



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 01:07 PM UTC

PDB ID : 4YV1 / pdb_00004yv1
Title : Crystal structure of Trypanosoma cruzi spermidine synthase in complex with quinolin-8-yl piperidine-1-carboxylate
Authors : Amano, Y.; Tateishi, Y.
Deposited on : 2015-03-19
Resolution : 1.85 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

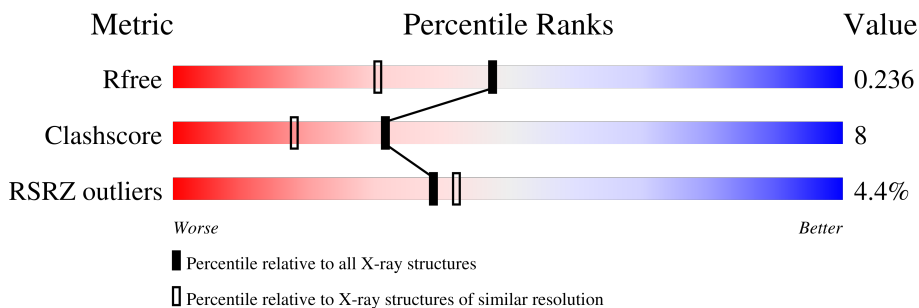
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.85 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	3428 (1.86-1.86)
Clashscore	190562	3579 (1.86-1.86)
RSRZ outliers	180081	3429 (1.86-1.86)

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	304	4% 74% 15% • 10%
1	B	304	4% 79% 15% • 5%
1	C	304	4% 77% 13% • 10%
1	D	304	5% 84% 11% 5%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9421 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 Spermidine synthase, putative.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	0	0
			2163	1374	371	404	14			
1	B	288	Total	C	N	O	S	0	0	0
			2268	1442	387	425	14			
1	C	275	Total	C	N	O	S	0	0	0
			2173	1379	373	407	14			
1	D	288	Total	C	N	O	S	0	0	0
			2268	1442	387	425	14			

There are 32 discrepancies between the modelled and reference sequences:

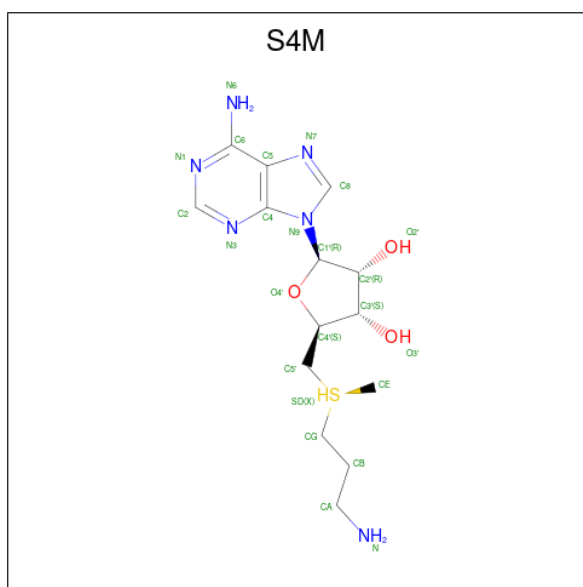
Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	MET	-	initiating methionine	UNP Q4DA73
A	-6	ALA	-	expression tag	UNP Q4DA73
A	-5	HIS	-	expression tag	UNP Q4DA73
A	-4	HIS	-	expression tag	UNP Q4DA73
A	-3	HIS	-	expression tag	UNP Q4DA73
A	-2	HIS	-	expression tag	UNP Q4DA73
A	-1	HIS	-	expression tag	UNP Q4DA73
A	0	HIS	-	expression tag	UNP Q4DA73
B	-7	MET	-	initiating methionine	UNP Q4DA73
B	-6	ALA	-	expression tag	UNP Q4DA73
B	-5	HIS	-	expression tag	UNP Q4DA73
B	-4	HIS	-	expression tag	UNP Q4DA73
B	-3	HIS	-	expression tag	UNP Q4DA73
B	-2	HIS	-	expression tag	UNP Q4DA73
B	-1	HIS	-	expression tag	UNP Q4DA73
B	0	HIS	-	expression tag	UNP Q4DA73
C	-7	MET	-	initiating methionine	UNP Q4DA73
C	-6	ALA	-	expression tag	UNP Q4DA73
C	-5	HIS	-	expression tag	UNP Q4DA73
C	-4	HIS	-	expression tag	UNP Q4DA73
C	-3	HIS	-	expression tag	UNP Q4DA73

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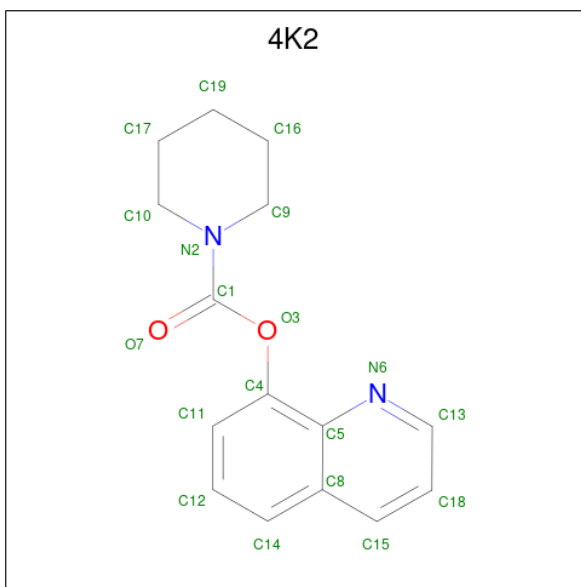
Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	HIS	-	expression tag	UNP Q4DA73
C	-1	HIS	-	expression tag	UNP Q4DA73
C	0	HIS	-	expression tag	UNP Q4DA73
D	-7	MET	-	initiating methionine	UNP Q4DA73
D	-6	ALA	-	expression tag	UNP Q4DA73
D	-5	HIS	-	expression tag	UNP Q4DA73
D	-4	HIS	-	expression tag	UNP Q4DA73
D	-3	HIS	-	expression tag	UNP Q4DA73
D	-2	HIS	-	expression tag	UNP Q4DA73
D	-1	HIS	-	expression tag	UNP Q4DA73
D	0	HIS	-	expression tag	UNP Q4DA73

- Molecule 2 is 5'-[(S)-(3-AMINOPROPYL)(METHYL)-LAMBDA 4 -SULFANYL]-5'-DEOXYADENOSINE (CCD ID: S4M) (formula: C₁₄H₂₄N₆O₃S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			24	14	6	3	1		
2	B	1	Total	C	N	O	S	0	0
			24	14	6	3	1		
2	C	1	Total	C	N	O	S	0	0
			24	14	6	3	1		
2	D	1	Total	C	N	O	S	0	0
			24	14	6	3	1		

- Molecule 3 is quinolin-8-yl piperidine-1-carboxylate (CCD ID: 4K2) (formula: C₁₅H₁₆N₂O₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	N	O	0	0
			19	15	2	2		
3	D	1	Total	C	N	O	0	0
			19	15	2	2		

