Full wwPDB X-ray Structure Validation Report (i)

Nov 11, 2025 – 03:11 pm GMT

PDB ID	:	9RCL / pdb_00009rcl
Title	:	Laccase (multicopper oxidase) from Pediococcus pentosaceus 4618 mutant M455A-M456A soaked with Copper 10 minutes
Authors	:	Paredes, F.; Casino, P.
Deposited on	:	2025-05-29
Resolution	:	2.20 Å(reported)

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

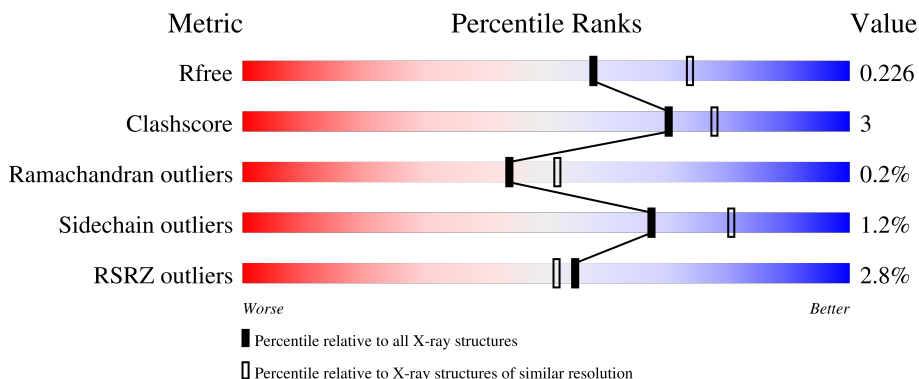|		
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.46

1 Overall quality at a glance ⓘ

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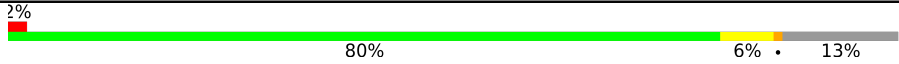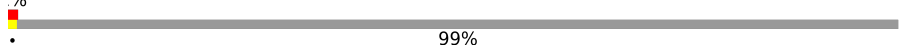*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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	Percentile Ranks	Value
Rfree		0.226
Clashscore		3
Ramachandran outliers		0.2%
Sidechain outliers		1.2%
RSRZ outliers		2.8%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	5791 (2.20-2.20)
Clashscore	180529	6634 (2.20-2.20)
Ramachandran outliers	177936	6560 (2.20-2.20)
Sidechain outliers	177891	6561 (2.20-2.20)
RSRZ outliers	164620	5791 (2.20-2.20)

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	532	2% / 80% / 6% · 13%
1	B	532	2% / 80% / 7% · 13%
1	E	532	% / · / 99%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 7636 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 Multicopper oxidase domain-containing protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	E	5	Total 45	C 27	N 13	O 5		0	0	0
1	A	462	Total 3639	C 2327	N 622	O 678	S 12	0	1	0
1	B	462	Total 3644	C 2331	N 622	O 679	S 12	0	1	0

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	-1	MET	-	initiating methionine	UNP A0AB73HHR8
E	0	GLY	-	expression tag	UNP A0AB73HHR8
E	1	SER	-	expression tag	UNP A0AB73HHR8
E	2	SER	-	expression tag	UNP A0AB73HHR8
E	3	HIS	-	expression tag	UNP A0AB73HHR8
E	4	HIS	-	expression tag	UNP A0AB73HHR8
E	5	HIS	-	expression tag	UNP A0AB73HHR8
E	6	HIS	-	expression tag	UNP A0AB73HHR8
E	7	HIS	-	expression tag	UNP A0AB73HHR8
E	8	HIS	-	expression tag	UNP A0AB73HHR8
E	9	SER	-	expression tag	UNP A0AB73HHR8
E	10	SER	-	expression tag	UNP A0AB73HHR8
E	11	GLY	-	expression tag	UNP A0AB73HHR8
E	12	LEU	-	expression tag	UNP A0AB73HHR8
E	13	VAL	-	expression tag	UNP A0AB73HHR8
E	14	PRO	-	expression tag	UNP A0AB73HHR8
E	15	ARG	-	expression tag	UNP A0AB73HHR8
E	16	GLY	-	expression tag	UNP A0AB73HHR8
E	17	SER	-	expression tag	UNP A0AB73HHR8
E	18	HIS	-	expression tag	UNP A0AB73HHR8
E	19	MET	-	expression tag	UNP A0AB73HHR8
E	20	ALA	-	expression tag	UNP A0AB73HHR8
E	21	SER	-	expression tag	UNP A0AB73HHR8

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Chain	Residue	Modelled	Actual	Comment	Reference
E	33	PRO	GLN	variant	UNP A0AB73HHR8
E	262	ASN	ASP	variant	UNP A0AB73HHR8
E	274	ALA	SER	variant	UNP A0AB73HHR8
E	476	ALA	MET	engineered mutation	UNP A0AB73HHR8
E	477	ALA	MET	engineered mutation	UNP A0AB73HHR8
A	-22	MET	-	initiating methionine	UNP A0AB73HHR8
A	-21	GLY	-	expression tag	UNP A0AB73HHR8
A	-20	SER	-	expression tag	UNP A0AB73HHR8
A	-19	SER	-	expression tag	UNP A0AB73HHR8
A	-18	HIS	-	expression tag	UNP A0AB73HHR8
A	-17	HIS	-	expression tag	UNP A0AB73HHR8
A	-16	HIS	-	expression tag	UNP A0AB73HHR8
A	-15	HIS	-	expression tag	UNP A0AB73HHR8
A	-14	HIS	-	expression tag	UNP A0AB73HHR8
A	-13	HIS	-	expression tag	UNP A0AB73HHR8
A	-12	SER	-	expression tag	UNP A0AB73HHR8
A	-11	SER	-	expression tag	UNP A0AB73HHR8
A	-10	GLY	-	expression tag	UNP A0AB73HHR8
A	-9	LEU	-	expression tag	UNP A0AB73HHR8
A	-8	VAL	-	expression tag	UNP A0AB73HHR8
A	-7	PRO	-	expression tag	UNP A0AB73HHR8
A	-6	ARG	-	expression tag	UNP A0AB73HHR8
A	-5	GLY	-	expression tag	UNP A0AB73HHR8
A	-4	SER	-	expression tag	UNP A0AB73HHR8
A	-3	HIS	-	expression tag	UNP A0AB73HHR8
A	-2	MET	-	expression tag	UNP A0AB73HHR8
A	-1	ALA	-	expression tag	UNP A0AB73HHR8
A	0	SER	-	expression tag	UNP A0AB73HHR8
A	12	PRO	GLN	variant	UNP A0AB73HHR8
A	241	ASN	ASP	variant	UNP A0AB73HHR8
A	253	ALA	SER	variant	UNP A0AB73HHR8
A	455	ALA	MET	engineered mutation	UNP A0AB73HHR8
A	456	ALA	MET	engineered mutation	UNP A0AB73HHR8
B	-22	MET	-	initiating methionine	UNP A0AB73HHR8
B	-21	GLY	-	expression tag	UNP A0AB73HHR8
B	-20	SER	-	expression tag	UNP A0AB73HHR8
B	-19	SER	-	expression tag	UNP A0AB73HHR8
B	-18	HIS	-	expression tag	UNP A0AB73HHR8
B	-17	HIS	-	expression tag	UNP A0AB73HHR8
B	-16	HIS	-	expression tag	UNP A0AB73HHR8
B	-15	HIS	-	expression tag	UNP A0AB73HHR8
B	-14	HIS	-	expression tag	UNP A0AB73HHR8

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-13	HIS	-	expression tag	UNP A0AB73HHR8
B	-12	SER	-	expression tag	UNP A0AB73HHR8
B	-11	SER	-	expression tag	UNP A0AB73HHR8
B	-10	GLY	-	expression tag	UNP A0AB73HHR8
B	-9	LEU	-	expression tag	UNP A0AB73HHR8
B	-8	VAL	-	expression tag	UNP A0AB73HHR8
B	-7	PRO	-	expression tag	UNP A0AB73HHR8
B	-6	ARG	-	expression tag	UNP A0AB73HHR8
B	-5	GLY	-	expression tag	UNP A0AB73HHR8
B	-4	SER	-	expression tag	UNP A0AB73HHR8
B	-3	HIS	-	expression tag	UNP A0AB73HHR8
B	-2	MET	-	expression tag	UNP A0AB73HHR8
B	-1	ALA	-	expression tag	UNP A0AB73HHR8
B	0	SER	-	expression tag	UNP A0AB73HHR8
B	12	PRO	GLN	variant	UNP A0AB73HHR8
B	241	ASN	ASP	variant	UNP A0AB73HHR8
B	253	ALA	SER	variant	UNP A0AB73HHR8
B	455	ALA	MET	engineered mutation	UNP A0AB73HHR8
B	456	ALA	MET	engineered mutation	UNP A0AB73HHR8

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O_4S) (labeled as "Ligand of Interest" by depositor).
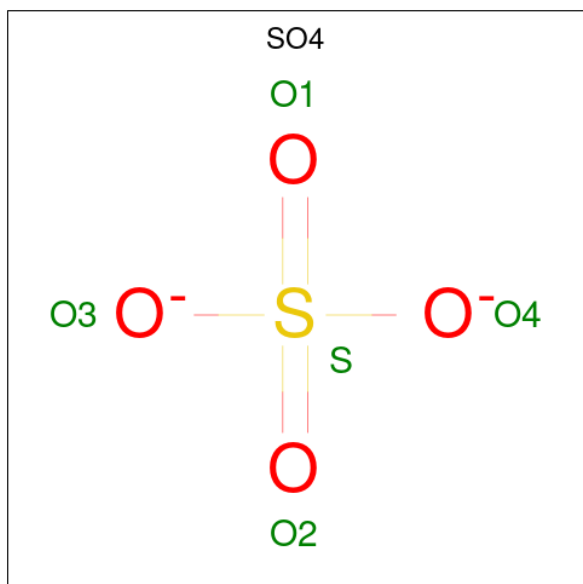
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	E	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is COPPER (II) ION (CCD ID: CU) (formula: Cu) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	12	Total 12	Cu 12	0	0
3	B	12	Total 12	Cu 12	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	149	Total 149	O 149	0	0
4	B	130	Total 130	O 130	0	0

3 Residue-property plots ⓘ

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: Multicopper oxidase domain-containing protein
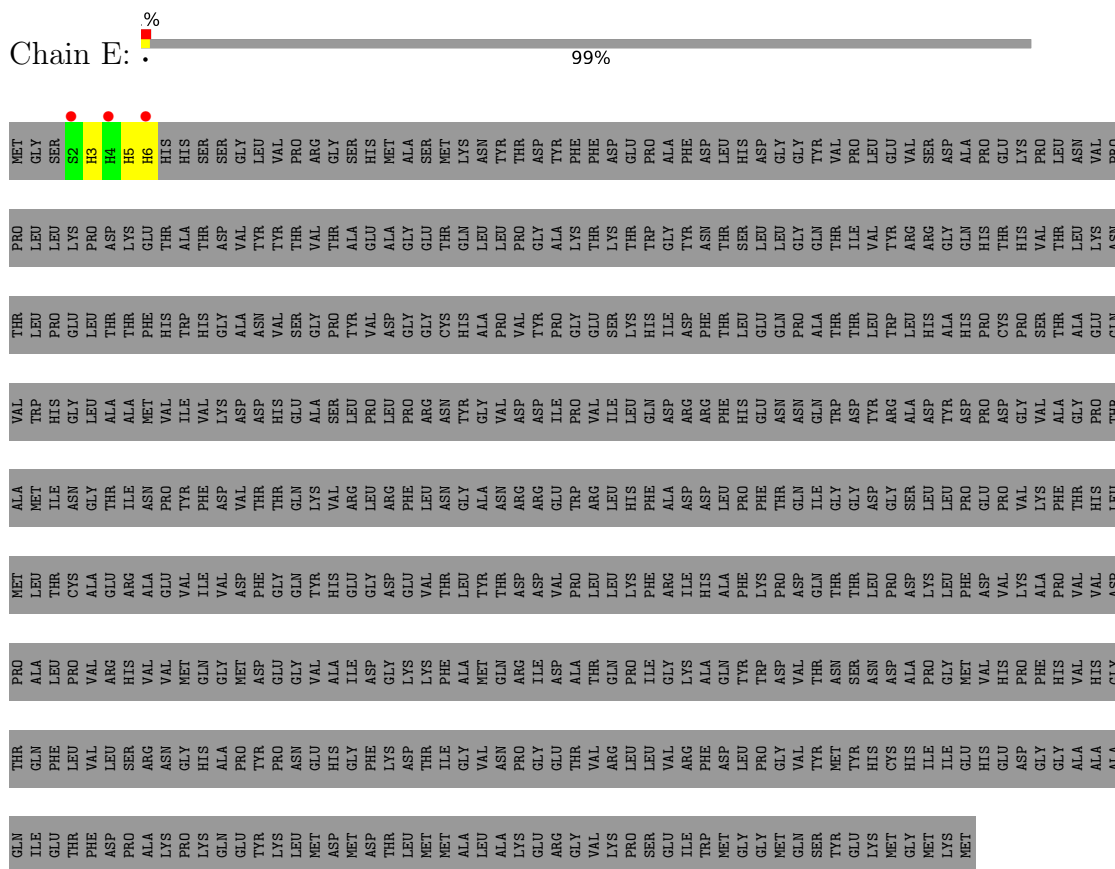
• Molecule 1: Multicopper oxidase domain-containing protein
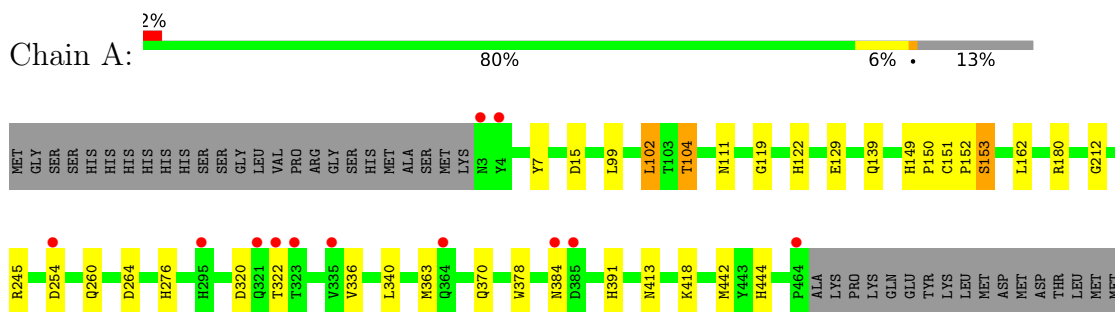
ALA LEU ALA LYS GLU ARG GLY VAL LYS PRO SER GLU ILE TRP MET GLY MET GLN SER TYR GLU LYS MET GLY MET LYS MET

