



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 3, 2023 – 07:13 AM EDT

PDB ID : 1FFX
Title : TUBULIN:STATHMIN-LIKE DOMAIN COMPLEX
Authors : Gigant, B.; Martin-Barbey, C.; Knossow, M.
Deposited on : 2000-07-26
Resolution : 3.95 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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

<https://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 : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.34

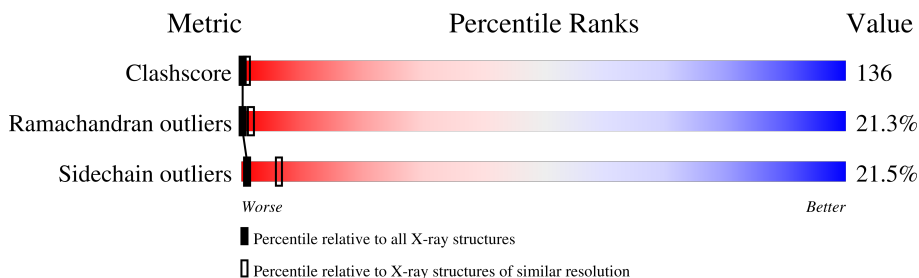
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.95 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	141614	1085 (4.22-3.70)
Ramachandran outliers	138981	1047 (4.22-3.70)
Sidechain outliers	138945	1039 (4.22-3.70)

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 was not executed.

Mol	Chain	Length	Quality of chain
1	A	451	9% 53% 27% 6%
1	C	451	9% 55% 25% 6%
2	B	445	6% 57% 25% 5% 8%
2	D	445	6% 56% 24% 6% 8%
3	E	91	32% 68%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
5	GDP	D	503	-	-	X	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 13568 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 (TUBULIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	423	3295	2082	559	632	22	0	0	0
1	C	423	3295	2082	559	632	22	0	0	0

- Molecule 2 is a protein called PROTEIN (TUBULIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	410	3201	2014	550	611	26	0	0	0
2	D	410	3201	2014	550	611	26	0	0	0

- Molecule 3 is a protein called PROTEIN (STATHMIN-LIKE DOMAIN OF RB3).

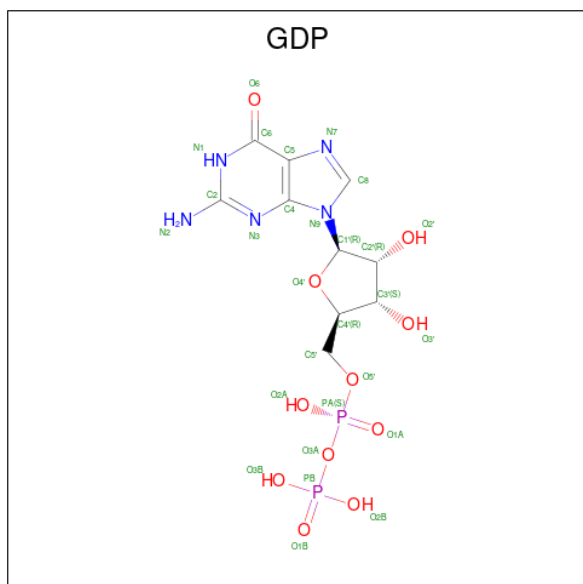
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	E	91	456	273	91	92	0	0	0

- Molecule 4 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula: C₁₀H₁₆N₅O₁₄P₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
4	A	1	32	10	5	14	3	0	0
4	C	1	32	10	5	14	3	0	0

- Molecule 5 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
5	B	1	28	10	5	11	2	0	0

