



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 10, 2023 – 04:31 AM EDT

PDB ID : 7SHQ  
Title : Structure of a functional construct of eukaryotic elongation factor 2 kinase in complex with calmodulin.  
Authors : Piserchio, A.; Isiorho, E.A.; Jeruzalmi, D.; Dalby, K.N.; Ghose, R.  
Deposited on : 2021-10-11  
Resolution : 2.34 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35.1

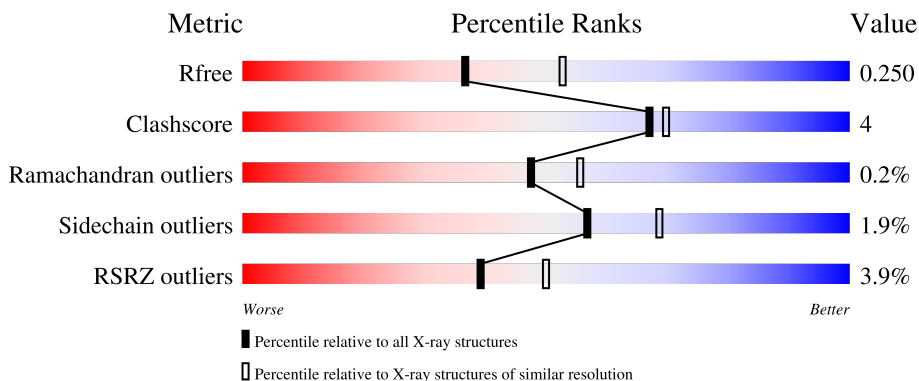
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.34 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))
$R_{free}$	130704	2096 (2.36-2.32)
Clashscore	141614	2193 (2.36-2.32)
Ramachandran outliers	138981	2159 (2.36-2.32)
Sidechain outliers	138945	2160 (2.36-2.32)
RSRZ outliers	127900	2067 (2.36-2.32)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	531	 4% 84% 8% 7%
2	B	148	 3% 82% 15% ..

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 5268 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 Eukaryotic elongation factor 2 kinase, Eukaryotic elongation factor 2 kinase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	P	S			
1	A	492	3979	2507	705	741	1	25	0	1	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	484	GLY	-	linker	UNP O00418
A	485	GLY	-	linker	UNP O00418
A	486	GLY	-	linker	UNP O00418
A	487	GLY	-	linker	UNP O00418
A	488	GLY	-	linker	UNP O00418
A	489	GLY	-	linker	UNP O00418

- Molecule 2 is a protein called Calmodulin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	145	1138	700	180	249	9	0	0	0

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Zn	0	0
			1	1		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	2	Total Mg 2 2	0	0
4	B	3	Total Mg 3 3	0	0

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	2	Total Ca 2 2	0	0

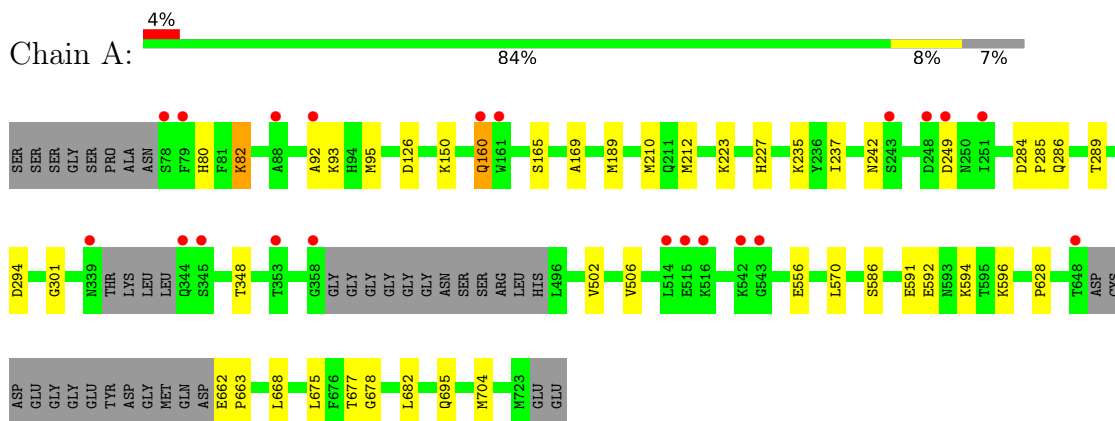
- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	120	Total O 120 120	0	0
6	B	23	Total O 23 23	0	0

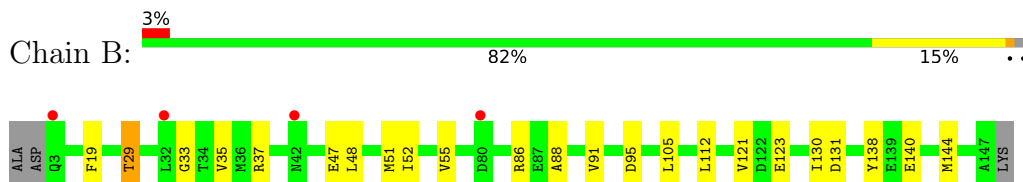
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Eukaryotic elongation factor 2 kinase, Eukaryotic elongation factor 2 kinase



