



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 11:22 AM UTC

PDB ID : 6UFF / pdb\_00006uff  
Title : Structure of Ene-reductase 1 NostocER1 from cyanobacteria  
Authors : Sandoval, B.; Jeffrey, P.D.; Hyster, T.  
Deposited on : 2019-09-24  
Resolution : 2.01 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

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

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>.

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

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Buster-report : wwPDB partial adaption of 1.1.7 (2018)  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

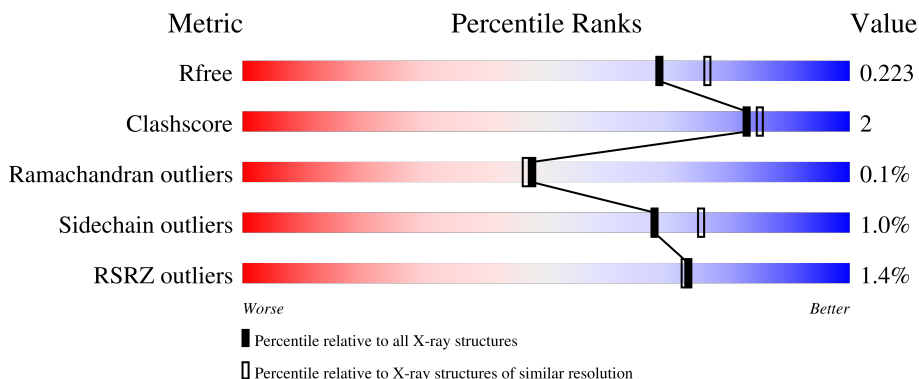
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.01 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)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	180053	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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 electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	410	 2% 82% 6% 12%
1	B	410	 % 80% 6% 13%
1	C	410	 % 82% 5% 12%
1	D	410	 2% 85% • 12%
1	E	410	 % 80% 8% 12%

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Mol	Chain	Length	Quality of chain
1	F	410	 <p>% 83% 5% 12%</p>
1	G	410	 <p>% 83% 5% 13%</p>
1	H	410	 <p>% 81% 5% 13%</p>

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 24102 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 Ene-reductase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	362	2790	1762	493	533	2	0	0	0
1	B	358	2758	1743	488	526	1	0	0	0
1	C	362	2791	1763	494	533	1	0	1	0
1	D	362	2787	1760	493	533	1	0	0	0
1	E	360	2774	1751	491	531	1	0	0	0
1	F	360	2770	1751	490	528	1	0	0	0
1	G	358	2758	1743	488	526	1	0	0	0
1	H	358	2758	1743	488	526	1	0	0	0

There are 64 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	403	LEU	-	expression tag	UNP Q8YVV8
A	404	GLU	-	expression tag	UNP Q8YVV8
A	405	HIS	-	expression tag	UNP Q8YVV8
A	406	HIS	-	expression tag	UNP Q8YVV8
A	407	HIS	-	expression tag	UNP Q8YVV8
A	408	HIS	-	expression tag	UNP Q8YVV8
A	409	HIS	-	expression tag	UNP Q8YVV8
A	410	HIS	-	expression tag	UNP Q8YVV8
B	403	LEU	-	expression tag	UNP Q8YVV8
B	404	GLU	-	expression tag	UNP Q8YVV8
B	405	HIS	-	expression tag	UNP Q8YVV8
B	406	HIS	-	expression tag	UNP Q8YVV8
B	407	HIS	-	expression tag	UNP Q8YVV8

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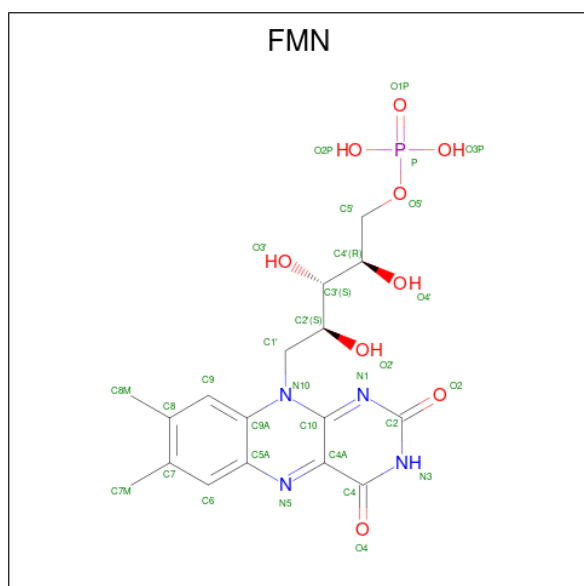
Chain	Residue	Modelled	Actual	Comment	Reference
B	408	HIS	-	expression tag	UNP Q8YVV8
B	409	HIS	-	expression tag	UNP Q8YVV8
B	410	HIS	-	expression tag	UNP Q8YVV8
C	403	LEU	-	expression tag	UNP Q8YVV8
C	404	GLU	-	expression tag	UNP Q8YVV8
C	405	HIS	-	expression tag	UNP Q8YVV8
C	406	HIS	-	expression tag	UNP Q8YVV8
C	407	HIS	-	expression tag	UNP Q8YVV8
C	408	HIS	-	expression tag	UNP Q8YVV8
C	409	HIS	-	expression tag	UNP Q8YVV8
C	410	HIS	-	expression tag	UNP Q8YVV8
D	403	LEU	-	expression tag	UNP Q8YVV8
D	404	GLU	-	expression tag	UNP Q8YVV8
D	405	HIS	-	expression tag	UNP Q8YVV8
D	406	HIS	-	expression tag	UNP Q8YVV8
D	407	HIS	-	expression tag	UNP Q8YVV8
D	408	HIS	-	expression tag	UNP Q8YVV8
D	409	HIS	-	expression tag	UNP Q8YVV8
D	410	HIS	-	expression tag	UNP Q8YVV8
E	403	LEU	-	expression tag	UNP Q8YVV8
E	404	GLU	-	expression tag	UNP Q8YVV8
E	405	HIS	-	expression tag	UNP Q8YVV8
E	406	HIS	-	expression tag	UNP Q8YVV8
E	407	HIS	-	expression tag	UNP Q8YVV8
E	408	HIS	-	expression tag	UNP Q8YVV8
E	409	HIS	-	expression tag	UNP Q8YVV8
E	410	HIS	-	expression tag	UNP Q8YVV8
F	403	LEU	-	expression tag	UNP Q8YVV8
F	404	GLU	-	expression tag	UNP Q8YVV8
F	405	HIS	-	expression tag	UNP Q8YVV8
F	406	HIS	-	expression tag	UNP Q8YVV8
F	407	HIS	-	expression tag	UNP Q8YVV8
F	408	HIS	-	expression tag	UNP Q8YVV8
F	409	HIS	-	expression tag	UNP Q8YVV8
F	410	HIS	-	expression tag	UNP Q8YVV8
G	403	LEU	-	expression tag	UNP Q8YVV8
G	404	GLU	-	expression tag	UNP Q8YVV8
G	405	HIS	-	expression tag	UNP Q8YVV8
G	406	HIS	-	expression tag	UNP Q8YVV8
G	407	HIS	-	expression tag	UNP Q8YVV8
G	408	HIS	-	expression tag	UNP Q8YVV8
G	409	HIS	-	expression tag	UNP Q8YVV8

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Chain	Residue	Modelled	Actual	Comment	Reference
G	410	HIS	-	expression tag	UNP Q8YVV8
H	403	LEU	-	expression tag	UNP Q8YVV8
H	404	GLU	-	expression tag	UNP Q8YVV8
H	405	HIS	-	expression tag	UNP Q8YVV8
H	406	HIS	-	expression tag	UNP Q8YVV8
H	407	HIS	-	expression tag	UNP Q8YVV8
H	408	HIS	-	expression tag	UNP Q8YVV8
H	409	HIS	-	expression tag	UNP Q8YVV8
H	410	HIS	-	expression tag	UNP Q8YVV8

- Molecule 2 is FLAVIN MONONUCLEOTIDE (CCD ID: FMN) (formula: C<sub>17</sub>H<sub>21</sub>N<sub>4</sub>O<sub>9</sub>P).



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

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	H	1	31	17	4	9	1	0	0

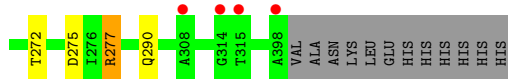
- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Ca		
3	A	2	2	2	0	0
3	B	1	1	1	0	0
3	C	2	2	2	0	0
3	D	2	2	2	0	0
3	E	2	2	2	0	0
3	F	1	1	1	0	0
3	G	1	1	1	0	0
3	H	1	1	1	0	0

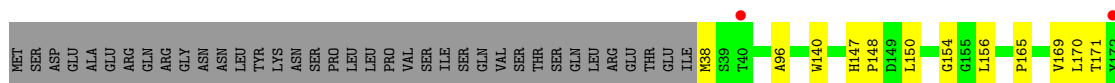
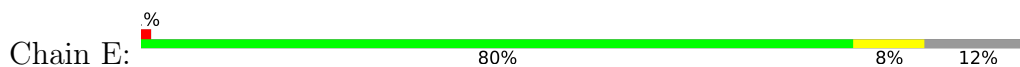
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	208	208	208	0	0
4	B	209	209	209	0	0
4	C	239	239	239	0	0
4	D	214	214	214	0	0
4	E	194	194	194	0	0
4	F	202	202	202	0	0
4	G	192	192	192	0	0
4	H	198	198	198	0	0

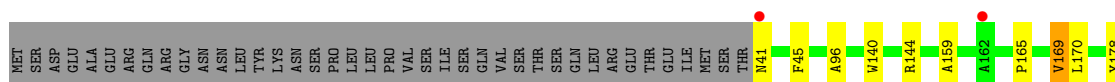
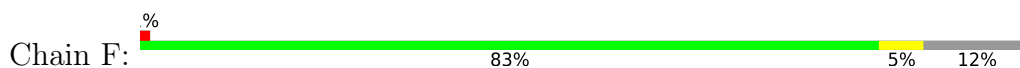




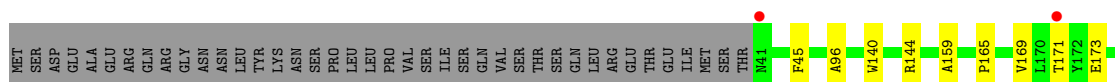
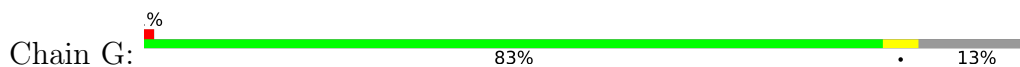
- Molecule 1: Ene-reductase 1



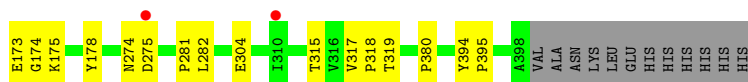
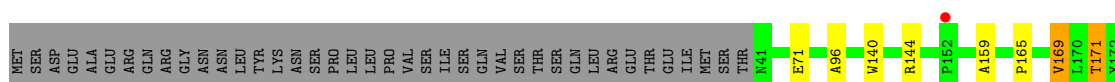
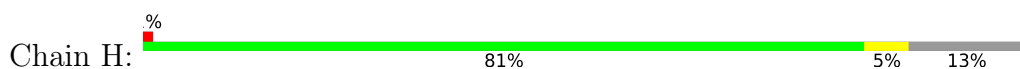
- Molecule 1: Ene-reductase 1



