W O R L D W I D E
wwPDB
P R O T E I N   D A T A   B A N K

wwPDB EM Validation Summary Report (i)

Dec 19, 2022 – 08:58 am GMT

PDB ID	:	7NGC
EMDB ID	:	EMD-12312
Title	:	P2a-state of wild type human mitochondrial LONP1 protease with bound substrate protein and in presence of ATPgS
Authors	:	Mohammed, I.; Schmitz, K.A.; Schenck, N.; Maier, T.; Abrahams, J.P.
Deposited on	:	2021-02-09
Resolution	:	7.50 Å(reported)

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

|		
EMDB validation analysis	:	0.0.1.dev43
Mogul	:	1.8.4, CSD as541be (2020)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ	:	1.9.9
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.31.3

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 7.50 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	Percentile Ranks	Value
Clashscore		7
Ramachandran outliers		0.0%
Sidechain outliers		0.5%

Worse　　　　　　　　　　　　　　　　　　　　　　*Better*

▮ Percentile relative to all structures

▯ Percentile relative to all EM structures
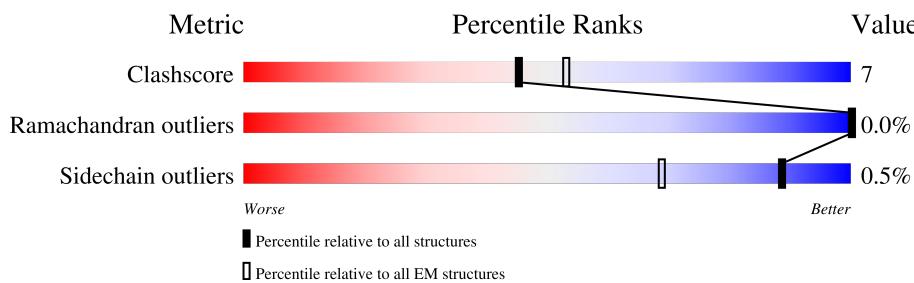
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion < 40%). The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	853	6%　74% 16% 9%
1	B	853	6%　75% 16% 9%
1	C	853	5%　77% 14% 9%
1	D	853	·　76% 14% · 9%
1	E	853	·　74% 17% 9%
1	F	853	6%　72% 18% · 9%
2	G	55	7%　51% · 47%
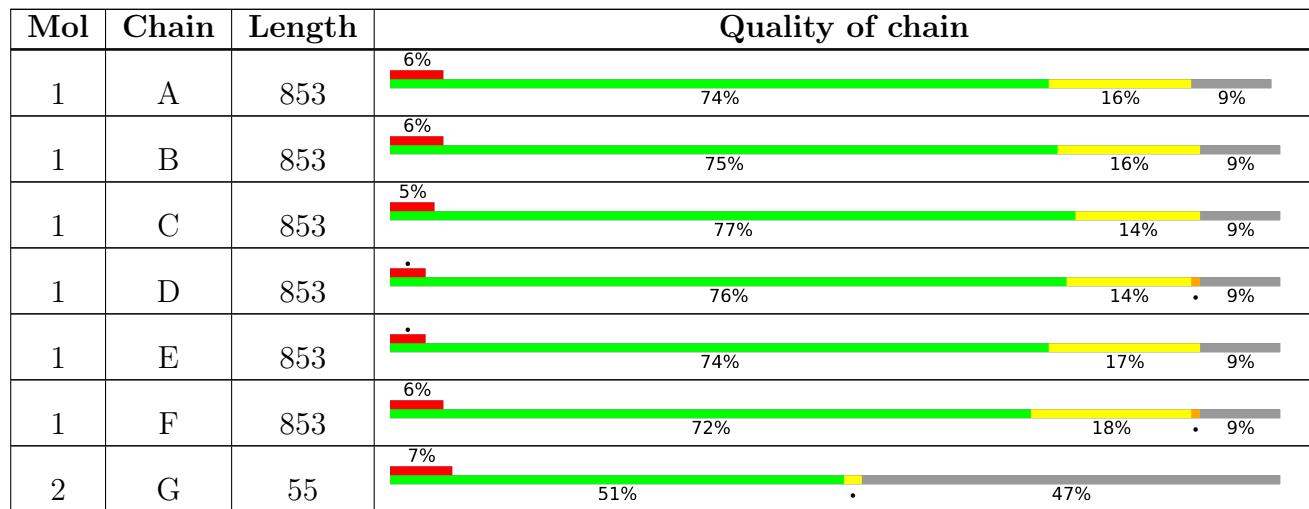
The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

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
3	AGS	A	1001	-	-	X	-

2   Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 75081 atoms, of which 37897 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 Lon protease homolog, mitochondrial.

Mol	Chain	Residues	Atoms						AltConf	Trace
1	A	776	Total	C	H	N	O	S	0	0
			12428	3897	6286	1066	1152	27		
1	B	776	Total	C	H	N	O	S	0	0
			12428	3897	6286	1066	1152	27		
1	C	776	Total	C	H	N	O	S	0	0
			12427	3897	6285	1066	1152	27		
1	D	776	Total	C	H	N	O	S	0	0
			12425	3897	6283	1066	1152	27		
1	E	776	Total	C	H	N	O	S	0	0
			12426	3897	6284	1066	1152	27		
1	F	776	Total	C	H	N	O	S	0	0
			12427	3897	6285	1066	1152	27		

There are 162 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	107	HIS	-	expression tag	UNP P36776
A	108	HIS	-	expression tag	UNP P36776
A	109	HIS	-	expression tag	UNP P36776
A	110	HIS	-	expression tag	UNP P36776
A	111	HIS	-	expression tag	UNP P36776
A	112	HIS	-	expression tag	UNP P36776
A	113	GLY	-	expression tag	UNP P36776
A	114	SER	-	expression tag	UNP P36776
A	115	MET	-	expression tag	UNP P36776
A	116	THR	-	expression tag	UNP P36776
A	117	ILE	-	expression tag	UNP P36776
A	118	PRO	-	expression tag	UNP P36776
A	119	ASP	-	expression tag	UNP P36776
A	120	VAL	-	expression tag	UNP P36776
A	121	PHE	-	expression tag	UNP P36776
A	122	PRO	-	expression tag	UNP P36776
A	949	ASP	-	expression tag	UNP P36776
A	950	GLU	-	expression tag	UNP P36776

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Chain	Residue	Modelled	Actual	Comment	Reference
A	951	GLN	-	expression tag	UNP P36776
A	952	ALA	-	expression tag	UNP P36776
A	953	GLU	-	expression tag	UNP P36776
A	954	ALA	-	expression tag	UNP P36776
A	955	LEU	-	expression tag	UNP P36776
A	956	ALA	-	expression tag	UNP P36776
A	957	VAL	-	expression tag	UNP P36776
A	958	GLU	-	expression tag	UNP P36776
A	959	ARG	-	expression tag	UNP P36776
B	107	HIS	-	expression tag	UNP P36776
B	108	HIS	-	expression tag	UNP P36776
B	109	HIS	-	expression tag	UNP P36776
B	110	HIS	-	expression tag	UNP P36776
B	111	HIS	-	expression tag	UNP P36776
B	112	HIS	-	expression tag	UNP P36776
B	113	GLY	-	expression tag	UNP P36776
B	114	SER	-	expression tag	UNP P36776
B	115	MET	-	expression tag	UNP P36776
B	116	THR	-	expression tag	UNP P36776
B	117	ILE	-	expression tag	UNP P36776
B	118	PRO	-	expression tag	UNP P36776
B	119	ASP	-	expression tag	UNP P36776
B	120	VAL	-	expression tag	UNP P36776
B	121	PHE	-	expression tag	UNP P36776
B	122	PRO	-	expression tag	UNP P36776
B	949	ASP	-	expression tag	UNP P36776
B	950	GLU	-	expression tag	UNP P36776
B	951	GLN	-	expression tag	UNP P36776
B	952	ALA	-	expression tag	UNP P36776
B	953	GLU	-	expression tag	UNP P36776
B	954	ALA	-	expression tag	UNP P36776
B	955	LEU	-	expression tag	UNP P36776
B	956	ALA	-	expression tag	UNP P36776
B	957	VAL	-	expression tag	UNP P36776
B	958	GLU	-	expression tag	UNP P36776
B	959	ARG	-	expression tag	UNP P36776
C	107	HIS	-	expression tag	UNP P36776
C	108	HIS	-	expression tag	UNP P36776
C	109	HIS	-	expression tag	UNP P36776
C	110	HIS	-	expression tag	UNP P36776
C	111	HIS	-	expression tag	UNP P36776
C	112	HIS	-	expression tag	UNP P36776

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Chain	Residue	Modelled	Actual	Comment	Reference
C	113	GLY	-	expression tag	UNP P36776
C	114	SER	-	expression tag	UNP P36776
C	115	MET	-	expression tag	UNP P36776
C	116	THR	-	expression tag	UNP P36776
C	117	ILE	-	expression tag	UNP P36776
C	118	PRO	-	expression tag	UNP P36776
C	119	ASP	-	expression tag	UNP P36776
C	120	VAL	-	expression tag	UNP P36776
C	121	PHE	-	expression tag	UNP P36776
C	122	PRO	-	expression tag	UNP P36776
C	949	ASP	-	expression tag	UNP P36776
C	950	GLU	-	expression tag	UNP P36776
C	951	GLN	-	expression tag	UNP P36776
C	952	ALA	-	expression tag	UNP P36776
C	953	GLU	-	expression tag	UNP P36776
C	954	ALA	-	expression tag	UNP P36776
C	955	LEU	-	expression tag	UNP P36776
C	956	ALA	-	expression tag	UNP P36776
C	957	VAL	-	expression tag	UNP P36776
C	958	GLU	-	expression tag	UNP P36776
C	959	ARG	-	expression tag	UNP P36776
D	107	HIS	-	expression tag	UNP P36776
D	108	HIS	-	expression tag	UNP P36776
D	109	HIS	-	expression tag	UNP P36776
D	110	HIS	-	expression tag	UNP P36776
D	111	HIS	-	expression tag	UNP P36776
D	112	HIS	-	expression tag	UNP P36776
D	113	GLY	-	expression tag	UNP P36776
D	114	SER	-	expression tag	UNP P36776
D	115	MET	-	expression tag	UNP P36776
D	116	THR	-	expression tag	UNP P36776
D	117	ILE	-	expression tag	UNP P36776
D	118	PRO	-	expression tag	UNP P36776
D	119	ASP	-	expression tag	UNP P36776
D	120	VAL	-	expression tag	UNP P36776
D	121	PHE	-	expression tag	UNP P36776
D	122	PRO	-	expression tag	UNP P36776
D	949	ASP	-	expression tag	UNP P36776
D	950	GLU	-	expression tag	UNP P36776
D	951	GLN	-	expression tag	UNP P36776
D	952	ALA	-	expression tag	UNP P36776
D	953	GLU	-	expression tag	UNP P36776

