



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 05:11 AM UTC

PDB ID : 1QGA / pdb\_00001qga  
Title : PEA FNR Y308W MUTANT IN COMPLEX WITH NADP+  
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Deposited on : 1999-04-18  
Resolution : 2.00 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](mailto: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>.

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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

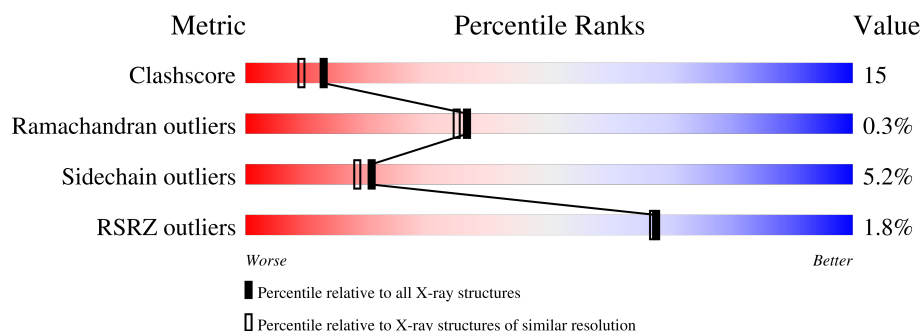
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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))
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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  $\geq 3$ , 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	308	<div> <div>2%</div> <div> <div></div> <div>68%</div> <div>28%</div> <div>.</div> </div> </div>
1	B	308	<div> <div>2%</div> <div> <div></div> <div>63%</div> <div>27%</div> <div>6%</div> <div>.</div> </div> </div>

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 5733 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 PROTEIN (FERREDOXIN:NADP+ REDUCTASE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	308	Total	C	N	O	S	0	0	0
			2447	1568	404	459	16			
1	B	295	Total	C	N	O	S	0	0	0
			2349	1506	386	441	16			

There are 2 discrepancies between the modelled and reference sequences:

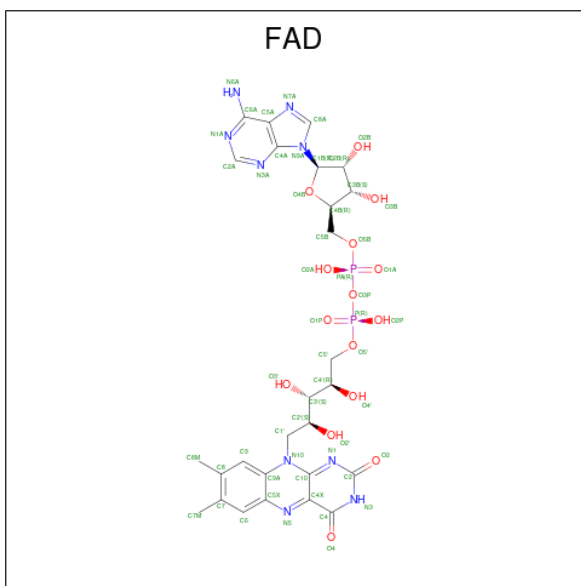
Chain	Residue	Modelled	Actual	Comment	Reference
A	308	TRP	TYR	engineered mutation	UNP P10933
B	808	TRP	TYR	engineered mutation	UNP P10933

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



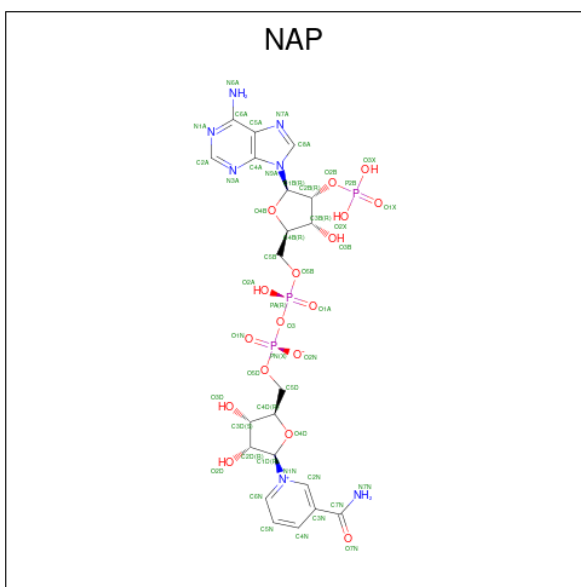
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula:  $\text{C}_{27}\text{H}_{33}\text{N}_9\text{O}_{15}\text{P}_2$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total 53	C 27	N 9	O 15	P 2	0	0
3	B	1	Total 53	C 27	N 9	O 15	P 2	0	0

- Molecule 4 is NADP NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (CCD ID: NAP) (formula:  $\text{C}_{21}\text{H}_{28}\text{N}_7\text{O}_{17}\text{P}_3$ ).



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

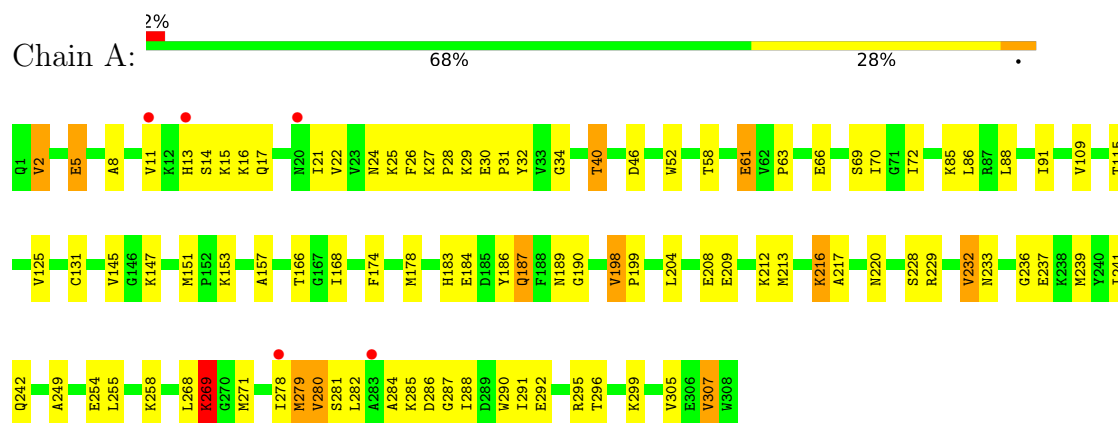
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	400	Total 400	O 400	0	0
5	B	330	Total 330	O 330	0	0

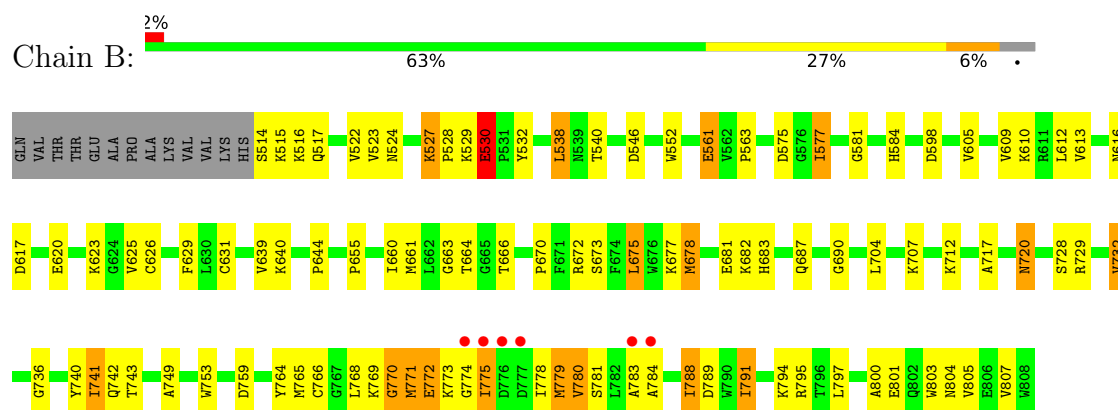
### 3 Residue-property plots

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: PROTEIN (FERREDOXIN:NADP+ REDUCTASE)



