



Full wwPDB X-ray Structure Validation Report ⓘ

Dec 16, 2023 – 09:29 pm GMT

PDB ID : 4BCA
Title : MAMMALIAN ALKYLDIHYDROXYACETONEPHOSPHATE SYNTHASE: Tyr578Phe mutant
Authors : Nenci, S.; Piano, V.; Rosati, S.; Aliverti, A.; Pandini, V.; Fraaije, M.W.; Heck, A.J.R.; Edmondson, D.E.; Mattevi, A.
Deposited on : 2012-10-01
Resolution : 2.40 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 : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

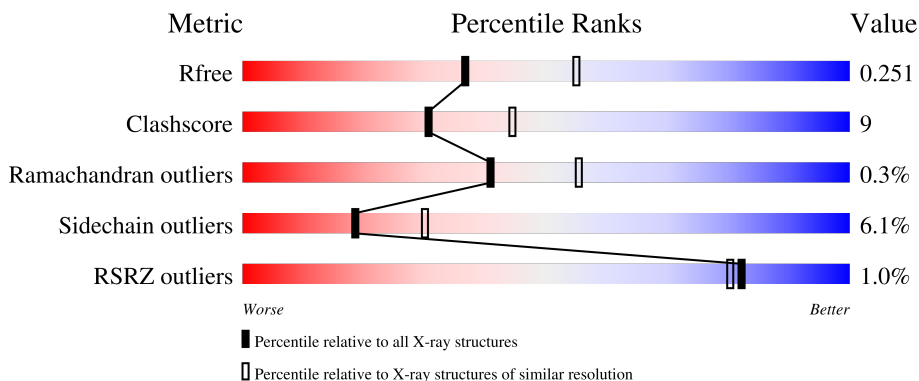
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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	658	 67% 16% • 16%
1	B	658	 66% 15% • 17%
1	C	658	 67% 16% • 15%
1	D	658	 68% 14% • 16%

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

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	CL	A	1659	-	-	X	-
4	SO4	B	1660	-	-	X	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 18202 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 ALKYLDIHYDROXYACETONEPHOSPHATE SYNTHASE, PEROXISOMAL.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	555	Total 4393	C 2789	N 762	O 818	S 24	0	0	0
1	B	543	Total 4300	C 2732	N 747	O 797	S 24	0	0	0
1	C	557	Total 4412	C 2799	N 766	O 822	S 25	0	2	0
1	D	550	Total 4354	C 2761	N 757	O 811	S 25	0	1	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	578	PHE	TYR	engineered mutation	UNP P97275
B	578	PHE	TYR	engineered mutation	UNP P97275
C	578	PHE	TYR	engineered mutation	UNP P97275
D	578	PHE	TYR	engineered mutation	UNP P97275

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).



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		
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 CHLORIDE ION (three-letter code: CL) (formula: Cl).

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

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		

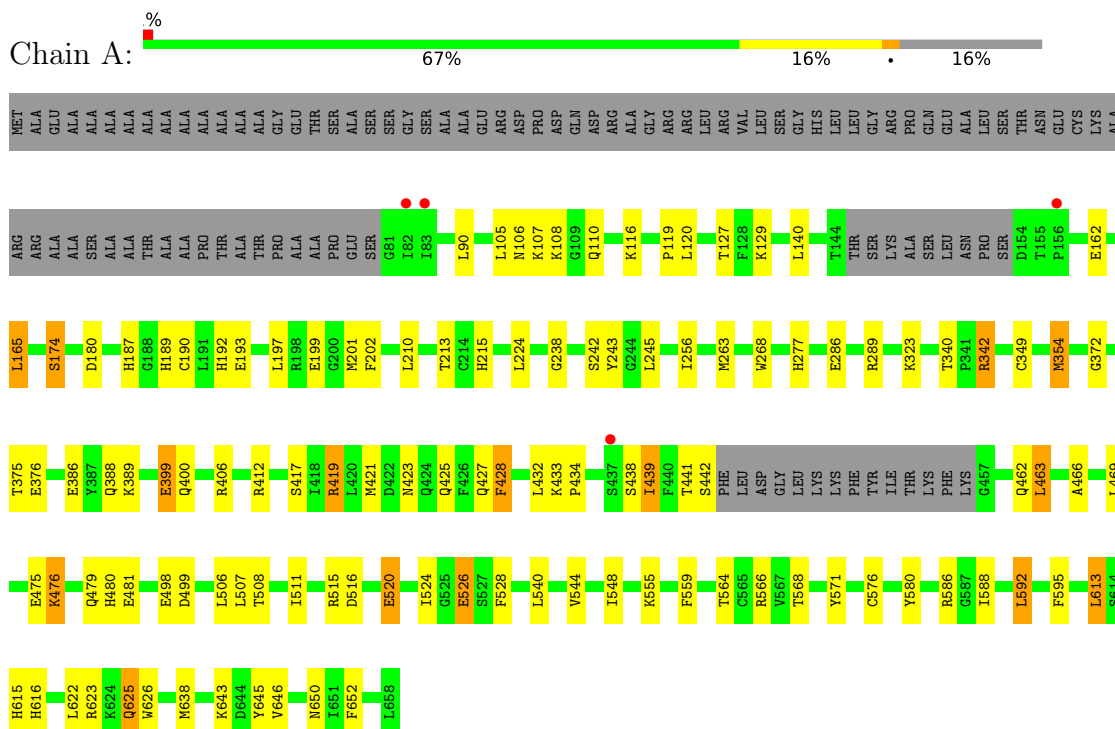
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	142	Total	O	0	0
			142	142		
5	B	95	Total	O	0	0
			95	95		
5	C	143	Total	O	0	0
			143	143		
5	D	112	Total	O	0	0
			112	112		

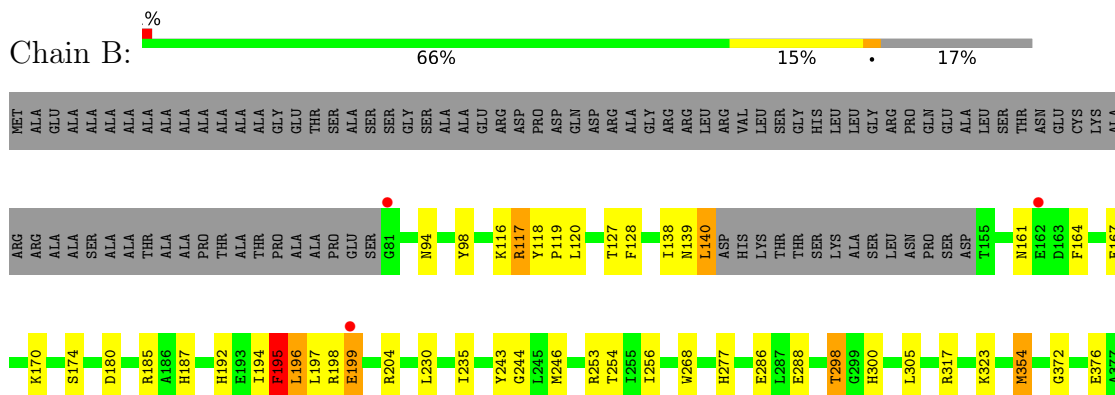
3 Residue-property plots [i](#)

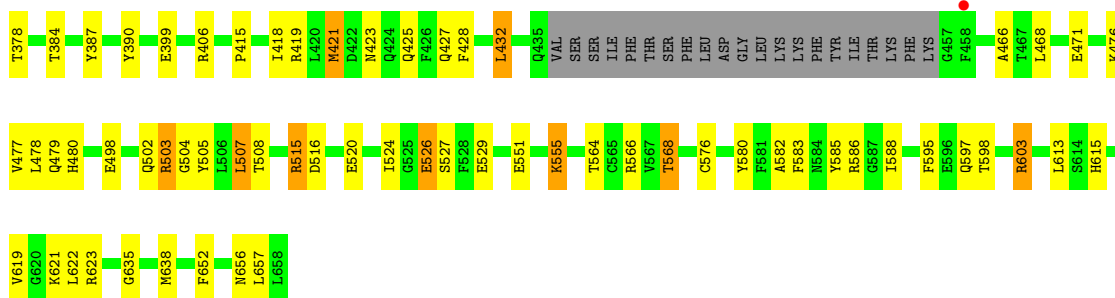
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: ALKYLDIHYDROXYACETONEPHOSPHATE SYNTHASE, PEROXISOMAL

