



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 09:24 AM UTC

PDB ID : 5MIO / pdb_00005mio
Title : KIF2C-DARPIN FUSION PROTEIN BOUND TO TUBULIN
Authors : Wang, W.; Gigant, B.
Deposited on : 2016-11-28
Resolution : 3.19 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

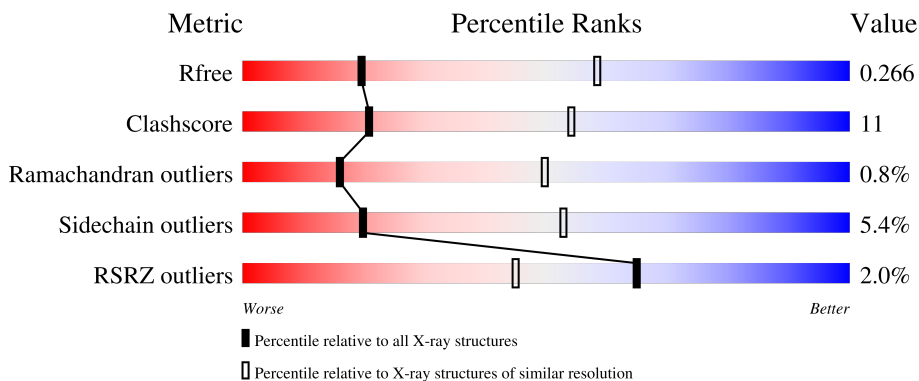
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.19 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}	180053	1466 (3.20-3.20)
Clashscore	190562	1573 (3.20-3.20)
Ramachandran outliers	187476	1548 (3.20-3.20)
Sidechain outliers	187428	1547 (3.20-3.20)
RSRZ outliers	180081	1466 (3.20-3.20)

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 $\leq 5\%$. 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	451	 2% 83% 12% 5%
2	B	445	 2% 84% 10% 5%
3	C	573	 2% 56% 20% 7% 17%

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 10421 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 Tubulin alpha-1B chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	429	3364	2133	572	637	22	0	0	0

- Molecule 2 is a protein called Tubulin beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	423	3331	2095	568	641	27	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	203	CYS	SER	conflict	UNP D0VWY9
B	318	ILE	VAL	conflict	UNP D0VWY9

- Molecule 3 is a protein called Kinesin-like protein KIF2C,KIF2C FUSED TO A DARPIN,KIF2C FUSED TO A DARPIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	477	3604	2267	633	681	23	0	0	0

There are 27 discrepancies between the modelled and reference sequences:

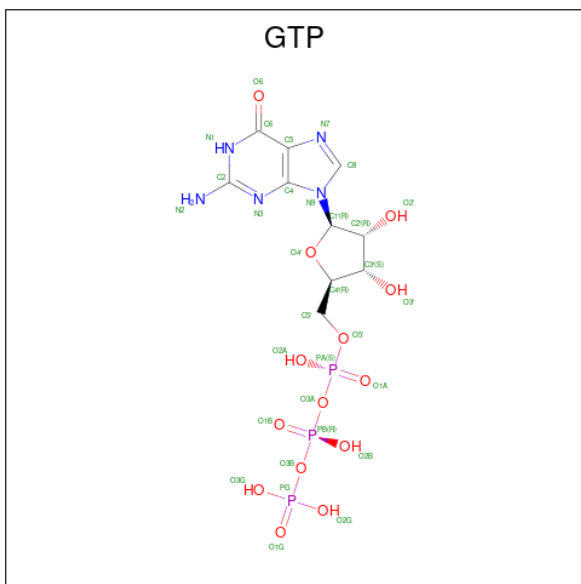
Chain	Residue	Modelled	Actual	Comment	Reference
C	214	MET	-	initiating methionine	UNP Q99661
C	215	GLY	-	expression tag	UNP Q99661
C	330	ALA	ARG	engineered mutation	UNP Q99661
C	379	ALA	ARG	engineered mutation	UNP Q99661
C	599	GLY	-	linker	UNP Q99661
C	600	GLY	-	linker	UNP Q99661
C	601	GLY	-	linker	UNP Q99661

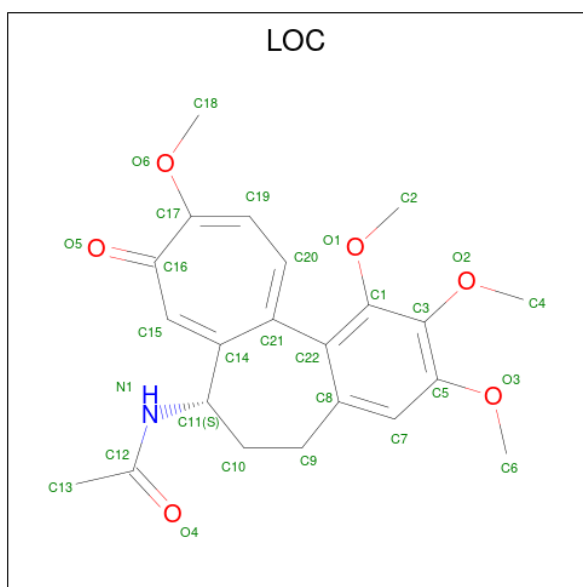
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Chain	Residue	Modelled	Actual	Comment	Reference
C	602	GLY	-	linker	UNP Q99661
C	603	SER	-	linker	UNP Q99661
C	604	GLY	-	linker	UNP Q99661
C	605	GLY	-	linker	UNP Q99661
C	606	GLY	-	linker	UNP Q99661
C	607	GLY	-	linker	UNP Q99661
C	608	SER	-	linker	UNP Q99661
C	609	GLY	-	linker	UNP Q99661
C	610	GLY	-	linker	UNP Q99661
C	611	GLY	-	linker	UNP Q99661
C	612	GLY	-	linker	UNP Q99661
C	613	SER	-	linker	UNP Q99661
C	614	GLY	-	linker	UNP Q99661
C	615	GLY	-	linker	UNP Q99661
C	616	GLY	-	linker	UNP Q99661
C	617	GLY	-	linker	UNP Q99661
C	618	SER	-	linker	UNP Q99661
C	619	GLY	-	linker	UNP Q99661
C	620	GLY	-	linker	UNP Q99661
C	621	SER	-	linker	UNP Q99661

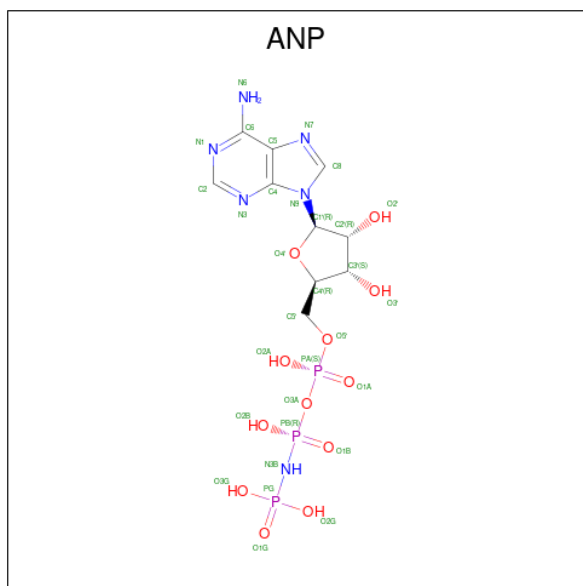
- Molecule 4 is GUANOSINE-5'-TRIPHOSPHATE (CCD ID: GTP) (formula: C₁₀H₁₆N₅O₁₄P₃).





Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
7	B	1	29	22	1	6	0	0

- Molecule 8 is PHOSPHOAMINOPHOSPHONIC ACID-ADENYLATE ESTER (CCD ID: ANP) (formula: $C_{10}H_{17}N_6O_{12}P_3$).

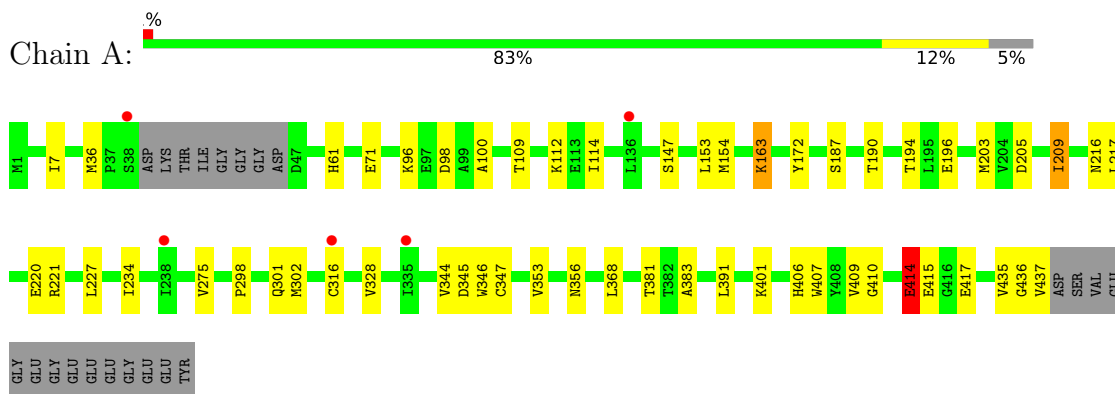


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
8	C	1	31	10	6	12	3	0	0

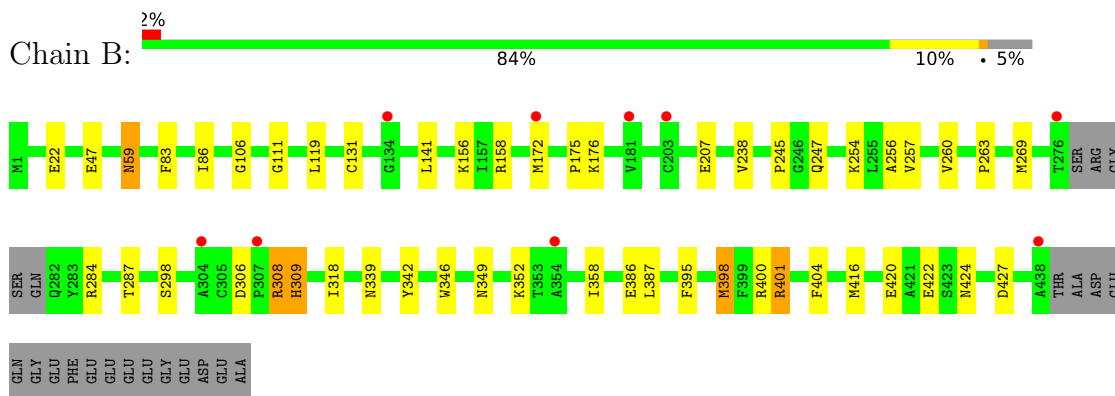
3 Residue-property plots

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 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.

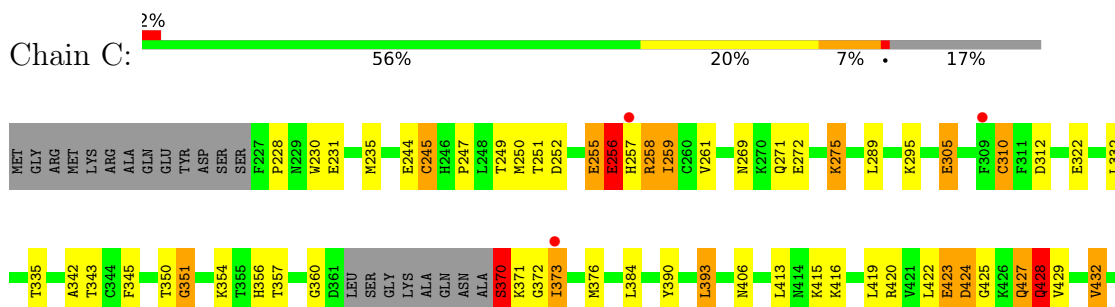
- Molecule 1: Tubulin alpha-1B chain



- Molecule 2: Tubulin beta chain



- Molecule 3: Kinesin-like protein KIF2C,KIF2C FUSED TO A DARPIN,KIF2C FUSED TO A DARPIN



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	51.81Å 229.76Å 293.95Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.91 – 3.19 42.91 – 3.19	Depositor EDS
% Data completeness (in resolution range)	66.3 (42.91-3.19) 66.3 (42.91-3.19)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.49 (at 3.19Å)	Xtrriage
Refinement program	BUSTER 2.10.2	Depositor
R, R_{free}	0.211 , 0.257 0.224 , 0.266	Depositor DCC
R_{free} test set	1009 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	77.5	Xtrriage
Anisotropy	0.500	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 82.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.26$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	10421	wwPDB-VP
Average B, all atoms (Å ²)	104.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.94% 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: GDP, ANP, GTP, MG, LOC

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	0.76	0/3441	1.12	5/4671 (0.1%)
2	B	0.79	2/3405 (0.1%)	1.09	6/4611 (0.1%)
3	C	0.97	6/3661 (0.2%)	1.46	39/4947 (0.8%)
All	All	0.85	8/10507 (0.1%)	1.24	50/14229 (0.4%)

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	398	MET	SD-CE	8.94	2.01	1.79
3	C	448	MET	SD-CE	-6.91	1.62	1.79
3	C	586	LYS	CA-C	6.55	1.61	1.52
3	C	530	LEU	CA-C	-6.14	1.45	1.52
2	B	269	MET	SD-CE	-5.84	1.65	1.79
3	C	453	SER	CA-C	-5.61	1.45	1.52
3	C	542	SER	CA-C	-5.44	1.46	1.52
3	C	370	SER	CA-C	5.22	1.64	1.52