#### • Molecule 1: PROTEIN (FERREDOXIN:NADP+ REDUCTASE)



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	50.40Å 110.30Å 80.60Å 90.00° 93.80° 90.00°	Depositor
Resolution (Å)	8.00 – 2.00 8.00 – 2.00	Depositor EDS
% Data completeness (in resolution range)	97.4 (8.00-2.00) 96.0 (8.00-2.00)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.05	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.53 (at 1.99Å)	Xtriage
Refinement program	X-PLOR 3.8	Depositor
R, $R_{free}$	0.198 , 0.264 0.212 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	30.7	Xtriage
Anisotropy	0.811	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.28 , 91.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5733	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 15.26% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: SO4, FAD, NAP

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	1.15	6/2502 (0.2%)	1.34	17/3371 (0.5%)
1	B	1.11	9/2402 (0.4%)	1.33	30/3234 (0.9%)
All	All	1.13	15/4904 (0.3%)	1.33	47/6605 (0.7%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	678	MET	SD-CE	-11.42	1.50	1.79
1	A	269	LYS	CG-CD	10.39	1.83	1.52
1	A	269	LYS	CE-NZ	-8.69	1.23	1.49
1	B	788	ILE	CA-CB	6.95	1.63	1.54
1	A	239	MET	SD-CE	-6.90	1.62	1.79
1	B	743	THR	CA-CB	6.75	1.64	1.53
1	B	741	ILE	CA-CB	6.72	1.62	1.54
1	A	13	HIS	C-O	6.66	1.31	1.23
1	B	610	LYS	C-O	6.57	1.31	1.24
1	B	639	VAL	CA-CB	6.38	1.63	1.54
1	A	11	VAL	CA-CB	6.38	1.64	1.54
1	B	661	MET	SD-CE	-6.15	1.64	1.79
1	A	307	VAL	CB-CG2	-6.08	1.32	1.52
1	B	660	ILE	CA-CB	6.03	1.61	1.54
1	B	530	GLU	C-O	5.60	1.30	1.24



All (47) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	269	LYS	CG-CD-CE	13.35	142.00	111.30
1	B	720	ASN	N-CA-C	11.15	126.03	113.21
1	B	772	GLU	N-CA-C	10.98	125.94	112.54
1	B	728	SER	N-CA-C	8.54	121.67	111.33
1	A	220	ASN	N-CA-C	8.53	123.26	113.02
1	B	598	ASP	N-CA-C	7.44	121.46	112.38
1	A	217	ALA	CA-C-N	7.29	127.00	119.56
1	A	217	ALA	C-N-CA	7.29	127.00	119.56
1	A	11	VAL	N-CA-C	7.27	119.21	108.45
1	B	797	LEU	N-CA-C	-7.08	103.49	111.14
1	B	770	GLY	N-CA-C	7.05	121.02	112.49
1	B	779	MET	N-CA-C	6.90	118.69	111.03
1	B	524	ASN	N-CA-C	6.87	121.01	111.74
1	B	773	LYS	N-CA-C	6.86	119.76	111.40
1	A	269	LYS	CD-CE-NZ	-6.64	90.64	111.90
1	A	125	VAL	N-CA-C	6.62	116.72	110.30
1	A	14	SER	N-CA-C	6.53	119.79	108.76
1	A	61	GLU	N-CA-C	6.37	119.03	111.71
1	B	530	GLU	CA-C-N	-6.20	114.23	120.31
1	B	530	GLU	C-N-CA	-6.20	114.23	120.31
1	B	625	VAL	N-CA-C	6.16	116.28	110.30
1	B	784	ALA	N-CA-C	-6.12	104.61	111.28
1	A	198	VAL	N-CA-C	-5.97	102.26	109.01
1	B	780	VAL	N-CA-C	5.97	121.76	109.34
1	A	305	VAL	N-CA-C	5.95	117.05	108.48
1	A	228	SER	N-CA-C	5.88	118.44	111.33
1	B	609	VAL	N-CA-C	5.79	116.21	108.11
1	B	538	LEU	CA-CB-CG	5.68	136.17	116.30
1	A	279	MET	N-CA-C	5.68	117.55	111.36
1	B	781	SER	N-CA-C	5.66	118.39	111.82
1	B	791	ILE	N-CA-C	5.59	118.03	111.05
1	A	109	VAL	N-CA-C	5.52	115.81	107.75
1	B	672	ARG	N-CA-C	-5.49	105.37	111.36
1	B	584	HIS	N-CA-C	5.43	117.73	110.35
1	A	8	ALA	N-CA-C	5.42	118.09	109.96
1	A	34	GLY	N-CA-C	-5.39	105.38	112.81
1	B	626	CYS	N-CA-C	5.35	116.92	111.14
1	B	803	TRP	N-CA-C	-5.35	98.30	107.61
1	B	775	ILE	N-CA-C	5.32	115.53	110.42
1	B	717	ALA	CA-C-N	5.14	124.80	119.56
1	B	717	ALA	C-N-CA	5.14	124.80	119.56
1	B	749	ALA	N-CA-C	5.14	118.33	111.75

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	805	VAL	N-CA-C	5.04	117.08	108.86
1	B	675	LEU	N-CA-C	5.04	116.85	111.36
1	A	199	PRO	N-CA-C	5.01	120.13	113.57
1	B	605	VAL	N-CA-C	-5.01	101.74	108.35
1	B	629	PHE	N-CA-C	-5.01	105.71	111.07

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	532	TYR	Sidechain

## 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	2447	0	2451	75	0
1	B	2349	0	2343	72	0
2	A	5	0	0	0	0
3	A	53	0	31	1	0
3	B	53	0	31	1	0
4	A	48	0	22	3	0
4	B	48	0	21	7	0
5	A	400	0	0	7	0
5	B	330	0	0	7	0
All	All	5733	0	4899	149	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 15.

All (149) 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:A:269:LYS:CD	1:A:269:LYS:CG	1.83	1.55
1:B:683:HIS:H	1:B:687:GLN:NE2	1.74	0.84

