Full wwPDB X-ray Structure Validation Report (i)

Mar 24, 2025 – 12:47 pm GMT

PDB ID	:	9EQL
Title	:	Hydrogenase-1 Ni-B state poised at +300mV
Authors	:	Carr, S.B.; Li, W.; Wong, K.l.; Ash, P.A.; Vincent, K.A.
Deposited on	:	2024-03-21
Resolution	:	1.51 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:

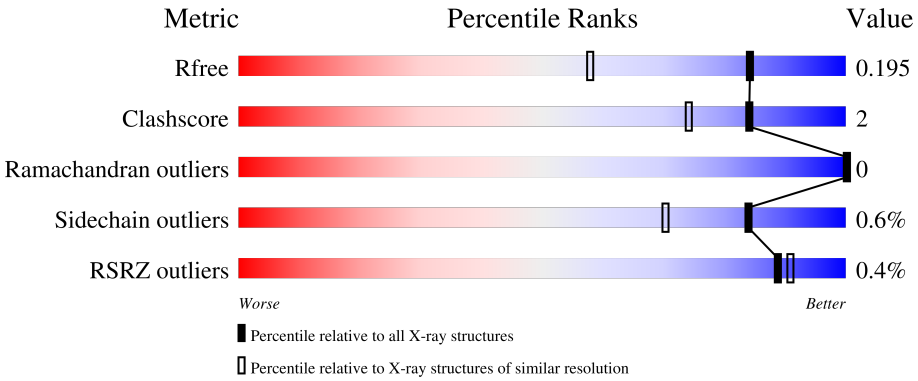
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.41.5

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 1.51 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}	164625	5293 (1.54-1.50)
Clashscore	180529	5759 (1.54-1.50)
Ramachandran outliers	177936	5653 (1.54-1.50)
Sidechain outliers	177891	5650 (1.54-1.50)
RSRZ outliers	164620	5293 (1.54-1.50)

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	S	279	89% 5% • 6%
1	T	279	85% 8% 6%
2	L	582	94% 6%
2	M	582	94% 5%

2 Entry composition (i)

There are 11 unique types of molecules in this entry. The entry contains 14684 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 Hydrogenase-1 small chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	S	263	Total	C	N	O	S	0	2	0
			2040	1294	351	375	20			
1	T	263	Total	C	N	O	S	0	3	0
			2041	1296	350	374	21			

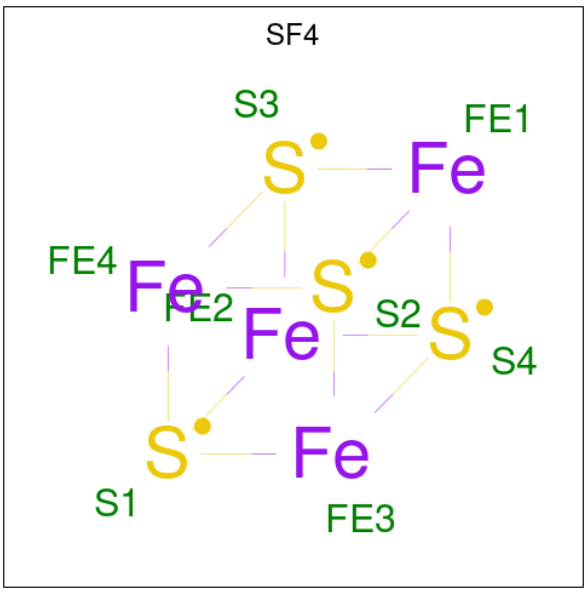
There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
S	272	ARG	-	expression tag	UNP P69739
S	273	SER	-	expression tag	UNP P69739
S	274	HIS	-	expression tag	UNP P69739
S	275	HIS	-	expression tag	UNP P69739
S	276	HIS	-	expression tag	UNP P69739
S	277	HIS	-	expression tag	UNP P69739
S	278	HIS	-	expression tag	UNP P69739
S	279	HIS	-	expression tag	UNP P69739
T	272	ARG	-	expression tag	UNP P69739
T	273	SER	-	expression tag	UNP P69739
T	274	HIS	-	expression tag	UNP P69739
T	275	HIS	-	expression tag	UNP P69739
T	276	HIS	-	expression tag	UNP P69739
T	277	HIS	-	expression tag	UNP P69739
T	278	HIS	-	expression tag	UNP P69739
T	279	HIS	-	expression tag	UNP P69739

- Molecule 2 is a protein called Hydrogenase-1 large chain.

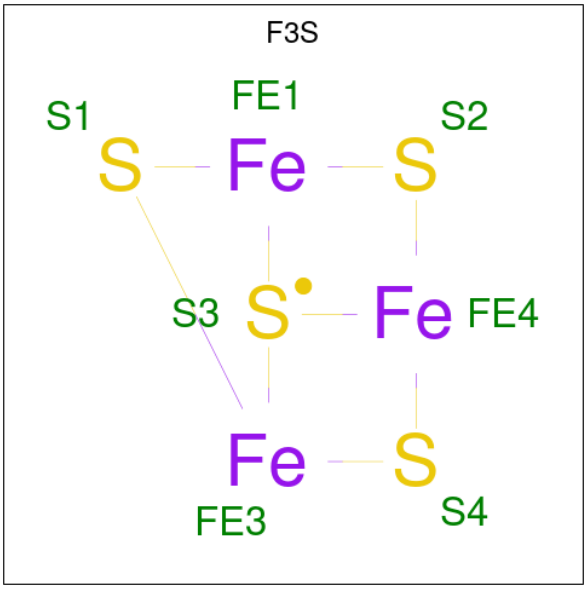
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	581	Total	C	N	O	S	0	14	0
			4628	2936	813	851	28			
2	M	581	Total	C	N	O	S	0	16	0
			4633	2946	806	853	28			

- Molecule 3 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe_4S_4).



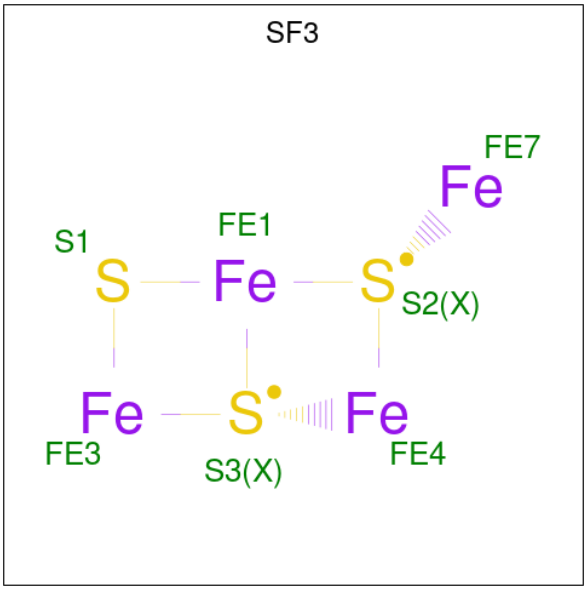
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	S	1	Total Fe S 8 4 4	0	0
3	T	1	Total Fe S 8 4 4	0	0

- Molecule 4 is FE3-S4 CLUSTER (three-letter code: F3S) (formula: Fe_3S_4) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	S	1	Total Fe S 7 3 4	0	0
4	T	1	Total Fe S 7 3 4	0	0

- Molecule 5 is FE4-S3 CLUSTER (three-letter code: SF3) (formula: Fe_4S_3).

