



wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 23, 2021 – 08:51 AM EDT

PDB ID : 1TVR
Title : HIV-1 RT/9-CL TIBO
Authors : Das, K.; Ding, J.; Hsiou, Y.; Arnold, E.
Deposited on : 1996-04-16
Resolution : 3.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.23.2
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.23.2

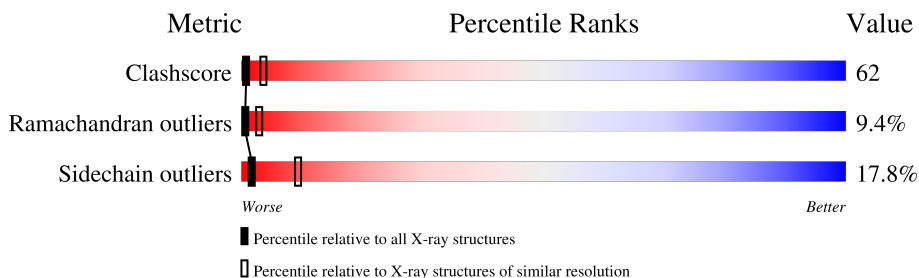
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)

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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	558	25% 58% 16% .
2	B	427	24% 58% 15% .

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

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	TB9	A	600	-	-	X	-

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7845 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 REVERSE TRANSCRIPTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	558	4382	2832	727	817	6	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	280	SER	CYS	engineered mutation	UNP P03366

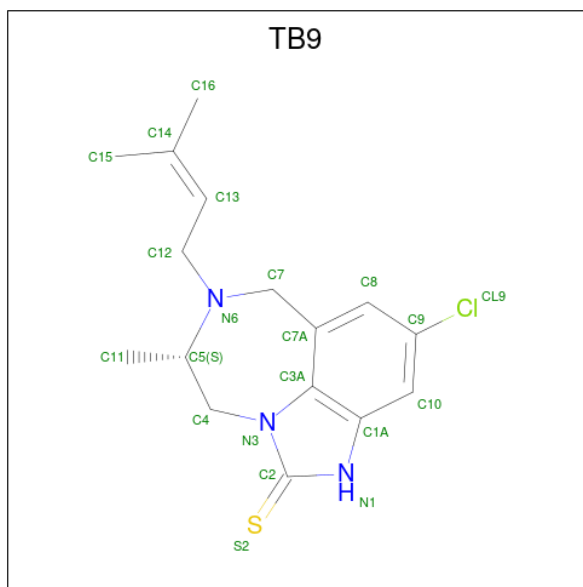
- Molecule 2 is a protein called REVERSE TRANSCRIPTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	427	3442	2240	567	630	5	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	280	SER	CYS	engineered mutation	UNP P03366

- Molecule 3 is 4-CHLORO-8-METHYL-7-(3-METHYL-BUT-2-ENYL)-6,7,8,9-TETRAHYDRO-2H-2,7,9A-TRIAZA-BENZO[CD]AZULENE-1-THIONE (three-letter code: TB9) (formula: C₁₆H₂₀ClN₃S).



