wwPDB X-ray Structure Validation Summary Report (i)

May 13, 2020 – 06:32 am BST

PDB ID	:	6FFI
Title	:	Crystal Structure of mGluR5 in complex with MMPEP at 2.2 A
Authors	:	Christopher, J.A.; Orgovan, Z.; Congreve, M.; Dore, A.S.; Errey, J.C.; Marshall, F.H.; Mason, J.S.; Okrasa, K.; Rucktooa, P.; Serrano-Vega, M.J.; Ferenczy, G.G.; Keseru, G.M.
Deposited on	:	2018-01-08
Resolution	:	2.20 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 (i) symbol.

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

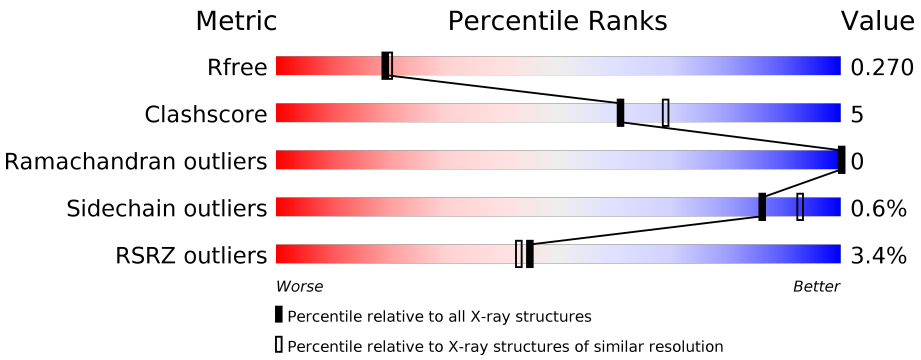
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

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

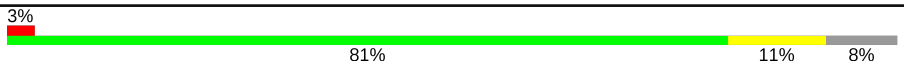
The reported resolution of this entry is 2.20 Å.

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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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 <=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	444	

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
2	OLA	A	4005	-	-	-	X
2	OLA	A	4007	-	-	-	X

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 3492 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.

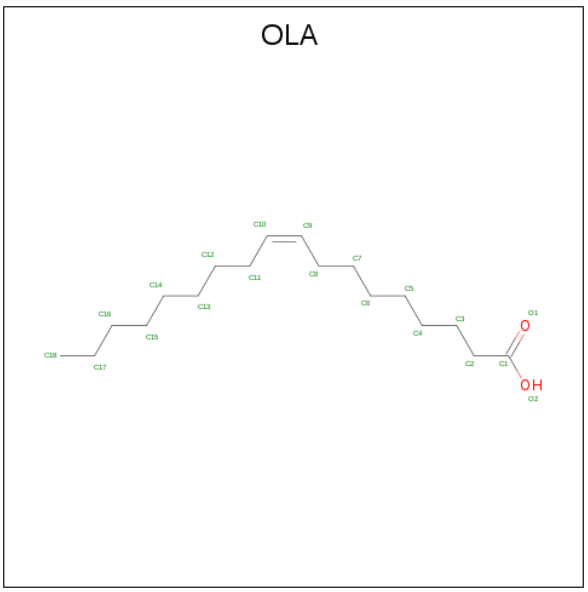
- Molecule 1 is a protein called Metabotropic glutamate receptor 5,Endolysin,Metabotropic glutamate receptor 5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	410	3223	2104	535	560	24	0	1	0

There are 26 discrepancies between the modelled and reference sequences:

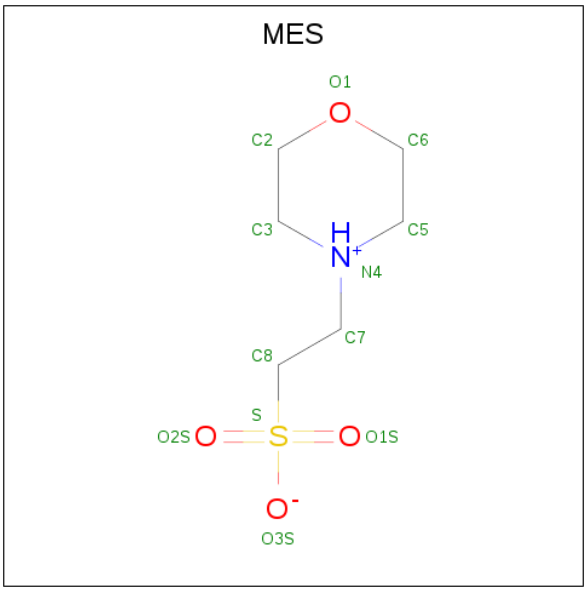
Chain	Residue	Modelled	Actual	Comment	Reference
A	566	ALA	-	expression tag	UNP P41594
A	567	ALA	-	expression tag	UNP P41594
A	568	SER	-	expression tag	UNP P41594
A	579	ALA	GLU	engineered mutation	UNP P41594
A	667	TYR	ASN	engineered mutation	UNP P41594
A	669	ALA	ILE	engineered mutation	UNP P41594
A	675	MET	GLY	engineered mutation	UNP P41594
A	689	GLY	ARG	conflict	UNP P00720
A	731	THR	CYS	conflict	UNP P00720
A	774	ALA	CYS	conflict	UNP P00720
A	814	ARG	ILE	conflict	UNP P00720
A	902	ALA	THR	engineered mutation	UNP P41594
A	913	ALA	SER	engineered mutation	UNP P41594
A	997	ALA	-	expression tag	UNP P41594
A	998	ALA	-	expression tag	UNP P41594
A	999	ALA	-	expression tag	UNP P41594
A	1000	HIS	-	expression tag	UNP P41594
A	1001	HIS	-	expression tag	UNP P41594
A	1002	HIS	-	expression tag	UNP P41594
A	1003	HIS	-	expression tag	UNP P41594
A	1004	HIS	-	expression tag	UNP P41594
A	1005	HIS	-	expression tag	UNP P41594
A	1006	HIS	-	expression tag	UNP P41594
A	1007	HIS	-	expression tag	UNP P41594
A	1008	HIS	-	expression tag	UNP P41594
A	1009	HIS	-	expression tag	UNP P41594

- Molecule 2 is OLEIC ACID (three-letter code: OLA) (formula: $C_{18}H_{34}O_2$).



