Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 10:56 AM EDT

PDB ID	:	6Y48
Title	:	Baeyer-Villiger monooxygenase BVMOAFL210 from Aspergillus flavus in complex with NADP
Authors	:	Opperman, D.J.; Tolmie, C.
Deposited on	:	2020-02-19
Resolution	:	2.09 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:

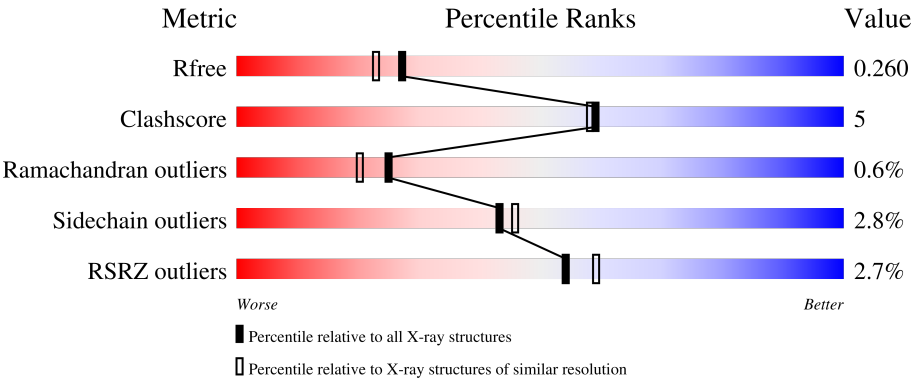
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	2.37.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.09 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}	130704	6189 (2.10-2.06)
Clashscore	141614	6738 (2.10-2.06)
Ramachandran outliers	138981	6663 (2.10-2.06)
Sidechain outliers	138945	6664 (2.10-2.06)
RSRZ outliers	127900	6057 (2.10-2.06)

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 <=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	561	85% 10%
1	B	561	81% 15%
1	C	561	84% 11%
1	D	561	7% 81% 12% 5%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 17933 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 Baeyer-Villiger monooxygenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	537	Total	C	N	O	S	0	0	0
			4342	2794	730	802	16			
1	B	538	Total	C	N	O	S	0	0	0
			4353	2800	734	803	16			
1	C	537	Total	C	N	O	S	0	0	0
			4342	2794	730	802	16			
1	D	534	Total	C	N	O	S	0	0	0
			4328	2787	727	798	16			

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	556	HIS	-	expression tag	UNP B8N5I0
A	557	HIS	-	expression tag	UNP B8N5I0
A	558	HIS	-	expression tag	UNP B8N5I0
A	559	HIS	-	expression tag	UNP B8N5I0
A	560	HIS	-	expression tag	UNP B8N5I0
A	561	HIS	-	expression tag	UNP B8N5I0
B	556	HIS	-	expression tag	UNP B8N5I0
B	557	HIS	-	expression tag	UNP B8N5I0
B	558	HIS	-	expression tag	UNP B8N5I0
B	559	HIS	-	expression tag	UNP B8N5I0
B	560	HIS	-	expression tag	UNP B8N5I0
B	561	HIS	-	expression tag	UNP B8N5I0
C	556	HIS	-	expression tag	UNP B8N5I0
C	557	HIS	-	expression tag	UNP B8N5I0
C	558	HIS	-	expression tag	UNP B8N5I0
C	559	HIS	-	expression tag	UNP B8N5I0
C	560	HIS	-	expression tag	UNP B8N5I0
C	561	HIS	-	expression tag	UNP B8N5I0
D	556	HIS	-	expression tag	UNP B8N5I0
D	557	HIS	-	expression tag	UNP B8N5I0
D	558	HIS	-	expression tag	UNP B8N5I0

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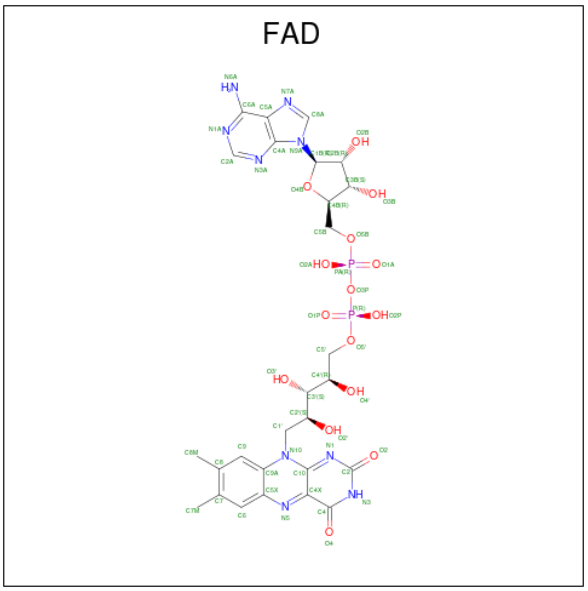
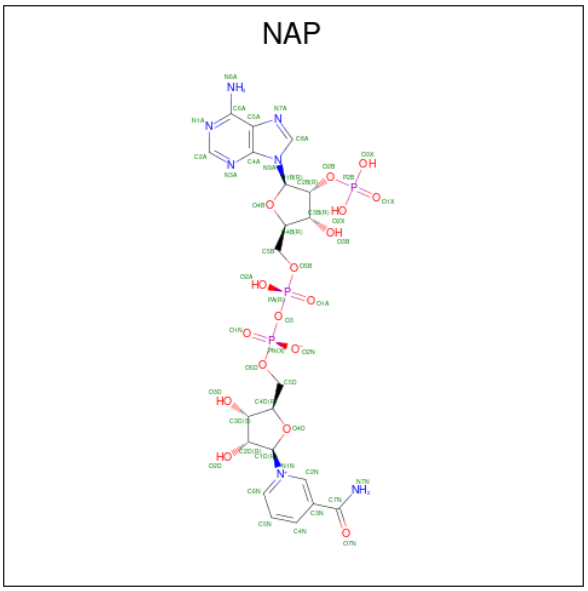
Chain	Residue	Modelled	Actual	Comment	Reference
D	559	HIS	-	expression tag	UNP B8N5I0
D	560	HIS	-	expression tag	UNP B8N5I0
D	561	HIS	-	expression tag	UNP B8N5I0

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: 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 NADP NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NAP) (formula: $C_{21}H_{28}N_7O_{17}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
3	B	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
3	C	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
3	D	1	Total	C	N	O	P	0	0
			48	21	7	17	3		

- Molecule 4 is water.

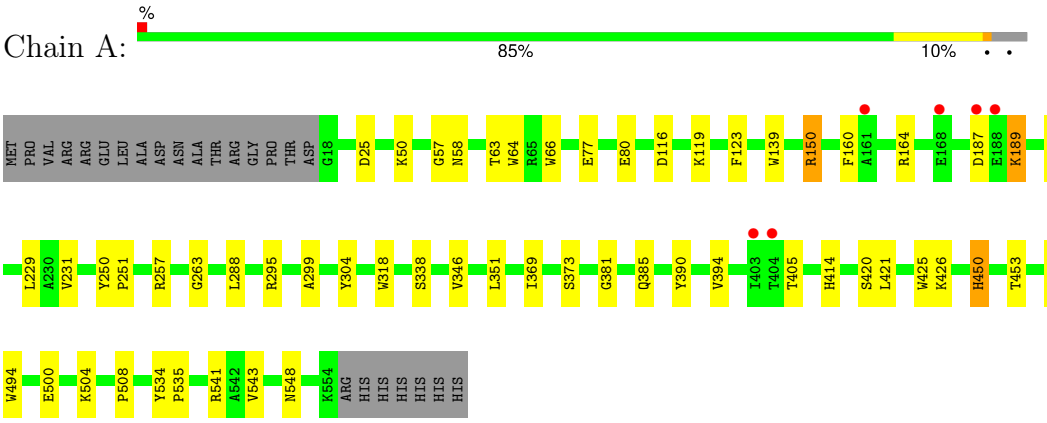
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	64	Total	O	0	0
			64	64		
4	B	54	Total	O	0	0
			54	54		
4	C	32	Total	O	0	0
			32	32		
4	D	14	Total	O	0	0
			14	14		

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.

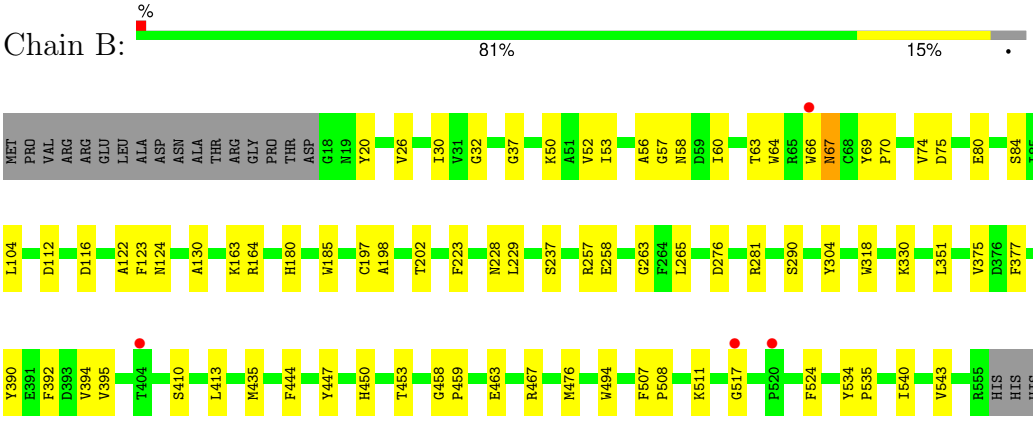
• Molecule 1: Baeyer-Villiger monooxygenase

Chain A:



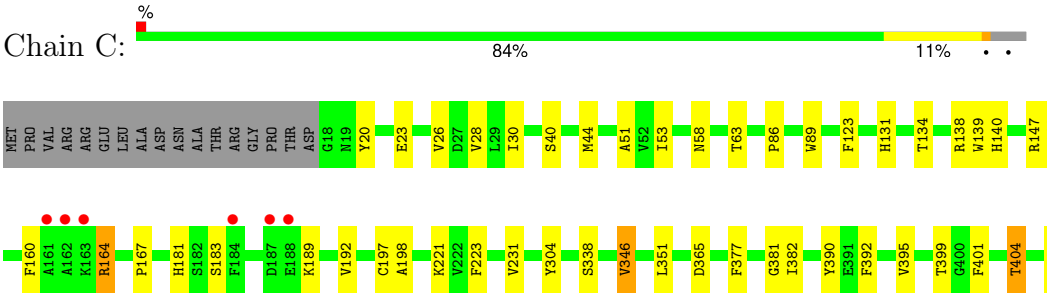
• Molecule 1: Baeyer-Villiger monooxygenase

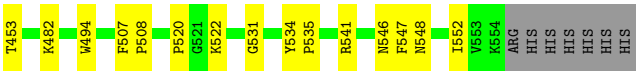
Chain B:



