



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 08:29 AM EDT

PDB ID : 6VW8
Title : Formate Dehydrogenase FdsABG subcomplex FdsBG from *C. necator*
Authors : Young, T.
Deposited on : 2020-02-18
Resolution : 2.30 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 2.37.1
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.37.1

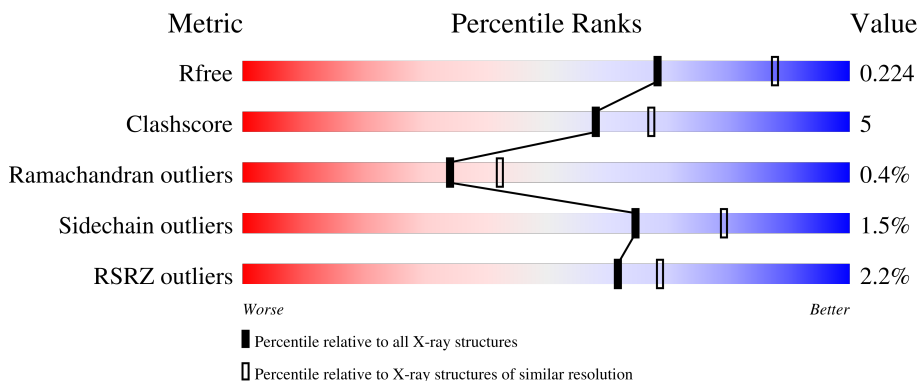
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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}	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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 $\leq 5\%$. 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	215	 6% 59% 11% 30%
1	C	215	 2% 64% 7% 29%
2	B	520	 % 88% 9% ..
2	D	520	 % 86% 13% .

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 10508 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 NAD-dependent formate dehydrogenase gamma subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	151	1123	701	208	207	7	0	0	0
1	C	152	1129	704	209	209	7	0	0	0

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-39	MET	-	initiating methionine	UNP Q0KDY3
A	-38	GLY	-	expression tag	UNP Q0KDY3
A	-37	GLY	-	expression tag	UNP Q0KDY3
A	-36	SER	-	expression tag	UNP Q0KDY3
A	-35	HIS	-	expression tag	UNP Q0KDY3
A	-34	HIS	-	expression tag	UNP Q0KDY3
A	-33	HIS	-	expression tag	UNP Q0KDY3
A	-32	HIS	-	expression tag	UNP Q0KDY3
A	-31	HIS	-	expression tag	UNP Q0KDY3
A	-30	HIS	-	expression tag	UNP Q0KDY3
A	-29	SER	-	expression tag	UNP Q0KDY3
A	-28	ARG	-	expression tag	UNP Q0KDY3
A	-27	ALA	-	expression tag	UNP Q0KDY3
A	-26	TRP	-	expression tag	UNP Q0KDY3
A	-25	ARG	-	expression tag	UNP Q0KDY3
A	-24	HIS	-	expression tag	UNP Q0KDY3
A	-23	PRO	-	expression tag	UNP Q0KDY3
A	-22	GLN	-	expression tag	UNP Q0KDY3
A	-21	GLY	-	expression tag	UNP Q0KDY3
A	-20	GLY	-	expression tag	UNP Q0KDY3
A	-19	SER	-	expression tag	UNP Q0KDY3
A	-18	HIS	-	expression tag	UNP Q0KDY3
A	-17	HIS	-	expression tag	UNP Q0KDY3
A	-16	HIS	-	expression tag	UNP Q0KDY3
A	-15	HIS	-	expression tag	UNP Q0KDY3

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-14	HIS	-	expression tag	UNP Q0KDY3
A	-13	HIS	-	expression tag	UNP Q0KDY3
A	-12	GLY	-	expression tag	UNP Q0KDY3
A	-11	MET	-	expression tag	UNP Q0KDY3
A	-10	ARG	-	expression tag	UNP Q0KDY3
A	-9	ASP	-	expression tag	UNP Q0KDY3
A	-8	LEU	-	expression tag	UNP Q0KDY3
A	-7	TYR	-	expression tag	UNP Q0KDY3
A	-6	ASP	-	expression tag	UNP Q0KDY3
A	-5	ASP	-	expression tag	UNP Q0KDY3
A	-4	ASP	-	expression tag	UNP Q0KDY3
A	-3	ASP	-	expression tag	UNP Q0KDY3
A	-2	LYS	-	expression tag	UNP Q0KDY3
A	-1	ASP	-	expression tag	UNP Q0KDY3
A	0	PRO	-	expression tag	UNP Q0KDY3
C	-39	MET	-	initiating methionine	UNP Q0KDY3
C	-38	GLY	-	expression tag	UNP Q0KDY3
C	-37	GLY	-	expression tag	UNP Q0KDY3
C	-36	SER	-	expression tag	UNP Q0KDY3
C	-35	HIS	-	expression tag	UNP Q0KDY3
C	-34	HIS	-	expression tag	UNP Q0KDY3
C	-33	HIS	-	expression tag	UNP Q0KDY3
C	-32	HIS	-	expression tag	UNP Q0KDY3
C	-31	HIS	-	expression tag	UNP Q0KDY3
C	-30	HIS	-	expression tag	UNP Q0KDY3
C	-29	SER	-	expression tag	UNP Q0KDY3
C	-28	ARG	-	expression tag	UNP Q0KDY3
C	-27	ALA	-	expression tag	UNP Q0KDY3
C	-26	TRP	-	expression tag	UNP Q0KDY3
C	-25	ARG	-	expression tag	UNP Q0KDY3
C	-24	HIS	-	expression tag	UNP Q0KDY3
C	-23	PRO	-	expression tag	UNP Q0KDY3
C	-22	GLN	-	expression tag	UNP Q0KDY3
C	-21	GLY	-	expression tag	UNP Q0KDY3
C	-20	GLY	-	expression tag	UNP Q0KDY3
C	-19	SER	-	expression tag	UNP Q0KDY3
C	-18	HIS	-	expression tag	UNP Q0KDY3
C	-17	HIS	-	expression tag	UNP Q0KDY3
C	-16	HIS	-	expression tag	UNP Q0KDY3
C	-15	HIS	-	expression tag	UNP Q0KDY3
C	-14	HIS	-	expression tag	UNP Q0KDY3
C	-13	HIS	-	expression tag	UNP Q0KDY3

