



Full wwPDB EM Validation Report ⓘ

Mar 10, 2026 – 02:51 AM UTC

PDB ID : 9FO4 / pdb_00009fo4
EMDB ID : EMD-50616
Title : Half-closed CODH/ACS (Class 2) in the methylated state
Authors : Ruickoldt, J.; Wendler, P.; Dobbek, H.
Deposited on : 2024-06-11
Resolution : 2.47 Å(reported)

This is a Full wwPDB EM Validation 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.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
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)
Validation Pipeline (wwPDB-VP) : 2.49

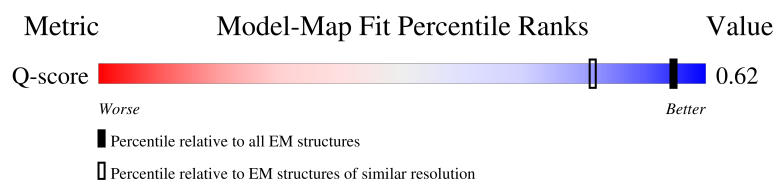
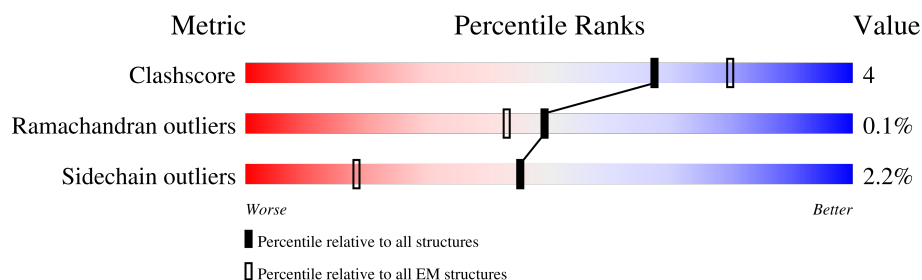
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.47 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	6086 (1.98 - 2.97)

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	669	 88% 11% .
1	B	669	 89% 11%
2	C	730	 87% 13% .
2	D	730	 40% . 57%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	SF4	A	702	-	-	X	-

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 18822 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 CO-dehydrogenase.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	669	Total	C	N	O	S	0	0
			5130	3254	885	958	33		
1	B	669	Total	C	N	O	S	0	0
			5130	3254	885	958	33		

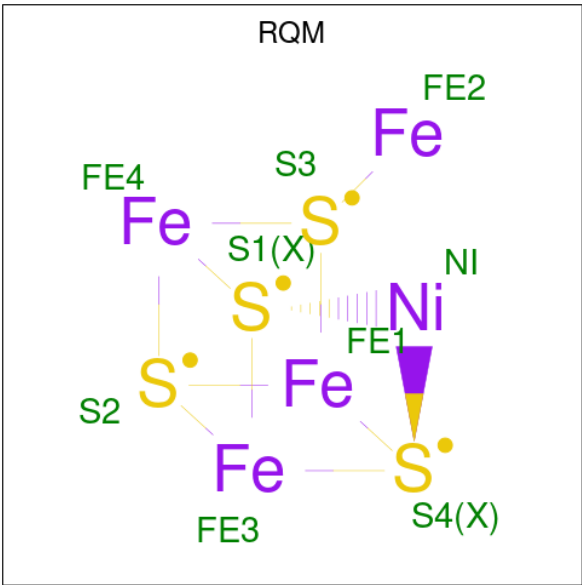
- Molecule 2 is a protein called CO-methylating acetyl-CoA synthase.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	C	730	Total	C	N	O	S	0	0
			5776	3706	969	1072	29		
2	D	311	Total	C	N	O	S	0	0
			2466	1599	411	447	9		

There are 4 discrepancies between the modelled and reference sequences:

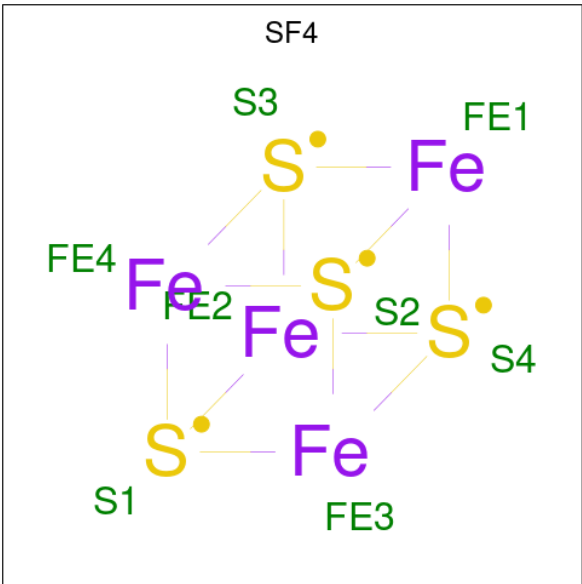
Chain	Residue	Modelled	Actual	Comment	Reference
C	733	ARG	-	expression tag	UNP P83789
C	734	SER	-	expression tag	UNP P83789
D	733	ARG	-	expression tag	UNP P83789
D	734	SER	-	expression tag	UNP P83789

- Molecule 3 is Fe(3)-Ni(1)-S(4) cluster (CCD ID: RQM) (formula: Fe₄NiS₄) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
3	A	1	Total	Fe	Ni	S	0
			9	4	1	4	
3	B	1	Total	Fe	Ni	S	0
			9	4	1	4	

- Molecule 4 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe_4S_4) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			AltConf
4	A	1	Total	Fe	S	0
			4	2	2	

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Mol	Chain	Residues	Atoms			AltConf
4	A	1	Total	Fe	S	0
			8	4	4	
4	B	1	Total	Fe	S	0
			4	2	2	
4	B	1	Total	Fe	S	0
			8	4	4	
4	C	1	Total	Fe	S	0
			8	4	4	

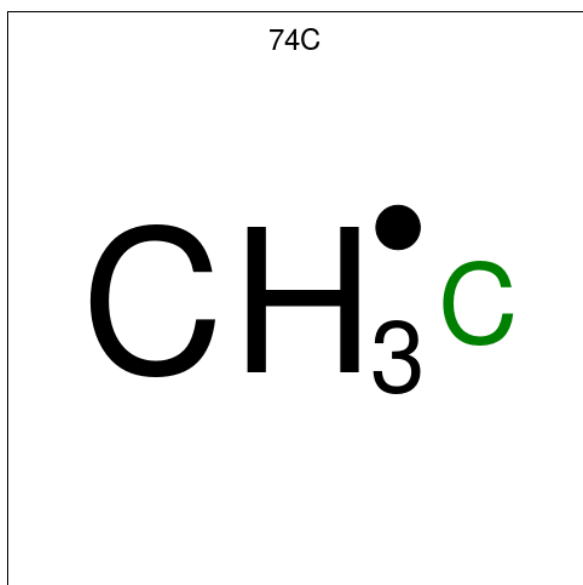
- Molecule 5 is NICKEL (II) ION (CCD ID: NI) (formula: Ni) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
5	C	2	Total	Ni	0
			2	2	

- Molecule 6 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		AltConf
6	C	1	Total	Na	0
			1	1	

- Molecule 7 is methyl radical (CCD ID: 74C) (formula: CH₃) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	AltConf
7	C	1	Total C 1 1	0

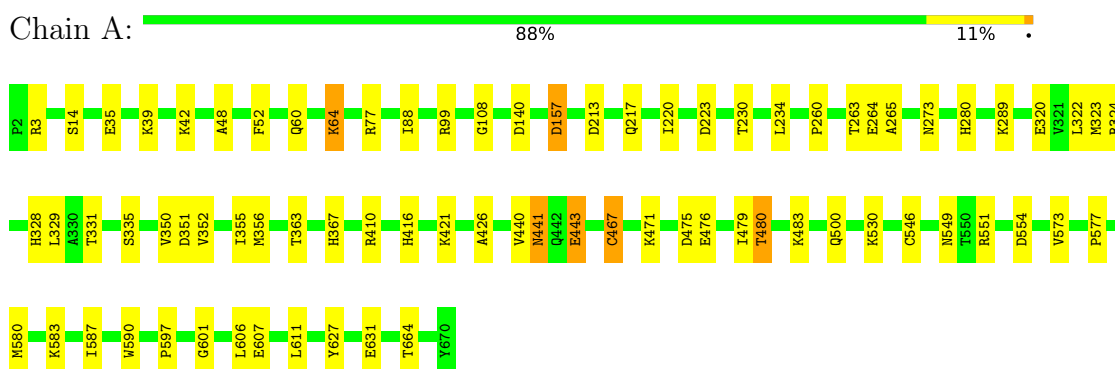
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	AltConf
8	A	263	Total O 263 263	0
8	B	1	Total O 1 1	0
8	C	2	Total O 2 2	0

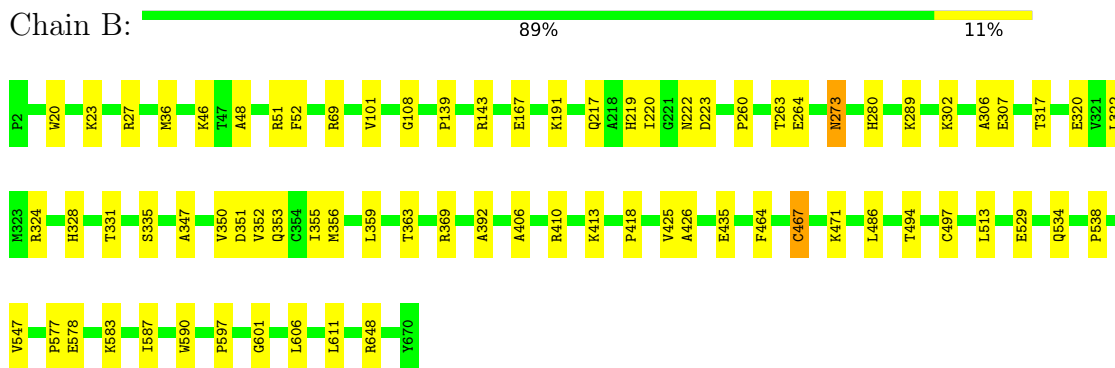
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

