



Full wwPDB X-ray Structure Validation Report ⓘ

Sep 26, 2024 – 12:02 PM EDT

PDB ID : 9DQM
Title : Crystal Structure Pyrophosphate-fructose 6-phosphate 1-phosphotransferase 1 (Pfk1) from *Trichomonas vaginalis* (AMP bound)
Authors : Seattle Structural Genomics Center for Infectious Disease (SSGCID)
Deposited on : 2024-09-24
Resolution : 2.20 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)
Xtrriage (Phenix) : 1.20.1
EDS : **FAILED**
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.38.3

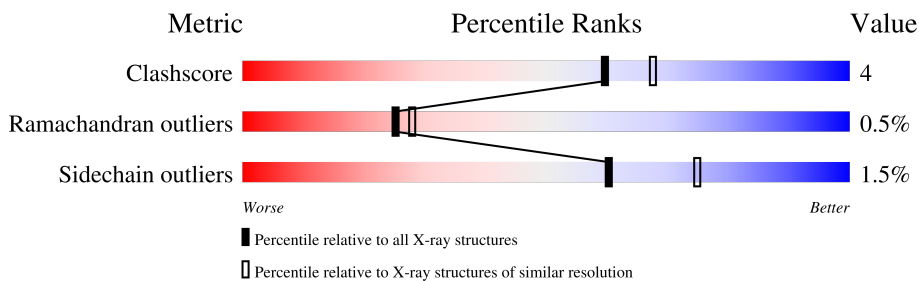
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	180529	6634 (2.20-2.20)
Ramachandran outliers	177936	6560 (2.20-2.20)
Sidechain outliers	177891	6561 (2.20-2.20)

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 $\leq 5\%$.

Note EDS failed to run properly.

Mol	Chain	Length	Quality of chain
1	A	434	
1	B	434	

2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 6281 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	420	3095	1969	530	580	16	0	1	0
1	B	421	3046	1940	524	566	16	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

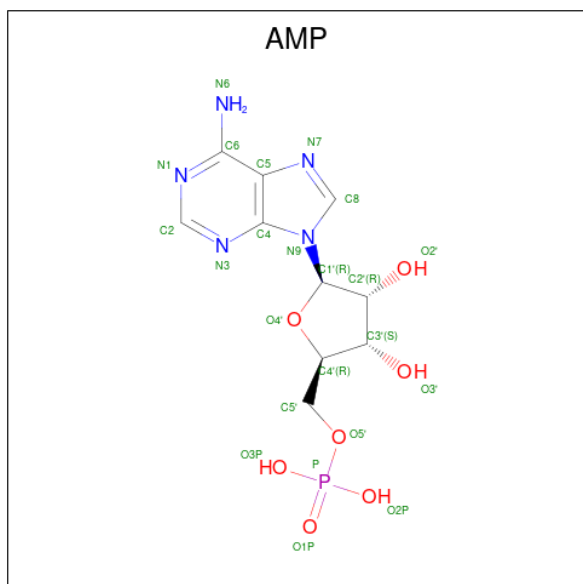
Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	MET	-	initiating methionine	UNP O61068
A	-6	ALA	-	expression tag	UNP O61068
A	-5	HIS	-	expression tag	UNP O61068
A	-4	HIS	-	expression tag	UNP O61068
A	-3	HIS	-	expression tag	UNP O61068
A	-2	HIS	-	expression tag	UNP O61068
A	-1	HIS	-	expression tag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

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O₄P) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 3 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
3	A	1	Total C N O P 23 10 5 7 1	0	0

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

- Molecule 4 is water.


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	43	Total	O	0	0
			43	43		
4	B	41	Total	O	0	0
			41	41		

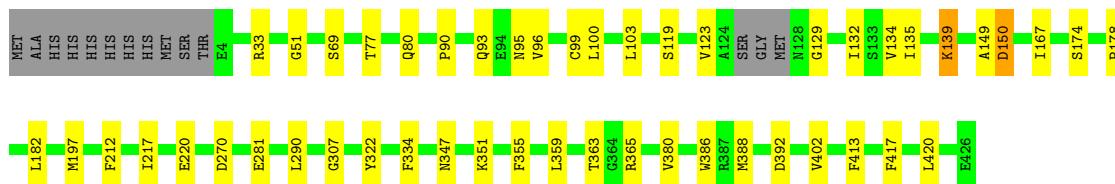
3 Residue-property plots

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. 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.