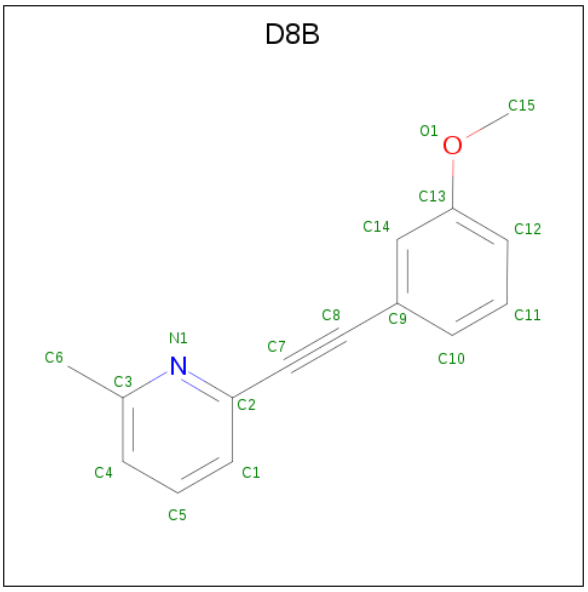
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	O		0	0
			20	18	2			
2	A	1	Total	C	O		0	0
			15	13	2			
2	A	1	Total	C	O		0	0
			14	12	2			
2	A	1	Total	C	O		0	0
			13	11	2			
2	A	1	Total	C	O		0	0
			11	9	2			
2	A	1	Total	C	O		0	0
			11	9	2			
2	A	1	Total	C	O		0	0
			14	12	2			

- Molecule 3 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: $C_6H_{13}NO_4S$).



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

- Molecule 4 is 2-[2-(3-methoxyphenyl)ethynyl]-6-methyl-pyridine (three-letter code: D8B) (formula: $C_{15}H_{13}NO$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	A	1	17	15	1	1	0	0

- Molecule 5 is water.

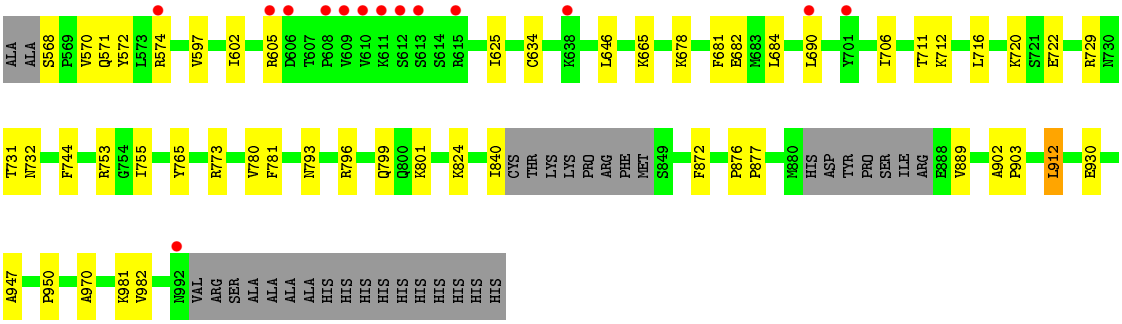
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	142	142	142	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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: Metabotropic glutamate receptor 5,Endolysin,Metabotropic glutamate receptor 5

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	142.82Å 43.42Å 81.98Å 90.00° 98.93° 90.00°	Depositor
Resolution (Å)	19.99 – 2.20 30.81 – 2.20	Depositor EDS
% Data completeness (in resolution range)	93.7 (19.99-2.20) 93.7 (30.81-2.20)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.52 (at 2.20Å)	Xtriage
Refinement program	PHENIX 1.8.1_1168	Depositor
R, R_{free}	0.226 , 0.269 0.229 , 0.270	Depositor DCC
R_{free} test set	1164 reflections (4.85%)	wwPDB-VP
Wilson B-factor (Å^2)	33.2	Xtriage
Anisotropy	0.751	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 63.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	3492	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.02% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: OLA, YCM, MES, D8B

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	0.35	0/3280	0.51	2/4447 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	801[A]	LYS	CA-C-O	5.68	132.03	120.10
1	A	801[B]	LYS	CA-C-O	5.68	132.03	120.10

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3223	0	3358	30	0
2	A	98	0	133	2	0
3	A	12	0	13	0	0
4	A	17	0	0	0	0
5	A	142	0	0	5	0
All	All	3492	0	3504	31	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 5.

