



Full wwPDB EM Validation Report ⓘ

Mar 27, 2026 – 05:00 AM UTC

PDB ID : 7NDG / pdb_00007ndg
EMDB ID : EMD-12286
Title : Cryo-EM structure of the ternary complex between Netrin-1, Neogenin and Repulsive Guidance Molecule B
Authors : Robinson, R.A.; Griffiths, S.C.; van de Haar, L.L.; Malinauskas, T.; van Batum, E.Y.; Zelina, P.; Schwab, R.A.; Karia, D.; Malinauskaite, L.; Brignani, S.; van den Munkhof, M.; Dudukcu, O.; De Ruiter, A.A.; Van den Heuvel, D.M.A.; Bishop, B.; Elegheert, J.; Aricescu, A.R.; Pasterkamp, R.J.; Siebold, C.
Deposited on : 2021-02-01
Resolution : 5.98 Å(reported)

This is a Full wwPDB EM Validation Report for a publicly released PDB entry.

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<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.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
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)

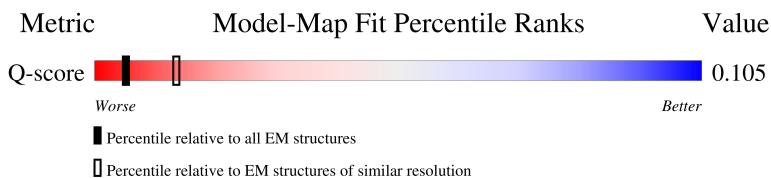
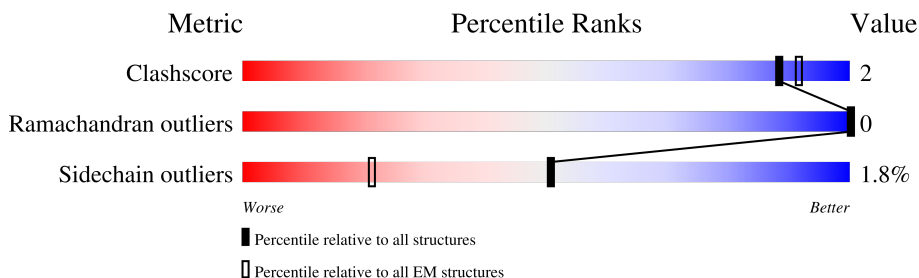
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 5.98 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	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	474 (5.48 - 6.48)

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	441	
1	D	441	
1	G	441	

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Validation Pipeline (wwPDB-VP) : 2.49

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Mol	Chain	Length	Quality of chain
2	B	354	9% 79% 6% 16%
2	E	354	10% 79% 6% 16%
2	H	354	8% 79% 6% 16%
3	C	252	17% 52% 8% 40%
3	F	252	17% 52% 8% 40%
3	I	252	17% 52% 8% 40%
4	M	119	12% 87%
4	N	119	12% 87%
4	O	119	12% 87%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 20934 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 Netrin-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	416	Total	C	N	O	S	0	0
			3267	1996	623	608	40		
1	G	416	Total	C	N	O	S	0	0
			3267	1996	623	608	40		
1	D	416	Total	C	N	O	S	0	0
			3267	1996	623	608	40		

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	454	GLY	-	expression tag	UNP O95631
A	455	SER	-	expression tag	UNP O95631
A	456	GLY	-	expression tag	UNP O95631
A	457	THR	-	expression tag	UNP O95631
A	458	GLU	-	expression tag	UNP O95631
A	459	THR	-	expression tag	UNP O95631
A	460	SER	-	expression tag	UNP O95631
A	461	GLN	-	expression tag	UNP O95631
A	462	VAL	-	expression tag	UNP O95631
A	463	ALA	-	expression tag	UNP O95631
A	464	PRO	-	expression tag	UNP O95631
A	465	ALA	-	expression tag	UNP O95631
G	454	GLY	-	expression tag	UNP O95631
G	455	SER	-	expression tag	UNP O95631
G	456	GLY	-	expression tag	UNP O95631
G	457	THR	-	expression tag	UNP O95631
G	458	GLU	-	expression tag	UNP O95631
G	459	THR	-	expression tag	UNP O95631
G	460	SER	-	expression tag	UNP O95631
G	461	GLN	-	expression tag	UNP O95631
G	462	VAL	-	expression tag	UNP O95631
G	463	ALA	-	expression tag	UNP O95631
G	464	PRO	-	expression tag	UNP O95631
G	465	ALA	-	expression tag	UNP O95631

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Chain	Residue	Modelled	Actual	Comment	Reference
D	454	GLY	-	expression tag	UNP O95631
D	455	SER	-	expression tag	UNP O95631
D	456	GLY	-	expression tag	UNP O95631
D	457	THR	-	expression tag	UNP O95631
D	458	GLU	-	expression tag	UNP O95631
D	459	THR	-	expression tag	UNP O95631
D	460	SER	-	expression tag	UNP O95631
D	461	GLN	-	expression tag	UNP O95631
D	462	VAL	-	expression tag	UNP O95631
D	463	ALA	-	expression tag	UNP O95631
D	464	PRO	-	expression tag	UNP O95631
D	465	ALA	-	expression tag	UNP O95631

- Molecule 2 is a protein called Neogenin.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	299	Total	C	N	O	S	0	0
			2358	1505	402	445	6		
2	H	299	Total	C	N	O	S	0	0
			2358	1505	402	445	6		
2	E	299	Total	C	N	O	S	0	0
			2358	1505	402	445	6		

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	763	GLU	-	expression tag	UNP Q7TQG5
B	764	THR	-	expression tag	UNP Q7TQG5
B	765	GLY	-	expression tag	UNP Q7TQG5
B	1124	GLY	-	expression tag	UNP Q7TQG5
B	1125	THR	-	expression tag	UNP Q7TQG5
B	1126	LYS	-	expression tag	UNP Q7TQG5
B	1127	HIS	-	expression tag	UNP Q7TQG5
B	1128	HIS	-	expression tag	UNP Q7TQG5
B	1129	HIS	-	expression tag	UNP Q7TQG5
B	1130	HIS	-	expression tag	UNP Q7TQG5
B	1131	HIS	-	expression tag	UNP Q7TQG5
B	1132	HIS	-	expression tag	UNP Q7TQG5
H	763	GLU	-	expression tag	UNP Q7TQG5
H	764	THR	-	expression tag	UNP Q7TQG5
H	765	GLY	-	expression tag	UNP Q7TQG5
H	1124	GLY	-	expression tag	UNP Q7TQG5

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Chain	Residue	Modelled	Actual	Comment	Reference
H	1125	THR	-	expression tag	UNP Q7TQG5
H	1126	LYS	-	expression tag	UNP Q7TQG5
H	1127	HIS	-	expression tag	UNP Q7TQG5
H	1128	HIS	-	expression tag	UNP Q7TQG5
H	1129	HIS	-	expression tag	UNP Q7TQG5
H	1130	HIS	-	expression tag	UNP Q7TQG5
H	1131	HIS	-	expression tag	UNP Q7TQG5
H	1132	HIS	-	expression tag	UNP Q7TQG5
E	763	GLU	-	expression tag	UNP Q7TQG5
E	764	THR	-	expression tag	UNP Q7TQG5
E	765	GLY	-	expression tag	UNP Q7TQG5
E	1124	GLY	-	expression tag	UNP Q7TQG5
E	1125	THR	-	expression tag	UNP Q7TQG5
E	1126	LYS	-	expression tag	UNP Q7TQG5
E	1127	HIS	-	expression tag	UNP Q7TQG5
E	1128	HIS	-	expression tag	UNP Q7TQG5
E	1129	HIS	-	expression tag	UNP Q7TQG5
E	1130	HIS	-	expression tag	UNP Q7TQG5
E	1131	HIS	-	expression tag	UNP Q7TQG5
E	1132	HIS	-	expression tag	UNP Q7TQG5

- Molecule 3 is a protein called Repulsive Guidance Molecule B (C-terminal region).

Mol	Chain	Residues	Atoms					AltConf	Trace
3	F	151	Total	C	N	O	S	0	0
			1175	737	203	228	7		
3	C	151	Total	C	N	O	S	0	0
			1175	737	203	228	7		
3	I	151	Total	C	N	O	S	0	0
			1175	737	203	228	7		

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	413	THR	-	expression tag	UNP Q6NW40
F	414	LYS	-	expression tag	UNP Q6NW40
F	415	HIS	-	expression tag	UNP Q6NW40
F	416	HIS	-	expression tag	UNP Q6NW40
F	417	HIS	-	expression tag	UNP Q6NW40
F	418	HIS	-	expression tag	UNP Q6NW40
F	419	HIS	-	expression tag	UNP Q6NW40
F	420	HIS	-	expression tag	UNP Q6NW40

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Chain	Residue	Modelled	Actual	Comment	Reference
C	413	THR	-	expression tag	UNP Q6NW40
C	414	LYS	-	expression tag	UNP Q6NW40
C	415	HIS	-	expression tag	UNP Q6NW40
C	416	HIS	-	expression tag	UNP Q6NW40
C	417	HIS	-	expression tag	UNP Q6NW40
C	418	HIS	-	expression tag	UNP Q6NW40
C	419	HIS	-	expression tag	UNP Q6NW40
C	420	HIS	-	expression tag	UNP Q6NW40
I	413	THR	-	expression tag	UNP Q6NW40
I	414	LYS	-	expression tag	UNP Q6NW40
I	415	HIS	-	expression tag	UNP Q6NW40
I	416	HIS	-	expression tag	UNP Q6NW40
I	417	HIS	-	expression tag	UNP Q6NW40
I	418	HIS	-	expression tag	UNP Q6NW40
I	419	HIS	-	expression tag	UNP Q6NW40
I	420	HIS	-	expression tag	UNP Q6NW40

- Molecule 4 is a protein called RGM domain family member B.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	N	15	Total	C	N	O	S	0	0
			121	80	18	21	2		
4	M	15	Total	C	N	O	S	0	0
			121	80	18	21	2		
4	O	15	Total	C	N	O	S	0	0
			121	80	18	21	2		

