



# wwPDB EM Validation Summary Report i

Nov 22, 2025 – 06:16 am GMT

PDB ID : 9GEQ / pdb\_00009geq  
EMDB ID : EMD-51301  
Title : Native dimeric Myeloperoxidase bound to nucleosome core particle; composite map  
Authors : Raisch, T.; Burn, G.L.; Tacke, S.; Winkler, M.; Prumbaum, D.; Thee, S.; Zychlinsky, A.; Raunser, S.  
Deposited on : 2024-08-07  
Resolution : 3.12 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](mailto: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 i 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](#) i) were used in the production of this report:

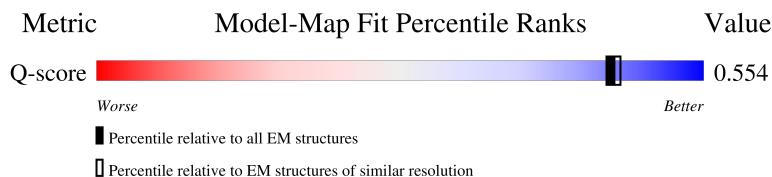
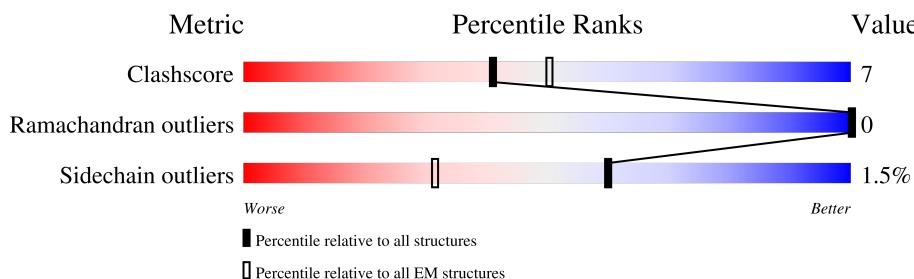
EMDB validation analysis : 0.0.1.dev129  
Mogul : 1.8.4, CSD as541be (2020)  
MolProbity : 4-5-2 with Phenix2.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.46

# 1 Overall quality at a glance

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

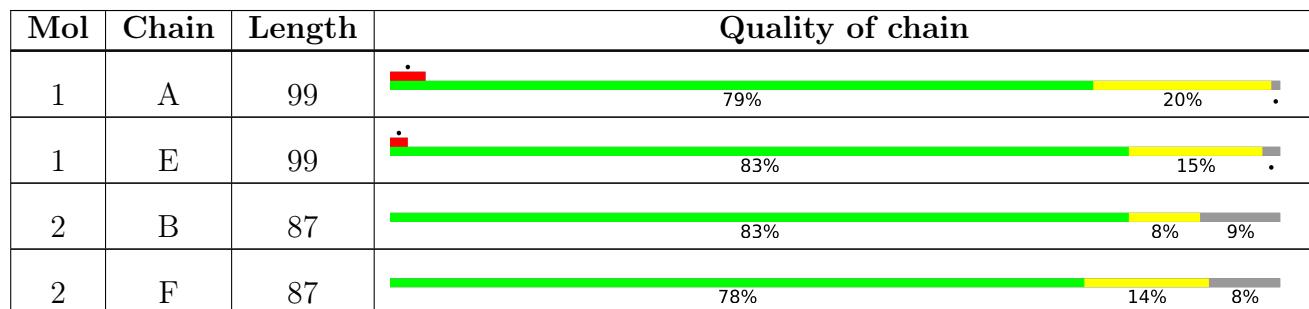
The reported resolution of this entry is 3.12 Å.

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.



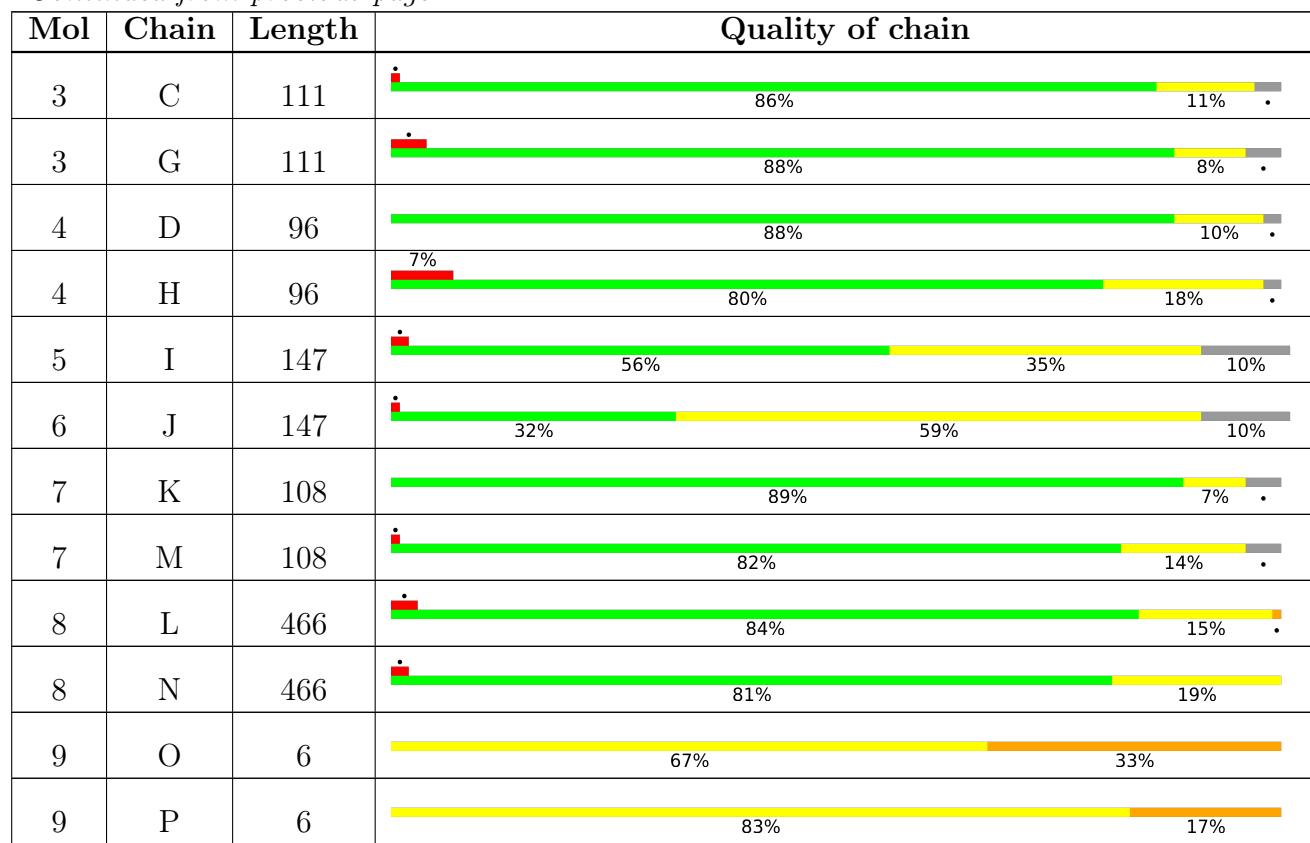
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	210492	15764	-
Ramachandran outliers	207382	16835	-
Sidechain outliers	206894	16415	-
Q-score	-	25397	14478 ( 2.62 - 3.62 )

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  $\geq 3$ , 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.



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## 2 Entry composition [\(i\)](#)

There are 13 unique types of molecules in this entry. The entry contains 20888 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 Histone H3.2.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	98	Total	C	N	O	S	0	0
			807	509	156	139	3		

1	E	97	Total	C	N	O	S	0	0
			802	506	155	138	3		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	102	ALA	GLY	conflict	UNP P84233
E	102	ALA	GLY	conflict	UNP P84233

- Molecule 2 is a protein called Histone H4.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	79	Total	C	N	O	S	0	0
			633	399	124	109	1		

2	F	80	Total	C	N	O	S	0	0
			638	401	125	111	1		

- Molecule 3 is a protein called Histone H2A type 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	108	Total	C	N	O		0	0
			834	525	165	144			

3	G	107	Total	C	N	O		0	0
			825	519	163	143			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	99	ARG	GLY	conflict	UNP P06897
G	99	ARG	GLY	conflict	UNP P06897

- Molecule 4 is a protein called Histone H2B 1.1.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	94	Total	C	N	O	S	0	0
			735	463	132	138	2		

4	H	94	Total	C	N	O	S	0	0
			735	463	132	138	2		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	29	THR	SER	conflict	UNP P02281
H	29	THR	SER	conflict	UNP P02281

- Molecule 5 is a DNA chain called Widom-601 DNA (133-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
5	I	133	Total	C	N	O	P	0	0
			2743	1298	514	798	133		

- Molecule 6 is a DNA chain called Widom-601 DNA (133-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
6	J	133	Total	C	N	O	P	0	0
			2710	1287	492	798	133		

- Molecule 7 is a protein called Myeloperoxidase light chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	M	104	Total	C	N	O	S	0	0
			837	529	148	155	5		

7	K	104	Total	C	N	O	S	0	0
			837	529	148	155	5		

- Molecule 8 is a protein called Myeloperoxidase light chain.

