



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 26, 2026 – 11:59 PM UTC

PDB ID : 4ORI / pdb\_00004ori  
Title : Rat dihydroorotate dehydrogenase bound with DSM338 (N-[3,5-difluoro-4-(trifluoromethyl)phenyl]-5-methyl-2-(trifluoromethyl)[1,2,4]triazolo[1,5-a]pyrimidin-7-amine)  
Authors : Deng, X.; Phillips, M.A.  
Deposited on : 2014-02-11  
Resolution : 1.50 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)
Xtriage (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

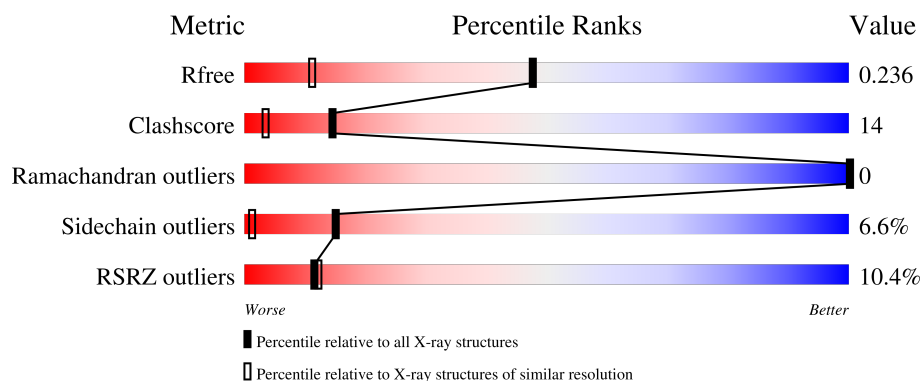
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.50 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	180053	4037 (1.50-1.50)
Clashscore	190562	4235 (1.50-1.50)
Ramachandran outliers	187476	4153 (1.50-1.50)
Sidechain outliers	187428	4150 (1.50-1.50)
RSRZ outliers	180081	4039 (1.50-1.50)

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	372	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	ORO	A	501	-	X	-	-

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 2887 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.

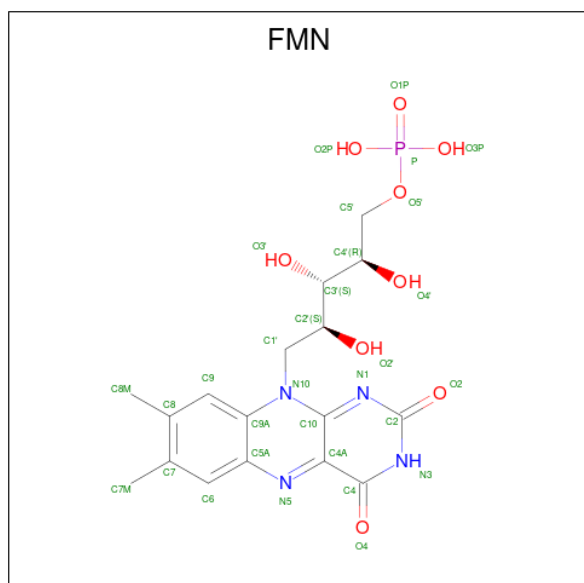
- Molecule 1 is a protein called Dihydroorotate dehydrogenase (quinone), mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	355	Total	C	N	O	S	0	0	0
			2707	1701	495	508	3			

There are 8 discrepancies between the modelled and reference sequences:

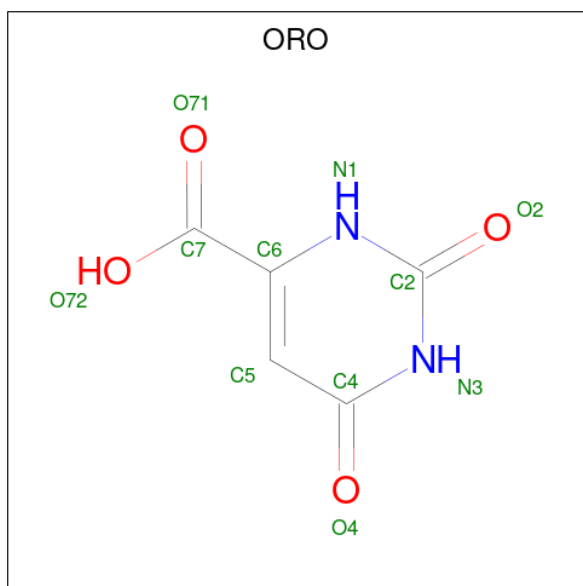
Chain	Residue	Modelled	Actual	Comment	Reference
A	397	LEU	-	expression tag	UNP Q63707
A	398	GLU	-	expression tag	UNP Q63707
A	399	HIS	-	expression tag	UNP Q63707
A	400	HIS	-	expression tag	UNP Q63707
A	401	HIS	-	expression tag	UNP Q63707
A	402	HIS	-	expression tag	UNP Q63707
A	403	HIS	-	expression tag	UNP Q63707
A	404	HIS	-	expression tag	UNP Q63707

- Molecule 2 is FLAVIN MONONUCLEOTIDE (CCD ID: FMN) (formula:  $C_{17}H_{21}N_4O_9P$ ).



