WORLDWIDE PDB

PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Sep 11, 2023 – 04:47 pm BST

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PDB ID	:	8C0U
Title	:	1,6-anhydro-n-actetylmuramic acid kinase (AnmK) in complex with their natural substrates and products
Authors	:	Jimenez-Faraco, E.; Hermoso, J.A.
Deposited on	:	2022-12-19
Resolution	:	2.11 Å(reported)

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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 2.11 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.
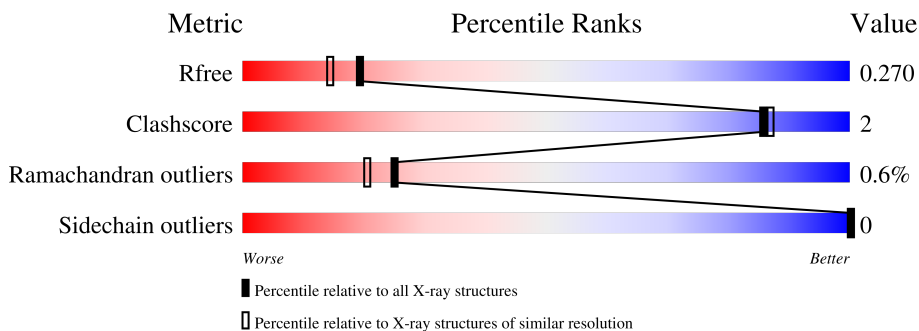
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	6241 (2.14-2.10)
Clashscore	141614	6778 (2.14-2.10)
Ramachandran outliers	138981	6705 (2.14-2.10)
Sidechain outliers	138945	6706 (2.14-2.10)

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%

Mol	Chain	Length	Quality of chain
1	A	368	93% ... 5% ..
1	B	368	94% ... . ..

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 5773 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 Anhydro-N-acetylmuramic acid kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	363	Total	C	N	O	S	0	0	0
			2751	1731	497	507	16			
1	B	363	Total	C	N	O	S	0	0	0
			2751	1731	497	507	16			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	GLY	-	expression tag	UNP Q9I5Q5
A	-3	ALA	-	expression tag	UNP Q9I5Q5
A	-2	GLY	-	expression tag	UNP Q9I5Q5
A	-1	ALA	-	expression tag	UNP Q9I5Q5
A	0	GLY	-	expression tag	UNP Q9I5Q5
B	-4	GLY	-	expression tag	UNP Q9I5Q5
B	-3	ALA	-	expression tag	UNP Q9I5Q5
B	-2	GLY	-	expression tag	UNP Q9I5Q5
B	-1	ALA	-	expression tag	UNP Q9I5Q5
B	0	GLY	-	expression tag	UNP Q9I5Q5

- Molecule 2 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).

ADP

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

• Molecule 3 is 2-(2-ACETYLAMINO-4-HYDROXY-6,8-DIOXA-BICYCLO[3.2.1]OCT-3-YLOXY)-PROPIONIC ACID (three-letter code: AH0) (formula: $C_{11}H_{17}NO_7$) (labeled as "Ligand of Interest" by depositor).

AH0
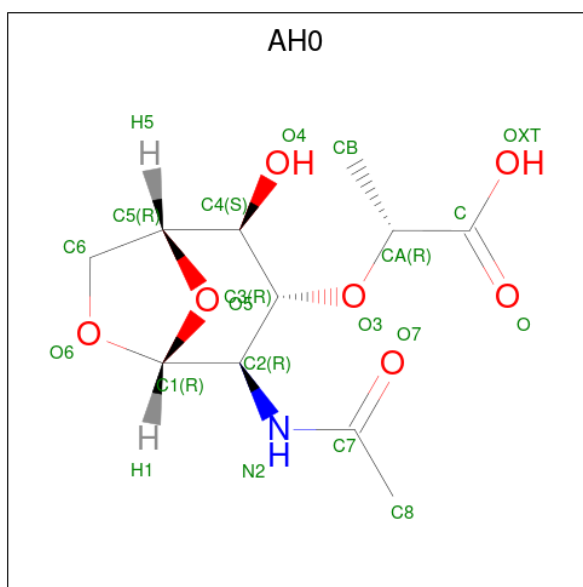
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			19	11	1	7		