The worst 5 of 31 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:824:LYS:NZ	5:A:4105:HOH:O	2.27	0.67
1:A:732:ASN:ND2	5:A:4104:HOH:O	2.26	0.64
2:A:4002:OLA:H21	2:A:4004:OLA:H52	1.81	0.63
1:A:690:LEU:HB3	1:A:706:ILE:HG12	1.85	0.58
1:A:793:ASN:OD1	1:A:796:ARG:NH1	2.37	0.55

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	404/444 (91%)	400 (99%)	4 (1%)	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	345/372 (93%)	343 (99%)	2 (1%)	86 93

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	722	GLU
1	A	912	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	641	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)

1 non-standard protein/DNA/RNA residue 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	$\#\|Z\| > 2$
1	YCM	A	634	1	7,9,10	1.17	0	4,10,12	1.13	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
1	YCM	A	634	1	-	3/6/8/10	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	634	YCM	SG-CD-CE-NZ2
1	A	634	YCM	CE-CD-SG-CB
1	A	634	YCM	SG-CD-CE-OZ1

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	634	YCM	1	0

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

9 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	OLA	A	4004	-	9,12,19	0.16	0	8,12,19	0.75	0
3	MES	A	4006	-	12,12,12	2.60	1 (8%)	14,16,16	1.95	3 (21%)
2	OLA	A	4005	-	7,10,19	0.12	0	6,10,19	0.64	0
2	OLA	A	4008	-	10,13,19	0.20	0	8,13,19	0.65	0
2	OLA	A	4001	-	16,19,19	0.12	0	15,19,19	0.70	0
2	OLA	A	4002	-	11,14,19	0.18	0	10,14,19	0.54	0
4	D8B	A	4009	-	18,18,18	1.05	1 (5%)	22,23,23	0.98	1 (4%)
2	OLA	A	4007	-	7,10,19	0.12	0	6,10,19	0.62	0
2	OLA	A	4003	-	10,13,19	0.22	0	8,13,19	0.64	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	OLA	A	4004	-	-	4/8/10/17	-
3	MES	A	4006	-	-	5/6/14/14	0/1/1/1
2	OLA	A	4005	-	-	2/6/8/17	-
2	OLA	A	4008	-	-	6/9/11/17	-
2	OLA	A	4001	-	-	10/15/17/17	-
2	OLA	A	4002	-	-	3/10/12/17	-
4	D8B	A	4009	-	-	2/6/7/7	0/2/2/2
2	OLA	A	4007	-	-	1/6/8/17	-
2	OLA	A	4003	-	-	6/9/11/17	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	4006	MES	C8-S	-8.86	1.64	1.77
4	A	4009	D8B	O1-C15	2.44	1.50	1.42

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	4006	MES	O2S-S-C8	5.36	113.37	106.92
4	A	4009	D8B	C15-O1-C13	-4.02	108.79	117.51
3	A	4006	MES	O2S-S-O1S	-2.24	106.18	113.95
3	A	4006	MES	O1S-S-C8	2.01	109.34	106.92

There are no chirality outliers.

5 of 39 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	4006	MES	C8-C7-N4-C3
3	A	4006	MES	N4-C7-C8-S
2	A	4008	OLA	C1-C2-C3-C4
2	A	4008	OLA	C9-C10-C11-C12
2	A	4002	OLA	C10-C11-C12-C13

There are no ring outliers.

3 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	4004	OLA	1	0
2	A	4002	OLA	1	0

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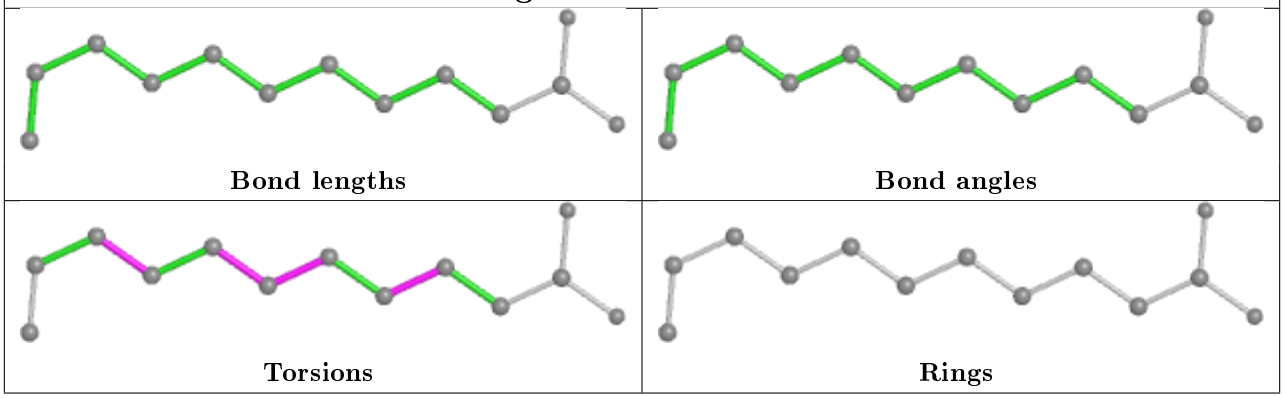
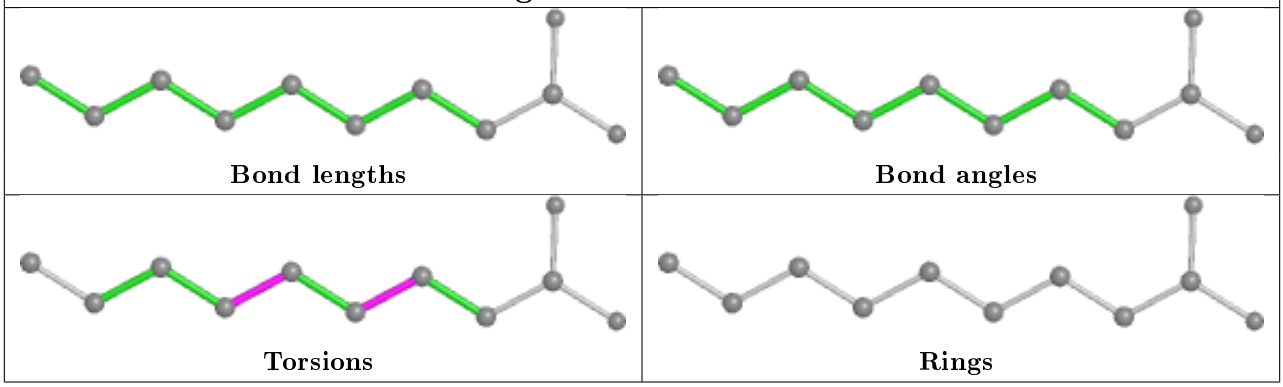
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	4003	OLA	1	0

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.

