



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 09:29 AM UTC

PDB ID : 4J56 / pdb_00004j56
Title : Structure of Plasmodium falciparum thioredoxin reductase-thioredoxin complex
Authors : Fritz-Wolf, K.; Jortzik, E.; Stumpf, M.; Preuss, J.; Iozef, R.; Rahlfs, S.; Becker, K.
Deposited on : 2013-02-08
Resolution : 2.37 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

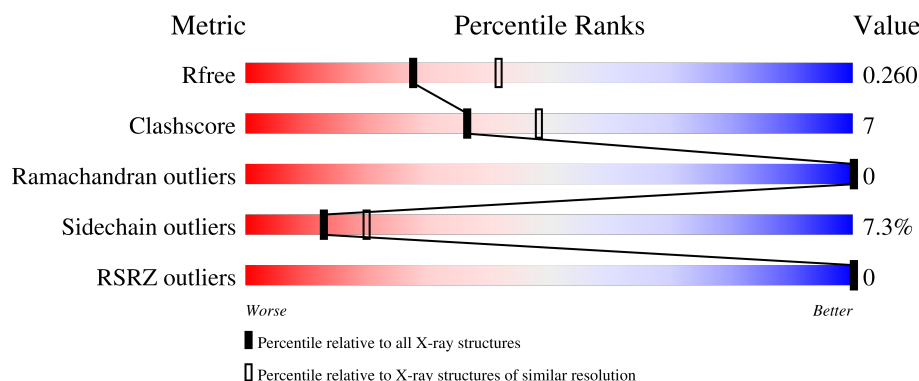
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.37 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	7164 (2.40-2.36)
Clashscore	190562	7722 (2.40-2.36)
Ramachandran outliers	187476	7626 (2.40-2.36)
Sidechain outliers	187428	7627 (2.40-2.36)
RSRZ outliers	180081	7170 (2.40-2.36)

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	541	74% 17% • 7%
1	B	541	73% 18% • 7%
1	C	541	75% 17% • 7%
1	D	541	74% 17% • 7%

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Mol	Chain	Length	Quality of chain
2	E	114	 63% 25% • 8%
2	F	114	 63% 26% • 8%
2	G	114	 62% 27% • 8%
2	H	114	 64% 25% • 8%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 19267 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 Thioredoxin reductase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	504	Total	C	N	O	S	0	0	0
			3887	2473	650	742	22			
1	B	504	Total	C	N	O	S	0	0	0
			3887	2473	650	742	22			
1	C	504	Total	C	N	O	S	0	0	0
			3887	2473	650	742	22			
1	D	504	Total	C	N	O	S	0	0	0
			3887	2473	650	742	22			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	535	SER	CYS	engineered mutation	UNP P61076
B	535	SER	CYS	engineered mutation	UNP P61076
C	535	SER	CYS	engineered mutation	UNP P61076
D	535	SER	CYS	engineered mutation	UNP P61076

- Molecule 2 is a protein called Thioredoxin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	105	Total	C	N	O	S	0	0	0
			823	526	126	167	4			
2	F	105	Total	C	N	O	S	0	0	0
			823	526	126	167	4			
2	G	105	Total	C	N	O	S	0	0	0
			823	526	126	167	4			
2	H	105	Total	C	N	O	S	0	0	0
			823	526	126	167	4			

There are 48 discrepancies between the modelled and reference sequences:

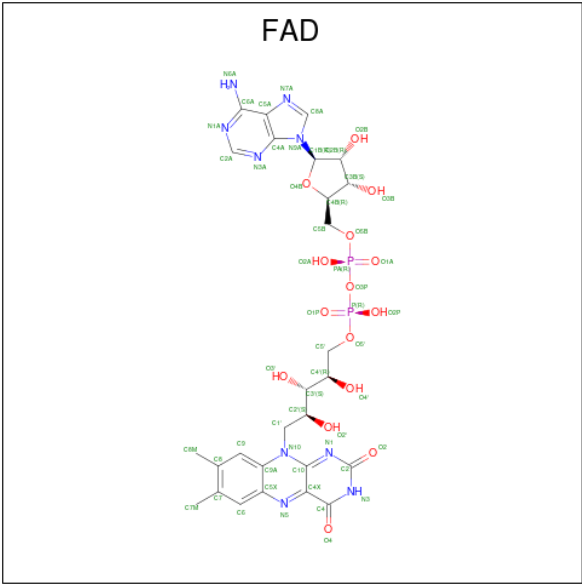
Chain	Residue	Modelled	Actual	Comment	Reference
E	-9	ARG	-	expression tag	UNP Q7KQL8
E	-8	GLY	-	expression tag	UNP Q7KQL8
E	-7	SER	-	expression tag	UNP Q7KQL8
E	-6	HIS	-	expression tag	UNP Q7KQL8
E	-5	HIS	-	expression tag	UNP Q7KQL8
E	-4	HIS	-	expression tag	UNP Q7KQL8
E	-3	HIS	-	expression tag	UNP Q7KQL8
E	-2	HIS	-	expression tag	UNP Q7KQL8
E	-1	HIS	-	expression tag	UNP Q7KQL8
E	0	GLY	-	expression tag	UNP Q7KQL8
E	1	SER	-	expression tag	UNP Q7KQL8
E	33	SER	CYS	engineered mutation	UNP Q7KQL8
F	-9	ARG	-	expression tag	UNP Q7KQL8
F	-8	GLY	-	expression tag	UNP Q7KQL8
F	-7	SER	-	expression tag	UNP Q7KQL8
F	-6	HIS	-	expression tag	UNP Q7KQL8
F	-5	HIS	-	expression tag	UNP Q7KQL8
F	-4	HIS	-	expression tag	UNP Q7KQL8
F	-3	HIS	-	expression tag	UNP Q7KQL8
F	-2	HIS	-	expression tag	UNP Q7KQL8
F	-1	HIS	-	expression tag	UNP Q7KQL8
F	0	GLY	-	expression tag	UNP Q7KQL8
F	1	SER	-	expression tag	UNP Q7KQL8
F	33	SER	CYS	engineered mutation	UNP Q7KQL8
G	-9	ARG	-	expression tag	UNP Q7KQL8
G	-8	GLY	-	expression tag	UNP Q7KQL8
G	-7	SER	-	expression tag	UNP Q7KQL8
G	-6	HIS	-	expression tag	UNP Q7KQL8
G	-5	HIS	-	expression tag	UNP Q7KQL8
G	-4	HIS	-	expression tag	UNP Q7KQL8
G	-3	HIS	-	expression tag	UNP Q7KQL8
G	-2	HIS	-	expression tag	UNP Q7KQL8
G	-1	HIS	-	expression tag	UNP Q7KQL8
G	0	GLY	-	expression tag	UNP Q7KQL8
G	1	SER	-	expression tag	UNP Q7KQL8
G	33	SER	CYS	engineered mutation	UNP Q7KQL8
H	-9	ARG	-	expression tag	UNP Q7KQL8
H	-8	GLY	-	expression tag	UNP Q7KQL8
H	-7	SER	-	expression tag	UNP Q7KQL8
H	-6	HIS	-	expression tag	UNP Q7KQL8
H	-5	HIS	-	expression tag	UNP Q7KQL8
H	-4	HIS	-	expression tag	UNP Q7KQL8
H	-3	HIS	-	expression tag	UNP Q7KQL8

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Chain	Residue	Modelled	Actual	Comment	Reference
H	-2	HIS	-	expression tag	UNP Q7KQL8
H	-1	HIS	-	expression tag	UNP Q7KQL8
H	0	GLY	-	expression tag	UNP Q7KQL8
H	1	SER	-	expression tag	UNP Q7KQL8
H	33	SER	CYS	engineered mutation	UNP Q7KQL8

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



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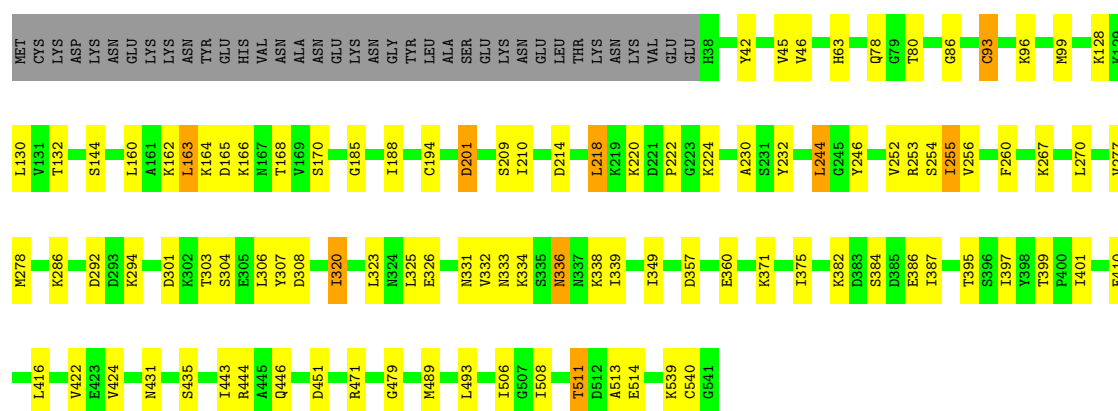
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	45	Total 45	O 45	0	0
4	E	2	Total 2	O 2	0	0
4	F	1	Total 1	O 1	0	0
4	G	2	Total 2	O 2	0	0
4	H	3	Total 3	O 3	0	0

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.

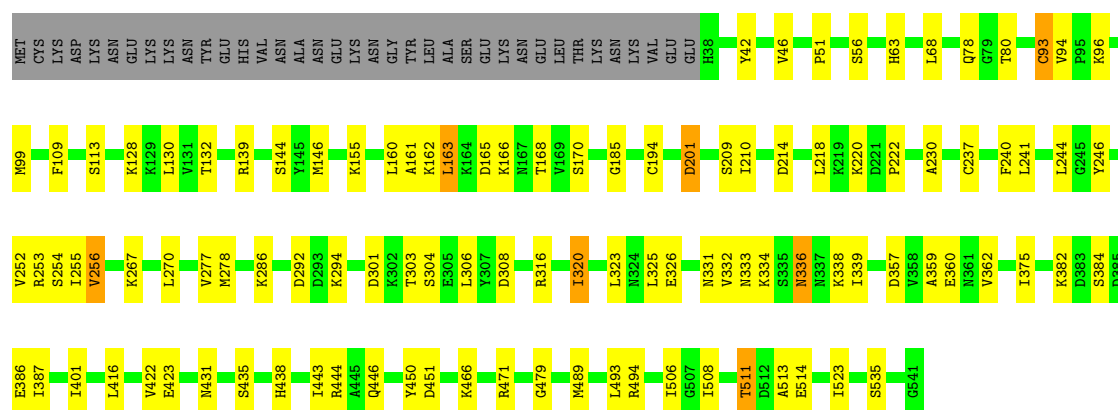
• Molecule 1: Thioredoxin reductase 2

Chain A: 



