



Full wwPDB X-ray Structure Validation Report ⓘ

Dec 3, 2020 – 09:10 AM GMT

PDB ID : 6ZRZ
Title : Crystal structure of 5-dimethylallyl tryptophan synthase from *Streptomyces coelicolor* in complex with DMASPP and Trp
Authors : Ostertag, E.; Broger, K.; Stehle, T.; Zocher, G.
Deposited on : 2020-07-15
Resolution : 1.70 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 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 : 2.14.6
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) : 2.14.6

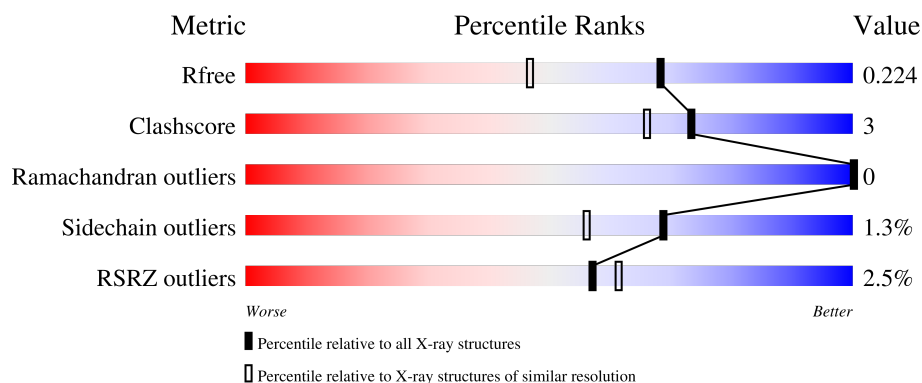
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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}	130704	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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 on 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	AAA	360	<div> <div>4%</div> <div>92%</div> <div>7%</div> </div>
1	BBB	360	<div> <div>%</div> <div>89%</div> <div>9%</div> </div>

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5791 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.

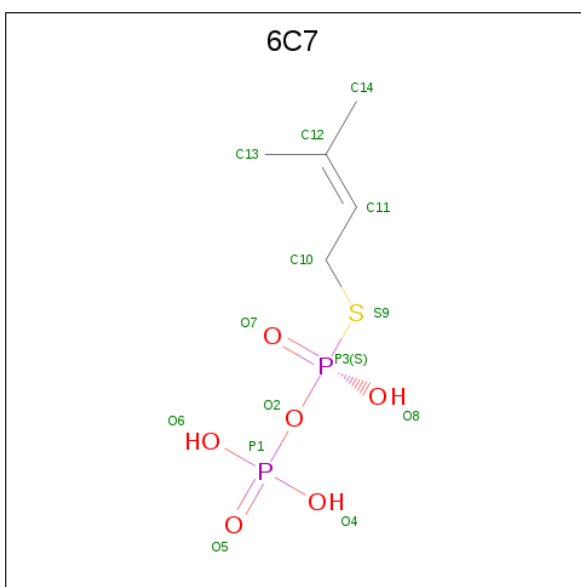
- Molecule 1 is a protein called DMATS type aromatic prenyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	AAA	357	Total	C	N	O	S	0	4	0
			2668	1676	484	500	8			
1	BBB	353	Total	C	N	O	S	0	3	0
			2653	1660	494	490	9			

There are 10 discrepancies between the modelled and reference sequences:

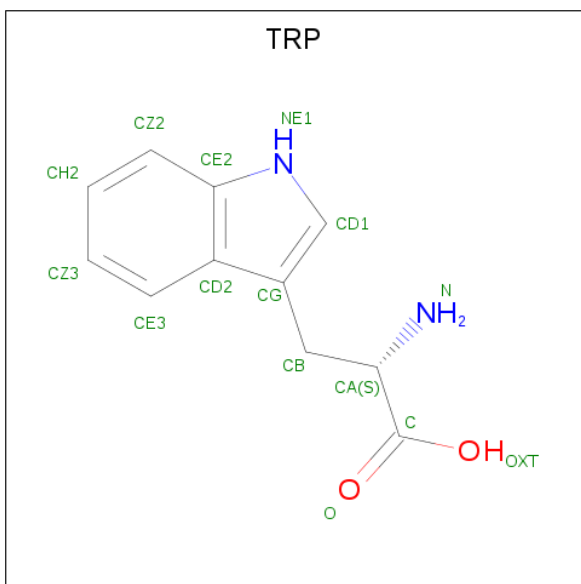
Chain	Residue	Modelled	Actual	Comment	Reference
AAA	1	MET	-	initiating methionine	UNP A0A4R8NF71
AAA	357	LEU	-	expression tag	UNP A0A4R8NF71
AAA	358	VAL	-	expression tag	UNP A0A4R8NF71
AAA	359	PRO	-	expression tag	UNP A0A4R8NF71
AAA	360	ARG	-	expression tag	UNP A0A4R8NF71
BBB	1	MET	-	initiating methionine	UNP A0A4R8NF71
BBB	357	LEU	-	expression tag	UNP A0A4R8NF71
BBB	358	VAL	-	expression tag	UNP A0A4R8NF71
BBB	359	PRO	-	expression tag	UNP A0A4R8NF71
BBB	360	ARG	-	expression tag	UNP A0A4R8NF71