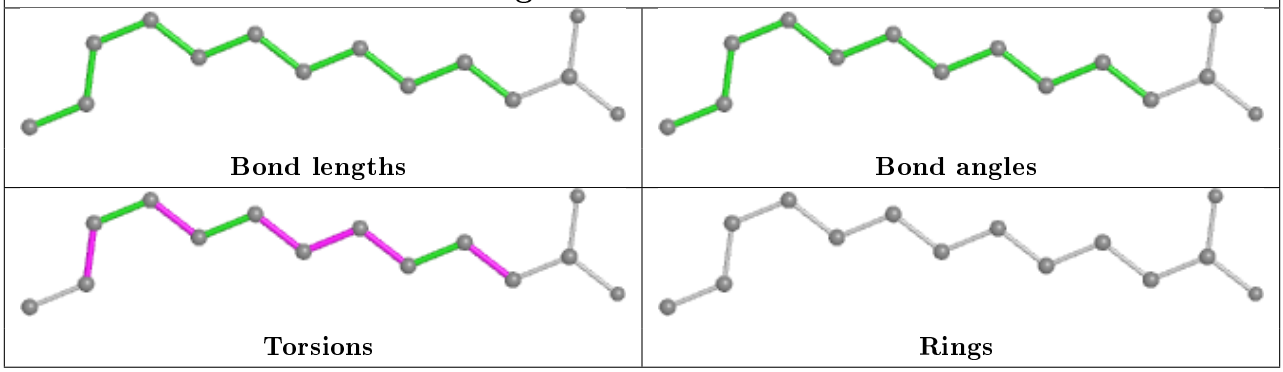
Ligand OLA A 4004



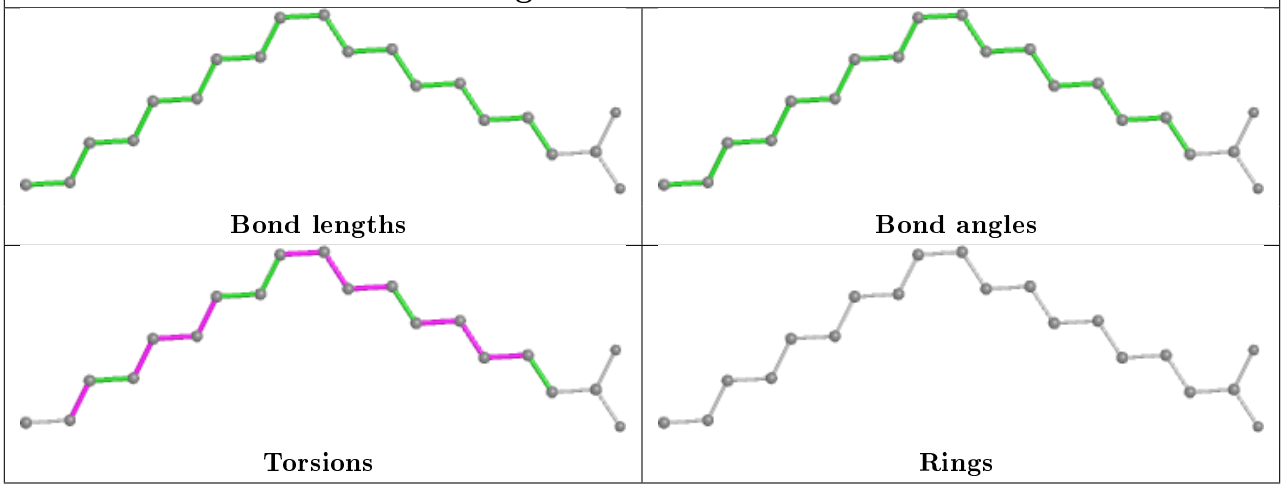
Ligand OLA A 4005



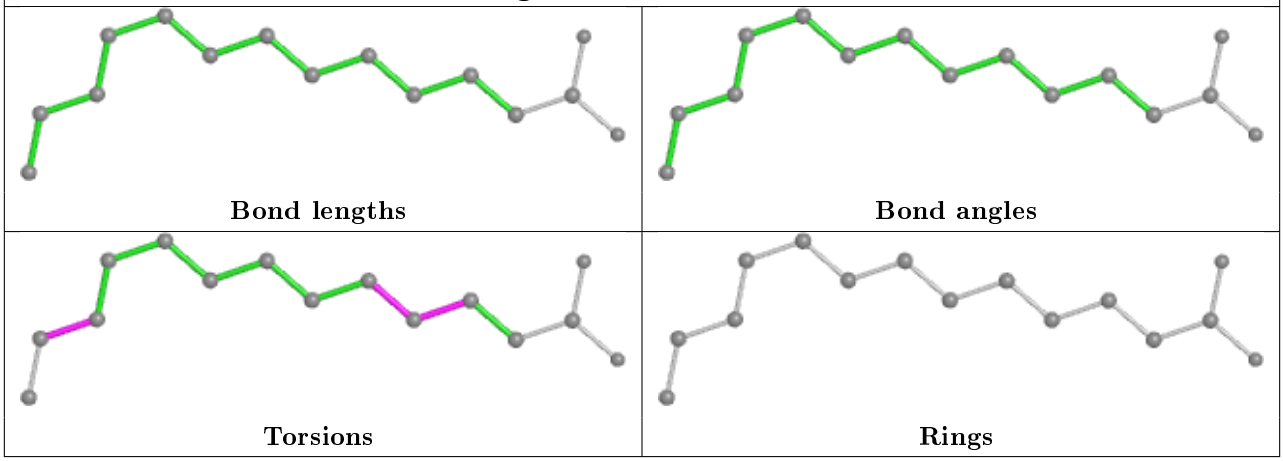
Ligand OLA A 4008

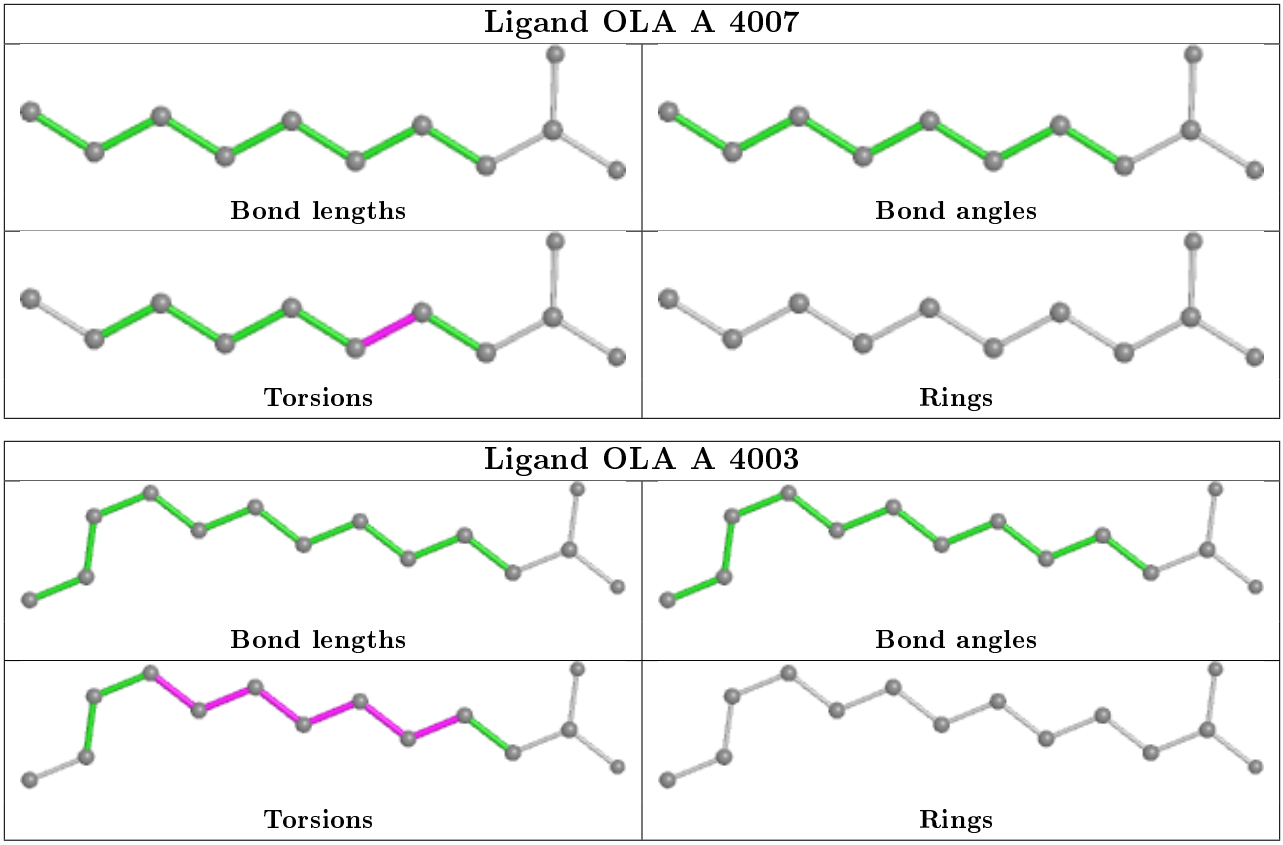


Ligand OLA A 4001



Ligand OLA A 4002





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 (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	A	409/444 (92%)	0.27	14 (3%) 45 43	12, 25, 49, 82	0

The worst 5 of 14 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	612	SER	7.2
