



wwPDB EM Validation Summary Report ⓘ

Mar 28, 2026 – 11:46 PM UTC

PDB ID : 2VDC / pdb_00002vdc
EMDB ID : EMD-1440
Title : THE 9.5 Å RESOLUTION STRUCTURE OF GLUTAMATE SYNTHASE FROM CRYO-ELECTRON MICROSCOPY AND ITS OLIGOMERIZATION BEHAVIOR IN SOLUTION: FUNCTIONAL IMPLICATIONS.
Authors : Cotteville, M.; Larquet, E.; Jonic, S.; Petoukhov, M.V.; Caprini, G.; Paravisi, S.; Svergun, D.I.; Vanoni, M.A.; Boisset, N.
Deposited on : 2007-10-04
Resolution : 9.50 Å(reported)
Based on initial model : 2VDC

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)

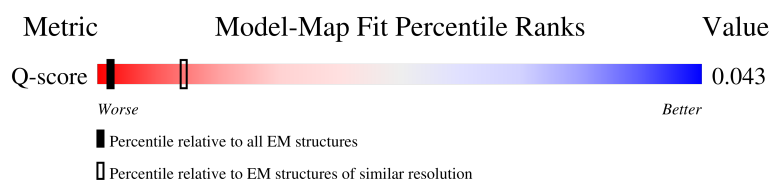
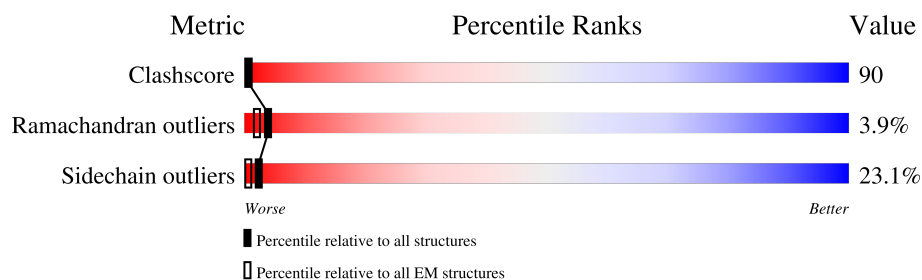
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 9.50 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	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	234 (9.00 - 10.00)

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	1472	<div> <div>29%</div> <div>20%</div> <div>48%</div> <div>26%</div> <div>6%</div> </div>
1	B	1472	<div> <div>29%</div> <div>23%</div> <div>47%</div> <div>24%</div> <div>6%</div> </div>
1	C	1472	<div> <div>31%</div> <div>20%</div> <div>49%</div> <div>25%</div> <div>6%</div> </div>

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Validation Pipeline (wwPDB-VP) : 2.49

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Mol	Chain	Length	Quality of chain
1	D	1472	
1	E	1472	
1	F	1472	
2	G	456	
2	H	456	
2	I	456	
2	J	456	
2	K	456	
2	L	456	

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	OMT	A	2473	-	X	-	-
3	OMT	B	2473	-	X	-	-
3	OMT	C	2473	-	X	-	-
3	OMT	D	2473	-	X	-	-
3	OMT	E	2473	-	X	-	-
3	OMT	F	2473	-	X	-	-
6	F3S	A	2476	-	-	X	-
6	F3S	B	2476	-	-	X	-
6	F3S	C	2476	-	-	X	-
6	F3S	D	2476	-	-	X	-
6	F3S	E	2476	-	-	X	-
6	F3S	F	2476	-	-	X	-
7	SF4	G	483	-	-	X	-
7	SF4	H	483	-	-	X	-
7	SF4	I	483	-	-	X	-
7	SF4	J	483	-	-	X	-
7	SF4	K	483	-	-	X	-
7	SF4	L	483	-	-	X	-

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 89598 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.

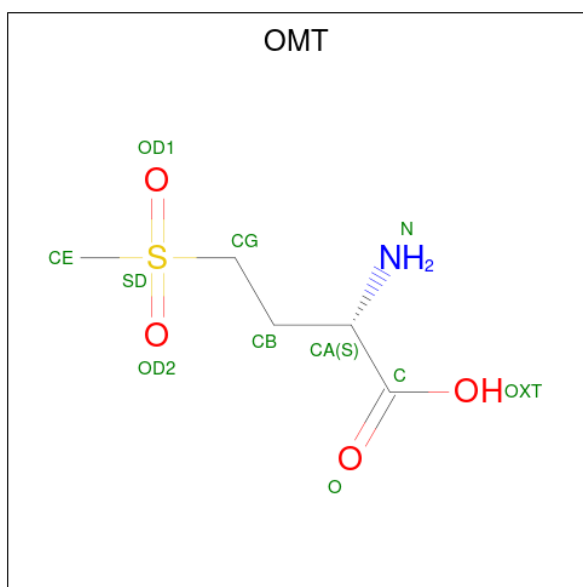
- Molecule 1 is a protein called GLUTAMATE SYNTHASE [NADPH] LARGE CHAIN.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1472	Total 11337	C 7109	N 2036	O 2132	S 60	0	0
1	B	1472	Total 11337	C 7109	N 2036	O 2132	S 60	0	0
1	C	1472	Total 11337	C 7109	N 2036	O 2132	S 60	0	0
1	D	1472	Total 11337	C 7109	N 2036	O 2132	S 60	0	0
1	E	1472	Total 11337	C 7109	N 2036	O 2132	S 60	0	0
1	F	1472	Total 11337	C 7109	N 2036	O 2132	S 60	0	0

- Molecule 2 is a protein called GLUTAMATE SYNTHASE [NADPH] SMALL CHAIN.

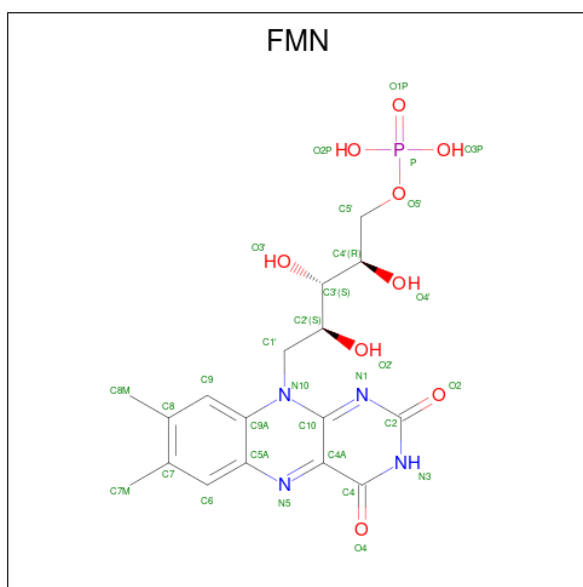
Mol	Chain	Residues	Atoms					AltConf	Trace
2	G	456	Total 3468	C 2163	N 624	O 666	S 15	0	0
2	H	456	Total 3468	C 2163	N 624	O 666	S 15	0	0
2	I	456	Total 3468	C 2163	N 624	O 666	S 15	0	0
2	J	456	Total 3468	C 2163	N 624	O 666	S 15	0	0
2	K	456	Total 3468	C 2163	N 624	O 666	S 15	0	0
2	L	456	Total 3468	C 2163	N 624	O 666	S 15	0	0

- Molecule 3 is S-DIOXYMETHIONINE (CCD ID: OMT) (formula: C₅H₁₁NO₄S).



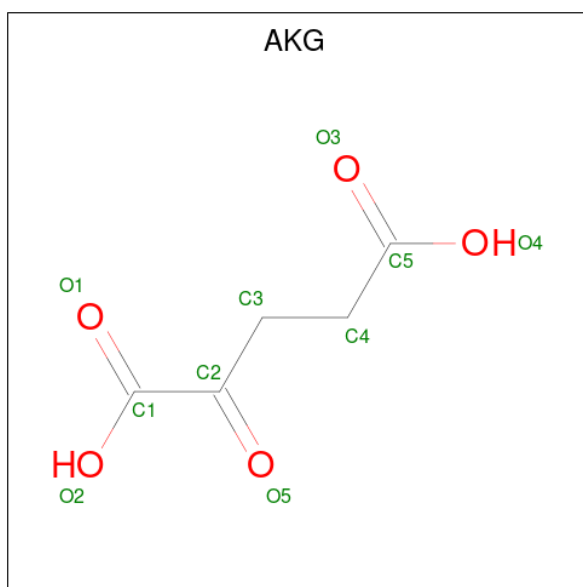
Mol	Chain	Residues	Atoms					AltConf
3	A	1	Total	C	N	O	S	0
			11	5	1	4	1	
3	B	1	Total	C	N	O	S	0
			11	5	1	4	1	
3	C	1	Total	C	N	O	S	0
			11	5	1	4	1	
3	D	1	Total	C	N	O	S	0
			11	5	1	4	1	
3	E	1	Total	C	N	O	S	0
			11	5	1	4	1	
3	F	1	Total	C	N	O	S	0
			11	5	1	4	1	

- Molecule 4 is FLAVIN MONONUCLEOTIDE (CCD ID: FMN) (formula: C₁₇H₂₁N₄O₉P).



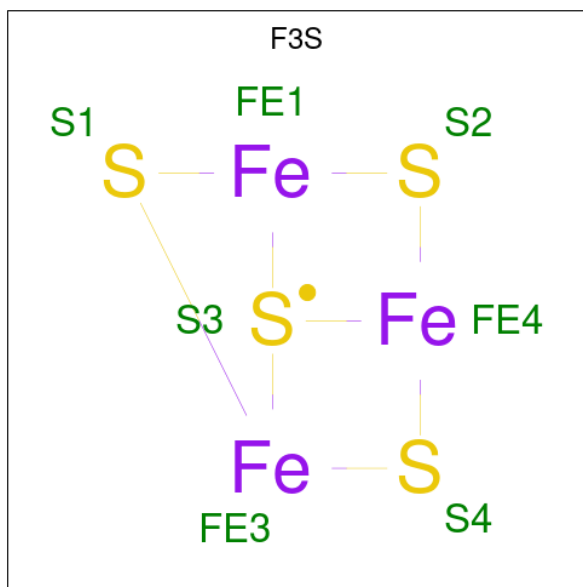
Mol	Chain	Residues	Atoms					AltConf
4	A	1	Total	C	N	O	P	0
			31	17	4	9	1	
4	B	1	Total	C	N	O	P	0
			31	17	4	9	1	
4	C	1	Total	C	N	O	P	0
			31	17	4	9	1	
4	D	1	Total	C	N	O	P	0
			31	17	4	9	1	
4	E	1	Total	C	N	O	P	0
			31	17	4	9	1	
4	F	1	Total	C	N	O	P	0
			31	17	4	9	1	

- Molecule 5 is 2-OXOGLUTARIC ACID (CCD ID: AKG) (formula: C₅H₆O₅).



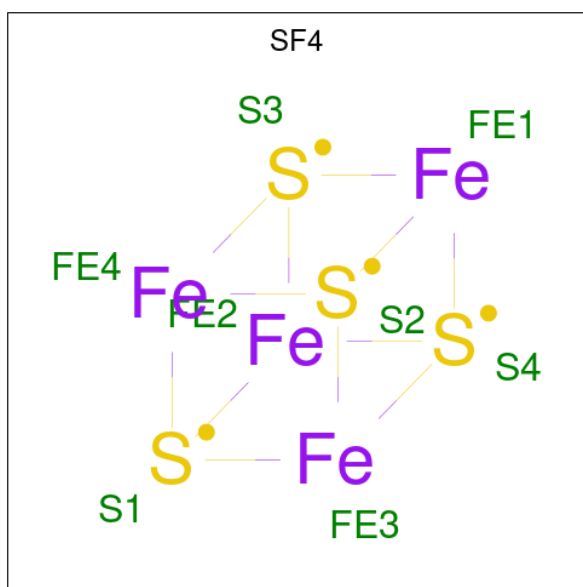
Mol	Chain	Residues	Atoms			AltConf
5	A	1	Total	C	O	0
			10	5	5	
5	B	1	Total	C	O	0
			10	5	5	
5	C	1	Total	C	O	0
			10	5	5	
5	D	1	Total	C	O	0
			10	5	5	
5	E	1	Total	C	O	0
			10	5	5	
5	F	1	Total	C	O	0
			10	5	5	

- Molecule 6 is FE3-S4 CLUSTER (CCD ID: F3S) (formula: Fe₃S₄).



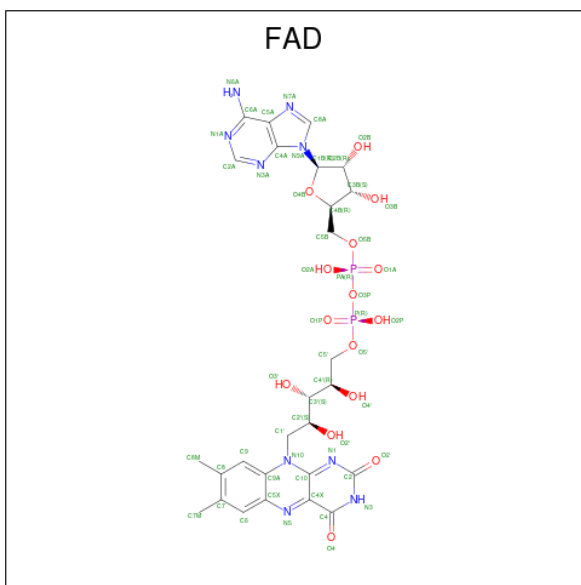
Mol	Chain	Residues	Atoms			AltConf
6	A	1	Total	Fe	S	0
			7	3	4	
6	B	1	Total	Fe	S	0
			7	3	4	
6	C	1	Total	Fe	S	0
			7	3	4	
6	D	1	Total	Fe	S	0
			7	3	4	
6	E	1	Total	Fe	S	0
			7	3	4	
6	F	1	Total	Fe	S	0
			7	3	4	

- Molecule 7 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe₄S₄).



Mol	Chain	Residues	Atoms			AltConf
7	G	1	Total	Fe	S	0
			8	4	4	
7	G	1	Total	Fe	S	0
			8	4	4	
7	H	1	Total	Fe	S	0
			8	4	4	
7	H	1	Total	Fe	S	0
			8	4	4	
7	I	1	Total	Fe	S	0
			8	4	4	
7	I	1	Total	Fe	S	0
			8	4	4	
7	J	1	Total	Fe	S	0
			8	4	4	
7	J	1	Total	Fe	S	0
			8	4	4	
7	K	1	Total	Fe	S	0
			8	4	4	
7	K	1	Total	Fe	S	0
			8	4	4	
7	L	1	Total	Fe	S	0
			8	4	4	
7	L	1	Total	Fe	S	0
			8	4	4	

- Molecule 8 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).

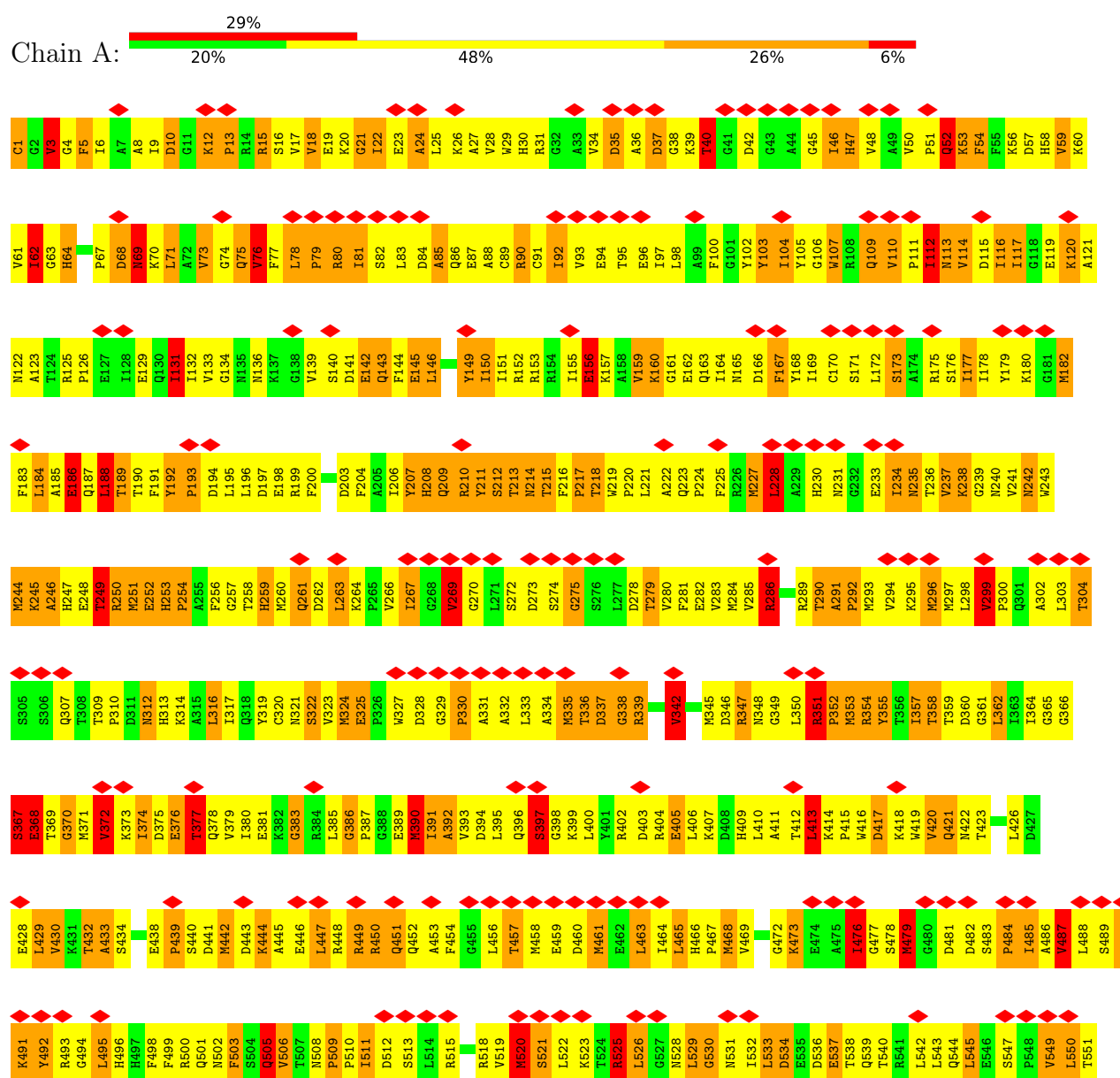


Mol	Chain	Residues	Atoms					AltConf
8	G	1	Total 53	C 27	N 9	O 15	P 2	0
8	H	1	Total 53	C 27	N 9	O 15	P 2	0
8	I	1	Total 53	C 27	N 9	O 15	P 2	0
8	J	1	Total 53	C 27	N 9	O 15	P 2	0
8	K	1	Total 53	C 27	N 9	O 15	P 2	0
8	L	1	Total 53	C 27	N 9	O 15	P 2	0

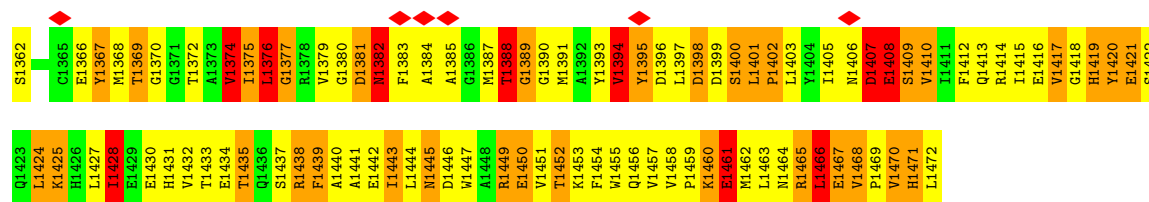
3 Residue-property plots

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.