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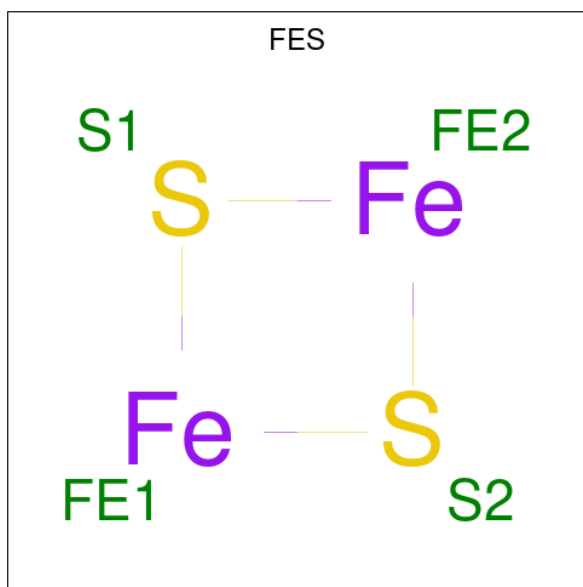
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Chain	Residue	Modelled	Actual	Comment	Reference
C	-12	GLY	-	expression tag	UNP Q0KDY3
C	-11	MET	-	expression tag	UNP Q0KDY3
C	-10	ARG	-	expression tag	UNP Q0KDY3
C	-9	ASP	-	expression tag	UNP Q0KDY3
C	-8	LEU	-	expression tag	UNP Q0KDY3
C	-7	TYR	-	expression tag	UNP Q0KDY3
C	-6	ASP	-	expression tag	UNP Q0KDY3
C	-5	ASP	-	expression tag	UNP Q0KDY3
C	-4	ASP	-	expression tag	UNP Q0KDY3
C	-3	ASP	-	expression tag	UNP Q0KDY3
C	-2	LYS	-	expression tag	UNP Q0KDY3
C	-1	ASP	-	expression tag	UNP Q0KDY3
C	0	PRO	-	expression tag	UNP Q0KDY3

- Molecule 2 is a protein called NAD-dependent formate dehydrogenase beta subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	513	Total 3825	C 2407	N 676	O 720	S 22	0	0	0
2	D	514	Total 3836	C 2415	N 677	O 721	S 23	0	0	0

- Molecule 3 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe₂S₂).

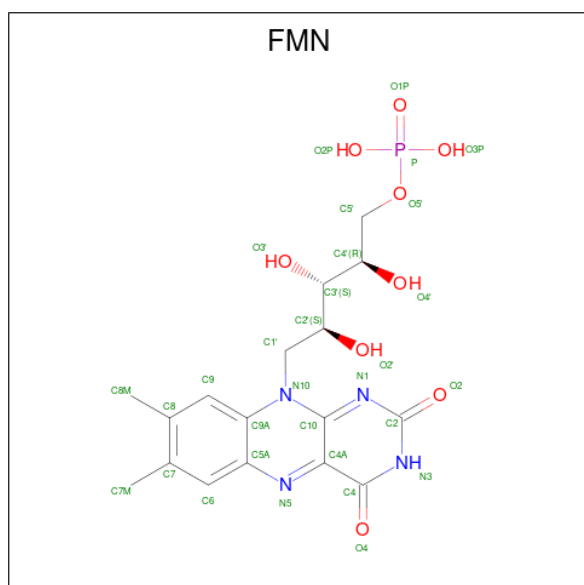


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Fe S 4 2 2	0	0
3	C	1	Total Fe S 4 2 2	0	0

- Molecule 4 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total K 1 1	0	0
4	C	1	Total K 1 1	0	0

- Molecule 5 is FLAVIN MONONUCLEOTIDE (three-letter code: FMN) (formula: C₁₇H₂₁N₄O₉P).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total C N O P 31 17 4 9 1	0	0
5	D	1	Total C N O P 31 17 4 9 1	0	0

- Molecule 6 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe₄S₄).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	1	Total Fe S 8 4 4	0	0
6	D	1	Total Fe S 8 4 4	0	0

- Molecule 7 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total O S 5 4 1	0	0
7	B	1	Total O S 5 4 1	0	0

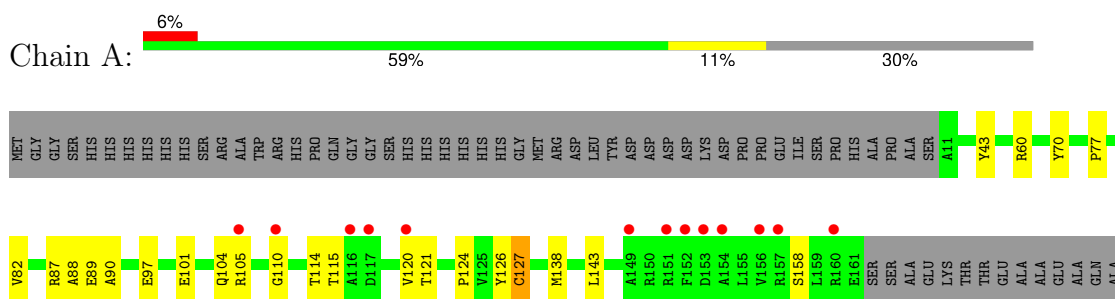
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	45	Total O 45 45	0	0
8	B	226	Total O 226 226	0	0
8	C	51	Total O 51 51	0	0
8	D	175	Total O 175 175	0	0