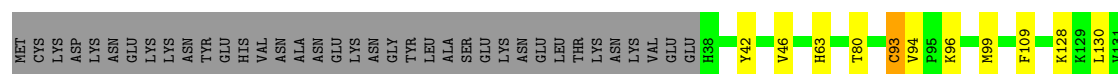
• Molecule 1: Thioredoxin reductase 2

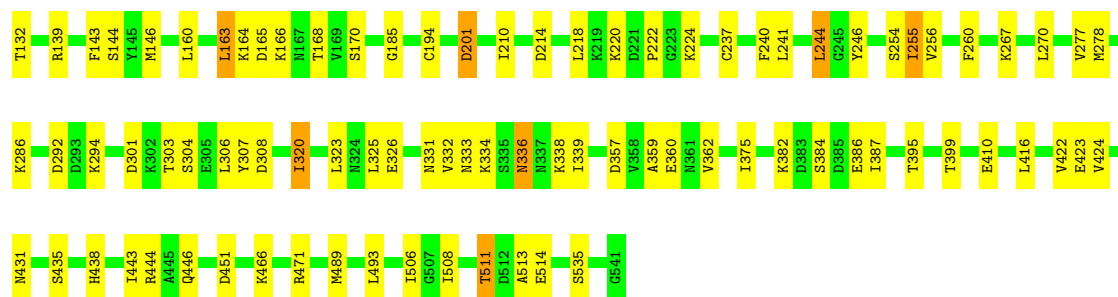
Chain B: 



• Molecule 1: Thioredoxin reductase 2

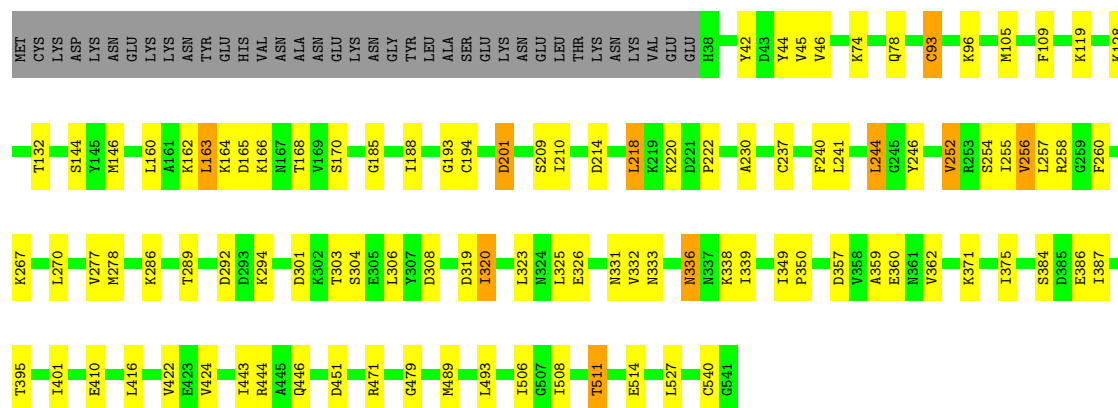
Chain C: 





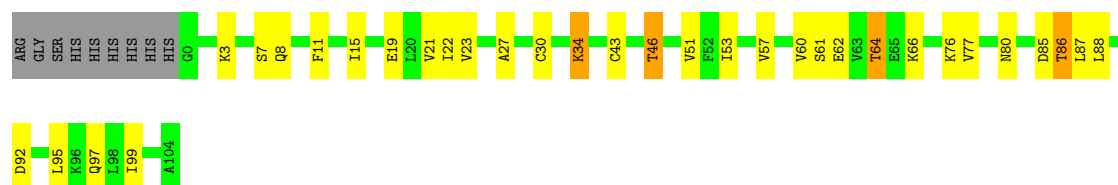
• Molecule 1: Thioredoxin reductase 2

Chain D: 74% 17% 7%



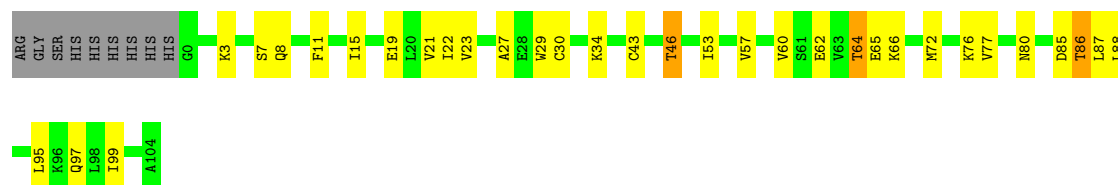
• Molecule 2: Thioredoxin

Chain E: 63% 25% 8%



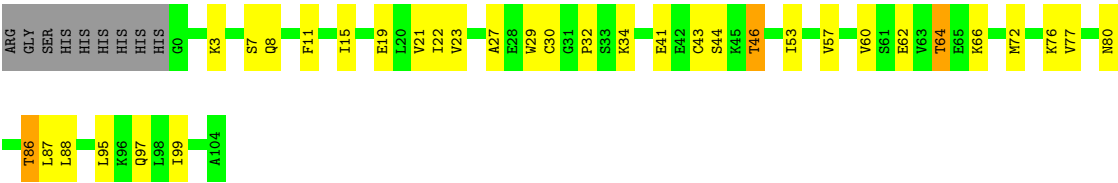
• Molecule 2: Thioredoxin

Chain F: 63% 26% 8%

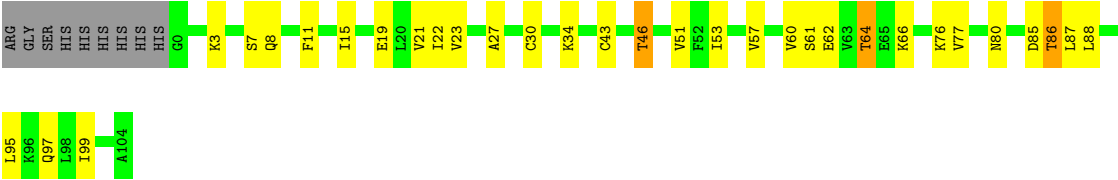


• Molecule 2: Thioredoxin

Chain G: 62% 27% 8%



● Molecule 2: Thioredoxin



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	101.88Å 89.18Å 151.33Å 90.00° 91.62° 90.00°	Depositor
Resolution (Å)	19.97 – 2.37 19.97 – 2.37	Depositor EDS
% Data completeness (in resolution range)	98.0 (19.97-2.37) 90.5 (19.97-2.37)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.49 (at 2.38Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7.2_869)	Depositor
R, R_{free}	0.236 , 0.259 0.237 , 0.260	Depositor DCC
R_{free} test set	7649 reflections (7.09%)	wwPDB-VP
Wilson B-factor (Å ²)	44.2	Xtriage
Anisotropy	0.358	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 28.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.26$	Xtriage
Estimated twinning fraction	0.216 for h,-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	19267	wwPDB-VP
Average B, all atoms (Å ²)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 15.53% 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	0.57	0/3961	0.87	4/5341 (0.1%)
1	B	0.57	0/3961	0.87	3/5341 (0.1%)
1	C	0.56	0/3961	0.89	5/5341 (0.1%)
1	D	0.57	0/3961	0.87	2/5341 (0.0%)
2	E	0.49	0/837	0.83	0/1130
2	F	0.45	0/837	0.84	0/1130
2	G	0.44	0/837	0.84	0/1130
2	H	0.47	0/837	0.83	0/1130
All	All	0.55	0/19192	0.87	14/25884 (0.1%)

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	255	ILE	N-CA-C	7.20	119.18	108.96
1	D	252	VAL	N-CA-C	6.89	116.83	106.42
1	C	94	VAL	CA-C-N	-5.79	113.71	119.56
1	C	94	VAL	C-N-CA	-5.79	113.71	119.56
1	B	94	VAL	CA-C-N	-5.67	113.83	119.56
1	B	94	VAL	C-N-CA	-5.67	113.83	119.56
1	C	399	THR	N-CA-C	-5.64	103.65	110.13
1	D	252	VAL	CB-CA-C	-5.46	105.71	111.23
1	A	349	ILE	CA-C-N	5.41	125.12	119.82
1	A	349	ILE	C-N-CA	5.41	125.12	119.82
1	A	255	ILE	N-CA-C	5.31	116.83	109.45
1	B	253	ARG	N-CA-C	-5.23	102.31	110.10
1	A	254	SER	CB-CA-C	-5.11	110.71	116.63
1	C	255	ILE	CB-CA-C	-5.02	104.32	111.19

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	3887	0	3898	49	0
1	B	3887	0	3898	57	0
1	C	3887	0	3898	52	0
1	D	3887	0	3898	53	0
2	E	823	0	818	18	0
2	F	823	0	818	18	0
2	G	823	0	818	18	0
2	H	823	0	818	17	0
3	A	53	0	31	3	0
3	B	53	0	31	5	0
3	C	53	0	31	3	0
3	D	53	0	31	2	0
4	A	47	0	0	0	0
4	B	53	0	0	1	0
4	C	62	0	0	0	0
4	D	45	0	0	1	0
4	E	2	0	0	0	0
4	F	1	0	0	0	0
4	G	2	0	0	0	0
4	H	3	0	0	0	0
All	All	19267	0	18988	272	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 7.

All (272) 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:165:ASP:HB3	1:B:168:THR:HB	1.69	0.74
1:C:165:ASP:HB3	1:C:168:THR:HB	1.70	0.73
1:A:165:ASP:HB3	1:A:168:THR:HB	1.72	0.72
1:D:384:SER:OG	1:D:386:GLU:HG2	1.92	0.70

