# wwPDB EM Validation Summary Report

Jul 24, 2025 – 12:50 PM EDT

| | | |
|---|---|---|
| PDB ID | : | 9MV0 / pdb_00009mv0 |
| EMDB ID | : | EMD-48650 |
| Title | : | Structure of HKU5 spike C-terminal domain in complex with ACE2 from Pipistrellus abramus |
| Authors | : | Li, N.; Tsybovsky, Y.; Teng, I.; Zhou, T. |
| Deposited on | : | 2025-01-15 |
| Resolution | : | 4.20 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:

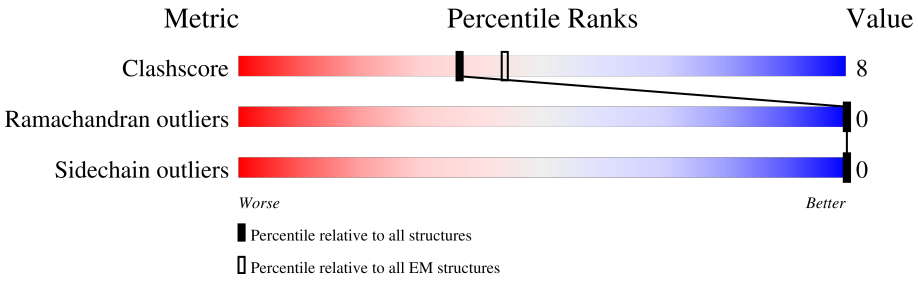
| | | |
|---|---|---|
| EMDB validation analysis | : | 0.0.1.dev118 |
| Mogul | : | 2022.3.0, CSD as543be (2022) |
| MolProbity | : | 4-5-2 with Phenix2.0rc1 |
| Percentile statistics | : | 20231227.v01 (using entries in the PDB archive December 27th 2023) |
| MapQ | : | 1.9.13 |
| Ideal geometry (proteins) | : | Engh & Huber (2001) |
| Ideal geometry (DNA, RNA) | : | Parkinson et al. (1996) |
| Validation Pipeline (wwPDB-VP) | : | 2.44 |

# 1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
*ELECTRON MICROSCOPY*

The reported resolution of this entry is 4.20 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 <=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 | 803 | 69% 17% 14% |
| 1 | C | 803 | 72% 14% 14% |
| 2 | B | 1352 | 12% 86% |
| 2 | D | 1352 | 12% 86% |
| 3 | E | 2 | 100% |
| 3 | F | 2 | 100% |
| 3 | G | 2 | 100% |
| 3 | H | 2 | 100% |

# 2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 14631 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 Angiotensin-converting enzyme.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 692 | Total | C | N | O | S | 0 | 0 |
| | | | 5686 | 3623 | 958 | 1071 | 34 | | |
| 1 | C | 692 | Total | C | N | O | S | 0 | 0 |
| | | | 5686 | 3623 | 958 | 1071 | 34 | | |

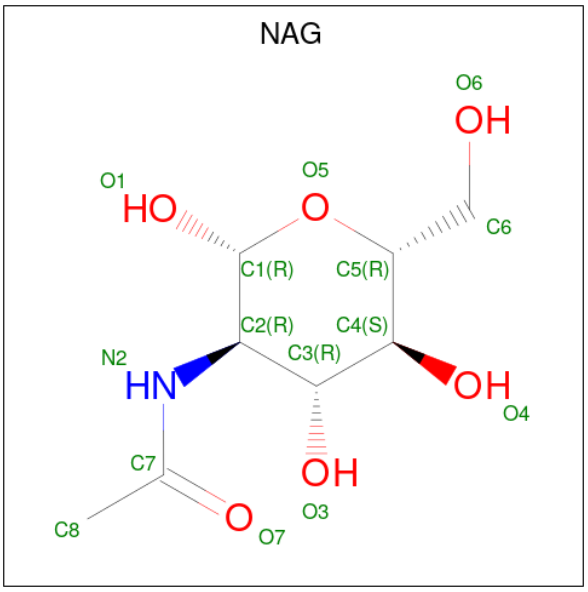
- Molecule 2 is a protein called Spike glycoprotein.

| Mol | Chain | Residues | Atoms | | | | | AltConf | Trace |
|---|---|---|---|---|---|---|---|---|---|
| 2 | B | 196 | Total | C | N | O | S | 0 | 0 |
| | | | 1521 | 970 | 238 | 301 | 12 | | |
| 2 | D | 195 | Total | C | N | O | S | 0 | 0 |
| | | | 1514 | 965 | 237 | 300 | 12 | | |

- Molecule 3 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.


| Mol | Chain | Residues | Atoms | | | | AltConf | Trace |
|---|---|---|---|---|---|---|---|---|
| 3 | E | 2 | Total | C | N | O | 0 | 0 |
| | | | 28 | 16 | 2 | 10 | | |
| 3 | F | 2 | Total | C | N | O | 0 | 0 |
| | | | 28 | 16 | 2 | 10 | | |
| 3 | G | 2 | Total | C | N | O | 0 | 0 |
| | | | 28 | 16 | 2 | 10 | | |
| 3 | H | 2 | Total | C | N | O | 0 | 0 |
| | | | 28 | 16 | 2 | 10 | | |

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



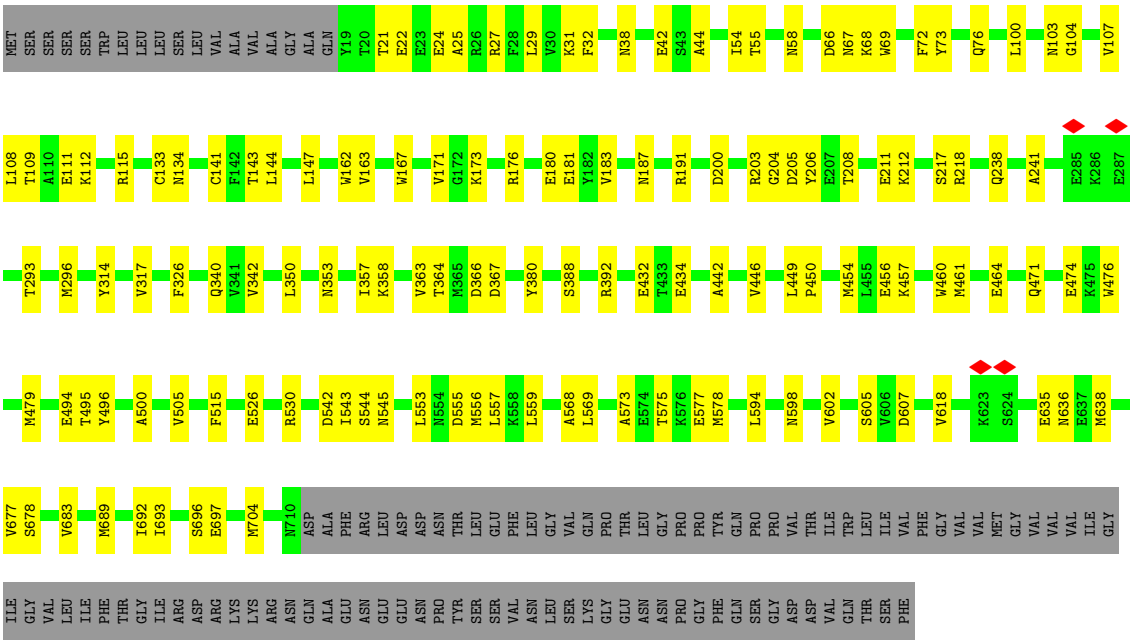

| Mol | Chain | Residues | Atoms | | | | AltConf |
|---|---|---|---|---|---|---|---|
| 4 | A | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |
| 4 | A | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |
| 4 | A | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |
| 4 | A | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |
| 4 | C | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |
| 4 | C | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |
| 4 | C | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |
| 4 | C | 1 | Total | C | N | O | 0 |
| | | | 14 | 8 | 1 | 5 | |

# 3 Residue-property plots (i)

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.

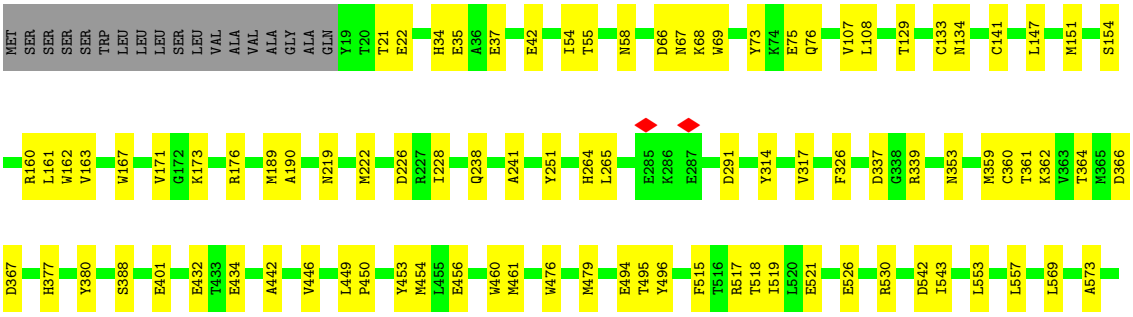
• Molecule 1: Angiotensin-converting enzyme

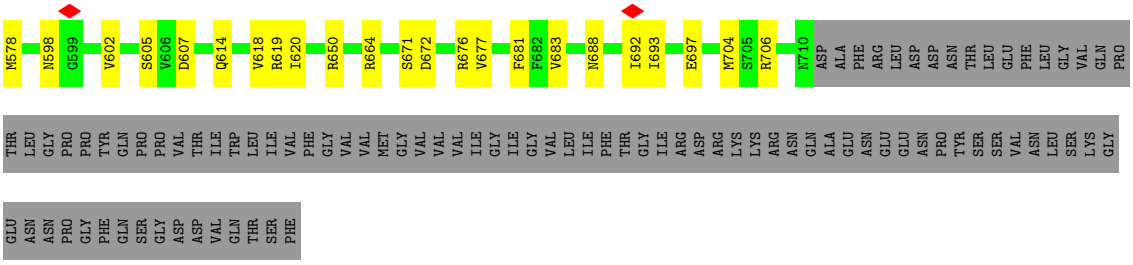
Chain A:


• Molecule 1: Angiotensin-converting enzyme

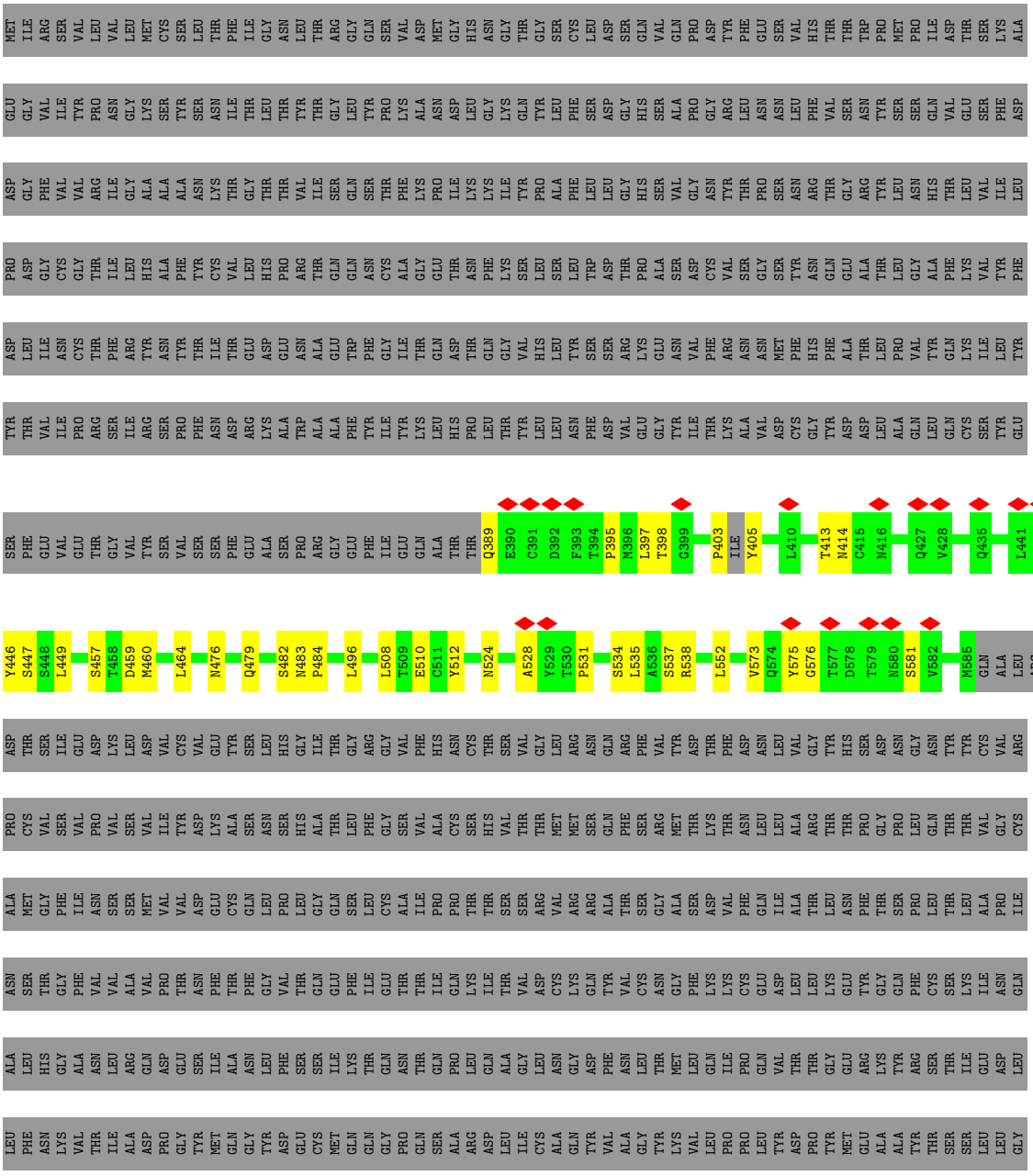
Chain C:

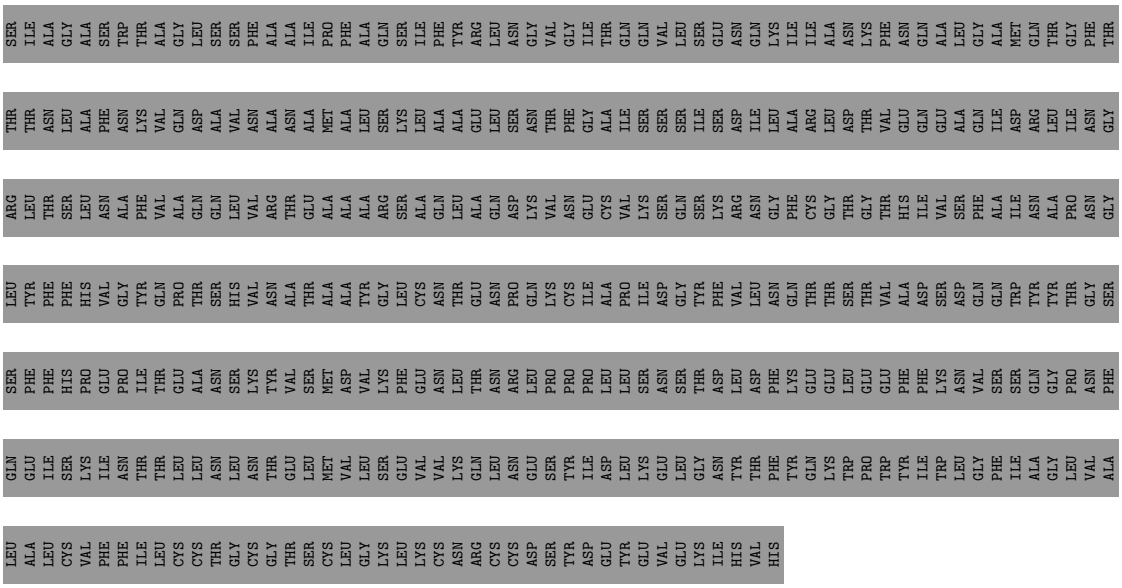






• Molecule 2: Spike glycoprotein

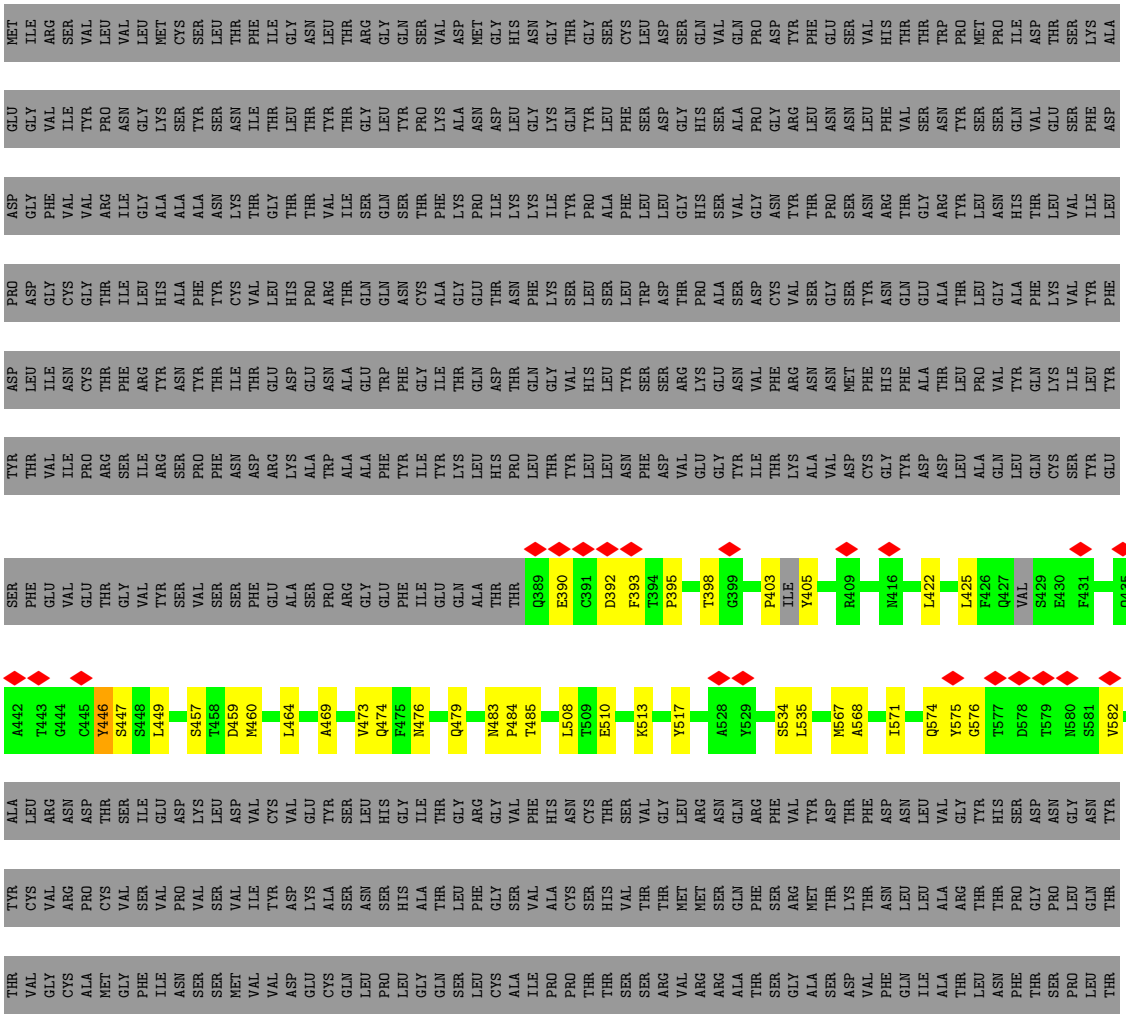
Chain B:



• Molecule 2: Spike glycoprotein

Chain D:

LEU ALA PRO ILE ASN SER THR GLY PHE VAL VAL ALA VAL PRO THR ASN PHE THR PHE GLY VAL THR GLN GLU PHE ILE GLU THR THR ILE GLN LYS ILE THR VAL ASP CYS LYS GLN TYR VAL CYS ASN GLY PHE LYS LYS CYS GLU ASP LEU LEU LYS GLU TYR GLY GLN PHE CYS SER

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

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

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

THR GLY PHE THR THR THR ASN LEU ALA PHE ASN LYS VAL GLN ASP ALA VAL ASN ALA ASN ALA MET ALA ALA LEU SER LYS LEU ALA ALA GLU LEU SER GLU PHE GLY ALA ILE SER SER SER ILE SER ASP ILE LEU ALA ARG LEU ASP THR VAL GLU GLN GLU ALA GLN ILE ASP ARG

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

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

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

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

GLY LEU VAL ALA LEU ALA LEU CYS VAL PHE PHE ILE LEU CYS CYS THR GLY CYS GLY THR SER CYS LEU GLY LYS LEU LYS CYS ASN ARG CYS CYS ASP SER TYR ASP GLU TYR GLU VAL GLU LYS ILE HIS VAL HIS

• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain E: 100%

NAG1 NAG2

• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain F: 100%

NAG1 NAG2

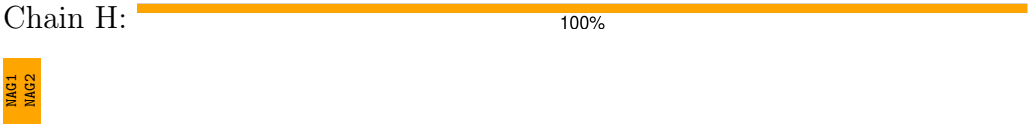
• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain G: 100%

NAG1 NAG2

• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain H:



# 4 Experimental information (i)

| Property | Value | Source |
|---|---|---|
| EM reconstruction method | SINGLE PARTICLE | Depositor |
| Imposed symmetry | POINT, C2 | Depositor |
| Number of particles used | 242675 | Depositor |
| Resolution determination method | FSC 0.143 CUT-OFF | Depositor |
| CTF correction method | PHASE FLIPPING AND AMPLITUDE CORRECTION | Depositor |
| Microscope | TFS KRIOS | Depositor |
| Voltage (kV) | 300 | Depositor |
| Electron dose ($e^-/Å^2$) | 40 | Depositor |
| Minimum defocus (nm) | 500 | Depositor |
| Maximum defocus (nm) | 1900 | Depositor |
| Magnification | 47000 | Depositor |
| Image detector | DIRECT ELECTRON APOLLO (4k x 4k) | Depositor |
| Maximum map value | 1.881 | Depositor |
| Minimum map value | -1.155 | Depositor |
| Average map value | -0.000 | Depositor |
| Map value standard deviation | 0.036 | Depositor |
| Recommended contour level | 0.23 | Depositor |
| Map size (Å) | 360.0, 360.0, 360.0 | wwPDB |
| Map dimensions | 360, 360, 360 | wwPDB |
| Map angles (°) | 90.0, 90.0, 90.0 | wwPDB |
| Pixel spacing (Å) | 1.0, 1.0, 1.0 | Depositor |

# 5 Model quality

## 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NAG

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 | 0.13 | 0/5834 | 0.33 | 0/7888 |
| 1 | C | 0.13 | 0/5834 | 0.30 | 0/7888 |
| 2 | B | 0.13 | 0/1562 | 0.35 | 0/2133 |
| 2 | D | 0.13 | 0/1554 | 0.34 | 0/2120 |
| All | All | 0.13 | 0/14784 | 0.32 | 0/20029 |

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 |
|---|---|---|---|
| 2 | D | 0 | 1 |

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

| Mol | Chain | Res | Type | Group |
|---|---|---|---|---|
| 2 | D | 446 | TYR | 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 | A | 5686 | 0 | 5510 | 94 | 0 |
| 1 | C | 5686 | 0 | 5510 | 77 | 0 |
| 2 | B | 1521 | 0 | 1444 | 23 | 0 |
| 2 | D | 1514 | 0 | 1434 | 25 | 0 |
| 3 | E | 28 | 0 | 25 | 0 | 0 |
| 3 | F | 28 | 0 | 25 | 0 | 0 |
| 3 | G | 28 | 0 | 25 | 0 | 0 |
| 3 | H | 28 | 0 | 25 | 2 | 0 |
| 4 | A | 56 | 0 | 52 | 0 | 0 |
| 4 | C | 56 | 0 | 52 | 0 | 0 |
| All | All | 14631 | 0 | 14102 | 216 | 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 8.

