



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 18, 2026 – 12:10 AM UTC

PDB ID : 6XXX / pdb_00006xxx
Title : 1.25 Angstrom crystal structure of Ca/CaM A102V:RyR2 peptide complex
Authors : Antonyuk, S.; Helassa, N.
Deposited on : 2020-01-28
Resolution : 1.25 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
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

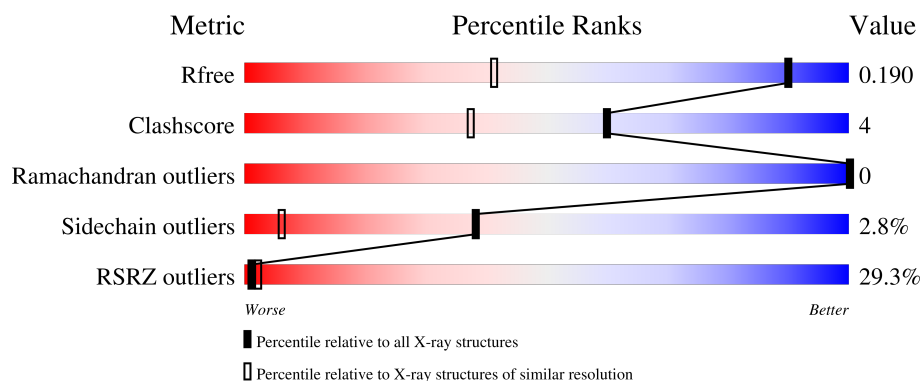
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.25 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	1693 (1.28-1.24)
Clashscore	190562	1730 (1.28-1.24)
Ramachandran outliers	187476	1695 (1.28-1.24)
Sidechain outliers	187428	1694 (1.28-1.24)
RSRZ outliers	180081	1693 (1.28-1.24)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	AAA	149	30% 88% 9% ..
2	BBB	21	24% 95% 5%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 2993 atoms, of which 1372 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 Calmodulin-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	AAA	146	Total	C	H	N	O	S	47	12	0
			2361	745	1151	194	261	10			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAA	103	VAL	ALA	conflict	UNP P0DP23

- Molecule 2 is a protein called LYS-LYS-ALA-VAL-TRP-HIS-LYS-LEU-LEU-SER-LYS-GLN-ARG-LYS-ARG-ALA-VAL-VAL-ALA-CYS-PHE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	BBB	21	Total	C	H	N	O	S	8	2	0
			411	124	221	40	25	1			

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	AAA	4	Total	Ca	0	0
			4	4		

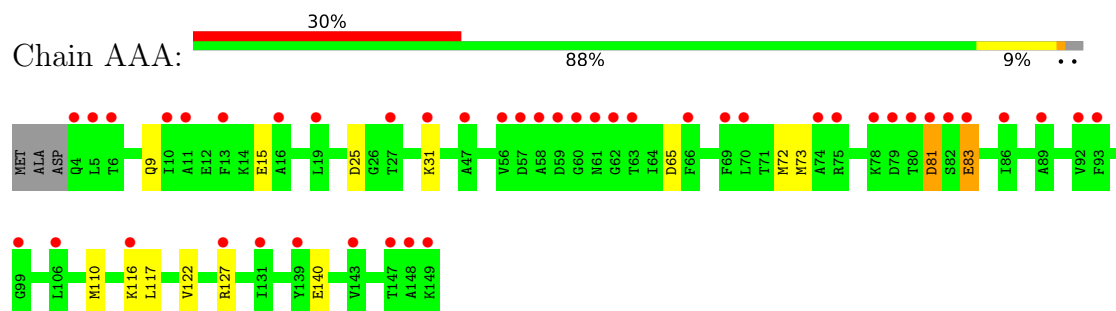
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	AAA	188	Total	O	0	12
			196	196		
4	BBB	21	Total	O	0	2
			21	21		