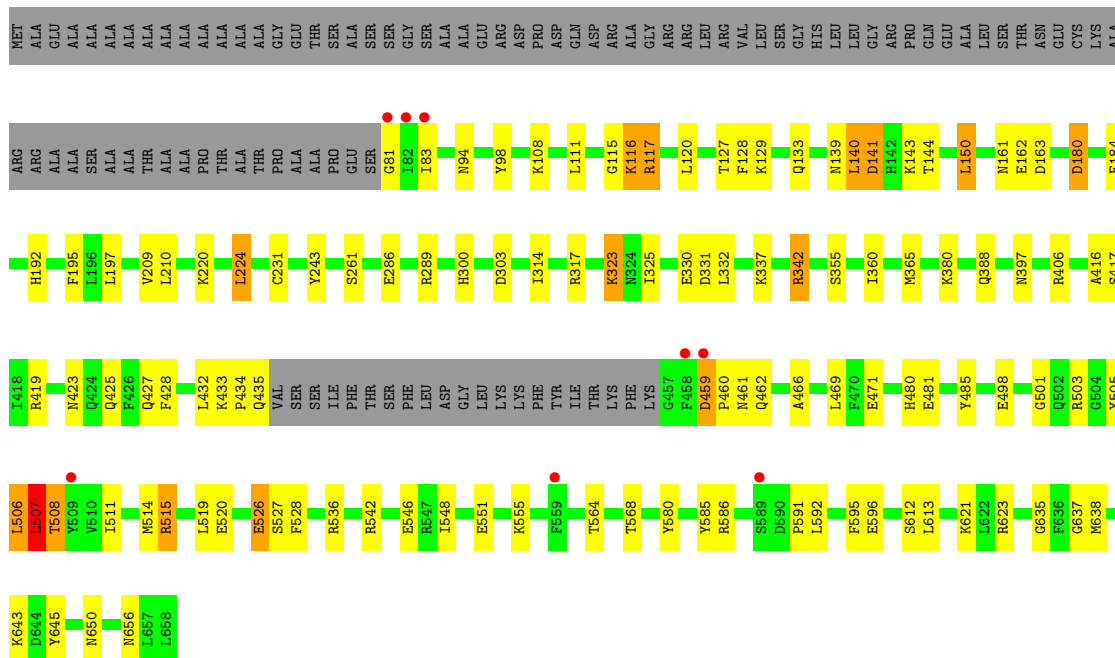


- Molecule 1: ALKYLDIHYDROXYACETONEPHOSPHATE SYNTHASE, PEROXISOMAL

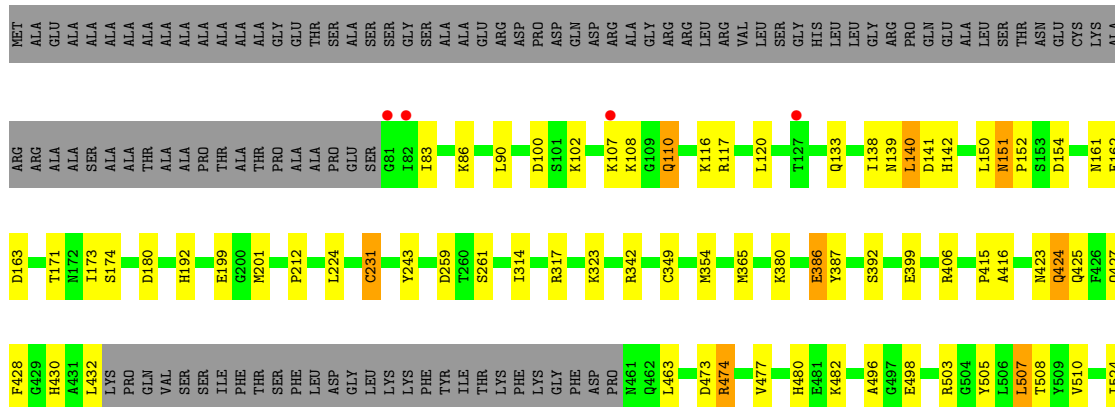




- Molecule 1: ALKYLDIHYDROXYACETONEPHOSPHATE SYNTHASE, PEROXISOMAL



- Molecule 1: ALKYLDIHYDROXYACETONEPHOSPHATE SYNTHASE, PEROXISOMAL





4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	61.68Å 99.32Å 107.98Å 90.43° 92.12° 95.20°	Depositor
Resolution (Å)	47.58 – 2.40 47.15 – 2.40	Depositor EDS
% Data completeness (in resolution range)	98.7 (47.58-2.40) 98.7 (47.15-2.40)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.32 (at 2.39Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.187 , 0.252 0.190 , 0.251	Depositor DCC
R_{free} test set	1080 reflections (1.10%)	wwPDB-VP
Wilson B-factor (Å ²)	26.8	Xtrriage
Anisotropy	0.075	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 33.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.016 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	18202	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.30% 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: CL, SO4, FAD

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	0.93	2/4492 (0.0%)	0.90	6/6071 (0.1%)
1	B	0.89	0/4397	0.88	7/5942 (0.1%)
1	C	0.96	4/4518 (0.1%)	0.90	9/6107 (0.1%)
1	D	0.96	3/4454 (0.1%)	0.91	12/6020 (0.2%)
All	All	0.94	9/17861 (0.1%)	0.90	34/24140 (0.1%)

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	C	0	2

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	231	CYS	CB-SG	-6.42	1.71	1.82
1	C	546	GLU	CG-CD	5.95	1.60	1.51
1	D	386	GLU	CG-CD	5.93	1.60	1.51
1	C	330	GLU	CB-CG	5.86	1.63	1.52
1	D	231	CYS	CB-SG	-5.74	1.72	1.81
1	D	349	CYS	CB-SG	-5.74	1.72	1.81
1	A	399	GLU	CG-CD	5.71	1.60	1.51
1	A	386	GLU	CG-CD	5.70	1.60	1.51
1	C	330	GLU	CG-CD	5.30	1.59	1.51

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	603	ARG	NE-CZ-NH1	9.93	125.27	120.30
1	C	317	ARG	NE-CZ-NH2	-8.97	115.82	120.30
1	D	603	ARG	NE-CZ-NH1	8.79	124.70	120.30
1	D	536	ARG	NE-CZ-NH2	-8.45	116.07	120.30
1	B	603	ARG	NE-CZ-NH2	-7.42	116.59	120.30
1	C	623	ARG	NE-CZ-NH1	7.01	123.80	120.30
1	D	603	ARG	NE-CZ-NH2	-6.63	116.99	120.30
1	C	623	ARG	NE-CZ-NH2	-6.43	117.09	120.30
1	B	515	ARG	NE-CZ-NH1	6.38	123.49	120.30
1	A	463	LEU	CA-CB-CG	6.37	129.95	115.30
1	D	90	LEU	CA-CB-CG	6.13	129.41	115.30
1	D	380	LYS	CD-CE-NZ	-5.98	97.94	111.70
1	C	180	ASP	CB-CG-OD1	5.91	123.62	118.30
1	D	100	ASP	CB-CG-OD1	5.72	123.45	118.30
1	D	603	ARG	CD-NE-CZ	5.71	131.59	123.60
1	D	140	LEU	CA-CB-CG	5.69	128.38	115.30
1	B	140	LEU	CA-CB-CG	5.66	128.33	115.30
1	A	623	ARG	NE-CZ-NH2	-5.65	117.47	120.30
1	B	317	ARG	NE-CZ-NH1	5.64	123.12	120.30
1	A	412	ARG	NE-CZ-NH2	-5.54	117.53	120.30
1	C	506	LEU	CA-CB-CG	5.53	128.01	115.30
1	C	515	ARG	NE-CZ-NH1	5.53	123.06	120.30
1	A	174	SER	N-CA-CB	-5.42	102.37	110.50
1	D	623	ARG	NE-CZ-NH1	5.34	122.97	120.30
1	A	623	ARG	NE-CZ-NH1	5.25	122.93	120.30
1	C	542	ARG	NE-CZ-NH2	-5.19	117.71	120.30
1	D	463	LEU	CA-CB-CG	5.17	127.18	115.30
1	B	623	ARG	NE-CZ-NH2	-5.15	117.73	120.30
1	C	140	LEU	CA-CB-CG	5.13	127.10	115.30
1	D	536	ARG	NE-CZ-NH1	5.12	122.86	120.30
1	A	638	MET	CG-SD-CE	5.11	108.37	100.20
1	D	317	ARG	NE-CZ-NH2	-5.09	117.76	120.30
1	B	515	ARG	NE-CZ-NH2	-5.06	117.77	120.30
1	C	289	ARG	NE-CZ-NH1	5.00	122.80	120.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	460	PRO	Peptide
1	C	507	LEU	Peptide

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4393	0	4328	87	0
1	B	4300	0	4242	76	1
1	C	4412	0	4356	97	1
1	D	4354	0	4300	63	0
2	A	53	0	31	3	0
2	B	53	0	31	2	0
2	C	53	0	31	1	0
2	D	53	0	31	1	0
3	A	1	0	0	2	0
3	B	1	0	0	1	0
3	C	1	0	0	1	0
3	D	1	0	0	1	0
4	A	10	0	0	1	0
4	B	10	0	0	2	0
4	C	5	0	0	1	0
4	D	10	0	0	2	0
5	A	142	0	0	12	0
5	B	95	0	0	4	0
5	C	143	0	0	5	0
5	D	112	0	0	4	0
All	All	18202	0	17350	321	1

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 9.

All (321) 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:192:HIS:HB3	1:A:243:TYR:OH	1.37	1.25
1:C:508:THR:HA	1:C:511:ILE:CD1	1.65	1.24
1:A:421:MET:CG	5:A:2099:HOH:O	1.93	1.15
1:C:507:LEU:HD11	1:C:511:ILE:CG1	1.77	1.14
1:C:508:THR:HA	1:C:511:ILE:HD11	1.28	1.13
1:A:192:HIS:HB3	1:A:243:TYR:HH	0.98	1.07
1:C:508:THR:HA	1:C:511:ILE:HD12	1.42	1.02

