



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 20, 2026 – 06:43 AM UTC

PDB ID : 1Q1R / pdb_00001q1r
Title : Crystal Structure of Putidaredoxin Reductase from Pseudomonas putida
Authors : Sevrioukova, I.F.; Li, H.; Poulos, T.L.
Deposited on : 2003-07-22
Resolution : 1.91 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

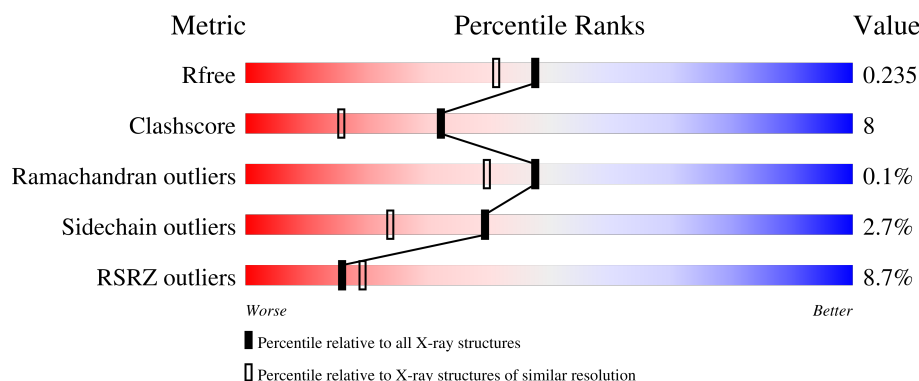
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.91 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1188 (1.92-1.92)
Clashscore	190562	1209 (1.92-1.92)
Ramachandran outliers	187476	1195 (1.92-1.92)
Sidechain outliers	187428	1195 (1.92-1.92)
RSRZ outliers	180081	1188 (1.92-1.92)

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	431	10% 78% 17% ..
1	B	431	6% 81% 15% ..

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7158 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.

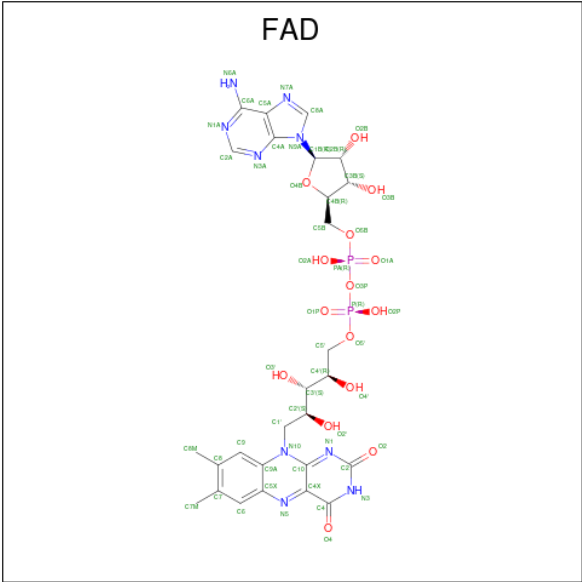
- Molecule 1 is a protein called Putidaredoxin reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	421	Total	C	N	O	S	0	0	0
			3197	2010	572	604	11			
1	B	421	Total	C	N	O	S	0	0	0
			3197	2010	572	604	11			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	423	PRO	-	cloning artifact	UNP P16640
A	424	ALA	-	cloning artifact	UNP P16640
A	425	ARG	-	cloning artifact	UNP P16640
A	426	HIS	-	expression tag	UNP P16640
A	427	HIS	-	expression tag	UNP P16640
A	428	HIS	-	expression tag	UNP P16640
A	429	HIS	-	expression tag	UNP P16640
A	430	HIS	-	expression tag	UNP P16640
A	431	HIS	-	expression tag	UNP P16640
B	423	PRO	-	cloning artifact	UNP P16640
B	424	ALA	-	cloning artifact	UNP P16640
B	425	ARG	-	cloning artifact	UNP P16640
B	426	HIS	-	expression tag	UNP P16640
B	427	HIS	-	expression tag	UNP P16640
B	428	HIS	-	expression tag	UNP P16640
B	429	HIS	-	expression tag	UNP P16640
B	430	HIS	-	expression tag	UNP P16640
B	431	HIS	-	expression tag	UNP P16640

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: 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		