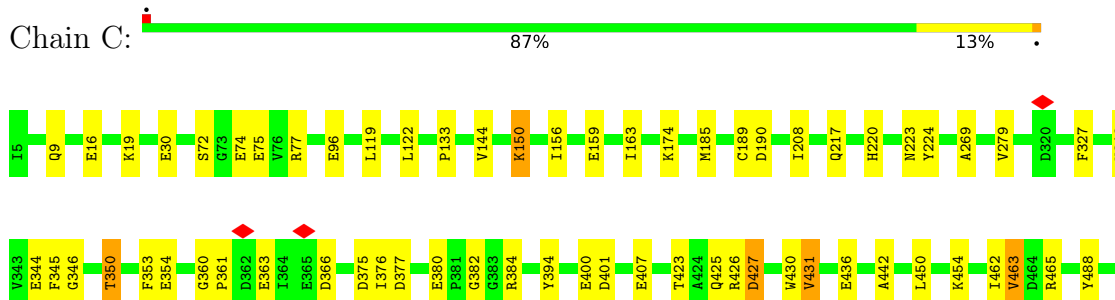
• Molecule 1: CO-dehydrogenase

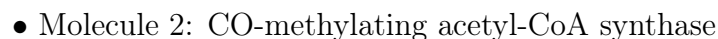


• Molecule 1: CO-dehydrogenase



• Molecule 2: CO-methylating acetyl-CoA synthase





LYS	ILE	ALA	ASP	THR	VAL	GLY	THR	CYS	SER	ASP	MET	15
ILE	ALA	ASP	THR	GLN	THR	GLY	GLU	VAL	ILE	PHE	HIS	
GLY	THR	GLU	PRO	THR	MET	ASP	MET	PRO	ASP	GLU	VAL	115
THR	VAL	GLY	THR	ASN	GLY	GLY	ASN	GLU	VAL	LEU	GLY	E16
VAL	GLY	MET	GLY	THR	THR	THR	THR	VAL	GLN	ARG	GLY	K19
THR	THR	THR	ILE	ILE	ILE	ILE	ILE	ILE	ILE	ARG	LYS	E20
VAL	VAL	GLY	GLY	MET	MET	GLY	MET	CYS	THR	HIS	PRO	E30
ASP	LYS	GLY	GLY	GLY	GLU	GLY	GLY	CYS	THR	THR	SER	P66
GLU	GLU	VAL	SER	SER	THR	THR	THR	ALA	ASP	PHE	PHE	S72
VAL	VAL	VAL	THR	PRO	PRO	PRO	PRO	ILE	GLY	THR	GLU	G73
LEU	LEU	ILE	ILE	MET	MET	ILE	MET	SER	GLN	ASN	LEU	E74
PRO	PRO	GLY	GLY	GLY	THR	THR	THR	TRP	LYS	THR	VAL	E100
PHE	PHE	SER	SER	SER	SER	SER	SER	LEU	VAL	GLY	ARG	E100
LEU	LEU	ARG	ARG	CYS	CYS	ARG	CYS	ASP	LEU	GLY	MET	E127
GLU	GLU	LYS	GLY	GLY	GLY	GLY	GLY	ALA	GLU	GLY	VAL	E127
GLU	GLU	PHE	PHE	CYS	CYS	VAL	CYS	LYS	LEU	PHE	GLY	
LYS	LYS	VAL	VAL	PHE	PHE	VAL	PHE	ALA	GLU	TRP	PRO	V176
HIS	HIS	LYS	LYS	GLY	GLY	GLY	GLY	ALA	ARG	HIS	ASP	D17
PRO	PRO	ALA	ALA	ALA	ALA	ALA	ALA	TYR	ILE	THR	GLY	D178
ASP	ASP	ILE	ILE	ILE	ILE	ILE	ILE	GLY	ALA	ALA	ILE	K182
ALA	ALA	GLY	MET	MET	ILE	ILE	MET	ILE	ARG	GLN	GLU	L196
LEU	LEU	GLY	ALA	ALA	ALA	ALA	ALA	PRO	LYS	ARG	ASP	L196
SER	SER	LEU	LEU	THR	THR	THR	THR	PRO	LYS	ASP	GLY	Q217
MET	MET	ALA	ALA	PRO	PRO	PRO	PRO	ASN	TYR	LEU	LYS	R227
GLU	GLU	ARG	ARG	PRO	PRO	GLY	GLY	ALA	ALA	THR	VAL	Q217
PRO	PRO	VAL	VAL	GLY	GLY	VAL	GLY	PRO	GLU	TRP	GLY	R227
LEU	LEU	THR	THR	ASN	ASN	ASN	ASN	ARG	VAL	VAL	VAL	I304
LEU	LEU	TRP	TRP	GLY	GLY	GLY	GLY	PRO	ILE	ILE	GLY	I304
ARG	ARG	MET	MET	PRO	PRO	PRO	PHE	ARG	SER	SER	PRO	K315
SER	SER	LYS	LYS	LYS	ILE	ILE	MET	PRO	LEU	LYS	ASP	K315
		ASP	ASP	ILE	ILE	ILE	ILE	LYS	ARG	GLY	ILE	THR
		LEU	LEU	VAL	VAL	VAL	VAL	GLU	GLU	ALA	ASP	THR
		LYS	LYS	GLY	GLY	GLY	ASN	GLY	LEU	PHE	SER	ILE
		GLU	GLU	ASN	ASN	ASN	ASN	LEU	SER	ALA	VAL	ILE
		GLN	GLN	ILE	ILE	ILE	GLY	ILE	ASP	LYS	GLY	THR
		LEU	LEU	HIS	HIS	HIS	HIS	ASP	GLY	PRO	GLY	ILE
		ARG	ARG	SER	SER	SER	SER	PRO	ALA	ALA	GLY	ASP
		SER	SER	GLY	GLY	GLY	GLY	VAL	VAL	ARG	GLY	LEU
		ILE	ILE	LYS	LYS	LYS	LYS	LYS	ASP	LEU	ARG	PRO
		THR	THR	THR	THR	THR	THR	GLN	THR	THR	THR	ILE
		GLU	GLU	ILE	ILE	ILE	ILE	TRP	THR	LEU	ILE	PHE
		ARG	ARG	GLY	GLY	GLY	GLY	GLY	SER	GLY	GLY	THR
		ALA	ALA	MET	MET	MET	MET	CYS	CYS	GLN	ILE	PRO
		GLU	GLU	THR	THR	THR	THR	LEU	LEU	LEU	VAL	PHE
		GLU	GLU	PHE	PHE	PHE	PHE	ASN	GLY	THR	VAL	PHE
		GLU	GLU	SER	SER	SER	SER	GLY	CYS	ASP	GLY	GLY
		GLY	GLY	THR	THR	THR	THR	TYR	GLN	ALA	ILE	GLU
		LEU	LEU	ILE	ILE	ILE	ILE	ILE	SER	LYS	TYR	GLU

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	78250	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 ($e^-/\text{\AA}^2$)	50.0	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2700	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	0.894	Depositor
Minimum map value	-0.489	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.014	Depositor
Recommended contour level	0.1	Depositor
Map size (Å)	368.128, 368.128, 368.128	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.719, 0.719, 0.719	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: RQM, SF4, NI, NA, 74C

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	0/5233	0.30	0/7083
1	B	0.13	0/5233	0.30	0/7083
2	C	0.12	0/5910	0.28	0/8000
2	D	0.12	0/2525	0.28	0/3425
All	All	0.13	0/18901	0.29	0/25591

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [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	5130	0	5149	47	0
1	B	5130	0	5149	37	0
2	C	5776	0	5754	52	0
2	D	2466	0	2487	9	0
3	A	9	0	0	1	0
3	B	9	0	0	0	0
4	A	12	0	0	2	0
4	B	12	0	0	0	0
4	C	8	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	C	2	0	0	0	0
6	C	1	0	0	0	0
7	C	1	0	0	0	0
8	A	263	0	0	5	0
8	B	1	0	0	0	0
8	C	2	0	0	0	0
All	All	18822	0	18539	140	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

All (140) 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:467:CYS:HB3	3:A:701:RQM:S2	1.97	1.04
1:A:441:ASN:ND2	1:A:443:GLU:OE1	2.21	0.74
1:B:464:PHE:HB2	1:B:494:THR:HG22	1.72	0.72
1:B:369:ARG:HD2	1:B:406:ALA:HB2	1.71	0.71
1:A:573:VAL:HG22	1:A:597:PRO:HG2	1.73	0.71
1:A:260:PRO:HA	1:A:426:ALA:O	1.91	0.70
2:C:425:GLN:HG2	2:C:426:ARG:HG2	1.74	0.68
1:A:280:HIS:HB3	1:A:350:VAL:HG12	1.74	0.68
1:A:48:ALA:HB2	1:A:356:MET:HE1	1.76	0.67
1:B:280:HIS:HB3	1:B:350:VAL:HG12	1.76	0.67
2:C:585:MET:HE1	2:C:587:LEU:HD13	1.77	0.66
1:B:48:ALA:HB2	1:B:356:MET:HE1	1.81	0.62
2:C:688:ARG:NH2	2:C:692:GLU:OE1	2.34	0.60
2:C:159:GLU:HG3	2:C:185:MET:HB3	1.84	0.60
1:A:476:GLU:O	1:A:480:THR:HG22	2.02	0.59
1:B:350:VAL:HB	1:B:355:ILE:HD13	1.84	0.59
2:C:366:ASP:HB2	2:C:465:ARG:HG2	1.85	0.58
2:C:423:THR:HG22	2:C:430:TRP:HB3	1.84	0.58
2:C:629:MET:HB3	2:C:633:THR:HB	1.86	0.58
1:A:350:VAL:HB	1:A:355:ILE:HD13	1.86	0.58
2:C:345:PHE:HB2	2:C:431:VAL:HG13	1.84	0.58
1:A:217:GLN:NE2	1:A:223:ASP:OD2	2.30	0.57
2:C:400:GLU:OE1	2:C:494:ARG:NH1	2.37	0.57
1:B:217:GLN:NE2	1:B:223:ASP:OD2	2.37	0.57
1:A:3:ARG:NH1	8:A:812:HOH:O	2.34	0.57
1:A:64:LYS:NZ	8:A:815:HOH:O	2.37	0.57
1:B:410:ARG:HA	1:B:413:LYS:HE2	1.86	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:540:LYS:NZ	2:C:544:GLU:OE2	2.34	0.56
2:C:700:ASP:O	2:C:721:LYS:NZ	2.38	0.56
2:C:353:PHE:HA	2:C:427:ASP:HA	1.88	0.56
1:A:35:GLU:OE2	1:A:416:HIS:NE2	2.39	0.55
2:C:354:GLU:O	2:C:488:TYR:OH	2.18	0.55
2:C:327:PHE:CE1	2:C:450:LEU:HD11	2.43	0.54
2:C:75:GLU:OE1	2:C:77:ARG:NH1	2.40	0.54
1:B:320:GLU:OE1	1:B:324:ARG:NH1	2.40	0.54
2:D:15:ILE:HG21	2:D:20:GLU:HG2	1.90	0.53
1:B:260:PRO:HA	1:B:426:ALA:O	2.07	0.53
2:C:590:ILE:HA	2:C:594:PRO:HB3	1.91	0.53
2:C:163:ILE:HG22	2:C:189:CYS:HB3	1.90	0.53
2:C:436:GLU:OE1	2:C:436:GLU:N	2.33	0.52
2:D:178:ASP:OD1	2:D:182:LYS:NZ	2.41	0.52
2:D:16:GLU:HG3	2:D:19:LYS:HB2	1.92	0.52
1:A:440:VAL:HG22	1:A:530:LYS:HD2	1.92	0.51
1:B:425:VAL:HB	1:B:538:PRO:HG3	1.90	0.51
2:C:407:GLU:OE1	2:C:491:ARG:NH1	2.41	0.51
1:B:351:ASP:OD1	1:B:352:VAL:N	2.44	0.51
1:A:479:ILE:HG22	1:A:483:LYS:HE2	1.93	0.51
2:C:582:ILE:HG23	2:C:643:GLN:HE21	1.76	0.50
1:B:331:THR:OG1	1:B:335:SER:OG	2.23	0.50
1:B:347:ALA:HA	1:B:369:ARG:O	2.11	0.50
2:C:185:MET:HG3	2:C:208:ILE:HG22	1.94	0.50
2:C:586:ASN:ND2	2:C:593:TYR:HB2	2.26	0.50
2:C:361:PRO:HB3	2:C:394:TYR:CZ	2.47	0.50
1:A:289:LYS:NZ	8:A:822:HOH:O	2.45	0.49
1:B:467:CYS:HA	1:B:497:CYS:HB2	1.93	0.49
2:C:535:SER:OG	2:C:538:ASP:OD1	2.29	0.49
1:B:529:GLU:OE1	1:B:534:GLN:NE2	2.41	0.49
1:A:108:GLY:HA2	1:A:583:LYS:HG3	1.94	0.49
2:C:16:GLU:HG2	2:C:19:LYS:HB2	1.93	0.49
2:C:72:SER:OG	2:C:74:GLU:OE1	2.28	0.49
1:A:367:HIS:CE1	1:A:410:ARG:HD3	2.48	0.49
2:C:16:GLU:H	2:C:16:GLU:CD	2.21	0.48
2:C:462:ILE:HG13	2:C:463:VAL:HG13	1.95	0.48
1:B:36:MET:HE3	1:B:418:PRO:HG3	1.96	0.48
1:B:273:ASN:HB3	1:B:307:GLU:OE1	2.14	0.47
1:A:320:GLU:OE1	1:A:324:ARG:NH1	2.42	0.47
1:B:139:PRO:O	1:B:143:ARG:HG3	2.15	0.47
1:B:108:GLY:HA2	1:B:583:LYS:HG2	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:77:ARG:HD3	4:A:702:SF4:S4	2.55	0.47
1:B:587:ILE:HA	1:B:590:TRP:CD1	2.49	0.47
1:B:467:CYS:O	1:B:578:GLU:HB2	2.15	0.47
2:C:150:LYS:HB3	2:C:156:ILE:HG13	1.96	0.47
2:C:669:ARG:HA	2:C:725:ALA:HB2	1.96	0.47
1:B:577:PRO:O	1:B:601:GLY:HA3	2.15	0.46
1:B:587:ILE:HA	1:B:590:TRP:NE1	2.29	0.46
2:C:585:MET:HE3	2:C:595:MET:HB2	1.98	0.46
1:A:587:ILE:HA	1:A:590:TRP:NE1	2.31	0.46
1:B:263:THR:HG21	1:B:322:LEU:HG	1.96	0.46
2:C:376:ILE:HD11	2:C:442:ALA:O	2.15	0.46
1:A:14:SER:OG	1:A:631:GLU:OE2	2.28	0.45
2:C:661:VAL:HG23	2:C:666:GLY:HA2	1.98	0.45
1:A:329:LEU:HD11	1:A:500:GLN:HG2	1.98	0.45
2:C:674:PRO:HD2	2:C:677:LEU:HD23	1.98	0.45
1:A:323:MET:HB3	1:A:323:MET:HE3	1.82	0.45
2:C:401:ASP:HA	2:C:494:ARG:HH12	1.82	0.44
2:D:66:PRO:HB3	2:D:227:ARG:HG3	1.98	0.44
1:A:99:ARG:NH2	8:A:827:HOH:O	2.48	0.44
1:A:577:PRO:O	1:A:601:GLY:HA3	2.18	0.44
1:A:587:ILE:HA	1:A:590:TRP:CD1	2.53	0.44
1:A:88:ILE:HA	1:B:51:ARG:HB3	2.00	0.44
1:A:597:PRO:HB3	1:A:627:TYR:CZ	2.53	0.44
2:C:342:HIS:O	2:C:382:GLY:N	2.51	0.44
1:B:101:VAL:HG21	1:B:606:LEU:HD23	2.00	0.43
2:D:176:VAL:HG21	2:D:196:LEU:HD11	2.00	0.43
1:A:546:CYS:O	1:A:549:ASN:ND2	2.46	0.43
1:A:583:LYS:HD3	1:B:219:HIS:CE1	2.52	0.43
1:A:611:LEU:HD12	2:C:30:GLU:HG2	2.01	0.43
1:B:52:PHE:CZ	1:B:471:LYS:HA	2.53	0.43
1:B:302:LYS:HA	1:B:306:ALA:O	2.19	0.43
2:C:220:HIS:HA	2:C:223:ASN:ND2	2.33	0.43
2:C:375:ASP:OD1	2:C:376:ILE:N	2.44	0.43
1:A:280:HIS:O	1:A:350:VAL:HA	2.18	0.43
2:D:72:SER:OG	2:D:74:GLU:OE1	2.23	0.43
2:D:100:GLU:OE1	2:D:100:GLU:N	2.43	0.43
2:C:582:ILE:HD12	2:C:643:GLN:HG3	2.00	0.43
1:B:611:LEU:HD12	2:D:30:GLU:HG2	2.01	0.42
1:A:273:ASN:ND2	8:A:813:HOH:O	2.35	0.42
1:B:191:LYS:HD2	1:B:191:LYS:HA	1.86	0.42
2:C:508:SER:HB3	2:C:554:ILE:HD11	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:551:ARG:O	1:A:554:ASP:HB2	2.18	0.42
1:B:46:LYS:HE3	1:B:46:LYS:HB3	1.73	0.42
1:B:597:PRO:HD3	1:B:648:ARG:CZ	2.49	0.42
1:A:52:PHE:CZ	1:A:471:LYS:HA	2.54	0.42
1:A:331:THR:OG1	1:A:335:SER:OG	2.29	0.42
1:A:580:MET:HE3	1:A:580:MET:HB3	1.96	0.42
1:A:664:THR:HG21	2:C:133:PRO:HD2	2.01	0.42
2:C:704:ASP:N	2:C:704:ASP:OD1	2.52	0.42
4:A:702:SF4:S1	1:B:69:ARG:HD2	2.60	0.42
2:C:346:GLY:H	2:C:350:THR:HG23	1.84	0.42
1:A:157:ASP:OD1	1:A:157:ASP:N	2.36	0.42
2:C:269:ALA:HB1	2:C:279:VAL:HG21	2.02	0.41
1:A:265:ALA:O	1:A:421:LYS:HA	2.20	0.41
2:C:586:ASN:HD22	2:C:593:TYR:HB2	1.84	0.41
1:A:475:ASP:O	1:A:479:ILE:HG12	2.20	0.41
2:C:561:ASP:CG	2:C:564:LYS:HB2	2.46	0.41
1:A:351:ASP:OD1	1:A:352:VAL:N	2.53	0.41
1:A:39:LYS:HA	1:A:42:LYS:HG2	2.03	0.41
1:A:289:LYS:HA	1:A:289:LYS:HD3	1.73	0.41
2:C:360:GLY:N	2:C:363:GLU:OE2	2.51	0.41
1:A:263:THR:HG21	1:A:322:LEU:HG	2.03	0.41
2:D:127:GLU:H	2:D:127:GLU:CD	2.29	0.41
2:C:375:ASP:HB3	2:C:377:ASP:OD1	2.20	0.41
2:C:144:VAL:HG22	2:C:224:TYR:CE2	2.56	0.41
1:A:60:GLN:O	1:A:64:LYS:HG2	2.21	0.40
1:A:230:THR:O	1:A:234:LEU:HG	2.21	0.40
1:B:20:TRP:O	1:B:27:ARG:NH2	2.46	0.40
1:B:289:LYS:HG3	1:B:392:ALA:HB1	2.04	0.40
1:B:23:LYS:HE3	1:B:23:LYS:HB2	1.98	0.40
2:C:119:LEU:O	2:C:122:LEU:HB2	2.21	0.40
2:C:344:GLU:O	2:C:384:ARG:HA	2.22	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	667/669 (100%)	646 (97%)	21 (3%)	0	100	100
1	B	667/669 (100%)	646 (97%)	20 (3%)	1 (0%)	48	66
2	C	728/730 (100%)	704 (97%)	23 (3%)	1 (0%)	48	66
2	D	309/730 (42%)	298 (96%)	11 (4%)	0	100	100
All	All	2371/2798 (85%)	2294 (97%)	75 (3%)	2 (0%)	49	66