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Chain	Residue	Modelled	Actual	Comment	Reference
D	954	ALA	-	expression tag	UNP P36776
D	955	LEU	-	expression tag	UNP P36776
D	956	ALA	-	expression tag	UNP P36776
D	957	VAL	-	expression tag	UNP P36776
D	958	GLU	-	expression tag	UNP P36776
D	959	ARG	-	expression tag	UNP P36776
E	107	HIS	-	expression tag	UNP P36776
E	108	HIS	-	expression tag	UNP P36776
E	109	HIS	-	expression tag	UNP P36776
E	110	HIS	-	expression tag	UNP P36776
E	111	HIS	-	expression tag	UNP P36776
E	112	HIS	-	expression tag	UNP P36776
E	113	GLY	-	expression tag	UNP P36776
E	114	SER	-	expression tag	UNP P36776
E	115	MET	-	expression tag	UNP P36776
E	116	THR	-	expression tag	UNP P36776
E	117	ILE	-	expression tag	UNP P36776
E	118	PRO	-	expression tag	UNP P36776
E	119	ASP	-	expression tag	UNP P36776
E	120	VAL	-	expression tag	UNP P36776
E	121	PHE	-	expression tag	UNP P36776
E	122	PRO	-	expression tag	UNP P36776
E	949	ASP	-	expression tag	UNP P36776
E	950	GLU	-	expression tag	UNP P36776
E	951	GLN	-	expression tag	UNP P36776
E	952	ALA	-	expression tag	UNP P36776
E	953	GLU	-	expression tag	UNP P36776
E	954	ALA	-	expression tag	UNP P36776
E	955	LEU	-	expression tag	UNP P36776
E	956	ALA	-	expression tag	UNP P36776
E	957	VAL	-	expression tag	UNP P36776
E	958	GLU	-	expression tag	UNP P36776
E	959	ARG	-	expression tag	UNP P36776
F	107	HIS	-	expression tag	UNP P36776
F	108	HIS	-	expression tag	UNP P36776
F	109	HIS	-	expression tag	UNP P36776
F	110	HIS	-	expression tag	UNP P36776
F	111	HIS	-	expression tag	UNP P36776
F	112	HIS	-	expression tag	UNP P36776
F	113	GLY	-	expression tag	UNP P36776
F	114	SER	-	expression tag	UNP P36776
F	115	MET	-	expression tag	UNP P36776

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Chain	Residue	Modelled	Actual	Comment	Reference
F	116	THR	-	expression tag	UNP P36776
F	117	ILE	-	expression tag	UNP P36776
F	118	PRO	-	expression tag	UNP P36776
F	119	ASP	-	expression tag	UNP P36776
F	120	VAL	-	expression tag	UNP P36776
F	121	PHE	-	expression tag	UNP P36776
F	122	PRO	-	expression tag	UNP P36776
F	949	ASP	-	expression tag	UNP P36776
F	950	GLU	-	expression tag	UNP P36776
F	951	GLN	-	expression tag	UNP P36776
F	952	ALA	-	expression tag	UNP P36776
F	953	GLU	-	expression tag	UNP P36776
F	954	ALA	-	expression tag	UNP P36776
F	955	LEU	-	expression tag	UNP P36776
F	956	ALA	-	expression tag	UNP P36776
F	957	VAL	-	expression tag	UNP P36776
F	958	GLU	-	expression tag	UNP P36776
F	959	ARG	-	expression tag	UNP P36776

- Molecule 2 is a protein called substrate protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	H	N	O		
2	G	29	261	87	116	29	29	0	0

- Molecule 3 is PHOSPHOTHIOPHOSPHORIC ACID-ADENYLATE ESTER (three-letter code: AGS) (formula: $C_{10}H_{16}N_5O_{12}P_3S$) (labeled as "Ligand of Interest" by depositor).
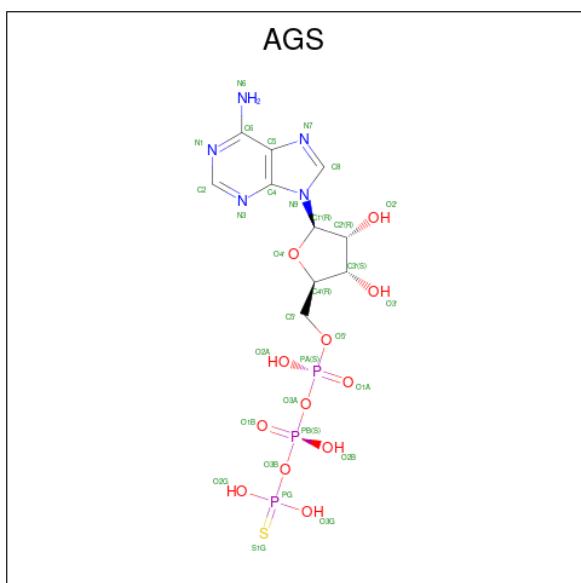
Mol	Chain	Residues	Atoms							AltConf
3	A	1	Total	C	H	N	O	P	S	0
			43	10	12	5	12	3	1	
3	B	1	Total	C	H	N	O	P	S	0
			43	10	12	5	12	3	1	
3	C	1	Total	C	H	N	O	P	S	0
			43	10	12	5	12	3	1	
3	E	1	Total	C	H	N	O	P	S	0
			43	10	12	5	12	3	1	
3	F	1	Total	C	H	N	O	P	S	0
			43	10	12	5	12	3	1	

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
4	A	1	Total	Mg	0
			1	1	
4	B	1	Total	Mg	0
			1	1	
4	C	1	Total	Mg	0
			1	1	
4	E	1	Total	Mg	0
			1	1	
4	F	1	Total	Mg	0
			1	1	

- Molecule 5 is A D E N O S I N E - 5'- D I P H O S P H A T E (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).
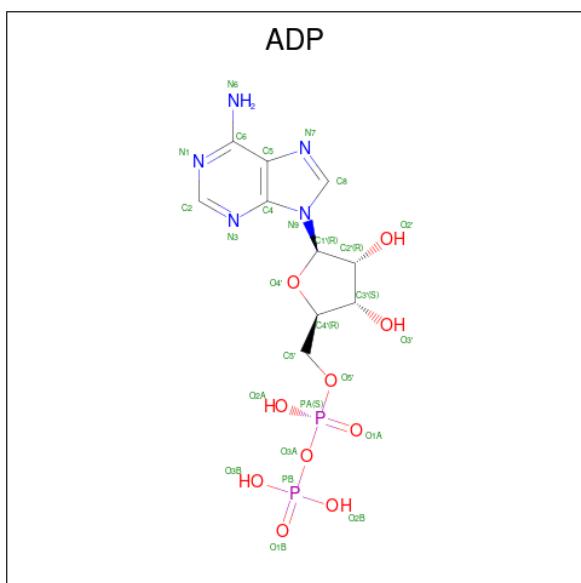
Mol	Chain	Residues	Atoms						AltConf
			Total	C	H	N	O	P	
5	D	1	39	10	12	5	10	2	0

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: Lon protease homolog, mitochondrial

Chain A:

• Molecule 1: Lon protease homolog, mitochondrial

Chain B:

• Molecule 1: Lon protease homolog, mitochondrial

• Molecule 1: Lon protease homolog, mitochondrial

• Molecule 1: Lon protease homolog, mitochondrial

Chain E:

L923 L931 E932 V933 H934 P948 ASP GLU GLN ALA GLU ALA LEU ALA VAL GLU ARG

• Molecule 1: Lon protease homolog, mitochondrial

Chain F:

6%

72%					18%		9%

HIS HIS HIS HIS HIS GLY SER MET THR ILE PRO ASP VAL PHE PRO H123 P133 I142 E151 R154 L159 A160 E180 D183 E184 I185 A192 V208 H211 R212 S217 R218 Q219 L220 E221 VAL GLU PRO GLU GLU PRO GLU ALA GLU ASN LYS HIS LYS

PRO ARG ARG LYS SER LYS ARG GLY LYS GLU GLU ALA GLU ASP GLU LEU SER ALA ARG HIS PRO ALA GLU LEU ALA MET GLU PRO THR PRO GLU LEU PRO ALA GLU VAL LEU M272 V273 E274 V275 V279 H280 E281 D282 F283 Q284 E287 E288 V289 K290 A291 L292 T293 A294 E295 K298

D302 A305 R311 V314 Q319 A320 G321 Q322 R323 V324 V325 D326 N327 P328 I329 I355 I387 R392 K393 Y394 L395 L396 Q397 E398 K401 I402 L407 L425 V430 V434 M435 V438 D439 E440 E441 L442 S443 H451 N456 R459 L462

L465 S474 N475 E476 N477 L478 D479 L480 A481 R482 L487 D490 H491 D496 V497 K498 K499 R500 I501 L502 A506 R511 K517 G526 K529 I536 N541 R542 E543 Y544 F545 S548 V549 M552 E557 I558 R563 K572 T582 E583 N584 L588

I589 D590 I595 G596 R597 G598 Y599 E614 Q615 N616 A617 N618 F619 L620 D621 L624 D625 V628 D629 L630 T638 I645 R650 D651 R652 M653 E654 M655 I656 K666 R679 A680 L681 A689 K690 L691 D694 R705 E706 R710 N711 K714 Q715 R721

A724 Y725 K726 I727 V728 E731 A732 V735 T738 N741 T752 V753 E754 R755 M756 Y757 D758 V759 L768 T771 A772 T782 S783 L784 R785 R786 P787 Q788 E801 I816 A817 Y818 T819 R822 V836 H839 A856 G857 C858 T859 I860 A863 S866

