Full wwPDB X-ray Structure Validation Report ⓘ

Dec 9, 2020 – 11:04 am GMT

PDB ID	:	7AGT
Title	:	Structure of the S726F mutant of AcylTransferase domain of Mycocerosic Acid Synthase from Mycobacterium tuberculosis acylated with Malonyl-coenzyme A
Authors	:	Brison, Y.; Mourey, L.; Maveyraud, L.
Deposited on	:	2020-09-23
Resolution	:	2.90 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:

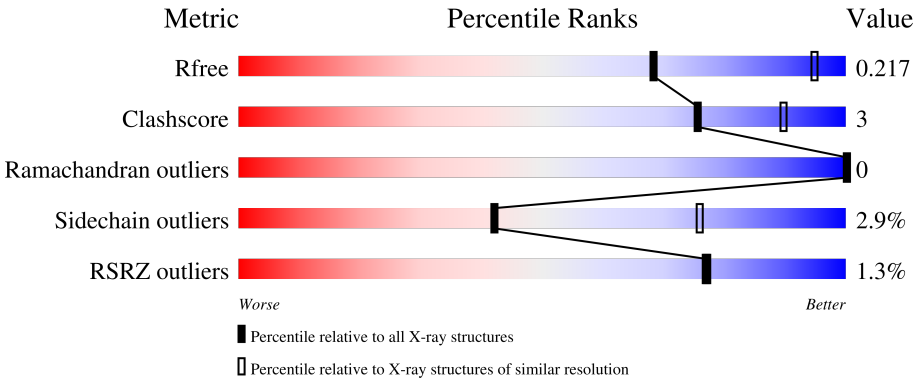
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.15.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.15.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

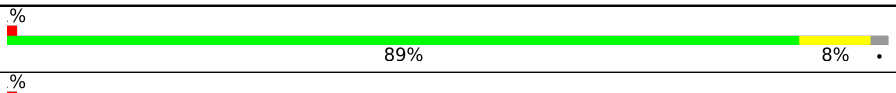
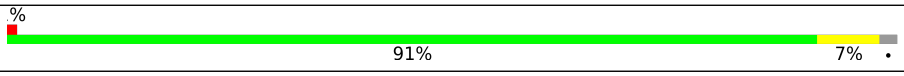
The reported resolution of this entry is 2.90 Å.

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	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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 <=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	439	
1	B	439	

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 6484 atoms, of which 6 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 Mycocerosic acid synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	429	Total	C	N	O	S	0	0	0
			3173	1988	563	607	15			
1	B	432	Total	C	N	O	S	0	0	0
			3191	1997	566	613	15			

There are 30 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	435	MET	-	initiating methionine	UNP Q02251
A	436	GLY	-	expression tag	UNP Q02251
A	437	SER	-	expression tag	UNP Q02251
A	438	SER	-	expression tag	UNP Q02251
A	439	HIS	-	expression tag	UNP Q02251
A	440	HIS	-	expression tag	UNP Q02251
A	441	HIS	-	expression tag	UNP Q02251
A	442	HIS	-	expression tag	UNP Q02251
A	443	HIS	-	expression tag	UNP Q02251
A	444	HIS	-	expression tag	UNP Q02251
A	445	SER	-	expression tag	UNP Q02251
A	446	SER	-	expression tag	UNP Q02251
A	726	PHE	SER	engineered mutation	UNP Q02251
A	872	GLY	-	cloning artifact	UNP Q02251
A	873	SER	-	cloning artifact	UNP Q02251
B	435	MET	-	initiating methionine	UNP Q02251
B	436	GLY	-	expression tag	UNP Q02251
B	437	SER	-	expression tag	UNP Q02251
B	438	SER	-	expression tag	UNP Q02251
B	439	HIS	-	expression tag	UNP Q02251
B	440	HIS	-	expression tag	UNP Q02251
B	441	HIS	-	expression tag	UNP Q02251
B	442	HIS	-	expression tag	UNP Q02251
B	443	HIS	-	expression tag	UNP Q02251
B	444	HIS	-	expression tag	UNP Q02251