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	353	GLN
2	C	190	ASP

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	548/548 (100%)	534 (97%)	14 (3%)	40	65
1	B	548/548 (100%)	534 (97%)	14 (3%)	40	65
2	C	612/612 (100%)	599 (98%)	13 (2%)	47	71
2	D	256/612 (42%)	254 (99%)	2 (1%)	73	87
All	All	1964/2320 (85%)	1921 (98%)	43 (2%)	45	70

All (43) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	64	LYS
1	A	140	ASP
1	A	157	ASP
1	A	213	ASP
1	A	220	ILE
1	A	264	GLU

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Mol	Chain	Res	Type
1	A	328	HIS
1	A	363	THR
1	A	441	ASN
1	A	443	GLU
1	A	467	CYS
1	A	480	THR
1	A	606	LEU
1	A	607	GLU
1	B	167	GLU
1	B	220	ILE
1	B	222	ASN
1	B	264	GLU
1	B	273	ASN
1	B	317	THR
1	B	328	HIS
1	B	359	LEU
1	B	363	THR
1	B	435	GLU
1	B	467	CYS
1	B	486	LEU
1	B	513	LEU
1	B	547	VAL
2	C	9	GLN
2	C	96	GLU
2	C	150	LYS
2	C	174	LYS
2	C	217	GLN
2	C	350	THR
2	C	380	GLU
2	C	427	ASP
2	C	431	VAL
2	C	454	LYS
2	C	463	VAL
2	C	620	GLU
2	C	655	ILE
2	D	217	GLN
2	D	304	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	439	HIS

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Mol	Chain	Res	Type
1	A	478	HIS
1	B	182	ASN
1	B	219	HIS
1	B	439	HIS
1	B	442	GLN
1	B	468	ASN
2	C	200	ASN
2	C	566	GLN
2	C	571	ASN

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 11 ligands modelled in this entry, 3 are monoatomic and 1 is modelled with single atom - leaving 7 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	$\# Z > 2$
3	RQM	A	701	1	0,12,12	-	-	-		
4	SF4	B	702	1,4	0,4,12	-	-	-		
3	RQM	B	701	1	0,12,12	-	-	-		
4	SF4	A	703	1	0,12,12	-	-	-		

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	SF4	C	802	2	0,12,12	-	-	-		
4	SF4	B	703	1	0,12,12	-	-	-		
4	SF4	A	702	1,4	0,4,12	-	-	-		

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	RQM	A	701	1	-	-	0/4/4/4
4	SF4	B	702	1,4	-	-	0/1/1/5
3	RQM	B	701	1	-	-	0/4/4/4
4	SF4	A	703	1	-	-	0/6/5/5
4	SF4	C	802	2	-	-	0/6/5/5
4	SF4	B	703	1	-	-	0/6/5/5
4	SF4	A	702	1,4	-	-	0/1/1/5

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

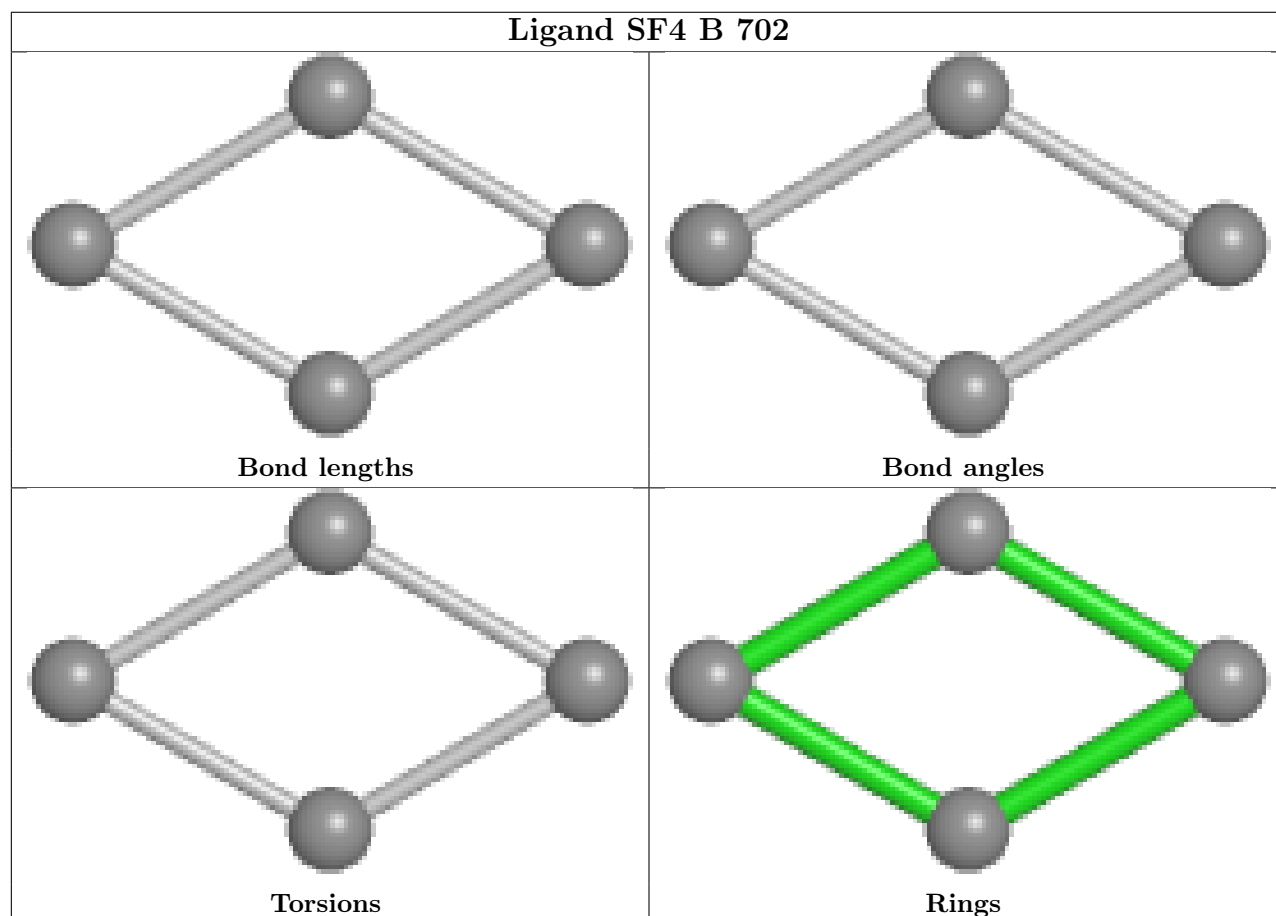
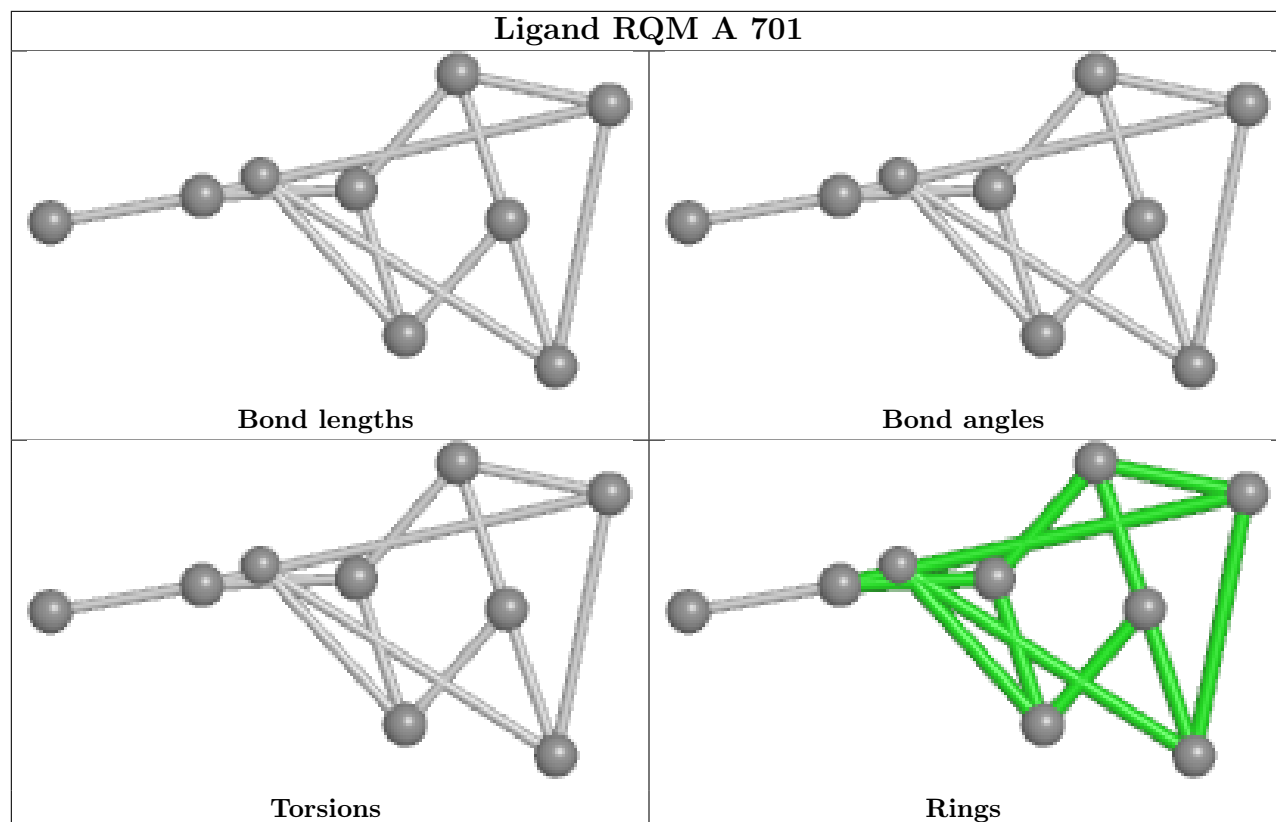
There are no torsion outliers.

