



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 15, 2026 – 11:18 am BST

PDB ID : 9RDN / pdb_00009rdn
Title : Sulfur Oxygenase Reductase from Thioalkalivibrio paradoxus
Authors : Salgueiro, B.A.; Frazao, C.; Archer, M.; Kletzin, A.; Ruhl, P.
Deposited on : 2025-06-03
Resolution : 2.85 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

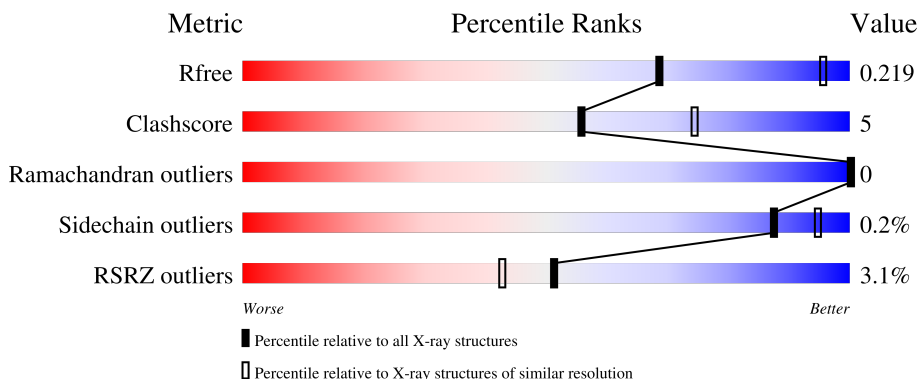
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.85 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}	180053	1407 (2.88-2.84)
Clashscore	190562	1446 (2.88-2.84)
Ramachandran outliers	187476	1406 (2.88-2.84)
Sidechain outliers	187428	1407 (2.88-2.84)
RSRZ outliers	180081	1408 (2.88-2.84)

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 $\leq 5\%$. 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	313	 4% 82% 16% ..
1	B	313	 3% 83% 16% .
1	C	313	 2% 87% 12% .
1	D	313	 4% 94% 5% .
1	E	313	 3% 87% 11% .

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Mol	Chain	Length	Quality of chain
1	F	313	<p>3% 90% 8%</p>
1	G	313	<p>3% 88% 9%</p>
1	H	313	<p>3% 90% 8%</p>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	ACT	A	403	-	-	X	-
4	ACT	E	403	-	-	-	X
4	ACT	F	403	-	-	X	-
4	ACT	G	403	-	-	X	-

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 38500 atoms, of which 19046 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 Sulfur oxygenase reductase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	310	4826	1528	2389	427	460	22	0	0	0
1	B	310	4828	1528	2391	427	460	22	0	0	0
1	C	310	4828	1528	2391	427	460	22	0	0	0
1	D	308	4806	1522	2381	424	457	22	0	0	0
1	E	309	4818	1525	2386	426	459	22	0	0	0
1	F	306	4774	1513	2364	421	455	21	0	0	0
1	G	304	4751	1507	2352	419	452	21	0	0	0
1	H	307	4797	1519	2377	423	456	22	0	0	0

- Molecule 2 is FE (III) ION (CCD ID: FE) (formula: Fe) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Fe 1 1	0	0
2	B	1	Total Fe 1 1	0	0
2	C	1	Total Fe 1 1	0	0
2	D	1	Total Fe 1 1	0	0
2	E	1	Total Fe 1 1	0	0
2	F	1	Total Fe 1 1	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	G	1	Total Fe 1 1	0	0
2	H	1	Total Fe 1 1	0	0

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

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Zn 1 1	0	0
3	B	1	Total Zn 1 1	0	0
3	C	1	Total Zn 1 1	0	0
3	D	1	Total Zn 1 1	0	0
3	E	1	Total Zn 1 1	0	0
3	F	1	Total Zn 1 1	0	0
3	G	1	Total Zn 1 1	0	0
3	H	1	Total Zn 1 1	0	0

- Molecule 4 is ACETATE ION (CCD ID: ACT) (formula: C₂H₃O₂) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
4	A	1	7	2	3	2	0	0
4	C	1	7	2	3	2	0	0
4	E	1	7	2	3	2	0	0
4	F	1	7	2	3	2	0	0
4	G	1	7	2	3	2	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	3	3	3	0	0
5	B	1	1	1	0	0
5	C	1	1	1	0	0
5	D	3	3	3	0	0
5	E	3	3	3	0	0
5	F	4	4	4	0	0
5	G	3	3	3	0	0

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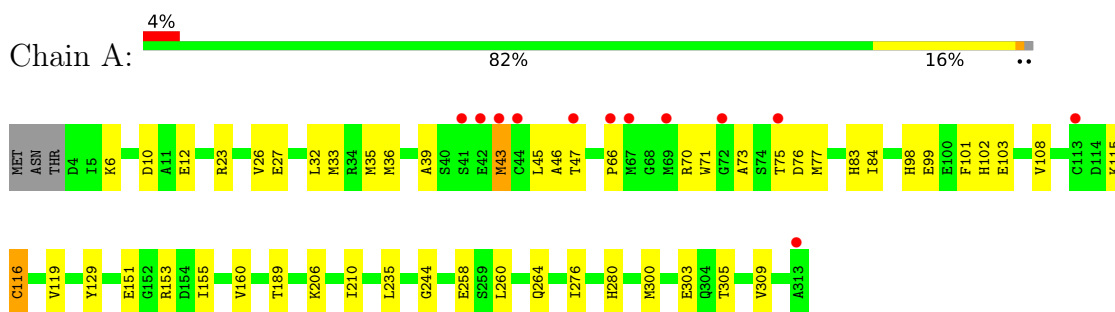
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	H	3	Total	O	0	0
			3	3		

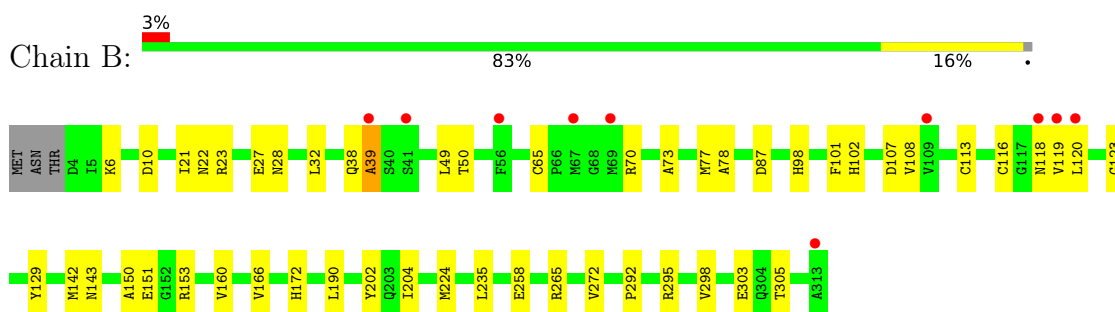
3 Residue-property plots [i](#)

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.

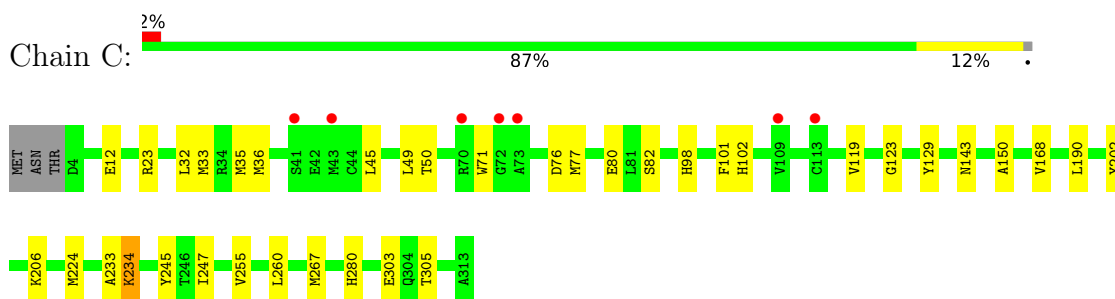
- Molecule 1: Sulfur oxygenase reductase



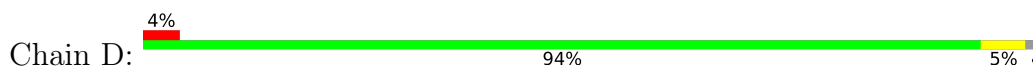
- Molecule 1: Sulfur oxygenase reductase

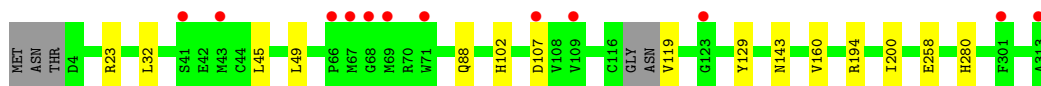


- Molecule 1: Sulfur oxygenase reductase

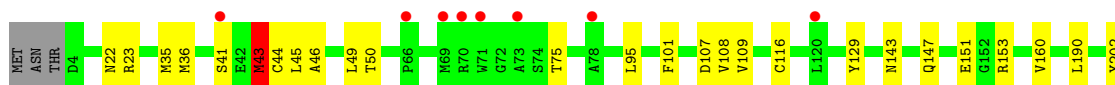
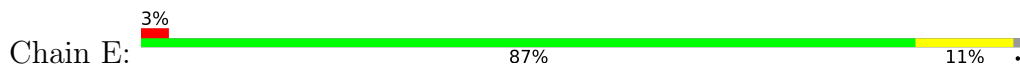


- Molecule 1: Sulfur oxygenase reductase

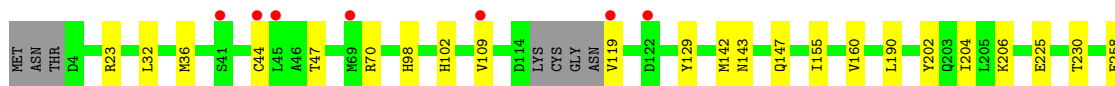
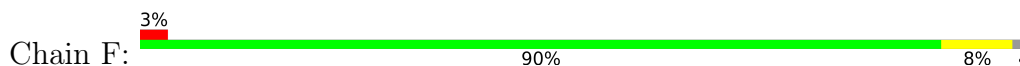




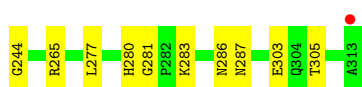
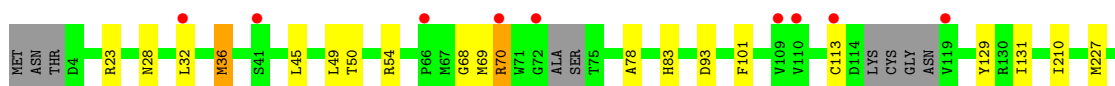
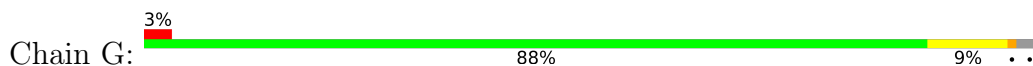
- Molecule 1: Sulfur oxygenase reductase



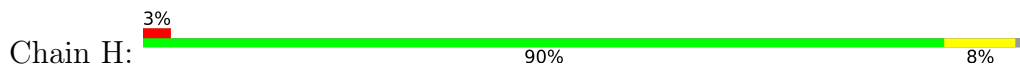
- Molecule 1: Sulfur oxygenase reductase



- Molecule 1: Sulfur oxygenase reductase



- Molecule 1: Sulfur oxygenase reductase



4 Data and refinement statistics i

Property	Value	Source
Space group	I 2 3	Depositor
Cell constants a, b, c, α , β , γ	278.03Å 278.03Å 278.03Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	80.26 – 2.85 80.26 – 2.85	Depositor EDS
% Data completeness (in resolution range)	99.9 (80.26-2.85) 94.2 (80.26-2.85)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.55 (at 2.86Å)	Xtrriage
Refinement program	PHENIX 1.19.1_4122	Depositor
R, R_{free}	0.163 , 0.223 0.191 , 0.219	Depositor DCC
R_{free} test set	2011 reflections (2.41%)	wwPDB-VP
Wilson B-factor (Å ²)	74.9	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 61.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	0.103 for -l,-k,-h	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	38500	wwPDB-VP
Average B, all atoms (Å ²)	91.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.87% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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: FE, ACT, ZN

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	0.50	5/2487 (0.2%)	0.58	6/3368 (0.2%)
1	B	0.29	0/2487	0.48	1/3368 (0.0%)
1	C	0.32	3/2487 (0.1%)	0.33	1/3368 (0.0%)
1	D	0.19	1/2474 (0.0%)	0.32	0/3349
1	E	0.23	1/2482 (0.0%)	0.33	1/3361 (0.0%)
1	F	0.22	1/2459 (0.0%)	0.34	0/3330
1	G	0.32	3/2447 (0.1%)	0.38	3/3312 (0.1%)
1	H	0.18	1/2469 (0.0%)	0.30	0/3342
All	All	0.30	15/19792 (0.1%)	0.39	12/26798 (0.0%)

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	G	69	MET	C-N	10.88	1.48	1.33
1	A	116	CYS	C-N	-10.59	1.18	1.33
1	A	115	LYS	C-N	-10.34	1.20	1.33
1	C	233	ALA	C-N	9.77	1.47	1.33
1	A	280	HIS	C-O	-8.88	1.13	1.24
1	A	46	ALA	C-N	-8.40	1.22	1.34
1	C	234	LYS	C-N	7.93	1.44	1.33
1	C	280	HIS	C-O	-7.74	1.15	1.24
1	H	280	HIS	C-O	-6.89	1.16	1.24
1	E	280	HIS	C-O	-6.88	1.16	1.24
1	A	47	THR	C-N	6.68	1.43	1.33
1	F	280	HIS	C-O	-6.55	1.16	1.24
1	D	280	HIS	C-O	-5.52	1.17	1.24
1	G	70	ARG	C-N	5.43	1.43	1.33
1	G	280	HIS	C-O	-5.06	1.17	1.24

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	115	LYS	O-C-N	-8.75	112.93	122.03
1	A	116	CYS	O-C-N	-6.59	115.28	122.79
1	A	116	CYS	CA-C-N	6.25	133.67	121.41
1	A	116	CYS	C-N-CA	6.25	133.67	121.41
1	G	69	MET	O-C-N	5.95	129.98	122.19
1	A	43	MET	CB-CA-C	-5.69	101.17	110.85
1	C	233	ALA	O-C-N	5.59	129.60	123.22
1	G	69	MET	N-CA-C	-5.54	105.31	112.68
1	B	39	ALA	CB-CA-C	-5.52	99.43	110.42
1	A	46	ALA	O-C-N	-5.44	116.47	122.07
1	G	68	GLY	N-CA-C	5.36	122.22	114.67
1	E	43	MET	CA-C-O	-5.15	115.09	120.55

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	2437	2389	2390	36	0
1	B	2437	2391	2391	44	0
1	C	2437	2391	2391	27	0
1	D	2425	2381	2381	11	0
1	E	2432	2386	2386	25	0
1	F	2410	2364	2363	24	0
1	G	2399	2352	2352	21	0
1	H	2420	2377	2376	20	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
2	G	1	0	0	0	0
2	H	1	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	1	0	0	0	0
3	D	1	0	0	0	0
3	E	1	0	0	0	0
3	F	1	0	0	0	0
3	G	1	0	0	0	0
3	H	1	0	0	0	0
4	A	4	3	3	2	0
4	C	4	3	3	1	0
4	E	4	3	3	0	0
4	F	4	3	3	3	0
4	G	4	3	3	4	0
5	A	3	0	0	0	0
5	B	1	0	0	1	0
5	C	1	0	0	0	0
5	D	3	0	0	0	0
5	E	3	0	0	1	0
5	F	4	0	0	0	0
5	G	3	0	0	1	0
5	H	3	0	0	0	0
All	All	19454	19046	19045	182	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 5.