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:192:HIS:HB3	1:D:243:TYR:OH	1.60	1.00
1:B:140:LEU:HB2	5:B:2014:HOH:O	1.62	1.00
1:D:386:GLU:HB2	5:D:2084:HOH:O	1.59	1.00
1:A:615:HIS:HD2	1:A:616:HIS:CD2	1.80	0.99
1:A:615:HIS:HD2	1:A:616:HIS:HD2	1.01	0.93
1:A:192:HIS:CB	1:A:243:TYR:OH	2.18	0.92
1:C:507:LEU:HD11	1:C:511:ILE:HG12	1.48	0.92
1:C:507:LEU:CD1	1:C:511:ILE:HG13	2.00	0.91
1:C:507:LEU:CD1	1:C:511:ILE:CG1	2.49	0.91
1:C:459:ASP:HB2	5:C:2111:HOH:O	1.71	0.89
1:A:439:ILE:HG13	1:D:535:ASP:HB2	1.55	0.88
1:A:421:MET:HG3	5:A:2099:HOH:O	1.60	0.88
1:B:192:HIS:CB	1:B:243:TYR:OH	2.21	0.88
1:B:140:LEU:CB	5:B:2014:HOH:O	2.21	0.88
1:C:192:HIS:HB3	1:C:243:TYR:OH	1.74	0.88
1:C:508:THR:CA	1:C:511:ILE:CD1	2.52	0.87
1:A:615:HIS:CD2	1:A:616:HIS:HD2	1.91	0.87
1:C:635:GLY:HA2	1:C:638:MET:HE3	1.57	0.85
1:A:439:ILE:HG13	1:D:535:ASP:CB	2.07	0.83
1:C:507:LEU:HD11	1:C:511:ILE:HG13	1.55	0.83
1:C:508:THR:CA	1:C:511:ILE:HD11	2.09	0.82
1:B:192:HIS:HB3	1:B:243:TYR:OH	1.82	0.78
1:A:571:TYR:OH	1:A:615:HIS:HE1	1.67	0.77
1:C:115:GLY:O	1:C:116:LYS:HD3	1.87	0.75
1:A:526:GLU:HB3	1:A:595:PHE:HZ	1.50	0.75
1:D:423:ASN:HD21	1:D:427:GLN:NE2	1.85	0.75
1:C:508:THR:CA	1:C:511:ILE:HD12	2.16	0.73
1:A:507:LEU:O	1:A:511:ILE:HD12	1.89	0.73
1:A:119:PRO:HG2	1:A:506:LEU:HD22	1.71	0.72
1:A:106:ASN:HD21	1:A:110:GLN:HE21	1.37	0.72
1:B:526:GLU:HB3	1:B:595:PHE:HZ	1.54	0.72
1:D:142:HIS:CE1	1:D:586:ARG:NH2	2.58	0.72
1:A:625:GLN:OE1	5:A:2132:HOH:O	2.07	0.71
1:A:421:MET:HG2	5:A:2099:HOH:O	1.75	0.71
1:B:555:LYS:NZ	1:B:597:GLN:HE21	1.88	0.70
1:D:425:GLN:HG3	1:D:564:THR:OG1	1.91	0.70
1:D:192:HIS:CB	1:D:243:TYR:OH	2.37	0.70
1:C:161:ASN:OD1	1:C:163:ASP:N	2.25	0.70
1:D:423:ASN:HD21	1:D:427:GLN:HE21	1.38	0.70
1:B:425:GLN:OE1	1:B:566:ARG:HD3	1.93	0.68
1:B:298:THR:CG2	1:B:300:HIS:H	2.06	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:213:THR:O	5:A:2032:HOH:O	2.13	0.67
2:A:999:FAD:N5	3:A:1659:CL:CL	2.65	0.66
1:B:505:TYR:HA	1:B:508:THR:OG1	1.96	0.66
1:A:615:HIS:CD2	1:A:616:HIS:CD2	2.73	0.65
1:D:424:GLN:NE2	1:D:563:SER:O	2.30	0.65
1:B:415:PRO:HA	4:B:1660:SO4:O1	1.97	0.65
1:B:503:ARG:O	1:B:505:TYR:N	2.30	0.65
1:C:480:HIS:ND1	4:C:1660:SO4:O3	2.29	0.64
1:C:507:LEU:HD12	1:C:507:LEU:C	2.18	0.64
1:A:439:ILE:CG1	1:D:535:ASP:HB2	2.28	0.64
1:C:144:THR:HG22	1:C:520:GLU:HA	1.78	0.64
1:B:98:TYR:CD2	1:B:117:ARG:HD3	2.32	0.64
2:D:999:FAD:N5	3:D:1659:CL:CL	2.68	0.64
1:D:526:GLU:HB3	1:D:595:PHE:HZ	1.63	0.63
1:C:423:ASN:HD21	1:C:427:GLN:NE2	1.96	0.63
1:C:526:GLU:HG3	1:C:527:SER:H	1.63	0.63
1:A:432:LEU:HD13	1:A:507:LEU:HD11	1.80	0.63
1:C:507:LEU:CD1	1:C:511:ILE:HD11	2.29	0.63
1:D:474:ARG:HG2	1:D:474:ARG:HH11	1.62	0.63
1:C:526:GLU:HB3	1:C:595:PHE:HZ	1.63	0.62
1:C:139:ASN:HB2	1:C:141:ASP:OD1	2.00	0.62
1:C:461:ASN:CG	5:C:2112:HOH:O	2.39	0.61
1:A:215:HIS:HD2	1:A:375:THR:OG1	1.83	0.61
1:B:635:GLY:HA2	1:B:638:MET:HE3	1.81	0.60
1:B:167:GLU:HA	1:B:170:LYS:HE3	1.81	0.60
1:B:195:PHE:O	1:B:196:LEU:C	2.40	0.60
1:C:331:ASP:O	1:C:380:LYS:HE3	2.02	0.60
1:C:507:LEU:CD1	1:C:511:ILE:CD1	2.80	0.59
1:B:128:PHE:CD1	1:B:432:LEU:HD11	2.37	0.59
1:D:151:ASN:C	1:D:151:ASN:HD22	2.06	0.59
1:A:342:ARG:HD2	1:A:645:TYR:CZ	2.38	0.59
1:B:139:ASN:O	1:B:140:LEU:CB	2.51	0.59
1:C:144:THR:HG21	1:C:519:LEU:O	2.02	0.58
1:B:192:HIS:HB2	1:B:243:TYR:OH	1.99	0.58
2:C:999:FAD:N5	3:C:1659:CL:CL	2.73	0.58
1:A:189:HIS:HE1	5:A:2027:HOH:O	1.86	0.58
1:D:314:ILE:HG23	1:D:365:MET:HG2	1.83	0.58
1:A:190:CYS:HB2	1:A:193:GLU:OE1	2.04	0.58
1:B:288:GLU:OE1	1:B:298:THR:HB	2.03	0.58
1:C:508:THR:OG1	1:C:511:ILE:CD1	2.51	0.57
1:D:423:ASN:ND2	1:D:427:GLN:NE2	2.52	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:314:ILE:HG23	1:C:365:MET:HG2	1.85	0.57
1:C:507:LEU:HD12	1:C:511:ILE:HG13	1.86	0.57
1:B:230:LEU:HD22	1:B:254:THR:HB	1.87	0.57
1:B:390:TYR:CE1	1:B:505:TYR:HB2	2.40	0.57
1:D:192:HIS:CE1	1:D:592:LEU:HD13	2.40	0.57
1:B:298:THR:HG23	1:B:300:HIS:H	1.70	0.57
1:B:421:MET:HG2	1:B:425:GLN:HB3	1.86	0.56
1:C:419:ARG:O	1:C:466:ALA:HA	2.06	0.56
1:D:392:SER:OG	1:D:496:ALA:HB3	2.05	0.56
1:B:432:LEU:HD23	1:B:507:LEU:HD21	1.88	0.56
1:D:151:ASN:HD22	1:D:152:PRO:N	2.04	0.56
1:B:139:ASN:O	1:B:140:LEU:HB2	2.05	0.56
1:B:419:ARG:O	1:B:466:ALA:HA	2.06	0.56
1:C:526:GLU:HG3	1:C:527:SER:N	2.20	0.56
1:B:298:THR:HG22	1:B:300:HIS:H	1.70	0.55
1:C:150:LEU:HD12	1:C:180:ASP:HB3	1.87	0.55
1:C:551:GLU:O	1:C:555:LYS:HD3	2.06	0.55
1:A:571:TYR:OH	1:A:615:HIS:CE1	2.56	0.55
1:B:423:ASN:HD21	1:B:427:GLN:NE2	2.05	0.55
1:C:508:THR:C	1:C:511:ILE:HD12	2.26	0.55
1:B:390:TYR:HE1	1:B:505:TYR:HB2	1.72	0.55
1:D:528:PHE:HZ	1:D:548:ILE:HD11	1.71	0.55
1:D:139:ASN:HB2	1:D:141:ASP:OD1	2.07	0.55
1:C:342:ARG:HD2	1:C:645:TYR:CZ	2.41	0.55
1:A:480:HIS:CE1	4:A:1661:SO4:O4	2.60	0.55
1:A:192:HIS:CG	1:A:243:TYR:OH	2.60	0.54
1:A:189:HIS:CE1	5:A:2027:HOH:O	2.59	0.54
1:A:419:ARG:O	1:A:466:ALA:HA	2.07	0.54
1:D:139:ASN:O	1:D:140:LEU:HB2	2.07	0.54
1:A:192:HIS:CD2	1:A:243:TYR:OH	2.61	0.54
1:A:277:HIS:HE1	1:A:376:GLU:OE1	1.89	0.54
1:D:505:TYR:HA	1:D:508:THR:OG1	2.08	0.54
1:A:210:LEU:HD13	1:A:256:ILE:HG23	1.90	0.54
1:A:389:LYS:HD3	1:A:481:GLU:OE1	2.08	0.54
1:C:505:TYR:O	1:C:508:THR:N	2.41	0.54
1:C:508:THR:O	1:C:511:ILE:HD12	2.07	0.54
1:C:507:LEU:HD11	1:C:511:ILE:CD1	2.37	0.54
1:B:555:LYS:HZ1	1:B:597:GLN:HE21	1.56	0.53
1:B:94:ASN:HA	1:B:197:LEU:HD13	1.90	0.53
1:C:141:ASP:OD1	1:C:141:ASP:N	2.41	0.53
1:A:479:GLN:HE22	1:B:479:GLN:HE22	1.55	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:423:ASN:HD21	1:A:427:GLN:NE2	2.07	0.52
1:C:515:ARG:NH2	5:C:2117:HOH:O	2.30	0.52
1:A:528:PHE:HZ	1:A:548:ILE:HD11	1.74	0.52
1:B:390:TYR:CD1	1:B:502:GLN:HA	2.45	0.52
1:D:161:ASN:OD1	1:D:163:ASP:N	2.42	0.52
1:C:129:LYS:O	1:C:133:GLN:HG3	2.09	0.52
1:C:300:HIS:HB2	1:C:332:LEU:CD1	2.40	0.52
1:A:613:LEU:HD21	1:A:626:TRP:HB2	1.91	0.52
1:C:643:LYS:NZ	1:C:650:ASN:HD22	2.08	0.52
1:C:481:GLU:HG2	1:C:485:TYR:CE2	2.45	0.51
1:B:194:ILE:O	1:B:198:ARG:HD3	2.09	0.51
1:D:480:HIS:ND1	4:D:1660:SO4:O2	2.43	0.51
1:D:108:LYS:HB2	1:D:110:GLN:HG3	1.92	0.51
1:A:428:PHE:CD1	1:A:428:PHE:C	2.84	0.51
1:A:428:PHE:C	1:A:428:PHE:HD1	2.14	0.51
1:D:474:ARG:HH11	1:D:474:ARG:CG	2.24	0.51
1:C:220:LYS:O	1:C:224:LEU:HD22	2.10	0.51
1:D:133:GLN:HG2	1:D:138:ILE:O	2.11	0.51
1:D:423:ASN:ND2	1:D:427:GLN:HE21	2.08	0.51
1:D:529:GLU:OE1	1:D:615:HIS:HB3	2.11	0.51
1:B:524:ILE:O	1:B:582:ALA:HA	2.10	0.50
1:A:238:GLY:HA2	1:A:245:LEU:HD11	1.93	0.50
1:A:268:TRP:CZ2	1:A:277:HIS:HB2	2.47	0.50
1:A:540:LEU:O	1:A:544:VAL:HG23	2.12	0.50
1:B:585:TYR:HA	1:B:588:ILE:HD13	1.93	0.50
2:B:999:FAD:N5	3:B:1659:CL:CL	2.82	0.50
1:A:432:LEU:CD1	1:A:507:LEU:HD11	2.41	0.50
1:C:303:ASP:OD1	1:C:508:THR:HG23	2.11	0.50
1:A:399:GLU:OE2	5:A:2094:HOH:O	2.19	0.50
1:B:140:LEU:HB3	5:B:2014:HOH:O	2.00	0.49
1:B:423:ASN:ND2	1:B:427:GLN:NE2	2.60	0.49
1:C:144:THR:CG2	1:C:520:GLU:HA	2.42	0.49
1:D:480:HIS:HB2	5:D:2093:HOH:O	2.12	0.49
1:D:527:SER:HB2	1:D:578:PHE:CE1	2.46	0.49
1:B:372:GLY:HA2	1:B:652:PHE:CZ	2.48	0.49
