



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 08:10 AM UTC

PDB ID : 5S4V / pdb_00005s4v
Title : Tubulin-Z57040482-complex
Authors : Muehlethaler, T.; Gioia, D.; Protá, A.E.; Sharpe, M.E.; Cavalli, A.; Steinmetz, M.O.
Deposited on : 2020-11-08
Resolution : 2.30 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

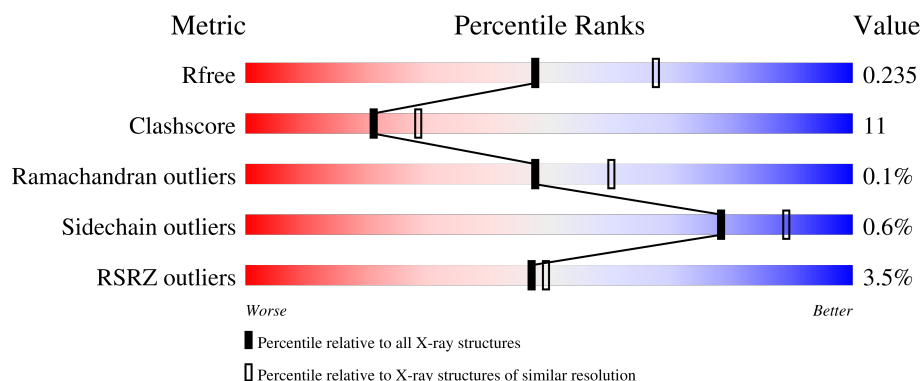
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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% 75% 22% . .
1	C	451	 2% 76% 21% .
2	B	445	 3% 69% 26% .
2	D	445	 4% 74% 22% .
3	E	143	 4% 74% 11% . 14%

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Mol	Chain	Length	Quality of chain
4	F	384	6% 69% 21% 10%

2 Entry composition

There are 12 unique types of molecules in this entry. The entry contains 18048 atoms, of which 18 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
1	A	438	Total	C	N	O	S	0	0	0
			3424	2167	582	653	22			
1	C	440	Total	C	N	O	S	0	1	0
			3443	2178	585	657	23			

- Molecule 2 is a protein called Tubulin beta-2B chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	425	Total	C	N	O	S	1	2	0
			3367	2114	578	647	28			
2	D	429	Total	C	N	O	S	5	0	0
			3358	2107	573	651	27			

- Molecule 3 is a protein called Stathmin-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	E	123	Total	C	N	O	S	0	0	0
			1014	625	183	201	5			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	3	MET	-	initiating methionine	UNP P63043
E	4	ALA	-	expression tag	UNP P63043

- Molecule 4 is a protein called Tubulin-Tyrosine Ligase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	F	347	Total	C	N	O	S	0	0	0
			2853	1830	490	519	14			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	379	HIS	-	expression tag	UNP E1BQ43
F	380	HIS	-	expression tag	UNP E1BQ43
F	381	HIS	-	expression tag	UNP E1BQ43
F	382	HIS	-	expression tag	UNP E1BQ43
F	383	HIS	-	expression tag	UNP E1BQ43
F	384	HIS	-	expression tag	UNP E1BQ43

- Molecule 5 is GUANOSINE-5'-TRIPHOSPHATE (CCD ID: GTP) (formula: $C_{10}H_{16}N_5O_{14}P_3$).



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

- Molecule 6 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	Mg	0	0
			1	1		
6	B	1	Total	Mg	0	0
			1	1		
6	C	1	Total	Mg	0	0
			1	1		
6	D	1	Total	Mg	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	F	1	Total	Mg	0	0
			1	1		

- Molecule 7 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	2	Total	Ca	0	0
			2	2		
7	B	1	Total	Ca	0	0
			1	1		
7	C	1	Total	Ca	0	0
			1	1		

- Molecule 8 is GUANOSINE-5'-DIPHOSPHATE (CCD ID: GDP) (formula: C₁₀H₁₅N₅O₁₁P₂).



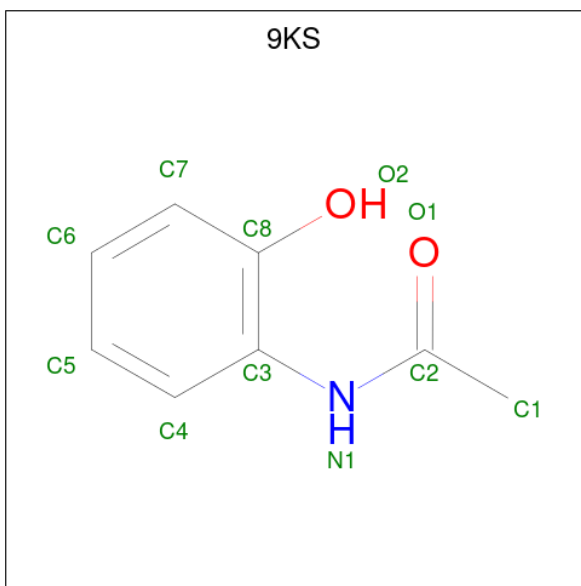
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
8	B	1	Total 28	C 10	N 5	O 11	P 2	0	0
8	D	1	Total 28	C 10	N 5	O 11	P 2	0	0

- Molecule 9 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: C₆H₁₃NO₄S).



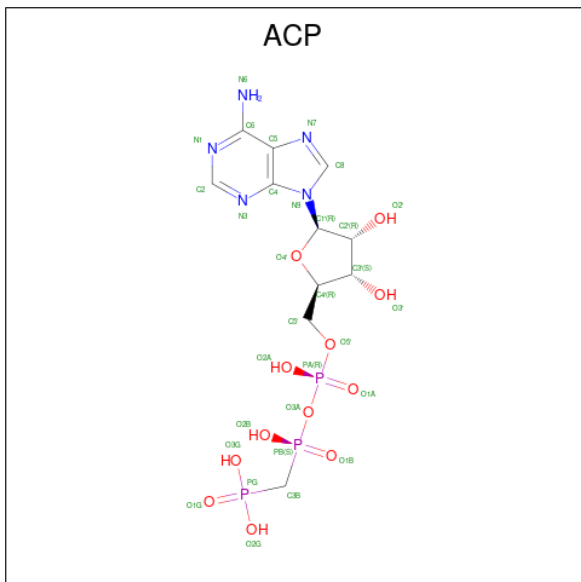
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
9	B	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 10 is N-(2-hydroxyphenyl)acetamide (CCD ID: 9KS) (formula: $C_8H_9NO_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
10	B	1	Total	C	H	N	O	0	0
			20	8	9	1	2		
10	B	1	Total	C	H	N	O	0	0
			20	8	9	1	2		

- Molecule 11 is PHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (CCD ID: ACP) (formula: $C_{11}H_{18}N_5O_{12}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
11	F	1	Total	C	N	O	P	0	0
			31	11	5	12	3		

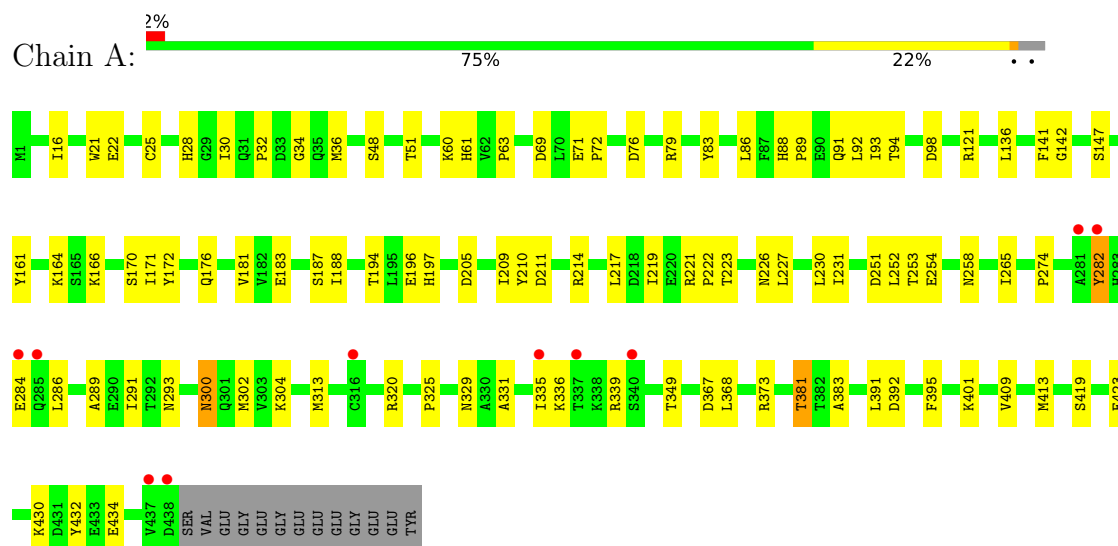
- Molecule 12 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	A	68	Total	O	0	0
			68	68		
12	B	76	Total	O	0	0
			76	76		
12	C	175	Total	O	0	0
			175	175		
12	D	34	Total	O	0	0
			34	34		
12	E	8	Total	O	0	0
			8	8		
12	F	16	Total	O	0	0
			16	16		

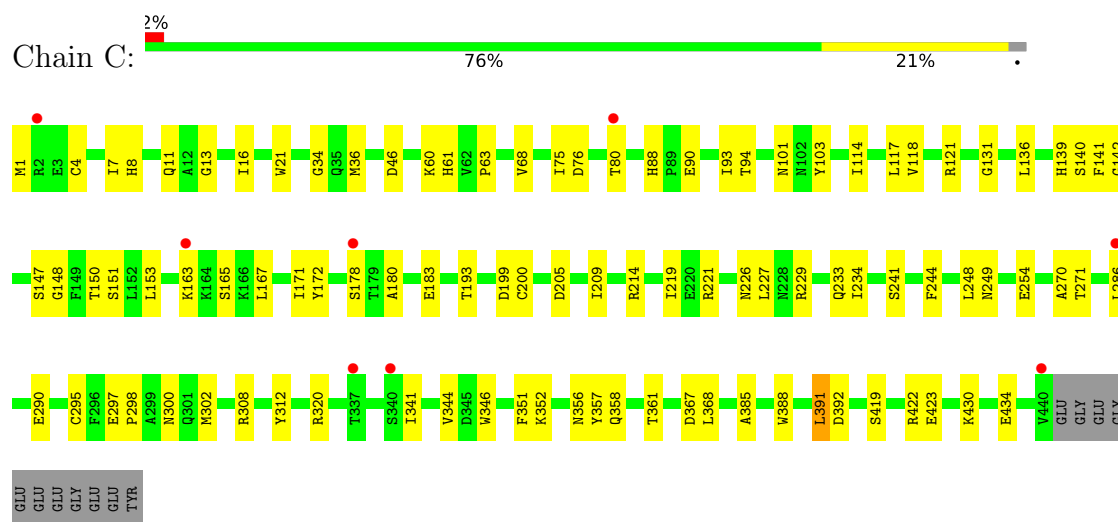
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Tubulin alpha-1B chain

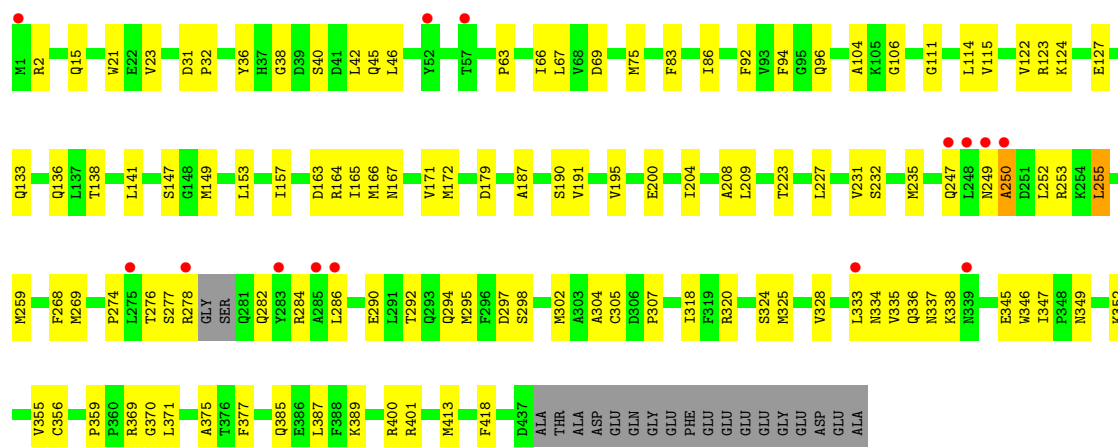


- Molecule 1: Tubulin alpha-1B chain

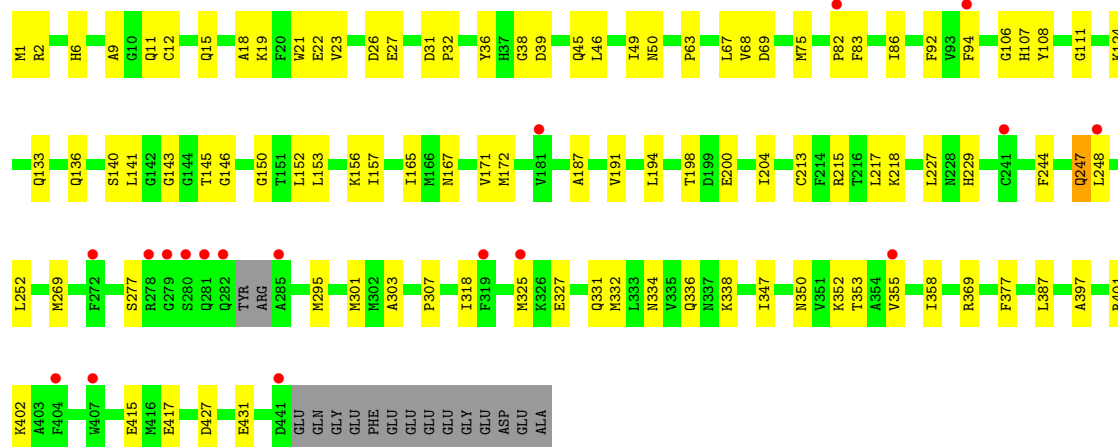
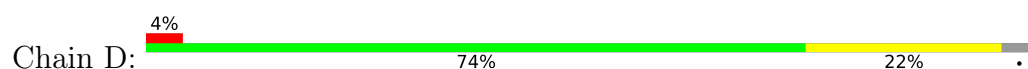