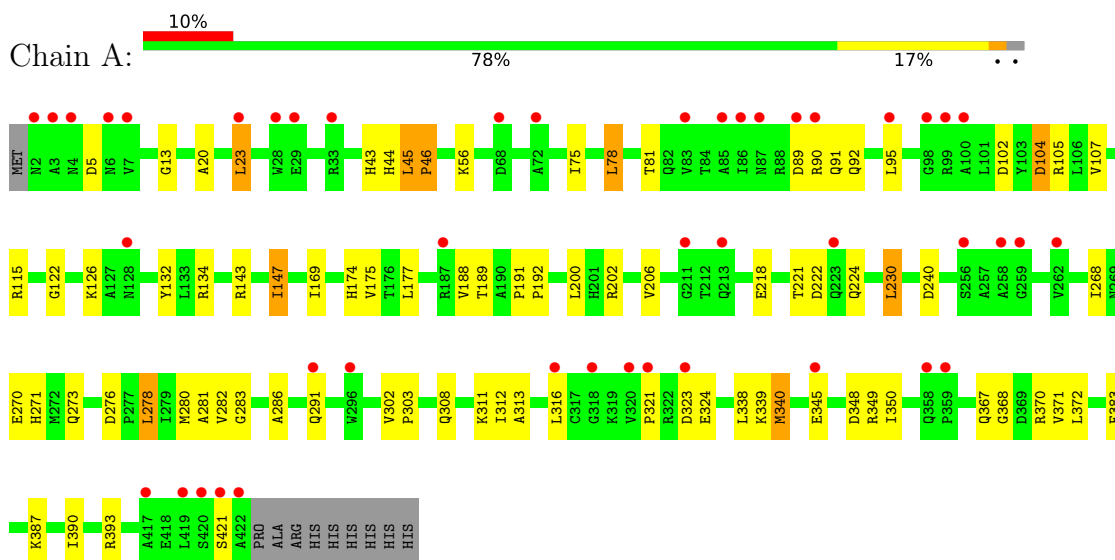
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	279	Total	O	0	0
			279	279		
3	B	379	Total	O	0	0
			379	379		

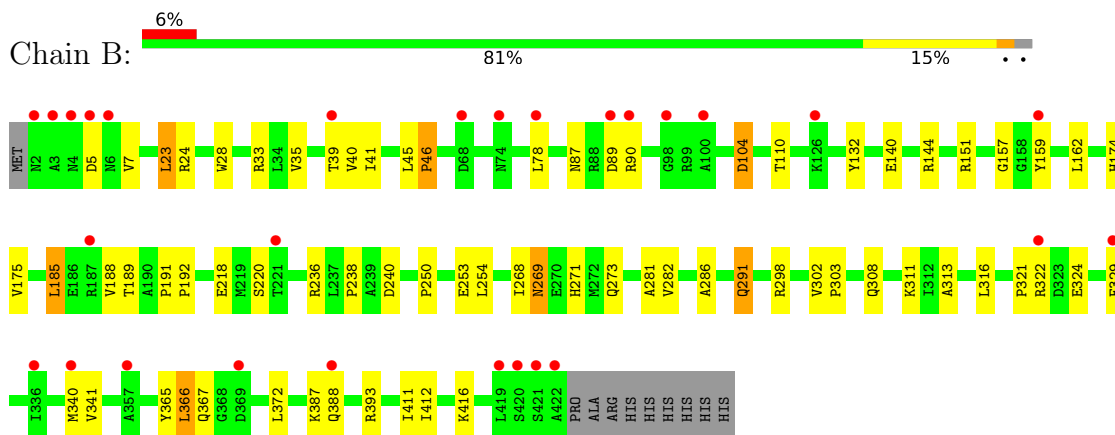
3 Residue-property plots [i](#)

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: Putidaredoxin reductase



- Molecule 1: Putidaredoxin reductase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	70.78Å 104.13Å 166.78Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.57 – 1.91 29.57 – 1.91	Depositor EDS
% Data completeness (in resolution range)	92.9 (29.57-1.91) 93.5 (29.57-1.91)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.71 (at 1.91Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.213 , 0.236 0.213 , 0.235	Depositor DCC
R_{free} test set	4197 reflections (4.38%)	wwPDB-VP
Wilson B-factor (Å ²)	23.4	Xtriage
Anisotropy	0.486	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 38.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	7158	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.22% 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

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	0.35	0/3251	0.89	12/4425 (0.3%)
1	B	0.37	0/3251	0.90	11/4425 (0.2%)
All	All	0.36	0/6502	0.89	23/8850 (0.3%)

There are no bond length outliers.

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	104	ASP	N-CA-C	-8.67	103.22	113.88
1	B	104	ASP	N-CA-C	-8.28	103.69	113.88
1	B	41	ILE	N-CA-C	-7.54	102.15	108.63
1	A	132	TYR	N-CA-C	-7.33	99.61	110.46
1	B	132	TYR	N-CA-C	-6.88	100.28	110.46
1	A	175	VAL	N-CA-C	6.51	117.22	108.11
1	B	286	ALA	N-CA-C	6.48	120.22	109.46
1	B	175	VAL	N-CA-C	6.39	117.06	108.11
1	A	276	ASP	CA-C-N	6.20	126.39	119.32
1	A	276	ASP	C-N-CA	6.20	126.39	119.32
1	A	174	HIS	N-CA-C	-6.11	99.25	108.96
1	B	411	ILE	N-CA-C	-5.98	104.68	110.72
1	B	174	HIS	N-CA-C	-5.91	99.56	108.96
1	A	240	ASP	N-CA-C	-5.64	106.56	113.50
1	A	147	ILE	N-CA-C	5.58	115.98	108.17
1	B	110	THR	N-CA-C	5.57	119.92	113.18
1	B	220	SER	N-CA-C	-5.51	103.25	110.53
1	A	46	PRO	N-CA-C	5.47	117.38	110.70
1	B	240	ASP	N-CA-C	-5.32	106.95	113.50
1	A	286	ALA	N-CA-C	5.28	118.22	109.46
1	B	46	PRO	N-CA-C	5.26	117.12	110.70
1	A	13	GLY	N-CA-C	-5.12	104.73	112.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	368	GLY	N-CA-C	-5.00	105.35	111.35