1:B:527:SER:HB3	1:B:580:TYR:CE1	2.48	0.49
1:A:242:SER:O	1:A:243:TYR:HB2	2.12	0.49
1:A:442:SER:HB3	1:D:542:ARG:NH1	2.26	0.49
1:C:425:GLN:HG3	1:C:564:THR:OG1	2.12	0.49
1:C:508:THR:OG1	1:C:511:ILE:HD13	2.11	0.49
1:A:349:CYS:SG	1:A:354:MET:CE	3.01	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:244:GLY:HA2	1:B:656:ASN:HD21	1.78	0.49
1:B:246:MET:HB3	1:B:621:LYS:HE2	1.95	0.49
1:B:399:GLU:CD	1:B:399:GLU:H	2.16	0.49
1:D:555:LYS:NZ	1:D:597:GLN:HE21	2.10	0.49
1:B:187:HIS:NE2	1:B:197:LEU:HD11	2.28	0.49
1:D:154:ASP:O	1:D:201:MET:HG2	2.13	0.48
1:C:161:ASN:OD1	1:C:161:ASN:C	2.51	0.48
1:D:503:ARG:O	1:D:507:LEU:HB2	2.13	0.48
1:D:507:LEU:O	1:D:510:VAL:HG22	2.13	0.48
1:B:387:TYR:O	1:B:471:GLU:HA	2.14	0.48
1:B:418:ILE:HG13	1:B:468:LEU:HD23	1.94	0.48
1:B:526:GLU:HB3	1:B:595:PHE:CZ	2.43	0.48
1:A:342:ARG:HG3	1:A:342:ARG:O	2.13	0.47
1:B:390:TYR:HE1	1:B:505:TYR:CB	2.27	0.47
1:C:635:GLY:HA2	1:C:638:MET:CE	2.38	0.47
1:C:564:THR:CG2	1:C:580:TYR:HB2	2.44	0.47
1:D:524:ILE:HG12	1:D:585:TYR:HD2	1.79	0.47
1:A:432:LEU:HD13	1:A:507:LEU:CD1	2.43	0.47
1:D:142:HIS:CE1	1:D:586:ARG:HH22	2.33	0.47
1:B:185:ARG:HG2	1:B:235:ILE:HD13	1.95	0.47
1:C:355:SER:HB2	1:D:616:HIS:HA	1.96	0.47
1:C:432:LEU:HD21	1:C:514:MET:HE1	1.97	0.47
1:D:399:GLU:CD	1:D:399:GLU:H	2.18	0.47
1:A:129:LYS:HD2	1:A:140:LEU:HD23	1.96	0.47
1:B:230:LEU:HD13	1:B:256:ILE:HD11	1.96	0.47
1:A:349:CYS:SG	1:A:354:MET:HE3	2.55	0.47
1:D:581:PHE:CZ	1:D:598:THR:HG21	2.49	0.47
1:A:400:GLN:HA	1:A:400:GLN:NE2	2.30	0.47
1:D:171:THR:OG1	1:D:173:ILE:HD12	2.15	0.46
1:A:524:ILE:HD12	1:A:595:PHE:HB2	1.98	0.46
1:C:419:ARG:HH12	1:C:508:THR:HG21	1.80	0.46
1:D:525:GLY:HA2	1:D:581:PHE:O	2.15	0.46
1:C:645:TYR:CZ	1:D:637:GLY:HA3	2.51	0.46
1:D:473:ASP:O	1:D:477:VAL:HG23	2.16	0.46
1:C:637:GLY:HA3	1:D:645:TYR:CZ	2.50	0.46
1:A:475:GLU:HA	1:A:475:GLU:OE1	2.15	0.46
1:A:643:LYS:NZ	1:A:650:ASN:HD22	2.14	0.46
1:C:300:HIS:HB2	1:C:332:LEU:HD11	1.98	0.46
1:C:507:LEU:HD12	1:C:511:ILE:HD11	1.98	0.46
1:B:138:ILE:HD12	1:B:140:LEU:HD23	1.96	0.46
1:B:524:ILE:HD11	1:B:583:PHE:CZ	2.50	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:529:GLU:OE1	1:B:615:HIS:HB3	2.16	0.45
1:C:360:ILE:HG12	5:C:2088:HOH:O	2.16	0.45
1:D:415:PRO:O	1:D:416:ALA:C	2.55	0.45
1:A:516:ASP:O	1:A:520:GLU:HG2	2.17	0.45
1:C:433:LYS:HD3	1:C:503:ARG:NH1	2.31	0.45
1:A:388:GLN:NE2	5:A:2064:HOH:O	2.48	0.45
1:A:506:LEU:HA	1:A:506:LEU:HD23	1.69	0.45
1:B:161:ASN:HB3	1:B:164:PHE:HB3	1.99	0.45
1:C:144:THR:HG22	1:C:520:GLU:CA	2.45	0.45
1:C:528:PHE:HZ	1:C:548:ILE:HD11	1.81	0.45
1:A:277:HIS:CE1	1:A:376:GLU:OE1	2.69	0.45
1:A:564:THR:HG22	1:A:580:TYR:HB3	1.98	0.45
1:C:116:LYS:HD2	1:C:116:LYS:HA	1.60	0.45
1:C:184:PHE:O	1:C:184:PHE:CD1	2.70	0.45
1:C:507:LEU:HD12	1:C:511:ILE:CD1	2.46	0.45
1:B:551:GLU:HB2	1:B:598:THR:HG23	1.99	0.45
1:C:323:LYS:HD2	1:C:323:LYS:C	2.37	0.45
1:C:423:ASN:HD21	1:C:427:GLN:HE21	1.62	0.45
1:D:161:ASN:OD1	1:D:161:ASN:C	2.55	0.45
1:A:243:TYR:HD2	1:A:622:LEU:HB2	1.82	0.44
1:A:526:GLU:CB	1:A:595:PHE:HZ	2.24	0.44
1:B:480:HIS:CE1	4:B:1660:SO4:O1	2.69	0.44
1:C:195:PHE:CD1	1:C:592:LEU:HD11	2.53	0.44
1:D:526:GLU:HB3	1:D:595:PHE:CZ	2.49	0.44
1:B:139:ASN:O	1:B:140:LEU:HG	2.18	0.44
1:B:277:HIS:HE1	1:B:376:GLU:OE1	2.01	0.44
1:A:425:GLN:HE21	1:A:564:THR:HG23	1.82	0.44
1:A:568:THR:HG22	1:A:576:CYS:SG	2.58	0.44
1:A:425:GLN:OE1	1:A:566:ARG:HD3	2.18	0.44
1:B:619:VAL:HB	1:B:657:LEU:HD23	1.99	0.44
1:B:204:ARG:NH2	1:B:253:ARG:O	2.51	0.43
1:C:388:GLN:NE2	1:C:471:GLU:OE1	2.50	0.43
1:A:417:SER:HB3	1:A:469:LEU:HB3	1.99	0.43
1:C:127:THR:HG22	1:C:127:THR:O	2.18	0.43
1:C:585:TYR:HB2	1:C:591:PRO:HB3	2.01	0.43
1:B:432:LEU:N	1:B:432:LEU:CD1	2.81	0.43
1:C:143:LYS:HE3	1:C:143:LYS:HB3	1.83	0.43
1:C:461:ASN:HB3	5:C:2110:HOH:O	2.18	0.43
1:D:387:TYR:CD2	1:D:474:ARG:HG3	2.54	0.43
1:C:94:ASN:HA	1:C:197:LEU:HD13	2.00	0.43
1:B:432:LEU:HD23	1:B:507:LEU:CD2	2.48	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:524:ILE:O	1:D:582:ALA:HA	2.18	0.43
2:B:999:FAD:H1'2	2:B:999:FAD:H9	1.76	0.43
1:C:111:LEU:HD13	1:C:128:PHE:CD2	2.53	0.43
1:A:127:THR:O	1:A:127:THR:HG22	2.19	0.42
1:A:480:HIS:CG	5:A:2110:HOH:O	2.72	0.42
1:B:268:TRP:CZ2	1:B:277:HIS:HB2	2.54	0.42
1:C:434:PRO:O	1:C:435:GLN:HB2	2.18	0.42
1:A:187:HIS:CE1	1:A:197:LEU:HD11	2.54	0.42
1:C:508:THR:CB	1:C:511:ILE:CD1	2.97	0.42
1:B:564:THR:CG2	1:B:580:TYR:HB2	2.49	0.42
1:C:342:ARG:HH11	1:C:342:ARG:HD3	1.63	0.42
1:C:621:LYS:HG3	1:C:656:ASN:HD22	1.83	0.42
1:A:201:MET:CG	1:A:202:PHE:N	2.82	0.42
1:B:196:LEU:O	1:B:199:GLU:N	2.45	0.42
1:C:150:LEU:HD12	1:C:180:ASP:CB	2.50	0.42
2:A:999:FAD:C4X	3:A:1659:CL:CL	3.04	0.42
1:C:81:GLY:HA3	1:C:286:GLU:OE1	2.19	0.42
1:C:325:ILE:CD1	1:C:416:ALA:HB2	2.49	0.42
1:A:433:LYS:HB3	1:A:434:PRO:HD2	2.00	0.42
1:C:501:GLY:C	1:C:503:ARG:H	2.23	0.42
1:A:372:GLY:HA2	1:A:652:PHE:CZ	2.54	0.42
1:A:476:LYS:O	1:A:480:HIS:HB2	2.19	0.42
1:D:83:ILE:HB	1:D:261:SER:HB2	2.02	0.42
1:D:212:PRO:HD2	1:D:259:ASP:O	2.20	0.42
1:C:417:SER:HB3	1:C:469:LEU:HB3	2.02	0.42
1:D:314:ILE:O	1:D:365:MET:HA	2.19	0.42
1:A:165:LEU:HD12	1:A:165:LEU:HA	1.83	0.42
1:A:439:ILE:HD13	1:A:439:ILE:HA	1.88	0.42
1:A:215:HIS:HE1	5:A:2034:HOH:O	2.03	0.41
1:B:196:LEU:O	1:B:197:LEU:C	2.57	0.41
1:C:98:TYR:CD1	1:C:117:ARG:HD3	2.55	0.41
1:B:118:TYR:HB3	1:B:119:PRO:HD2	2.02	0.41
1:C:612:SER:HB2	1:D:354[A]:MET:HG2	2.01	0.41
1:A:268:TRP:CE2	1:A:277:HIS:HB2	2.56	0.41
1:C:342:ARG:O	1:C:342:ARG:HG3	2.20	0.41
1:A:286:GLU:OE2	1:A:289:ARG:NH2	2.36	0.41
1:A:438:SER:HB3	1:A:441:THR:HG22	2.02	0.41
1:B:277:HIS:HD2	1:B:378:THR:OG1	2.03	0.41
1:A:192:HIS:HA	1:A:592:LEU:HD21	2.02	0.41
1:A:349:CYS:SG	1:A:354:MET:HE1	2.60	0.41
1:C:83:ILE:HB	1:C:261:SER:HB2	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:151:ASN:C	1:D:151:ASN:ND2	2.71	0.41
1:B:243:TYR:HD2	1:B:622:LEU:HB2	1.85	0.41
1:B:555:LYS:HZ2	1:B:597:GLN:HE21	1.63	0.41
1:C:481:GLU:HG2	1:C:485:TYR:HE2	1.85	0.41
1:B:286:GLU:OE1	1:B:286:GLU:HA	2.20	0.41
1:B:555:LYS:NZ	1:B:597:GLN:NE2	2.64	0.41
1:B:568:THR:HG22	1:B:576:CYS:SG	2.61	0.41
1:C:325:ILE:HD11	1:C:416:ALA:HB2	2.02	0.41
1:D:161:ASN:OD1	1:D:162:GLU:N	2.54	0.41
1:D:342:ARG:NE	1:D:645:TYR:O	2.33	0.41
1:A:520:GLU:HG2	1:A:520:GLU:H	1.74	0.40
1:B:127:THR:HG22	1:B:127:THR:O	2.21	0.40
1:B:354:MET:HE3	1:B:354:MET:HB2	1.98	0.40
1:C:397:ASN:HA	1:C:462:GLN:O	2.21	0.40
1:D:480:HIS:CE1	5:D:2088:HOH:O	2.74	0.40
1:A:342:ARG:HD2	1:A:645:TYR:OH	2.21	0.40
1:C:433:LYS:HD2	1:C:434:PRO:HD2	2.03	0.40
1:A:340:THR:HB	1:A:646:VAL:HG13	2.03	0.40
1:C:505:TYR:C	1:C:507:LEU:N	2.75	0.40
1:D:192:HIS:ND1	1:D:592:LEU:HD13	2.35	0.40
1:D:531:SER:HA	1:D:575:ALA:O	2.22	0.40
4:D:1661:SO4:O4	5:D:2067:HOH:O	2.20	0.40
1:A:189:HIS:CD2	5:A:2113:HOH:O	2.74	0.40
1:C:209:VAL:C	1:C:210:LEU:HD12	2.41	0.40
1:A:372:GLY:O	2:A:999:FAD:H2A	2.21	0.40
1:B:305:LEU:HD22	5:B:2039:HOH:O	2.21	0.40
1:D:524:ILE:HG12	1:D:585:TYR:CD2	2.55	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:139:ASN:ND2	1:C:536:ARG:NH2[1_546]	2.14	0.06