- Molecule 2 is S-(3-methylbut-2-en-1-yl) trihydrogen thiodiphosphate (three-letter code: 6C7) (formula: C₅H₁₂O₆P₂S) (labeled as "Ligand of Interest" by author).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	AAA	1	Total	C	O	P	S	0	0
			14	5	6	2	1		
2	BBB	1	Total	C	O	P	S	0	0
			14	5	6	2	1		

- Molecule 3 is TRYPTOPHAN (three-letter code: TRP) (formula: $C_{11}H_{12}N_2O_2$) (labeled as "Ligand of Interest" by author).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	AAA	1	Total	C	N	O	0	0
			15	11	2	2		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	BBB	1	Total	C	N	O	0	0
			15	11	2	2		

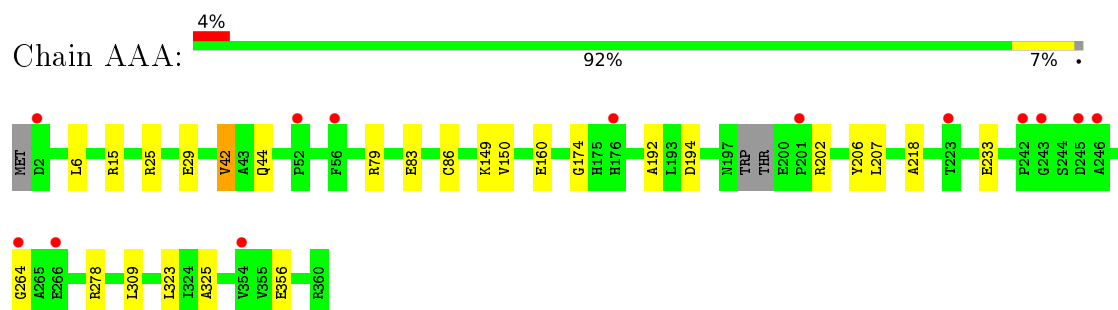
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	AAA	208	Total	O	0	0
			208	208		
4	BBB	204	Total	O	0	0
			204	204		

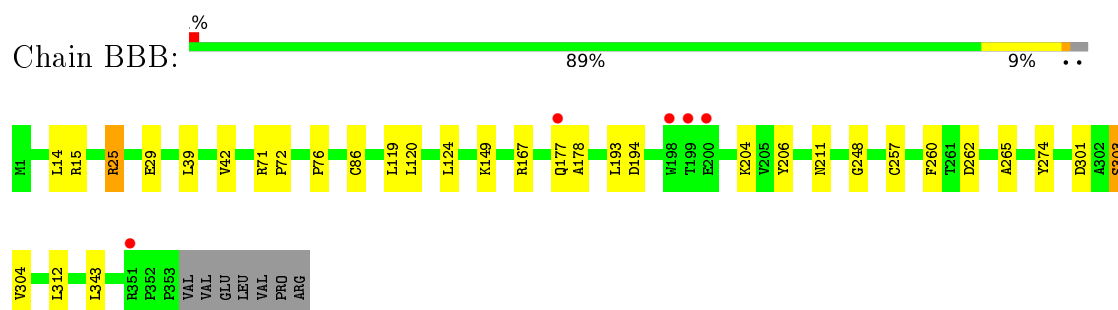
3 Residue-property plots [i](#)

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: DMATS type aromatic prenyltransferase



- Molecule 1: DMATS type aromatic prenyltransferase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	44.66Å 70.15Å 91.08Å 90.00° 92.72° 90.00°	Depositor
Resolution (Å)	45.49 – 1.70 45.49 – 1.70	Depositor EDS
% Data completeness (in resolution range)	96.9 (45.49-1.70) 97.0 (45.49-1.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.11 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.181 , 0.219 0.190 , 0.224	Depositor DCC
R_{free} test set	1812 reflections (3.00%)	wwPDB-VP
Wilson B-factor (Å ²)	24.7	Xtriage
Anisotropy	0.129	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 43.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.035 for h,-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5791	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.74% 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: 6C7

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	AAA	0.81	1/2736 (0.0%)	0.80	0/3735
1	BBB	0.80	0/2719	0.80	0/3709
All	All	0.81	1/5455 (0.0%)	0.80	0/7444

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	AAA	83	GLU	CD-OE1	-6.25	1.18	1.25

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	AAA	2668	0	2601	15	0
1	BBB	2653	0	2599	20	0
2	AAA	14	0	0	1	0
2	BBB	14	0	0	1	0
3	AAA	15	0	9	0	0
3	BBB	15	0	9	0	0
4	AAA	208	0	0	2	0
4	BBB	204	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	5791	0	5218	35	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 3.