- Molecule 1: Ene-reductase 1



- Molecule 1: Ene-reductase 1



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	81.56Å 95.59Å 99.90Å 66.79° 89.91° 82.58°	Depositor
Resolution (Å)	29.52 – 2.01 29.52 – 2.01	Depositor EDS
% Data completeness (in resolution range)	97.4 (29.52-2.01) 97.4 (29.52-2.01)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.42 (at 2.01Å)	Xtrriage
Refinement program	PHENIX	Depositor
R, $R_{free}$	0.173 , 0.223 0.175 , 0.223	Depositor DCC
$R_{free}$ test set	9137 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.7	Xtrriage
Anisotropy	0.075	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 42.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	24102	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 13.07% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 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: CA, FMN

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	0.38	0/2857	0.72	0/3897
1	B	0.38	0/2825	0.74	1/3854 (0.0%)
1	C	0.39	0/2861	0.72	1/3904 (0.0%)
1	D	0.38	0/2854	0.72	0/3894
1	E	0.37	0/2841	0.73	2/3876 (0.1%)
1	F	0.39	0/2837	0.74	1/3871 (0.0%)
1	G	0.37	0/2825	0.73	0/3854
1	H	0.39	0/2825	0.74	0/3854
All	All	0.38	0/22725	0.73	5/31004 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	394	TYR	CA-C-N	5.41	125.17	119.76
1	E	394	TYR	C-N-CA	5.41	125.17	119.76
1	F	189	ILE	CB-CA-C	-5.21	108.83	114.35
1	C	189	ILE	CB-CA-C	-5.15	108.89	114.35
1	B	189	ILE	CB-CA-C	-5.02	109.03	114.35

There are no chirality outliers.

There are no planarity outliers.

### 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	2790	0	2717	14	0
1	B	2758	0	2681	15	0
1	C	2791	0	2716	13	0
1	D	2787	0	2710	9	0
1	E	2774	0	2694	19	0
1	F	2770	0	2695	15	0
1	G	2758	0	2681	11	0
1	H	2758	0	2681	17	0
2	A	31	0	19	0	0
2	B	31	0	19	0	0
2	C	31	0	19	0	0
2	D	31	0	19	0	0
2	E	31	0	19	0	0
2	F	31	0	19	0	0
2	G	31	0	19	0	0
2	H	31	0	19	1	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
3	C	2	0	0	0	0
3	D	2	0	0	0	0
3	E	2	0	0	0	0
3	F	1	0	0	0	0
3	G	1	0	0	0	0
3	H	1	0	0	0	0
4	A	208	0	0	1	0
4	B	209	0	0	1	0
4	C	239	0	0	3	0
4	D	214	0	0	1	0
4	E	194	0	0	1	0
4	F	202	0	0	1	0
4	G	192	0	0	1	0
4	H	198	0	0	0	0
All	All	24102	0	21727	106	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 2.

All (106) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:171:THR:HG22	1:H:173:GLU:H	1.41	0.86
1:G:171:THR:HG22	1:G:173:GLU:H	1.46	0.78

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:171:THR:HG22	1:C:173:GLU:H	1.48	0.78
1:F:144:ARG:HH22	1:F:275:ASP:HB3	1.52	0.74
1:C:275:ASP:OD1	1:C:277:ARG:NH2	2.21	0.73
1:H:144:ARG:HH22	1:H:275:ASP:HB3	1.52	0.73
1:B:144:ARG:HH22	1:B:275:ASP:HB3	1.54	0.72
1:E:281:PRO:HG2	1:E:315:THR:HB	1.71	0.70
1:G:144:ARG:HH22	1:G:275:ASP:HB3	1.61	0.66
1:E:38:MET:N	4:E:601:HOH:O	2.28	0.65
1:G:165:PRO:HG2	1:G:178:TYR:CG	2.35	0.61
1:C:39:SER:N	4:C:602:HOH:O	2.32	0.61
1:C:165:PRO:HG2	1:C:178:TYR:CG	2.36	0.60
1:G:185:ASP:HB2	1:G:188:GLU:HG3	1.84	0.59
1:C:96:ALA:HB1	1:C:140:TRP:CD2	2.37	0.59
1:F:165:PRO:HG2	1:F:178:TYR:CG	2.39	0.58
1:D:275:ASP:OD1	1:D:277:ARG:NH2	2.33	0.58
1:B:281:PRO:HG2	1:B:315:THR:HB	1.86	0.56
1:C:294:ARG:NE	4:C:606:HOH:O	2.38	0.55
1:F:96:ALA:HB1	1:F:140:TRP:CD2	2.41	0.55
1:D:96:ALA:HB1	1:D:140:TRP:CD2	2.41	0.55
1:H:96:ALA:HB1	1:H:140:TRP:CD2	2.42	0.55
1:B:165:PRO:HG2	1:B:178:TYR:CD1	2.42	0.54
1:E:96:ALA:HB1	1:E:140:TRP:CD2	2.42	0.54
1:E:165:PRO:HG2	1:E:178:TYR:CG	2.43	0.53
1:F:41:ASN:N	4:F:605:HOH:O	2.42	0.53
1:D:169:VAL:HB	1:D:178:TYR:CE1	2.44	0.53
1:A:96:ALA:HB1	1:A:140:TRP:CD2	2.44	0.52
1:C:144:ARG:HB3	1:C:159:ALA:HB2	1.92	0.52
1:E:248:LEU:HD13	1:E:294:ARG:HH21	1.73	0.52
1:G:165:PRO:HG2	1:G:178:TYR:CD1	2.45	0.51
1:E:169:VAL:HB	1:E:178:TYR:CE1	2.45	0.51
1:G:96:ALA:HB1	1:G:140:TRP:CD2	2.46	0.51
1:A:165:PRO:HG2	1:A:178:TYR:CG	2.45	0.51
1:F:226:ARG:NH2	1:F:268:SER:O	2.43	0.51
1:D:165:PRO:HG2	1:D:178:TYR:CG	2.45	0.50
1:B:96:ALA:HB1	1:B:140:TRP:CD2	2.47	0.50
1:G:144:ARG:HB3	1:G:159:ALA:HB2	1.93	0.50
1:B:331:ILE:HG12	1:B:352:LEU:HB2	1.93	0.50
1:A:376:ASN:ND2	1:A:395:PRO:HD2	2.27	0.49
1:A:281:PRO:HG2	1:A:315:THR:HB	1.95	0.49
1:H:169:VAL:HB	1:H:178:TYR:CE1	2.46	0.49
1:B:282:LEU:HD21	1:B:318:PRO:HD2	1.95	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:187:SER:HB2	1:E:156:LEU:HD11	1.95	0.49
1:C:377:GLN:NE2	4:C:607:HOH:O	2.38	0.48
1:F:281:PRO:HG2	1:F:315:THR:HB	1.96	0.48
1:B:165:PRO:HG2	1:B:178:TYR:CG	2.48	0.48
1:H:165:PRO:HG2	1:H:178:TYR:CD1	2.48	0.48
1:A:310:ILE:HG13	1:A:316:VAL:HG21	1.95	0.47
1:A:148:PRO:O	1:A:154:GLY:HA2	2.14	0.47
1:E:170:LEU:HD21	1:F:380:PRO:HB2	1.95	0.47
1:H:144:ARG:HB3	1:H:159:ALA:HB2	1.97	0.47
1:H:394:TYR:HA	1:H:395:PRO:HD3	1.80	0.46
1:B:122:LYS:NZ	4:B:608:HOH:O	2.47	0.46
1:H:281:PRO:HG2	1:H:315:THR:HB	1.97	0.46
1:A:169:VAL:HB	1:A:178:TYR:CE1	2.50	0.46
1:H:165:PRO:HG2	1:H:178:TYR:CG	2.50	0.46
1:A:338:ARG:NH1	1:A:369:LEU:O	2.49	0.46
1:D:48:TYR:HB2	1:D:58:ARG:HD3	1.97	0.46
1:G:281:PRO:HG2	1:G:315:THR:HB	1.97	0.46
1:F:361:SER:HB3	1:F:378:ALA:HA	1.98	0.45
1:B:144:ARG:HB3	1:B:159:ALA:HB2	1.97	0.45
1:D:227:ASP:O	1:D:231:GLN:NE2	2.50	0.45
1:A:291:ALA:O	1:A:294:ARG:HG2	2.16	0.45
1:E:189:ILE:HG21	1:E:236:TYR:CE1	2.52	0.45
1:E:189:ILE:HG21	1:E:236:TYR:CZ	2.52	0.45
1:G:144:ARG:HH22	1:G:275:ASP:CB	2.29	0.45
1:A:172:TYR:O	1:B:377:GLN:NE2	2.50	0.45
1:E:380:PRO:HB2	1:F:170:LEU:HD11	1.99	0.45
1:H:282:LEU:HD21	1:H:318:PRO:HD2	1.99	0.45
1:H:304:GLU:OE1	1:H:319:THR:OG1	2.23	0.45
1:C:361:SER:HB3	1:C:378:ALA:HA	2.00	0.44
1:D:290:GLN:NE2	4:D:602:HOH:O	2.44	0.44
1:E:148:PRO:O	1:E:154:GLY:HA2	2.17	0.44
1:E:361:SER:HB3	1:E:378:ALA:HA	1.99	0.44
1:E:171:THR:O	1:F:380:PRO:HG3	2.19	0.43
1:E:368:ARG:HG2	1:E:397:LEU:HD11	2.00	0.43
1:B:394:TYR:HA	1:B:395:PRO:HD3	1.82	0.43
1:F:165:PRO:HG2	1:F:178:TYR:CD1	2.52	0.43
1:A:171:THR:O	1:B:380:PRO:HG3	2.18	0.43
1:E:307:ASP:O	1:E:311:ARG:HG3	2.19	0.43
1:E:147:HIS:HB2	1:E:169:VAL:HG11	2.01	0.42
1:F:144:ARG:HB3	1:F:159:ALA:HB2	2.01	0.42
1:D:171:THR:O	1:H:380:PRO:HG3	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:71:GLU:H	1:H:71:GLU:CD	2.28	0.42
1:B:189:ILE:HG21	1:B:236:TYR:CZ	2.54	0.42
1:E:170:LEU:HD13	1:E:175:LYS:HG2	2.02	0.42
1:C:282:LEU:HD21	1:C:318:PRO:HD2	2.02	0.41
1:F:144:ARG:HG2	1:F:223:GLN:CD	2.45	0.41
1:H:171:THR:HB	1:H:174:GLY:O	2.20	0.41
1:D:170:LEU:HD21	1:H:380:PRO:HB2	2.01	0.41
1:B:169:VAL:HB	1:B:178:TYR:CE1	2.56	0.41
1:C:189:ILE:HG21	1:C:236:TYR:CZ	2.56	0.41
1:E:367:GLU:OE1	1:E:367:GLU:N	2.48	0.41
1:G:182:ARG:NH2	4:G:701:HOH:O	2.31	0.41
1:B:43:ASN:HB2	1:B:342:ASP:OD1	2.21	0.41
1:H:175:LYS:HE3	1:H:175:LYS:HB2	1.82	0.41
1:F:45:PHE:CZ	1:F:370:GLU:HA	2.56	0.41
1:G:45:PHE:CZ	1:G:370:GLU:HA	2.56	0.41
1:A:222:ASP:HA	1:A:225:LEU:HD12	2.03	0.40
1:A:394:TYR:HA	1:A:395:PRO:HD3	1.91	0.40
1:C:94:ALA:HB2	1:C:135:ILE:HD11	2.03	0.40
1:A:37:ILE:N	4:A:618:HOH:O	2.53	0.40
1:F:169:VAL:HB	1:F:178:TYR:CE1	2.56	0.40
2:H:501:FMN:HM81	2:H:501:FMN:HM73	1.84	0.40
1:H:282:LEU:HD23	1:H:317:VAL:HG13	2.02	0.40

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 X-ray entries followed by that with respect to entries of similar resolution.