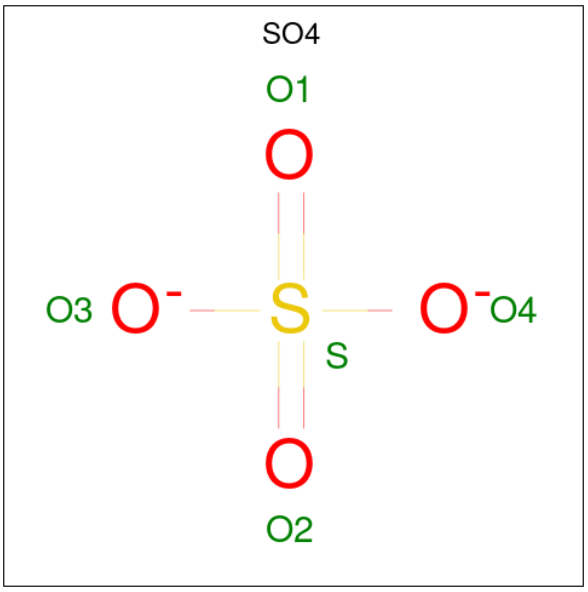


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	S	1	Total Fe S 7 4 3	0	0
5	T	1	Total Fe S 7 4 3	0	0

- Molecule 6 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

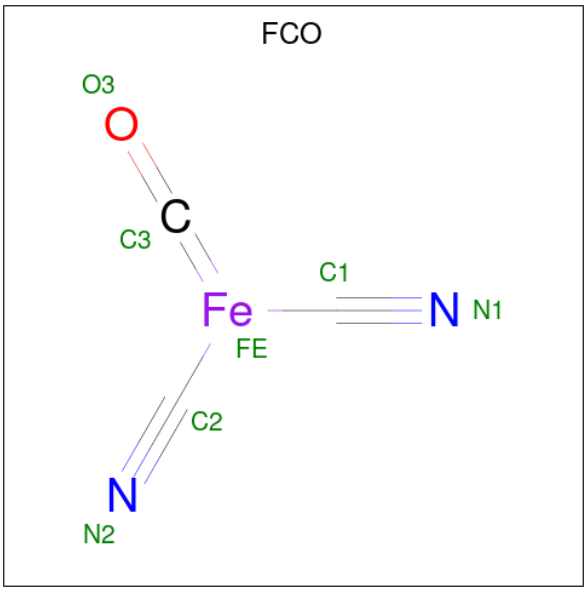
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	S	2	Total Cl 2 2	0	0
6	T	2	Total Cl 2 2	0	0

- Molecule 7 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	L	1	Total O S 5 4 1	0	0

- Molecule 8 is CARBONMONOXIDE-(DICYANO) IRON (three-letter code: FCO) (formula: C_3FeN_2O) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	L	1	Total C Fe N O 7 3 1 2 1	0	0
8	M	1	Total C Fe N O 7 3 1 2 1	0	0

- Molecule 9 is NICKEL (II) ION (three-letter code: NI) (formula: Ni) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	L	1	Total Ni 1 1	0	0
9	M	1	Total Ni 1 1	0	0

- Molecule 10 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	L	1	Total Mg 1 1	0	0
10	M	1	Total Mg 1 1	0	0

- Molecule 11 is water.

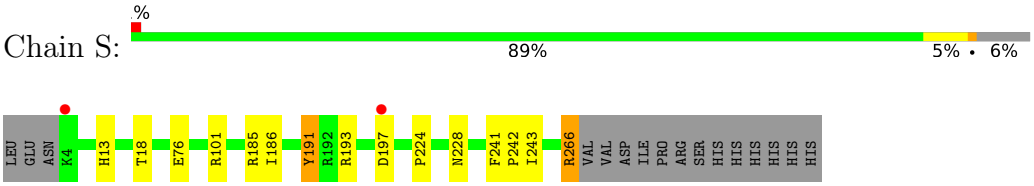
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
11	S	196	Total O 196 196	0	0
11	L	425	Total O 425 425	0	0
11	T	187	Total O 187 187	0	0
11	M	463	Total O 463 463	0	0

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.

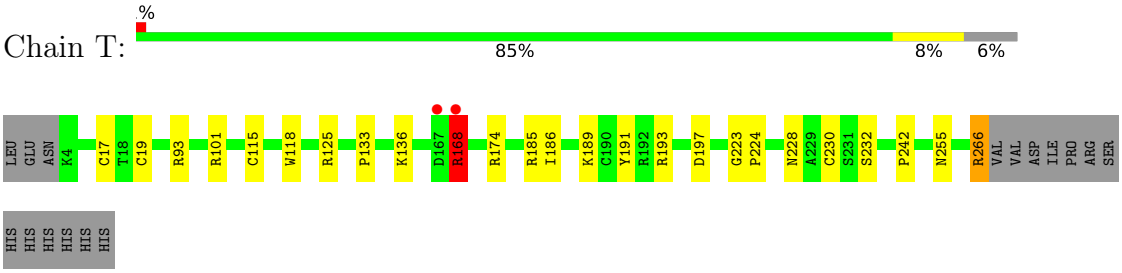
• Molecule 1: Hydrogenase-1 small chain

Chain S:



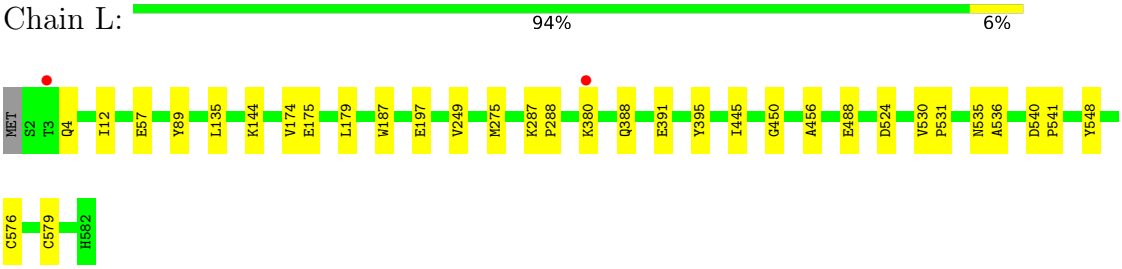
• Molecule 1: Hydrogenase-1 small chain

Chain T:



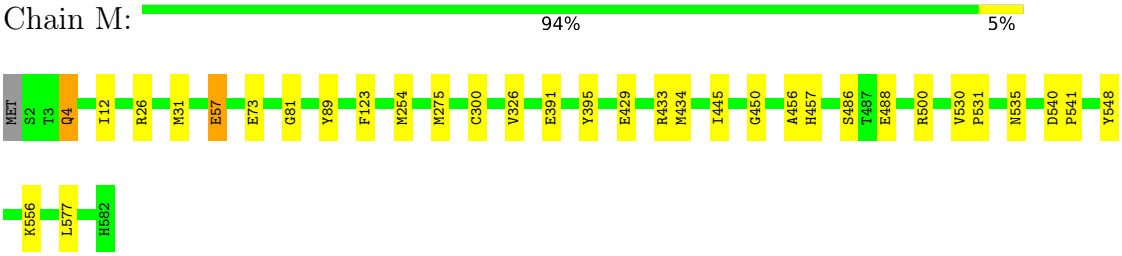
• Molecule 2: Hydrogenase-1 large chain

Chain L:



• Molecule 2: Hydrogenase-1 large chain

Chain M:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	93.37Å 97.04Å 183.22Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	67.28 – 1.51 67.28 – 1.51	Depositor EDS
% Data completeness (in resolution range)	99.7 (67.28-1.51) 99.7 (67.28-1.51)	Depositor EDS
R_{merge}	0.27	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.02 (at 1.51Å)	Xtriage
Refinement program	REFMAC 5.8.0419	Depositor
R, R_{free}	0.164 , 0.187 0.176 , 0.195	Depositor DCC
R_{free} test set	13108 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	18.4	Xtriage
Anisotropy	0.175	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 36.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.015 for k,h,-l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	14684	wwPDB-VP
Average B, all atoms (Å^2)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.56% 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: SO4, NI, MG, FCO, CL, F3S, SF4, SF3

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	S	0.46	0/2101	0.76	3/2853 (0.1%)
1	T	0.46	0/2105	0.78	3/2858 (0.1%)
2	L	0.44	2/4787 (0.0%)	0.74	3/6512 (0.0%)
2	M	0.45	0/4798	0.75	5/6527 (0.1%)
All	All	0.45	2/13791 (0.0%)	0.75	14/18750 (0.1%)

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	S	0	1
1	T	0	3
All	All	0	4

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	L	57	GLU	CD-OE2	-5.38	1.19	1.25
2	L	57	GLU	CD-OE1	-5.07	1.20	1.25

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	M	57	GLU	OE1-CD-OE2	-8.84	112.69	123.30
2	L	57	GLU	OE1-CD-OE2	-8.14	113.53	123.30
2	M	89	TYR	CB-CG-CD1	6.05	124.63	121.00
2	M	26	ARG	NE-CZ-NH1	5.95	123.28	120.30
1	T	125	ARG	NE-CZ-NH2	-5.89	117.35	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	T	168	ARG	NE-CZ-NH2	-5.89	117.36	120.30
2	L	89	TYR	CB-CG-CD1	5.58	124.34	121.00
2	M	89	TYR	CB-CG-CD2	-5.50	117.70	121.00
2	M	26	ARG	NE-CZ-NH2	-5.48	117.56	120.30
1	S	266	ARG	NE-CZ-NH2	-5.46	117.57	120.30
1	S	193	ARG	NE-CZ-NH2	-5.20	117.70	120.30
1	T	93	ARG	NE-CZ-NH1	5.19	122.89	120.30
1	S	193	ARG	CG-CD-NE	-5.16	100.96	111.80
2	L	89	TYR	CB-CG-CD2	-5.13	117.92	121.00