All (35) 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:AAA:42:VAL:HG11	1:AAA:86[B]:CYS:SG	2.13	0.89
1:BBB:206:TYR:OH	2:BBB:402:6C7:S9	2.42	0.76
1:BBB:204:LYS:NZ	1:BBB:257[A]:CYS:SG	2.60	0.68
1:AAA:206:TYR:OH	2:AAA:401:6C7:S9	2.54	0.61
1:AAA:25:ARG:O	1:AAA:29:GLU:HG2	2.07	0.54
1:BBB:119:LEU:HD12	1:BBB:193:LEU:HD11	1.90	0.53
1:BBB:120:LEU:HD22	1:BBB:124:LEU:HD12	1.91	0.52
1:AAA:174:GLY:O	1:AAA:264:GLY:HA2	2.10	0.51
1:BBB:301:ASP:OD2	1:BBB:303:SER:HB3	2.11	0.51
1:AAA:278:ARG:HD3	1:AAA:325:ALA:HA	1.93	0.49
1:AAA:15:ARG:HH22	1:AAA:29:GLU:CD	2.14	0.49
1:BBB:149:LYS:HG2	1:BBB:194:ASP:OD2	2.12	0.49
1:BBB:39:LEU:O	1:BBB:42:VAL:HG22	2.12	0.49
1:BBB:167:ARG:NH2	1:BBB:177:GLN:OE1	2.46	0.49
1:BBB:211:ASN:OD1	1:BBB:248:GLY:HA3	2.13	0.48
1:BBB:312:LEU:CD1	1:BBB:343:LEU:HB3	2.44	0.48
1:BBB:15[A]:ARG:HH22	1:BBB:29:GLU:CD	2.17	0.48
1:BBB:71:ARG:HG3	1:BBB:72:PRO:HD2	1.94	0.48
1:BBB:42:VAL:HG21	1:BBB:86:CYS:SG	2.56	0.46
1:AAA:44:GLN:NE2	4:AAA:504:HOH:O	2.34	0.45
1:AAA:194:ASP:HB2	1:AAA:202:ARG:HB3	1.99	0.44
1:AAA:194:ASP:OD2	1:AAA:202:ARG:HD3	2.18	0.44
1:BBB:76:PRO:HG2	1:BBB:304:VAL:HG11	1.99	0.44
1:BBB:262:ASP:HB2	1:BBB:265:ALA:HB2	2.00	0.44
1:BBB:178:ALA:HB1	1:BBB:260:PHE:CE1	2.53	0.44
1:AAA:218:ALA:HB2	1:AAA:233:GLU:HG3	2.00	0.43
1:BBB:257[B]:CYS:HB3	1:BBB:274:TYR:HE2	1.82	0.43
1:AAA:149[B]:LYS:CE	4:AAA:640:HOH:O	2.68	0.42
1:AAA:150:VAL:O	1:AAA:192:ALA:HA	2.21	0.41
1:AAA:309:LEU:HG	1:AAA:323:LEU:HD23	2.02	0.41
1:AAA:6:LEU:HA	1:AAA:6:LEU:HD23	1.97	0.41
1:BBB:14:LEU:HD23	1:BBB:14:LEU:C	2.42	0.41
1:BBB:25:ARG:CZ	1:BBB:25:ARG:H	2.33	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:AAA:42:VAL:HG11	1:AAA:86[B]:CYS:HG	1.83	0.40
1:BBB:204:LYS:NZ	1:BBB:206:TYR:OH	2.55	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	AAA	357/360 (99%)	349 (98%)	8 (2%)	0	100	100
1	BBB	354/360 (98%)	349 (99%)	5 (1%)	0	100	100
All	All	711/720 (99%)	698 (98%)	13 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	AAA	271/277 (98%)	266 (98%)	5 (2%)	59	43
1	BBB	268/277 (97%)	266 (99%)	2 (1%)	84	77
All	All	539/554 (97%)	532 (99%)	7 (1%)	69	56

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	42	VAL
1	AAA	79	ARG
1	AAA	160	GLU
1	AAA	207	LEU
1	AAA	356	GLU
1	BBB	25	ARG
1	BBB	303	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

4 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	TRP	BBB	401	-	12,16,16	0.72	0	12,22,22	0.89	0
2	6C7	AAA	401	-	9,13,13	3.39	4 (44%)	11,19,19	1.40	1 (9%)
2	6C7	BBB	402	-	9,13,13	3.20	4 (44%)	11,19,19	1.34	1 (9%)
3	TRP	AAA	402	-	12,16,16	0.64	0	12,22,22	0.85	1 (8%)

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	TRP	BBB	401	-	-	0/3/8/8	0/2/2/2
2	6C7	AAA	401	-	-	3/7/13/13	-
2	6C7	BBB	402	-	-	0/7/13/13	-
3	TRP	AAA	402	-	-	0/3/8/8	0/2/2/2

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	AAA	401	6C7	C11-C12	7.89	1.55	1.32
2	BBB	402	6C7	C11-C12	7.19	1.53	1.32
2	AAA	401	6C7	P1-O5	4.11	1.63	1.50
2	BBB	402	6C7	P1-O5	3.70	1.62	1.50
2	BBB	402	6C7	P3-O8	-3.03	1.49	1.56
2	BBB	402	6C7	C10-S9	-3.02	1.80	1.84
2	AAA	401	6C7	C10-S9	-3.01	1.80	1.84
2	AAA	401	6C7	P1-O4	2.30	1.63	1.54

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	BBB	402	6C7	O6-P1-O2	2.90	114.36	104.64
2	AAA	401	6C7	O6-P1-O2	2.87	114.26	104.64
3	AAA	402	TRP	CH2-CZ2-CE2	-2.04	117.15	120.08

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	AAA	401	6C7	P3-O2-P1-O6
2	AAA	401	6C7	P3-O2-P1-O4
2	AAA	401	6C7	P3-O2-P1-O5

There are no ring outliers.