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	549/658 (83%)	534 (97%)	15 (3%)	0	100	100
1	B	537/658 (82%)	514 (96%)	18 (3%)	5 (1%)	17	25
1	C	555/658 (84%)	528 (95%)	26 (5%)	1 (0%)	47	62
1	D	547/658 (83%)	525 (96%)	21 (4%)	1 (0%)	47	62
All	All	2188/2632 (83%)	2101 (96%)	80 (4%)	7 (0%)	41	55

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	504	GLY
1	B	195	PHE
1	B	196	LEU
1	C	506	LEU
1	B	503	ARG
1	D	430	HIS
1	B	477	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	476/545 (87%)	440 (92%)	36 (8%)	13	20
1	B	464/545 (85%)	436 (94%)	28 (6%)	19	31
1	C	479/545 (88%)	456 (95%)	23 (5%)	25	41
1	D	472/545 (87%)	444 (94%)	28 (6%)	19	32
All	All	1891/2180 (87%)	1776 (94%)	115 (6%)	18	30

All (115) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	90	LEU
1	A	105	LEU
1	A	107	LYS
1	A	108	LYS
1	A	116	LYS
1	A	120	LEU
1	A	162	GLU
1	A	165	LEU
1	A	174	SER
1	A	180	ASP
1	A	199	GLU
1	A	224	LEU
1	A	263	MET
1	A	323	LYS
1	A	342	ARG
1	A	354	MET
1	A	406	ARG
1	A	419	ARG
1	A	428	PHE
1	A	439	ILE
1	A	462	GLN
1	A	463	LEU
1	A	476	LYS
1	A	498	GLU
1	A	499	ASP
1	A	508	THR
1	A	515	ARG
1	A	520	GLU
1	A	526	GLU
1	A	555	LYS
1	A	559	PHE
1	A	586	ARG
1	A	588	ILE
1	A	592	LEU
1	A	613	LEU
1	A	625	GLN
1	B	116	LYS
1	B	117	ARG
1	B	120	LEU
1	B	174	SER
1	B	180	ASP
1	B	195	PHE
1	B	199	GLU

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Mol	Chain	Res	Type
1	B	298	THR
1	B	323	LYS
1	B	354	MET
1	B	384	THR
1	B	406	ARG
1	B	421	MET
1	B	428	PHE
1	B	432	LEU
1	B	476	LYS
1	B	478	LEU
1	B	498	GLU
1	B	507	LEU
1	B	515	ARG
1	B	516	ASP
1	B	520	GLU
1	B	526	GLU
1	B	555	LYS
1	B	568	THR
1	B	586	ARG
1	B	603	ARG
1	B	613	LEU
1	C	108	LYS
1	C	116	LYS
1	C	117	ARG
1	C	120	LEU
1	C	140	LEU
1	C	141	ASP
1	C	150	LEU
1	C	162	GLU
1	C	224	LEU
1	C	323	LYS
1	C	337	LYS
1	C	342	ARG
1	C	406	ARG
1	C	428	PHE
1	C	459	ASP
1	C	498	GLU
1	C	507	LEU
1	C	508	THR
1	C	526	GLU
1	C	568	THR
1	C	586	ARG

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Mol	Chain	Res	Type
1	C	596	GLU
1	C	613	LEU
1	D	86	LYS
1	D	102	LYS
1	D	107	LYS
1	D	110	GLN
1	D	116	LYS
1	D	117	ARG
1	D	120	LEU
1	D	150	LEU
1	D	151	ASN
1	D	174	SER
1	D	180	ASP
1	D	199	GLU
1	D	224	LEU
1	D	231	CYS
1	D	323	LYS
1	D	406	ARG
1	D	424	GLN
1	D	428	PHE
1	D	432	LEU
1	D	474	ARG
1	D	482	LYS
1	D	498	GLU
1	D	507	LEU
1	D	526	GLU
1	D	555	LYS
1	D	568	THR
1	D	586	ARG
1	D	603	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (48) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	110	GLN
1	A	142	HIS
1	A	177	GLN
1	A	187	HIS
1	A	189	HIS
1	A	192	HIS
1	A	215	HIS
1	A	262	GLN

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Mol	Chain	Res	Type
1	A	277	HIS
1	A	290	GLN
1	A	328	ASN
1	A	388	GLN
1	A	400	GLN
1	A	423	ASN
1	A	479	GLN
1	A	597	GLN
1	A	615	HIS
1	A	616	HIS
1	A	650	ASN
1	B	110	GLN
1	B	189	HIS
1	B	277	HIS
1	B	290	GLN
1	B	423	ASN
1	B	427	GLN
1	B	435	GLN
1	B	597	GLN
1	B	650	ASN
1	B	656	ASN
1	C	110	GLN
1	C	290	GLN
1	C	423	ASN
1	C	424	GLN
1	C	462	GLN
1	C	597	GLN
1	C	650	ASN
1	C	656	ASN
1	D	142	HIS
1	D	151	ASN
1	D	192	HIS
1	D	277	HIS
1	D	290	GLN
1	D	427	GLN
1	D	461	ASN
1	D	462	GLN
1	D	597	GLN
1	D	650	ASN
1	D	656	ASN

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 15 ligands modelled in this entry, 4 are monoatomic - leaving 11 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
4	SO4	A	1660	-	4,4,4	0.15	0	6,6,6	1.14	1 (16%)
2	FAD	A	999	-	53,58,58	1.24	5 (9%)	68,89,89	1.60	12 (17%)
4	SO4	D	1660	-	4,4,4	0.12	0	6,6,6	0.56	0
2	FAD	D	999	-	53,58,58	1.21	4 (7%)	68,89,89	1.68	18 (26%)
4	SO4	A	1661	-	4,4,4	0.38	0	6,6,6	0.74	0
4	SO4	B	1660	-	4,4,4	0.29	0	6,6,6	0.80	0
4	SO4	B	1661	-	4,4,4	0.24	0	6,6,6	0.71	0
4	SO4	C	1660	-	4,4,4	0.30	0	6,6,6	0.49	0
4	SO4	D	1661	-	4,4,4	0.32	0	6,6,6	0.91	0
2	FAD	C	999	-	53,58,58	1.24	5 (9%)	68,89,89	1.77	16 (23%)
2	FAD	B	999	-	53,58,58	1.48	7 (13%)	68,89,89	1.77	19 (27%)

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	C	999	-	-	2/30/50/50	0/6/6/6
2	FAD	D	999	-	-	3/30/50/50	0/6/6/6
2	FAD	A	999	-	-	4/30/50/50	0/6/6/6
2	FAD	B	999	-	-	4/30/50/50	0/6/6/6

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	999	FAD	C4X-N5	6.81	1.44	1.30
2	D	999	FAD	C4X-N5	4.77	1.40	1.30
2	A	999	FAD	C4X-N5	4.48	1.39	1.30
2	C	999	FAD	C4X-N5	4.08	1.38	1.30
2	C	999	FAD	C2A-N3A	3.82	1.38	1.32
2	B	999	FAD	C2A-N3A	3.55	1.37	1.32
2	D	999	FAD	C2A-N3A	3.17	1.37	1.32
2	A	999	FAD	C2A-N3A	3.01	1.37	1.32
2	C	999	FAD	C2B-C1B	-2.80	1.49	1.53
2	A	999	FAD	C10-N1	2.72	1.38	1.33
2	B	999	FAD	O4'-C4'	-2.64	1.37	1.43
2	C	999	FAD	C10-N1	2.61	1.38	1.33
2	B	999	FAD	C2A-N1A	2.51	1.38	1.33
2	D	999	FAD	C10-N1	2.33	1.38	1.33
2	A	999	FAD	C2A-N1A	2.26	1.38	1.33
2	C	999	FAD	C1'-C2'	2.24	1.55	1.52
2	B	999	FAD	C1'-C2'	2.21	1.55	1.52
2	D	999	FAD	C4X-C10	-2.20	1.37	1.44
2	B	999	FAD	C10-N1	2.11	1.37	1.33
2	B	999	FAD	C10-N10	2.10	1.41	1.37
2	A	999	FAD	O4-C4	2.07	1.27	1.23

