



wwPDB EM Validation Summary Report ⓘ

Nov 12, 2022 – 03:51 PM EST

PDB ID : 6PTO
EMDB ID : EMD-20473
Title : Structure of Ctf4 trimer in complex with three CMG helicases
Authors : Yuan, Z.; Georgescu, R.; Bai, L.; Santos, R.; Donnell, M.; Li, H.
Deposited on : 2019-07-16
Resolution : 7.00 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:

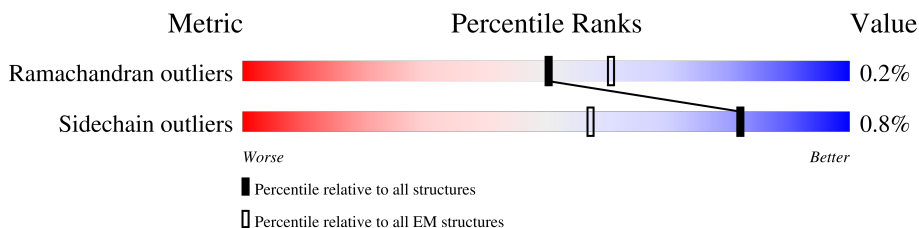
EMDB validation analysis : 0.0.1.dev43
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.9
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.2

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 7.00 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)
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. 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	X	927	46% 54%
1	Y	927	46% 54%
1	Z	927	46% 54%
2	A	208	19% 99%
2	a	208	23% 99%
2	n	208	12% 99%
3	B	213	7% 84% 15%
3	b	213	6% 84% 15%
3	o	213	5% 84% 15%



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Mol	Chain	Length	Quality of chain		
4	C	194	17%	80%	18%
4	c	194	19%	81%	18%
4	p	194	10%	80%	18%
5	D	294	9%	80%	20%
5	d	294	6%	80%	20%
5	q	294	5%	80%	20%
6	E	650	16%	83%	15%
6	e	650	12%	83%	15%
6	r	650	14%	83%	15%
7	2	868	56%	72%	27%
7	F	868	51%	72%	27%
7	h	868	45%	72%	27%
8	3	971	40%	61%	39%
8	G	971	39%	61%	39%
8	i	971	24%	61%	39%
9	4	933	63%	72%	27%
9	H	933	59%	72%	27%
9	j	933	51%	72%	27%
10	5	775	46%	76%	23%
10	I	775	43%	76%	23%
10	k	775	36%	76%	23%
11	6	1017	49%	59%	40%
11	J	1017	45%	59%	40%
11	l	1017	36%	59%	40%
12	7	845	65%	78%	22%

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Mol	Chain	Length	Quality of chain
12	K	845	
12	m	845	

2 Entry composition [i](#)

There are 13 unique types of molecules in this entry. The entry contains 132192 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 DNA polymerase alpha-binding protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	X	424	Total	C	N	O	S	1	0
			3416	2193	566	642	15		
1	Y	431	Total	C	N	O	S	0	0
			3464	2223	574	651	16		
1	Z	424	Total	C	N	O	S	1	0
			3416	2193	566	642	15		

- Molecule 2 is a protein called DNA replication complex GINS protein PSF1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	n	208	Total	C	N	O	S	0	0
			1696	1065	290	331	10		
2	A	208	Total	C	N	O	S	0	0
			1696	1065	290	331	10		
2	a	208	Total	C	N	O	S	0	0
			1696	1065	290	331	10		

- Molecule 3 is a protein called DNA replication complex GINS protein PSF2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	o	181	Total	C	N	O	S	0	0
			1513	978	261	270	4		
3	B	181	Total	C	N	O	S	0	0
			1513	978	261	270	4		
3	b	181	Total	C	N	O	S	0	0
			1513	978	261	270	4		

- Molecule 4 is a protein called DNA replication complex GINS protein PSF3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	p	159	Total	C	N	O	S	0	0
			1288	843	207	232	6		

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Mol	Chain	Residues	Atoms					AltConf	Trace
4	C	159	Total	C	N	O	S	0	0
			1288	843	207	232	6		
4	c	159	Total	C	N	O	S	0	0
			1288	843	207	232	6		

- Molecule 5 is a protein called DNA replication complex GINS protein SLD5.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	q	234	Total	C	N	O	S	0	0
			1924	1224	315	372	13		
5	D	234	Total	C	N	O	S	0	0
			1924	1224	315	372	13		
5	d	234	Total	C	N	O	S	0	0
			1924	1224	315	372	13		

- Molecule 6 is a protein called Cell division control protein 45.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	e	553	Total	C	N	O	S	0	0
			4482	2862	763	844	13		
6	E	553	Total	C	N	O	S	0	0
			4482	2862	763	844	13		
6	r	553	Total	C	N	O	S	0	0
			4482	2862	763	844	13		

- Molecule 7 is a protein called DNA replication licensing factor MCM2.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	h	634	Total	C	N	O	S	0	0
			4970	3122	897	934	17		
7	2	634	Total	C	N	O	S	0	0
			4970	3122	897	934	17		
7	F	634	Total	C	N	O	S	0	0
			4970	3122	897	934	17		

- Molecule 8 is a protein called DNA replication licensing factor MCM3.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	i	594	Total	C	N	O	S	0	0
			4659	2936	832	878	13		
8	3	594	Total	C	N	O	S	0	0
			4659	2936	832	878	13		

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Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
8	G	594	4659	2936	832	878	13	0	0

- Molecule 9 is a protein called DNA replication licensing factor MCM4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
9	j	682	5410	3397	946	1039	28	0	0
9	4	682	5410	3397	946	1039	28	0	0
9	H	682	5410	3397	946	1039	28	0	0

- Molecule 10 is a protein called Minichromosome maintenance protein 5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	k	597	4688	2946	808	910	24	0	0
10	5	597	4688	2946	808	910	24	0	0
10	I	597	4688	2946	808	910	24	0	0

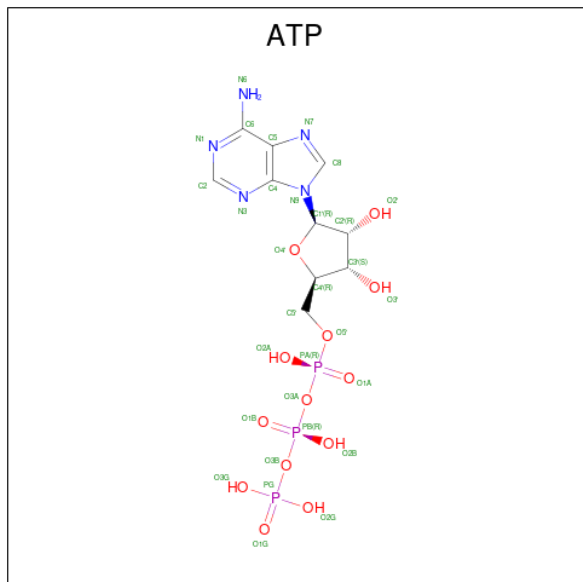
- Molecule 11 is a protein called DNA replication licensing factor MCM6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
11	l	614	4720	2971	836	893	20	0	0
11	6	614	4720	2971	836	893	20	0	0
11	J	614	4720	2971	836	893	20	0	0

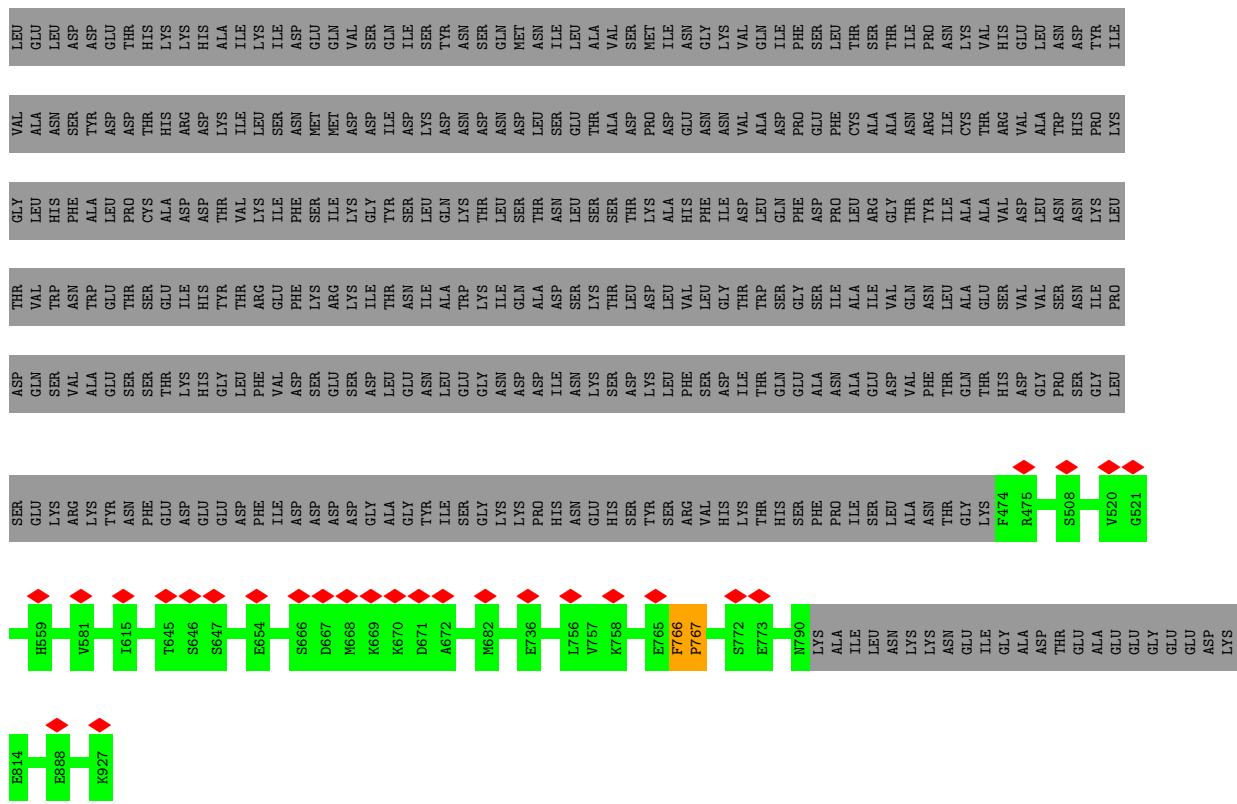
- Molecule 12 is a protein called DNA replication licensing factor MCM7.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
12	m	663	5220	3290	904	996	30	0	0
12	7	663	5220	3290	904	996	30	0	0
12	K	663	5220	3290	904	996	30	0	0

- Molecule 13 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).

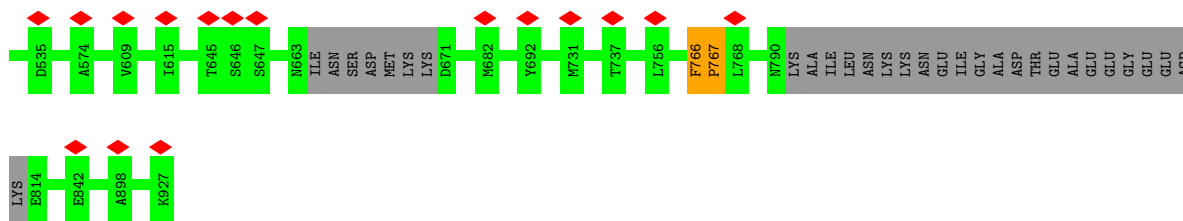


Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
13	h	1	Total 31	C 10	N 5	O 13	P 3	0
13	i	1	Total 31	C 10	N 5	O 13	P 3	0
13	k	1	Total 31	C 10	N 5	O 13	P 3	0
13	2	1	Total 31	C 10	N 5	O 13	P 3	0
13	3	1	Total 31	C 10	N 5	O 13	P 3	0
13	5	1	Total 31	C 10	N 5	O 13	P 3	0

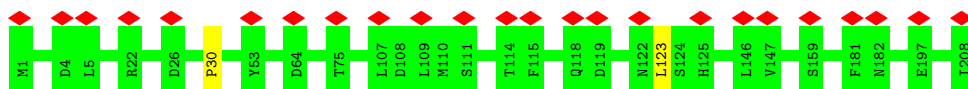


● Molecule 1: DNA polymerase alpha-binding protein

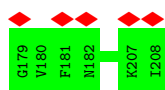
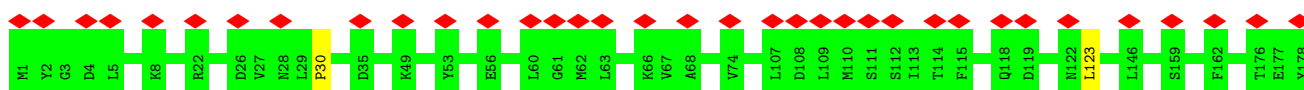




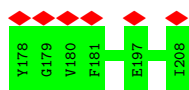
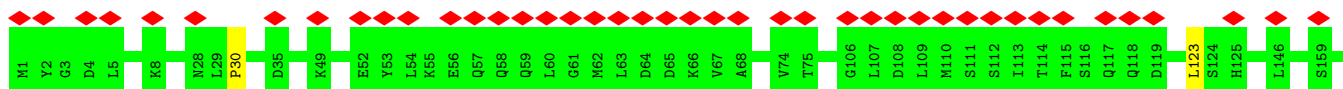
• Molecule 2: DNA replication complex GINS protein PSF1



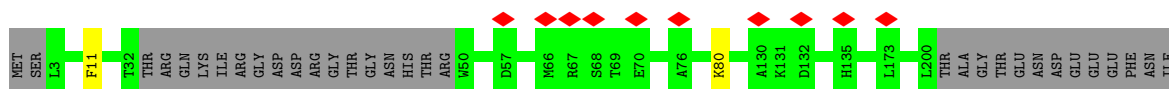
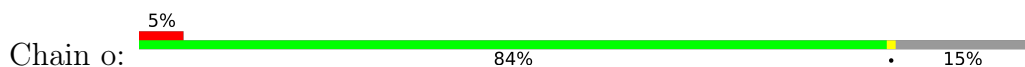
• Molecule 2: DNA replication complex GINS protein PSF1



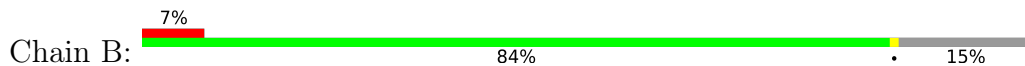
• Molecule 2: DNA replication complex GINS protein PSF1



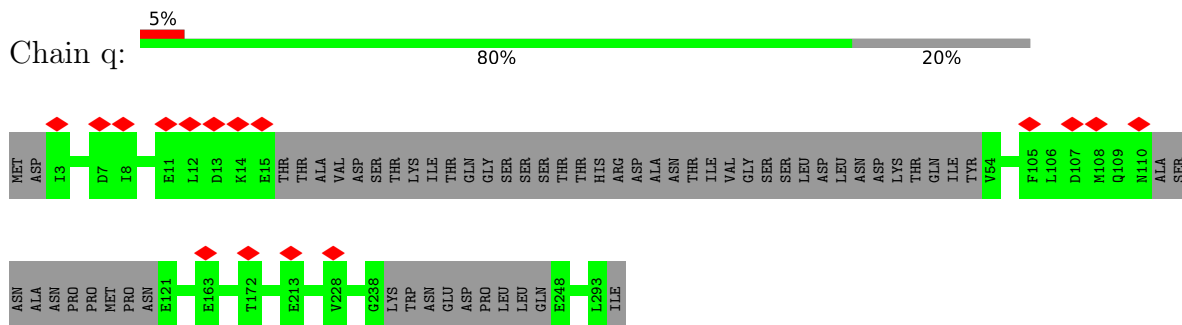
• Molecule 3: DNA replication complex GINS protein PSF2



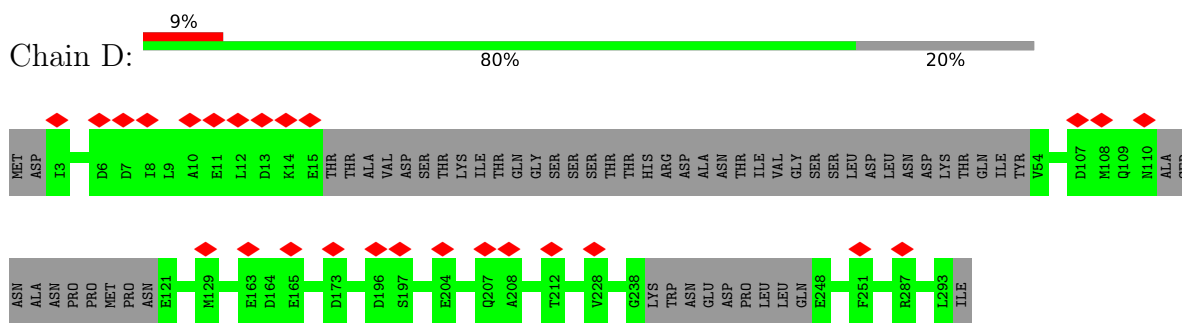
• Molecule 3: DNA replication complex GINS protein PSF2



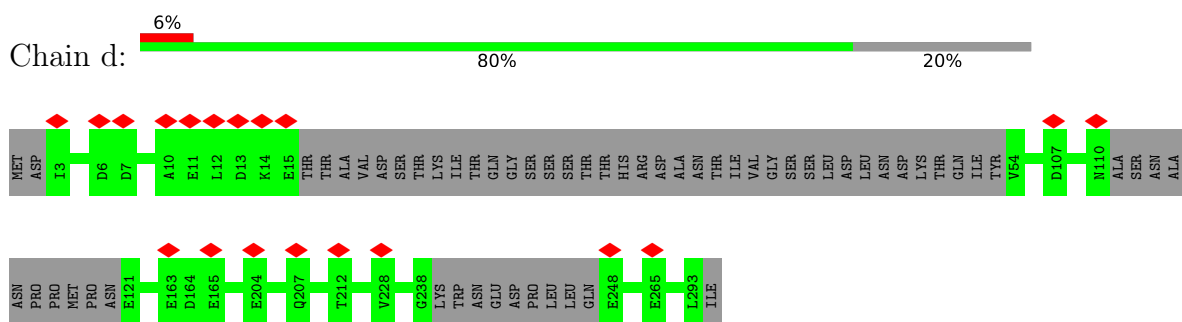
• Molecule 5: DNA replication complex GINS protein SLD5