2 monomers are involved in 2 short contacts:

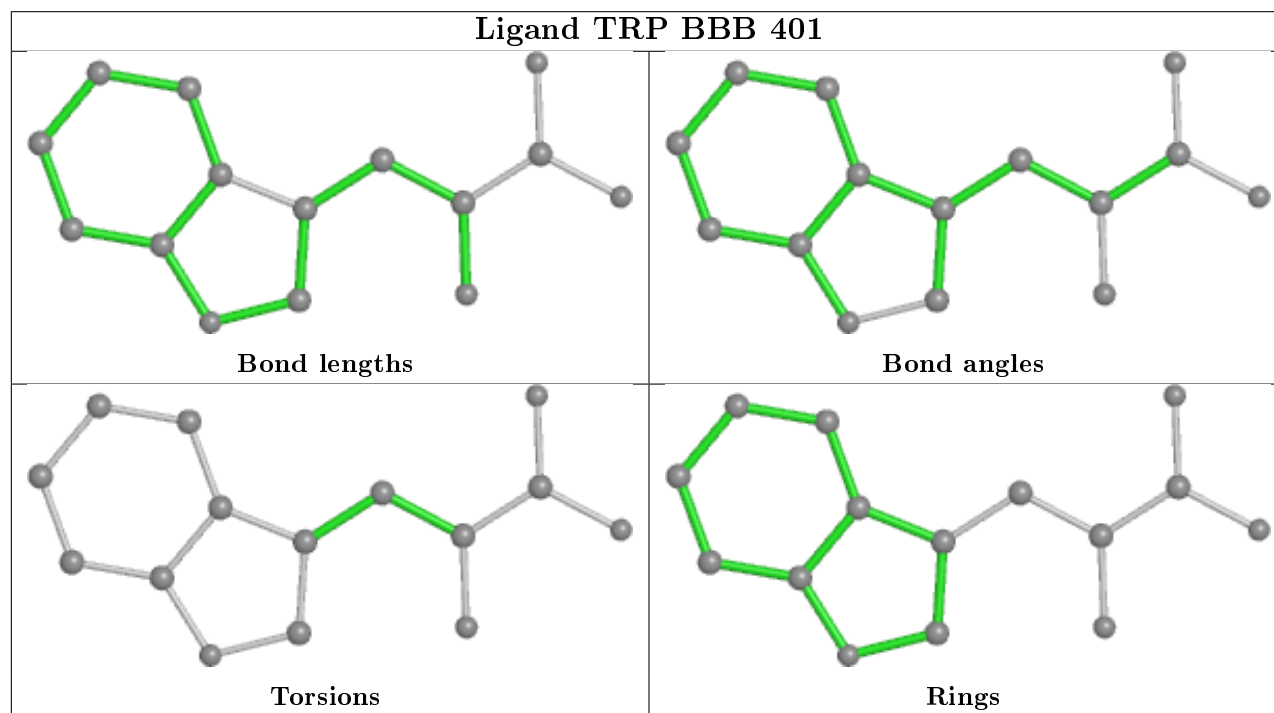
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	AAA	401	6C7	1	0

