



wwPDB EM Validation Summary Report ⓘ

Apr 6, 2026 – 01:57 AM UTC

PDB ID : 8YD0 / pdb_00008yd0
EMDB ID : EMD-39161
Title : CryoEM structure of M. tuberculosis ClpXP1P2 complex bound to bortezomib
Authors : Zhou, B.; Zhao, H.; Gao, Y.; Chen, X.; Zhang, T.; He, J.; Xiong, X.
Deposited on : 2024-02-18
Resolution : 2.24 Å(reported)

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

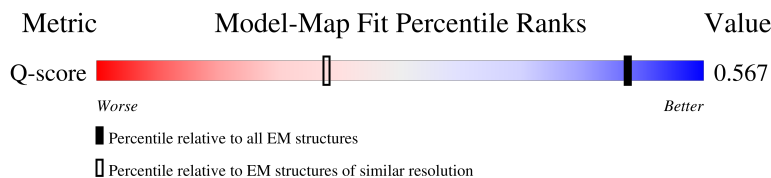
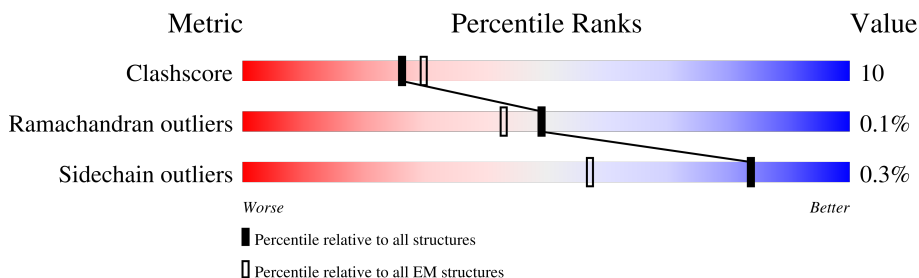
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

1 Overall quality at a glance

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 2.24 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.



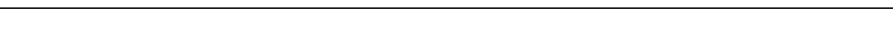
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	3381 (1.75 - 2.74)

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	355	7% 83% 14% .
1	B	355	7% 80% 18% .
1	C	355	6% 82% 13% .
1	D	355	5% 78% 17% 5%

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Mol	Chain	Length	Quality of chain
1	E	355	
1	F	355	
2	H	196	
2	I	196	
2	K	196	
2	L	196	
2	M	196	
2	N	196	
2	V	196	
3	O	178	
3	P	178	
3	Q	178	
3	R	178	
3	S	178	
3	T	178	
3	U	178	

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
5	ATP	D	501	-	-	X	-
6	ADP	E	501	-	-	X	-
7	BO2	H	301	-	-	X	-
7	BO2	K	301	-	-	X	-
7	BO2	L	301	-	-	X	-
7	BO2	M	301	-	-	X	-
7	BO2	O	201	-	-	X	-
7	BO2	Q	201	-	-	X	-
7	BO2	S	201	-	-	X	-
7	BO2	T	201	-	-	X	-

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Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
7	BO2	U	201	-	-	X	-
7	BO2	V	301	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 36147 atoms, of which 12 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 ATP-dependent Clp protease ATP-binding subunit ClpX.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	341	Total	C	N	O	S	0	0
			2623	1676	437	503	7		
1	B	349	Total	C	N	O	S	0	0
			2694	1717	459	510	8		
1	C	340	Total	C	N	O	S	0	0
			2624	1675	445	496	8		
1	D	338	Total	C	N	O	S	0	0
			2611	1667	446	490	8		
1	E	341	Total	C	N	O	S	0	0
			2630	1677	448	497	8		
1	F	329	Total	C	N	O	S	0	0
			2535	1624	427	476	8		

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	187	GLN	GLU	engineered mutation	UNP P9WPB9
B	187	GLN	GLU	engineered mutation	UNP P9WPB9
C	187	GLN	GLU	engineered mutation	UNP P9WPB9
D	187	GLN	GLU	engineered mutation	UNP P9WPB9
E	187	GLN	GLU	engineered mutation	UNP P9WPB9
F	187	GLN	GLU	engineered mutation	UNP P9WPB9

- Molecule 2 is a protein called ATP-dependent Clp protease proteolytic subunit 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	H	196	Total	C	N	O	S	0	0
			1507	948	257	294	8		
2	I	196	Total	C	N	O	S	0	0
			1507	948	257	294	8		
2	K	186	Total	C	N	O	S	0	0
			1427	898	244	277	8		
2	L	192	Total	C	N	O	S	0	0
			1473	927	251	287	8		

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Mol	Chain	Residues	Atoms					AltConf	Trace
2	M	196	Total	C	N	O	S	0	0
			1507	948	257	294	8		
2	N	192	Total	C	N	O	S	0	0
			1479	931	253	287	8		
2	V	189	Total	C	N	O	S	0	0
			1454	915	249	282	8		

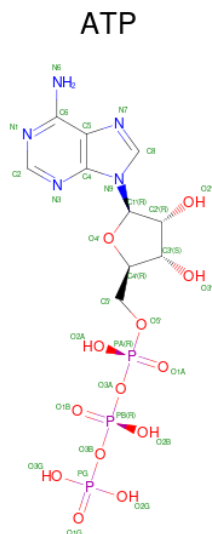
- Molecule 3 is a protein called ATP-dependent Clp protease proteolytic subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	O	178	Total	C	N	O	S	0	0
			1356	858	229	260	9		
3	P	178	Total	C	N	O	S	0	0
			1356	858	229	260	9		
3	Q	178	Total	C	N	O	S	0	0
			1356	858	229	260	9		
3	R	178	Total	C	N	O	S	0	0
			1356	858	229	260	9		
3	S	178	Total	C	N	O	S	0	0
			1356	858	229	260	9		
3	T	178	Total	C	N	O	S	0	0
			1356	858	229	260	9		
3	U	178	Total	C	N	O	S	0	0
			1356	858	229	260	9		

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

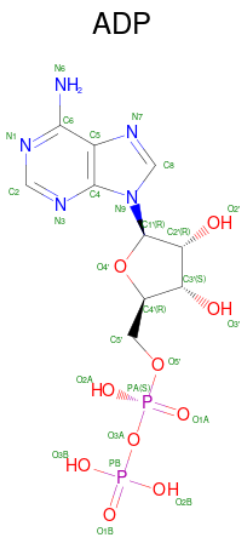
Mol	Chain	Residues	Atoms		AltConf
4	A	1	Total	Mg	0
			1	1	
4	E	1	Total	Mg	0
			1	1	

- Molecule 5 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: C₁₀H₁₆N₅O₁₃P₃) (labeled as "Ligand of Interest" by depositor).



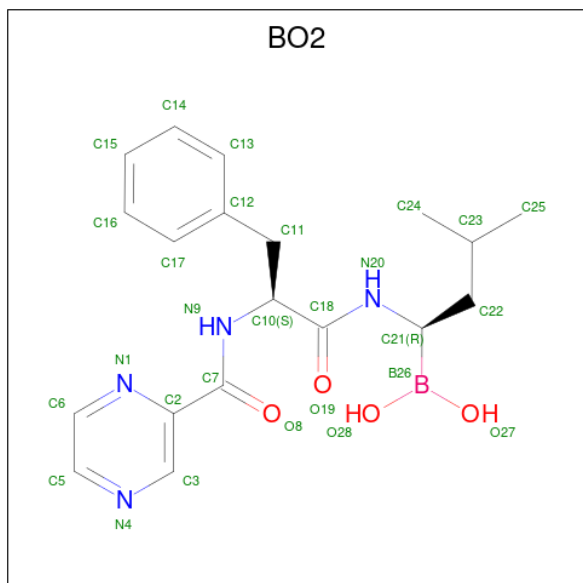
Id	Chain	Residues	Atoms					AltConf
5	A	1	Total 31	C 10	N 5	O 13	P 3	0
5	B	1	Total 31	C 10	N 5	O 13	P 3	0
5	D	1	Total 31	C 10	N 5	O 13	P 3	0
5	D	1	Total 31	C 10	N 5	O 13	P 3	0

- Molecule 6 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: $\text{C}_{10}\text{H}_{15}\text{N}_5\text{O}_{10}\text{P}_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						AltConf
6	E	1	Total	C	H	N	O	P	0
			39	10	12	5	10	2	
6	F	1	Total	C	N	O	P		0
			27	10	5	10	2		

- Molecule 7 is N-[(1R)-1-(DIHYDROXYBORYL)-3-METHYLBUTYL]-N-(PYRAZIN-2-YLCARBONYL)-L-PHENYLALANINAMIDE (CCD ID: BO2) (formula: $C_{19}H_{25}BN_4O_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
7	H	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	I	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	K	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	L	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	M	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	N	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	O	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	P	1	Total	B	C	N	O	0
			28	1	19	4	4	
7	Q	1	Total	B	C	N	O	0
			28	1	19	4	4	

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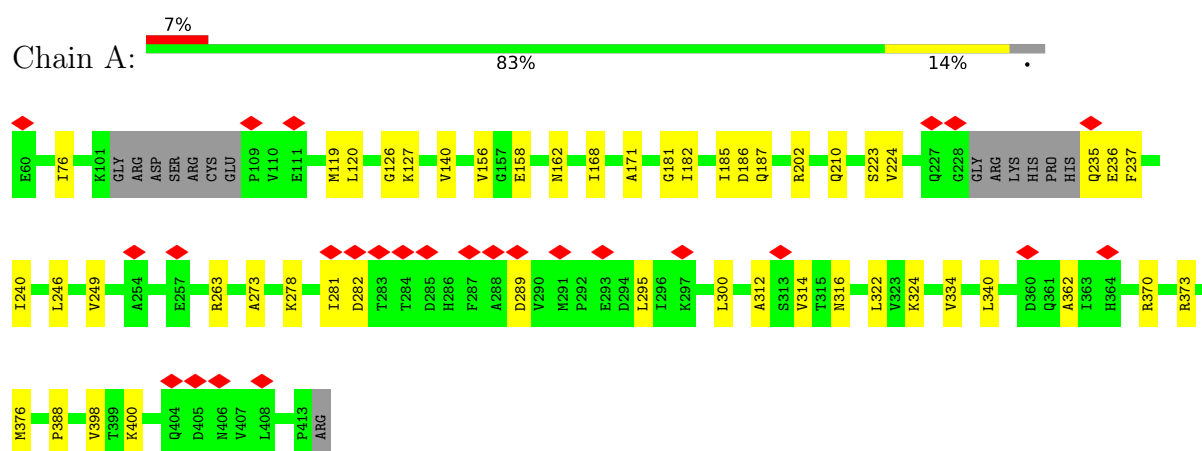
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Mol	Chain	Residues	Atoms					AltConf
7	R	1	Total 28	B 1	C 19	N 4	O 4	0
7	S	1	Total 28	B 1	C 19	N 4	O 4	0
7	T	1	Total 28	B 1	C 19	N 4	O 4	0
7	U	1	Total 28	B 1	C 19	N 4	O 4	0
7	V	1	Total 28	B 1	C 19	N 4	O 4	0

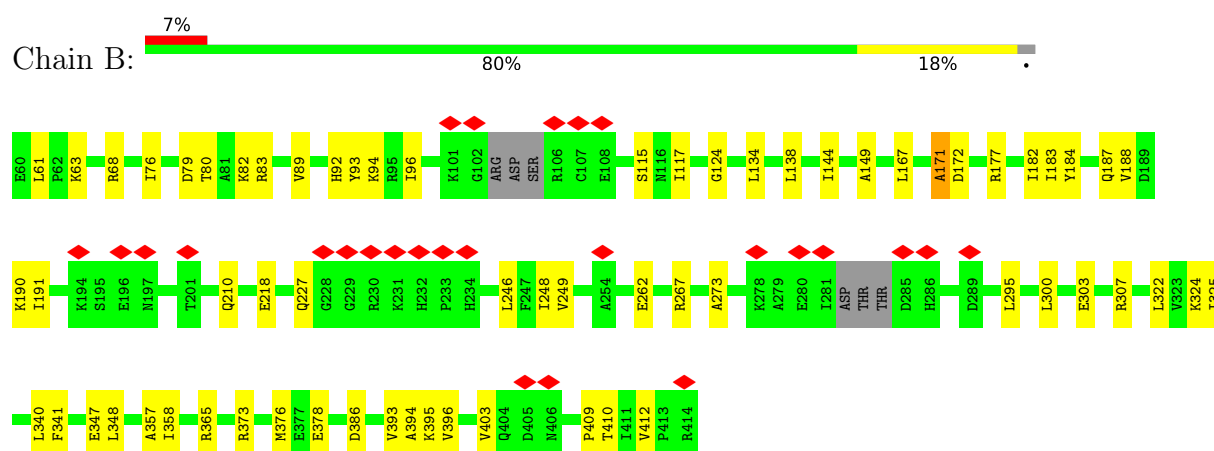
3 Residue-property plots

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.

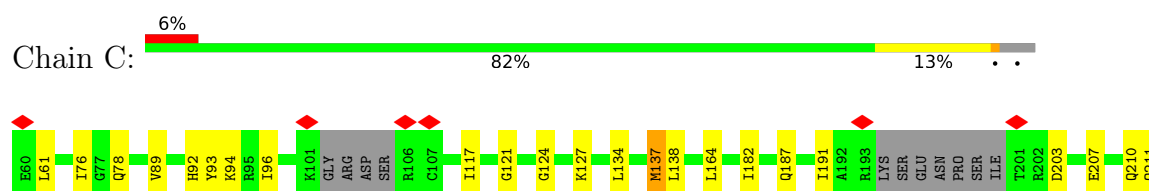
- Molecule 1: ATP-dependent Clp protease ATP-binding subunit ClpX

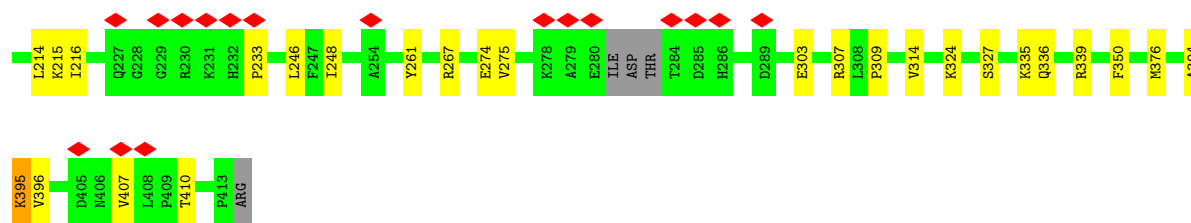


- Molecule 1: ATP-dependent Clp protease ATP-binding subunit ClpX

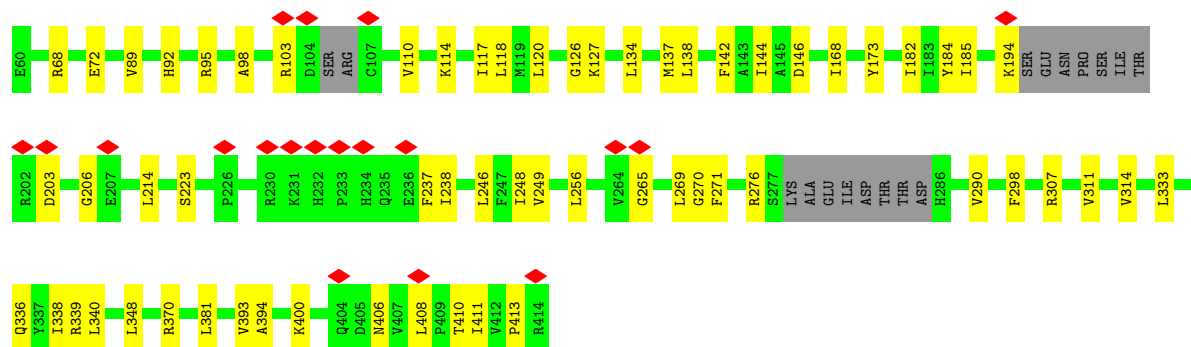
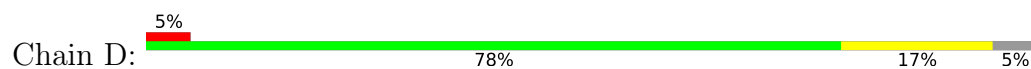


- Molecule 1: ATP-dependent Clp protease ATP-binding subunit ClpX

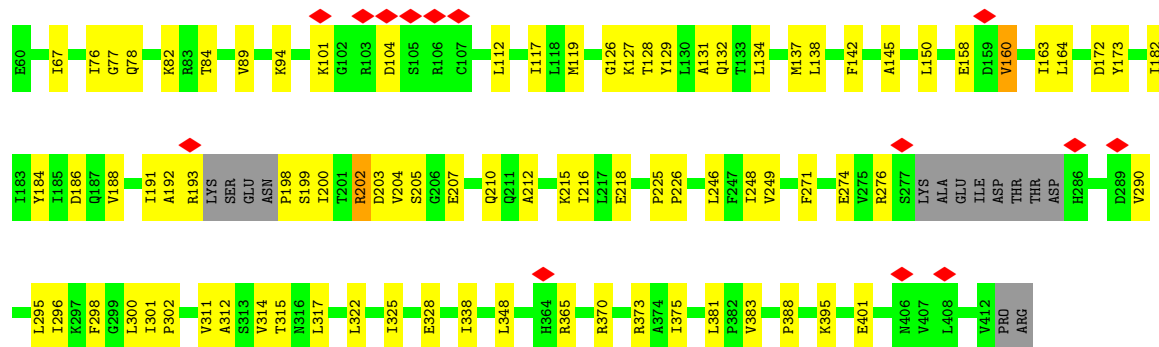




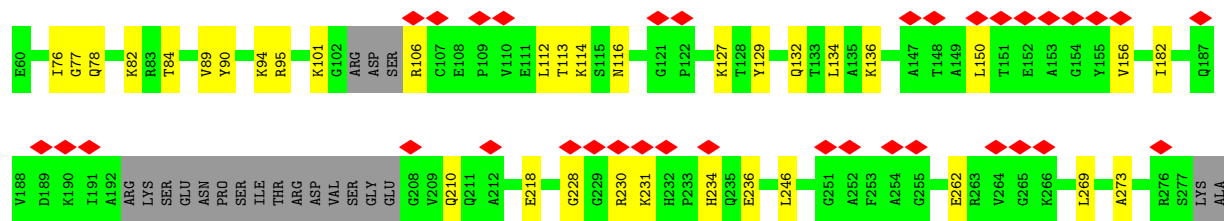
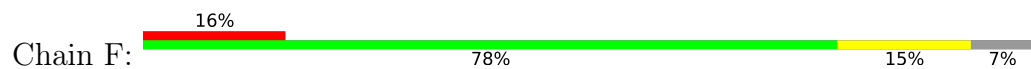
• Molecule 1: ATP-dependent Clp protease ATP-binding subunit ClpX

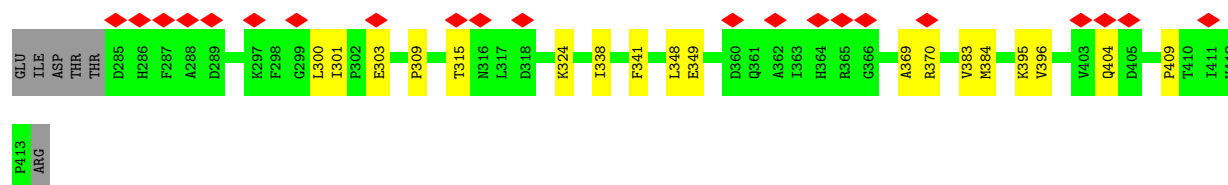


• Molecule 1: ATP-dependent Clp protease ATP-binding subunit ClpX



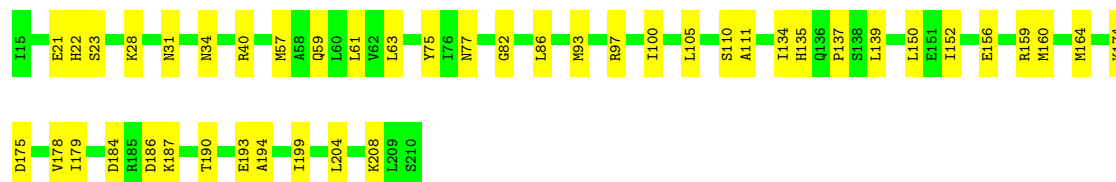
• Molecule 1: ATP-dependent Clp protease ATP-binding subunit ClpX





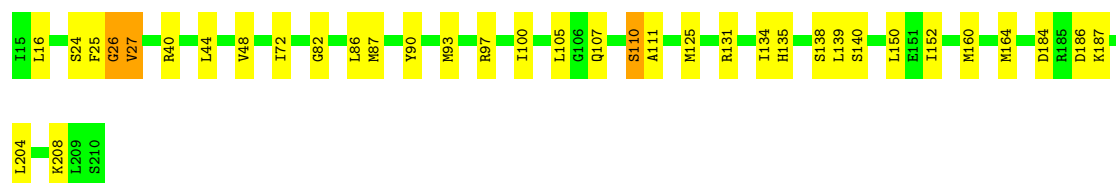
- Molecule 2: ATP-dependent Clp protease proteolytic subunit 2

Chain H: 78% 22%



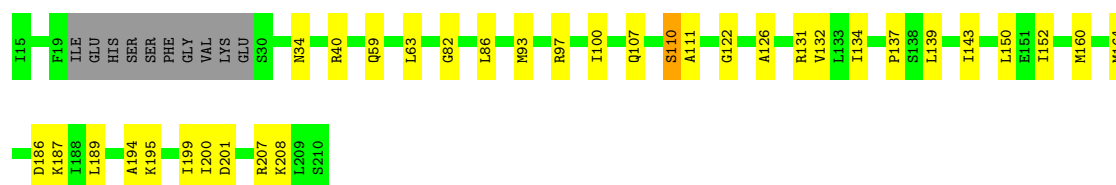
- Molecule 2: ATP-dependent Clp protease proteolytic subunit 2

Chain I: 82% 17%



- Molecule 2: ATP-dependent Clp protease proteolytic subunit 2

Chain K: 78% 17% 5%



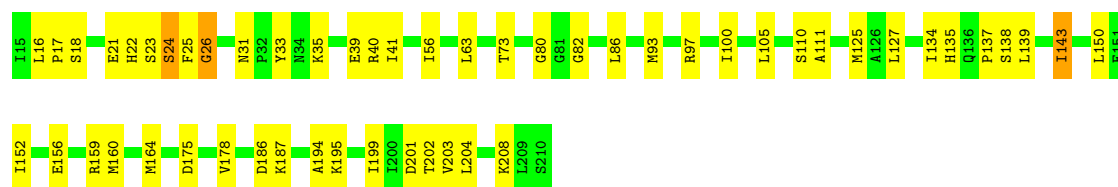
- Molecule 2: ATP-dependent Clp protease proteolytic subunit 2

Chain L: 82% 16% ..



