Full wwPDB X-ray Structure Validation Report (i)

Oct 3, 2023 – 12:20 AM EDT

PDB ID	:	6OP1
Title	:	Selenium incorporated, carbon monoxide inhibited FeMo-cofactor of azotobacter vinelandii
Authors	:	Arias, R.J.; Rees, D.C.
Deposited on	:	2019-04-24
Resolution	:	1.70 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 (1)) were used in the production of this report:

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

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 1.70 Å.

There are no overall percentile quality scores available for this entry.

MolProbity and EDS failed to run properly - the sequence quality summary graphics cannot be shown.

2 Entry composition (i)

There are 10 unique types of molecules in this entry. The entry contains 17994 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.

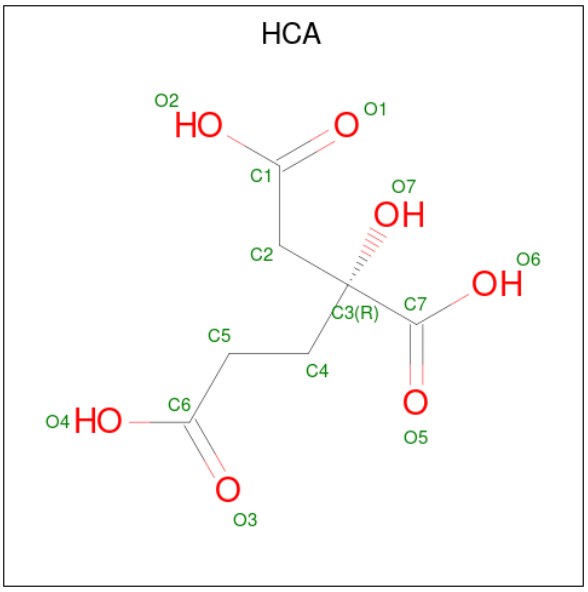
- Molecule 1 is a protein called Nitrogenase molybdenum-iron protein alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	477	3832	2433	653	718	28	0	5	0
1	C	477	3820	2426	652	714	28	0	7	0

- Molecule 2 is a protein called Nitrogenase molybdenum-iron protein beta chain.

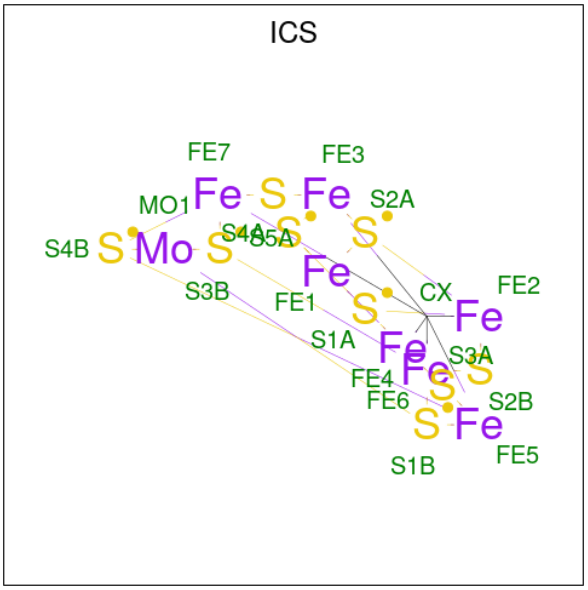
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	522	4186	2674	704	778	30	0	4	0
2	D	522	4238	2702	715	790	31	0	10	0

- Molecule 3 is 3-HYDROXY-3-CARBOXY-ADIPIC ACID (three-letter code: HCA) (formula: $C_7H_{10}O_7$).



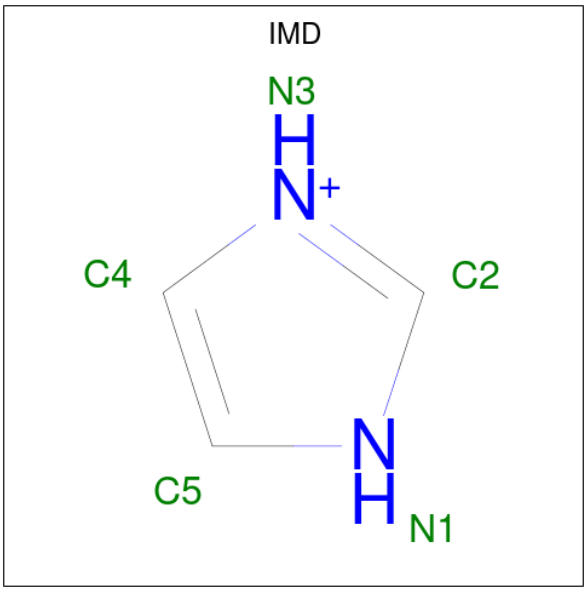
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	14	7	7	0	0
			Total	C	O		
3	C	1	14	7	7	0	0

- Molecule 4 is iron-sulfur-molybdenum cluster with interstitial carbon (three-letter code: ICS) (formula: CFe_7MoS_9) (labeled as "Ligand of Interest" by depositor).