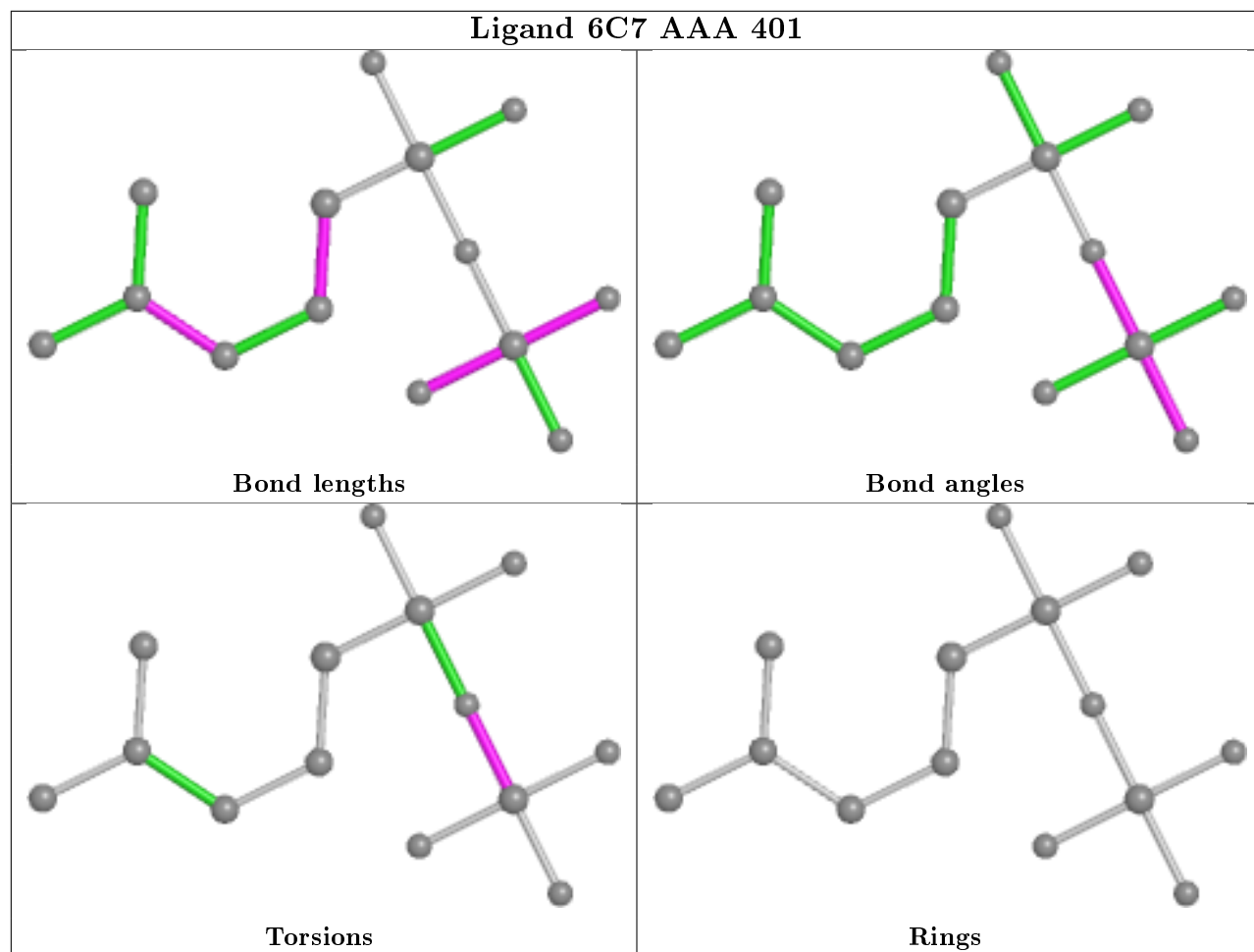
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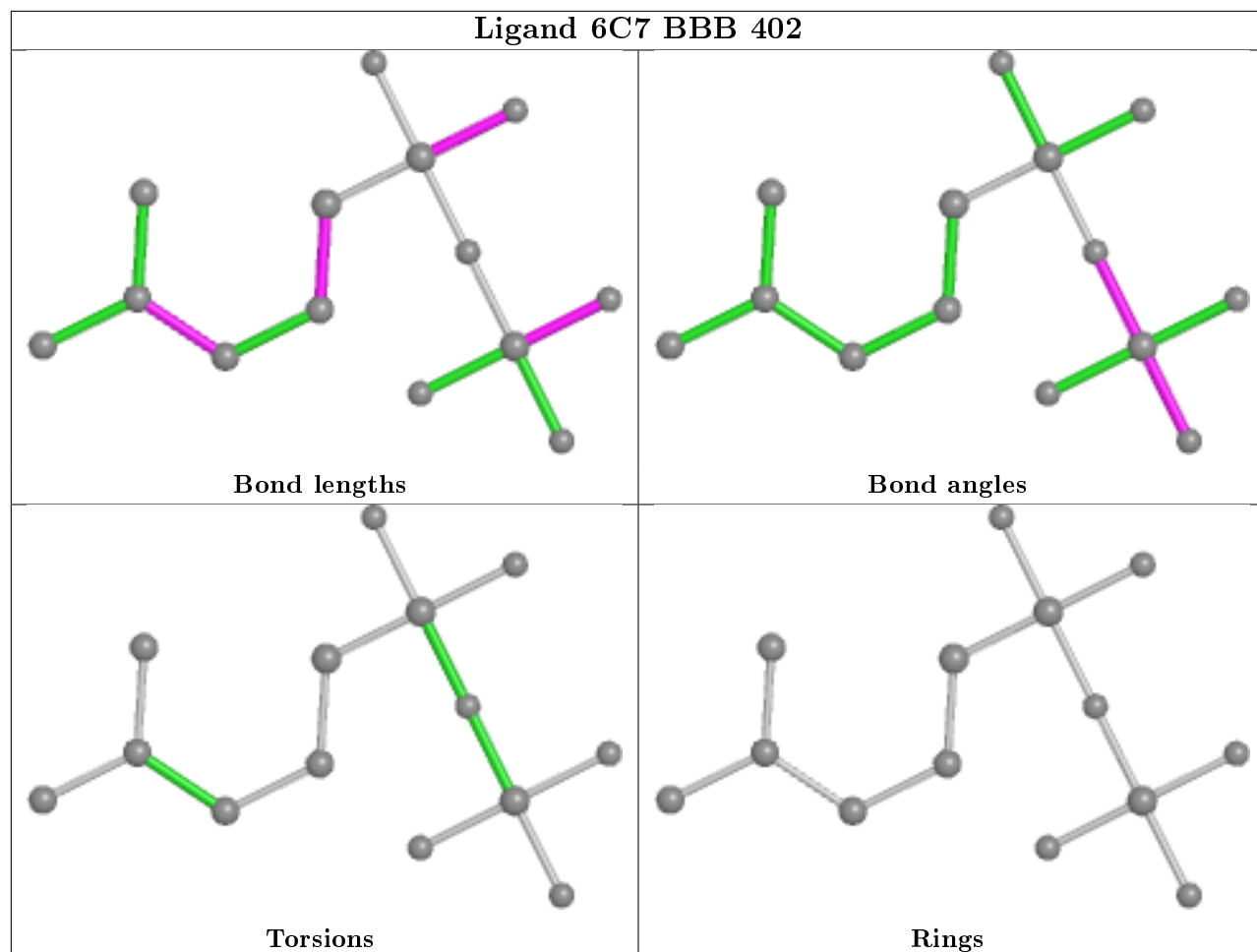
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	BBB	402	6C7	1	0