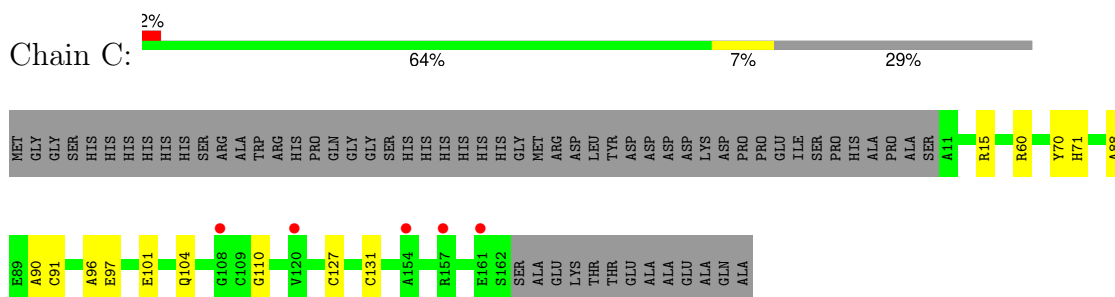
3 Residue-property plots

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 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.

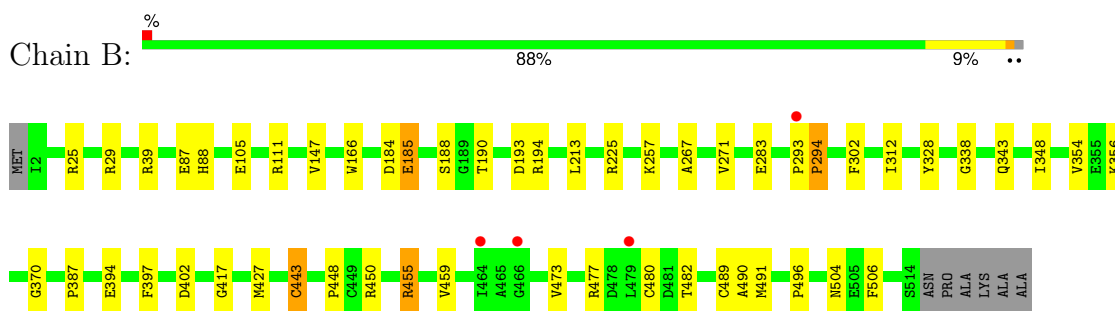
- Molecule 1: NAD-dependent formate dehydrogenase gamma subunit



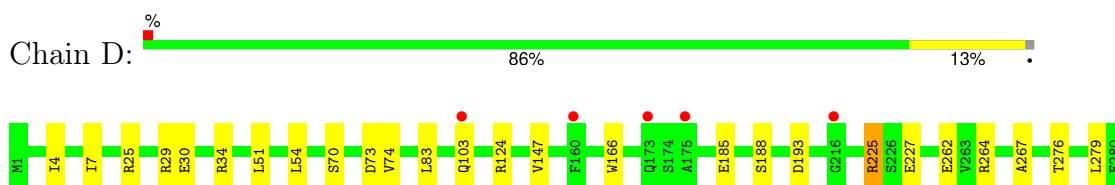
- Molecule 1: NAD-dependent formate dehydrogenase gamma subunit



- Molecule 2: NAD-dependent formate dehydrogenase beta subunit



- Molecule 2: NAD-dependent formate dehydrogenase beta subunit





4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	132.66Å 127.05Å 99.84Å 90.00° 123.50° 90.00°	Depositor
Resolution (Å)	48.53 – 2.30 48.53 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.8 (48.53-2.30) 99.8 (48.53-2.30)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.05 (at 2.29Å)	Xtrriage
Refinement program	PHENIX 1.16_3549	Depositor
R, R_{free}	0.182 , 0.223 0.183 , 0.224	Depositor DCC
R_{free} test set	1996 reflections (3.27%)	wwPDB-VP
Wilson B-factor (Å ²)	25.4	Xtrriage
Anisotropy	0.285	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 40.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	10508	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.01% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: FES, K, SO4, FMN, SF4

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	0.42	0/1145	0.62	0/1561
1	C	0.48	0/1151	0.62	0/1569
2	B	0.51	0/3896	0.63	0/5277
2	D	0.46	0/3907	0.61	0/5291
All	All	0.48	0/10099	0.62	0/13698

There are no bond length outliers.

There are no bond angle outliers.