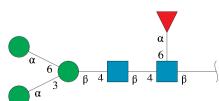
Mol	Chain	Residues	Atoms					AltConf	Trace
8	N	466	Total	C	N	O	S	0	0
			3732	2351	687	667	27		

8	L	466	Total	C	N	O	S	0	0
			3732	2351	687	667	27		

- Molecule 9 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[al

pha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				AltConf	Trace
9	O	6	Total	C	N	O	0	0
			71	40	2	29		

Mol	Chain	Residues	Atoms				AltConf
9	P	6	Total	C	N	O	0
			71	40	2	29	0

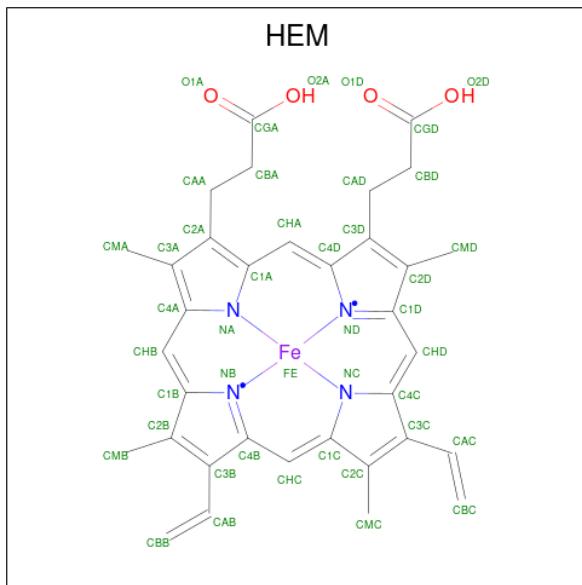
- Molecule 10 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		AltConf
10	M	1	Total Cl		0
			1	1	

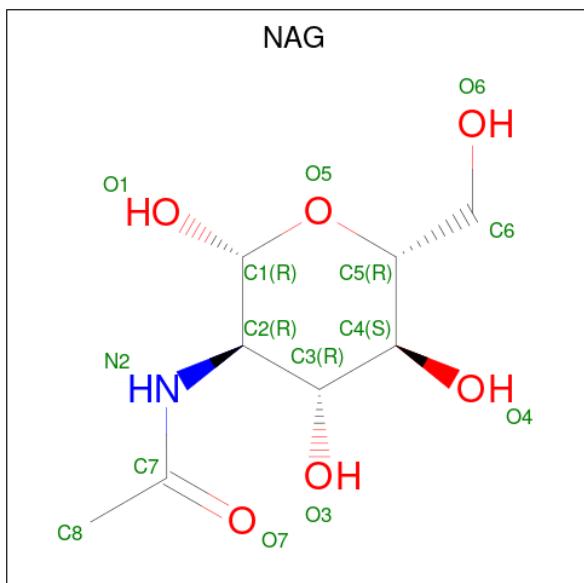
  

Mol	Chain	Residues	Atoms		AltConf
10	K	1	Total Cl		0
			1	1	

- Molecule 11 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: C<sub>34</sub>H<sub>32</sub>FeN<sub>4</sub>O<sub>4</sub>).



- Molecule 12 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



Mol	Chain	Residues	Atoms				AltConf
12	N	1	Total	C	N	O	0
			14	8	1	5	
12	N	1	Total	C	N	O	0
			14	8	1	5	
12	L	1	Total	C	N	O	0
			14	8	1	5	
12	L	1	Total	C	N	O	0
			14	8	1	5	

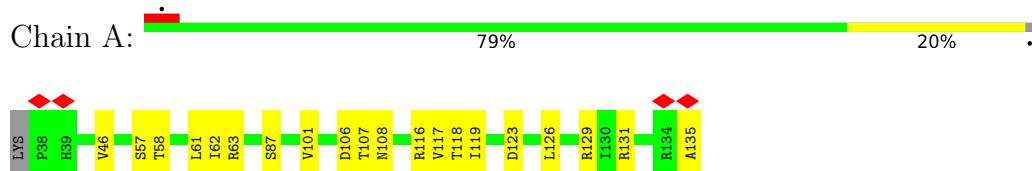
- Molecule 13 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		AltConf
13	N	1	Total	Ca	0
			1	1	
13	L	1	Total	Ca	0
			1	1	

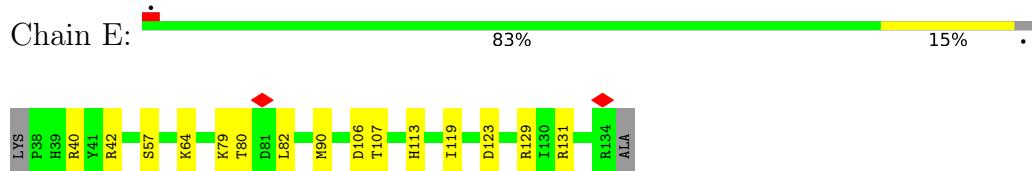
### 3 Residue-property plots [\(i\)](#)

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.

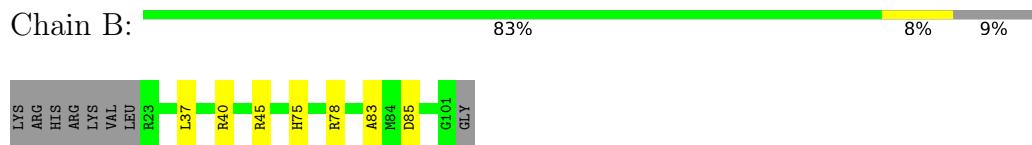
- Molecule 1: Histone H3.2



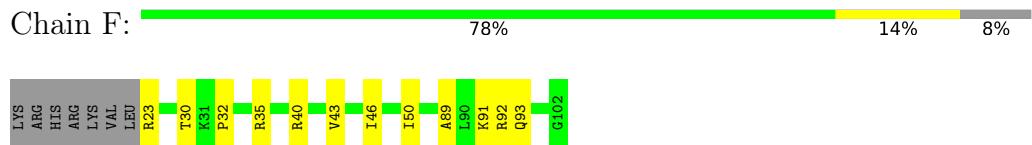
- Molecule 1: Histone H3.2



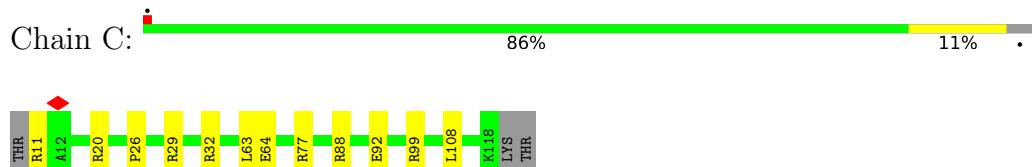
- Molecule 2: Histone H4



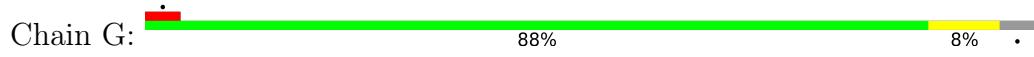
- Molecule 2: Histone H4



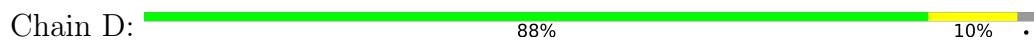
- Molecule 3: Histone H2A type 1



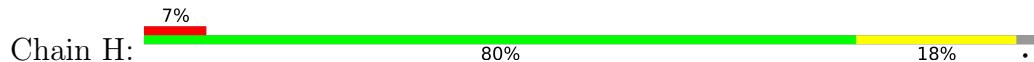
- Molecule 3: Histone H2A type 1



- Molecule 4: Histone H2B 1.1



- Molecule 4: Histone H2B 1.1



- Molecule 5: Widom-601 DNA (133-MER)



Diagram of the T32 gene structure showing exons (green) and introns (yellow). The gene is 1000 bp long, with exons spanning 100 bp and introns spanning 900 bp. The gene is transcribed from right to left, with the poly-A tail at the 3' end. The gene is flanked by T45 and T46 on the left, and T37 and T36 on the right. A red diamond marks the T-72 mutation site.

- Molecule 6: Widom-601 DNA (133-MER)



C4	C5	C6	C7	C8	C9	C10	T15	A16	A17	C18	C19	C20	C25	G26	G27	G28	C35	C36	C37	T38	A39	T43	C44	C45	A46	G47	G48
----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----



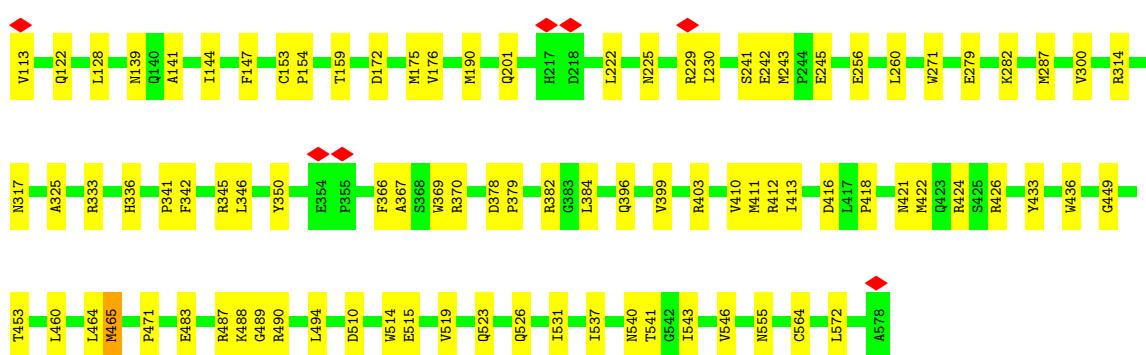
- Molecule 7: Myeloperoxidase light chain

Chain K:



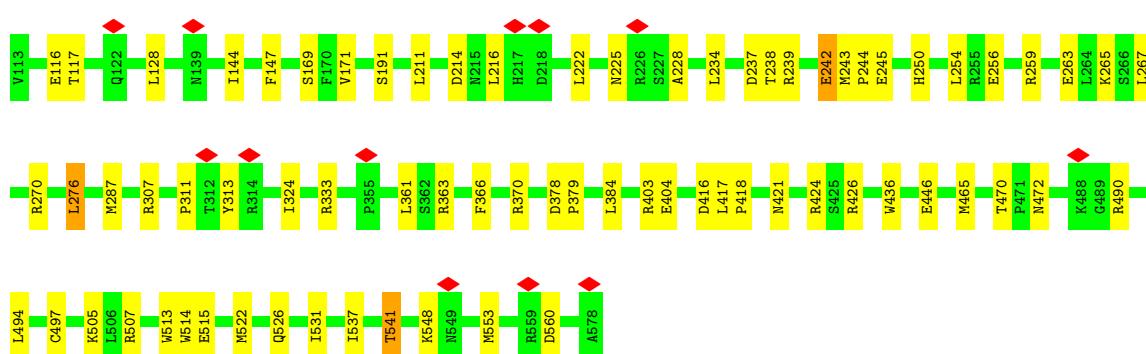
- Molecule 8: Myeloperoxidase light chain