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	3197	0	3224	55	0
1	B	3197	0	3224	50	0
2	A	53	0	31	0	0
2	B	53	0	31	0	0
3	A	279	0	0	4	0
3	B	379	0	0	6	0
All	All	7158	0	6510	104	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 (104) 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:388:GLN:NE2	1:B:416:LYS:HE2	1.81	0.94
1:B:388:GLN:HE22	1:B:416:LYS:CE	1.94	0.78
1:A:104:ASP:C	1:A:105:ARG:HD2	2.10	0.76
1:A:338:LEU:HB3	1:A:340:MET:HE1	1.67	0.76
1:A:280:MET:HE1	1:A:316:LEU:HD11	1.68	0.73
1:A:280:MET:HE2	3:A:885:HOH:O	1.89	0.72
1:A:143:ARG:HD2	3:B:997:HOH:O	1.89	0.71
1:B:33:ARG:NH1	1:B:78:LEU:HD11	2.06	0.71
1:B:340:MET:HE3	3:B:926:HOH:O	1.89	0.71
1:A:122:GLY:O	1:A:126:LYS:HG2	1.89	0.70
1:B:7:VAL:HG23	1:B:28:TRP:CZ2	2.27	0.70
1:B:250:PRO:HG3	1:B:298:ARG:CZ	2.22	0.69
1:B:388:GLN:HE22	1:B:416:LYS:HE2	1.47	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:162:LEU:HD11	1:B:185:LEU:HD11	1.75	0.68
1:A:104:ASP:O	1:A:105:ARG:HD2	1.99	0.63
1:B:269:ASN:C	1:B:269:ASN:HD22	2.05	0.63
1:A:370:ARG:NE	1:A:393:ARG:HE	1.97	0.62
1:A:311:LYS:HG3	1:A:321:PRO:HB3	1.83	0.60
1:A:383:PHE:CE2	1:A:387:LYS:HE3	2.37	0.59
1:B:5:ASP:HA	1:B:104:ASP:OD1	2.02	0.59
1:B:412:ILE:HG22	1:B:416:LYS:HE3	1.85	0.59
1:A:268:ILE:CG2	1:A:281:ALA:HB3	2.33	0.58
1:B:236:ARG:HD3	3:B:978:HOH:O	2.02	0.58
1:B:35:VAL:HG22	1:B:78:LEU:HD12	1.86	0.58
1:A:188:VAL:HG23	1:A:189:THR:HG23	1.84	0.58
1:B:151:ARG:HE	1:B:238:PRO:HG2	1.68	0.58
1:A:268:ILE:HG21	1:A:281:ALA:HB3	1.84	0.58
1:B:269:ASN:ND2	1:B:273:GLN:H	2.03	0.57
1:A:291:GLN:HG2	1:A:324:GLU:OE2	2.05	0.56
1:B:151:ARG:NE	1:B:238:PRO:HG2	2.21	0.56
1:A:278:LEU:HD22	1:A:278:LEU:H	1.71	0.56
1:A:278:LEU:HD22	1:A:278:LEU:N	2.22	0.55
1:A:280:MET:CE	1:A:316:LEU:HD11	2.36	0.55
1:B:185:LEU:HD12	1:B:185:LEU:N	2.21	0.55
1:B:218:GLU:CD	1:B:236:ARG:HH12	2.14	0.55
1:A:371:VAL:HG12	1:A:390:ILE:HD11	1.89	0.55
1:B:218:GLU:OE2	1:B:236:ARG:NH1	2.37	0.54
1:B:162:LEU:CD1	1:B:185:LEU:HD11	2.36	0.54
1:B:191:PRO:N	1:B:192:PRO:HD2	2.22	0.54
1:A:78:LEU:HD22	1:A:81:THR:OG1	2.08	0.53
1:A:5:ASP:HA	1:A:104:ASP:OD2	2.09	0.53
1:B:185:LEU:N	1:B:185:LEU:CD1	2.73	0.52
1:A:280:MET:HE1	1:A:316:LEU:CD1	2.39	0.52
1:A:367:GLN:HB2	1:A:372:LEU:HD11	1.91	0.51
1:B:322:ARG:HD2	3:B:1007:HOH:O	2.09	0.51
1:A:302:VAL:HB	1:A:303:PRO:HD3	1.92	0.51
1:B:302:VAL:HB	1:B:303:PRO:HD3	1.93	0.51
1:B:393:ARG:HG2	3:B:897:HOH:O	2.10	0.51
1:B:253:GLU:H	1:B:253:GLU:CD	2.19	0.51
1:A:283:GLY:H	1:A:308:GLN:NE2	2.08	0.50
1:B:269:ASN:ND2	1:B:271:HIS:H	2.08	0.50