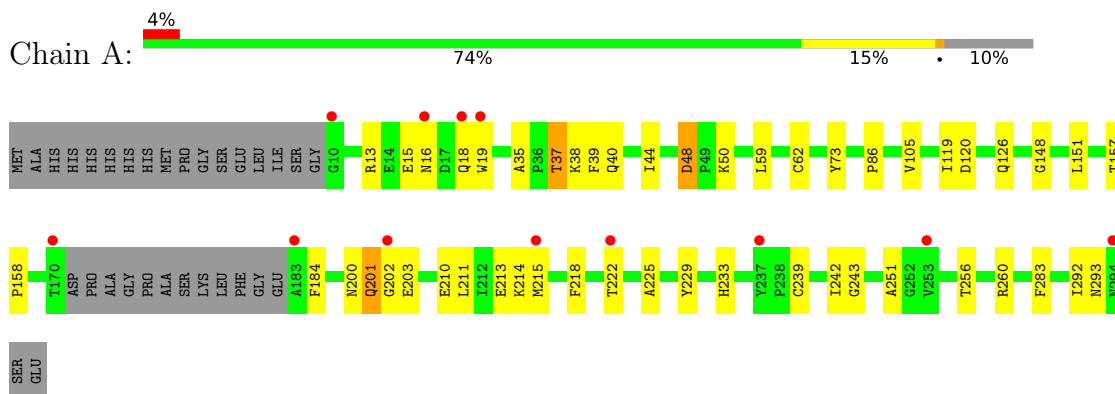
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	94	Total	O	0	0
			94	94		
4	B	105	Total	O	0	0
			105	105		
4	C	111	Total	O	0	0
			111	111		
4	D	105	Total	O	0	0
			105	105		

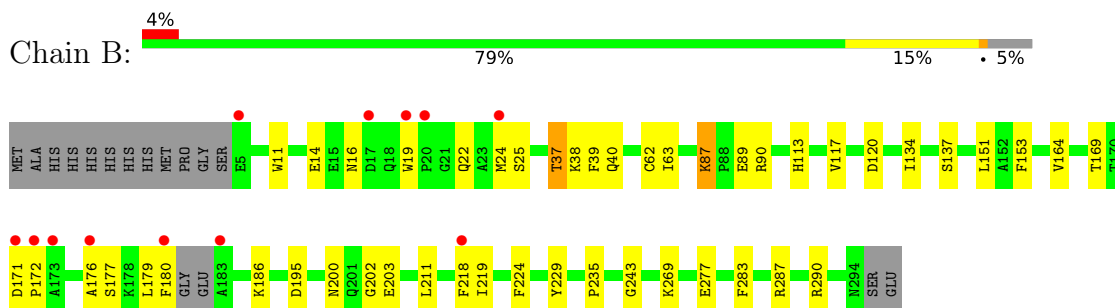
3 Residue-property plots [i](#)

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.

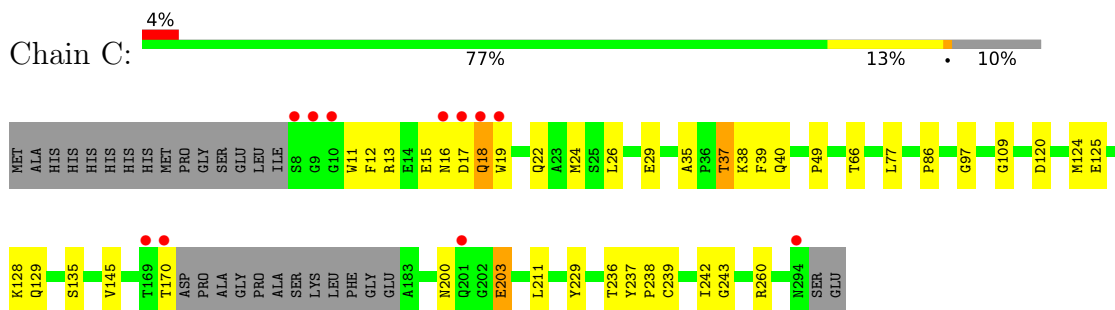
- Molecule 1: Spermidine synthase, putative



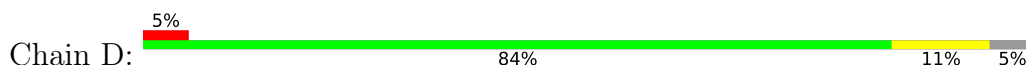
- Molecule 1: Spermidine synthase, putative

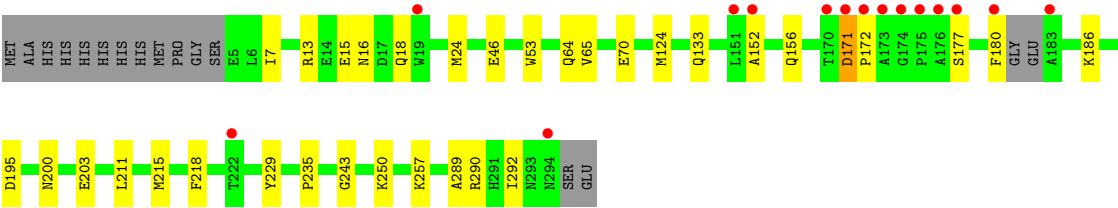


- Molecule 1: Spermidine synthase, putative



- Molecule 1: Spermidine synthase, putative





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	43.42Å 99.27Å 135.06Å 90.00° 90.54° 90.00°	Depositor
Resolution (Å)	34.15 – 1.85 34.15 – 1.85	Depositor EDS
% Data completeness (in resolution range)	99.5 (34.15-1.85) 85.9 (34.15-1.85)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.32 (at 1.85Å)	Xtriage
Refinement program	REFMAC 5.8.0049	Depositor
R, R_{free}	0.196 , 0.245 (Not available) , 0.236	Depositor DCC
R_{free} test set	4858 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	20.9	Xtriage
Anisotropy	0.042	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 39.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.023 for h,-k,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	9421	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 61.39 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.3205e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: 4K2, S4M

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	1.18	1/2216 (0.0%)	1.15	8/3005 (0.3%)
1	B	1.22	3/2324 (0.1%)	1.19	8/3152 (0.3%)
1	C	1.16	2/2226 (0.1%)	1.19	9/3018 (0.3%)
1	D	1.16	1/2324 (0.0%)	1.17	6/3152 (0.2%)
All	All	1.18	7/9090 (0.1%)	1.18	31/12327 (0.3%)

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	1
All	All	0	2

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	218	PHE	N-CA	6.39	1.54	1.46
1	B	164	VAL	C-O	6.23	1.30	1.24
1	C	203	GLU	N-CA	6.20	1.54	1.46
1	B	283	PHE	N-CA	5.22	1.52	1.46
1	B	277	GLU	N-CA	5.19	1.52	1.46
1	C	11	TRP	N-CA	5.18	1.52	1.46
1	A	105	VAL	CA-C	5.11	1.59	1.52