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	360/410 (88%)	350 (97%)	10 (3%)	0	100	100
1	B	356/410 (87%)	344 (97%)	12 (3%)	0	100	100
1	C	361/410 (88%)	348 (96%)	13 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	360/410 (88%)	347 (96%)	13 (4%)	0	100	100
1	E	358/410 (87%)	344 (96%)	13 (4%)	1 (0%)	36	35
1	F	358/410 (87%)	344 (96%)	14 (4%)	0	100	100
1	G	356/410 (87%)	343 (96%)	13 (4%)	0	100	100
1	H	356/410 (87%)	345 (97%)	10 (3%)	1 (0%)	36	35
All	All	2865/3280 (87%)	2765 (96%)	98 (3%)	2 (0%)	48	46

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	313	GLY
1	H	274	ASN

### 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 X-ray entries followed by that with respect to entries of similar resolution.

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	291/336 (87%)	288 (99%)	3 (1%)	68	75
1	B	286/336 (85%)	280 (98%)	6 (2%)	47	52
1	C	290/336 (86%)	287 (99%)	3 (1%)	68	75
1	D	290/336 (86%)	287 (99%)	3 (1%)	68	75
1	E	289/336 (86%)	286 (99%)	3 (1%)	68	75
1	F	287/336 (85%)	286 (100%)	1 (0%)	86	91
1	G	286/336 (85%)	285 (100%)	1 (0%)	86	91
1	H	286/336 (85%)	284 (99%)	2 (1%)	76	82
All	All	2305/2688 (86%)	2283 (99%)	22 (1%)	68	75

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	37	ILE

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Mol	Chain	Res	Type
1	A	166	LYS
1	A	306	ILE
1	B	169	VAL
1	B	179	VAL
1	B	180	THR
1	B	338	ARG
1	B	359	PHE
1	B	397	LEU
1	C	169	VAL
1	C	277	ARG
1	C	399	VAL
1	D	169	VAL
1	D	272	THR
1	D	277	ARG
1	E	150	LEU
1	E	272	THR
1	E	359	PHE
1	F	169	VAL
1	G	169	VAL
1	H	169	VAL
1	H	171	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	198	GLN
1	A	321	HIS
1	A	376	ASN
1	B	131	GLN
1	B	151	GLN
1	B	195	GLN
1	B	333	ASN
1	C	102	GLN
1	C	198	GLN
1	D	198	GLN
1	E	198	GLN
1	E	321	HIS
1	F	151	GLN
1	F	261	GLN
1	F	333	ASN
1	G	290	GLN
1	H	312	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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 20 ligands modelled in this entry, 12 are monoatomic - leaving 8 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
2	FMN	E	501	-	33,33,33	1.05	2 (6%)	48,50,50	1.24	8 (16%)
2	FMN	C	501	-	33,33,33	1.11	2 (6%)	48,50,50	1.33	7 (14%)
2	FMN	G	501	-	33,33,33	1.07	2 (6%)	48,50,50	1.38	7 (14%)
2	FMN	D	501	-	33,33,33	1.05	2 (6%)	48,50,50	1.23	7 (14%)
2	FMN	H	501	-	33,33,33	1.05	2 (6%)	48,50,50	1.27	7 (14%)
2	FMN	F	501	-	33,33,33	1.06	2 (6%)	48,50,50	1.30	8 (16%)
2	FMN	A	501	-	33,33,33	1.03	2 (6%)	48,50,50	1.32	10 (20%)
2	FMN	B	501	-	33,33,33	1.10	2 (6%)	48,50,50	1.22	5 (10%)

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
2	FMN	E	501	-	-	1/18/18/18	0/3/3/3
2	FMN	C	501	-	-	1/18/18/18	0/3/3/3
2	FMN	G	501	-	-	1/18/18/18	0/3/3/3
2	FMN	D	501	-	-	1/18/18/18	0/3/3/3
2	FMN	H	501	-	-	1/18/18/18	0/3/3/3
2	FMN	F	501	-	-	1/18/18/18	0/3/3/3
2	FMN	A	501	-	-	1/18/18/18	0/3/3/3
2	FMN	B	501	-	-	1/18/18/18	0/3/3/3

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	501	FMN	C4A-N5	3.71	1.38	1.30
2	B	501	FMN	C4A-N5	3.66	1.38	1.30
2	F	501	FMN	C4A-N5	3.58	1.38	1.30
2	D	501	FMN	C4A-N5	3.33	1.38	1.30
2	E	501	FMN	C4A-N5	3.32	1.37	1.30
2	H	501	FMN	C4A-N5	3.29	1.37	1.30
2	G	501	FMN	C4A-N5	3.23	1.37	1.30
2	A	501	FMN	C4A-N5	3.13	1.37	1.30
2	B	501	FMN	C10-N1	2.93	1.39	1.33
2	D	501	FMN	C10-N1	2.60	1.38	1.33
2	G	501	FMN	C10-N1	2.56	1.38	1.33
2	A	501	FMN	C10-N1	2.42	1.38	1.33
2	E	501	FMN	C10-N1	2.42	1.38	1.33
2	F	501	FMN	C10-N1	2.40	1.38	1.33
2	C	501	FMN	C10-N1	2.37	1.38	1.33
2	H	501	FMN	C10-N1	2.33	1.37	1.33

All (59) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	G	501	FMN	C4-N3-C2	-3.57	119.30	125.64
2	A	501	FMN	C4-N3-C2	-3.12	120.10	125.64
2	F	501	FMN	C4-N3-C2	-3.11	120.12	125.64
2	H	501	FMN	C4-N3-C2	-3.06	120.21	125.64
2	D	501	FMN	C4-N3-C2	-3.05	120.23	125.64
2	C	501	FMN	C4-N3-C2	-2.96	120.38	125.64
2	C	501	FMN	C9A-C5A-N5	-2.92	119.35	122.45
2	E	501	FMN	C4-N3-C2	-2.84	120.59	125.64
2	B	501	FMN	C4-N3-C2	-2.84	120.60	125.64
2	E	501	FMN	C4A-C10-N10	2.81	120.50	116.48
2	G	501	FMN	C10-C4A-N5	-2.78	119.12	124.81

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	501	FMN	O4-C4-C4A	-2.77	119.23	126.53
2	G	501	FMN	C4A-C4-N3	2.75	120.25	113.25
2	E	501	FMN	C10-C4A-N5	-2.72	119.26	124.81
2	F	501	FMN	C10-C4A-N5	-2.70	119.29	124.81
2	A	501	FMN	C4A-C10-N10	2.70	120.34	116.48
2	G	501	FMN	C4A-C10-N10	2.69	120.34	116.48
2	H	501	FMN	C4A-C10-N10	2.69	120.33	116.48
2	B	501	FMN	C9A-C5A-N5	-2.68	119.61	122.45
2	H	501	FMN	O4-C4-C4A	-2.66	119.51	126.53
2	A	501	FMN	C10-C4A-N5	-2.65	119.41	124.81
2	B	501	FMN	C10-C4A-N5	-2.63	119.44	124.81
2	F	501	FMN	C4A-C10-N10	2.62	120.23	116.48
2	B	501	FMN	C4A-C4-N3	2.59	119.83	113.25
2	G	501	FMN	O4-C4-C4A	-2.58	119.72	126.53
2	C	501	FMN	C10-C4A-N5	-2.58	119.55	124.81
2	C	501	FMN	C4A-C10-N10	2.56	120.14	116.48
2	D	501	FMN	C4A-C4-N3	2.55	119.75	113.25
2	C	501	FMN	C4A-C4-N3	2.54	119.72	113.25
2	F	501	FMN	O4-C4-C4A	-2.53	119.85	126.53
2	F	501	FMN	C4'-C3'-C2'	-2.53	109.36	113.57
2	C	501	FMN	C5A-C9A-N10	2.53	120.25	117.97
2	G	501	FMN	C9A-C5A-N5	-2.52	119.78	122.45
2	F	501	FMN	C4A-C4-N3	2.46	119.51	113.25
2	C	501	FMN	O4-C4-C4A	-2.44	120.09	126.53
2	H	501	FMN	C4A-C4-N3	2.43	119.44	113.25
2	A	501	FMN	O4-C4-C4A	-2.41	120.17	126.53
2	A	501	FMN	C4A-C4-N3	2.41	119.38	113.25
2	D	501	FMN	C4A-C10-N10	2.39	119.90	116.48
2	H	501	FMN	C10-C4A-N5	-2.37	119.97	124.81
2	D	501	FMN	C10-C4A-N5	-2.35	120.00	124.81
2	F	501	FMN	C9A-C5A-N5	-2.33	119.99	122.45
2	B	501	FMN	C4A-C10-N10	2.31	119.79	116.48
2	A	501	FMN	C9A-C5A-N5	-2.31	120.00	122.45
2	E	501	FMN	C4A-C4-N3	2.30	119.11	113.25
2	E	501	FMN	C9A-C5A-N5	-2.28	120.04	122.45
2	H	501	FMN	C9A-C5A-N5	-2.28	120.04	122.45
2	G	501	FMN	C4A-C10-N1	-2.21	119.17	124.59
2	H	501	FMN	C1'-C2'-C3'	2.21	115.65	109.66
2	D	501	FMN	C9A-C5A-N5	-2.18	120.14	122.45
2	E	501	FMN	C4A-C10-N1	-2.17	119.26	124.59
2	A	501	FMN	C4'-C3'-C2'	-2.17	109.96	113.57
2	E	501	FMN	O4-C4-C4A	-2.17	120.81	126.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	FMN	C4A-C10-N1	-2.13	119.36	124.59
2	D	501	FMN	C4A-C10-N1	-2.13	119.36	124.59
2	A	501	FMN	C1'-C2'-C3'	2.11	115.39	109.66
2	E	501	FMN	C4-C4A-C10	2.11	120.55	116.93
2	A	501	FMN	C4-C4A-C10	2.08	120.50	116.93
2	F	501	FMN	C4A-C10-N1	-2.06	119.54	124.59

There are no chirality outliers.

