



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 12:22 PM UTC

PDB ID : 1OYA / pdb_00001oya
Title : OLD YELLOW ENZYME AT 2 ANGSTROMS RESOLUTION: OVERALL
STRUCTURE, LIGAND BINDING AND COMPARISON WITH RELATED
FLAVOPROTEINS
Authors : Fox, K.M.; Karplus, P.A.
Deposited on : 1994-08-25
Resolution : 2.00 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

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>.

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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

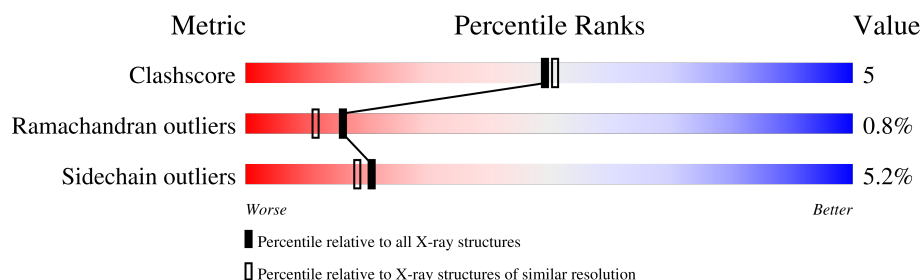
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (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 ≥ 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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	400	 74% 21% . .

2 Entry composition [i](#)

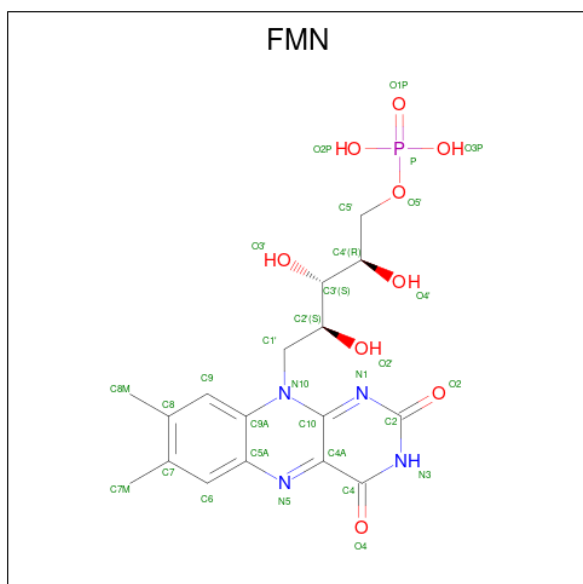
There are 3 unique types of molecules in this entry. The entry contains 3335 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 OLD YELLOW ENZYME.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	399	Total	C	N	O	S	4	0	0
			3178	2027	551	594	6			

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



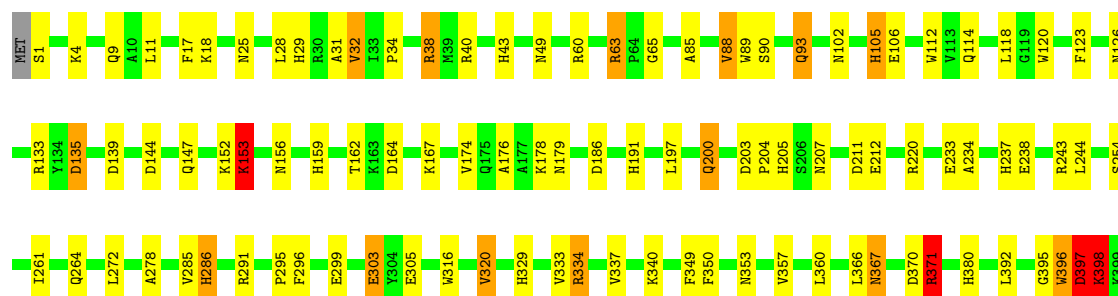
3 Residue-property plots

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. 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. 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.

Note EDS was not executed.

• Molecule 1: OLD YELLOW ENZYME

Chain A:  74% 21% ..