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	37	THR	N-CA-C	-8.19	98.16	109.95
1	C	35	ALA	CA-C-N	-7.94	112.53	120.31
1	C	35	ALA	C-N-CA	-7.94	112.53	120.31
1	C	19	TRP	CA-C-N	-7.87	112.59	120.31
1	C	19	TRP	C-N-CA	-7.87	112.59	120.31
1	B	177	SER	N-CA-C	7.49	119.45	111.28
1	C	37	THR	N-CA-C	-7.00	99.88	109.95
1	A	48	ASP	CA-C-N	-6.33	113.61	119.82
1	A	48	ASP	C-N-CA	-6.33	113.61	119.82
1	A	35	ALA	CA-C-N	-6.15	113.94	120.03
1	A	35	ALA	C-N-CA	-6.15	113.94	120.03
1	C	18	GLN	N-CA-C	-5.77	98.51	110.80
1	A	201	GLN	N-CA-C	-5.61	100.04	108.96
1	B	134	ILE	N-CA-C	-5.60	107.00	111.81
1	D	186	LYS	N-CA-C	-5.52	105.28	112.23
1	A	73	TYR	N-CA-C	-5.45	105.49	111.82
1	D	171	ASP	N-CA-C	5.43	116.83	110.31
1	A	214	LYS	N-CA-C	-5.42	105.28	111.07
1	D	177	SER	N-CA-C	5.35	117.11	111.28
1	B	186	LYS	N-CA-C	-5.33	105.51	112.23
1	C	77	LEU	N-CA-C	-5.28	105.44	111.14
1	B	195	ASP	CA-C-N	5.27	124.98	119.92
1	B	195	ASP	C-N-CA	5.27	124.98	119.92
1	D	257	LYS	CA-C-N	-5.21	114.21	119.83
1	D	257	LYS	C-N-CA	-5.21	114.21	119.83
1	C	37	THR	N-CA-CB	-5.19	102.72	110.60
1	C	109	GLY	N-CA-C	-5.19	108.23	114.66
1	A	37	THR	N-CA-C	-5.18	102.49	109.95
1	D	152	ALA	N-CA-C	5.17	116.92	111.28
1	B	87	LYS	CA-C-N	-5.03	113.55	119.84
1	B	87	LYS	C-N-CA	-5.03	113.55	119.84

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	293	ASN	Peptide
1	C	17	ASP	Peptide

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	2163	0	2115	44	0
1	B	2268	0	2220	41	0
1	C	2173	0	2123	35	0
1	D	2268	0	2220	30	0
2	A	24	0	24	0	0
2	B	24	0	24	0	0
2	C	24	0	24	1	0
2	D	24	0	24	1	0
3	B	19	0	16	2	0
3	D	19	0	16	2	0
4	A	94	0	0	2	0
4	B	105	0	0	4	0
4	C	111	0	0	1	0
4	D	105	0	0	6	0
All	All	9421	0	8806	145	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 8.

All (145) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:62:CYS:HB3	4:A:428:HOH:O	1.56	1.03
1:D:203:GLU:HG3	1:D:211:LEU:HD23	1.40	0.99
1:C:37:THR:HG21	1:C:120:ASP:OD2	1.63	0.99
1:B:37:THR:HG21	1:B:120:ASP:OD2	1.61	0.98
1:A:37:THR:HG21	1:A:120:ASP:OD2	1.62	0.98
1:A:37:THR:CG2	1:A:39:PHE:H	1.79	0.94
1:A:251:ALA:HB3	1:D:156:GLN:OE1	1.69	0.93
1:A:37:THR:HG22	1:A:40:GLN:H	1.35	0.91
1:C:37:THR:HG22	1:C:40:GLN:H	1.35	0.90
1:C:37:THR:HG22	1:C:39:PHE:H	1.39	0.88
1:D:46:GLU:HG2	4:D:488:HOH:O	1.76	0.84
1:A:210:GLU:HG3	4:A:412:HOH:O	1.76	0.83
1:A:37:THR:HG23	1:A:39:PHE:H	1.45	0.82

