W O R L D W I D E
wwPDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Feb 5, 2024 – 08:11 AM EST

PDB ID	:	1U8V
Title	:	Crystal Structure of 4-Hydroxybutyryl-CoA Dehydratase from Clostridium aminobutyricum: Radical catalysis involving a [4Fe-4S] cluster and flavin
Authors	:	Martins, B.M.; Dobbek, H.; Cinkaya, I.; Buckel, W.; Messerschmidt, A.
Deposited on	:	2004-08-07
Resolution	:	1.60 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:

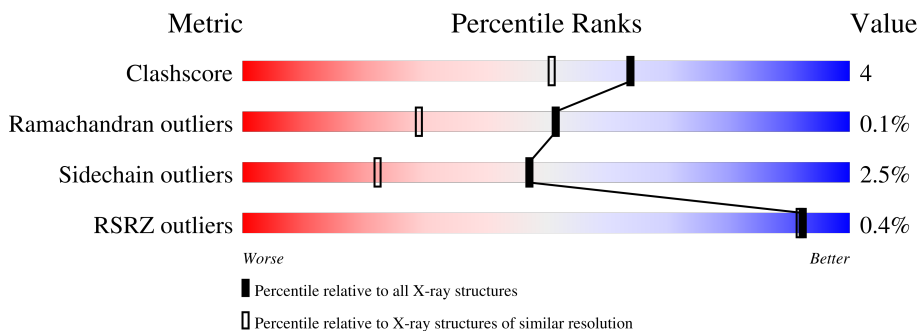|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.60 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	Percentile Ranks	Value
Clashscore		4
Ramachandran outliers		0.1%
Sidechain outliers		2.5%
RSRZ outliers		0.4%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)
RSRZ outliers	127900	3321 (1.60-1.60)

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 <=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	490	87% 12% ·
1	B	490	90% 8% ·
1	C	490	89% 10% ·
1	D	490	90% 9% ·

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 17824 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 Gamma-aminobutyrate metabolism dehydratase/isomerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	490	Total	C	N	O	S	4	0	0
			3811	2386	663	727	35			
1	B	490	Total	C	N	O	S	6	0	0
			3811	2386	663	727	35			
1	C	490	Total	C	N	O	S	4	0	0
			3811	2386	663	727	35			
1	D	490	Total	C	N	O	S	0	0	0
			3811	2386	663	727	35			

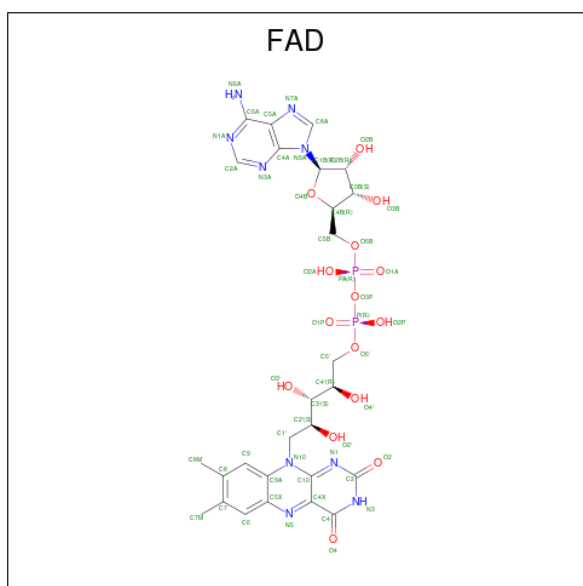There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	167	ASP	GLY	SEE REMARK 999	UNP P55792
A	357	GLY	ASP	SEE REMARK 999	UNP P55792
B	167	ASP	GLY	SEE REMARK 999	UNP P55792
B	357	GLY	ASP	SEE REMARK 999	UNP P55792
C	167	ASP	GLY	SEE REMARK 999	UNP P55792
C	357	GLY	ASP	SEE REMARK 999	UNP P55792
D	167	ASP	GLY	SEE REMARK 999	UNP P55792
D	357	GLY	ASP	SEE REMARK 999	UNP P55792

- Molecule 2 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe_4S_4).

SF4

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 8	Fe 4	S 4	0	0
2	B	1	Total 8	Fe 4	S 4	0	0
2	C	1	Total 8	Fe 4	S 4	0	0
2	D	1	Total 8	Fe 4	S 4	0	0

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).

FAD

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

- Molecule 4 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	519	Total 519	O 519	0	0
4	B	573	Total 573	O 573	0	0
4	C	636	Total 636	O 636	0	0
4	D	608	Total 608	O 608	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.
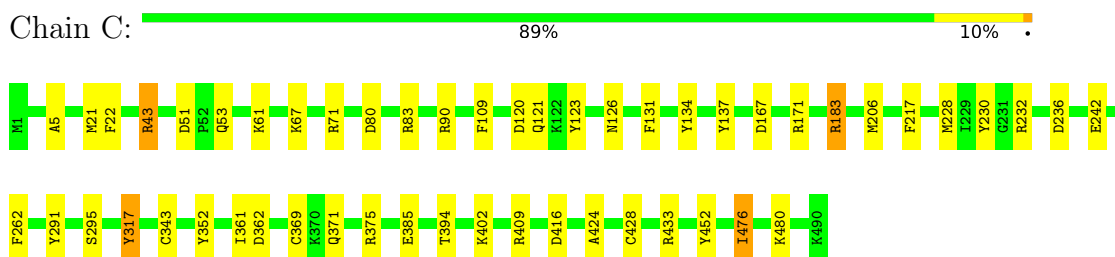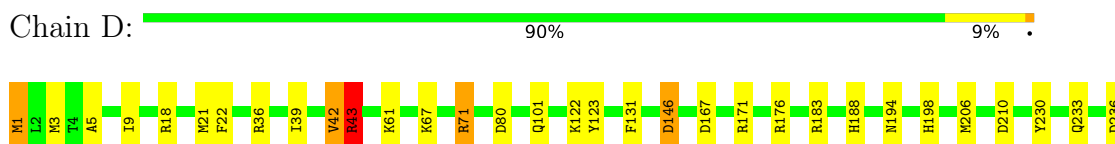
- Molecule 1: Gamma-aminobutyrate metabolism dehydratase/isomerase
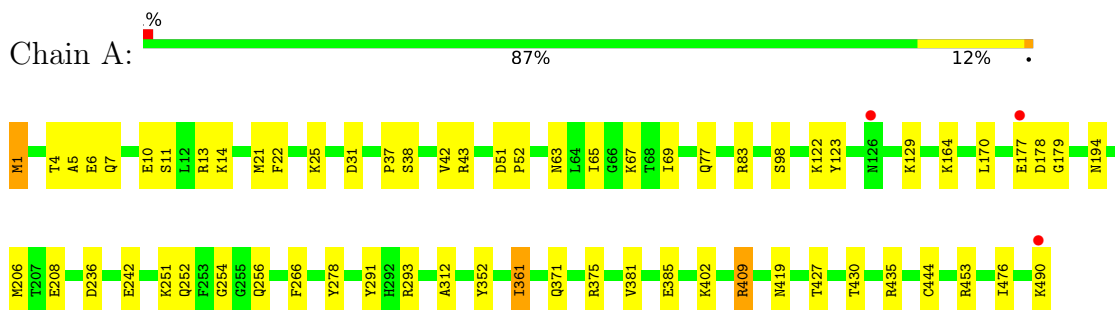
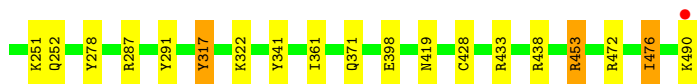- Molecule 1: Gamma-aminobutyrate metabolism dehydratase/isomerase
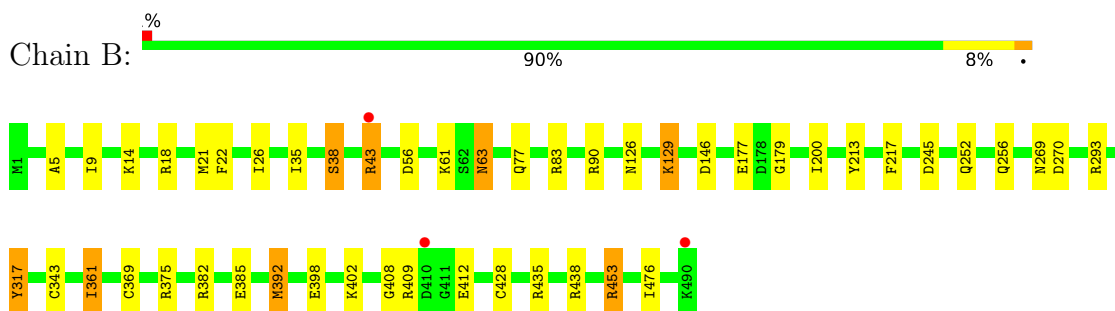
- Molecule 1: Gamma-aminobutyrate metabolism dehydratase/isomerase

