



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 03:18 AM UTC

PDB ID : 2IVD / pdb_00002ivd
Title : Structure of protoporphyrinogen oxidase from Myxococcus xanthus with acifluorfen
Authors : Corradi, H.R.; Corrigall, A.V.; Boix, E.; Mohan, C.G.; Sturrock, E.D.; Meissner, P.N.; Acharya, K.R.
Deposited on : 2006-06-12
Resolution : 2.30 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity	:	4-5-2 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

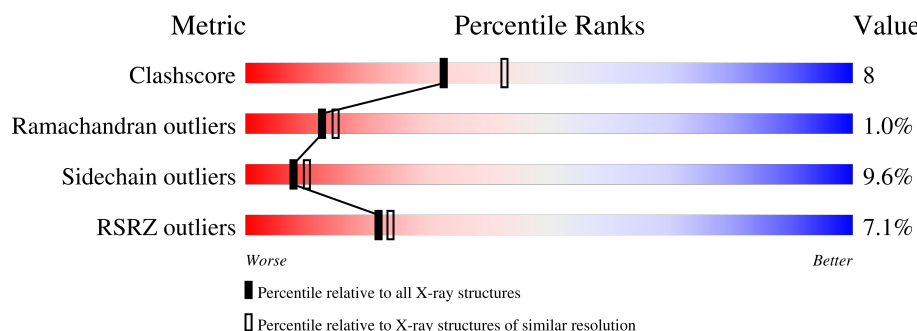
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	478	7% 75% 15% • 6%
1	B	478	6% 78% 13% • 6%

2 Entry composition [i](#)

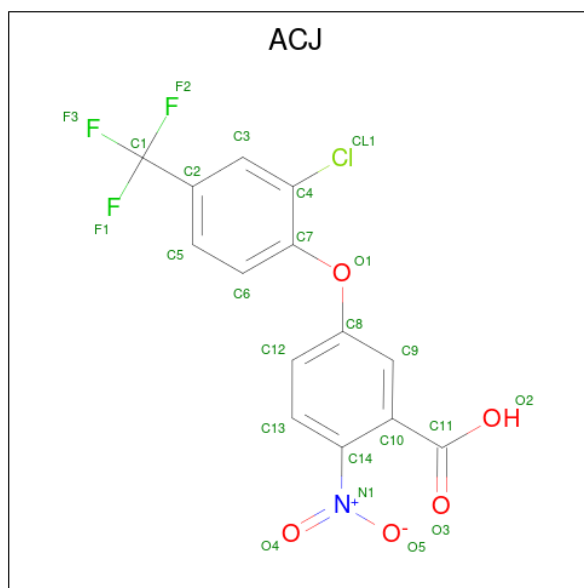
There are 6 unique types of molecules in this entry. The entry contains 7129 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 PROTOPORPHYRINOGEN OXIDASE.

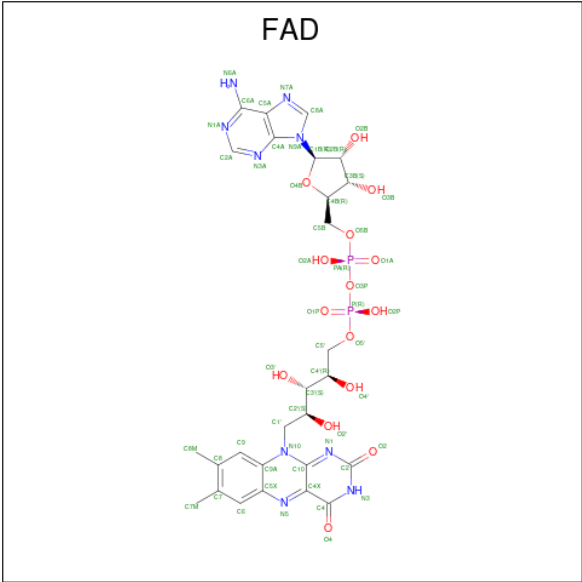
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	449	Total	C	N	O	S	20	0	0
			3313	2085	627	595	6			
1	B	449	Total	C	N	O	S	28	0	0
			3319	2087	627	599	6			

- Molecule 2 is 5-[2-CHLORO-4-(TRIFLUOROMETHYL)PHENOXY]-2-NITROBENZOIC ACID (CCD ID: ACJ) (formula: $C_{14}H_7ClF_3NO_5$).



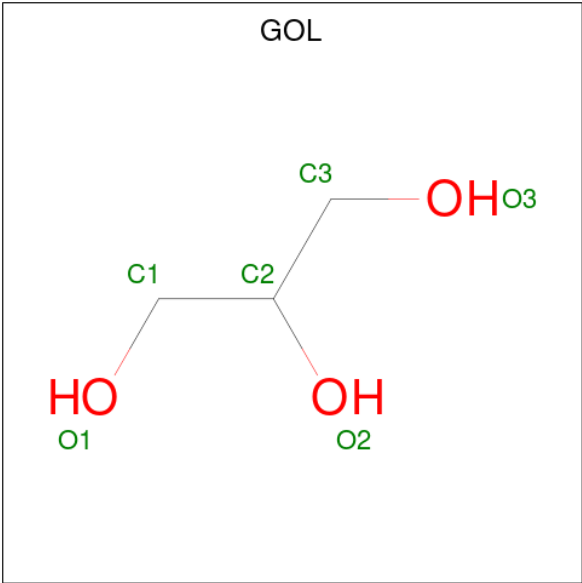
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	Cl	F	N	O	0	0
			24	14	1	3	1	5		
2	B	1	Total	C	Cl	F	N	O	0	0
			24	14	1	3	1	5		

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



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

- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



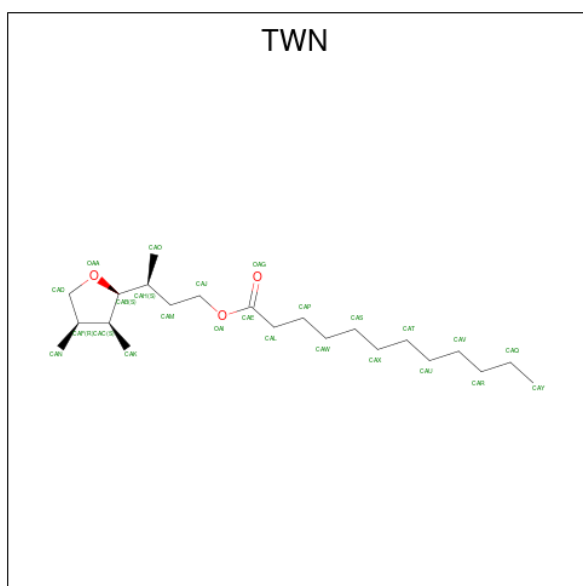
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	C	O	0	0
			6	3	3		
4	B	1	Total	C	O	0	0
			6	3	3		
4	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 5 is (3S)-3-[(2S,3S,4R)-3,4-DIMETHYLTETRAHYDROFURAN-2-YL]BUTYL LAURATE (CCD ID: TWN) (formula: C₂₂H₄₂O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	C	O	0	0
			25	22	3		

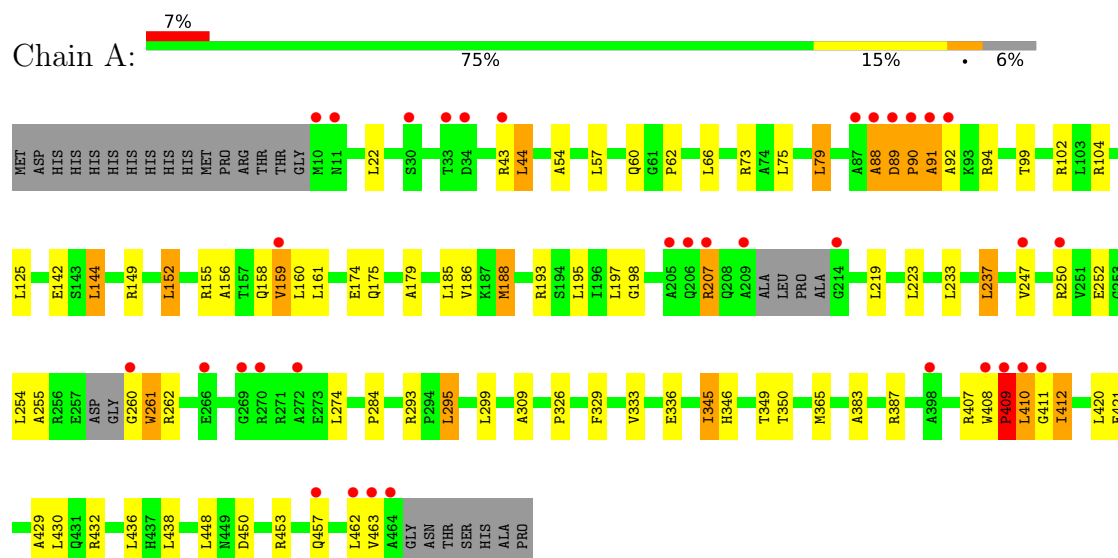
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	146	Total	O	0	0
			146	146		
6	B	142	Total	O	0	0
			142	142		