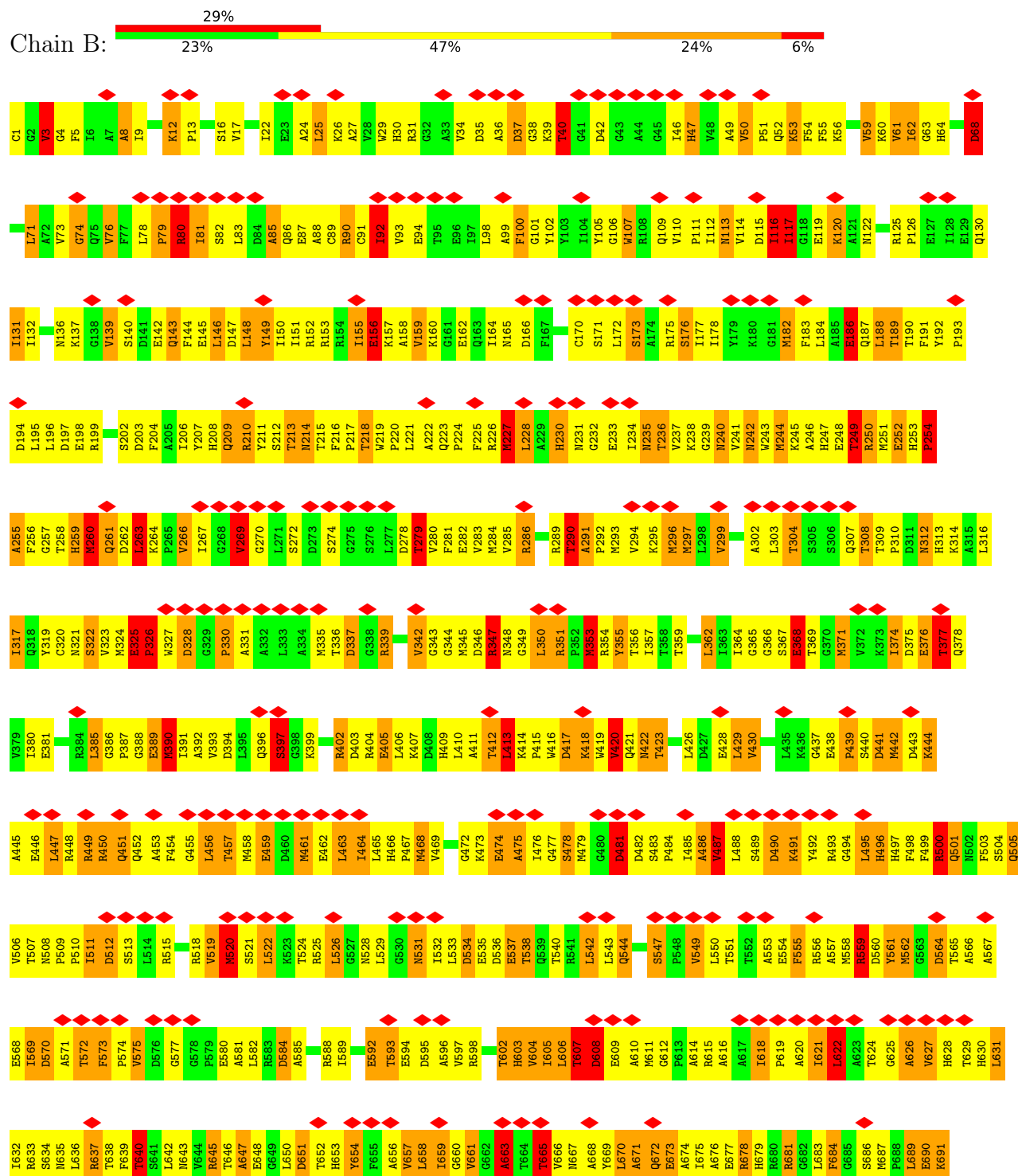
• Molecule 1: GLUTAMATE SYNTHASE [NADPH] LARGE CHAIN

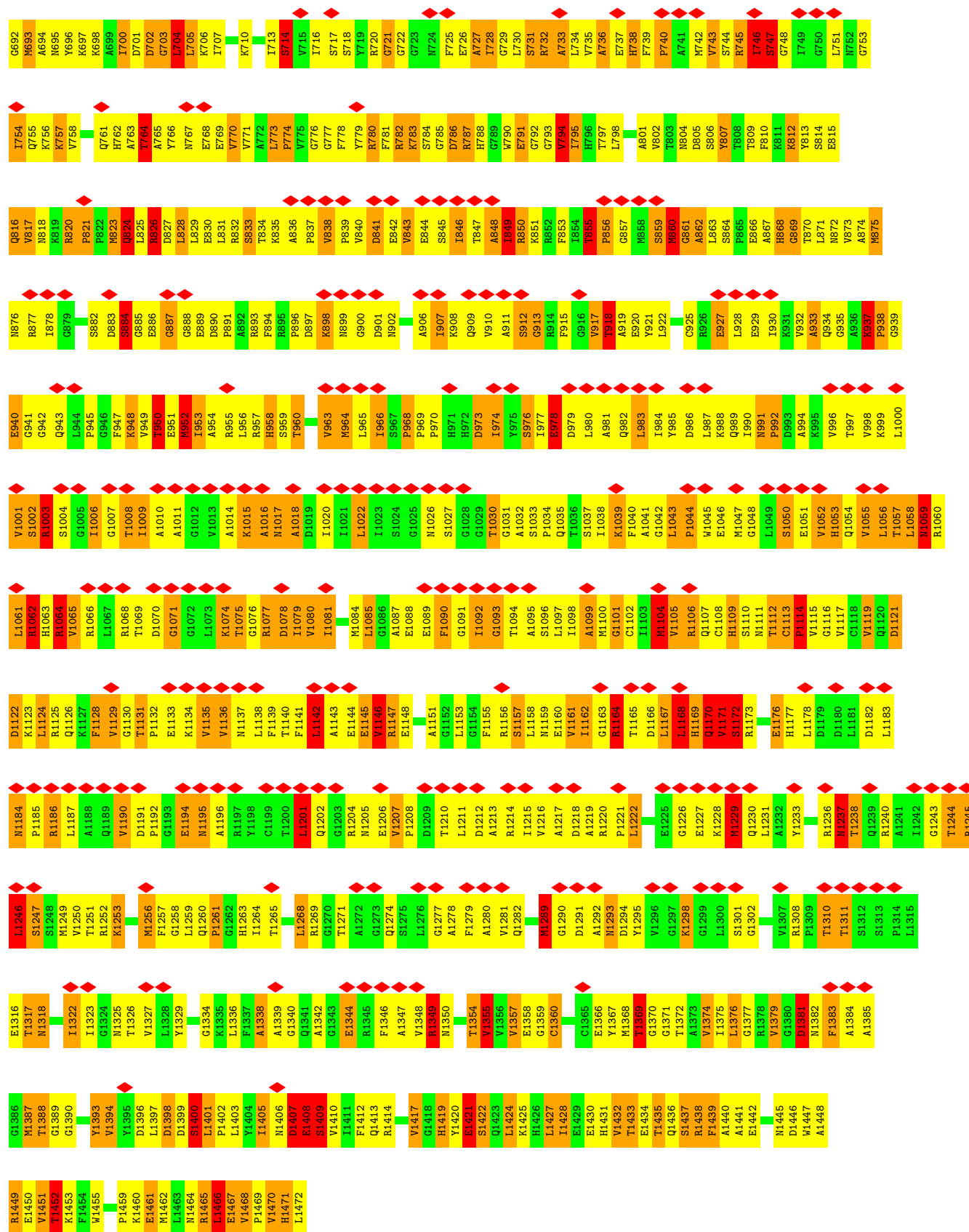


G1297	K1298	G1299	L1300	S1301	G1302	G1303	G1304	I1305	V1306	V1307	R1308	P1309	T1310	T1311	S1312	P1313	P1314	L1315	E1316	T1317	T1318	K1319	K1320	T1321	I1322	I1323	T1326	V1327	L1328	Y1329	A1333	G1334	K1335	L1336	F1337	A1338	A1339	G1340	G1341	E1344	R1345	F1346	A1347	V1348	R1349	K1350	S1351	T1354	V1355	V1356	V1357	E1358	G1359	G1360	G1361					
R1236	N1237	T1238	Q1239	R1240	A1241	I1242	G1243	T1244	R1245	L1246	S1247	M1248	M1249	V1250	T1251	K1253	F1254	G1255	M1256	F1257	Q1260	P1261	G1262	H1263	T1264	T1265	R1266	T1267	L1268	G1269	T1271	A1272	G1273	Q1274	S1275	L1276	G1277	A1278	F1279	A1280	V1281	Q1282	I1284	K1285	L1286	E1287	V1288	M1289	Q1290	D1291	A1292	N1293	D1294	Y1295	V1296					
V1115	G1116	V1117	C1118	V1119	Q1120	D1121	D1122	K1123	L1124	R1125	Q1126	V1129	G1130	T1131	P1132	E1133	K1134	V1135	V1136	N1137	L1138	F1139	T1140	F1141	L1142	A1143	E1144	E1145	V1146	R1147	E1148	L1149	L1150	A1151	G1152	L1153	L1154	F1155	R1156	S1157	L1158	N1159	E1160	V1161	I1162	G1163	R1164	T1165	L1166	L1167	L1168	H1169	Q1170	V1171	S1172	R1173	G1174	A1175		
E1176	H1177	L1178	D1179	D1180	L1181	D1182	L1183	N1184	P1185	R1186	L1187	A1188	Q1189	V1190	D1191	P1192	G1193	E1194	N1195	A1196	L1197	Y1198	G1199	T1200	L1201	Q1202	G1203	R1204	N1205	E1206	V1207	P1208	G1209	T1210	L1211	D1212	A1213	R1214	I1215	V1216	A1217	D1218	A1219	R1220	P1221	L1222	F1223	E1224	E1225	G1226	E1227	K1228	M1229	A1232	Y1233	N1234	A1235			
H1053	Q1054	V1055	L1056	T1057	L1058	N1059	R1060	L1061	R1062	H1063	R1064	V1065	L1066	L1067	R1068	T1069	D1070	G1071	G1072	L1073	K1074	T1075	G1076	R1077	D1078	L1079	V1080	I1081	M1084	L1085	G1086	E1087	L1088	E1089	F1090	G1091	I1092	G1093	T1094	S1096	A1099	M1100	G1101	C1102	T1103	M1104	R1106	Q1107	C1108	H1109	S1110	N1111	T1112	G1113	P1114					
I990	N991	P992	V996	T997	A993	Q994	G995	R996	L1000	V1001	S1002	R1003	S1004	G1005	I1006	G1007	I1008	I1009	A1010	T9950	E951	P952	A954	R955	L956	R957	H958	S959	T960	P961	G962	V963	L964	N965	Q966	S967	P968	P969	P970	H971	H972	D973	1974	Y975	S976	R977	1977	E978	D979	L980	A981	V1005	G1042	P1044	W1045	E985	D986	L987	K988	Q989
L928	E929	1930	K931	V932	T930	L871	N872	N875	N876	R877	L878	G879	D883	G885	E886	G887	G888	E889	P891	G892	L825	R826	D827	L828	L829	L831	R832	S833	T834	K835	A836	P837	V838	P839	V840	D841	E842	V843	E844	S845	T846	T847	A848	T849	R850	K851	R852	P853	T854	T855	P856	G857	M858	S859	M860	G861				
A862	L863	S864	G869	T870	L871	N872	N875	N876	R877	L878	G879	D883	G885	E886	G887	G888	E889	P891	G892	L825	R826	D827	L828	L829	L831	R832	S833	T834	K835	A836	P837	V838	P839	V840	D841	E842	V843	E844	S845	T846	T847	A848	T849	R850	K851	R852	P853	T854	T855	P856	G857	M858	S859	M860	G861					
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A862	L863	S864	G869	T870	L871	N872	N875	N876	R877	L878	G879	D883	G885	E886	G887	G888	E889	P891	G892	L825	R826	D827	L828	L829	L831	R832	S833	T834	K835	A836	P837	V838	P839	V840	D841	E842	V843	E844	S845	T846	T847	A848	T849	R850	K851	R852	P853	T854	T855	P856	G857	M858	S859	M860	G861					
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A862	L863	S864	G869	T870	L871	N872	N875	N876	R877	L878	G879	D883	G885	E886	G887	G888	E889	P891	G892	L825	R826	D827	L828	L829	L831	R832	S833	T834	K835	A836	P837	V838	P839	V840	D841	E842	V843	E844	S845	T846	T847	A848	T849	R850	K851	R852	P853	T854	T855	P856	G857	M858	S859	M860	G861					
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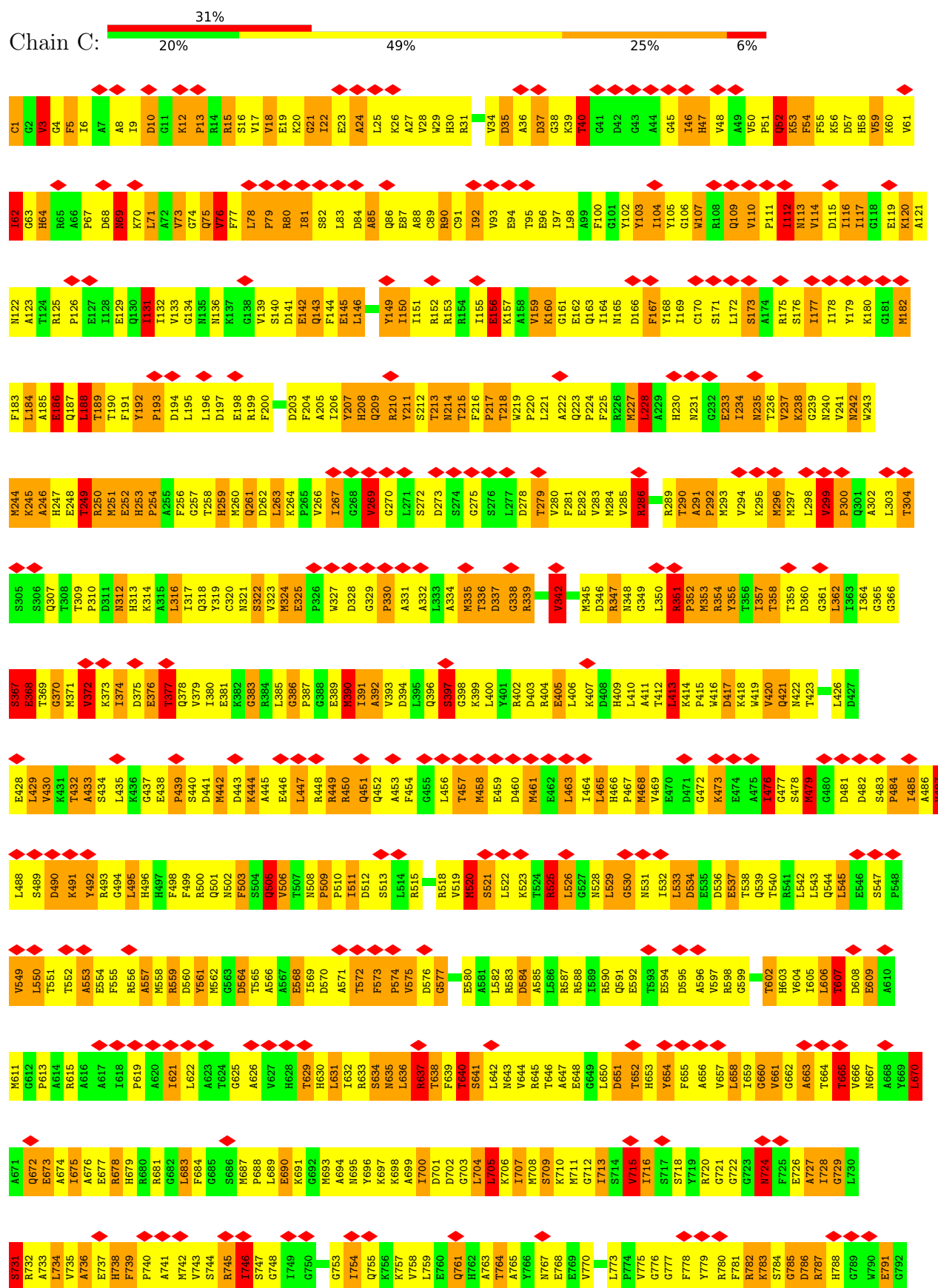


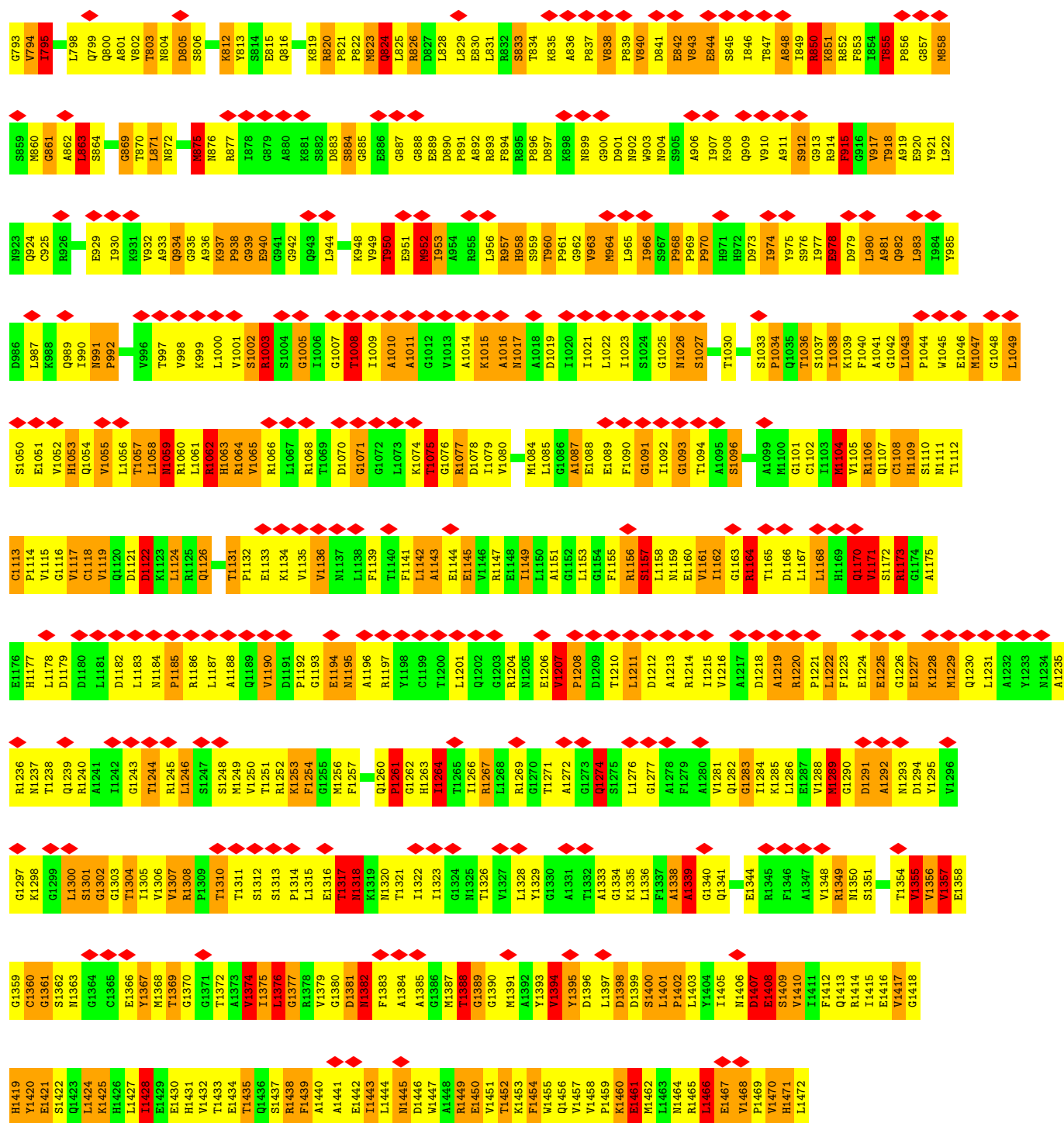
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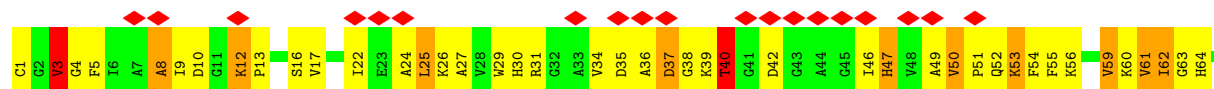
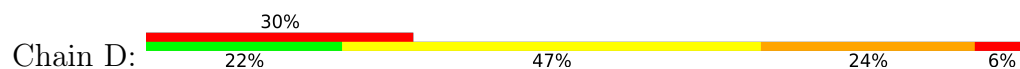


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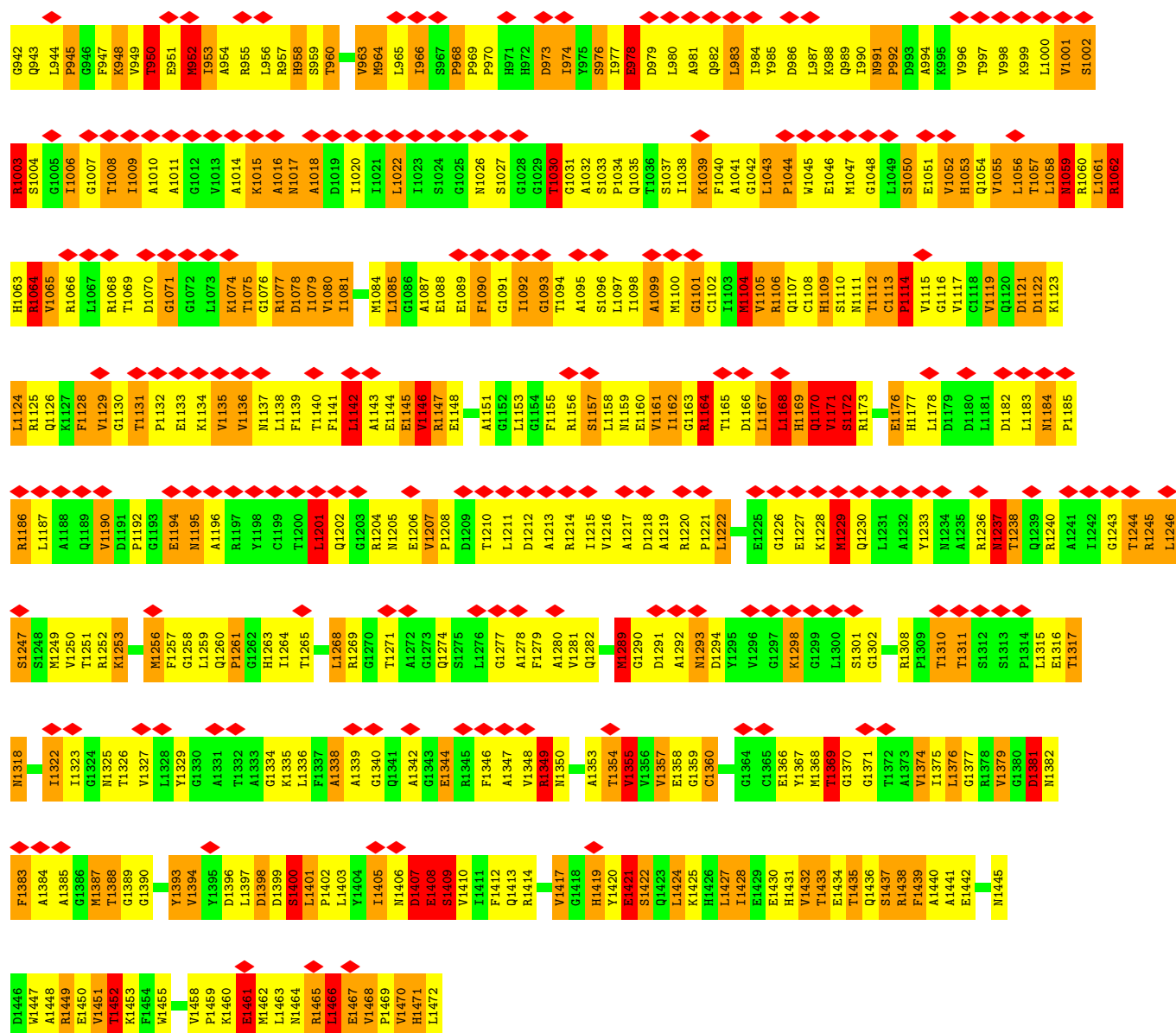