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:741:ILE:HG22	4:B:810:NAP:H2A	1.62	0.80
1:B:675:LEU:HD23	1:B:678:MET:CE	2.12	0.80
4:B:810:NAP:H3D	5:B:1723:HOH:O	1.80	0.79
1:A:307:VAL:HG23	5:A:1314:HOH:O	1.81	0.79
1:A:183:HIS:H	1:A:187:GLN:NE2	1.81	0.78
1:B:616:ASN:HD21	1:B:620:GLU:HB2	1.50	0.77
1:A:208:GLU:HG2	1:A:212:LYS:HE3	1.69	0.73
1:B:794:LYS:HE3	1:B:795:ARG:HH11	1.55	0.71
1:B:528:PRO:HD2	1:B:529:LYS:HZ3	1.55	0.71
1:A:25:LYS:HD3	1:A:26:PHE:CE1	2.27	0.70
1:A:70:ILE:HG23	1:A:91:ILE:HD11	1.74	0.70
1:B:791:ILE:O	1:B:795:ARG:HD3	1.91	0.70
1:A:281:SER:O	1:A:285:LYS:HG2	1.91	0.69
1:B:527:LYS:HB3	1:B:529:LYS:HZ3	1.58	0.68
1:B:774:GLY:O	1:B:778:ILE:HG13	1.93	0.67
1:A:249:ALA:HB1	1:A:282:LEU:HD21	1.75	0.67
1:A:21:ILE:HD13	1:A:147:LYS:HG2	1.78	0.65
1:B:546:ASP:HB2	5:B:1600:HOH:O	1.97	0.65
1:B:522:VAL:HG11	1:B:563:PRO:HG2	1.79	0.64
1:B:682:LYS:HA	1:B:687:GLN:HE22	1.62	0.64
1:A:69:SER:HB2	1:A:145:VAL:HG13	1.79	0.63
1:A:30:GLU:HG3	5:A:1091:HOH:O	1.98	0.63
1:B:753:TRP:CZ2	1:B:783:ALA:HA	2.34	0.62
1:A:29:LYS:HD3	1:A:29:LYS:H	1.64	0.62
1:B:675:LEU:HD23	1:B:678:MET:HE2	1.80	0.62
1:B:517:GLN:NE2	5:B:1038:HOH:O	2.32	0.61
1:B:683:HIS:H	1:B:687:GLN:HE21	1.48	0.61
3:A:309:FAD:H8A	5:A:1528:HOH:O	2.00	0.61
1:A:21:ILE:CD1	1:A:147:LYS:HG2	2.30	0.61
1:A:183:HIS:H	1:A:187:GLN:HE21	1.48	0.60
1:A:268:LEU:HD23	4:A:310:NAP:H4D	1.81	0.60
1:B:794:LYS:HE3	1:B:795:ARG:NH1	2.17	0.60
1:A:216:LYS:HB3	1:A:216:LYS:NZ	2.17	0.60
1:B:675:LEU:HD23	1:B:678:MET:HE1	1.82	0.59
1:A:40:THR:HG23	5:A:1302:HOH:O	2.02	0.59
1:A:269:LYS:CD	1:A:269:LYS:CB	2.80	0.58
1:A:212:LYS:O	1:A:216:LYS:HG3	2.04	0.58
1:B:666:THR:OG1	4:B:810:NAP:H6N	2.04	0.58
1:A:28:PRO:HD2	1:A:29:LYS:HZ2	1.69	0.57
1:A:307:VAL:CG2	5:A:1314:HOH:O	2.45	0.57
1:A:28:PRO:O	1:A:31:PRO:HD3	2.04	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:783:ALA:HB1	1:B:788:ILE:HB	1.85	0.57
1:B:527:LYS:HB3	1:B:529:LYS:NZ	2.19	0.57
1:A:291:ILE:HD12	1:A:291:ILE:H	1.71	0.56
1:A:29:LYS:HD3	1:A:29:LYS:N	2.20	0.56
1:B:561:GLU:O	1:B:563:PRO:HD3	2.06	0.56
1:A:296:THR:HA	1:A:299:LYS:HG2	1.87	0.56
1:A:32:TYR:CE1	1:A:61:GLU:HG3	2.42	0.55
1:B:742:GLN:HE22	4:B:810:NAP:C2A	2.20	0.55
1:B:664:THR:OG1	1:B:768:LEU:HG	2.07	0.55
1:B:522:VAL:HG11	1:B:563:PRO:CG	2.37	0.55
1:B:655:PRO:HB2	1:B:687:GLN:O	2.07	0.54
1:B:770:GLY:O	1:B:772:GLU:N	2.40	0.54
1:B:675:LEU:HA	1:B:678:MET:HE2	1.89	0.54
1:A:279:MET:HE3	1:A:279:MET:HA	1.90	0.54
1:A:280:VAL:HG23	1:A:290:TRP:HB3	1.90	0.53
1:B:529:LYS:HB2	1:B:530:GLU:OE1	2.09	0.53
1:A:88:LEU:HD22	1:A:145:VAL:HG11	1.90	0.52
1:A:32:TYR:HE1	1:A:61:GLU:HG3	1.73	0.52
1:B:616:ASN:ND2	1:B:620:GLU:HB2	2.21	0.52
1:B:552:TRP:CD1	1:B:631:CYS:HG	2.26	0.52
1:B:759:ASP:HB2	5:B:1369:HOH:O	2.10	0.51
1:B:681:GLU:HB3	1:B:683:HIS:CE1	2.46	0.51
1:B:690:GLY:O	1:B:720:ASN:HB2	2.11	0.51
1:B:515:LYS:HG3	1:B:801:GLU:OE1	2.10	0.51
1:B:789:ASP:HA	5:B:1093:HOH:O	2.10	0.50
1:A:198:VAL:HG21	1:A:204:LEU:HD23	1.93	0.49
1:B:740:TYR:HB3	1:B:742:GLN:NE2	2.27	0.49
1:A:174:PHE:O	1:A:178:MET:HG3	2.12	0.49
1:B:527:LYS:HB3	1:B:529:LYS:HE2	1.94	0.49
1:B:529:LYS:N	1:B:529:LYS:HD3	2.28	0.49
1:B:765:MET:CG	1:B:771:MET:HE2	2.43	0.49
1:B:765:MET:HG3	1:B:771:MET:HE2	1.93	0.49
1:A:233:ASN:ND2	1:A:237:GLU:OE1	2.37	0.48
1:A:268:LEU:O	1:A:271:MET:HG2	2.13	0.48
1:A:27:LYS:HB3	1:A:29:LYS:NZ	2.29	0.48
1:A:242:GLN:H	1:A:242:GLN:CD	2.22	0.48
1:B:527:LYS:HB3	1:B:529:LYS:CE	2.44	0.47
1:A:27:LYS:CB	1:A:29:LYS:HG2	2.44	0.47
1:A:209:GLU:O	1:A:213:MET:HG3	2.14	0.47
1:B:741:ILE:CG2	4:B:810:NAP:H2A	2.37	0.47
1:A:21:ILE:HG12	1:A:22:VAL:N	2.28	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:166:THR:OG1	4:A:310:NAP:H6N	2.15	0.47
1:A:280:VAL:HA	1:A:290:TRP:HB2	1.95	0.47
1:A:66:GLU:H	1:A:66:GLU:CD	2.22	0.47
1:B:527:LYS:N	1:B:527:LYS:HD3	2.30	0.47
1:A:281:SER:O	1:A:284:ALA:HB3	2.15	0.46
1:A:291:ILE:HD12	1:A:291:ILE:N	2.29	0.46
1:B:712:LYS:HE2	5:B:1218:HOH:O	2.14	0.46
1:B:769:LYS:HA	1:B:807:VAL:HB	1.97	0.46
1:B:523:VAL:HA	1:B:644:PRO:O	2.15	0.46
1:A:216:LYS:HB3	1:A:216:LYS:HZ1	1.80	0.46
1:A:291:ILE:H	1:A:291:ILE:CD1	2.28	0.46
1:B:514:SER:N	5:B:1584:HOH:O	2.48	0.46
1:A:2:VAL:O	1:A:2:VAL:HG13	2.16	0.46
1:A:287:GLY:O	1:A:288:ILE:HD13	2.16	0.46
1:A:183:HIS:HB2	1:A:186:TYR:O	2.17	0.45
1:A:291:ILE:O	1:A:295:ARG:HG2	2.16	0.45
1:B:753:TRP:HB2	1:B:779:MET:HE1	1.99	0.45
1:B:517:GLN:HE22	1:B:677:LYS:NZ	2.14	0.45
1:A:22:VAL:HG11	1:A:63:PRO:CG	2.47	0.45
1:A:26:PHE:CE2	1:A:32:TYR:HB2	2.52	0.45
1:B:764:TYR:CD2	1:B:804:ASN:HB2	2.52	0.45
1:A:29:LYS:H	1:A:29:LYS:CD	2.22	0.44
1:A:72:ILE:O	1:A:86:LEU:HA	2.17	0.44
1:A:86:LEU:HD12	1:A:86:LEU:C	2.42	0.44
1:A:232:VAL:HG22	1:A:236:GLY:C	2.42	0.44
1:B:682:LYS:HA	1:B:687:GLN:NE2	2.31	0.44
1:B:742:GLN:H	1:B:742:GLN:CD	2.25	0.44
1:A:24:ASN:HA	5:A:1310:HOH:O	2.17	0.44
1:A:258:LYS:HE3	5:A:1573:HOH:O	2.18	0.44
1:A:168:ILE:O	1:A:168:ILE:HG13	2.18	0.44
1:B:740:TYR:CB	1:B:742:GLN:HE21	2.30	0.44
1:A:58:THR:O	1:A:61:GLU:HG2	2.18	0.44
1:A:52:TRP:CD1	1:A:131:CYS:HG	2.36	0.43
1:B:612:LEU:HD21	3:B:809:FAD:C8A	2.47	0.43
1:A:85:LYS:HA	1:A:85:LYS:HD3	1.86	0.43
1:A:16:LYS:O	1:A:153:LYS:HE3	2.18	0.43
1:A:157:ALA:O	1:A:190:GLY:HA3	2.19	0.43
1:A:27:LYS:HB2	1:A:29:LYS:HG2	2.01	0.42
1:B:768:LEU:HD23	4:B:810:NAP:C4D	2.50	0.42
1:B:768:LEU:HD23	4:B:810:NAP:H4D	2.01	0.42
1:B:522:VAL:CG1	1:B:563:PRO:HG2	2.47	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:800:ALA:O	1:B:801:GLU:HB2	2.19	0.42
1:A:232:VAL:HA	1:A:237:GLU:O	2.20	0.42
1:A:255:LEU:HA	1:A:258:LYS:HD3	2.00	0.42
1:A:17:GLN:HG3	1:A:151:MET:O	2.20	0.42
1:B:768:LEU:O	1:B:771:MET:HG2	2.19	0.42
1:B:670:PRO:O	1:B:673:SER:HB3	2.19	0.42
1:A:241:ILE:HG22	4:A:310:NAP:H2A	2.02	0.41
1:B:663:GLY:HA2	1:B:766:CYS:O	2.20	0.41
1:A:5:GLU:O	1:A:5:GLU:HG3	2.21	0.41
1:B:732:VAL:HG13	1:B:736:GLY:HA2	2.02	0.41
1:B:775:ILE:O	1:B:779:MET:HG2	2.20	0.41
1:B:704:LEU:HD13	1:B:707:LYS:HD2	2.02	0.41
1:A:254:GLU:O	1:A:258:LYS:HD2	2.21	0.41
1:B:577:ILE:HG13	1:B:581:GLY:C	2.45	0.41
1:B:794:LYS:CE	1:B:795:ARG:NH1	2.83	0.41
1:A:279:MET:CE	1:A:282:LEU:HD12	2.51	0.41
1:B:740:TYR:HB3	1:B:742:GLN:HE21	1.86	0.41
1:B:681:GLU:OE1	1:B:683:HIS:HE1	2.04	0.40
1:B:783:ALA:HB1	1:B:788:ILE:CB	2.51	0.40
1:A:187:GLN:NE2	1:A:187:GLN:HA	2.34	0.40
1:B:613:VAL:HG22	1:B:623:LYS:HD2	2.03	0.40
1:A:27:LYS:HB3	1:A:29:LYS:HG2	2.04	0.40
1:A:32:TYR:CD2	1:A:32:TYR:C	2.99	0.40
1:B:575:ASP:OD1	1:B:640:LYS:NZ	2.48	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	306/308 (99%)	296 (97%)	10 (3%)	0	<a href="#">100</a> <a href="#">100</a>