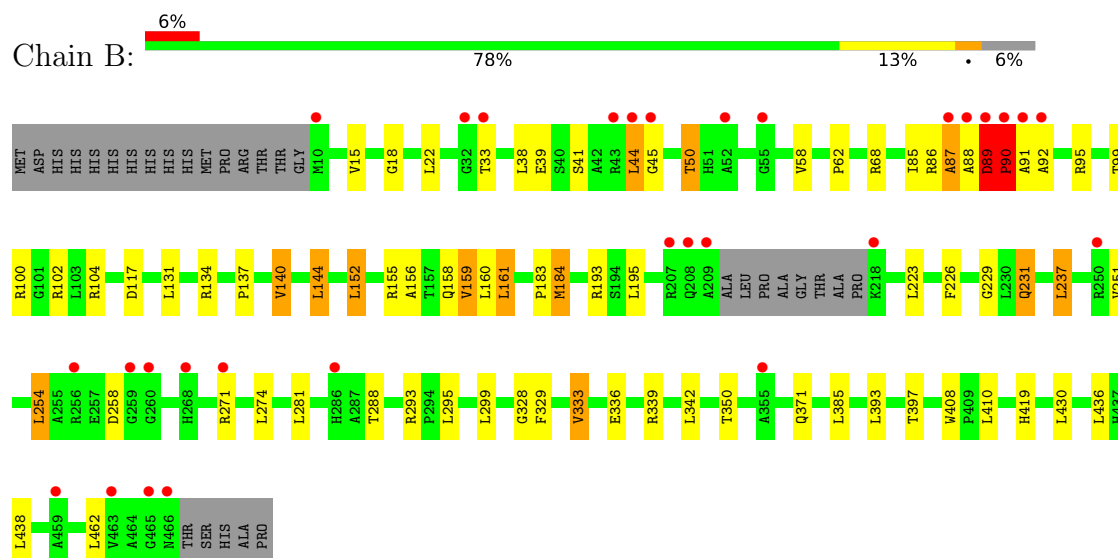
3 Residue-property plots

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: PROTOPORPHYRINOGEN OXIDASE



• Molecule 1: PROTOPORPHYRINOGEN OXIDASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 4 21 2	Depositor
Cell constants a, b, c, α , β , γ	148.92Å 148.92Å 131.92Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.39 – 2.30 49.39 – 2.30	Depositor EDS
% Data completeness (in resolution range)	86.3 (49.39-2.30) 86.2 (49.39-2.30)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.10 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.234 , 0.283 0.233 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	36.3	Xtriage
Anisotropy	0.257	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 32.6	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	0.92	EDS
Total number of atoms	7129	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.22% 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, ACJ, TWN, GOL

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	0.63	1/3370 (0.0%)	0.96	4/4574 (0.1%)
1	B	0.61	1/3376 (0.0%)	0.96	5/4580 (0.1%)
All	All	0.62	2/6746 (0.0%)	0.96	9/9154 (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	A	0	3
1	B	0	4
All	All	0	7

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	333	VAL	CA-CB	6.23	1.59	1.54
1	B	333	VAL	CA-CB	6.09	1.58	1.54

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	89	ASP	CA-C-N	6.98	128.57	119.84
1	B	89	ASP	C-N-CA	6.98	128.57	119.84
1	A	88	ALA	N-CA-C	6.46	119.75	108.52
1	A	345	ILE	CA-C-N	5.98	132.97	121.54
1	A	345	ILE	C-N-CA	5.98	132.97	121.54
1	B	419	HIS	N-CA-C	5.22	116.65	111.07
1	A	412	ILE	N-CA-CB	5.14	118.41	111.21

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	408	TRP	CA-C-N	5.00	124.72	119.82
1	B	408	TRP	C-N-CA	5.00	124.72	119.82

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	345	ILE	Peptide
1	A	409	PRO	Peptide
1	A	410	LEU	Peptide
1	B	87	ALA	Peptide
1	B	89	ASP	Peptide
1	B	90	PRO	Peptide
1	B	91	ALA	Peptide

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	3313	0	3367	53	0
1	B	3319	0	3375	49	0
2	A	24	0	6	1	0
2	B	24	0	6	1	0
3	A	53	0	31	3	0
3	B	53	0	31	1	0
4	A	12	0	16	2	0
4	B	18	0	24	1	0
5	B	25	0	42	12	0
6	A	146	0	0	3	0
6	B	142	0	0	1	0
All	All	7129	0	6898	108	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 8.