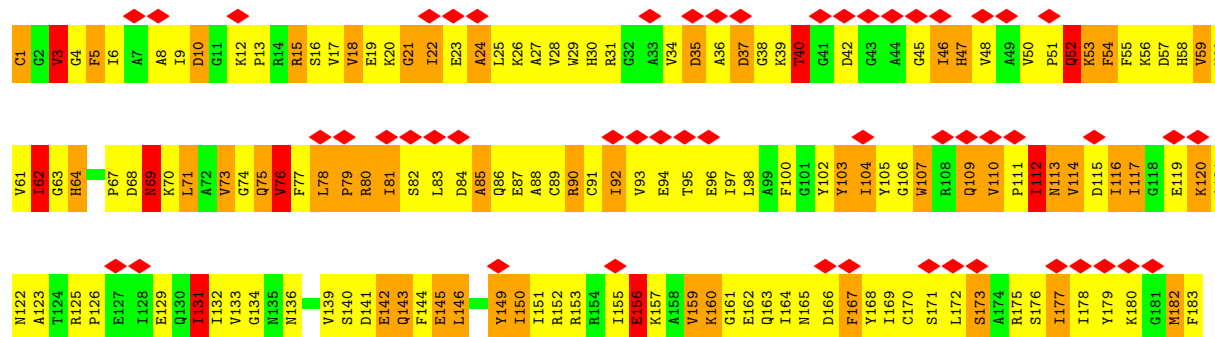
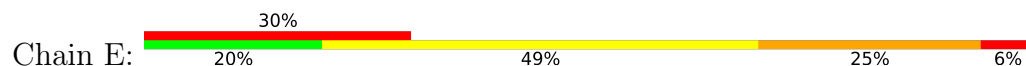
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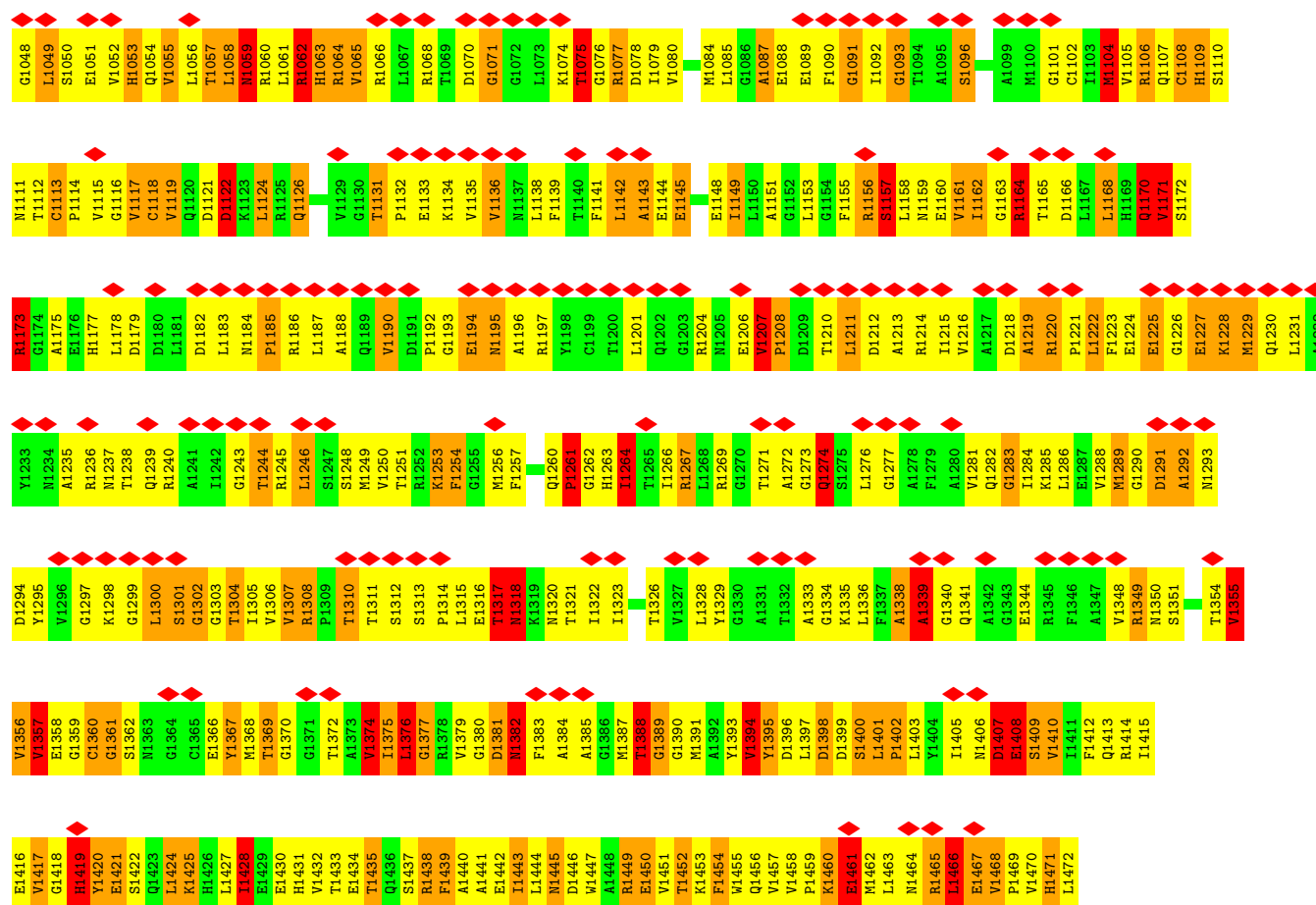




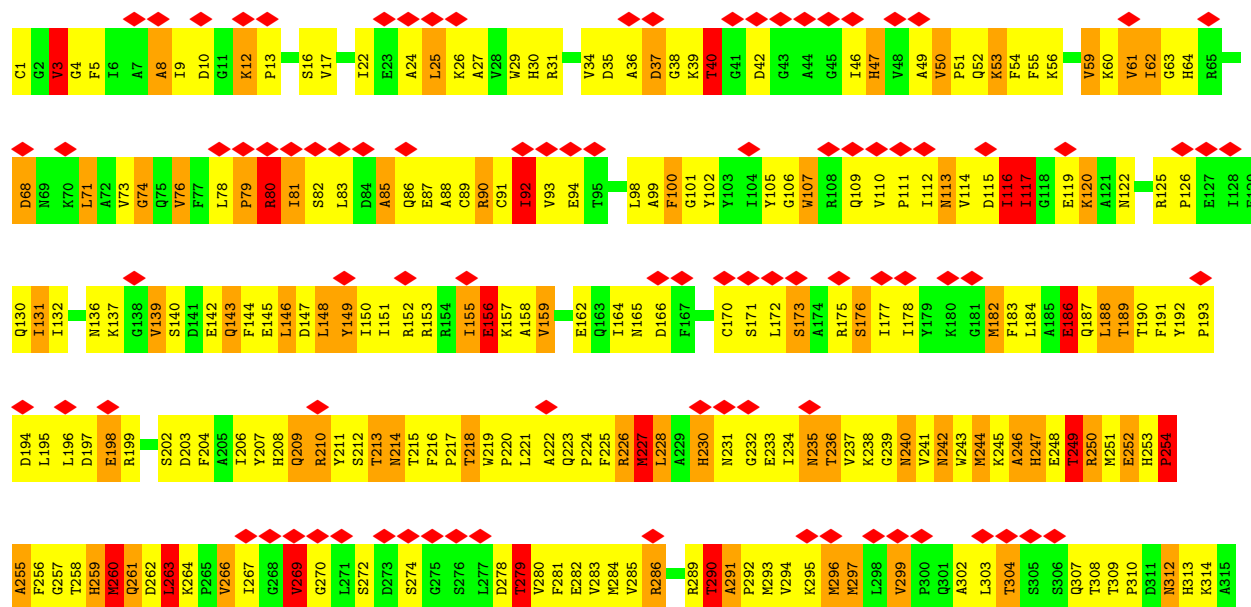
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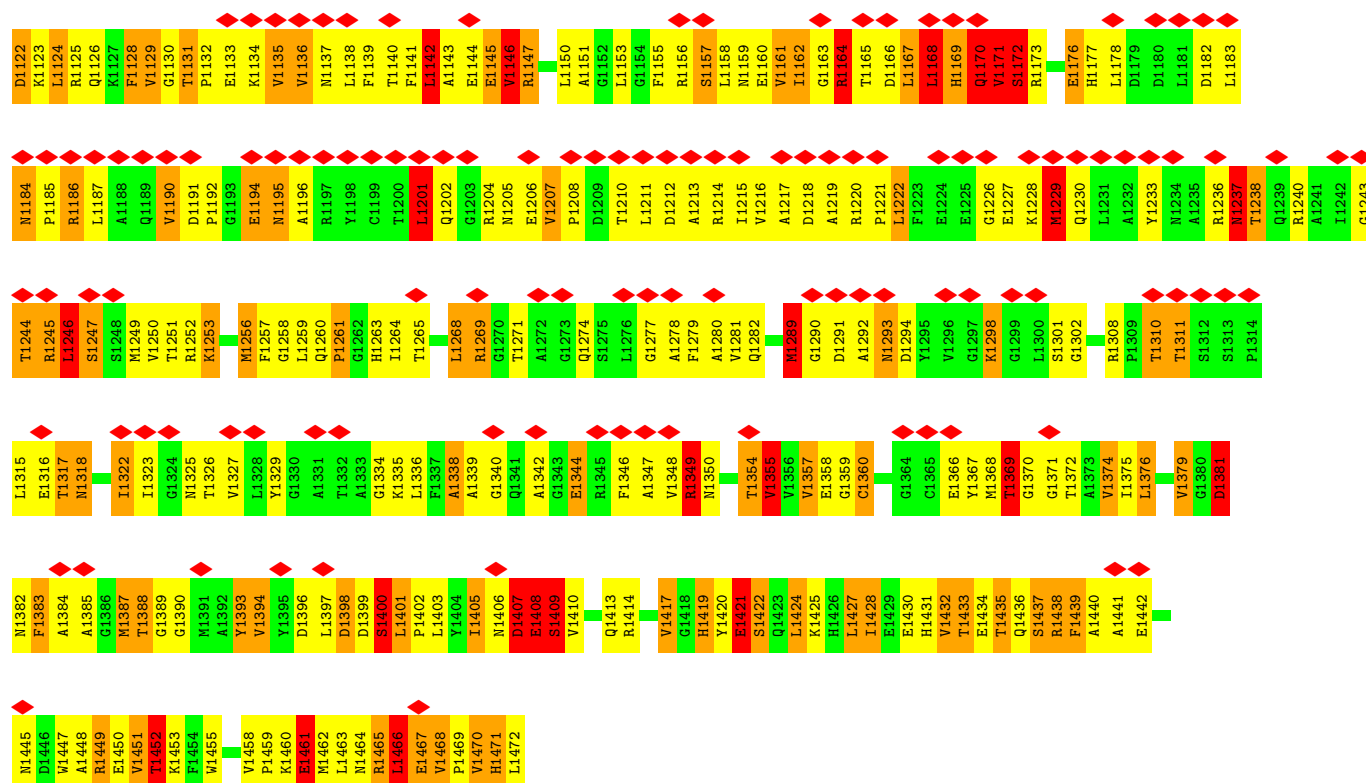
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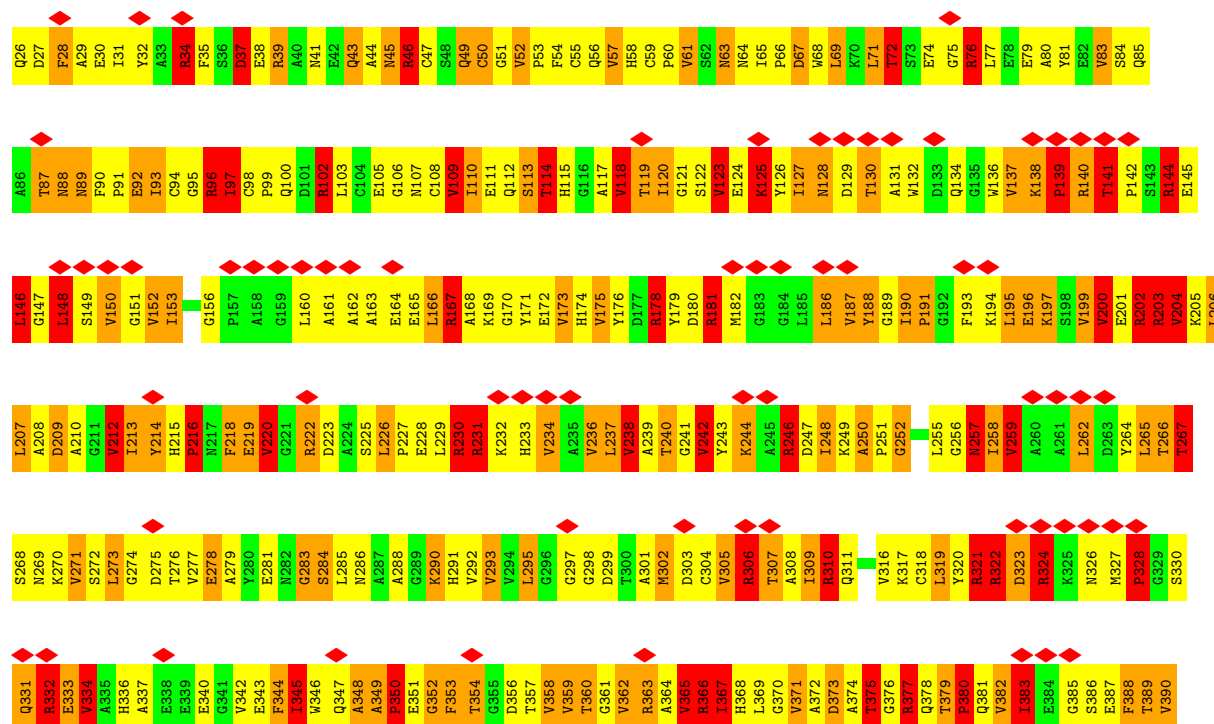
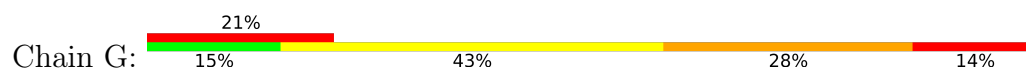
• Molecule 1: GLUTAMATE SYNTHASE [NADPH] LARGE CHAIN

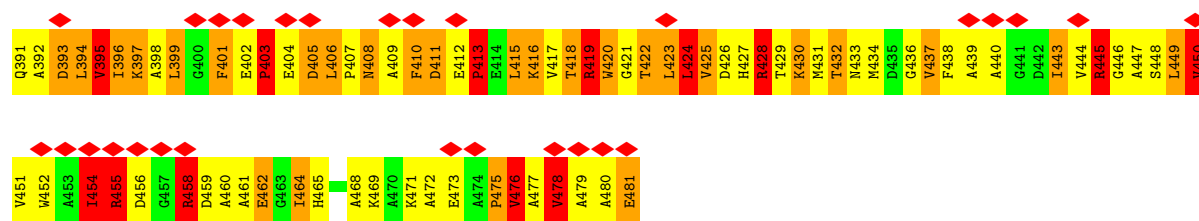




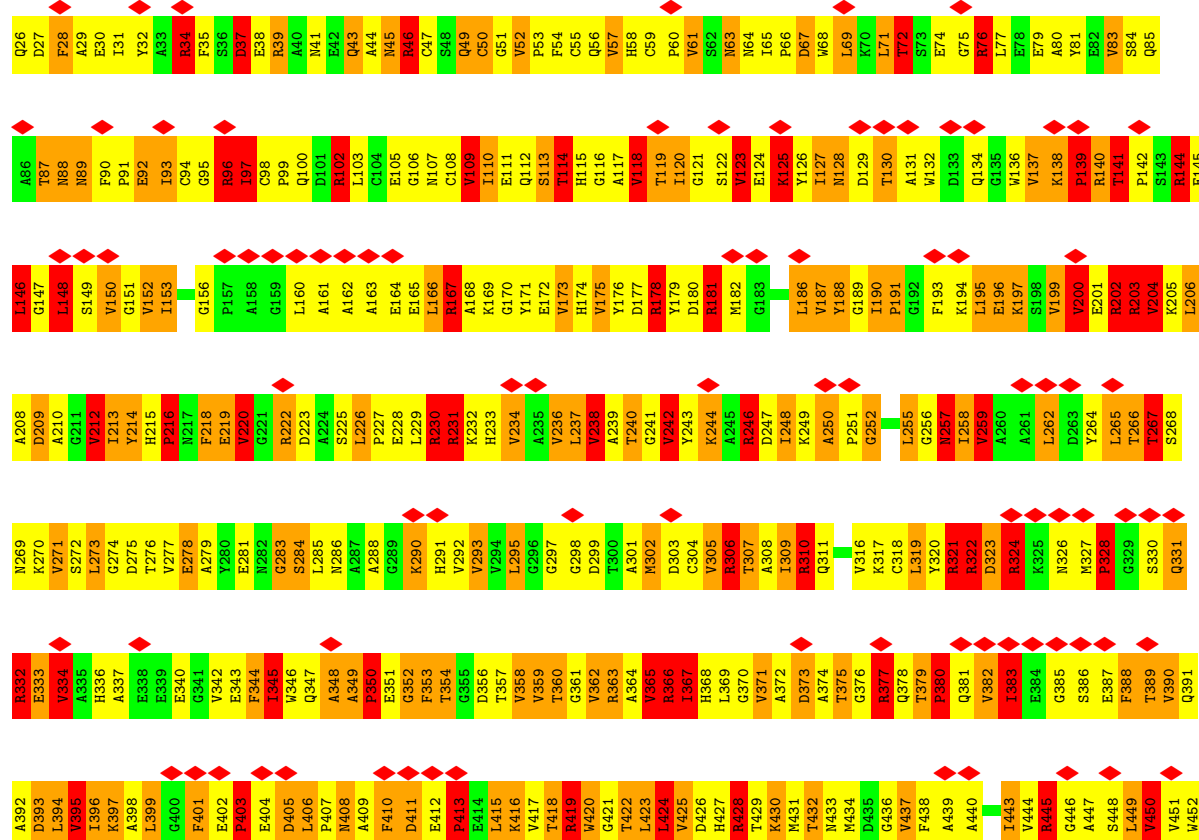
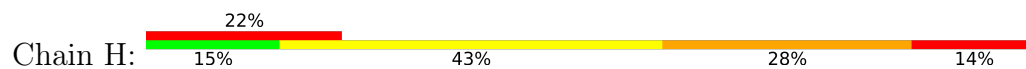


• Molecule 2: GLUTAMATE SYNTHASE [NADPH] SMALL CHAIN

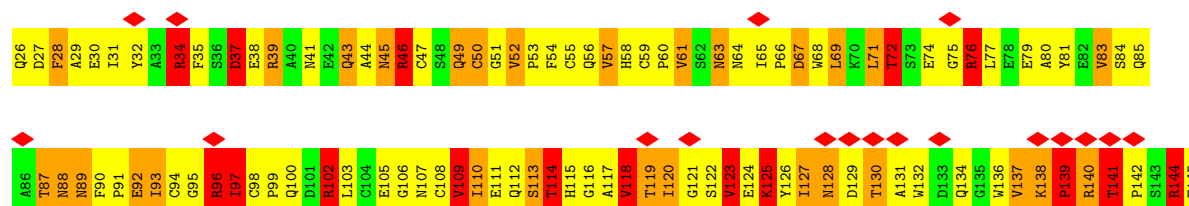
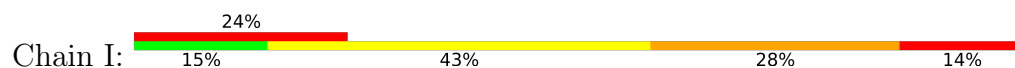


