



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 08:20 PM UTC

PDB ID : 7Y0A / pdb_00007y0a
Title : Crystal structure of human short-chain acyl-CoA dehydrogenase
Authors : Huang, Y.; Xu, Y.; Li, J.
Deposited on : 2022-06-04
Resolution : 2.32 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) : 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

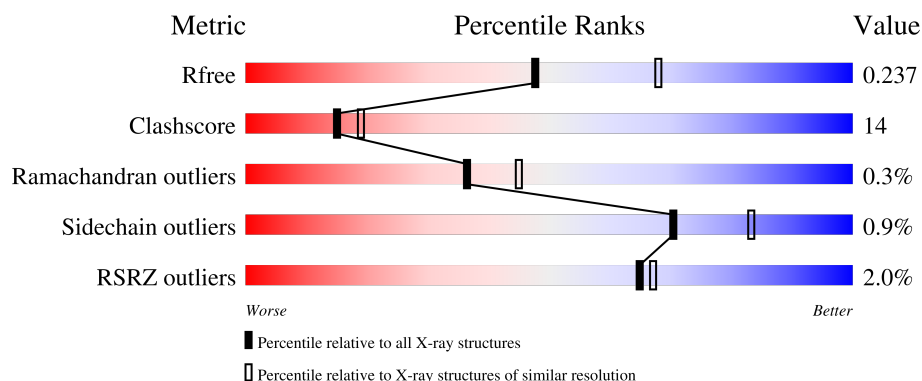
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.32 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	7754 (2.34-2.30)
Clashscore	190562	8383 (2.34-2.30)
Ramachandran outliers	187476	8303 (2.34-2.30)
Sidechain outliers	187428	8303 (2.34-2.30)
RSRZ outliers	180081	7760 (2.34-2.30)

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	398	<div> <div>3%</div> <div>71%</div> <div>26%</div> <div>.</div> </div>
1	B	398	<div> <div>2%</div> <div>68%</div> <div>26%</div> <div>..</div> </div>
1	C	398	<div> <div>%</div> <div>65%</div> <div>29%</div> <div>...</div> </div>
1	D	398	<div> <div>2%</div> <div>61%</div> <div>32%</div> <div>..</div> </div>

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12081 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 Short-chain specific acyl-CoA dehydrogenase, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	385	Total	C	N	O	S	0	0	0
			2879	1825	493	542	19			
1	B	383	Total	C	N	O	S	0	0	0
			2861	1812	491	538	20			
1	C	387	Total	C	N	O	S	0	2	0
			2900	1840	499	541	20			
1	D	385	Total	C	N	O	S	0	0	0
			2884	1827	492	545	20			

There are 40 discrepancies between the modelled and reference sequences:

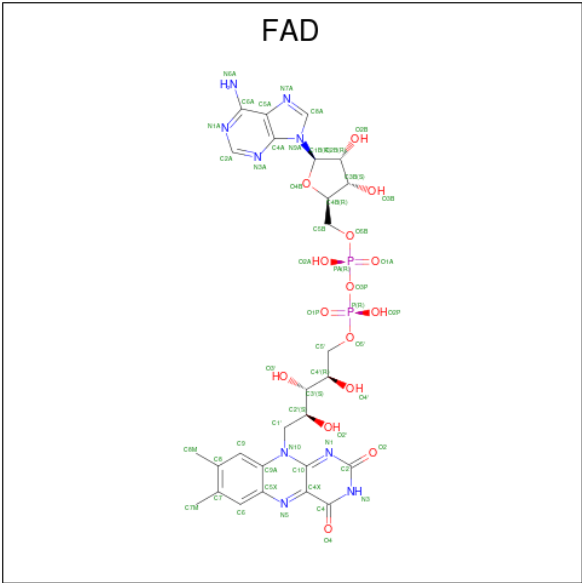
Chain	Residue	Modelled	Actual	Comment	Reference
A	23	MET	-	initiating methionine	UNP P16219
A	24	GLY	-	expression tag	UNP P16219
A	413	LEU	-	expression tag	UNP P16219
A	414	GLU	-	expression tag	UNP P16219
A	415	HIS	-	expression tag	UNP P16219
A	416	HIS	-	expression tag	UNP P16219
A	417	HIS	-	expression tag	UNP P16219
A	418	HIS	-	expression tag	UNP P16219
A	419	HIS	-	expression tag	UNP P16219
A	420	HIS	-	expression tag	UNP P16219
B	23	MET	-	initiating methionine	UNP P16219
B	24	GLY	-	expression tag	UNP P16219
B	413	LEU	-	expression tag	UNP P16219
B	414	GLU	-	expression tag	UNP P16219
B	415	HIS	-	expression tag	UNP P16219
B	416	HIS	-	expression tag	UNP P16219
B	417	HIS	-	expression tag	UNP P16219
B	418	HIS	-	expression tag	UNP P16219
B	419	HIS	-	expression tag	UNP P16219
B	420	HIS	-	expression tag	UNP P16219
C	23	MET	-	initiating methionine	UNP P16219

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Chain	Residue	Modelled	Actual	Comment	Reference
C	24	GLY	-	expression tag	UNP P16219
C	413	LEU	-	expression tag	UNP P16219
C	414	GLU	-	expression tag	UNP P16219
C	415	HIS	-	expression tag	UNP P16219
C	416	HIS	-	expression tag	UNP P16219
C	417	HIS	-	expression tag	UNP P16219
C	418	HIS	-	expression tag	UNP P16219
C	419	HIS	-	expression tag	UNP P16219
C	420	HIS	-	expression tag	UNP P16219
D	23	MET	-	initiating methionine	UNP P16219
D	24	GLY	-	expression tag	UNP P16219
D	413	LEU	-	expression tag	UNP P16219
D	414	GLU	-	expression tag	UNP P16219
D	415	HIS	-	expression tag	UNP P16219
D	416	HIS	-	expression tag	UNP P16219
D	417	HIS	-	expression tag	UNP P16219
D	418	HIS	-	expression tag	UNP P16219
D	419	HIS	-	expression tag	UNP P16219
D	420	HIS	-	expression tag	UNP P16219

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



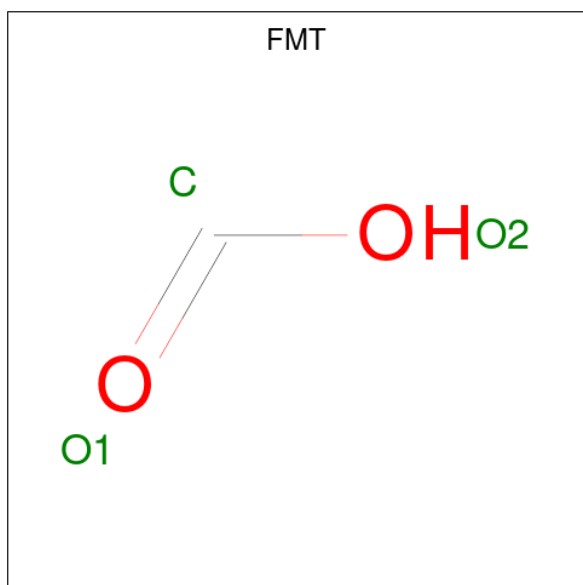
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	B	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	C	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	D	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 3 is FORMIC ACID (CCD ID: FMT) (formula: CH_2O_2).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			3	1	2		
3	B	1	Total	C	O	0	0
			3	1	2		
3	C	1	Total	C	O	0	0
			3	1	2		
3	D	1	Total	C	O	0	0
			3	1	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	98	Total	O	0	0
			98	98		
4	B	43	Total	O	0	0
			43	43		
4	C	105	Total	O	0	0
			105	105		

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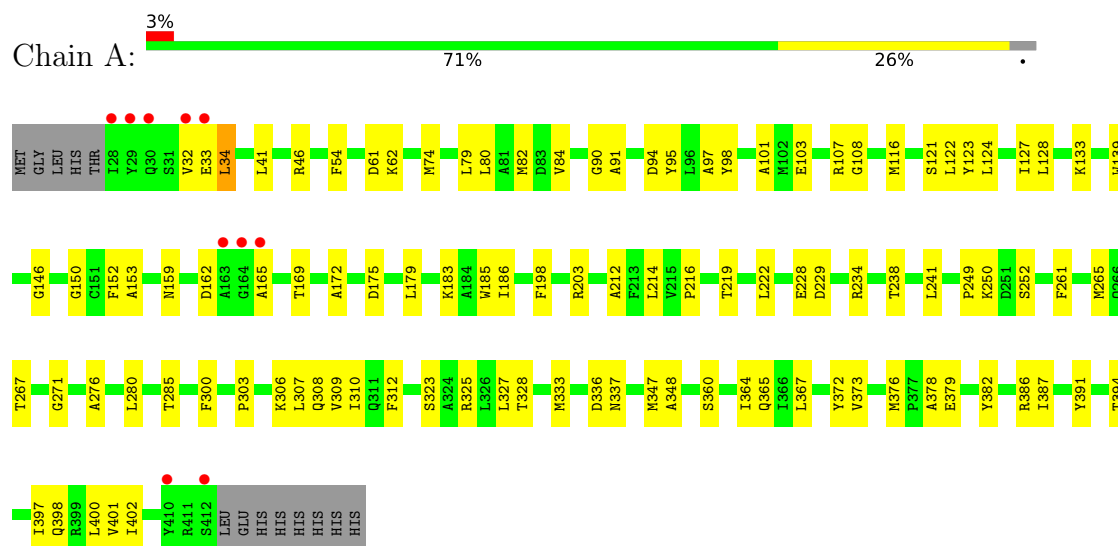
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	87	Total	O	0	0
			87	87		

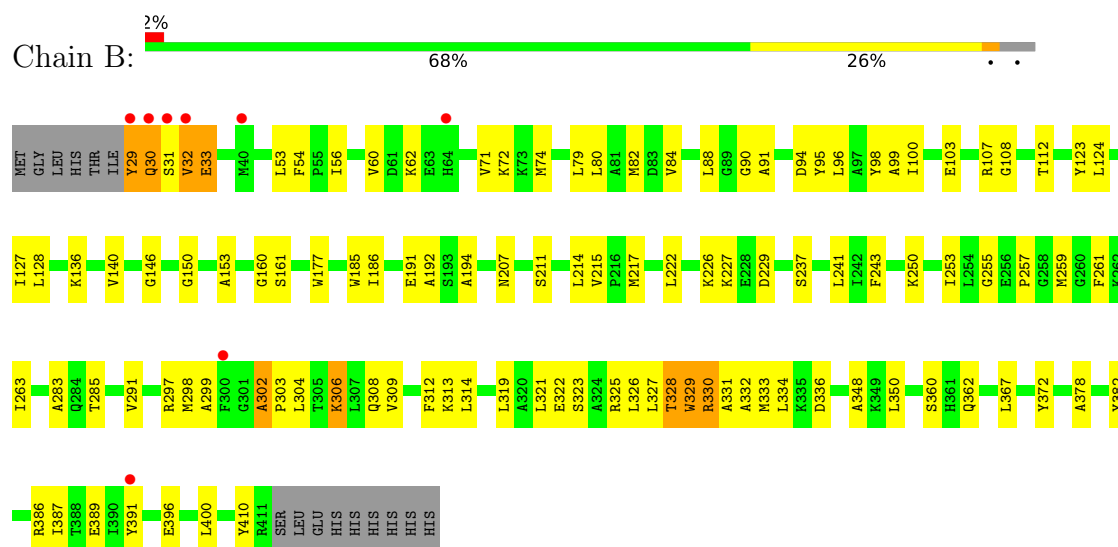
3 Residue-property plots [i](#)