R874 Q875 N876 L877 A878 E882 L885 T886 G887 K888 I889 V892 G893 G894 I895 T899 K903 R904 A905 G906 V907 T908 C909 A914 E915 N916 A924 A925 F926 I927 T928 G929 G930 L931 E932 V936 E937 H938 Y939 R940 D944 I945 P948 ASP GLU GLN ALA GLU ALA LEU

ALA VAL GLU ARG

• Molecule 2: substrate protein

Chain G:

7%

51%			47%

X59 X71 X72 X83 X84 X85 X86 X87 UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK UNK

4   Experimental information   ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	26800	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 $(e^-/\text{Å}^2)$	68	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	1.925	Depositor
Minimum map value	-0.959	Depositor
Average map value	0.004	Depositor
Map value standard deviation	0.063	Depositor
Recommended contour level	0.26	Depositor
Map size (Å)	423.19998, 423.19998, 423.19998	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.058, 1.058, 1.058	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MG, AGS, ADP

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	0.52	1/6244 (0.0%)	0.92	9/8429 (0.1%)
1	B	0.51	0/6244	0.89	4/8429 (0.0%)
1	C	0.51	0/6244	0.89	6/8429 (0.1%)
1	D	0.56	1/6244 (0.0%)	0.93	10/8429 (0.1%)
1	E	0.53	0/6244	0.90	4/8429 (0.0%)
1	F	0.50	1/6244 (0.0%)	0.87	11/8429 (0.1%)
All	All	0.52	3/37464 (0.0%)	0.90	44/50574 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	F	0	1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	858	CYS	CB-SG	-6.52	1.71	1.82
1	D	637	CYS	CB-SG	-5.76	1.72	1.81
1	F	548	SER	CA-CB	-5.61	1.44	1.52

The worst 5 of 44 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	629	ASP	CB-CG-OD1	8.04	125.54	118.30
1	B	612	ASP	CB-CG-OD1	7.92	125.43	118.30
1	A	852	ASP	CB-CG-OD1	7.46	125.02	118.30
1	A	449	ASP	CB-CG-OD1	7.13	124.72	118.30

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WORLDWIDE
wwPDB
PROTEIN DATA BANK

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	449	ASP	CB-CG-OD1	7.08	124.67	118.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	F	302	ASP	Mainchain

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	6142	6286	6285	90	0
1	B	6142	6286	6285	90	0
1	C	6142	6285	6285	77	0
1	D	6142	6283	6286	82	0
1	E	6142	6284	6285	93	0
1	F	6142	6285	6285	104	0
2	G	145	116	46	1	0
3	A	31	12	12	9	0
3	B	31	12	12	4	0
3	C	31	12	12	4	0
3	E	31	12	12	6	0
3	F	31	12	12	3	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
4	E	1	0	0	0	0
4	F	1	0	0	0	0
5	D	27	12	12	5	0
All	All	37184	37897	37829	503	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 503 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:B:694:ASP:O	1:B:697:THR:OG1	1.95	0.84
1:A:714:LYS:NZ	1:B:651:ASP:O	2.14	0.80
1:F:590:ASP:OD1	1:F:638:THR:OG1	2.00	0.79
1:F:645:ILE:O	1:F:650:ARG:NH1	2.15	0.79
1:F:679:ARG:NH2	1:F:689:ALA:O	2.16	0.79

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	772/853 (90%)	712 (92%)	59 (8%)	1 (0%)	51	86
1	B	772/853 (90%)	700 (91%)	72 (9%)	0	100	100
1	C	772/853 (90%)	705 (91%)	67 (9%)	0	100	100
1	D	772/853 (90%)	715 (93%)	57 (7%)	0	100	100
1	E	772/853 (90%)	709 (92%)	63 (8%)	0	100	100
1	F	772/853 (90%)	710 (92%)	62 (8%)	0	100	100
All	All	4632/5118 (90%)	4251 (92%)	380 (8%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	512	GLY

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	675/741 (91%)	672 (100%)	3 (0%)	91	94
1	B	675/741 (91%)	672 (100%)	3 (0%)	91	94
1	C	675/741 (91%)	671 (99%)	4 (1%)	86	92
1	D	675/741 (91%)	671 (99%)	4 (1%)	86	92
1	E	675/741 (91%)	672 (100%)	3 (0%)	91	94
1	F	675/741 (91%)	672 (100%)	3 (0%)	91	94
All	All	4050/4446 (91%)	4030 (100%)	20 (0%)	89	93

5 of 20 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	131	ARG
1	F	311	ARG
1	F	597	ARG
1	F	393	LYS
1	C	393	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	657	ASN
1	E	307	ASN
1	E	377	GLN
1	F	541	ASN
1	F	843	HIS

5.3.3   RNA ⓘ

There are no RNA molecules in this entry.

5.4   Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 11 ligands modelled in this entry, 5 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	$\#|Z| > 2$
5	ADP	D	1001	-	24,29,29	1.00	1 (4%)	29,45,45	1.76	8 (27%)
3	AGS	F	1001	4	26,33,33	0.74	0	26,52,52	1.25	3 (11%)
3	AGS	A	1001	4	26,33,33	0.78	0	26,52,52	1.61	3 (11%)
3	AGS	E	1001	4	26,33,33	0.82	0	26,52,52	1.50	4 (15%)
3	AGS	B	1001	4	26,33,33	0.77	1 (3%)	26,52,52	1.68	3 (11%)
3	AGS	C	1001	4	26,33,33	0.71	0	26,52,52	1.69	3 (11%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	ADP	D	1001	-	-	5/12/32/32	0/3/3/3
3	AGS	F	1001	4	-	1/17/38/38	0/3/3/3
3	AGS	A	1001	4	-	3/17/38/38	0/3/3/3
3	AGS	E	1001	4	-	5/17/38/38	0/3/3/3
3	AGS	B	1001	4	-	4/17/38/38	0/3/3/3
3	AGS	C	1001	4	-	0/17/38/38	0/3/3/3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	D	1001	ADP	C5-C4	2.26	1.46	1.40

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1001	AGS	PG-S1G	2.12	1.95	1.90

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

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	1001	AGS	PA-O3A-PB	-7.25	107.96	132.83
3	B	1001	AGS	PA-O3A-PB	-6.52	110.45	132.83
3	A	1001	AGS	PA-O3A-PB	-6.52	110.46	132.83
3	E	1001	AGS	PA-O3A-PB	-5.20	114.97	132.83
3	F	1001	AGS	PA-O3A-PB	-4.35	117.89	132.83

There are no chirality outliers.

5 of 18 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	E	1001	AGS	C5'-O5'-PA-O1A
5	D	1001	ADP	C5'-O5'-PA-O3A
3	B	1001	AGS	O4'-C4'-C5'-O5'
3	A	1001	AGS	C3'-C4'-C5'-O5'
3	A	1001	AGS	O4'-C4'-C5'-O5'

There are no ring outliers.

6 monomers are involved in 31 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	1001	ADP	5	0
3	F	1001	AGS	3	0
3	A	1001	AGS	9	0
3	E	1001	AGS	6	0
3	B	1001	AGS	4	0
3	C	1001	AGS	4	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 then 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.

Ligand ADP D 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand AGS F 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand AGS A 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand AGS E 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand AGS B 1001