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	1123	0	1088	14	0
1	C	1129	0	1093	8	0
2	B	3825	0	3794	42	0
2	D	3836	0	3815	43	0
3	A	4	0	0	1	0
3	C	4	0	0	1	0
4	A	1	0	0	0	0
4	C	1	0	0	0	0
5	B	31	0	19	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	D	31	0	19	2	0
6	B	8	0	0	0	0
6	D	8	0	0	0	0
7	B	10	0	0	0	0
8	A	45	0	0	2	0
8	B	226	0	0	3	0
8	C	51	0	0	1	0
8	D	175	0	0	3	0
All	All	10508	0	9828	95	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 (95) 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:B:293:PRO:CD	2:B:294:PRO:HD3	1.78	1.13
2:B:293:PRO:HD2	2:B:294:PRO:CD	1.87	1.04
2:B:293:PRO:HD2	2:B:294:PRO:HD3	1.01	1.01
2:B:293:PRO:CD	2:B:294:PRO:CD	2.52	0.80
2:B:25:ARG:HH21	2:D:29:ARG:HH12	1.33	0.74
2:B:293:PRO:N	2:B:294:PRO:CD	2.54	0.70
2:D:363:ARG:NH2	2:D:394:GLU:OE2	2.21	0.70
2:B:25:ARG:HH21	2:D:29:ARG:NH1	1.90	0.69
2:D:348:ILE:HD11	2:D:370:GLY:HA3	1.77	0.67
2:D:363:ARG:O	2:D:367:VAL:HG22	2.00	0.62
2:B:190:THR:HA	2:B:343:GLN:OE1	2.01	0.60
2:B:111:ARG:NH2	8:B:702:HOH:O	2.26	0.60
2:D:448:PRO:HB3	2:D:482:THR:HG22	1.85	0.58
2:D:445:LYS:HD3	2:D:488:LEU:HD23	1.87	0.56
1:A:104:GLN:HG2	1:A:110:GLY:HA2	1.88	0.55
1:A:87:ARG:HD3	1:A:124:PRO:HB3	1.87	0.55
2:D:30:GLU:HG3	2:D:74:VAL:HG12	1.87	0.55
2:B:448:PRO:HB3	2:B:482:THR:HG22	1.88	0.55
2:B:39:ARG:HD3	2:D:4:ILE:HD11	1.88	0.55
2:B:348:ILE:HD11	2:B:370:GLY:HA3	1.90	0.53
2:D:490:ALA:HB3	5:D:600:FMN:HM83	1.89	0.53
1:A:101:GLU:O	1:A:105:ARG:HG3	2.09	0.52
1:A:88:ALA:HB1	2:B:188:SER:HB3	1.91	0.52
2:B:480:CYS:HB3	2:B:496:PRO:HB3	1.92	0.52
1:A:90:ALA:HB3	3:A:301:FES:S2	2.50	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:87:GLU:HG2	2:B:88:HIS:N	2.25	0.51
1:C:88:ALA:HB1	2:D:188:SER:HB3	1.91	0.51
2:B:477:ARG:NH2	2:B:504:ASN:OD1	2.41	0.51
2:B:105:GLU:OE2	2:B:356:LYS:NZ	2.43	0.50
2:B:354:VAL:HG12	2:B:356:LYS:HG3	1.91	0.50
2:B:29:ARG:HH12	2:D:25:ARG:HH11	1.59	0.50
2:D:7:ILE:HD11	2:D:83:LEU:CD2	2.42	0.50
2:B:394:GLU:HA	2:B:397:PHE:CE2	2.47	0.50
2:B:87:GLU:HG2	2:B:88:HIS:H	1.77	0.50
2:D:488:LEU:HD12	2:D:488:LEU:O	2.12	0.50
2:D:491:MET:HB2	5:D:600:FMN:HM71	1.94	0.49
2:D:51:LEU:HB3	2:D:54:LEU:HD13	1.94	0.49
2:D:283:GLU:HG2	2:D:302:PHE:CE1	2.47	0.49
1:A:70:TYR:CD1	2:B:267:ALA:HB3	2.47	0.49
2:D:279:LEU:HD11	2:D:308:ILE:HD11	1.95	0.49
1:A:89:GLU:OE2	2:B:387:PRO:HB3	2.13	0.48
1:C:91:CYS:HB3	1:C:96:ALA:HB2	1.95	0.48
2:B:427:MET:HG3	2:B:506:PHE:CD2	2.49	0.48
2:D:348:ILE:HD12	2:D:372:GLY:O	2.13	0.48
2:B:473:VAL:O	2:B:477:ARG:HG3	2.14	0.47
2:D:427:MET:HG3	2:D:506:PHE:CD2	2.49	0.47
2:B:193:ASP:OD1	2:B:312:ILE:HG12	2.15	0.47
2:B:271:VAL:HG11	2:B:443:CYS:HB3	1.97	0.47
1:A:82:VAL:HG23	8:A:402:HOH:O	2.14	0.47
2:D:393:PRO:HG3	2:D:505:GLU:CD	2.35	0.46
2:D:34:ARG:NH1	8:D:704:HOH:O	2.34	0.46
2:B:29:ARG:NH1	2:D:25:ARG:HH11	2.14	0.46
1:A:43:TYR:CE1	1:A:77:PRO:HG3	2.50	0.46
2:D:450:ARG:NH1	8:D:720:HOH:O	2.48	0.45
2:B:490:ALA:HB3	5:B:601:FMN:HM83	1.97	0.45
1:A:138:MET:HE2	1:A:143:LEU:HG	1.99	0.45
2:D:361:THR:OG1	2:D:364:GLU:HG3	2.17	0.45
2:D:347:ASN:O	2:D:373:THR:HA	2.17	0.45
2:D:380:ARG:HB2	2:D:423:GLU:HA	1.99	0.44
2:D:124:ARG:NH1	8:D:726:HOH:O	2.50	0.44
1:A:126:TYR:O	1:A:127:CYS:HB3	2.18	0.44
2:B:491:MET:HB2	5:B:601:FMN:HM71	1.97	0.44
2:D:147:VAL:HG21	2:D:166:TRP:CZ3	2.52	0.44
2:D:317:VAL:N	2:D:318:PRO:HD2	2.32	0.44
1:C:104:GLN:HG2	1:C:110:GLY:HA2	2.00	0.43
2:B:328:TYR:CE2	2:B:338:GLY:HA3	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:257:LYS:NZ	8:B:730:HOH:O	2.51	0.43
2:D:388:LEU:HB3	2:D:494:MET:HB3	2.00	0.43
1:C:97:GLU:O	1:C:101:GLU:HG3	2.18	0.43
2:D:193:ASP:OD1	2:D:312:ILE:HG12	2.18	0.43
2:D:467:GLU:HG2	2:D:468:GLN:HG3	2.01	0.43
2:D:472:HIS:HD2	2:D:475:LEU:HD12	1.82	0.43
1:A:97:GLU:HB3	8:A:412:HOH:O	2.18	0.42
1:C:70:TYR:CD1	2:D:267:ALA:HB3	2.54	0.42
2:B:455:ARG:O	2:B:459:VAL:HG22	2.19	0.42
1:A:115:THR:HG23	1:A:120:VAL:HB	2.01	0.42
1:C:90:ALA:CB	1:C:131:CYS:HB3	2.49	0.42
2:D:225:ARG:HB2	2:D:227:GLU:OE1	2.20	0.42
2:B:194:ARG:HH11	2:B:194:ARG:HG2	1.85	0.42
2:D:276:THR:HG22	2:D:296:PRO:HG3	2.02	0.42
2:B:417:GLY:HA3	8:B:871:HOH:O	2.19	0.42
2:B:29:ARG:CZ	2:D:25:ARG:HE	2.33	0.41
1:C:71:HIS:HB2	8:C:451:HOH:O	2.21	0.41
2:D:262:GLU:OE1	2:D:264:ARG:NE	2.38	0.41
2:B:184:ASP:O	2:B:185:GLU:C	2.58	0.41
2:B:213:LEU:HD23	2:B:257:LYS:HE2	2.02	0.41
1:C:90:ALA:HB3	3:C:301:FES:S2	2.60	0.41
1:A:114:THR:OG1	1:A:121:THR:OG1	2.21	0.40
2:B:147:VAL:HG21	2:B:166:TRP:CZ3	2.56	0.40
2:B:394:GLU:HA	2:B:397:PHE:CD2	2.56	0.40
2:D:70:SER:HB3	2:D:73:ASP:OD2	2.21	0.40
2:B:25:ARG:NH2	2:D:29:ARG:HH22	2.18	0.40
2:B:283:GLU:HG2	2:B:302:PHE:CE1	2.56	0.40
2:D:103:GLN:O	2:D:356:LYS:NZ	2.54	0.40
2:D:333:MET:SD	2:D:359:GLY:HA2	2.62	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	149/215 (69%)	145 (97%)	3 (2%)	1 (1%)	22	26
1	C	150/215 (70%)	146 (97%)	3 (2%)	1 (1%)	22	26
2	B	511/520 (98%)	490 (96%)	19 (4%)	2 (0%)	34	42
2	D	512/520 (98%)	494 (96%)	17 (3%)	1 (0%)	47	58
All	All	1322/1470 (90%)	1275 (96%)	42 (3%)	5 (0%)	34	42