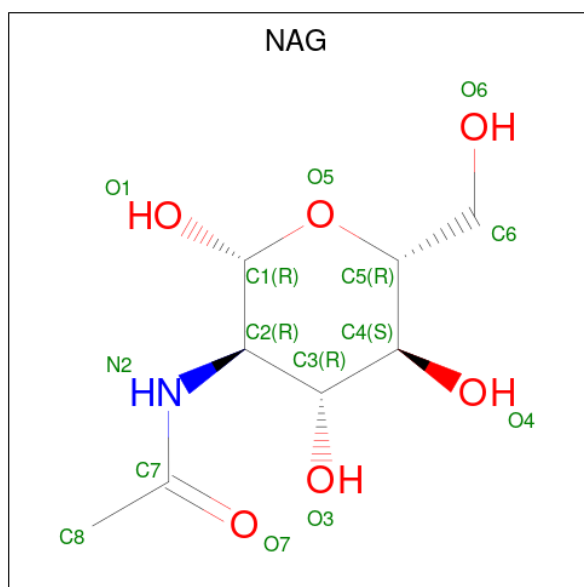
There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
N	50	GLU	-	expression tag	UNP Q6NW40
N	51	THR	-	expression tag	UNP Q6NW40
N	52	GLY	-	expression tag	UNP Q6NW40
M	50	GLU	-	expression tag	UNP Q6NW40
M	51	THR	-	expression tag	UNP Q6NW40
M	52	GLY	-	expression tag	UNP Q6NW40
O	50	GLU	-	expression tag	UNP Q6NW40
O	51	THR	-	expression tag	UNP Q6NW40
O	52	GLY	-	expression tag	UNP Q6NW40

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		AltConf
5	A	1	Total	Ca	0
			1	1	
5	G	1	Total	Ca	0
			1	1	
5	D	1	Total	Ca	0
			1	1	

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				AltConf
6	A	1	Total	C	N	O	0
			14	8	1	5	
6	A	1	Total	C	N	O	0
			14	8	1	5	
6	A	1	Total	C	N	O	0
			14	8	1	5	
6	B	1	Total	C	N	O	0
			14	8	1	5	
6	G	1	Total	C	N	O	0
			14	8	1	5	
6	G	1	Total	C	N	O	0
			14	8	1	5	
6	G	1	Total	C	N	O	0
			14	8	1	5	
6	H	1	Total	C	N	O	0
			14	8	1	5	

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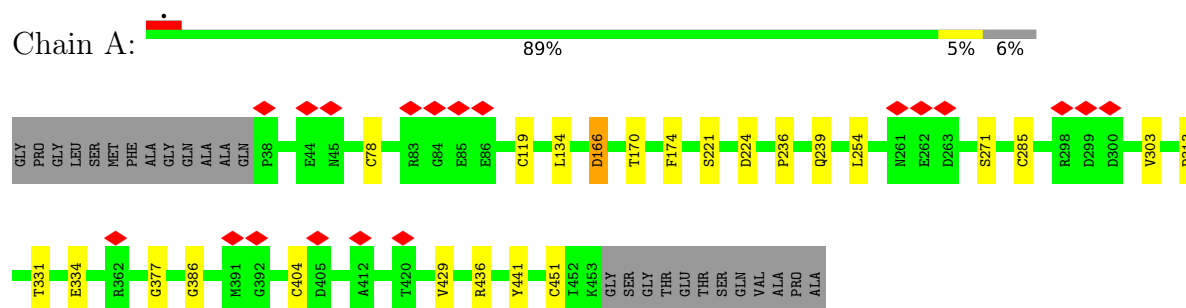
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Mol	Chain	Residues	Atoms				AltConf
6	D	1	Total	C	N	O	0
			14	8	1	5	
6	D	1	Total	C	N	O	0
			14	8	1	5	
6	D	1	Total	C	N	O	0
			14	8	1	5	
6	E	1	Total	C	N	O	0
			14	8	1	5	

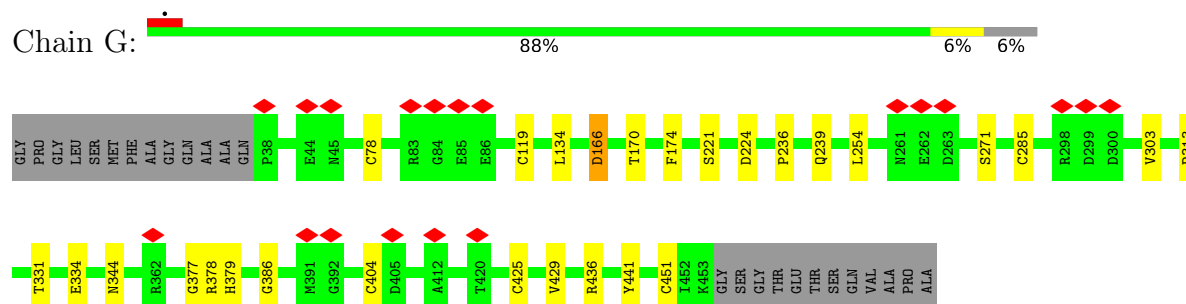
3 Residue-property plots [i](#)

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.

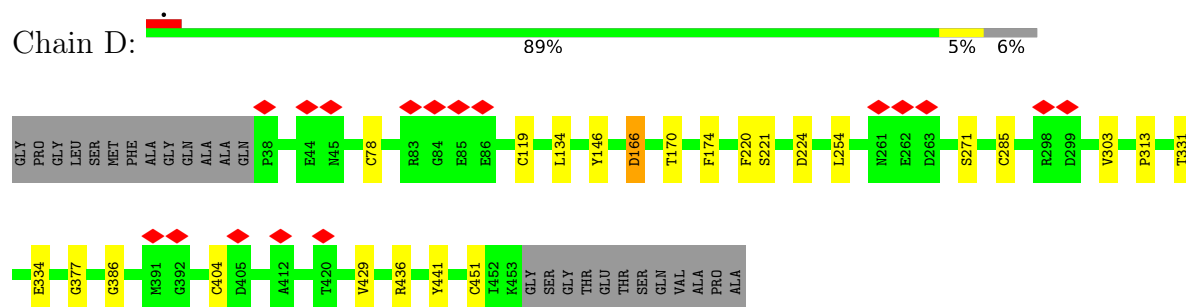
- Molecule 1: Netrin-1



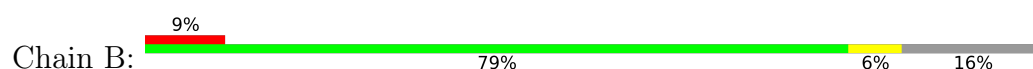
- Molecule 1: Netrin-1



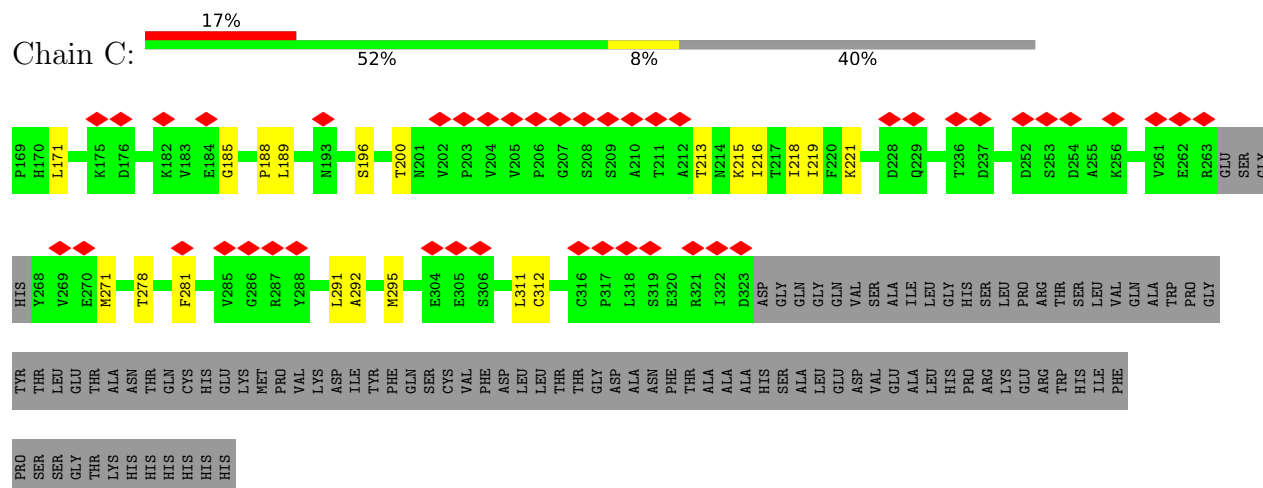
- Molecule 1: Netrin-1



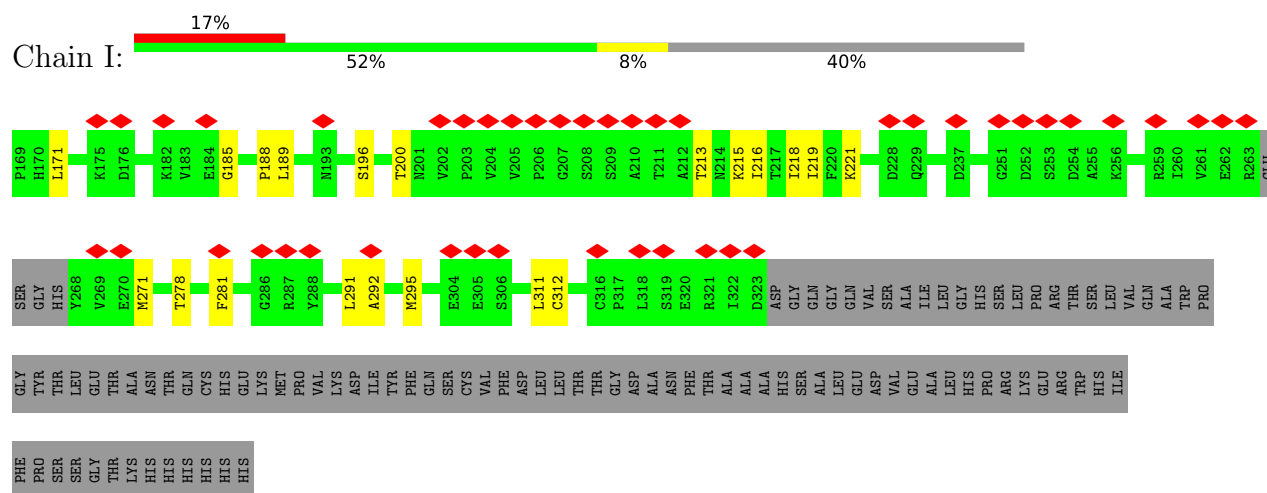
- Molecule 2: Neogenin



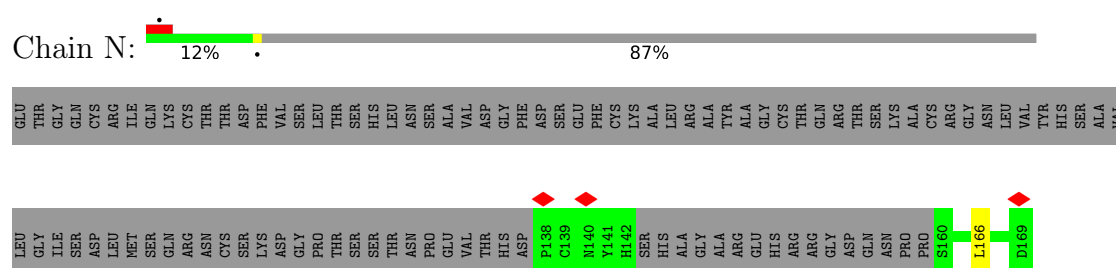
- Molecule 3: Repulsive Guidance Molecule B (C-terminal region)



