wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 9, 2023 – 08:54 PM EDT

PDB ID	:	7KO3
Title	:	Dihydrodipicolinate synthase (DHDPS) from C.jejuni, E88D mutant with pyruvate bound in the active site and L-lysine bound at the allosteric site
Authors	:	Saran, S.; Majdi Yazdi, M.; Sanders, D.A.R.
Deposited on	:	2020-11-06
Resolution	:	2.22 Å(reported)

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

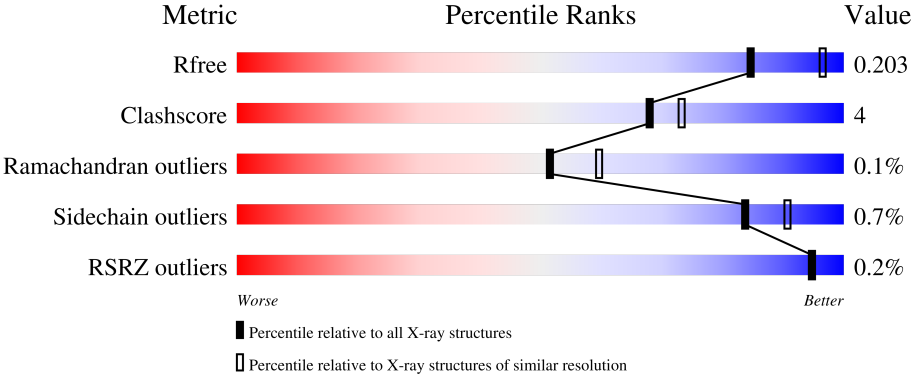
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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 2.22 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	5912 (2.24-2.20)
Clashscore	141614	6646 (2.24-2.20)
Ramachandran outliers	138981	6543 (2.24-2.20)
Sidechain outliers	138945	6544 (2.24-2.20)
RSRZ outliers	127900	5797 (2.24-2.20)

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 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	310	
1	B	310	
1	C	310	
1	D	310	
1	E	310	

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Mol	**Chain**	**Length**	**Quality of chain**
1	F	310	

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**
4	PGE	C	303	-	-	X	-
6	PEG	B	305	-	-	X	-
6	PEG	F	305	-	-	X	-

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 14493 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 4-hydroxy-tetrahydrodipicolinate synthase.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
1	A	296	Total C N O S 2259 1435 374 437 13	0	0	0
1	B	296	Total C N O S 2252 1430 372 437 13	0	0	0
1	C	296	Total C N O S 2271 1444 377 437 13	0	0	0
1	D	296	Total C N O S 2266 1440 376 437 13	0	0	0
1	E	296	Total C N O S 2270 1443 377 437 13	0	0	0
1	F	297	Total C N O S 2275 1445 377 440 13	0	0	0

There are 78 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-11	MET	-	expression tag	UNP Q9PPB4
A	-10	ARG	-	expression tag	UNP Q9PPB4
A	-9	GLY	-	expression tag	UNP Q9PPB4
A	-8	SER	-	expression tag	UNP Q9PPB4
A	-7	HIS	-	expression tag	UNP Q9PPB4
A	-6	HIS	-	expression tag	UNP Q9PPB4
A	-5	HIS	-	expression tag	UNP Q9PPB4
A	-4	HIS	-	expression tag	UNP Q9PPB4
A	-3	HIS	-	expression tag	UNP Q9PPB4
A	-2	HIS	-	expression tag	UNP Q9PPB4
A	-1	GLY	-	expression tag	UNP Q9PPB4
A	0	SER	-	expression tag	UNP Q9PPB4
A	88	ASP	GLU	engineered mutation	UNP Q9PPB4
B	-11	MET	-	expression tag	UNP Q9PPB4
B	-10	ARG	-	expression tag	UNP Q9PPB4
B	-9	GLY	-	expression tag	UNP Q9PPB4
B	-8	SER	-	expression tag	UNP Q9PPB4

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-7	HIS	-	expression tag	UNP Q9PPB4
B	-6	HIS	-	expression tag	UNP Q9PPB4
B	-5	HIS	-	expression tag	UNP Q9PPB4
B	-4	HIS	-	expression tag	UNP Q9PPB4
B	-3	HIS	-	expression tag	UNP Q9PPB4
B	-2	HIS	-	expression tag	UNP Q9PPB4
B	-1	GLY	-	expression tag	UNP Q9PPB4
B	0	SER	-	expression tag	UNP Q9PPB4
B	88	ASP	GLU	engineered mutation	UNP Q9PPB4
C	-11	MET	-	expression tag	UNP Q9PPB4
C	-10	ARG	-	expression tag	UNP Q9PPB4
C	-9	GLY	-	expression tag	UNP Q9PPB4
C	-8	SER	-	expression tag	UNP Q9PPB4
C	-7	HIS	-	expression tag	UNP Q9PPB4
C	-6	HIS	-	expression tag	UNP Q9PPB4
C	-5	HIS	-	expression tag	UNP Q9PPB4
C	-4	HIS	-	expression tag	UNP Q9PPB4
C	-3	HIS	-	expression tag	UNP Q9PPB4
C	-2	HIS	-	expression tag	UNP Q9PPB4
C	-1	GLY	-	expression tag	UNP Q9PPB4
C	0	SER	-	expression tag	UNP Q9PPB4
C	88	ASP	GLU	engineered mutation	UNP Q9PPB4
D	-11	MET	-	expression tag	UNP Q9PPB4
D	-10	ARG	-	expression tag	UNP Q9PPB4
D	-9	GLY	-	expression tag	UNP Q9PPB4
D	-8	SER	-	expression tag	UNP Q9PPB4
D	-7	HIS	-	expression tag	UNP Q9PPB4
D	-6	HIS	-	expression tag	UNP Q9PPB4
D	-5	HIS	-	expression tag	UNP Q9PPB4
D	-4	HIS	-	expression tag	UNP Q9PPB4
D	-3	HIS	-	expression tag	UNP Q9PPB4
D	-2	HIS	-	expression tag	UNP Q9PPB4
D	-1	GLY	-	expression tag	UNP Q9PPB4
D	0	SER	-	expression tag	UNP Q9PPB4
D	88	ASP	GLU	engineered mutation	UNP Q9PPB4
E	-11	MET	-	expression tag	UNP Q9PPB4
E	-10	ARG	-	expression tag	UNP Q9PPB4
E	-9	GLY	-	expression tag	UNP Q9PPB4
E	-8	SER	-	expression tag	UNP Q9PPB4
E	-7	HIS	-	expression tag	UNP Q9PPB4
E	-6	HIS	-	expression tag	UNP Q9PPB4
E	-5	HIS	-	expression tag	UNP Q9PPB4

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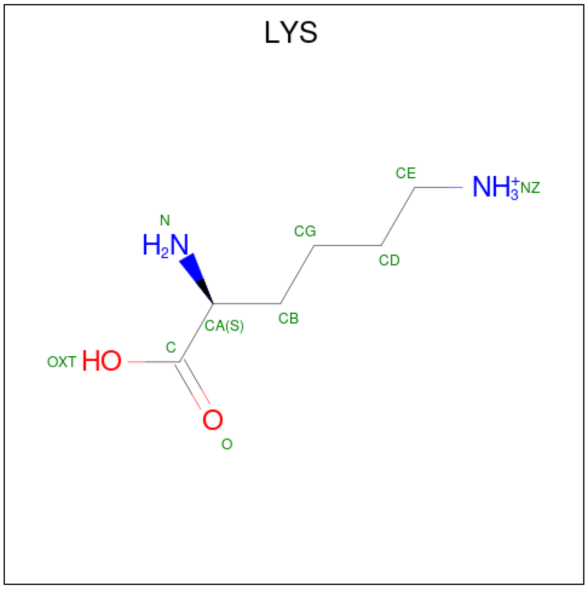
Chain	Residue	Modelled	Actual	Comment	Reference
E	-4	HIS	-	expression tag	UNP Q9PPB4
E	-3	HIS	-	expression tag	UNP Q9PPB4
E	-2	HIS	-	expression tag	UNP Q9PPB4
E	-1	GLY	-	expression tag	UNP Q9PPB4
E	0	SER	-	expression tag	UNP Q9PPB4
E	88	ASP	GLU	engineered mutation	UNP Q9PPB4
F	-11	MET	-	expression tag	UNP Q9PPB4
F	-10	ARG	-	expression tag	UNP Q9PPB4
F	-9	GLY	-	expression tag	UNP Q9PPB4
F	-8	SER	-	expression tag	UNP Q9PPB4
F	-7	HIS	-	expression tag	UNP Q9PPB4
F	-6	HIS	-	expression tag	UNP Q9PPB4
F	-5	HIS	-	expression tag	UNP Q9PPB4
F	-4	HIS	-	expression tag	UNP Q9PPB4
F	-3	HIS	-	expression tag	UNP Q9PPB4
F	-2	HIS	-	expression tag	UNP Q9PPB4
F	-1	GLY	-	expression tag	UNP Q9PPB4
F	0	SER	-	expression tag	UNP Q9PPB4
F	88	ASP	GLU	engineered mutation	UNP Q9PPB4

- Molecule 2 is LYSINE (three-letter code: LYS) (formula: $C_6H_{15}N_2O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	10	6	2	2	0	0

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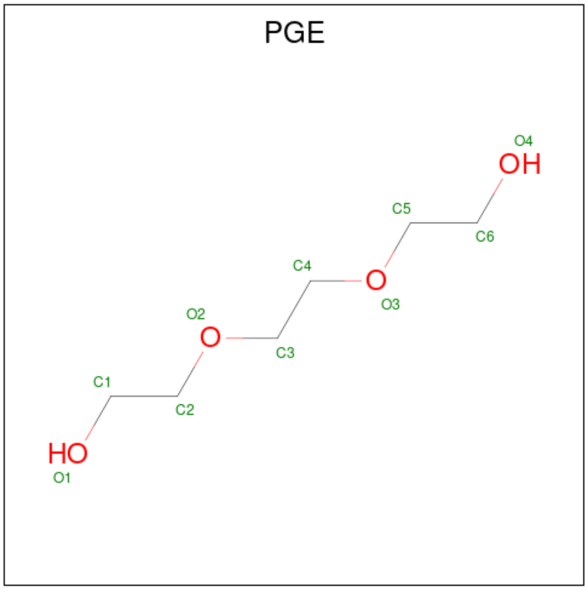
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total C N O 10 6 2 2	0	0
2	C	1	Total C N O 10 6 2 2	0	0
2	D	1	Total C N O 10 6 2 2	0	0
2	E	1	Total C N O 10 6 2 2	0	0
2	F	1	Total C N O 10 6 2 2	0	0

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

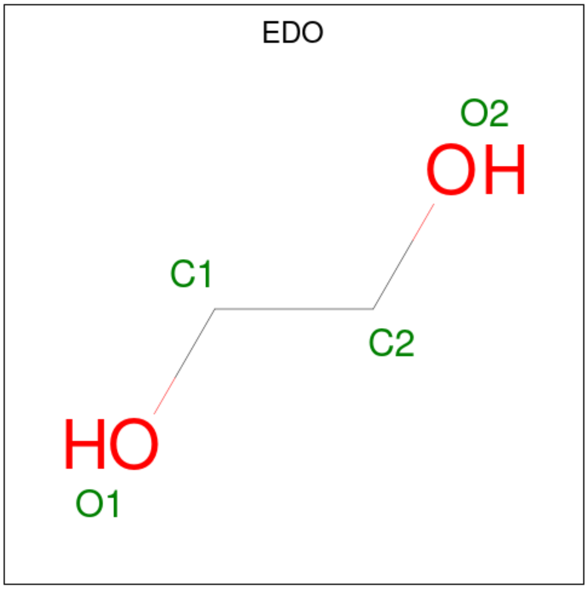
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	3	Total Mg 3 3	0	0
3	B	2	Total Mg 2 2	0	0
3	D	1	Total Mg 1 1	0	0
3	F	1	Total Mg 1 1	0	0

- Molecule 4 is TRIETHYLENE GLYCOL (three-letter code: PGE) (formula: $C_6H_{14}O_4$) (labeled as "Ligand of Interest" by depositor).



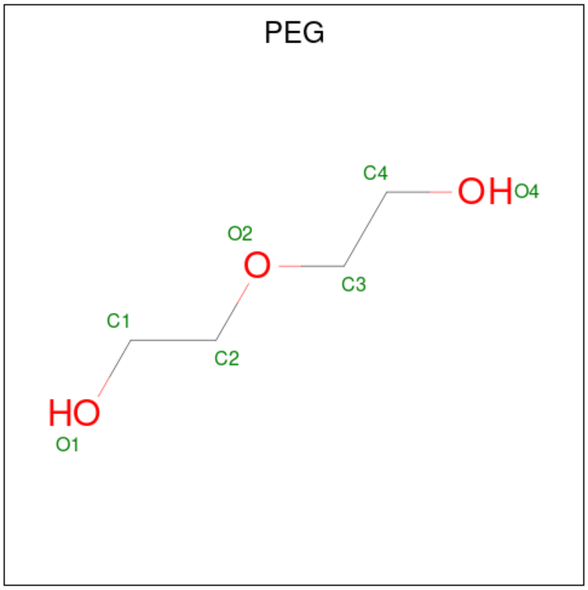
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 10 6 4	0	0
4	A	1	Total C O 10 6 4	0	0
4	C	1	Total C O 10 6 4	0	0
4	D	1	Total C O 10 6 4	0	0
4	E	1	Total C O 10 6 4	0	0

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$) (labeled as "Ligand of Interest" by depositor).



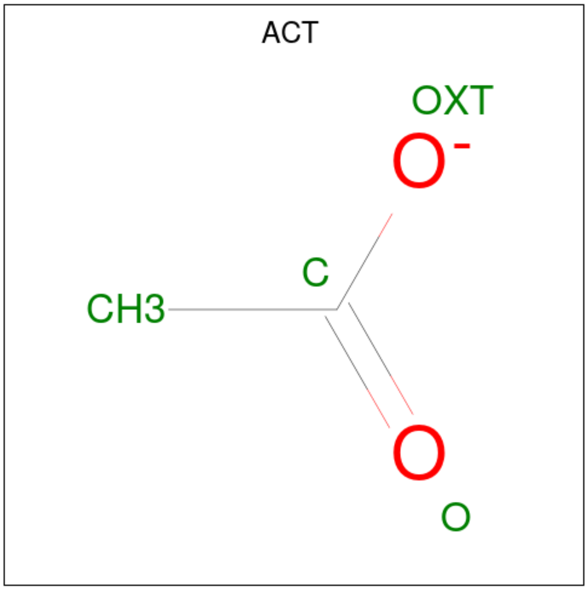
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total C O 4 2 2	0	0
5	D	1	Total C O 4 2 2	0	0
5	E	1	Total C O 4 2 2	0	0
5	F	1	Total C O 4 2 2	0	0

- Molecule 6 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: $C_4H_{10}O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	1	Total C O 7 4 3	0	0
6	F	1	Total C O 7 4 3	0	0

- Molecule 7 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	C	1	Total C O 4 2 2	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	F	1	Total C O 4 2 2	0	0

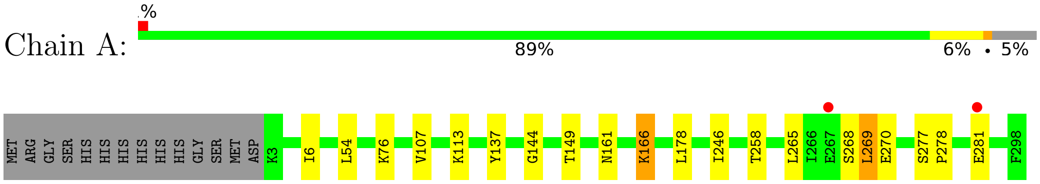
- Molecule 8 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	131	Total O 131 131	0	0
8	B	128	Total O 128 128	0	0
8	C	117	Total O 117 117	0	0
8	D	118	Total O 118 118	0	0
8	E	125	Total O 125 125	0	0
8	F	126	Total O 126 126	0	0

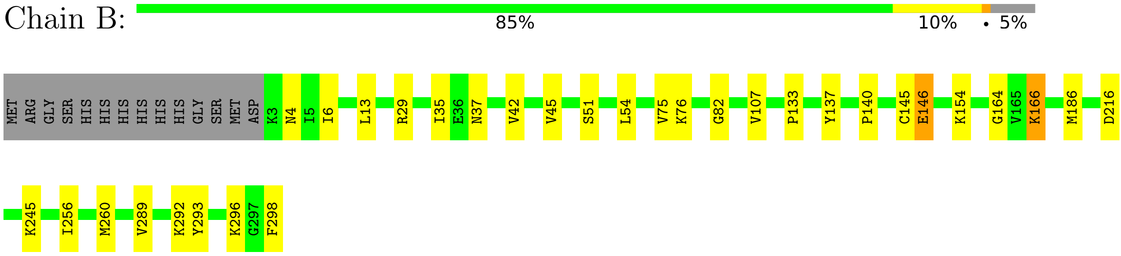
3 Residue-property plots ⓘ

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.

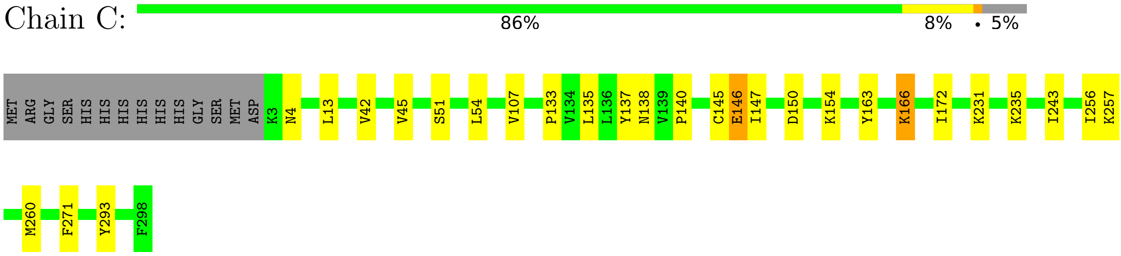
- Molecule 1: 4-hydroxy-tetrahydrodipicolinate synthase



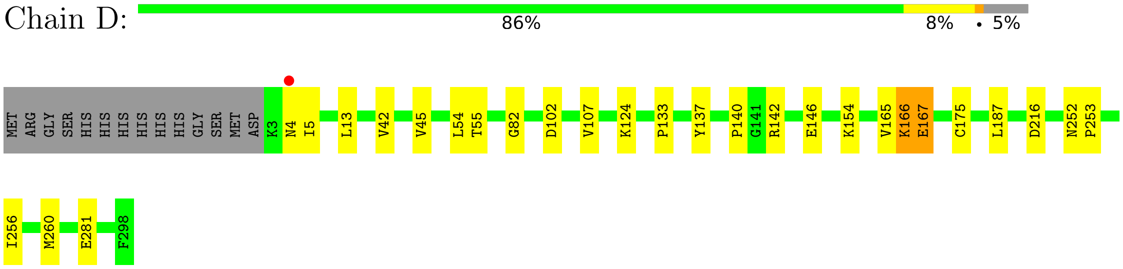
- Molecule 1: 4-hydroxy-tetrahydrodipicolinate synthase



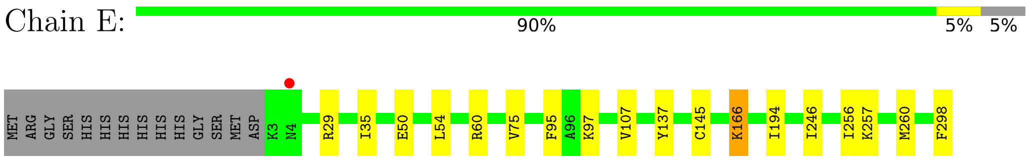
- Molecule 1: 4-hydroxy-tetrahydrodipicolinate synthase



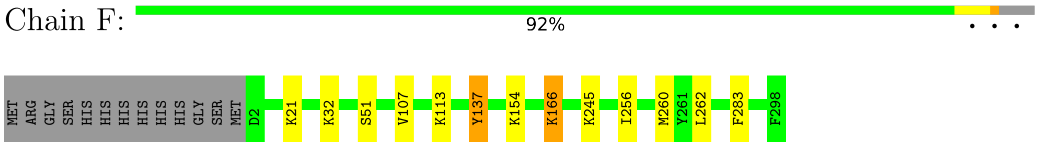
- Molecule 1: 4-hydroxy-tetrahydrodipicolinate synthase



- Molecule 1: 4-hydroxy-tetrahydrodipicolinate synthase



- Molecule 1: 4-hydroxy-tetrahydrodipicolinate synthase



4 Data and refinement statistics

Property	**Value**	**Source**
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	85.32Å 232.26Å 200.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.82 – 2.22 46.00 – 2.22	Depositor EDS
% Data completeness (in resolution range)	100.0 (43.82-2.22) 95.7 (46.00-2.22)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.32 (at 2.22Å)	Xtriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, R_{free}	0.157 , 0.206 0.158 , 0.203	Depositor DCC
R_{free} test set	4915 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	27.2	Xtriage
Anisotropy	0.119	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 44.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	14493	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.55% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: PGE, ACT, EDO, MG, PEG, KPI

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	0.61	0/2283	0.65	0/3093
1	B	0.59	0/2276	0.62	0/3086
1	C	0.51	0/2295	0.63	0/3105
1	D	0.55	0/2290	0.65	0/3100
1	E	0.61	0/2294	0.65	0/3104
1	F	0.55	0/2299	0.63	0/3111
All	All	0.57	0/13737	0.64	0/18599

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	F	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	F	166	KPI	Mainchain

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	2259	0	2264	11	0
1	B	2252	0	2244	26	0
1	C	2271	0	2298	25	0
1	D	2266	0	2283	25	0
1	E	2270	0	2294	10	0
1	F	2275	0	2291	13	0
2	A	10	0	12	1	0
2	B	10	0	12	1	0
2	C	10	0	12	1	0
2	D	10	0	12	0	0
2	E	10	0	12	1	0
2	F	10	0	12	1	0
3	A	3	0	0	0	0
3	B	2	0	0	0	0
3	D	1	0	0	0	0
3	F	1	0	0	0	0
4	A	20	0	28	0	0
4	C	10	0	14	8	0
4	D	10	0	14	1	0
4	E	10	0	14	0	0
5	B	4	0	6	0	0
5	D	4	0	6	0	0
5	E	4	0	6	0	0
5	F	4	0	6	1	0
6	B	7	0	10	6	0
6	F	7	0	10	4	0
7	C	4	0	3	0	0
7	F	4	0	3	0	0
8	A	131	0	0	0	0
8	B	128	0	0	0	0
8	C	117	0	0	0	0
8	D	118	0	0	1	0
8	E	125	0	0	0	0
8	F	126	0	0	0	0
All	All	14493	0	13866	106	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 4.

