WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Feb 23, 2026 – 12:17 pm GMT

PDB ID	:	9RJX / pdb_00009rjx
Title	:	W-formate dehydrogenase from Nitratidesulfovibrio vulgaris (Desulfovibrio vulgaris) - Soaking with Formamide
Authors	:	Vilela-Alves, G.; Manuel, R.R.; Pereira, I.C.; Romao, M.J.; Mota, C.
Deposited on	:	2025-06-12
Resolution	:	1.73 Å(reported)

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

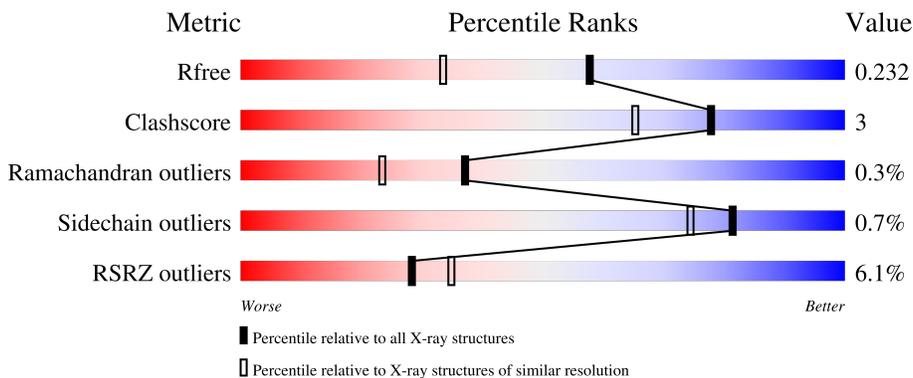|		
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.48.1

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 1.73 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		0.232
Clashscore		3
Ramachandran outliers		0.3%
Sidechain outliers		0.7%
RSRZ outliers		6.1%

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	1043 (1.74-1.74)
Clashscore	180529	1119 (1.74-1.74)
Ramachandran outliers	177936	1112 (1.74-1.74)
Sidechain outliers	177891	1112 (1.74-1.74)
RSRZ outliers	164620	1043 (1.74-1.74)

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	6% / 88% / 7% / 5%
2	B	215	7% / 94% / 6%
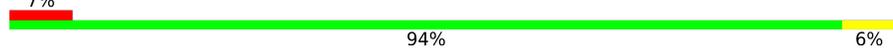
The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

WORLDWIDE
wwPDB
PROTEIN DATA BANK

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
11	ARF	A	1114	-	-	X	-

2 Entry composition (i)

There are 12 unique types of molecules in this entry. The entry contains 9786 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-contai ning.

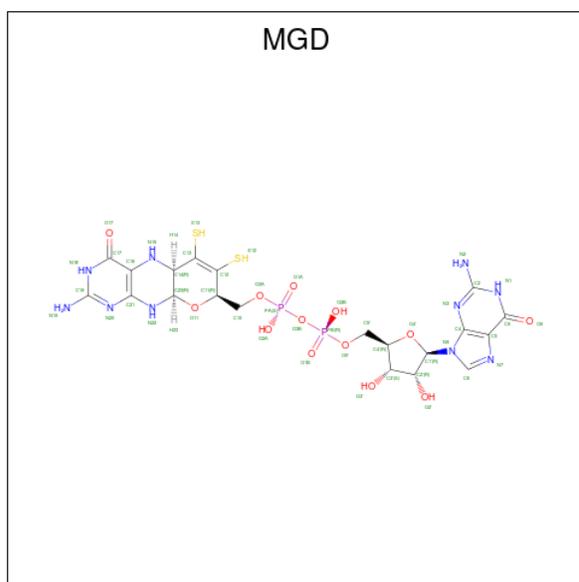| Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	959	7514	4790	1307	1373	43	1	0	3	0

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	1665	1041	291	317	16	0	0	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
3	A	1	Total	C	N	O	P	S	0	0
			47	20	10	13	2	2		
3	A	1	Total	C	N	O	P	S	0	0
			47	20	10	13	2	2		

- Molecule 4 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe_4S_4) (labeled as "Ligand of Interest" by depositor).
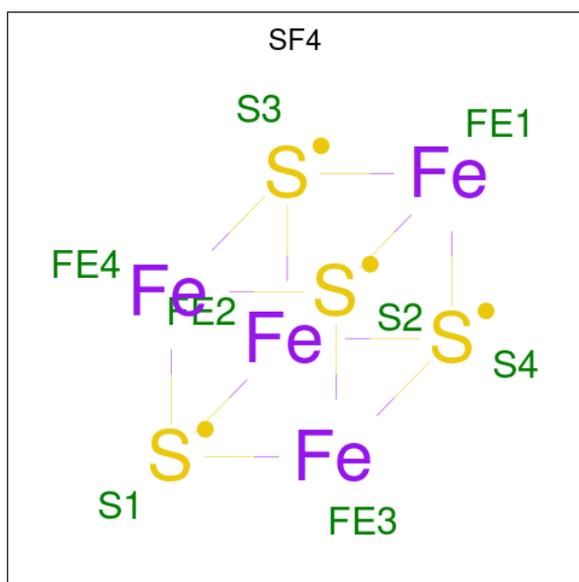
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	Fe	S	0	0
			8	4	4		

Continued on next page...

Continued from previous page...

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

- Molecule 5 is HYDROSULFURIC ACID (CCD ID: H2S) (formula: H_2S) (labeled as "Ligand of Interest" by depositor).
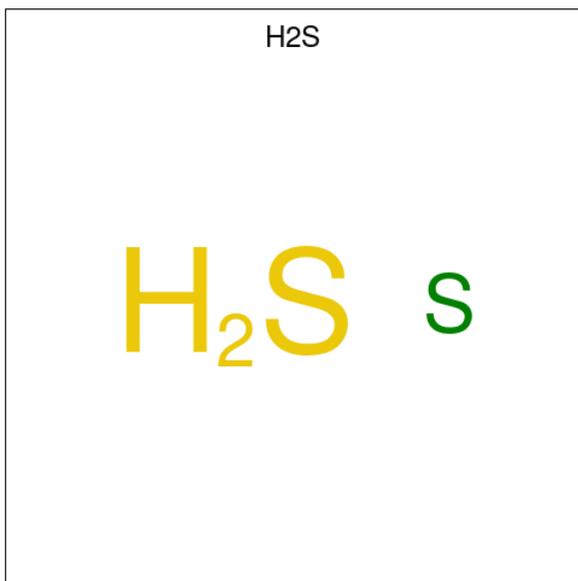
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	S 1	0	0

- 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 1	W 1	0	0

- Molecule 7 is TRIETHYLENE GLYCOL (CCD ID: PGE) (formula: $C_6H_{14}O_4$).

PGE
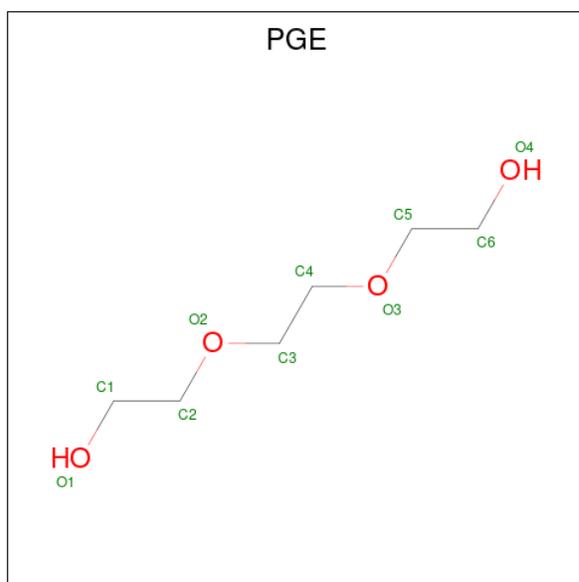
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			10	6	4		

- Molecule 8 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).

EDO
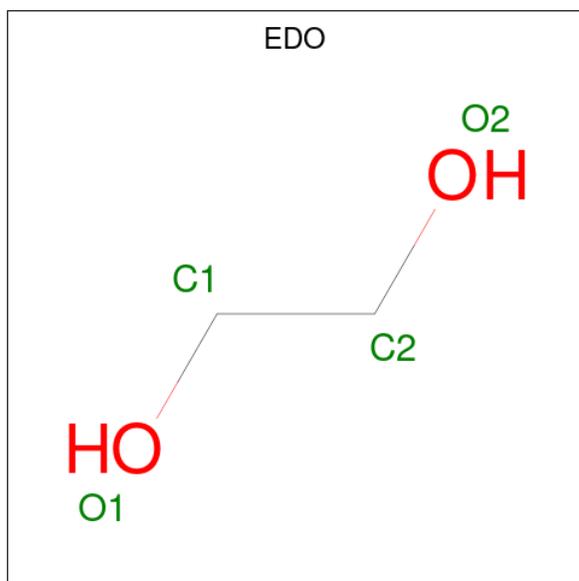
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	A	1	Total	C	O	0	0
			4	2	2		
8	A	1	Total	C	O	0	0
			4	2	2		
8	B	1	Total	C	O	0	0
			4	2	2		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	B	1	Total 4	C 2	O 2	0	0
8	B	1	Total 4	C 2	O 2	0	0

- Molecule 9 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).
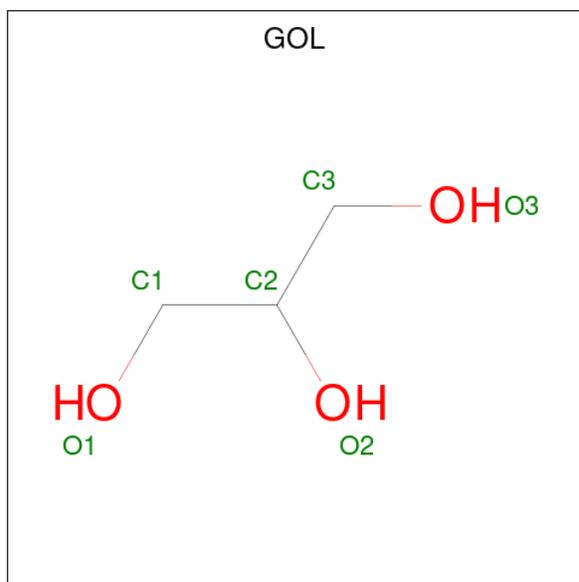
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	A	1	Total 6	C 3	O 3	0	0
9	A	1	Total 6	C 3	O 3	0	0
9	A	1	Total 6	C 3	O 3	0	0
9	A	1	Total 6	C 3	O 3	0	0
9	A	1	Total 6	C 3	O 3	0	0
9	A	1	Total 6	C 3	O 3	0	0

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

PEG

C4

OH O4

O2

O

C3

C1

HO

C2

O1
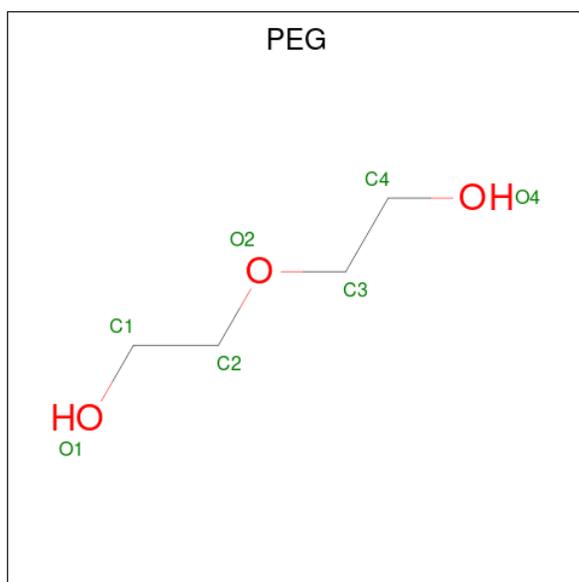
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
10	A	1	Total C O 7 4 3			0	0
10	A	1	Total C O 7 4 3			0	0

- Molecule 11 is FORMAMIDE (CCD ID: ARF) (formula: CH_3NO) (labeled as "Ligand of Interest" by depositor).