All (8) torsion outliers are listed below:

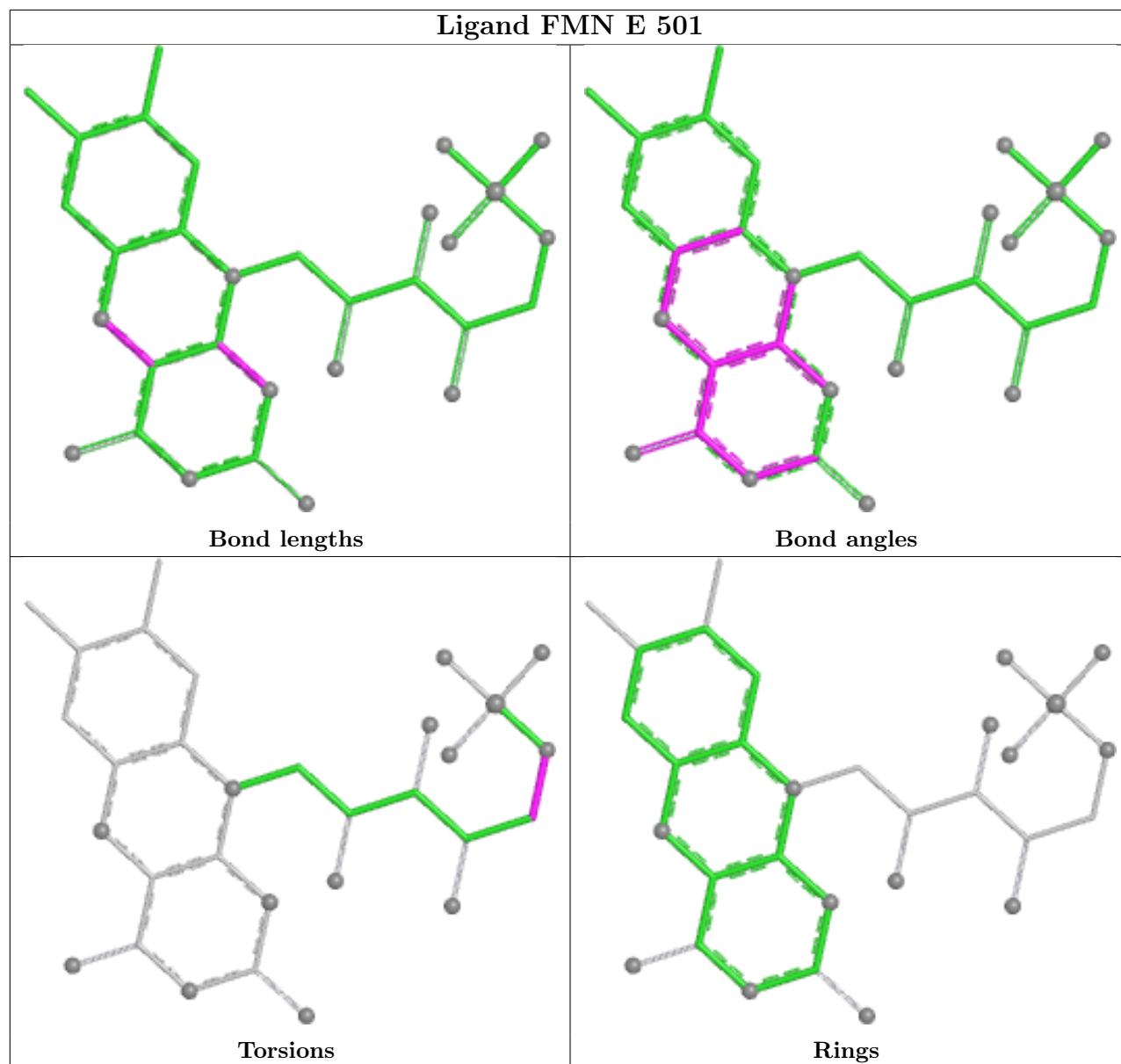
Mol	Chain	Res	Type	Atoms
2	E	501	FMN	C4'-C5'-O5'-P
2	C	501	FMN	C4'-C5'-O5'-P
2	G	501	FMN	C4'-C5'-O5'-P
2	A	501	FMN	C4'-C5'-O5'-P
2	B	501	FMN	C4'-C5'-O5'-P
2	D	501	FMN	C4'-C5'-O5'-P
2	F	501	FMN	C4'-C5'-O5'-P
2	H	501	FMN	C4'-C5'-O5'-P

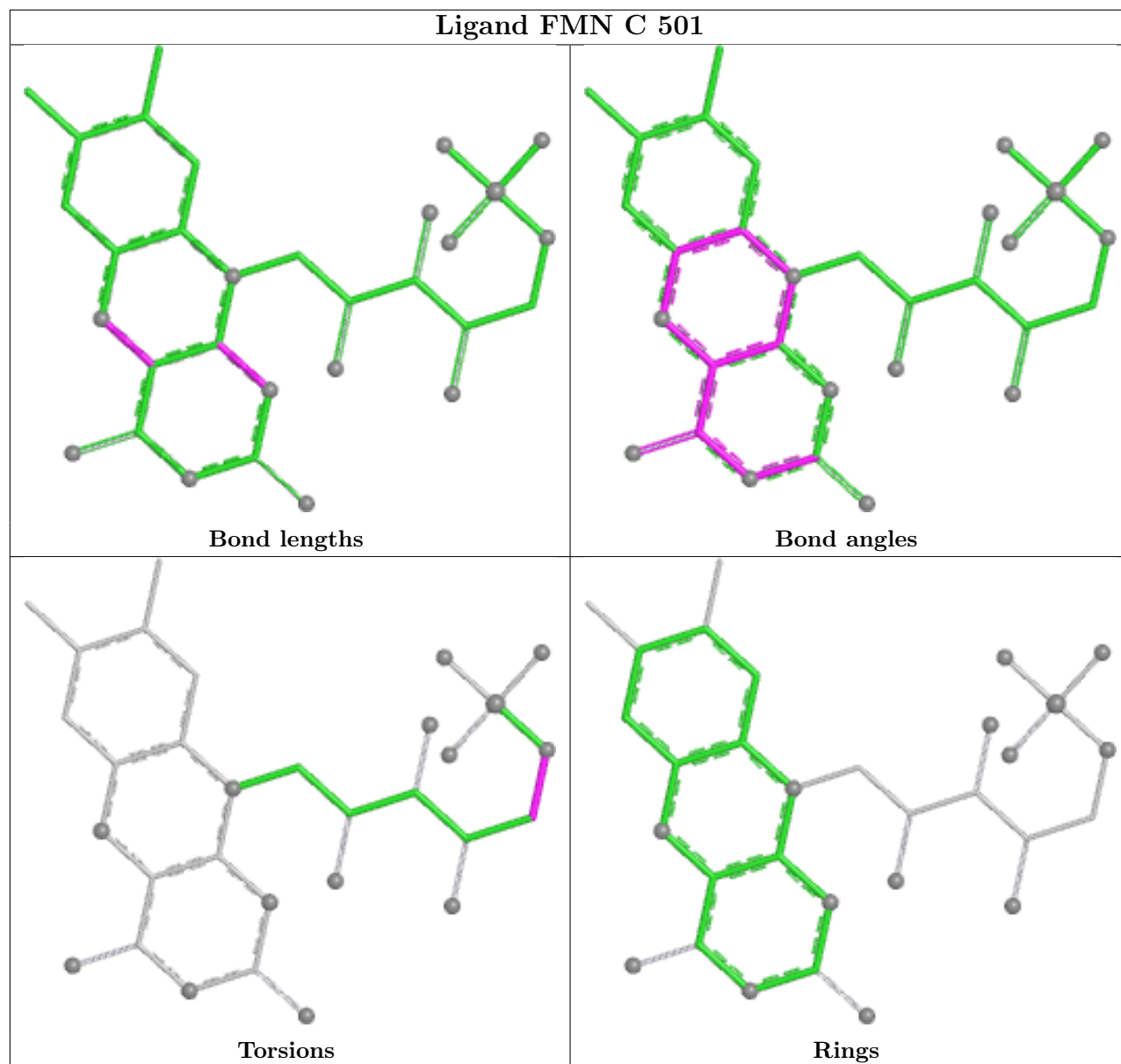
There are no ring outliers.

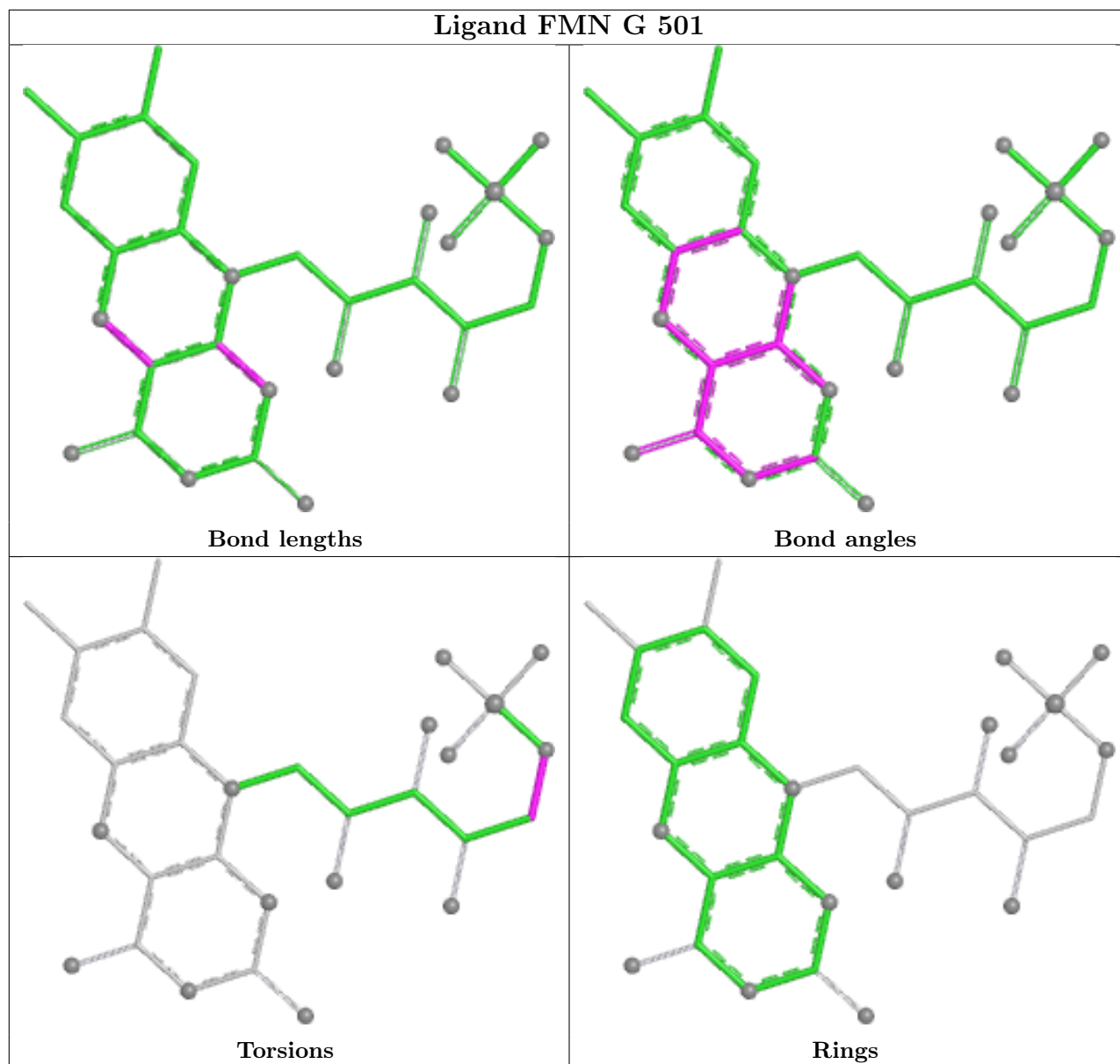
1 monomer is involved in 1 short contact:

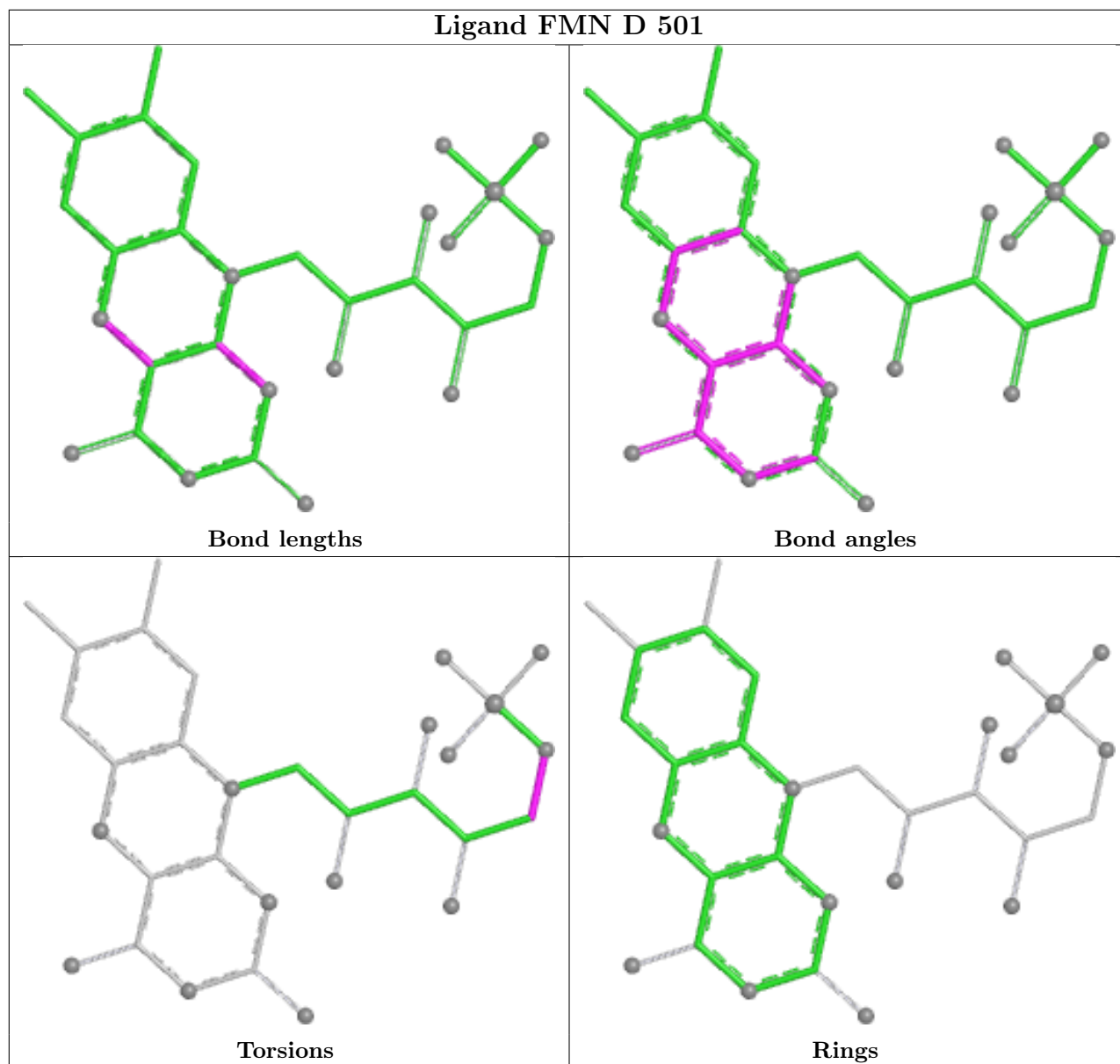
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	H	501	FMN	1	0

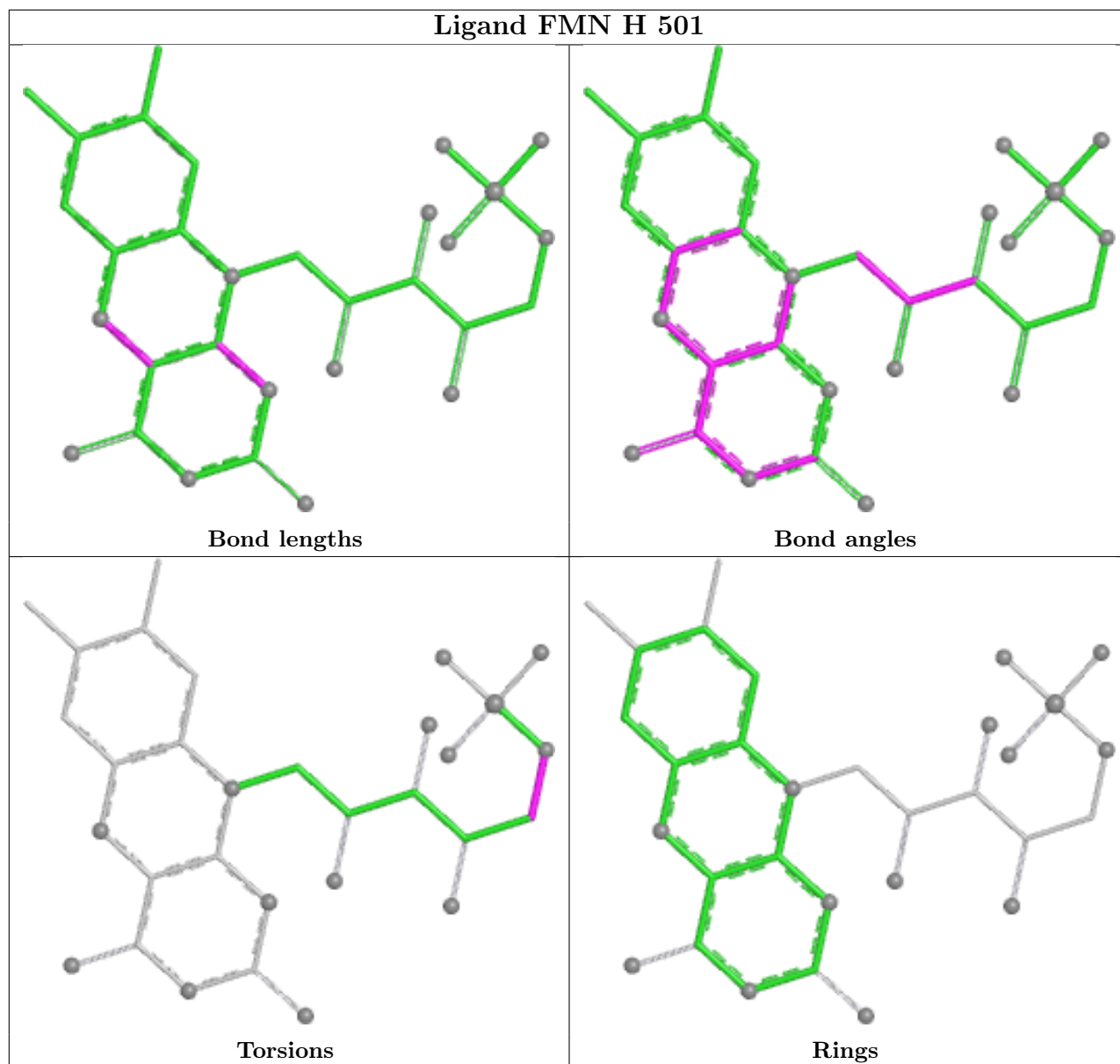
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