All (50) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	498	ARG	N-CA-C	-11.50	94.71	110.35
3	C	275	LYS	N-CA-C	-9.56	95.09	110.20
3	C	508	GLN	N-CA-C	-8.17	102.34	111.82
1	A	414	GLU	CB-CG-CD	8.10	126.37	112.60
3	C	735	LEU	CA-C-N	7.47	130.63	120.54
3	C	735	LEU	C-N-CA	7.47	130.63	120.54
3	C	373	ILE	CB-CG1-CD1	6.79	128.07	113.80
3	C	508	GLN	CA-C-N	6.46	128.94	120.28
3	C	508	GLN	C-N-CA	6.46	128.94	120.28
3	C	686	ASP	CA-CB-CG	6.39	119.00	112.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	231	GLU	N-CA-C	6.32	118.17	111.28
3	C	275	LYS	CA-C-N	-6.29	112.19	122.26
3	C	275	LYS	C-N-CA	-6.29	112.19	122.26
3	C	532	GLN	CA-C-N	6.23	131.43	122.40
3	C	532	GLN	C-N-CA	6.23	131.43	122.40
3	C	510	ARG	N-CA-C	-6.00	103.91	111.11
2	B	358	ILE	N-CA-C	5.98	113.01	107.56
3	C	370	SER	CA-C-N	5.98	132.47	121.70
3	C	370	SER	C-N-CA	5.98	132.47	121.70
3	C	564	THR	CB-CA-C	5.92	119.30	109.53
3	C	653	ASP	CA-CB-CG	5.91	118.51	112.60
3	C	539	PHE	N-CA-C	-5.86	106.47	113.97
3	C	305	GLU	CB-CG-CD	5.60	122.13	112.60
3	C	529	ALA	N-CA-C	5.56	117.14	111.14
2	B	287	THR	CA-C-N	5.54	124.76	120.33
2	B	287	THR	C-N-CA	5.54	124.76	120.33
1	A	415	GLU	CA-C-N	5.51	126.10	119.98
1	A	415	GLU	C-N-CA	5.51	126.10	119.98
3	C	454	ALA	N-CA-C	-5.48	105.31	111.28
2	B	308	ARG	CA-C-N	-5.43	111.29	120.58
2	B	308	ARG	C-N-CA	-5.43	111.29	120.58
3	C	640	ARG	CA-C-N	5.41	127.38	120.56
3	C	640	ARG	C-N-CA	5.41	127.38	120.56
3	C	551	SER	N-CA-C	5.28	117.11	111.36
1	A	356	ASN	CA-CB-CG	5.25	117.85	112.60
2	B	309	HIS	N-CA-C	-5.18	105.31	111.69
3	C	424	ASP	CA-C-N	5.18	131.56	121.41
3	C	424	ASP	C-N-CA	5.18	131.56	121.41
3	C	256	GLU	CA-C-N	5.16	131.40	121.54
3	C	256	GLU	C-N-CA	5.16	131.40	121.54
1	A	196	GLU	CB-CG-CD	5.14	121.34	112.60
3	C	275	LYS	CA-C-O	-5.13	115.20	121.05
3	C	312	ASP	N-CA-C	-5.11	105.61	111.07
3	C	622	ASP	CA-C-N	5.08	127.59	120.28
3	C	622	ASP	C-N-CA	5.08	127.59	120.28
3	C	504	SER	N-CA-C	-5.07	105.83	111.36
3	C	531	GLY	N-CA-C	-5.06	106.61	113.24
3	C	351	GLY	CA-C-N	5.05	127.46	120.29
3	C	351	GLY	C-N-CA	5.05	127.46	120.29
3	C	530	LEU	N-CA-C	-5.03	105.69	111.07

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	3364	0	3282	42	0
2	B	3331	0	3210	52	0
3	C	3604	0	3565	170	0
4	A	32	0	12	0	0
5	A	1	0	0	0	0
5	C	1	0	0	0	0
6	B	28	0	12	0	0
7	B	29	0	25	2	0
8	C	31	0	13	8	0
All	All	10421	0	10119	227	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 11.