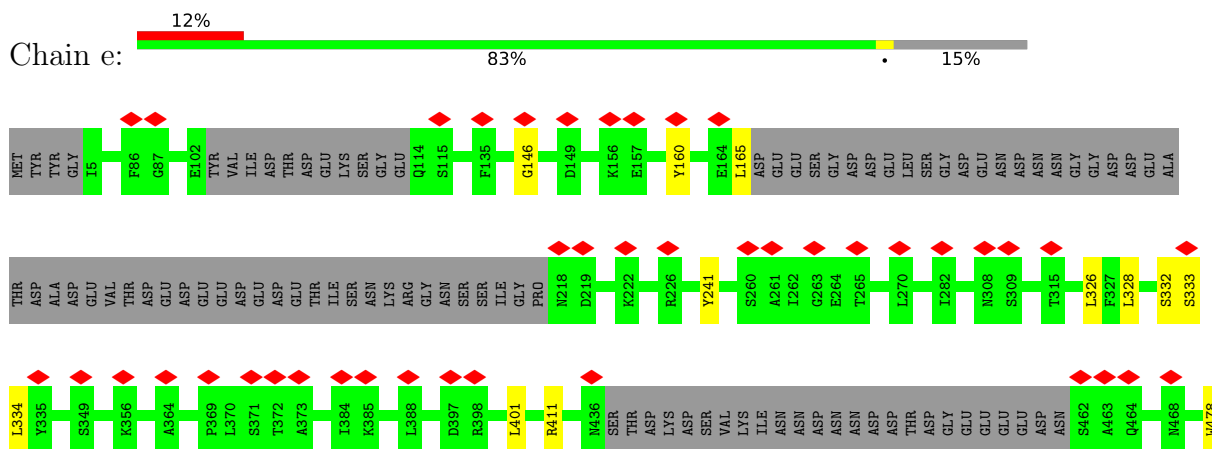
• Molecule 5: DNA replication complex GINS protein SLD5

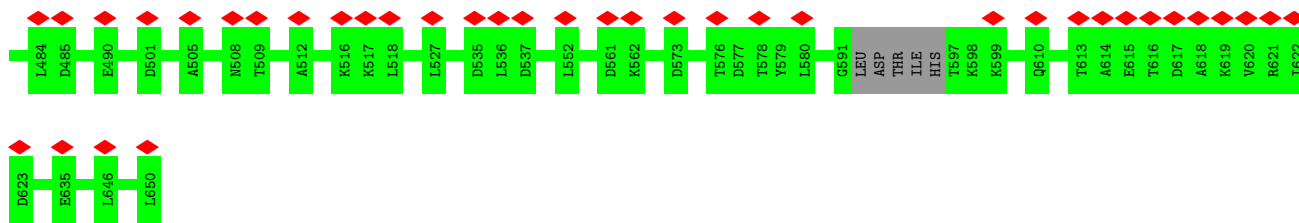


• Molecule 5: DNA replication complex GINS protein SLD5

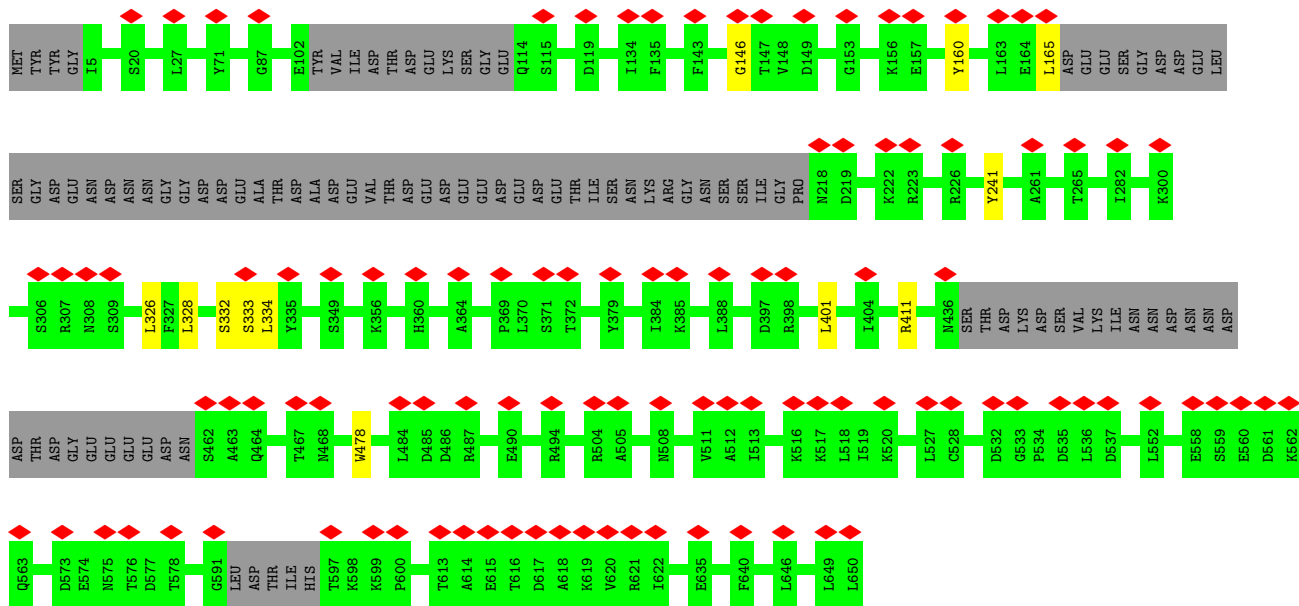
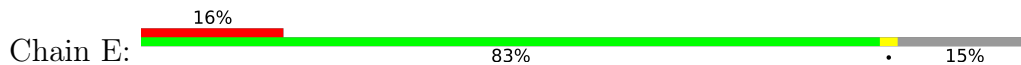


• Molecule 6: Cell division control protein 45

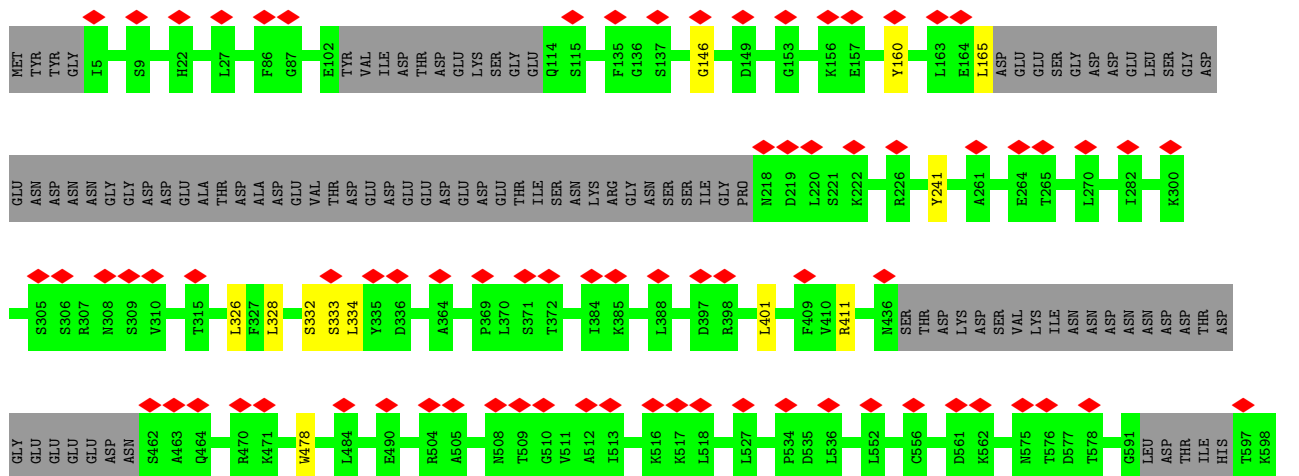
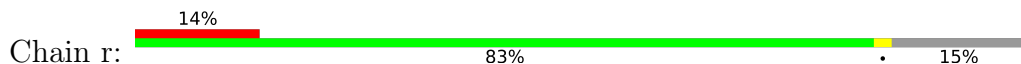


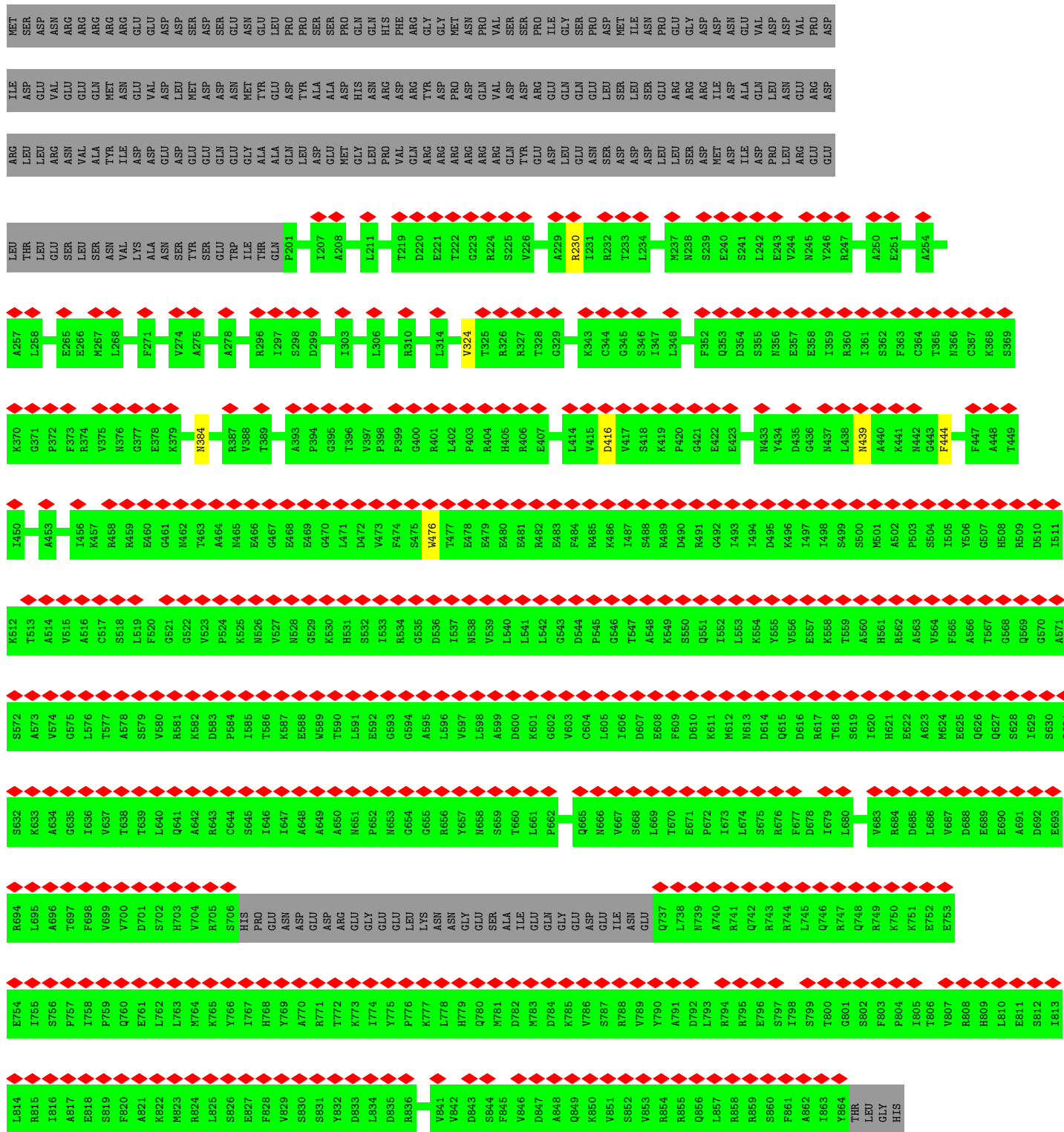
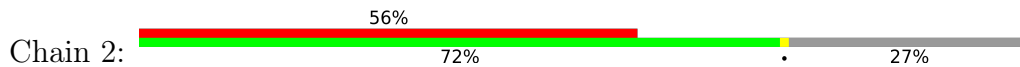


• Molecule 6: Cell division control protein 45



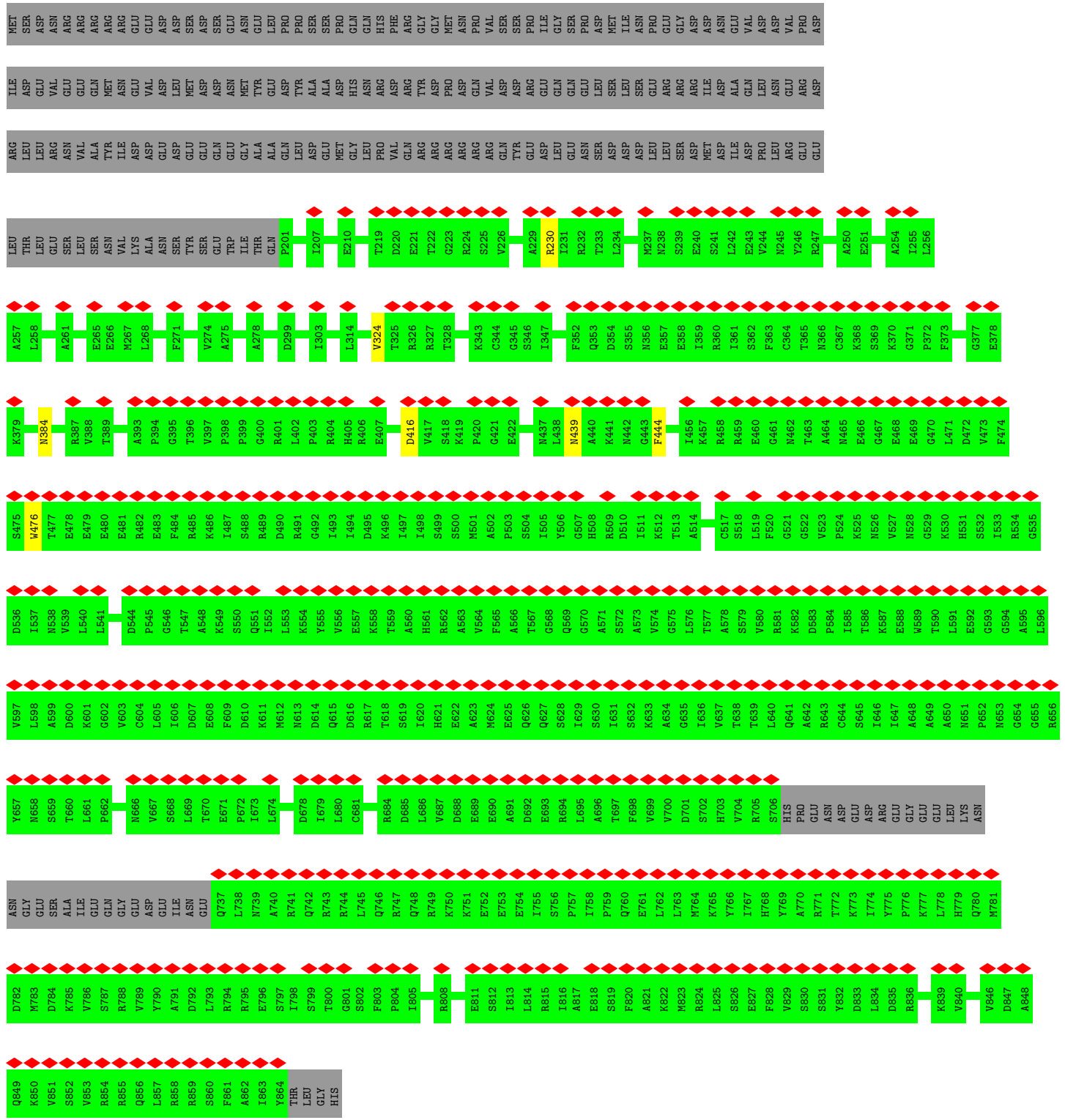
• Molecule 6: Cell division control protein 45



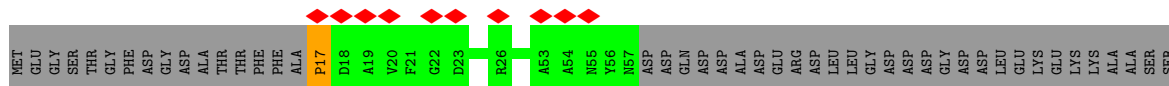


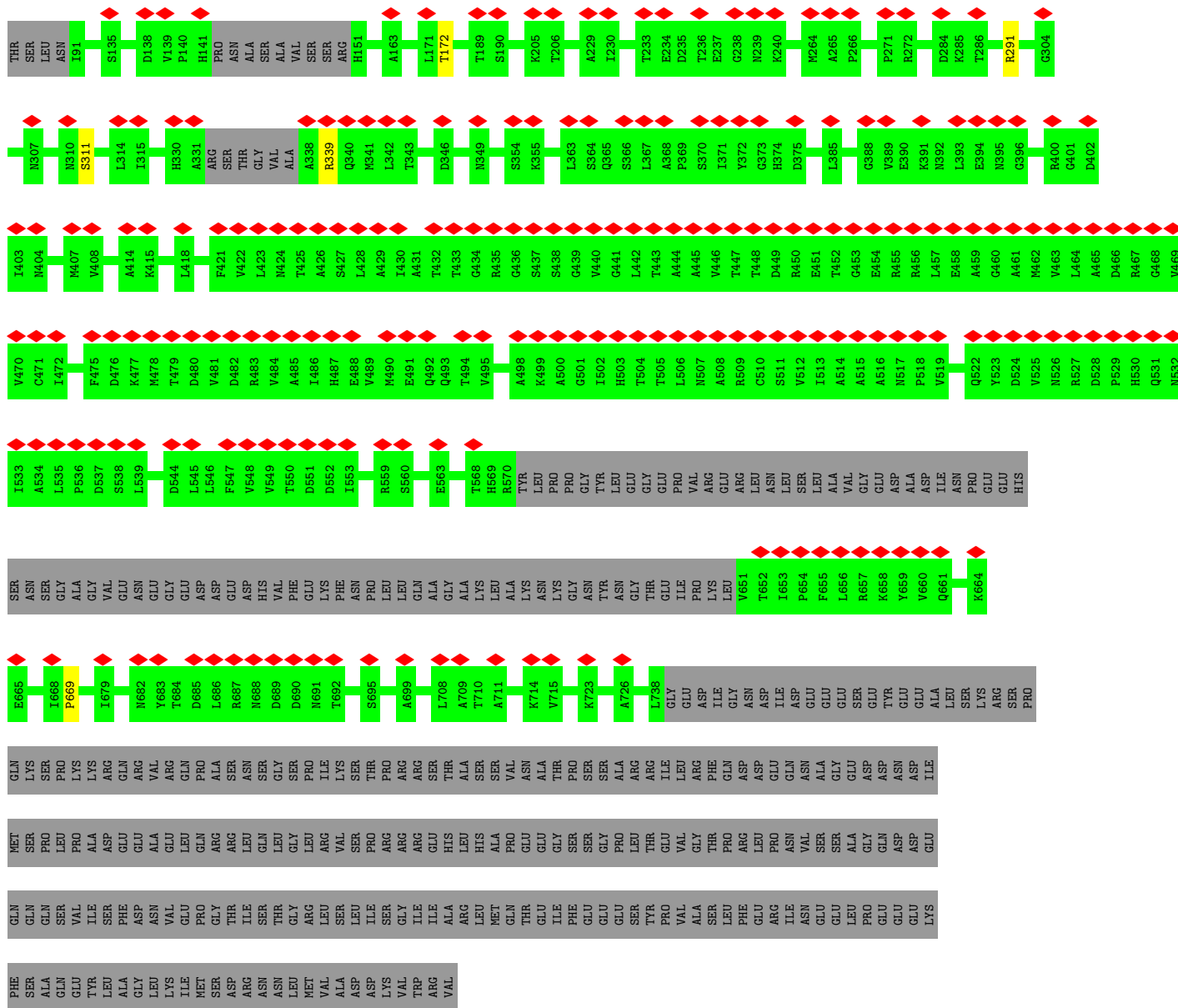
• Molecule 7: DNA replication licensing factor MCM2



