



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 05:23 PM UTC

PDB ID : 1RYI / pdb_00001ryi
Title : STRUCTURE OF GLYCINE OXIDASE WITH BOUND INHIBITOR GLYCOLATE
Authors : Moertl, M.; Diederichs, K.; Welte, W.; Pollegioni, L.; Molla, G.; Motteran, L.; Andriolo, G.; Pilone, M.S.
Deposited on : 2003-12-22
Resolution : 1.80 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

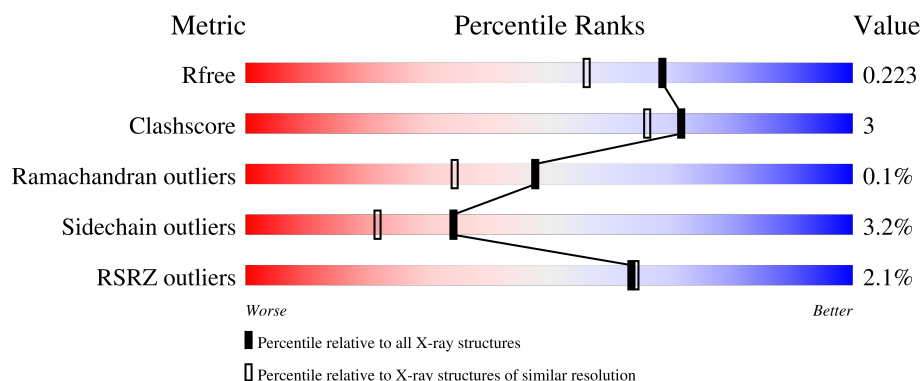
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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	382	3% 85% 8% 5%
1	B	382	2% 88% 7% 5%
1	C	382	0% 88% 6% 5%
1	D	382	2% 87% 7% 5%

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

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	GOA	A	9110	-	X	-	-
3	GOA	B	9210	-	X	-	-
3	GOA	C	9310	-	X	X	-
3	GOA	D	9410	-	X	-	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12720 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 GLYCINE OXIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	364	Total	C	N	O	S	0	1	0
			2855	1826	489	523	17			
1	B	364	Total	C	N	O	S	0	2	0
			2866	1835	490	524	17			
1	C	364	Total	C	N	O	S	0	1	0
			2855	1826	489	523	17			
1	D	364	Total	C	N	O	S	0	2	0
			2866	1835	490	524	17			

There are 52 discrepancies between the modelled and reference sequences:

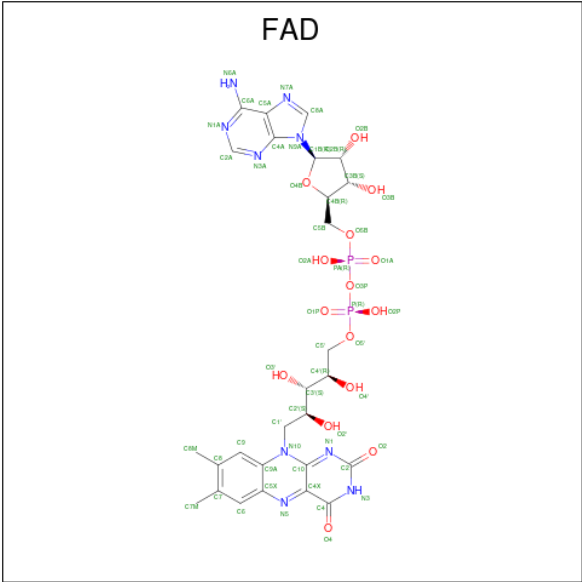
Chain	Residue	Modelled	Actual	Comment	Reference
A	-12	MET	-	expression tag	UNP O31616
A	-11	HIS	-	expression tag	UNP O31616
A	-10	HIS	-	expression tag	UNP O31616
A	-9	HIS	-	expression tag	UNP O31616
A	-8	HIS	-	expression tag	UNP O31616
A	-7	HIS	-	expression tag	UNP O31616
A	-6	HIS	-	expression tag	UNP O31616
A	-5	MET	-	expression tag	UNP O31616
A	-4	ALA	-	expression tag	UNP O31616
A	-3	ARG	-	expression tag	UNP O31616
A	-2	ILE	-	expression tag	UNP O31616
A	-1	ARG	-	expression tag	UNP O31616
A	0	ALA	-	expression tag	UNP O31616
B	-12	MET	-	expression tag	UNP O31616
B	-11	HIS	-	expression tag	UNP O31616
B	-10	HIS	-	expression tag	UNP O31616
B	-9	HIS	-	expression tag	UNP O31616
B	-8	HIS	-	expression tag	UNP O31616
B	-7	HIS	-	expression tag	UNP O31616
B	-6	HIS	-	expression tag	UNP O31616
B	-5	MET	-	expression tag	UNP O31616

Continued on next page...

Continued from previous page...

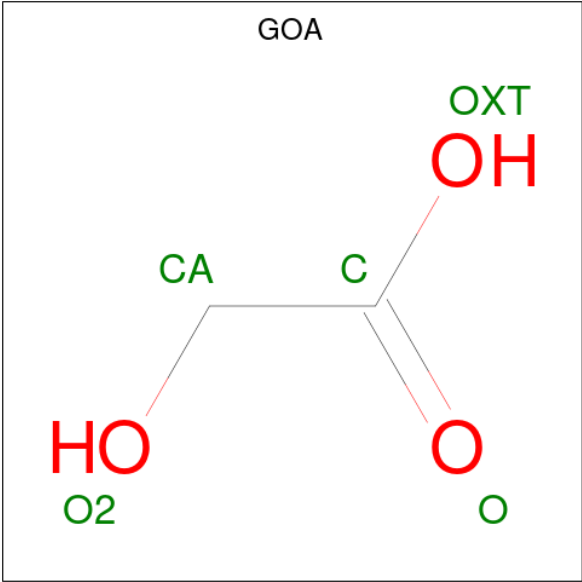
Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	ALA	-	expression tag	UNP O31616
B	-3	ARG	-	expression tag	UNP O31616
B	-2	ILE	-	expression tag	UNP O31616
B	-1	ARG	-	expression tag	UNP O31616
B	0	ALA	-	expression tag	UNP O31616
C	-12	MET	-	expression tag	UNP O31616
C	-11	HIS	-	expression tag	UNP O31616
C	-10	HIS	-	expression tag	UNP O31616
C	-9	HIS	-	expression tag	UNP O31616
C	-8	HIS	-	expression tag	UNP O31616
C	-7	HIS	-	expression tag	UNP O31616
C	-6	HIS	-	expression tag	UNP O31616
C	-5	MET	-	expression tag	UNP O31616
C	-4	ALA	-	expression tag	UNP O31616
C	-3	ARG	-	expression tag	UNP O31616
C	-2	ILE	-	expression tag	UNP O31616
C	-1	ARG	-	expression tag	UNP O31616
C	0	ALA	-	expression tag	UNP O31616
D	-12	MET	-	expression tag	UNP O31616
D	-11	HIS	-	expression tag	UNP O31616
D	-10	HIS	-	expression tag	UNP O31616
D	-9	HIS	-	expression tag	UNP O31616
D	-8	HIS	-	expression tag	UNP O31616
D	-7	HIS	-	expression tag	UNP O31616
D	-6	HIS	-	expression tag	UNP O31616
D	-5	MET	-	expression tag	UNP O31616
D	-4	ALA	-	expression tag	UNP O31616
D	-3	ARG	-	expression tag	UNP O31616
D	-2	ILE	-	expression tag	UNP O31616
D	-1	ARG	-	expression tag	UNP O31616
D	0	ALA	-	expression tag	UNP O31616