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	142.88Å 142.88Å 43.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.00	Depositor
% Data completeness (in resolution range)	(Not available) (10.00-2.00)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.180 , 0.241	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3335	wwPDB-VP
Average B, all atoms (Å ²)	19.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 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	1.04	12/3260 (0.4%)	1.74	72/4417 (1.6%)

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	2

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	320	VAL	CA-CB	7.98	1.64	1.54
1	A	105	HIS	CD2-NE2	-7.23	1.29	1.37
1	A	191	HIS	CD2-NE2	-7.14	1.29	1.37
1	A	159	HIS	CD2-NE2	-6.65	1.30	1.37
1	A	43	HIS	CD2-NE2	-6.51	1.30	1.37
1	A	380	HIS	CD2-NE2	-6.42	1.30	1.37
1	A	329	HIS	CD2-NE2	-6.42	1.30	1.37
1	A	237	HIS	CD2-NE2	-6.17	1.31	1.37
1	A	205	HIS	CD2-NE2	-6.17	1.31	1.37
1	A	29	HIS	CD2-NE2	-6.16	1.31	1.37
1	A	32	VAL	CA-CB	5.27	1.62	1.54
1	A	261	ILE	CA-CB	5.16	1.61	1.54

All (72) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	296	PHE	CA-CB-CG	-11.99	101.81	113.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	144	ASP	CA-CB-CG	10.37	122.97	112.60
1	A	38	ARG	NE-CZ-NH2	-10.18	110.04	119.20
1	A	179	ASN	OD1-CG-ND2	-9.60	113.00	122.60
1	A	38	ARG	CG-CD-NE	-9.23	91.69	112.00
1	A	397	ASP	CA-CB-CG	-8.10	104.50	112.60
1	A	93	GLN	OE1-CD-NE2	-7.98	114.62	122.60
1	A	349	PHE	CA-CB-CG	-7.83	105.97	113.80
1	A	254	SER	N-CA-C	7.63	119.67	111.36
1	A	397	ASP	O-C-N	7.47	132.53	122.59
1	A	211	ASP	CA-CB-CG	7.36	119.96	112.60
1	A	159	HIS	CB-CG-CD2	-7.32	121.69	131.20
1	A	233	GLU	CB-CG-CD	7.20	124.84	112.60
1	A	4	LYS	N-CA-C	7.17	118.78	110.97
1	A	207	ASN	OD1-CG-ND2	-6.93	115.67	122.60
1	A	398	LYS	N-CA-C	-6.93	96.04	110.80
1	A	105	HIS	CB-CG-CD2	-6.91	122.21	131.20
1	A	135	ASP	N-CA-C	6.68	120.94	110.32
1	A	334	ARG	NE-CZ-NH1	6.54	128.04	121.50
1	A	233	GLU	CA-CB-CG	6.46	127.02	114.10
1	A	179	ASN	CB-CG-ND2	6.46	126.09	116.40
1	A	156	ASN	OD1-CG-ND2	-6.35	116.25	122.60