All (182) 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:G:83:HIS:H	4:G:403:ACT:H2	1.34	0.92
1:C:32:LEU:HD22	1:C:119:VAL:HG11	1.54	0.88
1:H:168:VAL:HG11	1:H:267:MET:HE2	1.60	0.82
1:D:102:HIS:CE1	1:D:107:ASP:OD1	2.32	0.81
1:D:32:LEU:HD13	1:D:119:VAL:HG11	1.63	0.80
1:B:28:ASN:ND2	1:B:78:ALA:O	2.15	0.80
1:B:151:GLU:OE1	1:B:153:ARG:NH1	2.16	0.79
1:H:45:LEU:O	1:H:49:LEU:HD13	1.82	0.79
1:C:23:ARG:NH2	1:C:129:TYR:OH	2.16	0.78
1:E:41:SER:OG	5:E:501:HOH:O	2.01	0.78
1:G:83:HIS:O	4:G:403:ACT:CH3	2.30	0.78
1:B:142:MET:SD	5:B:501:HOH:O	2.42	0.78
1:F:206:LYS:NZ	4:F:403:ACT:OXT	2.14	0.77
1:A:23:ARG:NH2	1:A:129:TYR:OH	2.19	0.76

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:32:LEU:HD12	1:A:35:MET:HB2	1.67	0.76
1:E:303:GLU:OE2	1:E:305:THR:HG23	1.87	0.74
1:A:160:VAL:N	1:C:143:ASN:OD1	2.22	0.72
1:G:83:HIS:O	4:G:403:ACT:H1	1.90	0.72
1:B:120:LEU:HD21	1:B:123:GLY:HA2	1.70	0.72
1:G:303:GLU:OE2	1:G:305:THR:OG1	2.07	0.71
1:A:75:THR:OG1	1:A:264:GLN:OE1	2.09	0.71
1:A:83:HIS:H	4:A:403:ACT:H2	1.54	0.71
1:B:27:GLU:HB2	1:B:119:VAL:HG13	1.73	0.71
1:E:45:LEU:O	1:E:49:LEU:HD12	1.90	0.71
1:B:23:ARG:NH2	1:B:129:TYR:OH	2.23	0.71
1:G:83:HIS:N	4:G:403:ACT:H2	2.06	0.69
1:C:303:GLU:OE2	1:C:305:THR:OG1	2.10	0.69
1:G:54:ARG:NH1	1:G:93:ASP:OD1	2.26	0.69
1:A:27:GLU:HB3	1:A:119:VAL:HG13	1.74	0.69
1:F:23:ARG:NH2	1:F:129:TYR:OH	2.26	0.68
1:G:32:LEU:HD11	1:G:113:CYS:HA	1.75	0.68
1:C:76:ASP:HB2	1:C:260:LEU:HD21	1.75	0.68
1:H:23:ARG:NH2	1:H:129:TYR:OH	2.27	0.67
1:F:32:LEU:HD22	1:F:119:VAL:CG2	2.25	0.67
1:C:32:LEU:HD22	1:C:119:VAL:CG1	2.24	0.65
1:B:303:GLU:OE2	1:B:305:THR:OG1	2.14	0.65
1:D:194:ARG:NH2	1:D:200:ILE:O	2.30	0.64
1:B:21:ILE:HD12	1:B:129:TYR:CE1	2.33	0.63
1:B:32:LEU:HD13	1:B:116:CYS:SG	2.38	0.63
1:F:36:MET:HE1	1:F:109:VAL:HG12	1.81	0.62
1:C:50:THR:HG21	1:C:101:PHE:HB2	1.82	0.62
1:F:44:CYS:HA	1:F:47:THR:HG22	1.82	0.62
1:H:27:GLU:HB2	1:H:119:VAL:HG22	1.82	0.61
1:B:49:LEU:HD12	1:C:224:MET:SD	2.42	0.60
1:B:143:ASN:ND2	1:F:258:GLU:OE2	2.36	0.59
1:F:32:LEU:HD22	1:F:119:VAL:HG22	1.83	0.59
1:B:39:ALA:O	1:B:108:VAL:HG13	2.02	0.59
1:A:76:ASP:HB2	1:A:260:LEU:HD21	1.84	0.58
1:B:38:GLN:O	1:B:39:ALA:HB3	2.00	0.58
1:C:71:TRP:O	1:F:119:VAL:N	2.37	0.58
1:E:95:LEU:H	1:E:95:LEU:HD22	1.69	0.57
1:A:303:GLU:OE2	1:A:305:THR:OG1	2.22	0.56
1:D:160:VAL:HG21	1:F:142:MET:HE1	1.87	0.56
1:A:258:GLU:OE2	1:C:143:ASN:ND2	2.39	0.56
1:F:206:LYS:HZ2	4:F:403:ACT:C	2.12	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:113:CYS:HB3	1:H:120:LEU:HD22	1.88	0.54
1:B:160:VAL:N	1:E:143:ASN:OD1	2.35	0.54
1:G:23:ARG:NH2	1:G:129:TYR:OH	2.41	0.54
1:B:150:ALA:HB2	1:F:155:ILE:HD11	1.90	0.53
1:D:143:ASN:OD1	1:E:160:VAL:N	2.37	0.53
1:E:50:THR:HG21	1:E:101:PHE:HB2	1.89	0.53
1:C:49:LEU:HD22	1:H:224:MET:SD	2.49	0.53
1:D:160:VAL:N	1:F:143:ASN:OD1	2.37	0.53
1:E:75:THR:OG1	1:E:264:GLN:OE1	2.25	0.53
1:B:65:CYS:O	1:B:70:ARG:NH1	2.39	0.52
1:A:119:VAL:O	1:A:119:VAL:HG12	2.10	0.52
1:B:143:ASN:OD1	1:F:160:VAL:N	2.35	0.52
1:B:87:ASP:OD2	1:B:295:ARG:NH2	2.42	0.52
1:B:258:GLU:OE2	1:E:143:ASN:ND2	2.43	0.52
1:E:225:GLU:O	1:E:230:THR:HG22	2.10	0.52
1:B:272:VAL:HG13	1:E:44:CYS:HB3	1.91	0.52
1:D:32:LEU:HD22	1:D:119:VAL:HB	1.91	0.52
1:G:283:LYS:O	1:G:287:ASN:ND2	2.42	0.51
1:F:206:LYS:NZ	4:F:403:ACT:H1	2.25	0.51
1:D:23:ARG:NH2	1:D:129:TYR:OH	2.41	0.51
1:A:36:MET:HE3	1:A:300:MET:HE1	1.93	0.51
1:B:32:LEU:HD22	1:B:119:VAL:HG12	1.93	0.51
1:A:75:THR:HG21	1:A:264:GLN:HG2	1.93	0.51
1:B:32:LEU:HD22	1:B:119:VAL:CG1	2.41	0.51
1:E:75:THR:HG21	1:E:264:GLN:HG2	1.92	0.51
1:H:45:LEU:O	1:H:49:LEU:CD1	2.55	0.51
1:A:36:MET:CE	1:A:300:MET:HE1	2.42	0.50
1:G:277:LEU:HD21	1:H:49:LEU:CD1	2.40	0.50
1:C:123:GLY:N	1:F:70:ARG:HE	2.10	0.50
1:A:39:ALA:O	1:A:43:MET:HB3	2.12	0.50
1:B:39:ALA:C	1:B:108:VAL:HG13	2.36	0.50
1:H:168:VAL:HG22	1:H:296:MET:SD	2.52	0.49
1:B:120:LEU:HD23	1:G:70:ARG:HG2	1.94	0.49
1:G:45:LEU:O	1:G:49:LEU:HD12	2.13	0.49
1:C:32:LEU:O	1:C:36:MET:HG3	2.13	0.49
1:A:43:MET:C	1:A:45:LEU:N	2.70	0.48
1:D:258:GLU:OE2	1:F:143:ASN:ND2	2.42	0.48
1:A:155:ILE:HD11	1:C:150:ALA:HB2	1.95	0.48
1:D:45:LEU:HD23	1:D:49:LEU:HD12	1.96	0.48
1:C:12:GLU:OE2	1:C:206:LYS:NZ	2.42	0.48
1:A:189:THR:HG23	1:A:276:ILE:HG23	1.95	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:32:LEU:HD22	1:F:119:VAL:HG21	1.94	0.47
1:C:245:TYR:CD2	1:C:247:ILE:HD11	2.48	0.47
1:E:46:ALA:HB2	1:G:227:MET:HE3	1.96	0.47
1:G:277:LEU:HD21	1:H:49:LEU:HD11	1.97	0.47
1:B:22:ASN:ND2	1:B:107:ASP:OD2	2.44	0.47
1:B:224:MET:SD	1:H:49:LEU:HD23	2.54	0.47
1:D:88:GLN:NE2	1:D:107:ASP:OD2	2.48	0.46
1:E:35:MET:HE1	1:E:116:CYS:HB2	1.96	0.46
1:F:23:ARG:NH2	1:F:129:TYR:HH	2.10	0.46
1:A:43:MET:C	1:A:43:MET:SD	2.98	0.46
1:E:23:ARG:NH2	1:E:129:TYR:OH	2.49	0.46
1:A:32:LEU:HD13	1:A:116:CYS:HB2	1.97	0.46
1:A:73:ALA:HA	1:A:77:MET:HE1	1.96	0.46
1:C:32:LEU:CD2	1:C:119:VAL:HG11	2.34	0.46
1:A:66:PRO:HA	1:A:70:ARG:HB2	1.98	0.46
1:B:6:LYS:NZ	1:B:10:ASP:OD1	2.43	0.46
1:B:73:ALA:HA	1:B:77:MET:HE1	1.97	0.46
1:E:36:MET:HE2	1:E:109:VAL:HA	1.98	0.46
1:A:210:ILE:HG22	1:A:244:GLY:HA3	1.96	0.46
1:G:50:THR:HG21	1:G:101:PHE:HB2	1.98	0.45
1:E:151:GLU:OE1	1:E:153:ARG:NH1	2.49	0.45
1:A:43:MET:SD	1:A:108:VAL:HG23	2.56	0.45
1:G:32:LEU:O	1:G:36:MET:HG3	2.17	0.45
1:B:32:LEU:HB2	1:B:119:VAL:HG11	1.99	0.45
1:B:50:THR:HG21	1:B:101:PHE:HB2	1.98	0.45
1:G:131:ILE:O	5:G:501:HOH:O	2.21	0.45
1:A:83:HIS:O	4:A:403:ACT:H1	2.17	0.45
1:A:43:MET:C	1:A:45:LEU:H	2.25	0.44
1:E:43:MET:SD	1:E:108:VAL:HG23	2.56	0.44
1:A:43:MET:HE2	1:A:101:PHE:HZ	1.83	0.44
1:H:36:MET:HG2	1:H:58:LEU:HD21	1.98	0.44
1:C:32:LEU:HD13	1:C:119:VAL:HG11	1.99	0.44
1:C:82:SER:OG	4:C:403:ACT:H3	2.18	0.44
1:B:235:LEU:N	1:B:235:LEU:HD22	2.33	0.44
1:B:118:ASN:O	1:B:119:VAL:C	2.60	0.44
1:A:6:LYS:NZ	1:A:10:ASP:OD1	2.44	0.43
1:A:33:MET:HE3	1:A:84:ILE:HD11	2.00	0.43
1:B:38:GLN:O	1:B:39:ALA:CB	2.63	0.43
1:E:255:VAL:HG21	1:E:267:MET:HE1	2.01	0.43
1:H:75:THR:OG1	1:H:264:GLN:NE2	2.49	0.43
1:E:190:LEU:HD13	1:E:202:TYR:CD1	2.54	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:190:LEU:HD12	1:F:204:ILE:HD11	2.00	0.43
1:F:225:GLU:O	1:F:230:THR:HG22	2.19	0.43
1:A:99:GLU:O	1:A:103:GLU:HG3	2.19	0.43
1:H:34:ARG:NE	1:H:34:ARG:HA	2.33	0.42
1:B:98:HIS:NE2	1:B:102:HIS:CD2	2.87	0.42
1:B:172:HIS:ND1	1:B:292:PRO:HB3	2.34	0.42
1:A:235:LEU:H	1:A:235:LEU:HD22	1.83	0.42
1:H:12:GLU:OE2	1:H:206:LYS:NZ	2.50	0.42
1:E:22:ASN:ND2	1:E:107:ASP:OD2	2.49	0.42
1:B:32:LEU:CD1	1:B:116:CYS:SG	3.07	0.42
1:B:113:CYS:HA	1:B:116:CYS:SG	2.60	0.42
1:C:77:MET:HB2	1:C:80:GLU:HB2	2.02	0.42
1:A:71:TRP:O	1:H:119:VAL:HB	2.20	0.42
1:A:151:GLU:HG3	1:A:153:ARG:HG3	2.02	0.42
1:C:255:VAL:HG21	1:C:267:MET:HE1	2.02	0.42
1:B:32:LEU:O	1:B:32:LEU:HG	2.20	0.41
1:C:45:LEU:O	1:C:49:LEU:HD12	2.20	0.41
1:F:143:ASN:O	1:F:147:GLN:HG2	2.20	0.41
1:C:190:LEU:HD13	1:C:202:TYR:CD1	2.55	0.41
1:B:166:VAL:HG12	1:B:298:VAL:HG12	2.01	0.41
1:B:265:ARG:NH2	1:E:299:SER:O	2.53	0.41
1:C:33:MET:HA	1:C:33:MET:HE2	2.02	0.41
1:C:98:HIS:NE2	1:C:102:HIS:CD2	2.88	0.41
1:G:265:ARG:NH2	1:H:299:SER:OG	2.54	0.41
1:A:98:HIS:NE2	1:A:102:HIS:CD2	2.88	0.41
1:H:151:GLU:OE1	1:H:153:ARG:NH2	2.53	0.41
1:B:21:ILE:HG21	1:B:23:ARG:NH1	2.36	0.41
1:F:190:LEU:HD13	1:F:202:TYR:CD1	2.56	0.41
1:G:281:GLY:O	1:G:286:ASN:ND2	2.43	0.41
1:B:190:LEU:HD12	1:B:204:ILE:HD11	2.01	0.41
1:E:35:MET:HE1	1:E:116:CYS:SG	2.61	0.41
1:F:98:HIS:NE2	1:F:102:HIS:CD2	2.89	0.41
1:B:190:LEU:HD13	1:B:202:TYR:CD2	2.55	0.41
1:E:75:THR:HB	1:E:296:MET:HE3	2.02	0.41
1:E:143:ASN:O	1:E:147:GLN:HG2	2.21	0.41
1:F:32:LEU:O	1:F:36:MET:HG3	2.20	0.41
1:A:12:GLU:OE2	1:A:206:LYS:NZ	2.52	0.41
1:C:168:VAL:HG11	1:C:267:MET:HE2	2.03	0.40
1:H:98:HIS:NE2	1:H:102:HIS:CD2	2.89	0.40
1:A:305:THR:O	1:A:309:VAL:HG23	2.21	0.40
1:G:28:ASN:ND2	1:G:78:ALA:O	2.54	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:26:VAL:CG2	1:A:33:MET:HE1	2.52	0.40
1:B:49:LEU:HD12	1:C:224:MET:CE	2.52	0.40
1:H:120:LEU:HD23	1:H:120:LEU:N	2.37	0.40
1:G:210:ILE:HG22	1:G:244:GLY:HA3	2.03	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	308/313 (98%)	297 (96%)	11 (4%)	0	100	100
1	B	308/313 (98%)	295 (96%)	13 (4%)	0	100	100
1	C	308/313 (98%)	300 (97%)	8 (3%)	0	100	100
1	D	304/313 (97%)	294 (97%)	10 (3%)	0	100	100
1	E	307/313 (98%)	296 (96%)	11 (4%)	0	100	100
1	F	302/313 (96%)	294 (97%)	8 (3%)	0	100	100
1	G	298/313 (95%)	289 (97%)	9 (3%)	0	100	100
1	H	303/313 (97%)	295 (97%)	8 (3%)	0	100	100
All	All	2438/2504 (97%)	2360 (97%)	78 (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	A	264/267 (99%)	264 (100%)	0	100	100
1	B	264/267 (99%)	264 (100%)	0	100	100
1	C	264/267 (99%)	262 (99%)	2 (1%)	73	86
1	D	263/267 (98%)	263 (100%)	0	100	100
1	E	264/267 (99%)	263 (100%)	1 (0%)	84	92
1	F	261/267 (98%)	261 (100%)	0	100	100
1	G	260/267 (97%)	259 (100%)	1 (0%)	84	92
1	H	263/267 (98%)	263 (100%)	0	100	100
All	All	2103/2136 (98%)	2099 (100%)	4 (0%)	87	95

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	35	MET
1	C	234	LYS
1	E	43	MET
1	G	36	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	118	ASN
1	D	264	GLN
1	D	271	ASN
1	F	203	GLN
1	G	280	HIS
1	H	280	HIS

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 21 ligands modelled in this entry, 16 are monoatomic - leaving 5 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	ACT	F	403	-	3,3,3	0.95	0	3,3,3	0.80	0
4	ACT	A	403	-	3,3,3	0.94	0	3,3,3	0.82	0
4	ACT	E	403	-	3,3,3	0.95	0	3,3,3	0.80	0
4	ACT	G	403	-	3,3,3	0.95	0	3,3,3	0.82	0
4	ACT	C	403	-	3,3,3	0.94	0	3,3,3	0.80	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