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:165:ASP:HB3	1:D:168:THR:HB	1.74	0.70
1:A:93:CYS:HB3	3:A:600:FAD:C4	2.22	0.69
1:A:384:SER:OG	1:A:386:GLU:HG2	1.93	0.69
1:C:278:MET:SD	1:C:444:ARG:NH1	2.66	0.68
1:D:255:ILE:HD11	1:D:258:ARG:HG3	1.76	0.68
1:B:384:SER:OG	1:B:386:GLU:HG2	1.95	0.66
1:C:384:SER:OG	1:C:386:GLU:HG2	1.96	0.66
2:H:8:GLN:OE1	2:H:66:LYS:NZ	2.21	0.65
1:B:278:MET:SD	1:B:444:ARG:NH1	2.69	0.65
1:A:163:LEU:HD11	1:A:325:LEU:HD23	1.77	0.65
1:D:278:MET:SD	1:D:444:ARG:NH1	2.69	0.65
1:A:320:ILE:HD11	1:A:339:ILE:HD11	1.79	0.65
1:B:96:LYS:HZ3	3:B:600:FAD:H6	1.60	0.65
1:C:375:ILE:HG23	1:C:386:GLU:HG3	1.79	0.65
2:G:8:GLN:OE1	2:G:66:LYS:NZ	2.23	0.63
1:D:163:LEU:HD11	1:D:325:LEU:HD23	1.80	0.63
1:D:333:ASN:ND2	1:D:360:GLU:OE2	2.31	0.63
1:A:278:MET:SD	1:A:444:ARG:NH1	2.72	0.62
1:B:163:LEU:HD11	1:B:325:LEU:HD23	1.80	0.62
2:F:8:GLN:OE1	2:F:66:LYS:NZ	2.23	0.62
1:C:254:SER:OG	1:C:255:ILE:N	2.33	0.61
1:C:163:LEU:HD11	1:C:325:LEU:HD23	1.82	0.61
1:B:333:ASN:ND2	1:B:360:GLU:OE2	2.34	0.61
1:A:375:ILE:HG23	1:A:386:GLU:HG3	1.81	0.61
1:D:320:ILE:HD11	1:D:339:ILE:HD11	1.83	0.60
1:D:119:LYS:NZ	4:D:703:HOH:O	2.33	0.60
1:A:333:ASN:ND2	1:A:360:GLU:OE2	2.35	0.60
1:B:320:ILE:HD11	1:B:339:ILE:HD11	1.84	0.59
1:B:511:THR:HG22	1:B:514:GLU:H	1.67	0.59
1:A:99:MET:HG2	1:A:130:LEU:HD21	1.85	0.59
1:C:320:ILE:HD11	1:C:339:ILE:HD11	1.84	0.59
1:A:230:ALA:HB2	1:A:252:VAL:HG22	1.85	0.59
1:B:194:CYS:SG	1:B:357:ASP:HB3	2.43	0.58
1:C:333:ASN:ND2	1:C:360:GLU:OE2	2.37	0.58
1:C:511:THR:HG22	1:C:514:GLU:H	1.69	0.58
1:A:194:CYS:SG	1:A:357:ASP:HB3	2.44	0.58
1:C:80:THR:OG1	1:C:214:ASP:OD1	2.20	0.57
1:C:508:ILE:O	1:C:511:THR:HB	2.04	0.57
1:D:446:GLN:HG2	1:D:451:ASP:O	2.04	0.57
1:D:508:ILE:O	1:D:511:THR:HB	2.05	0.57
1:B:93:CYS:HB3	3:B:600:FAD:C4	2.35	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:511:THR:HG22	1:A:514:GLU:H	1.71	0.56
1:D:93:CYS:HB3	3:D:600:FAD:C4	2.34	0.56
1:B:80:THR:OG1	1:B:214:ASP:OD1	2.21	0.56
1:A:334:LYS:HB3	1:D:527:LEU:HD23	1.87	0.55
1:D:230:ALA:HB1	1:D:256:VAL:HA	1.88	0.55
1:D:410:GLU:HG3	1:D:424:VAL:HG21	1.88	0.55
1:A:301:ASP:OD1	1:A:303:THR:HG22	2.05	0.55
1:B:230:ALA:HB1	1:B:256:VAL:HG22	1.89	0.55
1:B:375:ILE:HG23	1:B:386:GLU:HG3	1.89	0.55
1:B:254:SER:OG	1:B:255:ILE:N	2.40	0.54
1:D:375:ILE:HG23	1:D:386:GLU:HG3	1.89	0.54
1:C:99:MET:HG2	1:C:130:LEU:HD21	1.89	0.54
1:C:194:CYS:SG	1:C:357:ASP:HB3	2.48	0.54
2:E:43:CYS:HA	2:E:46:THR:HG23	1.88	0.54
1:C:96:LYS:HZ3	3:C:600:FAD:H6	1.72	0.54
1:B:446:GLN:HG2	1:B:451:ASP:O	2.08	0.53
2:G:43:CYS:HA	2:G:46:THR:HG23	1.90	0.53
2:H:43:CYS:HA	2:H:46:THR:HG23	1.89	0.53
1:D:194:CYS:SG	1:D:357:ASP:HB3	2.48	0.53
1:A:401:ILE:HD11	1:A:479:GLY:HA2	1.91	0.53
1:C:201:ASP:OD1	1:C:201:ASP:N	2.41	0.53
1:A:446:GLN:HG2	1:A:451:ASP:O	2.09	0.53
1:D:540:CYS:SG	2:G:32:PRO:HD2	2.49	0.53
1:A:80:THR:OG1	1:A:214:ASP:OD1	2.22	0.53
1:B:508:ILE:O	1:B:511:THR:HB	2.09	0.53
1:B:320:ILE:HD12	1:B:323:LEU:HD12	1.91	0.53
2:F:43:CYS:HA	2:F:46:THR:HG23	1.91	0.53
1:D:301:ASP:OD1	1:D:303:THR:HG22	2.08	0.52
1:B:128:LYS:O	1:B:132:THR:HG23	2.09	0.52
1:B:96:LYS:NZ	3:B:600:FAD:H6	2.24	0.52
1:A:165:ASP:HB3	1:A:168:THR:CB	2.39	0.52
1:C:336:ASN:HB3	1:C:338:LYS:HG3	1.92	0.52
1:D:78:GLN:NE2	1:D:209:SER:O	2.43	0.52
1:D:511:THR:HG22	1:D:514:GLU:H	1.75	0.52
1:B:165:ASP:HB3	1:B:168:THR:CB	2.38	0.52
1:D:220:LYS:NZ	1:D:308:ASP:O	2.43	0.52
1:D:256:VAL:HG13	1:D:257:LEU:HG	1.92	0.52
2:E:27:ALA:HB3	2:E:30:CYS:HB2	1.92	0.52
1:A:294:LYS:HD2	1:A:306:LEU:HD21	1.93	0.51
1:B:336:ASN:HB3	1:B:338:LYS:HG3	1.92	0.51
1:A:128:LYS:O	1:A:132:THR:HG23	2.11	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:F:22:ILE:HG13	2:F:77:VAL:HG12	1.93	0.51
1:C:165:ASP:HB3	1:C:168:THR:CB	2.39	0.51
2:H:76:LYS:HG2	2:H:86:THR:HB	1.94	0.50
1:C:301:ASP:OD1	1:C:303:THR:HG22	2.11	0.50
1:C:446:GLN:HG2	1:C:451:ASP:O	2.11	0.50
2:H:27:ALA:HB3	2:H:30:CYS:HB2	1.93	0.50
1:C:128:LYS:O	1:C:132:THR:HG23	2.11	0.50
2:G:76:LYS:HG2	2:G:86:THR:HB	1.94	0.50
1:B:201:ASP:OD1	1:B:201:ASP:N	2.43	0.50
1:C:254:SER:HG	1:C:255:ILE:H	1.59	0.49
1:D:165:ASP:HB3	1:D:168:THR:CB	2.42	0.49
1:D:336:ASN:HB3	1:D:338:LYS:HG3	1.93	0.49
1:D:128:LYS:O	1:D:132:THR:HG23	2.13	0.49
2:E:76:LYS:HG2	2:E:86:THR:HB	1.95	0.49
2:H:3:LYS:HG2	2:H:53:ILE:HG22	1.93	0.49
1:B:301:ASP:OD1	1:B:303:THR:HG22	2.12	0.49
1:C:320:ILE:HD12	1:C:323:LEU:HD12	1.95	0.49
1:C:511:THR:HG23	1:C:513:ALA:H	1.78	0.48
2:E:11:PHE:HE1	2:E:23:VAL:HG21	1.79	0.48
1:A:539:LYS:HD2	2:F:88:LEU:HB3	1.95	0.48
1:A:86:GLY:HA2	3:A:600:FAD:O3B	2.13	0.48
2:F:95:LEU:O	2:F:99:ILE:HG13	2.13	0.48
2:G:22:ILE:HG13	2:G:77:VAL:HG12	1.95	0.48
1:A:201:ASP:OD1	1:A:201:ASP:N	2.44	0.48
1:A:220:LYS:NZ	1:A:308:ASP:O	2.47	0.48
2:E:22:ILE:HG13	2:E:77:VAL:HG12	1.95	0.48
1:B:222:PRO:HD2	1:B:246:TYR:CZ	2.49	0.48
1:C:237:CYS:HA	1:C:240:PHE:CE2	2.49	0.47
1:C:93:CYS:HB3	3:C:600:FAD:C4	2.45	0.47
1:D:201:ASP:OD1	1:D:201:ASP:N	2.44	0.47
2:E:8:GLN:OE1	2:E:66:LYS:NZ	2.29	0.47
2:G:11:PHE:HE1	2:G:23:VAL:HG21	1.80	0.47
1:C:222:PRO:HD2	1:C:246:TYR:CZ	2.49	0.47
1:A:508:ILE:O	1:A:511:THR:HB	2.13	0.47
1:B:139:ARG:HB3	2:F:29:TRP:CD1	2.49	0.47
1:D:326:GLU:CD	1:D:326:GLU:H	2.22	0.47
2:E:3:LYS:HG2	2:E:53:ILE:HG22	1.95	0.47
1:A:253:ARG:NH1	1:C:382:LYS:HA	2.29	0.47
2:H:22:ILE:HG13	2:H:77:VAL:HG12	1.96	0.47
1:B:230:ALA:HB2	1:B:252:VAL:HG13	1.97	0.47
1:A:410:GLU:HG3	1:A:424:VAL:HG21	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:165:ASP:OD1	1:D:166:LYS:N	2.48	0.46
2:F:3:LYS:HG2	2:F:53:ILE:HG22	1.96	0.46
1:B:161:ALA:H	3:B:600:FAD:H62A	1.64	0.46
1:B:431:ASN:O	1:B:435:SER:HB2	2.15	0.46
2:G:95:LEU:O	2:G:99:ILE:HG13	2.15	0.46
1:A:326:GLU:CD	1:A:326:GLU:H	2.23	0.46
1:B:316:ARG:NH2	4:B:704:HOH:O	2.46	0.46
1:B:146:MET:HE3	2:F:65:GLU:OE2	2.16	0.46
1:D:401:ILE:HD11	1:D:479:GLY:HA2	1.98	0.46
1:C:220:LYS:NZ	1:C:308:ASP:O	2.49	0.46
2:H:11:PHE:HE1	2:H:23:VAL:HG21	1.81	0.46
2:F:64:THR:C	2:F:66:LYS:H	2.24	0.46
1:A:320:ILE:HD12	1:A:323:LEU:HD12	1.98	0.46
2:E:64:THR:C	2:E:66:LYS:H	2.23	0.46
2:F:76:LYS:HG2	2:F:86:THR:HB	1.97	0.46
1:D:359:ALA:O	1:D:362:VAL:HG22	2.16	0.45