The worst 5 of 216 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:25:ALA:O | 1:A:29:LEU:HD23 | 1.79 | 0.81 |
| 1:C:226:ASP:OD1 | 1:C:453:TYR:OH | 2.03 | 0.76 |
| 1:A:55:THR:OG1 | 1:A:58:ASN:OD1 | 2.05 | 0.75 |
| 1:C:683:VAL:CG2 | 1:C:693:ILE:HG21 | 2.17 | 0.75 |
| 1:C:21:THR:HG22 | 1:C:22:GLU:OE1 | 1.87 | 0.74 |

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 | 690/803 (86%) | 633 (92%) | 57 (8%) | 0 | 100 | 100 |
| 1 | C | 690/803 (86%) | 645 (94%) | 45 (6%) | 0 | 100 | 100 |

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| Mol | Chain | Analysed | Favoured | Allowed | Outliers | Percentiles | |
|---|---|---|---|---|---|---|---|
| 2 | B | 192/1352 (14%) | 175 (91%) | 17 (9%) | 0 | 100 | 100 |
| 2 | D | 189/1352 (14%) | 171 (90%) | 18 (10%) | 0 | 100 | 100 |
| All | All | 1761/4310 (41%) | 1624 (92%) | 137 (8%) | 0 | 100 | 100 |

There are no Ramachandran outliers to report.

### 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 | 621/716 (87%) | 621 (100%) | 0 | 100 | 100 |
| 1 | C | 621/716 (87%) | 621 (100%) | 0 | 100 | 100 |
| 2 | B | 174/1174 (15%) | 174 (100%) | 0 | 100 | 100 |
| 2 | D | 173/1174 (15%) | 173 (100%) | 0 | 100 | 100 |
| All | All | 1589/3780 (42%) | 1589 (100%) | 0 | 100 | 100 |

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

| Mol | Chain | Res | Type |
|---|---|---|---|
| 1 | C | 51 | ASN |
| 1 | C | 400 | HIS |
| 1 | C | 504 | HIS |
| 1 | A | 539 | HIS |
| 1 | A | 614 | 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)

8 monosaccharides are modelled in this entry.

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

| Mol | Type | Chain | Res | Link | Bond lengths | | | Bond angles | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Counts | RMSZ | $\#\|Z\| > 2$ | Counts | RMSZ | $\#\|Z\| > 2$ |
| 3 | NAG | E | 1 | 3,1 | 14,14,15 | 0.70 | 0 | 17,19,21 | 1.01 | 1 (5%) |
| 3 | NAG | E | 2 | 3 | 14,14,15 | 0.69 | 0 | 17,19,21 | 1.14 | 1 (5%) |
| 3 | NAG | F | 1 | 3,1 | 14,14,15 | 0.74 | 0 | 17,19,21 | 0.80 | 0 |
| 3 | NAG | F | 2 | 3 | 14,14,15 | 0.70 | 0 | 17,19,21 | 0.85 | 0 |
| 3 | NAG | G | 1 | 3,1 | 14,14,15 | 0.72 | 0 | 17,19,21 | 1.01 | 0 |
| 3 | NAG | G | 2 | 3 | 14,14,15 | 0.70 | 0 | 17,19,21 | 0.83 | 0 |
| 3 | NAG | H | 1 | 3,1 | 14,14,15 | 0.74 | 0 | 17,19,21 | 0.93 | 1 (5%) |
| 3 | NAG | H | 2 | 3 | 14,14,15 | 0.73 | 0 | 17,19,21 | 1.68 | 2 (11%) |

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

| Mol | Type | Chain | Res | Link | Chirals | Torsions | Rings |
|---|---|---|---|---|---|---|---|
| 3 | NAG | E | 1 | 3,1 | - | 1/6/23/26 | 0/1/1/1 |
| 3 | NAG | E | 2 | 3 | - | 2/6/23/26 | 0/1/1/1 |
| 3 | NAG | F | 1 | 3,1 | - | 0/6/23/26 | 0/1/1/1 |
| 3 | NAG | F | 2 | 3 | - | 1/6/23/26 | 0/1/1/1 |
| 3 | NAG | G | 1 | 3,1 | - | 0/6/23/26 | 0/1/1/1 |
| 3 | NAG | G | 2 | 3 | - | 1/6/23/26 | 0/1/1/1 |
| 3 | NAG | H | 1 | 3,1 | - | 1/6/23/26 | 0/1/1/1 |
| 3 | NAG | H | 2 | 3 | - | 3/6/23/26 | 0/1/1/1 |

There are no bond length outliers.

All (5) bond angle outliers are listed below:

| Mol | Chain | Res | Type | Atoms | Z | Observed($^o$) | Ideal($^o$) |
|---|---|---|---|---|---|---|---|
| 3 | H | 2 | NAG | C2-N2-C7 | 5.48 | 130.24 | 122.90 |
| 3 | E | 2 | NAG | C2-N2-C7 | 3.40 | 127.46 | 122.90 |
| 3 | H | 1 | NAG | O5-C1-C2 | -2.33 | 107.68 | 111.29 |
| 3 | H | 2 | NAG | C8-C7-N2 | 2.15 | 119.69 | 116.12 |
| 3 | E | 1 | NAG | C1-O5-C5 | 2.08 | 114.97 | 112.19 |

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

| Mol | Chain | Res | Type | Atoms |
|---|---|---|---|---|
| 3 | E | 2 | NAG | C8-C7-N2-C2 |
| 3 | E | 2 | NAG | O7-C7-N2-C2 |
| 3 | H | 2 | NAG | C8-C7-N2-C2 |
| 3 | H | 2 | NAG | O7-C7-N2-C2 |
| 3 | E | 1 | NAG | O5-C5-C6-O6 |

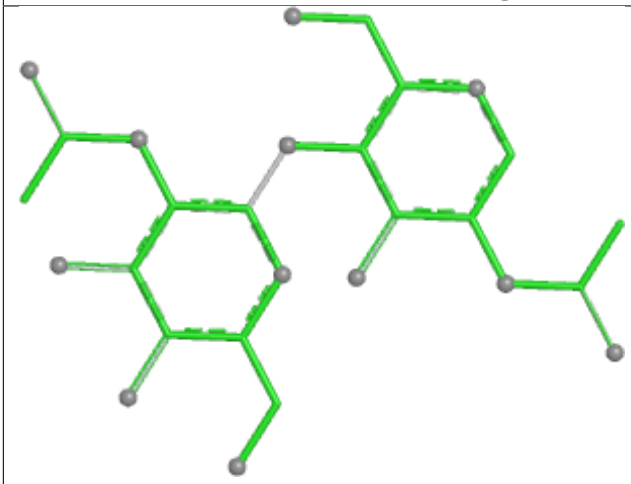
There are no ring outliers.

2 monomers are involved in 2 short contacts:

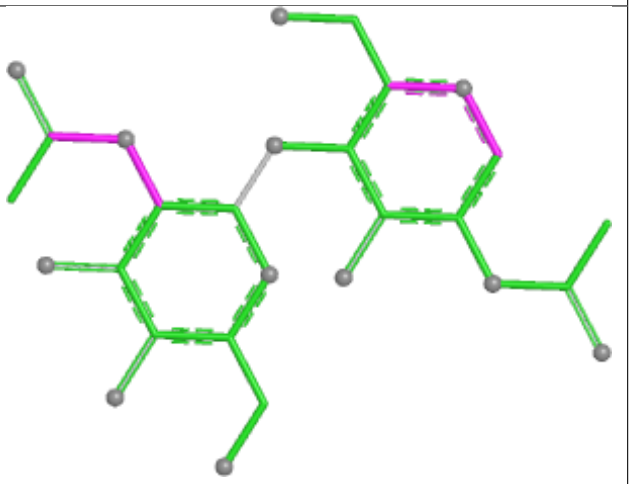
| Mol | Chain | Res | Type | Clashes | Symm-Clashes |
|---|---|---|---|---|---|
| 3 | H | 2 | NAG | 1 | 0 |
| 3 | H | 1 | NAG | 1 | 0 |