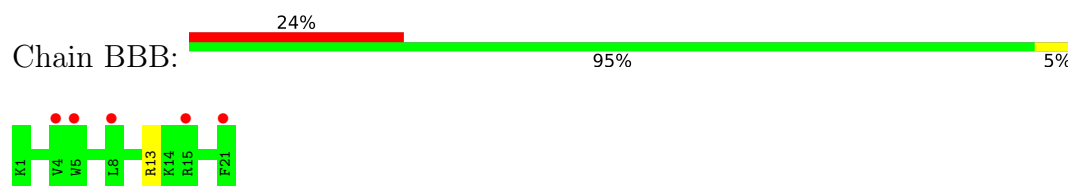
3 Residue-property plots

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: Calmodulin-1



• Molecule 2: LYS-LYS-ALA-VAL-TRP-HIS-LYS-LEU-LEU-SER-LYS-GLN-ARG-LYS-ARG-ALA-VAL-VAL-ALA-CYS-PHE



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	40.11Å 41.80Å 86.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.62 – 1.25 37.62 – 1.25	Depositor EDS
% Data completeness (in resolution range)	99.0 (37.62-1.25) 99.0 (37.62-1.25)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.70 (at 1.23Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.142 , 0.189 0.142 , 0.190	Depositor DCC
R_{free} test set	2092 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	16.8	Xtriage
Anisotropy	0.092	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 100.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.024 for k,h,-l	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	2993	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.92% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

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	AAA	1.19	0/1246	1.31	4/1669 (0.2%)
2	BBB	1.13	0/199	1.31	0/261
All	All	1.18	0/1445	1.31	4/1930 (0.2%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	AAA	83[A]	GLU	CB-CG-CD	6.65	123.90	112.60
1	AAA	83[A]	GLU	CA-CB-CG	5.83	125.76	114.10
1	AAA	9	GLN	CA-C-O	-5.13	114.99	120.42
1	AAA	65	ASP	CA-CB-CG	5.10	117.70	112.60

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	AAA	1210	1151	1152	12	0
2	BBB	190	221	222	1	0
3	AAA	4	0	0	0	0
4	AAA	196	0	0	4	0
4	BBB	21	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	1621	1372	1374	12	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 (12) 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:AAA:72:MET:HE3	1:AAA:73:MET:HE3	1.57	0.85
1:AAA:15:GLU:OE1	2:BBB:13:ARG:NH1	2.21	0.73
1:AAA:110[B]:MET:HE1	1:AAA:122:VAL:HG22	1.79	0.64
1:AAA:72:MET:HE3	1:AAA:73:MET:CE	2.31	0.58
1:AAA:127[B]:ARG:HD3	4:AAA:439:HOH:O	2.05	0.55
1:AAA:110[B]:MET:HE1	1:AAA:122:VAL:CG2	2.38	0.53
1:AAA:110[B]:MET:CE	1:AAA:122:VAL:HG22	2.40	0.51
1:AAA:72:MET:HG2	1:AAA:73:MET:HE2	1.94	0.50
1:AAA:110[B]:MET:HE3	1:AAA:117:LEU:HB3	1.99	0.44
1:AAA:31:LYS:HE3	4:AAA:450:HOH:O	2.19	0.43
1:AAA:116[B]:LYS:HG2	4:AAA:391:HOH:O	2.19	0.41
1:AAA:81:ASP:HB2	4:AAA:411:HOH:O	2.21	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	AAA	153/149 (103%)	151 (99%)	2 (1%)	0	100	100
2	BBB	21/21 (100%)	21 (100%)	0	0	100	100
All	All	174/170 (102%)	172 (99%)	2 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	AAA	134/128 (105%)	129 (96%)	5 (4%)	30	3
2	BBB	20/18 (111%)	20 (100%)	0	100	100
All	All	154/146 (106%)	149 (97%)	5 (3%)	38	4