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.

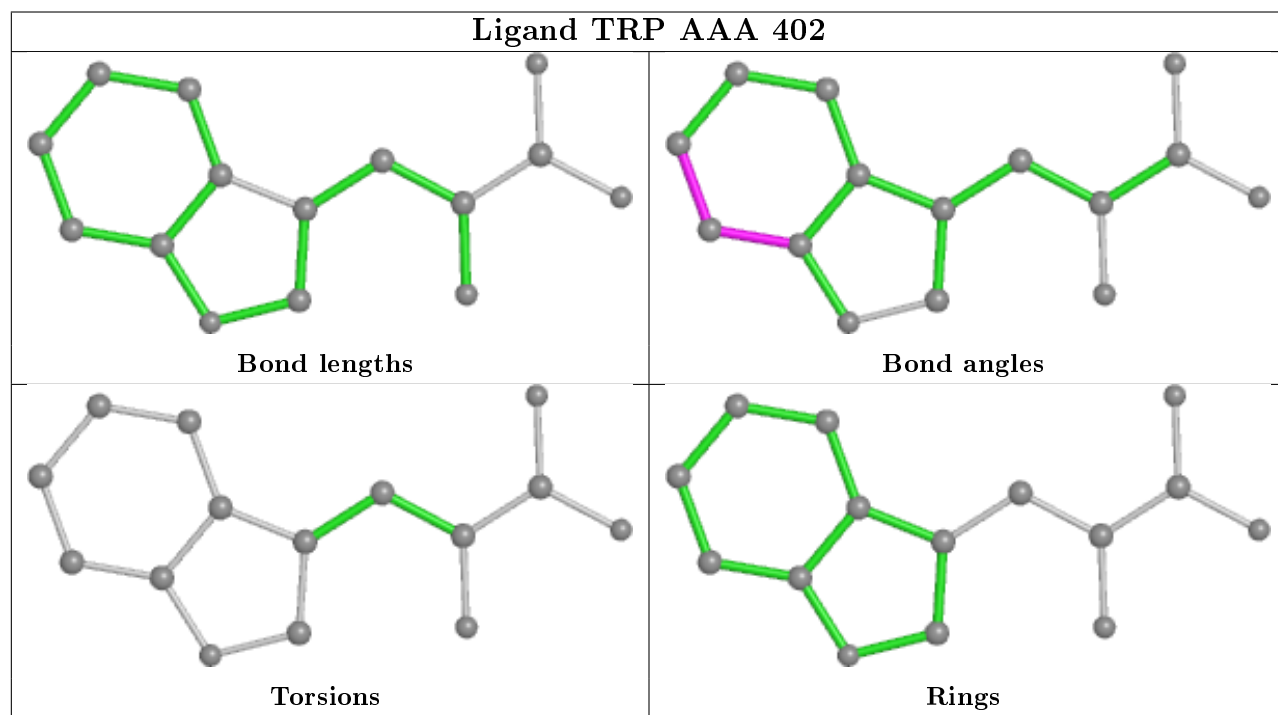




Ligand 6C7 BBB 402



Ligand TRP AAA 402



5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	AAA	357/360 (99%)	0.09	13 (3%) 42 47	15, 28, 54, 70	0
1	BBB	353/360 (98%)	0.04	5 (1%) 75 79	15, 28, 49, 71	0
All	All	710/720 (98%)	0.06	18 (2%) 57 61	15, 28, 52, 71	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	BBB	198	TRP	4.9
1	AAA	245	ASP	3.8
1	BBB	199	THR	3.8
1	AAA	243	GLY	3.6
1	AAA	56[A]	PHE	3.2
1	AAA	223	THR	3.2
1	AAA	242	PRO	2.9
1	AAA	246	ALA	2.7
1	BBB	351	ARG	2.4
1	AAA	2	ASP	2.4
1	AAA	52	PRO	2.3
1	BBB	200	GLU	2.3
1	BBB	177	GLN	2.2
1	AAA	264	GLY	2.2
1	AAA	266	GLU	2.1
1	AAA	176	HIS	2.1
1	AAA	201	PRO	2.1
1	AAA	354	VAL	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](#)