1	A	205	HIS	CB-CG-CD2	-6.19	123.16	131.20
1	A	88	VAL	N-CA-CB	-6.17	101.05	111.23
1	A	38	ARG	NE-CZ-NH1	6.10	127.60	121.50
1	A	162	THR	N-CA-C	-6.07	101.48	110.46
1	A	286	HIS	CB-CG-CD2	-6.00	123.39	131.20
1	A	17	PHE	CA-CB-CG	-5.99	107.81	113.80
1	A	102	ASN	OD1-CG-ND2	-5.94	116.66	122.60
1	A	118	LEU	N-CA-C	5.88	119.64	112.23
1	A	370	ASP	CA-C-O	5.82	126.51	120.40
1	A	123	PHE	CA-C-N	5.82	125.68	119.28
1	A	123	PHE	C-N-CA	5.82	125.68	119.28
1	A	153	LYS	N-CA-C	-5.82	104.84	111.07
1	A	147	GLN	N-CA-C	-5.78	104.95	112.23
1	A	397	ASP	CA-C-O	5.76	128.75	120.51
1	A	212	GLU	N-CA-CB	-5.74	99.88	110.32
1	A	200	GLN	OE1-CD-NE2	-5.70	116.90	122.60
1	A	60	ARG	CA-CB-CG	-5.66	102.78	114.10
1	A	102	ASN	CB-CG-ND2	5.63	124.85	116.40
1	A	264	GLN	OE1-CD-NE2	-5.61	116.99	122.60
1	A	139	ASP	CA-CB-CG	5.61	118.21	112.60
1	A	159	HIS	CB-CG-ND1	5.55	131.03	122.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	285	VAL	N-CA-C	-5.55	100.49	108.48
1	A	264	GLN	CG-CD-NE2	5.51	124.66	116.40
1	A	43	HIS	CB-CG-CD2	-5.49	124.07	131.20
1	A	85	ALA	N-CA-C	-5.46	103.29	110.39
1	A	286	HIS	CB-CG-ND1	5.42	130.83	122.70
1	A	29	HIS	CB-CG-CD2	-5.40	124.17	131.20
1	A	316	TRP	CG-CD2-CE3	5.39	139.29	133.90
1	A	197	LEU	N-CA-C	5.38	116.82	111.07
1	A	329	HIS	CA-CB-CG	-5.34	108.46	113.80
1	A	34	PRO	CB-CA-C	5.28	117.36	110.92
1	A	238	GLU	CB-CG-CD	5.28	121.58	112.60
1	A	367	ASN	CA-CB-CG	5.26	117.86	112.60
1	A	299	GLU	CB-CG-CD	5.21	121.45	112.60
1	A	4	LYS	CA-C-N	-5.19	115.44	123.17
1	A	4	LYS	C-N-CA	-5.19	115.44	123.17
1	A	396	TRP	CA-C-N	5.14	131.36	121.54
1	A	396	TRP	C-N-CA	5.14	131.36	121.54
1	A	371	ARG	CB-CG-CD	5.14	123.12	111.30
1	A	126	ASN	CA-CB-CG	5.14	117.74	112.60
1	A	126	ASN	OD1-CG-ND2	-5.11	117.50	122.60
1	A	212	GLU	CA-CB-CG	5.08	124.27	114.10
1	A	316	TRP	CB-CG-CD1	-5.07	119.29	126.90
1	A	397	ASP	CA-C-N	5.05	131.19	121.54
1	A	397	ASP	C-N-CA	5.05	131.19	121.54
1	A	178	LYS	CA-CB-CG	-5.05	104.01	114.10
1	A	220	ARG	CB-CG-CD	-5.04	99.71	111.30
1	A	18	LYS	CA-C-N	5.02	124.95	119.78
1	A	18	LYS	C-N-CA	5.02	124.95	119.78
1	A	31	ALA	CA-C-O	-5.02	114.99	120.36