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: Short-chain specific acyl-CoA dehydrogenase, mitochondrial

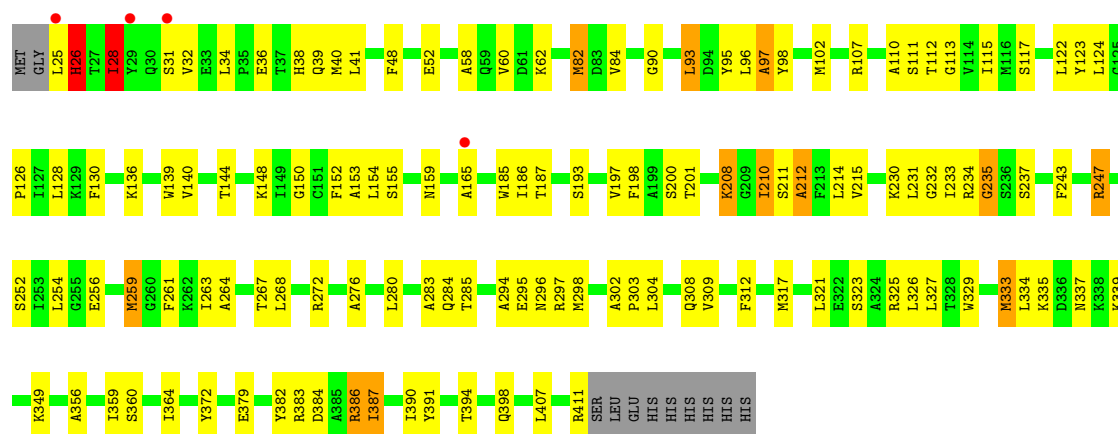


- Molecule 1: Short-chain specific acyl-CoA dehydrogenase, mitochondrial

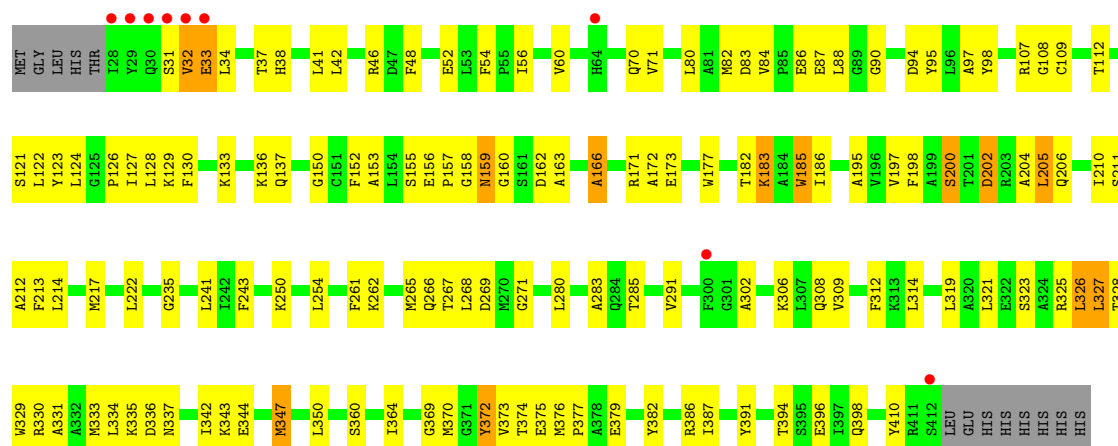


- Molecule 1: Short-chain specific acyl-CoA dehydrogenase, mitochondrial





● Molecule 1: Short-chain specific acyl-CoA dehydrogenase, mitochondrial



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	78.89Å 138.49Å 150.47Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.49 – 2.32 28.49 – 2.32	Depositor EDS
% Data completeness (in resolution range)	99.7 (28.49-2.32) 99.6 (28.49-2.32)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.22 (at 2.31Å)	Xtriage
Refinement program	PHENIX 1.14_3260	Depositor
R, R_{free}	0.195 , 0.239 0.196 , 0.237	Depositor DCC
R_{free} test set	2011 reflections (2.78%)	wwPDB-VP
Wilson B-factor (Å ²)	23.0	Xtriage
Anisotropy	0.889	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 28.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	12081	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.95% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: FAD, FMT

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	0.46	0/2930	0.61	1/3963 (0.0%)
1	B	0.91	21/2912 (0.7%)	0.72	5/3938 (0.1%)
1	C	1.30	43/2965 (1.5%)	0.84	8/4011 (0.2%)
1	D	1.10	36/2935 (1.2%)	0.76	2/3968 (0.1%)
All	All	0.99	100/11742 (0.9%)	0.74	16/15880 (0.1%)

All (100) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	156	GLU	C-O	-9.42	1.16	1.24
1	C	210	ILE	C-O	-9.07	1.12	1.24
1	C	337	ASN	C-O	-8.59	1.13	1.24
1	C	198	PHE	C-O	-8.04	1.14	1.24
1	D	329	TRP	C-O	-7.77	1.14	1.24
1	C	334	LEU	C-O	-7.58	1.15	1.24
1	C	302	ALA	C-O	-7.53	1.17	1.24
1	C	28	ILE	C-O	-7.41	1.14	1.24
1	D	327	LEU	C-O	-7.40	1.15	1.24
1	B	327	LEU	C-O	-7.38	1.15	1.24
1	C	233	ILE	C-O	-7.33	1.15	1.24
1	C	297	ARG	C-O	-7.32	1.15	1.24
1	C	264	ALA	C-O	-7.28	1.15	1.24
1	B	331	ALA	C-O	-7.21	1.15	1.24
1	D	204	ALA	C-O	-7.19	1.15	1.24
1	B	329	TRP	C-O	-7.17	1.15	1.24
1	D	347	MET	C-O	-7.09	1.16	1.24
1	D	374	THR	C-O	-7.06	1.15	1.24
1	D	330	ARG	C-O	-6.94	1.16	1.24
1	D	182	THR	C-O	-6.90	1.15	1.24
1	D	344	GLU	C-O	-6.86	1.16	1.24
1	C	112	THR	C-O	-6.84	1.16	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	298	MET	C-O	-6.83	1.15	1.23
1	C	38	HIS	C-O	-6.54	1.16	1.24
1	D	372	TYR	C-O	-6.54	1.15	1.24
1	D	369	GLY	C-O	-6.53	1.16	1.23
1	D	200	SER	N-CA	-6.50	1.38	1.46
1	D	183	LYS	C-O	-6.45	1.16	1.23
1	C	303	PRO	C-O	-6.45	1.16	1.23
1	C	333	MET	C-O	-6.43	1.16	1.24
1	C	113	GLY	C-O	-6.42	1.16	1.23
1	C	111	SER	C-O	-6.36	1.16	1.24
1	C	98	TYR	C-O	-6.36	1.16	1.24
1	B	99	ALA	C-O	-6.33	1.16	1.24
1	C	295	GLU	C-O	-6.32	1.15	1.24
1	B	96	LEU	C-O	-6.27	1.16	1.24
1	D	162	ASP	C-O	-6.23	1.17	1.23
1	D	158	GLY	C-O	-6.16	1.15	1.23
1	B	32	VAL	C-O	-6.15	1.16	1.24
1	B	330	ARG	C-O	-6.12	1.17	1.24
1	B	322	GLU	C-O	-6.07	1.16	1.24
1	C	296	ASN	C-O	-6.04	1.15	1.24
1	D	326	LEU	C-O	-6.02	1.17	1.24
1	B	326	LEU	C-O	-6.01	1.17	1.24
1	B	302	ALA	C-O	-5.92	1.16	1.24
1	C	304	LEU	C-O	-5.91	1.17	1.24
1	C	211	SER	C-O	-5.90	1.16	1.23
1	B	299	ALA	C-O	-5.89	1.17	1.23
1	C	383	ARG	C-O	-5.88	1.17	1.24
1	C	386	ARG	CZ-NH2	-5.87	1.25	1.33
1	C	235	GLY	C-O	-5.86	1.16	1.23
1	B	298	MET	C-O	-5.84	1.16	1.23
1	B	330	ARG	CZ-NH2	-5.84	1.25	1.33
1	D	160	GLY	C-O	-5.84	1.16	1.23
1	D	206	GLN	CA-C	-5.83	1.48	1.53
1	D	185	TRP	C-O	-5.82	1.16	1.23
1	C	386	ARG	C-O	-5.81	1.17	1.24
1	B	334	LEU	C-O	-5.79	1.17	1.24
1	D	373	VAL	C-O	-5.78	1.16	1.24
1	C	93	LEU	C-O	-5.77	1.17	1.23
1	C	231	LEU	C-O	-5.76	1.17	1.24
1	C	339	LYS	C-O	-5.72	1.18	1.24
1	B	332	ALA	C-O	-5.72	1.17	1.24
1	B	32	VAL	N-CA	-5.72	1.39	1.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	261	PHE	C-O	-5.70	1.17	1.24
1	D	182	THR	CA-C	-5.70	1.45	1.52
1	D	157	PRO	C-O	-5.70	1.17	1.24
1	D	202	ASP	C-O	-5.69	1.16	1.24
1	C	259	MET	C-O	-5.62	1.16	1.24
1	C	97	ALA	C-O	-5.61	1.17	1.24
1	C	387	ILE	C-O	-5.60	1.17	1.24
1	D	328	THR	C-O	-5.55	1.17	1.24
1	D	159	ASN	C-O	-5.53	1.17	1.23
1	D	331	ALA	C-O	-5.53	1.17	1.24
1	D	330	ARG	CZ-NH2	-5.52	1.26	1.33
1	B	328	THR	C-O	-5.45	1.17	1.24
1	C	96	LEU	C-O	-5.45	1.17	1.24
1	D	334	LEU	C-O	-5.44	1.17	1.24
1	D	333	MET	C-O	-5.41	1.17	1.24
1	D	337	ASN	C-O	-5.41	1.17	1.24
1	D	166	ALA	C-O	-5.39	1.17	1.24
1	C	208	LYS	C-O	-5.38	1.16	1.23
1	D	155	SER	C-O	-5.37	1.17	1.23
1	B	100	ILE	C-O	-5.34	1.18	1.24
1	C	297	ARG	CD-NE	-5.32	1.38	1.46
1	C	154	LEU	C-O	-5.28	1.16	1.23
1	C	200	SER	C-O	-5.26	1.17	1.24
1	C	110	ALA	C-O	-5.26	1.17	1.24
1	B	306	LYS	C-O	-5.23	1.17	1.24
1	D	337	ASN	N-CA	-5.22	1.39	1.46
1	C	294	ALA	C-O	-5.21	1.17	1.24
1	C	212	ALA	C-O	-5.18	1.17	1.23
1	D	163	ALA	N-CA	-5.17	1.39	1.46
1	C	159	ASN	C-O	-5.16	1.17	1.23
1	C	302	ALA	CA-C	-5.16	1.47	1.52
1	B	88	LEU	C-O	-5.14	1.17	1.24
1	D	200	SER	C-O	-5.12	1.17	1.24
1	D	198	PHE	C-O	-5.07	1.18	1.24
1	B	297	ARG	C-O	-5.04	1.17	1.24
1	C	333	MET	N-CA	-5.04	1.40	1.46