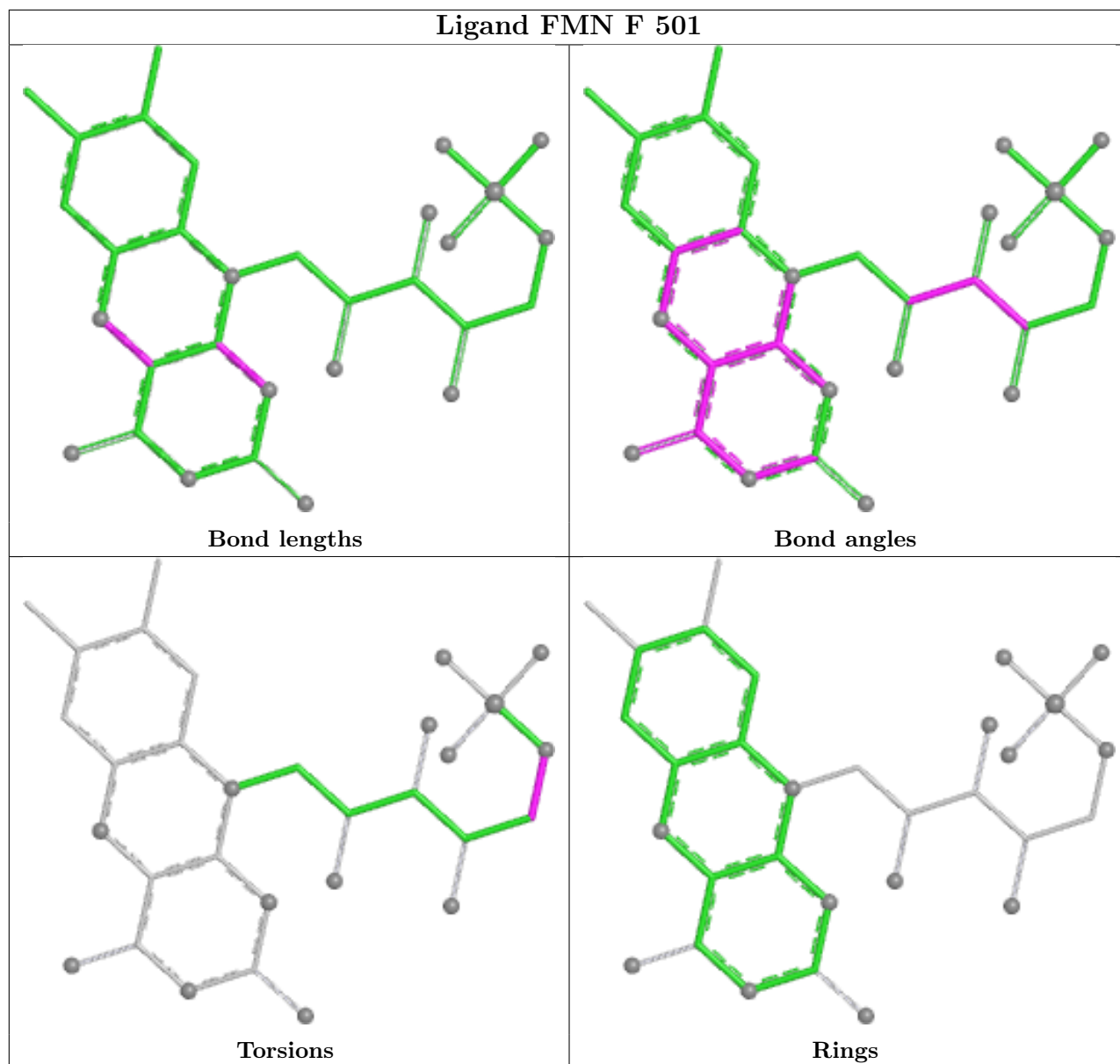


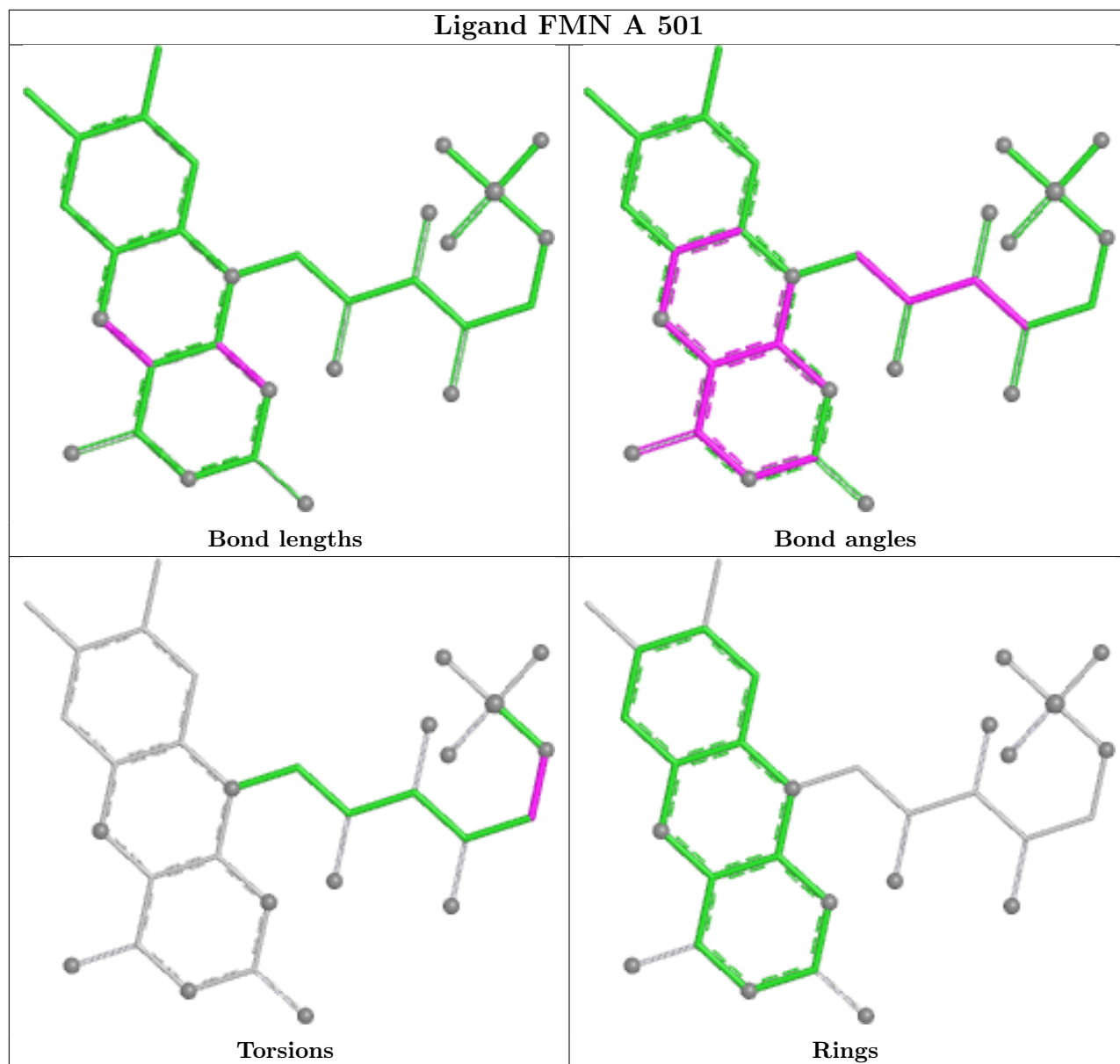


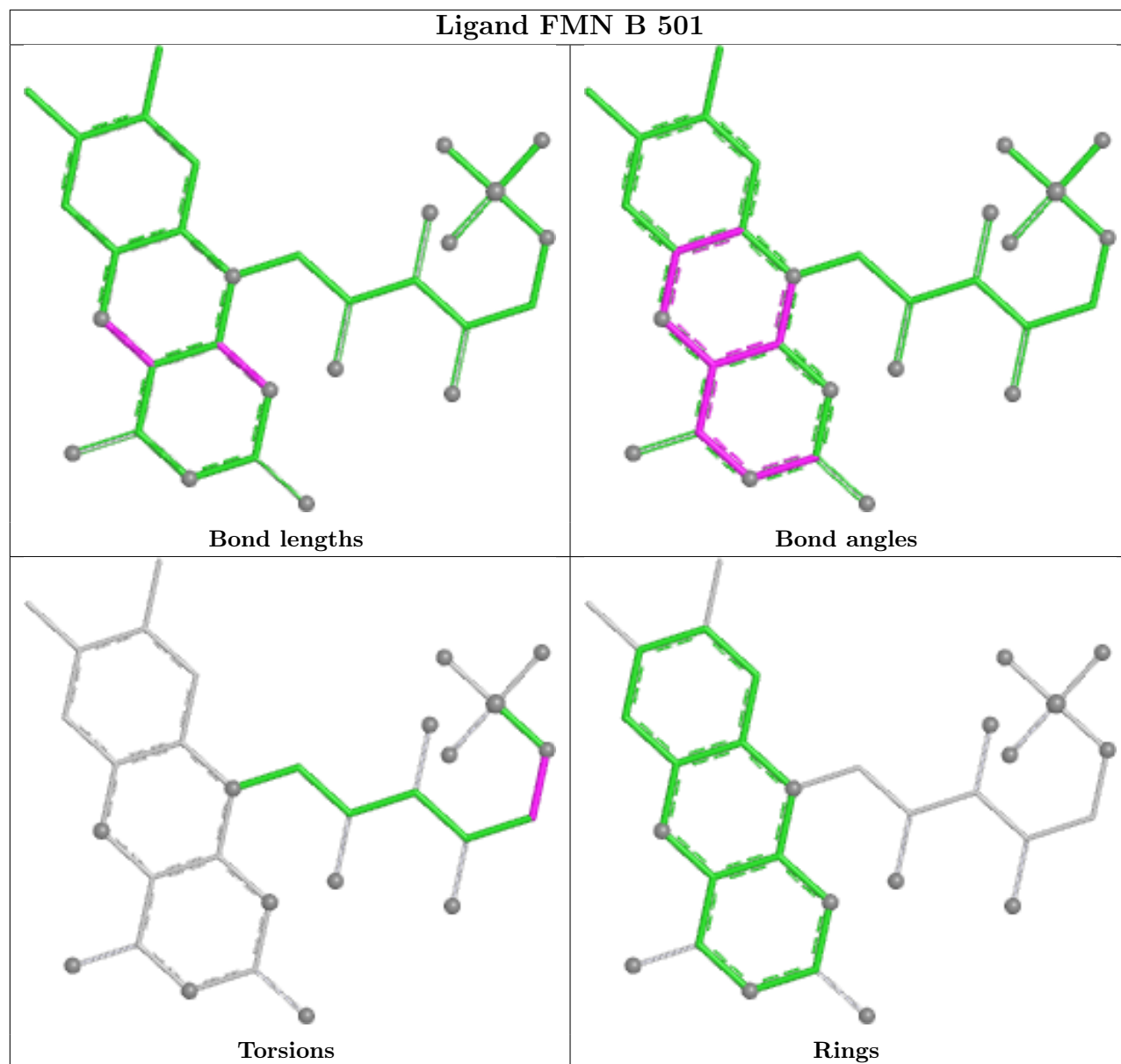












## 5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [\(i\)](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	362/410 (88%)	-0.17	7 (1%) 66 66	17, 28, 47, 64	0
1	B	358/410 (87%)	-0.21	4 (1%) 78 77	18, 27, 42, 52	0
1	C	362/410 (88%)	-0.33	3 (0%) 82 82	16, 25, 42, 59	1 (0%)
1	D	362/410 (88%)	-0.22	7 (1%) 66 66	18, 26, 47, 62	0
1	E	360/410 (87%)	-0.09	5 (1%) 73 73	19, 29, 49, 66	0
1	F	360/410 (87%)	-0.15	5 (1%) 73 73	18, 27, 43, 51	0
1	G	358/410 (87%)	-0.00	6 (1%) 69 68	19, 30, 47, 61	0
1	H	358/410 (87%)	-0.16	3 (0%) 82 82	18, 29, 44, 57	0
All	All	2880/3280 (87%)	-0.17	40 (1%) 73 73	16, 28, 46, 66	1 (0%)

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	398	ALA	4.6
1	D	398	ALA	4.2
1	A	314	GLY	3.8
1	D	37	ILE	3.6
1	E	314	GLY	3.4
1	F	41	ASN	3.4
1	E	313	GLY	3.2
1	B	41	ASN	3.1
1	A	398	ALA	3.1
1	E	397	LEU	3.0
1	C	400	ALA	2.9
1	D	315	THR	2.9
1	A	37	ILE	2.8
1	G	41	ASN	2.7
1	B	398	ALA	2.7
1	G	275	ASP	2.7

*Continued on next page...*

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Mol	Chain	Res	Type	RSRZ
1	A	313	GLY	2.7
1	E	172	TYR	2.7
1	C	172	TYR	2.6
1	G	272	THR	2.6
1	D	38	MET	2.6
1	B	275	ASP	2.6
1	D	314	GLY	2.5
1	B	378	ALA	2.5
1	A	38	MET	2.4
1	C	315	THR	2.4
1	H	275	ASP	2.4
1	F	274	ASN	2.3
1	A	306	ILE	2.3
1	H	152	PRO	2.3
1	F	275	ASP	2.3
1	D	308	ALA	2.2
1	E	40	THR	2.2
1	H	310	ILE	2.2
1	D	40	THR	2.1
1	F	162	ALA	2.1
1	G	233	THR	2.1
1	F	259	ASP	2.0
1	A	312	HIS	2.0
1	G	171	THR	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