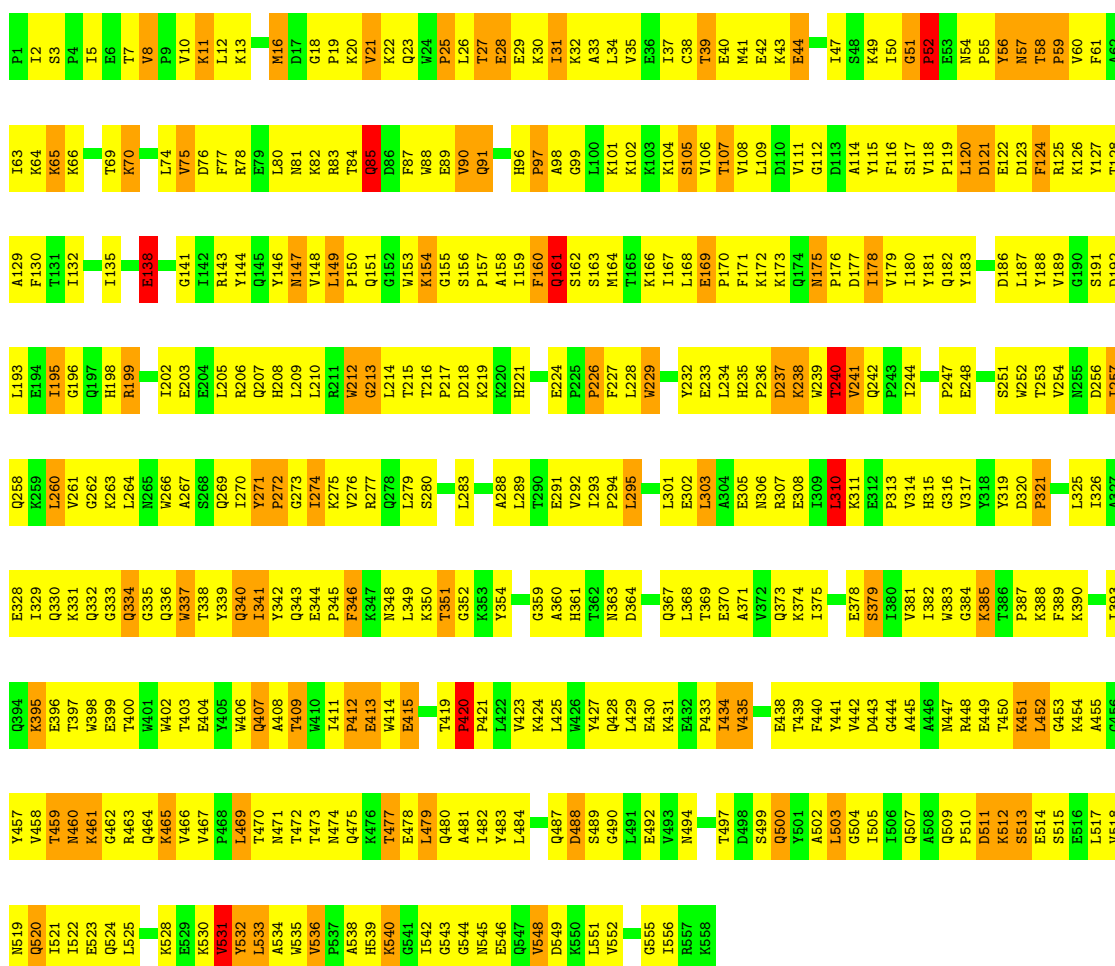
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Cl	N	S		
3	A	1	21	16	1	3	1	0	0

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. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

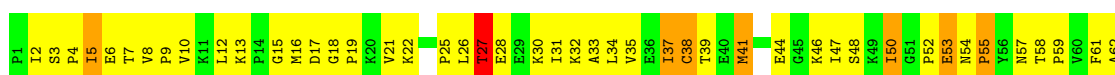
- Molecule 1: REVERSE TRANSCRIPTASE

Chain A:  25% 58% 16%



- Molecule 2: REVERSE TRANSCRIPTASE

Chain B:  24% 58% 15%



V381	D320	Q258	I195	T131	I63
I382	P321	K259	G196	I132	K64
W383	S322	L260	H198	P133	K65
F389	K323	V261	R199	S134	K66
K390	D324	G262	T200	I135	D67
L391	L325	K263	K201	M136	S68
F392	I326	L264	L202	T69	T69
E393	A327	M265	P140	P140	K70
E398	E328	W266	R143	R143	W71
T400	I329	Q269	Y144	Y144	R72
K395	Q330	L270	L205	L205	K73
E396	K331	I271	R206	Q145	L74
T397	Q332	Y271	Q207	Y146	L74
W398	G333	F272	H208	M147	W75
E399	Q334	G273	L209	V148	D76
T401	G335	I274	L210	L148	F77
W402	Q336	T275	R211	R150	L80
W403	W337	V276	W212	Q151	N81
E404	T338	R277	G213	G152	K82
Y405	Y339	Q278	L214	M153	R83
W406	Q340	L279	T215	K154	T84
Q407	I341	S280	T216	G155	Q85
P412	Y342	K281	P217	S156	D86
E413	Q343	L282	D218	P157	F87
W414	F344	L283	K219	A158	W88
E415	P345	R284	K220	L159	E89
E416	K347	G285	H221	F160	V90
F416	N348	T286	E224	Q161	Q91
V417	L349	K287	E225	S162	L92
N418	K350	A288	P225	S163	G93
T419	T351	L289	P226	M164	I94
P420	G352	T290	W229	T165	P95
P421	K353	E291	Y232	K166	H96
V423	Y354	V292	E233	L168	P97
K424	A355	I293	L294	E169	K103
L425	R356	L295	H235	P170	T107
W426	M357	T296	P236	F171	V108
Y427	A360	E297	D237	K172	L109
	H361	E298	W239	Q174	D110
	T362	A299	Y239	M175	V111
	N363	L301	E239	Q176	G112
	D364	E302	L241	D177	D113
	V365	L303	Q242	L178	A114
	K366	N306	P243	V179	Y115
	Q367	K311	I244	I180	F116
	L368	E312	V245	Y181	S117
	T369	P313	L246	Q182	L120
	E370	W314	F247	Y183	D121
	A371	H315	E248	M184	L121
	V372	G316	K249	L187	E122
	Q373	V317	R249	L187	D123
	K374	Y318	S251	Y188	F124
	I375	W319	W252	V189	R125
	T376	H315	T253	G190	K126
	T377	G316	V254	S191	Y127
	E378	Y318	M255	D192	T128
	S379	I319	D256	L193	A129
	I380	Y319	I257	E194	F130

