



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 05:15 AM UTC

PDB ID : 1FFX / pdb\_00001ffx  
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](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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

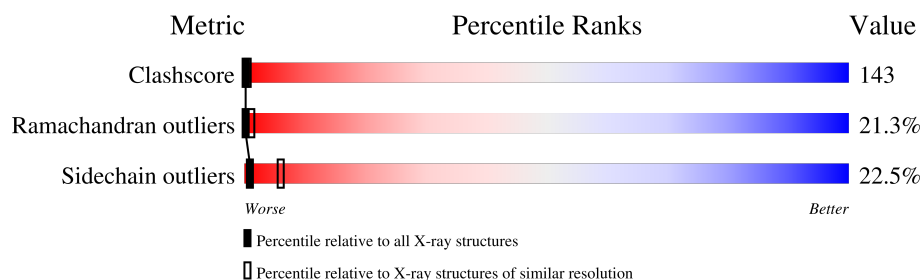
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 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	190562	1019 (4.14-3.78)
Ramachandran outliers	187476	1031 (4.16-3.76)
Sidechain outliers	187428	1024 (4.16-3.76)

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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	451	
1	C	451	
2	B	445	
2	D	445	
3	E	91	

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
1	A	423	Total	C	N	O	S	0	0	0
			3295	2082	559	632	22			
1	C	423	Total	C	N	O	S	0	0	0
			3295	2082	559	632	22			

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

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

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

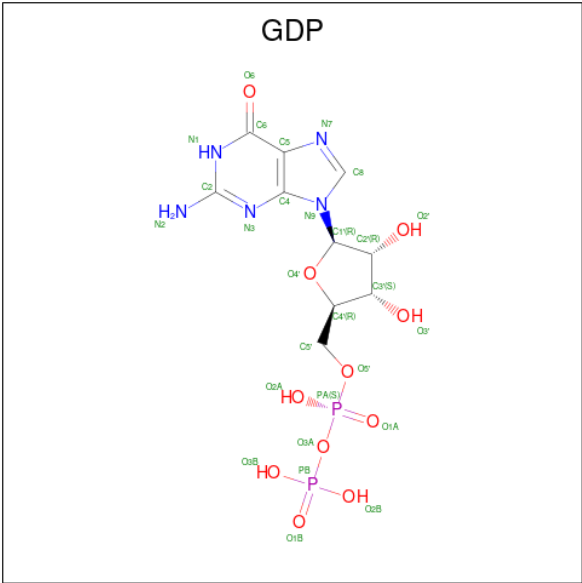
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	E	91	Total	C	N	O	0	0	0
			456	273	91	92			

- Molecule 4 is GUANOSINE-5'-TRIPHOSPHATE (CCD ID: GTP) (formula: C<sub>10</sub>H<sub>16</sub>N<sub>5</sub>O<sub>14</sub>P<sub>3</sub>).