All (227) 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:398:MET:CE	2:B:398:MET:SD	2.01	1.48
3:C:549:ARG:HD3	3:C:553:ILE:HD11	1.20	1.10
1:A:414:GLU:HG2	3:C:517:ASN:HD22	1.17	1.10
3:C:529:ALA:HA	3:C:532:GLN:HB2	1.38	1.03
2:B:404:PHE:HE2	3:C:699:ILE:HD12	1.22	1.02
3:C:530:LEU:HD23	3:C:537:THR:HG22	1.51	0.92
3:C:343:THR:HG21	3:C:551:SER:OG	1.69	0.92
1:A:414:GLU:HG2	3:C:517:ASN:ND2	1.86	0.90
3:C:528:ARG:O	3:C:532:GLN:HG2	1.72	0.90
2:B:404:PHE:CE2	3:C:699:ILE:HD12	2.07	0.89
3:C:462:PHE:HB2	3:C:502:THR:HG22	1.57	0.87
1:A:209:ILE:HG22	1:A:227:LEU:HD22	1.55	0.87
3:C:350:THR:HG23	8:C:802:ANP:O1G	1.76	0.86
3:C:413:LEU:HD13	3:C:448:MET:CE	2.05	0.86
2:B:395:PHE:HE2	2:B:422:GLU:HB2	1.41	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:500:ALA:H	3:C:503:SER:H	1.22	0.84
1:A:346:TRP:HZ2	1:A:435:VAL:HG13	1.42	0.84
3:C:496:ASN:HB3	3:C:520:LEU:HD13	1.61	0.83
3:C:427:GLN:HG2	3:C:428:GLN:H	1.45	0.80
3:C:549:ARG:HD3	3:C:553:ILE:CD1	2.09	0.80
3:C:499:GLY:CA	3:C:503:SER:HB2	2.12	0.79
2:B:395:PHE:CE2	2:B:422:GLU:HB2	2.19	0.77
3:C:259:ILE:HG23	3:C:559:THR:HG23	1.66	0.77
3:C:549:ARG:CD	3:C:553:ILE:HD11	2.08	0.76
1:A:163:LYS:HD2	1:A:163:LYS:H	1.51	0.76
3:C:529:ALA:CA	3:C:532:GLN:HB2	2.14	0.76
3:C:477:ILE:CG2	3:C:484:MET:HE2	2.17	0.75
1:A:406:HIS:CG	2:B:263:PRO:HD3	2.20	0.75
2:B:404:PHE:HZ	3:C:699:ILE:CG2	2.01	0.74
3:C:477:ILE:HG23	3:C:484:MET:HE2	1.71	0.72
1:A:409:VAL:HG21	3:C:521:LEU:HD22	1.72	0.72
3:C:703:GLU:CD	3:C:703:GLU:H	1.95	0.72
3:C:272:GLU:O	3:C:275:LYS:O	2.07	0.72
2:B:404:PHE:HZ	3:C:699:ILE:HG23	1.56	0.71
3:C:506:ASP:OD1	3:C:510:ARG:HB2	1.91	0.71
3:C:522:ALA:CB	3:C:542:SER:HB3	2.21	0.71
1:A:112:LYS:HE3	3:C:506:ASP:OD2	1.90	0.71
3:C:509:THR:HA	3:C:512:GLU:HB3	1.73	0.71
1:A:96:LYS:HD2	2:B:131:CYS:HB2	1.73	0.71
3:C:549:ARG:O	3:C:553:ILE:HG13	1.91	0.70
3:C:335:THR:HG23	3:C:558:ARG:HH11	1.57	0.70
1:A:344:VAL:HG23	1:A:347:CYS:HB2	1.74	0.69
3:C:370:SER:HA	3:C:372:GLY:H	1.58	0.69
1:A:203:MET:O	1:A:302:MET:HE3	1.93	0.69
3:C:461:THR:HG22	3:C:469:ARG:HH21	1.58	0.68
3:C:500:ALA:H	3:C:503:SER:N	1.91	0.68
3:C:456:ARG:NH2	3:C:470:SER:O	2.27	0.67
3:C:530:LEU:HD23	3:C:537:THR:CG2	2.22	0.67
3:C:456:ARG:NH1	3:C:472:ALA:CB	2.58	0.67
3:C:456:ARG:HH12	3:C:472:ALA:HB3	1.58	0.66
2:B:404:PHE:CZ	3:C:699:ILE:HG23	2.32	0.65
3:C:494:ALA:HB1	3:C:516:ILE:HD13	1.77	0.65
3:C:456:ARG:NH1	3:C:472:ALA:HB3	2.12	0.65
1:A:346:TRP:CZ2	1:A:435:VAL:HG13	2.30	0.64
3:C:544:LEU:HG	3:C:545:THR:N	2.12	0.64
3:C:496:ASN:HB3	3:C:520:LEU:CD1	2.28	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:306:ASP:HB3	2:B:309:HIS:CE1	2.34	0.62
3:C:437:HIS:ND1	3:C:448:MET:HE1	2.14	0.62
3:C:582:ALA:HA	3:C:585:VAL:HG13	1.81	0.62
1:A:328:VAL:HG11	1:A:353:VAL:HG11	1.82	0.62
3:C:424:ASP:OD1	3:C:427:GLN:O	2.18	0.62
3:C:528:ARG:O	3:C:532:GLN:CG	2.47	0.62
3:C:351:GLY:N	3:C:464:ASN:HD21	1.98	0.62
3:C:463:ALA:HB2	3:C:502:THR:HG21	1.82	0.61
3:C:343:THR:HG21	3:C:551:SER:HG	1.66	0.60
3:C:255:GLU:O	3:C:256:GLU:HB2	2.00	0.59
3:C:259:ILE:N	3:C:259:ILE:HD12	2.17	0.59
3:C:350:THR:HA	8:C:802:ANP:O1G	2.03	0.59
2:B:306:ASP:HB3	2:B:309:HIS:ND1	2.18	0.59
3:C:469:ARG:HG3	3:C:469:ARG:HH11	1.68	0.59
2:B:309:HIS:HE1	2:B:386:GLU:OE2	1.86	0.59
1:A:234:ILE:HG21	1:A:302:MET:SD	2.43	0.59
3:C:350:THR:HA	8:C:802:ANP:HNB1	1.67	0.59
3:C:471:HIS:HE2	3:C:544:LEU:HD22	1.67	0.58
3:C:524:LYS:HD3	3:C:581:TYR:CZ	2.38	0.58
2:B:420:GLU:HG2	3:C:422:LEU:HA	1.85	0.57
2:B:400:ARG:HB2	2:B:401:ARG:NH2	2.18	0.57
3:C:537:THR:O	3:C:539:PHE:CE2	2.57	0.57
3:C:537:THR:O	3:C:539:PHE:CD2	2.58	0.57
3:C:413:LEU:HD13	3:C:448:MET:HE3	1.85	0.56
3:C:259:ILE:HG13	3:C:559:THR:CG2	2.36	0.56
3:C:249:THR:C	3:C:251:THR:H	2.14	0.55
1:A:209:ILE:CG2	1:A:227:LEU:HD22	2.30	0.55
3:C:587:GLU:HG2	3:C:588:LEU:N	2.21	0.55
3:C:550:ASP:O	3:C:553:ILE:O	2.24	0.55
3:C:556:ASN:N	3:C:556:ASN:HD22	2.04	0.55
3:C:350:THR:HA	8:C:802:ANP:PG	2.47	0.54
3:C:529:ALA:O	3:C:533:ASN:N	2.41	0.54
3:C:497:GLU:HA	3:C:574:TYR:HE1	1.72	0.54
3:C:499:GLY:C	3:C:503:SER:HB2	2.33	0.54
3:C:373:ILE:HD12	3:C:376:MET:CE	2.38	0.53
2:B:398:MET:CE	2:B:398:MET:CG	2.84	0.53
1:A:163:LYS:H	1:A:163:LYS:CD	2.15	0.53
3:C:469:ARG:HG3	3:C:469:ARG:NH1	2.24	0.53
3:C:499:GLY:HA3	3:C:503:SER:HB2	1.89	0.53
3:C:429:VAL:HG23	3:C:549:ARG:NH1	2.25	0.52
3:C:583:ASP:O	3:C:586:LYS:HD2	2.09	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:427:ASP:CG	3:C:540:ARG:HG3	2.34	0.52
1:A:401:LYS:HG3	2:B:346:TRP:CD2	2.45	0.52
3:C:512:GLU:O	3:C:515:GLU:HB2	2.09	0.52
1:A:406:HIS:HE1	2:B:260:VAL:O	1.92	0.52
3:C:390:TYR:HA	3:C:393:LEU:HD12	1.92	0.52
3:C:429:VAL:HG23	3:C:549:ARG:HH12	1.73	0.52
3:C:453:SER:HA	3:C:456:ARG:HB2	1.92	0.52
3:C:245:CYS:SG	3:C:310:CYS:HB3	2.50	0.52
3:C:530:LEU:CD2	3:C:537:THR:CG2	2.88	0.52
3:C:456:ARG:NH1	3:C:472:ALA:HB2	2.25	0.51
1:A:409:VAL:CG1	3:C:518:LYS:HA	2.40	0.51
2:B:404:PHE:HZ	3:C:699:ILE:HG21	1.75	0.51
2:B:22:GLU:HG3	2:B:83:PHE:CD1	2.46	0.51
3:C:538:PRO:HB2	3:C:541:GLU:HG3	1.92	0.51
3:C:519:SER:O	3:C:522:ALA:HB3	2.10	0.51
3:C:350:THR:HA	8:C:802:ANP:N3B	2.25	0.51
3:C:555:GLU:C	3:C:556:ASN:HD22	2.18	0.50
3:C:335:THR:CG2	3:C:558:ARG:HD2	2.41	0.50