2:G:3:LYS:HG2	2:G:53:ILE:HG22	1.97	0.45
1:C:42:TYR:O	1:C:185:GLY:HA2	2.16	0.45
1:B:78:GLN:NE2	1:B:209:SER:O	2.49	0.45
1:C:210:ILE:HB	1:C:214:ASP:HB2	1.97	0.45
2:E:87:LEU:C	2:E:88:LEU:HD12	2.41	0.45
2:E:95:LEU:O	2:E:99:ILE:HG13	2.16	0.45
2:G:64:THR:C	2:G:66:LYS:H	2.25	0.44
1:C:63:HIS:CE1	1:C:382:LYS:HD2	2.52	0.44
1:C:96:LYS:NZ	3:C:600:FAD:H6	2.33	0.44
1:C:109:PHE:CE1	1:D:109:PHE:CE1	3.05	0.44
2:E:19:GLU:HA	2:E:80:ASN:HA	1.99	0.44
2:G:19:GLU:HA	2:G:80:ASN:HA	2.00	0.44
1:A:45:VAL:CG1	1:A:188:ILE:HG12	2.48	0.44
1:B:237:CYS:HA	1:B:240:PHE:CE2	2.52	0.44
1:D:237:CYS:HA	1:D:240:PHE:CE2	2.53	0.44
2:G:27:ALA:HB3	2:G:30:CYS:HB2	1.98	0.44
2:H:87:LEU:C	2:H:88:LEU:HD12	2.42	0.44
1:B:359:ALA:O	1:B:362:VAL:HG22	2.17	0.44
2:G:41:GLU:O	2:G:44:SER:OG	2.33	0.44
1:C:326:GLU:CD	1:C:326:GLU:H	2.24	0.44
1:A:244:LEU:HD12	1:A:244:LEU:HA	1.82	0.44
1:B:146:MET:HE2	1:B:146:MET:HB3	1.67	0.44
1:C:410:GLU:HG3	1:C:424:VAL:HG21	1.99	0.44
1:B:326:GLU:CD	1:B:326:GLU:H	2.25	0.44
1:A:96:LYS:HZ3	3:A:600:FAD:H6	1.81	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:F:87:LEU:C	2:F:88:LEU:HD12	2.42	0.44
1:B:438:HIS:ND1	1:B:535:SER:OG	2.34	0.43
1:D:218:LEU:HD23	1:D:218:LEU:HA	1.82	0.43
2:H:19:GLU:HA	2:H:80:ASN:HA	2.00	0.43
2:H:64:THR:C	2:H:66:LYS:H	2.25	0.43
1:C:511:THR:HG23	1:C:513:ALA:N	2.33	0.43
1:D:146:MET:HB3	1:D:146:MET:HE2	1.64	0.43
1:D:222:PRO:HD2	1:D:246:TYR:CZ	2.52	0.43
2:H:95:LEU:O	2:H:99:ILE:HG13	2.17	0.43
1:B:241:LEU:HD23	1:B:241:LEU:HA	1.91	0.43
1:C:431:ASN:O	1:C:435:SER:HB2	2.19	0.43
1:A:260:PHE:HE1	1:A:395:THR:HG21	1.83	0.43
1:B:220:LYS:NZ	1:B:308:ASP:O	2.51	0.43
1:A:224:LYS:HG2	1:A:307:TYR:HD2	1.83	0.43
1:B:210:ILE:HB	1:B:214:ASP:HB2	1.99	0.43
1:C:294:LYS:HD2	1:C:306:LEU:HD21	2.00	0.43
2:F:19:GLU:HA	2:F:80:ASN:HA	2.01	0.43
1:B:165:ASP:OD1	1:B:166:LYS:N	2.51	0.43
1:C:164:LYS:HB2	1:C:170:SER:OG	2.17	0.43
1:C:320:ILE:HD12	1:C:320:ILE:HA	1.87	0.43
1:B:401:ILE:HD11	1:B:479:GLY:HA2	2.01	0.43
1:B:63:HIS:CE1	1:B:382:LYS:HD2	2.54	0.43
2:E:34:LYS:HA	2:E:34:LYS:HD2	1.84	0.43
1:A:210:ILE:HB	1:A:214:ASP:HB2	2.00	0.43
1:B:51:PRO:HD2	3:B:600:FAD:O2A	2.19	0.43
1:B:294:LYS:HD2	1:B:306:LEU:HD21	2.01	0.43
2:G:15:ILE:HG12	2:G:21:VAL:HG11	2.01	0.43
1:A:371:LYS:O	1:A:375:ILE:HG13	2.19	0.42
1:D:162:LYS:HE3	1:D:170:SER:HB2	2.01	0.42
2:H:21:VAL:HG22	2:H:51:VAL:HB	2.01	0.42
1:A:431:ASN:O	1:A:435:SER:HB2	2.19	0.42
1:B:423:GLU:HG2	1:B:466:LYS:HG3	2.01	0.42
1:C:146:MET:HE2	1:C:146:MET:HB3	1.68	0.42
1:D:42:TYR:O	1:D:185:GLY:HA2	2.19	0.42
1:D:45:VAL:CG1	1:D:188:ILE:HG12	2.49	0.42
1:D:349:ILE:HA	1:D:350:PRO:HD3	1.87	0.42
2:E:21:VAL:HG22	2:E:51:VAL:HB	2.01	0.42
1:B:109:PHE:O	1:B:113:SER:OG	2.34	0.42
1:B:438:HIS:CE1	1:B:535:SER:HG	2.29	0.42
1:C:438:HIS:CE1	1:C:535:SER:HG	2.29	0.42
1:D:244:LEU:HD12	1:D:244:LEU:HA	1.85	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:F:72:MET:HE2	2:F:72:MET:HB2	1.85	0.42
1:B:162:LYS:HE3	1:B:170:SER:HB2	2.00	0.42
1:D:210:ILE:HB	1:D:214:ASP:HB2	2.00	0.42
1:D:294:LYS:HD2	1:D:306:LEU:HD21	2.02	0.42
2:F:11:PHE:HE1	2:F:23:VAL:HG21	1.85	0.42
1:C:165:ASP:OD1	1:C:166:LYS:N	2.52	0.42
1:A:78:GLN:NE2	1:A:209:SER:O	2.53	0.42
1:D:241:LEU:HD23	1:D:241:LEU:HA	1.88	0.42
1:D:252:VAL:HG12	1:D:254:SER:O	2.19	0.42
2:E:15:ILE:HG12	2:E:21:VAL:HG11	2.01	0.42
2:H:15:ILE:HG12	2:H:21:VAL:HG11	2.01	0.42
1:A:336:ASN:HB3	1:A:338:LYS:HG3	2.01	0.42
1:B:99:MET:HG2	1:B:130:LEU:HD21	2.01	0.42
1:D:105:MET:HE3	1:D:105:MET:HB2	1.97	0.42
1:A:42:TYR:O	1:A:185:GLY:HA2	2.19	0.42
1:C:143:PHE:CE2	2:G:72:MET:HE1	2.54	0.42
1:C:423:GLU:HG2	1:C:466:LYS:HG3	2.01	0.42
1:C:260:PHE:HE1	1:C:395:THR:HG21	1.85	0.42
1:D:320:ILE:HD12	1:D:323:LEU:HD12	2.02	0.42
2:E:61:SER:O	2:E:64:THR:HG23	2.20	0.42
1:B:42:TYR:O	1:B:185:GLY:HA2	2.20	0.41
1:A:164:LYS:HB2	1:A:170:SER:OG	2.20	0.41
1:C:224:LYS:HG2	1:C:307:TYR:HD2	1.85	0.41
2:F:27:ALA:HB3	2:F:30:CYS:HB2	2.01	0.41
1:A:165:ASP:OD1	1:A:166:LYS:N	2.54	0.41
2:G:87:LEU:C	2:G:88:LEU:HD12	2.45	0.41
2:G:57:VAL:O	2:G:64:THR:HG21	2.19	0.41
1:A:218:LEU:HD23	1:A:218:LEU:HA	1.82	0.41
1:D:74:LYS:NZ	1:D:319:ASP:OD1	2.51	0.41
2:E:77:VAL:HG22	2:E:85:ASP:HB3	2.02	0.41
2:F:15:ILE:HG12	2:F:21:VAL:HG11	2.02	0.41
1:C:241:LEU:HD23	1:C:241:LEU:HA	1.94	0.41
2:H:77:VAL:HG22	2:H:85:ASP:HB3	2.02	0.41
1:A:511:THR:HG23	1:A:513:ALA:H	1.86	0.41
1:D:260:PHE:HE1	1:D:395:THR:HG21	1.85	0.41
2:F:57:VAL:O	2:F:64:THR:HG21	2.20	0.41
1:C:139:ARG:HB3	2:G:29:TRP:CD1	2.56	0.41
1:C:334:LYS:HA	1:C:334:LYS:HD2	1.91	0.41
1:B:320:ILE:HD12	1:B:320:ILE:HA	1.85	0.41
1:B:334:LYS:HD2	1:B:334:LYS:HA	1.93	0.41
1:B:450:TYR:OH	2:E:92:ASP:HB2	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:494:ARG:HE	1:B:494:ARG:HB2	1.78	0.41
1:D:371:LYS:O	1:D:375:ILE:HG13	2.21	0.41
2:E:57:VAL:O	2:E:64:THR:HG21	2.20	0.41
2:G:72:MET:HE2	2:G:72:MET:HB2	1.86	0.41
2:H:3:LYS:HE3	2:H:3:LYS:HB2	1.95	0.41
1:B:68:LEU:HD12	1:B:155:LYS:O	2.20	0.41
1:C:359:ALA:O	1:C:362:VAL:HG22	2.20	0.41
1:D:96:LYS:HZ3	3:D:600:FAD:H6	1.86	0.41
2:H:57:VAL:O	2:H:64:THR:HG21	2.20	0.40
1:A:222:PRO:HD2	1:A:246:TYR:CZ	2.56	0.40
1:D:193:GLY:HA2	1:D:357:ASP:HB2	2.03	0.40
1:A:232:TYR:HB2	1:A:397:ILE:HG23	2.03	0.40
1:B:511:THR:HG23	1:B:513:ALA:N	2.36	0.40
1:C:244:LEU:HD12	1:C:244:LEU:HA	1.84	0.40
1:D:164:LYS:HB2	1:D:170:SER:OG	2.21	0.40
1:D:320:ILE:HD12	1:D:320:ILE:HA	1.84	0.40
1:A:63:HIS:CE1	1:A:382:LYS:HD2	2.57	0.40
1:A:162:LYS:HE3	1:A:170:SER:HB2	2.03	0.40
1:A:320:ILE:HD12	1:A:320:ILE:HA	1.86	0.40
1:B:511:THR:HG23	1:B:513:ALA:H	1.86	0.40
2:F:77:VAL:HG22	2:F:85:ASP:HB3	2.02	0.40
2:H:61:SER:O	2:H:64:THR:HG23	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	502/541 (93%)	471 (94%)	31 (6%)	0	100	100
1	B	502/541 (93%)	473 (94%)	29 (6%)	0	100	100
1	C	502/541 (93%)	472 (94%)	30 (6%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	502/541 (93%)	472 (94%)	30 (6%)	0	100	100
2	E	103/114 (90%)	93 (90%)	10 (10%)	0	100	100
2	F	103/114 (90%)	94 (91%)	9 (9%)	0	100	100
2	G	103/114 (90%)	94 (91%)	9 (9%)	0	100	100
2	H	103/114 (90%)	93 (90%)	10 (10%)	0	100	100
All	All	2420/2620 (92%)	2262 (94%)	158 (6%)	0	100	100