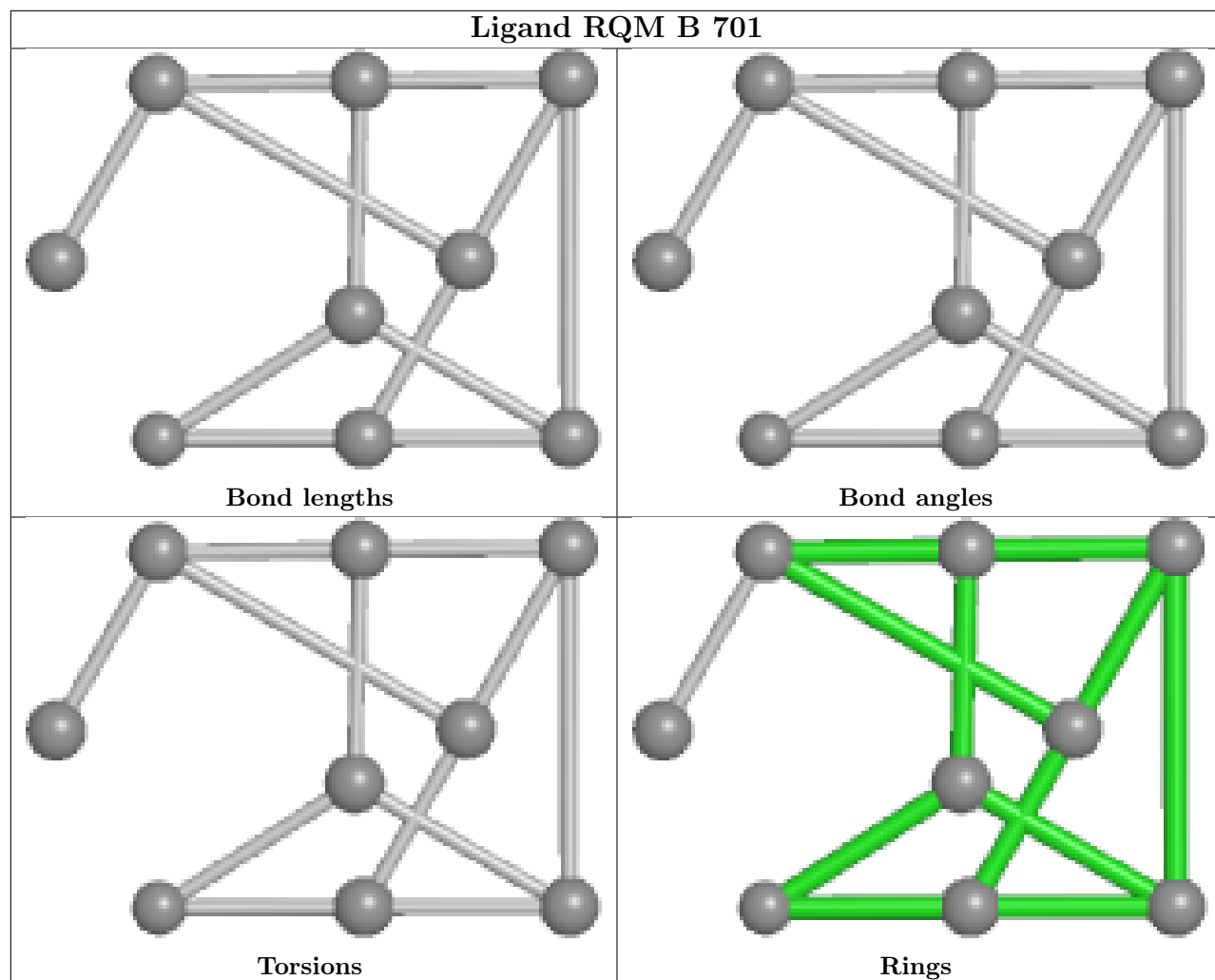
There are no ring outliers.

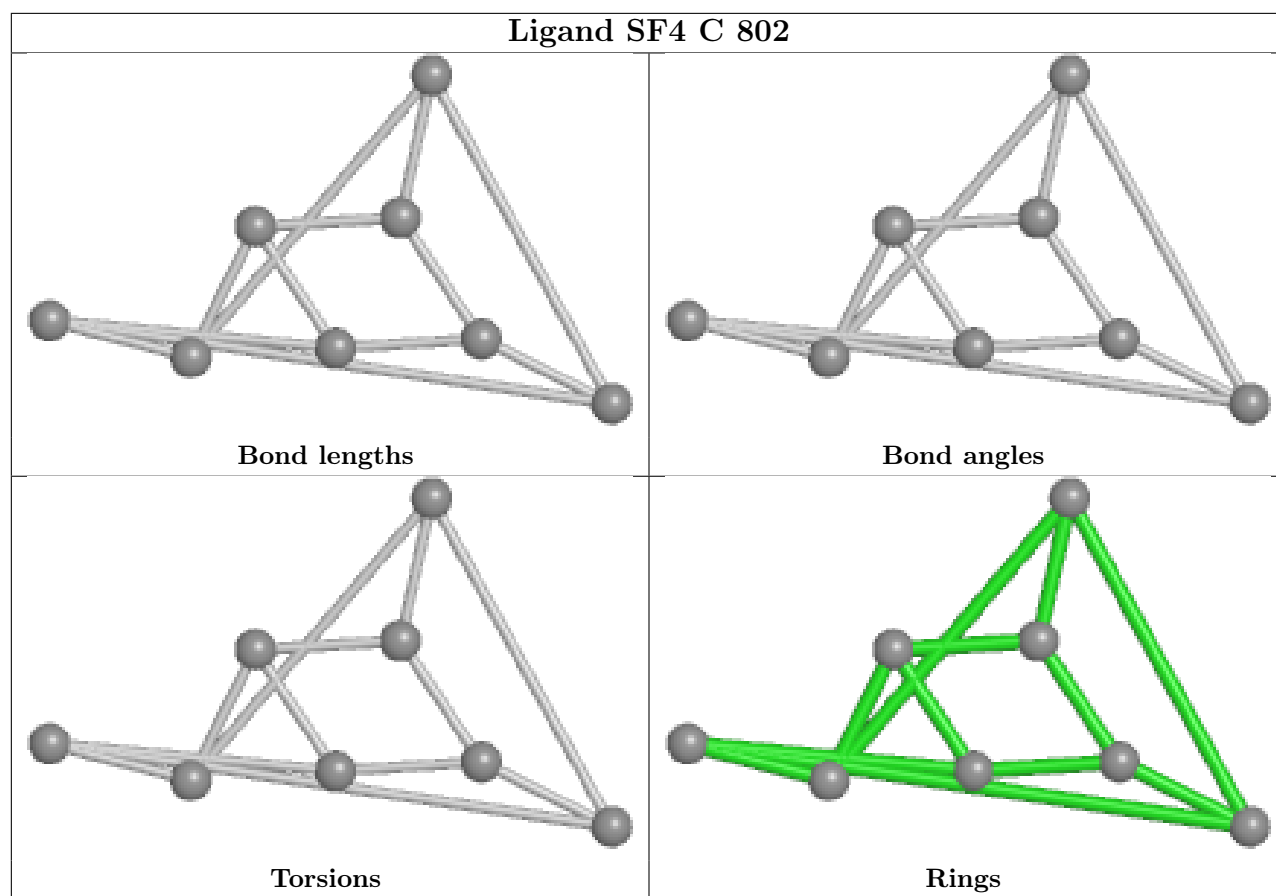
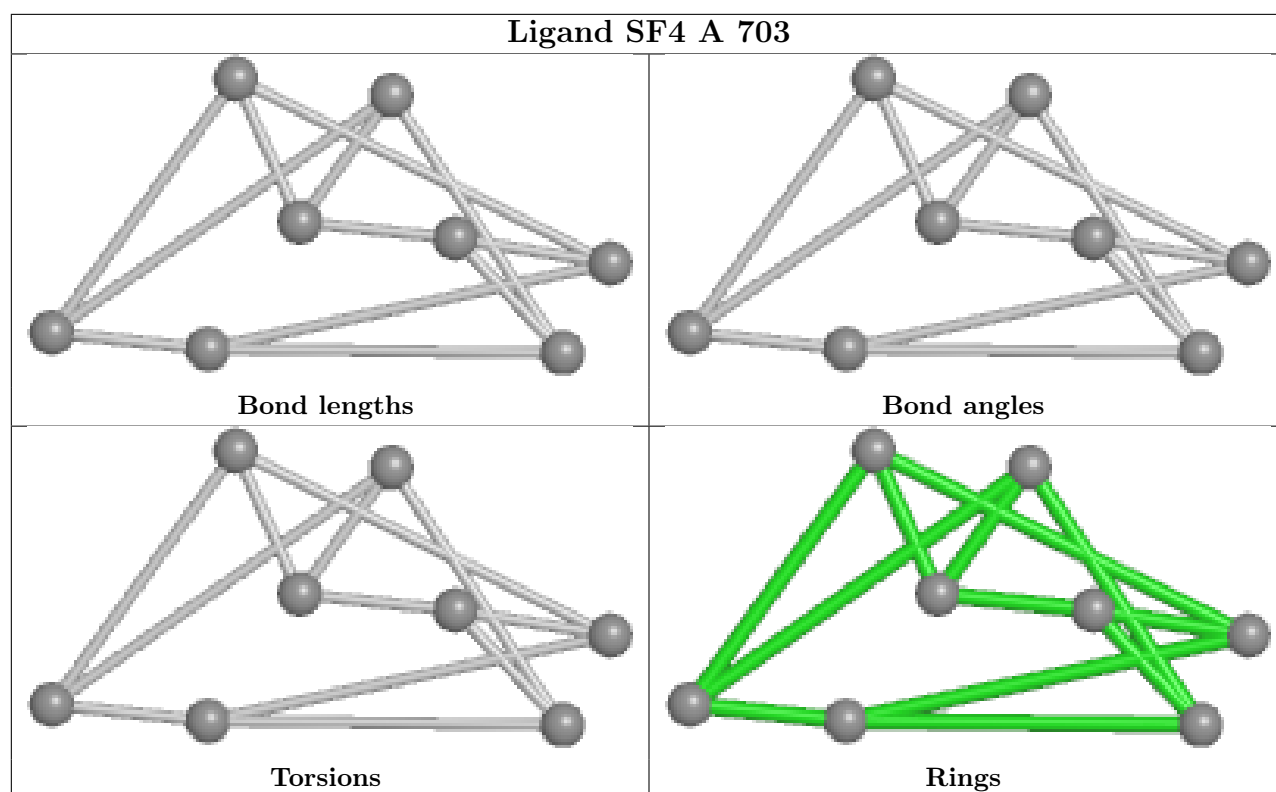
2 monomers are involved in 3 short contacts:

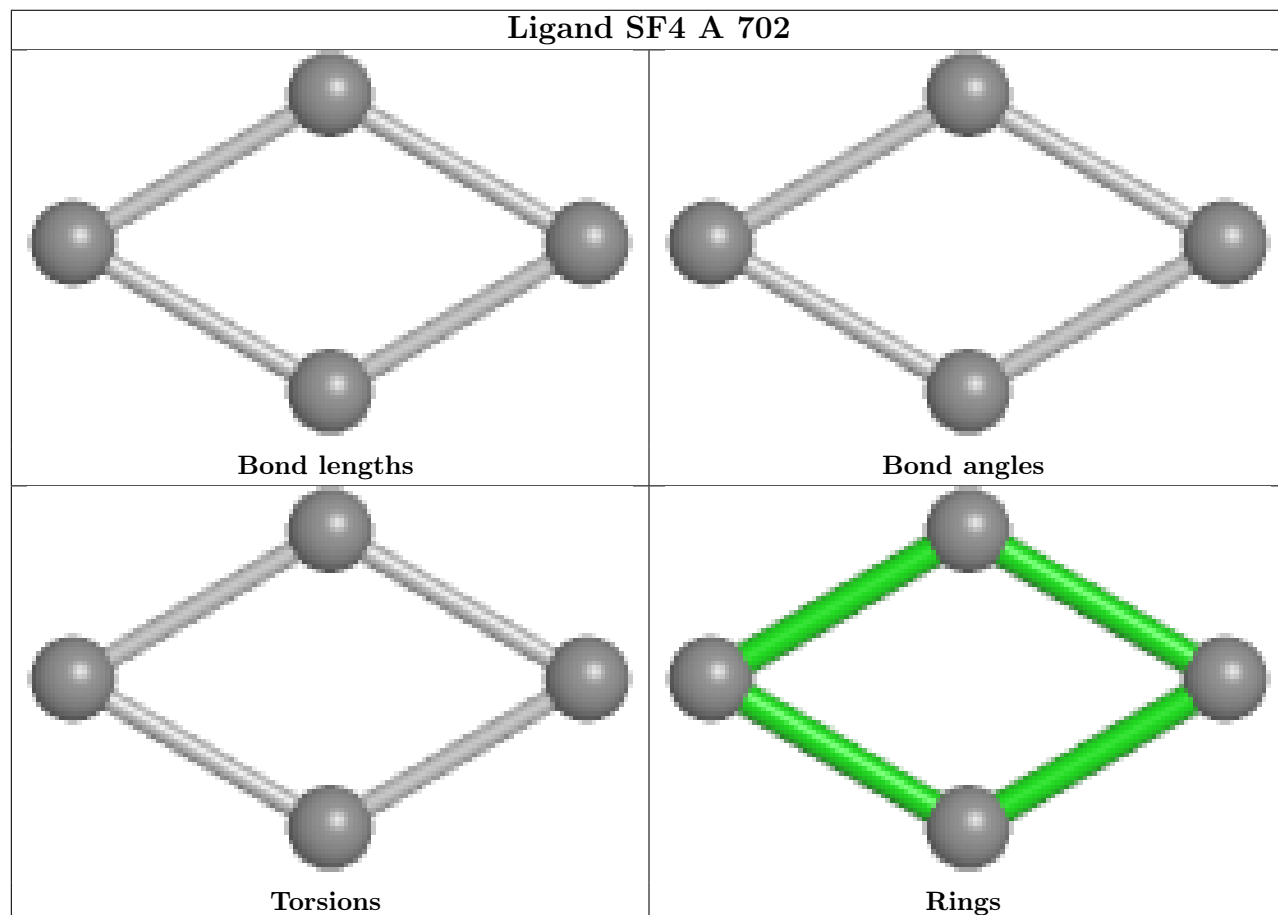
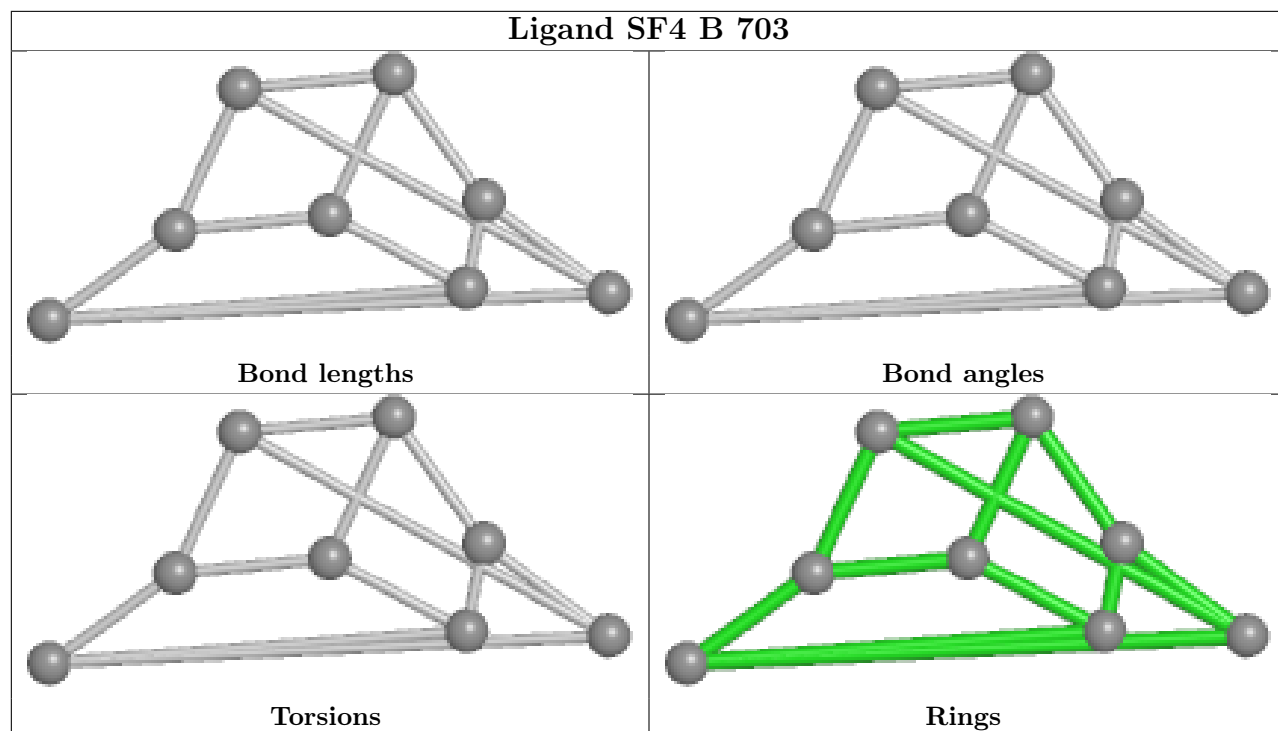
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	701	RQM	1	0
4	A	702	SF4	2	0

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

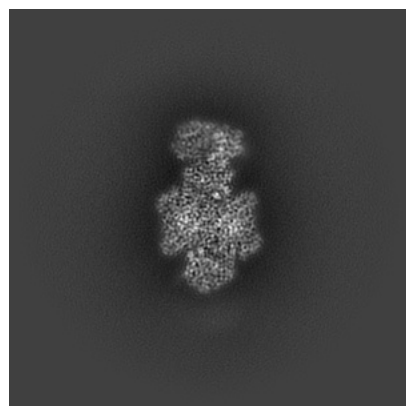
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-50616. These allow visual inspection of the internal detail of the map and identification of artifacts.

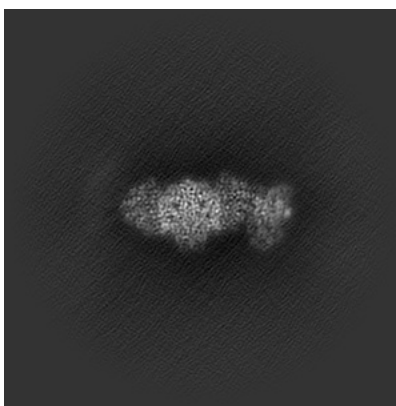
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

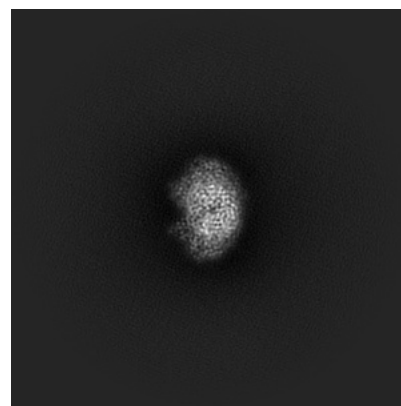
6.1.1 Primary map



X

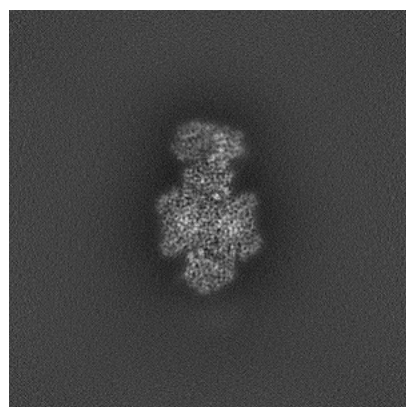


Y

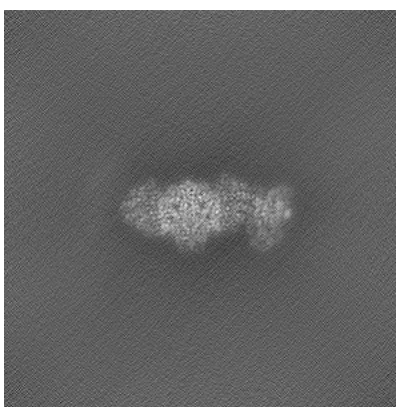


Z

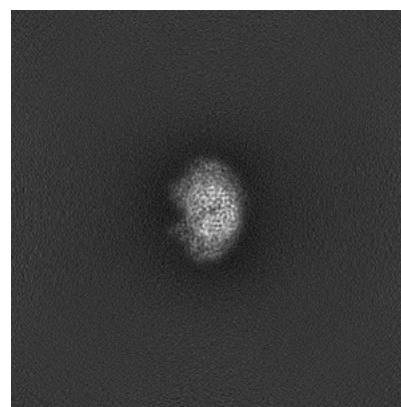
6.1.2 Raw map



X



Y

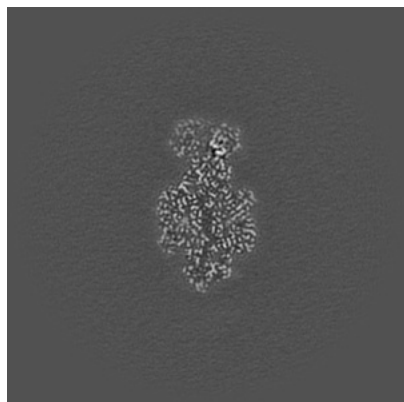


Z

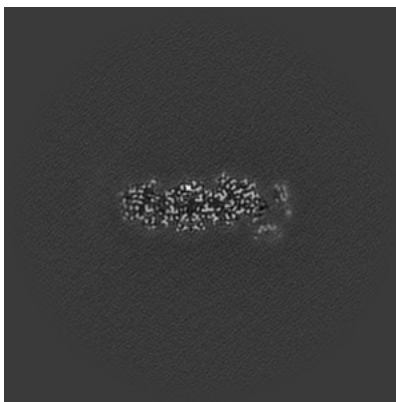
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

