wwPDB X-ray Structure Validation Summary Report (i)

Nov 19, 2023 – 11:49 PM JST

PDB ID	:	7C5H
Title	:	Crystal Structure of Glyceraldehyde-3-phosphate dehydrogenase1 from Escherichia coli at 2.09 Angstrom resolution
Authors	:	Zhang, L.; Liu, M.R.; Bao, L.Y.; Yao, Y.C.; Bostrom, I.K.; Wang, Y.D.; Chen, A.Q.; Li, J.X.; Gu, S.H.; Ji, C.N.
Deposited on	:	2020-05-20
Resolution	:	2.09 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 types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

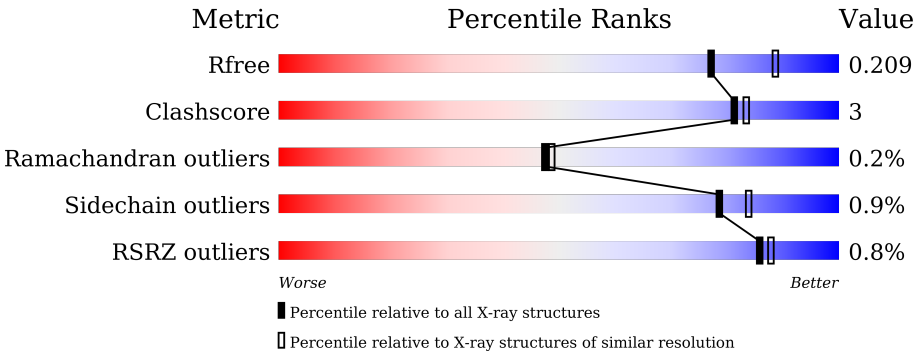
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.09 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	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

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	O	352	87% 7% 5%
1	P	352	88% 6% • 5%
1	Q	352	% 87% 7% • 5%
1	R	352	2% 85% 9% 5%

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	PO4	P	401	-	X	-	-
2	PO4	Q	403	-	-	X	-
2	PO4	R	401	-	X	-	-

2 Entry composition (i)

There are 8 unique types of molecules in this entry. The entry contains 11317 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 Glyceraldehyde-3-phosphate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	O	333	Total	C	N	O	S	0	7	0
			2575	1625	433	510	7			
1	P	333	Total	C	N	O	S	0	4	0
			2550	1610	431	502	7			
1	Q	333	Total	C	N	O	S	0	1	0
			2523	1595	425	496	7			
1	R	333	Total	C	N	O	S	0	1	0
			2523	1595	425	496	7			

There are 76 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
O	-18	HIS	-	expression tag	UNP A0A140NCK4
O	-17	HIS	-	expression tag	UNP A0A140NCK4
O	-16	HIS	-	expression tag	UNP A0A140NCK4
O	-15	HIS	-	expression tag	UNP A0A140NCK4
O	-14	HIS	-	expression tag	UNP A0A140NCK4
O	-13	HIS	-	expression tag	UNP A0A140NCK4
O	-12	SER	-	expression tag	UNP A0A140NCK4
O	-11	SER	-	expression tag	UNP A0A140NCK4
O	-10	GLY	-	expression tag	UNP A0A140NCK4
O	-9	LEU	-	expression tag	UNP A0A140NCK4
O	-8	VAL	-	expression tag	UNP A0A140NCK4
O	-7	PRO	-	expression tag	UNP A0A140NCK4
O	-6	ARG	-	expression tag	UNP A0A140NCK4
O	-5	GLY	-	expression tag	UNP A0A140NCK4
O	-4	SER	-	expression tag	UNP A0A140NCK4
O	-3	HIS	-	expression tag	UNP A0A140NCK4
O	-2	MET	-	expression tag	UNP A0A140NCK4
O	-1	ALA	-	expression tag	UNP A0A140NCK4
O	0	SER	-	expression tag	UNP A0A140NCK4
P	-18	HIS	-	expression tag	UNP A0A140NCK4
P	-17	HIS	-	expression tag	UNP A0A140NCK4

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Chain	Residue	Modelled	Actual	Comment	Reference
P	-16	HIS	-	expression tag	UNP A0A140NCK4
P	-15	HIS	-	expression tag	UNP A0A140NCK4
P	-14	HIS	-	expression tag	UNP A0A140NCK4
P	-13	HIS	-	expression tag	UNP A0A140NCK4
P	-12	SER	-	expression tag	UNP A0A140NCK4
P	-11	SER	-	expression tag	UNP A0A140NCK4
P	-10	GLY	-	expression tag	UNP A0A140NCK4
P	-9	LEU	-	expression tag	UNP A0A140NCK4
P	-8	VAL	-	expression tag	UNP A0A140NCK4
P	-7	PRO	-	expression tag	UNP A0A140NCK4
P	-6	ARG	-	expression tag	UNP A0A140NCK4
P	-5	GLY	-	expression tag	UNP A0A140NCK4
P	-4	SER	-	expression tag	UNP A0A140NCK4
P	-3	HIS	-	expression tag	UNP A0A140NCK4
P	-2	MET	-	expression tag	UNP A0A140NCK4
P	-1	ALA	-	expression tag	UNP A0A140NCK4
P	0	SER	-	expression tag	UNP A0A140NCK4
Q	-18	HIS	-	expression tag	UNP A0A140NCK4
Q	-17	HIS	-	expression tag	UNP A0A140NCK4
Q	-16	HIS	-	expression tag	UNP A0A140NCK4
Q	-15	HIS	-	expression tag	UNP A0A140NCK4
Q	-14	HIS	-	expression tag	UNP A0A140NCK4
Q	-13	HIS	-	expression tag	UNP A0A140NCK4
Q	-12	SER	-	expression tag	UNP A0A140NCK4
Q	-11	SER	-	expression tag	UNP A0A140NCK4
Q	-10	GLY	-	expression tag	UNP A0A140NCK4
Q	-9	LEU	-	expression tag	UNP A0A140NCK4
Q	-8	VAL	-	expression tag	UNP A0A140NCK4
Q	-7	PRO	-	expression tag	UNP A0A140NCK4
Q	-6	ARG	-	expression tag	UNP A0A140NCK4
Q	-5	GLY	-	expression tag	UNP A0A140NCK4
Q	-4	SER	-	expression tag	UNP A0A140NCK4
Q	-3	HIS	-	expression tag	UNP A0A140NCK4
Q	-2	MET	-	expression tag	UNP A0A140NCK4
Q	-1	ALA	-	expression tag	UNP A0A140NCK4
Q	0	SER	-	expression tag	UNP A0A140NCK4
R	-18	HIS	-	expression tag	UNP A0A140NCK4
R	-17	HIS	-	expression tag	UNP A0A140NCK4
R	-16	HIS	-	expression tag	UNP A0A140NCK4
R	-15	HIS	-	expression tag	UNP A0A140NCK4
R	-14	HIS	-	expression tag	UNP A0A140NCK4
R	-13	HIS	-	expression tag	UNP A0A140NCK4

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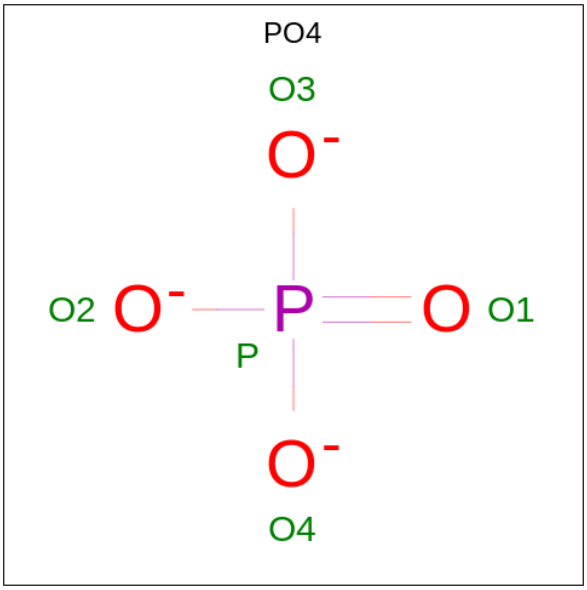
Chain	Residue	Modelled	Actual	Comment	Reference
R	-12	SER	-	expression tag	UNP A0A140NCK4
R	-11	SER	-	expression tag	UNP A0A140NCK4
R	-10	GLY	-	expression tag	UNP A0A140NCK4
R	-9	LEU	-	expression tag	UNP A0A140NCK4
R	-8	VAL	-	expression tag	UNP A0A140NCK4
R	-7	PRO	-	expression tag	UNP A0A140NCK4
R	-6	ARG	-	expression tag	UNP A0A140NCK4
R	-5	GLY	-	expression tag	UNP A0A140NCK4
R	-4	SER	-	expression tag	UNP A0A140NCK4
R	-3	HIS	-	expression tag	UNP A0A140NCK4
R	-2	MET	-	expression tag	UNP A0A140NCK4
R	-1	ALA	-	expression tag	UNP A0A140NCK4
R	0	SER	-	expression tag	UNP A0A140NCK4

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	O	1	Total O P 5 4 1	0	0
2	O	1	Total O P 5 4 1	0	0
2	P	1	Total O P 5 4 1	0	0
2	P	1	Total O P 5 4 1	0	0

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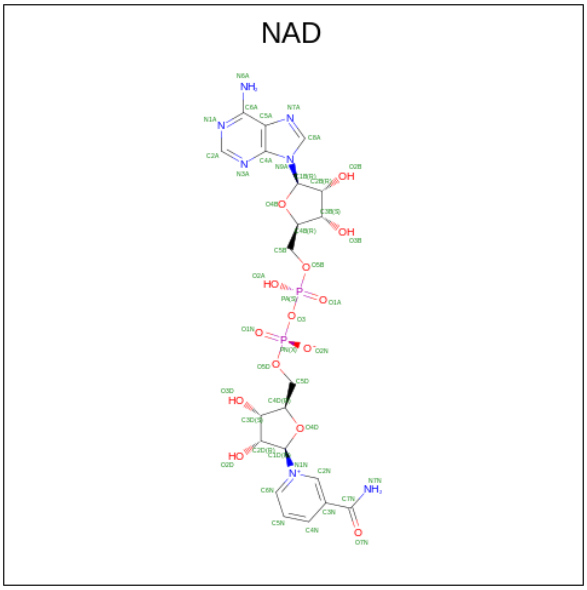
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	Q	1	Total O P 5 4 1	0	0
2	Q	1	Total O P 5 4 1	0	0
2	R	1	Total O P 5 4 1	0	0
2	R	1	Total O P 5 4 1	0	0
2	R	1	Total O P 5 4 1	0	0

- Molecule 3 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$) (labeled as "Ligand of Interest" by depositor).

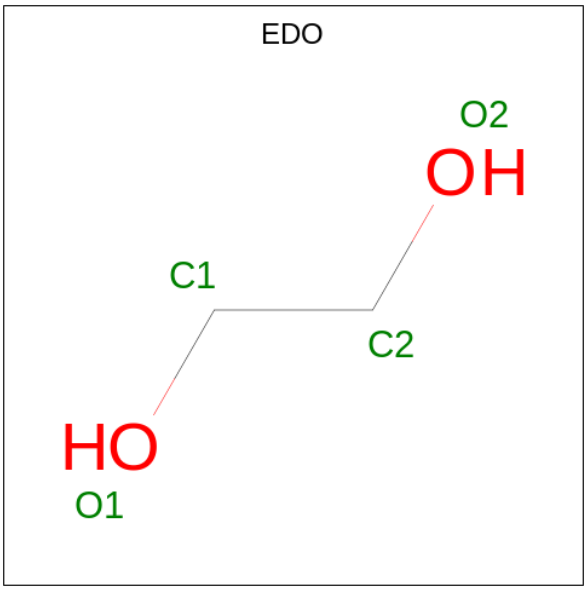


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	O	1	Total C N O P 44 21 7 14 2	0	0
3	P	1	Total C N O P 44 21 7 14 2	0	0
3	Q	1	Total C N O P 44 21 7 14 2	0	0
3	R	1	Total C N O P 44 21 7 14 2	0	0

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl) (labeled as "Ligand of Interest" by depositor).

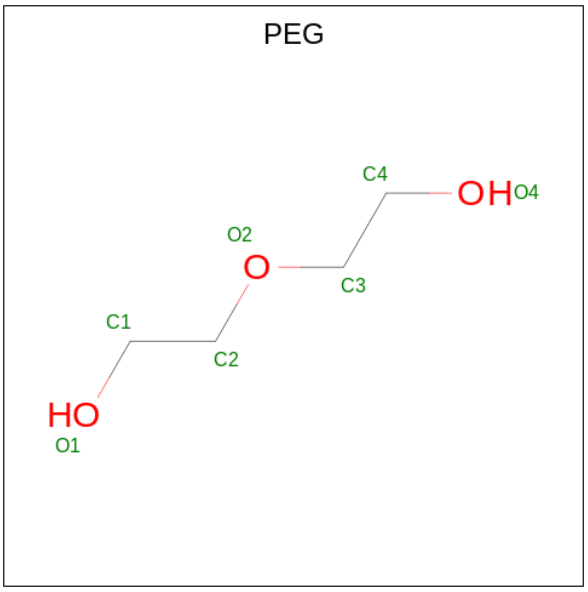
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	O	3	Total Cl 3 3	0	0
4	P	1	Total Cl 1 1	0	0
4	Q	1	Total Cl 1 1	0	0
4	R	2	Total Cl 2 2	0	0

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



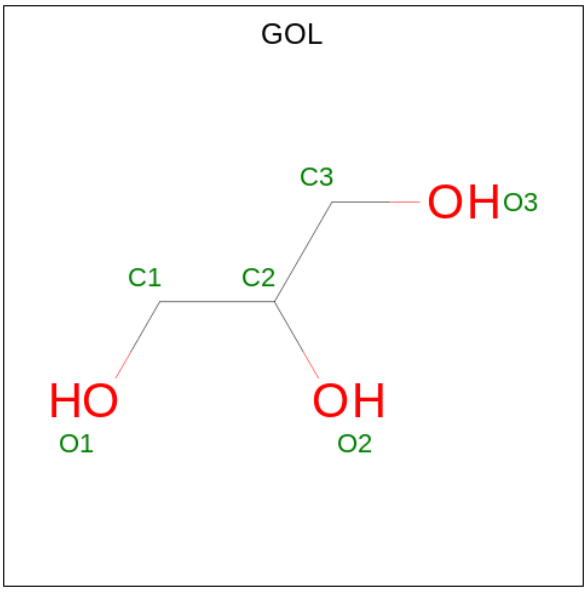
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	O	1	Total C O 4 2 2	0	0
5	O	1	Total C O 4 2 2	0	0
5	P	1	Total C O 4 2 2	0	0
5	P	1	Total C O 4 2 2	0	0
5	Q	1	Total C O 4 2 2	0	0
5	R	1	Total C O 4 2 2	0	0

- 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
			Total	C	O		
6	P	1	7	4	3	0	0

- Molecule 7 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
7	Q	1	6	3	3	0	0

- Molecule 8 is water.

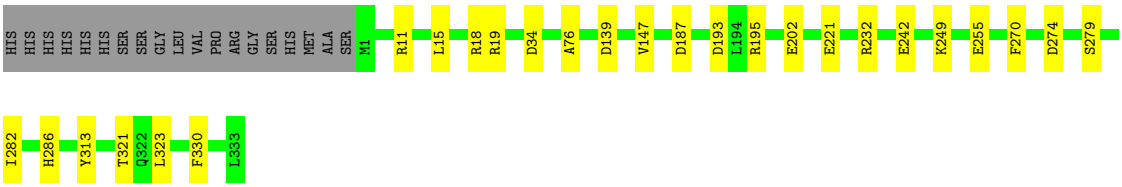
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	O	255	Total O 255 255	0	0
8	P	237	Total O 237 237	0	0
8	Q	225	Total O 225 225	0	0
8	R	164	Total O 164 164	0	0

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.

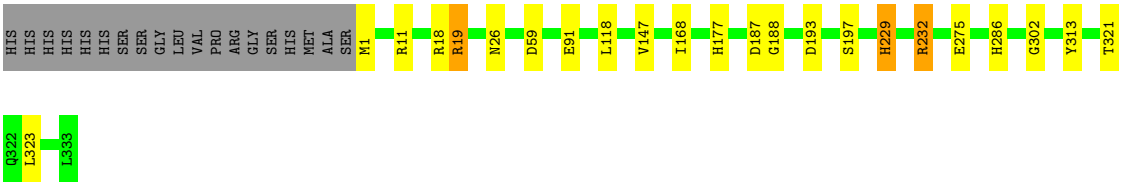
• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

Chain O:



• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

Chain P:

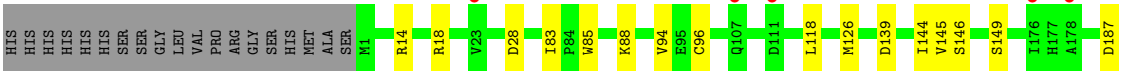


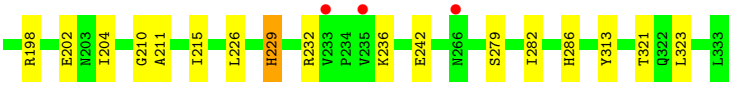
• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

Chain Q:

• Molecule 1: Glyceraldehyde-3-phosphate dehydrogenase

Chain R:




R198
E202
N203
I204
G210
A211
I215
L226
H229
R232
V233
P234
V235
K236
E242
N266
S279
I282
H286
Y313
T321
Q322
L323
L333

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	89.78Å 89.78Å 340.95Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 2.09 39.87 – 2.09	Depositor EDS
% Data completeness (in resolution range)	99.6 (40.00-2.09) 99.6 (39.87-2.09)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.27 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0131	Depositor
R, R_{free}	0.151 , 0.203 0.163 , 0.209	Depositor DCC
R_{free} test set	4181 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	19.7	Xtriage
Anisotropy	0.019	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 50.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	11317	wwPDB-VP
Average B, all atoms (Å^2)	21.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.26% 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: EDO, GOL, NAD, PEG, CL, PO4

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	O	0.89	2/2617 (0.1%)	1.01	15/3551 (0.4%)
1	P	0.87	0/2592	1.01	9/3517 (0.3%)
1	Q	0.88	1/2564 (0.0%)	0.99	9/3479 (0.3%)
1	R	0.89	1/2564 (0.0%)	0.94	8/3479 (0.2%)
All	All	0.88	4/10337 (0.0%)	0.99	41/14026 (0.3%)

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	Q	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	R	202	GLU	CD-OE2	8.01	1.34	1.25
1	O	202	GLU	CD-OE2	6.16	1.32	1.25
1	Q	202	GLU	CD-OE2	5.51	1.31	1.25
1	O	221	GLU	CG-CD	5.50	1.60	1.51

The worst 5 of 41 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	Q	18	ARG	NE-CZ-NH1	-14.01	113.30	120.30
1	O	18	ARG	NE-CZ-NH1	-12.55	114.02	120.30
1	Q	18	ARG	NE-CZ-NH2	11.84	126.22	120.30
1	O	18	ARG	NE-CZ-NH2	10.78	125.69	120.30
1	P	18	ARG	NE-CZ-NH2	10.57	125.59	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	Q	245	SER	Peptide

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	O	2575	0	2582	9	0
1	P	2550	0	2566	14	0
1	Q	2523	0	2550	14	0
1	R	2523	0	2550	23	0
2	O	10	0	0	0	0
2	P	10	0	0	1	0
2	Q	10	0	0	2	0
2	R	15	0	0	1	0
3	O	44	0	26	0	0
3	P	44	0	26	0	0
3	Q	44	0	26	0	0
3	R	44	0	26	0	0
4	O	3	0	0	0	0
4	P	1	0	0	0	0
4	Q	1	0	0	0	0
4	R	2	0	0	0	0
5	O	8	0	12	1	0
5	P	8	0	12	3	0
5	Q	4	0	6	1	0
5	R	4	0	6	1	0
6	P	7	0	10	0	0
7	Q	6	0	8	0	0
8	O	255	0	0	0	0
8	P	237	0	0	2	0
8	Q	225	0	0	3	0
8	R	164	0	0	3	0
All	All	11317	0	10406	55	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.

The worst 5 of 55 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:R:126:MET:HE2	1:R:146:SER:N	2.10	0.67
1:R:126:MET:HE3	1:R:145:VAL:HA	1.75	0.67
1:R:215:ILE:HG21	1:R:226:LEU:HD12	1.77	0.67
1:O:274[A]:ASP:OD1	5:O:406:EDO:H22	1.98	0.63
1:R:126:MET:CE	1:R:145:VAL:C	2.66	0.63

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	O	338/352 (96%)	327 (97%)	11 (3%)	0	100	100
1	P	335/352 (95%)	323 (96%)	11 (3%)	1 (0%)	41	41
1	Q	332/352 (94%)	320 (96%)	11 (3%)	1 (0%)	41	41
1	R	332/352 (94%)	323 (97%)	9 (3%)	0	100	100
All	All	1337/1408 (95%)	1293 (97%)	42 (3%)	2 (0%)	47	54

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	P	302	GLY
1	Q	167	GLY

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	O	280/289 (97%)	279 (100%)	1 (0%)	91 94
1	P	277/289 (96%)	273 (99%)	4 (1%)	67 73
1	Q	274/289 (95%)	271 (99%)	3 (1%)	73 79
1	R	274/289 (95%)	271 (99%)	3 (1%)	73 79
All	All	1105/1156 (96%)	1094 (99%)	11 (1%)	78 82

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

Mol	Chain	Res	Type
1	Q	313	TYR
1	R	28	ASP
1	R	313	TYR
1	R	229	HIS
1	P	313	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	Q	229	HIS
1	Q	266	ASN
1	Q	315	ASN
1	R	229	HIS
1	R	266	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 28 ligands modelled in this entry, 7 are monoatomic - leaving 21 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	$\#\|Z\| > 2$
2	PO4	P	401	-	4,4,4	1.40	1 (25%)	6,6,6	2.12	4 (66%)
5	EDO	O	405	-	3,3,3	0.63	0	2,2,2	0.21	0
2	PO4	Q	403	-	4,4,4	0.42	0	6,6,6	1.58	2 (33%)
3	NAD	Q	402	-	42,48,48	1.30	7 (16%)	50,73,73	1.42	10 (20%)
3	NAD	R	402	-	42,48,48	0.97	1 (2%)	50,73,73	1.50	6 (12%)
3	NAD	O	402	-	42,48,48	1.06	1 (2%)	50,73,73	1.35	7 (14%)
2	PO4	O	403	-	4,4,4	0.49	0	6,6,6	1.13	0
2	PO4	O	401	-	4,4,4	1.54	1 (25%)	6,6,6	2.03	1 (16%)
5	EDO	R	405	-	3,3,3	0.28	0	2,2,2	1.18	0
3	NAD	P	402	-	42,48,48	1.00	3 (7%)	50,73,73	1.46	8 (16%)
2	PO4	P	403	-	4,4,4	0.82	0	6,6,6	1.71	1 (16%)
2	PO4	R	404	-	4,4,4	0.59	0	6,6,6	1.09	0
5	EDO	P	406	-	3,3,3	0.44	0	2,2,2	0.71	0
6	PEG	P	404	-	6,6,6	0.53	0	5,5,5	0.57	0
5	EDO	Q	405	-	3,3,3	0.41	0	2,2,2	0.89	0
5	EDO	P	405	-	3,3,3	0.50	0	2,2,2	1.68	0
7	GOL	Q	404	-	5,5,5	0.37	0	5,5,5	0.61	0
5	EDO	O	406	-	3,3,3	0.24	0	2,2,2	0.77	0
2	PO4	R	401	-	4,4,4	1.65	1 (25%)	6,6,6	2.59	3 (50%)
2	PO4	Q	401	-	4,4,4	1.30	1 (25%)	6,6,6	1.46	1 (16%)
2	PO4	R	403	-	4,4,4	0.41	0	6,6,6	1.88	2 (33%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAD	P	402	-	-	6/26/62/62	0/5/5/5

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	EDO	O	406	-	-	0/1/1/1	-
5	EDO	P	406	-	-	0/1/1/1	-
6	PEG	P	404	-	-	1/4/4/4	-
5	EDO	O	405	-	-	1/1/1/1	-
3	NAD	R	402	-	-	5/26/62/62	0/5/5/5
5	EDO	Q	405	-	-	0/1/1/1	-
3	NAD	O	402	-	-	5/26/62/62	0/5/5/5
3	NAD	Q	402	-	-	5/26/62/62	0/5/5/5
5	EDO	P	405	-	-	0/1/1/1	-
7	GOL	Q	404	-	-	1/4/4/4	-
5	EDO	R	405	-	-	1/1/1/1	-

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	Q	402	NAD	C2B-C1B	-3.60	1.48	1.53
3	Q	402	NAD	C2N-N1N	3.38	1.39	1.35
3	Q	402	NAD	C7N-N7N	-3.12	1.27	1.33
3	Q	402	NAD	C2D-C1D	2.65	1.57	1.53
3	R	402	NAD	PA-O1A	-2.53	1.41	1.50

The worst 5 of 45 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	O	401	PO4	O3-P-O2	-4.44	93.73	107.97
3	R	402	NAD	N3A-C2A-N1A	-4.34	121.89	128.68
2	R	401	PO4	O2-P-O1	-4.34	95.03	110.89
3	R	402	NAD	C1B-N9A-C4A	-4.32	119.05	126.64
3	Q	402	NAD	O7N-C7N-C3N	4.25	124.72	119.63

There are no chirality outliers.