- Molecule 3: Repulsive Guidance Molecule B (C-terminal region)

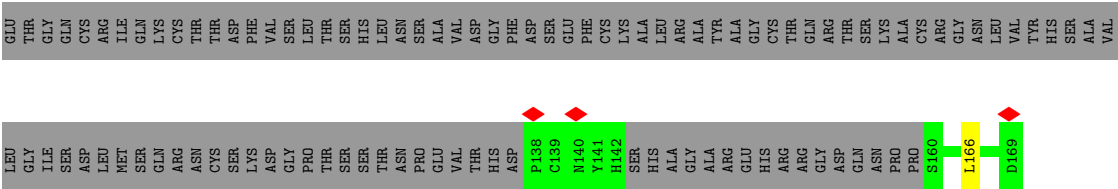


- Molecule 4: RGM domain family member B

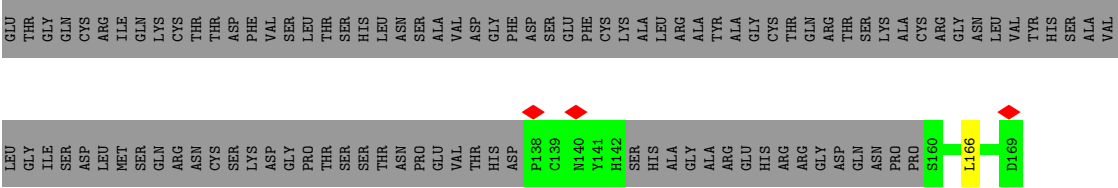


- Molecule 4: RGM domain family member B





● Molecule 4: RGM domain family member B



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C3	Depositor
Number of particles used	68541	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 ($e^-/\text{\AA}^2$)	40	Depositor
Minimum defocus (nm)	-500	Depositor
Maximum defocus (nm)	-700	Depositor
Magnification	96000	Depositor
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	0.018	Depositor
Minimum map value	-0.007	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.001	Depositor
Recommended contour level	0.007	Depositor
Map size (Å)	299.2, 299.2, 299.2	wwPDB
Map dimensions	352, 352, 352	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.85, 0.85, 0.85	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: NAG, CA

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	0.71	0/3349	1.17	2/4531 (0.0%)
1	D	0.71	0/3349	1.17	2/4531 (0.0%)
1	G	0.71	0/3349	1.17	3/4531 (0.1%)
2	B	0.77	1/2425 (0.0%)	1.08	0/3324
2	E	0.76	1/2425 (0.0%)	1.08	0/3324
2	H	0.77	0/2425	1.08	0/3324
3	C	0.76	0/1197	1.10	0/1626
3	F	0.76	0/1197	1.10	0/1626
3	I	0.76	0/1197	1.10	0/1626
4	M	0.62	0/125	1.22	0/166
4	N	0.61	0/125	1.22	0/166
4	O	0.62	0/125	1.22	0/166
All	All	0.74	2/21288 (0.0%)	1.13	7/28941 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	882	PRO	N-CD	5.27	1.55	1.47
2	B	882	PRO	N-CD	5.04	1.54	1.47

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	386	GLY	N-CA-C	-6.23	106.33	115.30
1	A	386	GLY	N-CA-C	-6.11	106.51	115.30
1	D	386	GLY	N-CA-C	-5.99	106.68	115.30
1	D	377	GLY	CA-C-O	-5.28	118.02	122.29
1	G	377	GLY	CA-C-O	-5.26	118.03	122.29
1	A	377	GLY	CA-C-O	-5.23	118.05	122.29
1	G	378	ARG	N-CA-C	-5.15	105.67	111.28

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3267	0	3072	8	0
1	D	3267	0	3072	8	0
1	G	3267	0	3072	10	0
2	B	2358	0	2339	9	0
2	E	2358	0	2339	9	0
2	H	2358	0	2339	9	0
3	C	1175	0	1148	11	0
3	F	1175	0	1148	11	0
3	I	1175	0	1148	11	0
4	M	121	0	100	1	0
4	N	121	0	100	1	0
4	O	121	0	100	1	0
5	A	1	0	0	0	0
5	D	1	0	0	0	0
5	G	1	0	0	0	0
6	A	42	0	39	0	0
6	B	14	0	13	0	0
6	D	42	0	39	0	0
6	E	14	0	13	0	0
6	G	42	0	39	0	0
6	H	14	0	13	0	0
All	All	20934	0	20133	77	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 2.

All (77) 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)
3:C:188:PRO:HG3	2:H:1047:THR:HG21	1.72	0.72
2:B:1047:THR:HG21	3:F:188:PRO:HG3	1.72	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:1047:THR:HG21	3:I:188:PRO:HG3	1.72	0.71
2:H:885:MET:HB2	2:H:970:SER:HB2	1.80	0.63
2:E:885:MET:HB2	2:E:970:SER:HB2	1.80	0.63
2:B:885:MET:HB2	2:B:970:SER:HB2	1.80	0.61
1:D:221:SER:HB3	1:D:224:ASP:HB2	1.91	0.53
1:G:221:SER:HB3	1:G:224:ASP:HB2	1.91	0.52
1:G:303:VAL:HG13	1:G:313:PRO:HA	1.91	0.52
1:D:303:VAL:HG13	1:D:313:PRO:HA	1.91	0.52
3:I:196:SER:HB3	3:I:219:ILE:HB	1.92	0.52
3:F:189:LEU:HD23	3:F:311:LEU:HB2	1.91	0.52
2:H:779:ARG:HB3	2:H:786:VAL:HB	1.92	0.52
1:A:221:SER:HB3	1:A:224:ASP:HB2	1.91	0.52
3:C:196:SER:HB3	3:C:219:ILE:HB	1.92	0.51
3:I:189:LEU:HD23	3:I:311:LEU:HB2	1.92	0.51
3:F:196:SER:HB3	3:F:219:ILE:HB	1.92	0.51
3:F:213:THR:HG21	4:N:166:LEU:HD21	1.92	0.51
2:B:993:THR:HG21	3:F:185:GLY:HA3	1.92	0.51
3:C:189:LEU:HD23	3:C:311:LEU:HB2	1.92	0.51
2:E:779:ARG:HB3	2:E:786:VAL:HB	1.92	0.51
1:A:303:VAL:HG13	1:A:313:PRO:HA	1.91	0.51
2:E:993:THR:HG21	3:I:185:GLY:HA3	1.92	0.51
3:I:213:THR:HG21	4:O:166:LEU:HD21	1.92	0.51
3:C:213:THR:HG21	4:M:166:LEU:HD21	1.93	0.50
2:B:779:ARG:HB3	2:B:786:VAL:HB	1.92	0.50
2:B:1010:PRO:HD3	2:B:1046:LEU:HD21	1.93	0.50
2:H:1010:PRO:HD3	2:H:1046:LEU:HD21	1.93	0.49
2:E:1010:PRO:HD3	2:E:1046:LEU:HD21	1.93	0.49
3:C:185:GLY:HA3	2:H:993:THR:HG21	1.92	0.49
1:A:429:VAL:HG13	1:A:436:ARG:O	2.14	0.48
1:G:429:VAL:HG13	1:G:436:ARG:O	2.13	0.48
1:G:441:TYR:HB3	1:G:451:CYS:HB3	1.96	0.48
1:A:441:TYR:HB3	1:A:451:CYS:HB3	1.96	0.48
2:H:1008:TRP:HB3	2:H:1063:ILE:HD13	1.96	0.48
2:E:1008:TRP:HB3	2:E:1063:ILE:HD13	1.96	0.48
3:F:200:THR:HG22	3:F:215:LYS:HB3	1.96	0.47
2:B:1008:TRP:HB3	2:B:1063:ILE:HD13	1.96	0.47
1:D:441:TYR:HB3	1:D:451:CYS:HB3	1.96	0.47
1:G:331:THR:HG23	1:G:334:GLU:H	1.79	0.47
1:D:429:VAL:HG13	1:D:436:ARG:O	2.14	0.47
3:C:200:THR:HG22	3:C:215:LYS:HB3	1.96	0.46
1:D:331:THR:HG23	1:D:334:GLU:H	1.79	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:331:THR:HG23	1:A:334:GLU:H	1.80	0.46
1:A:166:ASP:OD2	1:A:170:THR:HG22	2.16	0.46
3:C:216:ILE:HD13	3:C:291:LEU:HD13	1.98	0.46
1:G:166:ASP:OD2	1:G:170:THR:HG22	2.16	0.46
2:E:1044:ASN:HB2	3:I:221:LYS:HD3	1.98	0.46
1:D:166:ASP:OD2	1:D:170:THR:HG22	2.16	0.46
3:I:200:THR:HG22	3:I:215:LYS:HB3	1.96	0.46
3:F:216:ILE:HD13	3:F:291:LEU:HD13	1.98	0.46
3:F:218:ILE:HG13	3:F:271:MET:HE1	1.98	0.46
3:C:221:LYS:HD3	2:H:1044:ASN:HB2	1.98	0.45
2:B:1044:ASN:HB2	3:F:221:LYS:HD3	1.98	0.44
3:C:218:ILE:HG13	3:C:271:MET:HE1	1.98	0.44
3:I:216:ILE:HD13	3:I:291:LEU:HD13	1.98	0.44
2:H:898:HIS:HB2	2:H:953:PRO:HB3	2.00	0.44
3:I:218:ILE:HG13	3:I:271:MET:HE1	1.98	0.43
2:B:898:HIS:HB2	2:B:953:PRO:HB3	2.00	0.43
1:G:344:ASN:ND2	1:G:379:HIS:O	2.51	0.43
3:F:278:THR:HB	3:F:295:MET:HG3	2.01	0.43
3:C:278:THR:HB	3:C:295:MET:HG3	2.01	0.43
2:E:898:HIS:HB2	2:E:953:PRO:HB3	2.00	0.42
1:A:78:CYS:HB2	1:A:271:SER:HB3	2.01	0.42
1:D:78:CYS:HB2	1:D:271:SER:HB3	2.01	0.42
3:F:281:PHE:HB2	3:F:292:ALA:HB3	2.02	0.42
1:G:78:CYS:HB2	1:G:271:SER:HB3	2.01	0.41
3:I:278:THR:HB	3:I:295:MET:HG3	2.01	0.41
2:H:952:LYS:HB2	2:H:955:THR:HG21	2.03	0.41
3:C:281:PHE:HB2	3:C:292:ALA:HB3	2.02	0.41
1:G:236:PRO:HA	1:G:239:GLN:HB2	2.03	0.41
3:I:281:PHE:HB2	3:I:292:ALA:HB3	2.02	0.41
1:G:425:CYS:HB3	1:G:429:VAL:HB	2.03	0.41
2:B:952:LYS:HB2	2:B:955:THR:HG21	2.03	0.40
1:A:236:PRO:HA	1:A:239:GLN:HB2	2.03	0.40
1:D:146:TYR:HA	1:D:220:PHE:O	2.21	0.40
2:E:952:LYS:HB2	2:E:955:THR:HG21	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	414/441 (94%)	400 (97%)	14 (3%)	0	100	100
1	D	414/441 (94%)	399 (96%)	15 (4%)	0	100	100
1	G	414/441 (94%)	400 (97%)	14 (3%)	0	100	100
2	B	295/354 (83%)	285 (97%)	10 (3%)	0	100	100
2	E	295/354 (83%)	285 (97%)	10 (3%)	0	100	100
2	H	295/354 (83%)	285 (97%)	10 (3%)	0	100	100
3	C	147/252 (58%)	137 (93%)	10 (7%)	0	100	100
3	F	147/252 (58%)	137 (93%)	10 (7%)	0	100	100
3	I	147/252 (58%)	137 (93%)	10 (7%)	0	100	100
4	M	11/119 (9%)	11 (100%)	0	0	100	100
4	N	11/119 (9%)	11 (100%)	0	0	100	100
4	O	11/119 (9%)	11 (100%)	0	0	100	100
All	All	2601/3498 (74%)	2498 (96%)	103 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	360/375 (96%)	353 (98%)	7 (2%)	50	66
1	D	360/375 (96%)	353 (98%)	7 (2%)	50	66