The worst 5 of 106 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:D:142:ARG:HG2	1:F:113:LYS:HZ1	1.12	1.13
1:D:142:ARG:HG2	1:F:113:LYS:NZ	1.71	1.05
1:F:154:LYS:HE2	6:F:305:PEG:H22	1.56	0.87
1:D:137:TYR:HA	1:D:166:KPI:O	1.80	0.80
1:B:154:LYS:CE	6:B:305:PEG:H31	2.14	0.77

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	293/310 (94%)	289 (99%)	4 (1%)	0	100	100
1	B	293/310 (94%)	289 (99%)	4 (1%)	0	100	100
1	C	293/310 (94%)	289 (99%)	4 (1%)	0	100	100
1	D	293/310 (94%)	288 (98%)	4 (1%)	1 (0%)	41	45
1	E	293/310 (94%)	289 (99%)	4 (1%)	0	100	100
1	F	294/310 (95%)	290 (99%)	4 (1%)	0	100	100
All	All	1759/1860 (95%)	1734 (99%)	24 (1%)	1 (0%)	51	60

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	167	GLU

5.3.2 Protein sidechains ⓘ

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	243/260 (94%)	240 (99%)	3 (1%)	71	82
1	B	241/260 (93%)	239 (99%)	2 (1%)	81	89
1	C	246/260 (95%)	244 (99%)	2 (1%)	81	89
1	D	245/260 (94%)	245 (100%)	0	100	100
1	E	246/260 (95%)	244 (99%)	2 (1%)	81	89
1	F	246/260 (95%)	244 (99%)	2 (1%)	81	89
All	All	1467/1560 (94%)	1456 (99%)	11 (1%)	84	91

5 of 11 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	97	LYS
1	E	145	CYS
1	F	137	TYR
1	F	21	LYS
1	B	146	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	25	GLN
1	C	128	GLN
1	C	161	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

6 non-standard protein/DNA/RNA residues 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	$\#\|Z\| > 2$
1	KPI	C	166	1	11,13,14	1.65	3 (27%)	10,15,17	3.16	4 (40%)
1	KPI	B	166	1	11,13,14	2.02	3 (27%)	10,15,17	3.94	7 (70%)
1	KPI	D	166	1	11,13,14	1.07	1 (9%)	10,15,17	4.03	5 (50%)
1	KPI	F	166	1	11,13,14	2.34	2 (18%)	10,15,17	3.67	6 (60%)
1	KPI	E	166	1	11,13,14	1.96	2 (18%)	10,15,17	3.93	5 (50%)
1	KPI	A	166	1	11,13,14	1.90	3 (27%)	10,15,17	3.77	6 (60%)

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	KPI	C	166	1	-	3/13/14/16	-
1	KPI	B	166	1	-	1/13/14/16	-
1	KPI	D	166	1	-	2/13/14/16	-
1	KPI	F	166	1	-	3/13/14/16	-
1	KPI	E	166	1	-	1/13/14/16	-
1	KPI	A	166	1	-	3/13/14/16	-

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	F	166	KPI	O2-CX2	5.71	1.37	1.22
1	B	166	KPI	O2-CX2	5.36	1.36	1.22
1	E	166	KPI	O2-CX2	5.30	1.36	1.22
1	F	166	KPI	O-C	4.14	1.36	1.19
1	C	166	KPI	O-C	3.98	1.35	1.19

The worst 5 of 33 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	166	KPI	C1-CX1-CX2	-10.12	108.33	118.17
1	B	166	KPI	C1-CX1-CX2	-8.49	109.91	118.17
1	E	166	KPI	C1-CX1-CX2	-8.38	110.02	118.17
1	A	166	KPI	C1-CX1-CX2	-8.19	110.21	118.17
1	F	166	KPI	C1-CX1-CX2	-7.96	110.43	118.17

There are no chirality outliers.

5 of 13 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	166	KPI	C1-CX1-NZ-CE
1	B	166	KPI	C1-CX1-NZ-CE
1	C	166	KPI	C1-CX1-NZ-CE
1	D	166	KPI	C1-CX1-NZ-CE
1	E	166	KPI	C1-CX1-NZ-CE

There are no ring outliers.

5 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	C	166	KPI	1	0
1	B	166	KPI	1	0
1	D	166	KPI	2	0
1	E	166	KPI	1	0
1	A	166	KPI	1	0

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 26 ligands modelled in this entry, 7 are monoatomic - leaving 19 for Mogul analysis.

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	$\#\|Z\| > 2$
4	PGE	A	306	-	9,9,9	0.40	0	8,8,8	0.40	0
2	LYS	F	301	-	8,9,9	0.95	1 (12%)	9,10,10	1.19	2 (22%)
2	LYS	D	301	-	8,9,9	0.84	0	9,10,10	1.06	2 (22%)
7	ACT	F	303	-	3,3,3	1.62	1 (33%)	3,3,3	1.23	0
4	PGE	C	303	-	9,9,9	0.31	0	8,8,8	0.46	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
2	LYS	B	301	-	8,9,9	0.91	0	9,10,10	1.17	1 (11%)
5	EDO	B	304	-	3,3,3	0.47	0	2,2,2	0.54	0
5	EDO	D	304	-	3,3,3	0.51	0	2,2,2	0.24	0
4	PGE	D	303	-	9,9,9	0.35	0	8,8,8	0.37	0
5	EDO	E	303	-	3,3,3	0.52	0	2,2,2	0.24	0
4	PGE	E	302	-	9,9,9	0.34	0	8,8,8	0.36	0
4	PGE	A	305	-	9,9,9	0.33	0	8,8,8	0.33	0
5	EDO	F	304	-	3,3,3	0.65	0	2,2,2	0.48	0
7	ACT	C	302	-	3,3,3	1.68	1 (33%)	3,3,3	1.38	0
2	LYS	A	301	-	8,9,9	0.75	0	9,10,10	1.26	2 (22%)
6	PEG	B	305	-	6,6,6	0.39	0	5,5,5	0.37	0
6	PEG	F	305	-	6,6,6	0.35	0	5,5,5	0.62	0
2	LYS	E	301	-	8,9,9	0.82	0	9,10,10	1.12	2 (22%)
2	LYS	C	301	-	8,9,9	0.91	0	9,10,10	1.32	2 (22%)

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
4	PGE	C	303	-	-	3/7/7/7	-
4	PGE	A	306	-	-	3/7/7/7	-
2	LYS	B	301	-	-	1/9/9/9	-
2	LYS	F	301	-	-	2/9/9/9	-
5	EDO	F	304	-	-	1/1/1/1	-
4	PGE	D	303	-	-	6/7/7/7	-
5	EDO	E	303	-	-	0/1/1/1	-
2	LYS	A	301	-	-	0/9/9/9	-
2	LYS	D	301	-	-	1/9/9/9	-
4	PGE	E	302	-	-	1/7/7/7	-
6	PEG	B	305	-	-	3/4/4/4	-
5	EDO	B	304	-	-	1/1/1/1	-
5	EDO	D	304	-	-	0/1/1/1	-
6	PEG	F	305	-	-	2/4/4/4	-
4	PGE	A	305	-	-	1/7/7/7	-
2	LYS	E	301	-	-	0/9/9/9	-
2	LYS	C	301	-	-	0/9/9/9	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	F	303	ACT	CH3-C	2.40	1.59	1.49
7	C	302	ACT	CH3-C	2.37	1.59	1.49
2	F	301	LYS	OXT-C	-2.05	1.23	1.30

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	301	LYS	OXT-C-O	-2.87	117.57	124.09
2	C	301	LYS	OXT-C-CA	2.76	122.80	113.38
2	A	301	LYS	OXT-C-O	-2.67	118.03	124.09
2	F	301	LYS	OXT-C-O	-2.44	118.54	124.09
2	A	301	LYS	OXT-C-CA	2.41	121.58	113.38

There are no chirality outliers.

5 of 25 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	E	302	PGE	O1-C1-C2-O2
4	D	303	PGE	O3-C5-C6-O4
6	B	305	PEG	O2-C3-C4-O4
4	D	303	PGE	O2-C3-C4-O3
4	D	303	PGE	O1-C1-C2-O2

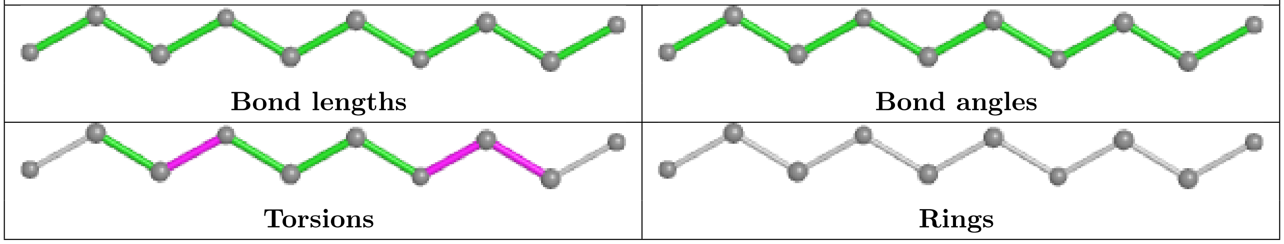
There are no ring outliers.

10 monomers are involved in 25 short contacts:

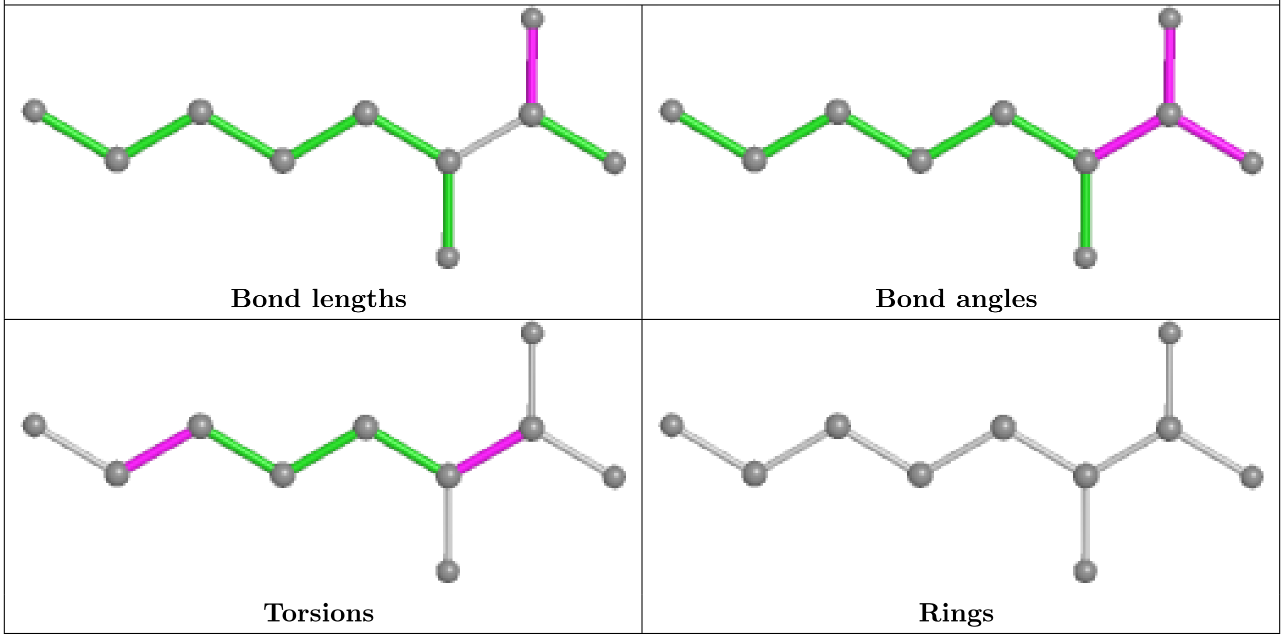
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	F	301	LYS	1	0
4	C	303	PGE	8	0
2	B	301	LYS	1	0
4	D	303	PGE	1	0
5	F	304	EDO	1	0
2	A	301	LYS	1	0
6	B	305	PEG	6	0
6	F	305	PEG	4	0
2	E	301	LYS	1	0
2	C	301	LYS	1	0

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.