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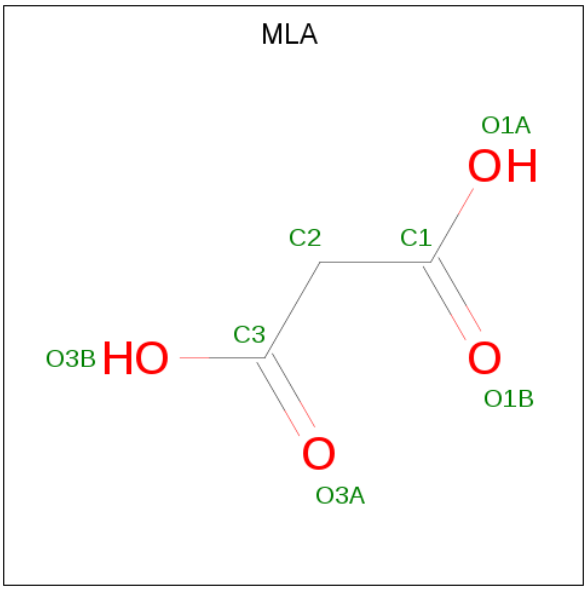
Chain	Residue	Modelled	Actual	Comment	Reference
B	445	SER	-	expression tag	UNP Q02251
B	446	SER	-	expression tag	UNP Q02251
B	726	PHE	SER	engineered mutation	UNP Q02251
B	872	GLY	-	cloning artifact	UNP Q02251
B	873	SER	-	cloning artifact	UNP Q02251

- Molecule 2 is MALONIC ACID (three-letter code: MLA) (formula: $C_3H_4O_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C H O 9 3 3 3	3	0
2	B	1	Total C H O 9 3 3 3	3	0

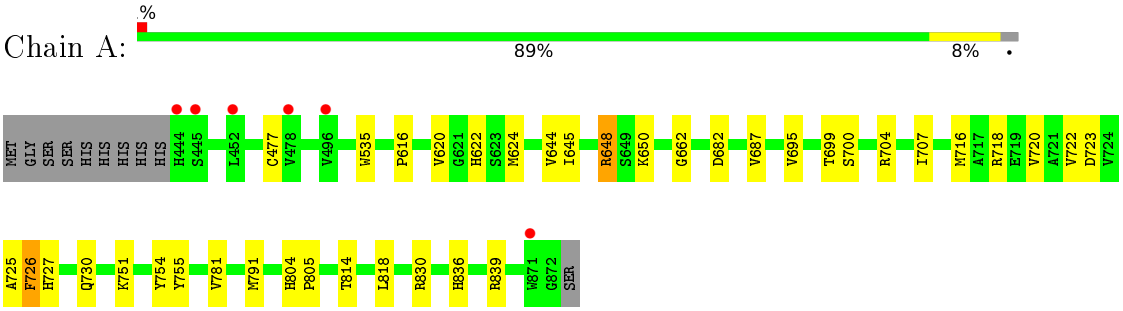
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	50	Total O 50 50	0	0
3	B	52	Total O 52 52	0	0

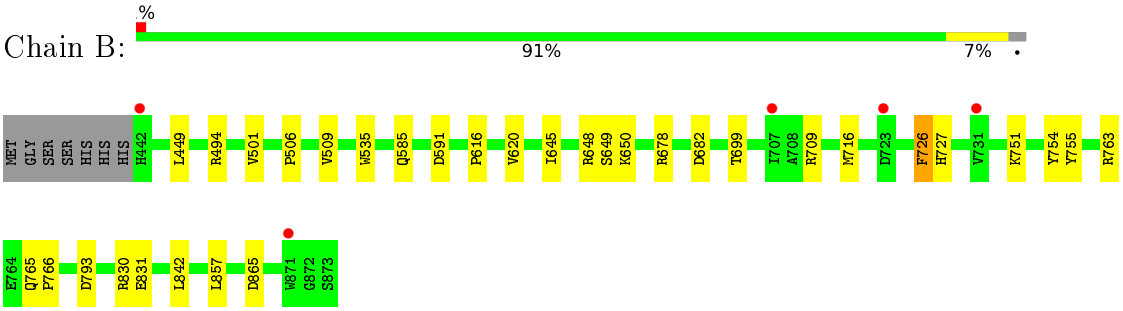
3 Residue-property plots (i)