1	A	606	ASP	6.4
1	A	611	LYS	4.5
1	A	613	SER	3.8
1	A	609	VAL	3.1

6.2 Non-standard residues in protein, DNA, RNA chains (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(Å^2)	Q<0.9
1	YCM	A	634	10/11	0.90	0.16	15,23,39,41	0

6.3 Carbohydrates (i)

There are no carbohydrates 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,

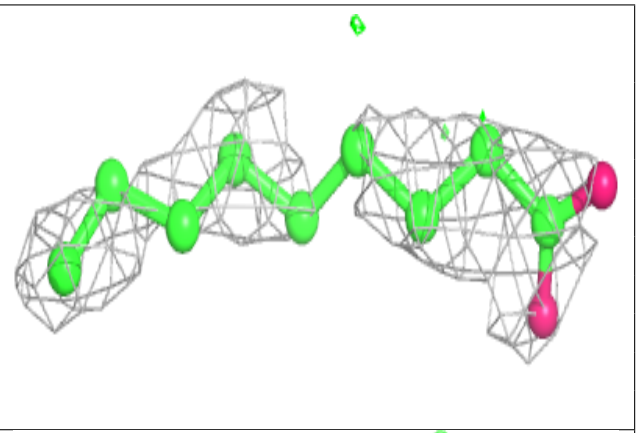
median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