Bond lengths

Bond angles

Torsions

Rings

Ligand AGS C 1001

Bond lengths

Bond angles

Torsions

Rings
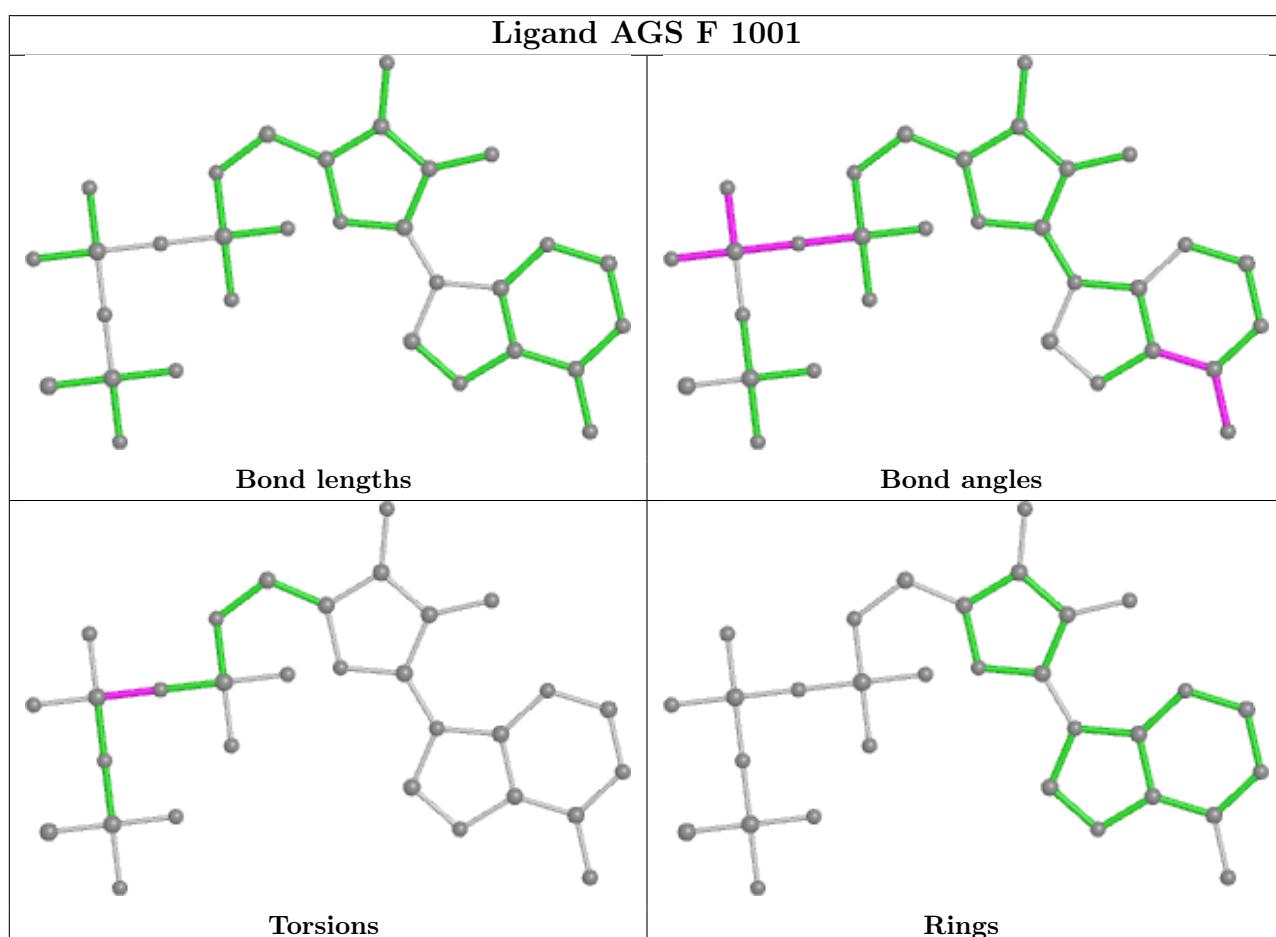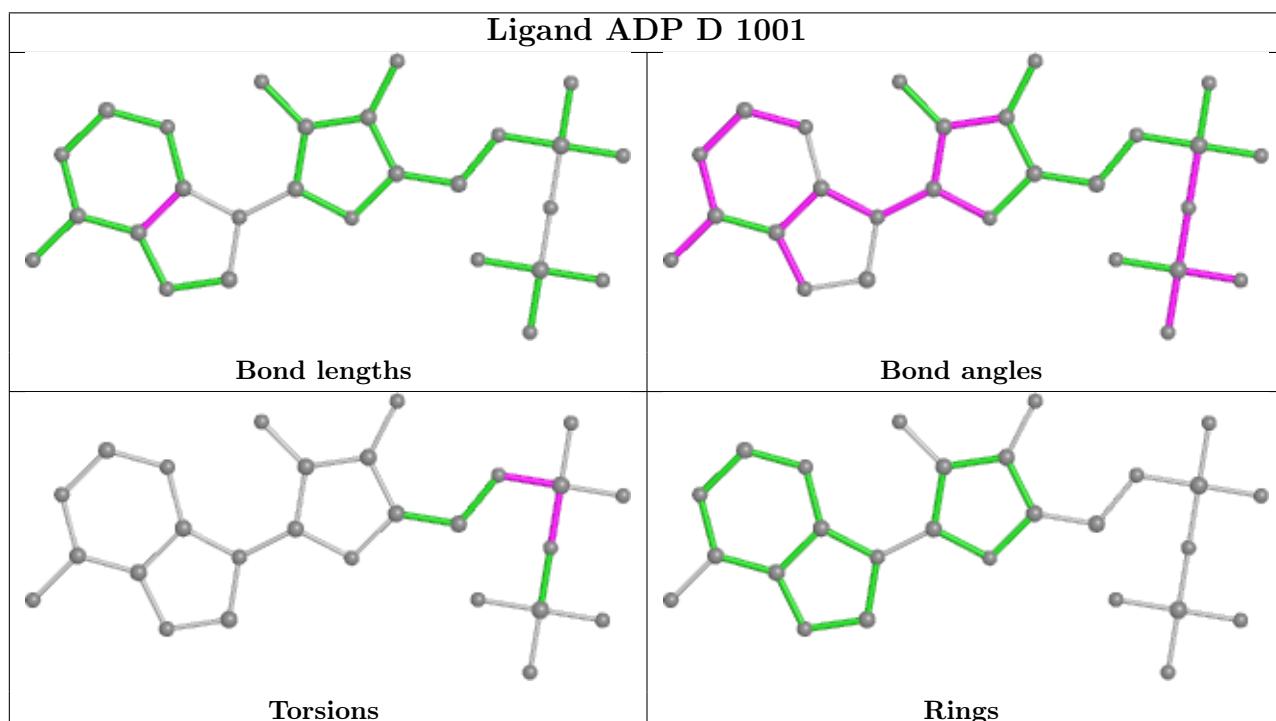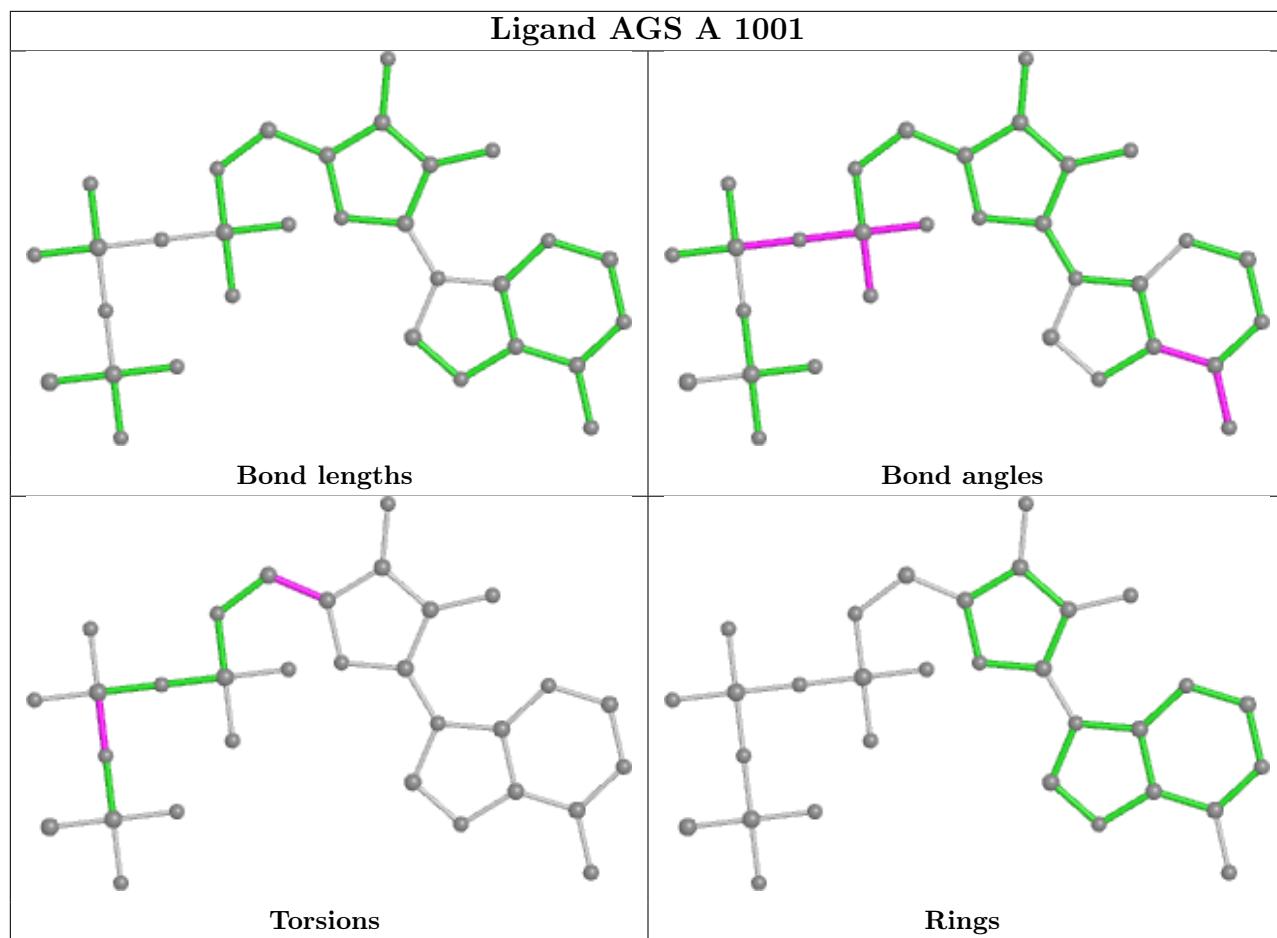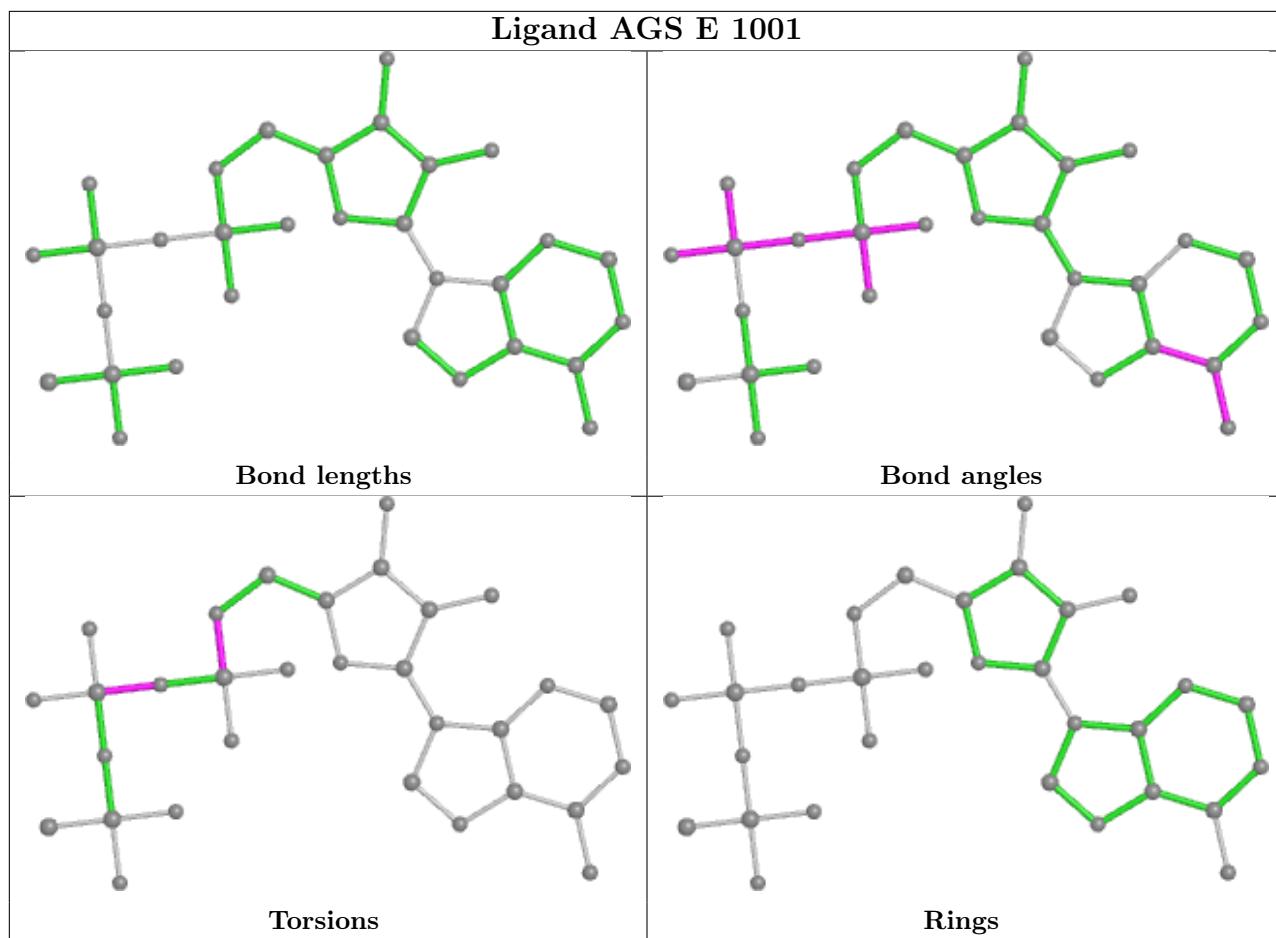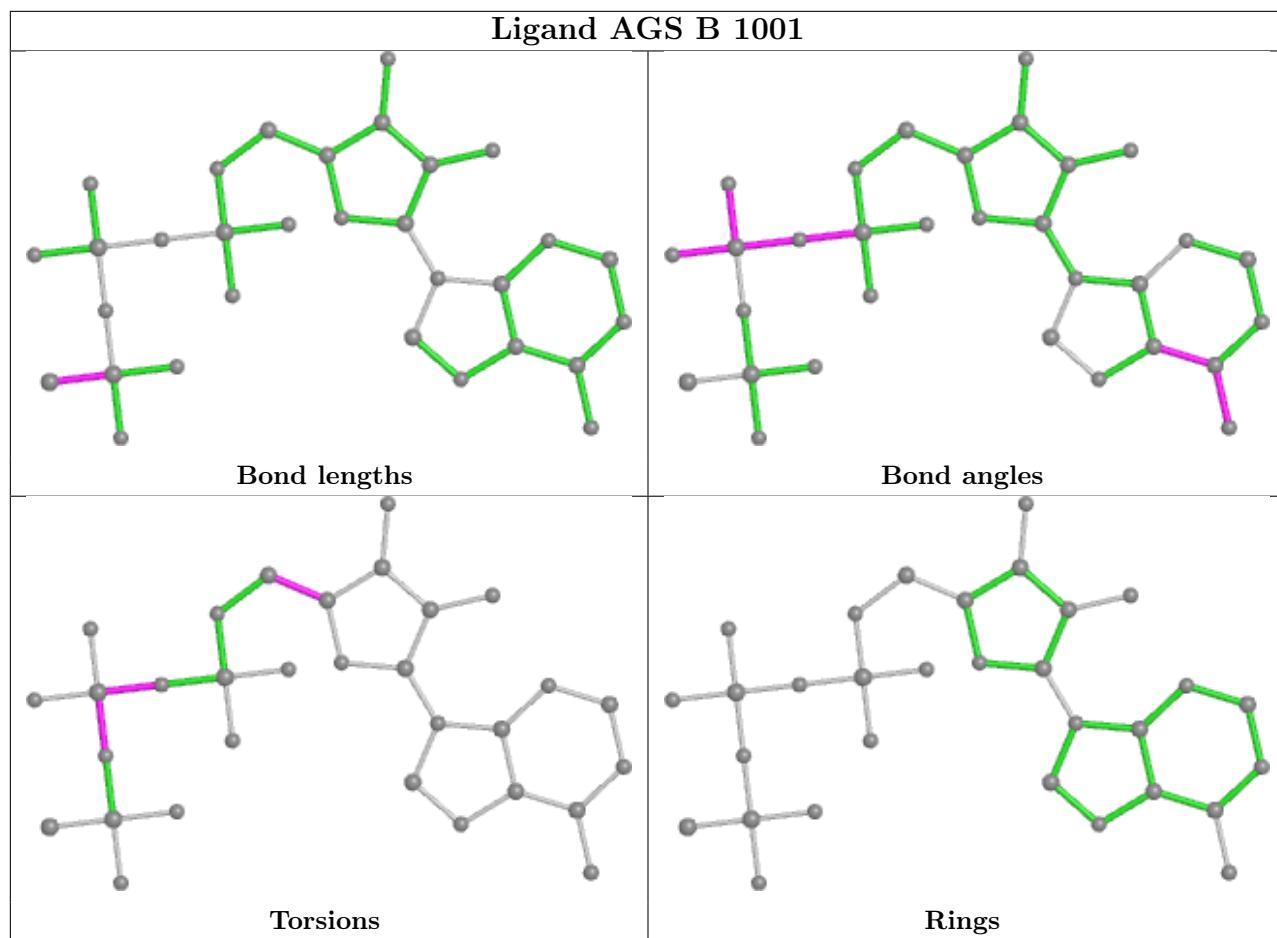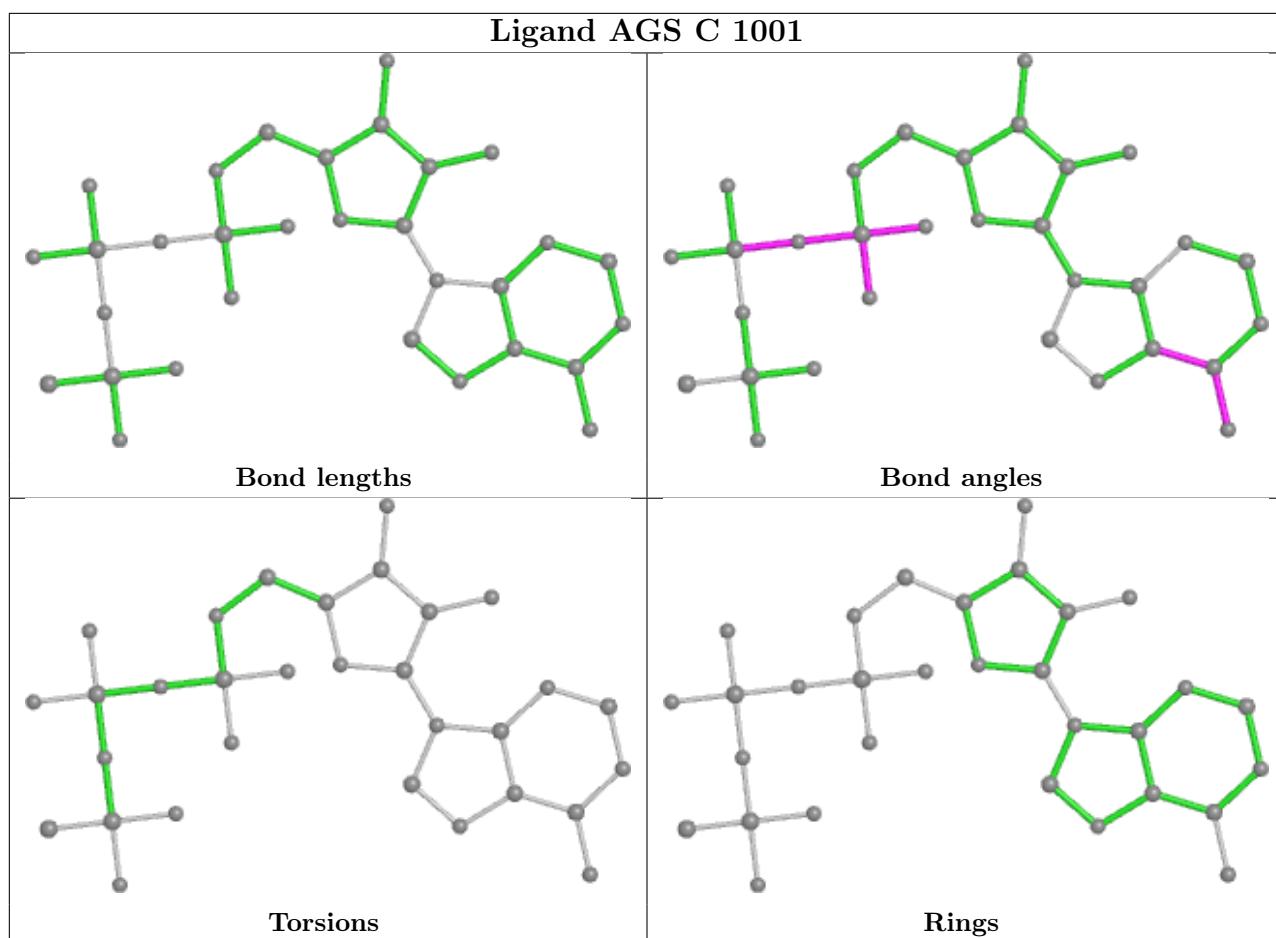
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Map visualisation ⓘ