- Molecule 1: Gamma-aminobutyrate metabolism dehydratase/isomerase

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	102.30Å 130.20Å 175.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	58.00 – 1.60 59.30 – 1.62	Depositor EDS
% Data completeness (in resolution range)	(Not available) (58.00-1.60) 99.7 (59.30-1.62)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.04	Depositor
$< I/\sigma(I) >$ [1]	2.81 (at 1.62Å)	Xtriage
Refinement program	CNS, SHELX	Depositor
R, R_{free}	0.163 , 0.212 0.161 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	16.6	Xtriage
Anisotropy	0.316	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 63.9	EDS
L-test for twinning[2]	$< |L| > = 0.47, < L^2 > = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	17824	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 2.86% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: SF4, 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	0.46	0/3877	1.09	12/5224 (0.2%)
1	B	0.49	0/3877	1.16	20/5224 (0.4%)
1	C	0.59	0/3877	1.29	34/5224 (0.7%)
1	D	0.53	0/3877	1.16	19/5224 (0.4%)
All	All	0.52	0/15508	1.18	85/20896 (0.4%)

There are no bond length outliers.

All (85) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	232	ARG	NE-CZ-NH1	13.75	127.18	120.30
1	C	232	ARG	NE-CZ-NH2	-11.97	114.31	120.30
1	C	236	ASP	CB-CG-OD1	10.68	127.92	118.30
1	A	409	ARG	CD-NE-CZ	9.72	137.21	123.60
1	C	375	ARG	NE-CZ-NH1	9.54	125.07	120.30
1	B	293	ARG	NE-CZ-NH2	-9.34	115.63	120.30
1	B	217	PHE	CB-CG-CD1	9.28	127.29	120.80
1	C	183	ARG	NE-CZ-NH2	9.17	124.89	120.30
1	B	409	ARG	NE-CZ-NH1	8.84	124.72	120.30
1	D	317	TYR	CB-CG-CD1	8.72	126.23	121.00
1	C	291	TYR	CB-CG-CD1	8.71	126.23	121.00
1	C	83	ARG	NE-CZ-NH1	8.27	124.43	120.30
1	D	80	ASP	CB-CG-OD1	8.23	125.71	118.30
1	D	236	ASP	CB-CG-OD1	8.19	125.67	118.30
1	C	90	ARG	NE-CZ-NH1	8.00	124.30	120.30
1	C	183	ARG	CD-NE-CZ	7.87	134.62	123.60
1	D	287	ARG	NE-CZ-NH2	7.56	124.08	120.30
1	C	433	ARG	NE-CZ-NH1	7.54	124.07	120.30
1	B	90	ARG	NE-CZ-NH1	7.51	124.06	120.30
1	A	435	ARG	NE-CZ-NH1	7.49	124.05	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	382	ARG	NE-CZ-NH1	7.40	124.00	120.30
1	C	452	TYR	CG-CD1-CE1	7.17	127.03	121.30
1	B	146	ASP	CB-CG-OD1	7.16	124.75	118.30
1	A	83	ARG	NE-CZ-NH1	6.99	123.80	120.30
1	B	270	ASP	CB-CG-OD2	6.96	124.57	118.30
1	B	375	ARG	NE-CZ-NH1	6.89	123.75	120.30
1	A	453	ARG	NE-CZ-NH1	-6.88	116.86	120.30
1	B	438	ARG	NE-CZ-NH1	6.88	123.74	120.30
1	B	83	ARG	NE-CZ-NH1	6.82	123.71	120.30
1	A	291	TYR	CB-CG-CD1	6.80	125.08	121.00
1	C	352	TYR	CB-CG-CD1	6.71	125.03	121.00
1	D	341	TYR	CB-CG-CD1	6.67	125.00	121.00
1	D	206	MET	CA-CB-CG	6.64	124.59	113.30
1	C	43	ARG	CD-NE-CZ	6.62	132.87	123.60
1	D	438	ARG	NE-CZ-NH1	6.49	123.54	120.30
1	C	262	PHE	CB-CG-CD1	-6.29	116.39	120.80
1	C	109	PHE	CB-CG-CD1	6.25	125.17	120.80
1	D	18	ARG	CD-NE-CZ	6.23	132.32	123.60
1	B	217	PHE	CB-CG-CD2	-6.16	116.49	120.80
1	C	109	PHE	CB-CG-CD2	-6.15	116.50	120.80
1	C	120	ASP	CB-CG-OD1	6.12	123.81	118.30
1	A	409	ARG	NE-CZ-NH1	6.11	123.36	120.30
1	A	236	ASP	CB-CG-OD1	6.10	123.79	118.30
1	C	206	MET	CA-CB-CG	6.03	123.55	113.30
1	D	43	ARG	CD-NE-CZ	5.96	131.94	123.60
1	D	433	ARG	NE-CZ-NH1	-5.94	117.33	120.30
1	B	317	TYR	CB-CG-CD1	5.85	124.51	121.00
1	C	137	TYR	CB-CG-CD2	5.82	124.49	121.00
1	D	291	TYR	CB-CG-CD1	5.77	124.46	121.00
1	C	416	ASP	CB-CG-OD1	5.69	123.42	118.30
1	C	452	TYR	CG-CD2-CE2	-5.66	116.78	121.30
1	B	245	ASP	CB-CG-OD1	5.61	123.35	118.30
1	D	71	ARG	NE-CZ-NH1	5.59	123.10	120.30
1	A	453	ARG	NE-CZ-NH2	5.57	123.09	120.30
1	C	409	ARG	CD-NE-CZ	5.57	131.39	123.60
1	C	317	TYR	CB-CG-CD1	5.56	124.34	121.00
1	B	409	ARG	CD-NE-CZ	5.55	131.37	123.60
1	B	293	ARG	NE-CZ-NH1	5.54	123.07	120.30
1	C	452	TYR	CD1-CE1-CZ	-5.50	114.85	119.80
1	C	123	TYR	CB-CG-CD2	5.50	124.30	121.00
1	C	452	TYR	CZ-CE2-CD2	5.48	124.73	119.80
1	C	217	PHE	CB-CG-CD1	5.45	124.62	120.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	80	ASP	CB-CG-OD1	5.43	123.19	118.30
1	B	375	ARG	NE-CZ-NH2	-5.39	117.60	120.30
1	C	291	TYR	CG-CD1-CE1	5.38	125.60	121.30
1	A	293	ARG	NE-CZ-NH1	5.38	122.99	120.30
1	D	210	ASP	CB-CG-OD1	5.33	123.10	118.30
1	C	131	PHE	CB-CG-CD1	-5.31	117.08	120.80
1	D	472	ARG	NE-CZ-NH1	-5.30	117.65	120.30
1	B	213	TYR	CB-CG-CD1	5.26	124.15	121.00
1	C	71	ARG	NE-CZ-NH1	-5.24	117.68	120.30
1	C	362	ASP	CB-CG-OD2	-5.24	113.58	118.30
1	A	375	ARG	NE-CZ-NH2	-5.23	117.69	120.30
1	D	36	ARG	NE-CZ-NH2	-5.22	117.69	120.30
1	D	131	PHE	CB-CG-CD1	-5.22	117.15	120.80
1	A	352	TYR	CB-CG-CD1	5.18	124.11	121.00
1	B	213	TYR	CB-CG-CD2	-5.17	117.90	121.00
1	C	134	TYR	CG-CD2-CE2	-5.16	117.17	121.30
1	D	291	TYR	CB-CG-CD2	-5.14	117.92	121.00
1	A	206	MET	CA-CB-CG	5.12	122.01	113.30
1	D	278	TYR	CB-CG-CD1	-5.11	117.93	121.00
1	D	317	TYR	CB-CG-CD2	-5.10	117.94	121.00
1	C	433	ARG	NE-CZ-NH2	-5.06	117.77	120.30
1	B	18	ARG	NE-CZ-NH1	5.02	122.81	120.30
1	B	435	ARG	NE-CZ-NH1	5.01	122.80	120.30

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	3811	0	3753	47	0
1	B	3811	0	3753	26	0
1	C	3811	0	3753	24	0
1	D	3811	0	3753	35	0
2	A	8	0	0	0	0
2	B	8	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	8	0	0	1	0
2	D	8	0	0	0	0
3	A	53	0	30	0	0
3	B	53	0	30	0	0
3	C	53	0	31	0	0
3	D	53	0	29	1	0
4	A	519	0	0	17	0
4	B	573	0	0	9	0
4	C	636	0	0	9	0
4	D	608	0	0	19	0
All	All	17824	0	15132	128	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 4.