• Molecule 1: Multicopper oxidase domain-containing protein

Chain B:

2%

80%　　　　7%　　·　　13%

MET GLY SER SER HIS HIS HIS HIS HIS HIS SER SER GLY LEU VAL PRO ARG GLY SER HIS MET ALA SER MET LYS N3 Y7 K41 K44 E45 T46 T91 K96 L102 T103 T104 N111 D118 G119 H122 E129 D134 Q139 H149 P152 S153

D170 R180 G212 R245 W248 H251 Q260 D264 H276 L277 M278 D305 V336 H344 Q348 G349 M350 G358 M363 Q370 Y377 W378 T381 N384 D385 H396 N413 K418 M442 Y443 H444 P464 ALA LYS PRO LYS

GLN GLU TYR LYS LEU MET ASP MET ASP THR LEU MET MET ALA LEU ALA LYS GLU ARG GLY VAL LYS PRO SER GLU ILE TRP MET GLY MET GLN SER TYR GLU LYS MET GLY MET LYS MET

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	123.59Å 123.59Å 179.93Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	58.51 – 2.20 58.51 – 2.20	Depositor EDS
% Data completeness (in resolution range)	100.0 (58.51-2.20) 100.0 (58.51-2.20)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.56 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.184 , 0.217 0.194 , 0.226	Depositor DCC
R_{free} test set	4069 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	44.2	Xtriage
Anisotropy	0.270	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 33.2	EDS
L-test for twinning[2]	$< \lvert L \rvert > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.020 for -h,-k,l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7636	wwPDB-VP
Average B, all atoms (Å^2)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.55% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< \lvert L \rvert >$, $< L^2 >$ 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, CU

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	0/3759	0.92	2/5148 (0.0%)
1	B	0.51	0/3764	0.91	3/5153 (0.1%)
1	E	0.69	0/48	1.89	2/64 (3.1%)
All	All	0.51	0/7571	0.93	7/10365 (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	A	0	1
1	B	0	1
All	All	0	2

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	E	6	HIS	CA-CB-CG	-6.39	107.41	113.80
1	E	5	HIS	CA-CB-CG	-5.71	108.09	113.80
1	A	129	GLU	CB-CA-C	5.65	120.42	110.36
1	B	170	ASP	CA-CB-CG	5.35	117.95	112.60
1	A	15	ASP	CA-CB-CG	5.29	117.89	112.60
1	B	118	ASP	CA-CB-CG	5.19	117.79	112.60
1	B	129	GLU	CB-CA-C	5.12	119.47	110.36

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	180	ARG	Sidechain
1	B	180	ARG	Sidechain

5.2 Too-close contacts ⓘ

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	3639	0	3442	22	0
1	B	3644	0	3453	25	0
1	E	45	0	29	0	0
2	E	5	0	0	0	0
3	A	12	0	0	0	0
3	B	12	0	0	0	0
4	A	149	0	0	1	0
4	B	130	0	0	1	0
All	All	7636	0	6924	47	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (47) 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:B:149:HIS:CE1	1:B:442:MET:HE1	2.01	0.96
1:A:104:THR:HG23	1:A:119:GLY:O	1.76	0.86
1:A:260:GLN:HE22	1:A:413:ASN:HD22	1.26	0.83
1:B:104:THR:HG23	1:B:119:GLY:O	1.81	0.80
1:B:442:MET:HE3	1:B:444:HIS:CD2	2.23	0.74
1:B:260:GLN:HE22	1:B:413:ASN:HD22	1.37	0.70
1:B:104:THR:CG2	1:B:119:GLY:O	2.39	0.70
1:A:104:THR:CG2	1:A:119:GLY:O	2.40	0.68
1:B:149:HIS:HE1	1:B:442:MET:HE1	1.61	0.64
1:B:149:HIS:NE2	1:B:442:MET:HE1	2.14	0.63
1:B:152:PRO:O	1:B:153:SER:CB	2.47	0.62
1:A:152:PRO:O	1:A:153:SER:CB	2.48	0.61
1:B:111:ASN:H	1:B:139:GLN:HE22	1.48	0.59
1:A:102:LEU:C	1:A:102:LEU:HD12	2.28	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:370:GLN:HE22	1:B:378:TRP:HE1	1.51	0.57
1:A:384:ASN:HD21	1:A:391:HIS:HE2	1.54	0.56
1:A:111:ASN:H	1:A:139:GLN:HE22	1.56	0.54
1:A:320:ASP:OD1	1:A:322:THR:HB	2.08	0.53
1:B:153:SER:HA	4:B:741:HOH:O	2.11	0.51
1:B:264:ASP:HB2	1:B:418:LYS:HA	1.93	0.49
1:A:370:GLN:HE22	1:A:378:TRP:HE1	1.60	0.49
1:A:384:ASN:ND2	1:A:391:HIS:HE2	2.10	0.48
1:B:251:HIS:HE1	1:B:305:ASP:O	1.95	0.48
1:A:153:SER:HA	4:A:743:HOH:O	2.13	0.48
1:B:7:TYR:CE1	1:B:276:HIS:HB3	2.49	0.47
1:B:102:LEU:C	1:B:102:LEU:HD12	2.40	0.47
1:B:111:ASN:H	1:B:139:GLN:NE2	2.13	0.47
1:A:264:ASP:HB2	1:A:418:LYS:HA	1.97	0.46
1:A:442:MET:HE2	1:A:444:HIS:CD2	2.51	0.46
1:B:396:HIS:CE1	1:B:442:MET:HE2	2.51	0.46
1:A:7:TYR:CE1	1:A:276:HIS:HB3	2.51	0.45
1:B:149:HIS:O	1:B:149:HIS:ND1	2.48	0.44
1:A:212:GLY:HA3	1:A:245:ARG:HG3	1.99	0.44
1:A:104:THR:HG21	1:A:149:HIS:HB3	2.00	0.44
1:A:111:ASN:H	1:A:139:GLN:NE2	2.15	0.43
1:B:212:GLY:HA3	1:B:245:ARG:HG3	2.00	0.43
1:B:122:HIS:CE1	1:B:363:MET:HG2	2.54	0.43
1:A:149:HIS:N	1:A:150:PRO:CD	2.83	0.42
1:A:99:LEU:HD11	1:A:162:LEU:HD11	2.01	0.42
1:A:122:HIS:CE1	1:A:363:MET:HG2	2.54	0.42
1:B:248:TRP:O	1:B:278:MET:HA	2.20	0.41
1:B:91:THR:O	1:B:134:ASP:HA	2.21	0.41
1:B:344[A]:HIS:HE1	1:B:381:THR:OG1	2.02	0.41
1:A:151:CYS:HA	1:A:152:PRO:HA	1.90	0.41
1:A:104:THR:CG2	1:A:149:HIS:HB3	2.50	0.41
1:B:348:GLN:NE2	1:B:358:GLY:H	2.19	0.41
1:B:336:VAL:HG11	1:B:377:TYR:CE1	2.56	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	461/532 (87%)	446 (97%)	14 (3%)	1 (0%)	44	52
1	B	461/532 (87%)	445 (96%)	15 (3%)	1 (0%)	44	52
1	E	3/532 (1%)	3 (100%)	0	0	100	100
All	All	925/1596 (58%)	894 (97%)	29 (3%)	2 (0%)	44	52

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	153	SER
1	B	153	SER

5.3.2 Protein sidechains ⓘ

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	386/452 (85%)	381 (99%)	5 (1%)	65	78
1	B	387/452 (86%)	384 (99%)	3 (1%)	79	88
1	E	4/452 (1%)	3 (75%)	1 (25%)	0	0
All	All	777/1356 (57%)	768 (99%)	9 (1%)	67	80

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

Mol	Chain	Res	Type
1	E	3	HIS

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Mol	Chain	Res	Type
1	A	102	LEU
1	A	104	THR
1	A	254	ASP
1	A	336	VAL
1	A	340	LEU
1	B	102	LEU
1	B	104	THR
1	B	336	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	62	GLN
1	A	111	ASN
1	A	139	GLN
1	A	199	ASN
1	A	260	GLN
1	A	348	GLN
1	A	370	GLN
1	A	384	ASN
1	A	458	GLN
1	B	62	GLN
1	B	139	GLN
1	B	251	HIS
1	B	260	GLN
1	B	348	GLN
1	B	370	GLN
1	B	415	HIS
1	B	458	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 25 ligands modelled in this entry, 24 are monoatomic - leaving 1 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	SO4	E	601	-	4,4,4	0.25	0	6,6,6	0.10	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.

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 SO4 E 601

Bond lengths

Bond angles

Torsions

Rings
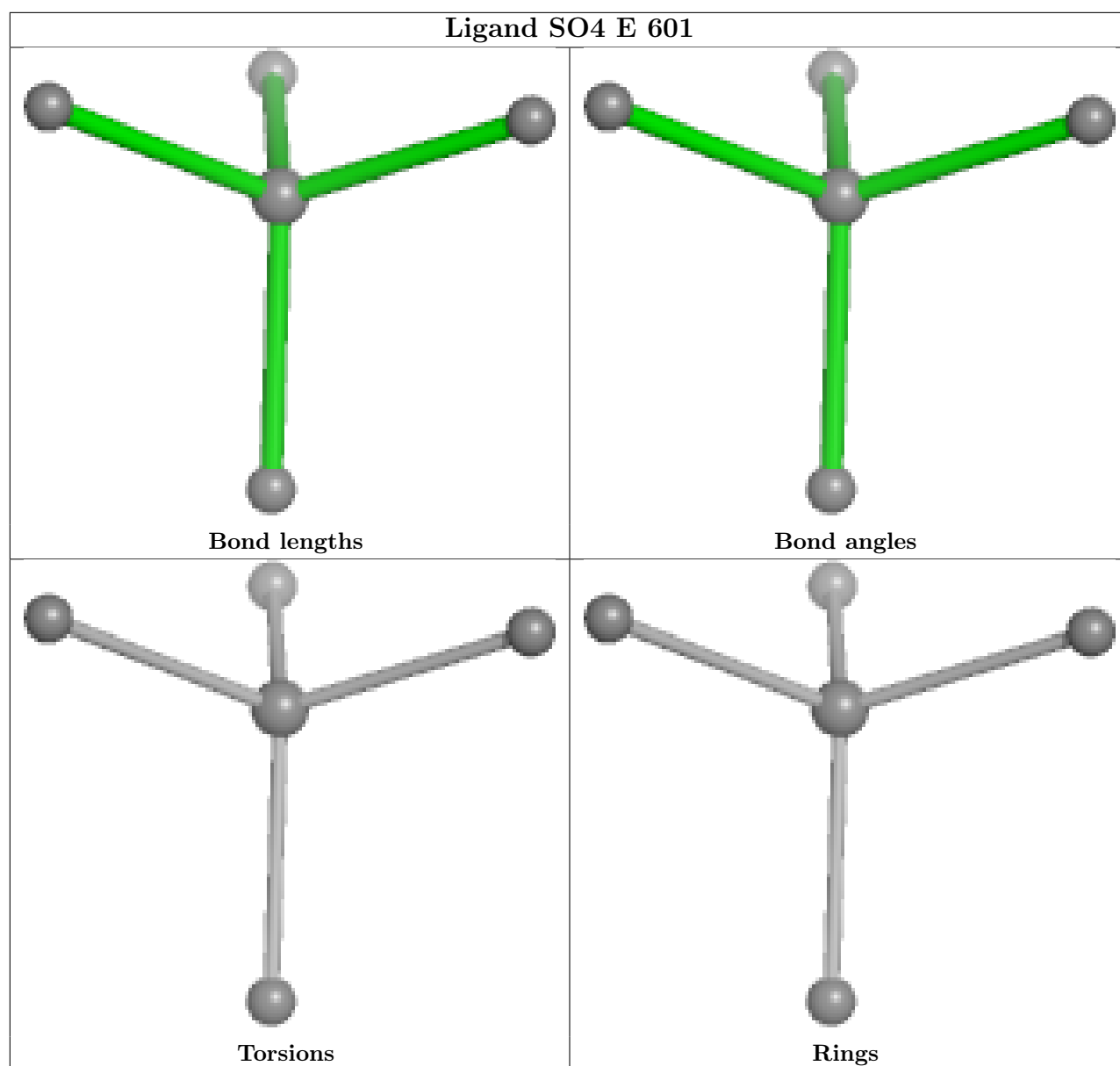
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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, 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(Å²)	Q<0.9
1	A	462/532 (86%)	-0.01	12 (2%)	57	54	25, 44, 68, 101	1 (0%)
1	B	462/532 (86%)	-0.05	11 (2%)	59	56	27, 43, 64, 89	1 (0%)
1	E	5/532 (0%)	3.23	3 (60%)	0	0	62, 70, 87, 94	0
All	All	929/1596 (58%)	-0.01	26 (2%)	55	52	25, 44, 67, 101	2 (0%)