### Chain N:



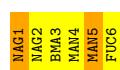
- Molecule 8: Myeloperoxidase light chain

### Chain L:



- Molecule 9: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose

Chain 0:



- Molecule 9: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose

Chain P:  83% 17%

MAG1
MAG2
BMA3
MAN4
MAN5
FUC6

## 4 Experimental information i

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	297845	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING ONLY	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	53.3	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2400	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	42.242	Depositor
Minimum map value	-4.874	Depositor
Average map value	0.264	Depositor
Map value standard deviation	1.103	Depositor
Recommended contour level	5	Depositor
Map size (Å)	274.04, 274.04, 274.04	wwPDB
Map dimensions	403, 403, 403	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.68, 0.68, 0.68	Depositor

## 5 Model quality [\(i\)](#)

### 5.1 Standard geometry [\(i\)](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CL, BMA, HEM, MAN, NAG, CA, FUC

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	0.10	0/819	0.21	0/1099
1	E	0.10	0/814	0.21	0/1092
2	B	0.10	0/640	0.23	0/857
2	F	0.10	0/645	0.22	0/862
3	C	0.11	0/844	0.24	0/1138
3	G	0.09	0/835	0.20	0/1127
4	D	0.10	0/746	0.21	0/1004
4	H	0.10	0/746	0.20	0/1004
5	I	0.17	0/3080	0.40	0/4756
6	J	0.17	0/3036	0.35	0/4679
7	K	0.10	0/862	0.27	0/1174
7	M	0.09	0/862	0.30	0/1174
8	L	0.11	0/3818	0.28	0/5180
8	N	0.11	0/3818	0.30	0/5180
All	All	0.13	0/21565	0.30	0/30326

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
8	L	0	1
8	N	0	1
All	All	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
8	L	242	GLU	Peptide
8	N	242	GLU	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	807	0	846	16	0
1	E	802	0	841	15	0
2	B	633	0	673	7	0
2	F	638	0	676	8	0
3	C	834	0	895	9	0
3	G	825	0	882	8	0
4	D	735	0	760	8	0
4	H	735	0	760	10	0
5	I	2743	0	1493	35	0
6	J	2710	0	1493	64	0
7	K	837	0	798	7	0
7	M	837	0	798	13	0
8	L	3732	0	3725	52	0
8	N	3732	0	3725	54	0
9	O	71	0	61	3	0
9	P	71	0	61	1	0
10	K	1	0	0	0	0
10	M	1	0	0	0	0
11	K	43	0	30	2	0
11	M	43	0	30	2	0
12	L	28	0	26	0	0
12	N	28	0	26	2	0
13	L	1	0	0	0	0
13	N	1	0	0	0	0
All	All	20888	0	18599	265	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 7.

The worst 5 of 265 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:107:THR:HG22	1:A:119:ILE:HD12	1.67	0.77
8:N:465:MET:HE1	8:N:471:PRO:HD3	1.67	0.75
6:J:-43:DT:H2'	6:J:-42:DT:H71	1.72	0.71
8:L:214:ASP:HB2	8:L:234:LEU:HB2	1.75	0.68
3:C:32:ARG:NH2	4:D:32:GLU:OE2	2.26	0.68

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	96/99 (97%)	93 (97%)	3 (3%)	0	100 100
1	E	95/99 (96%)	94 (99%)	1 (1%)	0	100 100
2	B	77/87 (88%)	77 (100%)	0	0	100 100
2	F	78/87 (90%)	78 (100%)	0	0	100 100
3	C	106/111 (96%)	106 (100%)	0	0	100 100
3	G	105/111 (95%)	104 (99%)	1 (1%)	0	100 100
4	D	92/96 (96%)	92 (100%)	0	0	100 100
4	H	92/96 (96%)	92 (100%)	0	0	100 100
7	K	102/108 (94%)	101 (99%)	1 (1%)	0	100 100
7	M	102/108 (94%)	99 (97%)	3 (3%)	0	100 100
8	L	464/466 (100%)	455 (98%)	9 (2%)	0	100 100
8	N	464/466 (100%)	454 (98%)	10 (2%)	0	100 100
All	All	1873/1934 (97%)	1845 (98%)	28 (2%)	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	85/86 (99%)	83 (98%)	2 (2%)	44 <span style="background-color: #f0f0f0;">68</span>
1	E	85/86 (99%)	85 (100%)	0	100 <span style="background-color: #f0f0f0;">100</span>
2	B	65/72 (90%)	65 (100%)	0	100 <span style="background-color: #f0f0f0;">100</span>
2	F	65/72 (90%)	64 (98%)	1 (2%)	60 <span style="background-color: #f0f0f0;">78</span>
3	C	85/88 (97%)	82 (96%)	3 (4%)	31 <span style="background-color: #f0f0f0;">59</span>
3	G	84/88 (96%)	83 (99%)	1 (1%)	67 <span style="background-color: #f0f0f0;">82</span>
4	D	80/82 (98%)	80 (100%)	0	100 <span style="background-color: #f0f0f0;">100</span>
4	H	80/82 (98%)	79 (99%)	1 (1%)	65 <span style="background-color: #f0f0f0;">80</span>
7	K	90/93 (97%)	90 (100%)	0	100 <span style="background-color: #f0f0f0;">100</span>
7	M	90/93 (97%)	89 (99%)	1 (1%)	70 <span style="background-color: #f0f0f0;">83</span>
8	L	411/411 (100%)	405 (98%)	6 (2%)	60 <span style="background-color: #f0f0f0;">78</span>
8	N	411/411 (100%)	401 (98%)	10 (2%)	44 <span style="background-color: #f0f0f0;">68</span>
All	All	1631/1664 (98%)	1606 (98%)	25 (2%)	60 <span style="background-color: #f0f0f0;">78</span>

5 of 25 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
8	N	410	VAL
8	N	526	GLN
8	L	541	THR
8	N	465	MET
8	N	572	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
8	L	472	ASN
8	L	434	ASN
8	N	204	GLN
8	L	204	GLN

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
8	N	201	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 [\(i\)](#)

12 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
9	NAG	O	1	9,8	14,14,15	1.10	2 (14%)	17,19,21	1.66	3 (17%)
9	NAG	O	2	9	14,14,15	0.78	0	17,19,21	0.97	0
9	BMA	O	3	9	11,11,12	0.88	0	15,15,17	2.49	6 (40%)
9	MAN	O	4	9	11,11,12	0.62	0	15,15,17	1.66	1 (6%)
9	MAN	O	5	9	11,11,12	0.68	0	15,15,17	1.56	1 (6%)
9	FUC	O	6	9	10,10,11	0.94	1 (10%)	14,14,16	0.88	0
9	NAG	P	1	9,8	14,14,15	1.04	2 (14%)	17,19,21	1.75	5 (29%)
9	NAG	P	2	9	14,14,15	0.80	0	17,19,21	0.94	0
9	BMA	P	3	9	11,11,12	0.86	0	15,15,17	2.59	6 (40%)
9	MAN	P	4	9	11,11,12	0.59	0	15,15,17	1.76	1 (6%)
9	MAN	P	5	9	11,11,12	0.65	0	15,15,17	1.54	1 (6%)
9	FUC	P	6	9	10,10,11	0.88	1 (10%)	14,14,16	0.83	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
9	NAG	O	1	9,8	-	2/6/23/26	0/1/1/1
9	NAG	O	2	9	-	0/6/23/26	0/1/1/1
9	BMA	O	3	9	-	0/2/19/22	0/1/1/1
9	MAN	O	4	9	-	2/2/19/22	0/1/1/1
9	MAN	O	5	9	-	0/2/19/22	0/1/1/1
9	FUC	O	6	9	-	-	0/1/1/1
9	NAG	P	1	9,8	-	1/6/23/26	0/1/1/1
9	NAG	P	2	9	-	0/6/23/26	0/1/1/1
9	BMA	P	3	9	-	0/2/19/22	0/1/1/1
9	MAN	P	4	9	-	0/2/19/22	0/1/1/1
9	MAN	P	5	9	-	0/2/19/22	0/1/1/1
9	FUC	P	6	9	-	-	0/1/1/1

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	O	1	NAG	O5-C1	-2.63	1.39	1.43
9	P	1	NAG	O5-C1	-2.38	1.39	1.43
9	O	6	FUC	O5-C1	-2.35	1.40	1.43
9	O	1	NAG	O5-C5	-2.23	1.38	1.43
9	P	1	NAG	O5-C5	-2.18	1.39	1.43

The worst 5 of 24 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	P	3	BMA	C1-O5-C5	7.13	121.85	112.19
9	O	3	BMA	C1-O5-C5	6.65	121.21	112.19
9	P	4	MAN	C1-O5-C5	6.04	120.38	112.19
9	O	4	MAN	C1-O5-C5	5.62	119.81	112.19
9	P	5	MAN	C1-O5-C5	5.06	119.05	112.19

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	O	4	MAN	O5-C5-C6-O6
9	O	4	MAN	C4-C5-C6-O6
9	O	1	NAG	O5-C5-C6-O6
9	P	1	NAG	O5-C5-C6-O6