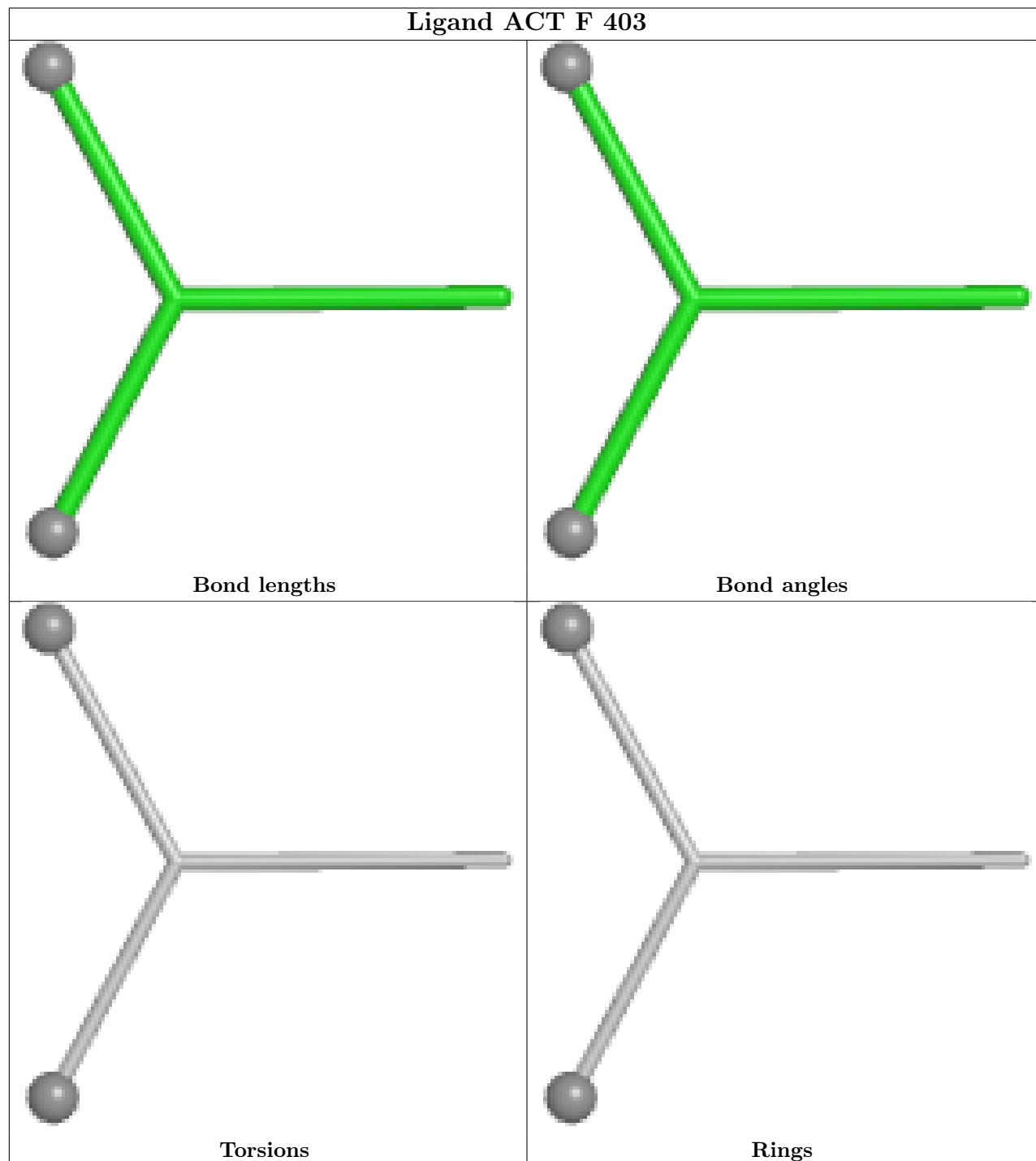
There are no ring outliers.

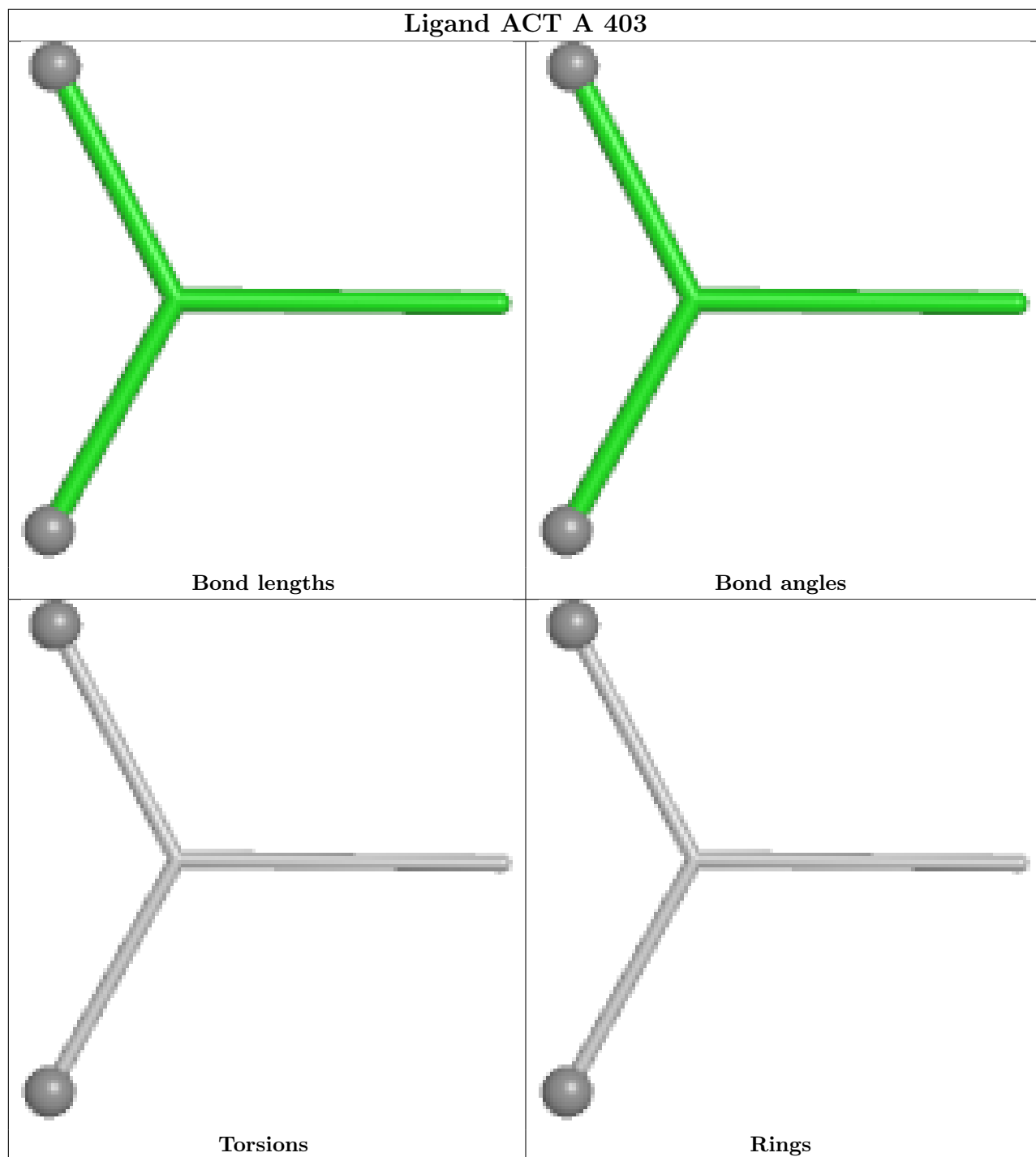
4 monomers are involved in 10 short contacts:

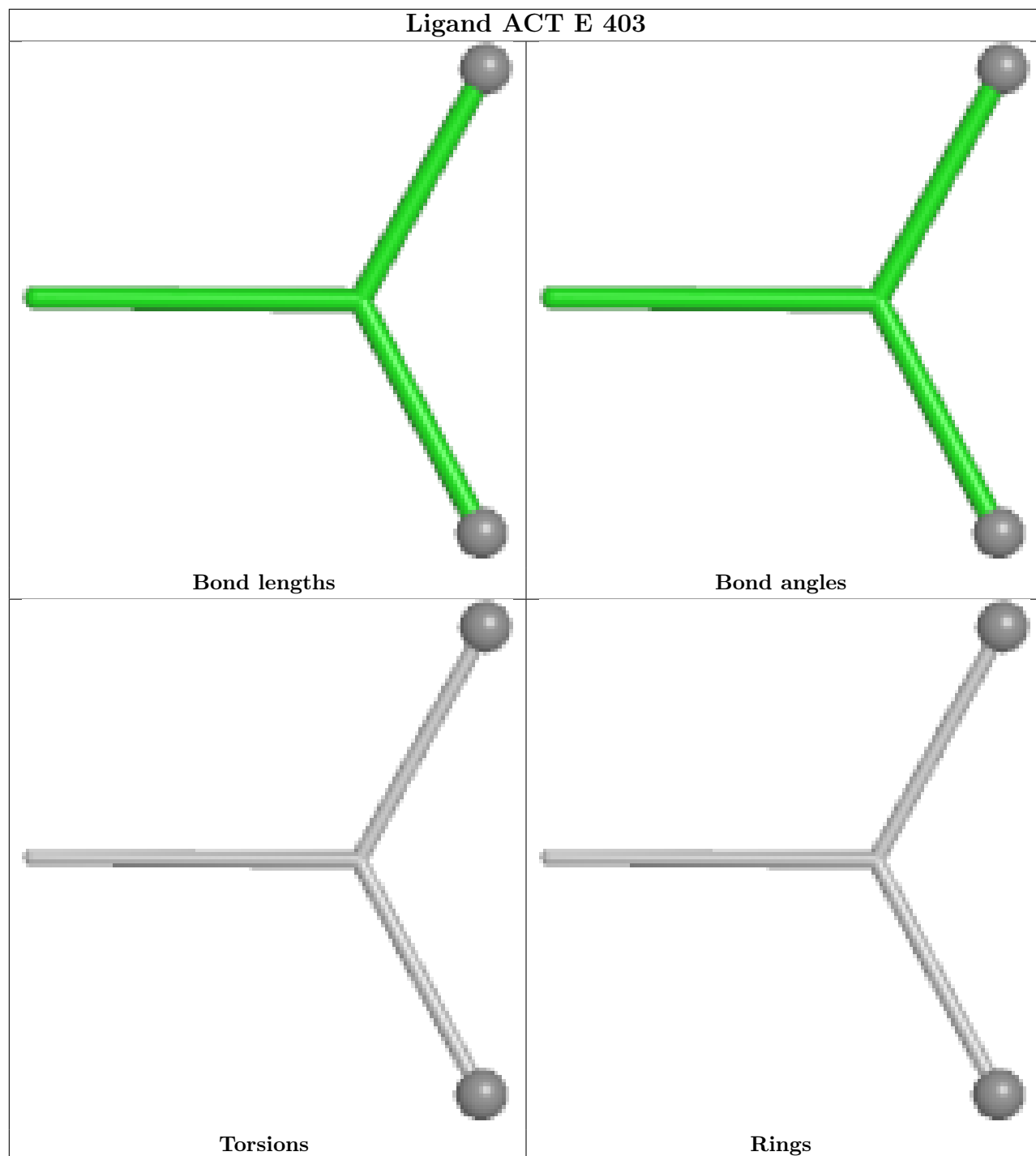
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	F	403	ACT	3	0
4	A	403	ACT	2	0
4	G	403	ACT	4	0
4	C	403	ACT	1	0

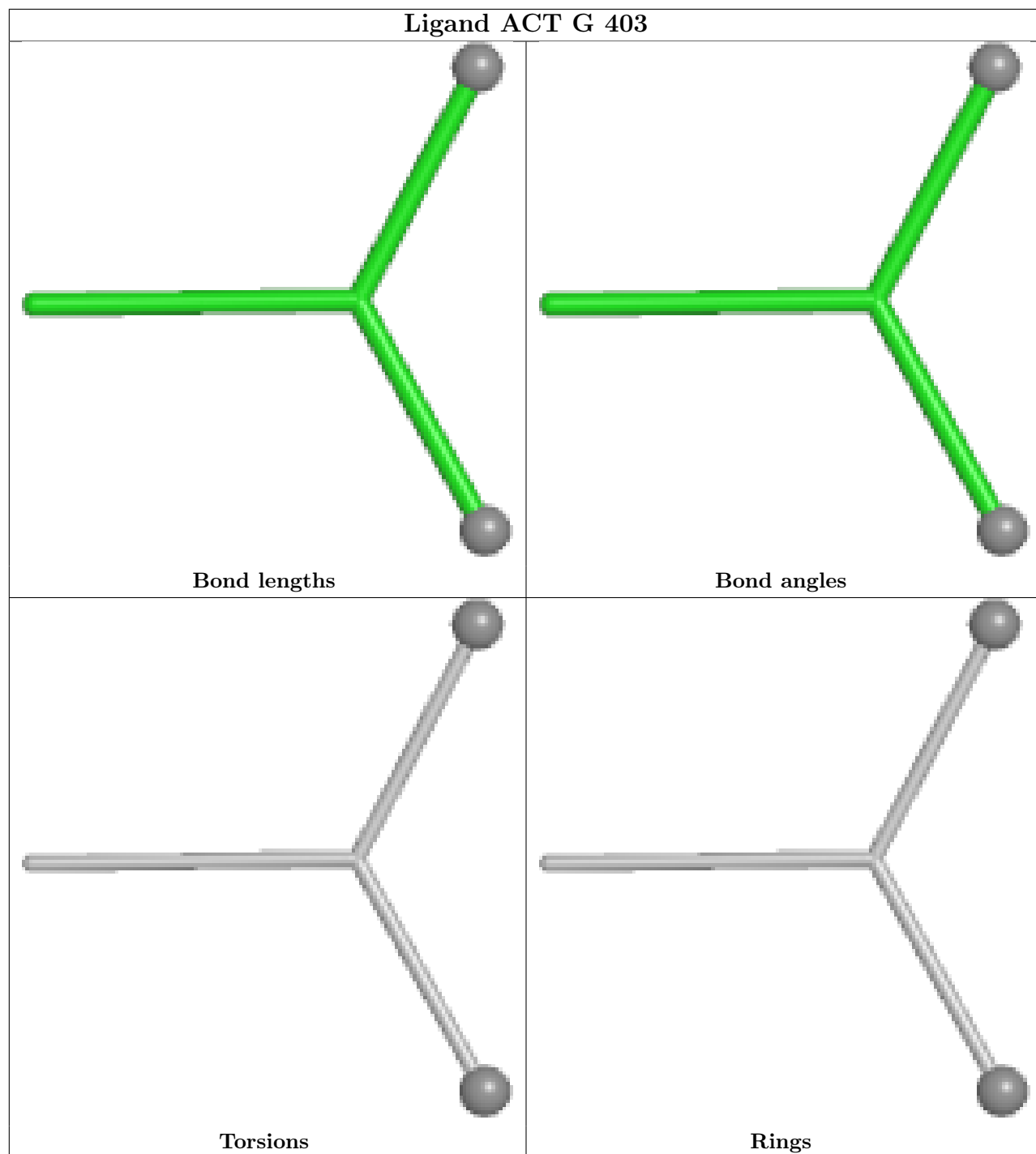
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

