



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 24, 2026 – 09:38 PM EDT

PDB ID : 1D4A / pdb_00001d4a
Title : CRYSTAL STRUCTURE OF HUMAN NAD[P]H-QUINONE OXIDOREDUCTASE AT 1.7 Å RESOLUTION
Authors : Faig, M.; Bianchet, M.A.; Chen, S.; Winski, S.; Ross, D.; Amzel, L.M.
Deposited on : 1999-10-01
Resolution : 1.70 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

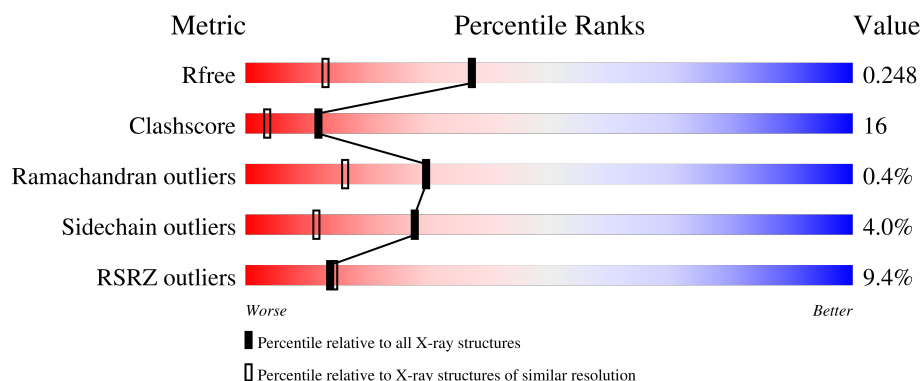
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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	5551 (1.70-1.70)
Clashscore	190562	5924 (1.70-1.70)
Ramachandran outliers	187476	5846 (1.70-1.70)
Sidechain outliers	187428	5846 (1.70-1.70)
RSRZ outliers	180081	5554 (1.70-1.70)

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	273	8% 71% 26% ••
1	B	273	7% 69% 28% •
1	C	273	12% 72% 25% •
1	D	273	11% 65% 31% •

2 Entry composition i

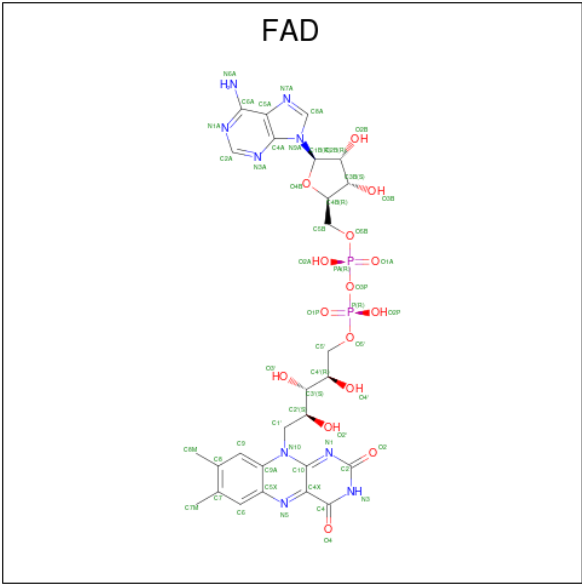
There are 3 unique types of molecules in this entry. The entry contains 9496 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 QUINONE REDUCTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	0	0
			2173	1412	365	389	7			
1	B	273	Total	C	N	O	S	0	0	0
			2173	1412	365	389	7			
1	C	273	Total	C	N	O	S	0	0	0
			2173	1412	365	389	7			
1	D	273	Total	C	N	O	S	0	0	0
			2173	1412	365	389	7			

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



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		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
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		

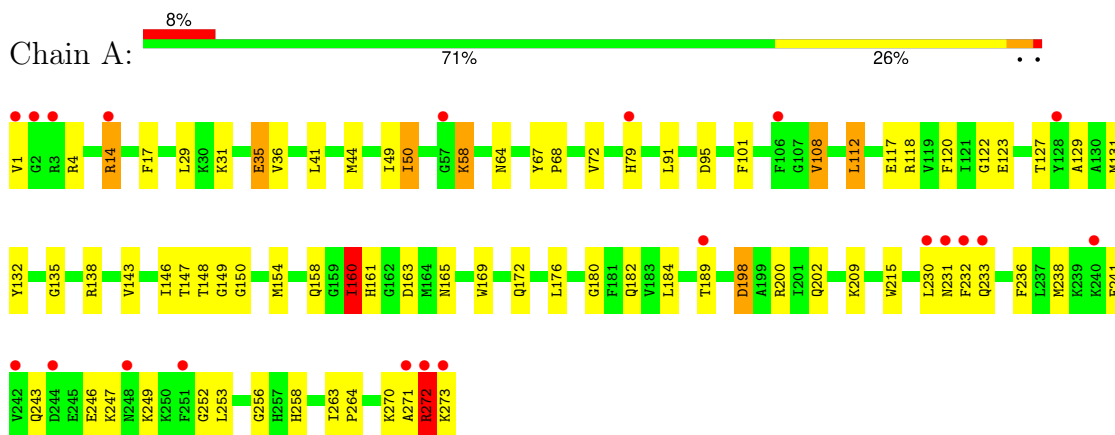
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	145	Total	O	0	0
			145	145		
3	B	170	Total	O	0	0
			170	170		
3	C	133	Total	O	0	0
			133	133		
3	D	144	Total	O	0	0
			144	144		

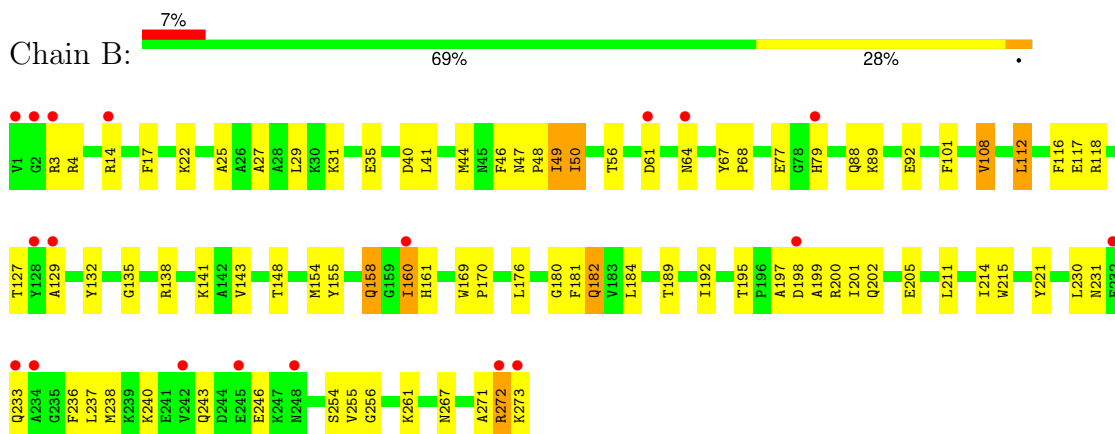
3 Residue-property plots [i](#)

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.

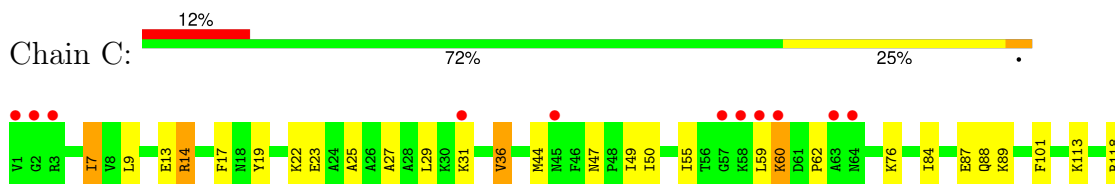
• Molecule 1: QUINONE REDUCTASE

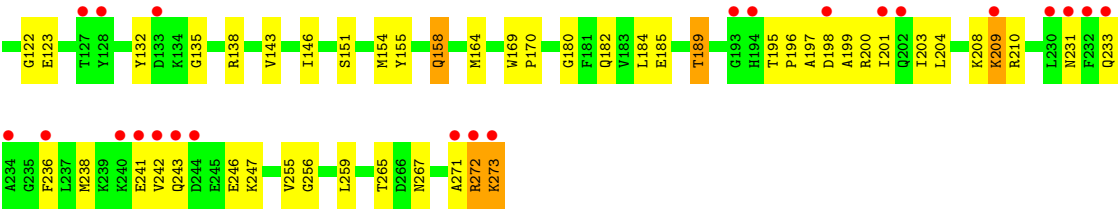


• Molecule 1: QUINONE REDUCTASE

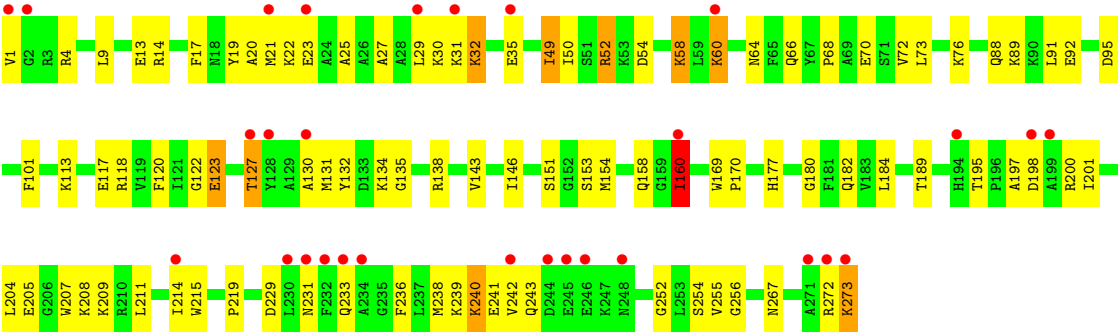


• Molecule 1: QUINONE REDUCTASE





● Molecule 1: QUINONE REDUCTASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	55.68Å 57.03Å 97.40Å 77.04° 76.72° 86.89°	Depositor
Resolution (Å)	43.63 – 1.70 43.63 – 1.70	Depositor EDS
% Data completeness (in resolution range)	78.6 (43.63-1.70) 78.7 (43.63-1.70)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.00 (at 1.70Å)	Xtriage
Refinement program	CNS 0.9	Depositor
R, R_{free}	0.209 , 0.253 0.204 , 0.248	Depositor DCC
R_{free} test set	9755 reflections (9.91%)	wwPDB-VP
Wilson B-factor (Å ²)	20.2	Xtriage
Anisotropy	0.019	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 43.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.012 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	9496	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.68% 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	0.47	0/2231	0.97	15/3012 (0.5%)
1	B	0.47	0/2231	0.97	8/3012 (0.3%)
1	C	0.46	0/2231	0.94	7/3012 (0.2%)
1	D	0.47	0/2231	0.97	12/3012 (0.4%)
All	All	0.47	0/8924	0.96	42/12048 (0.3%)

There are no bond length outliers.

