



wwPDB EM Validation Summary Report ⓘ

Mar 9, 2026 – 12:27 AM UTC

PDB ID : 7SY2 / pdb_00007sy2
EMDB ID : EMD-25514
Title : Cryo-EM structure of the SARS-CoV-2 D614G,N501Y mutant spike protein ectodomain bound to human ACE2 ectodomain (focused refinement of RBD and ACE2)
Authors : Zhu, X.; Mannar, D.; Saville, J.W.; Srivastava, S.S.; Berezuk, A.M.; Zhou, S.; Tuttle, K.S.; Kim, A.; Li, W.; Dimitrov, D.S.; Subramaniam, S.
Deposited on : 2021-11-24
Resolution : 3.11 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

EMDB validation analysis : 0.0.1.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)
Validation Pipeline (wwPDB-VP) : 2.49

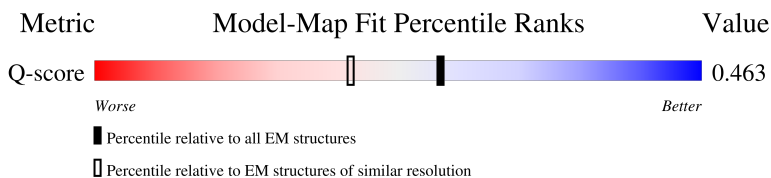
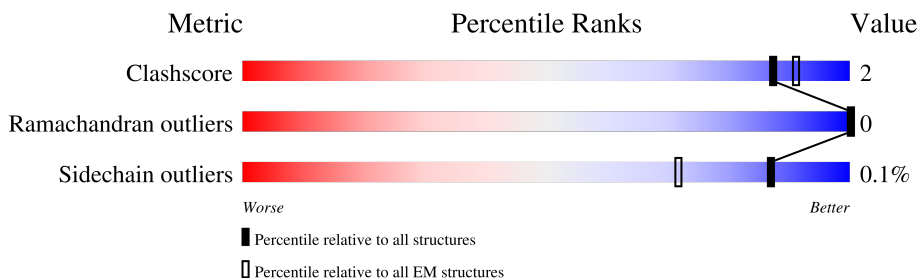
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.11 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	14465 (2.61 - 3.61)

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	B	1288	
2	E	606	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6554 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 Spike glycoprotein.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	B	201	Total	C	N	O	S	0	0
			1594	1024	265	297	8		

There are 91 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	501	TYR	ASN	engineered mutation	UNP P0DTC2
B	614	GLY	ASP	engineered mutation	UNP P0DTC2
B	682	GLY	ARG	conflict	UNP P0DTC2
B	683	SER	ARG	conflict	UNP P0DTC2
B	685	SER	ARG	conflict	UNP P0DTC2
B	817	PRO	PHE	conflict	UNP P0DTC2
B	892	PRO	ALA	conflict	UNP P0DTC2
B	899	PRO	ALA	conflict	UNP P0DTC2
B	942	PRO	ALA	conflict	UNP P0DTC2
B	986	PRO	LYS	conflict	UNP P0DTC2
B	987	PRO	VAL	conflict	UNP P0DTC2
B	1209	GLY	-	expression tag	UNP P0DTC2
B	1210	SER	-	expression tag	UNP P0DTC2
B	1211	GLY	-	expression tag	UNP P0DTC2
B	1212	TYR	-	expression tag	UNP P0DTC2
B	1213	ILE	-	expression tag	UNP P0DTC2
B	1214	PRO	-	expression tag	UNP P0DTC2
B	1215	GLU	-	expression tag	UNP P0DTC2
B	1216	ALA	-	expression tag	UNP P0DTC2
B	1217	PRO	-	expression tag	UNP P0DTC2
B	1218	ARG	-	expression tag	UNP P0DTC2
B	1219	ASP	-	expression tag	UNP P0DTC2
B	1220	GLY	-	expression tag	UNP P0DTC2
B	1221	GLN	-	expression tag	UNP P0DTC2
B	1222	ALA	-	expression tag	UNP P0DTC2
B	1223	TYR	-	expression tag	UNP P0DTC2
B	1224	VAL	-	expression tag	UNP P0DTC2
B	1225	ARG	-	expression tag	UNP P0DTC2