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	293/308 (95%)	279 (95%)	12 (4%)	2 (1%)	18	14
All	All	599/616 (97%)	575 (96%)	22 (4%)	2 (0%)	36	35

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	771	MET
1	B	780	VAL

### 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	267/267 (100%)	250 (94%)	17 (6%)	16	12
1	B	256/267 (96%)	246 (96%)	10 (4%)	28	28
All	All	523/534 (98%)	496 (95%)	27 (5%)	21	18

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	VAL
1	A	5	GLU
1	A	15	LYS
1	A	40	THR
1	A	46	ASP
1	A	115	THR
1	A	184	GLU
1	A	187	GLN
1	A	189	ASN
1	A	216	LYS
1	A	229	ARG
1	A	232	VAL
1	A	269	LYS
1	A	278	ILE

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Mol	Chain	Res	Type
1	A	280	VAL
1	A	286	ASP
1	A	292	GLU
1	B	516	LYS
1	B	527	LYS
1	B	530	GLU
1	B	538	LEU
1	B	540	THR
1	B	561	GLU
1	B	577	ILE
1	B	617	ASP
1	B	729	ARG
1	B	732	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	17	GLN
1	A	24	ASN
1	A	187	GLN
1	A	189	ASN
1	A	247	GLN
1	B	517	GLN
1	B	584	HIS
1	B	683	HIS
1	B	687	GLN
1	B	742	GLN
1	B	747	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

5 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
4	NAP	A	310	-	50,52,52	3.33	13 (26%)	71,80,80	1.75	13 (18%)
4	NAP	B	810	-	50,52,52	5.23	11 (22%)	71,80,80	1.73	13 (18%)
2	SO4	A	311	-	4,4,4	0.45	0	6,6,6	0.71	0
3	FAD	A	309	-	58,58,58	1.52	11 (18%)	85,89,89	0.98	2 (2%)
3	FAD	B	809	-	58,58,58	1.83	9 (15%)	85,89,89	0.87	5 (5%)

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
4	NAP	A	310	-	-	12/35/67/67	0/5/5/5
3	FAD	A	309	-	-	0/34/50/50	0/6/6/6
4	NAP	B	810	-	-	7/35/67/67	0/5/5/5
3	FAD	B	809	-	-	1/34/50/50	0/6/6/6

All (44) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	810	NAP	PN-O3	28.55	1.90	1.59
4	B	810	NAP	PA-O3	21.12	1.82	1.59
4	A	310	NAP	PN-O3	17.84	1.78	1.59
4	A	310	NAP	PA-O3	10.20	1.70	1.59
3	B	809	FAD	PA-O3P	-8.91	1.49	1.59
3	B	809	FAD	P-O3P	-4.66	1.54	1.59
4	B	810	NAP	C2N-N1N	4.57	1.40	1.35
4	A	310	NAP	C2N-N1N	4.48	1.39	1.35
4	A	310	NAP	O4D-C1D	4.21	1.46	1.40
4	B	810	NAP	O4D-C1D	4.06	1.46	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	309	FAD	C4X-N5	3.39	1.38	1.30
4	A	310	NAP	C5A-C4A	-3.25	1.33	1.39
3	B	809	FAD	C1'-C2'	3.22	1.57	1.52
3	B	809	FAD	C4X-N5	3.20	1.37	1.30
3	A	309	FAD	P-O2P	-3.19	1.40	1.55
4	A	310	NAP	C4N-C3N	3.17	1.44	1.39
3	A	309	FAD	C10-N1	3.13	1.39	1.33
3	B	809	FAD	C5A-C4A	3.12	1.44	1.39
4	A	310	NAP	P2B-O3X	-2.87	1.44	1.54
4	B	810	NAP	C5A-N7A	-2.77	1.34	1.39
3	A	309	FAD	C5'-C4'	2.68	1.55	1.51
3	A	309	FAD	PA-O5B	-2.66	1.49	1.59
3	B	809	FAD	O5'-C5'	2.66	1.54	1.44
4	B	810	NAP	C8A-N7A	2.66	1.36	1.31
3	A	309	FAD	P-O1P	-2.55	1.42	1.50
3	B	809	FAD	C4'-C3'	-2.54	1.49	1.53
4	A	310	NAP	C2B-C1B	-2.47	1.47	1.53
3	B	809	FAD	C5'-C4'	2.46	1.55	1.51
3	A	309	FAD	PA-O2A	-2.41	1.44	1.55
4	A	310	NAP	PN-O2N	-2.37	1.44	1.55
4	A	310	NAP	C5N-C4N	2.37	1.43	1.38
3	A	309	FAD	C9A-C5X	2.31	1.44	1.41
4	B	810	NAP	C6N-N1N	2.30	1.40	1.35
4	B	810	NAP	C5A-C4A	-2.25	1.35	1.39
3	B	809	FAD	C9A-C5X	2.24	1.44	1.41
4	B	810	NAP	C4A-N9A	-2.21	1.33	1.37
3	A	309	FAD	C2A-N1A	2.20	1.37	1.33
4	A	310	NAP	C6N-N1N	2.20	1.40	1.35
4	B	810	NAP	C2B-C1B	-2.20	1.47	1.53
3	A	309	FAD	P-O3P	-2.15	1.57	1.59
4	A	310	NAP	C5A-N7A	-2.14	1.35	1.39
4	A	310	NAP	P2B-O2B	2.14	1.63	1.59
3	A	309	FAD	C5A-C4A	2.08	1.42	1.39
4	B	810	NAP	P2B-O3X	-2.00	1.47	1.54