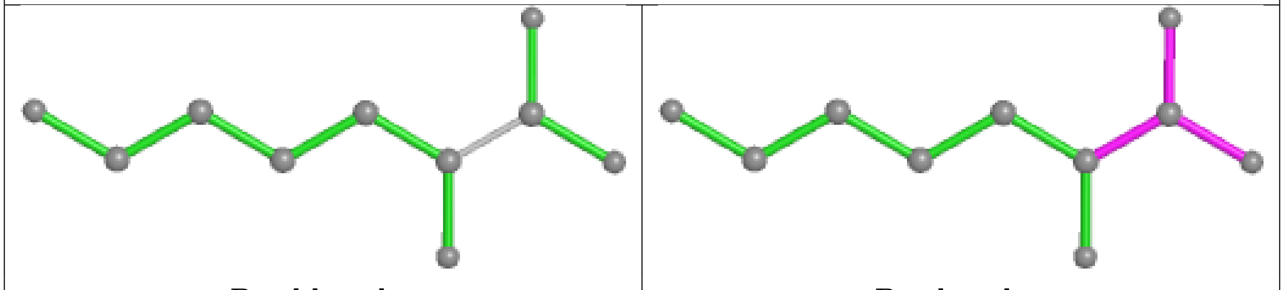
Ligand PGE A 306



Ligand LYS F 301

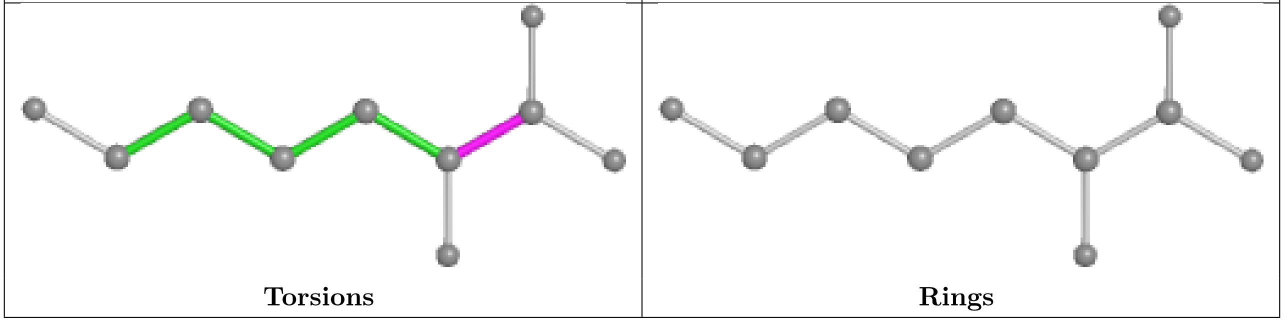


Ligand LYS D 301



Bond lengths

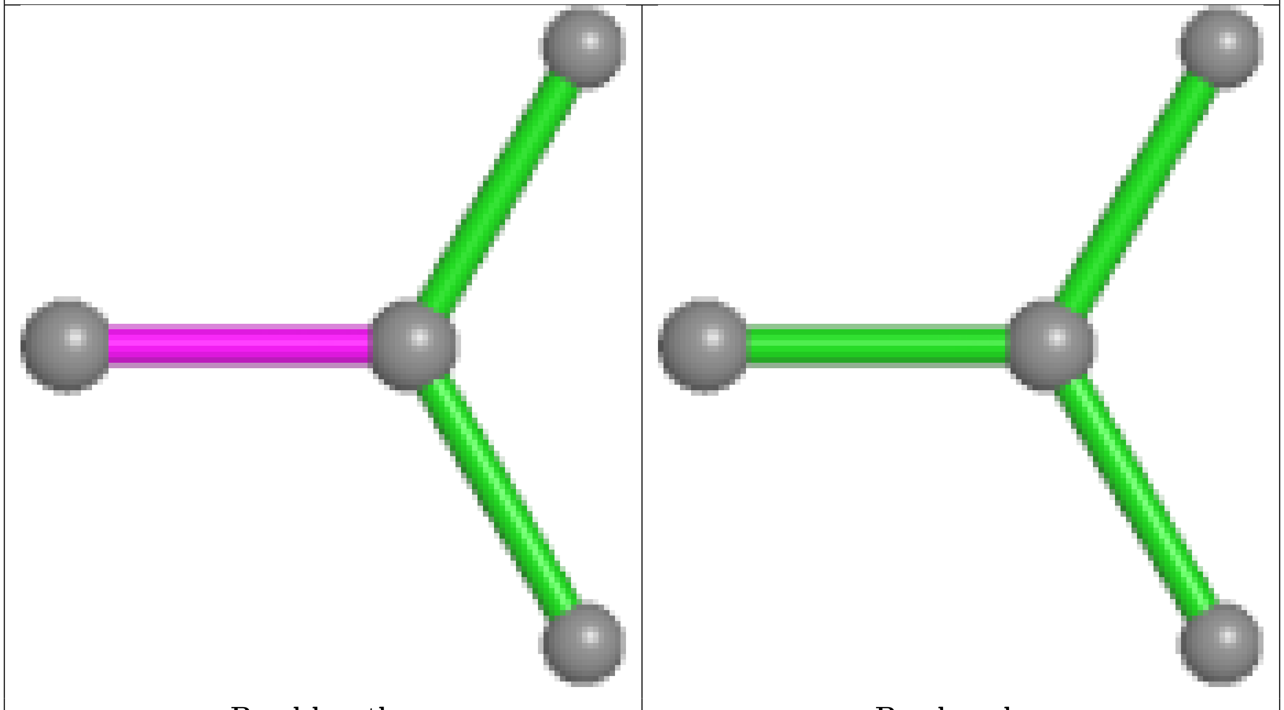
Bond angles



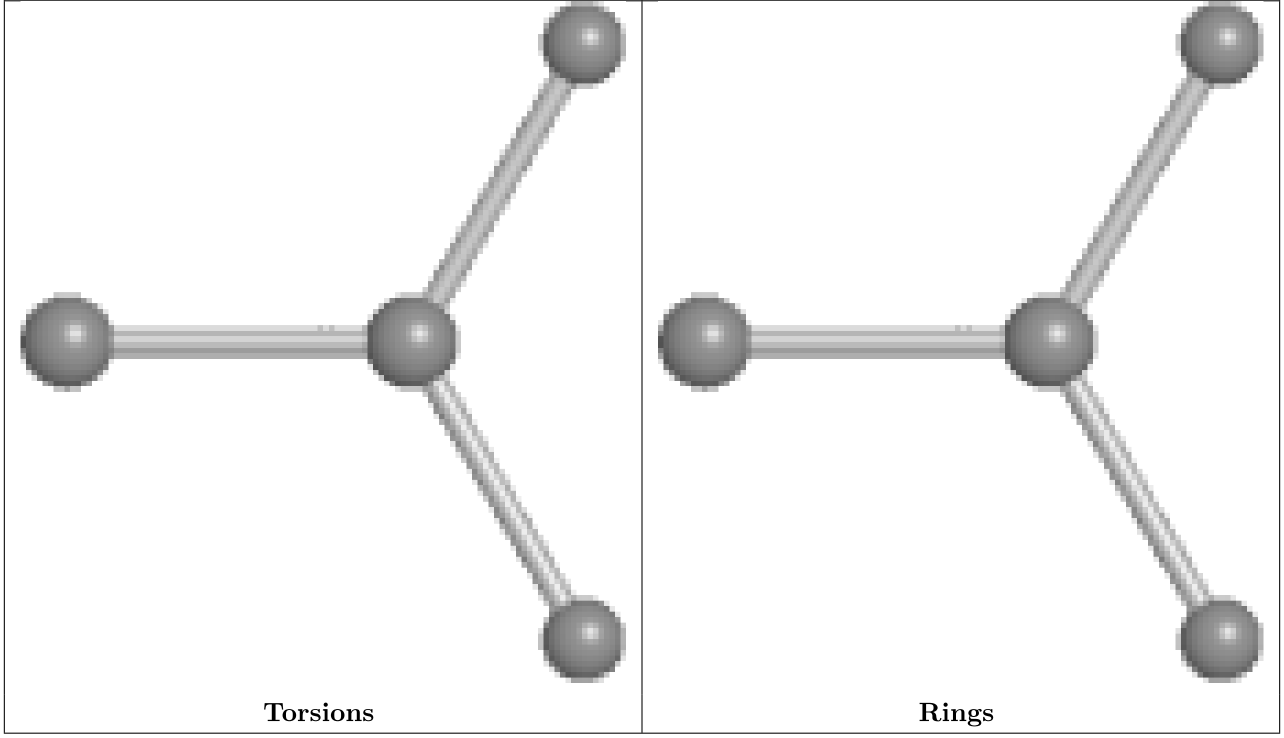
Torsions

Rings

Ligand ACT F 303

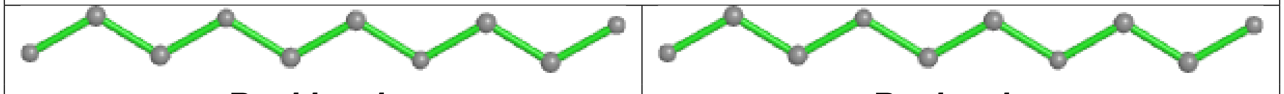


Bond lengths **Bond angles**

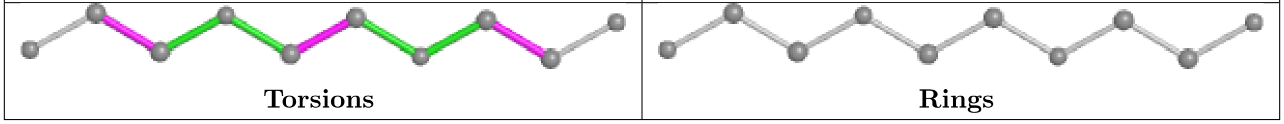


Torsions **Rings**

Ligand PGE C 303

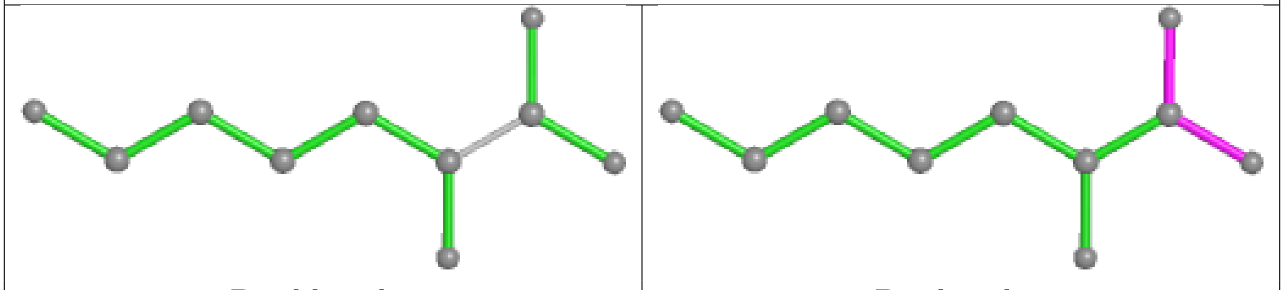


Bond lengths **Bond angles**

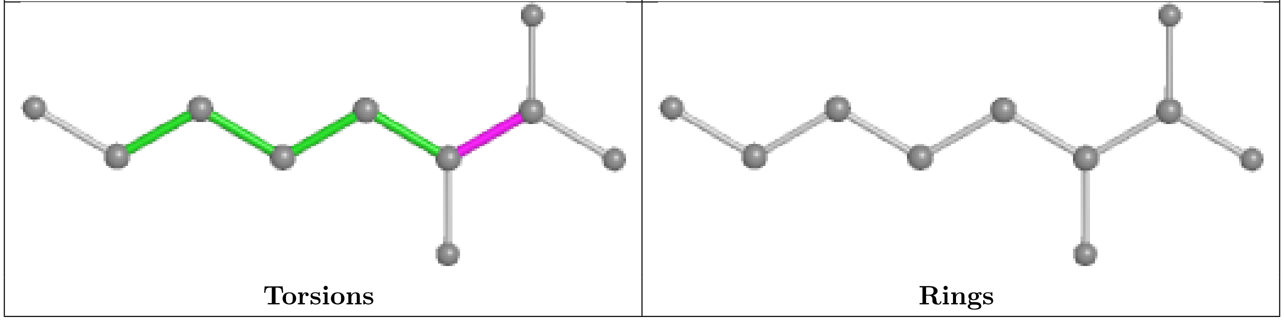


Torsions **Rings**

Ligand LYS B 301

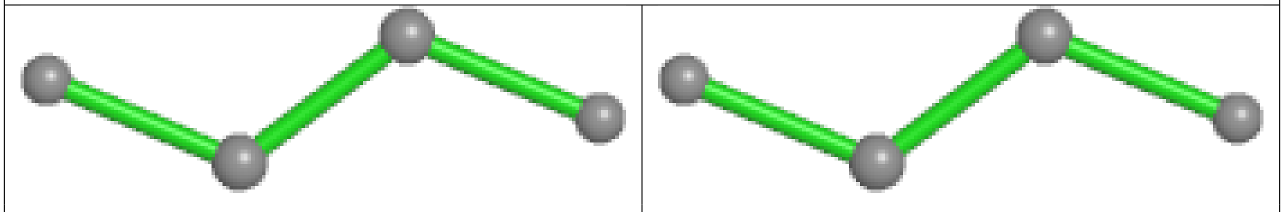


Bond lengths **Bond angles**

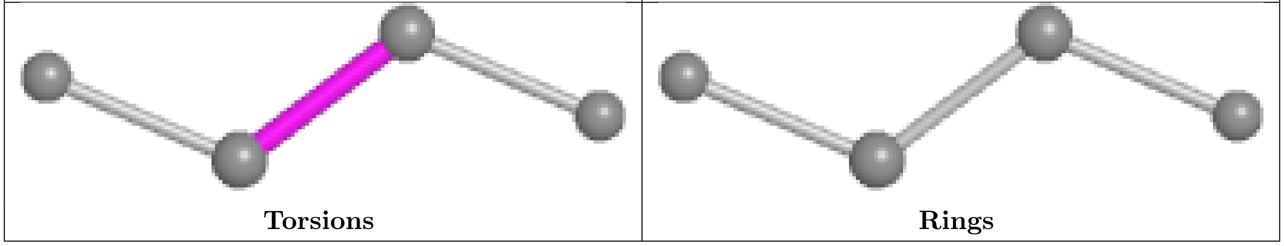


Torsions **Rings**

Ligand EDO B 304

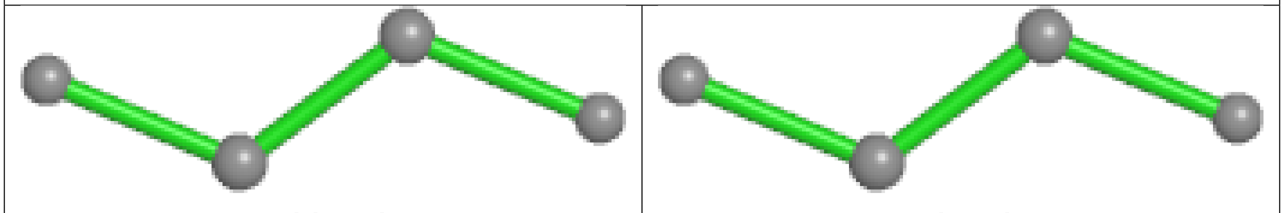


Bond lengths **Bond angles**

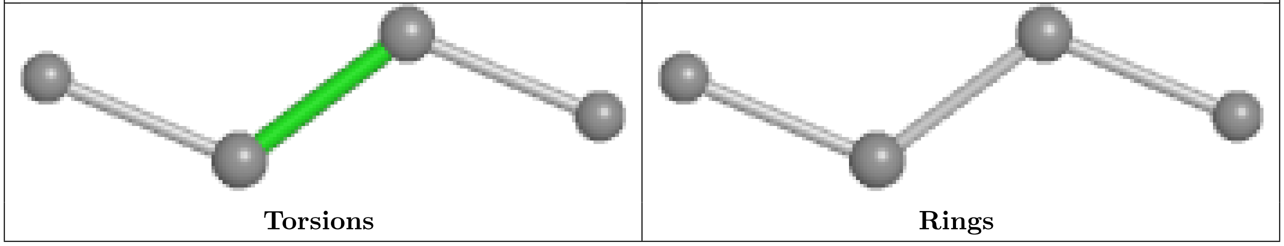


Torsions **Rings**

Ligand EDO D 304

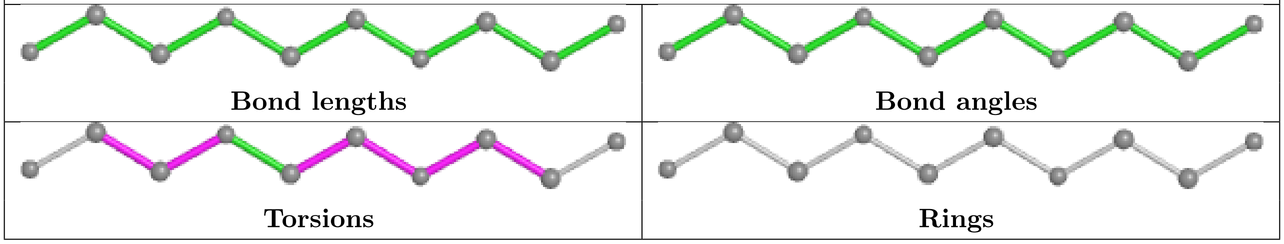


Bond lengths **Bond angles**

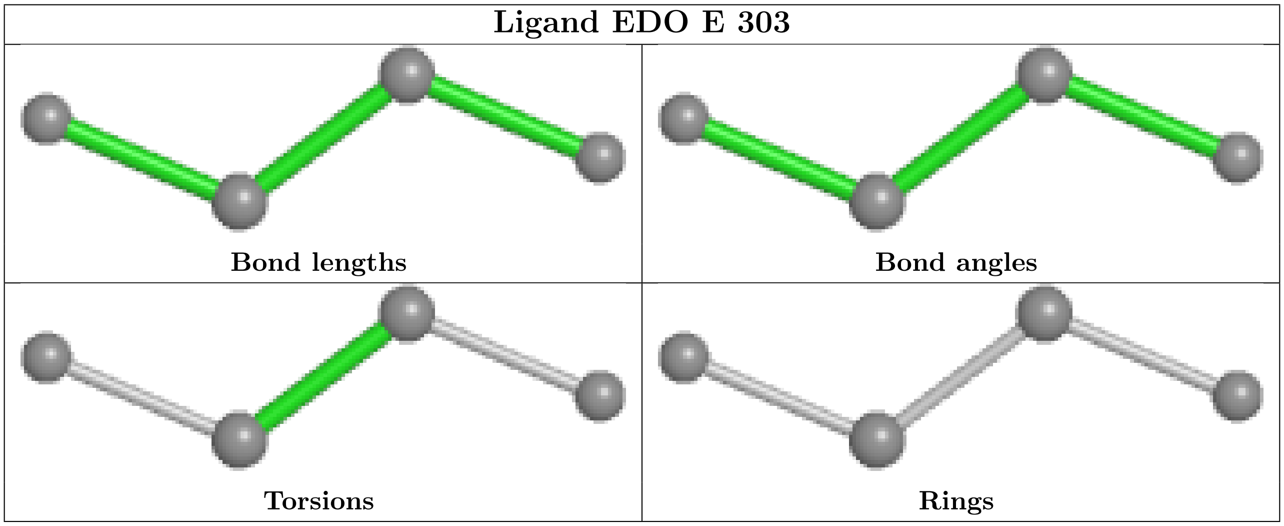


Torsions **Rings**

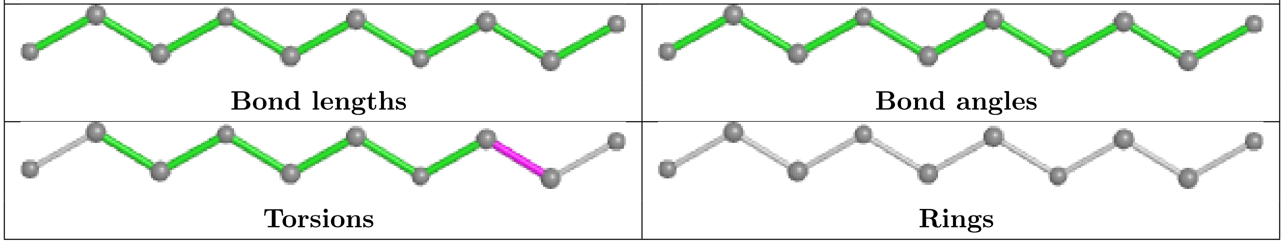
Ligand PGE D 303



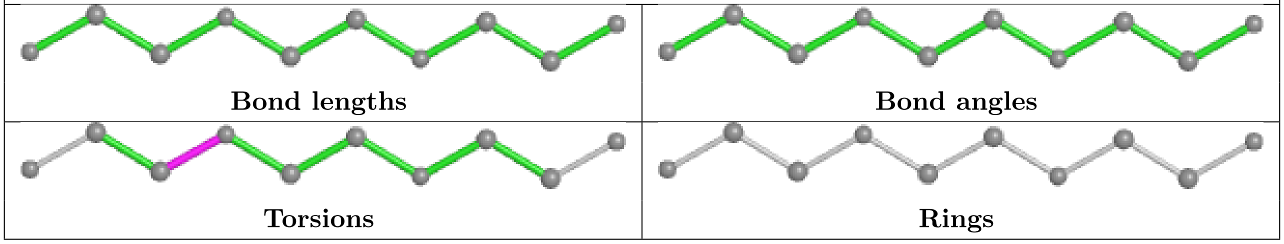
Ligand EDO E 303



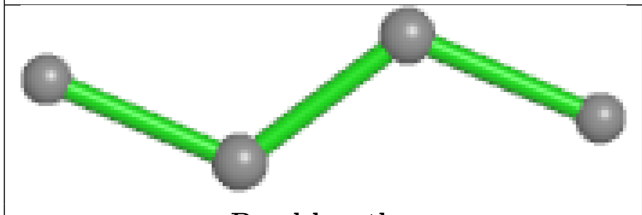
Ligand PGE E 302



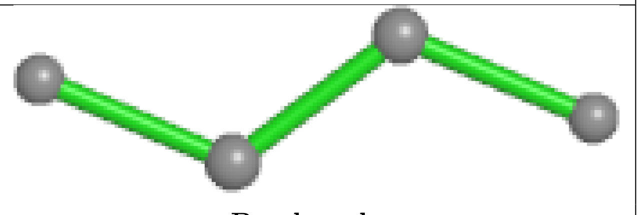
Ligand PGE A 305



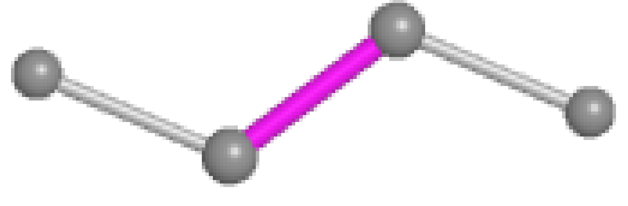
Ligand EDO F 304



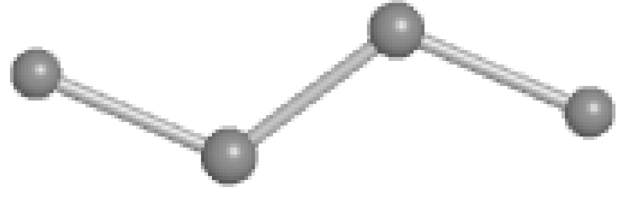
Bond lengths



Bond angles

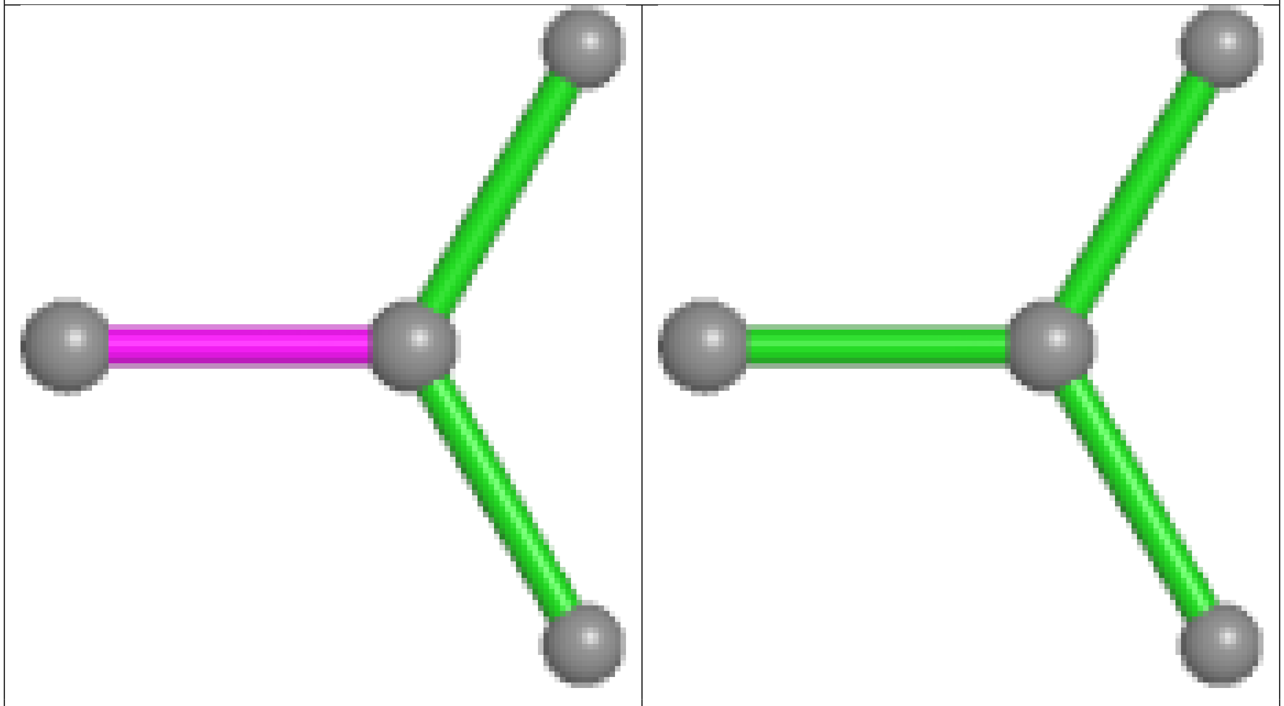


Torsions

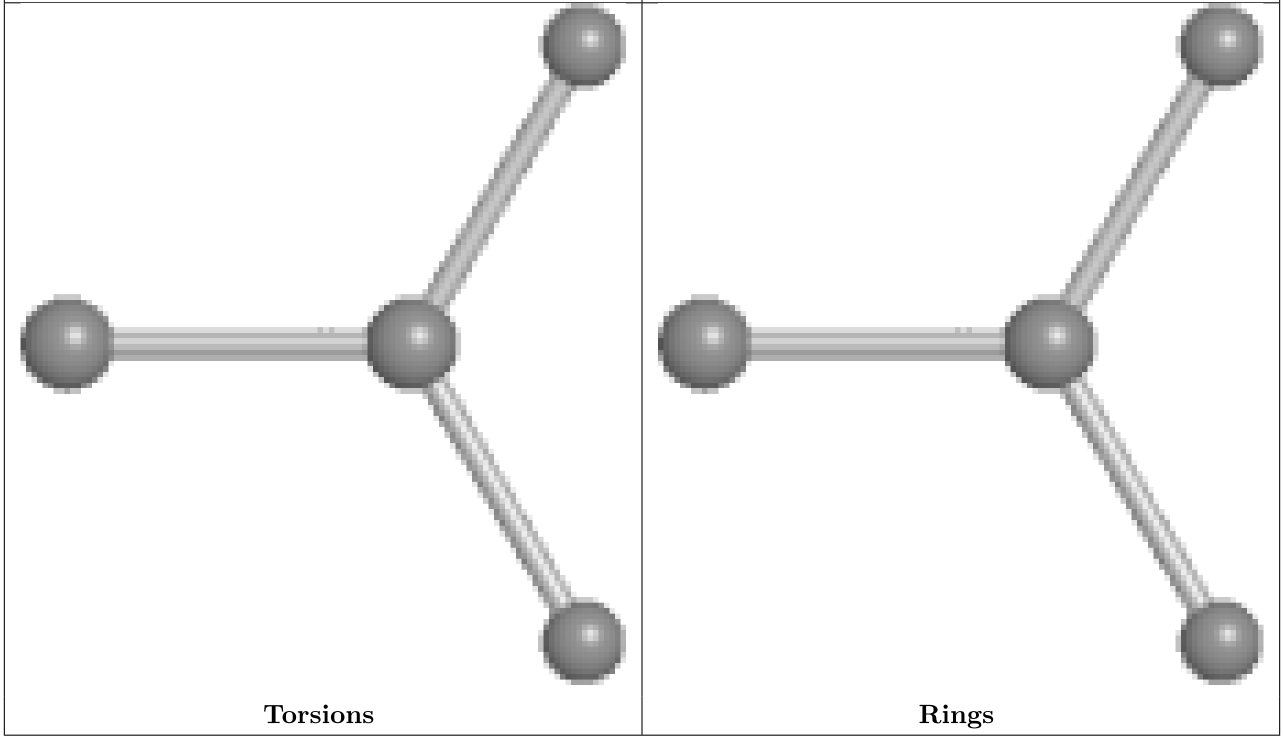


Rings

Ligand ACT C 302

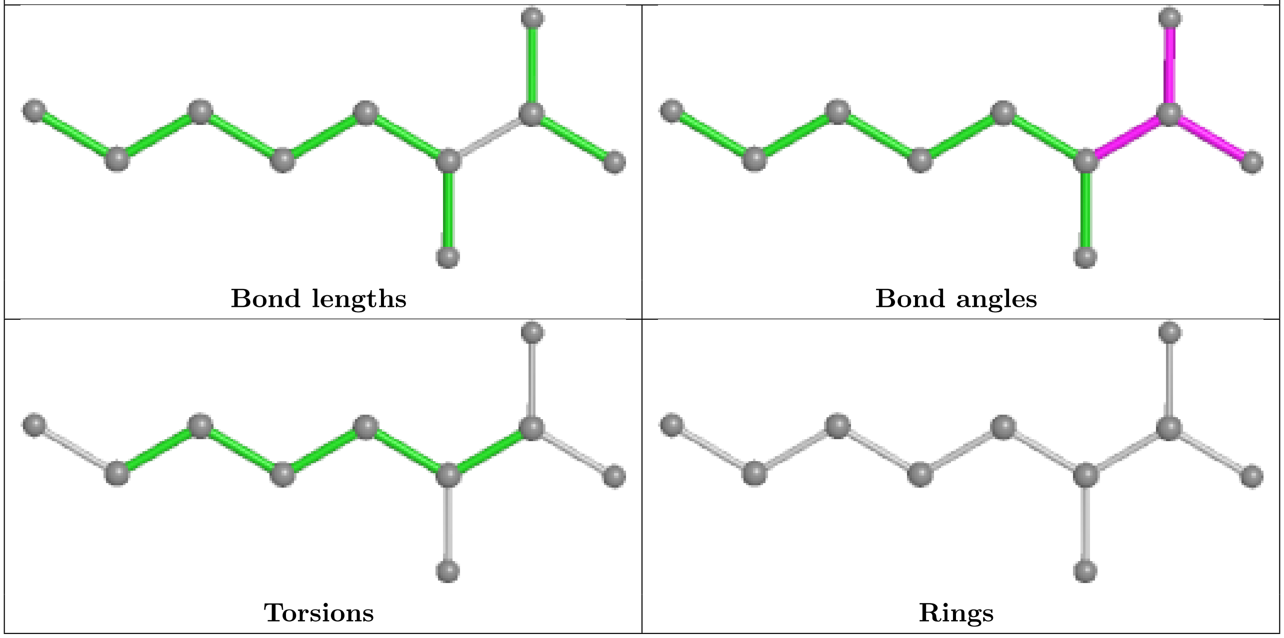