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

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



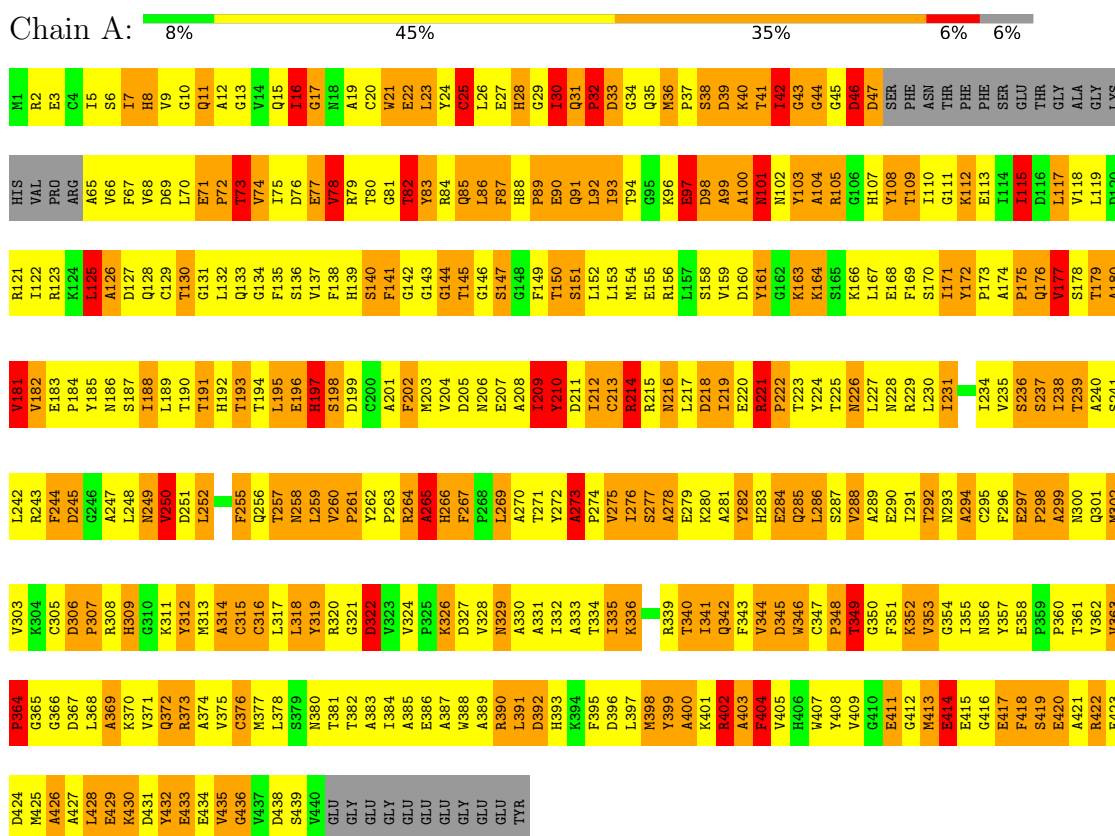
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	B	1	Total	C	N	O	P	0	0
			28	10	5	11	2		
5	D	1	Total	C	N	O	P	0	0
			28	10	5	11	2		

### 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)



V181	S241	M302	P364	D424
V182	L242	V303	G365	M425
P183	R243	K304	G366	A426
P184	F244	C305	D367	A427
Y185	L245	D306	L368	L428
M186	G246	P307	A369	E429
S187	A247	R308	K370	K430
L188	L248	H309	V371	D431
L189	N249	G310	Q372	Y432
T190	V250	K311	R373	E433
T191	D251	Y312	A374	E434
H192	T252	K313	V375	Y435
T193	T253	A314	Q376	G436
T194	E254	C315	K377	Y437
L195	P255	C316	L378	D438
E196	Q256	L317	S379	S439
H197	T257	L318	N380	Y440
S198	N258	Y319	T381	GLY
D199	L259	R320	T382	GLY
G200	V260	G321	A383	GLY
A201	P261	R322	I384	GLY
F202	Y262	K326	E386	GLY
M203	P263	D327	A387	GLY
V204	R264	V328	V388	GLY
D205	A265	N329	A389	GLY
N206	H266	A330	R390	GLY
E207	P267	A331	L391	TYR
A208	P268	I332	D392	
L209	L269	A333	H393	
Y210	L270	T334	K394	
D211	A271	I335	F395	
I212	G272	K336	D396	
C213	P273	T337	L397	
R214	V275	K338	N398	
R215	I276	R339	Y399	
N216	S277	T340	A400	
L217	A278	I341	K401	
D218	E279	Q342	R402	
I219	K280	F343	A403	
E220	A281	V344	P404	
P221	Y282	D345	H405	
T222	E283	W346	H406	
T223	E284	C347	W407	
Y224	Q285	P348	Y408	
T225	L286	T349	V409	
N226	V287	G350	G410	
L227	V288	F351	E411	
N228	A289	G412	G413	
R229	E290	M413	E414	
L230	I291	G353	E415	
I231	T292	N355	A416	
G232	N293	N356	G417	
Q233	A294	Y357	A418	
I234	C295	F258	S419	
V235	F296	P359	E420	
S236	E297	P360	A421	
S237	P298	T361	V422	
I238	A299	N300	L423	
T239	P301			
A240				

• Molecule 2: PROTEIN (TUBULIN)

