Full wwPDB X-ray Structure Validation Report ⓘ

Apr 4, 2026 – 10:27 PM UTC

PDB ID : 9RJW / pdb_00009rjw
Title : W-formate dehydrogenase from Nitratidesulfovibrio vulgaris (Desulfovibrio vulgaris) - aerobic soaked with 100 bar Kr
Authors : Vilela-Alves, G.; Manuel, R.R.; Carpentier, P.; Pereira, I.C.; Romao, M.J.; Mota, C.
Deposited on : 2025-06-12
Resolution : 1.64 Å(reported)

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

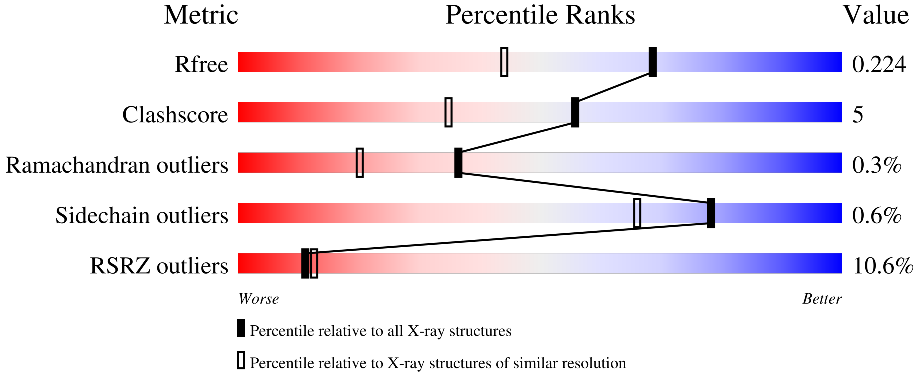
MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal 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

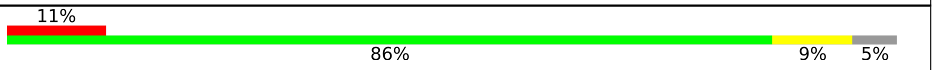
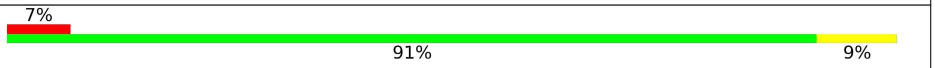
The reported resolution of this entry is 1.64 Å.

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	1141 (1.64-1.64)
Clashscore	190562	1171 (1.64-1.64)
Ramachandran outliers	187476	1151 (1.64-1.64)
Sidechain outliers	187428	1150 (1.64-1.64)
RSRZ outliers	180081	1141 (1.64-1.64)

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	1013	
2	B	215	

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
10	KR	A	1114	-	-	X	-
10	KR	A	1116	-	-	X	-
10	KR	A	1117	-	-	X	-
10	KR	A	1119	-	-	X	-
7	GOL	A	1111	-	-	X	-
8	PEG	A	1108	-	-	X	-
8	PEG	B	304	-	-	X	-

2 Entry composition ⓘ

There are 11 unique types of molecules in this entry. The entry contains 10014 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 Formate dehydrogenase, alpha subunit, selenocysteine-containing.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	967	7570	4825	1320	1383	41	1	0	0	0

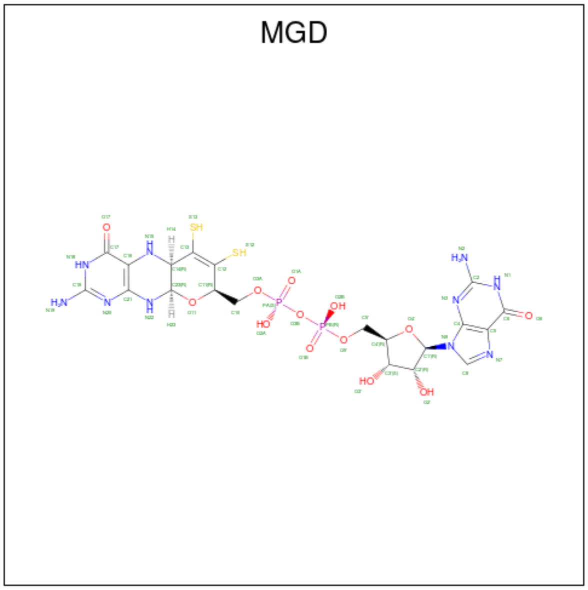
There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1006	TRP	-	expression tag	UNP Q72EJ1
A	1007	SER	-	expression tag	UNP Q72EJ1
A	1008	HIS	-	expression tag	UNP Q72EJ1
A	1009	PRO	-	expression tag	UNP Q72EJ1
A	1010	GLN	-	expression tag	UNP Q72EJ1
A	1011	PHE	-	expression tag	UNP Q72EJ1
A	1012	GLU	-	expression tag	UNP Q72EJ1
A	1013	LYS	-	expression tag	UNP Q72EJ1

- Molecule 2 is a protein called Formate dehydrogenase, beta subunit, putative.

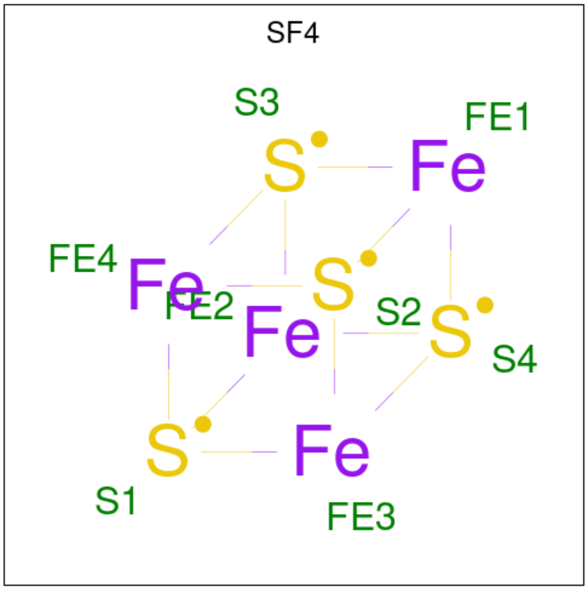
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	214	1664	1041	291	316	16	0	1	0

- Molecule 3 is 2-AMINO-5,6-DIMERCAPTO-7-METHYL-3,7,8A,9-TETRAHYDRO-8-OXA-1,3,9,10-TETRAAZA-ANTHRACEN-4-ONE GUANOSINE DINUCLEOTIDE (CCD ID: MGD) (formula: $C_{20}H_{26}N_{10}O_{13}P_2S_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	N	O	P	S		
3	A	1	47	20	10	13	2	2	0	0
3	A	1	47	20	10	13	2	2	0	0

- Molecule 4 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe_4S_4) (labeled as "Ligand of Interest" by depositor).



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

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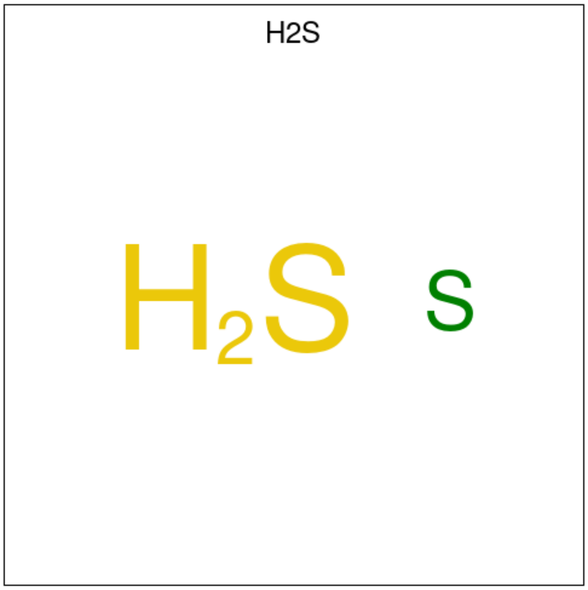
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total Fe S 8 4 4	0	0
4	B	1	Total Fe S 8 4 4	0	0
4	B	1	Total Fe S 8 4 4	0	0

- Molecule 5 is HYDROSULFURIC ACID (CCD ID: H2S) (formula: H_2S) (labeled as "Ligand of Interest" by depositor).

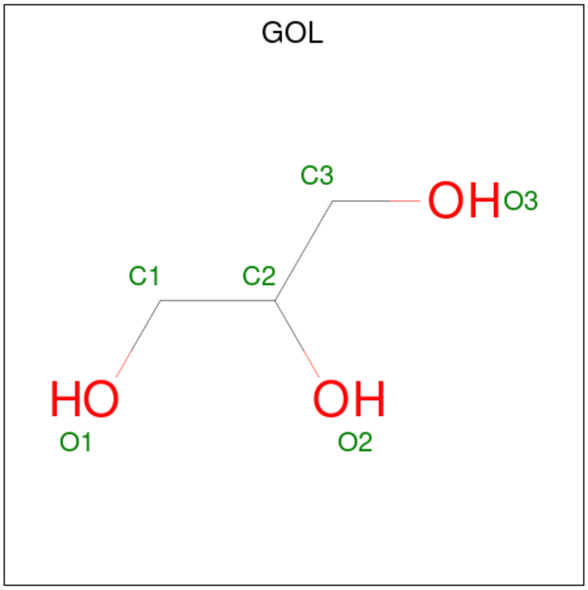


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total S 1 1	0	0

- Molecule 6 is TUNGSTEN ION (CCD ID: W) (formula: W) (labeled as "Ligand of Interest" by depositor).

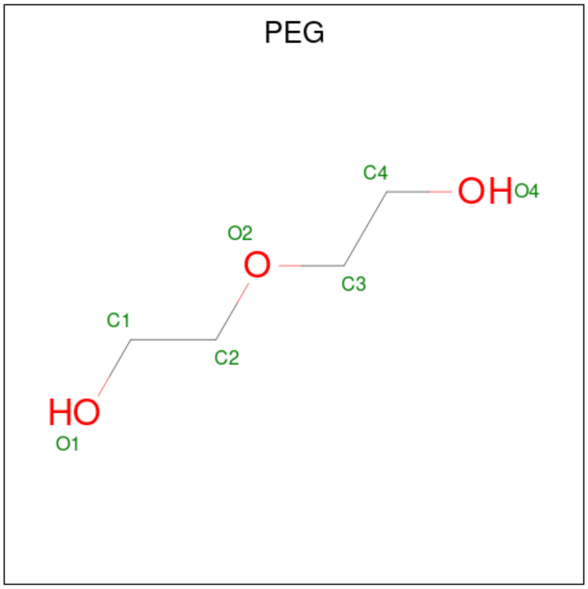
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total W 1 1	0	0

- Molecule 7 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



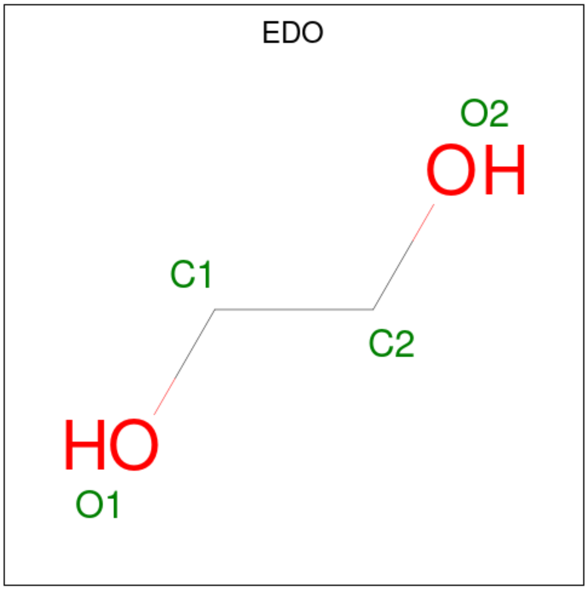
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total C O 6 3 3	0	0
7	A	1	Total C O 6 3 3	0	0
7	A	1	Total C O 6 3 3	0	0
7	A	1	Total C O 6 3 3	0	0

- Molecule 8 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	1	Total C O 7 4 3	0	0
8	B	1	Total C O 7 4 3	0	0

- Molecule 9 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	1	Total C O 4 2 2	0	0
9	A	1	Total C O 4 2 2	0	0

- Molecule 10 is KRYPTON (CCD ID: KR) (formula: Kr) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	12	Total Kr 12 12	0	0
10	B	1	Total Kr 1 1	0	0

- Molecule 11 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
11	A	474	Total O 474 474	0	0

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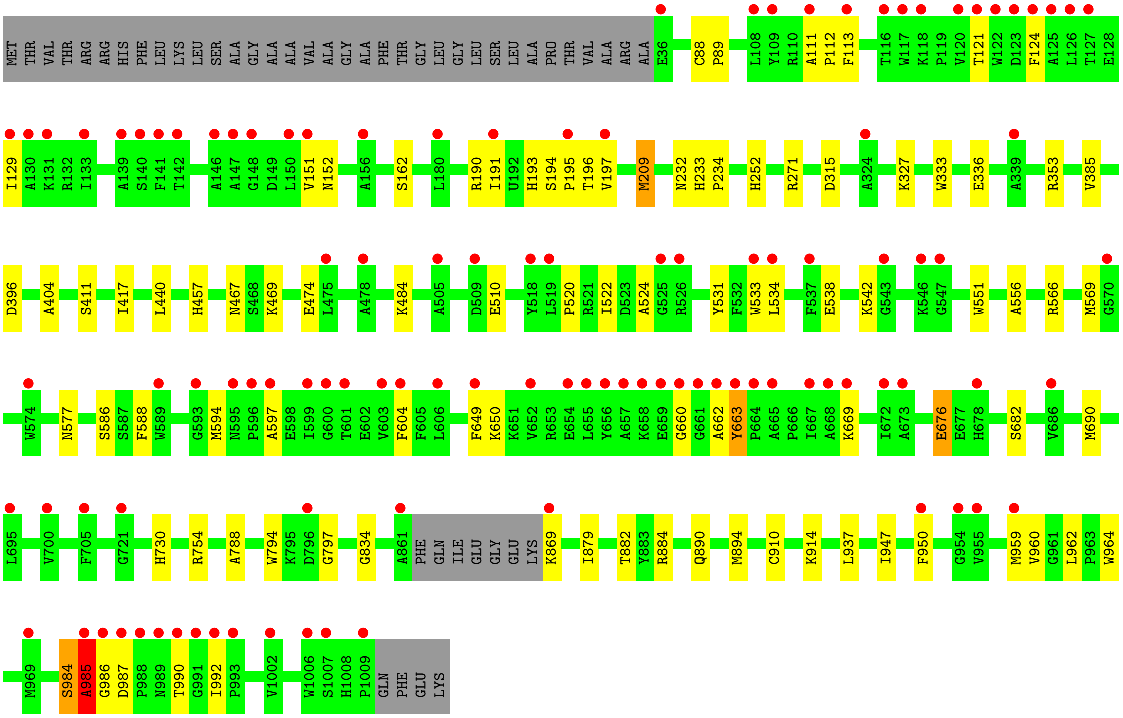
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
11	B	119	119	119	0	0

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.

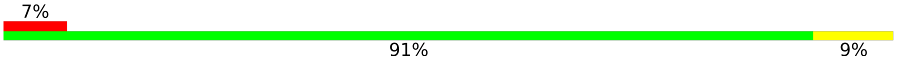
- Molecule 1: Formate dehydrogenase, alpha subunit, selenocysteine-containing

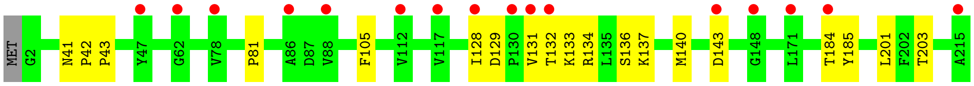
Chain A:



- Molecule 2: Formate dehydrogenase, beta subunit, putative

Chain B:





4 Data and refinement statistics ⓘ

Property	**Value**	**Source**
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	64.67Å 128.31Å 148.74Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	97.16 – 1.64 97.16 – 1.64	Depositor EDS
% Data completeness (in resolution range)	89.1 (97.16-1.64) 89.1 (97.16-1.64)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.61 (at 1.64Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.188 , 0.219 0.195 , 0.224	Depositor DCC
R_{free} test set	6672 reflections (2.30%)	wwPDB-VP
Wilson B-factor (Å^2)	23.8	Xtriage
Anisotropy	0.009	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 32.2	EDS
L-test for twinning[2]	$< \lvert L \rvert > = 0.51$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	10014	wwPDB-VP
Average B, all atoms (Å^2)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.08% 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 $< |L| >$, $< L^2 >$ 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: EDO, W, SEC, GOL, PEG, SF4, KR, MGD, H2S

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	1.05	3/7774 (0.0%)	1.30	6/10548 (0.1%)
2	B	1.07	1/1699 (0.1%)	1.30	1/2302 (0.0%)
All	All	1.05	4/9473 (0.0%)	1.30	7/12850 (0.1%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	985	ALA	C-O	5.55	1.30	1.24
1	A	682	SER	CA-CB	-5.25	1.47	1.53
1	A	252	HIS	CE1-NE2	5.16	1.37	1.32
2	B	43	PRO	C-O	-5.11	1.17	1.24

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	143	ASP	CA-CB-CG	11.42	124.02	112.60
1	A	209	MET	CG-SD-CE	-8.79	81.55	100.90
1	A	404	ALA	O-C-N	5.45	124.86	120.83
1	A	879	ILE	CA-C-N	5.37	125.44	120.34
1	A	879	ILE	C-N-CA	5.37	125.44	120.34
1	A	950	PHE	CA-CB-CG	5.16	118.96	113.80
1	A	396	ASP	CA-CB-CG	5.07	117.67	112.60

There are no chirality outliers.