- Molecule 2: Calmodulin-1



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	58.49Å 58.49Å 365.78Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.66 – 2.34 121.93 – 2.34	Depositor EDS
% Data completeness (in resolution range)	99.9 (50.66-2.34) 100.0 (121.93-2.34)	Depositor EDS
$R_{merge}$	0.36	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.41 (at 2.34Å)	Xtrriage
Refinement program	PHENIX 1.19.2_4158, ISOLDE 1.19.2_4158	Depositor
R, $R_{free}$	0.229 , 0.252 0.228 , 0.250	Depositor DCC
$R_{free}$ test set	1517 reflections (4.74%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	15.7	Xtrriage
Anisotropy	1.538	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 46.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.036 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.90	EDS
Total number of atoms	5268	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	35.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.70% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: TPO, CA, MG, ZN

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
1	A	0.28	0/4058	0.51	0/5463
2	B	0.29	0/1150	0.50	0/1545
All	All	0.28	0/5208	0.51	0/7008

There are no bond length outliers.

There are no bond angle outliers.

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	3979	0	3837	28	0
2	B	1138	0	1056	14	0
3	A	1	0	0	0	0
4	A	2	0	0	0	0
4	B	3	0	0	0	0
5	B	2	0	0	0	0
6	A	120	0	0	2	0
6	B	23	0	0	0	0
All	All	5268	0	4893	39	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 4.

All (39) 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:150:LYS:HZ2	1:A:165:SER:HB2	1.44	0.83
1:A:591:GLU:HG3	1:A:628:PRO:HG3	1.68	0.75
1:A:189:MET:HE3	1:A:212:MET:H	1.53	0.74
2:B:33:GLY:O	2:B:37:ARG:HG3	1.91	0.70
1:A:93:LYS:HD3	1:A:160:GLN:HB3	1.77	0.67
1:A:594:LYS:NZ	6:A:902:HOH:O	2.30	0.64
1:A:93:LYS:NZ	1:A:160:GLN:O	2.27	0.64
1:A:82:LYS:HD3	2:B:144:MET:O	2.02	0.59
1:A:591:GLU:HG3	1:A:628:PRO:CG	2.33	0.58
2:B:130:ILE:N	2:B:140:GLU:OE2	2.35	0.58
1:A:675:LEU:HD13	1:A:682:LEU:HD21	1.87	0.56
1:A:210:MET:HE2	2:B:95:ASP:HB3	1.87	0.56
1:A:286:GLN:NE2	6:A:901:HOH:O	2.28	0.56
1:A:677:THR:HG22	1:A:678:GLY:O	2.07	0.55
1:A:556:GLU:HA	1:A:570:LEU:HD11	1.90	0.53
2:B:19:PHE:CG	2:B:35:VAL:HG22	2.43	0.53
2:B:123:GLU:OE2	2:B:123:GLU:HA	2.09	0.53
2:B:105:LEU:HD23	2:B:121:VAL:HG13	1.91	0.52
2:B:86:ARG:HG2	2:B:138:TYR:OH	2.10	0.52
2:B:48:LEU:O	2:B:52:ILE:HG13	2.13	0.48
1:A:189:MET:HE3	1:A:212:MET:N	2.26	0.48
1:A:93:LYS:HE3	1:A:93:LYS:CA	2.43	0.48
1:A:169:ALA:HA	1:A:227:HIS:O	2.14	0.48
1:A:294:ASP:OD1	1:A:294:ASP:N	2.37	0.47
1:A:223:LYS:HB2	1:A:223:LYS:HE3	1.75	0.46
1:A:92:ALA:HB2	2:B:112:LEU:HD11	1.98	0.44
2:B:88:ALA:O	2:B:91:VAL:HG22	2.17	0.44
2:B:47:GLU:O	2:B:51:MET:HG3	2.18	0.43
1:A:289:THR:O	1:A:301:GLY:HA2	2.18	0.43
2:B:51:MET:O	2:B:55:VAL:HG12	2.18	0.43
2:B:29:THR:CG2	2:B:52:ILE:HG23	2.49	0.42
1:A:592:GLU:H	1:A:592:GLU:CD	2.23	0.42
1:A:284:ASP:N	1:A:285:PRO:HD3	2.35	0.42
1:A:668:LEU:HD13	1:A:695:GLN:HG2	2.02	0.41
1:A:80:HIS:CD2	1:A:80:HIS:N	2.88	0.41
1:A:662:GLU:HG3	1:A:663:PRO:HD3	2.01	0.41
1:A:235:LYS:HG2	1:A:237:ILE:HD11	2.04	0.40
1:A:93:LYS:HE3	1:A:93:LYS:HA	2.03	0.40
1:A:502:VAL:O	1:A:506:VAL:HG23	2.20	0.40



There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	484/531 (91%)	470 (97%)	13 (3%)	1 (0%)	47	55
2	B	143/148 (97%)	139 (97%)	4 (3%)	0	100	100
All	All	627/679 (92%)	609 (97%)	17 (3%)	1 (0%)	47	55