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Chain	Residue	Modelled	Actual	Comment	Reference
B	1226	LYS	-	expression tag	UNP P0DTC2
B	1227	ASP	-	expression tag	UNP P0DTC2
B	1228	GLY	-	expression tag	UNP P0DTC2
B	1229	GLU	-	expression tag	UNP P0DTC2
B	1230	TRP	-	expression tag	UNP P0DTC2
B	1231	VAL	-	expression tag	UNP P0DTC2
B	1232	LEU	-	expression tag	UNP P0DTC2
B	1233	LEU	-	expression tag	UNP P0DTC2
B	1234	SER	-	expression tag	UNP P0DTC2
B	1235	THR	-	expression tag	UNP P0DTC2
B	1236	PHE	-	expression tag	UNP P0DTC2
B	1237	LEU	-	expression tag	UNP P0DTC2
B	1238	GLY	-	expression tag	UNP P0DTC2
B	1239	ARG	-	expression tag	UNP P0DTC2
B	1240	SER	-	expression tag	UNP P0DTC2
B	1241	LEU	-	expression tag	UNP P0DTC2
B	1242	GLU	-	expression tag	UNP P0DTC2
B	1243	VAL	-	expression tag	UNP P0DTC2
B	1244	LEU	-	expression tag	UNP P0DTC2
B	1245	PHE	-	expression tag	UNP P0DTC2
B	1246	GLN	-	expression tag	UNP P0DTC2
B	1247	GLY	-	expression tag	UNP P0DTC2
B	1248	PRO	-	expression tag	UNP P0DTC2
B	1249	GLY	-	expression tag	UNP P0DTC2
B	1250	HIS	-	expression tag	UNP P0DTC2
B	1251	HIS	-	expression tag	UNP P0DTC2
B	1252	HIS	-	expression tag	UNP P0DTC2
B	1253	HIS	-	expression tag	UNP P0DTC2
B	1254	HIS	-	expression tag	UNP P0DTC2
B	1255	HIS	-	expression tag	UNP P0DTC2
B	1256	HIS	-	expression tag	UNP P0DTC2
B	1257	HIS	-	expression tag	UNP P0DTC2
B	1258	SER	-	expression tag	UNP P0DTC2
B	1259	ALA	-	expression tag	UNP P0DTC2
B	1260	TRP	-	expression tag	UNP P0DTC2
B	1261	SER	-	expression tag	UNP P0DTC2
B	1262	HIS	-	expression tag	UNP P0DTC2
B	1263	PRO	-	expression tag	UNP P0DTC2
B	1264	GLN	-	expression tag	UNP P0DTC2
B	1265	PHE	-	expression tag	UNP P0DTC2
B	1266	GLU	-	expression tag	UNP P0DTC2
B	1267	LYS	-	expression tag	UNP P0DTC2

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Chain	Residue	Modelled	Actual	Comment	Reference
B	1268	GLY	-	expression tag	UNP P0DTC2
B	1269	GLY	-	expression tag	UNP P0DTC2
B	1270	GLY	-	expression tag	UNP P0DTC2
B	1271	SER	-	expression tag	UNP P0DTC2
B	1272	GLY	-	expression tag	UNP P0DTC2
B	1273	GLY	-	expression tag	UNP P0DTC2
B	1274	GLY	-	expression tag	UNP P0DTC2
B	1275	GLY	-	expression tag	UNP P0DTC2
B	1276	SER	-	expression tag	UNP P0DTC2
B	1277	GLY	-	expression tag	UNP P0DTC2
B	1278	GLY	-	expression tag	UNP P0DTC2
B	1279	SER	-	expression tag	UNP P0DTC2
B	1280	ALA	-	expression tag	UNP P0DTC2
B	1281	TRP	-	expression tag	UNP P0DTC2
B	1282	SER	-	expression tag	UNP P0DTC2
B	1283	HIS	-	expression tag	UNP P0DTC2
B	1284	PRO	-	expression tag	UNP P0DTC2
B	1285	GLN	-	expression tag	UNP P0DTC2
B	1286	PHE	-	expression tag	UNP P0DTC2
B	1287	GLU	-	expression tag	UNP P0DTC2
B	1288	LYS	-	expression tag	UNP P0DTC2

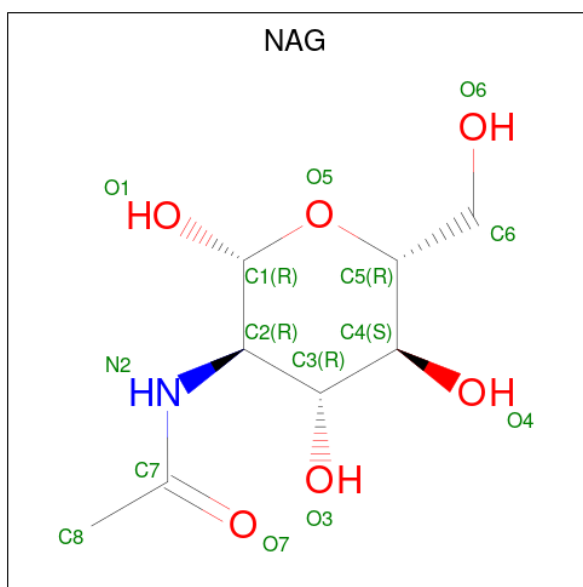
- Molecule 2 is a protein called Processed angiotensin-converting enzyme 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	E	596	Total	C	N	O	S	0	0
			4862	3111	805	917	29		

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	616	HIS	-	expression tag	UNP Q9BYF1
E	617	HIS	-	expression tag	UNP Q9BYF1
E	618	HIS	-	expression tag	UNP Q9BYF1
E	619	HIS	-	expression tag	UNP Q9BYF1
E	620	HIS	-	expression tag	UNP Q9BYF1
E	621	HIS	-	expression tag	UNP Q9BYF1
E	622	HIS	-	expression tag	UNP Q9BYF1
E	623	HIS	-	expression tag	UNP Q9BYF1

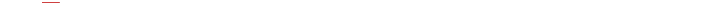
- Molecule 3 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).

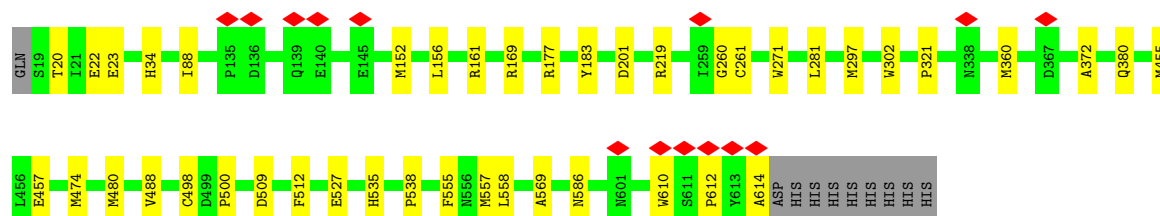


Mol	Chain	Residues	Atoms				AltConf
3	B	1	Total	C	N	O	0
			14	8	1	5	
3	E	1	Total	C	N	O	0
			14	8	1	5	
3	E	1	Total	C	N	O	0
			14	8	1	5	
3	E	1	Total	C	N	O	0
			14	8	1	5	
3	E	1	Total	C	N	O	0
			14	8	1	5	
3	E	1	Total	C	N	O	0
			14	8	1	5	