Note EDS failed to run properly.

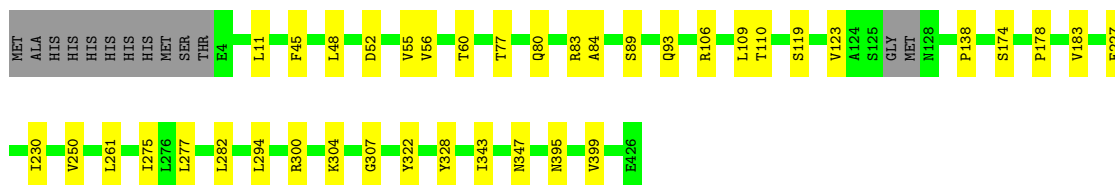
- Molecule 1: Pyrophosphate--fructose 6-phosphate 1-phosphotransferase 1

Chain A: 



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

Chain B: 



4 Data and refinement statistics

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	90.58Å 90.58Å 376.75Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.29 – 2.20	Depositor
% Data completeness (in resolution range)	99.9 (45.29-2.20)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.11 (at 2.20Å)	Xtrriage
Refinement program	PHENIX (dev_5462: ???)	Depositor
R, R_{free}	0.211 , 0.264	Depositor
Wilson B-factor (Å ²)	55.9	Xtrriage
Anisotropy	0.134	Xtrriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	6281	wwPDB-VP
Average B, all atoms (Å ²)	75.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.18% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality

5.1 Standard geometry

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

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	0.39	0/3154	0.58	0/4287
1	B	0.37	0/3102	0.55	0/4221
All	All	0.38	0/6256	0.57	0/8508

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	3095	0	3018	29	0
1	B	3046	0	2925	23	0
2	A	5	0	0	0	0
2	B	5	0	0	1	0
3	A	23	0	12	2	0
3	B	23	0	12	1	0
4	A	43	0	0	1	0
4	B	41	0	0	2	0
All	All	6281	0	5967	51	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 4.

