



wwPDB EM Validation Summary Report ⓘ

Mar 12, 2026 – 06:37 PM UTC

PDB ID : 6S6S / pdb_00006s6s
EMDB ID : EMD-10104
Title : Structure of Azospirillum brasilense Glutamate Synthase in a4b4 oligomeric state.
Authors : Chaves-Sanjuan, A.; Bolognesi, M.
Deposited on : 2019-07-03
Resolution : 3.90 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:

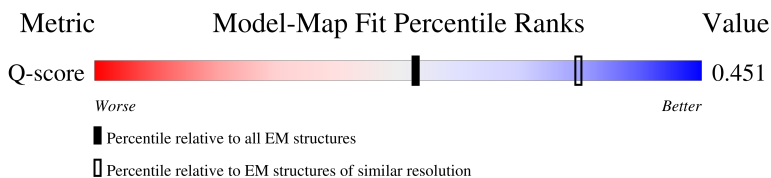
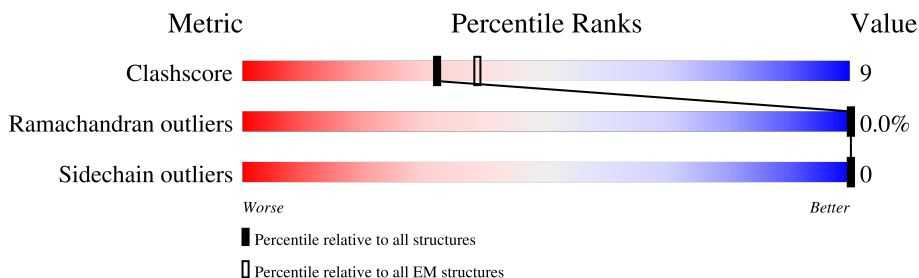
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data 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 3.90 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	8855 (3.40 - 4.40)

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	1515	10% 80% 17% .
1	B	1515	8% 77% 20% .
1	C	1515	8% 78% 19% .
1	D	1515	7% 79% 18% .

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Mol	Chain	Length	Quality of chain
2	E	482	
2	F	482	
2	G	482	
2	H	482	

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	F3S	A	1502	-	-	X	-
4	F3S	B	1502	-	-	X	-
4	F3S	C	1502	-	-	X	-
5	SF4	F	501	-	-	X	-
5	SF4	F	502	-	-	X	-
5	SF4	H	501	-	-	X	-

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 60044 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.

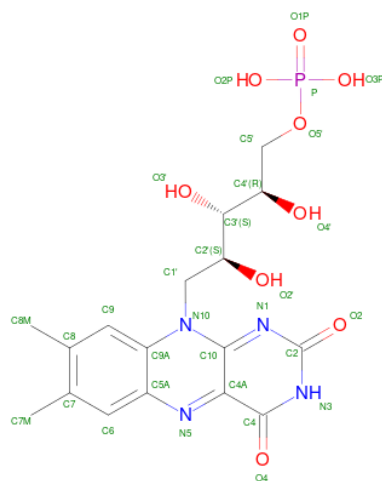
- Molecule 1 is a protein called Glutamate synthase [NADPH] large chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1468	Total 11311	C 7094	N 2032	O 2125	S 60	0	0
1	B	1468	Total 11311	C 7094	N 2032	O 2125	S 60	0	0
1	C	1468	Total 11311	C 7094	N 2032	O 2125	S 60	0	0
1	D	1468	Total 11311	C 7094	N 2032	O 2125	S 60	0	0

- Molecule 2 is a protein called Glutamate synthase [NADPH] small chain.

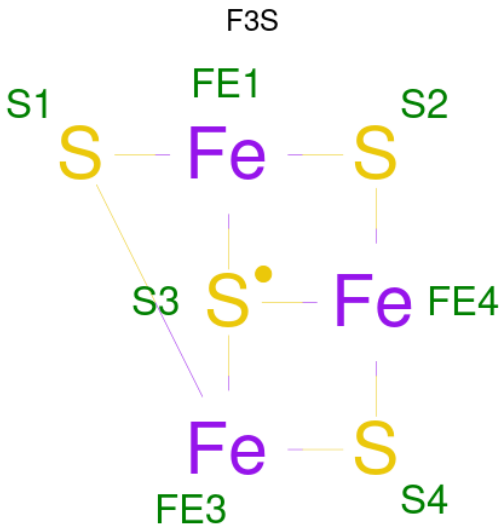
Mol	Chain	Residues	Atoms					AltConf	Trace
2	G	470	Total 3593	C 2239	N 654	O 683	S 17	0	0
2	E	470	Total 3593	C 2239	N 654	O 683	S 17	0	0
2	F	470	Total 3593	C 2239	N 654	O 683	S 17	0	0
2	H	470	Total 3593	C 2239	N 654	O 683	S 17	0	0

- Molecule 3 is FLAVIN MONONUCLEOTIDE (CCD ID: FMN) (formula: C₁₇H₂₁N₄O₉P) (labeled as "Ligand of Interest" by depositor).



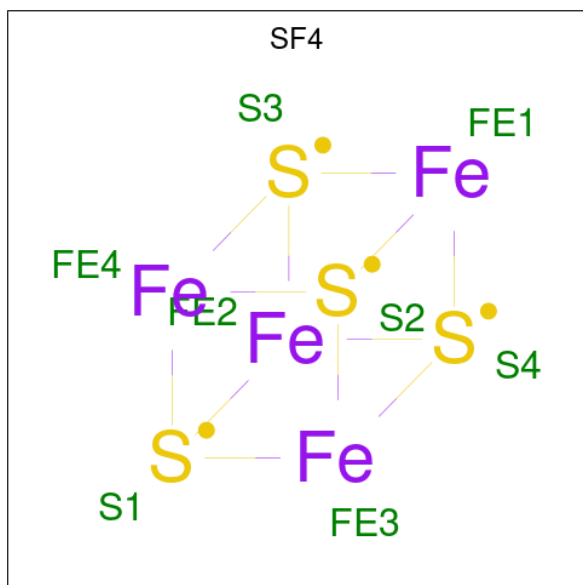
Mol	Chain	Residues	Atoms					AltConf
3	A	1	Total 31	C 17	N 4	O 9	P 1	0
3	B	1	Total 31	C 17	N 4	O 9	P 1	0
3	C	1	Total 31	C 17	N 4	O 9	P 1	0
3	D	1	Total 31	C 17	N 4	O 9	P 1	0

- Molecule 4 is FE3-S4 CLUSTER (CCD ID: F3S) (formula: Fe_3S_4).



Mol	Chain	Residues	Atoms			AltConf
4	A	1	Total	Fe	S	0
			7	3	4	
4	B	1	Total	Fe	S	0
			7	3	4	
4	C	1	Total	Fe	S	0
			7	3	4	
4	D	1	Total	Fe	S	0
			7	3	4	

- Molecule 5 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe₄S₄).



Mol	Chain	Residues	Atoms			AltConf
5	G	1	Total	Fe	S	0
			8	4	4	
5	G	1	Total	Fe	S	0
			8	4	4	
5	E	1	Total	Fe	S	0
			8	4	4	
5	E	1	Total	Fe	S	0
			8	4	4	
5	F	1	Total	Fe	S	0
			8	4	4	
5	F	1	Total	Fe	S	0
			8	4	4	
5	H	1	Total	Fe	S	0
			8	4	4	
5	H	1	Total	Fe	S	0
			8	4	4	

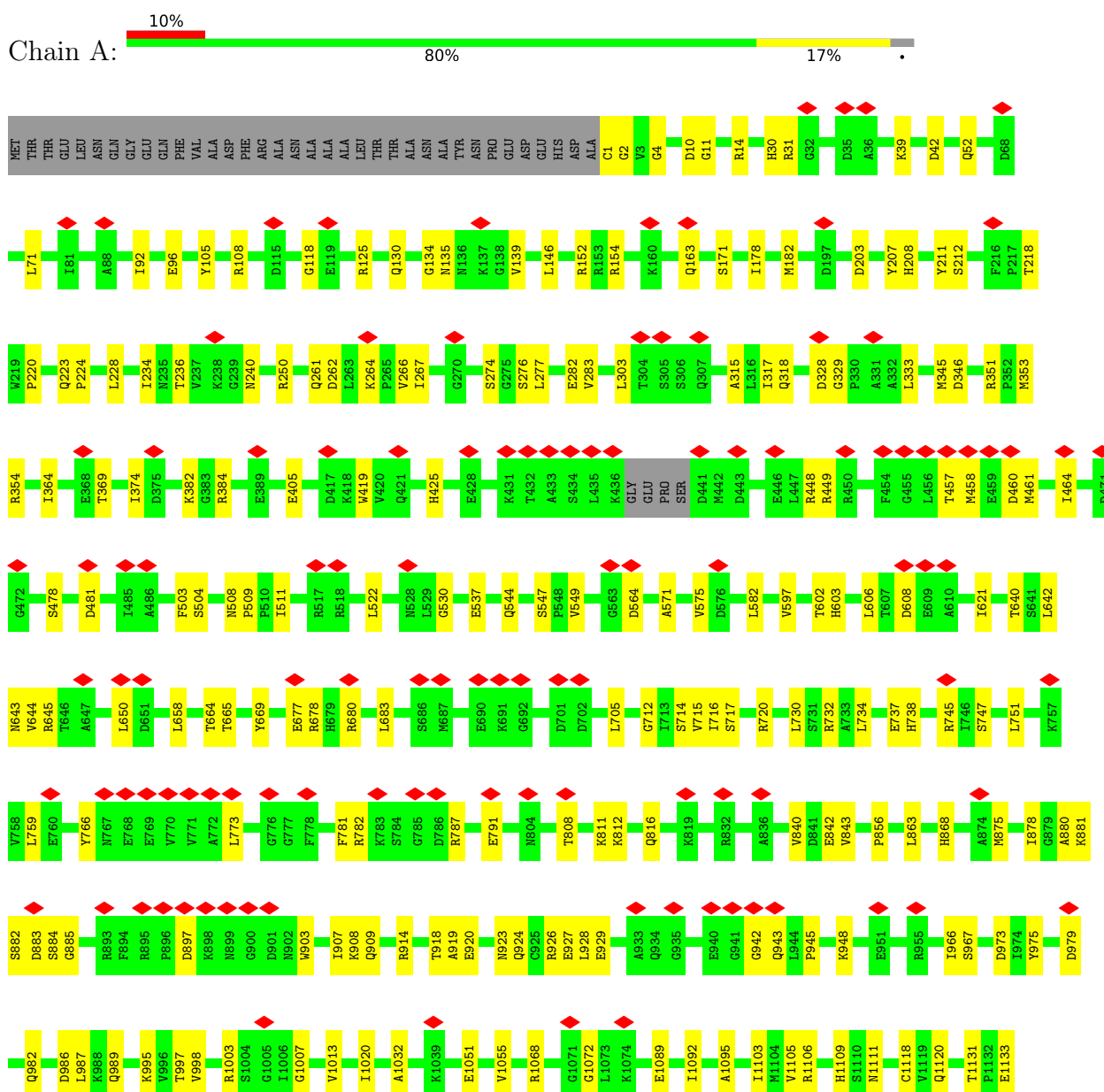
-
- The image displays the chemical structure of Flavin Adenine Dinucleotide (FAD). The structure is composed of several key components: an adenine base (a purine ring system with an amino group at position 6), a ribose sugar (a five-membered ring with hydroxyl groups at positions 2' and 3'), a pyrophosphate group (two phosphate groups linked by an oxygen atom), and a riboflavin moiety (a bicyclic system consisting of an isoalloxazine ring fused to a ribitol side chain). The ribitol side chain is shown in its oxidized form, with a carboxylate group at the end. The structure is labeled with various atoms and groups, including N1, N3, N7, N9, C2, C4, C6, C8, C10, C12, C14, C16, C18, C20, C22, C24, C26, C28, C30, C32, C34, C36, C38, C40, C42, C44, C46, C48, C50, C52, C54, C56, C58, C60, C62, C64, C66, C68, C70, C72, C74, C76, C78, C80, C82, C84, C86, C88, C90, C92, C94, C96, C98, C100, C102, C104, C106, C108, C110, C112, C114, C116, C118, C120, C122, C124, C126, C128, C130, C132, C134, C136, C138, C140, C142, C144, C146, C148, C150, C152, C154, C156, C158, C160, C162, C164, C166, C168, C170, C172, C174, C176, C178, C180, C182, C184, C186, C188, C190, C192, C194, C196, C198, C200, C202, C204, C206, C208, C210, C212, C214, C216, C218, C220, C222, C224, C226, C228, C230, C232, C234, C236, C238, C240, C242, C244, C246, C248, C250, C252, C254, C256, C258, C260, C262, C264, C266, C268, C270, C272, C274, C276, C278, C280, C282, C284, C286, C288, C290, C292, C294, C296, C298, C300, C302, C304, C306, C308, C310, C312, C314, C316, C318, C320, C322, C324, C326, C328, C330, C332, C334, C336, C338, C340, C342, C344, C346, C348, C350, C352, C354, C356, C358, C360, C362, C364, C366, C368, C370, C372, C374, C376, C378, C380, C382, C384, C386, C388, C390, C392, C394, C396, C398, C400, C402, C404, C406, C408, C410, C412, C414, C416, C418, C420, C422, C424, C426, C428, C430, C432, C434, C436, C438, C440, C442, C444, C446, C448, C450, C452, C454, C456, C458, C460, C462, C464, C466, C468, C470, C472, C474, C476, C478, C480, C482, C484, C486, C488, C490, C492, C494, C496, C498, C500, C502, C504, C506, C508, C510, C512, C514, C516, C518, C520, C522, C524, C526, C528, C530, C532, C534, C536, C538, C540, C542, C544, C546, C548, C550, C552, C554, C556, C558, C560, C562, C564, C566, C568, C570, C572, C574, C576, C578, C580, C582, C584, C586, C588, C590, C592, C594, C596, C598, C600, C602, C604, C606, C608, C610, C612, C614, C616, C618, C620, C622, C624, C626, C628, C630, C632, C634, C636, C638, C640, C642, C644, C646, C648, C650, C652, C654, C656, C658, C660, C662, C664, C666, C668, C670, C672, C674, C676, C678, C680, C682, C684, C686, C688, C690, C692, C694, C696, C698, C700, C702, C704, C706, C708, C710, C712, C714, C716, C718, C720, C722, C724, C726, C728, C730, C732, C734, C736, C738, C740, C742, C744, C746, C748, C750, C752, C754, C756, C758, C760, C762, C764, C766, C768, C770, C772, C774, C776, C778, C780, C782, C784, C786, C788, C790, C792, C794, C796, C798, C800, C802, C804, C806, C808, C810, C812, C814, C816, C818, C820, C822, C824, C826, C828, C830, C832, C834, C836, C838, C840, C842, C844, C846, C848, C850, C852, C854, C856, C858, C860, C862, C864, C866, C868, C870, C872, C874, C876, C878, C880, C882, C884, C886, C888, C890, C892, C894, C896, C898, C900, C902, C904, C906, C908, C910, C912, C914, C916, C918, C920, C922, C924, C926, C928, C930, C932, C934, C936, C938, C940, C942, C944, C946, C948, C950, C952, C954, C956, C958, C960, C962, C964, C966, C968, C970, C972, C974, C976, C978, C980, C982, C984, C986, C988, C990, C992, C994, C996, C998, C1000, C1002, C1004, C1006, C1008, C1010, C1012, C1014, C1016, C1018, C1020, C1022, C1024, C1026, C1028, C1030, C1032, C1034, C1036, C1038, C1040, C1042, C1044, C1046, C1048, C1050, C1052, C1054, C1056, C1058, C1060, C1062, C1064, C1066, C1068, C1070, C1072, C1074, C1076, C1078, C1080, C1082, C1084, C1086, C1088, C1090, C1092, C1094, C1096, C1098, C1100, C1102, C1104, C1106, C1108, C1110, C1112, C1114, C1116, C1118, C1120, C1122, C1124, C1126, C1128, C1130, C1132, C1134, C1136, C1138, C1140, C1142, C1144, C1146, C1148, C1150, C1152, C1154, C1156, C1158, C1160, C1162, C1164, C1166, C1168, C1170, C1172, C1174, C1176, C1178, C1180, C1182, C1184, C1186, C1188, C1190, C1192, C1194, C1196, C1198, C1200, C1202, C1204, C1206, C1208, C1210, C1212, C1214, C1216, C1218, C1220, C1222, C1224, C1226, C1228, C1230, C1232, C1234, C1236, C1238, C1240, C1242, C1244, C1246, C1248, C1250, C1252, C1254, C1256, C1258, C1260, C1262, C1264, C1266, C1268, C1270, C1272, C1274, C1276, C1278, C1280, C1282, C1284, C1286, C1288, C1290, C1292, C1294, C1296, C1298, C1300, C1302, C1304, C1306, C1308, C1310, C1312, C1314, C1316, C1318, C1320, C1322, C1324, C1326, C1328, C1330, C1332, C1334, C1336, C1338, C1340, C1342, C1344, C1346, C1348, C1350, C1352, C1354, C1356, C1358, C1360, C1362, C1364, C1366, C1368, C1370, C1372, C1374, C1376, C1378, C1380, C1382, C1384, C1386, C1388, C1390, C1392, C1394, C1396, C1398, C1400, C1402, C1404, C1406, C1408, C1410, C1412, C1414, C1416, C1418, C1420, C1422, C1424, C1426, C1428, C1430, C1432, C1434, C1436, C1438, C1440, C1442, C1444, C1446, C1448, C1450, C1452, C1454, C1456, C1458, C1460, C1462, C1464, C1466, C1468, C1470, C1472, C1474, C1476, C1478, C1480,