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	34	LEU	N-CA-C	9.25	120.24	109.60
1	C	259	MET	CG-SD-CE	7.90	118.29	100.90

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	34	LEU	N-CA-C	-7.56	99.59	110.40
1	C	115	ILE	N-CA-C	-7.27	103.70	110.53
1	B	30	GLN	N-CA-C	7.00	120.39	107.99
1	C	26	HIS	N-CA-C	6.67	125.01	110.80
1	C	165	ALA	N-CA-C	6.63	119.43	108.49
1	C	230	LYS	N-CA-C	6.49	120.48	110.42
1	B	32	VAL	N-CA-C	-5.67	97.55	109.34
1	B	96	LEU	N-CA-C	-5.62	105.07	111.14
1	B	33	GLU	N-CA-C	5.50	122.52	110.80
1	D	32	VAL	N-CA-C	5.38	120.54	109.34
1	C	96	LEU	N-CA-C	-5.24	105.65	111.36
1	C	82	MET	N-CA-C	5.23	116.79	111.14
1	C	390	ILE	N-CA-C	5.04	116.22	111.48
1	B	31	SER	N-CA-CB	5.03	118.99	110.49

There are no chirality outliers.

There are no planarity outliers.

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	2879	0	2895	90	0
1	B	2861	0	2865	95	0
1	C	2900	0	2917	74	0
1	D	2884	0	2892	98	0
2	A	53	0	31	9	0
2	B	53	0	31	16	0
2	C	53	0	31	5	0
2	D	53	0	31	7	0
3	A	3	0	1	0	0
3	B	3	0	1	0	0
3	C	3	0	1	0	0
3	D	3	0	1	0	0
4	A	98	0	0	3	0
4	B	43	0	0	1	0
4	C	105	0	0	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	D	87	0	0	0	0
All	All	12081	0	11697	322	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 (322) 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:D:262:LYS:HE3	1:D:266:GLN:NE2	1.54	1.19
1:D:262:LYS:CE	1:D:266:GLN:HE21	1.73	1.01
1:D:262:LYS:HE3	1:D:266:GLN:HE21	0.84	1.00
1:A:387:ILE:HG13	1:A:391:TYR:CD1	2.16	0.80
1:A:33:GLU:HG2	1:C:28:ILE:HB	1.61	0.80
1:A:84:VAL:HG22	1:A:128:LEU:HD11	1.68	0.75
1:A:347:MET:HG3	1:A:402:ILE:HD12	1.68	0.74
1:A:387:ILE:HG13	1:A:391:TYR:CE1	2.23	0.73
1:C:372:TYR:CZ	1:D:387:ILE:HB	2.24	0.72
1:A:303:PRO:HG2	1:A:306:LYS:HG2	1.70	0.72
1:D:370:MET:CE	1:D:376:MET:HG2	2.21	0.71
1:B:387:ILE:HG13	1:B:391:TYR:CD1	2.25	0.70
1:B:302:ALA:HB1	1:B:303:PRO:HD2	1.71	0.70
1:D:387:ILE:HG13	1:D:391:TYR:CE1	2.27	0.70
1:D:172:ALA:HB1	1:D:250:LYS:HZ1	1.57	0.69
1:D:87:GLU:HG2	1:D:88:LEU:HD12	1.75	0.68
1:B:84:VAL:HG22	1:B:128:LEU:HD11	1.76	0.68
1:C:95:TYR:CD2	1:C:335:LYS:HE3	2.28	0.68
1:A:122:LEU:HB3	1:A:152:PHE:HB2	1.74	0.68
1:B:71:VAL:HA	1:B:74:MET:HE3	1.76	0.67
1:A:398:GLN:O	1:A:402:ILE:HG12	1.95	0.67
1:C:36:GLU:HG2	1:C:40:MET:HE1	1.76	0.66
1:D:387:ILE:HD11	2:D:601:FAD:HM83	1.76	0.66
1:A:387:ILE:HB	1:B:372:TYR:CZ	2.31	0.66
1:C:153:ALA:HA	1:C:186:ILE:HD12	1.77	0.65
1:D:387:ILE:HG13	1:D:391:TYR:CD1	2.31	0.65
1:B:387:ILE:HD11	2:B:501:FAD:HM83	1.78	0.65
1:B:302:ALA:HB1	1:B:306:LYS:HD3	1.79	0.65
1:B:194:ALA:C	1:B:217:MET:HE2	2.23	0.64
1:B:302:ALA:HB1	1:B:303:PRO:CD	2.28	0.64
1:C:122:LEU:HB3	1:C:152:PHE:HB2	1.79	0.64
1:D:107:ARG:HG3	1:D:285:THR:HB	1.79	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:372:TYR:CZ	1:B:387:ILE:HB	2.33	0.63
1:D:84:VAL:HA	1:D:128:LEU:HD11	1.80	0.63
1:D:86:GLU:HG3	1:D:90:GLY:O	1.98	0.63
1:A:308:GLN:HB3	1:D:309:VAL:HG23	1.80	0.63
1:B:74:MET:HE1	1:B:112:THR:HG23	1.81	0.62
1:C:256:GLU:H	1:C:259:MET:HE3	1.64	0.62
1:A:327:LEU:HD11	1:C:323:SER:OG	2.00	0.61
1:D:370:MET:HE3	1:D:376:MET:HG2	1.80	0.61
1:C:84:VAL:HB	1:C:90:GLY:HA3	1.83	0.61
1:A:82:MET:HE1	1:A:101:ALA:HB3	1.83	0.60
1:C:82:MET:HE3	1:C:93:LEU:HD12	1.84	0.60
2:B:501:FAD:H61A	1:D:308:GLN:HE22	1.50	0.60
1:B:153:ALA:HA	1:B:186:ILE:HD12	1.83	0.60
1:C:185:TRP:O	2:C:502:FAD:C4X	2.50	0.60
1:D:364:ILE:HD11	1:D:379:GLU:HA	1.83	0.59
1:B:192:ALA:HB3	1:B:217:MET:HE1	1.85	0.59
1:A:387:ILE:HD11	2:A:601:FAD:HM83	1.85	0.59
1:B:312:PHE:CE2	1:C:309:VAL:HG21	2.38	0.58
1:D:84:VAL:HG21	1:D:124:LEU:HD13	1.84	0.58
1:C:387:ILE:HB	1:D:372:TYR:CZ	2.39	0.58
1:B:215:VAL:HG11	1:B:243:PHE:HE1	1.69	0.58
1:B:84:VAL:HB	1:B:90:GLY:HA3	1.85	0.57
1:C:107:ARG:HG3	1:C:285:THR:HB	1.86	0.57
1:A:387:ILE:HG12	2:A:601:FAD:HM72	1.87	0.57
1:B:387:ILE:HG13	1:B:391:TYR:CE1	2.40	0.57
1:A:122:LEU:HB3	1:A:152:PHE:CB	2.35	0.56
1:A:153:ALA:HA	1:A:186:ILE:HD12	1.87	0.56
1:C:123:TYR:CG	1:C:150:GLY:HA3	2.39	0.56
1:C:309:VAL:CG1	2:D:601:FAD:H2A	2.35	0.56
1:B:107:ARG:HG3	1:B:285:THR:HB	1.87	0.56
1:A:159:ASN:HD21	1:A:162:ASP:HB3	1.70	0.55
1:B:160:GLY:HA3	2:B:501:FAD:H5'2	1.88	0.55
1:C:329:TRP:HB3	1:C:333:MET:HE2	1.88	0.55
1:A:309:VAL:HG21	1:D:312:PHE:CE2	2.41	0.55
1:D:343:LYS:HD3	1:D:347:MET:HE3	1.88	0.55
1:B:74:MET:HG2	1:B:79:LEU:HD12	1.88	0.55
1:A:203:ARG:NH1	4:A:704:HOH:O	2.39	0.55
1:B:387:ILE:HG12	2:B:501:FAD:HM72	1.87	0.54
1:C:384:ASP:OD1	4:C:601:HOH:O	2.18	0.54
1:A:185:TRP:O	2:A:601:FAD:C4X	2.55	0.54
1:A:84:VAL:HG21	1:A:124:LEU:HD13	1.90	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:325:ARG:HD3	1:C:329:TRP:CZ2	2.43	0.54
1:B:80:LEU:HD12	1:B:146:GLY:HA2	1.91	0.53
1:B:400:LEU:HD11	2:B:501:FAD:N6A	2.24	0.53
1:A:107:ARG:HG3	1:A:285:THR:HB	1.90	0.53
1:B:226:LYS:HZ2	1:B:227:LYS:H	1.57	0.53
1:C:185:TRP:HB3	2:C:502:FAD:C9A	2.38	0.53
1:C:407:LEU:O	1:C:411:ARG:HD2	2.09	0.53
1:D:42:LEU:HD21	1:D:46:ARG:HH11	1.73	0.53
1:D:370:MET:HE1	1:D:375:GLU:HG2	1.90	0.53
1:C:122:LEU:HB3	1:C:152:PHE:CB	2.39	0.52
1:A:82:MET:HE3	1:A:98:TYR:HD1	1.73	0.52
1:D:42:LEU:HD21	1:D:46:ARG:NH1	2.25	0.52
1:B:84:VAL:HG21	1:B:124:LEU:HD13	1.91	0.52
1:A:159:ASN:ND2	1:A:165:ALA:HB3	2.25	0.52
1:A:360:SER:OG	1:A:382:TYR:HA	2.08	0.52
1:C:34:LEU:HB2	1:C:39:GLN:HG2	1.90	0.52
1:B:226:LYS:NZ	1:B:227:LYS:H	2.07	0.52
1:B:313:LYS:HG2	1:B:362:GLN:OE1	2.10	0.52
1:B:82:MET:HA	1:B:91:ALA:HB3	1.92	0.51
1:B:309:VAL:HG21	1:C:312:PHE:CE2	2.45	0.51
1:A:46:ARG:HH11	1:A:107:ARG:CZ	2.23	0.51
1:A:372:TYR:CG	1:B:387:ILE:HD13	2.45	0.51
1:D:48:PHE:CE1	1:D:52:GLU:HG3	2.45	0.51
1:D:302:ALA:HB1	1:D:306:LYS:HG3	1.93	0.51
1:C:26:HIS:CD2	1:C:333:MET:HG2	2.45	0.51
1:D:177:TRP:CD1	1:D:250:LYS:HA	2.45	0.51
1:D:94:ASP:HB2	1:D:336:ASP:CG	2.36	0.51
1:A:159:ASN:ND2	1:A:162:ASP:HB3	2.25	0.51
1:C:84:VAL:HG22	1:C:128:LEU:HD11	1.92	0.51
1:A:376:MET:HE2	1:A:376:MET:HA	1.92	0.50
1:B:29:TYR:CE2	1:D:33:GLU:HG3	2.46	0.50
1:B:309:VAL:HG22	1:B:313:LYS:HD2	1.93	0.50
1:D:185:TRP:O	2:D:601:FAD:C4X	2.59	0.50
1:D:283:ALA:HB3	1:D:321:LEU:HD13	1.93	0.50
1:D:122:LEU:HB3	1:D:152:PHE:CG	2.47	0.50
1:D:183:LYS:HB2	1:D:241:LEU:HB2	1.92	0.50
1:B:308:GLN:HB3	1:C:308:GLN:HB2	1.94	0.50
1:C:153:ALA:HB3	1:C:197:VAL:HG22	1.94	0.49
1:A:307:LEU:HD13	2:B:501:FAD:C5A	2.42	0.49
1:B:319:LEU:HD13	1:D:350:LEU:HD23	1.94	0.49
1:B:217:MET:HG2	1:B:222:LEU:CD2	2.41	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:94:ASP:HB2	1:A:336:ASP:CG	2.37	0.49
1:A:172:ALA:HB1	4:A:703:HOH:O	2.12	0.49
1:A:300:PHE:HE2	2:B:501:FAD:H2A	1.77	0.49
1:D:376:MET:HE3	1:D:377:PRO:HD2	1.94	0.49
1:C:41:LEU:HD22	1:C:97:ALA:HB1	1.95	0.49
1:B:207:ASN:HB2	1:B:261:PHE:CG	2.48	0.49
1:C:36:GLU:HG2	1:C:40:MET:CE	2.43	0.49
1:C:372:TYR:HE1	1:D:386:ARG:HB3	1.77	0.49
1:C:139:TRP:CG	1:C:214:LEU:HD13	2.48	0.49
1:B:177:TRP:CD1	1:B:250:LYS:HA	2.48	0.48
1:C:309:VAL:HG12	2:D:601:FAD:H2A	1.94	0.48
1:D:387:ILE:HD11	2:D:601:FAD:C8M	2.42	0.48
1:B:29:TYR:CE2	1:D:33:GLU:CD	2.91	0.48
1:A:84:VAL:HB	1:A:90:GLY:HA3	1.96	0.48
1:D:84:VAL:HB	1:D:90:GLY:HA3	1.96	0.48
1:B:95:TYR:HA	1:B:98:TYR:HB3	1.95	0.48
1:C:386:ARG:HB3	1:D:372:TYR:HE1	1.77	0.48
1:D:396:GLU:H	1:D:396:GLU:CD	2.21	0.48
1:B:30:GLN:CD	1:B:30:GLN:H	2.22	0.48
1:A:386:ARG:HB3	1:B:372:TYR:HE1	1.79	0.48
1:A:82:MET:CE	1:A:116:MET:HE3	2.44	0.47
1:B:396:GLU:HB2	2:B:501:FAD:O2B	2.14	0.47
1:D:133:LYS:O	1:D:137:GLN:HG3	2.14	0.47
1:B:103:GLU:OE2	1:B:325:ARG:NH2	2.33	0.47
1:B:185:TRP:O	2:B:501:FAD:C4X	2.61	0.47
1:B:323:SER:HB2	1:D:323:SER:OG	2.14	0.47
1:D:370:MET:HE1	1:D:375:GLU:CG	2.45	0.47
1:B:54:PHE:CD2	1:B:108:GLY:HA2	2.49	0.47
1:C:214:LEU:O	1:C:252:SER:HB3	2.15	0.47
2:A:601:FAD:H2A	1:B:309:VAL:CG1	2.44	0.47
1:A:276:ALA:O	1:A:280:LEU:HG	2.15	0.47
1:B:29:TYR:CZ	1:D:33:GLU:HG3	2.49	0.47
1:B:30:GLN:C	1:B:32:VAL:H	2.22	0.47
1:B:82:MET:HB3	1:B:82:MET:HE2	1.80	0.47
1:B:329:TRP:HB3	1:B:333:MET:CE	2.44	0.47