There are no planarity outliers.

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	7570	0	7395	65	0
2	B	1664	0	1624	19	0
3	A	94	0	44	3	0
4	A	8	0	0	0	0
4	B	24	0	0	1	0
5	A	1	0	0	0	0
6	A	1	0	0	0	0
7	A	24	0	32	4	0
8	A	7	0	10	5	0
8	B	7	0	9	9	0
9	A	8	0	12	1	0
10	A	12	0	0	14	0
10	B	1	0	0	1	0
11	A	474	0	0	3	0
11	B	119	0	0	1	0
All	All	10014	0	9126	87	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 (87) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:385:VAL:HG12	10:A:1119:KR:KR	1.86	1.37
1:A:385:VAL:CG1	10:A:1119:KR:KR	2.55	1.15
1:A:947:ILE:HG13	10:A:1116:KR:KR	2.25	0.97
1:A:457:HIS:NE2	7:A:1111:GOL:H32	1.79	0.96
1:A:121:THR:HG23	1:A:124:PHE:H	1.32	0.95
7:A:1111:GOL:H12	10:A:1124:KR:KR	2.34	0.89
1:A:195:PRO:HG3	1:A:992:ILE:CD1	2.02	0.88
1:A:947:ILE:CG1	10:A:1116:KR:KR	2.89	0.82
1:A:947:ILE:HD11	10:A:1116:KR:KR	2.41	0.81
2:B:132:THR:HG23	2:B:134:ARG:H	1.47	0.78
1:A:947:ILE:CD1	10:A:1116:KR:KR	2.94	0.76
1:A:467:ASN:HD22	8:A:1108:PEG:H21	1.52	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:195:PRO:HG3	1:A:992:ILE:HD13	1.69	0.73
10:A:1114:KR:KR	10:A:1120:KR:KR	3.29	0.73
2:B:129:ASP:OD2	2:B:132:THR:HG22	1.91	0.70
1:A:959:MET:HE3	10:A:1117:KR:KR	2.52	0.70
1:A:457:HIS:NE2	7:A:1111:GOL:C3	2.59	0.63
2:B:128:ILE:HB	10:B:305:KR:KR	2.60	0.62
1:A:510:GLU:OE2	1:A:669:LYS:HE3	2.00	0.61
1:A:197:VAL:HG11	7:A:1111:GOL:H2	1.85	0.58
2:B:137:LYS:H	8:B:304:PEG:H22	1.70	0.57
2:B:201:LEU:C	2:B:201:LEU:HD23	2.29	0.57
1:A:538:GLU:HG3	1:A:542:LYS:HE2	1.86	0.57
1:A:336:GLU:OE1	1:A:353:ARG:NH2	2.38	0.57
1:A:534:LEU:CD2	1:A:986:GLY:HA3	2.33	0.57
1:A:194:SER:N	1:A:195:PRO:CD	2.69	0.56
1:A:385:VAL:HG13	10:A:1119:KR:KR	2.65	0.56
1:A:467:ASN:HD22	8:A:1108:PEG:C2	2.20	0.53
1:A:937:LEU:C	1:A:937:LEU:HD12	2.33	0.53
2:B:41:ASN:HA	2:B:42:PRO:C	2.33	0.53
1:A:152:ASN:HB2	10:A:1123:KR:KR	2.70	0.53
2:B:137:LYS:N	8:B:304:PEG:H22	2.23	0.53
1:A:113:PHE:HD1	1:A:597:ALA:O	1.91	0.52
1:A:910:CYS:SG	1:A:960:VAL:HG13	2.49	0.52
1:A:959:MET:HG2	10:A:1117:KR:KR	2.71	0.52
1:A:577:ASN:OD1	1:A:586:SER:HB3	2.09	0.52
2:B:105:PHE:HB2	8:B:304:PEG:C1	2.41	0.51
1:A:233:HIS:N	1:A:234:PRO:HD3	2.25	0.51
1:A:196:THR:HB	1:A:417:ILE:HG13	1.93	0.51
1:A:650:LYS:NZ	1:A:676:GLU:OE1	2.30	0.49
2:B:140:MET:O	2:B:140:MET:HG2	2.11	0.49
1:A:990:THR:HB	1:A:992:ILE:HD12	1.95	0.49
1:A:467:ASN:ND2	8:A:1108:PEG:H21	2.25	0.49
1:A:984:SER:O	1:A:985:ALA:C	2.56	0.49
2:B:137:LYS:O	8:B:304:PEG:C2	2.60	0.49
1:A:754:ARG:HD2	1:A:788:ALA:O	2.12	0.49
2:B:105:PHE:HB2	8:B:304:PEG:H12	1.94	0.49
1:A:556:ALA:HB2	1:A:569:MET:HE1	1.97	0.47
1:A:894:MET:SD	3:A:1102:MGD:H2'	2.55	0.46
1:A:191:ILE:HD11	1:A:533:TRP:CE2	2.50	0.46
2:B:137:LYS:O	8:B:304:PEG:H21	2.16	0.45
1:A:914:LYS:NZ	11:A:1215:HOH:O	2.49	0.45
1:A:522:ILE:HB	1:A:531:TYR:CE2	2.51	0.45

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Atom-1	**Atom-2**	**Interatomic distance (Å)**	**Clash overlap (Å)**
1:A:794:TRP:CZ2	1:A:797:GLY:HA2	2.52	0.45
1:A:232:ASN:HA	3:A:1101:MGD:N20	2.32	0.44
8:A:1108:PEG:O1	9:A:1110:EDO:C2	2.66	0.44
1:A:209:MET:HE1	1:A:440:LEU:HD23	2.00	0.44
1:A:88:CYS:HB2	1:A:89:PRO:HD2	1.99	0.44
1:A:411:SER:HB3	1:A:987:ASP:OD1	2.18	0.44
1:A:884:ARG:HH22	3:A:1102:MGD:H15	1.64	0.44
2:B:137:LYS:H	8:B:304:PEG:C2	2.30	0.44
2:B:132:THR:O	2:B:133:LYS:HB2	2.18	0.43
1:A:662:ALA:O	1:A:663:TYR:C	2.60	0.43
1:A:469:LYS:HG2	1:A:524:ALA:CB	2.48	0.43
2:B:136:SER:HA	8:B:304:PEG:O2	2.19	0.43
1:A:882:THR:HA	1:A:962:LEU:O	2.19	0.43
1:A:129:ILE:HD11	1:A:604:PHE:CB	2.49	0.43
1:A:190:ARG:HH22	1:A:457:HIS:HD1	1.65	0.42
1:A:467:ASN:HB3	8:A:1108:PEG:H21	2.01	0.42
2:B:184:THR:HG23	11:B:410:HOH:O	2.19	0.42
1:A:890:GLN:HA	1:A:964:TRP:CH2	2.54	0.42
1:A:162:SER:HB2	1:A:551:TRP:O	2.19	0.42
1:A:151:VAL:O	1:A:520:PRO:HA	2.20	0.42
1:A:193:HIS:C	1:A:195:PRO:HD2	2.45	0.42
1:A:474:GLU:HA	11:A:1618:HOH:O	2.19	0.41
2:B:105:PHE:H	8:B:304:PEG:C1	2.32	0.41
1:A:947:ILE:CD1	10:A:1117:KR:KR	3.29	0.41
1:A:566:ARG:HA	1:A:569:MET:CE	2.51	0.41
1:A:111:ALA:O	1:A:112:PRO:C	2.62	0.41
1:A:510:GLU:OE2	1:A:669:LYS:CE	2.68	0.41
2:B:81:PRO:HD2	4:B:302:SF4:S3	2.61	0.41
1:A:333:TRP:CH2	1:A:834:GLY:HA2	2.56	0.40
1:A:690:MET:HE2	1:A:730:HIS:CE1	2.57	0.40
2:B:185:TYR:CD1	2:B:203:THR:HB	2.56	0.40
1:A:315:ASP:HA	11:A:1568:HOH:O	2.21	0.40
1:A:588:PHE:O	1:A:594:MET:HG3	2.21	0.40
1:A:649:PHE:HA	10:A:1114:KR:KR	2.82	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	962/1013 (95%)	930 (97%)	29 (3%)	3 (0%)	36	20
2	B	212/215 (99%)	204 (96%)	7 (3%)	1 (0%)	24	9
All	All	1174/1228 (96%)	1134 (97%)	36 (3%)	4 (0%)	36	20

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	660	GLY
1	A	985	ALA
1	A	663	TYR
2	B	131	VAL

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	786/819 (96%)	780 (99%)	6 (1%)	73	58
2	B	185/186 (100%)	185 (100%)	0	100	100
All	All	971/1005 (97%)	965 (99%)	6 (1%)	78	66

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	271	ARG
1	A	327	LYS

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Mol	Chain	Res	Type
1	A	484	LYS
1	A	676	GLU
1	A	869	LYS
1	A	984	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	383	GLN
1	A	855	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 29 ligands modelled in this entry, 1 is modelled with single atom and 14 are monoatomic - leaving 14 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	$\#\|Z\| > 2$
8	PEG	B	304	-	6,6,6	0.74	0	5,5,5	0.46	0
7	GOL	A	1107	-	5,5,5	0.20	0	5,5,5	0.27	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
4	SF4	B	301	2	0,12,12	-	-	-		
9	EDO	A	1112	-	3,3,3	0.27	0	2,2,2	0.15	0
4	SF4	B	302	2	0,12,12	-	-	-		
3	MGD	A	1102	6	47,52,52	0.96	4 (8%)	58,81,81	1.16	6 (10%)
7	GOL	A	1109	-	5,5,5	0.29	0	5,5,5	0.53	0
7	GOL	A	1111	-	5,5,5	0.21	0	5,5,5	0.47	0
4	SF4	B	303	2	0,12,12	-	-	-		
3	MGD	A	1101	6	47,52,52	1.11	3 (6%)	58,81,81	1.00	4 (6%)
9	EDO	A	1110	-	3,3,3	0.26	0	2,2,2	0.32	0
7	GOL	A	1106	-	5,5,5	0.11	0	5,5,5	0.74	0
4	SF4	A	1103	1	0,12,12	-	-	-		
8	PEG	A	1108	-	6,6,6	0.32	0	5,5,5	0.23	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
8	PEG	B	304	-	-	2/4/4/4	-
7	GOL	A	1107	-	-	0/4/4/4	-
4	SF4	B	301	2	-	-	0/6/5/5
9	EDO	A	1112	-	-	1/1/1/1	-
3	MGD	A	1102	6	-	4/22/66/66	0/6/6/6
7	GOL	A	1109	-	-	2/4/4/4	-
7	GOL	A	1111	-	-	2/4/4/4	-
4	SF4	B	302	2	-	-	0/6/5/5
4	SF4	B	303	2	-	-	0/6/5/5
3	MGD	A	1101	6	-	2/22/66/66	0/6/6/6
9	EDO	A	1110	-	-	1/1/1/1	-
7	GOL	A	1106	-	-	1/4/4/4	-
4	SF4	A	1103	1	-	-	0/6/5/5
8	PEG	A	1108	-	-	2/4/4/4	-

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1101	MGD	C23-C14	3.80	1.56	1.53
3	A	1101	MGD	PA-O3B	3.27	1.63	1.59
3	A	1102	MGD	PA-O3B	3.21	1.63	1.59

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1101	MGD	PB-O3B	3.12	1.62	1.59
3	A	1102	MGD	C23-C14	2.50	1.55	1.53
3	A	1102	MGD	PB-O3B	2.25	1.61	1.59
3	A	1102	MGD	C14-N15	-2.04	1.44	1.46

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1102	MGD	C19-N20-C21	3.53	119.58	113.36
3	A	1101	MGD	C19-N20-C21	3.43	119.42	113.36
3	A	1102	MGD	C23-C14-N15	3.14	110.95	107.87
3	A	1102	MGD	C17-C16-N15	2.91	124.20	116.27
3	A	1101	MGD	C23-C14-N15	2.55	110.38	107.87
3	A	1102	MGD	O4'-C1'-C2'	-2.38	101.51	106.62
3	A	1101	MGD	C17-C16-N15	2.35	122.68	116.27
3	A	1102	MGD	O11-C23-C14	2.23	110.45	108.96
3	A	1102	MGD	O17-C17-N18	-2.04	116.29	120.11
3	A	1101	MGD	N18-C19-N20	-2.03	119.61	123.32

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1102	MGD	C5'-O5'-PB-O2B
3	A	1102	MGD	C4'-C5'-O5'-PB
8	B	304	PEG	C4-C3-O2-C2
3	A	1102	MGD	O4'-C4'-C5'-O5'
8	A	1108	PEG	O2-C3-C4-O4
7	A	1109	GOL	C1-C2-C3-O3
7	A	1111	GOL	O1-C1-C2-C3
8	B	304	PEG	O1-C1-C2-O2
3	A	1102	MGD	C3'-C4'-C5'-O5'
8	A	1108	PEG	O1-C1-C2-O2
7	A	1109	GOL	O2-C2-C3-O3
3	A	1101	MGD	PA-O3B-PB-O5'
7	A	1111	GOL	O1-C1-C2-O2
7	A	1106	GOL	O1-C1-C2-O2
9	A	1110	EDO	O1-C1-C2-O2
9	A	1112	EDO	O1-C1-C2-O2
3	A	1101	MGD	PA-O3B-PB-O2B

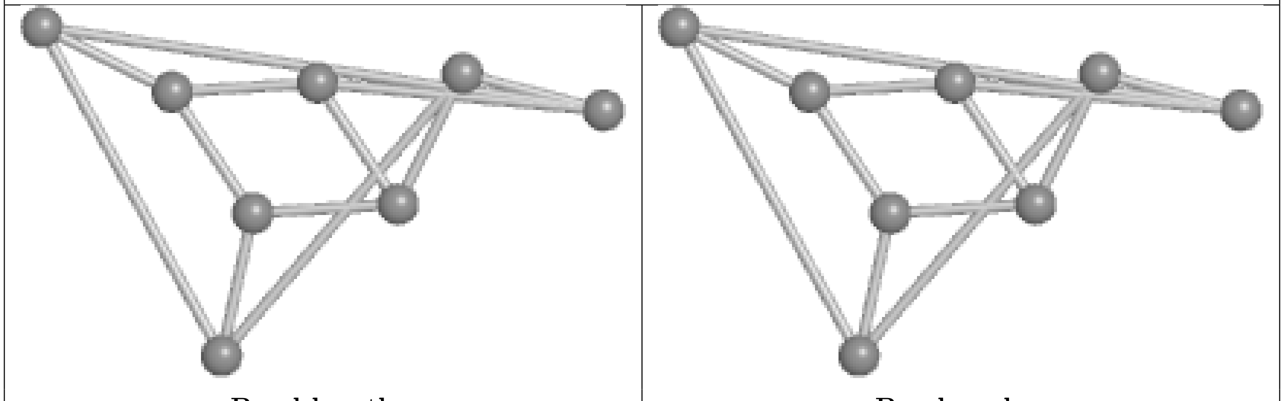
There are no ring outliers.