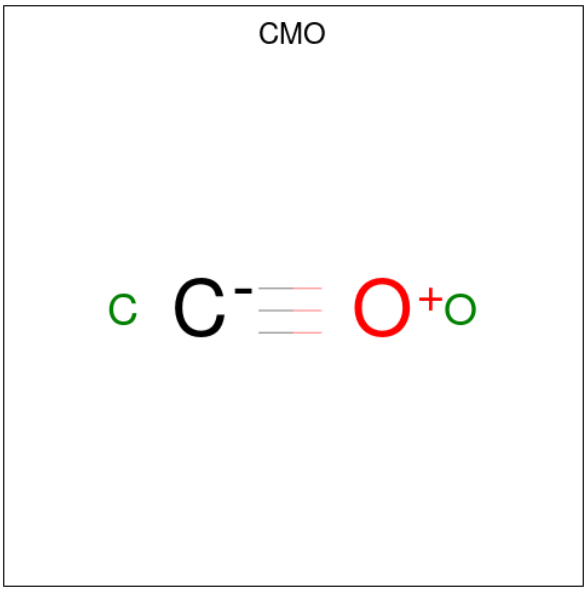
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Fe	Mo	S		
4	A	1	17	1	7	1	8	0	0
			Total	C	Fe	Mo	S		
4	C	1	17	1	7	1	8	0	0

- Molecule 5 is IMIDAZOLE (three-letter code: IMD) (formula: $C_3H_5N_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	N		
5	A	1	5	3	2	0	0
5	A	1	5	3	2	0	0
5	B	1	5	3	2	0	0
5	B	1	5	3	2	0	0
5	B	1	5	3	2	0	0
5	C	1	5	3	2	0	0
5	D	1	5	3	2	0	0
5	D	1	5	3	2	0	0
5	D	1	5	3	2	0	0

- Molecule 6 is CARBON MONOXIDE (three-letter code: CMO) (formula: CO).

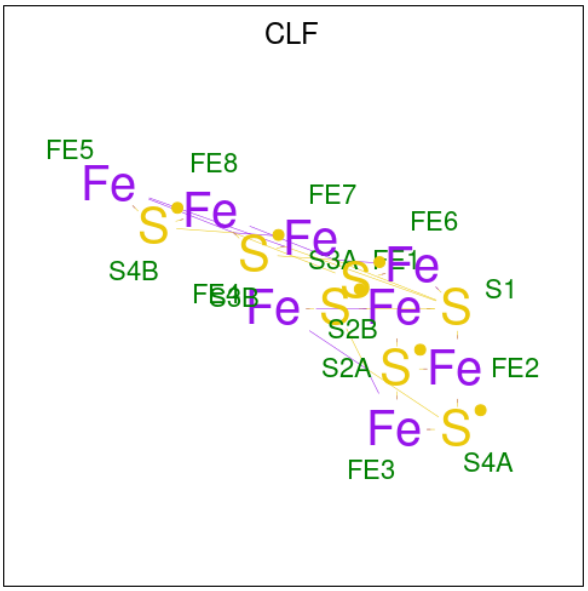


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
6	A	1	2	1	1	0	0
			Total	C	O		
6	C	1	2	1	1	0	0

- Molecule 7 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

- Molecule 8 is FE(8)-S(7) CLUSTER (three-letter code: CLF) (formula: Fe_8S_7).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total Fe S 15 8 7	0	0
8	C	1	Total Fe S 15 8 7	0	0

- Molecule 9 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	B	2	Total Ca 2 2	0	0

- Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	376	Total O 376 376	0	0
10	B	512	Total O 512 512	0	0
10	C	379	Total O 379 379	0	0
10	D	503	Total O 503 503	0	0

MolProbity and EDS failed to run properly - this section is therefore empty.

3 Data and refinement statistics (i)

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	77.19Å 128.00Å 107.63Å 90.00° 109.15° 90.00°	Depositor
Resolution (Å)	36.93 – 1.70	Depositor
% Data completeness (in resolution range)	98.5 (36.93-1.70)	Depositor
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.35 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.8.0230	Depositor
R, R_{free}	0.132 , 0.165	Depositor
Wilson B-factor (Å^2)	13.1	Xtriage
Anisotropy	0.023	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	0.019 for h,-k,-h-l	Xtriage
Total number of atoms	17994	wwPDB-VP
Average B, all atoms (Å^2)	16.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.44% 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.