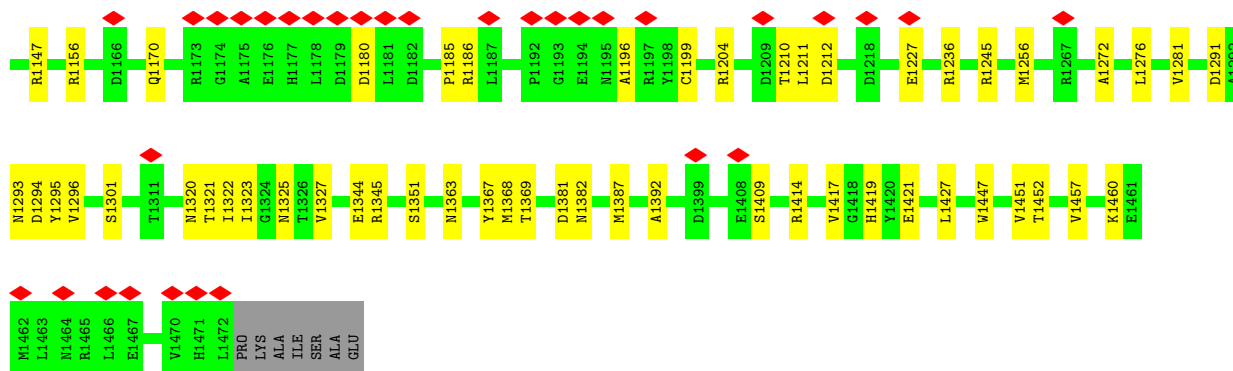
Mol	Chain	Residues	Atoms					AltConf
6	G	1	Total 53	C 27	N 9	O 15	P 2	0
6	E	1	Total 53	C 27	N 9	O 15	P 2	0
6	F	1	Total 53	C 27	N 9	O 15	P 2	0
6	H	1	Total 53	C 27	N 9	O 15	P 2	0

3 Residue-property plots

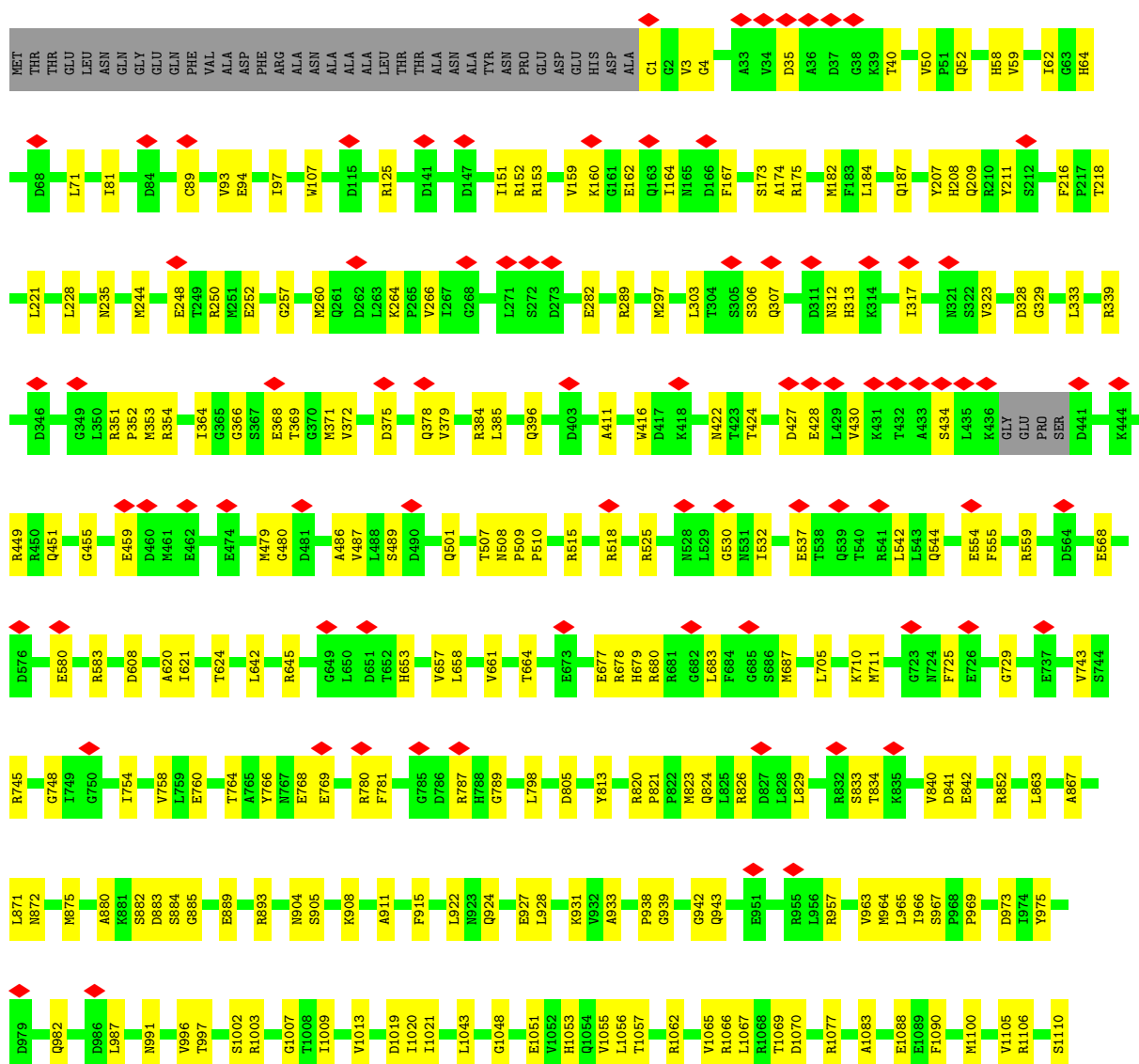
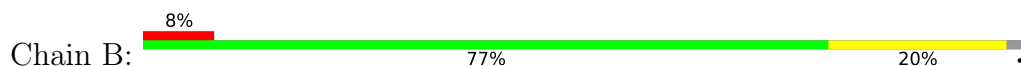
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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.

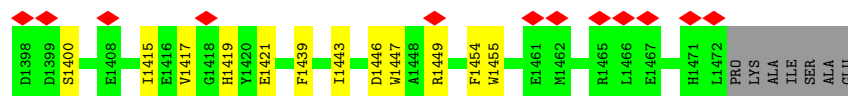
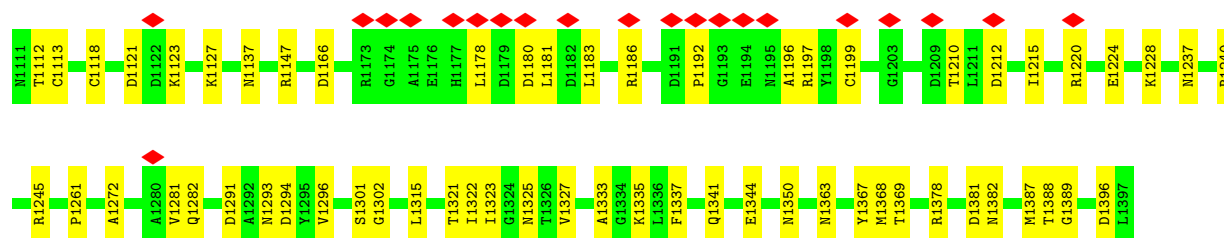
- Molecule 1: Glutamate synthase [NADPH] large chain



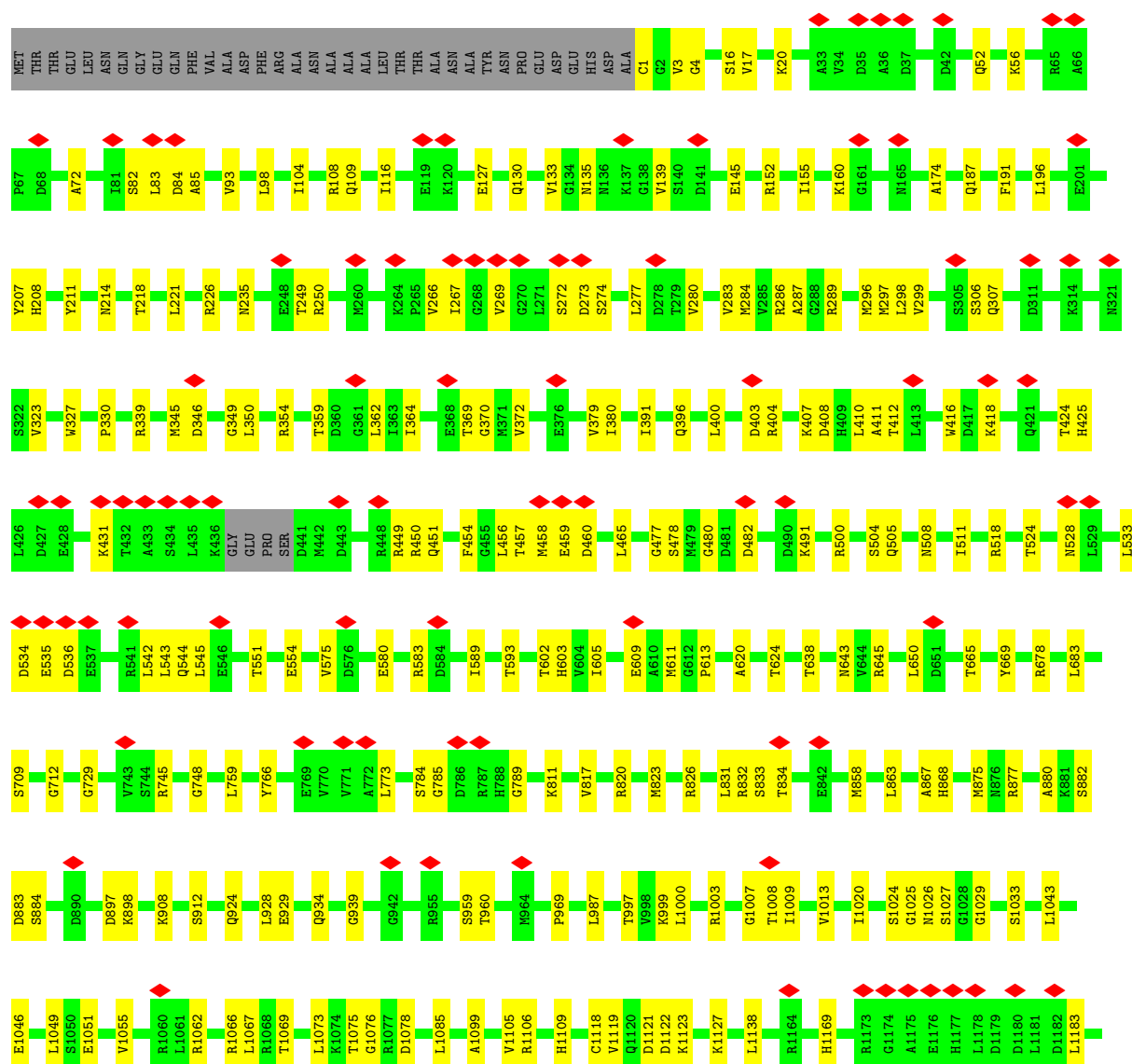
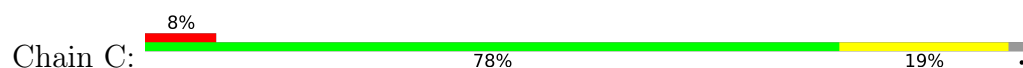


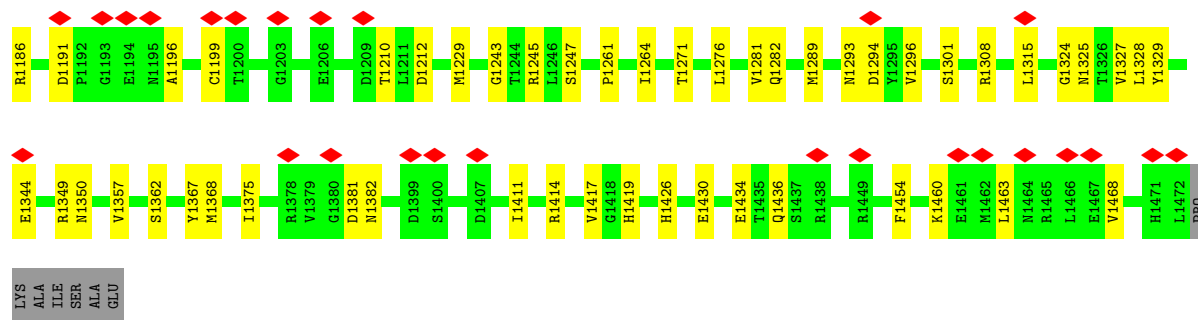
• Molecule 1: Glutamate synthase [NADPH] large chain