Chain B: . 52% 29% 8% 8%

K1	R64	K124	P184	F244	A304	K372	Y432
R2	A65	E125	Y185	P245	C305	M373	Q433
E3	I66	E126	N186	Q246	D306	M374	Q434
I4	L67	E127	A187	Q247	P307	A375	Y435
V5	V68	S128	T188	Q248	H309	T376	Q436
H6	D69	C129	L189	N249	G310	F377	D437
I7	L70	D130	S190	A250	R311	L378	ALA
Q8	E71	C131	V191	D251	A9	G379	THR
G9	P72	L132	H192	L252	A9	N380	ALA
G10	G73	Q133	Q193	R253	L133	S381	ASP
Q11	T74	G134	L194	K254	T314	T382	GLU
C12	M75	F135	V195	L255	V315	A383	GLN
G13	G76	A136	E196	A256	A316	T384	GLY
N14	S77	L137	N197	V257	A317	Q385	GLY
Q15	V78	T138	T198	M258	V318	E386	PHE
I16	R79	H139	D199	M259	R79	E387	GLU
A17	S80	S140	E200	V260	R320	F388	GLU
G18	G81	L141	T201	P261	G321	K389	GLU
K19	P82	G142	Y202	F262	R322	R390	GLY
F20	F83	G143	G203	P263	H323	T391	GLU
W21	G84	G144	L204	R264	M324	S392	GLU
E22	K85	T145	D205	L265	K325	E393	ASP
V23	L86	G146	N206	H266	K326	Q394	GLU
I24	F87	S147	E207	F267	E327	T395	GLU
S25	R88	G148	A208	F268	V328	T396	ALA
D26	P89	H149	L209	M269	D329	A397	
E27	D90	G150	Y210	G270	E330	K398	
I30	N91	T151	D211	G271	Q331	R399	
P31	V93	L152	T212	F272	M332	F399	
F94	K95	L153	C213	A273	K333	R401	
G95	F94	I154	F214	P274	N334	K402	
THR	G95	S155	R215	L275	V335	A403	
GLY	Q96	K156	T216	T276	Q336	F404	
SER	S97	T157	L217	S277	N337	L405	
TYR	G98	R158	K218	R278	K338	H406	
GLY	A99	E159	L219	G279	S339	W407	
ASP	G100	E160	T220	S280	S340	Y408	
ASP	N101	Y161	T221	Q281	S341	T409	
SER	M102	P162	P222	Q282	Y342	G410	
ASP	W103	D163	T223	Y283	F343	E411	
LEU	A104	R164	Y224	R284	V344	G412	
GLN	K105	I165	G225	A285	E345	M413	
LEU	G106	M166	D226	L286	V346	D414	
GLY	H107	N167	L227	T287	I347	E415	
ARG	Y108	T168	N228	V288	F348	M416	
ILE	T109	F169	H229	P289	N349	E417	
ASN	E110	S170	L230	E290	N350	F418	
Y51	G111	V171	V231	L291	V351	T419	
Y52	A112	V172	S232	T292	K352	E420	
Y53	E113	P173	A233	Q293	T353	M421	
N54	L114	S174	T234	Q294	A354	E422	
E55	V115	P175	M235	M295	S423	A423	
A56	D116	K176	S236	F296	C356	M424	
A57	S117	V177	G237	D297	D357	M425	
G58	V118	L118	V238	A298	L358	M426	
N59	L119	D179	T239	K299	P359	D427	
K60	D120	T180	T240	N300	P360	L428	
V61	V121	M181	C241	M301	R369	V429	
V62	V122	V182	L422	M302	G370	S430	
P63	R123	E183	R243	A303	L371	E431	

• Molecule 2: PROTEIN (TUBULIN)