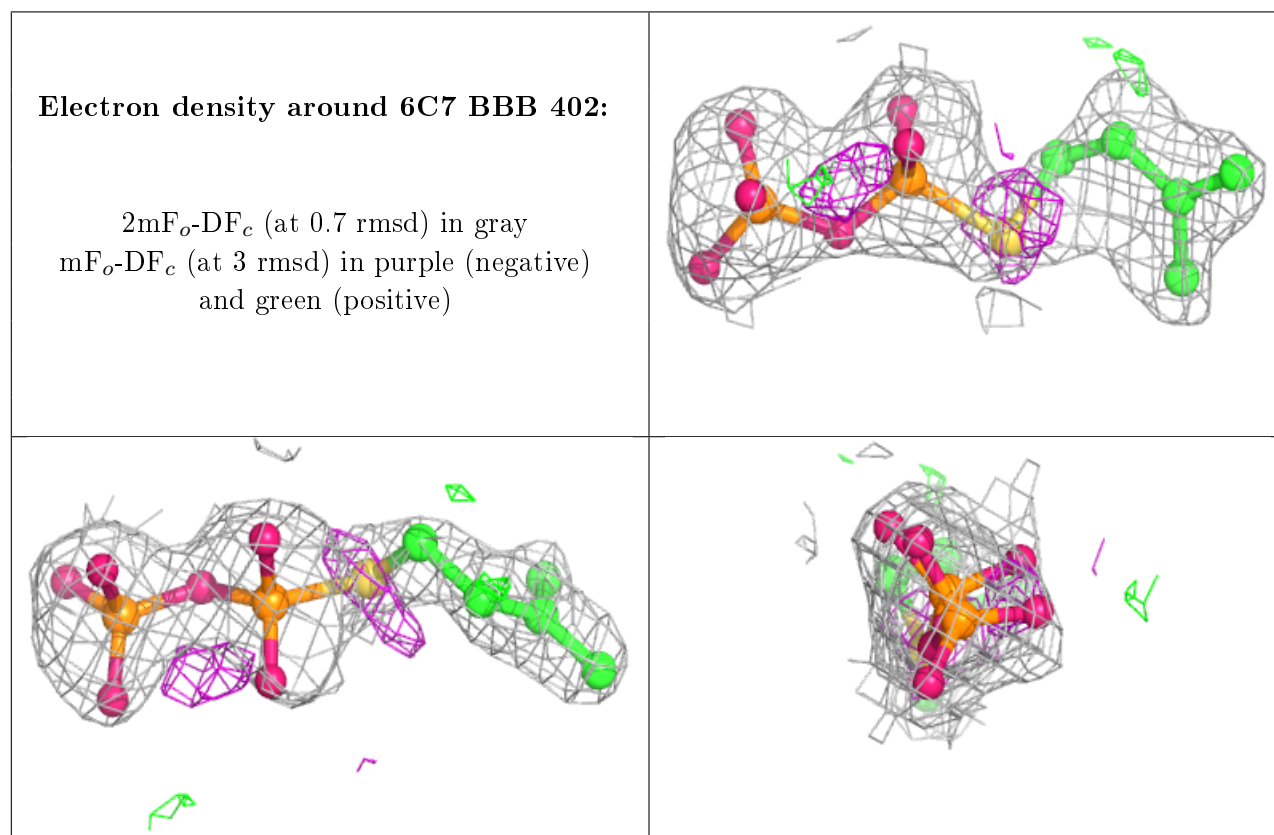
There are no monosaccharides in this entry.

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.

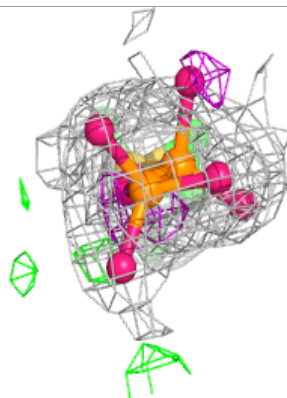
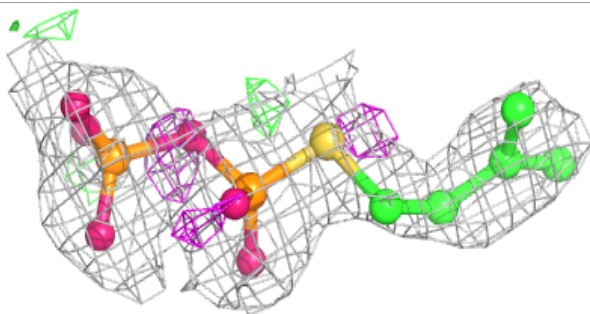
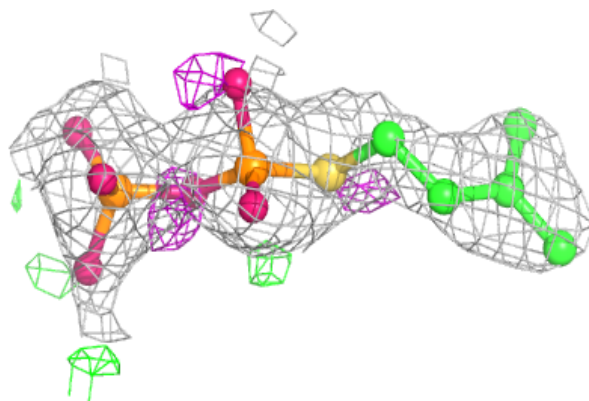
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	6C7	BBB	402	14/14	0.86	0.17	42,54,58,59	0
2	6C7	AAA	401	14/14	0.91	0.13	46,50,55,57	0
3	TRP	AAA	402	15/15	0.96	0.08	20,21,24,25	0
3	TRP	BBB	401	15/15	0.97	0.06	18,19,21,22	0

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.



