



Full wwPDB X-ray Structure Validation Report ⓘ

Dec 9, 2024 – 10:11 AM EST

PDB ID : 9MDT
Title : Crystal Structure Pyrophosphate-fructose 6-phosphate 1-phosphotransferase 1 (Pfk1) from *Trichomonas vaginalis* (ATP/Pyrophosphate complex)
Authors : Seattle Structural Genomics Center for Infectious Disease; Seattle Structural Genomics Center for Infectious Disease (SSGCID)
Deposited on : 2024-12-05
Resolution : 2.16 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) : 1.21
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.004 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.40

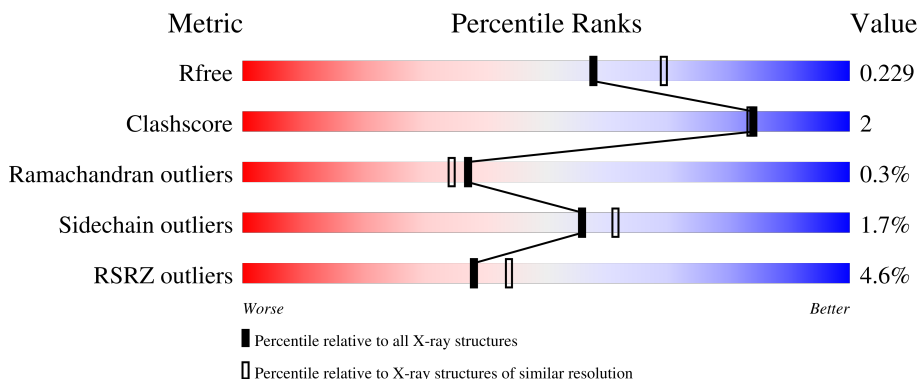
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.16 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}	164625	1881 (2.16-2.16)
Clashscore	180529	2047 (2.16-2.16)
Ramachandran outliers	177936	2027 (2.16-2.16)
Sidechain outliers	177891	2026 (2.16-2.16)
RSRZ outliers	164620	1882 (2.16-2.16)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	434	 7% 88% 7% . .
1	B	434	 3% 91% 6% .
1	C	434	 4% 92% 6% .
1	D	434	 4% 91% 5% .

2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 13243 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 Pyrophosphate--fructose 6-phosphate 1-phosphotransferase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	417	3191	2028	556	591	16	0	0	0
1	B	423	3248	2062	566	603	17	0	0	0
1	C	423	3244	2060	566	601	17	0	0	0
1	D	417	3188	2024	554	593	17	0	0	0

There are 32 discrepancies between the modelled and reference sequences:

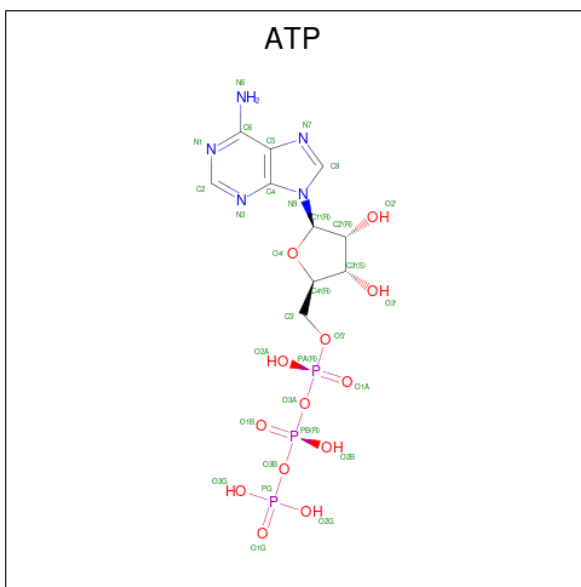
Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	MET	-	initiating methionine	UNP O61068
A	-6	ALA	-	expression tag	UNP O61068
A	-5	HIS	-	expression tag	UNP O61068
A	-4	HIS	-	expression tag	UNP O61068
A	-3	HIS	-	expression tag	UNP O61068
A	-2	HIS	-	expression tag	UNP O61068
A	-1	HIS	-	expression tag	UNP O61068
A	0	HIS	-	expression tag	UNP O61068
B	-7	MET	-	initiating methionine	UNP O61068
B	-6	ALA	-	expression tag	UNP O61068
B	-5	HIS	-	expression tag	UNP O61068
B	-4	HIS	-	expression tag	UNP O61068
B	-3	HIS	-	expression tag	UNP O61068
B	-2	HIS	-	expression tag	UNP O61068
B	-1	HIS	-	expression tag	UNP O61068
B	0	HIS	-	expression tag	UNP O61068
C	-7	MET	-	initiating methionine	UNP O61068
C	-6	ALA	-	expression tag	UNP O61068
C	-5	HIS	-	expression tag	UNP O61068
C	-4	HIS	-	expression tag	UNP O61068
C	-3	HIS	-	expression tag	UNP O61068

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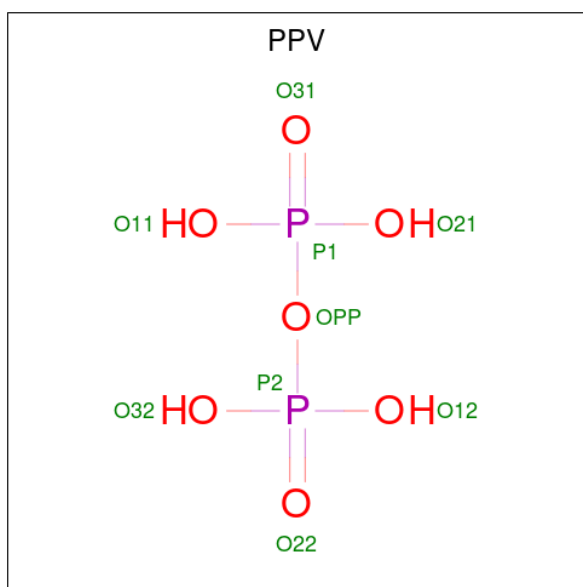
Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	HIS	-	expression tag	UNP O61068
C	-1	HIS	-	expression tag	UNP O61068
C	0	HIS	-	expression tag	UNP O61068
D	-7	MET	-	initiating methionine	UNP O61068
D	-6	ALA	-	expression tag	UNP O61068
D	-5	HIS	-	expression tag	UNP O61068
D	-4	HIS	-	expression tag	UNP O61068
D	-3	HIS	-	expression tag	UNP O61068
D	-2	HIS	-	expression tag	UNP O61068
D	-1	HIS	-	expression tag	UNP O61068
D	0	HIS	-	expression tag	UNP O61068

- Molecule 2 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).



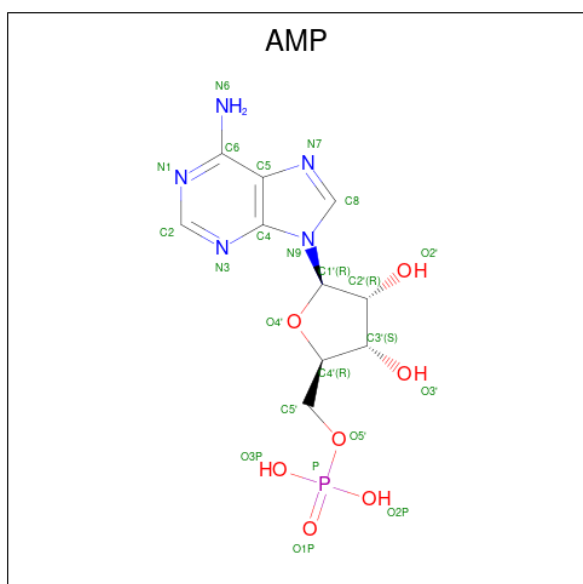
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total	C	N	O	P	0	0
			31	10	5	13	3		
2	B	1	Total	C	N	O	P	0	0
			31	10	5	13	3		
2	B	1	Total	C	N	O	P	0	0
			31	10	5	13	3		

- Molecule 3 is PYROPHOSPHATE (three-letter code: PPV) (formula: $H_4O_7P_2$) (labeled as "Ligand of Interest" by depositor).



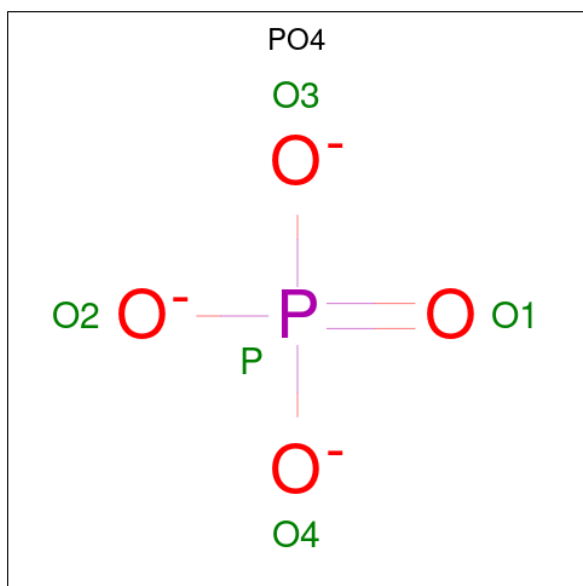
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O P 9 7 2	0	0
3	B	1	Total O P 9 7 2	0	0
3	C	1	Total O P 9 7 2	0	0
3	D	1	Total O P 9 7 2	0	0

- Molecule 4 is ADENOSINE MONOPHOSPHATE (three-letter code: AMP) (formula: $C_{10}H_{14}N_5O_7P$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
4	A	1	23	10	5	7	1	0	0

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O₄P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	P		
5	A	1	5	4	1	0	0
5	A	1	5	4	1	0	0
5	B	1	5	4	1	0	0
5	B	1	5	4	1	0	0
5	C	1	5	4	1	0	0
5	C	1	5	4	1	0	0
5	D	1	5	4	1	0	0
5	D	1	5	4	1	0	0

- Molecule 6 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	2	Total	Cl	0	0
			2	2		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	B	3	Total	Cl	0	0
			3	3		
6	D	2	Total	Cl	0	0
			2	2		