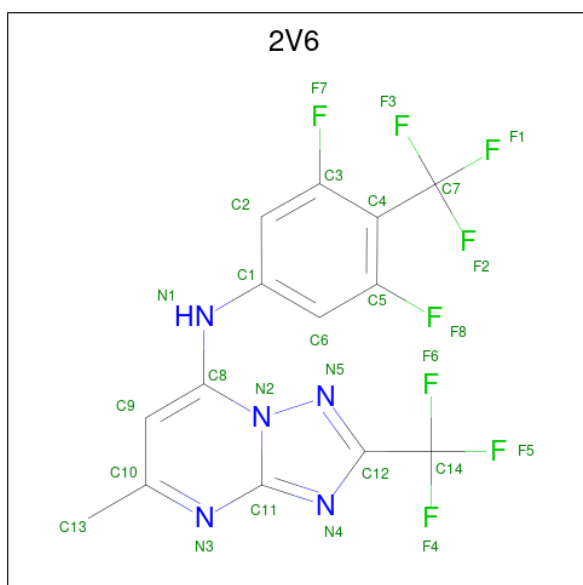
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			31	17	4	9	1		

- Molecule 3 is OROTIC ACID (CCD ID: ORO) (formula:  $C_5H_4N_2O_4$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			11	5	2	4		

- Molecule 4 is N-[3,5-difluoro-4-(trifluoromethyl)phenyl]-5-methyl-2-(trifluoromethyl)[1,2,4]triazolo[1,5-a]pyrimidin-7-amine (CCD ID: 2V6) (formula:  $C_{14}H_7F_8N_5$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	F	N	0	0
			27	14	8	5		

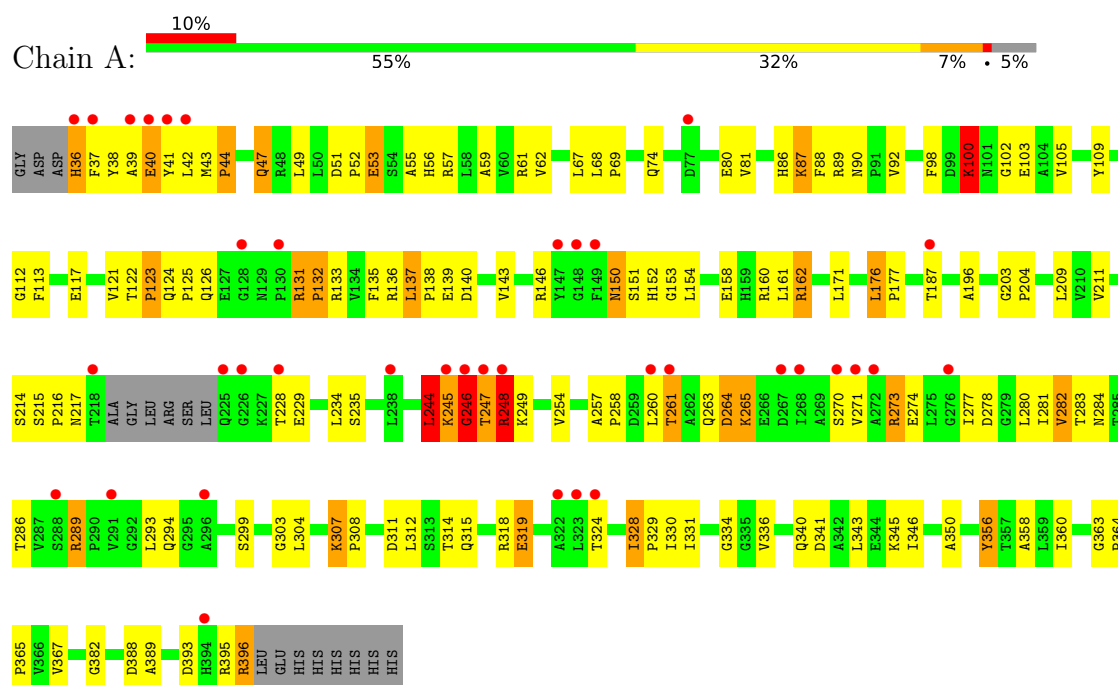
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	111	Total	O	0	0
			111	111		

### 3 Residue-property plots [i](#)

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 electron 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 dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). 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: Dihydroorotate dehydrogenase (quinone), mitochondrial



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	124.36Å 43.84Å 63.30Å 90.00° 99.96° 90.00°	Depositor
Resolution (Å)	20.00 – 1.50 20.00 – 1.50	Depositor EDS
% Data completeness (in resolution range)	95.4 (20.00-1.50) 97.3 (20.00-1.50)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.06	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.53 (at 1.46Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, $R_{free}$	0.180 , 0.234 0.188 , 0.236	Depositor DCC
$R_{free}$ test set	2837 reflections (4.81%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	22.2	Xtriage
Anisotropy	0.102	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.42 , 59.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	2887	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.63% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FMN, ORO, 2V6

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z  > 5$	RMSZ	$\# Z  > 5$
1	A	1.93	79/2749 (2.9%)	1.29	37/3721 (1.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3