4 Model quality (i)

4.1 Standard geometry (i)

MolProbity failed to run properly - this section is therefore empty.

4.2 Too-close contacts (i)

MolProbity failed to run properly - this section is therefore empty.

4.3 Torsion angles (i)

4.3.1 Protein backbone (i)

MolProbity failed to run properly - this section is therefore empty.

4.3.2 Protein sidechains (i)

MolProbity failed to run properly - this section is therefore empty.

4.3.3 RNA (i)

MolProbity failed to run properly - this section is therefore empty.

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

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

4.5 Carbohydrates (i)

There are no monosaccharides in this entry.

4.6 Ligand geometry (i)

Of 24 ligands modelled in this entry, 7 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	$\#\|Z\| > 2$
5	IMD	B	605	-	3,5,5	0.60	0	4,5,5	0.39	0
8	CLF	A	508	1,2	0,24,24	-	-	-		
3	HCA	C	501	4	13,13,13	1.37	1 (7%)	14,18,18	1.76	6 (42%)
8	CLF	C	505	1,2	0,24,24	-	-	-		
4	ICS	C	502	3,6,1	12,28,30	2.53	6 (50%)	-		
6	CMO	C	504	4	0,1,1	-	-	-		
5	IMD	A	504	-	3,5,5	0.96	0	4,5,5	0.51	0
5	IMD	B	603	-	3,5,5	0.30	0	4,5,5	0.70	0
5	IMD	B	602	-	3,5,5	0.56	0	4,5,5	0.94	0
5	IMD	C	503	-	3,5,5	0.31	0	4,5,5	0.53	0
5	IMD	D	603	-	3,5,5	0.64	0	4,5,5	0.60	0
5	IMD	D	601	-	3,5,5	0.43	0	4,5,5	0.56	0
6	CMO	A	505	4	0,1,1	-	-	-		
5	IMD	A	503	-	3,5,5	0.13	0	4,5,5	0.82	0
4	ICS	A	502	3,6,1	12,28,30	1.99	6 (50%)	-		
5	IMD	D	602	-	3,5,5	0.41	0	4,5,5	0.48	0
3	HCA	A	501	4	13,13,13	1.26	2 (15%)	14,18,18	2.03	6 (42%)

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
5	IMD	B	605	-	-	-	0/1/1/1
8	CLF	A	508	1,2	-	-	0/12/10/10
3	HCA	C	501	4	-	0/17/17/17	-
8	CLF	C	505	1,2	-	-	0/12/10/10
5	IMD	A	504	-	-	-	0/1/1/1
5	IMD	B	603	-	-	-	0/1/1/1
5	IMD	B	602	-	-	-	0/1/1/1
5	IMD	C	503	-	-	-	0/1/1/1
5	IMD	D	601	-	-	-	0/1/1/1
5	IMD	A	503	-	-	-	0/1/1/1
5	IMD	D	603	-	-	-	0/1/1/1
5	IMD	D	602	-	-	-	0/1/1/1
3	HCA	A	501	4	-	3/17/17/17	-

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	C	502	ICS	S3B-FE7	-4.64	2.21	2.32
4	C	502	ICS	S4B-FE5	-3.96	2.22	2.32
4	C	502	ICS	S4A-FE3	-3.66	2.23	2.32
4	A	502	ICS	S3A-FE5	2.84	2.31	2.24
4	A	502	ICS	S4B-FE5	-2.68	2.25	2.32
4	A	502	ICS	S3B-FE7	-2.64	2.25	2.32
4	C	502	ICS	S4B-FE7	-2.62	2.25	2.32
3	C	501	HCA	O3-C6	2.59	1.30	1.22
4	A	502	ICS	S4A-FE3	-2.56	2.26	2.32
4	C	502	ICS	S4A-FE4	-2.53	2.26	2.32
3	A	501	HCA	O3-C6	2.50	1.30	1.22
4	A	502	ICS	S3A-FE4	2.29	2.30	2.24
3	A	501	HCA	O2-C1	-2.26	1.23	1.30
4	C	502	ICS	S3A-FE4	2.26	2.30	2.24
4	A	502	ICS	S4B-FE7	-2.02	2.27	2.32