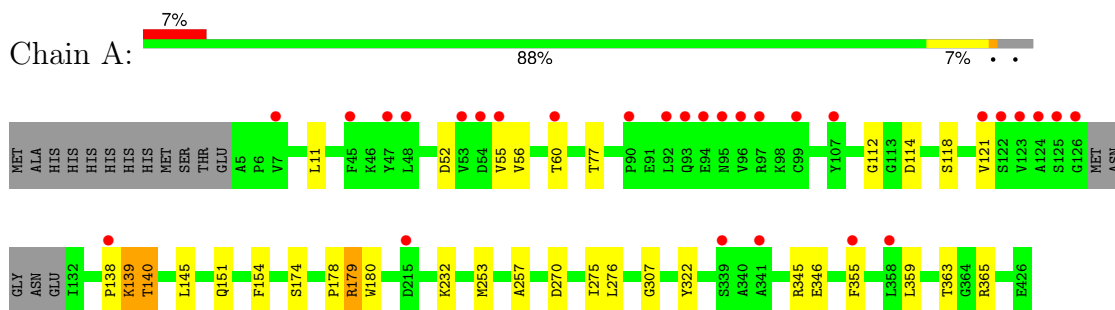
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	55	Total	O	0	0
			55	55		
7	B	41	Total	O	0	0
			41	41		
7	C	47	Total	O	0	0
			47	47		
7	D	30	Total	O	0	0
			30	30		

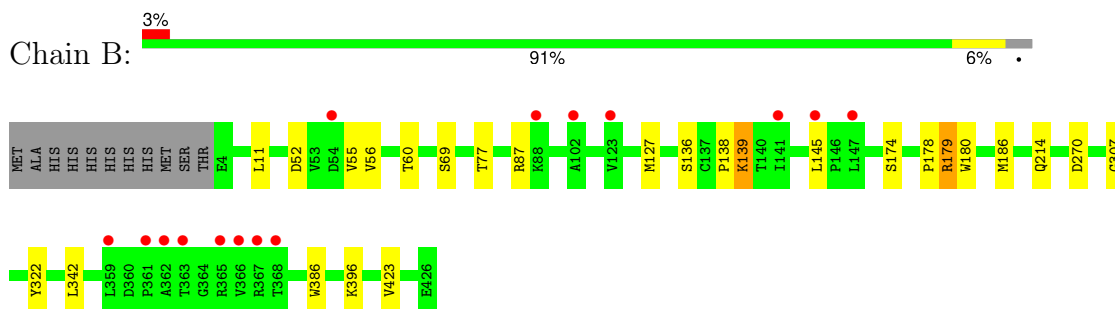
3 Residue-property plots [i](#)

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.

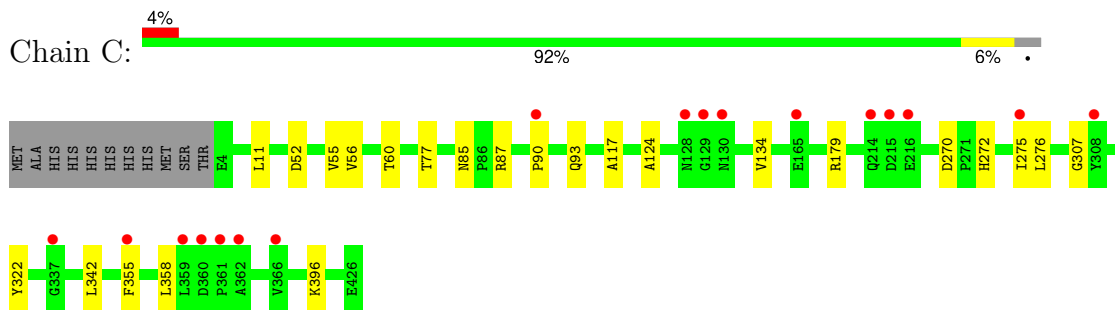
- Molecule 1: Pyrophosphate--fructose 6-phosphate 1-phosphotransferase 1



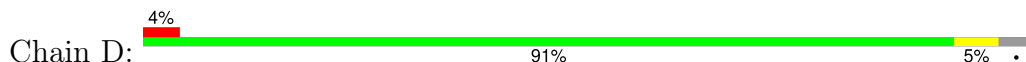
- Molecule 1: Pyrophosphate--fructose 6-phosphate 1-phosphotransferase 1

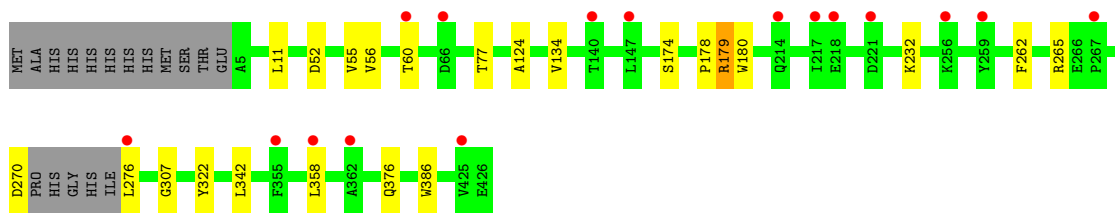


- Molecule 1: Pyrophosphate--fructose 6-phosphate 1-phosphotransferase 1



- Molecule 1: Pyrophosphate--fructose 6-phosphate 1-phosphotransferase 1





4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	87.11Å 87.11Å 478.24Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.74 – 2.16 48.74 – 2.16	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.74-2.16) 100.0 (48.74-2.16)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.57 (at 2.16Å)	Xtrriage
Refinement program	PHENIX dev_5508	Depositor
R, R_{free}	0.202 , 0.229 0.205 , 0.229	Depositor DCC
R_{free} test set	4984 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	46.5	Xtrriage
Anisotropy	0.077	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 51.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	13243	wwPDB-VP
Average B, all atoms (Å ²)	62.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.77% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ATP, PPV, PO4, AMP, CL

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	0.30	0/3250	0.51	0/4396
1	B	0.30	0/3308	0.51	0/4472
1	C	0.31	0/3304	0.51	0/4467
1	D	0.30	0/3244	0.50	0/4386
All	All	0.30	0/13106	0.51	0/17721

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 [i](#)

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	3191	0	3231	24	0
1	B	3248	0	3299	11	0
1	C	3244	0	3295	12	0
1	D	3188	0	3231	11	0
2	A	31	0	12	1	0
2	B	62	0	24	4	0
3	A	9	0	0	0	0
3	B	9	0	0	0	0
3	C	9	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	9	0	0	0	0
4	A	23	0	12	0	0
5	A	10	0	0	0	0
5	B	10	0	0	0	0
5	C	10	0	0	0	0
5	D	10	0	0	0	0
6	A	2	0	0	0	0
6	B	3	0	0	0	0
6	D	2	0	0	0	0
7	A	55	0	0	0	0
7	B	41	0	0	0	0
7	C	47	0	0	0	0
7	D	30	0	0	0	0
All	All	13243	0	13104	58	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 (58) 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:121:VAL:HG11	1:A:355:PHE:CG	2.26	0.71
1:A:363:THR:HG22	1:A:365:ARG:HD3	1.72	0.71
1:A:355:PHE:CE2	1:A:359:LEU:HD21	2.26	0.70
1:D:342:LEU:HD12	1:D:358:LEU:HD12	1.74	0.69
1:A:121:VAL:HG11	1:A:355:PHE:CD2	2.28	0.69
1:C:56:VAL:O	1:C:60:THR:HG23	1.93	0.69
1:C:124:ALA:HB2	1:C:134:VAL:HG21	1.77	0.66
1:C:342:LEU:HD12	1:C:358:LEU:HD12	1.83	0.59
1:C:275:ILE:HD12	1:C:275:ILE:H	1.67	0.59
1:C:52:ASP:OD2	1:C:55:VAL:HG23	2.03	0.59
1:B:52:ASP:OD2	1:B:55:VAL:HG23	2.04	0.58
1:C:270:ASP:HB3	1:C:276:LEU:HD21	1.86	0.57
1:C:117:ALA:HB1	1:C:355:PHE:CZ	2.40	0.56
1:A:112:GLY:HA2	1:A:139:LYS:HE3	1.90	0.53
1:A:114:ASP:OD1	1:A:145:LEU:HD23	2.08	0.53
1:A:275:ILE:HD12	1:A:275:ILE:H	1.73	0.51
1:D:52:ASP:OD2	1:D:55:VAL:HG23	2.10	0.51
1:D:124:ALA:HB2	1:D:134:VAL:HG21	1.91	0.51
1:A:138:PRO:CB	1:A:145:LEU:HD13	2.41	0.50
1:A:121:VAL:HG21	1:A:355:PHE:CE2	2.47	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:138:PRO:HB2	1:B:145:LEU:HD11	1.94	0.48
1:A:11:LEU:HD12	1:A:11:LEU:C	2.34	0.48
1:A:270:ASP:HB3	1:A:276:LEU:HD21	1.94	0.48
1:D:11:LEU:C	1:D:11:LEU:HD12	2.34	0.48
1:D:56:VAL:O	1:D:60:THR:HG23	2.13	0.48
1:B:179:ARG:HG3	1:B:180:TRP:N	2.28	0.48
1:B:11:LEU:HD12	1:B:11:LEU:C	2.35	0.47
1:A:52:ASP:OD2	1:A:55:VAL:HG23	2.14	0.47
1:C:90:PRO:HA	1:C:93:GLN:HB2	1.96	0.47
1:C:85:ASN:HD21	1:C:87:ARG:HE	1.63	0.47
1:C:11:LEU:C	1:C:11:LEU:HD12	2.36	0.46
1:A:151:GLN:NE2	1:A:346:GLU:HA	2.31	0.46
1:A:56:VAL:O	1:A:60:THR:HG23	2.16	0.46
1:B:56:VAL:O	1:B:60:THR:HG23	2.15	0.46
1:C:85:ASN:HD21	1:C:87:ARG:NE	2.14	0.46
1:A:139:LYS:O	1:A:140:THR:HB	2.16	0.45
1:A:139:LYS:HD2	1:A:139:LYS:C	2.37	0.44
1:B:139:LYS:HD2	1:B:139:LYS:C	2.37	0.44
1:C:117:ALA:HB1	1:C:355:PHE:HZ	1.82	0.44
1:D:270:ASP:HB3	1:D:276:LEU:HD21	2.00	0.43
2:B:502:ATP:HN61	1:D:232:LYS:NZ	2.17	0.43
1:B:214:GLN:HE22	1:B:423:VAL:HG13	1.82	0.43
1:B:386:TRP:HA	2:B:501:ATP:HN62	1.83	0.43
1:A:118:SER:O	1:A:121:VAL:HG22	2.19	0.43
1:A:138:PRO:O	1:A:154:PHE:CD2	2.72	0.43
1:A:253:MET:HB3	1:A:257:ALA:HB3	2.01	0.42
1:A:174:SER:O	1:A:178:PRO:HA	2.19	0.42
2:B:502:ATP:HN62	1:D:386:TRP:HA	1.83	0.42
1:B:174:SER:O	1:B:178:PRO:HA	2.20	0.42
1:A:151:GLN:OE1	1:A:345:ARG:O	2.37	0.42
1:A:179:ARG:HG3	1:A:180:TRP:N	2.34	0.42
1:D:262:PHE:O	1:D:265:ARG:NE	2.53	0.41
1:D:179:ARG:HG3	1:D:180:TRP:N	2.36	0.41
1:D:174:SER:O	1:D:178:PRO:HA	2.21	0.41
1:B:136:SER:O	1:B:342:LEU:HA	2.20	0.41
1:A:232:LYS:NZ	2:A:501:ATP:HN61	2.19	0.41
1:A:138:PRO:HB3	1:A:145:LEU:HD13	2.03	0.41
1:B:386:TRP:HA	2:B:501:ATP:N6	2.37	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	413/434 (95%)	405 (98%)	6 (2%)	2 (0%)	25	20
1	B	421/434 (97%)	414 (98%)	6 (1%)	1 (0%)	44	44
1	C	421/434 (97%)	413 (98%)	7 (2%)	1 (0%)	44	44
1	D	413/434 (95%)	405 (98%)	7 (2%)	1 (0%)	44	44
All	All	1668/1736 (96%)	1637 (98%)	26 (2%)	5 (0%)	37	34