• Molecule 1: Baeyer-Villiger monooxygenase

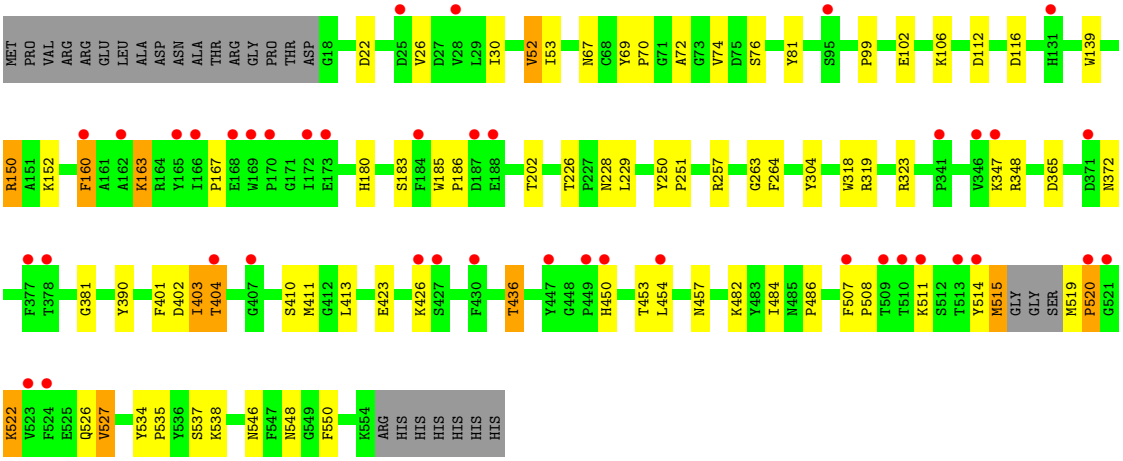
Chain C:





• Molecule 1: Baeyer-Villiger monooxygenase

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	87.89Å 117.31Å 133.34Å 90.00° 103.52° 90.00°	Depositor
Resolution (Å)	129.64 – 2.09 129.64 – 2.09	Depositor EDS
% Data completeness (in resolution range)	46.2 (129.64-2.09) 46.2 (129.64-2.09)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.65 (at 2.08Å)	Xtriage
Refinement program	REFMAC 5.8.0253	Depositor
R, R_{free}	0.206 , 0.262 0.209 , 0.260	Depositor DCC
R_{free} test set	3434 reflections (4.76%)	wwPDB-VP
Wilson B-factor (Å^2)	30.7	Xtriage
Anisotropy	0.195	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 30.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	17933	wwPDB-VP
Average B, all atoms (Å^2)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.50% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: NAP, 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	0.62	0/4471	0.72	0/6060
1	B	0.62	0/4482	0.72	0/6074
1	C	0.62	0/4471	0.72	0/6060
1	D	0.64	0/4456	0.73	0/6039
All	All	0.62	0/17880	0.72	0/24233

There are no bond length outliers.

There are no bond angle outliers.

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	4342	0	4177	26	0
1	B	4353	0	4190	48	0
1	C	4342	0	4177	35	0
1	D	4328	0	4165	52	0
2	A	53	0	31	1	0
2	B	53	0	31	1	0
2	C	53	0	31	0	0
2	D	53	0	31	1	0
3	A	48	0	25	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	48	0	25	0	0
3	C	48	0	25	2	0
3	D	48	0	25	3	0
4	A	64	0	0	0	0
4	B	54	0	0	0	0
4	C	32	0	0	0	0
4	D	14	0	0	0	0
All	All	17933	0	16933	163	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 5.

All (163) 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:D:160:PHE:HB2	1:D:403:ILE:HG22	1.59	0.85
1:C:425:TRP:O	1:C:522:LYS:NZ	2.10	0.84
1:D:160:PHE:CD1	1:D:403:ILE:HG21	2.15	0.81
1:D:163:LYS:HE2	1:D:402:ASP:HB3	1.64	0.78
1:C:140:HIS:CD2	1:C:150:ARG:HG2	2.23	0.73
1:C:192:VAL:HG22	1:C:197:CYS:SG	2.29	0.72
1:D:348:ARG:HB2	1:D:514:TYR:OH	1.92	0.69
1:D:402:ASP:O	1:D:404:THR:N	2.27	0.68
1:C:192:VAL:CG2	1:C:197:CYS:SG	2.84	0.66
1:B:57:GLY:HA3	1:B:66:TRP:CZ2	2.33	0.64
1:D:511:LYS:O	1:D:515:MET:HB2	1.97	0.64
1:D:69:TYR:OH	3:D:602:NAP:H4N	1.99	0.63
1:A:139:TRP:O	1:A:150:ARG:HA	1.99	0.63
1:B:74:VAL:CG1	1:B:104:LEU:HD11	2.30	0.61
1:D:160:PHE:HB2	1:D:403:ILE:CG2	2.30	0.60
1:B:534:TYR:HB3	1:B:535:PRO:HD3	1.83	0.60
1:D:436:THR:HG23	1:D:486:PRO:HG3	1.85	0.59
1:C:547:PHE:HB2	1:C:552:ILE:HD11	1.84	0.58
1:A:189:LYS:CE	1:A:189:LYS:HA	2.34	0.58
1:B:26:VAL:HG11	1:B:52:VAL:CG1	2.35	0.57
1:C:450:HIS:HB3	1:C:494:TRP:HE1	1.69	0.57
1:B:84:SER:OG	1:B:463:GLU:OE1	2.21	0.57
1:D:347:LYS:HA	1:D:514:TYR:HE1	1.70	0.57
1:A:346:VAL:HG13	1:A:508:PRO:HD3	1.87	0.56
1:C:534:TYR:HB3	1:C:535:PRO:HD3	1.86	0.56
1:D:160:PHE:CG	1:D:403:ILE:HG21	2.39	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:546:ASN:HB2	1:D:548:ASN:HD21	1.70	0.56
1:A:231:VAL:HG23	1:A:351:LEU:HD12	1.89	0.55
1:A:189:LYS:HA	1:A:189:LYS:HE2	1.88	0.55
1:C:231:VAL:HG23	1:C:351:LEU:HD12	1.87	0.55
1:A:80:GLU:O	1:A:257:ARG:NH1	2.40	0.55
1:D:257:ARG:O	1:D:263:GLY:HA2	2.06	0.54
1:B:74:VAL:HG13	1:B:104:LEU:HD11	1.90	0.54
1:D:347:LYS:HA	1:D:514:TYR:CE1	2.42	0.54
1:A:543:VAL:HA	1:A:548:ASN:HD22	1.73	0.53
1:C:399:THR:HA	3:C:602:NAP:O4B	2.08	0.53
1:B:26:VAL:HG11	1:B:52:VAL:HG13	1.90	0.53
1:B:64:TRP:CD2	1:B:104:LEU:HD13	2.43	0.53
1:D:112:ASP:O	1:D:116:ASP:N	2.40	0.53
1:D:202:THR:O	1:D:228:ASN:HB2	2.10	0.53
1:D:185:TRP:CG	1:D:186:PRO:HD2	2.44	0.52
1:B:257:ARG:O	1:B:263:GLY:HA2	2.09	0.52
1:D:514:TYR:O	1:D:526:GLN:HA	2.10	0.51
1:B:75:ASP:HB3	1:B:351:LEU:HG	1.92	0.51
1:A:288:LEU:HD22	1:A:295:ARG:HB3	1.93	0.51
1:B:229:LEU:HA	1:B:318:TRP:CZ2	2.46	0.51
1:D:226:THR:OG1	3:D:602:NAP:O1X	2.28	0.51
1:D:69:TYR:CD1	1:D:72:ALA:HB2	2.47	0.50
1:B:58:ASN:HA	1:B:123:PHE:HB3	1.93	0.50
1:B:130:ALA:HB3	1:B:413:LEU:HD23	1.94	0.49
1:B:30:ILE:O	1:B:53:ILE:HA	2.12	0.49
1:C:346:VAL:HG22	1:C:507:PHE:HA	1.94	0.49
1:D:534:TYR:HB3	1:D:535:PRO:HD3	1.95	0.49
1:D:411:MET:HG3	1:D:413:LEU:HD23	1.95	0.48
1:C:26:VAL:O	1:C:151:ALA:HA	2.13	0.48
1:D:160:PHE:CD1	1:D:160:PHE:C	2.86	0.48
1:C:381:GLY:HA3	1:C:390:TYR:O	2.13	0.48
1:B:276:ASP:O	1:B:281:ARG:NH1	2.48	0.47
1:A:500:GLU:OE2	1:A:504:LYS:NZ	2.41	0.47
1:A:534:TYR:HB3	1:A:535:PRO:HD3	1.96	0.47
1:B:223:PHE:CZ	1:B:382:ILE:HD11	2.48	0.47
1:C:139:TRP:O	1:C:150:ARG:HA	2.15	0.47
1:B:202:THR:O	1:B:228:ASN:HB2	2.14	0.47
1:B:198:ALA:HB3	1:B:395:VAL:HG22	1.96	0.47
1:D:319:ARG:HG2	1:D:323:ARG:HD2	1.97	0.47
1:C:198:ALA:HB2	1:C:392:PHE:CE1	2.51	0.46
1:D:163:LYS:CE	1:D:402:ASP:HB3	2.40	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:507:PHE:N	1:D:508:PRO:CD	2.79	0.46
1:A:450:HIS:HB3	1:A:494:TRP:HE1	1.81	0.46
1:D:76:SER:HB2	1:D:81:TYR:HB2	1.97	0.46
1:A:250:TYR:N	1:A:251:PRO:CD	2.79	0.46
1:A:541:ARG:HA	1:A:541:ARG:HD3	1.74	0.45
1:C:28:VAL:O	1:C:51:ALA:HA	2.16	0.45
1:B:112:ASP:O	1:B:116:ASP:N	2.46	0.45
1:D:185:TRP:CD2	1:D:186:PRO:HD2	2.52	0.45
1:D:250:TYR:N	1:D:251:PRO:CD	2.80	0.45
1:B:476:MET:HB3	1:B:476:MET:HE2	1.82	0.45
1:B:20:TYR:CZ	1:B:122:ALA:HA	2.52	0.45
1:B:69:TYR:HB2	1:B:70:PRO:CD	2.47	0.45
1:D:160:PHE:CD1	1:D:403:ILE:CG2	2.96	0.45
1:D:139:TRP:O	1:D:150:ARG:HA	2.17	0.45
1:C:541:ARG:HD3	1:C:541:ARG:HA	1.80	0.45
2:D:601:FAD:N1	2:D:601:FAD:O3'	2.49	0.45
1:D:102:GLU:O	1:D:106:LYS:HG3	2.16	0.45
1:B:435:MET:O	1:B:444:PHE:HA	2.18	0.44
1:D:519:MET:HB3	1:D:520:PRO:CD	2.46	0.44
1:A:257:ARG:O	1:A:263:GLY:HA2	2.17	0.44
1:D:450:HIS:N	1:D:527:VAL:O	2.51	0.44
1:D:74:VAL:HG22	1:D:99:PRO:O	2.18	0.44
1:A:373:SER:HB2	1:A:385:GLN:NE2	2.32	0.44
1:D:26:VAL:HG11	1:D:52:VAL:CG1	2.47	0.44
1:B:67:ASN:N	1:B:67:ASN:OD1	2.50	0.44
1:B:80:GLU:HG2	1:B:265:LEU:HG	2.00	0.44
1:B:447:TYR:CE1	1:B:458:GLY:HA2	2.53	0.44
1:B:511:LYS:HE2	1:B:517:GLY:O	2.18	0.44
1:C:223:PHE:CZ	1:C:382:ILE:HD11	2.53	0.44
1:D:69:TYR:HB2	1:D:70:PRO:CD	2.48	0.44
1:C:40:SER:O	1:C:44:MET:HG2	2.17	0.43
1:D:264:PHE:CE1	1:D:457:ASN:HB2	2.53	0.43
1:A:197:CYS:HA	1:A:394:VAL:O	2.19	0.43
1:B:75:ASP:CG	1:B:351:LEU:HB2	2.39	0.43
1:C:531:GLY:O	1:C:535:PRO:HG2	2.19	0.43
1:C:58:ASN:HA	1:C:123:PHE:HB3	2.01	0.43
1:A:57:GLY:HA3	1:A:66:TRP:CZ2	2.54	0.43
1:B:63:THR:HG23	2:B:601:FAD:O1A	2.17	0.43
1:C:134:THR:O	1:C:482:LYS:NZ	2.42	0.43
1:A:58:ASN:HA	1:A:123:PHE:HB3	2.00	0.43
1:A:295:ARG:HA	1:A:299:ALA:HB3	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:164:ARG:HB2	1:C:181:HIS:CE1	2.54	0.43
1:D:411:MET:HG3	1:D:413:LEU:CD2	2.49	0.43
1:B:511:LYS:HD3	1:B:524:PHE:HD1	1.83	0.43
1:D:423:GLU:O	1:D:426:LYS:HG2	2.18	0.43
1:B:507:PHE:N	1:B:508:PRO:CD	2.82	0.43
1:D:67:ASN:HA	1:D:183:SER:O	2.19	0.42
1:B:390:TYR:HB3	1:B:392:PHE:CZ	2.54	0.42
1:C:377:PHE:HZ	1:C:395:VAL:HG11	1.84	0.42
1:C:167:PRO:HD3	1:C:399:THR:OG1	2.19	0.42
1:A:421:LEU:HD11	1:A:425:TRP:CE2	2.55	0.42
1:C:198:ALA:HB2	1:C:392:PHE:CZ	2.54	0.42
1:B:60:ILE:HD11	1:B:112:ASP:HB2	2.01	0.42
1:A:77:GLU:O	1:A:80:GLU:HB2	2.20	0.42
1:D:152:LYS:NZ	1:D:482:LYS:O	2.53	0.42
1:A:229:LEU:HA	1:A:318:TRP:CZ2	2.55	0.42
1:B:86:PRO:HA	1:B:89:TRP:CE2	2.55	0.42
1:C:346:VAL:HG13	1:C:508:PRO:HD3	2.01	0.42
1:D:180:HIS:HB2	1:D:185:TRP:CE3	2.55	0.42
1:C:221:LYS:HA	1:C:365:ASP:O	2.19	0.41
1:D:229:LEU:HA	1:D:318:TRP:CZ2	2.56	0.41
1:B:26:VAL:HG12	1:B:50:LYS:HG3	2.03	0.41
1:A:369:ILE:CD1	3:A:602:NAP:H2A	2.50	0.41
1:B:197:CYS:HA	1:B:394:VAL:O	2.19	0.41
1:B:540:ILE:O	1:B:543:VAL:HG22	2.21	0.41
1:C:377:PHE:CZ	1:C:395:VAL:HG11	2.56	0.41
1:D:69:TYR:HH	3:D:602:NAP:H4N	1.85	0.41
1:B:32:GLY:O	1:B:37:GLY:HA3	2.21	0.41
1:C:30:ILE:O	1:C:53:ILE:HA	2.21	0.41
1:B:377:PHE:CD1	1:B:382:ILE:HG22	2.55	0.41
1:C:86:PRO:HA	1:C:89:TRP:CE2	2.56	0.41
1:C:164:ARG:HA	1:C:401:PHE:CD2	2.56	0.41
1:C:183:SER:HB3	1:C:401:PHE:CZ	2.56	0.41
1:D:381:GLY:HA3	1:D:390:TYR:O	2.20	0.41
1:A:64:TRP:CH2	2:A:601:FAD:C6	3.04	0.41
1:B:80:GLU:O	1:B:257:ARG:NH1	2.54	0.41
1:A:381:GLY:HA3	1:A:390:TYR:O	2.20	0.41
1:B:258:GLU:OE2	1:B:467:ARG:NH2	2.54	0.41
1:B:450:HIS:HB3	1:B:494:TRP:HE1	1.86	0.41
1:D:436:THR:CG2	1:D:486:PRO:HG3	2.49	0.41
1:D:484:ILE:HD12	1:D:550:PHE:CE2	2.55	0.41
1:D:522:LYS:HE2	1:D:522:LYS:HA	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:414:HIS:CE1	1:A:420:SER:HB3	2.56	0.40
1:B:163:LYS:HD3	1:B:410:SER:OG	2.21	0.40
1:B:180:HIS:HB2	1:B:185:TRP:CE3	2.56	0.40
1:B:64:TRP:CE2	1:B:104:LEU:HD13	2.56	0.40
1:B:459:PRO:O	1:B:463:GLU:HG3	2.22	0.40
1:C:404:THR:HB	1:C:522:LYS:HE2	2.03	0.40
1:D:486:PRO:HA	1:D:550:PHE:HA	2.04	0.40
1:D:534:TYR:O	1:D:537:SER:HB2	2.22	0.40
1:B:56:ALA:O	1:B:124:ASN:HA	2.21	0.40
1:C:20:TYR:O	1:C:147:ARG:HD3	2.22	0.40
1:B:375:VAL:CG2	1:B:385:GLN:HA	2.52	0.40
1:C:546:ASN:HB2	1:C:548:ASN:HD21	1.86	0.40
3:C:602:NAP:H51N	3:C:602:NAP:O2A	2.22	0.40
1:D:30:ILE:O	1:D:53:ILE:HA	2.22	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	535/561 (95%)	510 (95%)	23 (4%)	2 (0%)	34	31
1	B	536/561 (96%)	512 (96%)	23 (4%)	1 (0%)	47	47
1	C	535/561 (95%)	508 (95%)	23 (4%)	4 (1%)	22	17
1	D	530/561 (94%)	478 (90%)	46 (9%)	6 (1%)	14	8
All	All	2136/2244 (95%)	2008 (94%)	115 (5%)	13 (1%)	25	20