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

- Molecule 2: Processed angiotensin-converting enzyme 2

Chain E:  91% 7% 2%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	74520	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)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	1.648	Depositor
Minimum map value	-0.685	Depositor
Average map value	-0.001	Depositor
Map value standard deviation	0.032	Depositor
Recommended contour level	0.323	Depositor
Map size ($\text{\AA}$)	400.0, 400.0, 400.0	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.0, 1.0, 1.0	Depositor

5 Model quality

5.1 Standard geometry

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

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	B	0.21	0/1640	0.49	0/2231
2	E	0.21	0/4999	0.49	0/6792
All	All	0.21	0/6639	0.49	0/9023

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

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	B	1594	0	1518	5	0
2	E	4862	0	4635	21	0
3	B	14	0	13	0	0
3	E	84	0	78	0	0
All	All	6554	0	6244	26	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.

The worst 5 of 26 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)
2:E:152:MET:O	2:E:161:ARG:NH1	2.36	0.58
2:E:20:THR:HG23	2:E:23:GLU:H	1.73	0.54
2:E:260:GLY:HA3	2:E:612:PRO:HD3	1.90	0.53
2:E:261:CYS:HB2	2:E:488:VAL:HB	1.90	0.53
2:E:201:ASP:OD2	2:E:219:ARG:NH1	2.43	0.52

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	199/1288 (16%)	195 (98%)	4 (2%)	0	100	100
2	E	594/606 (98%)	587 (99%)	7 (1%)	0	100	100
All	All	793/1894 (42%)	782 (99%)	11 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	174/1115 (16%)	174 (100%)	0	100	100
2	E	526/536 (98%)	525 (100%)	1 (0%)	87	87
All	All	700/1651 (42%)	699 (100%)	1 (0%)	87	90

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	E	34	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
2	E	325	GLN
2	E	374	HIS
2	E	417	HIS
2	E	42	GLN
1	B	493	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](#)

7 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	NAG	E	702	2	14,14,15	0.58	0	17,19,21	0.63	0
3	NAG	B	1301	1	14,14,15	0.65	1 (7%)	17,19,21	1.10	2 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	NAG	E	704	2	14,14,15	0.58	0	17,19,21	0.64	1 (5%)
3	NAG	E	705	2	14,14,15	0.33	0	17,19,21	0.64	1 (5%)
3	NAG	E	706	2	14,14,15	0.46	0	17,19,21	0.77	1 (5%)
3	NAG	E	703	2	14,14,15	0.38	0	17,19,21	0.45	0
3	NAG	E	701	2	14,14,15	0.42	0	17,19,21	0.51	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
3	NAG	E	702	2	-	0/6/23/26	0/1/1/1
3	NAG	B	1301	1	-	2/6/23/26	0/1/1/1
3	NAG	E	704	2	-	2/6/23/26	0/1/1/1
3	NAG	E	705	2	-	0/6/23/26	0/1/1/1
3	NAG	E	706	2	-	2/6/23/26	0/1/1/1
3	NAG	E	703	2	-	2/6/23/26	0/1/1/1
3	NAG	E	701	2	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1301	NAG	C1-C2	2.22	1.55	1.52

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1301	NAG	C2-N2-C7	3.23	127.23	122.90
3	E	706	NAG	C1-O5-C5	2.88	116.04	112.19
3	E	705	NAG	C1-O5-C5	2.31	115.28	112.19
3	B	1301	NAG	C1-O5-C5	2.25	115.20	112.19
3	E	704	NAG	C1-O5-C5	2.17	115.10	112.19

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	E	704	NAG	O5-C5-C6-O6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms
3	E	706	NAG	C4-C5-C6-O6
3	E	704	NAG	C4-C5-C6-O6
3	E	701	NAG	C4-C5-C6-O6
3	E	706	NAG	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

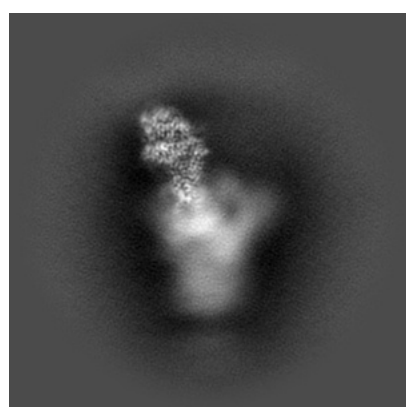
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-25514. These allow visual inspection of the internal detail of the map and identification of artifacts.

