Full wwPDB X-ray Structure Validation Report (i)

Jun 25, 2024 – 04:17 AM EDT

PDB ID	:	6HQV
Title	:	Pentafunctional AROM Complex from Chaetomium thermophilum
Authors	:	Arora Verasto, H.; Hartmann, M.D.
Deposited on	:	2018-09-25
Resolution	:	3.00 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (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:

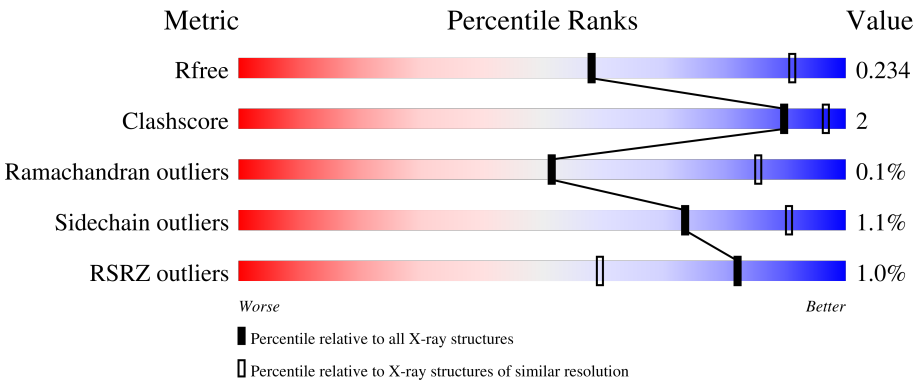
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 3.00 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	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

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	1589	% 93% 5% •
1	B	1589	% 92% 5% •

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 23618 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.

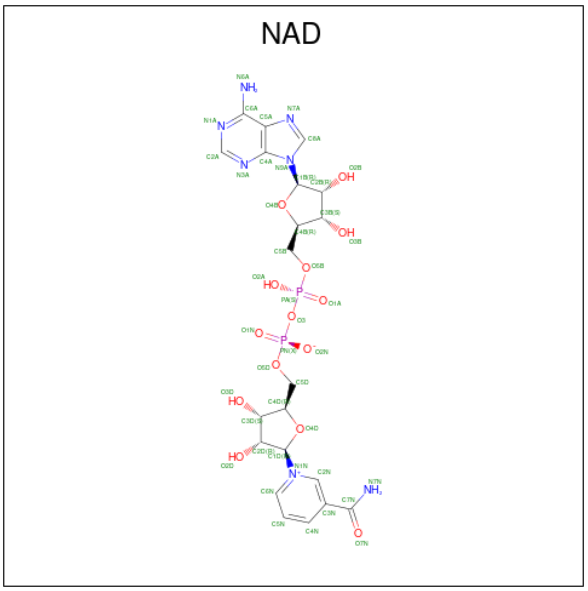
- Molecule 1 is a protein called Pentafunctional AROM polypeptide.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	1555	11773	7475	2019	2228	13	38	0	0	0
1	B	1536	11616	7376	1995	2195	13	37	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1582	LEU	-	expression tag	UNP G0S061
A	1583	GLU	-	expression tag	UNP G0S061
A	1584	HIS	-	expression tag	UNP G0S061
A	1585	HIS	-	expression tag	UNP G0S061
A	1586	HIS	-	expression tag	UNP G0S061
A	1587	HIS	-	expression tag	UNP G0S061
A	1588	HIS	-	expression tag	UNP G0S061
A	1589	HIS	-	expression tag	UNP G0S061
B	1582	LEU	-	expression tag	UNP G0S061
B	1583	GLU	-	expression tag	UNP G0S061
B	1584	HIS	-	expression tag	UNP G0S061
B	1585	HIS	-	expression tag	UNP G0S061
B	1586	HIS	-	expression tag	UNP G0S061
B	1587	HIS	-	expression tag	UNP G0S061
B	1588	HIS	-	expression tag	UNP G0S061
B	1589	HIS	-	expression tag	UNP G0S061

- Molecule 2 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).

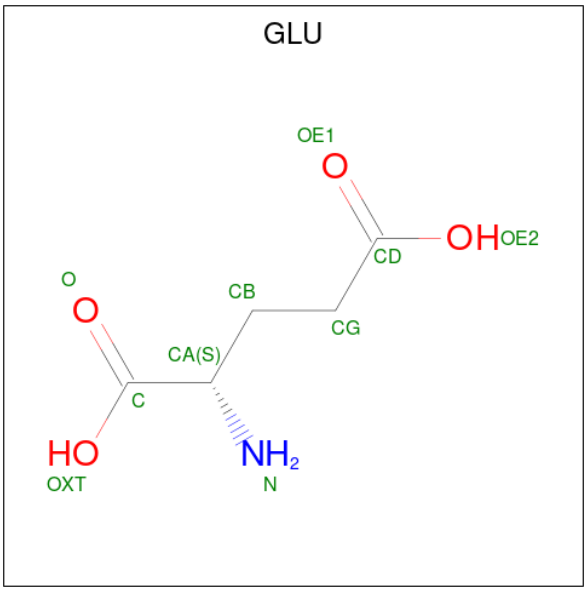


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	44	21	7	14	2	0	0
			Total	C	N	O	P		
2	B	1	44	21	7	14	2	0	0

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

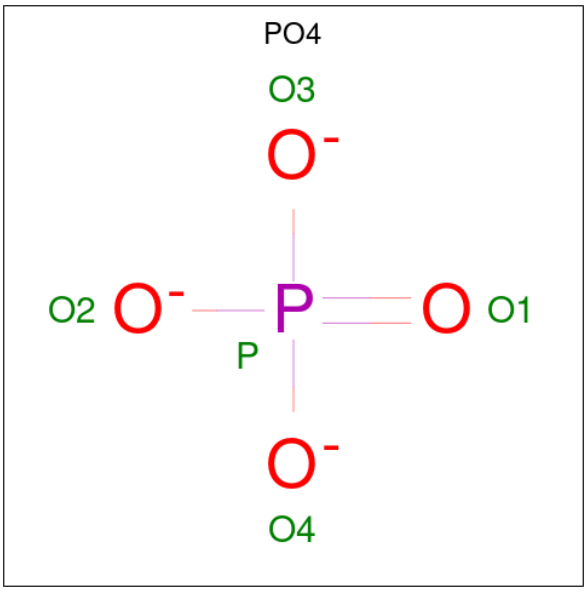
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
3	A	1	1	1	0	0
			Total	Zn		
3	B	1	1	1	0	0

- Molecule 4 is GLUTAMIC ACID (three-letter code: GLU) (formula: $C_5H_9NO_4$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	A	1	10	5	1	4	0	0
			Total	C	N	O		
4	B	1	10	5	1	4	0	0

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P) (labeled as "Ligand of Interest" by depositor).



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

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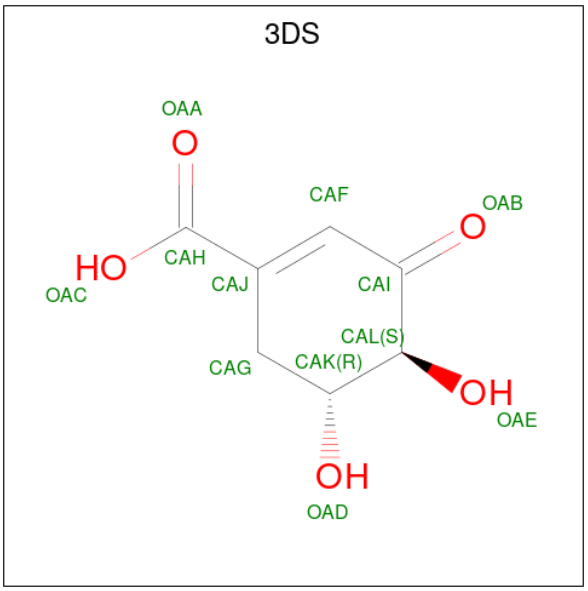
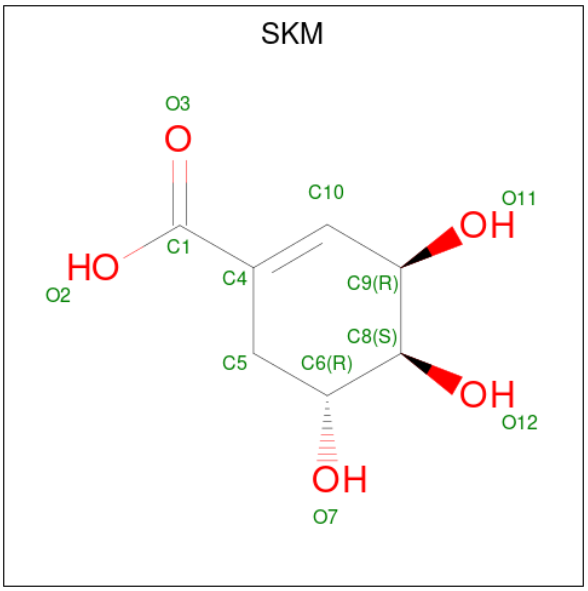
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total O P 5 4 1	0	0
5	A	1	Total O P 5 4 1	0	0
5	B	1	Total O P 5 4 1	0	0
5	B	1	Total O P 5 4 1	0	0

- Molecule 6 is (4S,5R)-4,5-dihydroxy-3-oxocyclohex-1-ene-1-carboxylic acid (three-letter code: 3DS) (formula: $C_7H_8O_5$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total C O 11 7 4	0	1
6	B	1	Total C O 11 7 4	0	1

- Molecule 7 is (3R,4S,5R)-3,4,5-TRIHYDROXYCYCLOHEX-1-ENE-1-CARBOXYLIC ACID (three-letter code: SKM) (formula: $C_7H_{10}O_5$) (labeled as "Ligand of Interest" by depositor).



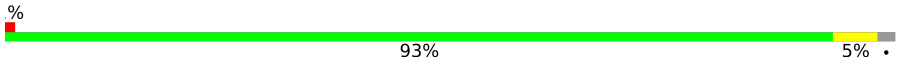
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total	C	O		0	0
			12	7	5			
7	A	1	Total	C	O		0	0
			12	7	5			
7	A	1	Total	C	O		0	0
			12	7	5			
7	B	1	Total	C	O		0	0
			12	7	5			
7	B	1	Total	C	O		0	0
			12	7	5			
7	B	1	Total	C	O		0	0
			12	7	5			

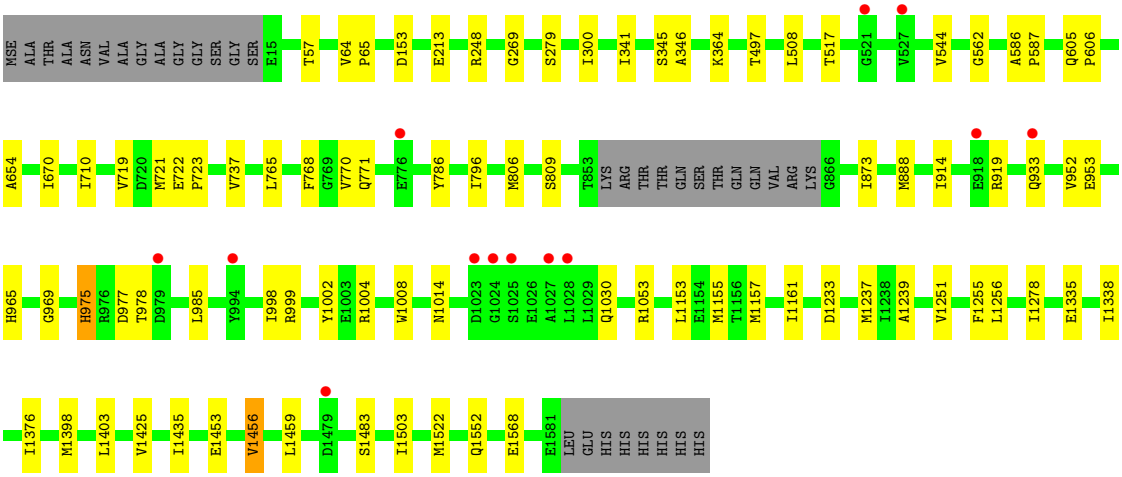
3 Residue-property plots (i)

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: Pentafunctional AROM polypeptide

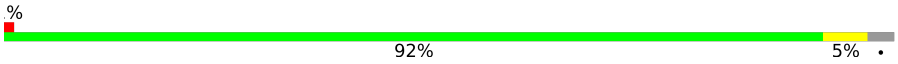
Chain A:

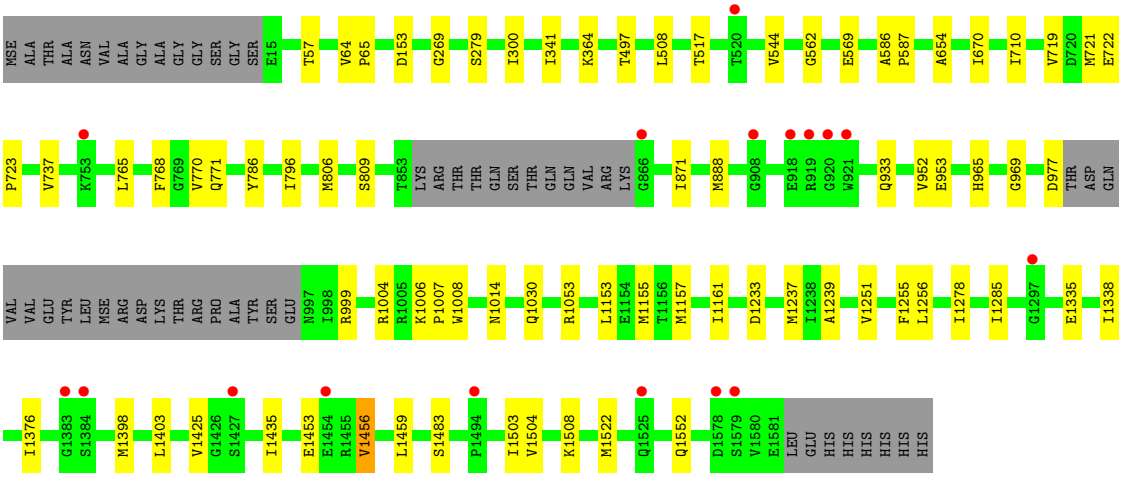




• Molecule 1: Pentafunctional AROM polypeptide

Chain B:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	153.94Å 377.62Å 70.88Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.80 – 3.00 39.77 – 3.00	Depositor EDS
% Data completeness (in resolution range)	99.7 (39.80-3.00) 99.8 (39.77-3.00)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.78 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.8.0049	Depositor
R, R_{free}	0.209 , 0.233 0.211 , 0.234	Depositor DCC
R_{free} test set	4170 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å^2)	95.2	Xtriage
Anisotropy	0.088	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 40.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	23618	wwPDB-VP
Average B, all atoms (Å^2)	110.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.54% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

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

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: 3DS, ZN, NAD, SKM, 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	A	0.29	0/11981	0.51	0/16255
1	B	0.29	0/11820	0.50	0/16036
All	All	0.29	0/23801	0.50	0/32291

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	11773	0	11766	44	0
1	B	11616	0	11616	40	0
2	A	44	0	26	0	0
2	B	44	0	26	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	10	0	5	1	0
4	B	10	0	5	1	0
5	A	15	0	0	0	0
5	B	10	0	0	0	0
6	A	11	0	7	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	11	0	7	0	0
7	A	36	0	27	0	0
7	B	36	0	27	0	0
All	All	23618	0	23512	84	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 2.