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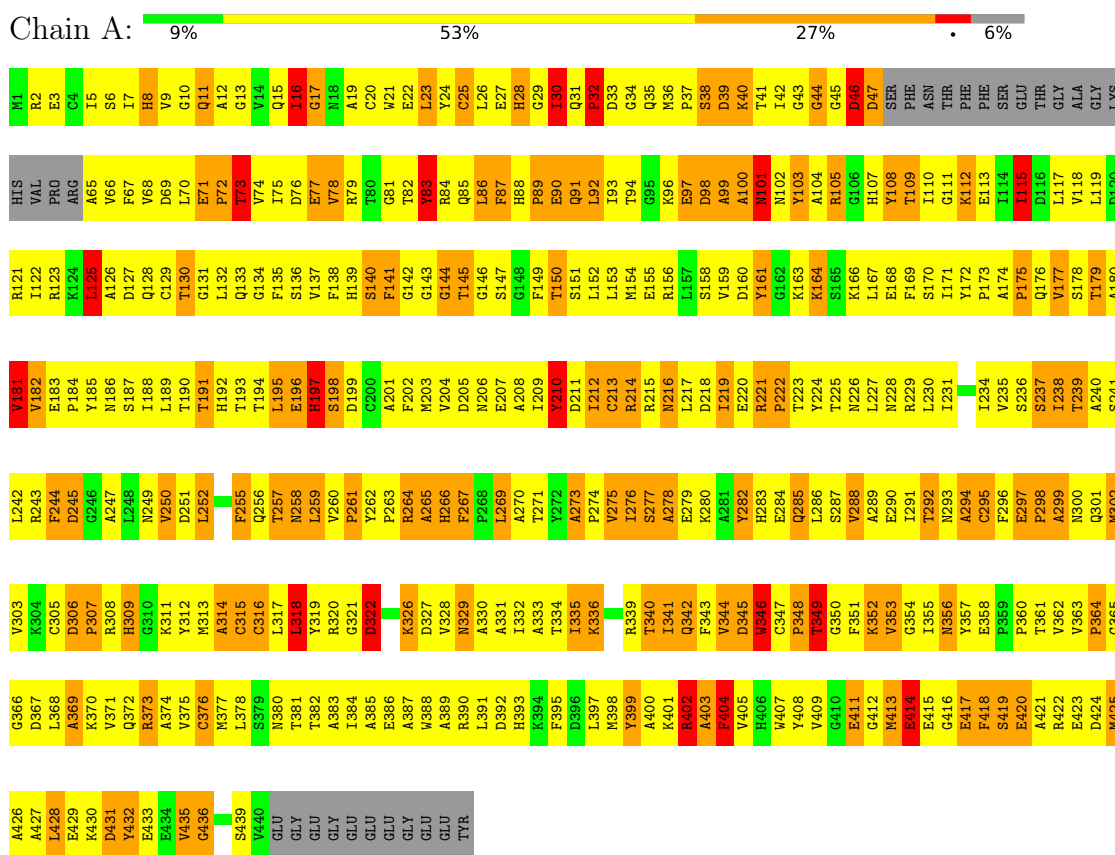
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
5	D	1	28	10	5	11	2	0	0

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. 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 was not executed.

- Molecule 1: PROTEIN (TUBULIN)



- Molecule 1: PROTEIN (TUBULIN)