All (79) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	90	ASN	C-N	9.22	1.40	1.33
1	A	257	ALA	C-N	8.12	1.40	1.33
1	A	121	VAL	C-O	-7.67	1.15	1.24
1	A	331	ILE	C-O	-7.20	1.16	1.24
1	A	336	VAL	C-O	-6.88	1.17	1.24
1	A	215	SER	C-N	6.86	1.39	1.33
1	A	55	ALA	C-O	-6.57	1.16	1.24
1	A	90	ASN	C-O	-6.55	1.17	1.24
1	A	109	TYR	C-O	-6.49	1.16	1.24
1	A	307	LYS	C-O	-6.43	1.18	1.24
1	A	152	HIS	CG-ND1	-6.41	1.31	1.38
1	A	143	VAL	C-O	-6.34	1.17	1.24
1	A	152	HIS	CD2-NE2	-6.26	1.30	1.37
1	A	92	VAL	C-O	-6.13	1.17	1.24
1	A	86	HIS	CG-ND1	-6.11	1.31	1.38
1	A	282	VAL	C-O	-6.06	1.17	1.24
1	A	343	LEU	C-O	-6.05	1.17	1.24
1	A	341	ASP	C-O	-5.99	1.17	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	356	TYR	C-O	-5.92	1.16	1.24
1	A	364	PRO	C-O	-5.87	1.18	1.24
1	A	364	PRO	N-CD	5.86	1.55	1.47
1	A	360	ILE	C-O	-5.86	1.17	1.24
1	A	81	VAL	C-O	-5.84	1.18	1.24
1	A	216	PRO	N-CD	5.81	1.55	1.47
1	A	254	VAL	C-O	-5.78	1.18	1.24
1	A	125	PRO	N-CD	5.68	1.55	1.47
1	A	280	LEU	C-O	-5.65	1.17	1.23
1	A	150	ASN	C-O	-5.64	1.17	1.24
1	A	176	LEU	C-N	5.64	1.40	1.33
1	A	112	GLY	C-O	-5.61	1.16	1.24
1	A	363	GLY	C-N	5.59	1.40	1.33
1	A	162	ARG	C-O	-5.58	1.17	1.24
1	A	161	LEU	C-O	-5.58	1.17	1.24
1	A	100	LYS	C-O	-5.54	1.17	1.24
1	A	281	ILE	C-O	-5.54	1.18	1.24
1	A	117	GLU	C-O	-5.53	1.17	1.24
1	A	284	ASN	C-O	-5.52	1.18	1.23
1	A	340	GLN	C-O	-5.51	1.17	1.24
1	A	138	PRO	N-CD	5.50	1.55	1.47
1	A	330	ILE	C-O	-5.49	1.18	1.24
1	A	135	PHE	C-O	-5.49	1.17	1.24
1	A	61	ARG	C-O	-5.43	1.17	1.24
1	A	346	ILE	C-O	-5.42	1.18	1.24
1	A	311	ASP	C-O	-5.40	1.17	1.24
1	A	286	THR	C-O	-5.39	1.17	1.23
1	A	249	LYS	C-N	5.38	1.40	1.33
1	A	303	GLY	C-O	-5.38	1.18	1.23
1	A	171	LEU	C-O	-5.37	1.17	1.24
1	A	177	PRO	N-CD	5.35	1.55	1.47
1	A	105	VAL	C-O	-5.34	1.18	1.24
1	A	132	PRO	N-CD	5.34	1.55	1.47
1	A	345	LYS	C-O	-5.33	1.17	1.24
1	A	38	TYR	C-O	-5.33	1.18	1.24
1	A	102	GLY	C-O	-5.32	1.17	1.24
1	A	86	HIS	CD2-NE2	-5.29	1.32	1.37
1	A	364	PRO	C-N	5.28	1.40	1.33
1	A	289	ARG	C-N	5.28	1.39	1.33
1	A	304	LEU	C-O	-5.27	1.17	1.23
1	A	258	PRO	N-CD	5.23	1.55	1.47
1	A	43	MET	C-N	5.23	1.40	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	211	VAL	C-O	-5.22	1.18	1.24
1	A	151	SER	C-O	-5.22	1.17	1.23
1	A	314	THR	C-O	-5.21	1.18	1.24
1	A	52	PRO	N-CD	5.17	1.54	1.47
1	A	367	VAL	C-O	-5.14	1.18	1.24
1	A	176	LEU	C-O	-5.14	1.18	1.24
1	A	69	PRO	N-CD	5.12	1.54	1.47
1	A	113	PHE	C-O	-5.09	1.17	1.23
1	A	358	ALA	C-O	-5.08	1.17	1.24
1	A	44	PRO	N-CD	5.08	1.54	1.47
1	A	53	GLU	C-O	-5.07	1.18	1.24
1	A	209	LEU	C-O	-5.06	1.17	1.23
1	A	350	ALA	C-O	-5.06	1.17	1.23
1	A	365	PRO	N-CD	5.05	1.54	1.47
1	A	88	PHE	C-O	-5.05	1.18	1.24
1	A	196	ALA	C-O	-5.04	1.18	1.24
1	A	47	GLN	C-O	-5.01	1.18	1.24
1	A	312	LEU	C-O	-5.01	1.18	1.24
1	A	334	GLY	C-O	-5.00	1.17	1.23