All (128) 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:B:5:ALA:HB1	1:B:43:ARG:HG3	1.62	0.80
1:D:398:GLU:HG3	4:D:8522:HOH:O	1.83	0.79
1:A:476:ILE:HB	4:C:7423:HOH:O	1.83	0.78
1:B:61:LYS:HB2	4:B:7747:HOH:O	1.83	0.77
1:C:67:LYS:HE3	4:C:7967:HOH:O	1.84	0.77
1:D:67:LYS:HD3	4:D:8137:HOH:O	1.84	0.77
3:D:492:FAD:H5'1	4:D:7196:HOH:O	1.84	0.77
1:D:167:ASP:HA	4:D:8119:HOH:O	1.85	0.76
1:A:77:GLN:HG3	4:A:8064:HOH:O	1.86	0.75
1:B:129:LYS:HE3	4:B:8329:HOH:O	1.85	0.75
1:A:4:THR:H	1:A:7:GLN:HE21	1.36	0.74
1:B:252:GLN:HG3	4:B:8358:HOH:O	1.89	0.73
1:B:398:GLU:HG3	4:B:7512:HOH:O	1.88	0.72
1:A:5:ALA:HB1	1:A:43:ARG:HG3	1.72	0.72
1:A:312:ALA:HB1	1:C:476:ILE:HD11	1.72	0.72
1:B:63:ASN:HB3	4:B:7342:HOH:O	1.89	0.72
1:D:419:ASN:HB3	4:D:8760:HOH:O	1.93	0.69
1:C:171:ARG:HG2	4:C:8468:HOH:O	1.92	0.69
1:A:6:GLU:HG3	4:A:7863:HOH:O	1.93	0.69
1:D:322:LYS:HD2	4:D:8410:HOH:O	1.92	0.68
1:A:11:SER:HA	1:A:14:LYS:HE3	1.78	0.64
1:B:77:GLN:HG3	4:B:7342:HOH:O	1.96	0.64
1:B:21:MET:HG2	1:B:22:PHE:CD2	2.34	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:43:ARG:HD3	4:C:8393:HOH:O	1.97	0.62
1:D:171:ARG:HG2	4:D:8119:HOH:O	1.99	0.62
1:A:10:GLU:HG2	4:A:8332:HOH:O	1.98	0.62
1:A:10:GLU:HG3	4:A:8279:HOH:O	2.00	0.62
1:A:10:GLU:O	1:A:14:LYS:HE3	2.00	0.62
1:C:402:LYS:HE2	4:C:7482:HOH:O	2.00	0.61
1:B:385:GLU:HA	1:B:392:MET:HE1	1.83	0.60
1:A:361:ILE:H	1:A:361:ILE:HD13	1.67	0.60
1:C:5:ALA:HB1	1:C:43:ARG:HG3	1.83	0.59
1:A:208:GLU:HG3	1:A:278:TYR:CE1	2.37	0.59
1:C:476:ILE:HD13	1:C:480:LYS:HE3	1.85	0.58
1:C:5:ALA:HB1	1:C:43:ARG:CD	2.33	0.58
1:C:21:MET:HG2	1:C:22:PHE:CD2	2.39	0.57
1:A:38:SER:HB3	1:A:256:GLN:NE2	2.20	0.57
1:A:25:LYS:HE3	4:A:8240:HOH:O	2.04	0.56
1:A:21:MET:HG2	1:A:22:PHE:CD2	2.40	0.56
1:B:402:LYS:O	1:B:402:LYS:HG2	2.03	0.56
1:D:5:ALA:HB1	1:D:43:ARG:HD2	1.86	0.56
1:A:312:ALA:CB	1:C:476:ILE:HD11	2.35	0.56
1:A:252:GLN:HG2	4:A:8134:HOH:O	2.05	0.56
1:D:43:ARG:HD3	4:D:8072:HOH:O	2.05	0.56
1:A:409:ARG:HD3	4:A:7387:HOH:O	2.05	0.56
1:D:21:MET:HG2	1:D:22:PHE:CD2	2.41	0.56
1:D:5:ALA:HB1	1:D:43:ARG:CD	2.36	0.55
1:A:427:THR:HB	4:A:7412:HOH:O	2.06	0.55
1:B:21:MET:HE3	1:B:26:ILE:HG13	1.87	0.55
1:B:21:MET:HG2	1:B:22:PHE:HD2	1.71	0.54
1:C:394:THR:OG1	1:D:188:HIS:HD2	1.91	0.54
1:D:122:LYS:HE2	1:D:123:TYR:CZ	2.44	0.52
1:B:408:GLY:HA3	1:B:412:GLU:OE1	2.09	0.52
1:D:61:LYS:HD3	4:D:7445:HOH:O	2.10	0.52
1:A:11:SER:HA	1:A:14:LYS:CE	2.40	0.51
1:D:1:MET:HE1	1:D:3:MET:N	2.25	0.51
1:C:51:ASP:OD1	1:C:53:GLN:HG2	2.09	0.51
1:D:233:GLN:HG2	4:D:7572:HOH:O	2.09	0.51
1:D:251:LYS:HE3	4:D:7938:HOH:O	2.10	0.51
1:A:252:GLN:HG3	4:A:6246:HOH:O	2.11	0.50
1:B:43:ARG:HD3	4:B:6871:HOH:O	2.10	0.50
1:C:476:ILE:CD1	1:C:480:LYS:HE3	2.41	0.50
1:D:43:ARG:HG2	4:D:7311:HOH:O	2.11	0.50
1:A:5:ALA:HB1	1:A:43:ARG:HE	1.76	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:37:PRO:HD2	4:A:7729:HOH:O	2.12	0.50
1:D:188:HIS:HE1	4:D:6171:HOH:O	1.94	0.49
1:D:42:VAL:HG13	1:D:101:GLN:HB2	1.94	0.49
1:D:9:ILE:HD11	1:D:43:ARG:HD3	1.94	0.49
1:D:317:TYR:CD1	1:D:428:CYS:HB3	2.48	0.48
1:D:42:VAL:HG21	1:D:194:ASN:ND2	2.29	0.48
1:A:381:VAL:HG13	1:A:444:CYS:SG	2.54	0.48
1:C:5:ALA:HB1	1:C:43:ARG:CG	2.44	0.48
1:A:65:ILE:HG13	1:A:67:LYS:HG2	1.95	0.48
1:B:179:GLY:HA2	1:B:269:ASN:ND2	2.28	0.48
1:C:167:ASP:HA	4:C:8468:HOH:O	2.14	0.48
1:A:67:LYS:HE3	1:A:69:ILE:HG22	1.95	0.48
1:D:43:ARG:HG3	4:D:8170:HOH:O	2.13	0.47
1:B:256:GLN:HB2	4:B:8029:HOH:O	2.14	0.47
1:C:295:SER:HB3	2:C:491:SF4:S3	2.55	0.47
1:A:5:ALA:CB	1:A:43:ARG:HG3	2.42	0.47
1:A:256:GLN:NE2	4:A:7729:HOH:O	2.48	0.47
1:B:63:ASN:HD22	1:B:63:ASN:H	1.61	0.47
1:B:14:LYS:O	1:B:14:LYS:HG2	2.14	0.47
1:C:183:ARG:HD3	4:C:7601:HOH:O	2.15	0.46
1:A:51:ASP:OD1	1:A:52:PRO:HD2	2.16	0.46
1:B:361:ILE:H	1:B:361:ILE:HD13	1.81	0.46
1:B:317:TYR:CD1	1:B:428:CYS:HB3	2.51	0.45
1:C:121:GLN:NE2	4:C:7234:HOH:O	2.49	0.45
1:A:37:PRO:HB2	4:A:7729:HOH:O	2.15	0.45
1:A:13:ARG:NH2	1:A:31:ASP:OD1	2.50	0.45
1:C:385:GLU:OE2	1:D:453:ARG:NH2	2.50	0.45
1:A:385:GLU:OE2	1:B:453:ARG:NH2	2.50	0.45
1:D:146:ASP:OD1	1:D:198:HIS:ND1	2.49	0.45
1:C:43:ARG:NH1	4:C:7867:HOH:O	2.50	0.45
1:A:10:GLU:C	1:A:14:LYS:HE3	2.37	0.44
1:C:343:CYS:HB3	1:C:369:CYS:HB2	1.99	0.44
1:B:43:ARG:HG2	4:B:8306:HOH:O	2.17	0.44
1:C:5:ALA:HB1	1:C:43:ARG:NE	2.31	0.44
1:D:183:ARG:NH1	4:D:7719:HOH:O	2.50	0.44
1:D:183:ARG:NH2	4:D:6680:HOH:O	2.50	0.44
1:A:4:THR:OG1	1:A:7:GLN:HG3	2.17	0.44
1:A:419:ASN:HA	1:A:430:THR:HG21	2.00	0.44
1:A:43:ARG:NH2	4:A:7450:HOH:O	2.50	0.44
1:B:9:ILE:HD11	1:B:43:ARG:HD2	2.00	0.44
1:A:251:LYS:NZ	4:A:8796:HOH:O	2.50	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:176:ARG:NH2	4:D:7481:HOH:O	2.49	0.44
1:A:13:ARG:NH1	4:A:8279:HOH:O	2.50	0.43
1:C:21:MET:HG3	1:C:230:TYR:CD2	2.53	0.43
1:A:51:ASP:HA	1:A:52:PRO:HD3	1.87	0.43
1:A:164:LYS:HE2	4:A:8200:HOH:O	2.18	0.43
1:A:65:ILE:HD11	1:A:67:LYS:HE3	2.01	0.43
1:A:361:ILE:H	1:A:361:ILE:CD1	2.30	0.43
1:D:252:GLN:NE2	4:D:8690:HOH:O	2.49	0.42
1:D:71:ARG:HD3	4:D:6710:HOH:O	2.20	0.42
1:A:178:ASP:OD1	1:A:178:ASP:N	2.49	0.41
1:A:254:GLY:HA2	4:A:7779:HOH:O	2.18	0.41
1:B:5:ALA:CB	1:B:43:ARG:HG3	2.41	0.41
1:A:179:GLY:HA3	1:A:266:PHE:CE1	2.56	0.41
1:C:317:TYR:CD1	1:C:428:CYS:HB3	2.56	0.41
1:A:1:MET:N	1:A:67:LYS:HZ3	2.18	0.41
1:D:476:ILE:O	1:D:476:ILE:HD12	2.20	0.41
1:D:122:LYS:HE2	1:D:123:TYR:CE2	2.55	0.41
1:B:35:ILE:O	1:B:38:SER:HB2	2.21	0.41
1:D:21:MET:HG3	1:D:230:TYR:CD2	2.55	0.41
1:B:343:CYS:HB3	1:B:369:CYS:HB2	2.03	0.41
1:A:122:LYS:HD3	1:A:123:TYR:CE2	2.56	0.40
1:D:39:ILE:O	1:D:43:ARG:HB3	2.21	0.40
1:D:1:MET:CE	1:D:3:MET:HG3	2.51	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	488/490 (100%)	474 (97%)	14 (3%)	0	100	100
1	B	488/490 (100%)	474 (97%)	14 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	488/490 (100%)	475 (97%)	12 (2%)	1 (0%)	47	26
1	D	488/490 (100%)	474 (97%)	14 (3%)	0	100	100
All	All	1952/1960 (100%)	1897 (97%)	54 (3%)	1 (0%)	51	29