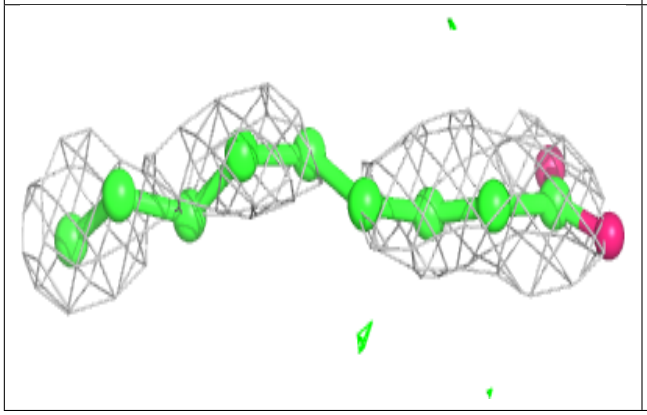
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	OLA	A	4005	11/20	0.71	0.43	38,49,69,74	0
2	OLA	A	4002	15/20	0.72	0.30	29,46,64,68	0
2	OLA	A	4008	14/20	0.77	0.33	26,38,58,68	0
2	OLA	A	4004	13/20	0.77	0.36	39,48,60,64	0
2	OLA	A	4007	11/20	0.80	0.41	36,42,53,59	0
2	OLA	A	4003	14/20	0.84	0.29	43,50,59,61	0
2	OLA	A	4001	20/20	0.88	0.35	25,34,53,60	0
4	D8B	A	4009	17/17	0.92	0.23	10,15,24,29	0
3	MES	A	4006	12/12	0.96	0.14	24,34,37,42	0

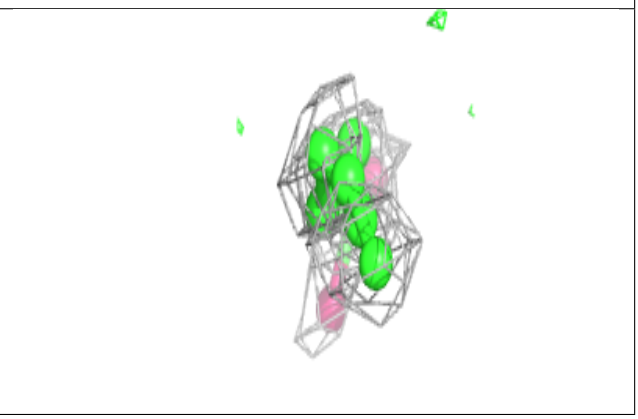
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around OLA A 4005:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative) and green (positive)

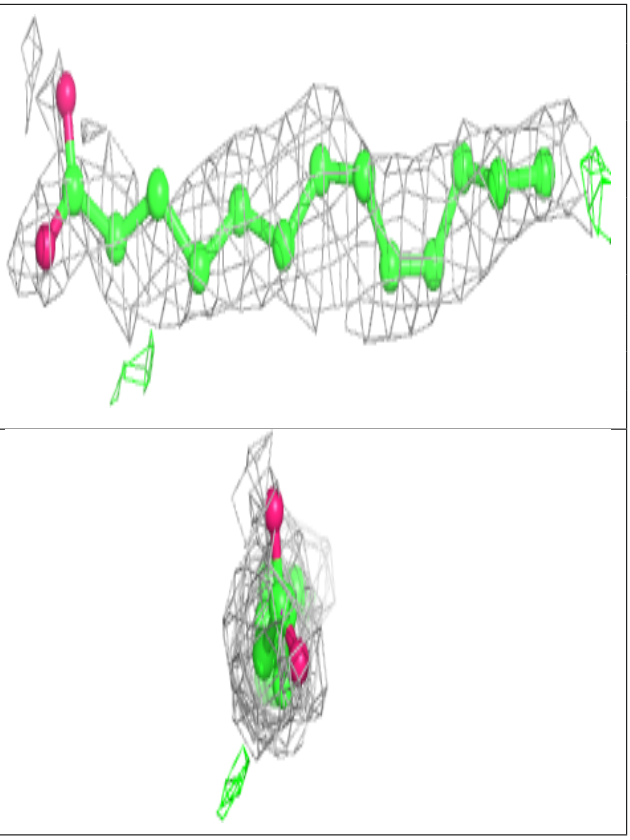


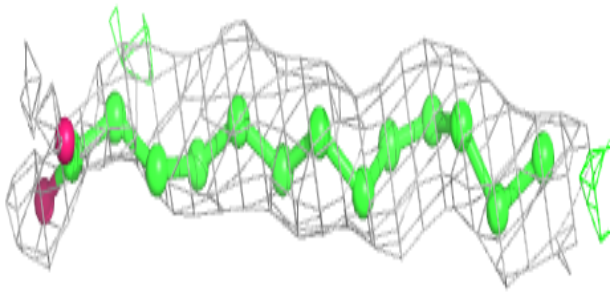




Electron density around OLA A 4002:

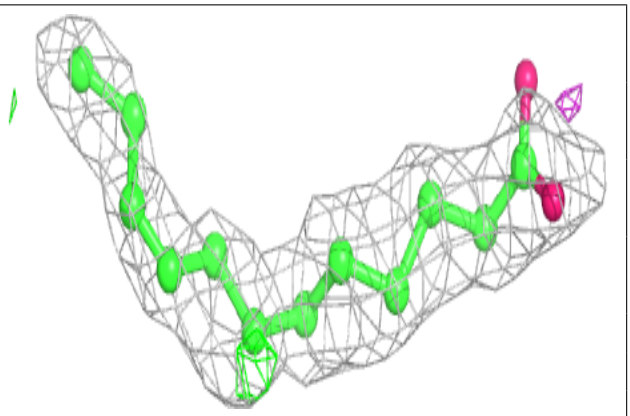
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