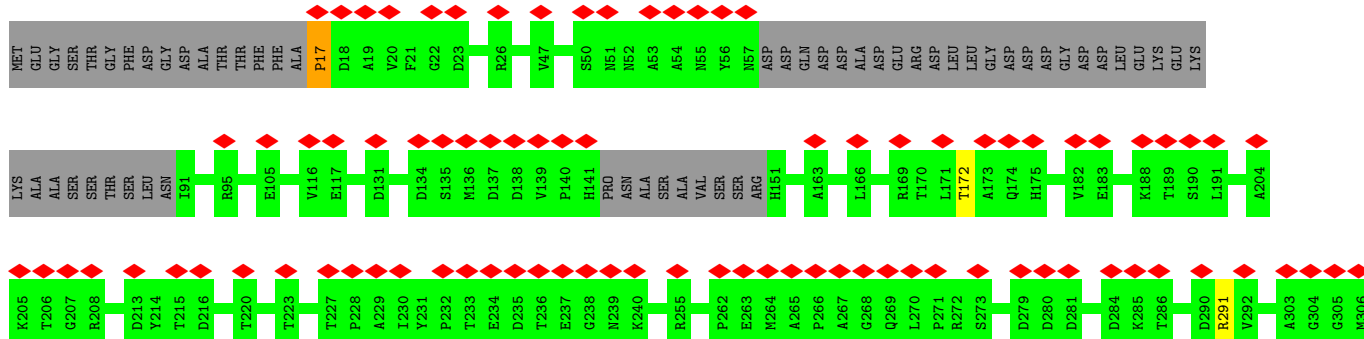
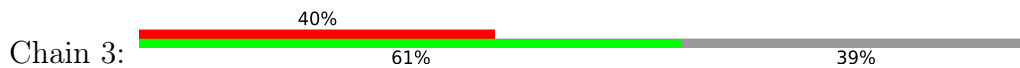


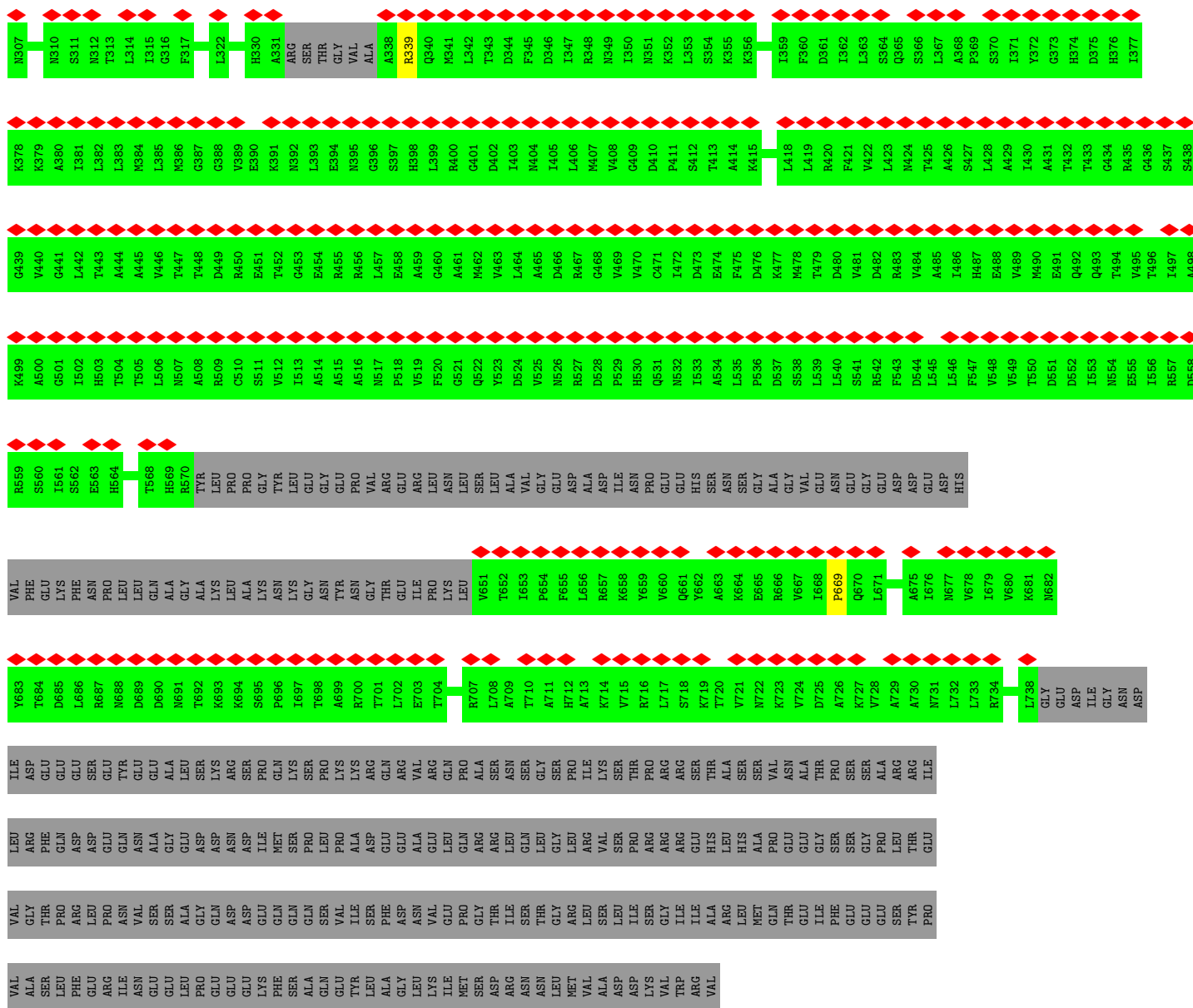
● Molecule 8: DNA replication licensing factor MCM3



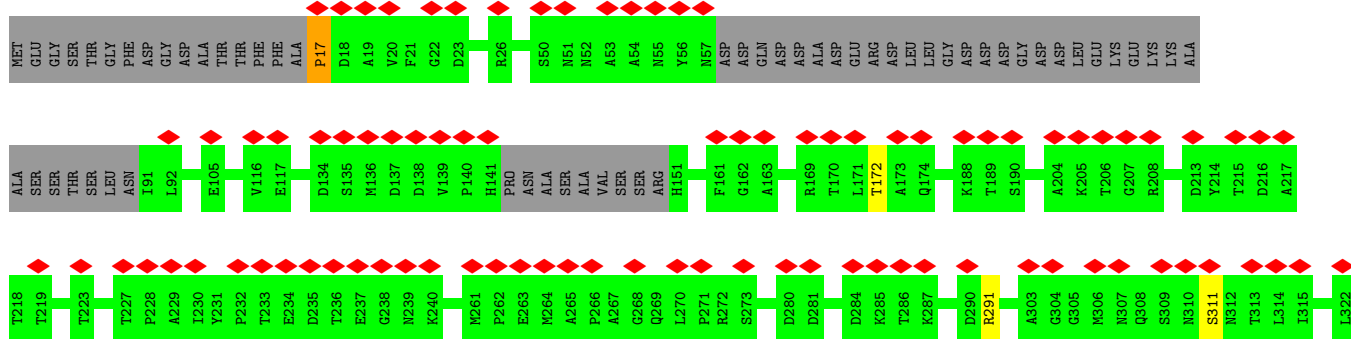
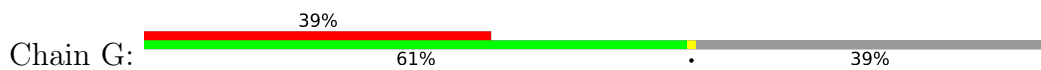


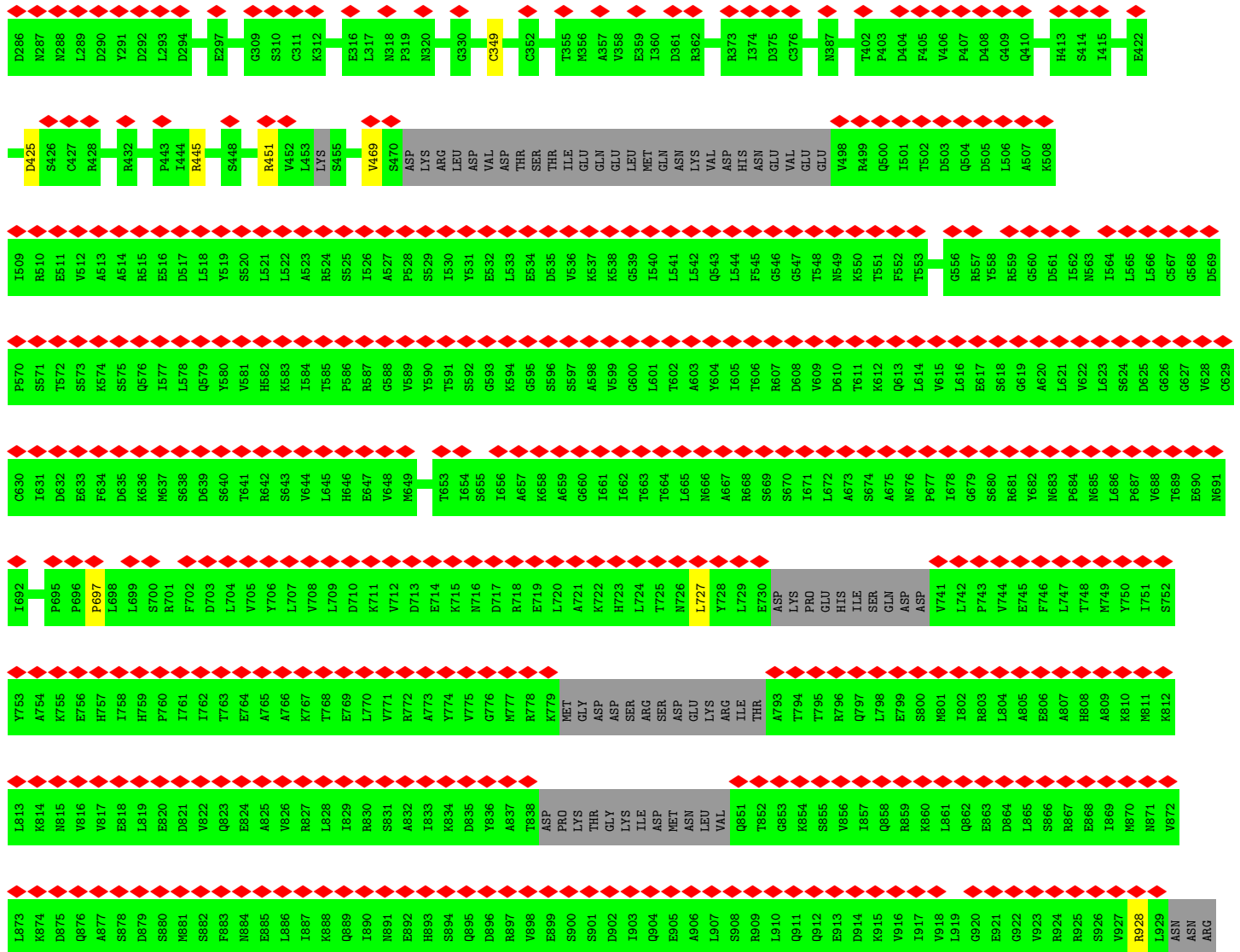
- Molecule 8: DNA replication licensing factor MCM3





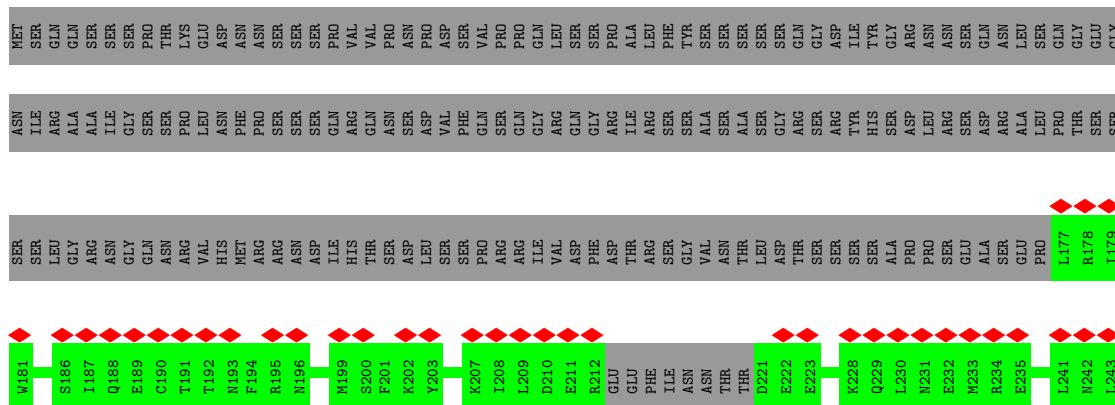
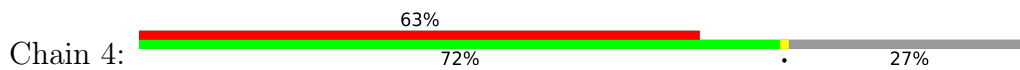
● Molecule 8: DNA replication licensing factor MCM3