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

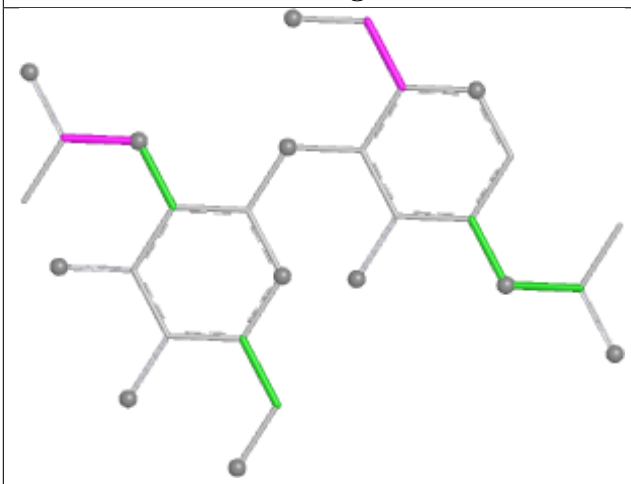
**Oligosaccharide Chain E**



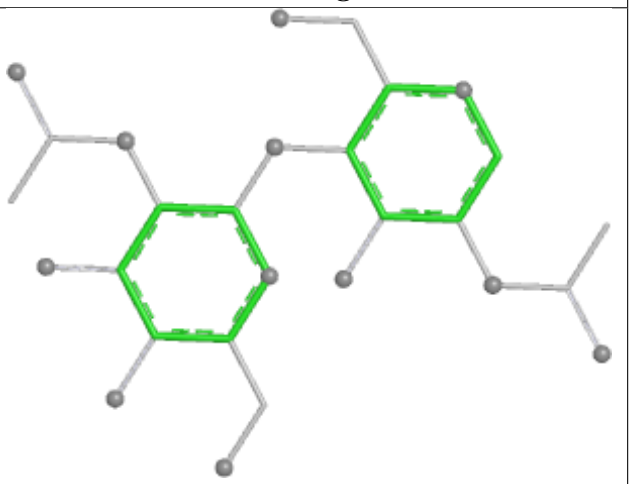
**Bond lengths**



**Bond angles**

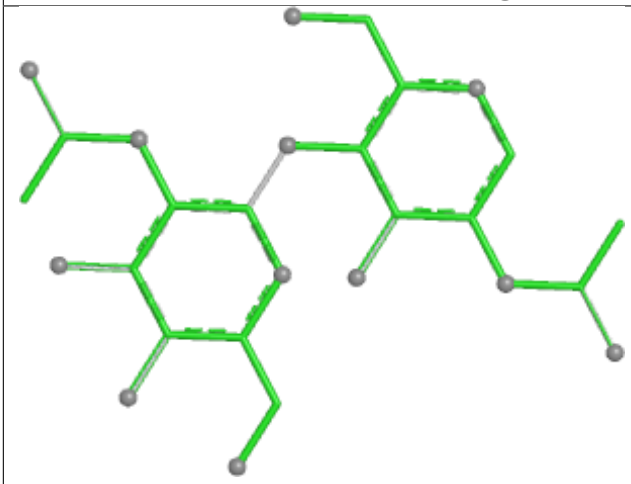


**Torsions**

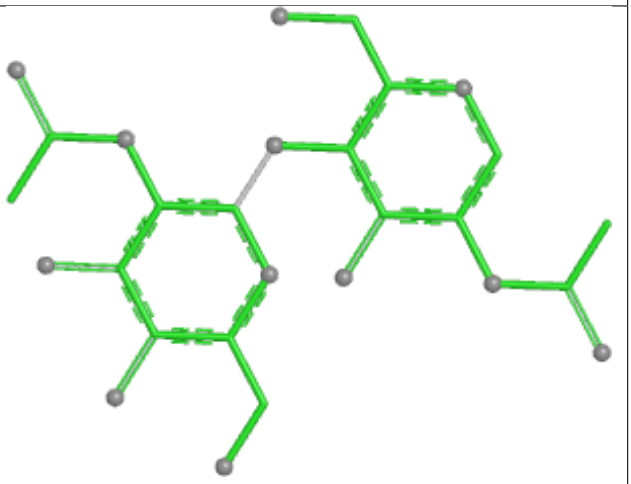


**Rings**

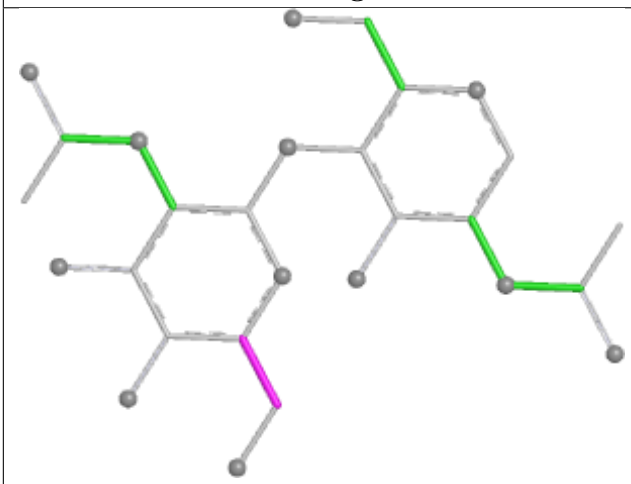
**Oligosaccharide Chain F**



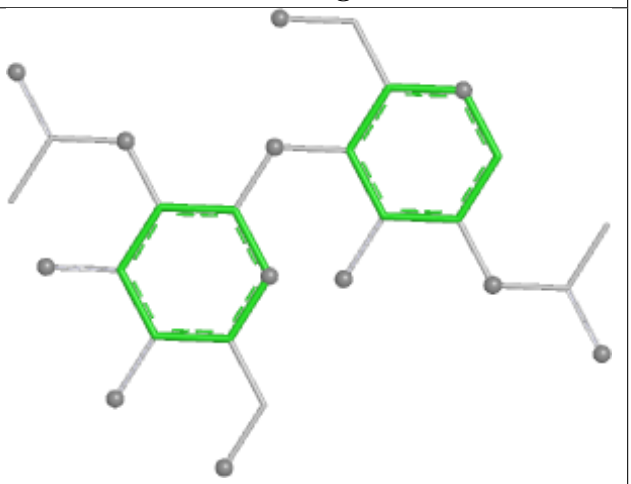
**Bond lengths**



**Bond angles**

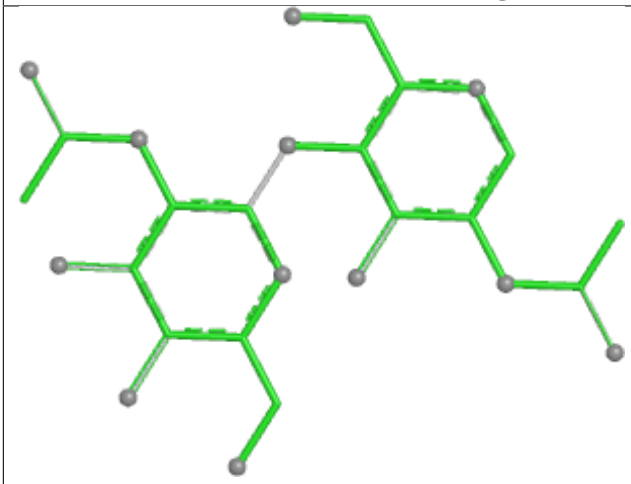


**Torsions**

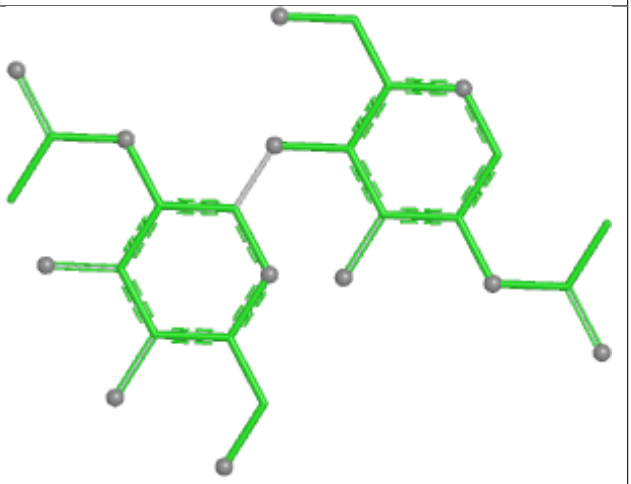


**Rings**

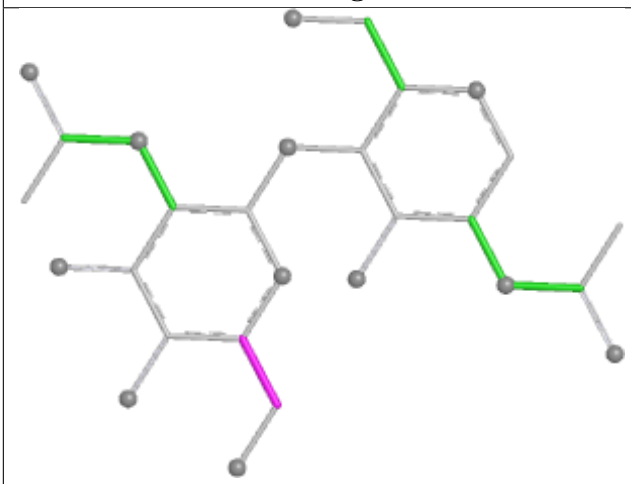
**Oligosaccharide Chain G**



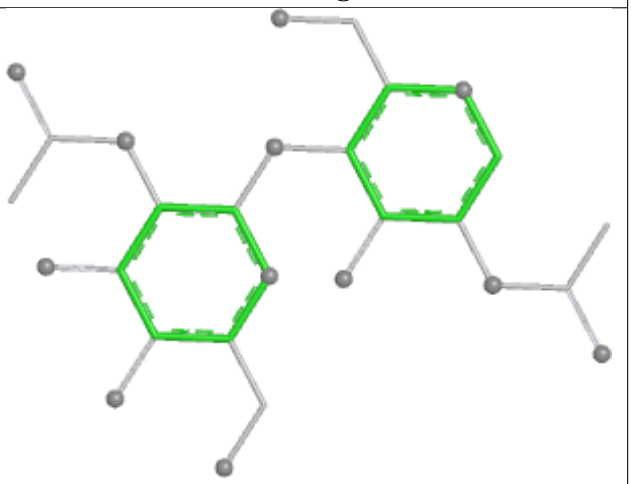
**Bond lengths**



**Bond angles**

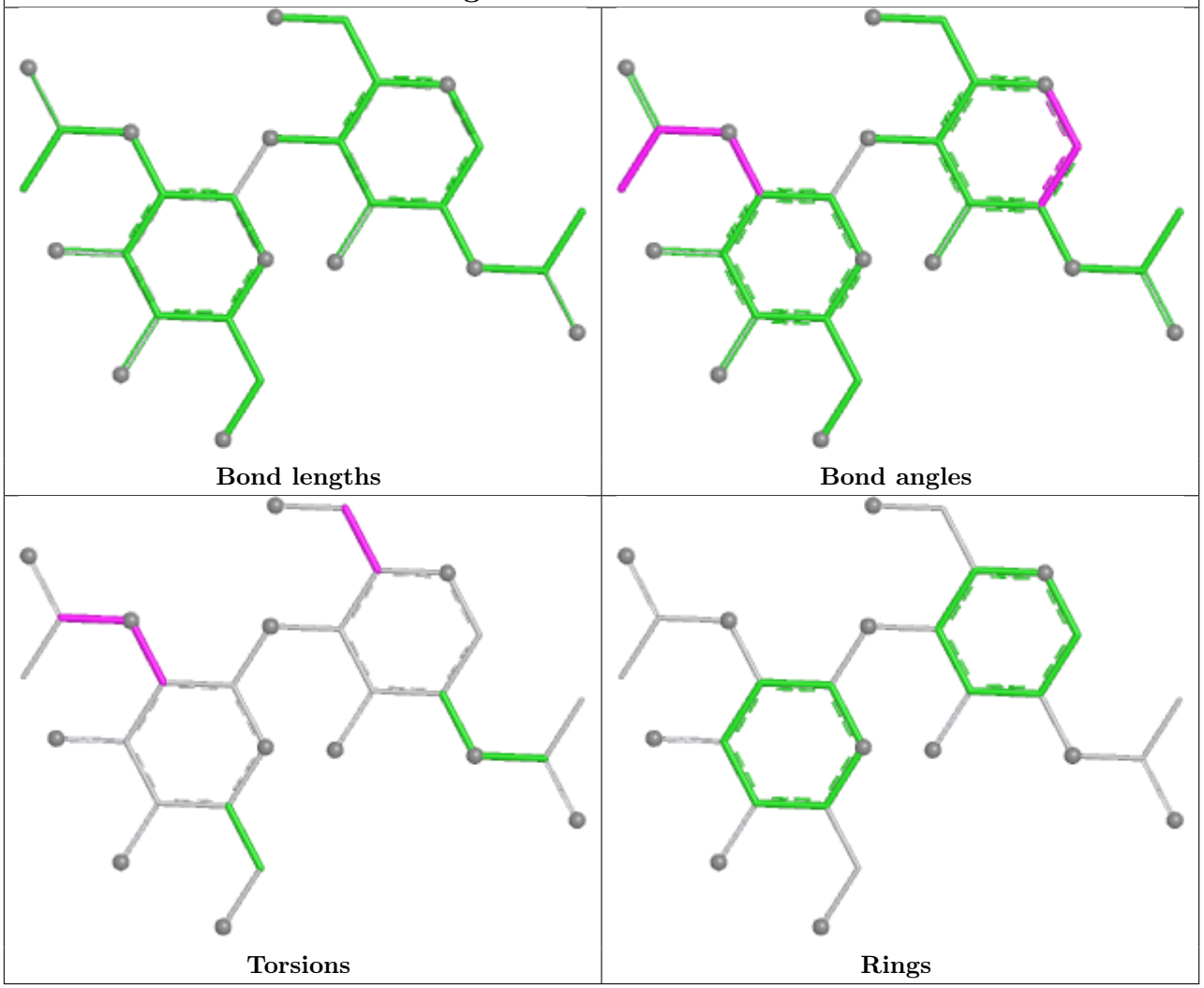


**Torsions**



**Rings**

**Oligosaccharide Chain H**




## 5.6 Ligand geometry (i)

8 ligands are modelled in this entry.