- Molecule 2: Tubulin beta-2B chain

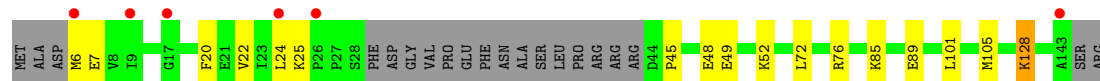




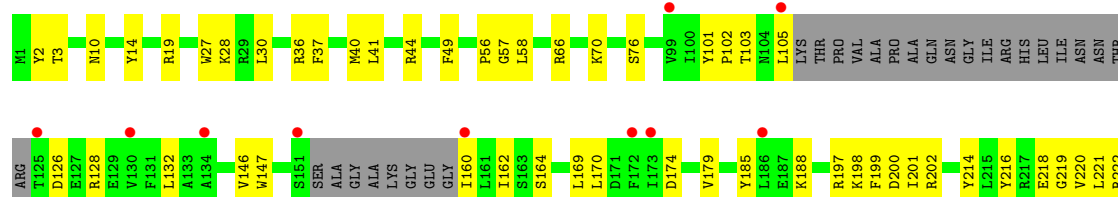
• Molecule 2: Tubulin beta-2B chain

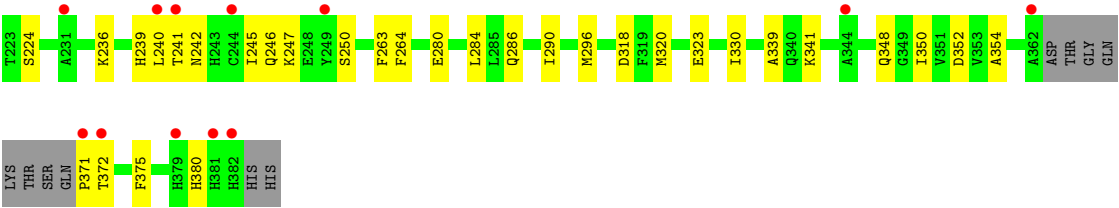


• Molecule 3: Stathmin-4



• Molecule 4: Tubulin-Tyrosine Ligase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	104.42Å 158.06Å 178.36Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	63.02 – 2.30 63.02 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.8 (63.02-2.30) 90.5 (63.02-2.30)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.14 (at 2.29Å)	Xtriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, R_{free}	0.205 , 0.242 (Not available) , 0.235	Depositor DCC
R_{free} test set	6506 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	58.5	Xtriage
Anisotropy	0.305	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 43.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	18048	wwPDB-VP
Average B, all atoms (Å ²)	76.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.41% 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: 9KS, MG, GTP, CA, GDP, ACP, MES

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	0.12	0/3502	0.29	0/4754
1	C	0.13	0/3521	0.31	0/4780
2	B	0.12	0/3441	0.31	0/4657
2	D	0.11	0/3431	0.29	0/4647
3	E	0.10	0/1022	0.23	0/1356
4	F	0.09	0/2920	0.27	0/3946
All	All	0.11	0/17837	0.29	0/24140