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	182	GLN	N-CA-C	-8.11	96.06	108.96
1	D	182	GLN	N-CA-C	-7.90	96.40	108.96
1	C	101	PHE	N-CA-C	7.78	115.22	108.22
1	D	101	PHE	N-CA-C	7.76	115.12	108.13
1	C	182	GLN	N-CA-C	-7.58	96.87	109.46
1	D	135	GLY	CA-C-N	7.44	127.47	119.28
1	D	135	GLY	C-N-CA	7.44	127.47	119.28
1	B	101	PHE	N-CA-C	7.35	114.83	108.22
1	B	182	GLN	N-CA-C	-6.74	98.25	108.96
1	A	101	PHE	N-CA-C	6.65	114.20	108.22
1	B	61	ASP	CA-C-N	6.64	126.42	119.05
1	B	61	ASP	C-N-CA	6.64	126.42	119.05
1	A	160	ILE	CB-CA-C	-6.56	103.44	112.04
1	B	35	GLU	N-CA-C	-6.44	98.74	109.24
1	C	36	VAL	N-CA-C	6.44	117.19	108.17
1	B	49	ILE	N-CA-C	6.09	116.64	107.80
1	D	160	ILE	N-CA-C	5.97	116.71	110.62
1	D	95	ASP	N-CA-C	-5.86	105.80	113.12
1	B	160	ILE	CB-CA-C	-5.81	104.43	112.04
1	C	135	GLY	CA-C-N	5.71	126.09	119.47

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	135	GLY	C-N-CA	5.71	126.09	119.47
1	A	95	ASP	N-CA-C	-5.68	106.02	113.12
1	A	146	ILE	N-CA-C	5.65	116.72	108.53
1	A	252	GLY	N-CA-C	-5.61	104.03	112.60
1	C	146	ILE	N-CA-C	5.49	116.38	108.48
1	A	79	HIS	N-CA-C	5.47	117.00	110.44
1	B	41	LEU	N-CA-C	5.42	117.89	111.33
1	A	36	VAL	N-CA-C	5.34	115.54	107.80
1	A	135	GLY	CA-C-N	5.31	125.12	119.28
1	A	135	GLY	C-N-CA	5.31	125.12	119.28
1	D	13	GLU	N-CA-C	5.30	117.37	108.73
1	D	146	ILE	N-CA-C	5.29	116.20	108.53
1	D	195	THR	CA-C-N	5.26	125.20	119.78
1	D	195	THR	C-N-CA	5.26	125.20	119.78
1	A	232	PHE	N-CA-C	5.23	116.98	111.28
1	C	13	GLU	N-CA-C	5.21	117.46	109.07
1	A	35	GLU	N-CA-C	-5.21	100.24	108.73
1	A	49	ILE	N-CA-C	5.17	115.22	107.51
1	A	176	LEU	N-CA-C	5.16	116.60	110.97
1	D	49	ILE	N-CA-C	5.16	115.53	107.99
1	D	252	GLY	N-CA-C	-5.05	104.71	112.85
1	A	58	LYS	N-CA-C	-5.01	102.35	110.32

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	2173	0	2172	65	0
1	B	2173	0	2172	75	0
1	C	2173	0	2172	66	0
1	D	2173	0	2172	89	0
2	A	53	0	31	4	0
2	B	53	0	31	2	0
2	C	53	0	31	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	53	0	31	1	0
3	A	145	0	0	3	0
3	B	170	0	0	5	0
3	C	133	0	0	5	0
3	D	144	0	0	9	0
All	All	9496	0	8812	278	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 16.

All (278) 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:135:GLY:O	1:B:138:ARG:HG3	1.56	1.05
1:A:127:THR:HG22	1:A:129:ALA:H	1.35	0.92
1:D:60:LYS:HG3	1:D:70:GLU:OE1	1.70	0.90
1:B:108:VAL:HG13	1:B:112:LEU:HB3	1.59	0.84
1:C:151:SER:H	1:C:154:MET:HE3	1.43	0.84
1:A:189:THR:HG22	3:A:674:HOH:O	1.79	0.82
1:B:143:VAL:HG22	1:B:184:LEU:HB2	1.62	0.81
1:B:50:ILE:HD12	1:B:117:GLU:HB3	1.63	0.80
1:C:59:LEU:HB2	1:C:62:PRO:HG3	1.63	0.80
1:D:17:PHE:HB2	2:D:604:FAD:H52A	1.64	0.78
1:B:236:PHE:HB3	1:D:160:ILE:HG13	1.68	0.76
1:D:127:THR:CG2	1:D:130:ALA:HB3	2.15	0.75
1:A:58:LYS:N	1:A:58:LYS:HD2	2.01	0.75
1:D:240:LYS:H	1:D:240:LYS:HD2	1.53	0.74
1:B:221:TYR:HB3	1:B:273:LYS:HA	1.70	0.74
1:A:108:VAL:HG13	1:A:112:LEU:HB3	1.70	0.74
1:D:151:SER:H	1:D:154:MET:HE3	1.53	0.73
1:A:202:GLN:HA	1:A:202:GLN:HE21	1.53	0.73
1:C:209:LYS:HD3	1:C:210:ARG:N	2.03	0.73
1:D:189:THR:HG22	3:D:629:HOH:O	1.88	0.72
1:A:17:PHE:HB2	2:A:601:FAD:H52A	1.70	0.71
1:B:154:MET:HE3	1:B:160:ILE:HD11	1.71	0.71
1:D:255:VAL:HG23	1:D:267:ASN:HD22	1.55	0.71
1:B:271:ALA:O	1:B:272:ARG:HB2	1.89	0.71
1:C:273:LYS:H	1:C:273:LYS:HD2	1.54	0.70
1:D:25:ALA:O	1:D:29:LEU:HD13	1.91	0.70
1:B:88:GLN:O	1:B:92:GLU:HG3	1.91	0.70
1:C:50:ILE:HG22	1:C:118:ARG:HG2	1.73	0.70