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	3	ASN	7.3
1	E	2	SER	7.1
1	B	3	ASN	6.8
1	B	385	ASP	5.7
1	A	322	THR	4.8
1	A	321	GLN	4.4
1	B	464	PRO	3.8
1	E	4	HIS	3.8
1	A	385	ASP	3.7
1	A	295	HIS	3.5
1	A	323	THR	3.4
1	E	6	HIS	3.1
1	A	464	PRO	2.8
1	B	350	MET	2.4
1	A	364	GLN	2.4
1	B	384	ASN	2.4
1	A	4	TYR	2.3
1	B	344[A]	HIS	2.3
1	A	384	ASN	2.2
1	B	96	LYS	2.2
1	A	335	VAL	2.2
1	B	336	VAL	2.2
1	B	46	THR	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	254	ASP	2.1
1	B	41	LYS	2.1
1	B	44	LYS	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 oligosaccharides 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, 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
3	CU	A	610	1/1	0.67	0.15	108,108,108,108	0
3	CU	A	611	1/1	0.83	0.19	90,90,90,90	0
3	CU	B	612	1/1	0.85	0.12	110,110,110,110	0
3	CU	B	609	1/1	0.91	0.07	102,102,102,102	0
3	CU	B	608	1/1	0.91	0.11	98,98,98,98	0
3	CU	B	611	1/1	0.92	0.15	104,104,104,104	0
3	CU	A	612	1/1	0.92	0.10	87,87,87,87	0
3	CU	B	610	1/1	0.94	0.12	96,96,96,96	0
3	CU	A	608	1/1	0.95	0.07	95,95,95,95	0
3	CU	A	609	1/1	0.95	0.12	95,95,95,95	0
3	CU	B	607	1/1	0.95	0.06	82,82,82,82	0
3	CU	A	607	1/1	0.95	0.06	84,84,84,84	0
2	SO4	E	601	5/5	0.96	0.12	43,52,57,59	0
3	CU	B	604	1/1	0.97	0.13	52,52,52,52	0
3	CU	A	604	1/1	0.98	0.09	53,53,53,53	0
3	CU	B	606	1/1	0.98	0.05	63,63,63,63	0
3	CU	B	605	1/1	0.99	0.07	57,57,57,57	0
3	CU	A	601	1/1	0.99	0.02	38,38,38,38	0
3	CU	A	605	1/1	0.99	0.04	76,76,76,76	0
3	CU	A	606	1/1	0.99	0.03	63,63,63,63	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	CU	A	602	1/1	0.99	0.03	44,44,44,44	0
3	CU	B	601	1/1	0.99	0.02	38,38,38,38	0
3	CU	B	602	1/1	0.99	0.03	46,46,46,46	0
3	CU	A	603	1/1	0.99	0.03	45,45,45,45	0
3	CU	B	603	1/1	1.00	0.03	43,43,43,43	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 CU A 610:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)
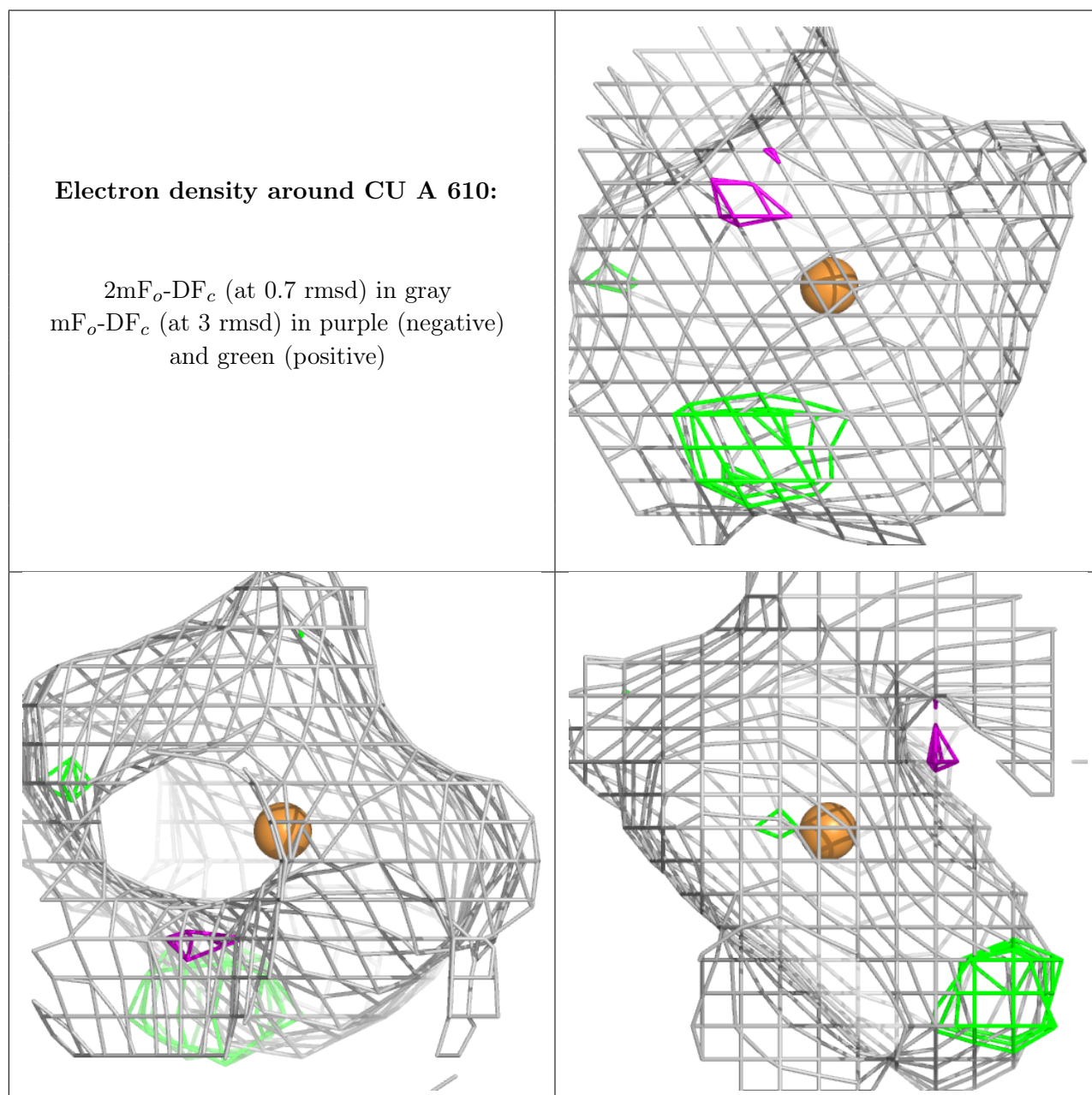
Electron density around CU A 611:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