All (84) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1155:MSE:HE3	1:A:1155:MSE:HA	1.61	0.80
1:B:1155:MSE:HE3	1:B:1155:MSE:HA	1.64	0.78
1:B:1285:ILE:HG22	1:B:1285:ILE:O	1.98	0.63
1:A:737:VAL:O	1:A:737:VAL:HG12	2.02	0.59
1:B:737:VAL:HG12	1:B:737:VAL:O	2.03	0.59
1:A:1155:MSE:HA	1:A:1155:MSE:CE	2.33	0.58
1:B:1504:VAL:HG12	1:B:1508:LYS:HE2	1.86	0.56
1:A:873:ILE:HD11	1:A:888:MSE:HE2	1.86	0.56
1:A:300:ILE:HD11	1:A:341:ILE:HD11	1.88	0.56
1:A:345:SER:O	1:A:346:ALA:HB3	2.06	0.56
1:B:1398:MSE:HE2	1:B:1522:MSE:SE	2.56	0.56
1:B:300:ILE:HD11	1:B:341:ILE:HD11	1.88	0.55
1:B:1155:MSE:HA	1:B:1155:MSE:CE	2.35	0.53
1:A:1338:ILE:HD11	1:A:1376:ILE:HD13	1.92	0.52
1:B:1425:VAL:HG21	1:B:1503:ILE:HD11	1.92	0.51
1:A:213:GLU:OE1	1:A:248:ARG:NE	2.38	0.51
1:A:1153:LEU:HD12	1:A:1153:LEU:O	2.11	0.51
1:B:1338:ILE:HD11	1:B:1376:ILE:HD13	1.91	0.51
1:B:1153:LEU:HD12	1:B:1153:LEU:O	2.11	0.51
1:A:1398:MSE:HE2	1:A:1522:MSE:SE	2.61	0.50
1:A:1425:VAL:HG21	1:A:1503:ILE:HD11	1.92	0.50
1:B:1335:GLU:HA	1:B:1338:ILE:HG22	1.94	0.50
1:B:977:ASP:C	1:B:977:ASP:OD1	2.50	0.49
1:A:1335:GLU:HA	1:A:1338:ILE:HG22	1.93	0.49
1:B:508:LEU:HD23	1:B:562:GLY:HA2	1.94	0.49
1:A:873:ILE:HD11	1:A:888:MSE:CE	2.43	0.48
1:A:765:LEU:HB3	1:A:770:VAL:HG23	1.96	0.48
1:B:765:LEU:HB3	1:B:770:VAL:HG23	1.96	0.48
1:A:508:LEU:HD23	1:A:562:GLY:HA2	1.95	0.48
1:B:952:VAL:HG22	1:B:1008:TRP:HB3	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1157:MSE:CE	1:B:1161:ILE:HG21	2.44	0.47
1:A:1157:MSE:CE	1:A:1161:ILE:HG21	2.44	0.47
1:A:914:ILE:HG23	1:A:919:ARG:HD3	1.96	0.47
1:A:722:GLU:N	1:A:723:PRO:CD	2.78	0.47
1:A:952:VAL:HG22	1:A:1008:TRP:HB3	1.96	0.47
1:A:1237:MSE:HE2	1:A:1239:ALA:HB2	1.97	0.47
1:A:279:SER:OG	1:A:364:LYS:NZ	2.47	0.46
1:A:300:ILE:HD11	1:A:341:ILE:CD1	2.44	0.46
1:A:978:THR:HG22	1:A:1002:TYR:CE1	2.50	0.46
1:B:722:GLU:N	1:B:723:PRO:CD	2.79	0.46
1:B:279:SER:OG	1:B:364:LYS:NZ	2.47	0.46
1:B:300:ILE:HD11	1:B:341:ILE:CD1	2.45	0.46
1:B:153:ASP:OD2	4:B:1603:GLU:N	2.49	0.45
1:B:719:VAL:HG11	1:B:721:MSE:HE3	1.99	0.45
1:A:985:LEU:HB2	1:A:998:ILE:HD13	1.99	0.45
1:A:975:HIS:CD2	1:A:1002:TYR:OH	2.70	0.45
1:B:1237:MSE:HE2	1:B:1239:ALA:HB2	1.99	0.45
1:A:768:PHE:CE2	1:A:796:ILE:HD11	2.51	0.45
1:A:1255:PHE:CE2	1:A:1256:LEU:HD12	2.52	0.44
1:A:710:ILE:HD12	1:A:710:ILE:H	1.82	0.44
1:B:737:VAL:HG13	1:B:786:TYR:HB3	1.99	0.44
1:B:768:PHE:CE2	1:B:796:ILE:HD11	2.52	0.44
1:A:1053:ARG:NH2	1:A:1233:ASP:O	2.51	0.44
1:A:1157:MSE:HE2	1:A:1161:ILE:HG21	2.00	0.44
1:A:719:VAL:HG11	1:A:721:MSE:HE3	2.00	0.43
1:A:737:VAL:HG13	1:A:786:TYR:HB3	2.00	0.43
1:A:1435:ILE:HD11	1:A:1459:LEU:HD21	2.00	0.43
1:B:1251:VAL:HA	1:B:1278:ILE:HG23	2.01	0.43
1:B:1255:PHE:CE2	1:B:1256:LEU:HD12	2.53	0.43
1:A:153:ASP:OD2	4:A:1603:GLU:N	2.51	0.43
1:B:710:ILE:H	1:B:710:ILE:HD12	1.83	0.43
1:B:1157:MSE:HE2	1:B:1161:ILE:HG21	2.01	0.43
1:B:654:ALA:HB1	1:B:670:ILE:CD1	2.49	0.42
1:B:586:ALA:N	1:B:587:PRO:CD	2.82	0.42
1:A:1251:VAL:HA	1:A:1278:ILE:HG23	2.02	0.42
1:B:64:VAL:HB	1:B:65:PRO:HD3	2.02	0.42
1:A:64:VAL:HB	1:A:65:PRO:HD3	2.02	0.42
1:A:965:HIS:HB2	1:A:1014:ASN:HB2	2.01	0.42
1:B:1006:LYS:HB3	1:B:1007:PRO:HD3	2.02	0.42
1:B:1053:ARG:NH2	1:B:1233:ASP:O	2.52	0.42
1:B:1435:ILE:HD11	1:B:1459:LEU:HD21	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:806:MSE:O	1:A:809:SER:HB3	2.20	0.42
1:A:586:ALA:N	1:A:587:PRO:CD	2.82	0.41
1:A:654:ALA:HB1	1:A:670:ILE:CD1	2.49	0.41
1:A:1453:GLU:HA	1:A:1456:VAL:HG12	2.02	0.41
1:B:806:MSE:O	1:B:809:SER:HB3	2.20	0.41
1:B:953:GLU:OE1	1:B:1004:ARG:NH2	2.53	0.41
1:B:965:HIS:HA	1:B:969:GLY:CA	2.50	0.41
1:B:1453:GLU:HA	1:B:1456:VAL:HG12	2.03	0.41
1:B:871:ILE:HG21	1:B:888:MSE:HE1	2.03	0.41
1:A:953:GLU:OE1	1:A:1004:ARG:NH2	2.54	0.41
1:B:965:HIS:HB2	1:B:1014:ASN:HB2	2.03	0.41
1:A:965:HIS:HA	1:A:969:GLY:CA	2.51	0.40
1:A:605:GLN:N	1:A:606:PRO:HD2	2.37	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	1551/1589 (98%)	1494 (96%)	55 (4%)	2 (0%)	51 85
1	B	1530/1589 (96%)	1474 (96%)	54 (4%)	2 (0%)	51 85
All	All	3081/3178 (97%)	2968 (96%)	109 (4%)	4 (0%)	51 85

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	269	GLY
1	B	269	GLY
1	A	544	VAL
1	B	544	VAL

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	1245/1257 (99%)	1231 (99%)	14 (1%)	73 90
1	B	1227/1257 (98%)	1215 (99%)	12 (1%)	76 91
All	All	2472/2514 (98%)	2446 (99%)	26 (1%)	73 90

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	57	THR
1	A	497	THR
1	A	517	THR
1	A	771	GLN
1	A	933	GLN
1	A	975	HIS
1	A	977	ASP
1	A	999	ARG
1	A	1030	GLN
1	A	1403	LEU
1	A	1456	VAL
1	A	1483	SER
1	A	1552	GLN
1	A	1568	GLU
1	B	57	THR
1	B	497	THR
1	B	517	THR
1	B	569	GLU
1	B	771	GLN
1	B	933	GLN
1	B	999	ARG
1	B	1030	GLN
1	B	1403	LEU
1	B	1456	VAL
1	B	1483	SER
1	B	1552	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	459	GLN
1	A	773	ASN
1	A	938	ASN
1	A	975	HIS
1	A	1124	GLN
1	A	1141	GLN
1	A	1223	ASN
1	B	459	GLN
1	B	938	ASN
1	B	1124	GLN
1	B	1141	GLN
1	B	1223	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 19 ligands modelled in this entry, 2 are monoatomic - leaving 17 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	$\#\|Z\| > 2$
7	SKM	B	1606	-	12,12,12	0.87	0	16,17,17	0.78	1 (6%)
7	SKM	A	1609	-	12,12,12	0.75	0	16,17,17	0.92	1 (6%)
7	SKM	B	1608	-	12,12,12	0.78	0	16,17,17	0.58	0
5	PO4	A	1608	-	4,4,4	0.93	0	6,6,6	0.47	0
2	NAD	A	1601	-	42,48,48	0.81	1 (2%)	50,73,73	1.17	4 (8%)
5	PO4	B	1609	-	4,4,4	0.93	0	6,6,6	0.48	0
6	3DS	A	1605[A]	1	11,11,12	0.97	0	12,15,17	1.06	0
7	SKM	A	1606	-	12,12,12	0.82	0	16,17,17	0.39	0
2	NAD	B	1601	-	42,48,48	0.83	1 (2%)	50,73,73	1.12	4 (8%)
5	PO4	A	1604	-	4,4,4	0.99	0	6,6,6	0.47	0
7	SKM	A	1607	-	12,12,12	0.81	0	16,17,17	0.63	0
5	PO4	A	1610	-	4,4,4	0.92	0	6,6,6	0.53	0
6	3DS	B	1605[A]	1	11,11,12	0.97	0	12,15,17	1.10	1 (8%)
4	GLU	B	1603	3	8,9,9	1.03	1 (12%)	10,11,11	1.34	2 (20%)
7	SKM	B	1607	-	12,12,12	0.86	0	16,17,17	0.63	0
4	GLU	A	1603	3	8,9,9	1.02	0	10,11,11	1.38	2 (20%)
5	PO4	B	1604	-	4,4,4	0.94	0	6,6,6	0.34	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
7	SKM	B	1606	-	-	4/4/20/20	0/1/1/1
7	SKM	A	1609	-	-	2/4/20/20	0/1/1/1
7	SKM	B	1608	-	-	4/4/20/20	0/1/1/1
2	NAD	A	1601	-	-	1/26/62/62	0/5/5/5
6	3DS	A	1605[A]	1	-	4/4/17/20	0/1/1/1
7	SKM	A	1606	-	-	0/4/20/20	0/1/1/1
2	NAD	B	1601	-	-	5/26/62/62	0/5/5/5
7	SKM	A	1607	-	-	4/4/20/20	0/1/1/1
6	3DS	B	1605[A]	1	-	4/4/17/20	0/1/1/1
4	GLU	B	1603	3	-	5/9/9/9	-
7	SKM	B	1607	-	-	4/4/20/20	0/1/1/1
4	GLU	A	1603	3	-	4/9/9/9	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1601	NAD	C5A-C4A	2.23	1.46	1.40
2	A	1601	NAD	C5A-C4A	2.08	1.46	1.40
4	B	1603	GLU	OXT-C	-2.07	1.23	1.30

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	1601	NAD	N3A-C2A-N1A	-3.87	122.64	128.68
2	B	1601	NAD	N3A-C2A-N1A	-3.69	122.90	128.68
2	A	1601	NAD	C4A-C5A-N7A	-3.10	106.17	109.40
4	B	1603	GLU	OXT-C-O	-2.92	117.45	124.09
4	A	1603	GLU	OXT-C-O	-2.90	117.50	124.09
2	A	1601	NAD	C3N-C7N-N7N	2.87	121.19	117.75
4	A	1603	GLU	OXT-C-CA	2.51	121.94	113.38
4	B	1603	GLU	OXT-C-CA	2.35	121.37	113.38
2	A	1601	NAD	C1B-N9A-C4A	-2.32	122.56	126.64
6	B	1605[A]	3DS	OAA-CAH-CAJ	-2.22	117.76	121.59
2	B	1601	NAD	C2A-N1A-C6A	2.14	122.41	118.75
2	B	1601	NAD	PN-O3-PA	-2.13	125.51	132.83
7	B	1606	SKM	O3-C1-C4	-2.09	117.99	121.59
2	B	1601	NAD	C4A-C5A-N7A	-2.08	107.23	109.40
7	A	1609	SKM	O2-C1-C4	2.04	119.82	115.49

There are no chirality outliers.

All (41) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1601	NAD	O4D-C1D-N1N-C6N
2	B	1601	NAD	O4D-C1D-N1N-C2N
2	B	1601	NAD	O4D-C1D-N1N-C6N
4	A	1603	GLU	N-CA-CB-CG
6	A	1605[A]	3DS	OAA-CAH-CAJ-CAF
6	A	1605[A]	3DS	OAA-CAH-CAJ-CAG
6	A	1605[A]	3DS	OAC-CAH-CAJ-CAF
6	A	1605[A]	3DS	OAC-CAH-CAJ-CAG
6	B	1605[A]	3DS	OAA-CAH-CAJ-CAF
6	B	1605[A]	3DS	OAA-CAH-CAJ-CAG
6	B	1605[A]	3DS	OAC-CAH-CAJ-CAF
6	B	1605[A]	3DS	OAC-CAH-CAJ-CAG
7	A	1607	SKM	O2-C1-C4-C5
7	A	1607	SKM	O3-C1-C4-C5
7	B	1606	SKM	O2-C1-C4-C5

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Mol	Chain	Res	Type	Atoms
7	B	1606	SKM	O3-C1-C4-C5
7	B	1607	SKM	O2-C1-C4-C5
7	B	1607	SKM	O3-C1-C4-C5
7	B	1607	SKM	O2-C1-C4-C10
7	B	1607	SKM	O3-C1-C4-C10
2	B	1601	NAD	O4B-C4B-C5B-O5B
7	A	1607	SKM	O2-C1-C4-C10
7	A	1607	SKM	O3-C1-C4-C10
7	A	1609	SKM	O2-C1-C4-C5
7	A	1609	SKM	O3-C1-C4-C5
7	B	1608	SKM	O2-C1-C4-C5
7	B	1608	SKM	O3-C1-C4-C5
7	B	1608	SKM	O2-C1-C4-C10
7	B	1608	SKM	O3-C1-C4-C10
4	A	1603	GLU	C-CA-CB-CG
4	B	1603	GLU	N-CA-CB-CG
2	B	1601	NAD	C3B-C4B-C5B-O5B
4	A	1603	GLU	OE1-CD-CG-CB
4	A	1603	GLU	OE2-CD-CG-CB
4	B	1603	GLU	CA-CB-CG-CD
7	B	1606	SKM	O2-C1-C4-C10
7	B	1606	SKM	O3-C1-C4-C10
4	B	1603	GLU	OE2-CD-CG-CB
4	B	1603	GLU	C-CA-CB-CG
4	B	1603	GLU	OE1-CD-CG-CB
2	B	1601	NAD	C4B-C5B-O5B-PA

There are no ring outliers.

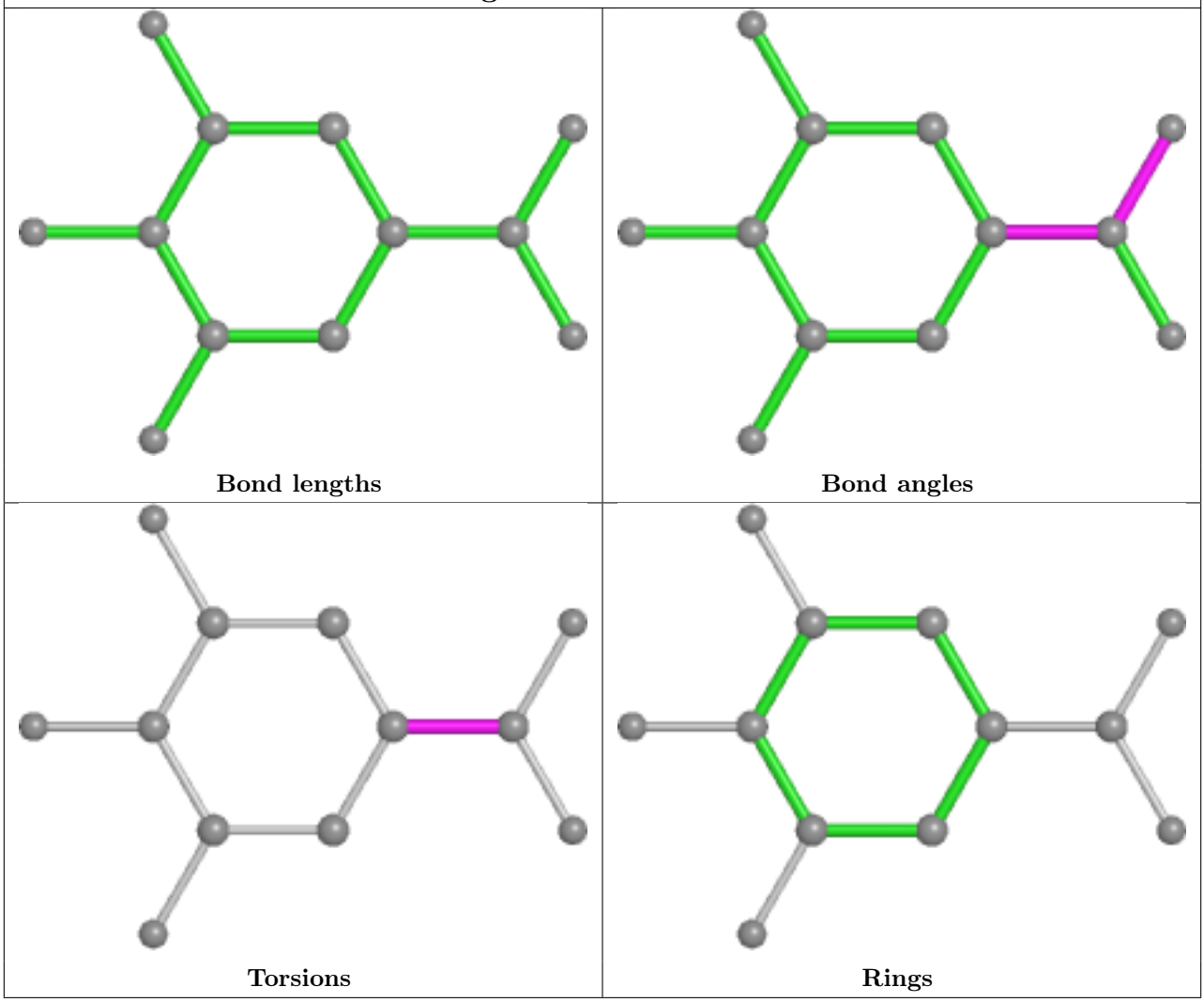
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	1603	GLU	1	0
4	A	1603	GLU	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 SKM B 1606