1:A:224:GLN:NE2	3:A:968:HOH:O	2.44	0.50
1:B:159:TYR:CE1	1:B:329:PHE:HZ	2.29	0.49
1:B:311:LYS:HG3	1:B:321:PRO:HB3	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:43:HIS:HE1	3:A:774:HOH:O	1.95	0.49
1:A:192:PRO:HG3	1:A:350:ILE:HD11	1.95	0.48
1:B:269:ASN:HD21	1:B:273:GLN:H	1.61	0.48
1:B:188:VAL:HG23	1:B:189:THR:HG23	1.95	0.48
1:B:269:ASN:C	1:B:269:ASN:ND2	2.71	0.47
1:B:367:GLN:HB2	1:B:372:LEU:HD11	1.96	0.47
1:B:33:ARG:HH11	1:B:78:LEU:HD11	1.79	0.46
1:A:270:GLU:HG2	1:A:271:HIS:ND1	2.30	0.46
1:A:107:VAL:HG22	1:A:280:MET:HE3	1.97	0.46
1:A:202:ARG:HA	1:A:206:VAL:O	2.15	0.46
1:B:23:LEU:HD13	1:B:313:ALA:HA	1.97	0.46
1:A:81:THR:HG21	1:A:95:LEU:HD13	1.98	0.45
1:A:43:HIS:HD2	1:A:44:HIS:O	2.00	0.45
1:A:339:LYS:HE2	1:A:383:PHE:CE2	2.52	0.45
1:B:282:VAL:HG23	1:B:308:GLN:HB3	1.98	0.45
1:A:370:ARG:CZ	1:A:393:ARG:HH21	2.30	0.45
1:B:236:ARG:HG3	1:B:236:ARG:HH11	1.81	0.45
1:A:177:LEU:C	1:A:177:LEU:HD23	2.43	0.44
1:A:45:LEU:N	1:A:46:PRO:CD	2.81	0.44
1:B:254:LEU:HB2	3:B:874:HOH:O	2.17	0.44
1:A:271:HIS:HB2	1:A:273:GLN:HE21	1.82	0.44
1:A:92:GLN:HG2	1:A:102:ASP:OD1	2.18	0.44
1:A:191:PRO:N	1:A:192:PRO:HD2	2.33	0.43
1:A:218:GLU:HG3	1:A:230:LEU:HD21	2.01	0.43
1:B:157:GLY:O	1:B:185:LEU:HD12	2.18	0.43
1:A:23:LEU:CD1	1:A:313:ALA:HA	2.49	0.43
1:A:169:ILE:HD13	1:A:169:ILE:HA	1.93	0.43
1:A:20:ALA:HB1	1:A:75:ILE:HD13	2.01	0.43
1:A:90:ARG:O	1:A:91:GLN:HB2	2.18	0.43
1:A:147:ILE:HD13	1:B:39:THR:O	2.20	0.42
1:B:24:ARG:HD3	1:B:24:ARG:HA	1.84	0.42
1:A:56:LYS:HE2	3:A:994:HOH:O	2.20	0.42
1:B:291:GLN:HB2	1:B:324:GLU:OE1	2.20	0.42
1:B:33:ARG:HH11	1:B:33:ARG:HG2	1.84	0.42
1:A:115:ARG:HH11	1:A:115:ARG:HG3	1.85	0.42
1:A:280:MET:HE1	1:A:312:ILE:HG23	2.01	0.42
1:B:87:ASN:OD1	1:B:90:ARG:NH2	2.53	0.41
1:B:268:ILE:CG2	1:B:281:ALA:HB3	2.50	0.41
1:A:89:ASP:OD1	1:A:89:ASP:N	2.53	0.41
1:A:221:THR:HG23	1:A:222:ASP:N	2.35	0.41
1:A:348:ASP:O	1:A:349:ARG:HB3	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:140:GLU:O	1:B:144:ARG:HG3	2.20	0.41
1:A:169:ILE:HG13	1:A:206:VAL:HG23	2.03	0.41
1:B:45:LEU:N	1:B:46:PRO:CD	2.83	0.41
1:B:341:VAL:HG21	1:B:387:LYS:HA	2.02	0.41
1:B:388:GLN:NE2	1:B:416:LYS:CE	2.56	0.40
1:A:370:ARG:NH1	1:A:393:ARG:HH21	2.19	0.40
1:A:393:ARG:HG3	1:A:393:ARG:NH1	2.36	0.40
1:B:365:TYR:C	1:B:366:LEU:HD23	2.46	0.40
1:A:282:VAL:HG23	1:A:308:GLN:HB3	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	419/431 (97%)	403 (96%)	16 (4%)	0	100	100
1	B	419/431 (97%)	408 (97%)	10 (2%)	1 (0%)	43	34
All	All	838/862 (97%)	811 (97%)	26 (3%)	1 (0%)	48	40