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	424	ALA

5.3.2 Protein sidechains ⓘ

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	403/403 (100%)	390 (97%)	13 (3%)	39	15
1	B	403/403 (100%)	391 (97%)	12 (3%)	41	16
1	C	403/403 (100%)	396 (98%)	7 (2%)	60	38
1	D	403/403 (100%)	394 (98%)	9 (2%)	52	27
All	All	1612/1612 (100%)	1571 (98%)	41 (2%)	47	22

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	42	VAL
1	A	63	ASN
1	A	98	SER
1	A	129	LYS
1	A	170	LEU
1	A	177	GLU
1	A	194	ASN
1	A	242	GLU
1	A	361	ILE
1	A	371	GLN

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Mol	Chain	Res	Type
1	A	402	LYS
1	A	490	LYS
1	B	38	SER
1	B	43	ARG
1	B	56	ASP
1	B	63	ASN
1	B	126	ASN
1	B	129	LYS
1	B	177	GLU
1	B	200	ILE
1	B	361	ILE
1	B	392	MET
1	B	453	ARG
1	B	476	ILE
1	C	61	LYS
1	C	126	ASN
1	C	228	MET
1	C	242	GLU
1	C	361	ILE
1	C	371	GLN
1	C	476	ILE
1	D	1	MET
1	D	42	VAL
1	D	43	ARG
1	D	146	ASP
1	D	361	ILE
1	D	371	GLN
1	D	453	ARG
1	D	476	ILE
1	D	490	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (32) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	7	GLN
1	A	77	GLN
1	A	139	GLN
1	A	252	GLN
1	A	256	GLN
1	B	53	GLN
1	B	63	ASN
1	B	77	GLN

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Mol	Chain	Res	Type
1	B	94	GLN
1	B	141	ASN
1	B	194	ASN
1	B	198	HIS
1	B	233	GLN
1	B	256	GLN
1	B	269	ASN
1	B	335	HIS
1	B	464	GLN
1	C	94	GLN
1	C	126	ASN
1	C	139	GLN
1	C	269	ASN
1	C	464	GLN
1	D	53	GLN
1	D	94	GLN
1	D	139	GLN
1	D	141	ASN
1	D	188	HIS
1	D	189	GLN
1	D	233	GLN
1	D	256	GLN
1	D	269	ASN
1	D	464	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 ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

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	SF4	B	491	4,1	0,12,12	-	-	-		
3	FAD	A	492	-	53,58,58	1.22	3 (5%)	68,89,89	1.53	12 (17%)
2	SF4	C	491	1	0,12,12	-	-	-		
2	SF4	D	491	1	0,12,12	-	-	-		
3	FAD	C	492	-	53,58,58	1.32	6 (11%)	68,89,89	1.60	10 (14%)
3	FAD	B	492	-	53,58,58	1.17	3 (5%)	68,89,89	1.53	11 (16%)
3	FAD	D	492	-	53,58,58	1.45	7 (13%)	68,89,89	2.10	17 (25%)
2	SF4	A	491	1	0,12,12	-	-	-		

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	SF4	B	491	4,1	-	-	0/6/5/5
3	FAD	A	492	-	-	1/30/50/50	0/6/6/6
2	SF4	C	491	1	-	-	0/6/5/5
2	SF4	D	491	1	-	-	0/6/5/5
3	FAD	C	492	-	-	3/30/50/50	0/5/6/6
3	FAD	B	492	-	-	4/30/50/50	0/6/6/6
3	FAD	D	492	-	-	12/30/50/50	0/6/6/6
2	SF4	A	491	1	-	-	0/6/5/5

All (19) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	492	FAD	C4X-N5	4.66	1.39	1.30
3	D	492	FAD	C4X-N5	4.35	1.39	1.30
3	A	492	FAD	C4X-N5	3.90	1.38	1.30
3	D	492	FAD	C5'-C4'	3.69	1.57	1.51
3	D	492	FAD	O4B-C1B	3.04	1.45	1.41
3	B	492	FAD	C4X-N5	2.99	1.36	1.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	492	FAD	C2A-N3A	2.99	1.36	1.32
3	D	492	FAD	C2'-C3'	-2.83	1.48	1.53
3	C	492	FAD	C10-N1	2.78	1.38	1.33
3	B	492	FAD	O4B-C4B	-2.65	1.39	1.45
3	C	492	FAD	O4B-C1B	2.63	1.44	1.41
3	D	492	FAD	C2A-N3A	2.59	1.36	1.32
3	D	492	FAD	C2A-N1A	2.48	1.38	1.33
3	D	492	FAD	C4'-C3'	-2.35	1.49	1.53
3	C	492	FAD	C4A-N3A	-2.32	1.32	1.35
3	C	492	FAD	PA-O2A	-2.26	1.44	1.55
3	A	492	FAD	C2A-N3A	2.25	1.35	1.32
3	B	492	FAD	C2A-N3A	2.21	1.35	1.32
3	A	492	FAD	O4B-C1B	2.07	1.44	1.41