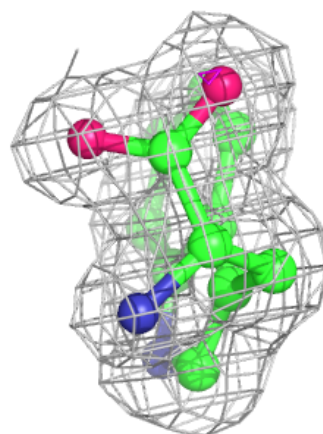
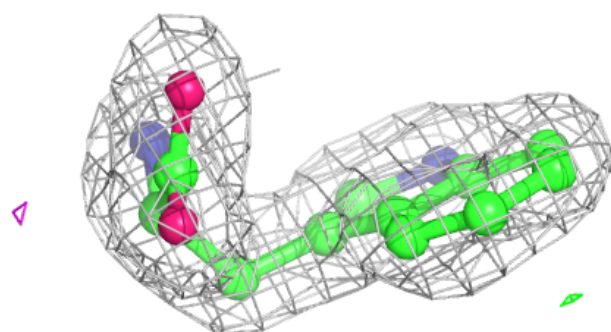
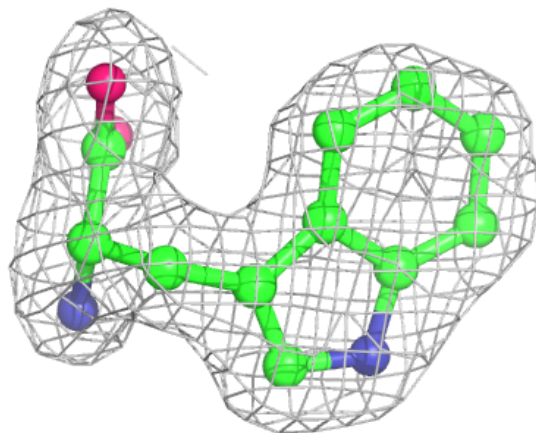
Electron density around 6C7 AAA 401:

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



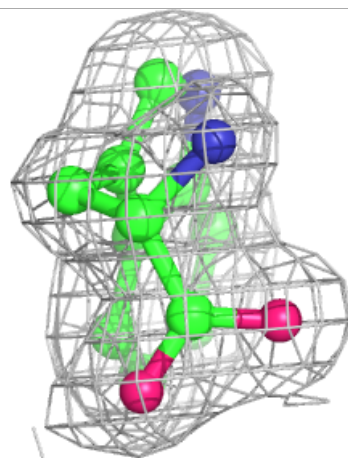
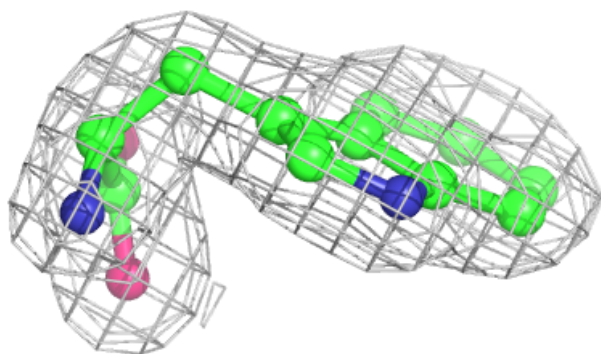
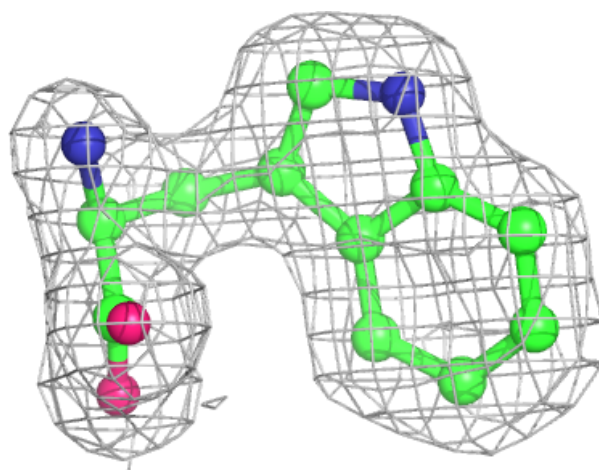
Electron density around TRP AAA 402:

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



Electron density around TRP BBB 401:

$2mF_o-DF_c$ (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.