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3424	0	3334	78	0
1	C	3443	0	3352	73	0
2	B	3367	0	3243	100	0
2	D	3358	0	3231	67	0
3	E	1014	0	1029	12	0
4	F	2853	0	2818	67	0
5	A	32	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	C	32	0	12	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
6	C	1	0	0	0	0
6	D	1	0	0	0	0
6	F	1	0	0	0	0
7	A	2	0	0	0	0
7	B	1	0	0	0	0
7	C	1	0	0	0	0
8	B	28	0	12	1	0
8	D	28	0	12	3	0
9	B	12	0	12	1	0
10	B	22	18	0	3	0
11	F	31	0	14	2	0
12	A	68	0	0	2	0
12	B	76	0	0	4	0
12	C	175	0	0	3	0
12	D	34	0	0	2	0
12	E	8	0	0	0	0
12	F	16	0	0	0	0
All	All	18030	18	17081	382	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 (382) 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)
4:F:102:PRO:HG2	4:F:105:LEU:HD13	1.51	0.91
2:D:217:LEU:HA	2:D:277:SER:HB3	1.50	0.91
2:D:1:MET:HE2	2:D:50:ASN:HB2	1.51	0.89
4:F:236:LYS:HB3	4:F:240:LEU:HD13	1.58	0.83
1:C:234:ILE:HG12	1:C:302:MET:HE2	1.64	0.79
1:A:335:ILE:HG23	1:A:339:ARG:HG3	1.63	0.79
1:C:254:GLU:HG2	1:C:352:LYS:HE2	1.65	0.78
1:C:209:ILE:HD11	1:C:302:MET:HE3	1.67	0.76
1:C:76:ASP:O	1:C:80:THR:HG22	1.85	0.76
2:B:274:PRO:HB3	2:B:286:LEU:HD22	1.69	0.75
4:F:10:ASN:HB2	4:F:44:ARG:HH22	1.52	0.74
2:B:337:ASN:OD1	4:F:36:ARG:HD3	1.88	0.74
2:B:2:ARG:HB2	2:B:133:GLN:HG3	1.69	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:176:GLN:HG3	4:F:56:PRO:HB3	1.70	0.72
2:D:295:MET:HE2	2:D:377:PHE:HB2	1.73	0.71
2:B:250:ALA:HB1	2:B:255:LEU:HD13	1.72	0.71
1:A:293:ASN:OD1	1:A:339:ARG:NH2	2.23	0.70
4:F:241:THR:OG1	11:F:401:ACP:O3'	1.97	0.70
2:D:136:GLN:HA	2:D:167:ASN:O	1.92	0.69
1:C:1:MET:O	12:C:601:HOH:O	2.09	0.69
4:F:102:PRO:HG2	4:F:105:LEU:CD1	2.22	0.69
2:B:250:ALA:HB1	2:B:255:LEU:CD1	2.23	0.68
2:D:325:MET:HE2	2:D:355:VAL:HG21	1.76	0.68
2:D:431:GLU:OE1	12:D:601:HOH:O	2.10	0.68
2:B:69:ASP:O	2:B:94:PHE:HA	1.93	0.68
2:B:284:ARG:NH2	2:B:290:GLU:OE2	2.28	0.67
4:F:371:PRO:HA	4:F:372:THR:O	1.95	0.67
1:A:336:LYS:HG3	3:E:24:LEU:HD13	1.76	0.66
1:A:166:LYS:HE2	1:A:197:HIS:O	1.94	0.66
2:B:2:ARG:HB2	2:B:133:GLN:CG	2.24	0.66
2:D:172:MET:HG3	2:D:387:LEU:HD11	1.78	0.66
1:A:217:LEU:HD21	1:A:368:LEU:HD23	1.76	0.66
2:D:327:GLU:O	2:D:331:GLN:HG2	1.95	0.65
2:B:2:ARG:HB2	2:B:133:GLN:HE21	1.60	0.65
2:D:397:ALA:O	2:D:401:ARG:NH1	2.29	0.65
1:A:210:TYR:CE1	1:A:222:PRO:HD2	2.32	0.65
1:C:209:ILE:HD11	1:C:302:MET:CE	2.27	0.65
3:E:85:LYS:O	3:E:89:GLU:HG3	1.96	0.64
2:B:164:ARG:HD2	12:B:661:HOH:O	1.96	0.64
2:B:163:ASP:OD1	12:B:601:HOH:O	2.15	0.64
2:B:333:LEU:HD13	4:F:57:GLY:HA3	1.78	0.64
2:D:2:ARG:NH1	12:D:602:HOH:O	2.24	0.64
1:A:187:SER:HB3	1:A:391:LEU:HD21	1.79	0.64
4:F:242:ASN:HD22	4:F:245:ILE:HD12	1.63	0.63
1:C:214:ARG:HG2	1:C:219:ILE:O	1.98	0.63
2:D:301:MET:HE3	2:D:307:PRO:HG3	1.80	0.63
1:C:270:ALA:O	1:C:302:MET:HG2	1.97	0.63
4:F:202:ARG:HB3	4:F:220:VAL:HG23	1.81	0.63
2:D:83:PHE:O	2:D:86:ILE:HG22	1.99	0.63
2:B:83:PHE:O	2:B:86:ILE:HG22	1.99	0.62
2:D:334:ASN:HD21	2:D:338:LYS:HE3	1.65	0.62
4:F:318:ASP:OD2	11:F:401:ACP:O2G	2.17	0.62
1:C:1:MET:HE3	1:C:131:GLY:HA3	1.82	0.61
1:C:209:ILE:HG22	1:C:227:LEU:HD22	1.82	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:138:THR:HG21	2:B:235:MET:HE1	1.82	0.61
4:F:146:VAL:HG22	4:F:164:SER:HB3	1.82	0.61
1:C:172:TYR:CE2	1:C:391:LEU:HD22	2.35	0.61
2:D:1:MET:CE	2:D:50:ASN:HB2	2.28	0.61
1:C:249:ASN:OD1	1:C:356:ASN:ND2	2.33	0.61
4:F:371:PRO:HA	4:F:372:THR:C	2.25	0.61
1:A:254:GLU:HG2	1:A:258:ASN:ND2	2.16	0.60
4:F:200:ASP:OD1	4:F:222:ARG:HB2	2.02	0.60
2:B:295:MET:CG	2:B:377:PHE:HB2	2.33	0.59
2:B:269:MET:HE1	2:B:307:PRO:HG3	1.82	0.59
2:D:19:LYS:O	2:D:23:VAL:HG23	2.03	0.59
2:B:253[A]:ARG:NH1	9:B:504:MES:O3S	2.35	0.59
1:A:36:MET:HB3	1:A:61:HIS:CE1	2.37	0.59
4:F:280:GLU:OE1	4:F:284:LEU:HD23	2.03	0.59
1:C:221:ARG:HG3	2:D:325:MET:HG2	1.83	0.58
1:A:32:PRO:HA	1:A:83:TYR:CD2	2.38	0.58
2:B:157:ILE:HG21	2:B:166:MET:HE1	1.86	0.58
2:D:141:LEU:HD12	2:D:172:MET:SD	2.43	0.58
2:B:204:ILE:HD13	2:B:231:VAL:HG13	1.85	0.58
1:C:93:ILE:HG22	1:C:114:ILE:HD11	1.84	0.58
1:A:28:HIS:O	1:A:36:MET:HE3	2.04	0.57
4:F:371:PRO:CA	4:F:372:THR:HB	2.34	0.57
2:B:255:LEU:HB3	2:B:259[B]:MET:CE	2.34	0.57
4:F:236:LYS:HB3	4:F:240:LEU:CD1	2.30	0.57
2:D:244:PHE:CE1	2:D:358:ILE:HD12	2.40	0.57
2:B:38:GLY:HA3	2:B:45:GLN:OE1	2.05	0.56
1:C:151:SER:HB2	1:C:193:THR:CG2	2.35	0.56
2:D:46:LEU:HA	2:D:49:ILE:HB	1.87	0.56
4:F:320:MET:HG3	4:F:330:ILE:HD11	1.87	0.56
1:A:88:HIS:CD2	1:A:91:GLN:HG3	2.41	0.56
2:B:106:GLY:O	2:B:111:GLY:HA3	2.06	0.56
10:B:505:9KS:O2	10:B:505:9KS:O1	2.24	0.56
2:B:325:MET:HE2	2:B:355:VAL:HG21	1.87	0.55
2:B:172:MET:HG3	2:B:387:LEU:HD11	1.87	0.55
1:A:98:ASP:HB2	5:A:501:GTP:O2G	2.06	0.55
2:D:21:TRP:CZ3	2:D:63:PRO:HB3	2.41	0.55
1:C:286:LEU:HA	1:C:290:GLU:OE1	2.06	0.55
1:C:93:ILE:HD11	1:C:121:ARG:HG3	1.87	0.55
2:B:67:LEU:HD22	2:B:92:PHE:CE2	2.42	0.55
1:C:271:THR:HG21	1:C:295:CYS:O	2.06	0.55
4:F:19:ARG:HD2	4:F:19:ARG:O	2.07	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:325:PRO:HB3	3:E:20:PHE:CE1	2.42	0.54
2:B:141:LEU:HD12	2:B:172:MET:SD	2.48	0.54
1:C:4[A]:CYS:SG	1:C:136:LEU:HG	2.47	0.54
1:C:180:ALA:O	1:C:183:GLU:HG3	2.06	0.54
2:D:67:LEU:HD22	2:D:92:PHE:CE2	2.42	0.54
1:C:308:ARG:HD2	12:C:736:HOH:O	2.06	0.54
4:F:371:PRO:HA	4:F:372:THR:HB	1.88	0.54
1:C:298:PRO:HG2	1:C:308:ARG:NH2	2.23	0.54
1:A:335:ILE:HG23	1:A:339:ARG:CG	2.36	0.54
2:B:66:ILE:HD12	2:B:122:VAL:HG22	1.89	0.54
2:D:11:GLN:O	2:D:15:GLN:HG2	2.07	0.54
1:A:227:LEU:O	1:A:231:ILE:HG13	2.08	0.53
1:C:165:SER:HA	1:C:199:ASP:OD2	2.07	0.53
2:D:171:VAL:HA	2:D:204:ILE:O	2.08	0.53
1:C:244:PHE:CD1	1:C:358:GLN:HG2	2.42	0.53
1:C:320:ARG:HA	1:C:356:ASN:O	2.07	0.53
2:D:165:ILE:HG21	2:D:252:LEU:HB3	1.91	0.53
2:B:115:VAL:HG23	2:B:153:LEU:HD23	1.90	0.53
2:B:136:GLN:HA	2:B:167:ASN:O	2.09	0.53
1:C:172:TYR:HB3	1:C:205:ASP:HA	1.91	0.53
2:D:124:LYS:C	2:D:124:LYS:HD3	2.33	0.53
1:C:229:ARG:NH1	12:C:608:HOH:O	2.40	0.53
2:B:21:TRP:CZ3	2:B:63:PRO:HB3	2.44	0.53
2:B:324:SER:O	2:B:328:VAL:HG23	2.09	0.53
1:A:430:LYS:O	1:A:434:GLU:HG3	2.09	0.53
2:B:36:TYR:CD1	2:B:46:LEU:HD21	2.43	0.53
4:F:128:ARG:NH2	4:F:174:ASP:OD1	2.41	0.53
2:D:1:MET:HG3	2:D:50:ASN:HB2	1.91	0.52
2:D:152:LEU:O	2:D:156:LYS:HG2	2.09	0.52
4:F:286:GLN:O	4:F:290:ILE:HG13	2.09	0.52
1:C:167:LEU:HG	1:C:200:CYS:HB3	1.91	0.52
4:F:147:TRP:HB2	4:F:169:LEU:CD1	2.39	0.52
2:D:2:ARG:HB3	2:D:133:GLN:CG	2.38	0.52
4:F:188:LYS:HD3	4:F:323:GLU:OE2	2.10	0.52
2:B:96:GLN:HB3	1:C:1:MET:HE2	1.92	0.52
2:B:318:ILE:N	2:B:318:ILE:HD12	2.25	0.52
1:C:21:TRP:CZ3	1:C:63:PRO:HB3	2.45	0.52
2:D:67:LEU:N	2:D:67:LEU:HD12	2.25	0.52
2:B:223:THR:O	2:B:227:LEU:HD13	2.10	0.52
1:A:214:ARG:HG2	1:A:219:ILE:O	2.10	0.51
1:A:265:ILE:HG23	1:A:432:TYR:CE1	2.45	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:104:ALA:HB2	2:B:413:MET:SD	2.49	0.51
2:B:123:ARG:O	2:B:127:GLU:HG3	2.11	0.51
2:D:106:GLY:O	2:D:111:GLY:HA3	2.09	0.51
1:A:25:CYS:SG	1:A:86:LEU:HD11	2.51	0.51
1:A:69:ASP:O	1:A:94:THR:HA	2.11	0.51
1:C:233:GLN:HG3	1:C:368:LEU:CD1	2.41	0.51
3:E:128:LYS:O	3:E:128:LYS:HD3	2.10	0.51
4:F:103:THR:HG23	4:F:128:ARG:NH2	2.26	0.51
2:B:40:SER:OG	2:B:42:LEU:HD13	2.11	0.51
2:B:200:GLU:HG2	2:B:268:PHE:CE2	2.46	0.51
2:D:332:MET:O	2:D:336:GLN:HG3	2.11	0.51
2:D:347:ILE:HG22	2:D:350:ASN:HB3	1.93	0.50
4:F:202:ARG:HB3	4:F:220:VAL:CG2	2.40	0.50
2:B:124:LYS:HD3	2:B:124:LYS:C	2.37	0.50
1:A:76:ASP:OD1	1:A:79:ARG:NH1	2.45	0.50
2:D:318:ILE:N	2:D:318:ILE:HD12	2.25	0.50
2:D:69:ASP:O	2:D:94:PHE:HA	2.11	0.50
4:F:242:ASN:HD22	4:F:245:ILE:CD1	2.24	0.50
1:A:71:GLU:HG2	1:A:72:PRO:N	2.25	0.50
1:A:88:HIS:HB2	1:A:89:PRO:HD2	1.94	0.50
1:A:187:SER:CB	1:A:391:LEU:HD21	2.41	0.50
4:F:246:GLN:O	4:F:250:SER:HB3	2.12	0.50
1:A:22:GLU:HG3	1:A:83:TYR:CE1	2.47	0.50
2:B:276:THR:HG21	2:B:282:GLN:HA	1.94	0.50
1:A:93:ILE:HD11	1:A:121:ARG:HG3	1.94	0.49
1:A:223:THR:HB	2:B:247:GLN:NE2	2.27	0.49
2:B:96:GLN:CB	1:C:1:MET:HE2	2.42	0.49
1:C:419:SER:O	1:C:423:GLU:HG3	2.12	0.49
1:A:335:ILE:CG2	1:A:339:ARG:HG3	2.40	0.49
2:D:387:LEU:HD23	2:D:387:LEU:C	2.36	0.49
2:B:274:PRO:HB3	2:B:286:LEU:CD2	2.41	0.49
1:C:234:ILE:CG1	1:C:302:MET:HE2	2.39	0.49
2:D:143:GLY:HA3	8:D:501:GDP:O3A	2.12	0.49
1:C:344:VAL:HG21	1:C:346:TRP:CE2	2.47	0.49
2:D:334:ASN:ND2	2:D:338:LYS:HE3	2.27	0.49
4:F:10:ASN:CB	4:F:44:ARG:HH22	2.23	0.49
1:A:22:GLU:HG3	1:A:83:TYR:HE1	1.77	0.49
1:A:265:ILE:HG21	1:A:313:MET:HE1	1.94	0.49
2:B:286:LEU:HD12	2:B:290:GLU:OE1	2.12	0.49
1:A:254:GLU:HG2	1:A:258:ASN:HD21	1.77	0.49
2:D:187:ALA:O	2:D:191:VAL:HG23	2.13	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:181:VAL:HG11	2:B:347:ILE:CG2	2.43	0.49
2:D:21:TRP:CE3	2:D:63:PRO:HB3	2.47	0.49
2:D:145:THR:HB	8:D:501:GDP:O2B	2.13	0.49
2:D:1:MET:HE2	2:D:50:ASN:CB	2.33	0.48
2:B:276:THR:HG22	2:B:277:SER:O	2.12	0.48
1:C:254:GLU:HG2	1:C:352:LYS:CE	2.38	0.48
1:C:117:LEU:HD11	1:C:121:ARG:NH2	2.28	0.48
4:F:214:TYR:HB3	4:F:375:PHE:HB3	1.95	0.48
4:F:222:ARG:O	4:F:241:THR:HB	2.13	0.48