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:122:GLY:O	1:C:123:GLU:HB2	1.92	0.70
1:A:68:PRO:O	1:A:72:VAL:HG23	1.92	0.69
1:A:1:VAL:HA	1:A:215:TRP:CD1	2.28	0.69
1:B:3:ARG:HE	1:B:3:ARG:HA	1.56	0.69
1:B:50:ILE:HG12	1:B:67:TYR:CZ	2.28	0.69
1:A:108:VAL:CG1	1:A:112:LEU:HB3	2.23	0.69
1:C:17:PHE:HB2	2:C:603:FAD:H52A	1.75	0.68
1:C:143:VAL:HG22	1:C:184:LEU:HB2	1.74	0.68
1:D:50:ILE:HG22	1:D:118:ARG:HG2	1.76	0.68
1:D:88:GLN:O	1:D:92:GLU:HG3	1.94	0.68
1:A:231:ASN:HD22	1:A:233:GLN:HG3	1.58	0.68
1:D:4:ARG:HG2	3:D:670:HOH:O	1.94	0.68
1:B:40:ASP:O	1:B:44:MET:HG2	1.94	0.67
1:B:17:PHE:HB2	2:B:602:FAD:H52A	1.75	0.67
1:C:233:GLN:HA	1:C:233:GLN:HE21	1.58	0.66
1:C:76:LYS:HE2	1:C:123:GLU:OE2	1.95	0.66
1:A:231:ASN:ND2	1:A:233:GLN:HG3	2.11	0.66
1:A:238:MET:HE2	1:A:243:GLN:HG2	1.78	0.66
1:C:14:ARG:NH1	1:C:14:ARG:HB2	2.12	0.65
1:D:60:LYS:HG2	1:D:73:LEU:CD2	2.27	0.65
1:B:202:GLN:HE21	1:B:202:GLN:HA	1.62	0.65
1:B:221:TYR:CB	1:B:273:LYS:HA	2.27	0.64
1:D:60:LYS:CD	1:D:73:LEU:HD22	2.27	0.63
1:A:238:MET:HE3	1:A:243:GLN:HA	1.81	0.63
1:A:271:ALA:O	1:A:272:ARG:HB3	1.99	0.63
1:B:50:ILE:HG13	1:B:118:ARG:HG2	1.80	0.63
1:B:64:ASN:HB2	3:B:715:HOH:O	1.99	0.63
1:B:192:ILE:HD11	1:B:200:ARG:HD3	1.80	0.63
1:A:200:ARG:NH1	2:A:601:FAD:H1B	2.14	0.62
1:C:243:GLN:O	1:C:247:LYS:HG3	2.00	0.62
1:A:246:GLU:OE1	1:A:249:LYS:HD2	1.98	0.62
1:C:272:ARG:H	1:C:273:LYS:HZ3	1.47	0.62
1:D:21:MET:HE2	1:D:207:TRP:CD1	2.34	0.62
1:D:231:ASN:OD1	1:D:233:GLN:HB3	1.99	0.62
1:A:148:THR:HG23	2:A:601:FAD:O2	2.00	0.61
1:A:50:ILE:HD12	1:A:117:GLU:HB3	1.82	0.61
1:C:169:TRP:HB3	1:C:170:PRO:HD3	1.81	0.61
1:B:236:PHE:HD2	1:D:160:ILE:HD11	1.65	0.61
1:D:189:THR:HG23	3:D:644:HOH:O	2.01	0.61
1:A:143:VAL:HG22	1:A:184:LEU:HB2	1.83	0.61
1:B:127:THR:HG22	1:B:129:ALA:H	1.66	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:255:VAL:HG23	1:B:267:ASN:HD22	1.64	0.61
1:A:264:PRO:HG3	1:A:273:LYS:HE3	1.83	0.61
1:A:160:ILE:CG1	1:C:236:PHE:HB3	2.32	0.60
1:B:197:ALA:HA	1:B:200:ARG:NH1	2.17	0.59
1:A:50:ILE:CD1	1:A:117:GLU:HB3	2.32	0.59
1:B:25:ALA:O	1:B:29:LEU:HD13	2.02	0.59
1:D:169:TRP:CZ2	1:D:256:GLY:HA3	2.38	0.59
1:C:84:ILE:O	1:C:88:GLN:HG3	2.02	0.59
1:D:89:LYS:HD2	3:D:717:HOH:O	2.03	0.59
1:B:108:VAL:HG22	1:B:112:LEU:HD13	1.84	0.59
1:B:148:THR:HG22	2:B:602:FAD:O2	2.02	0.59
1:D:20:ALA:HA	1:D:23:GLU:OE2	2.03	0.59
1:A:160:ILE:HG13	1:C:236:PHE:HB3	1.84	0.58
1:C:189:THR:HG22	3:C:721:HOH:O	2.02	0.58
1:B:48:PRO:HG3	1:D:49:ILE:HD11	1.86	0.58
1:B:89:LYS:HG3	3:B:703:HOH:O	2.04	0.58
1:C:238:MET:HE3	1:C:243:GLN:HG2	1.86	0.58
1:B:236:PHE:HD2	1:D:160:ILE:CD1	2.18	0.57
1:B:236:PHE:HB3	1:D:160:ILE:CG1	2.33	0.57
1:D:127:THR:HG23	1:D:130:ALA:HB3	1.84	0.57
1:A:148:THR:HG22	1:A:150:GLY:N	2.18	0.57
1:C:7:ILE:N	1:C:7:ILE:HD12	2.20	0.57
1:D:169:TRP:HB3	1:D:170:PRO:HD3	1.87	0.57
1:B:108:VAL:CG1	1:B:112:LEU:HB3	2.33	0.57
1:C:27:ALA:O	1:C:31:LYS:HD3	2.05	0.56
1:A:238:MET:CE	1:A:243:GLN:HG2	2.35	0.56
1:B:202:GLN:HA	1:B:202:GLN:NE2	2.21	0.56
1:B:272:ARG:O	1:B:273:LYS:HB2	2.05	0.55
1:D:29:LEU:CD1	1:D:211:LEU:HD13	2.36	0.55
1:A:138:ARG:HA	1:A:180:GLY:O	2.06	0.55
1:C:255:VAL:HG23	1:C:267:ASN:HD22	1.72	0.55
1:C:204:LEU:O	1:C:208:LYS:HG3	2.07	0.55
1:A:131:MET:HE1	1:A:236:PHE:CD2	2.42	0.55
1:D:58:LYS:NZ	1:D:58:LYS:HB2	2.22	0.54
1:D:122:GLY:O	1:D:123:GLU:HB2	2.07	0.54
1:B:169:TRP:CZ2	1:B:256:GLY:HA3	2.43	0.54
1:B:169:TRP:HB3	1:B:170:PRO:HD3	1.88	0.54
1:B:143:VAL:CG2	1:B:184:LEU:HD12	2.38	0.54
1:B:154:MET:HE2	1:B:161:HIS:NE2	2.22	0.54
1:C:14:ARG:CB	1:C:14:ARG:HH11	2.20	0.54
1:C:158:GLN:H	1:C:158:GLN:NE2	2.06	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:231:ASN:HD21	1:A:233:GLN:HE21	1.57	0.53
1:B:246:GLU:O	1:B:261:LYS:NZ	2.41	0.53
1:B:148:THR:HG21	1:B:155:TYR:CE2	2.43	0.53
1:D:127:THR:HG23	1:D:130:ALA:H	1.74	0.53
1:A:127:THR:HG22	1:A:129:ALA:N	2.16	0.53
1:D:201:ILE:O	1:D:205:GLU:HG2	2.08	0.53
1:A:14:ARG:CD	1:A:14:ARG:H	2.21	0.53
1:B:108:VAL:CG2	1:B:112:LEU:HD13	2.39	0.53
1:B:230:LEU:HD22	1:D:160:ILE:HD13	1.91	0.53
1:C:195:THR:HG22	1:C:199:ALA:HB3	1.91	0.53
1:D:273:LYS:HB3	3:D:648:HOH:O	2.09	0.52
1:D:127:THR:HG21	1:D:130:ALA:HB3	1.90	0.52
1:C:76:LYS:HE3	1:C:123:GLU:HG3	1.90	0.52
1:A:122:GLY:O	1:A:123:GLU:HB3	2.09	0.52
1:A:147:THR:HG22	1:A:189:THR:OG1	2.10	0.52
1:A:273:LYS:HG2	1:A:273:LYS:OXT	2.09	0.52
1:C:169:TRP:CZ2	1:C:256:GLY:HA3	2.44	0.52
1:D:255:VAL:H	1:D:267:ASN:ND2	2.08	0.52
1:C:231:ASN:OD1	1:C:233:GLN:HB3	2.10	0.52
1:B:189:THR:HG23	3:B:608:HOH:O	2.09	0.52
1:D:27:ALA:O	1:D:31:LYS:HG3	2.10	0.51
1:C:44:MET:HE1	1:C:87:GLU:OE2	2.10	0.51
1:C:197:ALA:HA	1:C:200:ARG:NH1	2.25	0.51
1:B:195:THR:HG22	1:B:199:ALA:HB3	1.93	0.51
1:A:198:ASP:O	1:A:202:GLN:HG2	2.11	0.51
1:B:154:MET:HE2	1:B:161:HIS:CD2	2.45	0.51
1:B:231:ASN:ND2	1:B:233:GLN:HB3	2.26	0.51
1:D:197:ALA:HA	1:D:200:ARG:NH1	2.25	0.51
1:A:200:ARG:HH11	2:A:601:FAD:H1B	1.76	0.51
1:C:189:THR:HG23	3:C:642:HOH:O	2.11	0.51
1:D:60:LYS:HG2	1:D:73:LEU:HD23	1.93	0.51
1:B:4:ARG:HB3	3:B:700:HOH:O	2.10	0.51
1:D:138:ARG:HA	1:D:180:GLY:O	2.11	0.51
1:B:230:LEU:CD2	1:D:160:ILE:HD13	2.41	0.50
1:D:204:LEU:O	1:D:208:LYS:HG3	2.11	0.50
1:C:271:ALA:O	1:C:272:ARG:HB2	2.10	0.50
1:B:237:LEU:HD21	1:D:153:SER:HB2	1.92	0.50
1:B:201:ILE:O	1:B:205:GLU:HG2	2.12	0.50
1:C:25:ALA:O	1:C:29:LEU:HD13	2.12	0.50
1:B:236:PHE:HB3	1:D:160:ILE:CD1	2.42	0.49
1:D:238:MET:HE3	1:D:243:GLN:HG2	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:47:ASN:ND2	1:B:49:ILE:H	2.09	0.49
1:C:60:LYS:NZ	1:C:60:LYS:HB3	2.27	0.49
1:D:19:TYR:O	1:D:23:GLU:HG2	2.12	0.49
1:C:89:LYS:HG3	3:C:623:HOH:O	2.12	0.49