- Molecule 4 is (2 {R})-2-[(2 {S},3 {R},4 {R},5 {S},6 {R})-3-acetamido-2,5-bis(oxidanyl) -6-(phosphonooxymethyl)oxan-4-yl]oxypropanoic acid (three-letter code: VW0) (formula: $C_{11}H_{20}NO_{11}P$) (labeled as "Ligand of Interest" by depositor).
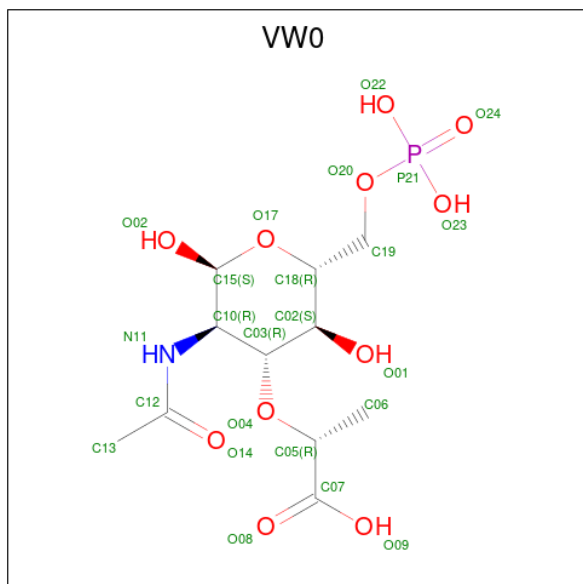
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	B	1	Total	C	N	O	P	0	0
			24	11	1	11	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	92	Total	O	0	0
			92	92		
5	B	82	Total	O	0	0
			82	82		

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. 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. 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: Anhydro-N-acetylmuramic acid kinase

Chain A:

• Molecule 1: Anhydro-N-acetylmuramic acid kinase

Chain B:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 63	Depositor
Cell constants a, b, c, α, β, γ	90.58Å 90.58Å 174.48Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	46.76 – 2.11 46.72 – 2.11	Depositor EDS
% Data completeness (in resolution range)	90.7 (46.76-2.11) 90.7 (46.72-2.11)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.60 (at 2.12Å)	Xtriage
Refinement program	REFMAC 5.8.0405	Depositor
R, R_{free}	0.230 , 0.268 0.236 , 0.270	Depositor DCC
R_{free} test set	2057 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å^2)	43.3	Xtriage
Anisotropy	0.049	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 30.5	EDS
L-test for twinning[2]	$< |L| > = 0.46, < L^2 > = 0.29$	Xtriage
Estimated twinning fraction	0.426 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5773	wwPDB-VP
Average B, all atoms (Å^2)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.22% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: VW0, ADP, AH0

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	0.28	0/2816	0.49	0/3830
1	B	0.28	0/2816	0.49	0/3830
All	All	0.28	0/5632	0.49	0/7660

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

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	129	ARG	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	2751	0	2707	13	0
1	B	2751	0	2707	11	0
2	A	27	0	12	0	0
2	B	27	0	12	0	0
3	A	19	0	16	0	0
4	B	24	0	0	0	0
5	A	92	0	0	0	0
5	B	82	0	0	1	0
All	All	5773	0	5454	24	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 2.

All (24) 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:143:VAL:N	1:B:144:PRO:CD	2.66	0.58
1:B:288:LEU:HD22	1:B:318:TYR:CE1	2.39	0.57
1:A:143:VAL:N	1:A:144:PRO:CD	2.69	0.56
1:A:113:PRO:HG2	1:A:361:TYR:CZ	2.43	0.53
1:B:144:PRO:HG2	1:B:348:VAL:HG11	1.92	0.51
1:B:111:GLY:O	1:B:112:ASN:C	2.48	0.51
1:A:243:LEU:HB3	1:A:244:PRO:HD3	1.91	0.51
1:A:290:CYS:HA	1:A:322:PRO:HB3	1.93	0.50
1:A:146:PHE:CZ	1:A:150:LEU:HD11	2.47	0.50
1:A:197:GLN:O	1:A:199:GLY:N	2.45	0.50
1:A:227:PHE:CE2	1:A:236:THR:HB	2.47	0.50
1:A:111:GLY:O	1:A:112:ASN:C	2.51	0.47
1:B:65:ARG:HD2	5:B:564:HOH:O	2.15	0.46
1:A:146:PHE:CE2	1:A:150:LEU:HD11	2.50	0.46
1:B:227:PHE:CE2	1:B:236:THR:HB	2.52	0.45
1:B:320:ILE:N	1:B:320:ILE:HD12	2.32	0.44
1:B:243:LEU:HB3	1:B:244:PRO:HD3	1.98	0.44
1:A:332:TRP:O	1:A:335:HIS:HB3	2.17	0.44
1:A:222:LEU:HD13	1:A:268:LEU:HD22	2.00	0.44
1:A:290:CYS:HA	1:A:322:PRO:CB	2.48	0.44
1:B:143:VAL:N	1:B:144:PRO:HD3	2.34	0.43
1:A:49:CYS:HA	1:A:98:ILE:O	2.19	0.42
1:B:49:CYS:HA	1:B:98:ILE:O	2.20	0.41
1:B:146:PHE:CZ	1:B:150:LEU:HD11	2.56	0.41