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	226.00Å 69.30Å 104.10Å 90.00° 107.00° 90.00°	Depositor
Resolution (Å)	10.00 – 3.00 19.95 – 2.90	Depositor EDS
% Data completeness (in resolution range)	(Not available) (10.00-3.00) 82.5 (19.95-2.90)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.47 (at 2.88Å)	Xtrriage
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.259 , (Not available) 0.302 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	78.3	Xtrriage
Anisotropy	0.253	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.42 , 200.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.85	EDS
Total number of atoms	7845	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.42% 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: TB9

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	0.71	1/4497 (0.0%)	0.98	10/6132 (0.2%)
2	B	0.77	3/3541 (0.1%)	0.99	7/4822 (0.1%)
All	All	0.74	4/8038 (0.0%)	0.98	17/10954 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
2	B	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	38	CYS	CB-SG	-5.32	1.73	1.81
1	A	337	TRP	CB-CG	-5.25	1.40	1.50
2	B	153	TRP	CB-CG	-5.21	1.40	1.50
2	B	266	TRP	CB-CG	5.09	1.59	1.50

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	325	LEU	CA-CB-CG	7.62	132.82	115.30
2	B	244	ILE	N-CA-C	-6.38	93.76	111.00
1	A	420	PRO	C-N-CD	6.19	141.40	128.40
1	A	420	PRO	N-CA-C	6.17	128.14	112.10
2	B	226	PRO	N-CA-CB	6.14	110.66	103.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	427	TYR	Sidechain

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4382	0	4279	576	0
2	B	3442	0	3405	410	0
3	A	21	0	20	15	0
All	All	7845	0	7704	962	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 62.

The worst 5 of 962 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:60:VAL:HA	1:A:75:VAL:HG22	1.24	1.17
1:A:420:PRO:HG2	1:A:421:PRO:HD3	1.31	1.10
1:A:419:THR:HG22	1:A:420:PRO:HD3	1.09	1.09
2:B:282:LEU:HG	2:B:293:ILE:HG22	1.32	1.09
2:B:85:GLN:HA	2:B:88:TRP:HB2	1.36	1.07

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	556/558 (100%)	381 (68%)	129 (23%)	46 (8%)	1	4
2	B	425/427 (100%)	291 (68%)	88 (21%)	46 (11%)	0	2
All	All	981/985 (100%)	672 (68%)	217 (22%)	92 (9%)	0	3

5 of 92 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	154	LYS
1	A	213	GLY
1	A	412	PRO
1	A	462	GLY
1	A	474	ASN

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	457/498 (92%)	372 (81%)	85 (19%)	1	8
2	B	367/389 (94%)	305 (83%)	62 (17%)	2	11
All	All	824/887 (93%)	677 (82%)	147 (18%)	2	9

5 of 147 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	208	HIS
2	B	421	PRO
2	B	232	TYR
2	B	315	HIS
1	A	351	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	57	ASN

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Mol	Chain	Res	Type
2	B	334	GLN
2	B	145	GLN
2	B	407	GLN
2	B	207	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is 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	TB9	A	600	-	19,23,23	4.20	12 (63%)	18,34,34	5.71	14 (77%)

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	TB9	A	600	-	-	0/4/17/17	0/2/3/3