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	160	GLN

### 5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	409/437 (94%)	401 (98%)	8 (2%)	55	66
2	B	121/126 (96%)	119 (98%)	2 (2%)	60	72
All	All	530/563 (94%)	520 (98%)	10 (2%)	57	68

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	82	LYS
1	A	95	MET

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Mol	Chain	Res	Type
1	A	126	ASP
1	A	242	ASN
1	A	249	ASP
1	A	586	SER
1	A	596	LYS
1	A	704	MET
2	B	29	THR
2	B	131	ASP

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	80	HIS
1	A	286	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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	$\# Z  > 2$
1	TPO	A	348	1	8,10,11	1.07	0	10,14,16	1.74	1 (10%)

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
1	TPO	A	348	1	-	3/9/11/13	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	348	TPO	P-OG1-CB	-5.10	107.81	123.21

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	348	TPO	O-C-CA-CB
1	A	348	TPO	CB-OG1-P-O3P
1	A	348	TPO	C-CA-CB-CG2

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 8 are monoatomic - leaving 0 for Mogul analysis.

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.

## 5.7 Other polymers [i](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	491/531 (92%)	0.11	21 (4%) 35 46	9, 27, 71, 105	0
2	B	145/148 (97%)	0.40	4 (2%) 53 63	18, 41, 69, 116	0
All	All	636/679 (93%)	0.17	25 (3%) 39 50	9, 30, 71, 116	0

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	353	THR	4.4
1	A	358	GLY	4.1
1	A	514	LEU	3.9
1	A	248	ASP	3.8
1	A	249	ASP	3.4
1	A	648	THR	3.2
1	A	516	LYS	3.2
1	A	515	GLU	3.2
2	B	80	ASP	3.1
1	A	345	SER	3.0
1	A	160	GLN	2.9
1	A	339	ASN	2.9
1	A	161	TRP	2.8
1	A	88	ALA	2.6
1	A	92	ALA	2.6
1	A	251	ILE	2.6
1	A	344	GLN	2.5
2	B	42	ASN	2.3
1	A	243	SER	2.2
1	A	543	GLY	2.1
1	A	79	PHE	2.1
2	B	32	LEU	2.1
1	A	542	LYS	2.0
2	B	3	GLN	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	78	SER	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	TPO	A	348	11/12	0.97	0.11	18,36,47,53	0

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

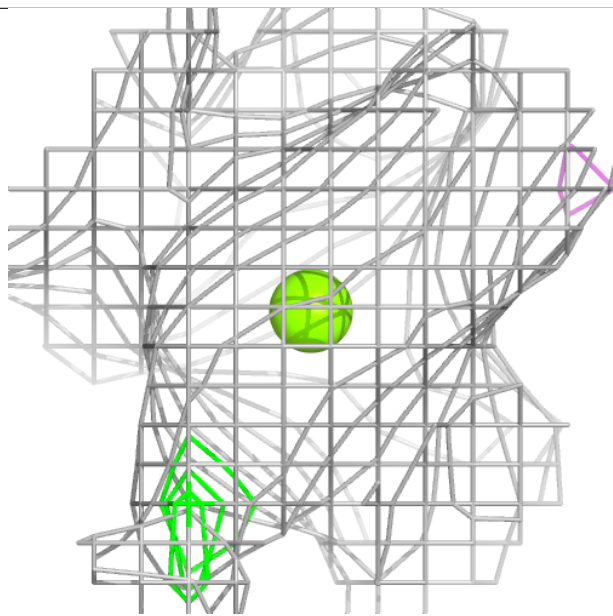
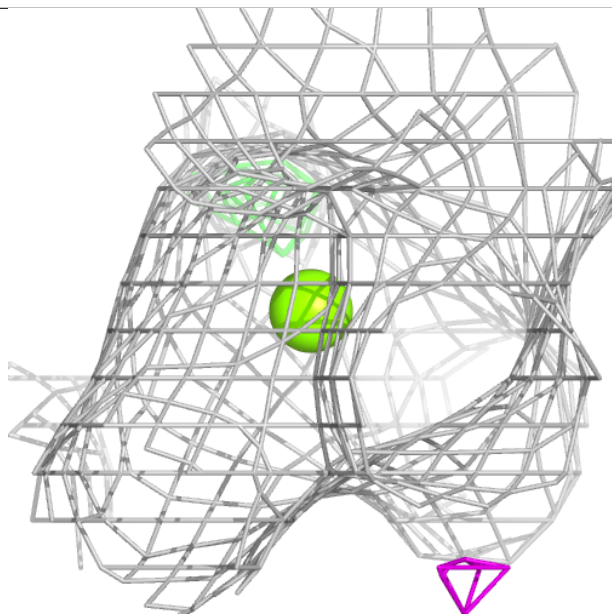
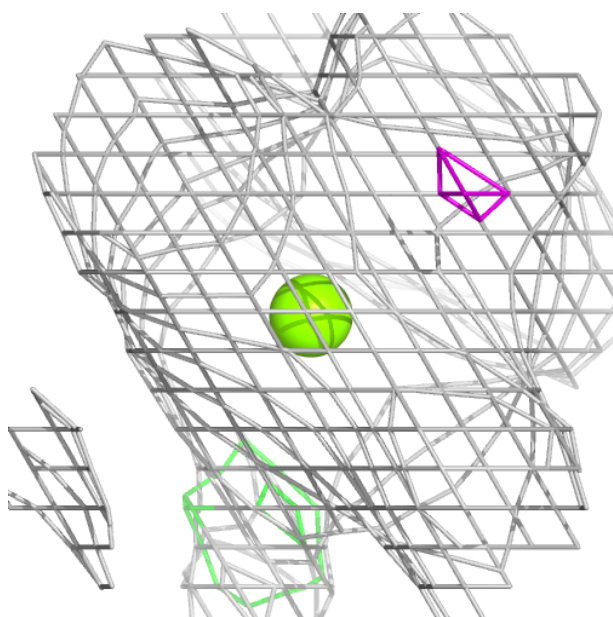
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
4	MG	B	204	1/1	0.90	0.07	31,31,31,31	0
4	MG	B	205	1/1	0.93	0.04	27,27,27,27	1
5	CA	B	201	1/1	0.93	0.07	27,27,27,27	0
4	MG	B	203	1/1	0.95	0.12	33,33,33,33	0
4	MG	A	803	1/1	0.95	0.12	42,42,42,42	0
4	MG	A	802	1/1	0.96	0.04	34,34,34,34	0
3	ZN	A	801	1/1	0.99	0.08	19,19,19,19	0
5	CA	B	202	1/1	0.99	0.10	17,17,17,17	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