All (51) 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:56:VAL:O	1:B:60:THR:HG23	1.93	0.68
1:B:275:ILE:HD12	1:B:275:ILE:H	1.62	0.65
1:A:355:PHE:O	1:A:359:LEU:HD12	2.00	0.62
1:A:149:ALA:O	1:A:150:ASP:HB2	2.01	0.59
1:A:135:ILE:HD12	1:A:334:PHE:CE1	2.38	0.59
1:B:230:ILE:HG21	1:B:294:LEU:HD23	1.86	0.57
1:A:132:ILE:HD13	1:A:134:VAL:HG23	1.86	0.57
1:A:167:ILE:HD11	1:A:197:MET:HE3	1.87	0.57
1:A:119:SER:O	1:A:123:VAL:HG23	2.04	0.57
1:B:250:VAL:CG1	1:B:277:LEU:HD22	2.37	0.55
1:A:132:ILE:C	1:A:132:ILE:HD12	2.29	0.53
1:A:69:SER:OG	2:B:501:PO4:O2	2.27	0.52
1:B:109:LEU:HD12	1:B:110:THR:N	2.25	0.52
1:A:212:PHE:CD1	1:A:217:ILE:HD11	2.46	0.51
1:A:281:GLU:HA	1:A:281:GLU:OE1	2.13	0.49
1:B:48:LEU:HD12	1:B:48:LEU:N	2.27	0.49
1:B:347:ASN:CB	4:B:631:HOH:O	2.61	0.49
1:B:119:SER:O	1:B:123:VAL:HG23	2.12	0.48
1:A:388:MET:SD	1:A:392:ASP:HB3	2.53	0.48
1:A:212:PHE:CG	1:A:217:ILE:HD11	2.49	0.47
1:A:220:GLU:H	1:A:220:GLU:CD	2.17	0.47
1:B:45:PHE:HB2	1:B:84:ALA:O	2.14	0.47
1:A:51:GLY:HA3	1:A:95:ASN:OD1	2.14	0.47
1:A:90:PRO:HA	1:A:93:GLN:NE2	2.31	0.46
1:A:99:CYS:O	1:A:103:LEU:HD23	2.15	0.46
1:A:386:TRP:HA	3:A:502:AMP:N6	2.31	0.46
1:B:395:ASN:O	1:B:399:VAL:HG23	2.16	0.46
1:A:402:VAL:HG12	1:A:413:PHE:HE2	1.81	0.45
1:A:380:VAL:HG22	1:B:328:TYR:CD1	2.51	0.45
1:B:52:ASP:CB	1:B:55:VAL:HG22	2.46	0.45
1:A:96:VAL:O	1:A:100:LEU:HG	2.16	0.45
1:A:347:ASN:CB	4:A:639:HOH:O	2.65	0.44
1:B:174:SER:O	1:B:178:PRO:HA	2.16	0.44
1:A:33:ARG:HD3	3:B:502:AMP:C4	2.53	0.44
1:A:182:LEU:HD11	1:A:290:LEU:HD12	2.00	0.44
1:B:45:PHE:HA	1:B:48:LEU:HD13	2.00	0.44
1:B:183:VAL:HA	1:B:304:LYS:O	2.17	0.44
1:B:227:GLU:HG3	1:B:294:LEU:HD11	1.99	0.43
1:B:11:LEU:HD12	1:B:11:LEU:C	2.39	0.43
1:A:363:THR:HG23	1:A:365:ARG:N	2.33	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:139:LYS:HD2	1:A:139:LYS:C	2.41	0.41
1:A:386:TRP:HA	3:A:502:AMP:HN62	1.86	0.41
1:B:83:ARG:NH1	4:B:602:HOH:O	2.54	0.41
1:A:417:PHE:O	1:A:420:LEU:HD12	2.21	0.40
1:B:106:ARG:NH1	1:B:106:ARG:O	2.54	0.40
1:B:138:PRO:HD2	1:B:343:ILE:O	2.21	0.40
1:B:48:LEU:HD12	1:B:48:LEU:H	1.86	0.40
1:B:89:SER:O	1:B:93:GLN:HG3	2.21	0.40
1:B:261:LEU:HD11	1:B:282:LEU:HA	2.04	0.40
1:A:129:GLY:O	1:A:132:ILE:O	2.40	0.40
1:A:174:SER:O	1:A:178:PRO: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	417/434 (96%)	404 (97%)	11 (3%)	2 (0%)	25	28
1	B	417/434 (96%)	401 (96%)	14 (3%)	2 (0%)	25	28
All	All	834/868 (96%)	805 (96%)	25 (3%)	4 (0%)	25	28

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	80	GLN
1	A	307	GLY
1	B	80	GLN
1	B	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	308/355 (87%)	302 (98%)	6 (2%)	52	67
1	B	292/355 (82%)	289 (99%)	3 (1%)	73	84
All	All	600/710 (84%)	591 (98%)	9 (2%)	60	75

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	77	THR
1	A	139	LYS
1	A	150	ASP
1	A	270	ASP
1	A	322	TYR
1	A	351	LYS
1	B	77	THR
1	B	300	ARG
1	B	322	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	93	GLN
1	A	169	ASN
1	A	354	GLN
1	A	376	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

4 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	PO4	B	501	-	4,4,4	1.03	0	6,6,6	1.06	0
2	PO4	A	501	-	4,4,4	1.44	1 (25%)	6,6,6	0.80	0
3	AMP	B	502	-	21,25,25	0.84	1 (4%)	23,38,38	1.45	3 (13%)
3	AMP	A	502	-	21,25,25	0.77	0	23,38,38	1.47	2 (8%)

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	AMP	B	502	-	-	1/6/26/26	0/3/3/3
3	AMP	A	502	-	-	4/6/26/26	0/3/3/3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	PO4	P-O1	2.57	1.56	1.50
3	B	502	AMP	C2-N3	2.20	1.35	1.32

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	502	AMP	N3-C2-N1	-4.88	122.05	128.67
3	B	502	AMP	N3-C2-N1	-4.54	122.51	128.67

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	502	AMP	O2P-P-O5'	-2.39	100.44	106.67
3	B	502	AMP	C4-C5-N7	-2.27	106.94	109.34
3	A	502	AMP	N6-C6-N1	2.26	123.17	118.33

There are no chirality outliers.