1:A:410:GLY:HA2	3:C:518:LYS:HD2	1.92	0.50
2:B:119:LEU:HD11	2:B:156:LYS:HB3	1.94	0.50
2:B:59:ASN:O	2:B:59:ASN:CG	2.54	0.50
3:C:468:SER:HB2	8:C:802:ANP:O2G	2.12	0.50
1:A:407:TRP:CE2	2:B:257:VAL:HA	2.47	0.50
2:B:424:ASN:HD22	3:C:540:ARG:HH11	1.60	0.49
3:C:522:ALA:HB3	3:C:542:SER:HB3	1.94	0.49
3:C:523:LEU:HD12	3:C:523:LEU:O	2.12	0.49
3:C:529:ALA:HA	3:C:532:GLN:CB	2.28	0.49
1:A:100:ALA:HA	2:B:254:LYS:CG	2.42	0.49
2:B:47:GLU:HB3	2:B:245:PRO:HG3	1.95	0.49
1:A:71:GLU:HG2	1:A:98:ASP:HB3	1.95	0.49
2:B:424:ASN:HD22	3:C:540:ARG:NH1	2.11	0.49
3:C:500:ALA:N	3:C:503:SER:HB2	2.28	0.49
3:C:351:GLY:H	3:C:464:ASN:HD21	1.60	0.49
2:B:176:LYS:HG3	2:B:207:GLU:HG3	1.95	0.49
3:C:247:PRO:HG3	3:C:310:CYS:SG	2.53	0.48
3:C:258:ARG:C	3:C:259:ILE:HD12	2.39	0.48
3:C:460:GLN:HA	3:C:465:SER:O	2.12	0.48
3:C:508:GLN:O	3:C:512:GLU:N	2.42	0.48
1:A:187:SER:HB3	1:A:391:LEU:HD21	1.94	0.48
2:B:401:ARG:HG2	2:B:401:ARG:HH21	1.78	0.48
3:C:235:MET:HB3	3:C:235:MET:HE2	1.74	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:555:GLU:HB3	3:C:556:ASN:HD22	1.79	0.47
2:B:318:ILE:HD11	7:B:502:LOC:H4	1.96	0.47
2:B:416:MET:HE3	3:C:432:VAL:HG22	1.96	0.47
2:B:172:MET:HG3	2:B:387:LEU:HD11	1.96	0.47
1:A:406:HIS:CE1	2:B:260:VAL:O	2.67	0.47
2:B:352:LYS:HG3	7:B:502:LOC:C16	2.44	0.47
1:A:36:MET:HB3	1:A:61:HIS:CE1	2.50	0.47
1:A:172:TYR:HB3	1:A:205:ASP:HA	1.95	0.47
3:C:456:ARG:NH2	3:C:468:SER:HB3	2.30	0.47
3:C:506:ASP:C	3:C:507:ARG:HG2	2.39	0.47
1:A:154:MET:HG3	1:A:194:THR:HG23	1.96	0.47
3:C:636:ASP:O	3:C:640:ARG:HG3	2.15	0.46
3:C:506:ASP:O	3:C:507:ARG:HG2	2.15	0.46
1:A:346:TRP:HH2	1:A:435:VAL:HA	1.81	0.46
3:C:427:GLN:CG	3:C:428:GLN:H	2.24	0.46
3:C:269:ASN:HD21	3:C:271:GLN:HB2	1.80	0.46
3:C:529:ALA:C	3:C:532:GLN:HB2	2.40	0.46
3:C:582:ALA:HA	3:C:585:VAL:CG1	2.44	0.46
3:C:507:ARG:HB2	3:C:508:GLN:H	1.46	0.45
2:B:309:HIS:CE1	2:B:386:GLU:OE2	2.67	0.45
3:C:688:MET:HE2	3:C:688:MET:HA	1.98	0.45
3:C:373:ILE:HD12	3:C:376:MET:HE1	1.96	0.45
3:C:500:ALA:N	3:C:503:SER:H	2.02	0.45
3:C:528:ARG:C	3:C:532:GLN:HG2	2.38	0.45
1:A:216:ASN:HD22	1:A:275:VAL:HB	1.81	0.45
3:C:354:LYS:CG	3:C:564:THR:HG21	2.47	0.45
3:C:536:HIS:C	3:C:537:THR:OG1	2.59	0.45
1:A:414:GLU:CG	3:C:517:ASN:HD22	2.06	0.45
3:C:350:THR:CG2	8:C:802:ANP:O1G	2.57	0.45
3:C:469:ARG:HD2	3:C:512:GLU:OE1	2.17	0.44
2:B:420:GLU:HG2	3:C:423:GLU:H	1.82	0.44
3:C:524:LYS:HD3	3:C:581:TYR:CE2	2.52	0.44
1:A:109:THR:HG23	3:C:510:ARG:HH11	1.83	0.44
2:B:339:ASN:HB3	2:B:342:TYR:HD2	1.82	0.44
3:C:345:PHE:CE2	3:C:561:MET:HG3	2.52	0.44
1:A:409:VAL:HG11	3:C:518:LYS:HA	1.98	0.44
3:C:497:GLU:C	3:C:498:ARG:O	2.52	0.44
1:A:407:TRP:NE1	2:B:260:VAL:O	2.49	0.44
3:C:406:ASN:HA	3:C:515:GLU:HG3	1.99	0.44
1:A:7:ILE:HG21	1:A:153:LEU:HD21	2.00	0.44
1:A:100:ALA:HA	2:B:254:LYS:HG3	2.00	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:249:THR:C	3:C:251:THR:N	2.75	0.43
3:C:523:LEU:HA	3:C:545:THR:CG2	2.47	0.43
2:B:106:GLY:O	2:B:111:GLY:HA3	2.18	0.43
3:C:259:ILE:N	3:C:259:ILE:CD1	2.81	0.43
3:C:269:ASN:HD22	3:C:271:GLN:H	1.66	0.43
3:C:456:ARG:HH21	3:C:468:SER:HB3	1.83	0.43
3:C:688:MET:HE2	3:C:720:THR:HG21	2.00	0.43
3:C:343:THR:CG2	3:C:551:SER:OG	2.54	0.43
3:C:543:LYS:HA	3:C:543:LYS:HD3	1.81	0.43
3:C:506:ASP:C	3:C:507:ARG:CG	2.90	0.43
3:C:342:ALA:HA	3:C:558:ARG:O	2.19	0.43
3:C:456:ARG:HH12	3:C:472:ALA:CB	2.22	0.43
2:B:420:GLU:CG	3:C:422:LEU:HA	2.49	0.43
3:C:460:GLN:O	3:C:461:THR:CG2	2.65	0.43
1:A:217:LEU:HD21	1:A:368:LEU:HD23	2.00	0.43
3:C:356:HIS:O	3:C:360:GLY:HA2	2.18	0.43
2:B:308:ARG:HA	2:B:342:TYR:CE1	2.53	0.42
2:B:83:PHE:O	2:B:86:ILE:HG22	2.19	0.42
1:A:381:THR:HG22	1:A:383:ALA:H	1.85	0.42
2:B:141:LEU:HD12	2:B:172:MET:SD	2.60	0.42
3:C:289:LEU:HD11	3:C:565:ILE:HD11	2.01	0.42
2:B:349:ASN:O	2:B:352:LYS:HE2	2.19	0.42
3:C:357:THR:O	3:C:373:ILE:HD13	2.19	0.42
3:C:437:HIS:HD1	3:C:448:MET:HE1	1.83	0.42
3:C:508:GLN:HG3	3:C:512:GLU:HB2	2.02	0.42
2:B:306:ASP:O	2:B:309:HIS:CE1	2.74	0.41
3:C:523:LEU:HA	3:C:545:THR:HG21	2.03	0.41
3:C:528:ARG:O	3:C:532:GLN:N	2.53	0.41
1:A:407:TRP:CH2	2:B:256:ALA:HB1	2.55	0.41
1:A:414:GLU:HB2	3:C:498:ARG:HA	2.02	0.41
3:C:351:GLY:N	3:C:464:ASN:ND2	2.68	0.41
1:A:298:PRO:HA	1:A:301:GLN:CD	2.46	0.41
2:B:175:PRO:CB	3:C:733:GLY:HA3	2.51	0.41
2:B:404:PHE:CZ	3:C:699:ILE:CG2	2.91	0.41
3:C:295:LYS:CD	3:C:305:GLU:HB2	2.51	0.41
3:C:477:ILE:HG23	3:C:484:MET:CE	2.46	0.41
3:C:521:LEU:HD12	3:C:521:LEU:O	2.21	0.41
3:C:471:HIS:NE2	3:C:544:LEU:HD22	2.34	0.41
3:C:506:ASP:HB2	3:C:510:ARG:H	1.86	0.41
3:C:525:GLU:OE1	3:C:528:ARG:NE	2.53	0.41
2:B:175:PRO:HB2	3:C:733:GLY:HA3	2.02	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:582:ALA:CA	3:C:585:VAL:HG13	2.50	0.40
3:C:295:LYS:HD2	3:C:305:GLU:HB2	2.02	0.40
3:C:464:ASN:OD1	8:C:802:ANP:H5'1	2.22	0.40
3:C:509:THR:O	3:C:510:ARG:C	2.61	0.40
1:A:147:SER:HB2	1:A:190:THR:HB	2.03	0.40
3:C:506:ASP:HB2	3:C:510:ARG:N	2.36	0.40
2:B:427:ASP:CG	3:C:536:HIS:NE2	2.79	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	425/451 (94%)	409 (96%)	15 (4%)	1 (0%)	43 73
2	B	419/445 (94%)	408 (97%)	11 (3%)	0	100 100
3	C	471/573 (82%)	446 (95%)	15 (3%)	10 (2%)	5 31
All	All	1315/1469 (90%)	1263 (96%)	41 (3%)	11 (1%)	16 50