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 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: Mycocerosic acid synthase



- Molecule 1: Mycocerosic acid synthase



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	148.48Å 156.12Å 115.55Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.11 – 2.90 49.11 – 2.90	Depositor EDS
% Data completeness (in resolution range)	97.1 (49.11-2.90) 97.1 (49.11-2.90)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.06	Depositor
$< I/\sigma(I) >$ [1]	1.11 (at 2.91Å)	Xtriage
Refinement program	BUSTER 2.10.3, REFMAC 5.8.0258	Depositor
R, R_{free}	0.192 , 0.209 0.195 , 0.217	Depositor DCC
R_{free} test set	1442 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å^2)	95.3	Xtriage
Anisotropy	0.332	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 71.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.000 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	6484	wwPDB-VP
Average B, all atoms (Å^2)	100.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.79% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MLA

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	0.53	0/3235	0.66	0/4420
1	B	0.55	0/3253	0.65	0/4443
All	All	0.54	0/6488	0.65	0/8863

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

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	3173	0	3134	24	0
1	B	3191	0	3146	15	0
2	A	6	3	2	2	0
2	B	6	3	2	1	0
3	A	50	0	0	0	0
3	B	52	0	0	0	0
All	All	6478	6	6284	39	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 (39) 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:804:HIS:HD2	1:A:830:ARG:H	1.25	0.84
1:A:725:ALA:HB3	1:A:730:GLN:HG3	1.69	0.74
1:A:791:MET:CE	1:A:814:THR:HG22	2.23	0.69
1:B:830:ARG:HG2	1:B:831:GLU:HG2	1.75	0.67
1:A:791:MET:HE3	1:A:818:LEU:HD12	1.81	0.62
1:A:804:HIS:CD2	1:A:830:ARG:H	2.13	0.61
1:B:449:LEU:HD23	1:B:501:VAL:HG22	1.82	0.60
1:B:682:ASP:OD2	1:B:699:THR:CG2	2.49	0.60
1:B:763:ARG:NH1	1:B:793:ASP:OD1	2.35	0.59
1:A:624:MET:HB2	1:A:645:ILE:HD11	1.86	0.58
1:B:727:HIS:NE2	2:B:901:MLA:O3B	2.39	0.55
1:A:682:ASP:HB2	1:A:699:THR:HG23	1.91	0.53
1:A:791:MET:HE3	1:A:814:THR:HG22	1.90	0.52
1:A:836:HIS:CD2	1:A:839:ARG:NH1	2.79	0.50
1:A:620:VAL:HG22	1:A:755:TYR:HB2	1.95	0.49
1:A:791:MET:HE1	1:A:814:THR:HG22	1.92	0.49
1:B:506:PRO:HA	1:B:509:VAL:HG22	1.94	0.49
1:A:700:SER:HB3	1:A:704:ARG:HH12	1.78	0.49
1:A:791:MET:HE1	1:A:814:THR:CG2	2.43	0.48
1:B:620:VAL:HG22	1:B:755:TYR:HB2	1.95	0.48
1:B:591:ASP:HA	1:B:649:SER:HB2	1.96	0.47
1:B:682:ASP:OD2	1:B:699:THR:HG21	2.15	0.47
1:B:726:PHE:HB2	1:B:727:HIS:CD2	2.51	0.46
1:B:678:ARG:HE	1:B:709:ARG:NH1	2.14	0.46
1:A:687:VAL:HB	1:A:695:VAL:HB	1.97	0.45
1:A:644:VAL:O	1:A:648:ARG:HB3	2.17	0.45
1:A:720:VAL:HG12	1:A:722:VAL:HG13	1.99	0.44
1:B:842:LEU:HD21	1:B:857:LEU:HD22	1.99	0.44
1:A:622:HIS:HE1	1:A:687:VAL:HG11	1.82	0.44
1:A:648:ARG:HH21	2:A:901:MLA:C3	2.30	0.44
1:A:535:TRP:CD1	1:A:616:PRO:HB3	2.53	0.43
1:A:648:ARG:NH2	2:A:901:MLA:O3B	2.49	0.43
1:B:535:TRP:CD1	1:B:616:PRO:HB3	2.54	0.43
1:B:682:ASP:OD2	1:B:699:THR:HG22	2.17	0.42
1:A:662:GLY:HA3	1:A:707:ILE:HD11	2.02	0.41
1:A:726:PHE:HB2	1:A:727:HIS:CD2	2.53	0.41
1:A:687:VAL:HG13	1:A:781:VAL:HB	2.01	0.41
1:B:765:GLN:HA	1:B:766:PRO:HD3	1.88	0.41
1:A:804:HIS:CD2	1:A:805:PRO:HD2	2.56	0.41