5 of 25 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	O	402	NAD	O4D-C1D-N1N-C2N
3	O	402	NAD	O4D-C1D-N1N-C6N
3	O	402	NAD	C2D-C1D-N1N-C2N
3	O	402	NAD	C2D-C1D-N1N-C6N
3	P	402	NAD	O4D-C1D-N1N-C2N

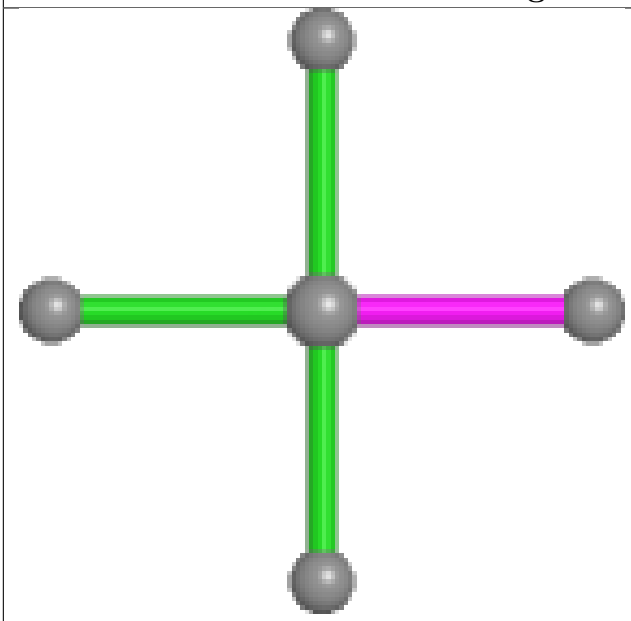
There are no ring outliers.

8 monomers are involved in 10 short contacts:

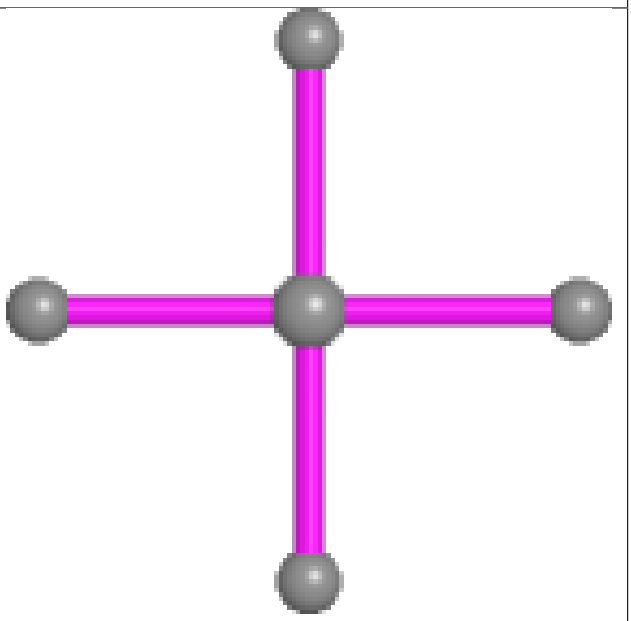
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	Q	403	PO4	2	0
5	R	405	EDO	1	0
2	P	403	PO4	1	0
2	R	404	PO4	1	0
5	P	406	EDO	1	0
5	Q	405	EDO	1	0
5	P	405	EDO	2	0
5	O	406	EDO	1	0

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.

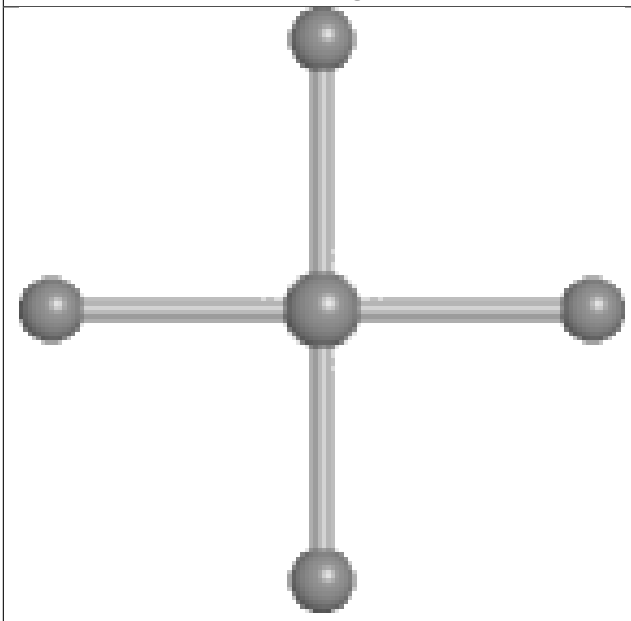
Ligand PO4 P 401



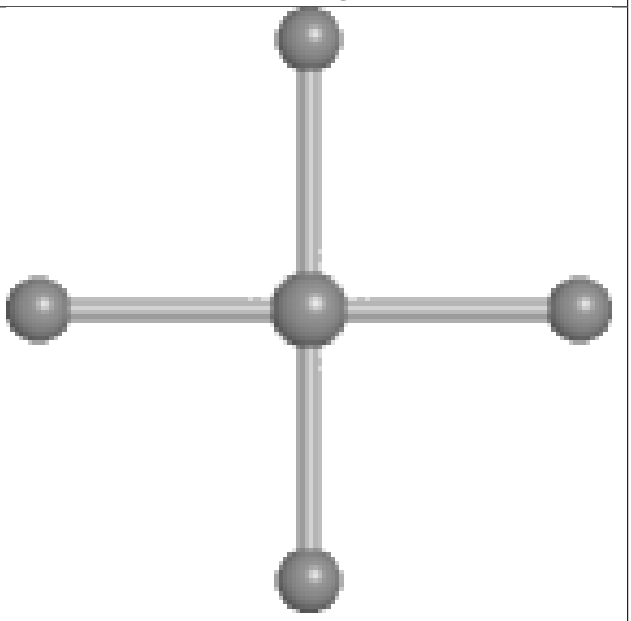
Bond lengths



Bond angles

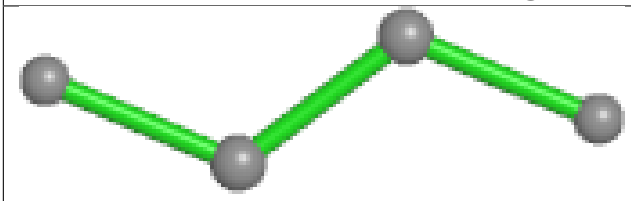


Torsions



Rings

Ligand EDO O 405



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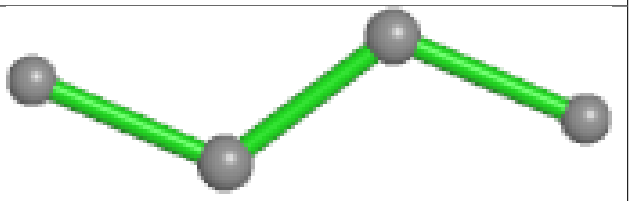

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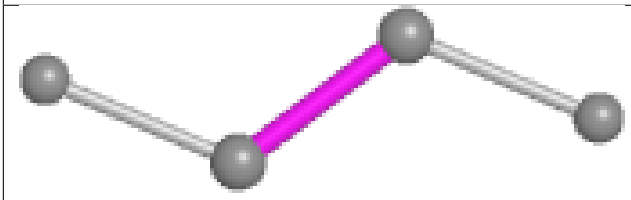

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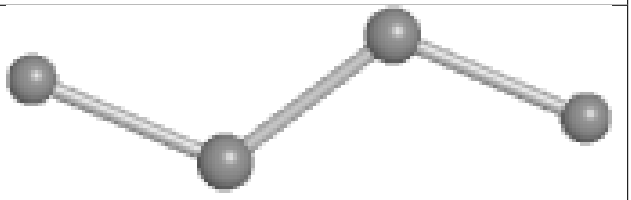
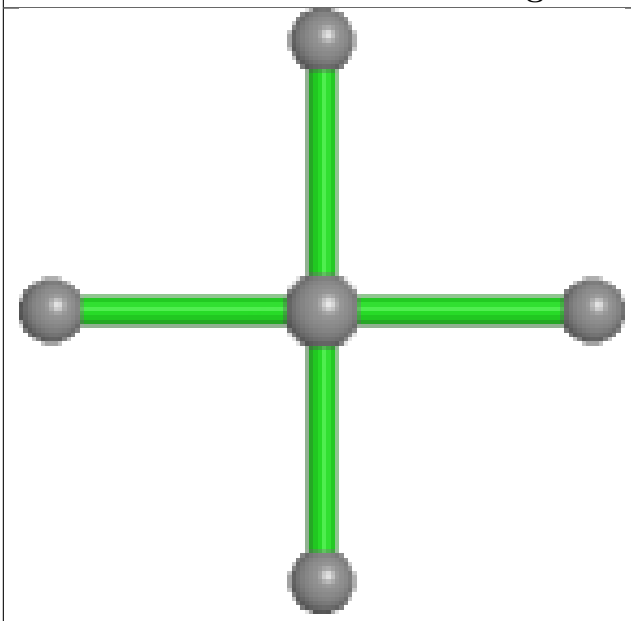


Rings

Ligand PO4 Q 403



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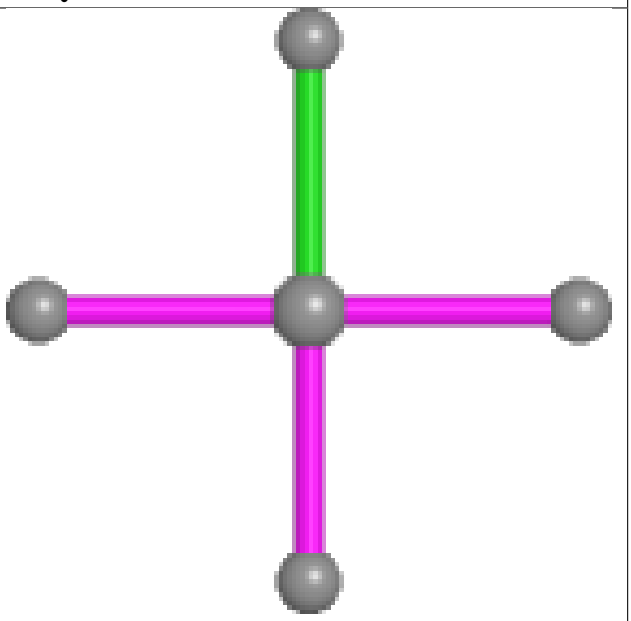

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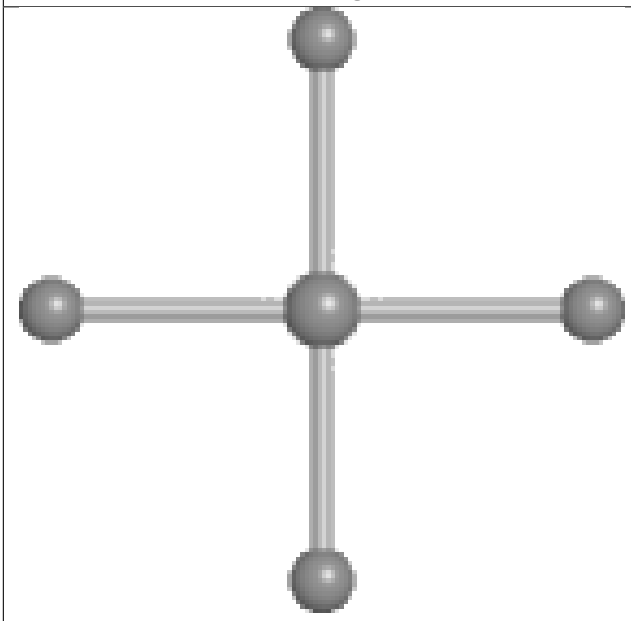

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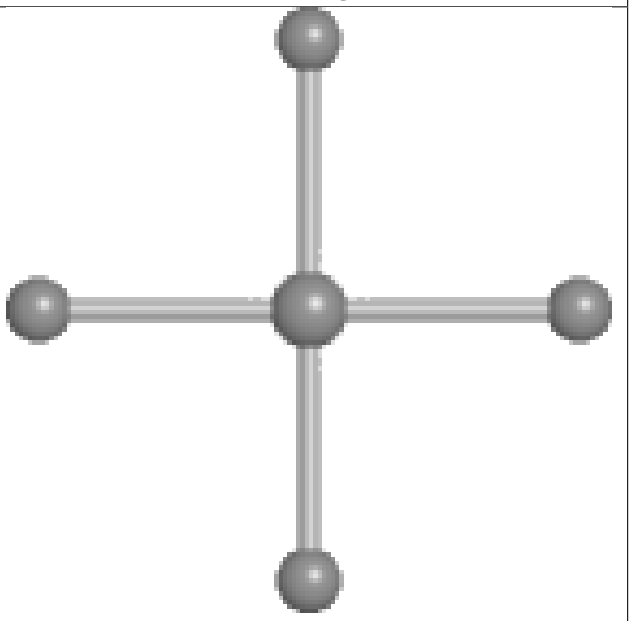
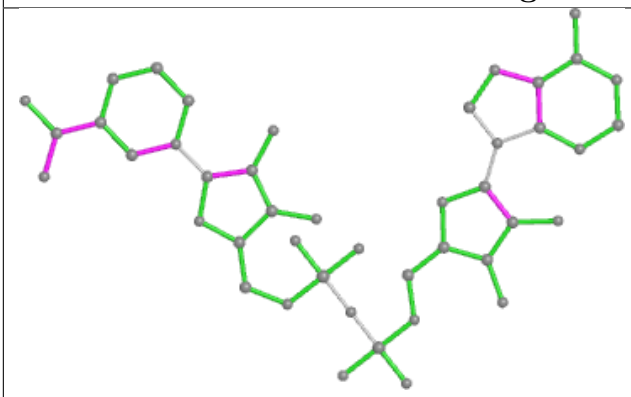


Rings

Ligand NAD Q 402



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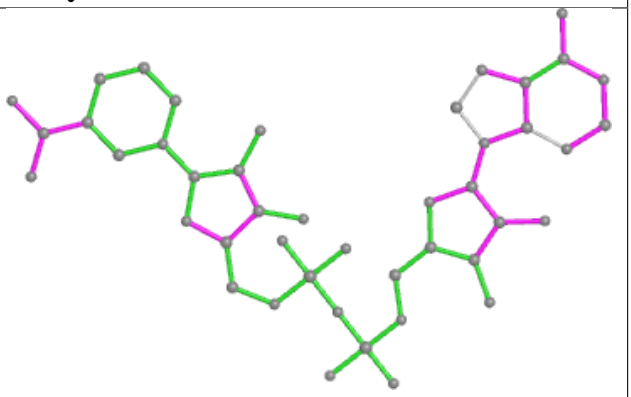

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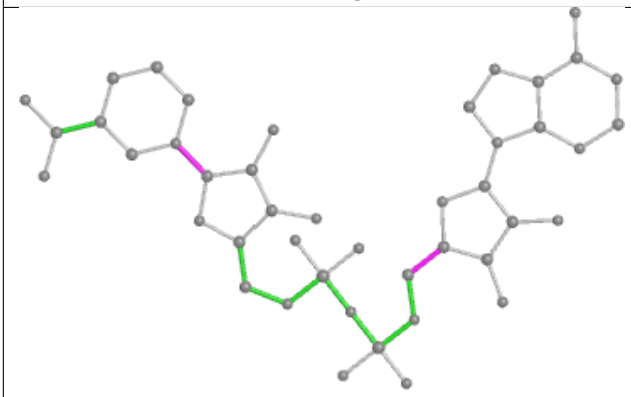

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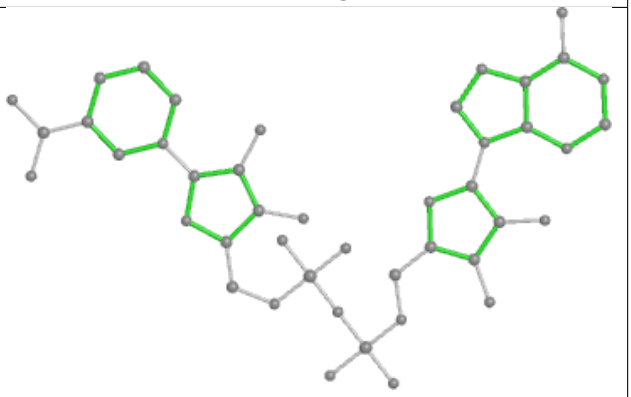
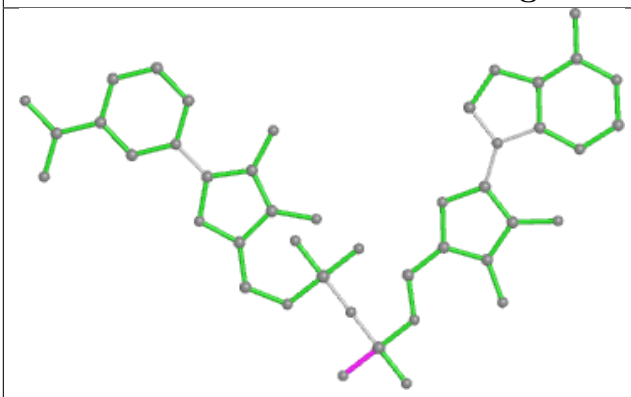


Rings

Ligand NAD R 402



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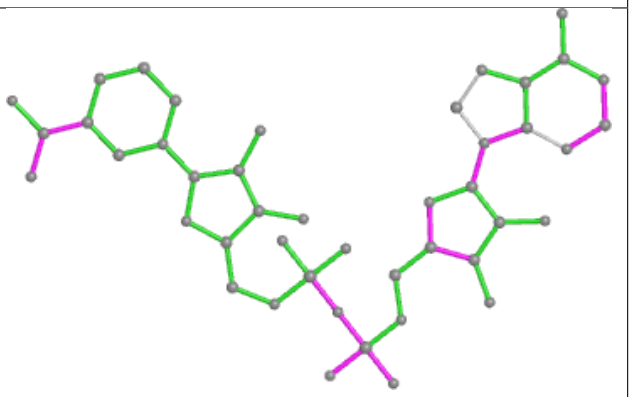

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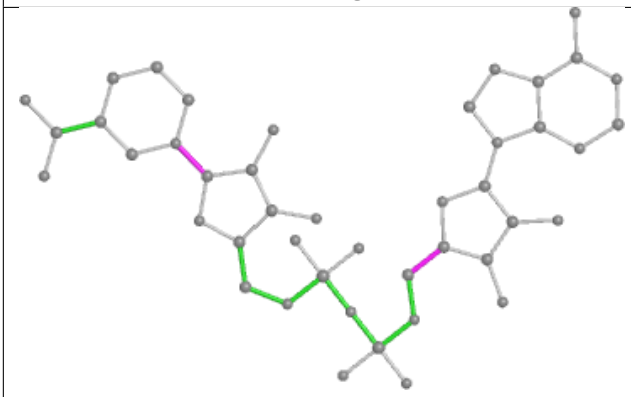

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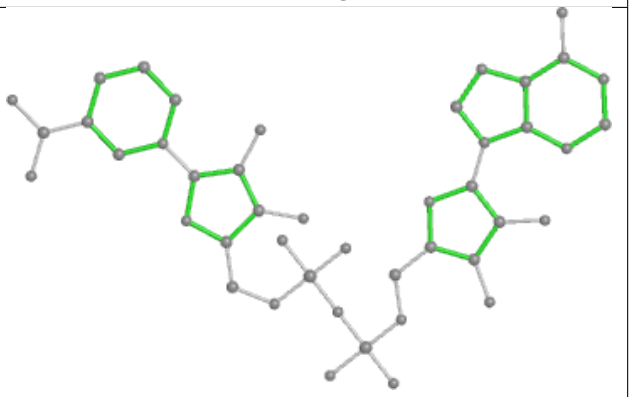
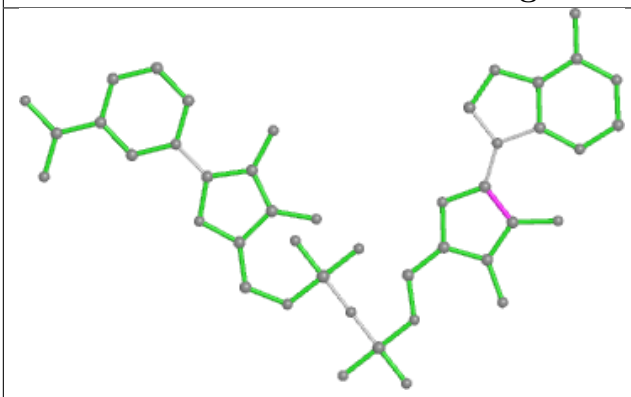


Rings

Ligand NAD O 402



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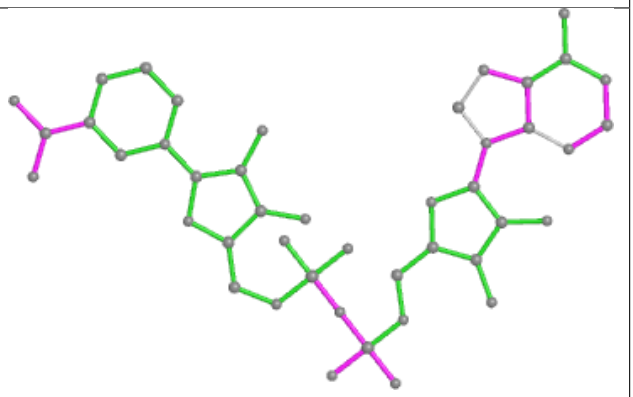
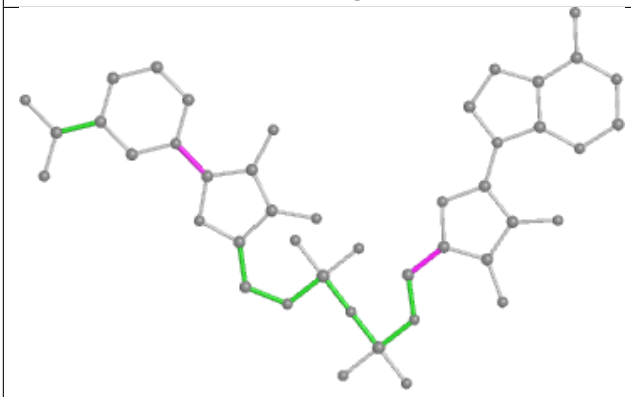