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	S	101	ARG	Sidechain
1	T	168	ARG	Sidechain
1	T	174	ARG	Sidechain
1	T	193	ARG	Sidechain

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	S	2040	0	1978	9	0
1	T	2041	0	1981	13	0
2	L	4628	0	4528	20	0
2	M	4633	0	4544	18	0
3	S	8	0	0	0	0
3	T	8	0	0	0	0
4	S	7	0	0	0	0
4	T	7	0	0	0	0
5	S	7	0	0	0	0
5	T	7	0	0	0	0
6	S	2	0	0	0	0
6	T	2	0	0	0	0
7	L	5	0	0	0	0
8	L	7	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
8	M	7	0	0	0	0
9	L	1	0	0	0	0
9	M	1	0	0	0	0
10	L	1	0	0	0	0
10	M	1	0	0	0	0
11	L	425	0	0	3	0
11	M	463	0	0	3	0
11	S	196	0	0	2	0
11	T	187	0	0	2	0
All	All	14684	0	13031	57	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 (57) 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)
2:L:175:GLU:OE1	11:L:701:HOH:O	2.14	0.65
2:M:254:MET:HA	2:M:254:MET:HE2	1.84	0.59
1:S:266:ARG:NE	1:S:266:ARG:HA	2.18	0.58
2:M:556:LYS:NZ	11:M:704:HOH:O	2.39	0.55
2:L:275[B]:MET:HE2	2:L:456:ALA:HA	1.89	0.55
2:M:275[B]:MET:HE1	2:M:456:ALA:HA	1.89	0.54
1:S:197:ASP:HB2	11:T:505:HOH:O	2.07	0.53
2:L:530:VAL:CG1	2:L:531:PRO:HD2	2.39	0.52
1:T:186:ILE:HD11	1:T:228:ASN:HB3	1.92	0.52
1:T:118:TRP:CD2	1:T:255:ASN:HB2	2.46	0.51
2:M:123:PHE:HB2	2:M:275[B]:MET:HE3	1.93	0.51
1:T:266:ARG:NE	1:T:266:ARG:HA	2.26	0.51
1:S:197:ASP:HB2	1:T:197:ASP:OD2	2.12	0.50
2:M:500[B]:ARG:NH2	11:M:708:HOH:O	2.45	0.49
2:M:540:ASP:HB2	2:M:541:PRO:CD	2.43	0.49
2:M:486[A]:SER:OG	2:M:488[A]:GLU:OE1	2.27	0.49
2:L:488:GLU:HB2	11:L:928:HOH:O	2.12	0.49
1:S:186:ILE:HD11	1:S:228:ASN:HB3	1.96	0.48
2:M:434:MET:SD	2:M:457[B]:HIS:CE1	3.07	0.48
2:M:530:VAL:CG1	2:M:531:PRO:HD2	2.45	0.47
2:L:445:ILE:O	2:L:450:GLY:HA3	2.14	0.47
11:S:665:HOH:O	1:T:197:ASP:HB3	2.15	0.46
2:L:4:GLN:HA	2:L:12:ILE:O	2.15	0.46
2:L:576:CYS:CB	11:L:1064:HOH:O	2.64	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:L:535:ASN:HB3	2:L:548:TYR:CE1	2.51	0.45
2:M:445:ILE:O	2:M:450:GLY:HA3	2.16	0.45
2:M:4:GLN:HA	2:M:12:ILE:O	2.17	0.45
1:T:133:PRO:HG2	1:T:136:LYS:HG2	1.99	0.45
2:L:144:LYS:HB3	2:L:197[A]:GLU:HG2	1.97	0.45
2:M:57:GLU:OE1	11:M:701:HOH:O	2.20	0.45
2:M:429:GLU:OE2	2:M:433:ARG:NH2	2.44	0.45
2:M:535:ASN:HB3	2:M:548:TYR:CE1	2.52	0.45
1:T:186:ILE:HD12	1:T:230:CYS:HB2	1.99	0.44
2:L:135:LEU:HD22	2:L:187:TRP:CD1	2.53	0.44
2:L:174:VAL:HG13	2:L:179:LEU:HD11	1.99	0.43
2:L:530:VAL:HG12	2:L:531:PRO:HD2	2.00	0.43
1:S:13:HIS:HD2	11:S:573:HOH:O	2.02	0.43
2:L:530:VAL:HG11	2:L:579:CYS:HB3	2.00	0.43
1:T:17:CYS:SG	1:T:19:CYS:HB3	2.59	0.43
1:T:223:GLY:N	1:T:224:PRO:CD	2.82	0.43
1:S:241:PHE:CE2	1:S:243:ILE:HB	2.54	0.42
2:M:31:MET:HB2	2:M:577:LEU:HG	2.01	0.42
2:L:380:LYS:HD2	2:L:388:GLN:HB3	2.01	0.42
1:T:185:ARG:HD3	1:T:224:PRO:O	2.20	0.42
2:L:380:LYS:NZ	2:L:388:GLN:NE2	2.67	0.42
2:L:249:VAL:HB	1:T:232[B]:SER:OG	2.20	0.41
2:L:540:ASP:HB2	2:L:541:PRO:CD	2.49	0.41
1:S:18:THR:HA	1:S:76:GLU:OE2	2.20	0.41
2:M:391:GLU:HA	2:M:395:TYR:CD2	2.55	0.41
1:S:191:TYR:HB2	1:T:189:LYS:O	2.20	0.41
1:S:185:ARG:HD3	1:S:224:PRO:O	2.20	0.41
1:T:115:CYS:HB2	11:T:555:HOH:O	2.20	0.41
2:M:300:CYS:HA	2:M:326:VAL:O	2.20	0.41
2:L:287:LYS:N	2:L:288:PRO:CD	2.84	0.40
2:L:536:ALA:HB2	2:L:548:TYR:CE2	2.56	0.40
2:M:73:GLU:OE2	2:M:81:GLY:HA2	2.21	0.40
2:L:391:GLU:HA	2:L:395:TYR:CD1	2.57	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	S	263/279 (94%)	251 (95%)	12 (5%)	0	100	100
1	T	264/279 (95%)	252 (96%)	12 (4%)	0	100	100
2	L	593/582 (102%)	579 (98%)	14 (2%)	0	100	100
2	M	595/582 (102%)	577 (97%)	18 (3%)	0	100	100
All	All	1715/1722 (100%)	1659 (97%)	56 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	S	218/232 (94%)	216 (99%)	2 (1%)	75	56
1	T	218/232 (94%)	213 (98%)	5 (2%)	45	16
2	L	494/481 (103%)	493 (100%)	1 (0%)	92	84
2	M	496/481 (103%)	495 (100%)	1 (0%)	92	84
All	All	1426/1426 (100%)	1417 (99%)	9 (1%)	84	70

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	S	191	TYR
1	S	242	PRO

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	L	524	ASP
1	T	101	ARG
1	T	168	ARG
1	T	191	TYR
1	T	242	PRO
1	T	266	ARG
2	M	4	GLN

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

Mol	Chain	Res	Type
1	S	66	GLN
2	L	388	GLN
2	M	346	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 17 ligands modelled in this entry, 8 are monoatomic - leaving 9 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	SF3	S	403	1	0,8,8	-	-	-		
4	F3S	S	402	1	0,9,9	-	-	-		
3	SF4	T	401	1	0,12,12	-	-	-		
4	F3S	T	402	1	0,9,9	-	-	-		
3	SF4	S	401	1	0,12,12	-	-	-		
5	SF3	T	403	1	0,8,8	-	-	-		
8	FCO	L	602	2,11	0,6,6	-	-	-		
7	SO4	L	601	-	4,4,4	0.48	0	6,6,6	0.17	0
8	FCO	M	601	2,11	0,6,6	-	-	-		

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	SF3	S	403	1	-	-	0/2/2/2
4	F3S	S	402	1	-	-	0/3/3/3
3	SF4	T	401	1	-	-	0/6/5/5
4	F3S	T	402	1	-	-	0/3/3/3
3	SF4	S	401	1	-	-	0/6/5/5
5	SF3	T	403	1	-	-	0/2/2/2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

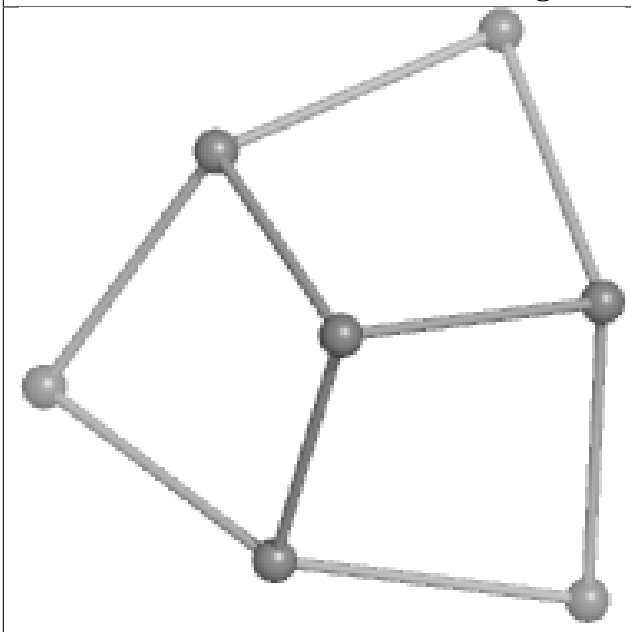
There are no ring outliers.