All (50) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	492	FAD	O4'-C4'-C5'	-8.43	90.97	109.92
3	D	492	FAD	C4'-C3'-C2'	6.64	127.18	113.36
3	C	492	FAD	N3A-C2A-N1A	-5.57	119.97	128.68
3	D	492	FAD	C5'-C4'-C3'	-4.79	102.95	112.20
3	D	492	FAD	N3A-C2A-N1A	-4.74	121.27	128.68
3	D	492	FAD	O4'-C4'-C3'	4.63	120.35	109.10
3	C	492	FAD	C4X-C10-N10	4.16	122.57	116.48
3	A	492	FAD	C3B-C2B-C1B	-3.79	95.27	100.98
3	C	492	FAD	C9A-N10-C10	-3.49	115.32	120.77
3	B	492	FAD	C4X-C10-N10	3.45	121.53	116.48
3	A	492	FAD	N3A-C2A-N1A	-3.43	123.31	128.68
3	C	492	FAD	C3B-C2B-C1B	-3.30	96.01	100.98
3	D	492	FAD	C5A-C6A-N6A	3.22	125.25	120.35
3	B	492	FAD	O4'-C4'-C3'	3.16	116.78	109.10
3	A	492	FAD	O3B-C3B-C4B	3.13	120.09	111.05
3	B	492	FAD	N3A-C2A-N1A	-3.09	123.85	128.68
3	D	492	FAD	C4X-C10-N10	3.09	121.00	116.48
3	B	492	FAD	O3B-C3B-C4B	3.08	119.95	111.05
3	B	492	FAD	C5A-C6A-N6A	3.06	125.01	120.35
3	B	492	FAD	C5B-C4B-C3B	2.89	126.03	115.18
3	A	492	FAD	C10-C4X-N5	-2.80	118.92	124.86
3	A	492	FAD	C4X-C10-N10	2.78	120.55	116.48
3	A	492	FAD	C4'-C3'-C2'	2.75	119.09	113.36
3	B	492	FAD	O2A-PA-O1A	2.75	125.83	112.24
3	C	492	FAD	O3B-C3B-C4B	2.61	118.59	111.05

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	D	492	FAD	C4-N3-C2	-2.55	120.93	125.64
3	C	492	FAD	C5A-C6A-N6A	2.52	124.19	120.35
3	A	492	FAD	C1'-N10-C9A	-2.52	116.31	120.51
3	A	492	FAD	C5B-C4B-C3B	2.50	124.56	115.18
3	C	492	FAD	C10-C4X-N5	-2.49	119.56	124.86
3	D	492	FAD	C10-C4X-N5	-2.46	119.64	124.86
3	A	492	FAD	C5A-C6A-N6A	2.45	124.08	120.35
3	A	492	FAD	C4-C4X-N5	2.39	121.63	118.23
3	D	492	FAD	C3B-C2B-C1B	-2.38	97.39	100.98
3	C	492	FAD	O2A-PA-O1A	2.38	124.00	112.24
3	C	492	FAD	C4-N3-C2	-2.35	121.31	125.64
3	D	492	FAD	C4X-C10-N1	-2.32	119.36	124.73
3	D	492	FAD	O3B-C3B-C4B	2.31	117.72	111.05
3	B	492	FAD	C10-C4X-N5	-2.22	120.15	124.86
3	D	492	FAD	O3'-C3'-C4'	2.19	114.09	108.81
3	D	492	FAD	C2A-N1A-C6A	2.16	122.45	118.75
3	A	492	FAD	O4B-C1B-C2B	-2.14	103.80	106.93
3	C	492	FAD	C2A-N1A-C6A	2.13	122.39	118.75
3	A	492	FAD	C4X-C10-N1	-2.12	119.82	124.73
3	D	492	FAD	C1'-N10-C9A	-2.07	117.05	120.51
3	B	492	FAD	C3B-C2B-C1B	-2.07	97.86	100.98
3	B	492	FAD	O4-C4-C4X	-2.06	121.13	126.60
3	D	492	FAD	C4X-C4-N3	2.06	118.41	113.19
3	D	492	FAD	C5B-C4B-C3B	2.05	122.88	115.18
3	B	492	FAD	C9A-N10-C10	-2.01	117.64	120.77

There are no chirality outliers.

All (20) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	492	FAD	C2'-C1'-N10-C10
3	B	492	FAD	C2'-C1'-N10-C10
3	C	492	FAD	C5B-O5B-PA-O2A
3	C	492	FAD	C2'-C1'-N10-C10
3	D	492	FAD	C5B-O5B-PA-O2A
3	D	492	FAD	C1'-C2'-C3'-C4'
3	D	492	FAD	O2'-C2'-C3'-C4'
3	D	492	FAD	C3'-C4'-C5'-O5'
3	D	492	FAD	O4'-C4'-C5'-O5'
3	D	492	FAD	C2'-C3'-C4'-O4'
3	D	492	FAD	C2'-C3'-C4'-C5'
3	D	492	FAD	O3'-C3'-C4'-C5'