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	G	360/375 (96%)	353 (98%)	7 (2%)	50	66
2	B	267/313 (85%)	262 (98%)	5 (2%)	50	66
2	E	267/313 (85%)	262 (98%)	5 (2%)	50	66
2	H	267/313 (85%)	262 (98%)	5 (2%)	50	66
3	C	131/217 (60%)	129 (98%)	2 (2%)	57	71
3	F	131/217 (60%)	129 (98%)	2 (2%)	57	71
3	I	131/217 (60%)	129 (98%)	2 (2%)	57	71
4	M	13/101 (13%)	13 (100%)	0	100	100
4	N	13/101 (13%)	13 (100%)	0	100	100
4	O	13/101 (13%)	13 (100%)	0	100	100
All	All	2313/3018 (77%)	2271 (98%)	42 (2%)	51	67

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	119	CYS
1	A	134	LEU
1	A	166	ASP
1	A	174	PHE
1	A	254	LEU
1	A	285	CYS
1	A	404	CYS
2	B	781	LEU
2	B	804	ILE
2	B	840	LEU
2	B	1029	VAL
2	B	1050	ILE
3	F	171	LEU
3	F	312	CYS
3	C	171	LEU
3	C	312	CYS
1	G	119	CYS
1	G	134	LEU
1	G	166	ASP
1	G	174	PHE
1	G	254	LEU
1	G	285	CYS
1	G	404	CYS

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Mol	Chain	Res	Type
2	H	781	LEU
2	H	804	ILE
2	H	840	LEU
2	H	1029	VAL
2	H	1050	ILE
1	D	119	CYS
1	D	134	LEU
1	D	166	ASP
1	D	174	PHE
1	D	254	LEU
1	D	285	CYS
1	D	404	CYS
2	E	781	LEU
2	E	804	ILE
2	E	840	LEU
2	E	1029	VAL
2	E	1050	ILE
3	I	171	LEU
3	I	312	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (38) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	47	HIS
1	A	124	ASN
1	A	196	GLN
1	A	288	ASN
1	A	336	ASN
1	A	342	ASN
1	A	344	ASN
1	A	381	HIS
2	B	1044	ASN
2	B	1048	HIS
2	B	1049	GLN
3	F	179	GLN
3	F	198	GLN
3	C	179	GLN
3	C	198	GLN
1	G	47	HIS
1	G	124	ASN
1	G	196	GLN
1	G	288	ASN

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Mol	Chain	Res	Type
1	G	342	ASN
1	G	381	HIS
2	H	1044	ASN
2	H	1048	HIS
2	H	1049	GLN
2	H	1064	GLN
1	D	47	HIS
1	D	124	ASN
1	D	196	GLN
1	D	261	ASN
1	D	288	ASN
1	D	336	ASN
1	D	342	ASN
2	E	861	HIS
2	E	1044	ASN
2	E	1048	HIS
2	E	1049	GLN
3	I	179	GLN
3	I	198	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](#)

Of 15 ligands modelled in this entry, 3 are monoatomic - leaving 12 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	$\# Z > 2$
6	NAG	A	502	1	14,14,15	0.33	0	17,19,21	0.75	0
6	NAG	B	1201	2	14,14,15	0.30	0	17,19,21	0.85	1 (5%)
6	NAG	G	503	1	14,14,15	0.31	0	17,19,21	1.03	2 (11%)
6	NAG	G	502	1	14,14,15	0.33	0	17,19,21	0.72	0
6	NAG	A	503	1	14,14,15	0.31	0	17,19,21	1.03	2 (11%)
6	NAG	G	504	1	14,14,15	0.37	0	17,19,21	0.70	0
6	NAG	E	1201	2	14,14,15	0.29	0	17,19,21	0.83	1 (5%)
6	NAG	H	1201	2	14,14,15	0.28	0	17,19,21	0.84	1 (5%)
6	NAG	D	503	1	14,14,15	0.33	0	17,19,21	1.04	2 (11%)
6	NAG	A	504	1	14,14,15	0.33	0	17,19,21	0.71	0
6	NAG	D	504	1	14,14,15	0.36	0	17,19,21	0.70	0
6	NAG	D	502	1	14,14,15	0.33	0	17,19,21	0.74	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
6	NAG	A	502	1	-	1/6/23/26	0/1/1/1
6	NAG	B	1201	2	-	1/6/23/26	0/1/1/1
6	NAG	G	503	1	-	2/6/23/26	0/1/1/1
6	NAG	G	502	1	-	1/6/23/26	0/1/1/1
6	NAG	A	503	1	-	2/6/23/26	0/1/1/1
6	NAG	G	504	1	-	1/6/23/26	0/1/1/1
6	NAG	E	1201	2	-	1/6/23/26	0/1/1/1
6	NAG	H	1201	2	-	1/6/23/26	0/1/1/1
6	NAG	D	503	1	-	2/6/23/26	0/1/1/1
6	NAG	A	504	1	-	1/6/23/26	0/1/1/1
6	NAG	D	504	1	-	1/6/23/26	0/1/1/1
6	NAG	D	502	1	-	1/6/23/26	0/1/1/1

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	D	503	NAG	C1-C2-N2	2.62	114.57	110.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	503	NAG	C1-C2-N2	2.61	114.55	110.43
6	G	503	NAG	C1-C2-N2	2.58	114.50	110.43
6	B	1201	NAG	C1-O5-C5	2.35	115.34	112.19
6	H	1201	NAG	C1-O5-C5	2.32	115.30	112.19
6	E	1201	NAG	C1-O5-C5	2.31	115.28	112.19
6	G	503	NAG	C2-N2-C7	2.25	125.92	122.90
6	A	503	NAG	C2-N2-C7	2.20	125.84	122.90
6	D	503	NAG	C2-N2-C7	2.15	125.78	122.90

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	D	502	NAG	O5-C5-C6-O6
6	A	502	NAG	O5-C5-C6-O6
6	G	502	NAG	O5-C5-C6-O6
6	A	504	NAG	O5-C5-C6-O6
6	G	504	NAG	O5-C5-C6-O6
6	D	504	NAG	O5-C5-C6-O6
6	A	503	NAG	C1-C2-N2-C7
6	G	503	NAG	C1-C2-N2-C7
6	D	503	NAG	C1-C2-N2-C7
6	A	503	NAG	C3-C2-N2-C7
6	G	503	NAG	C3-C2-N2-C7
6	D	503	NAG	C3-C2-N2-C7
6	B	1201	NAG	C1-C2-N2-C7
6	H	1201	NAG	C1-C2-N2-C7
6	E	1201	NAG	C1-C2-N2-C7

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.

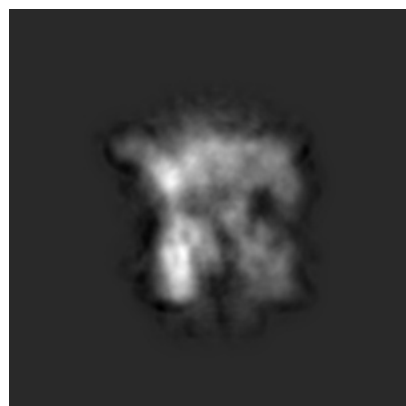
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-12286. These allow visual inspection of the internal detail of the map and identification of artifacts.