All (13) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	167	PRO

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Mol	Chain	Res	Type
1	D	403	ILE
1	D	453	THR
1	D	520	PRO
1	D	410	SER
1	B	453	THR
1	D	372	ASN
1	A	453	THR
1	C	23	GLU
1	C	453	THR
1	A	116	ASP
1	C	404	THR
1	C	520	PRO

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	451/472 (96%)	433 (96%)	18 (4%)	31	31
1	B	452/472 (96%)	446 (99%)	6 (1%)	69	74
1	C	451/472 (96%)	440 (98%)	11 (2%)	49	52
1	D	450/472 (95%)	435 (97%)	15 (3%)	38	39
All	All	1804/1888 (96%)	1754 (97%)	50 (3%)	43	46

All (50) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	25	ASP
1	A	50	LYS
1	A	63	THR
1	A	119	LYS
1	A	150	ARG
1	A	160	PHE
1	A	164	ARG
1	A	187	ASP
1	A	189	LYS

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Mol	Chain	Res	Type
1	A	193	ARG
1	A	196	ARG
1	A	304	TYR
1	A	338	SER
1	A	405	THR
1	A	426	LYS
1	A	450	HIS
1	A	456	SER
1	A	478	ARG
1	B	67	ASN
1	B	164	ARG
1	B	237	SER
1	B	290	SER
1	B	304	TYR
1	B	330	LYS
1	C	63	THR
1	C	131	HIS
1	C	138	ARG
1	C	148	THR
1	C	160	PHE
1	C	164	ARG
1	C	189	LYS
1	C	304	TYR
1	C	338	SER
1	C	346	VAL
1	C	450	HIS
1	D	22	ASP
1	D	52	VAL
1	D	150	ARG
1	D	160	PHE
1	D	163	LYS
1	D	304	TYR
1	D	365	ASP
1	D	401	PHE
1	D	404	THR
1	D	436	THR
1	D	454	LEU
1	D	515	MET
1	D	522	LYS
1	D	527	VAL
1	D	538	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such

sidechains are listed below:

Mol	Chain	Res	Type
1	A	133	HIS
1	A	385	GLN
1	A	450	HIS
1	A	548	ASN
1	B	548	ASN
1	C	548	ASN
1	D	211	GLN
1	D	528	ASN
1	D	548	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

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	$\#\|Z\| > 2$
3	NAP	A	602	-	46,52,52	0.87	3 (6%)	61,80,80	1.11	5 (8%)
2	FAD	C	601	-	54,58,58	0.71	0	71,89,89	0.72	1 (1%)
3	NAP	D	602	-	46,52,52	0.90	2 (4%)	61,80,80	1.25	4 (6%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
2	FAD	A	601	-	54,58,58	0.63	0	71,89,89	0.71	2 (2%)
3	NAP	C	602	-	46,52,52	0.95	3 (6%)	61,80,80	1.19	5 (8%)
2	FAD	B	601	-	54,58,58	0.68	0	71,89,89	0.69	2 (2%)
2	FAD	D	601	-	54,58,58	0.65	0	71,89,89	0.73	2 (2%)
3	NAP	B	602	-	46,52,52	0.92	3 (6%)	61,80,80	1.16	6 (9%)

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	NAP	A	602	-	-	11/31/67/67	0/5/5/5
2	FAD	C	601	-	-	8/30/50/50	0/6/6/6
3	NAP	D	602	-	-	11/31/67/67	0/5/5/5
2	FAD	A	601	-	-	6/30/50/50	0/6/6/6
3	NAP	C	602	-	-	8/31/67/67	0/5/5/5
2	FAD	B	601	-	-	6/30/50/50	0/6/6/6
2	FAD	D	601	-	-	4/30/50/50	0/6/6/6
3	NAP	B	602	-	-	3/31/67/67	0/5/5/5

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	602	NAP	PA-O3	2.65	1.62	1.59
3	A	602	NAP	C2A-N3A	2.62	1.36	1.32
3	B	602	NAP	PN-O3	2.49	1.62	1.59
3	D	602	NAP	PN-O3	2.44	1.62	1.59
3	C	602	NAP	C2A-N3A	2.34	1.35	1.32
3	D	602	NAP	PA-O3	2.29	1.62	1.59
3	C	602	NAP	PN-O3	2.21	1.61	1.59
3	C	602	NAP	PA-O3	2.20	1.61	1.59
3	B	602	NAP	O4D-C1D	2.17	1.43	1.40
3	A	602	NAP	O4D-C1D	2.15	1.43	1.40
3	A	602	NAP	O4B-C1B	2.08	1.43	1.40