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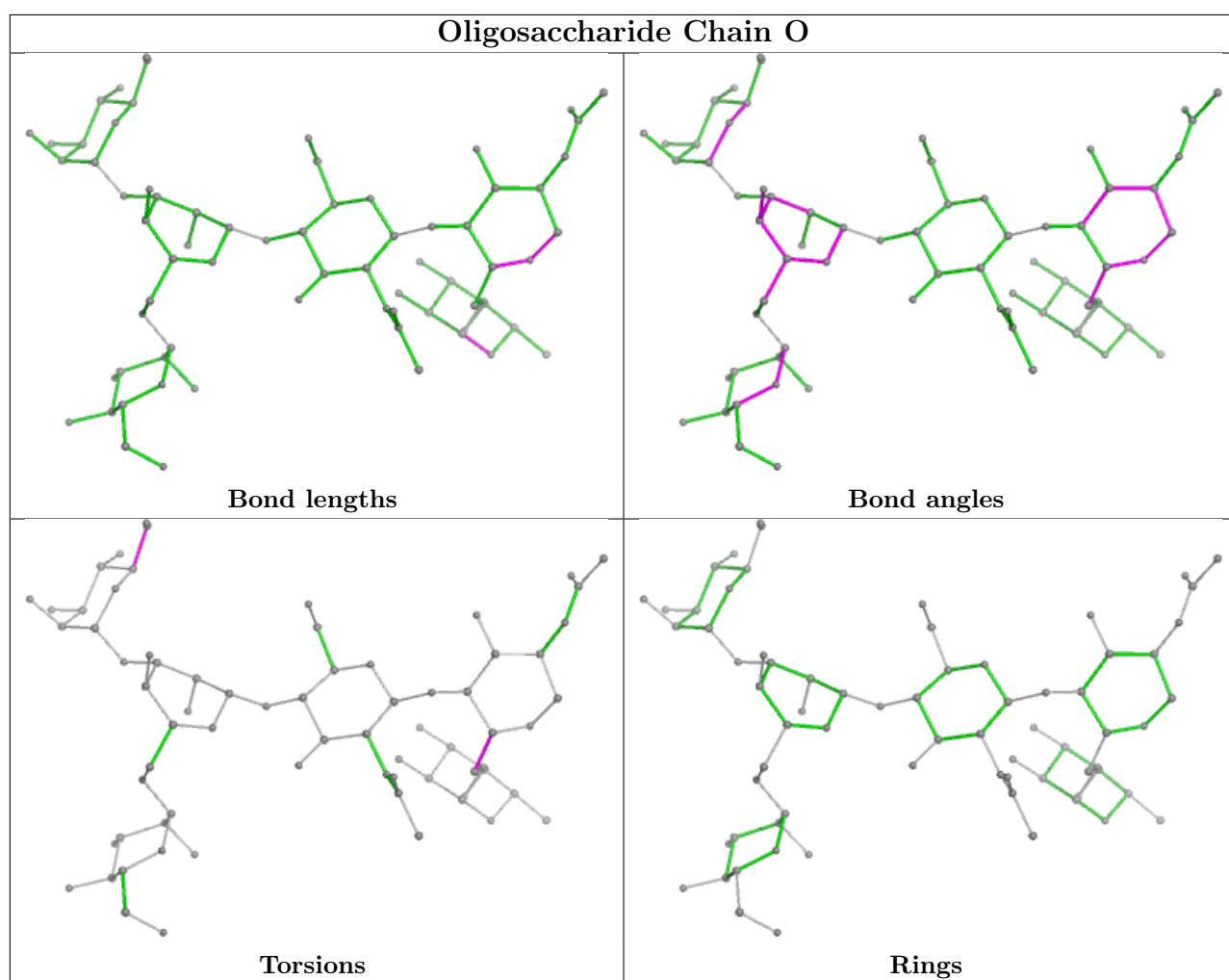
Mol	Chain	Res	Type	Atoms
9	O	1	NAG	C4-C5-C6-O6

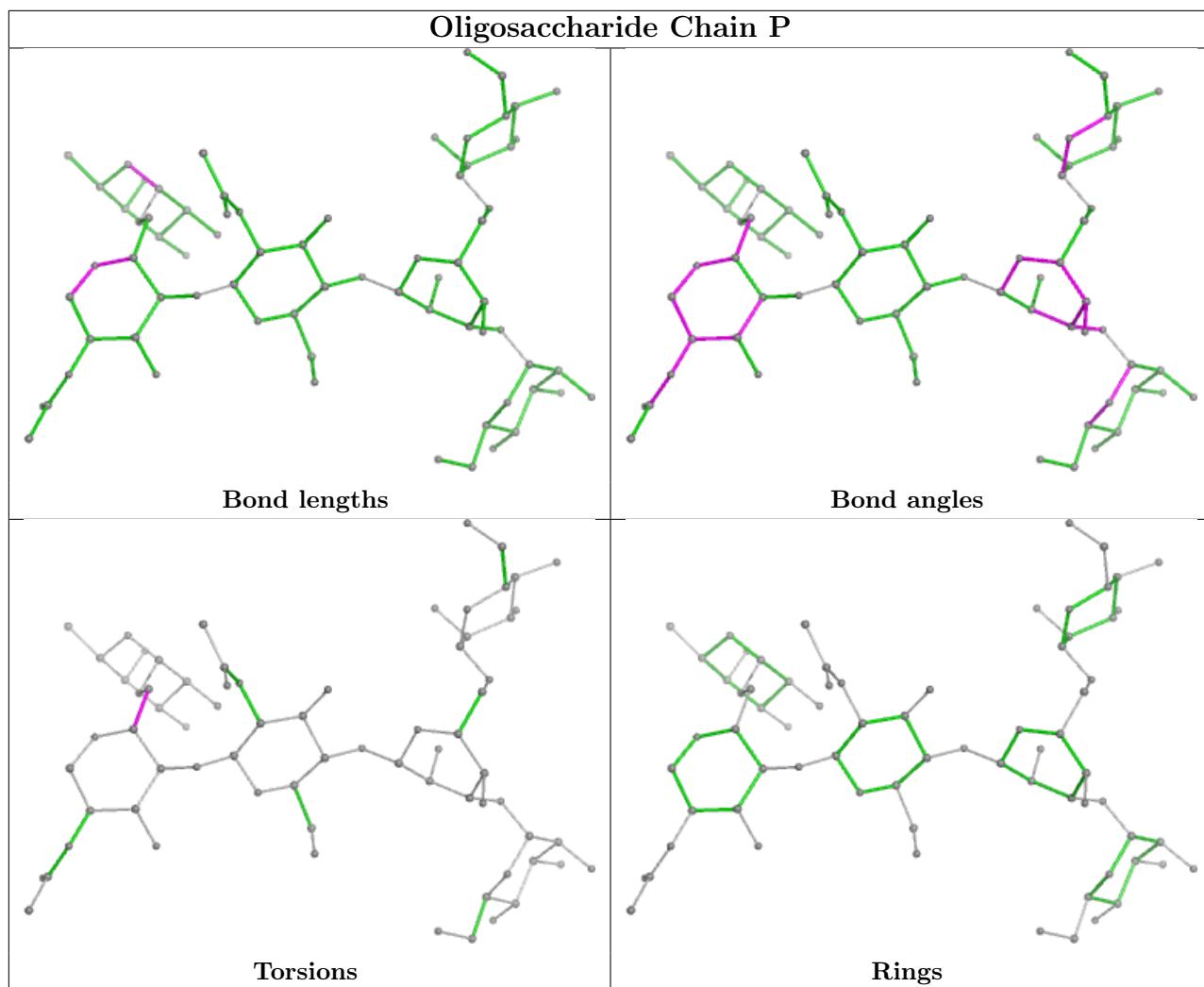
There are no ring outliers.

5 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	P	2	NAG	1	0
9	O	2	NAG	2	0
9	O	5	MAN	1	0
9	P	1	NAG	1	0
9	O	1	NAG	2	0

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





## 5.6 Ligand geometry i

Of 10 ligands modelled in this entry, 4 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	$\# Z  > 2$
12	NAG	N	602	8	14,14,15	0.78	0	17,19,21	1.27	2 (11%)
12	NAG	L	602	8	14,14,15	0.82	0	17,19,21	1.00	1 (5%)
11	HEM	K	202	8	41,50,50	1.53	6 (14%)	45,82,82	1.43	6 (13%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
11	HEM	M	202	8	41,50,50	1.49	5 (12%)	45,82,82	1.35	7 (15%)
12	NAG	N	601	8	14,14,15	0.77	0	17,19,21	0.86	0
12	NAG	L	601	8	14,14,15	0.74	0	17,19,21	0.89	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
12	NAG	N	602	8	-	0/6/23/26	0/1/1/1
12	NAG	L	602	8	-	0/6/23/26	0/1/1/1
11	HEM	K	202	8	-	4/12/54/54	-
11	HEM	M	202	8	-	2/12/54/54	-
12	NAG	N	601	8	-	0/6/23/26	0/1/1/1
12	NAG	L	601	8	-	0/6/23/26	0/1/1/1

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
11	K	202	HEM	C3C-CAC	3.87	1.55	1.47
11	M	202	HEM	C3C-CAC	3.85	1.55	1.47
11	K	202	HEM	C3C-C2C	-3.76	1.35	1.40
11	M	202	HEM	C3C-C2C	-3.70	1.35	1.40
11	K	202	HEM	CAB-C3B	3.38	1.56	1.47

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
11	K	202	HEM	C3B-C2B-C1B	3.31	108.94	106.49
11	K	202	HEM	CMB-C2B-C1B	-3.13	120.27	125.04
11	K	202	HEM	C4C-CHD-C1D	2.90	126.39	122.56
11	M	202	HEM	C4D-ND-C1D	2.85	108.02	105.07
12	N	602	NAG	C1-O5-C5	2.81	116.00	112.19

There are no chirality outliers.