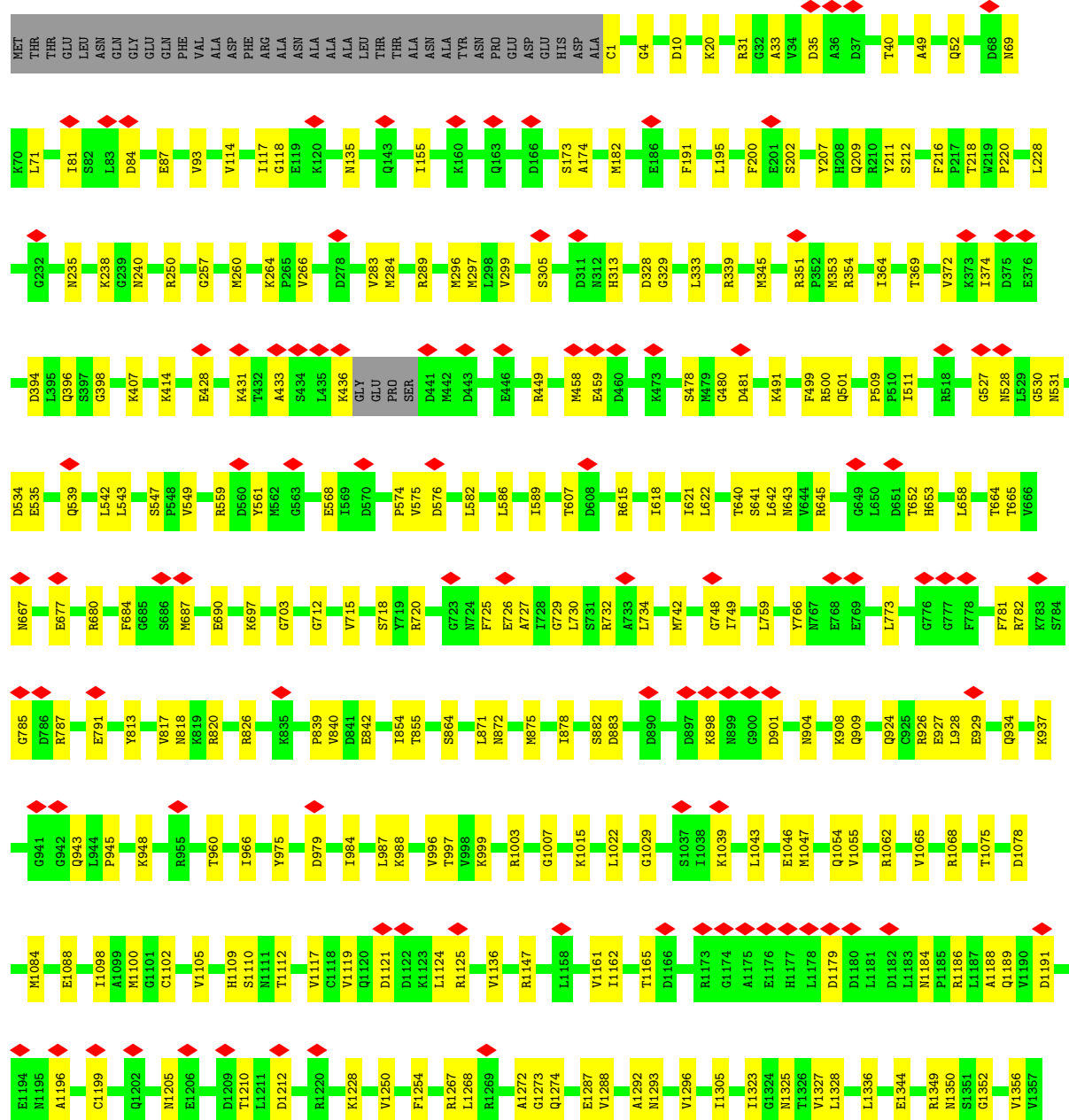
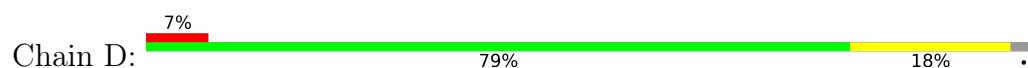


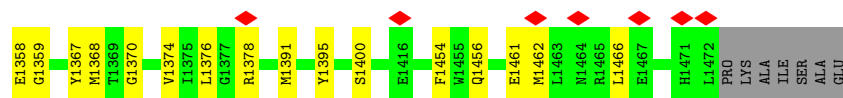
• Molecule 1: Glutamate synthase [NADPH] large chain



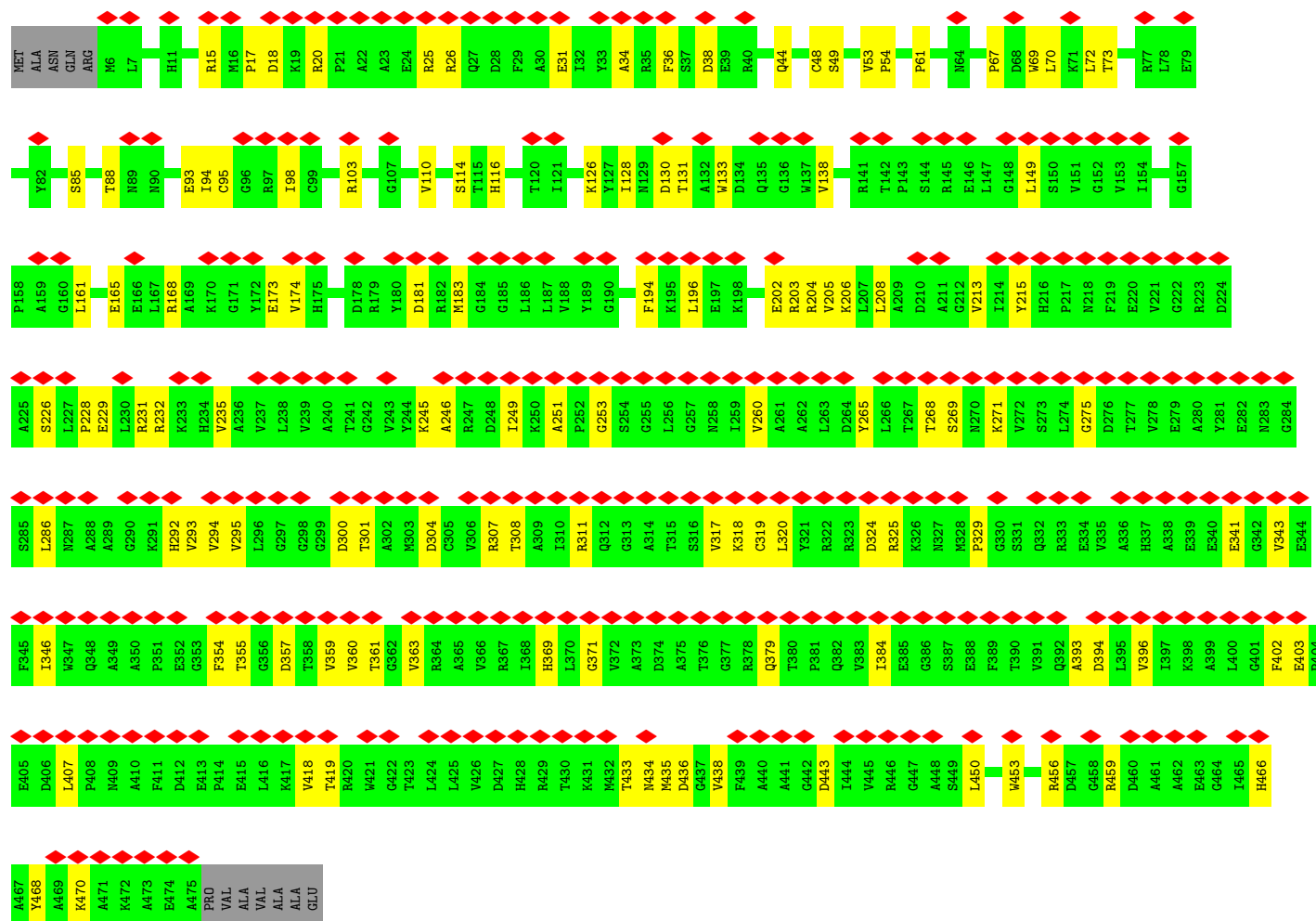
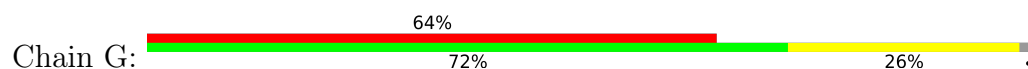


• Molecule 1: Glutamate synthase [NADPH] large chain

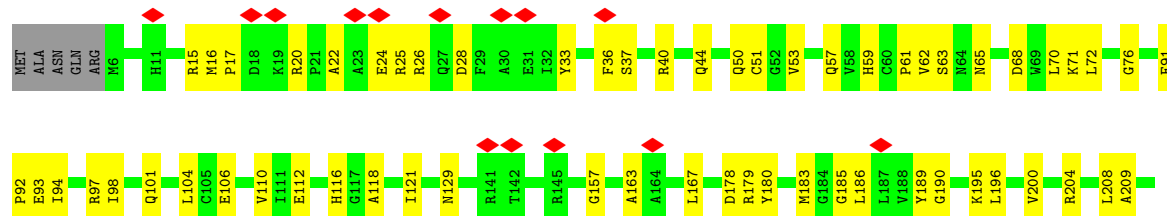
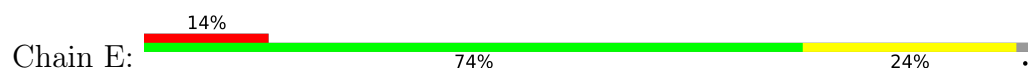


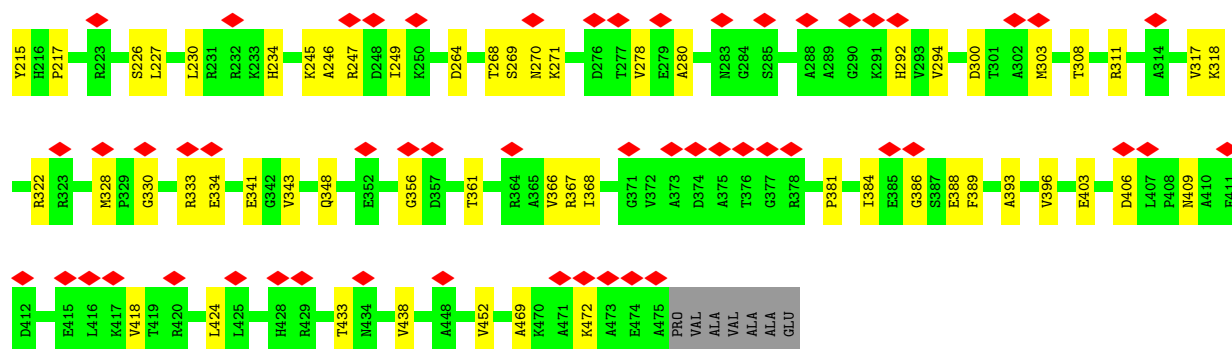


• Molecule 2: Glutamate synthase [NADPH] small chain

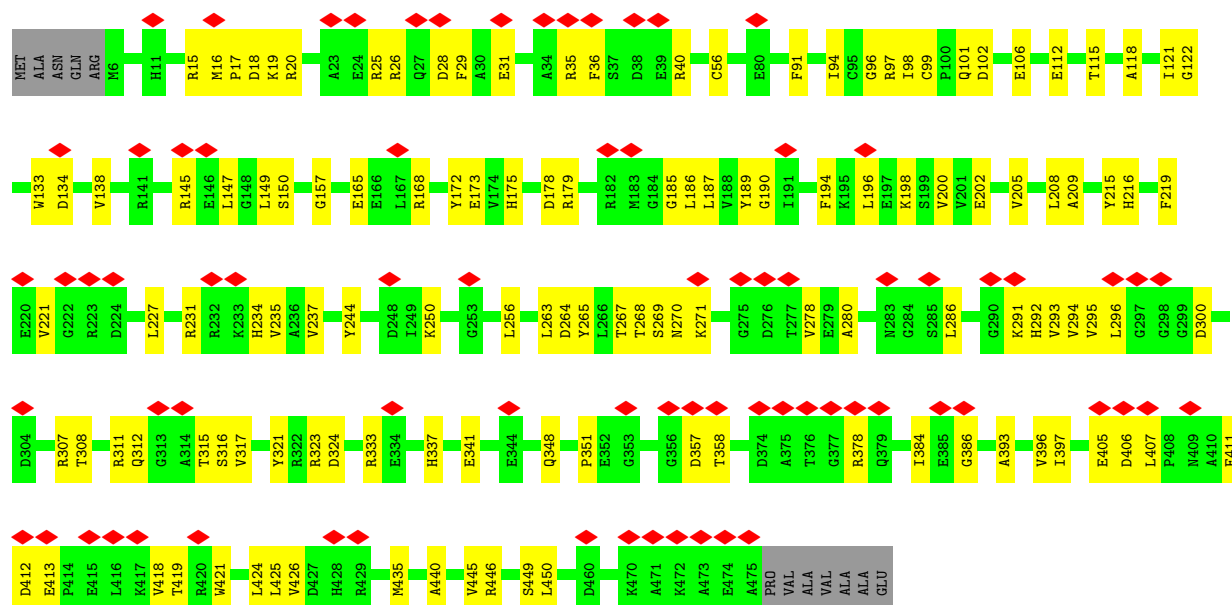


• Molecule 2: Glutamate synthase [NADPH] small chain

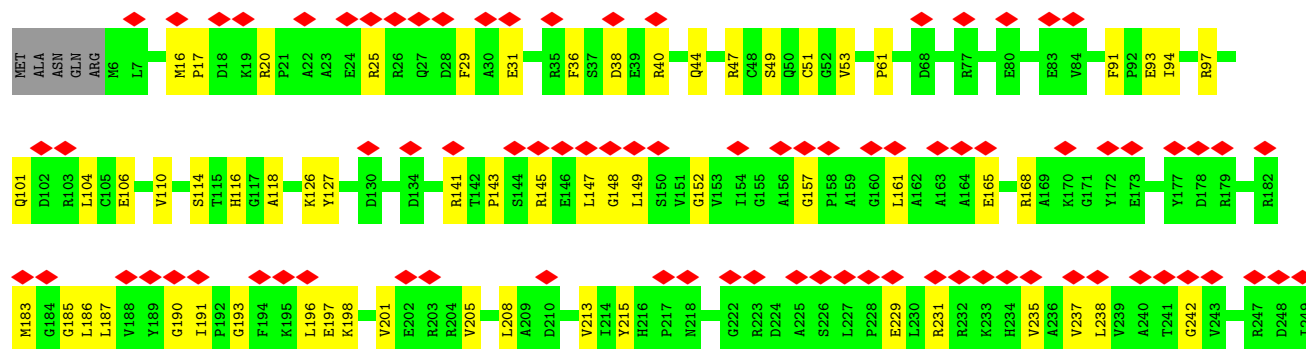




• Molecule 2: Glutamate synthase [NADPH] small chain



• Molecule 2: Glutamate synthase [NADPH] small chain



T433	R311	K250
N434	Q312	A251
M435	G313	P252
D436	A314	G253
C437	T315	S254
V438	S316	G255
F439	V317	L256
A440	K318	G257
A441	C319	N258
G442	L320	T259
D443	Y321	V260
I444	R322	A261
W445	R323	A262
R446	D324	L263
S449	R325	L266
L450	K326	T267
V451	N327	T268
W452	N328	S269
W453	Q332	N270
D460	R333	K271
A461	E334	V272
A462	V335	S273
H466	A336	L274
K470	H337	G275
A471	A338	D276
K472	E339	T277
A473	E340	V278
E474	E341	E279
A475	G342	A280
PRO	V343	Y281
VAL	E344	E282
ALA	F345	N283
VAL	T346	G284
ALA	W347	S285
ALA	Q348	L286
GLU	A349	N287
	A350	A288
	P351	A289
	G352	G290
	G353	K291
	F354	H292
	T355	T293
	G356	V294
	D357	V295
	T358	L296
	V359	G297
	V360	G298
	T361	G299
	G362	D300
	V363	T301
	R364	A302
	A365	M303
	V366	D304
	R367	C305
	T368	V306
	H369	R307
	L370	T308
	G371	A309
	W372	T310

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	54434	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TALOS ARCTICA	Depositor
Voltage (kV)	200	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	0.661	Depositor
Minimum map value	-0.189	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.019	Depositor
Recommended contour level	0.09	Depositor
Map size ($\text{\AA}$)	439.208, 439.208, 439.208	wwPDB
Map dimensions	308, 308, 308	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.426, 1.426, 1.426	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FAD, FMN, SF4, F3S

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	0.15	0/11517	0.32	0/15573
1	B	0.15	0/11517	0.32	0/15573
1	C	0.15	0/11517	0.31	0/15573
1	D	0.15	0/11517	0.31	0/15573
2	E	0.15	0/3661	0.36	0/4962
2	F	0.16	0/3661	0.39	2/4962 (0.0%)
2	G	0.13	0/3661	0.36	0/4962
2	H	0.13	0/3661	0.34	0/4962
All	All	0.15	0/60712	0.33	2/82140 (0.0%)

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
2	F	0	1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	412	ASP	CA-C-N	-7.53	112.47	122.56
2	F	412	ASP	C-N-CA	-7.53	112.47	122.56

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	F	406	ASP	Peptide

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	11311	0	11333	163	0
1	B	11311	0	11333	193	0
1	C	11311	0	11333	178	0
1	D	11311	0	11333	184	0
2	E	3593	0	3532	77	0
2	F	3593	0	3532	90	0
2	G	3593	0	3532	81	0
2	H	3593	0	3532	77	0
3	A	31	0	19	2	0
3	B	31	0	19	0	0
3	C	31	0	19	0	0
3	D	31	0	19	1	0
4	A	7	0	0	2	0
4	B	7	0	0	4	0
4	C	7	0	0	3	0
4	D	7	0	0	1	0
5	E	16	0	0	0	0
5	F	16	0	0	5	0
5	G	16	0	0	0	0
5	H	16	0	0	2	0
6	E	53	0	31	2	0
6	F	53	0	31	6	0
6	G	53	0	31	0	0
6	H	53	0	31	1	0
All	All	60044	0	59660	1026	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 9.