All (108) 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:134:ARG:HE	5:B:1472:TWN:HAF	0.98	1.10
1:B:18:GLY:HA2	1:B:45:GLY:O	1.51	1.09
1:B:134:ARG:NE	5:B:1472:TWN:HAF	1.69	1.05
1:A:309:ALA:O	1:A:411:GLY:HA3	1.58	1.04
1:B:134:ARG:HH11	5:B:1472:TWN:HAN1	1.20	1.02
1:A:155:ARG:O	1:A:159:VAL:HG13	1.59	1.00
1:A:260:GLY:O	1:A:261:TRP:CD1	2.18	0.97
5:B:1472:TWN:HAO3	5:B:1472:TWN:HAK2	1.51	0.90
1:A:260:GLY:O	1:A:261:TRP:CG	2.33	0.81
1:B:155:ARG:O	1:B:159:VAL:HG13	1.81	0.80
1:B:134:ARG:HH11	5:B:1472:TWN:CAN	1.95	0.79
1:B:50:THR:H	1:B:231:GLN:HG3	1.49	0.78
1:A:89:ASP:CB	1:A:90:PRO:HD2	2.15	0.77
5:B:1472:TWN:HAO1	5:B:1472:TWN:HAD2	1.66	0.76
1:B:158:GLN:HG2	1:B:336:GLU:OE1	1.84	0.75
1:A:158:GLN:HG2	1:A:336:GLU:OE1	1.88	0.73
1:B:158:GLN:CG	1:B:336:GLU:OE1	2.36	0.72
1:A:188:MET:HE1	1:A:195:LEU:HA	1.73	0.71
1:B:50:THR:H	1:B:231:GLN:CG	2.05	0.70
1:A:89:ASP:CB	1:A:350:THR:O	2.40	0.70
1:A:188:MET:HE3	1:A:198:GLY:HA3	1.74	0.68
1:A:193:ARG:HH21	4:A:1468:GOL:H32	1.59	0.68
1:A:329:PHE:O	1:A:346:HIS:HB2	1.93	0.67
5:B:1472:TWN:HAO3	5:B:1472:TWN:CAK	2.26	0.66
1:B:89:ASP:HA	1:B:90:PRO:O	1.97	0.64
1:B:131:LEU:O	1:B:193:ARG:NH2	2.32	0.63
1:B:137:PRO:HB2	1:B:140:VAL:HG13	1.80	0.62
1:A:144:LEU:HD22	1:A:161:LEU:HD21	1.82	0.62
1:A:156:ALA:O	1:A:160:LEU:HB2	2.00	0.60
1:A:188:MET:CE	1:A:195:LEU:HA	2.32	0.60
1:A:188:MET:CE	1:A:198:GLY:HA3	2.30	0.60
1:A:411:GLY:O	1:A:412:ILE:HD13	2.03	0.59
1:A:155:ARG:O	1:A:159:VAL:CG1	2.43	0.59
1:A:450:ASP:OD2	1:A:453:ARG:NH2	2.36	0.59
1:B:134:ARG:HE	5:B:1472:TWN:CAF	1.92	0.58
1:B:430:LEU:HD11	1:B:438:LEU:HG	1.86	0.57
1:A:158:GLN:CG	1:A:336:GLU:OE1	2.53	0.57
1:A:22:LEU:HD21	1:A:44:LEU:HG	1.88	0.55
1:B:183:PRO:HD2	1:B:184:MET:HE3	1.88	0.55
1:B:158:GLN:HG3	1:B:336:GLU:OE1	2.06	0.54
5:B:1472:TWN:HAK2	5:B:1472:TWN:CAO	2.31	0.54
1:A:149:ARG:NH2	1:A:174:GLU:OE2	2.41	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:88:ALA:HB2	1:A:223:LEU:O	2.08	0.53
1:A:102:ARG:HD2	6:A:2034:HOH:O	2.10	0.52
1:A:412:ILE:HD11	3:A:1466:FAD:C8	2.39	0.52
1:B:87:ALA:HA	1:B:223:LEU:O	2.11	0.51
1:B:134:ARG:NH1	5:B:1472:TWN:HAN1	2.05	0.51
1:B:88:ALA:HB1	1:B:350:THR:CG2	2.41	0.51
1:B:137:PRO:HB2	1:B:140:VAL:CG1	2.40	0.50
1:B:88:ALA:HB1	1:B:350:THR:HG23	1.92	0.50
1:A:159:VAL:HG22	1:A:160:LEU:HG	1.94	0.50
1:A:89:ASP:CB	1:A:90:PRO:CD	2.86	0.50
1:B:152:LEU:HB3	1:B:156:ALA:HB3	1.92	0.50
1:A:309:ALA:O	1:A:411:GLY:CA	2.46	0.49
1:B:134:ARG:CZ	5:B:1472:TWN:HAF	2.41	0.49
1:B:22:LEU:HB3	1:B:237:LEU:HG	1.95	0.49
1:A:149:ARG:HH22	1:A:174:GLU:CD	2.21	0.49
1:A:383:ALA:O	1:A:387:ARG:HG3	2.12	0.49
1:B:22:LEU:HD21	1:B:44:LEU:HD13	1.95	0.48
1:A:299:LEU:HD13	1:A:429:ALA:HB3	1.96	0.48
1:A:430:LEU:HD11	1:A:438:LEU:HG	1.95	0.48
1:B:62:PRO:HA	3:B:1469:FAD:N5	2.29	0.48
1:A:73:ARG:HG3	1:A:219:LEU:HD21	1.96	0.47
1:B:18:GLY:CA	1:B:45:GLY:O	2.43	0.47
1:A:62:PRO:HA	3:A:1466:FAD:N5	2.29	0.47
1:A:75:LEU:CD1	1:A:233:LEU:HD11	2.44	0.47
1:A:91:ALA:O	1:A:92:ALA:HB3	2.15	0.46
1:B:223:LEU:HD21	1:B:329:PHE:CE1	2.51	0.46
1:B:15:VAL:HG22	1:B:251:VAL:HG21	1.97	0.46
1:B:85:ILE:C	1:B:86:ARG:HG2	2.39	0.46
1:A:89:ASP:CB	1:A:349:THR:O	2.64	0.46
1:B:226:PHE:HB2	1:B:229:GLY:O	2.16	0.46
1:A:197:LEU:CD1	4:A:1468:GOL:H12	2.46	0.45
1:A:99:THR:HG23	1:A:104:ARG:HD3	1.99	0.45
1:B:159:VAL:CG2	1:B:160:LEU:N	2.77	0.45
1:B:159:VAL:HG22	1:B:160:LEU:N	2.31	0.45
1:B:39:GLU:OE1	1:B:41:SER:HB2	2.17	0.45
1:B:144:LEU:HD22	1:B:161:LEU:HD11	1.99	0.45
1:A:188:MET:HB3	1:A:188:MET:HE2	1.61	0.44
1:A:207:ARG:O	1:A:207:ARG:HG2	2.17	0.44
1:B:193:ARG:NE	4:B:1467:GOL:H2	2.33	0.43
1:A:179:ALA:HA	1:A:186:VAL:HG21	2.01	0.43
1:B:254:LEU:HD13	1:B:295:LEU:HD11	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:B:1472:TWN:HAO1	5:B:1472:TWN:CAD	2.44	0.43
1:B:339:ARG:HA	1:B:339:ARG:HD3	1.63	0.43
1:A:408:TRP:N	1:A:409:PRO:HD3	2.33	0.42
1:B:92:ALA:HB1	1:B:328:GLY:H	1.82	0.42
1:A:407:ARG:C	1:A:409:PRO:HD3	2.44	0.42
1:B:161:LEU:HD23	1:B:161:LEU:HA	1.82	0.42
1:A:365:MET:HG3	2:A:1465:ACJ:C7	2.50	0.41
1:A:79:LEU:HD21	1:A:237:LEU:HD13	2.01	0.41
1:B:155:ARG:NH2	1:B:158:GLN:HG2	2.35	0.41
1:B:339:ARG:HG3	1:B:393:LEU:HD21	2.03	0.41
1:B:99:THR:HG23	1:B:104:ARG:HD2	2.02	0.41
1:B:385:LEU:C	1:B:385:LEU:HD23	2.45	0.41
1:A:88:ALA:HB2	1:A:223:LEU:HB3	2.01	0.41
1:A:152:LEU:HB3	1:A:156:ALA:HB3	2.01	0.41
1:A:326:PRO:HB2	1:A:346:HIS:CE1	2.56	0.41
1:B:281:LEU:HD13	1:B:288:THR:HG23	2.02	0.41
1:A:175:GLN:NE2	6:A:2077:HOH:O	2.37	0.41
1:A:255:ALA:HA	1:A:295:LEU:HD11	2.03	0.41
1:B:156:ALA:O	1:B:160:LEU:HB2	2.21	0.41
1:B:158:GLN:NE2	6:B:2049:HOH:O	2.53	0.41
2:B:1468:ACJ:C11	2:B:1468:ACJ:O4	2.69	0.41
1:A:54:ALA:HB1	6:A:2009:HOH:O	2.20	0.41
1:A:22:LEU:HB3	1:A:237:LEU:HG	2.03	0.40
1:B:100:ARG:NH2	1:B:117:ASP:O	2.55	0.40
1:A:284:PRO:HD3	3:A:1466:FAD:H51A	2.04	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	443/478 (93%)	423 (96%)	15 (3%)	5 (1%)	11 13

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	445/478 (93%)	431 (97%)	10 (2%)	4 (1%)	14	17
All	All	888/956 (93%)	854 (96%)	25 (3%)	9 (1%)	12	15

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	90	PRO
1	B	258	ASP
1	A	90	PRO
1	A	91	ALA
1	A	261	TRP
1	B	44	LEU
1	A	89	ASP
1	B	89	ASP
1	A	409	PRO

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	317/344 (92%)	284 (90%)	33 (10%)	7	8
1	B	319/344 (93%)	291 (91%)	28 (9%)	9	12
All	All	636/688 (92%)	575 (90%)	61 (10%)	8	10

All (61) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	43	ARG
1	A	44	LEU
1	A	57	LEU
1	A	60	GLN
1	A	66	LEU
1	A	79	LEU
1	A	94	ARG

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Mol	Chain	Res	Type
1	A	125	LEU
1	A	142	GLU
1	A	144	LEU
1	A	152	LEU
1	A	159	VAL
1	A	185	LEU
1	A	188	MET
1	A	207	ARG
1	A	237	LEU
1	A	247	VAL
1	A	250	ARG
1	A	252	GLU
1	A	254	LEU
1	A	262	ARG
1	A	274	LEU
1	A	293	ARG
1	A	295	LEU
1	A	410	LEU
1	A	420	LEU
1	A	421	GLU
1	A	432	ARG
1	A	436	LEU
1	A	448	LEU
1	A	457	GLN
1	A	462	LEU
1	A	463	VAL
1	B	33	THR
1	B	38	LEU
1	B	50	THR
1	B	58	VAL
1	B	68	ARG
1	B	95	ARG
1	B	102	ARG
1	B	140	VAL
1	B	144	LEU
1	B	152	LEU
1	B	159	VAL
1	B	161	LEU
1	B	184	MET
1	B	195	LEU
1	B	231	GLN
1	B	237	LEU