All (66) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	999	FAD	N3A-C2A-N1A	-5.79	119.63	128.68
2	C	999	FAD	N3A-C2A-N1A	-5.31	120.37	128.68
2	B	999	FAD	O4'-C4'-C5'	-4.33	100.18	109.92
2	C	999	FAD	O4B-C1B-C2B	-4.33	100.60	106.93
2	B	999	FAD	N3A-C2A-N1A	-4.27	122.00	128.68
2	D	999	FAD	N3A-C2A-N1A	-4.23	122.07	128.68
2	B	999	FAD	C4-C4X-N5	4.22	124.24	118.23
2	C	999	FAD	C9A-C5X-N5	-3.97	118.11	122.43
2	A	999	FAD	C9A-C5X-N5	-3.82	118.28	122.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	999	FAD	C4-N3-C2	-3.72	118.76	125.64
2	C	999	FAD	O4'-C4'-C5'	-3.61	101.81	109.92
2	B	999	FAD	C10-C4X-N5	-3.54	117.35	124.86
2	B	999	FAD	C10-N1-C2	3.53	123.96	116.90
2	C	999	FAD	O2-C2-N1	-3.44	116.13	121.83
2	B	999	FAD	C4X-C10-N10	3.43	121.49	116.48
2	D	999	FAD	C4X-C10-N10	3.42	121.48	116.48
2	D	999	FAD	C9A-C5X-N5	-3.35	118.79	122.43
2	B	999	FAD	C4A-C5A-N7A	-3.33	105.93	109.40
2	D	999	FAD	C10-C4X-N5	-3.32	117.82	124.86
2	C	999	FAD	C4-N3-C2	-3.31	119.52	125.64
2	C	999	FAD	C5'-C4'-C3'	3.27	118.53	112.20
2	C	999	FAD	C4X-C10-N10	3.13	121.05	116.48
2	A	999	FAD	C10-C4X-N5	-3.12	118.24	124.86
2	D	999	FAD	C10-N1-C2	3.06	123.03	116.90
2	D	999	FAD	O4'-C4'-C5'	-3.04	103.08	109.92
2	A	999	FAD	C5X-N5-C4X	3.03	123.12	118.07
2	B	999	FAD	C4X-C4-N3	2.98	120.75	113.19
2	B	999	FAD	C5A-C6A-N6A	2.83	124.65	120.35
2	C	999	FAD	O5'-C5'-C4'	-2.83	101.81	109.36
2	D	999	FAD	C4X-C10-N1	-2.78	118.29	124.73
2	D	999	FAD	C5X-N5-C4X	2.75	122.65	118.07
2	D	999	FAD	O3'-C3'-C4'	2.74	115.42	108.81
2	B	999	FAD	C4X-C10-N1	-2.73	118.40	124.73
2	B	999	FAD	O4-C4-N3	-2.69	114.97	120.12
2	D	999	FAD	C6-C5X-C9A	2.68	122.73	118.94
2	D	999	FAD	O4'-C4'-C3'	2.66	115.56	109.10
2	C	999	FAD	C10-C4X-N5	-2.63	119.28	124.86
2	B	999	FAD	C4-N3-C2	-2.62	120.80	125.64
2	C	999	FAD	C4A-C5A-N7A	-2.59	106.70	109.40
2	D	999	FAD	C4-C4X-N5	2.56	121.88	118.23
2	D	999	FAD	C2A-N1A-C6A	2.55	123.11	118.75
2	A	999	FAD	O2'-C2'-C1'	2.51	115.87	109.80
2	A	999	FAD	C4X-C10-N10	2.50	120.13	116.48
2	B	999	FAD	C5X-C9A-N10	2.49	120.53	117.95
2	D	999	FAD	C5A-C6A-N1A	-2.47	114.74	120.35
2	D	999	FAD	O2-C2-N3	2.42	123.34	118.65
2	B	999	FAD	C9A-C5X-N5	-2.41	119.82	122.43
4	A	1660	SO4	O4-S-O3	2.37	119.16	109.06
2	C	999	FAD	C4-C4X-C10	2.35	120.74	116.79
2	A	999	FAD	C4X-C4-N3	2.33	119.09	113.19
2	B	999	FAD	P-O3P-PA	-2.31	124.90	132.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	999	FAD	C4X-C4-N3	2.30	119.04	113.19
2	C	999	FAD	O4-C4-C4X	-2.29	120.53	126.60
2	A	999	FAD	C4-C4X-N5	2.28	121.48	118.23
2	C	999	FAD	C4X-C10-N1	-2.27	119.47	124.73
2	B	999	FAD	C5'-C4'-C3'	2.24	116.54	112.20
2	B	999	FAD	C1B-N9A-C4A	-2.22	122.74	126.64
2	C	999	FAD	C5X-N5-C4X	2.21	121.74	118.07
2	B	999	FAD	C9-C9A-N10	-2.19	118.87	121.84
2	A	999	FAD	O3'-C3'-C2'	-2.16	103.59	108.81
2	C	999	FAD	C4X-C4-N3	2.16	118.67	113.19
2	B	999	FAD	O2-C2-N3	2.13	122.79	118.65
2	A	999	FAD	C5X-C9A-N10	2.12	120.15	117.95
2	D	999	FAD	C4-C4X-C10	2.09	120.30	116.79
2	A	999	FAD	C4-C4X-C10	2.06	120.26	116.79
2	D	999	FAD	O5'-C5'-C4'	-2.04	103.91	109.36

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	999	FAD	N10-C1'-C2'-O2'
2	A	999	FAD	N10-C1'-C2'-C3'
2	B	999	FAD	N10-C1'-C2'-O2'
2	B	999	FAD	N10-C1'-C2'-C3'
2	C	999	FAD	N10-C1'-C2'-O2'
2	C	999	FAD	N10-C1'-C2'-C3'
2	D	999	FAD	N10-C1'-C2'-O2'
2	D	999	FAD	N10-C1'-C2'-C3'
2	B	999	FAD	PA-O3P-P-O2P
2	A	999	FAD	PA-O3P-P-O1P
2	A	999	FAD	PA-O3P-P-O2P
2	B	999	FAD	PA-O3P-P-O1P
2	D	999	FAD	PA-O3P-P-O2P

There are no ring outliers.

9 monomers are involved in 13 short contacts:

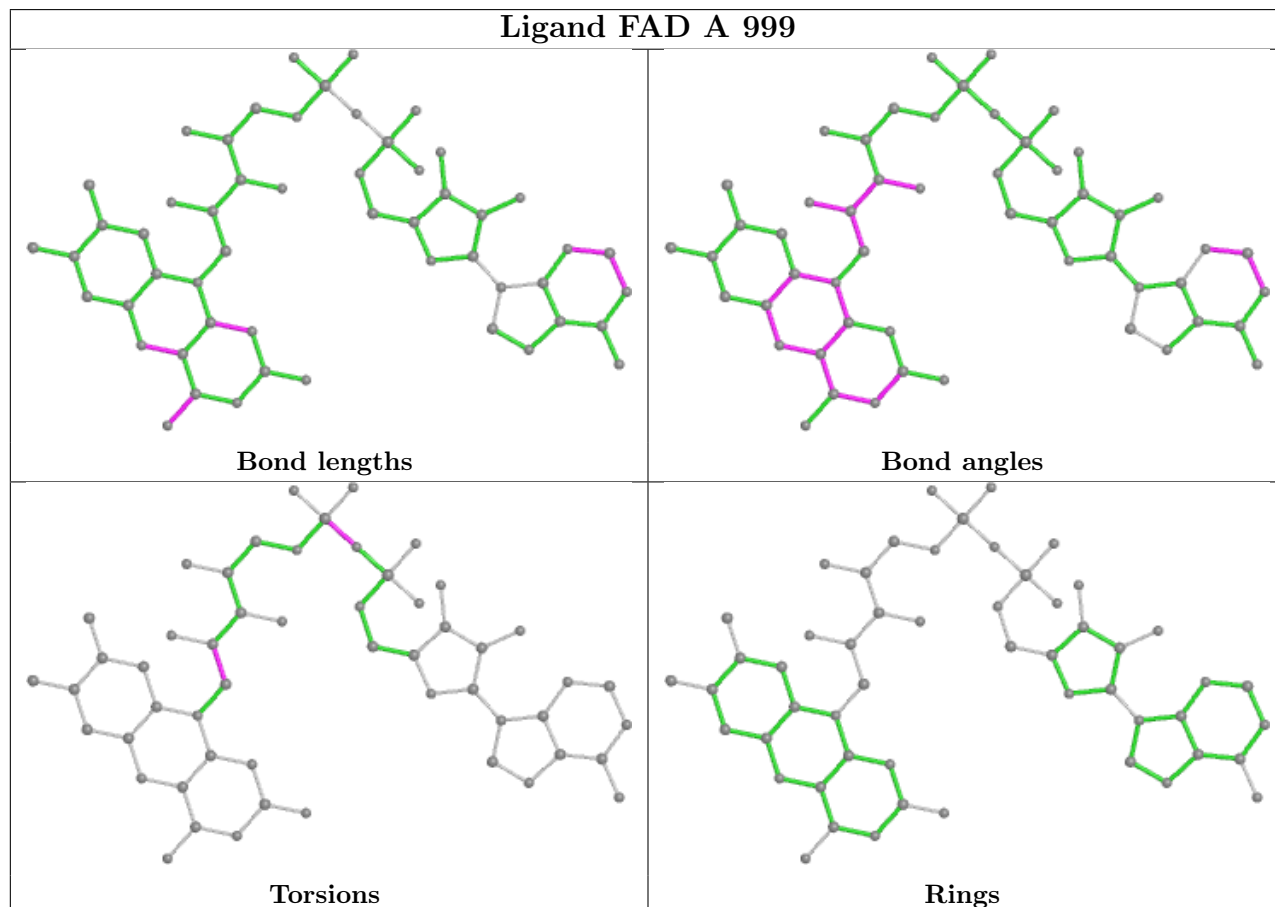
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	999	FAD	3	0
4	D	1660	SO4	1	0
2	D	999	FAD	1	0