No monomer is involved in short contacts.

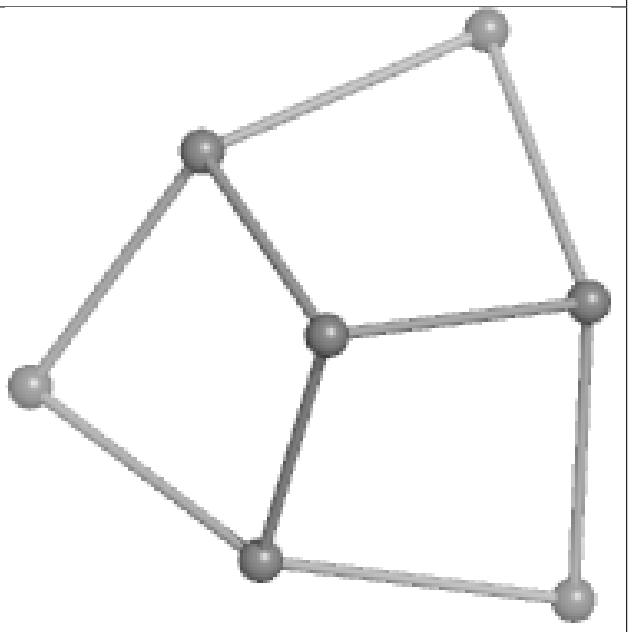
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