Chain D: . 52% 29% 7% 8%

M1	R64	K124	P184	F244	A304	K372	Y432
R2	A65	E125	Y185	P245	C305	M373	Q433
I4	I66	E126	N186	Q246	D306	M374	Q434
V5	L67	E127	A187	Q247	P307	A375	Y435
H6	V68	S128	T188	Q248	H309	T376	Q436
I7	D69	C129	L189	N249	G310	F377	D437
Q8	L70	D130	S190	A250	R311	L378	ALA
A9	E71	C131	V191	D251	A9	G379	THR
G10	P72	L132	H192	L252	A9	N380	ALA
G73	G73	Q133	Q193	R253	L133	S381	ASP
T74	T74	G134	L194	K254	T314	T382	GLU
C12	M75	F135	V195	L255	V315	A383	GLN
G13	G76	A136	E196	A256	A316	T384	GLY
N14	S77	L137	N197	V257	A317	Q385	GLY
Q15	V78	T138	T198	M258	V318	E386	PHE
R79	R79	H139	D199	M259	R79	E387	GLU
G17	S80	S140	E200	V260	R320	F388	GLU
A18	G81	L141	T201	P261	G321	K389	GLU
K19	P82	G142	Y202	F262	R322	R390	GLY
F20	F83	G143	G203	P263	H323	T391	GLU
W21	G84	G144	L204	R264	M324	S392	GLU
E22	K85	T145	D205	L265	K325	E393	ASP
V23	L86	G146	N206	H266	K326	Q394	GLU
I24	F87	S147	E207	F267	E327	T395	GLU
S25	R88	G148	A208	F268	V328	T396	ALA
D26	P89	H149	L209	M269	D329	A397	
E27	D90	G150	Y210	G270	E330	K398	
I30	N91	T151	D211	G271	Q331	R399	
P31	V93	L152	T212	F272	M332	F399	
F94	K95	L153	C213	A273	K333	R401	
G95	F94	I154	F214	P274	N334	K402	
THR	G95	S155	R215	L275	V335	A403	
GLY	Q96	K156	T216	T276	Q336	F404	
SER	S97	T157	L217	S277	N337	L405	
TYR	G98	R158	K218	R278	K338	H406	
GLY	A99	E159	L219	G279	S339	W407	
ASP	G100	E160	T220	S280	S340	Y408	
ASP	N101	Y161	T221	Q281	S341	T409	
SER	M102	P162	P222	Q282	Y342	G410	
ASP	W103	D163	T223	Y283	F343	E411	
LEU	A104	R164	Y224	R284	V344	G412	
GLN	K105	I165	G225	A285	E345	M413	
G106	G106	M166	D226	L286	V346	D414	
GLY	H107	N167	L227	T287	I347	E415	
ARG	Y108	T168	N228	V288	F348	M416	
ILE	T109	F169	H229	P289	N349	E417	
ASN	E110	S170	L230	E290	N350	F418	
Y51	G111	V171	V231	L291	V351	T419	
Y52	A112	V172	S232	T292	K352	E420	
Y53	E113	P173	A233	Q293	T353	M421	
N54	L114	S174	T234	Q294	A354	E422	
E55	V115	P175	M235	M295	S423	A423	
A56	D116	K176	S236	F296	C356	M424	
S117	S117	V177	G237	D297	D357	M425	
G58	V118	L118	V238	A298	L358	M426	
N59	L119	D179	T239	K299	P359	D427	
K60	D120	T180	T240	N300	P360	L428	
V61	V121	M181	C241	M301	R369	V429	
V62	V122	V182	L422	M302	G370	S430	
P63	R123	E183	R243	A303	L371	E431	