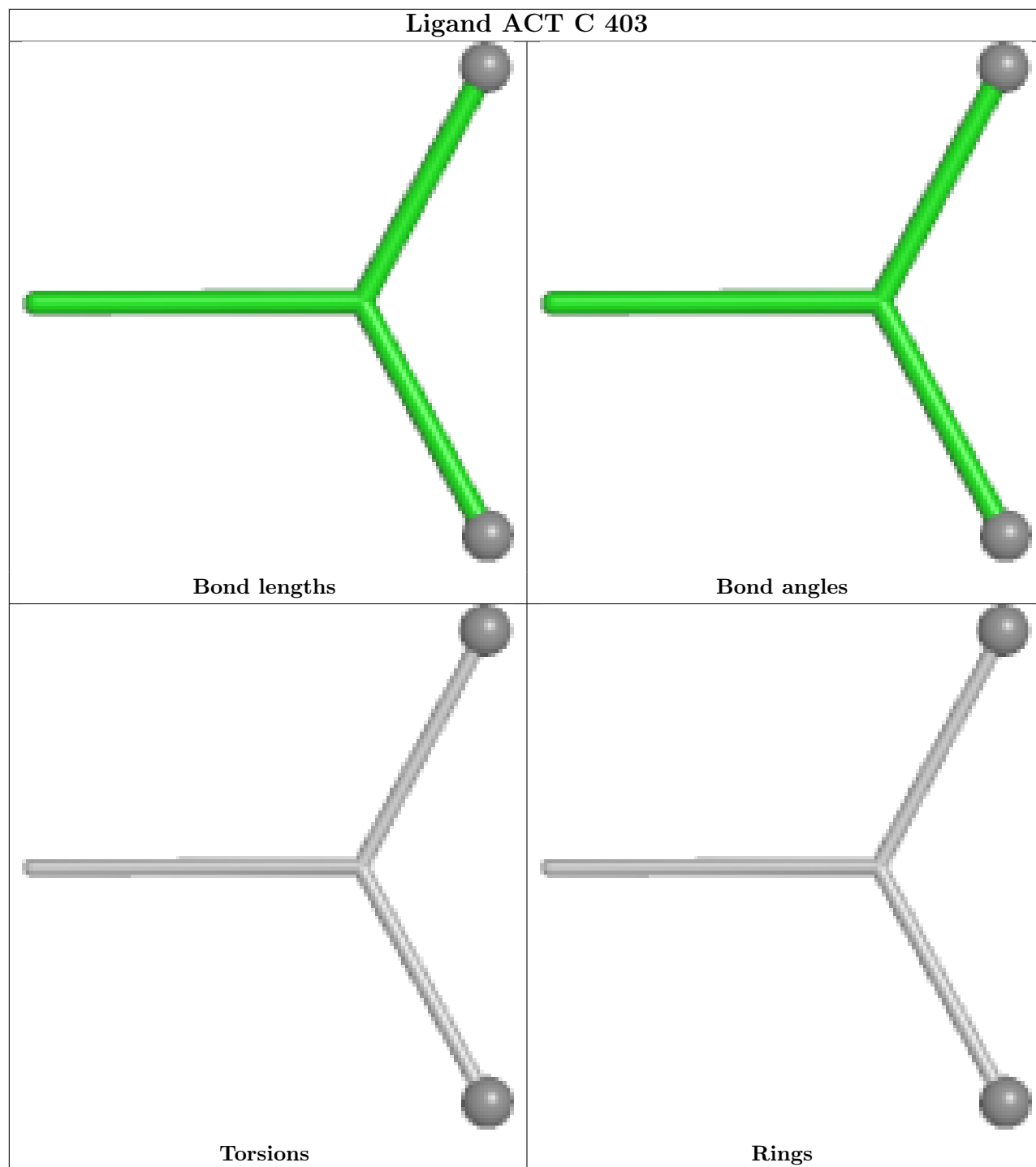
highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified 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.











5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	115:LYS	C	116:CYS	N	1.19
1	A	116:CYS	C	117:GLY	N	1.18

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, 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	310/313 (99%)	0.07	12 (3%) 43 34	65, 84, 139, 159	0
1	B	310/313 (99%)	0.05	10 (3%) 50 41	66, 84, 138, 150	0
1	C	310/313 (99%)	0.00	7 (2%) 61 52	67, 84, 132, 155	0
1	D	308/313 (98%)	0.08	12 (3%) 43 34	65, 84, 132, 149	0
1	E	309/313 (98%)	0.01	8 (2%) 57 48	64, 83, 129, 147	0
1	F	306/313 (97%)	0.04	8 (2%) 57 48	66, 84, 127, 147	0
1	G	304/313 (97%)	0.11	10 (3%) 49 40	69, 86, 129, 140	0
1	H	307/313 (98%)	0.09	9 (2%) 53 45	67, 87, 137, 147	0
All	All	2464/2504 (98%)	0.06	76 (3%) 51 43	64, 84, 134, 159	0

All (76) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	72	GLY	5.4
1	F	109	VAL	4.0
1	H	109	VAL	3.9
1	C	41	SER	3.7
1	B	67	MET	3.6
1	H	43	MET	3.6
1	E	71	TRP	3.6
1	D	69	MET	3.5
1	B	313	ALA	3.5
1	B	119	VAL	3.5
1	B	120	LEU	3.5
1	G	109	VAL	3.4
1	E	69	MET	3.3
1	H	119	VAL	3.3
1	G	32	LEU	3.3
1	G	41	SER	3.2

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Mol	Chain	Res	Type	RSRZ
1	E	120	LEU	3.2
1	C	113	CYS	3.1
1	E	41	SER	3.1
1	H	113	CYS	3.0
1	B	69	MET	3.0
1	B	41	SER	2.9
1	G	313	ALA	2.9
1	A	67	MET	2.9
1	A	47	THR	2.8
1	A	44	CYS	2.8
1	G	119	VAL	2.7
1	G	70	ARG	2.7
1	A	43	MET	2.7
1	D	123	GLY	2.7
1	F	45	LEU	2.7
1	C	73	ALA	2.6
1	B	118	ASN	2.6
1	F	41	SER	2.6
1	A	72	GLY	2.6
1	H	121	LEU	2.6
1	D	313	ALA	2.6
1	D	107	ASP	2.6
1	E	66	PRO	2.5
1	C	109	VAL	2.5
1	A	66	PRO	2.5
1	D	43	MET	2.5
1	H	111	THR	2.5
1	A	113	CYS	2.5
1	F	69	MET	2.5
1	A	313	ALA	2.4
1	E	73	ALA	2.4
1	F	313	ALA	2.4
1	A	69	MET	2.4
1	H	69	MET	2.4
1	D	41	SER	2.4
1	D	71	TRP	2.4
1	D	66	PRO	2.4
1	E	78	ALA	2.3
1	F	44	CYS	2.3
1	D	109	VAL	2.3
1	F	122	ASP	2.3
1	G	113	CYS	2.3

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Mol	Chain	Res	Type	RSRZ
1	H	71	TRP	2.3
1	G	66	PRO	2.3
1	C	43	MET	2.2
1	A	42	GLU	2.2
1	D	68	GLY	2.2
1	A	75	THR	2.1
1	C	72	GLY	2.1
1	F	119	VAL	2.1
1	B	56	PHE	2.1
1	B	39	ALA	2.1
1	D	67	MET	2.0
1	B	109	VAL	2.0
1	G	110	VAL	2.0
1	D	301	PHE	2.0
1	E	70	ARG	2.0
1	H	68	GLY	2.0
1	A	41	SER	2.0
1	C	70	ARG	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 oligosaccharides 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
4	ACT	F	403	4/4	0.68	0.18	78,86,93,93	0
4	ACT	E	403	4/4	0.75	0.45	68,85,103,103	0
3	ZN	G	402	1/1	0.86	0.18	160,160,160,160	0
3	ZN	H	402	1/1	0.86	0.21	142,142,142,142	0
2	FE	A	401	1/1	0.87	0.14	106,106,106,106	0

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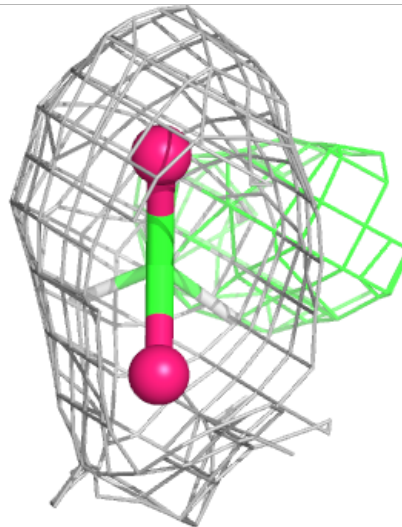
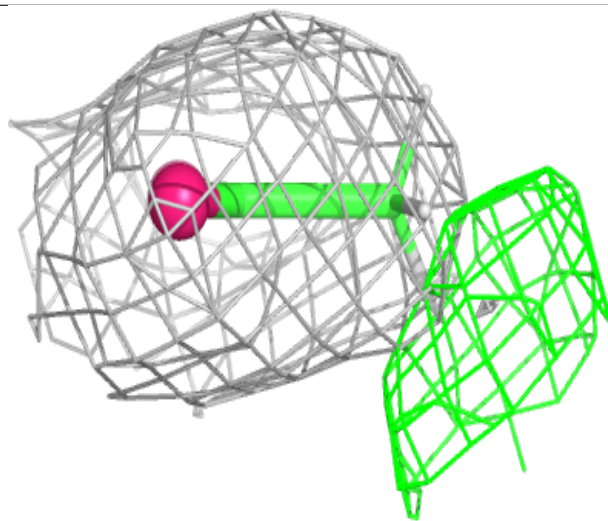
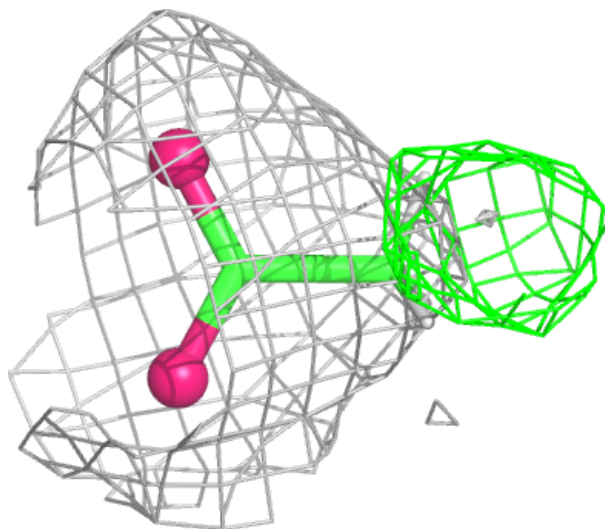
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	FE	E	401	1/1	0.88	0.12	101,101,101,101	0
3	ZN	A	402	1/1	0.88	0.17	145,145,145,145	0
2	FE	B	401	1/1	0.88	0.13	103,103,103,103	0
4	ACT	G	403	4/4	0.88	0.19	79,84,100,100	0
2	FE	F	401	1/1	0.89	0.10	96,96,96,96	0
2	FE	H	401	1/1	0.90	0.10	98,98,98,98	0
4	ACT	A	403	4/4	0.90	0.14	70,77,84,84	0
4	ACT	C	403	4/4	0.90	0.20	66,76,83,83	0
3	ZN	C	402	1/1	0.91	0.20	130,130,130,130	0
3	ZN	E	402	1/1	0.91	0.27	134,134,134,134	0
2	FE	D	401	1/1	0.91	0.09	106,106,106,106	0
2	FE	C	401	1/1	0.92	0.10	98,98,98,98	0
3	ZN	B	402	1/1	0.93	0.15	129,129,129,129	0
3	ZN	D	402	1/1	0.93	0.22	148,148,148,148	0
2	FE	G	401	1/1	0.95	0.08	95,95,95,95	0
3	ZN	F	402	1/1	0.96	0.19	138,138,138,138	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.

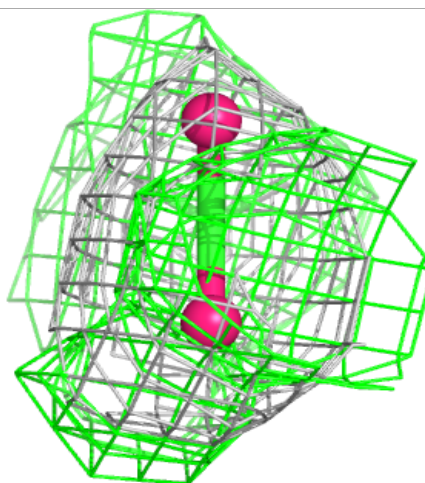
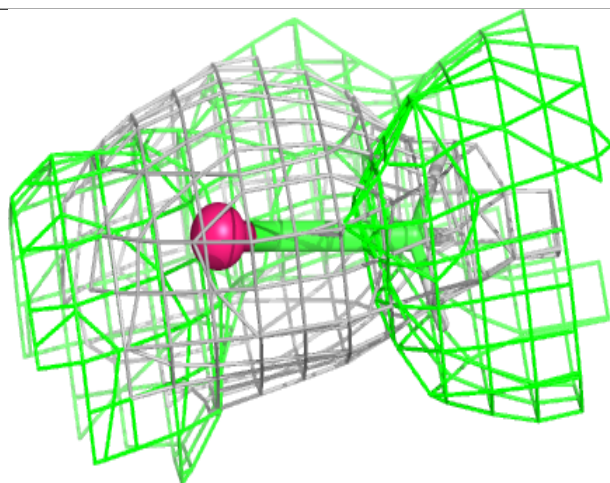
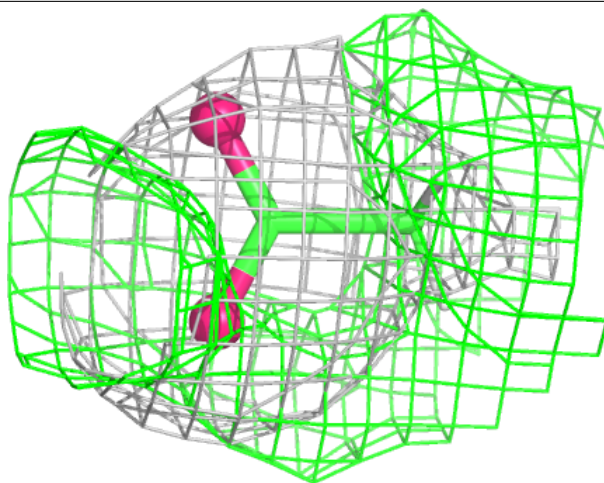
Electron density around ACT F 403:

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



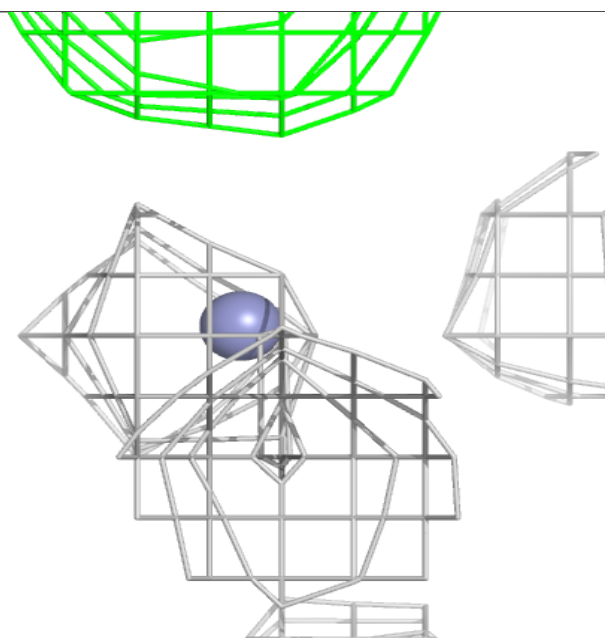
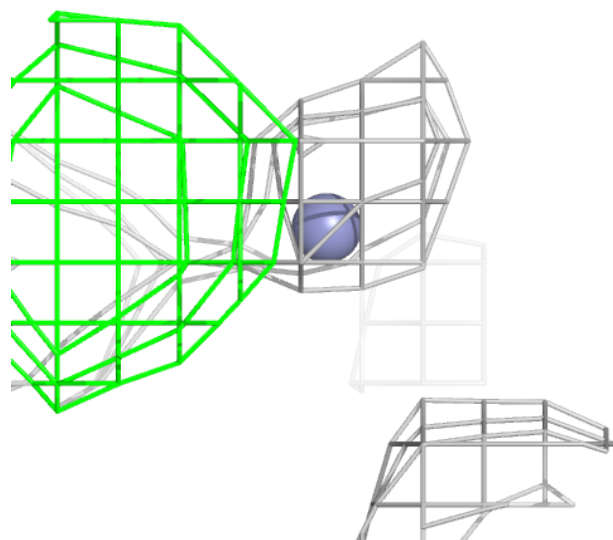
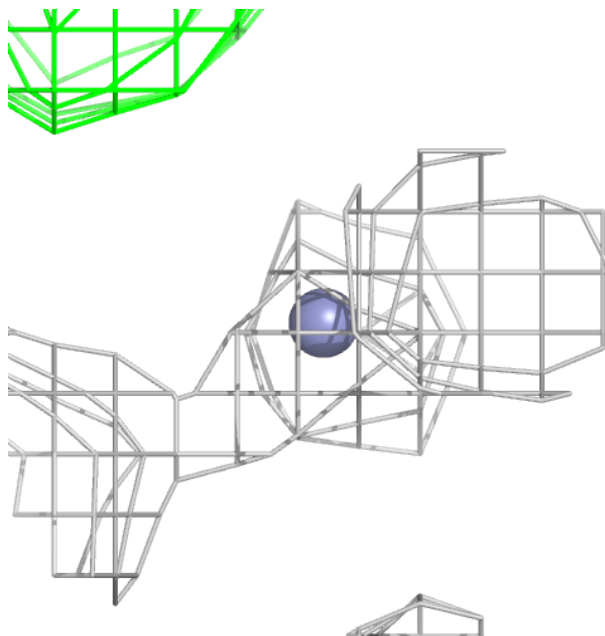
Electron density around ACT E 403:

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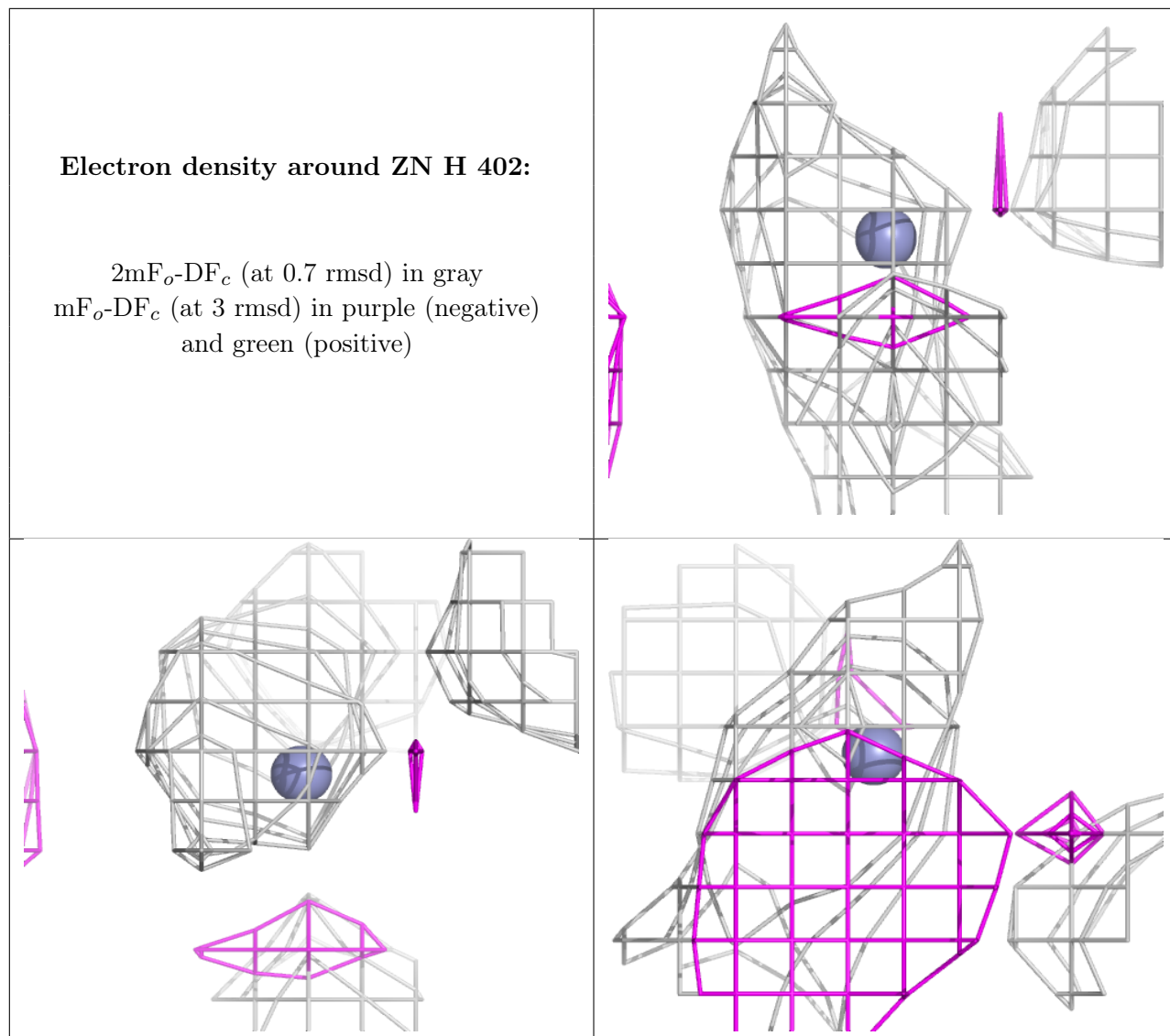
Electron density around ZN G 402:

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and green (positive)



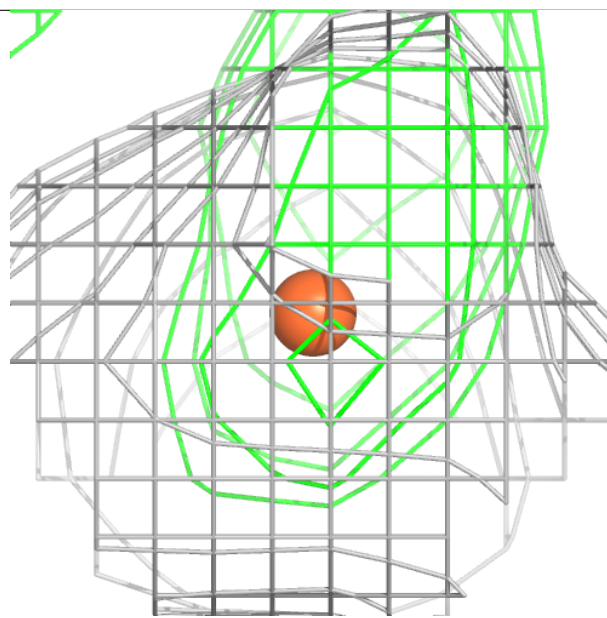
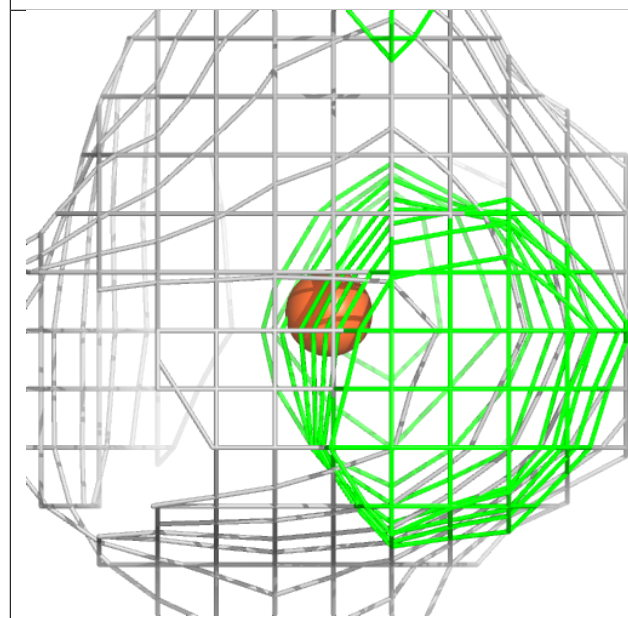
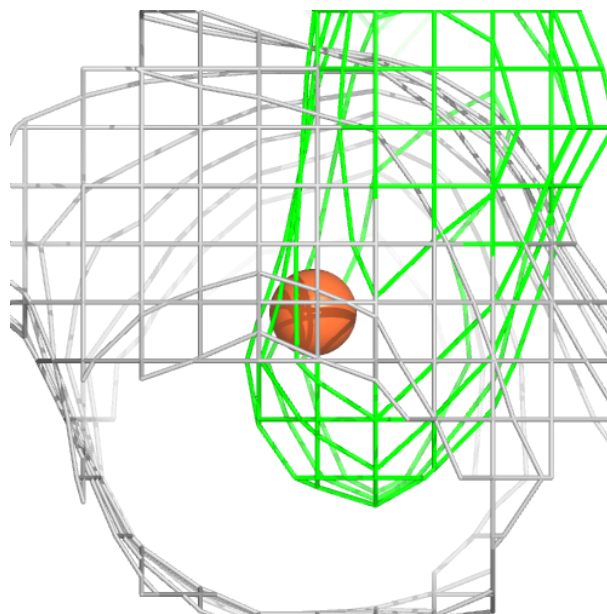
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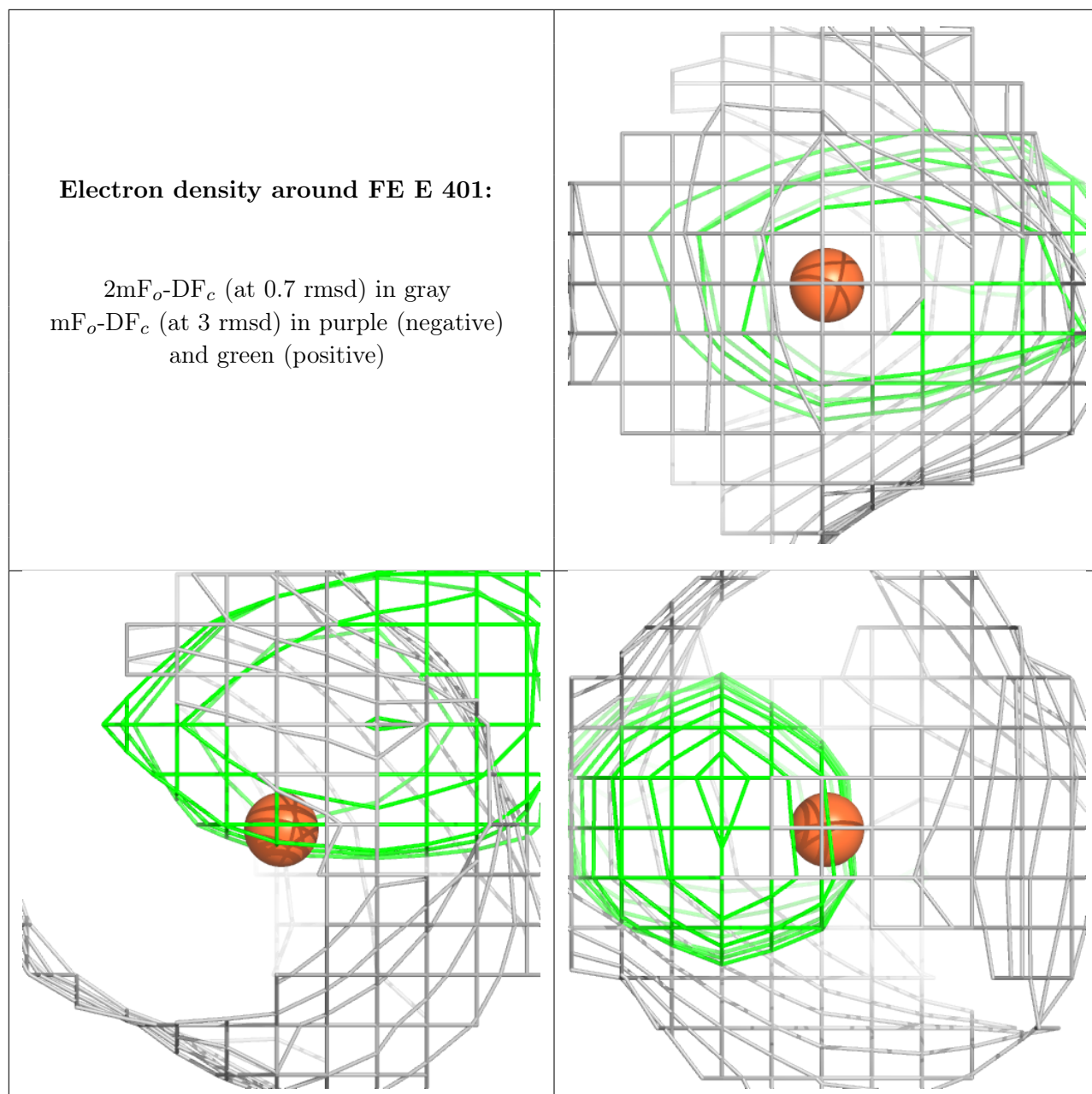
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and green (positive)



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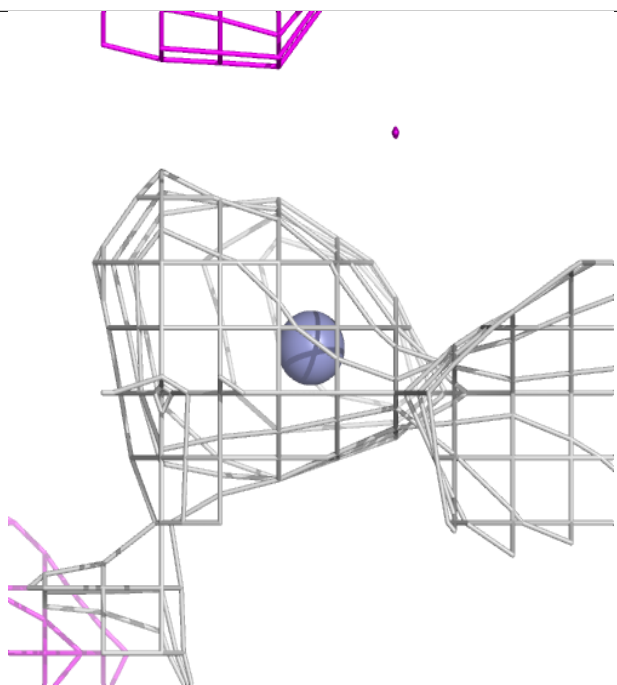
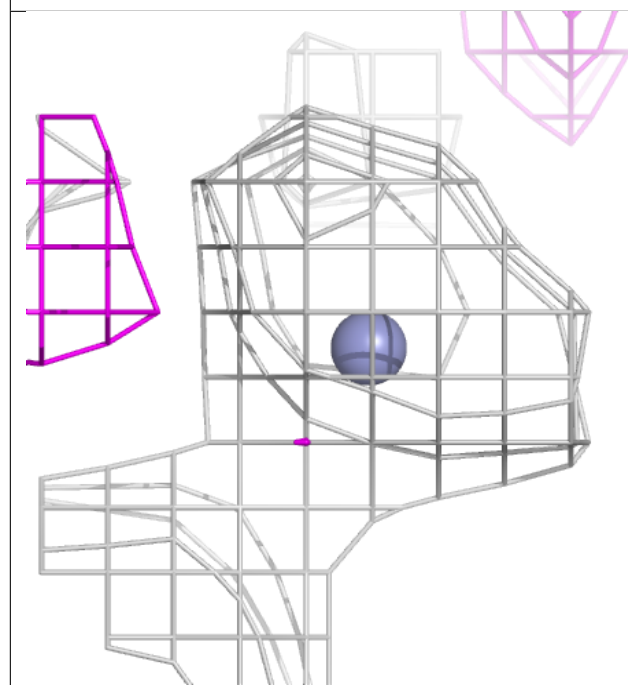
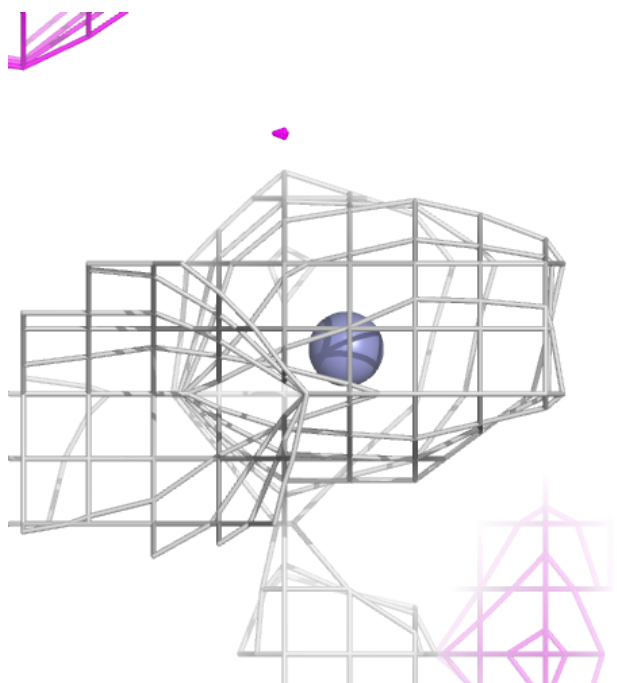
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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