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	427/439 (97%)	420 (98%)	7 (2%)	0	100	100
1	B	430/439 (98%)	423 (98%)	7 (2%)	0	100	100
All	All	857/878 (98%)	843 (98%)	14 (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	A	322/335 (96%)	313 (97%)	9 (3%)	43	76
1	B	324/335 (97%)	314 (97%)	10 (3%)	40	74
All	All	646/670 (96%)	627 (97%)	19 (3%)	42	76

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	477	CYS
1	A	648	ARG
1	A	650	LYS
1	A	716	MET
1	A	718	ARG
1	A	723	ASP
1	A	726	PHE
1	A	751	LYS

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Mol	Chain	Res	Type
1	A	754	TYR
1	B	494	ARG
1	B	585	GLN
1	B	645	ILE
1	B	648	ARG
1	B	650	LYS
1	B	716	MET
1	B	726	PHE
1	B	751	LYS
1	B	754	TYR
1	B	865	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	474	HIS
1	A	550	GLN
1	A	622	HIS
1	A	804	HIS
1	A	836	HIS
1	B	474	HIS
1	B	585	GLN

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

2 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	$\#\|Z\| > 2$
2	MLA	A	901	1	2,5,6	0.62	0	1,5,7	0.68	0
2	MLA	B	901	1	2,5,6	0.59	0	1,5,7	1.01	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	MLA	A	901	1	-	0/0/3/4	-
2	MLA	B	901	1	-	0/0/3/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

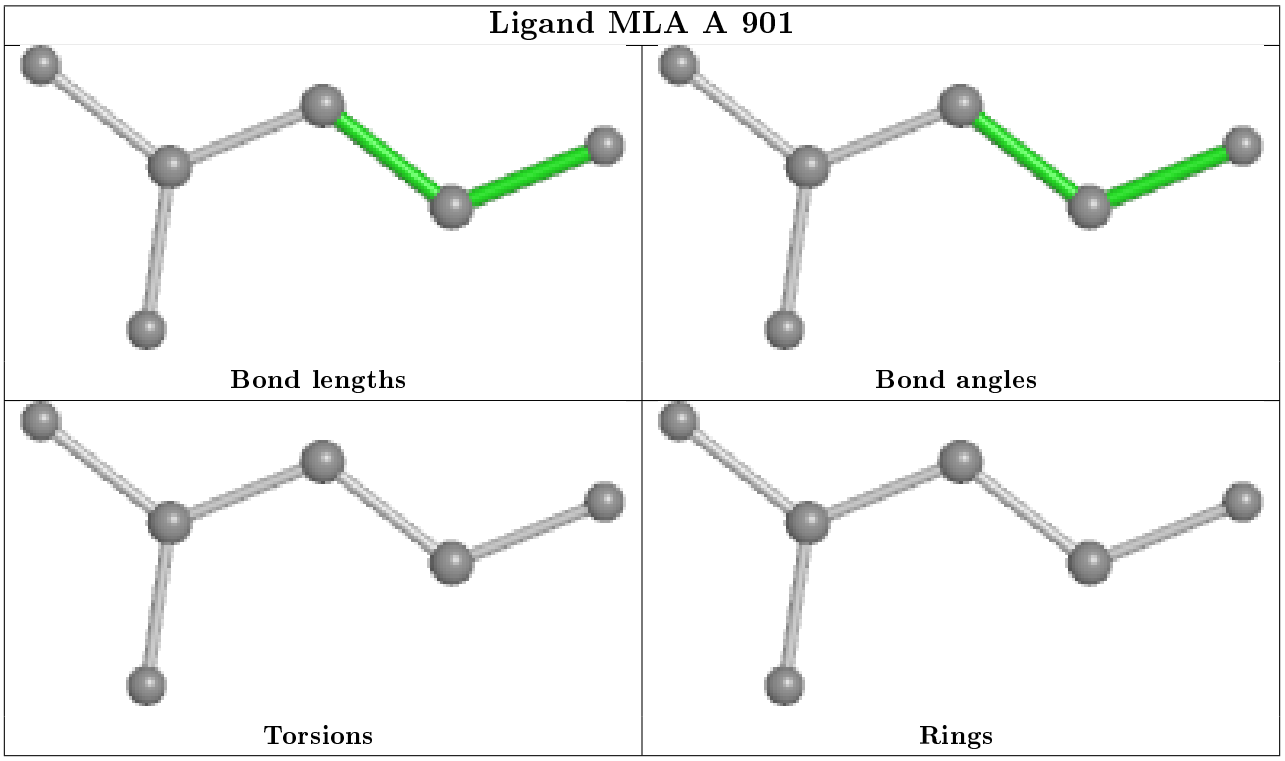
There are no ring outliers.