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	40	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	336/345 (97%)	325 (97%)	11 (3%)	33	17
1	B	336/345 (97%)	329 (98%)	7 (2%)	47	33
All	All	672/690 (97%)	654 (97%)	18 (3%)	39	24

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	23	LEU
1	A	45	LEU
1	A	78	LEU
1	A	134	ARG
1	A	200	LEU
1	A	230	LEU
1	A	278	LEU
1	A	323	ASP
1	A	340	MET
1	A	345	GLU
1	A	421	SER
1	B	23	LEU
1	B	89	ASP
1	B	185	LEU
1	B	269	ASN
1	B	291	GLN
1	B	316	LEU
1	B	366	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (26) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	ASN
1	A	43	HIS
1	A	74	ASN
1	A	76	GLN
1	A	82	GLN
1	A	87	ASN
1	A	213	GLN
1	A	304	ASN
1	A	308	GLN
1	A	358	GLN

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Mol	Chain	Res	Type
1	A	367	GLN
1	A	384	ASN
1	A	388	GLN
1	B	43	HIS
1	B	73	GLN
1	B	82	GLN
1	B	199	HIS
1	B	224	GLN
1	B	269	ASN
1	B	271	HIS
1	B	273	GLN
1	B	289	HIS
1	B	333	GLN
1	B	367	GLN
1	B	385	GLN
1	B	388	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	FAD	A	749	-	58,58,58	1.35	6 (10%)	85,89,89	1.54	16 (18%)
2	FAD	B	750	-	58,58,58	1.44	7 (12%)	85,89,89	1.55	16 (18%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FAD	A	749	-	-	3/34/50/50	0/6/6/6
2	FAD	B	750	-	-	4/34/50/50	0/6/6/6

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	750	FAD	C10-N1	3.93	1.41	1.33
2	A	749	FAD	C10-N1	3.85	1.41	1.33
2	B	750	FAD	PA-O3P	3.61	1.63	1.59
2	B	750	FAD	P-O3P	3.48	1.63	1.59
2	B	750	FAD	C5A-N7A	-3.27	1.33	1.39
2	A	749	FAD	P-O3P	3.07	1.62	1.59
2	A	749	FAD	C5A-N7A	-3.07	1.33	1.39
2	A	749	FAD	PA-O3P	2.98	1.62	1.59
2	B	750	FAD	C4X-N5	2.96	1.37	1.30
2	A	749	FAD	C4X-N5	2.83	1.36	1.30
2	B	750	FAD	C5'-C4'	2.54	1.55	1.51
2	B	750	FAD	C4A-N9A	-2.21	1.33	1.37
2	A	749	FAD	C4A-N9A	-2.09	1.33	1.37

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	750	FAD	N3A-C2A-N1A	-5.36	120.47	128.58
2	A	749	FAD	N3A-C2A-N1A	-5.30	120.56	128.58
2	A	749	FAD	C5A-C4A-N3A	-5.01	119.81	126.72
2	B	750	FAD	C5A-C4A-N3A	-4.89	119.99	126.72
2	A	749	FAD	C2A-N3A-C4A	3.72	120.91	111.83
2	B	750	FAD	C2A-N3A-C4A	3.68	120.81	111.83
2	B	750	FAD	N9A-C8A-N7A	-3.52	108.94	113.94
2	A	749	FAD	N9A-C8A-N7A	-3.48	109.00	113.94
2	A	749	FAD	N3A-C4A-N9A	3.31	132.80	127.17