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:37:THR:CG2	1:C:39:PHE:H	1.93	0.82
1:D:13:ARG:NH2	1:D:15:GLU:OE1	2.13	0.81
1:D:215:MET:HG2	4:D:462:HOH:O	1.78	0.81
1:C:22:GLN:NE2	1:D:53:TRP:HE1	1.81	0.78
1:B:90:ARG:HG3	1:B:90:ARG:HH11	1.49	0.77
1:B:37:THR:HG22	1:B:40:GLN:H	1.50	0.77
1:A:48:ASP:OD1	1:A:50:LYS:HG2	1.86	0.76
1:A:201:GLN:NE2	1:A:242:ILE:HD11	2.01	0.76
1:D:171:ASP:HB2	1:D:172:PRO:CD	2.17	0.75
1:A:37:THR:HG22	1:A:39:PHE:H	1.49	0.74
1:B:176:ALA:HA	1:B:179:LEU:HD22	1.69	0.74
1:B:37:THR:HG22	1:B:39:PHE:H	1.54	0.73
1:C:13:ARG:NH2	1:C:15:GLU:OE2	2.23	0.71
1:A:13:ARG:HD3	1:A:15:GLU:OE2	1.90	0.71
1:B:202:GLY:O	1:B:203:GLU:HB2	1.89	0.71
1:A:16:ASN:HB3	1:A:18:GLN:HE21	1.55	0.71
1:B:269:LYS:HB2	4:B:467:HOH:O	1.92	0.70
1:B:37:THR:CG2	1:B:39:PHE:H	2.05	0.69
1:A:218:PHE:O	1:A:222:THR:HG23	1.93	0.69
1:D:215:MET:CG	4:D:462:HOH:O	2.39	0.68
1:A:13:ARG:NH2	1:A:15:GLU:OE2	2.16	0.68
1:B:180:PHE:C	4:B:432:HOH:O	2.38	0.67
1:A:202:GLY:O	1:A:203:GLU:HB2	1.94	0.67
1:C:22:GLN:HE21	1:D:53:TRP:HE1	1.44	0.66
1:A:225:ALA:HB1	1:A:251:ALA:HA	1.77	0.65
1:A:225:ALA:CB	1:A:251:ALA:HA	2.26	0.65
1:B:90:ARG:HH11	1:B:90:ARG:CG	2.08	0.65
1:B:203:GLU:HG3	1:B:211:LEU:HD23	1.79	0.65
1:C:200:ASN:OD1	1:C:200:ASN:C	2.41	0.63
1:A:40:GLN:HG3	1:A:59:LEU:HD22	1.79	0.62
1:B:169:THR:HG21	1:B:179:LEU:HD23	1.81	0.62
1:A:16:ASN:HB2	1:A:19:TRP:NE1	2.15	0.61
1:C:24:MET:HE2	1:C:238:PRO:HG3	1.81	0.61
1:C:242:ILE:HG13	1:C:243:GLY:H	1.66	0.60
1:A:37:THR:HG22	1:A:40:GLN:N	2.15	0.56
1:D:171:ASP:HB2	1:D:172:PRO:HD2	1.87	0.56
1:C:203:GLU:HG3	1:C:211:LEU:HD23	1.87	0.56
1:D:16:ASN:ND2	1:D:18:GLN:HB2	2.21	0.56
1:B:117:VAL:HG21	1:B:153:PHE:CD2	2.41	0.55
1:B:219:ILE:HG23	1:B:224:PHE:CD1	2.44	0.53
1:A:37:THR:HG22	1:A:39:PHE:N	2.21	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:16:ASN:HB3	1:C:18:GLN:CB	2.39	0.53
1:B:202:GLY:O	1:B:203:GLU:CB	2.56	0.52
1:B:16:ASN:HB3	1:B:19:TRP:CE3	2.45	0.52
1:C:37:THR:HG22	1:C:40:GLN:N	2.16	0.52
1:D:16:ASN:HD22	1:D:18:GLN:HB2	1.74	0.52
1:D:171:ASP:HB2	1:D:172:PRO:HD3	1.91	0.52
1:D:64:GLN:OE1	2:D:301:S4M:HG1	2.10	0.52
1:B:218:PHE:C	1:B:218:PHE:CD1	2.88	0.51
1:B:37:THR:HG23	1:B:38:LYS:N	2.26	0.51
1:D:133:GLN:HB2	4:D:463:HOH:O	2.10	0.51
1:B:171:ASP:HB2	1:B:172:PRO:HD2	1.93	0.51
1:A:86:PRO:O	1:A:260:ARG:HD3	2.11	0.50
1:D:7:ILE:HD13	1:D:7:ILE:O	2.12	0.50
1:B:14:GLU:OE2	1:B:63:ILE:N	2.37	0.49
1:A:151:LEU:CD1	1:A:184:PHE:HB2	2.42	0.49
1:D:195:ASP:OD1	1:D:195:ASP:N	2.36	0.49
1:C:97:GLY:O	1:C:124:MET:HG3	2.13	0.49
1:C:170:THR:HG21	4:C:427:HOH:O	2.12	0.49
1:A:44:ILE:CD1	1:A:126:GLN:HB3	2.43	0.48
1:B:229:TYR:CZ	1:B:243:GLY:HA3	2.47	0.48
1:C:37:THR:HB	1:C:40:GLN:O	2.12	0.48
1:C:66:THR:HG21	1:C:236:THR:HG21	1.95	0.48
1:C:37:THR:HG22	1:C:39:PHE:N	2.18	0.48
1:B:87:LYS:HE3	1:B:89:GLU:OE1	2.13	0.48
1:D:200:ASN:OD1	1:D:200:ASN:C	2.55	0.48
1:D:250:LYS:NZ	4:D:402:HOH:O	2.39	0.48
1:B:287:ARG:O	1:B:290:ARG:HG2	2.14	0.47
1:A:40:GLN:CG	1:A:59:LEU:HD22	2.44	0.47
1:B:200:ASN:C	1:B:200:ASN:OD1	2.55	0.47
1:A:16:ASN:HB3	1:A:18:GLN:NE2	2.28	0.47
1:A:239:CYS:HB3	1:B:235:PRO:HB3	1.96	0.47
1:A:251:ALA:CB	1:D:156:GLN:OE1	2.52	0.47
2:C:301:S4M:HE2	2:C:301:S4M:HB1	1.59	0.47
1:D:229:TYR:CZ	1:D:243:GLY:HA3	2.49	0.47
1:D:7:ILE:HD13	1:D:7:ILE:C	2.40	0.46
1:B:171:ASP:HB2	1:B:172:PRO:CD	2.45	0.46
1:D:290:ARG:CG	1:D:290:ARG:HH11	2.28	0.46
1:B:290:ARG:HG3	1:B:290:ARG:HH11	1.81	0.46
1:A:37:THR:HG23	1:A:38:LYS:N	2.31	0.46
1:C:26:LEU:HD21	3:D:302:4K2:H7	1.98	0.46
1:A:200:ASN:OD1	1:A:200:ASN:C	2.59	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:203:GLU:HA	1:C:242:ILE:HD11	1.98	0.45
1:D:65:VAL:HG13	1:D:70:GLU:HB3	1.97	0.45
1:A:44:ILE:HD12	1:A:126:GLN:HB3	1.98	0.45
1:D:180:PHE:HD2	1:D:215:MET:CE	2.29	0.45
1:C:242:ILE:HG13	1:C:243:GLY:N	2.31	0.45
1:B:90:ARG:NH1	1:B:113:HIS:HD2	2.15	0.44
1:C:86:PRO:O	1:C:260:ARG:HD3	2.16	0.44
1:B:151:LEU:CD1	1:B:179:LEU:HD12	2.47	0.44
1:C:37:THR:HG23	1:C:38:LYS:N	2.32	0.44
1:C:124:MET:HE3	1:C:145:VAL:CG1	2.47	0.44
1:B:137:SER:HA	4:B:498:HOH:O	2.17	0.44
1:C:237:TYR:CE2	1:C:242:ILE:HD13	2.53	0.44
1:A:215:MET:HB3	1:A:215:MET:HE2	1.62	0.44
1:A:229:TYR:CZ	1:A:243:GLY:HA3	2.53	0.43
1:A:202:GLY:O	1:A:203:GLU:CB	2.61	0.43
1:A:40:GLN:CD	1:A:59:LEU:HD22	2.44	0.43
1:B:169:THR:CG2	1:B:179:LEU:HD23	2.47	0.43
1:B:24:MET:HB2	3:B:302:4K2:C11	2.48	0.43
1:D:46:GLU:CG	4:D:488:HOH:O	2.51	0.43
1:D:289:ALA:O	1:D:292:ILE:HG12	2.18	0.43
1:B:16:ASN:CB	1:B:19:TRP:CE3	3.02	0.43
1:C:239:CYS:HB3	1:D:235:PRO:HB3	1.99	0.43
1:A:225:ALA:CB	1:A:251:ALA:CA	2.96	0.43
1:B:38:LYS:HB3	1:B:38:LYS:HE2	1.65	0.43
1:C:128:LYS:HA	1:C:135:SER:OG	2.18	0.43
1:C:125:GLU:O	1:C:129:GLN:HG2	2.19	0.43
1:B:90:ARG:CG	1:B:90:ARG:NH1	2.73	0.42
1:C:12:PHE:CD1	1:C:12:PHE:C	2.95	0.42
1:C:16:ASN:HB3	1:C:18:GLN:HB2	2.00	0.42
1:B:151:LEU:HD13	1:B:179:LEU:CD1	2.50	0.42
1:B:203:GLU:HG3	1:B:211:LEU:CD2	2.47	0.42
1:C:16:ASN:HB3	1:C:18:GLN:HB3	2.01	0.42
1:C:37:THR:CG2	1:C:120:ASP:OD2	2.51	0.42
1:A:203:GLU:HG3	1:A:211:LEU:HD23	2.03	0.41
1:B:37:THR:HB	1:B:40:GLN:O	2.20	0.41
1:D:124:MET:H	1:D:124:MET:HG2	1.67	0.41
1:A:256:THR:HA	1:A:283:PHE:CD2	2.56	0.41
1:C:229:TYR:CZ	1:C:243:GLY:HA3	2.55	0.41
1:A:48:ASP:OD1	1:A:50:LYS:HE2	2.20	0.41
1:A:213:GLU:HG3	1:A:292:ILE:HD11	2.01	0.41
1:D:24:MET:HB2	3:D:302:4K2:C11	2.50	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:29:GLU:HB2	1:C:49:PRO:HD3	2.01	0.41
1:A:233:HIS:HE1	4:B:502:HOH:O	2.04	0.41
1:B:14:GLU:OE2	1:B:62:CYS:HA	2.21	0.41
1:A:157:THR:HA	1:A:158:PRO:HD3	1.94	0.40
1:B:11:TRP:HE3	1:B:25:SER:HB3	1.86	0.40
1:B:22:GLN:HB2	3:B:302:4K2:H16	2.02	0.40
1:A:119:ILE:HA	1:A:148:GLY:O	2.22	0.40
1:A:151:LEU:HD12	1:A:184:PHE:HB2	2.03	0.40
1:C:37:THR:HG23	1:C:39:PHE:H	1.79	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

5.3.2 Protein sidechains [i](#)

There are no protein residues with a non-rotameric sidechain to report in this entry.