1:C:84:VAL:HG21	1:C:124:LEU:HD13	1.96	0.47
1:A:34:LEU:HD23	1:A:34:LEU:HA	1.61	0.47
1:A:121:SER:HB3	1:A:271:GLY:HA2	1.95	0.47
1:A:103:GLU:OE2	1:A:325:ARG:NH1	2.47	0.47
1:A:312:PHE:CZ	1:D:309:VAL:HG21	2.50	0.47
1:D:37:THR:HG23	1:D:38:HIS:ND1	2.28	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:82:MET:HE2	1:D:82:MET:HB3	1.76	0.47
1:A:122:LEU:HB3	1:A:152:PHE:CG	2.50	0.46
1:A:328:THR:HA	1:A:348:ALA:HB1	1.96	0.46
2:A:601:FAD:H51A	1:B:304:LEU:HD11	1.97	0.46
1:D:172:ALA:HB1	1:D:250:LYS:NZ	2.27	0.46
1:A:133:LYS:HD2	1:A:133:LYS:HA	1.81	0.46
1:B:217:MET:HG2	1:B:222:LEU:HD21	1.97	0.46
1:A:222:LEU:HD11	1:A:241:LEU:HG	1.97	0.46
1:D:41:LEU:CD2	1:D:97:ALA:HB1	2.45	0.46
1:B:54:PHE:CE2	1:B:108:GLY:HA2	2.49	0.46
1:B:192:ALA:CB	1:B:217:MET:HE1	2.45	0.46
1:C:360:SER:OG	1:C:382:TYR:HA	2.15	0.46
1:A:153:ALA:O	1:A:183:LYS:HE2	2.16	0.46
1:D:48:PHE:CD1	1:D:52:GLU:HG3	2.51	0.46
1:D:222:LEU:HD13	1:D:243:PHE:CE1	2.51	0.46
1:A:32:VAL:HG22	1:C:333:MET:HB3	1.97	0.46
1:A:41:LEU:HD22	1:A:97:ALA:HB1	1.98	0.46
1:A:82:MET:HE2	1:A:116:MET:HE3	1.98	0.46
1:A:387:ILE:CG1	1:A:391:TYR:CE1	2.97	0.46
1:A:123:TYR:CG	1:A:150:GLY:HA3	2.51	0.46
1:C:60:VAL:HG13	1:C:235:GLY:HA3	1.98	0.46
1:D:387:ILE:CD1	2:D:601:FAD:HM83	2.45	0.46
1:A:300:PHE:CE2	2:B:501:FAD:H2A	2.51	0.45
1:B:387:ILE:HD11	2:B:501:FAD:C8M	2.46	0.45
1:C:394:THR:O	1:C:398:GLN:HG2	2.17	0.45
1:D:212:ALA:HB3	1:D:254:LEU:HB3	1.98	0.45
1:A:94:ASP:HB2	1:A:336:ASP:OD1	2.16	0.45
1:A:394:THR:O	1:A:398:GLN:HG2	2.16	0.45
1:C:48:PHE:CE1	1:C:52:GLU:HG3	2.50	0.45
2:C:502:FAD:H2'	2:C:502:FAD:C9	2.46	0.45
1:D:128:LEU:HD23	1:D:128:LEU:HA	1.77	0.45
1:A:328:THR:HA	1:A:348:ALA:CB	2.47	0.45
1:A:169:THR:O	1:A:179:LEU:HA	2.17	0.45
1:B:74:MET:HE1	1:B:112:THR:CG2	2.44	0.45
1:A:367:LEU:HD22	1:A:378:ALA:HB2	1.99	0.45
1:B:386:ARG:NH1	1:B:389:GLU:HB2	2.31	0.45
1:C:256:GLU:N	1:C:259:MET:HE3	2.31	0.45
1:C:276:ALA:HB2	1:C:349:LYS:HA	1.99	0.45
1:D:56:ILE:HD13	1:D:70:GLN:CD	2.42	0.45
1:C:325:ARG:HD2	4:C:665:HOH:O	2.16	0.45
1:D:129:LYS:HB3	1:D:130:PHE:CD2	2.52	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:127:ILE:HG12	1:B:214:LEU:HD21	1.99	0.44
1:C:155:SER:OG	2:C:502:FAD:H1'1	2.17	0.44
1:D:122:LEU:HB3	1:D:152:PHE:HB2	1.99	0.44
1:B:29:TYR:CD2	1:D:33:GLU:OE2	2.70	0.44
1:B:330:ARG:HD3	1:D:326:LEU:HD21	1.99	0.44
1:C:364:ILE:HD11	1:C:379:GLU:HA	1.99	0.44
1:D:211:SER:HB2	1:D:213:PHE:CE2	2.53	0.44
1:B:387:ILE:CD1	2:B:501:FAD:HM83	2.46	0.44
1:C:212:ALA:HB3	1:C:254:LEU:HB3	1.98	0.44
1:C:386:ARG:HA	1:C:386:ARG:HD2	1.72	0.44
1:D:71:VAL:HG13	1:D:80:LEU:HD11	1.99	0.44
1:C:95:TYR:CE2	1:C:335:LYS:HE3	2.52	0.44
1:C:140:VAL:O	1:C:144:THR:HG23	2.18	0.44
1:C:272:ARG:NE	1:C:398:GLN:HE22	2.15	0.44
1:D:83:ASP:OD2	1:D:335:LYS:NZ	2.49	0.44
1:A:216:PRO:HG2	1:A:219:THR:HB	1.99	0.44
1:B:323:SER:HB3	1:D:327:LEU:HD11	2.00	0.44
1:D:88:LEU:HD21	1:D:136:LYS:HD2	1.99	0.44
1:D:122:LEU:HB3	1:D:152:PHE:CB	2.48	0.44
1:A:153:ALA:HB1	1:A:183:LYS:HG3	1.98	0.44
1:C:326:LEU:HD23	1:C:326:LEU:HA	1.83	0.44
1:C:58:ALA:HB1	1:C:62:LYS:HE3	2.00	0.43
1:D:195:ALA:HB2	1:D:217:MET:SD	2.58	0.43
1:A:95:TYR:HA	1:A:98:TYR:HB3	2.01	0.43
1:B:30:GLN:C	1:B:32:VAL:N	2.76	0.43
1:C:130:PHE:CD2	1:C:263:ILE:HG12	2.53	0.43
1:C:187:THR:HA	1:C:237:SER:O	2.19	0.43
1:D:126:PRO:HD3	1:D:267:THR:HG23	2.00	0.43
1:B:29:TYR:CE2	1:D:33:GLU:CG	3.02	0.43
1:C:36:GLU:O	1:C:40:MET:HE2	2.18	0.43
1:A:61:ASP:OD1	1:A:234:ARG:HD3	2.18	0.43
1:B:328:THR:HA	1:B:348:ALA:HB1	2.00	0.43
1:A:400:LEU:HD11	2:A:601:FAD:N1A	2.33	0.43
1:D:123:TYR:CG	1:D:150:GLY:HA3	2.53	0.43
1:D:394:THR:O	1:D:398:GLN:HG2	2.19	0.43
1:B:161:SER:N	2:B:501:FAD:H5'2	2.33	0.43
1:D:183:LYS:HB3	1:D:186:ILE:HD11	2.00	0.43
1:D:314:LEU:HD23	1:D:314:LEU:HA	1.83	0.43
1:A:387:ILE:HD12	1:A:387:ILE:HA	1.78	0.43
1:B:123:TYR:CG	1:B:150:GLY:HA3	2.53	0.43
1:B:410:TYR:CG	1:D:291:VAL:HG11	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:317:MET:HG2	1:C:359:ILE:HA	2.01	0.43
1:D:109:CYS:HB3	1:D:112:THR:HB	1.99	0.43
1:A:364:ILE:HD11	1:A:379:GLU:HA	2.01	0.43
1:B:291:VAL:HG11	1:D:410:TYR:CG	2.54	0.43
1:D:127:ILE:HG12	1:D:214:LEU:HD21	2.00	0.43
1:D:370:MET:HE2	1:D:376:MET:HG2	2.00	0.43
1:C:102:MET:SD	1:C:117:SER:HB2	2.59	0.42
1:D:171:ARG:NH1	1:D:173:GLU:OE2	2.49	0.42
1:C:148:LYS:HB3	1:C:193:SER:HB2	2.01	0.42
1:D:280:LEU:HD11	1:D:325:ARG:HA	2.00	0.42
1:A:310:ILE:HD11	2:B:501:FAD:H1B	2.01	0.42
1:B:283:ALA:HB3	1:B:321:LEU:HD13	2.00	0.42
1:D:261:PHE:CE1	1:D:265:MET:HE3	2.53	0.42
1:A:333:MET:HB2	1:C:32:VAL:HG21	2.01	0.42
1:A:397:ILE:O	1:A:401:VAL:HG23	2.19	0.42
1:A:153:ALA:HA	1:A:186:ILE:CD1	2.50	0.42
1:B:56:ILE:HD12	1:B:60:VAL:HG21	2.01	0.42
1:D:268:LEU:HD23	1:D:268:LEU:HA	1.91	0.42
1:A:228:GLU:HB2	1:A:238:THR:HB	2.00	0.42
1:A:323:SER:HB2	1:C:327:LEU:HD11	2.01	0.42
2:A:601:FAD:H2A	1:B:309:VAL:HG11	2.02	0.42
1:B:30:GLN:CD	1:B:30:GLN:N	2.78	0.42
1:B:386:ARG:HA	1:B:386:ARG:HD2	1.80	0.42
1:D:121:SER:HB3	1:D:271:GLY:HA2	2.02	0.42
1:C:283:ALA:HB2	1:C:356:ALA:HA	2.02	0.42
1:D:54:PHE:CD2	1:D:108:GLY:HA2	2.55	0.42
1:A:139:TRP:CG	1:A:214:LEU:HD13	2.55	0.41
1:A:365:GLN:O	2:B:501:FAD:O3B	2.28	0.41
1:A:387:ILE:HD11	2:A:601:FAD:C8M	2.49	0.41
1:B:360:SER:OG	1:B:382:TYR:HA	2.20	0.41
1:B:367:LEU:HD22	1:B:378:ALA:HB2	2.01	0.41
1:C:268:LEU:HD23	1:C:268:LEU:HA	1.88	0.41
1:A:82:MET:HA	1:A:91:ALA:HB3	2.02	0.41
1:C:126:PRO:HD3	1:C:267:THR:HG23	2.01	0.41
1:D:166:ALA:HB3	1:D:210:ILE:HD12	2.02	0.41
1:A:74:MET:HB3	1:A:79:LEU:HB2	2.01	0.41
1:A:80:LEU:HD12	1:A:146:GLY:HA2	2.02	0.41
1:A:387:ILE:HD13	1:B:372:TYR:CG	2.55	0.41
1:B:94:ASP:HB2	1:B:336:ASP:CG	2.45	0.41
1:C:31:SER:CB	1:C:333:MET:HE1	2.50	0.41
1:C:276:ALA:O	1:C:280:LEU:HG	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:372:TYR:CG	1:D:387:ILE:HD13	2.55	0.41
1:D:54:PHE:CE2	1:D:108:GLY:HA2	2.56	0.41
1:A:249:PRO:O	1:A:252:SER:HB2	2.20	0.41
1:A:261:PHE:CE2	1:A:265:MET:HE2	2.56	0.41
1:A:337:ASN:ND2	4:A:714:HOH:O	2.50	0.41
1:B:396:GLU:OE1	2:B:501:FAD:O2B	2.36	0.41
1:C:136:LYS:O	1:C:140:VAL:HB	2.20	0.41
1:C:215:VAL:HG11	1:C:243:PHE:HE1	1.85	0.41
1:B:259:MET:O	1:B:263:ILE:HG13	2.20	0.41
1:D:95:TYR:HA	1:D:98:TYR:HB3	2.02	0.41
1:D:343:LYS:HD3	1:D:347:MET:CE	2.50	0.41
1:B:29:TYR:OH	1:D:33:GLU:HG3	2.19	0.41
1:B:350:LEU:HD23	1:D:319:LEU:HD13	2.02	0.41
1:D:360:SER:OG	1:D:382:TYR:HA	2.21	0.41
1:A:152:PHE:CE1	1:A:267:THR:HG21	2.56	0.41
1:A:198:PHE:CE1	1:A:212:ALA:HB2	2.56	0.41
1:B:191:GLU:OE1	1:B:237:SER:OG	2.32	0.41
1:B:211:SER:OG	1:B:257:PRO:HA	2.21	0.41
2:C:502:FAD:H2'	2:C:502:FAD:H9	2.01	0.41
1:D:202:ASP:HB3	1:D:205:LEU:HD22	2.02	0.41
1:B:222:LEU:HD11	1:B:241:LEU:HG	2.03	0.41
1:D:153:ALA:HB3	1:D:197:VAL:HG22	2.02	0.41
1:A:54:PHE:CE1	1:A:108:GLY:HA2	2.56	0.41
1:D:60:VAL:HG13	1:D:235:GLY:HA3	2.03	0.41
1:D:269:ASP:CG	1:D:342:ILE:HG12	2.45	0.41
1:D:396:GLU:CD	1:D:396:GLU:N	2.79	0.41
1:A:373:VAL:HG11	1:B:185:TRP:HZ3	1.86	0.41
1:B:53:LEU:O	1:B:56:ILE:HG13	2.21	0.41
1:B:314:LEU:HD23	1:B:314:LEU:HA	1.92	0.40
1:C:58:ALA:O	1:C:62:LYS:HG3	2.21	0.40
1:A:62:LYS:HE3	1:B:229:ASP:OD2	2.20	0.40
1:B:303:PRO:HD2	1:B:306:LYS:HD3	2.04	0.40
1:C:232:GLY:C	1:C:234:ARG:N	2.74	0.40
1:A:175:ASP:C	1:A:250:LYS:HB2	2.46	0.40
1:B:72:LYS:HE3	4:B:621:HOH:O	2.21	0.40
1:A:123:TYR:O	1:A:127:ILE:HG13	2.22	0.40
1:B:253:ILE:HG12	1:B:255:GLY:O	2.22	0.40
1:C:124:LEU:HD22	1:C:140:VAL:HG13	2.03	0.40
1:A:185:TRP:HB3	2:A:601:FAD:C9A	2.52	0.40
1:A:229:ASP:OD2	1:B:62:LYS:NZ	2.49	0.40
1:B:136:LYS:O	1:B:140:VAL:HB	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:284:GLN:OE1	1:C:321:LEU:HD21	2.22	0.40
1:D:387:ILE:HG12	2:D:601:FAD:HM72	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	383/398 (96%)	367 (96%)	16 (4%)	0	100	100
1	B	381/398 (96%)	361 (95%)	19 (5%)	1 (0%)	36	45
1	C	387/398 (97%)	376 (97%)	10 (3%)	1 (0%)	36	45
1	D	383/398 (96%)	367 (96%)	13 (3%)	3 (1%)	16	19
All	All	1534/1592 (96%)	1471 (96%)	58 (4%)	5 (0%)	36	45