K124	P184	G246	D306	A376	Y435	E125	Y165	Q247	P307	T376	Q436	S126	M186	L248	R308	F377	D437	D437	A187	R309	N249	H309	F378	ALA	ALA	C129	A250	A250	G310	G379	THR	THR	ALA	ASP	D130	L189	L189	R311	N380	ALA	ASP	ASP	GLU	C131	V191	V191	X312	S381	ASP	ASP	GLN	GLU	L132	R192	R253	L313	F382	GLN	GLN	GLN	GLU	Q133	Q193	K254	T314	A383	GLY	GLY	GLY	GLY	G134	R194	L255	V315	I384	GLY	GLY	GLY	GLY	F135	F195	L256	A316	Q385	GLU	GLU	GLU	GLU	Q136	E196	V257	A317	E386	PHE	PHE	PHE	PHE	L137	M197	M258	V318	L387	GLU	GLU	GLU	GLU	T138	T198	M259	F319	F388	GLU	GLU	GLU	GLU	H139	D199	V260	R320	R389	GLU	GLU	GLU	GLU	S140	E200	P261	G321	R390	GLY	GLY	GLY	GLY	L141	T201	F262	M322	I391	GLU	GLU	GLU	GLU	G142	Y202	P263	M323	S392	GLU	GLU	GLU	GLU	G143	C203	R264	S324	F393	ASP	ASP	ASP	ALA	G144	L204	H266	M325	Q394	GLU	GLU	GLU	ALA	T145	D205	F267	K326	F395	GLU	GLU	GLU		G146	F206	F268	E327	T396	GLU	GLU	GLU		S147	E207	M269	E327	A397	GLU	GLU	GLU		G148	A208	M269	E330	R398	GLU	GLU	GLU		M149	L209	L209	Q331	F399	GLU	GLU	GLU		G150	Y210	Y210	M382	R400	GLU	GLU	GLU		T151	D211	F272	L333	R401	GLU	GLU	GLU		L152	I212	A273	N334	K402	GLU	GLU	GLU		L153	C213	P274	V335	F403	GLU	GLU	GLU		I154	L214	L275	Q336	R404	GLU	GLU	GLU		S155	F215	T276	N337	L405	GLU	GLU	GLU		K156	R215	S277	K338	H406	GLU	GLU	GLU		I157	L217	R278	M339	H407	GLU	GLU	GLU		R158	K218	G279	S340	Y408	GLU	GLU	GLU		E159	L219	Q281	S341	T409	GLU	GLU	GLU		E160	L219	Q281	Y342	G410	GLU	GLU	GLU		Y161	P222	Y283	V344	E411	GLU	GLU	GLU		P162	T223	R284	E345	G412	GLU	GLU	GLU		D163	Y224	A285	W346	M413	GLU	GLU	GLU		R164	G225	L286	I347	D414	GLU	GLU	GLU		I165	D226	T287	P348	E415	GLU	GLU	GLU		M166	L227	V288	M349	R416	GLU	GLU	GLU		M167	M228	P289	N350	F417	GLU	GLU	GLU		T168	H229	E290	V351	T418	GLU	GLU	GLU		F169	L230	L291	K352	E420	GLU	GLU	GLU		S170	V231	T292	T353	A421	GLU	GLU	GLU		V171	T234	Q293	A354	E422	GLU	GLU	GLU		V172	G234	Q294	V355	S423	GLU	GLU	GLU		P173	M235	M295	C356	R424	GLU	GLU	GLU		S174	S236	F296	D357	M425	GLU	GLU	GLU		P175	G237	D297	I388	M426	GLU	GLU	GLU		K176	V238	A298	P359	D427	GLU	GLU	GLU		V177	T239	K299	P360	L428	GLU	GLU	GLU		S178	T240	R300	R369	V429	GLU	GLU	GLU		D179	C241	M301	G370	S430	GLU	GLU	GLU		T180	L242	M302	L371	E431	GLU	GLU	GLU		V181	R243	A303	K372	Y432	GLU	GLU	GLU		V182	F244	A304	M373	Q433	GLU	GLU	GLU		E183	P245	C305	S374	Q434	GLU	GLU	GLU	
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• Molecule 3: PROTEIN (STATHMIN-LIKE DOMAIN OF RB3)



X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23	X24	X25	X26	X27	X28	X29	X30	X31	X32	X33	X34	X35	X36	X37	X38	X39	X40	X41	X42	X43	X44	X45	X46	X47	X48	X49	X50	X51	X52	X53	X54	X55	X56	X57	X58	X59	X60	X61	X62	X63	X64																																				
X65	X66	X67	X68	X69	X70	X71	X72	X73	X74	X75	X76	X77	X78	X79	X80	X81	X82	X83	X84	X85	X86	X87	X88	X89	X90	X91	X92	X93	X94	X95	X96	X97	X98	X99	X100	X101	X102	X103	X104	X105	X106	X107	X108	X109	X110	X111	X112	X113	X114	X115	X116	X117	X118	X119	X120	X121	X122	X123	X124	X125	X126	X127	X128	X129	X130	X131	X132	X133	X134	X135	X136	X137	X138	X139	X140	X141	X142	X143	X144	X145	X146	X147	X148	X149	X150	X151	X152	X153	X154	X155	X156	X157	X158	X159	X160	X161	X162	X163	X164

4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α , β , γ	328.50Å 328.50Å 54.40Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	7.00 – 3.95	Depositor
% Data completeness (in resolution range)	94.3 (7.00-3.95)	Depositor
R_{merge}	0.06	Depositor
R_{sym}	0.06	Depositor
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.267 , 0.367	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	13568	wwPDB-VP
Average B, all atoms (Å ²)	67.0	wwPDB-VP

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: GTP, GDP

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	0.59	0/3367	0.86	5/4570 (0.1%)
1	C	0.56	0/3367	0.84	5/4570 (0.1%)
2	B	0.56	0/3270	0.82	1/4428 (0.0%)
2	D	0.58	0/3270	0.84	0/4428
All	All	0.57	0/13274	0.84	11/17996 (0.1%)

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	A	0	1
1	C	0	2
2	B	0	1
2	D	0	1
All	All	0	5

There are no bond length outliers.