All (5) torsion outliers are listed below:

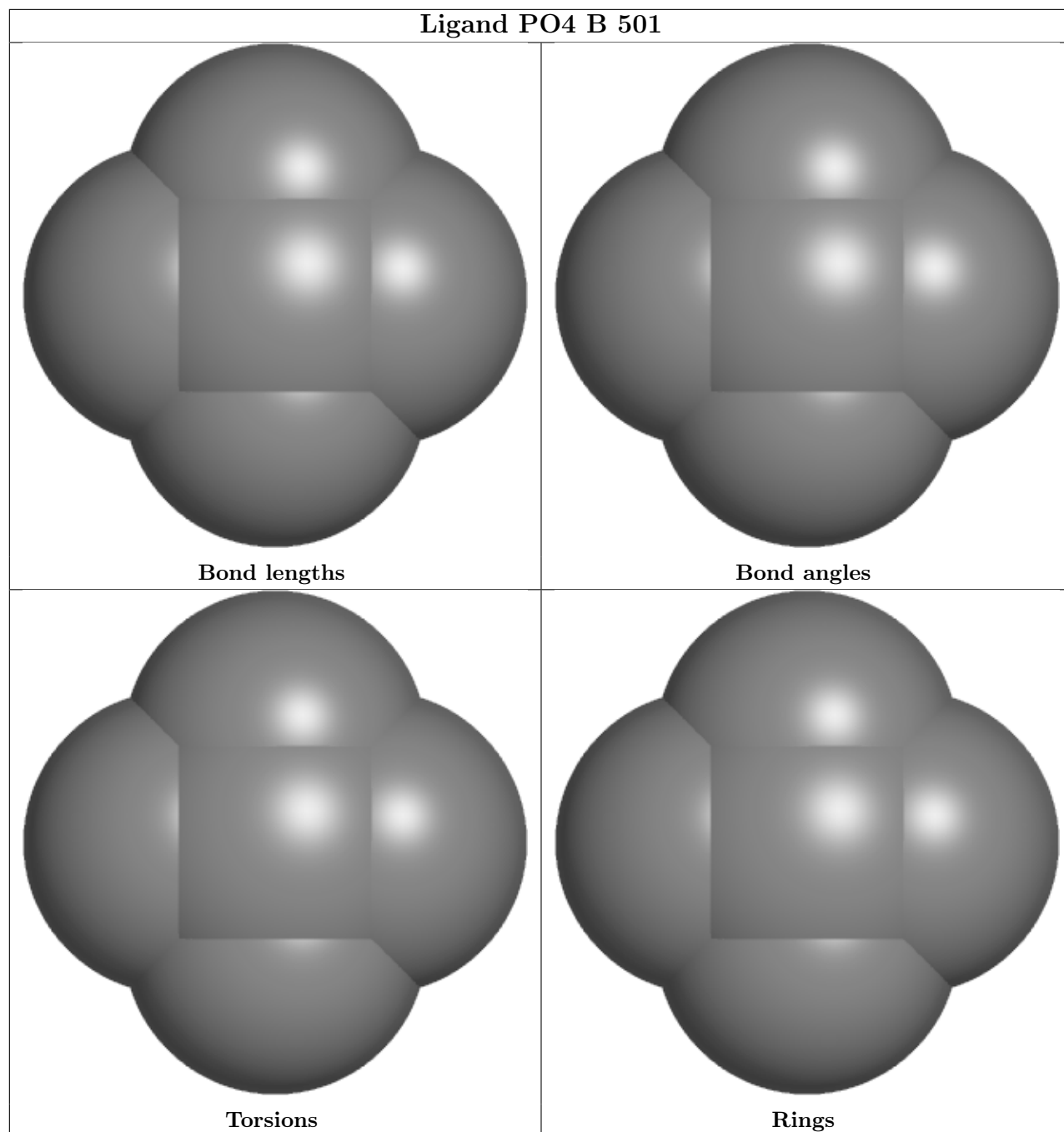
Mol	Chain	Res	Type	Atoms
3	A	502	AMP	C5'-O5'-P-O2P
3	A	502	AMP	C5'-O5'-P-O3P
3	A	502	AMP	O4'-C4'-C5'-O5'
3	A	502	AMP	C3'-C4'-C5'-O5'
3	B	502	AMP	C5'-O5'-P-O3P