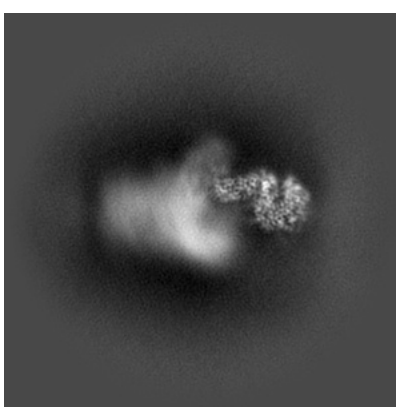
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

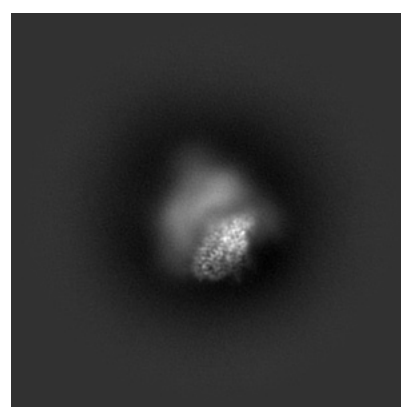
6.1.1 Primary map



X



Y

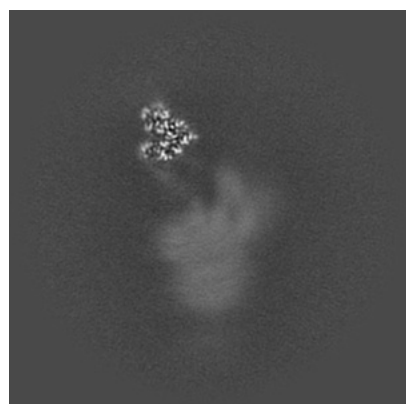


Z

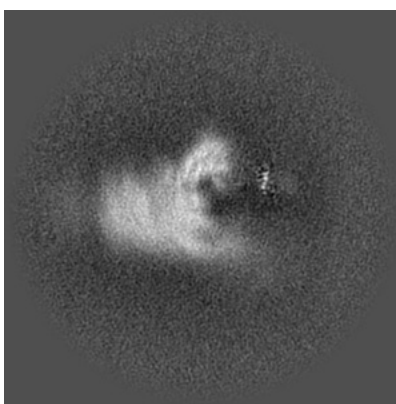
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

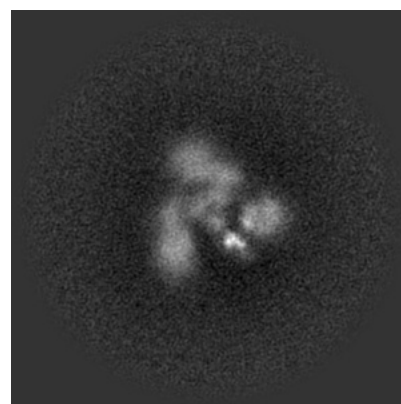
6.2.1 Primary map



X Index: 200



Y Index: 200

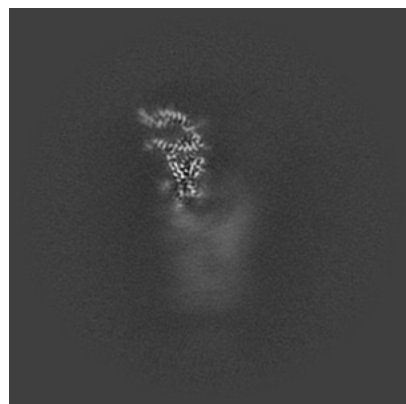


Z Index: 200

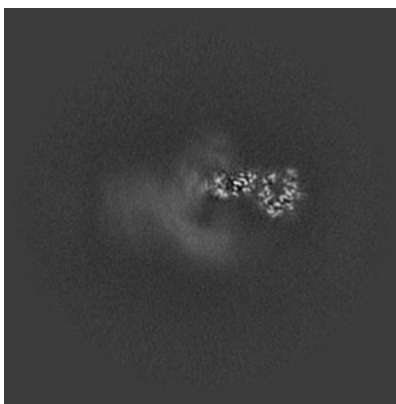
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

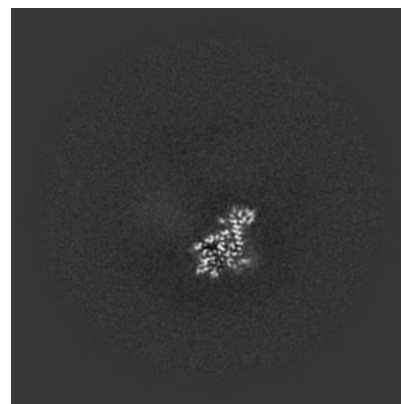
6.3.1 Primary map



X Index: 225



Y Index: 173

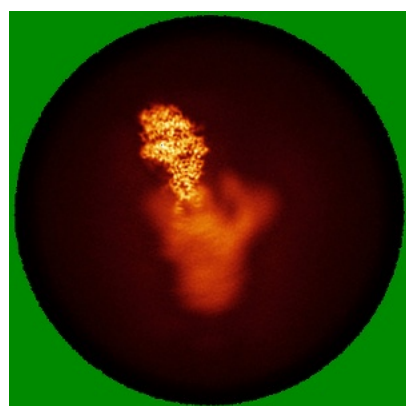


Z Index: 259

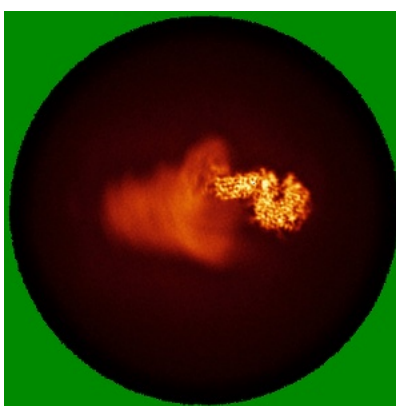
The images above show the largest variance slices of the map in three orthogonal directions.