The worst 5 of 1026 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:D:1:CYS:HA	1:D:209:GLN:O	1.69	0.91
2:E:15:ARG:HH11	2:E:40:ARG:HD3	1.48	0.78
1:A:458:MET:HB2	1:A:773:LEU:HB2	1.67	0.77
1:C:135:ASN:HD21	1:C:139:VAL:H	1.33	0.77
1:D:928:LEU:HD13	1:D:987:LEU:HD12	1.66	0.77

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	1464/1515 (97%)	1391 (95%)	73 (5%)	0	100	100
1	B	1464/1515 (97%)	1399 (96%)	65 (4%)	0	100	100
1	C	1464/1515 (97%)	1392 (95%)	72 (5%)	0	100	100
1	D	1464/1515 (97%)	1400 (96%)	64 (4%)	0	100	100
2	E	468/482 (97%)	435 (93%)	33 (7%)	0	100	100
2	F	468/482 (97%)	429 (92%)	38 (8%)	1 (0%)	43	74
2	G	468/482 (97%)	429 (92%)	39 (8%)	0	100	100
2	H	468/482 (97%)	434 (93%)	34 (7%)	0	100	100
All	All	7728/7988 (97%)	7309 (95%)	418 (5%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	F	405	GLU

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	1198/1233 (97%)	1198 (100%)	0	100	100
1	B	1198/1233 (97%)	1198 (100%)	0	100	100
1	C	1198/1233 (97%)	1198 (100%)	0	100	100
1	D	1198/1233 (97%)	1198 (100%)	0	100	100
2	E	371/379 (98%)	371 (100%)	0	100	100
2	F	371/379 (98%)	371 (100%)	0	100	100
2	G	371/379 (98%)	371 (100%)	0	100	100
2	H	371/379 (98%)	371 (100%)	0	100	100
All	All	6276/6448 (97%)	6276 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 113 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	972	HIS
2	H	234	HIS
1	D	307	GLN
2	H	216	HIS
2	F	46	ASN

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 [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

20 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	FMN	A	1501	-	33,33,33	1.05	2 (6%)	48,50,50	1.18	6 (12%)
6	FAD	E	503	-	58,58,58	0.32	0	85,89,89	0.26	0
6	FAD	H	503	-	58,58,58	0.35	0	85,89,89	0.28	0
5	SF4	H	502	2	0,12,12	-	-	-	-	-
5	SF4	F	501	2	0,12,12	-	-	-	-	-
3	FMN	B	1501	-	33,33,33	1.06	2 (6%)	48,50,50	1.23	7 (14%)
6	FAD	G	503	-	58,58,58	0.32	0	85,89,89	0.28	0
4	F3S	B	1502	1	0,9,9	-	-	-	-	-
5	SF4	H	501	2	0,12,12	-	-	-	-	-
4	F3S	D	1502	1	0,9,9	-	-	-	-	-
4	F3S	A	1502	1	0,9,9	-	-	-	-	-
4	F3S	C	1502	1	0,9,9	-	-	-	-	-
5	SF4	E	502	2	0,12,12	-	-	-	-	-
5	SF4	F	502	2	0,12,12	-	-	-	-	-
6	FAD	F	503	-	58,58,58	0.37	0	85,89,89	0.30	0
5	SF4	E	501	2	0,12,12	-	-	-	-	-
3	FMN	C	1501	-	33,33,33	1.07	2 (6%)	48,50,50	1.19	7 (14%)
3	FMN	D	1501	-	33,33,33	1.06	2 (6%)	48,50,50	1.19	6 (12%)
5	SF4	G	502	2	0,12,12	-	-	-	-	-
5	SF4	G	501	2	0,12,12	-	-	-	-	-

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	FMN	A	1501	-	-	8/18/18/18	0/3/3/3
6	FAD	E	503	-	-	11/34/50/50	0/6/6/6
6	FAD	H	503	-	-	8/34/50/50	0/6/6/6
5	SF4	H	502	2	-	-	0/6/5/5
5	SF4	F	501	2	-	-	0/6/5/5
3	FMN	B	1501	-	-	8/18/18/18	0/3/3/3
6	FAD	G	503	-	-	10/34/50/50	0/6/6/6
4	F3S	B	1502	1	-	-	0/3/3/3
5	SF4	H	501	2	-	-	0/6/5/5
4	F3S	D	1502	1	-	-	0/3/3/3
4	F3S	A	1502	1	-	-	0/3/3/3
4	F3S	C	1502	1	-	-	0/3/3/3
5	SF4	E	502	2	-	-	0/6/5/5
5	SF4	F	502	2	-	-	0/6/5/5
6	FAD	F	503	-	-	15/34/50/50	0/6/6/6
5	SF4	E	501	2	-	-	0/6/5/5
3	FMN	C	1501	-	-	8/18/18/18	0/3/3/3
3	FMN	D	1501	-	-	8/18/18/18	0/3/3/3
5	SF4	G	502	2	-	-	0/6/5/5
5	SF4	G	501	2	-	-	0/6/5/5

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1501	FMN	C4A-N5	3.29	1.37	1.30
3	C	1501	FMN	C4A-N5	3.28	1.37	1.30
3	D	1501	FMN	C4A-N5	3.26	1.37	1.30
3	A	1501	FMN	C4A-N5	3.24	1.37	1.30
3	B	1501	FMN	C10-N1	2.44	1.38	1.33

The worst 5 of 26 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1501	FMN	C4-N3-C2	-3.36	119.68	125.64
3	A	1501	FMN	C4-N3-C2	-3.27	119.83	125.64
3	D	1501	FMN	C4-N3-C2	-3.26	119.85	125.64
3	C	1501	FMN	C4-N3-C2	-3.20	119.96	125.64
3	B	1501	FMN	C4A-C4-N3	2.72	120.17	113.25

There are no chirality outliers.

5 of 76 torsion outliers are listed below:

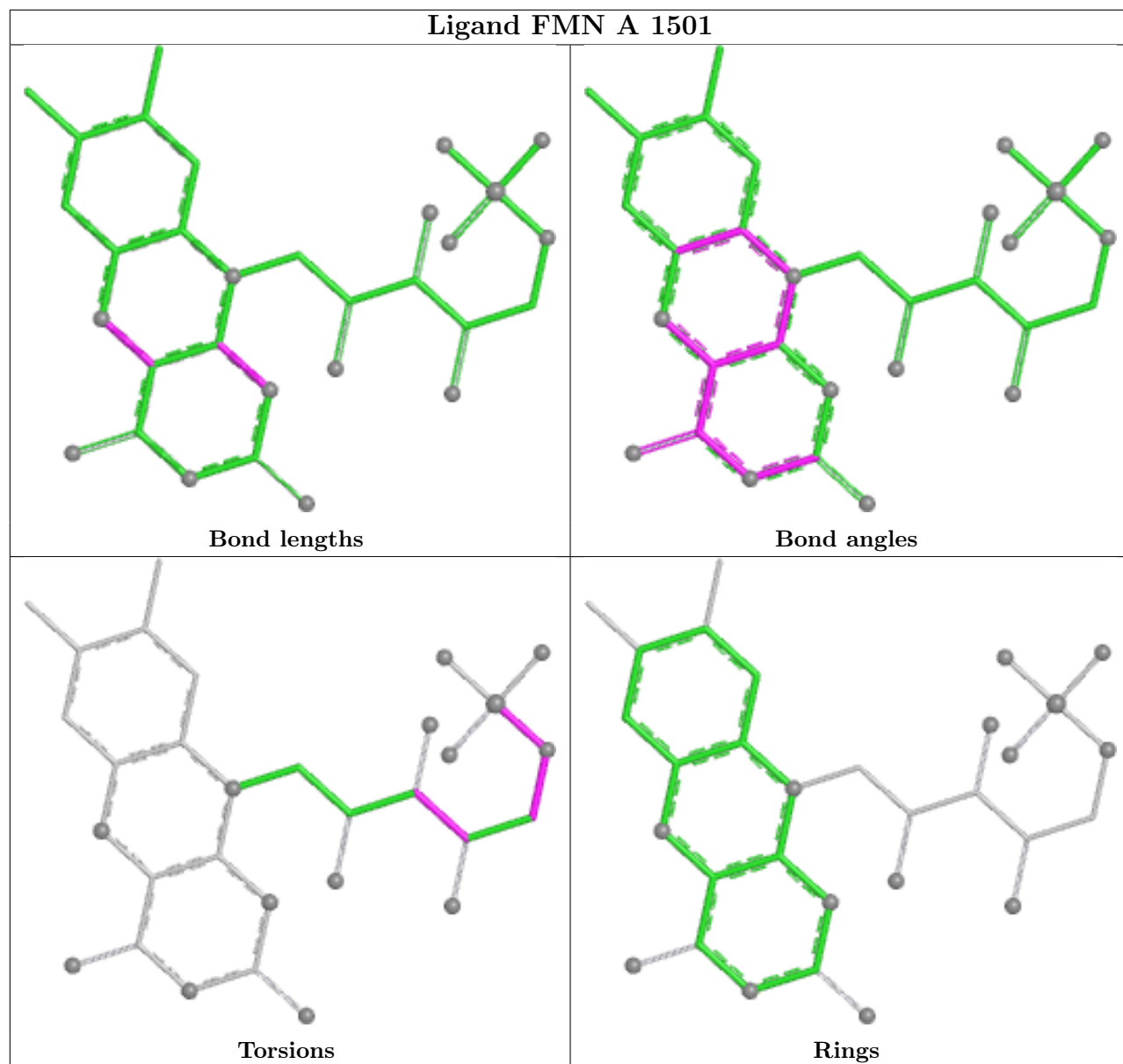
Mol	Chain	Res	Type	Atoms
3	A	1501	FMN	C5'-O5'-P-O2P
3	A	1501	FMN	C5'-O5'-P-O3P
3	B	1501	FMN	C5'-O5'-P-O1P
3	B	1501	FMN	C5'-O5'-P-O2P
3	B	1501	FMN	C5'-O5'-P-O3P

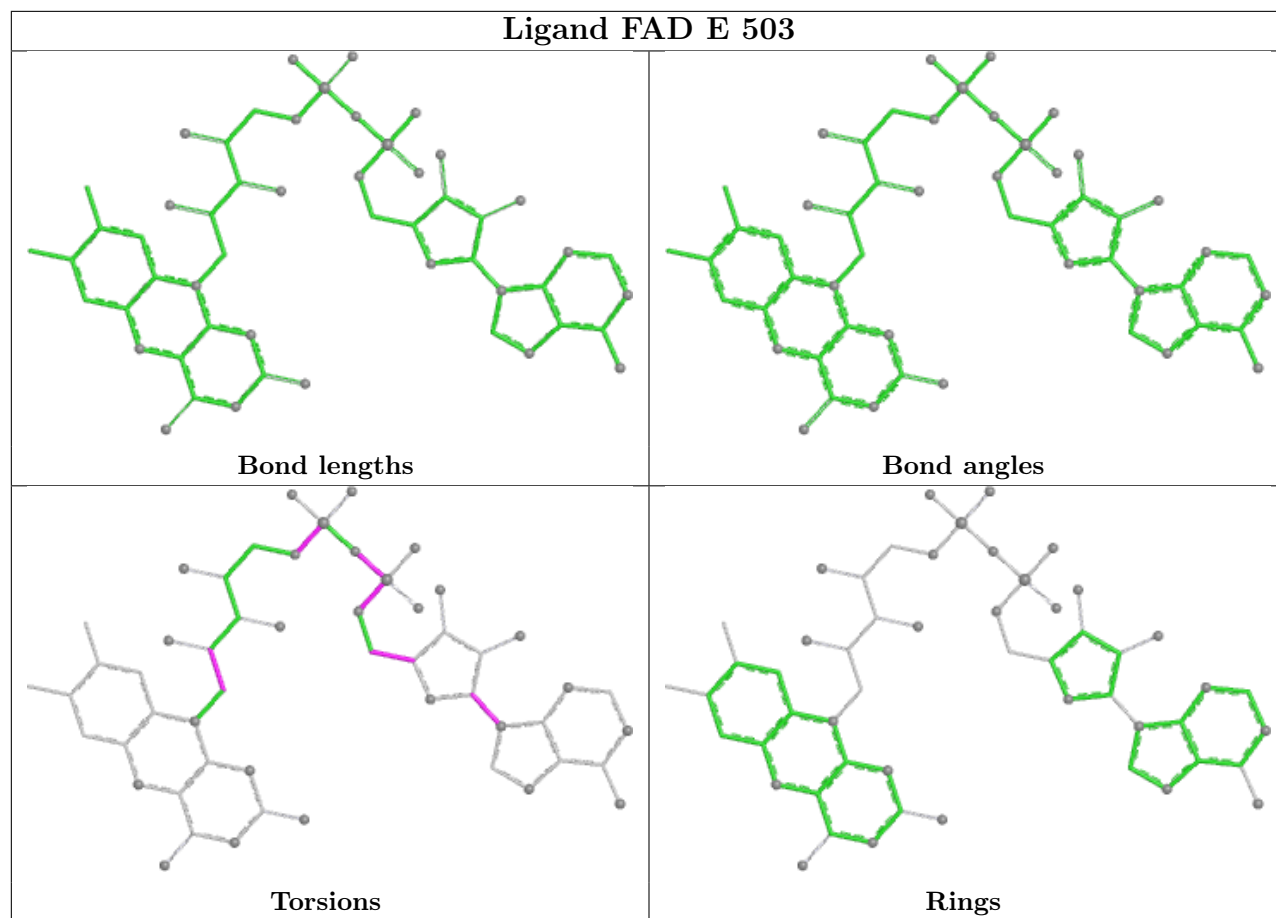
There are no ring outliers.