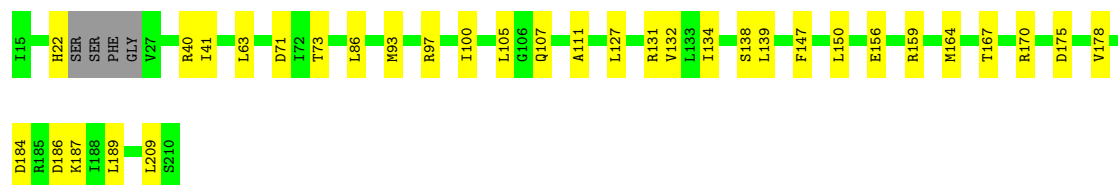
- Molecule 2: ATP-dependent Clp protease proteolytic subunit 2

Chain M:  73% 26% .



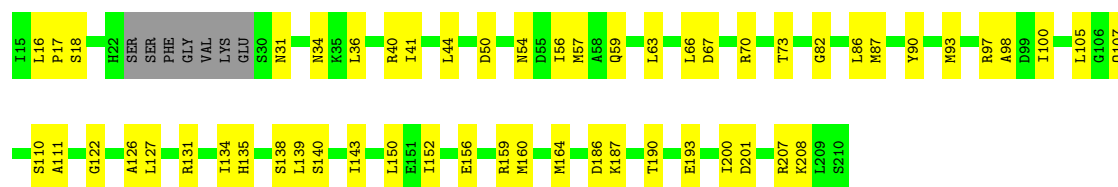
- Molecule 2: ATP-dependent Clp protease proteolytic subunit 2

Chain N:  81% 17% .



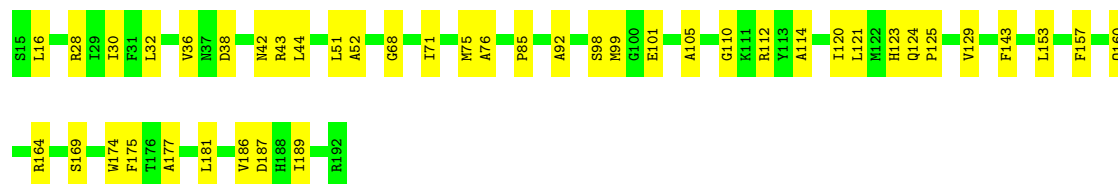
- Molecule 2: ATP-dependent Clp protease proteolytic subunit 2

Chain V:  68% 28% .



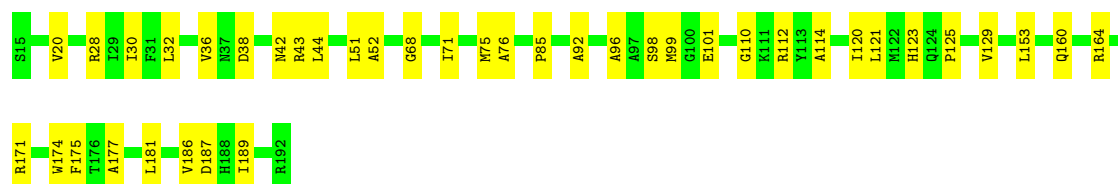
- Molecule 3: ATP-dependent Clp protease proteolytic subunit 1

Chain O:  76% 24% .



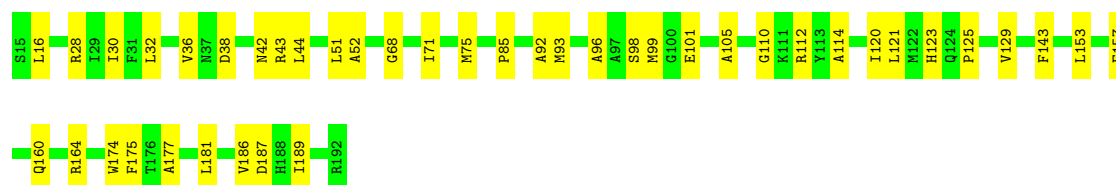
- Molecule 3: ATP-dependent Clp protease proteolytic subunit 1

Chain P:  78% 22% .



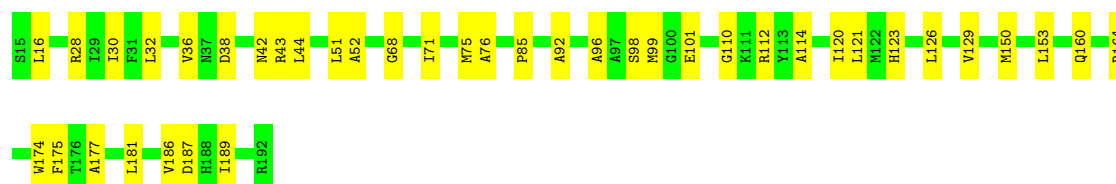
- Molecule 3: ATP-dependent Clp protease proteolytic subunit 1

Chain Q:  76% 24%



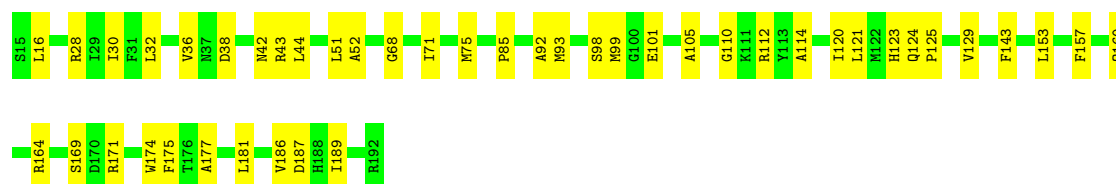
- Molecule 3: ATP-dependent Clp protease proteolytic subunit 1

Chain R:  78% 22%



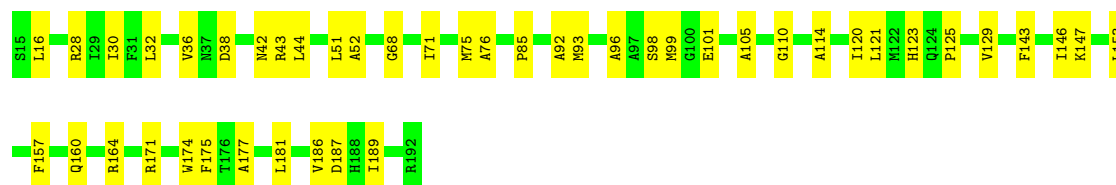
- Molecule 3: ATP-dependent Clp protease proteolytic subunit 1

Chain S:  75% 25%



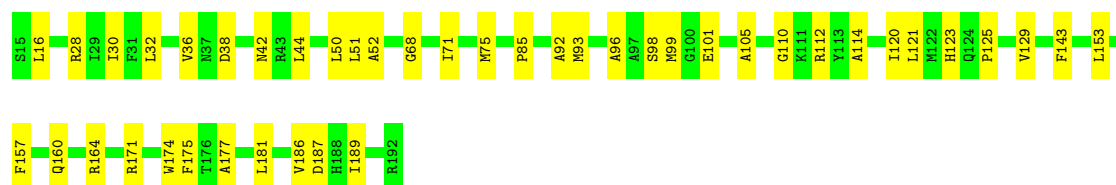
- Molecule 3: ATP-dependent Clp protease proteolytic subunit 1

Chain T:  75% 25%



- Molecule 3: ATP-dependent Clp protease proteolytic subunit 1

Chain U:  76% 24%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	380684	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2400	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	0.678	Depositor
Minimum map value	-0.052	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.015	Depositor
Recommended contour level	0.05	Depositor
Map size (Å)	363.52, 363.52, 363.52	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.71, 0.71, 0.71	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ADP, ATP, MG, BO2

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.37	0/2660	0.64	0/3603
1	B	0.41	0/2734	0.67	4/3700 (0.1%)
1	C	0.44	0/2662	0.66	0/3603
1	D	0.43	0/2649	0.70	1/3583 (0.0%)
1	E	0.42	1/2669 (0.0%)	0.66	0/3612
1	F	0.31	0/2573	0.67	1/3484 (0.0%)
2	H	0.53	0/1528	0.65	0/2067
2	I	0.54	0/1528	0.67	1/2067 (0.0%)
2	K	0.55	0/1445	0.62	0/1955
2	L	0.56	0/1491	0.71	1/2016 (0.0%)
2	M	0.58	0/1528	0.73	1/2067 (0.0%)
2	N	0.54	0/1498	0.66	0/2026
2	V	0.53	0/1473	0.63	0/1993
3	O	0.53	0/1378	0.58	0/1863
3	P	0.54	0/1378	0.58	0/1863
3	Q	0.53	0/1378	0.58	0/1863
3	R	0.53	0/1378	0.58	0/1863
3	S	0.53	0/1378	0.58	0/1863
3	T	0.53	0/1378	0.58	0/1863
3	U	0.54	0/1378	0.58	0/1863
All	All	0.48	1/36084 (0.0%)	0.65	9/48817 (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	B	0	1
1	C	0	2
1	E	0	1

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Mol	Chain	#Chirality outliers	#Planarity outliers
All	All	0	4

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	328	GLU	C-N	5.83	1.40	1.33

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	386	ASP	CA-C-N	8.47	125.57	120.24
1	B	386	ASP	C-N-CA	8.47	125.57	120.24
2	I	110	SER	CB-CA-C	-6.34	109.27	116.63
1	F	404	GLN	N-CA-C	-6.28	105.51	113.43
1	D	98	ALA	N-CA-C	-6.13	107.02	114.75

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	172	ASP	Peptide
1	C	137	MET	Peptide
1	C	61	LEU	Peptide
1	E	202	ARG	Sidechain

5.2 Too-close contacts [i](#)

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	2623	0	2694	31	0
1	B	2694	0	2765	45	0
1	C	2624	0	2692	38	0
1	D	2611	0	2683	55	0
1	E	2630	0	2699	78	0
1	F	2535	0	2602	38	0
2	H	1507	0	1517	61	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	I	1507	0	1519	53	0
2	K	1427	0	1444	31	0
2	L	1473	0	1492	35	0
2	M	1507	0	1519	59	0
2	N	1479	0	1496	32	0
2	V	1454	0	1468	46	0
3	O	1356	0	1348	33	0
3	P	1356	0	1348	33	0
3	Q	1356	0	1348	35	0
3	R	1356	0	1348	31	0
3	S	1356	0	1348	34	0
3	T	1356	0	1348	36	0
3	U	1356	0	1348	36	0
4	A	1	0	0	0	0
4	E	1	0	0	0	0
5	A	31	0	12	4	0
5	B	31	0	12	3	0
5	D	62	0	24	18	0
6	E	27	12	12	22	0
6	F	27	0	12	7	0
7	H	28	0	25	12	0
7	I	28	0	25	8	0
7	K	28	0	25	12	0
7	L	28	0	25	12	0
7	M	28	0	25	13	0
7	N	28	0	25	6	0
7	O	28	0	25	9	0
7	P	28	0	25	8	0
7	Q	28	0	25	10	0
7	R	28	0	25	6	0
7	S	28	0	25	9	0
7	T	28	0	25	9	0
7	U	28	0	25	9	0
7	V	28	0	25	11	0
All	All	36135	12	36448	730	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 10.

The worst 5 of 730 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:M:25:PHE:HE2	2:N:22:HIS:NE2	1.01	1.49
2:M:25:PHE:CE2	2:N:22:HIS:NE2	1.88	1.41
1:E:127:LYS:CD	6:E:501:ADP:O1B	1.72	1.34
2:M:25:PHE:HE2	2:N:22:HIS:CE1	1.50	1.29
1:E:128:THR:CG2	6:E:501:ADP:O2A	1.84	1.24

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	335/355 (94%)	314 (94%)	21 (6%)	0	100	100
1	B	343/355 (97%)	321 (94%)	22 (6%)	0	100	100
1	C	332/355 (94%)	312 (94%)	19 (6%)	1 (0%)	36	38
1	D	330/355 (93%)	298 (90%)	32 (10%)	0	100	100
1	E	335/355 (94%)	316 (94%)	17 (5%)	2 (1%)	21	20
1	F	321/355 (90%)	308 (96%)	13 (4%)	0	100	100
2	H	194/196 (99%)	188 (97%)	6 (3%)	0	100	100
2	I	194/196 (99%)	184 (95%)	9 (5%)	1 (0%)	24	23
2	K	182/196 (93%)	177 (97%)	5 (3%)	0	100	100
2	L	188/196 (96%)	178 (95%)	10 (5%)	0	100	100
2	M	194/196 (99%)	187 (96%)	6 (3%)	1 (0%)	24	23
2	N	188/196 (96%)	184 (98%)	4 (2%)	0	100	100
2	V	185/196 (94%)	178 (96%)	7 (4%)	0	100	100
3	O	176/178 (99%)	174 (99%)	2 (1%)	0	100	100
3	P	176/178 (99%)	172 (98%)	4 (2%)	0	100	100
3	Q	176/178 (99%)	172 (98%)	4 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	R	176/178 (99%)	173 (98%)	3 (2%)	0	100	100
3	S	176/178 (99%)	173 (98%)	3 (2%)	0	100	100
3	T	176/178 (99%)	172 (98%)	4 (2%)	0	100	100
3	U	176/178 (99%)	173 (98%)	3 (2%)	0	100	100
All	All	4553/4748 (96%)	4354 (96%)	194 (4%)	5 (0%)	49	54

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	M	24	SER
1	C	396	VAL
1	E	160	VAL
2	I	26	GLY
1	E	388	PRO

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	283/295 (96%)	282 (100%)	1 (0%)	84	88
1	B	289/295 (98%)	289 (100%)	0	100	100
1	C	281/295 (95%)	280 (100%)	1 (0%)	84	88
1	D	279/295 (95%)	279 (100%)	0	100	100
1	E	282/295 (96%)	279 (99%)	3 (1%)	65	74
1	F	271/295 (92%)	271 (100%)	0	100	100
2	H	163/163 (100%)	163 (100%)	0	100	100
2	I	163/163 (100%)	161 (99%)	2 (1%)	63	72
2	K	154/163 (94%)	153 (99%)	1 (1%)	78	83
2	L	159/163 (98%)	159 (100%)	0	100	100
2	M	163/163 (100%)	161 (99%)	2 (1%)	63	72

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	N	160/163 (98%)	160 (100%)	0	100	100
2	V	157/163 (96%)	157 (100%)	0	100	100
3	O	139/139 (100%)	139 (100%)	0	100	100
3	P	139/139 (100%)	139 (100%)	0	100	100
3	Q	139/139 (100%)	139 (100%)	0	100	100
3	R	139/139 (100%)	139 (100%)	0	100	100
3	S	139/139 (100%)	139 (100%)	0	100	100
3	T	139/139 (100%)	139 (100%)	0	100	100
3	U	139/139 (100%)	139 (100%)	0	100	100
All	All	3777/3884 (97%)	3767 (100%)	10 (0%)	84	90

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	K	110	SER
2	M	56	ILE
2	M	143	ILE
1	E	173	TYR
1	E	205	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 59 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	361	GLN
3	U	188	HIS
2	L	144	GLN
3	U	160	GLN
3	S	188	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 22 ligands modelled in this entry, 2 are monoatomic - leaving 20 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
7	BO2	U	201	-	25,29,29	0.26	0	33,38,38	0.45	0
5	ATP	B	501	-	32,33,33	1.46	6 (18%)	48,52,52	1.76	8 (16%)
5	ATP	D	502	-	32,33,33	1.46	6 (18%)	48,52,52	1.77	8 (16%)
7	BO2	S	201	-	25,29,29	0.27	0	33,38,38	0.48	0
6	ADP	F	501	-	28,29,29	1.43	4 (14%)	43,45,45	1.95	8 (18%)
7	BO2	K	301	-	25,29,29	0.19	0	33,38,38	0.39	0
7	BO2	I	301	-	25,29,29	0.21	0	33,38,38	0.33	0
7	BO2	Q	201	-	25,29,29	0.26	0	33,38,38	0.51	0
7	BO2	M	301	-	25,29,29	0.23	0	33,38,38	0.39	0
5	ATP	A	502	4	32,33,33	0.51	0	48,52,52	0.54	0
7	BO2	H	301	-	25,29,29	0.23	0	33,38,38	0.36	0
7	BO2	R	201	-	25,29,29	0.26	0	33,38,38	0.38	0
7	BO2	L	301	-	25,29,29	0.23	0	33,38,38	0.29	0
7	BO2	O	201	-	25,29,29	0.27	0	33,38,38	0.49	0
7	BO2	T	201	-	25,29,29	0.27	0	33,38,38	0.51	0
7	BO2	P	201	-	25,29,29	0.26	0	33,38,38	0.47	0
5	ATP	D	501	-	32,33,33	1.35	4 (12%)	48,52,52	1.78	8 (16%)
7	BO2	N	301	-	25,29,29	0.24	0	33,38,38	0.32	0
7	BO2	V	301	-	25,29,29	0.21	0	33,38,38	0.32	0
6	ADP	E	501	4	28,29,29	0.46	0	43,45,45	0.45	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
7	BO2	U	201	-	-	9/23/28/28	0/2/2/2
5	ATP	B	501	-	-	1/22/38/38	0/3/3/3
5	ATP	D	502	-	-	1/22/38/38	0/3/3/3
7	BO2	S	201	-	-	9/23/28/28	0/2/2/2
6	ADP	F	501	-	-	4/16/32/32	0/3/3/3
7	BO2	K	301	-	-	13/23/28/28	0/2/2/2
7	BO2	I	301	-	-	8/23/28/28	0/2/2/2
7	BO2	Q	201	-	-	9/23/28/28	0/2/2/2
7	BO2	M	301	-	-	9/23/28/28	0/2/2/2
5	ATP	A	502	4	-	0/22/38/38	0/3/3/3
7	BO2	H	301	-	-	9/23/28/28	0/2/2/2
7	BO2	R	201	-	-	8/23/28/28	0/2/2/2
7	BO2	L	301	-	-	13/23/28/28	0/2/2/2
7	BO2	O	201	-	-	9/23/28/28	0/2/2/2
7	BO2	T	201	-	-	9/23/28/28	0/2/2/2
7	BO2	P	201	-	-	9/23/28/28	0/2/2/2
5	ATP	D	501	-	-	1/22/38/38	0/3/3/3
7	BO2	N	301	-	-	6/23/28/28	0/2/2/2
7	BO2	V	301	-	-	15/23/28/28	0/2/2/2
6	ADP	E	501	4	-	0/16/32/32	0/3/3/3

The worst 5 of 20 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	F	501	ADP	C5-C4	4.86	1.47	1.39
5	D	501	ATP	C5-C4	4.73	1.47	1.39
5	B	501	ATP	C5-C4	4.71	1.47	1.39
5	D	502	ATP	C5-C4	4.70	1.47	1.39
6	F	501	ADP	C5-C6	2.77	1.48	1.41

The worst 5 of 32 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	F	501	ADP	C5-C4-N3	-6.67	117.53	126.72
5	D	501	ATP	C5-C4-N3	-5.85	118.67	126.72
5	D	502	ATP	C5-C4-N3	-5.81	118.71	126.72
5	B	501	ATP	C5-C4-N3	-5.80	118.73	126.72
6	F	501	ADP	N3-C4-N9	5.38	136.32	127.17

There are no chirality outliers.