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	C	252	ASP
3	C	257	HIS
3	C	425	GLY
3	C	586	LYS
1	A	436	GLY
3	C	228	PRO
3	C	250	MET
3	C	427	GLN
3	C	507	ARG
3	C	256	GLU

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Mol	Chain	Res	Type
3	C	428	GLN

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	363/379 (96%)	353 (97%)	10 (3%)	38 68
2	B	365/383 (95%)	358 (98%)	7 (2%)	50 73
3	C	377/462 (82%)	334 (89%)	43 (11%)	5 24
All	All	1105/1224 (90%)	1045 (95%)	60 (5%)	20 53

All (60) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	114	ILE
1	A	163	LYS
1	A	209	ILE
1	A	220	GLU
1	A	221	ARG
1	A	316	CYS
1	A	345	ASP
1	A	414	GLU
1	A	417	GLU
1	A	437	VAL
2	B	59	ASN
2	B	158	ARG
2	B	238	VAL
2	B	247	GLN
2	B	284	ARG
2	B	298	SER
2	B	401	ARG
3	C	230	TRP
3	C	244	GLU
3	C	245	CYS
3	C	255	GLU

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Mol	Chain	Res	Type
3	C	258	ARG
3	C	259	ILE
3	C	261	VAL
3	C	310	CYS
3	C	322	GLU
3	C	332	LEU
3	C	370	SER
3	C	371	LYS
3	C	384	LEU
3	C	393	LEU
3	C	415	LYS
3	C	416	LYS
3	C	419	LEU
3	C	420	ARG
3	C	423	GLU
3	C	428	GLN
3	C	432	VAL
3	C	435	GLN
3	C	440	ASN
3	C	456	ARG
3	C	457	THR
3	C	501	ASP
3	C	502	THR
3	C	507	ARG
3	C	508	GLN
3	C	537	THR
3	C	544	LEU
3	C	548	LEU
3	C	549	ARG
3	C	553	ILE
3	C	555	GLU
3	C	556	ASN
3	C	576	LEU
3	C	585	VAL
3	C	586	LYS
3	C	587	GLU
3	C	629	GLU
3	C	688	MET
3	C	703	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (23) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	61	HIS
1	A	309	HIS
1	A	356	ASN
1	A	406	HIS
2	B	11	GLN
2	B	45	GLN
2	B	197	ASN
2	B	247	GLN
2	B	300	ASN
2	B	309	HIS
2	B	331	GLN
2	B	424	ASN
3	C	269	ASN
3	C	307	GLN
3	C	387	GLN
3	C	435	GLN
3	C	460	GLN
3	C	517	ASN
3	C	533	ASN
3	C	546	GLN
3	C	556	ASN
3	C	645	ASN
3	C	711	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 6 ligands modelled in this entry, 2 are monoatomic - leaving 4 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
7	LOC	B	502	-	31,31,31	0.55	0	44,44,44	0.61	0
6	GDP	B	501	-	29,30,30	0.37	0	45,47,47	0.52	0
8	ANP	C	802	5	33,33,33	1.32	2 (6%)	45,52,52	1.00	3 (6%)
4	GTP	A	501	5	33,34,34	0.61	1 (3%)	50,54,54	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
7	LOC	B	502	-	-	0/12/25/25	0/3/3/3
6	GDP	B	501	-	-	5/16/32/32	0/3/3/3
8	ANP	C	802	5	-	1/18/38/38	0/3/3/3
4	GTP	A	501	5	-	7/22/38/38	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	C	802	ANP	PG-O1G	5.58	1.54	1.46
8	C	802	ANP	PG-O3G	-4.34	1.45	1.56
4	A	501	GTP	PG-O1G	2.57	1.58	1.50

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	C	802	ANP	O1G-PG-N3B	3.80	117.37	111.77
8	C	802	ANP	O3G-PG-O1G	-2.85	106.31	113.45
8	C	802	ANP	O2G-PG-O1G	-2.38	107.47	113.45

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	501	GTP	PB-O3B-PG-O2G

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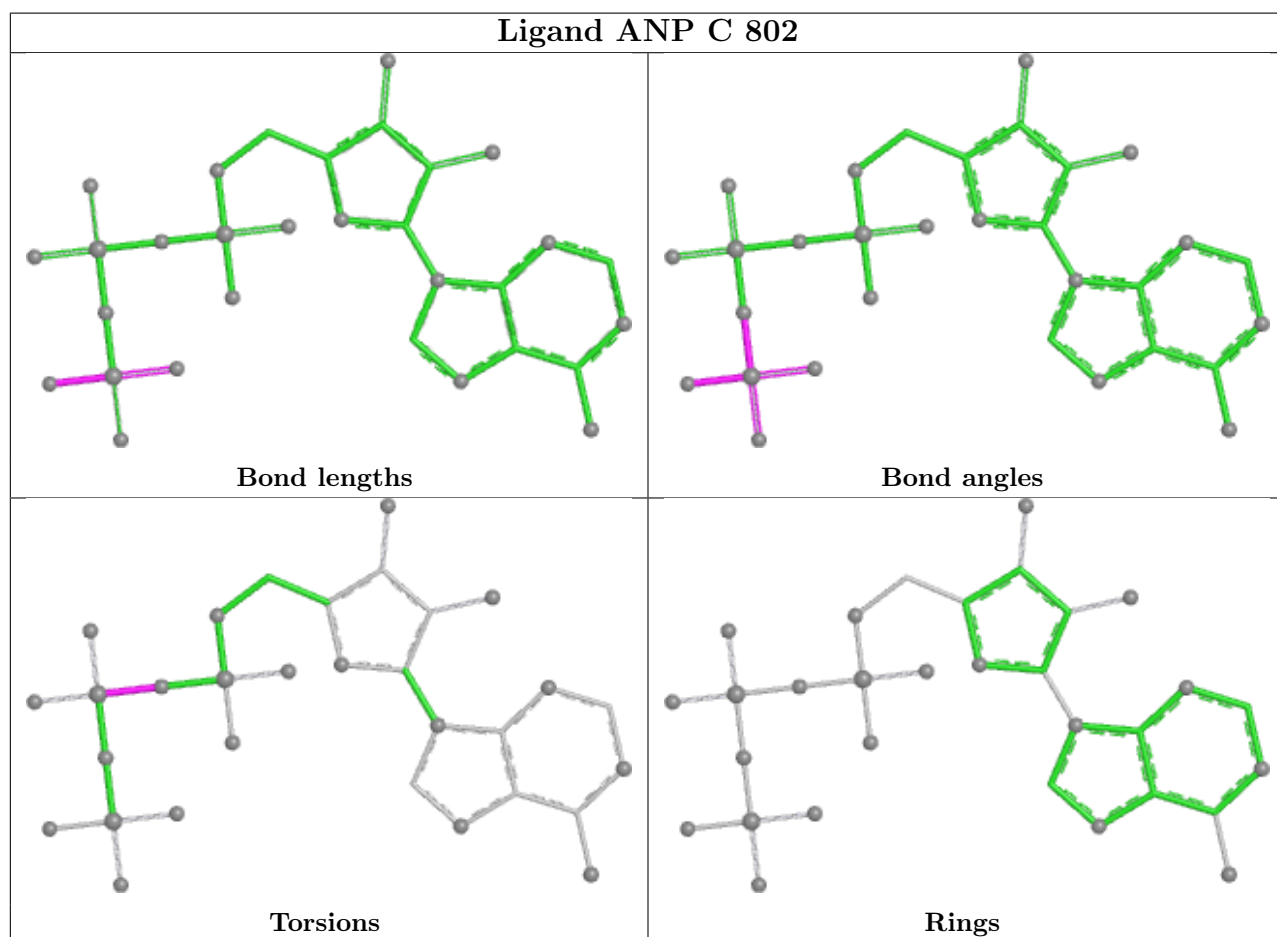
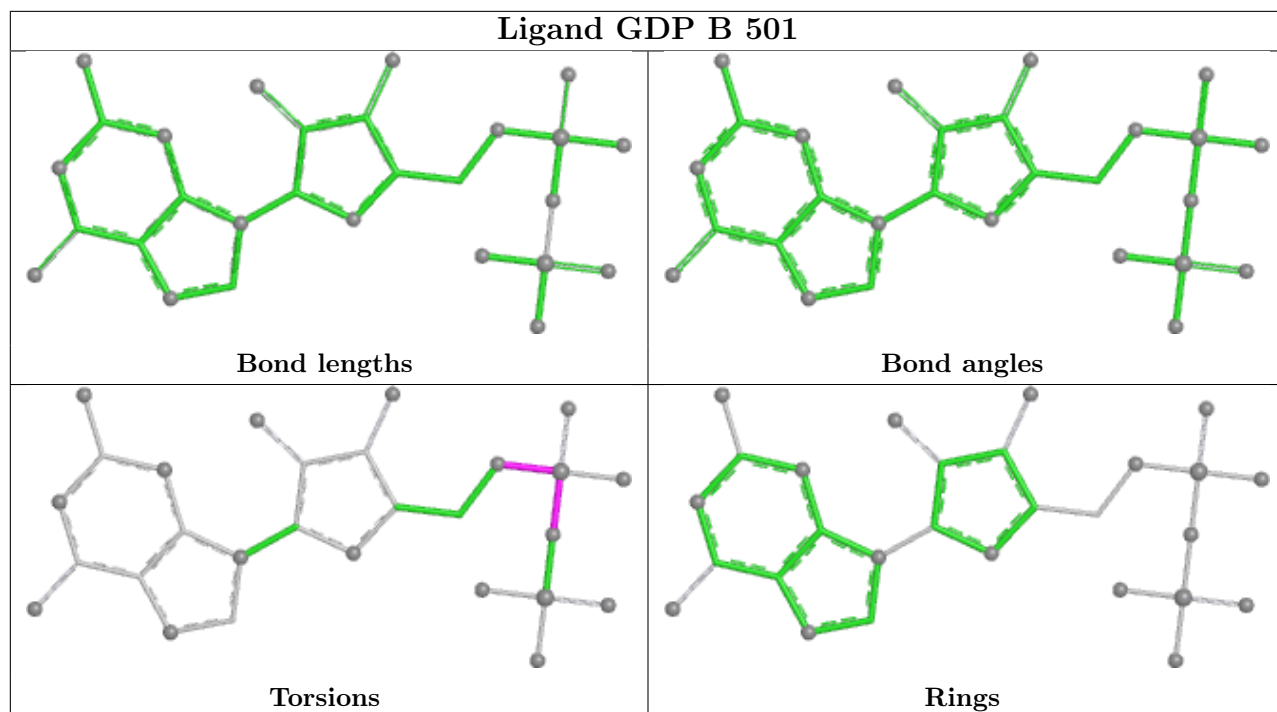
Mol	Chain	Res	Type	Atoms
4	A	501	GTP	C5'-O5'-PA-O3A
4	A	501	GTP	C5'-O5'-PA-O1A
4	A	501	GTP	C5'-O5'-PA-O2A
6	B	501	GDP	C5'-O5'-PA-O3A
6	B	501	GDP	C5'-O5'-PA-O1A
6	B	501	GDP	C5'-O5'-PA-O2A
4	A	501	GTP	PB-O3A-PA-O2A
6	B	501	GDP	PB-O3A-PA-O2A
4	A	501	GTP	C4'-C5'-O5'-PA
6	B	501	GDP	PB-O3A-PA-O1A
8	C	802	ANP	PA-O3A-PB-O1B
4	A	501	GTP	PB-O3A-PA-O1A