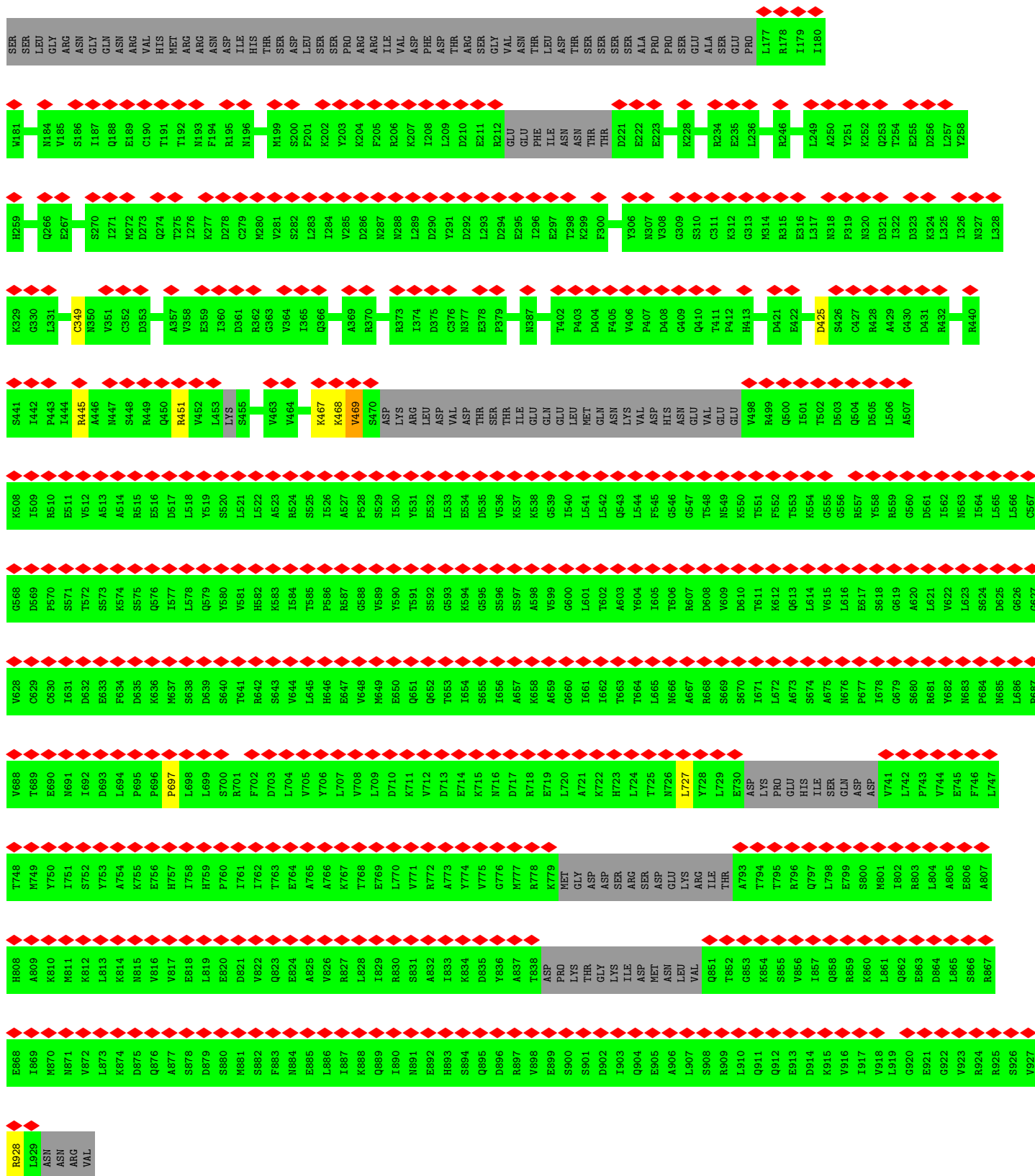




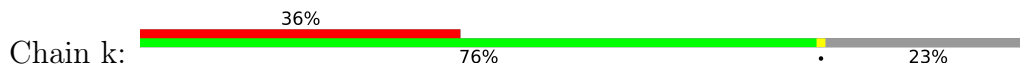
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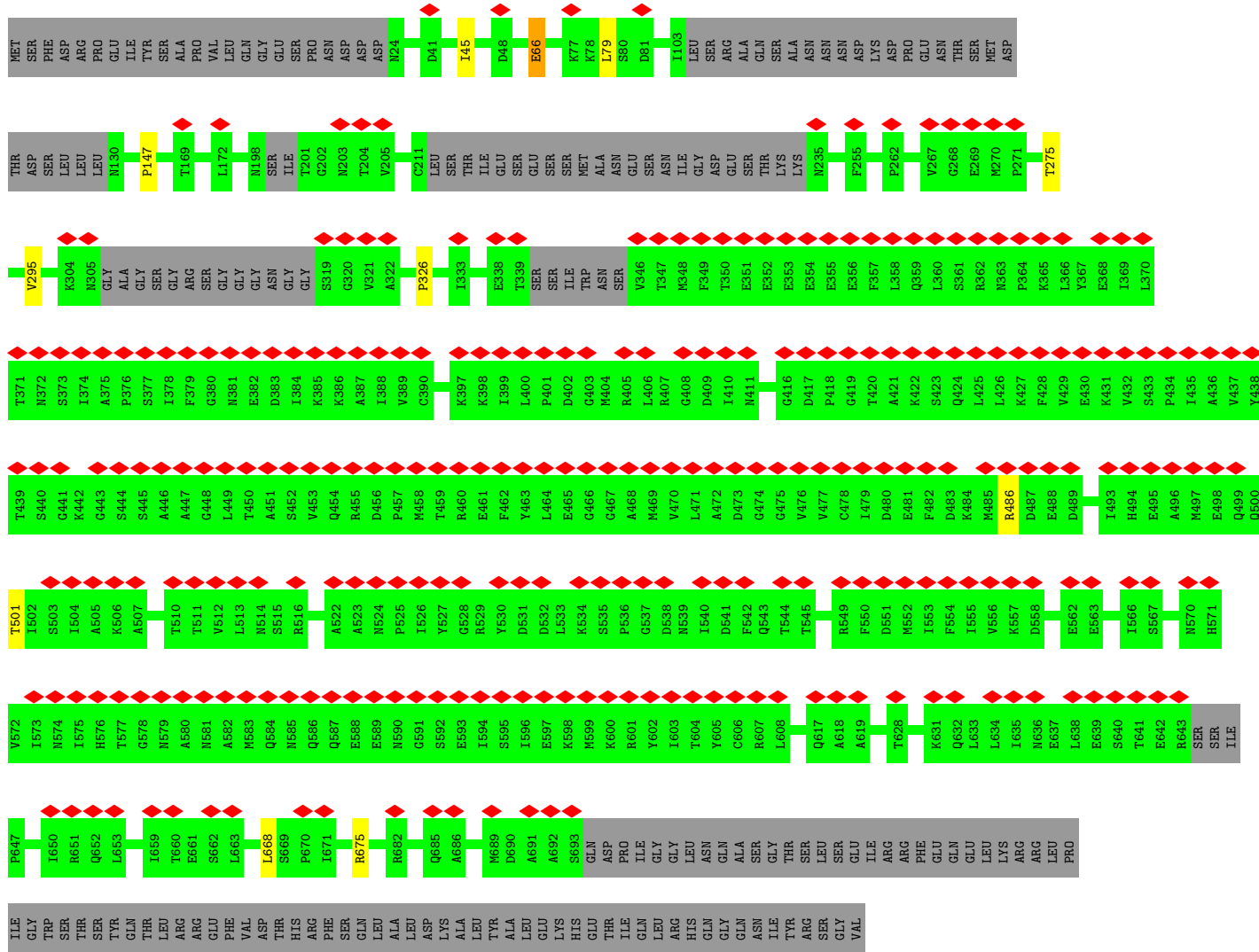
• Molecule 9: DNA replication licensing factor MCM4



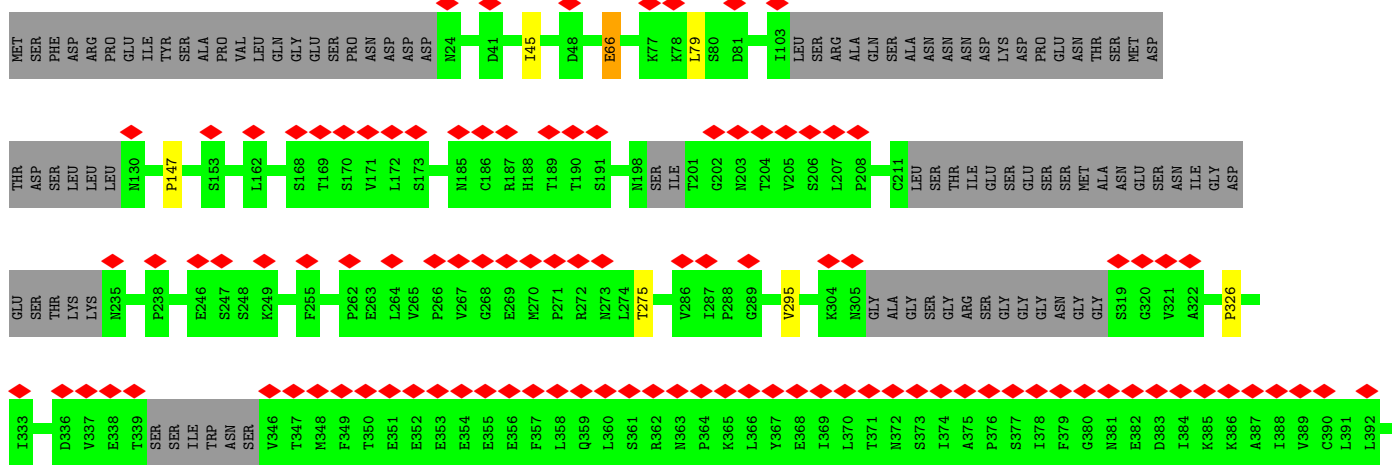
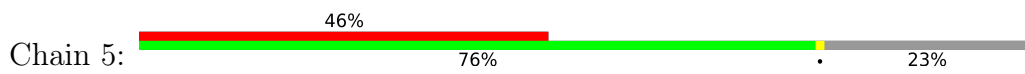


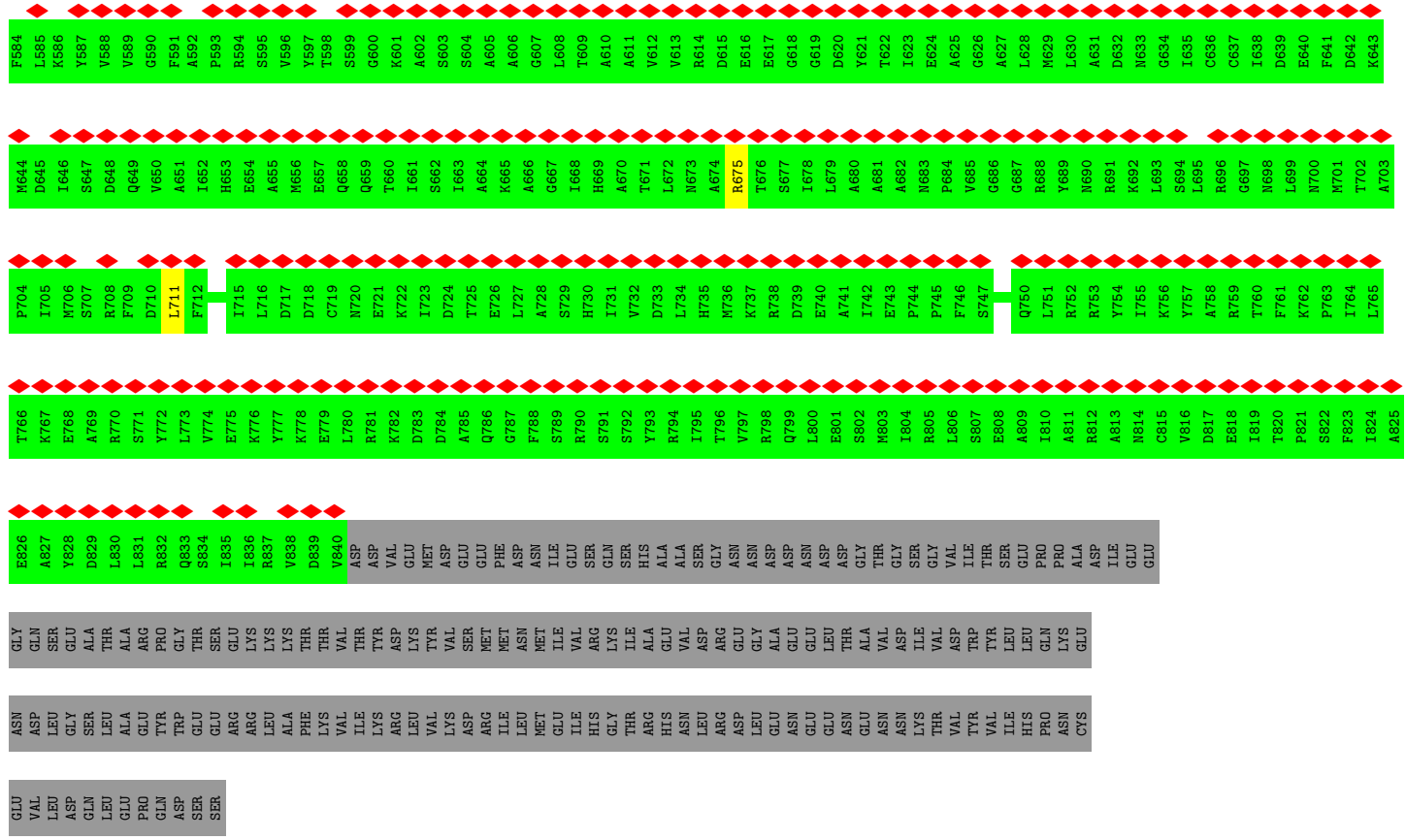
• Molecule 10: Minichromosome maintenance protein 5



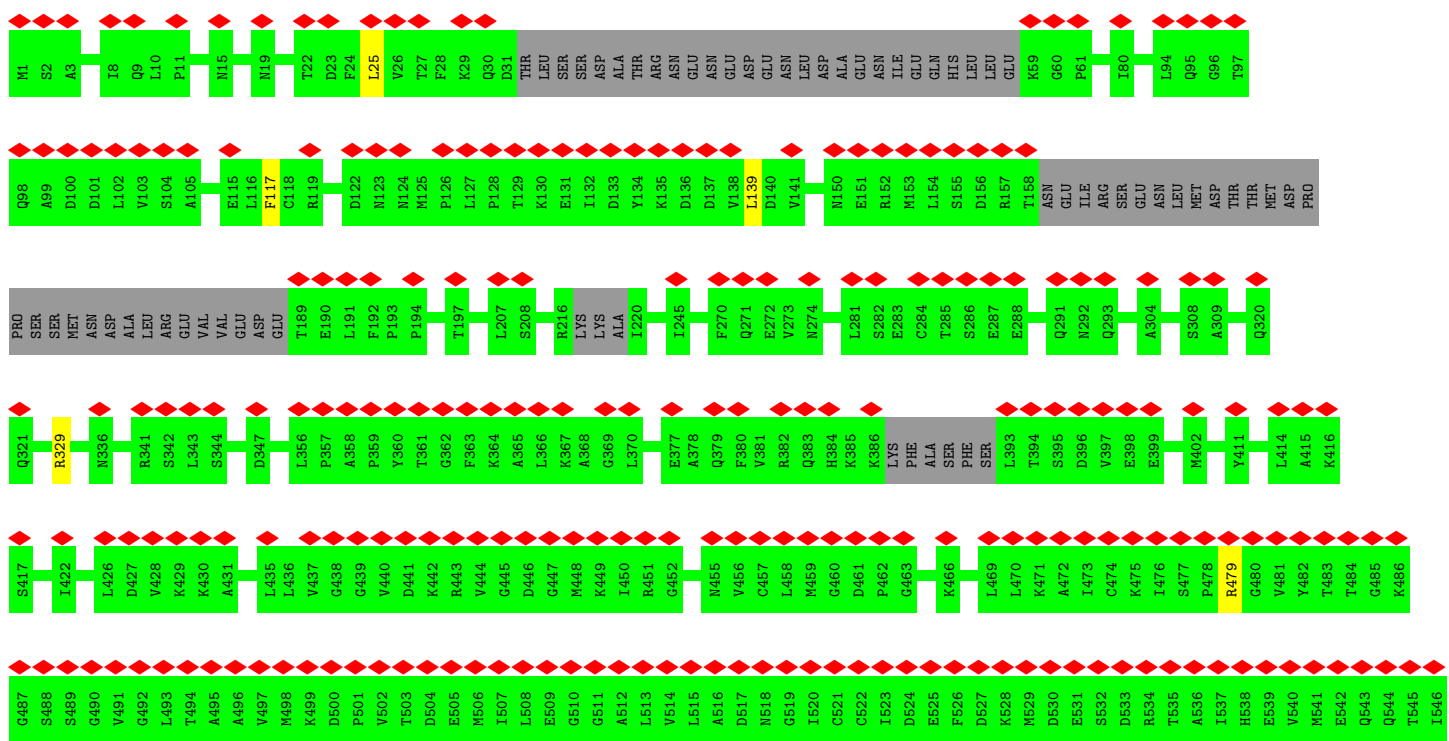
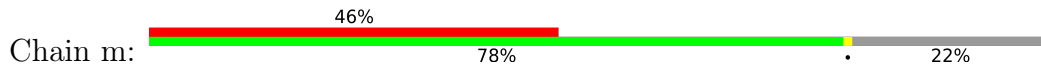


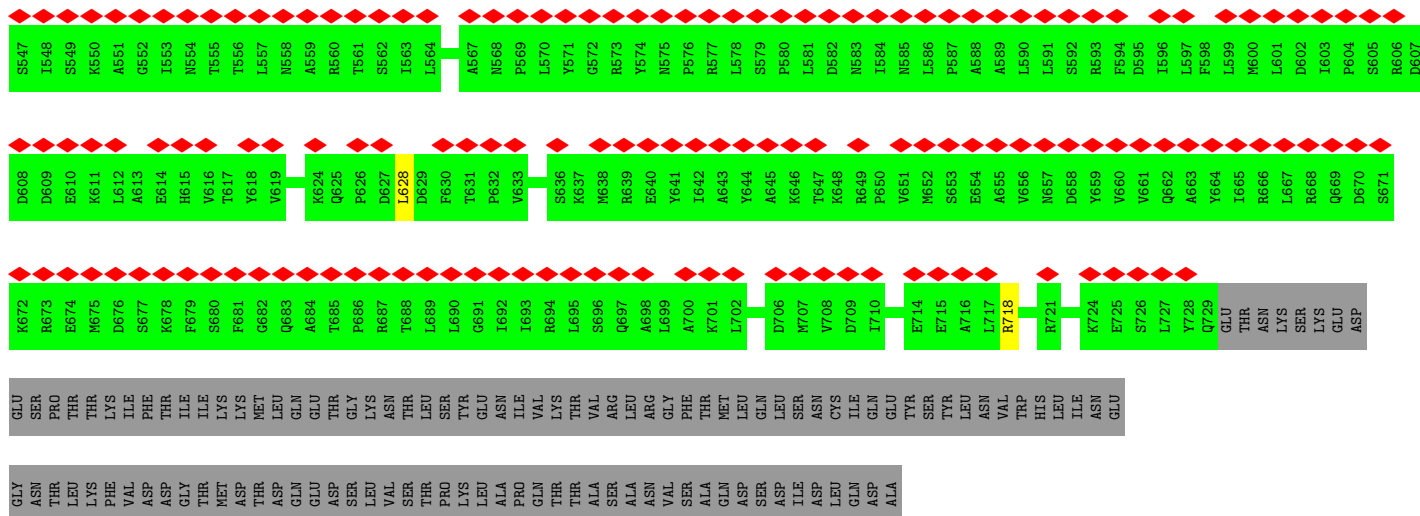
• Molecule 10: Minichromosome maintenance protein 5