All (37) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	39	ALA	N-CA-C	11.74	124.16	111.36
1	A	247	THR	N-CA-C	-8.50	98.79	110.35
1	A	131	ARG	C-N-CD	7.96	138.12	120.60
1	A	49	LEU	N-CA-C	7.49	119.53	111.36
1	A	289	ARG	CA-C-N	-6.57	113.53	120.03
1	A	289	ARG	C-N-CA	-6.57	113.53	120.03
1	A	249	LYS	CA-C-N	-6.34	113.42	119.76
1	A	249	LYS	C-N-CA	-6.34	113.42	119.76
1	A	68	LEU	CA-C-N	-6.32	113.25	119.76
1	A	68	LEU	C-N-CA	-6.32	113.25	119.76
1	A	319	GLU	CB-CA-C	-6.32	100.96	110.88
1	A	215	SER	CA-C-N	-6.30	113.27	120.89
1	A	215	SER	C-N-CA	-6.30	113.27	120.89
1	A	244	LEU	CA-C-N	6.17	132.32	122.83
1	A	244	LEU	C-N-CA	6.17	132.32	122.83
1	A	328	ILE	CA-C-N	-6.16	113.60	119.76
1	A	328	ILE	C-N-CA	-6.16	113.60	119.76
1	A	364	PRO	N-CA-C	6.10	118.14	110.70
1	A	177	PRO	N-CA-C	6.04	120.46	111.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	257	ALA	CA-C-N	-6.00	114.03	121.00
1	A	257	ALA	C-N-CA	-6.00	114.03	121.00
1	A	214	SER	N-CA-C	5.88	121.23	112.94
1	A	42	LEU	N-CA-C	5.67	117.26	111.14
1	A	124	GLN	CA-C-N	-5.58	114.04	119.78
1	A	124	GLN	C-N-CA	-5.58	114.04	119.78
1	A	187	THR	CB-CA-C	-5.44	101.75	110.79
1	A	246	GLY	CA-C-N	5.39	128.89	120.75
1	A	246	GLY	C-N-CA	5.39	128.89	120.75
1	A	364	PRO	CA-C-N	-5.39	114.07	119.56
1	A	364	PRO	C-N-CA	-5.39	114.07	119.56
1	A	382	GLY	N-CA-C	5.37	123.01	115.43
1	A	126	GLN	N-CA-C	5.25	117.23	108.99
1	A	90	ASN	CA-C-N	-5.22	114.95	121.00
1	A	90	ASN	C-N-CA	-5.22	114.95	121.00
1	A	51	ASP	CA-C-N	-5.11	113.38	119.05
1	A	51	ASP	C-N-CA	-5.11	113.38	119.05
1	A	389	ALA	N-CA-C	5.01	118.65	112.54

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	244	LEU	Peptide
1	A	246	GLY	Peptide
1	A	248	ARG	Peptide

## 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	2707	0	2778	76	0
2	A	31	0	19	0	0
3	A	11	0	3	0	0
4	A	27	0	6	3	0
5	A	111	0	0	3	0
All	All	2887	0	2806	78	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 14.

All (78) 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:A:140:ASP:OD2	1:A:293:LEU:HA	1.66	0.94
1:A:315:GLN:HE22	1:A:318:ARG:HH22	1.14	0.93
1:A:229:GLU:N	1:A:229:GLU:OE1	2.01	0.92
1:A:234:LEU:HD13	1:A:277:ILE:HD11	1.52	0.92
1:A:271:VAL:HA	1:A:274:GLU:HG2	1.61	0.83
1:A:315:GLN:NE2	1:A:318:ARG:HH22	1.79	0.80
1:A:57:ARG:HH22	1:A:131:ARG:HH22	1.28	0.79
1:A:247:THR:O	1:A:248:ARG:NH2	2.16	0.79
1:A:246:GLY:C	1:A:248:ARG:HH22	1.91	0.78
1:A:246:GLY:HA2	1:A:248:ARG:HH22	1.53	0.74
1:A:246:GLY:HA2	1:A:248:ARG:NH2	2.03	0.73
1:A:246:GLY:CA	1:A:248:ARG:HH22	2.02	0.72
1:A:36:HIS:N	5:A:702:HOH:O	2.21	0.72
1:A:89:ARG:HD3	1:A:176:LEU:HD21	1.71	0.71
1:A:273:ARG:NH1	1:A:273:ARG:HG2	2.05	0.69
1:A:244:LEU:CD2	1:A:245:LYS:HE2	2.21	0.69
1:A:244:LEU:HD22	1:A:245:LYS:HE2	1.77	0.66
1:A:139:GLU:HB3	1:A:294:GLN:HB2	1.77	0.65
1:A:53:GLU:HG2	1:A:57:ARG:NH2	2.12	0.65
1:A:158:GLU:OE2	1:A:162:ARG:HG3	1.97	0.65
1:A:234:LEU:HD13	1:A:277:ILE:CD1	2.27	0.63
1:A:37:PHE:HA	1:A:41:TYR:HD2	1.63	0.62
1:A:278:ASP:O	1:A:329:PRO:HD2	2.00	0.62
1:A:136:ARG:C	1:A:137:LEU:HD12	2.26	0.61
1:A:273:ARG:HG2	1:A:273:ARG:HH11	1.63	0.60
1:A:271:VAL:HA	1:A:274:GLU:CG	2.29	0.60
1:A:53:GLU:HG2	1:A:57:ARG:HH22	1.67	0.59
1:A:388:ASP:O	1:A:395:ARG:NH1	2.34	0.59
1:A:261:THR:O	1:A:265:LYS:HD3	2.03	0.59
1:A:261:THR:HB	1:A:264:ASP:OD1	2.02	0.59
1:A:261:THR:HG21	5:A:711:HOH:O	2.02	0.58
1:A:80:GLU:OE2	1:A:87:LYS:HD2	2.03	0.57
1:A:37:PHE:HA	1:A:41:TYR:CD2	2.39	0.57
1:A:264:ASP:OD1	1:A:264:ASP:N	2.38	0.56
1:A:123:PRO:HA	1:A:154:LEU:HD12	1.88	0.55
1:A:273:ARG:HG3	1:A:328:ILE:HD11	1.88	0.55
1:A:273:ARG:HH11	1:A:273:ARG:CG	2.21	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:265:LYS:HE3	1:A:319:GLU:OE2	2.08	0.53
1:A:100:LYS:HE2	5:A:710:HOH:O	2.09	0.52
1:A:260:LEU:HB2	1:A:265:LYS:HD2	1.92	0.51
1:A:261:THR:HB	1:A:264:ASP:CG	2.36	0.51
1:A:36:HIS:N	1:A:36:HIS:ND1	2.59	0.50
1:A:139:GLU:CB	1:A:294:GLN:HB2	2.40	0.50
1:A:146:ARG:HA	1:A:217:ASN:ND2	2.26	0.50
1:A:57:ARG:NH2	1:A:131:ARG:HH22	2.04	0.49
1:A:137:LEU:CD1	1:A:137:LEU:N	2.75	0.49
1:A:44:PRO:O	1:A:47:GLN:HB3	2.12	0.48
1:A:137:LEU:HD12	1:A:137:LEU:N	2.29	0.48
1:A:271:VAL:CA	1:A:274:GLU:HG2	2.38	0.48
1:A:356:TYR:C	1:A:356:TYR:CD1	2.89	0.48
1:A:36:HIS:N	1:A:36:HIS:HD1	2.12	0.48
1:A:57:ARG:HH22	1:A:131:ARG:NH2	2.05	0.47
1:A:40:GLU:N	1:A:40:GLU:OE1	2.48	0.47
1:A:324:THR:HB	1:A:328:ILE:HG13	1.97	0.45
1:A:315:GLN:NE2	1:A:315:GLN:HA	2.32	0.45
1:A:203:GLY:N	1:A:204:PRO:CD	2.80	0.45
1:A:315:GLN:HE22	1:A:318:ARG:NH2	1.96	0.45
1:A:37:PHE:O	1:A:41:TYR:HB2	2.17	0.45
1:A:57:ARG:HH12	1:A:131:ARG:HH12	1.63	0.45
1:A:393:ASP:O	1:A:396:ARG:HD2	2.17	0.44
1:A:307:LYS:N	1:A:308:PRO:CD	2.80	0.44
1:A:56:HIS:HE1	1:A:98:PHE:O	2.00	0.44
1:A:270:SER:O	1:A:274:GLU:HG2	2.18	0.44
1:A:53:GLU:OE1	1:A:133:ARG:NH1	2.44	0.43
1:A:150:ASN:OD1	1:A:150:ASN:N	2.52	0.43
1:A:261:THR:HG22	1:A:263:GLN:N	2.34	0.42
4:A:502:2V6:C2	4:A:502:2V6:H4	2.47	0.42
1:A:282:VAL:HG12	1:A:283:THR:CG2	2.48	0.42
1:A:103:GLU:HA	1:A:160:ARG:HD3	2.02	0.41
1:A:282:VAL:HG12	1:A:283:THR:HG23	2.02	0.41
1:A:122:THR:O	1:A:153:GLY:HA2	2.20	0.41
4:A:502:2V6:C2	4:A:502:2V6:C9	2.97	0.41
1:A:261:THR:HG22	1:A:263:GLN:H	1.86	0.41
1:A:123:PRO:HA	1:A:154:LEU:CD1	2.51	0.40
1:A:59:ALA:HB2	4:A:502:2V6:C2	2.52	0.40
1:A:62:VAL:HG13	1:A:67:LEU:HB2	2.03	0.40
1:A:158:GLU:CD	1:A:162:ARG:HG3	2.46	0.40
1:A:315:GLN:NE2	1:A:318:ARG:NH2	2.59	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	351/372 (94%)	344 (98%)	7 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	288/302 (95%)	269 (93%)	19 (7%)	15	1

