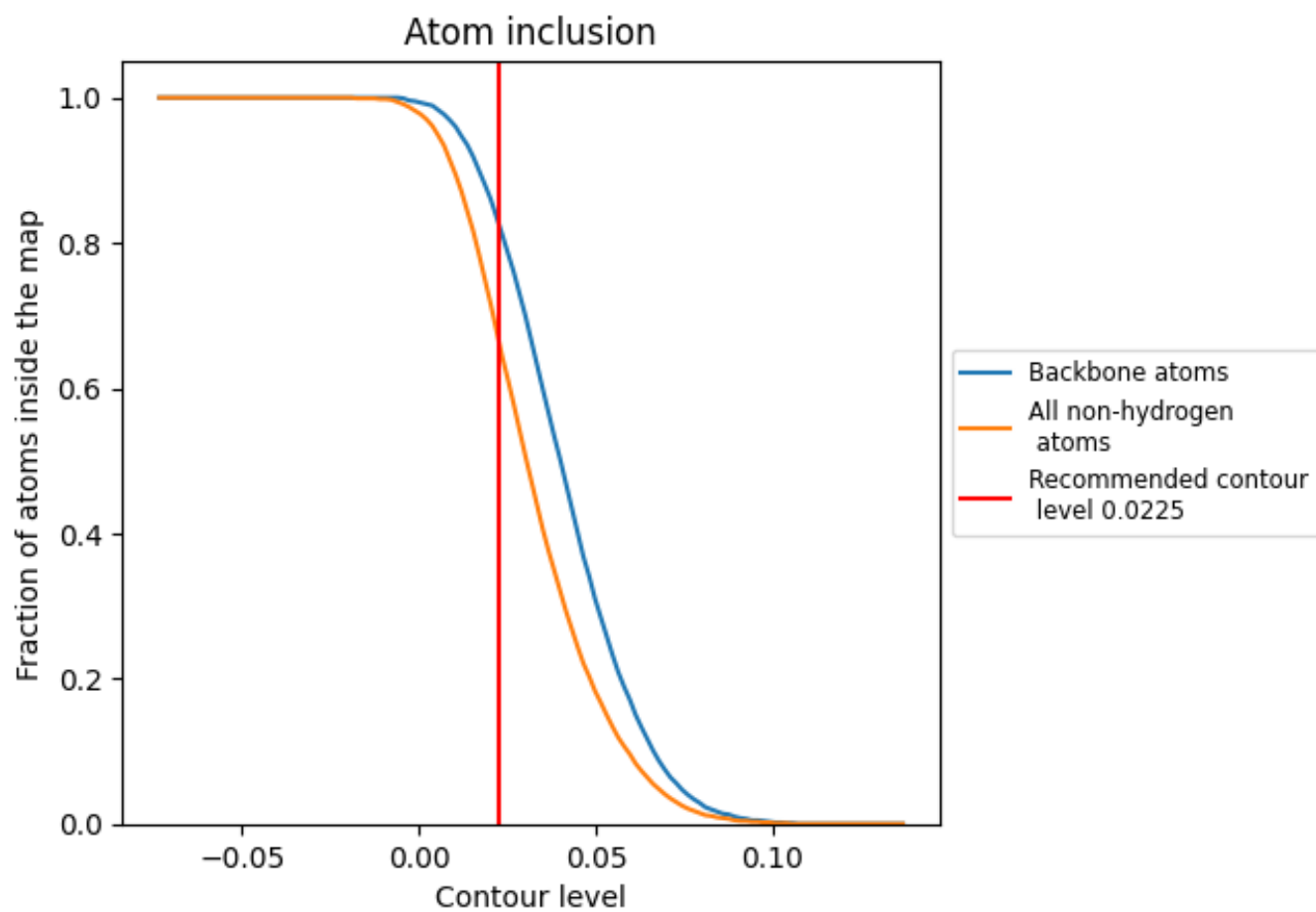
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 [i](#)



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 (0.0225).





9.4 Atom inclusion [i](#)



At the recommended contour level, 83% of all backbone atoms, 66% 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 (0.0225) and Q-score for the entire model and for each chain.

| Chain | Atom inclusion | Q-score |
|-------|--|--|
| All |  0.6650 |  0.2760 |
| A |  0.6650 |  0.2760 |