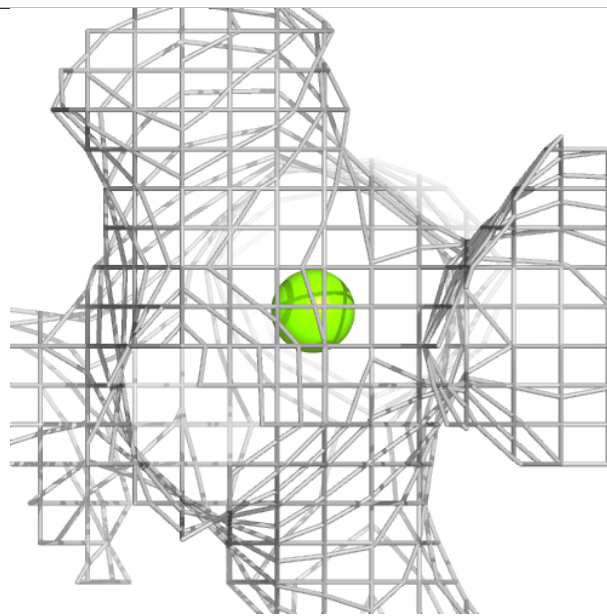
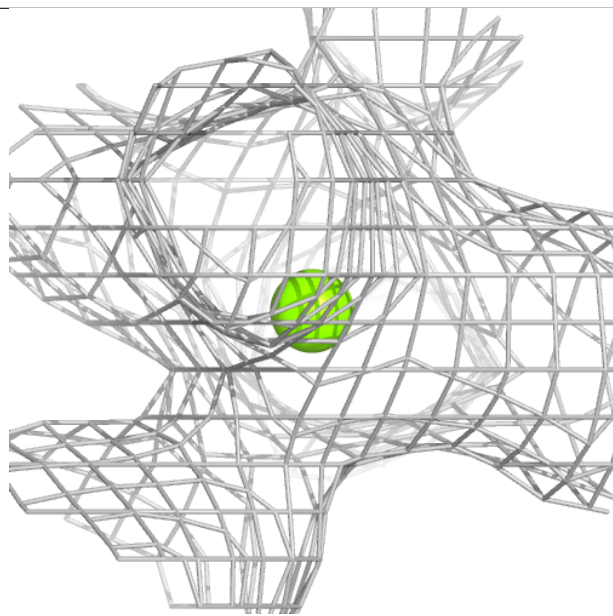
**Electron density around MG B 204:**