1:C:197:ALA:O	1:C:201:ILE:HG13	2.11	0.49
1:B:238:MET:HE3	1:B:243:GLN:HG2	1.93	0.49
1:C:143:VAL:CG2	1:C:184:LEU:HD12	2.43	0.49
1:D:60:LYS:HB2	1:D:60:LYS:NZ	2.28	0.49
1:C:14:ARG:HB2	1:C:14:ARG:HH11	1.77	0.49
1:C:138:ARG:HA	1:C:180:GLY:O	2.11	0.49
1:A:253:LEU:O	1:A:273:LYS:HE3	2.13	0.49
1:B:112:LEU:HD22	1:B:116:PHE:CE2	2.48	0.49
1:B:77:GLU:HB2	1:B:79:HIS:CE1	2.48	0.48
1:C:273:LYS:HD2	1:C:273:LYS:N	2.27	0.48
1:D:113:LYS:O	1:D:117:GLU:HG3	2.13	0.48
1:A:169:TRP:CZ2	1:A:256:GLY:HA3	2.48	0.48
1:A:264:PRO:HG3	1:A:273:LYS:CE	2.42	0.48
1:A:270:LYS:O	1:A:272:ARG:NH1	2.46	0.48
1:B:46:PHE:O	1:B:48:PRO:HD3	2.14	0.48
1:C:233:GLN:HA	1:C:233:GLN:NE2	2.26	0.48
1:B:271:ALA:O	1:B:272:ARG:CB	2.61	0.48
1:C:55:ILE:N	1:C:55:ILE:HD12	2.29	0.48
1:D:197:ALA:HA	1:D:200:ARG:CZ	2.44	0.48
1:A:202:GLN:HA	1:A:202:GLN:NE2	2.23	0.47
1:D:23:GLU:HG3	3:D:687:HOH:O	2.14	0.47
1:D:60:LYS:HG2	1:D:73:LEU:HD22	1.96	0.47
1:D:4:ARG:HG3	1:D:35:GLU:HB2	1.96	0.47
1:C:238:MET:HE2	1:C:259:LEU:HD21	1.97	0.47
1:D:68:PRO:O	1:D:72:VAL:HG23	2.14	0.47
1:B:240:LYS:HD2	1:B:240:LYS:C	2.39	0.47
1:D:272:ARG:O	1:D:273:LYS:HE3	2.14	0.47
1:A:50:ILE:HG13	1:A:118:ARG:HG2	1.95	0.47
1:B:22:LYS:C	1:B:22:LYS:HD2	2.40	0.47
1:C:14:ARG:HG2	1:C:19:TYR:CZ	2.50	0.47
1:D:60:LYS:HD3	1:D:73:LEU:HD22	1.97	0.47
1:D:240:LYS:H	1:D:240:LYS:CD	2.23	0.47
1:B:202:GLN:NE2	1:B:202:GLN:CA	2.78	0.47
1:C:200:ARG:HA	1:C:203:ILE:HD12	1.98	0.46
1:A:67:TYR:HB3	1:A:68:PRO:HD3	1.97	0.46
1:C:272:ARG:H	1:C:273:LYS:NZ	2.13	0.46
1:A:243:GLN:O	1:A:247:LYS:HG3	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:32:LYS:HD2	1:D:32:LYS:HA	1.75	0.46
1:B:236:PHE:CD2	1:D:160:ILE:HD11	2.48	0.45
1:C:155:TYR:HB3	1:C:164:MET:HB2	1.98	0.45
1:C:7:ILE:HD13	1:C:36:VAL:HG13	1.99	0.45
1:D:229:ASP:O	1:D:236:PHE:HA	2.16	0.45
1:A:4:ARG:HE	1:A:35:GLU:CD	2.25	0.45
1:A:163:ASP:OD2	1:A:165:ASN:HB2	2.15	0.45
1:B:198:ASP:O	1:B:202:GLN:HG2	2.16	0.45
1:A:258:HIS:HB3	1:A:263:ILE:HG12	1.98	0.45
1:D:30:LYS:C	1:D:32:LYS:H	2.22	0.45
1:A:148:THR:CG2	1:A:149:GLY:N	2.79	0.45
3:B:734:HOH:O	1:D:52:ARG:HD3	2.16	0.45
1:D:29:LEU:HD11	1:D:211:LEU:HD13	1.97	0.45
1:D:54:ASP:OD2	1:D:118:ARG:HD2	2.17	0.45
1:D:132:TYR:O	1:D:180:GLY:HA2	2.16	0.45
1:A:272:ARG:N	1:A:272:ARG:HD3	2.32	0.45
1:B:236:PHE:CD2	1:D:160:ILE:CD1	3.00	0.45
1:C:185:GLU:HG3	3:C:662:HOH:O	2.15	0.45
1:D:233:GLN:HE21	1:D:233:GLN:HA	1.82	0.45
1:A:14:ARG:HD2	1:A:14:ARG:N	2.32	0.45
1:A:202:GLN:NE2	1:A:202:GLN:CA	2.80	0.44
1:D:241:GLU:CD	1:D:241:GLU:H	2.24	0.44
1:B:158:GLN:HE21	1:D:238:MET:CE	2.31	0.44
1:D:1:VAL:HA	1:D:215:TRP:NE1	2.32	0.44
1:D:132:TYR:HA	1:D:177:HIS:O	2.18	0.44
1:A:172:GLN:NE2	3:A:604:HOH:O	2.50	0.44
1:C:272:ARG:N	1:C:273:LYS:HZ3	2.14	0.44
1:A:148:THR:HG22	1:A:149:GLY:N	2.32	0.44
1:D:64:ASN:HD21	1:D:66:GLN:NE2	2.15	0.44
1:D:143:VAL:HG22	1:D:184:LEU:HB2	1.99	0.44
1:A:31:LYS:HE3	1:A:31:LYS:HB2	1.79	0.44
1:C:246:GLU:HG3	3:C:670:HOH:O	2.18	0.44
1:B:214:ILE:HG23	1:B:215:TRP:N	2.33	0.43
1:C:272:ARG:HG2	1:C:272:ARG:HH11	1.83	0.43
1:D:52:ARG:H	1:D:52:ARG:HG2	1.57	0.43
1:B:176:LEU:O	1:B:181:PHE:HB2	2.17	0.43
1:C:255:VAL:H	1:C:267:ASN:ND2	2.17	0.43
1:B:141:LYS:HG2	1:B:182:GLN:HB2	2.01	0.43
1:C:241:GLU:CD	1:C:241:GLU:H	2.26	0.43
1:D:239:LYS:HB2	1:D:242:VAL:HG23	2.01	0.43
1:D:272:ARG:N	3:D:680:HOH:O	2.50	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:254:SER:HB2	1:B:267:ASN:HD21	1.83	0.43
1:A:41:LEU:HD23	1:A:44:MET:CE	2.49	0.43
1:D:127:THR:HG23	1:D:130:ALA:N	2.32	0.42
1:A:64:ASN:HB2	3:A:700:HOH:O	2.18	0.42
1:A:132:TYR:O	1:A:180:GLY:HA2	2.19	0.42
1:B:132:TYR:O	1:B:180:GLY:HA2	2.19	0.42
1:B:238:MET:CE	1:B:243:GLN:HG2	2.49	0.42
1:C:14:ARG:NH1	1:C:14:ARG:CB	2.78	0.42
1:C:233:GLN:HE21	1:C:233:GLN:CA	2.25	0.42
1:A:108:VAL:O	1:C:113:LYS:NZ	2.52	0.42
1:D:91:LEU:HD11	1:D:120:PHE:HE1	1.85	0.42
1:B:67:TYR:HB3	1:B:68:PRO:HD3	2.00	0.42
1:D:64:ASN:HB2	3:D:744:HOH:O	2.18	0.42
1:D:130:ALA:HB1	1:D:134:LYS:O	2.20	0.42
1:D:198:ASP:HA	1:D:201:ILE:HD12	2.01	0.42
1:D:211:LEU:HA	1:D:214:ILE:HB	2.00	0.42
1:B:160:ILE:HD13	1:D:131:MET:HE1	2.02	0.42
1:C:132:TYR:O	1:C:180:GLY:HA2	2.19	0.42
1:D:197:ALA:O	1:D:201:ILE:HG13	2.20	0.42
1:C:196:PRO:HB2	1:C:198:ASP:OD1	2.20	0.42
1:B:202:GLN:HE21	1:B:202:GLN:CA	2.26	0.42
1:C:47:ASN:ND2	1:C:49:ILE:H	2.18	0.42
1:B:240:LYS:HB3	1:B:240:LYS:HE3	1.84	0.42
1:A:127:THR:CG2	1:A:129:ALA:HB3	2.50	0.41
1:B:254:SER:HB2	1:B:267:ASN:ND2	2.36	0.41
1:A:161:HIS:HD2	1:C:132:TYR:OH	2.03	0.41
1:B:29:LEU:CD1	1:B:211:LEU:HD13	2.51	0.41
1:D:76:LYS:CE	1:D:123:GLU:HG3	2.51	0.41
1:D:209:LYS:HD3	1:D:209:LYS:C	2.46	0.41
1:C:9:LEU:HD22	1:C:22:LYS:HD3	2.01	0.41
1:D:60:LYS:HG3	1:D:70:GLU:CD	2.44	0.41
1:A:58:LYS:N	1:A:58:LYS:CD	2.78	0.41
1:D:219:PRO:HG2	3:D:736:HOH:O	2.21	0.41
1:C:22:LYS:HE3	1:C:23:GLU:OE1	2.20	0.41
1:C:158:GLN:NE2	1:C:158:GLN:N	2.69	0.41
1:A:50:ILE:HD11	1:A:117:GLU:O	2.21	0.41
1:D:9:LEU:HD22	1:D:22:LYS:HD3	2.02	0.41
1:D:254:SER:HB2	1:D:267:ASN:HD21	1.86	0.41
1:C:242:VAL:O	1:C:246:GLU:HB2	2.21	0.41
1:B:27:ALA:O	1:B:31:LYS:HG3	2.20	0.40
1:A:91:LEU:HD11	1:A:120:PHE:HE1	1.85	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:154:MET:HG2	1:A:160:ILE:HD11	2.03	0.40
1:A:202:GLN:HE21	1:A:202:GLN:CA	2.21	0.40
1:D:60:LYS:CG	1:D:73:LEU:HD22	2.49	0.40
1:A:91:LEU:HD11	1:A:120:PHE:CE1	2.56	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	271/273 (99%)	258 (95%)	11 (4%)	2 (1%)	18	7
1	B	271/273 (99%)	259 (96%)	11 (4%)	1 (0%)	30	16
1	C	271/273 (99%)	259 (96%)	11 (4%)	1 (0%)	30	16
1	D	271/273 (99%)	257 (95%)	14 (5%)	0	100	100
All	All	1084/1092 (99%)	1033 (95%)	47 (4%)	4 (0%)	30	16