5 of 6 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
11	M	202	HEM	C3D-CAD-CBD-CGD
11	K	202	HEM	C3D-CAD-CBD-CGD

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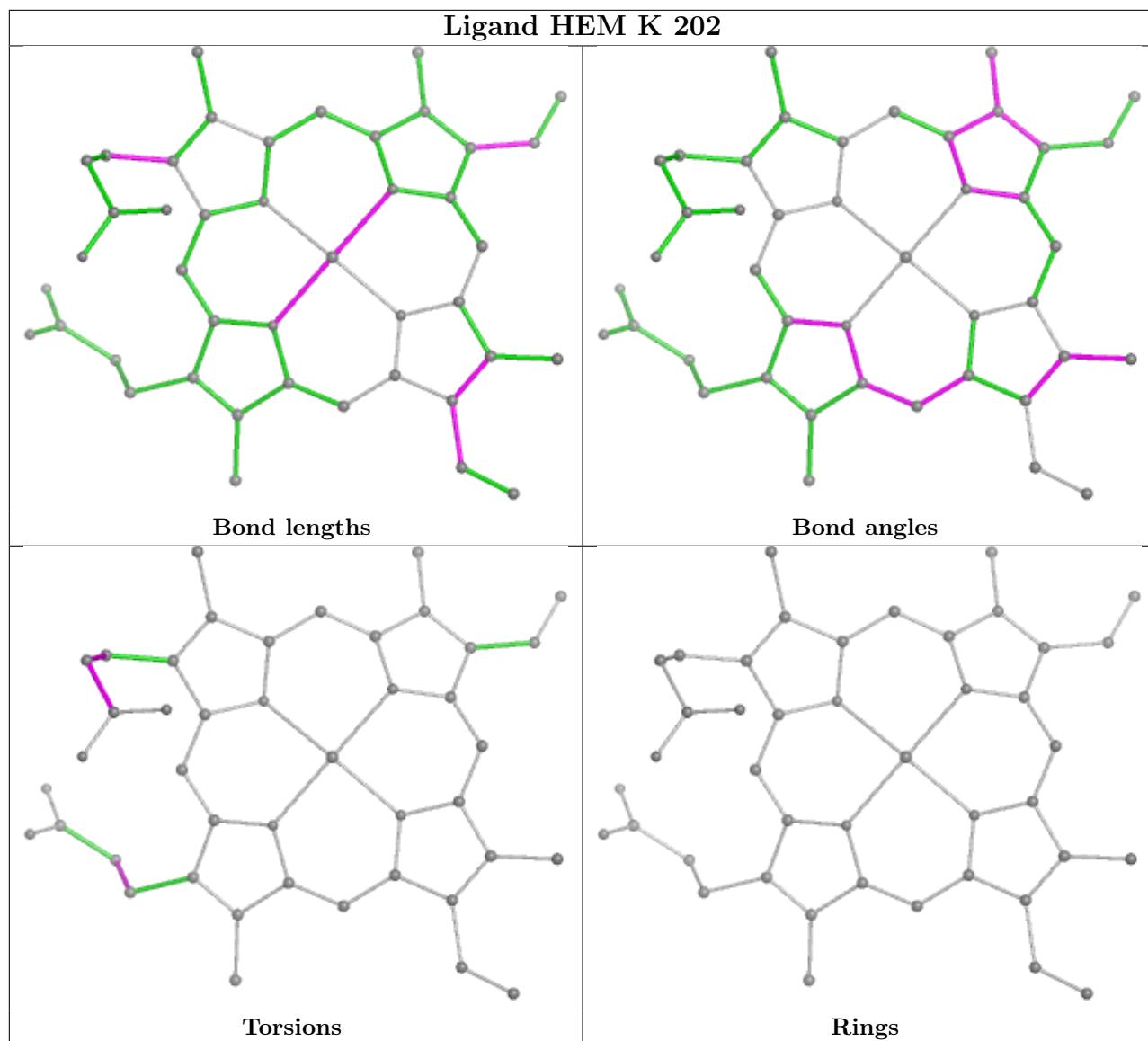
Mol	Chain	Res	Type	Atoms
11	M	202	HEM	C2A-CAA-CBA-CGA
11	K	202	HEM	C2A-CAA-CBA-CGA
11	K	202	HEM	CAA-CBA-CGA-O1A

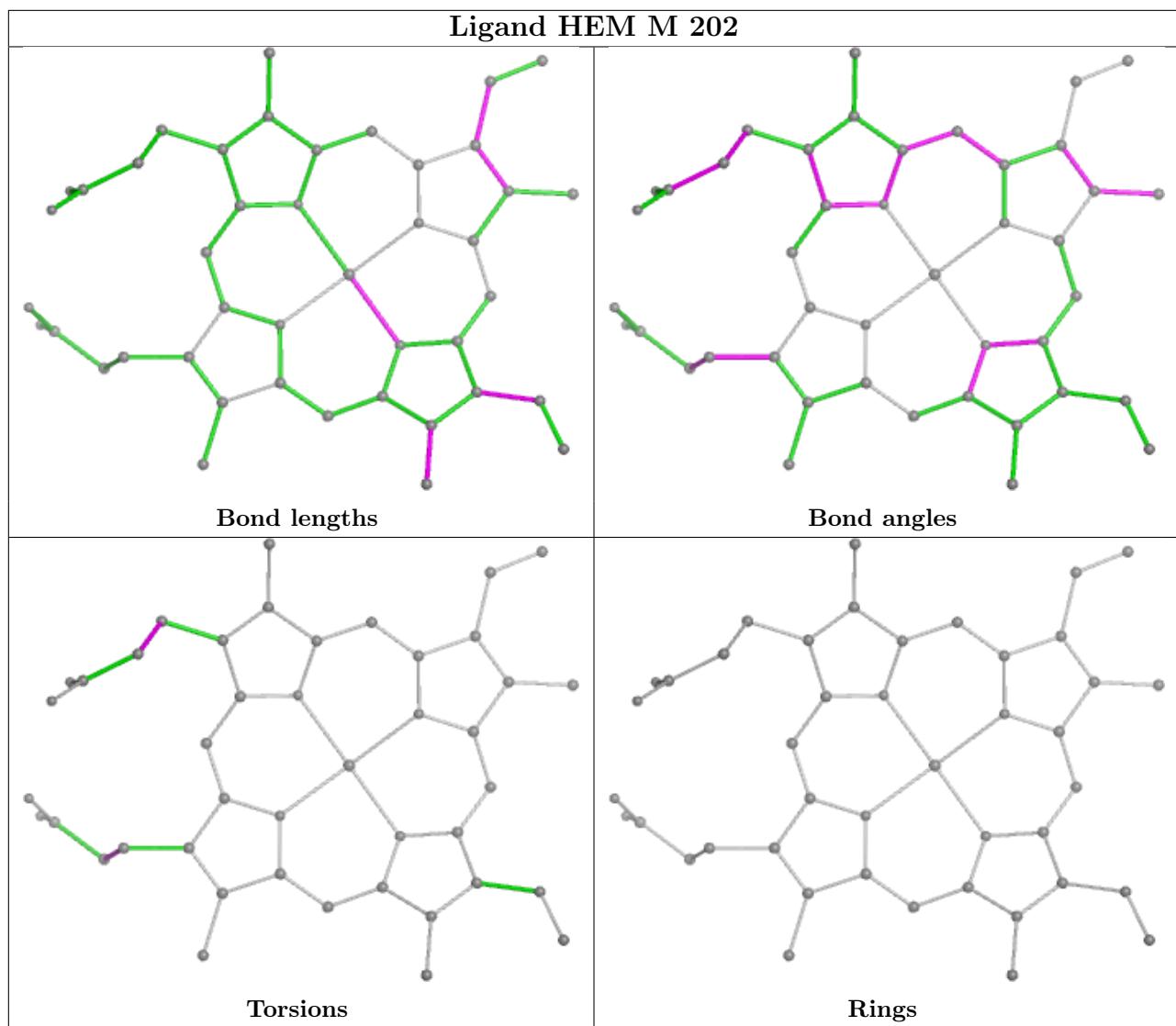
There are no ring outliers.

4 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
12	N	602	NAG	1	0
11	K	202	HEM	2	0
11	M	202	HEM	2	0
12	N	601	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 all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





## 5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [\(i\)](#)

There are no chain breaks in this entry.

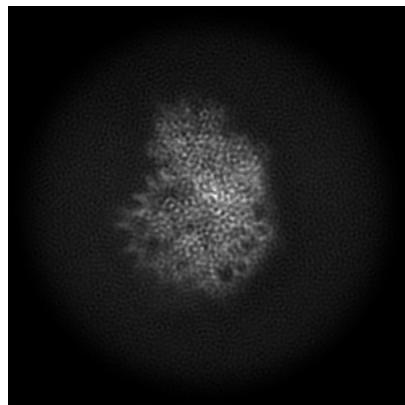
## 6 Map visualisation (i)

This section contains visualisations of the EMDB entry EMD-51301. These allow visual inspection of the internal detail of the map and identification of artifacts.