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Mol	Chain	Res	Type
1	B	254	LEU
1	B	271	ARG
1	B	274	LEU
1	B	293	ARG
1	B	299	LEU
1	B	333	VAL
1	B	342	LEU
1	B	371	GLN
1	B	397	THR
1	B	410	LEU
1	B	436	LEU
1	B	462	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	26	HIS
1	A	208	GLN
1	A	338	GLN
1	A	346	HIS
1	A	437	HIS
1	A	457	GLN
1	B	431	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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

10 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	ACJ	A	1465	-	25,25,25	2.73	5 (20%)	34,37,37	1.00	2 (5%)
4	GOL	A	1468	-	5,5,5	0.51	0	5,5,5	0.86	0
5	TWN	B	1472	-	25,25,25	0.55	0	25,30,30	1.33	4 (16%)
4	GOL	A	1467	-	5,5,5	0.38	0	5,5,5	0.59	0
4	GOL	B	1467	-	5,5,5	0.45	0	5,5,5	0.54	0
3	FAD	B	1469	-	58,58,58	1.21	7 (12%)	85,89,89	1.56	18 (21%)
3	FAD	A	1466	-	58,58,58	1.25	7 (12%)	85,89,89	1.64	17 (20%)
2	ACJ	B	1468	-	25,25,25	2.76	5 (20%)	34,37,37	2.53	8 (23%)
4	GOL	B	1471	-	5,5,5	0.35	0	5,5,5	0.49	0
4	GOL	B	1470	-	5,5,5	0.28	0	5,5,5	0.69	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	ACJ	A	1465	-	-	4/16/18/18	0/2/2/2
4	GOL	A	1468	-	-	2/4/4/4	-
5	TWN	B	1472	-	-	12/21/34/34	0/1/1/1
4	GOL	A	1467	-	-	4/4/4/4	-
4	GOL	B	1467	-	-	1/4/4/4	-
3	FAD	B	1469	-	-	3/34/50/50	0/6/6/6
3	FAD	A	1466	-	-	1/34/50/50	0/6/6/6
2	ACJ	B	1468	-	-	4/16/18/18	0/2/2/2
4	GOL	B	1471	-	-	2/4/4/4	-
4	GOL	B	1470	-	-	2/4/4/4	-

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1468	ACJ	O4-N1	10.14	1.40	1.22

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1465	ACJ	O4-N1	9.73	1.39	1.22
2	A	1465	ACJ	C7-C4	5.53	1.49	1.39
2	A	1465	ACJ	C14-N1	-5.16	1.36	1.45
2	B	1468	ACJ	C7-C4	5.08	1.48	1.39
2	B	1468	ACJ	C14-N1	-4.75	1.37	1.45
2	B	1468	ACJ	C10-C14	4.48	1.50	1.41
2	A	1465	ACJ	C10-C14	4.31	1.50	1.41
3	A	1466	FAD	C4X-N5	3.62	1.38	1.30
3	A	1466	FAD	PA-O3P	3.23	1.63	1.59
3	B	1469	FAD	P-O3P	3.21	1.63	1.59
3	B	1469	FAD	C4X-N5	3.18	1.37	1.30
3	A	1466	FAD	C10-N1	3.15	1.39	1.33
3	B	1469	FAD	PA-O3P	3.12	1.62	1.59
3	A	1466	FAD	P-O3P	3.07	1.62	1.59
3	B	1469	FAD	C10-N1	2.95	1.39	1.33
3	A	1466	FAD	C2A-N3A	2.75	1.38	1.33
3	B	1469	FAD	C2A-N1A	2.74	1.38	1.33
3	A	1466	FAD	C2A-N1A	2.64	1.38	1.33
3	B	1469	FAD	C2A-N3A	2.48	1.38	1.33
2	B	1468	ACJ	C4-CL1	2.41	1.79	1.73
2	A	1465	ACJ	C4-CL1	2.33	1.79	1.73
3	A	1466	FAD	C8A-N7A	2.33	1.36	1.31
3	B	1469	FAD	C8A-N7A	2.16	1.35	1.31

All (49) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1468	ACJ	F3-C1-C2	-7.82	96.16	112.90
2	B	1468	ACJ	F2-C1-C2	-6.73	98.48	112.90
2	B	1468	ACJ	F1-C1-C2	-6.56	98.85	112.90
3	A	1466	FAD	N3A-C2A-N1A	-6.14	119.28	128.58
3	B	1469	FAD	N3A-C2A-N1A	-6.01	119.49	128.58
3	A	1466	FAD	C5A-C4A-N3A	-4.41	120.65	126.72
3	B	1469	FAD	N9A-C8A-N7A	-3.90	108.41	113.94
2	B	1468	ACJ	F3-C1-F1	3.84	119.64	105.77
3	A	1466	FAD	N9A-C8A-N7A	-3.74	108.63	113.94
3	B	1469	FAD	C5A-C4A-N3A	-3.67	121.66	126.72
3	A	1466	FAD	C2A-N3A-C4A	3.63	120.69	111.83
3	B	1469	FAD	O4-C4-C4X	-3.39	117.58	126.53
3	A	1466	FAD	C5A-N7A-C8A	3.28	108.61	103.45
3	B	1469	FAD	C5A-N7A-C8A	3.25	108.56	103.45
2	B	1468	ACJ	F2-C1-F1	3.24	117.47	105.77

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1466	FAD	O4-C4-C4X	-3.24	117.98	126.53
2	B	1468	ACJ	F3-C1-F2	3.23	117.42	105.77
3	B	1469	FAD	C2A-N3A-C4A	3.18	119.61	111.83
3	A	1466	FAD	C9A-C5X-N5	-3.02	119.25	122.45
3	A	1466	FAD	C5X-C9A-N10	3.00	120.68	117.97
5	B	1472	TWN	CAJ-OAI-CAE	-2.97	107.61	116.90
3	A	1466	FAD	N3A-C4A-N9A	2.93	132.16	127.17
5	B	1472	TWN	OAI-CAE-CAL	2.91	120.70	111.83
3	A	1466	FAD	O4B-C1B-N9A	2.81	113.49	108.09
3	A	1466	FAD	C8M-C8-C9	-2.70	114.81	119.57
3	B	1469	FAD	N3A-C4A-N9A	2.59	131.56	127.17
3	A	1466	FAD	C4-N3-C2	-2.56	121.10	125.64
2	B	1468	ACJ	C3-C4-CL1	2.55	122.63	118.45
3	B	1469	FAD	C9A-C5X-N5	-2.54	119.76	122.45
5	B	1472	TWN	CAJ-CAM-CAH	-2.53	109.05	114.89
3	B	1469	FAD	C4X-C10-N10	2.44	119.97	116.48
2	A	1465	ACJ	C13-C14-N1	2.39	119.03	116.47
3	B	1469	FAD	C10-C4X-N5	-2.39	119.94	124.81
3	B	1469	FAD	C4-N3-C2	-2.37	121.43	125.64
2	B	1468	ACJ	C13-C14-N1	2.26	118.89	116.47
3	A	1466	FAD	C4-C4X-C10	2.20	120.71	116.93
3	B	1469	FAD	C4-C4X-C10	2.18	120.67	116.93
5	B	1472	TWN	OAI-CAE-OAG	-2.18	118.18	123.63
3	A	1466	FAD	C4A-C5A-N7A	-2.17	108.10	110.58
2	A	1465	ACJ	C3-C4-CL1	2.16	121.99	118.45
3	B	1469	FAD	C4A-N9A-C8A	2.16	108.01	105.74
3	A	1466	FAD	C4X-C4-N3	2.15	118.73	113.25
3	B	1469	FAD	O4B-C1B-N9A	2.13	112.18	108.09
3	A	1466	FAD	C10-C4X-N5	-2.12	120.48	124.81
3	B	1469	FAD	C8M-C8-C9	-2.07	115.93	119.57
3	B	1469	FAD	C4X-C10-N1	-2.06	119.53	124.59
3	A	1466	FAD	C4X-C10-N1	-2.06	119.54	124.59
3	B	1469	FAD	C4A-C5A-N7A	-2.04	108.25	110.58
3	B	1469	FAD	C4X-C4-N3	2.03	118.41	113.25

There are no chirality outliers.