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	417	GLU	N-CA-C	-5.93	94.99	111.00
1	C	318	LEU	CA-CB-CG	5.91	128.90	115.30
1	A	417	GLU	N-CA-C	-5.77	95.43	111.00
1	A	318	LEU	CA-CB-CG	5.63	128.26	115.30
1	A	294	ALA	N-CA-C	-5.38	96.46	111.00

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	108	TYR	Sidechain
2	B	61	TYR	Sidechain
1	C	108	TYR	Sidechain
1	C	210	TYR	Sidechain
2	D	312	TYR	Sidechain

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	3295	0	3202	883	0
1	C	3295	0	3202	910	0
2	B	3201	0	3091	916	0
2	D	3201	0	3091	883	0
3	E	456	0	103	79	0
4	A	32	0	12	4	0
4	C	32	0	12	8	0
5	B	28	0	12	5	0
5	D	28	0	12	9	0
All	All	13568	0	12737	3585	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 136.

The worst 5 of 3585 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)
2:B:175:PRO:HD2	2:B:207:GLU:HB2	1.23	1.16
2:D:158:ARG:HD3	2:D:197:ASN:ND2	1.63	1.14
1:A:214:ARG:HH21	1:A:220:GLU:HA	1.04	1.14
2:B:179:ASP:HA	1:C:352:LYS:HE2	1.20	1.12
1:C:222:PRO:HB2	1:C:227:LEU:HD11	1.31	1.12

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	419/451 (93%)	221 (53%)	111 (26%)	87 (21%)	0	2
1	C	419/451 (93%)	219 (52%)	114 (27%)	86 (20%)	0	2
2	B	406/445 (91%)	184 (45%)	133 (33%)	89 (22%)	0	1
2	D	406/445 (91%)	186 (46%)	130 (32%)	90 (22%)	0	1
All	All	1650/1792 (92%)	810 (49%)	488 (30%)	352 (21%)	0	1

5 of 352 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	16	ILE
1	A	32	PRO
1	A	46	ASP
1	A	83	TYR
1	A	90	GLU

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	354/377 (94%)	278 (78%)	76 (22%)	1	6
1	C	354/377 (94%)	279 (79%)	75 (21%)	1	6
2	B	347/381 (91%)	274 (79%)	73 (21%)	1	6
2	D	347/381 (91%)	270 (78%)	77 (22%)	1	6
All	All	1402/1516 (92%)	1101 (78%)	301 (22%)	1	6

5 of 301 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	D	88	ARG
2	D	395	PHE
2	D	139	HIS
2	D	252	LEU
2	D	437	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 66 such sidechains are listed below:

Mol	Chain	Res	Type
2	D	228	ASN
2	D	294	GLN
2	D	434	GLN
2	B	228	ASN
2	B	206	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

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
4	GTP	A	500	-	26,34,34	1.36	5 (19%)	32,54,54	0.92	0
4	GTP	C	502	-	26,34,34	1.31	2 (7%)	32,54,54	1.02	2 (6%)
5	GDP	D	503	-	24,30,30	1.35	4 (16%)	30,47,47	0.96	2 (6%)
5	GDP	B	501	-	24,30,30	1.53	5 (20%)	30,47,47	0.91	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
4	GTP	A	500	-	-	5/18/38/38	0/3/3/3
4	GTP	C	502	-	-	3/18/38/38	0/3/3/3
5	GDP	D	503	-	-	6/12/32/32	0/3/3/3
5	GDP	B	501	-	-	4/12/32/32	0/3/3/3

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	501	GDP	C6-N1	3.79	1.43	1.37
5	D	503	GDP	C6-N1	3.44	1.43	1.37
4	A	500	GTP	C5-C6	-3.33	1.40	1.47
5	B	501	GDP	C2'-C1'	-3.28	1.48	1.53
4	C	502	GTP	C5-C6	-3.06	1.41	1.47

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	502	GTP	PA-O3A-PB	2.75	142.26	132.83
4	C	502	GTP	O2G-PG-O3B	2.65	113.51	104.64
5	D	503	GDP	O2B-PB-O3A	2.31	112.38	104.64
5	D	503	GDP	O3B-PB-O3A	2.10	111.68	104.64

There are no chirality outliers.