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	185	GLU
2	B	185	GLU
1	A	127	CYS
2	B	294	PRO
1	C	127	CYS

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	111/165 (67%)	109 (98%)	2 (2%)	59	75
1	C	112/165 (68%)	110 (98%)	2 (2%)	59	75
2	B	385/391 (98%)	379 (98%)	6 (2%)	62	78
2	D	387/391 (99%)	382 (99%)	5 (1%)	69	82
All	All	995/1112 (90%)	980 (98%)	15 (2%)	65	79

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	60	ARG
1	A	158	SER
2	B	225	ARG
2	B	402	ASP
2	B	443	CYS
2	B	450	ARG

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Mol	Chain	Res	Type
2	B	455	ARG
2	B	489	CYS
1	C	15	ARG
1	C	60	ARG
2	D	225	ARG
2	D	281	SER
2	D	356	LYS
2	D	443	CYS
2	D	489	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 10 ligands modelled in this entry, 2 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	$\# Z > 2$
6	SF4	B	602	2	0,12,12	-	-	-		

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	FMN	B	601	-	33,33,33	2.91	14 (42%)	48,50,50	1.83	10 (20%)
7	SO4	B	603	-	4,4,4	0.25	0	6,6,6	0.31	0
7	SO4	B	604	-	4,4,4	0.30	0	6,6,6	0.16	0
5	FMN	D	600	-	33,33,33	2.85	11 (33%)	48,50,50	1.72	11 (22%)
3	FES	C	301	1	0,4,4	-	-	-	-	-
3	FES	A	301	1	0,4,4	-	-	-	-	-
6	SF4	D	601	2	0,12,12	-	-	-	-	-

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
6	SF4	B	602	2	-	-	0/6/5/5
5	FMN	B	601	-	-	4/18/18/18	0/3/3/3
5	FMN	D	600	-	-	2/18/18/18	0/3/3/3
3	FES	C	301	1	-	-	0/1/1/1
3	FES	A	301	1	-	-	0/1/1/1
6	SF4	D	601	2	-	-	0/6/5/5

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	D	600	FMN	C4A-N5	6.97	1.45	1.30
5	B	601	FMN	C10-N1	6.75	1.46	1.33
5	D	600	FMN	C10-N1	6.70	1.46	1.33
5	B	601	FMN	C4A-N5	6.58	1.44	1.30
5	B	601	FMN	C9A-N10	5.68	1.51	1.41
5	B	601	FMN	C5A-N5	5.49	1.49	1.39
5	D	600	FMN	C9A-N10	5.43	1.50	1.41
5	B	601	FMN	C2-N1	5.15	1.48	1.36
5	D	600	FMN	C5A-N5	5.06	1.48	1.39
5	D	600	FMN	C2-N1	4.90	1.47	1.36
5	D	600	FMN	C2-N3	4.63	1.49	1.39
5	B	601	FMN	C2-N3	4.42	1.48	1.39
5	D	600	FMN	C4-N3	4.00	1.46	1.38
5	B	601	FMN	C10-N10	3.68	1.45	1.37
5	B	601	FMN	C4-N3	3.68	1.45	1.38
5	D	600	FMN	C10-N10	3.44	1.44	1.37
5	B	601	FMN	C8M-C8	3.05	1.56	1.51