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

| Mol | Type | Chain | Res | Link | Bond lengths | | | Bond angles | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Counts | RMSZ | $\#\|Z\| > 2$ | Counts | RMSZ | $\#\|Z\| > 2$ |
| 4 | NAG | A | 904 | 1 | 14,14,15 | 0.70 | 0 | 17,19,21 | 0.70 | 0 |
| 4 | NAG | A | 903 | 1 | 14,14,15 | 0.69 | 0 | 17,19,21 | 1.11 | 2 (11%) |
| 4 | NAG | A | 901 | 1 | 14,14,15 | 0.72 | 0 | 17,19,21 | 0.83 | 0 |

| Mol | Type | Chain | Res | Link | Bond lengths | | | Bond angles | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Counts | RMSZ | $\#\|Z\|>2$ | Counts | RMSZ | $\#\|Z\|>2$ |
| 4 | NAG | C | 903 | 1 | 14,14,15 | 0.71 | 0 | 17,19,21 | 1.10 | 1 (5%) |
| 4 | NAG | C | 902 | 1 | 14,14,15 | 0.74 | 0 | 17,19,21 | 0.99 | 1 (5%) |
| 4 | NAG | A | 902 | 1 | 14,14,15 | 0.73 | 0 | 17,19,21 | 1.02 | 1 (5%) |
| 4 | NAG | C | 904 | 1 | 14,14,15 | 0.72 | 0 | 17,19,21 | 0.77 | 0 |
| 4 | NAG | C | 901 | 1 | 14,14,15 | 0.72 | 0 | 17,19,21 | 0.93 | 0 |

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

| Mol | Type | Chain | Res | Link | Chirals | Torsions | Rings |
|---|---|---|---|---|---|---|---|
| 4 | NAG | A | 904 | 1 | - | 0/6/23/26 | 0/1/1/1 |
| 4 | NAG | A | 903 | 1 | - | 1/6/23/26 | 0/1/1/1 |
| 4 | NAG | A | 901 | 1 | - | 1/6/23/26 | 0/1/1/1 |
| 4 | NAG | C | 903 | 1 | - | 1/6/23/26 | 0/1/1/1 |
| 4 | NAG | C | 902 | 1 | - | 1/6/23/26 | 0/1/1/1 |
| 4 | NAG | A | 902 | 1 | - | 1/6/23/26 | 0/1/1/1 |
| 4 | NAG | C | 904 | 1 | - | 0/6/23/26 | 0/1/1/1 |
| 4 | NAG | C | 901 | 1 | - | 0/6/23/26 | 0/1/1/1 |

There are no bond length outliers.

All (5) bond angle outliers are listed below:

| Mol | Chain | Res | Type | Atoms | Z | Observed($^o$) | Ideal($^o$) |
|---|---|---|---|---|---|---|---|
| 4 | C | 903 | NAG | C2-N2-C7 | 2.57 | 126.35 | 122.90 |
| 4 | A | 903 | NAG | C2-N2-C7 | 2.50 | 126.25 | 122.90 |
| 4 | A | 902 | NAG | C2-N2-C7 | 2.28 | 125.95 | 122.90 |
| 4 | C | 902 | NAG | C2-N2-C7 | 2.10 | 125.72 | 122.90 |
| 4 | A | 903 | NAG | O5-C1-C2 | -2.03 | 108.15 | 111.29 |

There are no chirality outliers.

All (5) torsion outliers are listed below:

| Mol | Chain | Res | Type | Atoms |
|---|---|---|---|---|
| 4 | A | 902 | NAG | C1-C2-N2-C7 |
| 4 | A | 903 | NAG | C1-C2-N2-C7 |
| 4 | C | 902 | NAG | C1-C2-N2-C7 |
| 4 | C | 903 | NAG | C1-C2-N2-C7 |
| 4 | A | 901 | NAG | O5-C5-C6-O6 |

There are no ring outliers.

No monomer is involved in short contacts.

## 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.

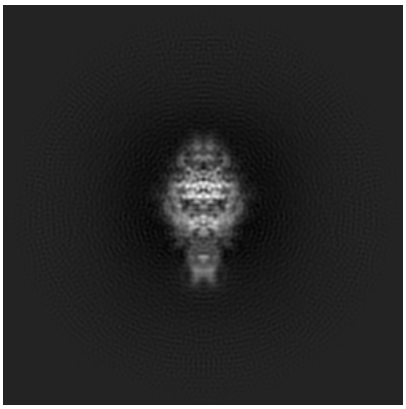
# 6 Map visualisation

This section contains visualisations of the EMDB entry EMD-48650. These allow visual inspection of the internal detail of the map and identification of artifacts.

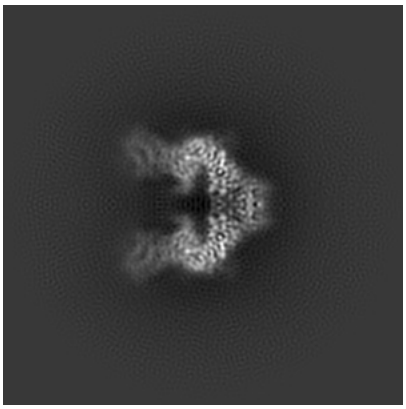
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

## 6.1 Orthogonal projections

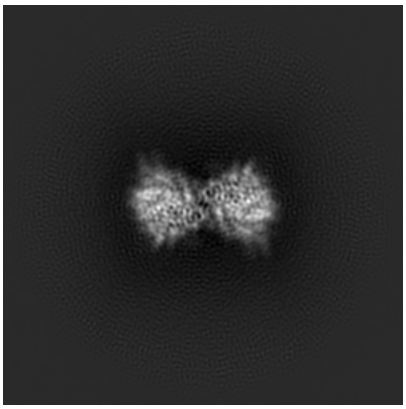
### 6.1.1 Primary map



X

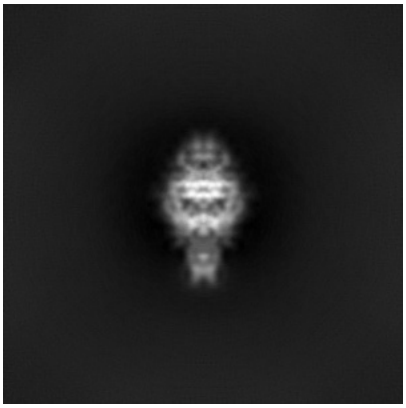


Y

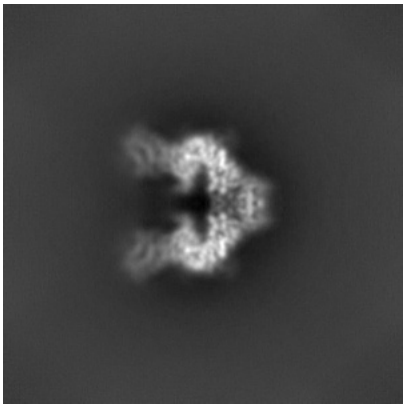


Z

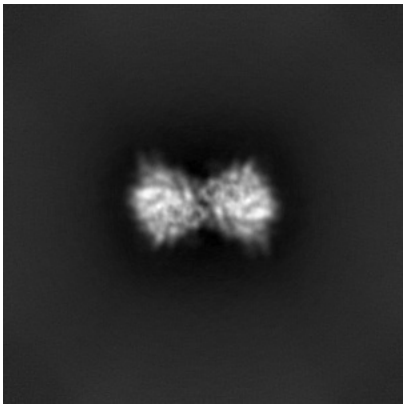
### 6.1.2 Raw map



X



Y

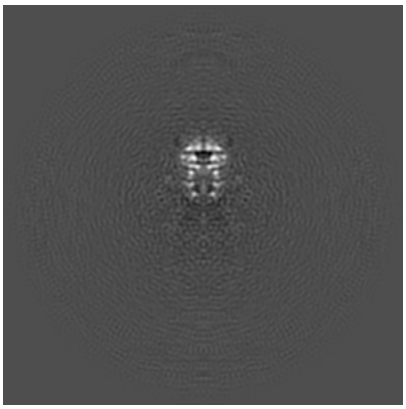


Z

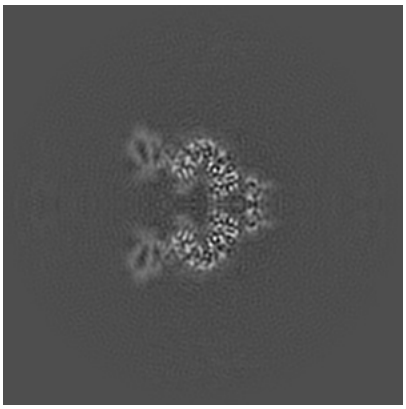
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices (i)

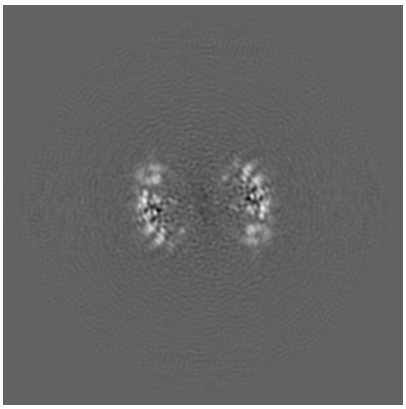
### 6.2.1 Primary map



X Index: 180

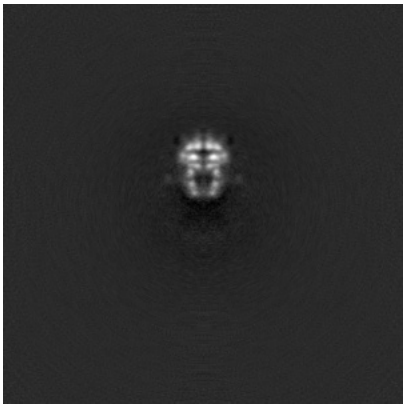


Y Index: 180

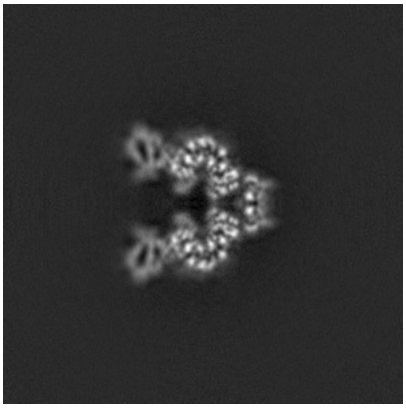


Z Index: 180

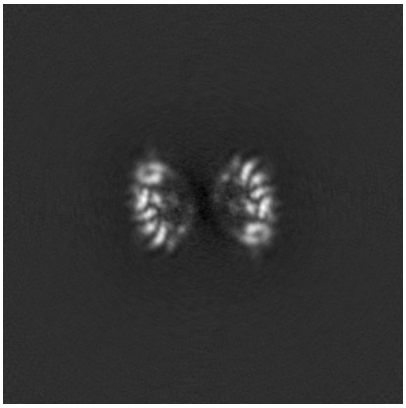
### 6.2.2 Raw map



X Index: 180



Y Index: 180

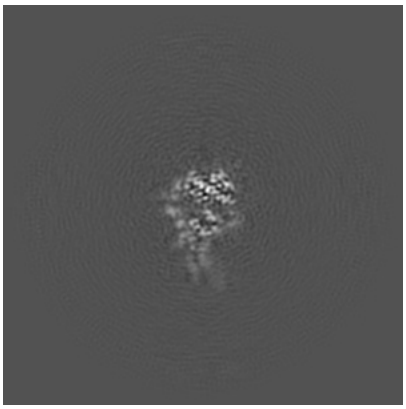


Z Index: 180

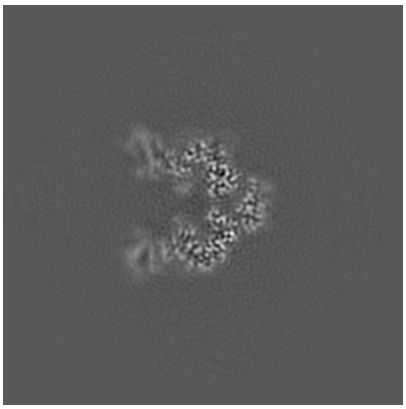
The images above show central slices of the map in three orthogonal directions.