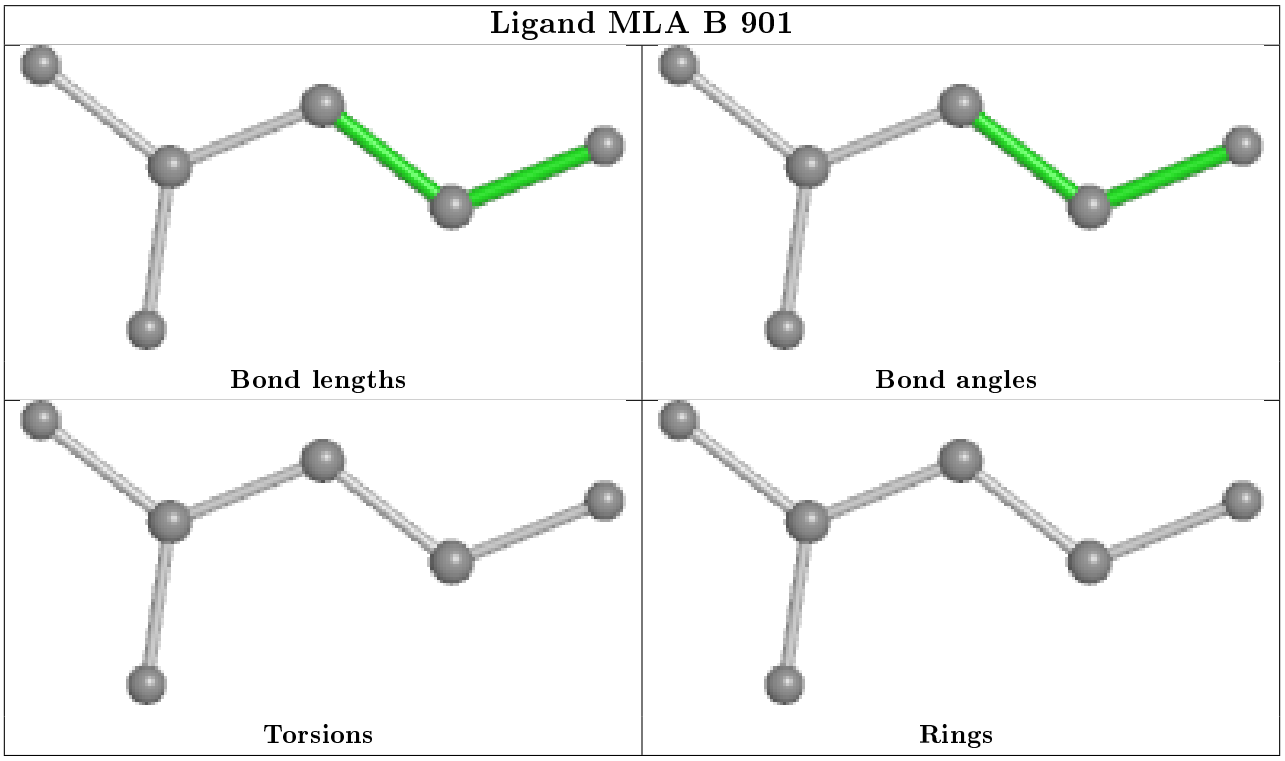
2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	901	MLA	2	0
2	B	901	MLA	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 then 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