Bond angles



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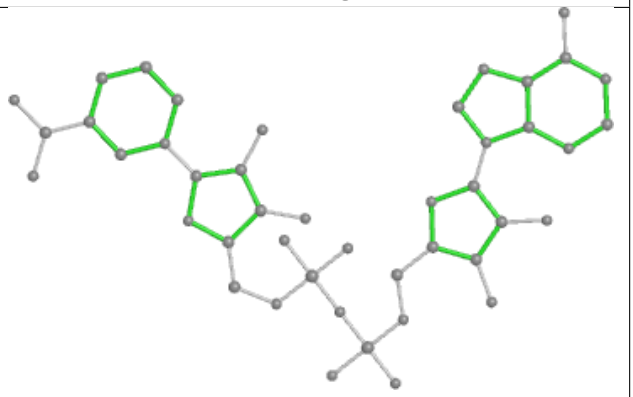
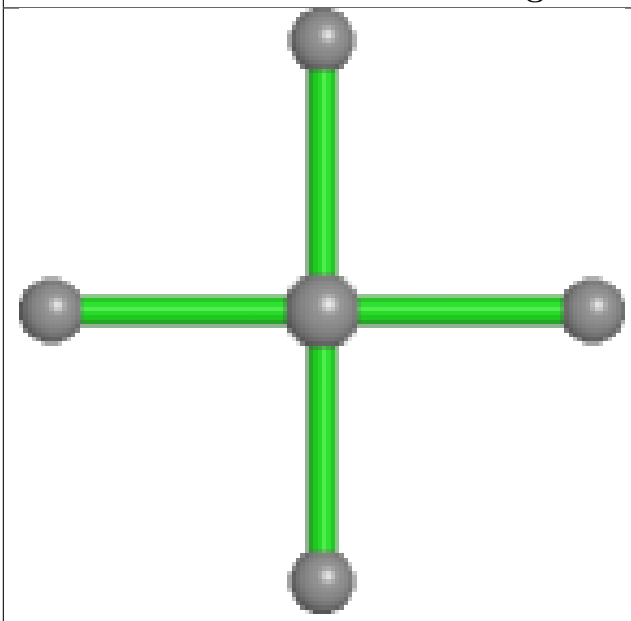


Rings

Ligand PO4 O 403



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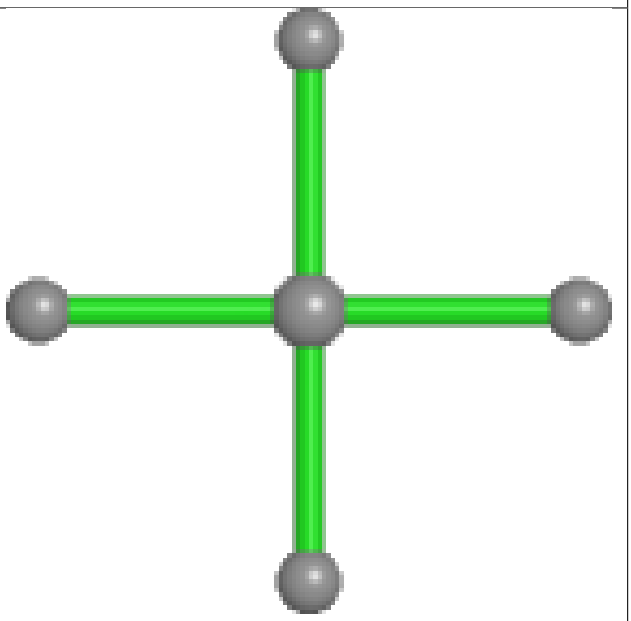

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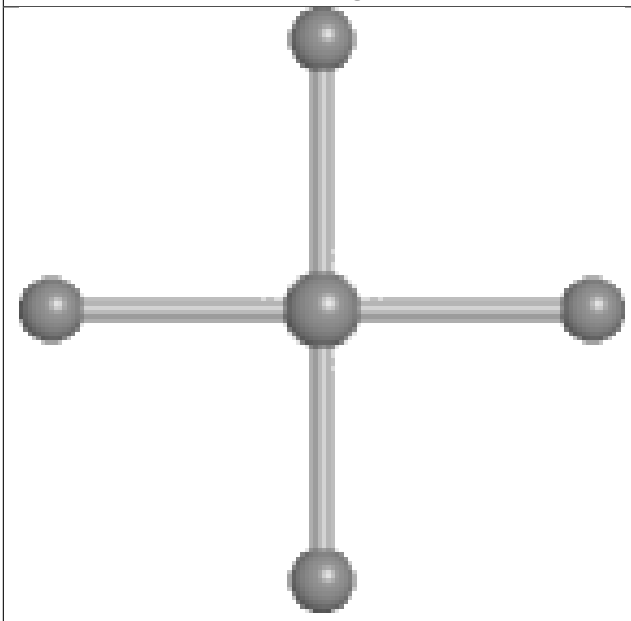

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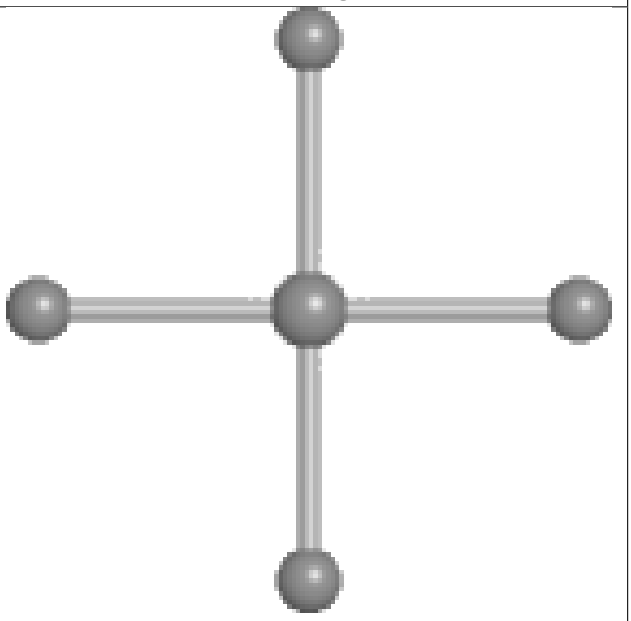
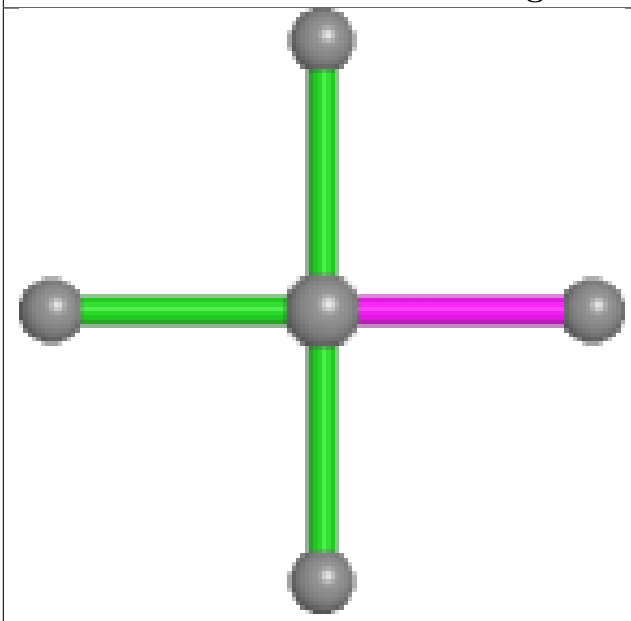


Rings

Ligand PO4 O 401



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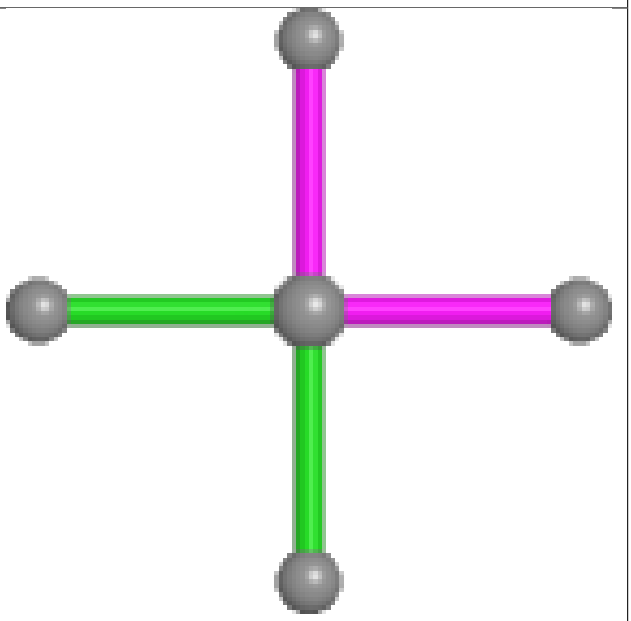
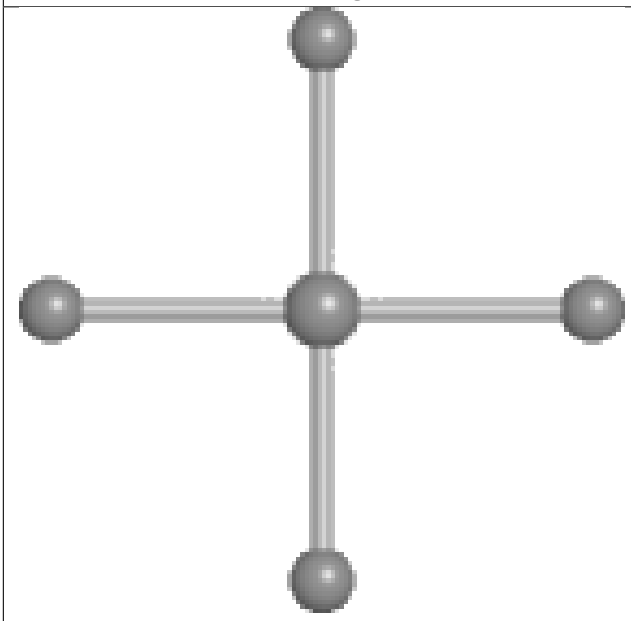
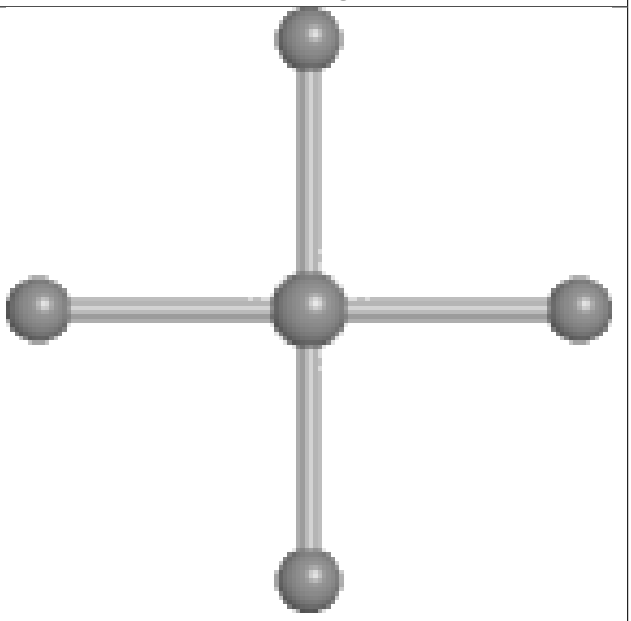


Bond angles

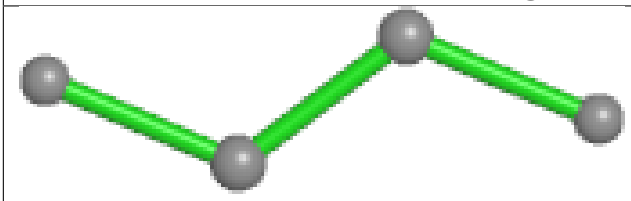


Torsions

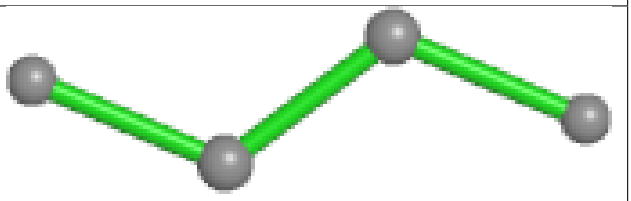


Rings

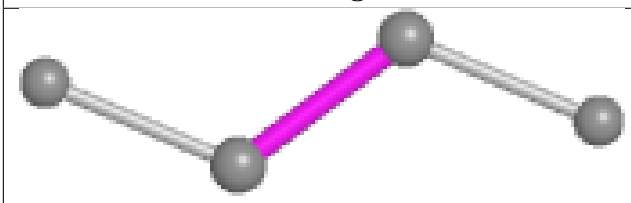
Ligand EDO R 405



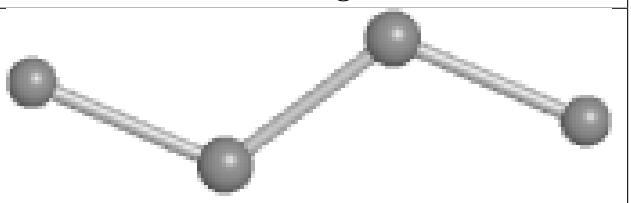
Bond lengths



Bond angles

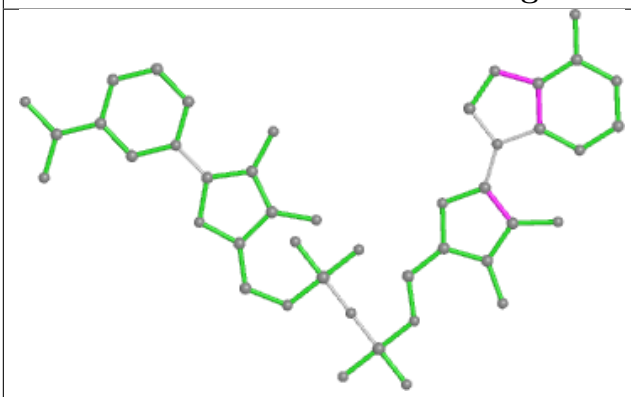


Torsions



Rings

Ligand NAD P 402



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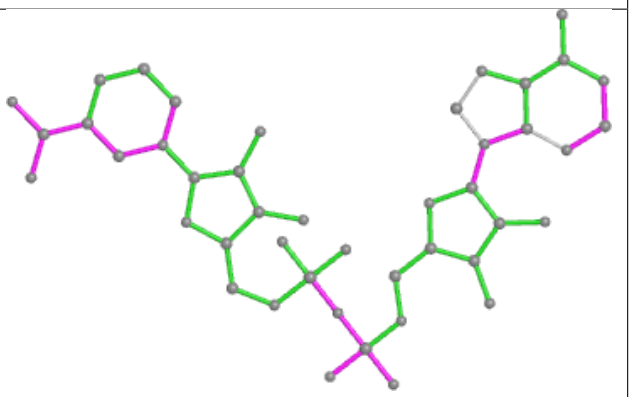

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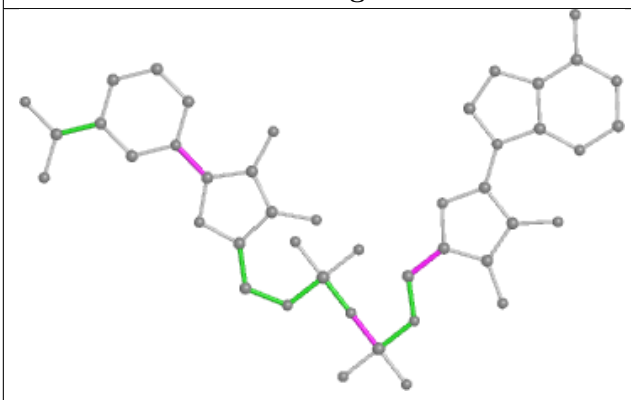

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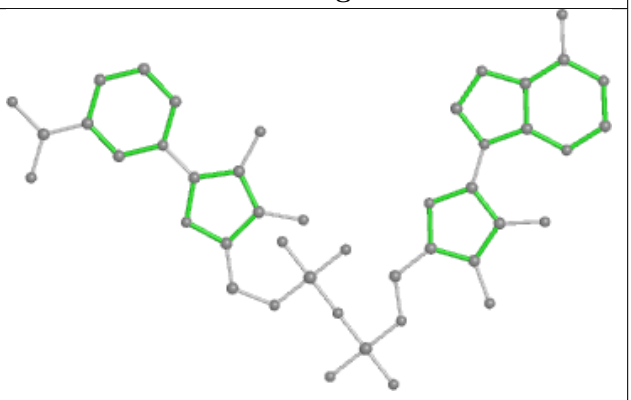
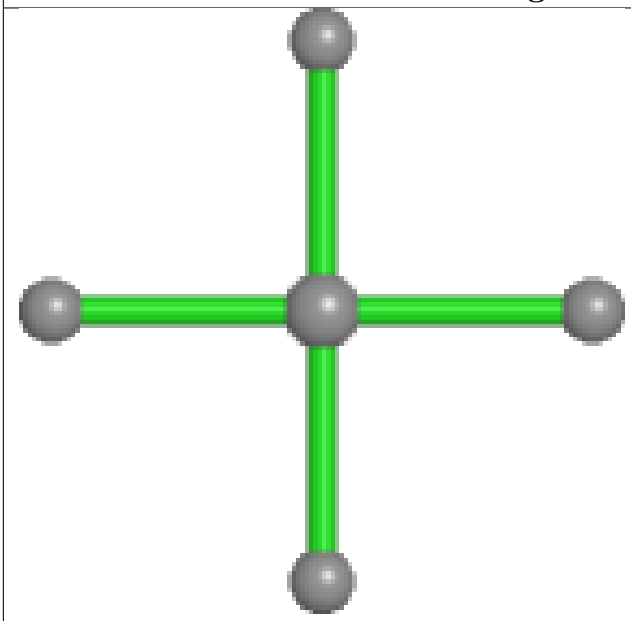


Rings

Ligand PO4 P 403



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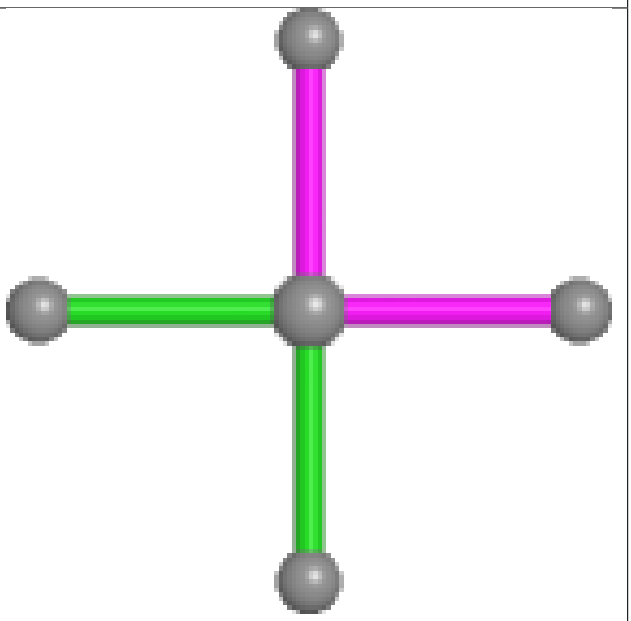
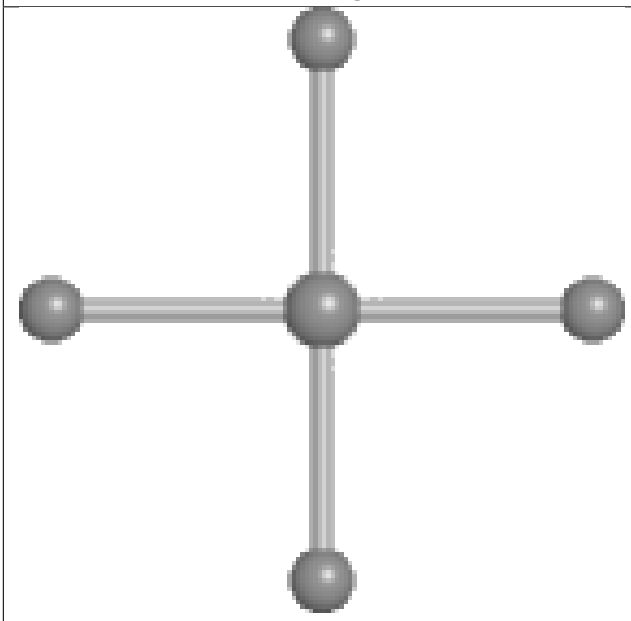
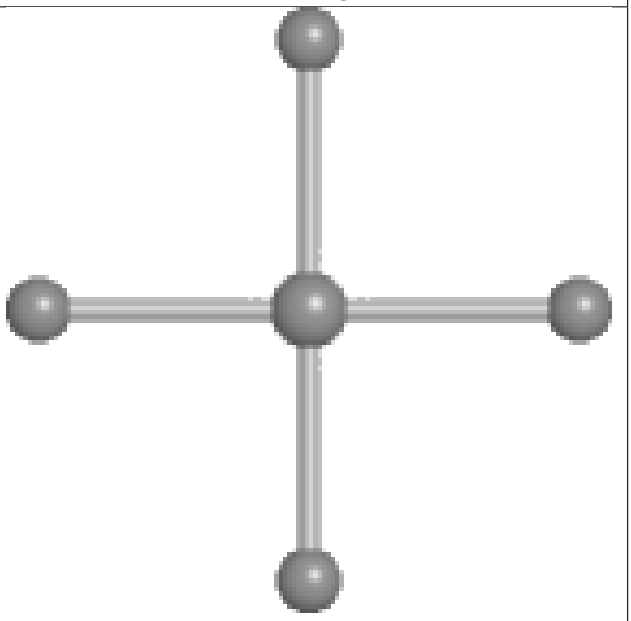


Bond angles

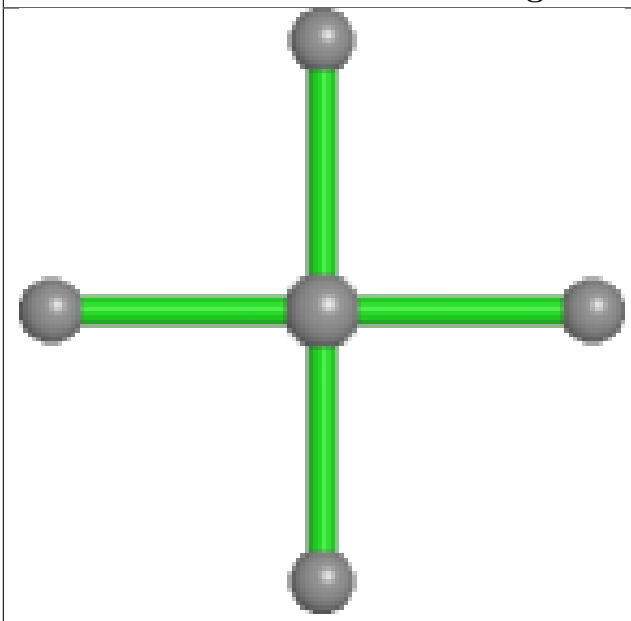


Torsions



Rings

Ligand PO4 R 404



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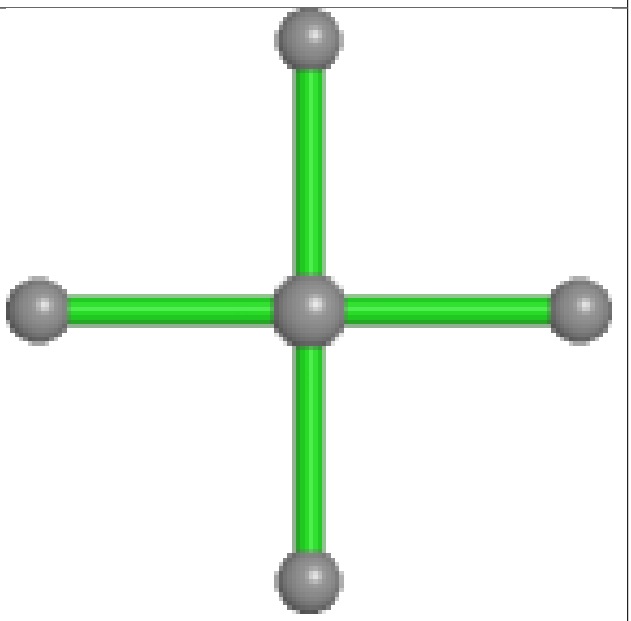
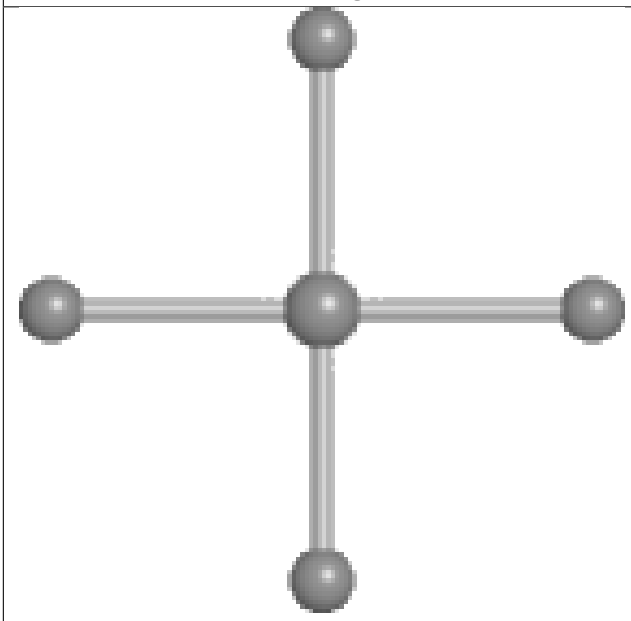
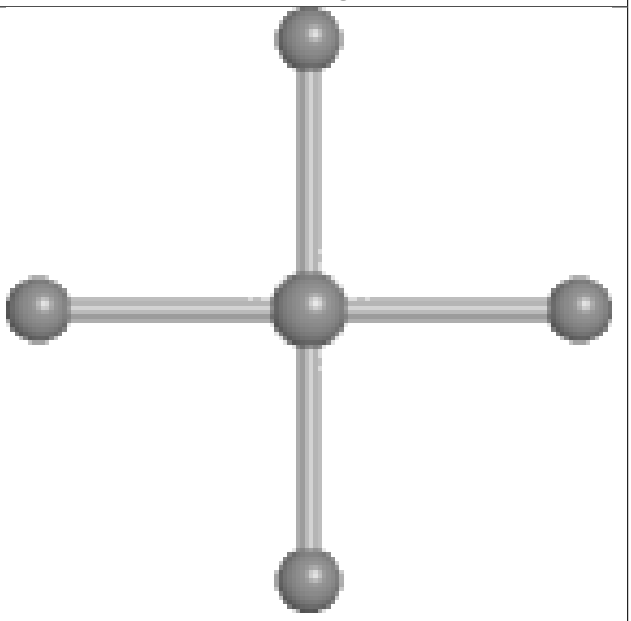