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	307	GLY
1	B	307	GLY
1	D	307	GLY
1	A	140	THR
1	C	307	GLY

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	337/355 (95%)	333 (99%)	4 (1%)	67	73
1	B	345/355 (97%)	335 (97%)	10 (3%)	37	38
1	C	344/355 (97%)	339 (98%)	5 (2%)	60	66
1	D	337/355 (95%)	333 (99%)	4 (1%)	67	73
All	All	1363/1420 (96%)	1340 (98%)	23 (2%)	56	61

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	77	THR
1	A	139	LYS
1	A	179	ARG
1	A	322	TYR
1	B	69	SER
1	B	77	THR
1	B	87	ARG
1	B	127	MET
1	B	139	LYS
1	B	179	ARG
1	B	186	MET
1	B	270	ASP
1	B	322	TYR
1	B	396	LYS
1	C	77	THR
1	C	179	ARG
1	C	272	HIS
1	C	322	TYR
1	C	396	LYS
1	D	77	THR
1	D	179	ARG
1	D	322	TYR
1	D	376	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	151	GLN
1	B	274	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 23 ligands modelled in this entry, 7 are monoatomic - leaving 16 for Mogul analysis.

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	PPV	D	501	-	6,8,8	0.67	0	12,13,13	0.89	0
4	AMP	A	503	-	21,25,25	0.84	1 (4%)	23,38,38	1.37	2 (8%)
2	ATP	B	501	-	28,33,33	0.65	0	34,52,52	0.98	2 (5%)
5	PO4	B	504	-	4,4,4	1.68	1 (25%)	6,6,6	0.58	0
2	ATP	B	502	-	28,33,33	0.64	0	34,52,52	1.09	3 (8%)
2	ATP	A	501	-	28,33,33	0.66	0	34,52,52	1.08	4 (11%)
5	PO4	C	502	-	4,4,4	1.70	1 (25%)	6,6,6	0.63	0
5	PO4	D	502	-	4,4,4	1.44	1 (25%)	6,6,6	0.52	0
3	PPV	B	503	-	6,8,8	0.55	0	12,13,13	0.82	0
5	PO4	B	505	-	4,4,4	1.68	1 (25%)	6,6,6	0.47	0
3	PPV	C	501	-	6,8,8	0.62	0	12,13,13	0.93	0
5	PO4	A	505	-	4,4,4	1.64	1 (25%)	6,6,6	0.46	0
5	PO4	A	504	-	4,4,4	1.31	1 (25%)	6,6,6	0.60	0
3	PPV	A	502	-	6,8,8	0.68	0	12,13,13	0.89	0
5	PO4	C	503	-	4,4,4	1.70	1 (25%)	6,6,6	0.47	0
5	PO4	D	503	-	4,4,4	1.66	1 (25%)	6,6,6	0.50	0

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	PPV	D	501	-	-	1/6/6/6	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	AMP	A	503	-	-	0/6/26/26	0/3/3/3
2	ATP	B	501	-	-	0/18/38/38	0/3/3/3
2	ATP	B	502	-	-	2/18/38/38	0/3/3/3
2	ATP	A	501	-	-	1/18/38/38	0/3/3/3
3	PPV	B	503	-	-	0/6/6/6	-
3	PPV	C	501	-	-	0/6/6/6	-
3	PPV	A	502	-	-	0/6/6/6	-

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	504	PO4	P-O1	3.21	1.58	1.50
5	C	502	PO4	P-O1	3.11	1.57	1.50
5	C	503	PO4	P-O1	2.96	1.57	1.50
5	B	505	PO4	P-O1	2.92	1.57	1.50
5	A	505	PO4	P-O1	2.88	1.57	1.50
5	D	503	PO4	P-O1	2.87	1.57	1.50
5	D	502	PO4	P-O1	2.46	1.56	1.50
5	A	504	PO4	P-O1	2.39	1.56	1.50
4	A	503	AMP	C2-N3	2.18	1.35	1.32

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	503	AMP	N3-C2-N1	-4.63	122.39	128.67
2	B	502	ATP	C4'-O4'-C1'	-3.16	107.03	109.92
2	A	501	ATP	C4'-O4'-C1'	-2.96	107.21	109.92
4	A	503	AMP	C4-C5-N7	-2.36	106.84	109.34
2	B	501	ATP	O4'-C1'-N9	-2.35	105.62	108.75
2	A	501	ATP	O4'-C1'-N9	-2.20	105.82	108.75
2	B	501	ATP	C5-C6-N6	2.17	123.62	120.31
2	B	502	ATP	O4'-C1'-N9	-2.14	105.91	108.75
2	B	502	ATP	C5-C6-N6	2.12	123.55	120.31
2	A	501	ATP	C5-C6-N6	2.09	123.49	120.31
2	A	501	ATP	O3'-C3'-C4'	-2.08	105.11	111.08

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	ATP	PB-O3A-PA-O5'