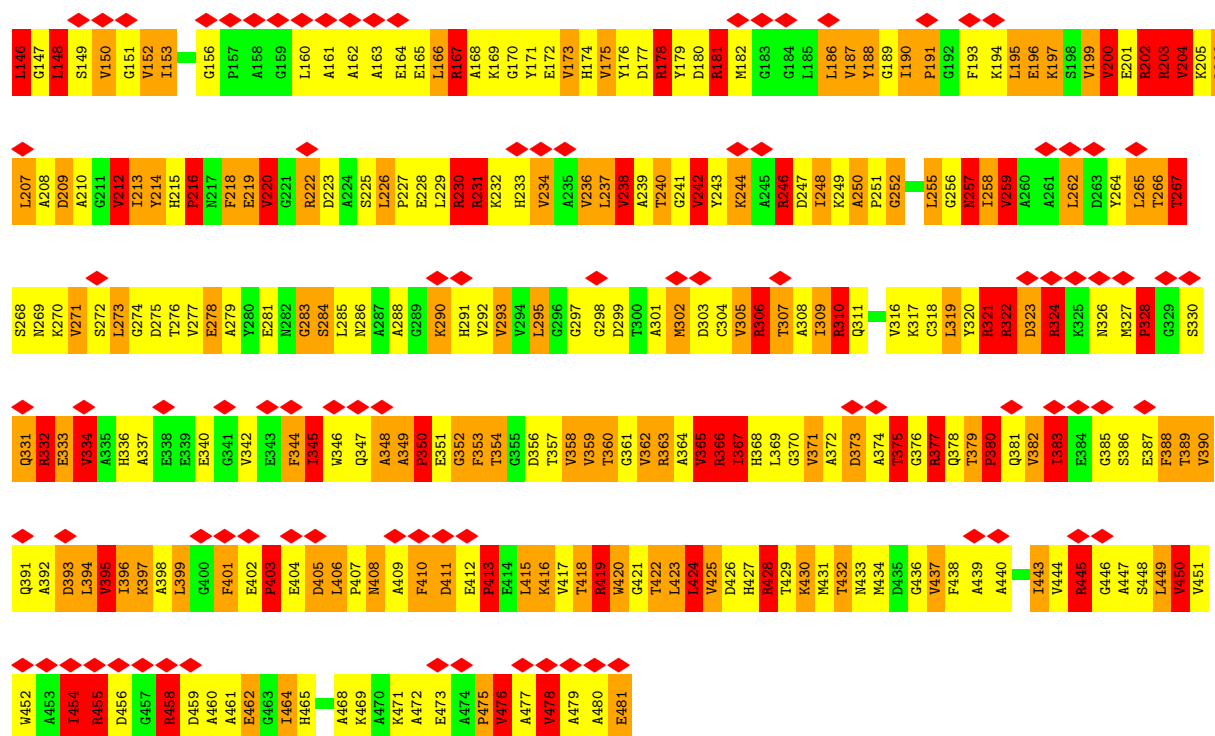


• Molecule 2: GLUTAMATE SYNTHASE [NADPH] SMALL CHAIN

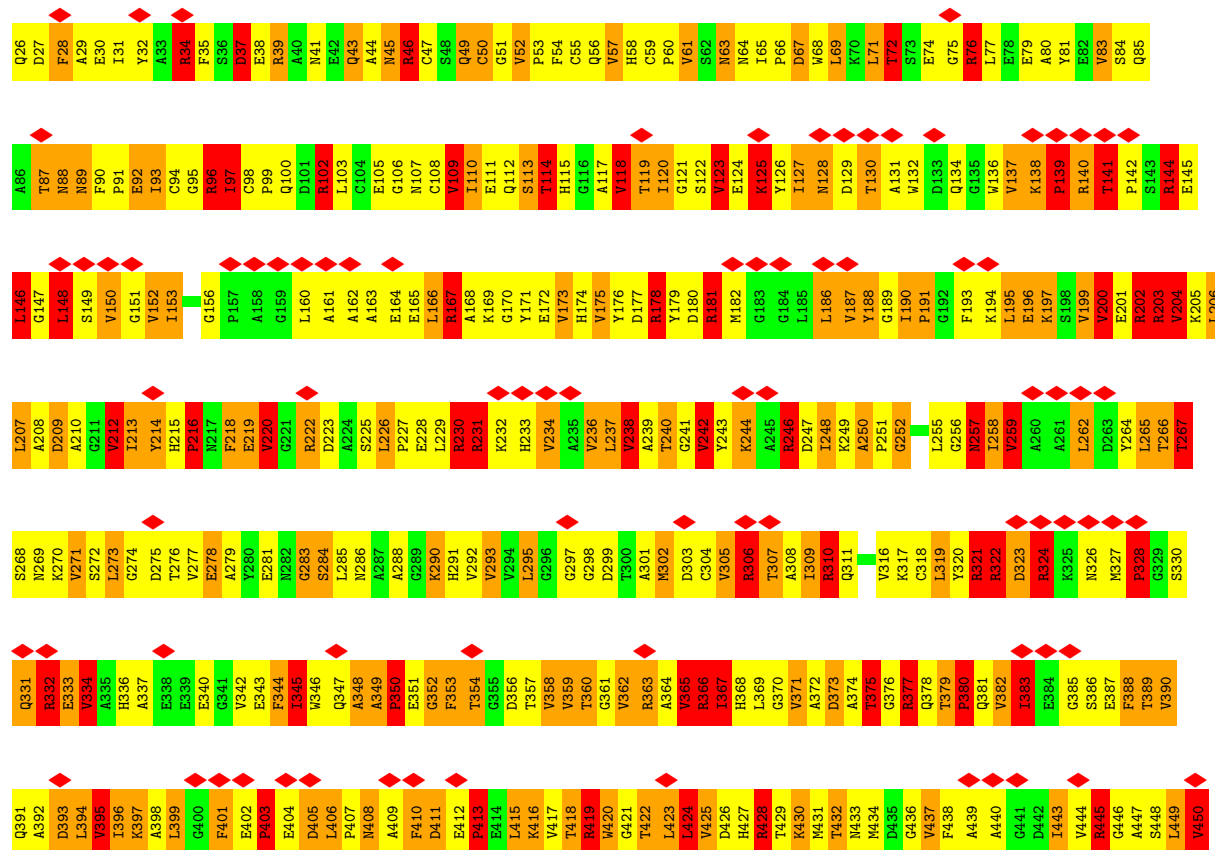
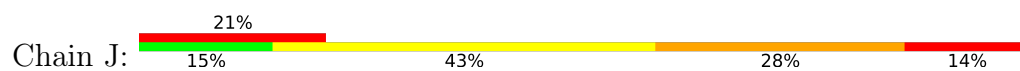


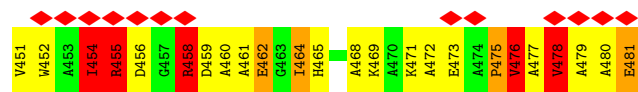
• Molecule 2: GLUTAMATE SYNTHASE [NADPH] SMALL CHAIN



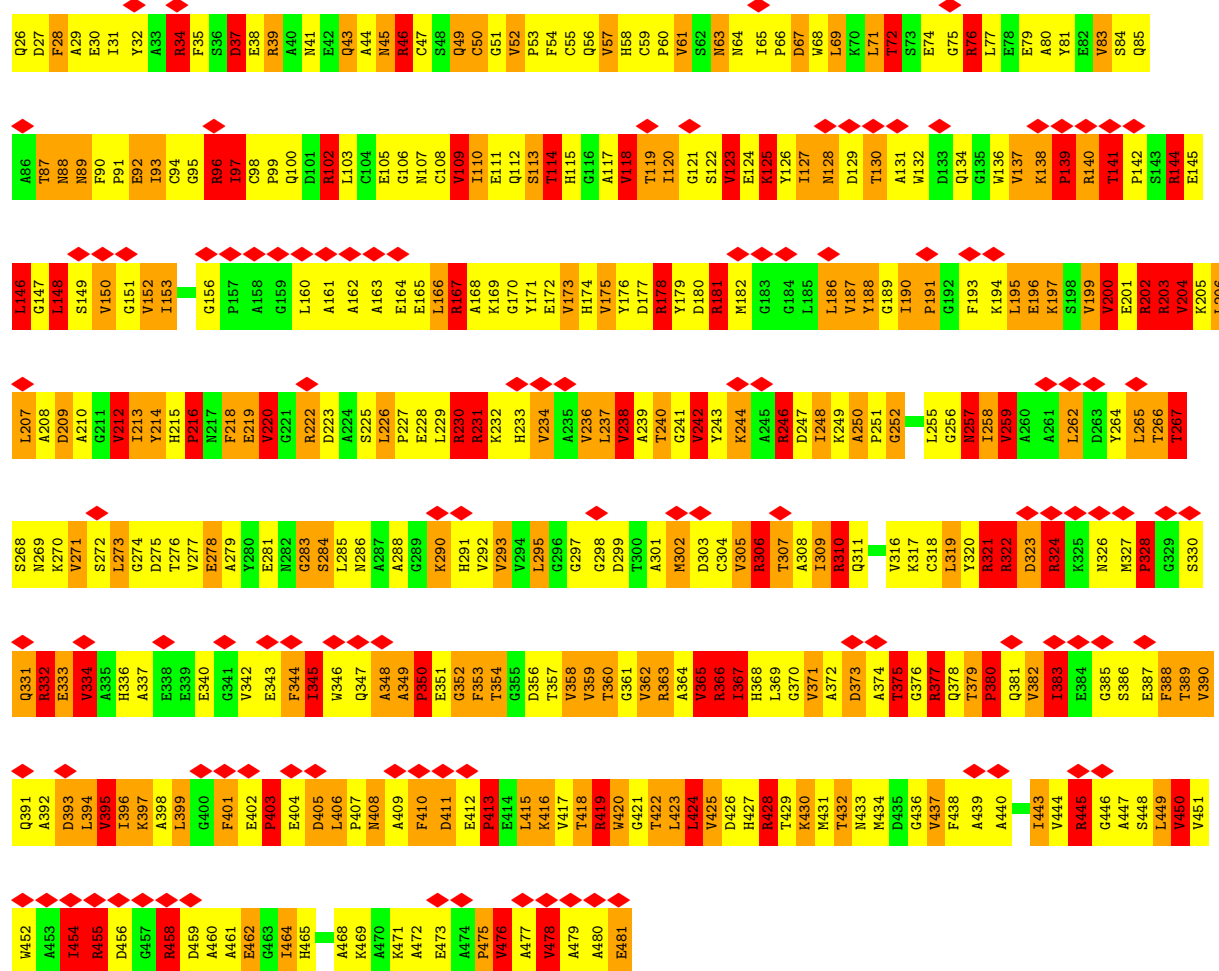
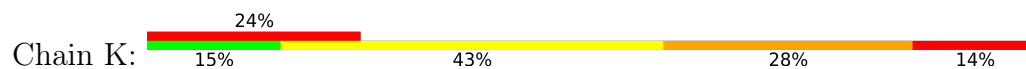


• Molecule 2: GLUTAMATE SYNTHASE [NADPH] SMALL CHAIN

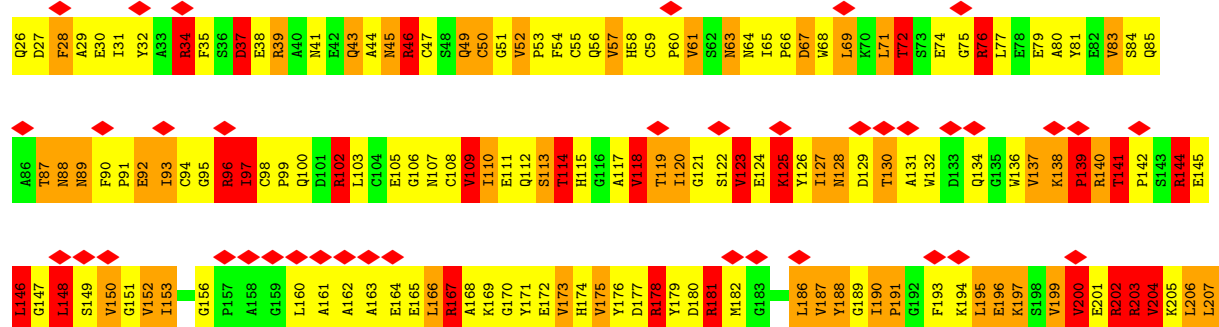
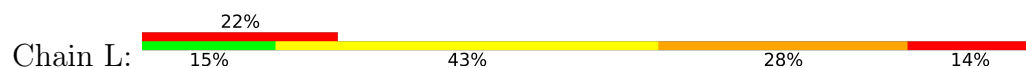


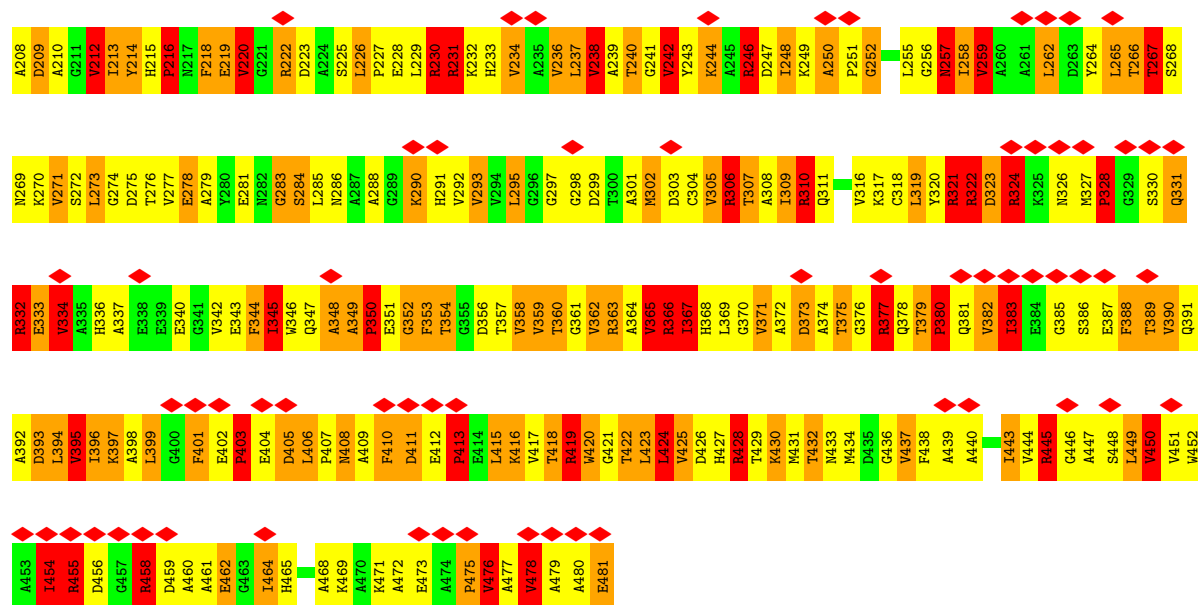


• Molecule 2: GLUTAMATE SYNTHASE [NADPH] SMALL CHAIN



• Molecule 2: GLUTAMATE SYNTHASE [NADPH] SMALL CHAIN





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, I	Depositor
Number of particles used	12800	Depositor
Resolution determination method	Not provided	
CTF correction method	WIENER FILTERING OF VOLUMES FROM FOCAL SERIES	Depositor
Microscope	JEOL 2010UHR	Depositor
Voltage (kV)	200	Depositor
Electron dose ($e^-/\text{\AA}^2$)	10	Depositor
Minimum defocus (nm)	1700	Depositor
Maximum defocus (nm)	3200	Depositor
Magnification	50000	Depositor
Image detector	KODAK SO-163 FILM	Depositor
Maximum map value	1332.420	Depositor
Minimum map value	-799.538	Depositor
Average map value	5.063	Depositor
Map value standard deviation	98.686	Depositor
Recommended contour level	125	Depositor
Map size (\AA)	304.8, 304.8, 304.8	wwPDB
Map dimensions	192, 192, 192	wwPDB
Map angles ($^\circ$)	90, 90, 90	wwPDB
Pixel spacing (\AA)	1.5875, 1.5875, 1.5875	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

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

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	1.45	82/11545 (0.7%)	2.02	427/15613 (2.7%)
1	B	1.49	96/11545 (0.8%)	2.00	415/15613 (2.7%)
1	C	1.45	81/11545 (0.7%)	2.02	427/15613 (2.7%)
1	D	1.49	96/11545 (0.8%)	2.00	416/15613 (2.7%)
1	E	1.45	82/11545 (0.7%)	2.02	427/15613 (2.7%)
1	F	1.49	94/11545 (0.8%)	2.00	415/15613 (2.7%)
2	G	1.39	1/3533 (0.0%)	2.29	190/4793 (4.0%)
2	H	1.39	1/3533 (0.0%)	2.29	188/4793 (3.9%)
2	I	1.39	1/3533 (0.0%)	2.29	190/4793 (4.0%)
2	J	1.39	1/3533 (0.0%)	2.29	190/4793 (4.0%)
2	K	1.39	1/3533 (0.0%)	2.29	190/4793 (4.0%)
2	L	1.39	1/3533 (0.0%)	2.29	188/4793 (3.9%)
All	All	1.45	537/90468 (0.6%)	2.08	3663/122436 (3.0%)

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
1	A	1	3
1	B	0	2
1	C	1	3
1	D	0	2
1	E	1	3
1	F	0	2
2	G	0	31
2	H	0	31
2	I	0	31
2	J	0	31
2	K	0	31

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Mol	Chain	#Chirality outliers	#Planarity outliers
2	L	0	31
All	All	3	201

The worst 5 of 537 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	838	VAL	CA-CB	-18.99	1.38	1.55
1	A	838	VAL	CA-CB	-18.92	1.38	1.55
1	E	838	VAL	CA-CB	-18.88	1.38	1.55
1	E	746	ILE	CA-CB	-13.00	1.37	1.54
1	A	746	ILE	CA-CB	-12.94	1.37	1.54

The worst 5 of 3663 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	45	ASN	CB-CG-OD1	-39.59	41.63	120.80
2	L	45	ASN	CB-CG-OD1	-39.59	41.63	120.80
2	G	45	ASN	CB-CG-OD1	-39.58	41.65	120.80
2	J	45	ASN	CB-CG-OD1	-39.58	41.65	120.80
2	I	45	ASN	CB-CG-OD1	-39.55	41.70	120.80

All (3) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	915	PHE	CA
1	C	915	PHE	CA
1	E	915	PHE	CA

5 of 201 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	1002	SER	Mainchain
1	A	1171	VAL	Peptide
1	A	325	GLU	Mainchain
1	B	1168	LEU	Mainchain
1	B	725	PHE	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	11337	0	11347	1845	0
1	B	11337	0	11350	1645	0
1	C	11337	0	11347	1850	0
1	D	11337	0	11350	1640	0
1	E	11337	0	11347	1864	0
1	F	11337	0	11350	1631	0
2	G	3468	0	3397	1119	0
2	H	3468	0	3397	1113	0
2	I	3468	0	3397	1118	0
2	J	3468	0	3399	1104	0
2	K	3468	0	3399	1101	0
2	L	3468	0	3399	1110	0
3	A	11	0	10	3	0
3	B	11	0	10	2	0
3	C	11	0	10	3	0
3	D	11	0	10	2	0
3	E	11	0	10	3	0
3	F	11	0	10	2	0
4	A	31	0	19	5	0
4	B	31	0	19	8	0
4	C	31	0	19	4	0
4	D	31	0	19	8	0
4	E	31	0	19	5	0
4	F	31	0	19	7	0
5	A	10	0	4	0	0
5	B	10	0	4	2	0
5	C	10	0	4	0	0
5	D	10	0	4	3	0
5	E	10	0	4	0	0
5	F	10	0	4	2	0
6	A	7	0	0	3	0
6	B	7	0	0	3	0
6	C	7	0	0	3	0
6	D	7	0	0	3	0
6	E	7	0	0	4	0
6	F	7	0	0	3	0
7	G	16	0	0	3	0
7	H	16	0	0	3	0
7	I	16	0	0	3	0
7	J	16	0	0	3	0
7	K	16	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	L	16	0	0	3	0
8	G	53	0	31	17	0
8	H	53	0	31	17	0
8	I	53	0	31	17	0
8	J	53	0	31	17	0
8	K	53	0	31	17	0
8	L	53	0	31	17	0
All	All	89598	0	88863	16132	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 90.