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

6 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
3	4K2	D	302	-	21,21,21	1.37	2 (9%)	28,28,28	1.23	3 (10%)
2	S4M	B	301	-	25,26,26	0.67	1 (4%)	33,37,37	1.51	7 (21%)
2	S4M	C	301	-	25,26,26	0.62	1 (4%)	33,37,37	1.04	3 (9%)
2	S4M	D	301	-	25,26,26	0.56	1 (4%)	33,37,37	1.60	7 (21%)
3	4K2	B	302	-	21,21,21	1.29	3 (14%)	28,28,28	1.79	4 (14%)
2	S4M	A	301	-	25,26,26	0.81	1 (4%)	33,37,37	1.32	6 (18%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	4K2	D	302	-	-	0/8/16/16	0/3/3/3
2	S4M	B	301	-	-	3/12/28/28	0/3/3/3
2	S4M	C	301	-	-	5/12/28/28	0/3/3/3
2	S4M	D	301	-	-	3/12/28/28	0/3/3/3
3	4K2	B	302	-	-	0/8/16/16	0/3/3/3
2	S4M	A	301	-	-	4/12/28/28	0/3/3/3

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	302	4K2	C4-C5	-3.24	1.38	1.42
2	A	301	S4M	C6-N6	3.16	1.42	1.34
3	B	302	4K2	C4-C5	-2.71	1.38	1.42
3	B	302	4K2	C8-C5	-2.42	1.39	1.42
3	B	302	4K2	C1-N2	2.40	1.39	1.35
2	C	301	S4M	C6-N6	2.34	1.40	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	302	4K2	O7-C1	2.25	1.24	1.21
2	B	301	S4M	C6-N6	2.23	1.39	1.34
2	D	301	S4M	C6-N6	2.01	1.39	1.34

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	302	4K2	C4-O3-C1	-6.48	106.97	116.98
2	A	301	S4M	CG-SD-C5'	-3.75	94.26	103.43
2	B	301	S4M	N9-C8-N7	-3.75	108.61	113.94
2	D	301	S4M	C4'-O4'-C1'	-3.63	101.46	109.47
2	D	301	S4M	CG-SD-C5'	-3.61	94.61	103.43
3	D	302	4K2	C4-O3-C1	-3.45	111.65	116.98
2	B	301	S4M	C5-N7-C8	3.31	108.66	103.45
3	D	302	4K2	O3-C1-N2	-3.02	107.10	110.75
2	B	301	S4M	C4-N9-C8	3.00	108.89	105.74
3	B	302	4K2	C4-C5-N6	2.90	122.32	118.89
2	B	301	S4M	O4'-C1'-C2'	-2.75	100.73	106.62
2	D	301	S4M	N3-C4-N9	2.73	131.81	127.17
2	B	301	S4M	CG-SD-C5'	-2.69	96.85	103.43
2	C	301	S4M	O4'-C4'-C5'	2.62	115.50	108.88
2	D	301	S4M	O4'-C1'-C2'	-2.55	101.15	106.62
2	C	301	S4M	O4'-C1'-N9	2.55	112.98	108.09
2	A	301	S4M	C4'-O4'-C1'	-2.49	103.96	109.47
2	D	301	S4M	C5-C4-N3	-2.47	123.31	126.72
3	B	302	4K2	C10-N2-C9	2.42	117.61	112.68
2	B	301	S4M	C4-C5-N7	-2.41	107.83	110.58
2	A	301	S4M	O4'-C4'-C5'	2.26	114.58	108.88
2	D	301	S4M	C5-C6-N6	-2.20	117.83	123.29
3	D	302	4K2	C14-C8-C5	2.20	121.77	118.26
2	B	301	S4M	C4'-O4'-C1'	-2.13	104.76	109.47
2	C	301	S4M	O3'-C3'-C4'	-2.12	104.99	111.08
2	A	301	S4M	C5-N7-C8	2.08	106.72	103.45
3	B	302	4K2	C14-C8-C5	2.08	121.56	118.26
2	D	301	S4M	C1'-N9-C8	-2.02	122.61	127.09
2	A	301	S4M	O4'-C1'-N9	2.02	111.97	108.09
2	A	301	S4M	O3'-C3'-C2'	2.00	118.24	111.82

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	S4M	CA-CB-CG-SD
2	A	301	S4M	O4'-C4'-C5'-SD
2	A	301	S4M	C3'-C4'-C5'-SD
2	B	301	S4M	CA-CB-CG-SD
2	C	301	S4M	CA-CB-CG-SD
2	C	301	S4M	O4'-C4'-C5'-SD
2	C	301	S4M	C3'-C4'-C5'-SD
2	D	301	S4M	C3'-C4'-C5'-SD
2	C	301	S4M	N-CA-CB-CG
2	B	301	S4M	O4'-C4'-C5'-SD
2	D	301	S4M	O4'-C4'-C5'-SD
2	B	301	S4M	C3'-C4'-C5'-SD
2	D	301	S4M	CA-CB-CG-SD
2	A	301	S4M	CB-CG-SD-C5'
2	C	301	S4M	CB-CG-SD-C5'

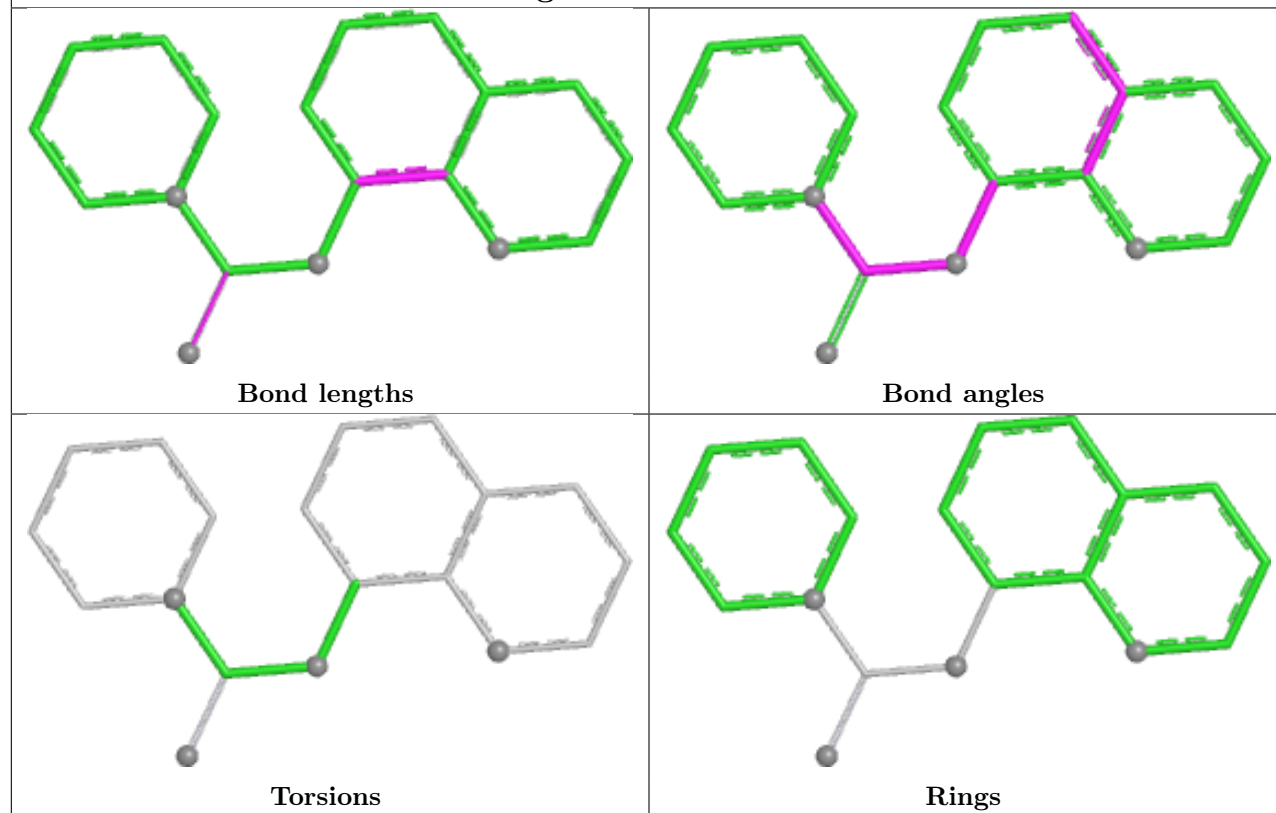
There are no ring outliers.