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



**Electron density around MG B 205:**

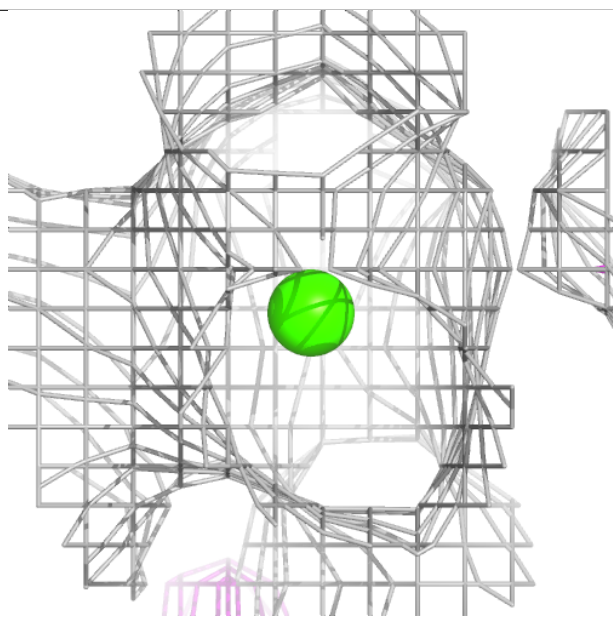
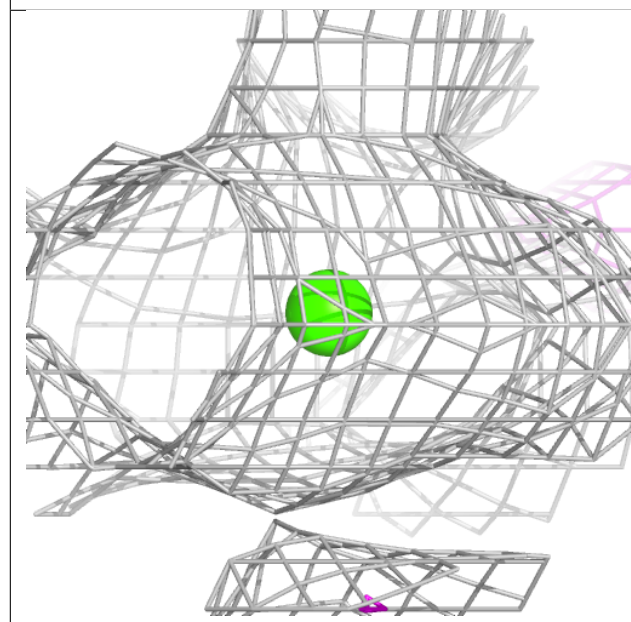
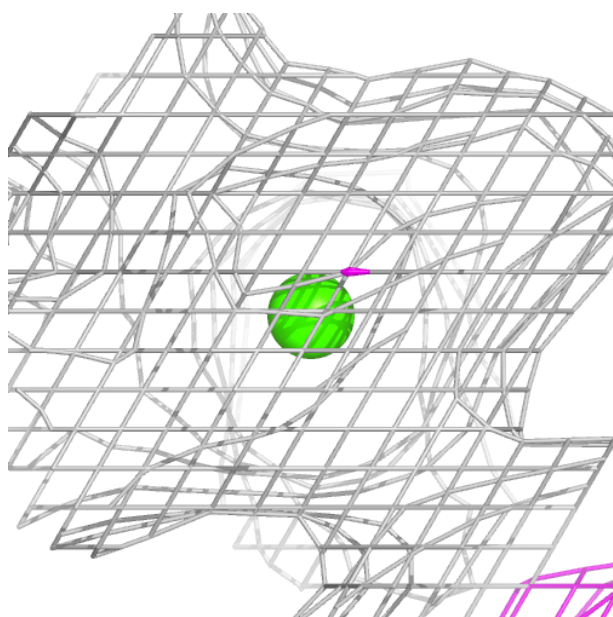
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





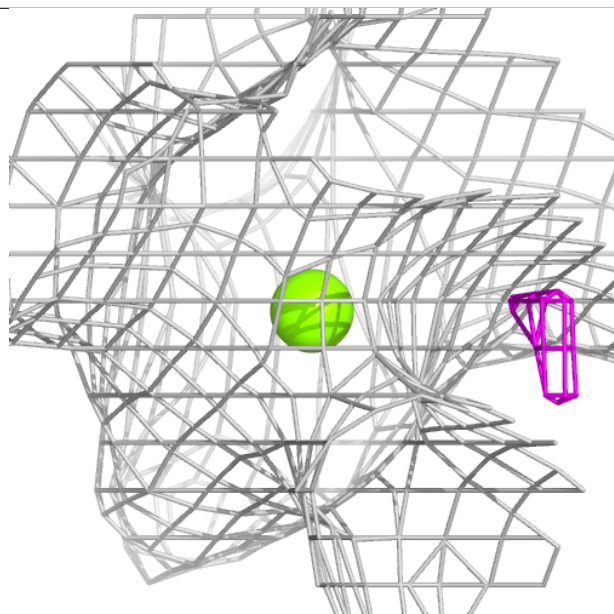
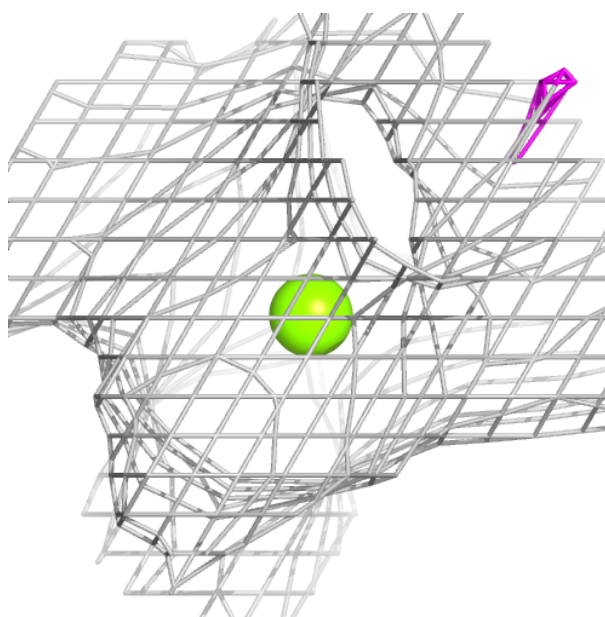
**Electron density around CA B 201:**