All (35) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1466	FAD	N10-C1'-C2'-O2'
3	B	1469	FAD	N10-C1'-C2'-O2'
3	B	1469	FAD	N10-C1'-C2'-C3'

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Mol	Chain	Res	Type	Atoms
3	B	1469	FAD	C5'-O5'-P-O3P
4	A	1468	GOL	C1-C2-C3-O3
4	B	1470	GOL	O1-C1-C2-C3
4	B	1471	GOL	C1-C2-C3-O3
5	B	1472	TWN	OAA-CAB-CAH-CAM
4	A	1468	GOL	O2-C2-C3-O3
4	B	1470	GOL	O1-C1-C2-O2
4	A	1467	GOL	C1-C2-C3-O3
4	B	1471	GOL	O2-C2-C3-O3
5	B	1472	TWN	CAT-CAU-CAV-CAR
5	B	1472	TWN	CAQ-CAR-CAV-CAU
2	A	1465	ACJ	C14-C10-C11-O3
5	B	1472	TWN	CAX-CAT-CAU-CAV
5	B	1472	TWN	CAL-CAP-CAW-CAS
2	A	1465	ACJ	C14-C10-C11-O2
4	A	1467	GOL	O2-C2-C3-O3
5	B	1472	TWN	CAX-CAS-CAW-CAP
5	B	1472	TWN	CAU-CAT-CAX-CAS
5	B	1472	TWN	CAO-CAH-CAM-CAJ
5	B	1472	TWN	CAY-CAQ-CAR-CAV
5	B	1472	TWN	CAW-CAS-CAX-CAT
4	B	1467	GOL	O2-C2-C3-O3
5	B	1472	TWN	CAC-CAB-CAH-CAO
2	B	1468	ACJ	C14-C10-C11-O2
2	A	1465	ACJ	C9-C10-C11-O3
2	A	1465	ACJ	C9-C10-C11-O2
2	B	1468	ACJ	C14-C10-C11-O3
2	B	1468	ACJ	C9-C10-C11-O3
2	B	1468	ACJ	C9-C10-C11-O2
4	A	1467	GOL	O1-C1-C2-C3
4	A	1467	GOL	O1-C1-C2-O2
5	B	1472	TWN	OAA-CAB-CAH-CAO

There are no ring outliers.

7 monomers are involved in 21 short contacts:

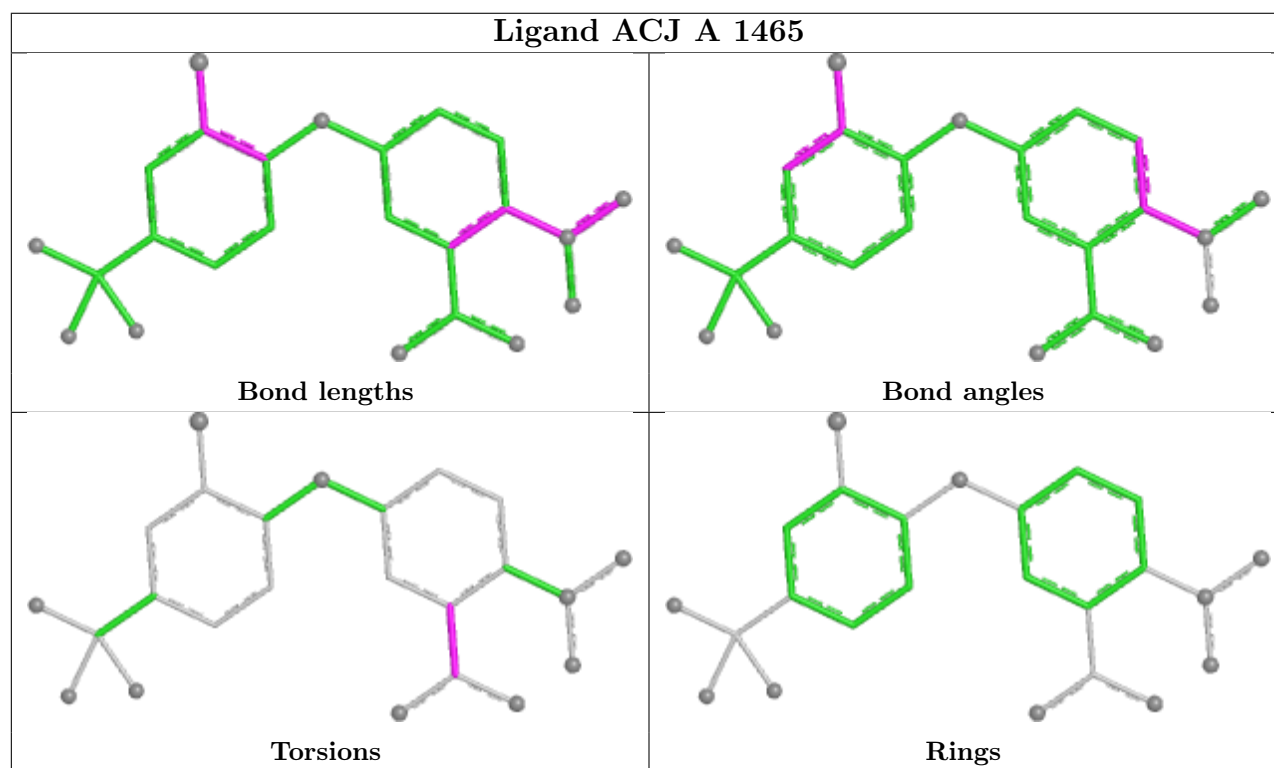
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1465	ACJ	1	0
4	A	1468	GOL	2	0
5	B	1472	TWN	12	0
4	B	1467	GOL	1	0
3	B	1469	FAD	1	0