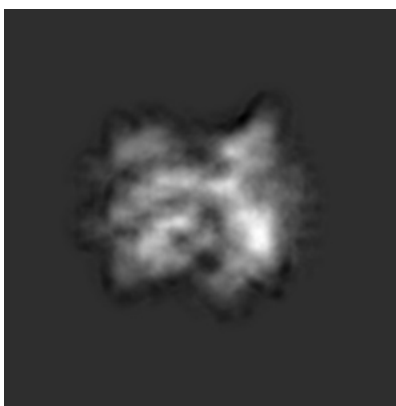
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

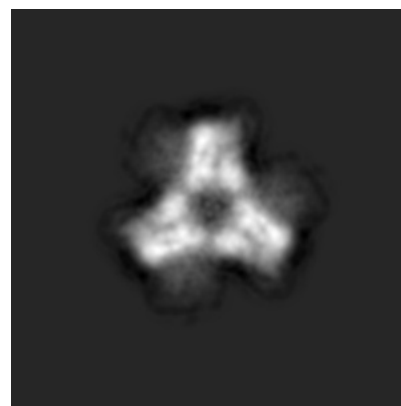
6.1.1 Primary map



X

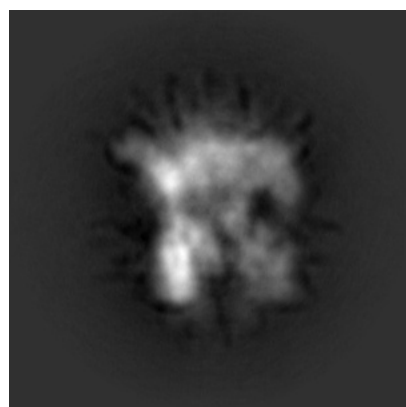


Y

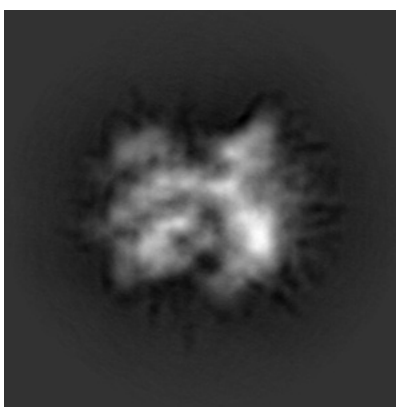


Z

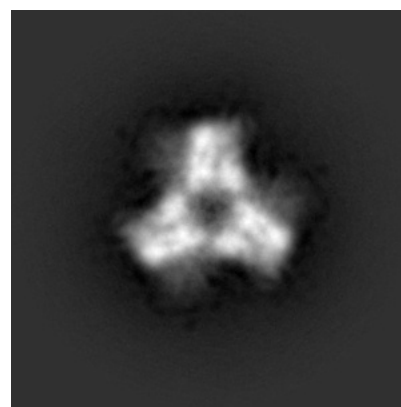
6.1.2 Raw map



X



Y

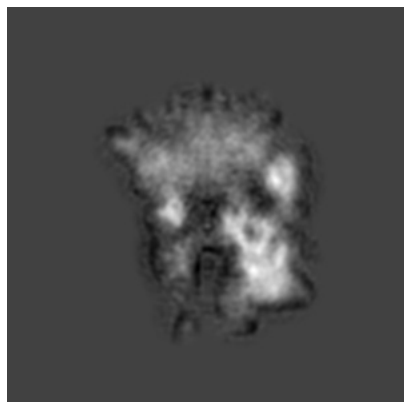


Z

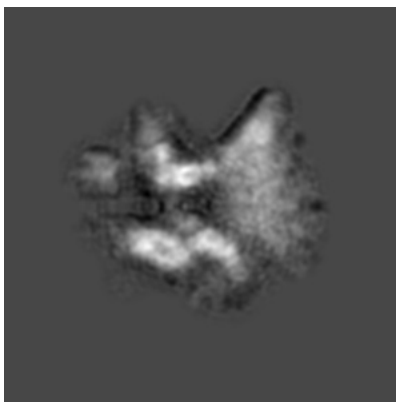
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

6.2.1 Primary map



X Index: 176

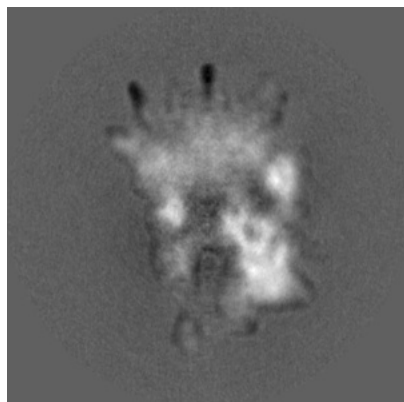


Y Index: 176

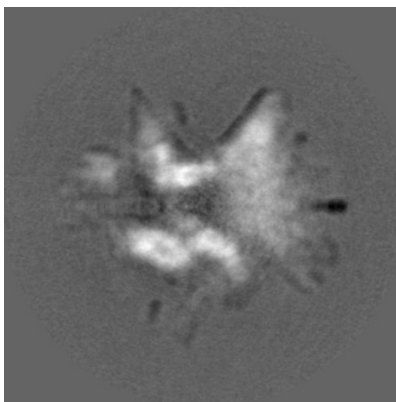


Z Index: 176

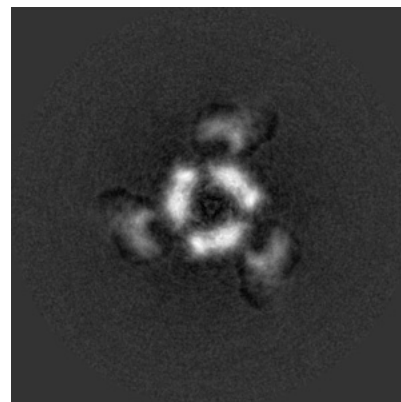
6.2.2 Raw map



X Index: 176



Y Index: 176

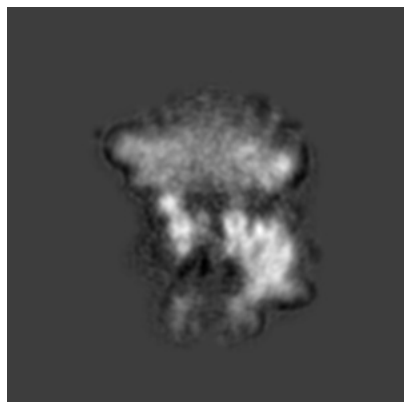


Z Index: 176

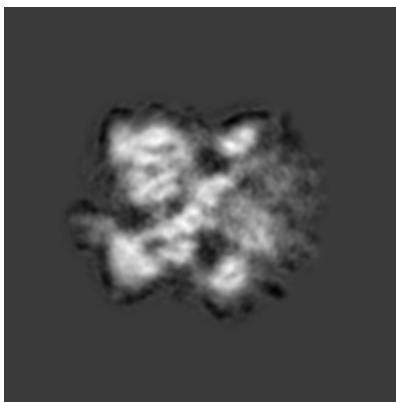
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

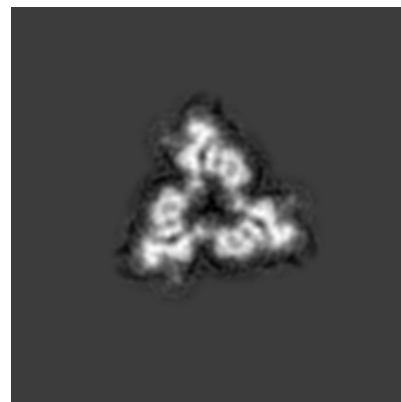
6.3.1 Primary map



X Index: 164

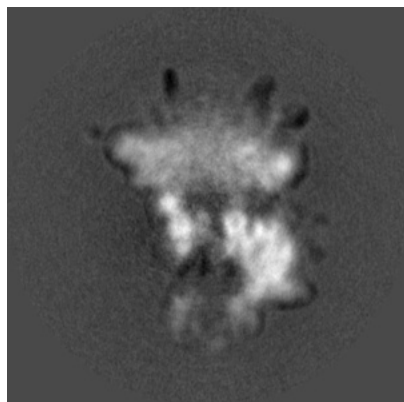


Y Index: 149

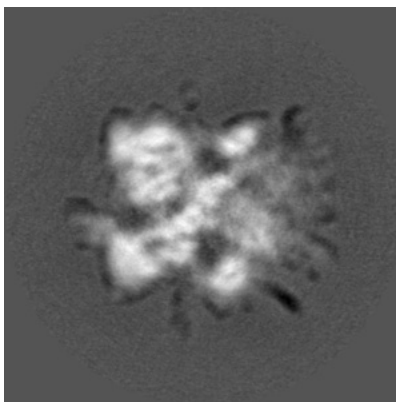


Z Index: 137

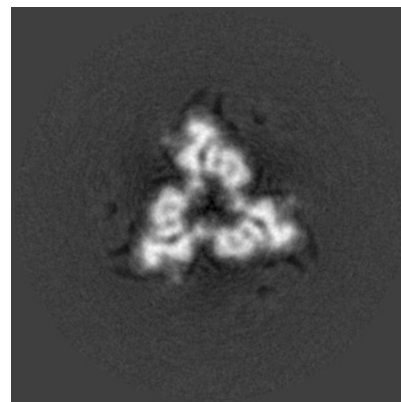
6.3.2 Raw map



X Index: 164



Y Index: 149



Z Index: 137

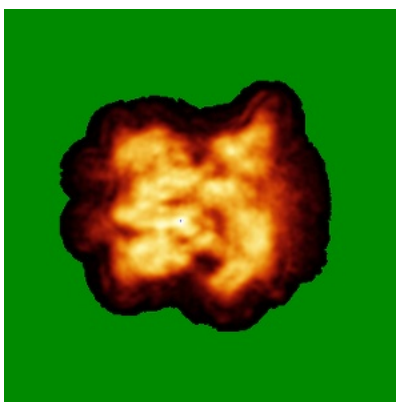
The images above show the largest variance slices of the map in three orthogonal directions.