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	272	ARG
1	C	272	ARG
1	A	230	LEU
1	B	272	ARG

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	226/227 (100%)	215 (95%)	11 (5%)	22	8
1	B	226/227 (100%)	220 (97%)	6 (3%)	39	23
1	C	226/227 (100%)	218 (96%)	8 (4%)	32	15
1	D	226/227 (100%)	215 (95%)	11 (5%)	22	8
All	All	904/908 (100%)	868 (96%)	36 (4%)	28	12

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	ARG
1	A	29	LEU
1	A	50	ILE
1	A	108	VAL
1	A	112	LEU
1	A	158	GLN
1	A	160	ILE
1	A	198	ASP
1	A	209	LYS
1	A	241	GLU
1	A	272	ARG
1	B	14	ARG
1	B	50	ILE
1	B	56	THR
1	B	108	VAL
1	B	112	LEU
1	B	158	GLN
1	C	7	ILE
1	C	14	ARG
1	C	60	LYS
1	C	158	GLN
1	C	189	THR
1	C	209	LYS
1	C	265	THR
1	C	273	LYS
1	D	14	ARG
1	D	32	LYS
1	D	52	ARG
1	D	58	LYS
1	D	60	LYS

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Mol	Chain	Res	Type
1	D	123	GLU
1	D	127	THR
1	D	158	GLN
1	D	160	ILE
1	D	240	LYS
1	D	273	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (42) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	A	47	ASN
1	A	104	GLN
1	A	158	GLN
1	A	161	HIS
1	A	172	GLN
1	A	182	GLN
1	A	202	GLN
1	A	231	ASN
1	A	267	ASN
1	A	268	GLN
1	B	47	ASN
1	B	64	ASN
1	B	66	GLN
1	B	100	GLN
1	B	104	GLN
1	B	158	GLN
1	B	172	GLN
1	B	194	HIS
1	B	202	GLN
1	B	267	ASN
1	B	268	GLN
1	C	47	ASN
1	C	64	ASN
1	C	66	GLN
1	C	88	GLN
1	C	104	GLN
1	C	158	GLN
1	C	182	GLN
1	C	233	GLN
1	C	267	ASN
1	C	268	GLN

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Mol	Chain	Res	Type
1	D	45	ASN
1	D	64	ASN
1	D	66	GLN
1	D	79	HIS
1	D	158	GLN
1	D	177	HIS
1	D	233	GLN
1	D	243	GLN
1	D	267	ASN
1	D	268	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 ⓘ

4 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	603	-	58,58,58	2.70	20 (34%)	85,89,89	1.06	6 (7%)
2	FAD	B	602	-	58,58,58	2.69	20 (34%)	85,89,89	1.08	7 (8%)
2	FAD	A	601	-	58,58,58	2.77	21 (36%)	85,89,89	1.09	5 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	FAD	D	604	-	58,58,58	2.77	23 (39%)	85,89,89	1.08	6 (7%)

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	603	-	-	6/34/50/50	0/6/6/6
2	FAD	B	602	-	-	5/34/50/50	0/6/6/6
2	FAD	A	601	-	-	6/34/50/50	0/6/6/6
2	FAD	D	604	-	-	4/34/50/50	0/6/6/6

All (84) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	601	FAD	P-O3P	-14.88	1.43	1.59
2	C	603	FAD	P-O3P	-14.09	1.44	1.59
2	D	604	FAD	P-O3P	-14.06	1.44	1.59
2	B	602	FAD	P-O3P	-13.37	1.45	1.59
2	A	601	FAD	C9A-N10	4.62	1.49	1.41
2	C	603	FAD	PA-O2A	-4.20	1.35	1.55
2	D	604	FAD	PA-O2A	-4.16	1.36	1.55
2	A	601	FAD	PA-O2A	-4.15	1.36	1.55
2	B	602	FAD	C9A-N10	4.13	1.48	1.41
2	B	602	FAD	PA-O2A	-4.11	1.36	1.55
2	C	603	FAD	C9A-N10	3.93	1.48	1.41
2	D	604	FAD	C5A-C6A	3.91	1.51	1.41
2	D	604	FAD	C1'-C2'	3.85	1.58	1.52
2	D	604	FAD	C9A-N10	3.85	1.47	1.41
2	B	602	FAD	C5A-C6A	3.65	1.51	1.41
2	D	604	FAD	C5A-C4A	3.64	1.45	1.39
2	A	601	FAD	C5A-C6A	3.60	1.51	1.41
2	C	603	FAD	C5A-C6A	3.55	1.50	1.41
2	B	602	FAD	C5A-C4A	3.50	1.45	1.39
2	B	602	FAD	C4X-N5	3.50	1.38	1.30
2	C	603	FAD	C4A-N3A	3.45	1.40	1.34
2	D	604	FAD	C4X-N5	3.42	1.38	1.30
2	C	603	FAD	C4X-N5	3.41	1.38	1.30
2	A	601	FAD	PA-O5B	-3.40	1.46	1.59
2	A	601	FAD	C4X-N5	3.39	1.38	1.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	602	FAD	PA-O3P	3.38	1.63	1.59
2	B	602	FAD	C6-C5X	3.37	1.45	1.40
2	B	602	FAD	C2A-N1A	3.36	1.39	1.33
2	C	603	FAD	C5A-C4A	3.33	1.45	1.39
2	D	604	FAD	O5'-C5'	3.31	1.57	1.44
2	B	602	FAD	C9A-C5X	3.29	1.46	1.41
2	C	603	FAD	P-O2P	-3.27	1.40	1.55
2	B	602	FAD	P-O2P	-3.25	1.40	1.55
2	A	601	FAD	P-O2P	-3.23	1.40	1.55
2	A	601	FAD	C9A-C5X	3.22	1.46	1.41
2	D	604	FAD	C6-C5X	3.22	1.44	1.40
2	D	604	FAD	C4A-N3A	3.20	1.40	1.34
2	C	603	FAD	O5'-C5'	3.20	1.56	1.44
2	B	602	FAD	C4A-N3A	3.19	1.40	1.34
2	D	604	FAD	P-O2P	-3.10	1.41	1.55
2	A	601	FAD	C1'-C2'	3.10	1.57	1.52
2	B	602	FAD	O5'-C5'	3.09	1.56	1.44
2	D	604	FAD	C2A-N1A	3.09	1.39	1.33
2	C	603	FAD	C2-N3	3.07	1.45	1.39
2	D	604	FAD	C9A-C5X	3.06	1.46	1.41
2	A	601	FAD	O5'-C5'	3.06	1.56	1.44
2	B	602	FAD	C8-C7	3.04	1.48	1.40
2	D	604	FAD	O4B-C1B	3.04	1.49	1.42
2	D	604	FAD	C8-C7	3.03	1.48	1.40
2	A	601	FAD	C5A-C4A	3.03	1.44	1.39
2	D	604	FAD	PA-O5B	-3.03	1.47	1.59
2	C	603	FAD	C9A-C5X	3.02	1.46	1.41
2	B	602	FAD	C1'-C2'	3.02	1.56	1.52
2	C	603	FAD	C8-C7	2.99	1.48	1.40
2	C	603	FAD	C2A-N1A	2.94	1.39	1.33
2	C	603	FAD	C6-C5X	2.91	1.44	1.40
2	A	601	FAD	C2A-N1A	2.85	1.39	1.33
2	A	601	FAD	C4A-N3A	2.85	1.39	1.34
2	A	601	FAD	C8-C7	2.83	1.47	1.40
2	A	601	FAD	C6-C5X	2.75	1.44	1.40
2	C	603	FAD	O4B-C4B	2.68	1.51	1.45
2	D	604	FAD	C10-N1	2.64	1.38	1.33
2	A	601	FAD	C10-N1	2.64	1.38	1.33
2	A	601	FAD	C9-C9A	2.63	1.43	1.39
2	B	602	FAD	PA-O5B	-2.62	1.49	1.59
2	C	603	FAD	C9-C9A	2.61	1.43	1.39
2	C	603	FAD	PA-O5B	-2.60	1.49	1.59

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	604	FAD	C2-N3	2.55	1.44	1.39
2	B	602	FAD	C10-N1	2.54	1.38	1.33
2	D	604	FAD	C9-C9A	2.50	1.43	1.39
2	B	602	FAD	O4B-C1B	2.49	1.47	1.42
2	A	601	FAD	O4B-C1B	2.47	1.47	1.42
2	C	603	FAD	C10-N1	2.45	1.38	1.33
2	B	602	FAD	C2-N3	2.41	1.44	1.39
2	B	602	FAD	C9-C9A	2.40	1.43	1.39
2	C	603	FAD	O4B-C1B	2.38	1.47	1.42
2	C	603	FAD	C1'-C2'	2.35	1.55	1.52
2	A	601	FAD	O4B-C4B	2.31	1.50	1.45
2	D	604	FAD	O4B-C4B	2.31	1.50	1.45
2	A	601	FAD	C2-N3	2.29	1.44	1.39
2	A	601	FAD	C9-C8	2.21	1.42	1.39
2	D	604	FAD	C9-C8	2.08	1.42	1.39
2	D	604	FAD	O2-C2	-2.02	1.20	1.24
2	D	604	FAD	C2A-N3A	2.00	1.37	1.33