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	D	602	NAP	O4B-C1B-N9A	4.51	114.72	108.75
3	D	602	NAP	N3A-C2A-N1A	-4.00	123.24	128.67
3	C	602	NAP	N3A-C2A-N1A	-3.97	123.28	128.67
3	B	602	NAP	N3A-C2A-N1A	-3.93	123.33	128.67
3	A	602	NAP	N3A-C2A-N1A	-3.20	124.33	128.67
3	C	602	NAP	C6N-N1N-C2N	-2.98	119.35	121.88
3	D	602	NAP	C4A-C5A-N7A	-2.76	106.42	109.34
3	C	602	NAP	O4B-C1B-N9A	2.70	112.33	108.75
3	A	602	NAP	C6N-N1N-C2N	-2.63	119.64	121.88
3	A	602	NAP	O4B-C1B-N9A	2.59	112.18	108.75
3	B	602	NAP	C1B-N9A-C4A	-2.58	122.10	126.64
3	C	602	NAP	C4A-C5A-N7A	-2.53	106.66	109.34
3	B	602	NAP	C4A-C5A-N7A	-2.51	106.69	109.34
3	B	602	NAP	C3N-C7N-N7N	2.50	120.82	117.74
3	A	602	NAP	C4A-C5A-N7A	-2.49	106.71	109.34
3	B	602	NAP	O4B-C1B-N9A	2.35	111.86	108.75
2	B	601	FAD	C5A-C6A-N6A	2.33	123.86	120.31
2	A	601	FAD	C5A-C6A-N6A	2.32	123.84	120.31
3	D	602	NAP	C4D-O4D-C1D	2.27	112.00	109.92
2	D	601	FAD	C5A-C6A-N6A	2.21	123.67	120.31
3	C	602	NAP	C3N-C7N-N7N	2.20	120.44	117.74
2	D	601	FAD	C4-N3-C2	-2.09	121.93	125.64
2	A	601	FAD	C4-N3-C2	-2.09	121.94	125.64
3	B	602	NAP	O5D-C5D-C4D	2.06	116.00	108.99
3	A	602	NAP	O2A-PA-O1A	2.02	121.83	112.44
2	C	601	FAD	C4-N3-C2	-2.02	122.06	125.64
2	B	601	FAD	C4-N3-C2	-2.00	122.09	125.64

There are no chirality outliers.

All (57) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	FAD	N10-C1'-C2'-O2'
2	A	601	FAD	N10-C1'-C2'-C3'
2	B	601	FAD	N10-C1'-C2'-O2'
2	B	601	FAD	N10-C1'-C2'-C3'
2	C	601	FAD	N10-C1'-C2'-O2'
2	C	601	FAD	N10-C1'-C2'-C3'
2	C	601	FAD	PA-O3P-P-O5'
2	D	601	FAD	N10-C1'-C2'-O2'
2	D	601	FAD	N10-C1'-C2'-C3'
3	A	602	NAP	C5B-O5B-PA-O1A
3	A	602	NAP	C5B-O5B-PA-O3

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Mol	Chain	Res	Type	Atoms
3	B	602	NAP	C5D-O5D-PN-O3
3	C	602	NAP	PN-O3-PA-O5B
3	C	602	NAP	C5D-O5D-PN-O2N
3	C	602	NAP	C4D-C5D-O5D-PN
3	C	602	NAP	C2D-C1D-N1N-C2N
3	C	602	NAP	C2D-C1D-N1N-C6N
3	D	602	NAP	C2N-C3N-C7N-O7N
2	A	601	FAD	O3'-C3'-C4'-C5'
3	D	602	NAP	C2N-C3N-C7N-N7N
2	A	601	FAD	C2'-C3'-C4'-O4'
2	A	601	FAD	O3'-C3'-C4'-O4'
3	A	602	NAP	O4B-C4B-C5B-O5B
3	A	602	NAP	O4D-C4D-C5D-O5D
3	A	602	NAP	C3D-C4D-C5D-O5D
2	C	601	FAD	O3'-C3'-C4'-C5'
2	A	601	FAD	C2'-C3'-C4'-C5'
3	D	602	NAP	C4N-C3N-C7N-O7N
3	D	602	NAP	O4D-C4D-C5D-O5D
2	C	601	FAD	O3'-C3'-C4'-O4'
3	D	602	NAP	C4N-C3N-C7N-N7N
2	C	601	FAD	C2'-C3'-C4'-C5'
3	D	602	NAP	C3D-C4D-C5D-O5D
2	C	601	FAD	C2'-C3'-C4'-O4'
3	A	602	NAP	PA-O3-PN-O5D
3	D	602	NAP	PA-O3-PN-O5D
3	D	602	NAP	C3B-C4B-C5B-O5B
3	D	602	NAP	O4B-C4B-C5B-O5B
2	B	601	FAD	O4B-C4B-C5B-O5B
2	D	601	FAD	O4B-C4B-C5B-O5B
3	C	602	NAP	C3D-C4D-C5D-O5D
3	C	602	NAP	C5D-O5D-PN-O3
3	C	602	NAP	C5D-O5D-PN-O1N
3	A	602	NAP	C2N-C3N-C7N-O7N
3	A	602	NAP	C2N-C3N-C7N-N7N
2	B	601	FAD	O3'-C3'-C4'-C5'
2	B	601	FAD	O3'-C3'-C4'-O4'
3	B	602	NAP	C3B-C2B-O2B-P2B
3	B	602	NAP	C1B-C2B-O2B-P2B
2	D	601	FAD	C3B-C4B-C5B-O5B
2	C	601	FAD	P-O3P-PA-O2A
3	D	602	NAP	PN-O3-PA-O1A
3	A	602	NAP	C4N-C3N-C7N-N7N

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Mol	Chain	Res	Type	Atoms
3	A	602	NAP	C3B-C4B-C5B-O5B
3	A	602	NAP	C4N-C3N-C7N-O7N
2	B	601	FAD	C3B-C4B-C5B-O5B
3	D	602	NAP	PN-O3-PA-O2A

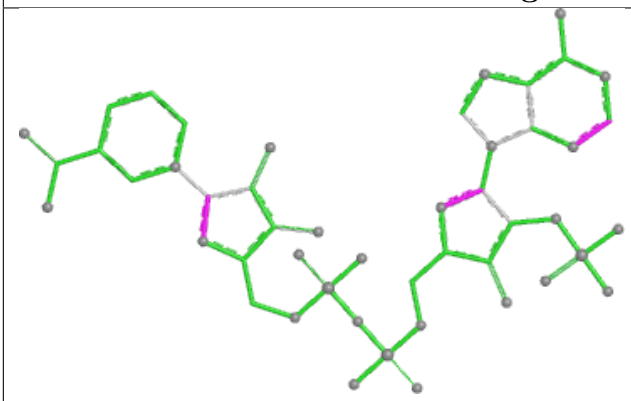
There are no ring outliers.

6 monomers are involved in 9 short contacts:

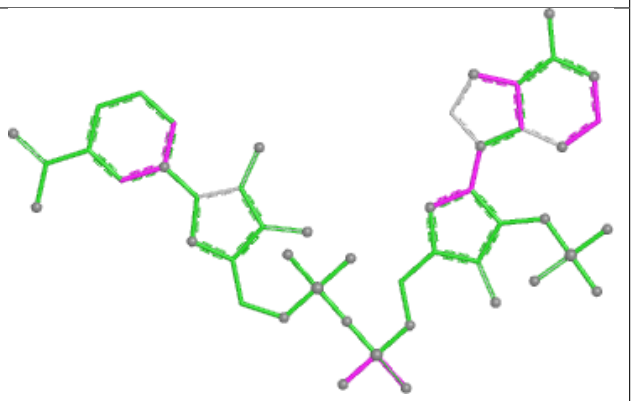
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	602	NAP	1	0
3	D	602	NAP	3	0
2	A	601	FAD	1	0
3	C	602	NAP	2	0
2	B	601	FAD	1	0
2	D	601	FAD	1	0

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 then 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.