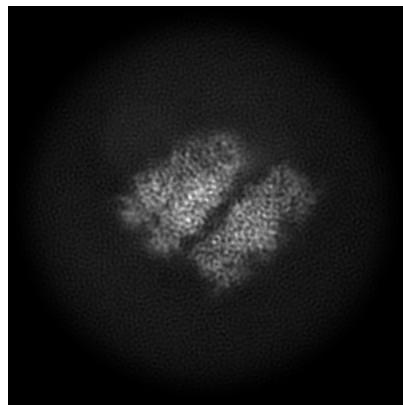
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

### 6.1 Orthogonal projections (i)

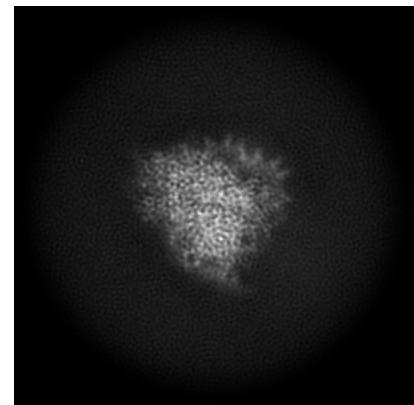
#### 6.1.1 Primary map



X



Y

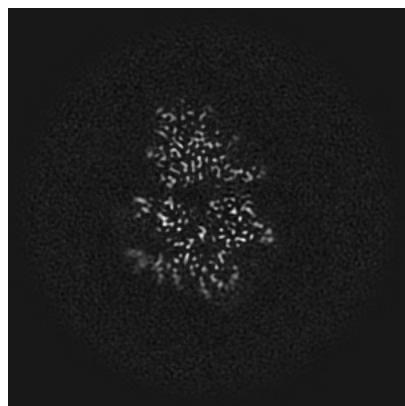


Z

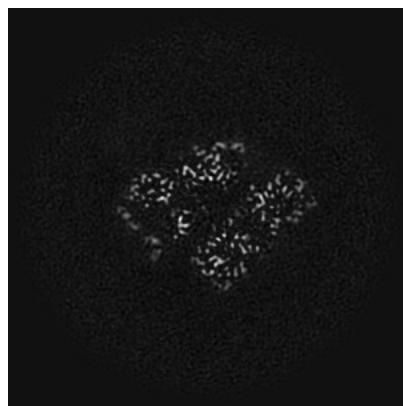
The images above show the map projected in three orthogonal directions.

### 6.2 Central slices (i)

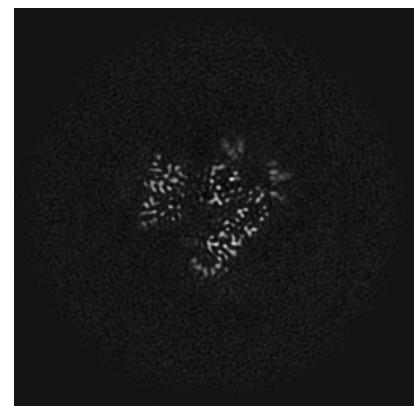
#### 6.2.1 Primary map



X Index: 201



Y Index: 201

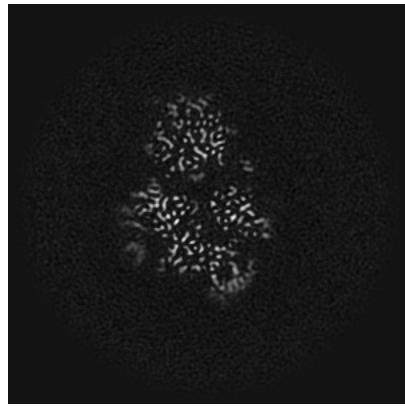


Z Index: 201

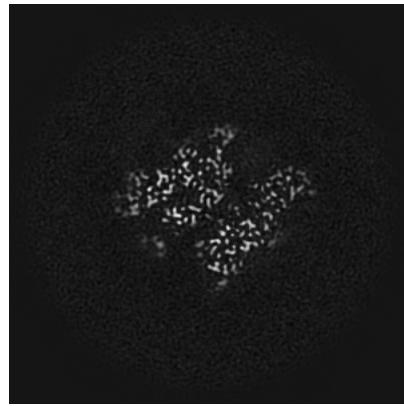
The images above show central slices of the map in three orthogonal directions.

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

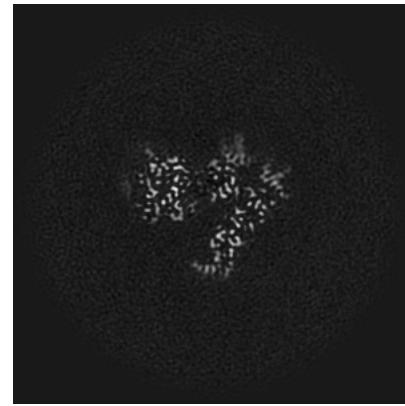
#### 6.3.1 Primary map



X Index: 207



Y Index: 209

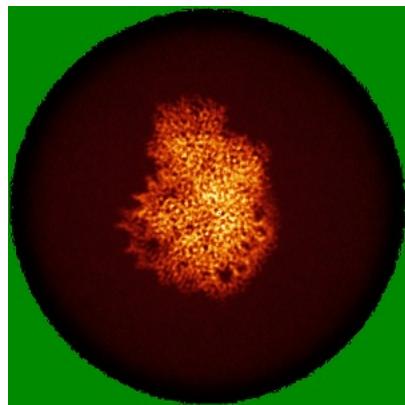


Z Index: 207

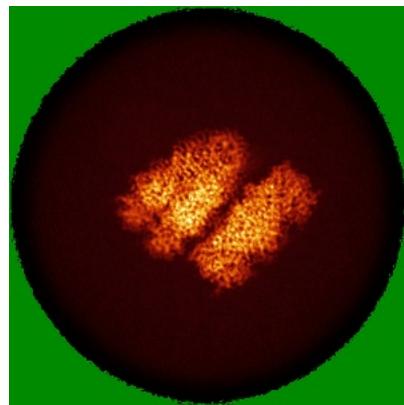
The images above show the largest variance slices of the map in three orthogonal directions.

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

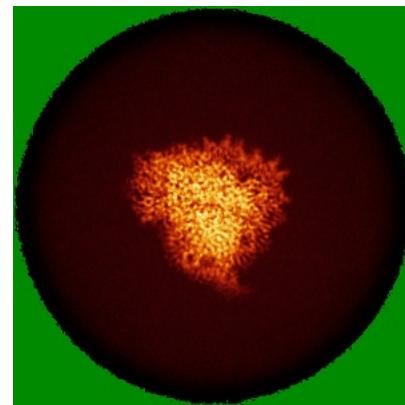
#### 6.4.1 Primary map



X



Y

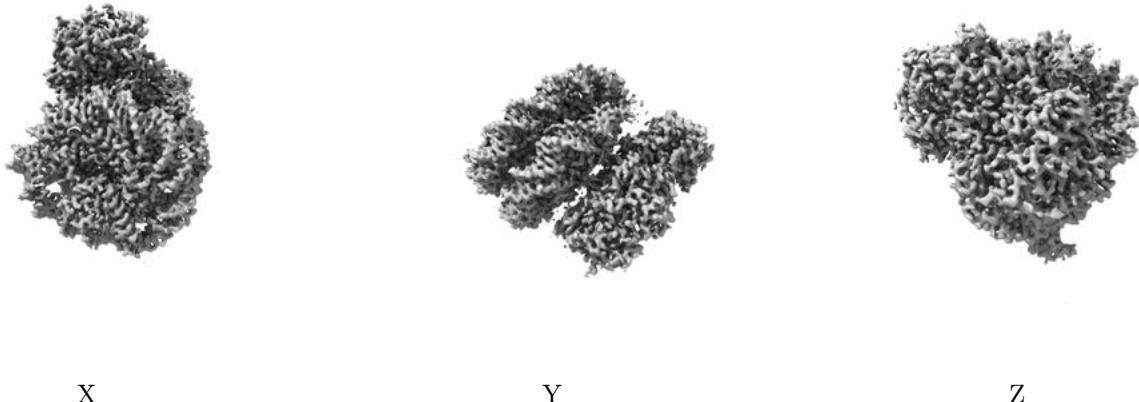


Z

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



The images above show the 3D surface view of the map at the recommended contour level 5.0. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

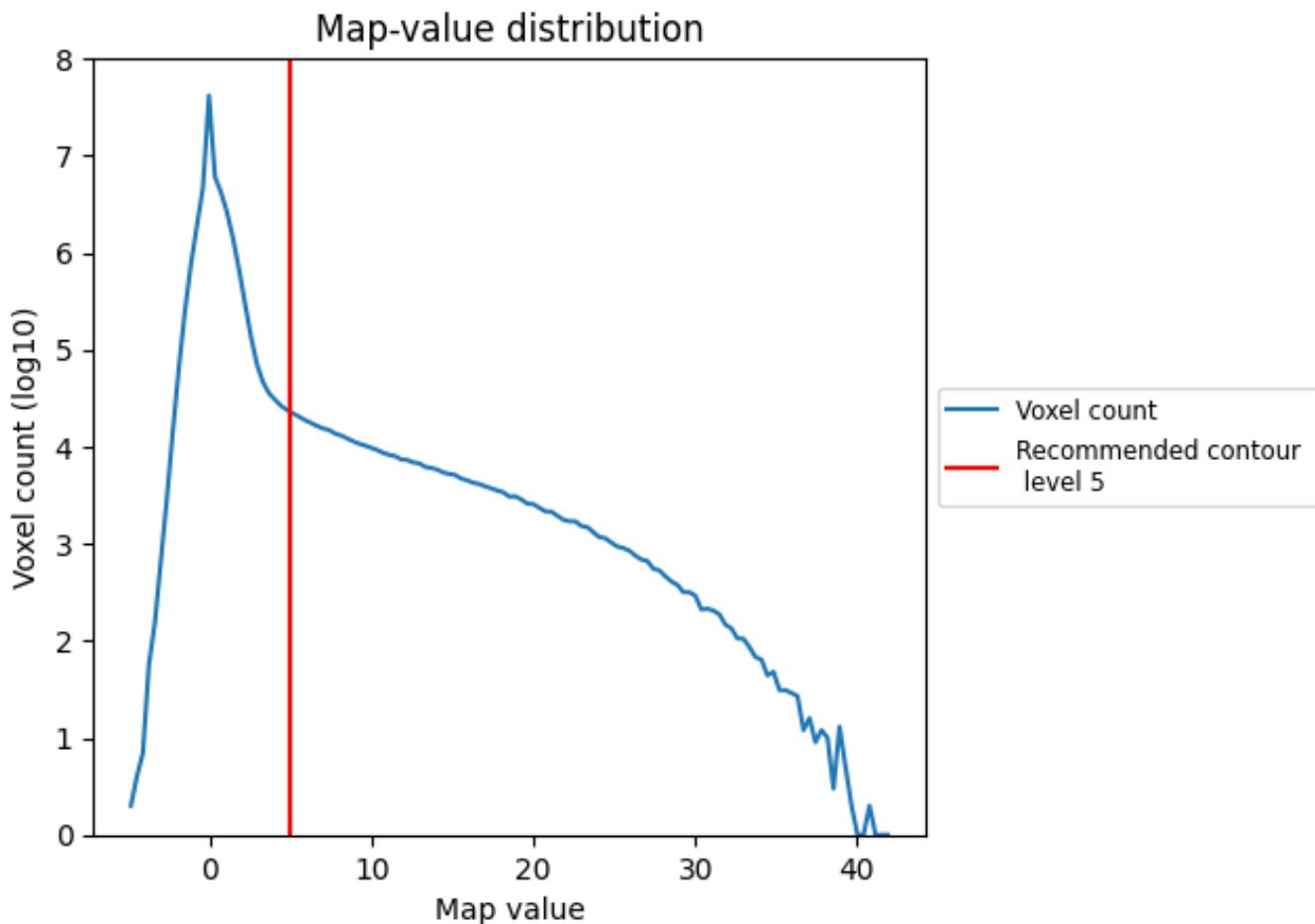
## 6.6 Mask visualisation [\(i\)](#)