ARF

C

NH_2 N

O

O
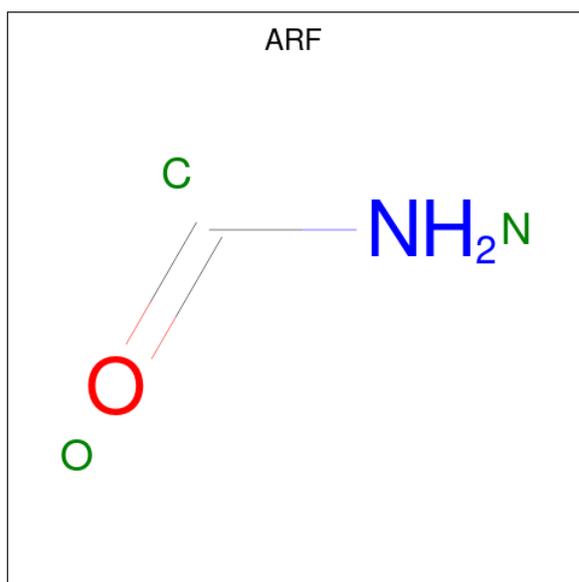
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	A	1	Total C N O 3 1 1 1				0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	A	1	Total 3	C 1	N 1	O 1	0	0
11	B	1	Total 3	C 1	N 1	O 1	0	0
11	B	1	Total 3	C 1	N 1	O 1	0	0
11	B	1	Total 3	C 1	N 1	O 1	0	0

- Molecule 12 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	A	298	Total 298	O 298	0	0
12	B	65	Total 65	O 65	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:
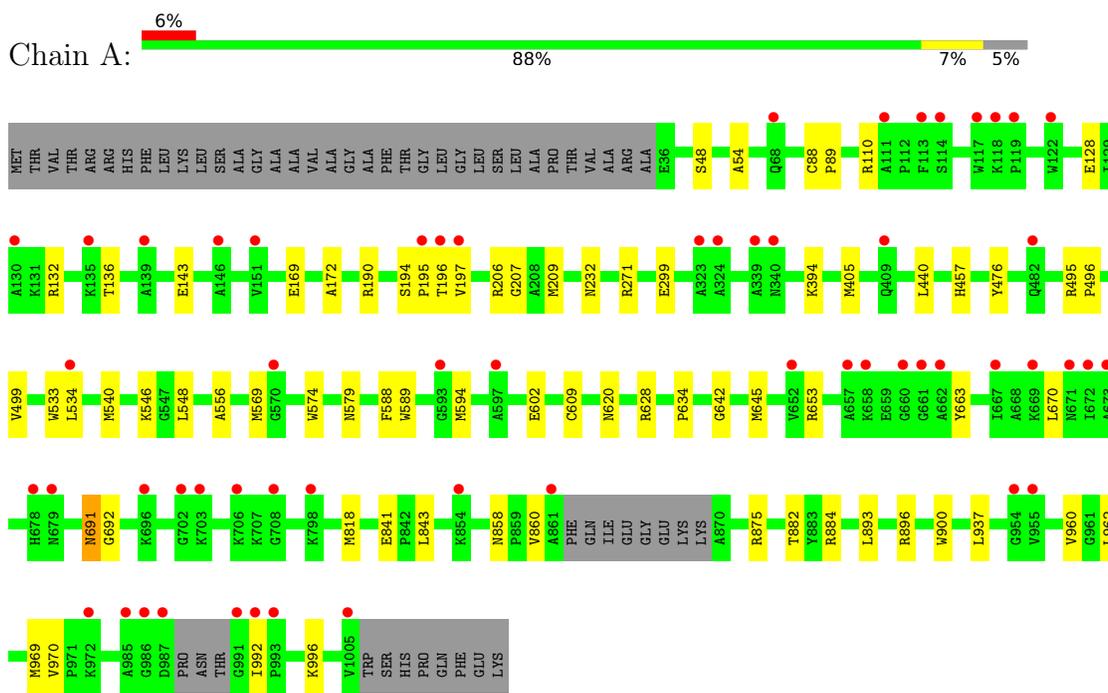
• Molecule 2: Formate dehydrogenase, beta subunit, putative

Chain B:
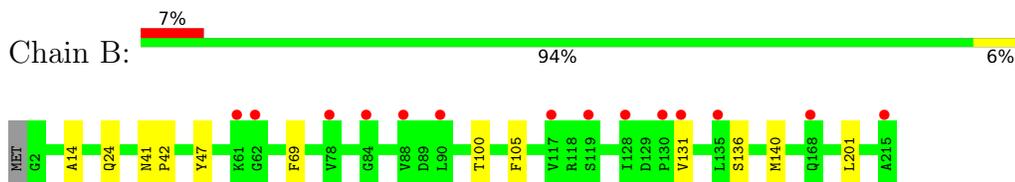
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	123.09Å 148.56Å 64.21Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	94.78 – 1.73 94.78 – 1.73	Depositor EDS
% Data completeness (in resolution range)	70.9 (94.78-1.73) 70.9 (94.78-1.73)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.12 (at 1.73Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.192 , 0.228 0.199 , 0.232	Depositor DCC
R_{free} test set	4436 reflections (3.62%)	wwPDB-VP
Wilson B-factor (Å^2)	24.0	Xtriage
Anisotropy	0.025	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 31.3	EDS
L-test for twinning [2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	9786	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 3.50% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: SEC, PGE, PEG, MGD, EDO, GOL, H2S, SF4, ARF, W

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	0.97	0/7721	1.31	3/10471 (0.0%)
2	B	0.98	0/1700	1.34	0/2302
All	All	0.97	0/9421	1.32	3/12773 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	196	THR	CA-C-N	5.04	125.27	120.43
1	A	196	THR	C-N-CA	5.04	125.27	120.43
1	A	692	GLY	CA-C-O	-5.02	118.84	122.45

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	7514	0	7353	43	0
2	B	1665	0	1633	8	0
3	A	94	0	44	2	0
4	A	8	0	0	0	0
4	B	24	0	0	0	0
5	A	1	0	0	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	1	0	0	0	0
7	A	10	0	14	0	0
8	A	8	0	12	0	0
8	B	12	0	18	2	0
9	A	36	0	48	1	0
10	A	14	0	20	1	0
11	A	27	0	27	2	0
11	B	9	0	9	0	0
12	A	298	0	0	0	0
12	B	65	0	0	0	0
All	All	9786	0	9178	50	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 (50) 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:653:ARG:NH2	1:A:670:LEU:O	2.14	0.81
1:A:579:ASN:OD1	3:A:1102:MGD:O2'	1.99	0.78
1:A:195:PRO:HG3	1:A:992:ILE:HG12	1.73	0.71
1:A:405:MET:HE1	1:A:884:ARG:NH1	2.09	0.67
1:A:405:MET:HE1	1:A:884:ARG:HH12	1.64	0.63
1:A:642:GLY:HA2	1:A:645[B]:MET:HE2	1.88	0.54
1:A:556:ALA:HB2	1:A:569:MET:HE1	1.88	0.54
1:A:209:MET:CE	1:A:440:LEU:HD23	2.38	0.54
1:A:405:MET:HE3	1:A:996:LYS:HE2	1.90	0.54
1:A:818:MET:SD	11:A:1114:ARF:H	2.47	0.54
1:A:405:MET:HE3	1:A:996:LYS:CE	2.40	0.52
2:B:41:ASN:HA	2:B:42:PRO:C	2.35	0.51
1:A:172:ALA:HB3	1:A:645[B]:MET:HE3	1.93	0.50
1:A:299:GLU:HA	9:A:1112:GOL:H32	1.94	0.49
1:A:88:CYS:HB2	1:A:89:PRO:HD2	1.94	0.49
1:A:169:GLU:O	1:A:645[B]:MET:HE1	2.13	0.49
1:A:540:MET:HE1	1:A:548:LEU:HD22	1.94	0.49
1:A:172:ALA:HB3	1:A:645[B]:MET:CE	2.43	0.49
2:B:105:PHE:H	8:B:305:EDO:H12	1.79	0.48
1:A:232:ASN:HA	3:A:1101:MGD:N20	2.30	0.47
1:A:896:ARG:HD2	1:A:970:VAL:O	2.15	0.47
1:A:194:SER:N	1:A:195:PRO:CD	2.78	0.47
1:A:136:THR:HG23	1:A:546:LYS:HD2	1.96	0.46

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:100:THR:HB	2:B:140:MET:HE1	1.97	0.46
1:A:197:VAL:HG13	1:A:207:GLY:HA3	1.98	0.45
1:A:858:ASN:OD1	1:A:860:VAL:HG22	2.16	0.45
1:A:206:ARG:HH21	11:A:1114:ARF:C	2.30	0.45
1:A:893:LEU:C	1:A:893:LEU:HD23	2.42	0.44
2:B:105:PHE:HB2	8:B:305:EDO:H12	1.99	0.44
1:A:190:ARG:HH22	1:A:457:HIS:HD1	1.65	0.44
1:A:609[B]:CYS:SG	1:A:634:PRO:HB3	2.59	0.43
1:A:128:GLU:O	1:A:132:ARG:HG2	2.19	0.43
1:A:476:TYR:HE1	1:A:499:VAL:HG21	1.83	0.43
1:A:588:PHE:O	1:A:594:MET:HG3	2.19	0.43
1:A:691:ASN:ND2	1:A:691:ASN:C	2.77	0.43
2:B:47:TYR:CE1	2:B:136:SER:HB3	2.54	0.42
2:B:201:LEU:C	2:B:201:LEU:HD23	2.44	0.42
1:A:110:ARG:HG3	1:A:589:TRP:CZ2	2.54	0.42
1:A:169:GLU:HA	1:A:645[B]:MET:HE1	2.01	0.41
1:A:88:CYS:CB	1:A:89:PRO:HD2	2.50	0.41
1:A:48:SER:HA	1:A:628:ARG:HB2	2.02	0.41
1:A:937:LEU:C	1:A:937:LEU:HD12	2.45	0.41
1:A:841:GLU:HG3	1:A:843:LEU:O	2.21	0.41
1:A:875:ARG:HA	10:A:1120:PEG:H11	2.02	0.41
2:B:14:ALA:HB2	2:B:69:PHE:CG	2.56	0.41
1:A:54:ALA:O	1:A:620:ASN:HB2	2.21	0.41
1:A:574:TRP:HA	1:A:602:GLU:O	2.21	0.40
1:A:900:TRP:CH2	2:B:24:GLN:HA	2.57	0.40
1:A:882:THR:HA	1:A:962:LEU:O	2.20	0.40
1:A:495:ARG:N	1:A:496:PRO:CD	2.85	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	955/1013 (94%)	927 (97%)	26 (3%)	2 (0%)	44	29
2	B	212/215 (99%)	202 (95%)	9 (4%)	1 (0%)	25	11
All	All	1167/1228 (95%)	1129 (97%)	35 (3%)	3 (0%)	37	23