7 monomers are involved in 22 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	B	304	PEG	9	0
4	B	302	SF4	1	0
3	A	1102	MGD	2	0
7	A	1111	GOL	4	0
3	A	1101	MGD	1	0
9	A	1110	EDO	1	0
8	A	1108	PEG	5	0

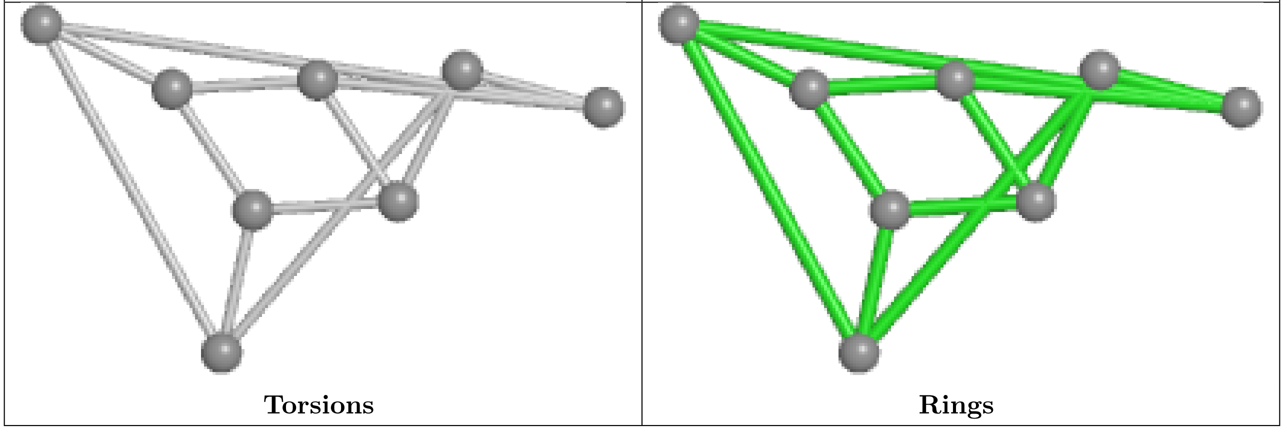
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand SF4 B 301



Bond lengths

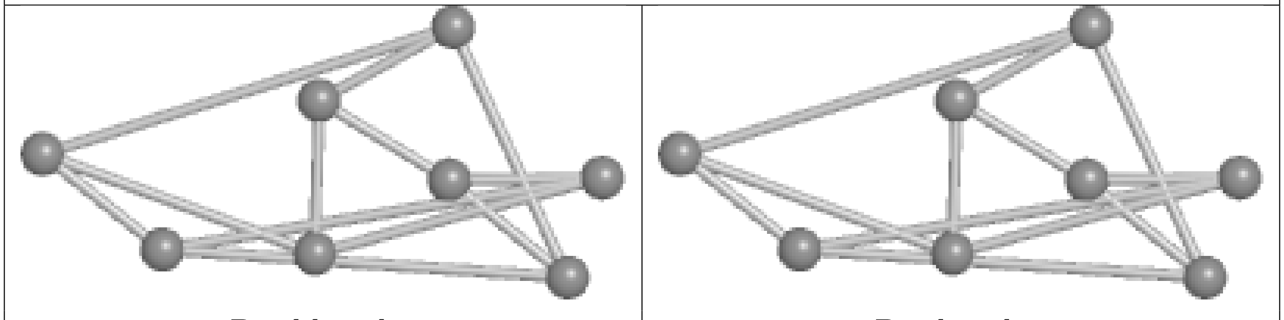
Bond angles



Torsions

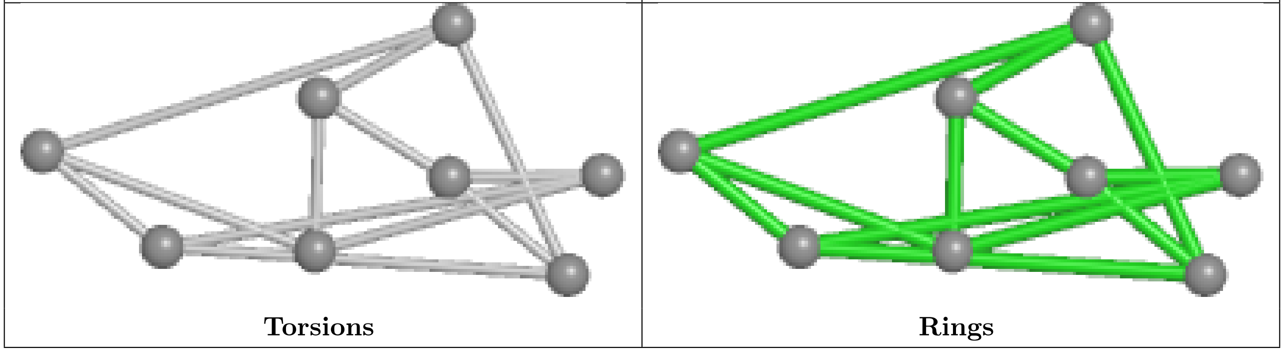
Rings

Ligand SF4 B 302



Bond lengths

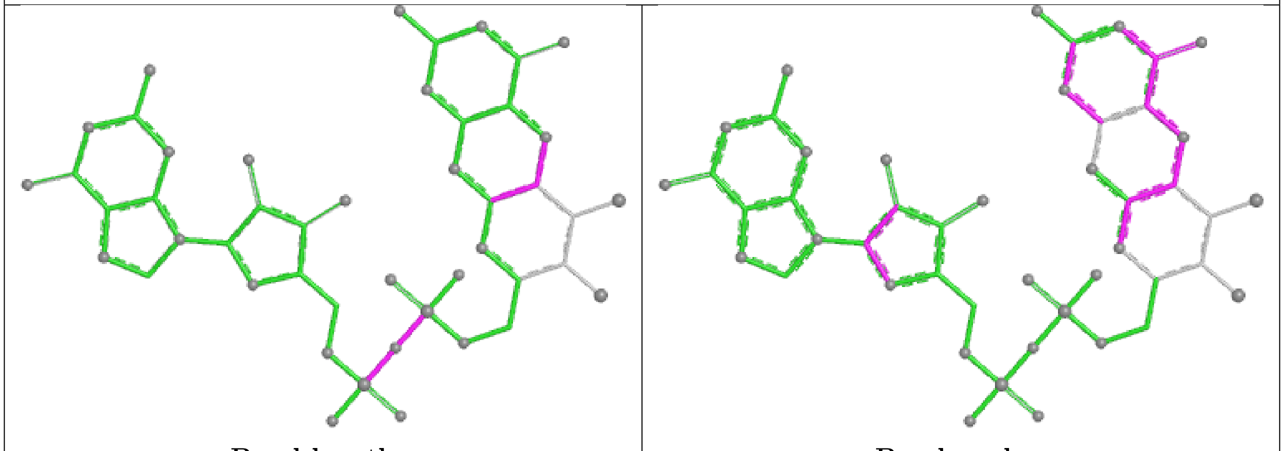
Bond angles



Torsions

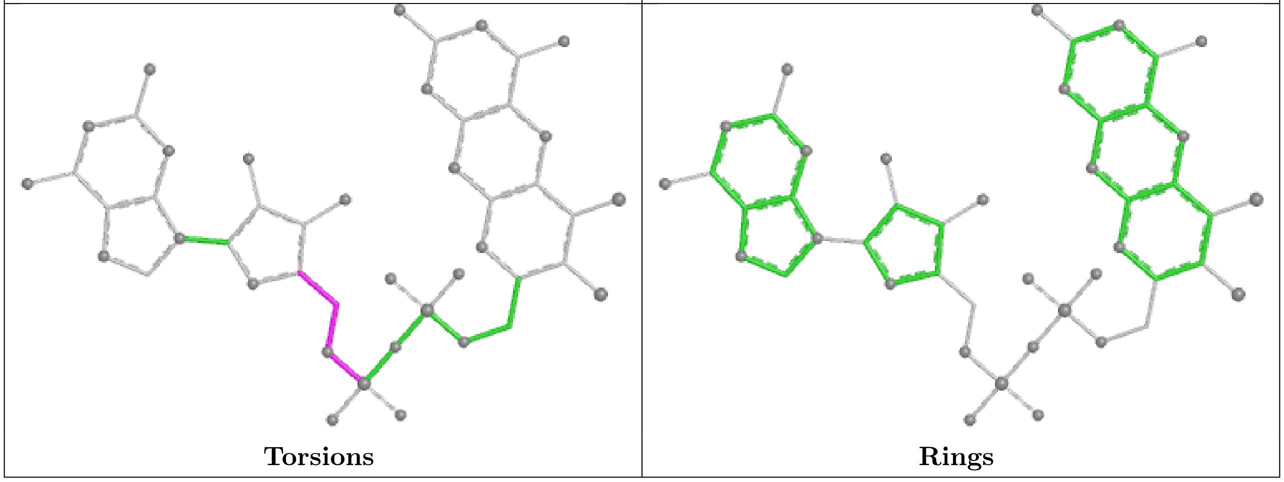
Rings

Ligand MGD A 1102



Bond lengths

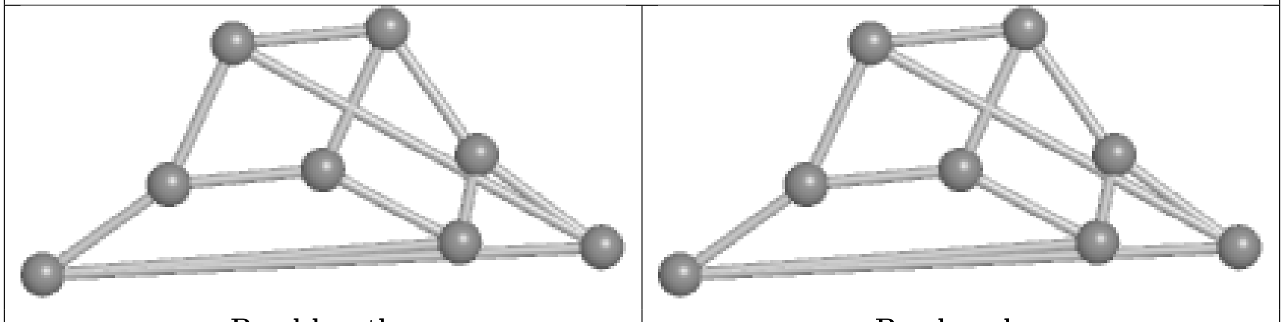
Bond angles



Torsions

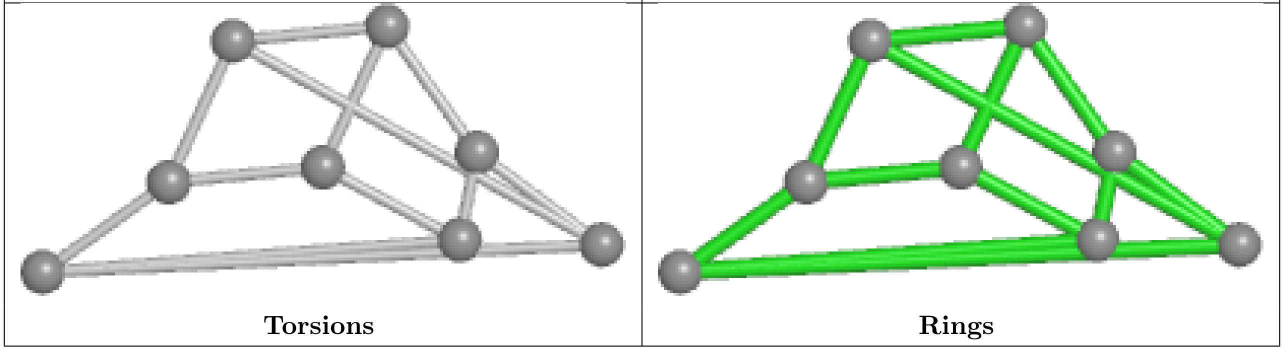
Rings

Ligand SF4 B 303



Bond lengths

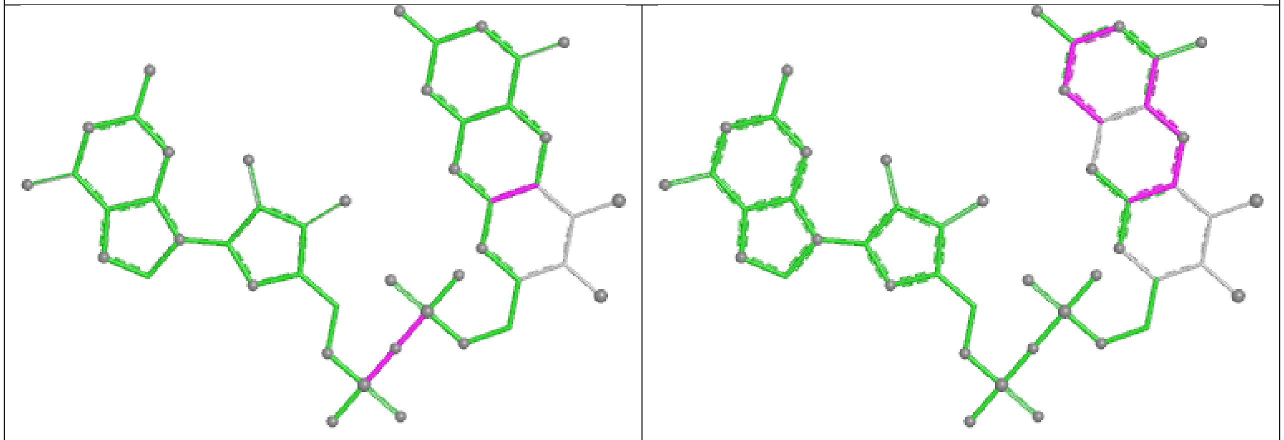
Bond angles



Torsions

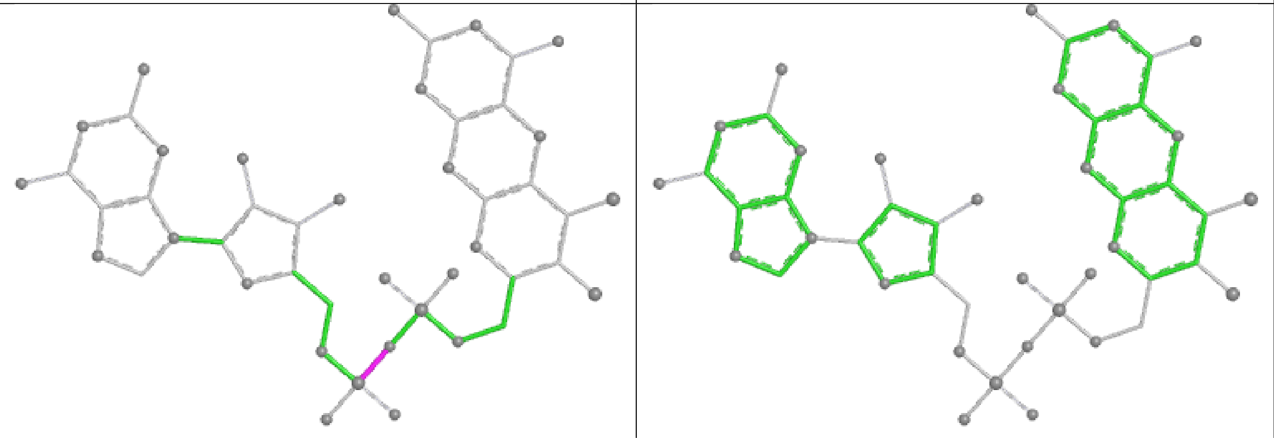
Rings

Ligand MGD A 1101



Bond lengths

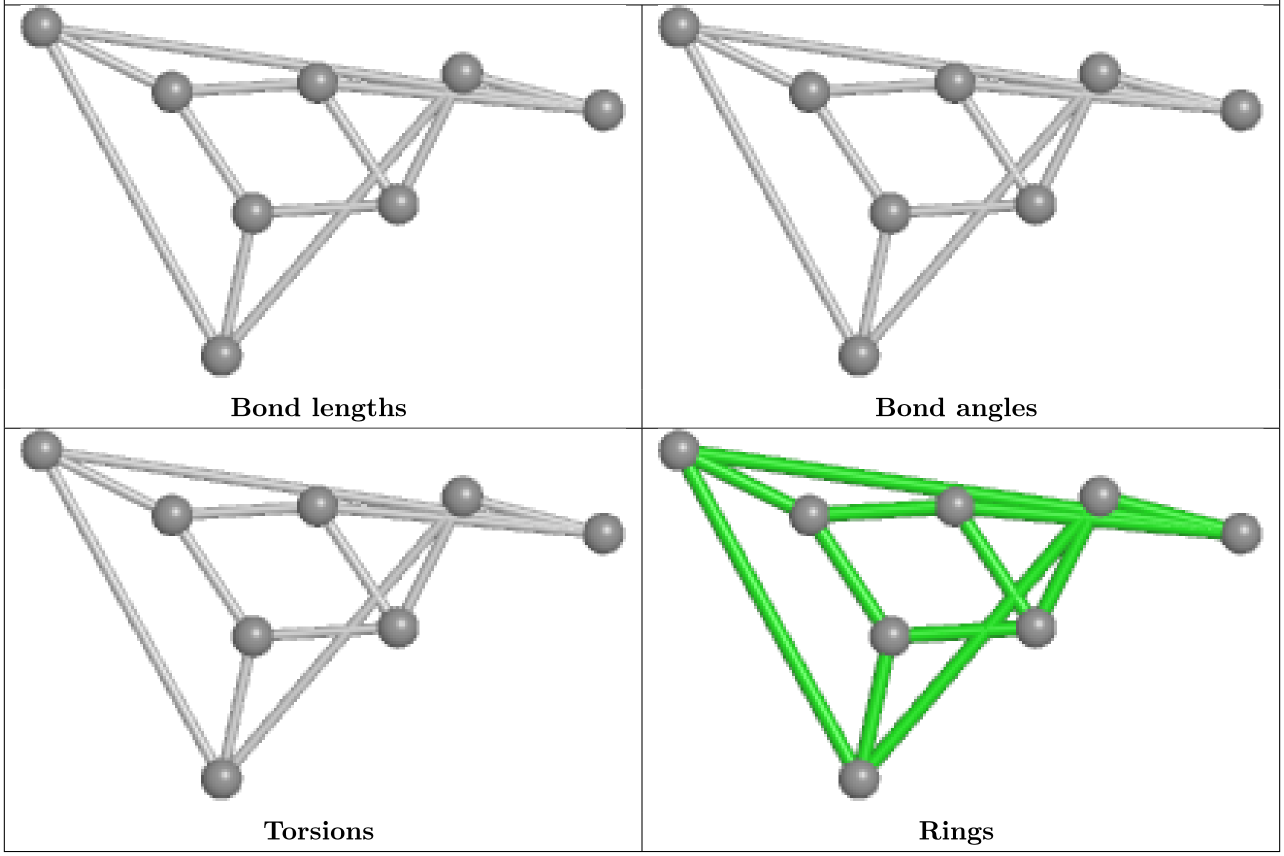
Bond angles



Torsions

Rings

Ligand SF4 A 1103



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(Å^2)	Q<0.9
1	A	966/1013 (95%)	0.65	109 (11%)	10	11	15, 29, 50, 72	0
2	B	214/215 (99%)	0.70	16 (7%)	20	23	18, 31, 48, 57	0
All	All	1180/1228 (96%)	0.66	125 (10%)	11	12	15, 29, 50, 72	0