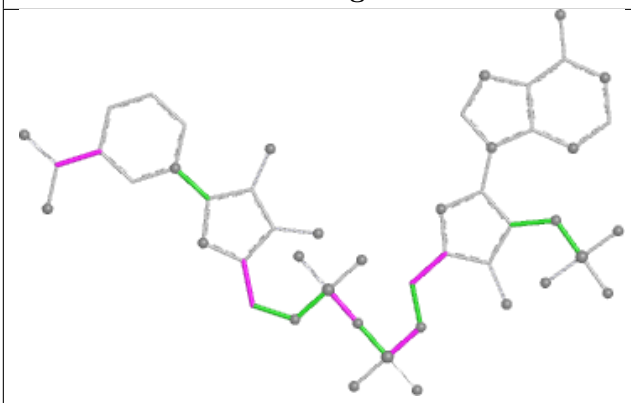
Ligand NAP A 602



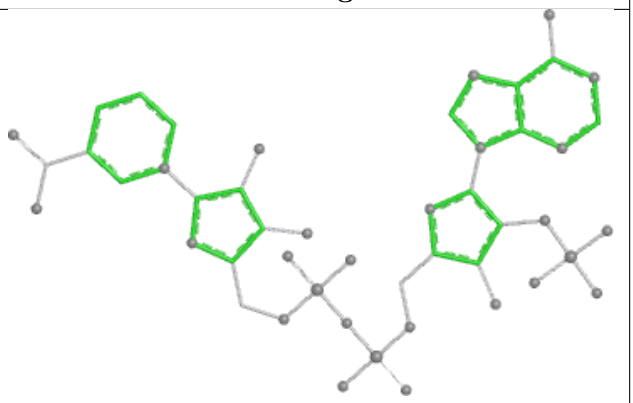
Bond lengths



Bond angles

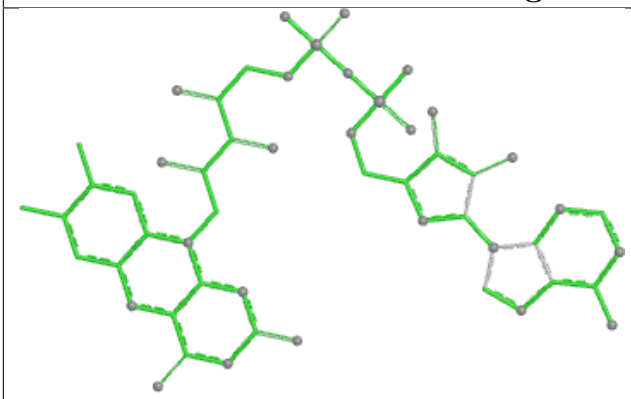


Torsions

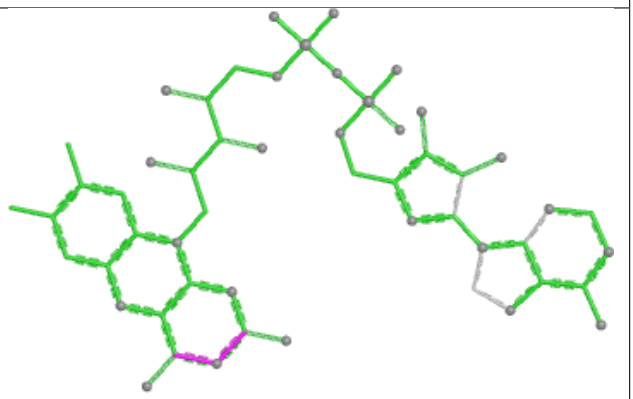


Rings

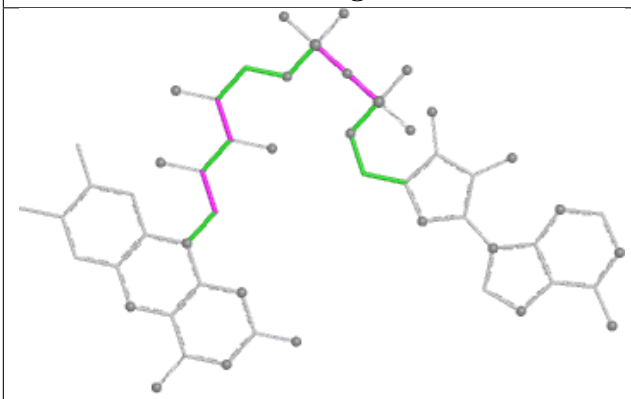
Ligand FAD C 601



Bond lengths



Bond angles



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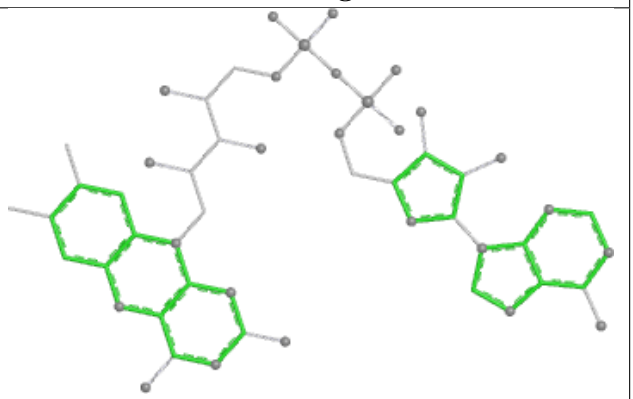
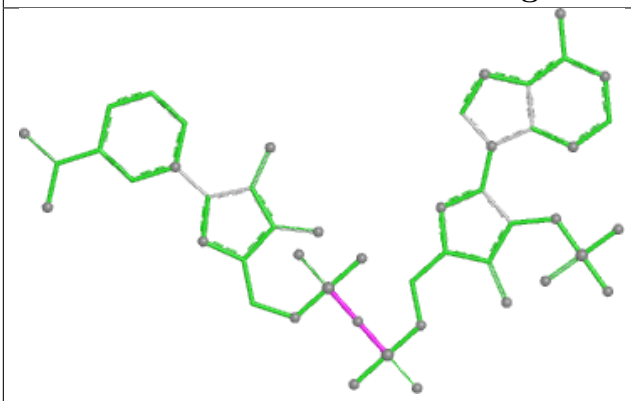


Rings

Ligand NAP D 602



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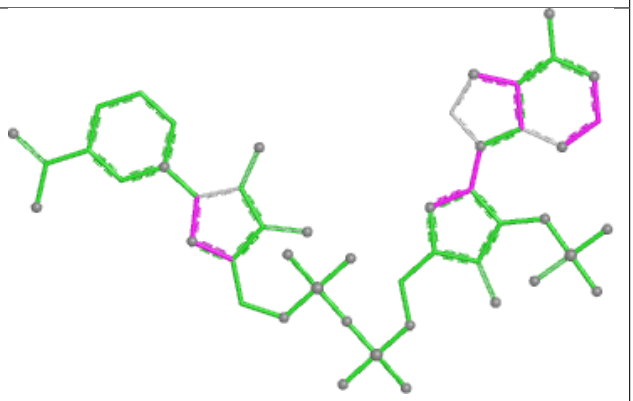
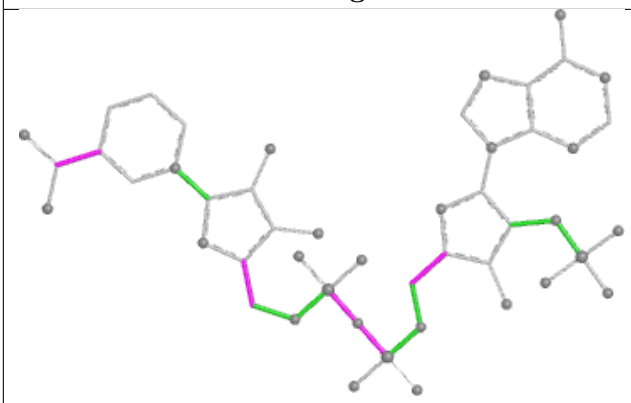


Bond angles



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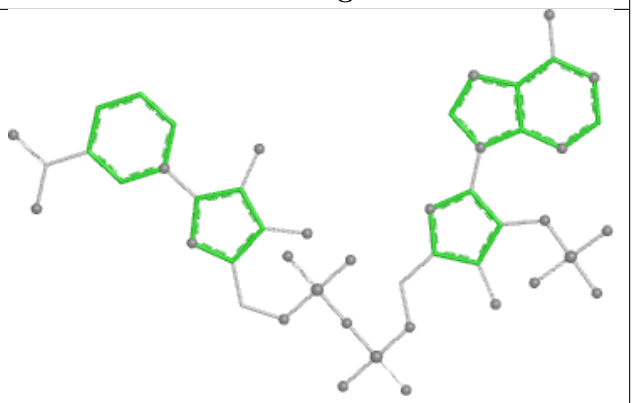
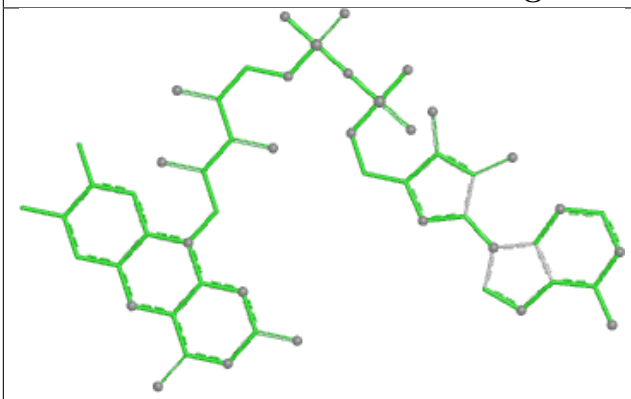


Rings

Ligand FAD A 601



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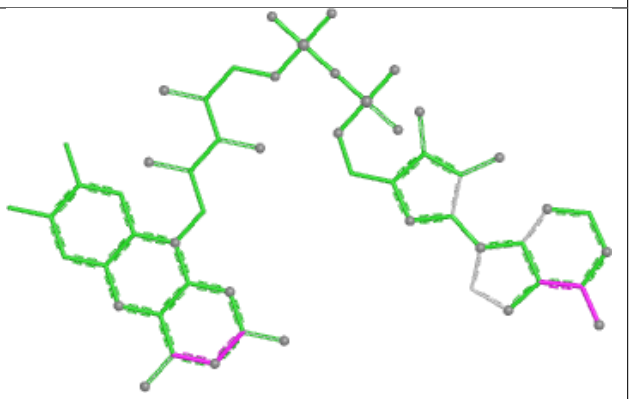

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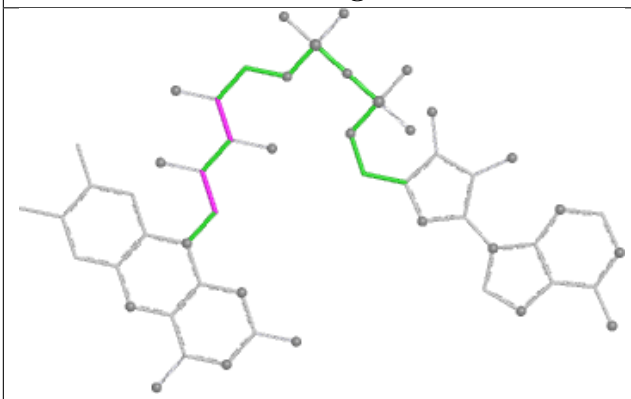

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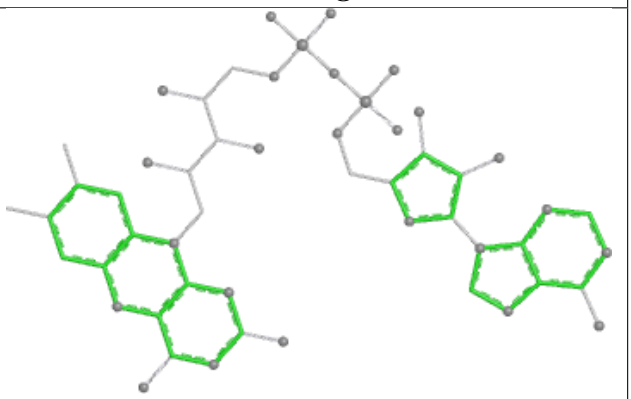
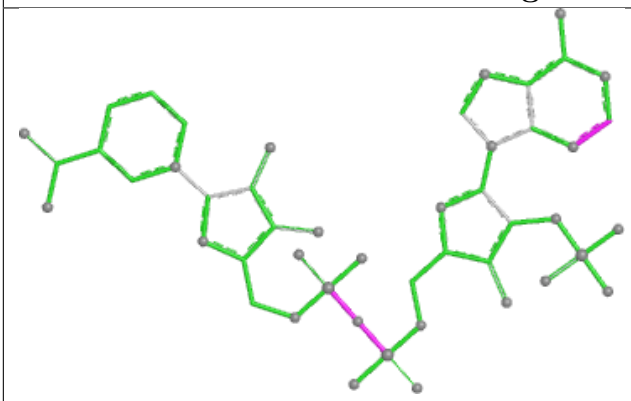
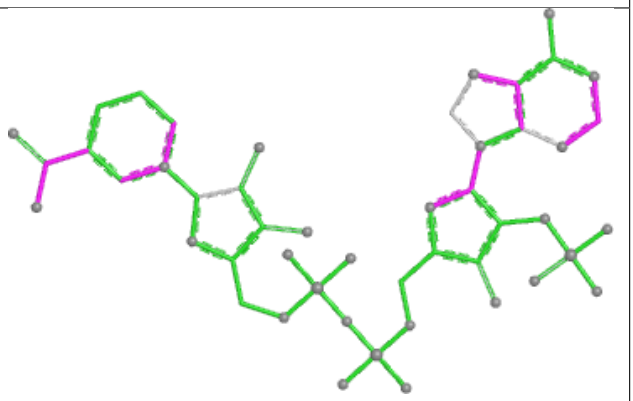