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

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, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	429/439 (97%)	0.02	6 (1%)	75	75	75, 100, 133, 151	0
1	B	432/439 (98%)	0.13	5 (1%)	79	79	69, 96, 126, 169	0
All	All	861/878 (98%)	0.08	11 (1%)	77	77	69, 99, 130, 169	0

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	444	HIS	4.1
1	B	442	HIS	4.1
1	A	445	SER	3.0
1	B	731	VAL	2.9
1	A	496	VAL	2.6
1	B	871	TRP	2.5
1	B	723	ASP	2.4
1	A	452	LEU	2.2
1	B	707	ILE	2.2
1	A	871	TRP	2.1
1	A	478	VAL	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 monosaccharides in this entry.

6.4 Ligands

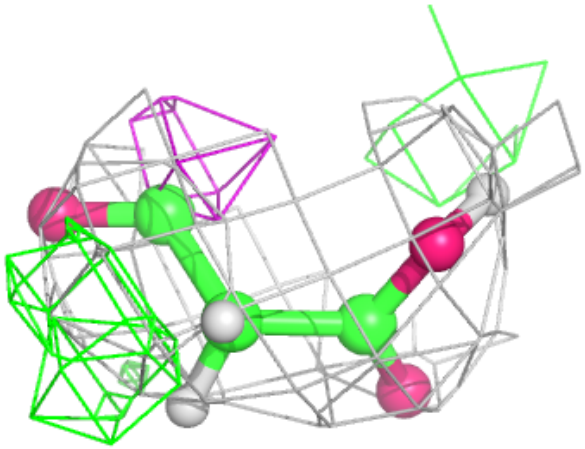
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

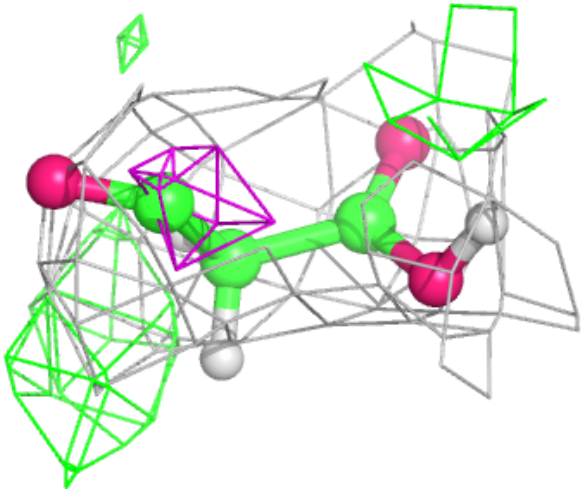
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	MLA	B	901	6/7	0.81	0.32	111,114,168,171	3
2	MLA	A	901	6/7	0.88	0.27	104,106,158,160	3

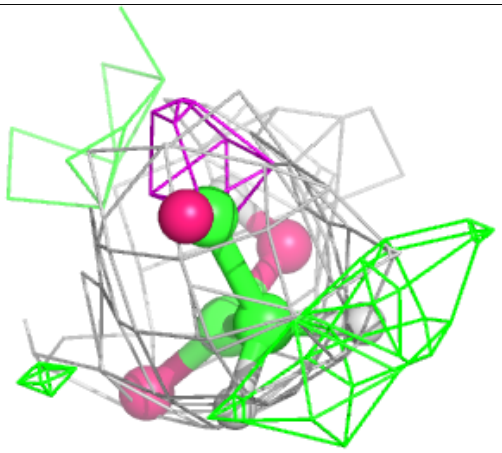
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around MLA B 901:

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

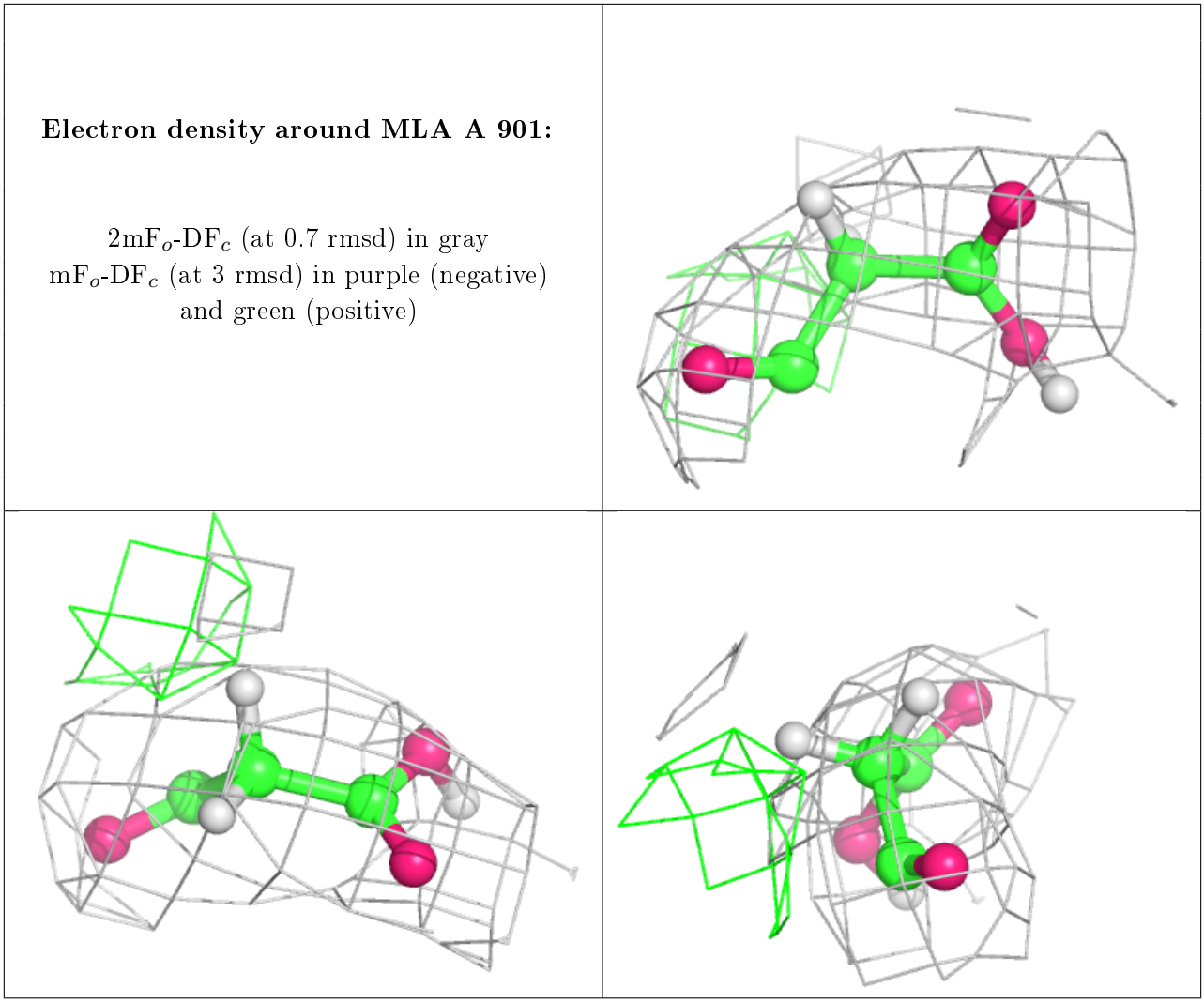






Electron density around MLA A 901:

$2mF_o$-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.