Bond lengths **Bond angles**

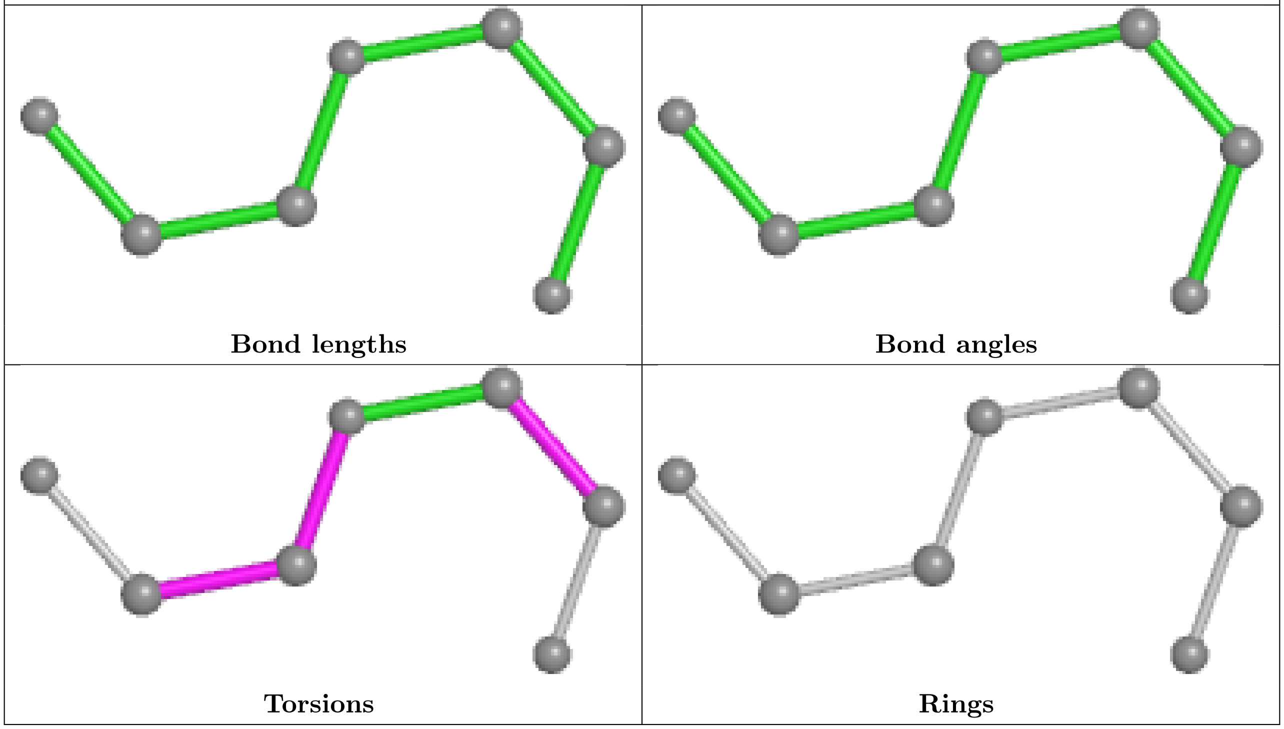


Torsions **Rings**

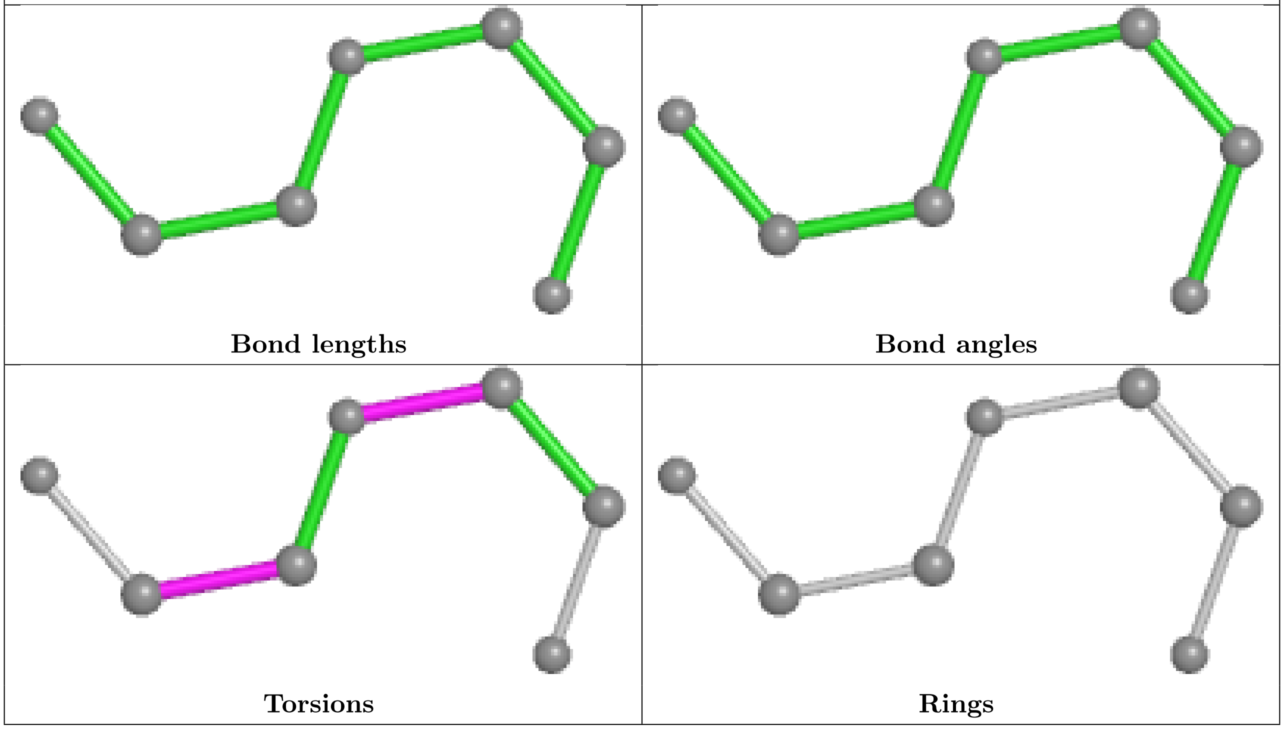
Ligand LYS A 301



Ligand PEG B 305



Ligand PEG F 305



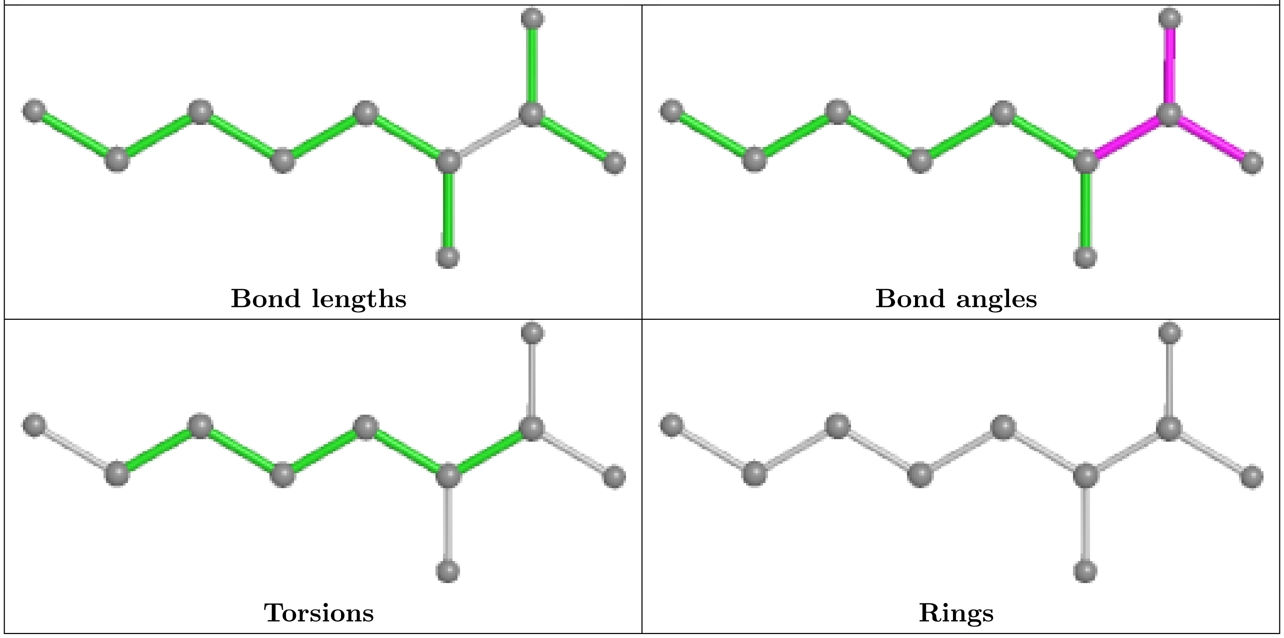
Bond lengths

Bond angles

Torsions

Rings

Ligand LYS E 301



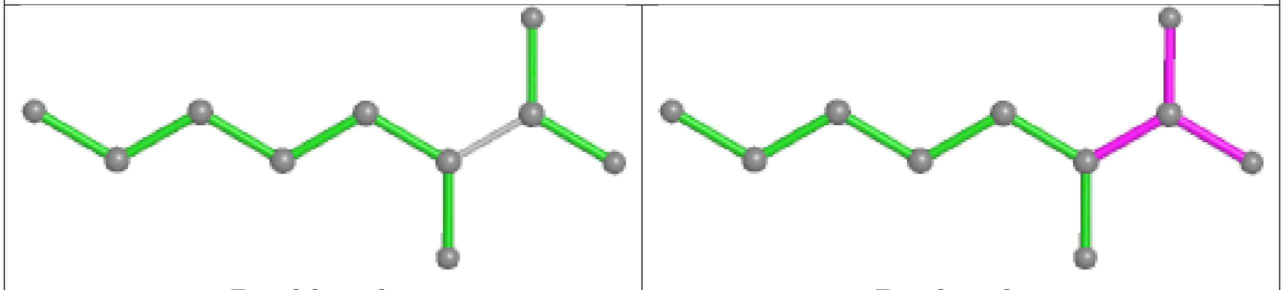
Bond lengths

Bond angles

Torsions

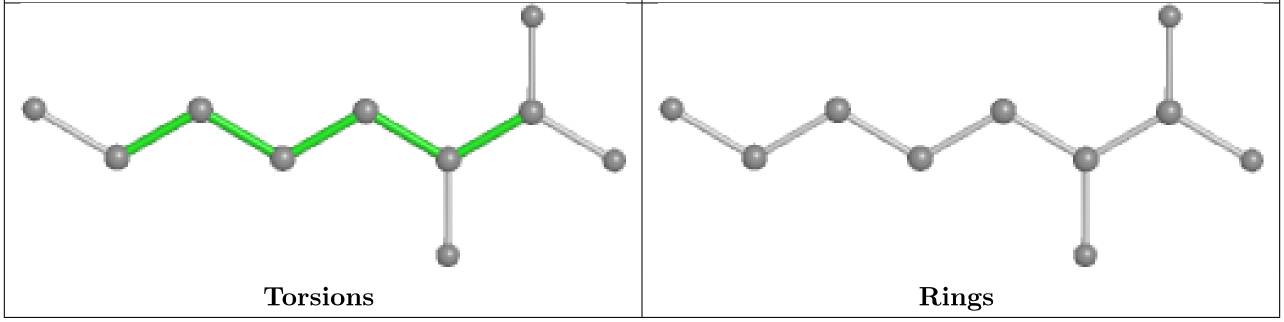
Rings

Ligand LYS C 301



Bond lengths

Bond angles



Torsions

Rings

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	295/310 (95%)	-0.38	2 (0%)	87	86	20, 27, 44, 55	0
1	B	295/310 (95%)	-0.44	0	100	100	20, 28, 42, 60	0
1	C	295/310 (95%)	-0.37	0	100	100	21, 28, 45, 58	0
1	D	295/310 (95%)	-0.42	1 (0%)	94	93	20, 29, 46, 60	0
1	E	295/310 (95%)	-0.35	1 (0%)	94	93	21, 29, 45, 63	0
1	F	296/310 (95%)	-0.37	0	100	100	21, 29, 47, 65	0
All	All	1771/1860 (95%)	-0.39	4 (0%)	95	95	20, 28, 45, 65	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	4	ASN	3.4
1	A	281	GLU	2.5
1	D	4	ASN	2.4
1	A	267	GLU	2.1

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

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
1	KPI	D	166	14/15	0.88	0.16	22,28,41,50	0
1	KPI	A	166	14/15	0.93	0.16	15,21,44,45	0
1	KPI	E	166	14/15	0.93	0.15	19,24,38,39	0
1	KPI	C	166	14/15	0.94	0.14	17,22,37,37	0
1	KPI	F	166	14/15	0.94	0.14	16,25,37,43	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\AA^2$)	Q<0.9
1	KPI	B	166	14/15	0.95	0.12	17,25,37,41	0

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

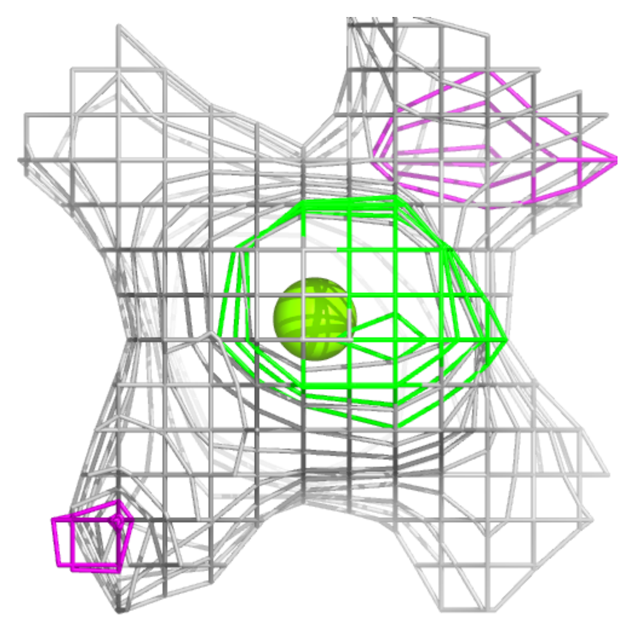
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