- 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		
2	C	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	D	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 3 is GLYCOLIC ACID (CCD ID: GOA) (formula: C₂H₄O₃).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 5 2 3	0	0
3	B	1	Total C O 5 2 3	0	0
3	C	1	Total C O 5 2 3	0	0
3	D	1	Total C O 5 2 3	0	0

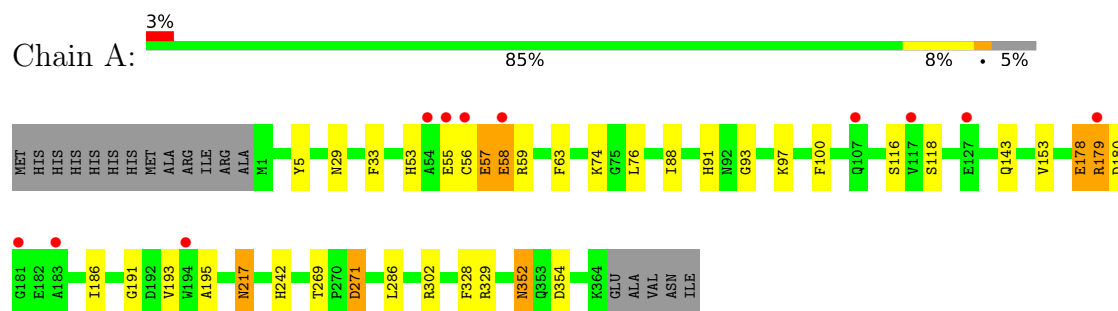
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	267	Total O 267 267	0	0
4	B	262	Total O 262 262	0	0
4	C	298	Total O 298 298	0	0
4	D	219	Total O 219 219	0	0

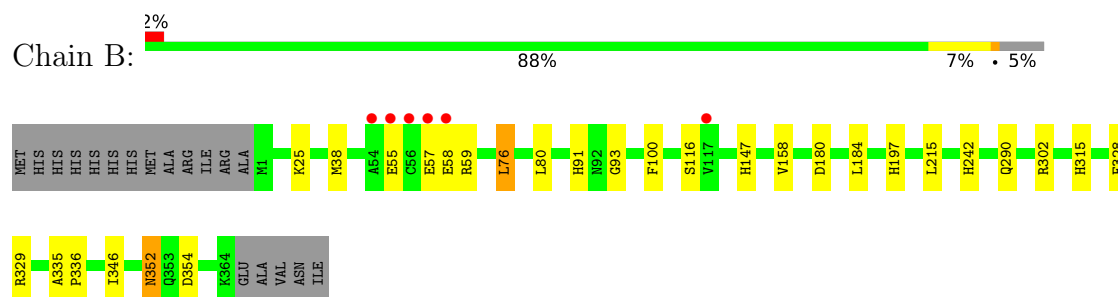
3 Residue-property plots

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.

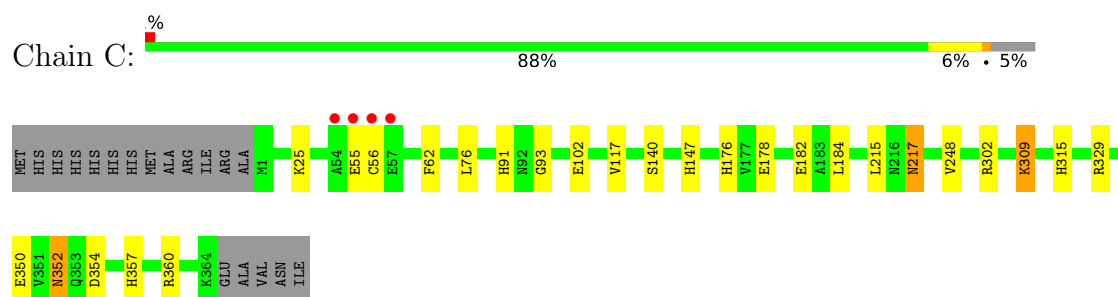
• Molecule 1: GLYCINE OXIDASE



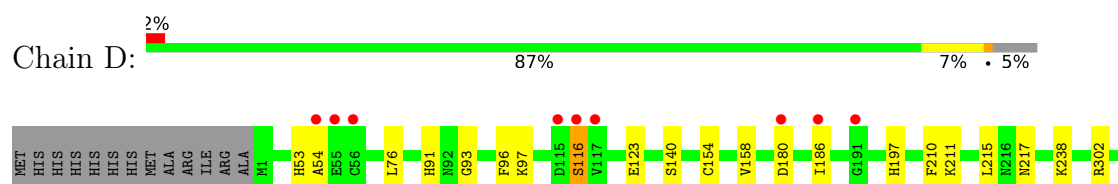
• Molecule 1: GLYCINE OXIDASE



• Molecule 1: GLYCINE OXIDASE



• Molecule 1: GLYCINE OXIDASE



H315	
H327	
F328	
R329	
A335	
P336	
A337	
T338	
I346	
N352	
K364	
GLU	
ALA	
VAL	
ASN	
ILE	

4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	73.71Å 218.76Å 217.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.92 – 1.80 19.92 – 1.80	Depositor EDS
% Data completeness (in resolution range)	98.3 (19.92-1.80) 98.2 (19.92-1.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.76 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.1.25	Depositor
R, R_{free}	0.177 , 0.214 0.189 , 0.223	Depositor DCC
R_{free} test set	8006 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	23.8	Xtriage
Anisotropy	0.048	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 42.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	12720	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.61% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOA, 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	0.69	0/2926	0.86	4/3952 (0.1%)
1	B	0.67	0/2938	0.84	1/3968 (0.0%)
1	C	0.68	0/2926	0.84	0/3952
1	D	0.65	0/2938	0.81	0/3968
All	All	0.67	0/11728	0.84	5/15840 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	180	ASP	N-CA-C	5.99	118.60	111.71
1	A	178	GLU	CA-C-N	5.43	131.48	121.70
1	A	178	GLU	C-N-CA	5.43	131.48	121.70
1	A	191	GLY	N-CA-C	5.40	117.55	112.04
1	A	271	ASP	CB-CA-C	-5.00	101.08	109.83

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2855	0	2803	25	0
1	B	2866	0	2811	14	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	2855	0	2803	19	0
1	D	2866	0	2811	18	0
2	A	53	0	31	0	0
2	B	53	0	31	0	0
2	C	53	0	31	0	0
2	D	53	0	31	0	0
3	A	5	0	0	1	0
3	B	5	0	0	1	0
3	C	5	0	0	2	0
3	D	5	0	0	1	0
4	A	267	0	0	5	0
4	B	262	0	0	1	0
4	C	298	0	0	0	0
4	D	219	0	0	3	0
All	All	12720	0	11352	76	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 3.