2:B:2:ARG:CB	2:B:133:GLN:HE21	2.27	0.48
2:D:6:HIS:CD2	2:D:21:TRP:HE1	2.32	0.48
1:A:320:ARG:HD2	12:A:642:HOH:O	2.14	0.48
1:A:188:ILE:HD12	1:A:395:PHE:CD2	2.49	0.48
1:A:211:ASP:OD2	1:A:304:LYS:NZ	2.23	0.48
2:B:2:ARG:HD3	2:B:133:GLN:NE2	2.28	0.48
2:B:334:ASN:OD1	2:B:338:LYS:HD3	2.13	0.48
1:C:34:GLY:HA3	1:C:60:LYS:HG3	1.95	0.48
1:A:274:PRO:HB3	1:A:286:LEU:HD12	1.94	0.48
2:B:2:ARG:HB2	2:B:133:GLN:NE2	2.28	0.47
1:C:241:SER:HA	1:C:249:ASN:OD1	2.14	0.47
1:A:329:ASN:HB3	3:E:6:MET:HE3	1.96	0.47
1:A:209:ILE:HG23	1:A:230:LEU:HD23	1.95	0.47
1:C:312:TYR:CD1	1:C:341:ILE:HG23	2.50	0.47
1:A:142:GLY:HA3	1:A:183:GLU:HG2	1.95	0.47
1:A:221:ARG:HG3	2:B:325:MET:HG2	1.96	0.47
2:B:292:THR:HG22	2:B:335:VAL:HG21	1.95	0.47
1:C:141:PHE:O	1:C:147:SER:HB3	2.14	0.47
2:B:66:ILE:CD1	2:B:122:VAL:HG22	2.45	0.47
2:B:387:LEU:C	2:B:387:LEU:HD23	2.40	0.47
1:C:36:MET:HB3	1:C:61:HIS:CE1	2.50	0.47
3:E:45:PRO:HA	3:E:49:GLU:OE1	2.14	0.47
4:F:160:ILE:HD12	4:F:160:ILE:N	2.30	0.47
4:F:219:GLY:HA3	4:F:264:PHE:CZ	2.50	0.47
2:D:2:ARG:HB2	2:D:133:GLN:HE21	1.80	0.47
2:B:320:ARG:HA	2:B:356:CYS:O	2.15	0.47
12:B:639:HOH:O	1:C:163:LYS:HD2	2.15	0.47
1:C:88:HIS:HE1	1:C:90:GLU:HG3	1.80	0.47
2:D:269:MET:HG3	2:D:303:ALA:HB3	1.96	0.47
4:F:37:PHE:CZ	4:F:40:MET:HE3	2.51	0.46
1:A:71:GLU:HG2	1:A:72:PRO:HD2	1.95	0.46
1:A:25:CYS:HB3	1:A:30:ILE:O	2.16	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:295:MET:HG3	2:B:377:PHE:HB2	1.97	0.46
2:D:18:ALA:O	2:D:22:GLU:HG3	2.15	0.46
1:A:16:ILE:CD1	1:A:171:ILE:HD11	2.46	0.46
2:B:114:LEU:HD23	2:B:149:MET:HE1	1.97	0.46
2:B:191:VAL:O	2:B:195:VAL:HG23	2.16	0.46
2:B:359:PRO:HB2	2:B:371:LEU:O	2.16	0.46
1:C:234:ILE:HD12	1:C:234:ILE:H	1.81	0.46
1:A:289:ALA:HA	1:A:331:ALA:HB1	1.97	0.46
1:A:161:TYR:HB3	1:A:164:LYS:HD3	1.98	0.46
2:B:115:VAL:HG23	2:B:153:LEU:CD2	2.44	0.46
3:E:7:GLU:O	3:E:22:VAL:HA	2.16	0.46
2:B:187:ALA:O	2:B:191:VAL:HG23	2.15	0.46
1:A:172:TYR:HB3	1:A:205:ASP:HA	1.98	0.45
1:C:298:PRO:HG2	1:C:308:ARG:HH21	1.79	0.45
2:D:402:LYS:HE2	2:D:415:GLU:OE1	2.15	0.45
4:F:280:GLU:HA	4:F:284:LEU:HB2	1.97	0.45
1:A:71:GLU:HG2	1:A:72:PRO:CD	2.47	0.45
4:F:280:GLU:HA	4:F:284:LEU:CB	2.46	0.45
1:A:34:GLY:HA3	1:A:60:LYS:HG3	1.98	0.45
1:A:217:LEU:HD21	1:A:368:LEU:CD2	2.44	0.45
1:A:251:ASP:OD1	1:A:253:THR:HB	2.16	0.45
2:D:213:CYS:SG	2:D:227:LEU:HD23	2.57	0.45
4:F:216:TYR:CZ	4:F:218:GLU:HB2	2.51	0.45
1:A:141:PHE:O	1:A:147:SER:HB3	2.16	0.45
2:B:165:ILE:HG21	2:B:252:LEU:HB3	1.98	0.45
1:A:79:ARG:HG2	1:A:92:LEU:HD12	1.97	0.45
2:D:67:LEU:HB2	2:D:75:MET:HE3	1.98	0.45
1:A:48:SER:O	1:A:51:THR:HG23	2.16	0.45
1:A:381:THR:HG22	1:A:383:ALA:H	1.82	0.45
1:C:234:ILE:HD12	1:C:234:ILE:N	2.32	0.45
1:C:312:TYR:CE1	1:C:341:ILE:HG23	2.52	0.45
2:D:38:GLY:HA3	2:D:45:GLN:OE1	2.17	0.45
4:F:3:THR:HA	4:F:28:LYS:O	2.16	0.45
4:F:70:LYS:HA	4:F:76:SER:HB3	1.97	0.45
1:A:401:LYS:HG3	2:B:346:TRP:CE3	2.51	0.45
4:F:198:LYS:HG2	4:F:199:PHE:H	1.82	0.45
2:B:209:LEU:HD23	2:B:302:MET:HG2	1.99	0.44
2:B:297:ASP:OD1	2:B:298:SER:N	2.50	0.44
4:F:162:ILE:HD13	4:F:185:TYR:CE1	2.52	0.44
1:A:300:ASN:HB3	12:A:601:HOH:O	2.16	0.44
2:B:114:LEU:O	2:B:114:LEU:HG	2.16	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:8:HIS:HB3	1:C:13:GLY:O	2.17	0.44
1:C:80:THR:O	1:C:80:THR:OG1	2.35	0.44
1:C:226:ASN:ND2	1:C:367:ASP:OD2	2.51	0.44
2:D:1:MET:HG3	2:D:50:ASN:CB	2.47	0.44
2:D:12:CYS:HB2	8:D:501:GDP:C8	2.52	0.44
2:D:108:TYR:OH	2:D:417:GLU:OE2	2.25	0.44
2:D:248:LEU:HD22	2:D:353:THR:O	2.16	0.44
1:A:196:GLU:OE1	1:A:196:GLU:HA	2.17	0.44
2:D:9:ALA:HA	2:D:68:VAL:O	2.18	0.44
4:F:132:LEU:HD21	4:F:170:LEU:HD11	1.99	0.44
1:C:271:THR:HG21	1:C:295:CYS:HA	1.98	0.44
2:D:23:VAL:O	2:D:27:GLU:HG3	2.18	0.44
4:F:348:GLN:NE2	4:F:352:ASP:OD1	2.51	0.44
2:B:42:LEU:H	2:B:42:LEU:HD12	1.83	0.44
1:C:11:GLN:HE22	2:D:247:GLN:NE2	2.16	0.44
2:B:413:MET:HE2	2:B:418:PHE:CE1	2.52	0.44
1:A:188:ILE:HD12	1:A:395:PHE:HB2	2.00	0.44
1:A:302:MET:N	1:A:302:MET:HE2	2.33	0.44
1:A:419:SER:O	1:A:423:GLU:HG3	2.18	0.44
2:B:163:ASP:O	2:B:253[A]:ARG:NH2	2.48	0.44
2:D:107:HIS:O	2:D:152:LEU:HD22	2.17	0.44
4:F:198:LYS:HE3	4:F:320:MET:HE1	1.98	0.44
2:B:295:MET:HG2	2:B:377:PHE:HB2	1.99	0.43
10:B:506:9KS:C1	10:B:506:9KS:C4	2.96	0.43
1:A:289:ALA:HA	1:A:331:ALA:CB	2.48	0.43
2:B:385:GLN:OE1	2:B:389:LYS:HE3	2.18	0.43
1:C:248:LEU:HD12	1:C:357:TYR:OH	2.19	0.43
1:C:385:ALA:HA	1:C:388:TRP:CD1	2.53	0.43
4:F:220:VAL:HG12	4:F:263:PHE:CE1	2.53	0.43
1:A:291:ILE:HD13	1:A:373:ARG:HG3	1.99	0.43
2:B:147:SER:OG	2:B:190:SER:OG	2.31	0.43
2:B:349:ASN:O	2:B:352:LYS:HE2	2.17	0.43
1:A:136:LEU:HD21	1:A:252:LEU:HD21	2.01	0.43
2:B:75:MET:HE3	2:B:92:PHE:CD2	2.54	0.43
1:C:16:ILE:CD1	1:C:171:ILE:HD11	2.49	0.43
2:B:171:VAL:HA	2:B:204:ILE:O	2.19	0.43
1:C:7:ILE:HG21	1:C:153:LEU:HD21	2.01	0.43
2:B:290:GLU:O	2:B:294:GLN:HG3	2.19	0.43
2:B:325:MET:HE2	2:B:355:VAL:CB	2.49	0.43
3:E:48:GLU:HG2	3:E:52:LYS:HE3	2.01	0.43
4:F:263:PHE:CZ	4:F:341:LYS:HE2	2.54	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:71:GLU:CG	1:A:72:PRO:HD2	2.49	0.43
2:B:23:VAL:HG21	2:B:232:SER:HB3	2.01	0.43
4:F:247:LYS:HG2	4:F:247:LYS:O	2.19	0.43
1:A:188:ILE:HD11	1:A:392:ASP:OD1	2.19	0.42
2:B:42:LEU:HD12	2:B:42:LEU:N	2.34	0.42
2:B:400:ARG:HG3	2:B:401:ARG:HG2	2.01	0.42
2:D:146:GLY:O	2:D:150:GLY:HA3	2.19	0.42
2:D:153:LEU:O	2:D:157:ILE:HG13	2.19	0.42
2:B:67:LEU:N	2:B:67:LEU:HD12	2.34	0.42
2:B:345:GLU:OE1	2:B:345:GLU:N	2.42	0.42
1:C:68:VAL:HG11	1:C:118:VAL:HG21	2.02	0.42
1:C:178:SER:OG	2:D:352:LYS:NZ	2.50	0.42
4:F:320:MET:CG	4:F:330:ILE:HD11	2.47	0.42
2:B:305:CYS:O	2:B:307:PRO:HD3	2.19	0.42
1:C:430:LYS:HE2	1:C:434:GLU:OE2	2.19	0.42
2:D:427:ASP:O	2:D:431:GLU:HG3	2.19	0.42
4:F:126:ASP:OD2	4:F:128:ARG:HG3	2.19	0.42
1:A:141:PHE:CE1	1:A:170:SER:HB3	2.55	0.42
1:A:329:ASN:HB3	3:E:6:MET:CE	2.49	0.42
1:C:297:GLU:HB3	1:C:300:ASN:HD22	1.85	0.42
2:D:12:CYS:HB3	2:D:140:SER:HB3	2.01	0.42
2:B:2:ARG:CG	2:B:133:GLN:HE21	2.32	0.42
2:B:31:ASP:HB2	2:B:32:PRO:CD	2.49	0.42
2:B:179:ASP:HB2	12:B:634:HOH:O	2.20	0.42
1:C:151:SER:HB2	1:C:193:THR:HG22	2.02	0.42
3:E:72:LEU:O	3:E:76:ARG:HG2	2.20	0.42
4:F:101:TYR:CD2	4:F:179:VAL:HG22	2.54	0.42
4:F:201:ILE:HG12	4:F:221:LEU:HG	2.01	0.42
1:A:210:TYR:CZ	1:A:222:PRO:HD2	2.54	0.42
2:B:370:GLY:O	2:B:371:LEU:HD23	2.20	0.42
4:F:49:PHE:CD1	4:F:66:ARG:HB2	2.54	0.42
1:A:32:PRO:HA	1:A:83:TYR:CE2	2.55	0.42
2:B:15:GLN:NE2	8:B:501:GDP:O6	2.53	0.42
2:B:325:MET:HE2	2:B:355:VAL:CG2	2.49	0.42
1:C:101:ASN:ND2	1:C:180:ALA:HB2	2.35	0.42
2:B:133:GLN:OE1	2:B:252:LEU:HG	2.20	0.41
1:C:75:ILE:HD12	1:C:94:THR:HG22	2.02	0.41
1:C:142:GLY:HA3	1:C:183:GLU:OE1	2.19	0.41
1:C:271:THR:CG2	1:C:295:CYS:HA	2.50	0.41
4:F:236:LYS:O	4:F:240:LEU:HD13	2.20	0.41
1:A:21:TRP:CZ3	1:A:63:PRO:HB3	2.56	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:31:ASP:HB2	2:D:32:PRO:CD	2.50	0.41
2:D:36:TYR:CD2	2:D:46:LEU:HD11	2.56	0.41
1:A:194:THR:O	1:A:194:THR:HG22	2.20	0.41
2:B:278:ARG:HG2	2:B:282:GLN:NE2	2.35	0.41
1:C:351:PHE:N	1:C:351:PHE:CD1	2.88	0.41
4:F:296:MET:SD	4:F:380:HIS:HB2	2.59	0.41
4:F:185:TYR:OH	4:F:239:HIS:HB3	2.21	0.41
4:F:197:ARG:HB2	4:F:224:SER:O	2.20	0.41
4:F:371:PRO:HA	4:F:372:THR:CB	2.49	0.41
4:F:220:VAL:HG11	4:F:339:ALA:HB2	2.02	0.41
1:C:139:HIS:CD2	1:C:150:THR:HG21	2.56	0.41
2:D:215:ARG:O	2:D:218:LYS:HE3	2.21	0.41
2:B:208:ALA:HB2	2:B:304:ALA:HB2	2.03	0.41
1:C:46:ASP:OD1	1:C:46:ASP:N	2.52	0.41
1:A:226:ASN:ND2	1:A:367:ASP:OD2	2.54	0.41
1:A:349:THR:HB	3:E:25:LYS:HB3	2.03	0.41
2:B:295:MET:SD	2:B:375:ALA:HB1	2.61	0.41
2:B:337:ASN:ND2	4:F:58:LEU:HD21	2.35	0.41
2:B:352:LYS:HD3	2:B:352:LYS:HA	1.89	0.41
1:C:140:SER:HA	1:C:171:ILE:HB	2.03	0.41
2:B:21:TRP:CE3	2:B:63:PRO:HB3	2.56	0.41
2:B:249:ASN:O	2:B:250:ALA:HB3	2.20	0.41
2:B:336:GLN:C	2:B:338:LYS:H	2.29	0.41
2:D:194:LEU:HD22	2:D:198:THR:HG21	2.03	0.41
4:F:320:MET:HG2	4:F:330:ILE:CG1	2.51	0.41
10:B:505:9KS:O2	10:B:505:9KS:C2	2.69	0.40
1:C:392:ASP:HB3	1:C:422:ARG:CZ	2.51	0.40
3:E:101:LEU:O	3:E:105:MET:HG2	2.21	0.40
4:F:3:THR:HB	4:F:30:LEU:HD11	2.02	0.40
4:F:198:LYS:HG2	4:F:199:PHE:N	2.36	0.40
4:F:341:LYS:HG2	4:F:341:LYS:O	2.21	0.40
4:F:2:TYR:HB3	4:F:27:TRP:CZ3	2.56	0.40
4:F:14:TYR:HB3	4:F:41:LEU:HD13	2.02	0.40
1:A:284:GLU:H	1:A:284:GLU:CD	2.28	0.40
2:D:26:ASP:OD2	2:D:369:ARG:HD2	2.21	0.40
1:C:103:TYR:CE2	1:C:148:GLY:HA2	2.56	0.40
1:C:117:LEU:HD11	1:C:121:ARG:CZ	2.51	0.40
4:F:350:ILE:O	4:F:354:ALA:HB3	2.22	0.40
1:A:136:LEU:HD21	1:A:252:LEU:CD2	2.52	0.40
1:A:409:VAL:HA	1:A:413:MET:O	2.22	0.40
2:B:369:ARG:HA	2:B:369:ARG:HD3	1.96	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	436/451 (97%)	428 (98%)	7 (2%)	1 (0%)	43	55
1	C	439/451 (97%)	431 (98%)	8 (2%)	0	100	100
2	B	423/445 (95%)	407 (96%)	15 (4%)	1 (0%)	43	55
2	D	425/445 (96%)	410 (96%)	14 (3%)	1 (0%)	43	55
3	E	119/143 (83%)	118 (99%)	1 (1%)	0	100	100
4	F	339/384 (88%)	326 (96%)	13 (4%)	0	100	100
All	All	2181/2319 (94%)	2120 (97%)	58 (3%)	3 (0%)	48	60