All (33) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	810	NAP	C5A-C4A-N3A	-5.54	119.09	126.72
4	A	310	NAP	C5A-C4A-N3A	-5.34	119.37	126.72
4	B	810	NAP	O2N-PN-O3	5.15	121.18	107.27
4	A	310	NAP	N3A-C2A-N1A	-4.86	121.23	128.58

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	810	NAP	N3A-C2A-N1A	-4.64	121.56	128.58
4	A	310	NAP	N9A-C8A-N7A	-4.62	107.39	113.94
4	A	310	NAP	N3A-C4A-N9A	4.21	134.33	127.17
4	B	810	NAP	N9A-C8A-N7A	-4.09	108.13	113.94
4	A	310	NAP	O3-PN-O1N	-4.09	98.40	110.70
4	B	810	NAP	N3A-C4A-N9A	3.74	133.53	127.17
4	B	810	NAP	C2A-N3A-C4A	3.57	120.55	111.83
4	A	310	NAP	C4A-N9A-C8A	3.54	109.45	105.74
4	A	310	NAP	C2A-N3A-C4A	3.50	120.37	111.83
3	A	309	FAD	C4A-C5A-N7A	-3.18	106.94	110.58
4	B	810	NAP	O4B-C4B-C5B	3.18	119.53	109.33
3	A	309	FAD	C5A-N7A-C8A	2.89	108.00	103.45
4	B	810	NAP	O2A-PA-O3	-2.89	99.45	107.27
4	B	810	NAP	C4A-N9A-C8A	2.81	108.69	105.74
4	B	810	NAP	C6A-C5A-C4A	2.56	120.68	117.18
4	A	310	NAP	C6A-C5A-C4A	2.51	120.60	117.18
3	B	809	FAD	C5A-N7A-C8A	2.43	107.27	103.45
3	B	809	FAD	C4A-C5A-N7A	-2.24	108.02	110.58
4	A	310	NAP	C5A-N7A-C8A	2.21	106.92	103.45
4	A	310	NAP	O4B-C1B-C2B	2.19	110.37	106.59
3	B	809	FAD	C4-N3-C2	-2.19	121.75	125.64
4	A	310	NAP	O2N-PN-O3	2.18	113.16	107.27
3	B	809	FAD	C4X-C10-N10	2.09	119.47	116.48
4	A	310	NAP	O5B-PA-O1A	-2.08	100.69	108.94
4	B	810	NAP	O3-PN-O1N	-2.05	104.54	110.70
4	A	310	NAP	O2X-P2B-O2B	2.05	113.82	105.85
4	B	810	NAP	O4D-C4D-C3D	2.02	109.17	105.15
4	B	810	NAP	O3-PA-O1A	2.02	116.79	110.70
3	B	809	FAD	O2A-PA-O1A	2.02	121.83	112.44

There are no chirality outliers.

All (20) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	310	NAP	C5B-O5B-PA-O2A
4	A	310	NAP	O4D-C1D-N1N-C6N
4	B	810	NAP	O4B-C4B-C5B-O5B
4	B	810	NAP	O4D-C1D-N1N-C6N
4	B	810	NAP	C3B-C4B-C5B-O5B
4	A	310	NAP	O4B-C4B-C5B-O5B
4	A	310	NAP	C3B-C4B-C5B-O5B
4	B	810	NAP	C2B-C1B-N9A-C4A

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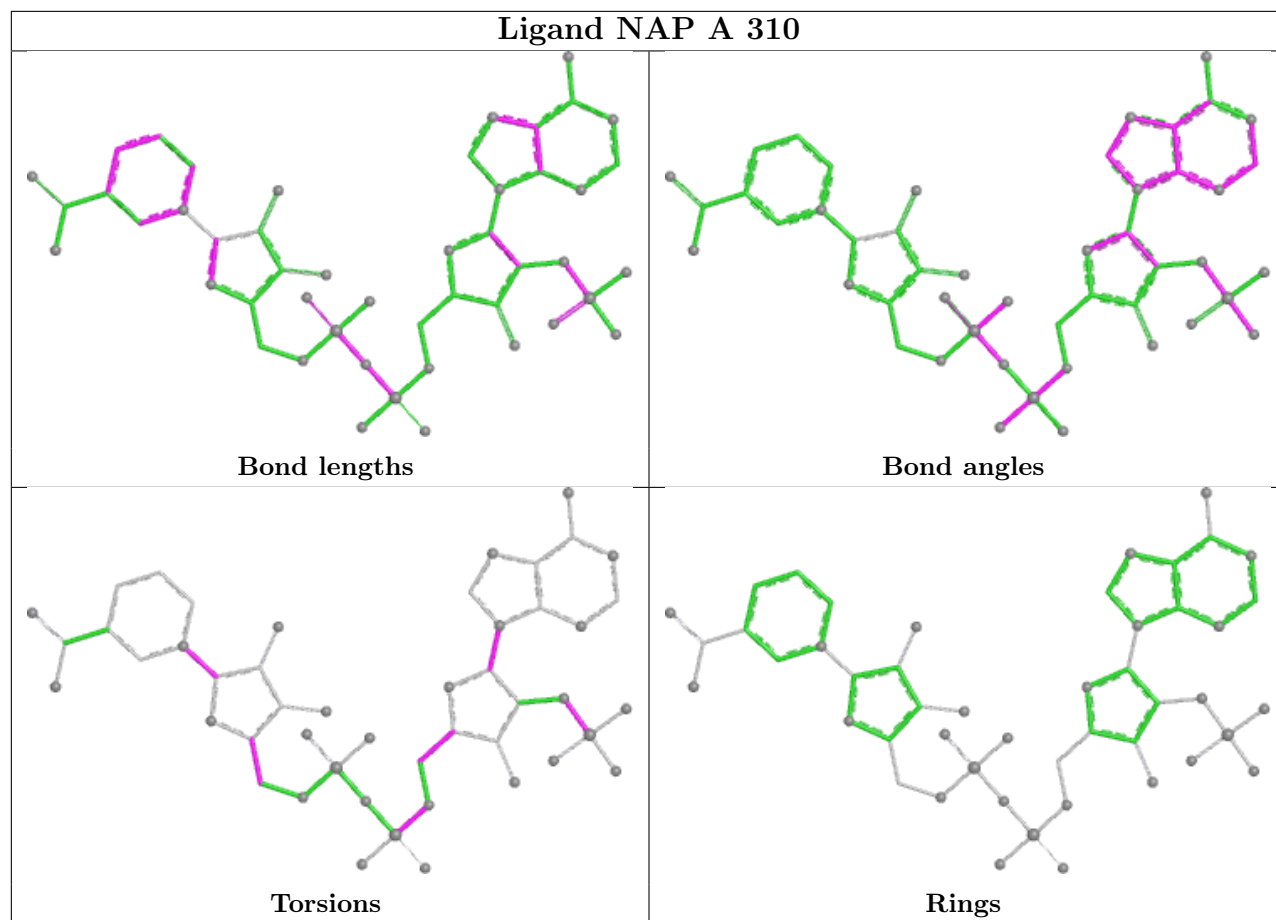
Mol	Chain	Res	Type	Atoms
4	B	810	NAP	C2B-C1B-N9A-C8A
4	A	310	NAP	C2B-C1B-N9A-C8A
4	A	310	NAP	C5B-O5B-PA-O1A
4	A	310	NAP	C5B-O5B-PA-O3
4	A	310	NAP	C2B-C1B-N9A-C4A
4	A	310	NAP	C2B-O2B-P2B-O3X
4	A	310	NAP	O4D-C4D-C5D-O5D
4	A	310	NAP	O4D-C1D-N1N-C2N
4	B	810	NAP	O4D-C1D-N1N-C2N
4	B	810	NAP	O4D-C4D-C5D-O5D
3	B	809	FAD	PA-O3P-P-O2P
4	A	310	NAP	O4B-C1B-N9A-C8A