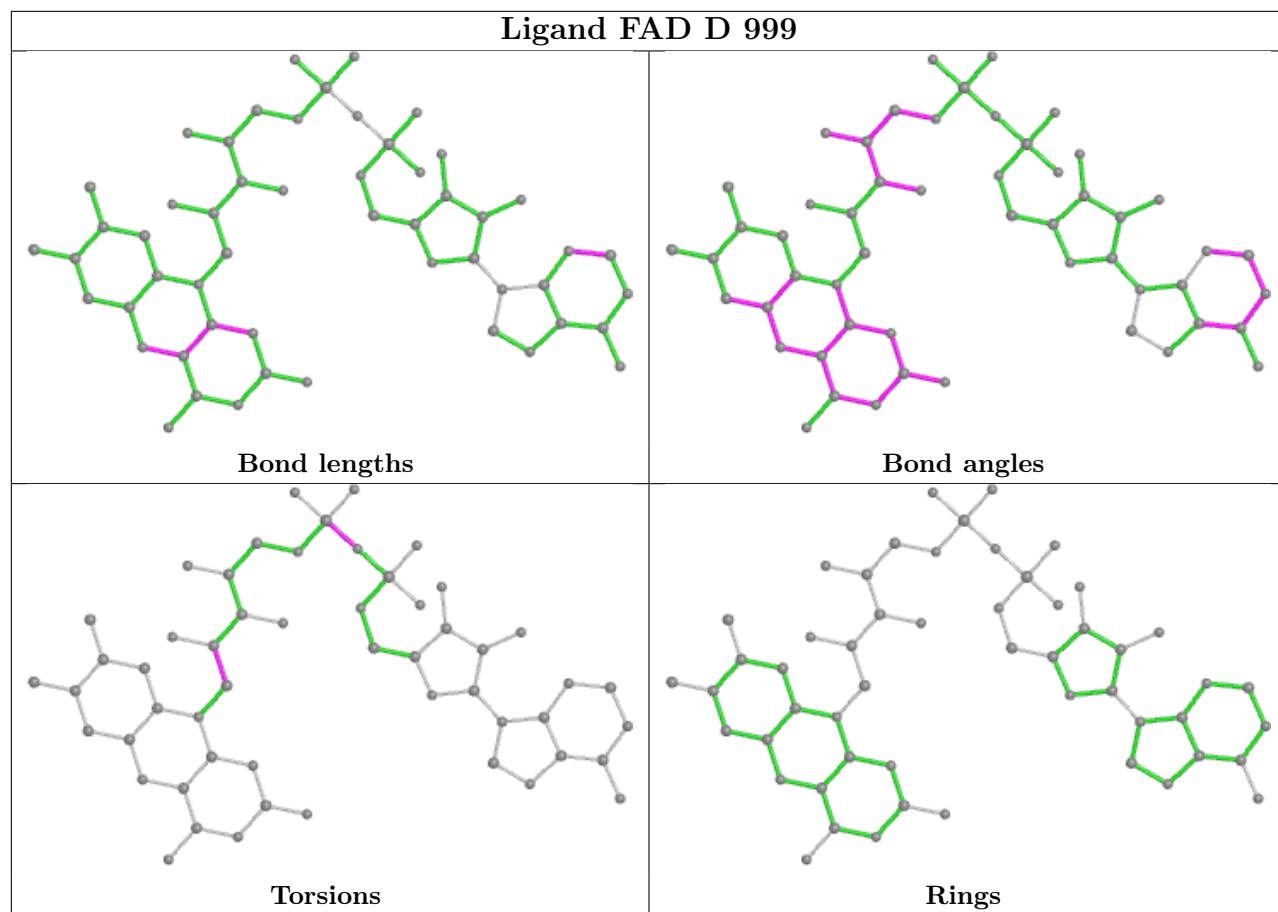
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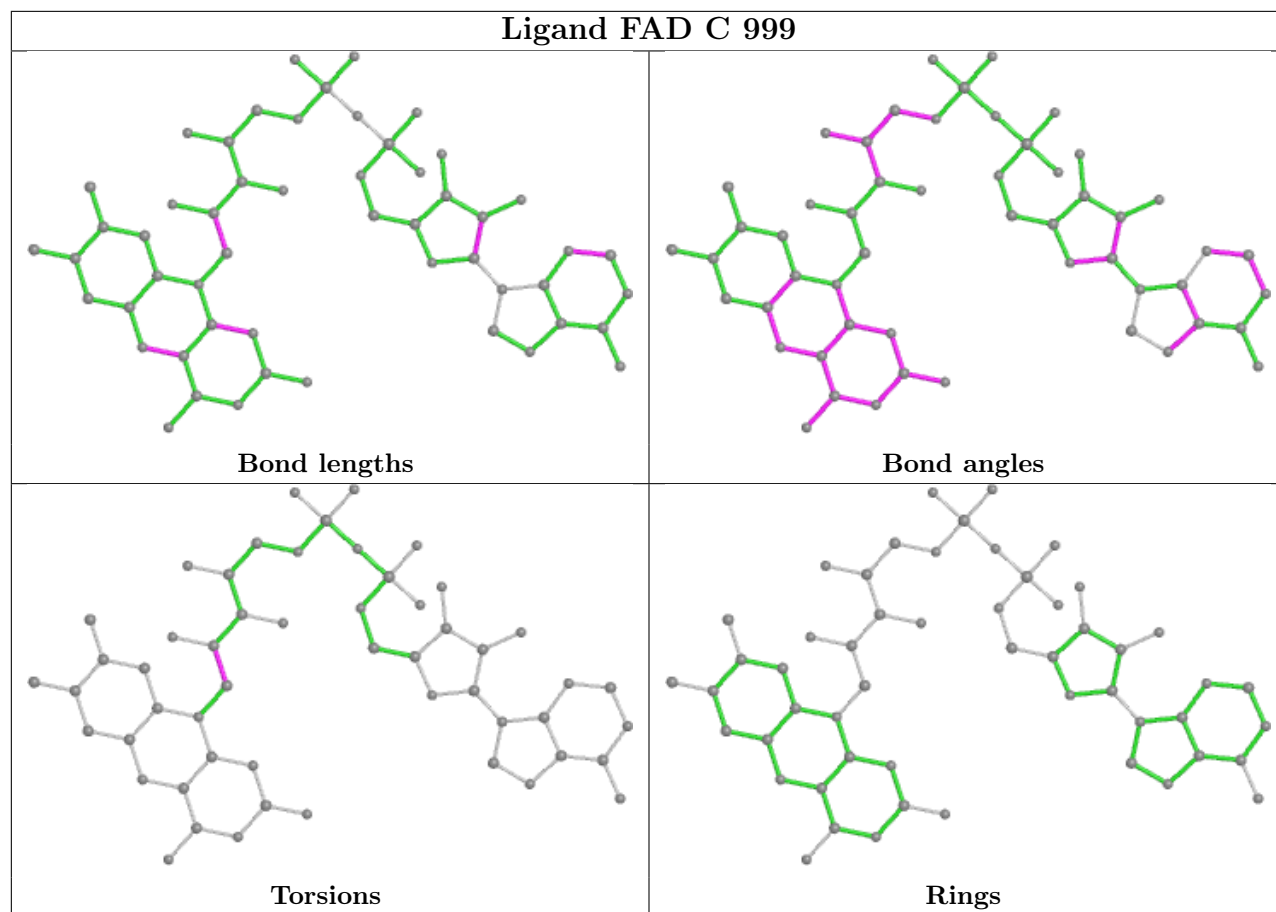
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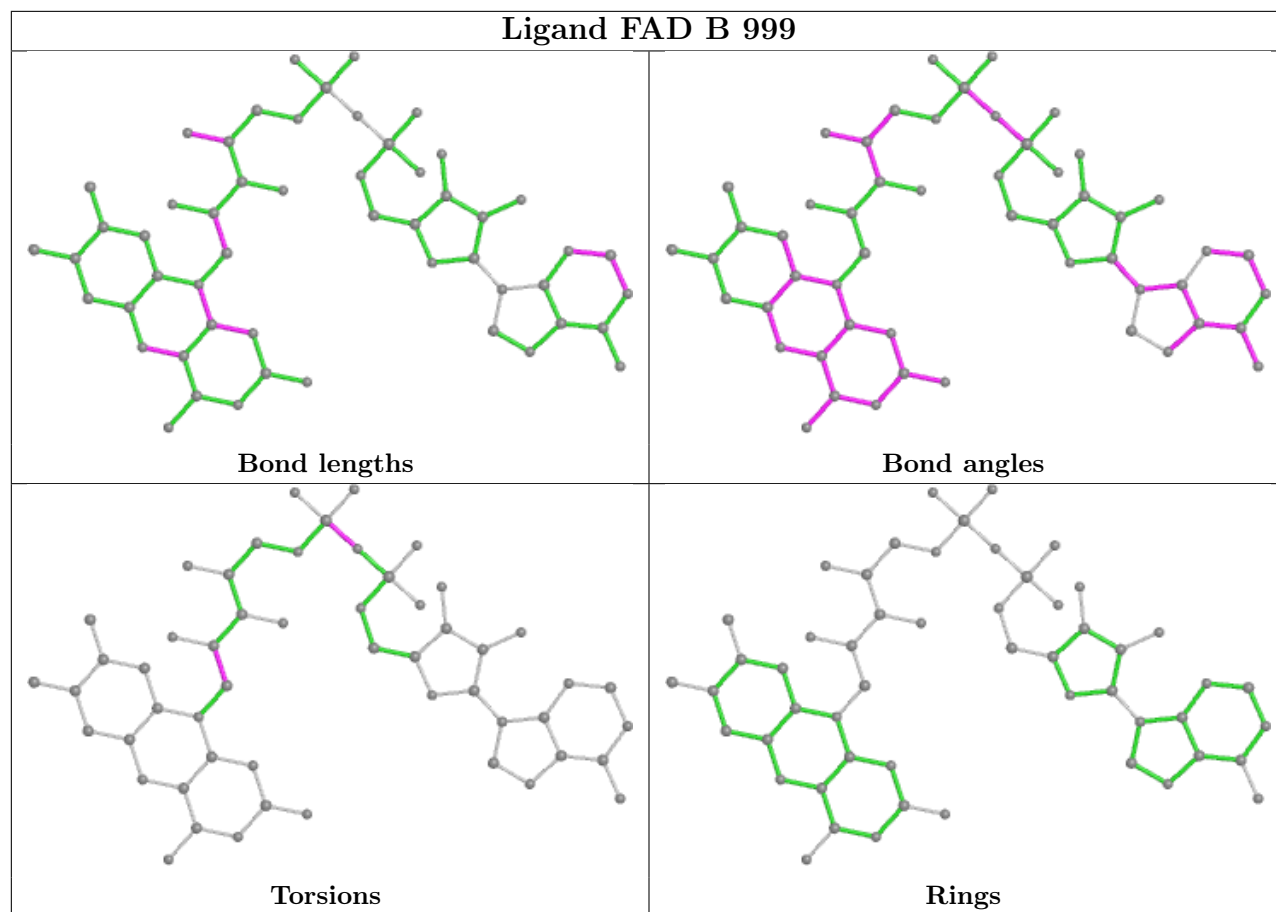
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1661	SO4	1	0
4	B	1660	SO4	2	0
4	C	1660	SO4	1	0
4	D	1661	SO4	1	0
2	C	999	FAD	1	0
2	B	999	FAD	2	0