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	282	TYR
2	B	250	ALA
2	D	82	PRO

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	369/379 (97%)	366 (99%)	3 (1%)	73	86
1	C	372/379 (98%)	370 (100%)	2 (0%)	81	90

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	369/383 (96%)	368 (100%)	1 (0%)	86	93
2	D	368/383 (96%)	364 (99%)	4 (1%)	65	81
3	E	110/127 (87%)	109 (99%)	1 (1%)	70	84
4	F	314/342 (92%)	314 (100%)	0	100	100
All	All	1902/1993 (95%)	1891 (99%)	11 (1%)	78	89

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	282	TYR
1	A	300	ASN
1	A	381	THR
2	B	255	LEU
1	C	361	THR
1	C	391	LEU
2	D	39	ASP
2	D	200	GLU
2	D	229	HIS
2	D	247	GLN
3	E	128	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (31) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	11	GLN
1	A	101	ASN
1	A	283	HIS
1	A	301	GLN
2	B	15	GLN
2	B	96	GLN
2	B	133	GLN
2	B	192	HIS
2	B	247	GLN
2	B	282	GLN
2	B	294	GLN
2	B	337	ASN
2	B	434	GLN
1	C	11	GLN
1	C	101	ASN
1	C	293	ASN

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Mol	Chain	Res	Type
1	C	300	ASN
2	D	8	GLN
2	D	133	GLN
2	D	136	GLN
2	D	167	ASN
2	D	294	GLN
2	D	394	GLN
2	D	436	GLN
3	E	71	HIS
3	E	115	HIS
3	E	136	ASN
4	F	180	HIS
4	F	242	ASN
4	F	269	GLN
4	F	380	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 17 ligands modelled in this entry, 9 are monoatomic - leaving 8 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
8	GDP	B	501	6	29,30,30	1.19	3 (10%)	45,47,47	1.69	6 (13%)
10	9KS	B	505	-	11,11,11	0.22	0	14,14,14	0.45	0
11	ACP	F	401	6	31,33,33	1.69	9 (29%)	47,52,52	1.86	9 (19%)
9	MES	B	504	-	12,12,12	2.32	1 (8%)	15,16,16	1.88	4 (26%)
10	9KS	B	506	-	11,11,11	0.21	0	14,14,14	0.64	0
8	GDP	D	501	6	29,30,30	1.15	3 (10%)	45,47,47	1.71	6 (13%)
5	GTP	A	501	6	33,34,34	0.99	3 (9%)	50,54,54	1.49	8 (16%)
5	GTP	C	501	6	33,34,34	0.94	1 (3%)	50,54,54	1.48	8 (16%)

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
8	GDP	B	501	6	-	3/16/32/32	0/3/3/3
10	9KS	B	505	-	-	2/4/4/4	0/1/1/1
11	ACP	F	401	6	-	11/19/38/38	0/3/3/3
9	MES	B	504	-	-	4/6/14/14	0/1/1/1
10	9KS	B	506	-	-	2/4/4/4	0/1/1/1
8	GDP	D	501	6	-	6/16/32/32	0/3/3/3
5	GTP	A	501	6	-	7/22/38/38	0/3/3/3
5	GTP	C	501	6	-	9/22/38/38	0/3/3/3

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	B	504	MES	C8-S	-7.76	1.66	1.77
11	F	401	ACP	C5-C4	4.76	1.47	1.39
8	D	501	GDP	C5-C4	3.12	1.47	1.38
8	B	501	GDP	C5-C4	3.06	1.47	1.38
11	F	401	ACP	PG-O2G	3.00	1.61	1.55
11	F	401	ACP	PG-O3G	2.96	1.61	1.55
11	F	401	ACP	PB-O3A	2.93	1.61	1.58
11	F	401	ACP	C5-C6	2.73	1.48	1.41
8	B	501	GDP	C6-N1	-2.44	1.34	1.38
5	A	501	GTP	PA-O3A	2.38	1.62	1.59
8	D	501	GDP	C6-N1	-2.33	1.34	1.38
11	F	401	ACP	C8-N7	2.32	1.36	1.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	B	501	GDP	PA-O3A	2.29	1.62	1.59
11	F	401	ACP	C5-N7	-2.28	1.34	1.39
5	C	501	GTP	PB-O3B	2.23	1.61	1.59
11	F	401	ACP	PA-O3A	2.18	1.61	1.59
11	F	401	ACP	PB-O2B	2.11	1.61	1.56
5	A	501	GTP	PB-O3B	2.04	1.61	1.59
8	D	501	GDP	C5-N7	-2.01	1.35	1.39
5	A	501	GTP	C2-N3	2.00	1.38	1.33

All (41) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	D	501	GDP	C5-C4-N3	-5.86	119.07	128.39
11	F	401	ACP	C5-C4-N3	-5.76	118.78	126.72
8	B	501	GDP	C5-C4-N3	-5.66	119.38	128.39
8	D	501	GDP	C2-N3-C4	5.00	120.91	112.30
8	B	501	GDP	C2-N3-C4	4.88	120.71	112.30
5	A	501	GTP	C5-C4-N3	-4.68	120.94	128.39
11	F	401	ACP	N3-C4-N9	4.66	135.09	127.17
5	C	501	GTP	C5-C4-N3	-4.60	121.06	128.39
5	A	501	GTP	C2-N3-C4	4.50	120.06	112.30
5	C	501	GTP	C2-N3-C4	4.35	119.78	112.30
8	D	501	GDP	N9-C4-N3	4.21	134.37	125.95
8	B	501	GDP	N9-C4-N3	4.18	134.31	125.95
11	F	401	ACP	PB-O3A-PA	-4.01	119.29	132.37
9	B	504	MES	C5-N4-C3	3.86	117.15	108.84
11	F	401	ACP	C2-N3-C4	3.63	120.70	111.83
8	B	501	GDP	C6-C5-N7	3.60	136.84	130.29
8	D	501	GDP	C6-C5-N7	3.55	136.75	130.29
11	F	401	ACP	C4-C5-N7	-3.31	106.79	110.58
9	B	504	MES	C6-C5-N4	-3.21	105.23	110.12
11	F	401	ACP	N3-C2-N1	-3.15	123.81	128.58
5	C	501	GTP	N9-C4-N3	2.85	131.66	125.95
5	A	501	GTP	N9-C4-N3	2.85	131.65	125.95
5	C	501	GTP	C2-N1-C6	-2.80	120.03	125.11
5	A	501	GTP	C2-N1-C6	-2.80	120.03	125.11
5	C	501	GTP	N9-C8-N7	-2.75	108.31	113.40
8	D	501	GDP	C4-C5-N7	-2.71	106.38	110.67
5	A	501	GTP	N9-C8-N7	-2.67	108.45	113.40
11	F	401	ACP	C4-N9-C8	2.66	108.53	105.74
8	B	501	GDP	C4-C5-N7	-2.60	106.55	110.67
11	F	401	ACP	C3'-C2'-C1'	2.49	106.18	101.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	C	501	GTP	C8-N7-C5	2.48	108.67	104.26
9	B	504	MES	O1S-S-C8	2.46	110.44	106.73
11	F	401	ACP	C5-N7-C8	2.45	107.30	103.45
5	A	501	GTP	O6-C6-C5	-2.45	120.07	126.53
5	A	501	GTP	C8-N7-C5	2.43	108.59	104.26
5	C	501	GTP	C5-C6-N1	2.42	119.42	113.25
5	A	501	GTP	C5-C6-N1	2.39	119.33	113.25
5	C	501	GTP	O6-C6-C5	-2.28	120.51	126.53
8	B	501	GDP	O6-C6-C5	-2.11	120.96	126.53
8	D	501	GDP	O6-C6-C5	-2.04	121.15	126.53
9	B	504	MES	C7-N4-C5	2.03	116.64	111.24

There are no chirality outliers.

All (44) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	501	GTP	C5'-O5'-PA-O3A
5	A	501	GTP	C5'-O5'-PA-O1A
5	A	501	GTP	C5'-O5'-PA-O2A
5	C	501	GTP	C5'-O5'-PA-O3A
5	C	501	GTP	C5'-O5'-PA-O1A
5	C	501	GTP	C5'-O5'-PA-O2A
8	B	501	GDP	C5'-O5'-PA-O3A
8	B	501	GDP	C5'-O5'-PA-O1A
8	B	501	GDP	C5'-O5'-PA-O2A
8	D	501	GDP	C5'-O5'-PA-O3A
8	D	501	GDP	C5'-O5'-PA-O1A
8	D	501	GDP	C5'-O5'-PA-O2A
9	B	504	MES	C8-C7-N4-C5
10	B	506	9KS	O1-C2-N1-C3
11	F	401	ACP	PB-C3B-PG-O1G
11	F	401	ACP	PB-C3B-PG-O2G
11	F	401	ACP	PB-C3B-PG-O3G
11	F	401	ACP	PG-C3B-PB-O1B
11	F	401	ACP	PG-C3B-PB-O3A
11	F	401	ACP	C5'-O5'-PA-O1A
11	F	401	ACP	C5'-O5'-PA-O2A
11	F	401	ACP	C5'-O5'-PA-O3A
10	B	506	9KS	C1-C2-N1-C3
9	B	504	MES	C7-C8-S-O3S
9	B	504	MES	C7-C8-S-O1S
9	B	504	MES	C7-C8-S-O2S

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Mol	Chain	Res	Type	Atoms
5	C	501	GTP	PB-O3B-PG-O1G
8	D	501	GDP	PA-O3A-PB-O1B
5	A	501	GTP	PB-O3B-PG-O2G
10	B	505	9KS	C8-C3-N1-C2
11	F	401	ACP	PG-C3B-PB-O2B
5	A	501	GTP	PB-O3A-PA-O2A
10	B	505	9KS	C4-C3-N1-C2
5	A	501	GTP	C4'-C5'-O5'-PA
5	C	501	GTP	PB-O3B-PG-O2G
5	C	501	GTP	PB-O3B-PG-O3G
8	D	501	GDP	PA-O3A-PB-O2B
8	D	501	GDP	PA-O3A-PB-O3B
11	F	401	ACP	C3'-C4'-C5'-O5'
11	F	401	ACP	PB-O3A-PA-O2A
5	C	501	GTP	PB-O3A-PA-O2A
5	C	501	GTP	C4'-C5'-O5'-PA
5	A	501	GTP	PB-O3A-PA-O1A
5	C	501	GTP	PB-O3A-PA-O1A