There are no Ramachandran outliers to report.

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	423/457 (93%)	392 (93%)	31 (7%)	13	20
1	B	423/457 (93%)	393 (93%)	30 (7%)	13	21
1	C	423/457 (93%)	395 (93%)	28 (7%)	15	24
1	D	423/457 (93%)	393 (93%)	30 (7%)	13	21
2	E	94/102 (92%)	86 (92%)	8 (8%)	10	15
2	F	94/102 (92%)	86 (92%)	8 (8%)	10	15
2	G	94/102 (92%)	86 (92%)	8 (8%)	10	15
2	H	94/102 (92%)	86 (92%)	8 (8%)	10	15
All	All	2068/2236 (92%)	1917 (93%)	151 (7%)	13	20

All (151) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	46	VAL
1	A	93	CYS
1	A	144	SER
1	A	160	LEU
1	A	163	LEU

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Mol	Chain	Res	Type
1	A	201	ASP
1	A	218	LEU
1	A	244	LEU
1	A	255	ILE
1	A	256	VAL
1	A	267	LYS
1	A	270	LEU
1	A	277	VAL
1	A	286	LYS
1	A	292	ASP
1	A	304	SER
1	A	320	ILE
1	A	331	ASN
1	A	332	VAL
1	A	336	ASN
1	A	387	ILE
1	A	399	THR
1	A	416	LEU
1	A	422	VAL
1	A	443	ILE
1	A	471	ARG
1	A	489	MET
1	A	493	LEU
1	A	506	ILE
1	A	511	THR
1	A	540	CYS
1	B	46	VAL
1	B	56	SER
1	B	93	CYS
1	B	144	SER
1	B	160	LEU
1	B	163	LEU
1	B	201	ASP
1	B	218	LEU
1	B	244	LEU
1	B	256	VAL
1	B	267	LYS
1	B	270	LEU
1	B	277	VAL
1	B	286	LYS
1	B	292	ASP
1	B	304	SER

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Mol	Chain	Res	Type
1	B	320	ILE
1	B	331	ASN
1	B	332	VAL
1	B	336	ASN
1	B	387	ILE
1	B	416	LEU
1	B	422	VAL
1	B	443	ILE
1	B	471	ARG
1	B	489	MET
1	B	493	LEU
1	B	506	ILE
1	B	511	THR
1	B	523	ILE
1	C	46	VAL
1	C	93	CYS
1	C	144	SER
1	C	160	LEU
1	C	163	LEU
1	C	201	ASP
1	C	218	LEU
1	C	244	LEU
1	C	256	VAL
1	C	267	LYS
1	C	270	LEU
1	C	277	VAL
1	C	286	LYS
1	C	292	ASP
1	C	304	SER
1	C	320	ILE
1	C	331	ASN
1	C	332	VAL
1	C	336	ASN
1	C	387	ILE
1	C	416	LEU
1	C	422	VAL
1	C	443	ILE
1	C	471	ARG
1	C	489	MET
1	C	493	LEU
1	C	506	ILE
1	C	511	THR

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Mol	Chain	Res	Type
1	D	44	TYR
1	D	46	VAL
1	D	93	CYS
1	D	144	SER
1	D	160	LEU
1	D	163	LEU
1	D	201	ASP
1	D	218	LEU
1	D	244	LEU
1	D	256	VAL
1	D	267	LYS
1	D	270	LEU
1	D	277	VAL
1	D	286	LYS
1	D	289	THR
1	D	292	ASP
1	D	304	SER
1	D	320	ILE
1	D	331	ASN
1	D	332	VAL
1	D	336	ASN
1	D	387	ILE
1	D	416	LEU
1	D	422	VAL
1	D	443	ILE
1	D	471	ARG
1	D	489	MET
1	D	493	LEU
1	D	506	ILE
1	D	511	THR
2	E	7	SER
2	E	34	LYS
2	E	46	THR
2	E	60	VAL
2	E	62	GLU
2	E	64	THR
2	E	86	THR
2	E	97	GLN
2	F	7	SER
2	F	34	LYS
2	F	46	THR
2	F	60	VAL

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Mol	Chain	Res	Type
2	F	62	GLU
2	F	64	THR
2	F	86	THR
2	F	97	GLN
2	G	7	SER
2	G	34	LYS
2	G	46	THR
2	G	60	VAL
2	G	62	GLU
2	G	64	THR
2	G	86	THR
2	G	97	GLN
2	H	7	SER
2	H	34	LYS
2	H	46	THR
2	H	60	VAL
2	H	62	GLU
2	H	64	THR
2	H	86	THR
2	H	97	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	90	ASN
1	A	137	HIS
1	A	142	ASN
1	A	197	HIS
1	A	242	ASN
1	A	324	ASN
1	B	90	ASN
1	B	137	HIS
1	B	142	ASN
1	B	242	ASN
1	B	481	ASN
1	C	90	ASN
1	C	137	HIS
1	C	142	ASN
1	C	197	HIS
1	C	242	ASN
1	C	427	GLN
1	D	90	ASN

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Mol	Chain	Res	Type
1	D	142	ASN
1	D	242	ASN
1	D	324	ASN

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](#)

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	$\# Z > 2$
3	FAD	C	600	-	58,58,58	2.11	10 (17%)	85,89,89	1.98	24 (28%)
3	FAD	A	600	-	58,58,58	2.19	8 (13%)	85,89,89	1.93	23 (27%)
3	FAD	D	600	-	58,58,58	2.09	8 (13%)	85,89,89	1.92	25 (29%)
3	FAD	B	600	-	58,58,58	2.07	10 (17%)	85,89,89	1.91	25 (29%)

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
3	FAD	C	600	-	-	11/34/50/50	0/6/6/6
3	FAD	A	600	-	-	6/34/50/50	0/6/6/6
3	FAD	D	600	-	-	9/34/50/50	0/6/6/6
3	FAD	B	600	-	-	8/34/50/50	0/6/6/6

All (36) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	600	FAD	O2-C2	9.41	1.43	1.24
3	A	600	FAD	O4-C4	8.50	1.39	1.23
3	C	600	FAD	O2-C2	8.45	1.41	1.24
3	D	600	FAD	O2-C2	8.40	1.41	1.24
3	B	600	FAD	O4-C4	8.34	1.39	1.23
3	D	600	FAD	O4-C4	8.30	1.39	1.23
3	C	600	FAD	O4-C4	8.25	1.39	1.23
3	B	600	FAD	O2-C2	8.22	1.40	1.24
3	D	600	FAD	C2B-C3B	-5.46	1.38	1.53
3	C	600	FAD	C2B-C3B	-5.45	1.38	1.53
3	A	600	FAD	C2B-C3B	-5.36	1.38	1.53
3	B	600	FAD	C2B-C3B	-5.14	1.39	1.53
3	D	600	FAD	C6A-N6A	3.55	1.43	1.34
3	C	600	FAD	C6A-N6A	3.54	1.43	1.34
3	B	600	FAD	C6A-N6A	3.43	1.43	1.34
3	A	600	FAD	C6A-N6A	3.42	1.42	1.34
3	B	600	FAD	C4-N3	-2.65	1.33	1.38
3	A	600	FAD	C4X-N5	2.46	1.36	1.30
3	B	600	FAD	C5X-N5	-2.46	1.34	1.39
3	A	600	FAD	O3'-C3'	-2.38	1.37	1.43
3	C	600	FAD	C2-N3	-2.28	1.34	1.39
3	A	600	FAD	C8A-N7A	2.26	1.36	1.31
3	C	600	FAD	O3'-C3'	-2.23	1.37	1.43
3	C	600	FAD	C10-N1	2.21	1.37	1.33
3	D	600	FAD	C3B-C4B	-2.20	1.47	1.53
3	D	600	FAD	C9A-N10	-2.18	1.37	1.41
3	C	600	FAD	C4X-N5	2.14	1.35	1.30
3	B	600	FAD	O3'-C3'	-2.14	1.37	1.43
3	C	600	FAD	C3B-C4B	-2.13	1.47	1.53
3	D	600	FAD	C8A-N7A	2.11	1.35	1.31
3	B	600	FAD	C2-N3	-2.08	1.34	1.39
3	D	600	FAD	C4X-N5	2.08	1.35	1.30
3	C	600	FAD	C4-N3	-2.07	1.35	1.38
3	B	600	FAD	C8A-N7A	2.03	1.35	1.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	600	FAD	C3B-C4B	-2.03	1.47	1.53
3	B	600	FAD	C4X-N5	2.02	1.35	1.30

All (97) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	600	FAD	C5A-C4A-N3A	-6.29	118.06	126.72
3	C	600	FAD	C5A-C4A-N3A	-6.05	118.38	126.72
3	B	600	FAD	C5A-C4A-N3A	-5.63	118.96	126.72
3	A	600	FAD	C5A-C4A-N3A	-5.60	119.00	126.72
3	D	600	FAD	N3A-C4A-N9A	4.91	135.52	127.17
3	C	600	FAD	N3A-C4A-N9A	4.85	135.42	127.17
3	A	600	FAD	C2B-C1B-N9A	4.37	124.16	113.30
3	A	600	FAD	N3A-C2A-N1A	-4.35	121.99	128.58
3	C	600	FAD	N9A-C8A-N7A	-4.35	107.77	113.94
3	B	600	FAD	C2B-C1B-N9A	4.25	123.87	113.30
3	D	600	FAD	C4X-C10-N10	4.20	122.50	116.48
3	B	600	FAD	N3A-C4A-N9A	4.19	134.30	127.17
3	B	600	FAD	O5B-C5B-C4B	4.14	123.09	108.99
3	C	600	FAD	N3A-C2A-N1A	-4.09	122.40	128.58
3	C	600	FAD	C4A-N9A-C8A	3.98	109.92	105.74
3	D	600	FAD	N3A-C2A-N1A	-3.92	122.64	128.58
3	C	600	FAD	C2A-N3A-C4A	3.92	121.41	111.83
3	A	600	FAD	N3A-C4A-N9A	3.89	133.78	127.17
3	D	600	FAD	C2B-C1B-N9A	3.87	122.92	113.30
3	B	600	FAD	N3A-C2A-N1A	-3.78	122.87	128.58
3	A	600	FAD	C2A-N3A-C4A	3.76	121.01	111.83
3	B	600	FAD	O5'-C5'-C4'	3.72	119.30	109.36
3	C	600	FAD	C5A-N7A-C8A	3.72	109.29	103.45
3	A	600	FAD	O2A-PA-O3P	3.68	117.22	107.27
3	A	600	FAD	N9A-C8A-N7A	-3.61	108.82	113.94
3	A	600	FAD	C4A-N9A-C1B	-3.56	118.30	126.63
3	D	600	FAD	C2A-N3A-C4A	3.56	120.53	111.83
3	C	600	FAD	C4-N3-C2	-3.49	119.44	125.64
3	B	600	FAD	C2A-N3A-C4A	3.49	120.35	111.83
3	D	600	FAD	C4-C4X-N5	3.35	122.83	118.21
3	C	600	FAD	C4A-C5A-N7A	-3.29	106.82	110.58
3	D	600	FAD	C4-N3-C2	-3.28	119.82	125.64
3	B	600	FAD	C4-N3-C2	-3.26	119.85	125.64
3	C	600	FAD	C4X-C10-N1	-3.26	116.59	124.59
3	C	600	FAD	O5B-C5B-C4B	3.17	119.79	108.99
3	A	600	FAD	C5A-N7A-C8A	3.17	108.43	103.45