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

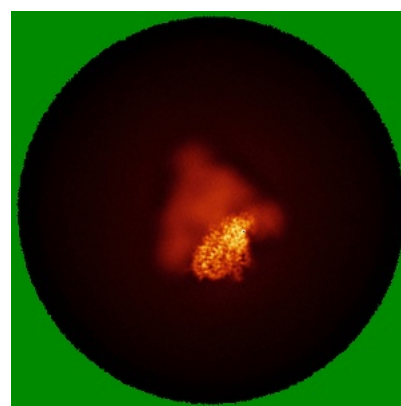
6.4.1 Primary map



X



Y



Z

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

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.323. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

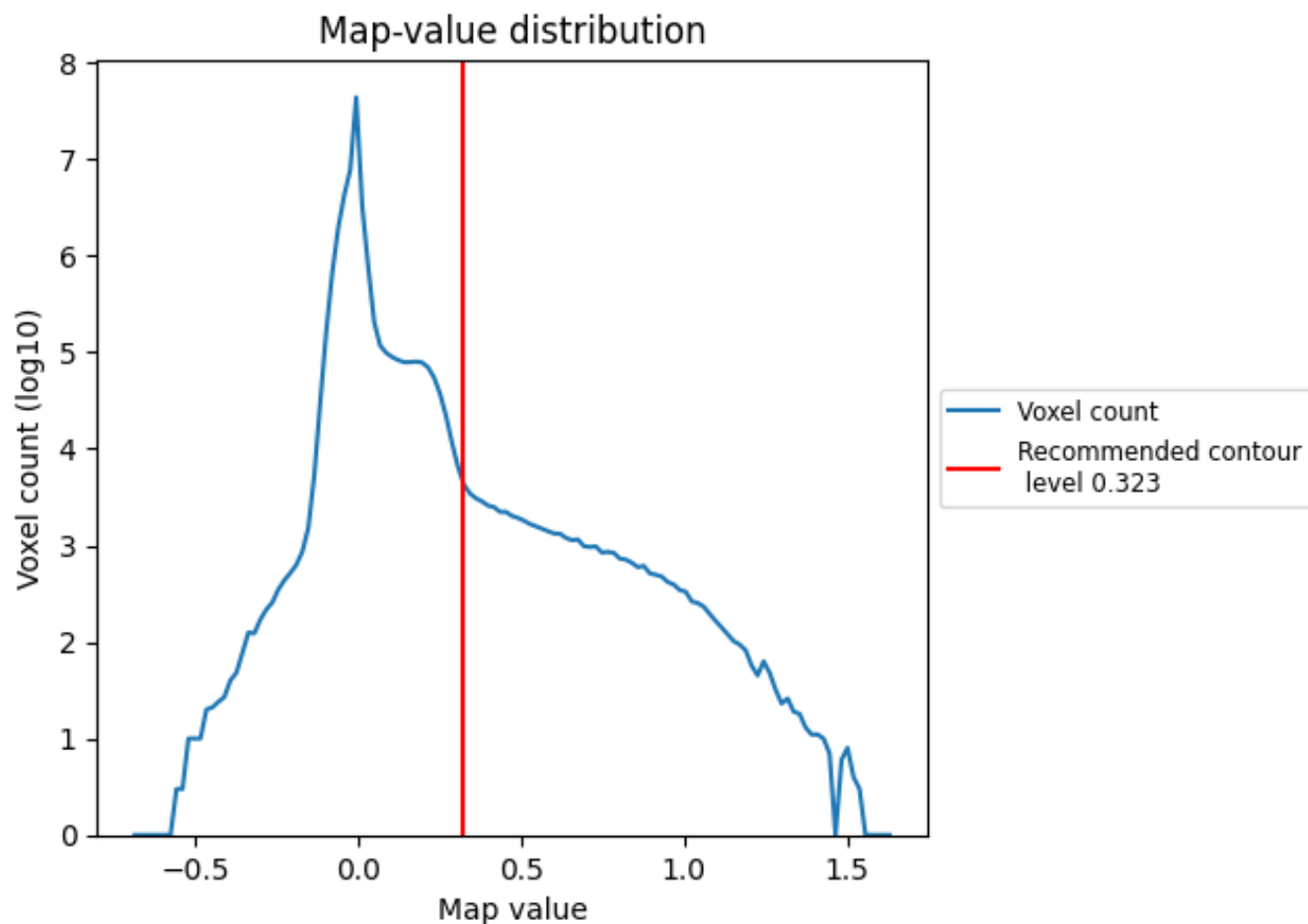
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