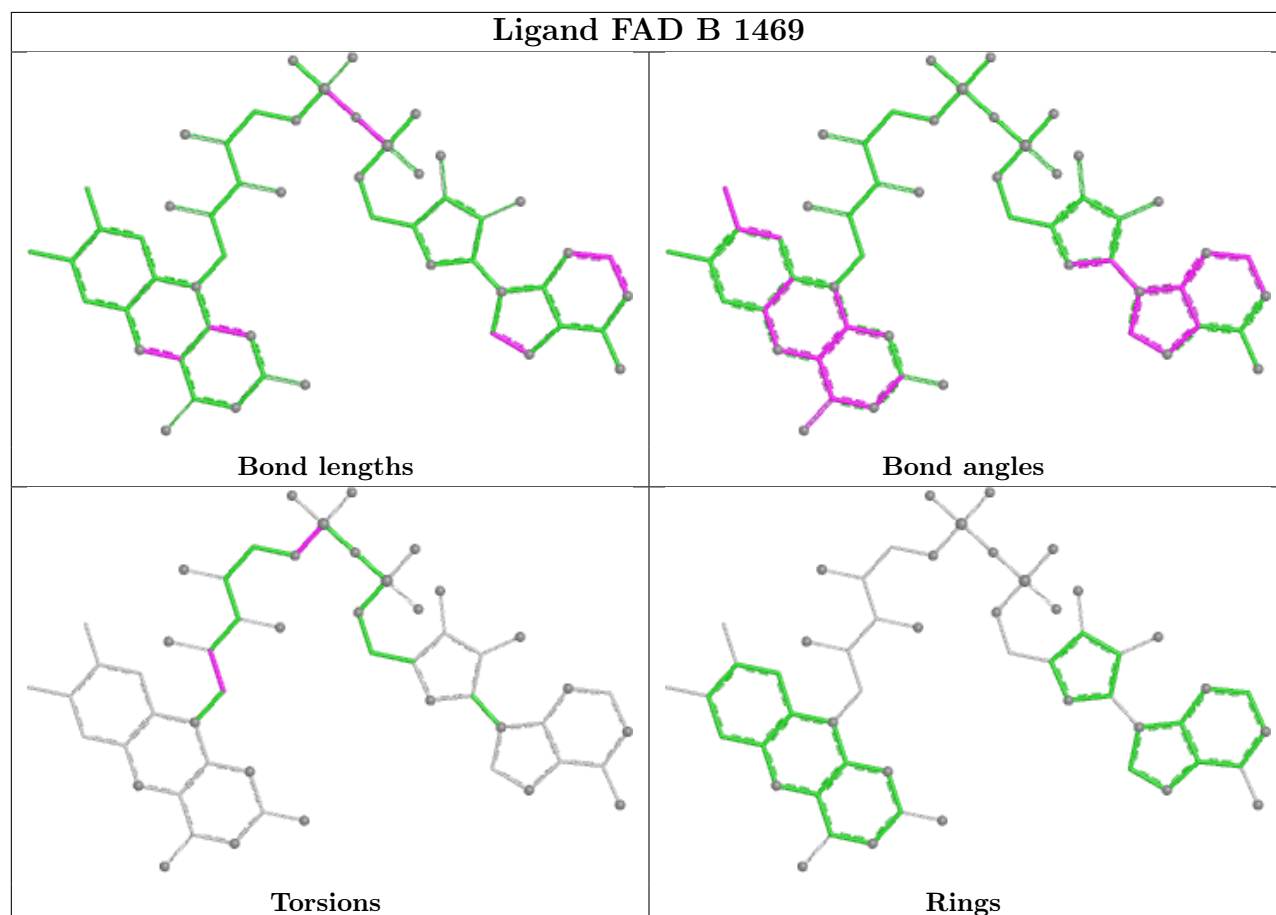
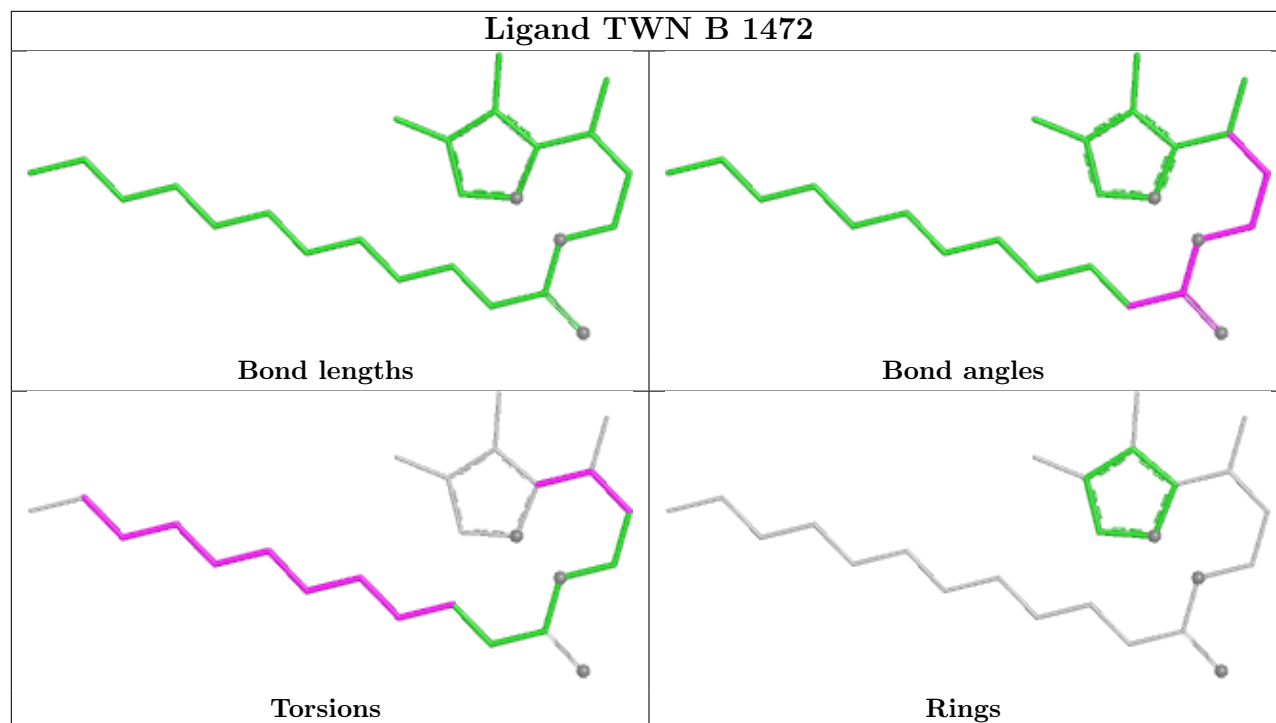
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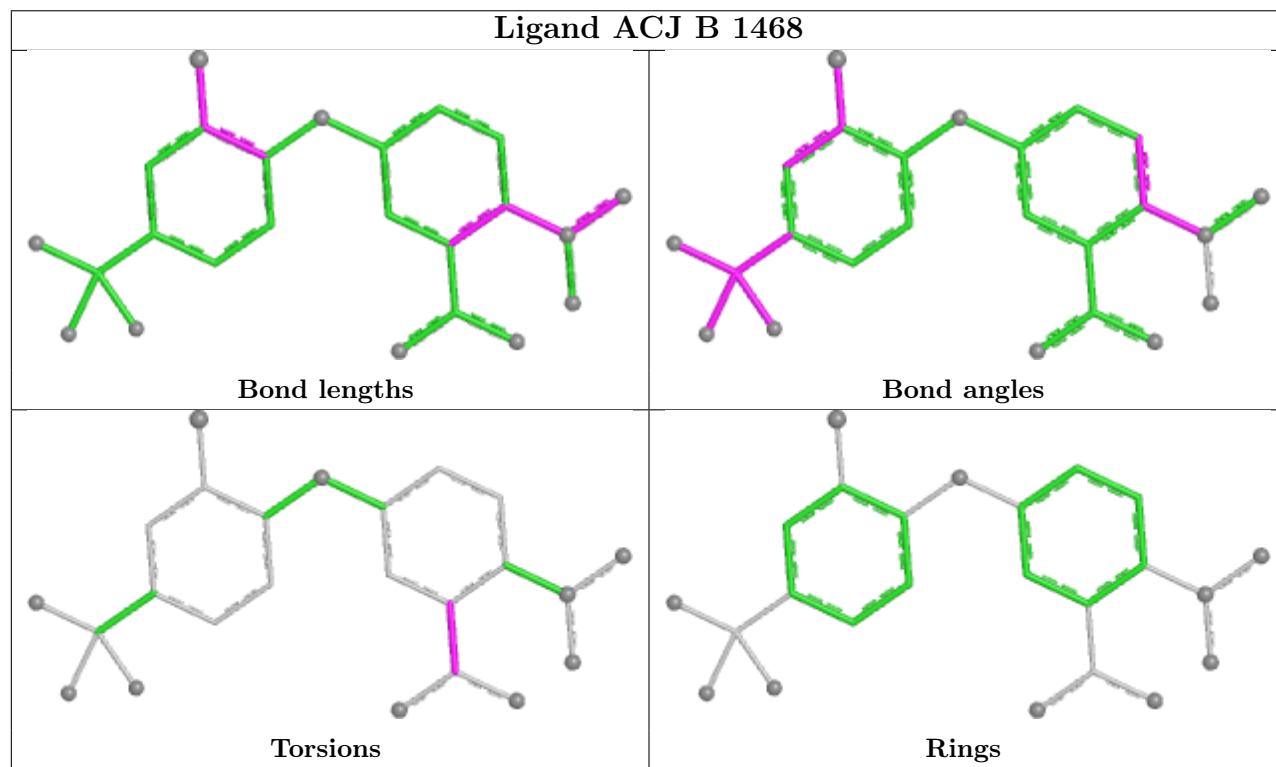
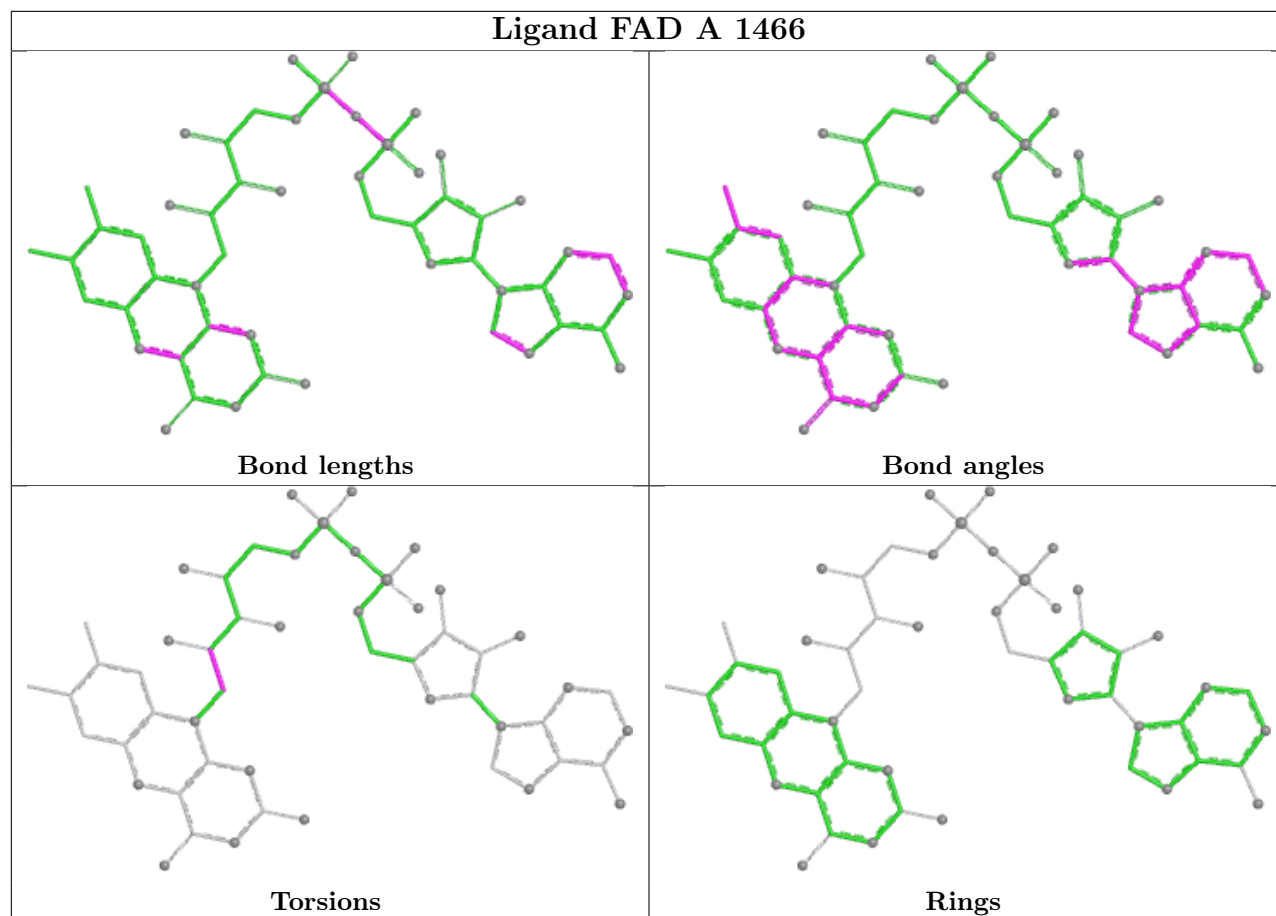
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1466	FAD	3	0
2	B	1468	ACJ	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.