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	533	TRP
2	B	131	VAL
1	A	663	TYR

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	781/819 (95%)	774 (99%)	7 (1%)	75	66
2	B	185/186 (100%)	185 (100%)	0	100	100
All	All	966/1005 (96%)	959 (99%)	7 (1%)	81	74

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	143	GLU
1	A	271	ARG
1	A	394	LYS
1	A	534	LEU
1	A	691	ASN
1	A	960	VAL
1	A	969	MET

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

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	B	194	ASN

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 34 ligands modelled in this entry, 1 is modelled with single atom and 1 is monoatomic - leaving 32 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 Counts	Bond lengths RMSZ	Bond lengths #$|Z| > 2$	Bond angles Counts	Bond angles RMSZ	Bond angles #$|Z| > 2$
4	SF4	B	303	2	0,12,12	-	-	-		
3	MGD	A	1102	6	41,52,52	0.83	2 (4%)	40,81,81	1.16	5 (12%)
8	EDO	A	1123	-	3,3,3	0.10	0	2,2,2	0.24	0
7	PGE	A	1106	-	9,9,9	0.15	0	8,8,8	0.13	0
8	EDO	B	306	-	3,3,3	0.06	0	2,2,2	0.19	0
4	SF4	B	301	2	0,12,12	-	-	-		
11	ARF	A	1114	-	2,2,2	0.39	0	1,1,1	0.56	0
11	ARF	B	307	-	2,2,2	0.36	0	1,1,1	0.82	0
11	ARF	A	1115	-	2,2,2	0.42	0	1,1,1	0.81	0
11	ARF	A	1121	-	2,2,2	0.40	0	1,1,1	0.86	0
11	ARF	A	1113	-	2,2,2	0.42	0	1,1,1	0.84	0
11	ARF	A	1122	-	2,2,2	0.39	0	1,1,1	0.65	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
11	ARF	A	1117	-	2,2,2	0.47	0	1,1,1	0.71	0
10	PEG	A	1111	-	6,6,6	0.19	0	5,5,5	0.11	0
9	GOL	A	1108	-	5,5,5	0.13	0	5,5,5	0.34	0
9	GOL	A	1118	-	5,5,5	0.11	0	5,5,5	0.34	0
11	ARF	A	1124	-	2,2,2	0.39	0	1,1,1	0.75	0
4	SF4	A	1103	1	0,12,12	-	-	-		
9	GOL	A	1119	-	5,5,5	0.09	0	5,5,5	0.22	0
8	EDO	B	304	-	3,3,3	0.30	0	2,2,2	0.23	0
9	GOL	A	1112	-	5,5,5	0.12	0	5,5,5	0.26	0
9	GOL	A	1109	-	5,5,5	0.09	0	5,5,5	0.25	0
9	GOL	A	1110	-	5,5,5	0.09	0	5,5,5	0.31	0
11	ARF	A	1116	-	2,2,2	0.40	0	1,1,1	0.89	0
4	SF4	B	302	2	0,12,12	-	-	-		
11	ARF	B	308	-	2,2,2	0.38	0	1,1,1	0.79	0
8	EDO	A	1107	-	3,3,3	0.07	0	2,2,2	0.24	0
11	ARF	A	1125	-	2,2,2	0.38	0	1,1,1	0.95	0
10	PEG	A	1120	-	6,6,6	0.19	0	5,5,5	0.29	0
11	ARF	B	309	-	2,2,2	0.43	0	1,1,1	0.84	0
8	EDO	B	305	-	3,3,3	0.18	0	2,2,2	0.30	0
3	MGD	A	1101	6	41,52,52	0.78	1 (2%)	40,81,81	1.04	2 (5%)

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
4	SF4	B	303	2	-	-	0/6/5/5
3	MGD	A	1102	6	-	4/18/66/66	0/6/6/6
8	EDO	A	1123	-	-	1/1/1/1	-
7	PGE	A	1106	-	-	3/7/7/7	-
8	EDO	B	306	-	-	1/1/1/1	-
4	SF4	B	301	2	-	-	0/6/5/5
10	PEG	A	1111	-	-	3/4/4/4	-
9	GOL	A	1108	-	-	0/4/4/4	-
9	GOL	A	1118	-	-	2/4/4/4	-
4	SF4	A	1103	1	-	-	0/6/5/5
9	GOL	A	1119	-	-	4/4/4/4	-
8	EDO	B	304	-	-	1/1/1/1	-
9	GOL	A	1112	-	-	2/4/4/4	-
9	GOL	A	1109	-	-	0/4/4/4	-

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
9	GOL	A	1110	-	-	0/4/4/4	-
4	SF4	B	302	2	-	-	0/6/5/5
8	EDO	A	1107	-	-	1/1/1/1	-
10	PEG	A	1120	-	-	<mark>2/4/4/4</mark>	-
8	EDO	B	305	-	-	0/1/1/1	-
3	MGD	A	1101	6	-	1/18/66/66	0/6/6/6

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1101	MGD	C5-C6	-2.46	1.42	1.47
3	A	1102	MGD	C5-C6	-2.35	1.42	1.47
3	A	1102	MGD	C23-C14	2.28	1.55	1.53

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1102	MGD	O11-C23-C14	3.03	110.99	108.96
3	A	1101	MGD	C19-N20-C21	3.03	118.89	113.43
3	A	1102	MGD	C19-N20-C21	2.77	118.43	113.43
3	A	1102	MGD	O4'-C1'-C2'	-2.62	103.10	106.93
3	A	1102	MGD	O6-C6-C5	2.32	128.91	124.37
3	A	1102	MGD	C17-C16-N15	2.17	122.59	116.76
3	A	1101	MGD	O6-C6-C5	2.10	128.47	124.37

There are no chirality outliers.

All (25) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1102	MGD	C4'-C5'-O5'-PB
9	A	1112	GOL	O1-C1-C2-C3
9	A	1118	GOL	C1-C2-C3-O3
10	A	1120	PEG	O1-C1-C2-O2
3	A	1102	MGD	O4'-C4'-C5'-O5'
3	A	1102	MGD	C3'-C4'-C5'-O5'
9	A	1119	GOL	O1-C1-C2-C3
9	A	1119	GOL	C1-C2-C3-O3
9	A	1112	GOL	O1-C1-C2-O2
9	A	1118	GOL	O2-C2-C3-O3
10	A	1111	PEG	O2-C3-C4-O4
8	A	1123	EDO	O1-C1-C2-O2

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms
10	A	1120	PEG	O2-C3-C4-O4
8	B	306	EDO	O1-C1-C2-O2
8	A	1107	EDO	O1-C1-C2-O2
3	A	1101	MGD	PA-O3B-PB-O5'
7	A	1106	PGE	O2-C3-C4-O3
10	A	1111	PEG	O1-C1-C2-O2
7	A	1106	PGE	C1-C2-O2-C3
7	A	1106	PGE	O1-C1-C2-O2
10	A	1111	PEG	C4-C3-O2-C2
9	A	1119	GOL	O1-C1-C2-O2
9	A	1119	GOL	O2-C2-C3-O3
8	B	304	EDO	O1-C1-C2-O2
3	A	1102	MGD	C5'-O5'-PB-O1B

There are no ring outliers.

6 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1102	MGD	1	0
11	A	1114	ARF	2	0
9	A	1112	GOL	1	0
10	A	1120	PEG	1	0
8	B	305	EDO	2	0
3	A	1101	MGD	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 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 303

Bond lengths

Bond angles

Torsions

Rings

Ligand MGD A 1102

Bond lengths

Bond angles

Torsions

Rings

Ligand SF4 B 301

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1114

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF B 307

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1115

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1121

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1113

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1122

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1117

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1124

Bond lengths

Bond angles

Torsions

Rings

Ligand SF4 A 1103

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1116

Bond lengths

Bond angles

Torsions

Rings

Ligand SF4 B 302

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF B 308

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF A 1125

Bond lengths

Bond angles

Torsions

Rings

Ligand ARF B 309

Bond lengths

Bond angles

Torsions

Rings

Ligand MGD A 1101

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	958/1013 (94%)	0.45	57 (5%)	29	36	14, 28, 51, 80	3 (0%)
2	B	214/215 (99%)	0.69	14 (6%)	26	32	17, 33, 55, 66	0
All	All	1172/1228 (95%)	0.50	71 (6%)	28	35	14, 29, 52, 80	3 (0%)

All (71) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	985	ALA	7.2
1	A	991	GLY	6.1
2	B	131	VAL	4.3
2	B	88	VAL	4.3
1	A	992	ILE	4.2
1	A	993	PRO	4.1
2	B	90	LEU	4.1
1	A	657	ALA	3.9
1	A	661	GLY	3.8
1	A	196	THR	3.8
1	A	1005	VAL	3.7
1	A	197	VAL	3.6
2	B	117	VAL	3.4
1	A	593	GLY	3.3
1	A	854	LYS	3.3
2	B	135	LEU	3.2
1	A	987	ASP	3.2
1	A	861	ALA	3.2
1	A	409	GLN	3.2
1	A	122	TRP	3.0
1	A	955	VAL	3.0
1	A	986	GLY	2.9
2	B	61	LYS	2.8
1	A	673	ALA	2.7