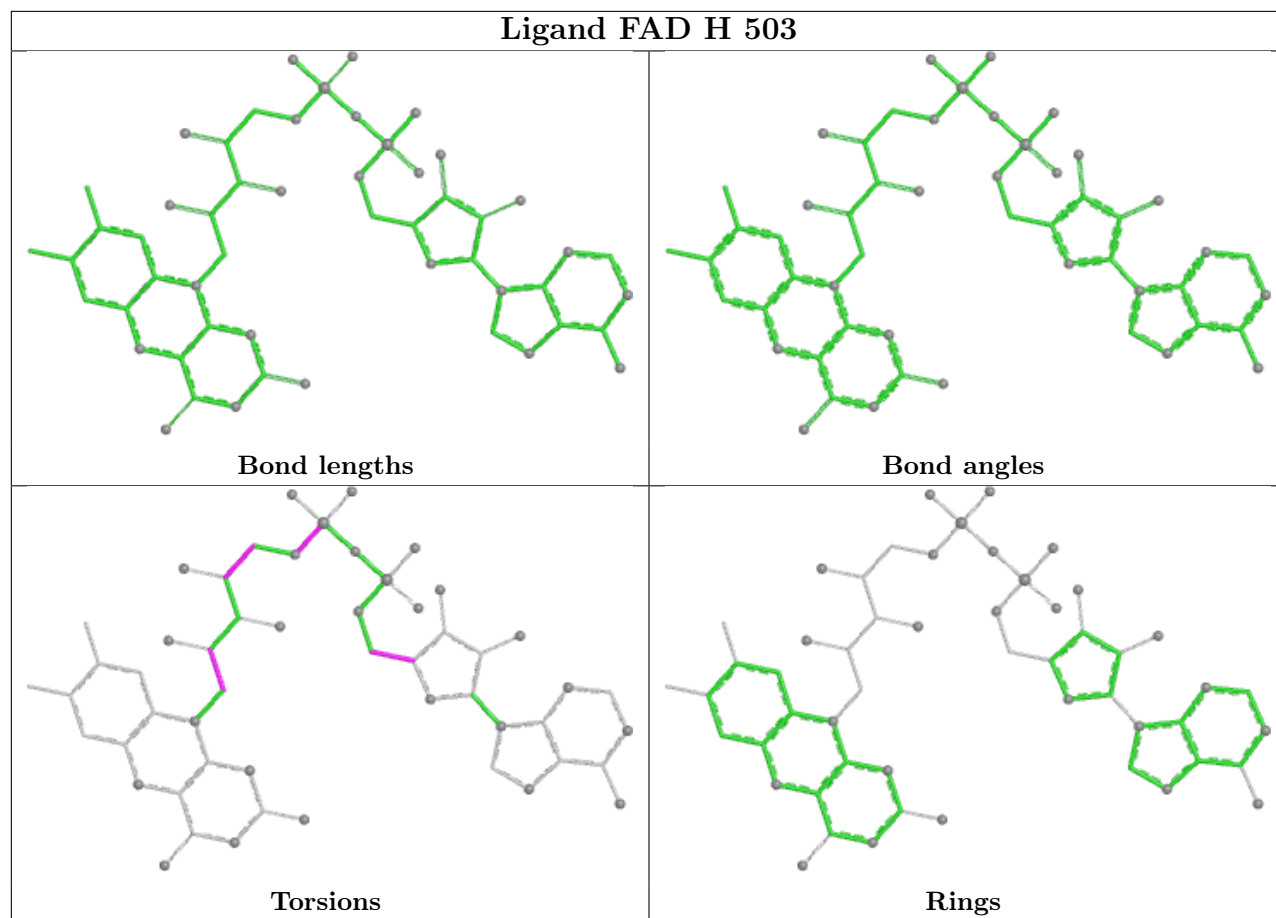
12 monomers are involved in 29 short contacts:

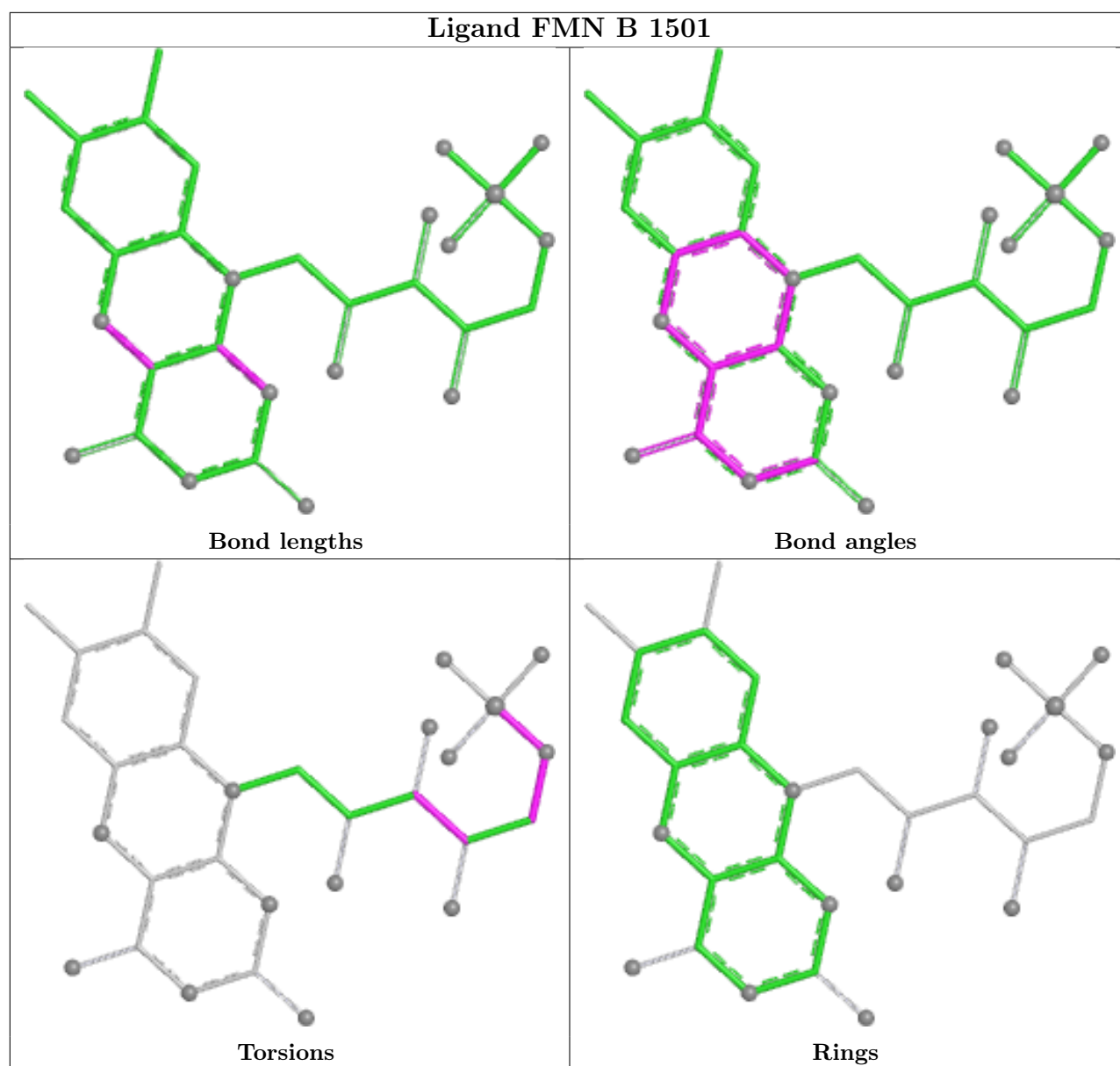
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1501	FMN	2	0
6	E	503	FAD	2	0
6	H	503	FAD	1	0
5	F	501	SF4	2	0
4	B	1502	F3S	4	0
5	H	501	SF4	2	0
4	D	1502	F3S	1	0
4	A	1502	F3S	2	0
4	C	1502	F3S	3	0
5	F	502	SF4	3	0
6	F	503	FAD	6	0
3	D	1501	FMN	1	0

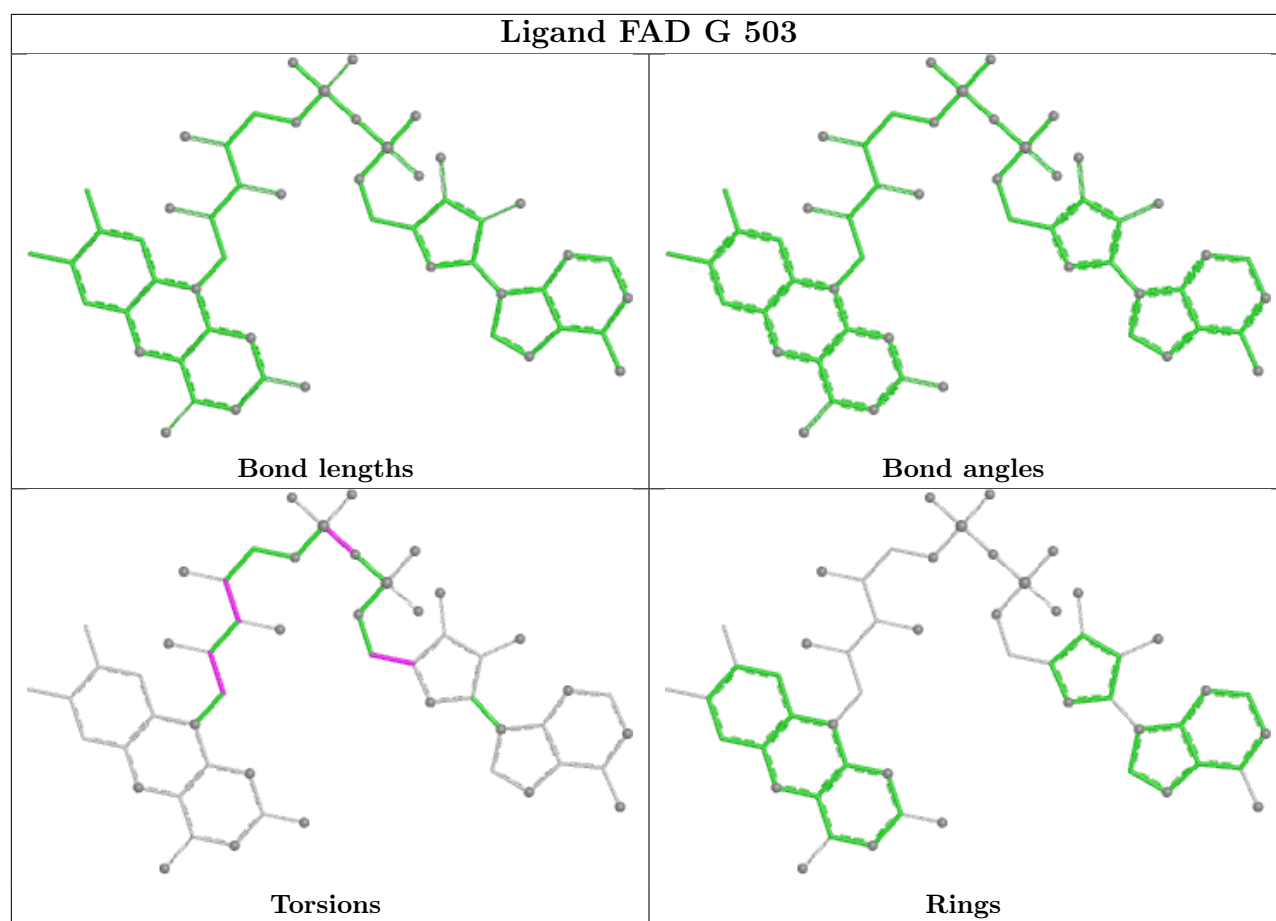
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