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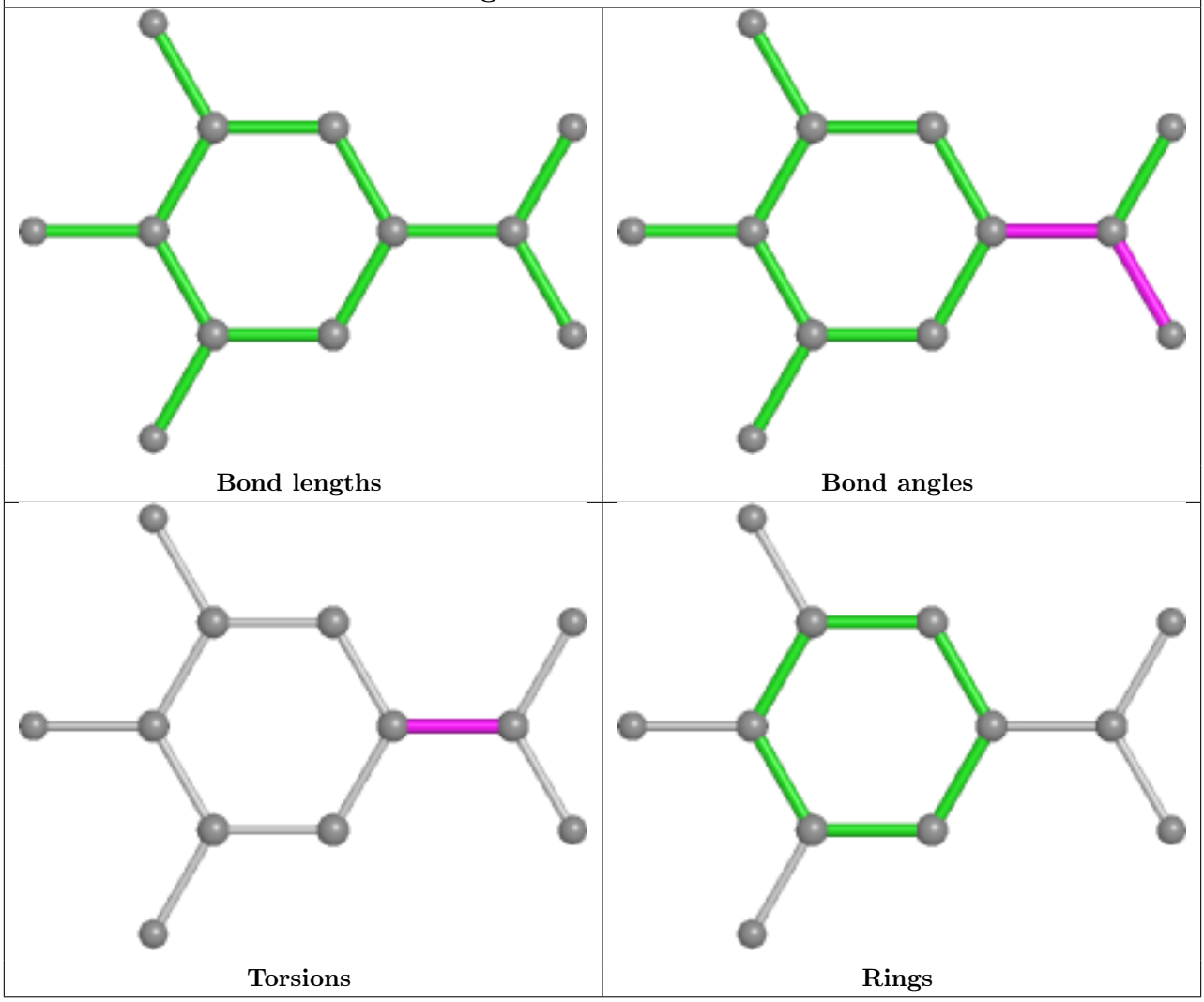

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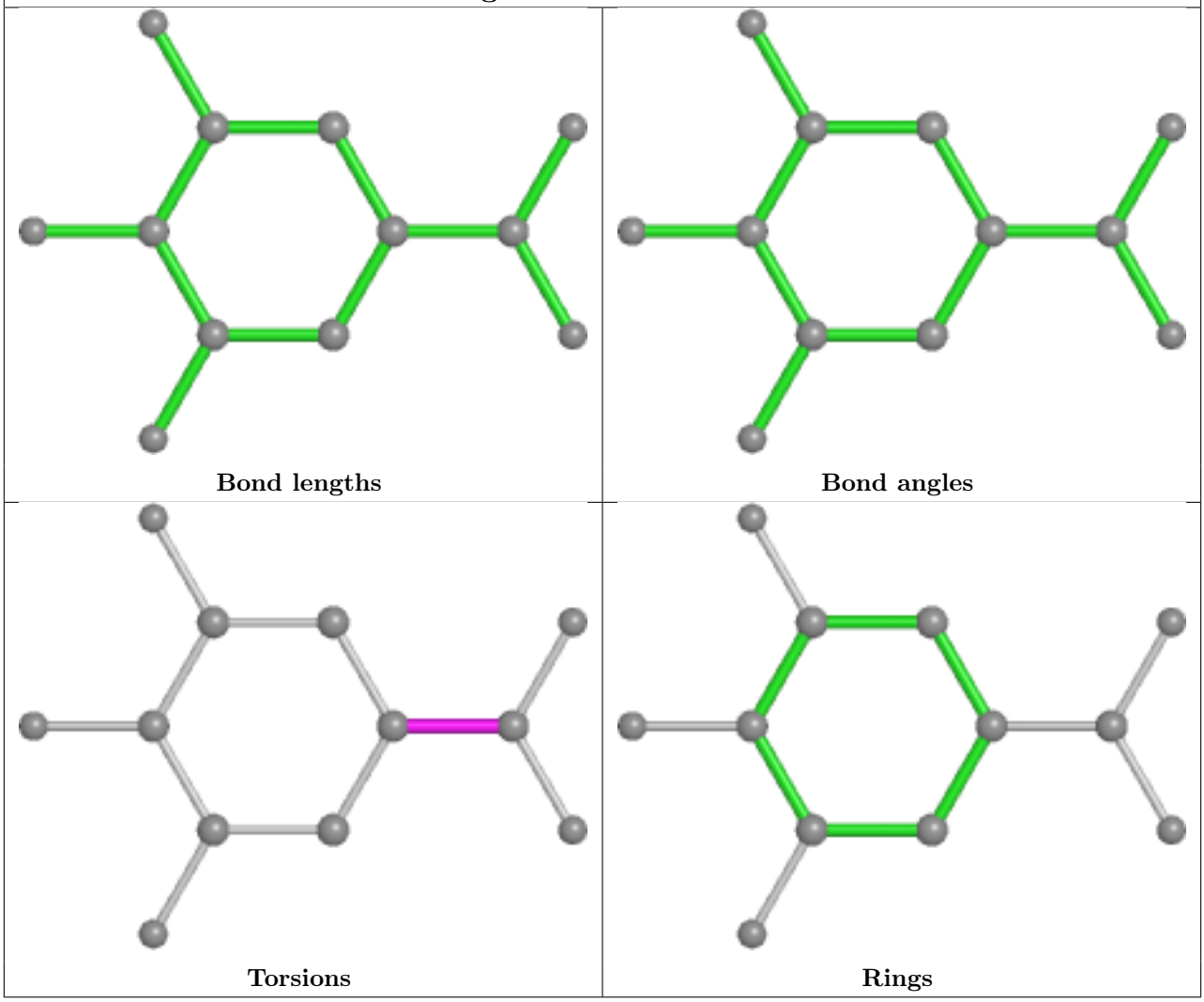

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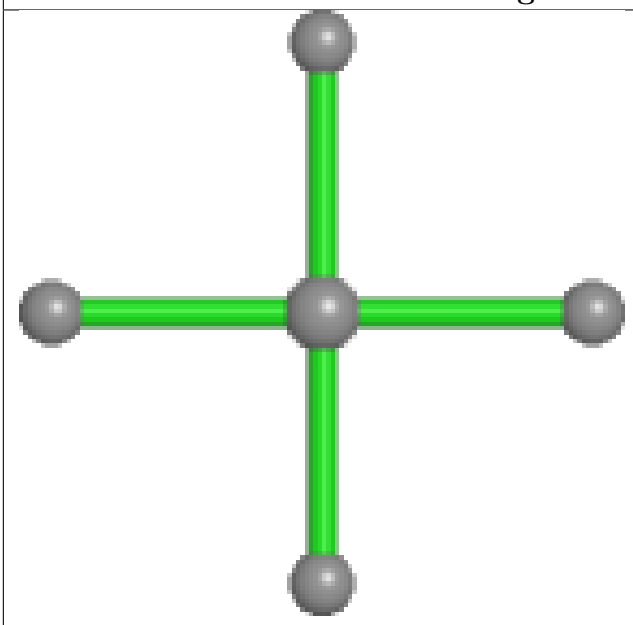
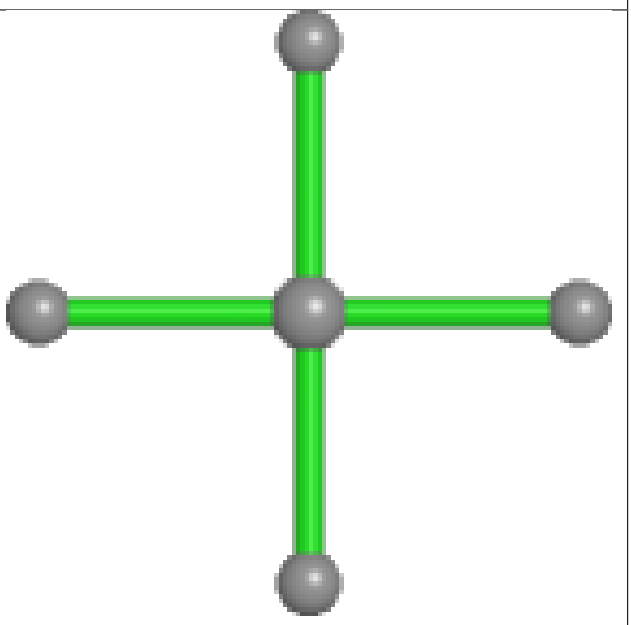
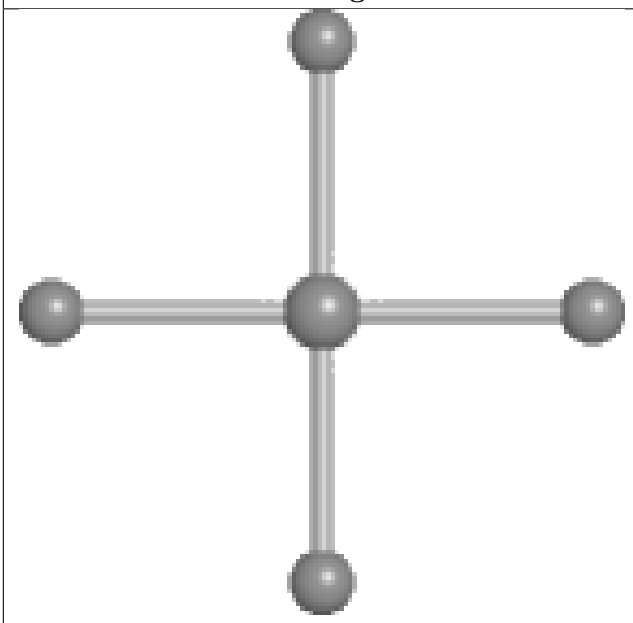


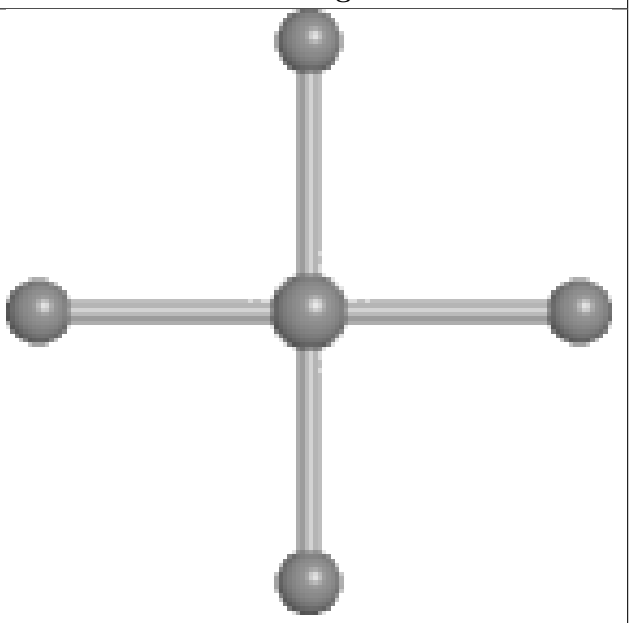
Bond lengths



Bond angles

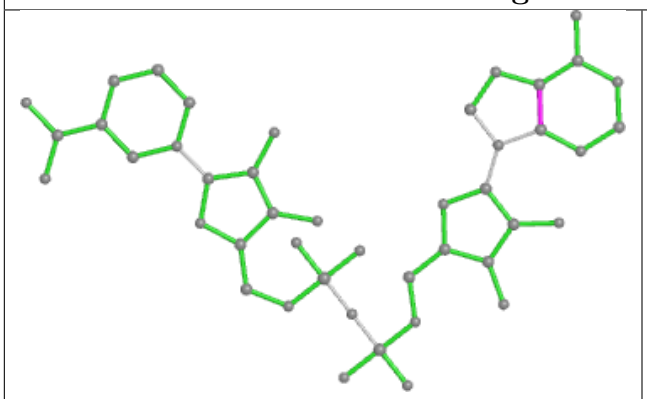


Torsions



Rings

Ligand NAD A 1601



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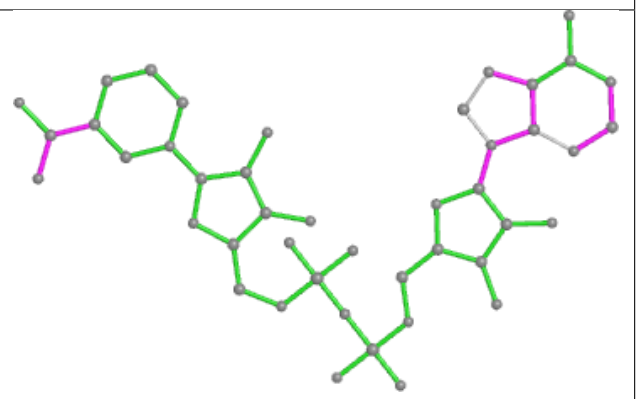

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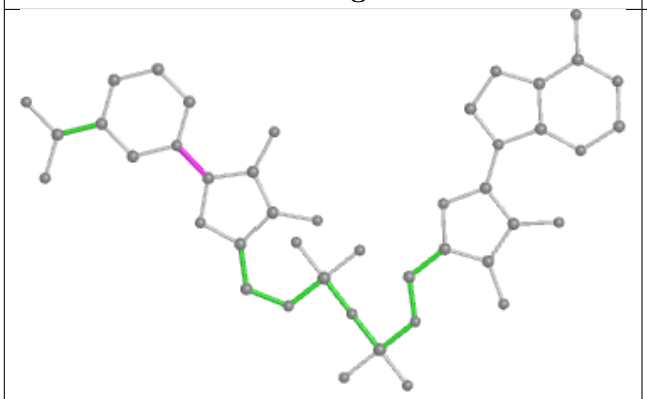

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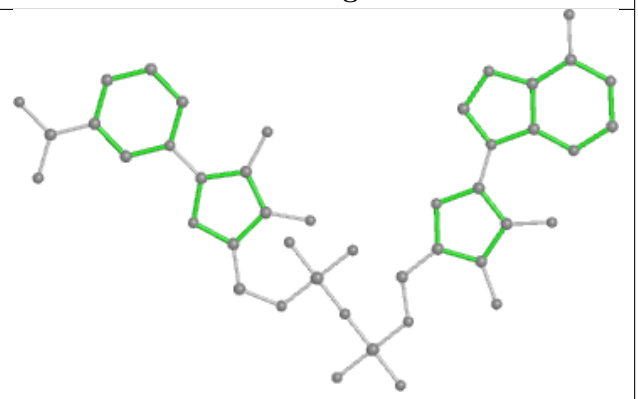
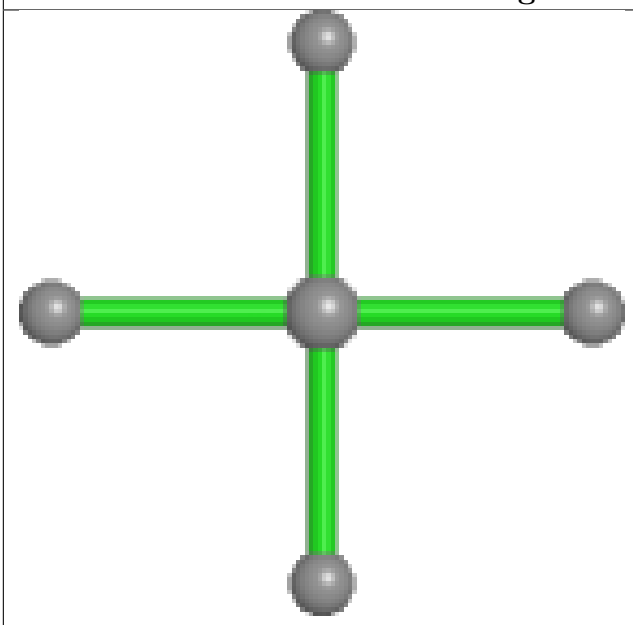
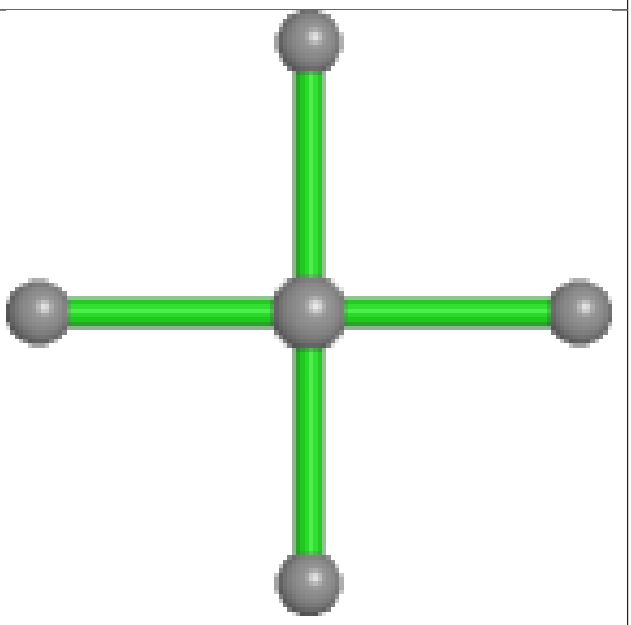