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	600	TB9	C10-C1A	-9.58	1.38	1.53
3	A	600	TB9	C2-N1	7.57	1.44	1.34
3	A	600	TB9	C10-C9	-6.92	1.43	1.52
3	A	600	TB9	C2-S2	5.97	1.77	1.67
3	A	600	TB9	C7A-C3A	-5.14	1.44	1.53

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	600	TB9	C8-C9-CL9	12.50	121.09	109.77
3	A	600	TB9	C16-C14-C15	9.39	135.34	114.60
3	A	600	TB9	C10-C9-CL9	9.11	118.02	109.77
3	A	600	TB9	C10-C9-C8	7.61	120.70	111.79
3	A	600	TB9	C1A-C3A-N3	7.58	112.66	102.58

There are no chirality outliers.

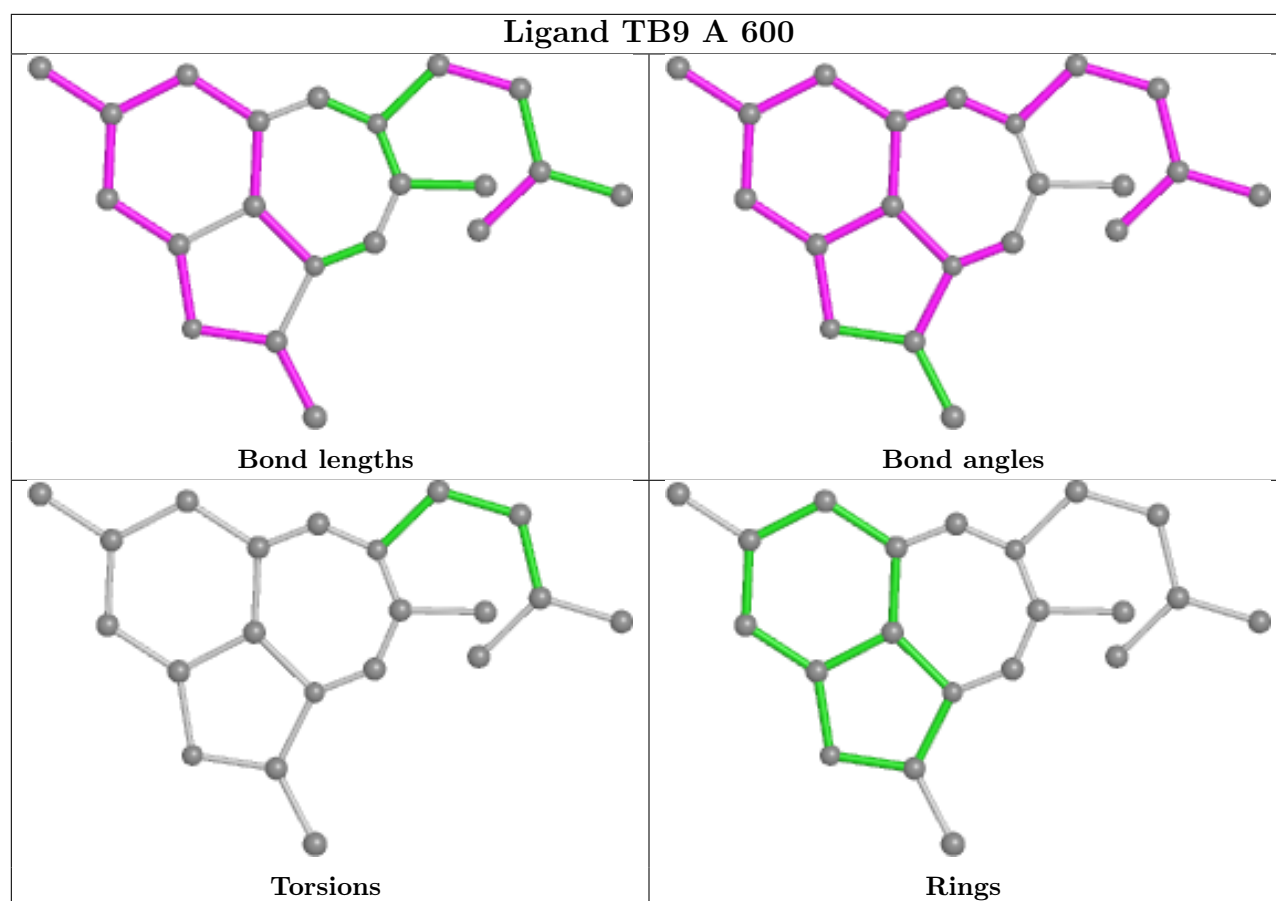
There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 15 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	600	TB9	15	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