5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	449/478 (93%)	0.72	34 (7%) 20 21	16, 33, 49, 62	6 (1%)
1	B	449/478 (93%)	0.73	30 (6%) 24 26	16, 33, 49, 62	8 (1%)
All	All	898/956 (93%)	0.73	64 (7%) 22 24	16, 34, 49, 62	14 (1%)

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	87	ALA	8.0
1	B	89	ASP	7.1
1	A	88	ALA	6.7
1	B	88	ALA	6.2
1	A	260	GLY	6.1
1	A	91	ALA	6.1
1	A	89	ASP	5.8
1	B	259	GLY	5.8
1	B	92	ALA	5.4
1	A	270	ARG	5.3
1	B	91	ALA	4.8
1	B	260	GLY	4.7
1	B	466	ASN	4.7
1	A	90	PRO	4.7
1	B	90	PRO	4.2
1	B	45	GLY	4.1
1	A	411	GLY	4.0
1	B	465	GLY	4.0
1	A	10	MET	3.9
1	B	355	ALA	3.8
1	A	214	GLY	3.8
1	A	464	ALA	3.6
1	A	409	PRO	3.4
1	A	87	ALA	3.4

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Mol	Chain	Res	Type	RSRZ
1	B	10	MET	3.4
1	B	286	HIS	3.4
1	A	410	LEU	3.3
1	A	34	ASP	3.3
1	B	209	ALA	3.3
1	A	92	ALA	3.2
1	B	32	GLY	3.2
1	B	256	ARG	3.2
1	B	208	GLN	3.2
1	B	463	VAL	3.1
1	A	269	GLY	3.0
1	B	44	LEU	2.9
1	A	207	ARG	2.9
1	A	457	GLN	2.8
1	A	159	VAL	2.7
1	B	43	ARG	2.5
1	B	207	ARG	2.5
1	A	463	VAL	2.5
1	A	206	GLN	2.4
1	A	250	ARG	2.4
1	A	408	TRP	2.4
1	B	55	GLY	2.4
1	A	30	SER	2.3
1	B	218	LYS	2.3
1	A	272	ALA	2.3
1	A	398	ALA	2.3
1	A	33	THR	2.3
1	B	52	ALA	2.3
1	A	266	GLU	2.3
1	A	209	ALA	2.2
1	A	462	LEU	2.2
1	A	205	ALA	2.2
1	A	43	ARG	2.1
1	B	271	ARG	2.1
1	A	247	VAL	2.1
1	B	33	THR	2.1
1	B	250	ARG	2.1
1	B	459	ALA	2.0
1	B	268	HIS	2.0
1	A	11	ASN	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](#)

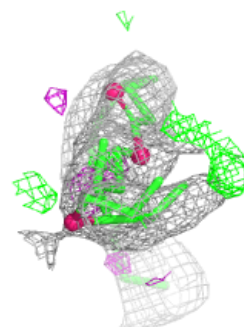
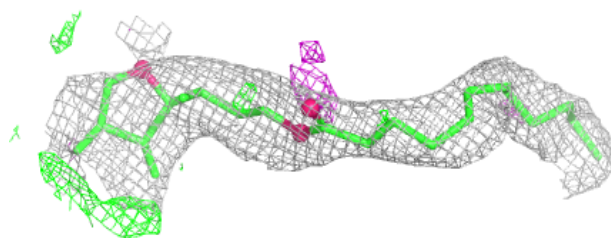
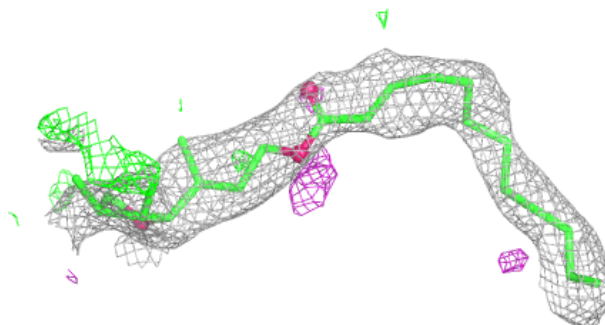
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	TWN	B	1472	25/25	0.78	0.25	63,65,66,67	0
2	ACJ	B	1468	24/24	0.83	0.17	52,53,54,56	0
2	ACJ	A	1465	24/24	0.86	0.14	49,50,51,52	0
4	GOL	A	1468	6/6	0.88	0.15	23,29,31,33	0
4	GOL	B	1467	6/6	0.88	0.14	42,42,43,43	0
4	GOL	A	1467	6/6	0.88	0.15	32,34,36,37	0
4	GOL	B	1470	6/6	0.92	0.10	28,29,29,29	0
3	FAD	B	1469	53/53	0.95	0.09	25,28,32,32	0
4	GOL	B	1471	6/6	0.96	0.11	32,35,37,39	0
3	FAD	A	1466	53/53	0.96	0.09	23,26,29,29	0