K124	P184	R245	C305	M373	Q433
E125	Y185	G246	D306	S374	Q434
S126	N186	Q247	P307	A375	Y435
E127	A187	L248	R308	T376	Q436
S128	T188	N249	H309	F377	D437
G129	G189	A250	G310	I378	ALA
D130	S190	D251	R311	G379	THR
C131	V191	L252	Y312	N380	ALA
L132	H192	R253	L313	S381	ASP
Q133	Q193	K254	T314	T382	GLU
L134	L194	L255	V315	A383	GLN
F135	V195	A256	I384	I384	GLY
E136	E196	Q257	A316	Q385	GLY
L137	N197	N258	A317	E386	PHE
T138	T198	M259	V318	L387	GLU
H139	D199	V260	F319	F388	GLU
S140	E200	P261	R320	F389	GLU
L141	T201	F262	G321	K389	GLY
G142	Y202	P263	R322	R390	GLY
G143	C203	R264	M323	I391	GLU
G144	L204	L265	S324	S392	GLU
T145	D205	H266	N325	E393	ASP
G146	N206	F267	K326	Q394	ALA
S147	E207	F268	E327	F395	
G148	A208	M269	V328	T396	
R149	L209	F270	D329	A397	
G150	Y210	G271	E330	K388	
L151	D211	F272	Q331	F399	
L152	L212	A273	N332	R400	
L153	C213	P274	L333	R401	
I154	F214	L275	N334	K402	
S155	R215	T276	Q335	A403	
K156	T216	S277	Q336	F404	
I157	L217	R278	N337	L405	
E158	K218	G279	K338	H406	
E159	L219	S280	N339	Y407	
E160		Q281	S341	Y408	
Y161	P222	Q282	Y342	T409	
P162	T223	Y283	F343	G410	
D163	Y224	R284	V344	E411	
R164	G225	A285	E345	G412	
I165	D226	L286	D414	M413	
M166	L227	T287	I347	D414	
N167	N228	V288	P348	E415	
T168	H229	P289	N348	M416	
F169	L230	E290	N350	E417	
S170	V231	L291	V351	F418	
V171	S232	T292	K352	T419	
V172	A233	Q293	T353	E420	
P173	T234	Q294	A354	E421	
S174	M235	M295	V355	E422	
P175	S236	F296	C356	S423	
K176	D237	D297	D357	M424	
V177	V238	A298	I358	M425	
S178	K299	K299	P359	M426	
D179	T240	M300	P360	D427	
T180	C241	M301	R369	L428	
V181	L242	M302	G370	V429	
V182	R243	A303	L371	S430	
E183	F244	A304	K372	E431	
				Y432	

● Molecule 3: PROTEIN (STATHMIN-LIKE DOMAIN OF RB3)

Chain E:  32% 68%

X1	X10	X24	X42
X2	X11	X25	X43
X3	X12	X26	X44
X4	X13	X27	X45
X5	X14	X28	X46
X6	X15	X29	X47
X7	X16	X30	X48
X8	X17	X31	X49
X9	X18	X32	X50
X10	X19	X33	X51
X11	X20	X34	X52
X12	X21	X35	X53
X13		X36	X54
X14		X37	X55
X15		X38	X56
X16		X39	X57
X17			X58
X18			X59
X19			X60
X20			X61
X21			X62
X22			X63
X23			X64
X24			
X25			
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X81			
X82			
X83			
X84			
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X86			
X87			
X88			
X89			
X90			
X91			



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	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.	Xtriage
Total number of atoms	13568	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	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	0.78	5/3367 (0.1%)	1.35	60/4570 (1.3%)
1	C	0.71	1/3367 (0.0%)	1.33	65/4570 (1.4%)
2	B	0.69	0/3270	1.26	51/4428 (1.2%)
2	D	0.72	1/3270 (0.0%)	1.27	48/4428 (1.1%)
All	All	0.73	7/13274 (0.1%)	1.31	224/17996 (1.2%)

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

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	93	ILE	CA-CB	-6.30	1.45	1.54
1	A	78	VAL	CA-CB	5.80	1.62	1.54
1	A	250	VAL	CA-CB	5.65	1.59	1.55
2	D	86	ILE	CA-CB	5.30	1.61	1.54
1	C	16	ILE	CA-CB	5.11	1.61	1.54

The worst 5 of 224 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	417	GLU	N-CA-C	-14.39	94.99	112.54
1	A	417	GLU	N-CA-C	-14.03	95.43	112.54
1	A	294	ALA	N-CA-C	-13.67	96.46	111.36
1	C	294	ALA	N-CA-C	-13.53	96.61	111.36
1	A	117	LEU	N-CA-C	-12.32	98.72	113.88

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

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	916	0
1	C	3295	0	3202	966	0
2	B	3201	0	3091	964	0
2	D	3201	0	3091	924	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	3761	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 143.

The worst 5 of 3761 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	1
1	C	419/451 (93%)	219 (52%)	114 (27%)	86 (20%)	0	1
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%)	268 (76%)	86 (24%)	1	5
1	C	354/377 (94%)	272 (77%)	82 (23%)	1	5
2	B	347/381 (91%)	273 (79%)	74 (21%)	1	7
2	D	347/381 (91%)	274 (79%)	73 (21%)	1	7
All	All	1402/1516 (92%)	1087 (78%)	315 (22%)	1	6

5 of 315 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	398	MET
2	D	302	MET
1	C	420	GLU
2	D	160	GLU
2	D	388	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 68 such sidechains are listed below:

Mol	Chain	Res	Type
2	D	193	GLN
2	D	206	ASN
2	D	385	GLN
2	B	206	ASN
2	B	197	ASN

### 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

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	C	502	-	33,34,34	1.47	3 (9%)	50,54,54	0.82	2 (4%)
5	GDP	B	501	-	29,30,30	1.68	4 (13%)	45,47,47	0.82	1 (2%)
4	GTP	A	500	-	33,34,34	2.79	5 (15%)	50,54,54	0.79	0
5	GDP	D	503	-	29,30,30	1.10	3 (10%)	45,47,47	0.85	2 (4%)

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	C	502	-	-	3/22/38/38	0/3/3/3
5	GDP	B	501	-	-	4/16/32/32	0/3/3/3
4	GTP	A	500	-	-	5/22/38/38	0/3/3/3
5	GDP	D	503	-	-	6/16/32/32	0/3/3/3

The worst 5 of 15 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	500	GTP	PA-O3A	-10.33	1.48	1.59
4	A	500	GTP	PB-O3A	-8.66	1.50	1.59
5	B	501	GDP	PA-O3A	-6.91	1.52	1.59
4	A	500	GTP	PB-O3B	6.48	1.66	1.59
4	C	502	GTP	PB-O3B	5.64	1.65	1.59

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	502	GTP	O2G-PG-O3B	2.65	113.51	104.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	502	GTP	O2A-PA-O3A	2.41	113.79	107.27
5	D	503	GDP	O2B-PB-O3A	2.31	112.38	104.64
5	B	501	GDP	C4'-O4'-C1'	-2.26	104.48	109.47
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:

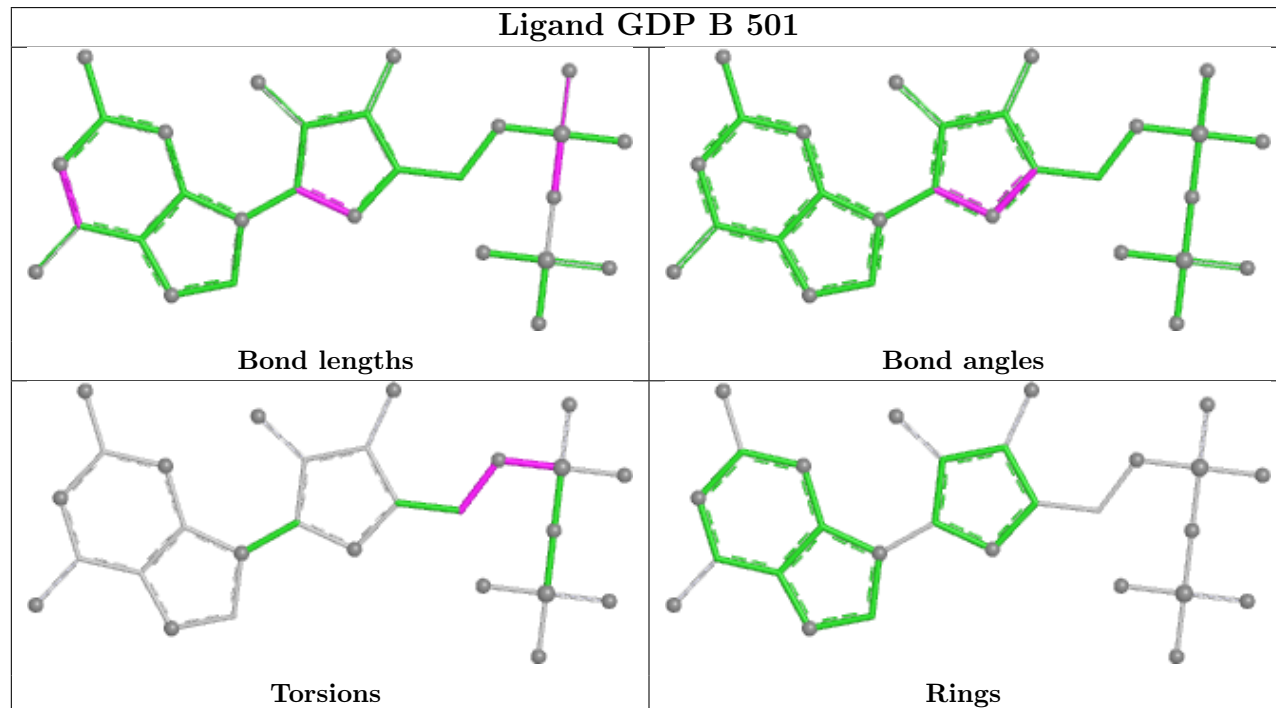
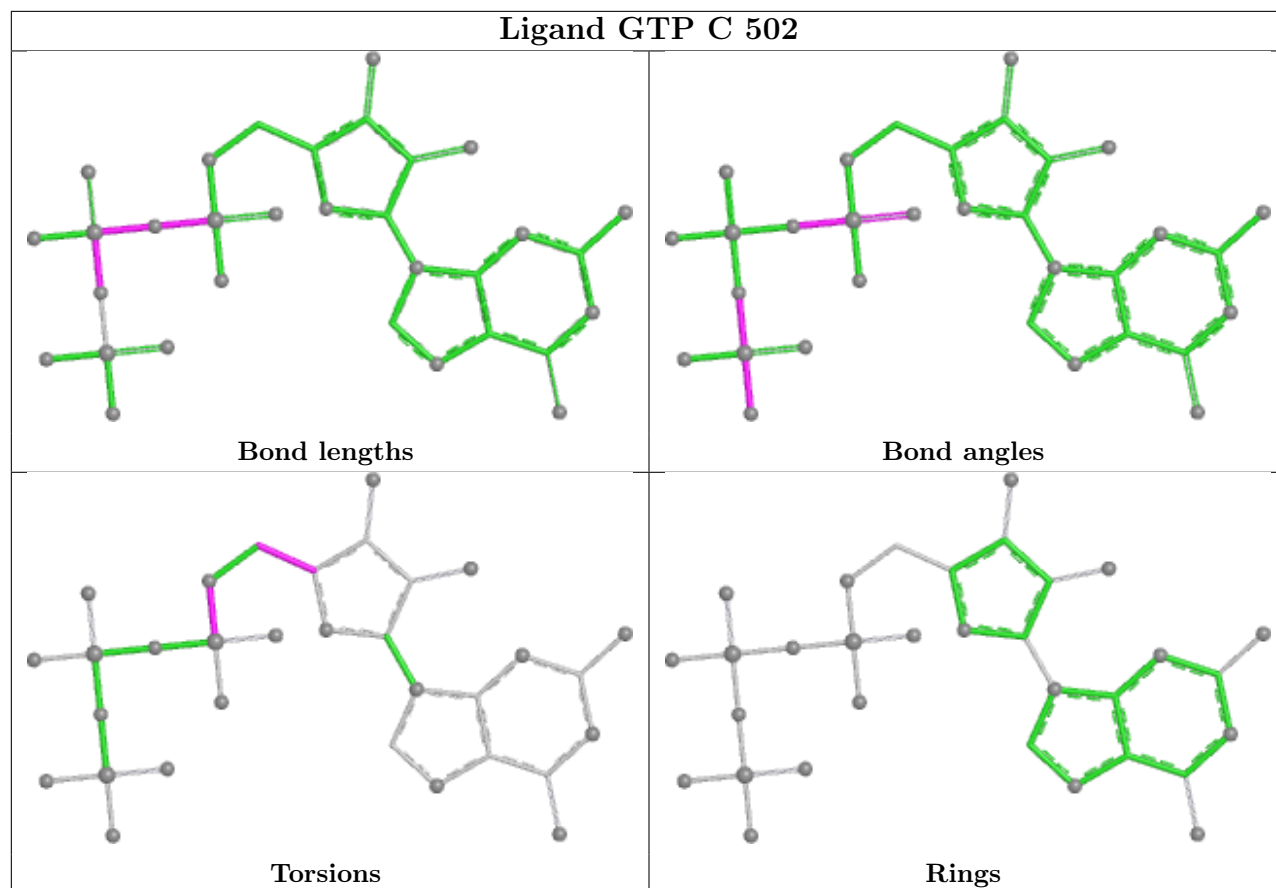
Mol	Chain	Res	Type	Atoms
5	B	501	GDP	C5'-O5'-PA-O3A
5	B	501	GDP	C5'-O5'-PA-O1A
5	B	501	GDP	C5'-O5'-PA-O2A
5	B	501	GDP	C4'-C5'-O5'-PA
5	D	503	GDP	C5'-O5'-PA-O3A

There are no ring outliers.