## 6.3 Largest variance slices (i)

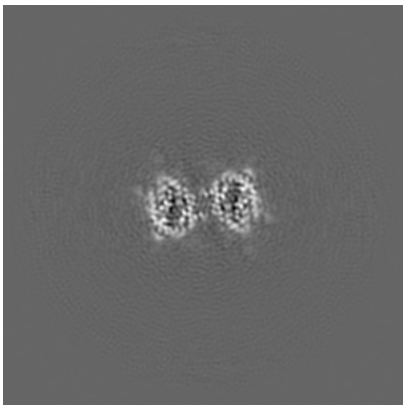
### 6.3.1 Primary map



X Index: 214

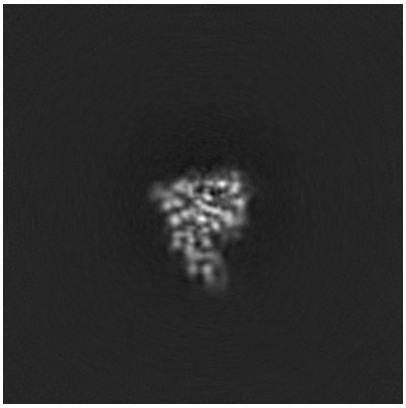


Y Index: 177

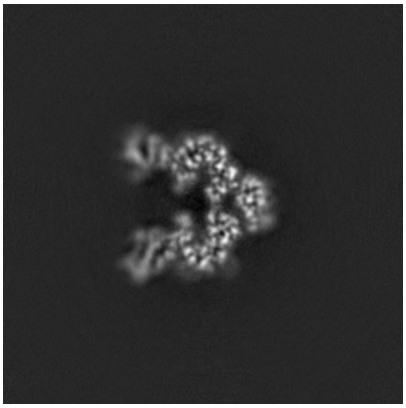


Z Index: 197

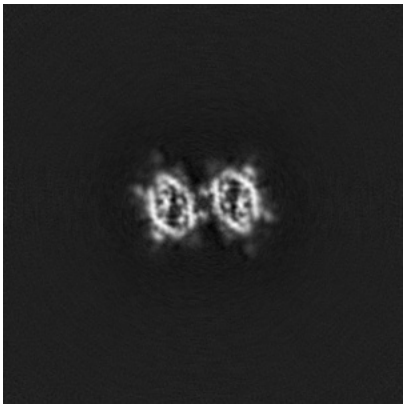
### 6.3.2 Raw map



X Index: 221



Y Index: 184

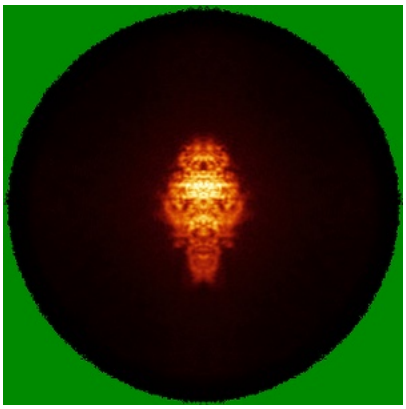


Z Index: 197

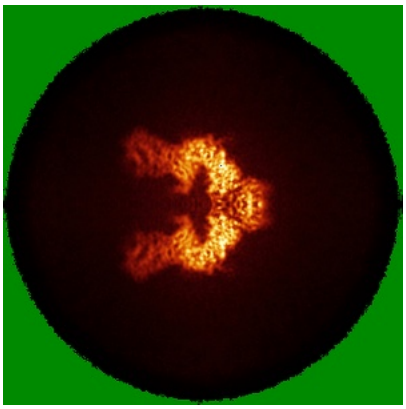
The images above show the largest variance slices of the map in three orthogonal directions.

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

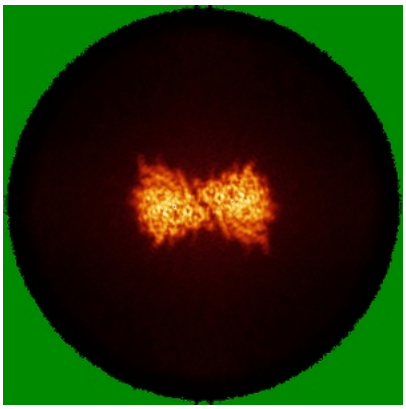
### 6.4.1 Primary map



X

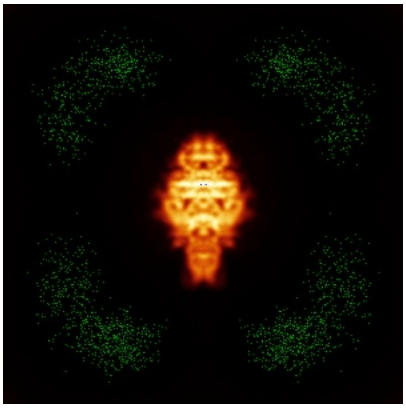


Y

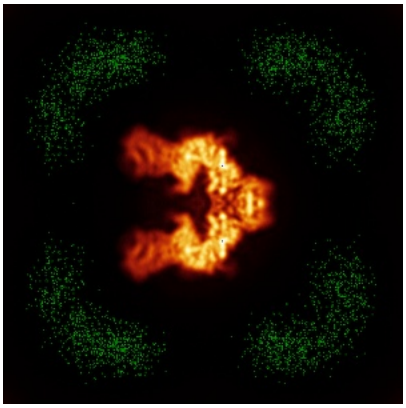


Z

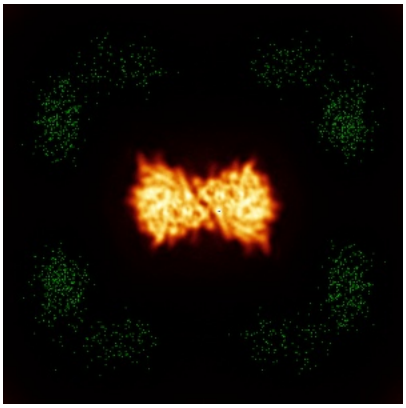
### 6.4.2 Raw map



X



Y

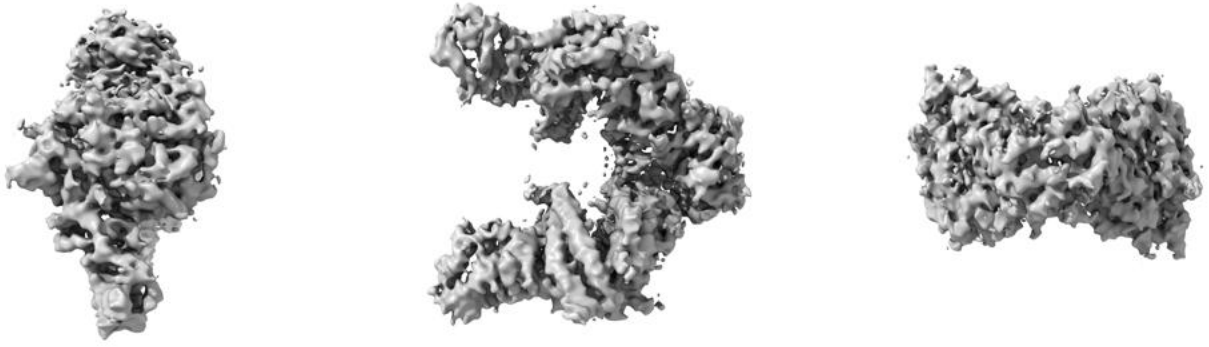


Z

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 0.23. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

### 6.5.2 Raw map

X Y Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

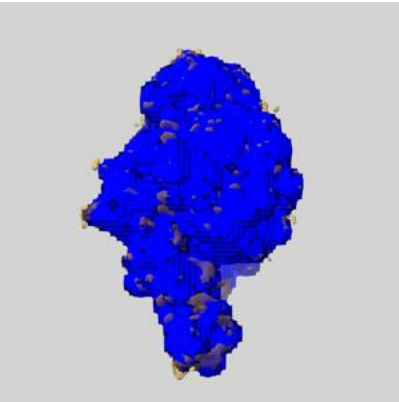
## 6.6 Mask visualisation (i)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

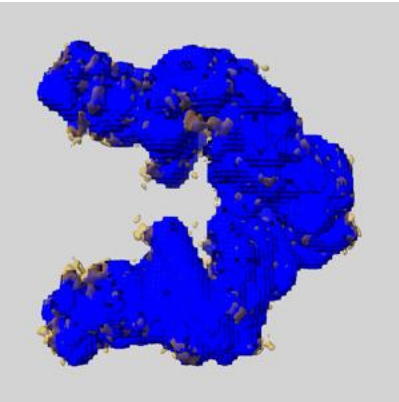
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

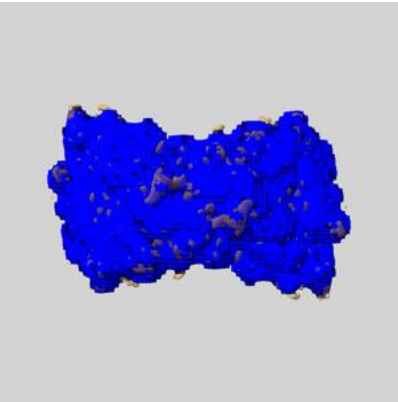
### 6.6.1 emd_48650_msk_1.map (i)