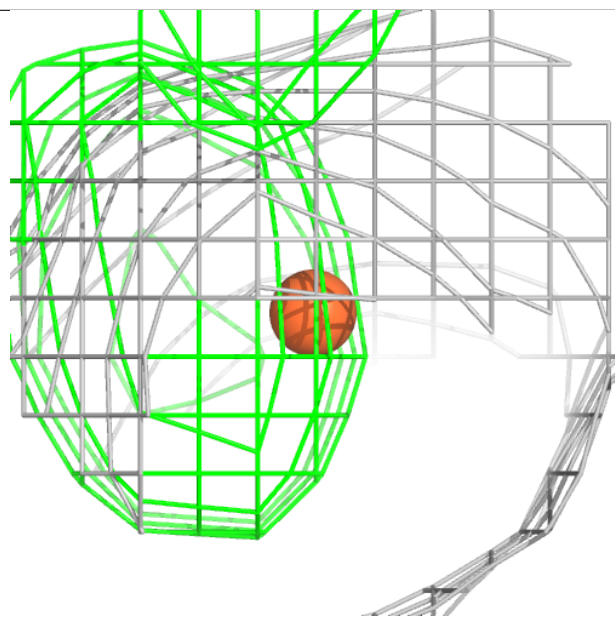
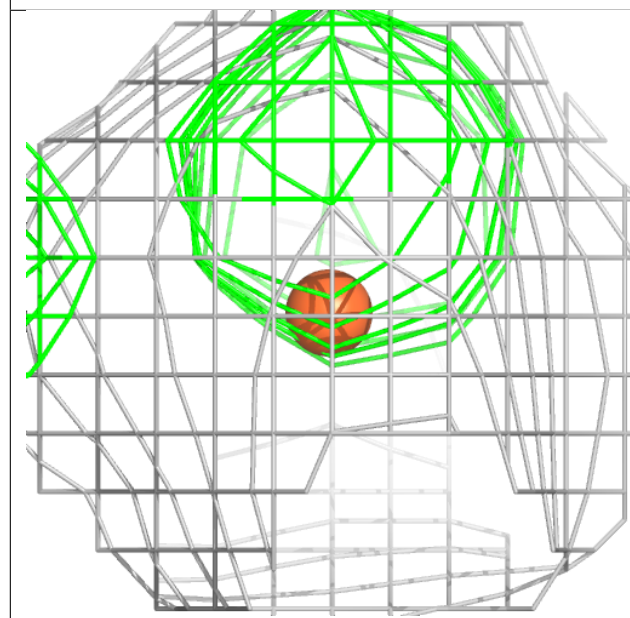
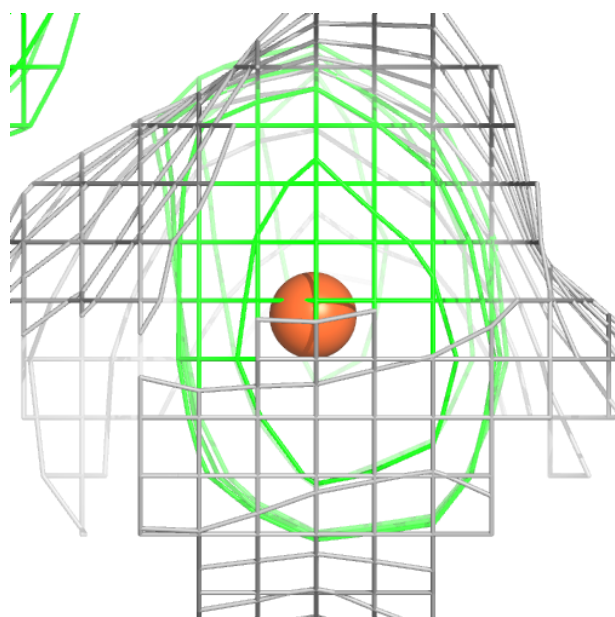
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and green (positive)



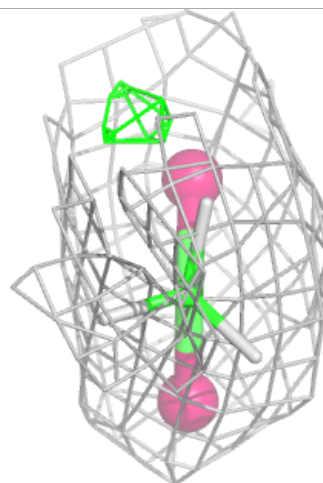
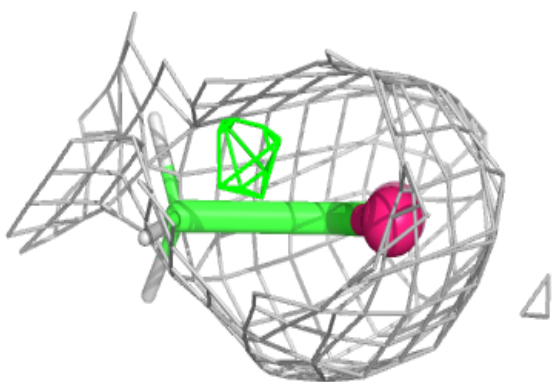
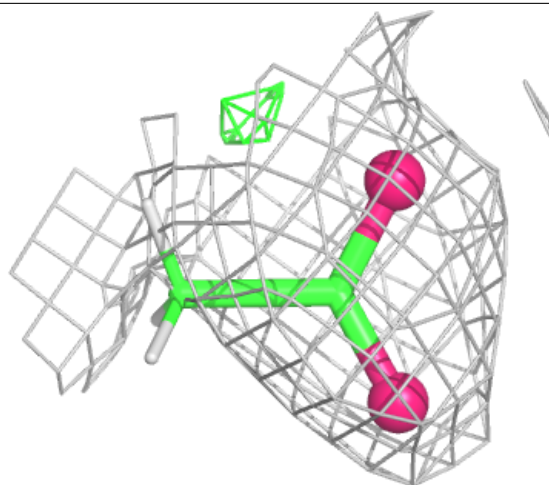
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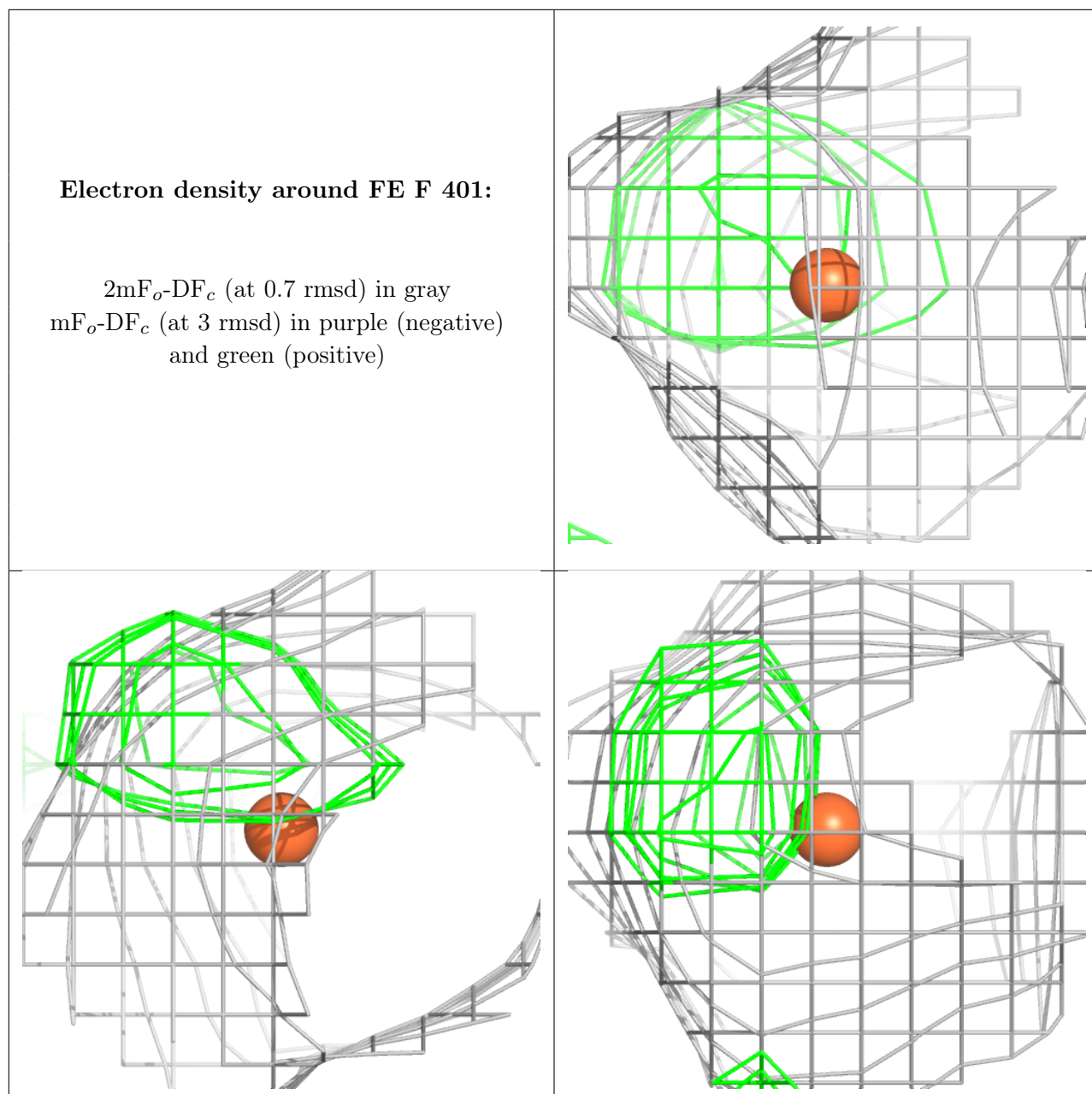
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and green (positive)



Electron density around ACT G 403:

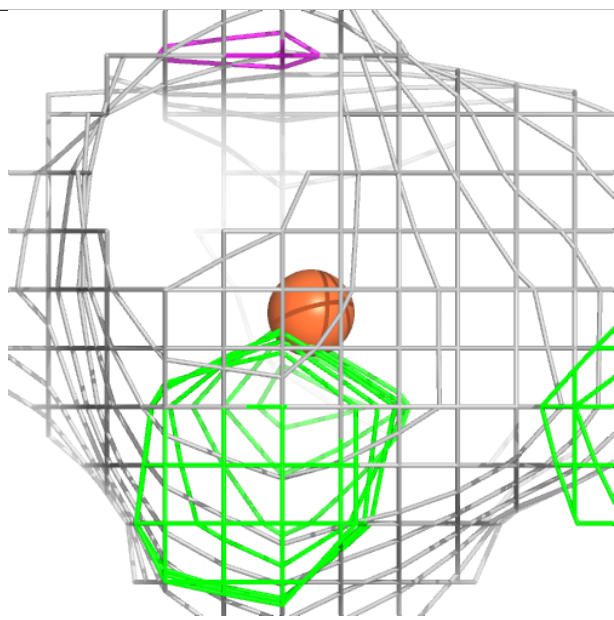
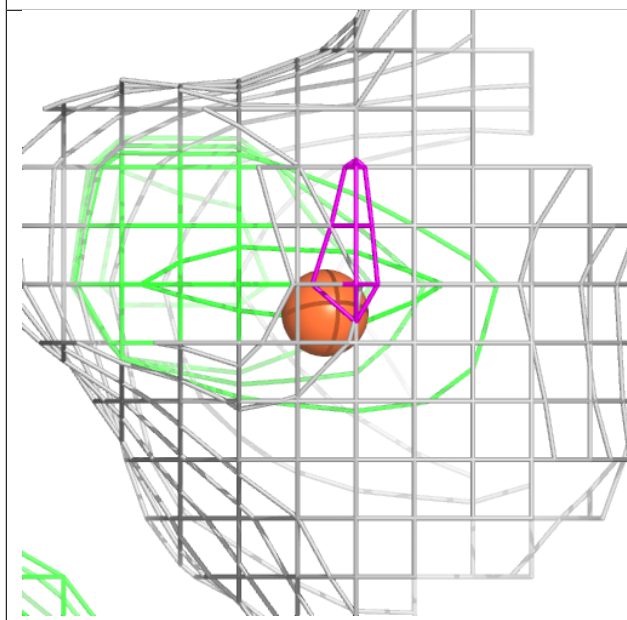
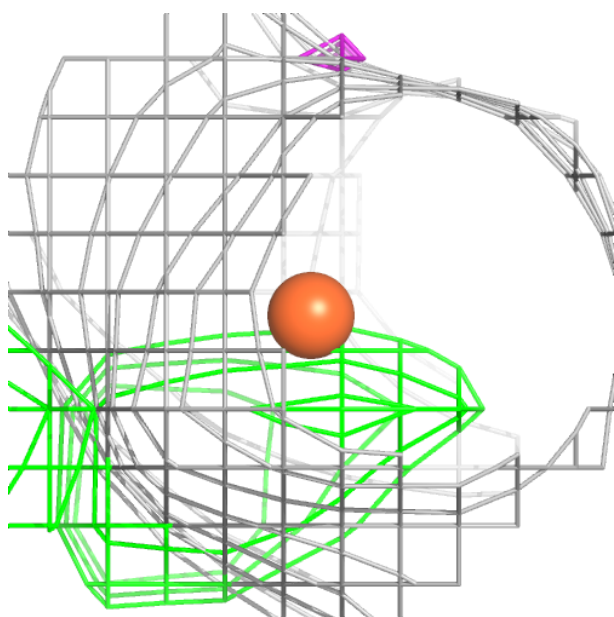
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and green (positive)