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	601	FAD	O2A-PA-O3P	2.93	115.19	107.27
2	B	602	FAD	O5B-PA-O1A	-2.79	97.87	108.94
2	D	604	FAD	O5B-PA-O1A	-2.78	97.91	108.94
2	C	603	FAD	O5B-PA-O1A	-2.74	98.08	108.94
2	A	601	FAD	O5B-PA-O1A	-2.70	98.22	108.94
2	C	603	FAD	C4'-C3'-C2'	-2.59	109.27	113.57
2	B	602	FAD	O2A-PA-O3P	2.43	113.84	107.27
2	D	604	FAD	O2A-PA-O3P	2.37	113.68	107.27
2	B	602	FAD	C4'-C3'-C2'	-2.33	109.69	113.57
2	D	604	FAD	C4'-C3'-C2'	-2.33	109.69	113.57
2	D	604	FAD	C2A-N1A-C6A	2.28	122.48	118.73
2	C	603	FAD	C2A-N1A-C6A	2.24	122.41	118.73
2	C	603	FAD	O2A-PA-O3P	2.18	113.18	107.27
2	D	604	FAD	C4-N3-C2	-2.18	121.77	125.64
2	C	603	FAD	C4-N3-C2	-2.17	121.78	125.64
2	A	601	FAD	C2A-N1A-C6A	2.16	122.28	118.73
2	B	602	FAD	C2A-N1A-C6A	2.13	122.22	118.73
2	D	604	FAD	C5X-C9A-N10	-2.09	116.08	117.97
2	B	602	FAD	O4B-C1B-N9A	-2.08	104.10	108.09
2	B	602	FAD	C5X-C9A-N10	-2.08	116.09	117.97
2	B	602	FAD	C4-N3-C2	-2.07	121.96	125.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	601	FAD	C5X-C9A-N10	-2.03	116.13	117.97
2	C	603	FAD	C5X-C9A-N10	-2.03	116.13	117.97
2	A	601	FAD	C4-N3-C2	-2.02	122.06	125.64

There are no chirality outliers.

All (21) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	603	FAD	C2B-C1B-N9A-C8A
2	A	601	FAD	C2B-C1B-N9A-C8A
2	B	602	FAD	C2B-C1B-N9A-C8A
2	D	604	FAD	C2B-C1B-N9A-C8A
2	B	602	FAD	PA-O3P-P-O2P
2	C	603	FAD	PA-O3P-P-O2P
2	D	604	FAD	PA-O3P-P-O2P
2	C	603	FAD	C2B-C1B-N9A-C4A
2	A	601	FAD	PA-O3P-P-O2P
2	A	601	FAD	O4B-C1B-N9A-C8A
2	C	603	FAD	O4B-C1B-N9A-C8A
2	D	604	FAD	O4B-C1B-N9A-C8A
2	A	601	FAD	PA-O3P-P-O1P
2	B	602	FAD	PA-O3P-P-O1P
2	C	603	FAD	PA-O3P-P-O1P
2	B	602	FAD	O4B-C4B-C5B-O5B
2	B	602	FAD	O4B-C1B-N9A-C8A
2	D	604	FAD	O4B-C4B-C5B-O5B
2	A	601	FAD	C4'-C5'-O5'-P
2	A	601	FAD	O4B-C4B-C5B-O5B
2	C	603	FAD	O4B-C4B-C5B-O5B

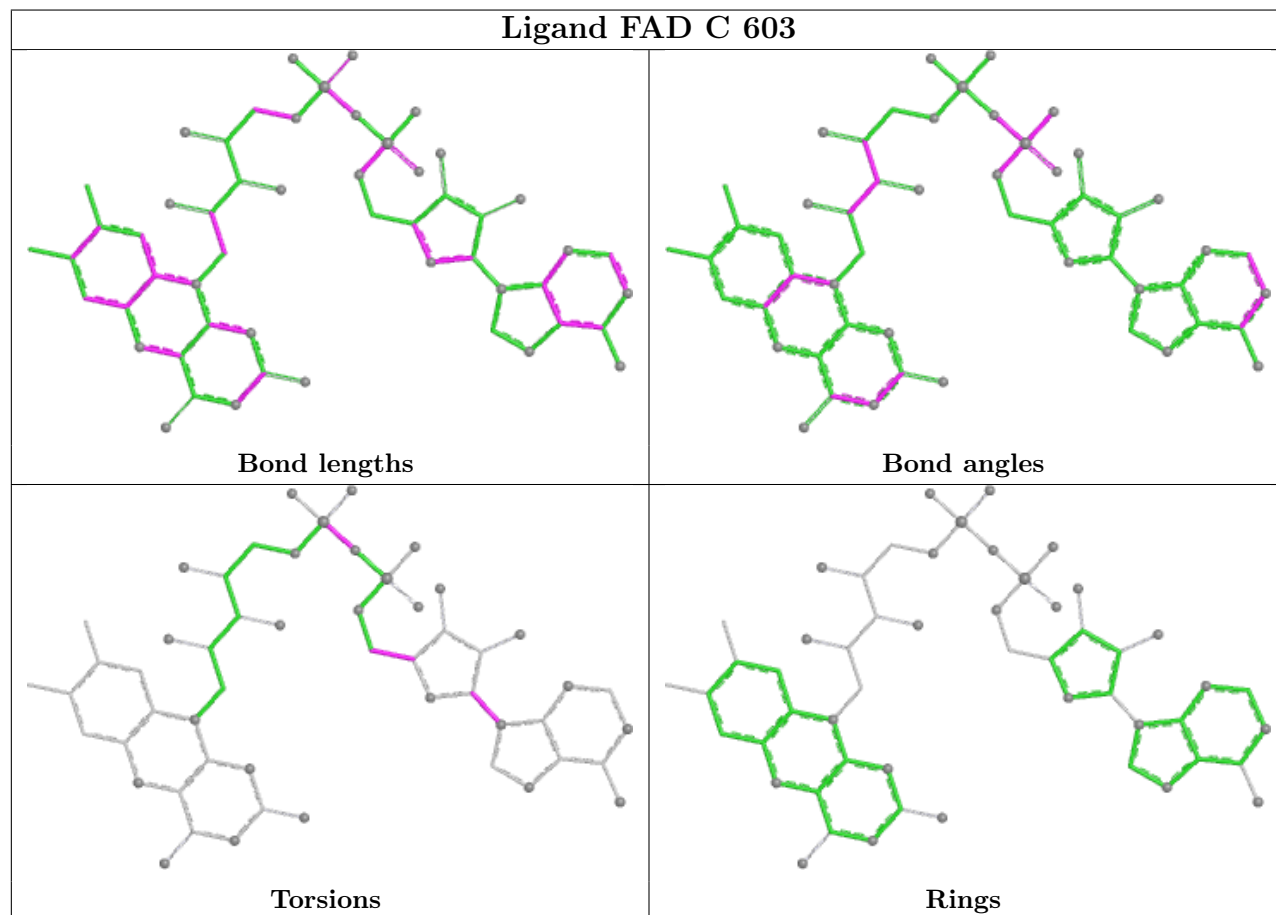
There are no ring outliers.

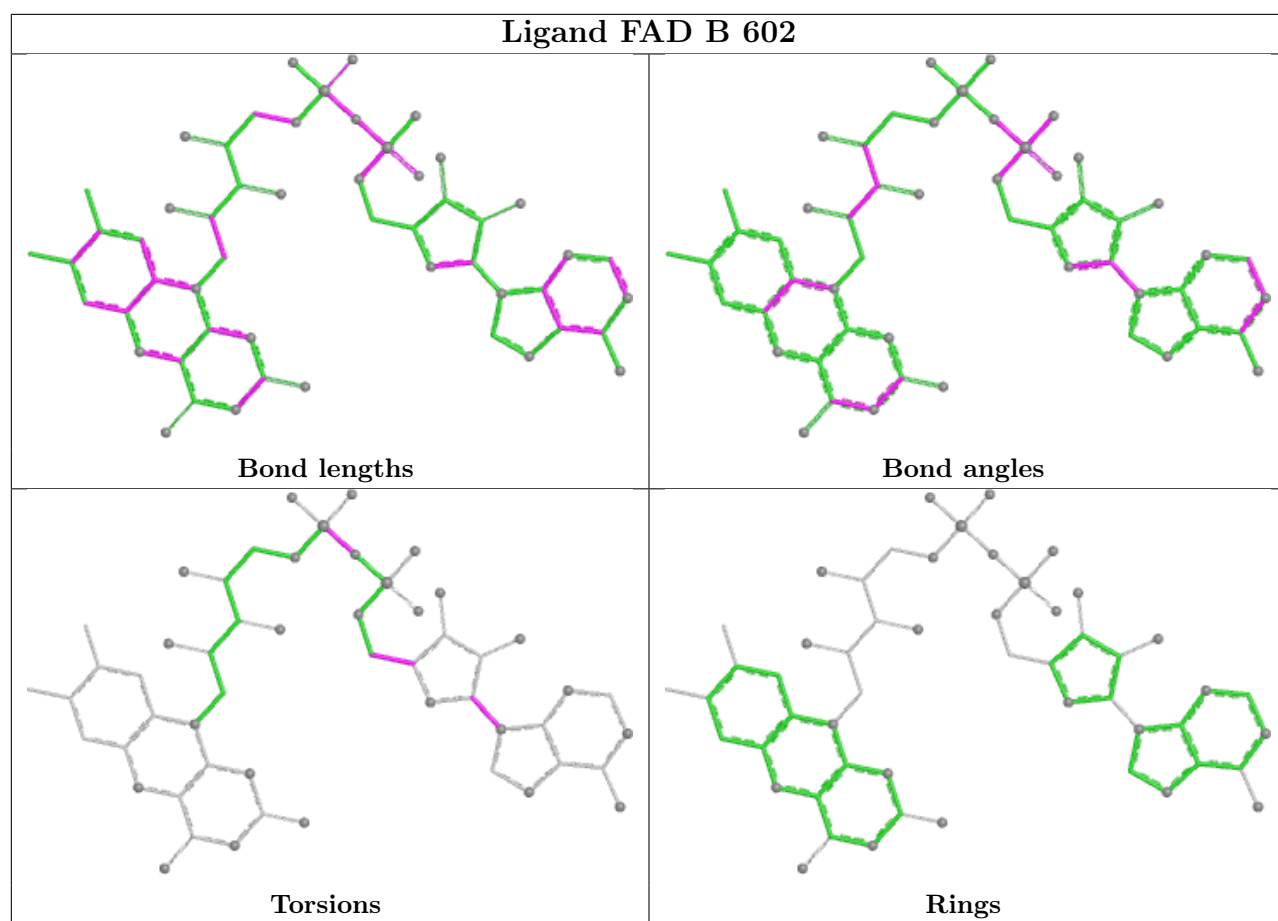
4 monomers are involved in 8 short contacts:

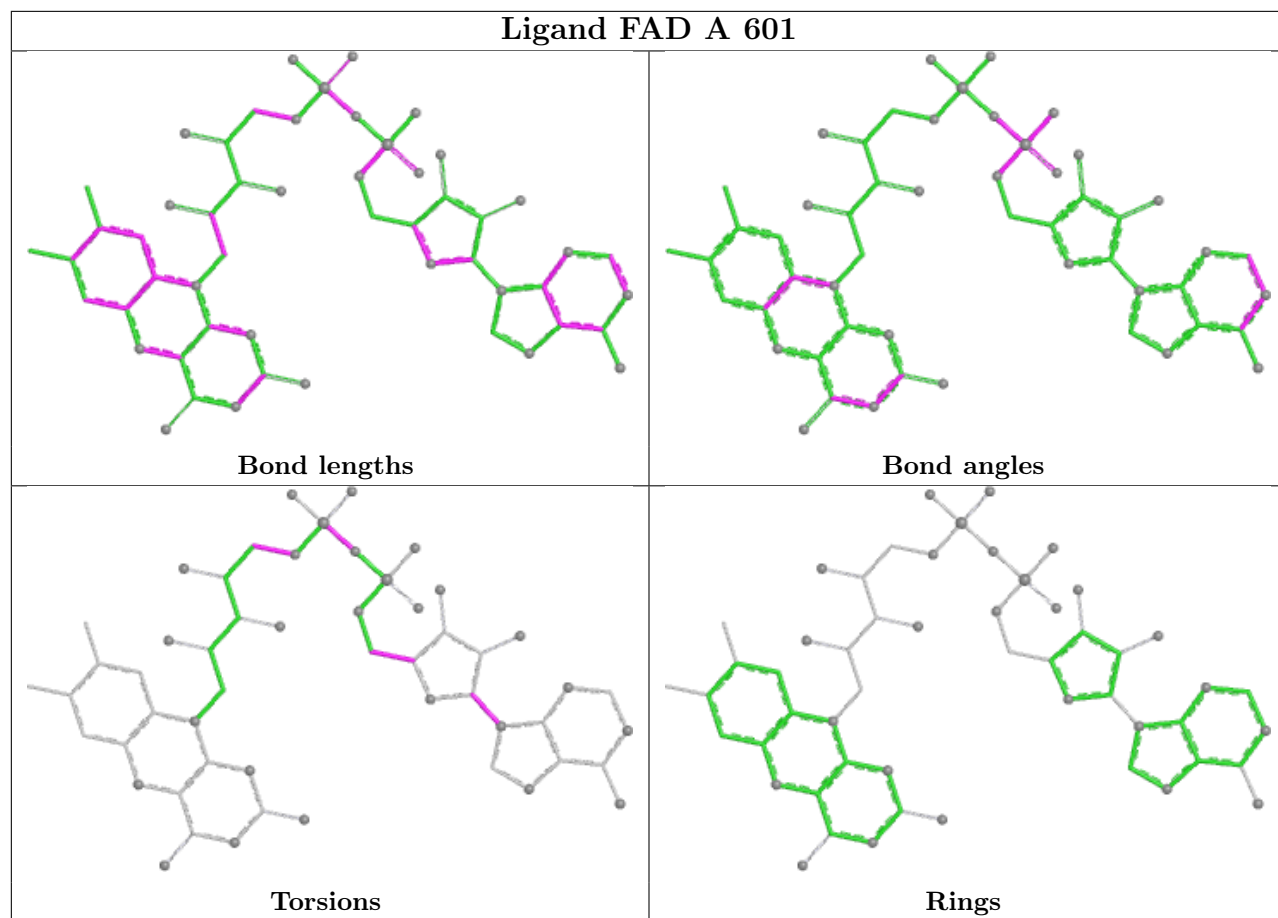
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	603	FAD	1	0
2	B	602	FAD	2	0
2	A	601	FAD	4	0
2	D	604	FAD	1	0

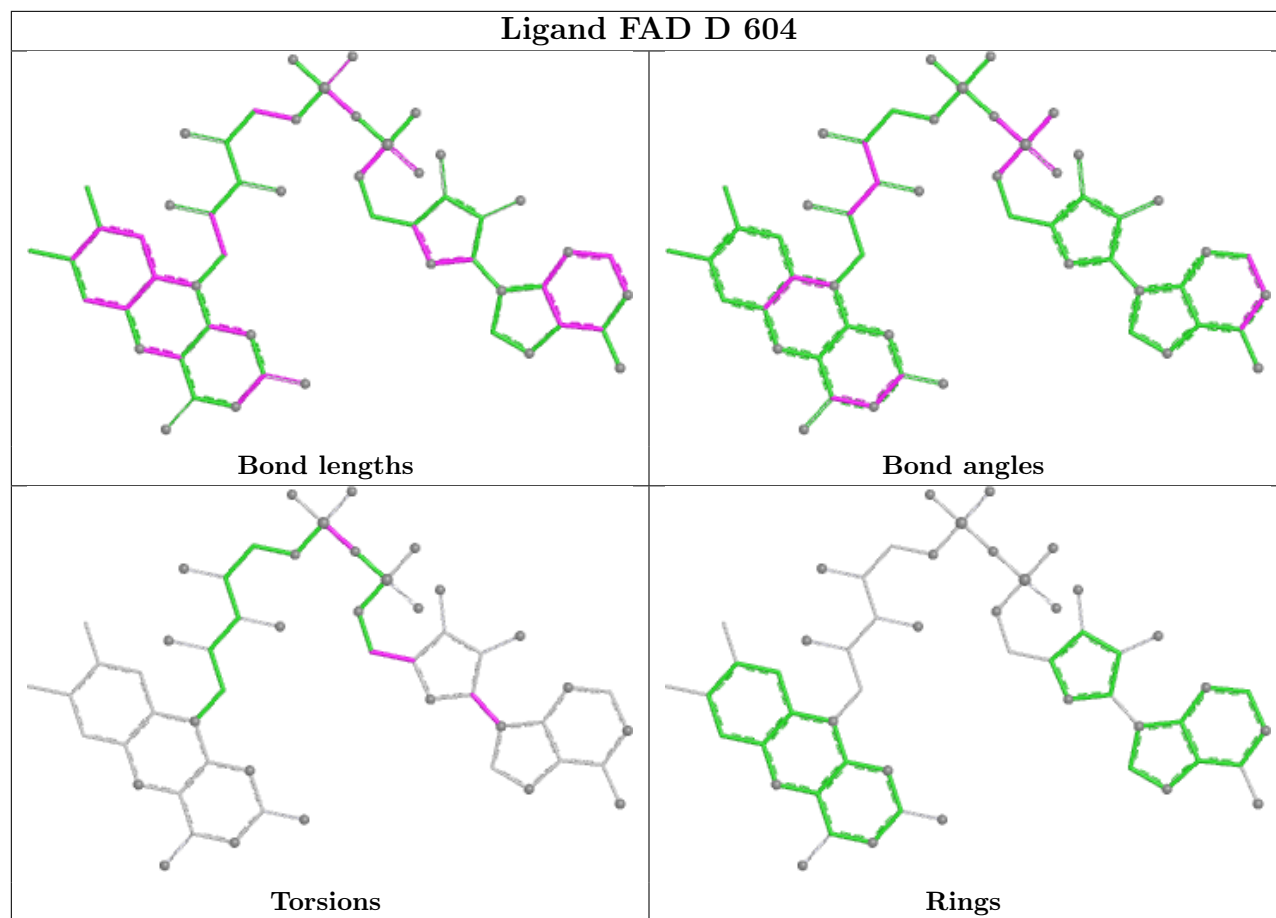
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In

addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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	273/273 (100%)	0.55	21 (7%)	19 21	9, 20, 41, 50	0
1	B	273/273 (100%)	0.54	19 (6%)	22 24	8, 19, 40, 47	0
1	C	273/273 (100%)	0.80	34 (12%)	8 8	11, 24, 43, 49	0
1	D	273/273 (100%)	0.69	29 (10%)	11 11	9, 22, 40, 49	0
All	All	1092/1092 (100%)	0.64	103 (9%)	14 14	8, 21, 42, 50	0

All (103) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	273	LYS	6.9
1	A	232	PHE	5.7
1	D	273	LYS	5.6
1	D	1	VAL	5.6
1	C	2	GLY	5.3
1	A	272	ARG	4.6
1	C	232	PHE	4.6
1	D	128	TYR	4.5
1	A	2	GLY	4.4
1	D	272	ARG	4.3
1	B	1	VAL	4.1
1	B	128	TYR	4.0
1	C	128	TYR	4.0
1	A	271	ALA	3.9
1	B	14	ARG	3.9
1	A	1	VAL	3.8
1	A	128	TYR	3.8
1	C	57	GLY	3.7
1	D	130	ALA	3.7
1	D	160	ILE	3.6
1	D	232	PHE	3.6