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	36	HIS
1	A	40	GLU
1	A	74	GLN
1	A	87	LYS
1	A	100	LYS
1	A	123	PRO
1	A	132	PRO
1	A	137	LEU
1	A	228	THR
1	A	235	SER

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Mol	Chain	Res	Type
1	A	245	LYS
1	A	248	ARG
1	A	261	THR
1	A	264	ASP
1	A	265	LYS
1	A	273	ARG
1	A	289	ARG
1	A	299	SER
1	A	396	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	56	HIS
1	A	217	ASN
1	A	315	GLN
1	A	325	GLN
1	A	347	GLN

### 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](#)

3 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond



length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	FMN	A	500	-	33,33,33	1.89	10 (30%)	48,50,50	1.47	9 (18%)
4	2V6	A	502	-	29,29,29	2.31	7 (24%)	40,46,46	2.20	10 (25%)
3	ORO	A	501	-	11,11,11	2.59	7 (63%)	14,15,15	2.71	7 (50%)

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	A	500	-	-	5/18/18/18	0/3/3/3
4	2V6	A	502	-	-	0/16/16/16	0/3/3/3
3	ORO	A	501	-	-	4/4/4/4	0/1/1/1

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	502	2V6	C8-N2	-7.64	1.30	1.37
4	A	502	2V6	C4-C5	5.92	1.47	1.39
2	A	500	FMN	C4-N3	-4.45	1.30	1.38
3	A	501	ORO	C2-N3	-4.08	1.30	1.37
3	A	501	ORO	C5-C4	-3.70	1.34	1.42
2	A	500	FMN	C9A-C5A	3.65	1.47	1.41
4	A	502	2V6	C8-N1	-3.48	1.28	1.36
3	A	501	ORO	C2-N1	-3.43	1.31	1.37
3	A	501	ORO	C4-N3	-3.43	1.32	1.38
2	A	500	FMN	C5A-N5	-3.18	1.33	1.39
2	A	500	FMN	C9-C8	-3.15	1.35	1.39
4	A	502	2V6	C11-N2	-2.93	1.34	1.38
3	A	501	ORO	O4-C4	-2.79	1.19	1.24
4	A	502	2V6	C1-N1	-2.64	1.36	1.41
3	A	501	ORO	O72-C7	-2.59	1.23	1.30
2	A	500	FMN	P-O2P	-2.53	1.45	1.54
4	A	502	2V6	C9-C8	2.53	1.42	1.38
2	A	500	FMN	C2-N3	-2.43	1.33	1.39
3	A	501	ORO	C6-N1	-2.36	1.33	1.38
2	A	500	FMN	C6-C5A	-2.34	1.36	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	500	FMN	P-O3P	-2.21	1.46	1.54
2	A	500	FMN	C8-C7	2.20	1.46	1.40
4	A	502	2V6	C12-N5	2.16	1.36	1.33
2	A	500	FMN	C9A-N10	-2.08	1.37	1.41