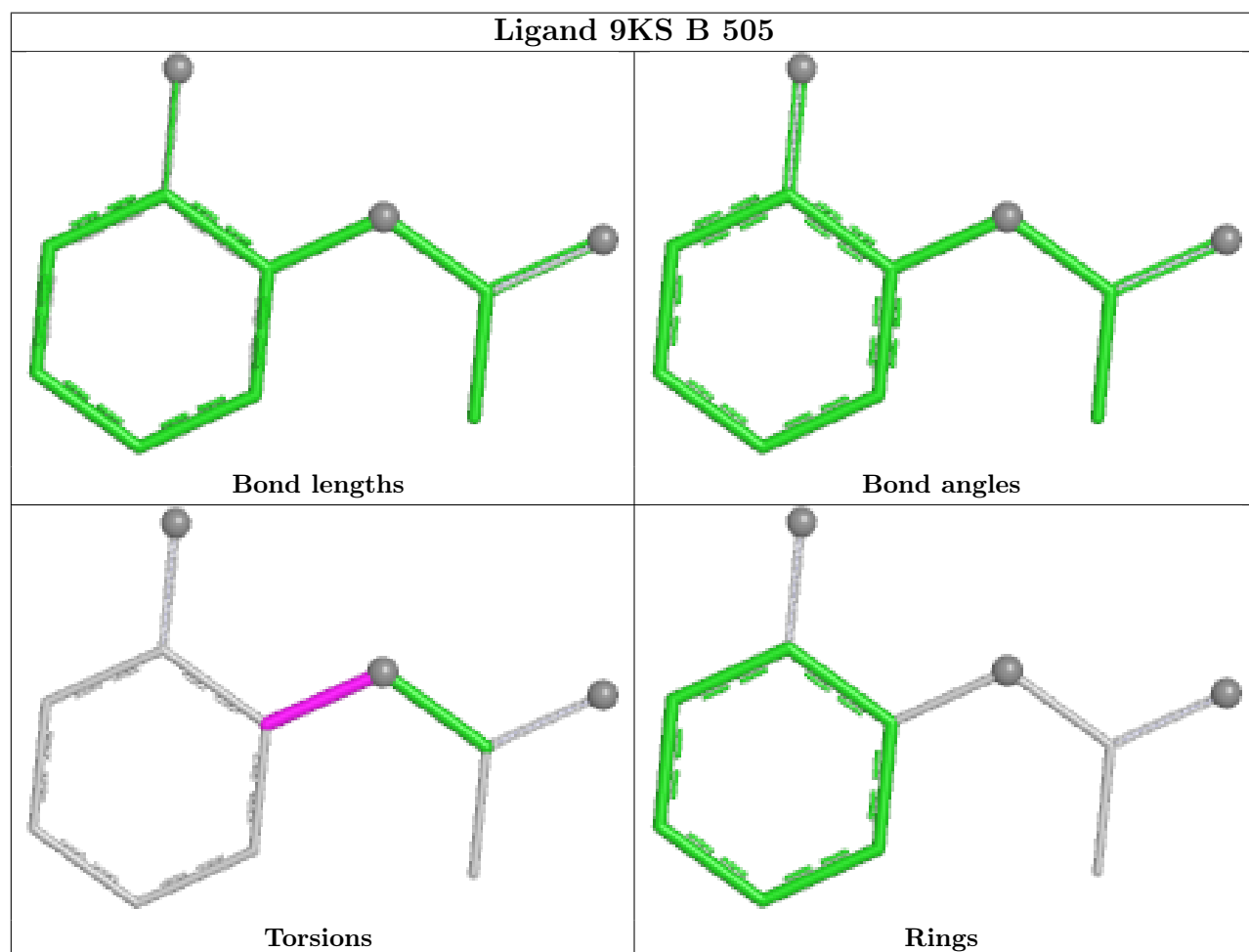
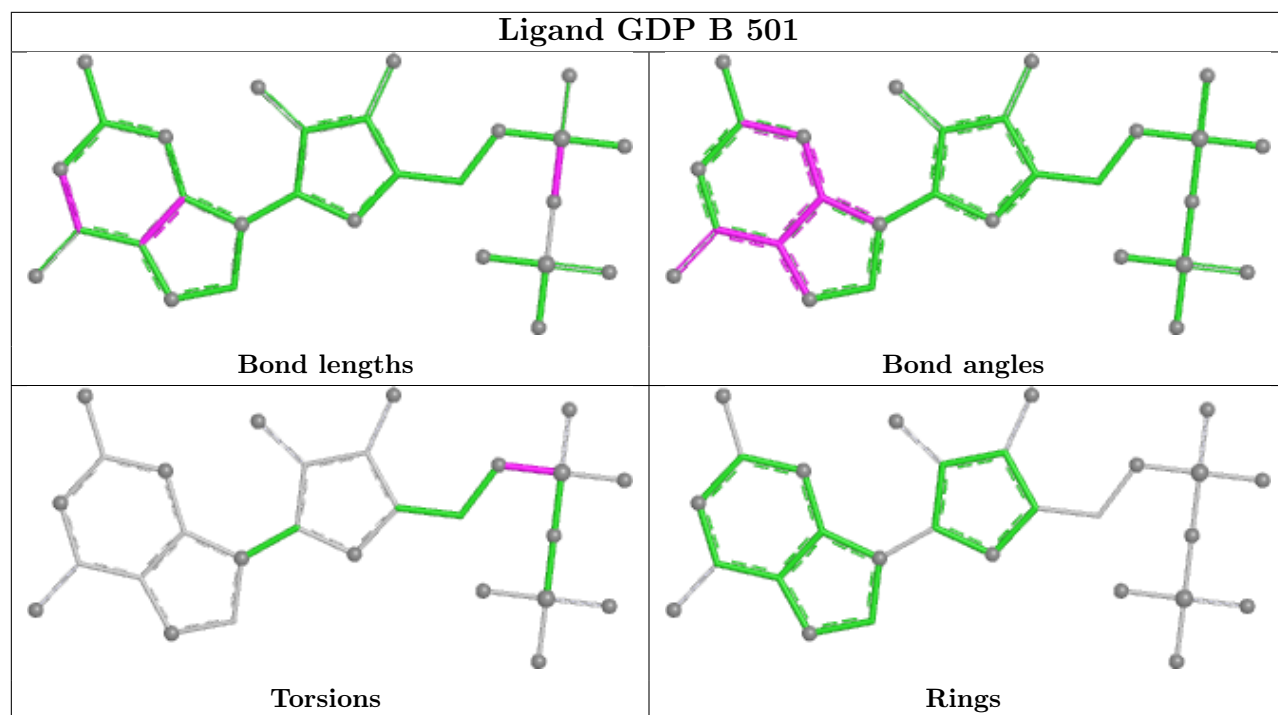
There are no ring outliers.

7 monomers are involved in 11 short contacts:

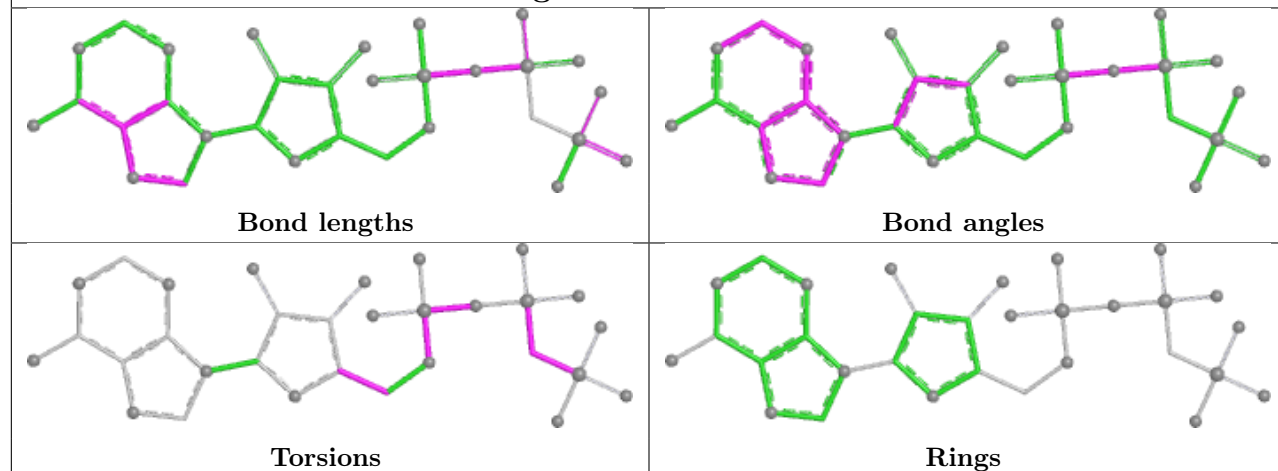
Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	B	501	GDP	1	0
10	B	505	9KS	2	0
11	F	401	ACP	2	0
9	B	504	MES	1	0
10	B	506	9KS	1	0
8	D	501	GDP	3	0
5	A	501	GTP	1	0

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

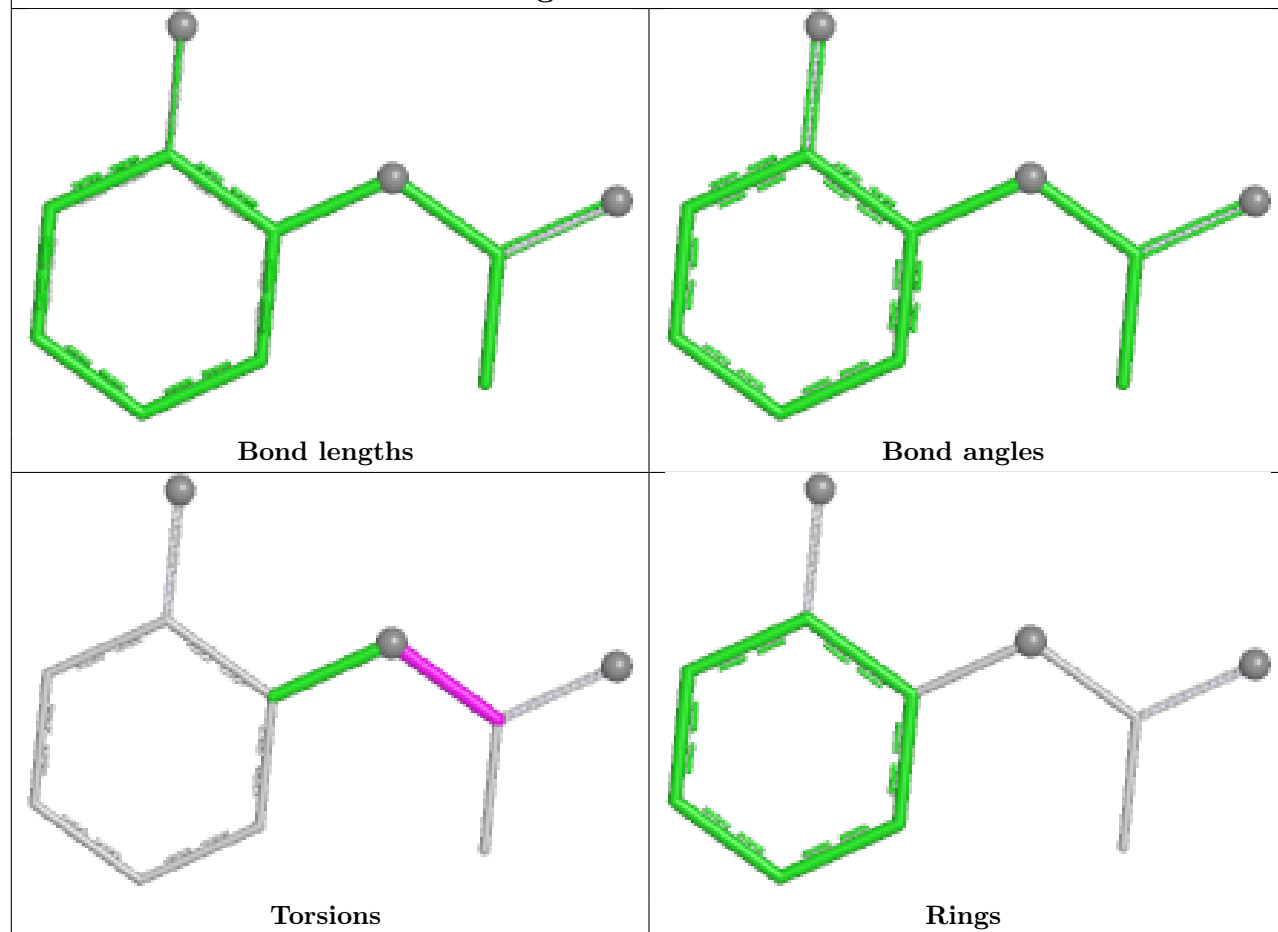
equivalents in the CSD to analyse the geometry.