5 of 142 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	F	501	ADP	C5'-O5'-PA-O3A
6	F	501	ADP	O4'-C4'-C5'-O5'
7	H	301	BO2	C10-C18-N20-C21
7	H	301	BO2	O19-C18-N20-C21
7	H	301	BO2	C22-C21-N20-C18

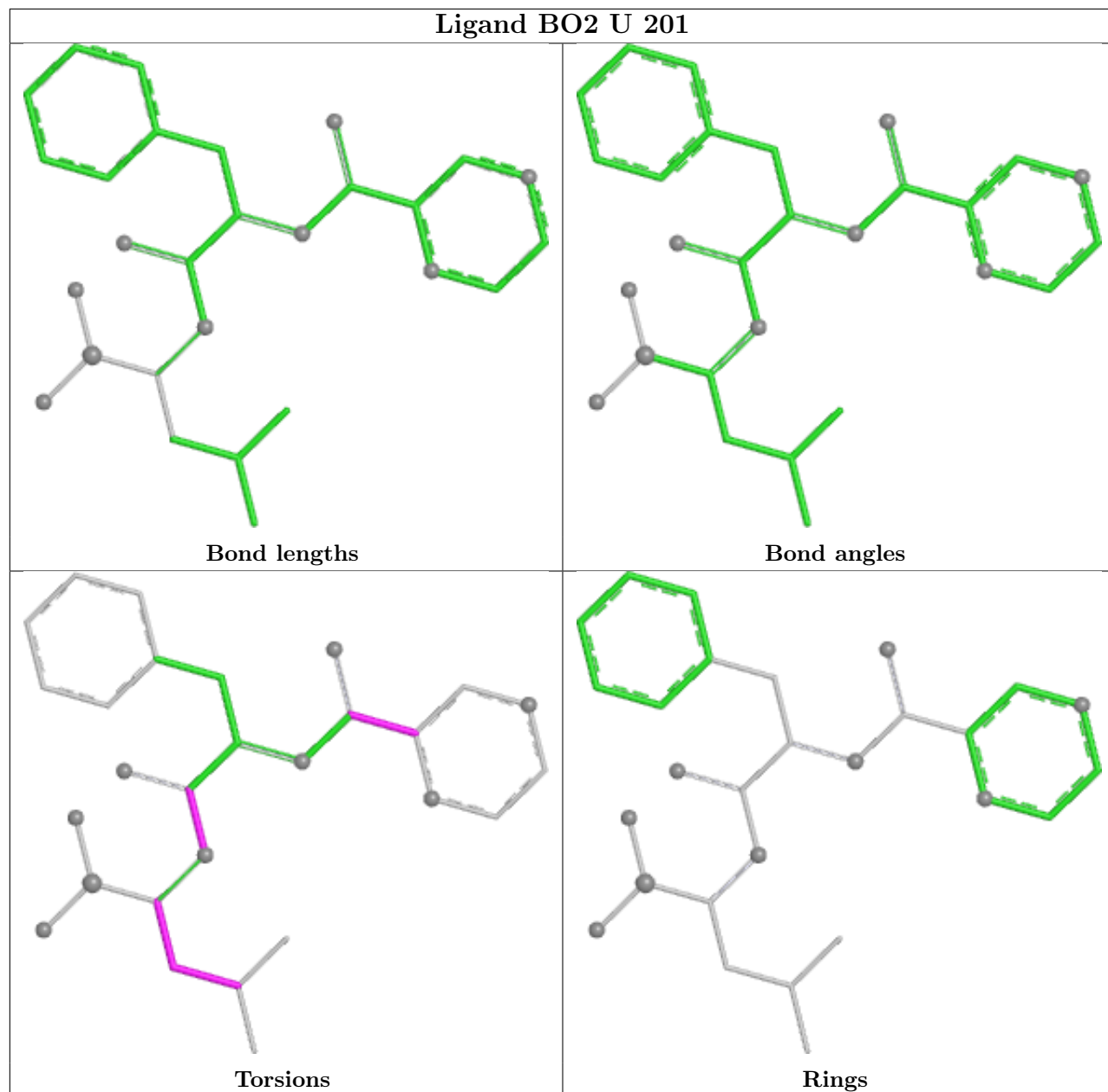
There are no ring outliers.

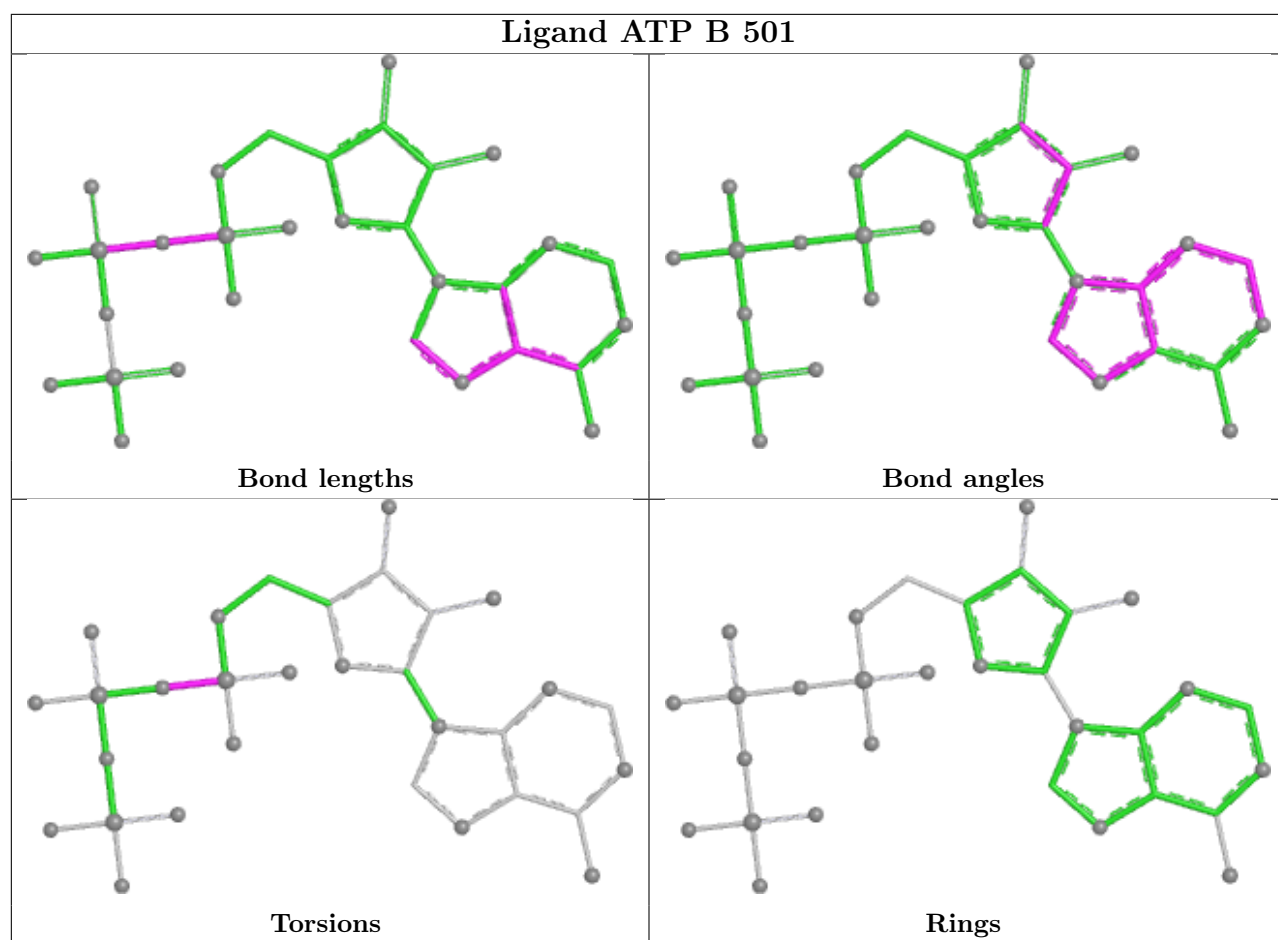
20 monomers are involved in 188 short contacts:

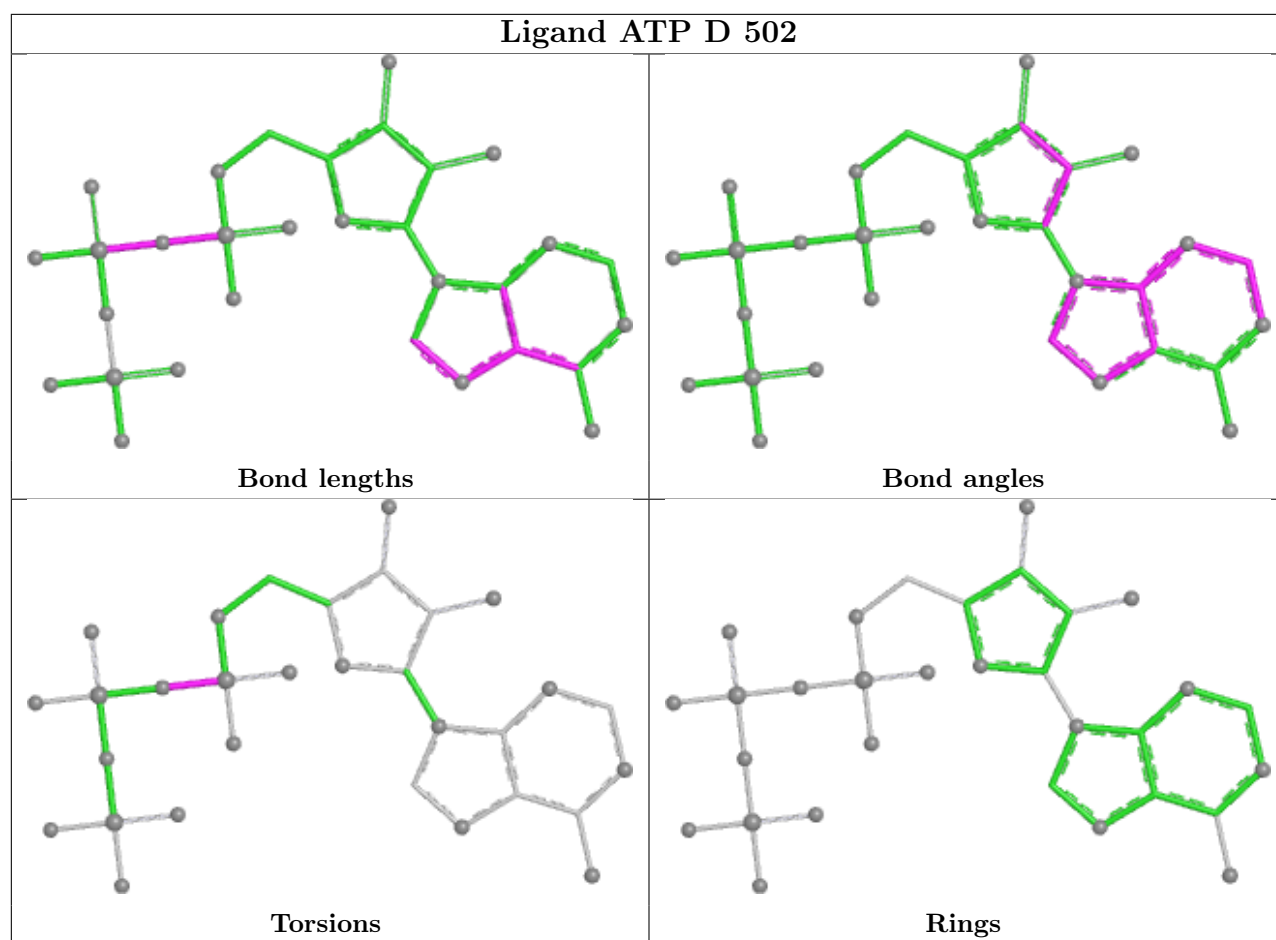
Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	U	201	BO2	9	0
5	B	501	ATP	3	0
5	D	502	ATP	6	0
7	S	201	BO2	9	0
6	F	501	ADP	7	0
7	K	301	BO2	12	0
7	I	301	BO2	8	0
7	Q	201	BO2	10	0
7	M	301	BO2	13	0
5	A	502	ATP	4	0
7	H	301	BO2	12	0
7	R	201	BO2	6	0
7	L	301	BO2	12	0
7	O	201	BO2	9	0
7	T	201	BO2	9	0
7	P	201	BO2	8	0
5	D	501	ATP	12	0
7	N	301	BO2	6	0
7	V	301	BO2	11	0
6	E	501	ADP	22	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

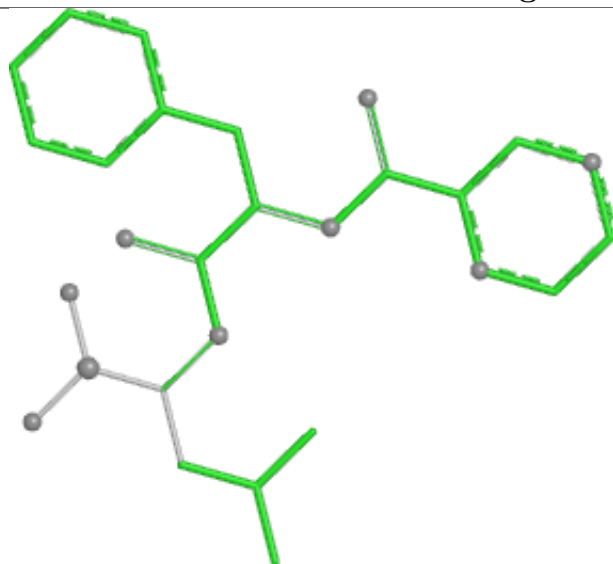
equivalents in the CSD to analyse the geometry.



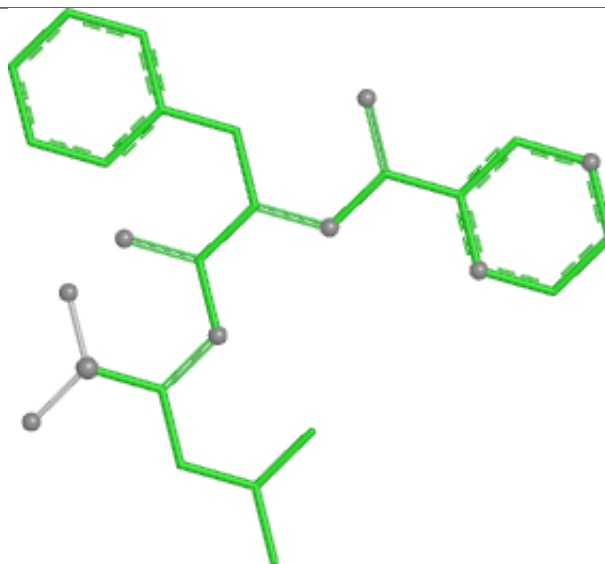




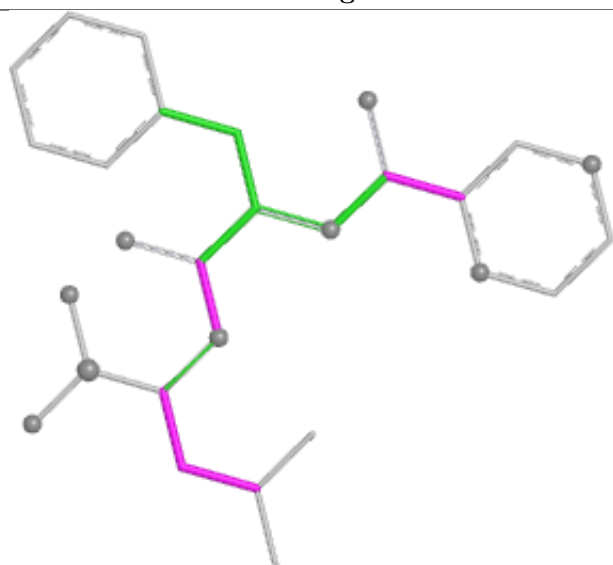
Ligand BO2 S 201



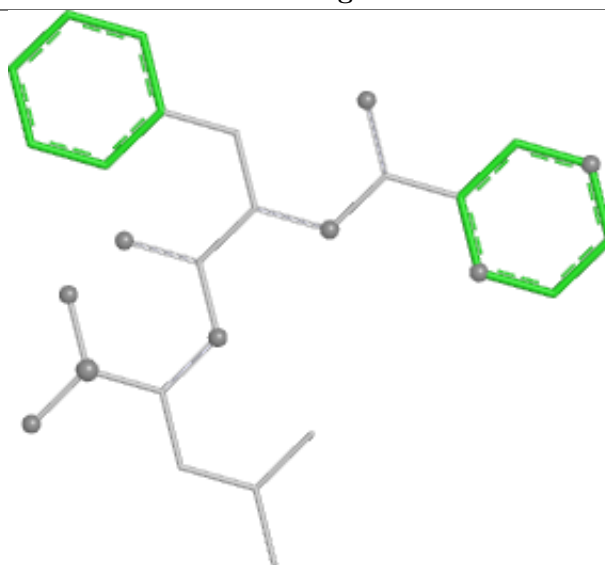
Bond lengths



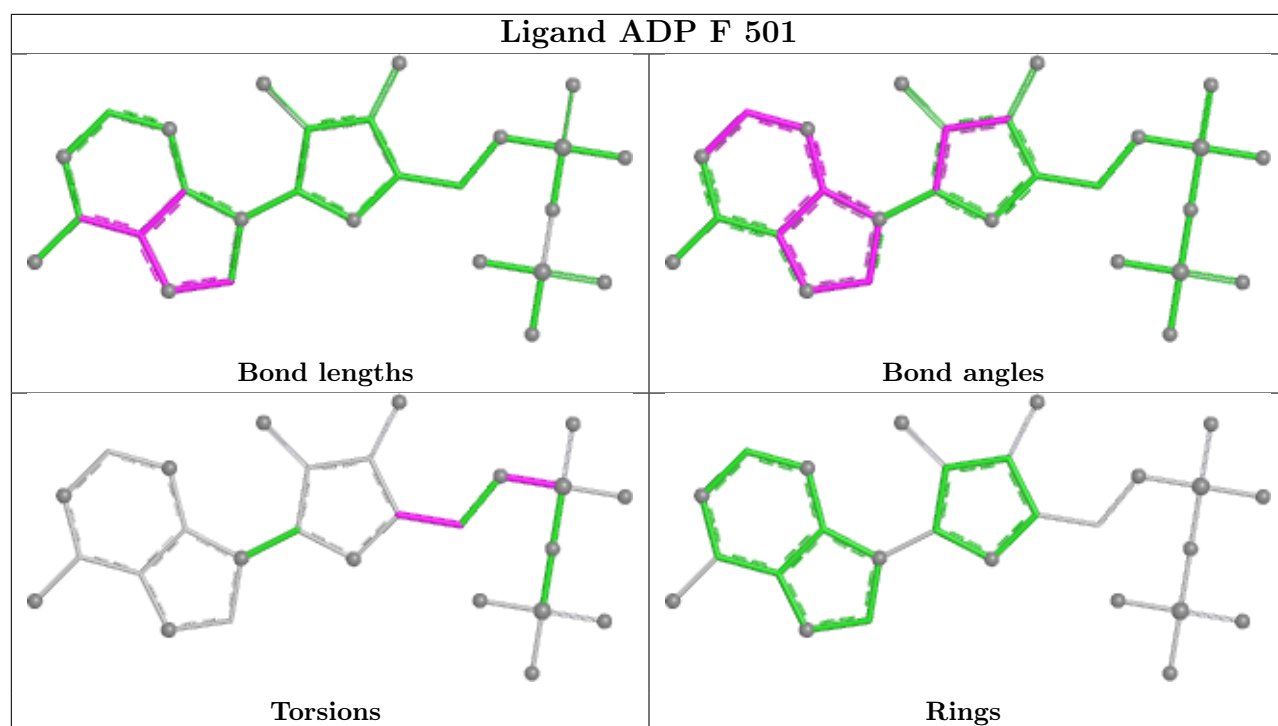
Bond angles



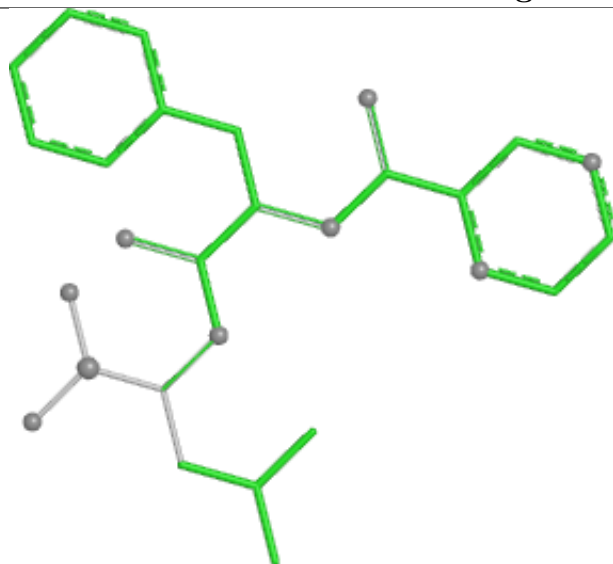
Torsions



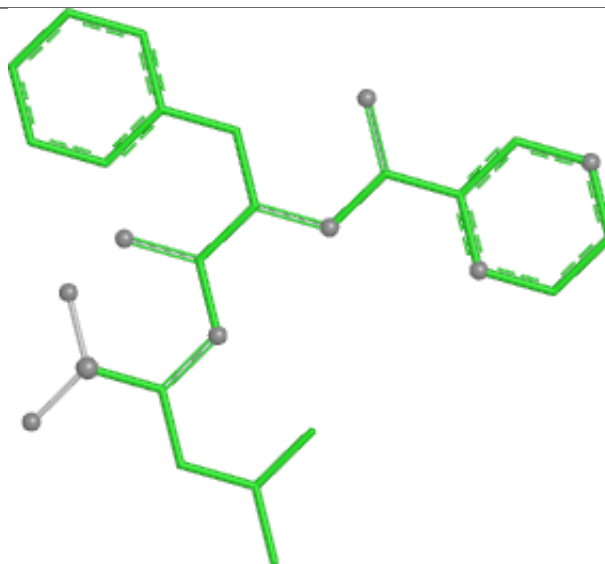
Rings



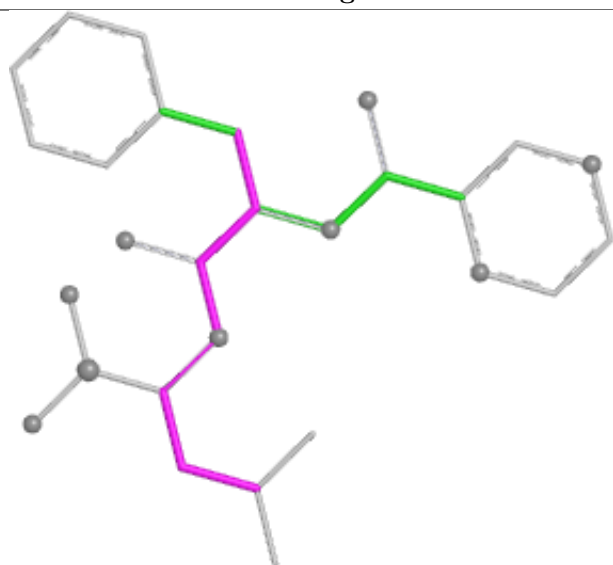
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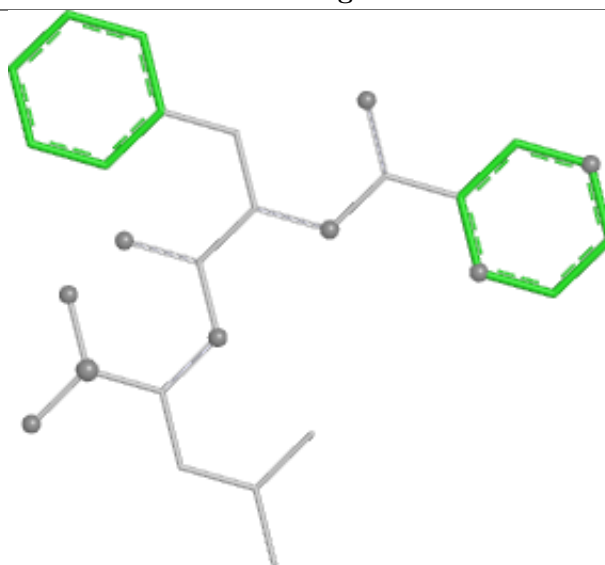
Bond lengths