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	502	2V6	C11-N2-N5	8.74	116.94	110.41
4	A	502	2V6	C12-N5-N2	-6.12	96.17	100.19
3	A	501	ORO	C4-N3-C2	-5.29	120.42	125.55
3	A	501	ORO	O4-C4-C5	-4.87	118.73	125.46
3	A	501	ORO	C5-C4-N3	3.94	120.14	115.24
3	A	501	ORO	N3-C2-N1	3.47	121.19	115.74
2	A	500	FMN	C4-C4A-N5	3.38	122.88	118.21
2	A	500	FMN	O2-C2-N1	-3.36	116.21	121.80
2	A	500	FMN	C9A-C5A-N5	-3.30	118.95	122.45
2	A	500	FMN	O4-C4-C4A	-3.17	118.16	126.53
4	A	502	2V6	F6-C14-C12	-2.98	106.13	112.25
4	A	502	2V6	C9-C10-N3	-2.91	119.85	122.71
4	A	502	2V6	N2-C11-N3	2.68	124.94	122.61
3	A	501	ORO	C7-C6-N1	2.57	120.17	115.47
4	A	502	2V6	C13-C10-C9	2.42	123.60	120.44
3	A	501	ORO	O2-C2-N1	-2.23	117.90	121.86
4	A	502	2V6	N2-C11-N4	-2.20	107.71	109.14
4	A	502	2V6	F7-C3-C2	2.18	123.00	118.64
2	A	500	FMN	C5A-C9A-N10	2.18	119.94	117.97
2	A	500	FMN	C4A-C4-N3	2.11	118.63	113.25
2	A	500	FMN	O5'-C5'-C4'	2.08	114.90	109.36
2	A	500	FMN	C5A-N5-C4A	2.07	121.44	118.09
2	A	500	FMN	O3P-P-O2P	2.05	115.49	107.80
3	A	501	ORO	C6-N1-C2	-2.02	120.48	122.65
4	A	502	2V6	C2-C1-C6	2.02	122.33	119.59
4	A	502	2V6	C1-C2-C3	2.00	120.49	118.82

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	501	ORO	N1-C6-C7-O71
3	A	501	ORO	N1-C6-C7-O72
2	A	500	FMN	C2'-C3'-C4'-O4'

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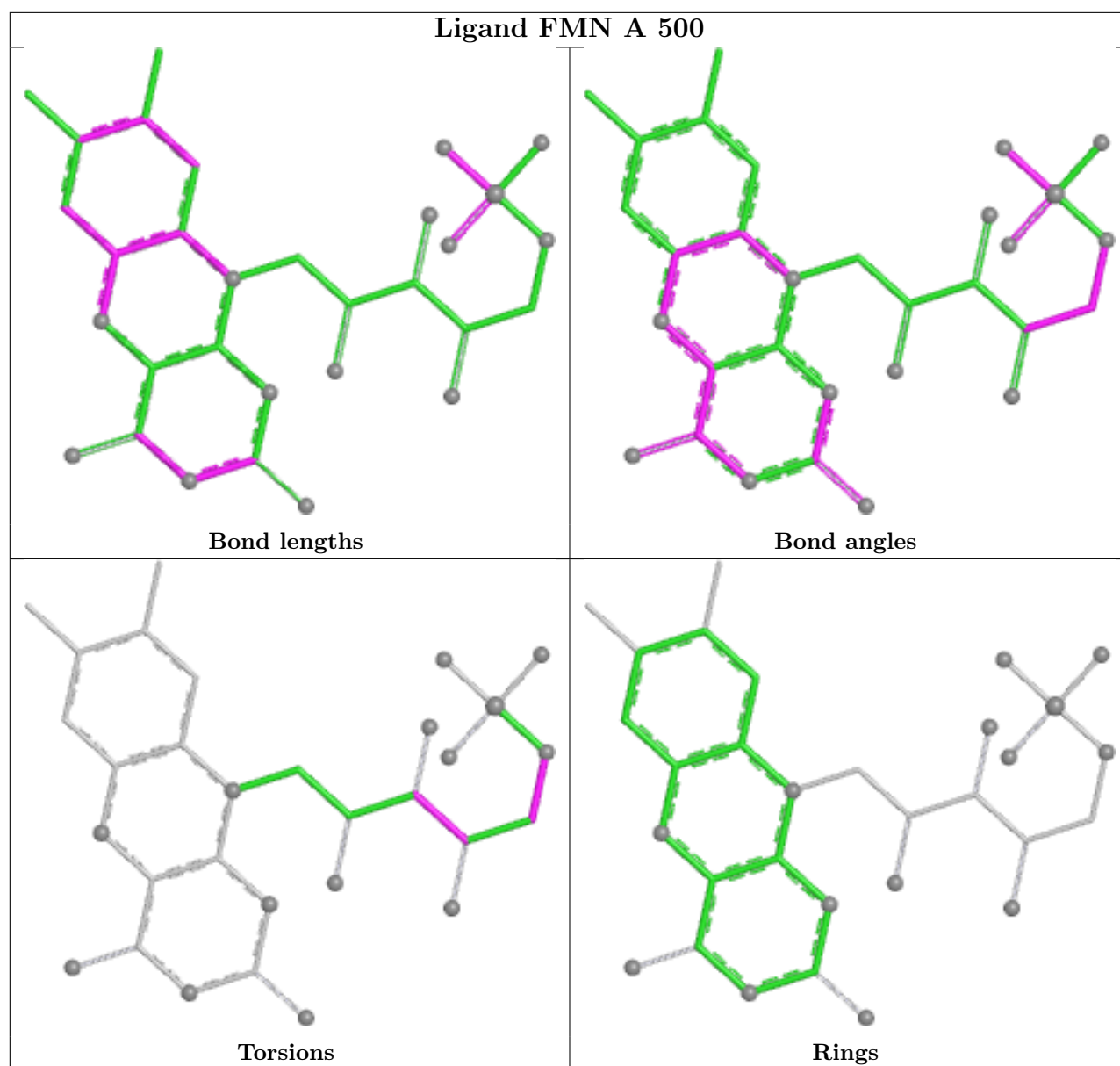
Mol	Chain	Res	Type	Atoms
2	A	500	FMN	O3'-C3'-C4'-O4'
2	A	500	FMN	C4'-C5'-O5'-P
3	A	501	ORO	C5-C6-C7-O71
3	A	501	ORO	C5-C6-C7-O72
2	A	500	FMN	O3'-C3'-C4'-C5'
2	A	500	FMN	C2'-C3'-C4'-C5'