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



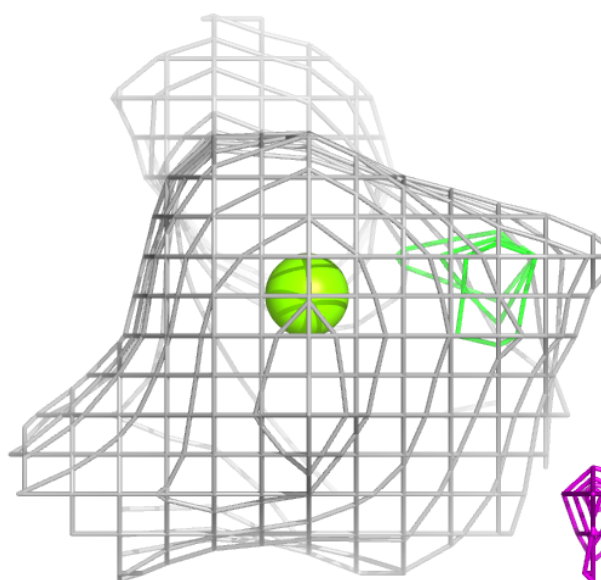
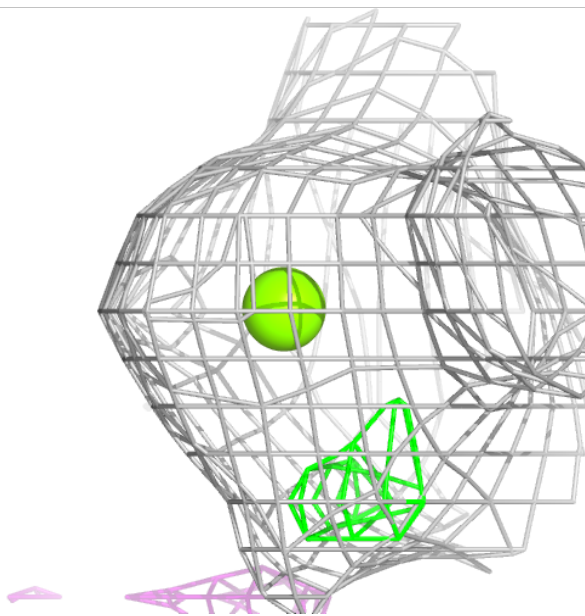
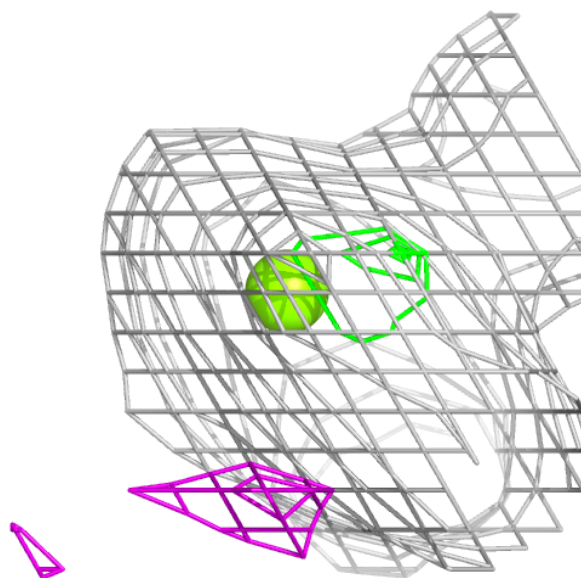
**Electron density around MG B 203:**