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	501	HCA	C4-C5-C6	3.51	120.70	112.75
3	A	501	HCA	O3-C6-C5	-3.45	112.01	123.08
3	C	501	HCA	C4-C5-C6	3.10	119.76	112.75
3	C	501	HCA	O7-C3-C7	-2.87	104.84	108.86
3	A	501	HCA	O5-C7-C3	-2.84	118.24	122.25
3	A	501	HCA	O1-C1-C2	-2.70	115.05	122.94
3	C	501	HCA	O6-C7-C3	2.46	117.33	113.05
3	C	501	HCA	O4-C6-O3	2.16	128.67	123.30
3	C	501	HCA	O1-C1-C2	-2.12	116.76	122.94
3	A	501	HCA	O6-C7-C3	2.09	116.68	113.05
3	C	501	HCA	O3-C6-C5	-2.06	116.47	123.08
3	A	501	HCA	O2-C1-O1	2.02	128.32	123.30

There are no chirality outliers.

All (3) torsion outliers are listed below:

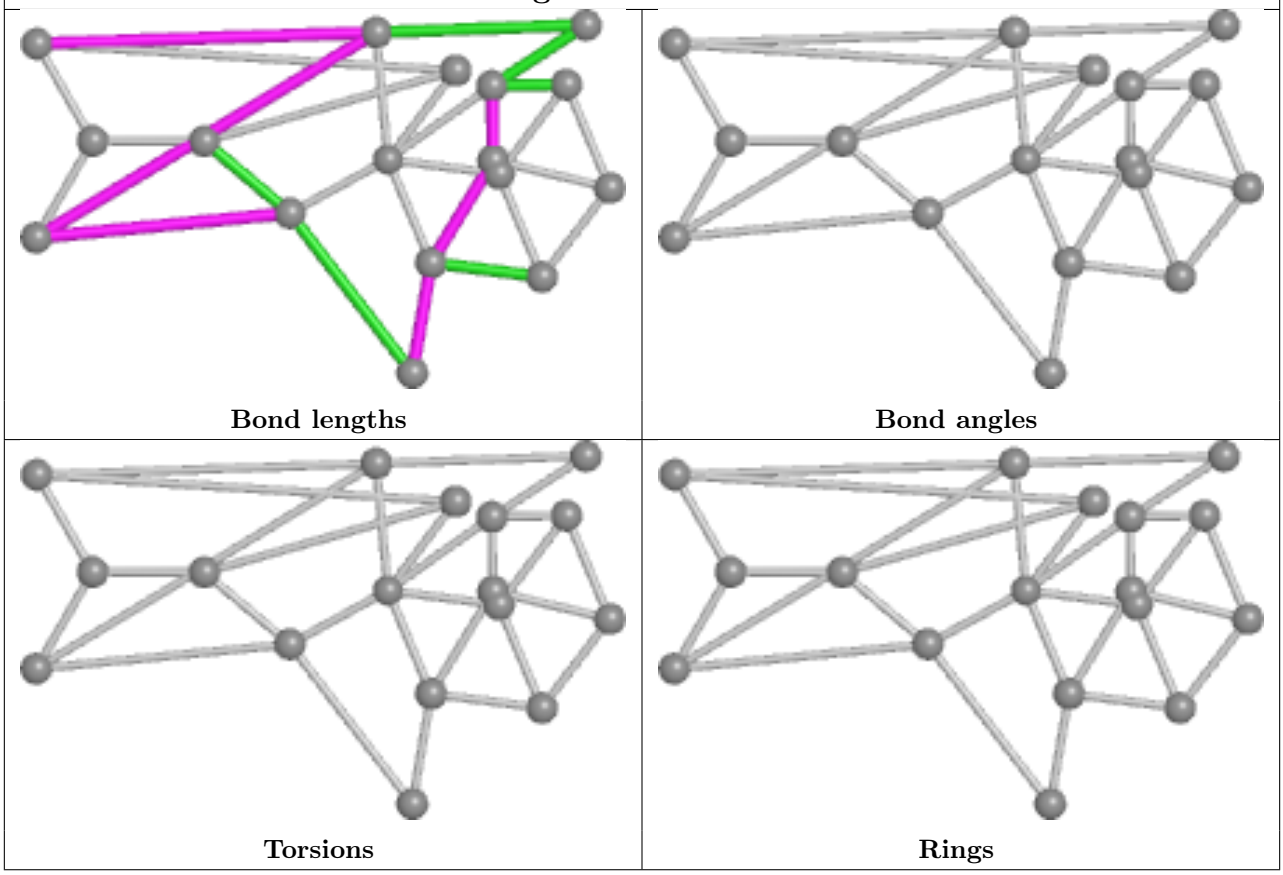
Mol	Chain	Res	Type	Atoms
3	A	501	HCA	O2-C1-C2-C3
3	A	501	HCA	O1-C1-C2-C3
3	A	501	HCA	C4-C5-C6-O4

There are no ring outliers.