Bond angles

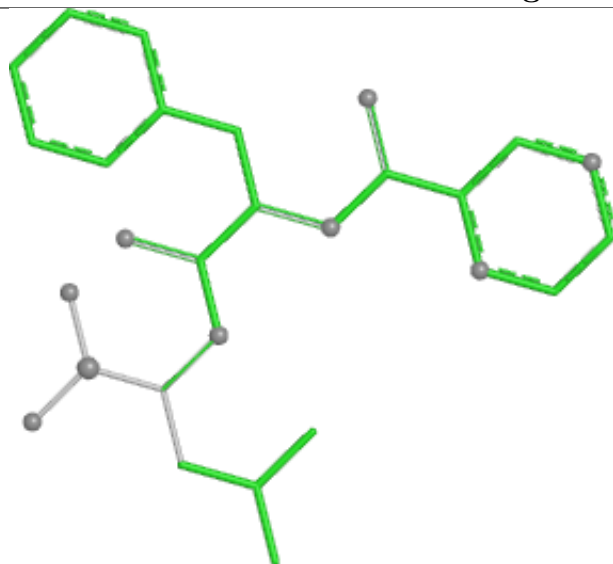


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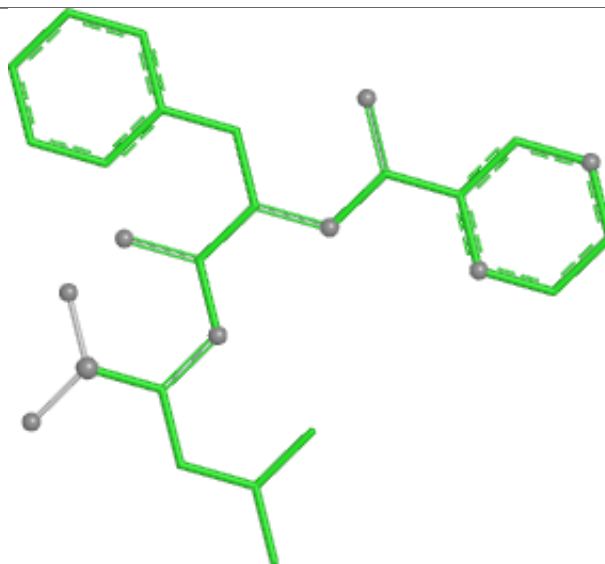


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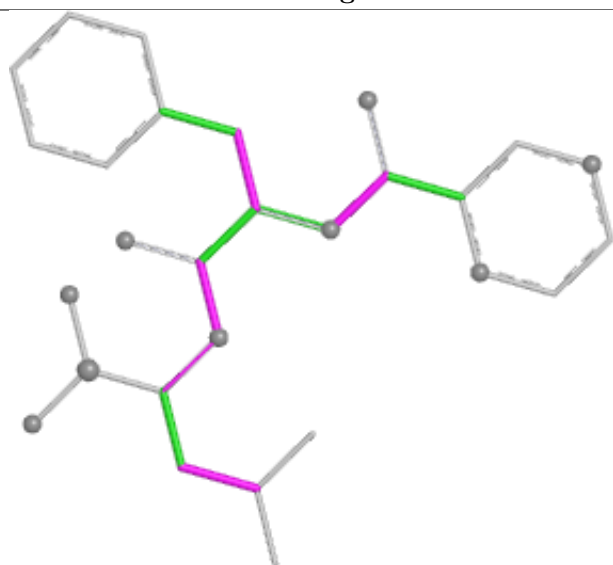
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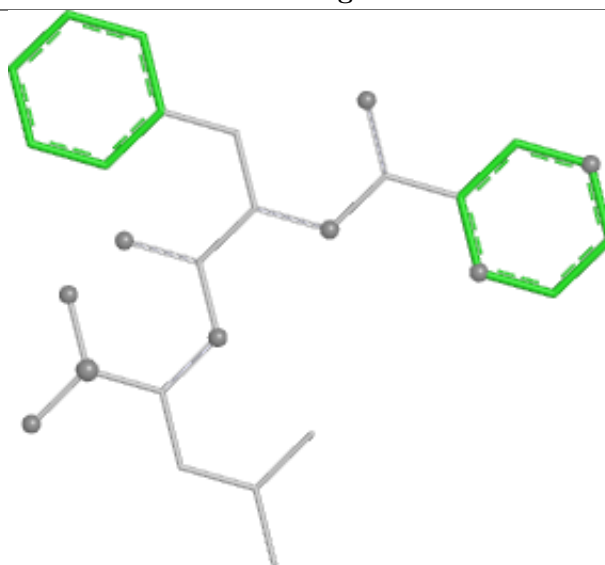
Bond lengths



Bond angles

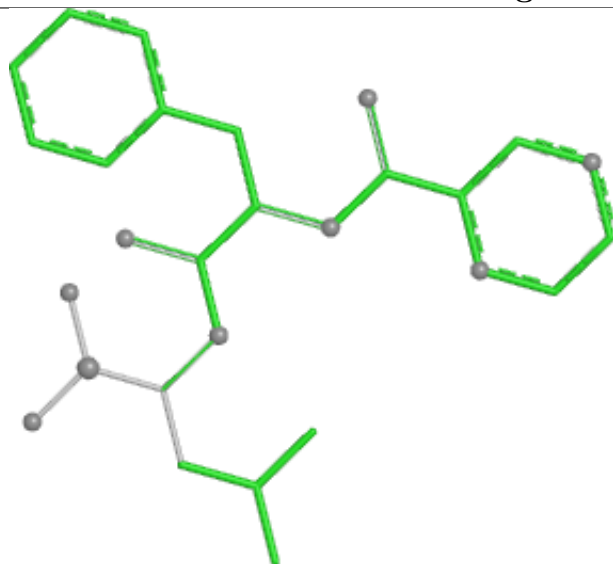


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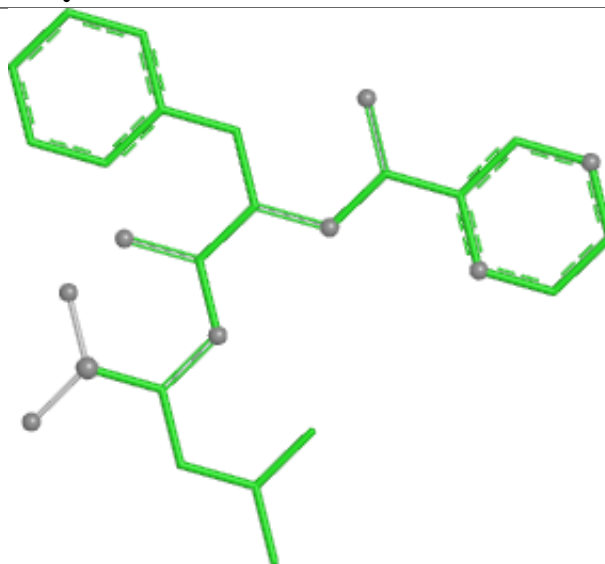


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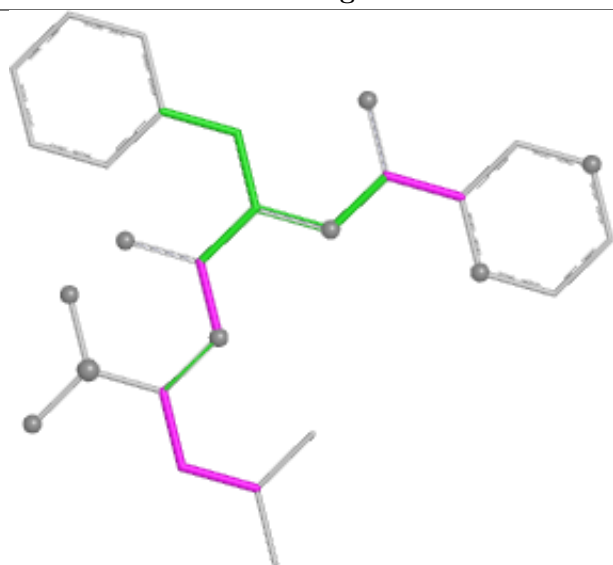
Ligand BO2 Q 201



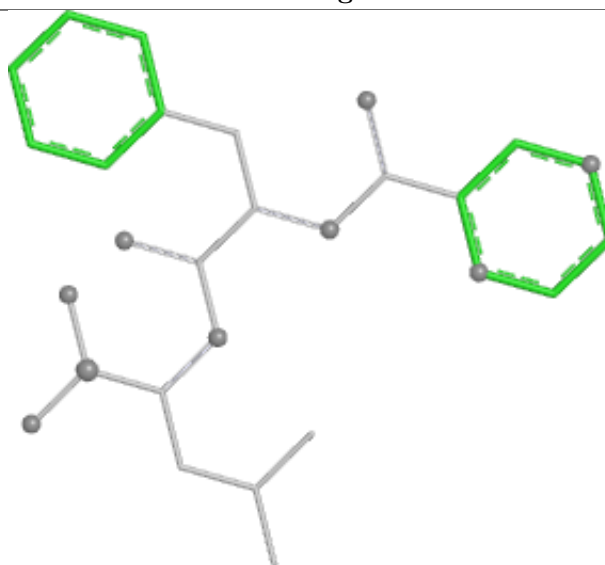
Bond lengths



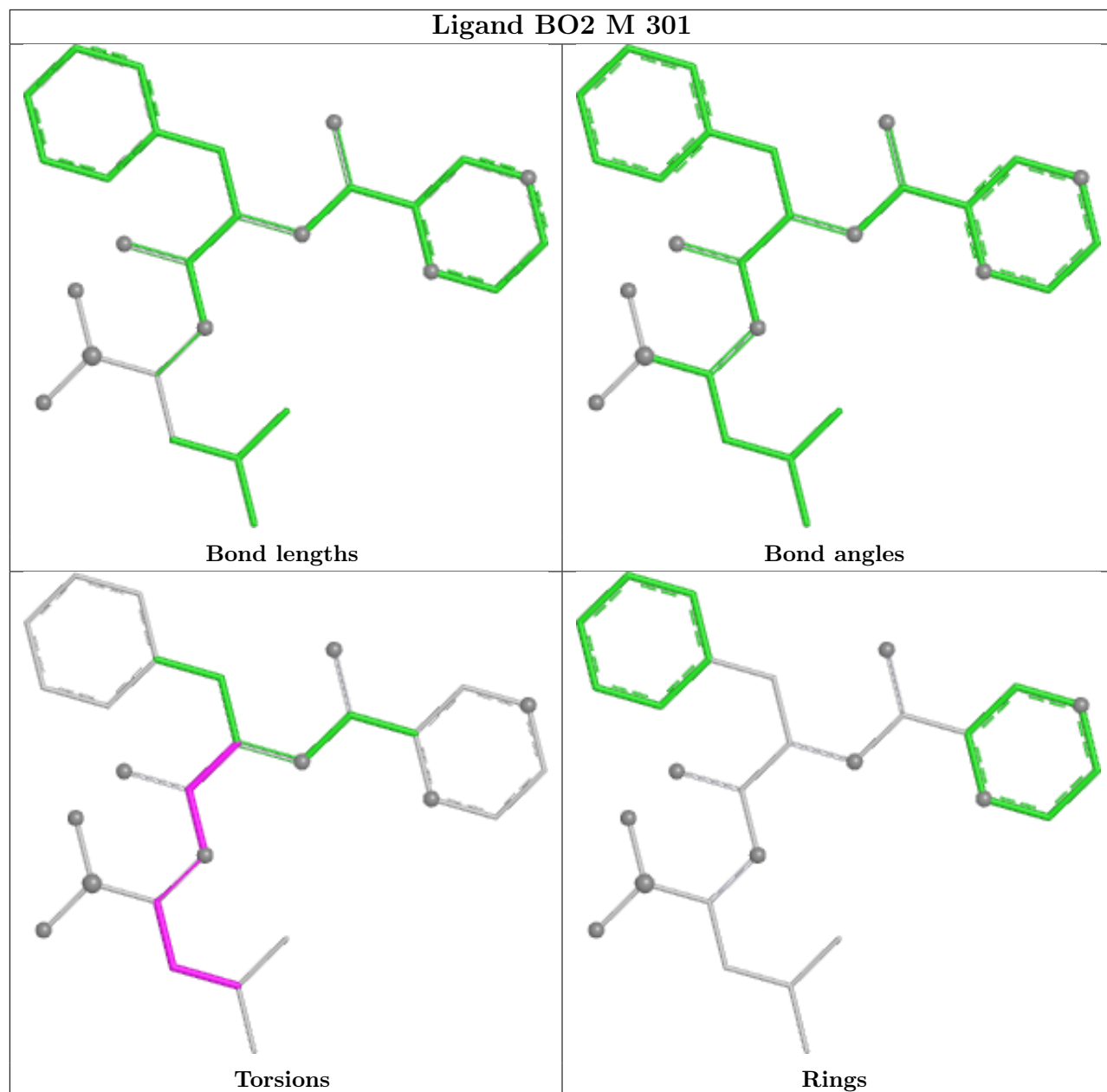
Bond angles

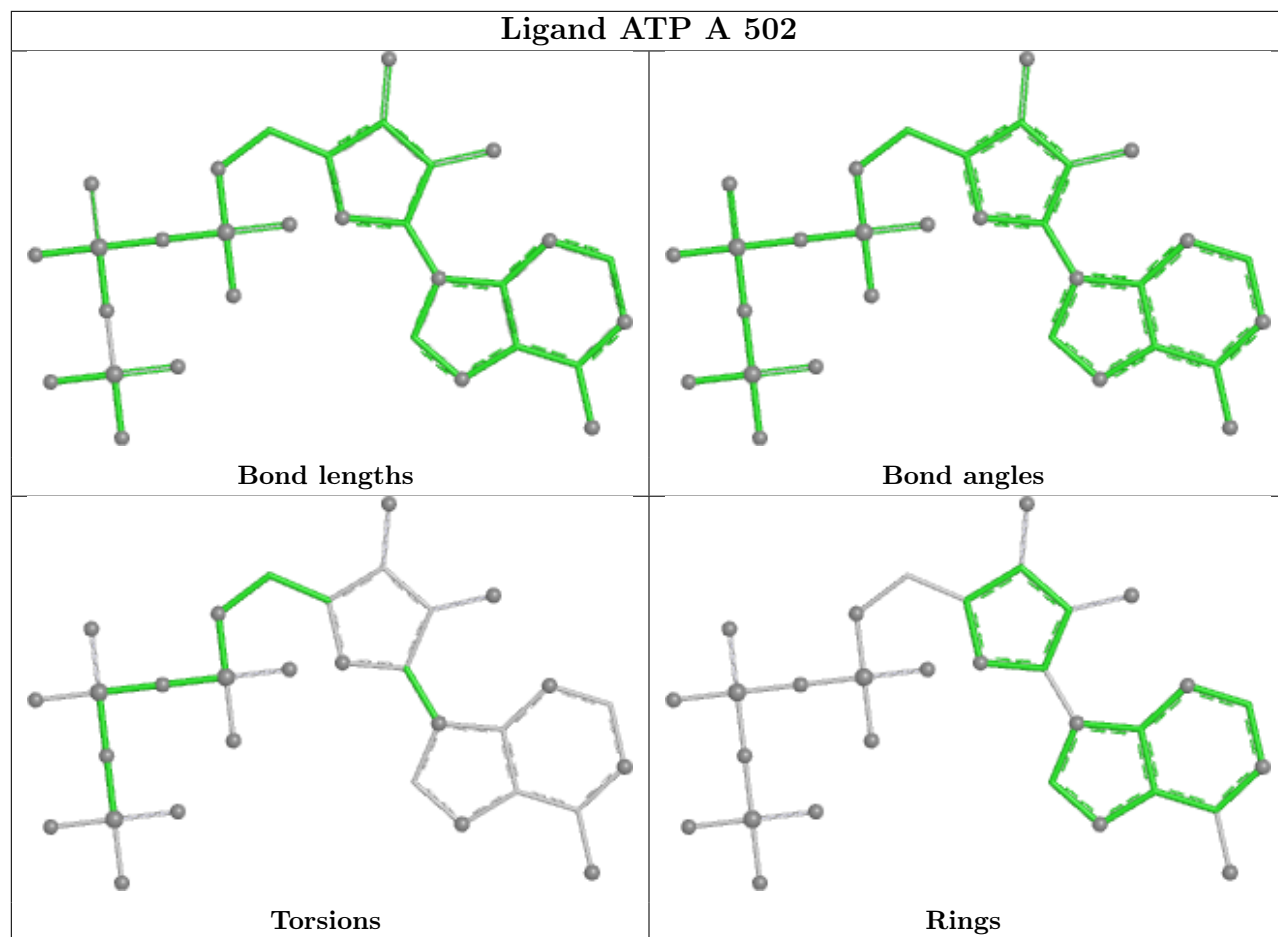


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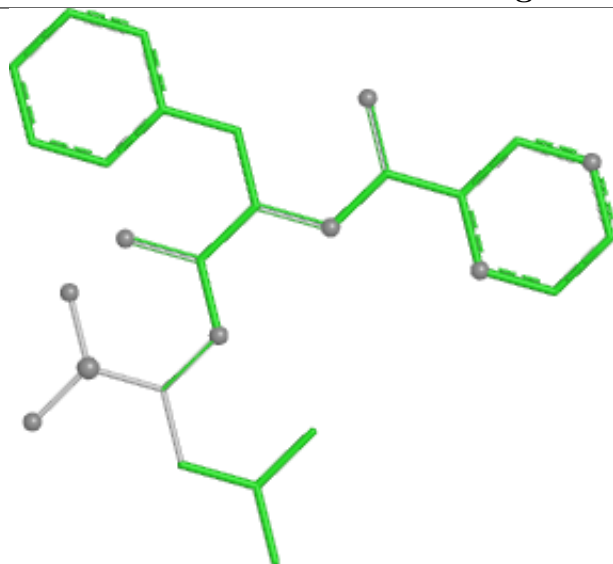