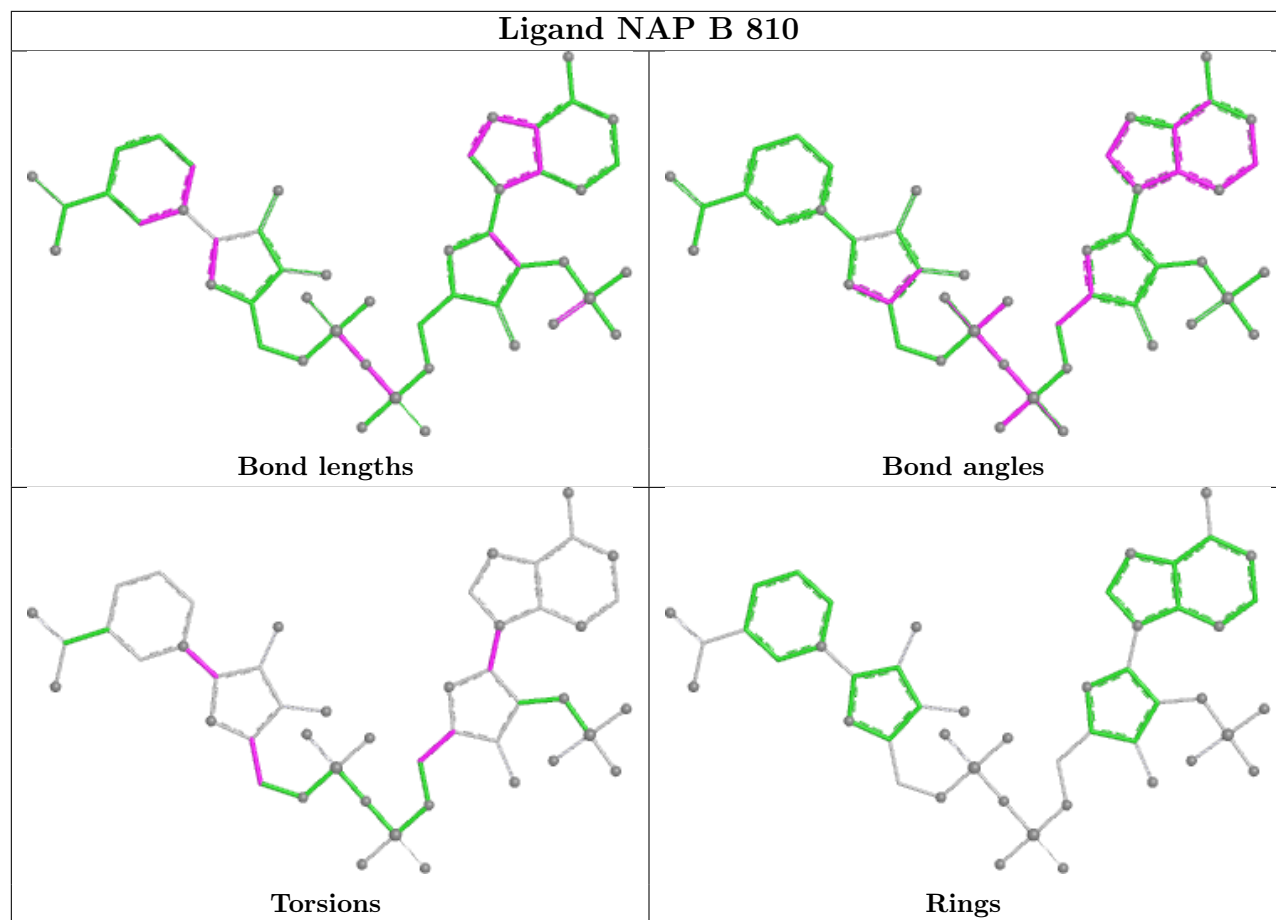
There are no ring outliers.

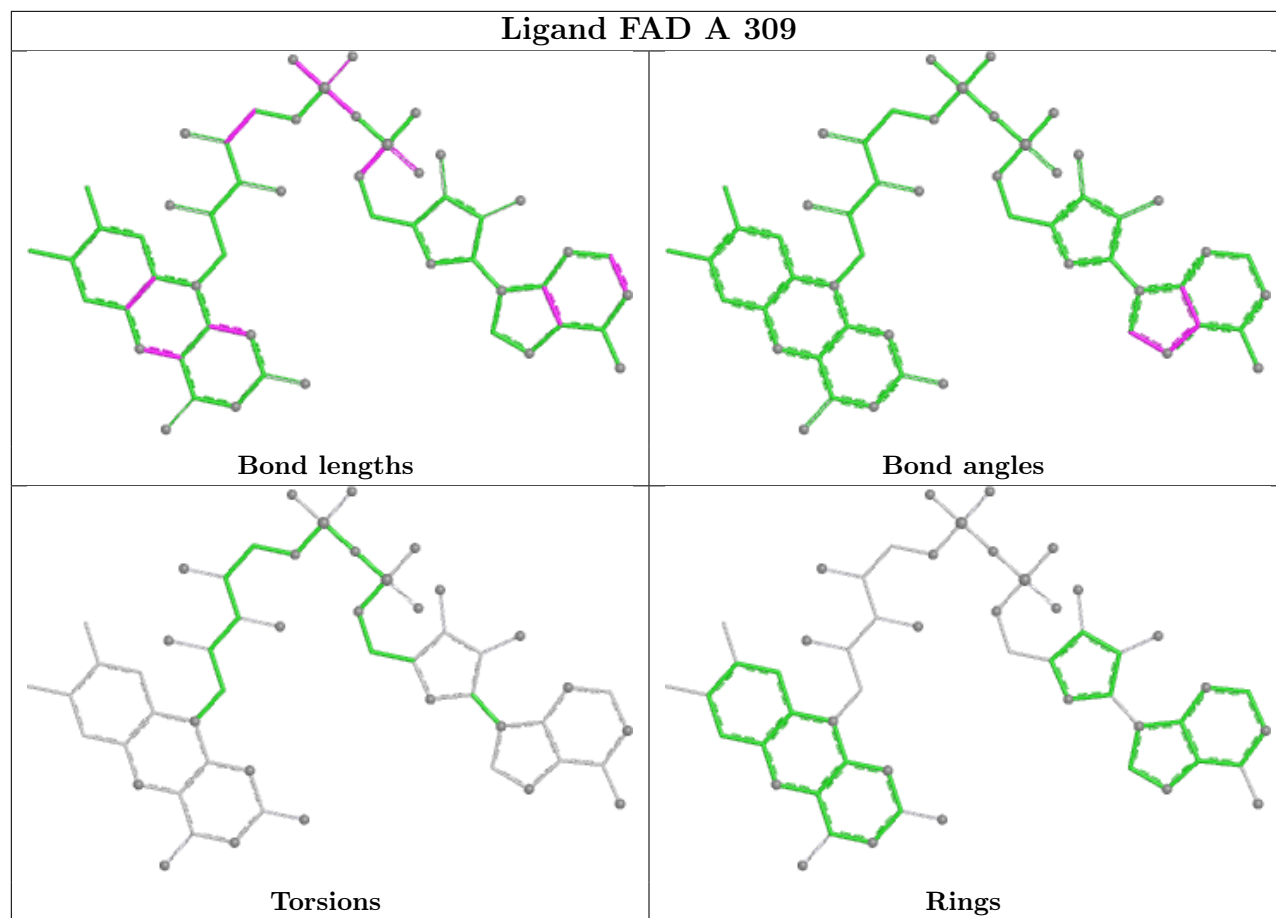
4 monomers are involved in 12 short contacts:

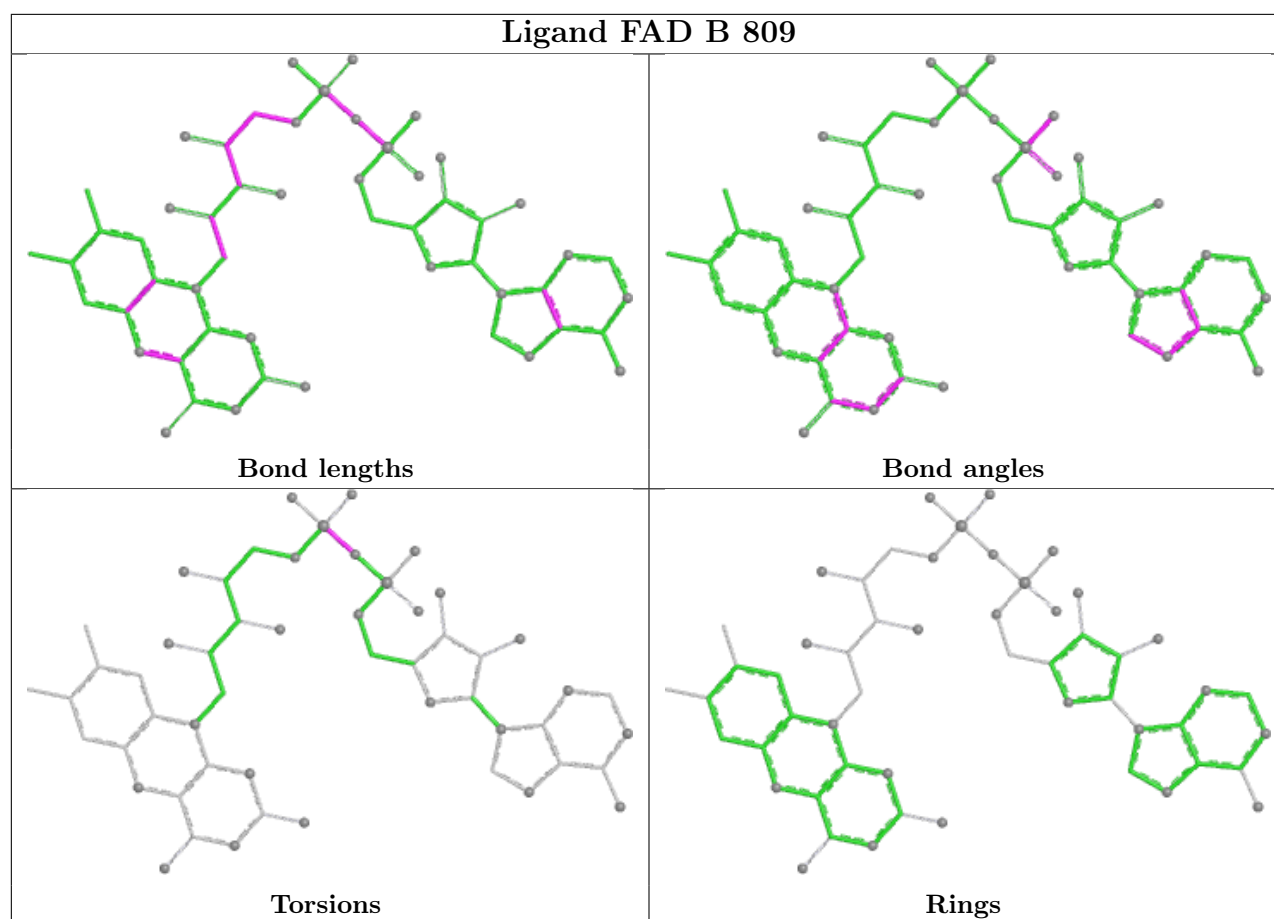
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	310	NAP	3	0
4	B	810	NAP	7	0
3	A	309	FAD	1	0
3	B	809	FAD	1	0

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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	308/308 (100%)	-0.50	5 (1%) 70 70	17, 34, 69, 81	1 (0%)
1	B	295/308 (95%)	-0.42	6 (2%) 65 64	22, 37, 75, 88	1 (0%)
All	All	603/616 (97%)	-0.46	11 (1%) 67 67	17, 36, 72, 88	2 (0%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	13	HIS	3.3
1	B	776	ASP	2.9
1	B	774	GLY	2.9
1	B	775	ILE	2.7
1	A	283	ALA	2.7
1	B	783	ALA	2.6
1	A	11	VAL	2.5
1	A	278	ILE	2.2
1	B	784	ALA	2.2
1	A	20	ASN	2.1
1	B	777	ASP	2.1

### 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](#)

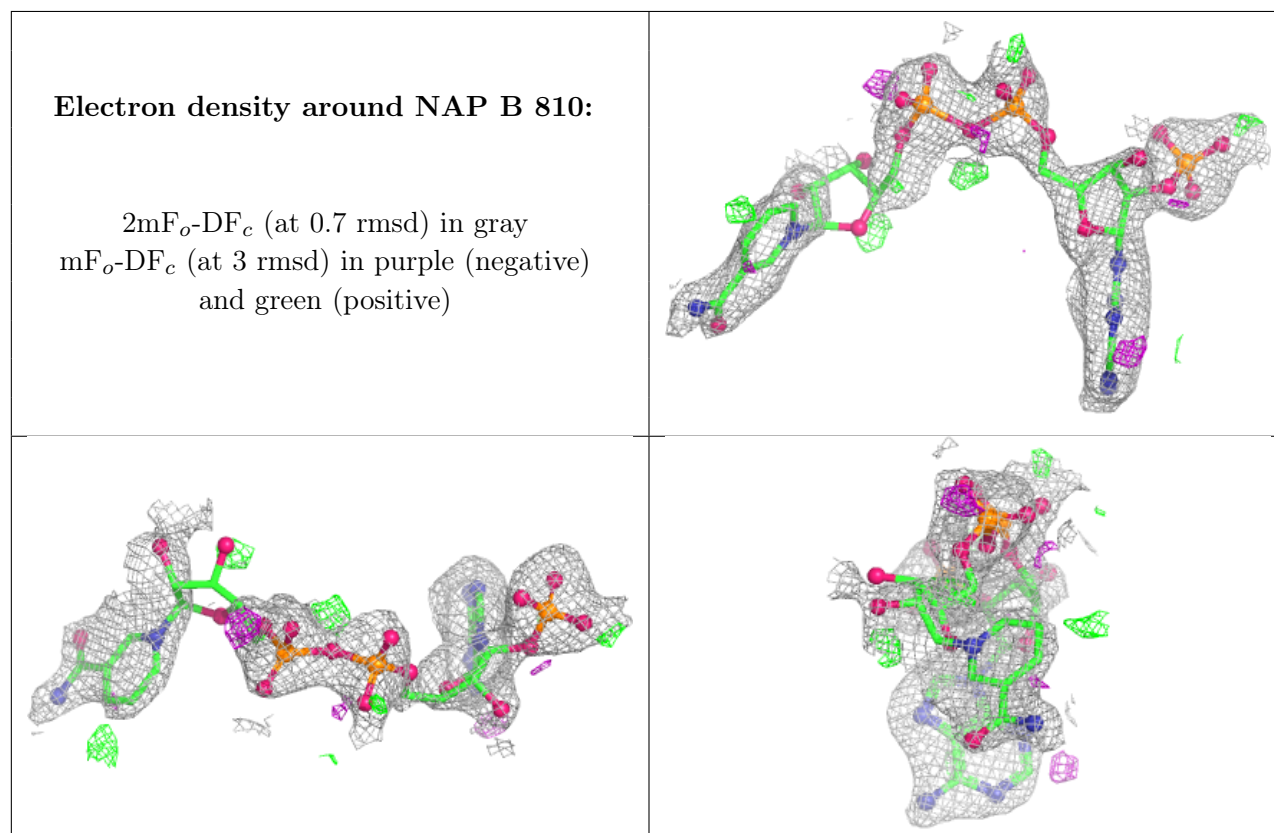
There are no oligosaccharides in this entry.