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

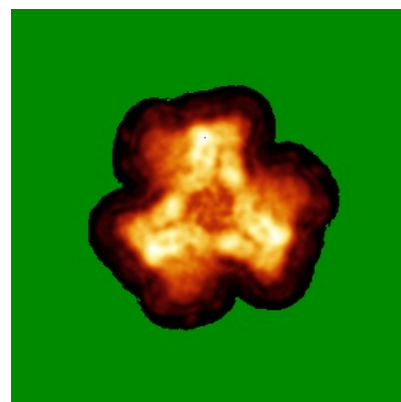
6.4.1 Primary map



X

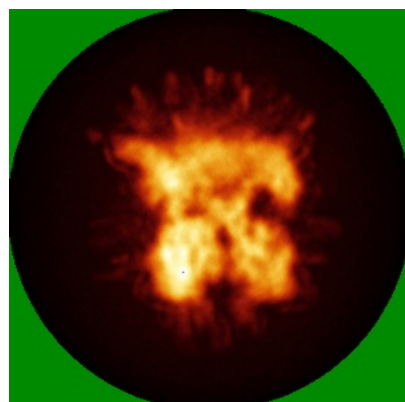


Y

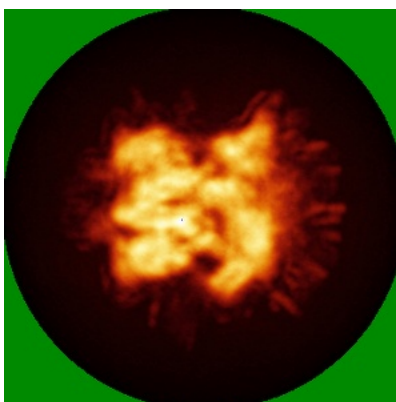


Z

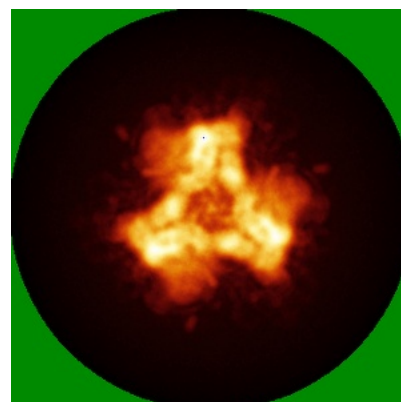
6.4.2 Raw map



X



Y

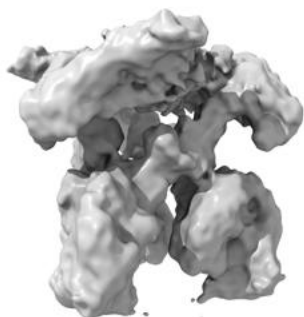


Z

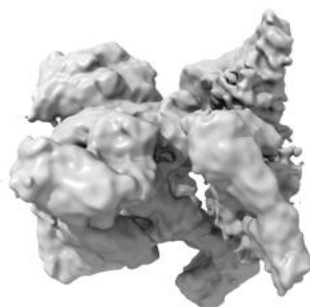
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

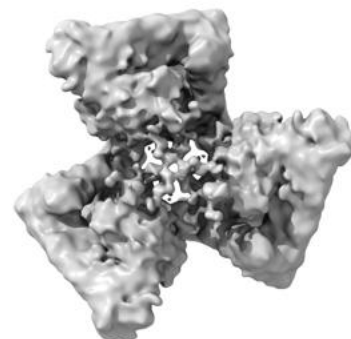
6.5.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.007. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

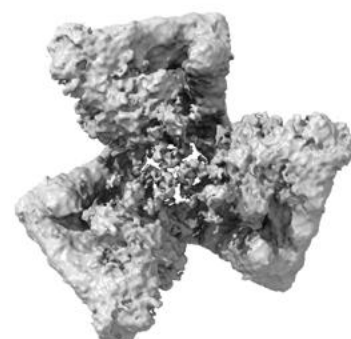
6.5.2 Raw map



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.

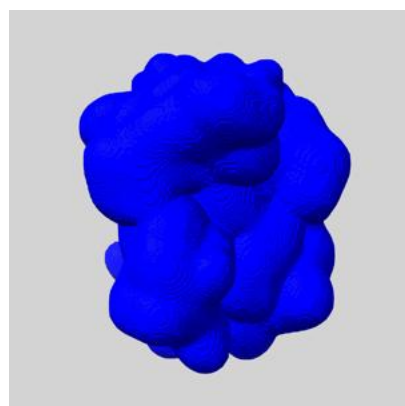
6.6 Mask visualisation [i](#)

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

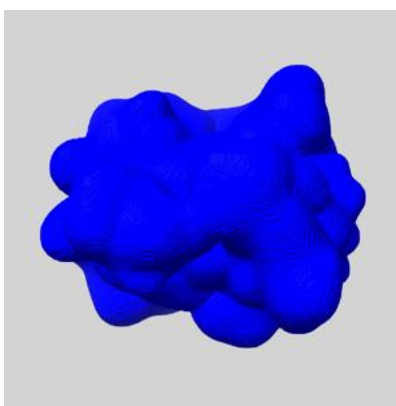
A mask typically either:

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

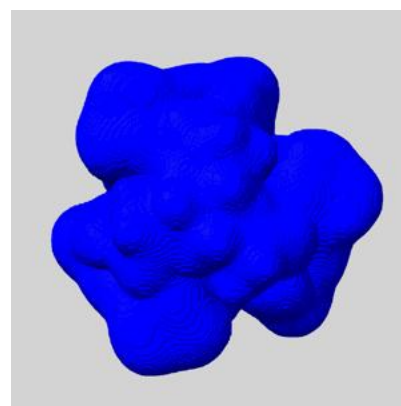
6.6.1 emd_12286_msk_1.map [i](#)