Rings

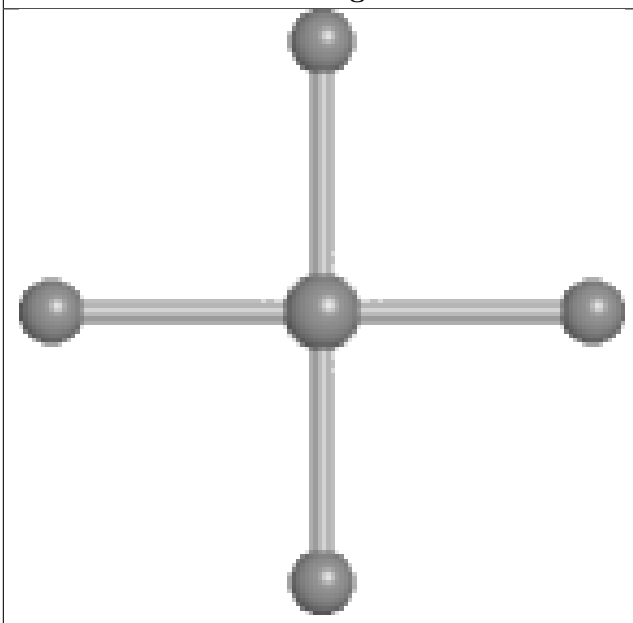
Ligand PO4 B 1609



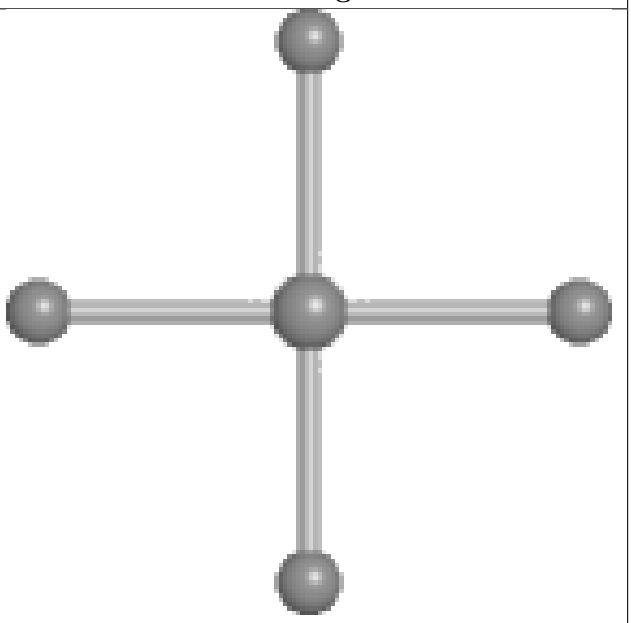
Bond lengths



Bond angles

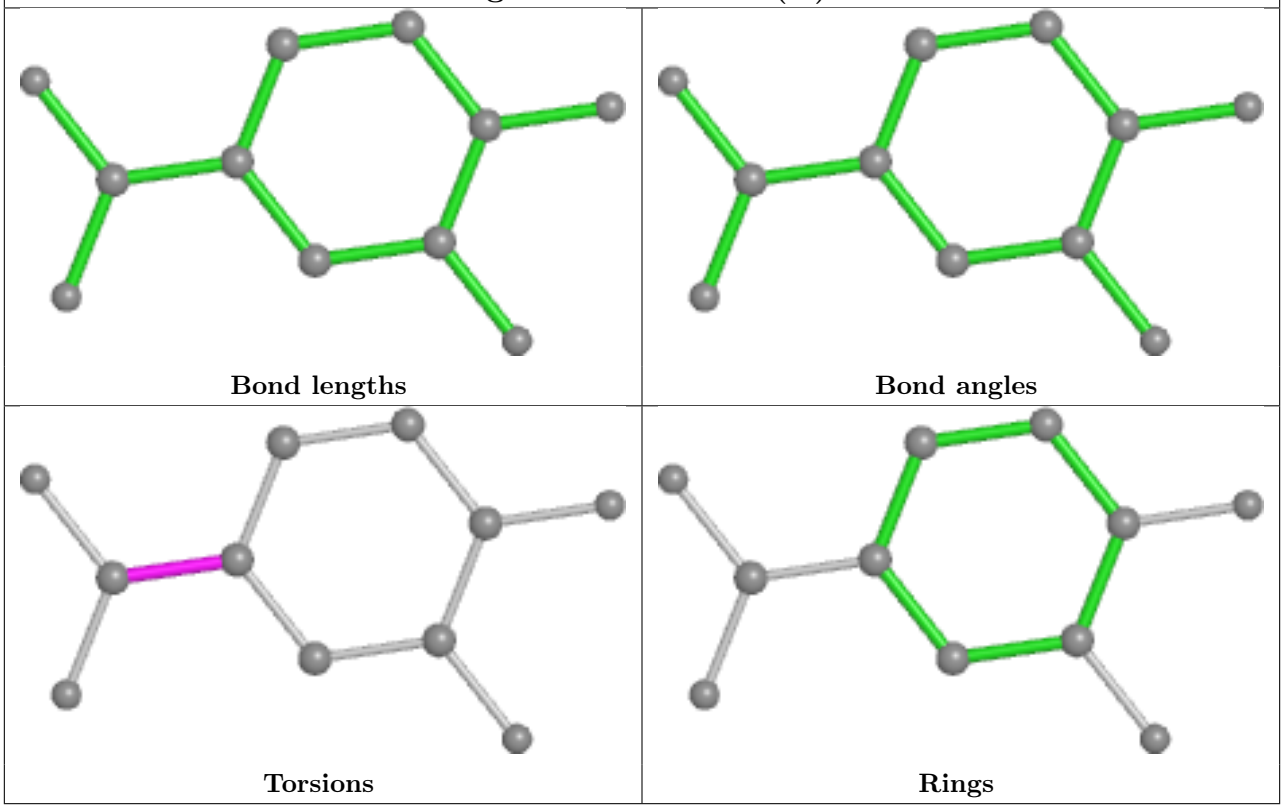


Torsions

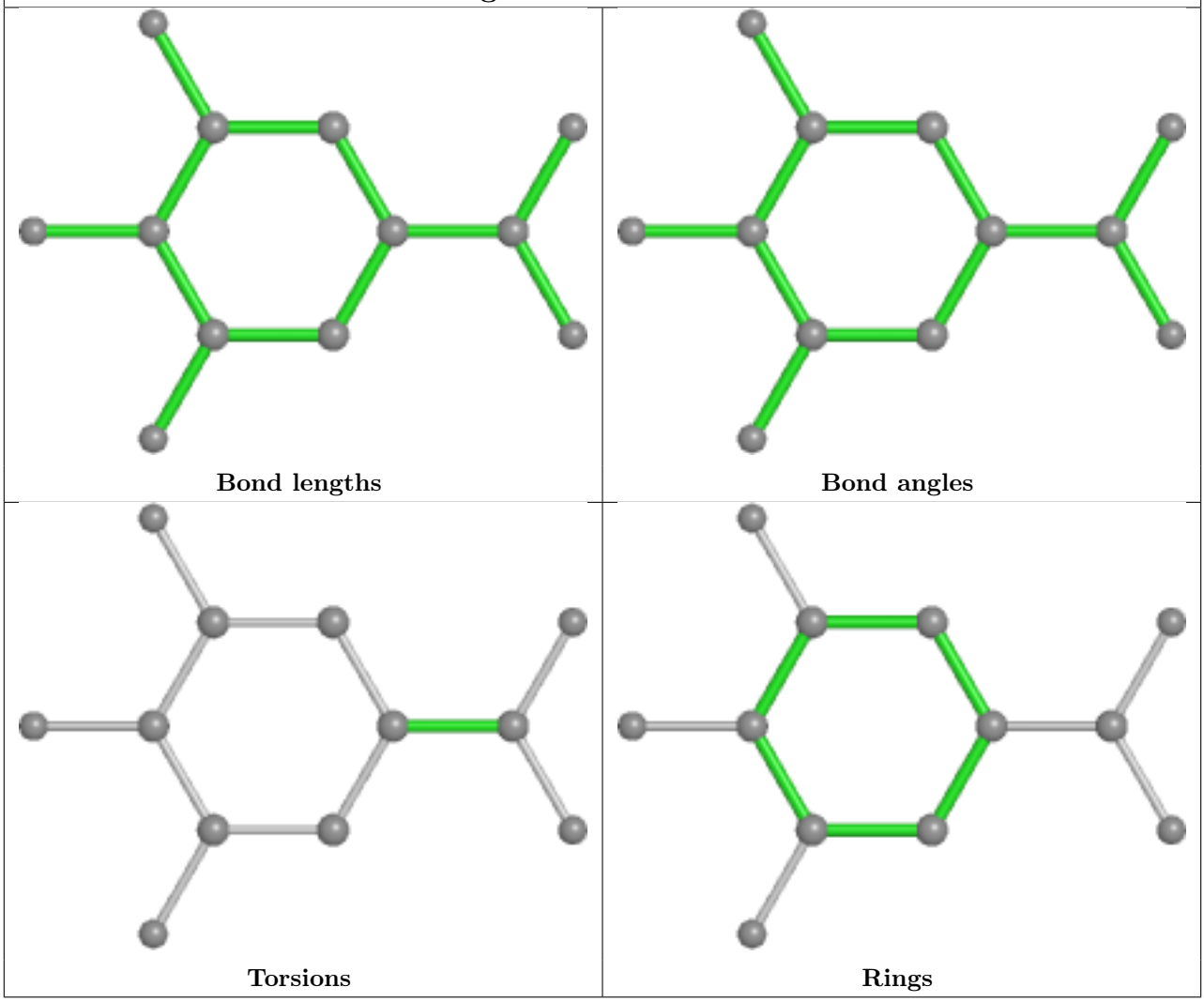


Rings

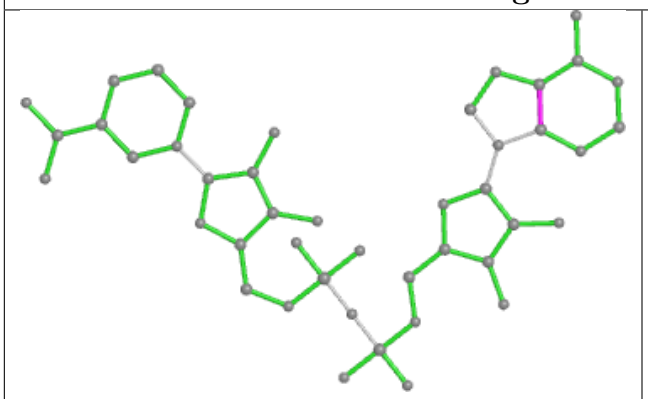
Ligand 3DS A 1605 (A)



Ligand SKM A 1606



Ligand NAD B 1601



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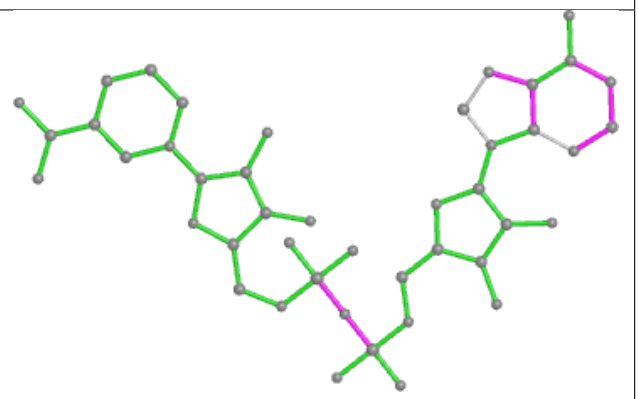
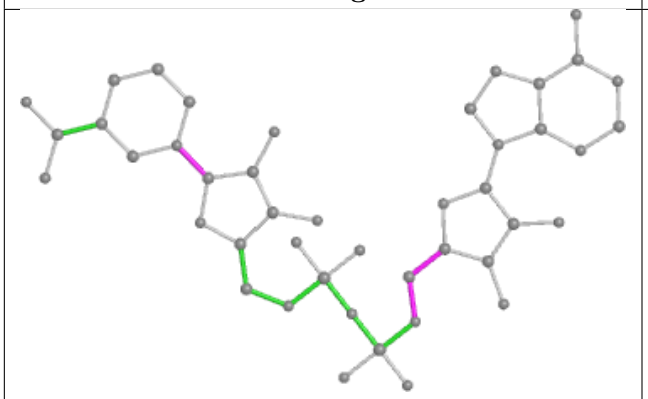
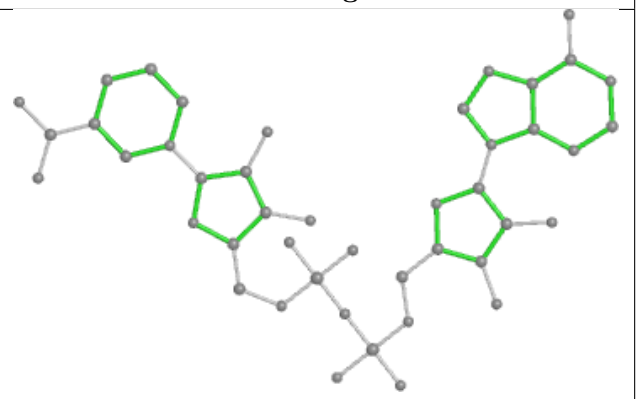