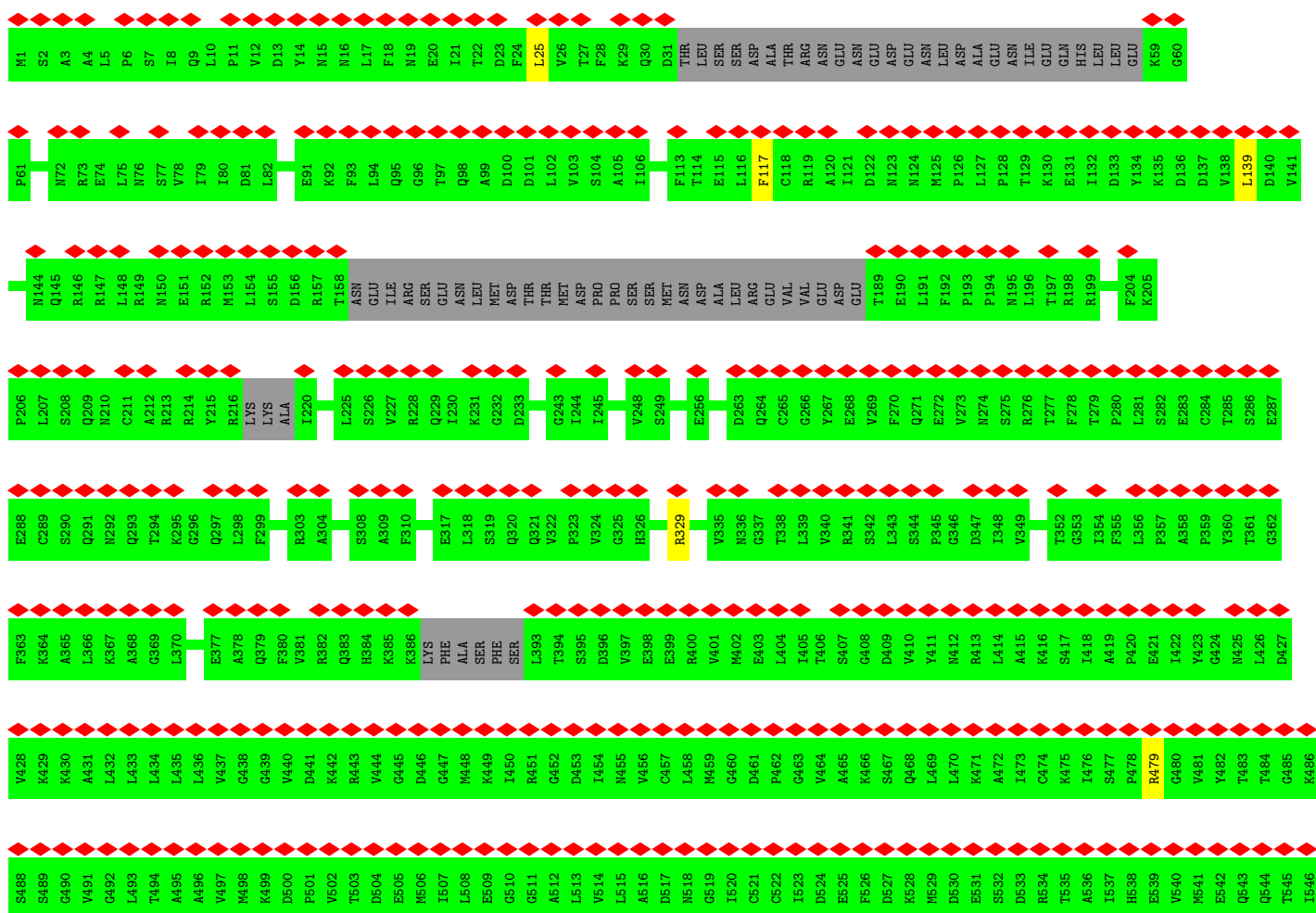
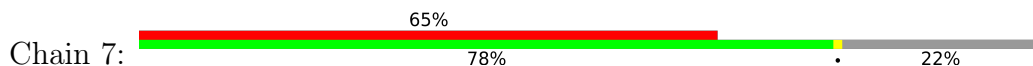


• Molecule 12: DNA replication licensing factor MCM7



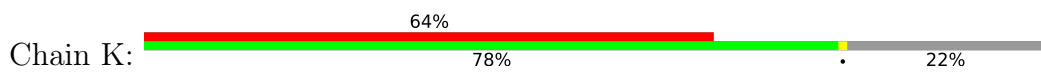


• Molecule 12: DNA replication licensing factor MCM7



I548	D608	R668	Y728	THR
S649	D609	Q669	Q729	LEU
K550	E610	D670	GLU	VAL
A651	K611	S671	THR	TRP
G552	L612	K672	LEU	HIS
I653	A613	R673	ILE	LEU
N554	E614	E674	LYS	ILE
T655	H615	M675	GLU	ASN
T556	V616	D676	ASP	GLY
L657	T617	S677	GLU	ASN
N558	Y618	K678	THR	THR
A659	V619	F679	THR	LEU
R660	H620	S680	LYS	LYS
T661	M621	F681	ASP	PHE
S662	H622	G682	THR	THR
I663	N623	Q683	ILE	ILE
L664	K624	A684	THR	THR
A665	Q625	T685	LYS	MET
A666	P626	P686	LYS	ASP
A667	D627	R687	MET	ASP
N668	L628	T688	GLN	GLN
L570	D629	L689	GLU	ASP
Y571	F630	G691	LEU	LEU
R572	T631	I692	VAL	VAL
G573	P632	I693	ASN	SER
Y574	V633	R694	THR	THR
N575	E634	R694	LYS	PRO
P576	P635	L695	LYS	LYS
R577	S636	Q697	THR	LEU
L578	K637	T698	ALA	ALA
S579	M638	A698	PRO	GLN
P580	E640	L699	THR	THR
D582	Y641	A700	THR	ALA
N583	I642	K701	VAL	SER
I584	A643	L702	ALA	ALA
N585	Y644	R703	ASN	ASN
L586	A645	A705	VAL	VAL
P587	K646	D706	ARG	ARG
A588	T647	M707	THR	THR
A589	K648	V708	LEU	LEU
L590	R649	D709	ASP	ASP
L591	P650	I710	LEU	LEU
S592	V651	D711	ASP	ASP
R593	M652	D712	ALA	ALA
F594	S653	V713	GLU	GLU
D595	E654	E714	ASP	ASP
L596	A655	E715	GLN	GLN
L597	V656	A716	HIS	HIS
F598	M657	L717	LEU	LEU
L599	D658	R718	LEU	LEU
M600	Y659	L719	GLU	GLU
L601	V660	V720	ALA	ALA
D602	P661	R721	ASP	ASP
I603	Q662	V722	ILE	ILE
P604	A663	S723	GLU	GLU
S605	Y664	K724	ASP	ASP
R606	I665	E725	ALA	ALA
D607	R666	S726	SER	SER

• Molecule 12: DNA replication licensing factor MCM7



M1	P61	Y134	P194	S286	V381	D441	P501
S2	K62	K135	M195	E287	R382	K442	V502
A3	Y63	D136	L196	E288	Q383	R443	T503
A4	M64	D137	T197	C289	H384	V444	D504
L5	A65	V138	R198	S290	K385	G445	E505
P6	M66	L139	R199	Q291	K386	D446	M506
S7	L67	D140	F204	N292	LYS	G447	I507
I8	Q68	V141	K205	Q293	PHE	M448	L508
O9	K69	I142	P206	T294	ALA	M449	L509
L10	N72	L143	L207	R303	SER	E509	G510
P11	R73	Q144	S208	A304	PHE	I450	G511
V12	E74	Q145	Q209	F310	SER	R451	G512
D13	Y14	R146	N210	Q320	L393	G452	A512
Y14	L75	R147	C211	Q321	T394	D453	L513
N15	I80	L148	A212	V322	S395	D454	V514
N16	D83	N150	R213	V323	D396	N455	L515
L17	F18	E151	R214	P323	V397	V456	A516
F18	M19	R152	Y215	V324	E398	C457	D517
M19	E20	M153	R216	V325	E399	L458	N518
E20	L86	R154	LYS	H326	R400	M459	G519
I21	Q87	S155	ALA	R329	M401	G460	I520
T22	Y88	D156	I220	N336	E403	D461	C521
D23	Q89	R157	L225	G337	L404	P462	C522
F24	N90	T158	S226	T338	T405	G463	I523
L25	V26	ASN	V227	L339	T406	V464	D524
V26	E91	GLU	L225	V340	I406	A465	E525
T27	K92	ILE	S226	R341	S407	K466	F526
F28	F93	ARG	V227	R342	G408	S467	D527
K29	L94	SER	I230	V340	D409	Q468	K528
Q30	Q95	GLU	K231	R341	V410	L469	M529
D31	G96	ASN	G232	L343	Y411	L470	D530
THR	T97	LEU	D233	P345	M412	K471	E531
LEU	Q98	MET	I245	G346	L414	A472	S532
LEU	A99	THR	T246	D347	A415	I473	D533
SER	SER	ASP	R247	I354	K416	K475	T535
SER	SER	THR	D263	F355	S417	I476	A536
ASP	ASP	THR	Q264	L356	I418	S477	I537
ALA	ALA	PRO	C265	P357	A419	P478	H538
ALA	ALA	PRO	E267	A358	P420	R479	E539
ARG	ARG	PRO	Y269	P359	E421	G480	V540
VAL	VAL	PRO	F270	P359	I422	V481	M541
VAL	VAL	SER	Q271	P360	Y423	Y482	E542
VAL	VAL	SER	E272	T361	G424	T483	Q543
GLY	GLY	SER	V273	G362	M425	T484	Q544
PHE	PHE	MET	V274	F363	L426	G485	T545
ALA	ALA	ASN	N274	K364	D427	K486	I546
GLN	GLN	ASN	S275	A365	V428	G487	V547
GLU	GLU	ASP	F278	L366	K429	S488	I548
GLU	GLU	ASP	T279	K367	K430	S489	S549
LEU	LEU	ALA	P280	A368	A431	K500	K550
LEU	LEU	LEU	L127	E283	L432	G490	K551
LEU	LEU	LEU	P128	C284	L433	V491	A551
GLU	GLU	GLU	T129	T285	L434	G492	G552
GLU	GLU	GLU	K130	E132	L435	L493	I553
GLU	GLU	GLU	E131	I132	L436	T494	N554
GLU	GLU	GLU	I132	D133	L437	A495	T555
G60	K59	G60	D133	P193	V437	A496	T556
					G438	A497	L557
					F380	M498	N558
						G439	A559
						V440	R560

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	53117	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 ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.076	Depositor
Minimum map value	-0.035	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.005	Depositor
Recommended contour level	0.0234	Depositor
Map size (Å)	429.6, 429.6, 429.6	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.074, 1.074, 1.074	Depositor

5 Model quality i

5.1 Standard geometry i

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

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	X	0.41	0/3501	0.60	3/4741 (0.1%)
1	Y	0.40	0/3550	0.61	3/4806 (0.1%)
1	Z	0.41	0/3500	0.62	3/4738 (0.1%)
2	A	0.42	0/1718	0.66	2/2314 (0.1%)
2	a	0.42	0/1718	0.66	2/2314 (0.1%)
2	n	0.43	0/1718	0.66	2/2314 (0.1%)
3	B	0.46	1/1545 (0.1%)	0.65	0/2092
3	b	0.46	1/1545 (0.1%)	0.65	0/2092
3	o	0.46	1/1545 (0.1%)	0.65	0/2092
4	C	0.47	0/1320	0.63	1/1784 (0.1%)
4	c	0.47	0/1320	0.63	0/1784
4	p	0.47	0/1320	0.63	1/1784 (0.1%)
5	D	0.43	0/1956	0.58	0/2638
5	d	0.43	0/1956	0.58	0/2638
5	q	0.43	0/1956	0.58	0/2638
6	E	0.46	1/4563 (0.0%)	0.67	5/6173 (0.1%)
6	e	0.46	1/4563 (0.0%)	0.67	5/6173 (0.1%)
6	r	0.46	1/4563 (0.0%)	0.67	5/6173 (0.1%)
7	2	0.45	0/5051	0.64	1/6821 (0.0%)
7	F	0.45	0/5051	0.64	1/6821 (0.0%)
7	h	0.45	0/5051	0.64	1/6821 (0.0%)
8	3	0.44	0/4739	0.78	3/6425 (0.0%)
8	G	0.44	0/4739	0.78	3/6425 (0.0%)
8	i	0.44	0/4739	0.78	3/6425 (0.0%)
9	4	0.37	0/5479	0.61	2/7392 (0.0%)
9	H	0.38	1/5479 (0.0%)	0.65	5/7392 (0.1%)
9	j	0.37	0/5479	0.61	2/7392 (0.0%)
10	5	0.47	0/4750	0.69	4/6412 (0.1%)
10	I	0.47	0/4750	0.69	4/6412 (0.1%)
10	k	0.47	0/4750	0.69	4/6412 (0.1%)
11	6	0.43	0/4789	0.65	3/6466 (0.0%)
11	J	0.43	0/4789	0.65	3/6466 (0.0%)

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
11	l	0.43	0/4789	0.65	3/6466 (0.0%)
12	7	0.37	0/5299	0.61	3/7160 (0.0%)
12	K	0.37	0/5299	0.61	3/7160 (0.0%)
12	m	0.37	0/5299	0.61	3/7160 (0.0%)
All	All	0.43	7/134178 (0.0%)	0.66	83/181316 (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
1	X	0	1
1	Y	0	1
1	Z	0	1
8	3	0	1
8	G	0	1
8	i	0	1
All	All	0	6

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	E	478	TRP	CB-CG	-6.10	1.39	1.50
6	e	478	TRP	CB-CG	-6.08	1.39	1.50
6	r	478	TRP	CB-CG	-6.07	1.39	1.50
3	o	11	PHE	C-N	-5.28	1.22	1.34
3	B	11	PHE	C-N	-5.27	1.22	1.34

The worst 5 of 83 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	3	17	PRO	CA-C-O	-29.20	50.11	120.20
8	i	17	PRO	CA-C-O	-29.18	50.16	120.20
8	G	17	PRO	CA-C-O	-29.18	50.17	120.20
8	G	17	PRO	CA-C-N	15.27	150.79	117.20
8	3	17	PRO	CA-C-N	15.26	150.76	117.20

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
8	3	17	PRO	Mainchain
1	X	766	PHE	Peptide
1	Y	766	PHE	Peptide
1	Z	766	PHE	Peptide
8	i	17	PRO	Mainchain

5.2 Too-close contacts [i](#)

Due to software issues we are unable to calculate clashes - this section is therefore empty.

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	X	419/927 (45%)	408 (97%)	10 (2%)	1 (0%)	47	81
1	Y	427/927 (46%)	414 (97%)	12 (3%)	1 (0%)	47	81
1	Z	417/927 (45%)	407 (98%)	9 (2%)	1 (0%)	47	81
2	A	206/208 (99%)	179 (87%)	26 (13%)	1 (0%)	29	69
2	a	206/208 (99%)	180 (87%)	25 (12%)	1 (0%)	29	69
2	n	206/208 (99%)	180 (87%)	25 (12%)	1 (0%)	29	69
3	B	177/213 (83%)	150 (85%)	27 (15%)	0	100	100
3	b	177/213 (83%)	150 (85%)	27 (15%)	0	100	100
3	o	177/213 (83%)	150 (85%)	27 (15%)	0	100	100
4	C	151/194 (78%)	140 (93%)	11 (7%)	0	100	100
4	c	151/194 (78%)	139 (92%)	12 (8%)	0	100	100
4	p	151/194 (78%)	139 (92%)	12 (8%)	0	100	100
5	D	226/294 (77%)	202 (89%)	24 (11%)	0	100	100
5	d	226/294 (77%)	202 (89%)	24 (11%)	0	100	100
5	q	226/294 (77%)	202 (89%)	24 (11%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
6	E	543/650 (84%)	476 (88%)	64 (12%)	3 (1%)	25	66
6	e	543/650 (84%)	476 (88%)	64 (12%)	3 (1%)	25	66
6	r	543/650 (84%)	476 (88%)	64 (12%)	3 (1%)	25	66
7	2	630/868 (73%)	538 (85%)	92 (15%)	0	100	100
7	F	630/868 (73%)	538 (85%)	92 (15%)	0	100	100
7	h	630/868 (73%)	537 (85%)	93 (15%)	0	100	100
8	3	584/971 (60%)	506 (87%)	77 (13%)	1 (0%)	47	81
8	G	584/971 (60%)	506 (87%)	76 (13%)	2 (0%)	41	77
8	i	584/971 (60%)	505 (86%)	77 (13%)	2 (0%)	41	77
9	4	668/933 (72%)	579 (87%)	88 (13%)	1 (0%)	51	86
9	H	668/933 (72%)	578 (86%)	88 (13%)	2 (0%)	41	77
9	j	668/933 (72%)	579 (87%)	88 (13%)	1 (0%)	51	86
10	5	583/775 (75%)	493 (85%)	89 (15%)	1 (0%)	47	81
10	I	583/775 (75%)	493 (85%)	89 (15%)	1 (0%)	47	81
10	k	583/775 (75%)	493 (85%)	89 (15%)	1 (0%)	47	81
11	6	606/1017 (60%)	506 (84%)	99 (16%)	1 (0%)	47	81
11	J	606/1017 (60%)	506 (84%)	99 (16%)	1 (0%)	47	81
11	l	606/1017 (60%)	507 (84%)	98 (16%)	1 (0%)	47	81
12	7	653/845 (77%)	556 (85%)	97 (15%)	0	100	100
12	K	653/845 (77%)	555 (85%)	98 (15%)	0	100	100
12	m	653/845 (77%)	555 (85%)	98 (15%)	0	100	100
All	All	16344/23685 (69%)	14200 (87%)	2114 (13%)	30 (0%)	50	81

5 of 30 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
9	j	469	VAL
9	H	469	VAL
6	e	334	LEU
6	E	334	LEU
6	r	334	LEU

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	X	377/825 (46%)	377 (100%)	0	100	100
1	Y	383/825 (46%)	383 (100%)	0	100	100
1	Z	377/825 (46%)	377 (100%)	0	100	100
2	A	193/193 (100%)	193 (100%)	0	100	100
2	a	193/193 (100%)	193 (100%)	0	100	100
2	n	193/193 (100%)	193 (100%)	0	100	100
3	B	171/198 (86%)	170 (99%)	1 (1%)	86	92
3	b	171/198 (86%)	170 (99%)	1 (1%)	86	92
3	o	171/198 (86%)	170 (99%)	1 (1%)	86	92
4	C	144/173 (83%)	142 (99%)	2 (1%)	67	80
4	c	144/173 (83%)	142 (99%)	2 (1%)	67	80
4	p	144/173 (83%)	142 (99%)	2 (1%)	67	80
5	D	225/279 (81%)	225 (100%)	0	100	100
5	d	225/279 (81%)	225 (100%)	0	100	100
5	q	225/279 (81%)	225 (100%)	0	100	100
6	E	499/586 (85%)	496 (99%)	3 (1%)	86	92
6	e	499/586 (85%)	496 (99%)	3 (1%)	86	92
6	r	499/586 (85%)	496 (99%)	3 (1%)	86	92
7	2	535/770 (70%)	529 (99%)	6 (1%)	73	84
7	F	535/770 (70%)	529 (99%)	6 (1%)	73	84
7	h	535/770 (70%)	529 (99%)	6 (1%)	73	84
8	3	515/835 (62%)	512 (99%)	3 (1%)	86	92
8	G	515/835 (62%)	512 (99%)	3 (1%)	86	92
8	i	515/835 (62%)	512 (99%)	3 (1%)	86	92
9	4	610/848 (72%)	605 (99%)	5 (1%)	81	89
9	H	610/848 (72%)	604 (99%)	6 (1%)	76	86