The worst 5 of 16132 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:1263:HIS:CE1	1:D:900:GLY:CA	1.77	1.66
1:A:782:ARG:CG	2:J:53:PRO:HD2	1.19	1.65
1:E:782:ARG:CG	2:L:53:PRO:HD2	1.19	1.64
1:C:875:MET:HE1	1:C:1139:PHE:CE2	1.35	1.62
1:F:182:MET:CE	1:F:217:PRO:HB2	1.30	1.61

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	1470/1472 (100%)	1174 (80%)	231 (16%)	65 (4%)	2	17
1	B	1470/1472 (100%)	1191 (81%)	215 (15%)	64 (4%)	2	17
1	C	1470/1472 (100%)	1175 (80%)	230 (16%)	65 (4%)	2	17
1	D	1470/1472 (100%)	1191 (81%)	215 (15%)	64 (4%)	2	17

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	E	1470/1472 (100%)	1174 (80%)	231 (16%)	65 (4%)	2	17
1	F	1470/1472 (100%)	1192 (81%)	214 (15%)	64 (4%)	2	17
2	G	454/456 (100%)	419 (92%)	25 (6%)	10 (2%)	5	29
2	H	454/456 (100%)	420 (92%)	24 (5%)	10 (2%)	5	29
2	I	454/456 (100%)	420 (92%)	24 (5%)	10 (2%)	5	29
2	J	454/456 (100%)	419 (92%)	25 (6%)	10 (2%)	5	29
2	K	454/456 (100%)	420 (92%)	24 (5%)	10 (2%)	5	29
2	L	454/456 (100%)	420 (92%)	24 (5%)	10 (2%)	5	29
All	All	11544/11568 (100%)	9615 (83%)	1482 (13%)	447 (4%)	4	19

5 of 447 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	25	LEU
1	A	444	LYS
1	A	451	GLN
1	A	705	LEU
1	A	712	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	1201/1201 (100%)	948 (79%)	253 (21%)	1	6
1	B	1201/1201 (100%)	953 (79%)	248 (21%)	1	6
1	C	1201/1201 (100%)	949 (79%)	252 (21%)	1	6
1	D	1201/1201 (100%)	953 (79%)	248 (21%)	1	6
1	E	1201/1201 (100%)	949 (79%)	252 (21%)	1	6
1	F	1201/1201 (100%)	953 (79%)	248 (21%)	1	6
2	G	358/358 (100%)	248 (69%)	110 (31%)	0	2
2	H	358/358 (100%)	248 (69%)	110 (31%)	0	2

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	I	358/358 (100%)	248 (69%)	110 (31%)	0	2
2	J	358/358 (100%)	248 (69%)	110 (31%)	0	2
2	K	358/358 (100%)	248 (69%)	110 (31%)	0	2
2	L	358/358 (100%)	248 (69%)	110 (31%)	0	2
All	All	9354/9354 (100%)	7193 (77%)	2161 (23%)	2	5

5 of 2161 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	J	152	VAL
2	J	375	THR
2	J	148	LEU
2	L	197	LYS
1	D	189	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 319 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	242	ASN
2	I	134	GLN
1	F	452	GLN
1	F	1318	ASN
2	K	45	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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

42 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
6	F3S	C	2476	1	0,9,9	-	-	-		
3	OMT	F	2473	-	9,10,10	4.54	5 (55%)	9,14,14	6.30	5 (55%)
4	FMN	C	2474	-	33,33,33	1.50	5 (15%)	48,50,50	2.80	19 (39%)
3	OMT	D	2473	-	9,10,10	4.54	5 (55%)	9,14,14	6.30	5 (55%)
6	F3S	F	2476	1	0,9,9	-	-	-		
6	F3S	B	2476	1	0,9,9	-	-	-		
7	SF4	H	483	2	0,12,12	-	-	-		
4	FMN	B	2474	-	33,33,33	1.38	4 (12%)	48,50,50	2.69	20 (41%)
4	FMN	E	2474	-	33,33,33	1.50	5 (15%)	48,50,50	2.80	19 (39%)
5	AKG	A	2475	-	9,9,9	3.16	4 (44%)	11,11,11	2.98	4 (36%)
8	FAD	I	484	-	58,58,58	2.27	23 (39%)	85,89,89	1.66	8 (9%)
3	OMT	A	2473	-	9,10,10	4.68	5 (55%)	9,14,14	5.23	6 (66%)
7	SF4	K	483	2	0,12,12	-	-	-		
8	FAD	G	484	-	58,58,58	2.27	24 (41%)	85,89,89	1.66	8 (9%)
3	OMT	C	2473	-	9,10,10	4.69	5 (55%)	9,14,14	5.24	6 (66%)
8	FAD	K	484	-	58,58,58	2.27	23 (39%)	85,89,89	1.66	8 (9%)
7	SF4	L	482	2	0,12,12	-	-	-		
7	SF4	L	483	2	0,12,12	-	-	-		
5	AKG	F	2475	-	9,9,9	3.59	4 (44%)	11,11,11	2.77	4 (36%)
4	FMN	F	2474	-	33,33,33	1.39	4 (12%)	48,50,50	2.69	20 (41%)
8	FAD	L	484	-	58,58,58	2.27	22 (37%)	85,89,89	1.66	8 (9%)
5	AKG	C	2475	-	9,9,9	3.16	4 (44%)	11,11,11	2.98	4 (36%)
3	OMT	B	2473	-	9,10,10	4.54	5 (55%)	9,14,14	6.30	5 (55%)
5	AKG	D	2475	-	9,9,9	3.59	4 (44%)	11,11,11	2.77	4 (36%)
4	FMN	D	2474	-	33,33,33	1.39	4 (12%)	48,50,50	2.69	20 (41%)
6	F3S	A	2476	1	0,9,9	-	-	-		
6	F3S	D	2476	1	0,9,9	-	-	-		
7	SF4	J	483	2	0,12,12	-	-	-		

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
6	F3S	E	2476	1	0,9,9	-	-	-		
7	SF4	I	483	2	0,12,12	-	-	-		
8	FAD	H	484	-	58,58,58	2.27	22 (37%)	85,89,89	1.66	8 (9%)
3	OMT	E	2473	-	9,10,10	4.68	5 (55%)	9,14,14	5.23	6 (66%)
7	SF4	I	482	2	0,12,12	-	-	-		
7	SF4	G	483	2	0,12,12	-	-	-		
5	AKG	B	2475	-	9,9,9	3.58	4 (44%)	11,11,11	2.77	4 (36%)
7	SF4	G	482	2	0,12,12	-	-	-		
7	SF4	H	482	2	0,12,12	-	-	-		
7	SF4	J	482	2	0,12,12	-	-	-		
7	SF4	K	482	2	0,12,12	-	-	-		
4	FMN	A	2474	-	33,33,33	1.50	5 (15%)	48,50,50	2.80	18 (37%)
5	AKG	E	2475	-	9,9,9	3.16	4 (44%)	11,11,11	2.98	4 (36%)
8	FAD	J	484	-	58,58,58	2.27	24 (41%)	85,89,89	1.66	8 (9%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	F3S	C	2476	1	-	-	0/3/3/3
3	OMT	F	2473	-	-	5/10/10/10	-
4	FMN	C	2474	-	-	7/18/18/18	0/3/3/3
3	OMT	D	2473	-	-	5/10/10/10	-
6	F3S	F	2476	1	-	-	0/3/3/3
6	F3S	B	2476	1	-	-	0/3/3/3
7	SF4	H	483	2	-	-	0/6/5/5
4	FMN	B	2474	-	-	4/18/18/18	0/3/3/3
4	FMN	E	2474	-	-	7/18/18/18	0/3/3/3
5	AKG	A	2475	-	-	2/9/9/9	-
8	FAD	I	484	-	-	4/34/50/50	0/6/6/6
3	OMT	A	2473	-	-	4/10/10/10	-
8	FAD	G	484	-	-	4/34/50/50	0/6/6/6
7	SF4	K	483	2	-	-	0/6/5/5
3	OMT	C	2473	-	-	4/10/10/10	-
8	FAD	K	484	-	-	4/34/50/50	0/6/6/6
7	SF4	L	482	2	-	-	0/6/5/5
7	SF4	L	483	2	-	-	0/6/5/5

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	AKG	F	2475	-	-	1/9/9/9	-
4	FMN	F	2474	-	-	4/18/18/18	0/3/3/3
8	FAD	L	484	-	-	4/34/50/50	0/6/6/6
5	AKG	C	2475	-	-	2/9/9/9	-
3	OMT	B	2473	-	-	5/10/10/10	-
5	AKG	D	2475	-	-	1/9/9/9	-
4	FMN	D	2474	-	-	4/18/18/18	0/3/3/3
6	F3S	A	2476	1	-	-	0/3/3/3
6	F3S	D	2476	1	-	-	0/3/3/3
7	SF4	J	483	2	-	-	0/6/5/5
6	F3S	E	2476	1	-	-	0/3/3/3
8	FAD	H	484	-	-	4/34/50/50	0/6/6/6
7	SF4	I	483	2	-	-	0/6/5/5
3	OMT	E	2473	-	-	4/10/10/10	-
7	SF4	I	482	2	-	-	0/6/5/5
7	SF4	G	483	2	-	-	0/6/5/5
5	AKG	B	2475	-	-	1/9/9/9	-
7	SF4	G	482	2	-	-	0/6/5/5
7	SF4	H	482	2	-	-	0/6/5/5
7	SF4	J	482	2	-	-	0/6/5/5
7	SF4	K	482	2	-	-	0/6/5/5
4	FMN	A	2474	-	-	7/18/18/18	0/3/3/3
5	AKG	E	2475	-	-	2/9/9/9	-
8	FAD	J	484	-	-	4/34/50/50	0/6/6/6

The worst 5 of 219 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	H	484	FAD	PA-O3P	8.13	1.68	1.59
8	L	484	FAD	PA-O3P	8.13	1.68	1.59
8	I	484	FAD	PA-O3P	8.13	1.68	1.59
8	K	484	FAD	PA-O3P	8.13	1.68	1.59
8	G	484	FAD	PA-O3P	8.12	1.68	1.59

The worst 5 of 221 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	2473	OMT	OD2-SD-CG	-16.16	96.68	108.33
3	F	2473	OMT	OD2-SD-CG	-16.14	96.69	108.33
3	B	2473	OMT	OD2-SD-CG	-16.12	96.70	108.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	2473	OMT	OD2-SD-CE	-12.54	97.22	108.87
3	A	2473	OMT	OD2-SD-CE	-12.51	97.24	108.87

There are no chirality outliers.

5 of 93 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	2473	OMT	C-CA-CB-CG
3	A	2473	OMT	CB-CG-SD-OD1
3	A	2473	OMT	CB-CG-SD-OD2
3	B	2473	OMT	N-CA-CB-CG
3	B	2473	OMT	C-CA-CB-CG

There are no ring outliers.

39 monomers are involved in 198 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	C	2476	F3S	3	0
3	F	2473	OMT	2	0
4	C	2474	FMN	4	0
3	D	2473	OMT	2	0
6	F	2476	F3S	3	0
6	B	2476	F3S	3	0
7	H	483	SF4	2	0
4	B	2474	FMN	8	0
4	E	2474	FMN	5	0
8	I	484	FAD	17	0
3	A	2473	OMT	3	0
7	K	483	SF4	2	0
8	G	484	FAD	17	0
3	C	2473	OMT	3	0
8	K	484	FAD	17	0
7	L	482	SF4	1	0
7	L	483	SF4	2	0
5	F	2475	AKG	2	0
4	F	2474	FMN	7	0
8	L	484	FAD	17	0
3	B	2473	OMT	2	0
5	D	2475	AKG	3	0
4	D	2474	FMN	8	0
6	A	2476	F3S	3	0

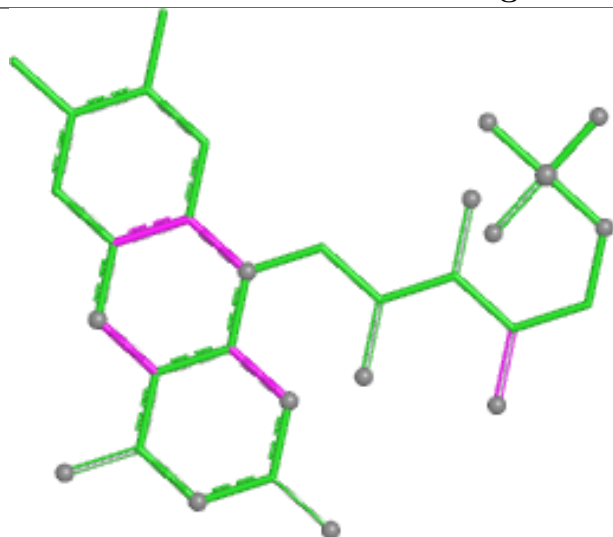
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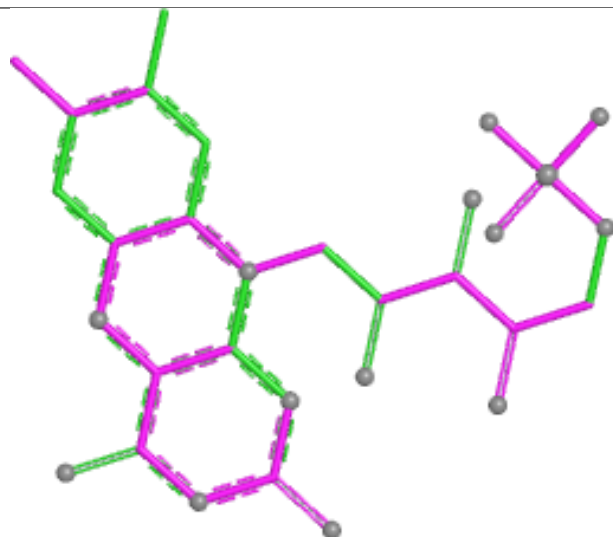
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	D	2476	F3S	3	0
7	J	483	SF4	2	0
6	E	2476	F3S	4	0
7	I	483	SF4	2	0
8	H	484	FAD	17	0
3	E	2473	OMT	3	0
7	I	482	SF4	1	0
7	G	483	SF4	2	0
5	B	2475	AKG	2	0
7	G	482	SF4	1	0
7	H	482	SF4	1	0
7	J	482	SF4	1	0
7	K	482	SF4	1	0
4	A	2474	FMN	5	0
8	J	484	FAD	17	0

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.