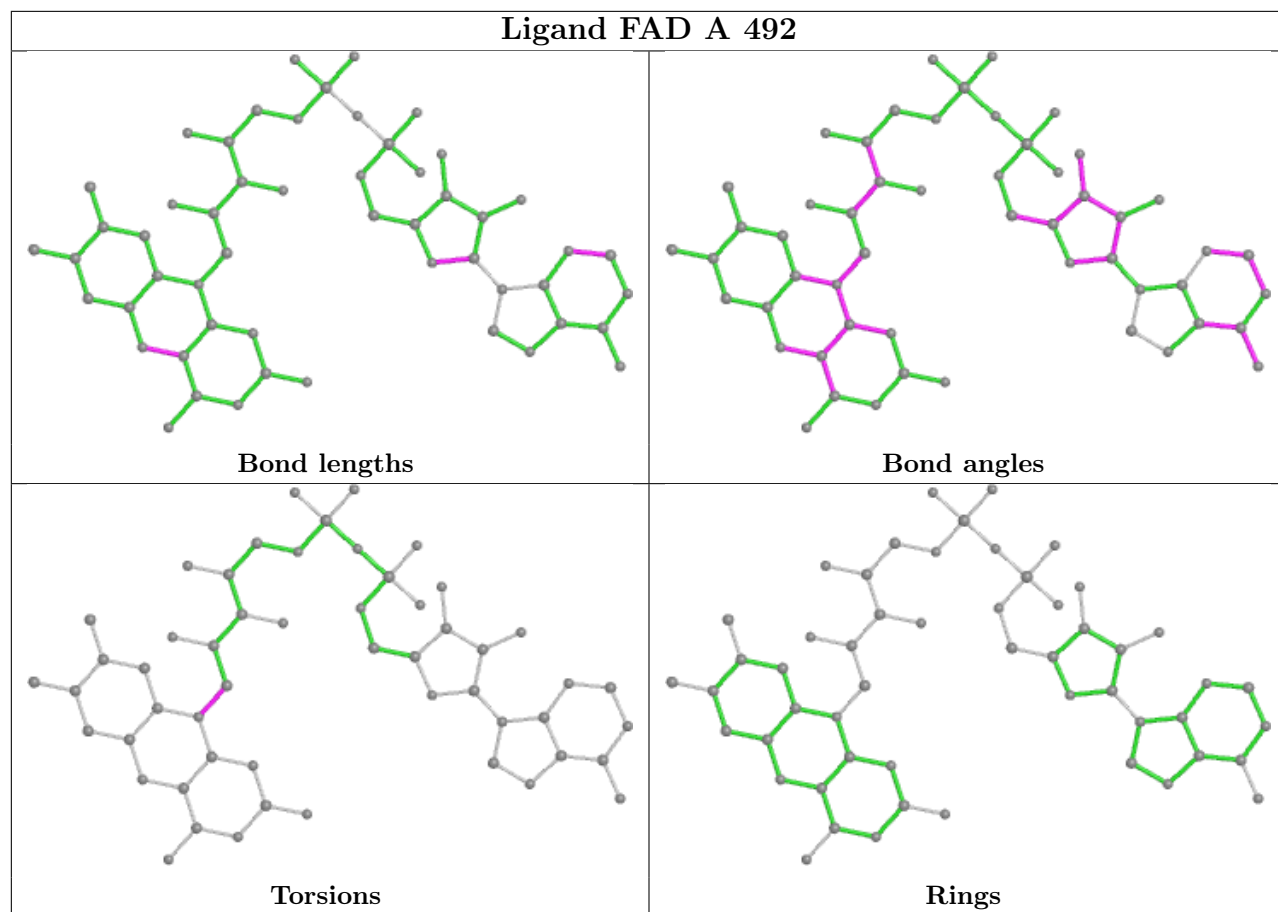*Continued on next page...*

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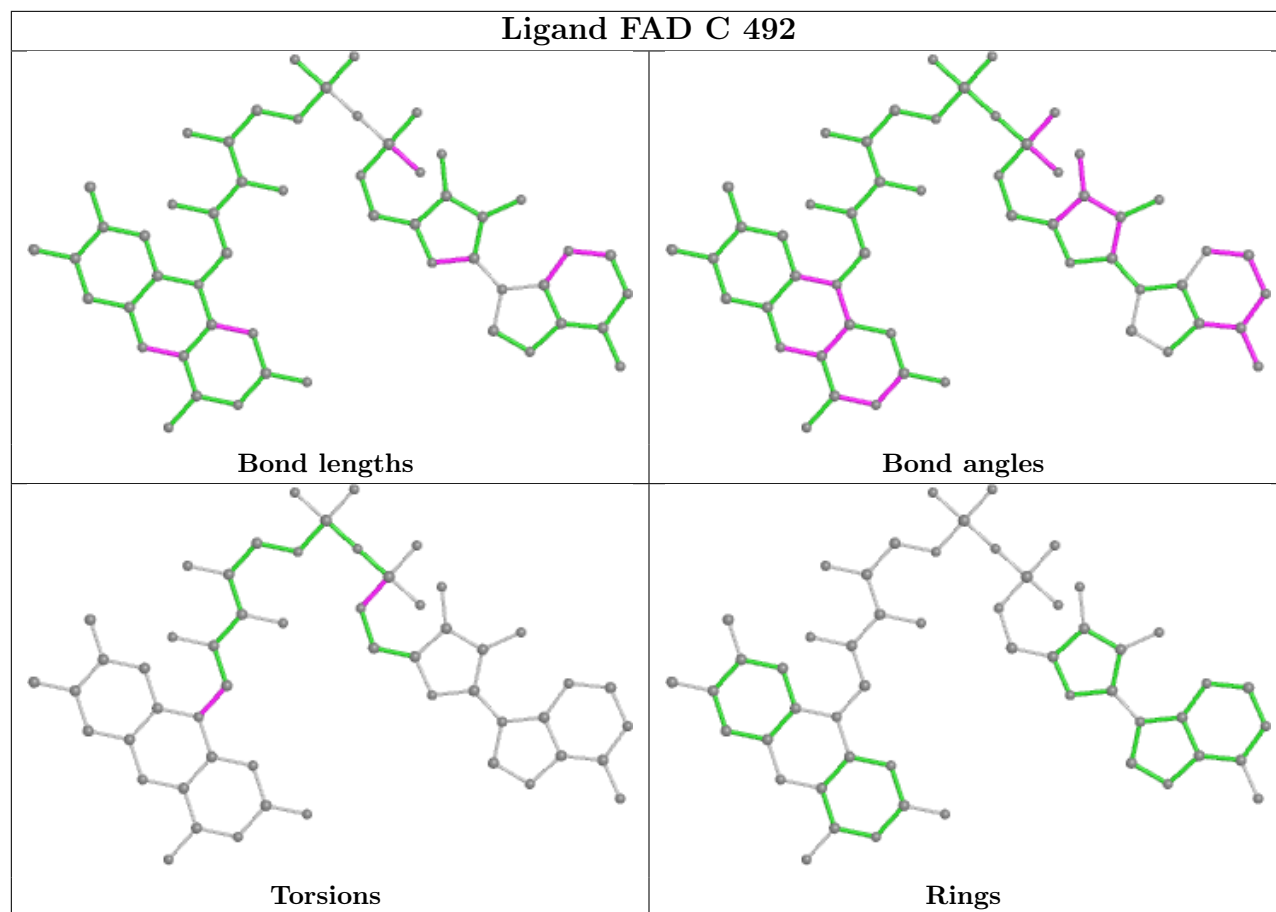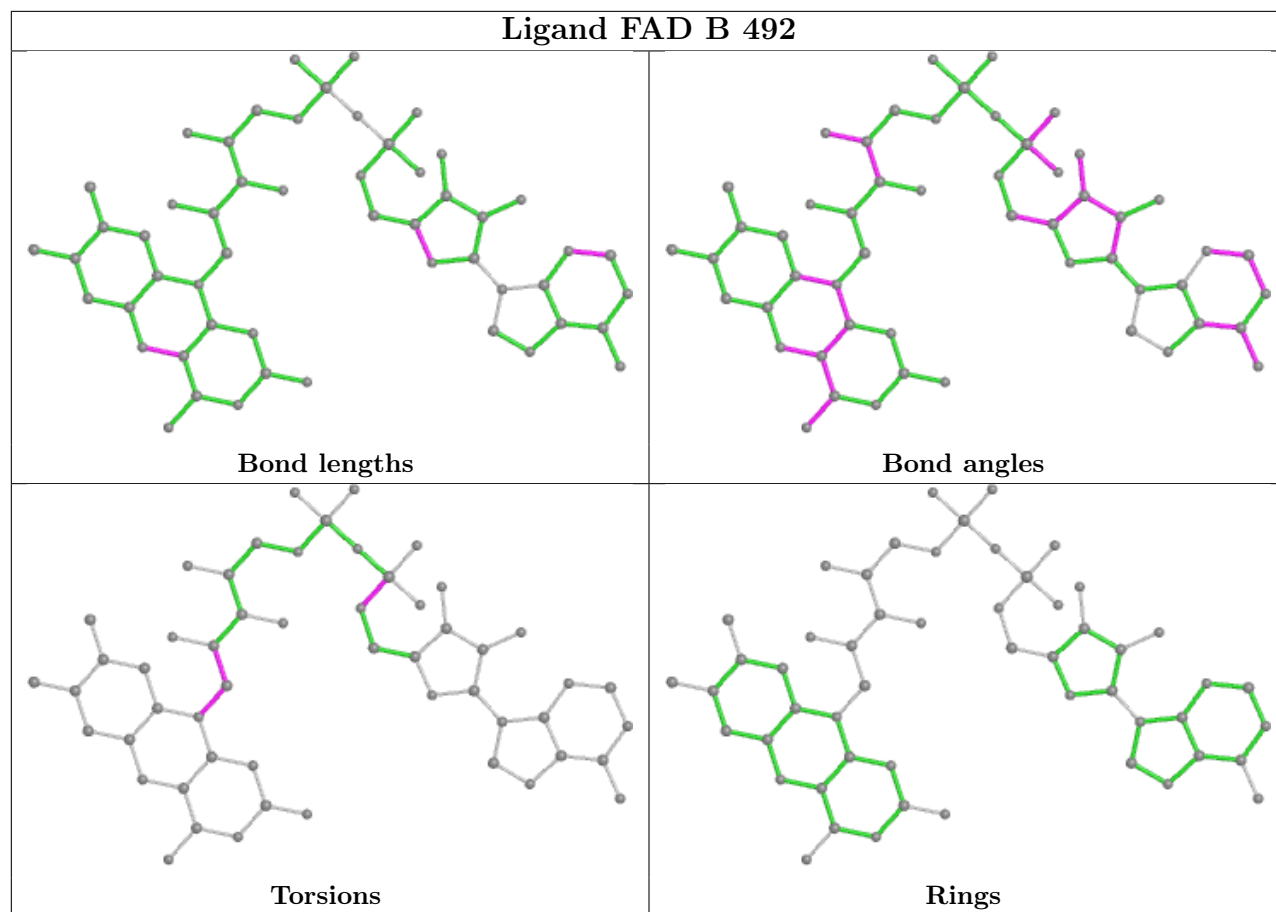| Mol	Chain	Res	Type	Atoms
3	C	492	FAD	C5B-O5B-PA-O3P
3	D	492	FAD	C5B-O5B-PA-O3P
3	D	492	FAD	C4'-C5'-O5'-P
3	B	492	FAD	C5B-O5B-PA-O3P
3	B	492	FAD	C5B-O5B-PA-O2A
3	D	492	FAD	C5B-O5B-PA-O1A
3	B	492	FAD	N10-C1'-C2'-O2'
3	D	492	FAD	C2'-C1'-N10-C10