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	361/368 (98%)	352 (98%)	7 (2%)	2 (1%)	25	20
1	B	361/368 (98%)	346 (96%)	13 (4%)	2 (1%)	25	20
All	All	722/736 (98%)	698 (97%)	20 (3%)	4 (1%)	25	20

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	111	GLY
1	A	112	ASN
1	B	112	ASN
1	B	111	GLY

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	280/280 (100%)	280 (100%)	0	100	100
1	B	280/280 (100%)	280 (100%)	0	100	100
All	All	560/560 (100%)	560 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

4 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
3	AH0	A	402	-	20,20,20	0.64	0	25,29,29	0.97	1 (4%)
4	VW0	B	402	-	24,24,24	1.20	2 (8%)	31,35,35	0.79	0
2	ADP	A	401	-	24,29,29	0.64	0	29,45,45	0.80	1 (3%)
2	ADP	B	401	-	24,29,29	0.62	0	29,45,45	0.80	1 (3%)

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	AH0	A	402	-	-	2/12/37/37	0/3/2/2
4	VW0	B	402	-	-	7/18/38/38	0/1/1/1
2	ADP	A	401	-	-	0/12/32/32	0/3/3/3
2	ADP	B	401	-	-	0/12/32/32	0/3/3/3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	402	VW0	O17-C15	-2.24	1.37	1.42
4	B	402	VW0	C03-C10	2.11	1.56	1.53

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	402	AH0	O3-C3-C4	2.71	114.50	107.28
2	B	401	ADP	C5-C6-N6	2.32	123.89	120.35
2	A	401	ADP	C5-C6-N6	2.18	123.67	120.35

There are no chirality outliers.

All (9) torsion outliers are listed below:

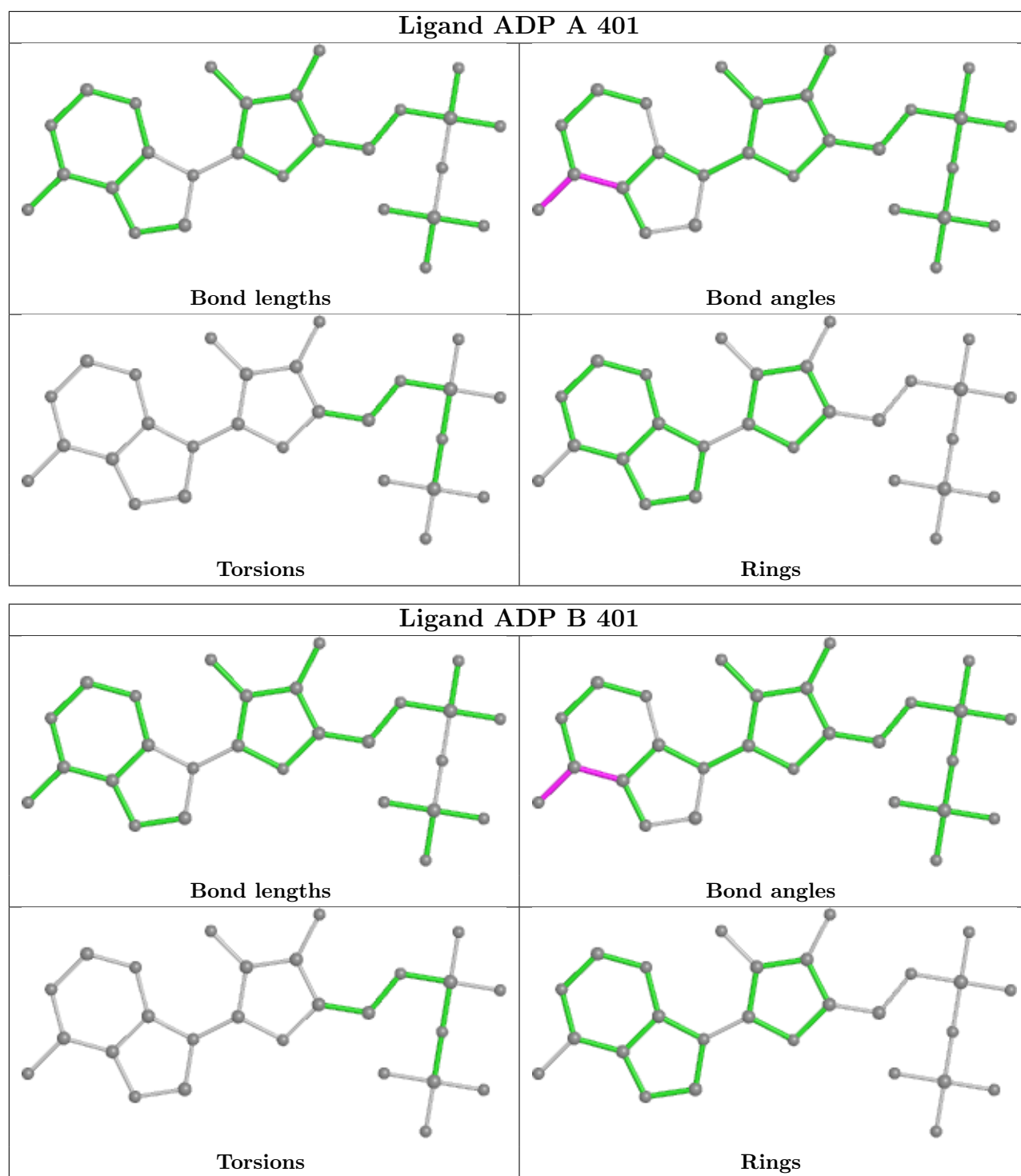| Mol	Chain	Res	Type	Atoms
3	A	402	AH0	C4-C3-O3-CA
3	A	402	AH0	C-CA-O3-C3
4	B	402	VW0	O04-C05-C07-O08
4	B	402	VW0	O04-C05-C07-O09
4	B	402	VW0	C07-C05-O04-C03
4	B	402	VW0	C19-O20-P21-O22
4	B	402	VW0	C19-O20-P21-O23
4	B	402	VW0	C19-O20-P21-O24
4	B	402	VW0	C18-C19-O20-P21