X



Y

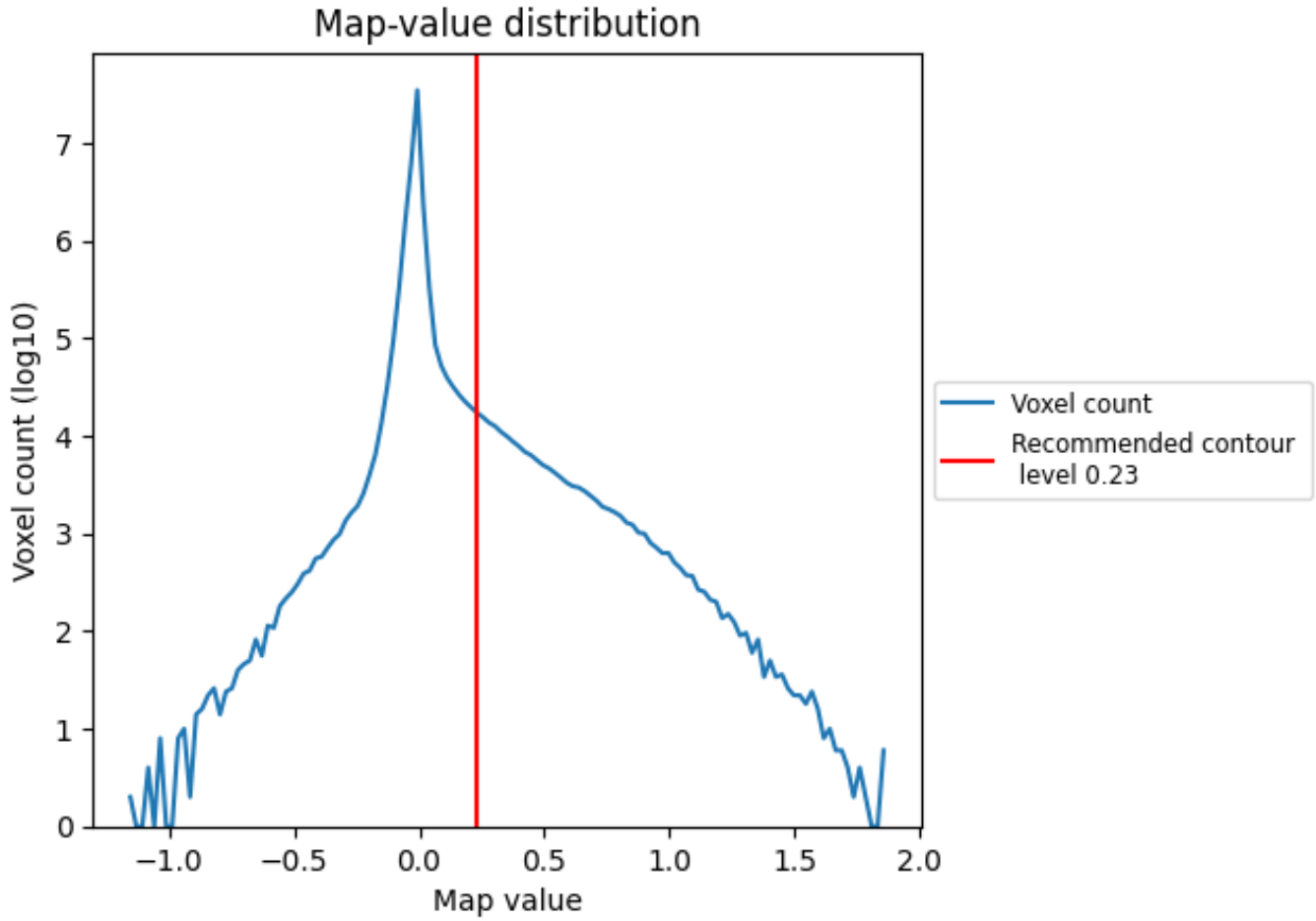


Z

# 7 Map analysis

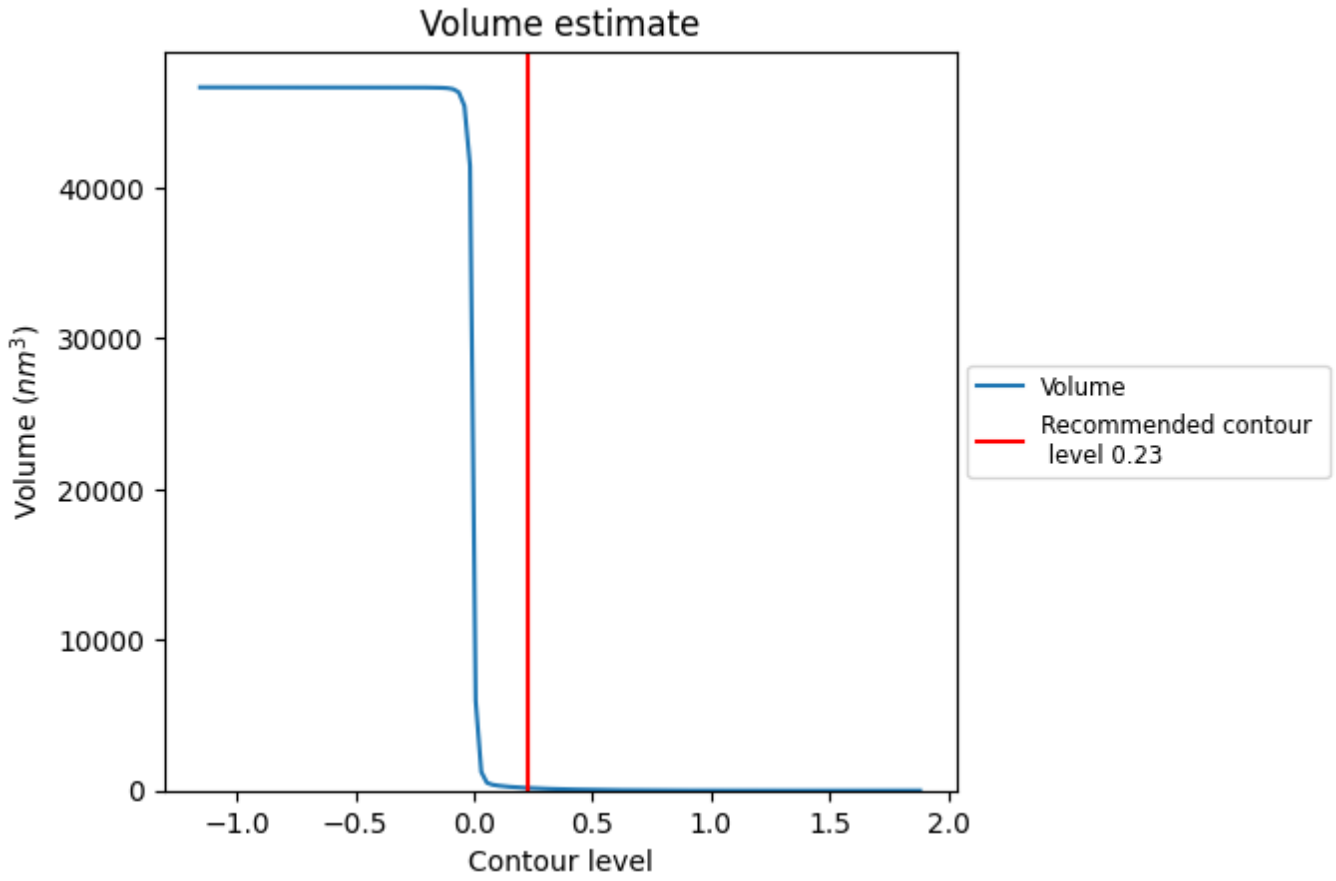
This section contains the results of statistical analysis of the map.

## 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.

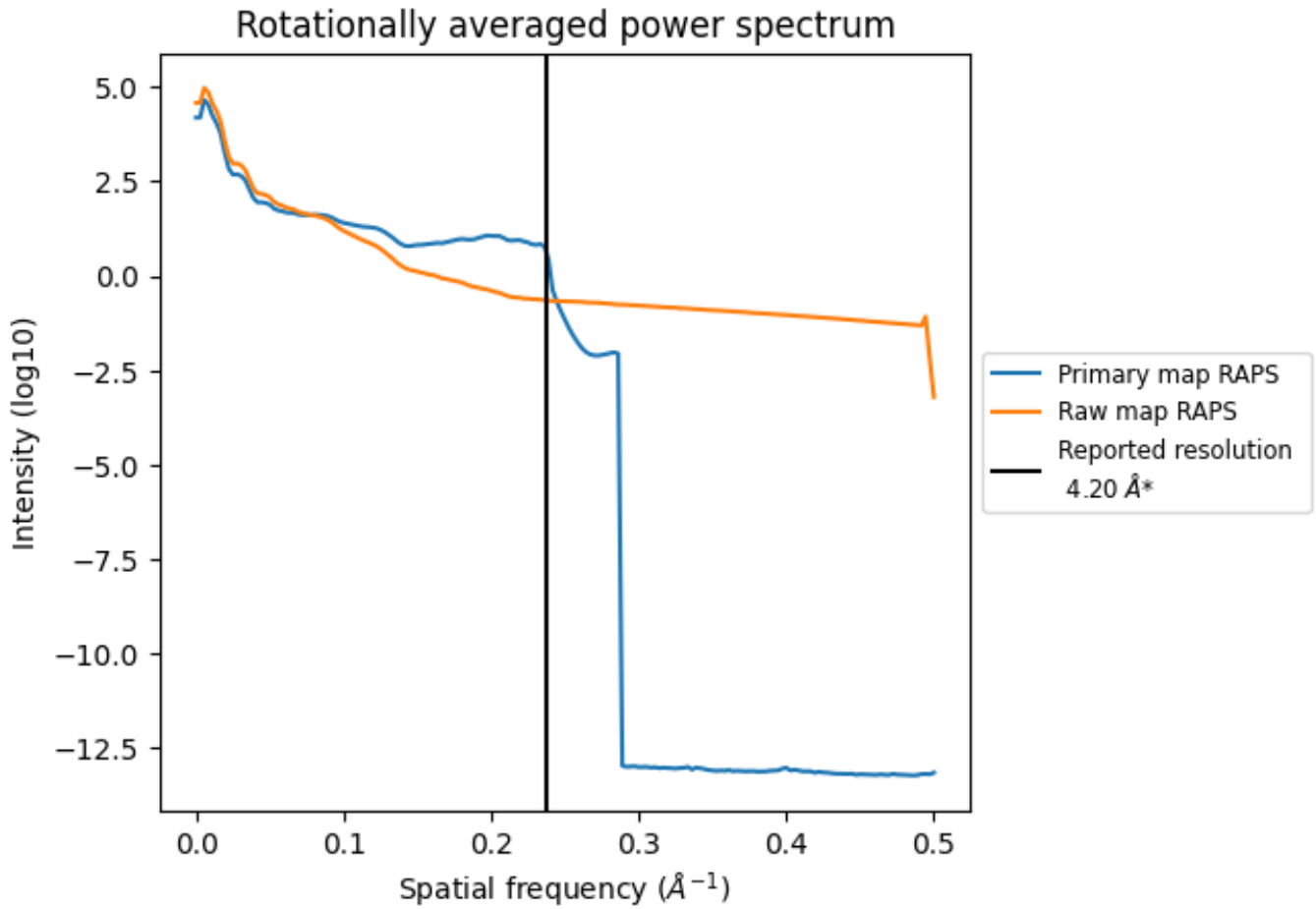
## 7.2 Volume estimate (i)




The volume at the recommended contour level is 169 $nm^3$; this corresponds to an approximate mass of 153 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)