4 monomers are involved in 6 short contacts:

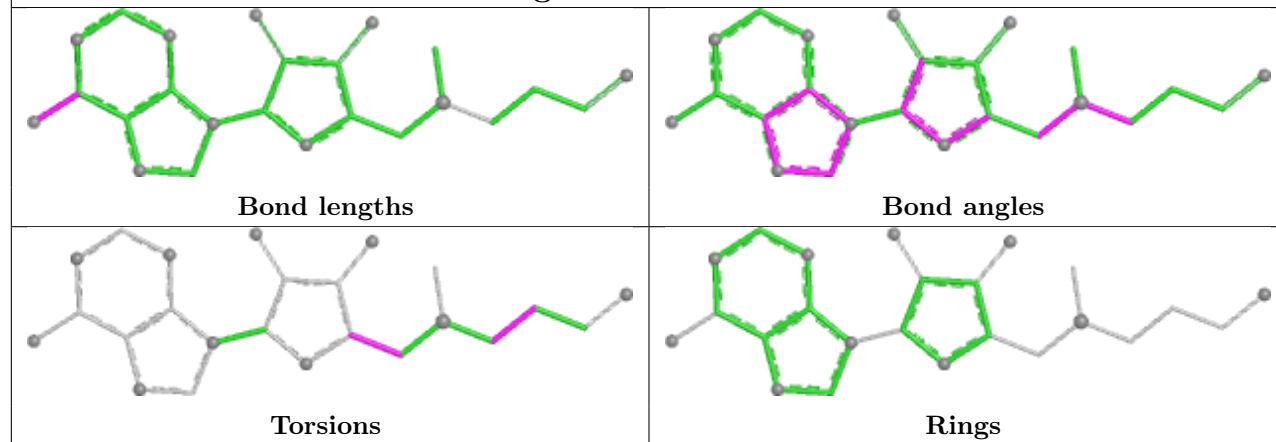
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	302	4K2	2	0
2	C	301	S4M	1	0
2	D	301	S4M	1	0
3	B	302	4K2	2	0

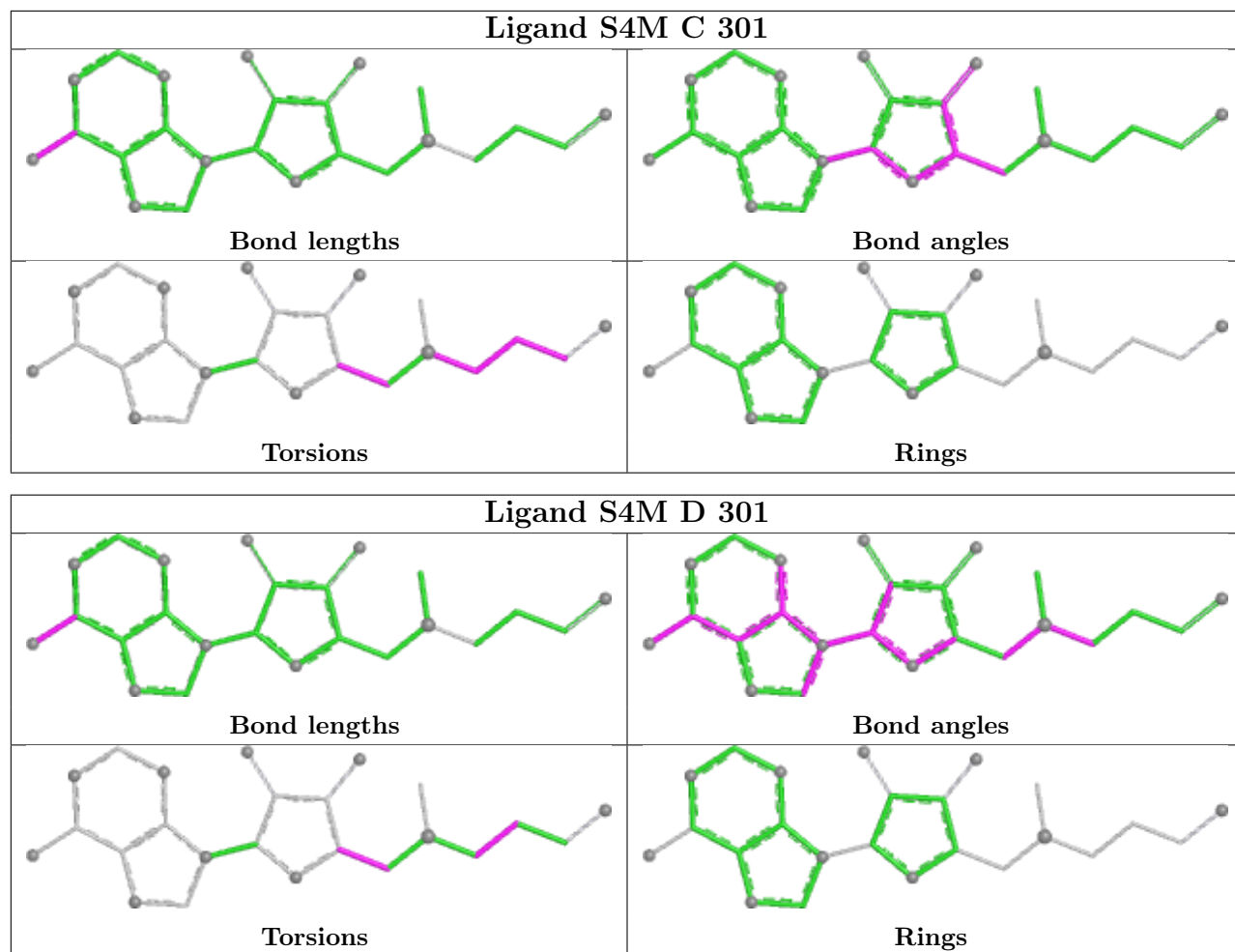
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