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Mol	Chain	Res	Type	RSRZ
1	B	232	PHE	3.5
1	A	273	LYS	3.5
1	D	230	LEU	3.5
1	B	2	GLY	3.3
1	A	230	LEU	3.3
1	C	273	LYS	3.3
1	A	251	PHE	3.2
1	D	242	VAL	3.2
1	B	64	ASN	3.2
1	A	233	GLN	3.2
1	C	45	ASN	3.1
1	A	57	GLY	3.1
1	D	2	GLY	3.1
1	D	127	THR	3.1
1	C	133	ASP	3.1
1	C	234	ALA	3.1
1	C	64	ASN	3.0
1	B	248	ASN	3.0
1	C	242	VAL	2.9
1	A	3	ARG	2.9
1	C	272	ARG	2.9
1	D	23	GLU	2.9
1	B	272	ARG	2.8
1	C	59	LEU	2.7
1	A	231	ASN	2.7
1	D	234	ALA	2.7
1	C	1	VAL	2.7
1	D	31	LYS	2.7
1	B	245	GLU	2.7
1	C	201	ILE	2.7
1	D	198	ASP	2.7
1	C	271	ALA	2.7
1	C	194	HIS	2.6
1	C	58	LYS	2.6
1	B	3	ARG	2.6
1	C	3	ARG	2.6
1	C	198	ASP	2.6
1	C	241	GLU	2.6
1	C	244	ASP	2.6
1	D	245	GLU	2.6
1	D	246	GLU	2.6
1	C	202	GLN	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	14	ARG	2.5
1	D	35	GLU	2.5
1	D	244	ASP	2.5
1	B	233	GLN	2.4
1	B	61	ASP	2.4
1	D	29	LEU	2.4
1	D	194	HIS	2.4
1	B	242	VAL	2.4
1	D	21	MET	2.4
1	B	198	ASP	2.3
1	D	271	ALA	2.3
1	A	79	HIS	2.3
1	A	248	ASN	2.3
1	D	248	ASN	2.3
1	C	31	LYS	2.3
1	A	242	VAL	2.3
1	C	240	LYS	2.3
1	C	63	ALA	2.3
1	D	233	GLN	2.3
1	B	79	HIS	2.2
1	A	106	PHE	2.2
1	D	231	ASN	2.2
1	B	160	ILE	2.2
1	C	233	GLN	2.2
1	C	243	GLN	2.2
1	C	236	PHE	2.2
1	A	240	LYS	2.2
1	B	129	ALA	2.1
1	C	230	LEU	2.1
1	C	60	LYS	2.1
1	D	60	LYS	2.1
1	D	214	ILE	2.1
1	D	199	ALA	2.1
1	B	234	ALA	2.1
1	C	209	LYS	2.1
1	C	231	ASN	2.1
1	A	244	ASP	2.1
1	A	189	THR	2.0
1	C	127	THR	2.0
1	C	193	GLY	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](#)

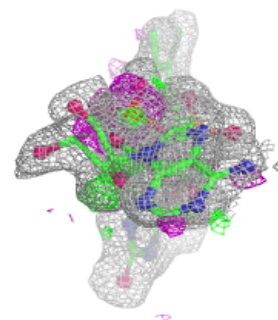
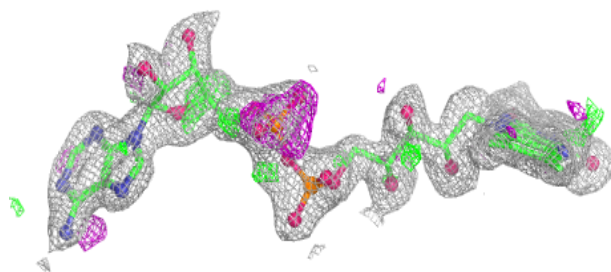
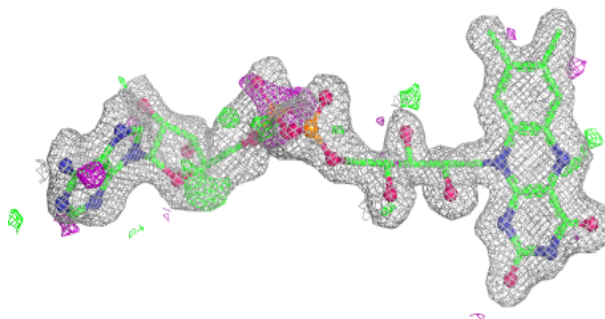
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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
2	FAD	B	602	53/53	0.85	0.13	24,29,33,34	0
2	FAD	A	601	53/53	0.91	0.09	15,19,27,29	0
2	FAD	D	604	53/53	0.91	0.10	15,22,33,35	0
2	FAD	C	603	53/53	0.92	0.09	16,22,33,34	0

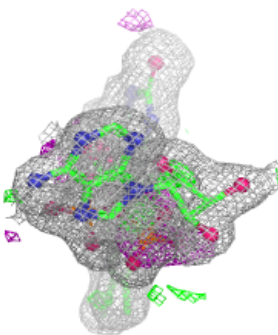
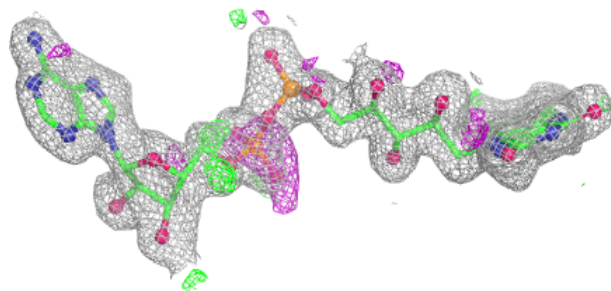
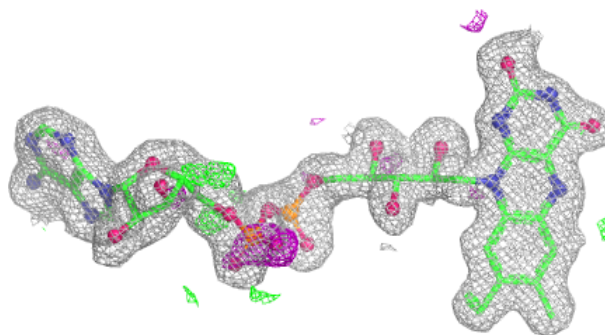
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FAD B 602:

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

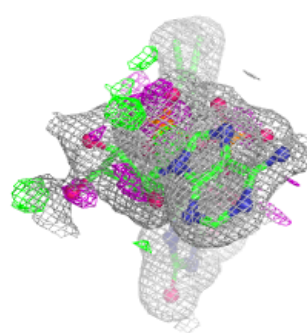
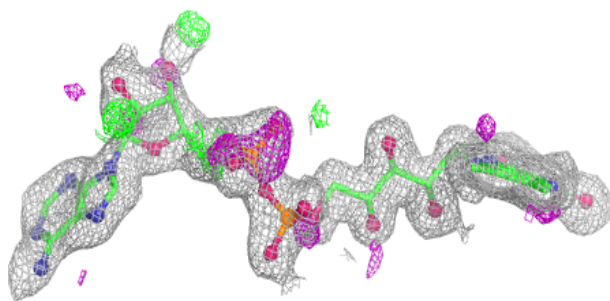
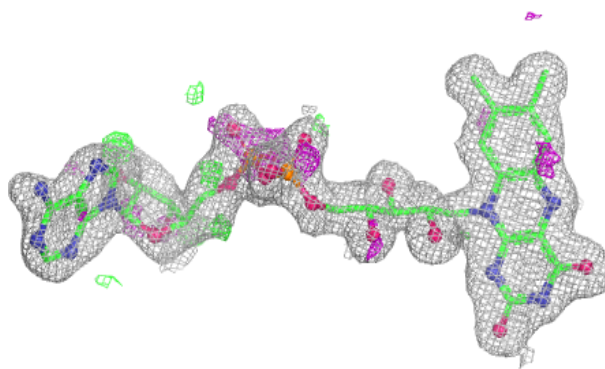
**Electron density around FAD A 601:**

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

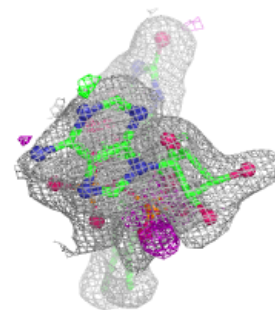
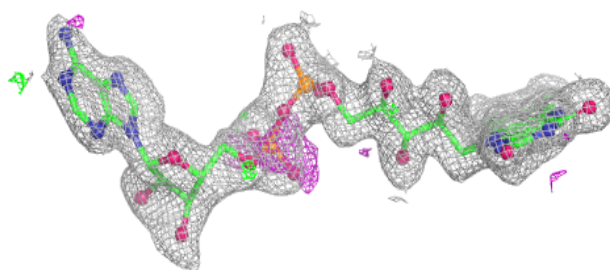
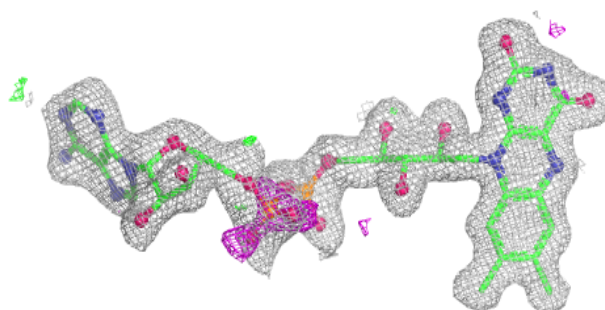


Electron density around FAD D 604:

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

**Electron density around FAD C 603:**

$2mF_o-DF_c$ (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.