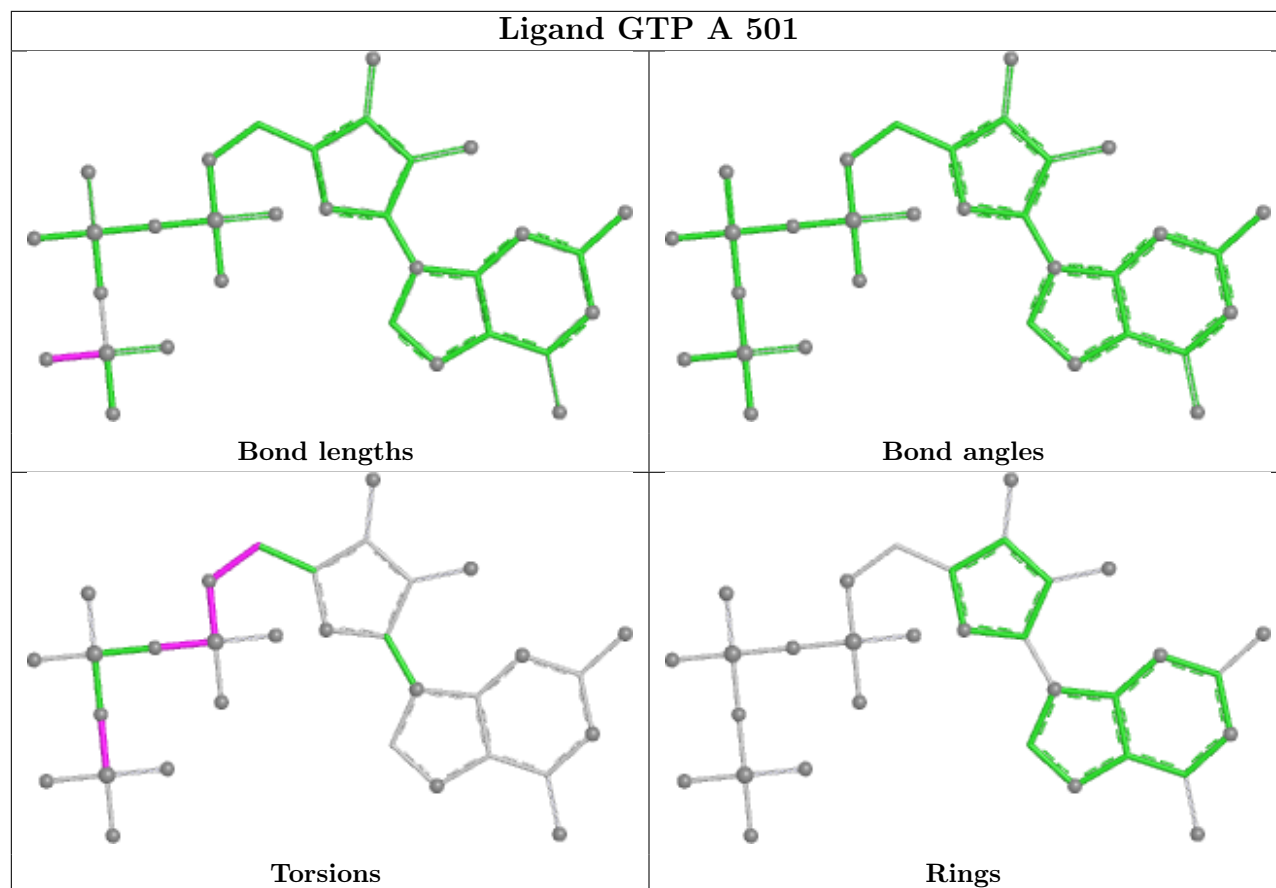
There are no ring outliers.