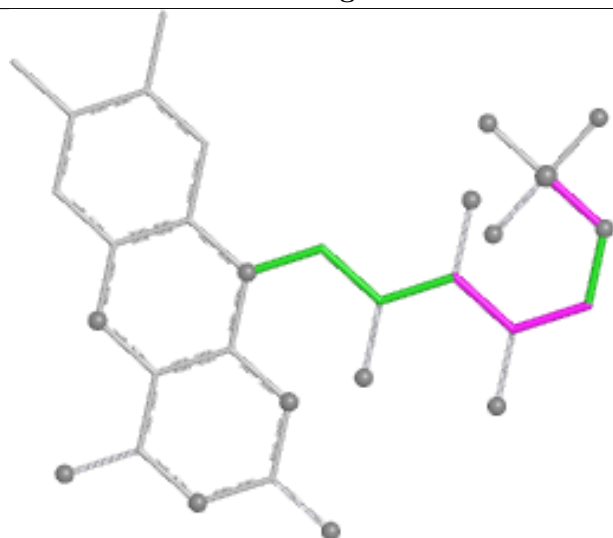
Ligand FMN C 2474



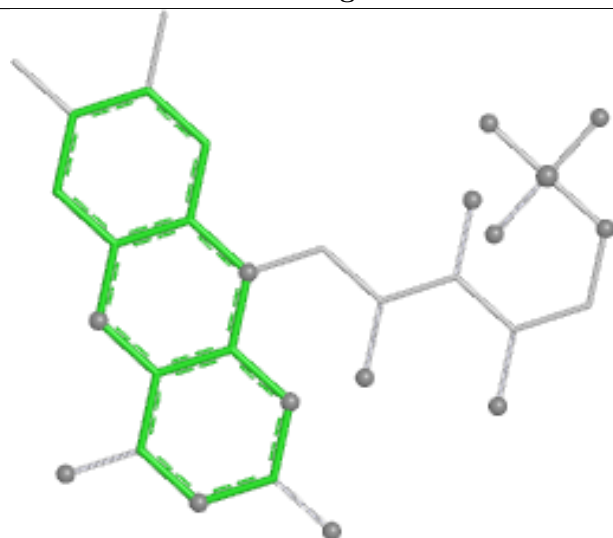
Bond lengths



Bond angles

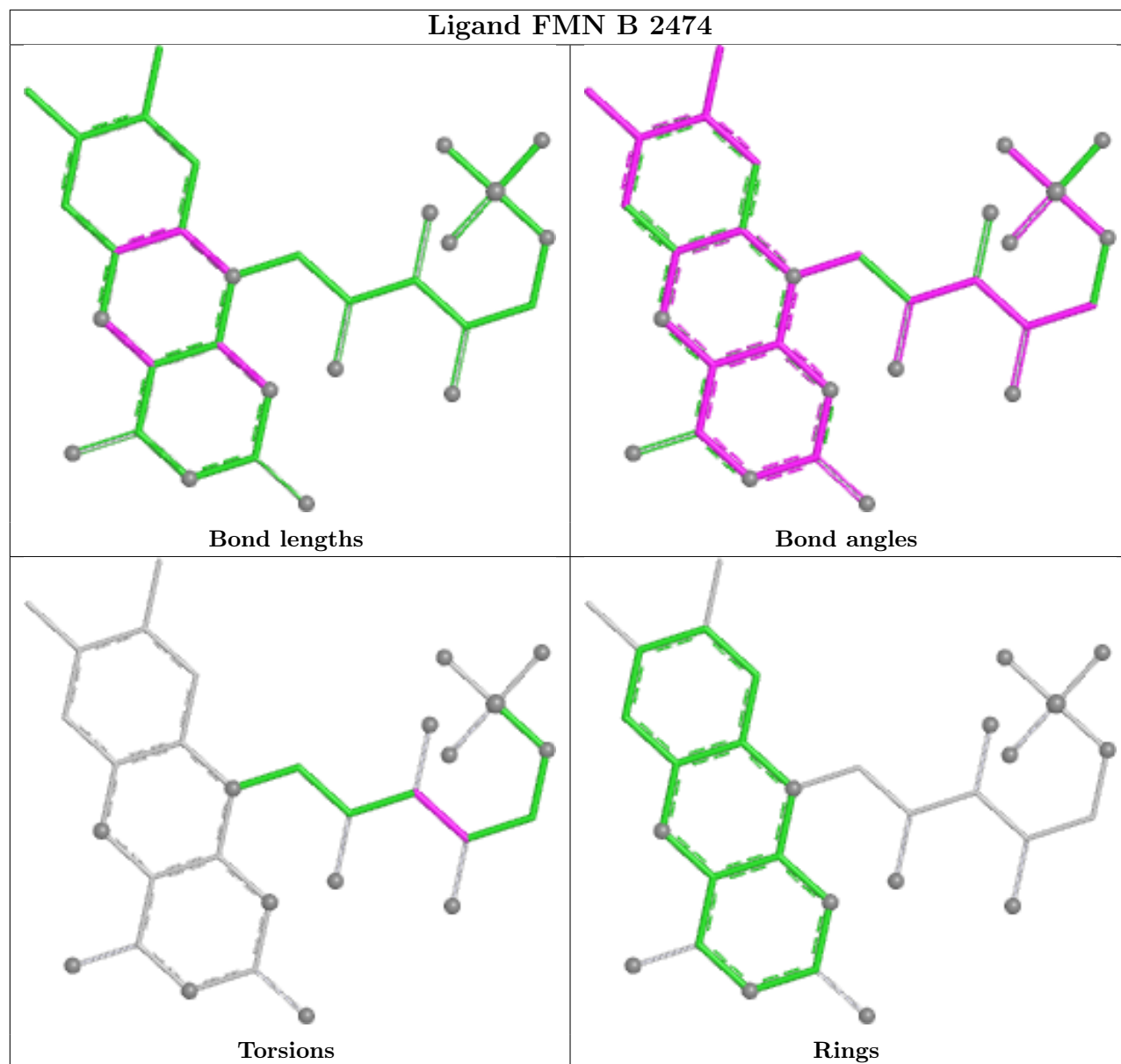


Torsions

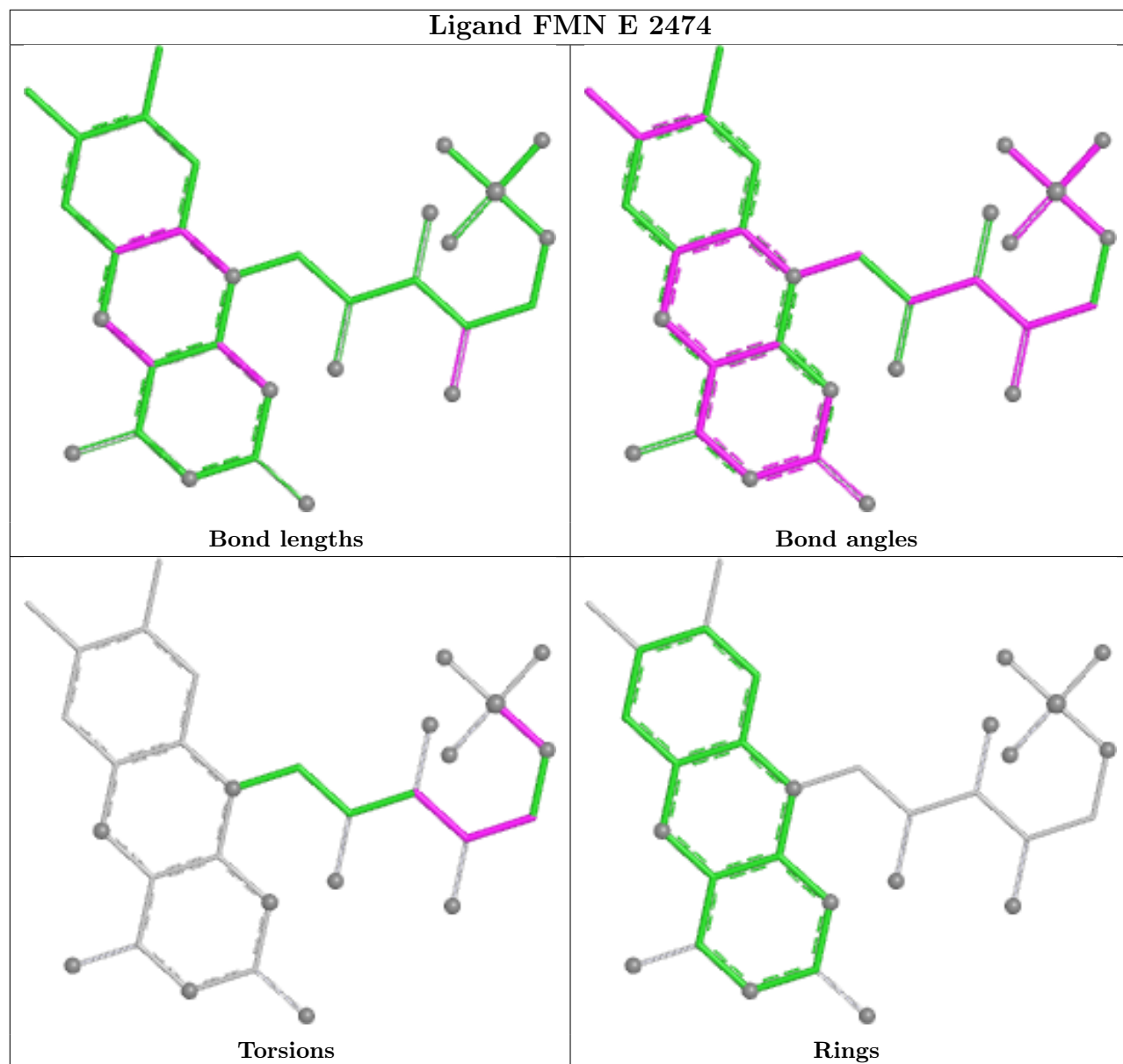


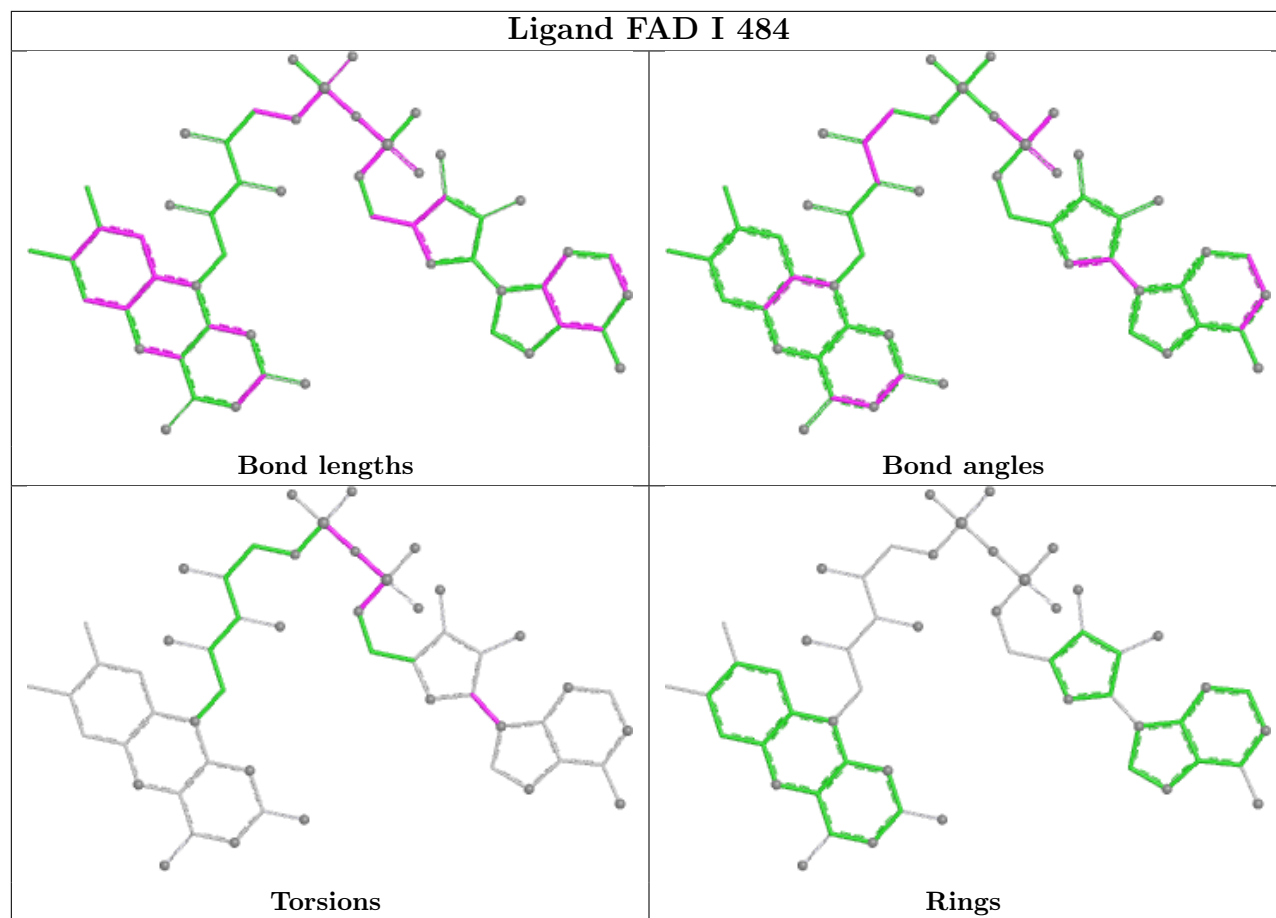
Rings

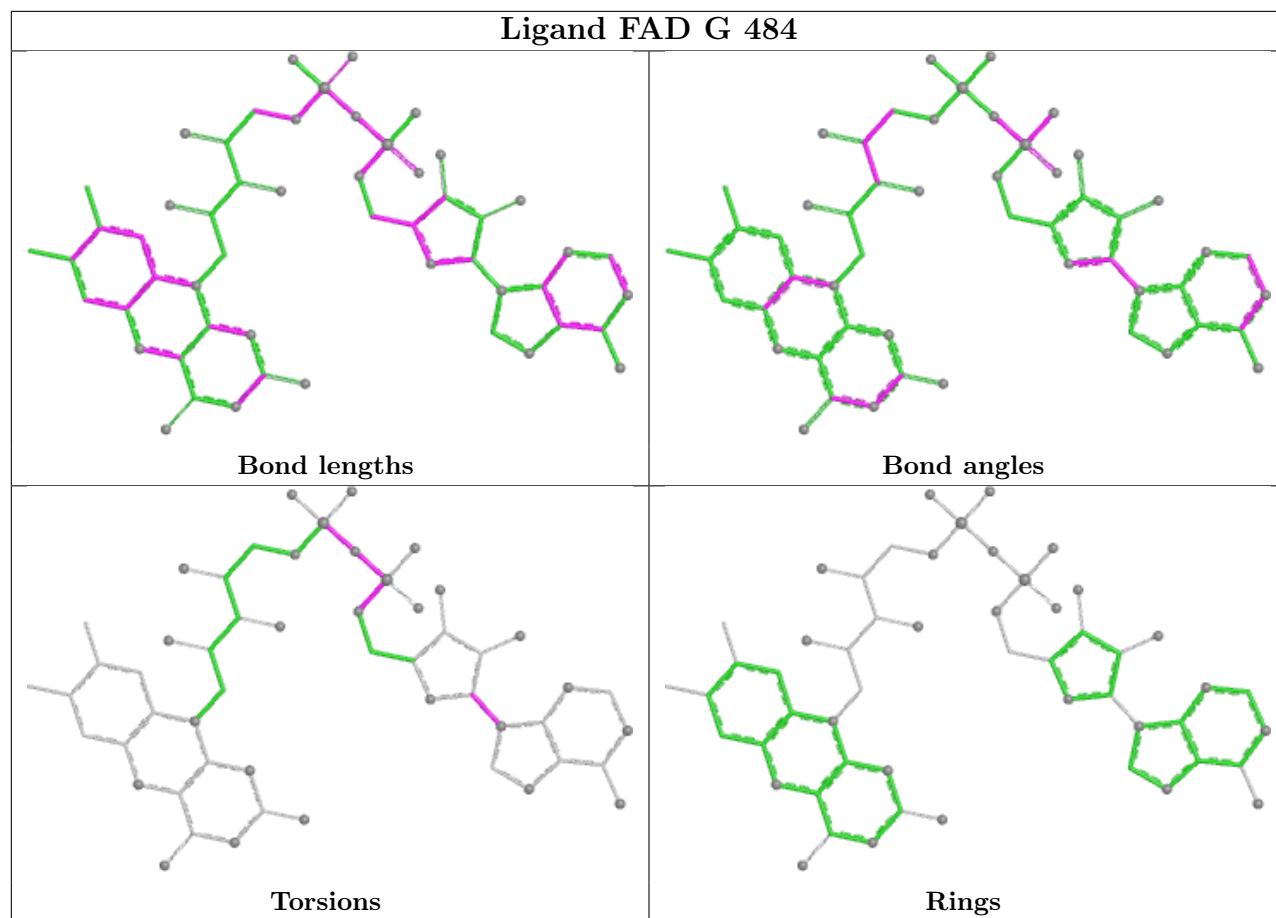
Ligand FMN B 2474

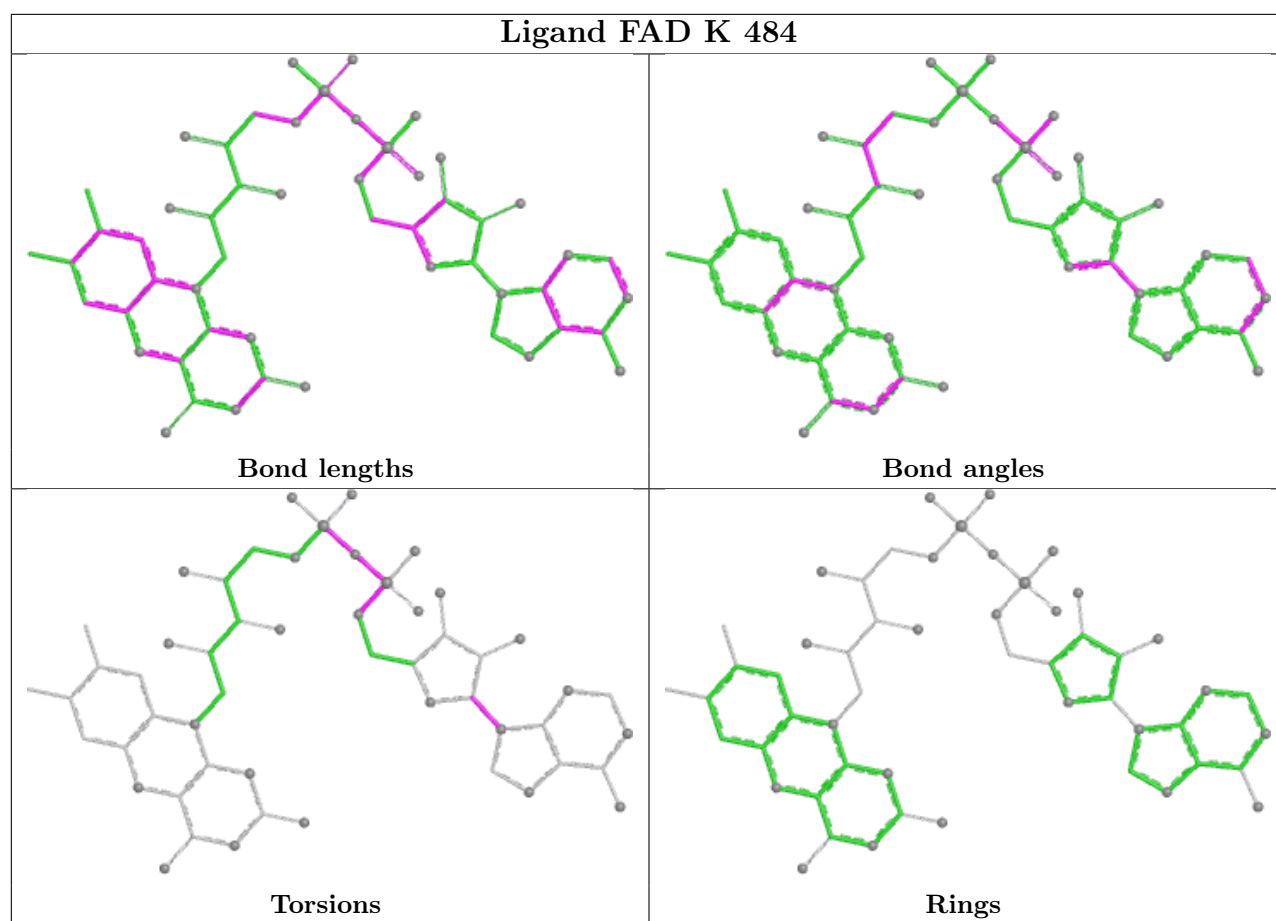


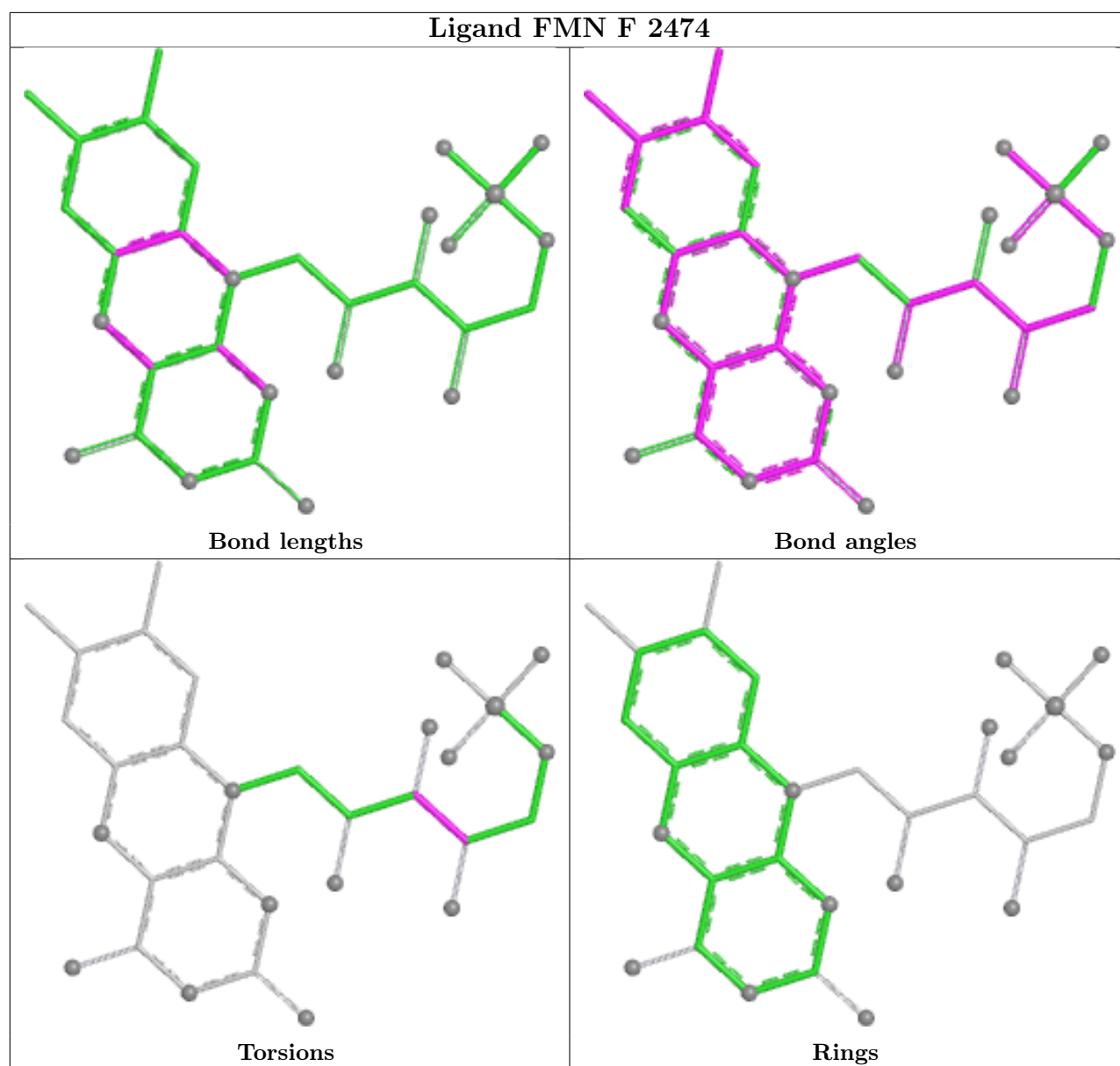
Ligand FMN E 2474

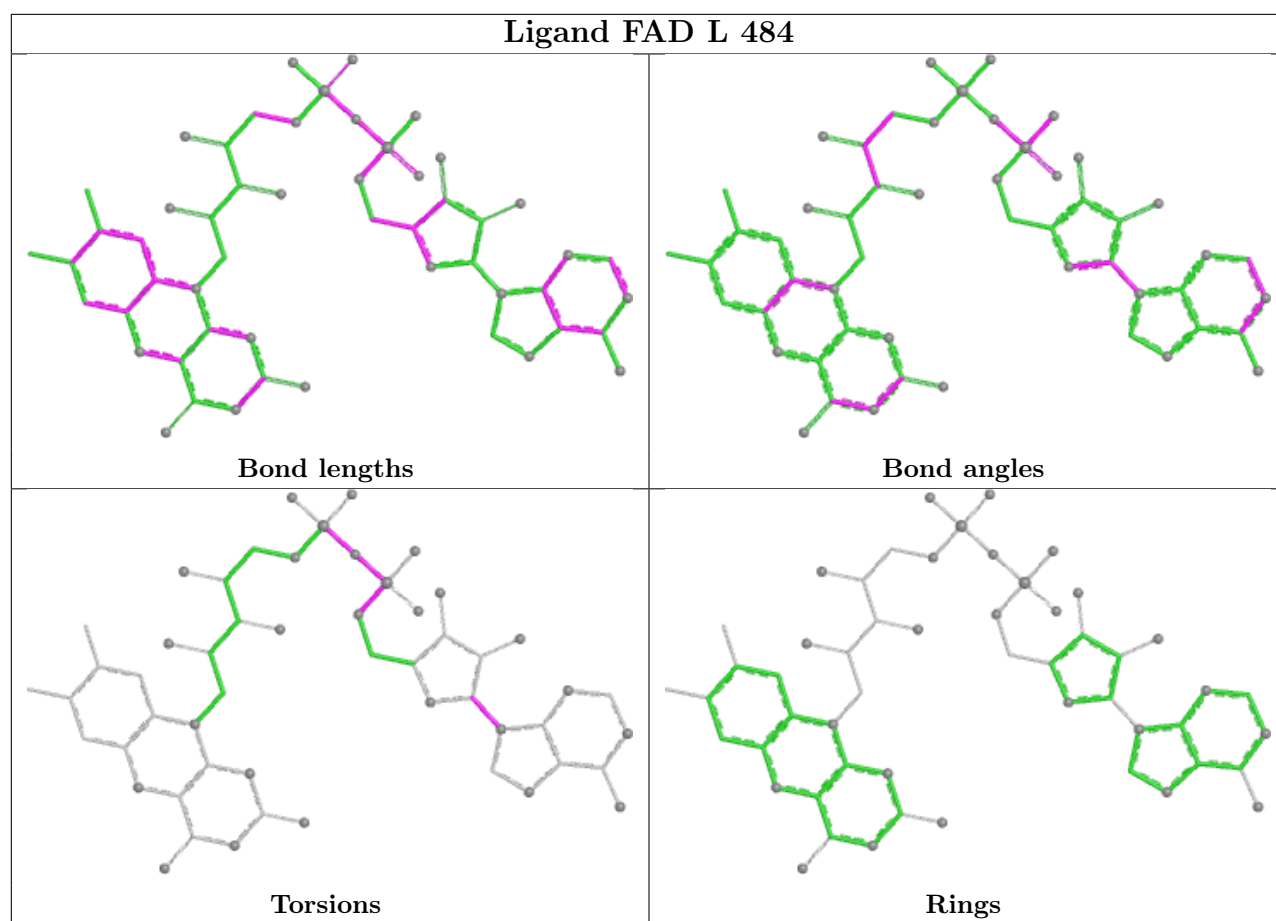




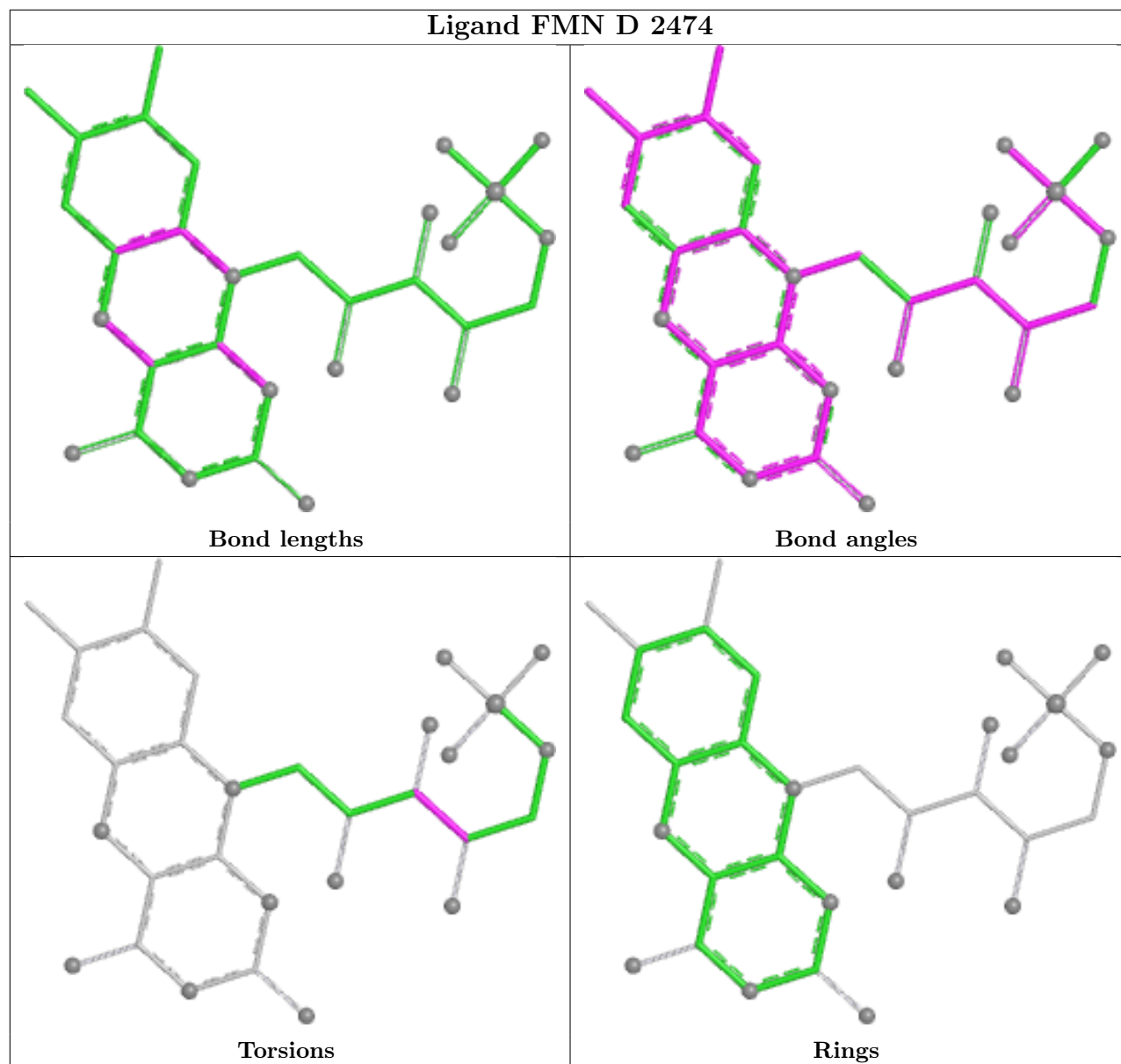


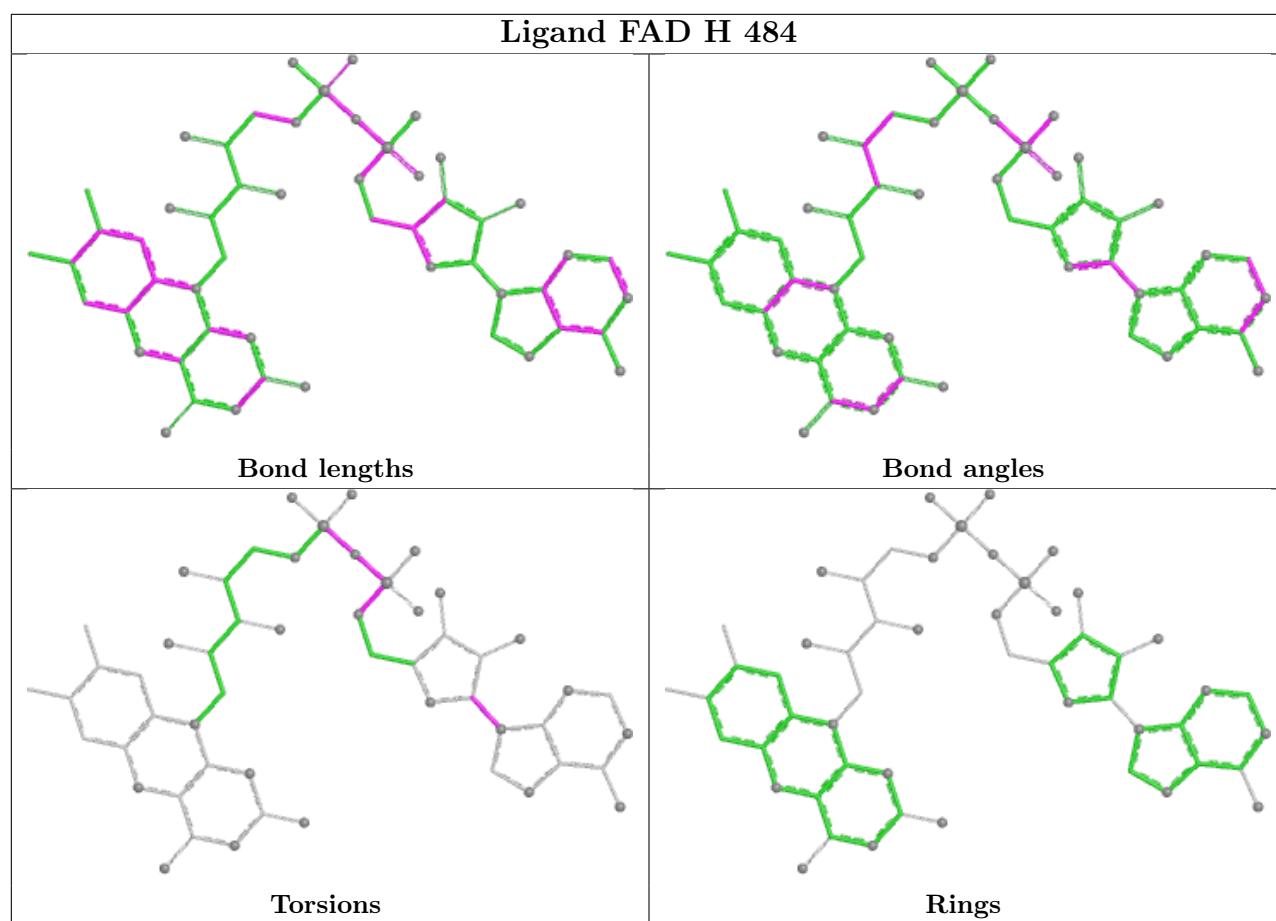




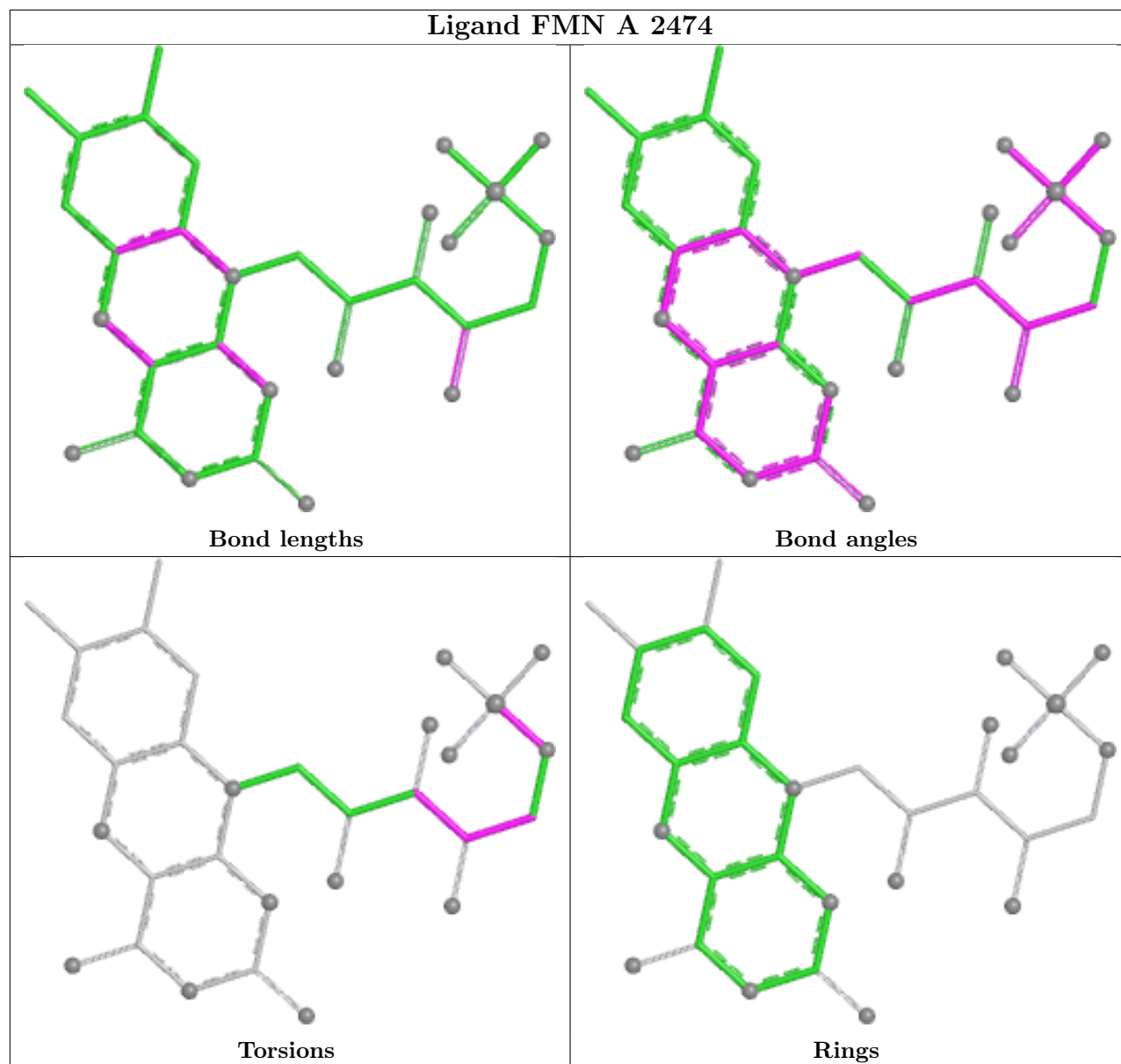


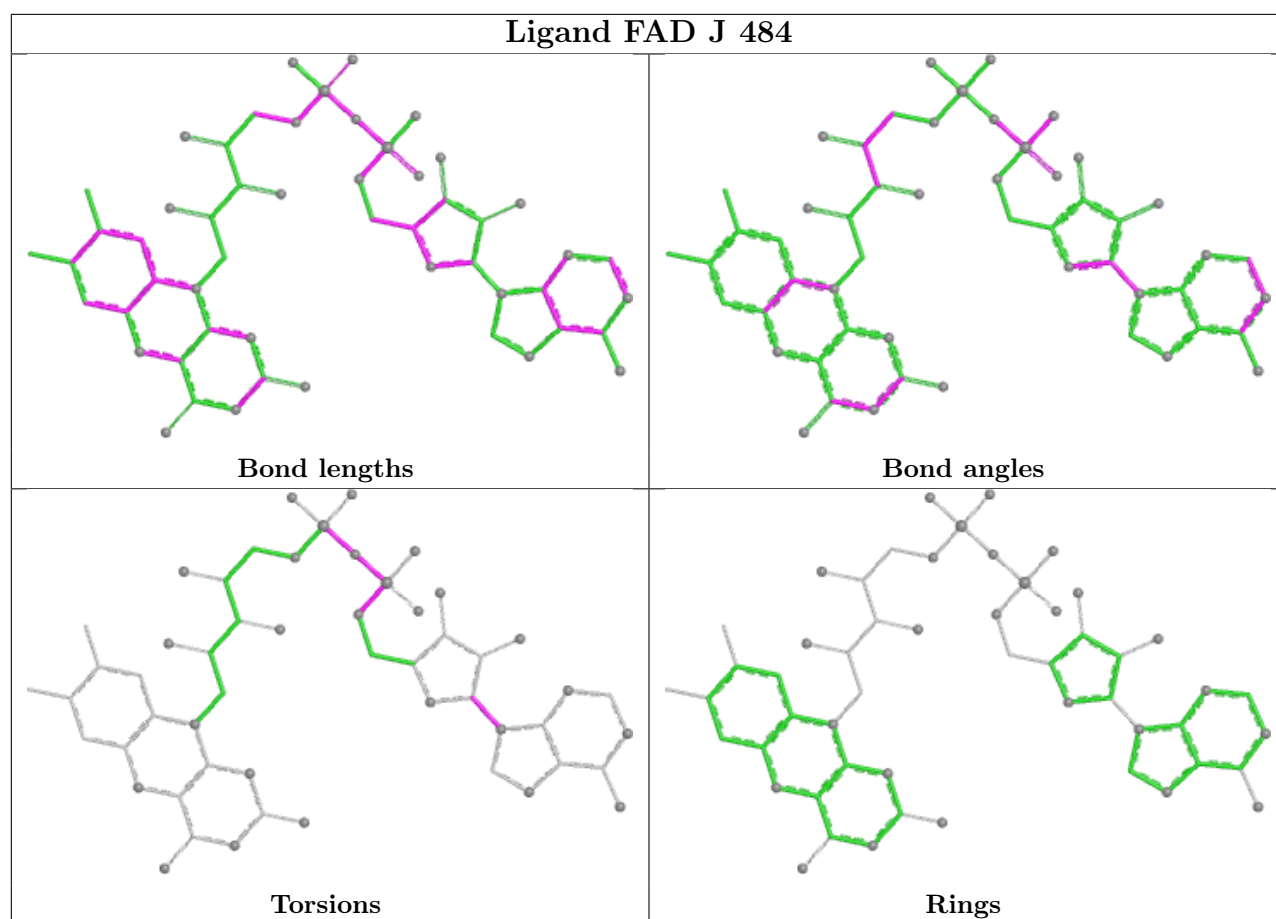
Ligand FMN D 2474





Ligand FMN A 2474





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-1440. These allow visual inspection of the internal detail of the map and identification of artifacts.

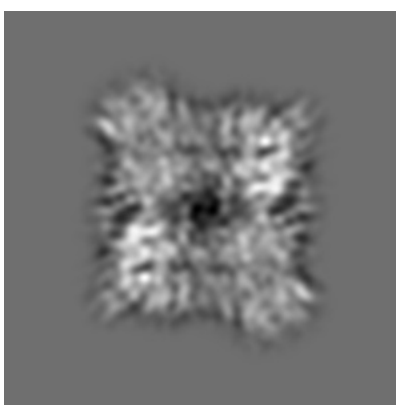
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