All (76) 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:C:147:HIS:CD2	1:C:248:VAL:HG13	2.02	0.95
1:C:91:HIS:HB3	1:C:147:HIS:CE1	2.17	0.80
1:A:178:GLU:HA	1:A:179:ARG:CB	2.17	0.74
1:D:197:HIS:CD2	1:D:346:ILE:HG23	2.28	0.69
1:C:62:PHE:CE1	1:C:309:LYS:HG2	2.28	0.69
1:B:215:LEU:HD11	1:B:315:HIS:CD2	2.29	0.68
1:A:302:ARG:HE	3:A:9110:GOA:CA	2.06	0.67
1:D:302:ARG:HE	3:D:9410:GOA:CA	2.07	0.67
1:D:91:HIS:HD2	1:D:93:GLY:H	1.43	0.67
1:A:271:ASP:OD2	4:A:9253:HOH:O	2.15	0.64
1:C:147:HIS:CD2	1:C:248:VAL:CG1	2.80	0.64
1:A:178:GLU:HA	1:A:179:ARG:HB2	1.79	0.63
1:A:217:ASN:HD22	1:A:217:ASN:H	1.46	0.63
1:C:147:HIS:HD2	1:C:248:VAL:HG13	1.60	0.61
1:B:302:ARG:HE	3:B:9210:GOA:CA	2.13	0.61
1:A:100:PHE:HD1	1:A:242:HIS:CD2	2.19	0.60
1:B:197:HIS:CD2	1:B:346:ILE:HG23	2.36	0.60
1:D:215:LEU:HD11	1:D:315:HIS:CD2	2.37	0.60
1:C:352:ASN:HD21	1:C:354:ASP:HB2	1.66	0.59

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:91:HIS:HD2	1:A:93:GLY:H	1.50	0.59
1:B:91:HIS:HD2	1:B:93:GLY:H	1.50	0.58
1:C:217:ASN:HD22	1:C:217:ASN:H	1.51	0.57
1:C:352:ASN:C	1:C:352:ASN:HD22	2.12	0.56
1:A:180:ASP:HA	4:A:9333:HOH:O	2.05	0.55
1:A:56:CYS:HB3	1:A:63:PHE:CE1	2.42	0.55
1:A:352:ASN:C	1:A:352:ASN:HD22	2.14	0.55
1:B:147:HIS:HD2	4:B:9241:HOH:O	1.90	0.55
1:A:178:GLU:HA	1:A:179:ARG:HB3	1.88	0.55
1:D:53:HIS:CE1	1:D:116:SER:HB2	2.43	0.53
1:C:302:ARG:HE	3:C:9310:GOA:CA	2.22	0.53
1:B:91:HIS:HB3	1:B:147:HIS:CE1	2.45	0.51
1:C:117:VAL:CG1	1:C:140:SER:OG	2.58	0.51
1:C:91:HIS:CB	1:C:147:HIS:CE1	2.90	0.51
1:C:91:HIS:HD2	1:C:93:GLY:H	1.59	0.51
1:A:33:PHE:CE1	1:A:186:ILE:HD11	2.47	0.49
1:B:352:ASN:HD21	1:B:354:ASP:HB2	1.77	0.49
1:A:53:HIS:HE1	1:A:116:SER:OG	1.96	0.48
1:B:352:ASN:C	1:B:352:ASN:HD22	2.21	0.48
1:D:97:LYS:NZ	4:D:9606:HOH:O	2.46	0.48
1:D:54:ALA:HA	1:D:97:LYS:NZ	2.28	0.48
1:D:217:ASN:H	1:D:217:ASN:HD22	1.61	0.48
1:A:57:GLU:O	1:A:58:GLU:CB	2.62	0.48
1:B:100:PHE:HD1	1:B:242:HIS:CD2	2.33	0.47
1:A:5:TYR:O	1:A:195:ALA:HA	2.15	0.47
1:A:328:PHE:CD2	1:A:329:ARG:HG3	2.51	0.46
1:C:91:HIS:CD2	1:C:93:GLY:H	2.34	0.45
1:A:29:ASN:OD1	4:A:9270:HOH:O	2.21	0.45
1:A:100:PHE:CD1	1:A:242:HIS:CD2	3.02	0.45
1:D:154:CYS:O	1:D:158:VAL:HG23	2.17	0.45
1:C:357:HIS:HD2	1:C:360:ARG:HD3	1.82	0.45
1:B:76:LEU:HD22	1:B:80:LEU:HG	2.00	0.44
1:D:352:ASN:HD22	1:D:352:ASN:C	2.26	0.44
1:A:97:LYS:NZ	4:A:9374:HOH:O	2.51	0.44
1:A:178:GLU:CA	1:A:179:ARG:CB	2.93	0.44
1:D:96:PHE:CE1	1:D:238:LYS:HD3	2.54	0.43
1:C:215:LEU:HD11	1:C:315:HIS:CD2	2.53	0.43
1:D:335:ALA:HB3	1:D:336:PRO:HD3	2.01	0.43
1:A:57:GLU:O	1:A:58:GLU:HB2	2.19	0.42
1:B:328:PHE:CD2	1:B:329:ARG:HG3	2.53	0.42
1:D:53:HIS:HE1	1:D:116:SER:HB2	1.83	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:117:VAL:CG1	1:C:140:SER:HG	2.32	0.42
1:D:328:PHE:CD2	1:D:329:ARG:HG3	2.54	0.42
1:C:91:HIS:HB3	1:C:147:HIS:ND1	2.35	0.42
1:D:91:HIS:HE1	4:D:9431:HOH:O	2.02	0.42
1:C:176:HIS:HE1	1:C:178:GLU:OE2	2.02	0.42
1:B:335:ALA:HB3	1:B:336:PRO:HD3	2.02	0.42
1:D:210:PHE:CD2	1:D:217:ASN:HB2	2.55	0.42
1:A:352:ASN:HD21	1:A:354:ASP:HB2	1.85	0.42
1:B:38:MET:HE2	1:B:158:VAL:HG21	2.02	0.41
1:D:116:SER:HB3	4:D:9569:HOH:O	2.19	0.41
1:A:88:ILE:HG22	1:A:153:VAL:HA	2.01	0.41
1:A:143:GLN:HG3	4:A:9354:HOH:O	2.20	0.41
1:B:58:GLU:O	1:B:59:ARG:C	2.62	0.41
1:C:329:ARG:HG2	3:C:9310:GOA:CA	2.51	0.41
1:A:352:ASN:ND2	1:A:354:ASP:H	2.20	0.40
1:D:327:HIS:HE1	1:D:338:THR:OG1	2.05	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	363/382 (95%)	353 (97%)	8 (2%)	2 (1%)	21	11
1	B	364/382 (95%)	350 (96%)	14 (4%)	0	100	100
1	C	363/382 (95%)	353 (97%)	10 (3%)	0	100	100
1	D	364/382 (95%)	350 (96%)	14 (4%)	0	100	100
All	All	1454/1528 (95%)	1406 (97%)	46 (3%)	2 (0%)	48	34