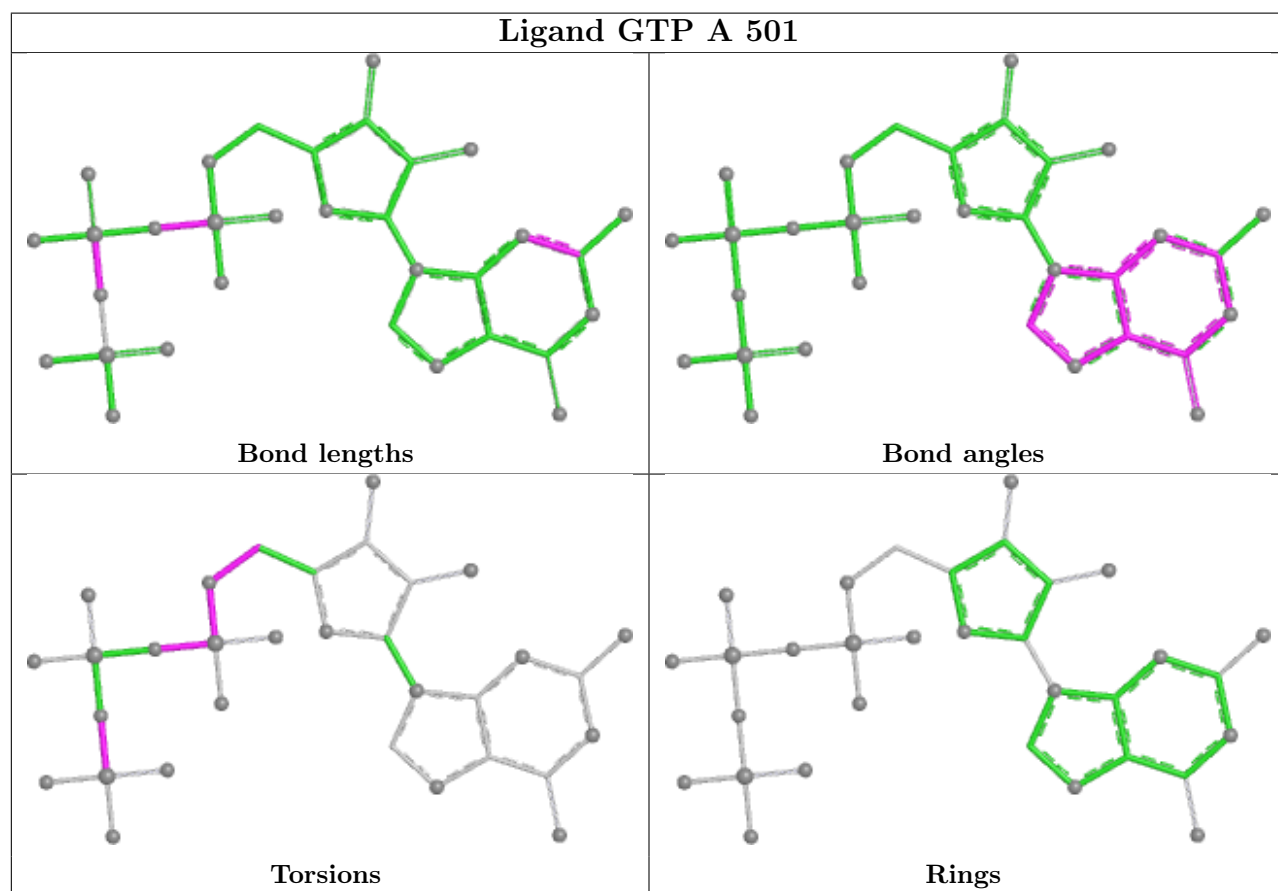
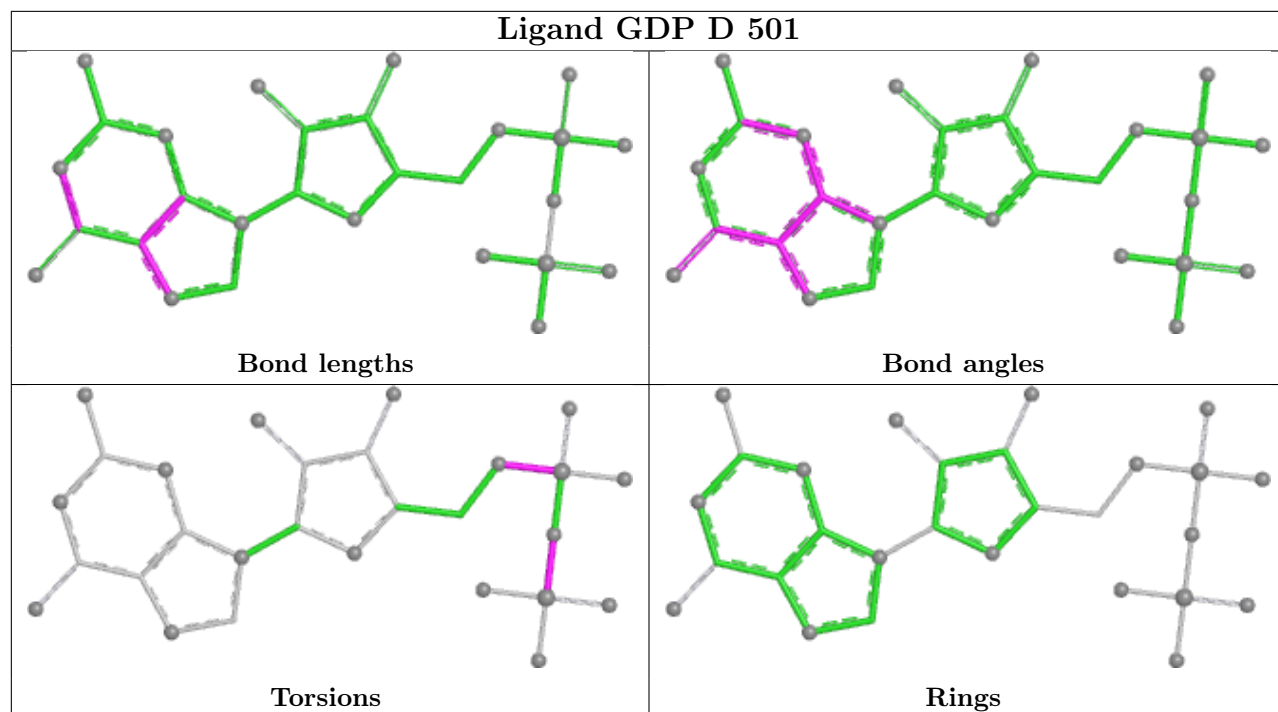


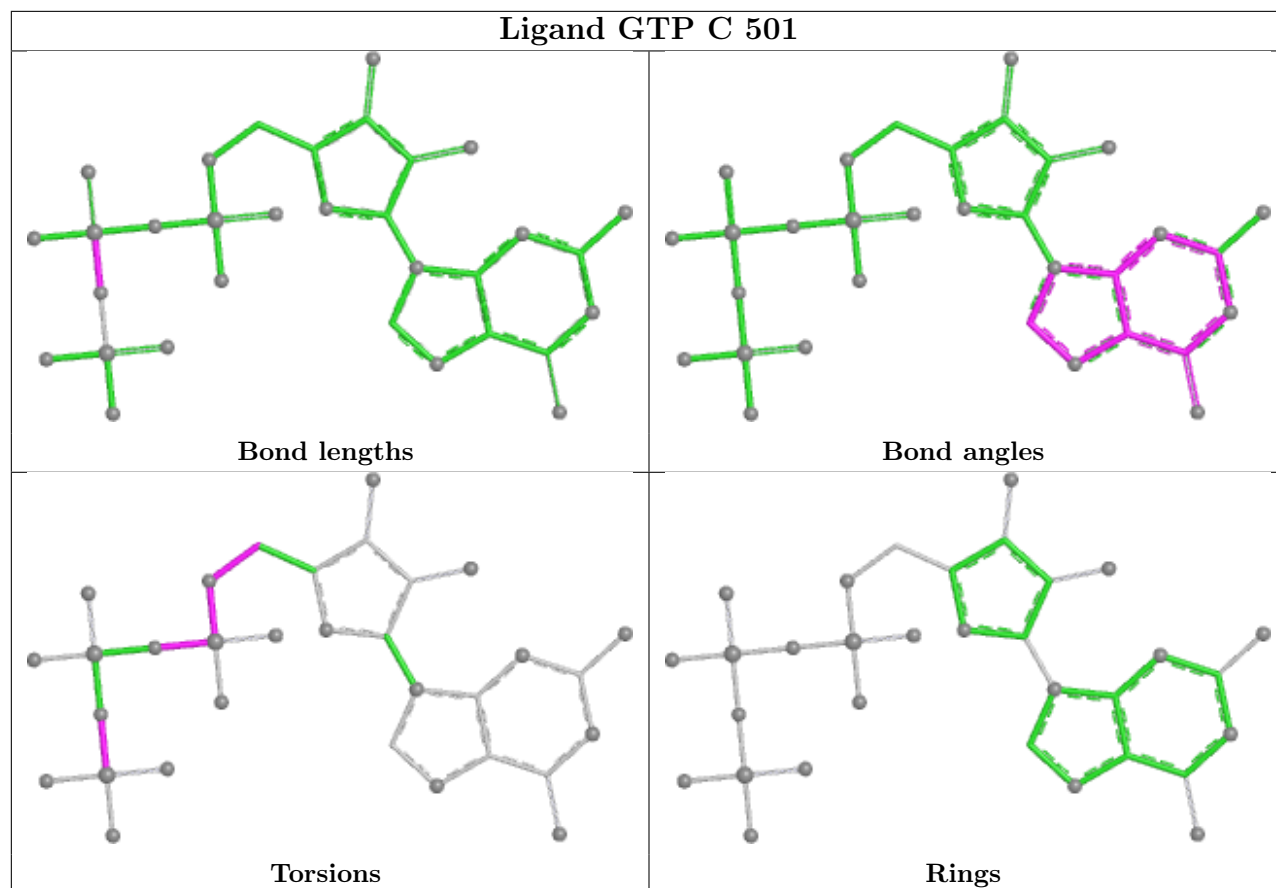
Ligand ACP F 401



Ligand 9KS B 506







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	438/451 (97%)	0.33	10 (2%) 61 63	51, 68, 104, 187	0
1	C	440/451 (97%)	0.09	8 (1%) 67 69	28, 57, 81, 128	1 (0%)
2	B	425/445 (95%)	0.36	14 (3%) 49 51	29, 66, 116, 168	4 (0%)
2	D	429/445 (96%)	0.48	18 (4%) 40 42	53, 75, 107, 160	4 (0%)
3	E	123/143 (86%)	0.61	6 (4%) 35 36	56, 78, 124, 161	0
4	F	347/384 (90%)	0.66	22 (6%) 26 28	63, 97, 164, 202	0
All	All	2202/2319 (94%)	0.39	78 (3%) 47 49	28, 71, 128, 202	9 (0%)

All (78) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	249	ASN	6.0
2	D	282	GLN	5.6
2	B	248	LEU	4.7
2	D	285	ALA	4.7
4	F	371	PRO	4.4
3	E	143	ALA	3.8
4	F	125	THR	3.8
1	C	440	VAL	3.6
2	D	407	TRP	3.6
4	F	160	ILE	3.5
4	F	240	LEU	3.5
2	D	281	GLN	3.5
1	A	437	VAL	3.4
2	B	333	LEU	3.4
2	D	404	PHE	3.4
4	F	344	ALA	3.4
3	E	26	PRO	3.2
4	F	362	ALA	3.2
2	D	272	PHE	3.2

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Mol	Chain	Res	Type	RSRZ
4	F	105	LEU	3.2
2	D	280	SER	3.2
2	B	285	ALA	3.1
1	A	438	ASP	3.0
3	E	24	LEU	2.9
1	A	340	SER	2.8
1	C	80	THR	2.8
1	A	282	TYR	2.7
4	F	249	TYR	2.7
1	C	2	ARG	2.7
1	A	316	CYS	2.6
2	D	279	GLY	2.6
2	B	283	TYR	2.6
2	B	1	MET	2.5
4	F	186	LEU	2.5
3	E	6	MET	2.5
2	D	441	ASP	2.5
4	F	99	VAL	2.5
2	B	250	ALA	2.5
1	A	281	ALA	2.5
1	C	337	THR	2.4
4	F	244	CYS	2.4
1	A	284	GLU	2.4
4	F	151	SER	2.4
2	B	57	THR	2.3
2	D	241	CYS	2.3
4	F	172	PHE	2.3
2	D	248	LEU	2.3
2	B	275	LEU	2.3
2	D	325	MET	2.3
4	F	382	HIS	2.3
2	D	82	PRO	2.2
2	D	278	ARG	2.2
1	C	340	SER	2.2
2	B	247	GLN	2.2
1	C	163	LYS	2.2
1	A	337	THR	2.2
1	C	286	LEU	2.2
4	F	231	ALA	2.2
2	D	319	PHE	2.2
4	F	381	HIS	2.2
4	F	134	ALA	2.2

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Mol	Chain	Res	Type	RSRZ
4	F	372	THR	2.2
2	B	52	TYR	2.1
3	E	9	ILE	2.1
1	A	285	GLN	2.1
4	F	379	HIS	2.1
1	C	178	SER	2.1
2	B	278	ARG	2.1
4	F	173	ILE	2.1
2	D	355	VAL	2.1
3	E	17	GLY	2.1
2	B	286	LEU	2.1
1	A	335	ILE	2.1
4	F	130	VAL	2.1
4	F	241	THR	2.0
2	B	339	ASN	2.0
2	D	181	VAL	2.0
2	D	94	PHE	2.0

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

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

6.3 Carbohydrates [i](#)

There are no 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($\text{\AA}^2$)	Q<0.9
7	CA	B	503	1/1	0.82	0.12	106,106,106,106	0
6	MG	D	502	1/1	0.83	0.12	77,77,77,77	0
11	ACP	F	401	31/31	0.85	0.10	99,109,117,124	0
10	9KS	B	506	11/11	0.88	0.17	68,77,91,93	20
6	MG	F	402	1/1	0.89	0.08	104,104,104,104	0
9	MES	B	504	12/12	0.91	0.12	81,90,104,110	0

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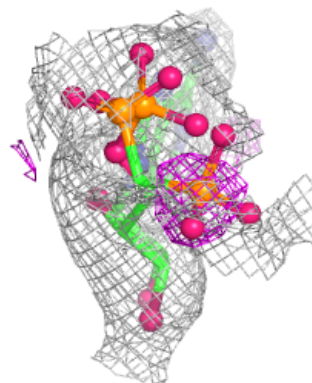
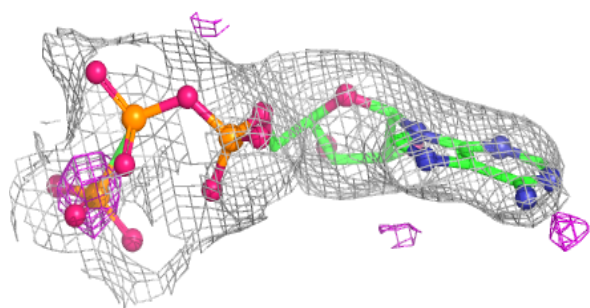
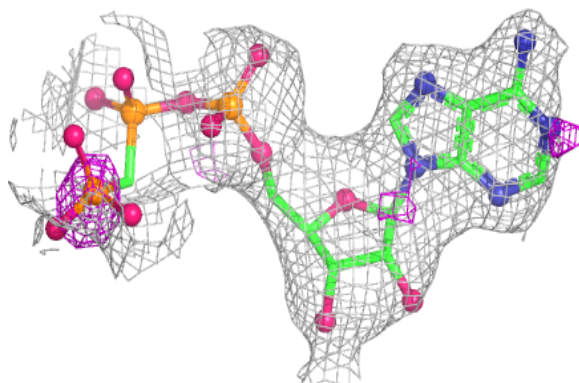
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
10	9KS	B	505	11/11	0.92	0.11	40,53,64,64	20
7	CA	A	504	1/1	0.93	0.09	97,97,97,97	0
8	GDP	D	501	28/28	0.95	0.09	60,69,76,81	0
8	GDP	B	501	28/28	0.98	0.06	44,49,54,54	0
5	GTP	A	501	32/32	0.98	0.06	45,53,58,60	0
5	GTP	C	501	32/32	0.98	0.07	44,50,54,55	0
6	MG	C	502	1/1	0.99	0.03	45,45,45,45	0
6	MG	A	502	1/1	0.99	0.03	49,49,49,49	0
6	MG	B	502	1/1	0.99	0.11	44,44,44,44	0
7	CA	A	503	1/1	0.99	0.04	87,87,87,87	0
7	CA	C	503	1/1	1.00	0.02	74,74,74,74	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.