There are no ring outliers.

No monomer is involved in short contacts.

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 AH0 A 402

Bond lengths

Bond angles

Torsions

Rings

Ligand VW0 B 402

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP A 401

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP B 401

Bond lengths

Bond angles

Torsions

Rings
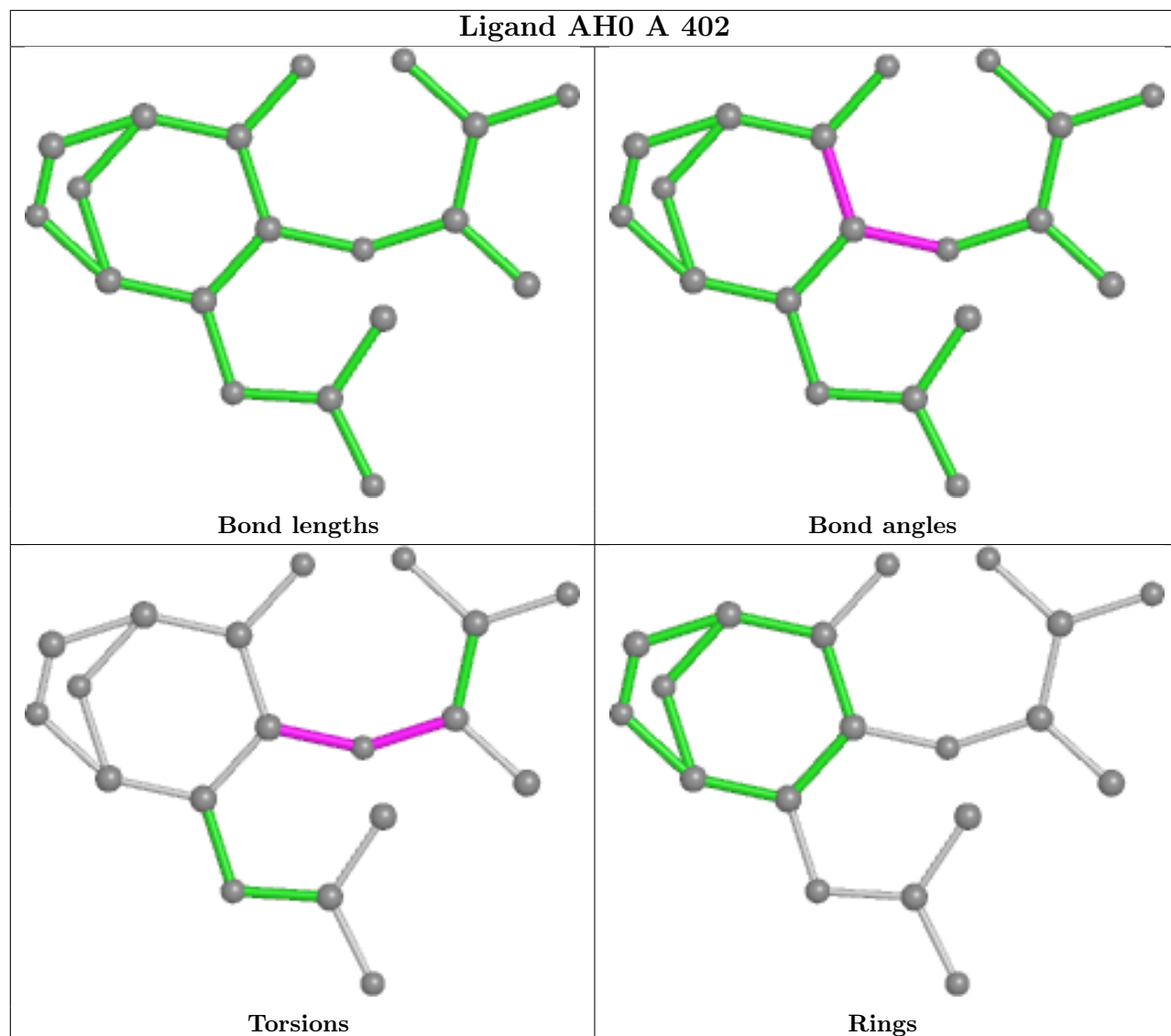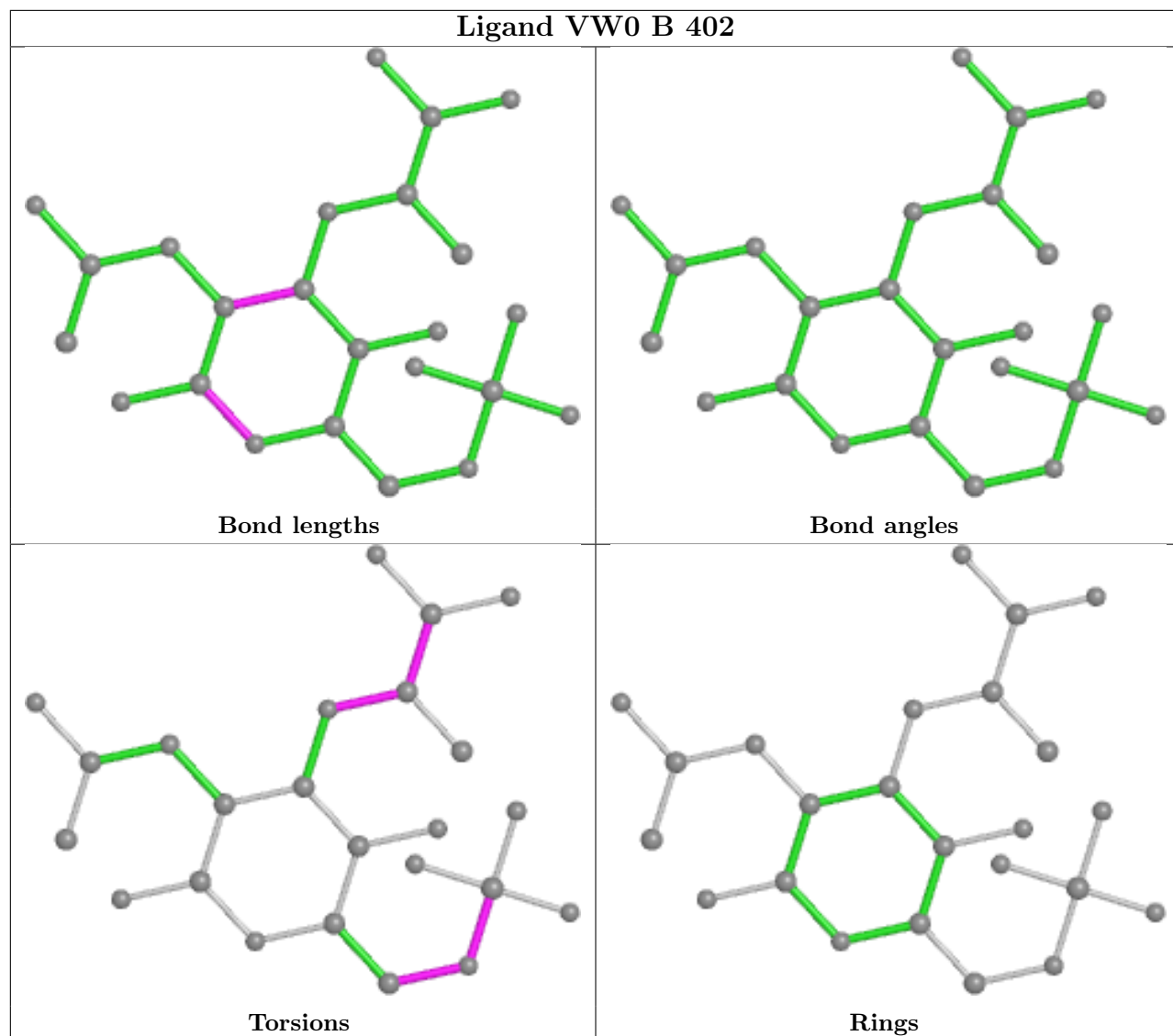
5.7 Other polymers ⓘ