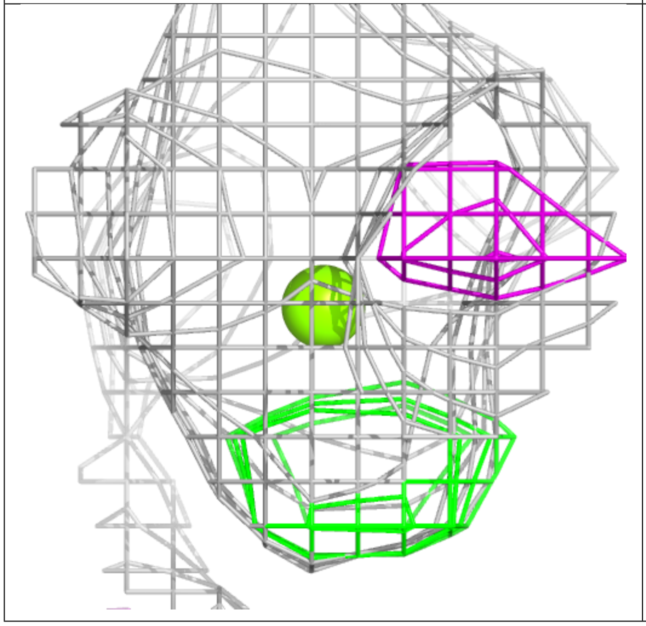
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\AA^2$)	Q<0.9
3	MG	A	302	1/1	0.73	0.11	39,39,39,39	0
3	MG	D	302	1/1	0.78	0.25	49,49,49,49	0
7	ACT	F	303	4/4	0.80	0.17	38,52,56,59	0
5	EDO	E	303	4/4	0.81	0.40	51,51,53,54	0
5	EDO	F	304	4/4	0.82	0.18	34,35,45,47	0
4	PGE	A	306	10/10	0.84	0.20	44,51,64,65	0
3	MG	B	302	1/1	0.84	0.26	41,41,41,41	0
7	ACT	C	302	4/4	0.88	0.23	44,45,54,57	0
6	PEG	B	305	7/7	0.89	0.27	20,20,20,20	0
6	PEG	F	305	7/7	0.89	0.26	20,20,20,20	0
3	MG	A	303	1/1	0.90	0.32	51,51,51,51	0
4	PGE	A	305	10/10	0.91	0.26	36,42,55,56	0
4	PGE	C	303	10/10	0.91	0.17	35,46,58,62	0
4	PGE	E	302	10/10	0.91	0.17	37,44,53,55	0
5	EDO	B	304	4/4	0.92	0.16	41,43,44,50	0
5	EDO	D	304	4/4	0.92	0.11	46,48,50,59	0
4	PGE	D	303	10/10	0.93	0.15	39,47,56,57	0
2	LYS	A	301	10/10	0.93	0.13	24,26,28,31	0
3	MG	A	304	1/1	0.94	0.07	47,47,47,47	0
2	LYS	D	301	10/10	0.95	0.12	22,28,31,33	0
2	LYS	E	301	10/10	0.96	0.12	19,26,36,38	0
2	LYS	F	301	10/10	0.96	0.14	25,27,31,36	0
2	LYS	C	301	10/10	0.96	0.13	22,26,30,32	0
2	LYS	B	301	10/10	0.96	0.11	23,27,33,34	0
3	MG	B	303	1/1	0.97	0.29	48,48,48,48	0
3	MG	F	302	1/1	0.98	0.16	26,26,26,26	0

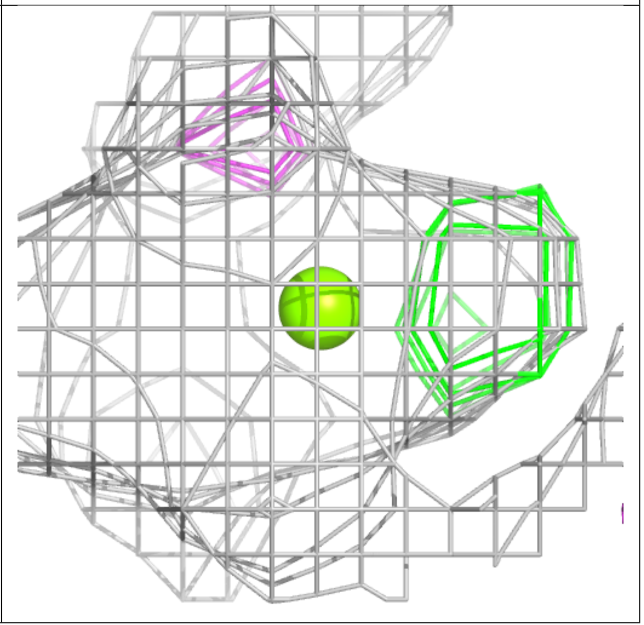
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around MG A 302:

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

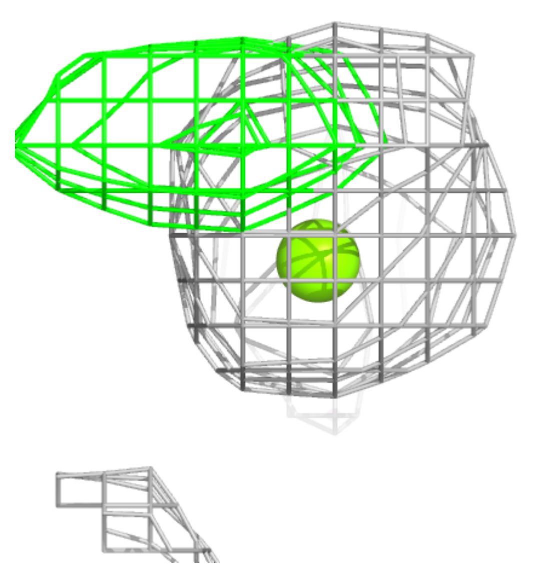


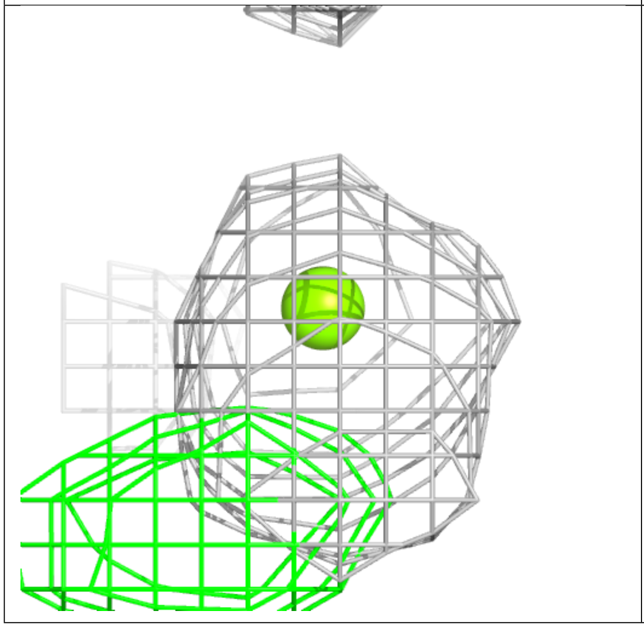


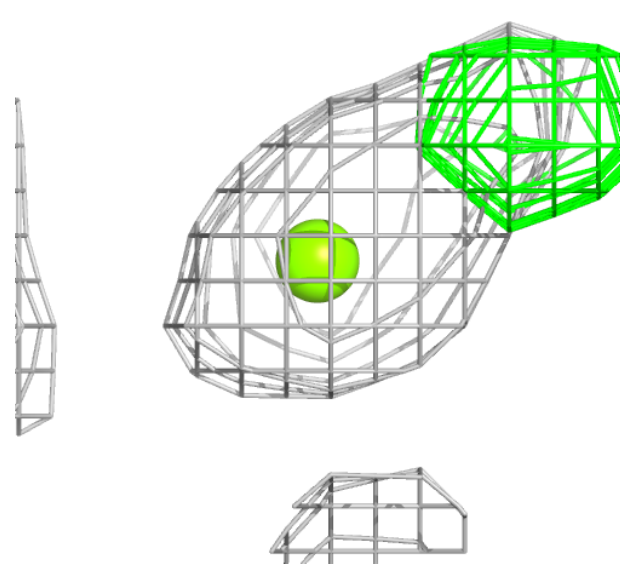


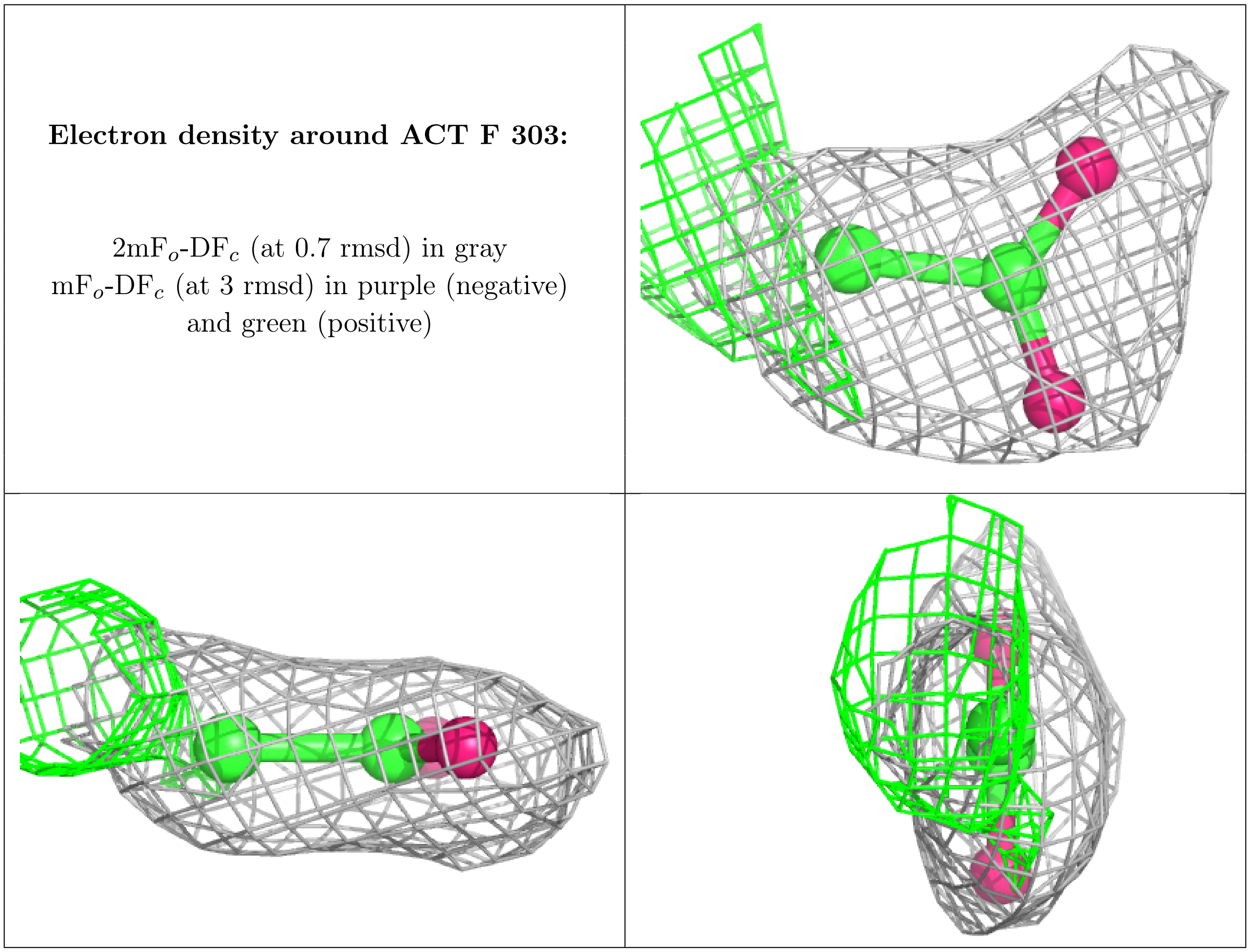
Electron density around MG D 302:

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







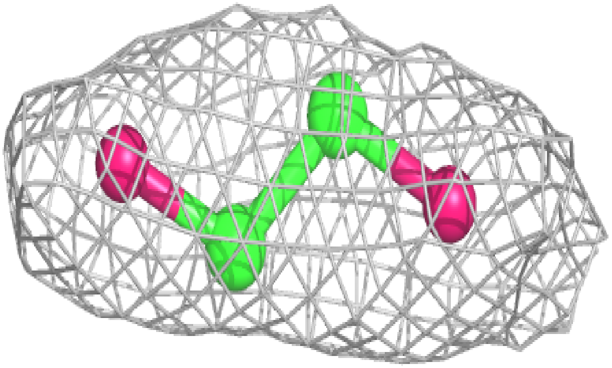


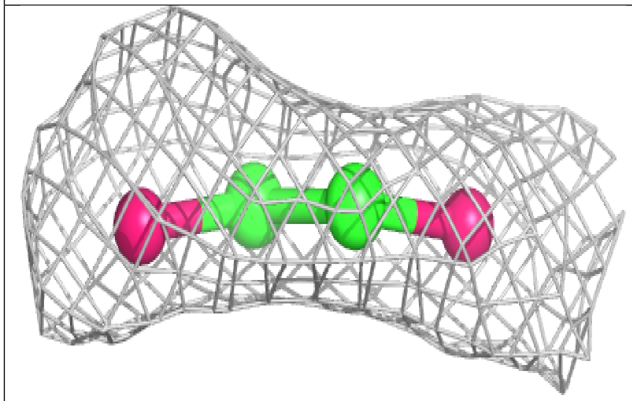
Electron density around ACT F 303:

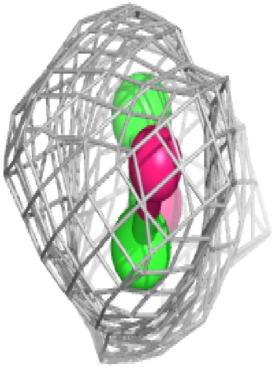
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around EDO E 303:

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 EDO F 304:

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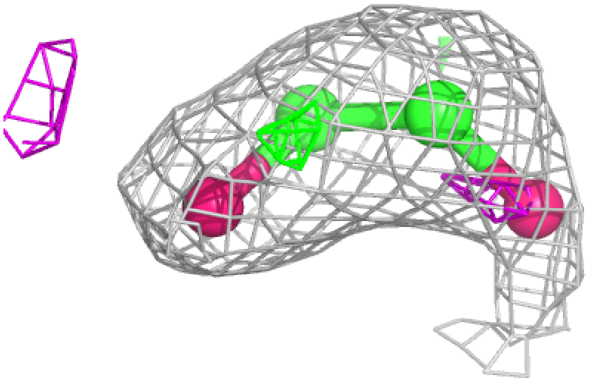
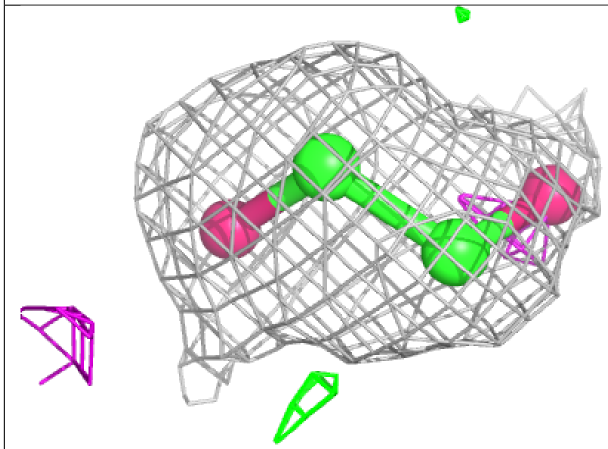
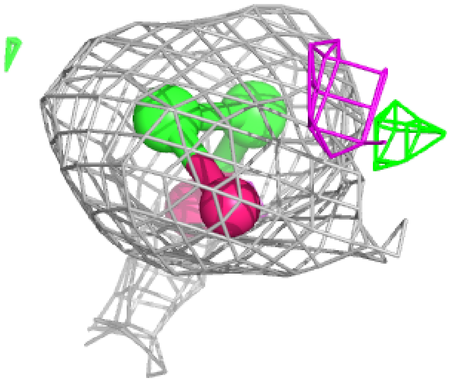
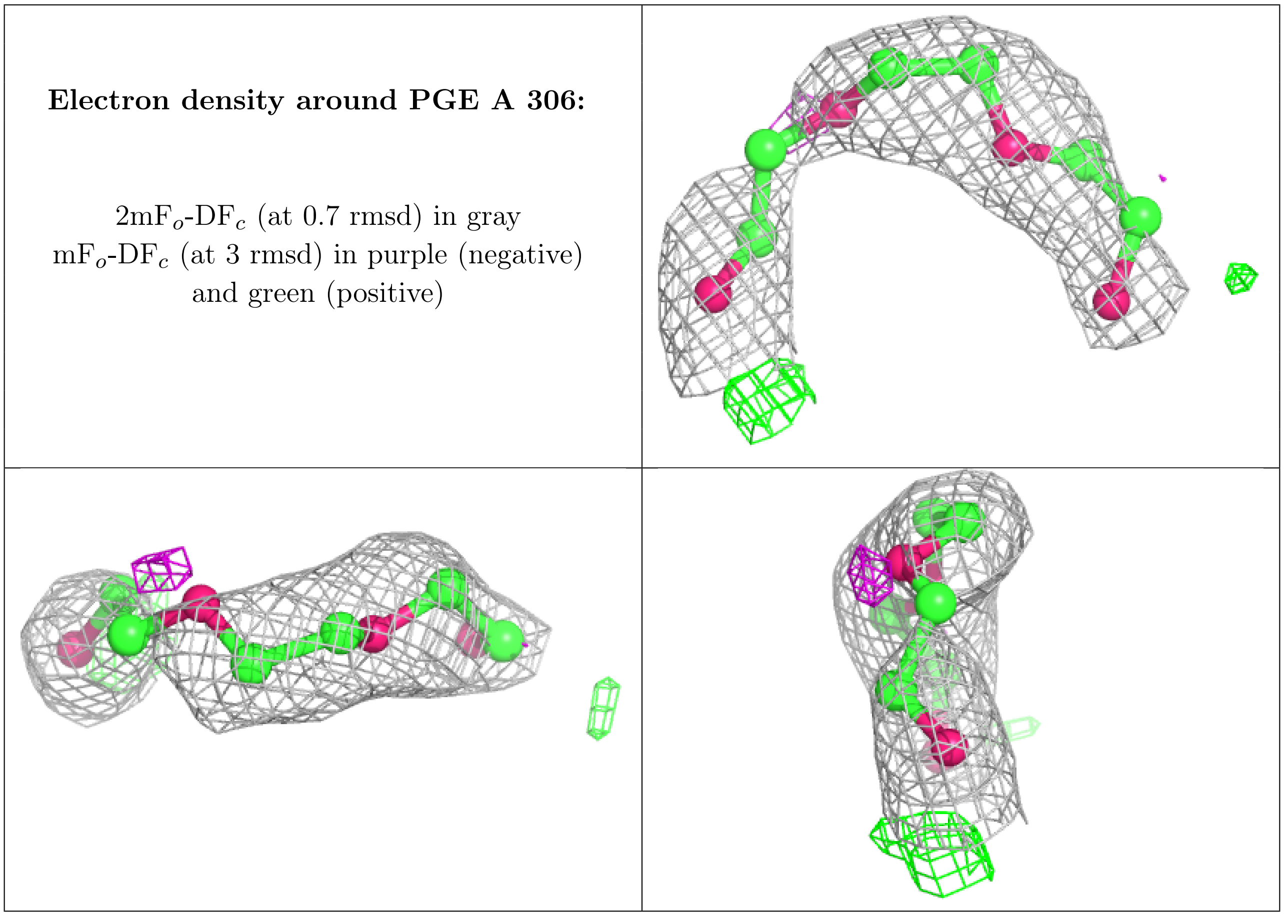
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)