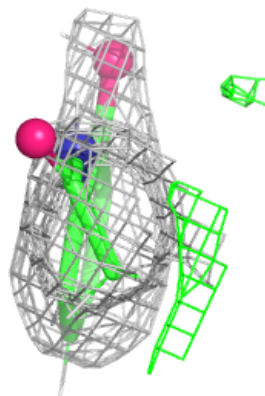
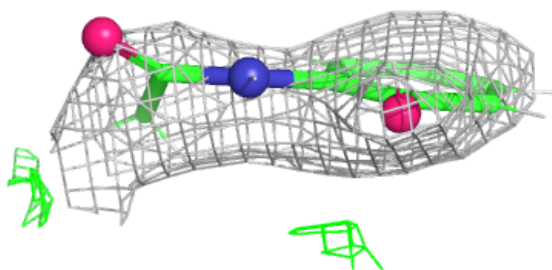
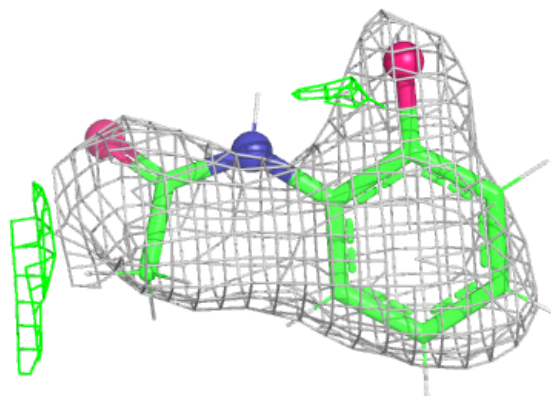
Electron density around ACP F 401:

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

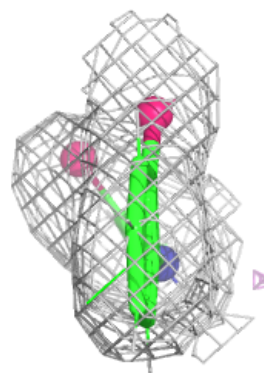
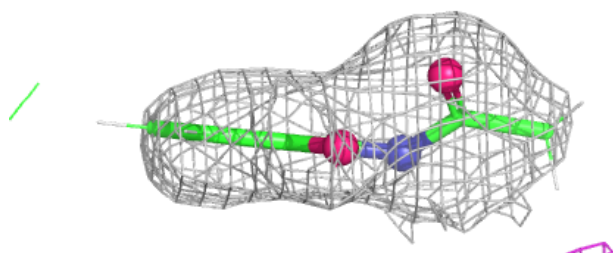
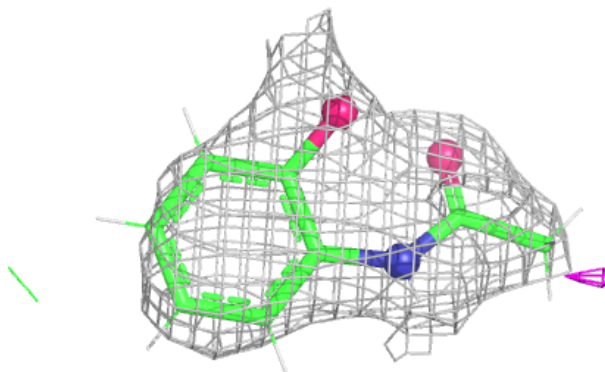


Electron density around 9KS B 506:

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

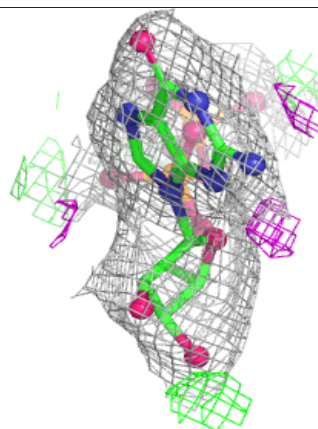
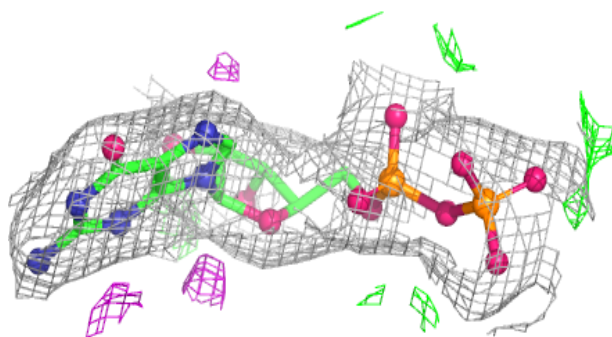
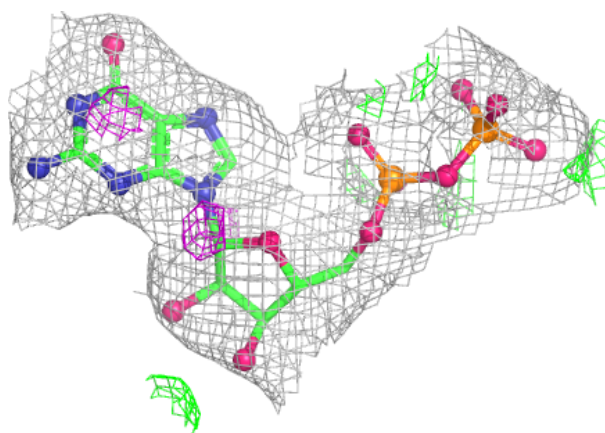
**Electron density around 9KS B 505:**

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



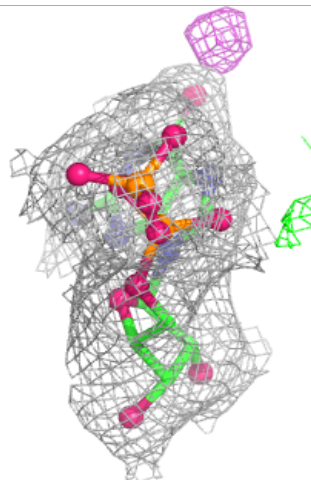
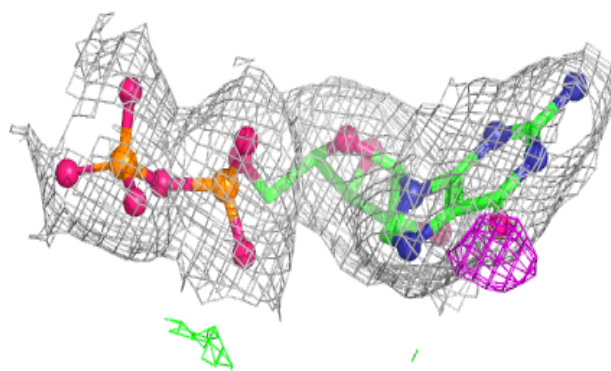
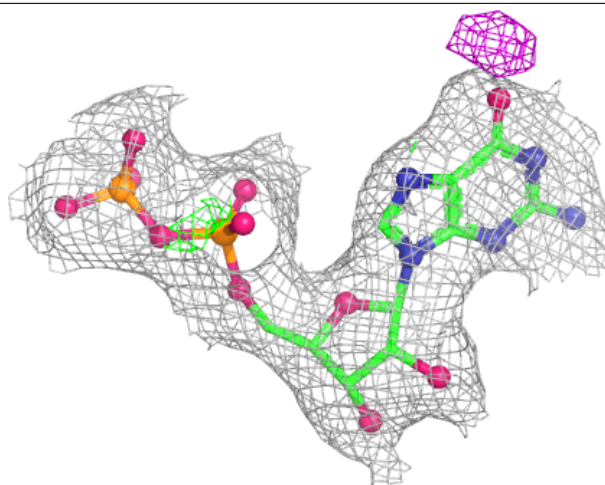
Electron density around GDP D 501:

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



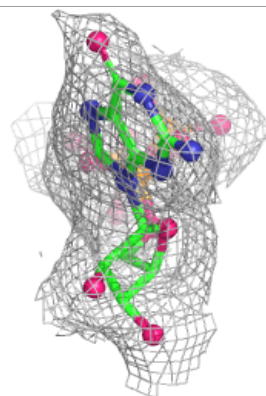
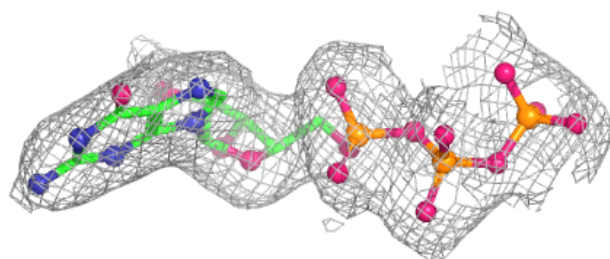
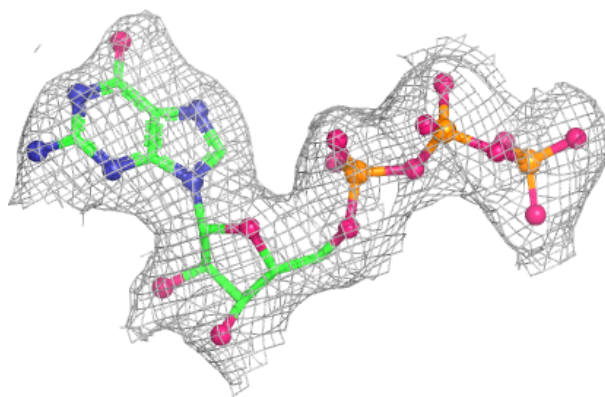
Electron density around GDP B 501:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

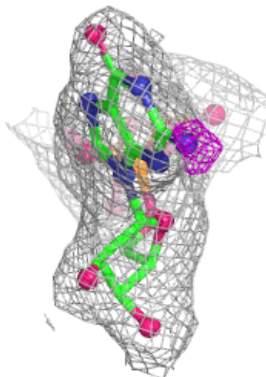
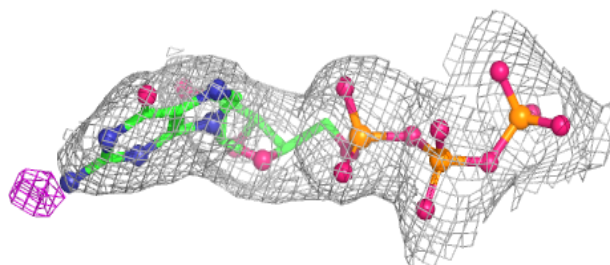
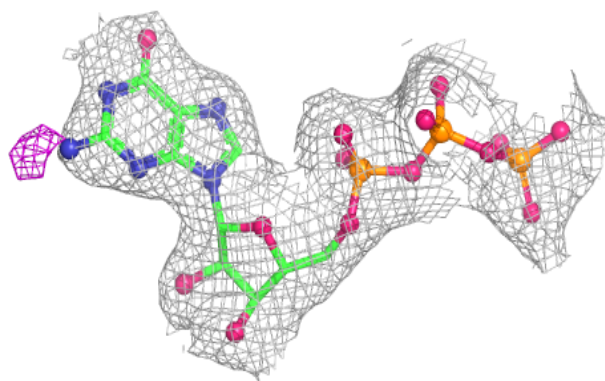


Electron density around GTP A 501:

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

**Electron density around GTP C 501:**

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



6.5 Other polymers ⓘ

There are no such residues in this entry.