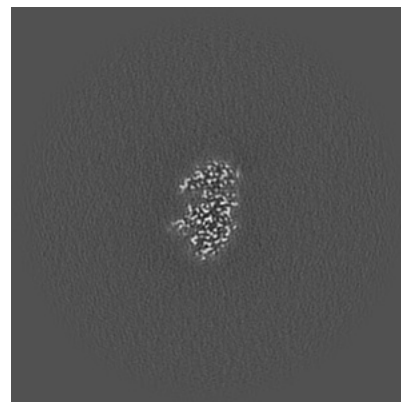
6.2.1 Primary map



X Index: 256

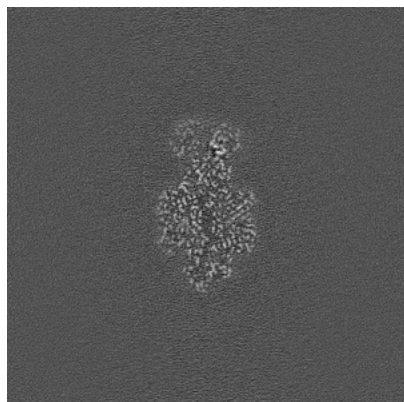


Y Index: 256

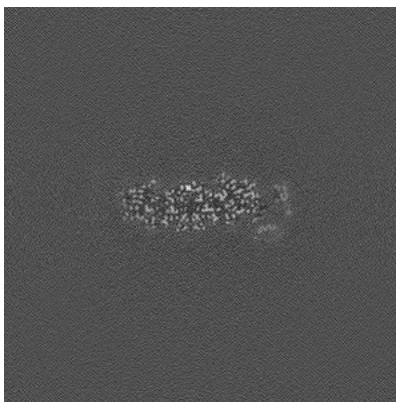


Z Index: 256

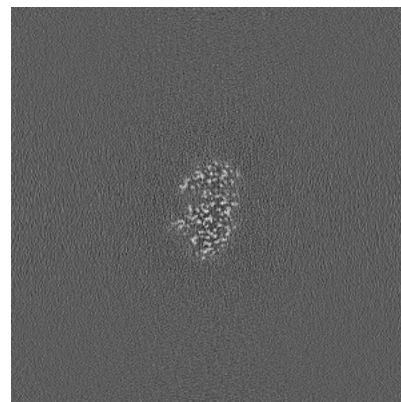
6.2.2 Raw map



X Index: 256



Y Index: 256

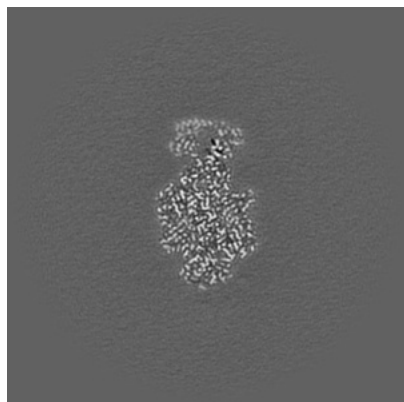


Z Index: 256

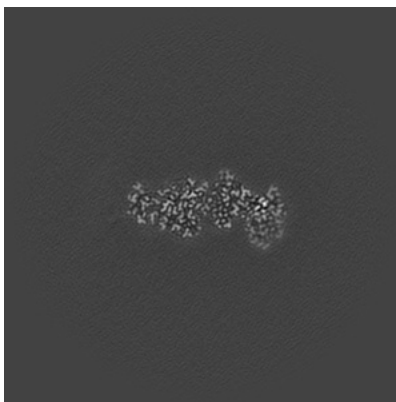
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

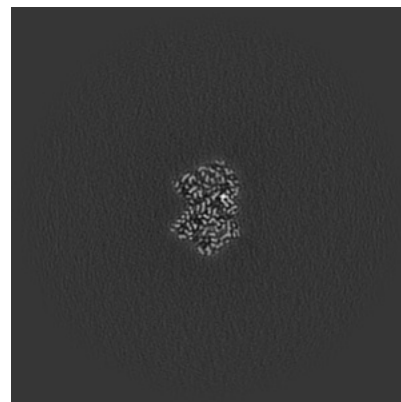
6.3.1 Primary map



X Index: 252

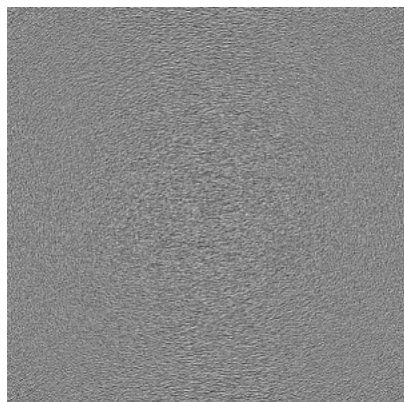


Y Index: 271

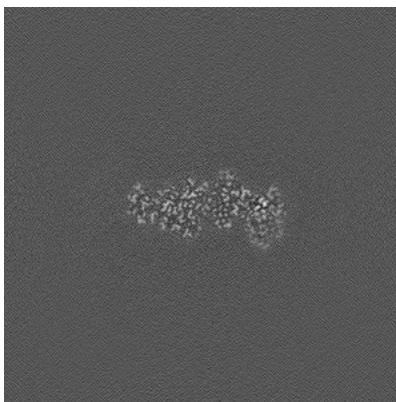


Z Index: 242

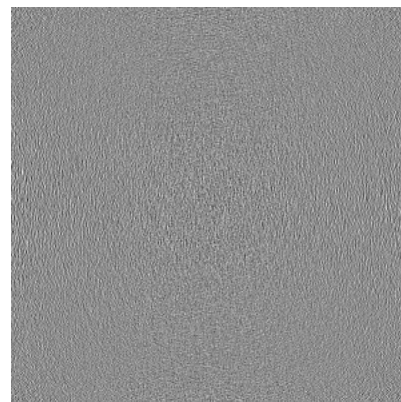
6.3.2 Raw map



X Index: 0



Y Index: 271

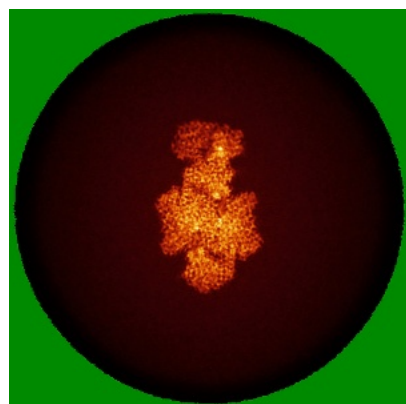


Z Index: 0

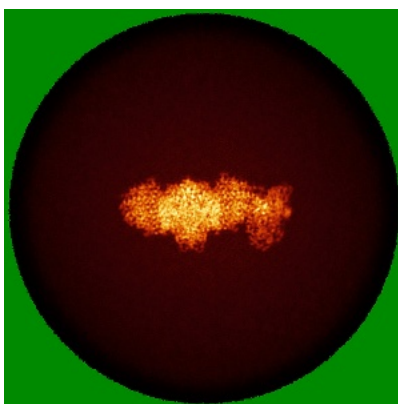
The images above show the largest variance slices of the map in three orthogonal directions.

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

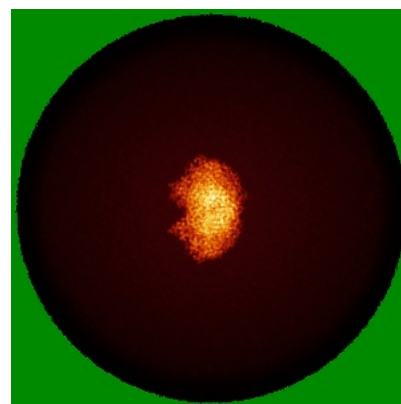
6.4.1 Primary map



X

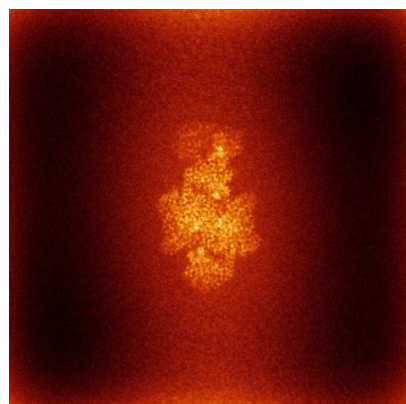


Y

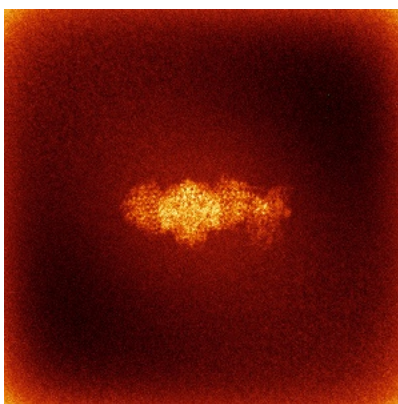


Z

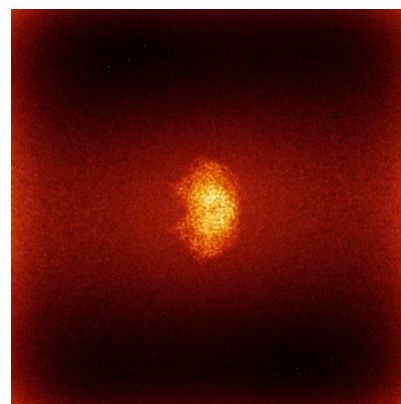
6.4.2 Raw map



X



Y

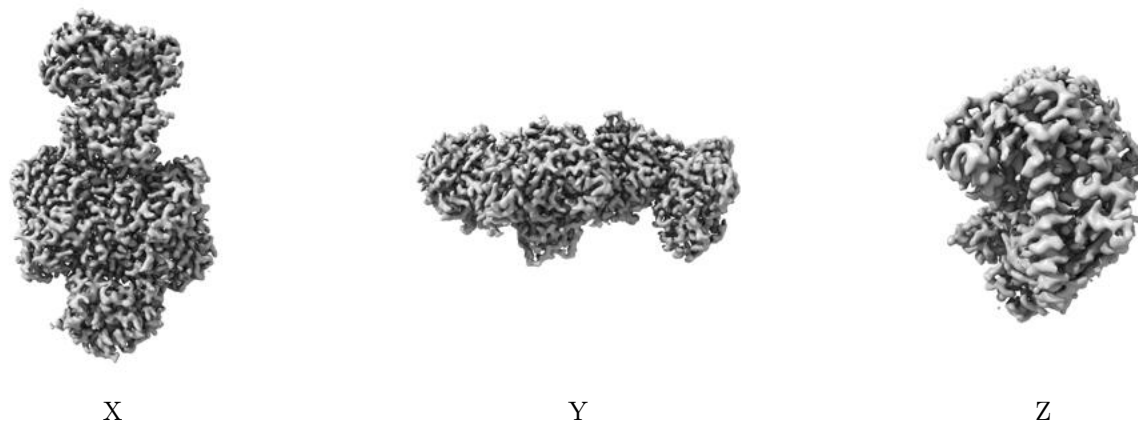


Z

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.

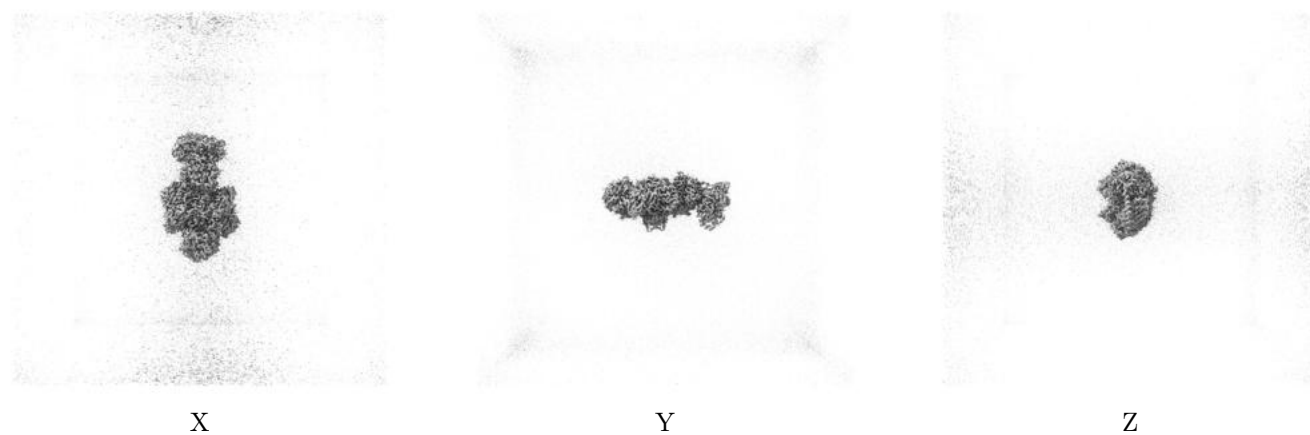
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.1. 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



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.