Rings

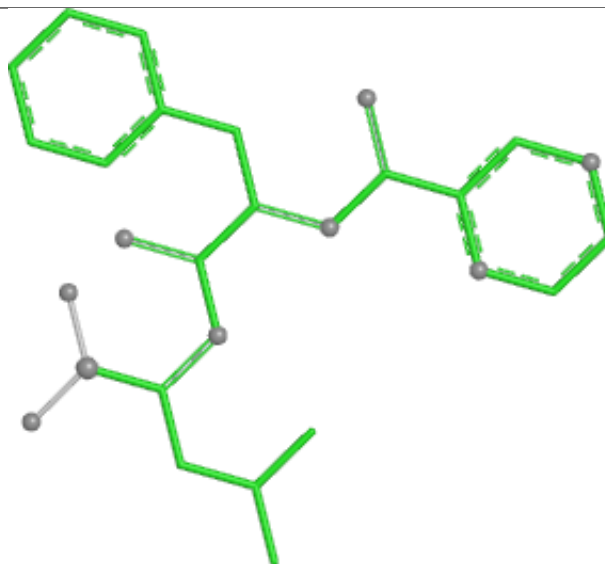




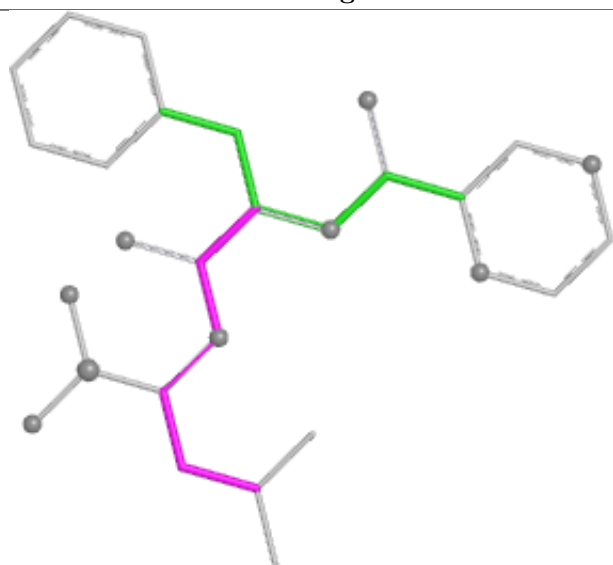
Ligand BO2 H 301



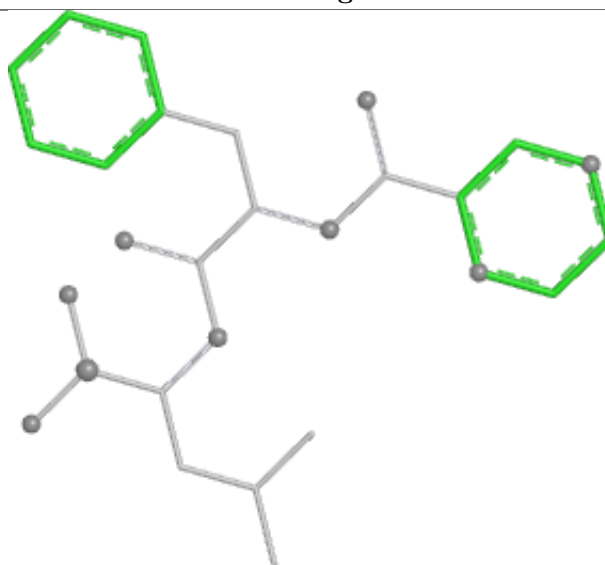
Bond lengths



Bond angles

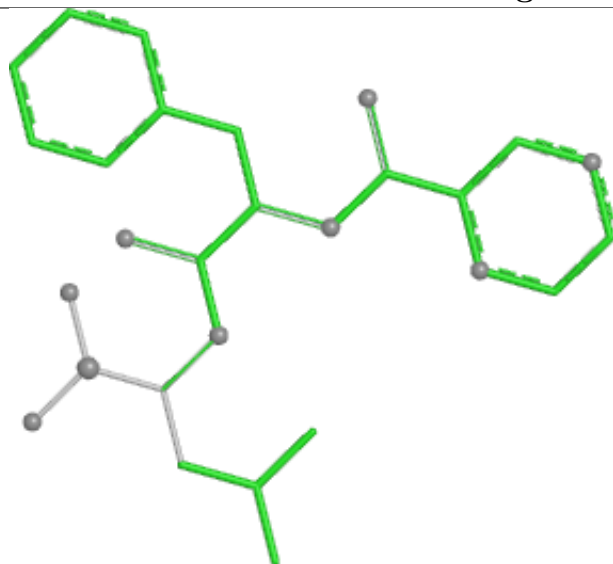


Torsions

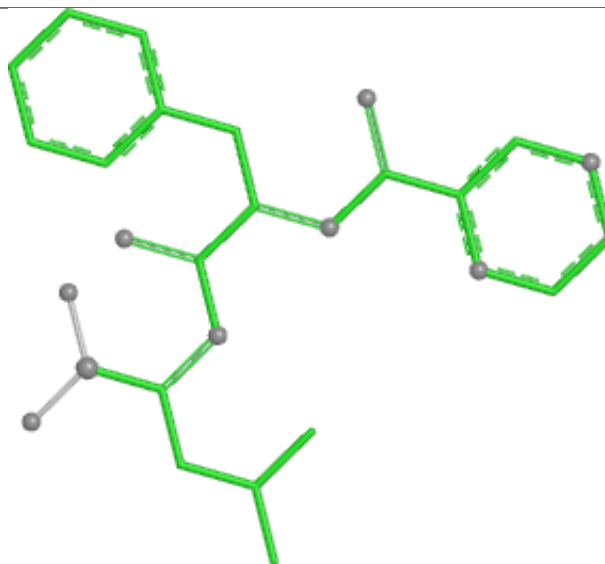


Rings

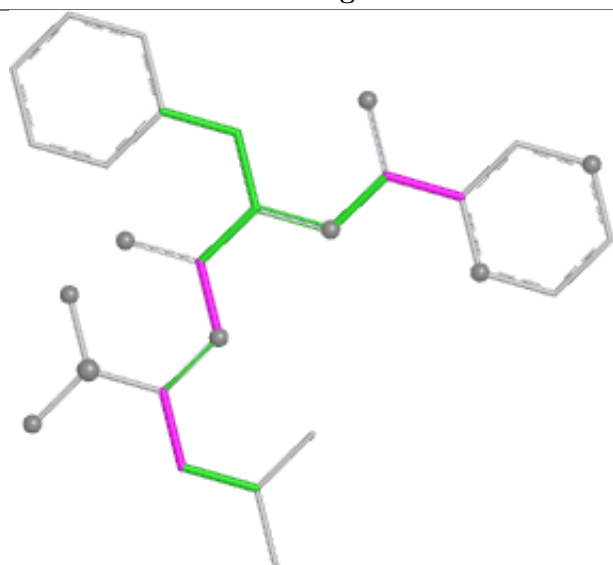
Ligand BO2 R 201



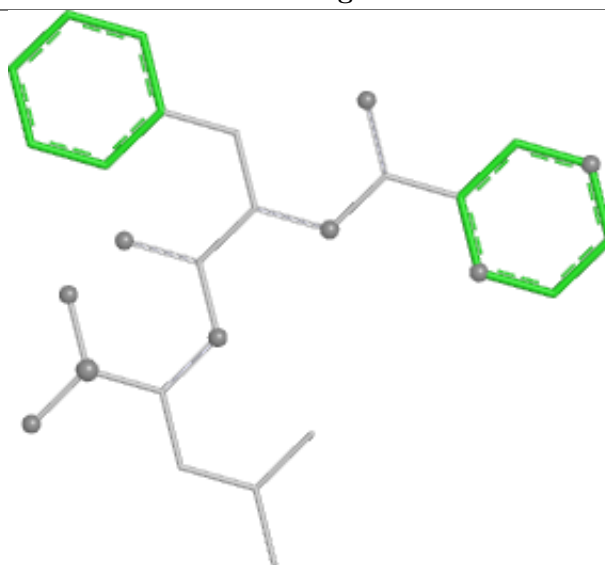
Bond lengths



Bond angles

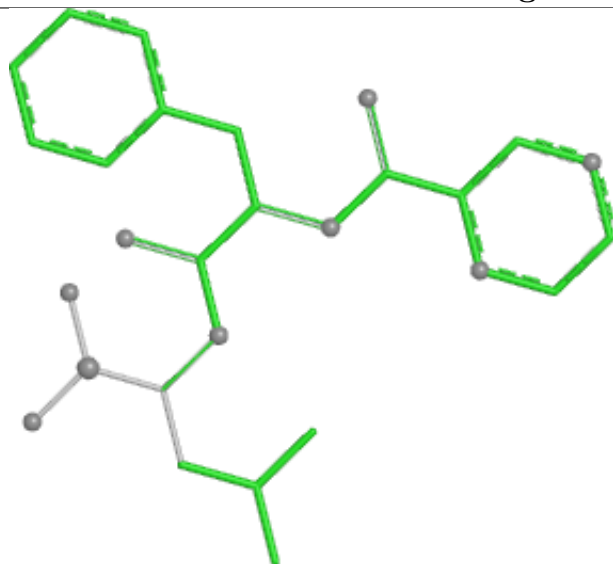


Torsions

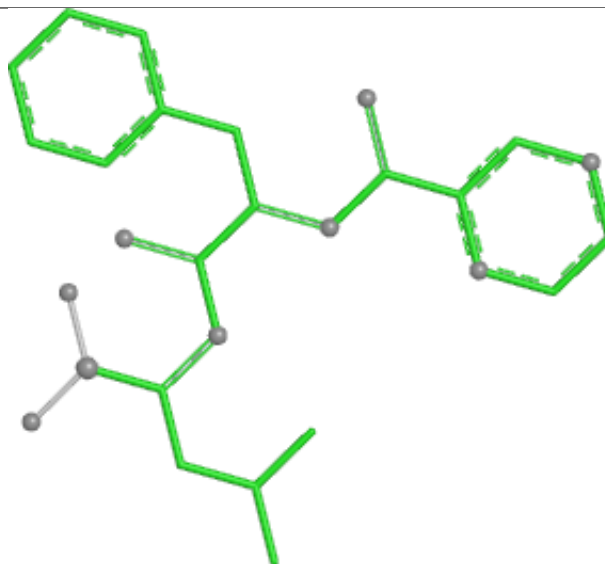


Rings

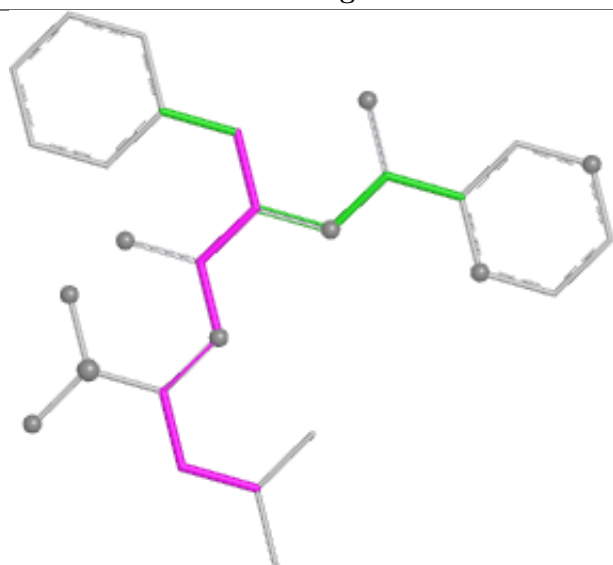
Ligand BO2 L 301



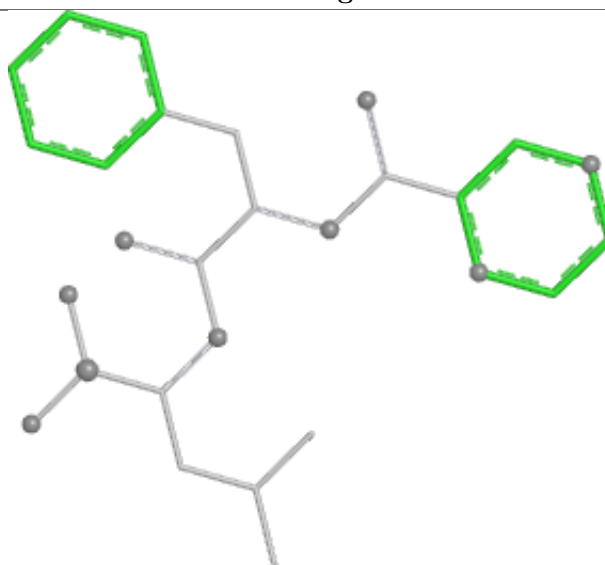
Bond lengths



Bond angles

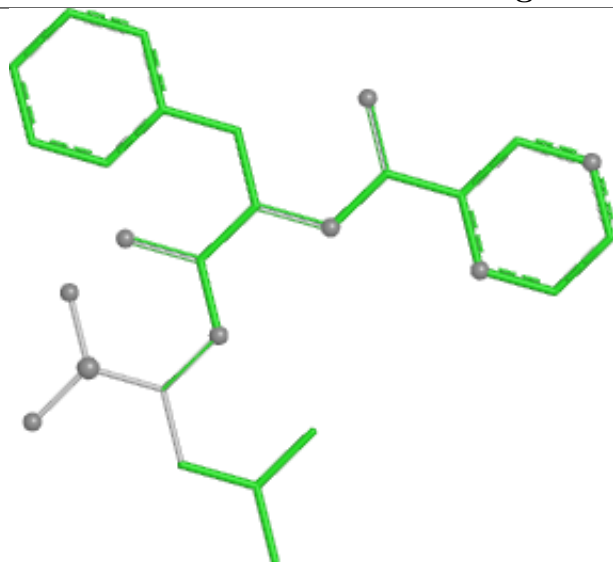


Torsions

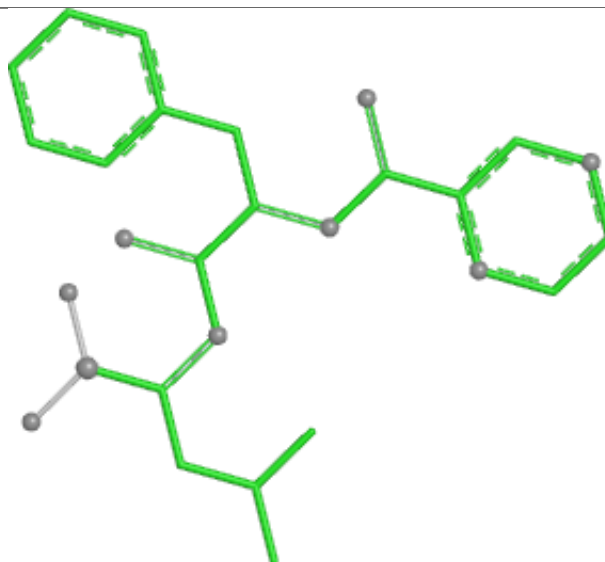


Rings

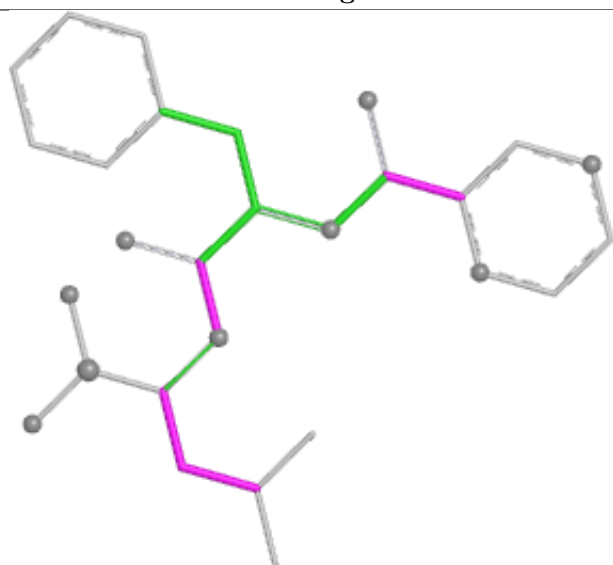
Ligand BO2 O 201



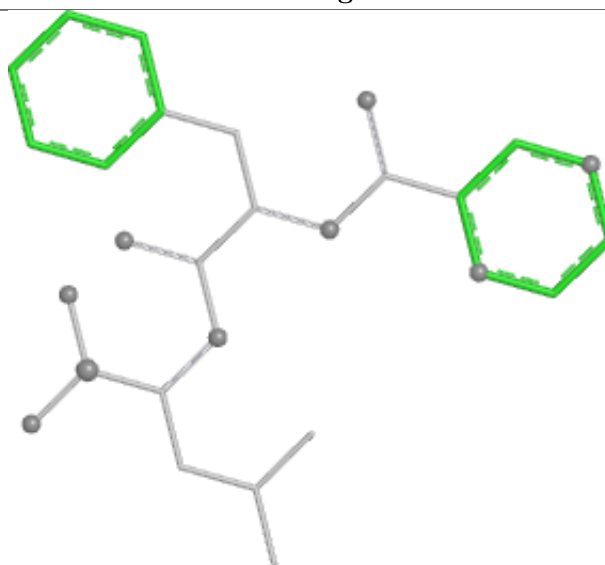
Bond lengths



Bond angles

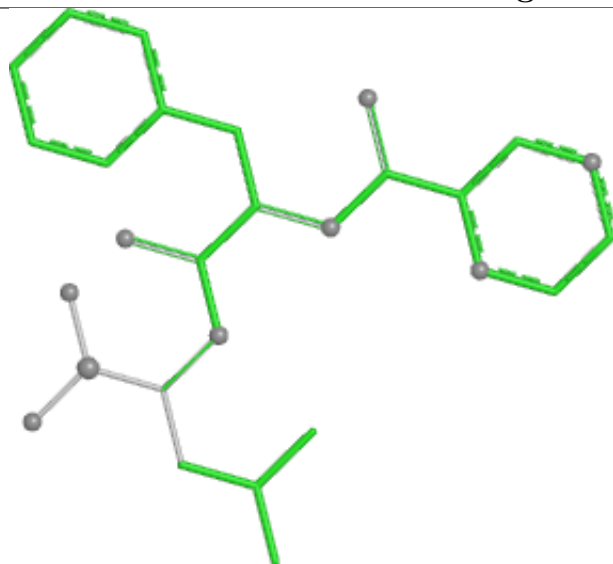


Torsions

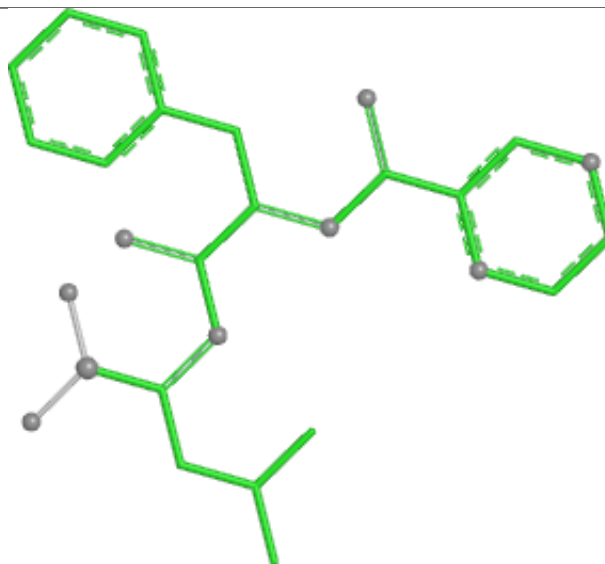


Rings

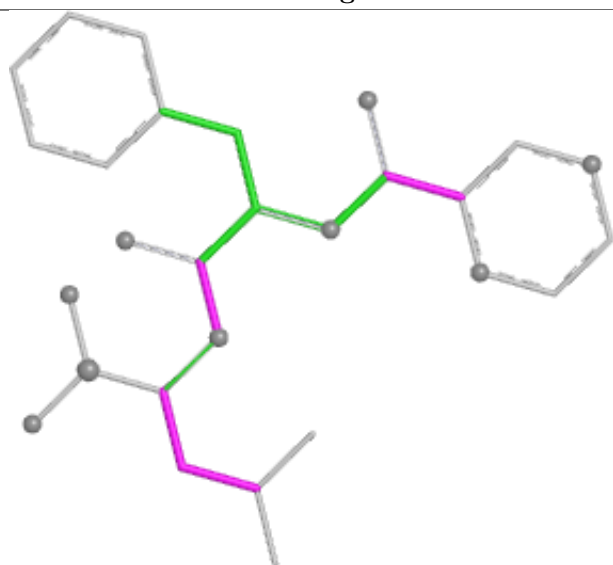
Ligand BO2 T 201



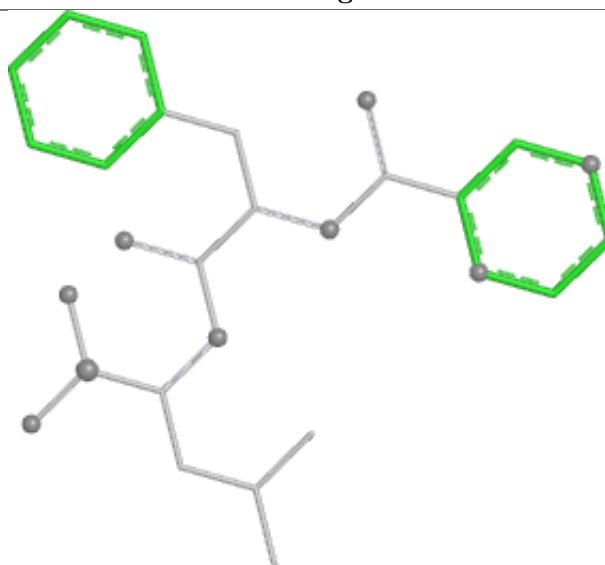