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	118	LYS	2.7
1	A	570	GLY	2.7
1	A	669	LYS	2.6
2	B	168	GLN	2.6
1	A	324	ALA	2.6
1	A	703	LYS	2.5
1	A	679	ASN	2.5
2	B	128	ILE	2.5
1	A	972	LYS	2.5
1	A	662	ALA	2.5
1	A	678	HIS	2.5
1	A	114	SER	2.4
1	A	323	ALA	2.4
1	A	672	ILE	2.4
1	A	111	ALA	2.4
1	A	113	PHE	2.4
1	A	954	GLY	2.4
1	A	658	LYS	2.3
1	A	146	ALA	2.3
1	A	195	PRO	2.3
2	B	119	SER	2.3
1	A	139	ALA	2.3
1	A	702	GLY	2.3
2	B	78	VAL	2.3
1	A	597	ALA	2.3
1	A	671	ASN	2.2
1	A	534	LEU	2.2
2	B	130	PRO	2.2
1	A	340	ASN	2.2
1	A	68	GLN	2.2
1	A	135	LYS	2.2
1	A	660	GLY	2.2
1	A	706	LYS	2.1
2	B	215	ALA	2.1
1	A	708	GLY	2.1
1	A	798	LYS	2.1
1	A	117	TRP	2.1
2	B	84	GLY	2.1
1	A	482	GLN	2.1
1	A	130	ALA	2.1
1	A	339	ALA	2.1
1	A	667	ILE	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	696	LYS	2.1
1	A	652	VAL	2.1
2	B	62	GLY	2.0
1	A	119	PRO	2.0
1	A	151	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(Å^2)	Q<0.9
11	ARF	A	1117	3/3	0.74	0.18	45,45,52,58	0
7	PGE	A	1106	10/10	0.77	0.19	48,59,64,66	0
9	GOL	A	1119	6/6	0.79	0.23	64,65,69,69	0
9	GOL	A	1118	6/6	0.79	0.20	44,45,49,52	0
11	ARF	A	1125	3/3	0.79	0.17	55,55,56,58	0
10	PEG	A	1111	7/7	0.80	0.16	41,46,49,52	0
11	ARF	A	1115	3/3	0.80	0.21	40,40,45,46	0
10	PEG	A	1120	7/7	0.81	0.19	55,58,59,59	0
11	ARF	A	1113	3/3	0.84	0.14	43,43,45,46	0
11	ARF	B	307	3/3	0.84	0.15	45,45,45,49	0
11	ARF	A	1121	3/3	0.85	0.12	42,42,43,45	0
11	ARF	A	1116	3/3	0.85	0.13	53,53,54,57	0
8	EDO	B	306	4/4	0.85	0.17	47,50,53,56	0
9	GOL	A	1112	6/6	0.86	0.13	45,45,46,49	0
8	EDO	A	1123	4/4	0.87	0.17	37,38,40,43	0
11	ARF	A	1114	3/3	0.87	0.18	39,39,41,43	0
9	GOL	A	1110	6/6	0.91	0.13	41,44,46,46	0
11	ARF	A	1124	3/3	0.91	0.16	49,49,50,50	0