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	750	FAD	N3A-C4A-N9A	3.21	132.62	127.17
2	A	749	FAD	C4-N3-C2	-3.10	120.13	125.64
2	B	750	FAD	C4-N3-C2	-2.95	120.39	125.64
2	B	750	FAD	C5A-N7A-C8A	2.85	107.93	103.45
2	A	749	FAD	C5A-N7A-C8A	2.78	107.83	103.45
2	A	749	FAD	C4X-C4-N3	2.76	120.28	113.25
2	B	750	FAD	C4X-C4-N3	2.70	120.11	113.25
2	A	749	FAD	C5X-N5-C4X	2.61	122.30	118.09
2	B	750	FAD	C4A-C5A-N7A	-2.48	107.75	110.58
2	B	750	FAD	C5X-N5-C4X	2.43	122.02	118.09
2	A	749	FAD	C4A-C5A-N7A	-2.43	107.81	110.58
2	B	750	FAD	C9A-C5X-N5	-2.40	119.91	122.45
2	A	749	FAD	O4B-C1B-N9A	2.37	112.64	108.09
2	A	749	FAD	C10-C4X-N5	-2.37	119.97	124.81
2	A	749	FAD	O4-C4-C4X	-2.36	120.30	126.53
2	B	750	FAD	C10-C4X-N5	-2.35	120.01	124.81
2	A	749	FAD	C9A-C5X-N5	-2.34	119.97	122.45
2	B	750	FAD	O4B-C1B-N9A	2.26	112.44	108.09
2	B	750	FAD	O4-C4-C4X	-2.26	120.57	126.53
2	B	750	FAD	C4X-C10-N10	2.22	119.66	116.48
2	B	750	FAD	C4A-N9A-C8A	2.14	107.99	105.74
2	A	749	FAD	C4A-N9A-C8A	2.13	107.98	105.74
2	A	749	FAD	C4X-C10-N10	2.10	119.49	116.48

There are no chirality outliers.

All (7) torsion outliers are listed below:

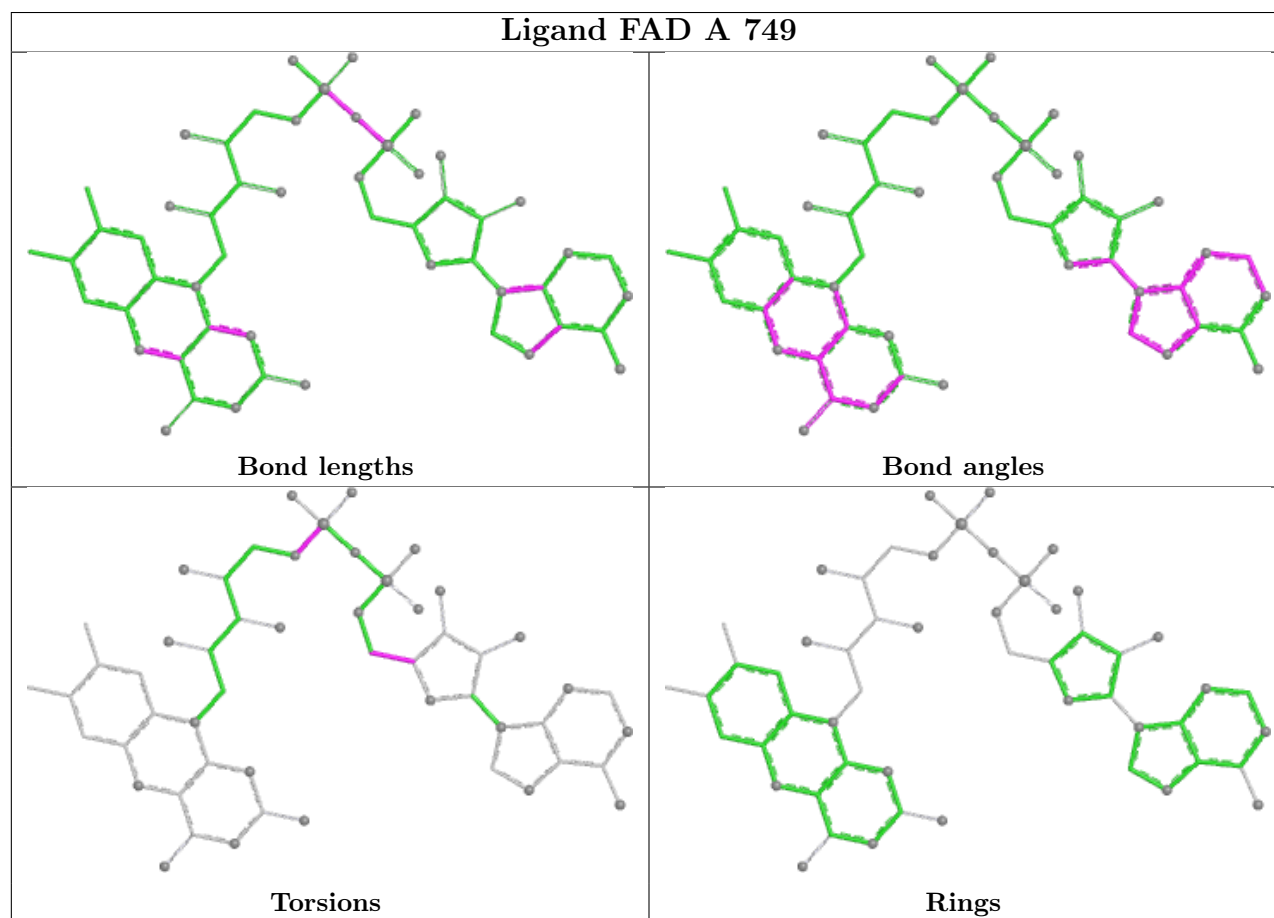
Mol	Chain	Res	Type	Atoms
2	A	749	FAD	C5'-O5'-P-O1P
2	A	749	FAD	C5'-O5'-P-O3P
2	B	750	FAD	C5'-O5'-P-O1P
2	B	750	FAD	C5'-O5'-P-O3P
2	B	750	FAD	O4B-C4B-C5B-O5B
2	A	749	FAD	O4B-C4B-C5B-O5B
2	B	750	FAD	C3B-C4B-C5B-O5B