Bond lengths



Bond angles

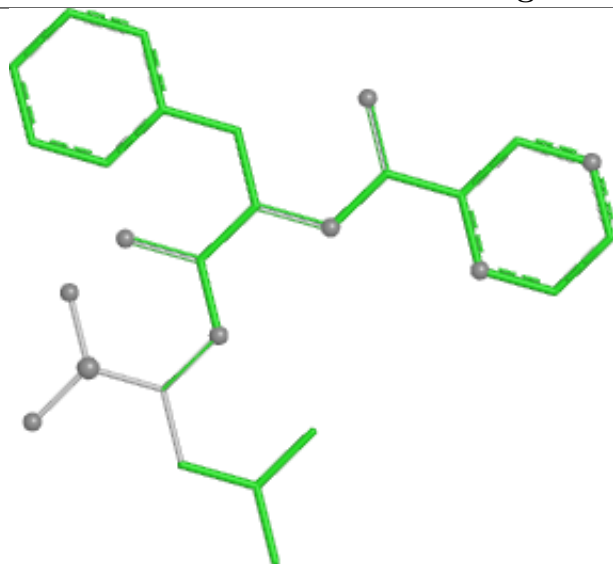


Torsions

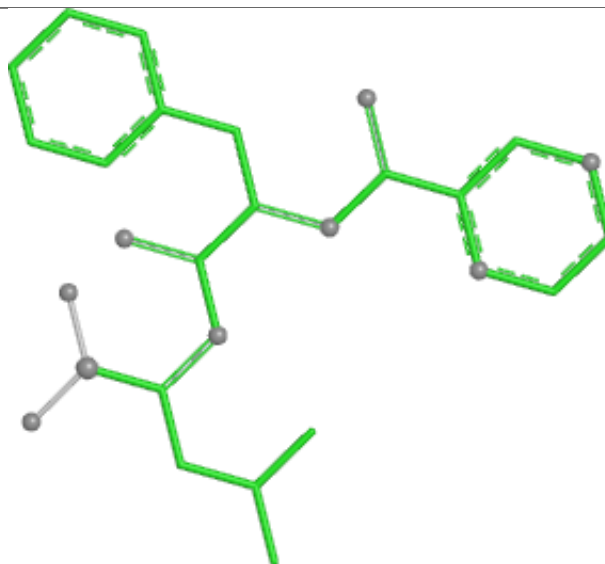


Rings

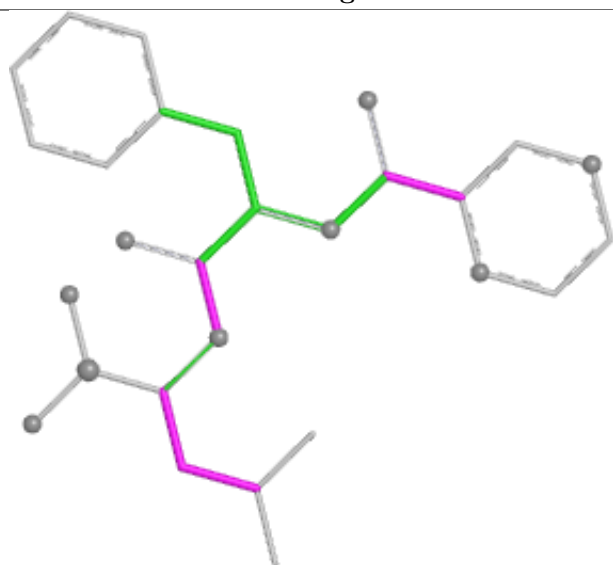
Ligand BO2 P 201



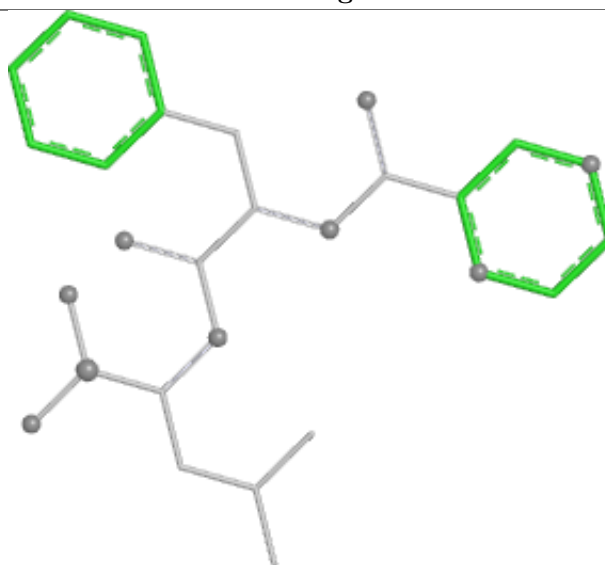
Bond lengths



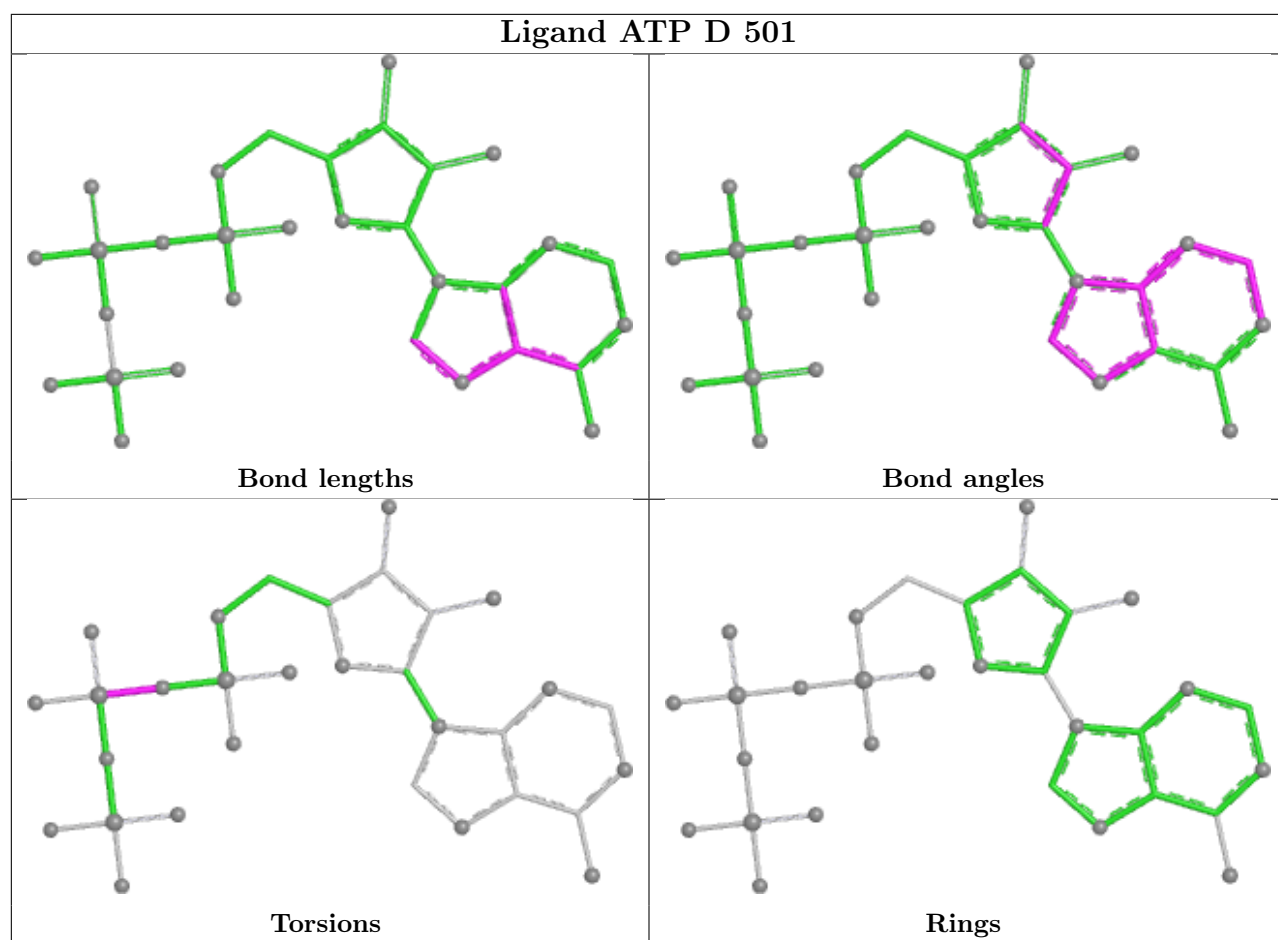
Bond angles



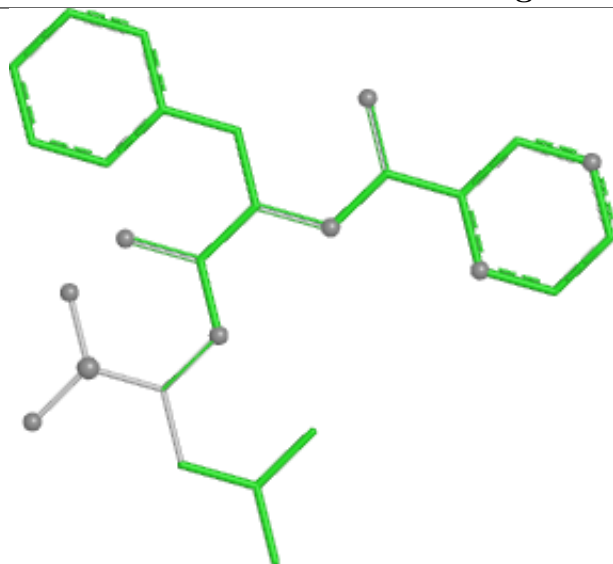
Torsions



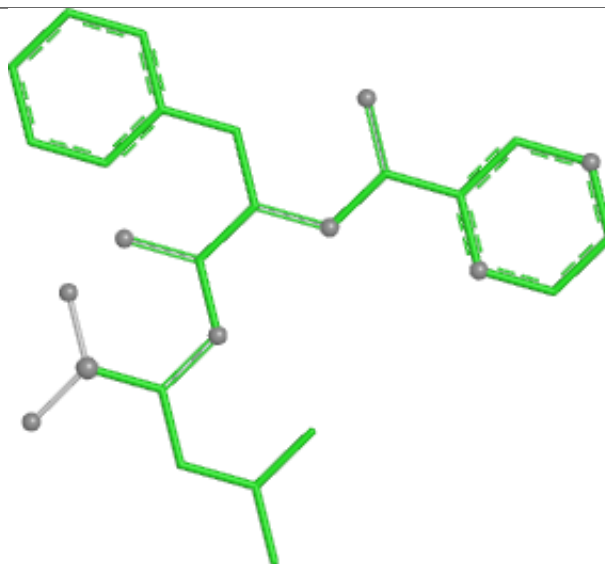
Rings



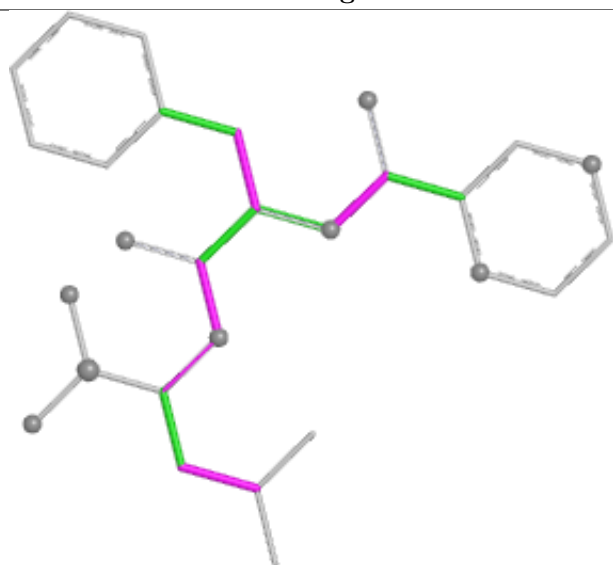
Ligand BO2 N 301



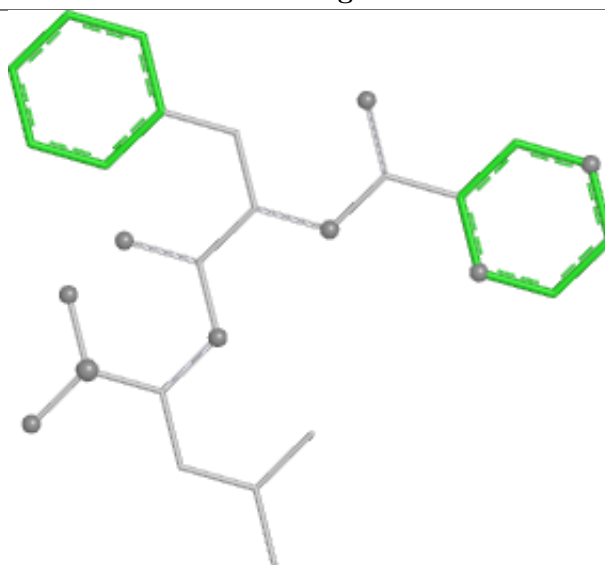
Bond lengths



Bond angles

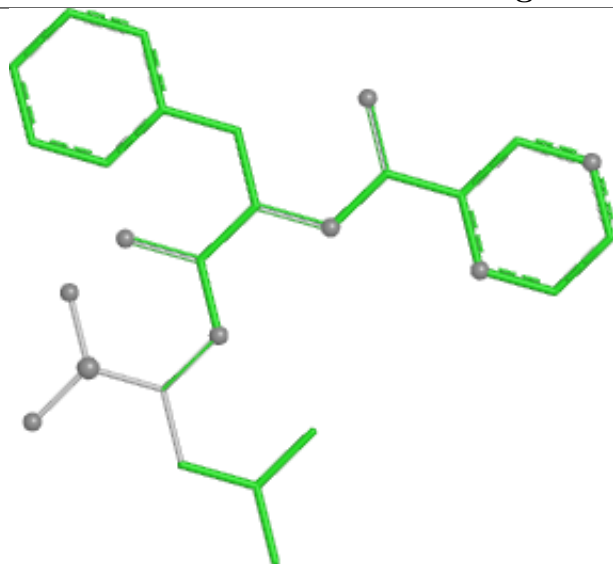


Torsions

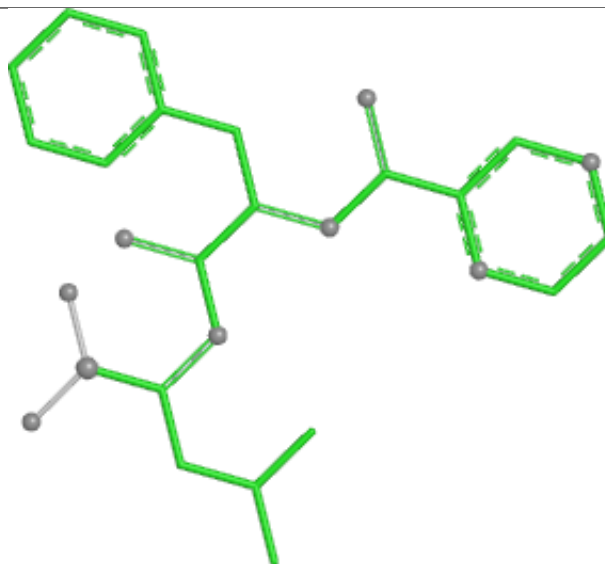


Rings

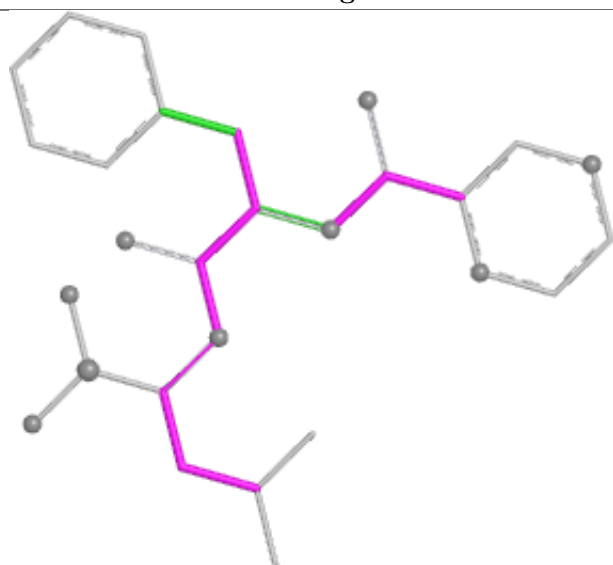
Ligand BO2 V 301



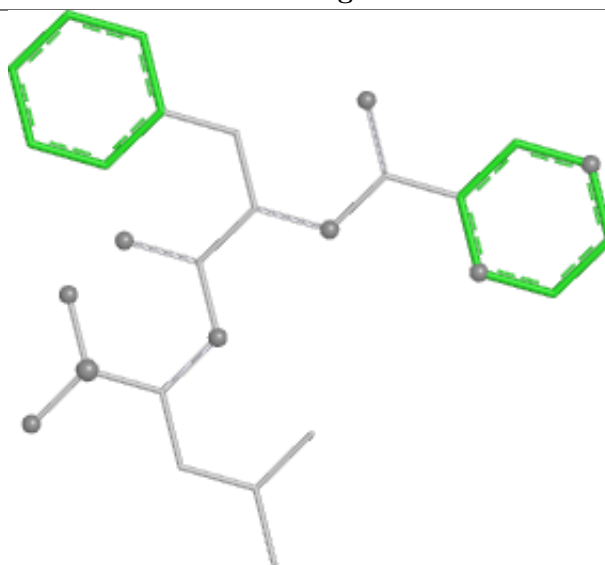
Bond lengths



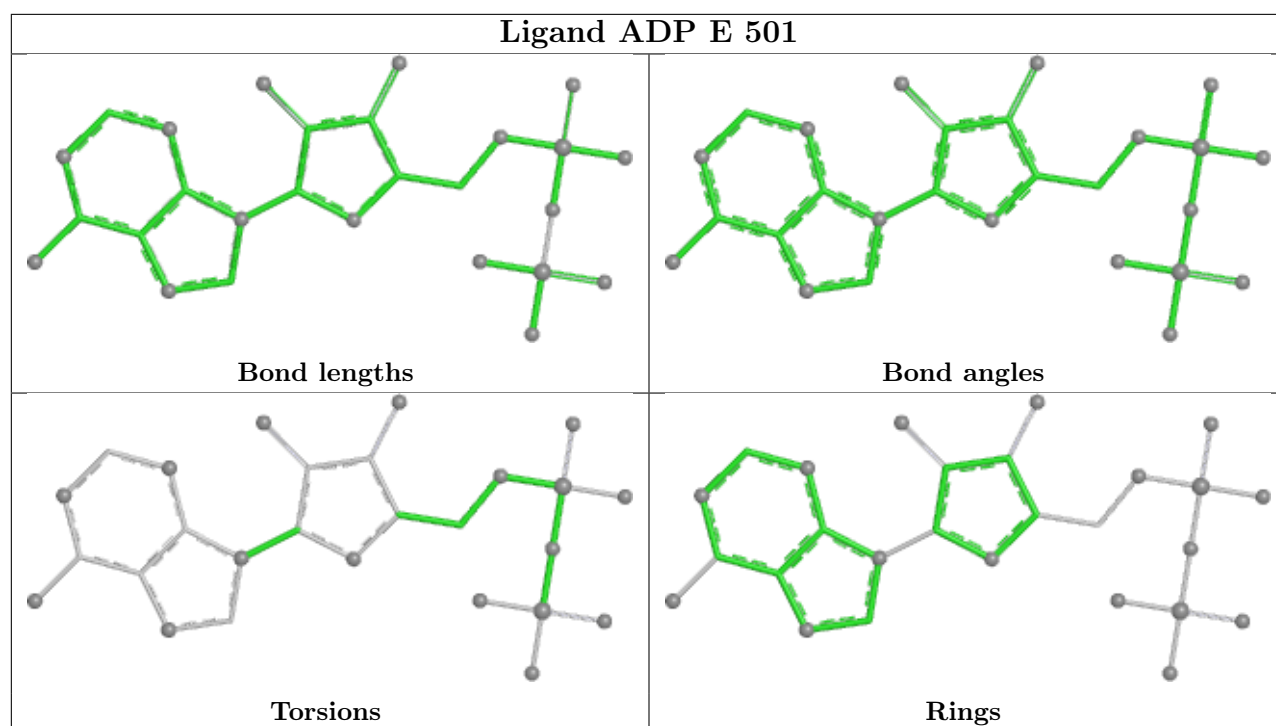
Bond angles



Torsions



Rings



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.

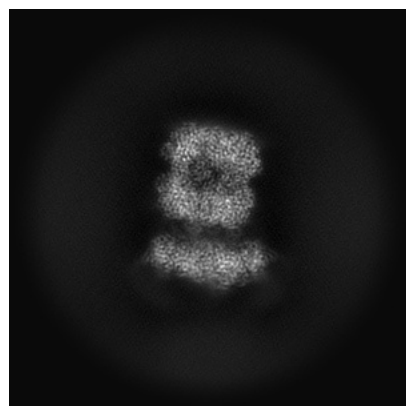
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-39161. These allow visual inspection of the internal detail of the map and identification of artifacts.