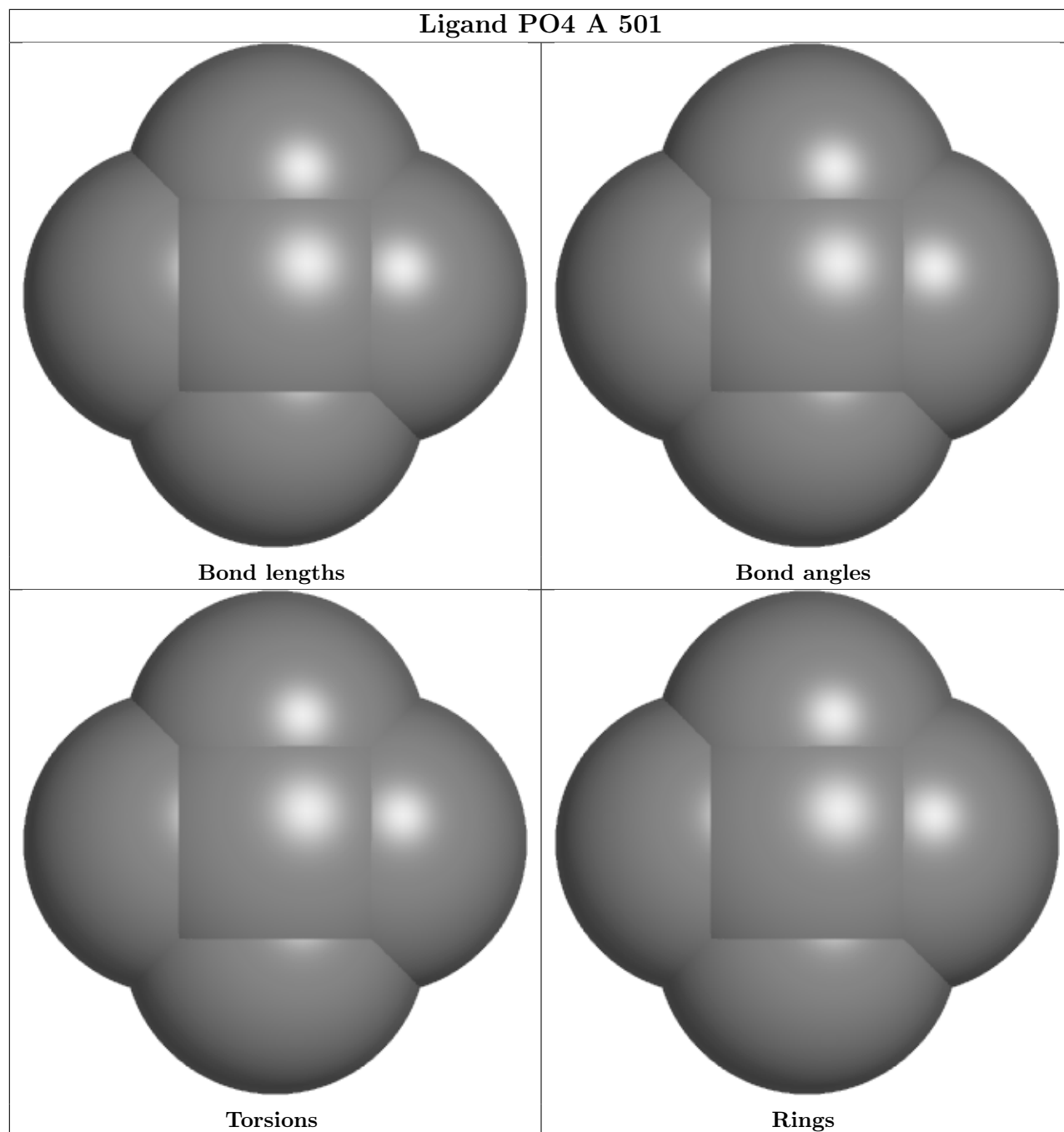
There are no ring outliers.