This section contains visualisations of the EMDB entry EMD-12312. 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 ⓘ

6.1.1 Primary map

| X | Y | Z |
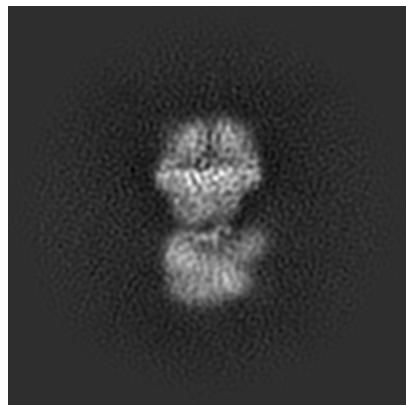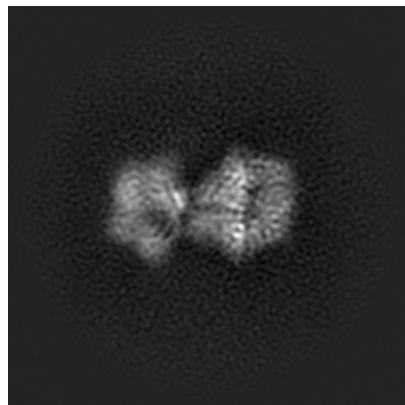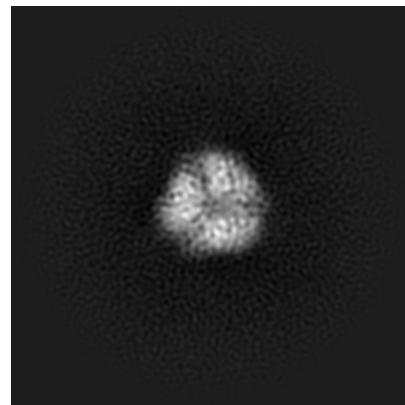
The images above show the map projected in three orthogonal directions.