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 ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.
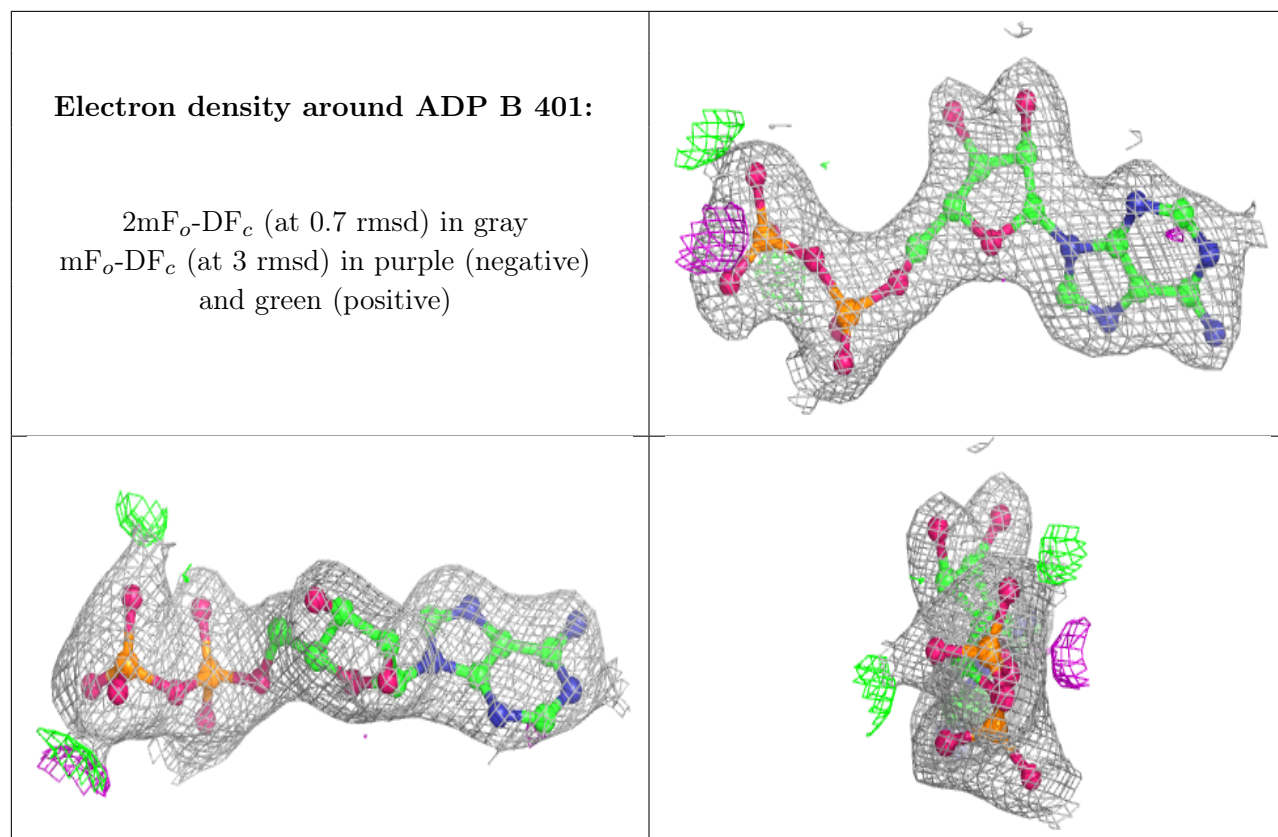
6.3 Carbohydrates ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands ⓘ