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	396	TRP	Mainchain
1	A	397	ASP	Mainchain

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen

atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3178	0	3093	34	0
2	A	31	0	19	2	0
3	A	126	0	0	2	0
All	All	3335	0	3112	34	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 5.

All (34) 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:114:GLN:HE22	2:A:401:FMN:HN3	1.12	0.93
1:A:353:ASN:HD21	1:A:367:ASN:H	1.25	0.82
1:A:90:SER:H	1:A:93:GLN:NE2	1.97	0.63
1:A:114:GLN:NE2	2:A:401:FMN:HN3	1.93	0.62
1:A:9:GLN:HE21	1:A:334:ARG:NH1	1.99	0.60
1:A:63:ARG:HG2	1:A:357:VAL:HG11	1.85	0.59
1:A:392:LEU:HD22	1:A:398:LYS:HB3	1.85	0.59
1:A:371:ARG:H	1:A:371:ARG:CD	2.15	0.59
1:A:9:GLN:NE2	1:A:334:ARG:HH11	2.04	0.55
1:A:25:ASN:ND2	1:A:112:TRP:HE1	2.05	0.54
1:A:397:ASP:O	1:A:398:LYS:HB2	2.06	0.54
1:A:243:ARG:HH21	1:A:286:HIS:CE1	2.26	0.54
1:A:9:GLN:HE21	1:A:334:ARG:HH11	1.55	0.53
1:A:105:HIS:HE1	1:A:186:ASP:OD2	1.93	0.51
1:A:164:ASP:HA	1:A:167:LYS:HE3	1.92	0.50
1:A:333:VAL:O	1:A:337:VAL:HG22	2.12	0.50
1:A:120:TRP:H	1:A:200:GLN:HE22	1.61	0.49
1:A:152:LYS:HD2	1:A:152:LYS:HA	1.50	0.48
1:A:28:LEU:HB2	1:A:65:GLY:HA3	1.95	0.48
1:A:133:ARG:HD2	1:A:135:ASP:OD1	2.13	0.48
1:A:291:ARG:HA	1:A:303:GLU:HG3	1.96	0.47
1:A:89:TRP:H	1:A:93:GLN:HE22	1.63	0.46
1:A:89:TRP:H	1:A:93:GLN:NE2	2.14	0.45
1:A:371:ARG:H	1:A:371:ARG:HD2	1.82	0.43
1:A:174:VAL:HG13	1:A:234:ALA:HB2	2.00	0.43
1:A:295:PRO:HG3	3:A:616:HOH:O	2.18	0.43
1:A:88:VAL:HG13	1:A:176:ALA:HB1	2.01	0.43
1:A:395:GLY:O	1:A:397:ASP:N	2.49	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:153:LYS:HB2	1:A:153:LYS:NZ	2.35	0.42
1:A:90:SER:H	1:A:93:GLN:HE21	1.66	0.42
1:A:40:ARG:O	1:A:49:ASN:HB2	2.20	0.42
1:A:38:ARG:NH2	3:A:548:HOH:O	2.53	0.41
1:A:203:ASP:HA	1:A:204:PRO:HD2	1.85	0.41
1:A:353:ASN:ND2	1:A:367:ASN:H	2.03	0.41

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	397/400 (99%)	383 (96%)	11 (3%)	3 (1%)	16 11

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	397	ASP
1	A	398	LYS
1	A	278	ALA

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	328/329 (100%)	311 (95%)	17 (5%)	21	18

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	SER
1	A	11	LEU
1	A	32	VAL
1	A	63	ARG
1	A	106	GLU
1	A	153	LYS
1	A	244	LEU
1	A	272	LEU
1	A	303	GLU
1	A	305	GLU
1	A	320	VAL
1	A	340	LYS
1	A	350	PHE
1	A	360	LEU
1	A	366	LEU
1	A	371	ARG
1	A	398	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	9	GLN
1	A	25	ASN
1	A	46	ASN
1	A	84	ASN
1	A	93	GLN
1	A	105	HIS
1	A	114	GLN
1	A	140	ASN
1	A	147	GLN
1	A	156	ASN
1	A	191	HIS
1	A	194	ASN
1	A	200	GLN
1	A	286	HIS
1	A	353	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

1 ligand is 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	401	-	33,33,33	1.37	5 (15%)	48,50,50	1.16	6 (12%)

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	401	-	-	1/18/18/18	0/3/3/3

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	FMN	P-O2P	-2.66	1.44	1.54
2	A	401	FMN	C4A-N5	2.63	1.36	1.30
2	A	401	FMN	C5A-N5	-2.19	1.35	1.39
2	A	401	FMN	P-O1P	-2.10	1.43	1.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	FMN	C10-N1	2.02	1.37	1.33

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	FMN	O3P-P-O5'	-2.46	100.25	106.67
2	A	401	FMN	C4-C4A-N5	2.29	121.37	118.21
2	A	401	FMN	O2P-P-O1P	2.27	119.68	110.83
2	A	401	FMN	C10-N1-C2	2.16	121.52	116.85
2	A	401	FMN	C10-C4A-N5	-2.15	120.43	124.81
2	A	401	FMN	C4-N3-C2	-2.06	121.99	125.64

There are no chirality outliers.