6.2 Central slices ⓘ
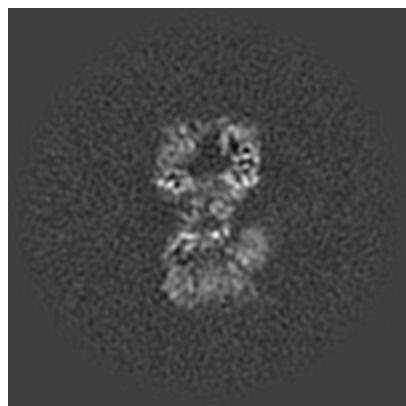
6.2.1 Primary map
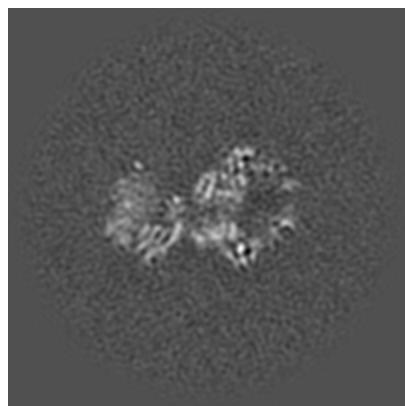
| X Index: 200 | Y Index: 200 | Z Index: 200 |
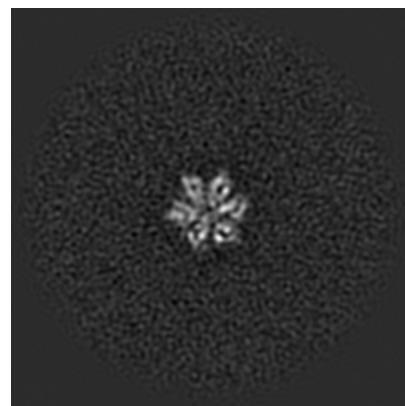
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices ⓘ
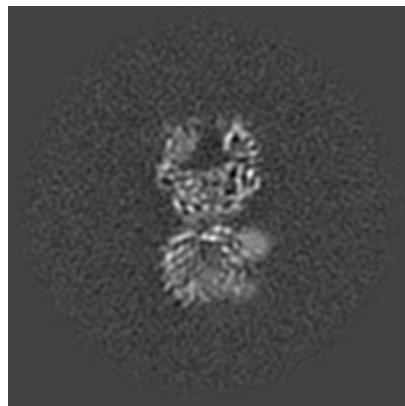
6.3.1 Primary map
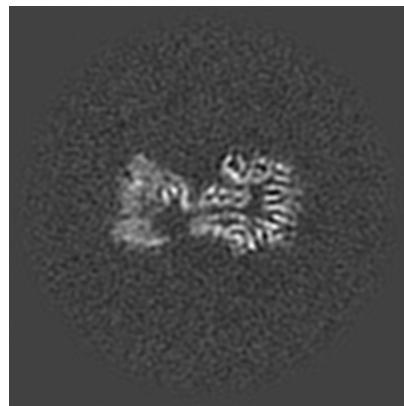
| X Index: 209 | Y Index: 217 | Z Index: 232 |
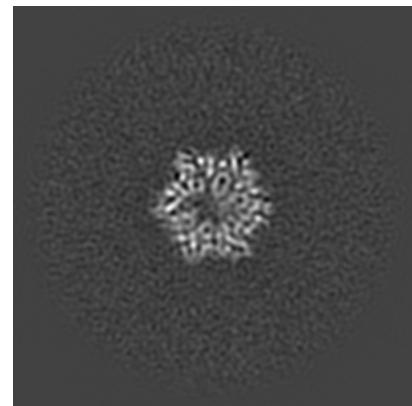
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal surface views ⓘ
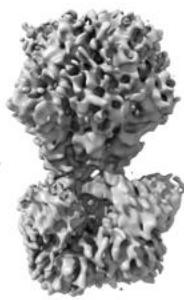
6.4.1 Primary map

| X | Y | Z |

The images above show the 3D surface view of the map at the recommended contour level 0.26. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5   Mask visualisation ⓘ

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

6.5.1   emd_12312_msk_1.map ⓘ
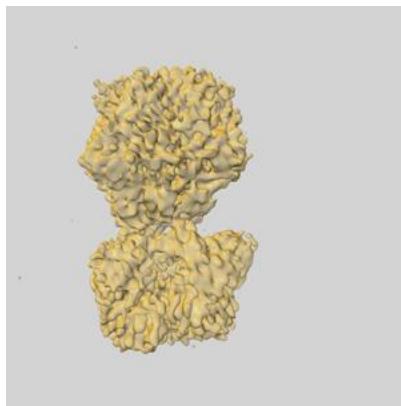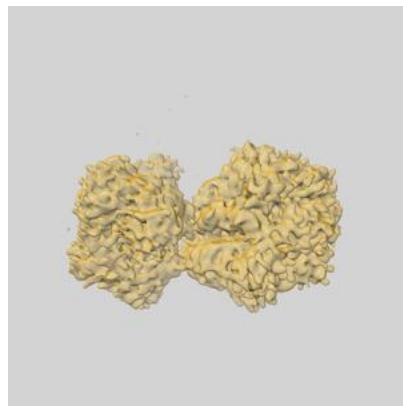
| X | Y | Z |

6.5.2   emd_12312_msk_2.map ⓘ
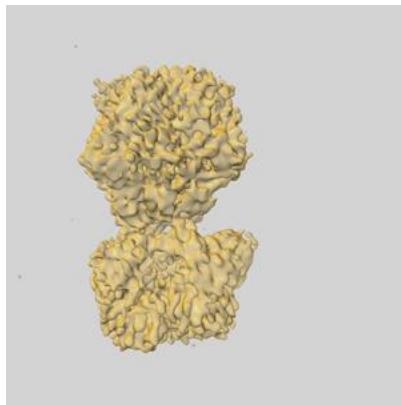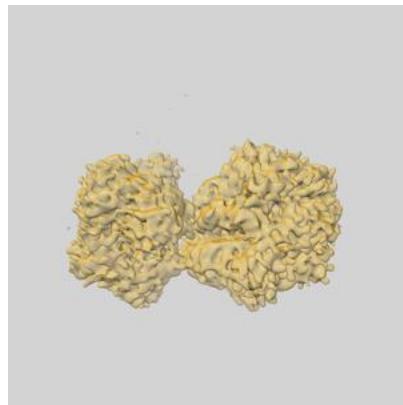
| X | Y | Z |

6.5.3   emd_12312_msk_3.map ⓘ

X   Y   Z
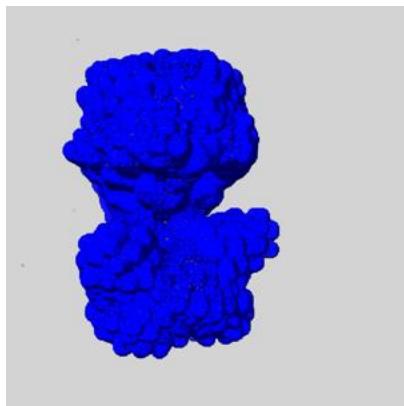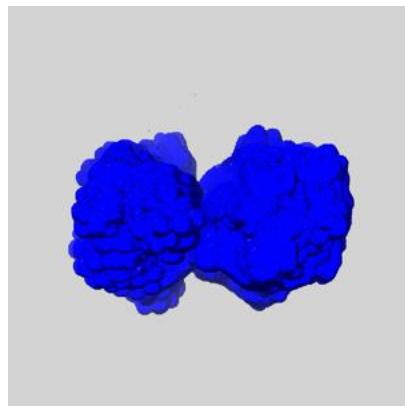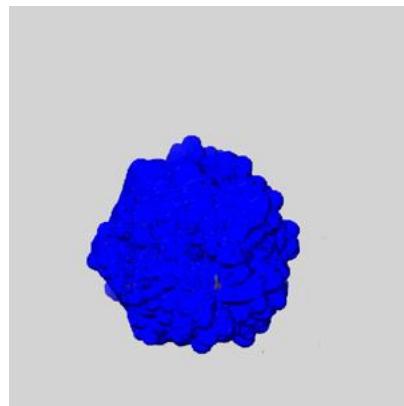
7   Map analysis ⓘ