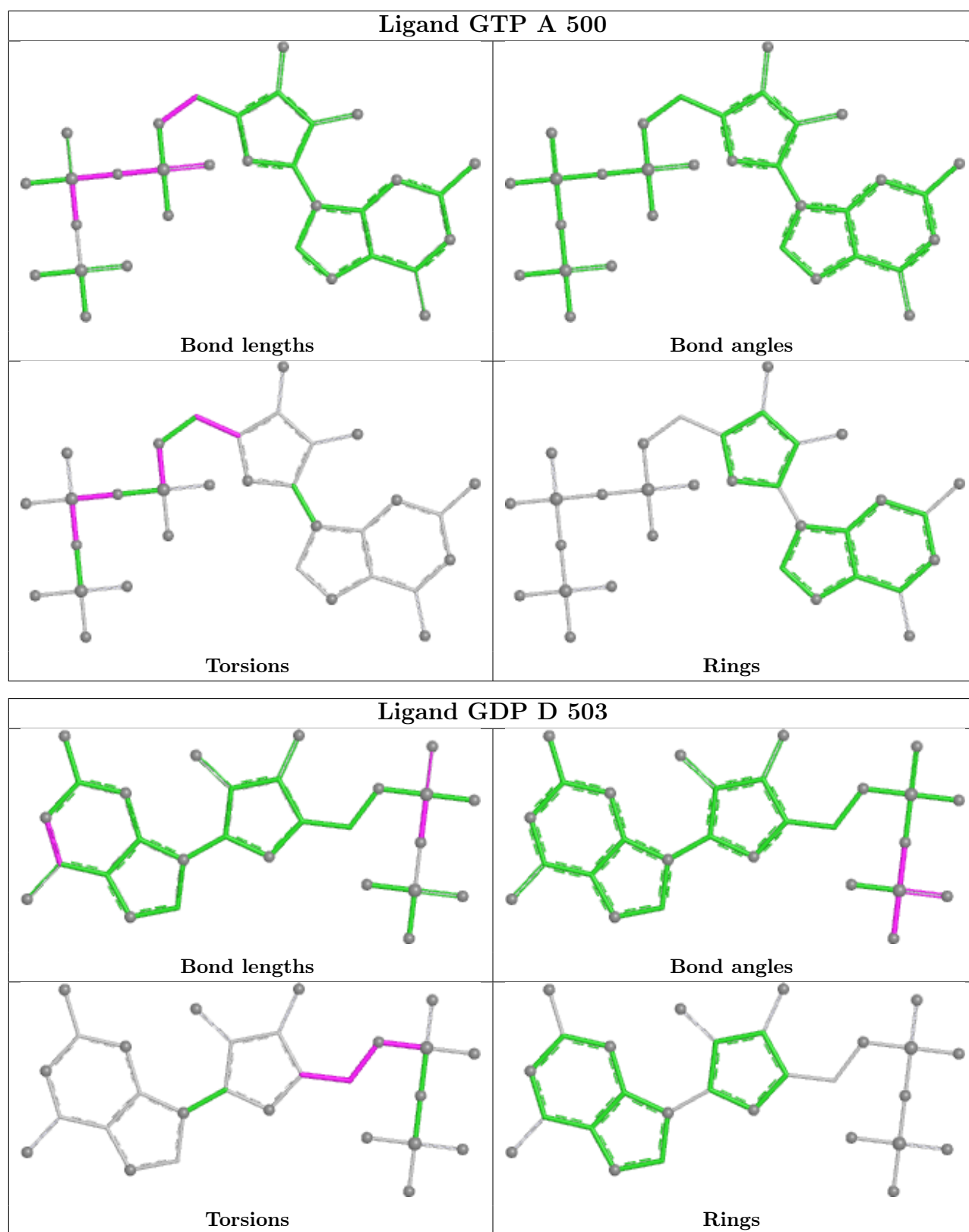
4 monomers are involved in 26 short contacts:

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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.