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
9	j	610/848 (72%)	605 (99%)	5 (1%)	81	89
10	5	534/688 (78%)	527 (99%)	7 (1%)	69	81
10	I	534/688 (78%)	527 (99%)	7 (1%)	69	81
10	k	534/688 (78%)	527 (99%)	7 (1%)	69	81
11	6	493/886 (56%)	487 (99%)	6 (1%)	71	83
11	J	493/886 (56%)	487 (99%)	6 (1%)	71	83
11	l	493/886 (56%)	487 (99%)	6 (1%)	71	83
12	7	585/753 (78%)	581 (99%)	4 (1%)	84	90
12	K	585/753 (78%)	581 (99%)	4 (1%)	84	90
12	m	585/753 (78%)	581 (99%)	4 (1%)	84	90
All	All	14649/21102 (69%)	14537 (99%)	112 (1%)	82	89

5 of 112 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
10	5	66	GLU
12	K	479	ARG
12	7	329	ARG
12	K	329	ARG
10	I	486	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 241 such sidechains are listed below:

Mol	Chain	Res	Type
7	2	238	ASN
10	I	561	ASN
10	5	254	GLN
10	I	254	GLN
12	K	326	HIS

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

6 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
13	ATP	i	1001	-	26,33,33	0.92	1 (3%)	31,52,52	1.90	6 (19%)
13	ATP	2	901	-	26,33,33	0.92	1 (3%)	31,52,52	1.64	5 (16%)
13	ATP	5	801	-	26,33,33	0.86	0	31,52,52	1.93	7 (22%)
13	ATP	3	1001	-	26,33,33	0.92	1 (3%)	31,52,52	1.91	6 (19%)
13	ATP	h	901	-	26,33,33	0.92	1 (3%)	31,52,52	1.64	5 (16%)
13	ATP	k	801	-	26,33,33	0.86	0	31,52,52	1.93	7 (22%)

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
13	ATP	i	1001	-	-	4/18/38/38	0/3/3/3
13	ATP	2	901	-	-	6/18/38/38	0/3/3/3
13	ATP	5	801	-	-	4/18/38/38	0/3/3/3
13	ATP	3	1001	-	-	4/18/38/38	0/3/3/3
13	ATP	h	901	-	-	6/18/38/38	0/3/3/3
13	ATP	k	801	-	-	4/18/38/38	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	h	901	ATP	C5-C4	2.17	1.46	1.40
13	2	901	ATP	C5-C4	2.15	1.46	1.40
13	i	1001	ATP	C5-C4	2.12	1.46	1.40
13	3	1001	ATP	C5-C4	2.11	1.46	1.40

The worst 5 of 36 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
13	3	1001	ATP	PA-O3A-PB	-6.31	111.16	132.83
13	i	1001	ATP	PA-O3A-PB	-6.31	111.18	132.83
13	k	801	ATP	PA-O3A-PB	-5.28	114.69	132.83
13	5	801	ATP	PA-O3A-PB	-5.26	114.77	132.83
13	k	801	ATP	PB-O3B-PG	-5.03	115.56	132.83

There are no chirality outliers.

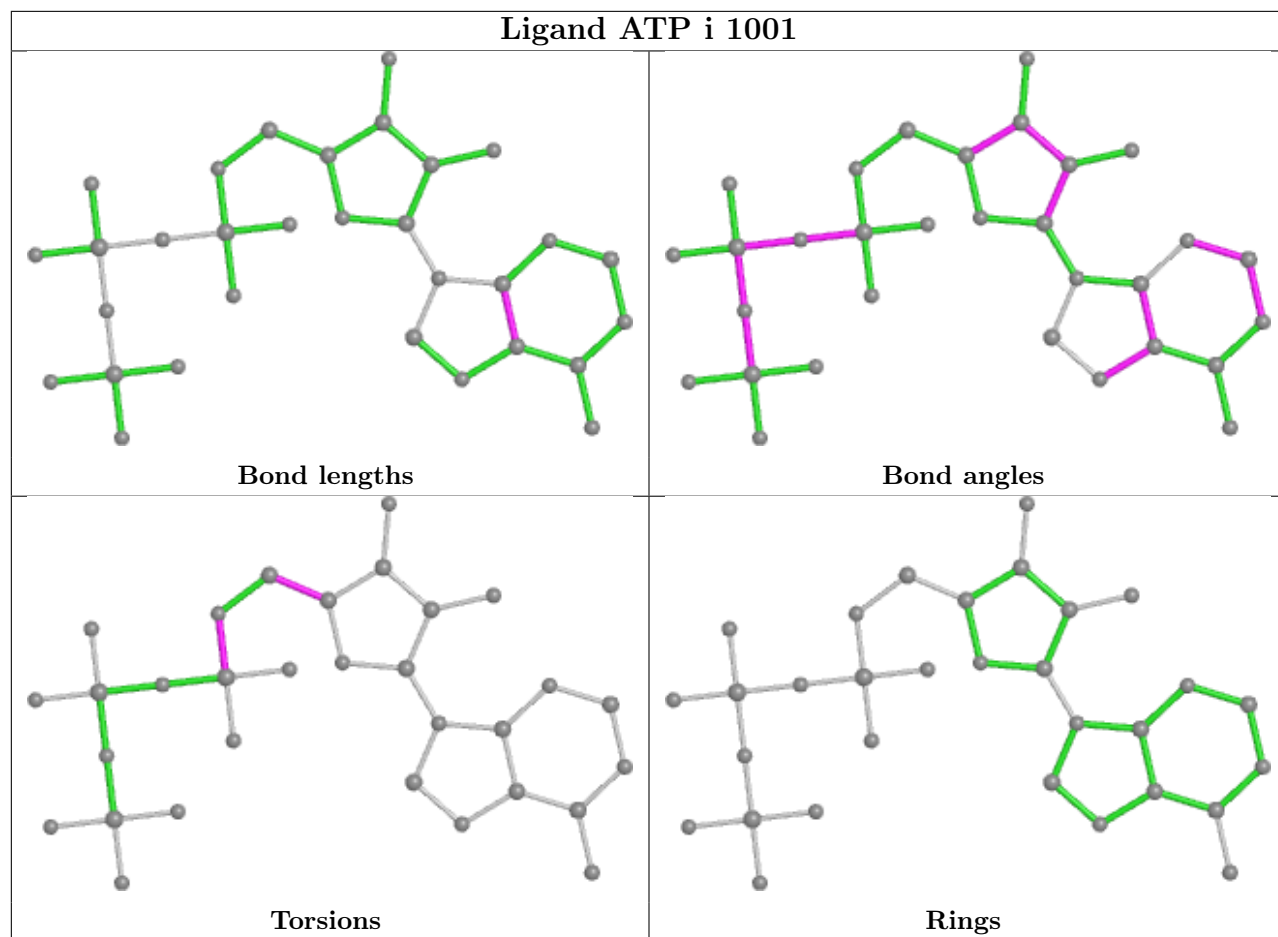
5 of 28 torsion outliers are listed below:

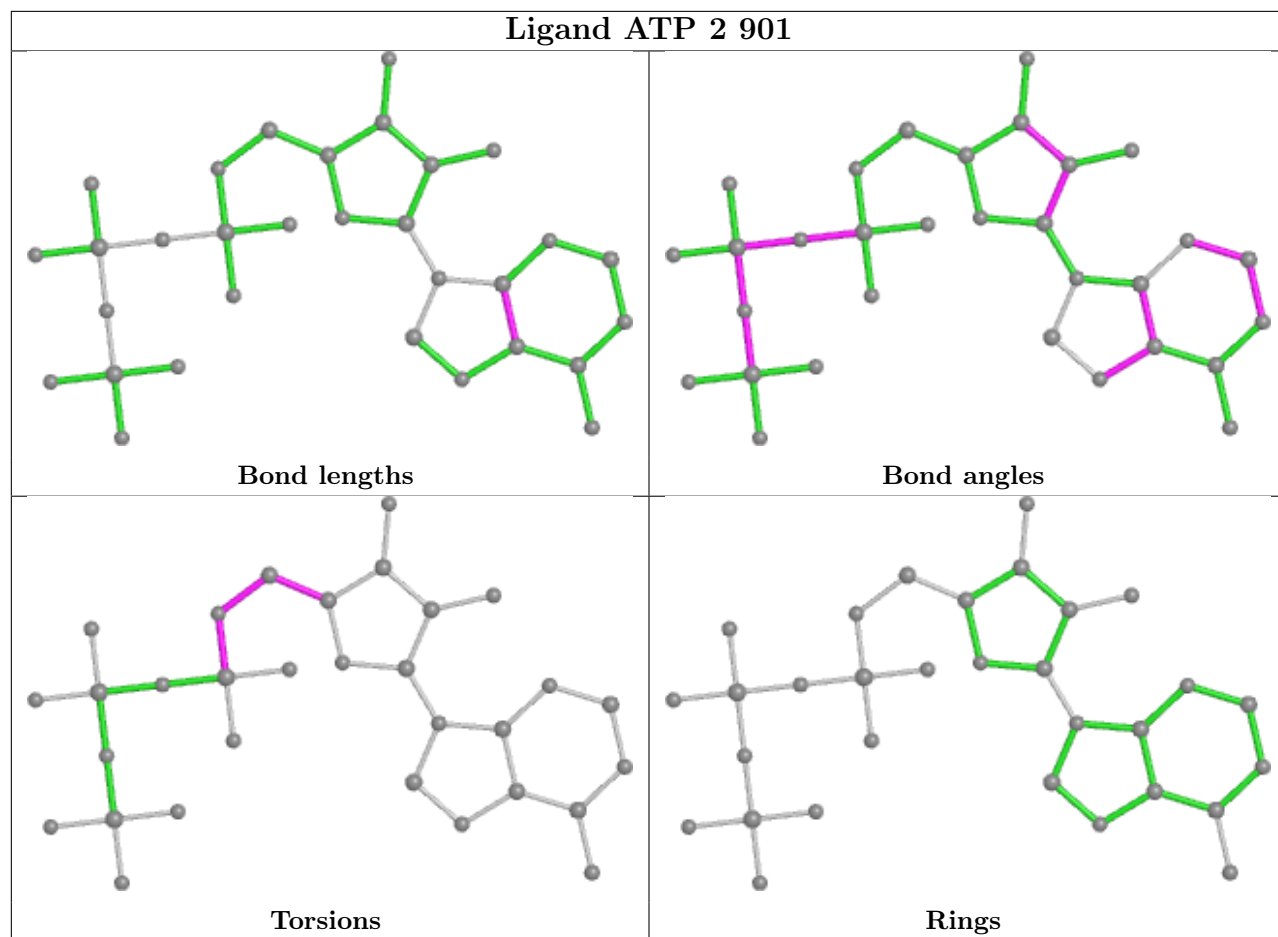
Mol	Chain	Res	Type	Atoms
13	h	901	ATP	C5'-O5'-PA-O1A
13	h	901	ATP	C5'-O5'-PA-O2A
13	i	1001	ATP	C5'-O5'-PA-O2A
13	i	1001	ATP	C5'-O5'-PA-O3A
13	2	901	ATP	C5'-O5'-PA-O1A

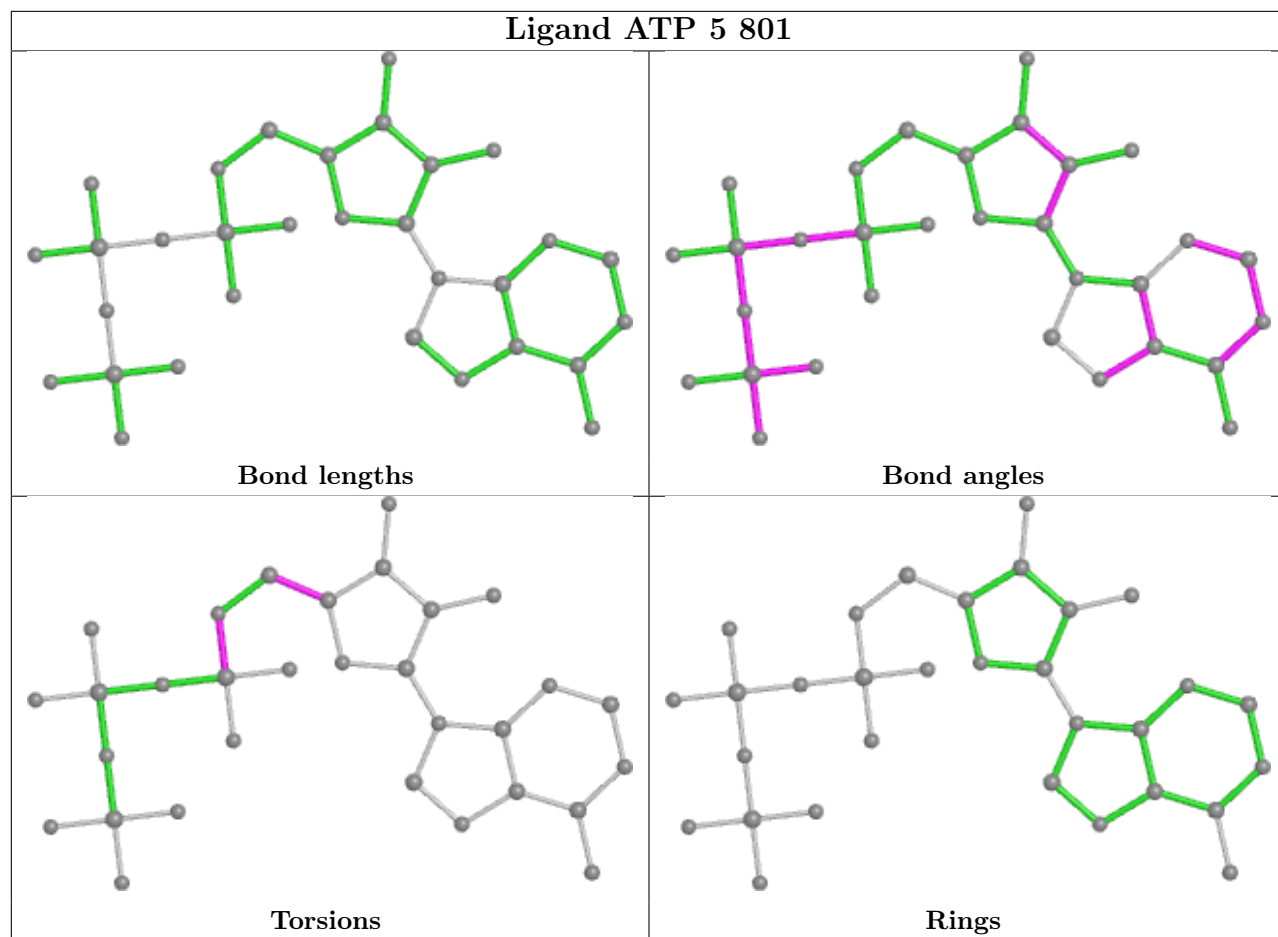
There are no ring outliers.

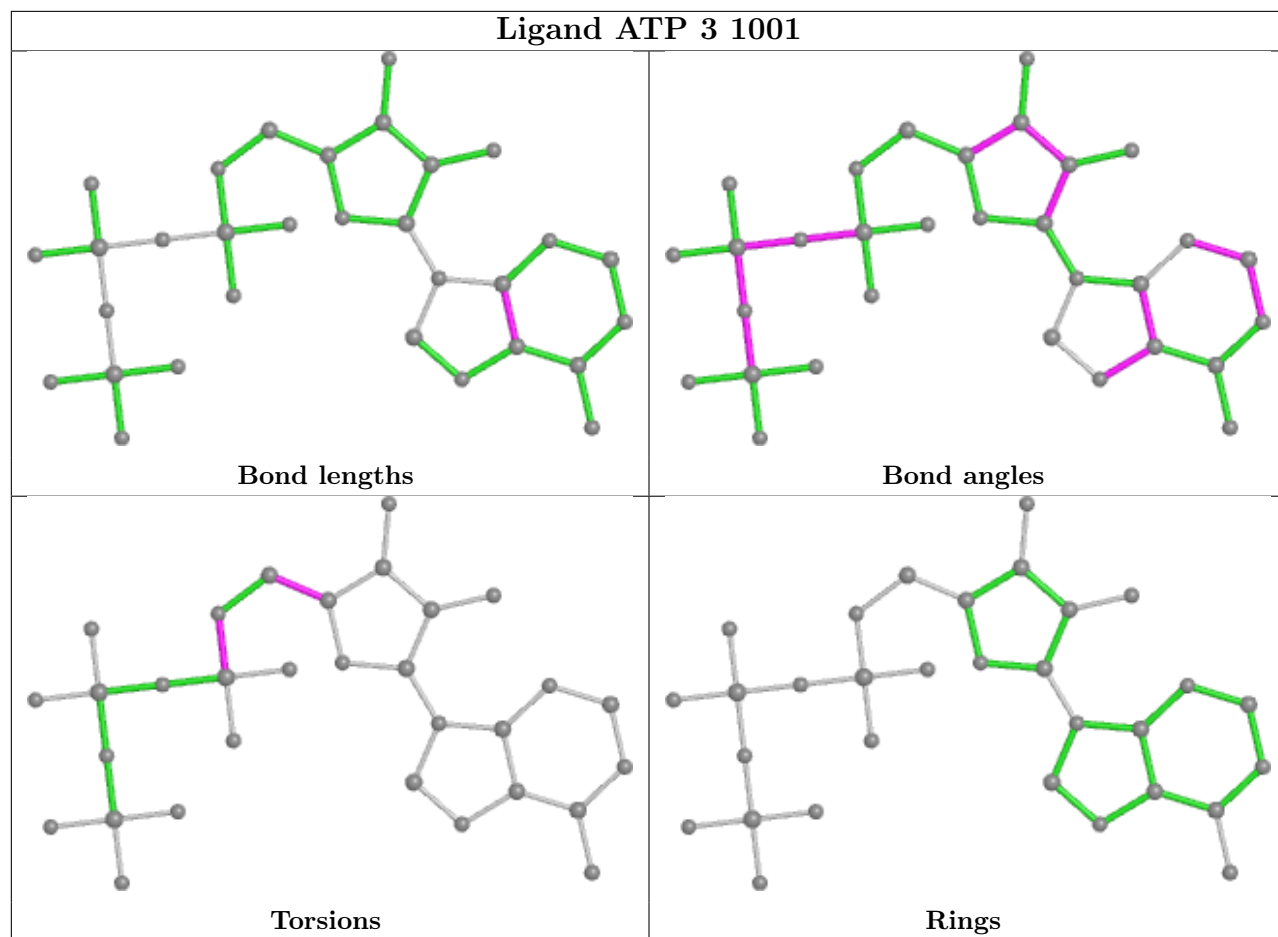
No monomer is involved in short contacts.