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	601	FMN	O2-C2	-2.97	1.18	1.24
5	D	600	FMN	O2-C2	-2.96	1.18	1.24
5	D	600	FMN	C7M-C7	2.70	1.56	1.51
5	B	601	FMN	O4-C4	-2.67	1.18	1.23
5	D	600	FMN	C4A-C4	2.50	1.53	1.44
5	B	601	FMN	C9-C8	2.24	1.42	1.39
5	B	601	FMN	C7M-C7	2.13	1.55	1.51
5	B	601	FMN	O2'-C2'	-2.08	1.39	1.43

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	601	FMN	C7M-C7-C6	-6.44	108.23	119.57
5	B	601	FMN	C7M-C7-C8	5.17	131.32	120.76
5	D	600	FMN	C7M-C7-C6	-4.72	111.25	119.57
5	D	600	FMN	C7M-C7-C8	3.70	128.32	120.76
5	D	600	FMN	C4-N3-C2	-3.49	119.45	125.64
5	B	601	FMN	C4-N3-C2	-3.41	119.58	125.64
5	D	600	FMN	C4A-C10-N10	3.40	121.34	116.48
5	D	600	FMN	C5'-C4'-C3'	-3.07	106.42	112.22
5	B	601	FMN	C5'-C4'-C3'	-2.99	106.58	112.22
5	B	601	FMN	O4-C4-C4A	-2.98	118.66	126.53
5	D	600	FMN	C10-C4A-N5	-2.91	118.86	124.81
5	D	600	FMN	O3P-P-O5'	2.80	113.97	106.67
5	D	600	FMN	C9A-C5A-N5	-2.37	119.94	122.45
5	B	601	FMN	C4A-C4-N3	2.34	119.20	113.25
5	B	601	FMN	C4-C4A-C10	2.32	120.92	116.93
5	B	601	FMN	C9A-C5A-N5	-2.25	120.07	122.45
5	B	601	FMN	C10-C4A-N5	-2.23	120.26	124.81
5	B	601	FMN	C4A-C10-N10	2.21	119.65	116.48
5	D	600	FMN	C4A-C4-N3	2.20	118.84	113.25
5	D	600	FMN	C6-C5A-C9A	2.07	121.90	119.05
5	D	600	FMN	C4-C4A-C10	2.02	120.39	116.93

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	601	FMN	C1'-C2'-C3'-C4'
5	B	601	FMN	C4'-C5'-O5'-P
5	B	601	FMN	C1'-C2'-C3'-O3'
5	D	600	FMN	C4'-C5'-O5'-P

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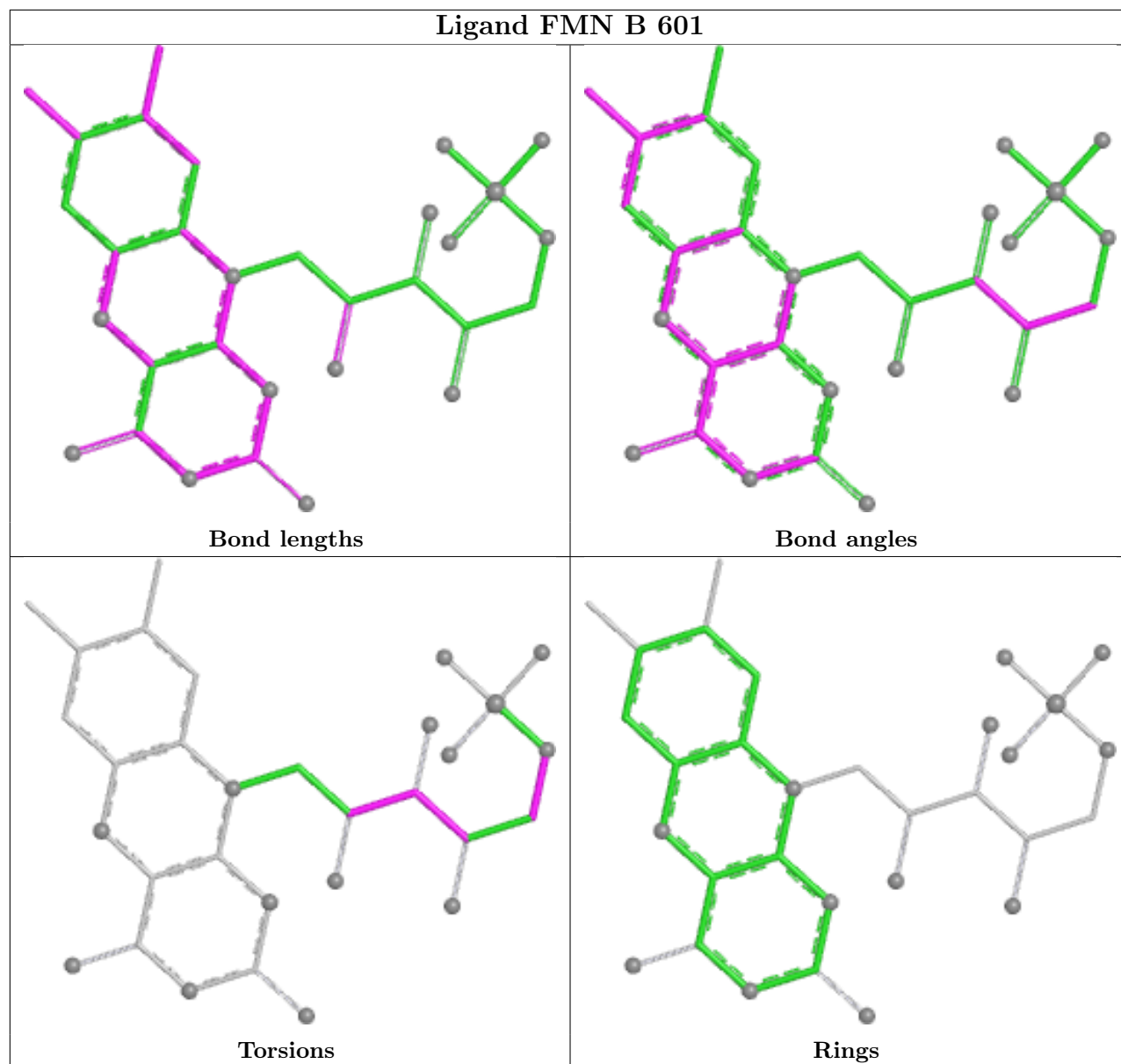
Mol	Chain	Res	Type	Atoms
5	B	601	FMN	O3'-C3'-C4'-C5'
5	D	600	FMN	N10-C1'-C2'-O2'