## 6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 6.4 Ligands [i](#)

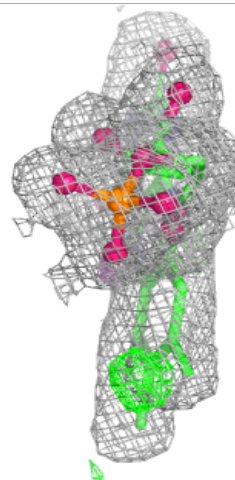
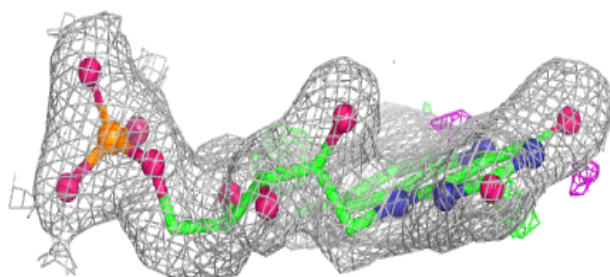
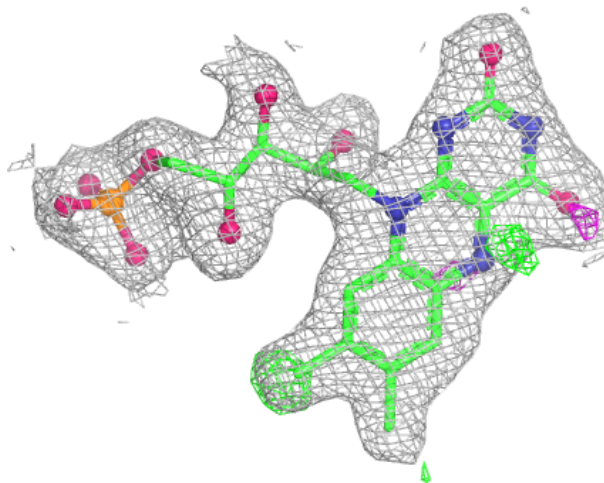
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	CA	A	503	1/1	0.92	0.08	59,59,59,59	0
3	CA	D	502	1/1	0.94	0.12	50,50,50,50	0
3	CA	E	503	1/1	0.94	0.08	55,55,55,55	0
2	FMN	A	501	31/31	0.95	0.06	17,22,27,30	0
2	FMN	E	501	31/31	0.95	0.07	20,24,26,28	0
3	CA	D	503	1/1	0.95	0.08	47,47,47,47	0
3	CA	A	502	1/1	0.95	0.13	42,42,42,42	0
2	FMN	D	501	31/31	0.96	0.06	17,20,22,23	0
2	FMN	B	501	31/31	0.96	0.06	16,19,22,25	0
3	CA	C	502	1/1	0.96	0.13	43,43,43,43	0
3	CA	C	503	1/1	0.96	0.07	44,44,44,44	0
2	FMN	F	501	31/31	0.96	0.06	15,19,22,24	0
2	FMN	G	501	31/31	0.96	0.06	18,22,25,26	0
2	FMN	H	501	31/31	0.96	0.06	18,22,24,26	0
3	CA	E	502	1/1	0.97	0.09	46,46,46,46	0
2	FMN	C	501	31/31	0.97	0.06	16,19,21,23	0
3	CA	G	502	1/1	0.97	0.12	49,49,49,49	0
3	CA	H	502	1/1	0.97	0.14	50,50,50,50	0
3	CA	B	502	1/1	0.98	0.09	43,43,43,43	0
3	CA	F	502	1/1	0.98	0.09	46,46,46,46	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

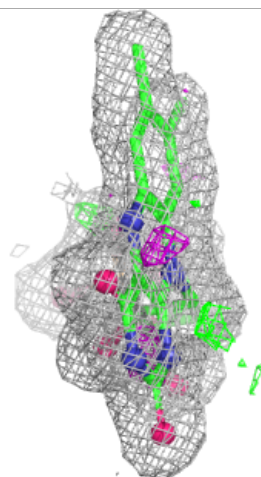
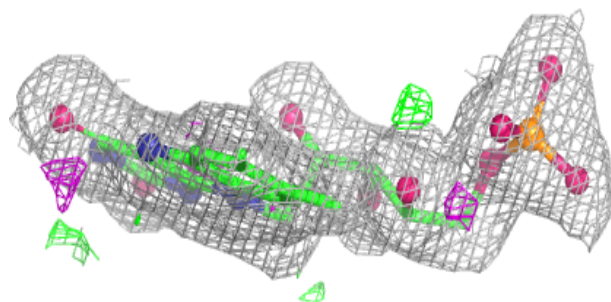
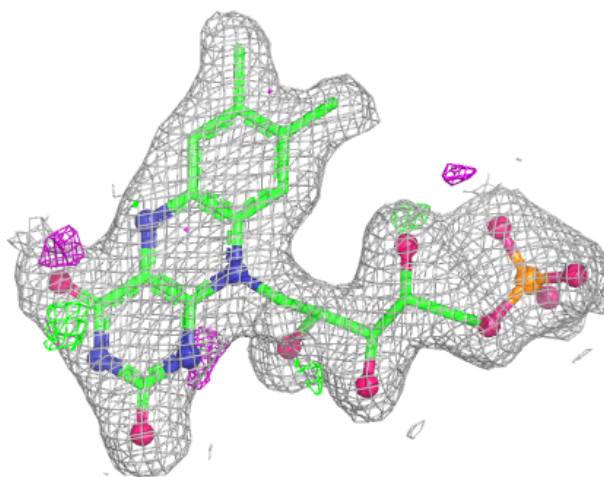
**Electron density around FMN A 501:**

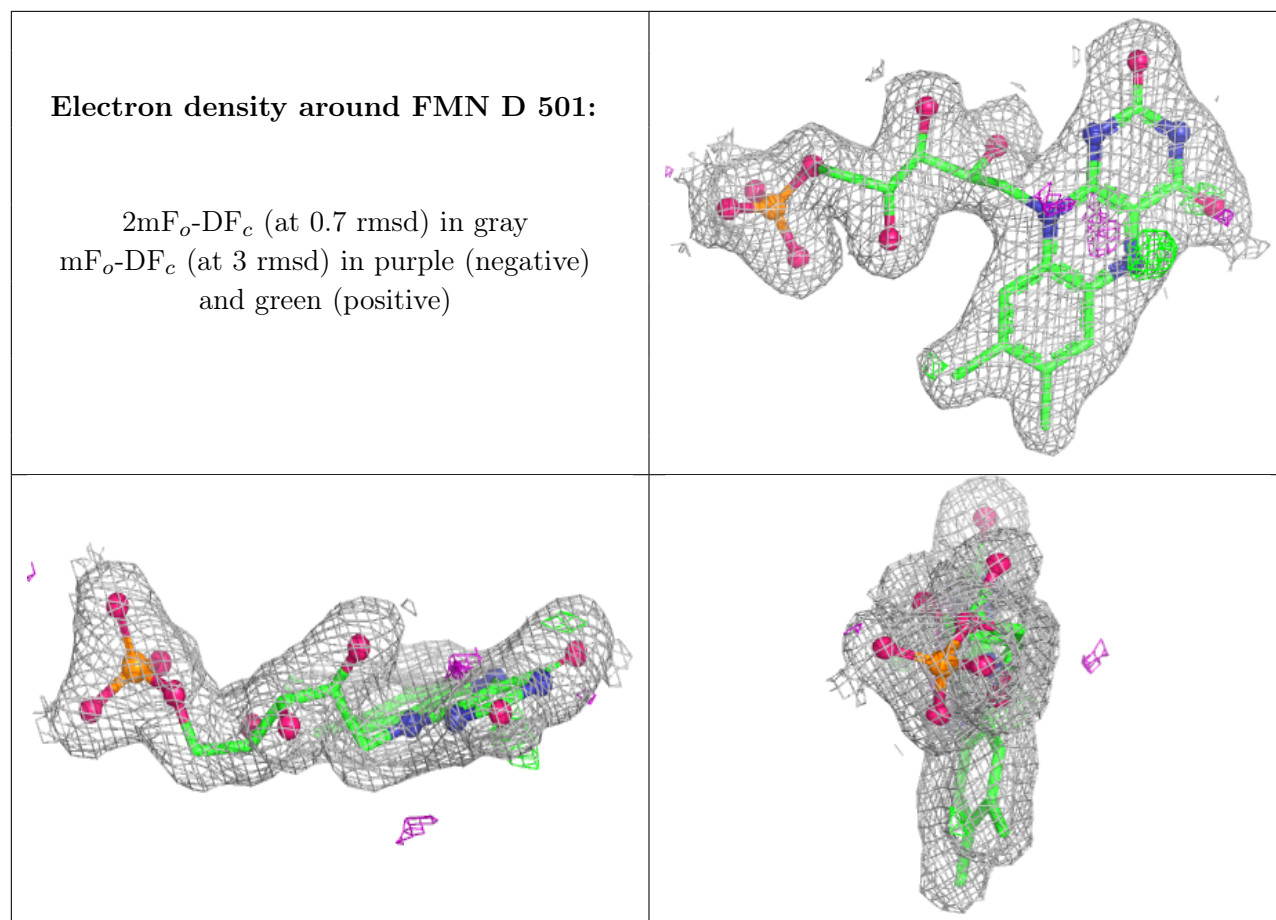
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

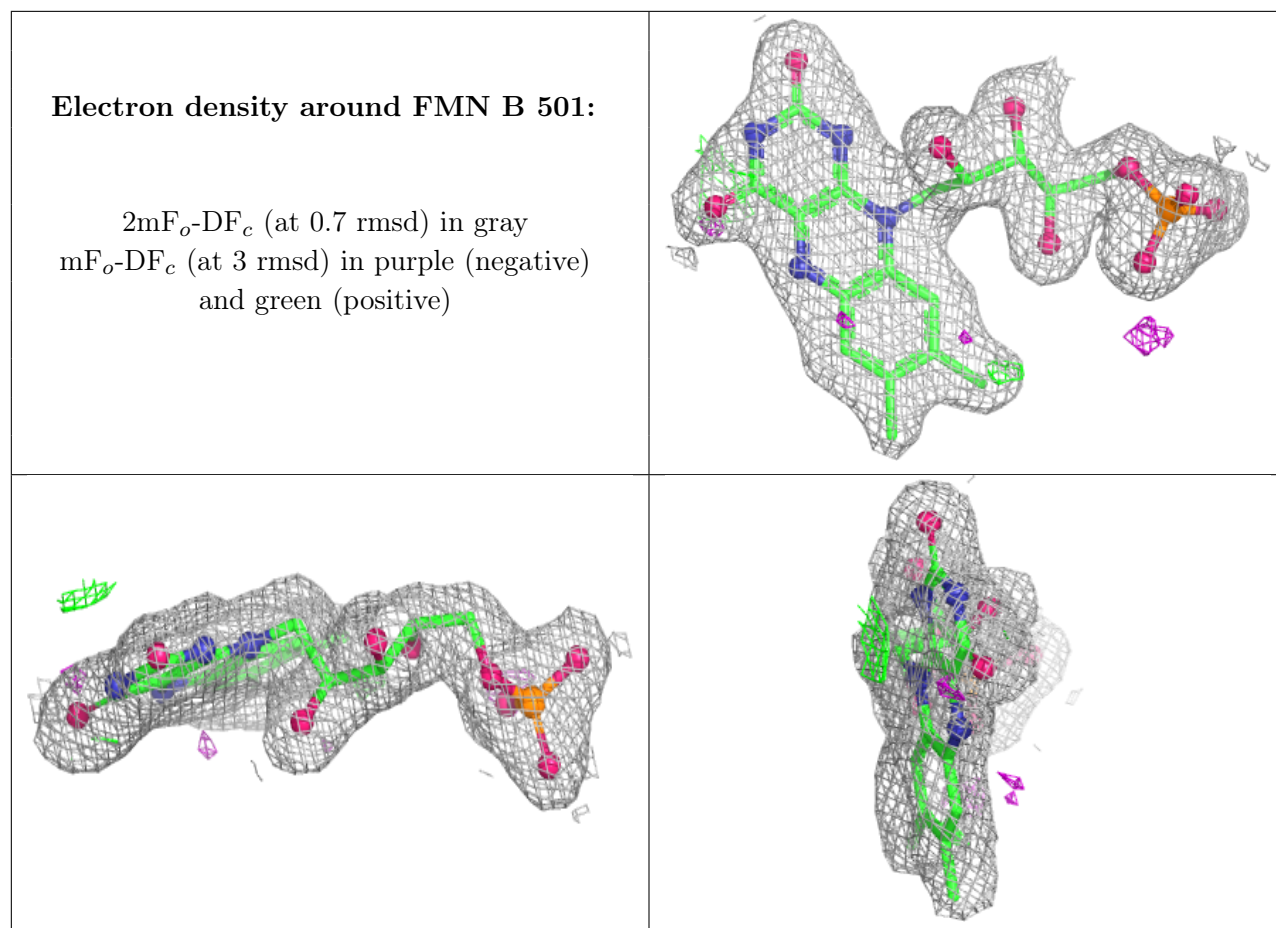


**Electron density around FMN E 501:**

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 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