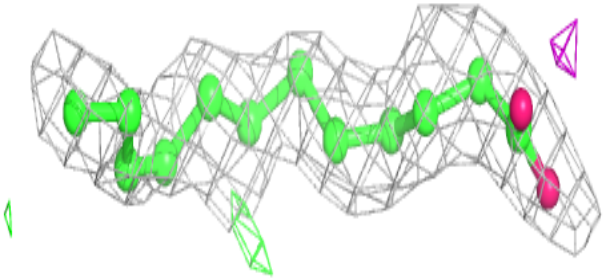


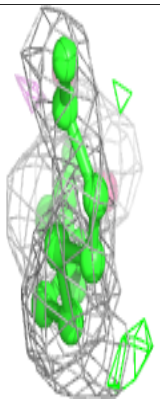


Electron density around OLA A 4008:

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

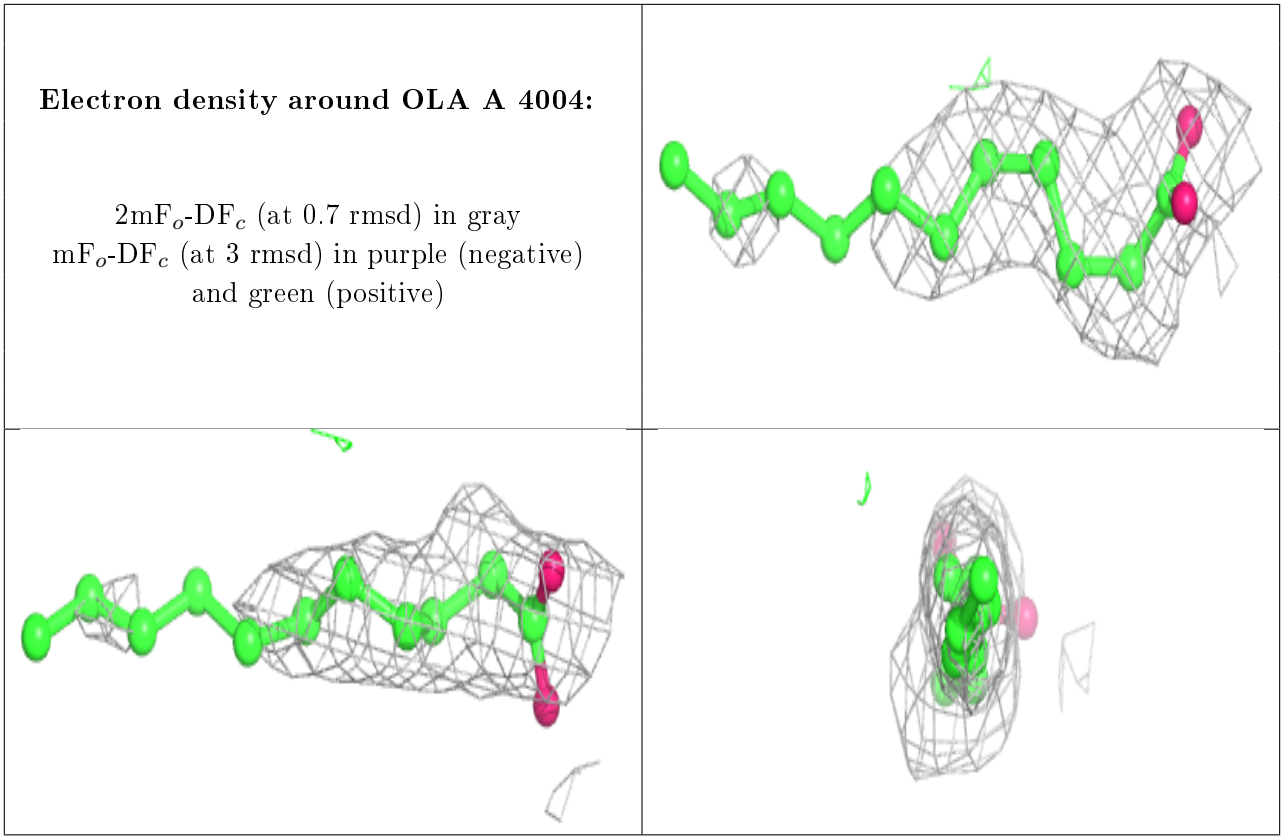






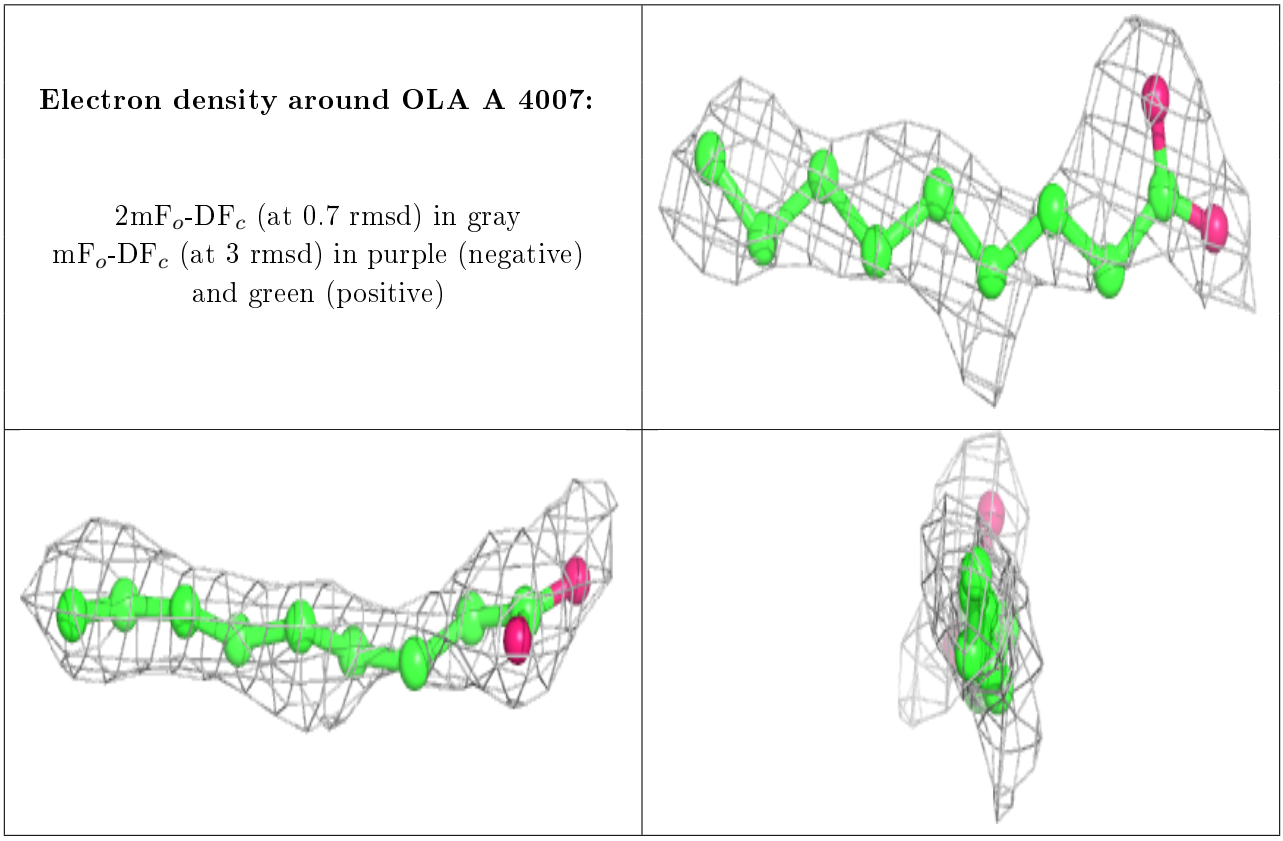
Electron density around OLA A 4004:

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



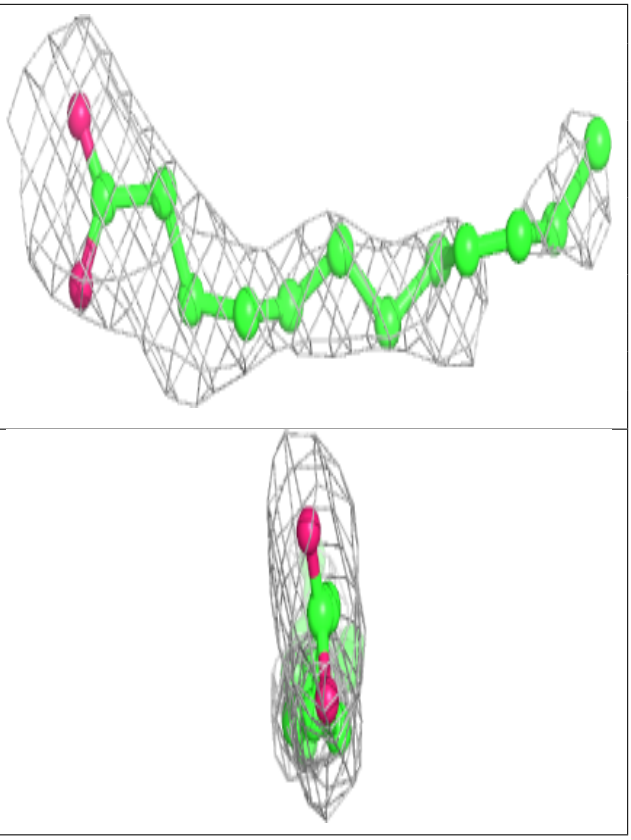
Electron density around OLA A 4007:

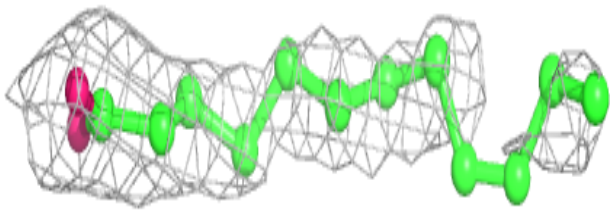
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around OLA A 4003:

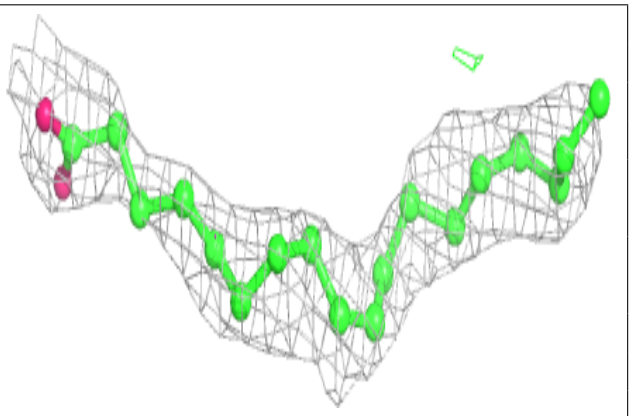
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

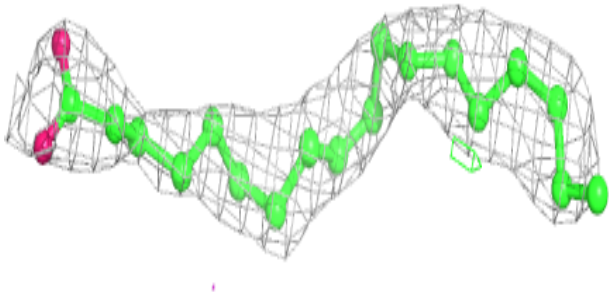


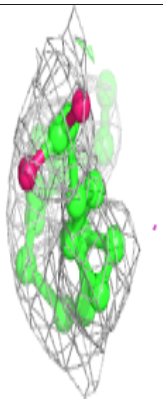


Electron density around OLA A 4001:

$2mF_o$-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.