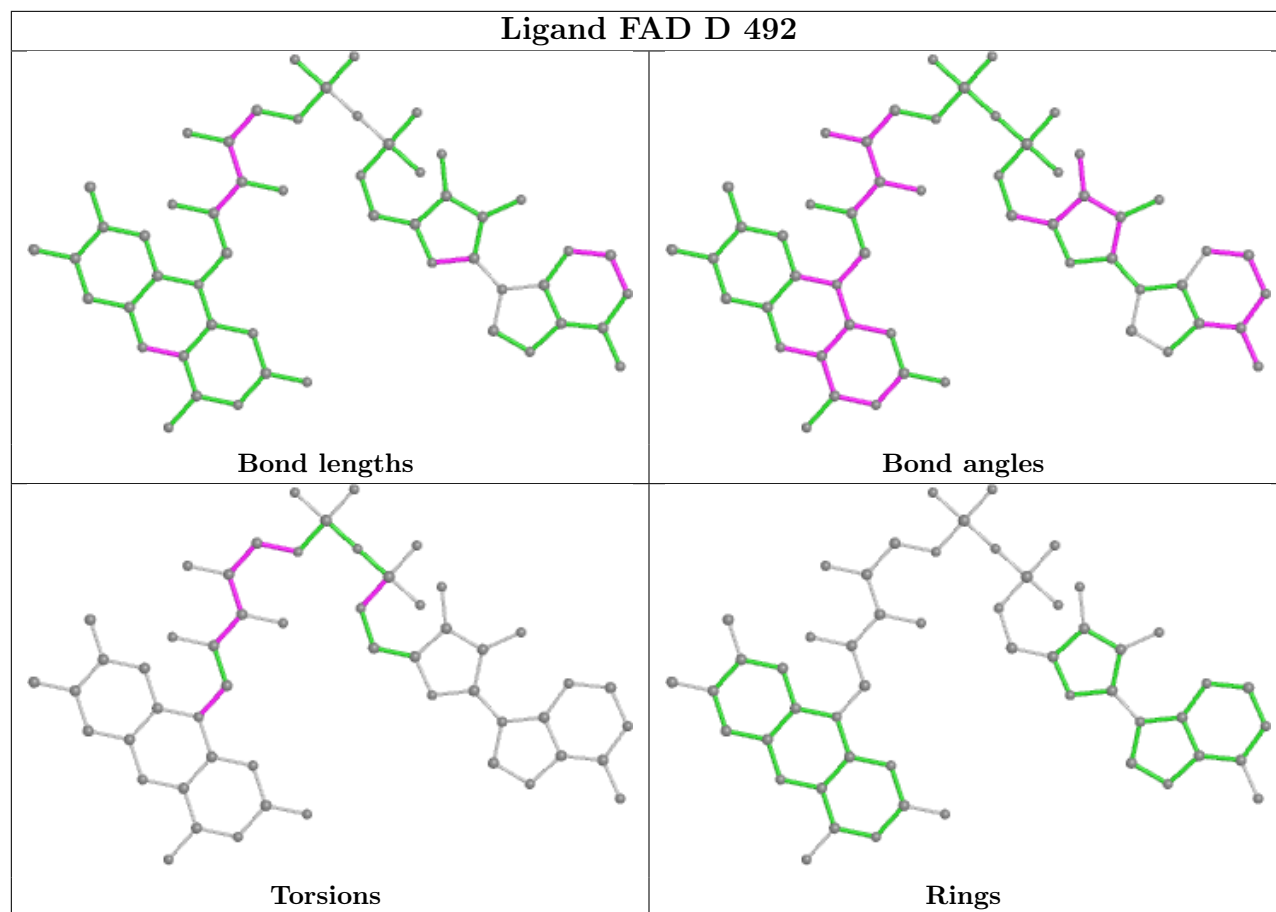There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	491	SF4	1	0
3	D	492	FAD	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 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.

Ligand FAD A 492

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD C 492

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD B 492

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD D 492

Bond lengths

Bond angles

Torsions

Rings

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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(Å²)	Q<0.9
1	A	490/490 (100%)	-0.16	3 (0%)	89	89	11, 23, 45, 78	1 (0%)
1	B	490/490 (100%)	-0.31	3 (0%)	89	89	11, 20, 37, 69	1 (0%)
1	C	490/490 (100%)	-0.44	0	100	100	10, 16, 29, 83	1 (0%)
1	D	490/490 (100%)	-0.39	1 (0%)	95	94	11, 18, 34, 73	0
All	All	1960/1960 (100%)	-0.32	7 (0%)	92	92	10, 19, 37, 83	3 (0%)

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	177	GLU	3.3
1	B	490	LYS	3.1
1	D	490	LYS	2.6
1	A	490	LYS	2.5
1	B	410	ASP	2.5
1	B	43	ARG	2.3
1	A	126	ASN	2.2