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



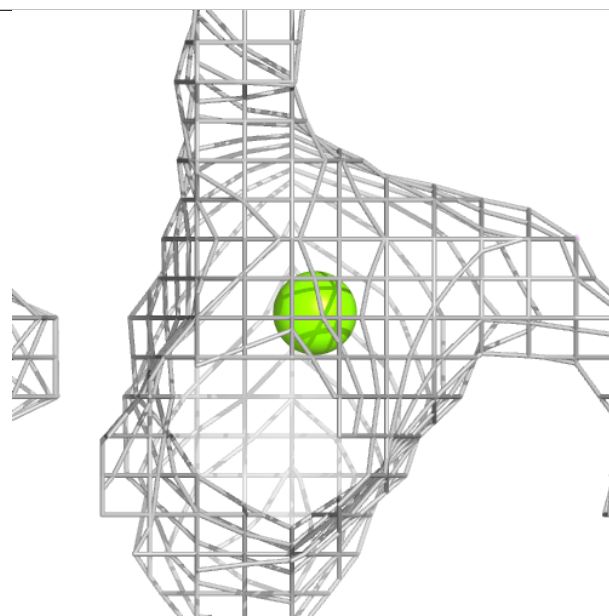
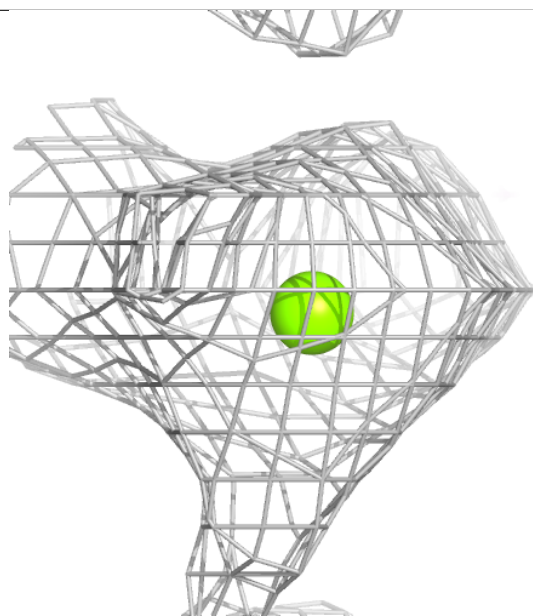
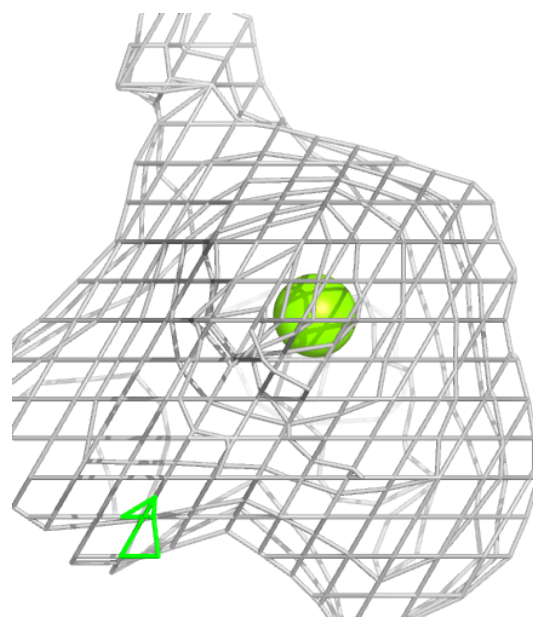
**Electron density around MG A 803:**

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



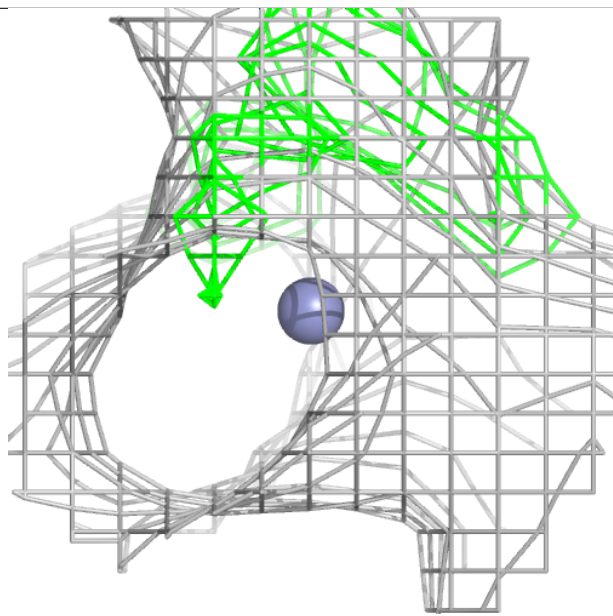
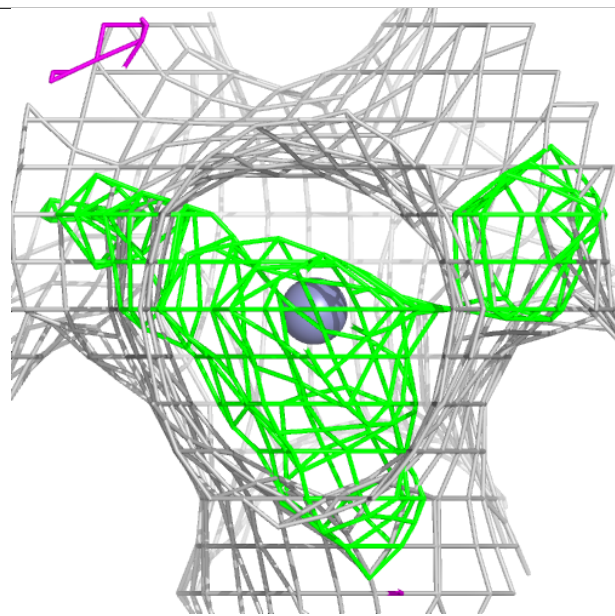
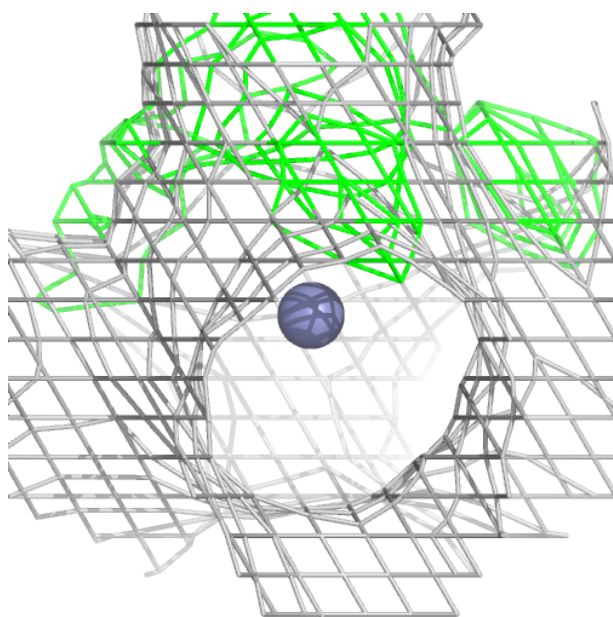
**Electron density around MG A 802:**