5 of 18 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	500	GTP	C3'-C4'-C5'-O5'
5	B	501	GDP	C5'-O5'-PA-O1A
5	B	501	GDP	C5'-O5'-PA-O2A

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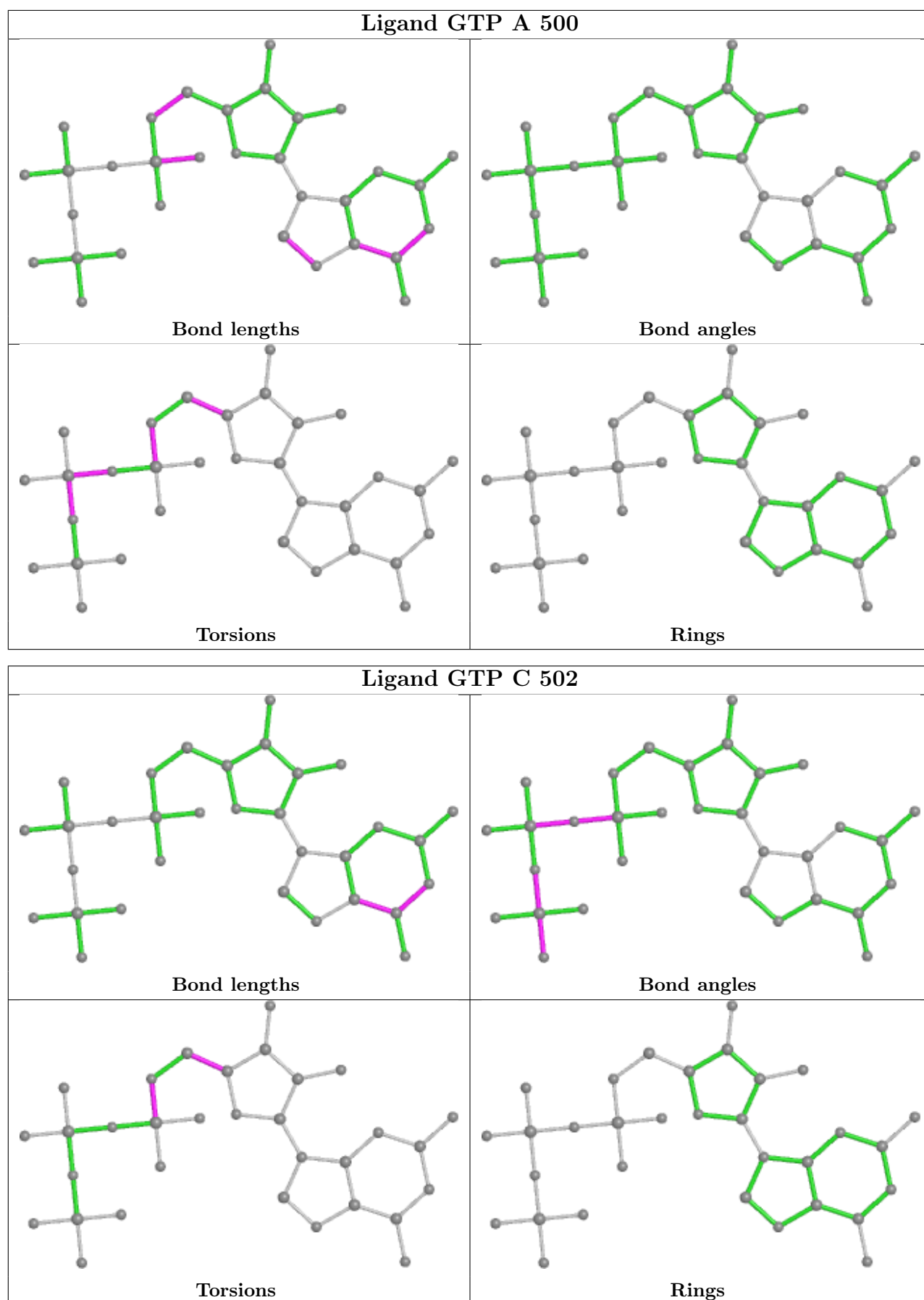
Mol	Chain	Res	Type	Atoms
5	B	501	GDP	C4'-C5'-O5'-PA
5	D	503	GDP	C5'-O5'-PA-O1A