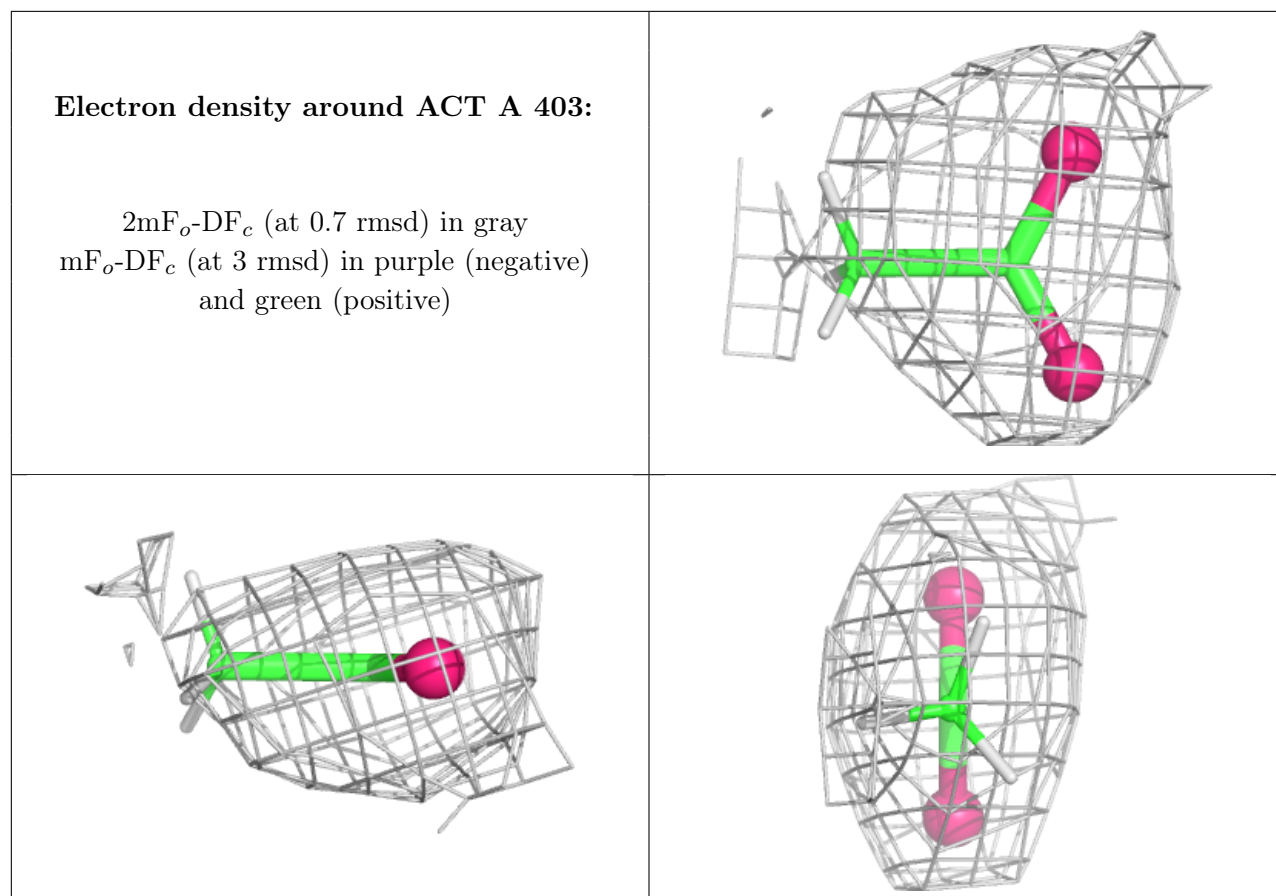


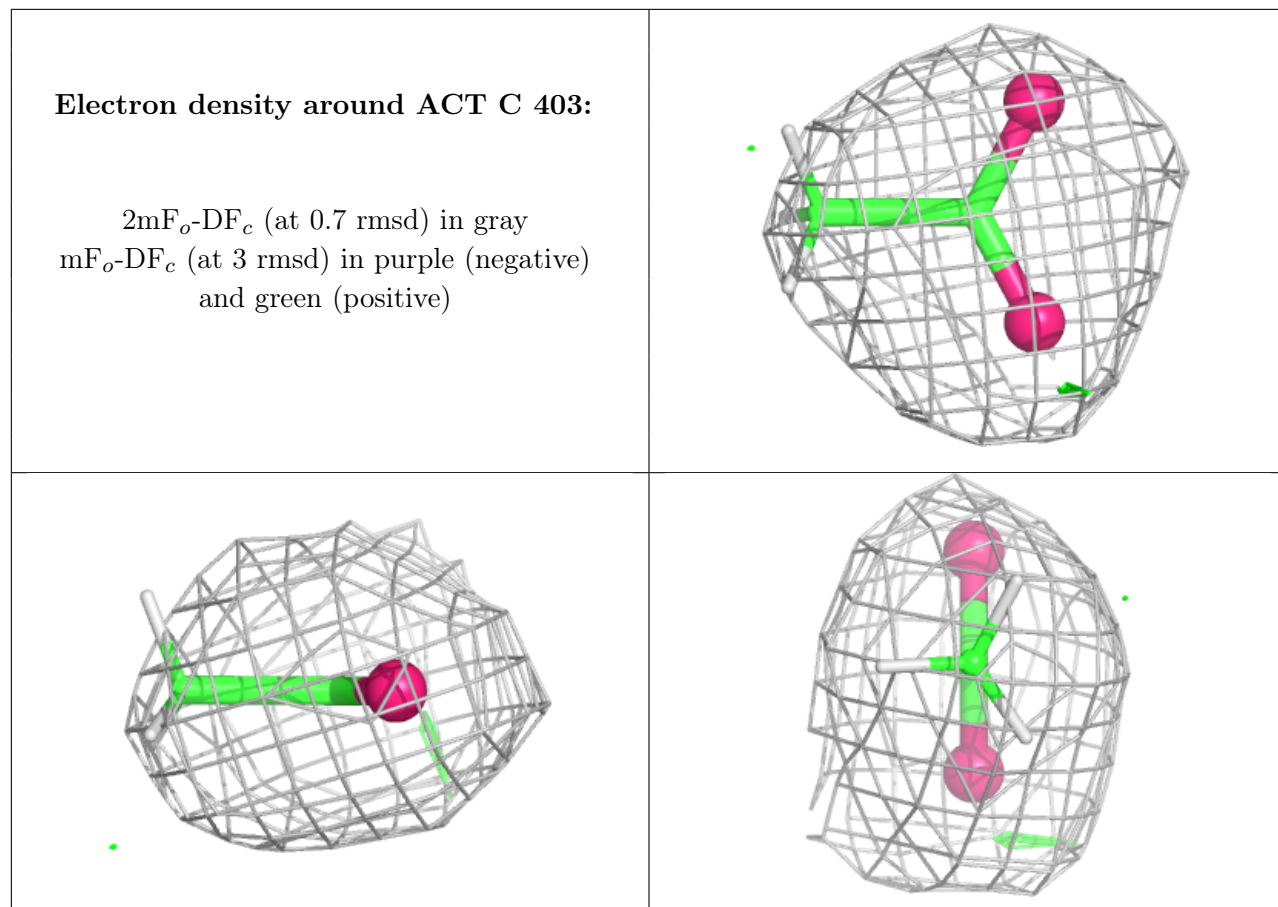


Electron density around FE H 401:

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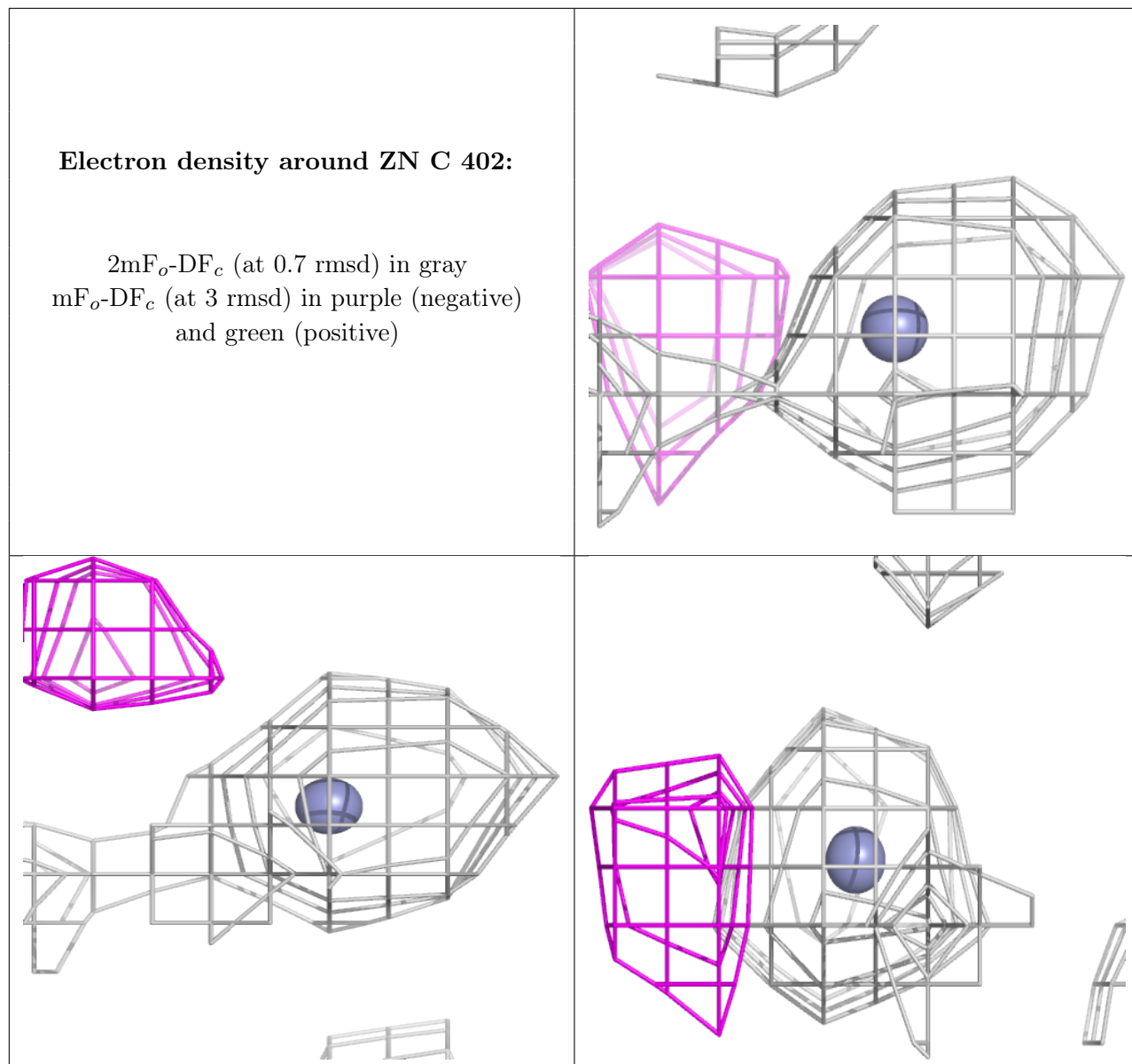


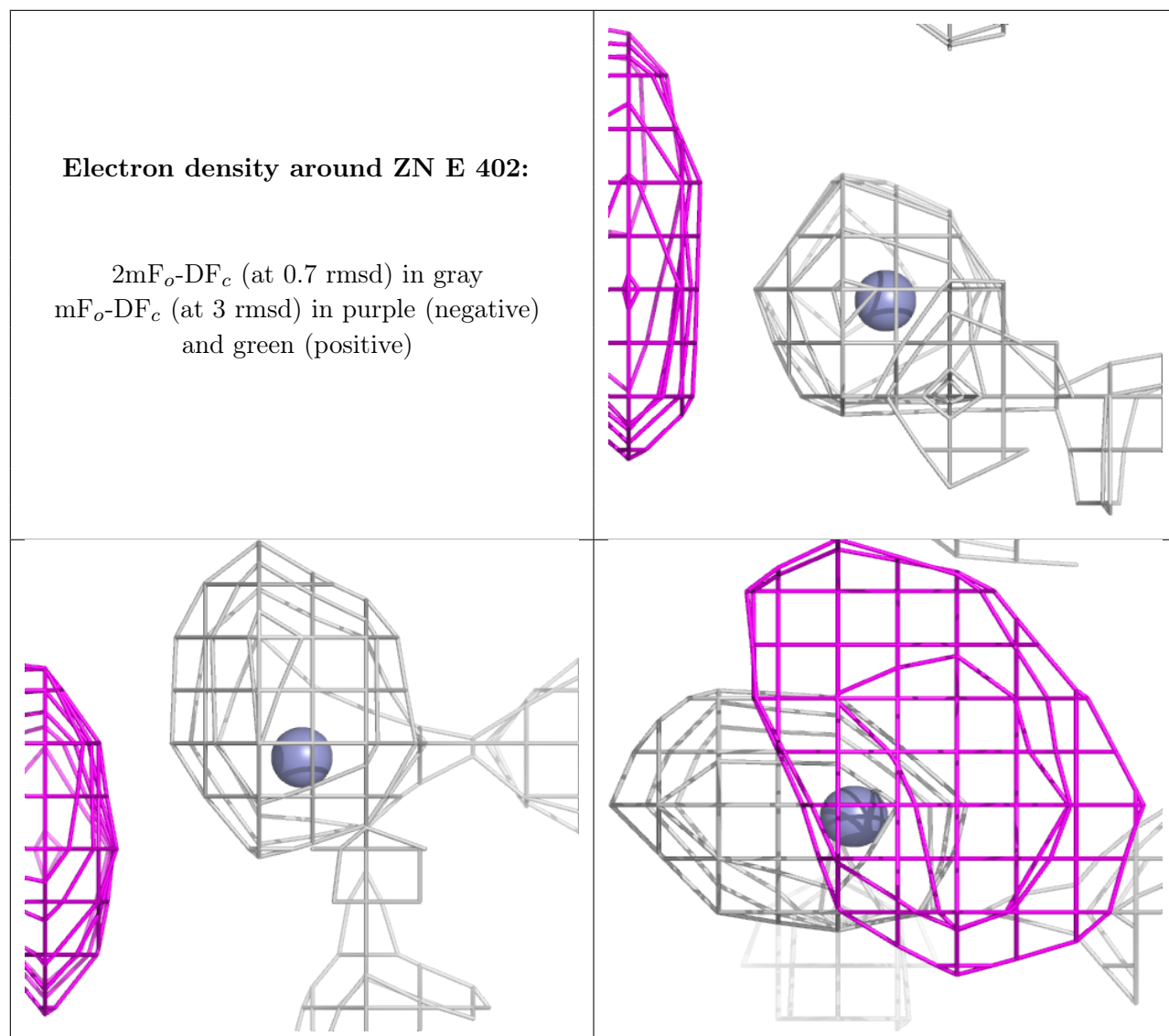




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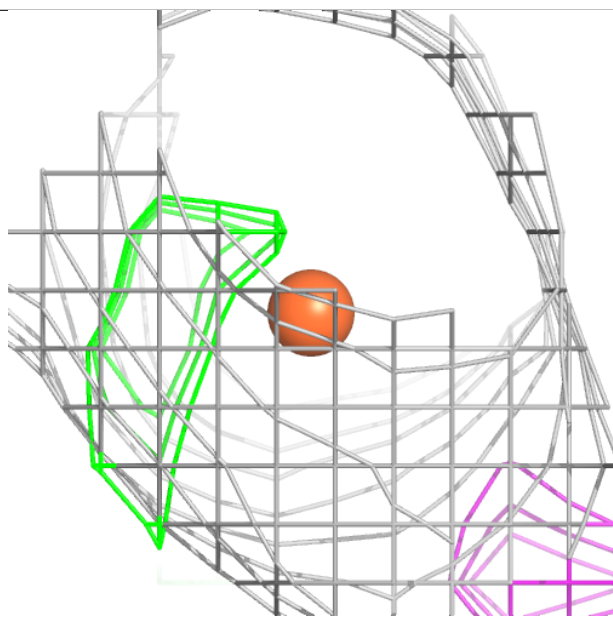
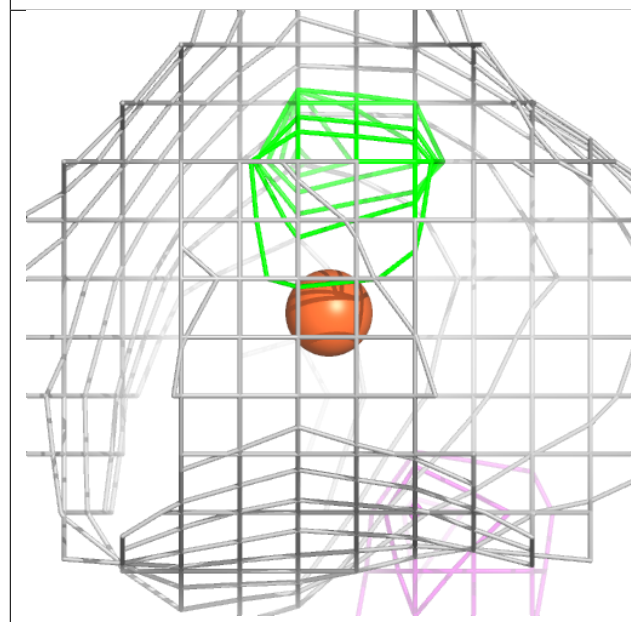
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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