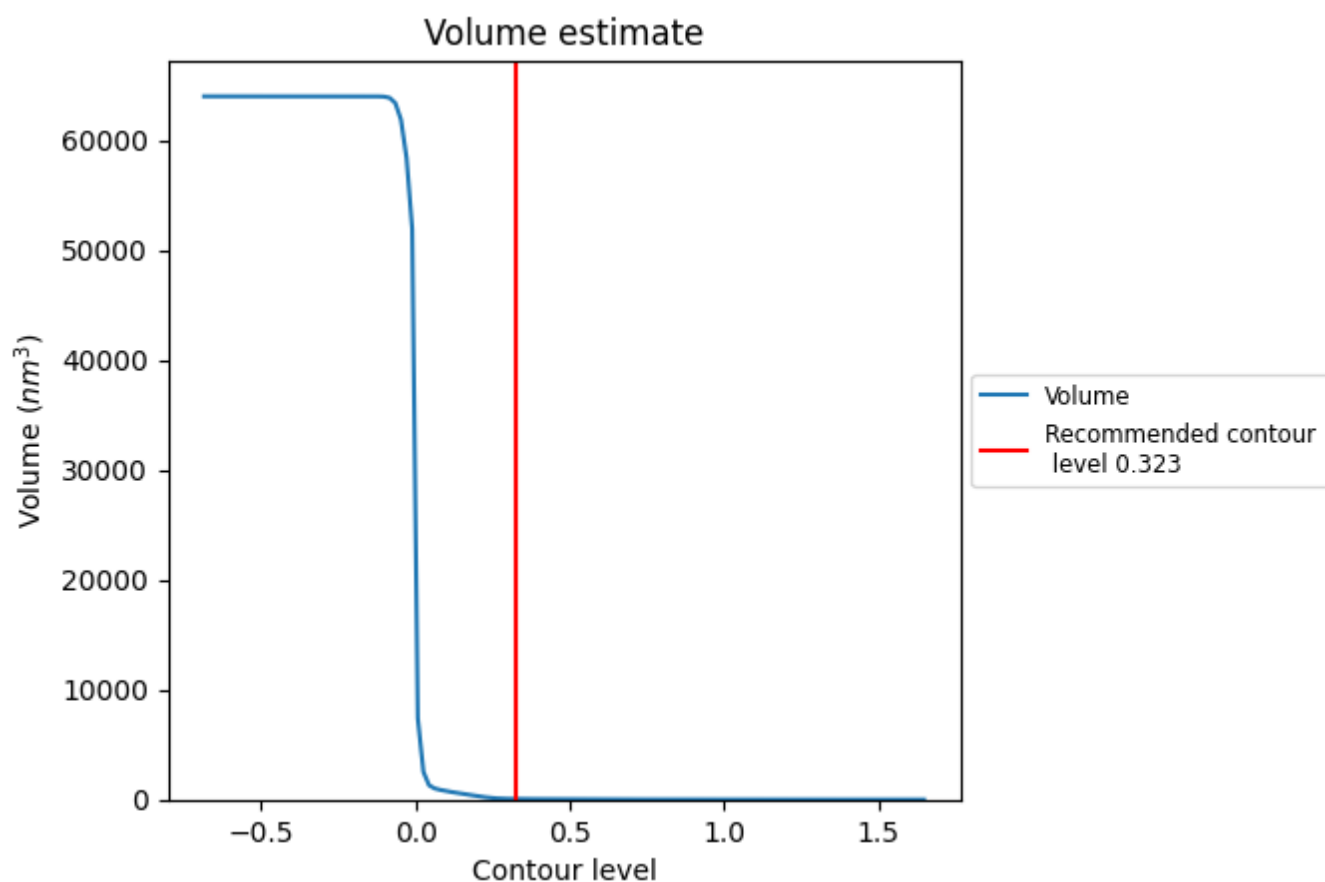
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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

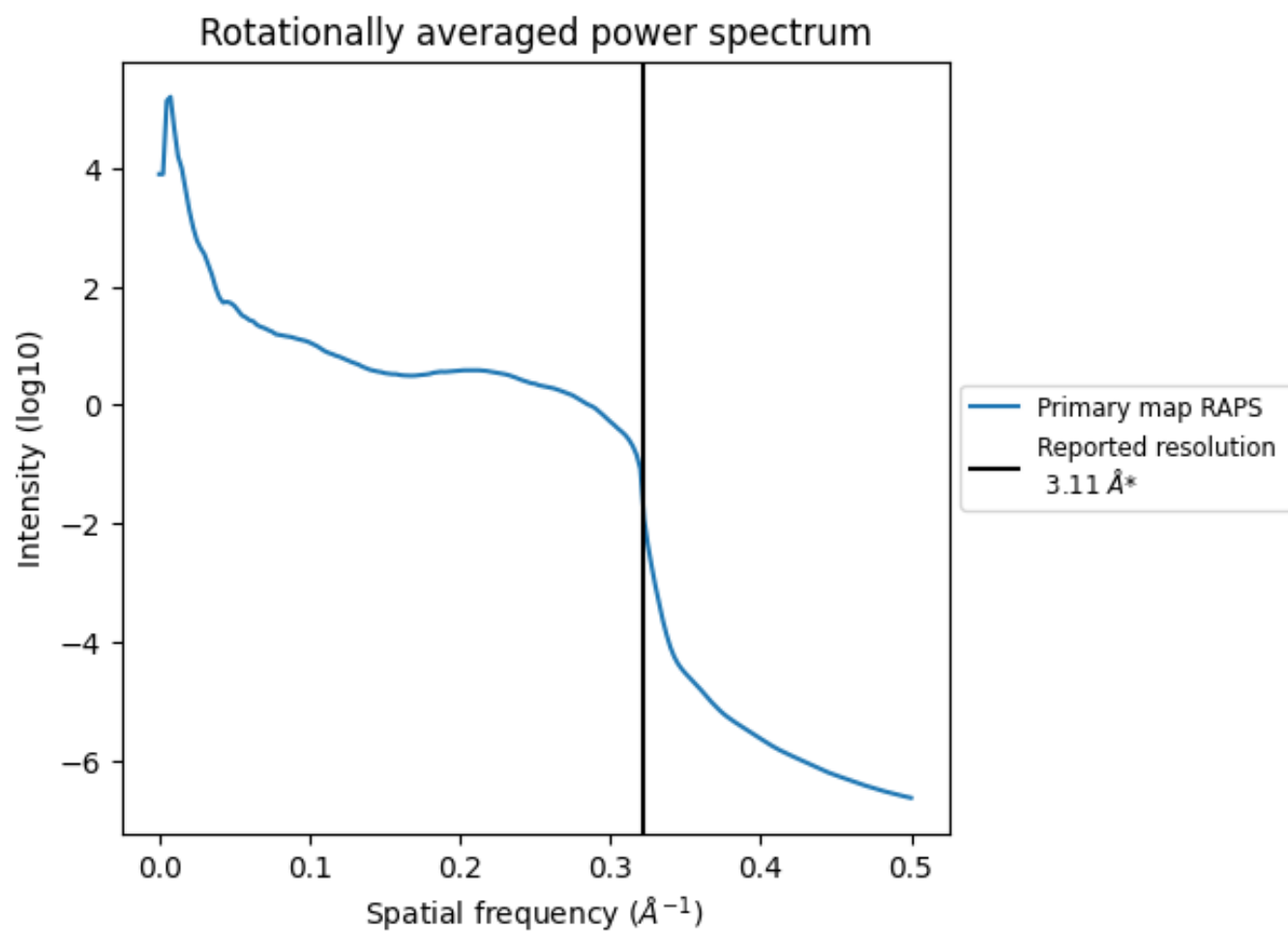
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 56 nm^3 ; this corresponds to an approximate mass of 50 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 ⓘ