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	179	ARG
1	A	58	GLU

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	296/310 (96%)	285 (96%)	11 (4%)	30	18
1	B	297/310 (96%)	289 (97%)	8 (3%)	39	27
1	C	296/310 (96%)	285 (96%)	11 (4%)	30	18
1	D	297/310 (96%)	289 (97%)	8 (3%)	39	27
All	All	1186/1240 (96%)	1148 (97%)	38 (3%)	34	22

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	55	GLU
1	A	57	GLU
1	A	59	ARG
1	A	74	LYS
1	A	76	LEU
1	A	118	SER
1	A	193	VAL
1	A	217	ASN
1	A	269	THR
1	A	286	LEU
1	A	352	ASN
1	B	25	LYS
1	B	55	GLU
1	B	57	GLU
1	B	76	LEU
1	B	116	SER
1	B	184	LEU
1	B	290	GLN
1	B	352	ASN
1	C	25	LYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	C	55	GLU
1	C	56	CYS
1	C	76	LEU
1	C	102	GLU
1	C	182	GLU
1	C	184	LEU
1	C	217	ASN
1	C	309	LYS
1	C	350	GLU
1	C	352	ASN
1	D	76	LEU
1	D	116	SER
1	D	123	GLU
1	D	140	SER
1	D	180	ASP
1	D	186	ILE
1	D	211	LYS
1	D	352	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (36) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	29	ASN
1	A	53	HIS
1	A	91	HIS
1	A	197	HIS
1	A	217	ASN
1	A	327	HIS
1	A	352	ASN
1	B	90	GLN
1	B	91	HIS
1	B	147	HIS
1	B	197	HIS
1	B	216	ASN
1	B	217	ASN
1	B	290	GLN
1	B	315	HIS
1	B	348	ASN
1	B	352	ASN
1	C	29	ASN
1	C	53	HIS
1	C	68	HIS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	C	91	HIS
1	C	147	HIS
1	C	176	HIS
1	C	197	HIS
1	C	217	ASN
1	C	291	ASN
1	C	352	ASN
1	D	53	HIS
1	D	91	HIS
1	D	147	HIS
1	D	217	ASN
1	D	290	GLN
1	D	327	HIS
1	D	348	ASN
1	D	352	ASN
1	D	357	HIS

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 ⓘ

8 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	FAD	C	9300	-	58,58,58	1.20	5 (8%)	85,89,89	1.57	15 (17%)
3	GOA	A	9110	-	4,4,4	3.12	2 (50%)	4,4,4	2.14	2 (50%)
2	FAD	D	9400	-	58,58,58	1.20	8 (13%)	85,89,89	1.76	15 (17%)
3	GOA	C	9310	-	4,4,4	2.89	2 (50%)	4,4,4	2.57	3 (75%)
3	GOA	D	9410	-	4,4,4	3.15	2 (50%)	4,4,4	3.13	2 (50%)
2	FAD	A	9100	-	58,58,58	1.24	7 (12%)	85,89,89	1.51	12 (14%)
2	FAD	B	9200	-	58,58,58	1.24	6 (10%)	85,89,89	1.54	14 (16%)
3	GOA	B	9210	-	4,4,4	3.11	2 (50%)	4,4,4	2.54	2 (50%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FAD	C	9300	-	-	0/34/50/50	0/6/6/6
3	GOA	A	9110	-	-	2/2/2/2	-
2	FAD	D	9400	-	-	0/34/50/50	0/6/6/6
3	GOA	C	9310	-	-	0/2/2/2	-
3	GOA	D	9410	-	-	2/2/2/2	-
2	FAD	A	9100	-	-	0/34/50/50	0/6/6/6
2	FAD	B	9200	-	-	0/34/50/50	0/6/6/6
3	GOA	B	9210	-	-	2/2/2/2	-

All (34) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	9110	GOA	CA-C	-5.40	1.31	1.50
3	D	9410	GOA	CA-C	-5.32	1.31	1.50
3	B	9210	GOA	CA-C	-5.31	1.31	1.50
3	C	9310	GOA	CA-C	-5.00	1.32	1.50
2	C	9300	FAD	PA-O3P	4.44	1.64	1.59
2	B	9200	FAD	C4X-N5	4.10	1.39	1.30
2	C	9300	FAD	C4X-N5	4.07	1.39	1.30
2	A	9100	FAD	C4X-N5	3.70	1.38	1.30
2	D	9400	FAD	C4X-N5	3.69	1.38	1.30
2	A	9100	FAD	PA-O3P	3.51	1.63	1.59
2	A	9100	FAD	P-O3P	3.48	1.63	1.59
2	B	9200	FAD	PA-O3P	3.28	1.63	1.59
2	D	9400	FAD	C10-N1	3.22	1.39	1.33

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	9200	FAD	P-O3P	3.10	1.62	1.59
3	D	9410	GOA	O2-CA	-3.09	1.31	1.41
2	B	9200	FAD	C2A-N1A	3.08	1.39	1.33
2	A	9100	FAD	C10-N1	2.91	1.39	1.33
3	B	9210	GOA	O2-CA	-2.87	1.32	1.41
2	D	9400	FAD	C2A-N1A	2.78	1.38	1.33
3	A	9110	GOA	O2-CA	-2.77	1.32	1.41
2	D	9400	FAD	PA-O3P	2.64	1.62	1.59
3	C	9310	GOA	O2-CA	-2.62	1.33	1.41
2	D	9400	FAD	C2A-N3A	2.59	1.38	1.33
2	B	9200	FAD	C10-N1	2.51	1.38	1.33
2	C	9300	FAD	C10-N1	2.48	1.38	1.33
2	D	9400	FAD	C8A-N7A	2.42	1.36	1.31
2	D	9400	FAD	C1'-N10	2.40	1.53	1.47
2	B	9200	FAD	C8A-N7A	2.39	1.36	1.31
2	C	9300	FAD	C2A-N3A	2.36	1.38	1.33
2	A	9100	FAD	C2A-N1A	2.33	1.38	1.33
2	A	9100	FAD	C8A-N7A	2.28	1.36	1.31
2	C	9300	FAD	C8A-N7A	2.22	1.35	1.31
2	A	9100	FAD	C2A-N3A	2.19	1.37	1.33
2	D	9400	FAD	P-O3P	2.11	1.61	1.59