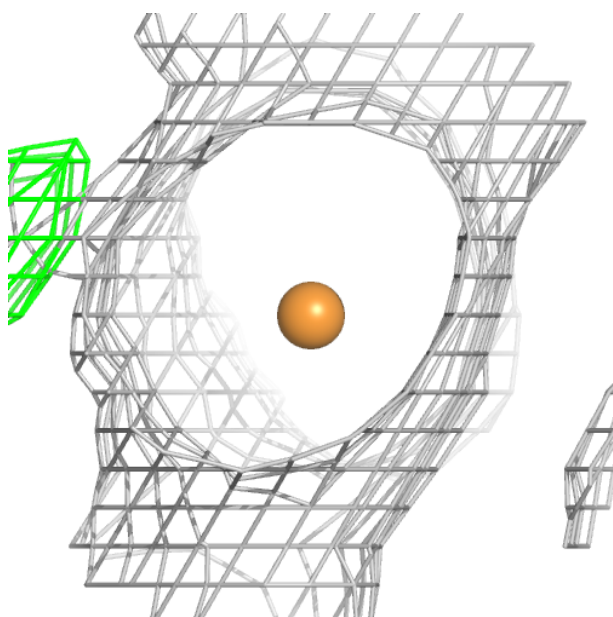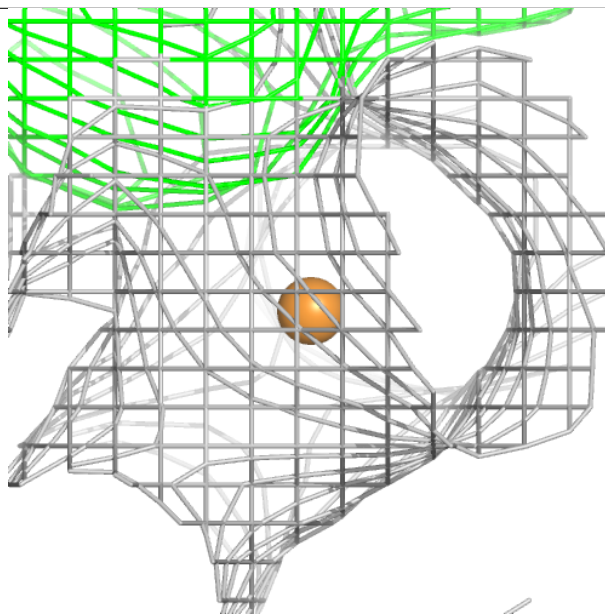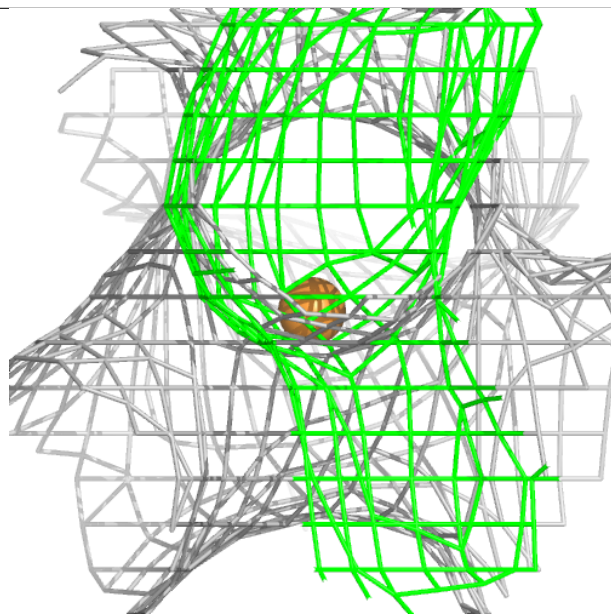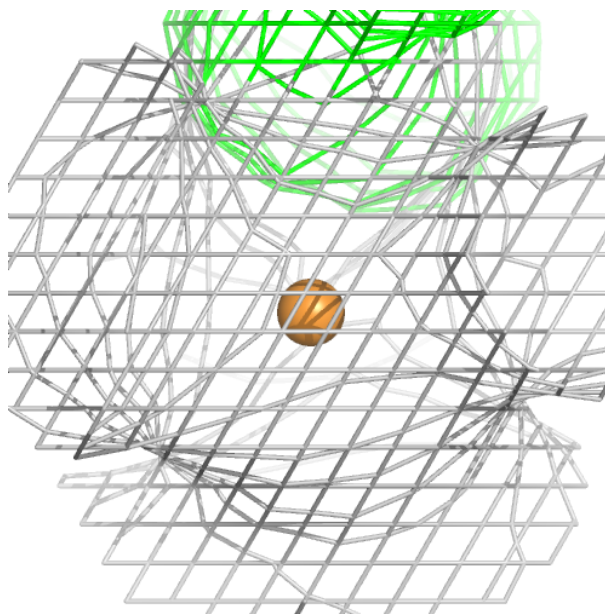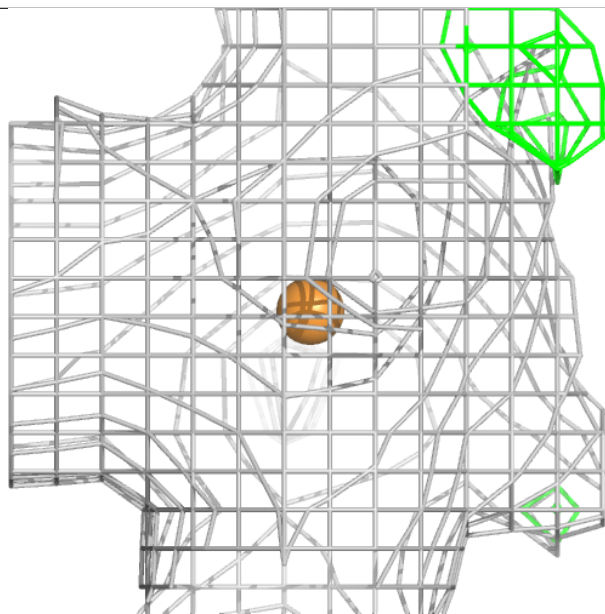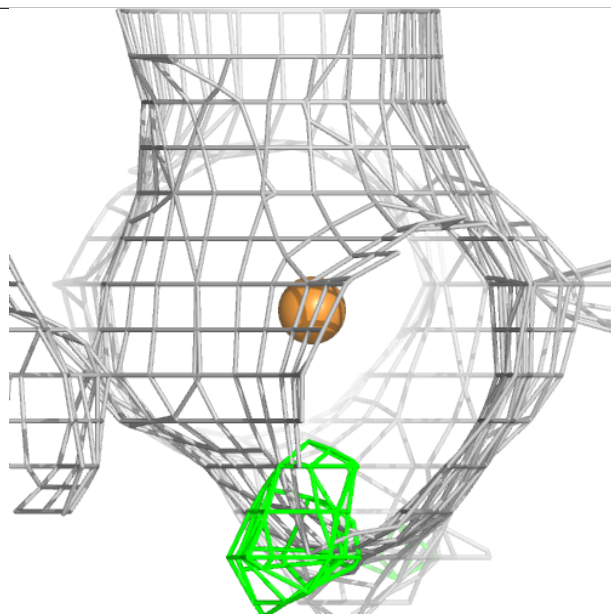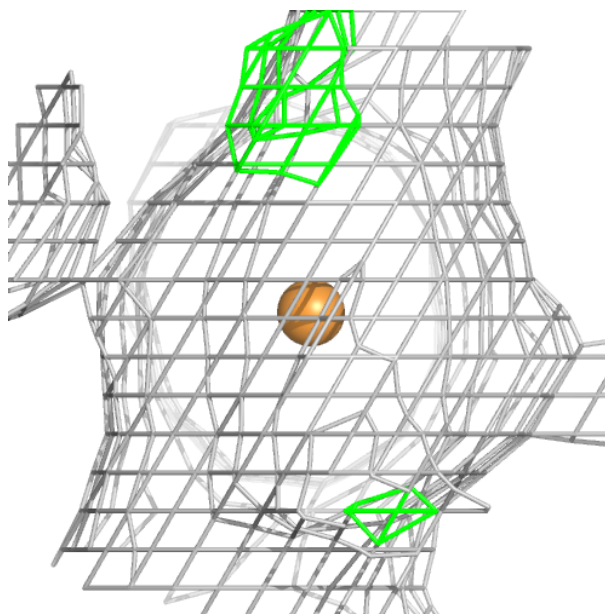and green (positive)
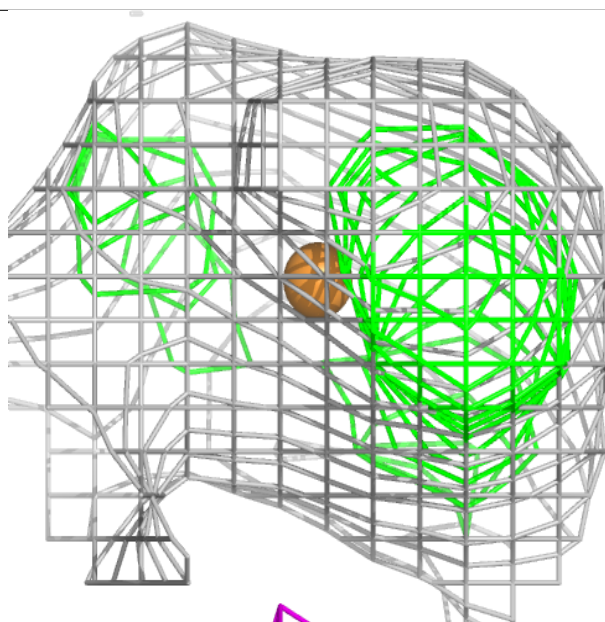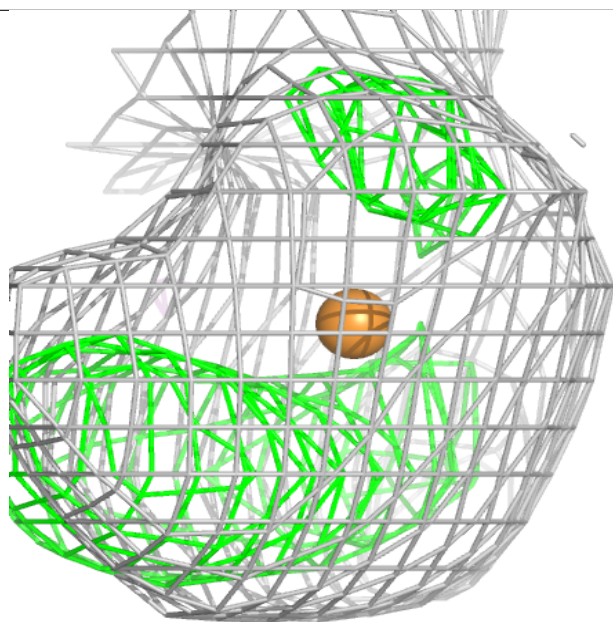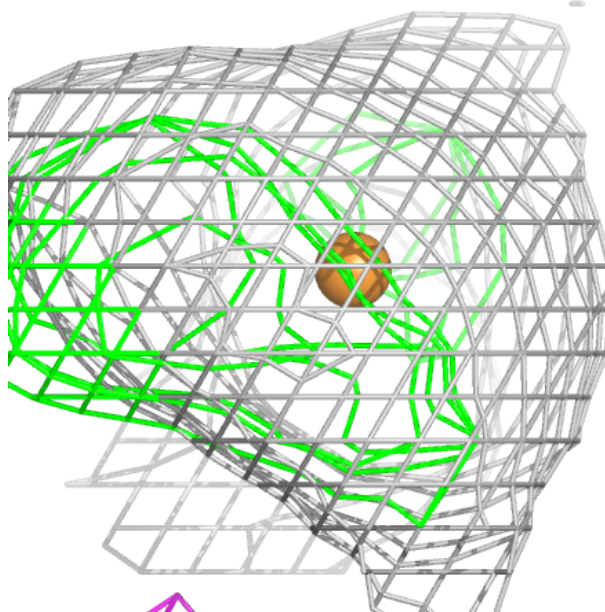
Electron density around CU B 612:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
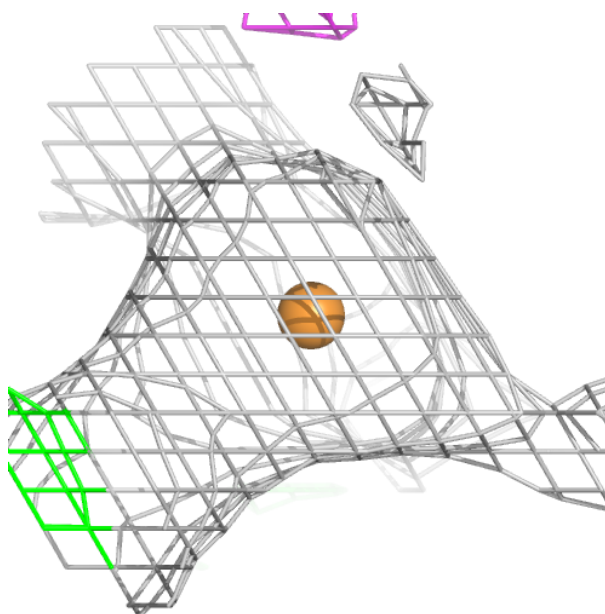
Electron density around CU B 609:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
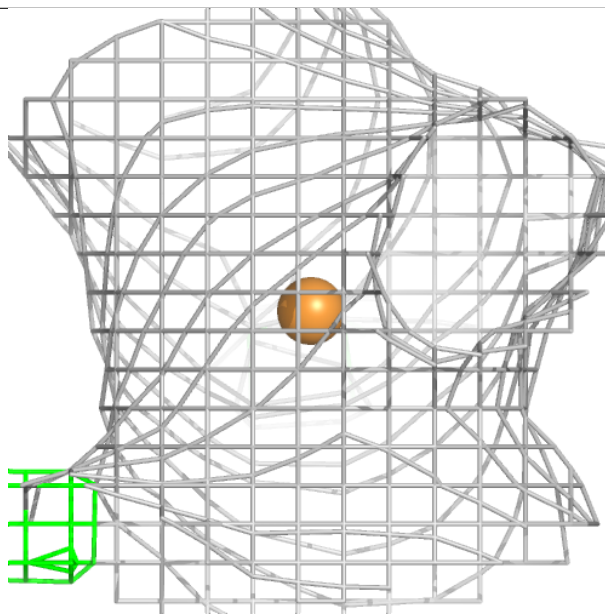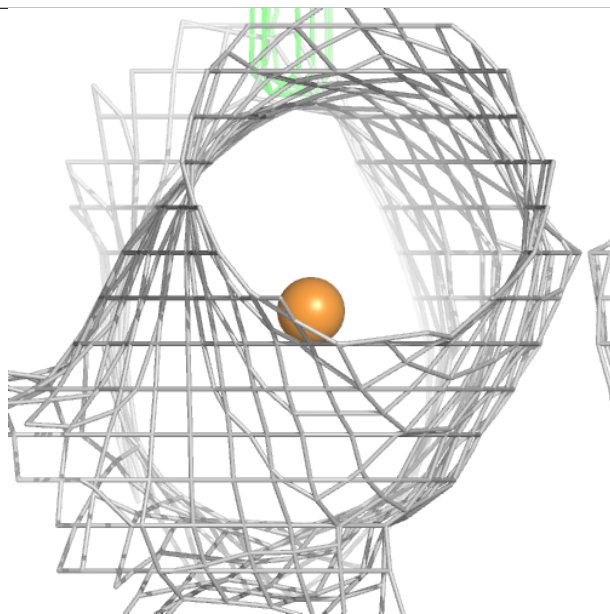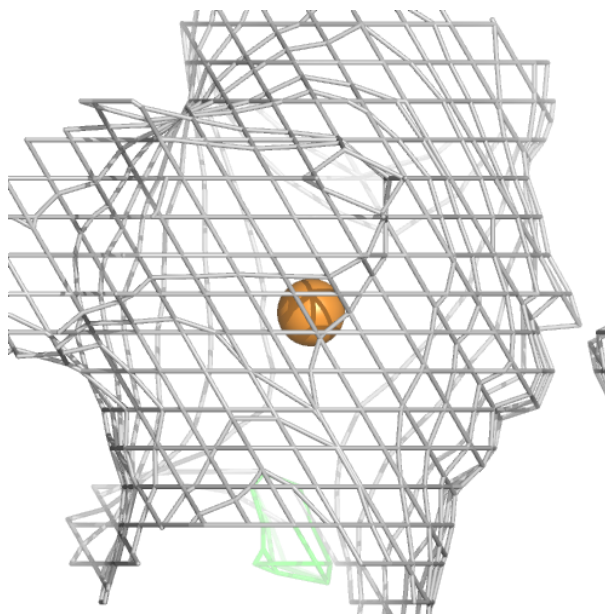and green (positive)
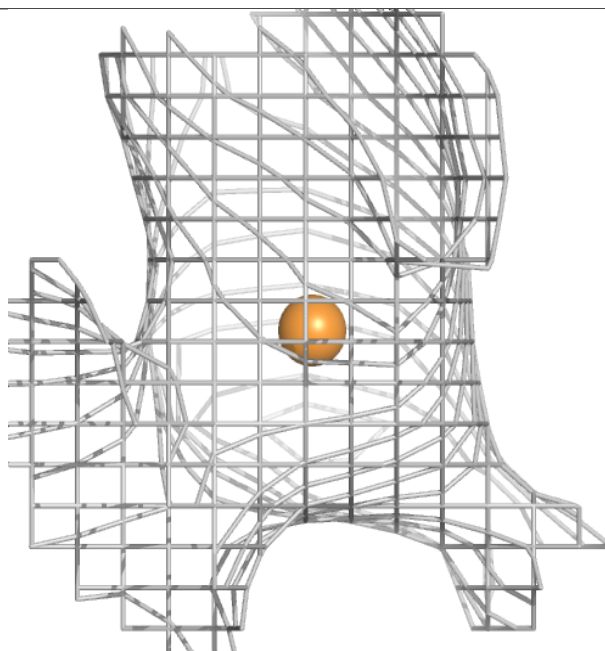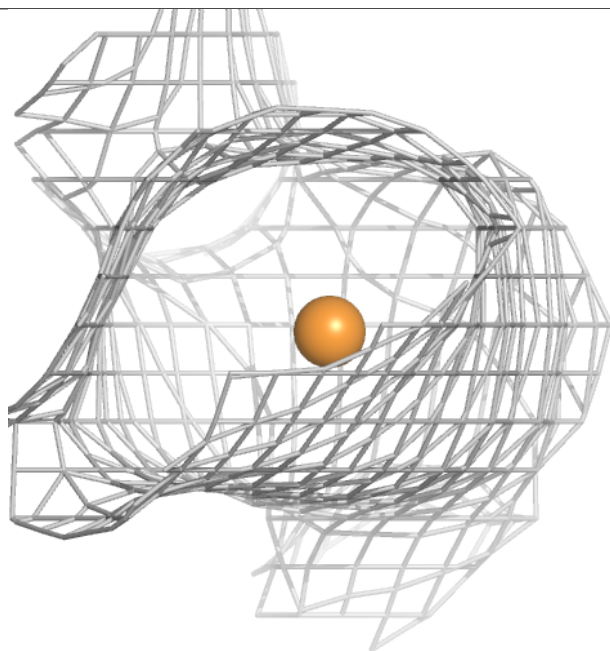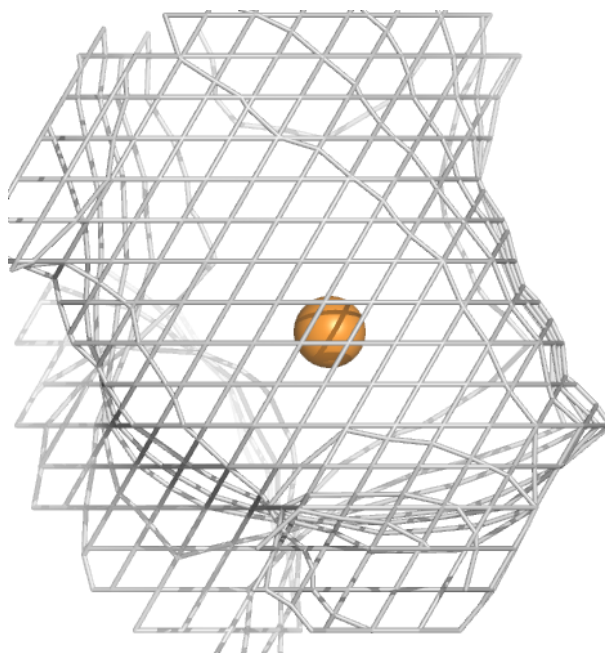
Electron density around CU B 608:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
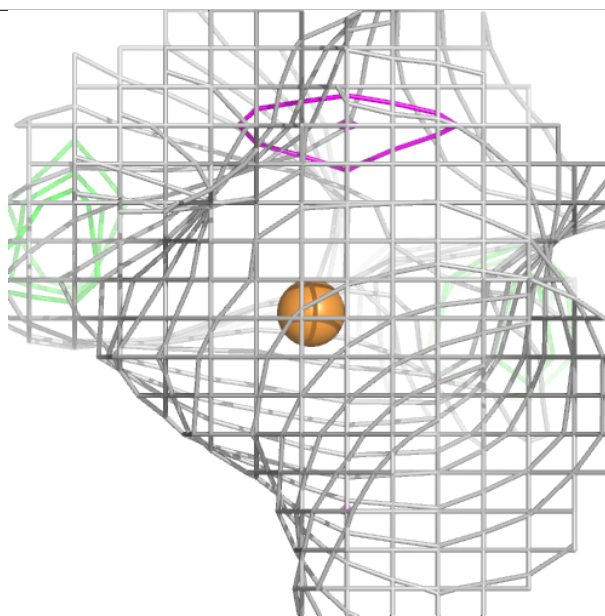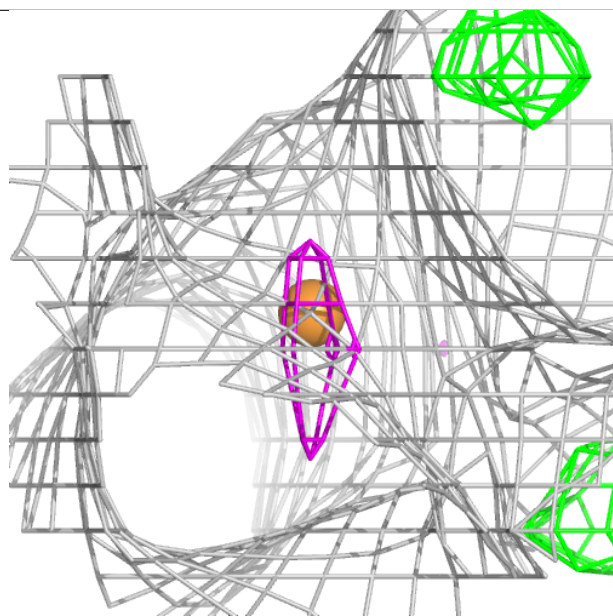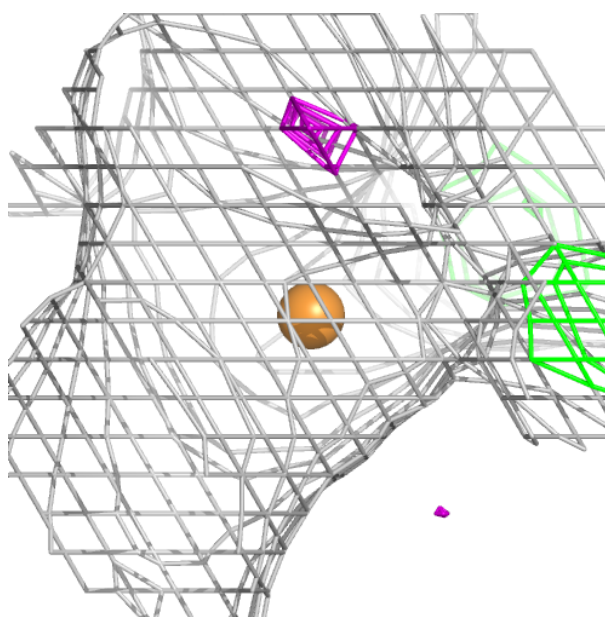
Electron density around CU B 611:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
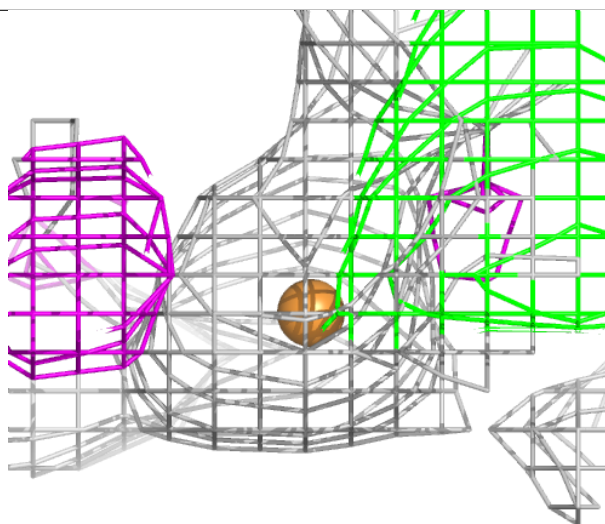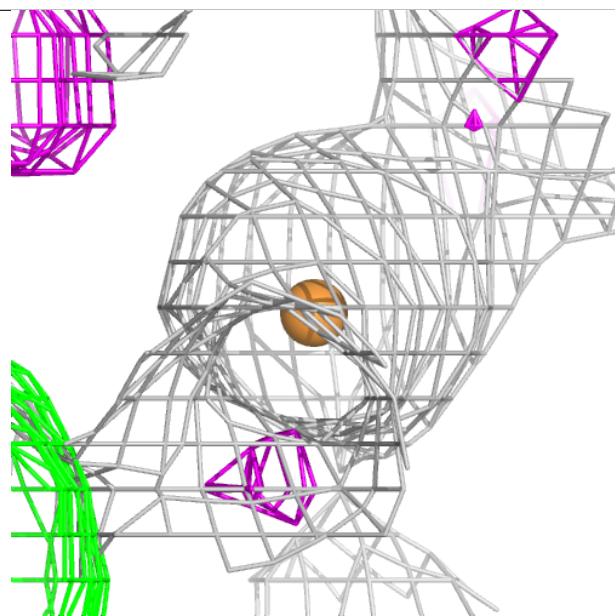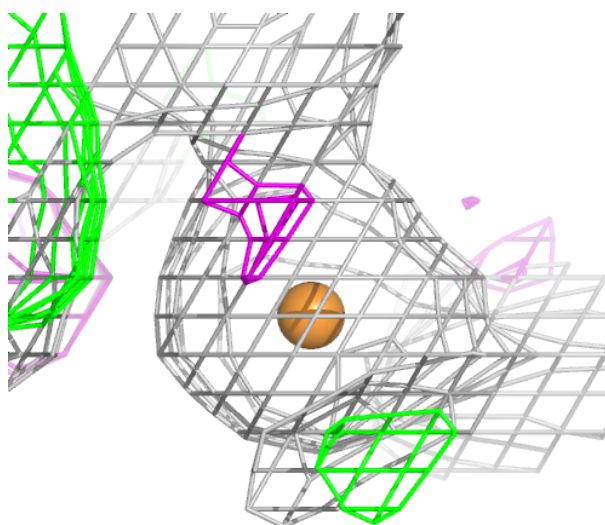
Electron density around CU A 612:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
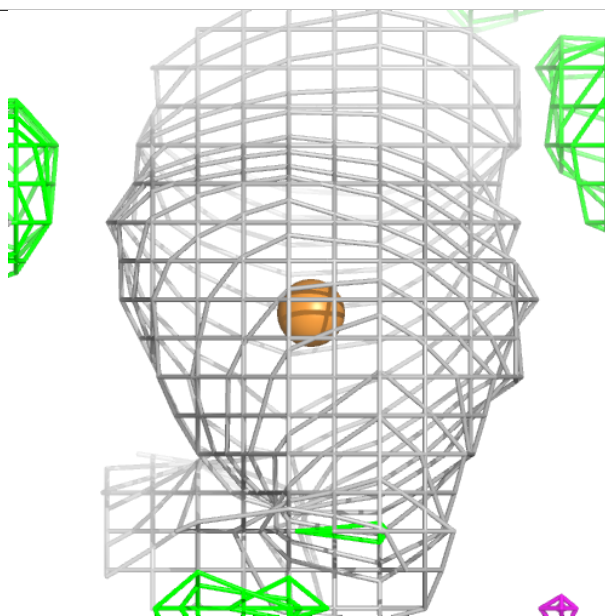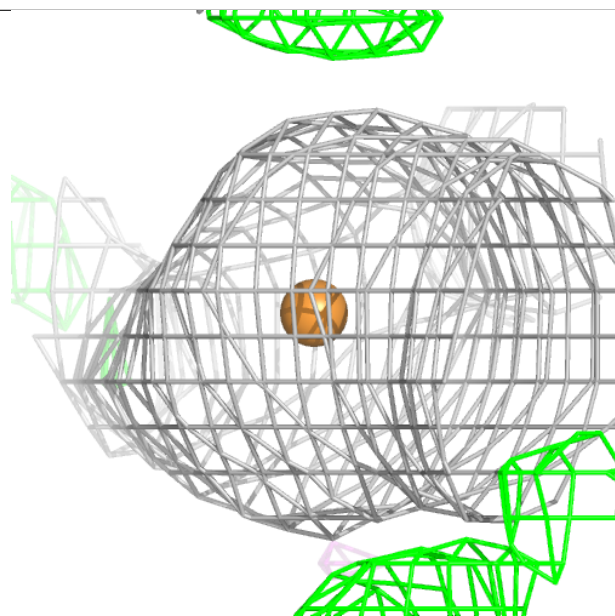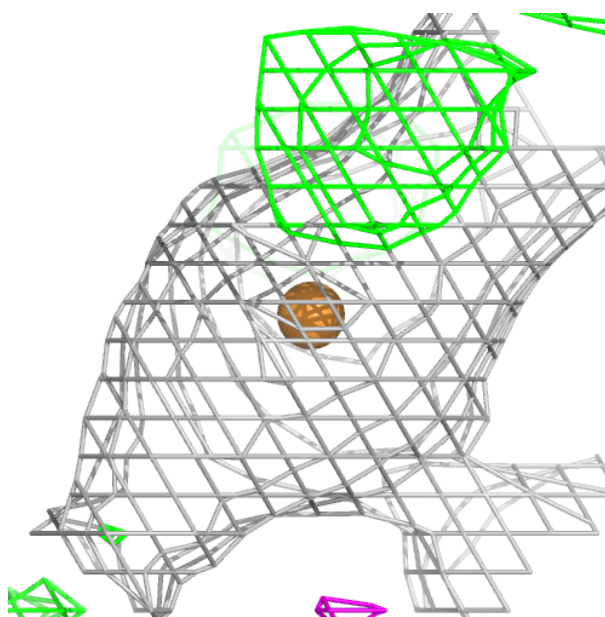
Electron density around CU B 610:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
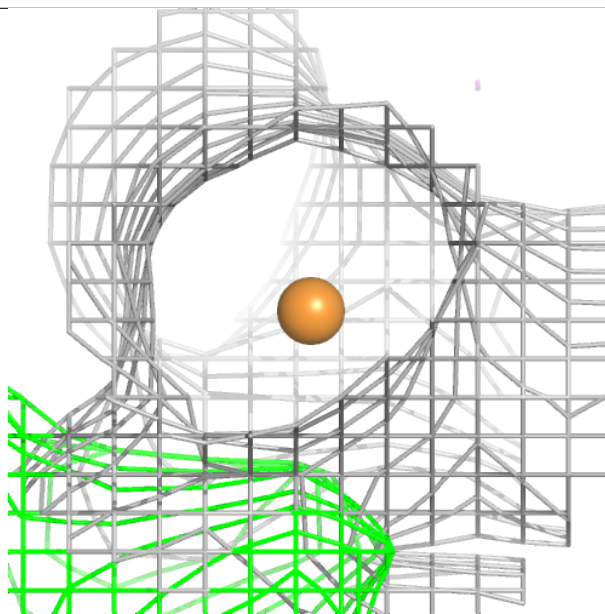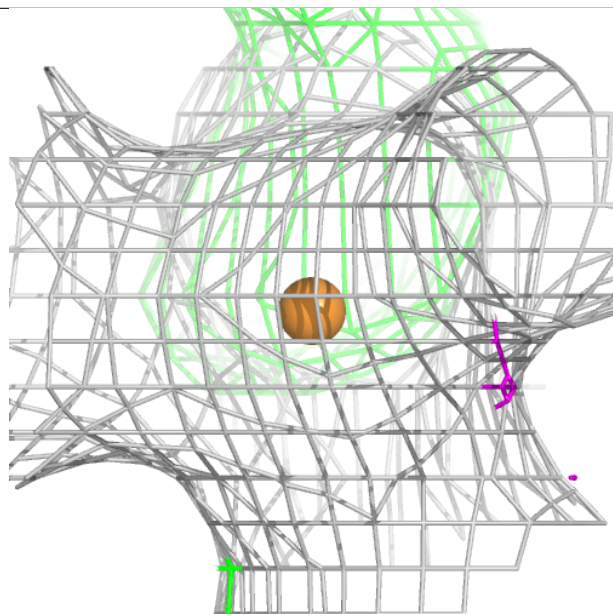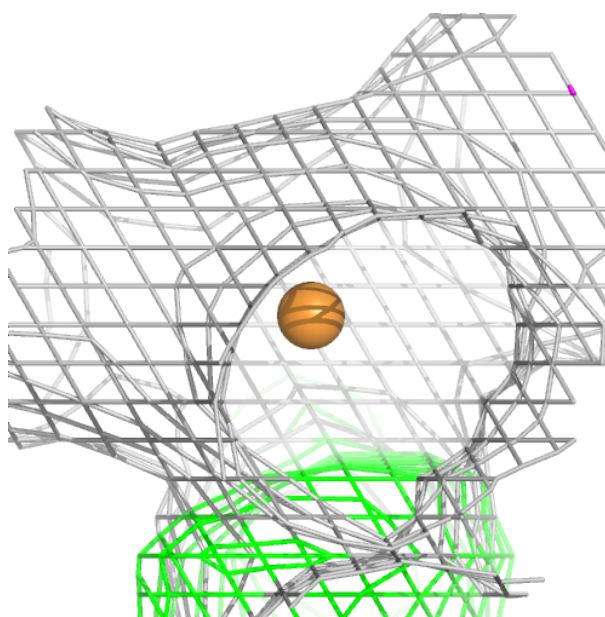and green (positive)
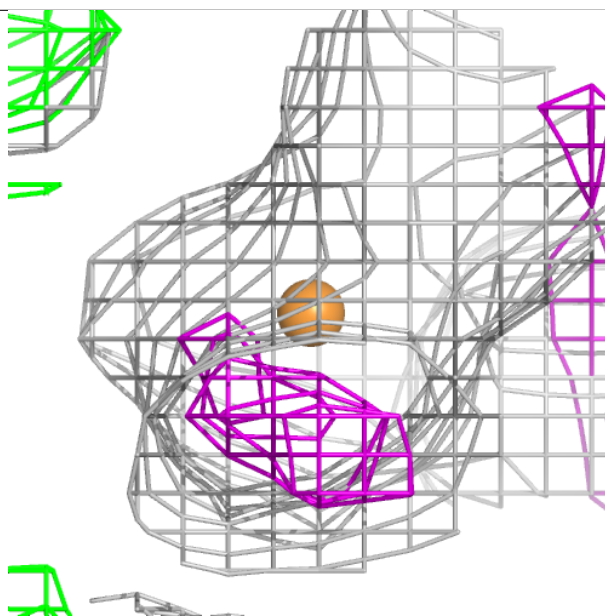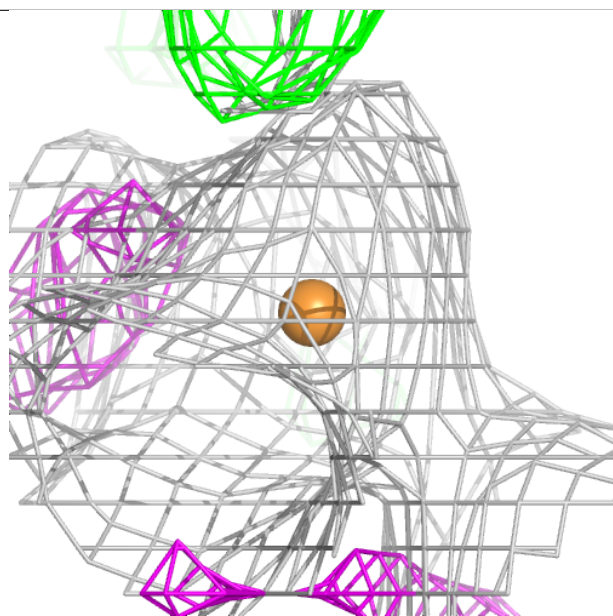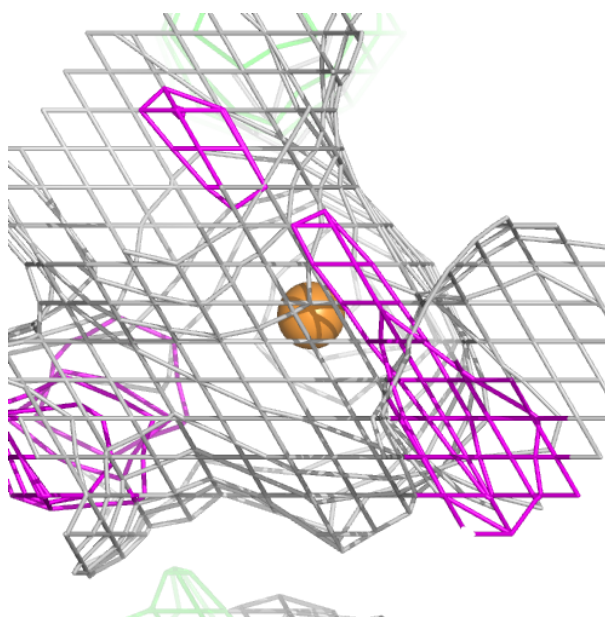
Electron density around CU A 608:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
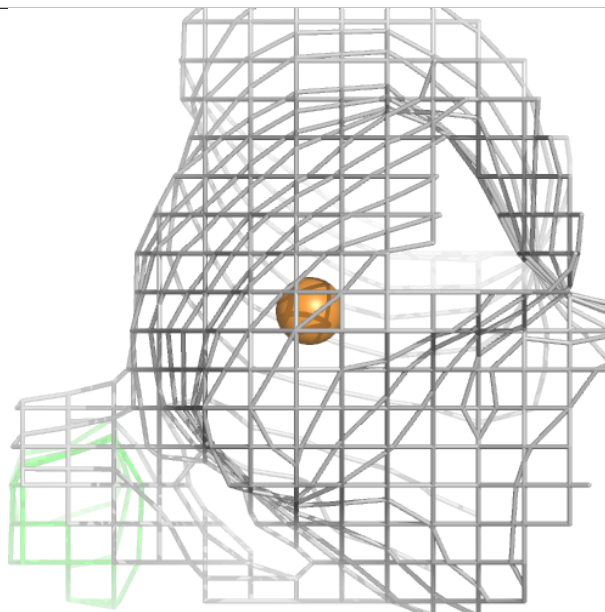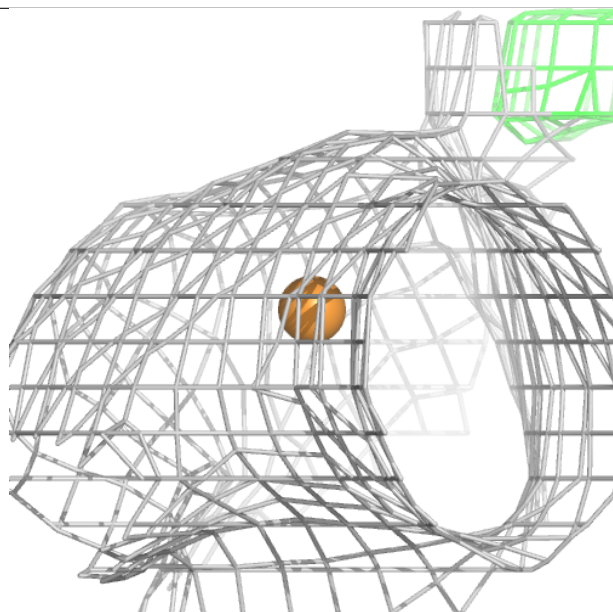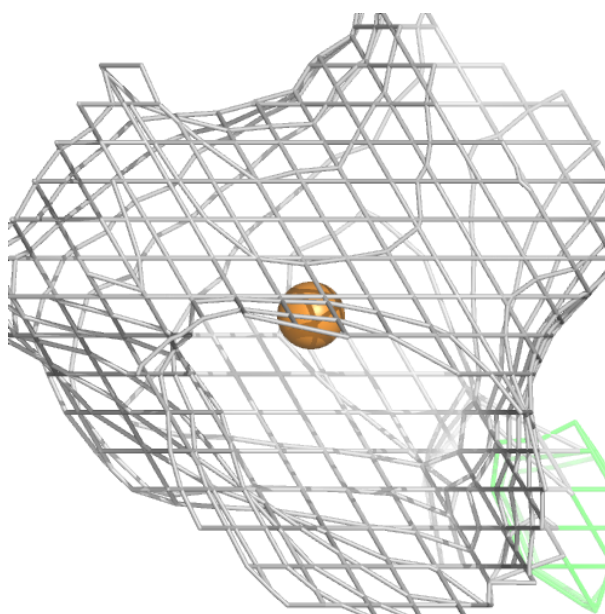
Electron density around CU A 609:

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mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
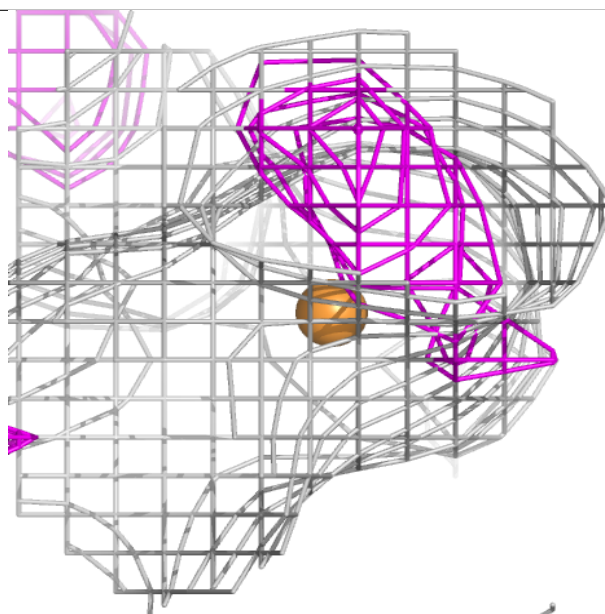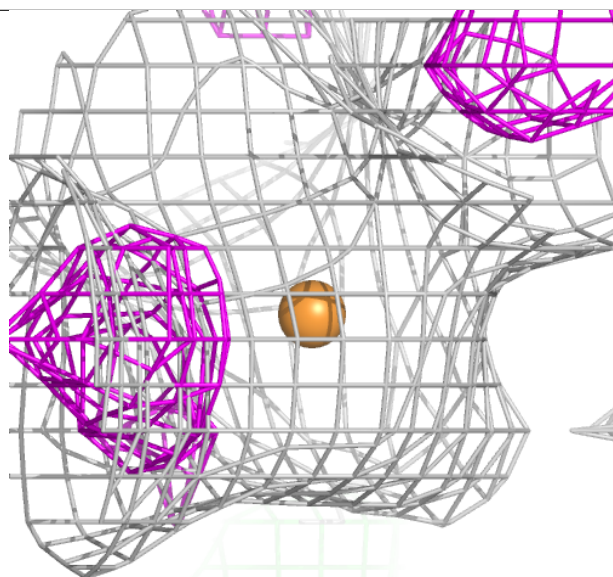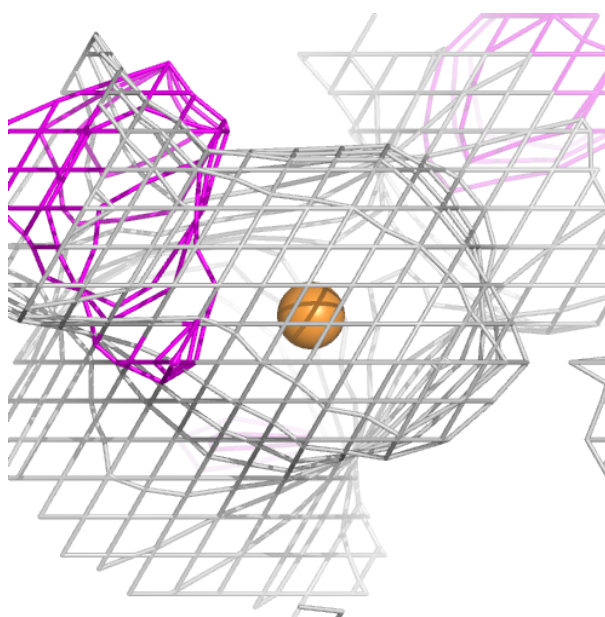
Electron density around CU B 607:

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mF_o-DF_c (at 3 rmsd) in purple (negative)
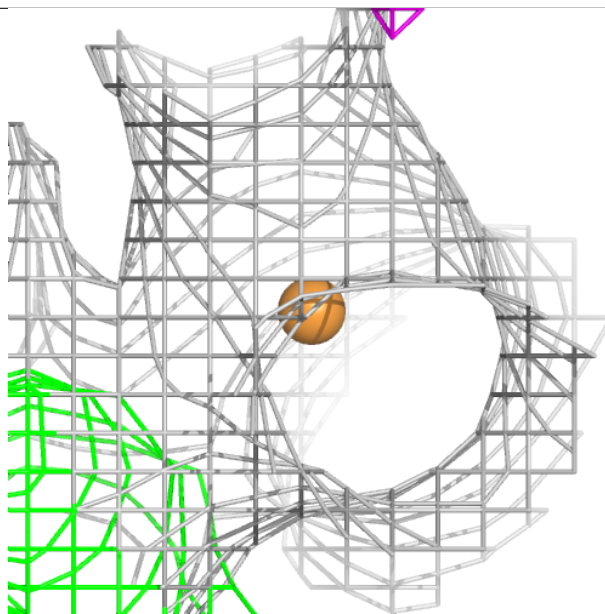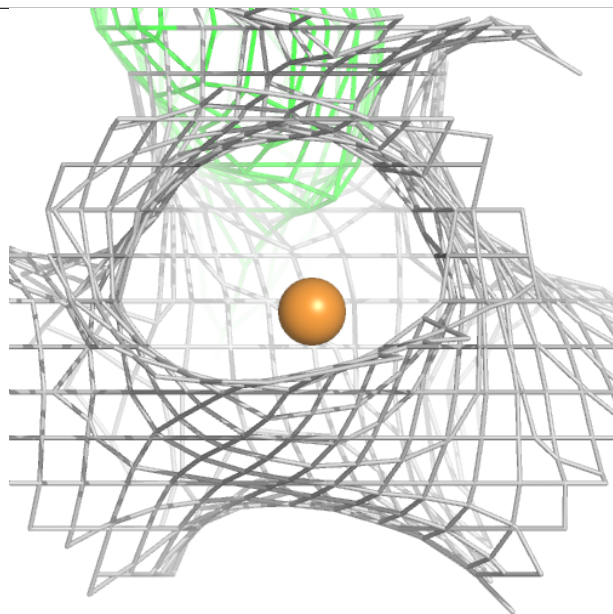and green (positive)
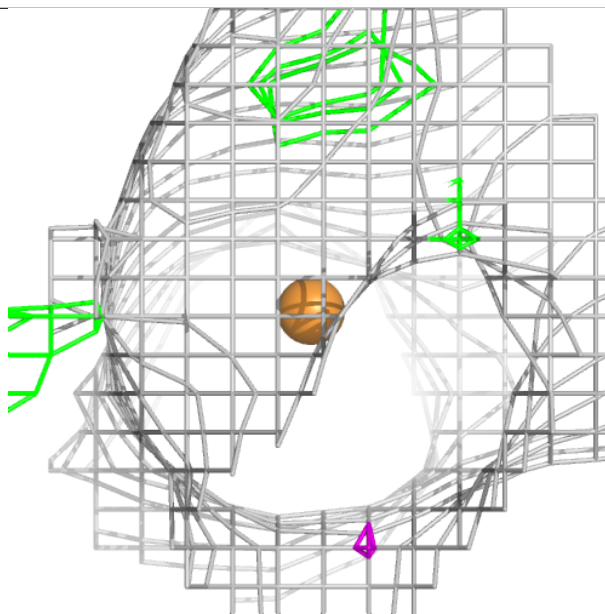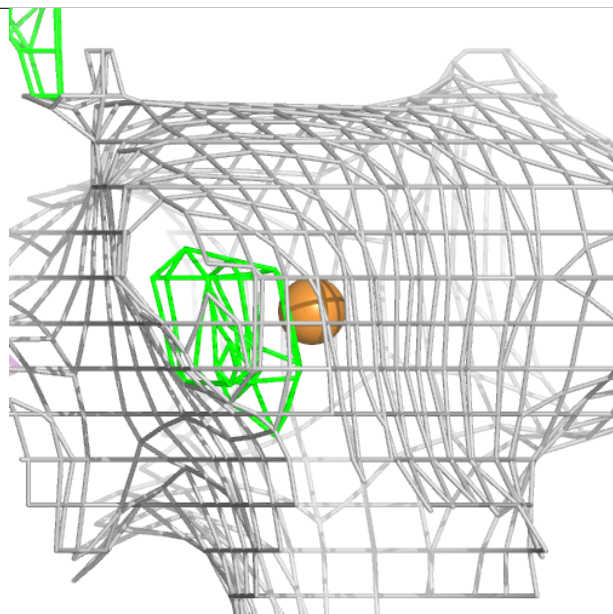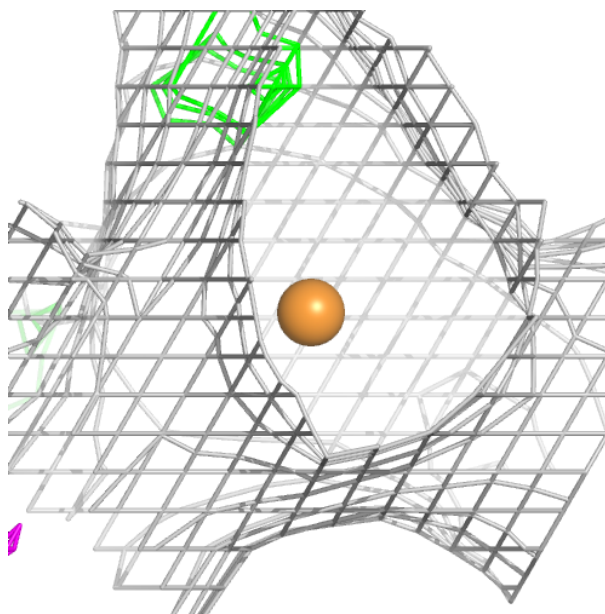
Electron density around CU A 607:

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mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
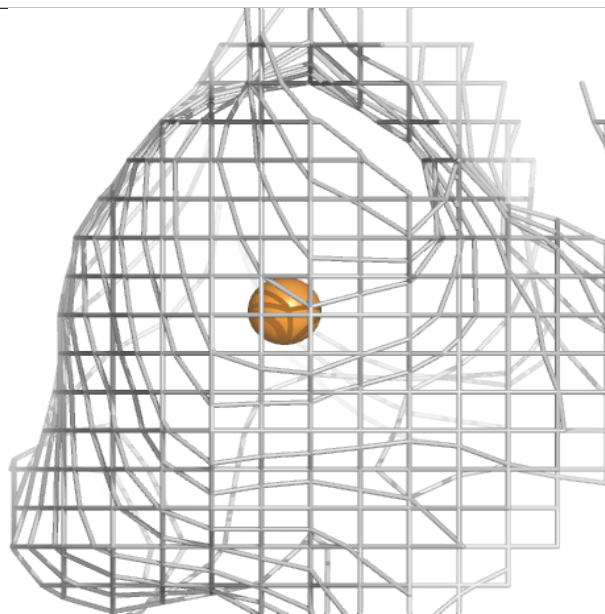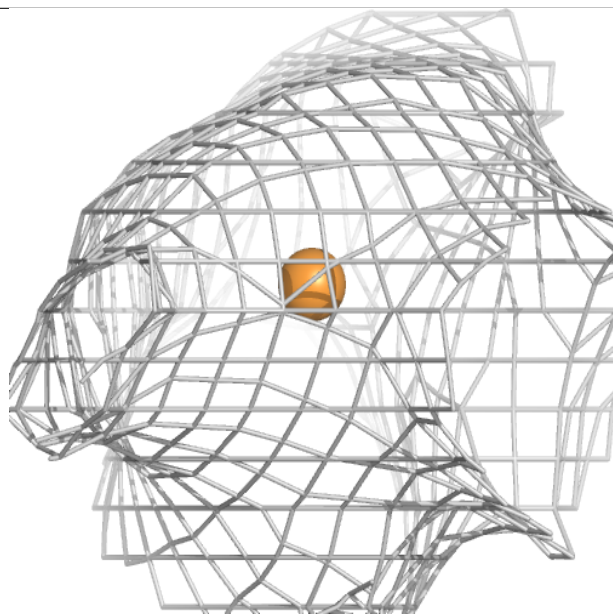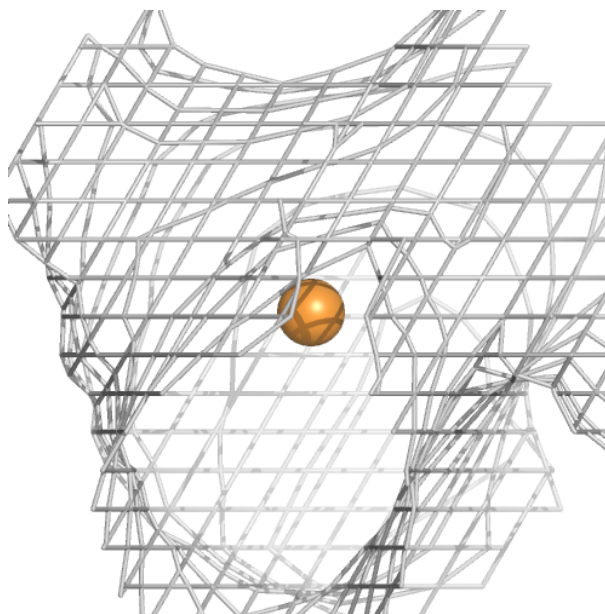
Electron density around SO4 E 601:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
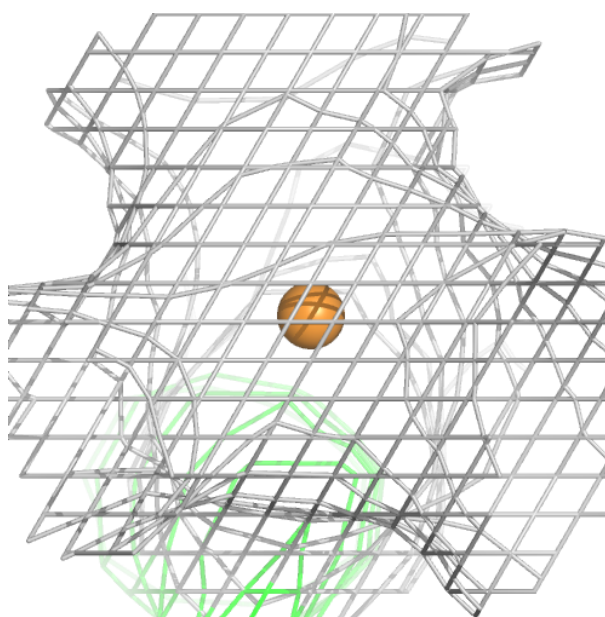
Full wwPDB X-ray Structure Validation Report
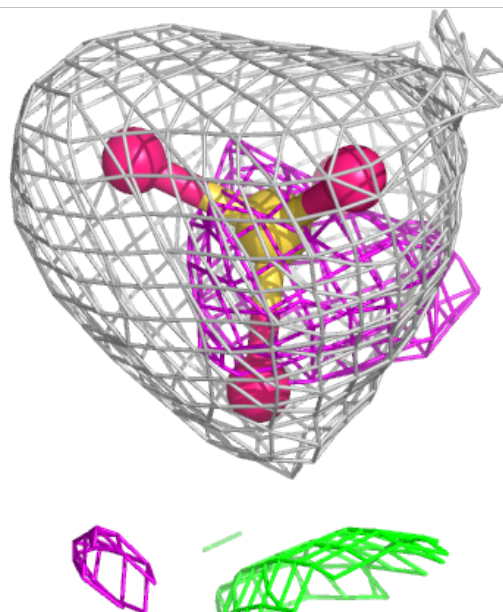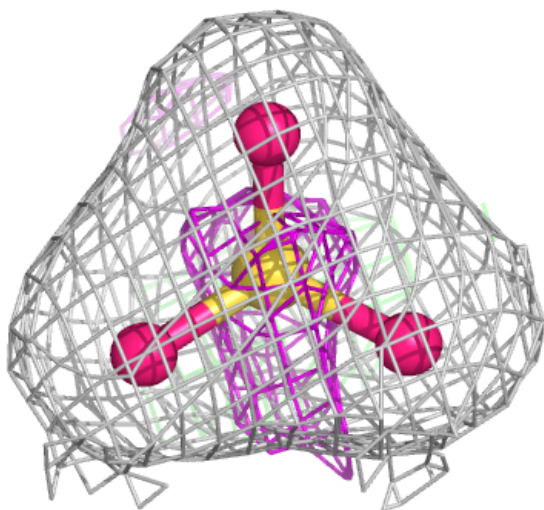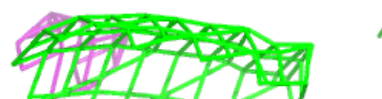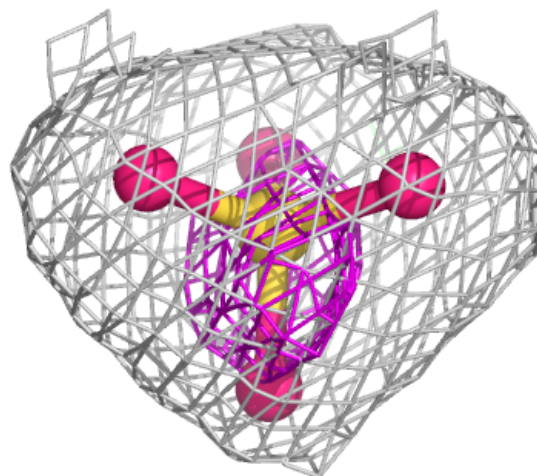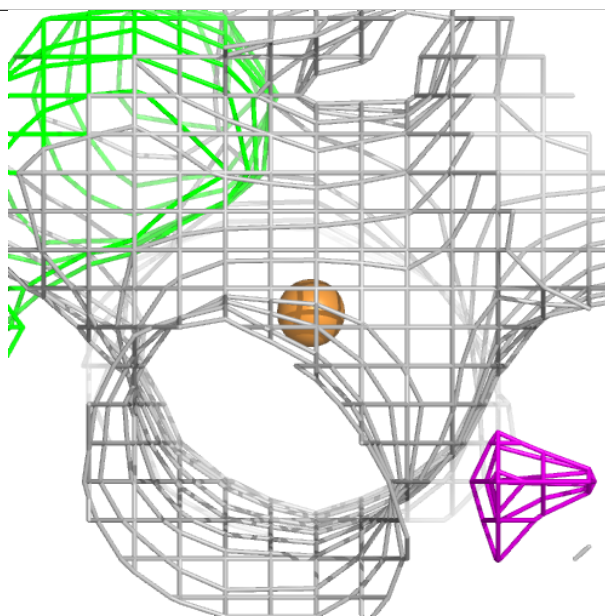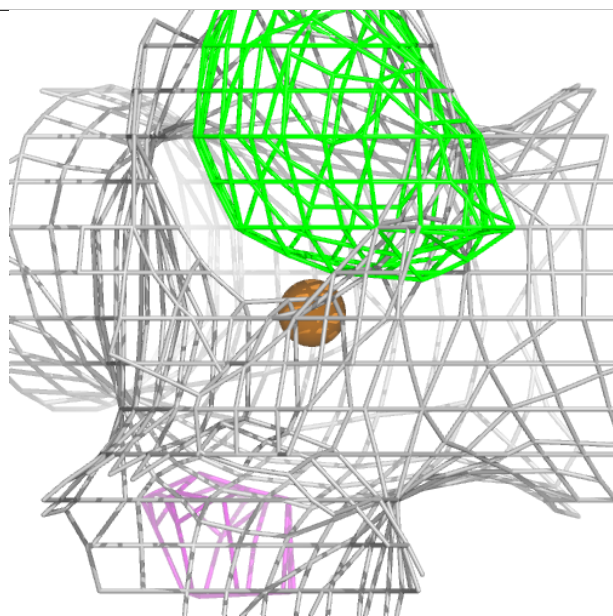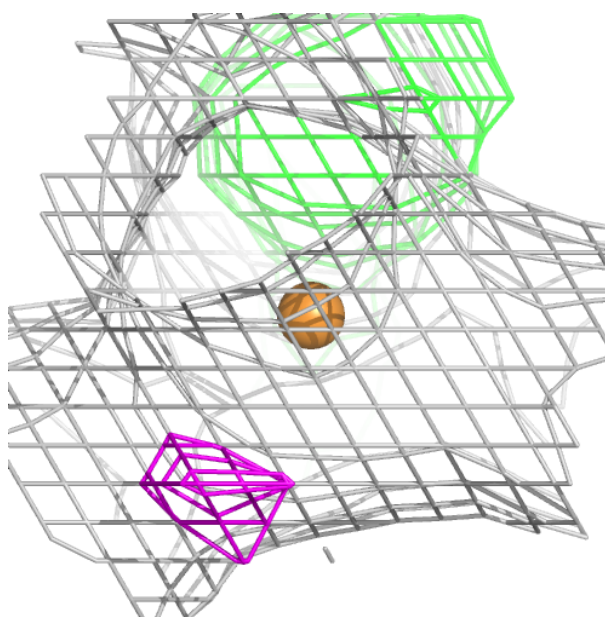
Electron density around CU B 604:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
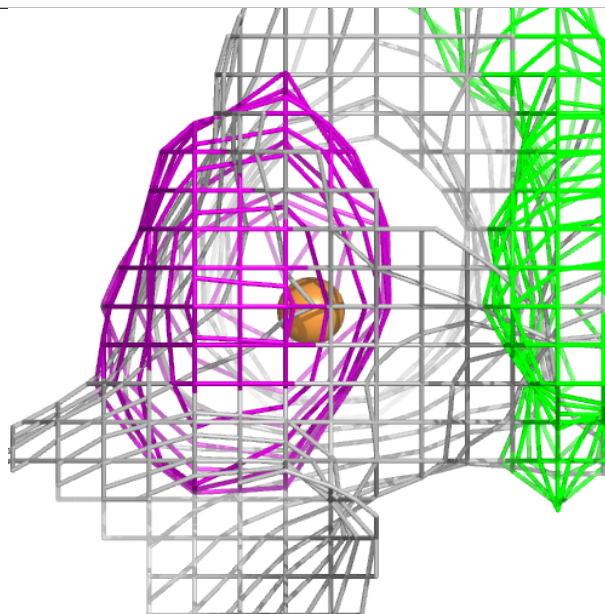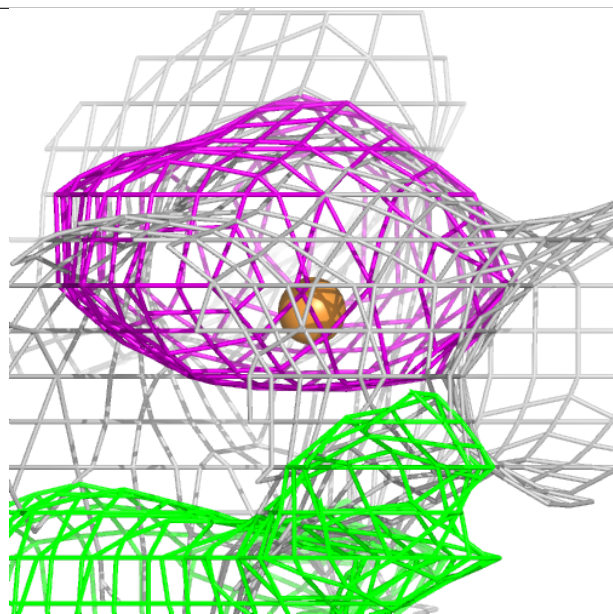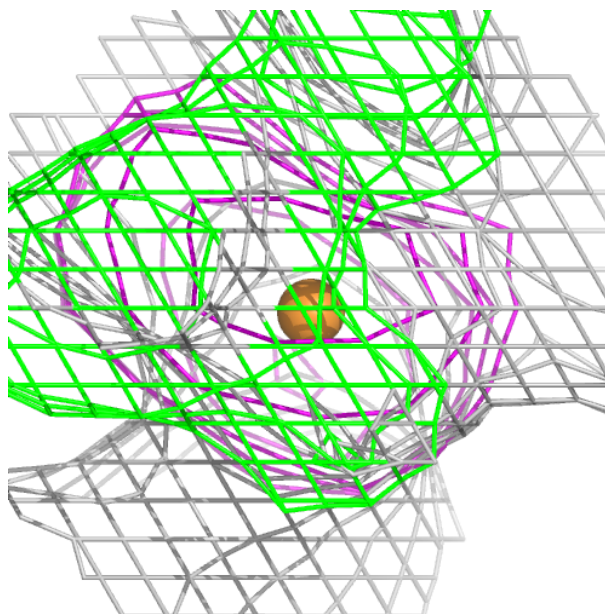
Electron density around CU A 604:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
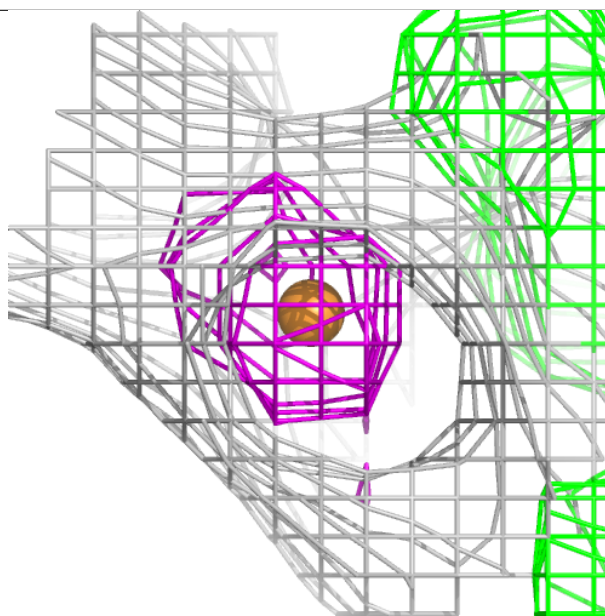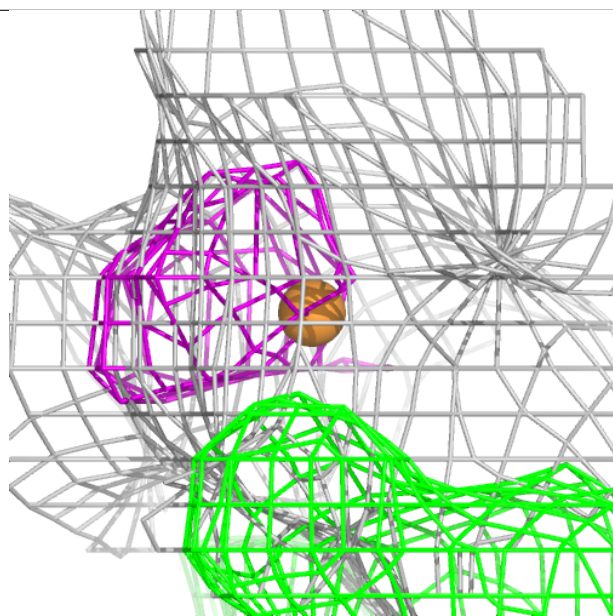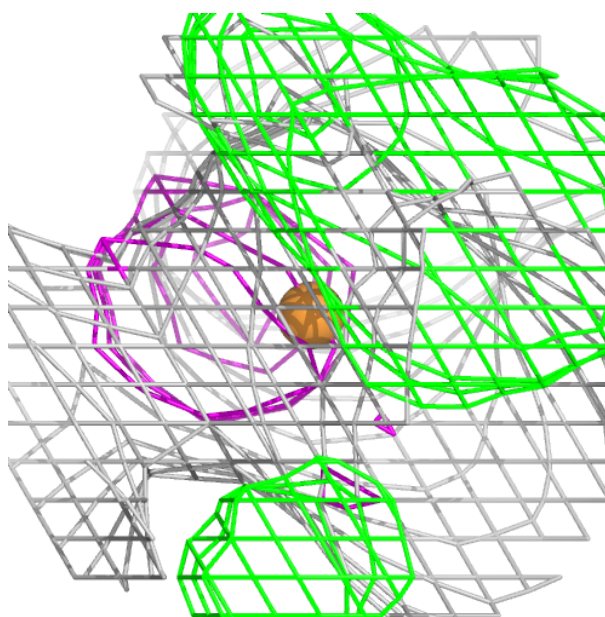
Electron density around CU B 606:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
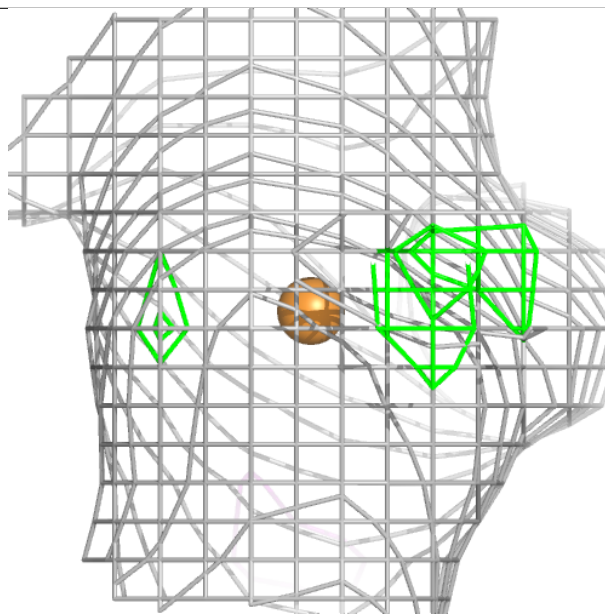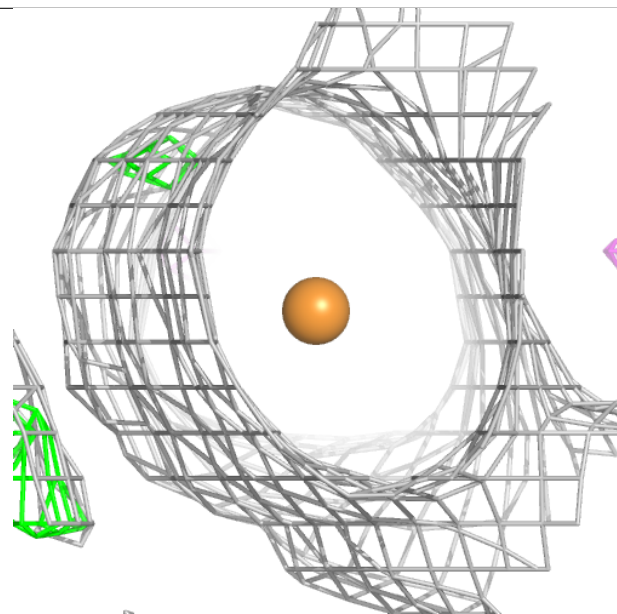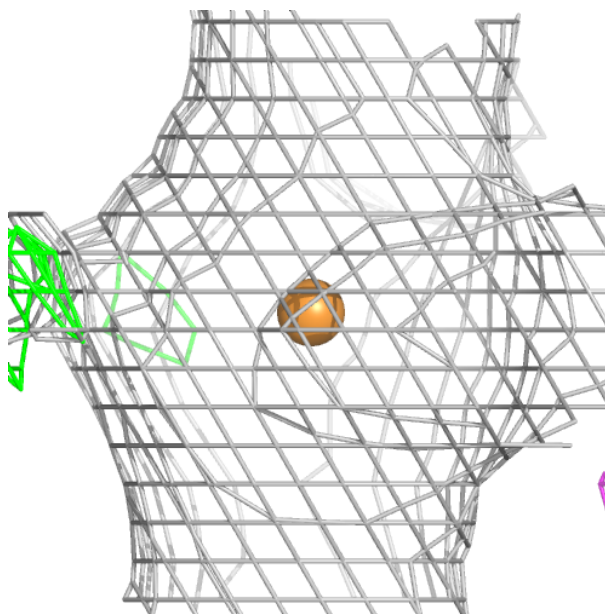
Electron density around CU B 605:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
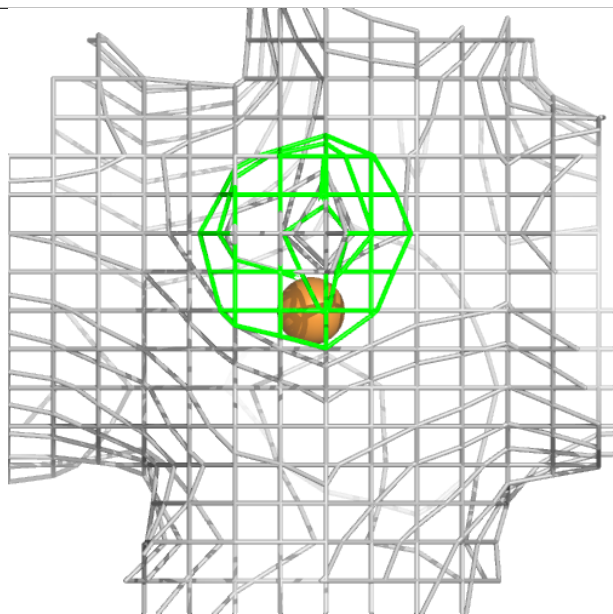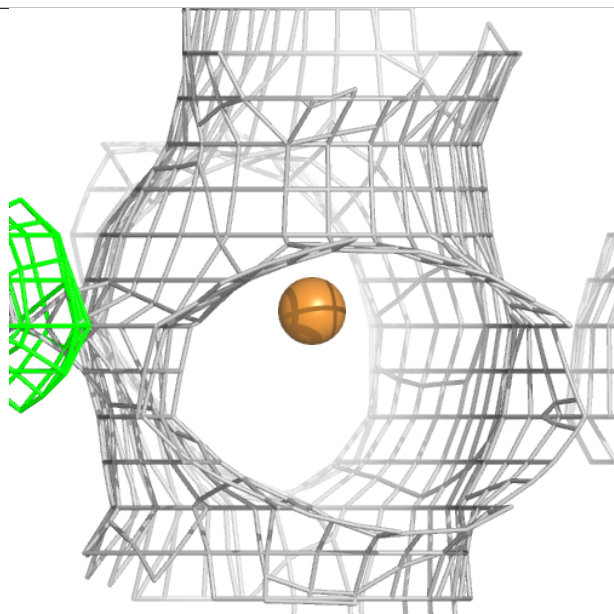
Electron density around CU A 601:

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

Electron density around CU A 605:

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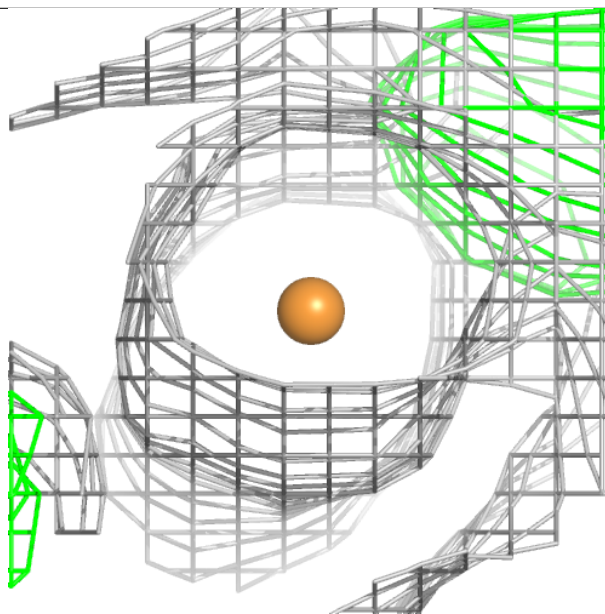$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
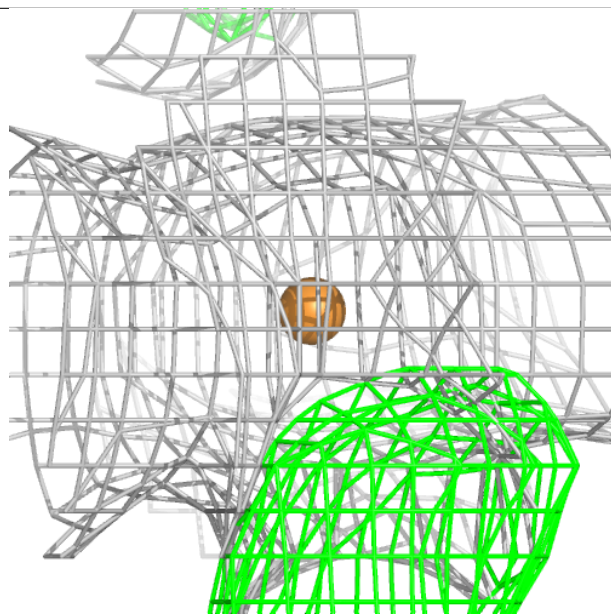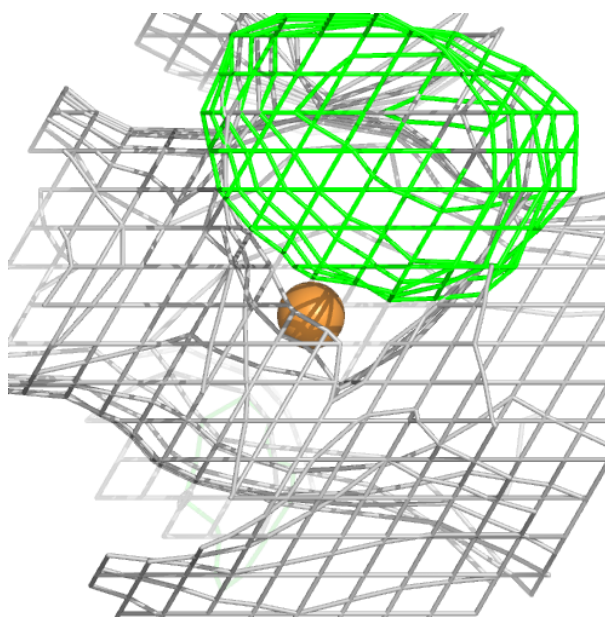and green (positive)

Electron density around CU A 606:

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

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Electron density around CU A 602:

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

Electron density around CU B 601:

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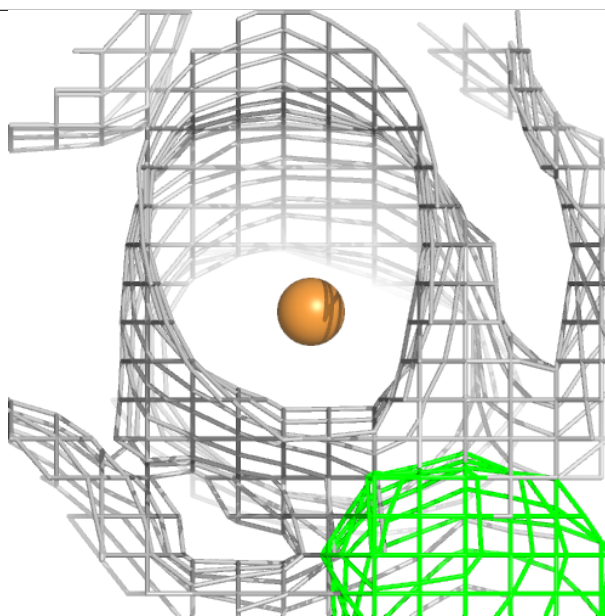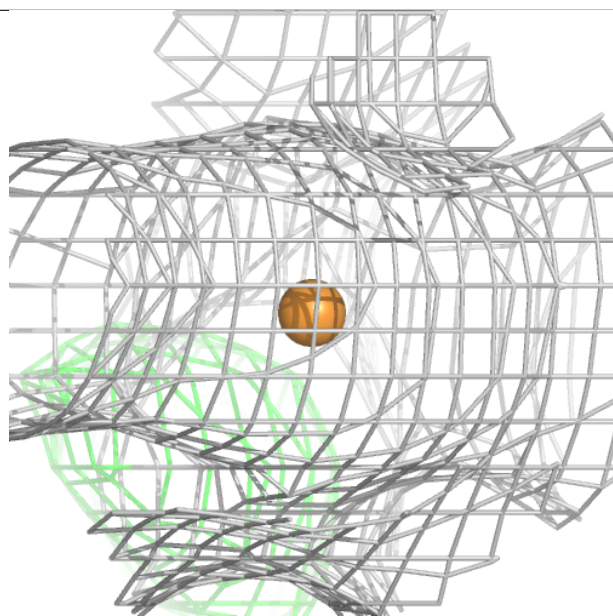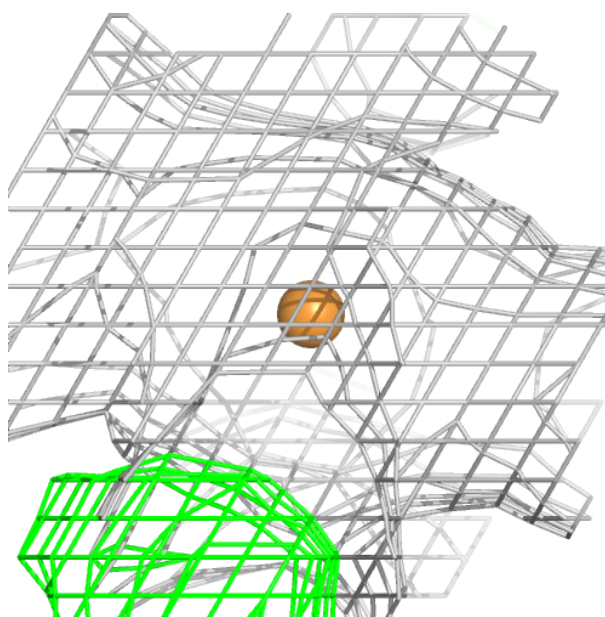and green (positive)

Electron density around CU B 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 CU A 603:

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

Electron density around CU B 603:

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

6.5 Other polymers ⓘ

There are no such residues in this entry.