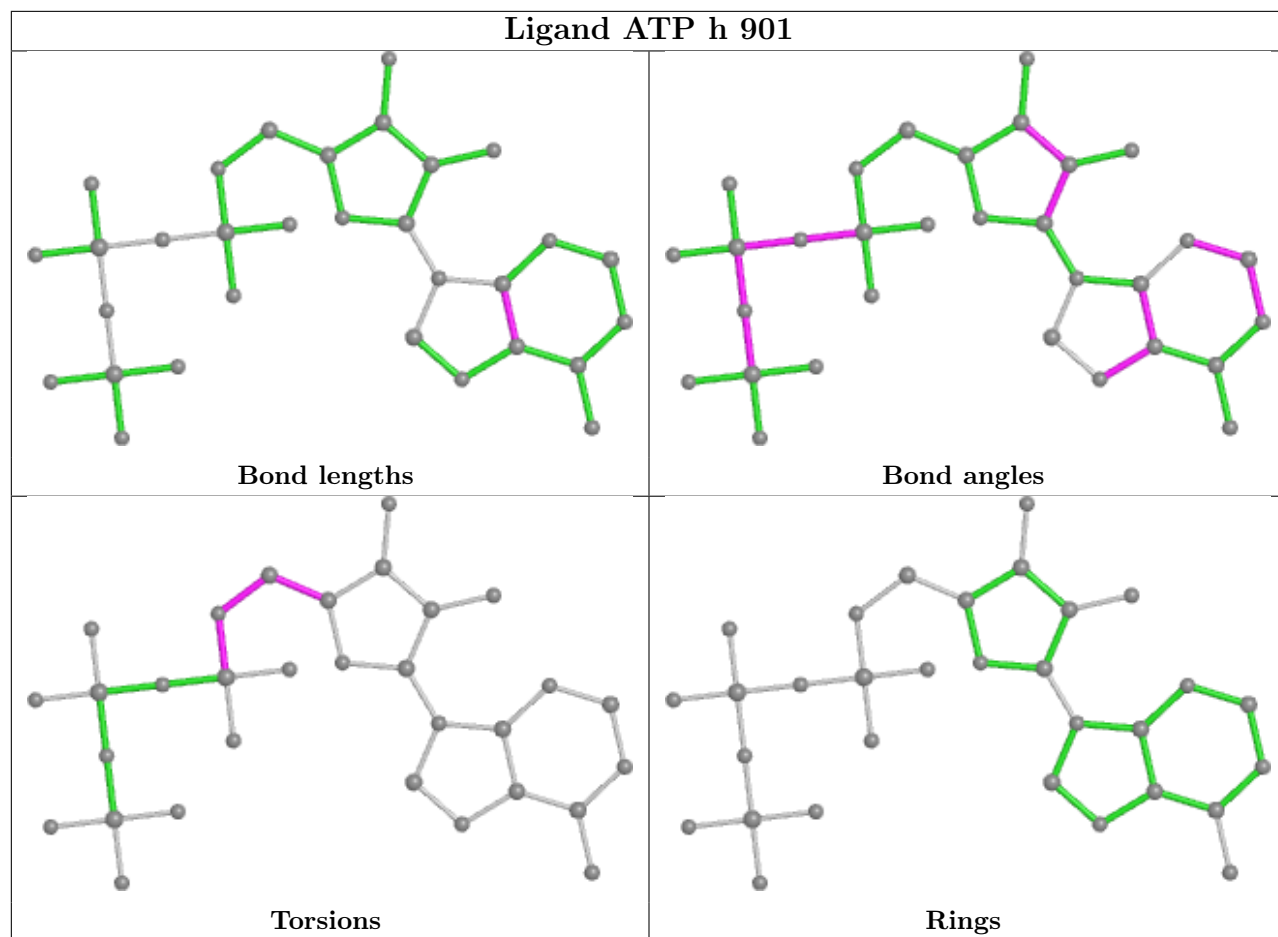
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

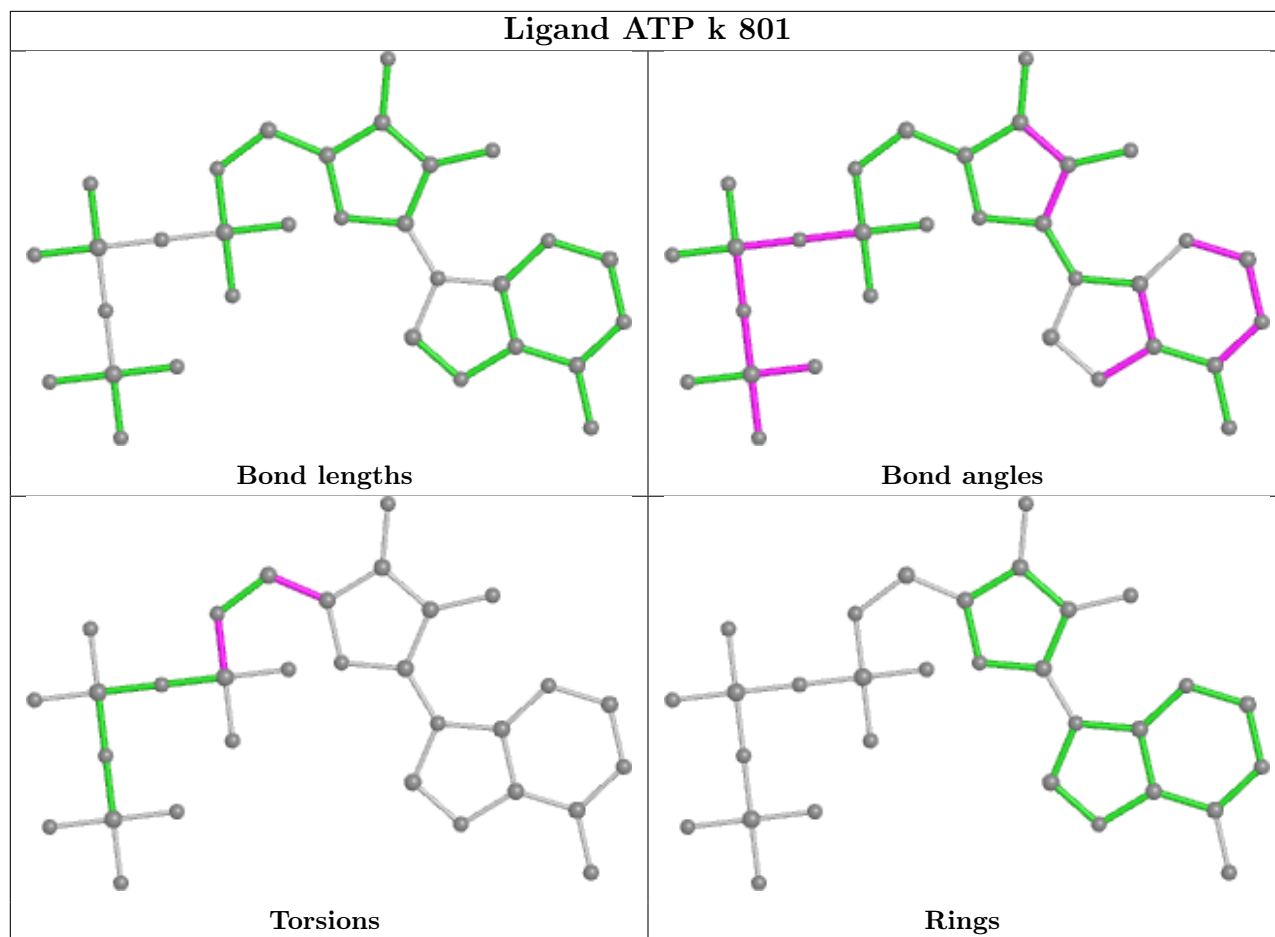












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	Z	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	Z	776:ILE	C	777:ARG	N	2.04

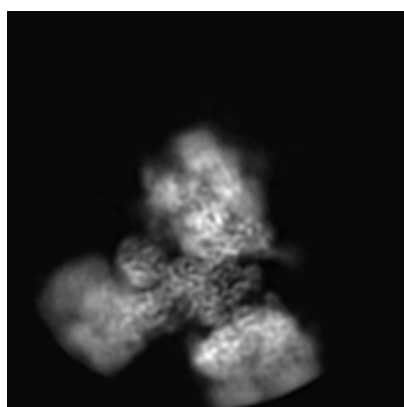
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-20473. These allow visual inspection of the internal detail of the map and identification of artifacts.

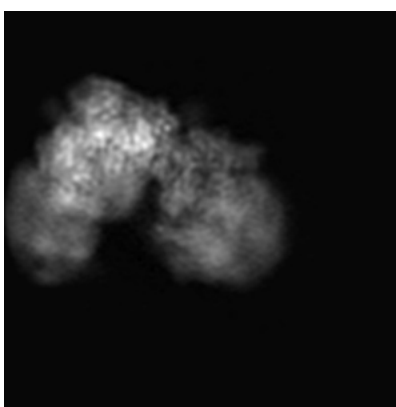
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

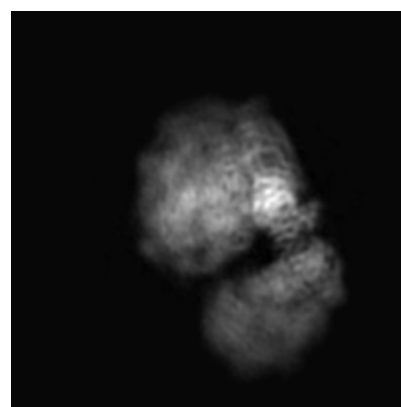
6.1.1 Primary map



X



Y

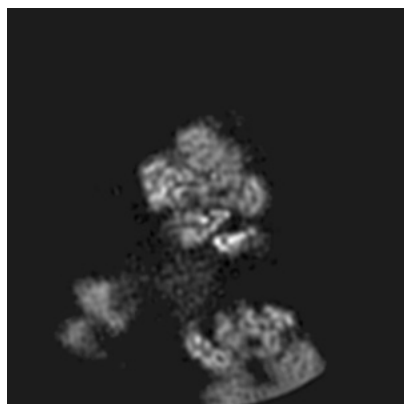


Z

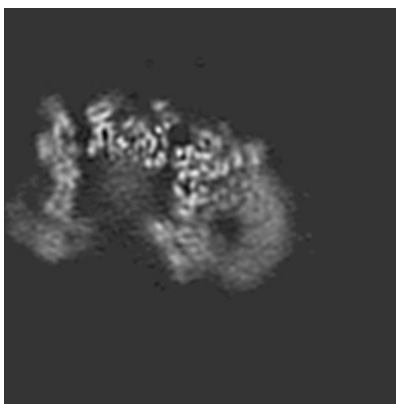
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

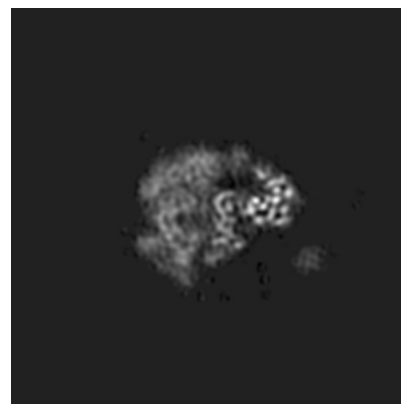
6.2.1 Primary map



X Index: 200



Y Index: 200

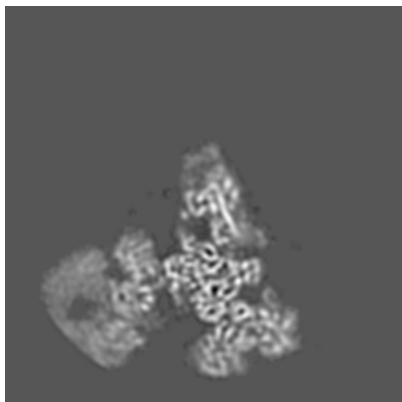


Z Index: 200

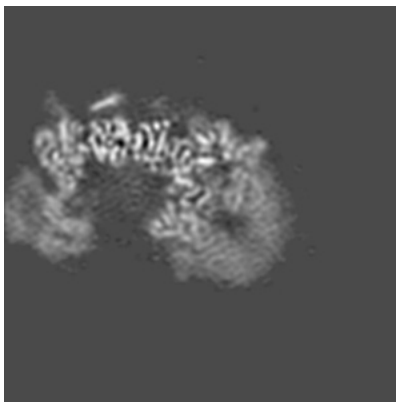
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

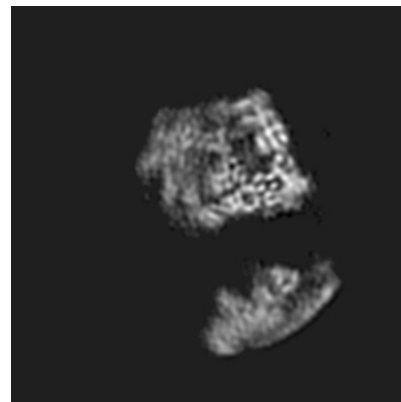
6.3.1 Primary map



X Index: 265



Y Index: 207



Z Index: 66

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

6.4 Orthogonal surface views [i](#)

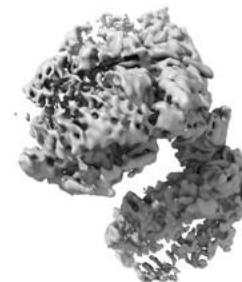
6.4.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.0234. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