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	25	ASP
1	AAA	81	ASP
1	AAA	83[A]	GLU
1	AAA	140[A]	GLU
1	AAA	140[B]	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 4 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 [i](#)

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	AAA	146/149 (97%)	1.59	44 (30%)  	8, 20, 41, 59	16 (10%)
2	BBB	21/21 (100%)	1.46	5 (23%)  	9, 18, 29, 34	2 (9%)
All	All	167/170 (98%)	1.57	49 (29%)  	8, 19, 41, 59	18 (10%)

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	AAA	80	THR	4.8
1	AAA	5	LEU	4.0
1	AAA	75	ARG	3.7
1	AAA	149	LYS	3.7
1	AAA	56	VAL	3.6
1	AAA	4[A]	GLN	3.5
1	AAA	79	ASP	3.5
1	AAA	131	ILE	3.4
1	AAA	147	THR	3.2
1	AAA	66	PHE	3.2
1	AAA	83[A]	GLU	3.2
1	AAA	81	ASP	3.2
1	AAA	58	ALA	3.2
1	AAA	74	ALA	3.1
1	AAA	143	VAL	3.0
1	AAA	60	GLY	2.8
1	AAA	62	GLY	2.7
1	AAA	57[A]	ASP	2.7
1	AAA	99	GLY	2.6
1	AAA	31	LYS	2.6
1	AAA	82[A]	SER	2.6
1	AAA	78	LYS	2.6
1	AAA	10	ILE	2.6
1	AAA	139	TYR	2.5

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Mol	Chain	Res	Type	RSRZ
2	BBB	4	VAL	2.5
1	AAA	148	ALA	2.5
1	AAA	93	PHE	2.5
1	AAA	11	ALA	2.5
1	AAA	86	ILE	2.5
1	AAA	47	ALA	2.5
1	AAA	89	ALA	2.5
1	AAA	63	THR	2.4
2	BBB	21	PHE	2.4
2	BBB	8	LEU	2.4
1	AAA	19	LEU	2.4
1	AAA	70	LEU	2.4
1	AAA	16	ALA	2.4
1	AAA	6	THR	2.3
1	AAA	61	ASN	2.2
2	BBB	5	TRP	2.2
1	AAA	69	PHE	2.2
1	AAA	116[A]	LYS	2.2
1	AAA	13	PHE	2.1
1	AAA	106	LEU	2.1
1	AAA	127[A]	ARG	2.1
1	AAA	92	VAL	2.1
1	AAA	27	THR	2.0
2	BBB	15[A]	ARG	2.0
1	AAA	59	ASP	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 ⓘ