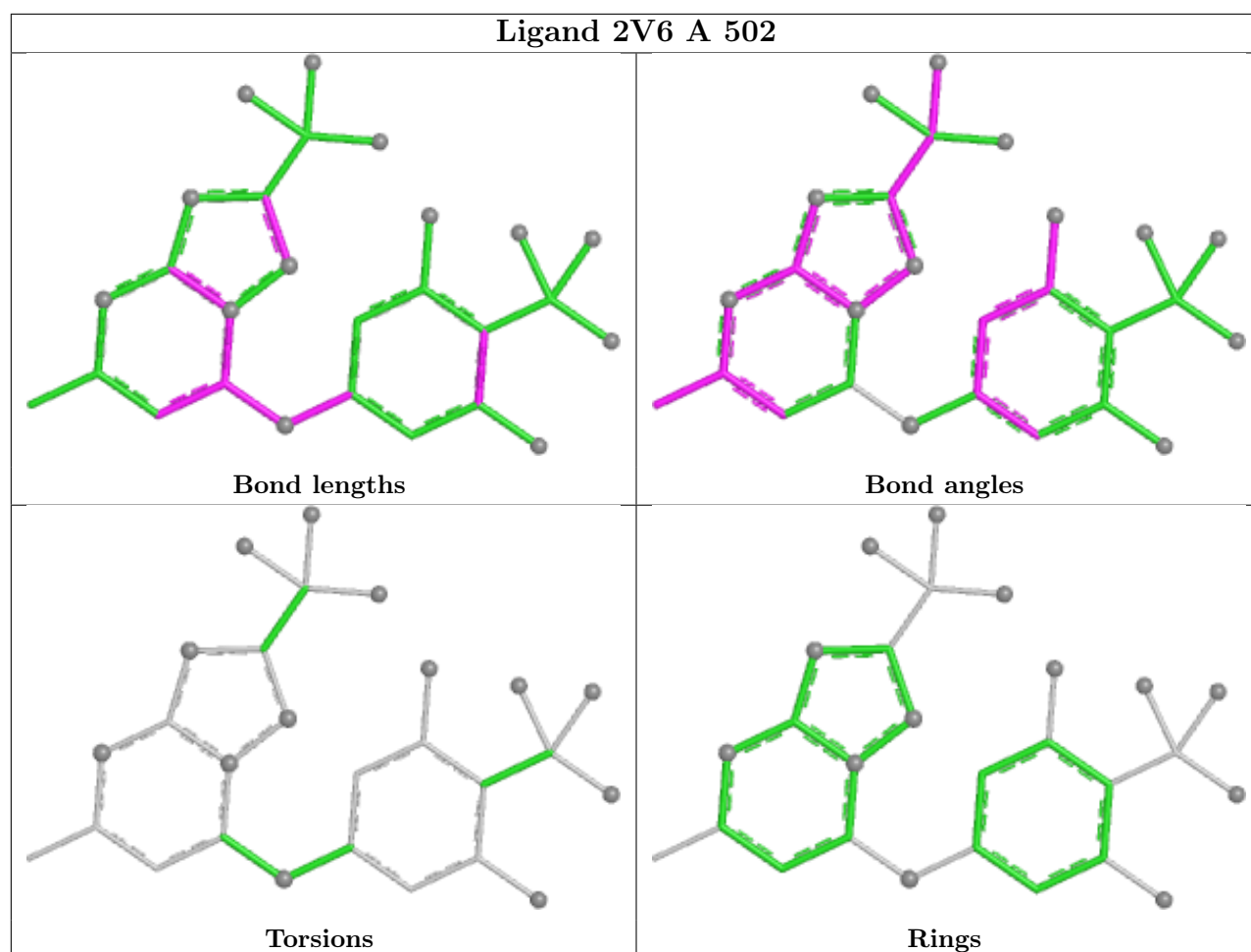
There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	502	2V6	3	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	355/372 (95%)	0.77	37 (10%)	11 12	16, 38, 66, 84	4 (1%)