Rings

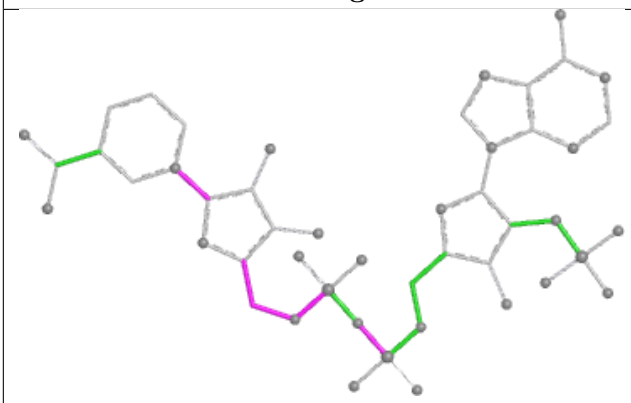
Ligand NAP C 602



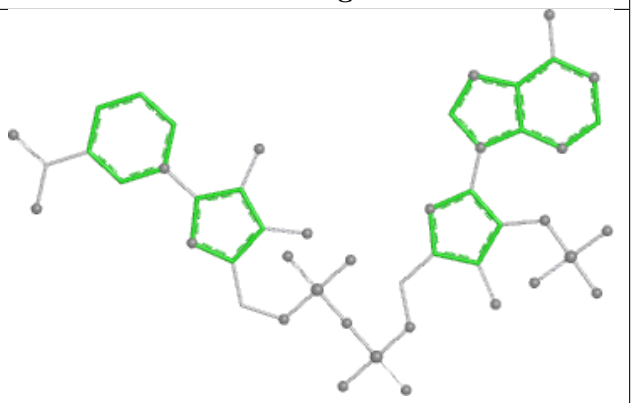
Bond lengths



Bond angles

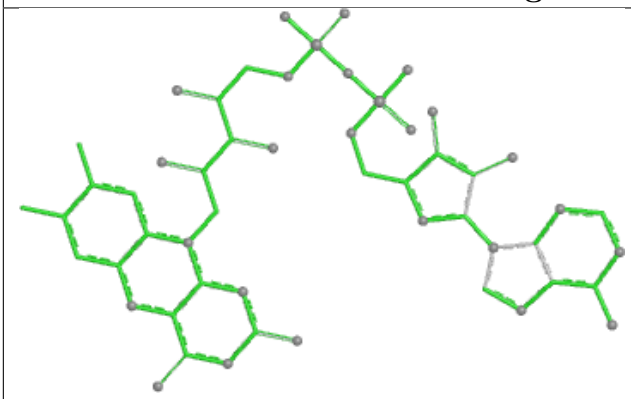


Torsions



Rings

Ligand FAD B 601



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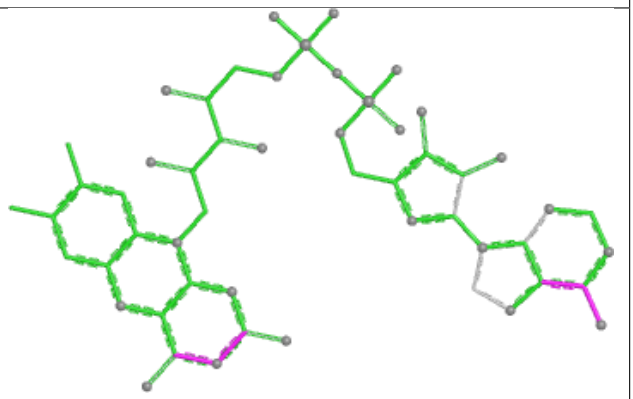
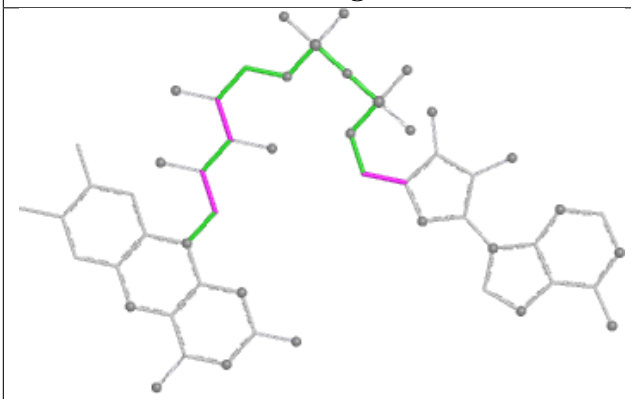
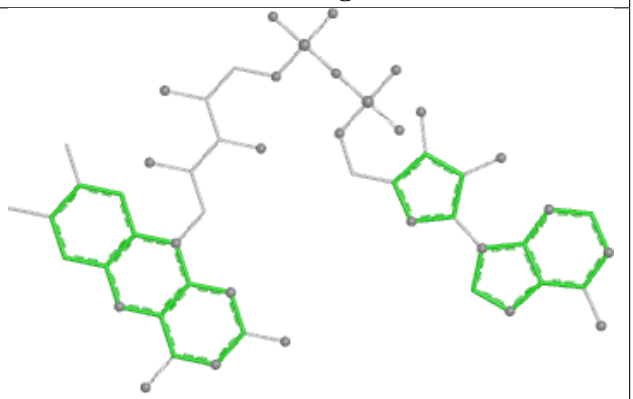


Bond angles

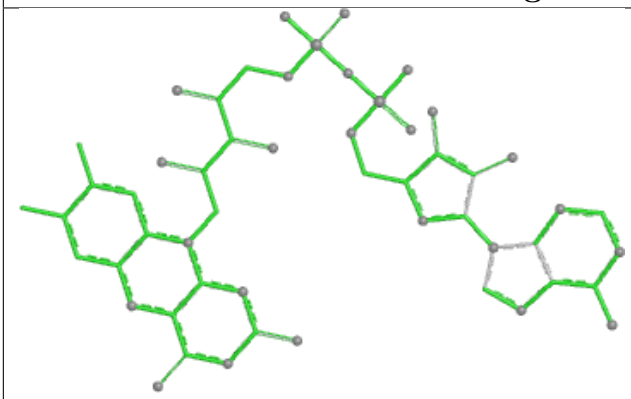


Torsions

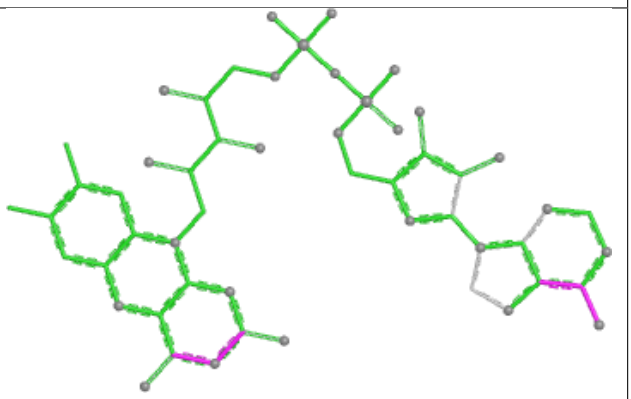


Rings

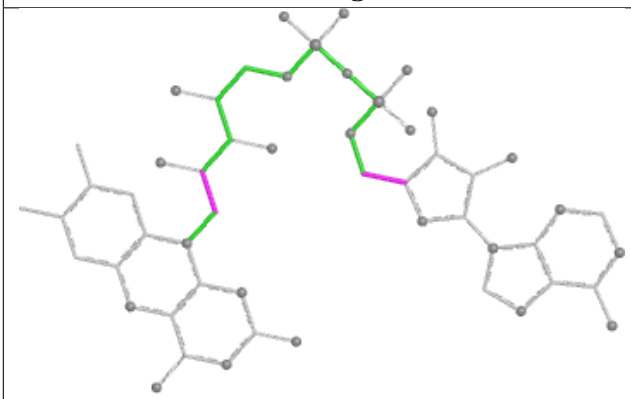
Ligand FAD D 601



Bond lengths



Bond angles



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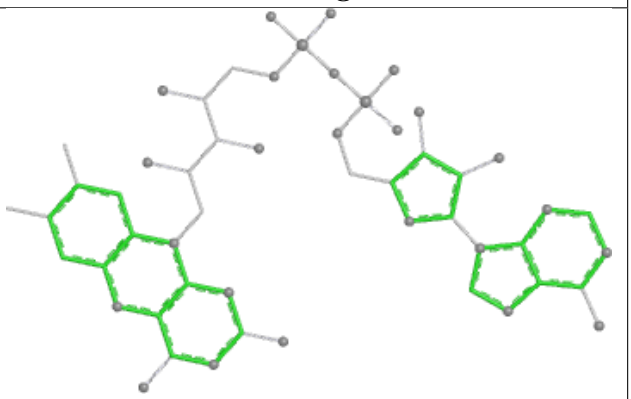
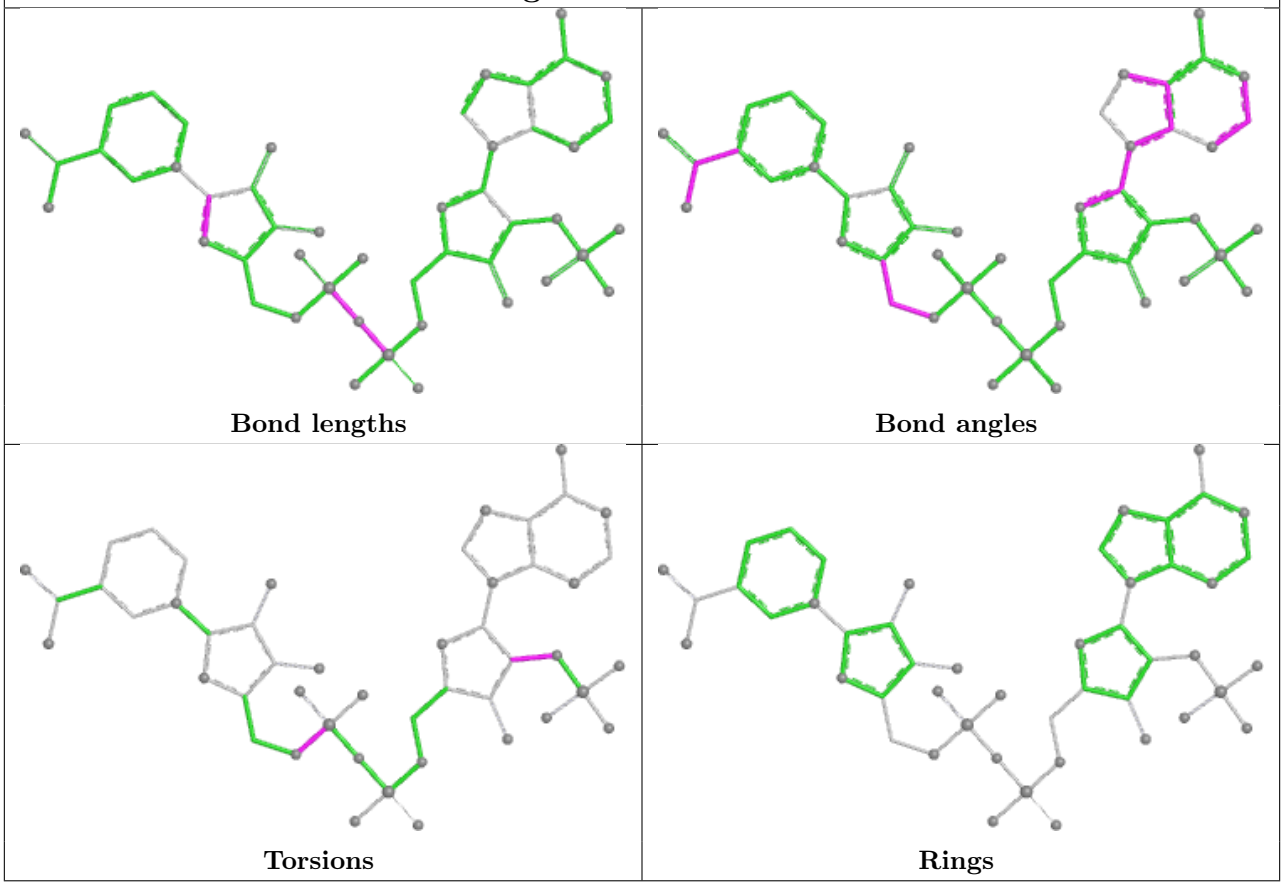