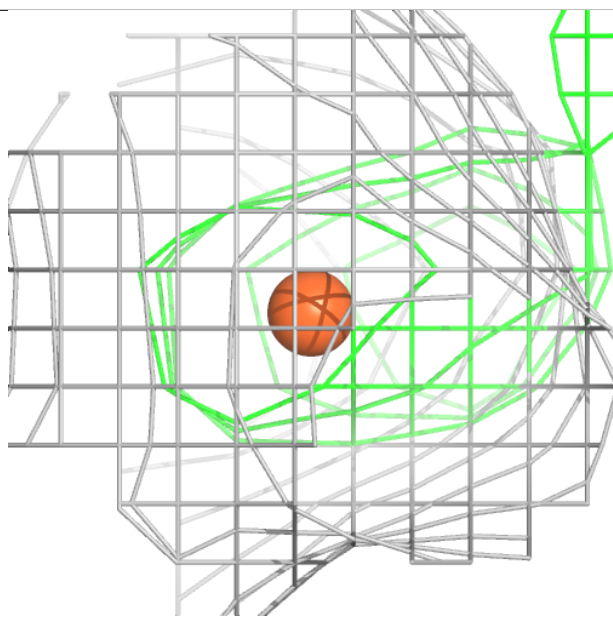
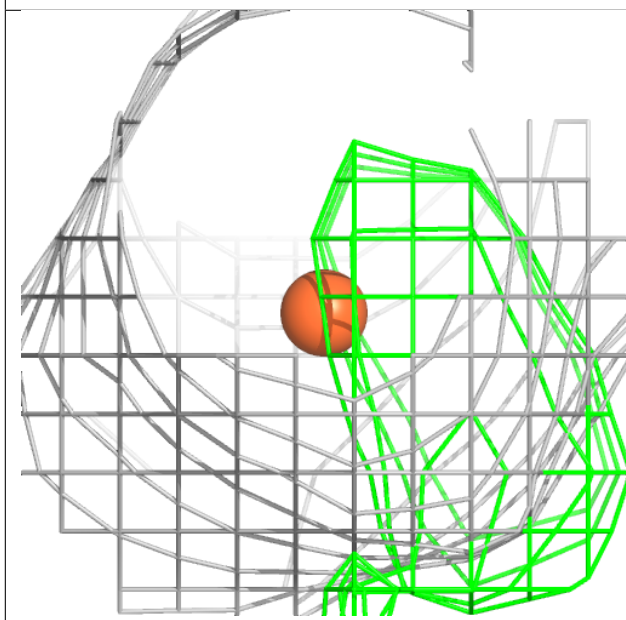
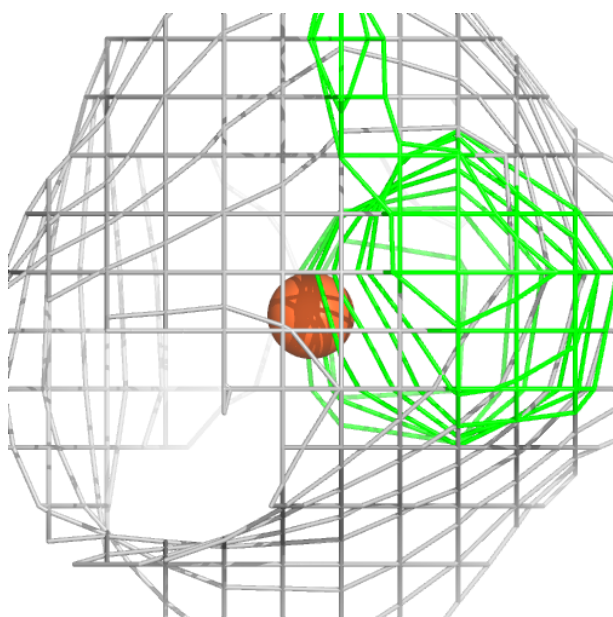
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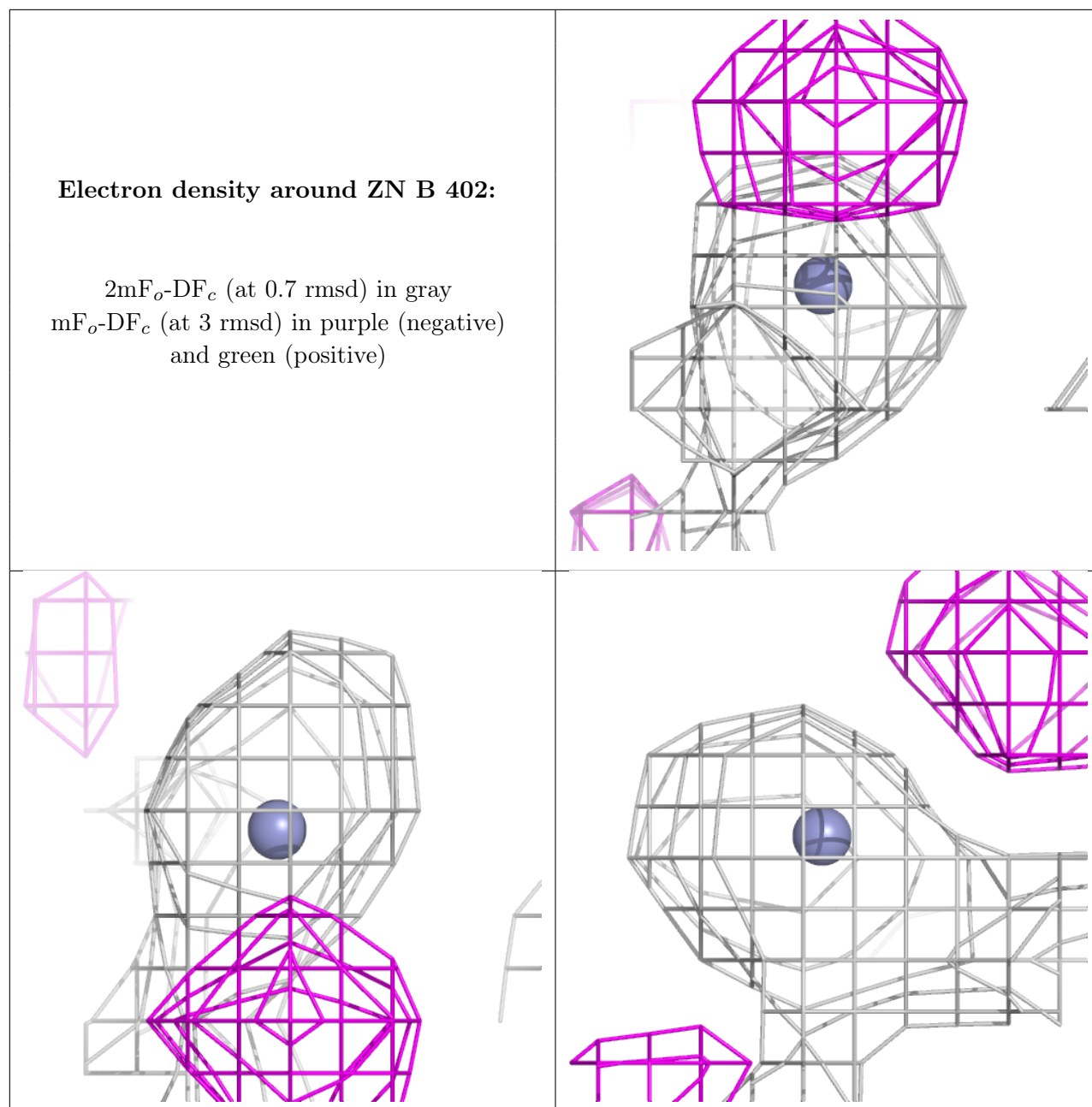
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and green (positive)



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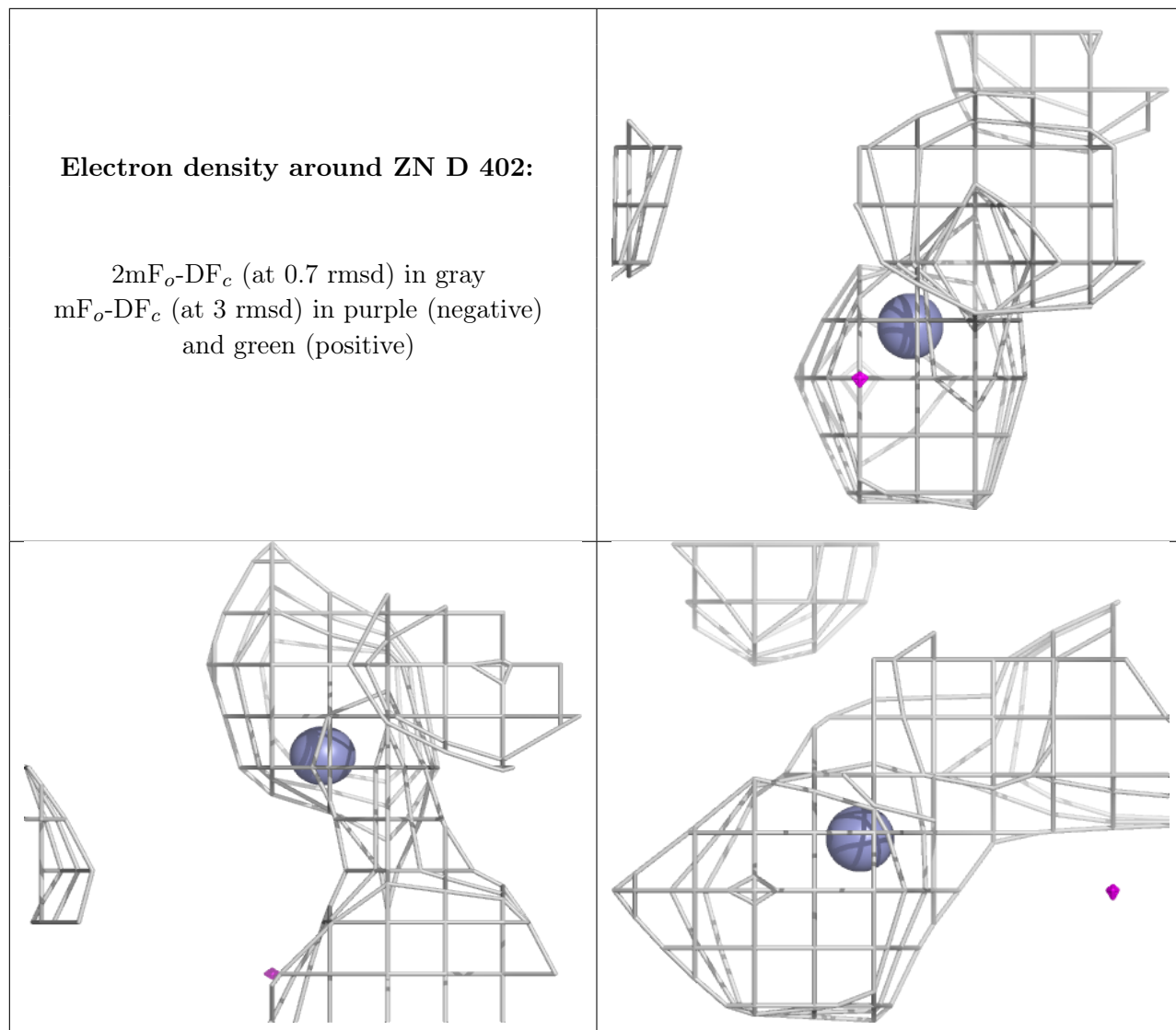
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and green (positive)





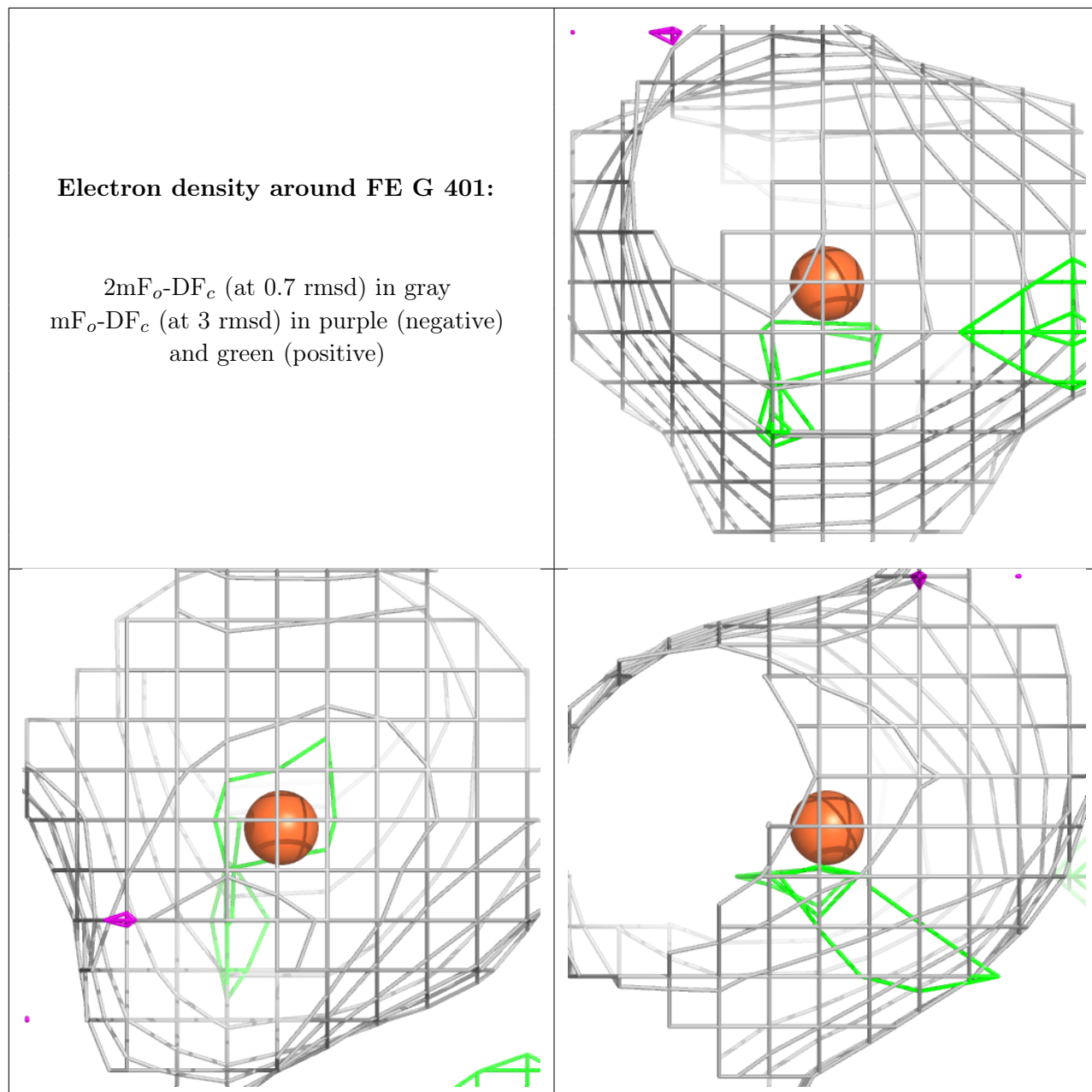
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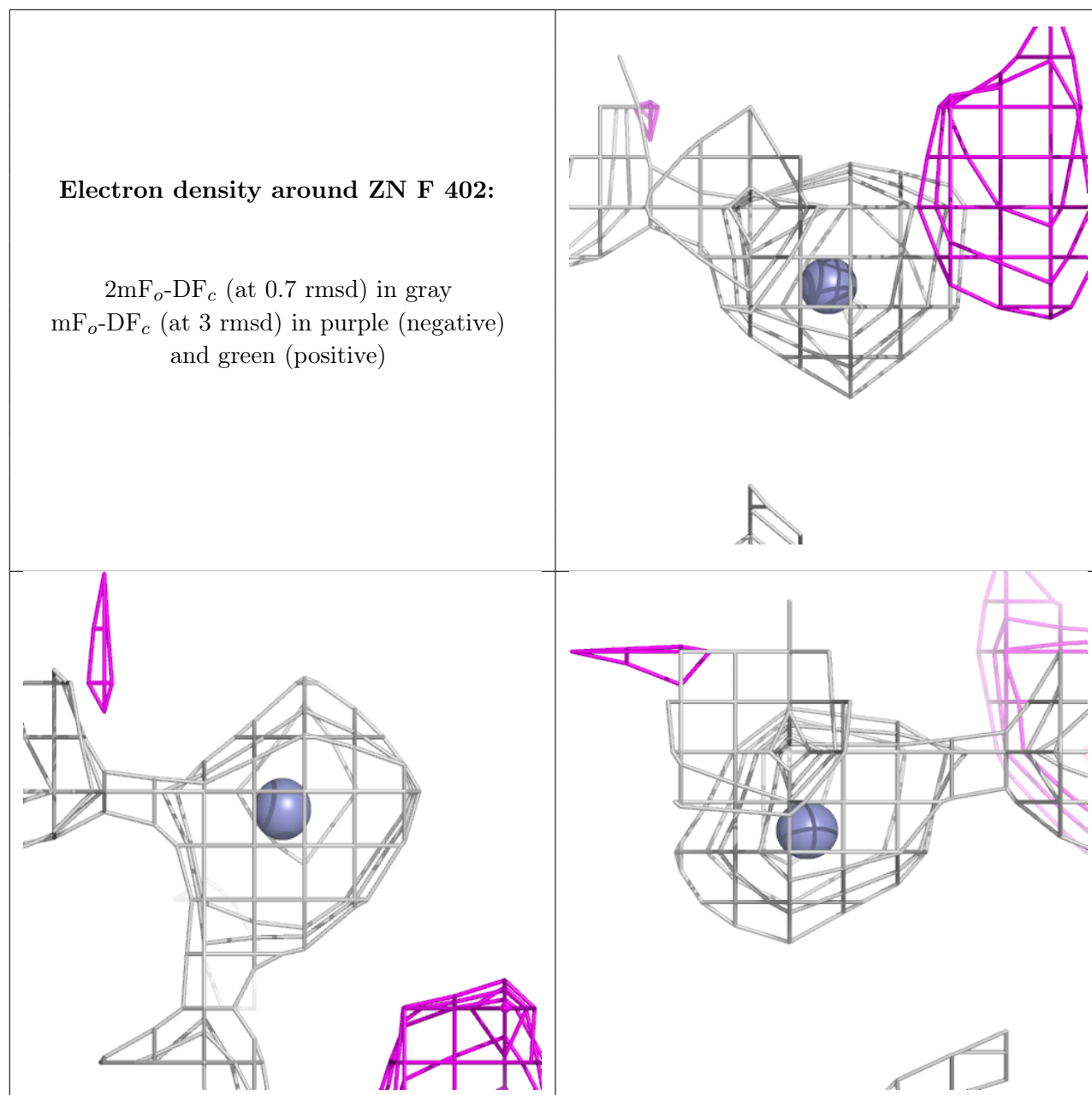
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and green (positive)



Electron density around FE G 401:

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 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.