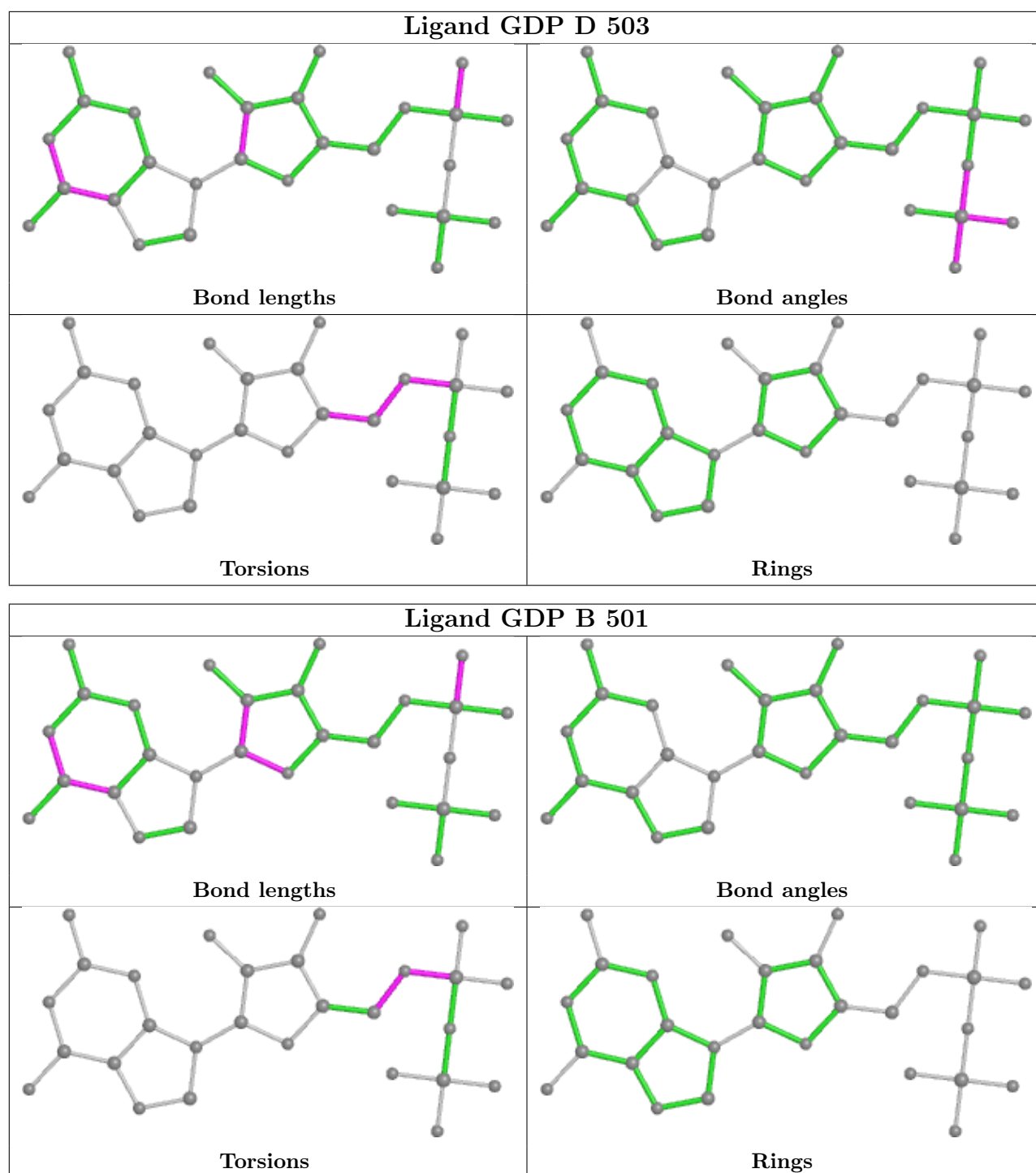
There are no ring outliers.

4 monomers are involved in 26 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	500	GTP	4	0
4	C	502	GTP	8	0
5	D	503	GDP	9	0
5	B	501	GDP	5	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](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.