X



Y

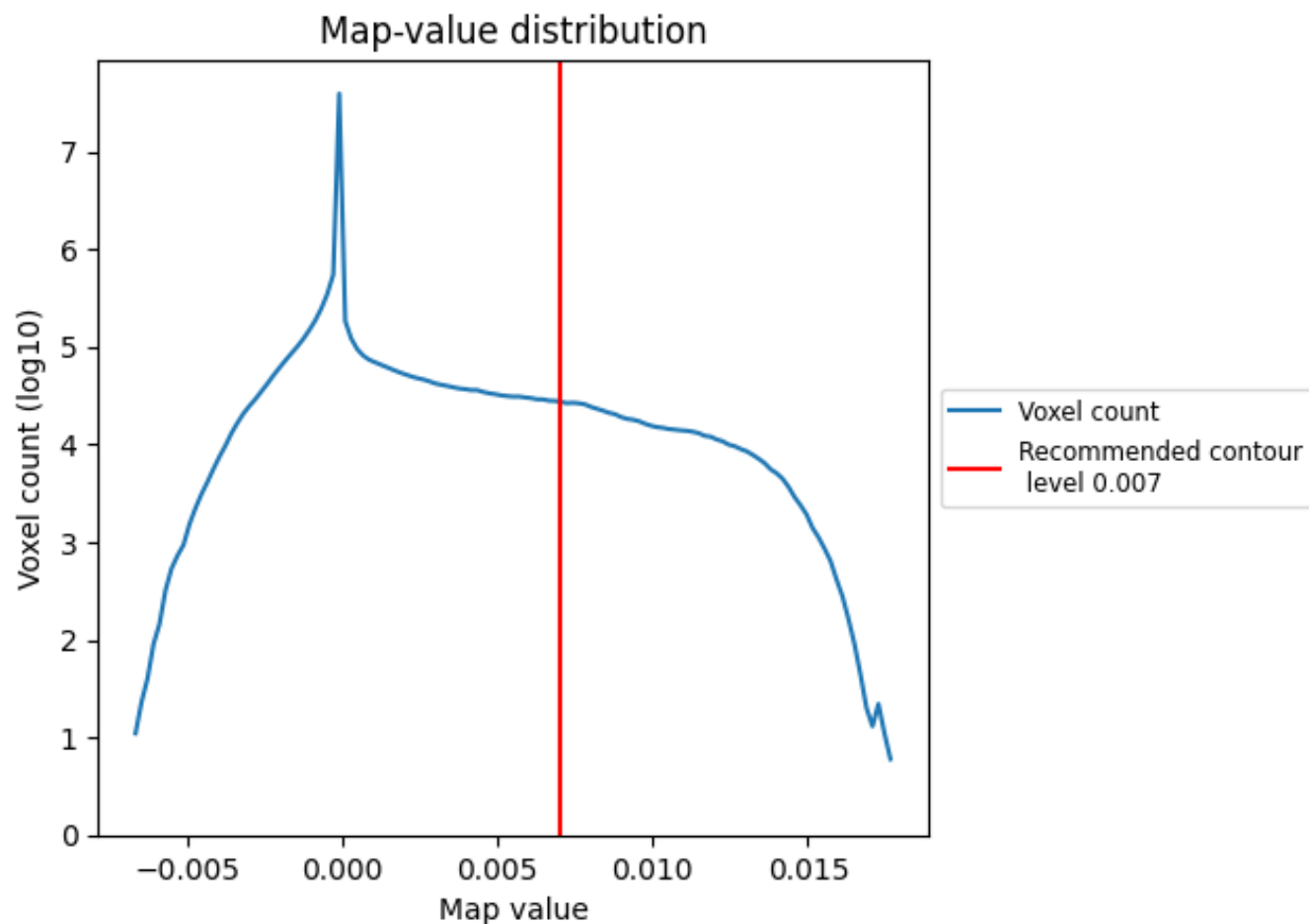


Z

7 Map analysis [i](#)

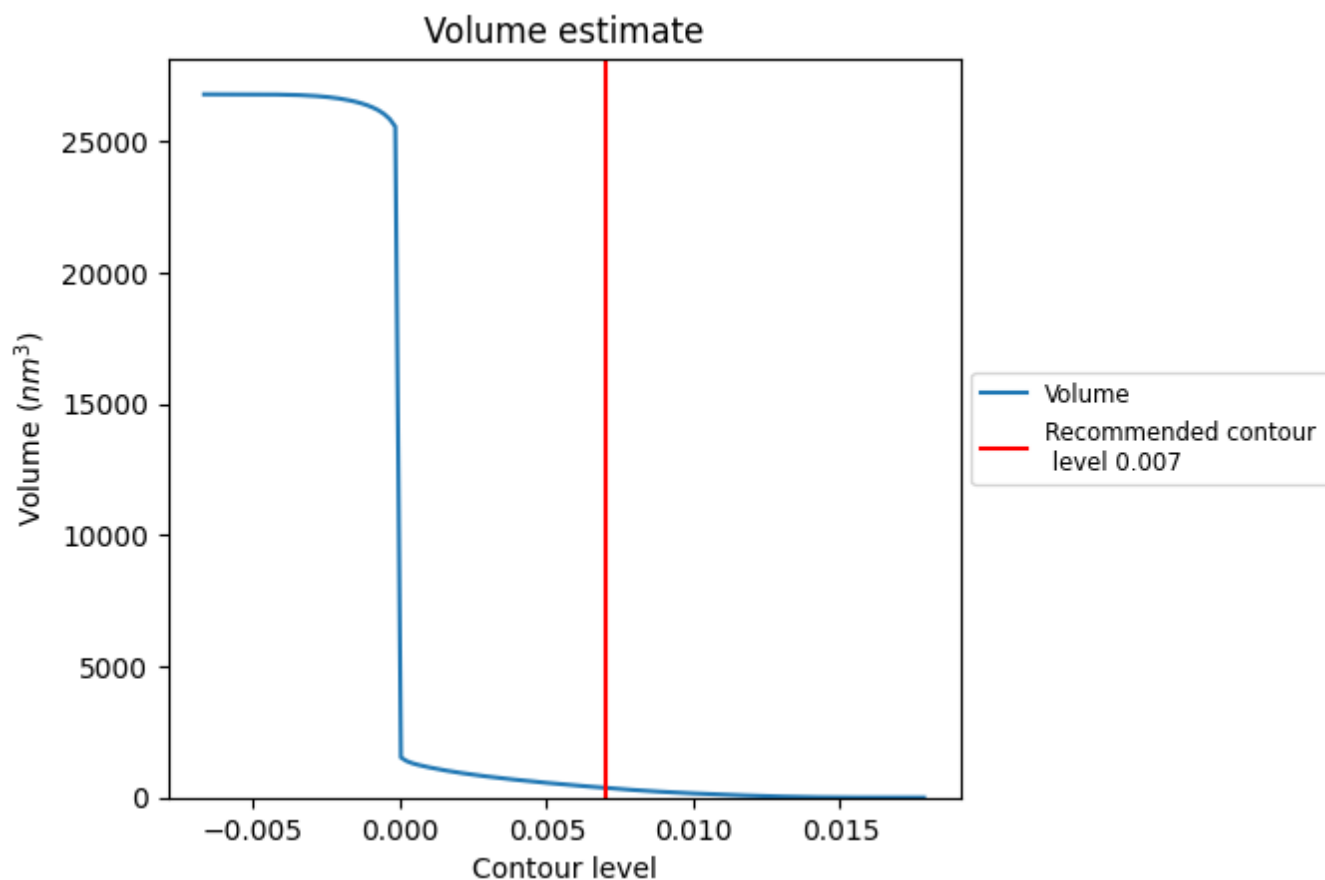
This section contains the results of statistical analysis of the map.

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.

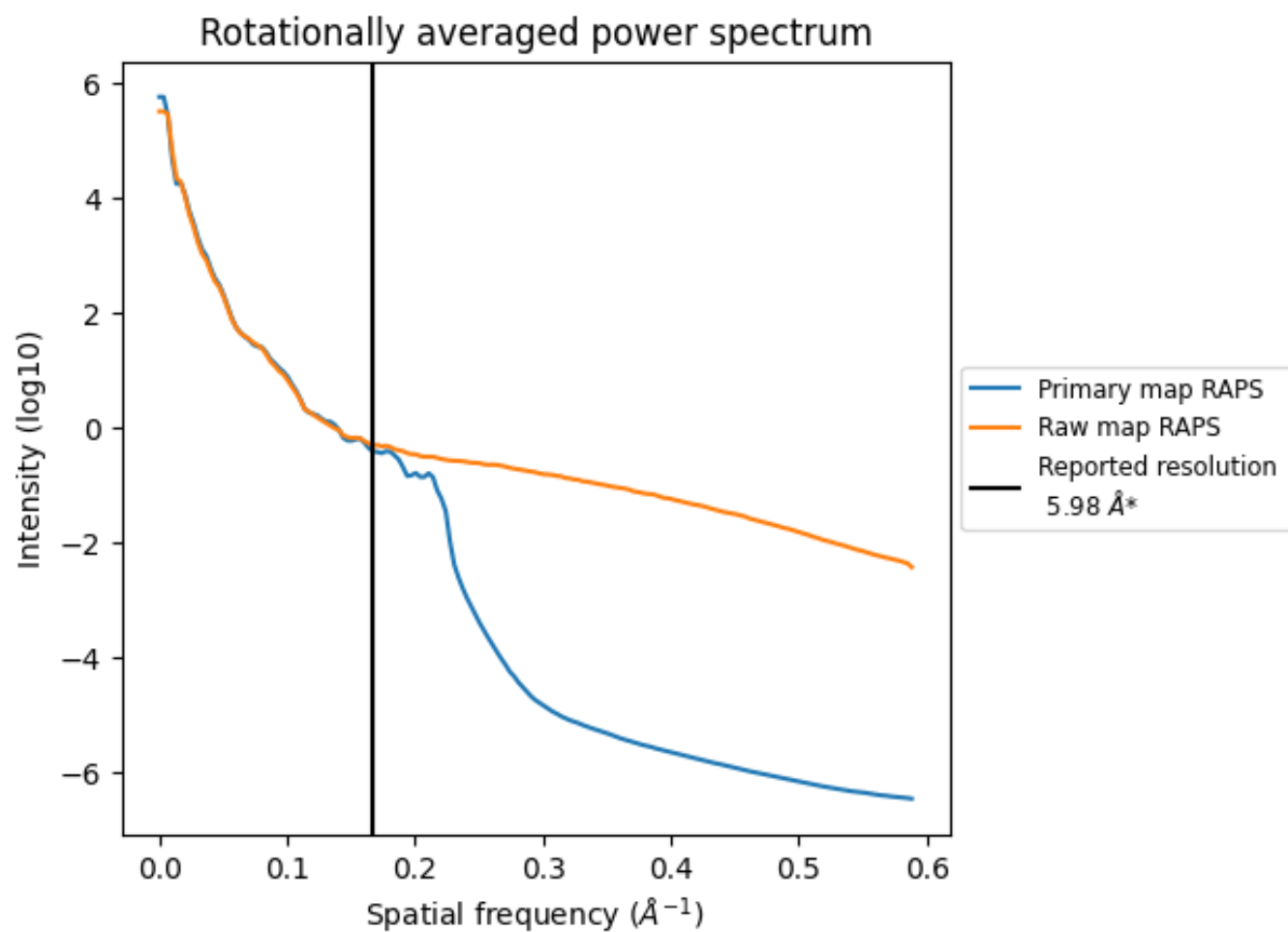
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 370 nm³; this corresponds to an approximate mass of 334 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 ⓘ

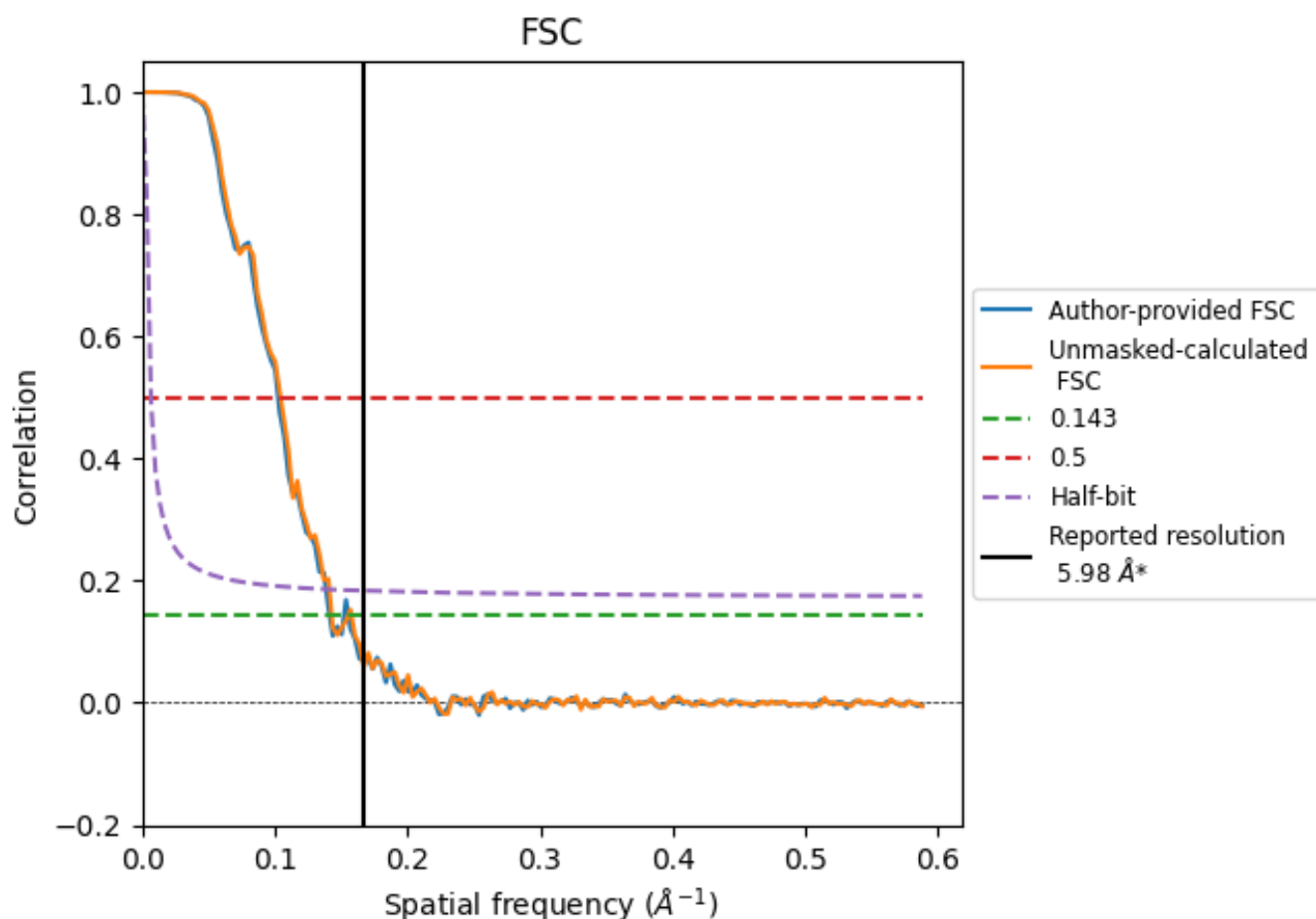


*Reported resolution corresponds to spatial frequency of 0.167 $\text{\AA}^{-1}$

8 Fourier-Shell correlation [i](#)

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 [i](#)