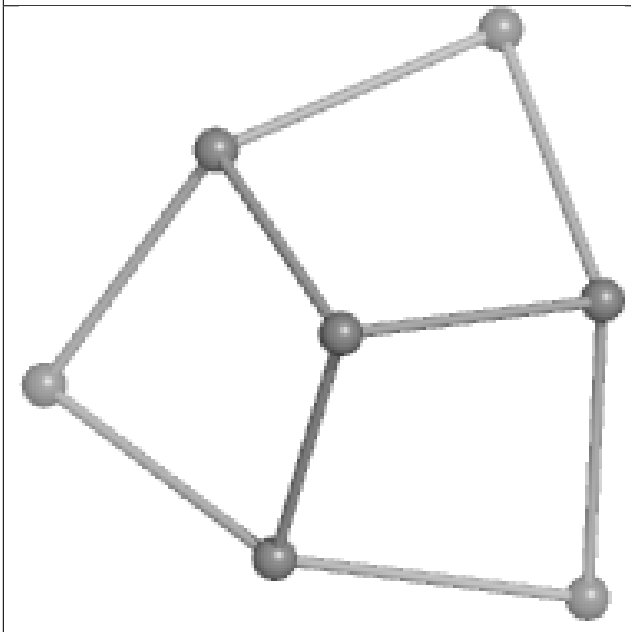
Ligand F3S S 402



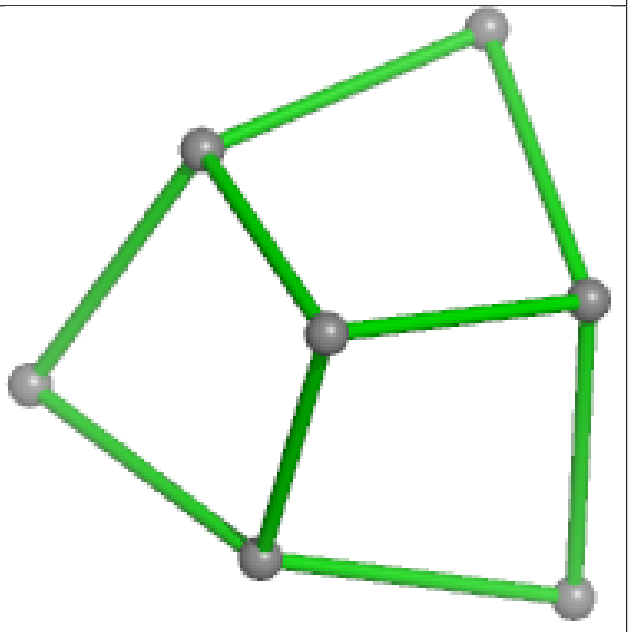
Bond lengths



Bond angles

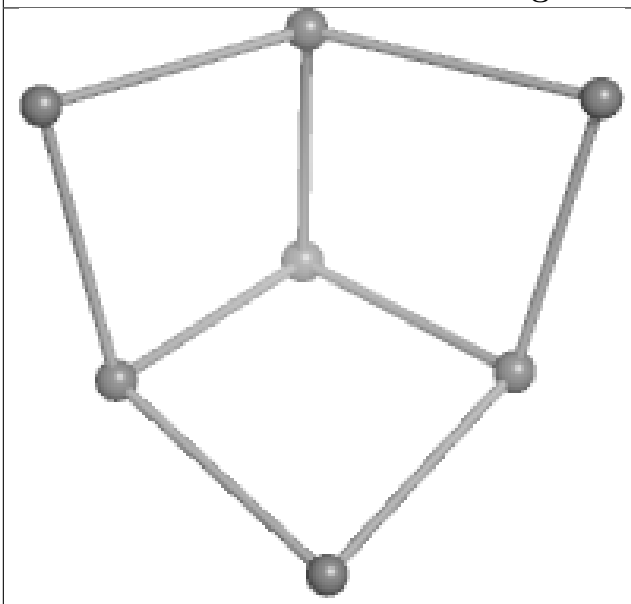


Torsions

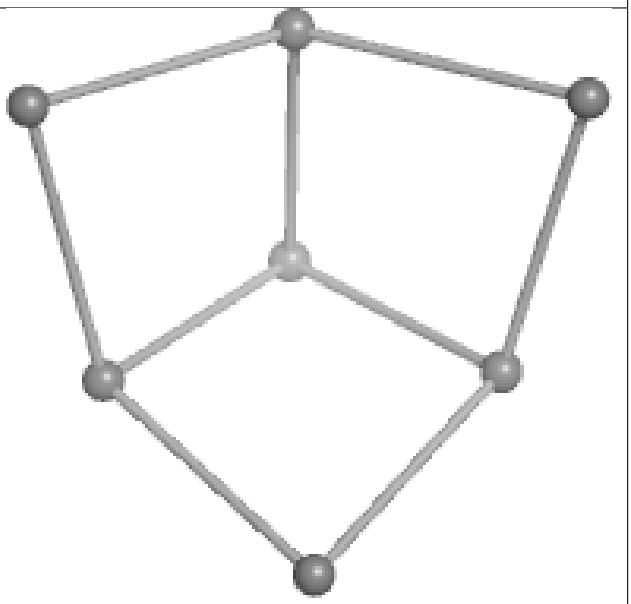


Rings

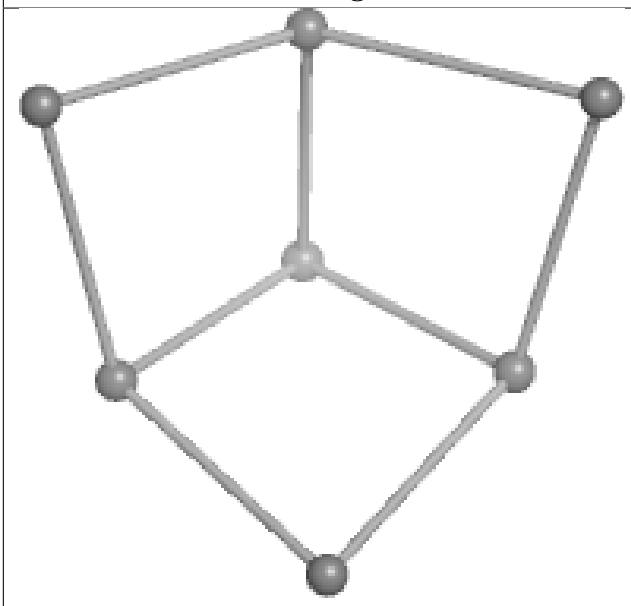
Ligand F3S T 402



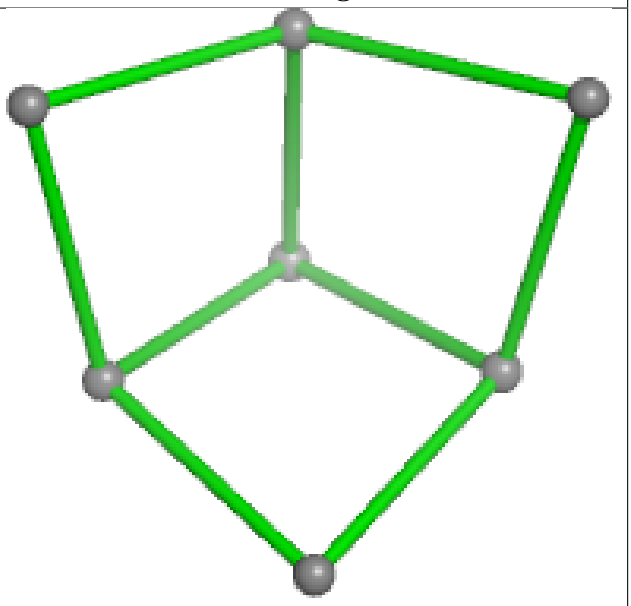
Bond lengths



Bond angles

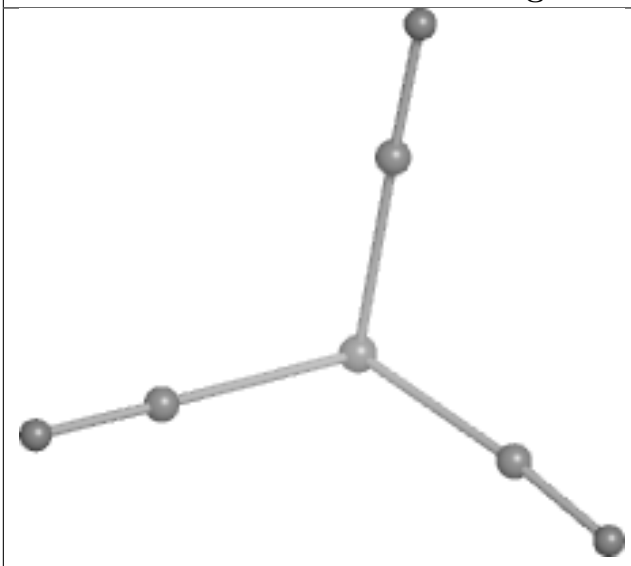


Torsions

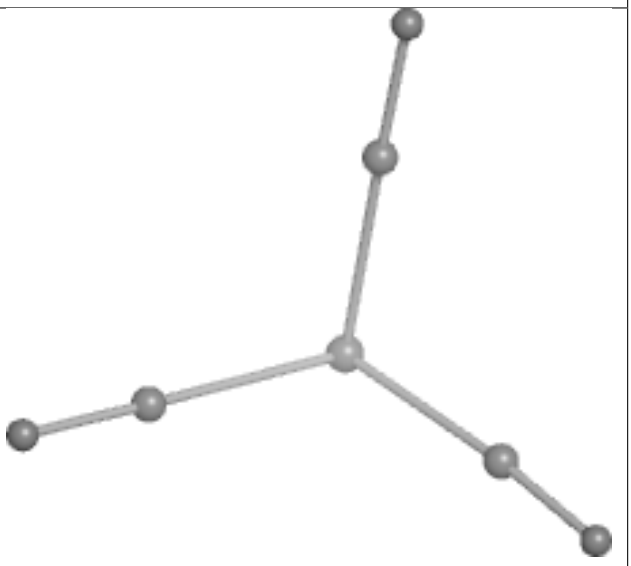


Rings

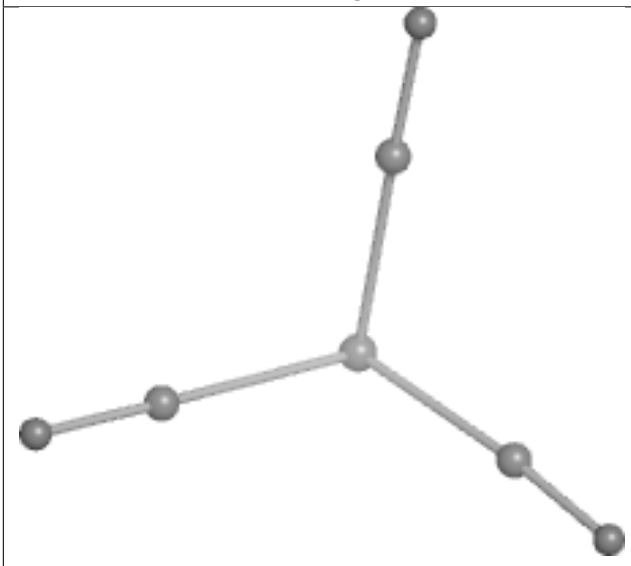
Ligand FCO L 602



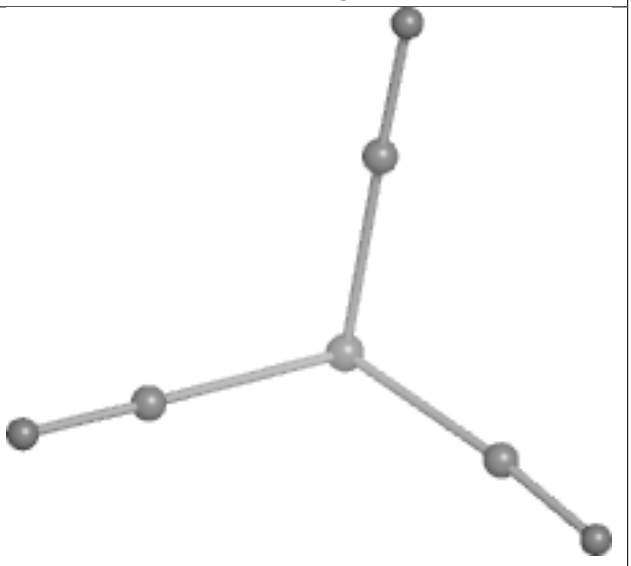
Bond lengths



Bond angles

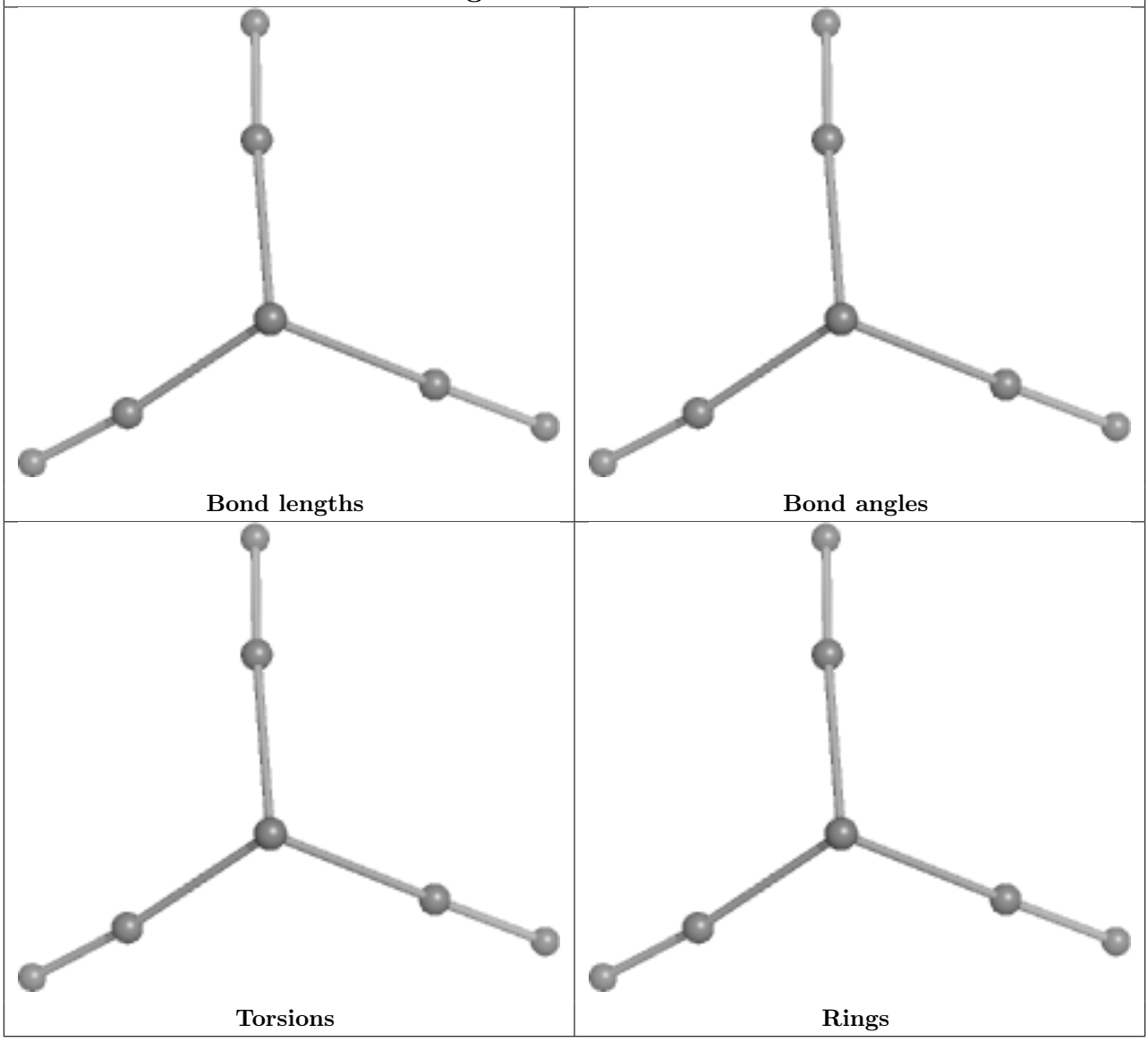


Torsions



Rings

Ligand FCO M 601



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	S	263/279 (94%)	-0.29	2 (0%)	82	86	12, 19, 31, 67	2 (0%)
1	T	263/279 (94%)	-0.21	2 (0%)	82	86	11, 20, 33, 51	3 (1%)
2	L	581/582 (99%)	-0.17	2 (0%)	90	92	12, 21, 35, 59	14 (2%)
2	M	581/582 (99%)	-0.21	0	100	100	10, 21, 32, 50	16 (2%)
All	All	1688/1722 (98%)	-0.21	6 (0%)	89	91	10, 20, 33, 67	35 (2%)