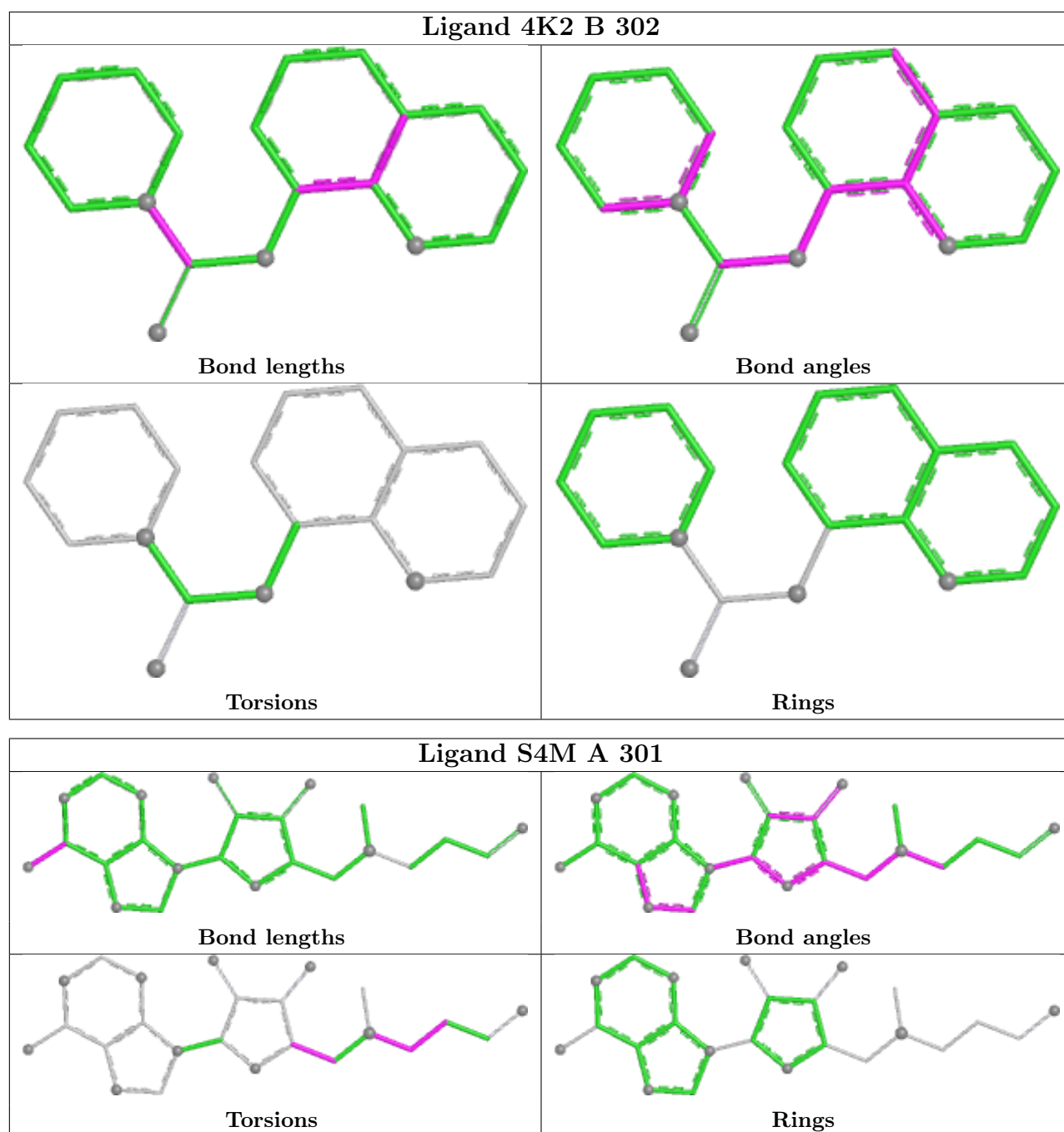
Ligand 4K2 D 302



Ligand S4M B 301







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	273/304 (89%)	0.17	12 (4%) 39 42	11, 24, 44, 78	0
1	B	288/304 (94%)	0.16	12 (4%) 40 44	12, 22, 47, 72	0
1	C	275/304 (90%)	0.04	11 (4%) 42 46	11, 20, 42, 71	0
1	D	288/304 (94%)	0.14	15 (5%) 33 35	11, 22, 47, 77	0
All	All	1124/1216 (92%)	0.13	50 (4%) 39 42	11, 22, 44, 78	0

All (50) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	19	TRP	7.2
1	D	173	ALA	6.8
1	B	173	ALA	4.8
1	C	9	GLY	4.6
1	B	19	TRP	4.1
1	D	171	ASP	4.0
1	C	170	THR	3.8
1	C	10	GLY	3.7
1	A	19	TRP	3.7
1	D	176	ALA	3.6
1	B	180	PHE	3.4
1	D	172	PRO	3.3
1	C	169	THR	3.2
1	D	180	PHE	3.2
1	C	8	SER	3.1
1	A	183	ALA	3.1
1	A	10	GLY	3.1
1	B	171	ASP	3.0
1	C	294	ASN	3.0
1	B	176	ALA	3.0
1	A	294	ASN	2.8

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Mol	Chain	Res	Type	RSRZ
1	D	152	ALA	2.7
1	D	174	GLY	2.7
1	A	237	TYR	2.6
1	C	17	ASP	2.6
1	C	16	ASN	2.5
1	C	201	GLN	2.5
1	B	17	ASP	2.5
1	B	218	PHE	2.5
1	B	24	MET	2.5
1	D	19	TRP	2.4
1	A	18	GLN	2.4
1	D	222	THR	2.4
1	D	177	SER	2.4
1	B	183	ALA	2.3
1	A	253	VAL	2.3
1	A	16	ASN	2.3
1	A	215	MET	2.3
1	B	5	GLU	2.2
1	D	294	ASN	2.2
1	A	170	THR	2.2
1	B	172	PRO	2.2
1	D	183	ALA	2.2
1	C	18	GLN	2.1
1	A	202	GLY	2.1
1	D	175	PRO	2.1
1	D	170	THR	2.1
1	B	20	PRO	2.1
1	A	222	THR	2.0
1	D	151	LEU	2.0

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

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

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

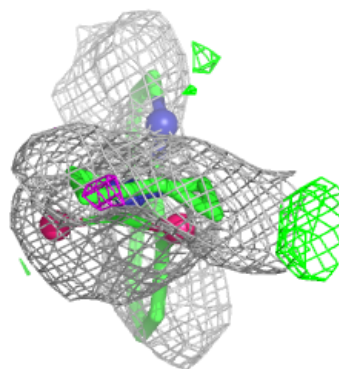
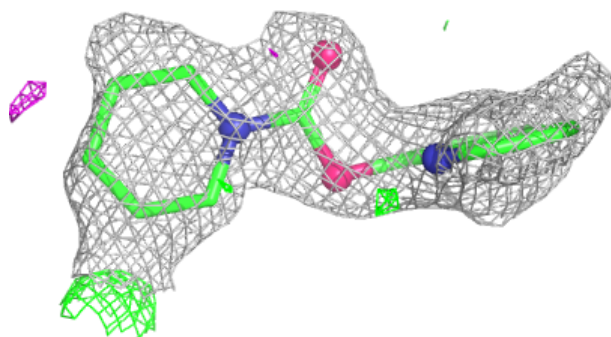
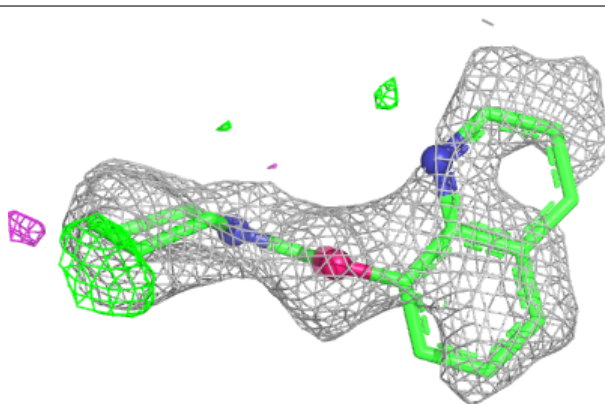
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	4K2	B	302	19/19	0.84	0.12	40,49,54,55	0
2	S4M	C	301	24/24	0.91	0.10	21,26,43,52	0
2	S4M	D	301	24/24	0.92	0.09	22,30,40,48	0
2	S4M	B	301	24/24	0.94	0.07	20,23,32,38	0
2	S4M	A	301	24/24	0.94	0.08	22,24,31,42	0
3	4K2	D	302	19/19	0.94	0.08	28,36,41,41	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.