Bond angles

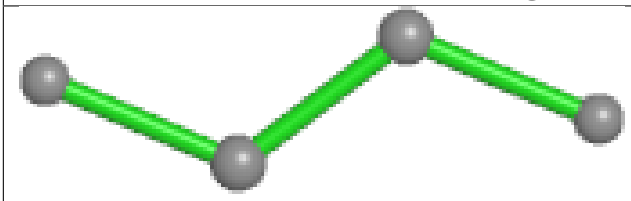


Torsions

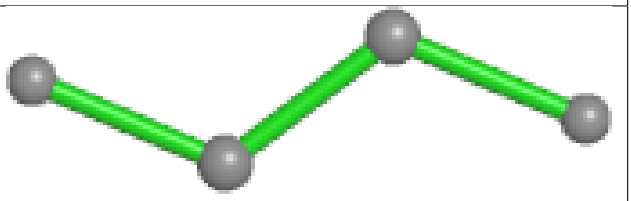


Rings

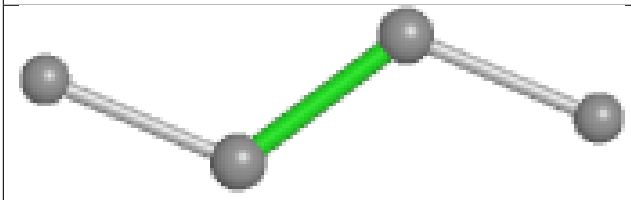
Ligand EDO P 406



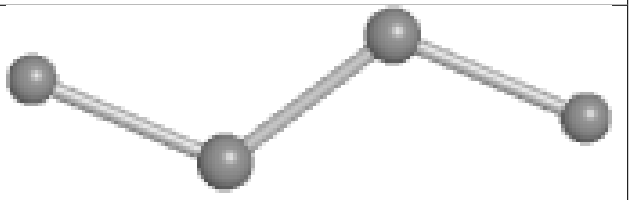
Bond lengths



Bond angles

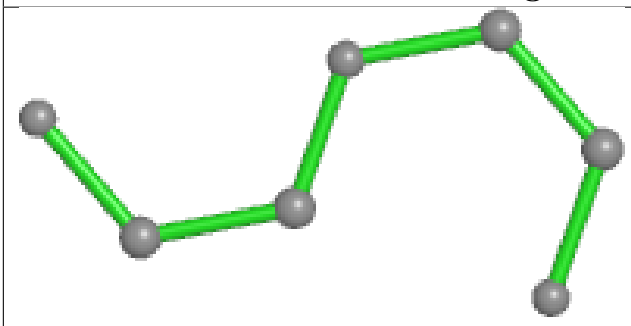


Torsions

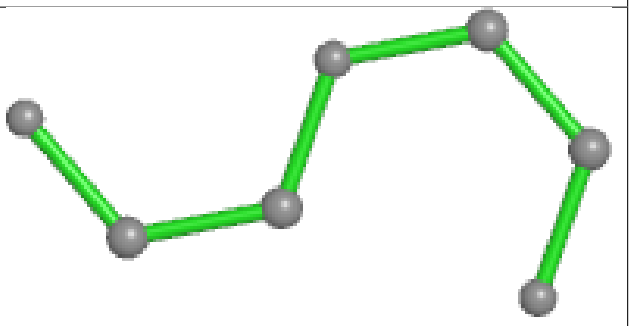


Rings

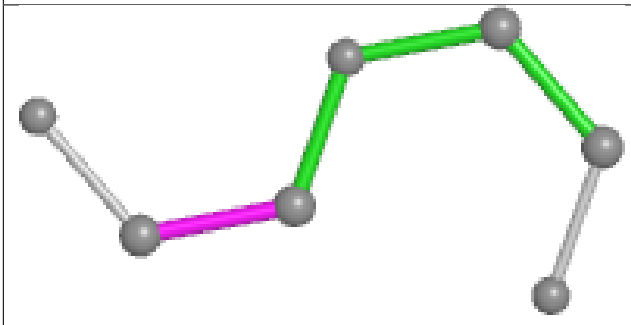
Ligand PEG P 404



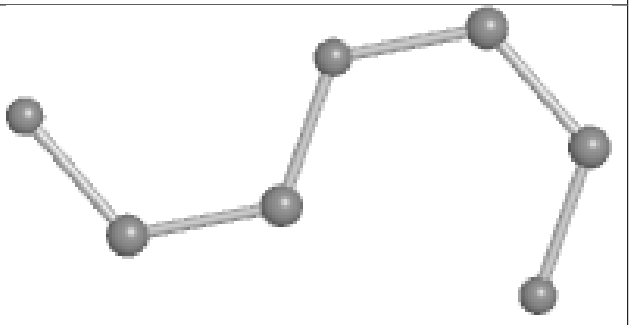
Bond lengths



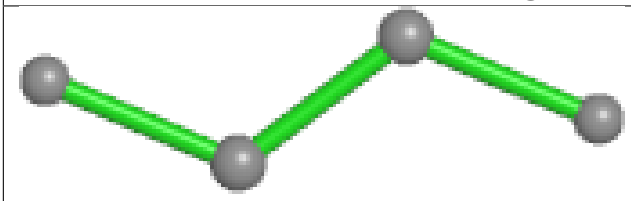
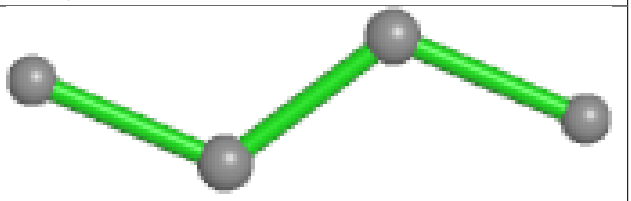
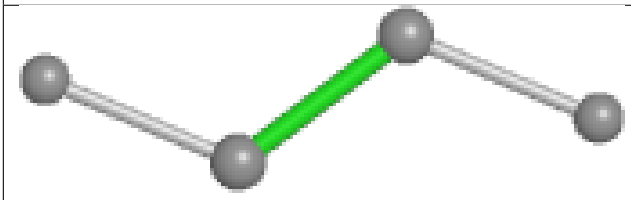
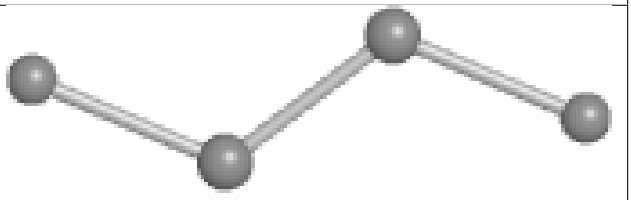
Bond angles

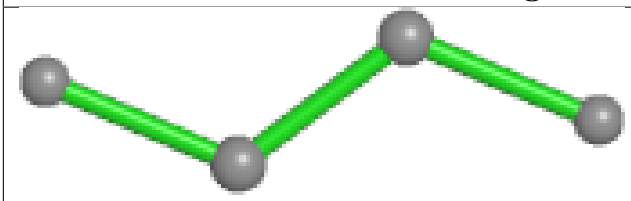
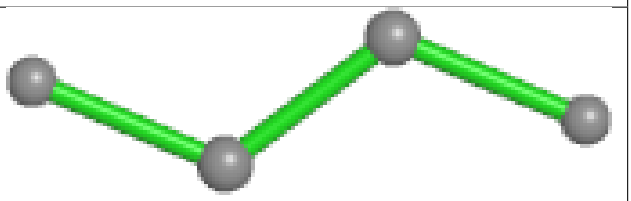
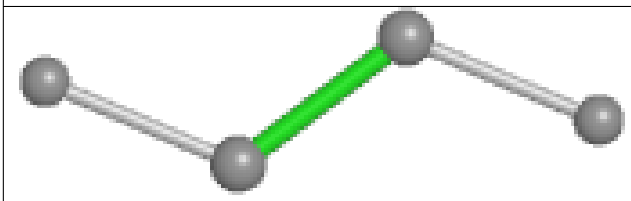
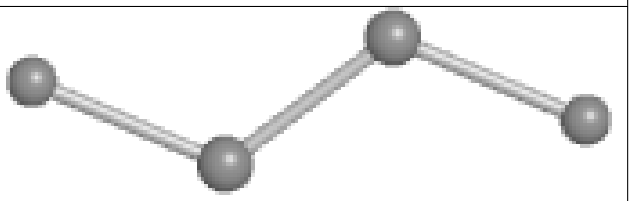


Torsions

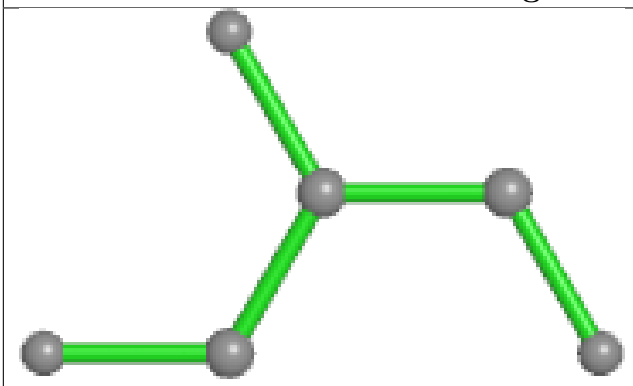


Rings

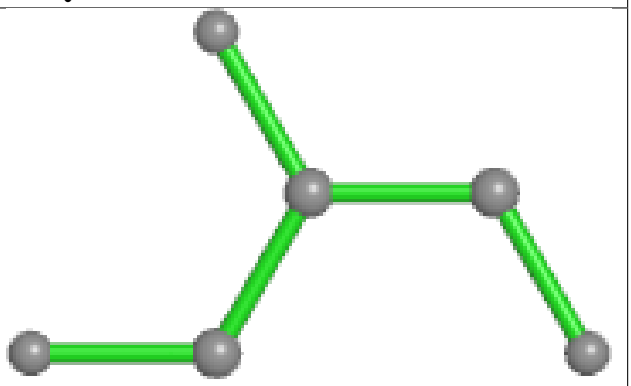
Ligand EDO Q 405	
	
Bond lengths	**Bond angles**
	
Torsions	**Rings**

Ligand EDO P 405	
	
Bond lengths	**Bond angles**
	
Torsions	**Rings**

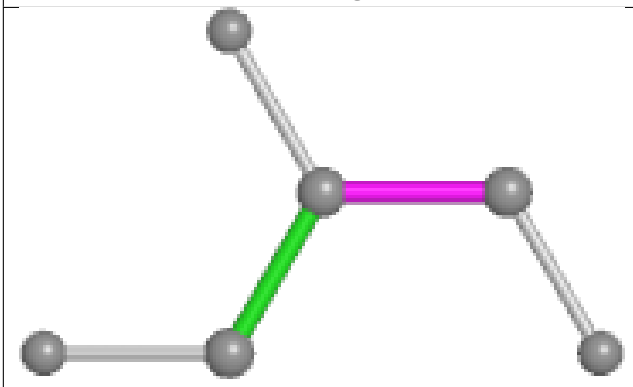
Ligand GOL Q 404



Bond lengths



Bond angles



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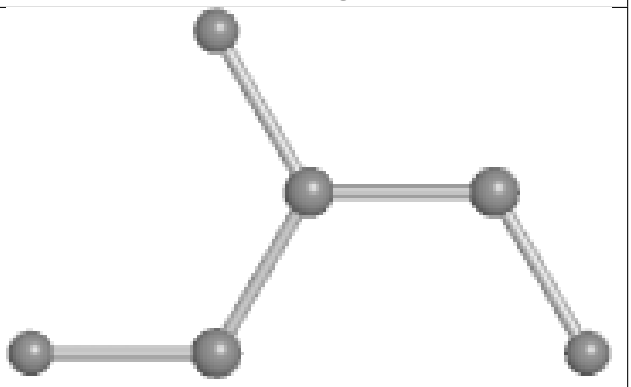
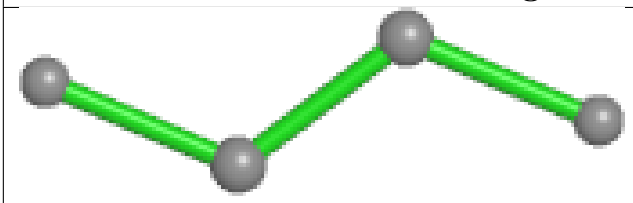
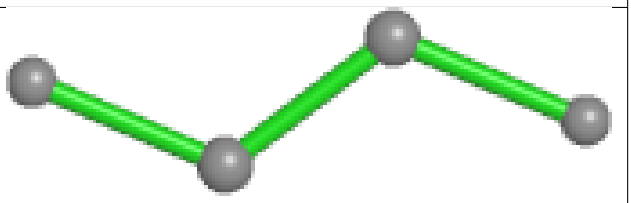


Rings

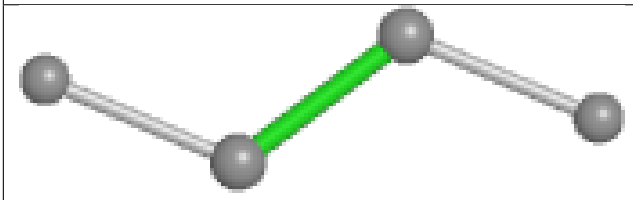
Ligand EDO O 406



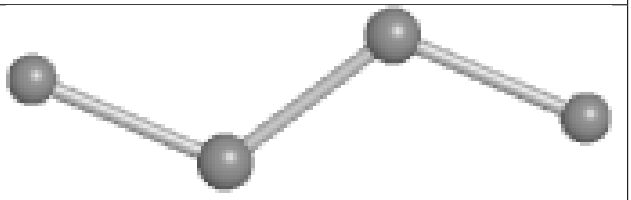
Bond lengths



Bond angles

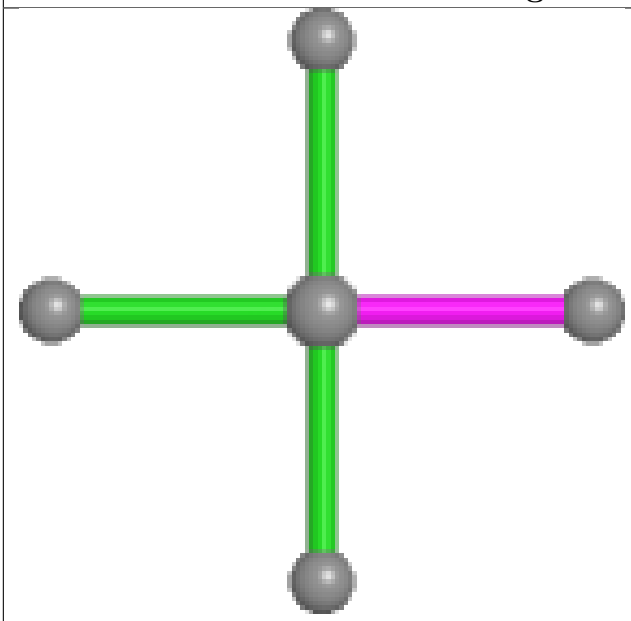


Torsions



Rings

Ligand PO4 R 401



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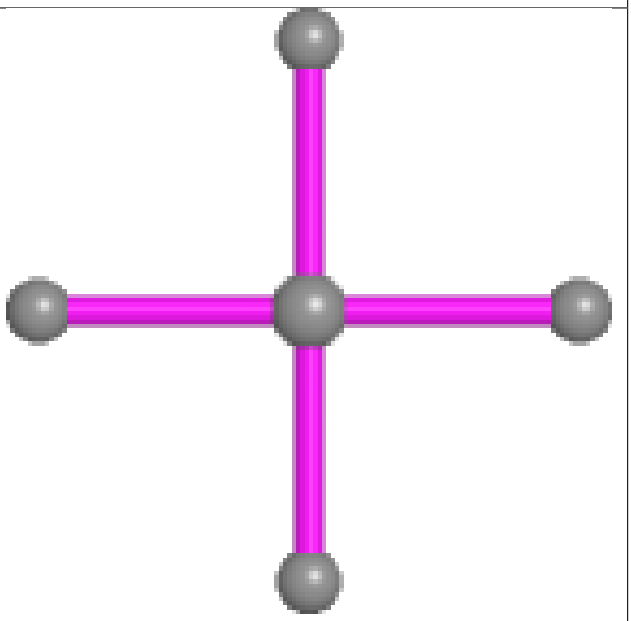
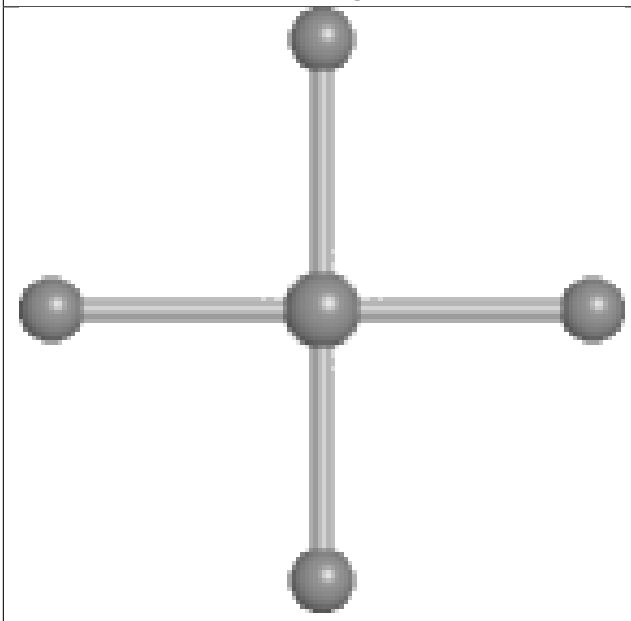
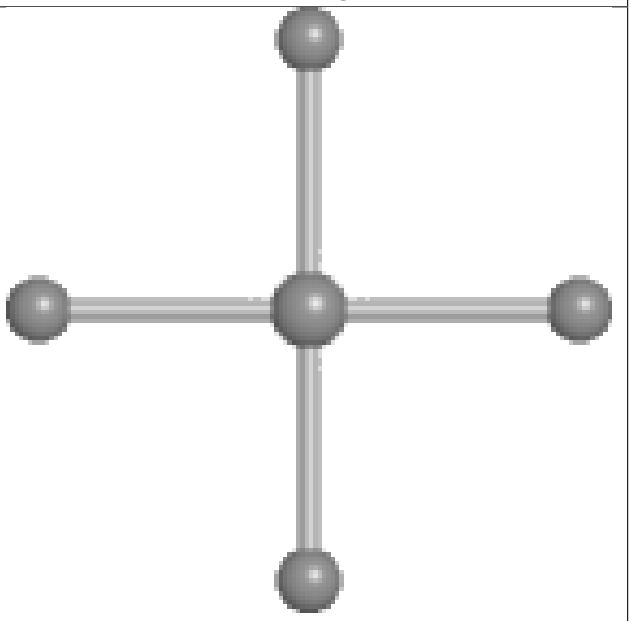