Rings

Ligand NAP B 602



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, 95^{th} 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	537/561 (95%)	-0.17	6 (1%)	80	83	13, 27, 47, 80	0
1	B	538/561 (95%)	-0.12	4 (0%)	87	89	15, 29, 57, 81	0
1	C	537/561 (95%)	-0.06	6 (1%)	80	83	18, 34, 57, 81	0
1	D	534/561 (95%)	0.42	41 (7%)	13	16	22, 50, 85, 116	0
All	All	2146/2244 (95%)	0.02	57 (2%)	54	59	13, 34, 67, 116	0

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	523	VAL	6.6
1	D	520	PRO	5.4
1	C	162	ALA	5.2
1	D	524	PHE	5.0
1	D	162	ALA	5.0
1	D	511	LYS	4.8
1	D	184	PHE	4.6
1	D	426	LYS	4.5
1	D	507	PHE	4.3
1	B	404	THR	4.2
1	D	160	PHE	4.1
1	D	510	THR	3.9
1	D	427	SER	3.8
1	D	404	THR	3.7
1	D	513	THR	3.7
1	A	188	GLU	3.5
1	D	341	PRO	3.4
1	D	346	VAL	3.3
1	D	430	PHE	3.2
1	D	187	ASP	3.2
1	B	66	TRP	3.1

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Mol	Chain	Res	Type	RSRZ
1	D	450	HIS	3.1
1	C	184	PHE	3.0
1	C	187	ASP	2.9
1	C	161	ALA	2.9
1	D	521	GLY	2.9
1	D	447	TYR	2.9
1	A	404	THR	2.8
1	D	509	THR	2.8
1	D	514	TYR	2.8
1	B	520	PRO	2.7
1	A	187	ASP	2.7
1	D	166	ILE	2.6
1	D	407	GLY	2.6
1	A	161	ALA	2.5
1	D	188	GLU	2.5
1	D	173	GLU	2.4
1	C	188	GLU	2.3
1	D	95	SER	2.3
1	D	25	ASP	2.3
1	D	454	LEU	2.3
1	D	377	PHE	2.3
1	D	449	PRO	2.2
1	D	165	TYR	2.2
1	D	169	TRP	2.2
1	D	347	LYS	2.2
1	B	517	GLY	2.2
1	A	168	GLU	2.1
1	D	131	HIS	2.1
1	D	371	ASP	2.1
1	D	168	GLU	2.1
1	D	172	ILE	2.1
1	D	170	PRO	2.1
1	C	163	LYS	2.1
1	A	403	ILE	2.1
1	D	378	THR	2.1
1	D	28	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 monosaccharides in this entry.

6.4 Ligands (i)

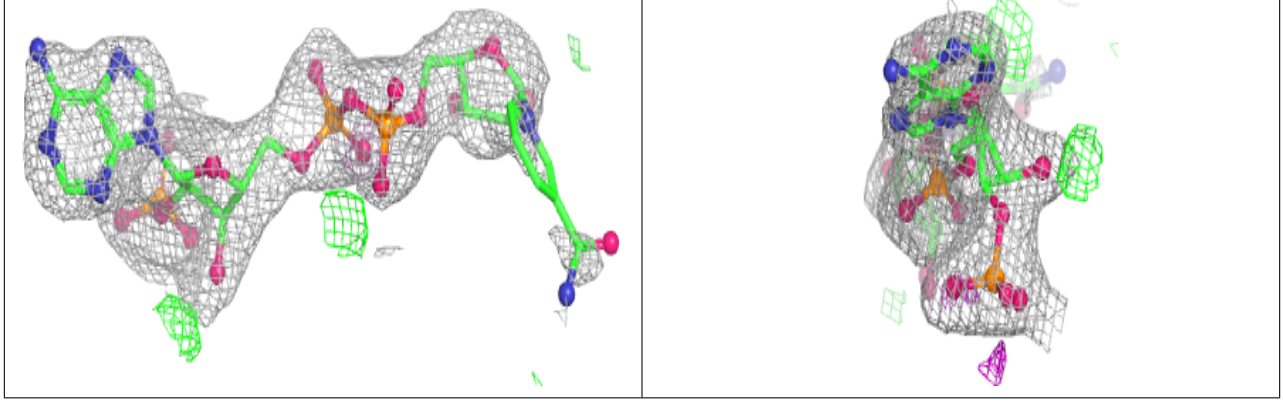
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	NAP	D	602	48/48	0.94	0.16	56,66,112,114	0
2	FAD	D	601	53/53	0.95	0.13	45,50,106,109	0
2	FAD	B	601	53/53	0.96	0.10	28,36,57,58	0
3	NAP	A	602	48/48	0.97	0.13	26,31,89,95	0
3	NAP	C	602	48/48	0.97	0.12	25,32,77,80	0
2	FAD	A	601	53/53	0.97	0.11	20,24,29,29	0
2	FAD	C	601	53/53	0.98	0.10	22,25,35,37	0
3	NAP	B	602	48/48	0.98	0.10	32,34,60,67	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.

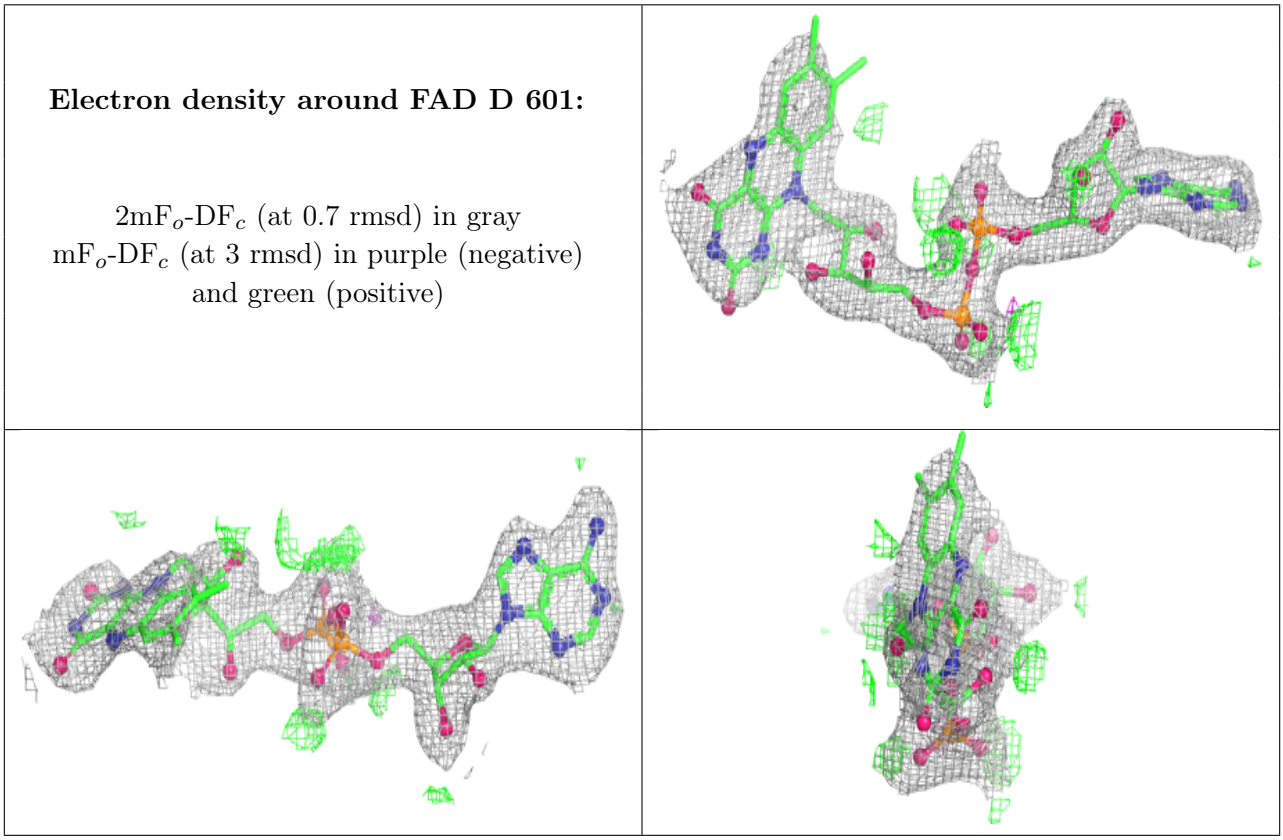
Electron density around NAP D 602:

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



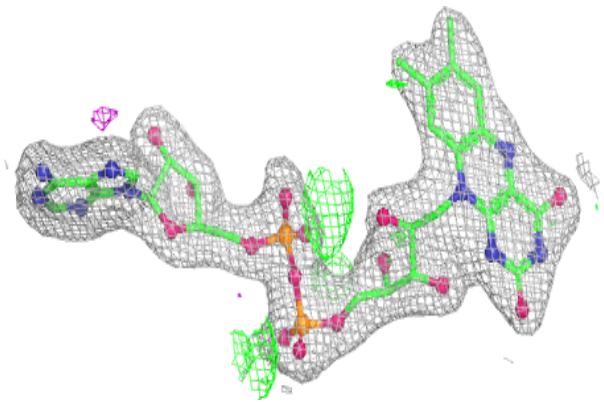
Electron density around FAD D 601:

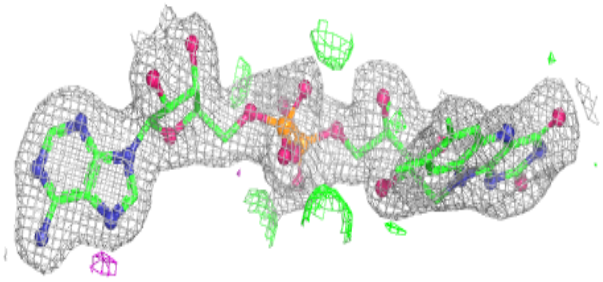
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

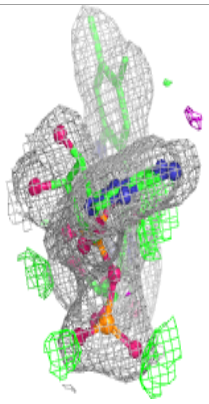


Electron density around FAD B 601:

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

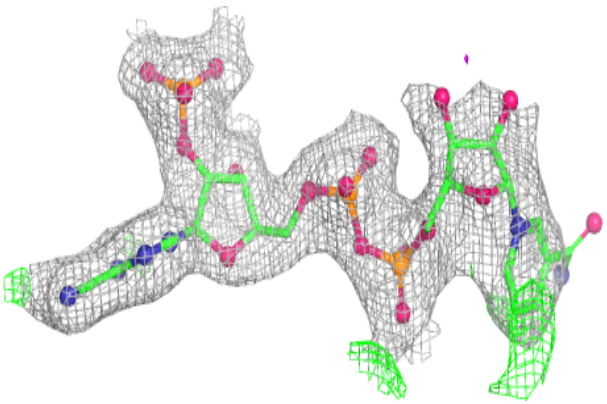


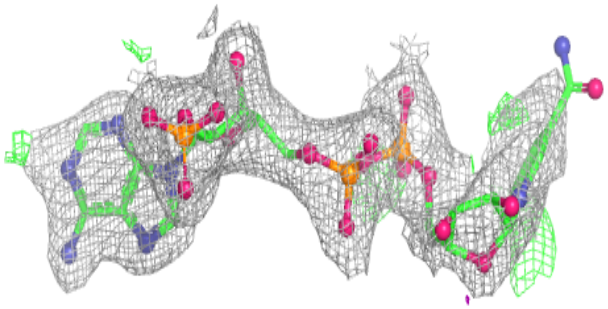


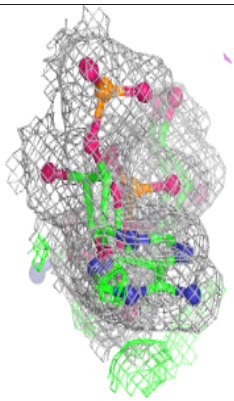


Electron density around NAP A 602:

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

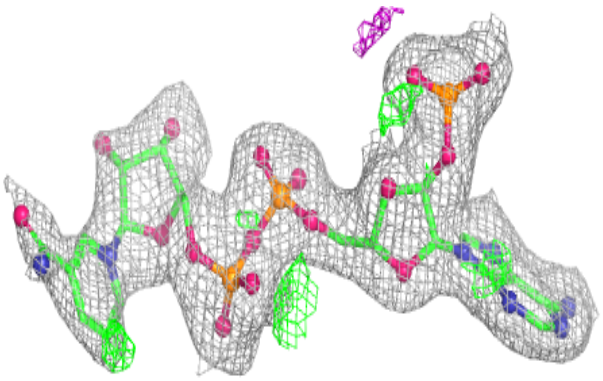


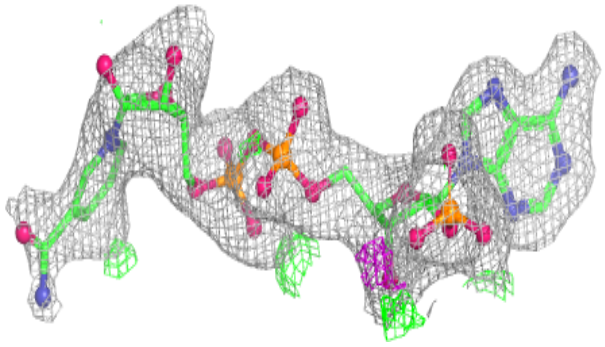


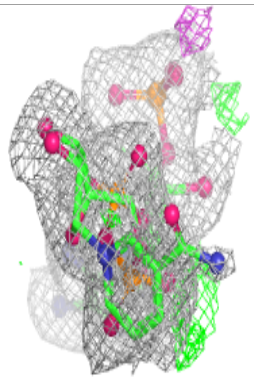


Electron density around NAP C 602:

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

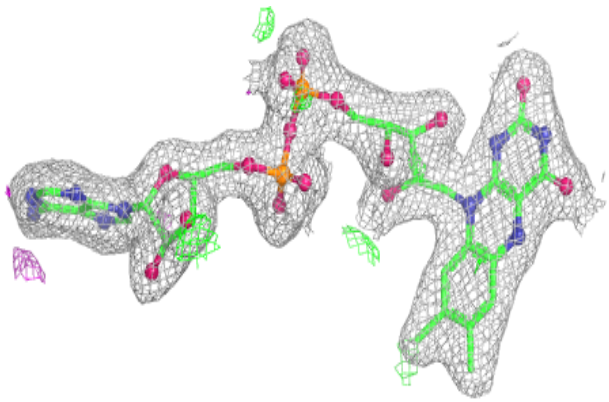


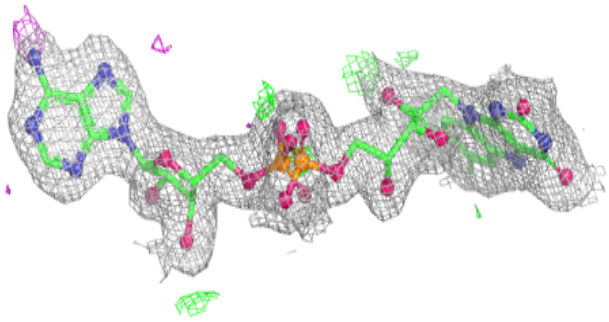


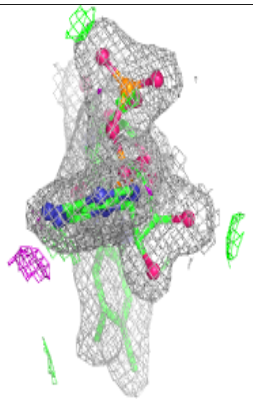


Electron density around FAD A 601:

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

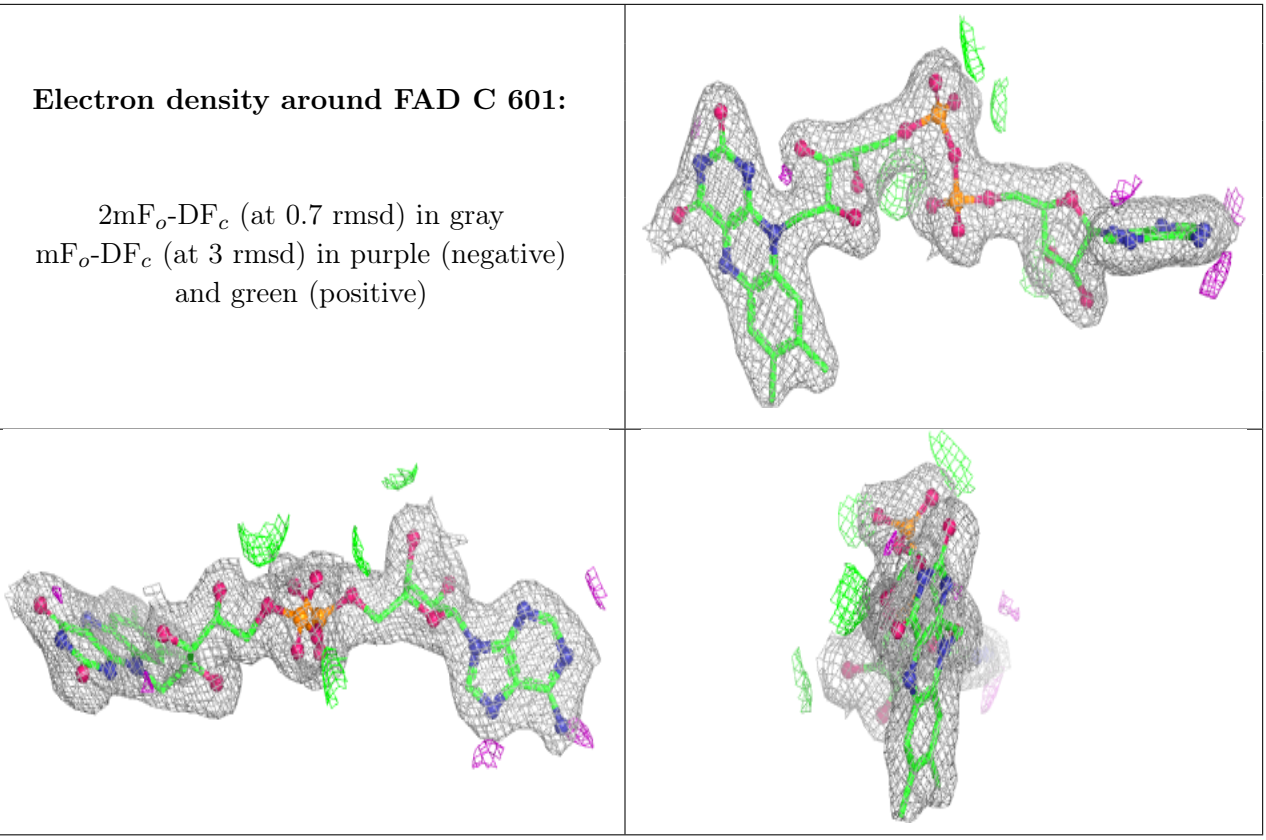






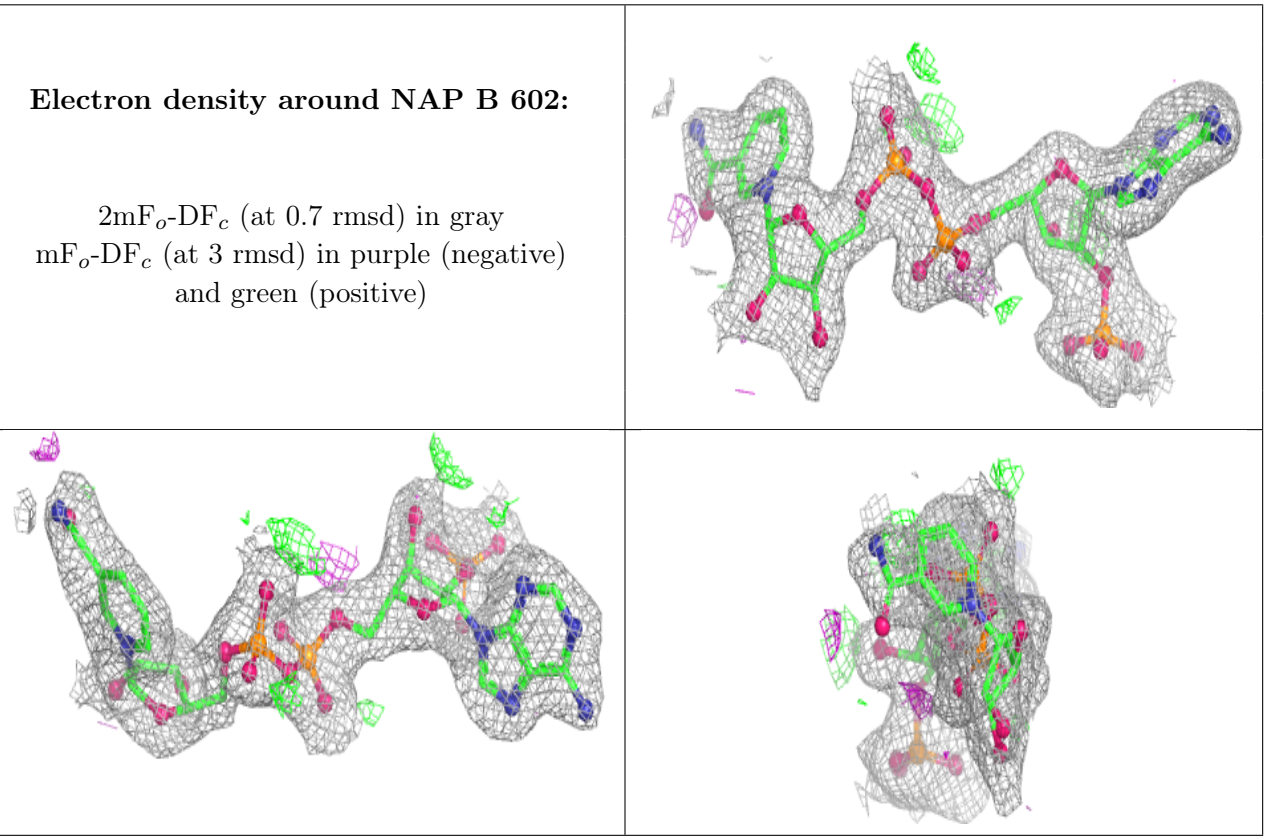
Electron density around FAD C 601:

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



Electron density around NAP 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)



6.5 Other polymers (i)

There are no such residues in this entry.