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	T	167	ASP	2.4
1	S	4	LYS	2.3
2	L	380	LYS	2.2
1	T	168	ARG	2.2
2	L	3	THR	2.1
1	S	197	ASP	2.1

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,

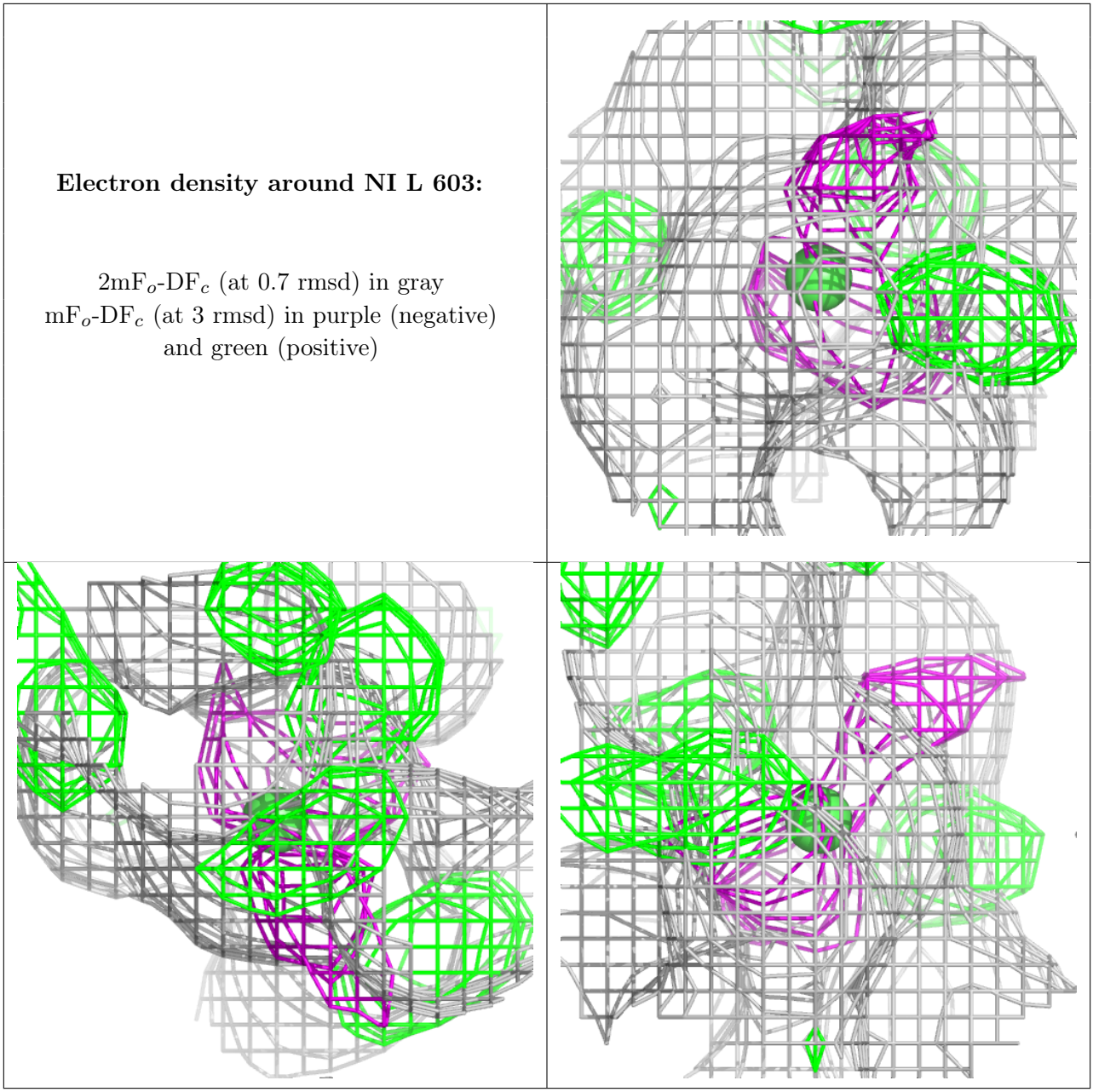
median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
7	SO4	L	601	5/5	0.95	0.07	26,28,30,35	5
10	MG	L	604	1/1	0.95	0.05	15,15,15,15	0
10	MG	M	603	1/1	0.96	0.05	15,15,15,15	0
6	CL	T	405	1/1	0.99	0.12	35,35,35,35	0
6	CL	S	404	1/1	0.99	0.04	21,21,21,21	0
9	NI	L	603	1/1	0.99	0.04	21,21,21,21	0
9	NI	M	602	1/1	0.99	0.04	21,21,21,21	0
6	CL	S	405	1/1	0.99	0.11	31,31,31,31	0
6	CL	T	404	1/1	0.99	0.04	22,22,22,22	0
4	F3S	T	402	7/7	1.00	0.02	15,16,16,18	0
5	SF3	S	403	7/7	1.00	0.02	16,16,17,23	0
8	FCO	L	602	7/7	1.00	0.04	15,17,17,18	0
8	FCO	M	601	7/7	1.00	0.03	15,17,18,18	0
5	SF3	T	403	7/7	1.00	0.03	16,18,18,23	0
3	SF4	S	401	8/8	1.00	0.03	16,16,17,17	0
3	SF4	T	401	8/8	1.00	0.02	15,16,17,17	0
4	F3S	S	402	7/7	1.00	0.02	14,15,17,17	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.