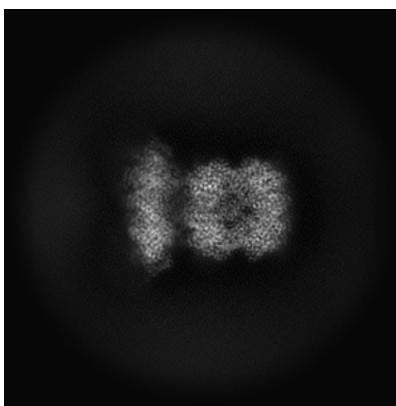
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

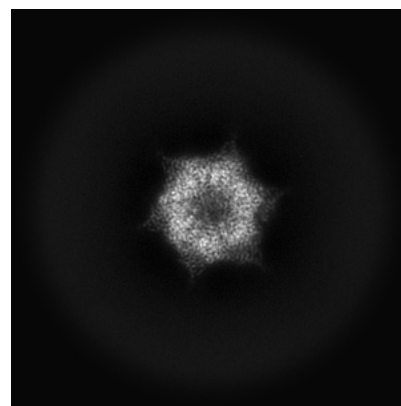
6.1.1 Primary map



X

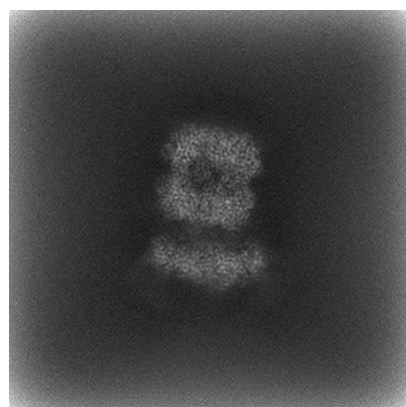


Y

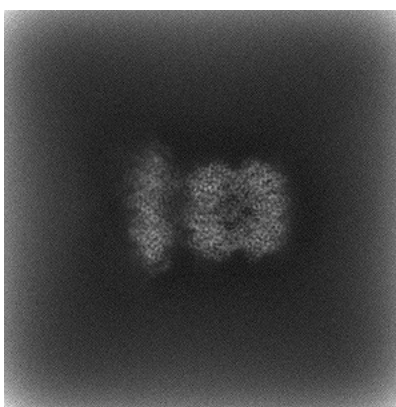


Z

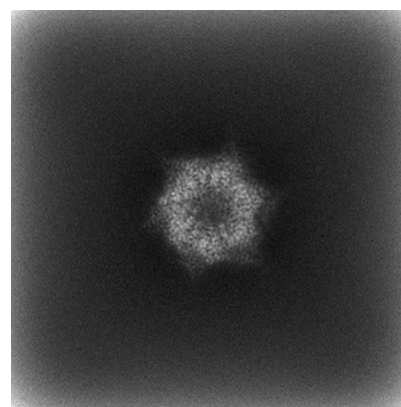
6.1.2 Raw map



X



Y

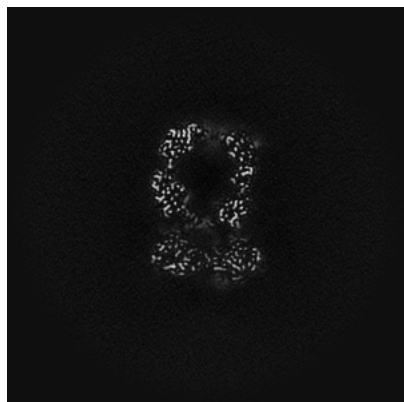


Z

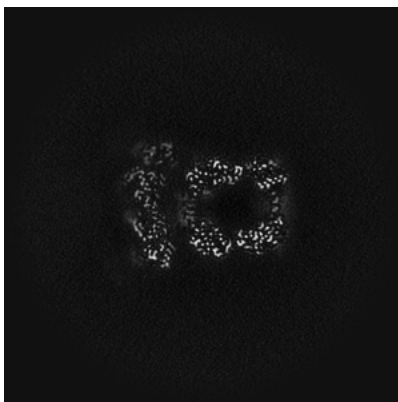
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

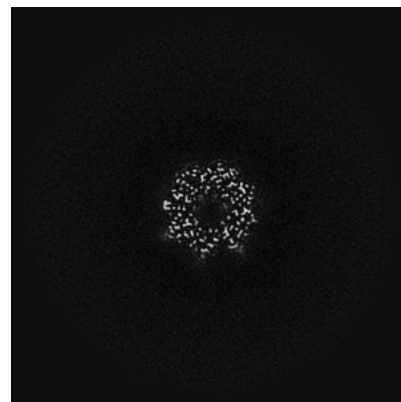
6.2.1 Primary map



X Index: 256

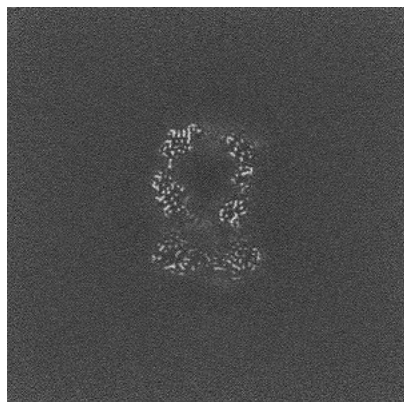


Y Index: 256

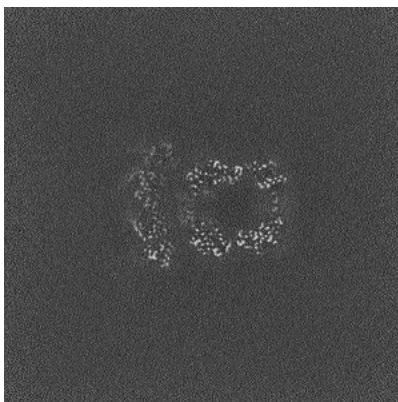


Z Index: 256

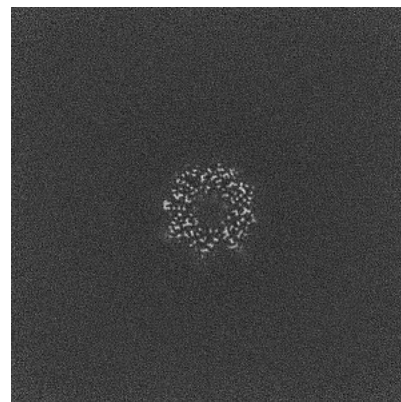
6.2.2 Raw map



X Index: 256



Y Index: 256

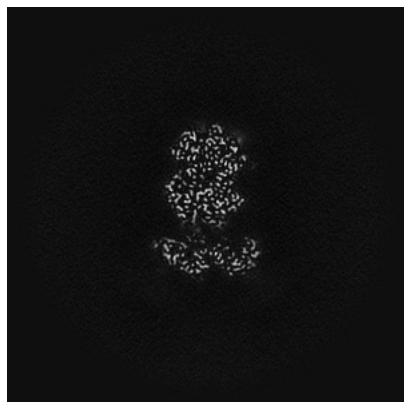


Z Index: 256

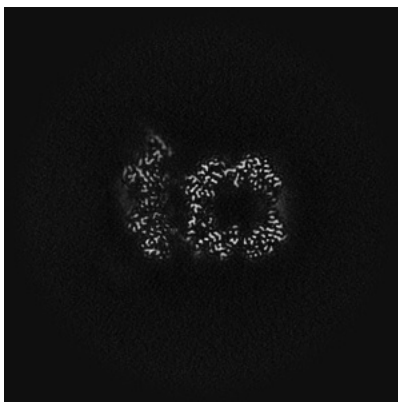
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

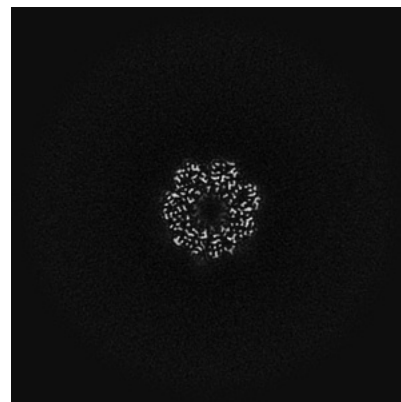
6.3.1 Primary map



X Index: 214

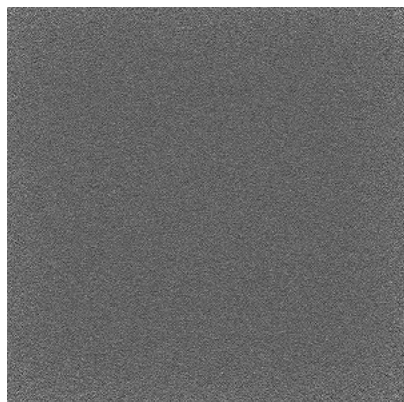


Y Index: 273

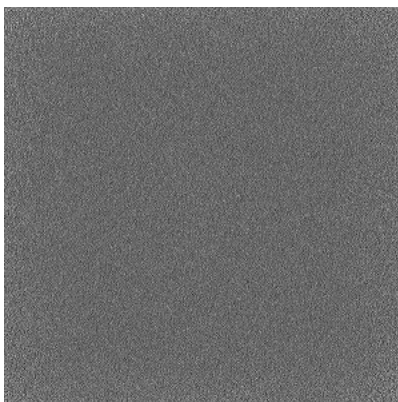


Z Index: 264

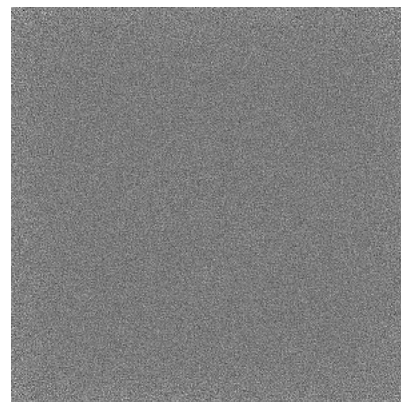
6.3.2 Raw map



X Index: 0



Y Index: 0

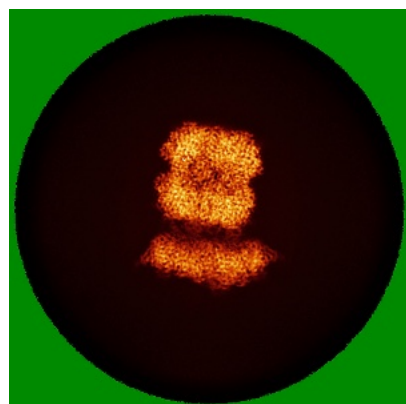


Z Index: 511

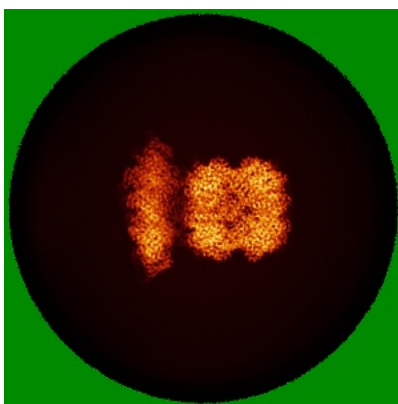
The images above show the largest variance slices of the map in three orthogonal directions.

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

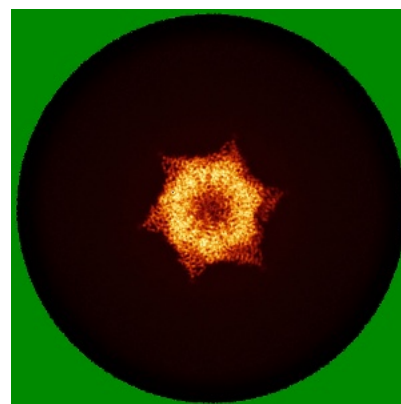
6.4.1 Primary map



X

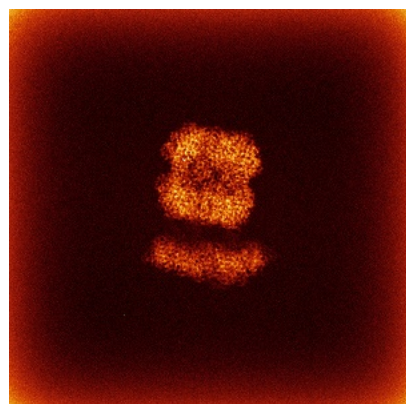


Y

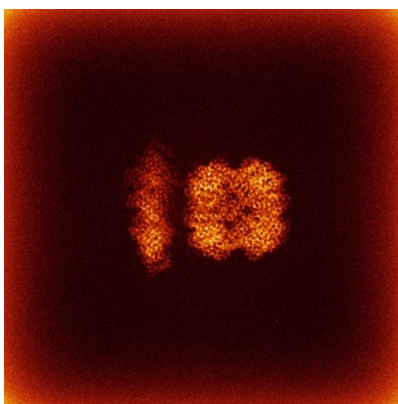


Z

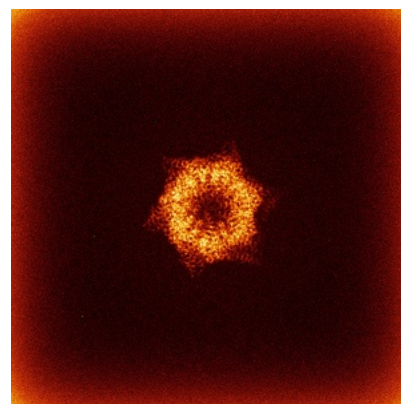
6.4.2 Raw map



X



Y



Z

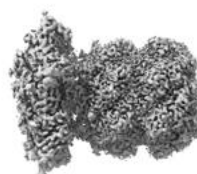
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



X



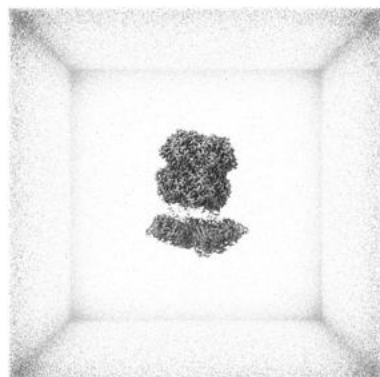
Y



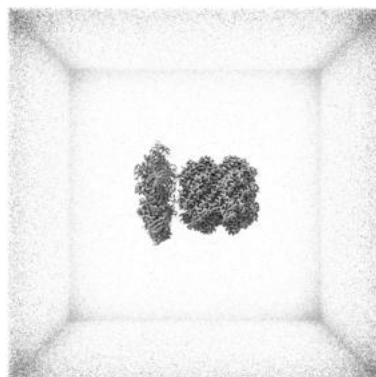
Z

The images above show the 3D surface view of the map at the recommended contour level 0.05. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

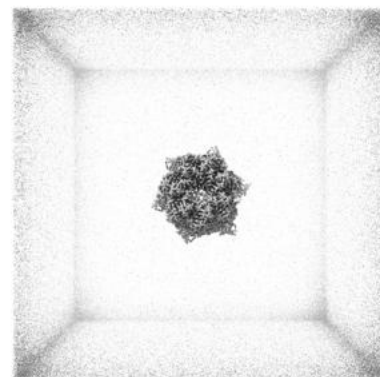
6.5.2 Raw map



X



Y



Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

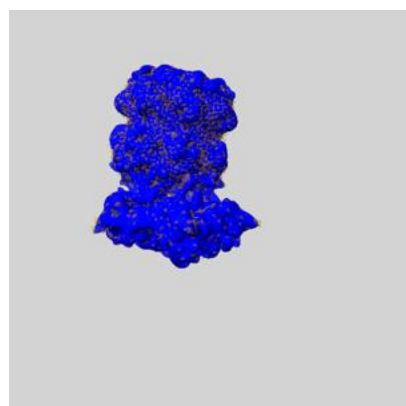
6.6 Mask visualisation [i](#)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

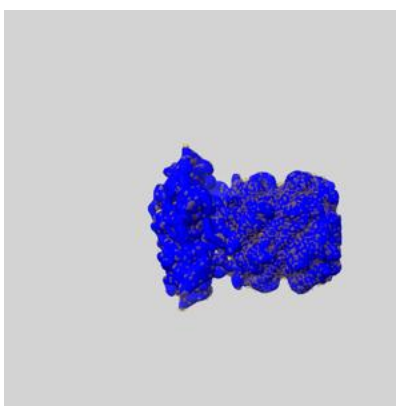
A mask typically either:

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

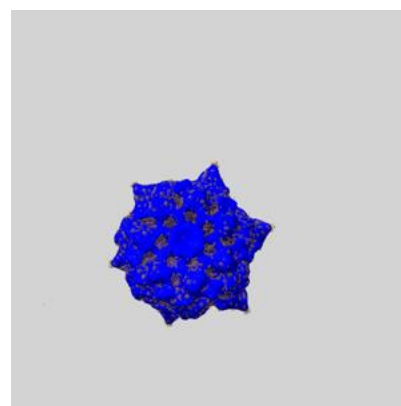
6.6.1 emd_39161_msk_1.map [i](#)



X



Y

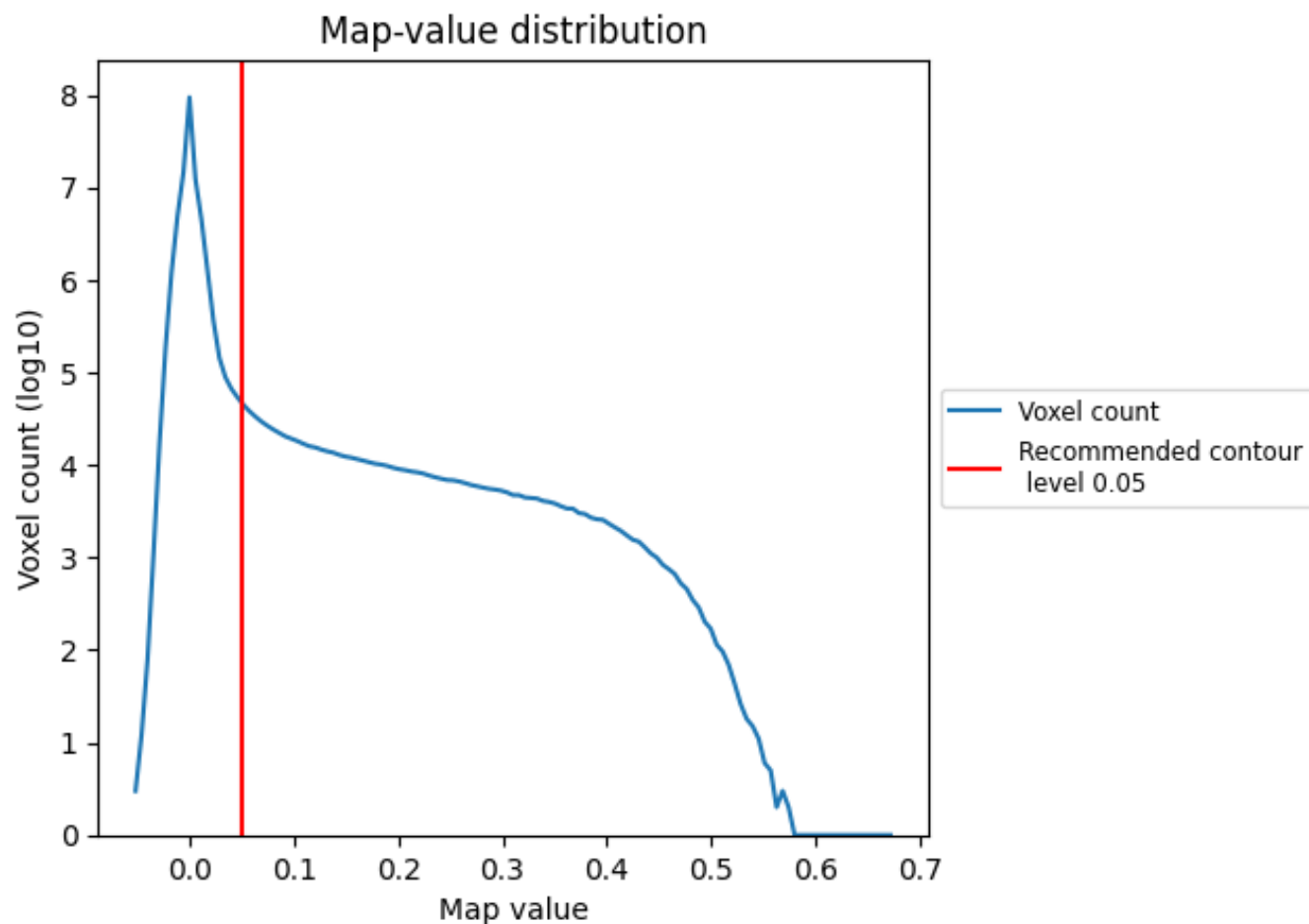


Z

7 Map analysis [i](#)

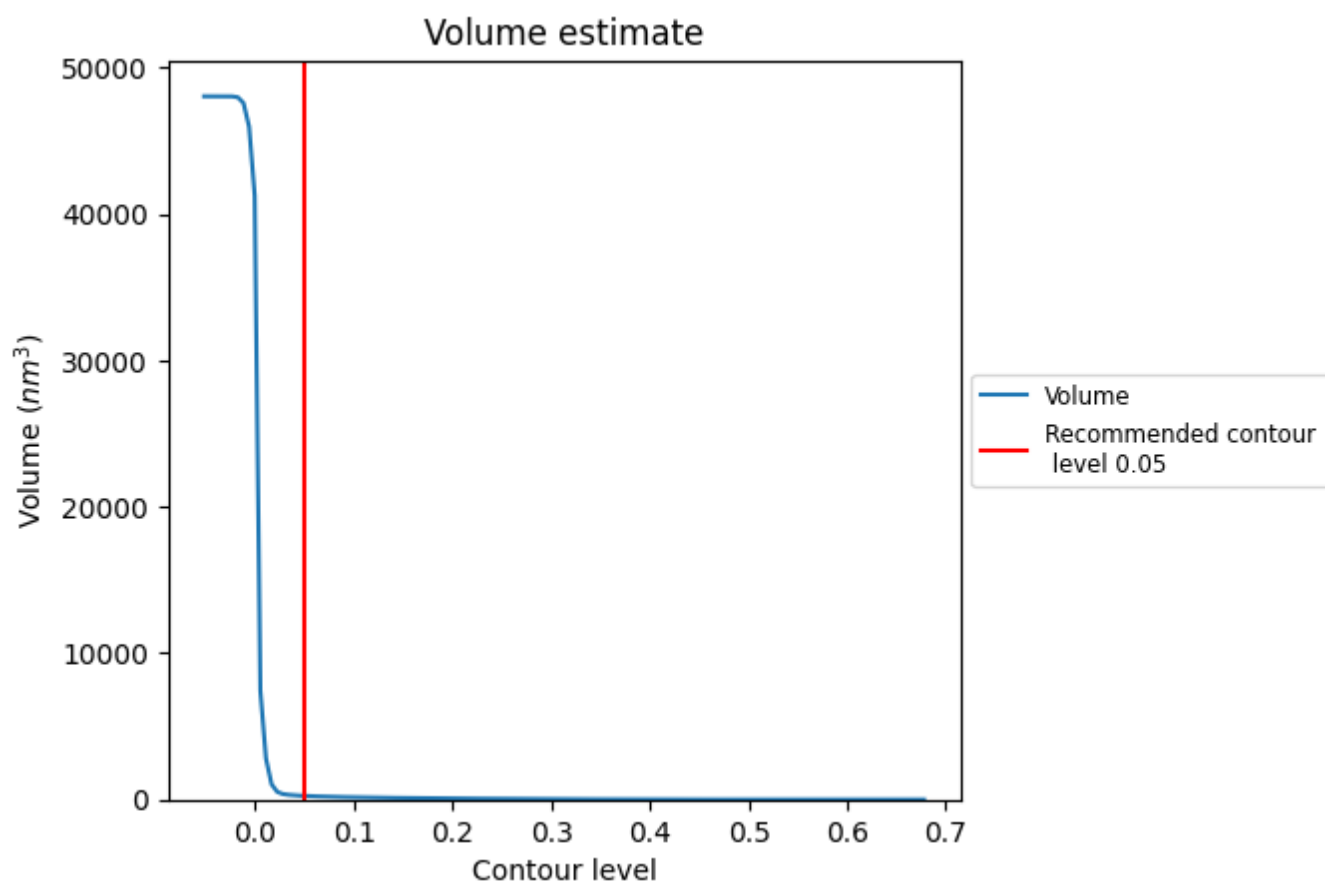
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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