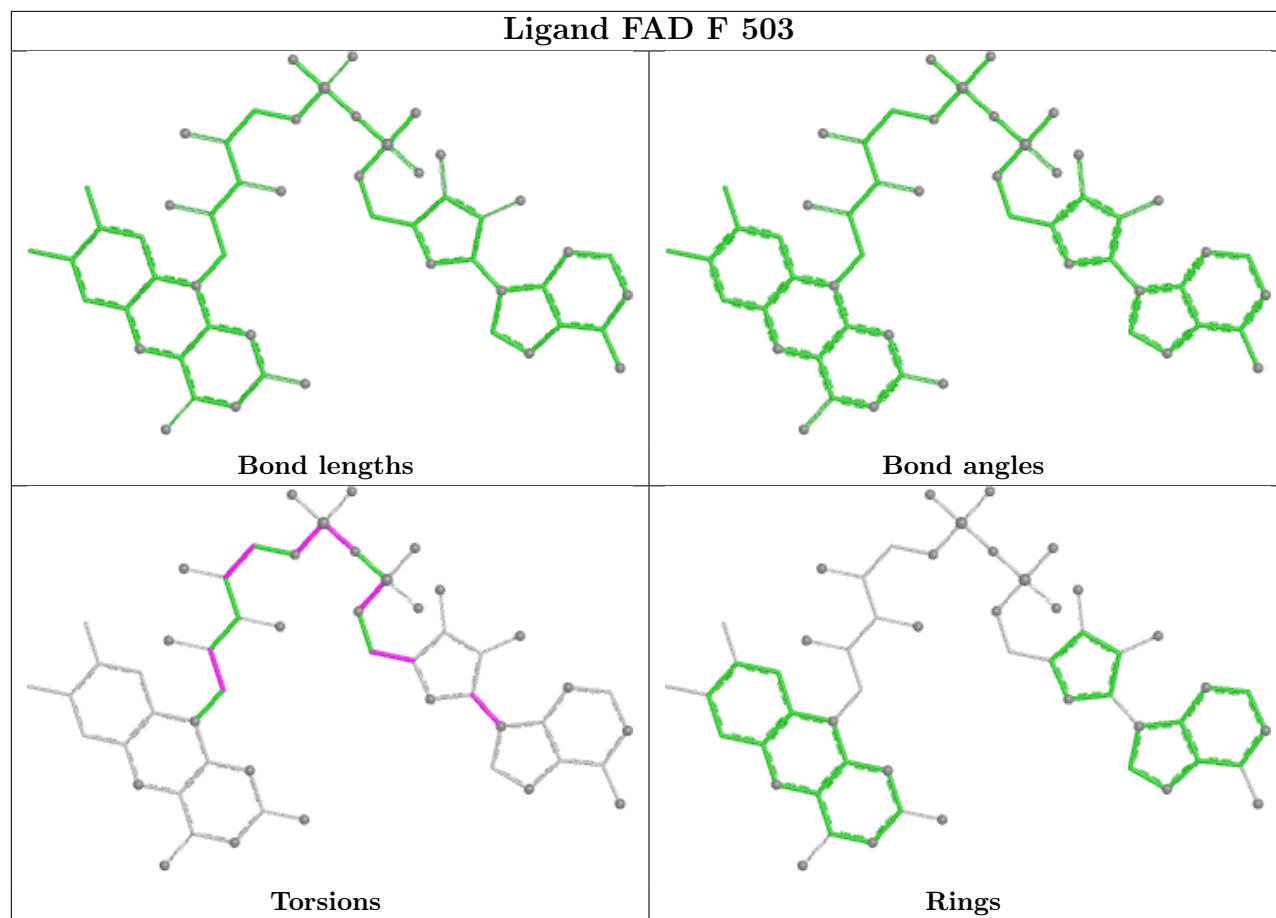




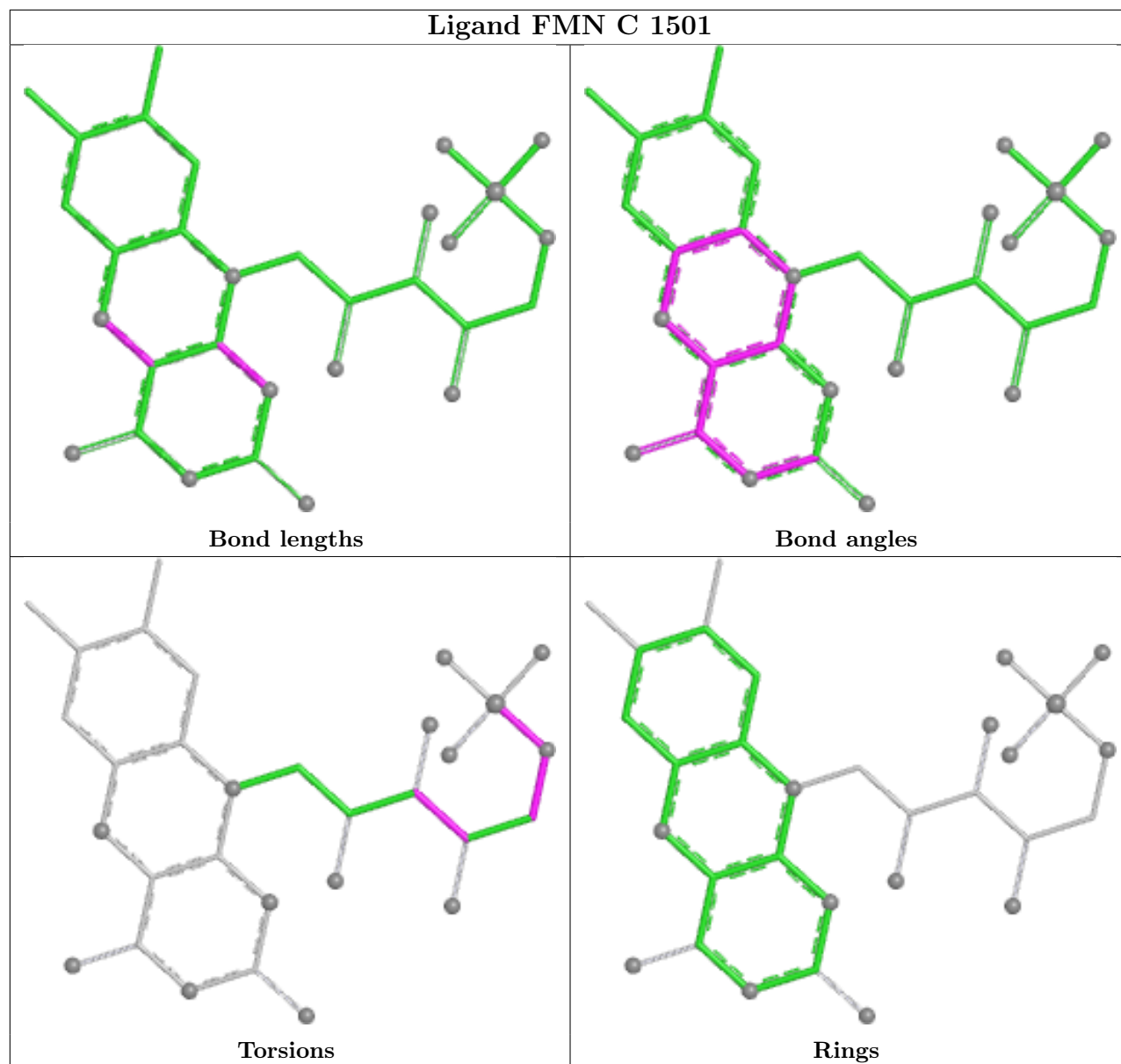


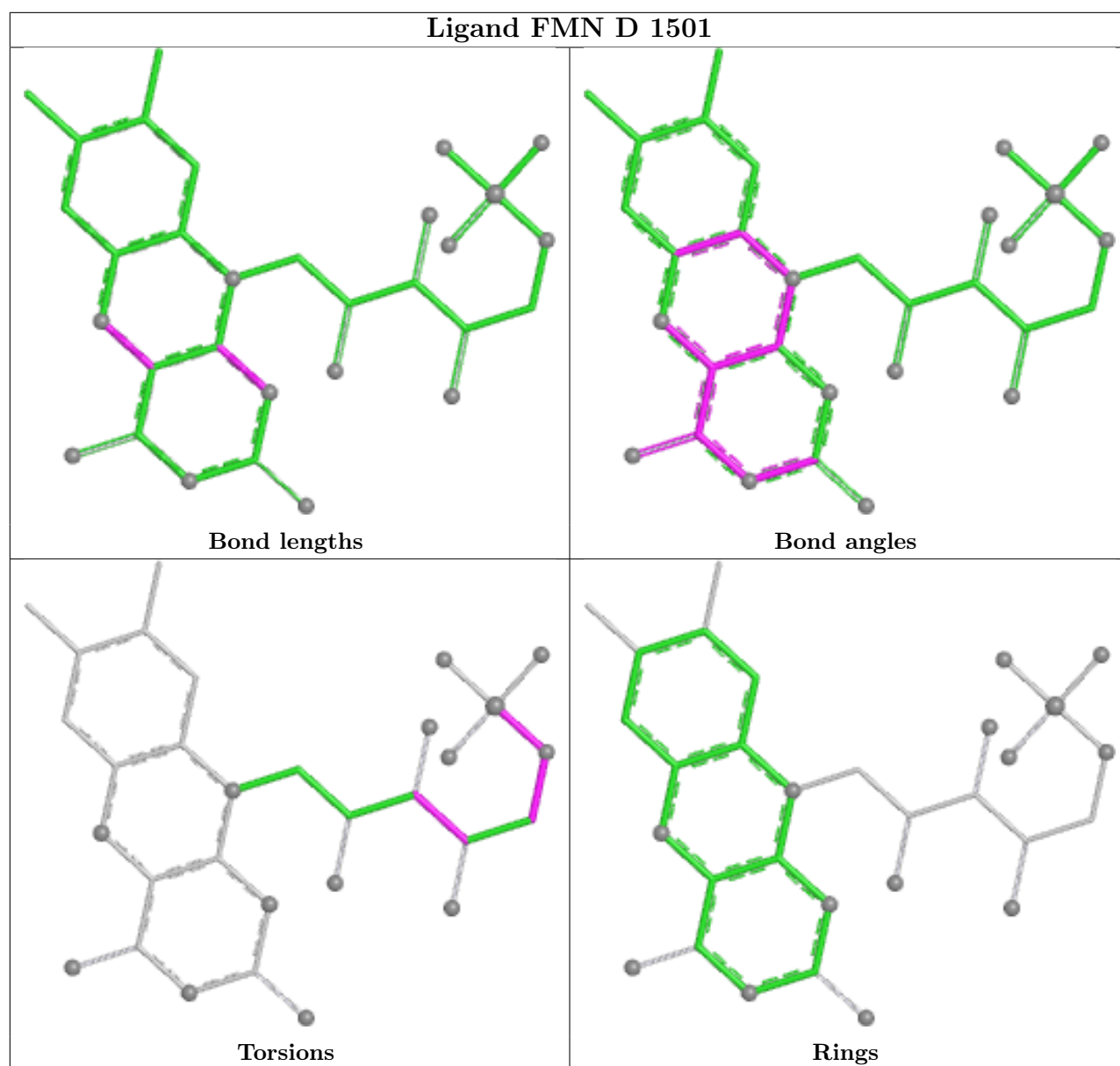


Ligand FAD F 503



Ligand FMN C 1501





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.

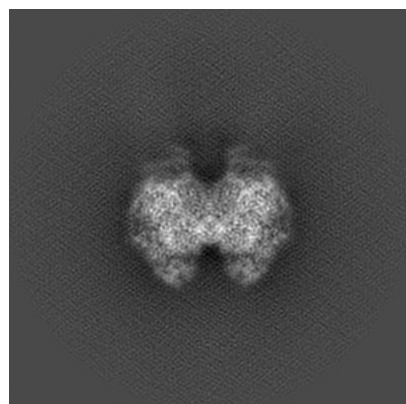
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-10104. These allow visual inspection of the internal detail of the map and identification of artifacts.

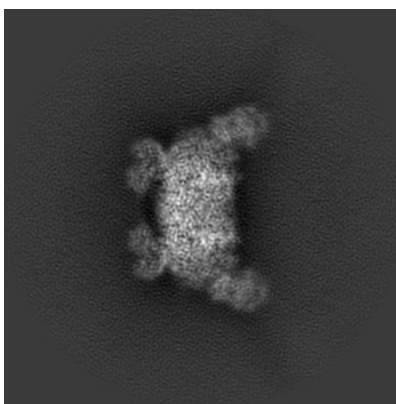
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

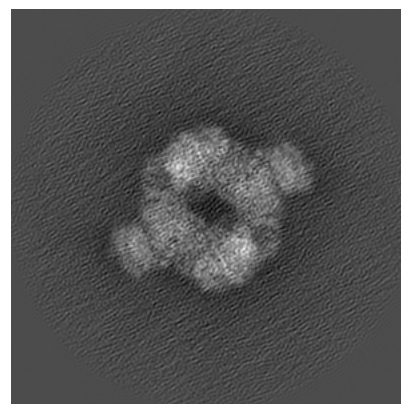
6.1.1 Primary map



X

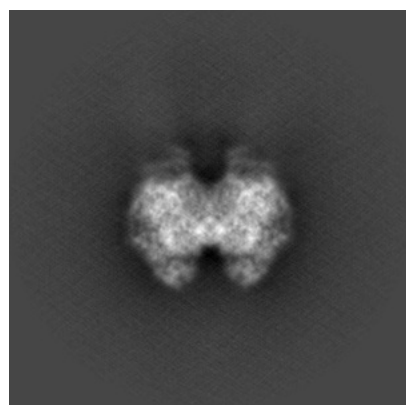


Y

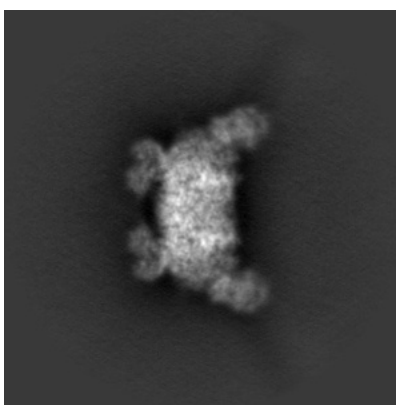


Z

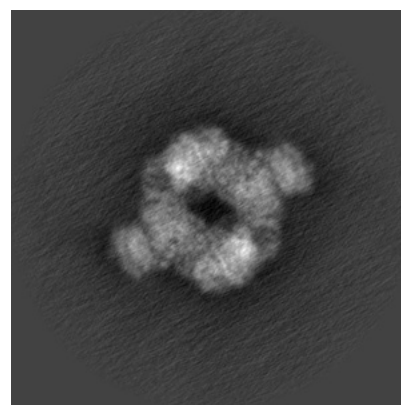
6.1.2 Raw map



X



Y

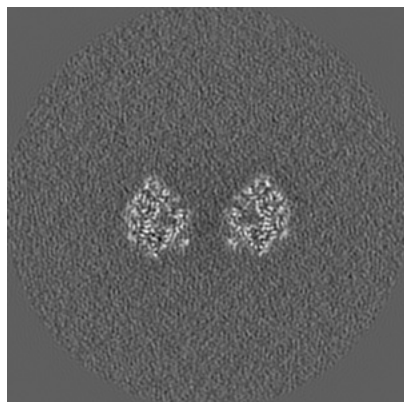


Z

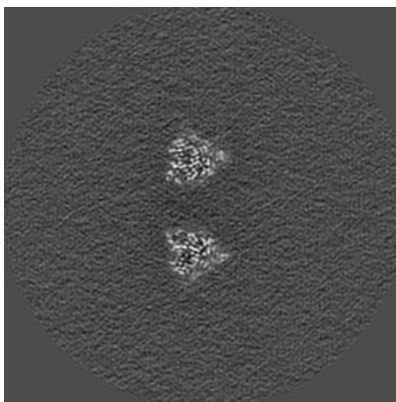
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

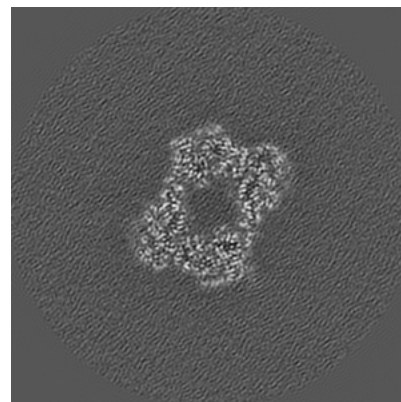
6.2.1 Primary map



X Index: 154

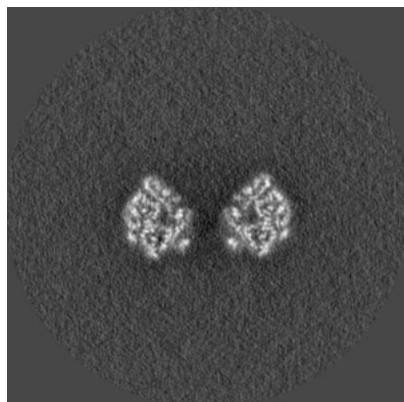


Y Index: 154

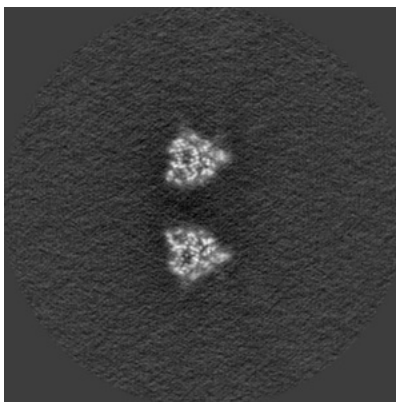


Z Index: 154

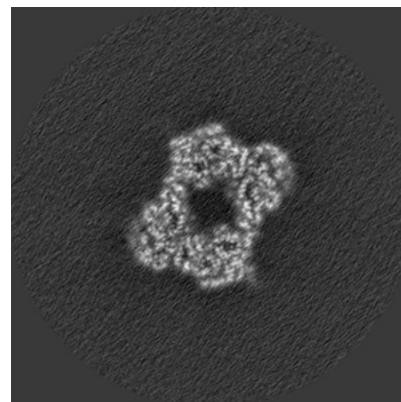
6.2.2 Raw map



X Index: 154



Y Index: 154

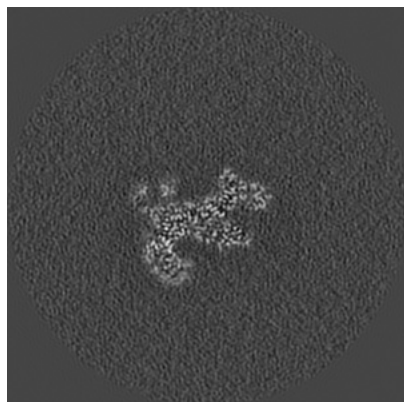


Z Index: 154

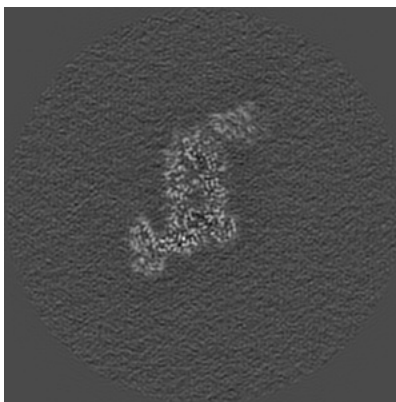
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

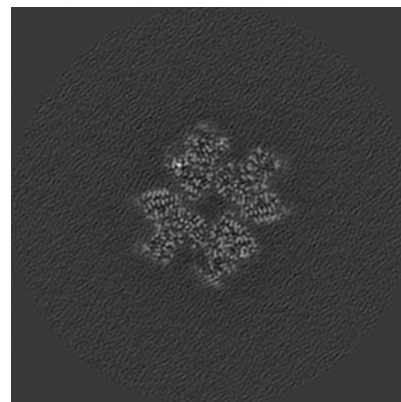
6.3.1 Primary map



X Index: 180

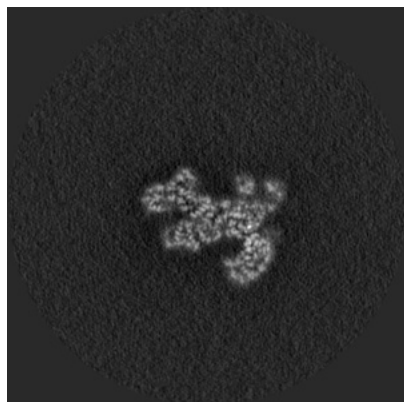


Y Index: 185

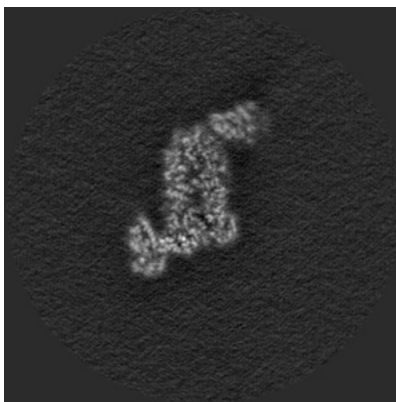


Z Index: 138

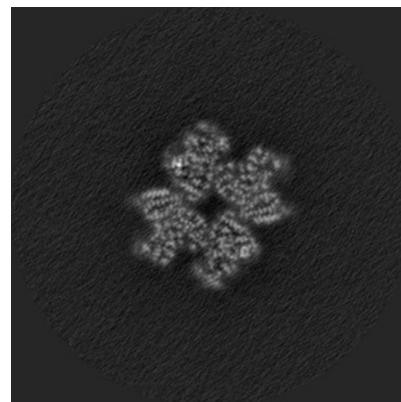
6.3.2 Raw map



X Index: 128



Y Index: 185

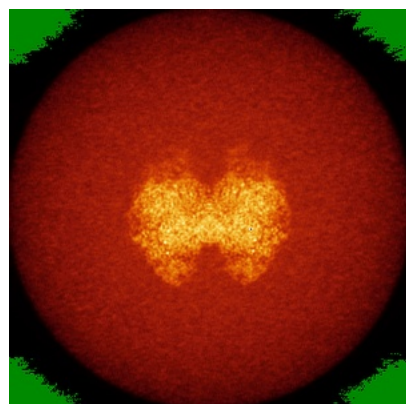


Z Index: 138

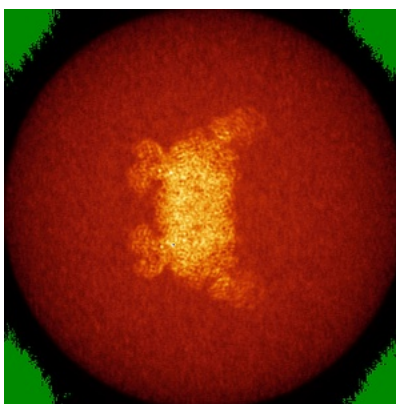
The images above show the largest variance slices of the map in three orthogonal directions.