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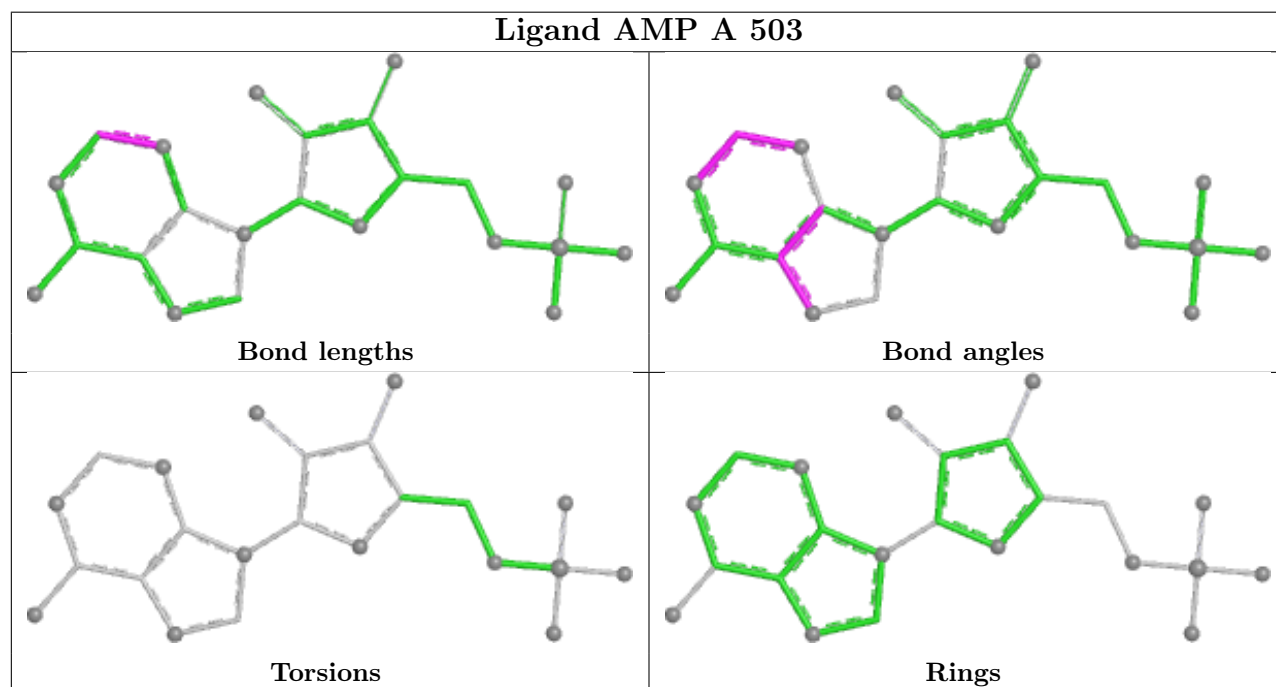
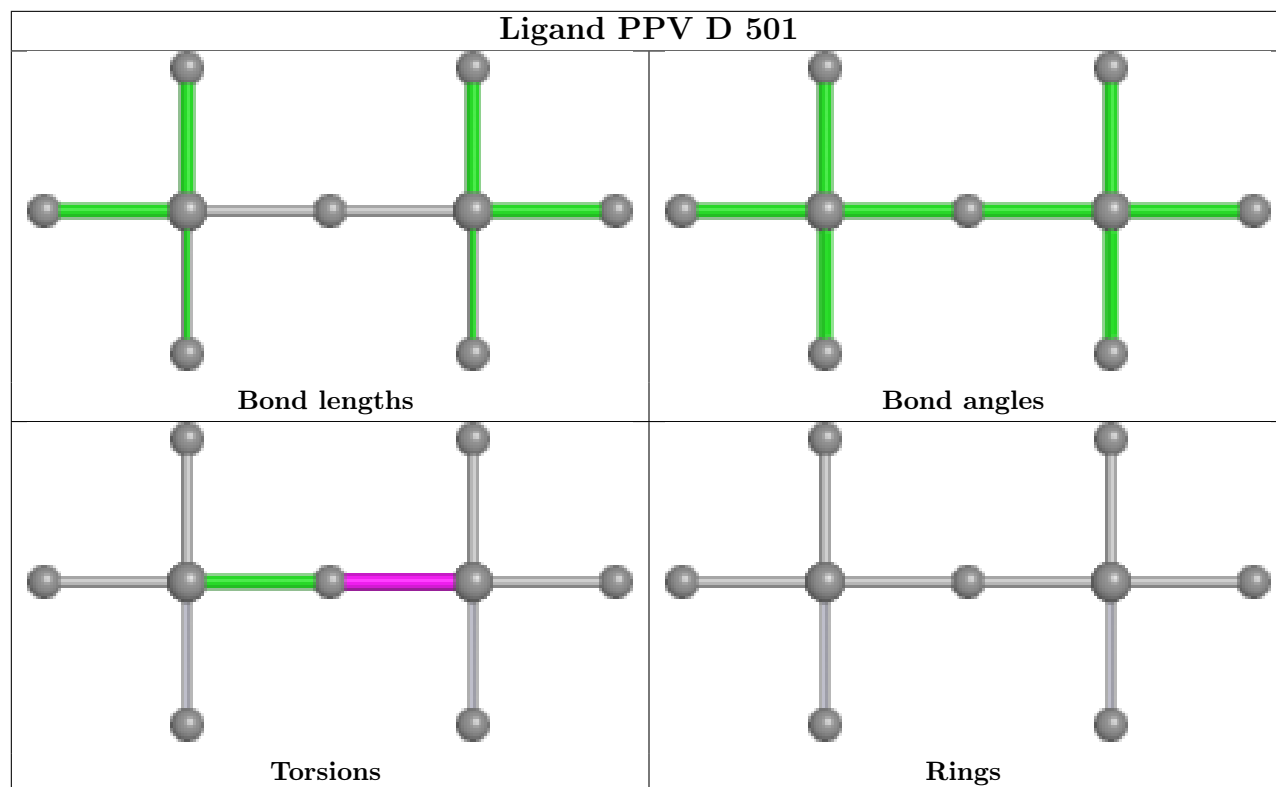
Mol	Chain	Res	Type	Atoms
2	B	502	ATP	PB-O3A-PA-O1A
2	B	502	ATP	PB-O3A-PA-O5'
3	D	501	PPV	P2-OPP-P1-O31

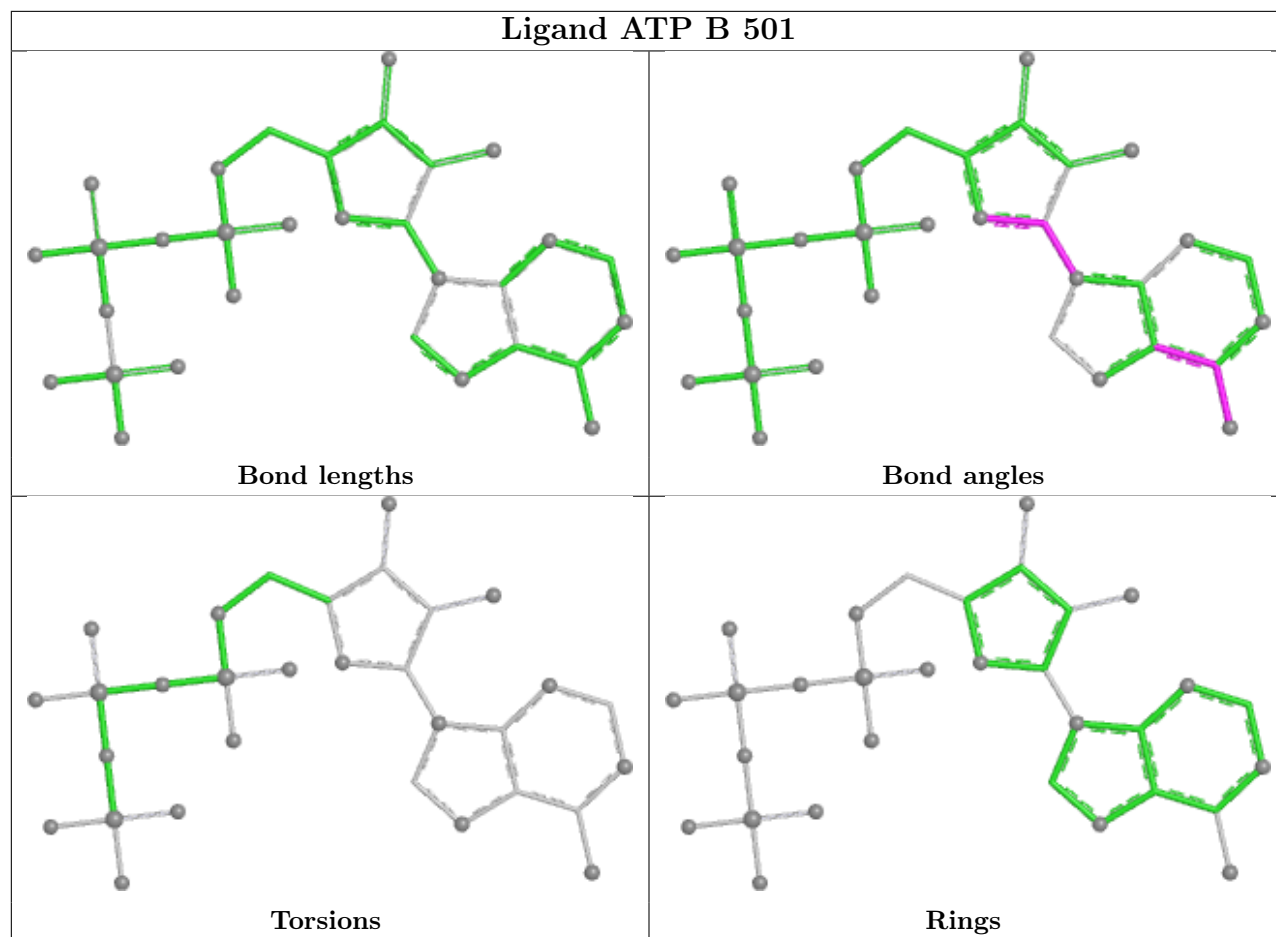
There are no ring outliers.

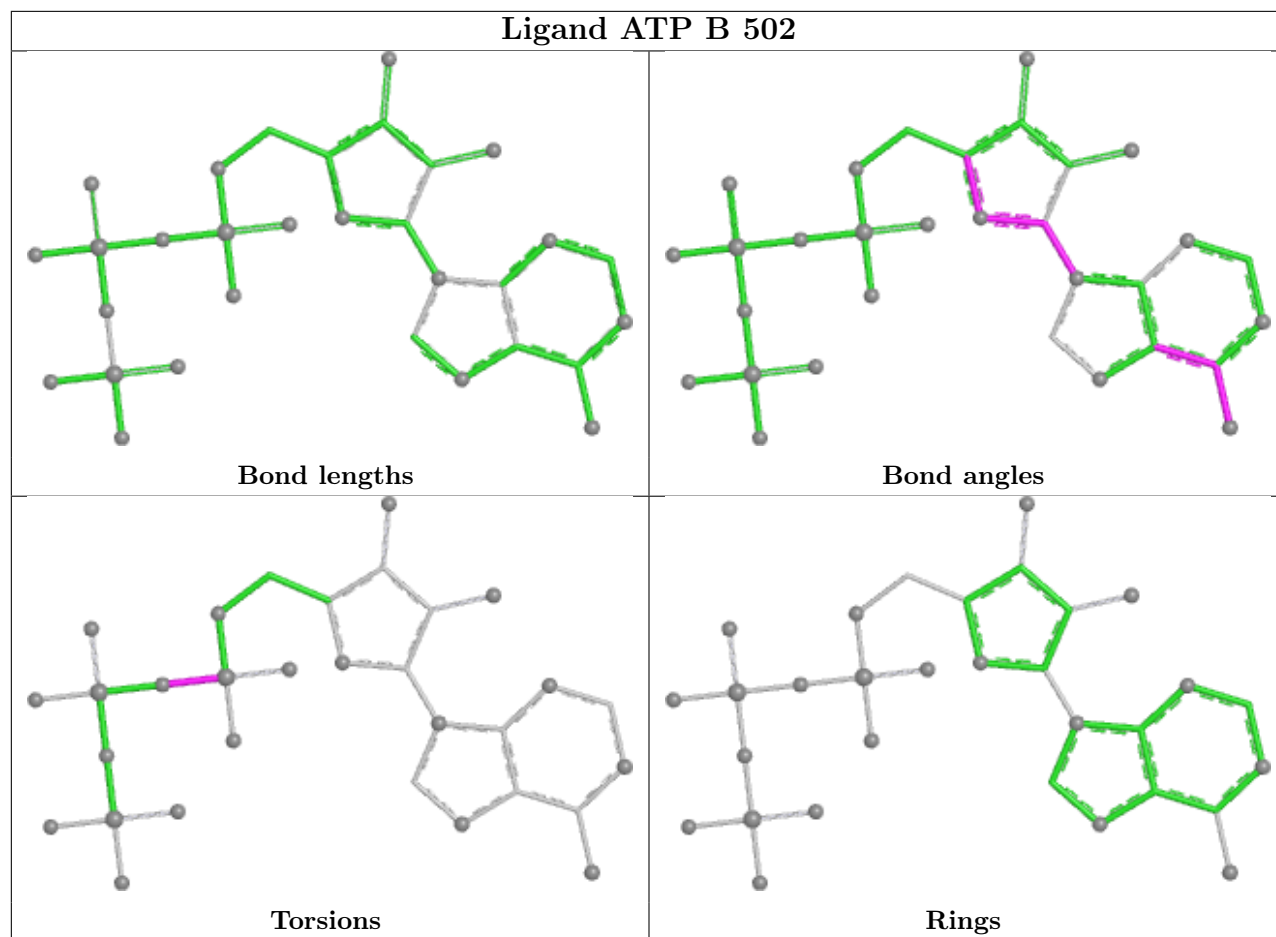
3 monomers are involved in 5 short contacts:

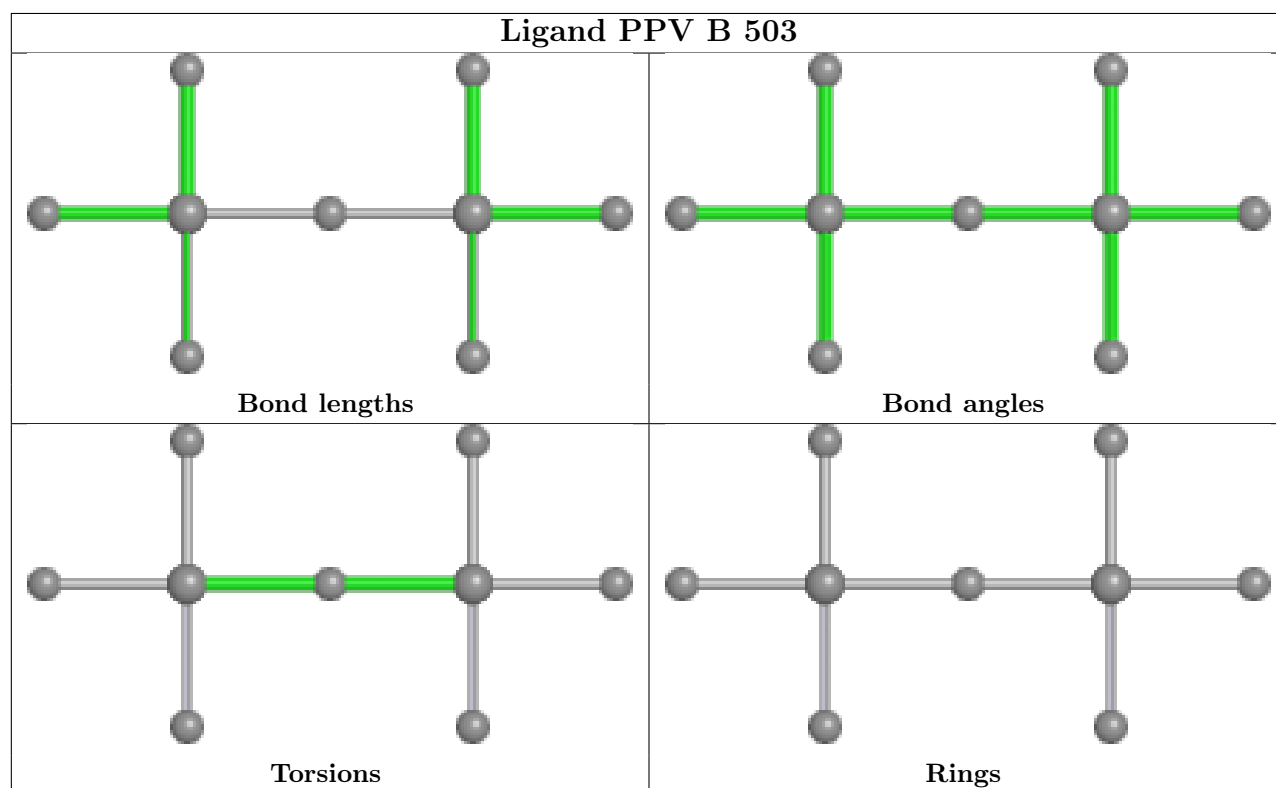
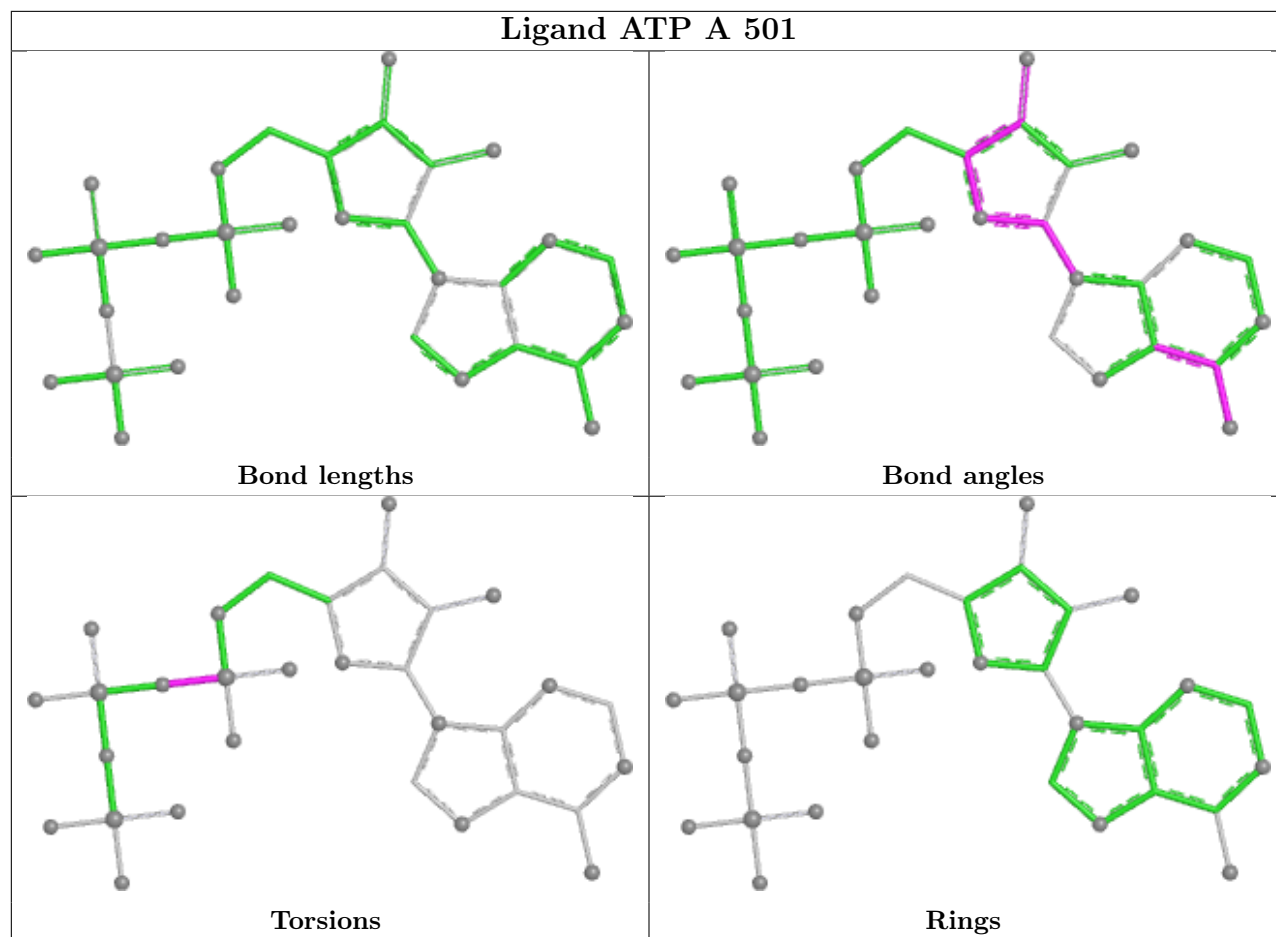
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	501	ATP	2	0
2	B	502	ATP	2	0
2	A	501	ATP	1	0