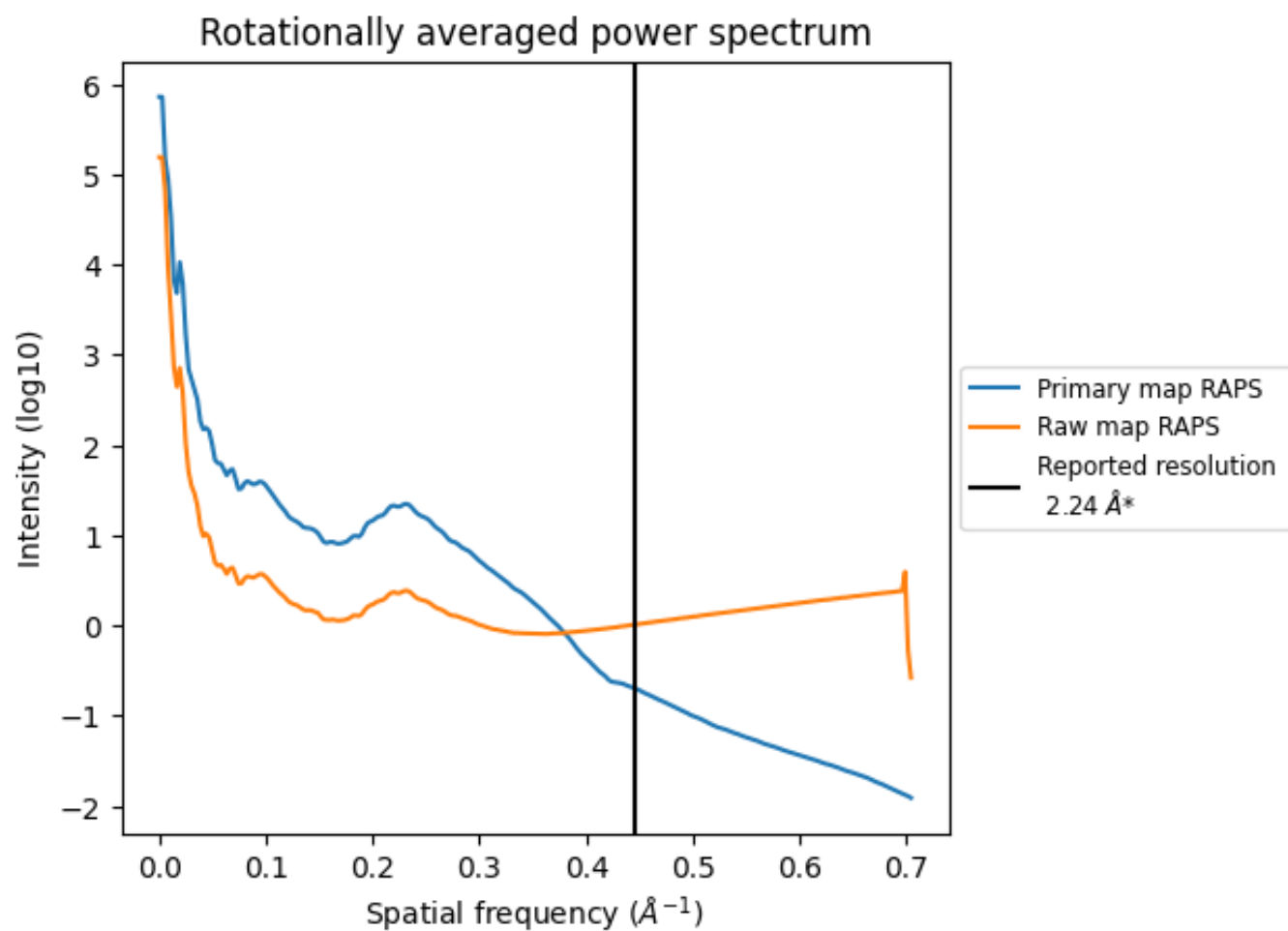
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 250 nm³; this corresponds to an approximate mass of 226 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 ⓘ

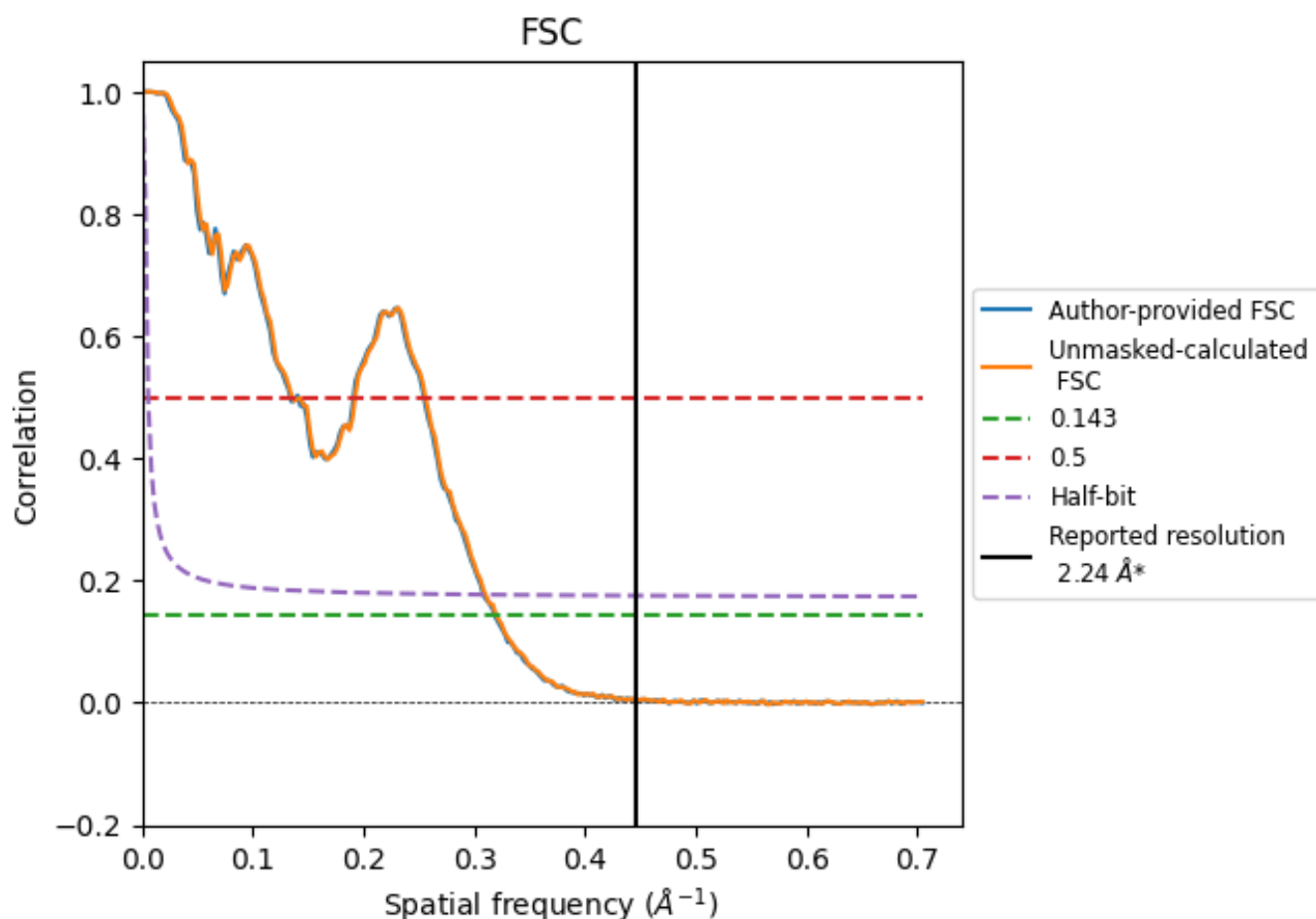


*Reported resolution corresponds to spatial frequency of 0.446 $\text{\AA}^{-1}$

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 $0.446 \text{ \AA}^{-1}$

8.2 Resolution estimates

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.24	-	-
Author-provided FSC curve	3.14	7.47	3.25
Unmasked-calculated*	3.13	7.37	3.23

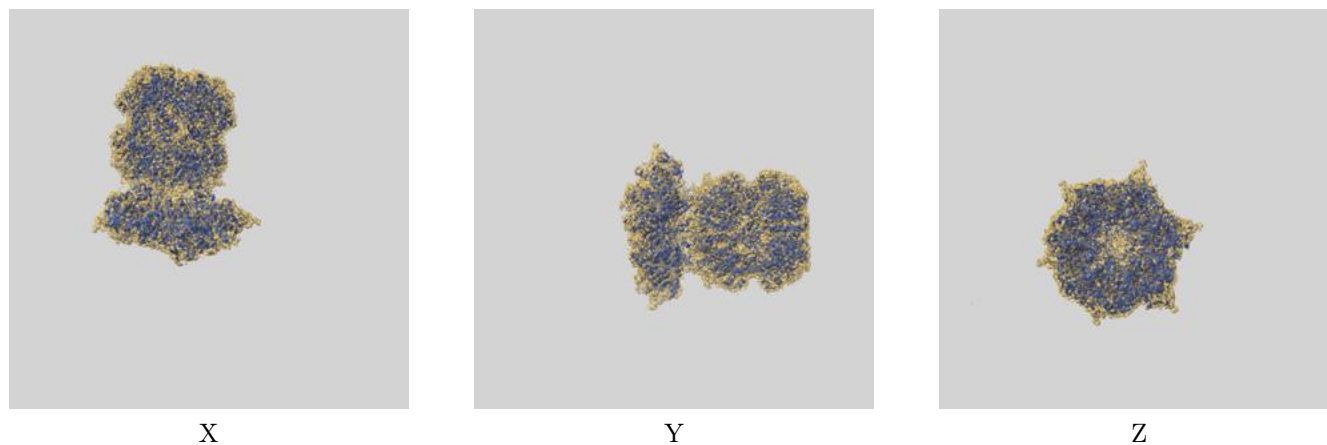
*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from author-provided FSC intersecting FSC 0.143 CUT-OFF 3.14 differs from the reported value 2.24 by more than 10 %

The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 3.13 differs from the reported value 2.24 by more than 10 %

9 Map-model fit [i](#)

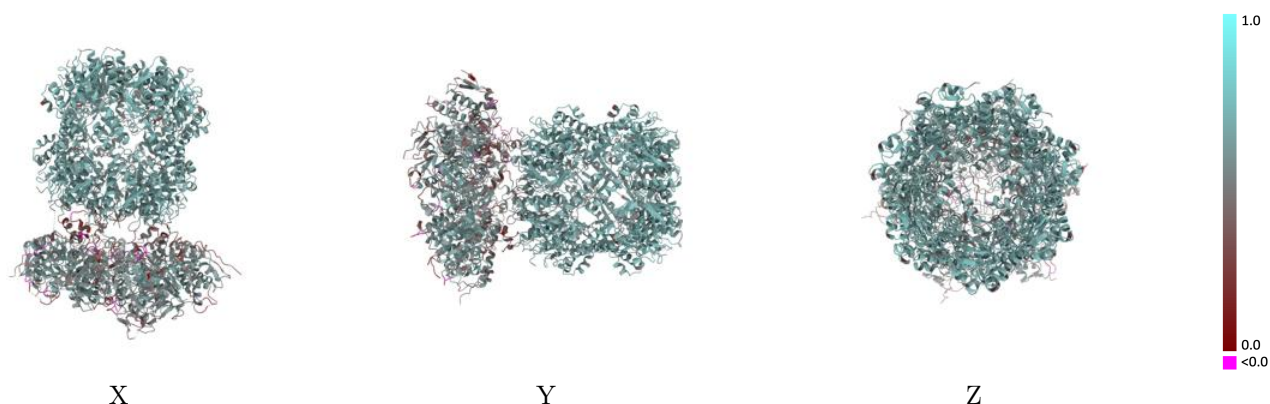
This section contains information regarding the fit between EMDB map EMD-39161 and PDB model 8YD0. Per-residue inclusion information can be found in [section 3](#) on [page 10](#).

9.1 Map-model overlay [i](#)



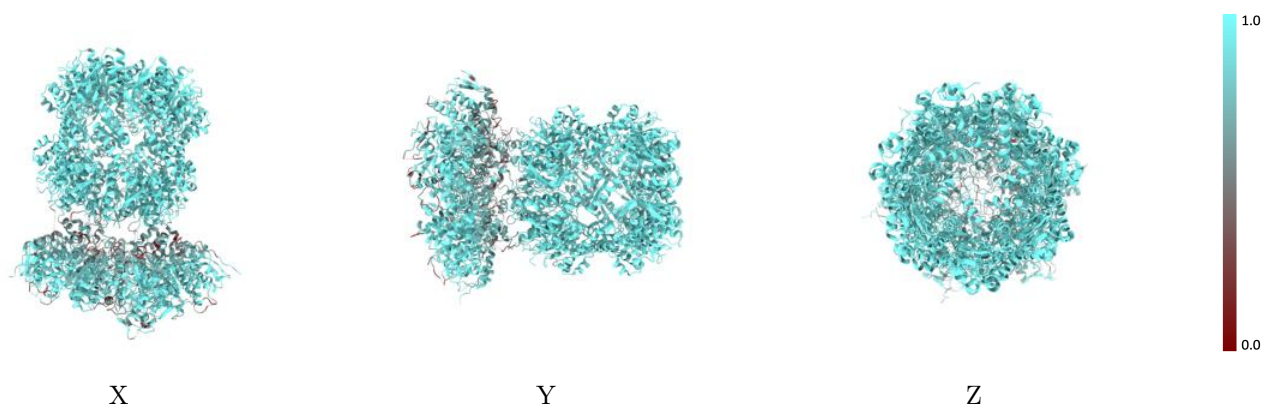
The images above show the 3D surface view of the map at the recommended contour level 0.05 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



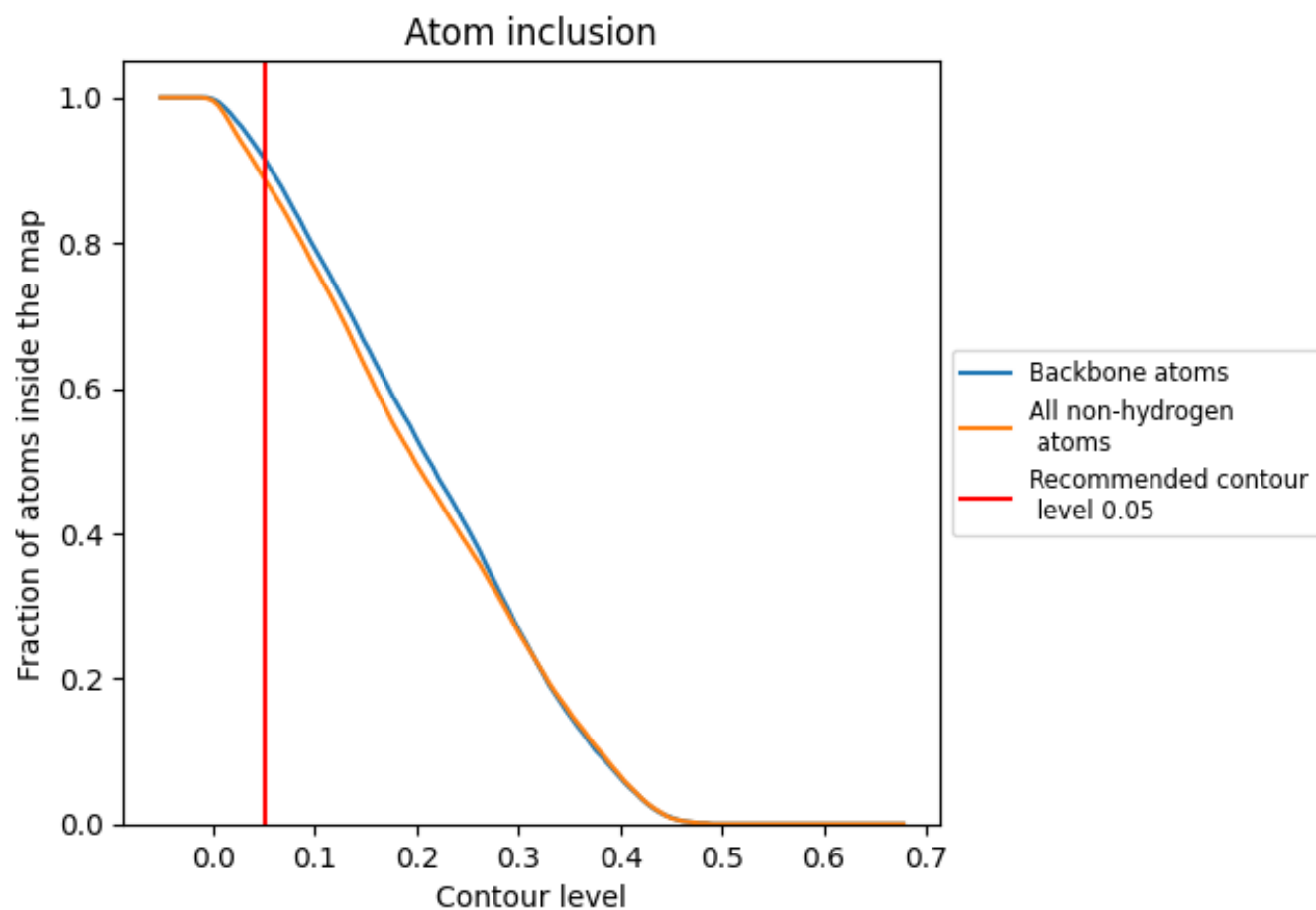
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.05).

9.4 Atom inclusion [i](#)



At the recommended contour level, 92% of all backbone atoms, 89% 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 (0.05) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8890	 0.5670
A	 0.7960	 0.4850
B	 0.8180	 0.5090
C	 0.8400	 0.5070
D	 0.8360	 0.5070
E	 0.8220	 0.5100
F	 0.7040	 0.4250
H	 0.9460	 0.6120
I	 0.9480	 0.6080
K	 0.9670	 0.6340
L	 0.9480	 0.6130
M	 0.9460	 0.6130
N	 0.9610	 0.6190
O	 0.9700	 0.6380
P	 0.9690	 0.6380
Q	 0.9650	 0.6370
R	 0.9680	 0.6380
S	 0.9680	 0.6360
T	 0.9690	 0.6390
U	 0.9690	 0.6370
V	 0.9570	 0.6200