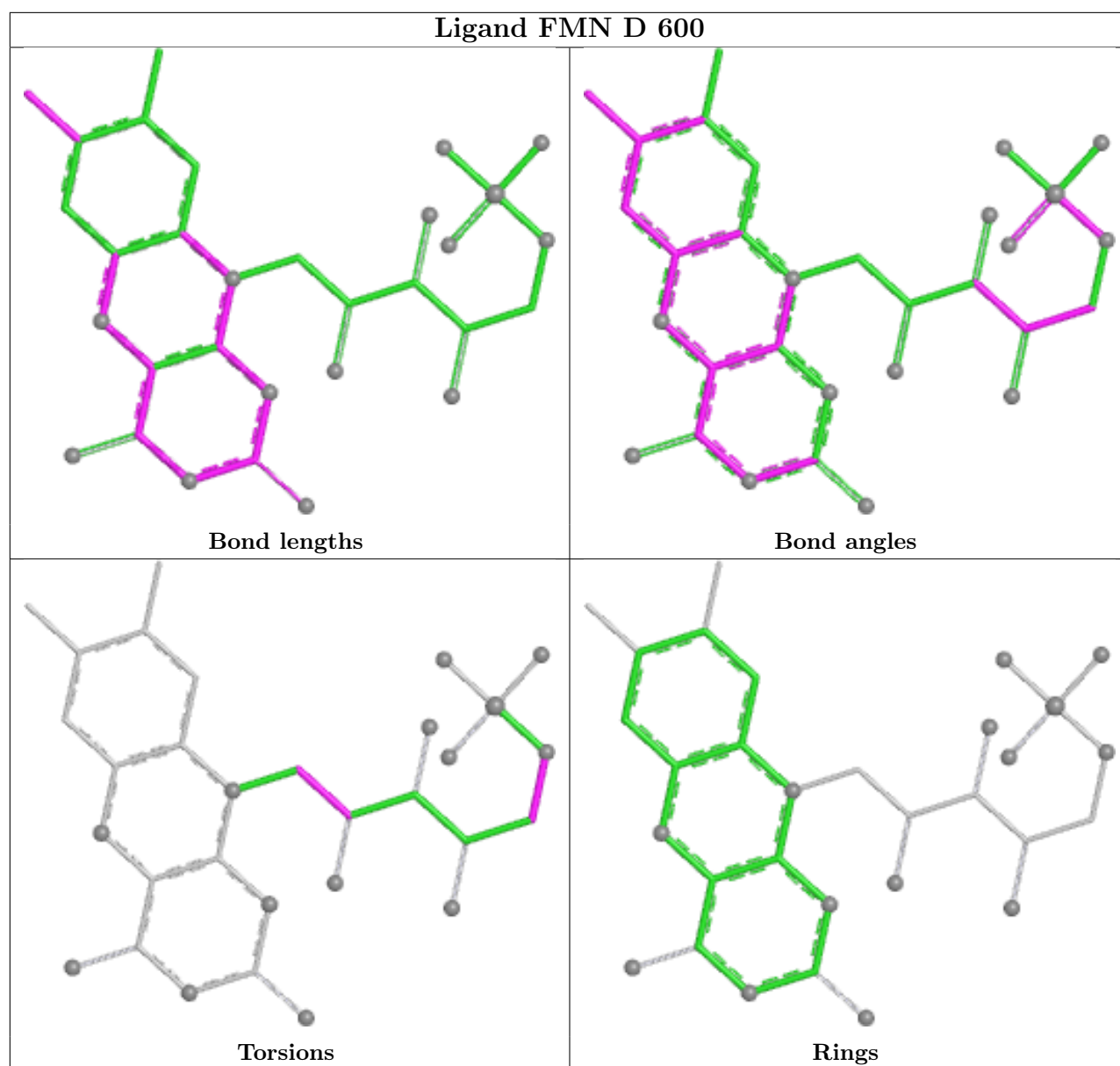
There are no ring outliers.