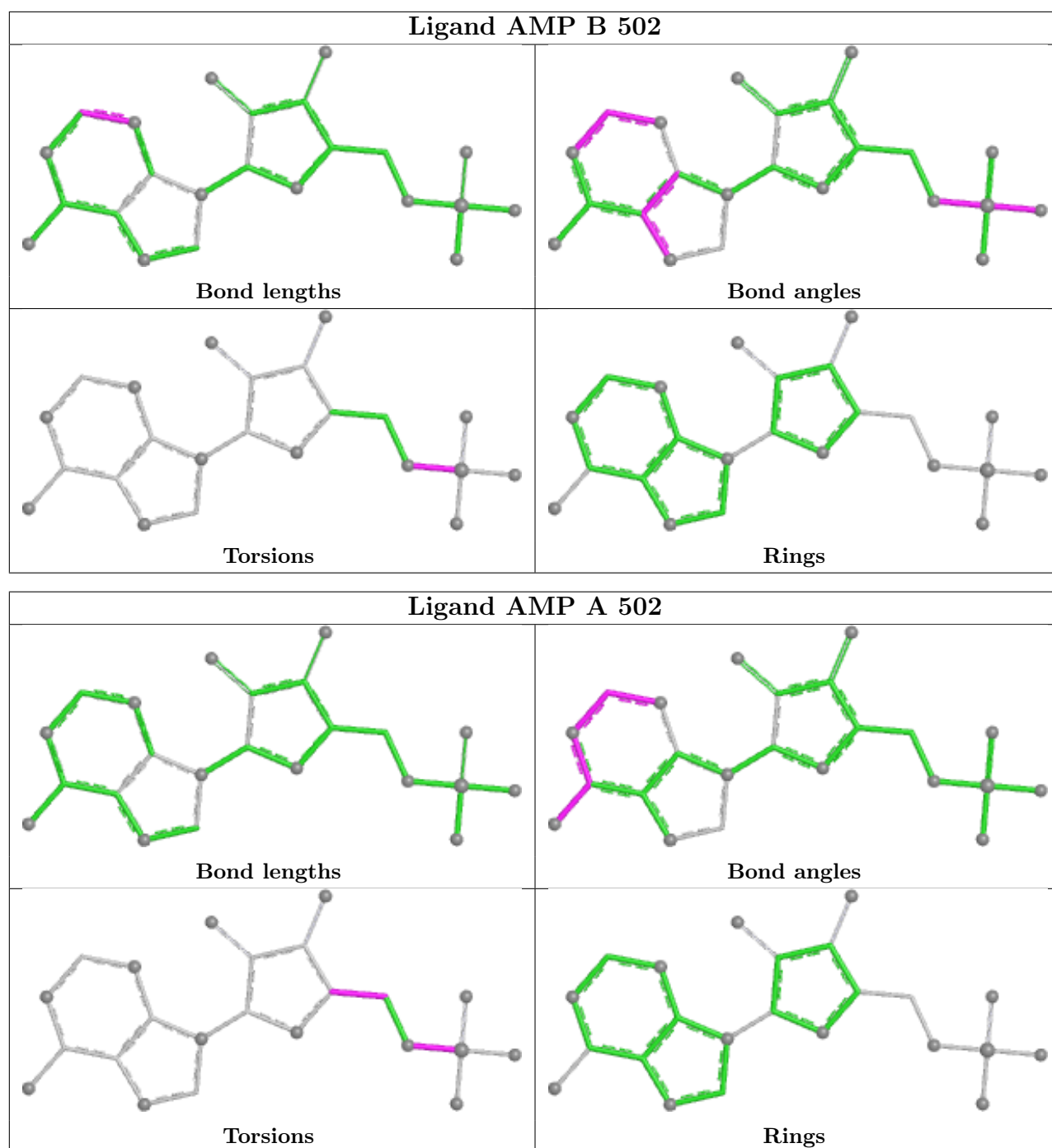
3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	501	PO4	1	0
3	B	502	AMP	1	0
3	A	502	AMP	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.







5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS failed to run properly - this section is therefore empty.

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

EDS failed to run properly - this section is therefore empty.

6.3 Carbohydrates

EDS failed to run properly - this section is therefore empty.

6.4 Ligands

EDS failed to run properly - this section is therefore empty.

6.5 Other polymers

EDS failed to run properly - this section is therefore empty.