All (65) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	9400	FAD	N3A-C2A-N1A	-7.02	117.95	128.58
2	C	9300	FAD	N3A-C2A-N1A	-6.20	119.20	128.58
2	A	9100	FAD	N3A-C2A-N1A	-5.78	119.83	128.58
2	B	9200	FAD	N3A-C2A-N1A	-5.21	120.69	128.58
3	D	9410	GOA	OXT-C-CA	5.00	120.99	111.90
2	D	9400	FAD	C5A-C4A-N3A	-4.43	120.61	126.72
2	D	9400	FAD	C2A-N3A-C4A	4.13	121.92	111.83
2	B	9200	FAD	N9A-C8A-N7A	-3.95	108.33	113.94
2	A	9100	FAD	N9A-C8A-N7A	-3.93	108.36	113.94
2	D	9400	FAD	N9A-C8A-N7A	-3.89	108.42	113.94
3	B	9210	GOA	OXT-C-CA	3.81	118.83	111.90
2	B	9200	FAD	O2P-P-O3P	3.81	117.58	107.27
2	C	9300	FAD	N9A-C8A-N7A	-3.70	108.68	113.94
3	C	9310	GOA	OXT-C-CA	3.65	118.54	111.90
2	C	9300	FAD	C5A-N7A-C8A	3.60	109.11	103.45
2	C	9300	FAD	C4A-C5A-N7A	-3.54	106.53	110.58
2	D	9400	FAD	C5A-N7A-C8A	3.54	109.01	103.45

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	9200	FAD	C5A-C4A-N3A	-3.51	121.88	126.72
2	B	9200	FAD	C5A-N7A-C8A	3.47	108.90	103.45
2	D	9400	FAD	O2P-P-O3P	3.41	116.50	107.27
3	D	9410	GOA	O-C-CA	-3.41	113.60	123.48
2	A	9100	FAD	C5A-C4A-N3A	-3.30	122.17	126.72
2	D	9400	FAD	C4X-C10-N10	3.27	121.16	116.48
2	C	9300	FAD	C4X-C10-N10	3.24	121.12	116.48
2	A	9100	FAD	C5A-N7A-C8A	3.15	108.40	103.45
3	A	9110	GOA	OXT-C-CA	3.14	117.61	111.90
2	C	9300	FAD	C5A-C4A-N3A	-3.14	122.39	126.72
2	D	9400	FAD	O3P-P-O1P	-3.13	101.28	110.70
2	A	9100	FAD	O2P-P-O3P	3.10	115.66	107.27
2	A	9100	FAD	C2A-N3A-C4A	2.99	119.12	111.83
2	C	9300	FAD	C2A-N3A-C4A	2.97	119.10	111.83
2	B	9200	FAD	O3P-P-O1P	-2.91	101.96	110.70
3	B	9210	GOA	O-C-CA	-2.90	115.09	123.48
2	D	9400	FAD	C4-N3-C2	-2.88	120.53	125.64
2	D	9400	FAD	C4X-C4-N3	2.86	120.53	113.25
2	A	9100	FAD	C4X-C10-N10	2.85	120.56	116.48
2	A	9100	FAD	O3P-P-O1P	-2.82	102.23	110.70
2	B	9200	FAD	C4X-C10-N10	2.82	120.51	116.48
2	D	9400	FAD	C4A-C5A-N7A	-2.79	107.40	110.58
2	C	9300	FAD	C2A-N1A-C6A	2.72	123.20	118.73
2	B	9200	FAD	C2A-N3A-C4A	2.71	118.45	111.83
2	D	9400	FAD	N3A-C4A-N9A	2.65	131.67	127.17
2	A	9100	FAD	C5X-C9A-N10	2.65	120.36	117.97
2	B	9200	FAD	C4-N3-C2	-2.63	120.97	125.64
3	C	9310	GOA	O-C-CA	-2.63	115.88	123.48
2	B	9200	FAD	C4A-C5A-N7A	-2.61	107.60	110.58
2	C	9300	FAD	C4-N3-C2	-2.57	121.08	125.64
2	A	9100	FAD	C4A-C5A-N7A	-2.56	107.65	110.58
2	B	9200	FAD	C10-C4X-N5	-2.52	119.66	124.81
3	A	9110	GOA	O-C-CA	-2.52	116.19	123.48
2	C	9300	FAD	O3P-P-O1P	-2.50	103.17	110.70
2	C	9300	FAD	C4X-C4-N3	2.47	119.53	113.25
2	C	9300	FAD	C4'-C3'-C2'	-2.42	109.55	113.57
2	B	9200	FAD	C4X-C4-N3	2.33	119.19	113.25
3	C	9310	GOA	O2-CA-C	2.32	118.13	112.37
2	D	9400	FAD	C10-C4X-N5	-2.29	120.13	124.81
2	A	9100	FAD	C10-C4X-N5	-2.28	120.14	124.81
2	C	9300	FAD	C10-C4X-N5	-2.27	120.16	124.81
2	D	9400	FAD	C4-C4X-N5	2.26	121.33	118.21

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	9200	FAD	N3A-C4A-N9A	2.19	130.88	127.17
2	B	9200	FAD	C4A-N9A-C8A	2.10	107.94	105.74
2	C	9300	FAD	C5A-C4A-N9A	2.08	108.07	105.81
2	C	9300	FAD	O2P-P-O3P	2.02	112.73	107.27
2	A	9100	FAD	C4X-C4-N3	2.01	118.37	113.25
2	D	9400	FAD	O4-C4-C4X	-2.01	121.23	126.53

There are no chirality outliers.

All (6) torsion outliers are listed below:

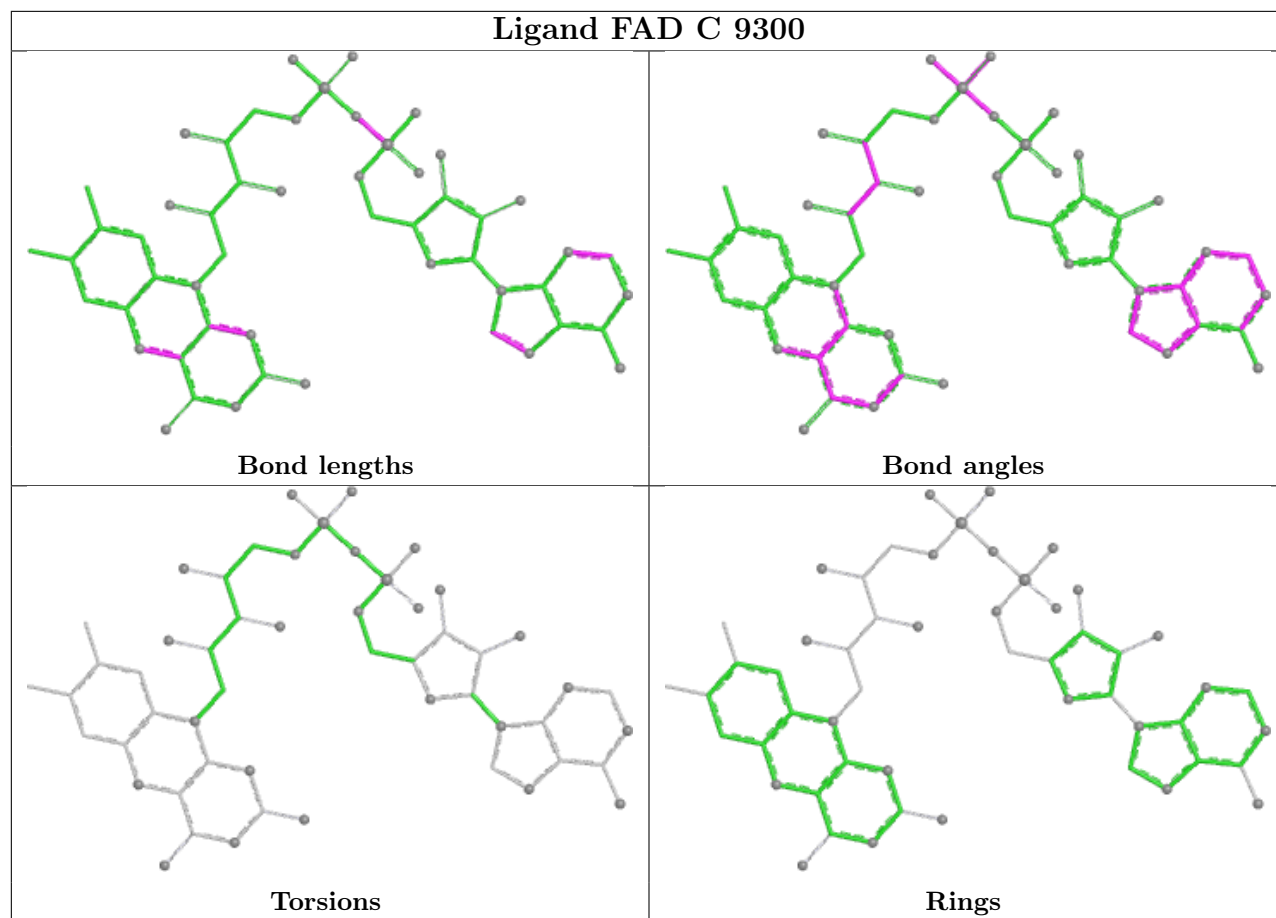
Mol	Chain	Res	Type	Atoms
3	A	9110	GOA	O-C-CA-O2
3	A	9110	GOA	OXT-C-CA-O2
3	B	9210	GOA	O-C-CA-O2
3	B	9210	GOA	OXT-C-CA-O2
3	D	9410	GOA	O-C-CA-O2
3	D	9410	GOA	OXT-C-CA-O2

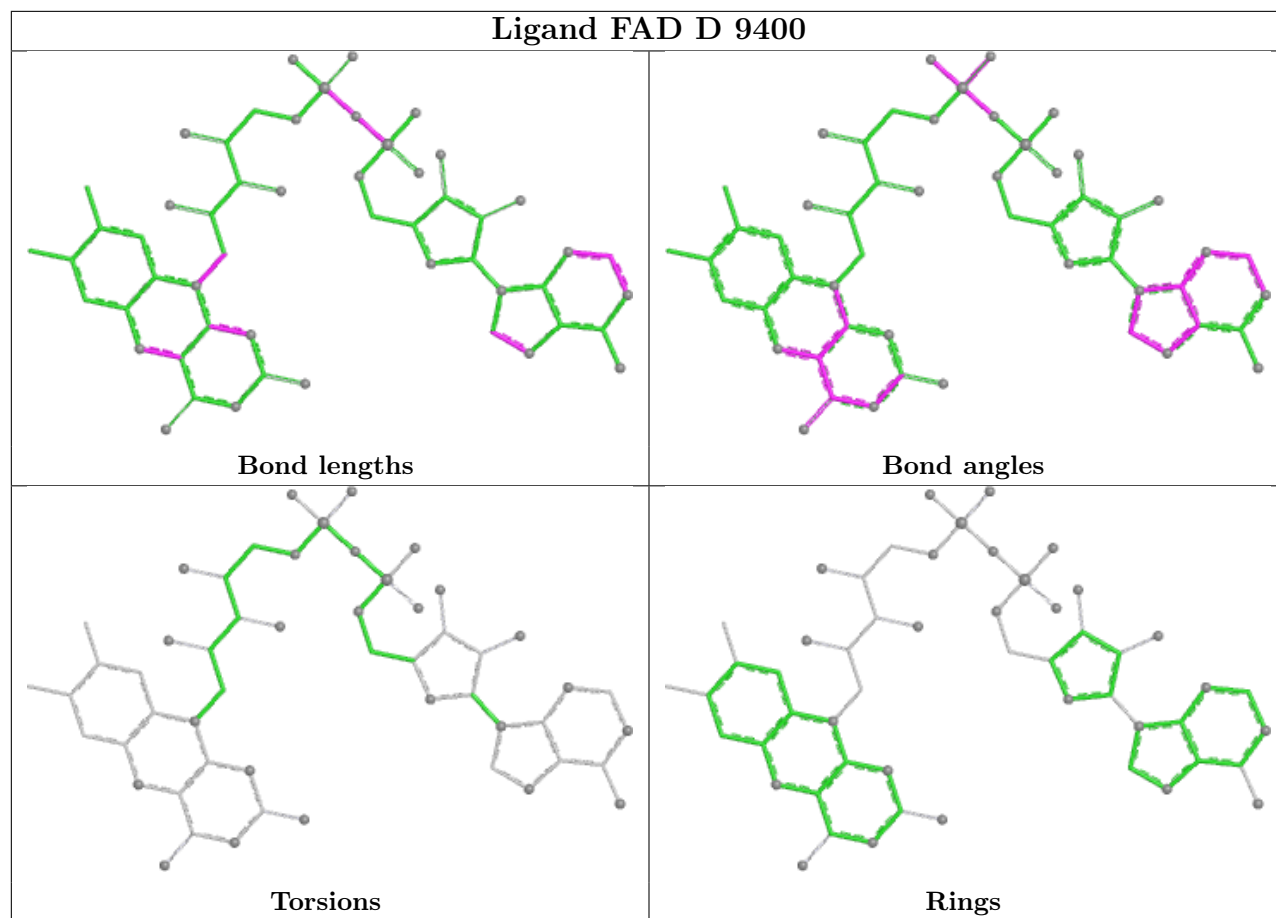
There are no ring outliers.