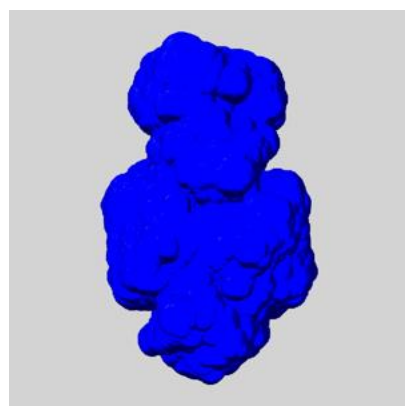
6.6 Mask visualisation [i](#)

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

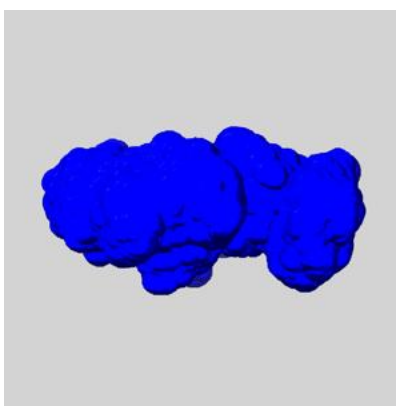
A mask typically either:

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

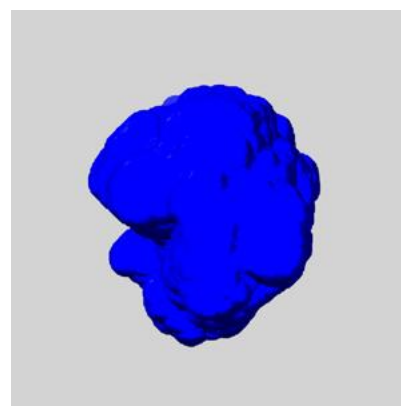
6.6.1 emd_50616_msk_1.map [i](#)



X



Y

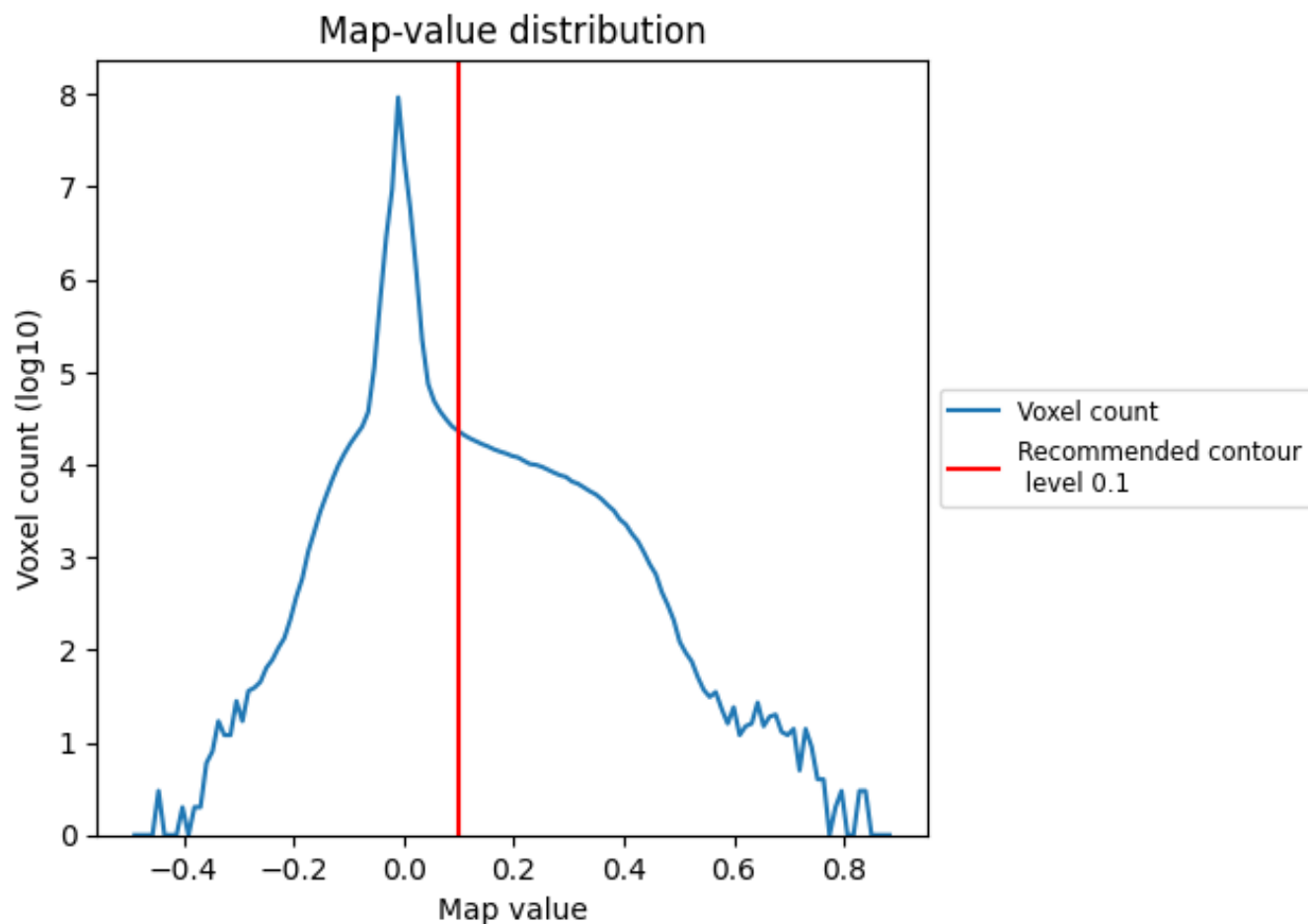


Z

7 Map analysis [i](#)

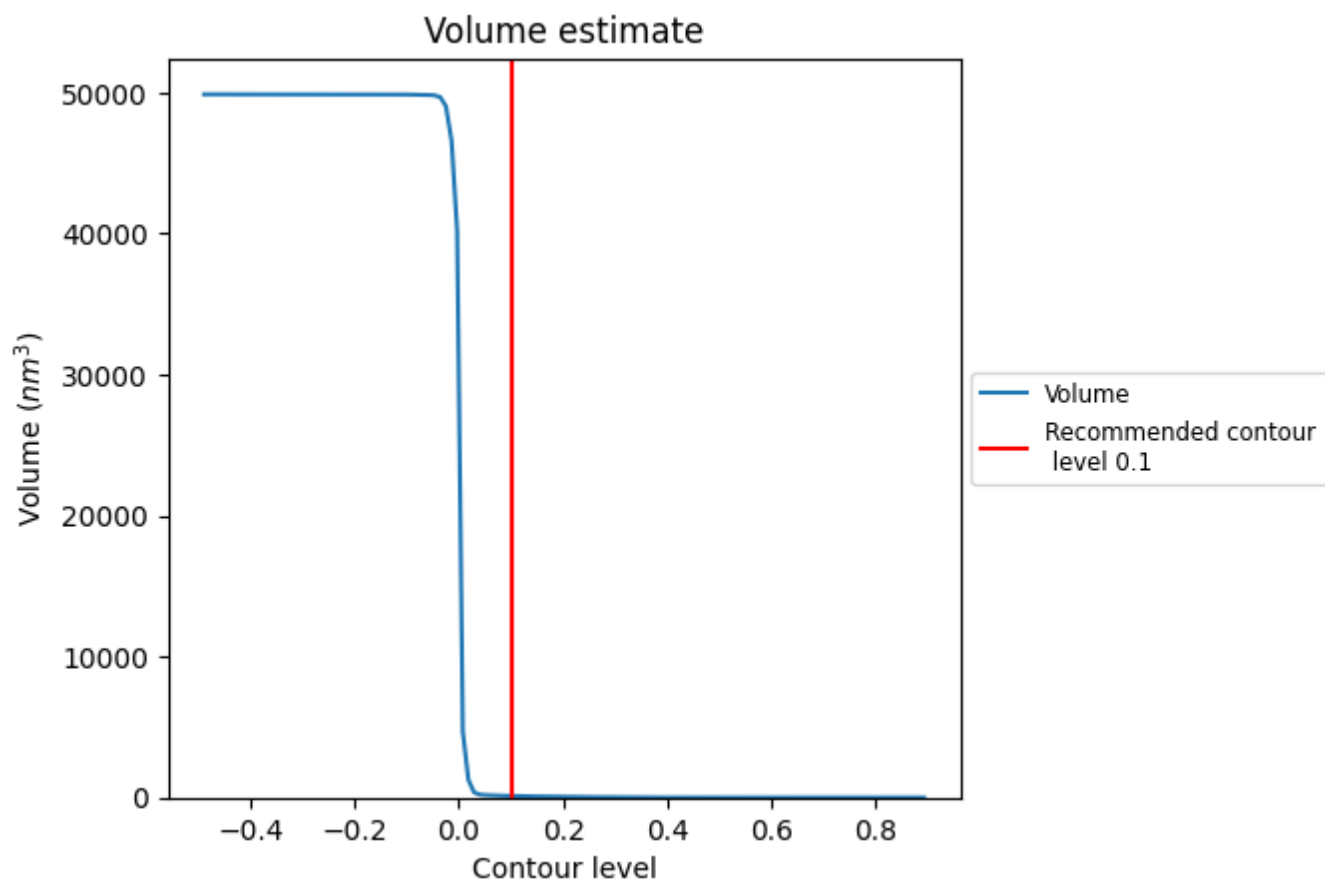
This section contains the results of statistical analysis of the map.

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.

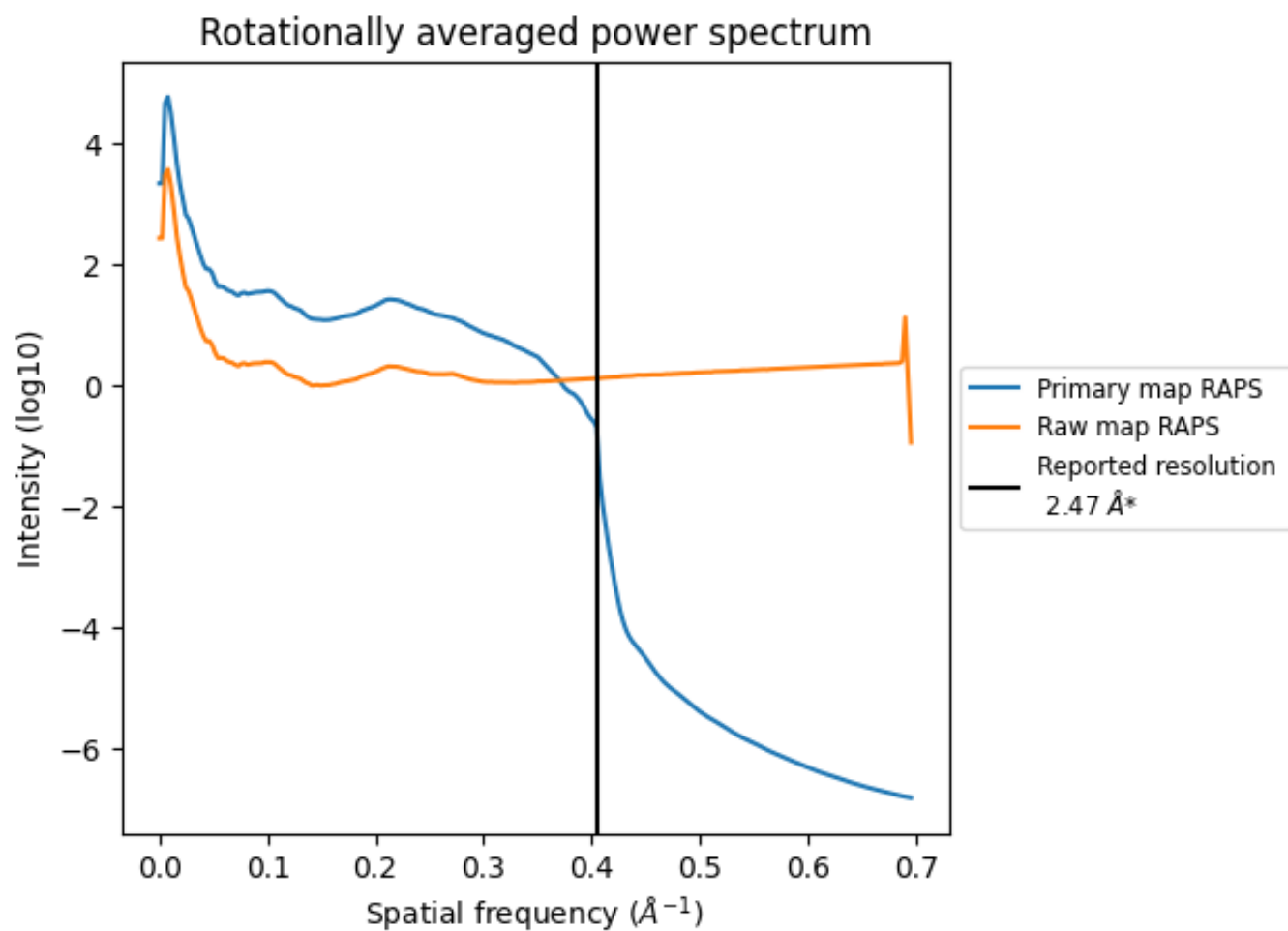
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 112 nm^3 ; this corresponds to an approximate mass of 101 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 ⓘ