Bond angles

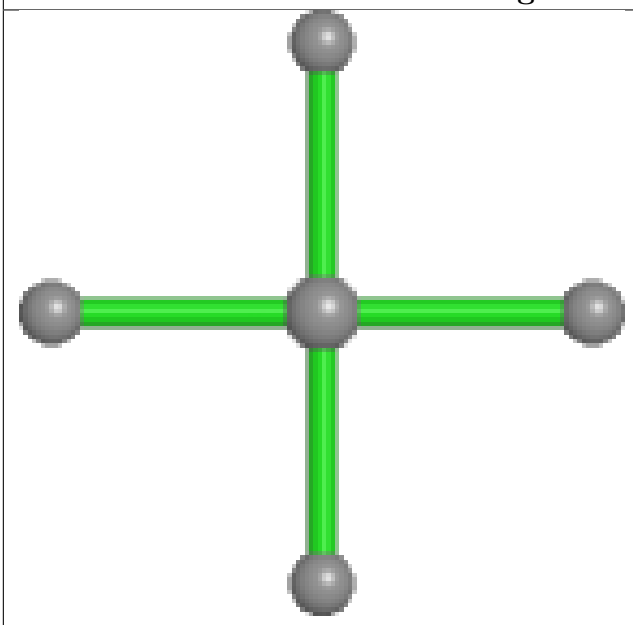


Torsions

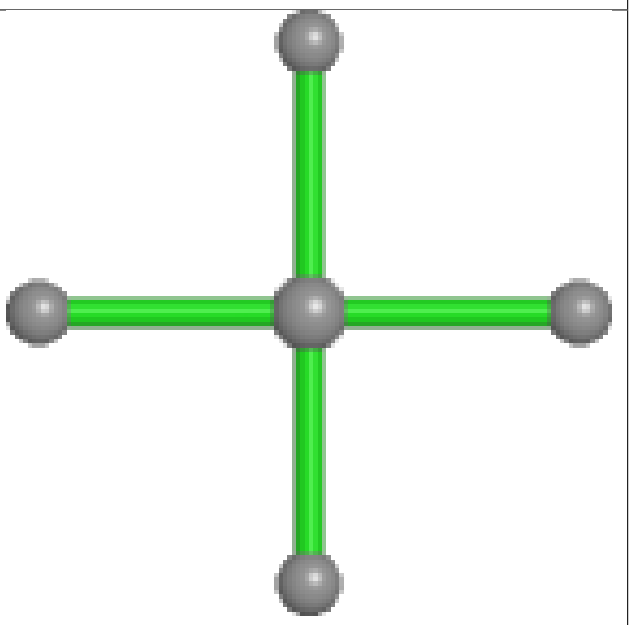


Rings

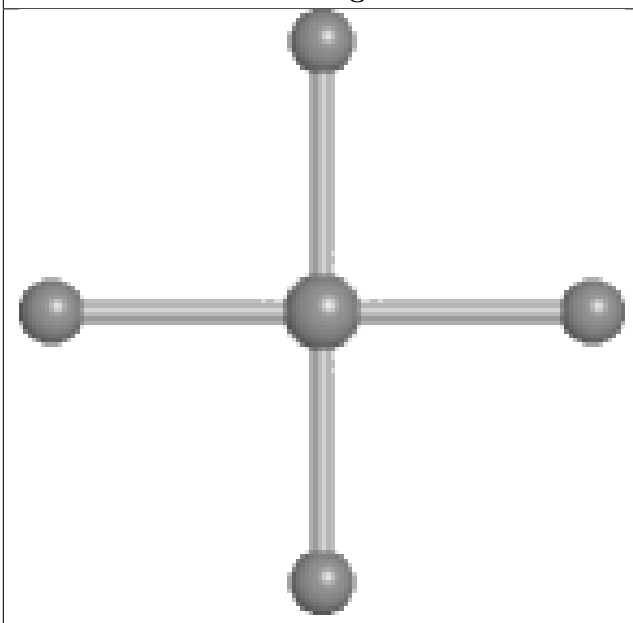
Ligand PO4 A 1604



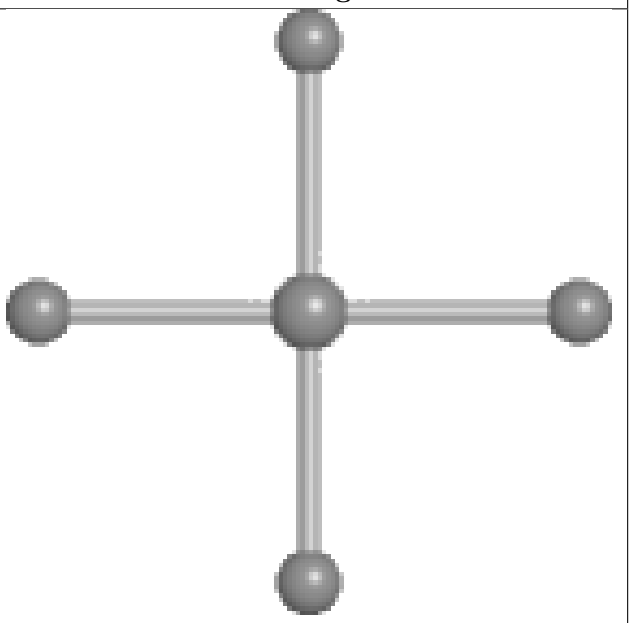
Bond lengths



Bond angles

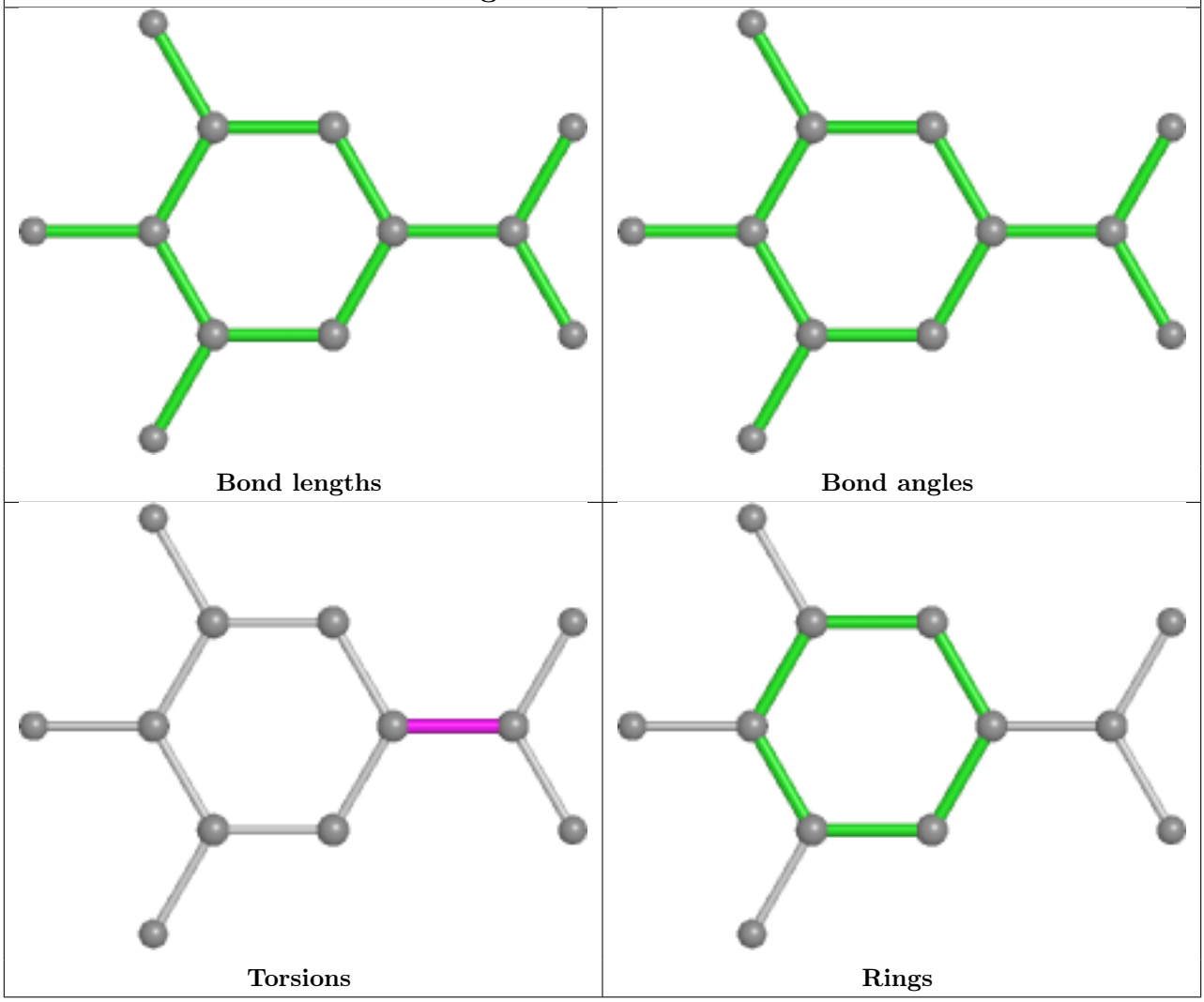


Torsions

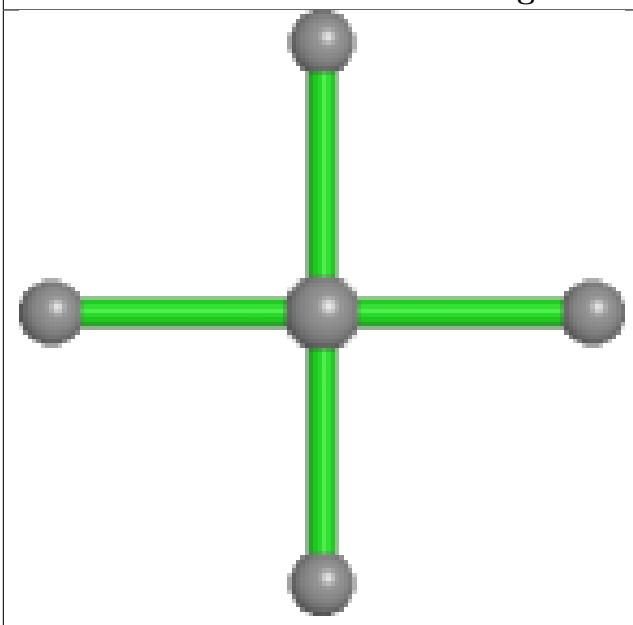


Rings

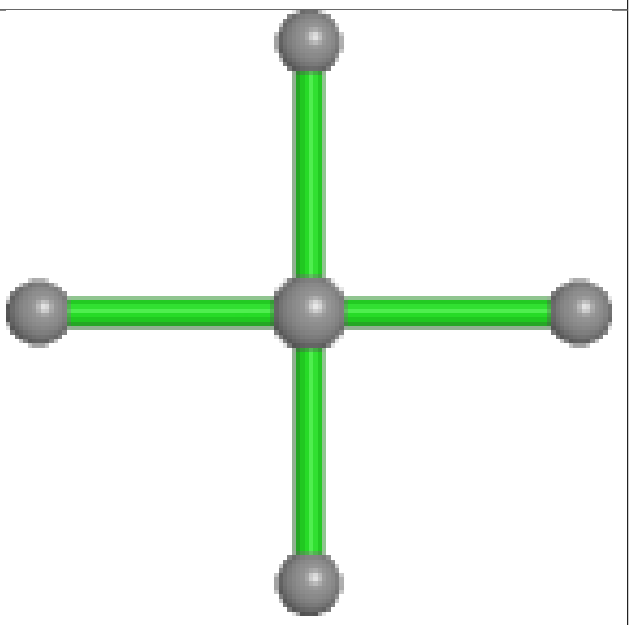
Ligand SKM A 1607



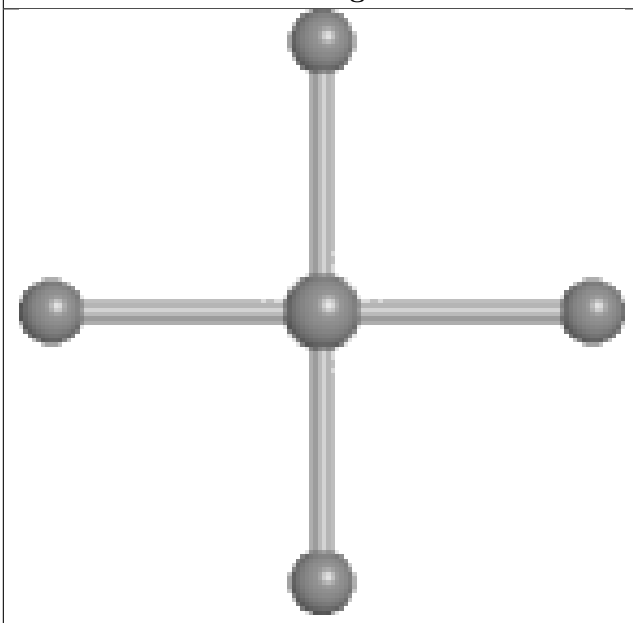
Ligand PO4 A 1610



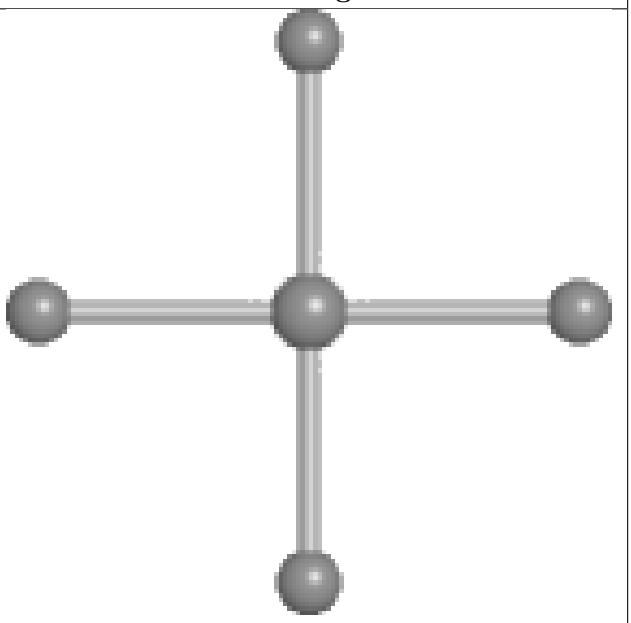
Bond lengths



Bond angles

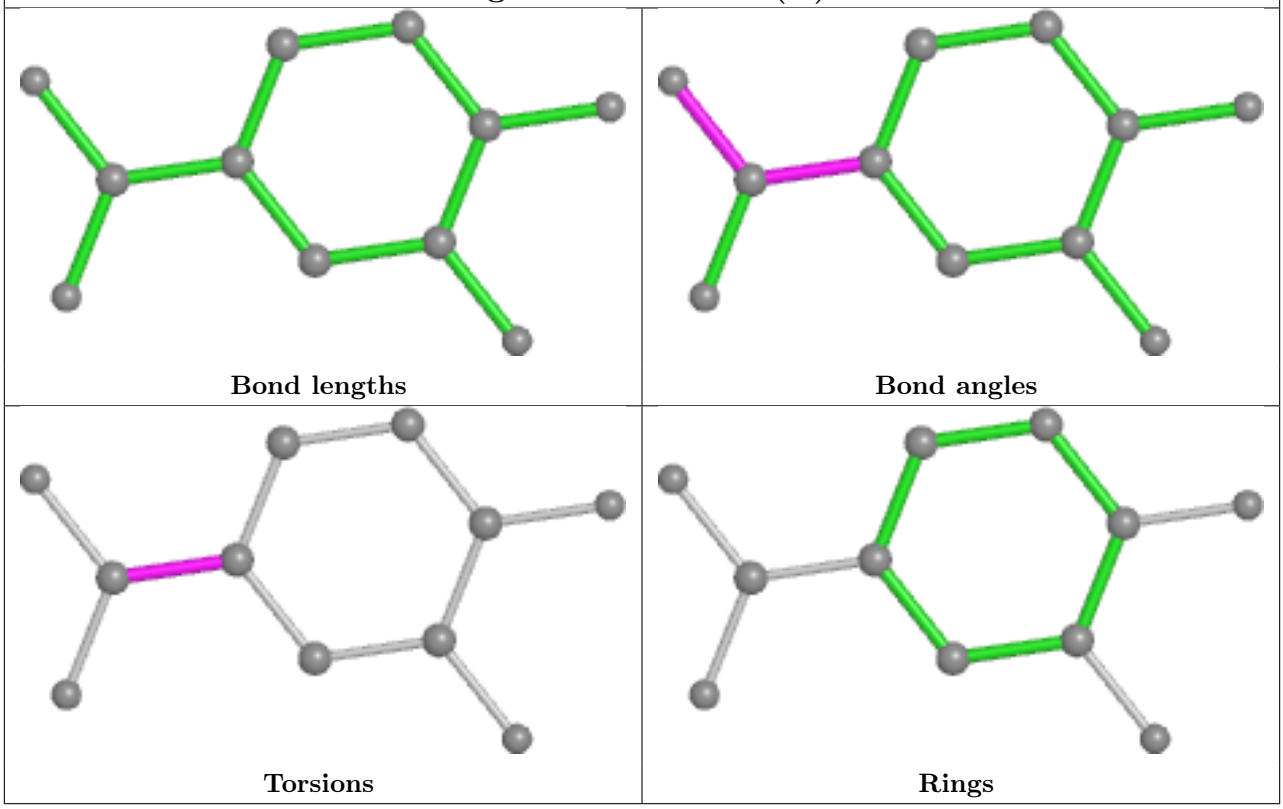


Torsions

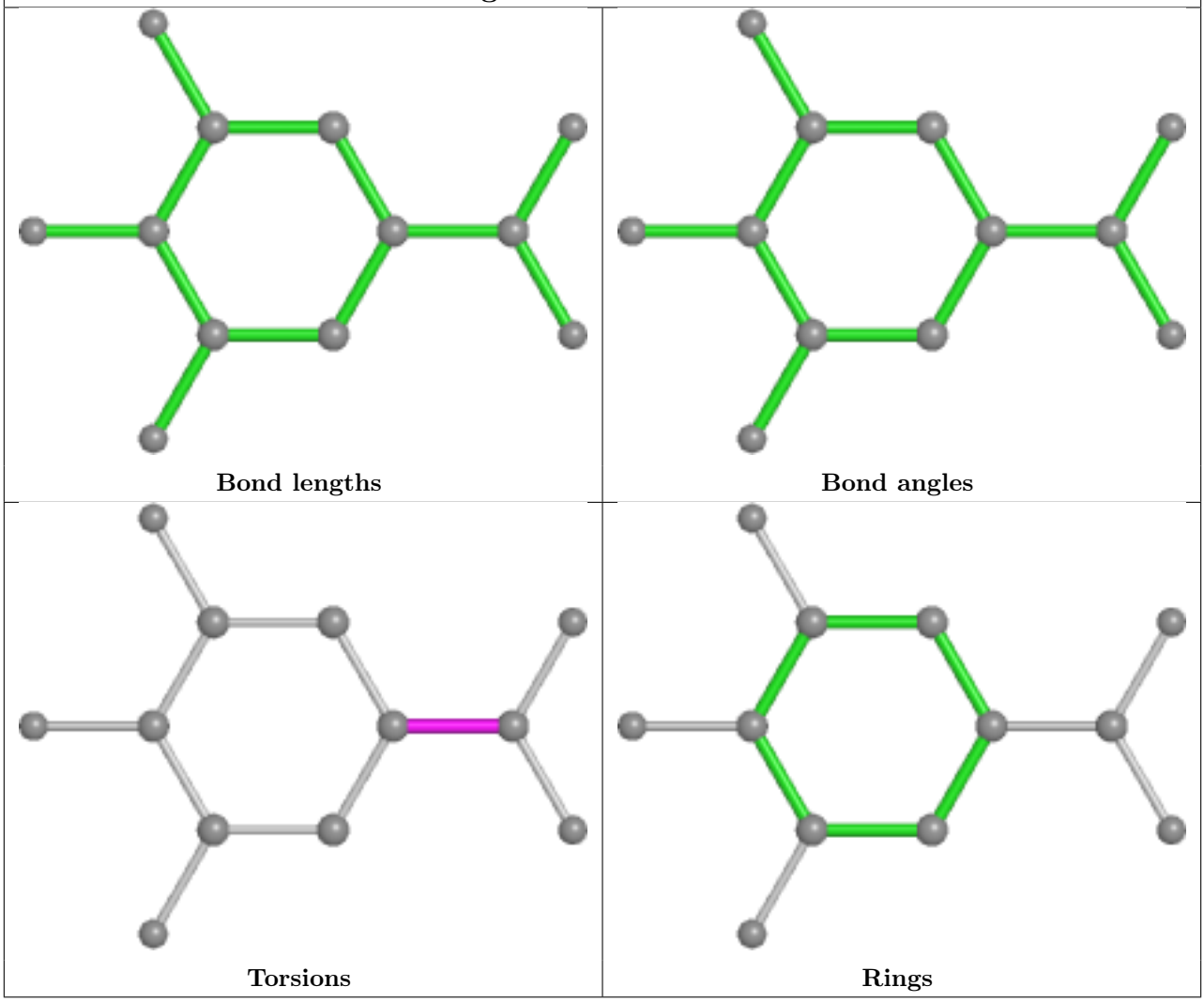


Rings

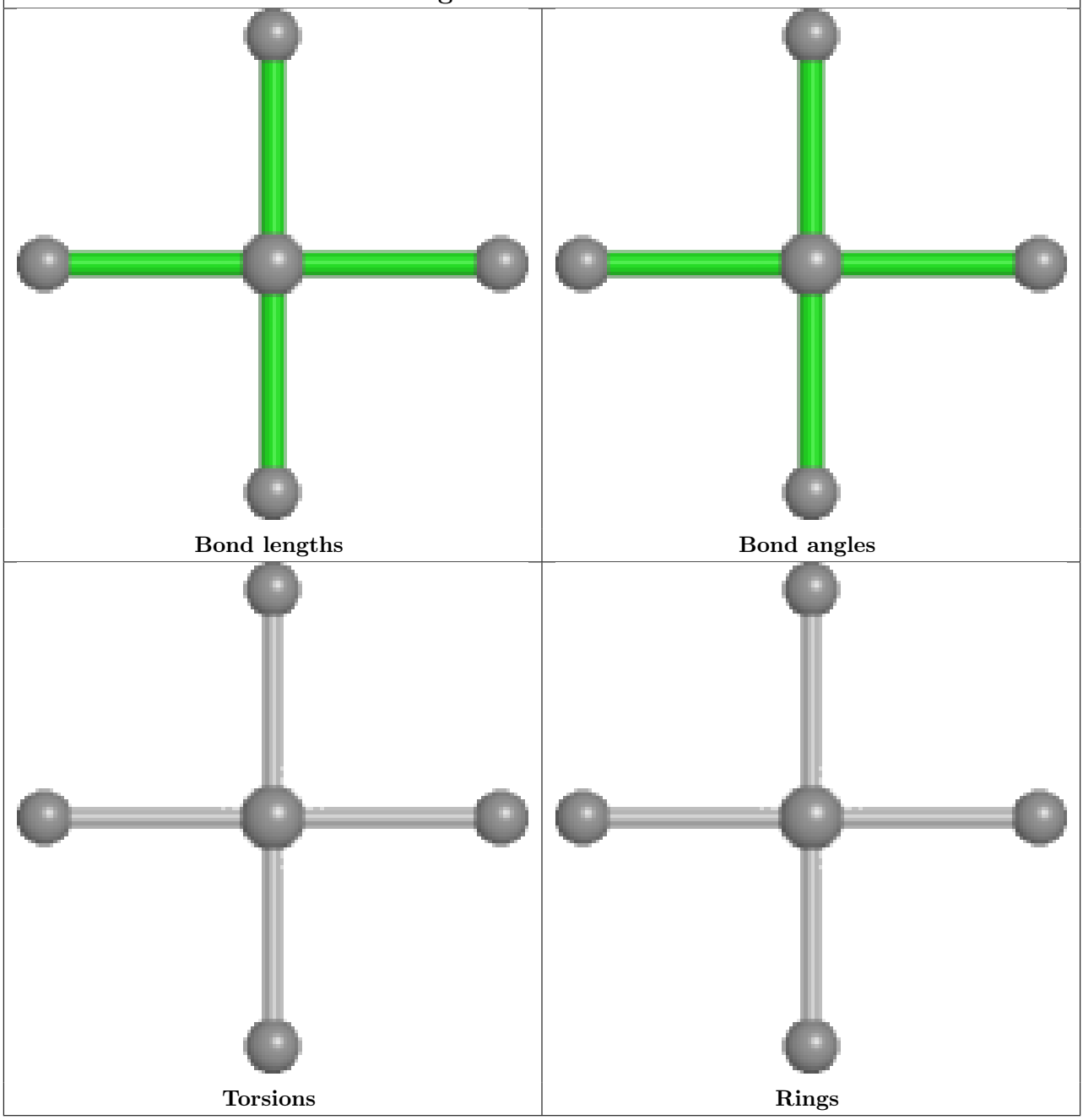
Ligand 3DS B 1605 (A)



Ligand SKM B 1607



Ligand PO4 B 1604



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	1517/1589 (95%)	-0.19	13 (0%)	84	63	66, 107, 174, 222	0
1	B	1499/1589 (94%)	-0.20	17 (1%)	80	56	69, 104, 154, 206	0
All	All	3016/3178 (94%)	-0.19	30 (0%)	82	59	66, 105, 168, 222	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1023	ASP	4.0
1	A	1028	LEU	3.6
1	B	1383	GLY	3.1
1	B	918	GLU	3.1
1	A	1027	ALA	3.1
1	B	1454	GLU	3.0
1	A	918	GLU	2.9
1	B	1427	SER	2.7
1	A	979	ASP	2.7
1	B	1525	GLN	2.6
1	A	994	TYR	2.6
1	A	1024	GLY	2.6
1	A	521	GLY	2.6
1	B	920	GLY	2.5
1	A	1025	SER	2.5
1	B	1578	ASP	2.5
1	B	1384	SER	2.5
1	A	933	GLN	2.4
1	B	1579	SER	2.3
1	B	921	TRP	2.3
1	B	908	GLY	2.3
1	A	776	GLU	2.2
1	B	520	THR	2.2
1	B	919	ARG	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	1494	PRO	2.1
1	A	1479	ASP	2.1
1	B	866	GLY	2.1
1	B	1297	GLY	2.1
1	B	753	LYS	2.0
1	A	527	VAL	2.0

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

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

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	PO4	A	1608	5/5	0.74	0.17	131,134,135,138	1