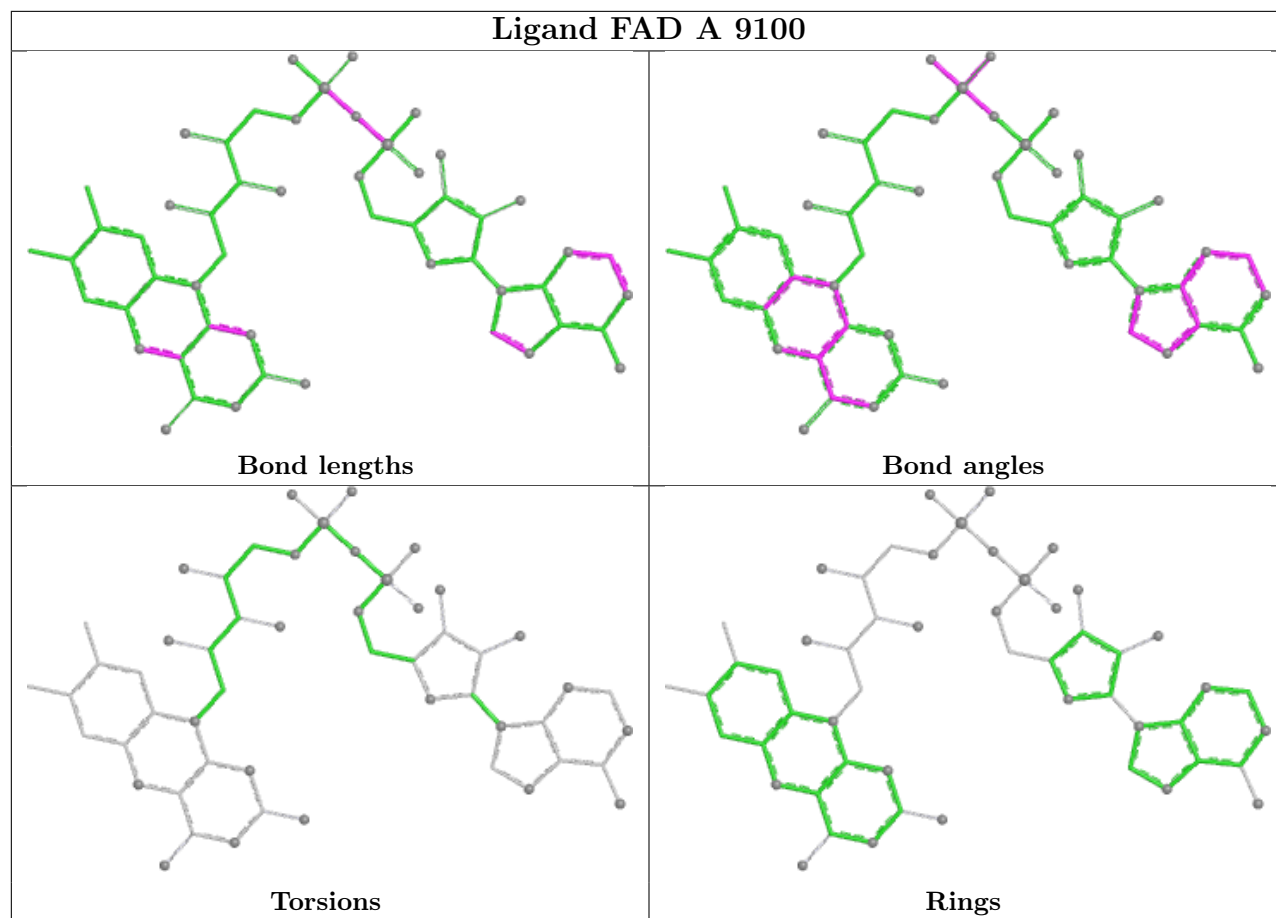
4 monomers are involved in 5 short contacts:

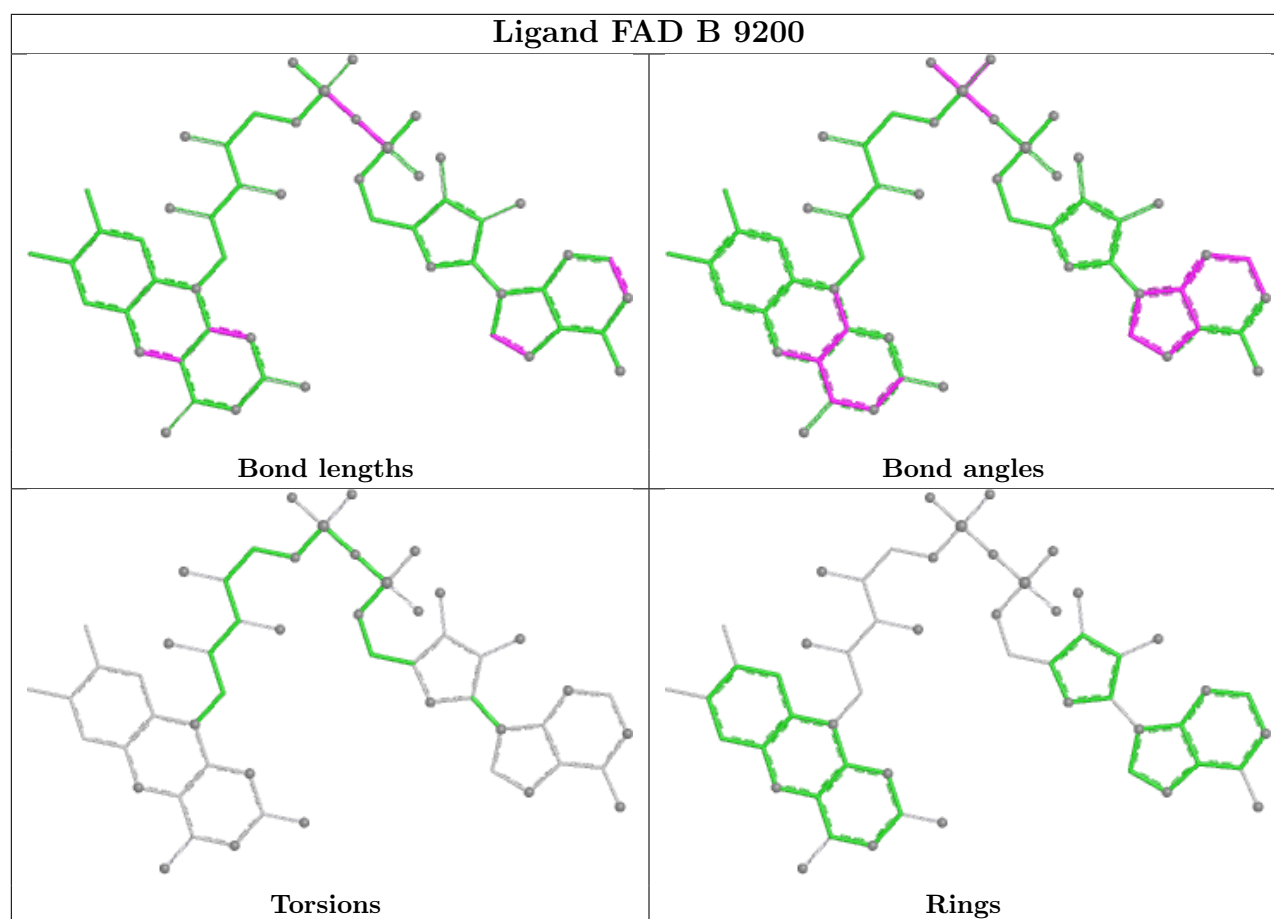
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	9110	GOA	1	0
3	C	9310	GOA	2	0
3	D	9410	GOA	1	0
3	B	9210	GOA	1	0

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	364/382 (95%)	-0.07	11 (3%) 52 52	11, 26, 50, 71	1 (0%)
1	B	364/382 (95%)	-0.08	6 (1%) 70 71	10, 25, 44, 83	2 (0%)
1	C	364/382 (95%)	-0.19	4 (1%) 78 78	10, 23, 44, 75	1 (0%)
1	D	364/382 (95%)	0.13	9 (2%) 58 58	10, 28, 49, 83	2 (0%)
All	All	1456/1528 (95%)	-0.05	30 (2%) 63 64	10, 26, 48, 83	6 (0%)