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	33	GLU
1	C	26	HIS
1	D	33	GLU
1	D	31	SER
1	D	32	VAL

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	291/309 (94%)	291 (100%)	0	100	100
1	B	287/309 (93%)	286 (100%)	1 (0%)	86	92
1	C	293/309 (95%)	285 (97%)	8 (3%)	39	56
1	D	291/309 (94%)	288 (99%)	3 (1%)	68	81
All	All	1162/1236 (94%)	1150 (99%)	12 (1%)	70	81

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	29	TYR
1	C	25	LEU
1	C	28	ILE
1	C	201	THR
1	C	208	LYS
1	C	210	ILE
1	C	247[A]	ARG
1	C	247[B]	ARG
1	C	391	TYR
1	D	159	ASN
1	D	200	SER
1	D	205	LEU

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	337	ASN
1	B	39	GLN
1	B	206	GLN
1	C	337	ASN
1	D	266	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

8 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	FAD	A	601	-	58,58,58	0.56	2 (3%)	85,89,89	0.45	0
2	FAD	D	601	-	58,58,58	2.94	31 (53%)	85,89,89	1.48	17 (20%)
2	FAD	B	501	-	58,58,58	0.57	0	85,89,89	0.86	3 (3%)
3	FMT	C	501	-	2,2,2	0.57	0	1,1,1	0.21	0
2	FAD	C	502	-	58,58,58	2.94	33 (56%)	85,89,89	1.65	23 (27%)
3	FMT	B	502	-	2,2,2	0.65	0	1,1,1	0.21	0
3	FMT	D	602	-	2,2,2	0.65	0	1,1,1	0.22	0
3	FMT	A	602	-	2,2,2	0.68	0	1,1,1	0.31	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FAD	A	601	-	-	1/34/50/50	0/6/6/6
2	FAD	D	601	-	-	6/34/50/50	0/6/6/6
2	FAD	C	502	-	-	5/34/50/50	0/6/6/6
2	FAD	B	501	-	-	10/34/50/50	0/6/6/6