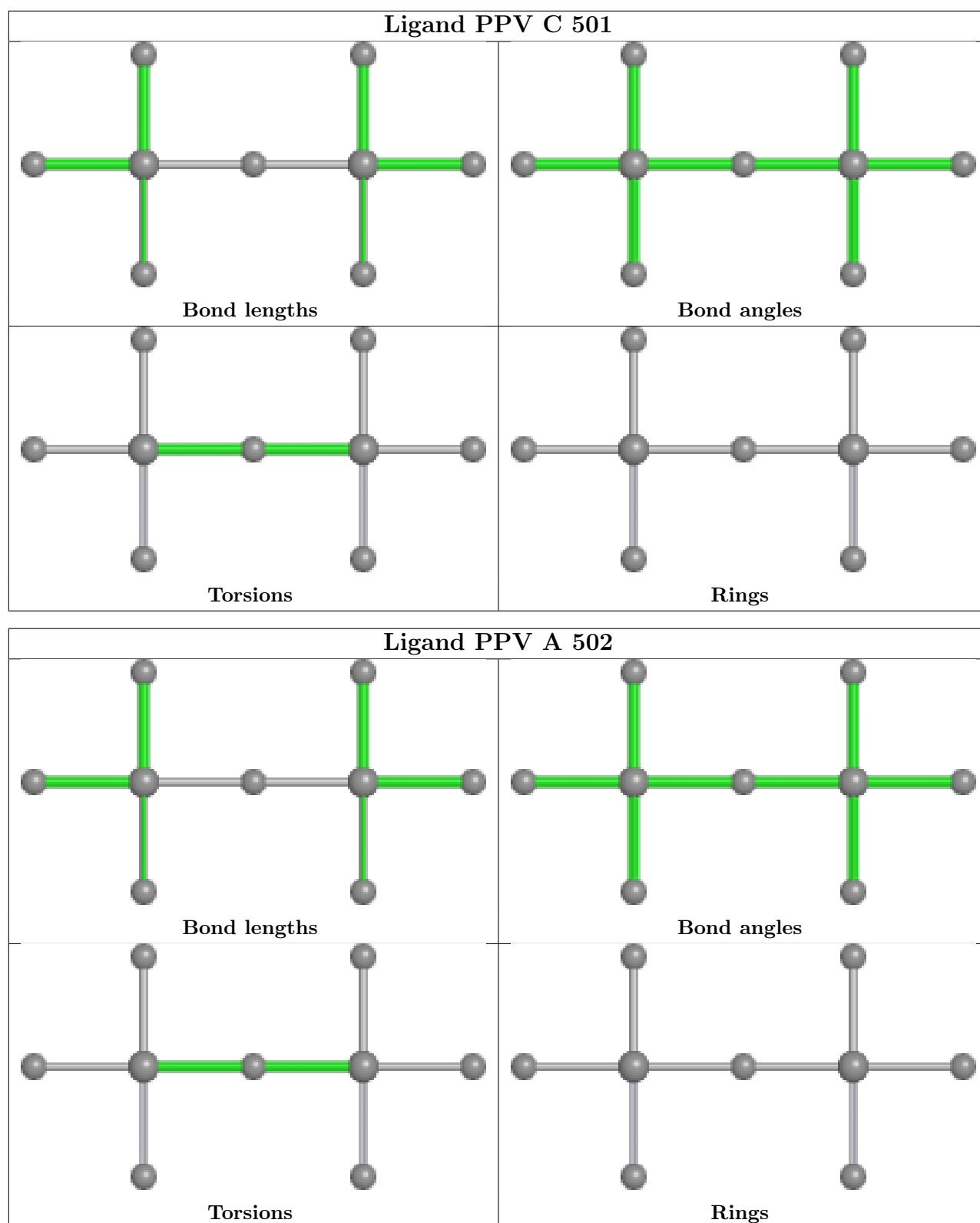
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	417/434 (96%)	0.39	29 (6%) 24 28	32, 54, 106, 134	0
1	B	423/434 (97%)	0.30	15 (3%) 47 53	34, 60, 96, 130	0
1	C	423/434 (97%)	0.26	17 (4%) 43 48	33, 56, 92, 124	0
1	D	417/434 (96%)	0.28	16 (3%) 44 50	36, 64, 102, 138	0
All	All	1680/1736 (96%)	0.31	77 (4%) 38 44	32, 59, 101, 138	0

All (77) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	124	ALA	5.2
1	A	96	VAL	5.1
1	C	362	ALA	4.9
1	C	214	GLN	4.6
1	A	123	VAL	4.5
1	A	95	ASN	4.2
1	C	337	GLY	4.0
1	D	355	PHE	3.7
1	A	355	PHE	3.7
1	D	217	ILE	3.5
1	C	355	PHE	3.5
1	A	53	VAL	3.5
1	C	215	ASP	3.4
1	A	92	LEU	3.3
1	A	126	GLY	3.2
1	B	368	THR	3.1
1	B	145	LEU	3.1
1	B	102	ALA	3.0
1	A	122	SER	3.0
1	D	276	LEU	3.0
1	A	94	GLU	3.0

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Mol	Chain	Res	Type	RSRZ
1	D	214	GLN	2.9
1	D	218	GLU	2.8
1	B	361	PRO	2.8
1	A	125	SER	2.8
1	D	267	PRO	2.8
1	B	54	ASP	2.8
1	C	129	GLY	2.7
1	A	121	VAL	2.7
1	B	147	LEU	2.7
1	B	123	VAL	2.7
1	C	216	GLU	2.7
1	C	361	PRO	2.6
1	D	259	TYR	2.6
1	A	60	THR	2.6
1	A	339	SER	2.6
1	C	275	ILE	2.5
1	C	130	ASN	2.5
1	D	140	THR	2.5
1	A	47	TYR	2.4
1	A	93	GLN	2.4
1	D	147	LEU	2.4
1	D	221	ASP	2.4
1	A	341	ALA	2.4
1	D	362	ALA	2.4
1	B	363	THR	2.4
1	C	308	TYR	2.4
1	A	358	LEU	2.3
1	D	358	LEU	2.3
1	A	90	PRO	2.3
1	A	97	ARG	2.3
1	B	367	ARG	2.3
1	B	366	VAL	2.3
1	D	425	VAL	2.3
1	B	365	ARG	2.3
1	A	54	ASP	2.2
1	A	215	ASP	2.2
1	A	107	TYR	2.2
1	C	359	LEU	2.2
1	A	55	VAL	2.2
1	A	45	PHE	2.1
1	A	48	LEU	2.1
1	C	90	PRO	2.1

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Mol	Chain	Res	Type	RSRZ
1	C	165	GLU	2.1
1	B	359	LEU	2.1
1	C	366	VAL	2.1
1	B	88	LYS	2.1
1	D	256	LYS	2.1
1	B	141	ILE	2.1
1	D	60	THR	2.1
1	A	138	PRO	2.0
1	B	362	ALA	2.0
1	C	128	ASN	2.0
1	D	66	ASP	2.0
1	A	7	VAL	2.0
1	A	99	CYS	2.0
1	C	360	ASP	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, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists the number of atoms with occupancy less than 0.9.

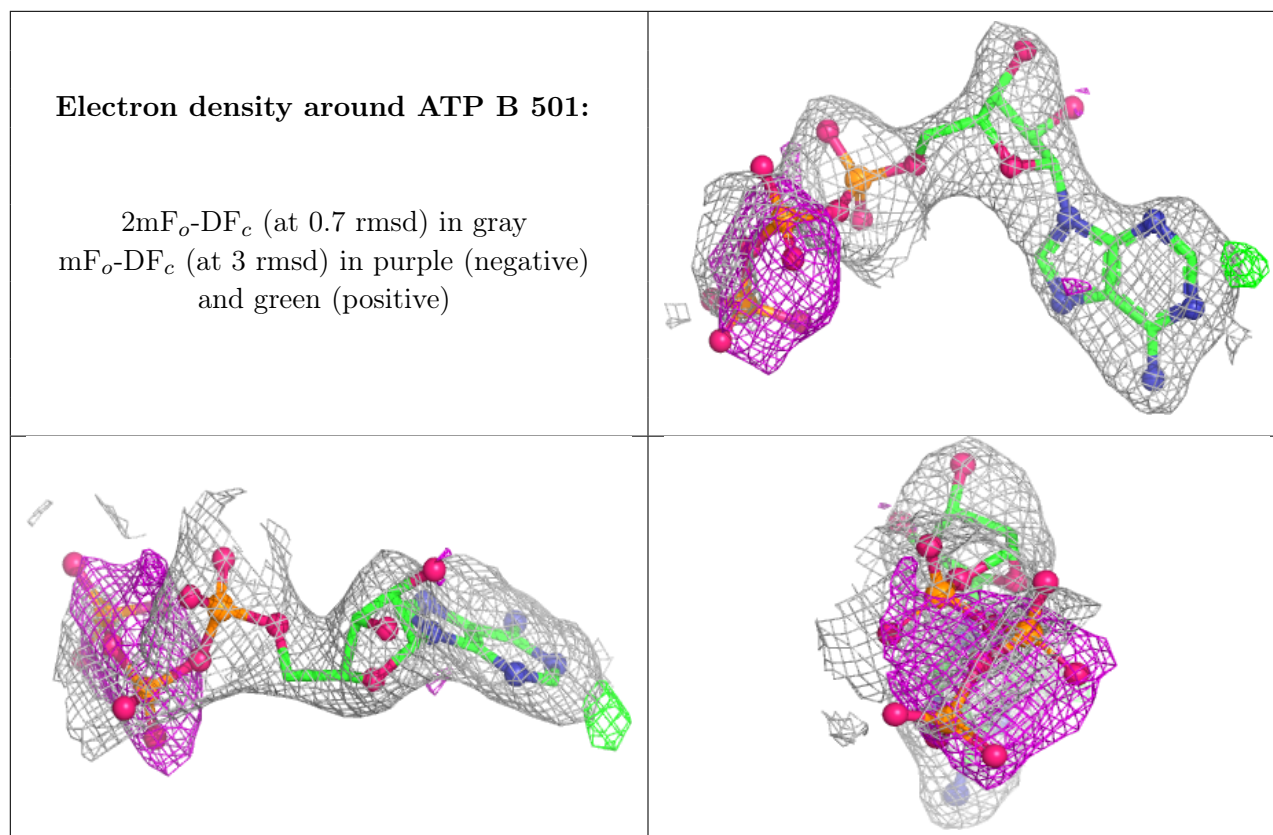
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	PO4	A	505	5/5	0.66	0.09	107,109,127,133	0
2	ATP	B	501	31/31	0.69	0.11	65,87,138,144	0
2	ATP	A	501	31/31	0.72	0.15	42,57,107,125	0
3	PPV	C	501	9/9	0.74	0.12	75,86,98,102	0
3	PPV	B	503	9/9	0.75	0.10	65,77,85,88	0
3	PPV	D	501	9/9	0.76	0.11	83,94,103,106	0
2	ATP	B	502	31/31	0.76	0.13	56,68,112,122	0
3	PPV	A	502	9/9	0.81	0.11	67,82,108,115	0
5	PO4	B	505	5/5	0.81	0.09	89,92,118,120	0