Bond angles

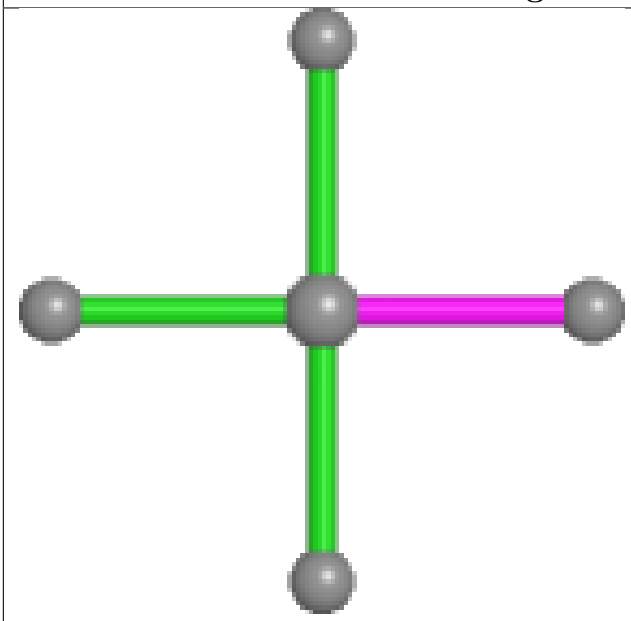


Torsions

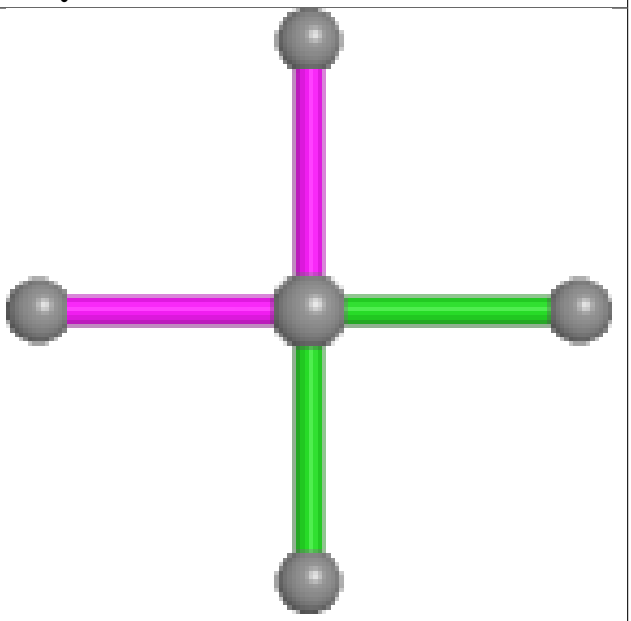


Rings

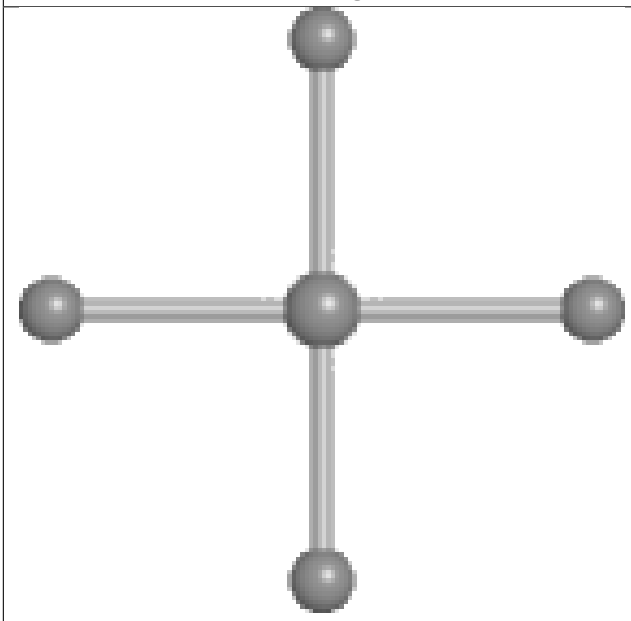
Ligand PO4 Q 401



Bond lengths



Bond angles



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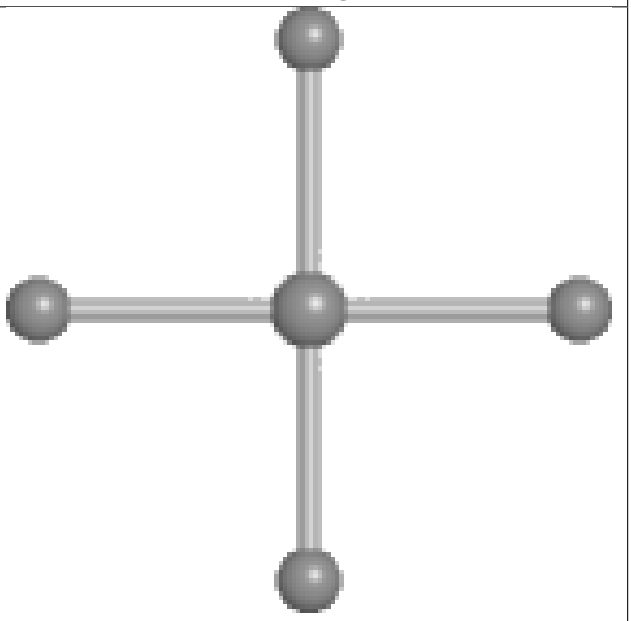
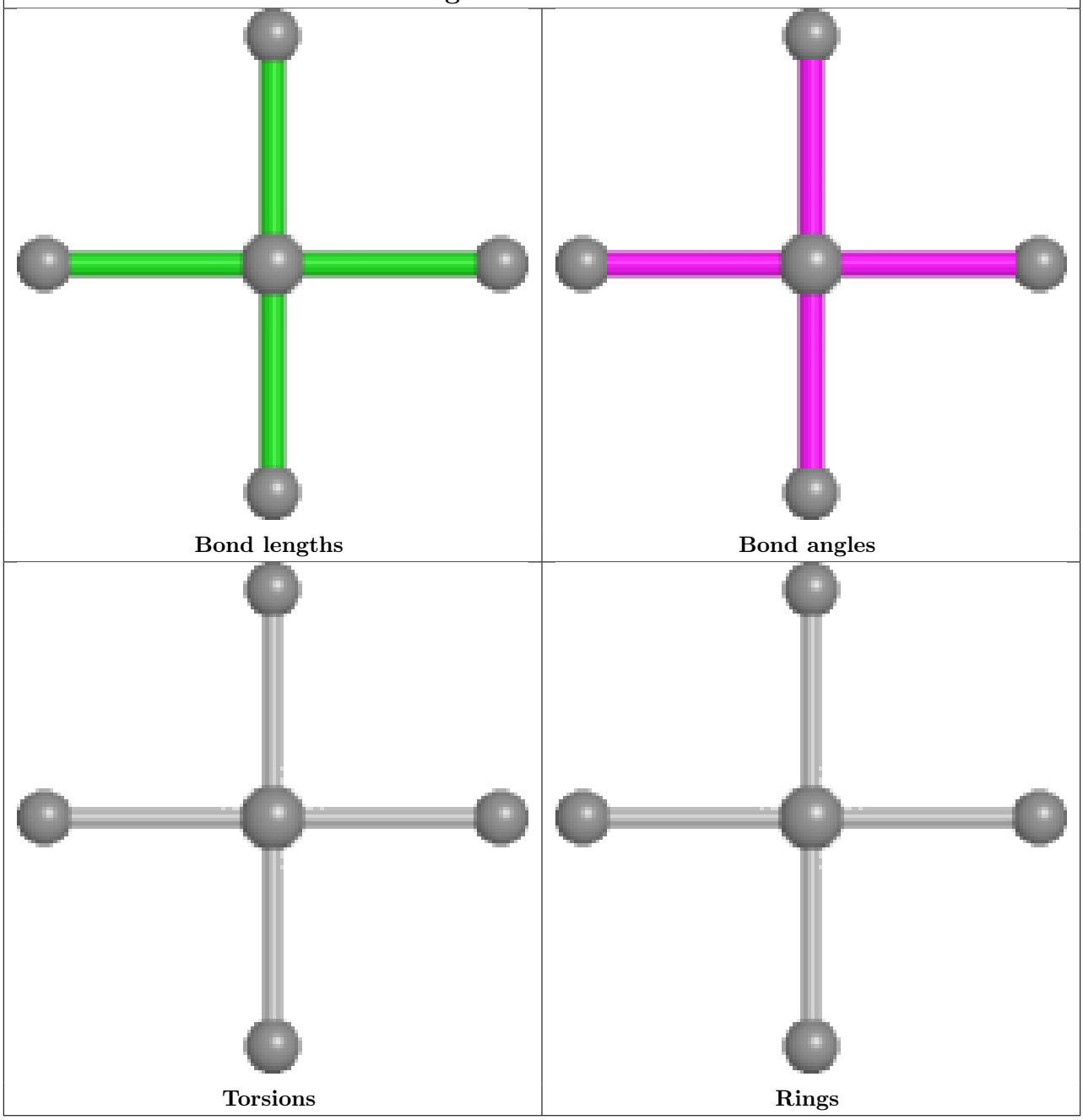


Rings

Ligand PO4 R 403



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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	O	333/352 (94%)	-0.53	0 100 100	11, 17, 31, 43	0
1	P	333/352 (94%)	-0.52	0 100 100	11, 17, 34, 57	0
1	Q	333/352 (94%)	-0.23	3 (0%) 84 86	12, 19, 37, 53	0
1	R	333/352 (94%)	0.07	8 (2%) 59 64	12, 24, 46, 62	0
All	All	1332/1408 (94%)	-0.30	11 (0%) 86 88	11, 19, 40, 62	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	R	233	VAL	3.0
1	Q	265	THR	2.7
1	Q	233	VAL	2.4
1	R	235	VAL	2.3
1	R	23	VAL	2.2

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

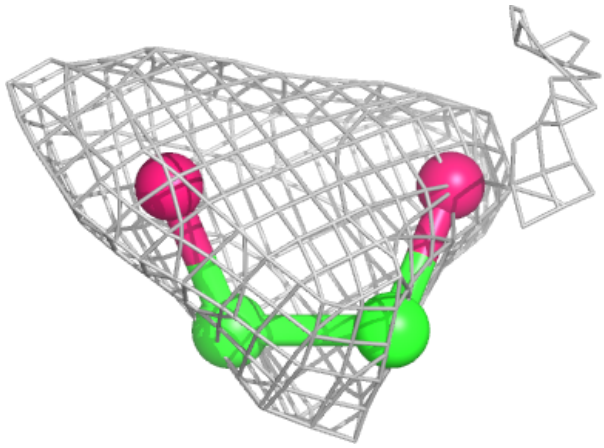
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

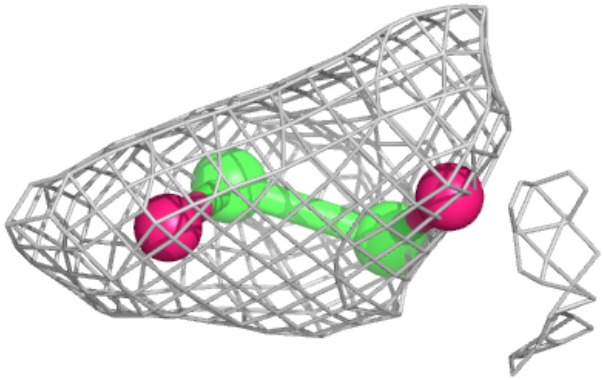
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	EDO	Q	405	4/4	0.75	0.28	47,52,53,55	0
6	PEG	P	404	7/7	0.81	0.22	49,52,53,53	0
5	EDO	P	406	4/4	0.82	0.15	45,46,48,50	0
7	GOL	Q	404	6/6	0.83	0.26	44,45,46,49	0
2	PO4	Q	403	5/5	0.85	0.22	58,62,70,73	0
5	EDO	O	405	4/4	0.86	0.30	27,31,36,40	0
5	EDO	P	405	4/4	0.87	0.17	33,35,36,40	0
5	EDO	O	406	4/4	0.90	0.15	39,41,44,45	0
5	EDO	R	405	4/4	0.90	0.26	36,39,44,45	0
2	PO4	R	403	5/5	0.91	0.17	43,48,53,54	0
2	PO4	P	403	5/5	0.92	0.14	23,24,31,35	5
2	PO4	R	404	5/5	0.93	0.19	60,64,74,76	0
3	NAD	R	402	44/44	0.97	0.09	15,18,23,23	0
2	PO4	O	401	5/5	0.98	0.11	22,23,26,29	0
3	NAD	P	402	44/44	0.98	0.08	11,14,16,16	0
3	NAD	Q	402	44/44	0.98	0.08	10,14,20,22	0
2	PO4	O	403	5/5	0.98	0.16	29,30,34,39	0
4	CL	R	406	1/1	0.98	0.05	31,31,31,31	0
4	CL	R	407	1/1	0.98	0.10	43,43,43,43	0
2	PO4	P	401	5/5	0.98	0.09	24,25,29,33	0
2	PO4	Q	401	5/5	0.99	0.07	24,25,27,29	0
2	PO4	R	401	5/5	0.99	0.09	27,27,30,39	0
3	NAD	O	402	44/44	0.99	0.07	11,12,14,15	0
4	CL	O	404	1/1	0.99	0.07	22,22,22,22	0
4	CL	Q	406	1/1	0.99	0.04	23,23,23,23	0
4	CL	P	407	1/1	1.00	0.06	24,24,24,24	0
4	CL	O	407	1/1	1.00	0.03	19,19,19,19	0
4	CL	O	408	1/1	1.00	0.05	18,18,18,18	0

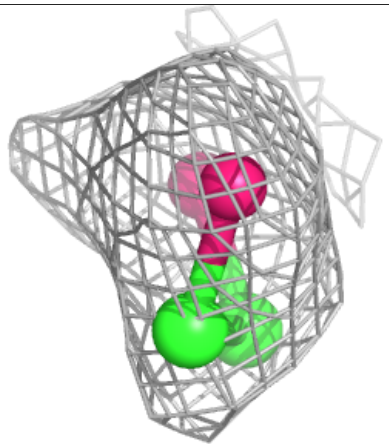
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around EDO Q 405:

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

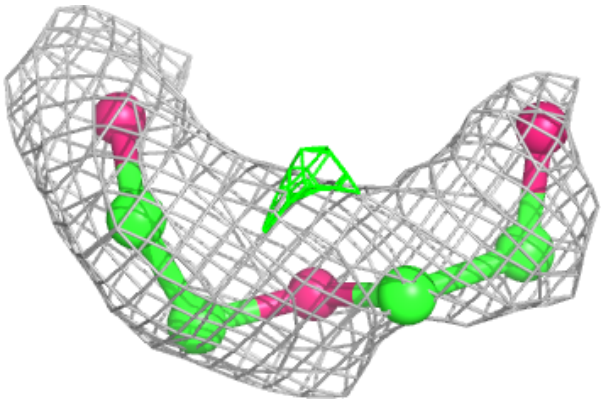


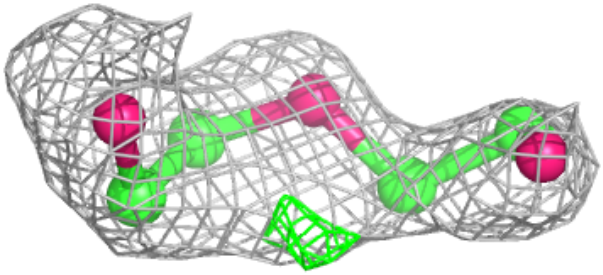


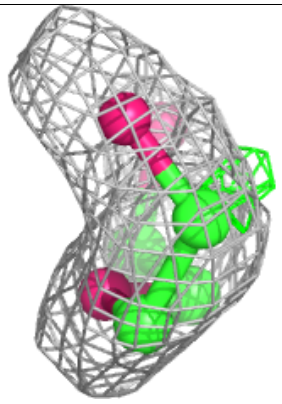


Electron density around PEG P 404:

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

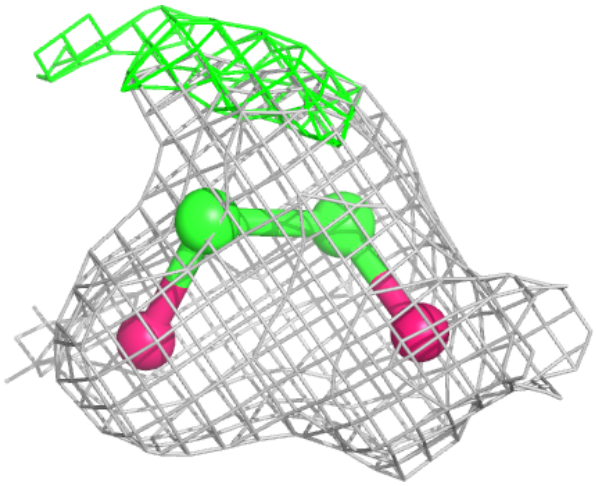


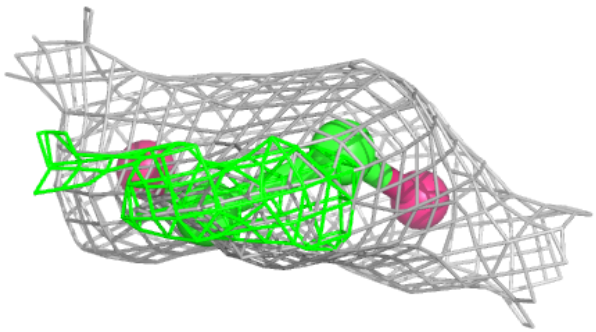


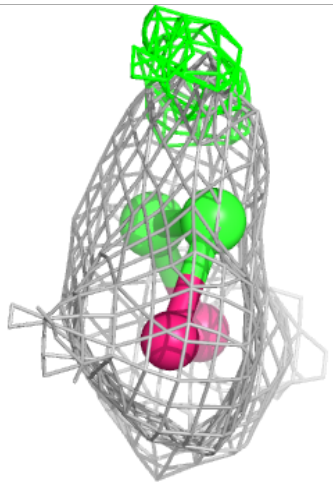


Electron density around EDO P 406:

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

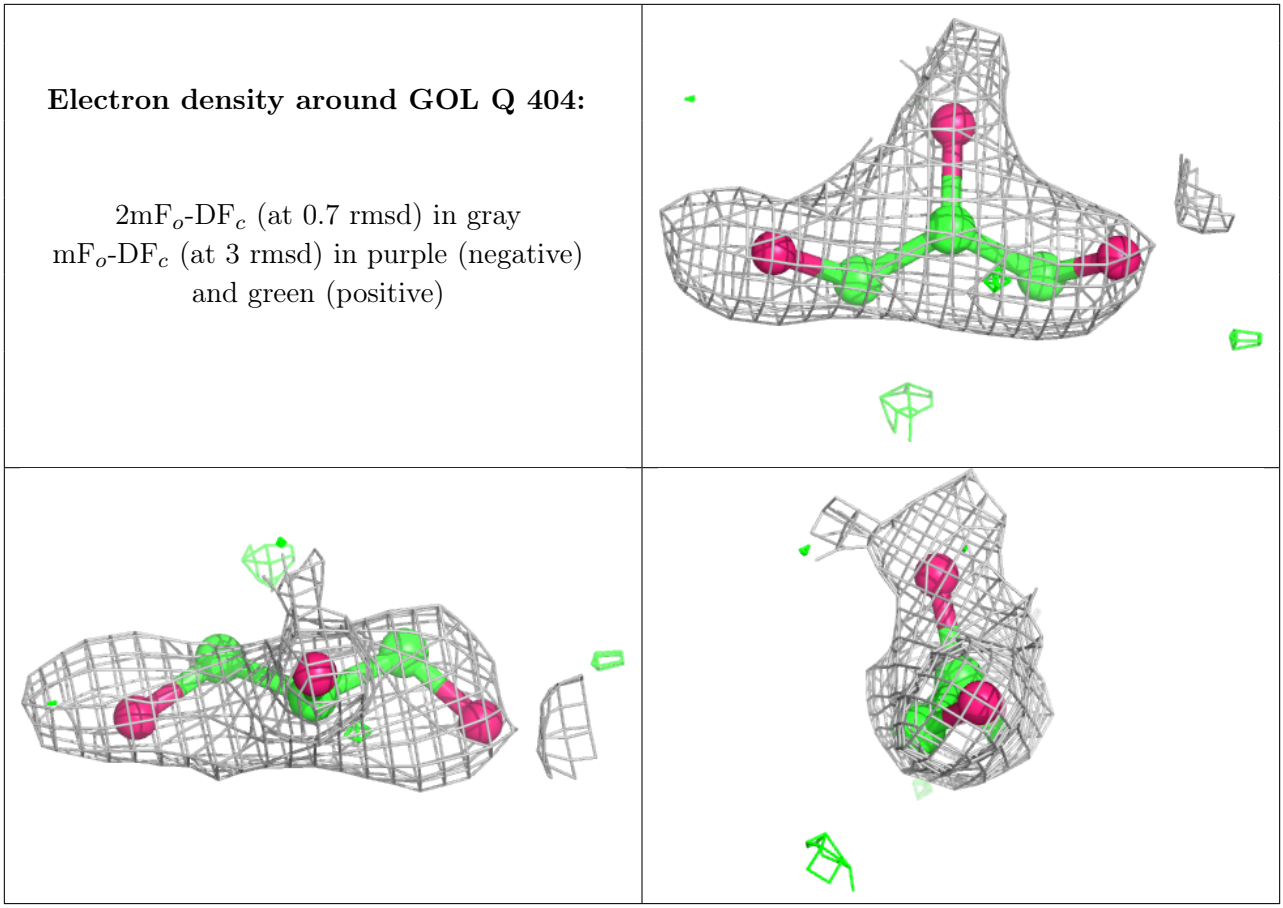






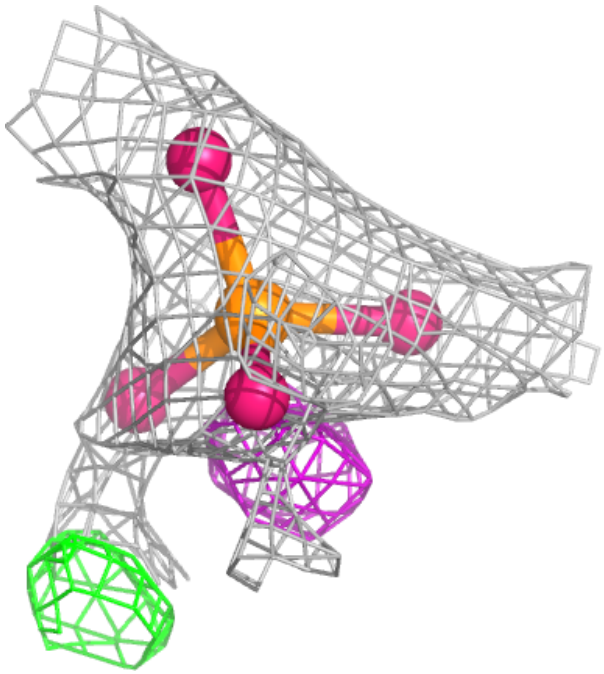
Electron density around GOL Q 404:

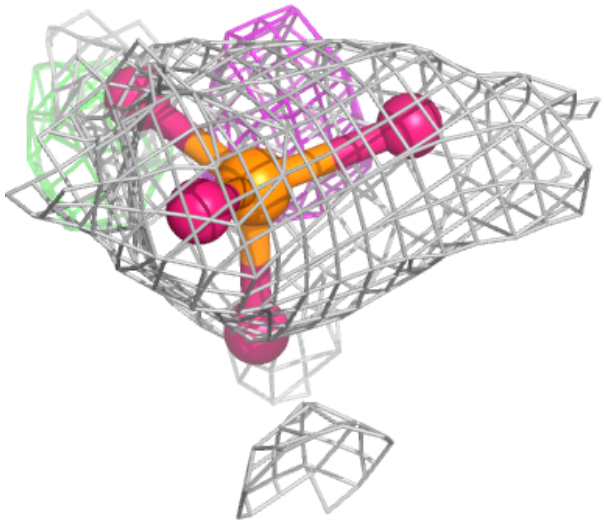
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

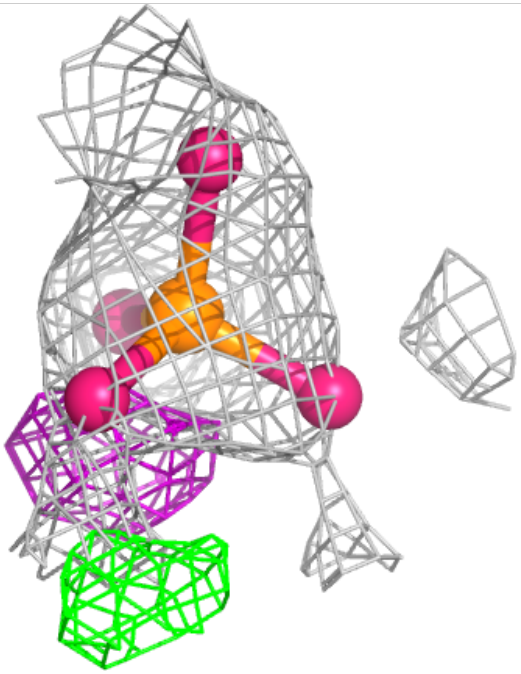


Electron density around PO4 Q 403:

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

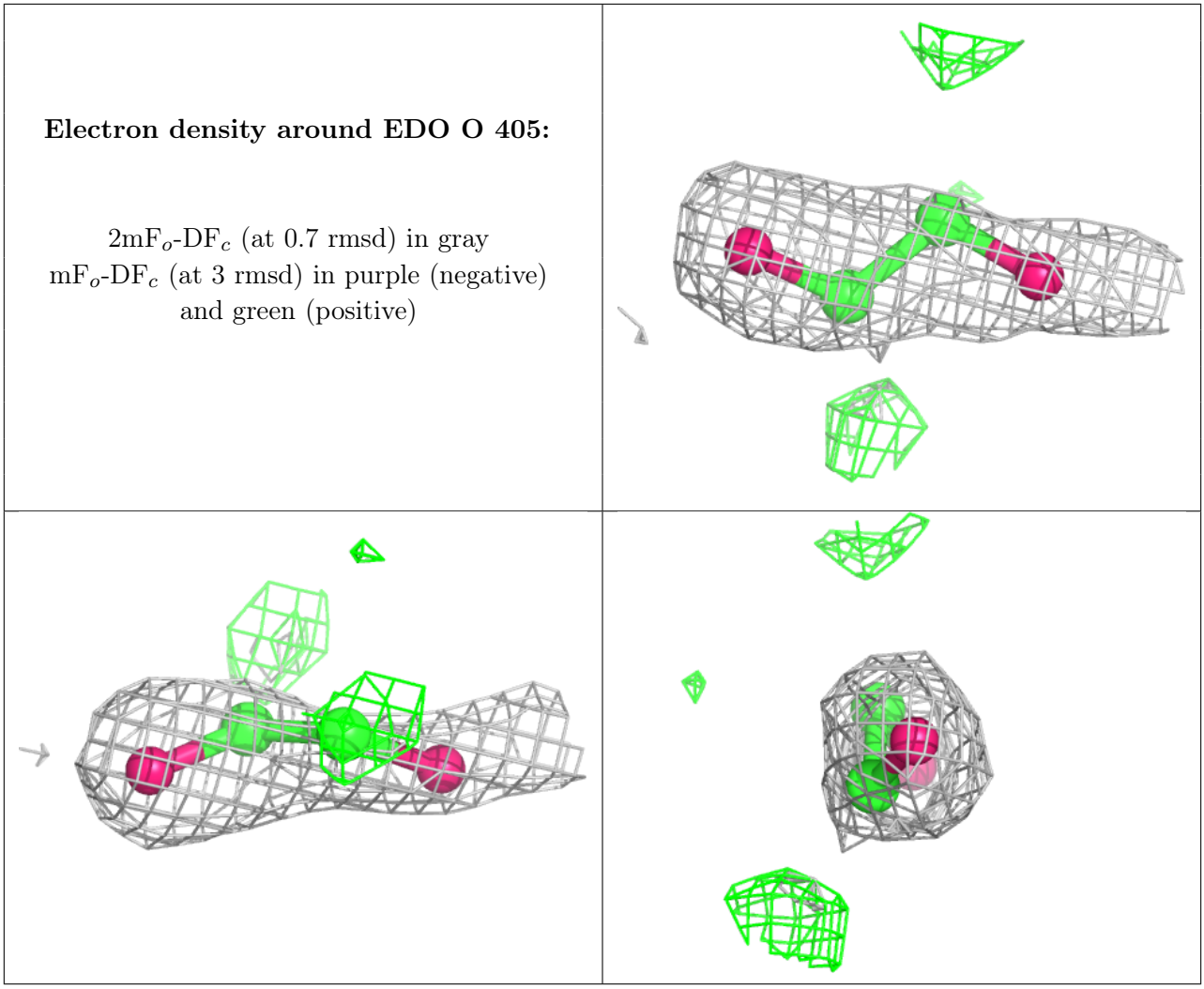






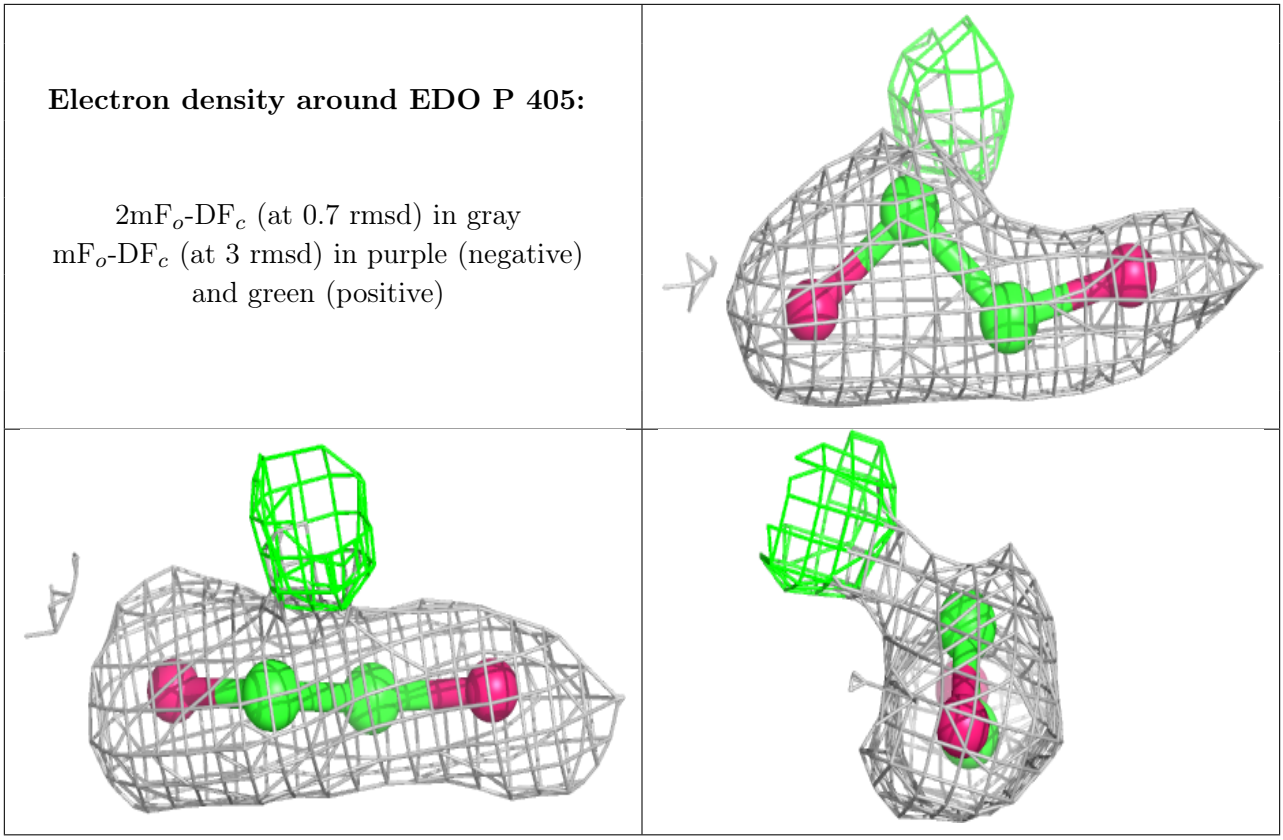
Electron density around EDO O 405:

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



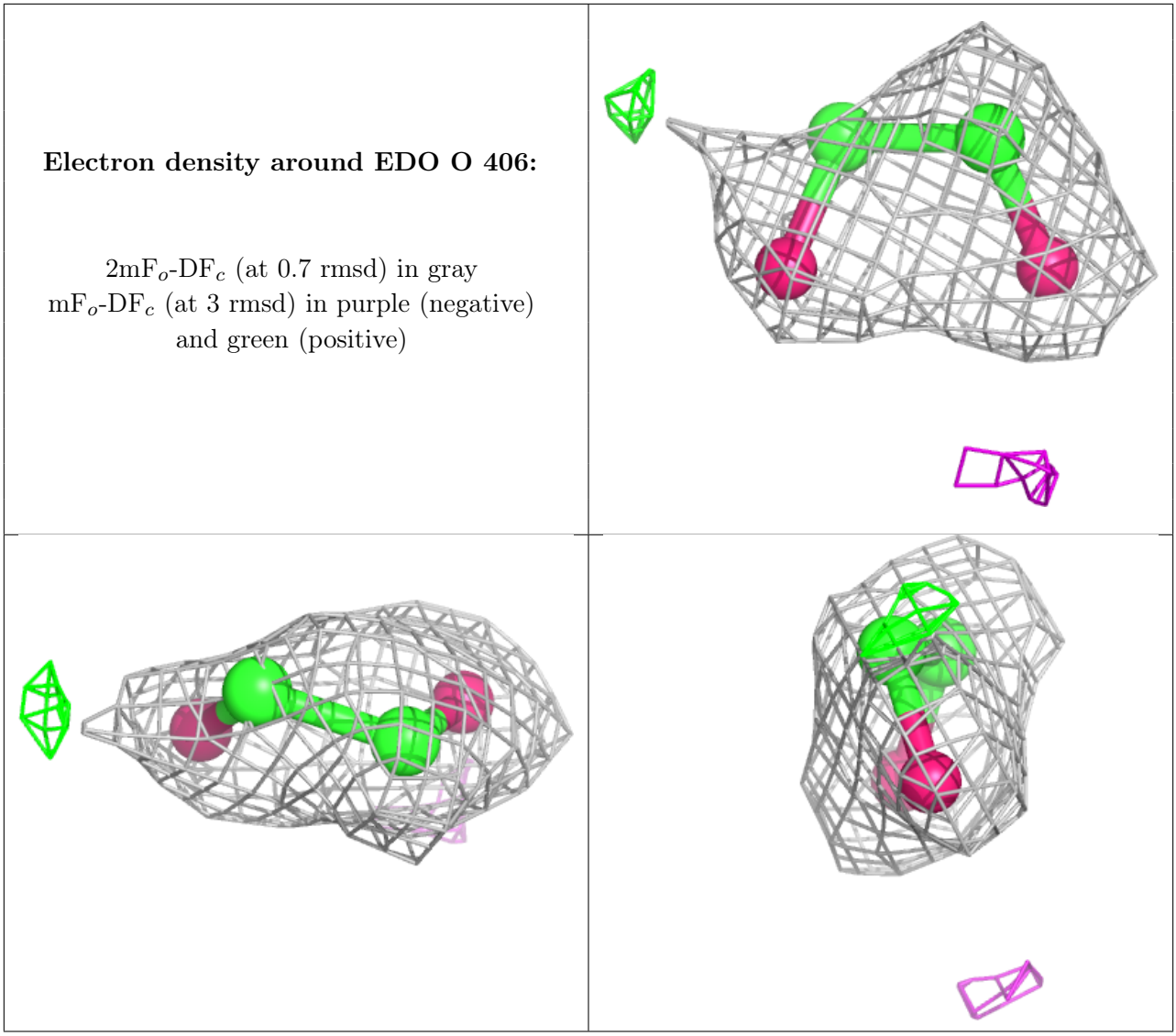
Electron density around EDO P 405:

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



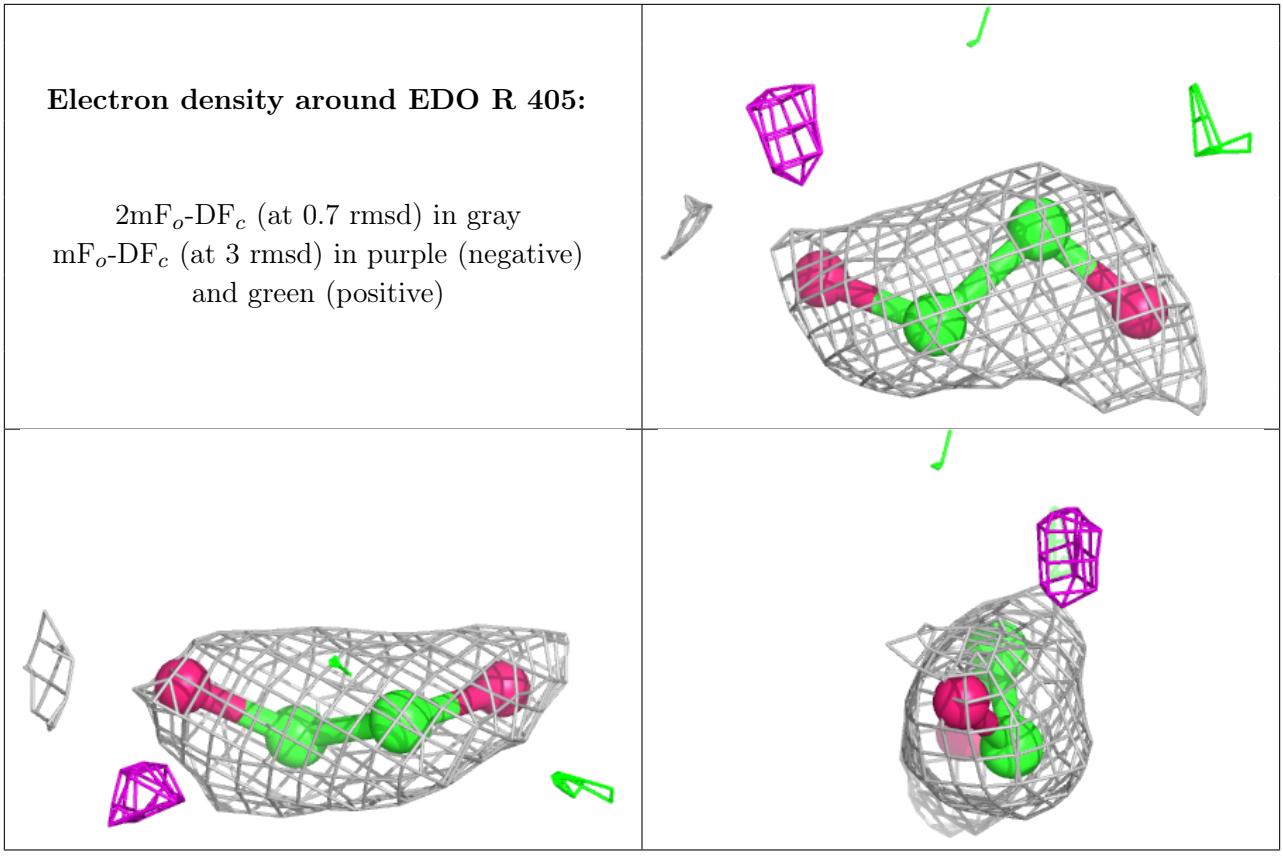
Electron density around EDO O 406:

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



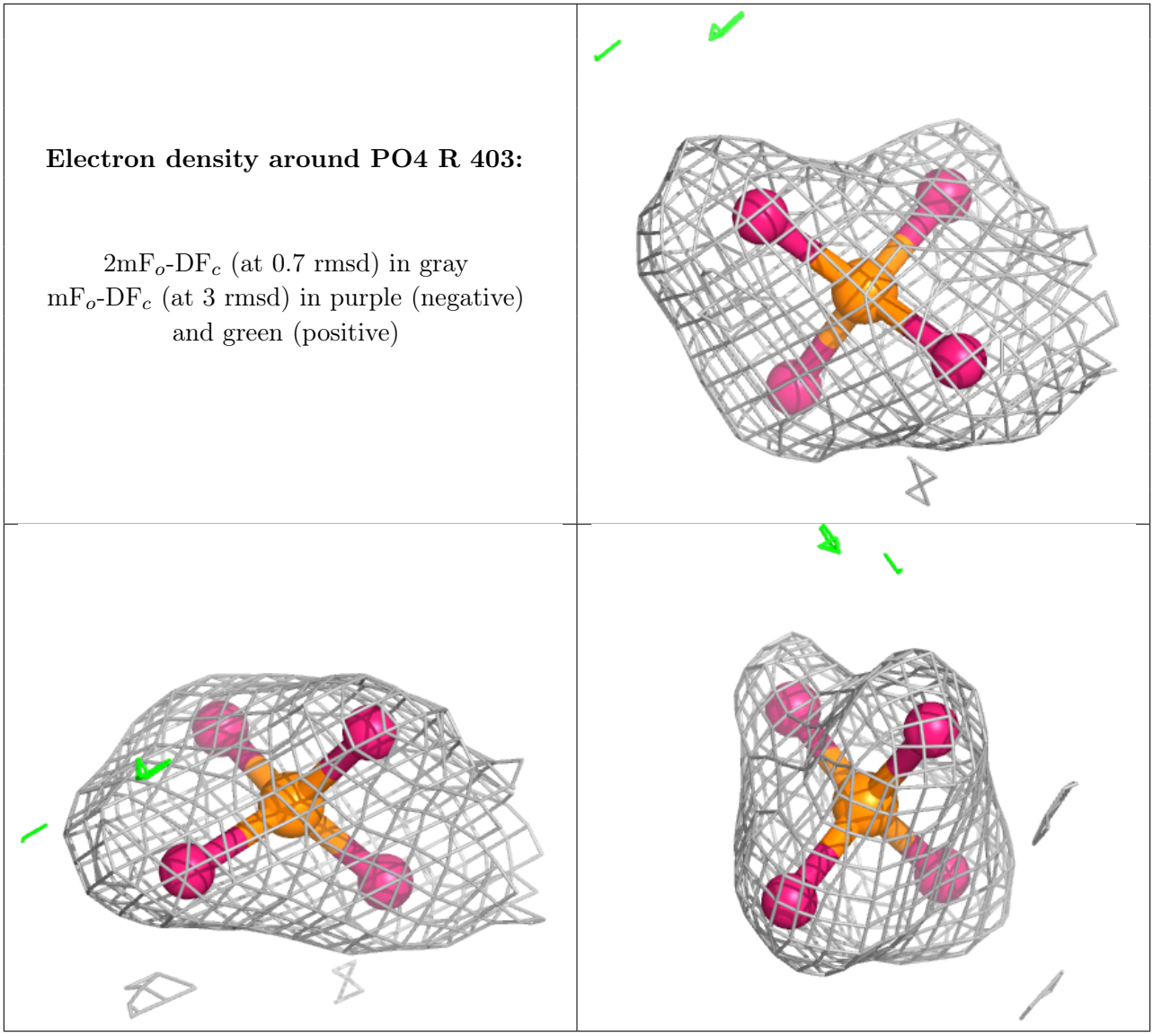
Electron density around EDO R 405:

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



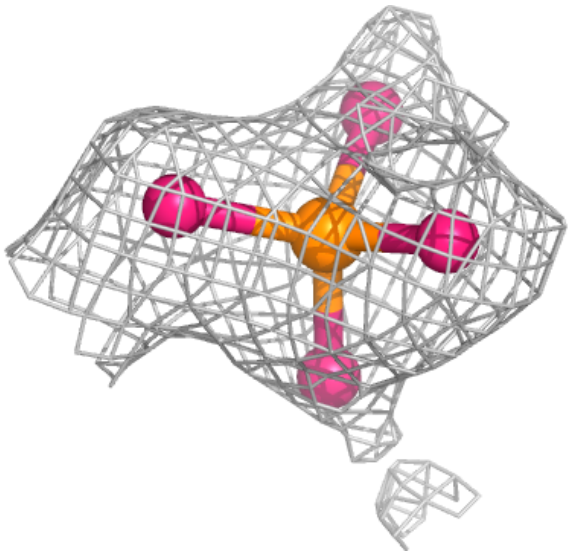
Electron density around PO4 R 403:

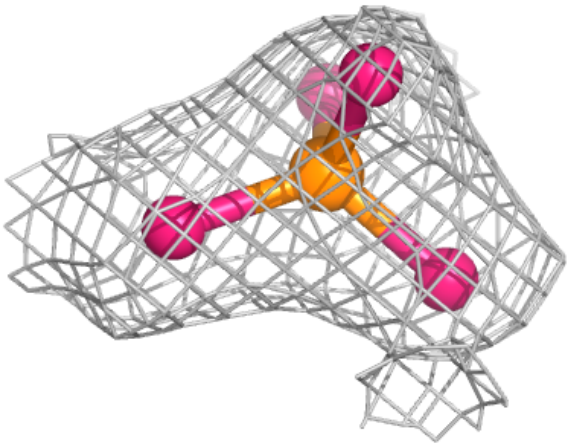
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

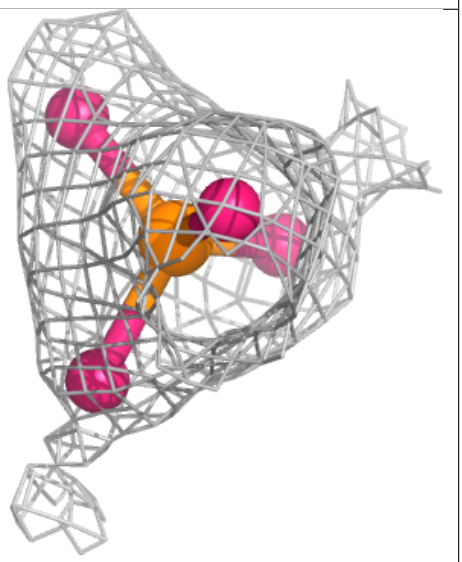


Electron density around PO4 P 403:

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

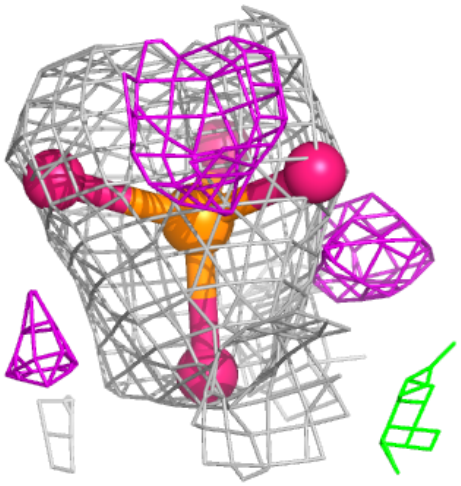


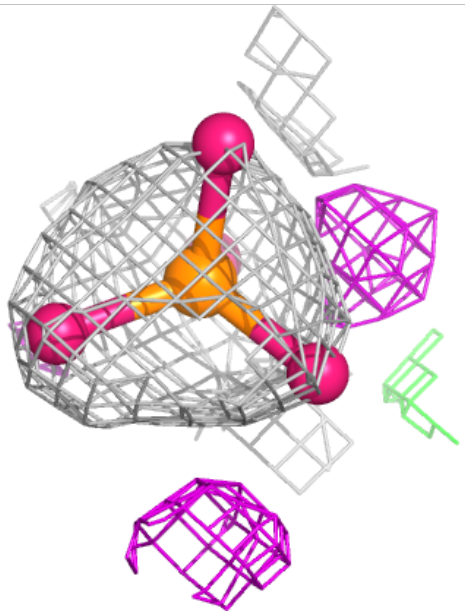


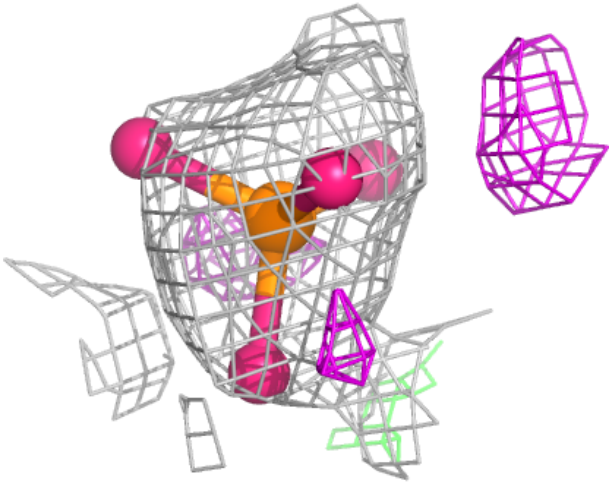


Electron density around PO4 R 404:

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

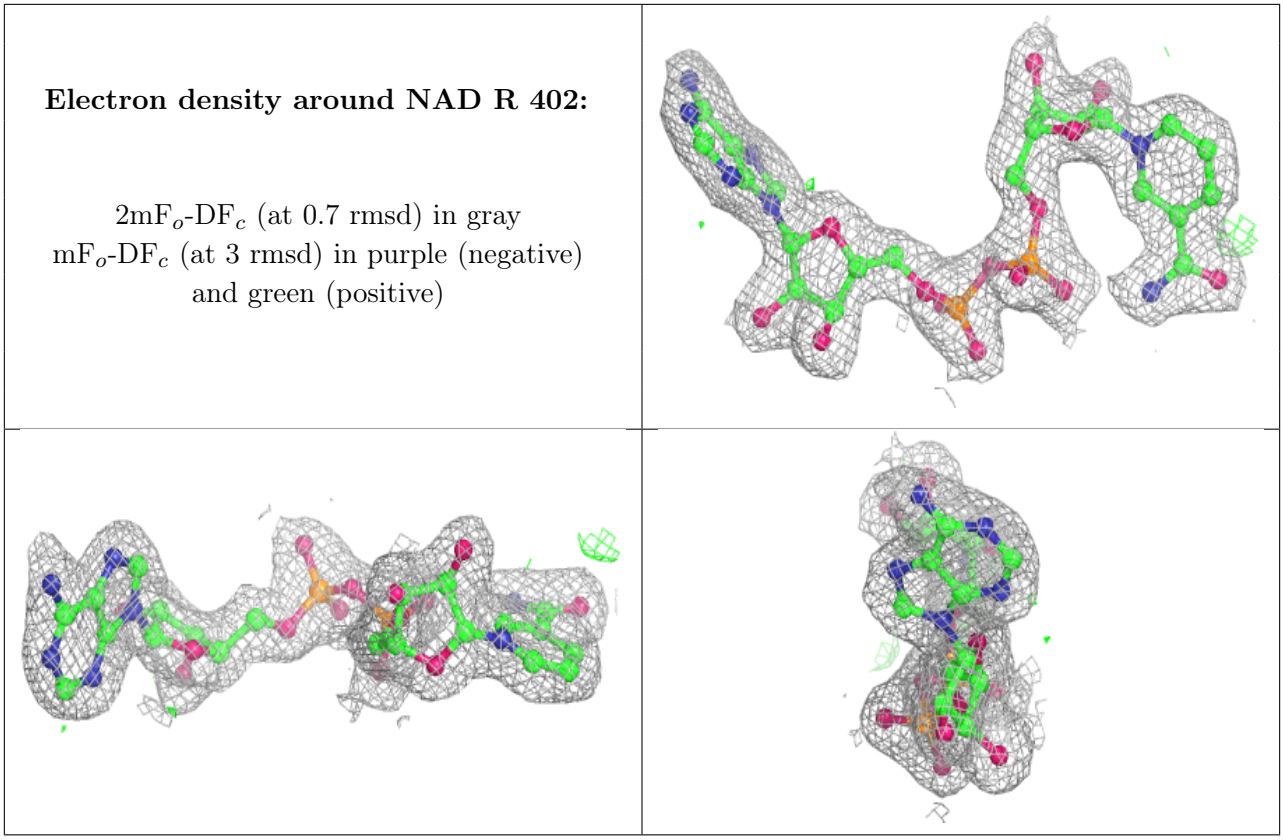






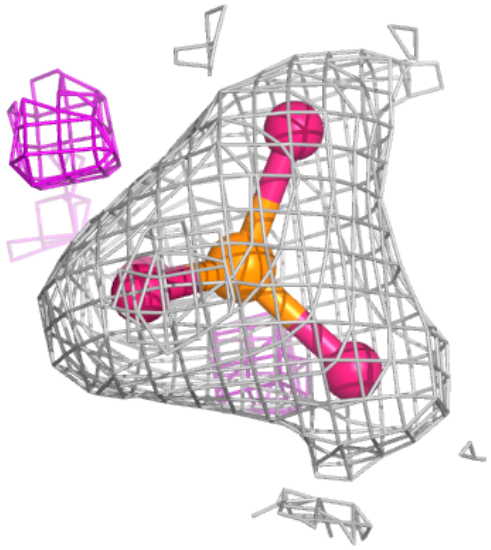
Electron density around NAD R 402:

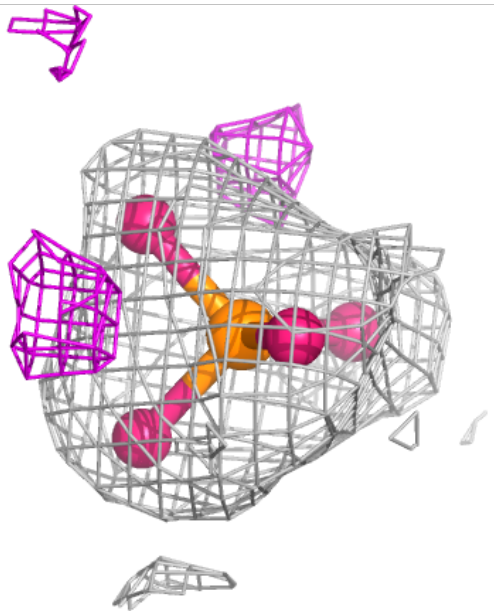
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

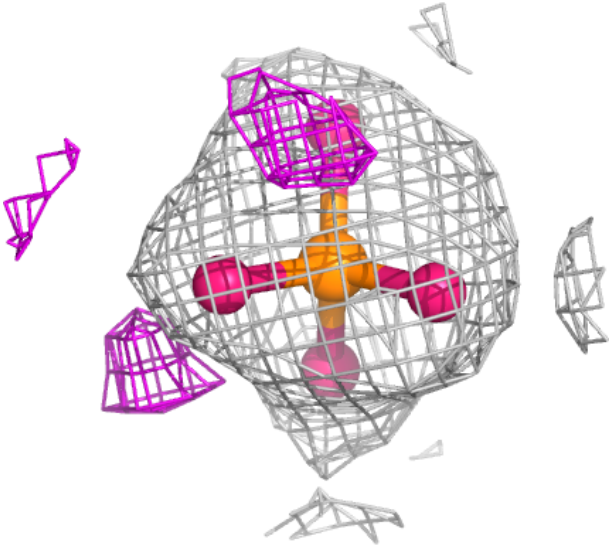


Electron density around PO4 O 401:

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

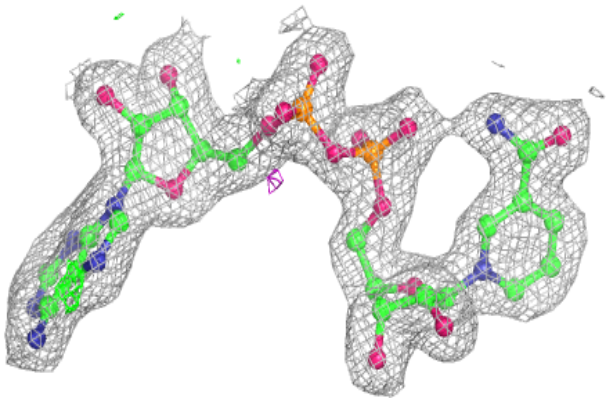


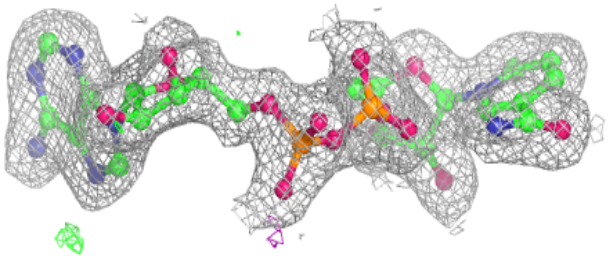


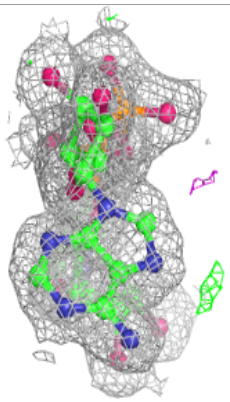


Electron density around NAD P 402:

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







Electron density around NAD Q 402:

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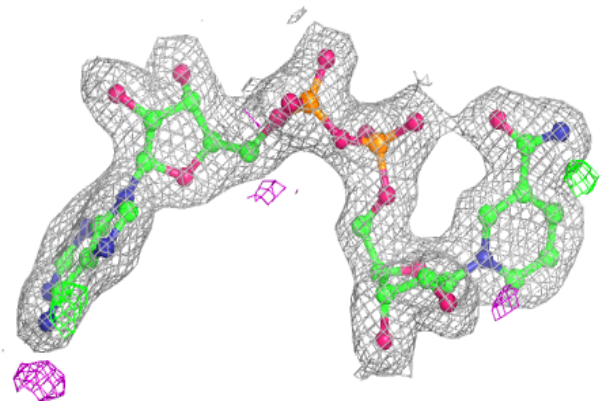
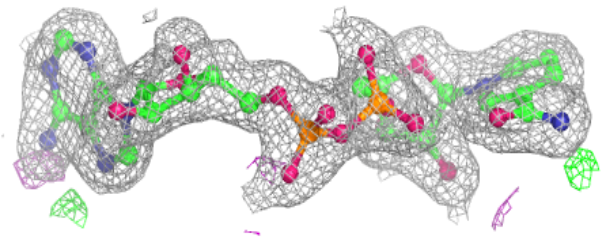
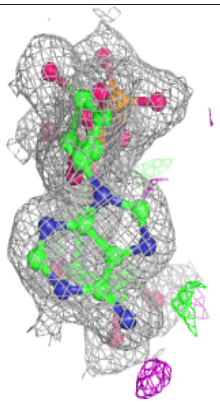
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

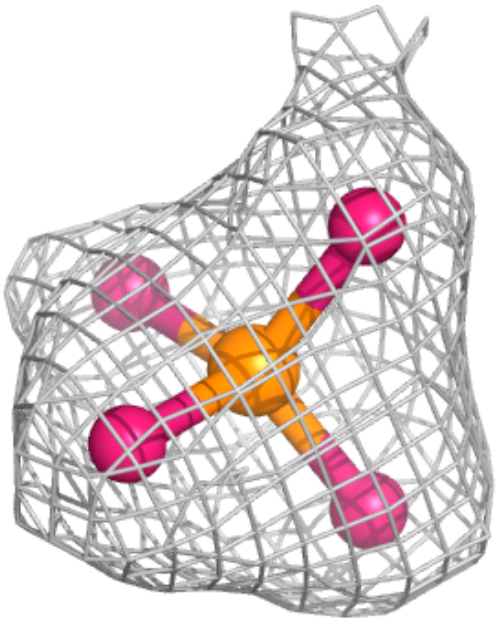


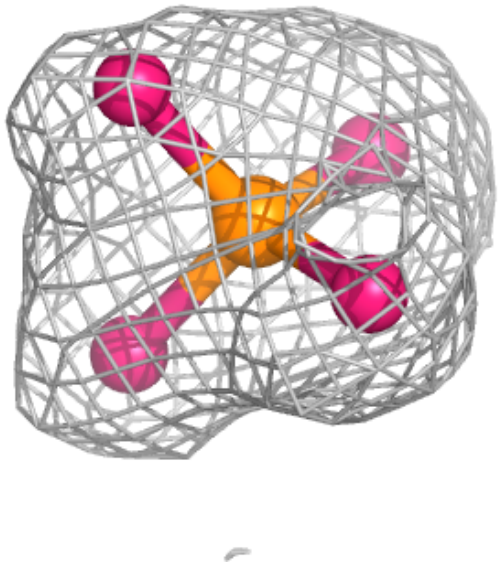


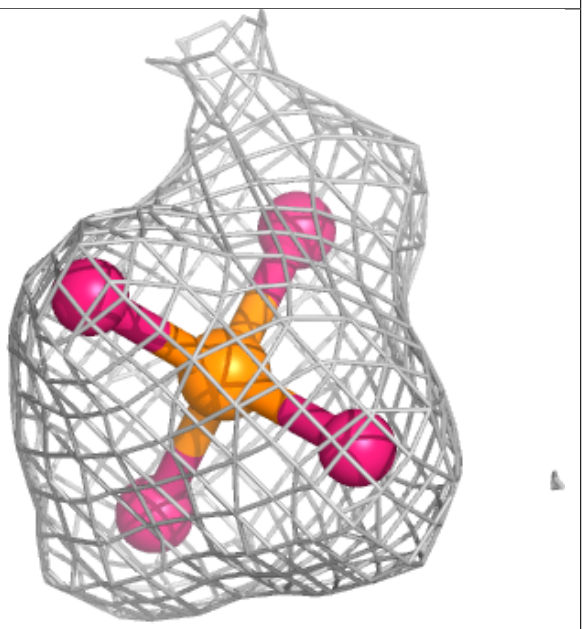


Electron density around PO4 O 403:

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

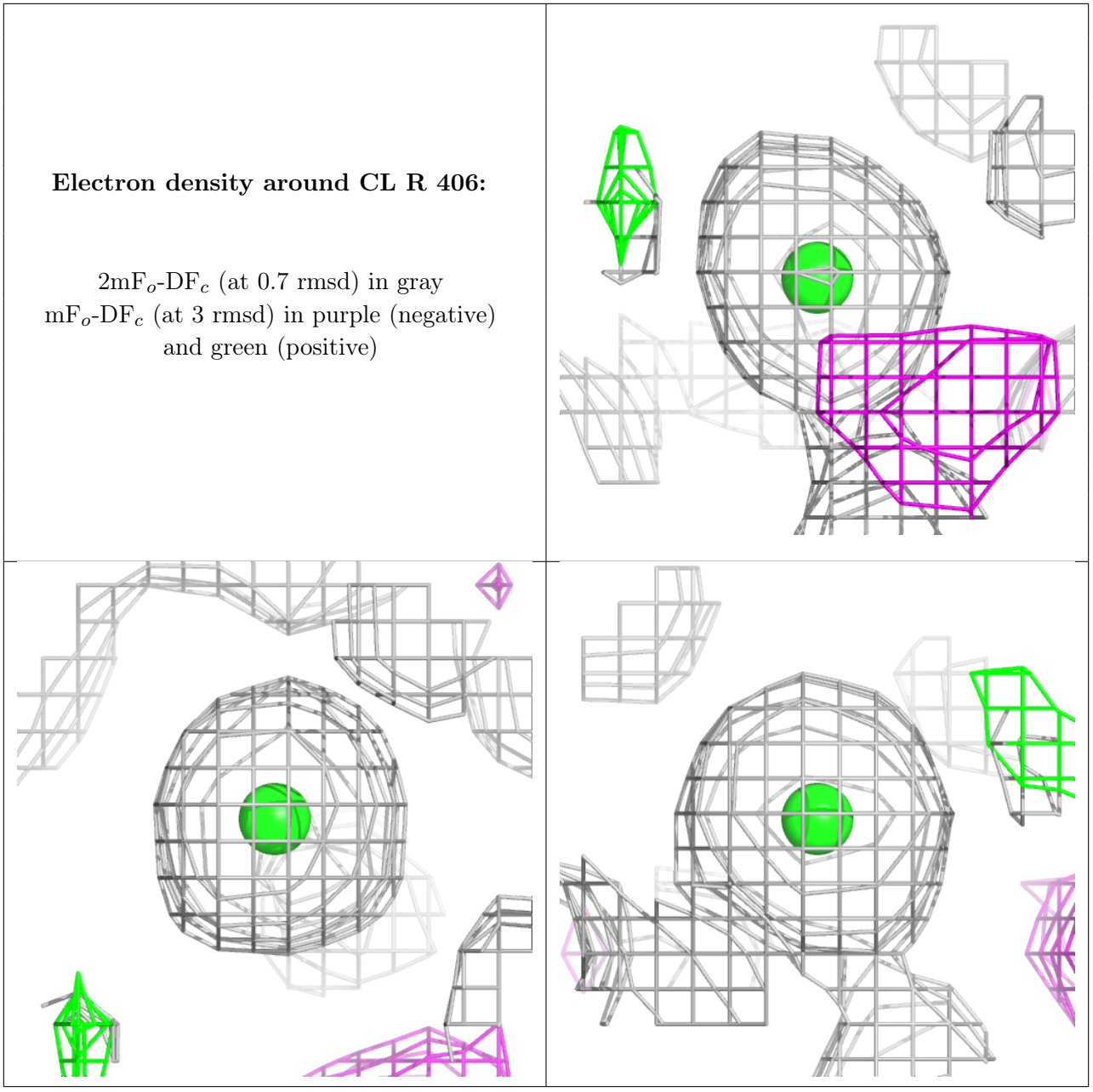






Electron density around CL R 406:

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



Electron density around CL R 407:

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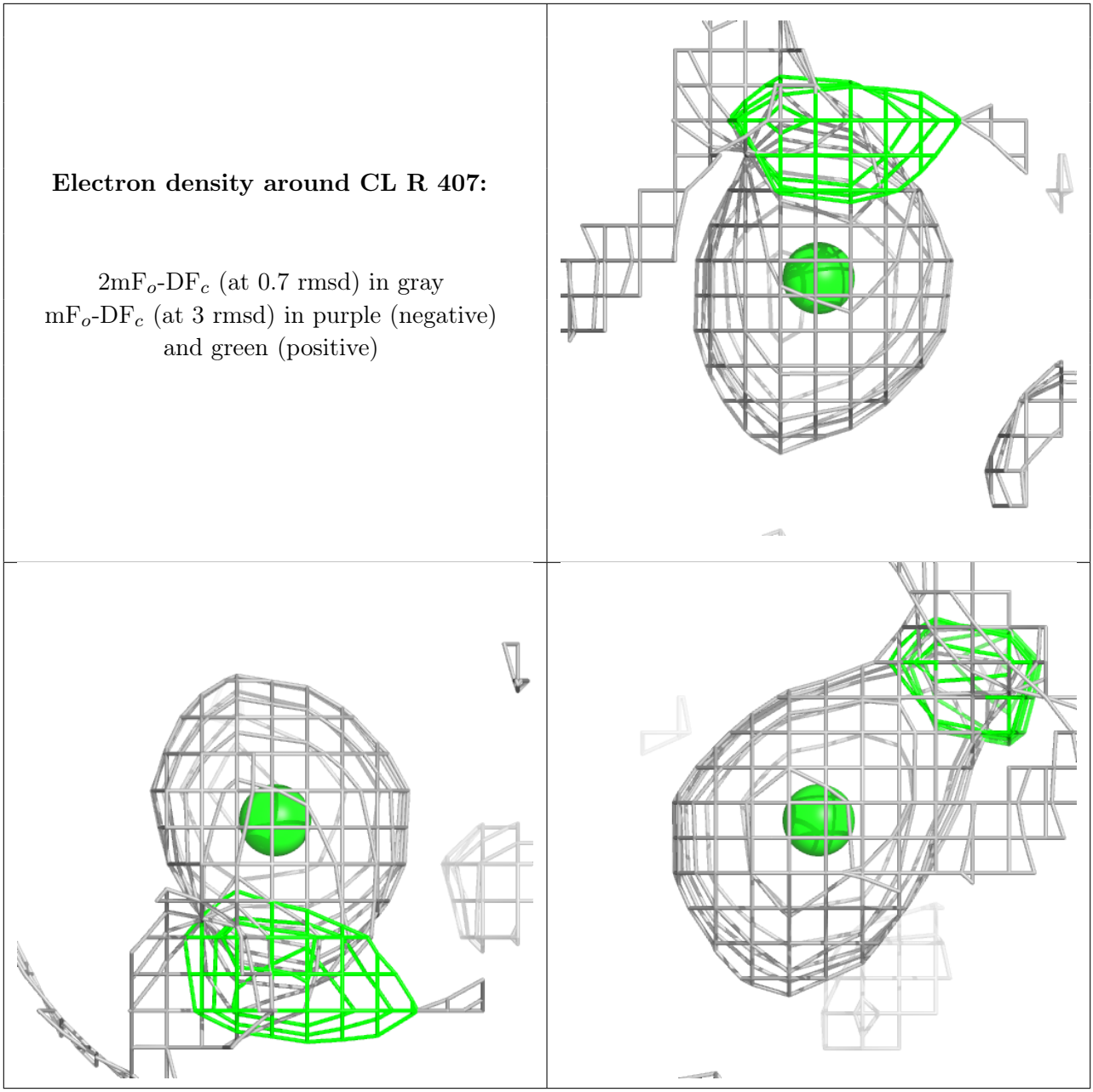
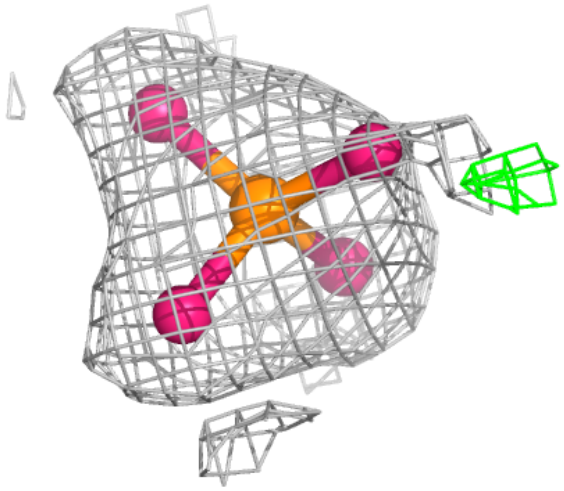
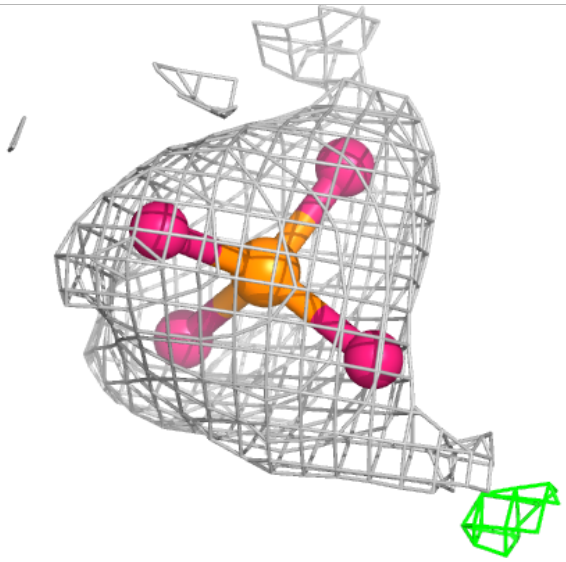
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

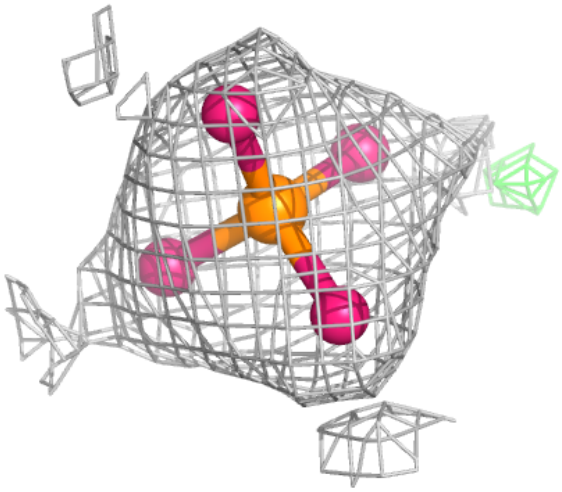


Electron density around PO4 P 401:

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

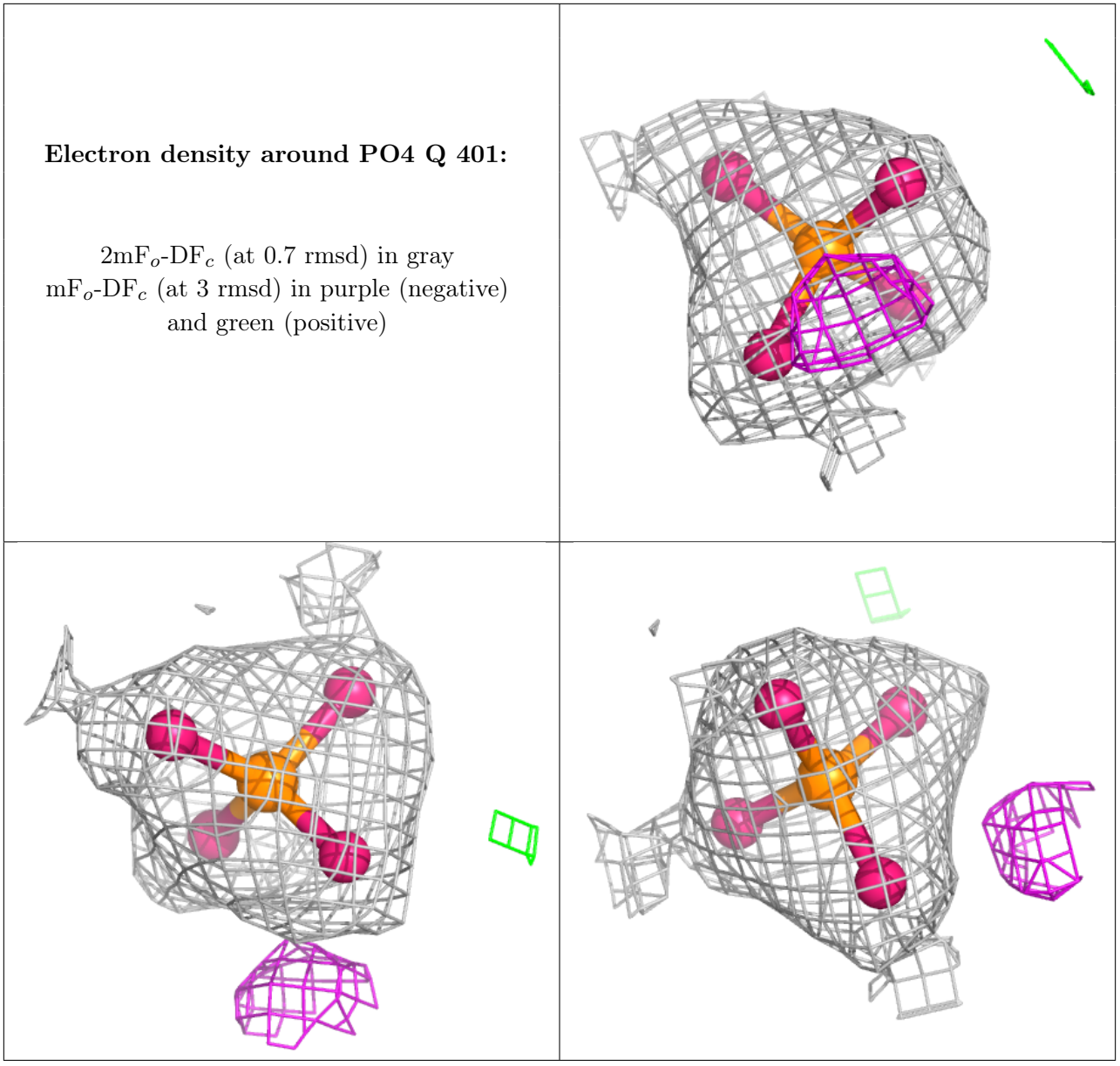






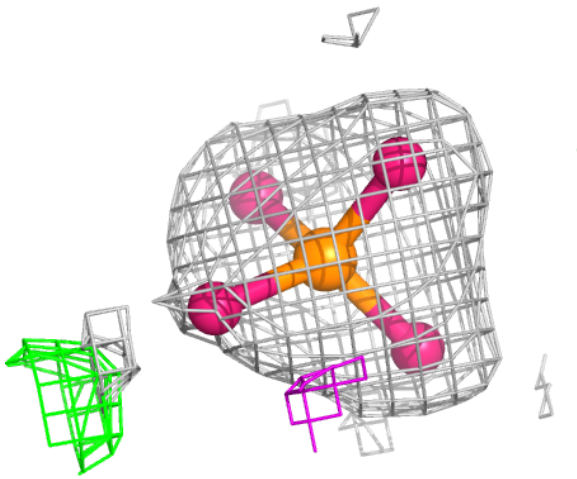
Electron density around PO4 Q 401:

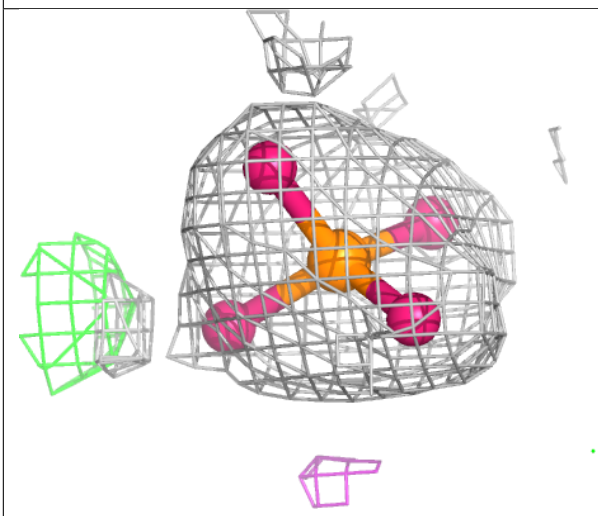
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

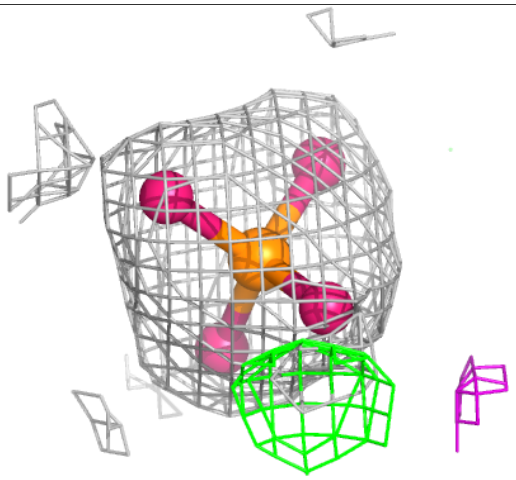


Electron density around PO4 R 401:

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

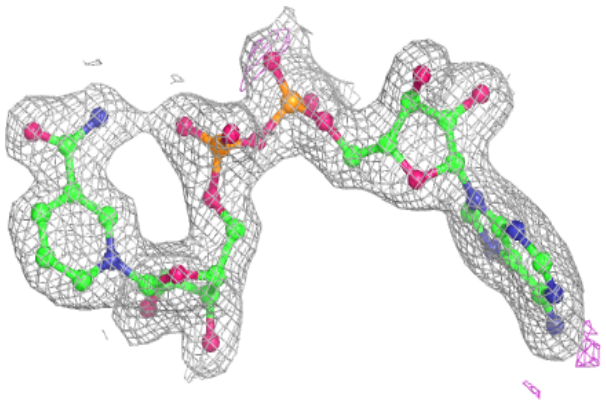


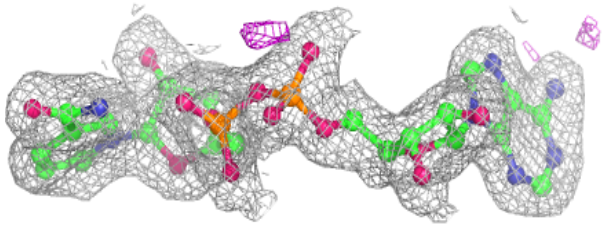


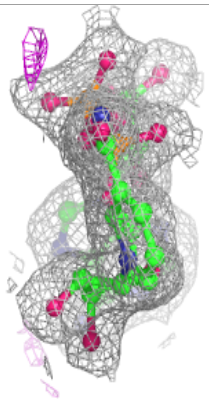


Electron density around NAD O 402:

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

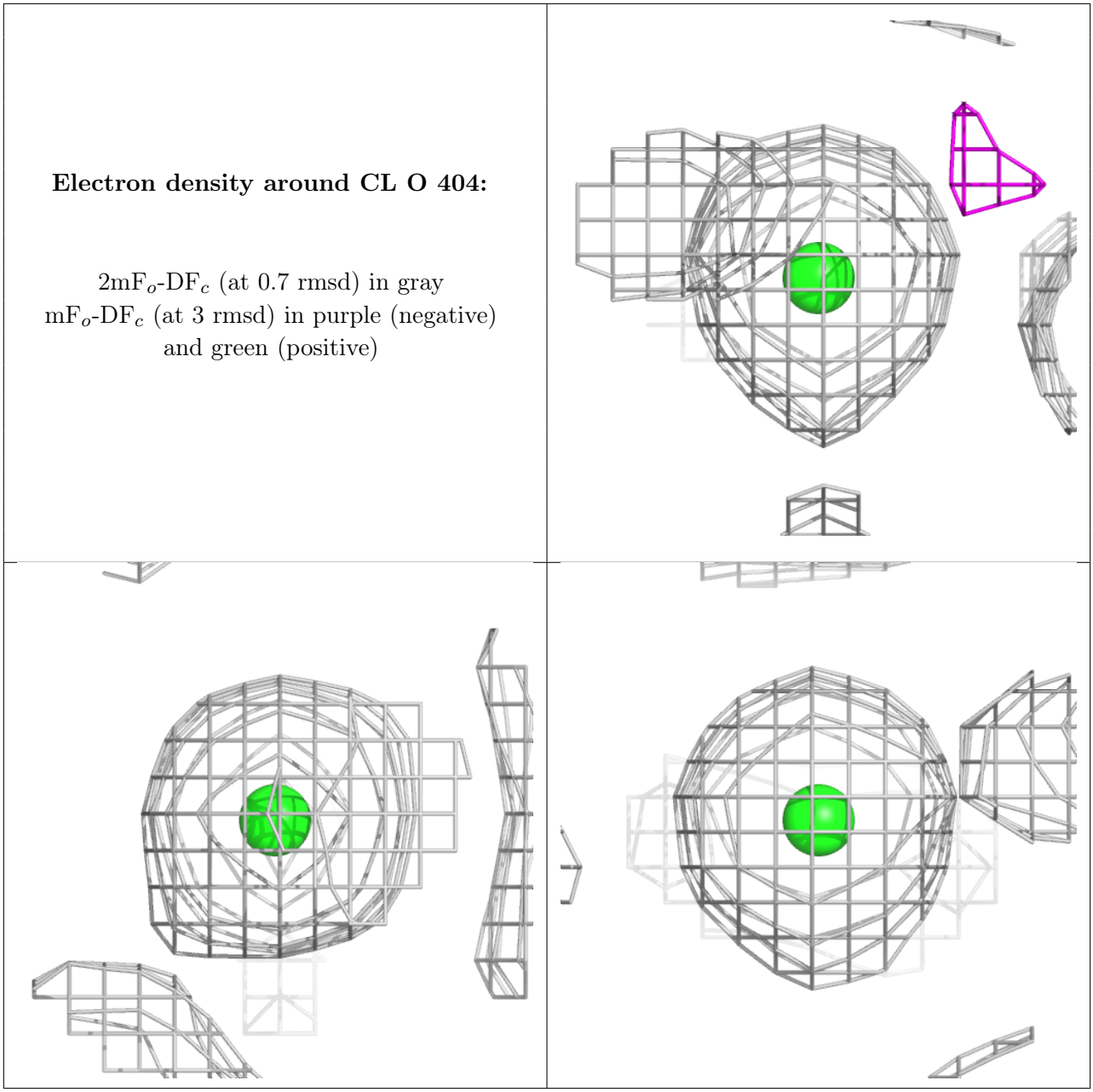






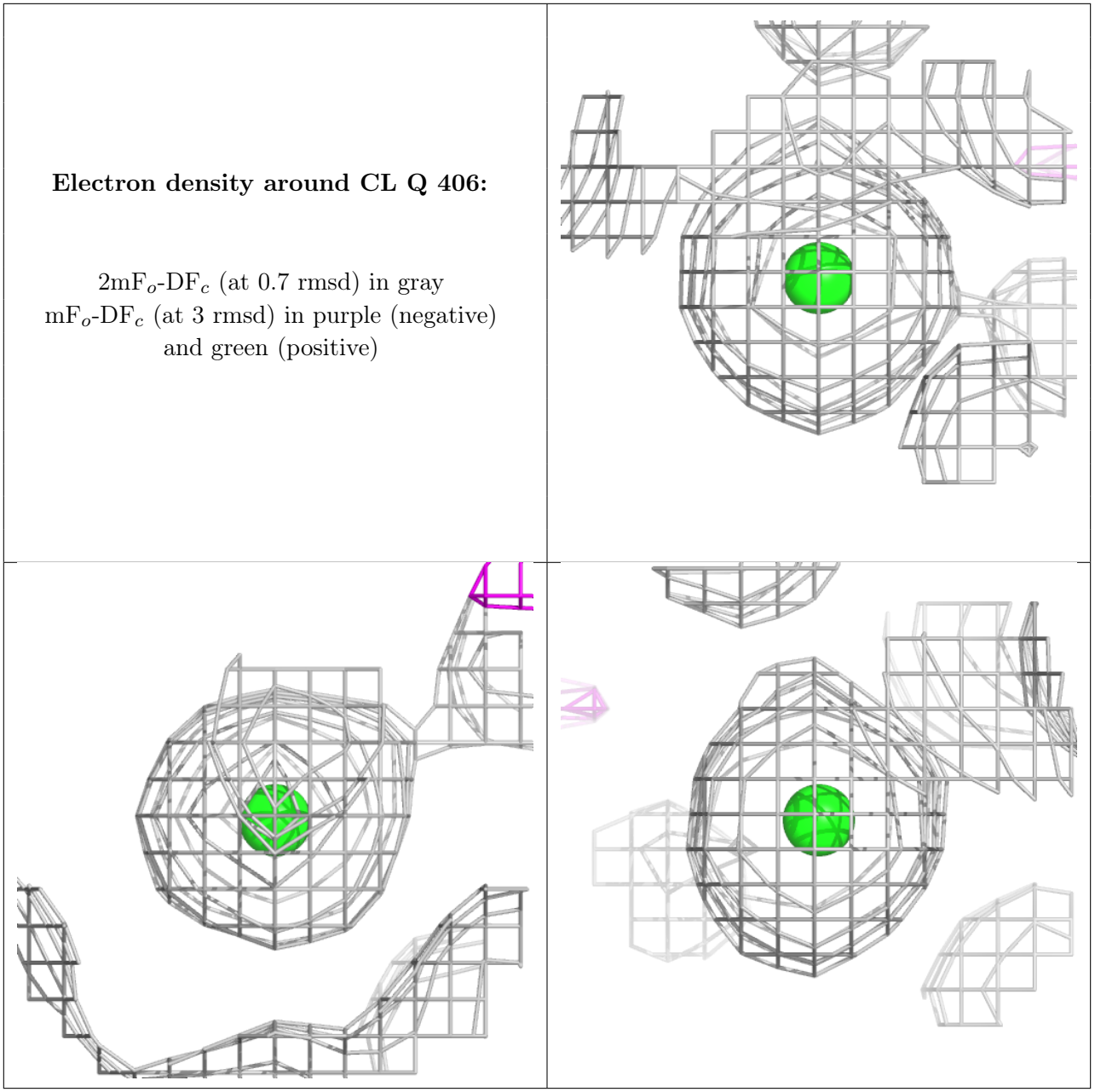
Electron density around CL O 404:

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



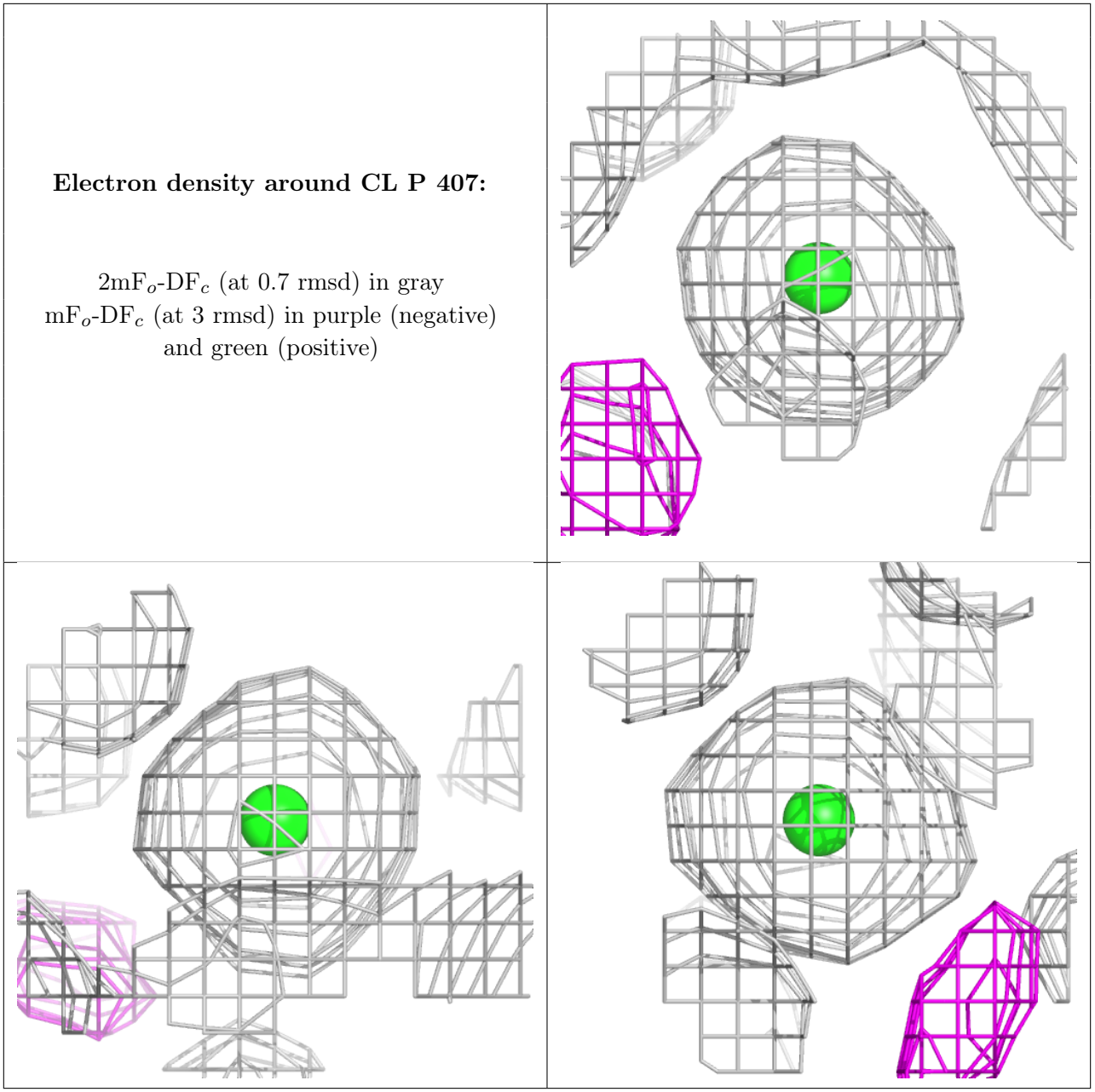
Electron density around CL Q 406:

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



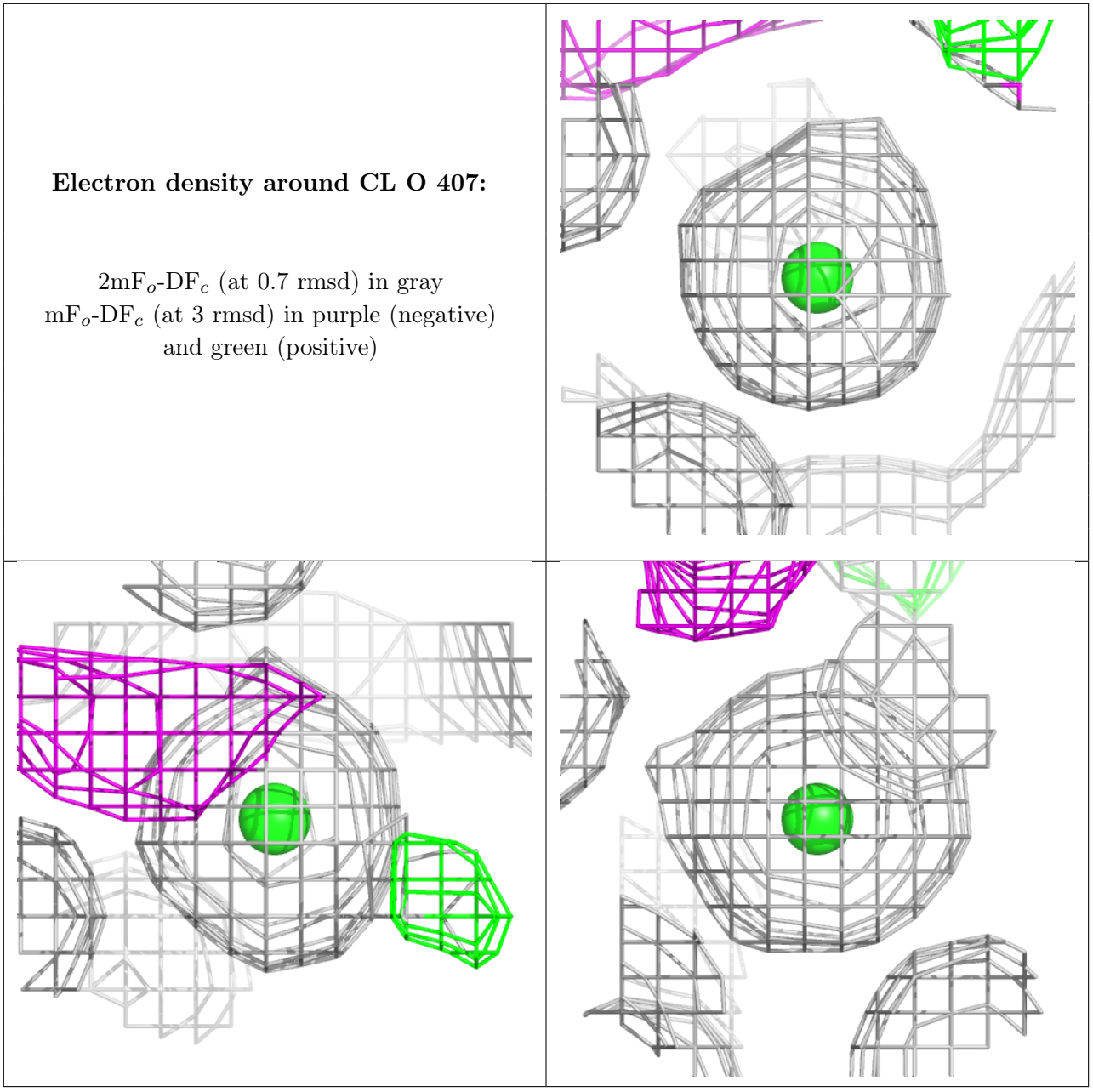
Electron density around CL P 407:

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



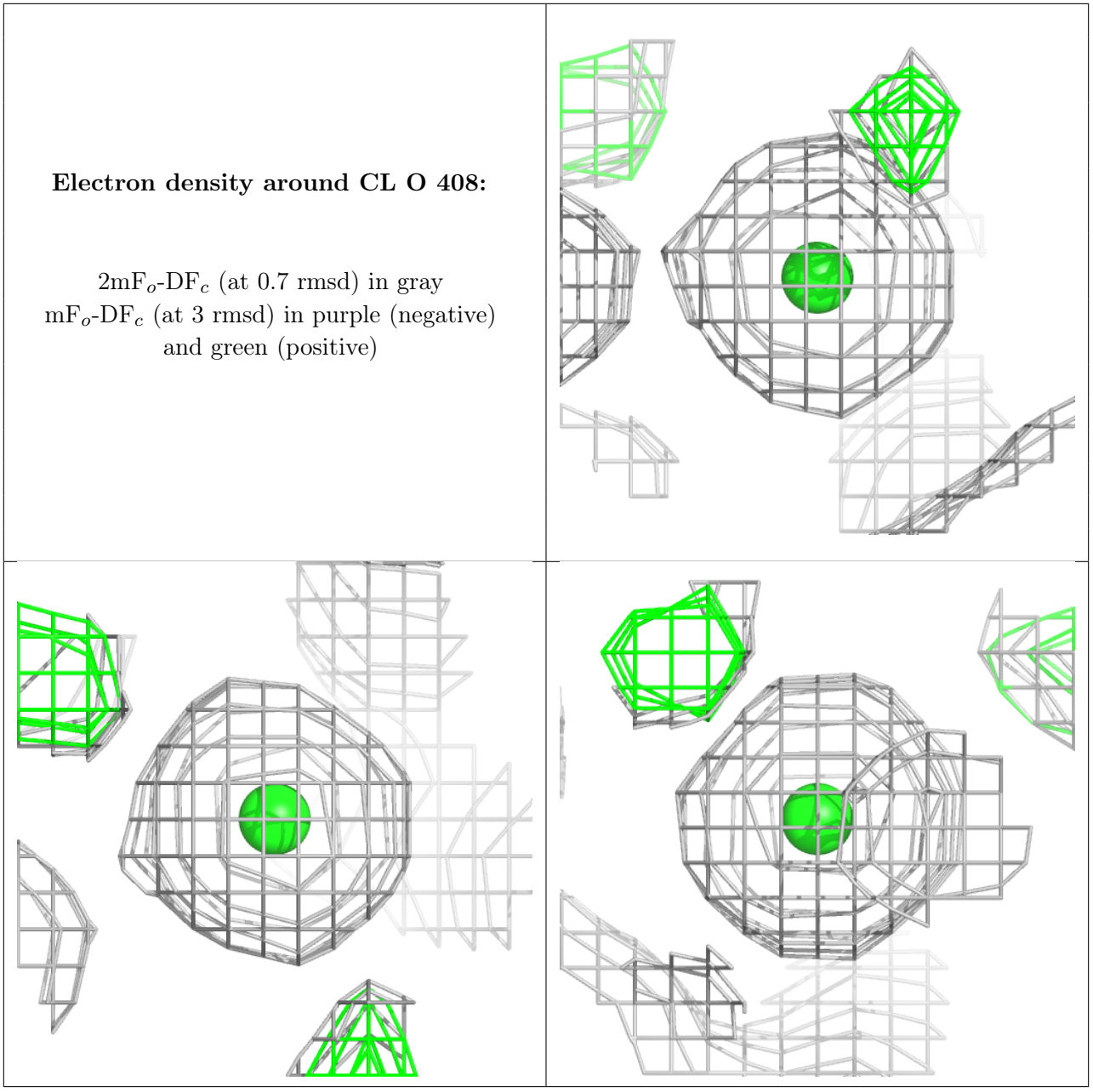
Electron density around CL O 407:

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



Electron density around CL O 408:

$2mF_o$-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.