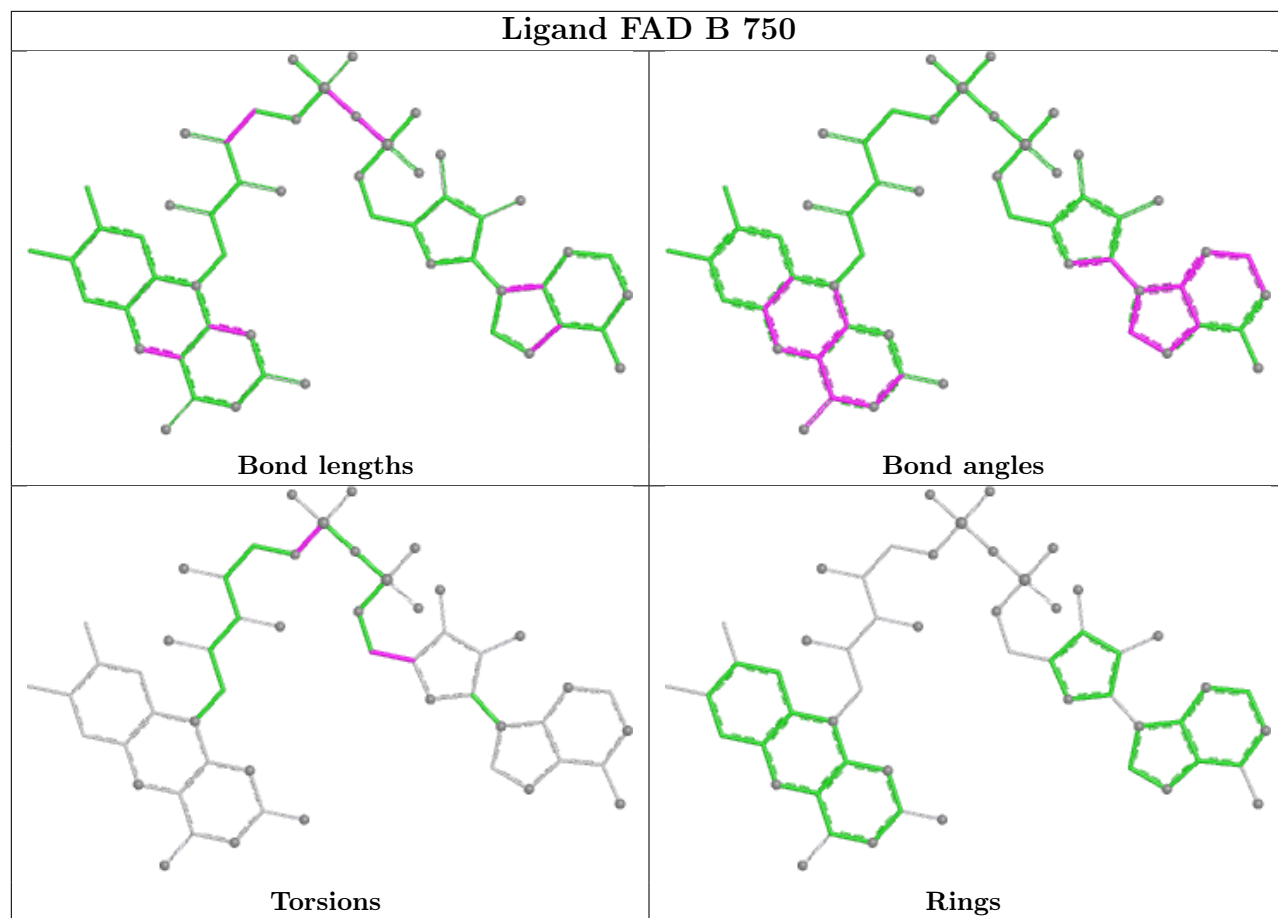
There are no ring outliers.

No monomer is involved in short contacts.