All (125) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	985	ALA	5.4
1	A	1006	TRP	5.4
1	A	986	GLY	4.8
1	A	992	ILE	4.8
1	A	655	LEU	4.2
1	A	661	GLY	4.2
1	A	129	ILE	4.1
1	A	988	PRO	3.7
1	A	950	PHE	3.6
1	A	993	PRO	3.6
1	A	1009	PRO	3.6
1	A	109	TYR	3.5
1	A	657	ALA	3.5
2	B	88	VAL	3.5
1	A	599	ILE	3.4
1	A	533	TRP	3.4
2	B	131	VAL	3.4
1	A	122	TRP	3.4
1	A	125	ALA	3.2
1	A	664	PRO	3.2
1	A	131	LYS	3.2
1	A	597	ALA	3.1
1	A	673	ALA	3.1
1	A	700	VAL	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	662	ALA	3.0
1	A	124	PHE	3.0
2	B	62	GLY	3.0
1	A	151	VAL	3.0
1	A	660	GLY	3.0
1	A	111	ALA	2.9
1	A	570	GLY	2.9
1	A	604	PHE	2.9
1	A	127	THR	2.9
1	A	652	VAL	2.9
1	A	593	GLY	2.9
1	A	721	GLY	2.9
1	A	113	PHE	2.8
1	A	665	ALA	2.8
1	A	658	LYS	2.8
1	A	603	VAL	2.8
1	A	133	ILE	2.8
1	A	120	VAL	2.8
1	A	197	VAL	2.8
1	A	990	THR	2.8
1	A	678	HIS	2.8
1	A	991	GLY	2.7
2	B	148	GLY	2.7
1	A	339	ALA	2.7
1	A	519	LEU	2.7
1	A	121	THR	2.7
1	A	954	GLY	2.7
1	A	989	ASN	2.7
1	A	959	MET	2.7
1	A	130	ALA	2.7
1	A	146	ALA	2.7
1	A	147	ALA	2.7
2	B	215	ALA	2.7
1	A	649	PHE	2.6
1	A	150	LEU	2.6
1	A	663	TYR	2.6
1	A	861	ALA	2.6
1	A	668	ALA	2.6
1	A	36	GLU	2.6
2	B	143	ASP	2.6
1	A	796	ASP	2.5
1	A	537	PHE	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	987	ASP	2.5
1	A	525	GLY	2.5
1	A	547	GLY	2.5
1	A	142	THR	2.5
1	A	656	TYR	2.5
1	A	596	PRO	2.5
1	A	108	LEU	2.5
1	A	667	ILE	2.5
2	B	184	THR	2.5
1	A	195	PRO	2.4
1	A	116	THR	2.4
1	A	955	VAL	2.4
2	B	78	VAL	2.4
2	B	132	THR	2.4
1	A	574	TRP	2.4
1	A	600	GLY	2.4
2	B	130	PRO	2.4
2	B	171	LEU	2.4
1	A	140	SER	2.4
1	A	1007	SER	2.4
2	B	112	VAL	2.4
1	A	595	ASN	2.4
1	A	141	PHE	2.4
2	B	117	VAL	2.3
1	A	546	LYS	2.3
1	A	601	THR	2.3
1	A	543	GLY	2.3
1	A	534	LEU	2.3
1	A	869	LYS	2.3
1	A	156	ALA	2.2
1	A	126	LEU	2.2
1	A	589	TRP	2.2
1	A	505	ALA	2.2
1	A	509	ASP	2.2
1	A	695	LEU	2.2
1	A	191	ILE	2.2
1	A	139	ALA	2.2
1	A	659	GLU	2.2
1	A	475	LEU	2.2
1	A	606	LEU	2.2
1	A	118	LYS	2.2
2	B	128	ILE	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	654	GLU	2.1
1	A	148	GLY	2.1
1	A	180	LEU	2.1
1	A	526	ARG	2.1
1	A	478	ALA	2.1
1	A	686	VAL	2.1
1	A	705	PHE	2.1
1	A	672	ILE	2.1
1	A	117	TRP	2.1
1	A	669	LYS	2.1
1	A	324	ALA	2.0
2	B	86	ALA	2.0
1	A	123	ASP	2.0
1	A	969	MET	2.0
1	A	518	TYR	2.0
2	B	47	TYR	2.0
1	A	1002	VAL	2.0

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($\AA^2$)	Q<0.9
9	EDO	A	1112	4/4	0.79	0.19	38,44,45,51	0
8	PEG	A	1108	7/7	0.80	0.17	42,52,58,61	0
7	GOL	A	1111	6/6	0.81	0.16	34,43,45,47	0
10	KR	A	1123	1/1	0.81	0.23	43,43,43,43	1
10	KR	A	1122	1/1	0.82	0.36	26,26,26,26	1
9	EDO	A	1110	4/4	0.87	0.13	38,44,45,51	0

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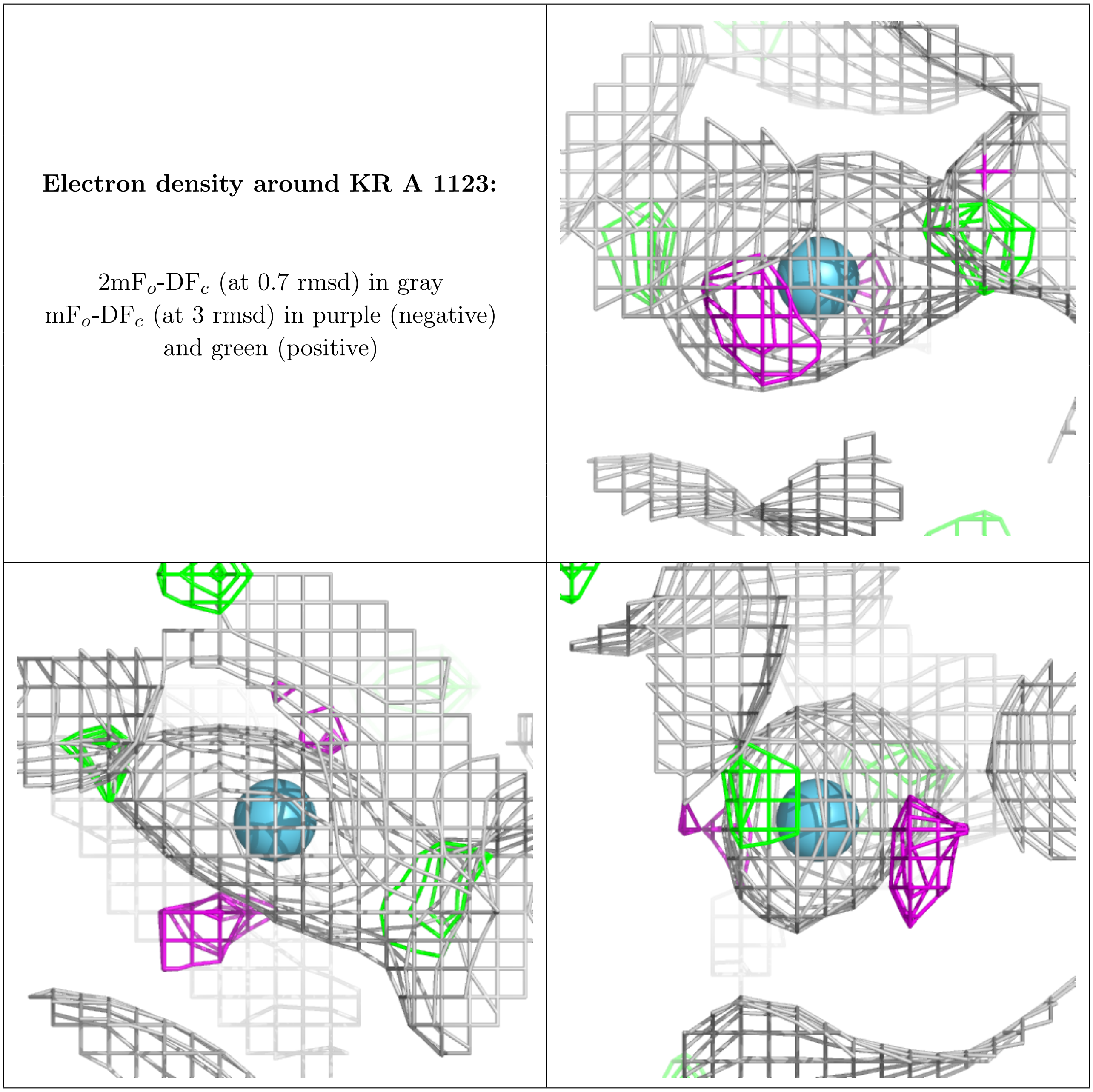
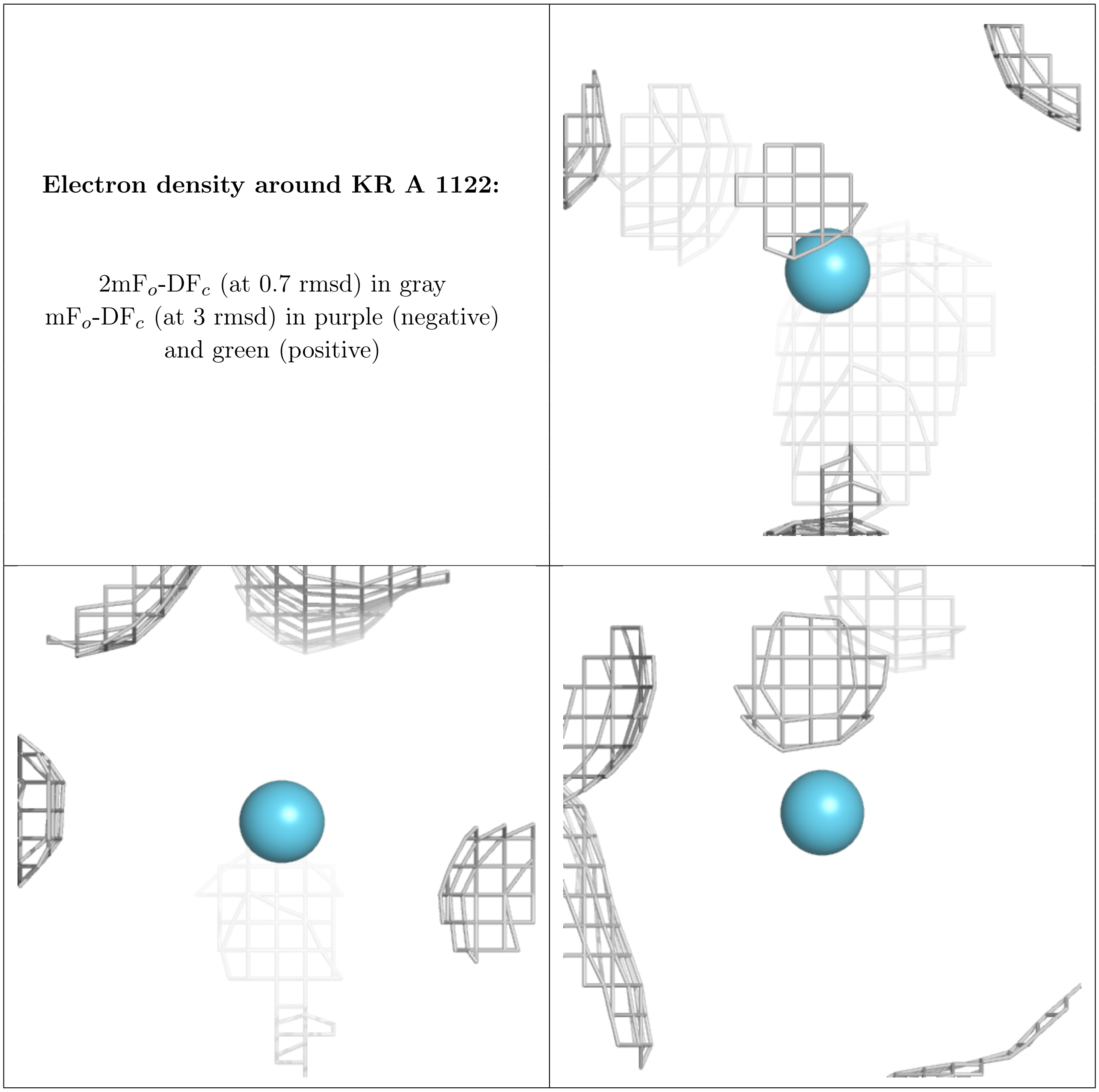
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
10	KR	A	1120	1/1	0.87	0.17	48,48,48,48	1
10	KR	A	1117	1/1	0.89	0.14	35,35,35,35	1
8	PEG	B	304	7/7	0.91	0.13	16,31,36,37	0
7	GOL	A	1106	6/6	0.92	0.12	32,36,36,41	0
10	KR	A	1114	1/1	0.92	0.10	40,40,40,40	1
7	GOL	A	1109	6/6	0.92	0.10	32,33,36,36	0
10	KR	A	1118	1/1	0.93	0.16	30,30,30,30	1
10	KR	A	1124	1/1	0.93	0.14	42,42,42,42	1
7	GOL	A	1107	6/6	0.94	0.07	21,23,26,27	0
5	H2S	A	1104	1/1	0.94	0.11	26,26,26,26	0
10	KR	A	1115	1/1	0.95	0.11	39,39,39,39	1
10	KR	A	1119	1/1	0.95	0.13	26,26,26,26	1
10	KR	B	305	1/1	0.95	0.19	58,58,58,58	1
10	KR	A	1116	1/1	0.96	0.10	31,31,31,31	1
10	KR	A	1121	1/1	0.96	0.17	15,15,15,15	1
4	SF4	B	302	8/8	0.97	0.06	29,32,33,33	0
10	KR	A	1113	1/1	0.97	0.05	30,30,30,30	1
3	MGD	A	1101	47/47	0.98	0.05	15,18,21,22	0
4	SF4	B	303	8/8	0.98	0.04	22,24,25,26	0
3	MGD	A	1102	47/47	0.98	0.06	17,22,24,26	0
4	SF4	B	301	8/8	0.99	0.03	19,20,20,20	0
4	SF4	A	1103	8/8	0.99	0.02	16,17,17,18	0
6	W	A	1105	1/1	0.99	0.02	20,20,20,20	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 KR A 1123:

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

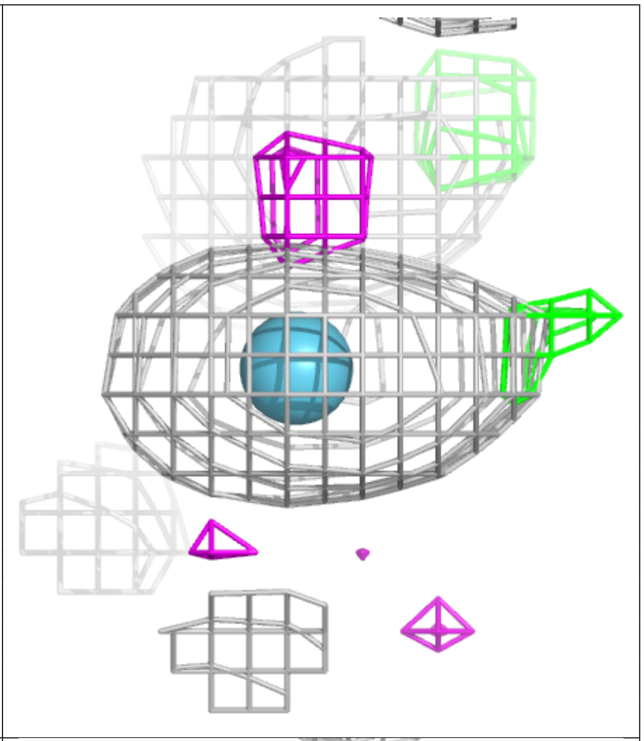


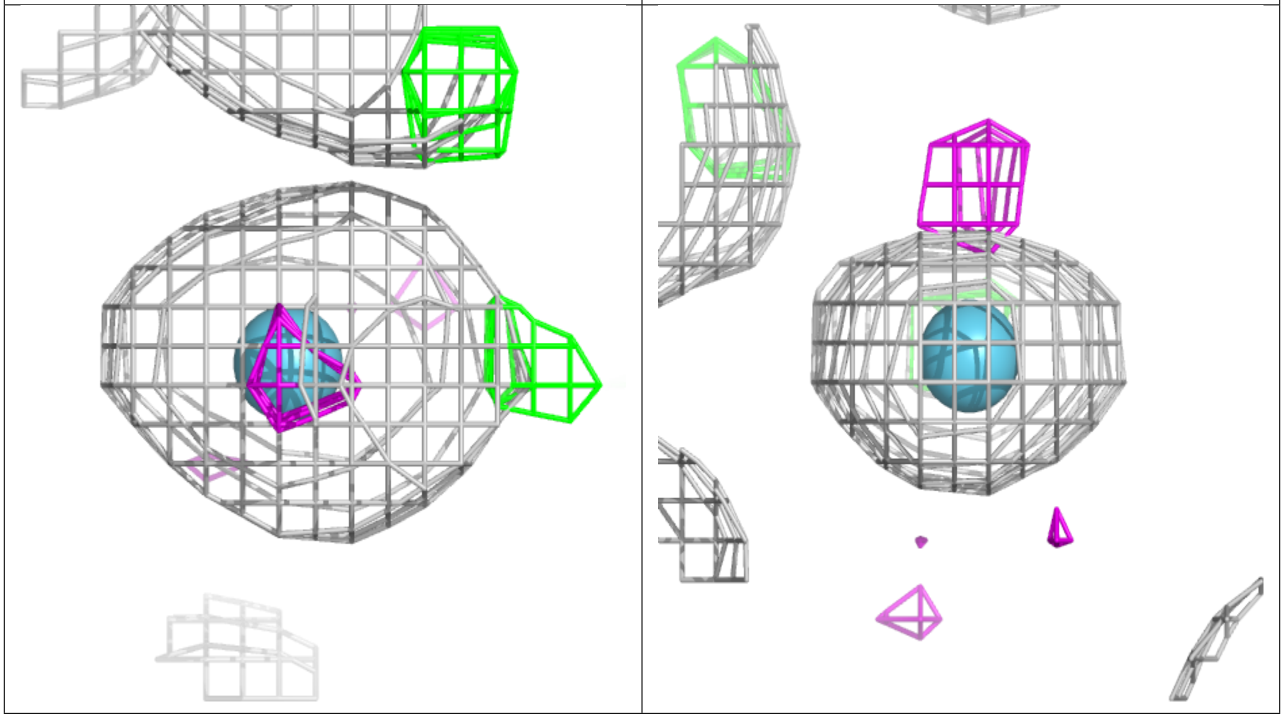
Electron density around KR A 1122:

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 KR A 1120:

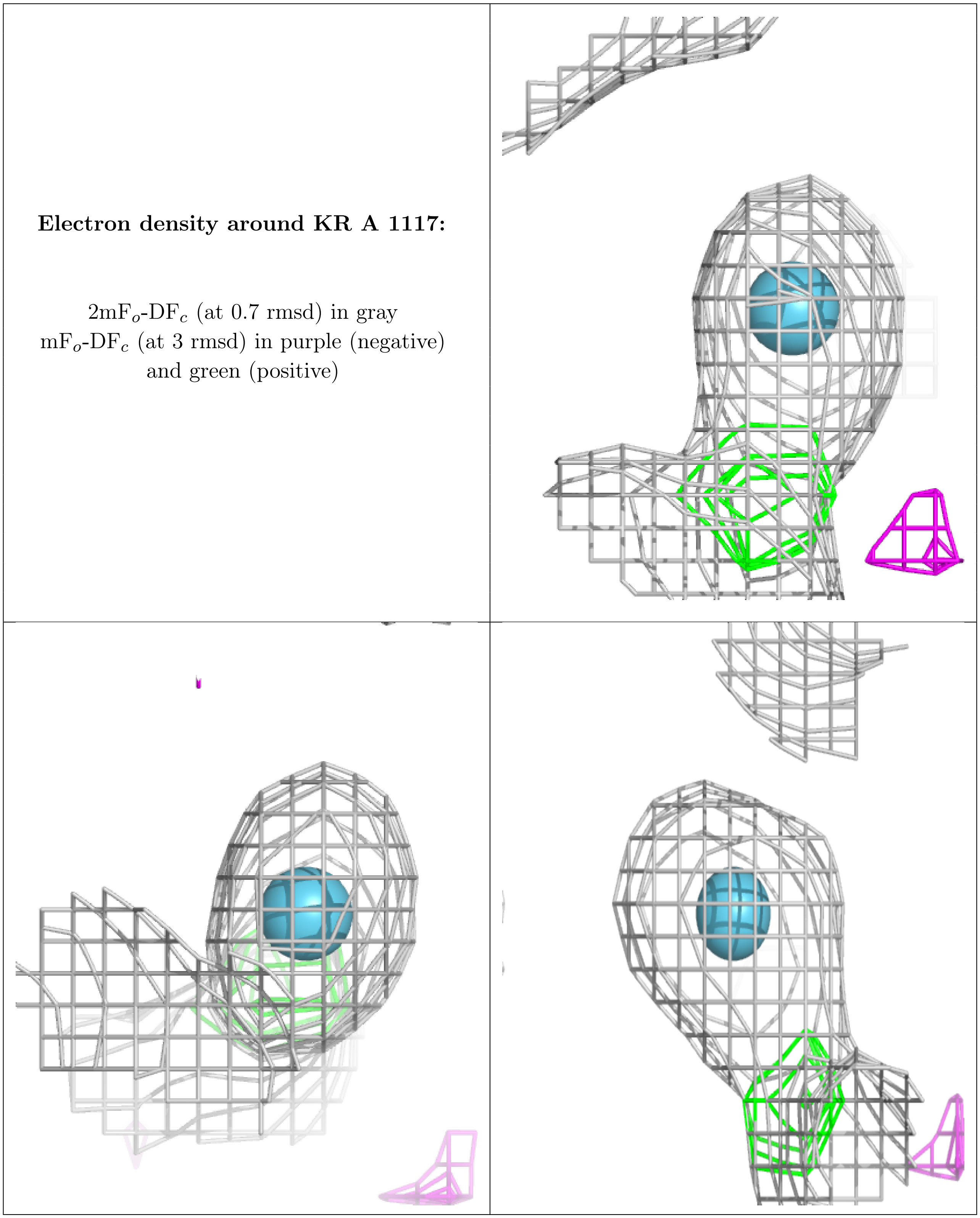
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)





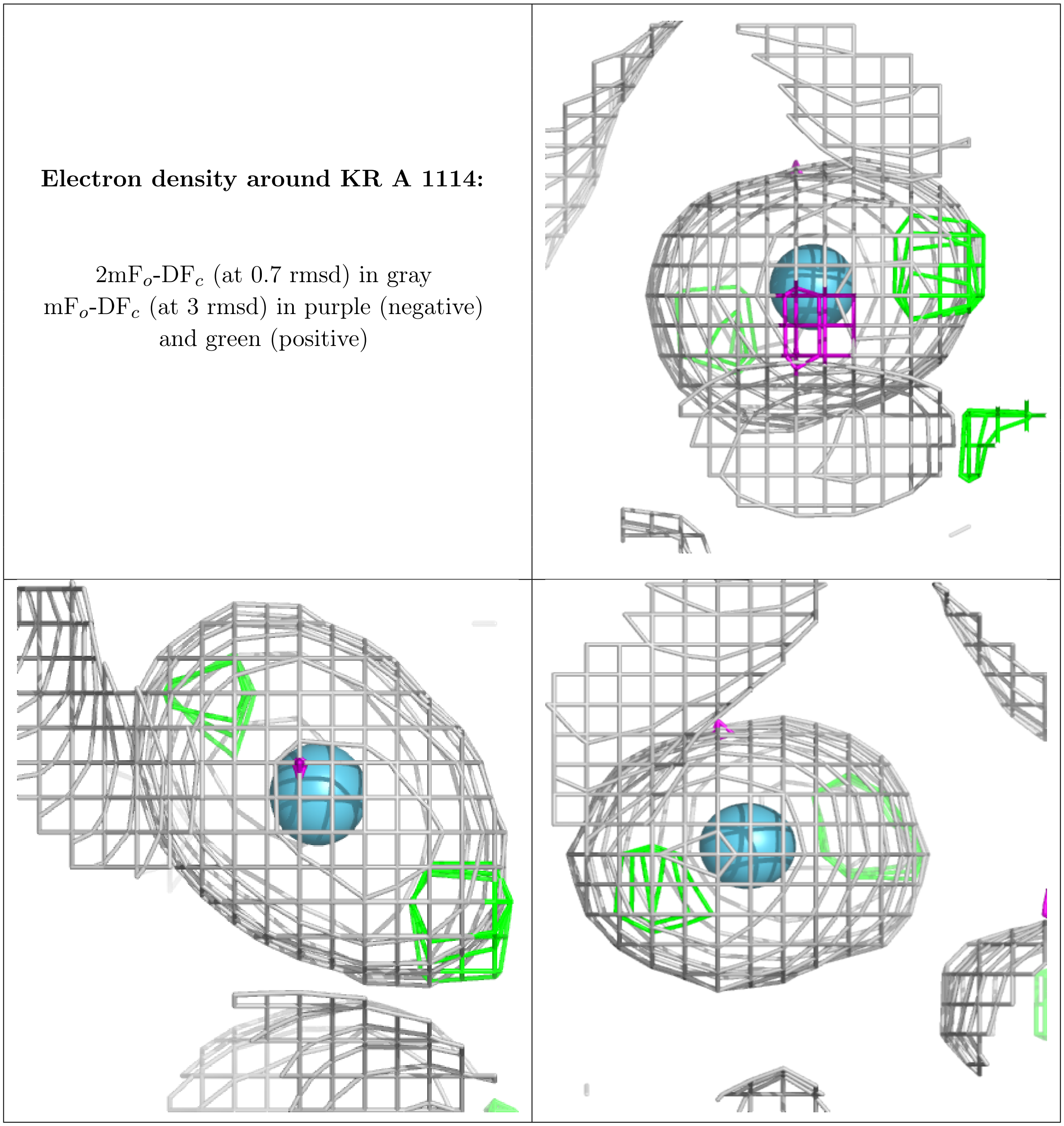
Electron density around KR A 1117:

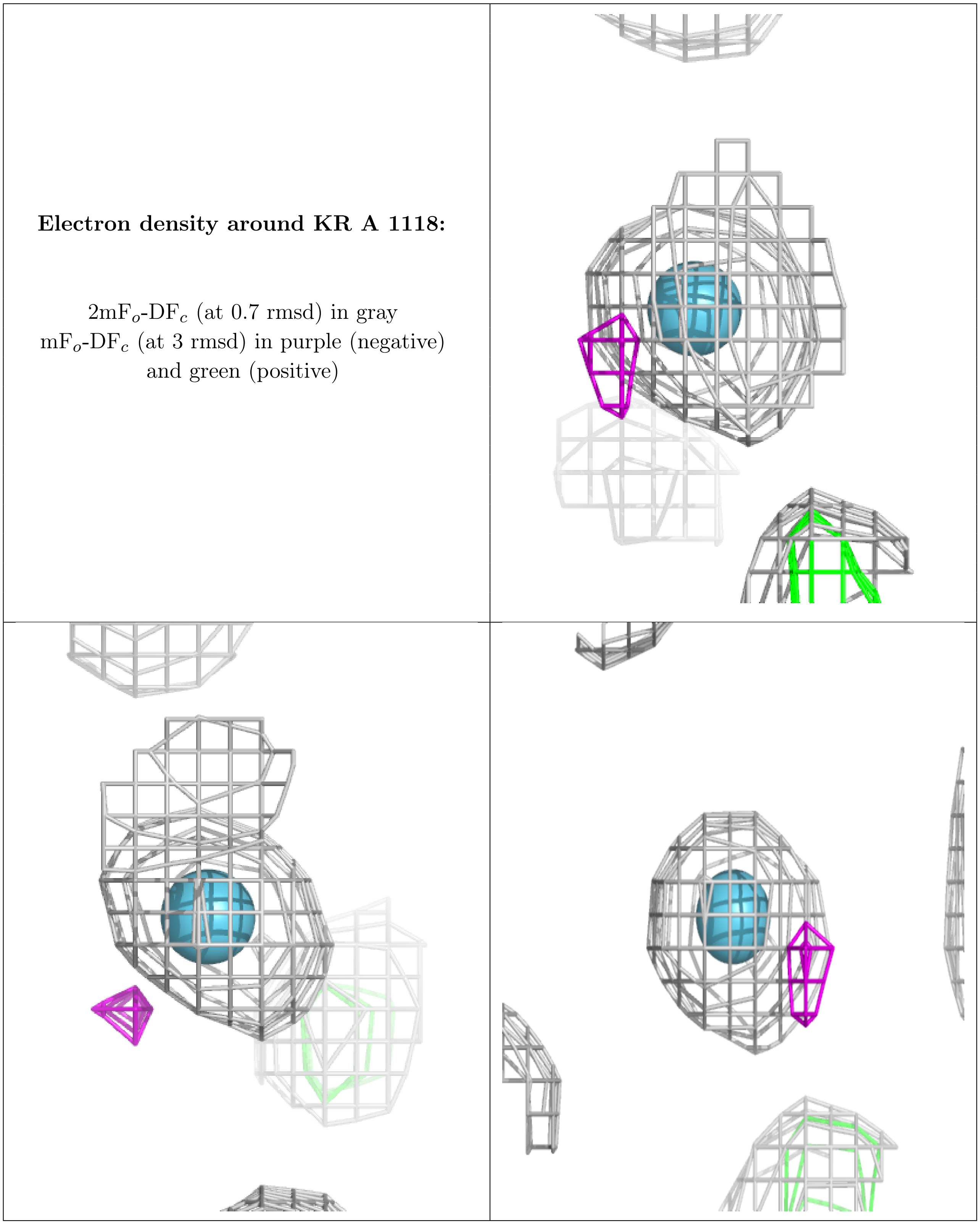
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around KR A 1114:

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



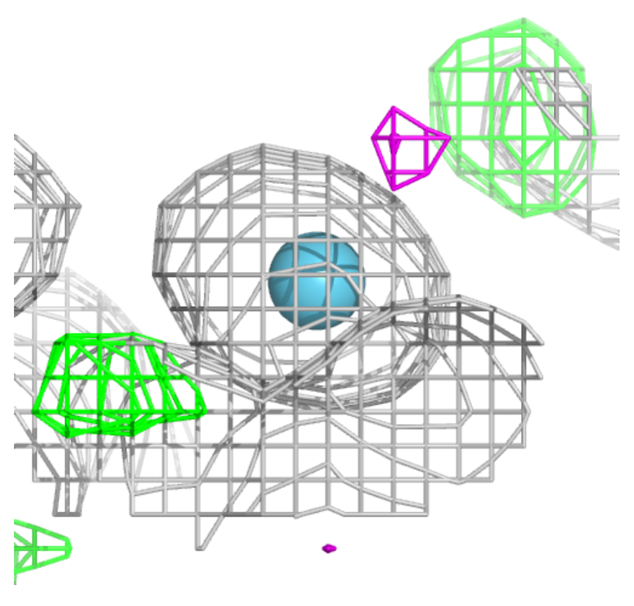


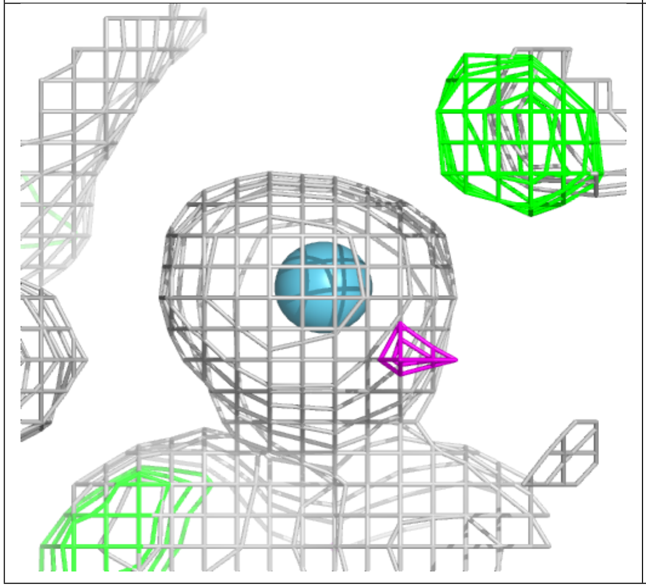
Electron density around KR A 1118:

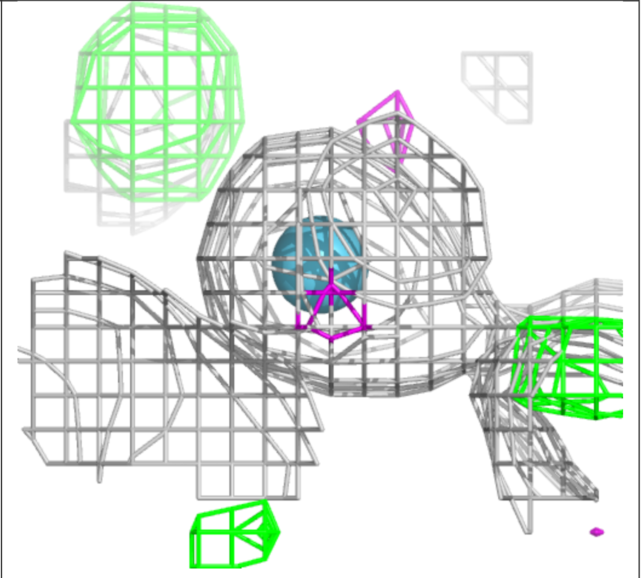
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around KR A 1124:

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

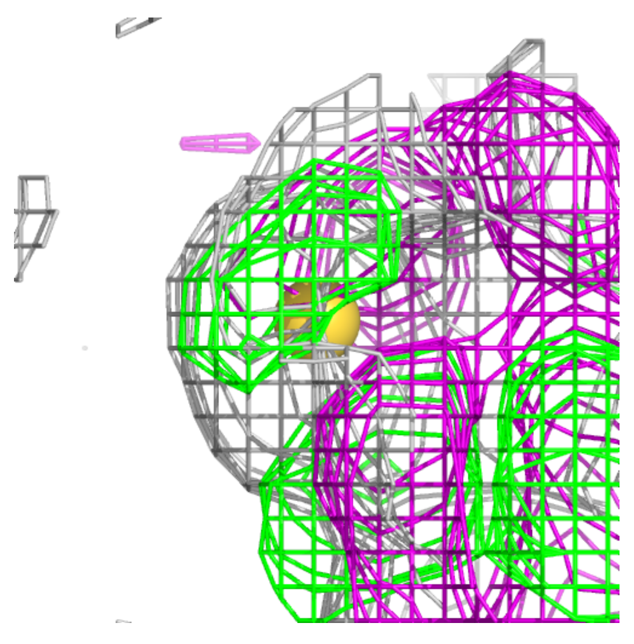


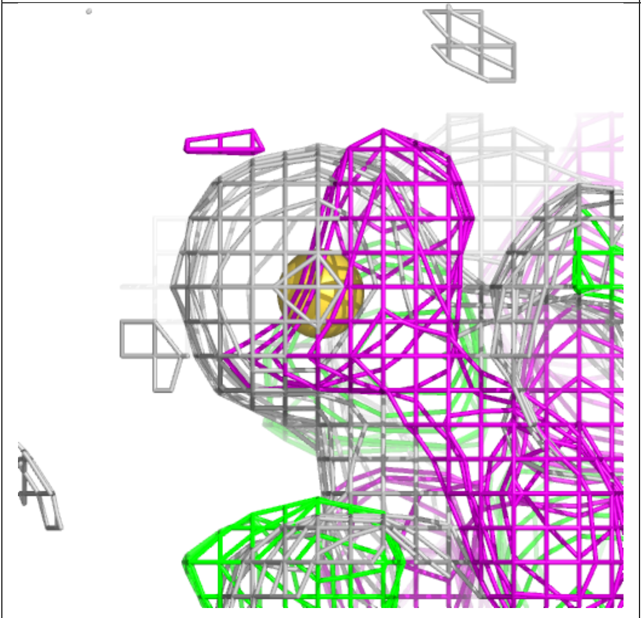


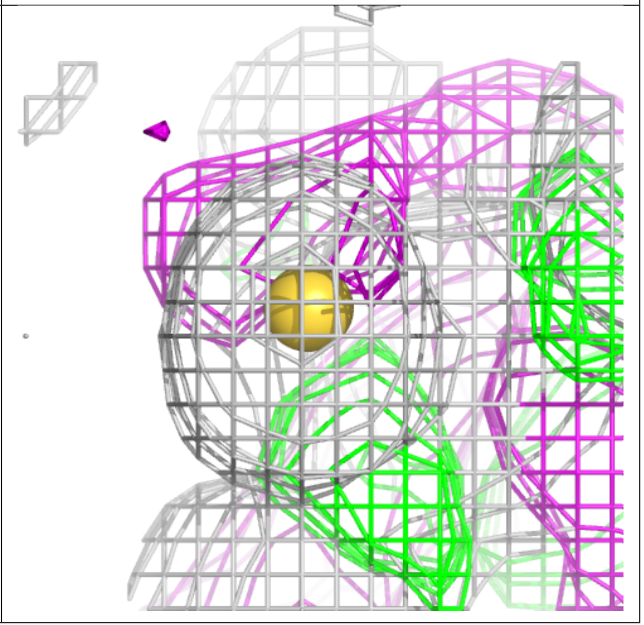


Electron density around H2S A 1104:

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

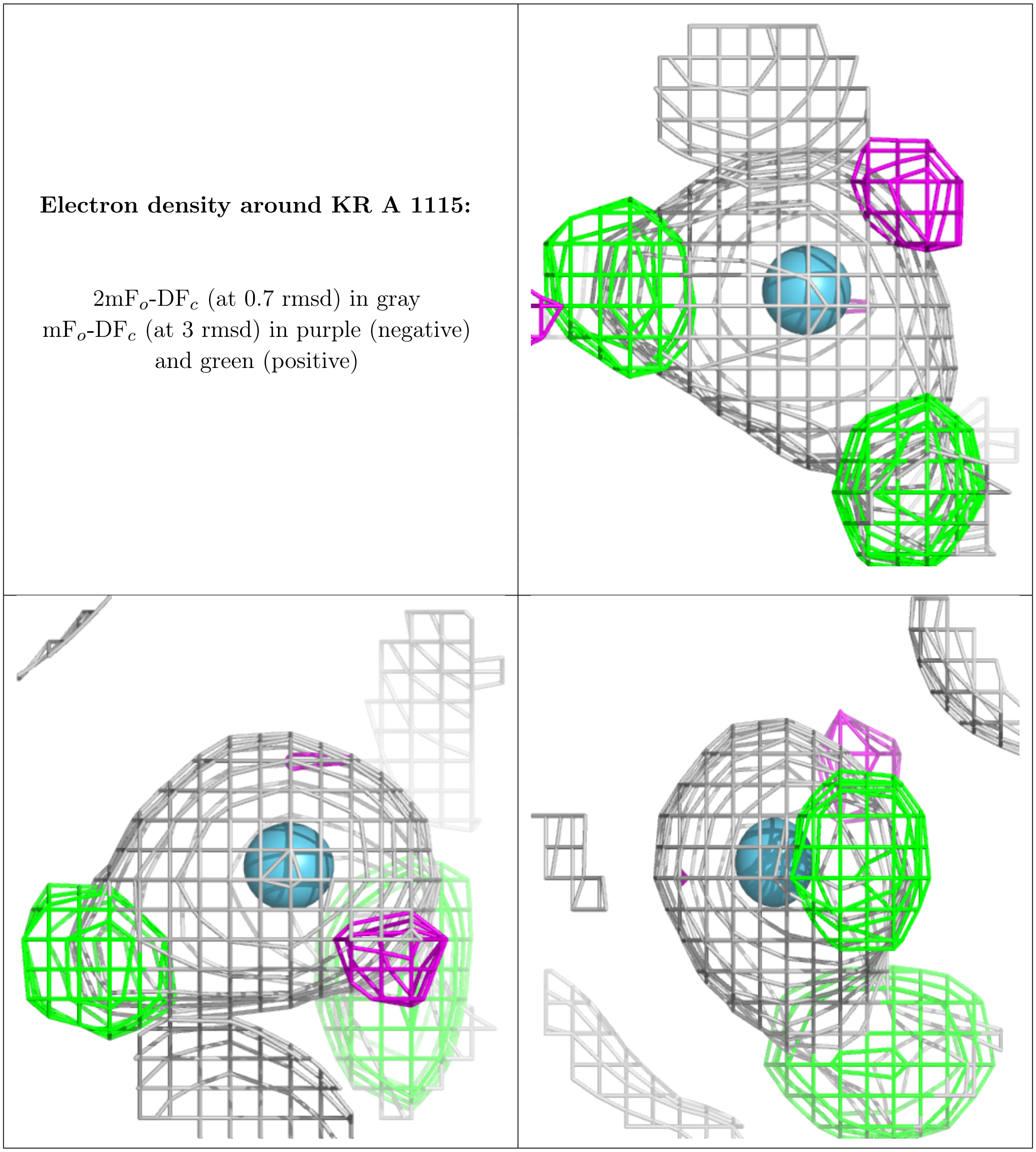


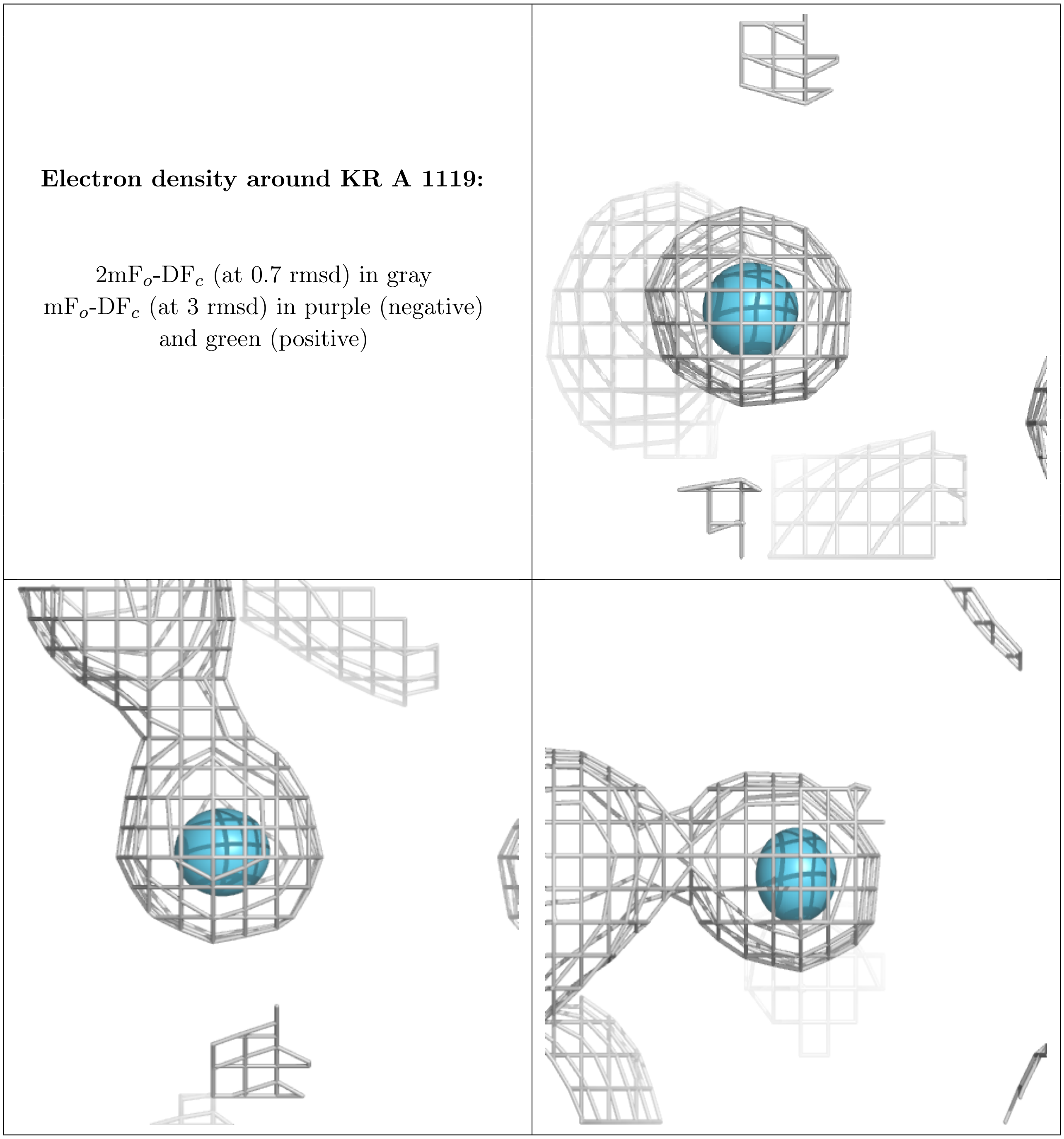




Electron density around KR A 1115:

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



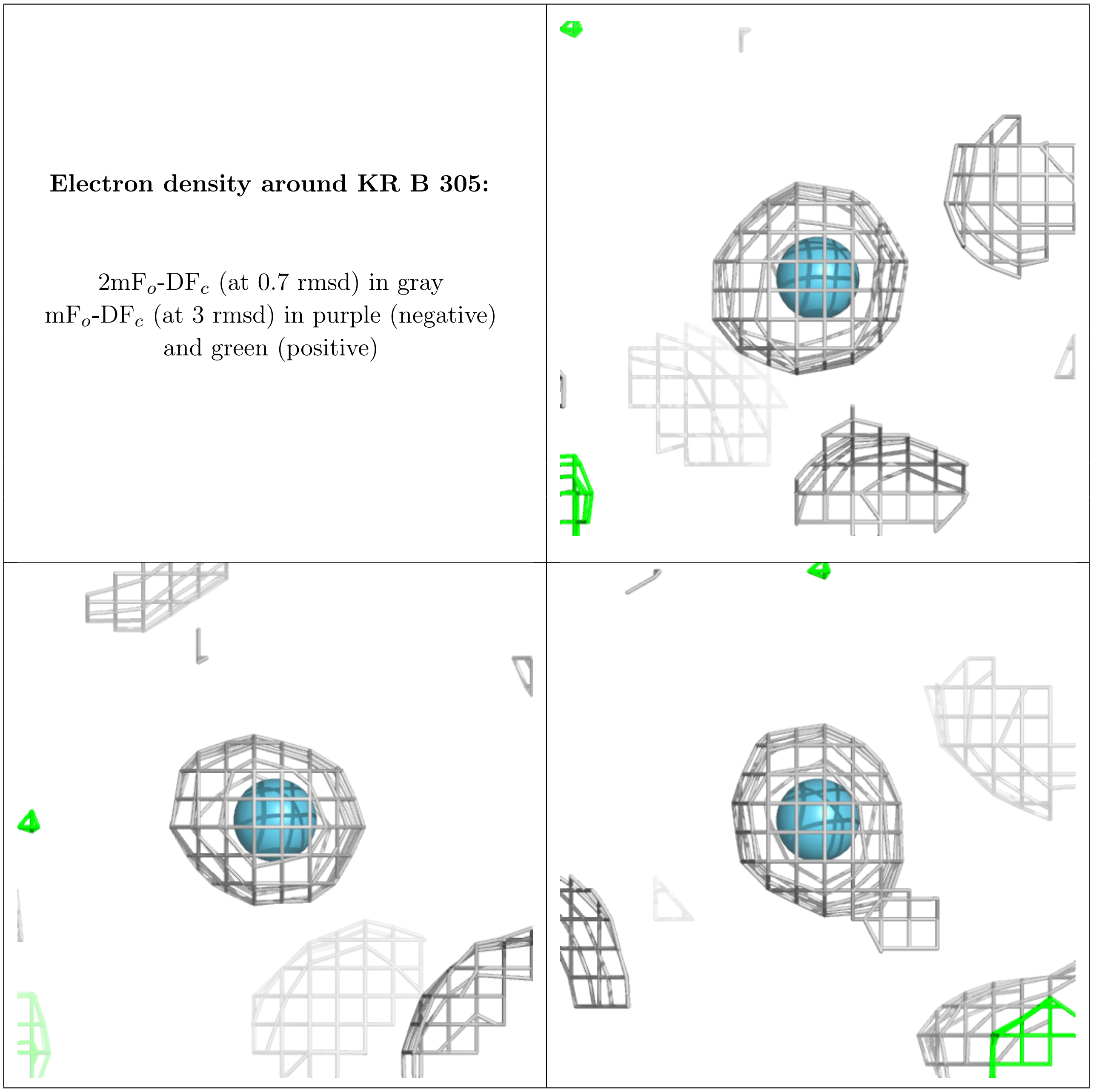


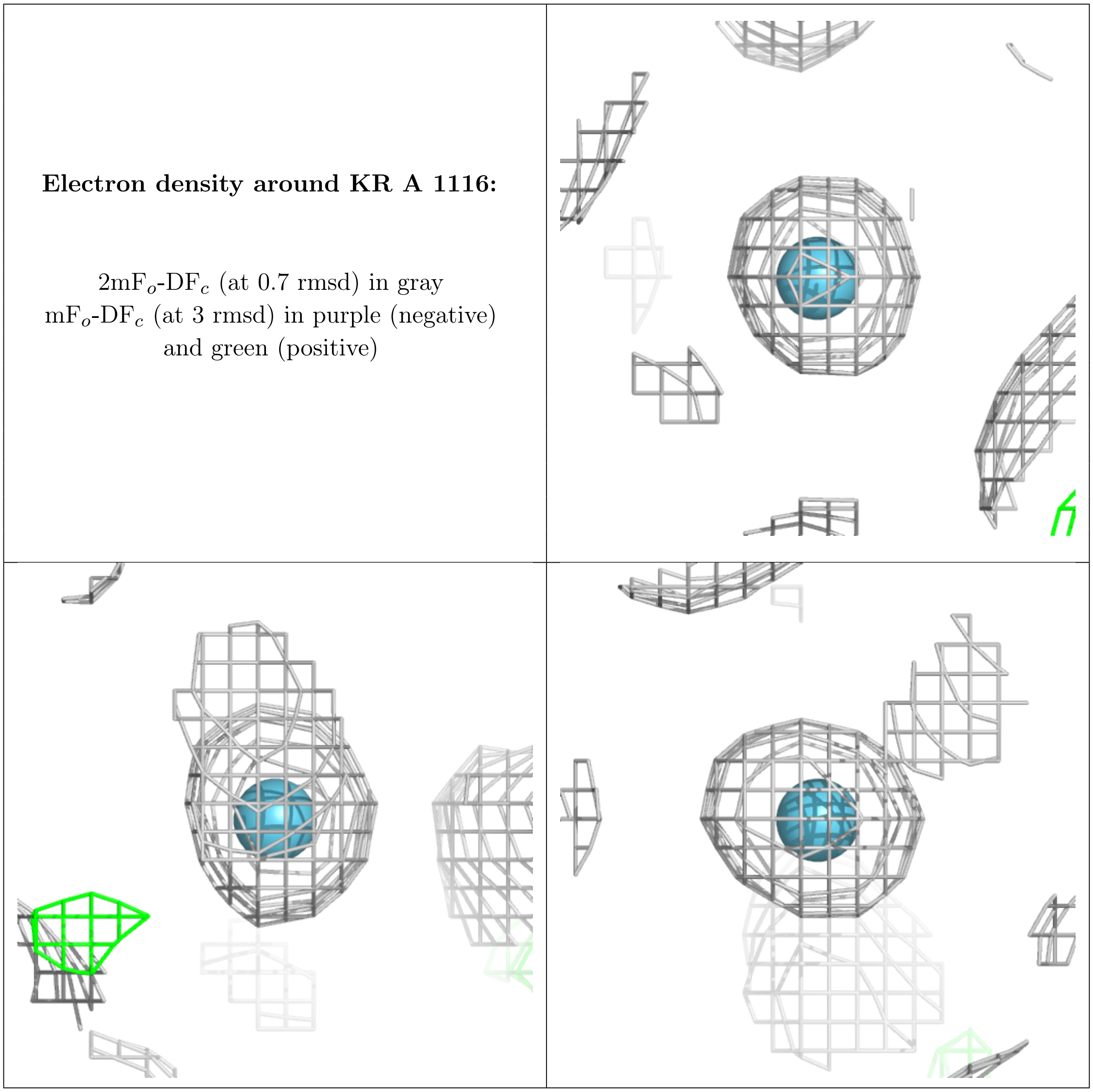
Electron density around KR A 1119:

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

Electron density around KR B 305:

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



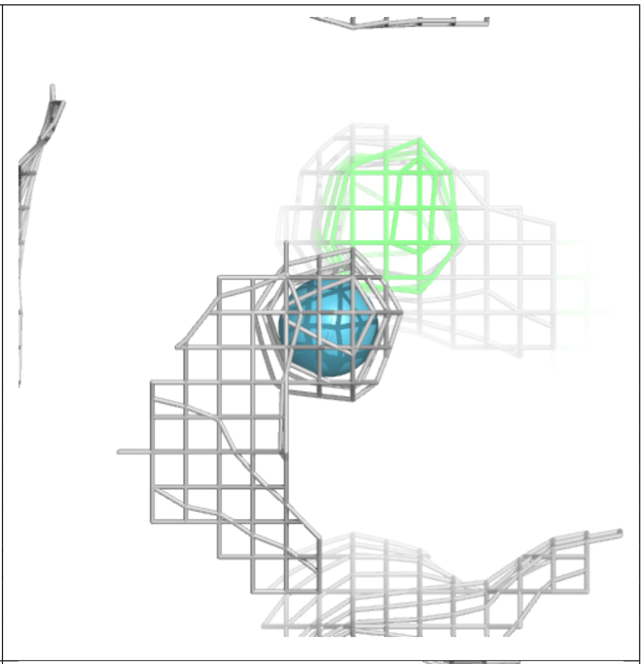


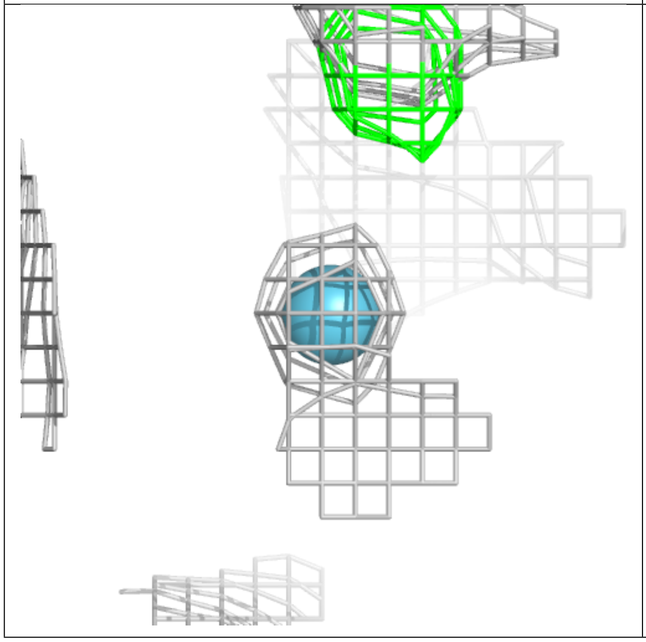
Electron density around KR A 1116:

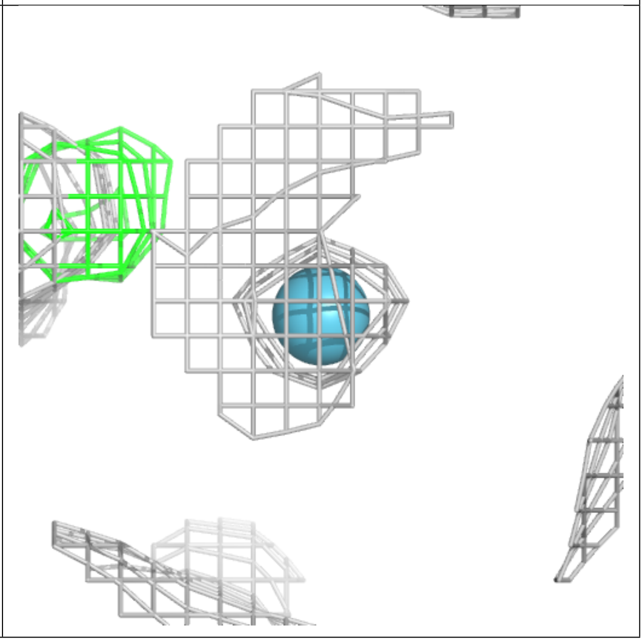
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around KR A 1121:

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

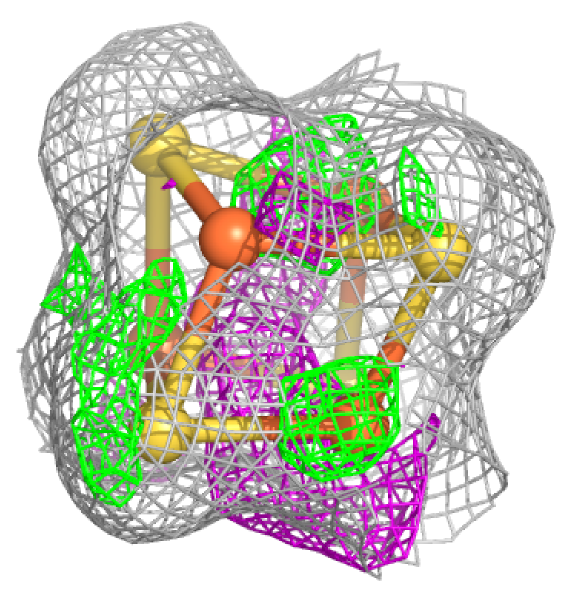


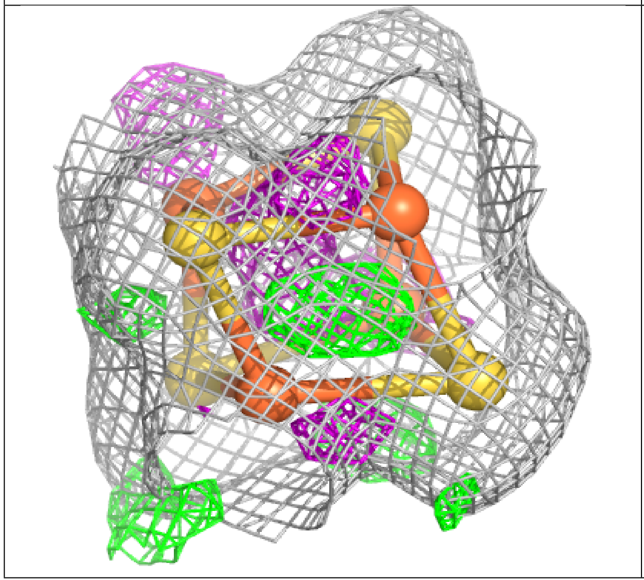


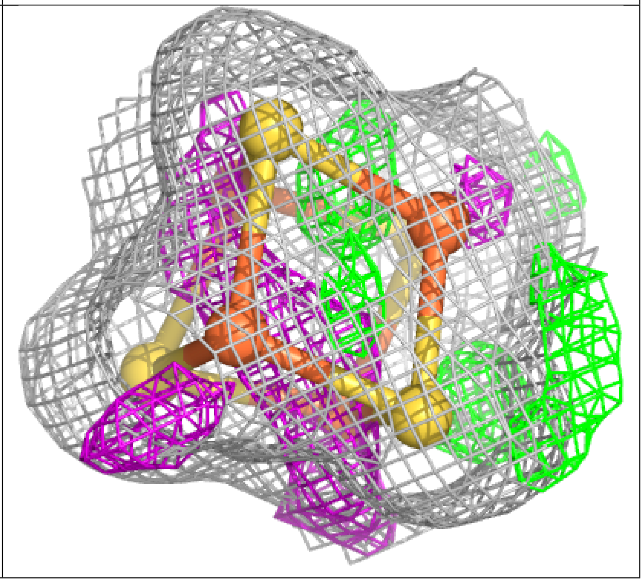


Electron density around SF4 B 302:

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

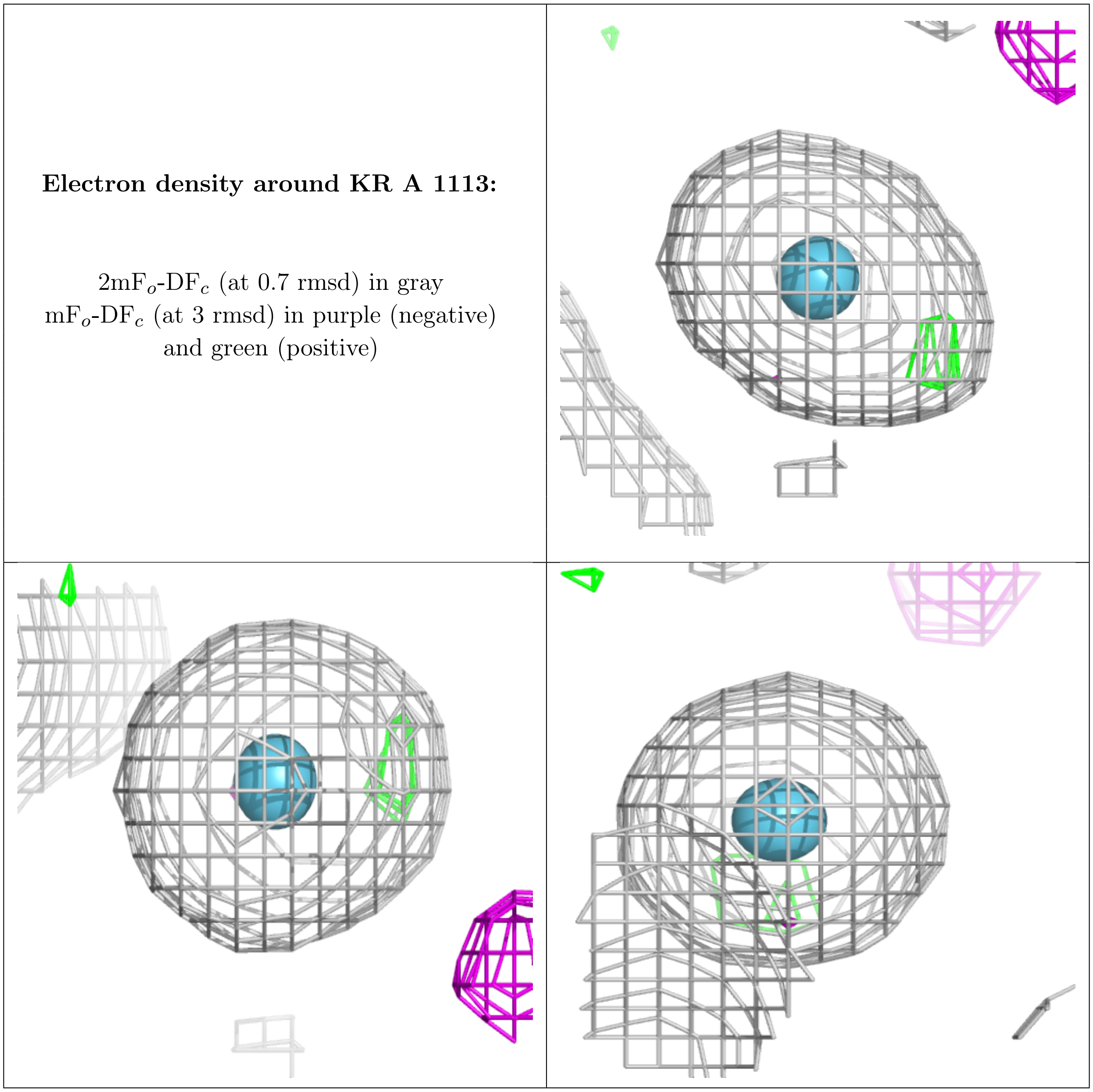






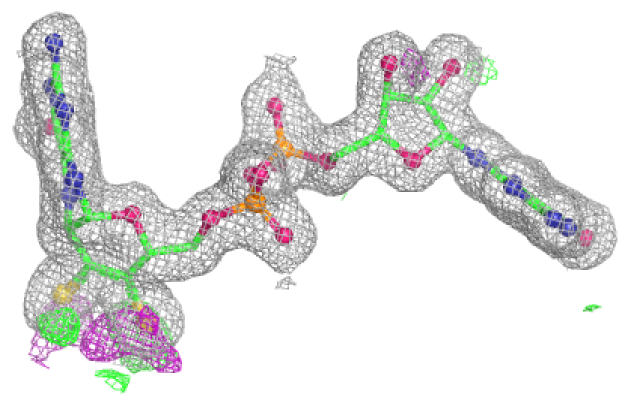
Electron density around KR A 1113:

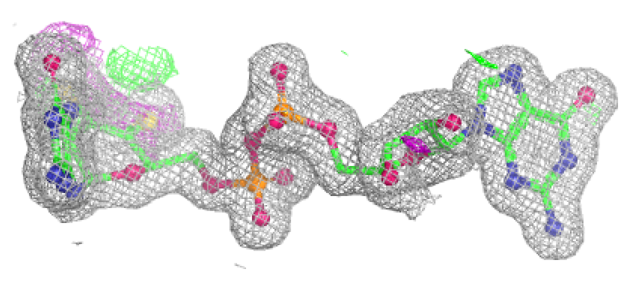
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

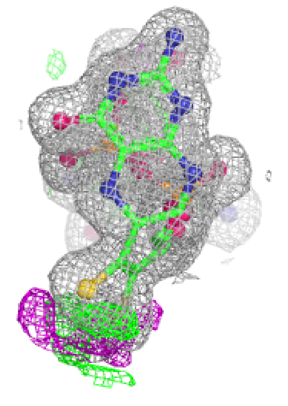


Electron density around MGD A 1101:

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

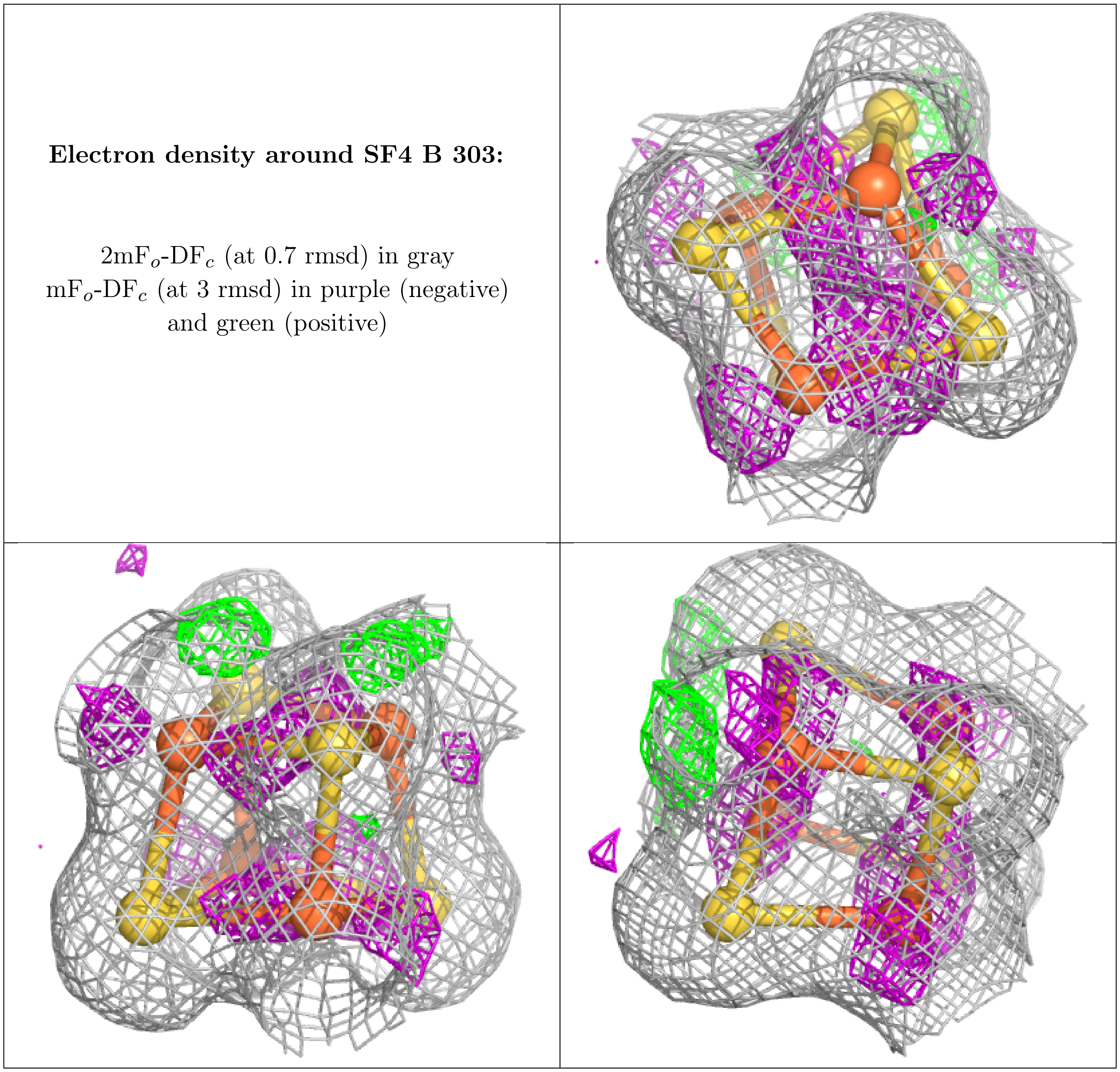






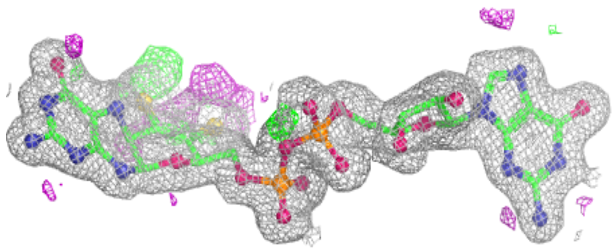
Electron density around SF4 B 303:

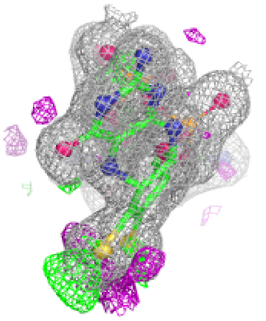
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around MGD A 1102:

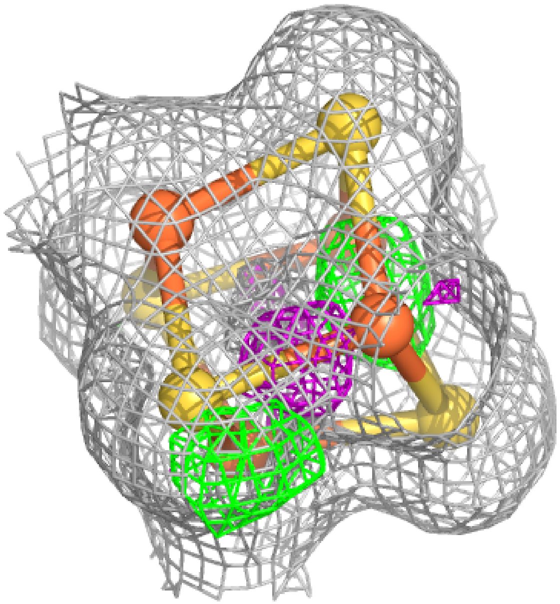
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

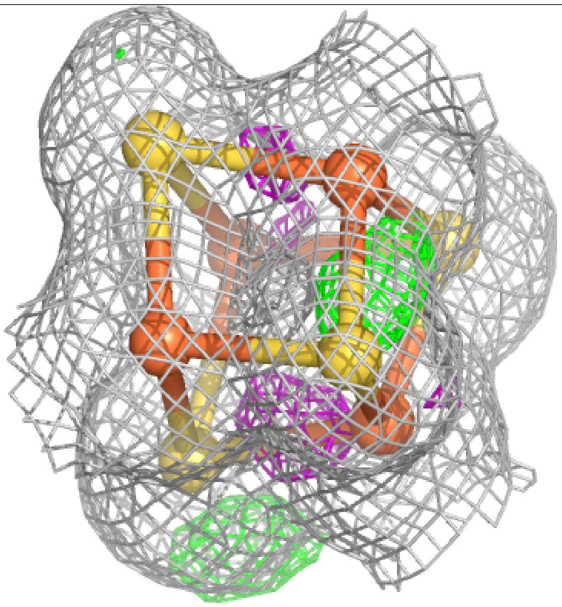


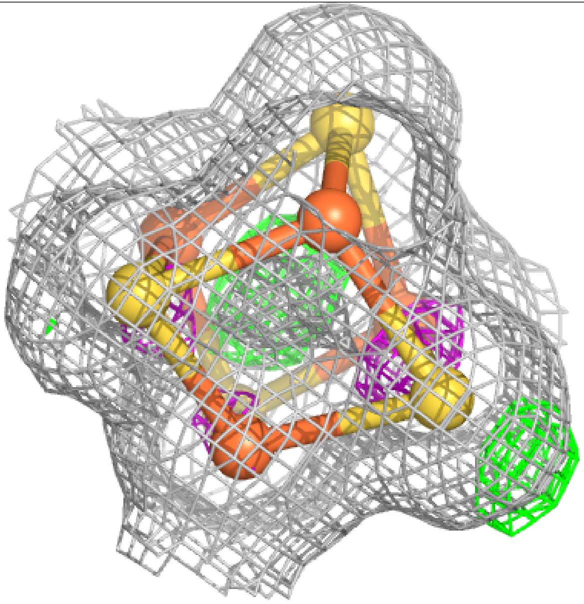


Electron density around SF4 B 301:

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

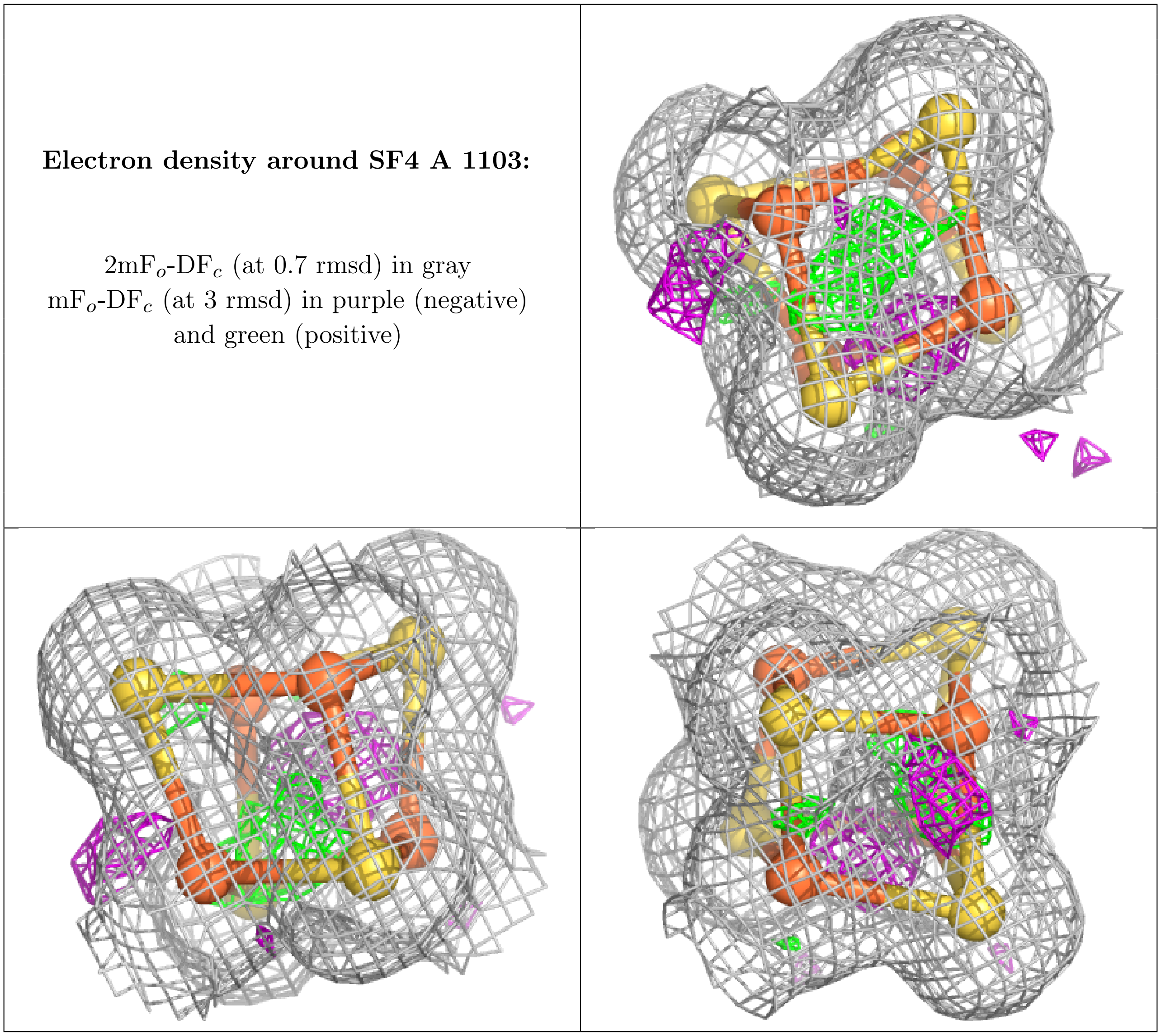


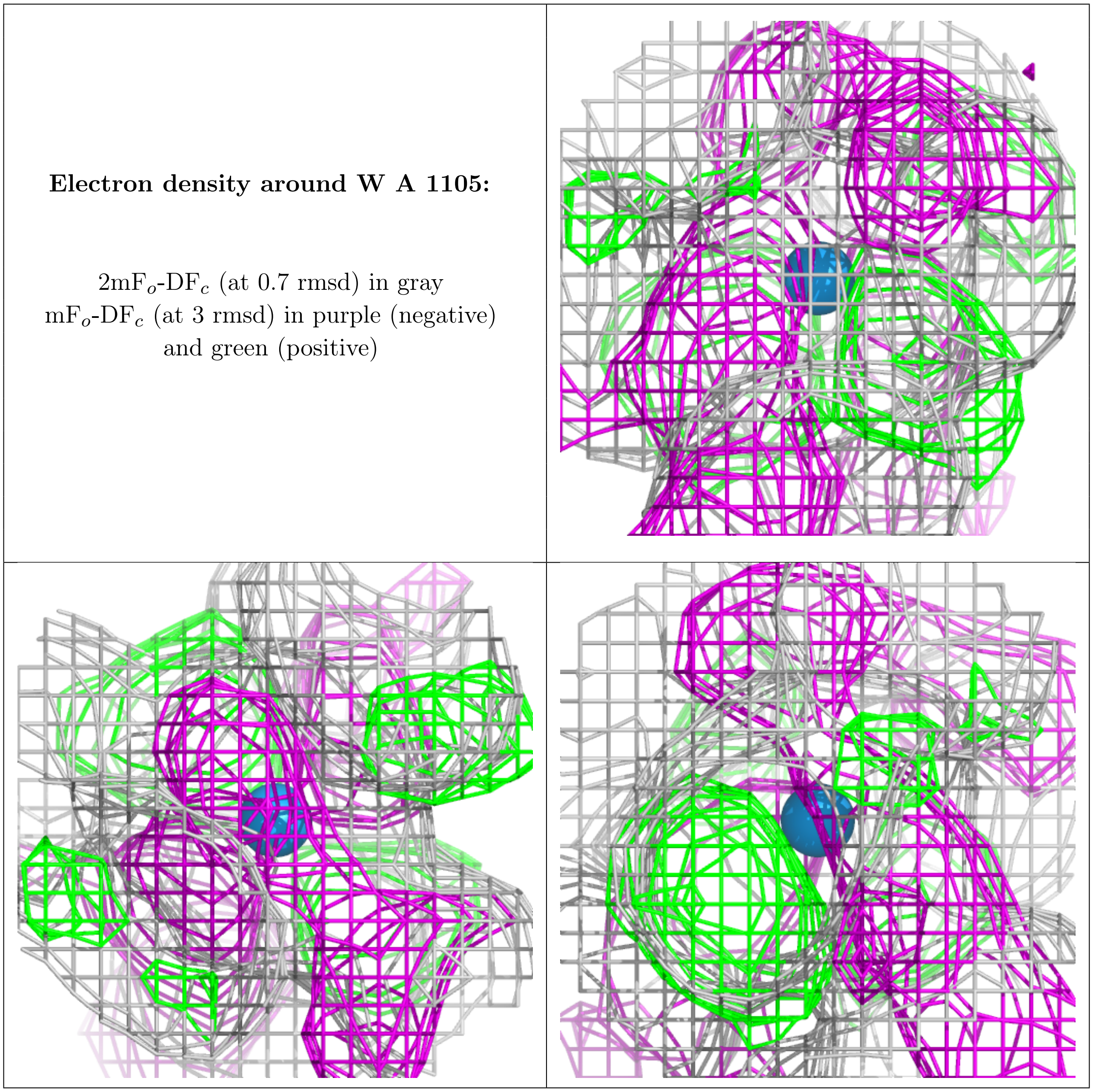




Electron density around SF4 A 1103:

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 W A 1105:

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.