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

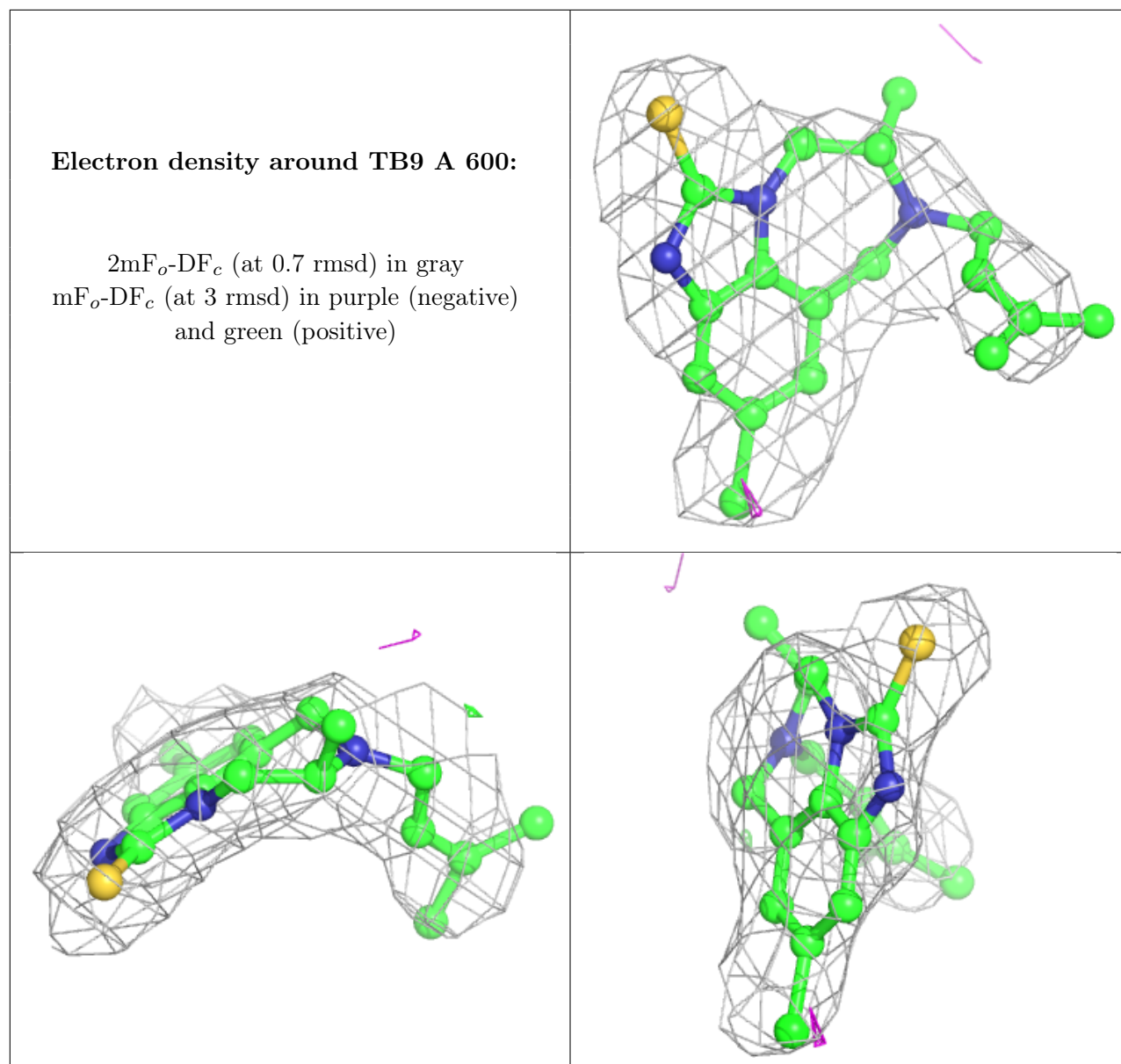
6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

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.



6.5 Other polymers [\(i\)](#)

Unable to reproduce the depositors R factor - this section is therefore empty.