All (1) torsion outliers are listed below:

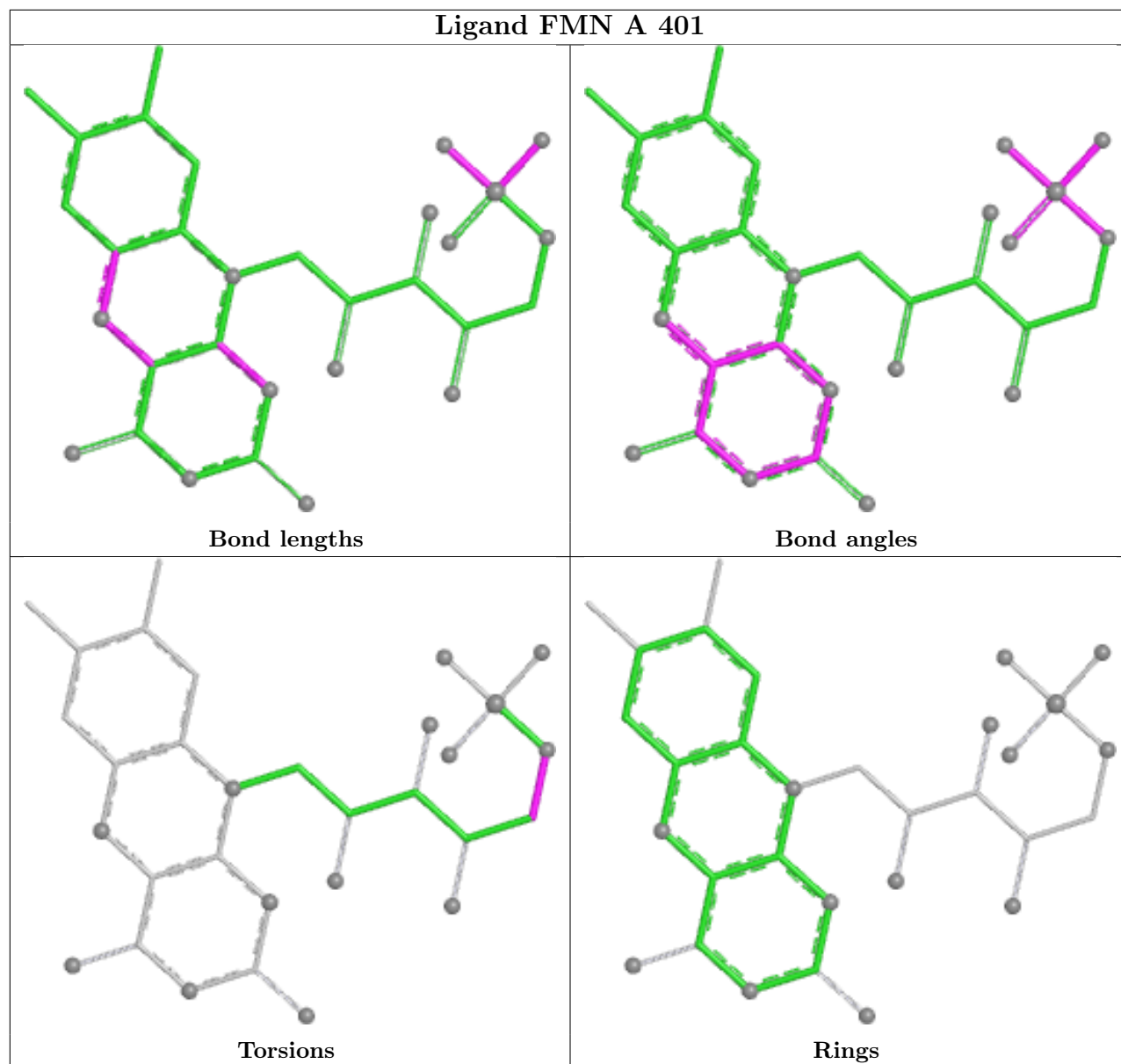
Mol	Chain	Res	Type	Atoms
2	A	401	FMN	C4'-C5'-O5'-P

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	FMN	2	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

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.