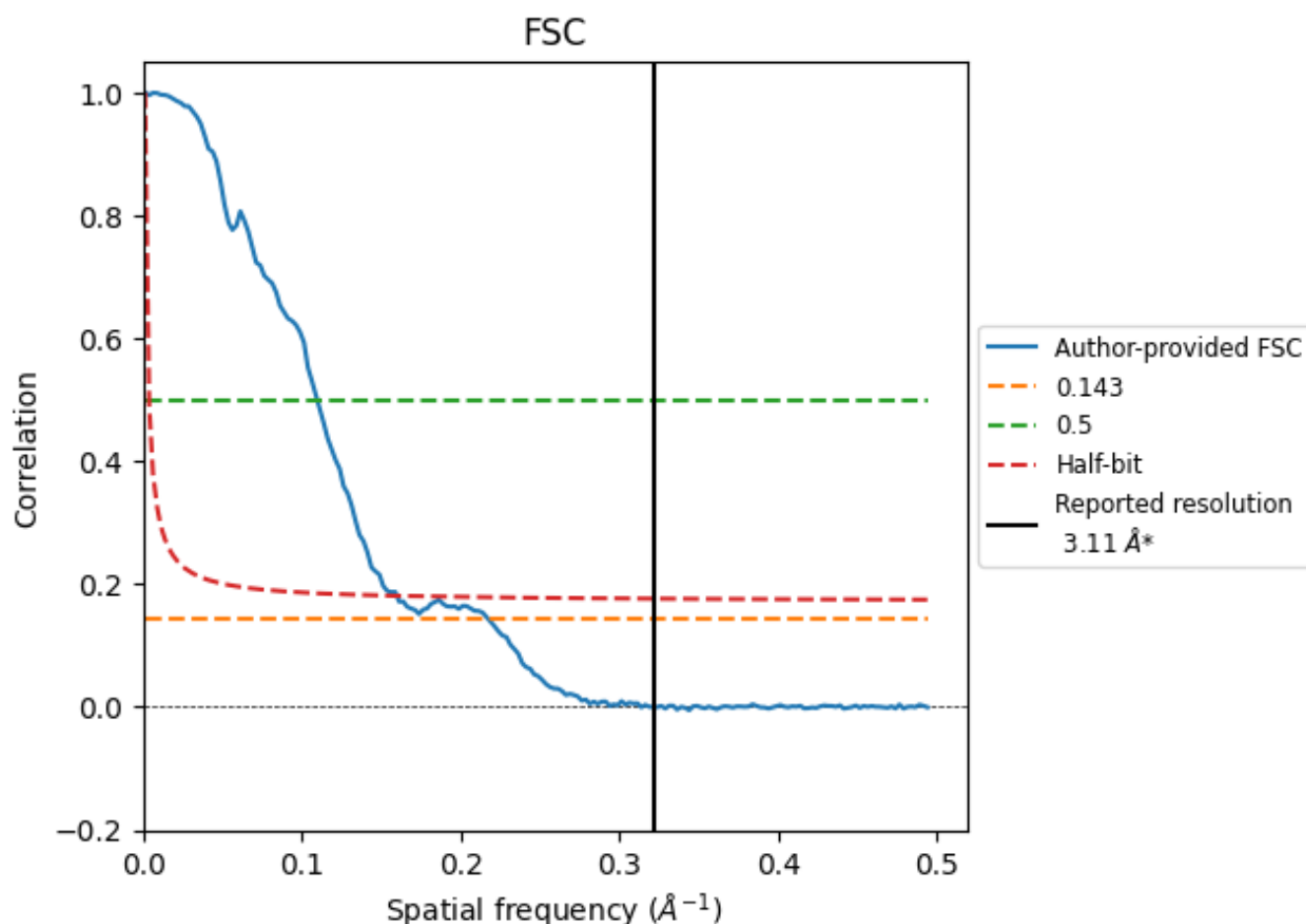


*Reported resolution corresponds to spatial frequency of 0.322 Å⁻¹

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 0.322 Å⁻¹

8.2 Resolution estimates [i](#)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.11	-	-
Author-provided FSC curve	4.60	9.12	6.26
Unmasked-calculated*	-	-	-

*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 4.60 differs from the reported value 3.11 by more than 10 %