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
8	EDO	B	304	4/4	0.92	0.16	20,27,32,34	0
9	GOL	A	1109	6/6	0.92	0.09	24,29,29,31	0
11	ARF	A	1122	3/3	0.92	0.09	32,32,33,38	0
11	ARF	B	309	3/3	0.92	0.10	36,36,36,36	0
8	EDO	A	1107	4/4	0.94	0.11	46,49,50,50	0
11	ARF	B	308	3/3	0.94	0.08	21,21,23,32	0
9	GOL	A	1108	6/6	0.94	0.07	18,20,20,21	0
8	EDO	B	305	4/4	0.95	0.10	18,24,29,30	0
4	SF4	B	302	8/8	0.96	0.06	28,31,34,34	0
3	MGD	A	1102	47/47	0.97	0.06	18,23,27,35	0
4	SF4	B	303	8/8	0.97	0.04	22,24,25,26	0
3	MGD	A	1101	47/47	0.98	0.05	15,17,20,21	0
5	H2S	A	1104	1/1	0.98	0.05	21,21,21,21	0
4	SF4	B	301	8/8	0.99	0.03	17,19,20,21	0
4	SF4	A	1103	8/8	0.99	0.03	16,17,18,18	0
6	W	A	1105	1/1	1.00	0.01	19,19,19,19	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 ARF 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)
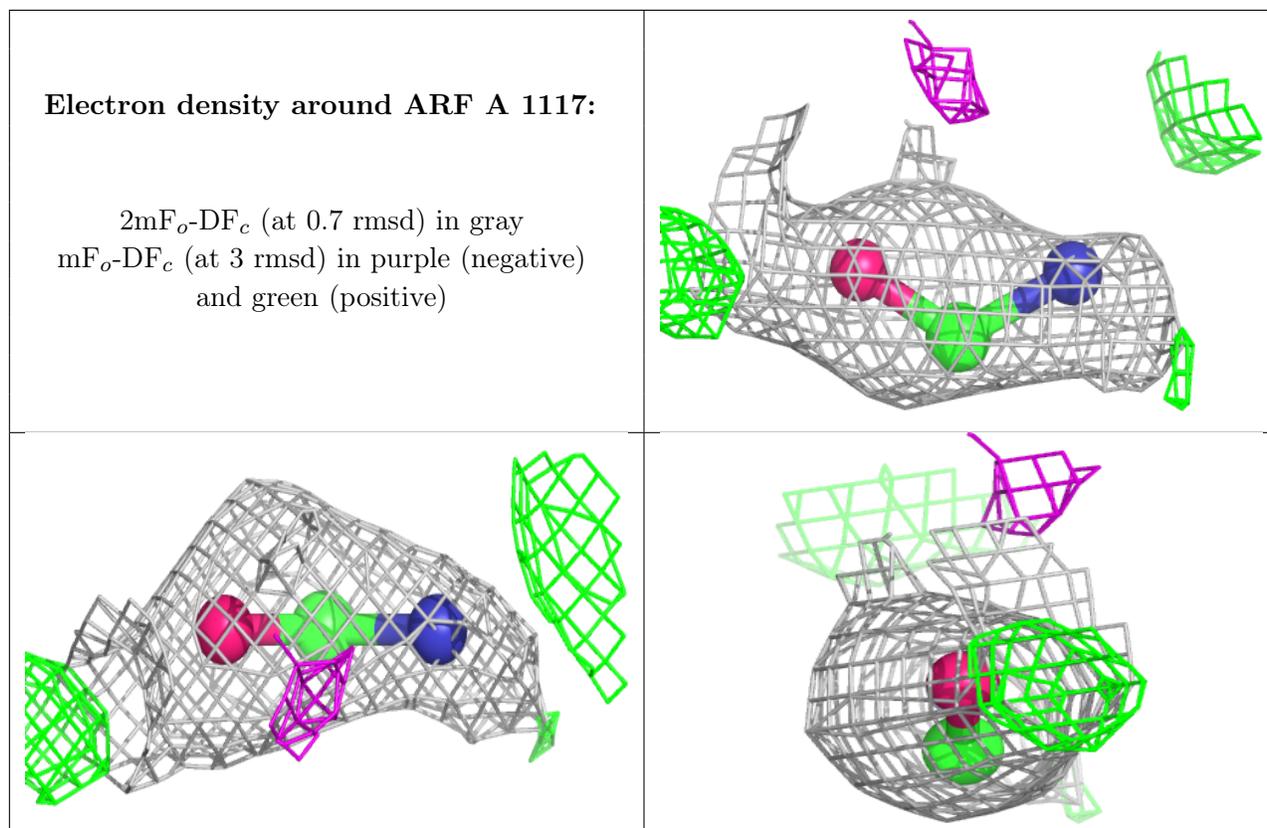
Electron density around ARF A 1125:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
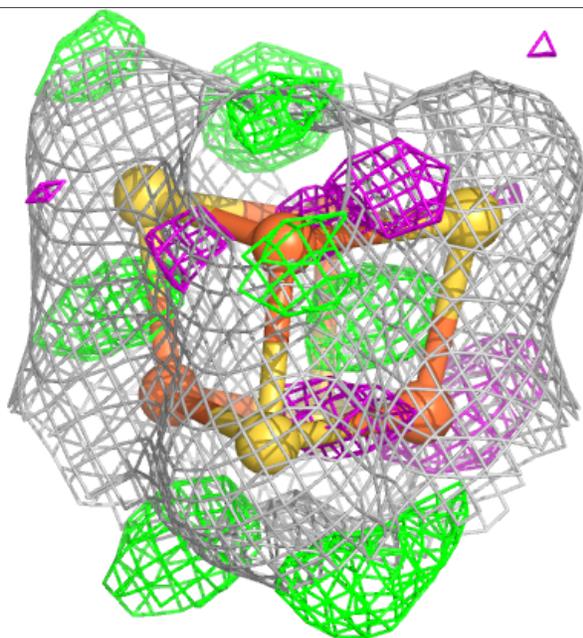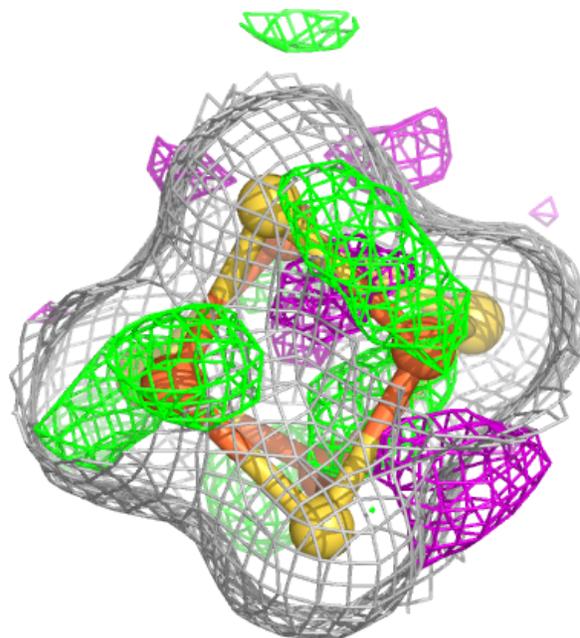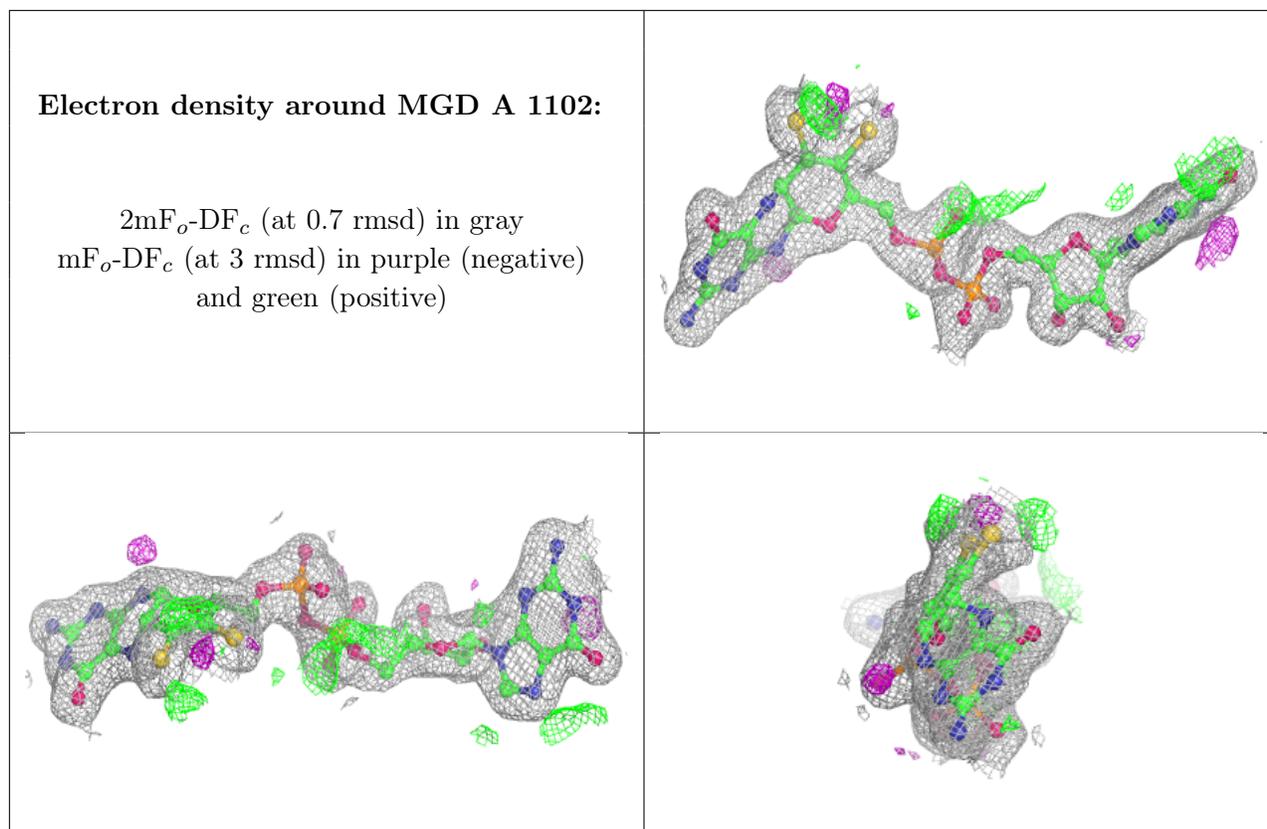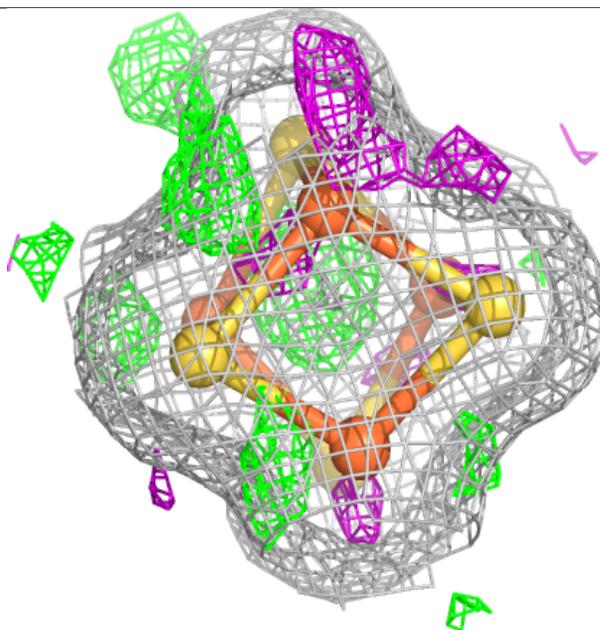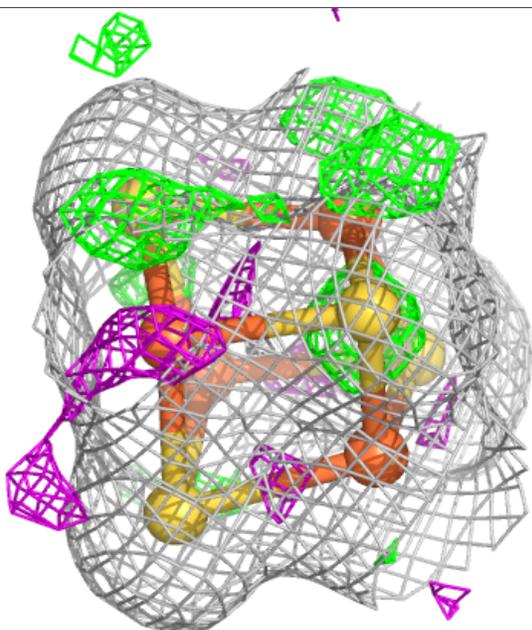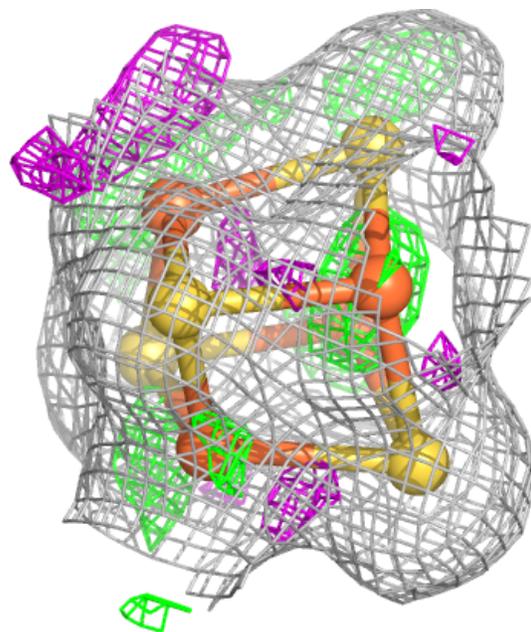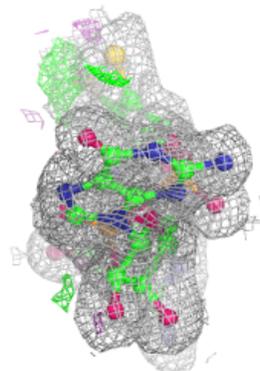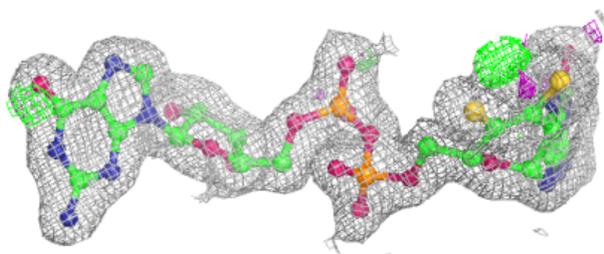and green (positive)
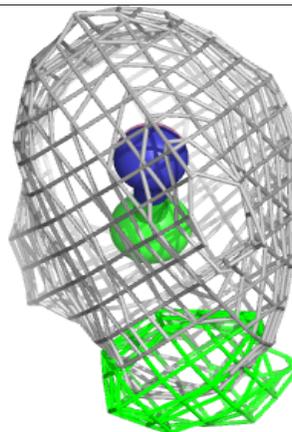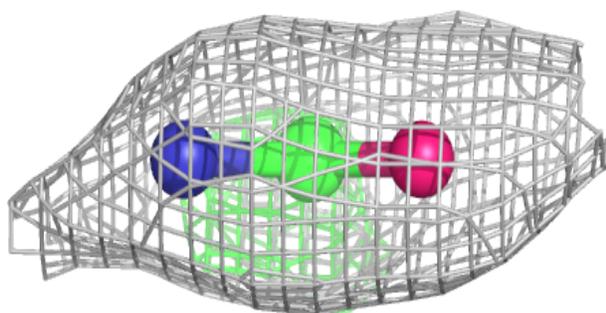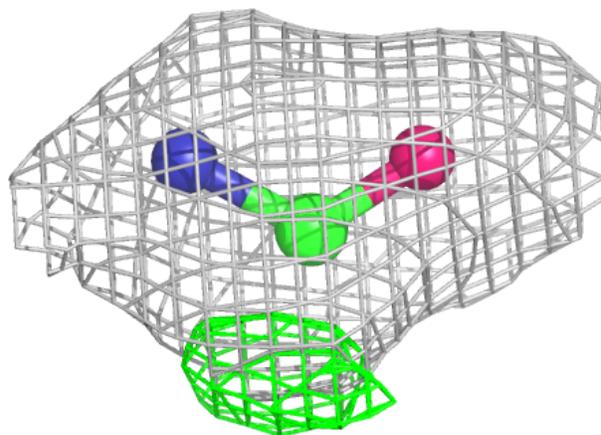
Electron density around ARF A 1115:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
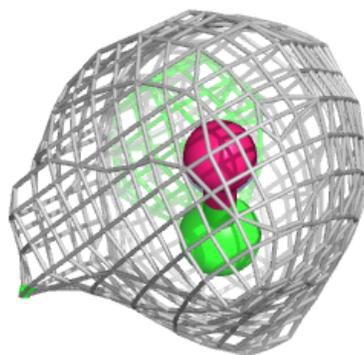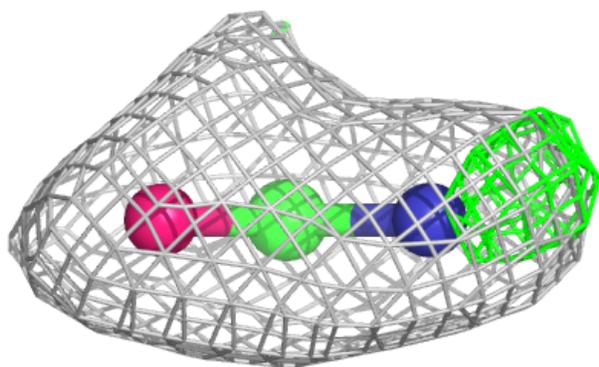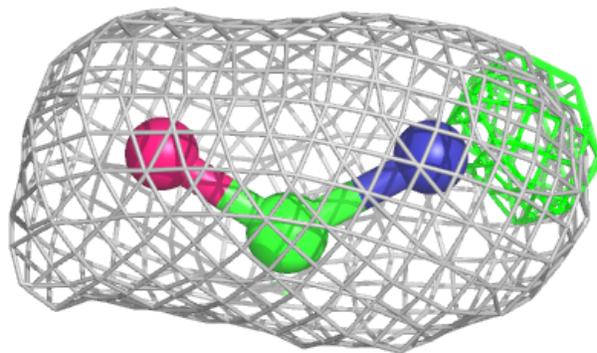
Electron density around ARF A 1113:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
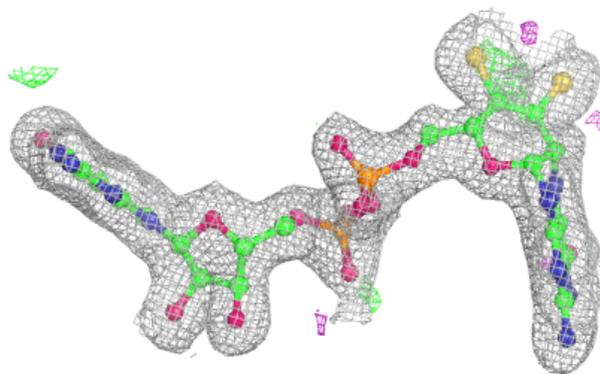and green (positive)
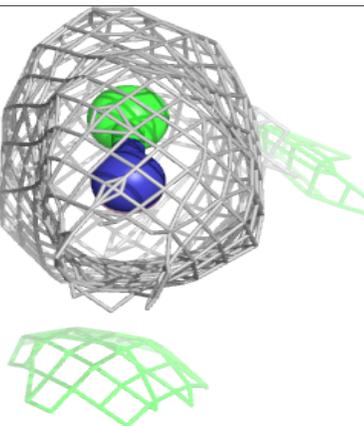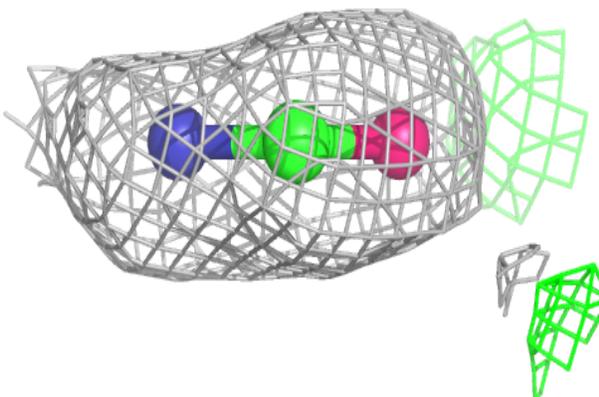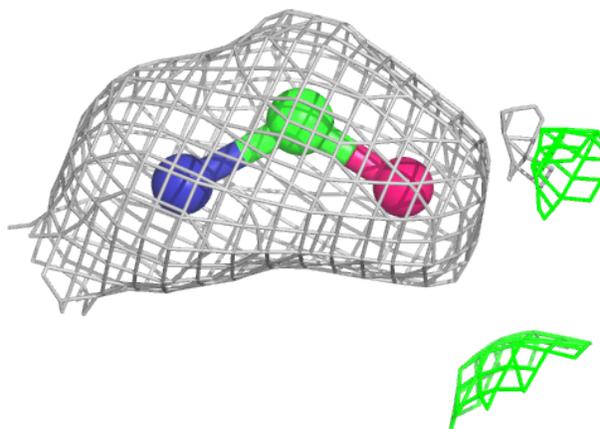
Electron density around ARF B 307:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
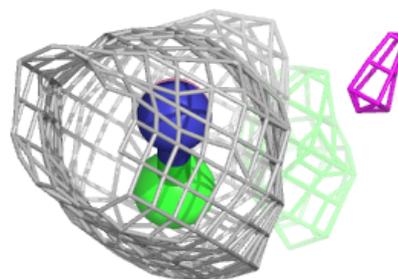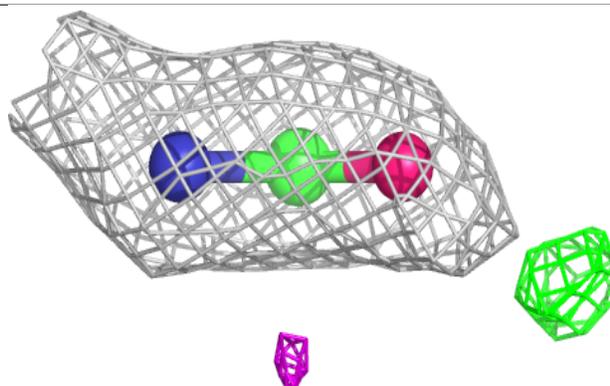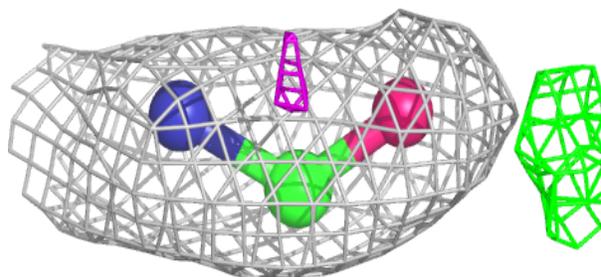
Electron density around ARF A 1121:

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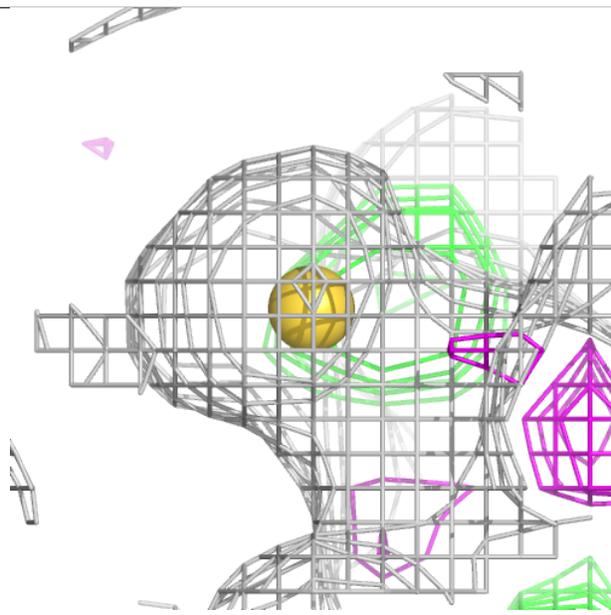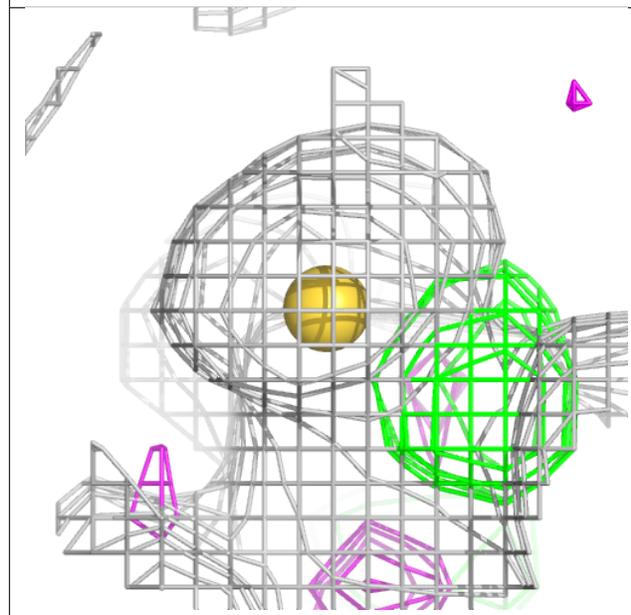and green (positive)