4 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	601	FMN	2	0
5	D	600	FMN	2	0
3	C	301	FES	1	0
3	A	301	FES	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, 95th 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 ²)	Q<0.9
1	A	151/215 (70%)	0.27	13 (8%) 10 14	20, 34, 63, 85	0
1	C	152/215 (70%)	0.10	5 (3%) 46 53	19, 35, 50, 79	0
2	B	513/520 (98%)	-0.14	4 (0%) 86 89	16, 27, 45, 79	0
2	D	514/520 (98%)	-0.09	7 (1%) 75 80	19, 32, 49, 70	0
All	All	1330/1470 (90%)	-0.05	29 (2%) 62 69	16, 31, 52, 85	0

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	293	PRO	4.6
1	A	116	ALA	3.4
2	B	293	PRO	3.1
1	C	108	GLY	2.9
1	A	156	VAL	2.9
2	D	513	ALA	2.7
1	A	152	PHE	2.7
1	A	154	ALA	2.7
2	D	216	GLY	2.7
1	C	157	ARG	2.6
1	A	117	ASP	2.6
2	D	175	ALA	2.6
1	A	120	VAL	2.5
1	A	151	ARG	2.5
1	C	161	GLU	2.5
1	A	160	ARG	2.5
2	B	464	ILE	2.5
1	A	157	ARG	2.4
1	A	149	ALA	2.3
1	C	154	ALA	2.3
2	D	160	PHE	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	105	ARG	2.2
1	A	153	ASP	2.2
1	A	110	GLY	2.1
2	B	466	GLY	2.1
2	D	173	GLN	2.0
2	B	479	LEU	2.0
1	C	120	VAL	2.0
2	D	103	GLN	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 monosaccharides in this entry.

6.4 Ligands [i](#)

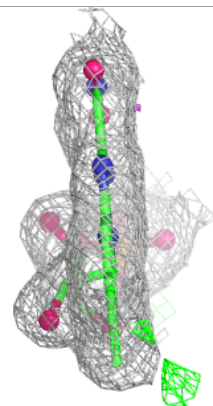
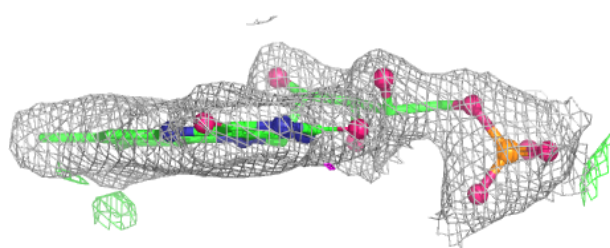
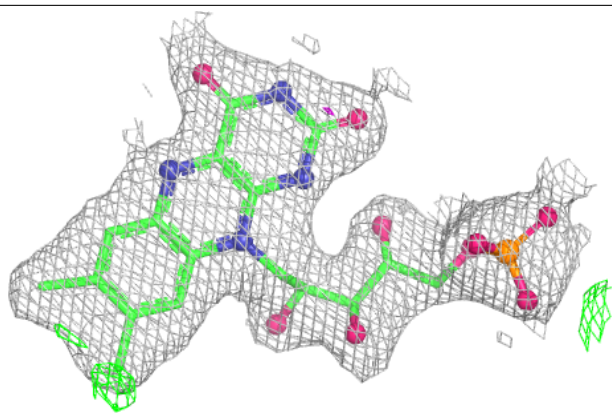
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
7	SO4	B	603	5/5	0.95	0.14	40,43,44,45	0
7	SO4	B	604	5/5	0.95	0.10	58,58,59,60	0
4	K	A	302	1/1	0.96	0.08	53,53,53,53	0
5	FMN	D	600	31/31	0.96	0.15	21,26,33,34	0
5	FMN	B	601	31/31	0.97	0.12	18,22,23,24	0
6	SF4	D	601	8/8	0.98	0.08	24,27,30,32	0
4	K	C	302	1/1	0.98	0.10	37,37,37,37	0
6	SF4	B	602	8/8	0.98	0.08	27,30,32,38	0
3	FES	A	301	4/4	0.99	0.13	26,26,28,28	0
3	FES	C	301	4/4	0.99	0.12	22,23,24,25	0

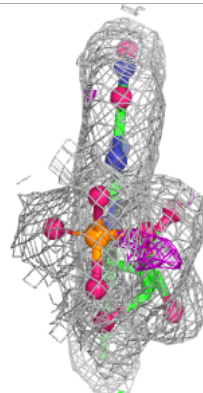
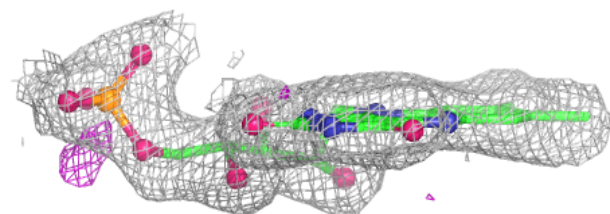
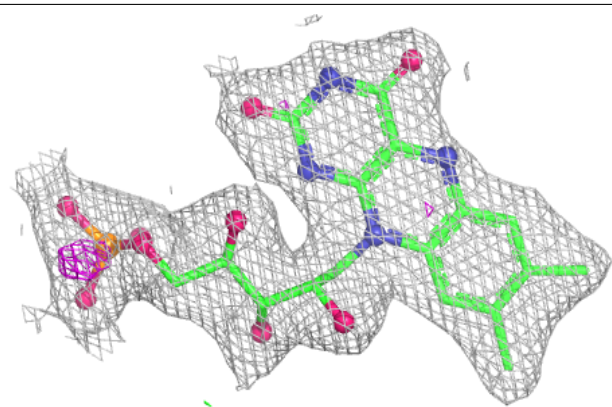
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FMN D 600:

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

**Electron density around FMN B 601:**

$2mF_o-DF_c$ (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.