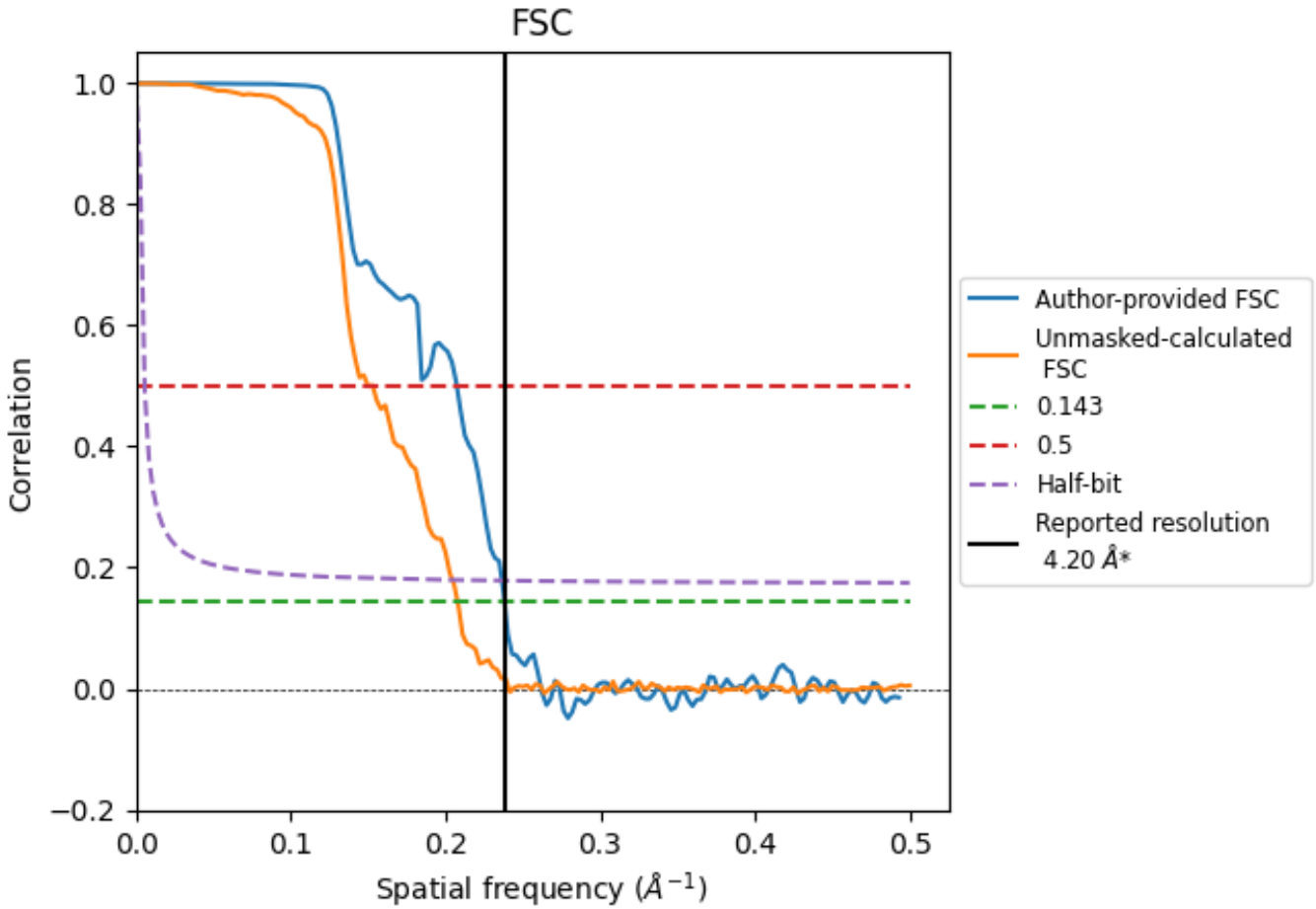



*Reported resolution corresponds to spatial frequency of 0.238 $Å^{-1}$

# 8 Fourier-Shell correlation

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

## 8.1 FSC




*Reported resolution corresponds to spatial frequency of 0.238 Å$^{-1}$

## 8.2 Resolution estimates (i)

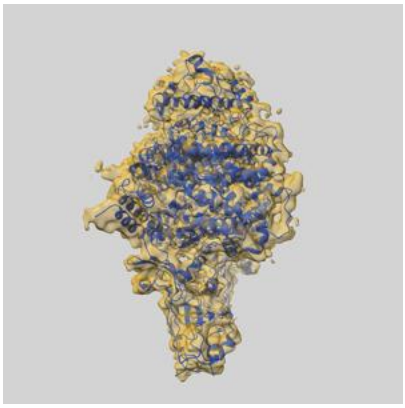
| Resolution estimate (Å) | Estimation criterion (FSC cut-off) | | |
|---|---|---|---|
| | 0.143 | 0.5 | Half-bit |
| Reported by author | 4.20 | - | - |
| Author-provided FSC curve | 4.20 | 4.82 | 4.23 |
| Unmasked-calculated* | 4.81 | 6.67 | 4.89 |

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 4.81 differs from the reported value 4.2 by more than 10 %

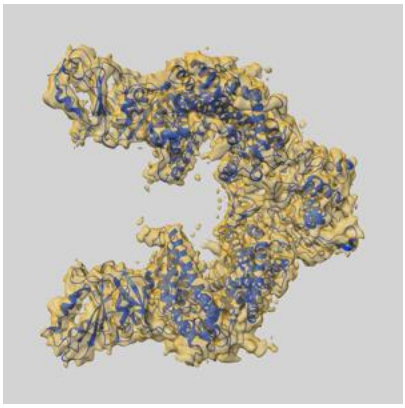
# 9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-48650 and PDB model 9MV0. Per-residue inclusion information can be found in section 3 on page 5.

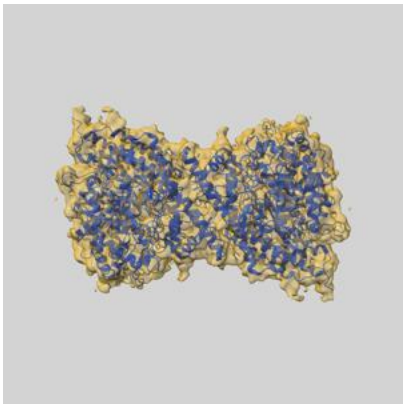
## 9.1 Map-model overlay



X



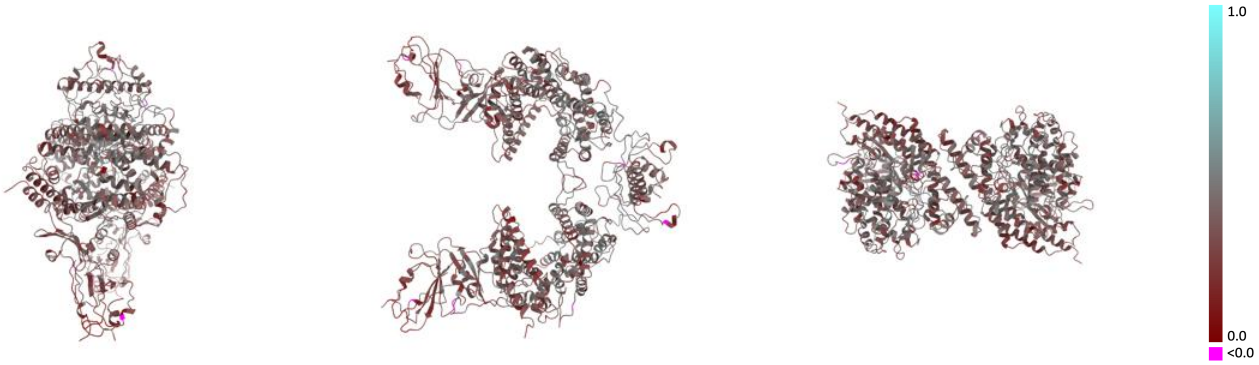
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.23 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.

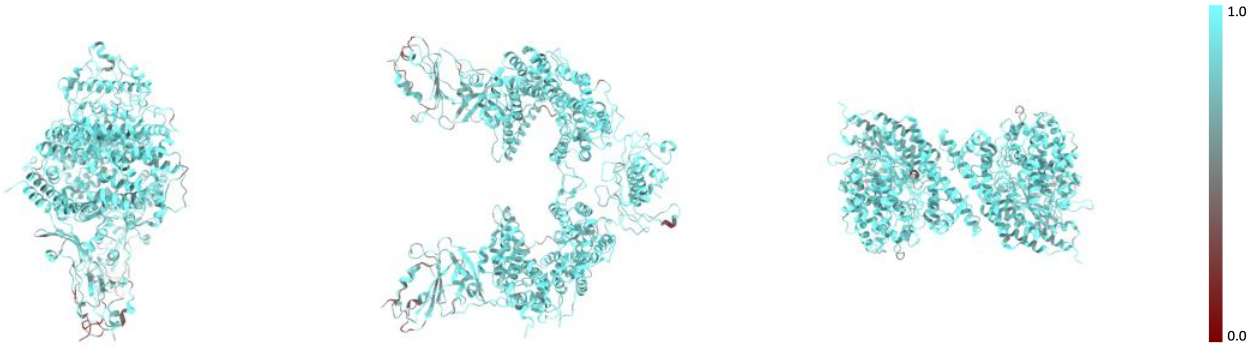
## 9.2 Q-score mapped to coordinate model (i)




X Y Z

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.

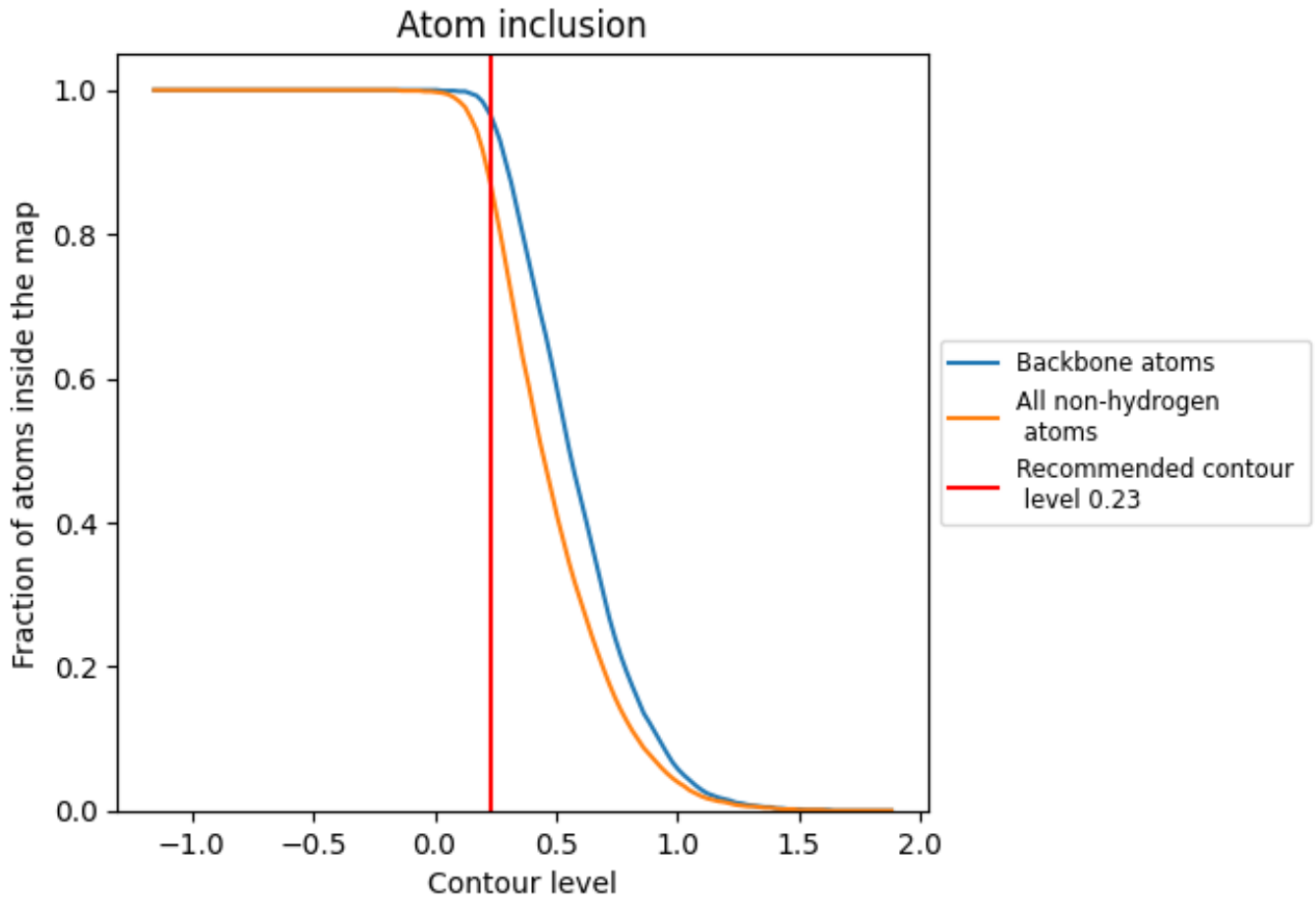
## 9.3 Atom inclusion mapped to coordinate model (i)




X Y Z

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 (0.23).

## 9.4 Atom inclusion (i)




At the recommended contour level, 96% of all backbone atoms, 87% of all non-hydrogen atoms, are inside the map.

## 9.5 Map-model fit summary

The table lists the average atom inclusion at the recommended contour level (0.23) and Q-score for the entire model and for each chain.

| Chain | Atom inclusion | Q-score |
|---|---|---|
| All | 0.8700 | 0.3560 |
| A | 0.9040 | 0.3720 |
| B | 0.7410 | 0.2940 |
| C | 0.9050 | 0.3740 |
| D | 0.7390 | 0.2910 |
| E | 0.8570 | 0.3710 |
| F | 0.8210 | 0.4200 |
| G | 0.7140 | 0.2900 |
| H | 0.8210 | 0.3940 |