*Reported resolution corresponds to spatial frequency of 0.167 Å⁻¹

8.2 Resolution estimates

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	5.98	-	-
Author-provided FSC curve	7.08	9.76	7.21
Unmasked-calculated*	7.00	9.59	7.09

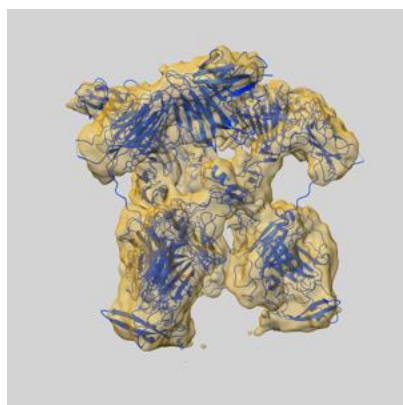
*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from author-provided FSC intersecting FSC 0.143 CUT-OFF 7.08 differs from the reported value 5.98 by more than 10 %

The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 7.00 differs from the reported value 5.98 by more than 10 %

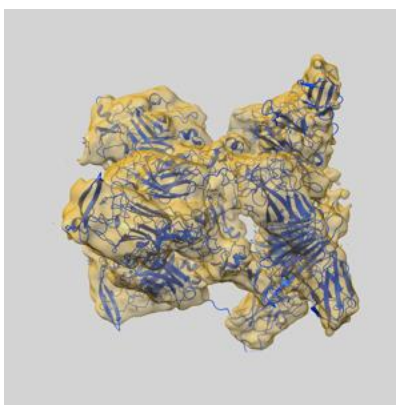
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-12286 and PDB model 7NDG. Per-residue inclusion information can be found in section [3](#) on page [10](#).

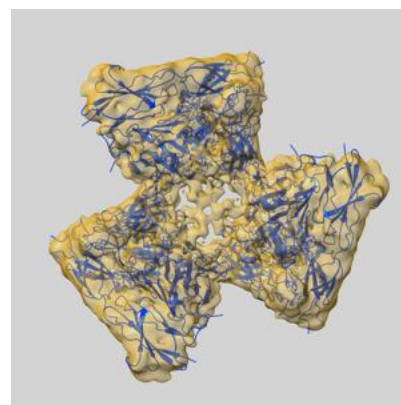
9.1 Map-model overlay [i](#)



X



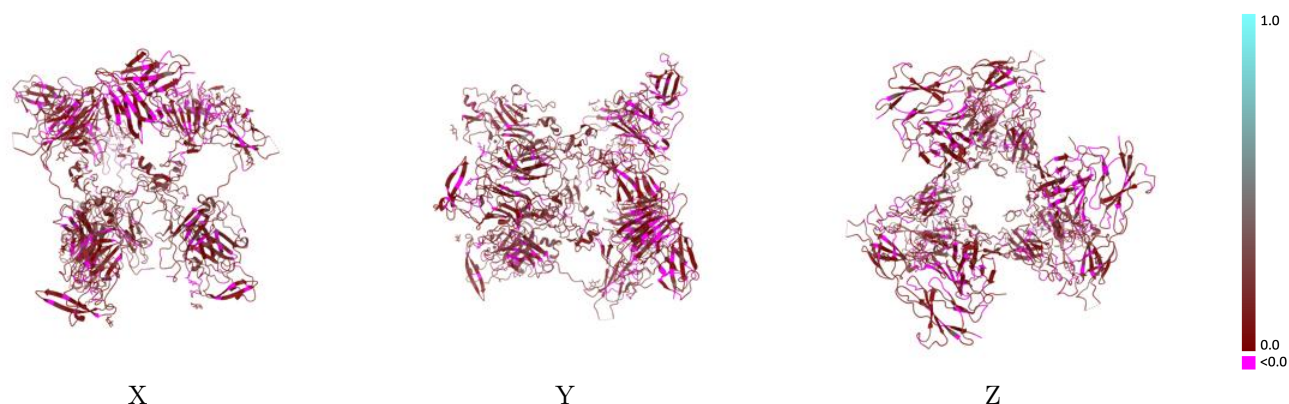
Y



Z

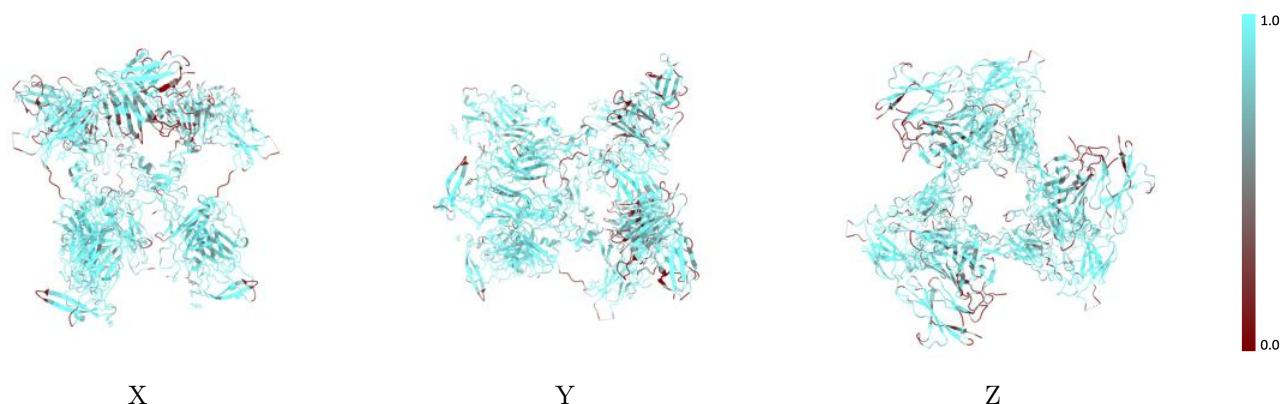
The images above show the 3D surface view of the map at the recommended contour level 0.007 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



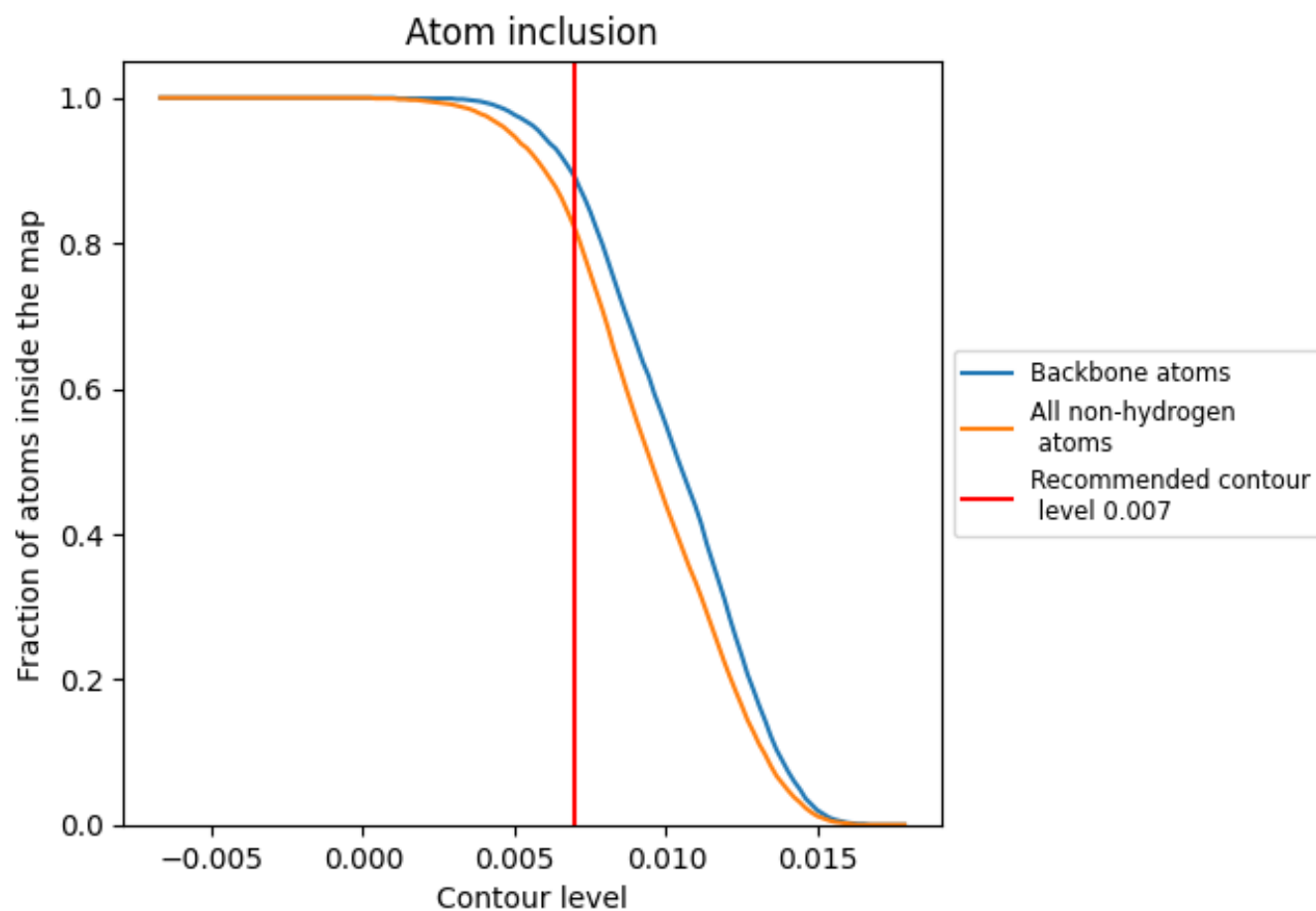
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.007).

9.4 Atom inclusion [i](#)



At the recommended contour level, 89% of all backbone atoms, 82% 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 (0.007) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8190	0.1050
A	0.8830	0.1250
B	0.8320	0.1010
C	0.6300	0.0520
D	0.8840	0.1240
E	0.8280	0.1040
F	0.6420	0.0590
G	0.8840	0.1250
H	0.8330	0.1020
I	0.6390	0.0620
M	0.5880	0.0940
N	0.5800	0.0710
O	0.5880	0.0840

1.0

0.0

<0.0