6.1.1 Primary map



X



Y



Z

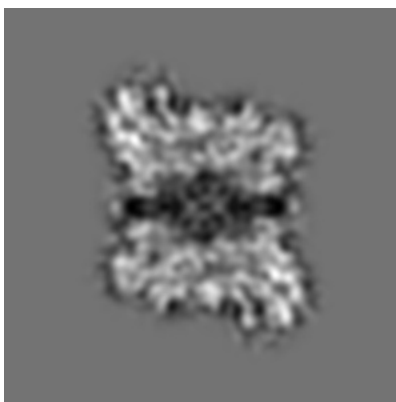
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

6.2.1 Primary map



X Index: 96



Y Index: 96



Z Index: 96

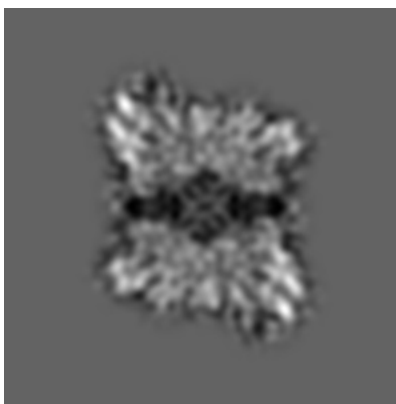
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

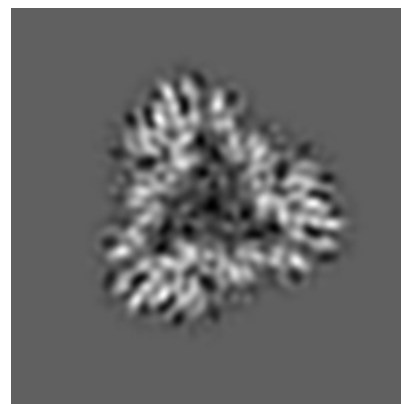
6.3.1 Primary map



X Index: 96



Y Index: 98

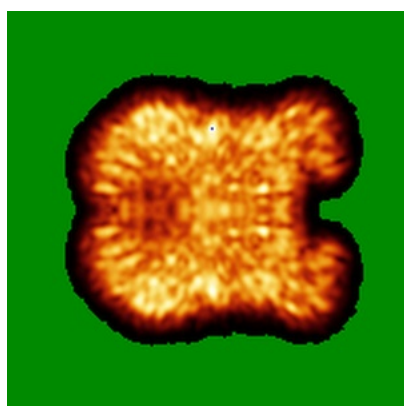


Z Index: 59

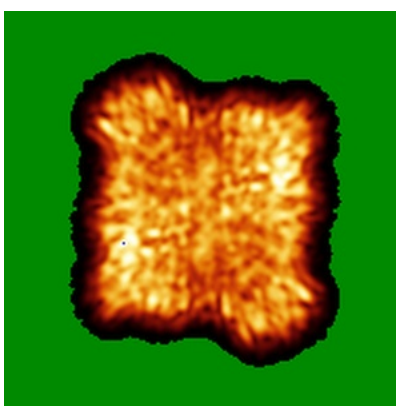
The images above show the largest variance slices of the map in three orthogonal directions.

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

6.4.1 Primary map



X



Y

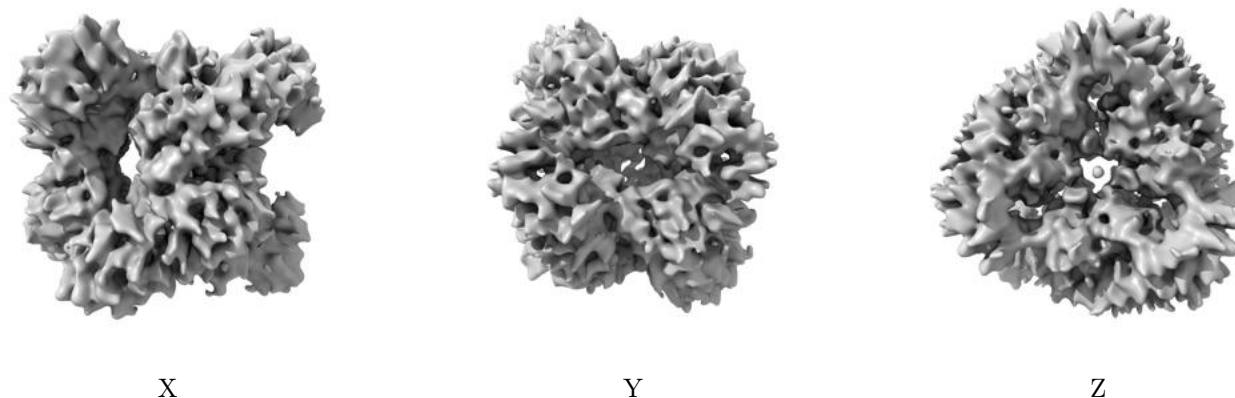


Z

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 125.0. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

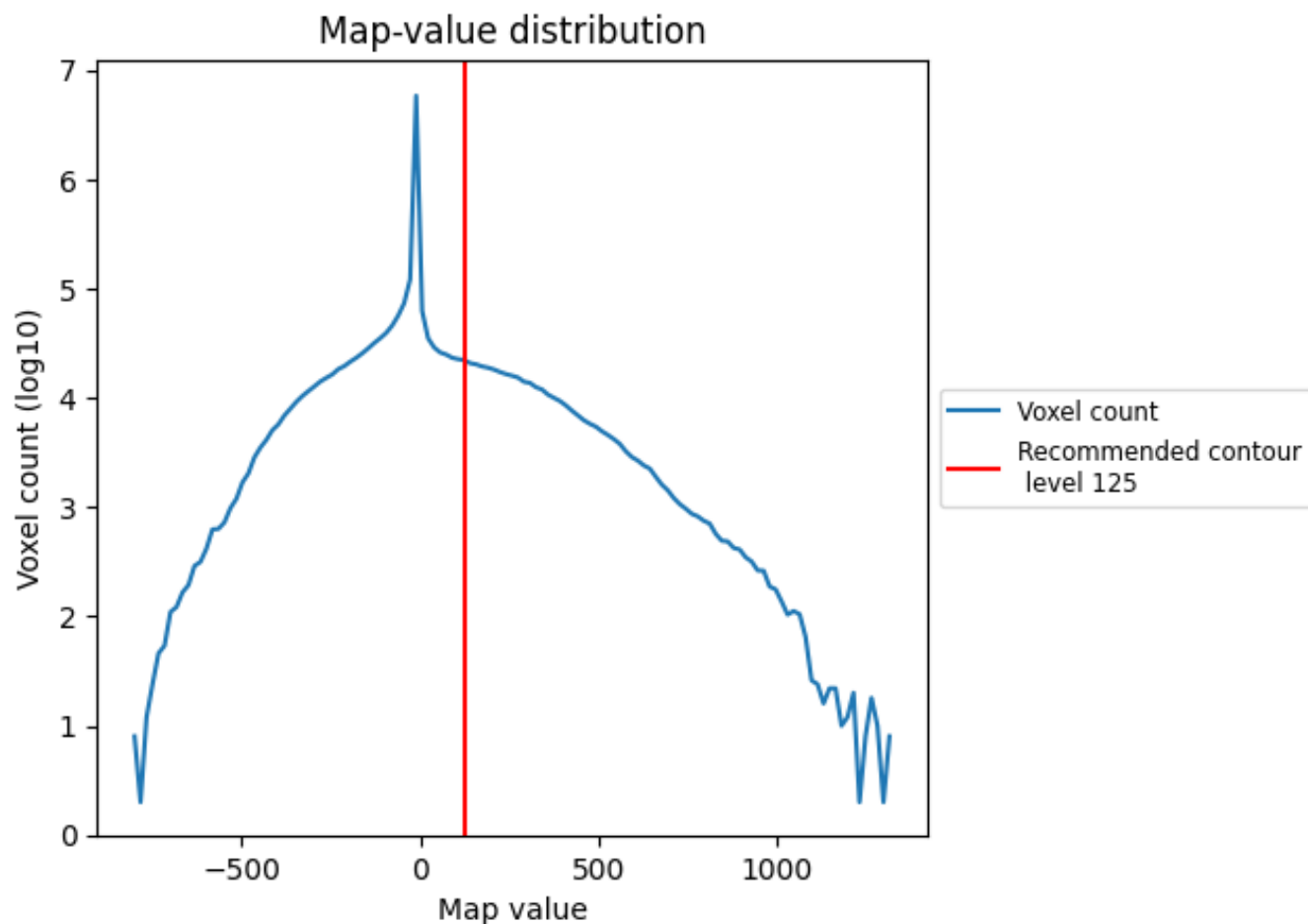
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