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

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	555/658 (84%)	-0.47	4 (0%) 87 86	10, 24, 49, 73	0
1	B	543/658 (82%)	-0.36	4 (0%) 87 86	13, 30, 60, 75	0
1	C	557/658 (84%)	-0.34	8 (1%) 75 73	9, 24, 51, 73	0
1	D	550/658 (83%)	-0.35	5 (0%) 84 82	9, 25, 53, 67	0
All	All	2205/2632 (83%)	-0.38	21 (0%) 82 80	9, 25, 54, 75	0

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	82	ILE	4.8
1	C	82	ILE	4.2
1	B	162	GLU	3.2
1	D	82	ILE	3.2
1	D	81	GLY	2.9
1	A	156	PRO	2.9
1	D	559	PHE	2.9
1	C	83	ILE	2.7
1	C	458	PHE	2.7
1	A	83	ILE	2.7
1	C	81	GLY	2.5
1	C	509	TYR	2.5
1	C	589	SER	2.4
1	B	458	PHE	2.4
1	D	107	LYS	2.4
1	C	459	ASP	2.4
1	B	199	GLU	2.3
1	C	559	PHE	2.1
1	A	437	SER	2.1
1	D	127	THR	2.1
1	B	81	GLY	2.1

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](#)

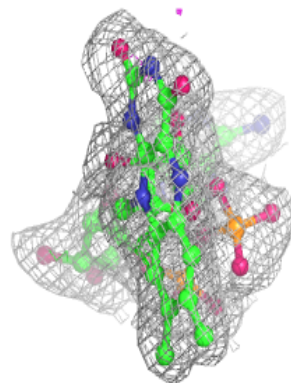
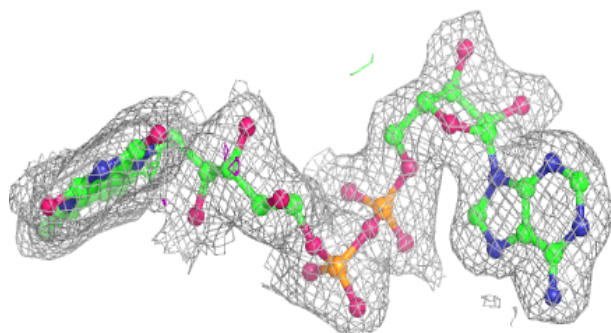
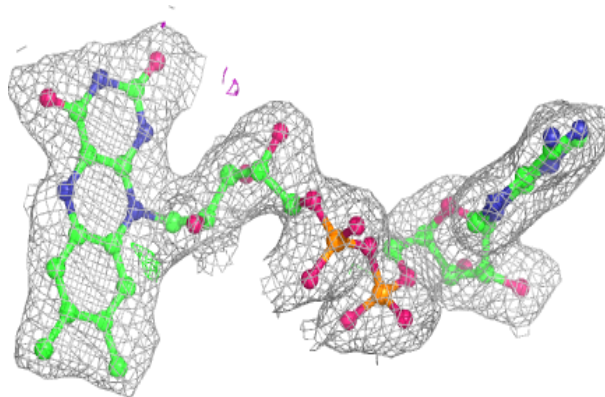
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	D	1661	5/5	0.89	0.20	41,44,53,53	0
4	SO4	B	1661	5/5	0.92	0.19	64,66,66,67	0
3	CL	A	1659	1/1	0.93	0.25	36,36,36,36	0
3	CL	B	1659	1/1	0.93	0.23	56,56,56,56	0
4	SO4	A	1660	5/5	0.94	0.14	42,42,46,49	0
3	CL	D	1659	1/1	0.95	0.29	44,44,44,44	0
4	SO4	B	1660	5/5	0.95	0.19	47,49,51,51	0
4	SO4	C	1660	5/5	0.96	0.15	44,44,47,49	0
3	CL	C	1659	1/1	0.96	0.22	39,39,39,39	0
2	FAD	B	999	53/53	0.98	0.14	12,15,18,21	0
2	FAD	C	999	53/53	0.98	0.12	7,9,12,15	0
2	FAD	D	999	53/53	0.98	0.12	8,10,13,15	0
2	FAD	A	999	53/53	0.98	0.14	9,11,14,16	0
4	SO4	D	1660	5/5	0.99	0.14	36,38,39,43	0
4	SO4	A	1661	5/5	0.99	0.13	30,30,33,33	0

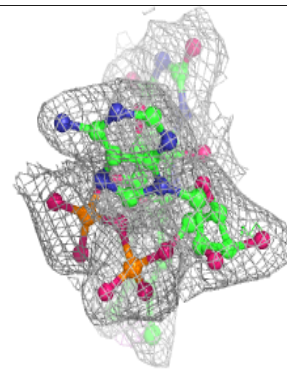
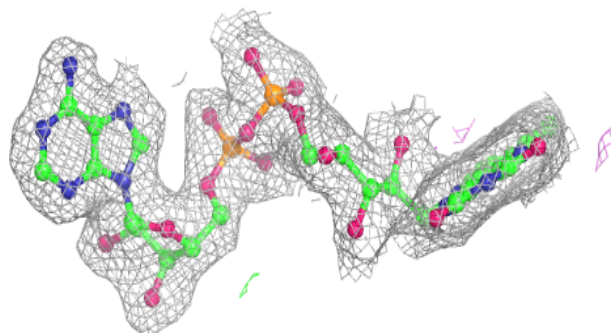
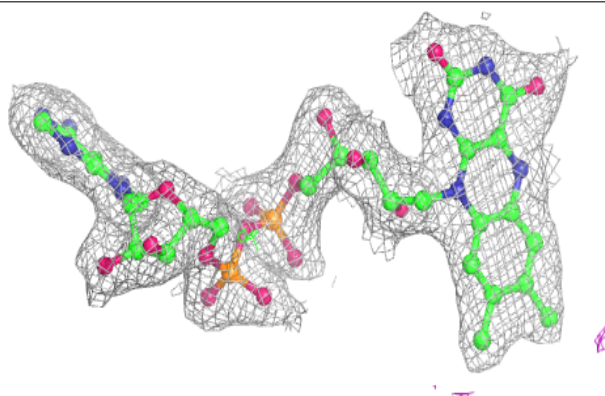
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FAD B 999:

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

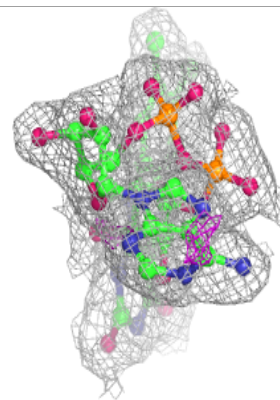
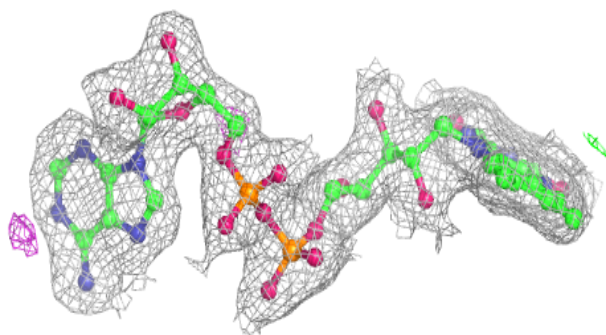
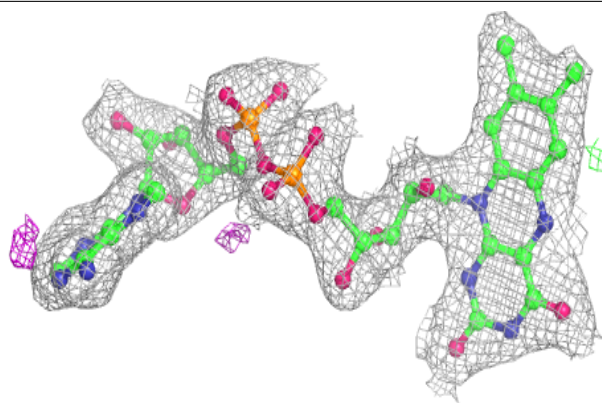
**Electron density around FAD C 999:**

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

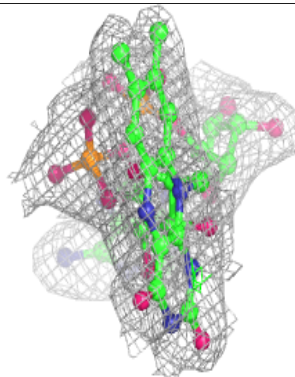
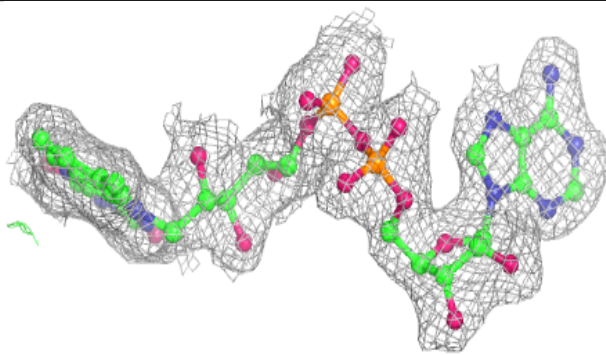
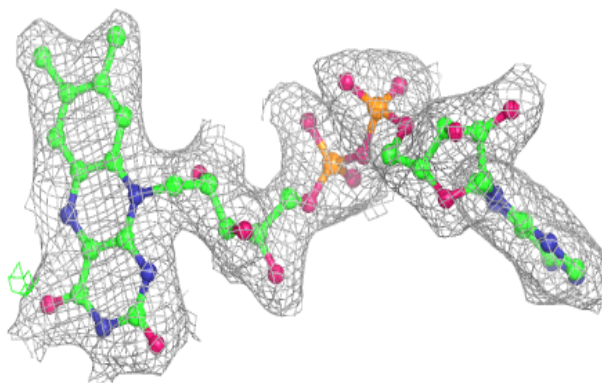


Electron density around FAD D 999:

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

**Electron density around FAD A 999:**

$2mF_o-DF_c$ (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.