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

7.1   Map-value distribution ⓘ

The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

7.2 Volume estimate ⓘ
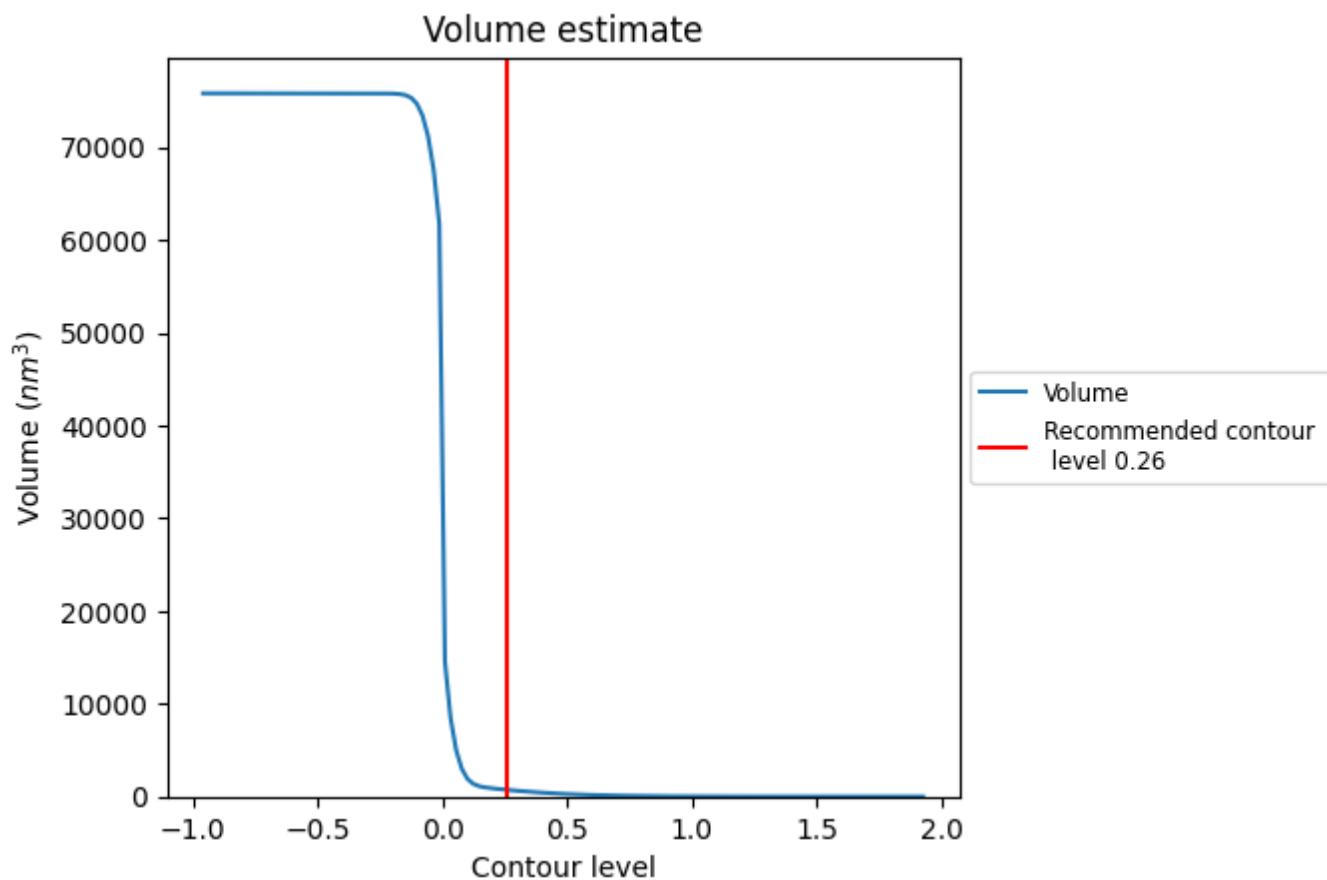
The volume at the recommended contour level is 720 nm^3; this corresponds to an approximate mass of 650 kDa.

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 ⓘ
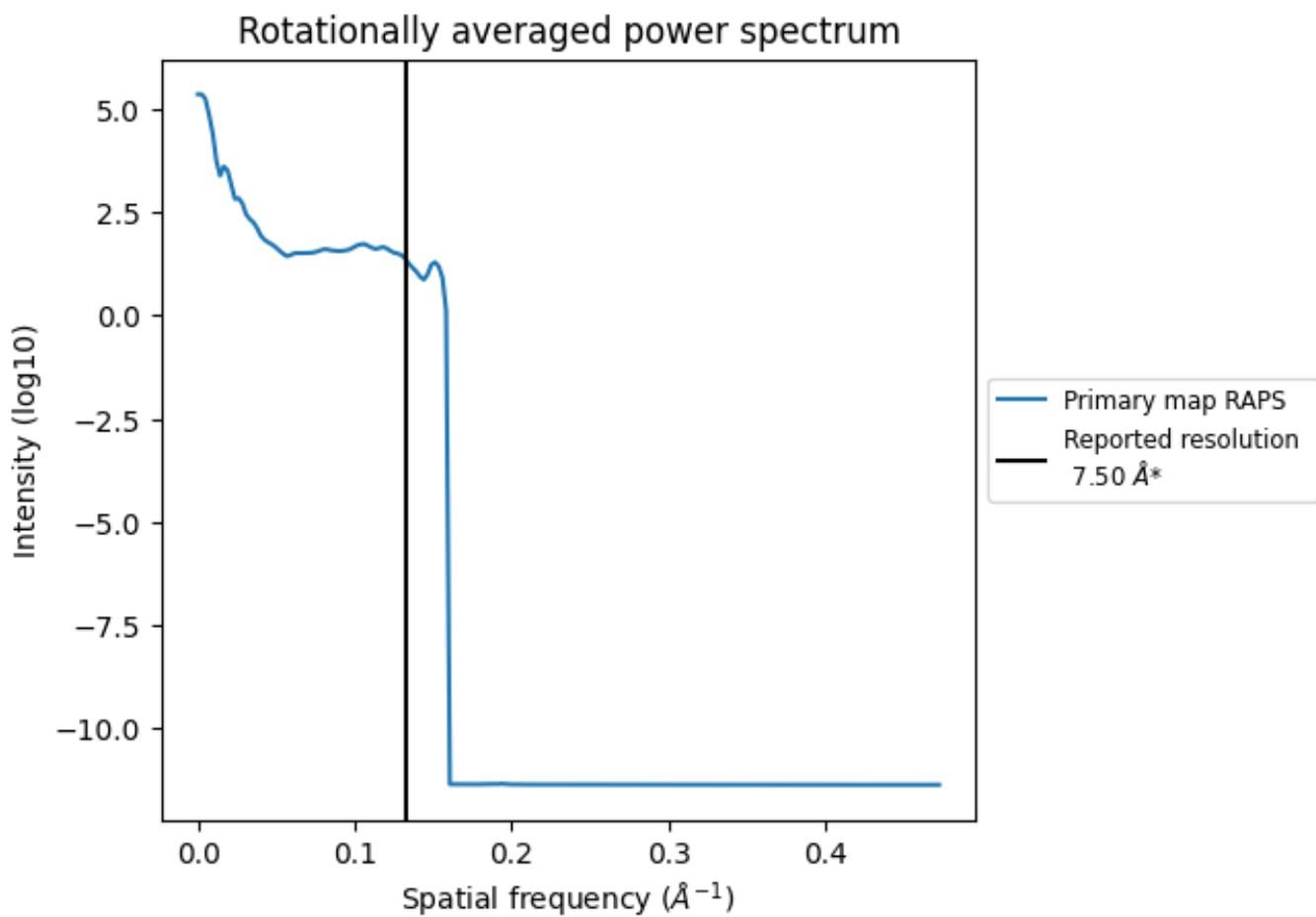
*Reported resolution corresponds to spatial frequency of 0.133 Å^{-1}

8   Fourier-Shell correlation ⓘ

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

8.1   FSC ⓘ
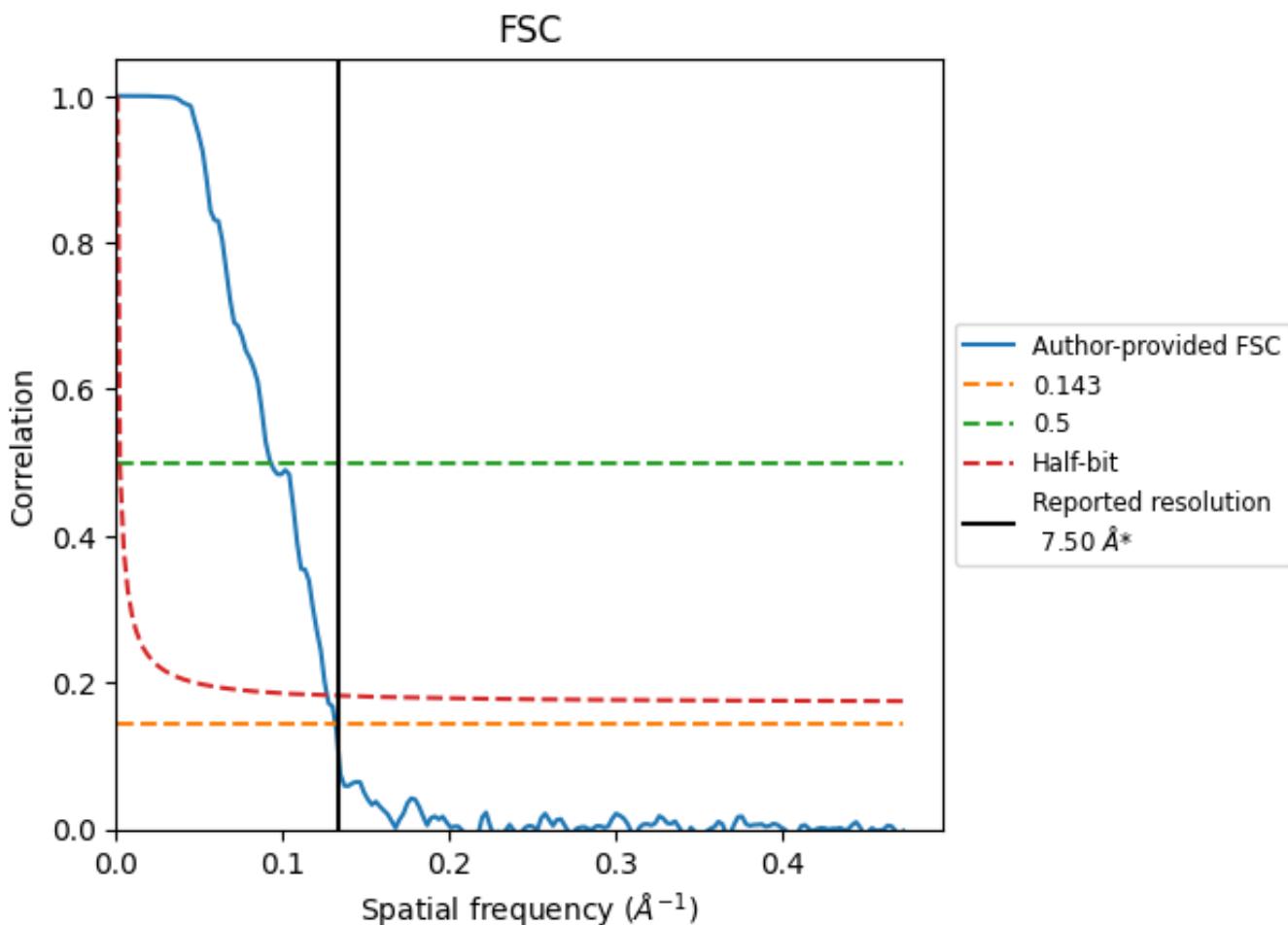
*Reported resolution corresponds to spatial frequency of 0.133 Å^{-1}

8.2   Resolution estimates (i)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	7.50	-	-
Author-provided FSC curve	7.59	10.76	7.89
Unmasked-calculated*	-	-	-

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

9 Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-12312 and PDB model 7NGC. Per-residue inclusion information can be found in section 3 on page 11.