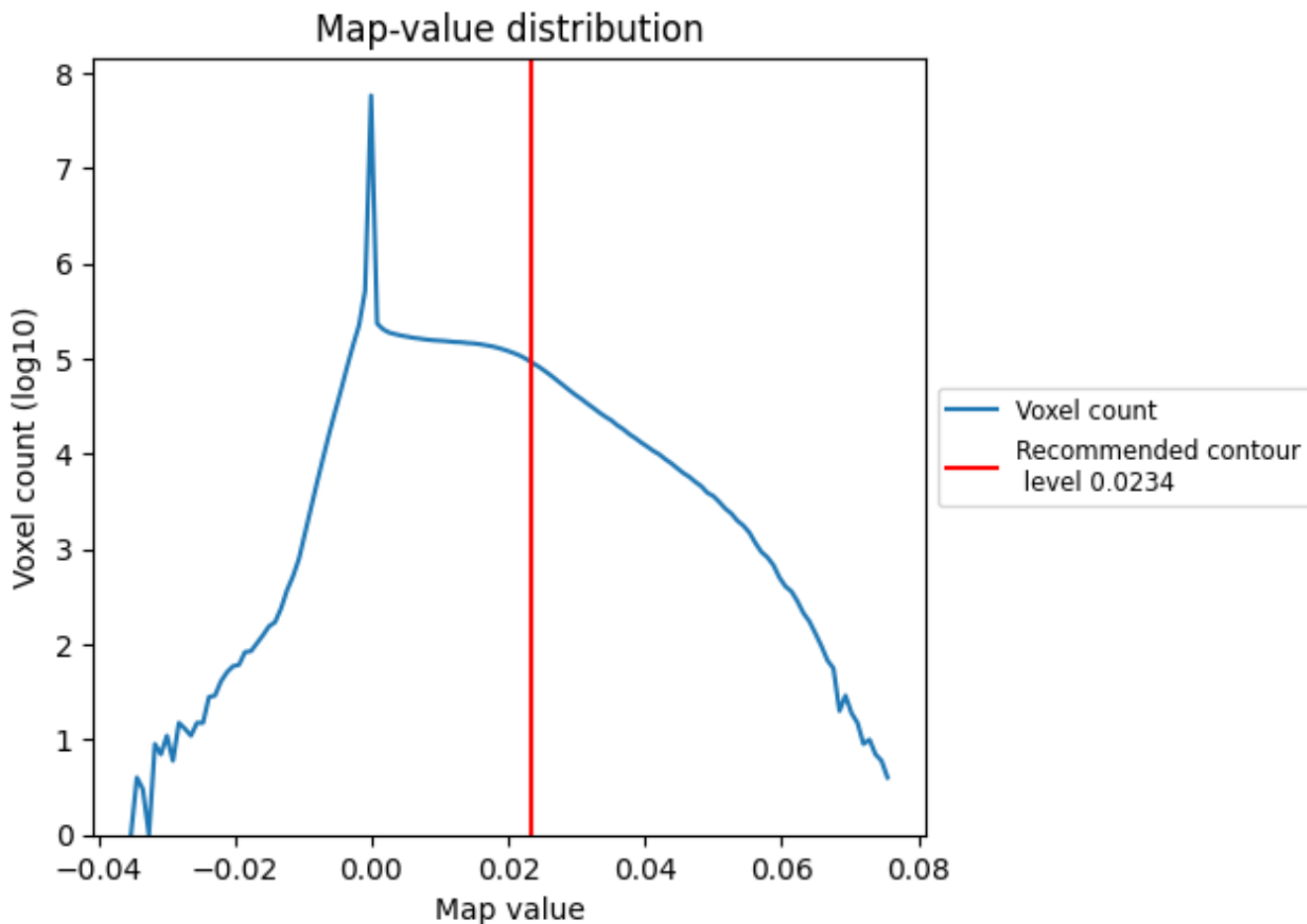
6.5 Mask visualisation

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

7 Map analysis [i](#)

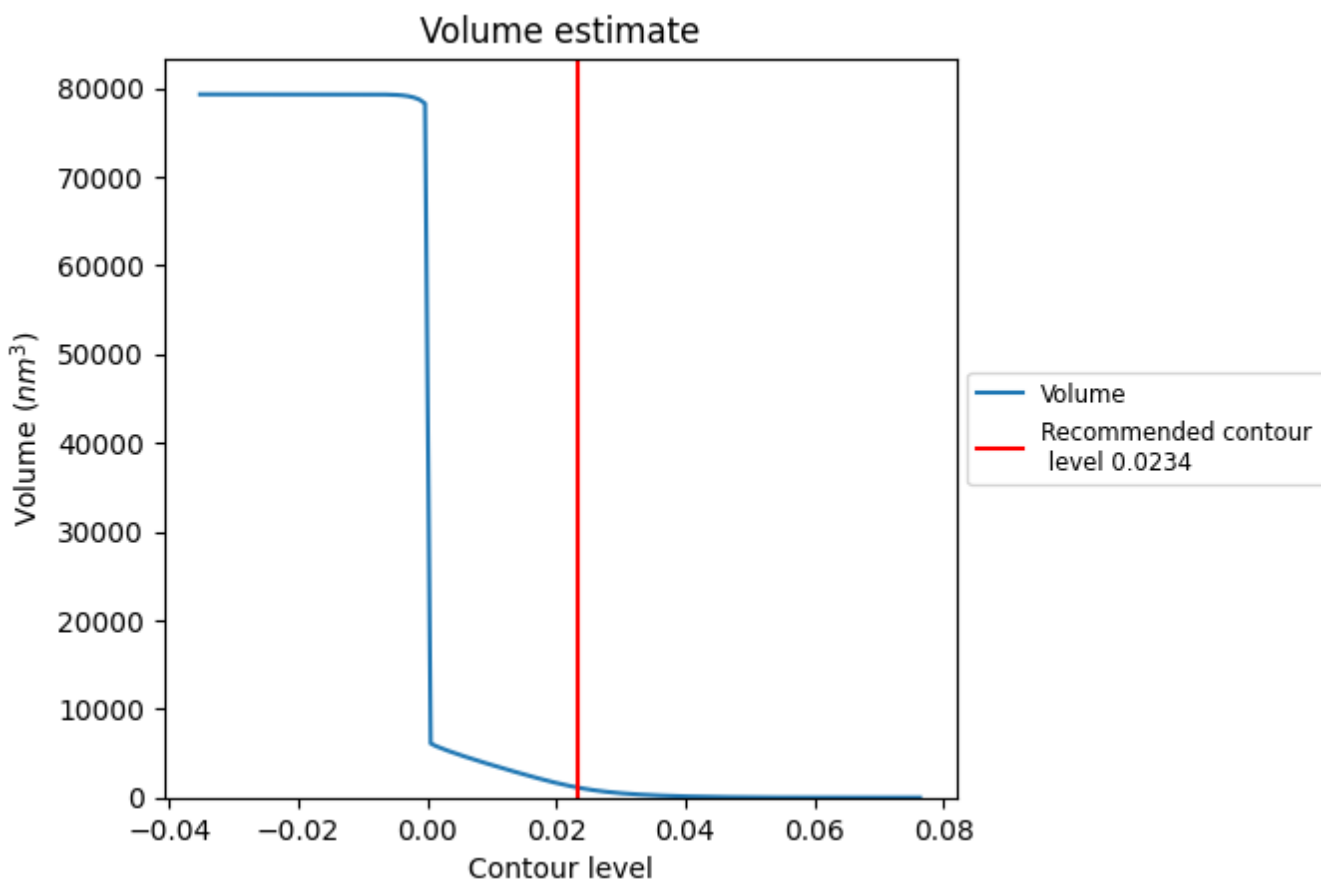
This section contains the results of statistical analysis of the map.

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.

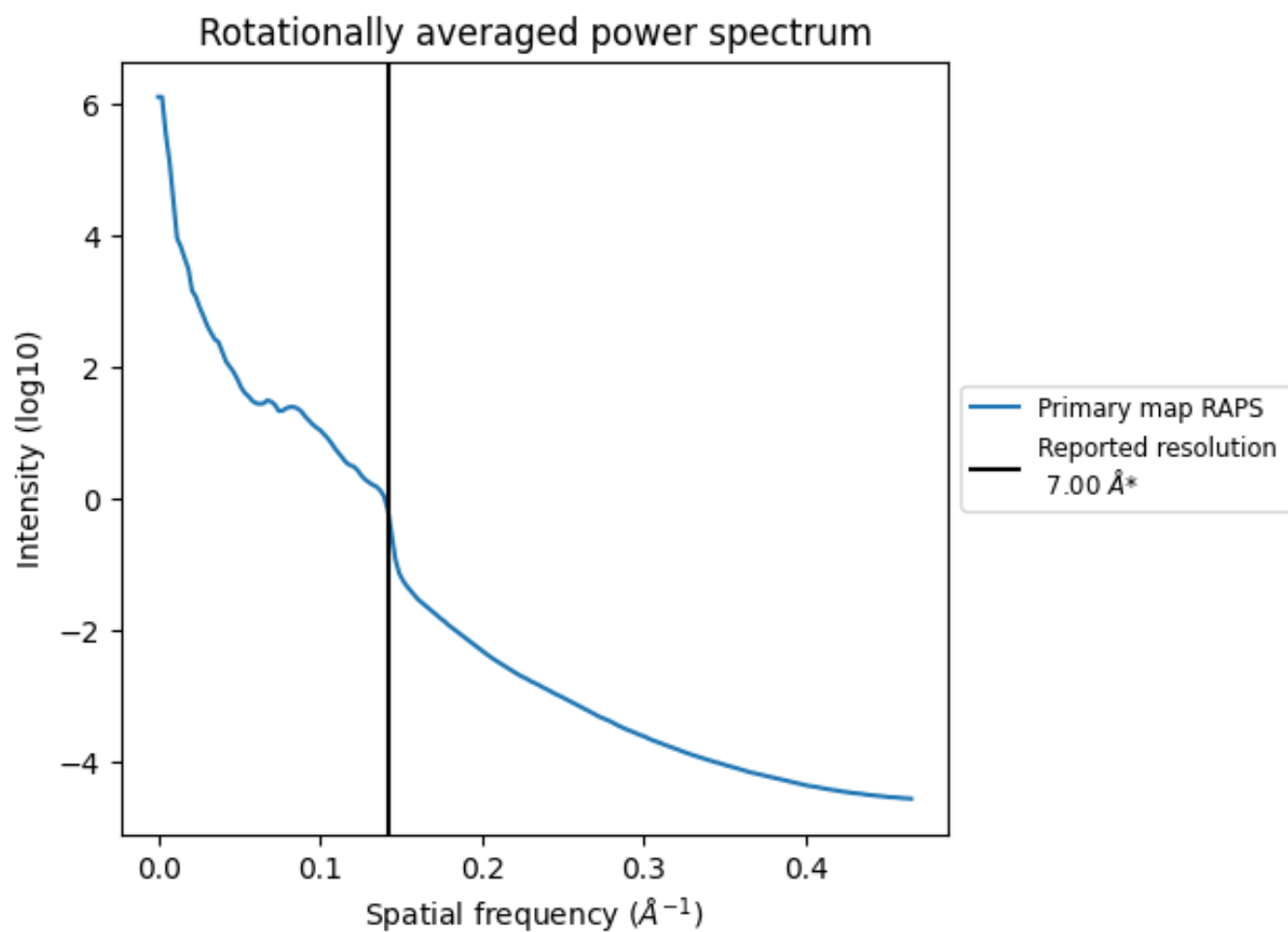
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 1122 nm^3 ; this corresponds to an approximate mass of 1014 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 [i](#)



*Reported resolution corresponds to spatial frequency of 0.143\AA^{-1}

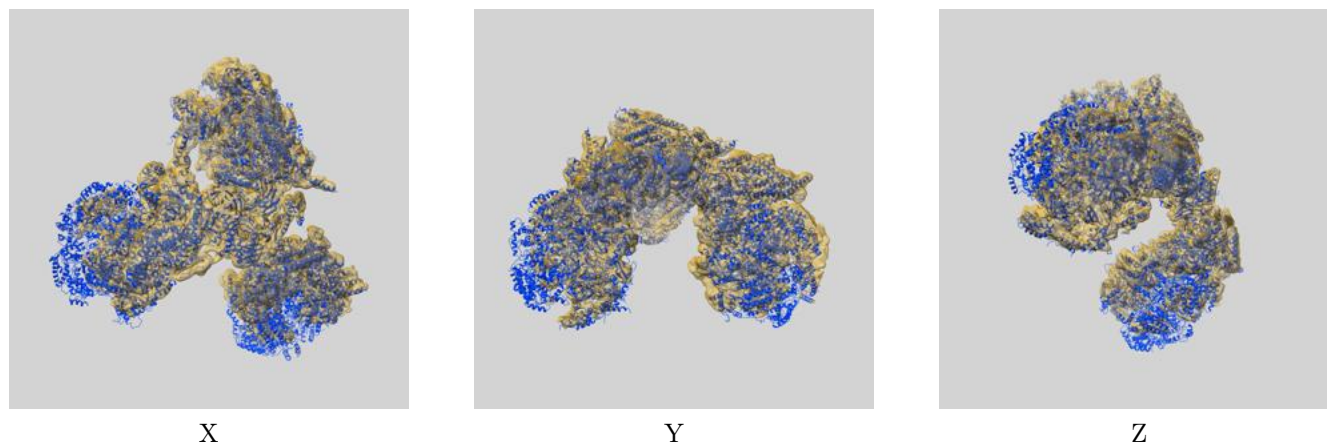
8 Fourier-Shell correlation

This section was not generated. No FSC curve or half-maps provided.

9 Map-model fit [i](#)

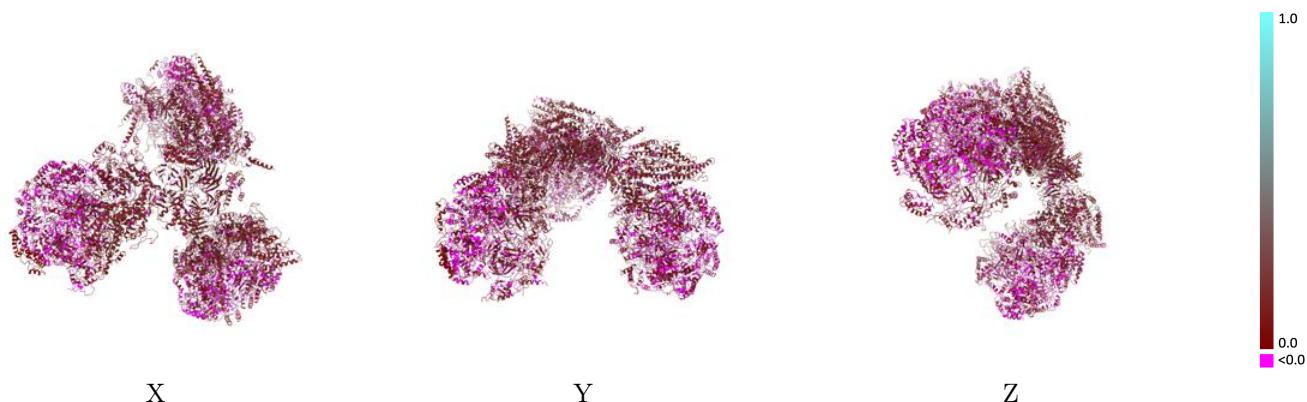
This section contains information regarding the fit between EMDB map EMD-20473 and PDB model 6PTO. Per-residue inclusion information can be found in section 3 on page 9.

9.1 Map-model overlay [i](#)



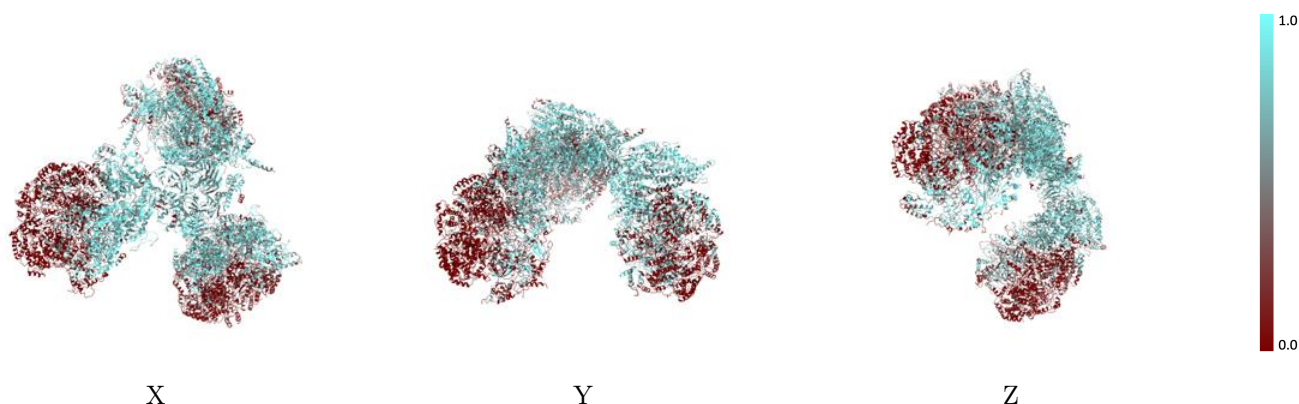
The images above show the 3D surface view of the map at the recommended contour level 0.0234 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



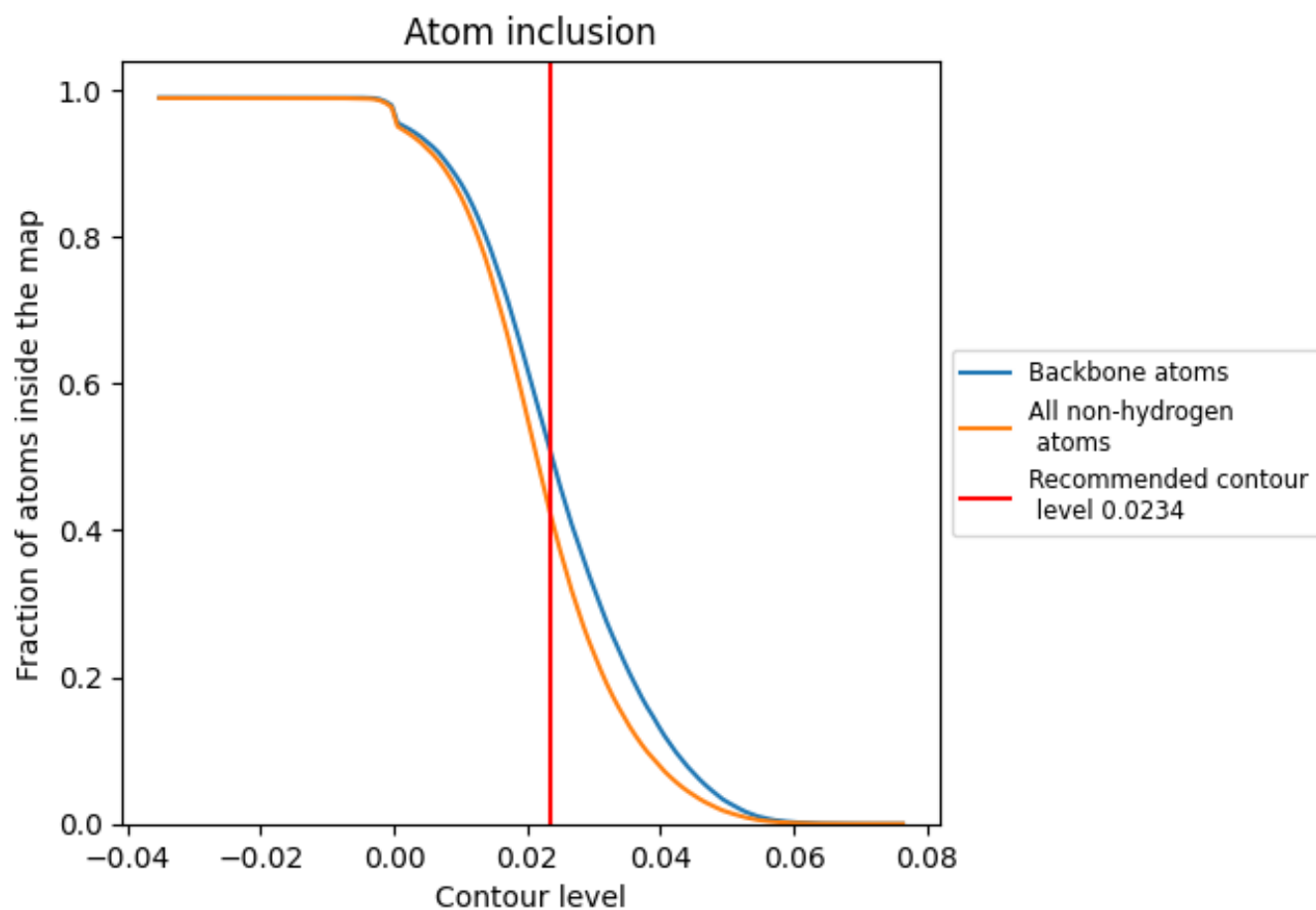
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.0234).







































































9.4 Atom inclusion [i](#)



At the recommended contour level, 51% of all backbone atoms, 43% 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 (0.0234) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.4255	 0.0870
2	 0.2186	 0.0410
3	 0.2967	 0.0790
4	 0.1307	 0.0410
5	 0.3338	 0.0720
6	 0.1702	 0.0510
7	 0.1564	 0.0520
A	 0.6578	 0.1510
B	 0.7133	 0.1650
C	 0.6751	 0.1510
D	 0.7319	 0.1650
E	 0.6714	 0.1370
F	 0.2623	 0.0490
G	 0.3148	 0.0730
H	 0.1726	 0.0370
I	 0.3689	 0.0780
J	 0.2409	 0.0570
K	 0.1669	 0.0350
X	 0.7231	 0.1610
Y	 0.7177	 0.1510
Z	 0.7204	 0.1520
a	 0.6518	 0.1330
b	 0.7174	 0.1590
c	 0.6719	 0.1470
d	 0.7663	 0.1680
e	 0.7239	 0.1340
h	 0.3569	 0.0330
i	 0.5375	 0.0840
j	 0.2779	 0.0500
k	 0.4547	 0.0760
l	 0.3826	 0.0590
m	 0.3765	 0.0560
n	 0.7414	 0.1570
o	 0.7402	 0.1680
p	 0.7608	 0.1550



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Chain	Atom inclusion	Q-score
q	 0.7805	 0.1700
r	 0.6997	 0.1360