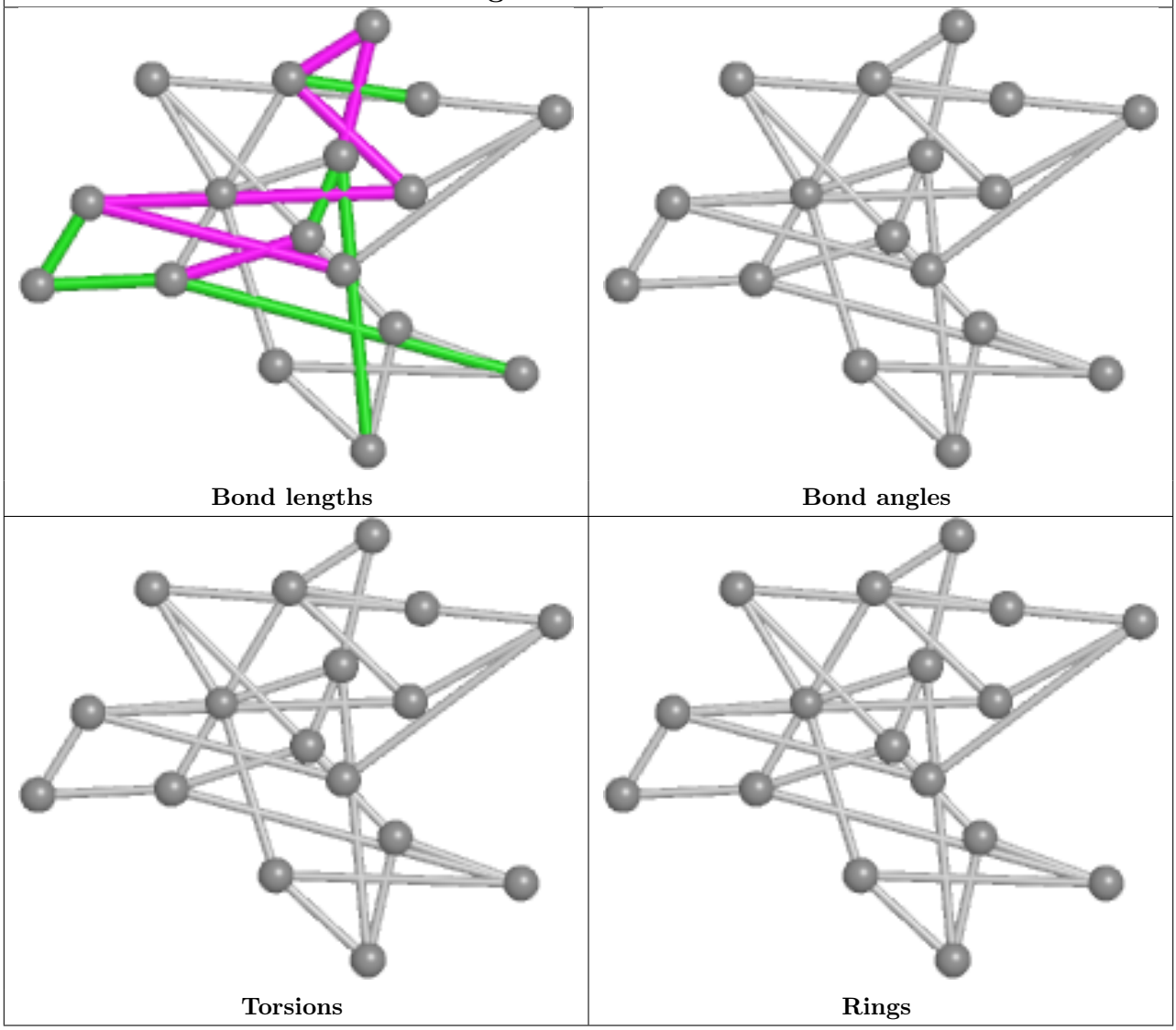
No monomer is involved in short contacts.

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 ICS C 502



Ligand ICS A 502



4.7 Other polymers (i)

There are no such residues in this entry.

4.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

5 Fit of model and data (i)

5.1 Protein, DNA and RNA chains (i)

EDS failed to run properly - this section is therefore empty.

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

EDS failed to run properly - this section is therefore empty.

5.3 Carbohydrates (i)

EDS failed to run properly - this section is therefore empty.

5.4 Ligands (i)

EDS failed to run properly - this section is therefore empty.

5.5 Other polymers (i)

EDS failed to run properly - this section is therefore empty.