All (66) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	502	FAD	C5A-N7A	-6.90	1.26	1.39
2	D	601	FAD	C5A-N7A	-6.76	1.26	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	502	FAD	C4A-N9A	-6.30	1.24	1.37
2	D	601	FAD	PA-O3P	-6.16	1.52	1.59
2	D	601	FAD	C5X-N5	-6.15	1.28	1.39
2	D	601	FAD	C4A-N9A	-5.86	1.25	1.37
2	D	601	FAD	C4-N3	-5.63	1.28	1.38
2	C	502	FAD	C4-N3	-5.60	1.28	1.38
2	C	502	FAD	P-O3P	-5.14	1.53	1.59
2	C	502	FAD	C8A-N9A	-5.04	1.29	1.37
2	D	601	FAD	C8A-N9A	-5.03	1.29	1.37
2	D	601	FAD	P-O1P	-5.01	1.33	1.50
2	C	502	FAD	C5X-N5	-5.01	1.30	1.39
2	C	502	FAD	P-O1P	-4.88	1.33	1.50
2	D	601	FAD	C6-C7	-4.50	1.33	1.39
2	D	601	FAD	PA-O2A	-4.49	1.34	1.55
2	D	601	FAD	PA-O1A	-4.27	1.36	1.50
2	D	601	FAD	P-O2P	-3.98	1.36	1.55
2	C	502	FAD	PA-O1A	-3.97	1.37	1.50
2	C	502	FAD	C6-C7	-3.97	1.34	1.39
2	C	502	FAD	P-O2P	-3.96	1.37	1.55
2	C	502	FAD	PA-O3P	-3.96	1.55	1.59
2	C	502	FAD	C9-C9A	-3.95	1.33	1.39
2	D	601	FAD	C2-N3	-3.56	1.31	1.39
2	C	502	FAD	C6-C5X	-3.54	1.34	1.40
2	D	601	FAD	C9-C9A	-3.49	1.34	1.39
2	C	502	FAD	O4-C4	-3.45	1.17	1.23
2	C	502	FAD	C2A-N1A	-3.40	1.27	1.33
2	D	601	FAD	O4B-C4B	-3.30	1.37	1.45
2	C	502	FAD	C9-C8	-3.30	1.35	1.39
2	C	502	FAD	C2-N3	-3.29	1.31	1.39
2	C	502	FAD	C9A-C5X	3.25	1.46	1.41
2	D	601	FAD	PA-O5B	-3.10	1.47	1.59
2	C	502	FAD	PA-O2A	-3.07	1.41	1.55
2	D	601	FAD	C6-C5X	-3.02	1.35	1.40
2	D	601	FAD	C2A-N3A	-2.87	1.28	1.33
2	C	502	FAD	O4B-C4B	-2.86	1.38	1.45
2	C	502	FAD	C4A-N3A	-2.84	1.29	1.34
2	C	502	FAD	C2-N1	-2.84	1.30	1.36
2	D	601	FAD	O2-C2	-2.80	1.18	1.24
2	C	502	FAD	C2A-N3A	-2.74	1.29	1.33
2	C	502	FAD	P-O5'	-2.63	1.49	1.59
2	A	601	FAD	P-O3P	-2.61	1.56	1.59
2	D	601	FAD	P-O5'	-2.60	1.49	1.59

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	601	FAD	C5A-C4A	2.58	1.43	1.39
2	C	502	FAD	C8M-C8	-2.54	1.46	1.51
2	D	601	FAD	C9-C8	-2.51	1.36	1.39
2	D	601	FAD	O4'-C4'	-2.50	1.38	1.43
2	D	601	FAD	O4-C4	-2.50	1.18	1.23
2	D	601	FAD	C2-N1	-2.48	1.31	1.36
2	D	601	FAD	O2B-C2B	-2.45	1.36	1.43
2	D	601	FAD	P-O3P	-2.43	1.56	1.59
2	D	601	FAD	C7M-C7	-2.42	1.46	1.51
2	C	502	FAD	PA-O5B	-2.42	1.49	1.59
2	C	502	FAD	C10-N1	-2.38	1.28	1.33
2	C	502	FAD	C2B-C3B	-2.38	1.46	1.53
2	D	601	FAD	O3'-C3'	-2.34	1.37	1.43
2	D	601	FAD	C1'-N10	-2.27	1.42	1.47
2	D	601	FAD	C2B-C3B	-2.25	1.47	1.53
2	D	601	FAD	C9A-N10	-2.23	1.37	1.41
2	C	502	FAD	C6A-N1A	-2.21	1.29	1.35
2	C	502	FAD	O2B-C2B	-2.18	1.37	1.43
2	C	502	FAD	O5'-C5'	-2.17	1.36	1.44
2	C	502	FAD	C1'-N10	-2.13	1.42	1.47
2	A	601	FAD	PA-O5B	-2.10	1.51	1.59
2	C	502	FAD	C7M-C7	-2.02	1.47	1.51

All (43) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	502	FAD	C5A-C4A-N3A	-4.43	120.62	126.72
2	B	501	FAD	O2P-P-O5'	4.07	126.02	107.57
2	C	502	FAD	N3A-C4A-N9A	3.67	133.41	127.17
2	C	502	FAD	C2A-N3A-C4A	3.43	120.21	111.83
2	C	502	FAD	N3A-C2A-N1A	-3.39	123.44	128.58
2	D	601	FAD	C5A-C4A-N3A	-3.36	122.09	126.72
2	D	601	FAD	C4A-N9A-C8A	3.30	109.20	105.74
2	D	601	FAD	N3A-C4A-N9A	3.30	132.77	127.17
2	C	502	FAD	C5X-C9A-N10	3.17	120.83	117.97
2	D	601	FAD	C4A-C5A-N7A	-3.14	106.99	110.58
2	D	601	FAD	C4'-C3'-C2'	3.11	118.75	113.57
2	C	502	FAD	O4'-C4'-C3'	2.85	115.91	109.25
2	C	502	FAD	C4-C4X-N5	2.67	121.90	118.21
2	C	502	FAD	C9A-N10-C10	-2.64	116.72	120.75
2	C	502	FAD	C2A-N1A-C6A	2.60	123.00	118.73
2	D	601	FAD	C6A-C5A-N7A	2.57	137.05	132.09

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	601	FAD	C2A-N1A-C6A	2.55	122.92	118.73
2	D	601	FAD	C4X-C10-N1	-2.49	118.48	124.59
2	C	502	FAD	C4A-N9A-C1B	-2.48	120.84	126.63
2	C	502	FAD	C4-N3-C2	-2.46	121.28	125.64
2	B	501	FAD	C3B-C2B-C1B	-2.45	96.83	101.46
2	C	502	FAD	O2-C2-N1	-2.43	117.77	121.80
2	B	501	FAD	C4B-O4B-C1B	-2.42	104.13	109.47
2	C	502	FAD	C1'-N10-C9A	2.41	125.32	120.63
2	D	601	FAD	C5A-N7A-C8A	2.38	107.19	103.45
2	C	502	FAD	O3B-C3B-C4B	-2.37	104.28	111.08
2	C	502	FAD	C4A-N9A-C8A	2.37	108.22	105.74
2	C	502	FAD	C4A-C5A-N7A	-2.35	107.89	110.58
2	C	502	FAD	O4'-C4'-C5'	-2.31	104.90	109.99
2	C	502	FAD	N3-C2-N1	2.30	124.40	119.50
2	C	502	FAD	C4X-C4-N3	2.23	118.93	113.25
2	D	601	FAD	C2A-N3A-C4A	2.22	117.26	111.83
2	D	601	FAD	O4B-C4B-C3B	2.18	109.49	105.15
2	C	502	FAD	C6A-C5A-N7A	2.16	136.25	132.09
2	D	601	FAD	O2P-P-O5'	2.14	117.27	107.57
2	D	601	FAD	N3-C2-N1	2.11	123.99	119.50
2	D	601	FAD	C5X-C9A-N10	2.09	119.86	117.97
2	C	502	FAD	C4X-C10-N10	2.09	119.47	116.48
2	C	502	FAD	O2A-PA-O1A	2.07	122.05	112.44
2	D	601	FAD	N10-C10-N1	2.03	124.48	118.51
2	C	502	FAD	C4X-C10-N1	-2.02	119.64	124.59
2	D	601	FAD	N3A-C2A-N1A	-2.02	125.53	128.58
2	D	601	FAD	C6-C5X-C9A	2.01	121.81	119.05

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	FAD	C5B-O5B-PA-O2A
2	B	501	FAD	C5B-O5B-PA-O1A
2	B	501	FAD	C1'-C2'-C3'-O3'
2	B	501	FAD	C1'-C2'-C3'-C4'
2	B	501	FAD	C5'-O5'-P-O1P
2	B	501	FAD	C5'-O5'-P-O2P
2	B	501	FAD	C5'-O5'-P-O3P
2	C	502	FAD	C5B-O5B-PA-O1A
2	D	601	FAD	C5B-O5B-PA-O1A
2	D	601	FAD	C5B-O5B-PA-O3P

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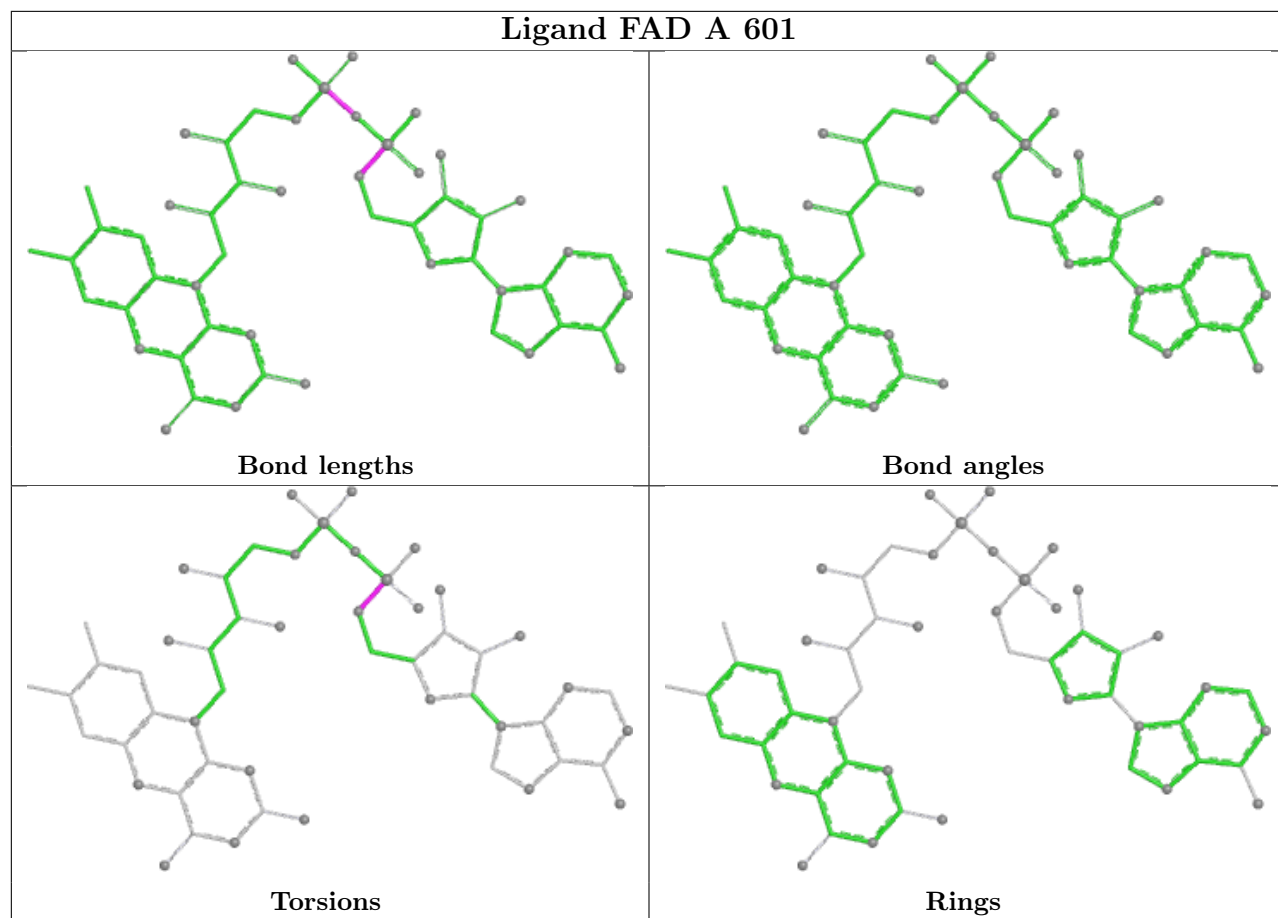
Mol	Chain	Res	Type	Atoms
2	B	501	FAD	O2'-C2'-C3'-C4'
2	D	601	FAD	O2'-C2'-C3'-C4'
2	B	501	FAD	O2'-C2'-C3'-O3'
2	D	601	FAD	O2'-C2'-C3'-O3'
2	C	502	FAD	O2'-C2'-C3'-C4'
2	D	601	FAD	C1'-C2'-C3'-O3'
2	C	502	FAD	C5B-O5B-PA-O2A
2	C	502	FAD	C5B-O5B-PA-O3P
2	D	601	FAD	C5B-O5B-PA-O2A
2	C	502	FAD	O2'-C2'-C3'-O3'
2	B	501	FAD	P-O3P-PA-O1A
2	B	501	FAD	P-O3P-PA-O2A