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	421/431 (97%)	0.69	45 (10%) 11 14	16, 32, 50, 79	0
1	B	421/431 (97%)	0.23	28 (6%) 24 28	15, 25, 39, 81	0
All	All	842/862 (97%)	0.46	73 (8%) 16 19	15, 28, 48, 81	0

All (73) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	422	ALA	7.0
1	A	422	ALA	6.2
1	B	2	ASN	5.7
1	B	3	ALA	5.6
1	A	421	SER	5.4
1	A	3	ALA	5.3
1	A	419	LEU	5.1
1	B	4	ASN	4.8
1	B	6	ASN	4.3
1	B	5	ASP	4.3
1	B	187	ARG	3.8
1	B	419	LEU	3.8
1	B	78	LEU	3.8
1	A	4	ASN	3.6
1	A	98	GLY	3.5
1	A	323	ASP	3.4
1	A	2	ASN	3.3
1	A	291	GLN	3.3
1	B	98	GLY	3.2
1	A	86	ILE	3.1
1	A	128	ASN	3.0
1	B	89	ASP	3.0
1	B	340	MET	3.0
1	B	421	SER	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	89	ASP	2.9
1	B	68	ASP	2.9
1	B	388	GLN	2.8
1	B	159	TYR	2.8
1	A	262	VAL	2.8
1	A	358	GLN	2.8
1	A	87	ASN	2.7
1	B	39	THR	2.7
1	A	100	ALA	2.7
1	B	90	ARG	2.7
1	A	417	ALA	2.6
1	B	420	SER	2.6
1	A	7	VAL	2.6
1	B	221	THR	2.6
1	A	28	TRP	2.6
1	B	329	PHE	2.5
1	A	90	ARG	2.5
1	A	68	ASP	2.5
1	A	23	LEU	2.4
1	A	345	GLU	2.4
1	A	321	PRO	2.4
1	A	420	SER	2.4
1	A	316	LEU	2.3
1	A	6	ASN	2.3
1	A	359	PRO	2.3
1	A	320	VAL	2.3
1	A	72	ALA	2.3
1	A	33	ARG	2.3
1	A	258	ALA	2.2
1	B	369	ASP	2.2
1	A	83	VAL	2.2
1	A	259	GLY	2.2
1	B	100	ALA	2.2
1	B	126	LYS	2.2
1	A	187	ARG	2.2
1	A	223	GLN	2.2
1	A	85	ALA	2.2
1	B	357	ALA	2.2
1	A	296	TRP	2.2
1	A	99	ARG	2.2
1	A	318	GLY	2.1
1	B	322	ARG	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	29	GLU	2.1
1	B	336	ILE	2.1
1	B	74	ASN	2.1
1	A	95	LEU	2.1
1	A	256	SER	2.0
1	A	211	GLY	2.0
1	A	213	GLN	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

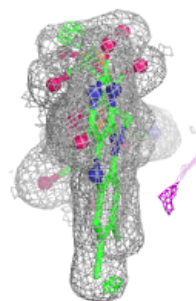
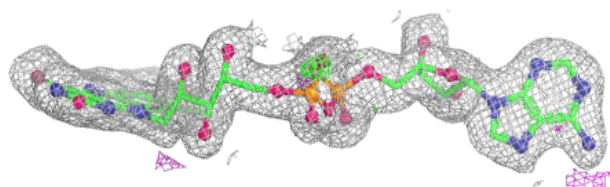
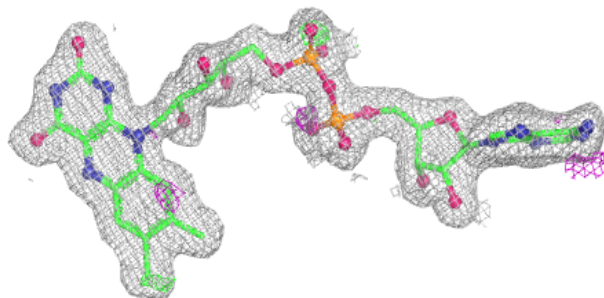
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	FAD	A	749	53/53	0.97	0.06	16,21,29,29	0
2	FAD	B	750	53/53	0.98	0.05	14,17,22,23	0

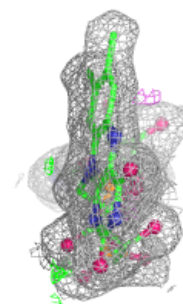
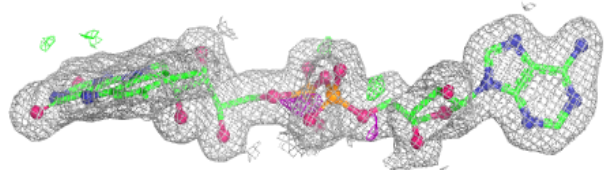
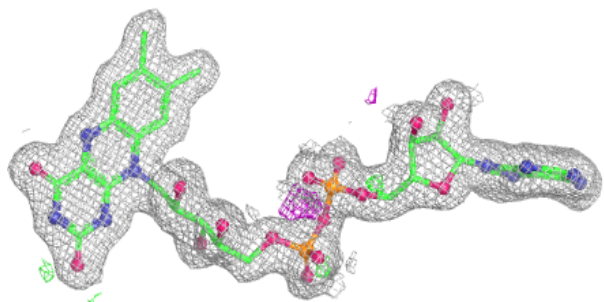
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FAD A 749:

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

**Electron density around FAD B 750:**

$2mF_o-DF_c$ (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.