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

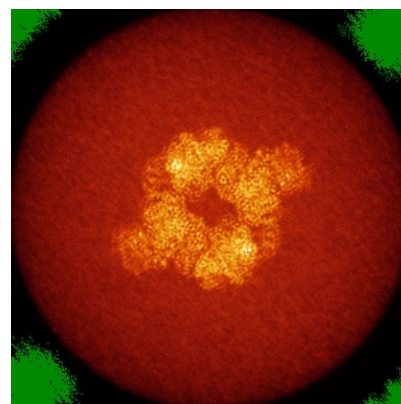
6.4.1 Primary map



X

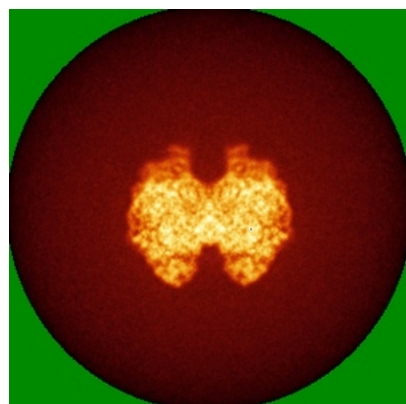


Y

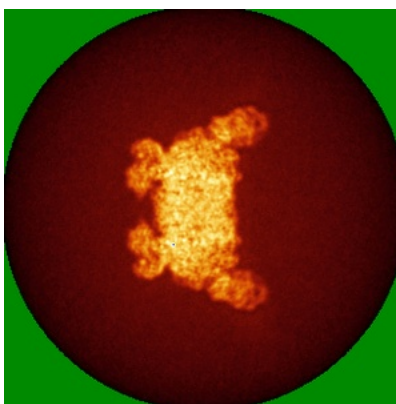


Z

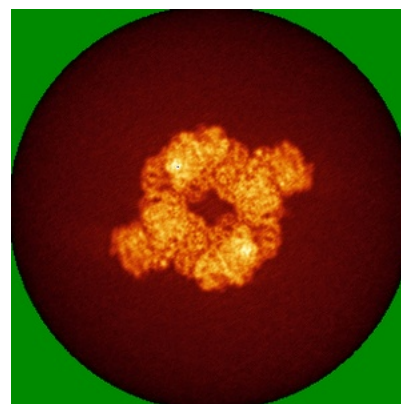
6.4.2 Raw map



X



Y

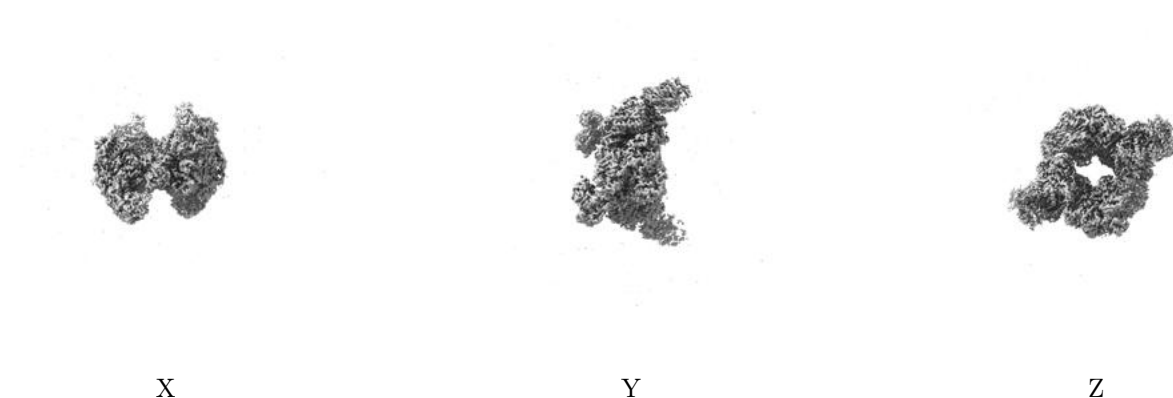


Z

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.

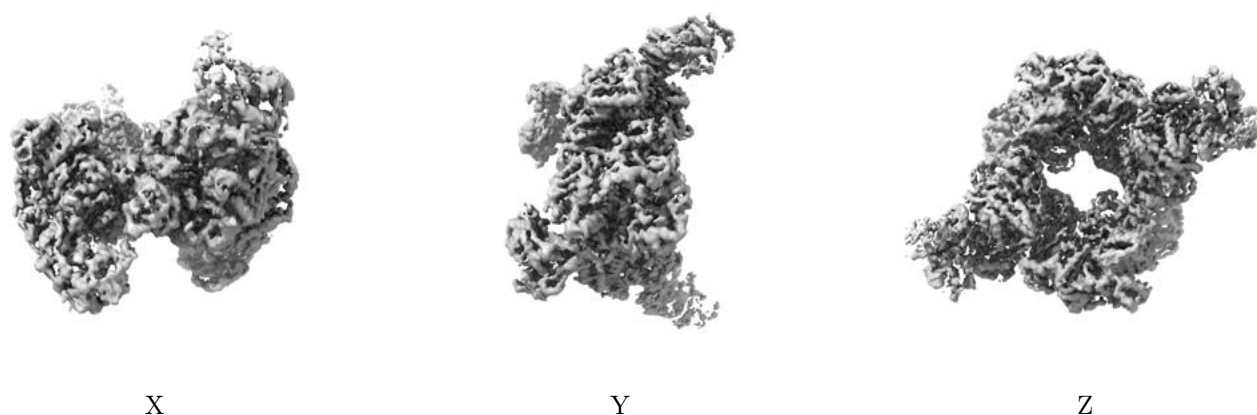
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.09. 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

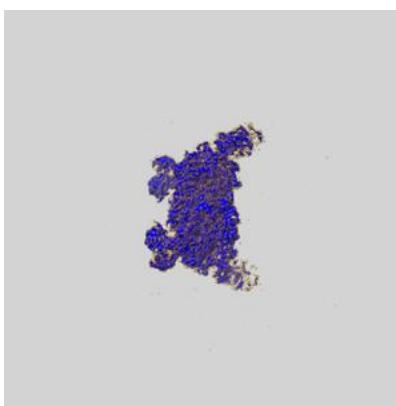
A mask typically either:

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

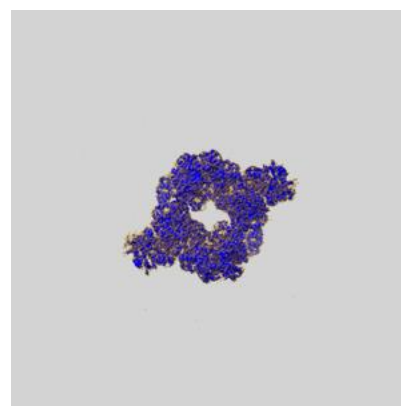
6.6.1 emd_10104_msk_1.map [i](#)



X



Y

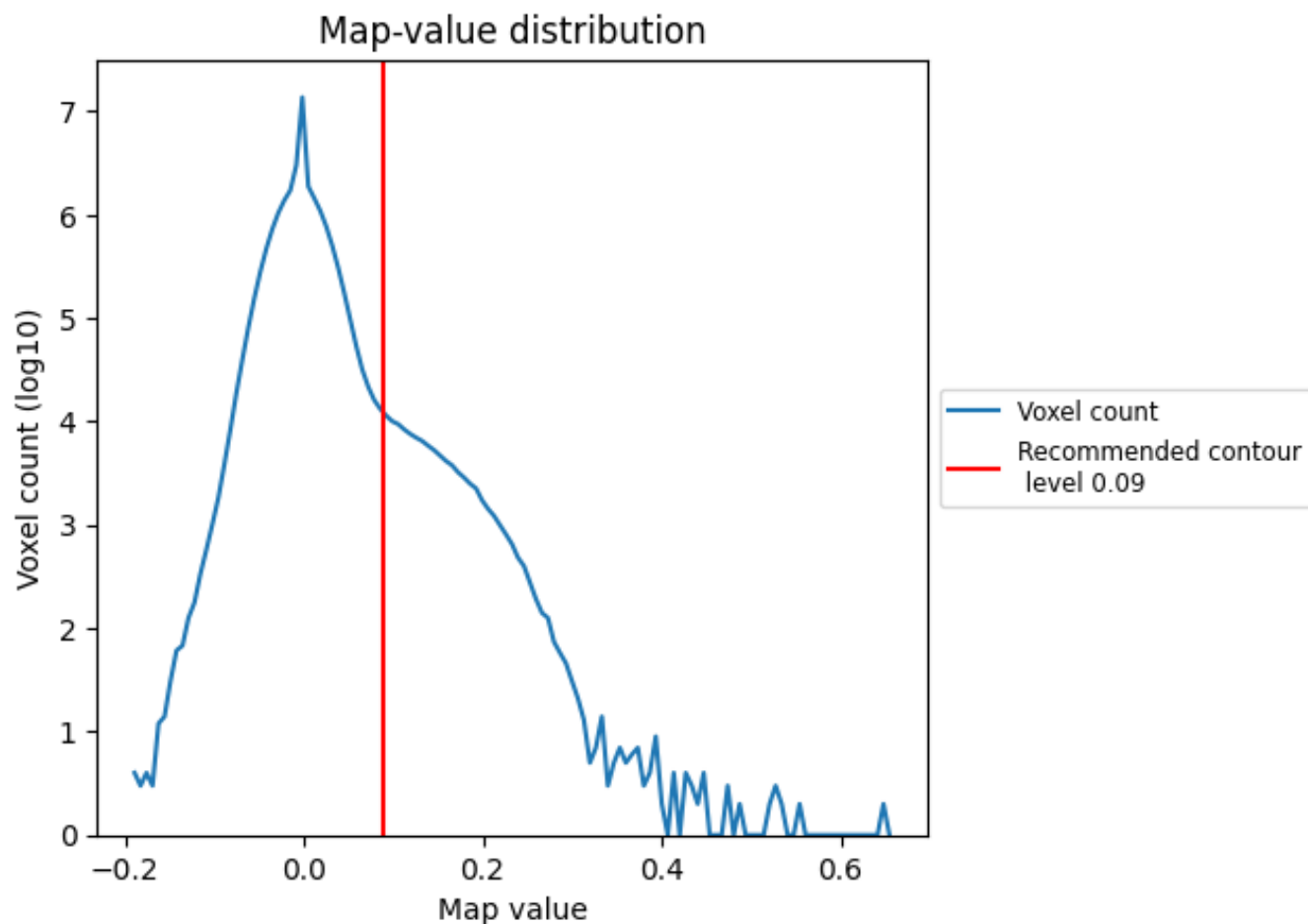


Z

7 Map analysis [i](#)

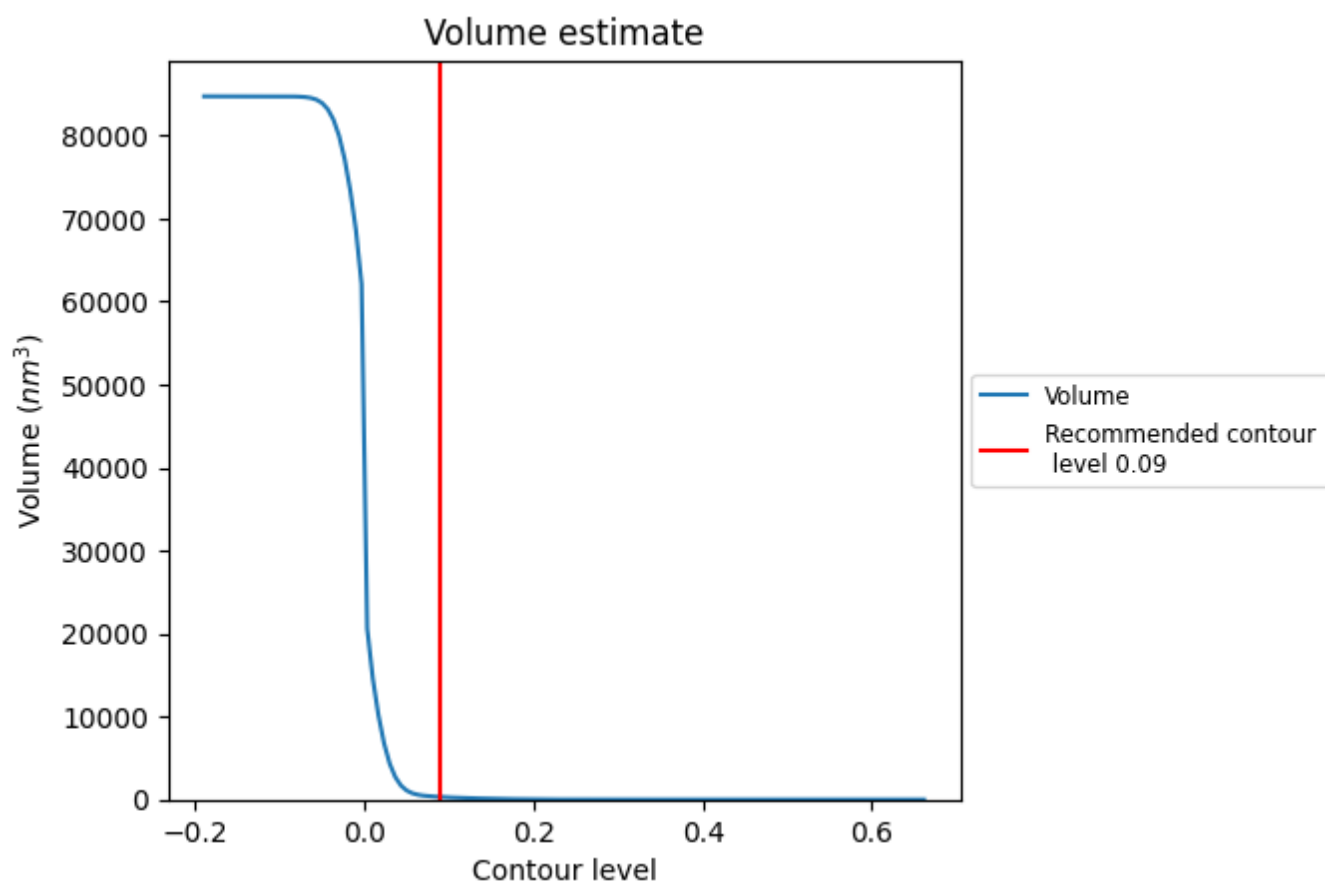
This section contains the results of statistical analysis of the map.

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.