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	261	THR	4.8
1	A	247	THR	4.6
1	A	268	ILE	4.2
1	A	149	PHE	3.3
1	A	296	ALA	3.2
1	A	36	HIS	3.2
1	A	322	ALA	3.2
1	A	41	TYR	3.2
1	A	148	GLY	2.9
1	A	291	VAL	2.7
1	A	288	SER	2.7
1	A	260	LEU	2.7
1	A	323	LEU	2.7
1	A	37	PHE	2.7
1	A	271	VAL	2.6
1	A	40	GLU	2.6
1	A	218	THR	2.5
1	A	77	ASP	2.5
1	A	394	HIS	2.5
1	A	270	SER	2.4
1	A	128	GLY	2.4
1	A	272	ALA	2.3
1	A	228	THR	2.3
1	A	324	THR	2.2
1	A	246	GLY	2.2
1	A	276	GLY	2.2
1	A	42	LEU	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	130	PRO	2.1
1	A	226	GLY	2.1
1	A	39	ALA	2.1
1	A	187	THR	2.1
1	A	245	LYS	2.1
1	A	238	LEU	2.0
1	A	225	GLN	2.0
1	A	147	TYR	2.0
1	A	267	ASP	2.0
1	A	248	ARG	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](#)

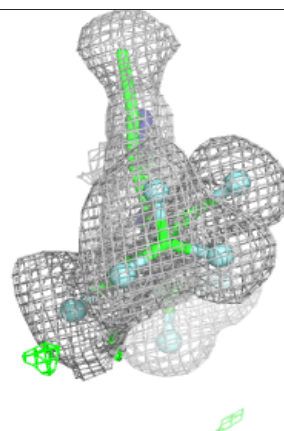
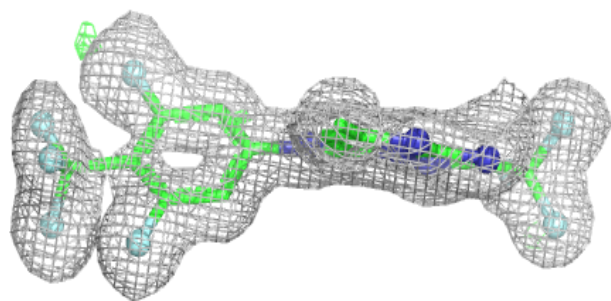
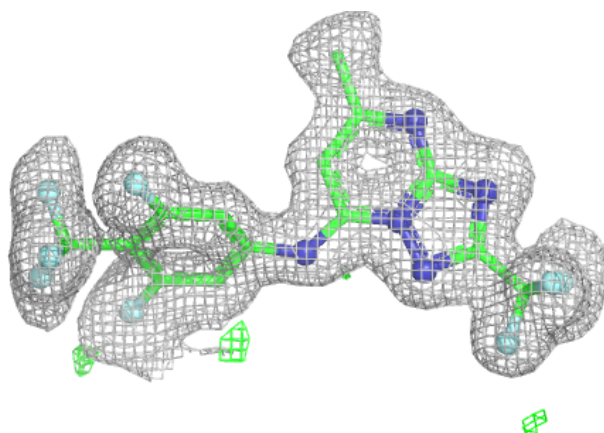
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	ORO	A	501	11/11	0.94	0.08	26,29,34,34	0
4	2V6	A	502	27/27	0.97	0.06	24,28,38,47	0
2	FMN	A	500	31/31	0.98	0.05	16,20,25,27	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 2V6 A 502:**

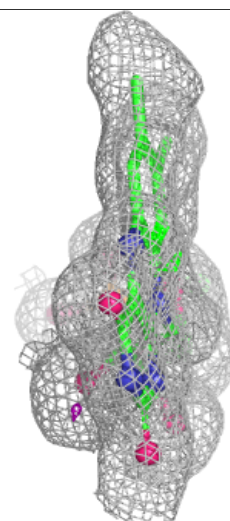
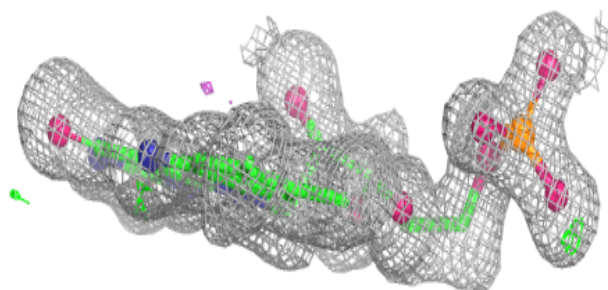
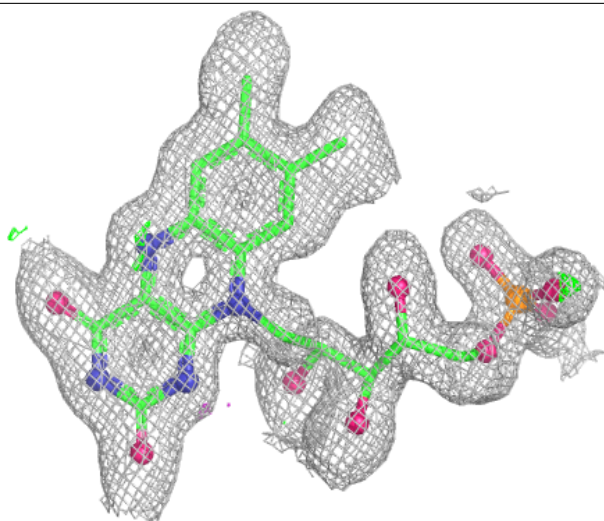
$2mF_o - DF_c$  (at 0.7 rmsd) in gray  
 $mF_o - DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





**Electron density around FMN A 500:**

$2mF_o-DF_c$  (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.