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

## 7 Map analysis (i)

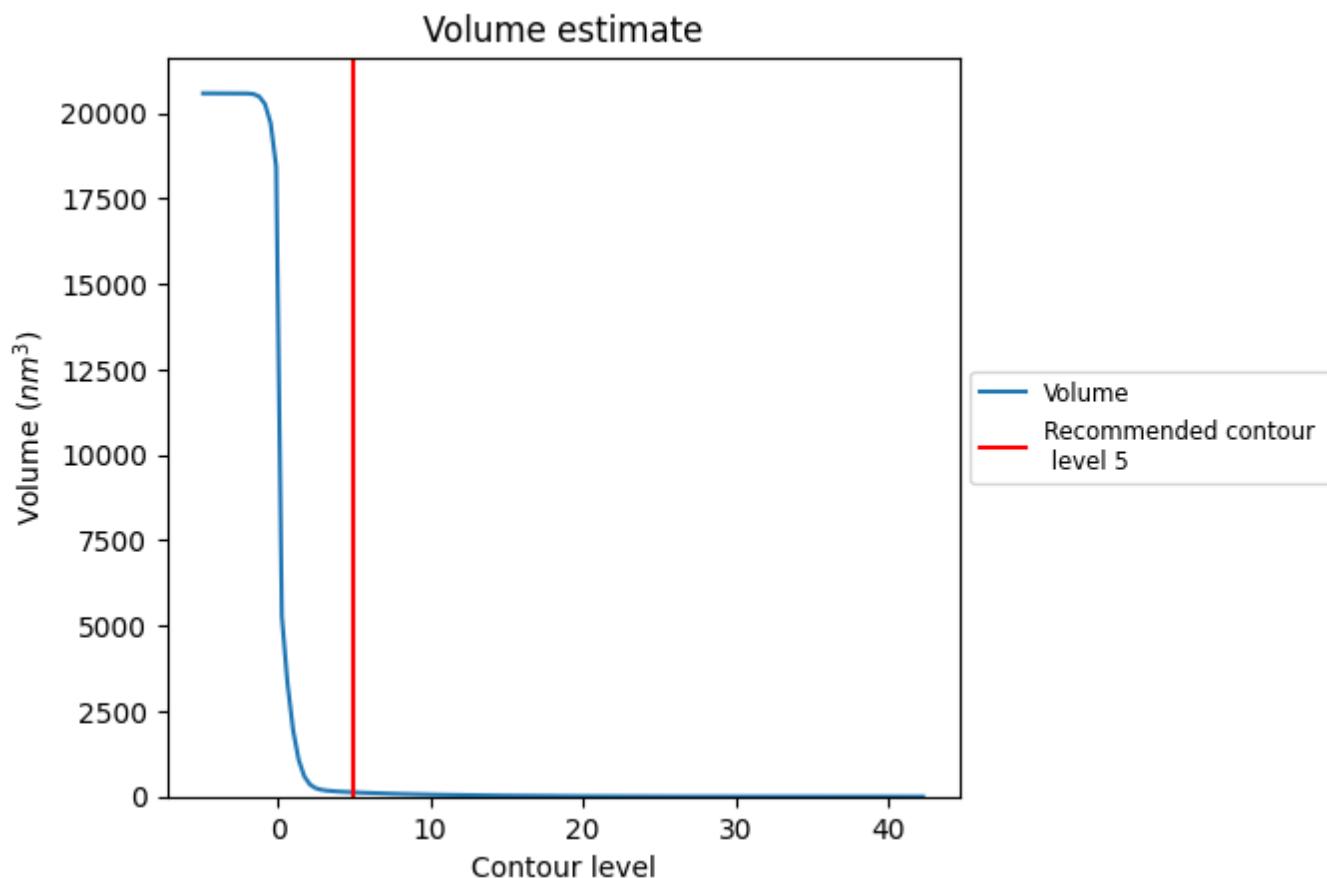
This section contains the results of statistical analysis of the map.

### 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.

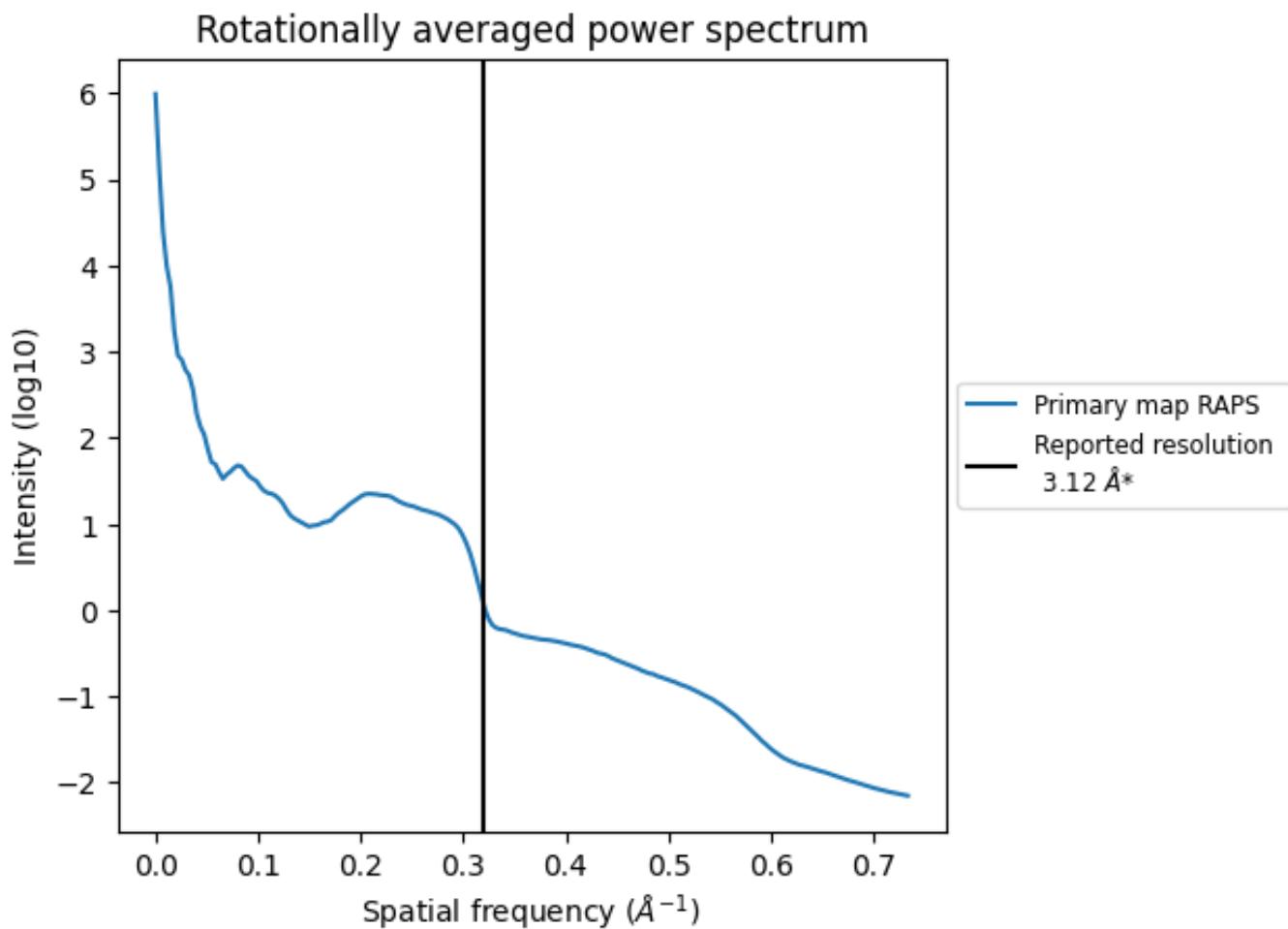
## 7.2 Volume estimate (i)



The volume at the recommended contour level is 123 nm<sup>3</sup>; this corresponds to an approximate mass of 111 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  $0.321 \text{ \AA}^{-1}$