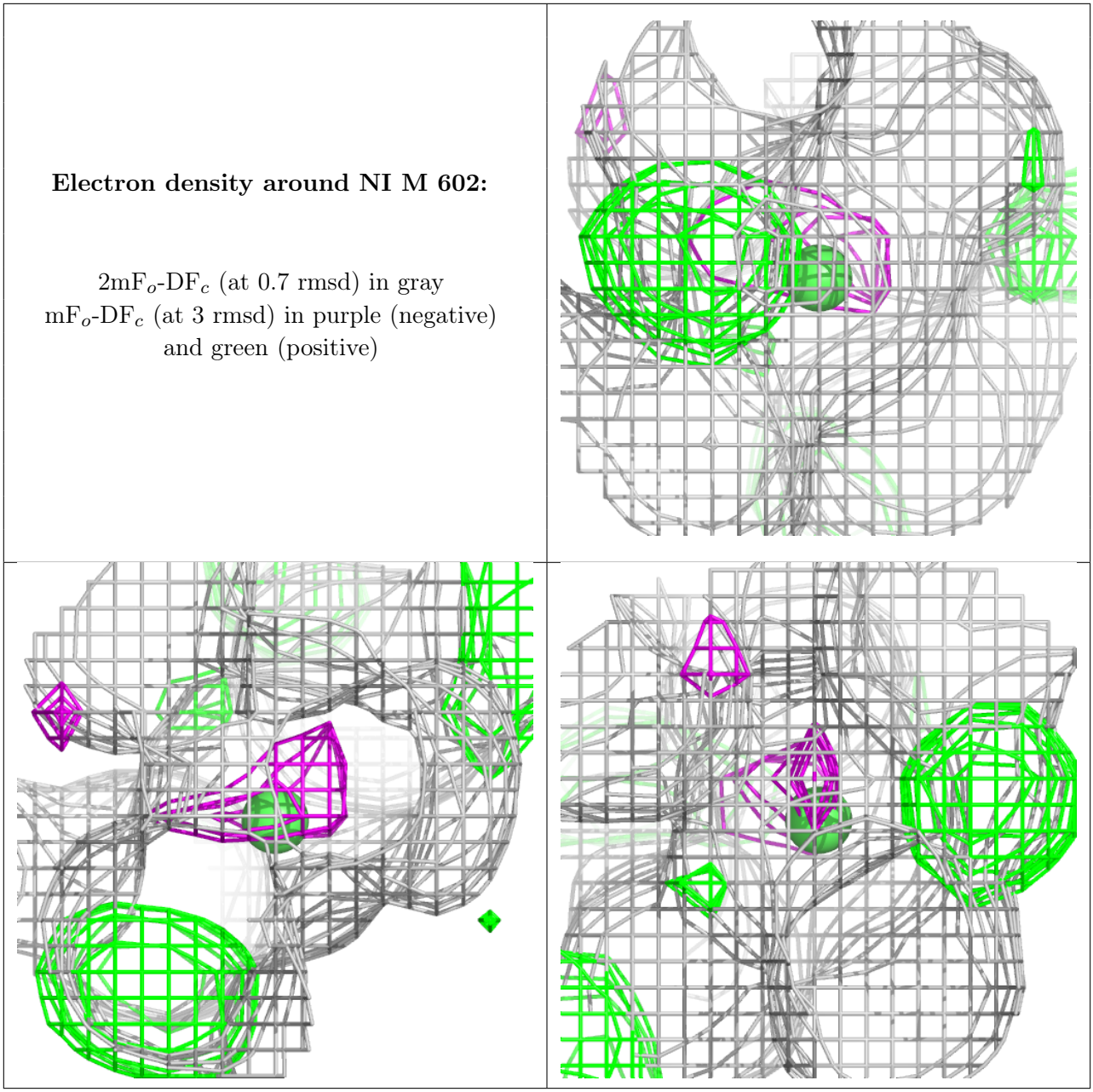
Electron density around NI L 603:

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



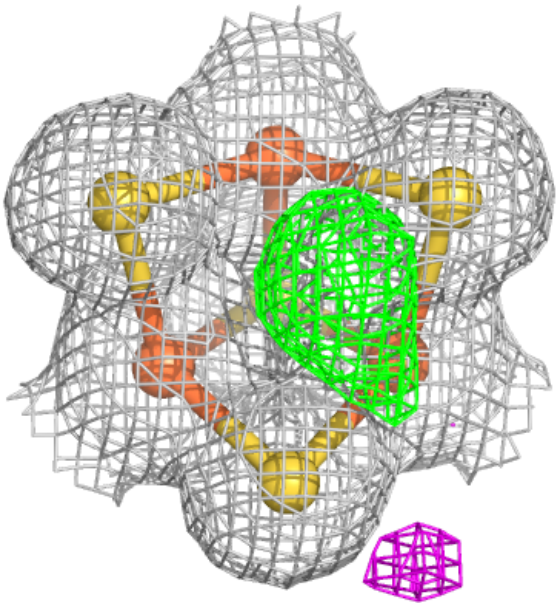
Electron density around NI M 602:

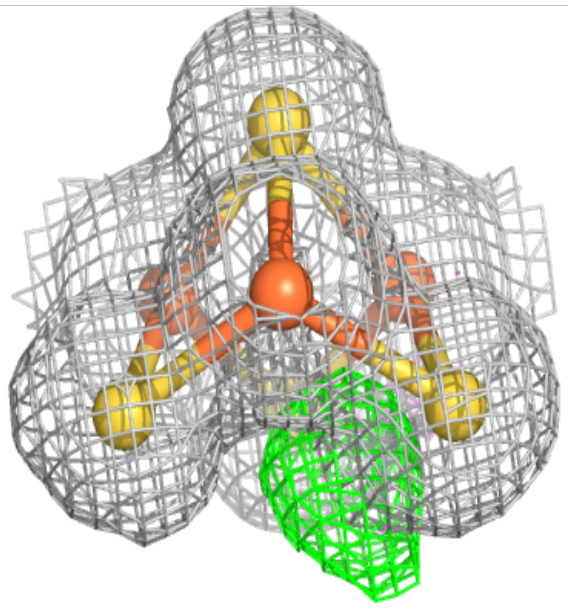
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

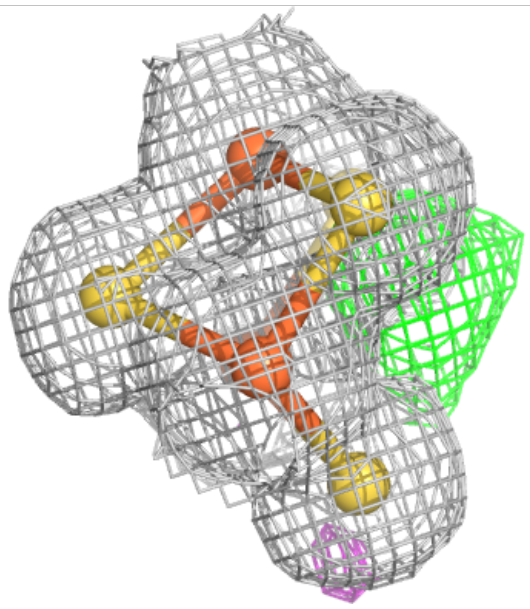


Electron density around F3S T 402:

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

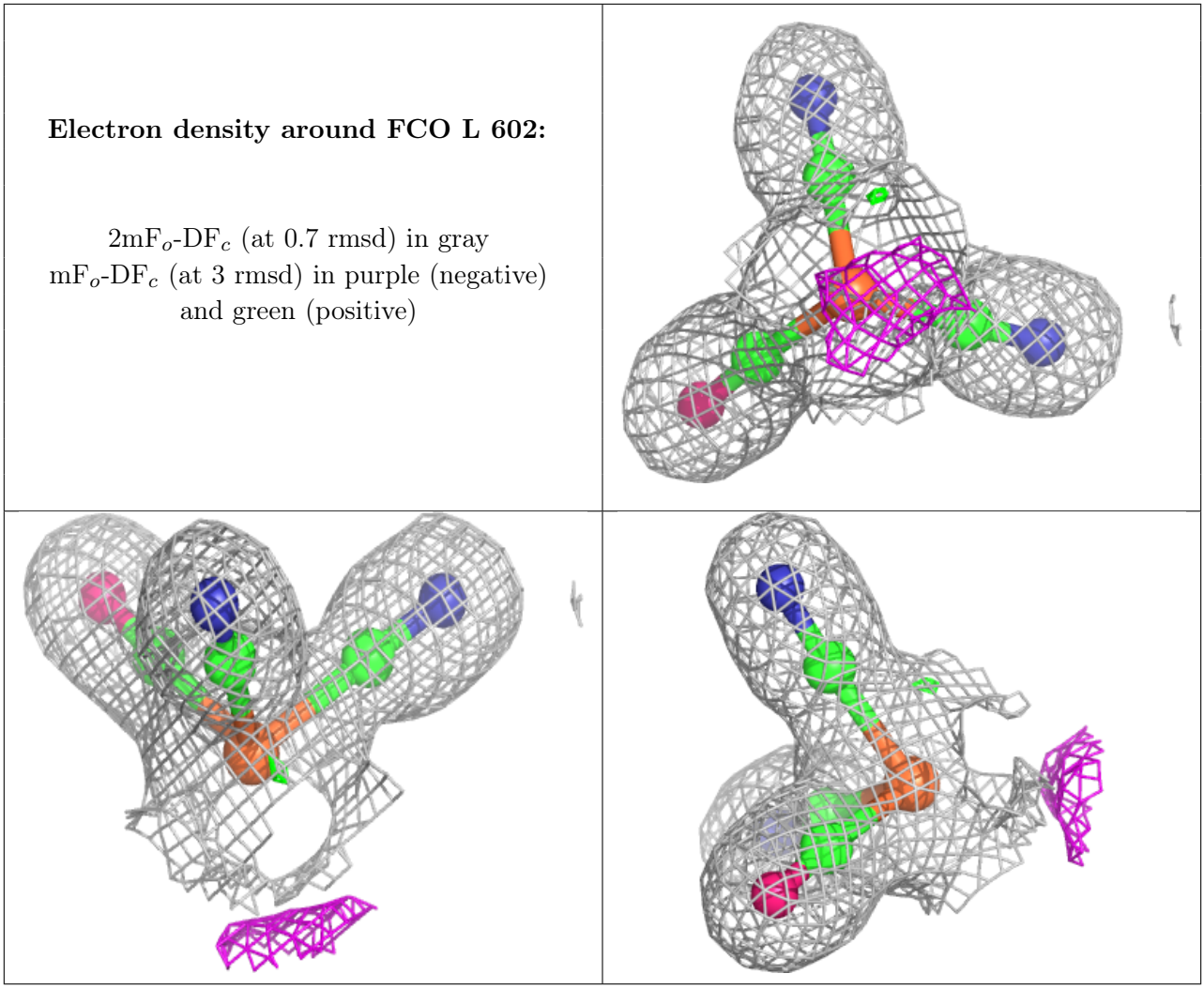






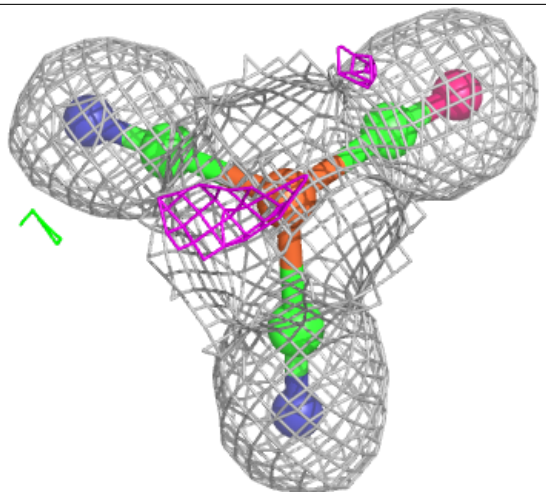
Electron density around FCO L 602:

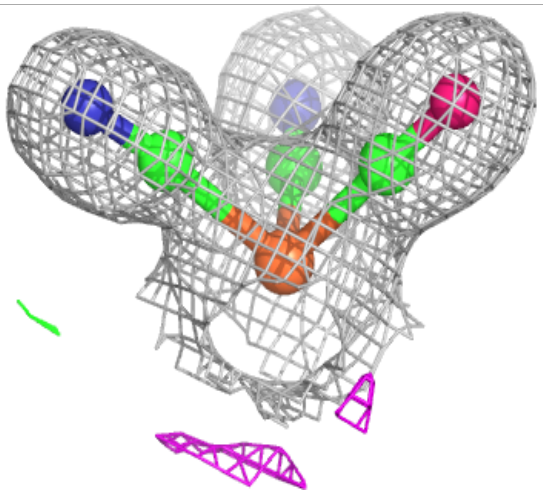
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

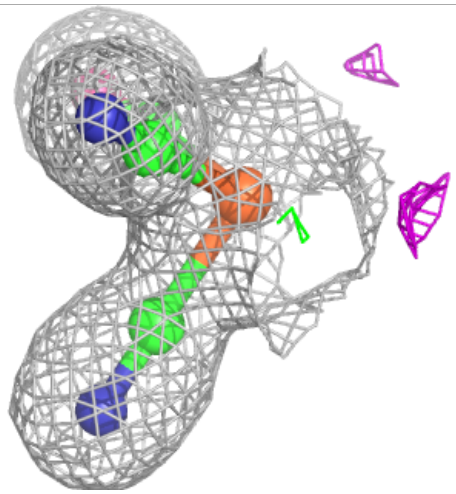


Electron density around FCO M 601:

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

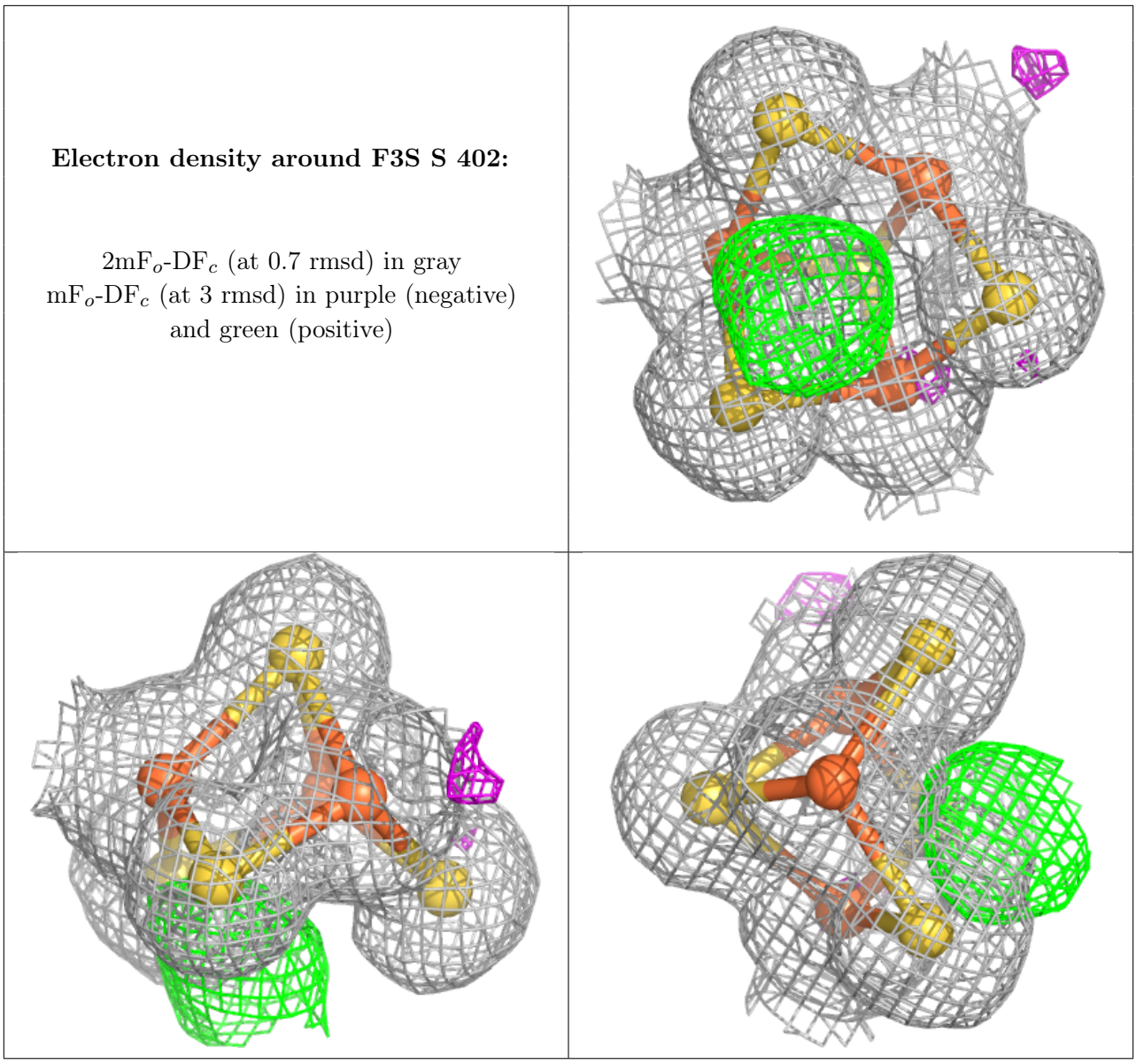






Electron density around F3S S 402:

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



6.5 Other polymers

There are no such residues in this entry.