9.1 Map-model overlay ⓘ

| X | Y | Z |
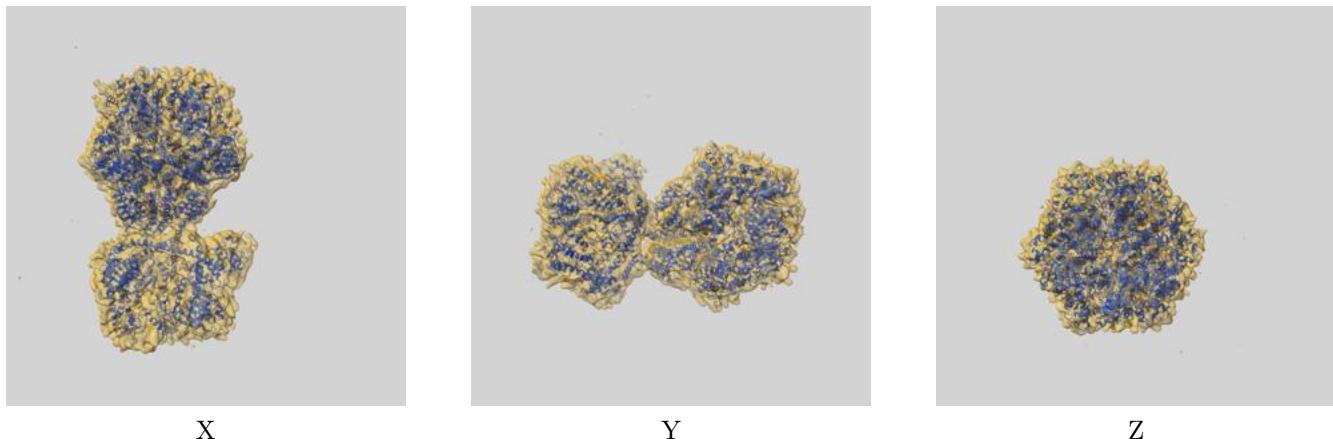
The images above show the 3D surface view of the map at the recommended contour level 0.26 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2　Q-score mapped to coordinate model ⓘ

X　　　　　　　　　Y　　　　　　　　　Z
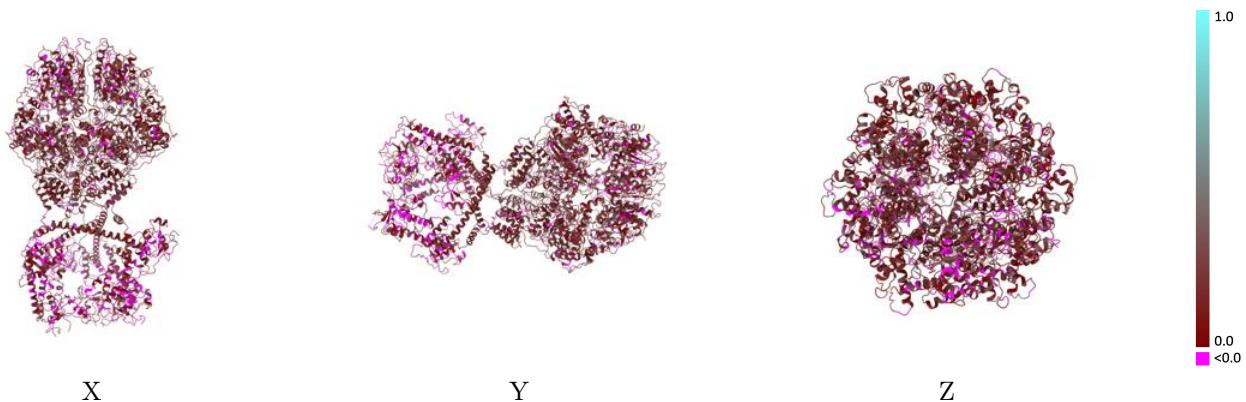
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

9.3　Atom inclusion mapped to coordinate model ⓘ

X　　　　　　　　　Y　　　　　　　　　Z
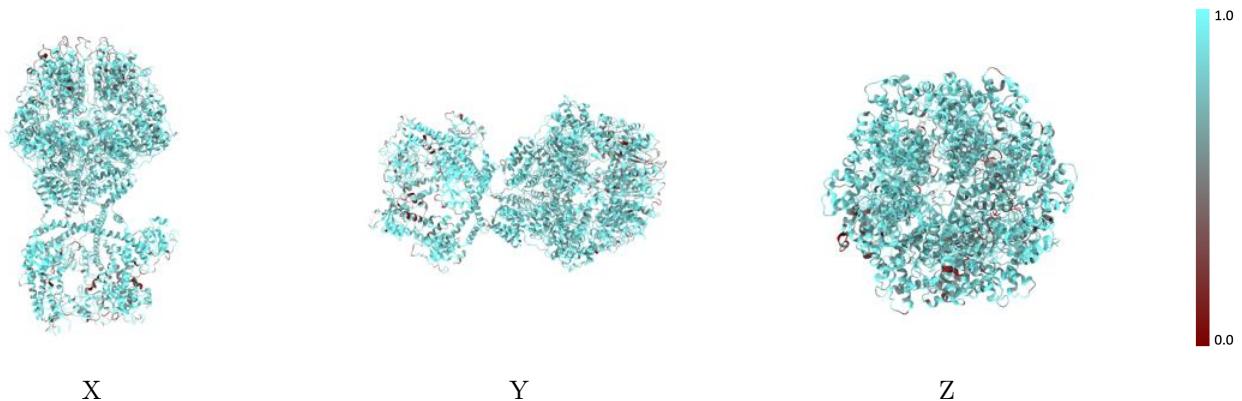
The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.26).

9.4 Atom inclusion ⓘ
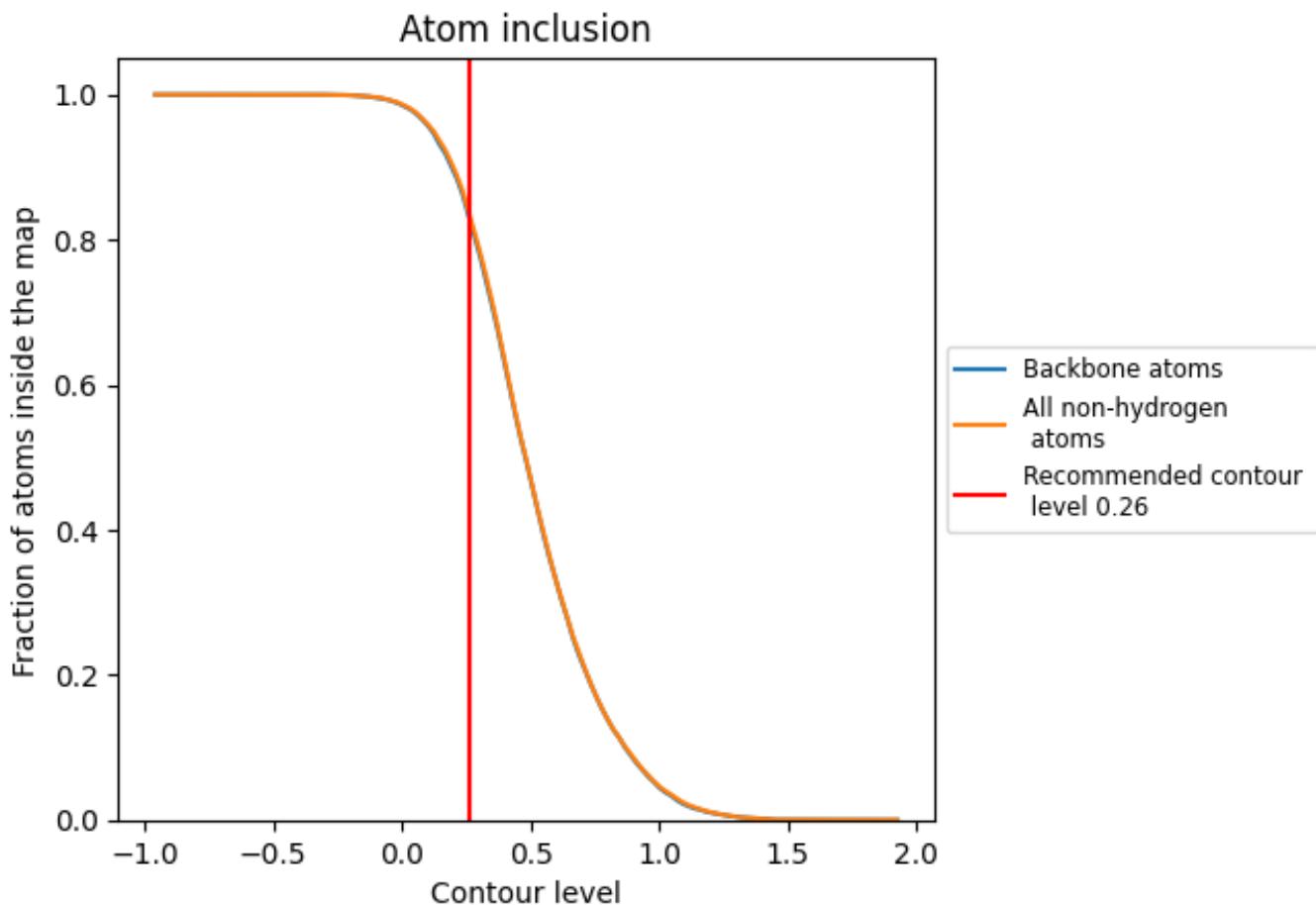
At the recommended contour level, 83% of all backbone atoms, 84% of all non-hydrogen atoms, are inside the map.

9.5   Map-model fit summary ⓘ

The table lists the average atom inclusion at the recommended contour level (0.26) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8372	0.1450
A	0.8378	0.1350
B	0.8261	0.1440
C	0.8279	0.1480
D	0.8420	0.1510
E	0.8587	0.1510
F	0.8365	0.1370
G	0.8069	0.3130

1.0

0.0
<0.0