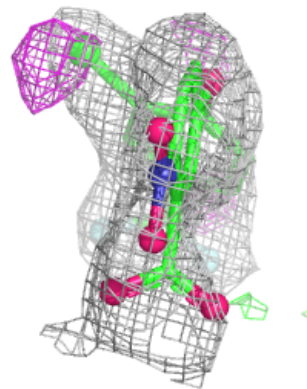
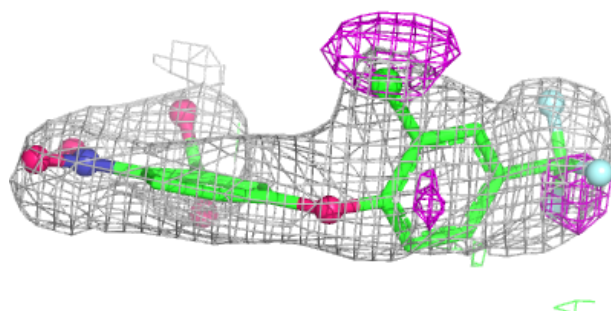
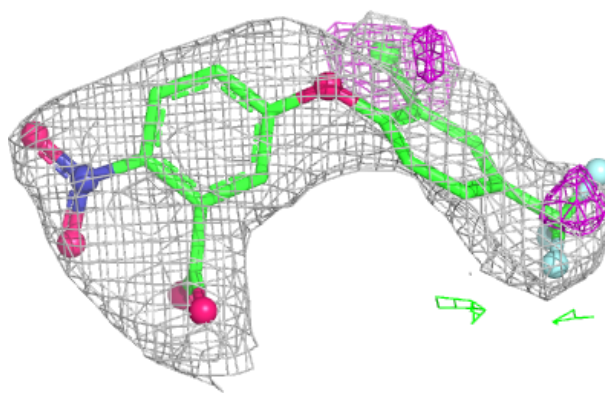
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around TWN B 1472:

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

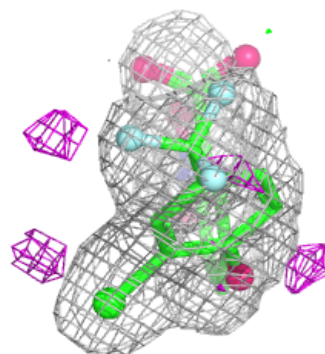
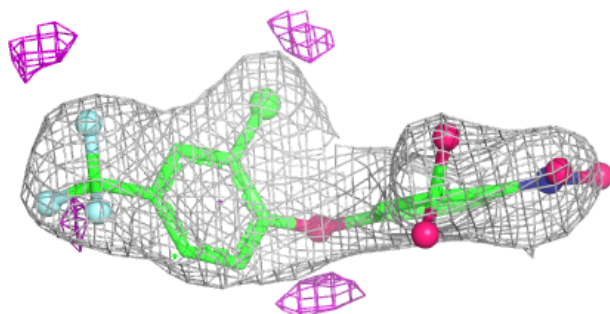
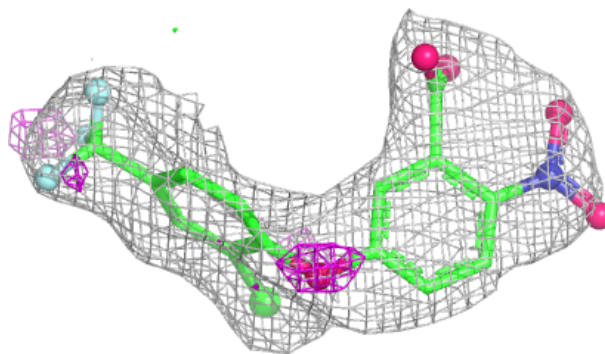
**Electron density around ACJ B 1468:**

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

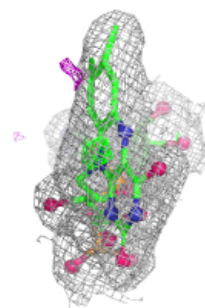
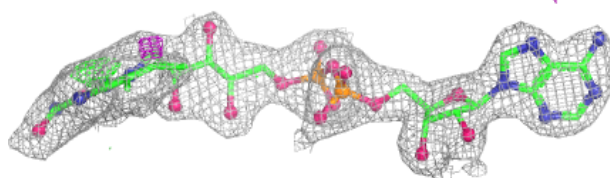
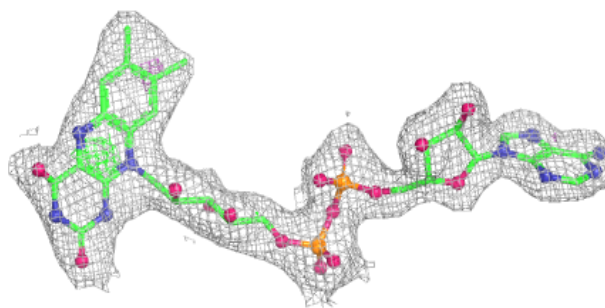


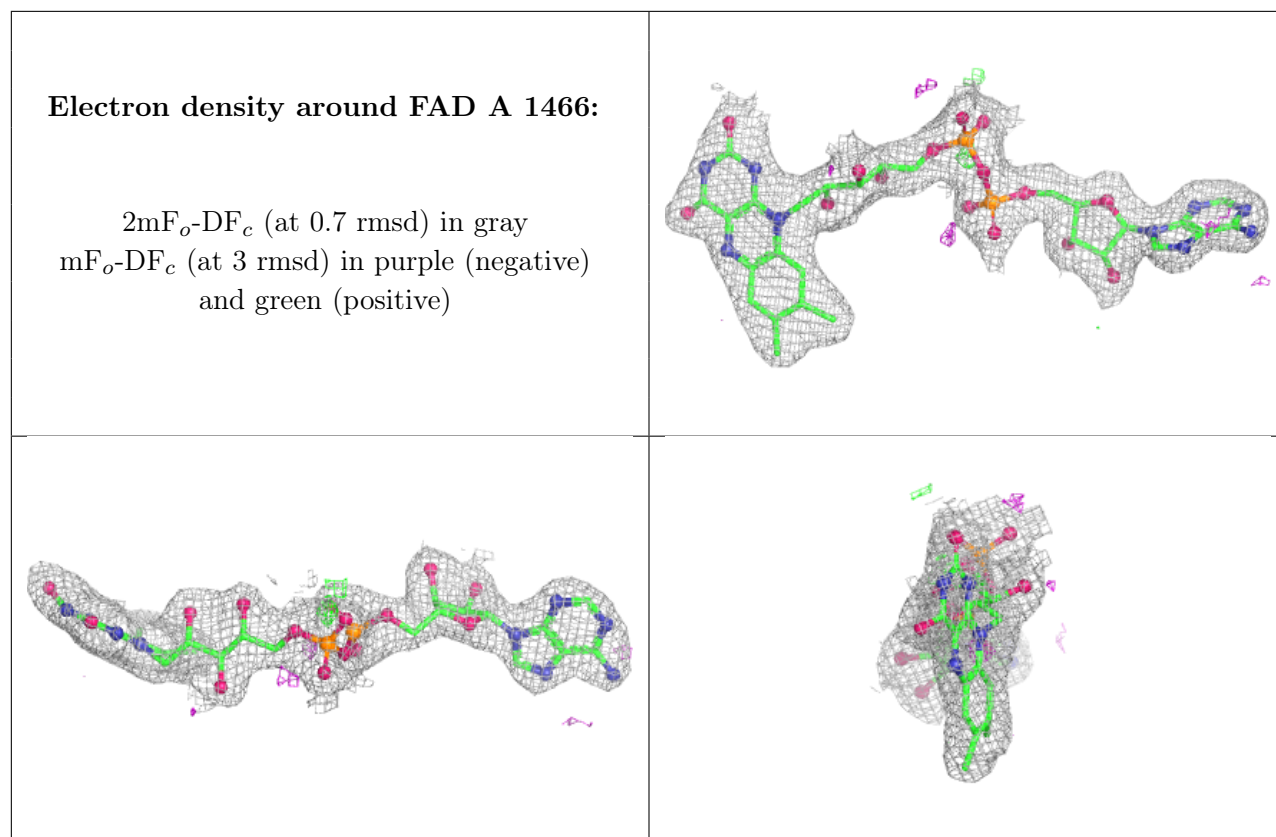
Electron density around ACJ A 1465:

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

**Electron density around FAD B 1469:**

$2mF_o-DF_c$ (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.