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	600	FAD	N9A-C8A-N7A	-3.16	109.45	113.94
3	B	600	FAD	C4A-N9A-C1B	-3.14	119.29	126.63
3	C	600	FAD	C4X-C4-N3	3.09	121.12	113.25
3	A	600	FAD	C4A-C5A-N7A	-3.09	107.05	110.58
3	A	600	FAD	C4-C4X-N5	3.08	122.47	118.21
3	B	600	FAD	C4X-C10-N1	-3.07	117.05	124.59
3	D	600	FAD	C1'-N10-C9A	3.04	126.53	120.63
3	B	600	FAD	C5A-N7A-C8A	3.04	108.22	103.45
3	B	600	FAD	O4B-C1B-C2B	-3.02	100.14	106.62
3	B	600	FAD	C4A-C5A-N7A	-3.02	107.13	110.58
3	A	600	FAD	C4X-C10-N10	3.01	120.79	116.48
3	A	600	FAD	C10-N1-C2	2.98	123.31	116.85
3	A	600	FAD	C4X-C4-N3	2.94	120.73	113.25
3	D	600	FAD	C4X-C4-N3	2.94	120.73	113.25
3	A	600	FAD	O5B-C5B-C4B	2.92	118.95	108.99
3	D	600	FAD	O5B-C5B-C4B	2.91	118.89	108.99
3	C	600	FAD	C4A-N9A-C1B	-2.91	119.83	126.63
3	A	600	FAD	C4-N3-C2	-2.80	120.66	125.64
3	C	600	FAD	O5'-C5'-C4'	2.80	116.83	109.36
3	A	600	FAD	O5'-C5'-C4'	2.78	116.79	109.36
3	D	600	FAD	N9A-C8A-N7A	-2.74	110.05	113.94
3	A	600	FAD	C1B-N9A-C8A	2.72	133.13	127.09
3	B	600	FAD	C4X-C10-N10	2.71	120.36	116.48
3	A	600	FAD	C4X-C10-N1	-2.71	117.95	124.59
3	C	600	FAD	C4X-C10-N10	2.69	120.33	116.48
3	B	600	FAD	C4X-C4-N3	2.69	120.09	113.25
3	C	600	FAD	C10-N1-C2	2.67	122.64	116.85
3	D	600	FAD	C5A-N7A-C8A	2.63	107.58	103.45
3	A	600	FAD	C4A-N9A-C8A	2.61	108.48	105.74
3	D	600	FAD	C10-C4X-N5	-2.60	119.50	124.81
3	B	600	FAD	C4A-N9A-C8A	2.59	108.46	105.74
3	A	600	FAD	C10-C4X-N5	-2.56	119.59	124.81
3	D	600	FAD	C10-N1-C2	2.51	122.28	116.85
3	C	600	FAD	O4B-C1B-C2B	-2.49	101.29	106.62
3	D	600	FAD	O2-C2-N1	-2.46	117.72	121.80
3	C	600	FAD	C10-C4X-N5	-2.44	119.83	124.81
3	C	600	FAD	C1'-N10-C9A	2.39	125.28	120.63
3	C	600	FAD	C9-C9A-N10	2.39	125.07	121.85
3	D	600	FAD	O2A-PA-O3P	2.37	113.67	107.27
3	D	600	FAD	C4X-C10-N1	-2.36	118.81	124.59
3	C	600	FAD	C9-C9A-C5X	-2.34	115.89	120.03
3	B	600	FAD	C10-C4X-N5	-2.32	120.06	124.81

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	600	FAD	C1B-N9A-C8A	2.29	132.17	127.09
3	D	600	FAD	C2'-C1'-N10	2.27	120.95	110.20
3	C	600	FAD	O4-C4-C4X	-2.26	120.57	126.53
3	B	600	FAD	C6-C5X-C9A	2.24	122.13	119.05
3	A	600	FAD	O4-C4-C4X	-2.23	120.64	126.53
3	B	600	FAD	C10-N1-C2	2.22	121.66	116.85
3	B	600	FAD	C9-C9A-C5X	-2.22	116.11	120.03
3	D	600	FAD	C5A-C6A-N6A	-2.21	117.80	123.29
3	C	600	FAD	C2B-C1B-N9A	2.21	118.79	113.30
3	B	600	FAD	C1'-N10-C9A	2.20	124.92	120.63
3	D	600	FAD	O5'-C5'-C4'	2.18	115.19	109.36
3	D	600	FAD	C4A-N9A-C1B	-2.17	121.55	126.63
3	D	600	FAD	O4-C4-C4X	-2.16	120.84	126.53
3	C	600	FAD	C4-C4X-N5	2.13	121.15	118.21
3	D	600	FAD	C2B-C3B-C4B	2.13	106.72	102.61
3	D	600	FAD	C3B-C2B-C1B	2.12	105.47	101.46
3	A	600	FAD	C2B-C3B-C4B	2.10	106.68	102.61
3	B	600	FAD	O4-C4-C4X	-2.05	121.12	126.53
3	B	600	FAD	C2B-C3B-C4B	2.01	106.49	102.61

There are no chirality outliers.

All (34) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	600	FAD	C5B-O5B-PA-O1A
3	C	600	FAD	C5B-O5B-PA-O2A
3	C	600	FAD	C5B-O5B-PA-O3P
3	C	600	FAD	C5'-O5'-P-O2P
3	D	600	FAD	O4'-C4'-C5'-O5'
3	C	600	FAD	O4B-C4B-C5B-O5B
3	C	600	FAD	C3B-C4B-C5B-O5B
3	B	600	FAD	O4B-C4B-C5B-O5B
3	B	600	FAD	C3B-C4B-C5B-O5B
3	C	600	FAD	C3'-C4'-C5'-O5'
3	D	600	FAD	P-O3P-PA-O1A
3	D	600	FAD	O4B-C4B-C5B-O5B
3	B	600	FAD	PA-O3P-P-O5'
3	D	600	FAD	PA-O3P-P-O5'
3	D	600	FAD	C3B-C4B-C5B-O5B
3	B	600	FAD	O2'-C2'-C3'-C4'
3	B	600	FAD	O2'-C2'-C3'-O3'
3	A	600	FAD	C5'-O5'-P-O1P

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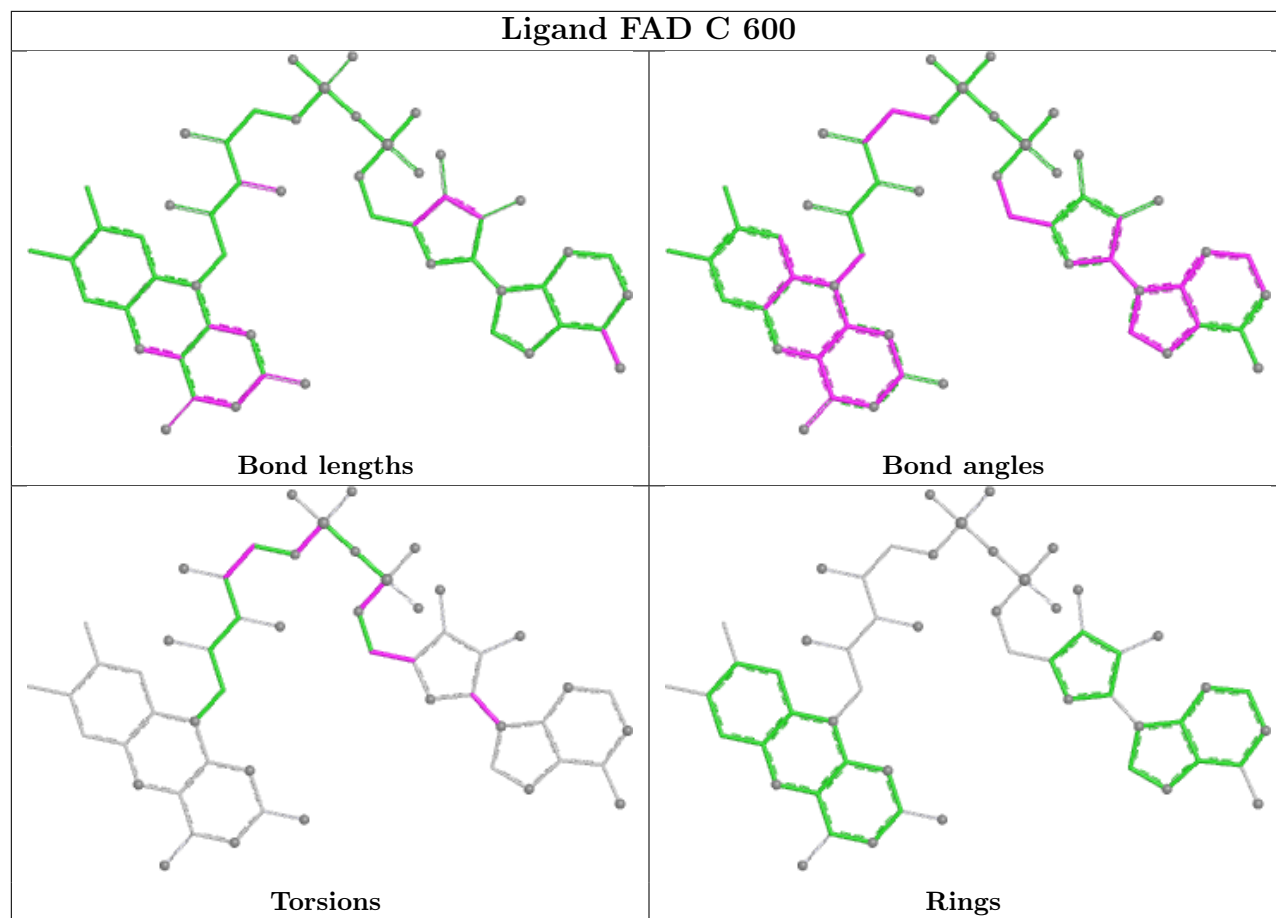
Mol	Chain	Res	Type	Atoms
3	B	600	FAD	C5B-O5B-PA-O2A
3	B	600	FAD	C5B-O5B-PA-O3P
3	C	600	FAD	C5'-O5'-P-O1P
3	C	600	FAD	C5'-O5'-P-O3P
3	D	600	FAD	C5'-O5'-P-O1P
3	D	600	FAD	C5'-O5'-P-O2P
3	A	600	FAD	P-O3P-PA-O1A
3	A	600	FAD	PA-O3P-P-O5'
3	B	600	FAD	C1'-C2'-C3'-O3'
3	A	600	FAD	P-O3P-PA-O2A
3	A	600	FAD	PA-O3P-P-O2P
3	C	600	FAD	O4'-C4'-C5'-O5'
3	C	600	FAD	C2B-C1B-N9A-C8A
3	D	600	FAD	C2B-C1B-N9A-C8A
3	A	600	FAD	O4B-C4B-C5B-O5B
3	D	600	FAD	P-O3P-PA-O2A