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

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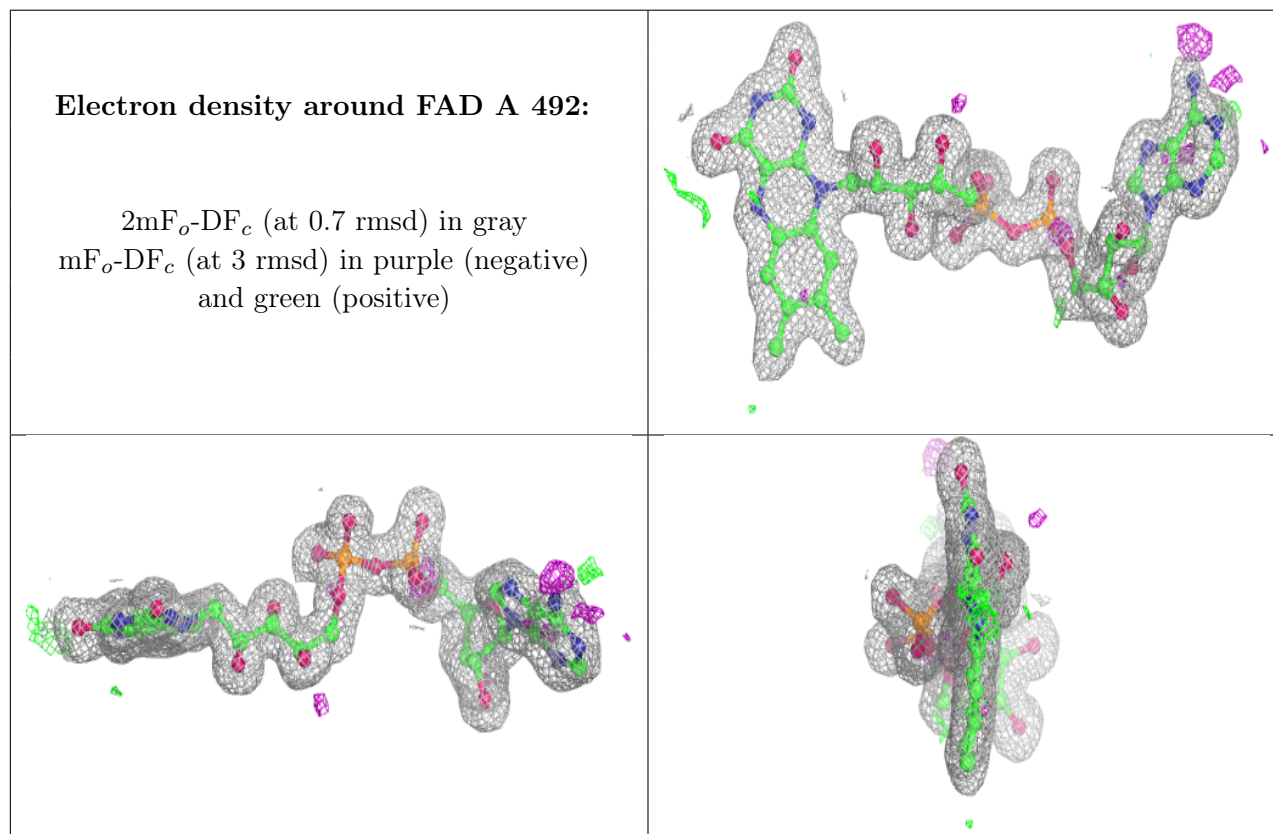
6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands (i)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	FAD	A	492	53/53	0.96	0.09	14,19,27,38	0
3	FAD	D	492	53/53	0.96	0.08	11,16,28,43	0
3	FAD	C	492	53/53	0.97	0.07	10,15,28,41	0
3	FAD	B	492	53/53	0.97	0.07	10,16,32,37	0
2	SF4	A	491	8/8	0.98	0.05	21,23,27,27	0
2	SF4	D	491	8/8	0.98	0.05	18,21,24,25	0
2	SF4	C	491	8/8	0.99	0.06	15,19,21,22	0
2	SF4	B	491	8/8	0.99	0.05	18,22,24,25	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.
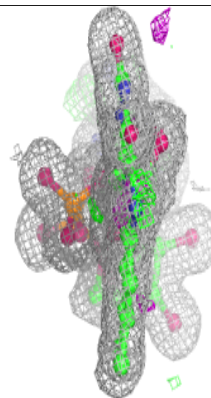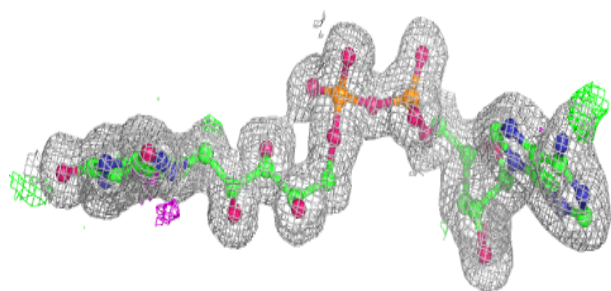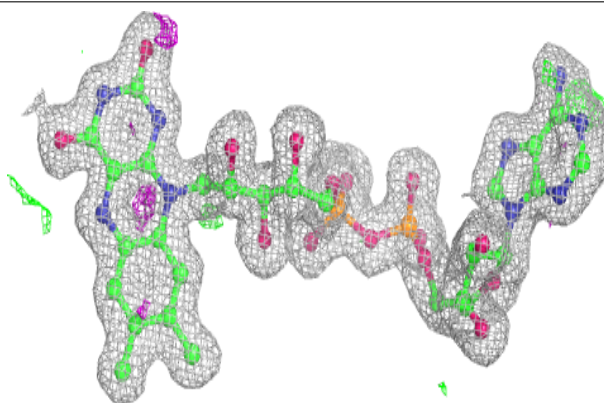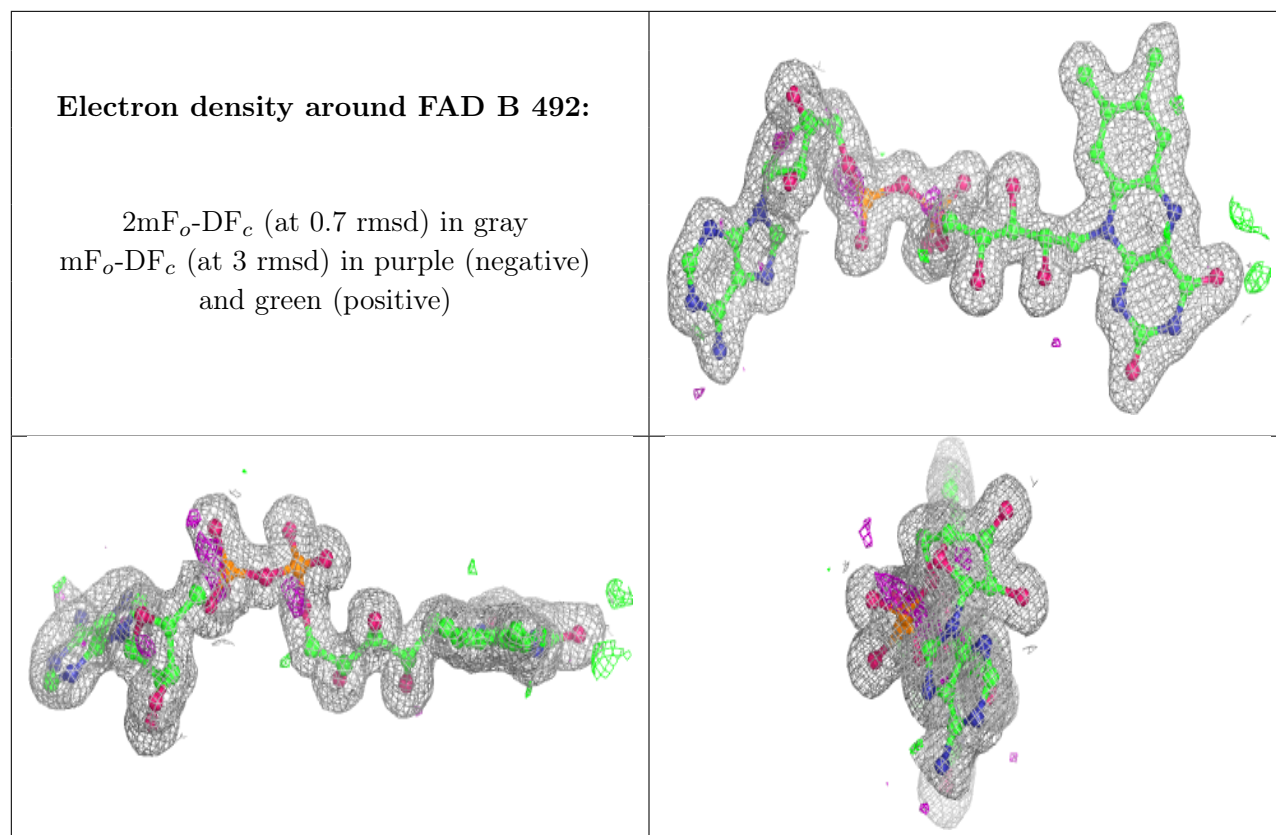
Electron density around FAD A 492:

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

Electron density around FAD D 492:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
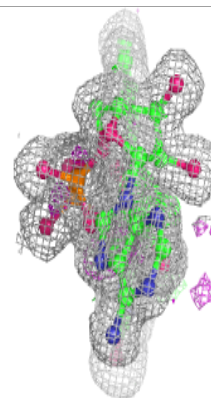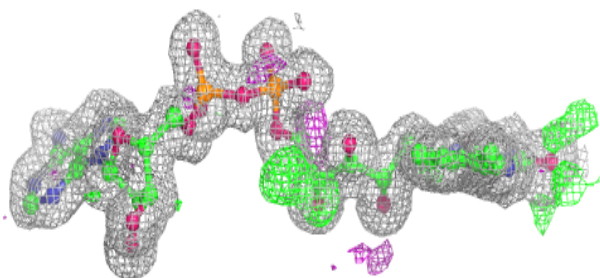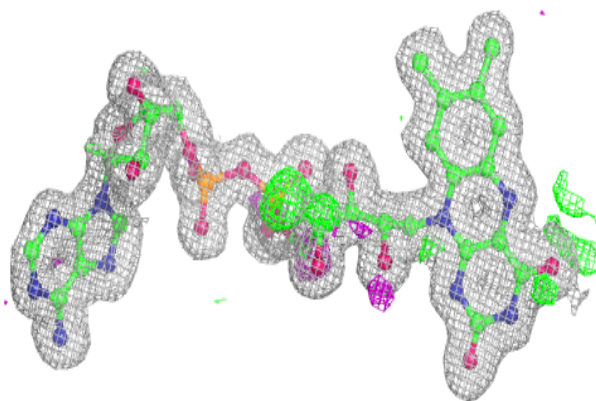
Electron density around FAD C 492:

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 B 492:

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

6.5 Other polymers ⓘ

There are no such residues in this entry.