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	56	CYS	6.1
1	B	56	CYS	4.9
1	D	54	ALA	4.7
1	B	54	ALA	4.4
1	C	57	GLU	3.9
1	D	56	CYS	3.6
1	B	55	GLU	3.5
1	B	58	GLU	3.5
1	A	183	ALA	3.5
1	A	56	CYS	3.4
1	D	186	ILE	3.4
1	A	179	ARG	2.9
1	A	55	GLU	2.9
1	A	58	GLU	2.9
1	A	54	ALA	2.8
1	D	55	GLU	2.8
1	A	181	GLY	2.7
1	D	116	SER	2.6
1	D	191	GLY	2.5
1	C	54	ALA	2.4
1	A	127	GLU	2.4

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	C	55	GLU	2.4
1	D	180	ASP	2.3
1	A	194	TRP	2.2
1	B	57	GLU	2.1
1	A	107	GLN	2.1
1	D	115	ASP	2.1
1	A	117	VAL	2.0
1	D	117	VAL	2.0
1	B	117	VAL	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](#)

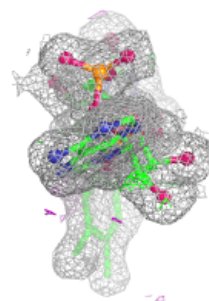
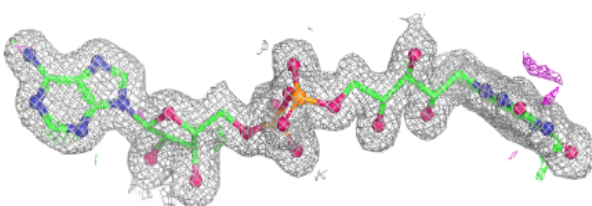
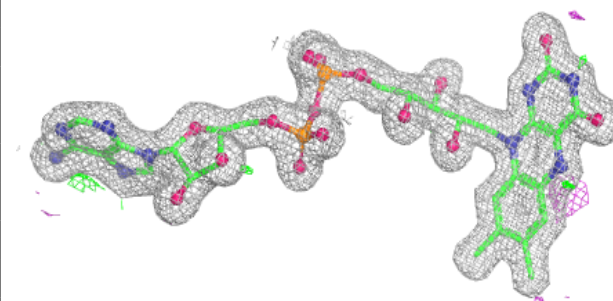
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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
3	GOA	B	9210	5/5	0.91	0.18	26,30,36,55	0
3	GOA	D	9410	5/5	0.91	0.19	28,29,35,41	0
3	GOA	C	9310	5/5	0.92	0.21	21,26,34,51	0
3	GOA	A	9110	5/5	0.93	0.14	22,25,32,44	0
2	FAD	C	9300	53/53	0.98	0.04	12,16,19,20	0
2	FAD	D	9400	53/53	0.98	0.06	14,21,27,29	0
2	FAD	B	9200	53/53	0.98	0.05	13,18,22,23	0
2	FAD	A	9100	53/53	0.99	0.04	14,18,20,26	0

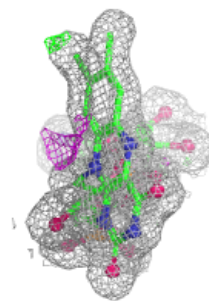
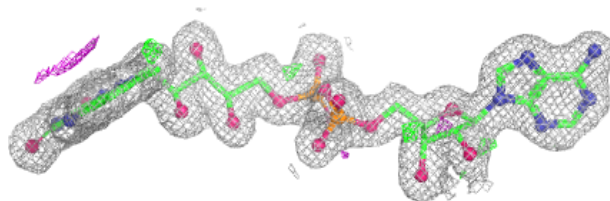
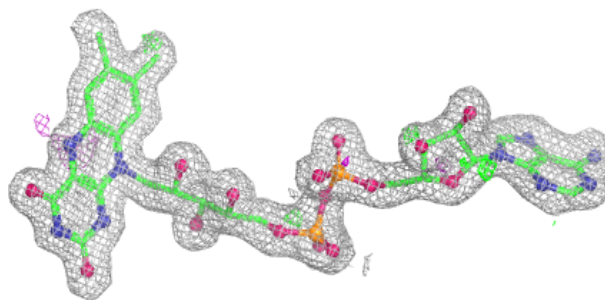
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FAD C 9300:

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

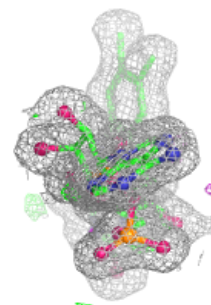
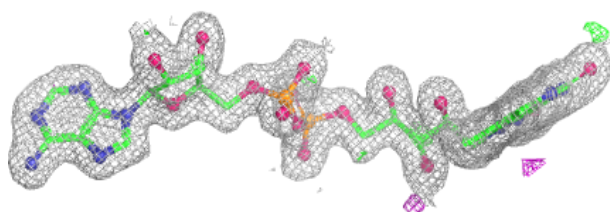
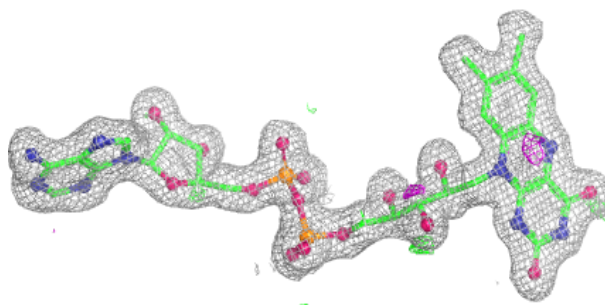
**Electron density around FAD D 9400:**

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

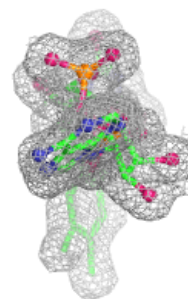
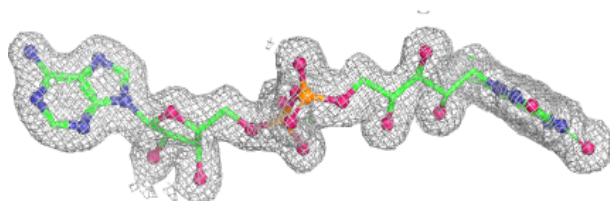
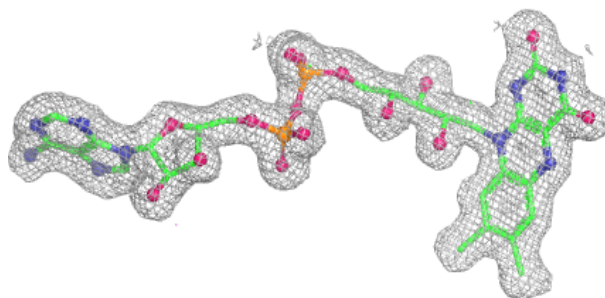


Electron density around FAD B 9200:

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

**Electron density around FAD A 9100:**

$2mF_o-DF_c$ (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.