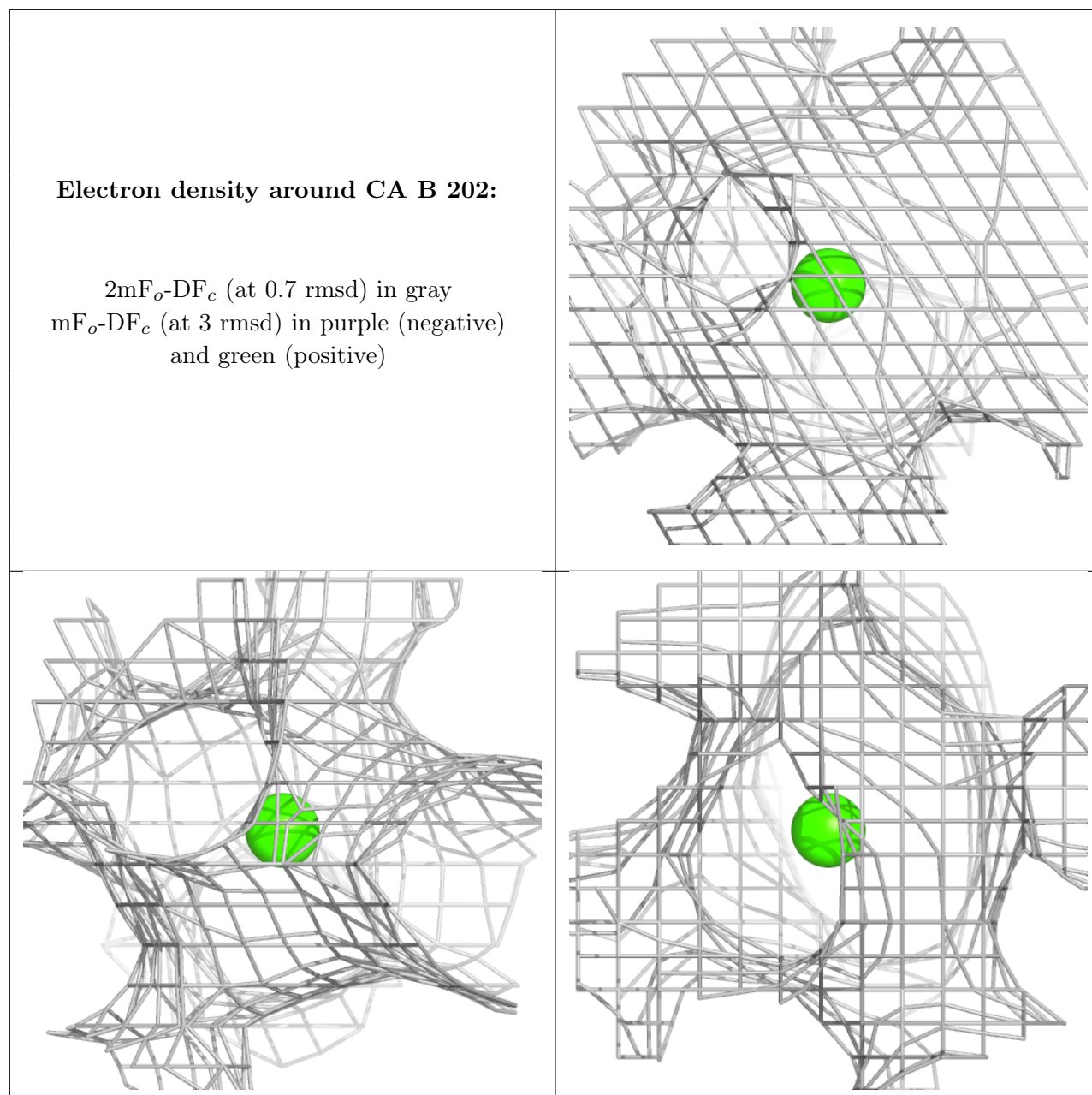
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around ZN A 801:**

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





## 6.5 Other polymers [i](#)

There are no such residues in this entry.