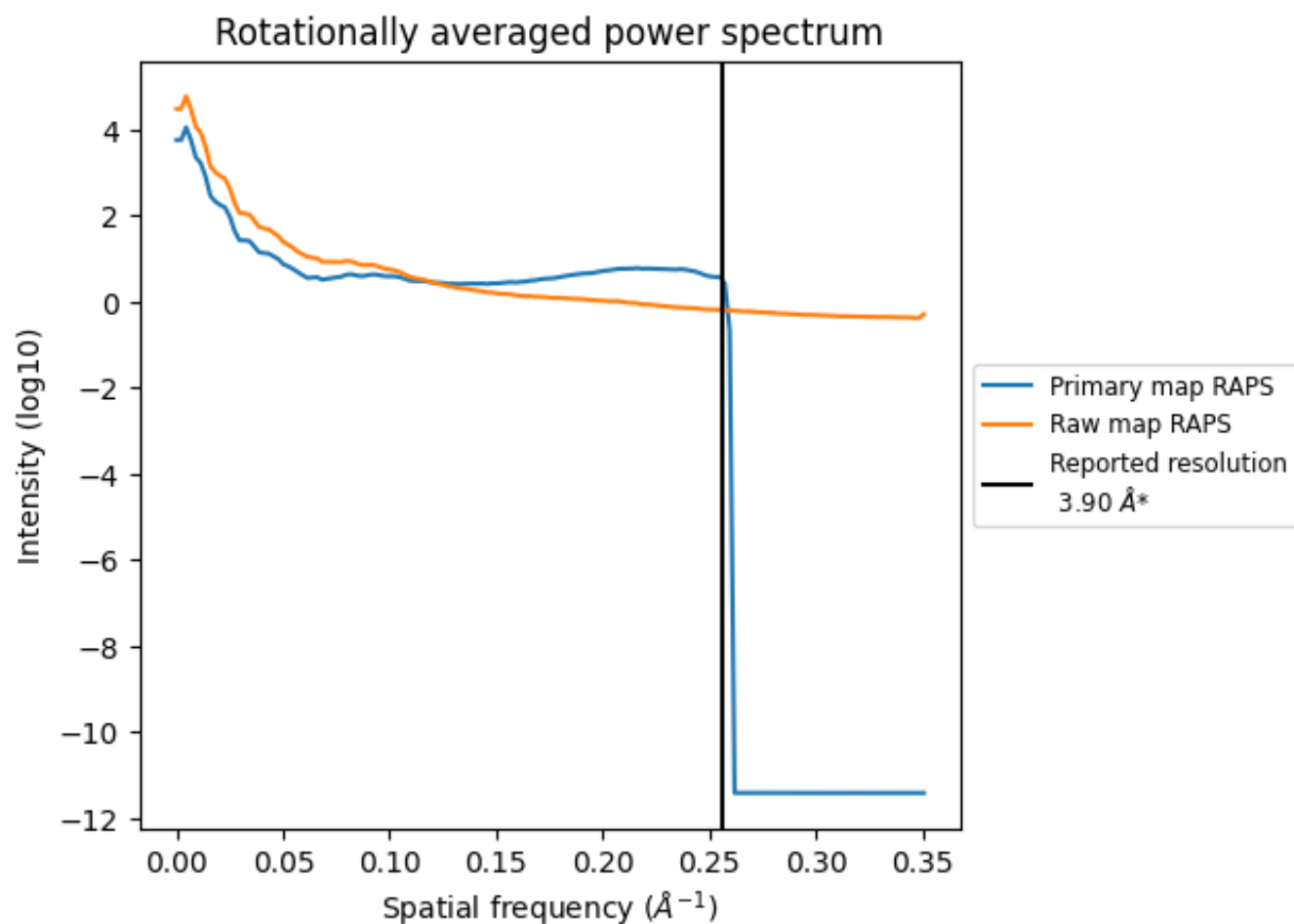
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 313 nm³; this corresponds to an approximate mass of 283 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 ⓘ

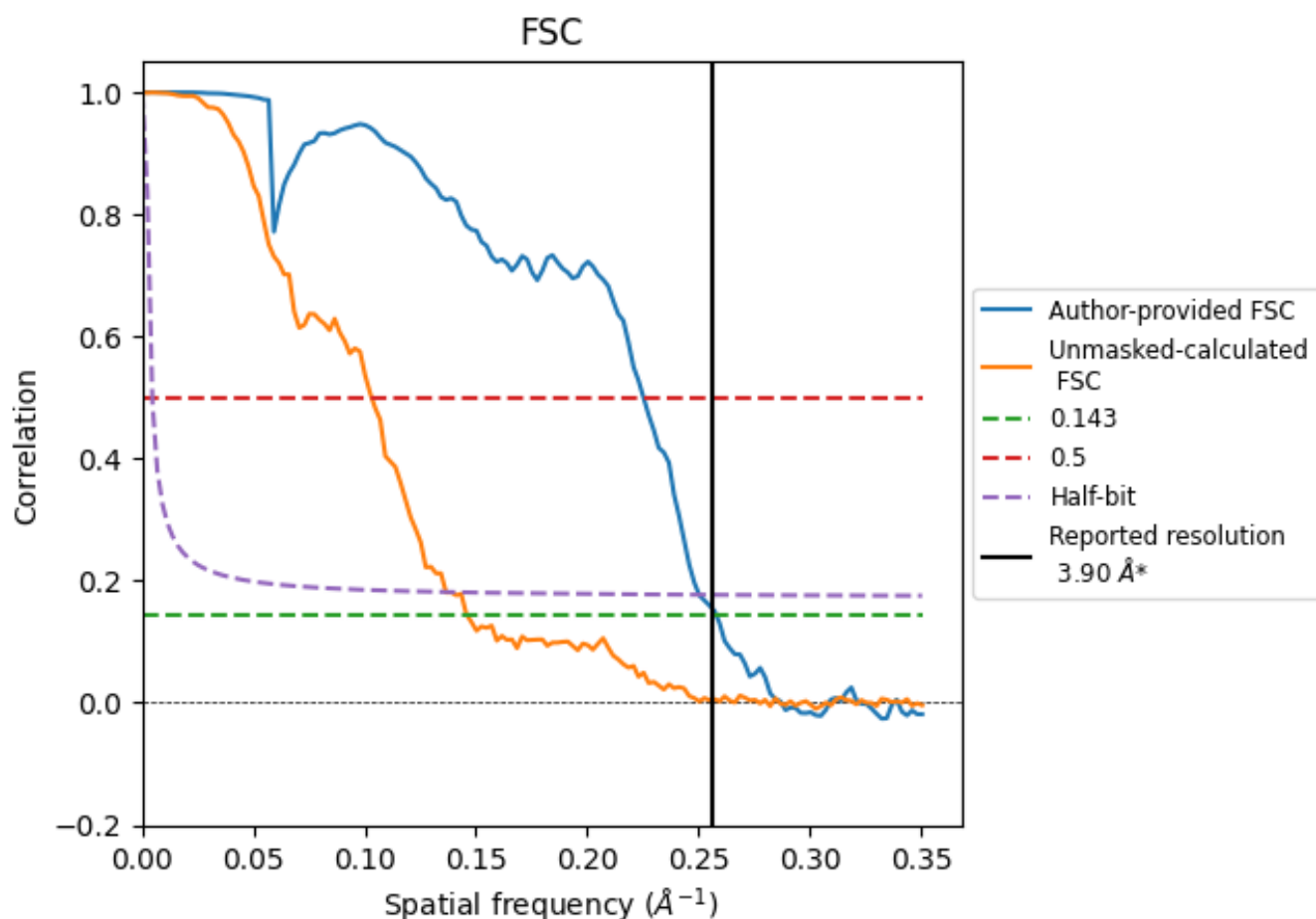


*Reported resolution corresponds to spatial frequency of 0.256 Å⁻¹

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 0.256 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

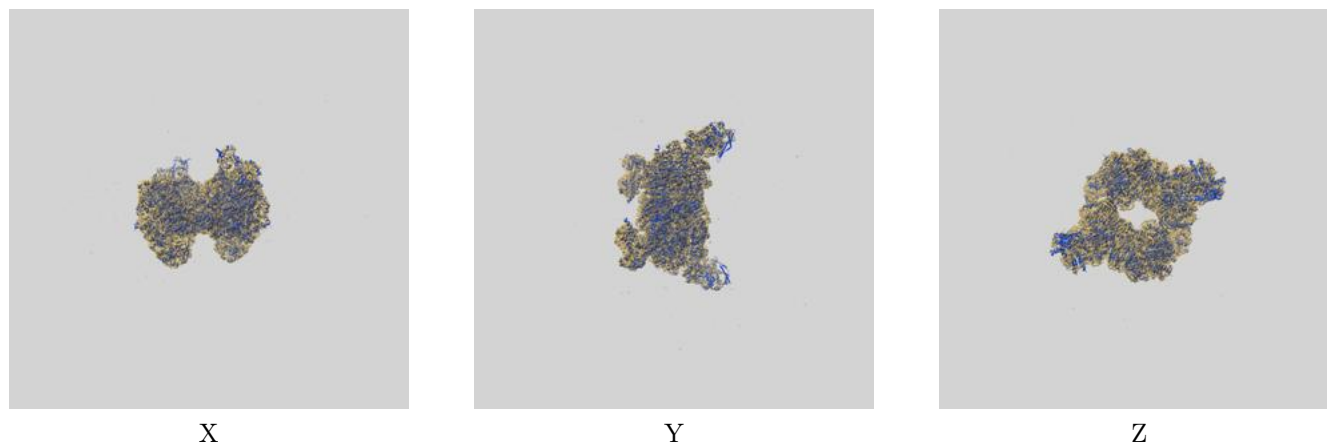
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.90	-	-
Author-provided FSC curve	3.87	4.44	4.00
Unmasked-calculated*	6.84	9.70	7.32

*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 6.84 differs from the reported value 3.9 by more than 10 %

9 Map-model fit [i](#)

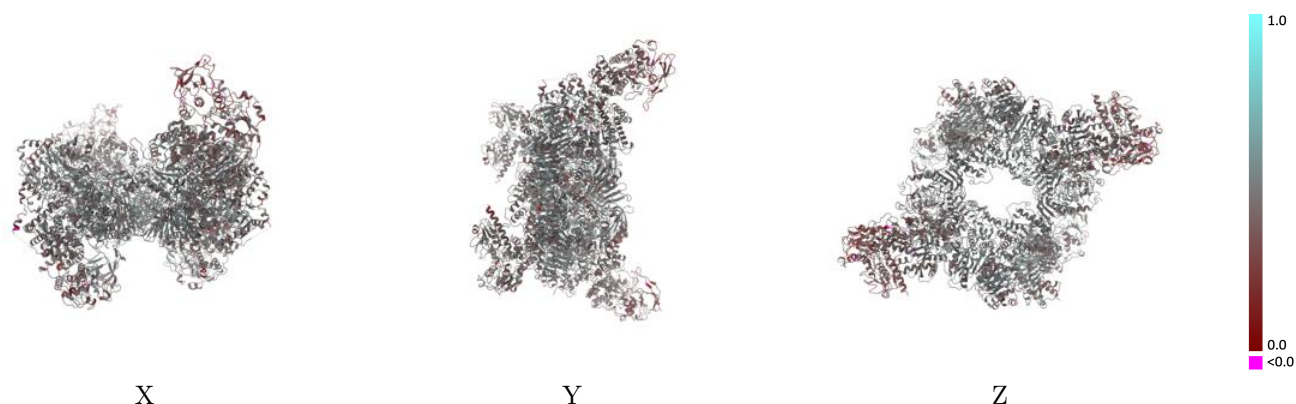
This section contains information regarding the fit between EMDB map EMD-10104 and PDB model 6S6S. Per-residue inclusion information can be found in section [3](#) on page [8](#).

9.1 Map-model overlay [i](#)



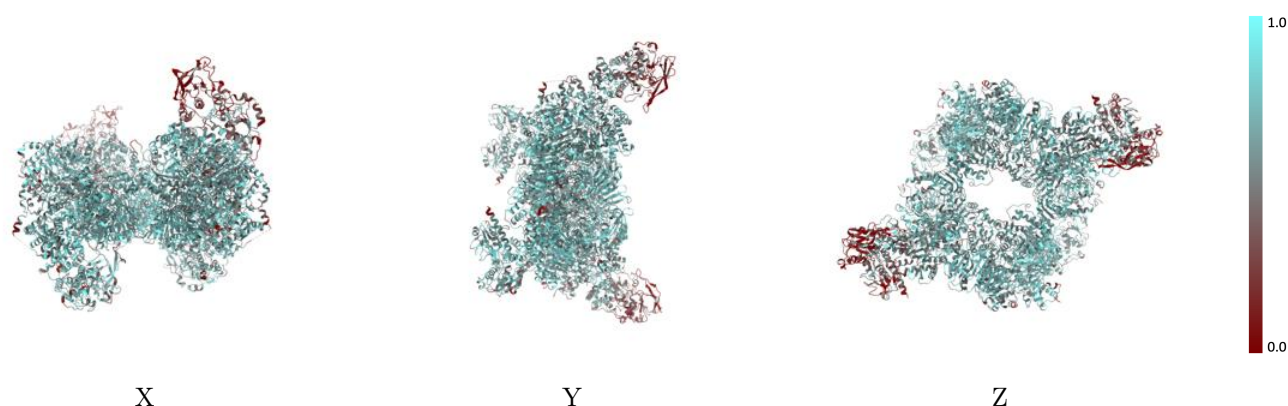
The images above show the 3D surface view of the map at the recommended contour level 0.09 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



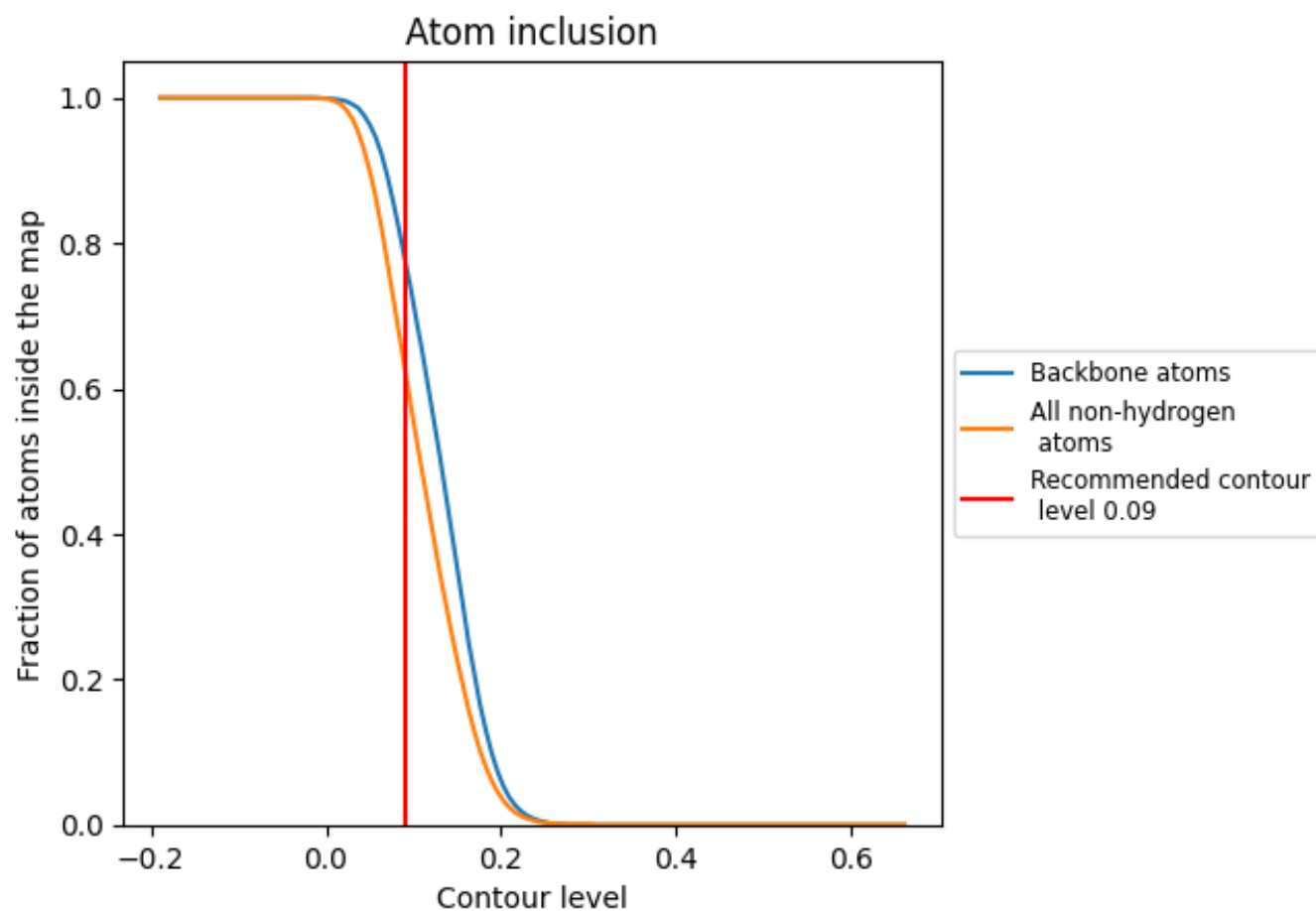
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.09).

9.4 Atom inclusion [i](#)



At the recommended contour level, 78% of all backbone atoms, 63% 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 (0.09) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6270	0.4510
A	0.6640	0.4670
B	0.6720	0.4690
C	0.6740	0.4700
D	0.6690	0.4700
E	0.6250	0.4310
F	0.6250	0.4290
G	0.3230	0.3440
H	0.3970	0.3680

1.0

0.0

<0.0