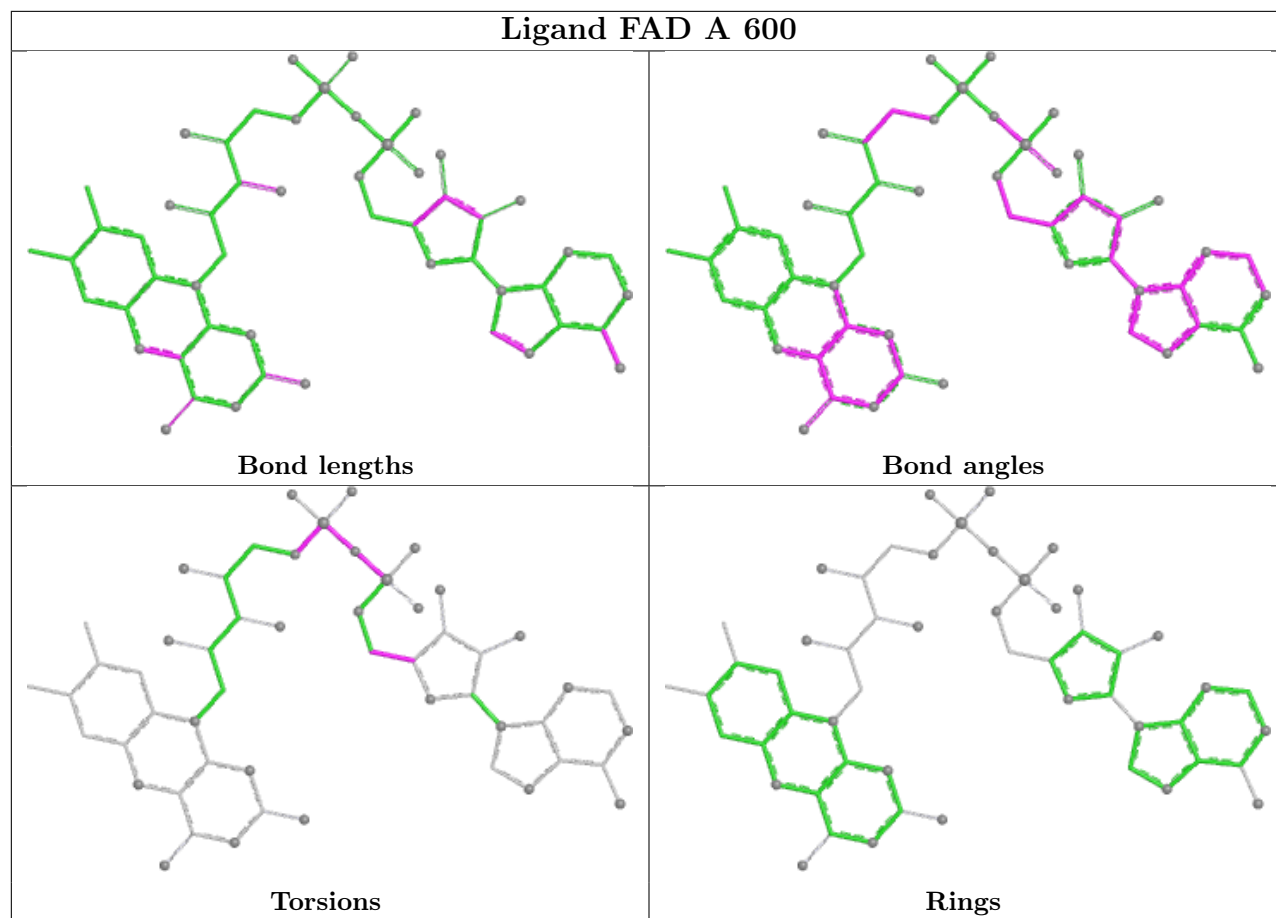
There are no ring outliers.

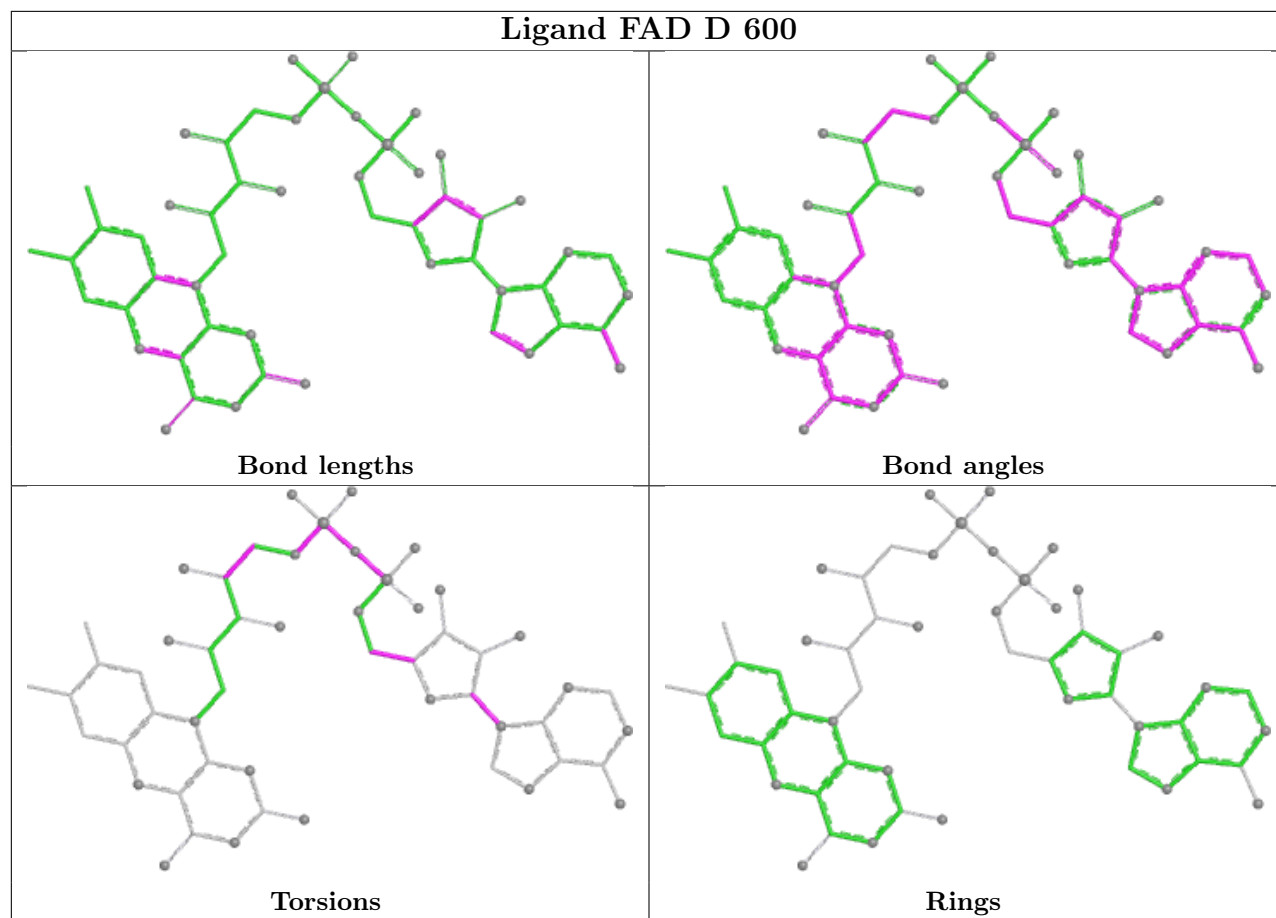
4 monomers are involved in 13 short contacts:

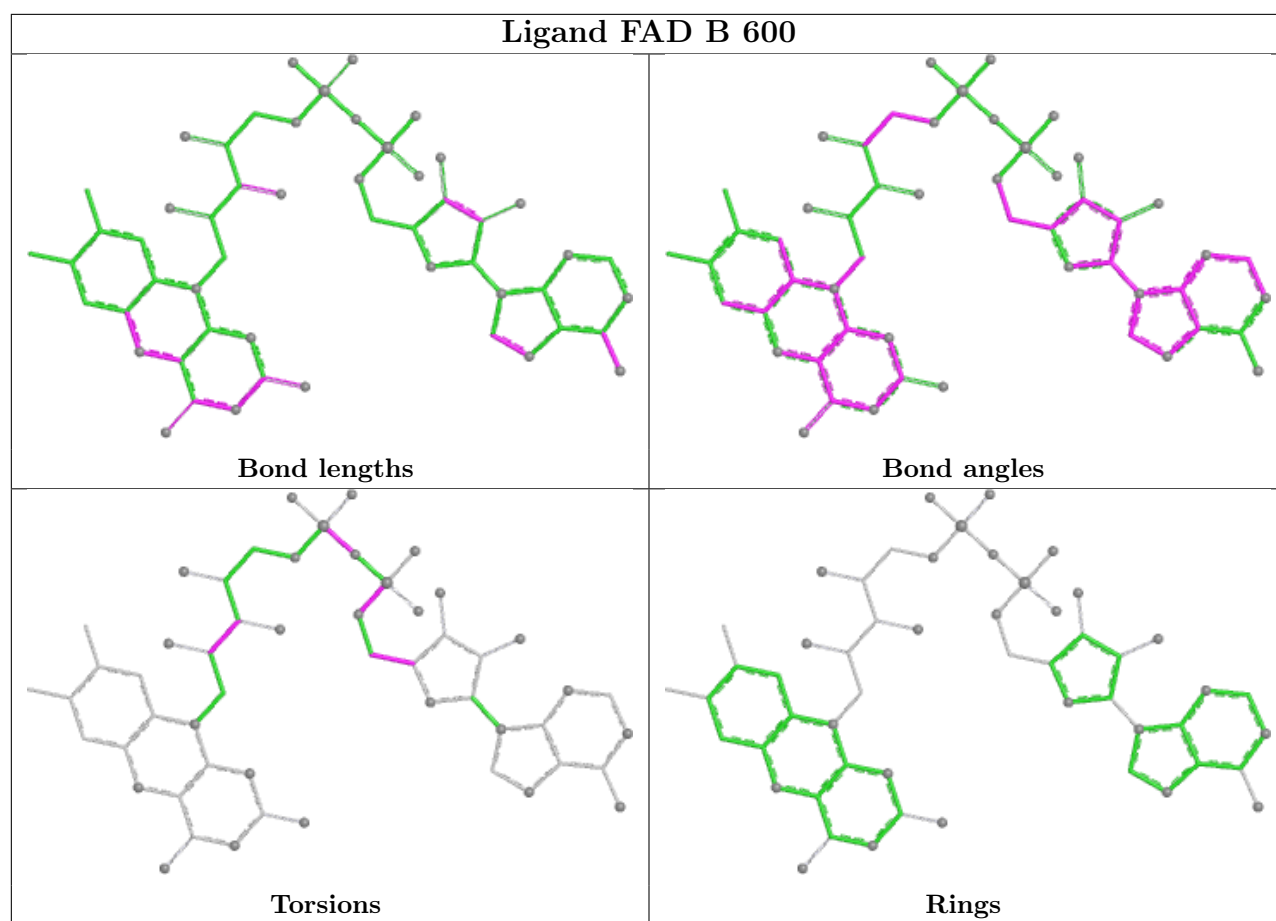
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	600	FAD	3	0
3	A	600	FAD	3	0
3	D	600	FAD	2	0
3	B	600	FAD	5	0

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	504/541 (93%)	-1.29	0 100 100	22, 39, 63, 78	0
1	B	504/541 (93%)	-1.32	0 100 100	19, 37, 60, 80	0
1	C	504/541 (93%)	-1.31	0 100 100	17, 40, 59, 79	0
1	D	504/541 (93%)	-1.30	0 100 100	20, 38, 62, 83	0
2	E	105/114 (92%)	-1.03	0 100 100	37, 51, 58, 61	105 (100%)
2	F	105/114 (92%)	-1.01	0 100 100	37, 54, 62, 65	105 (100%)
2	G	105/114 (92%)	-0.92	0 100 100	37, 53, 59, 64	105 (100%)
2	H	105/114 (92%)	-1.06	0 100 100	34, 47, 56, 66	105 (100%)
All	All	2436/2620 (92%)	-1.25	0 100 100	17, 41, 61, 83	420 (17%)

There are no RSRZ outliers to report.