7	SKM	A	1609	12/12	0.76	0.32	143,148,149,150	0
7	SKM	B	1608	12/12	0.83	0.35	114,126,127,131	0
5	PO4	A	1610	5/5	0.90	0.27	100,100,101,103	1
7	SKM	A	1607	12/12	0.90	0.17	137,140,143,144	0
6	3DS	B	1605[A]	11/12	0.92	0.35	63,64,66,67	11
5	PO4	B	1609	5/5	0.92	0.17	90,91,93,94	1
5	PO4	B	1604	5/5	0.93	0.22	77,79,82,83	1
7	SKM	B	1607	12/12	0.93	0.21	131,132,137,138	0
6	3DS	A	1605[A]	11/12	0.93	0.30	60,65,68,68	11
7	SKM	B	1606	12/12	0.94	0.19	108,115,119,119	0
2	NAD	A	1601	44/44	0.94	0.32	73,80,84,87	0
5	PO4	A	1604	5/5	0.94	0.25	82,83,84,85	1
7	SKM	A	1606	12/12	0.96	0.16	88,92,95,97	0
4	GLU	A	1603	10/10	0.96	0.39	90,97,98,101	0
2	NAD	B	1601	44/44	0.96	0.21	72,80,84,87	0
4	GLU	B	1603	10/10	0.97	0.20	73,88,91,95	0

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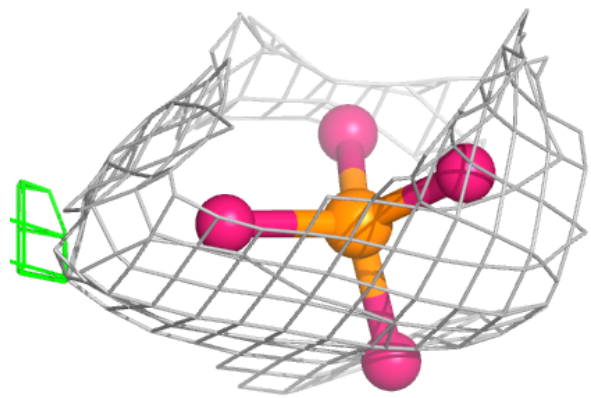
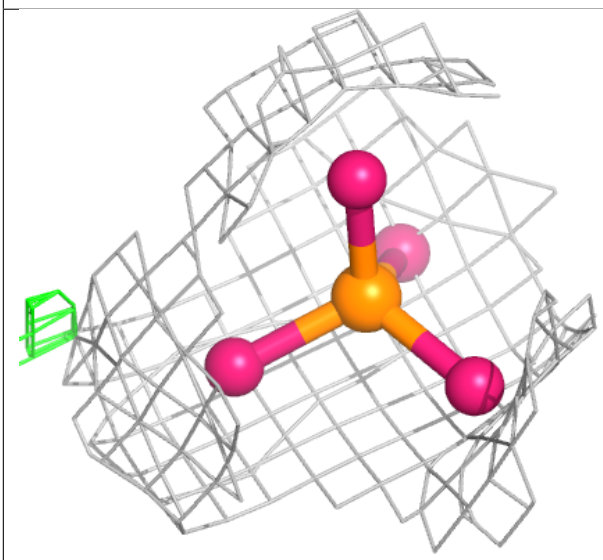
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	ZN	A	1602	1/1	0.99	0.25	78,78,78,78	0
3	ZN	B	1602	1/1	1.00	0.18	77,77,77,77	0

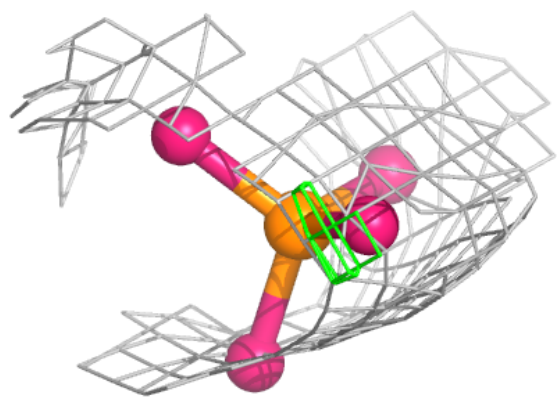
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around PO4 A 1608:

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

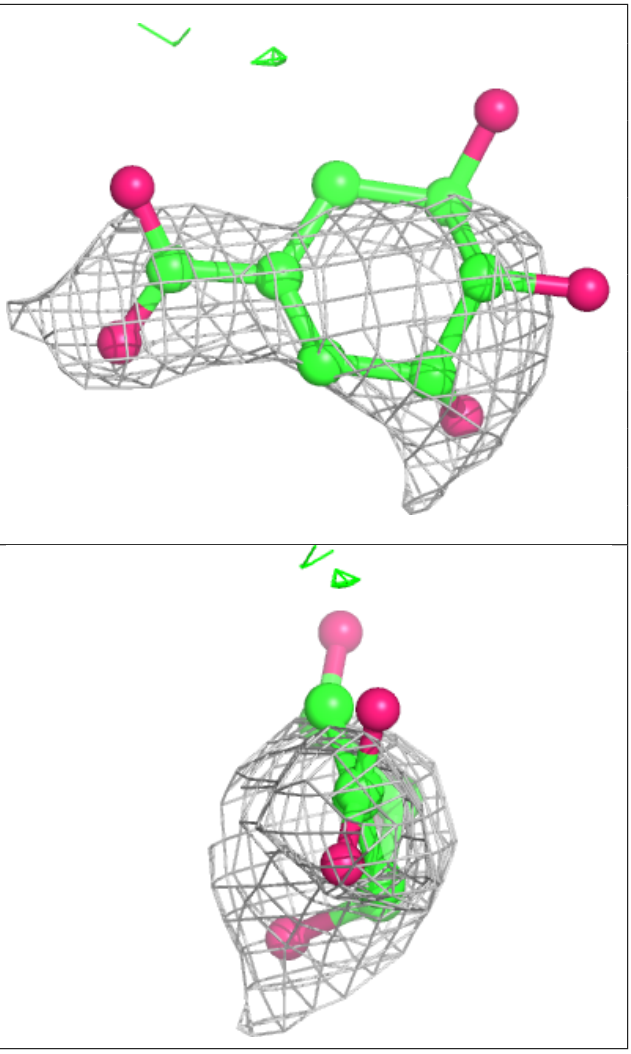






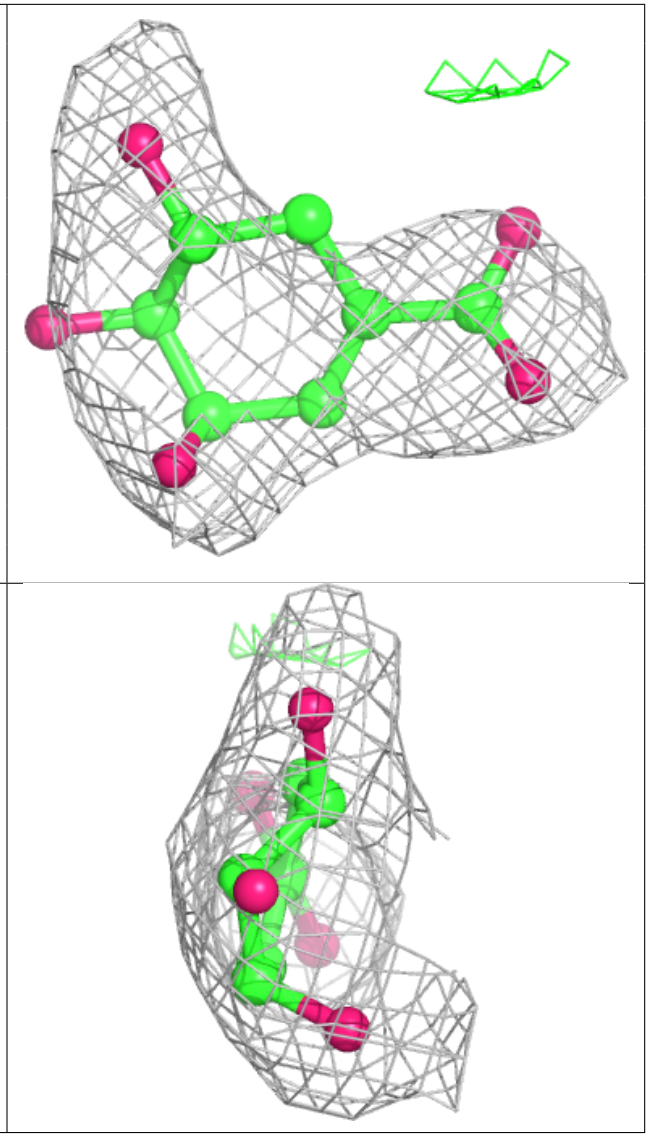
Electron density around SKM A 1609:

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



Electron density around SKM B 1608:

$2mF_o$-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 A 1610:

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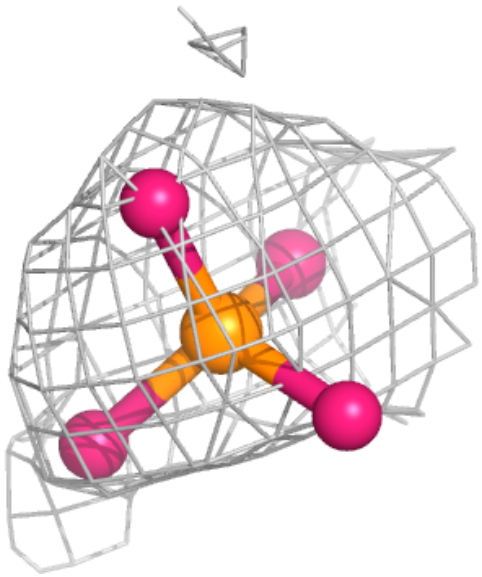
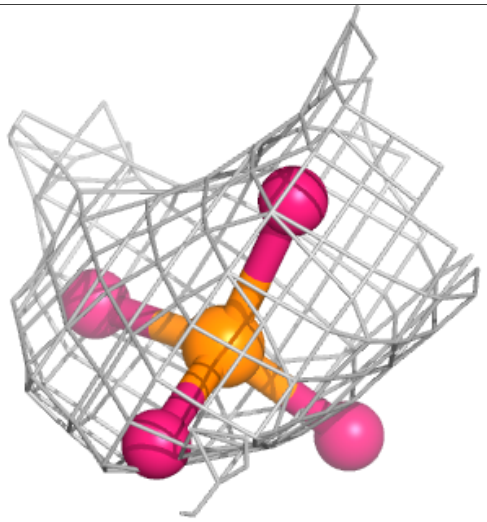
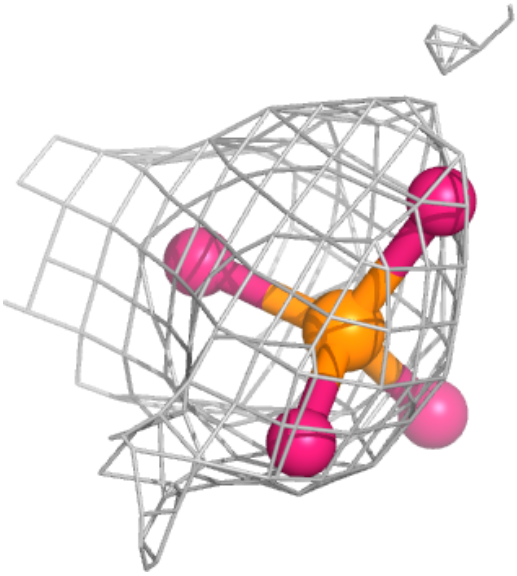
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)







Electron density around SKM A 1607:

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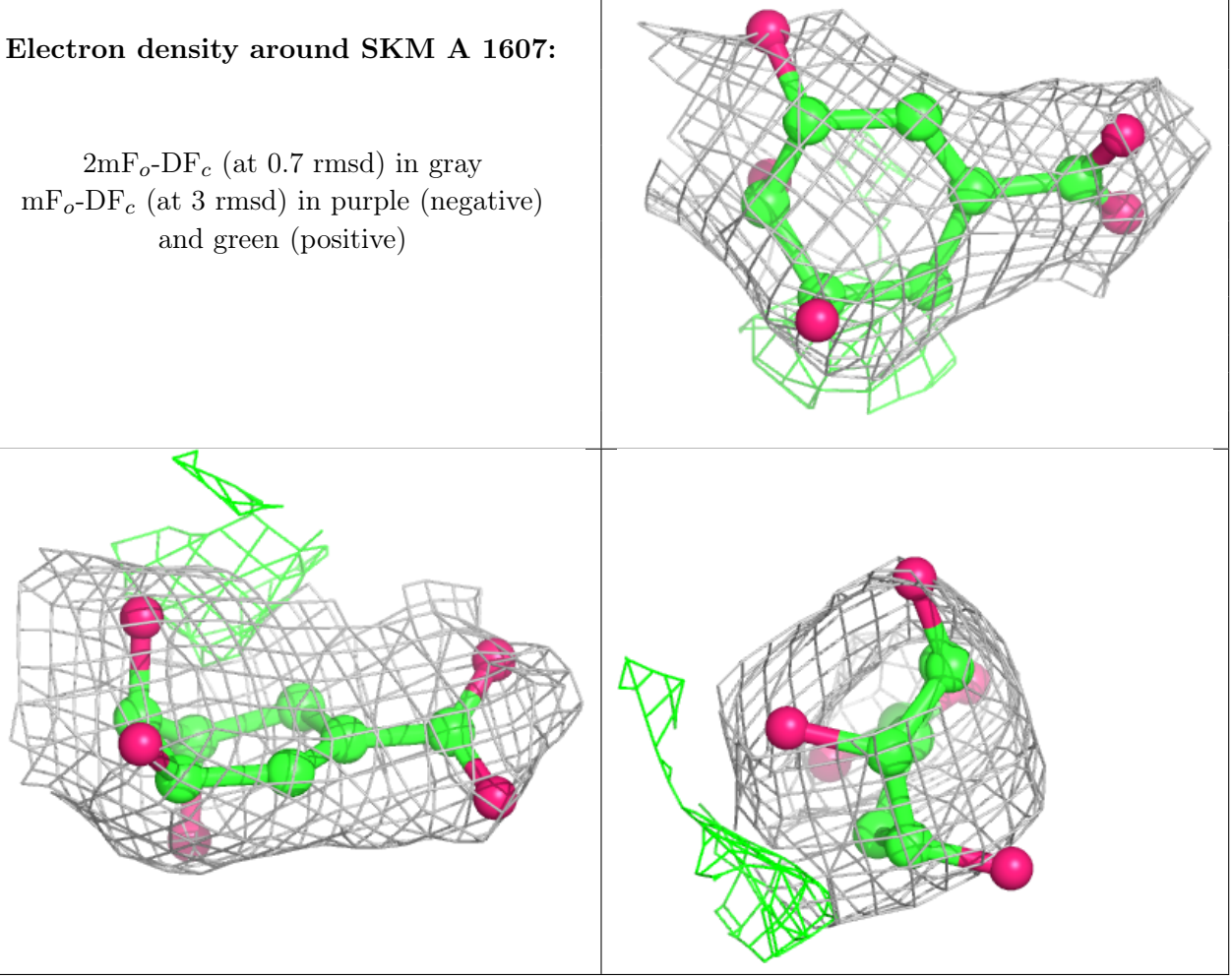
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around 3DS B 1605 (A):

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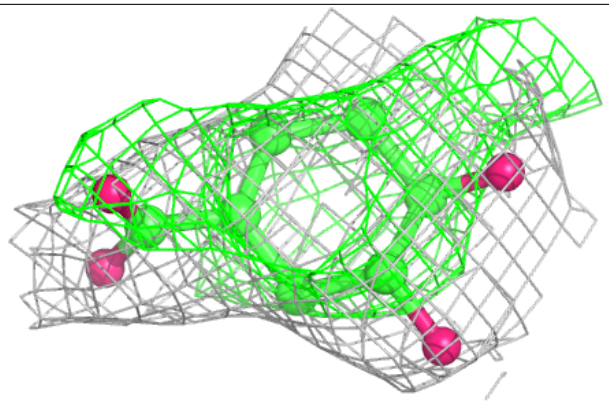
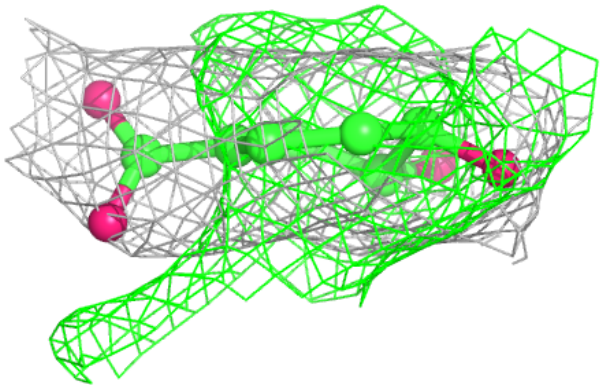
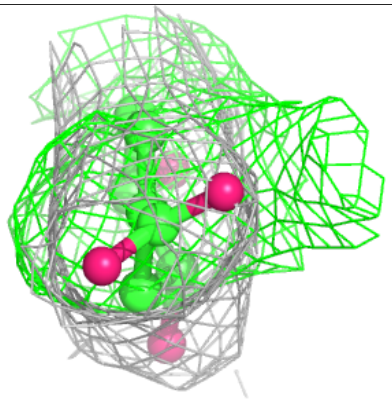
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)







Electron density around PO4 B 1609:

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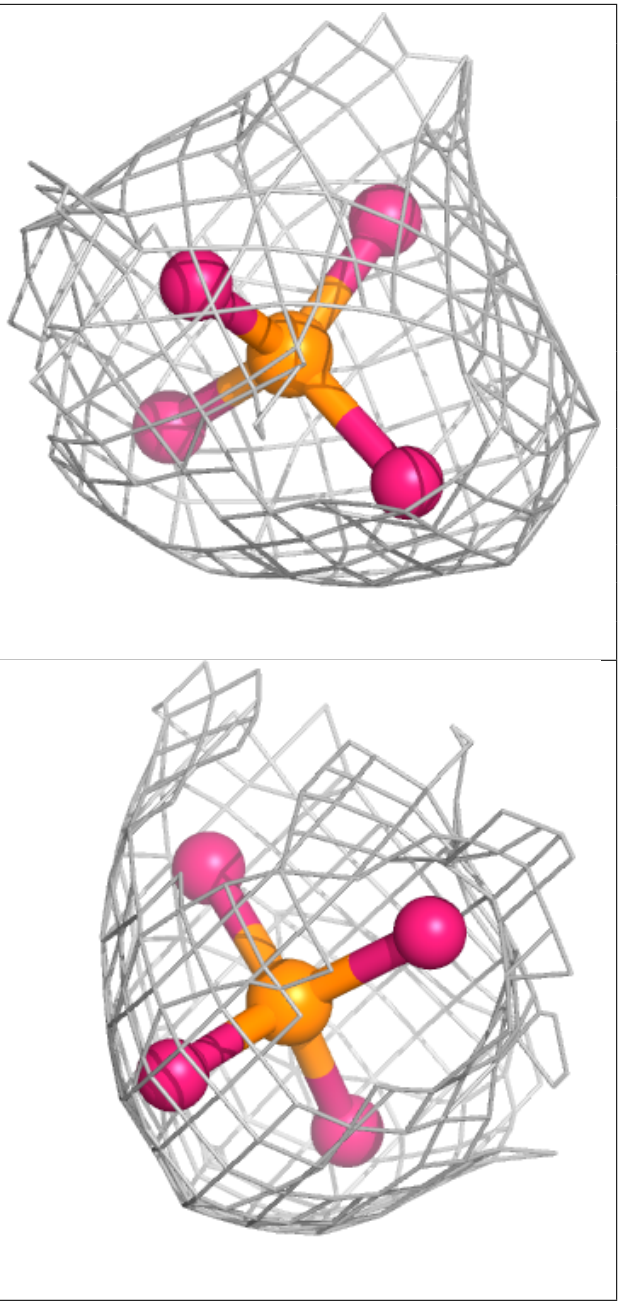
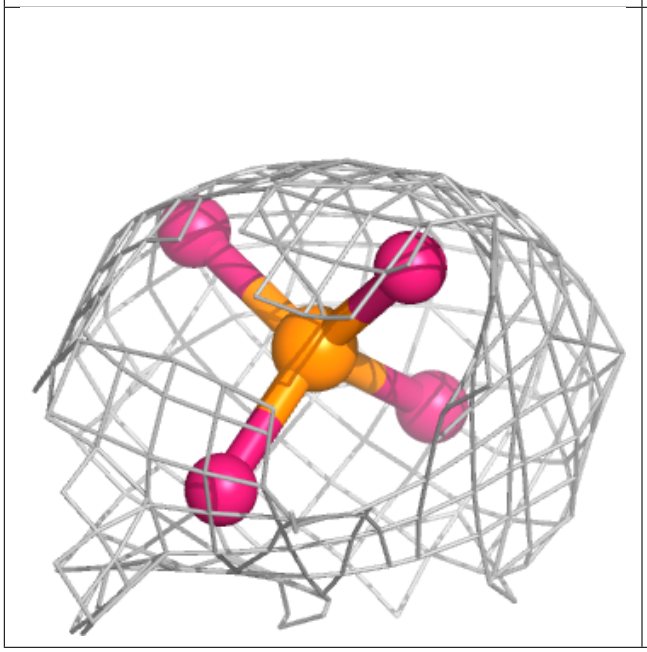
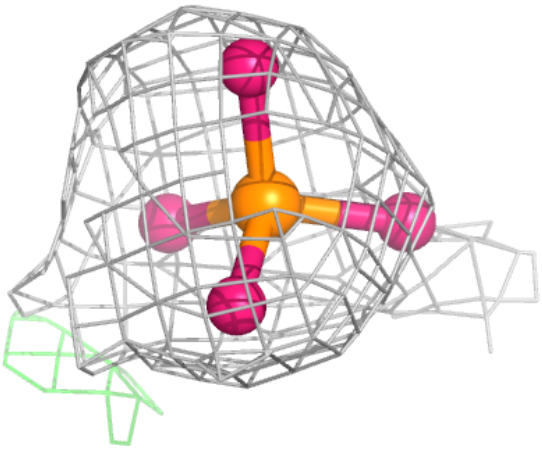
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

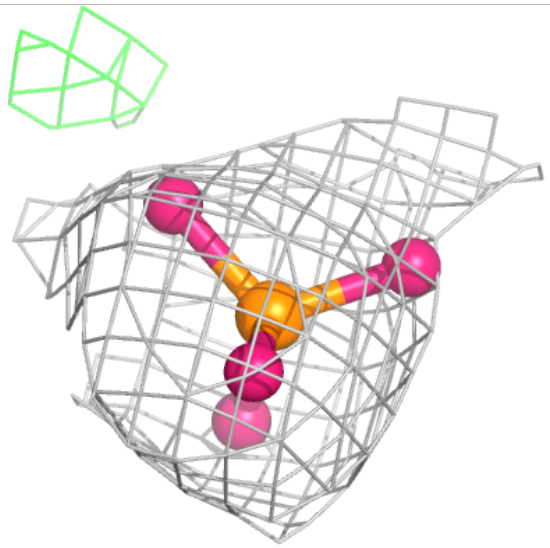


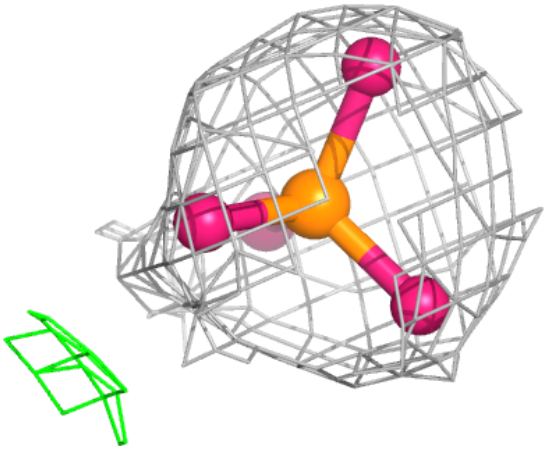


Electron density around PO4 B 1604:

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

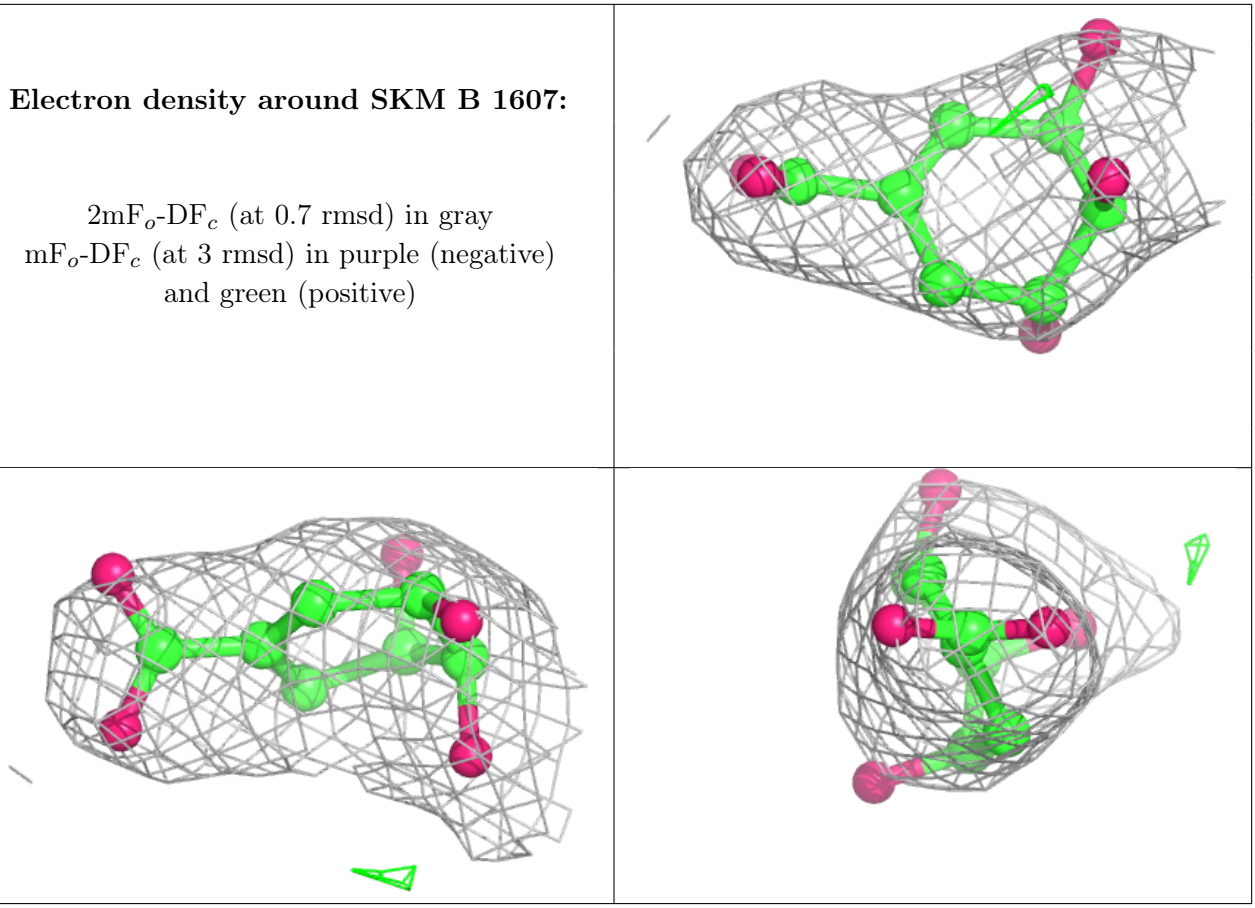






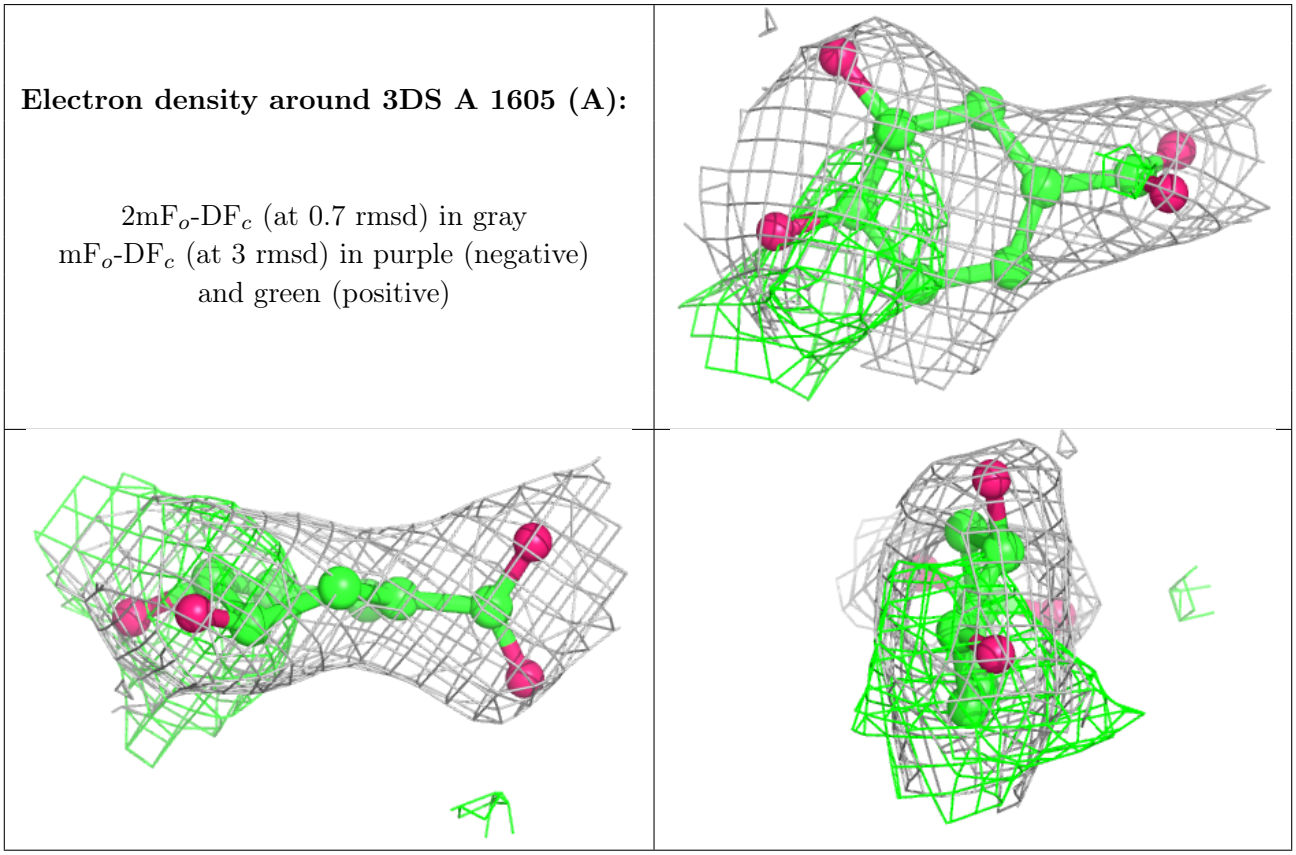
Electron density around SKM B 1607:

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



Electron density around 3DS A 1605 (A):

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



Electron density around SKM B 1606:

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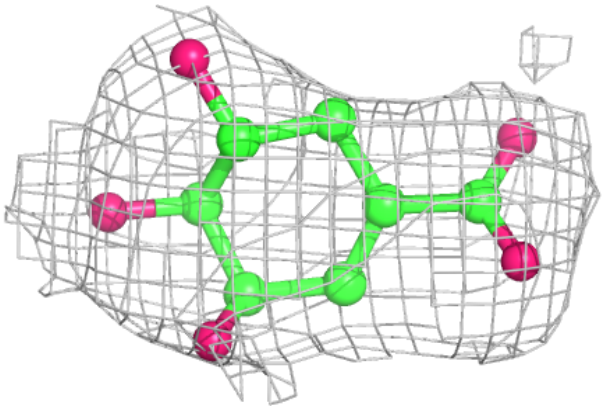
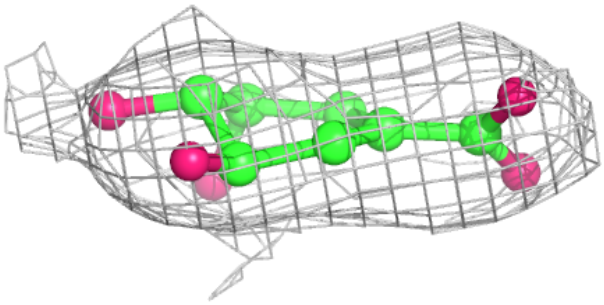
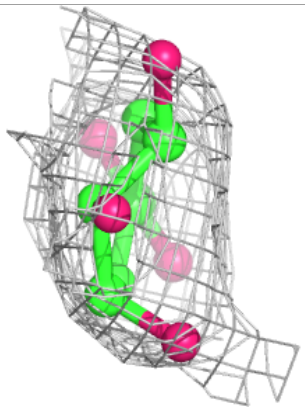
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)







Electron density around NAD A 1601:

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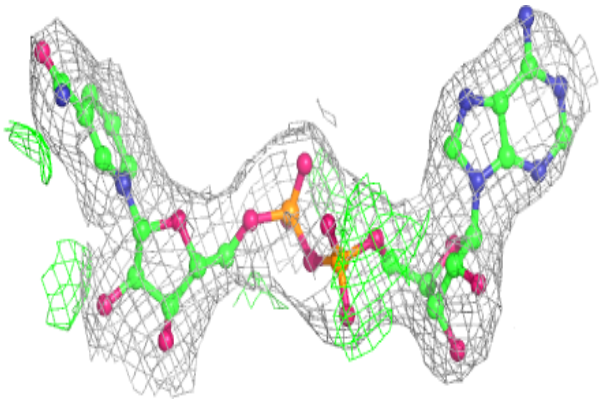
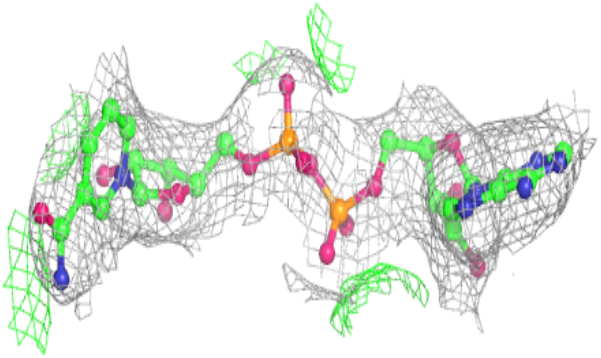
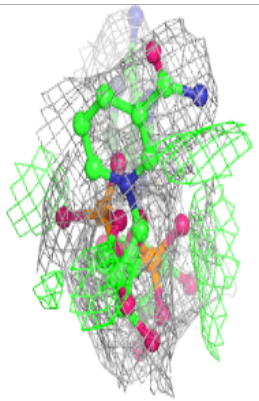
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

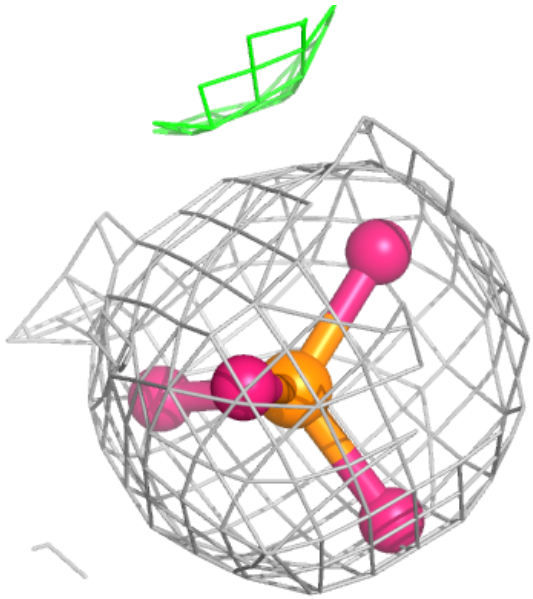


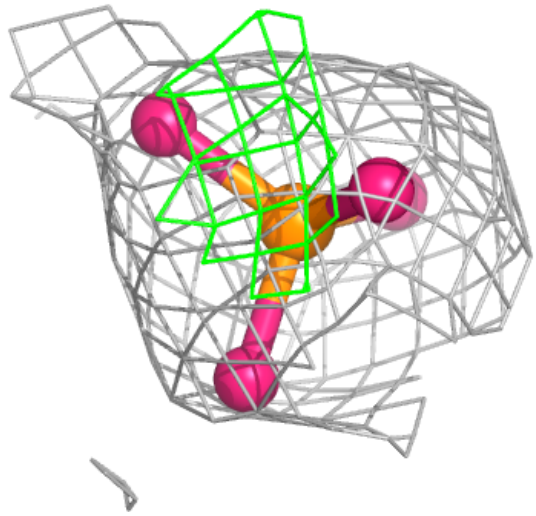


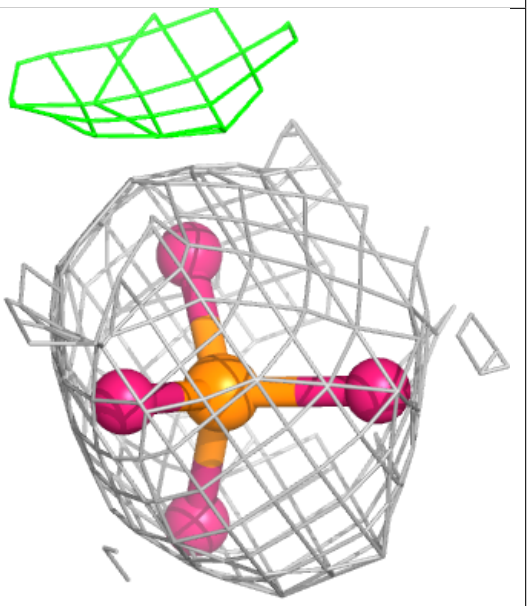


Electron density around PO4 A 1604:

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

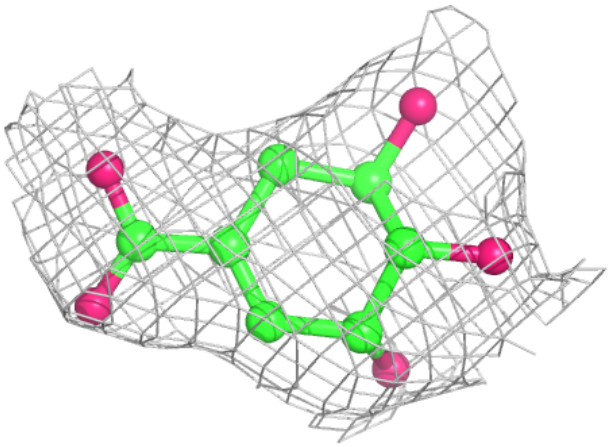


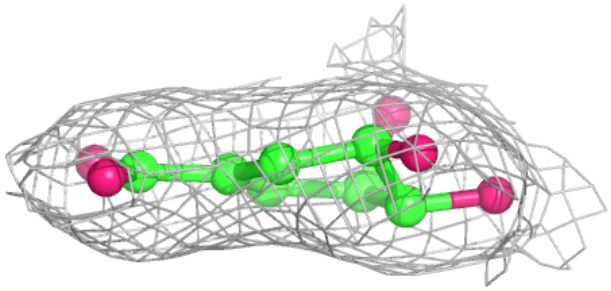


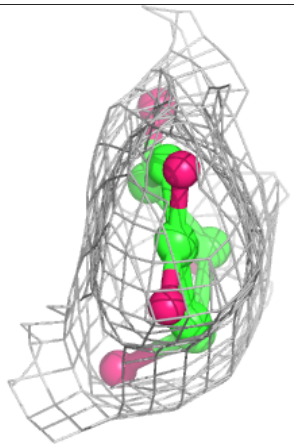


Electron density around SKM A 1606:

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

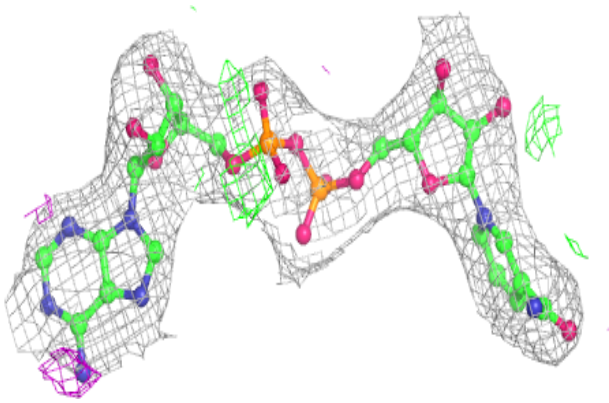


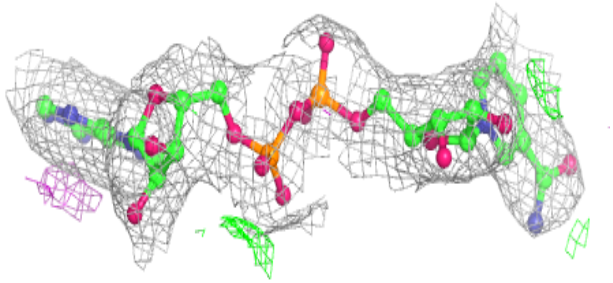


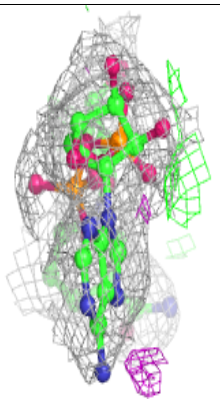


Electron density around NAD B 1601:

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

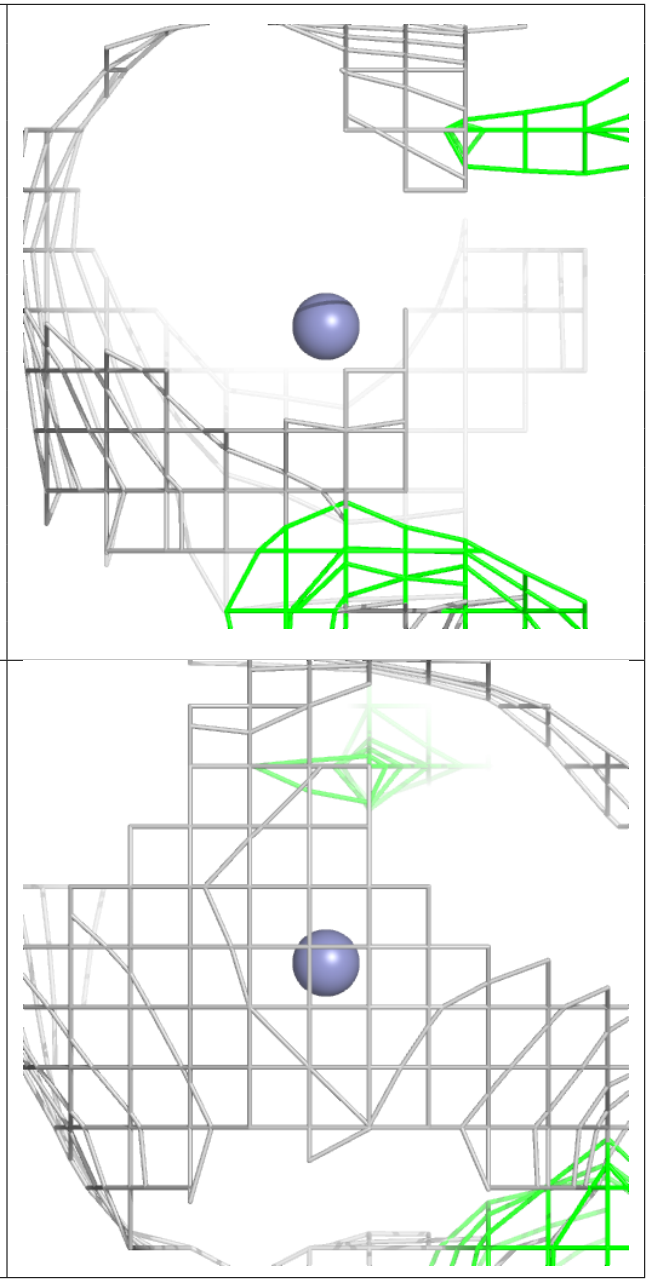






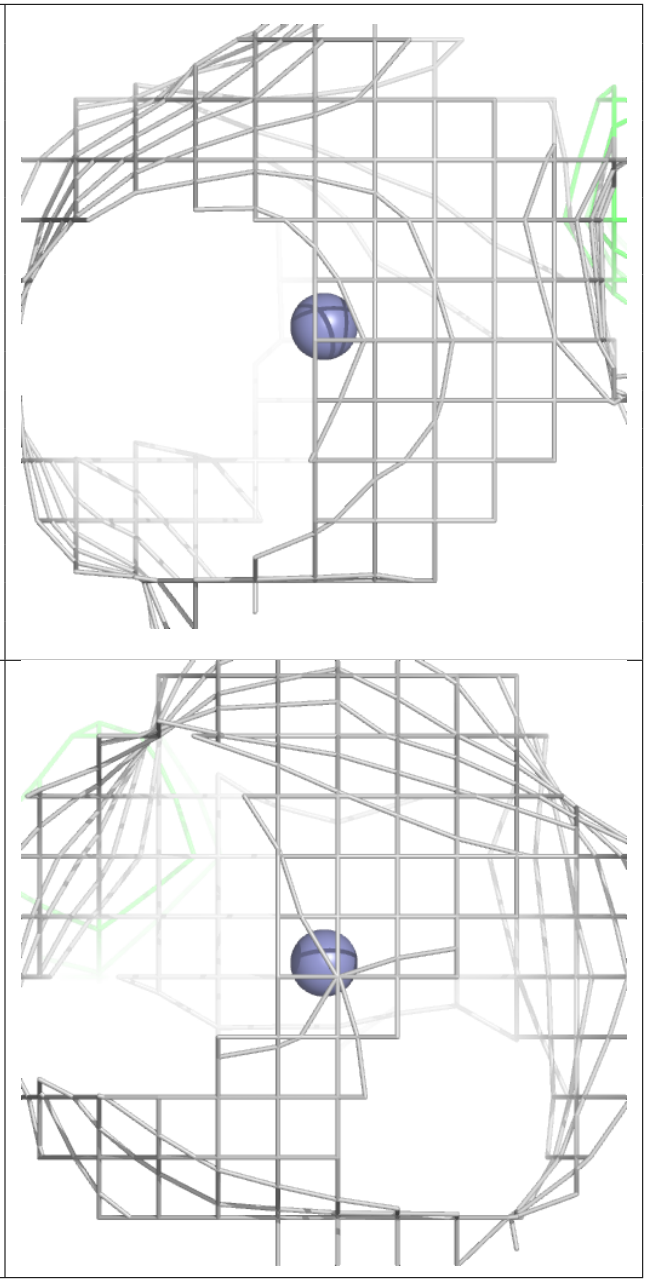
Electron density around ZN A 1602:

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



Electron density around ZN B 1602:

$2mF_o$-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.