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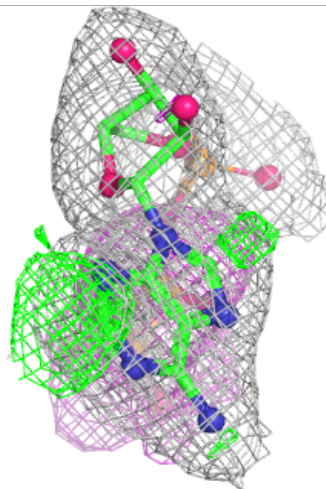
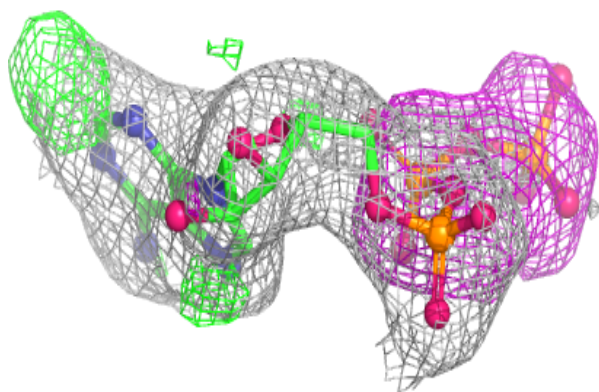
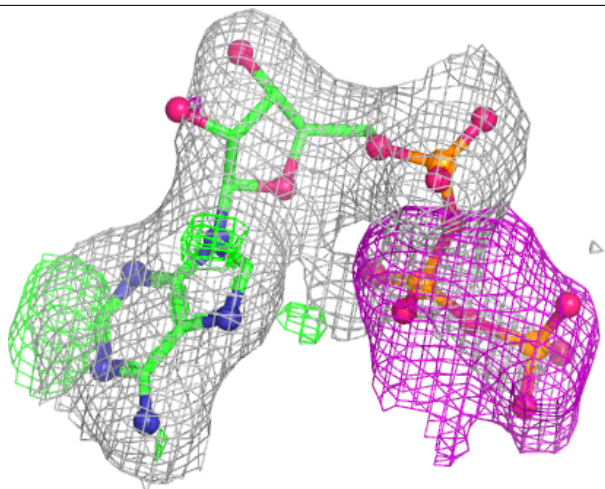
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	AMP	A	503	23/23	0.83	0.09	60,72,83,94	0
5	PO4	D	503	5/5	0.84	0.07	93,93,107,116	0
6	CL	B	508	1/1	0.86	0.10	92,92,92,92	0
5	PO4	C	503	5/5	0.88	0.08	82,82,86,101	0
6	CL	A	506	1/1	0.92	0.12	72,72,72,72	0
6	CL	B	507	1/1	0.93	0.08	60,60,60,60	0
6	CL	B	506	1/1	0.94	0.07	65,65,65,65	0
5	PO4	D	502	5/5	0.95	0.07	54,55,56,64	0
6	CL	D	504	1/1	0.95	0.08	74,74,74,74	0
5	PO4	A	504	5/5	0.97	0.08	48,49,52,55	0
5	PO4	C	502	5/5	0.97	0.07	51,52,56,58	0
5	PO4	B	504	5/5	0.97	0.07	53,54,54,57	0
6	CL	A	507	1/1	0.97	0.09	68,68,68,68	0
6	CL	D	505	1/1	0.97	0.06	59,59,59,59	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.



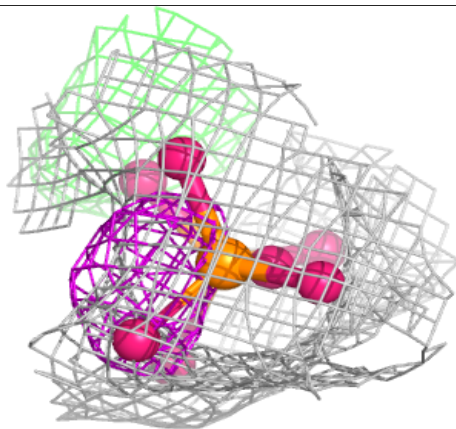
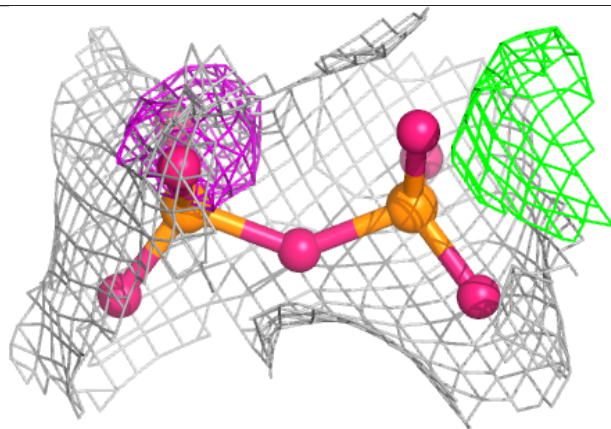
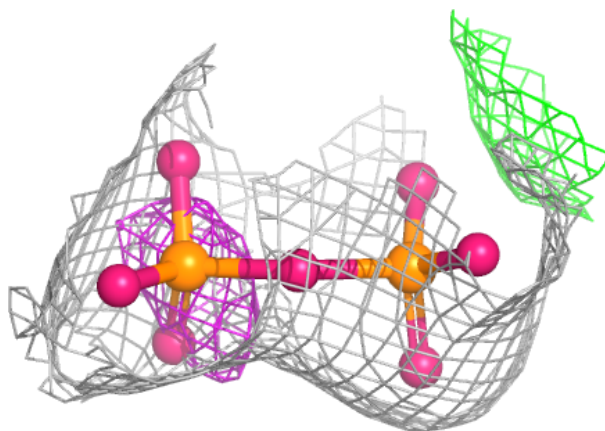
Electron density around ATP A 501:

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



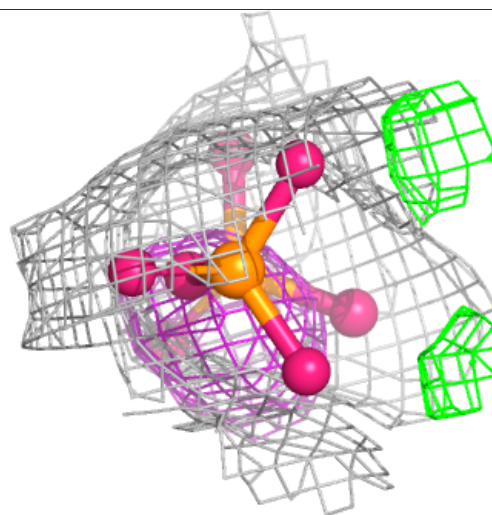
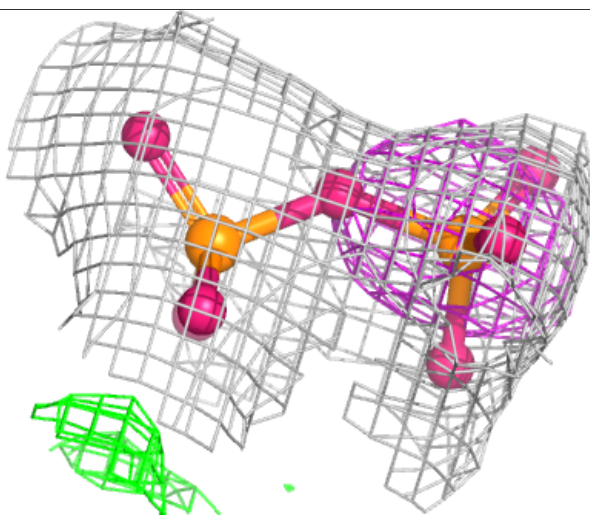
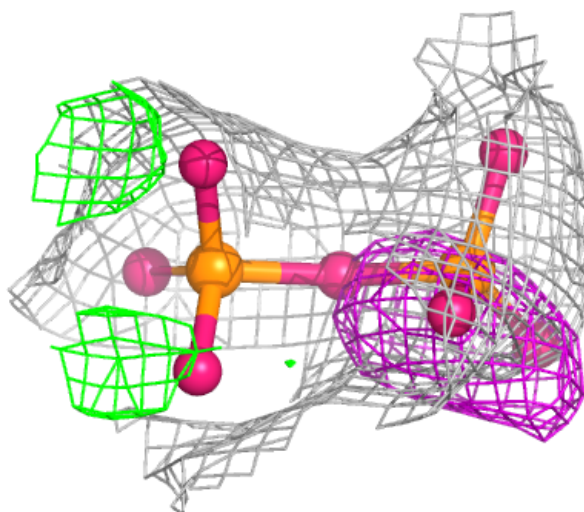
Electron density around PPV C 501:

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



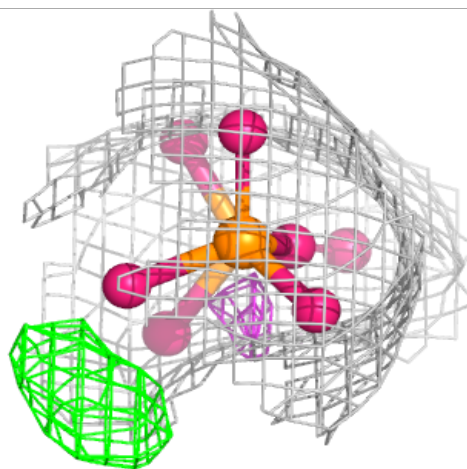
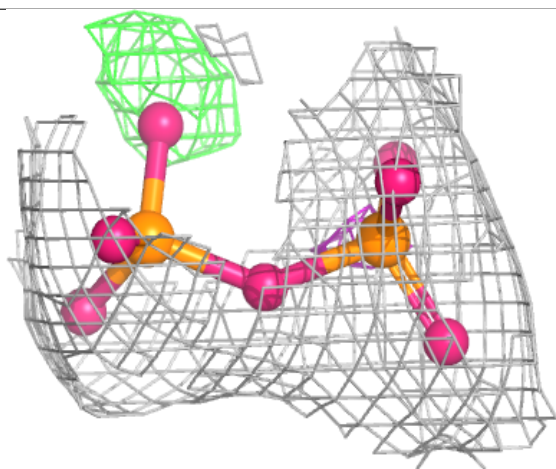
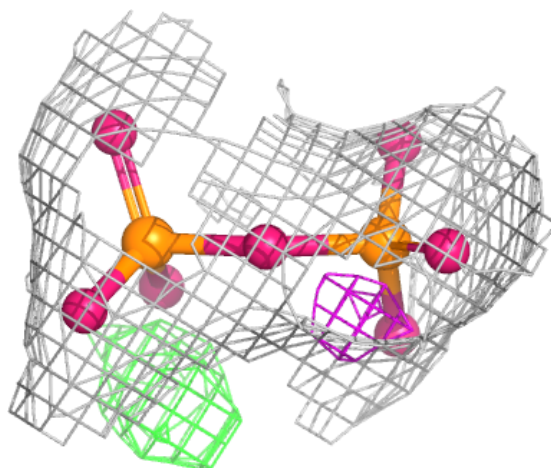
Electron density around PPV B 503:

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



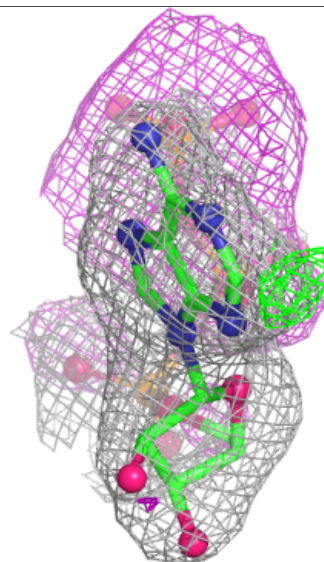
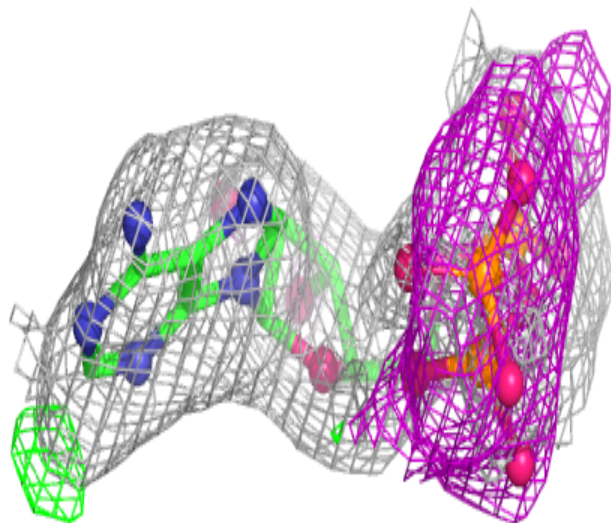
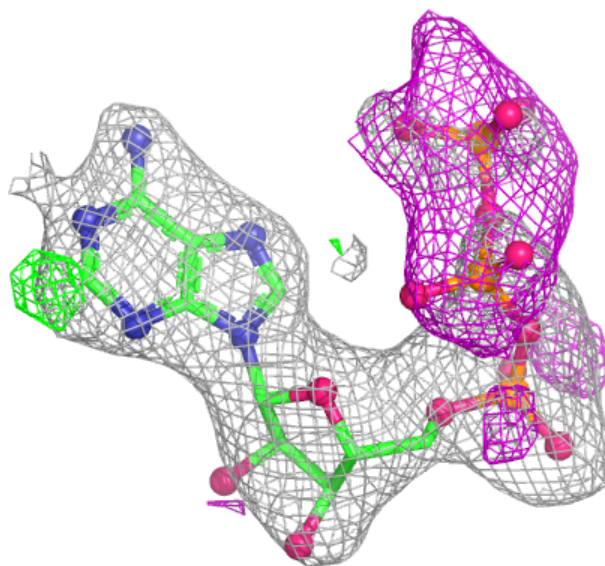
Electron density around PPV D 501:

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



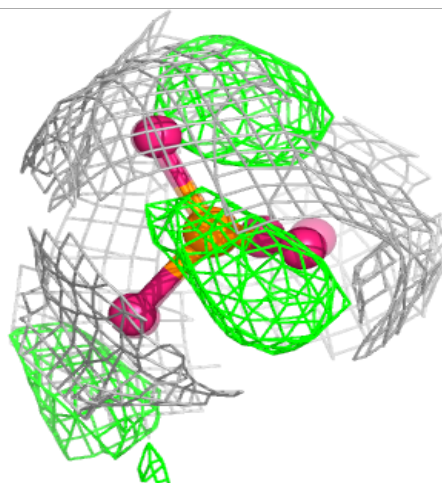
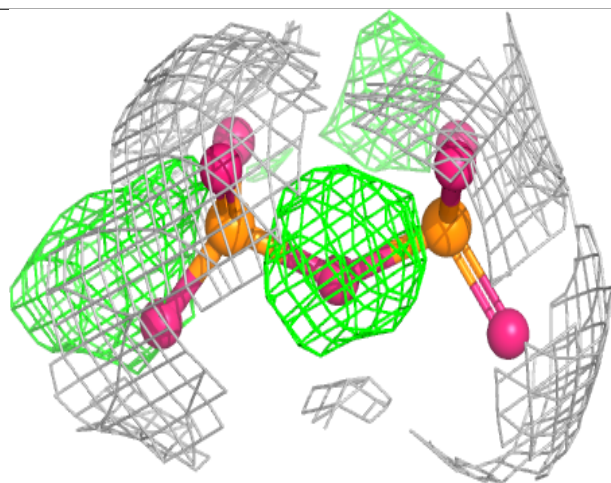
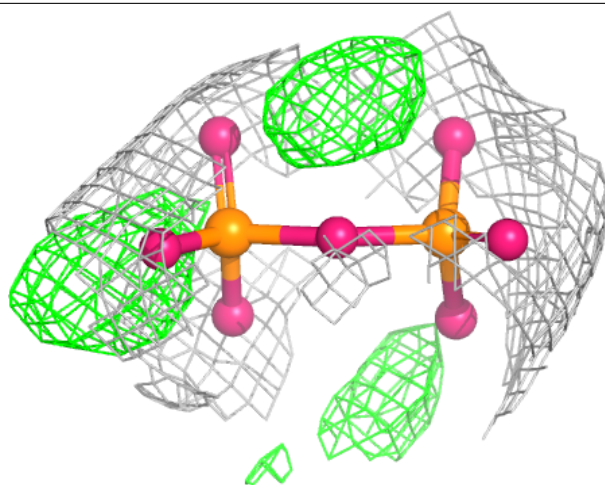
Electron density around ATP B 502:

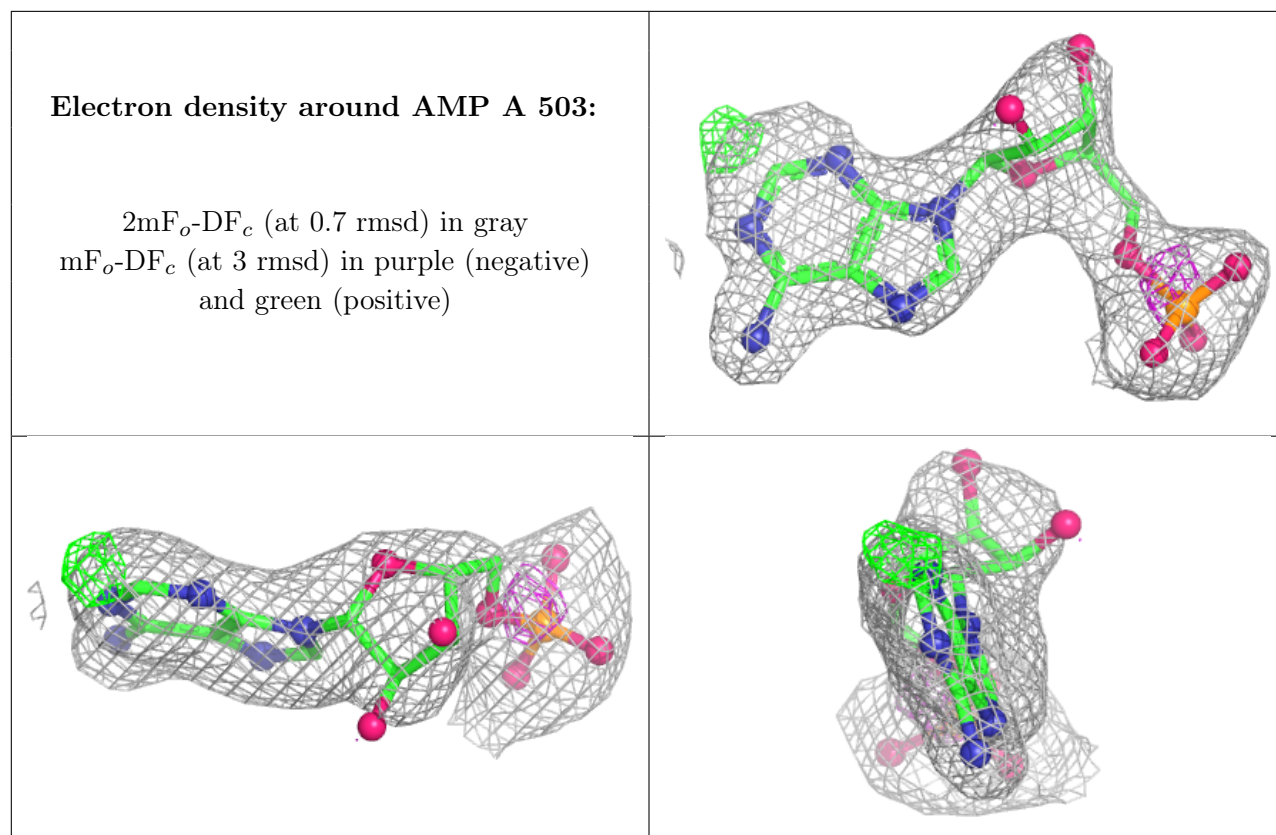
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around PPV A 502:

$2mF_o-DF_c$ (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.