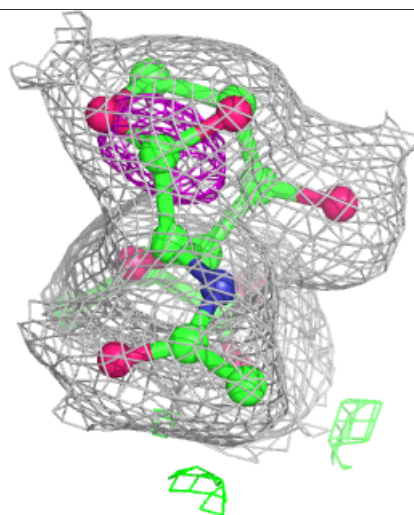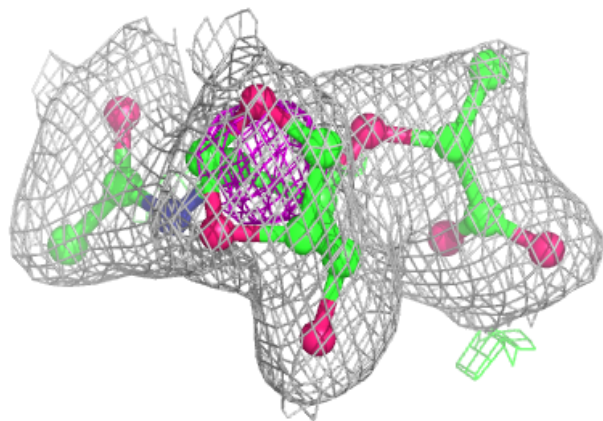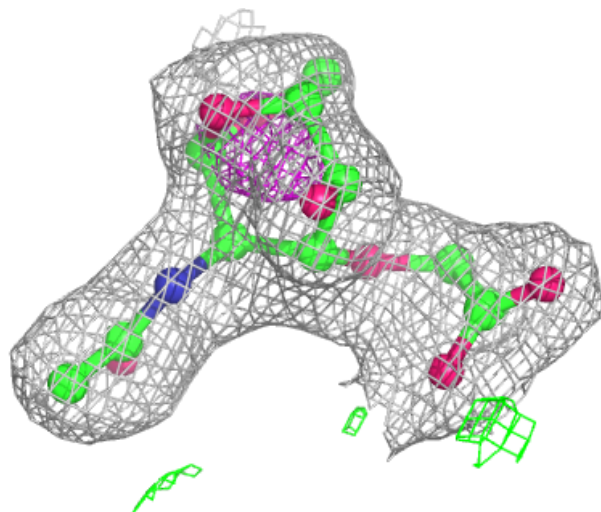Unable to reproduce the depositors R factor - this section is therefore empty.

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.
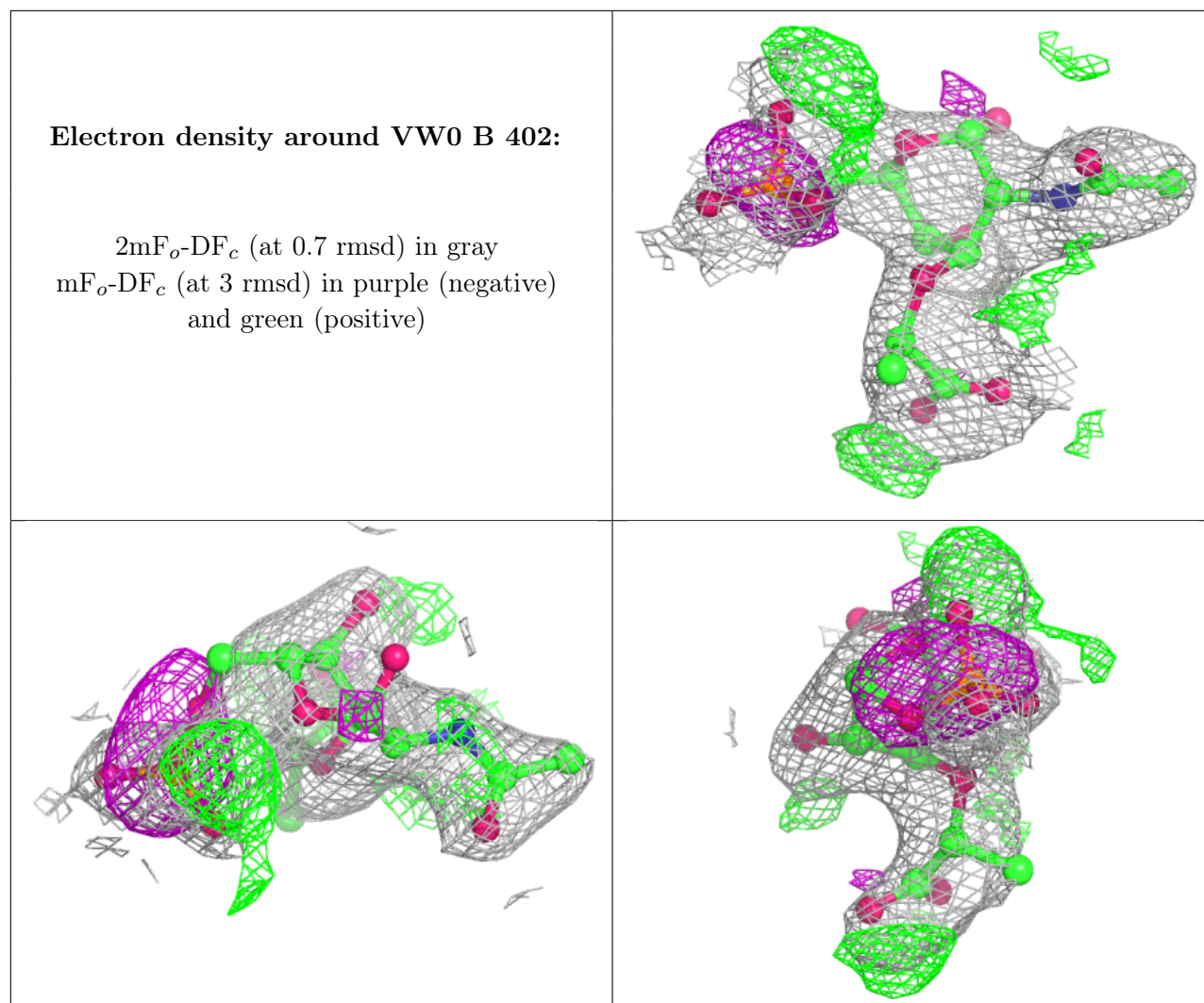
Electron density around ADP A 401:

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

Electron density around ADP B 401:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
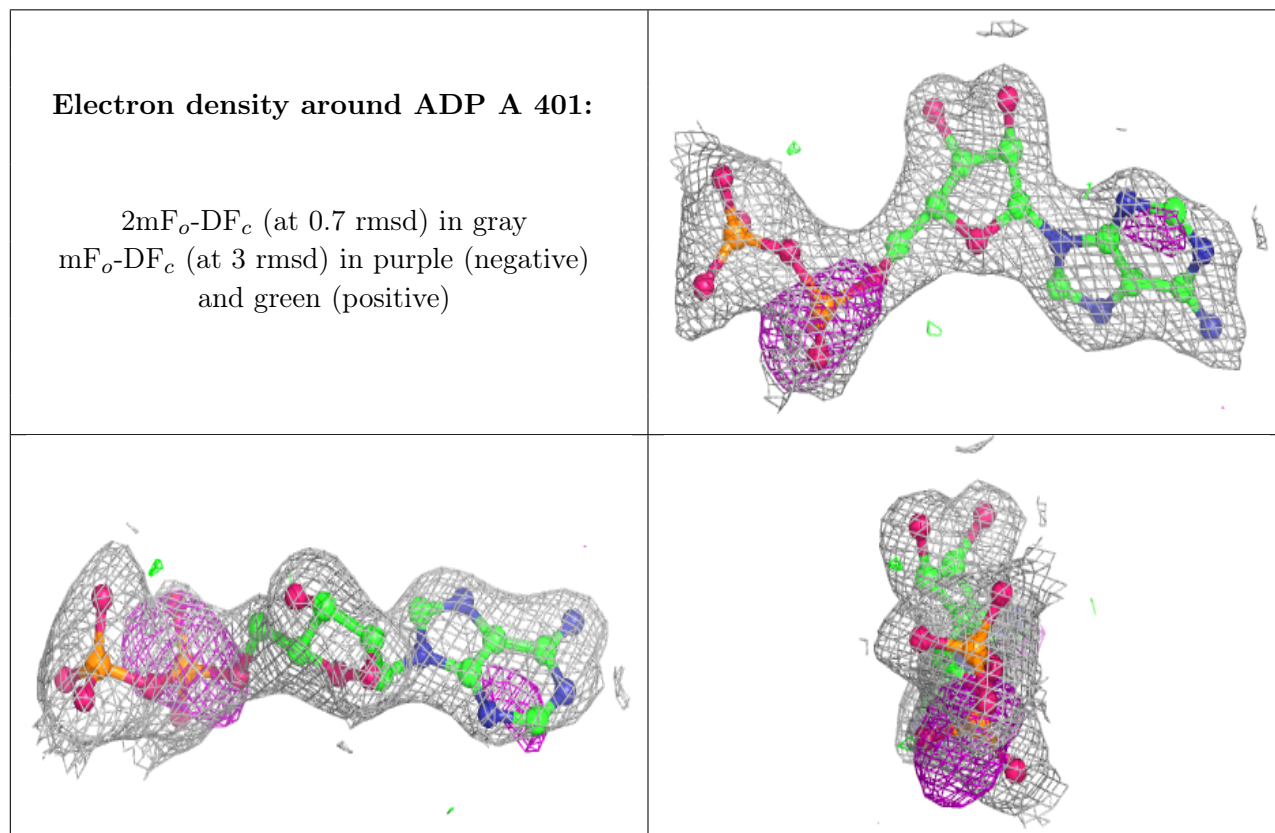
Electron density around AH0 A 402:

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

Electron density around VW0 B 402:

$2mF_o$-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 ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.