## 6.4 Ligands ⓘ

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<sup>th</sup> 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.

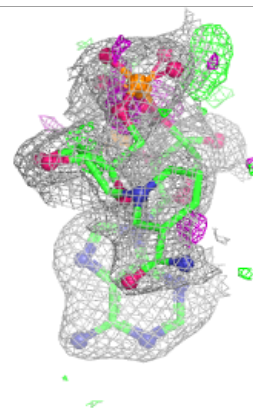
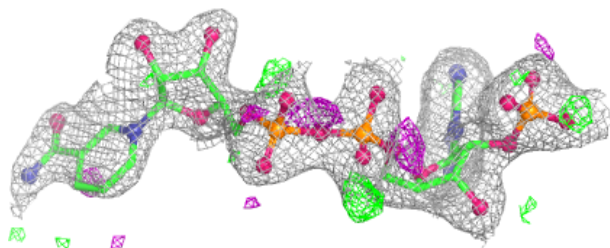
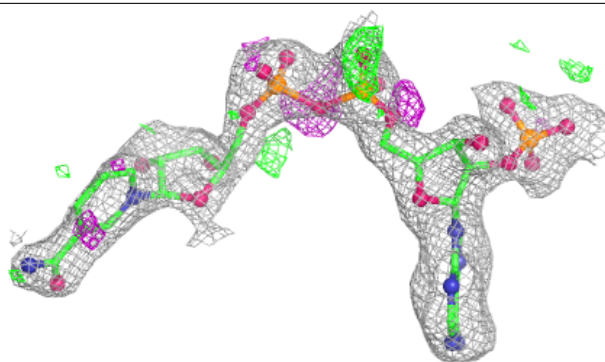
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	NAP	B	810	48/48	0.88	0.10	25,64,80,86	18
4	NAP	A	310	48/48	0.92	0.08	14,37,56,59	18
2	SO4	A	311	5/5	0.95	0.08	44,54,58,58	0
3	FAD	B	809	53/53	0.97	0.06	17,28,81,83	0
3	FAD	A	309	53/53	0.98	0.05	17,23,59,60	0

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.

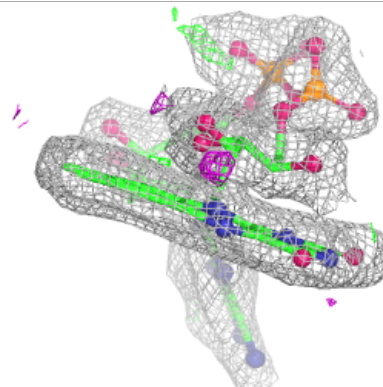
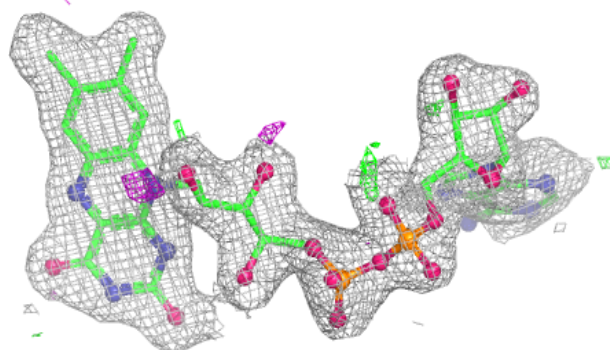
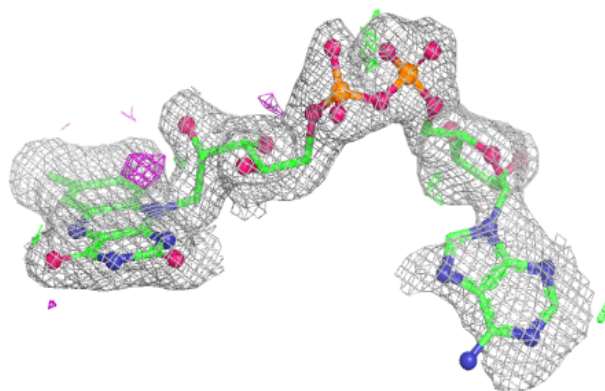


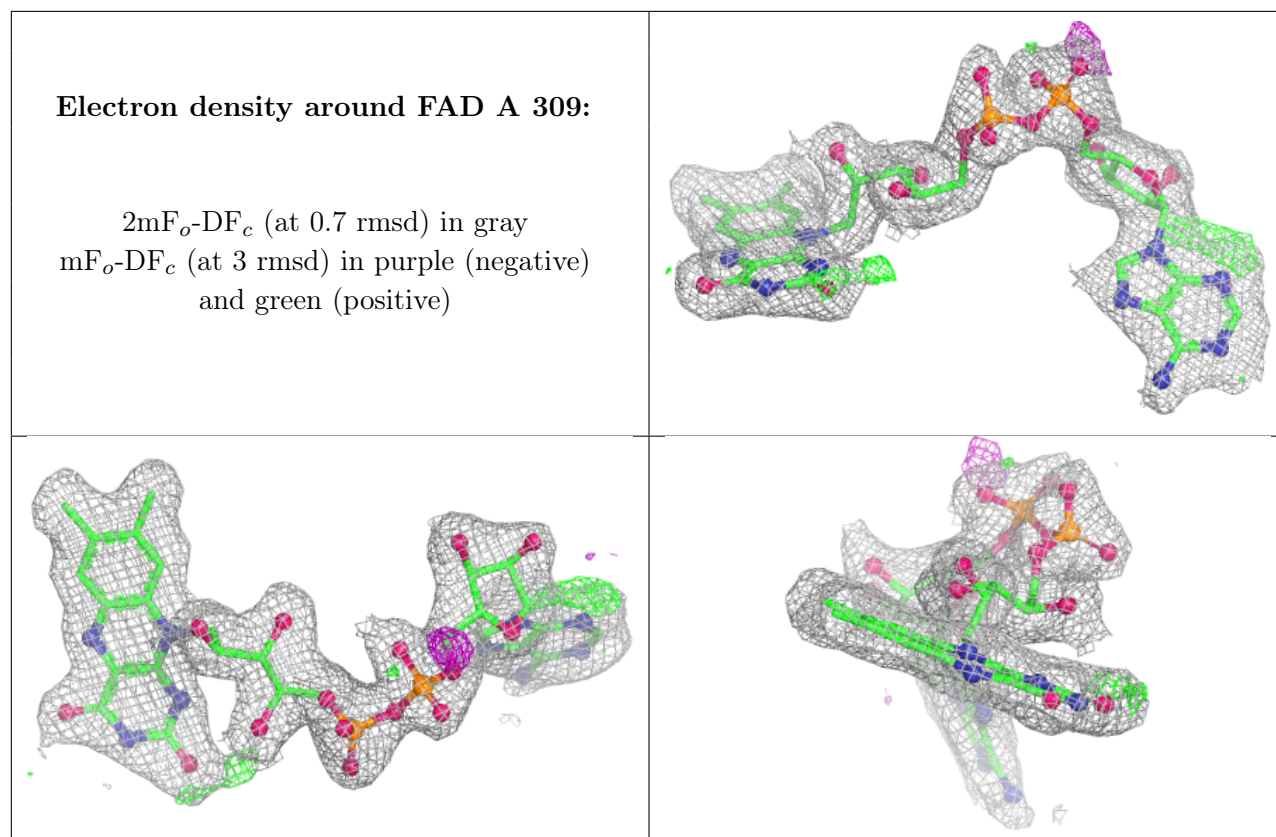
**Electron density around NAP A 310:**

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

**Electron density around FAD B 809:**

$2mF_o-DF_c$  (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.