2 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	B	502	LOC	2	0
8	C	802	ANP	8	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

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	429/451 (95%)	0.16	5 (1%) 76 58	62, 94, 140, 161	0
2	B	423/445 (95%)	0.19	9 (2%) 63 43	66, 103, 136, 163	2 (0%)
3	C	477/573 (83%)	0.24	12 (2%) 58 39	68, 107, 145, 174	0
All	All	1329/1469 (90%)	0.20	26 (1%) 65 45	62, 102, 140, 174	2 (0%)

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	307	PRO	4.1
2	B	304	ALA	3.9
2	B	438	ALA	3.4
2	B	276	THR	3.4
1	A	335	ILE	3.3
1	A	316	CYS	3.3
1	A	238	ILE	3.2
3	C	579	LEU	3.2
3	C	588	LEU	3.1
3	C	257	HIS	3.0
3	C	473	CYS	2.9
3	C	527	ILE	2.9
3	C	309	PHE	2.8
3	C	469	ARG	2.6
3	C	534	LYS	2.6
3	C	463	ALA	2.4
2	B	354	ALA	2.4
1	A	136	LEU	2.4
2	B	172	MET	2.2
3	C	495	GLY	2.2
3	C	713	ALA	2.2
1	A	38	SER	2.2
3	C	373	ILE	2.2

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Mol	Chain	Res	Type	RSRZ
2	B	203	CYS	2.2
2	B	181	VAL	2.1
2	B	134	GLY	2.1

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 oligosaccharides in this entry.

6.4 Ligands [i](#)

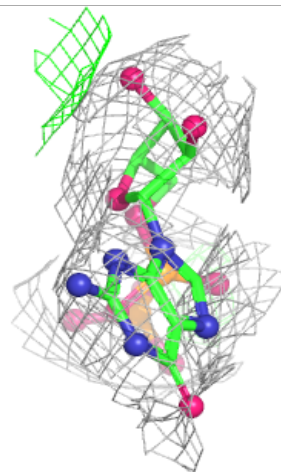
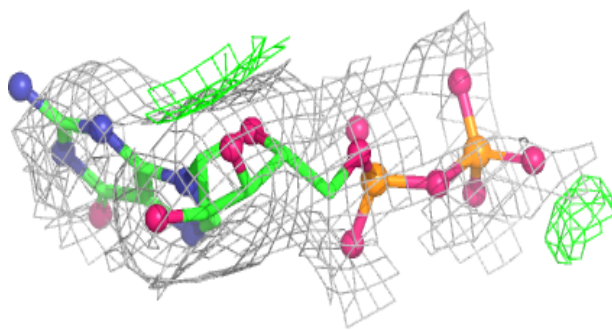
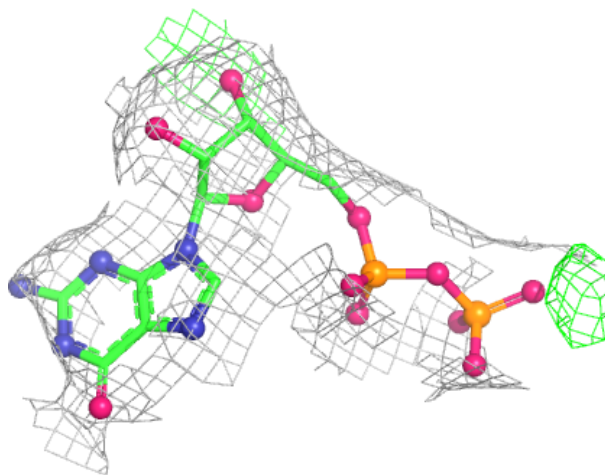
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	MG	A	502	1/1	0.77	0.28	54,54,54,54	0
6	GDP	B	501	28/28	0.92	0.09	103,108,119,122	0
4	GTP	A	501	32/32	0.94	0.09	72,82,89,93	0
7	LOC	B	502	29/29	0.94	0.11	75,84,90,92	0
8	ANP	C	802	31/31	0.94	0.07	88,103,113,117	0
5	MG	C	801	1/1	0.97	0.05	70,70,70,70	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.

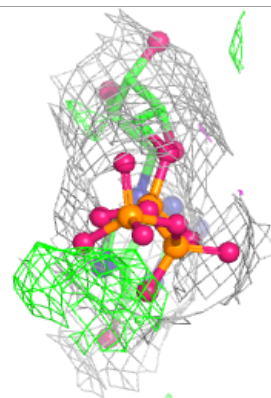
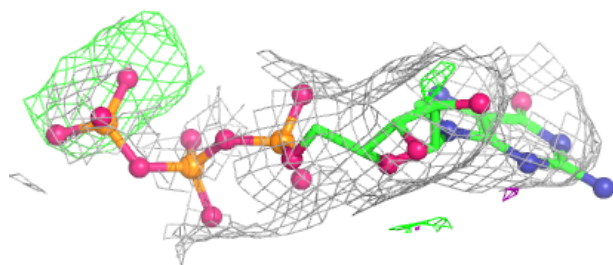
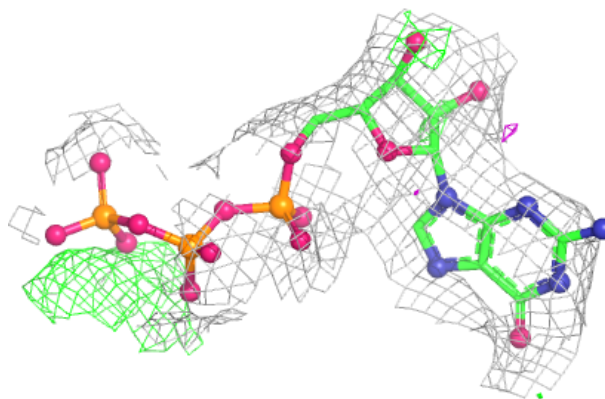
Electron density around GDP B 501:

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

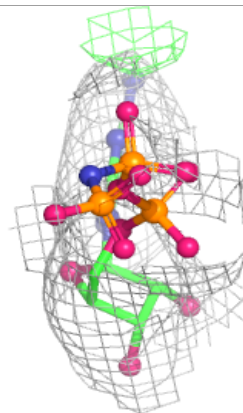
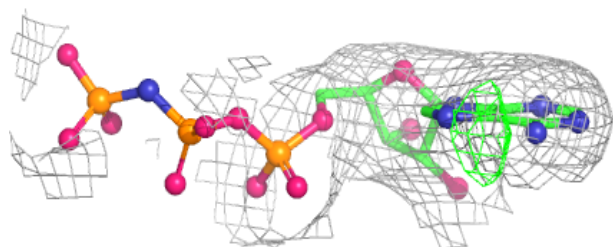
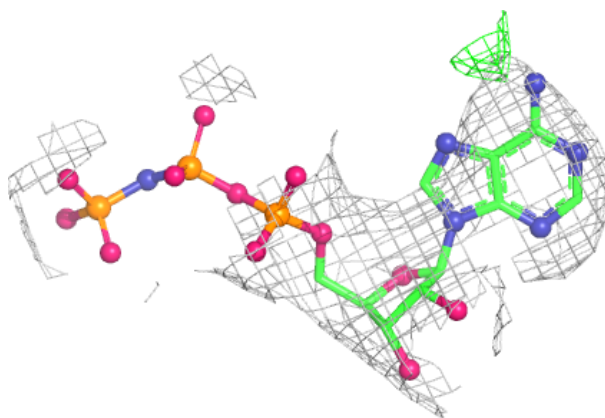


Electron density around GTP A 501:

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

**Electron density around ANP C 802:**

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



6.5 Other polymers

There are no such residues in this entry.