9 Map-model fit [i](#)

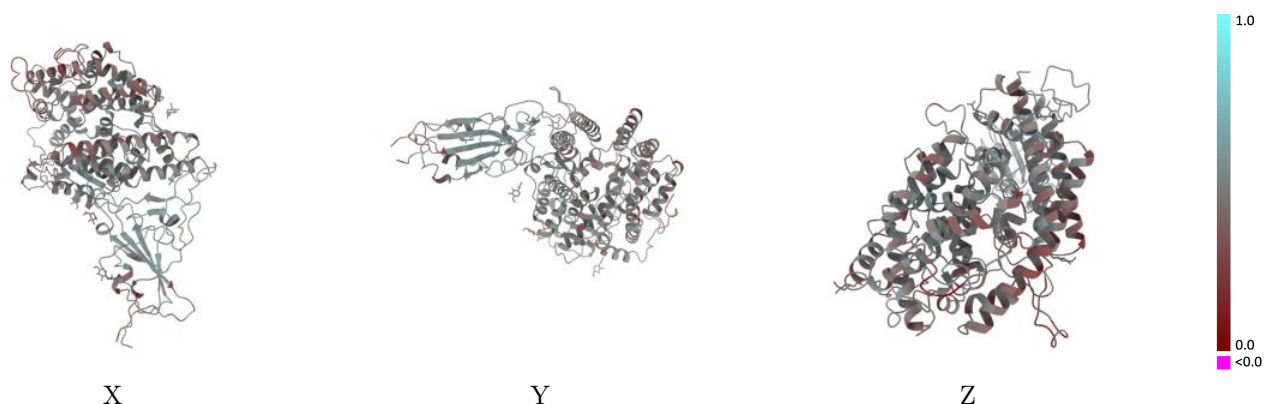
This section contains information regarding the fit between EMDB map EMD-25514 and PDB model 7SY2. Per-residue inclusion information can be found in section [3](#) on page [7](#).

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.323 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](#)



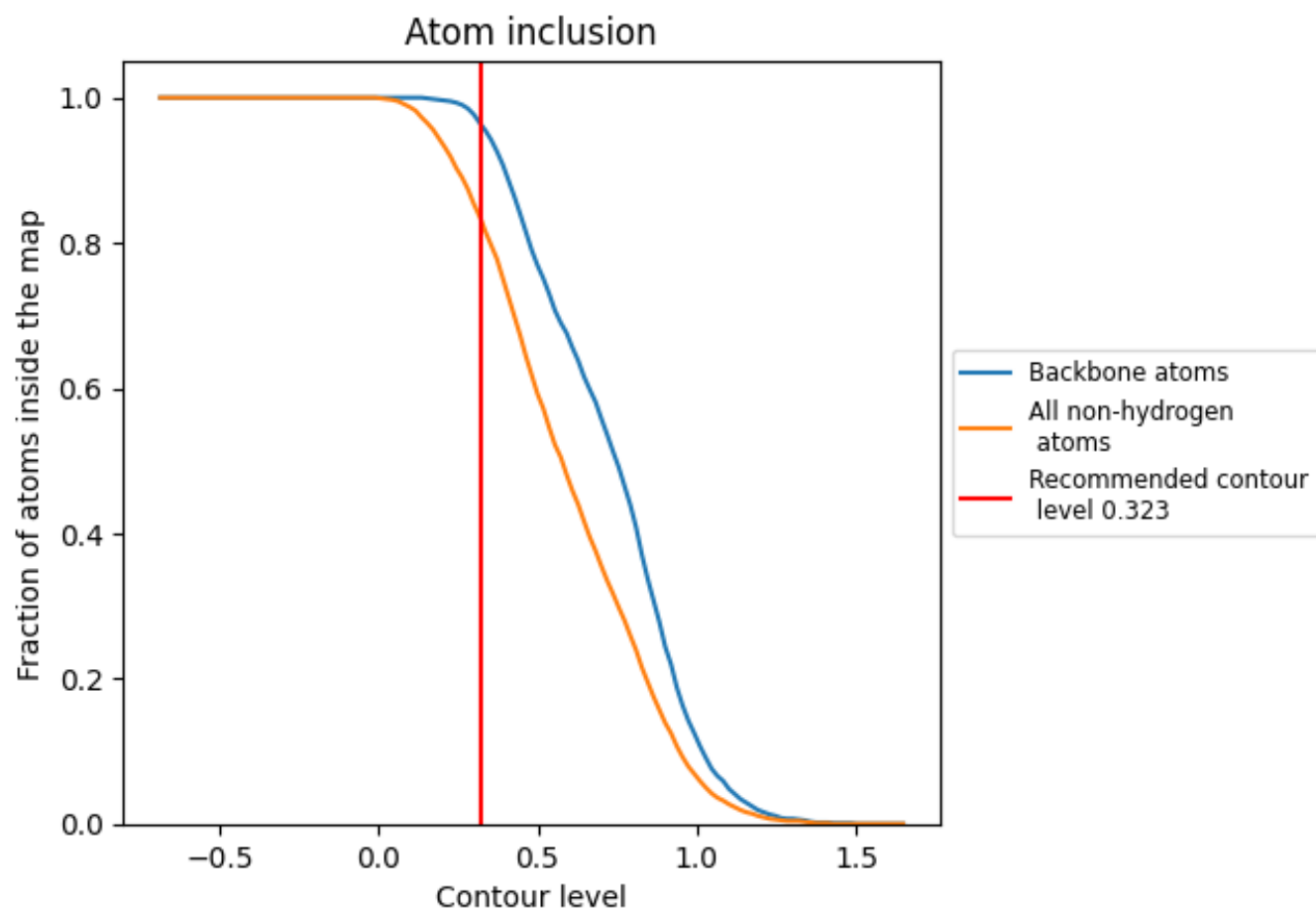
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.323).

9.4 Atom inclusion [i](#)



At the recommended contour level, 96% of all backbone atoms, 83% 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 (0.323) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8310	0.4630
B	0.9080	0.4920
E	0.8060	0.4530