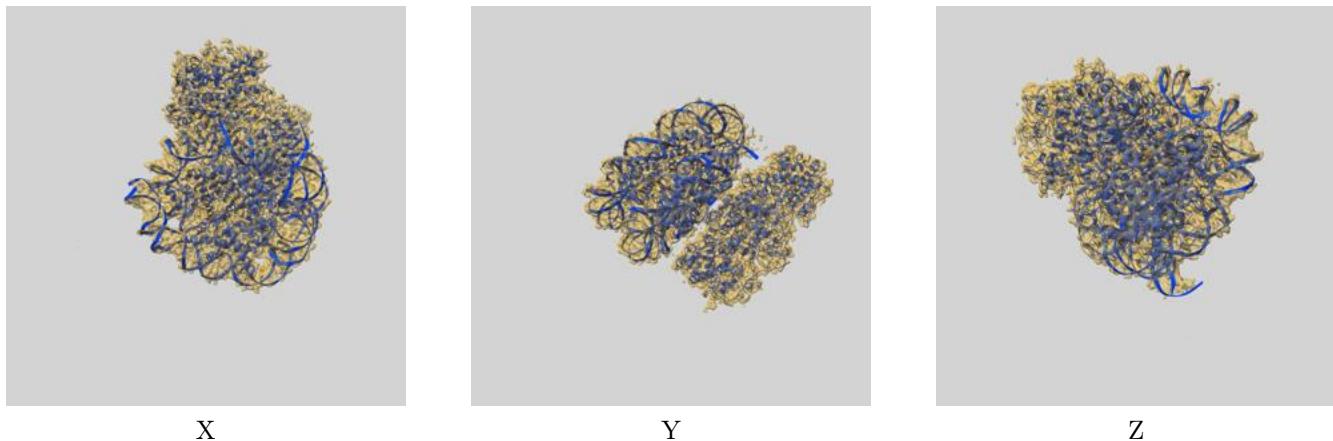
## 8 Fourier-Shell correlation

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

## 9 Map-model fit i

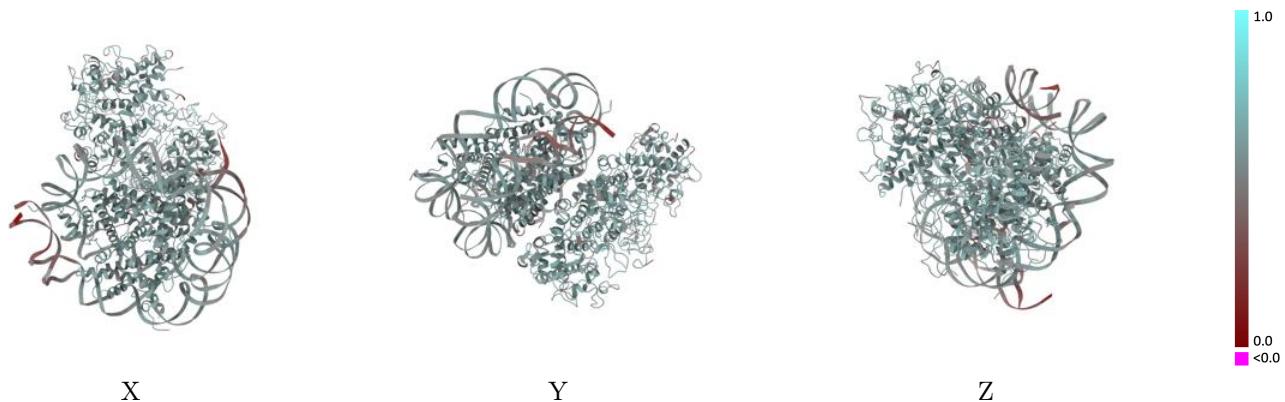
This section contains information regarding the fit between EMDB map EMD-51301 and PDB model 9GEQ. Per-residue inclusion information can be found in section [3](#) on page [8](#).

### 9.1 Map-model overlay i



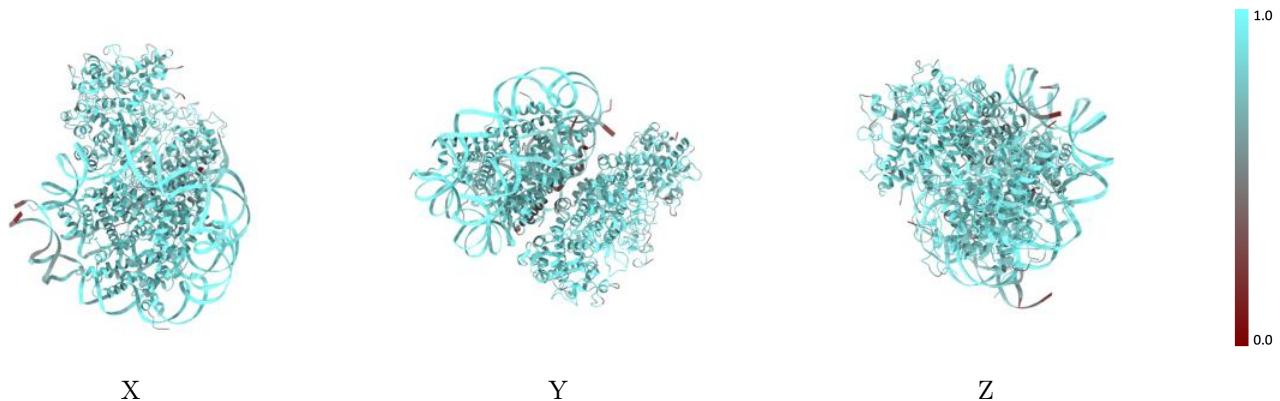
The images above show the 3D surface view of the map at the recommended contour level 5.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



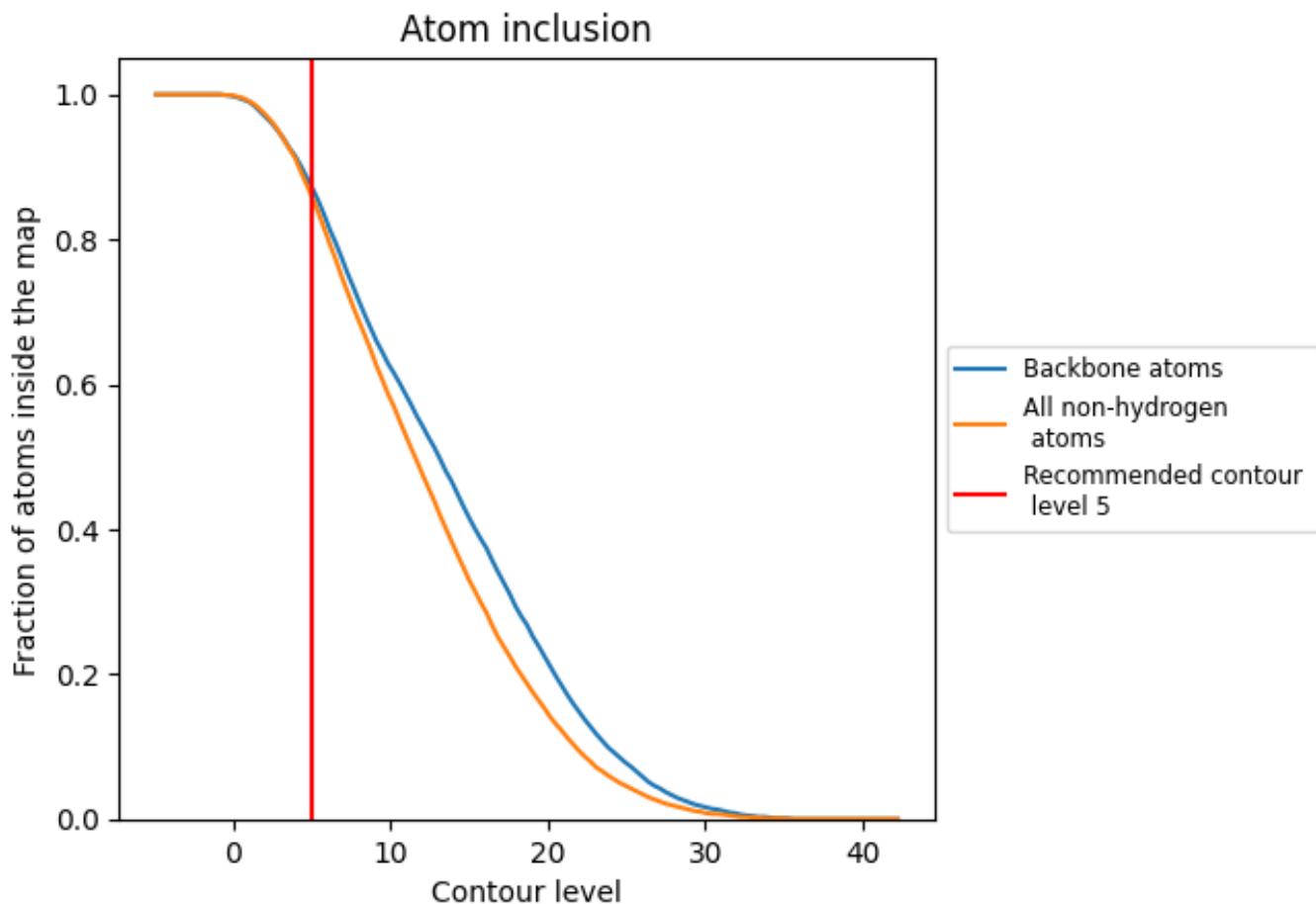
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (5).

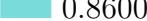
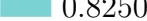
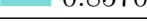
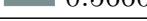
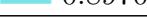
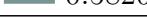
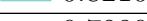
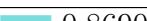
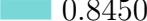
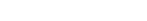
## 9.4 Atom inclusion [\(i\)](#)



At the recommended contour level, 87% of all backbone atoms, 86% 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 (5) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8600	 0.5540
A	 0.8250	 0.5690
B	 0.9040	 0.5850
C	 0.8710	 0.5780
D	 0.8610	 0.5600
E	 0.8570	 0.5660
F	 0.8970	 0.5820
G	 0.8210	 0.5690
H	 0.7980	 0.5570
I	 0.8630	 0.5060
J	 0.8690	 0.4960
K	 0.9040	 0.5810
L	 0.8640	 0.5770
M	 0.8820	 0.5800
N	 0.8440	 0.5710
O	 0.8450	 0.5280
P	 0.8450	 0.5060