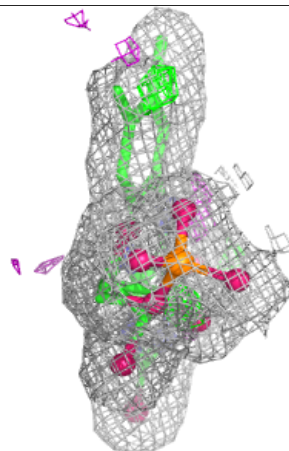
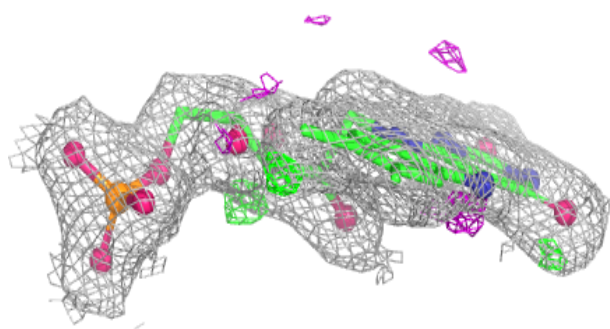
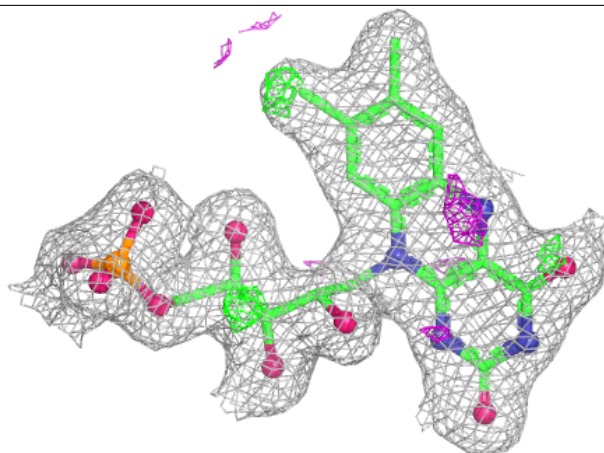






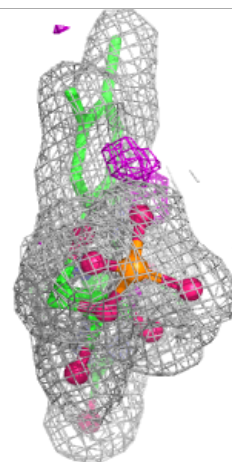
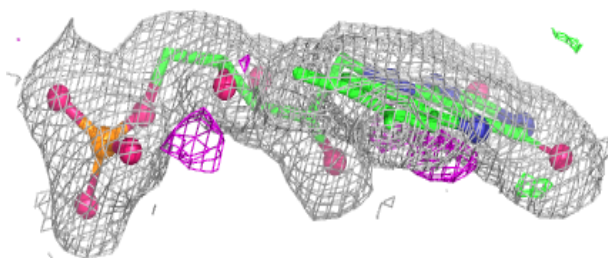
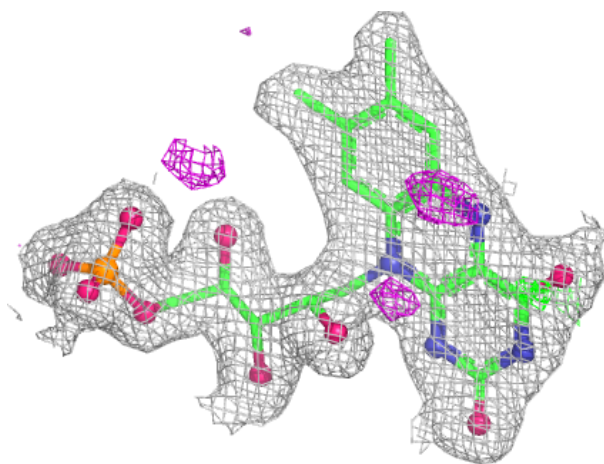
**Electron density around FMN F 501:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



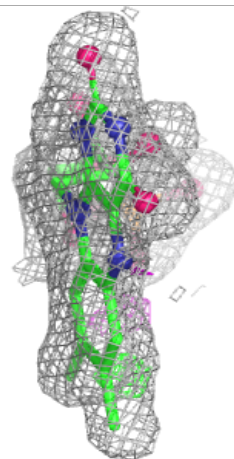
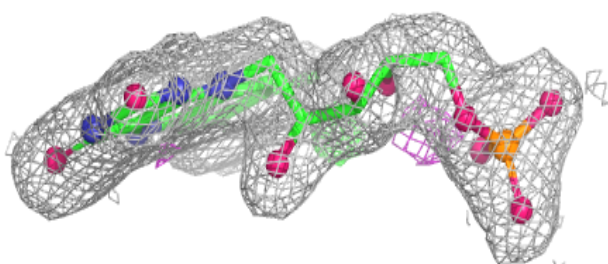
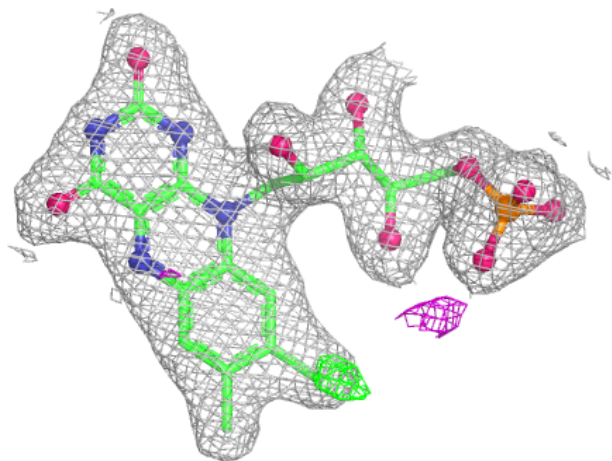
**Electron density around FMN G 501:**

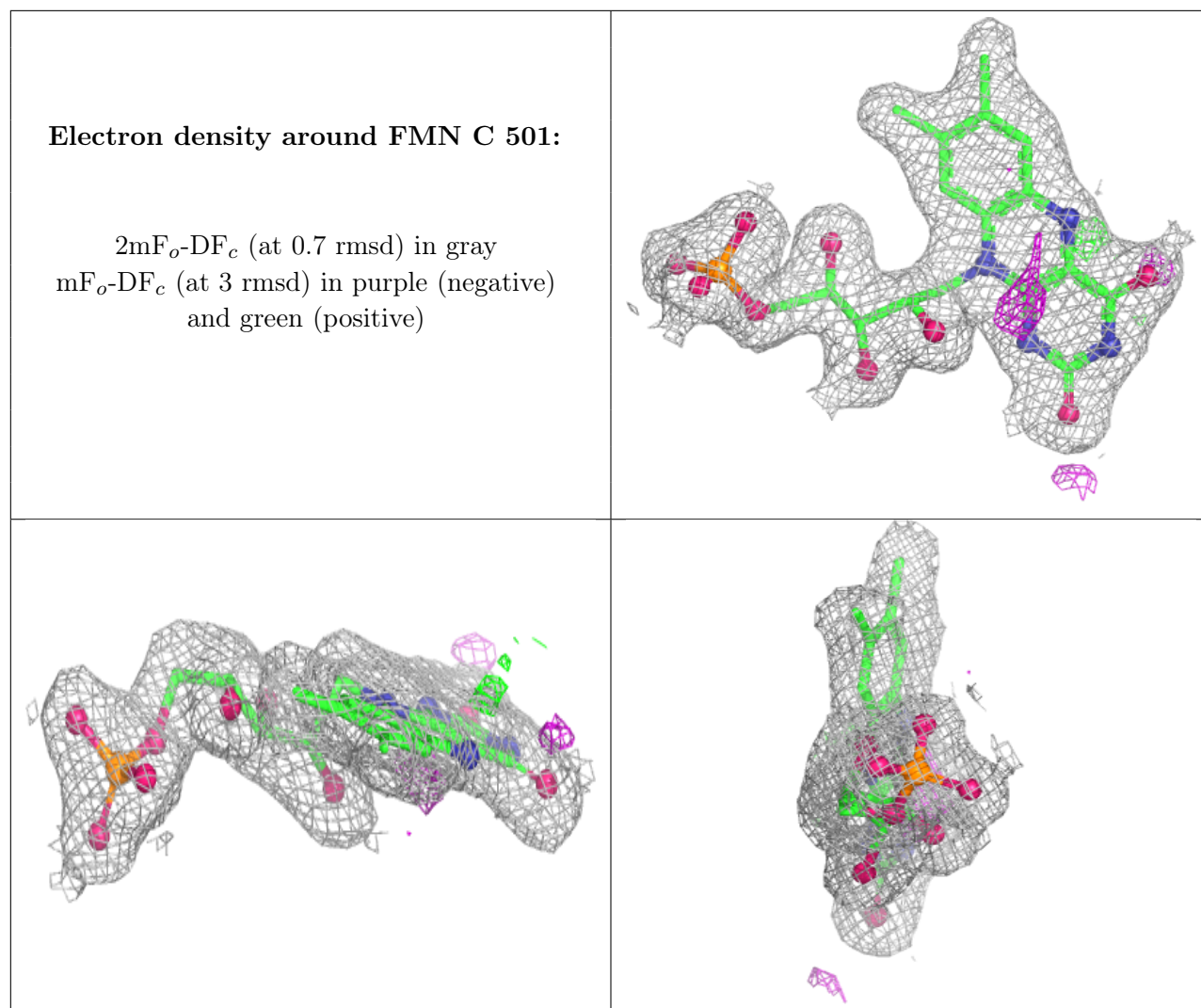
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around FMN H 501:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.