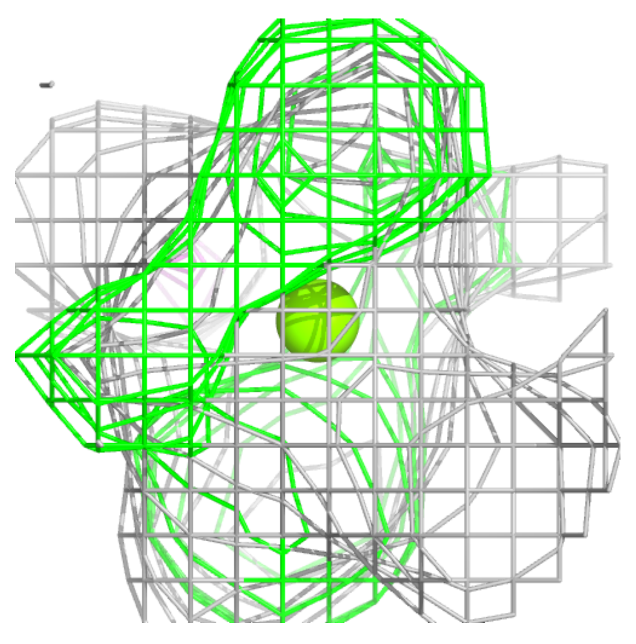


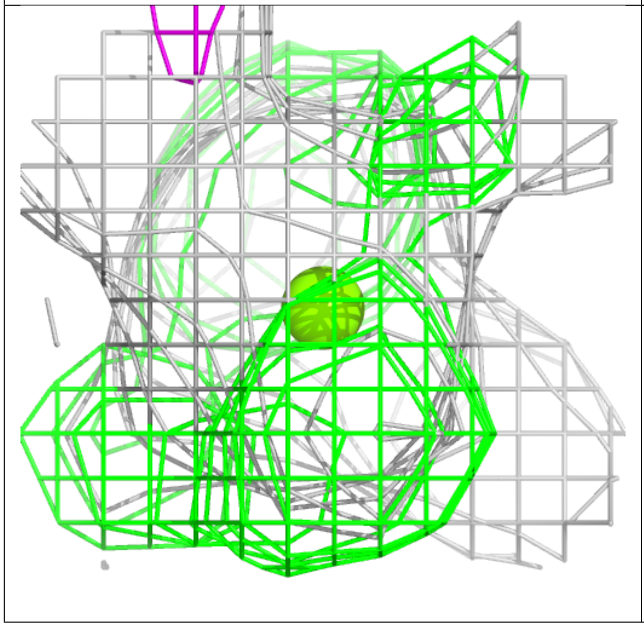
Electron density around PGE A 306:

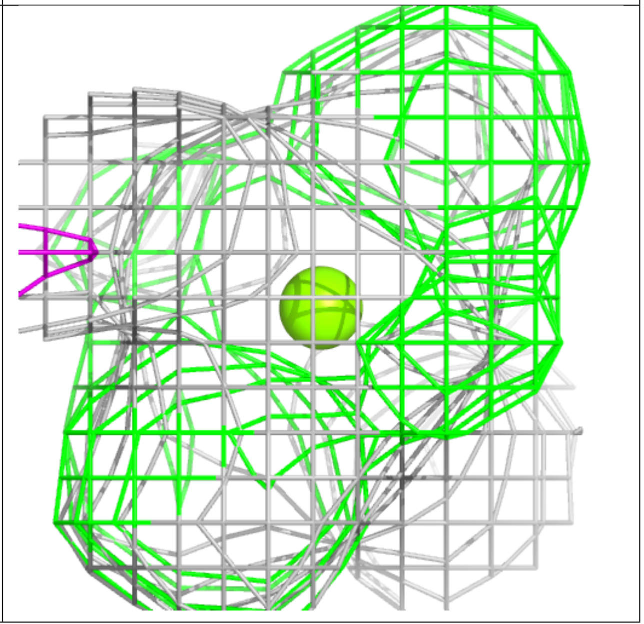
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around MG 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)

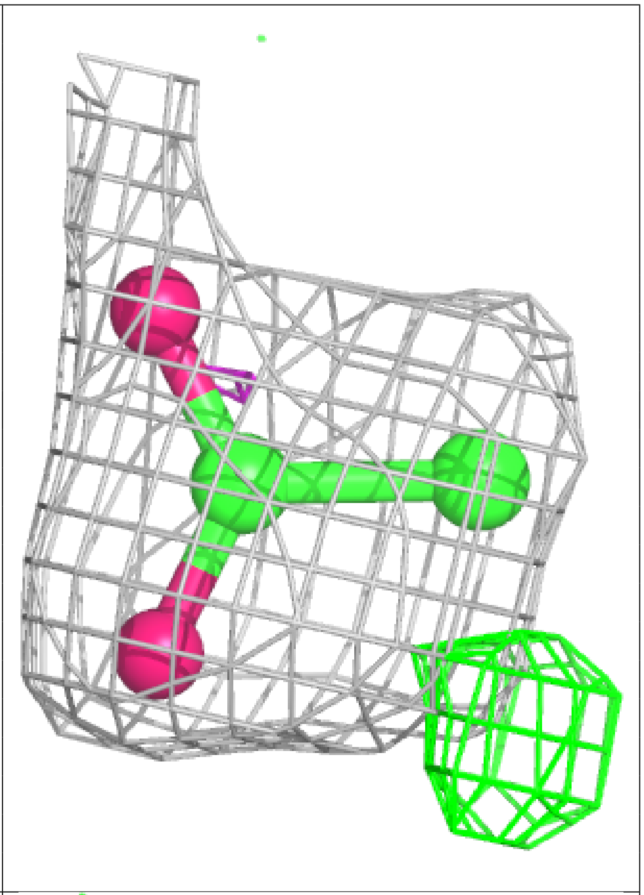


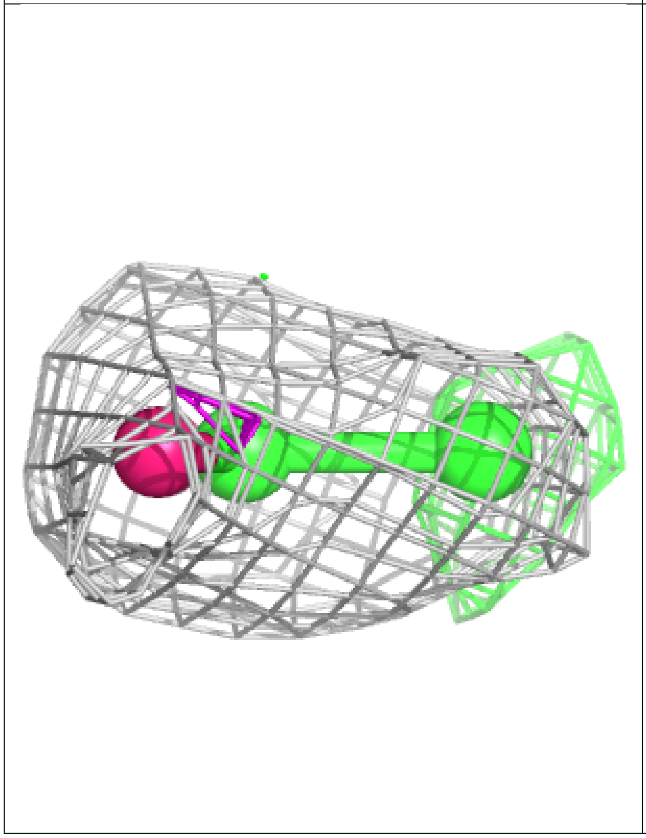


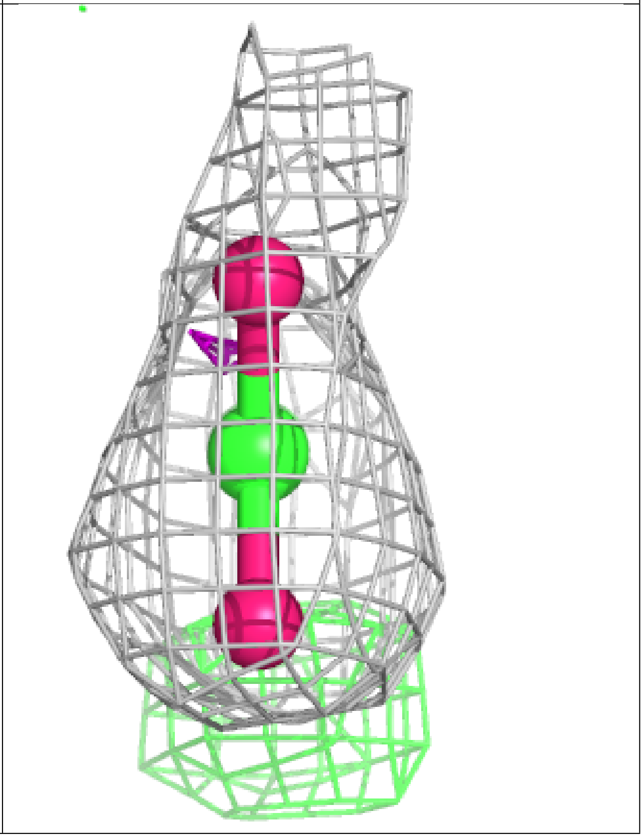


Electron density around ACT C 302:

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

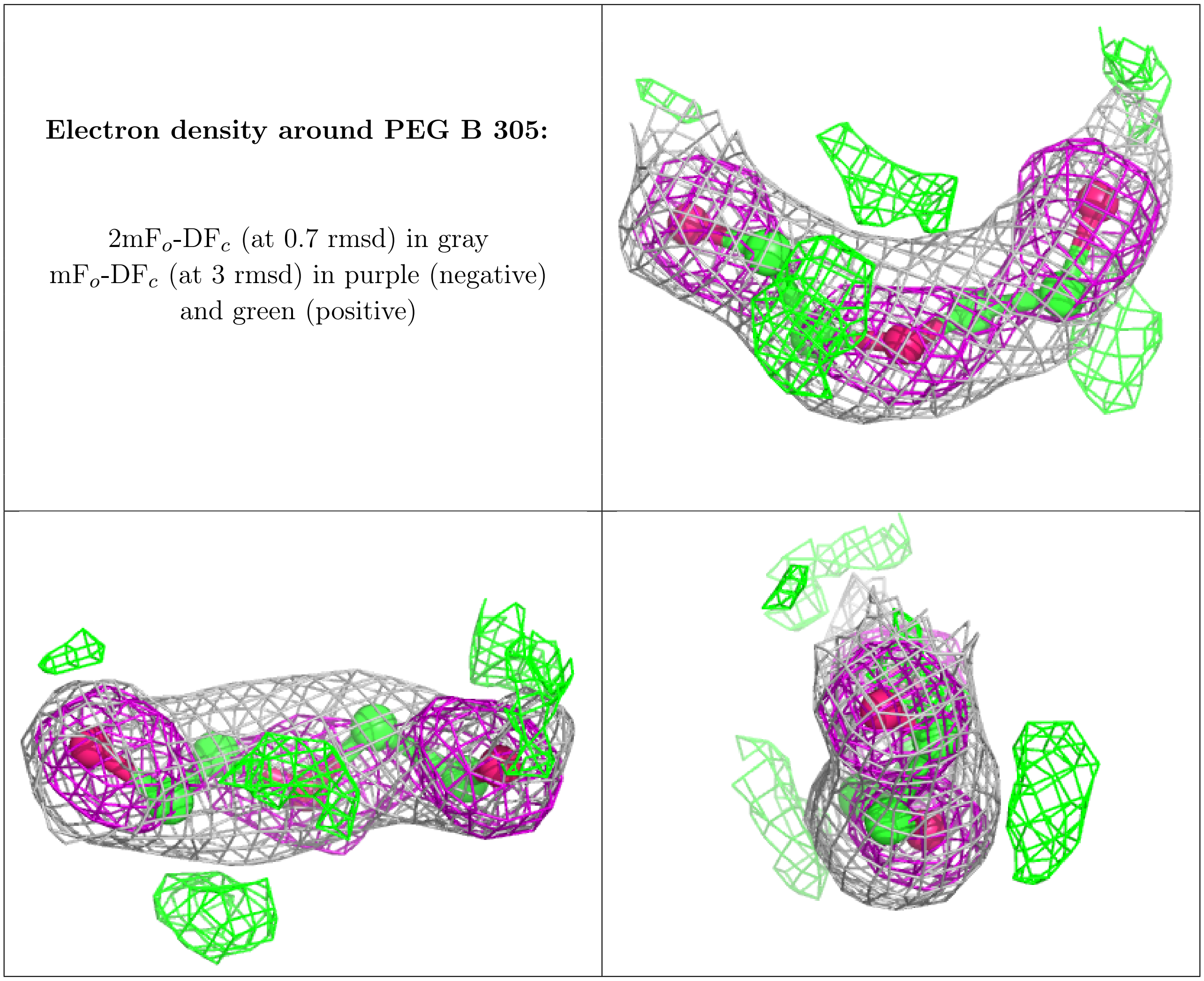






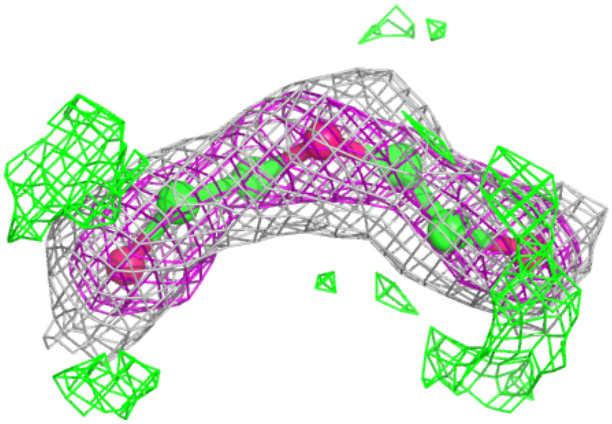
Electron density around PEG B 305:

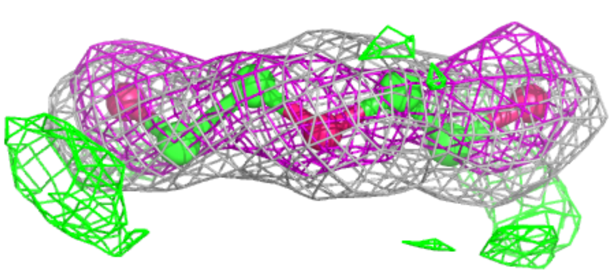
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

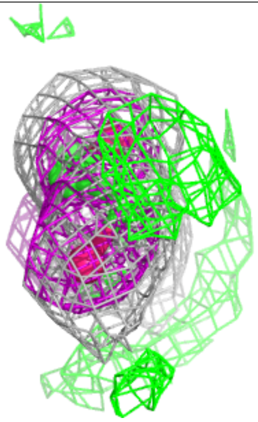


Electron density around PEG F 305:

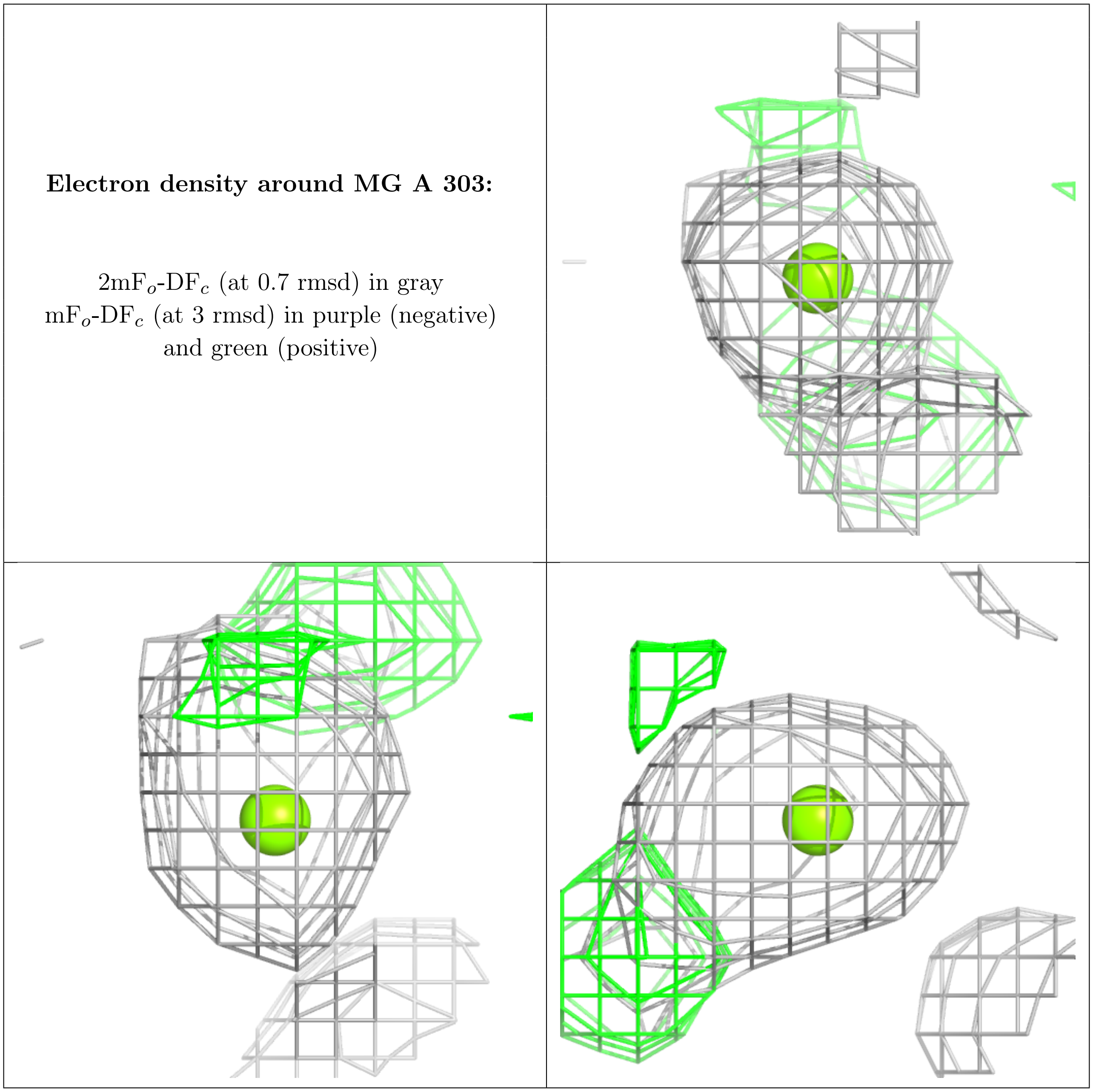
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)







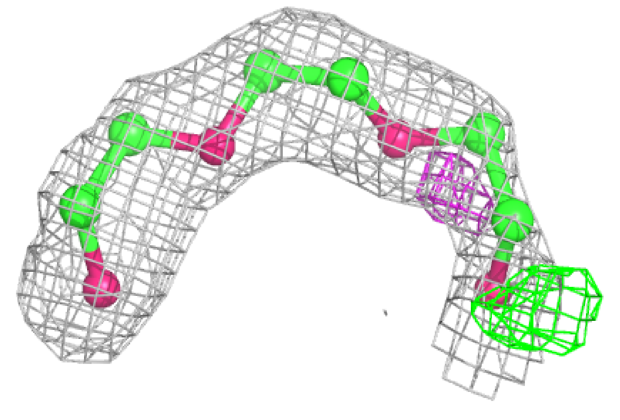
Electron density around MG A 303:

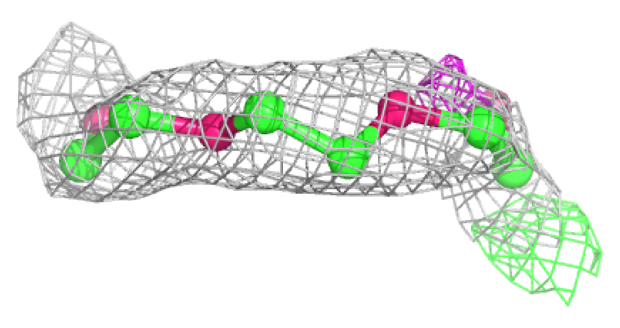


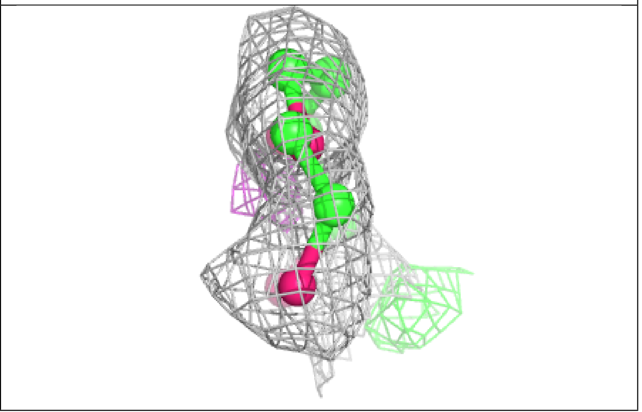
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around PGE A 305:

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

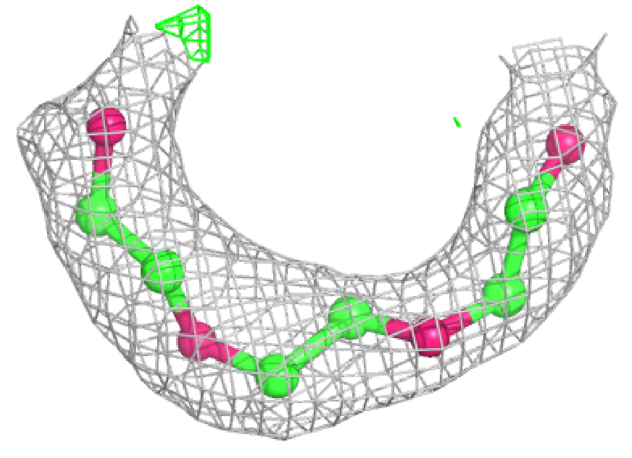


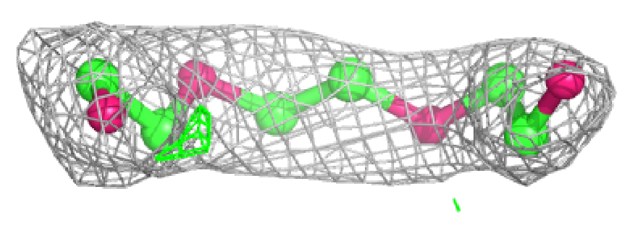


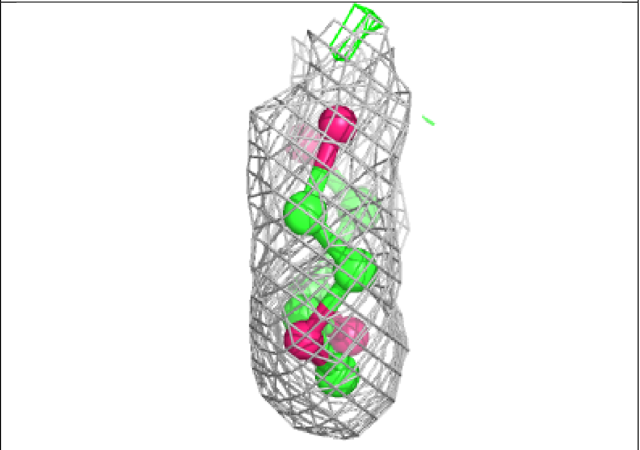


Electron density around PGE C 303:

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







Electron density around PGE E 302:

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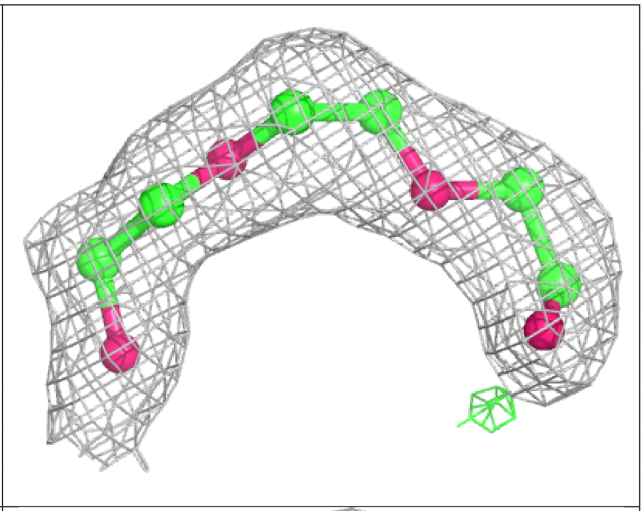
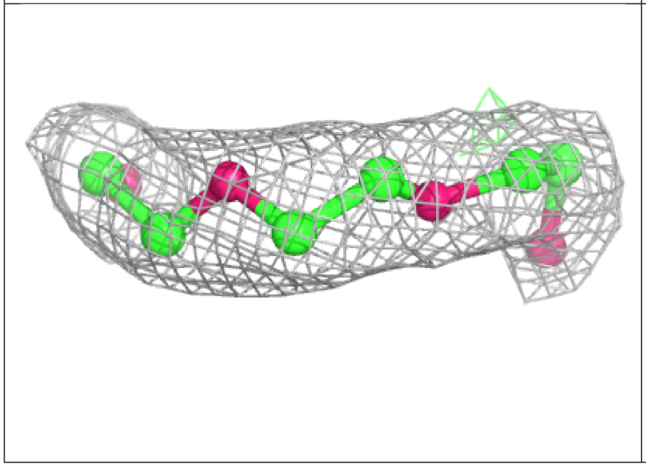
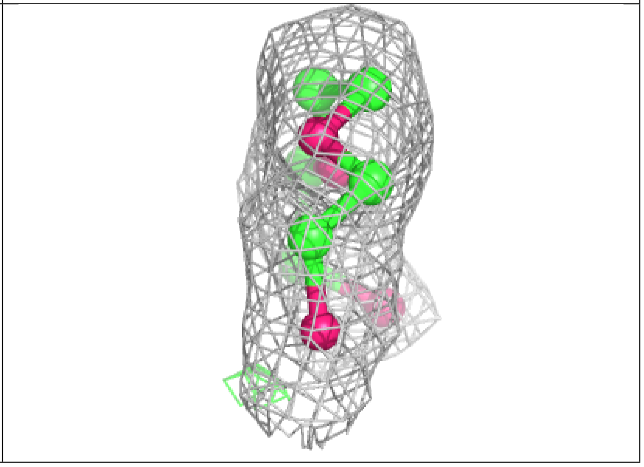
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

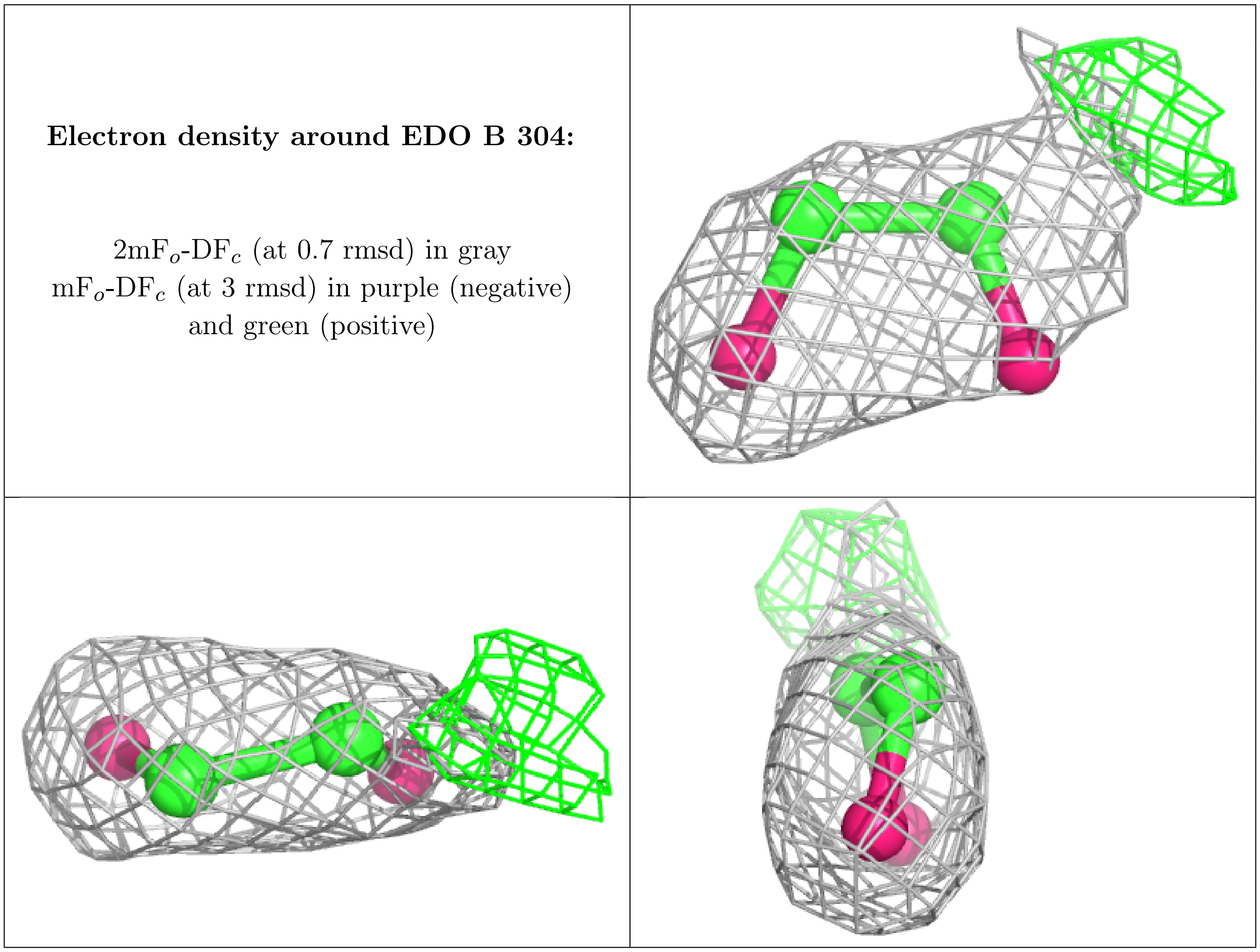






Electron density around EDO B 304:

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 EDO D 304:

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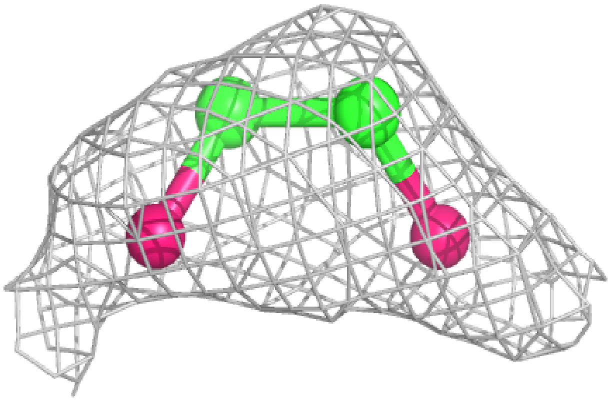
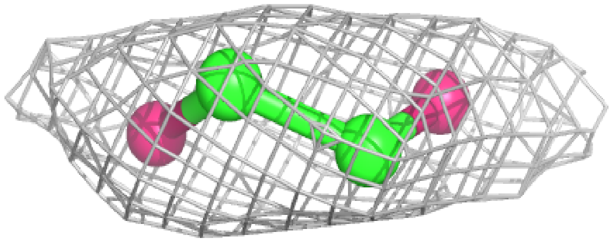
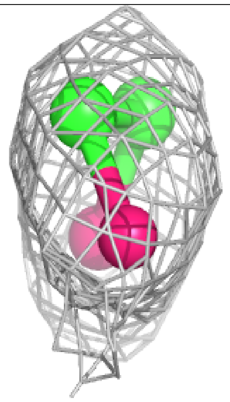
and green (positive)







Electron density around PGE D 303:

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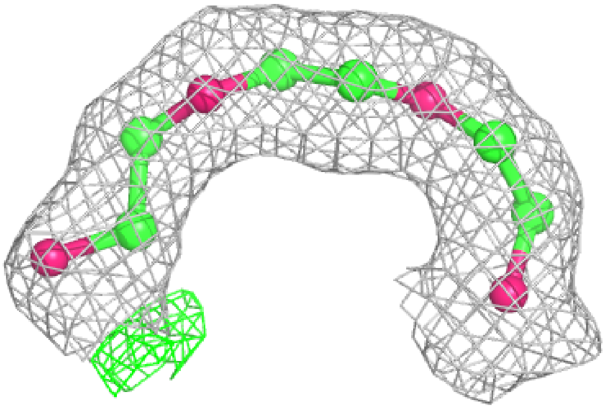
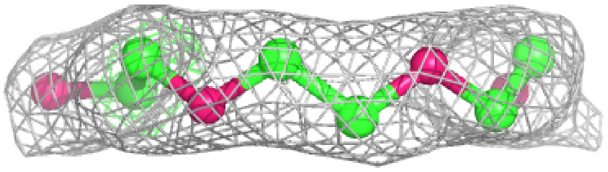
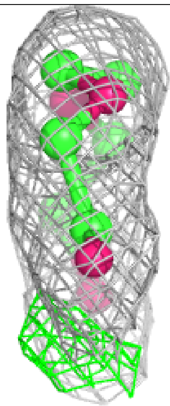
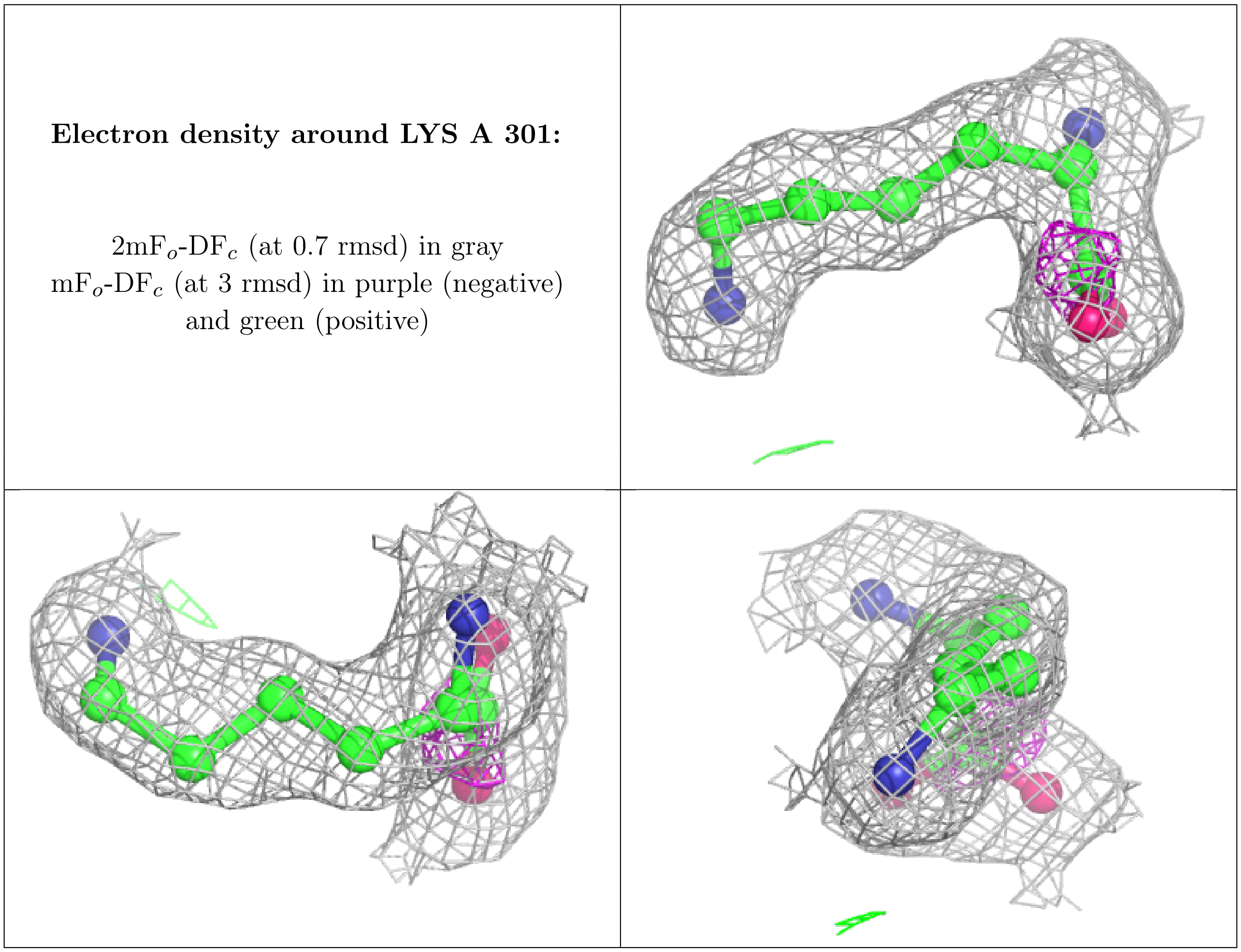
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)









Electron density around LYS A 301:

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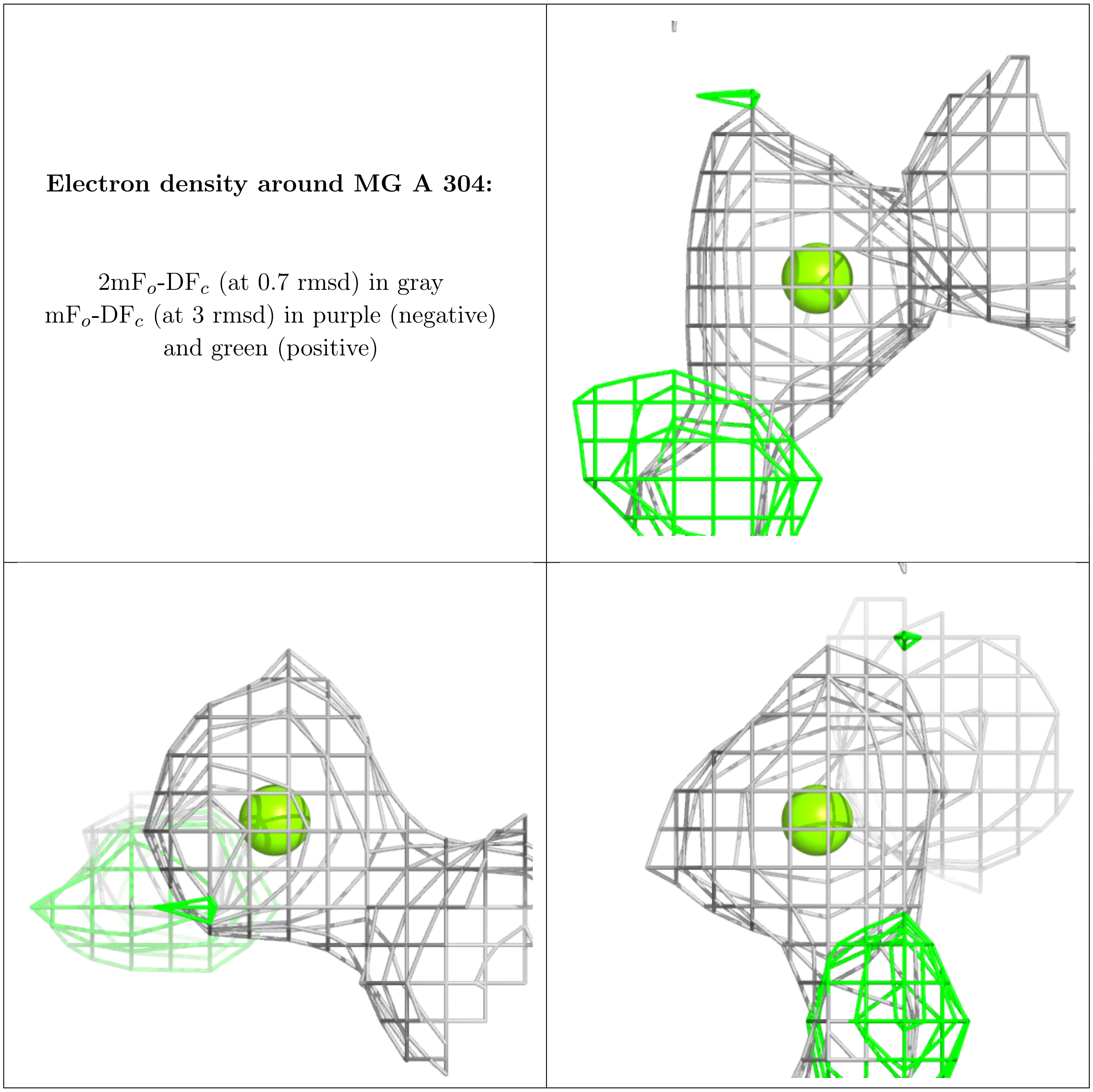
and green (positive)



Electron density around MG A 304:

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

Electron density around LYS D 301:

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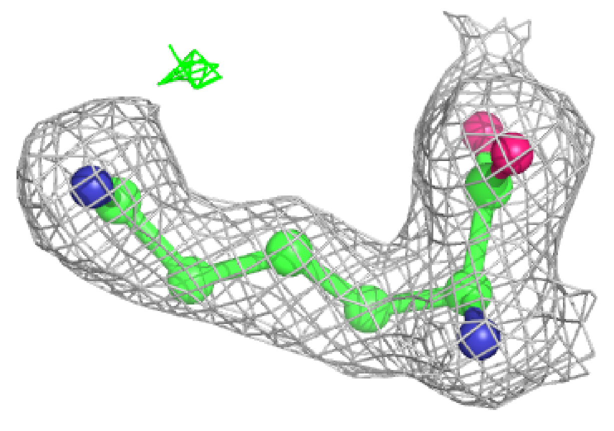
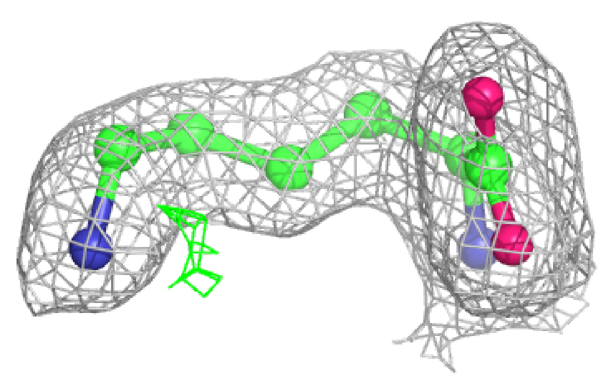
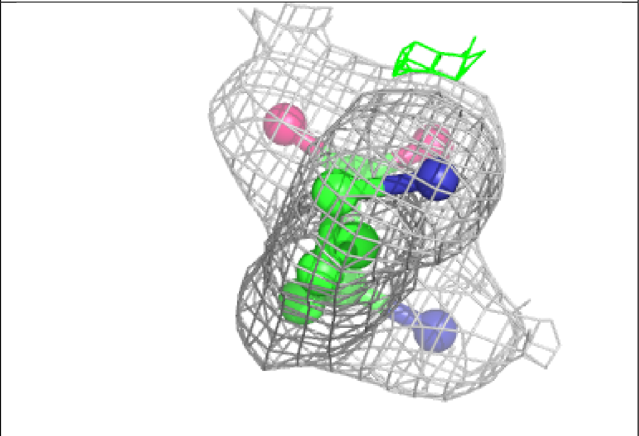
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)







Electron density around LYS E 301:

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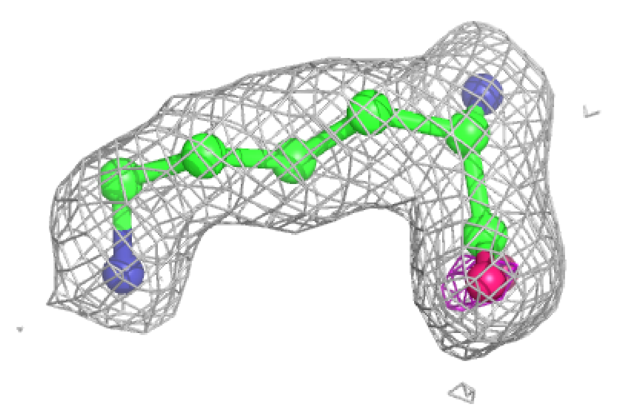
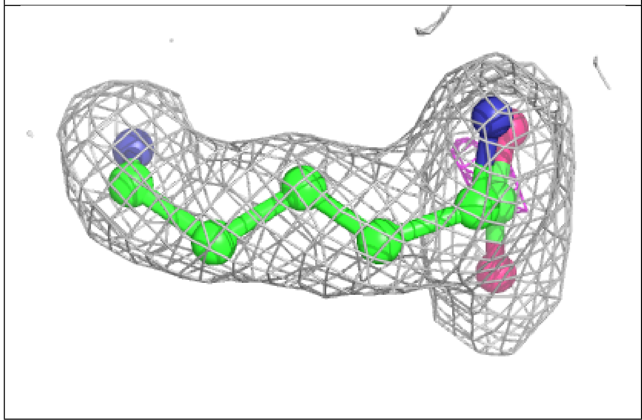
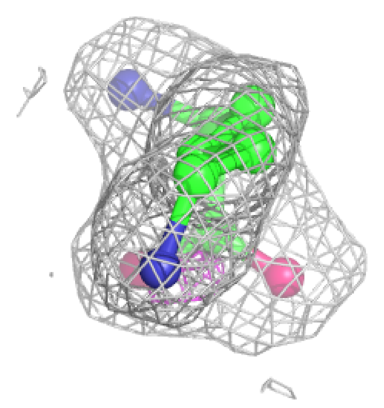
and green (positive)







Electron density around LYS F 301:

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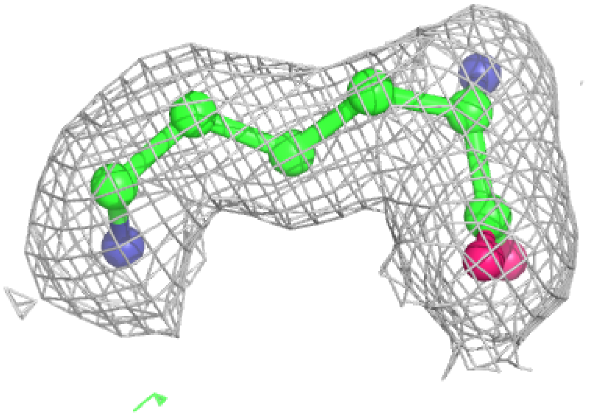
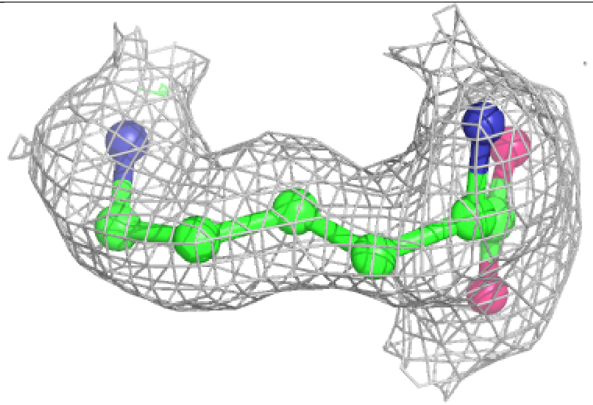
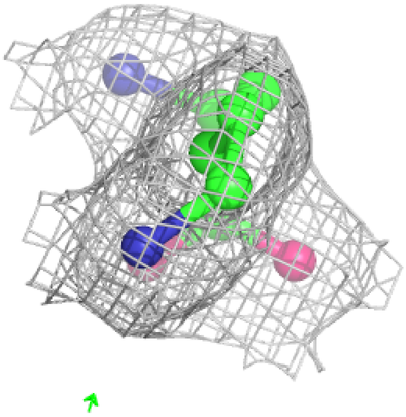
and green (positive)

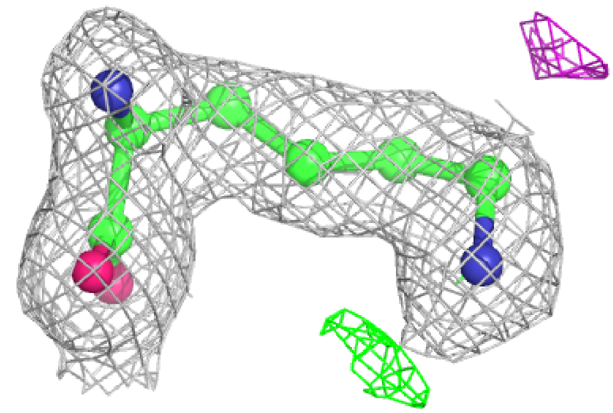


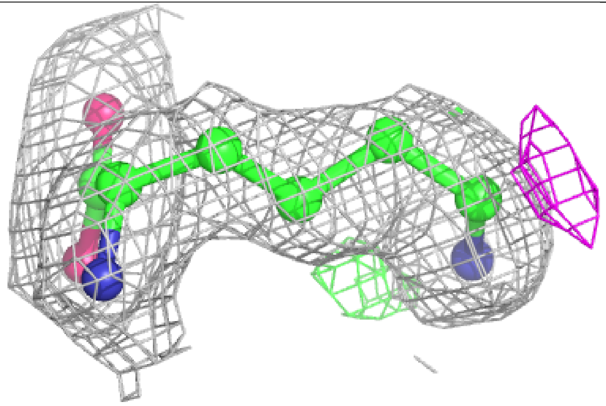


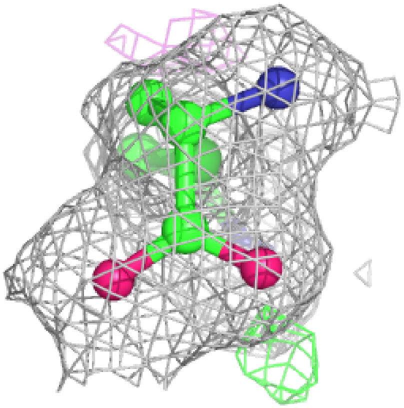


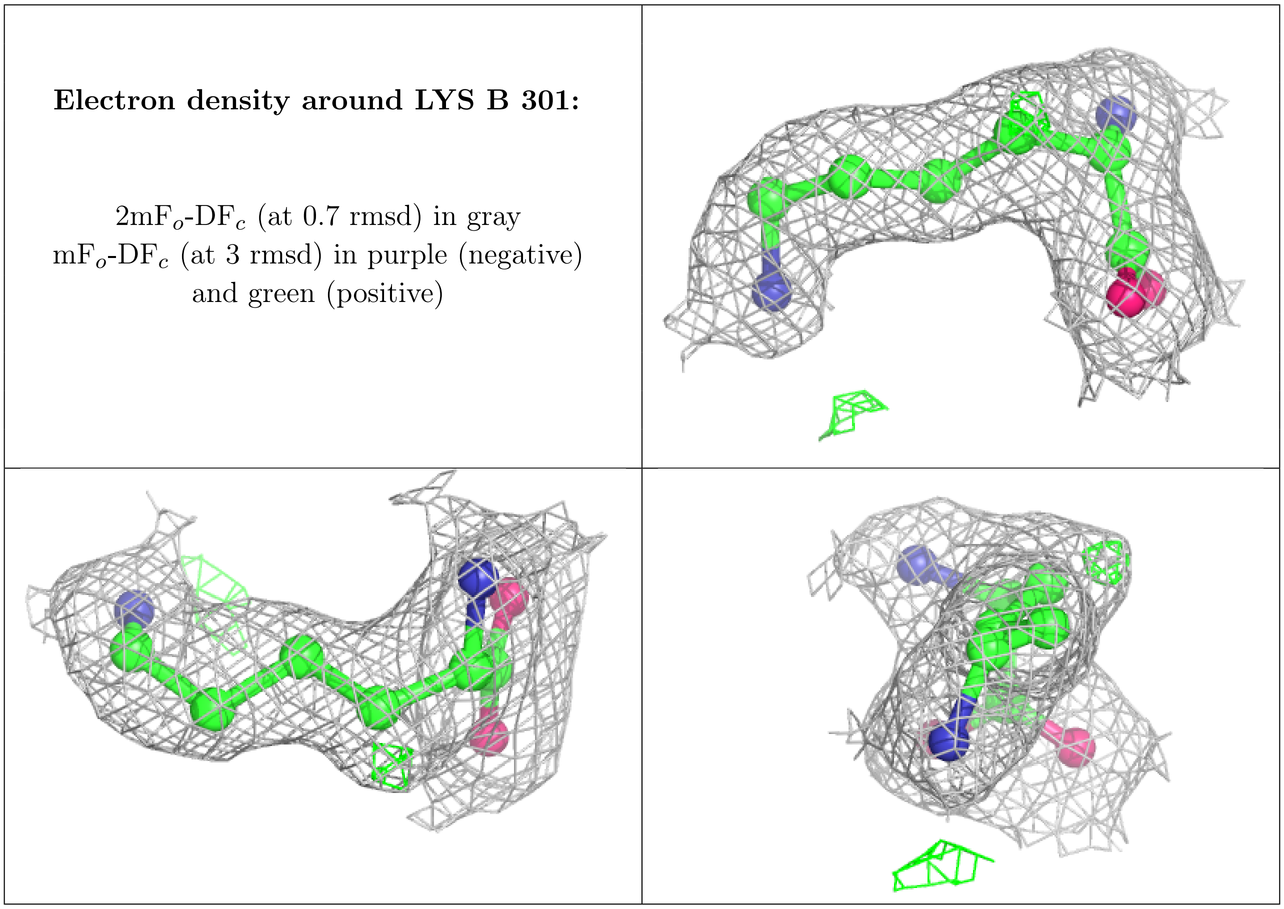
Electron density around LYS C 301:

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







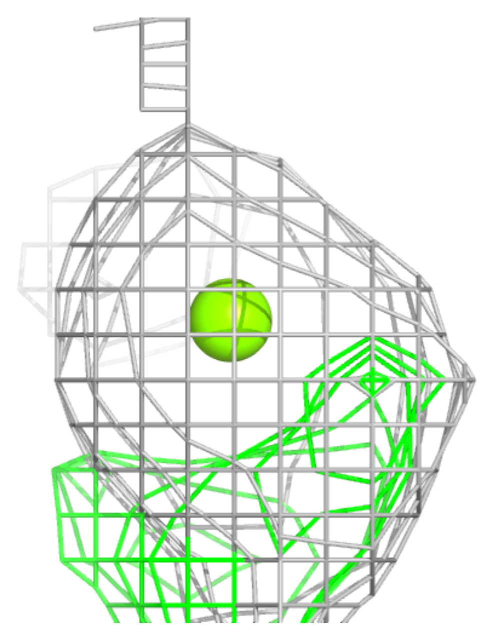


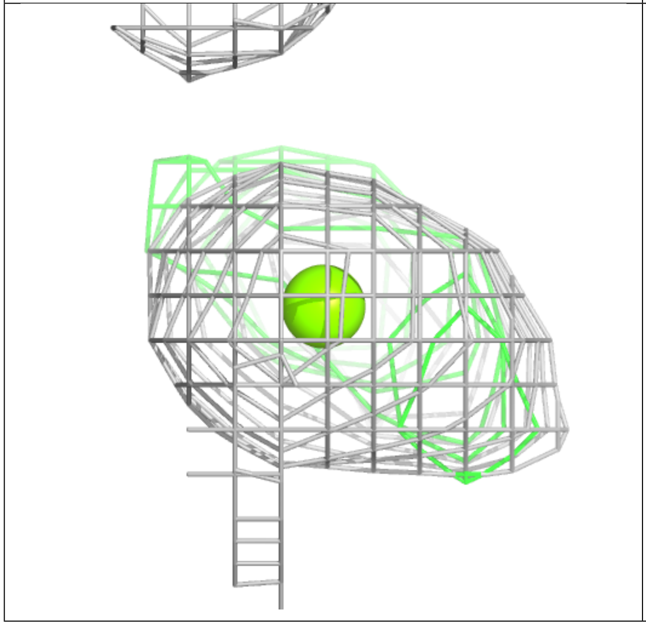
Electron density around LYS B 301:

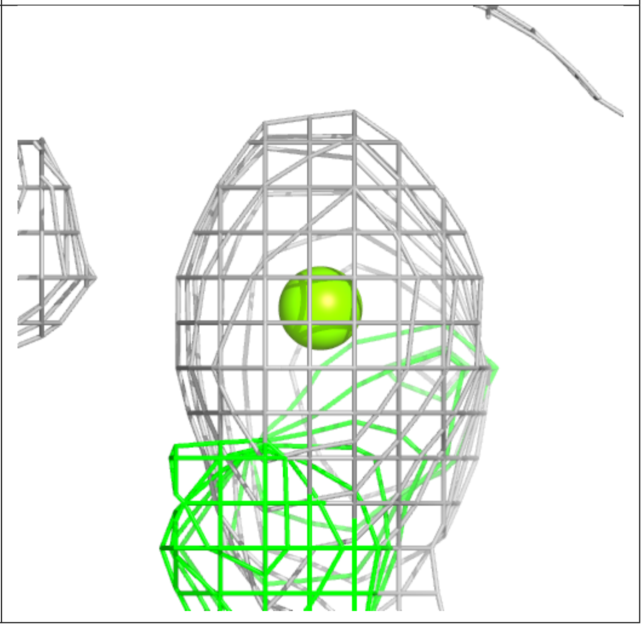
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

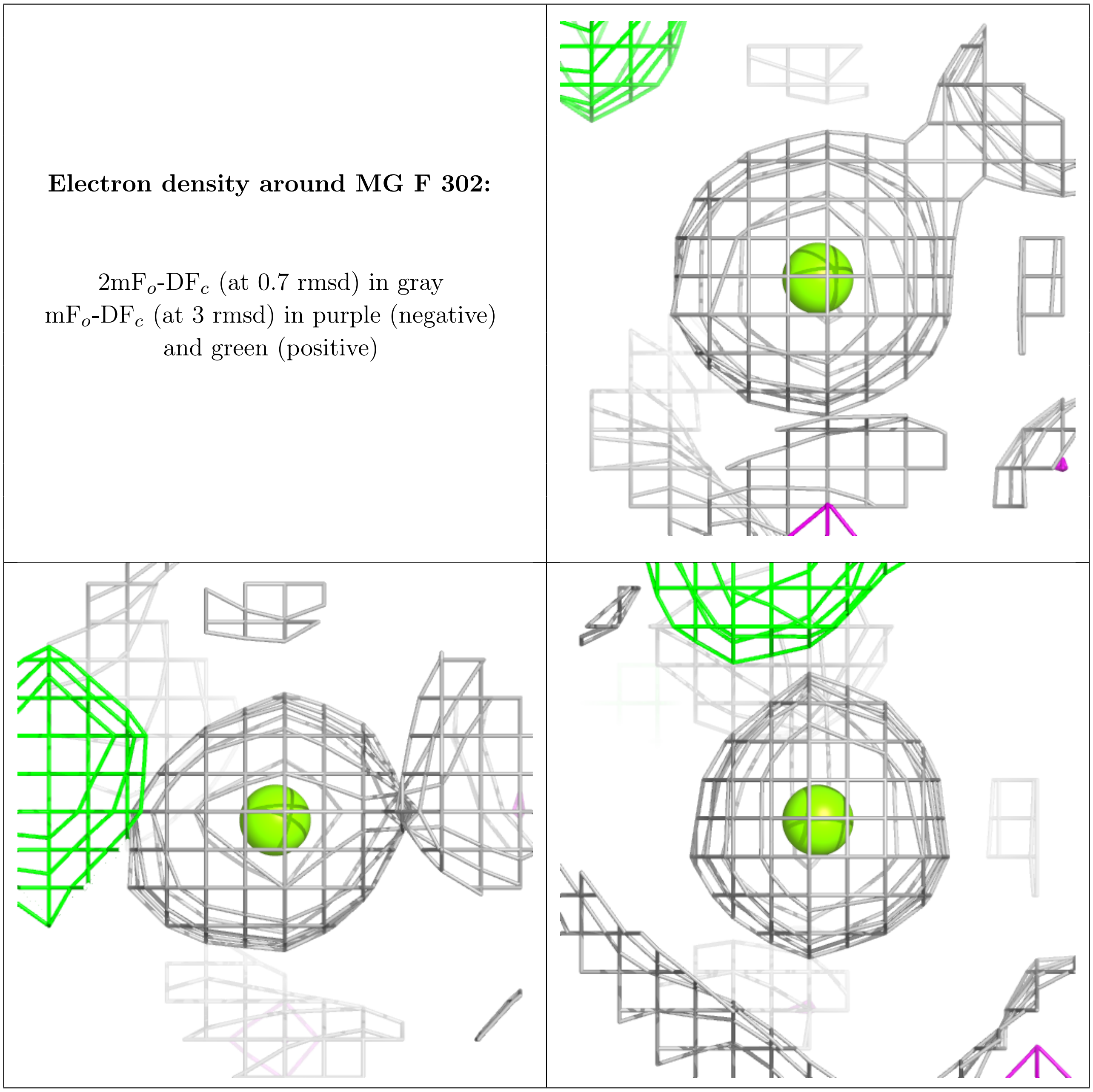
Electron density around MG B 303:

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









Electron density around MG F 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 ⓘ

There are no such residues in this entry.