Electron density around ARF 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 ARF A 1114:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
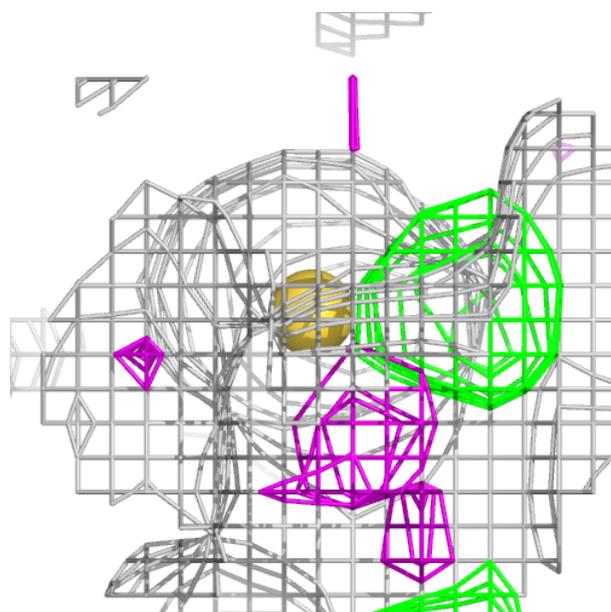and green (positive)
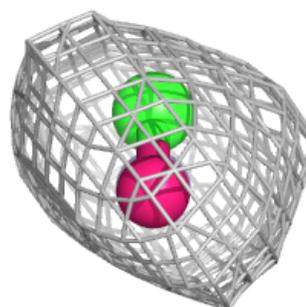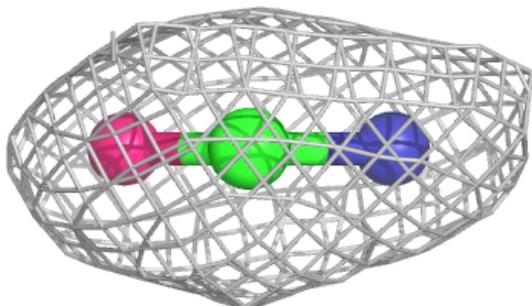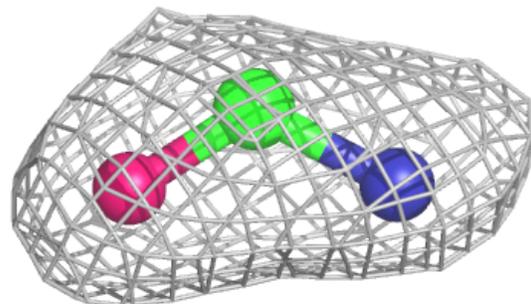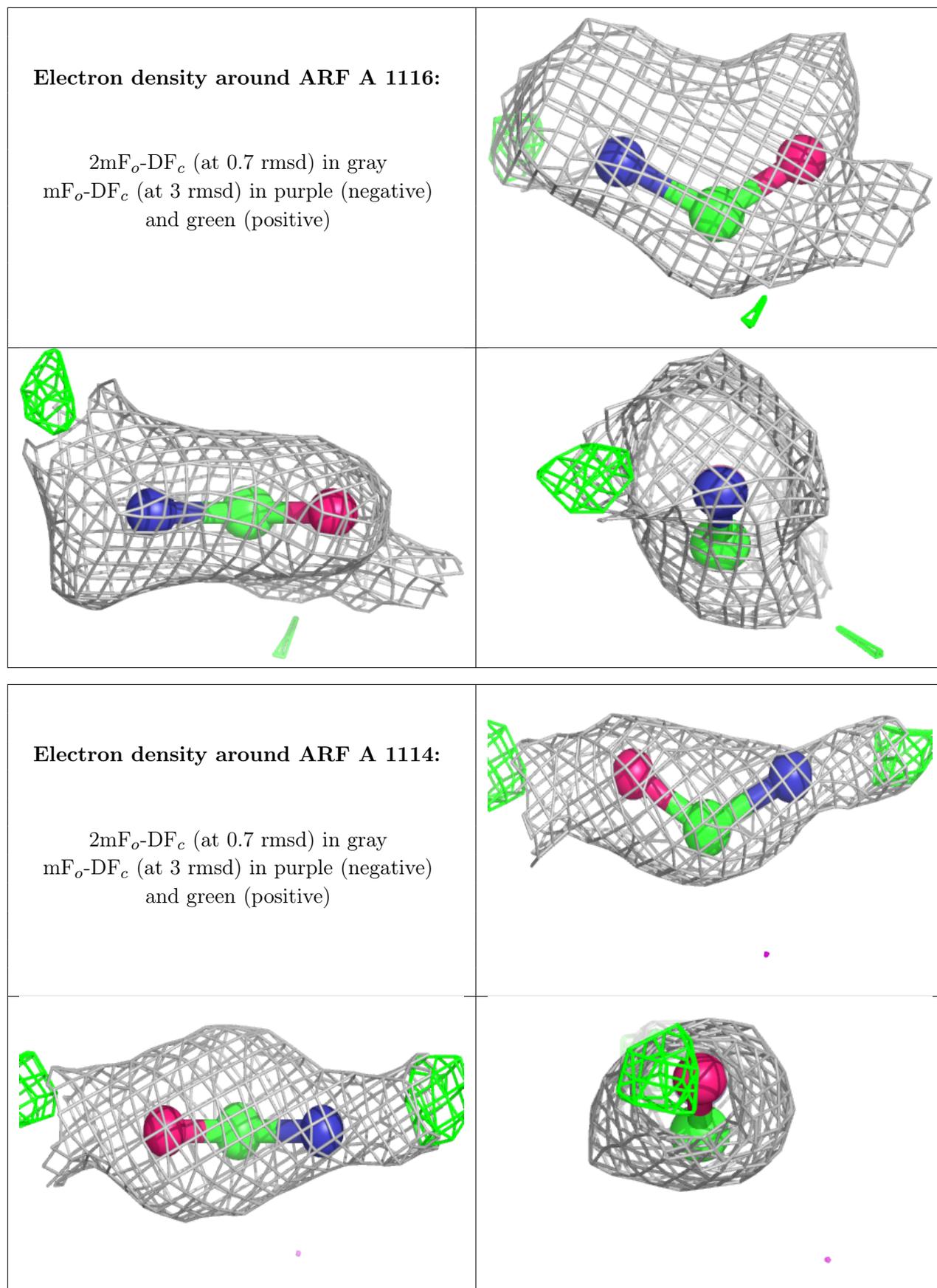
Electron density around ARF A 1124:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
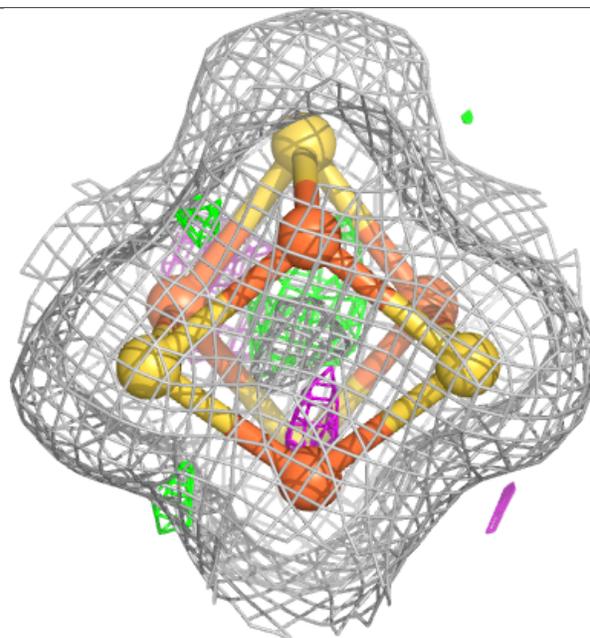and green (positive)
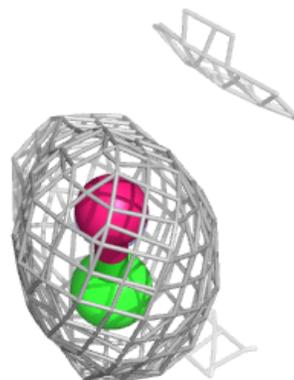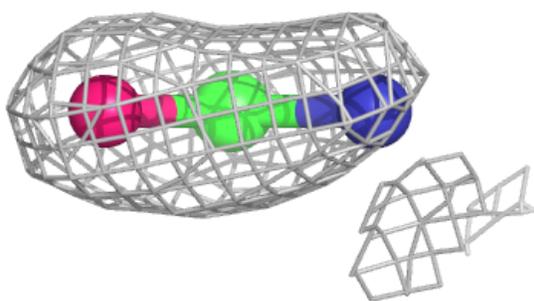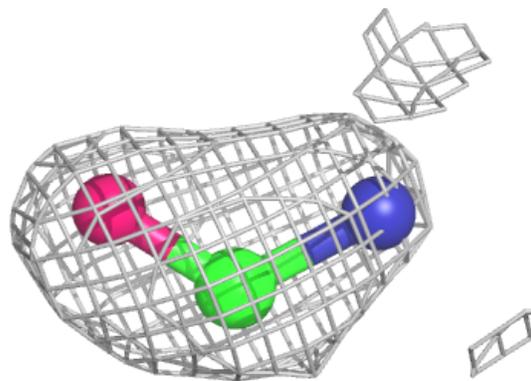
Electron density around ARF A 1122:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
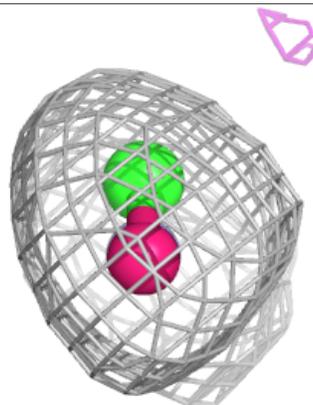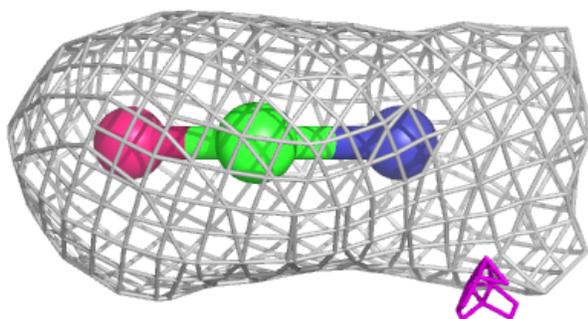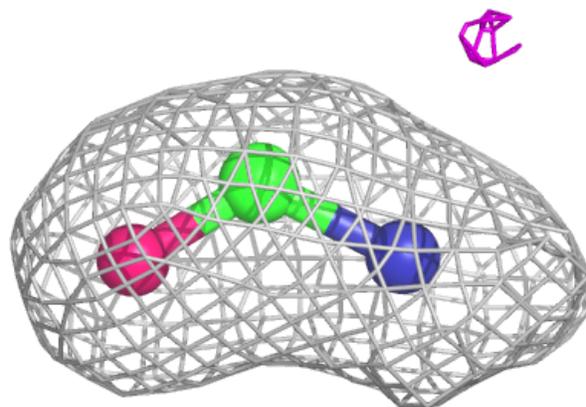
Electron density around ARF B 309:

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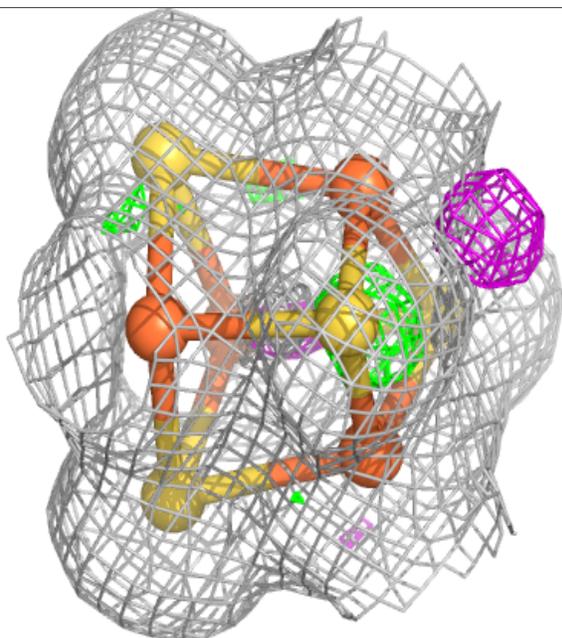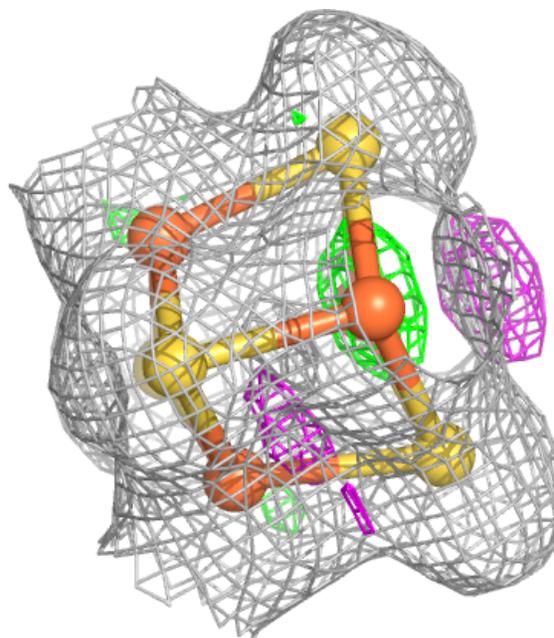$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around ARF B 308:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
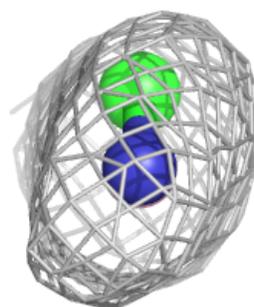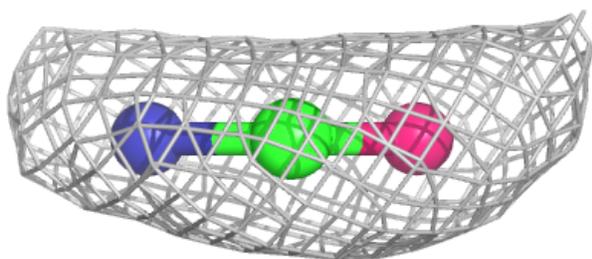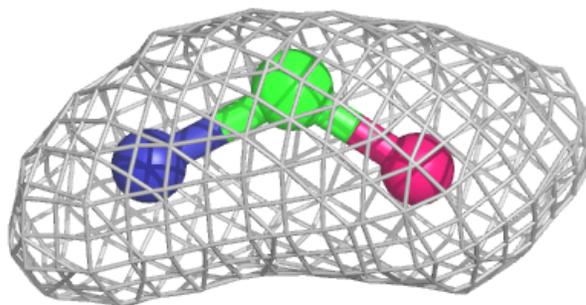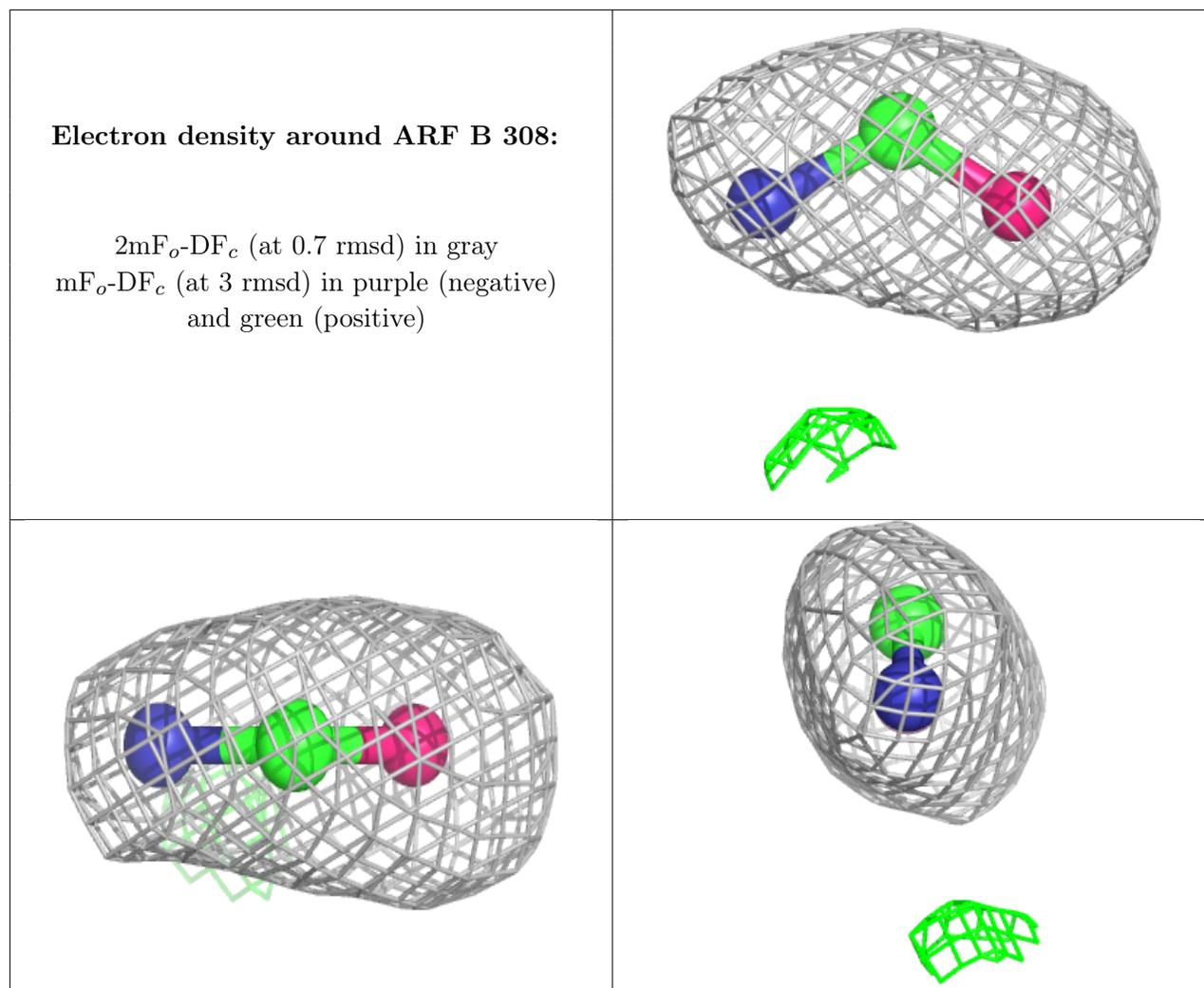
Electron density around SF4 B 302:

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

Electron density around MGD A 1102:

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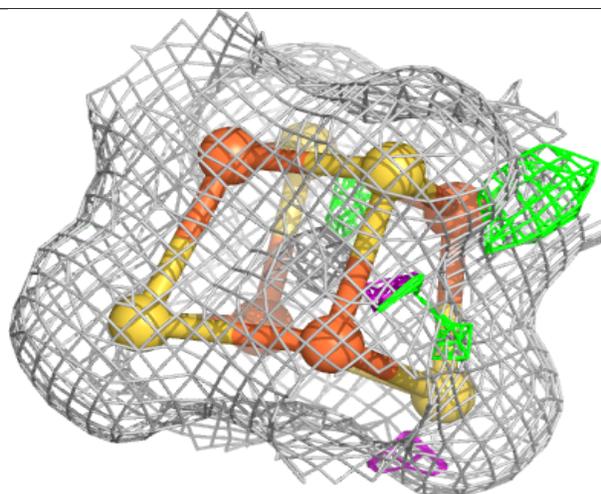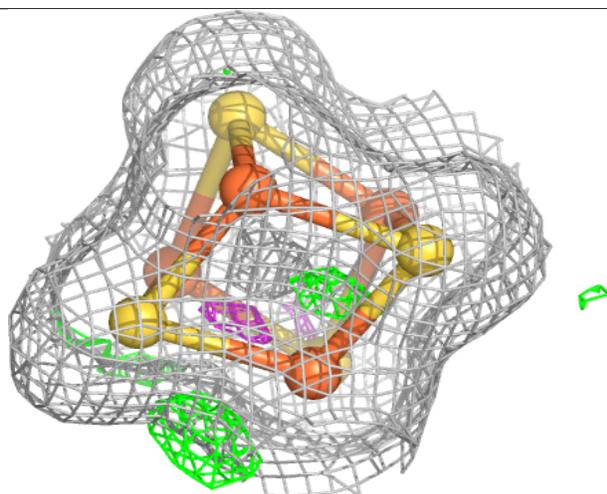mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around SF4 B 303:

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

Electron density around MGD A 1101:

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

Electron density around H2S A 1104:

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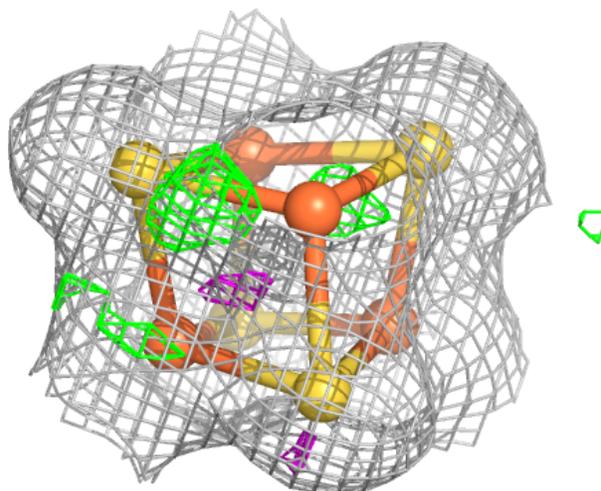$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around SF4 B 301:

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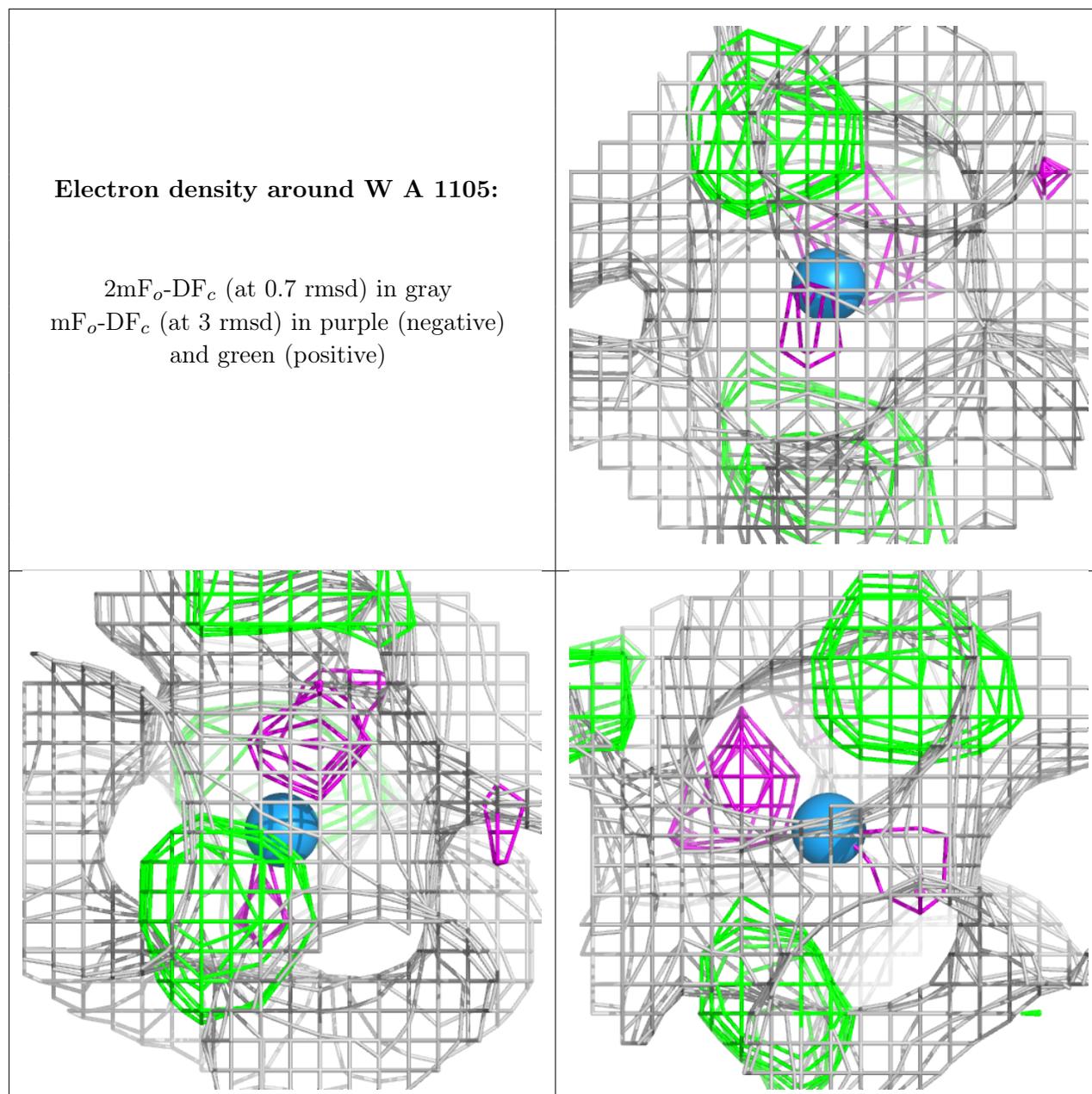and green (positive)

Electron density around 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.