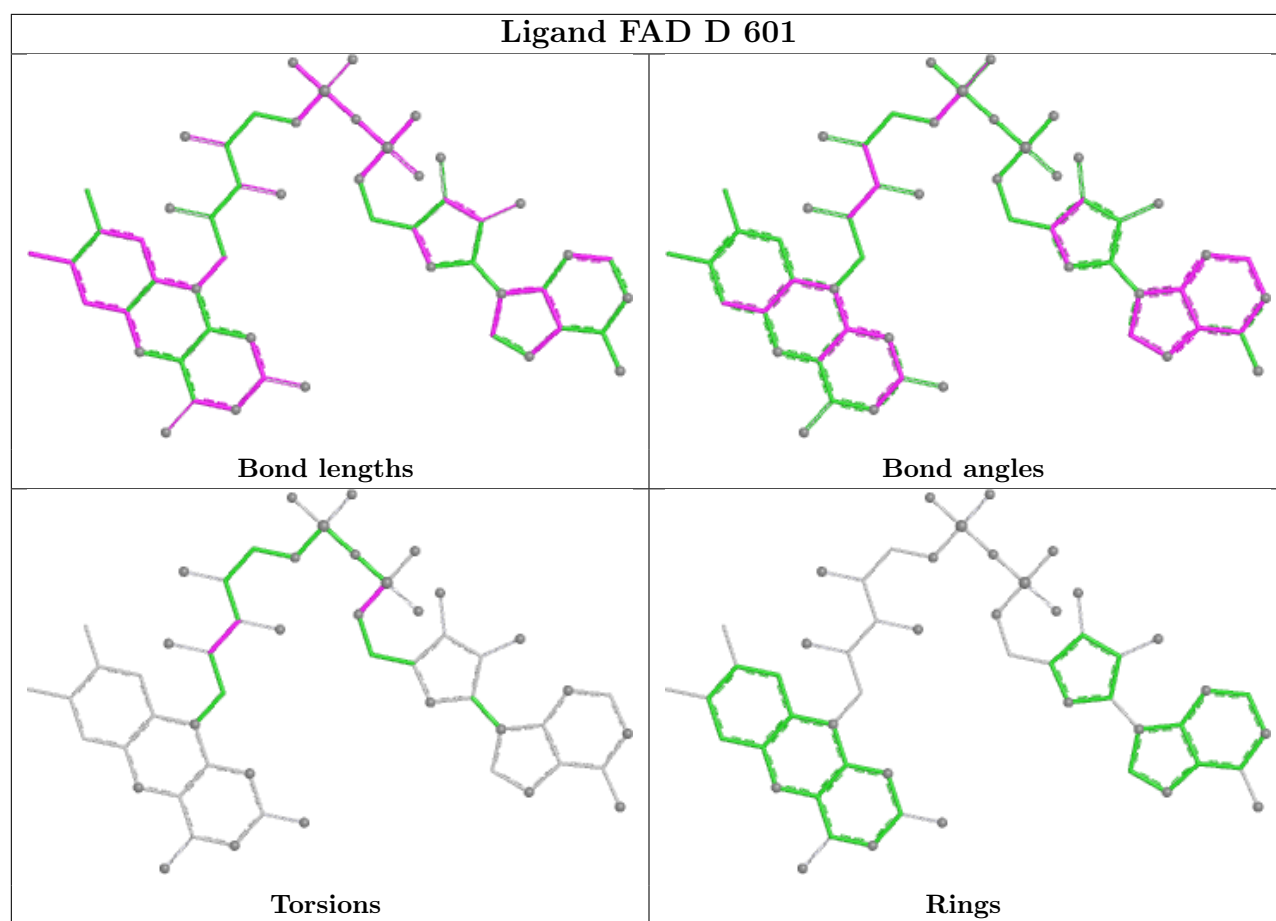
There are no ring outliers.

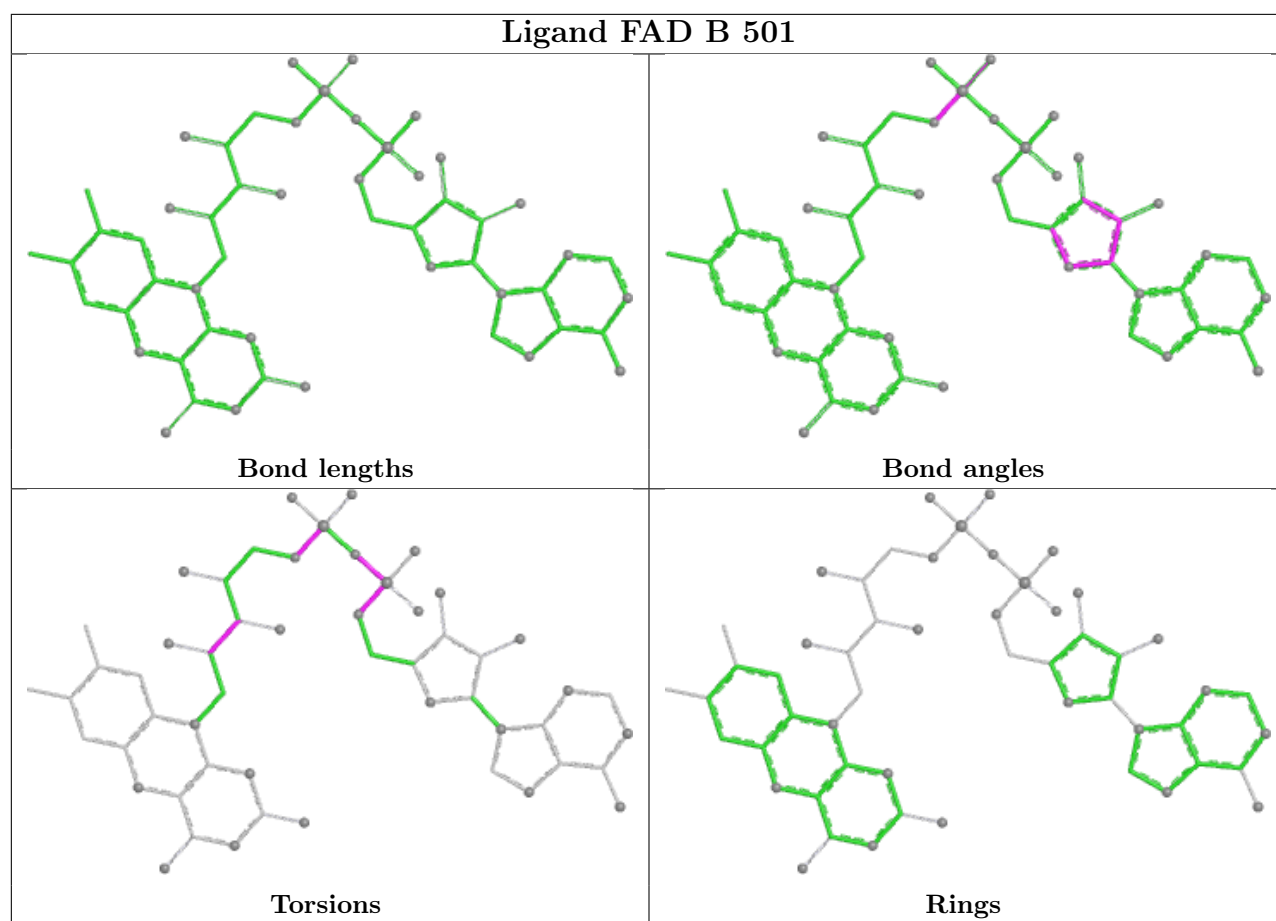
4 monomers are involved in 37 short contacts:

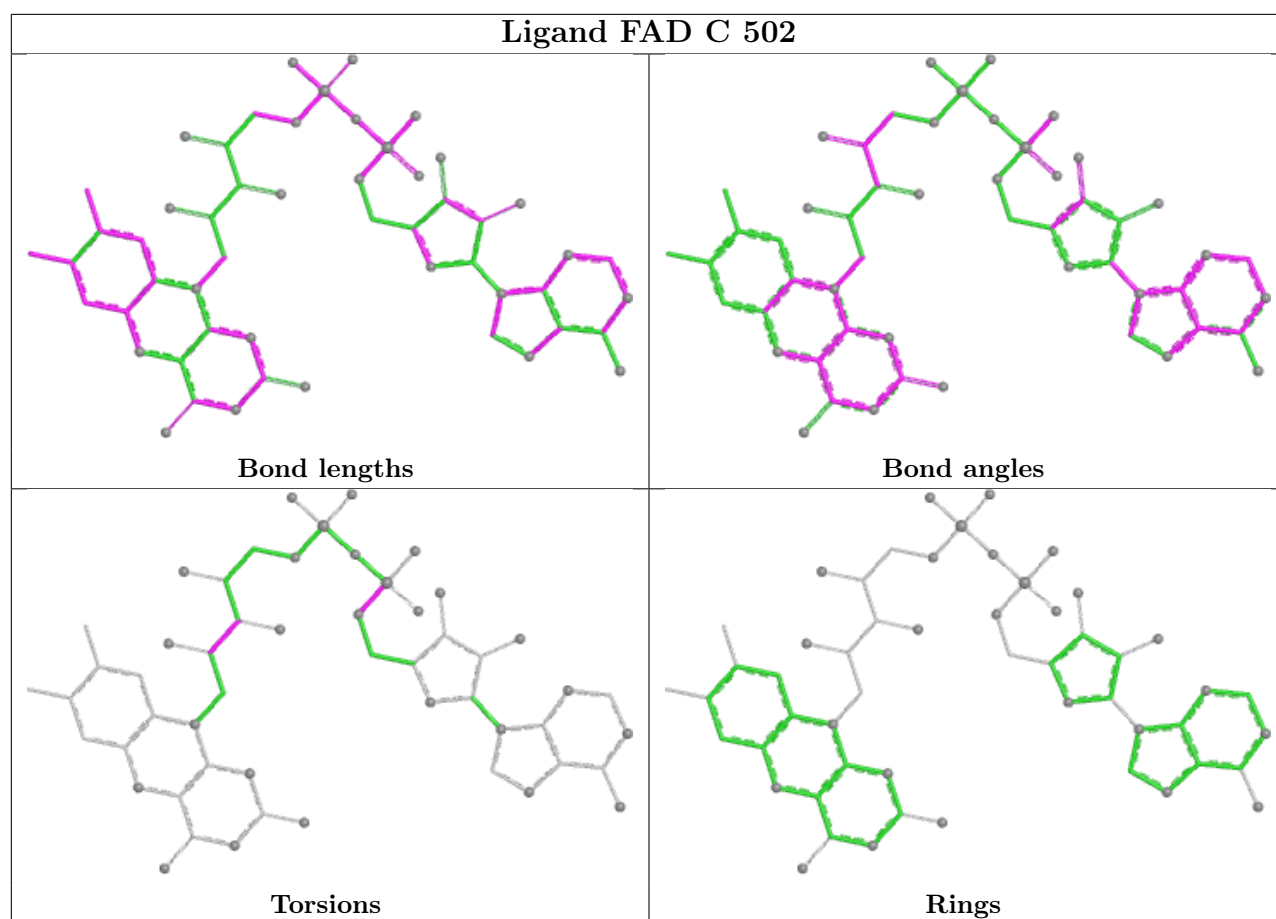
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	601	FAD	9	0
2	D	601	FAD	7	0
2	B	501	FAD	16	0
2	C	502	FAD	5	0

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	385/398 (96%)	-0.10	10 (2%) 57 60	13, 21, 36, 54	0
1	B	383/398 (96%)	-0.13	8 (2%) 63 66	13, 20, 34, 56	0
1	C	387/398 (97%)	-0.16	4 (1%) 79 81	14, 22, 36, 50	2 (0%)
1	D	385/398 (96%)	-0.08	9 (2%) 61 63	15, 22, 37, 58	0
All	All	1540/1592 (96%)	-0.12	31 (2%) 65 67	13, 21, 36, 58	2 (0%)

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	32	VAL	5.0
1	D	300	PHE	5.0
1	A	28	ILE	4.3
1	B	30	GLN	4.1
1	A	32	VAL	4.0
1	D	28	ILE	3.8
1	B	29	TYR	3.8
1	B	300	PHE	3.5
1	D	31	SER	3.4
1	D	32	VAL	3.3
1	A	29	TYR	3.1
1	A	30	GLN	2.8
1	A	33	GLU	2.8
1	D	29	TYR	2.7
1	C	25	LEU	2.7
1	A	410	TYR	2.7
1	A	165	ALA	2.6
1	C	31	SER	2.6
1	B	391	TYR	2.6
1	B	31	SER	2.5
1	A	412	SER	2.5

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Mol	Chain	Res	Type	RSRZ
1	C	29	TYR	2.4
1	D	30	GLN	2.4
1	D	412	SER	2.4
1	D	33	GLU	2.3
1	B	64	HIS	2.3
1	D	64	HIS	2.2
1	A	164	GLY	2.1
1	A	163	ALA	2.1
1	B	40	MET	2.1
1	C	165	ALA	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](#)

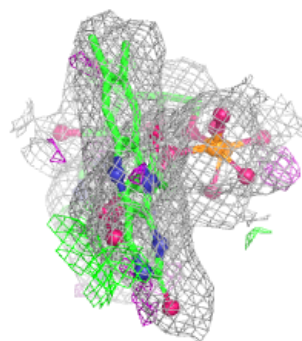
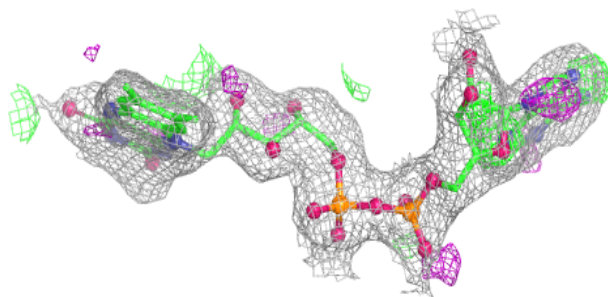
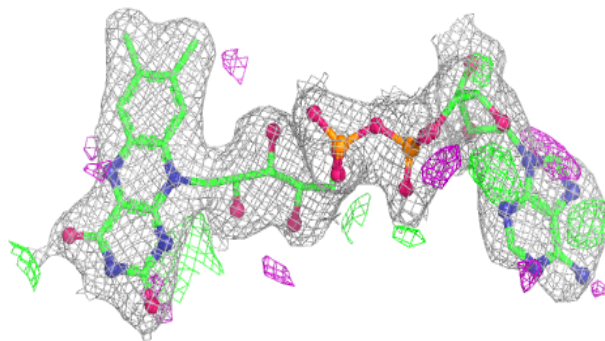
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	FAD	B	501	53/53	0.91	0.11	15,19,28,32	0
3	FMT	D	602	3/3	0.91	0.11	23,23,25,31	0
3	FMT	C	501	3/3	0.93	0.09	24,24,27,31	0
3	FMT	B	502	3/3	0.95	0.07	21,21,24,25	0
2	FAD	C	502	53/53	0.95	0.07	15,19,24,24	0
3	FMT	A	602	3/3	0.95	0.07	22,22,27,29	0
2	FAD	A	601	53/53	0.96	0.07	14,18,21,23	0
2	FAD	D	601	53/53	0.96	0.06	15,18,21,23	0

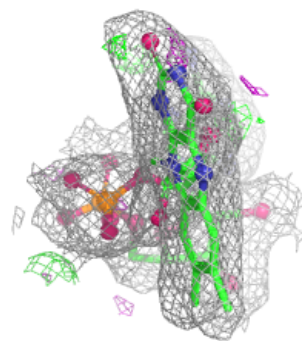
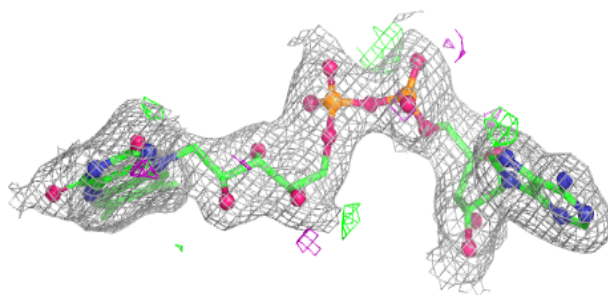
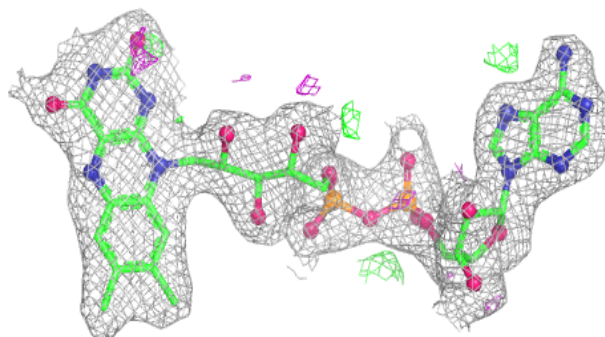
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FAD B 501:

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

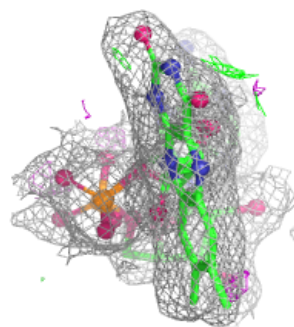
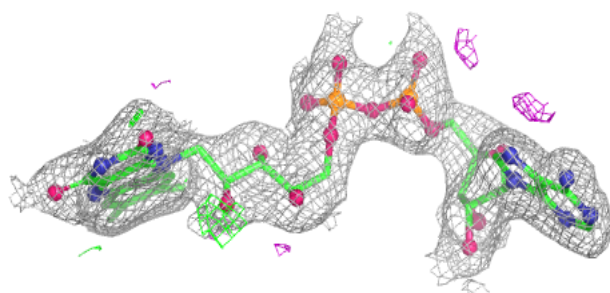
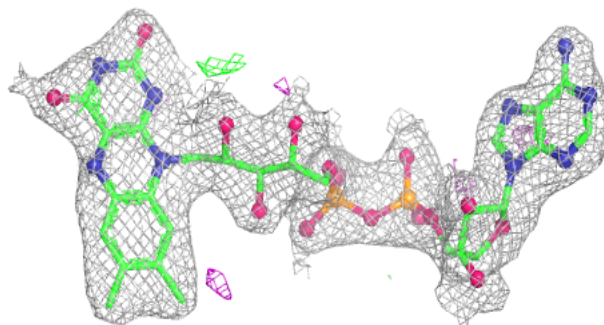
**Electron density around FAD C 502:**

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

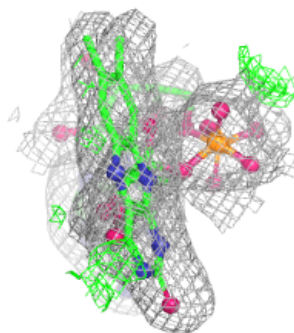
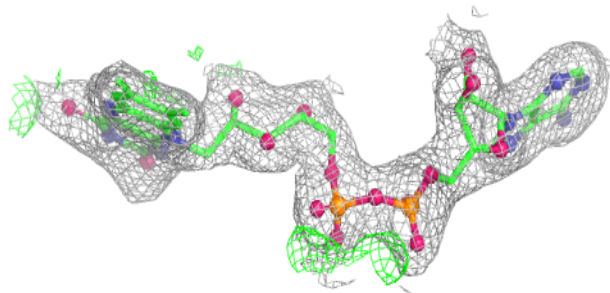
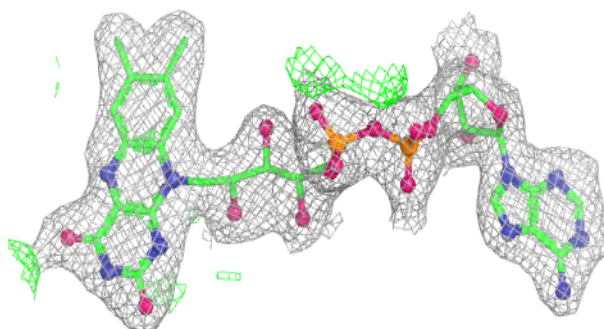


Electron density around FAD A 601:

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

**Electron density around FAD D 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.