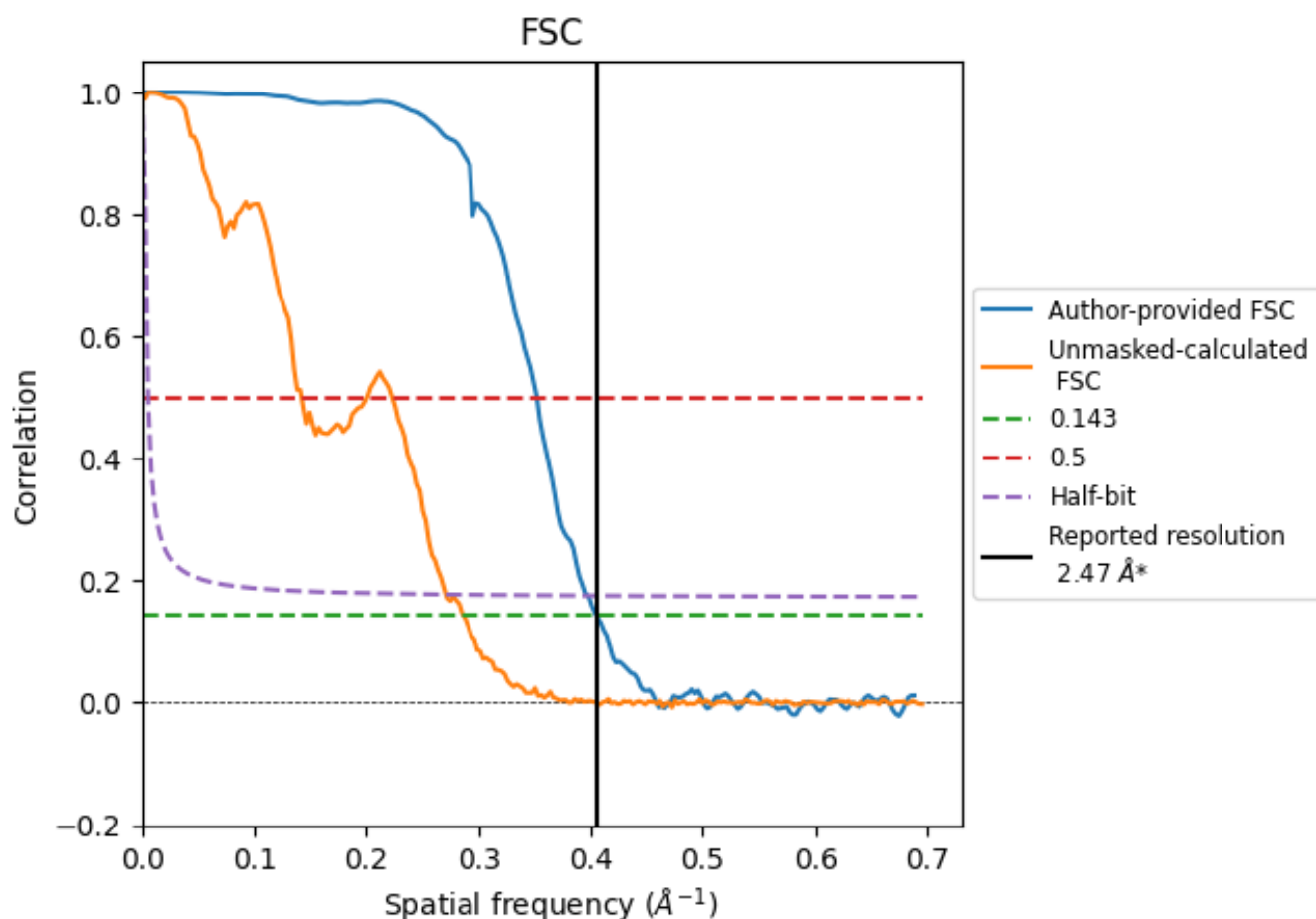


*Reported resolution corresponds to spatial frequency of 0.405 Å⁻¹

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 0.405 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

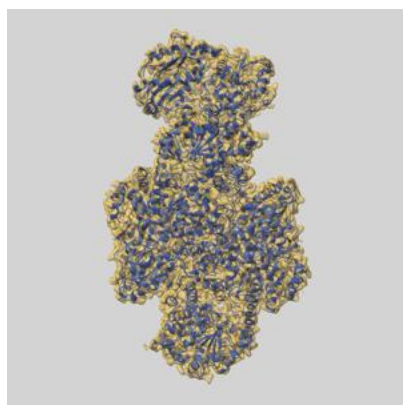
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.47	-	-
Author-provided FSC curve	2.47	2.84	2.52
Unmasked-calculated*	3.49	7.02	3.69

*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 3.49 differs from the reported value 2.47 by more than 10 %

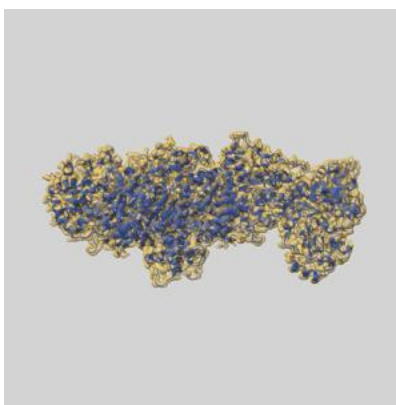
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-50616 and PDB model 9FO4. Per-residue inclusion information can be found in section [3](#) on page [8](#).

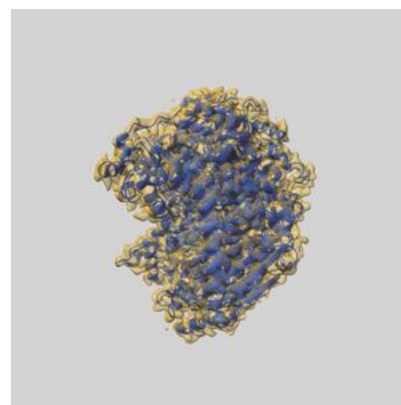
9.1 Map-model overlay [i](#)



X



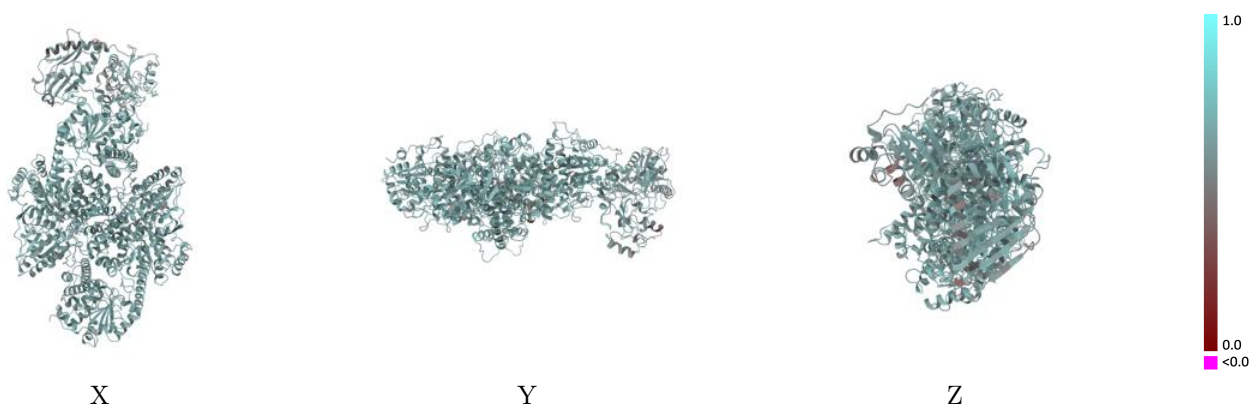
Y



Z

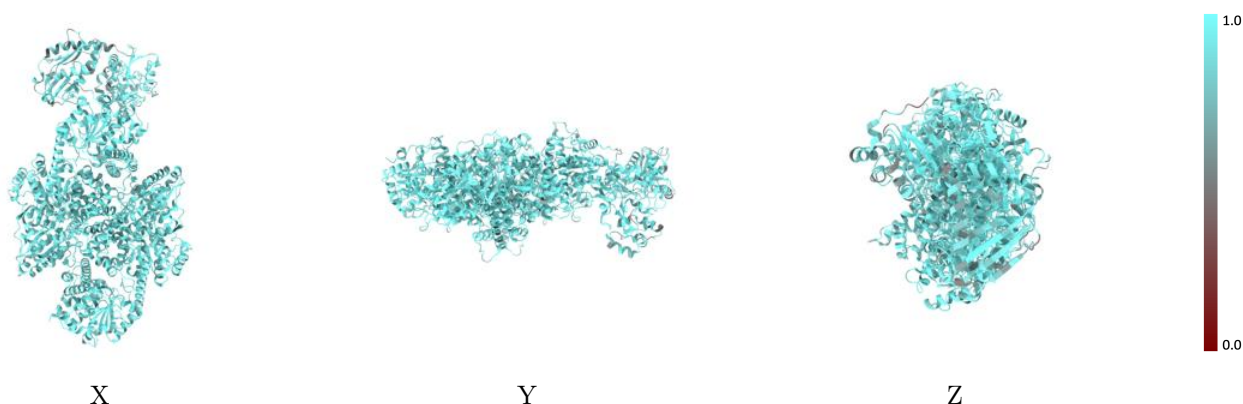
The images above show the 3D surface view of the map at the recommended contour level 0.1 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



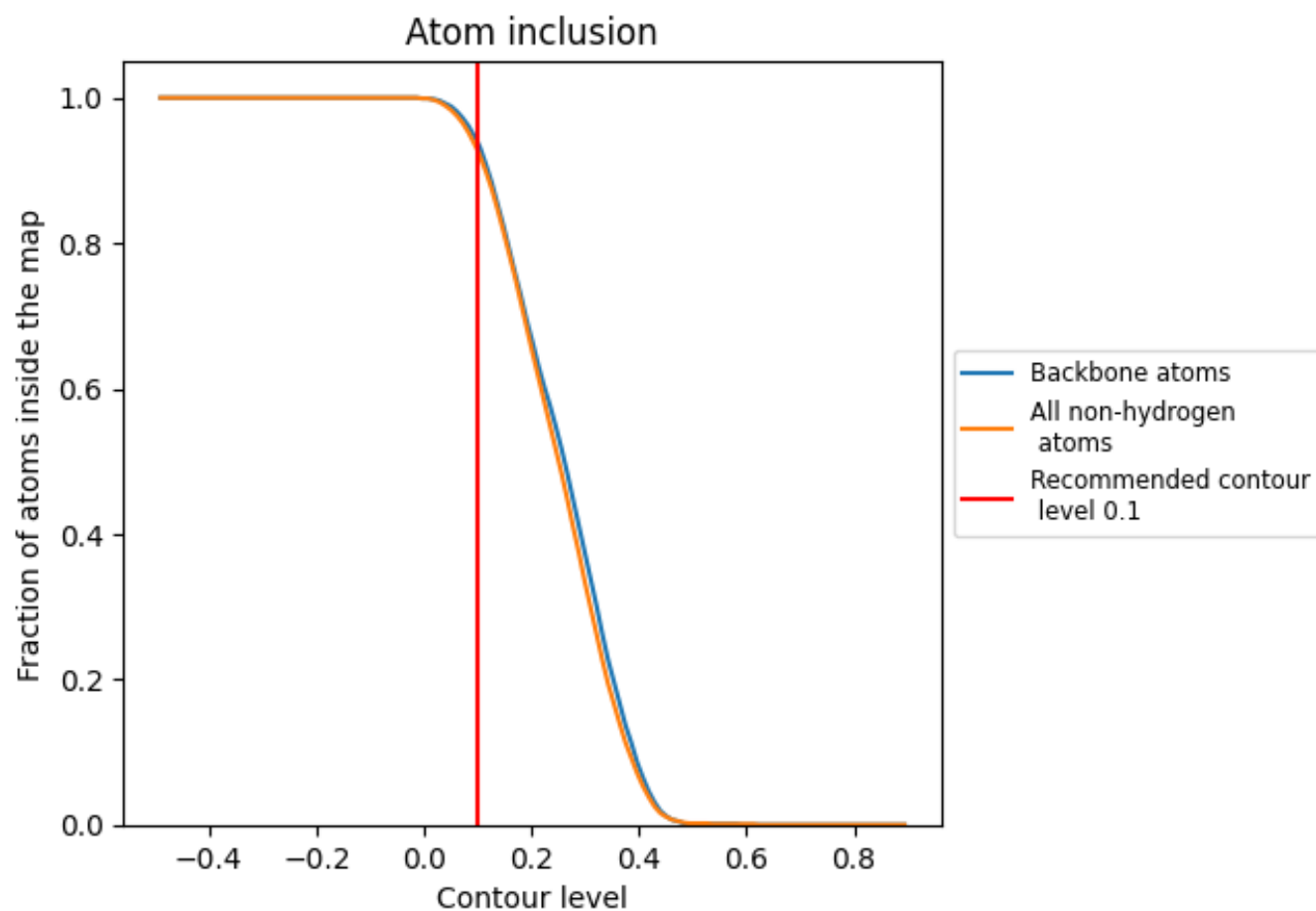
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.1).

9.4 Atom inclusion [i](#)



At the recommended contour level, 94% of all backbone atoms, 93% 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 (0.1) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9280	0.6200
A	0.9450	0.6330
B	0.9470	0.6310
C	0.8960	0.5990
D	0.9340	0.6220