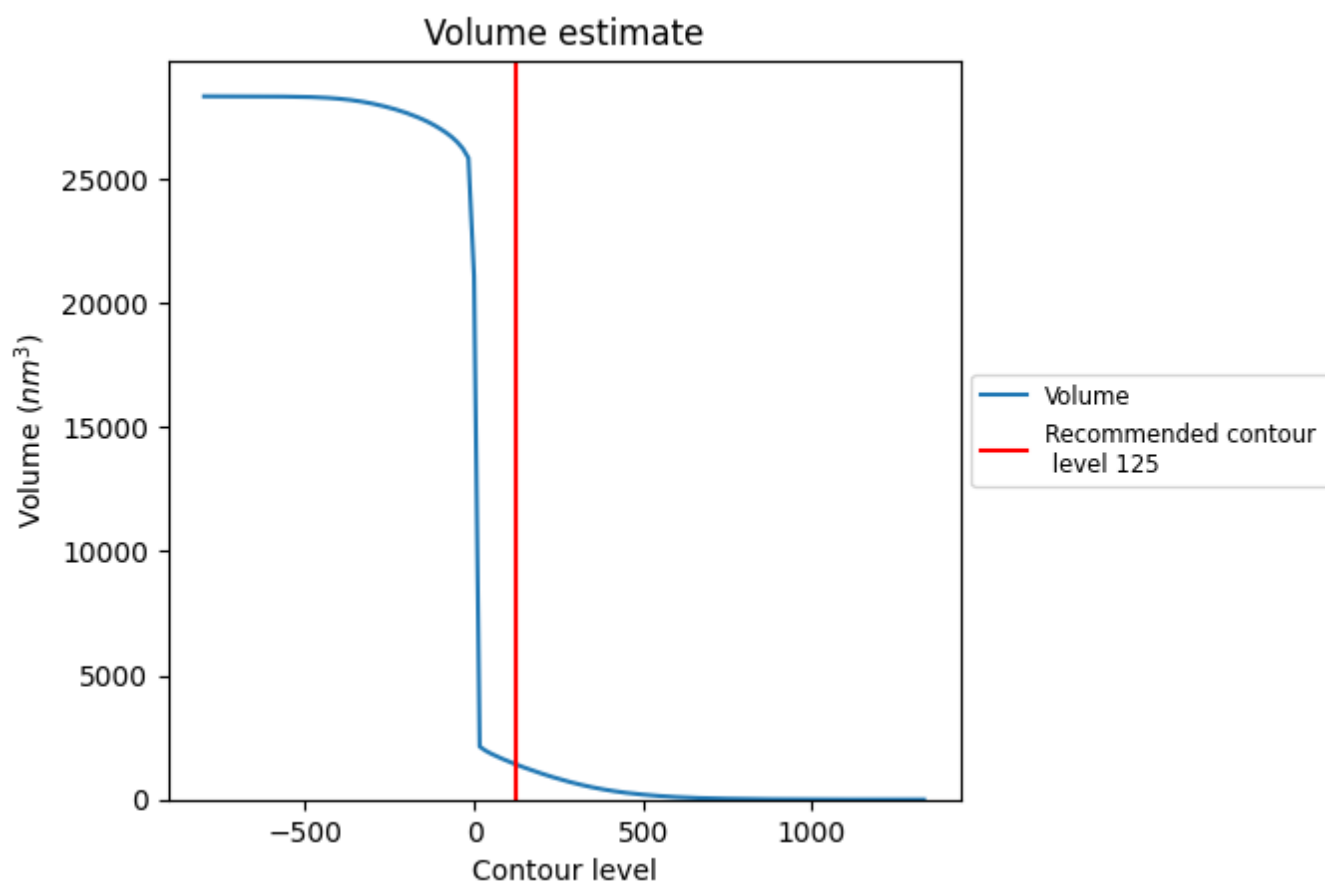
This section contains the results of statistical analysis of the map.

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.

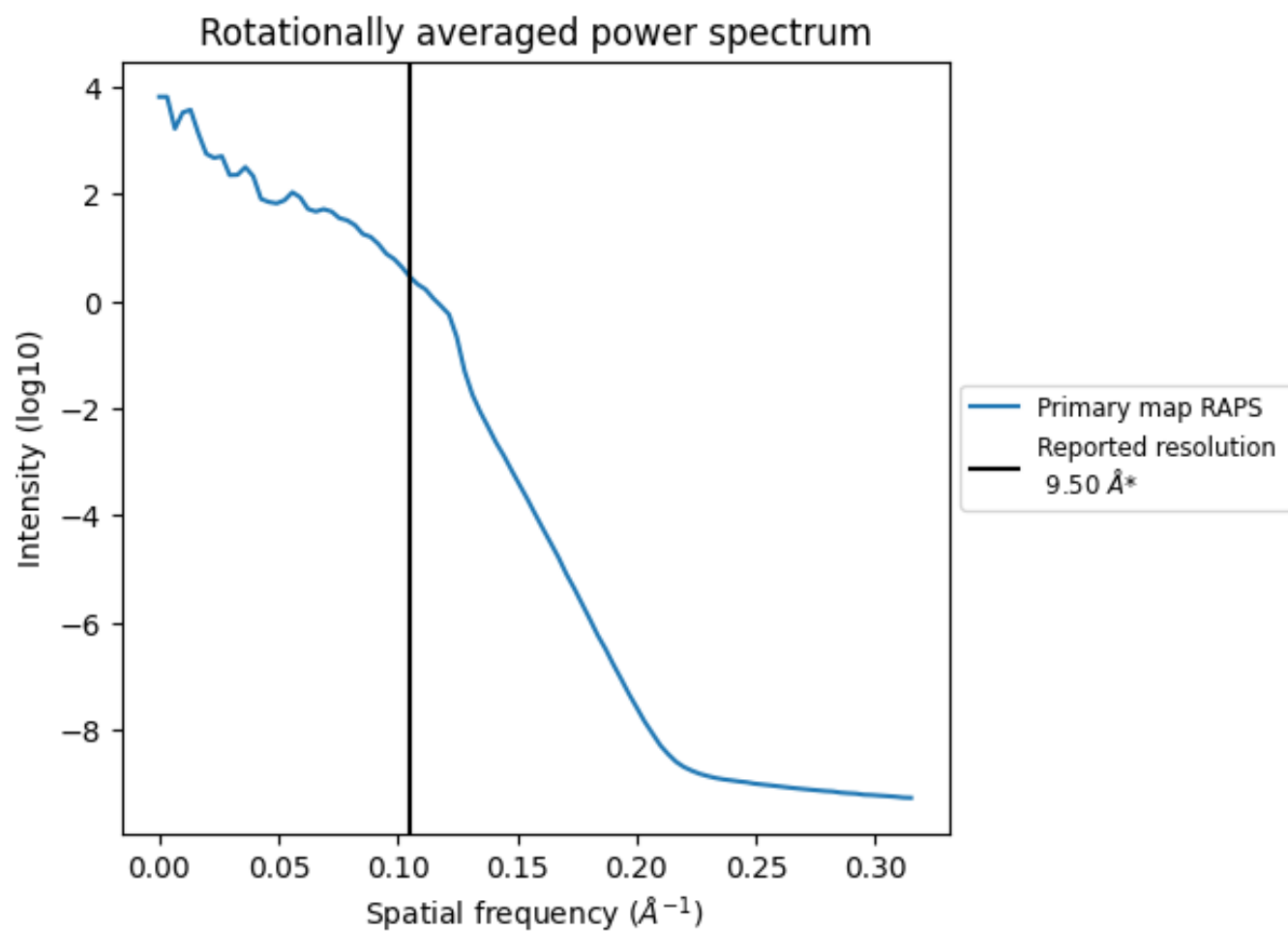
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 1412 nm³; this corresponds to an approximate mass of 1276 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 ⓘ

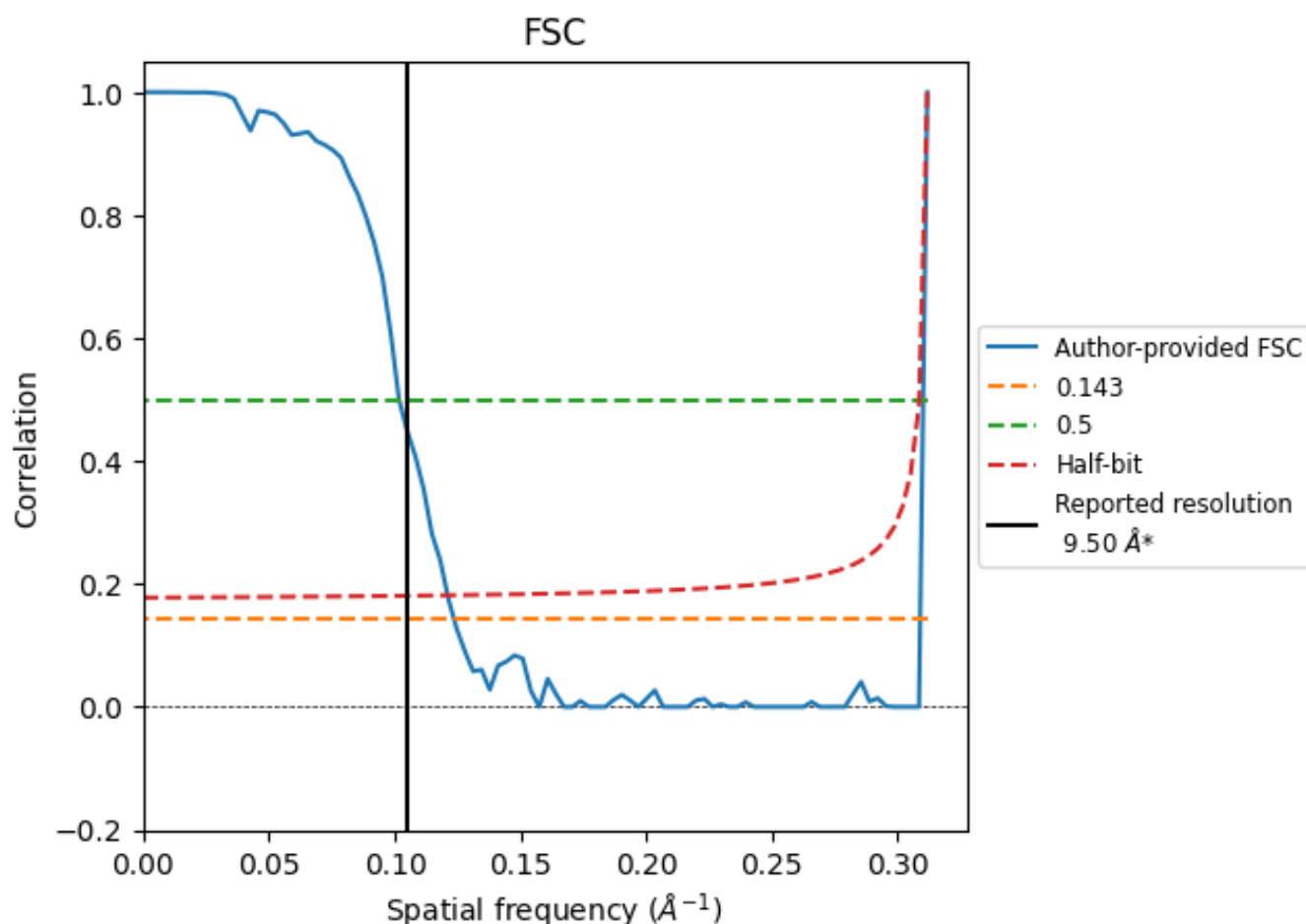


*Reported resolution corresponds to spatial frequency of 0.105 Å⁻¹

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 0.105 Å⁻¹

8.2 Resolution estimates [i](#)

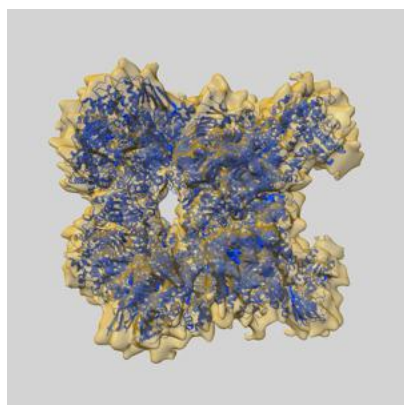
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	-	-	-
Author-provided FSC curve	8.10	9.83	8.26
Unmasked-calculated*	-	-	-

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

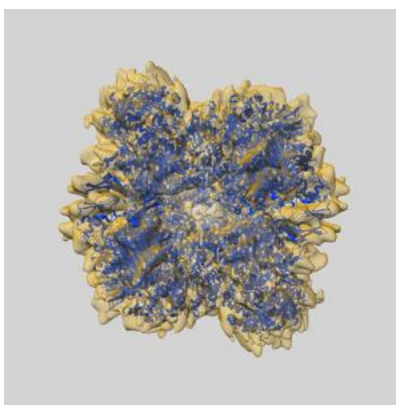
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-1440 and PDB model 2VDC. Per-residue inclusion information can be found in [section 3](#) on [page 11](#).

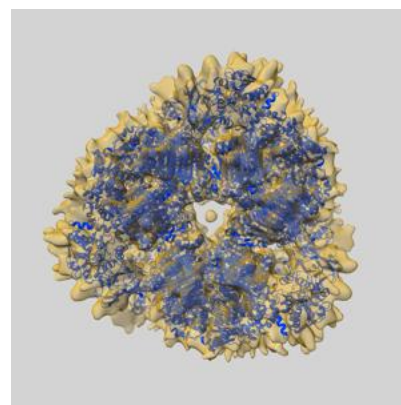
9.1 Map-model overlay [i](#)



X



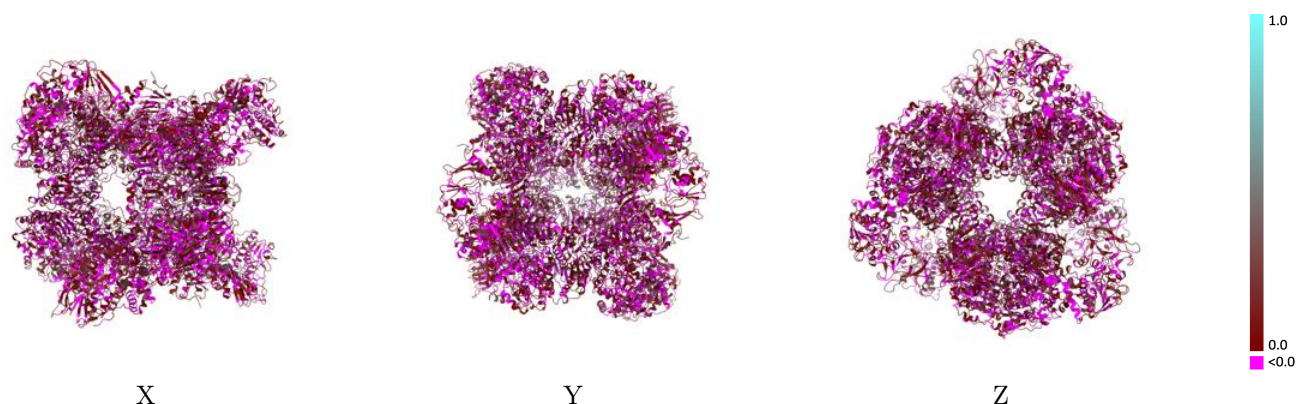
Y



Z

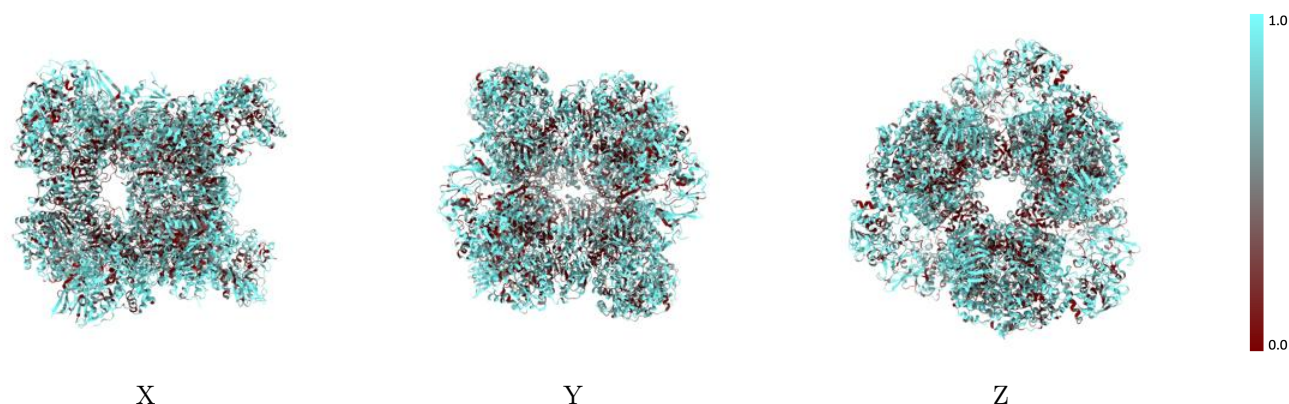
The images above show the 3D surface view of the map at the recommended contour level 125.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



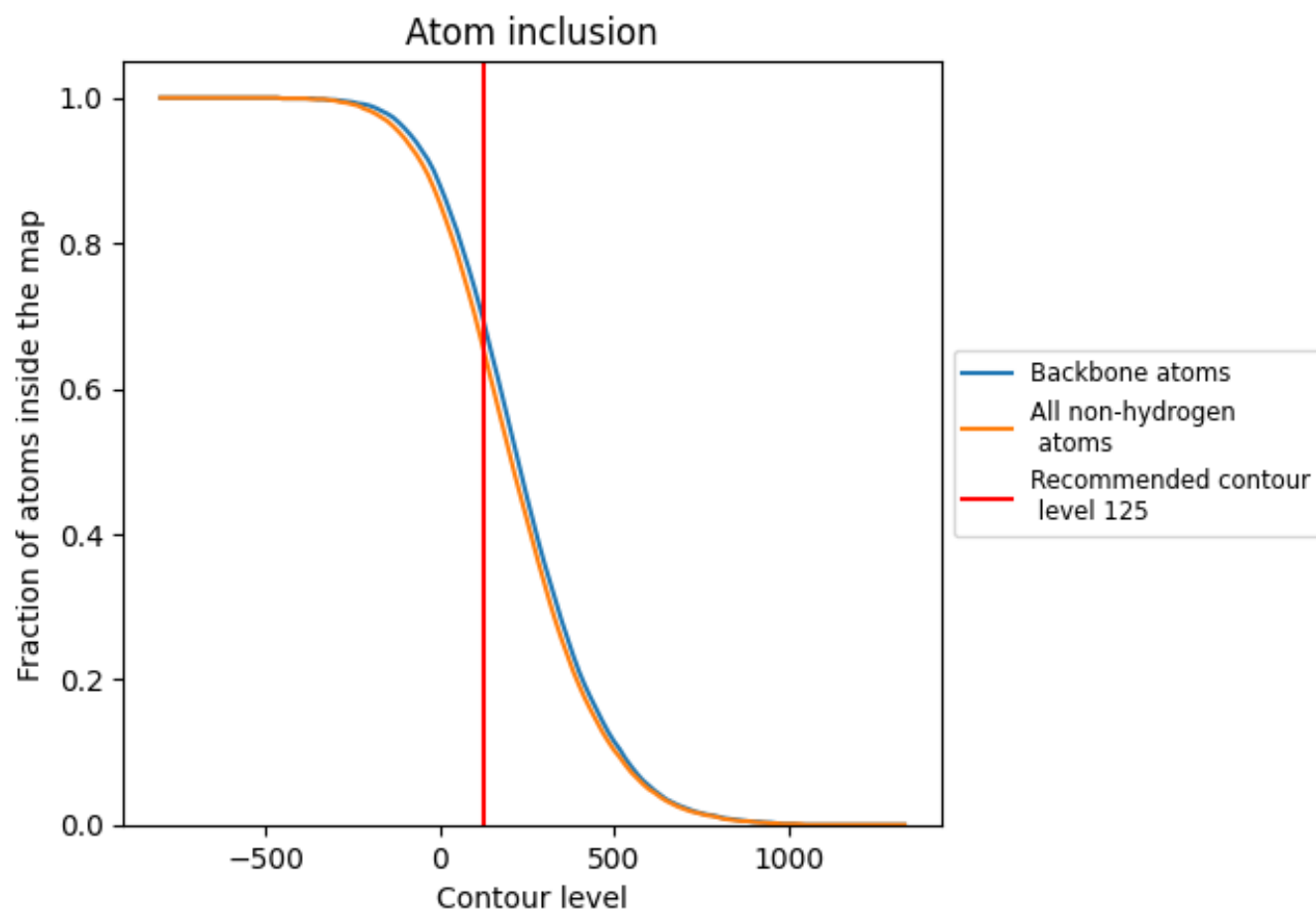
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

9.3 Atom inclusion mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (125).

9.4 Atom inclusion [i](#)



At the recommended contour level, 70% of all backbone atoms, 66% 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 (125) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div></div> 0.6560	<div></div> 0.0430
A	<div></div> 0.6470	<div></div> 0.0430
B	<div></div> 0.6460	<div></div> 0.0430
C	<div></div> 0.6350	<div></div> 0.0400
D	<div></div> 0.6350	<div></div> 0.0430
E	<div></div> 0.6360	<div></div> 0.0450
F	<div></div> 0.6350	<div></div> 0.0410
G	<div></div> 0.7250	<div></div> 0.0460
H	<div></div> 0.7080	<div></div> 0.0430
I	<div></div> 0.7010	<div></div> 0.0470
J	<div></div> 0.7250	<div></div> 0.0490
K	<div></div> 0.7010	<div></div> 0.0470
L	<div></div> 0.7080	<div></div> 0.0430