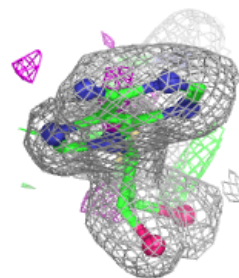
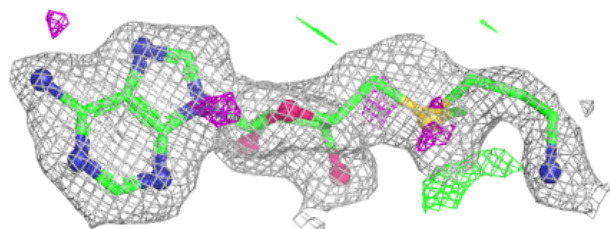
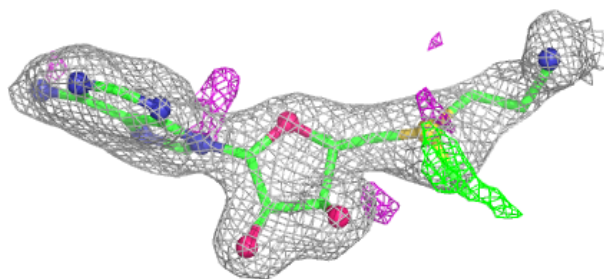
Electron density around 4K2 B 302:

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

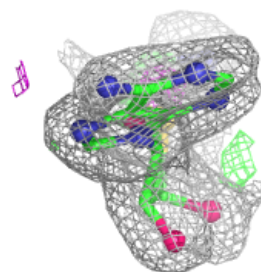
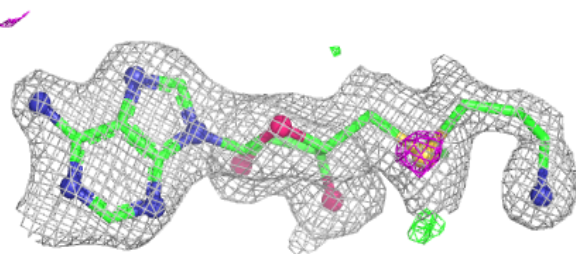
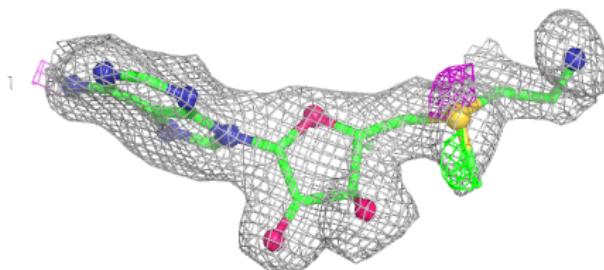


Electron density around S4M C 301:

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

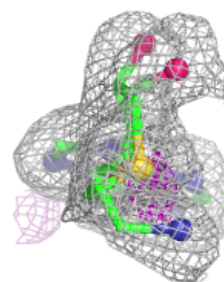
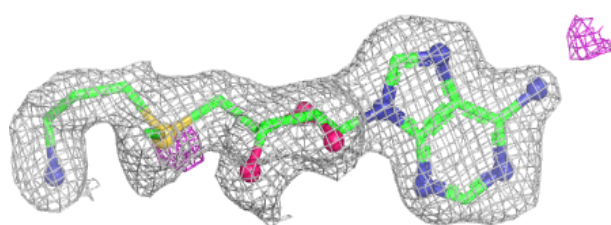
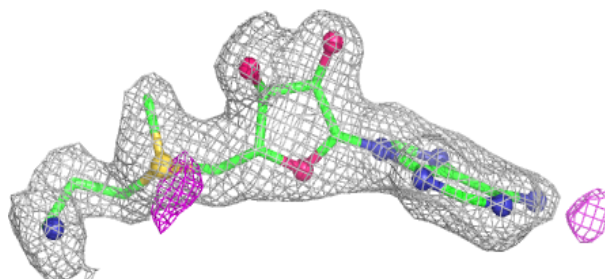
**Electron density around S4M D 301:**

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

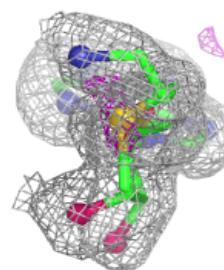
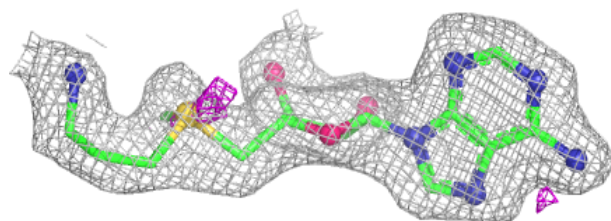
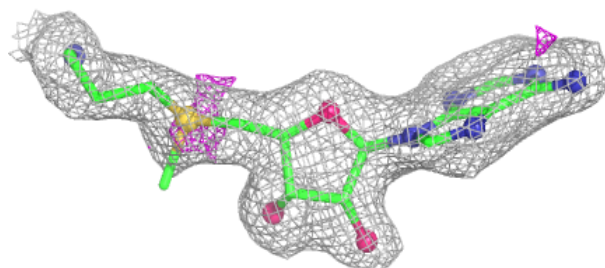


Electron density around S4M B 301:

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

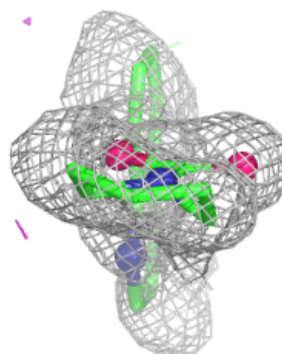
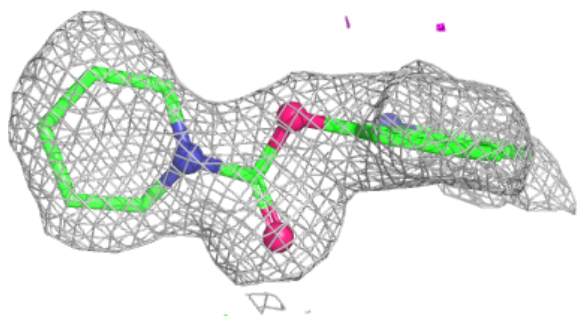
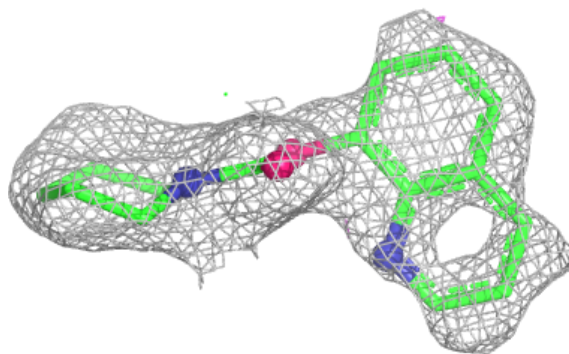
**Electron density around S4M A 301:**

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



Electron density around 4K2 D 302:

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



6.5 Other polymers [i](#)

There are no such residues in this entry.