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

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

6.3 Carbohydrates ⓘ

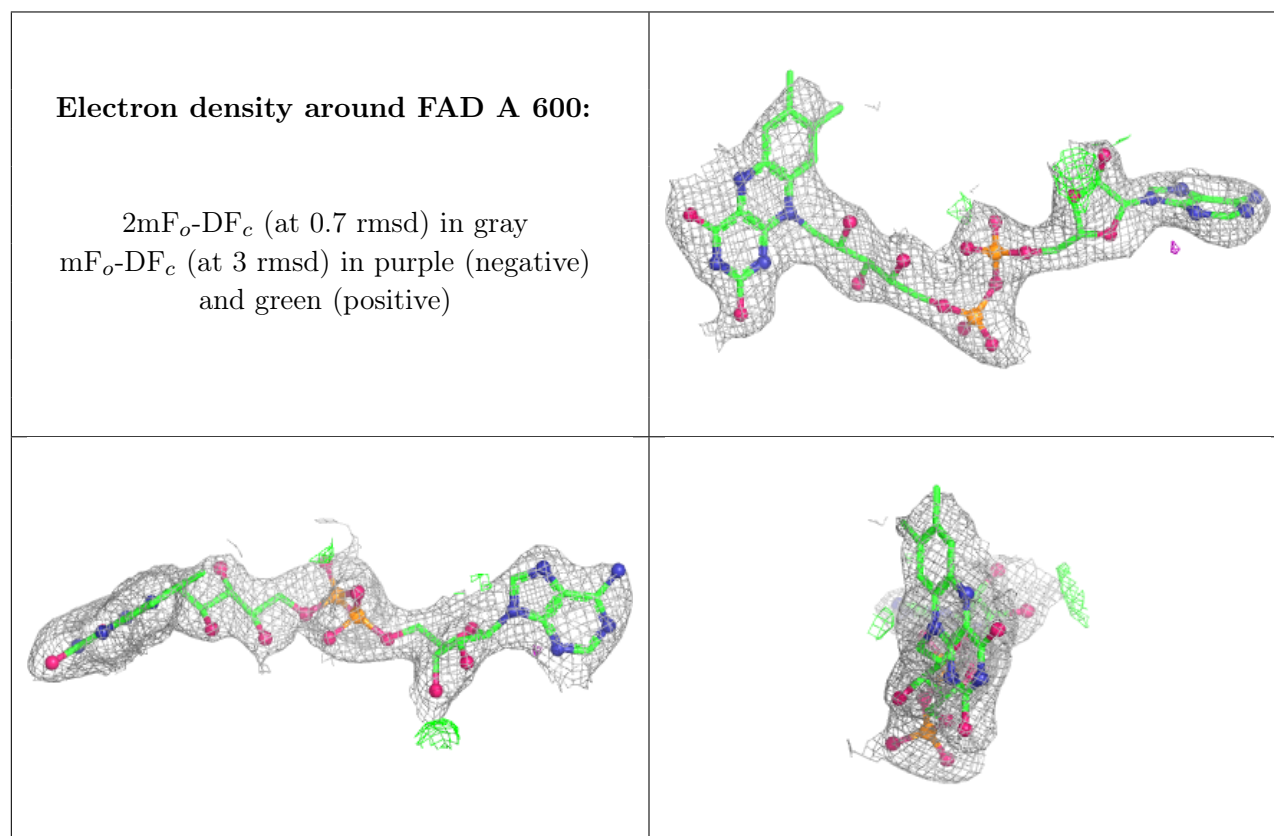
There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

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.

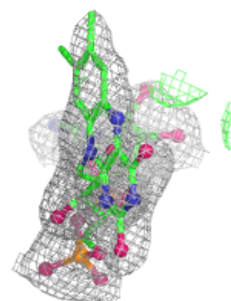
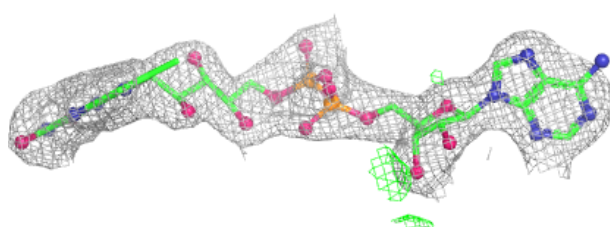
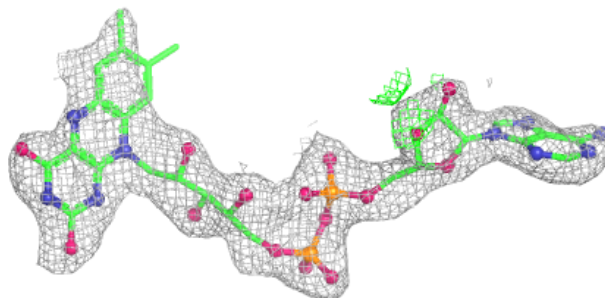
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	FAD	A	600	53/53	0.99	0.04	30,42,47,48	0
3	FAD	B	600	53/53	0.99	0.03	31,43,49,54	0
3	FAD	C	600	53/53	0.99	0.04	32,44,56,58	0
3	FAD	D	600	53/53	0.99	0.03	28,38,45,45	0

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.

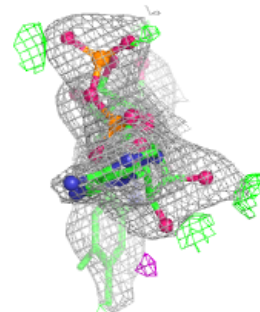
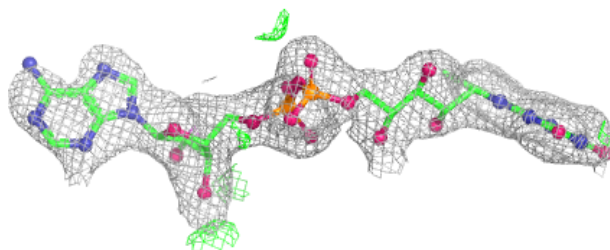
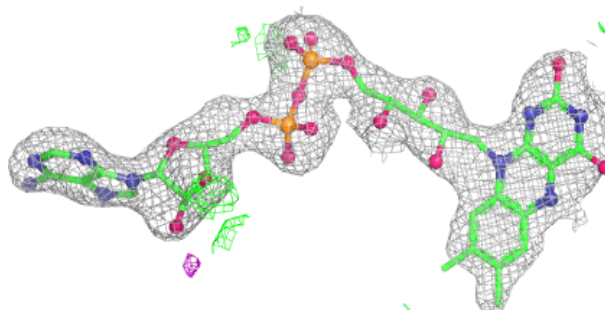


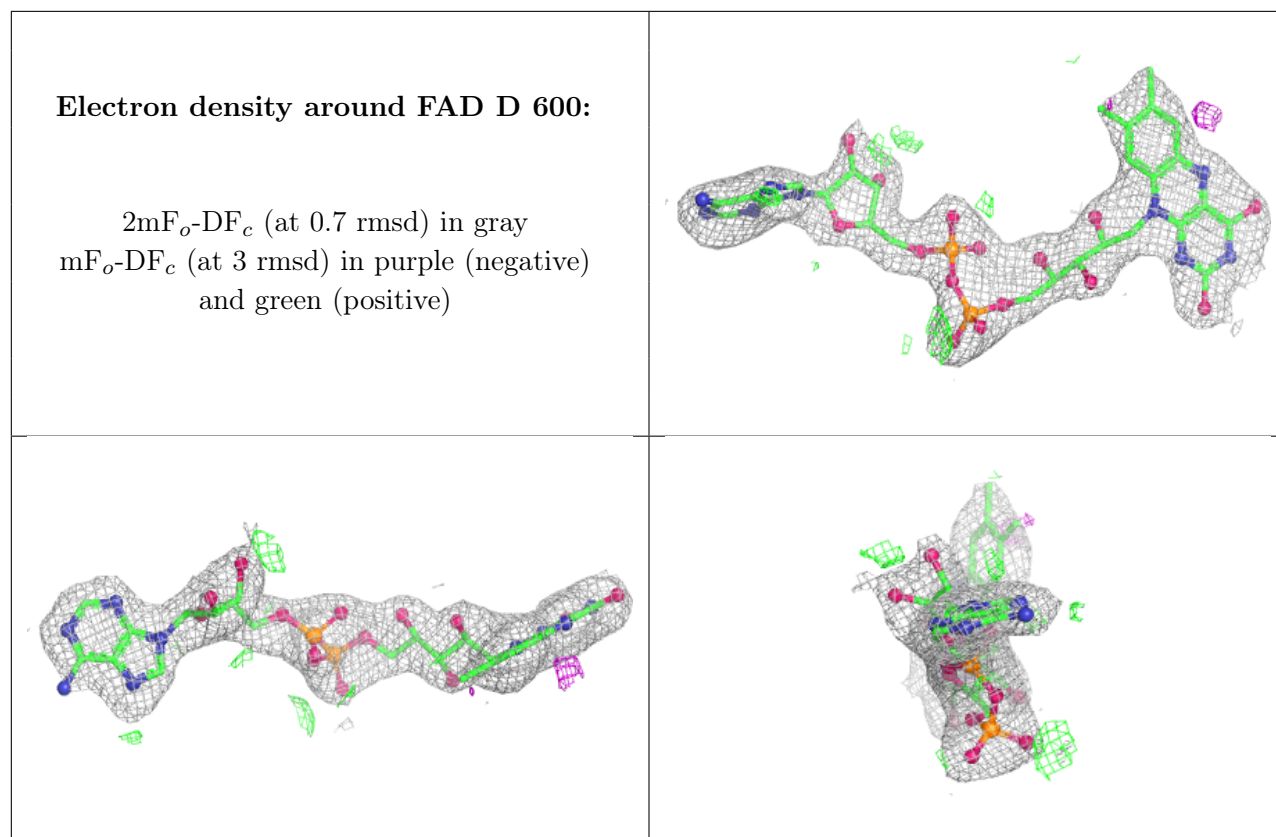
Electron density around FAD B 600:

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

**Electron density around FAD C 600:**

$2mF_o-DF_c$ (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.