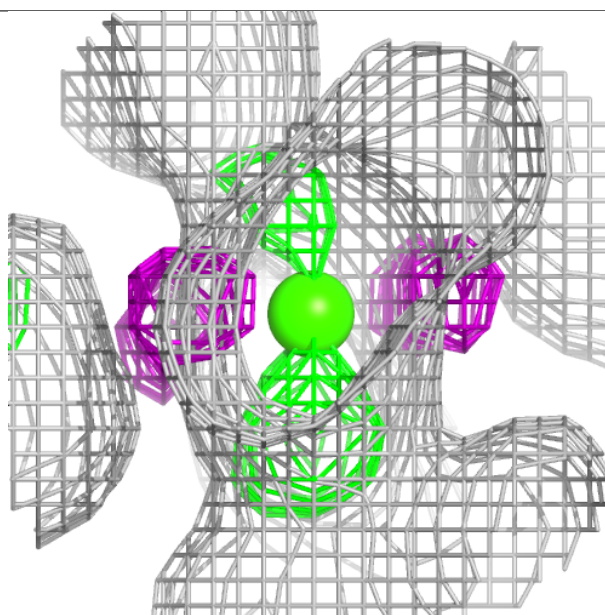
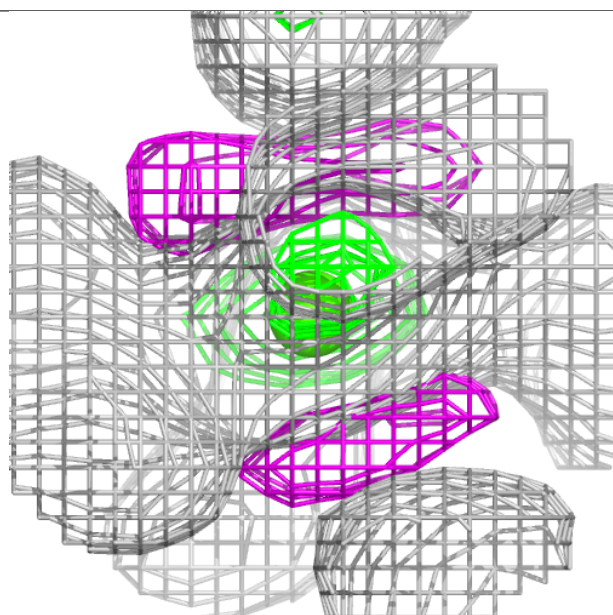
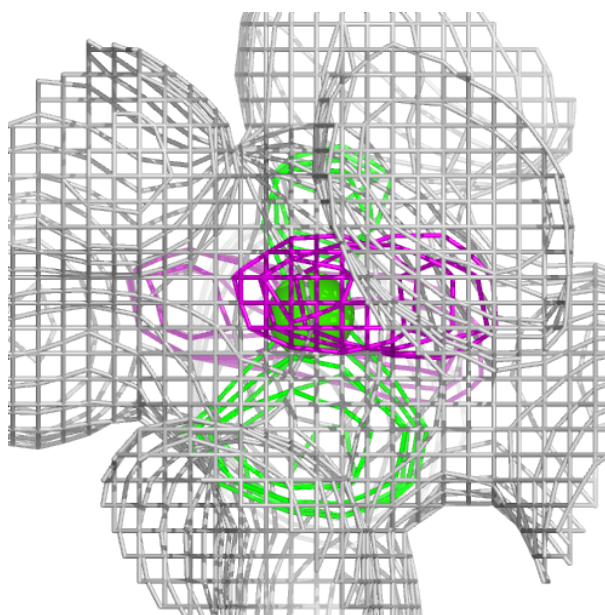
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	CA	AAA	202	1/1	0.83	0.11	25,25,25,25	0
3	CA	AAA	201	1/1	0.84	0.10	18,18,18,18	0
3	CA	AAA	204	1/1	0.85	0.12	16,16,16,16	0
3	CA	AAA	203	1/1	0.89	0.12	15,15,15,15	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.

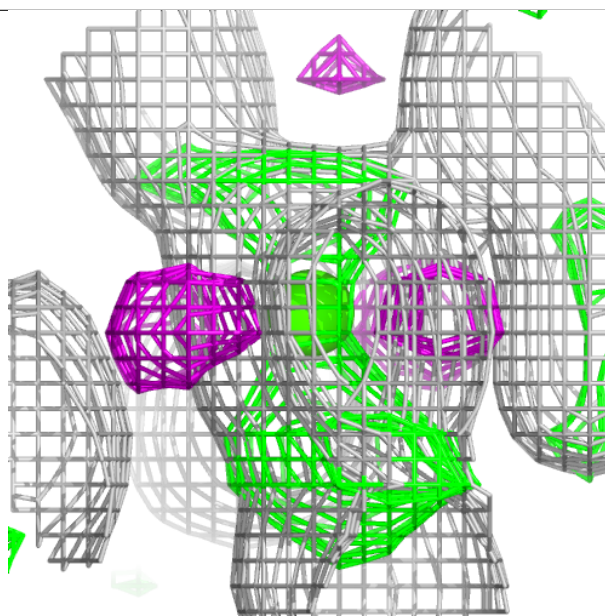
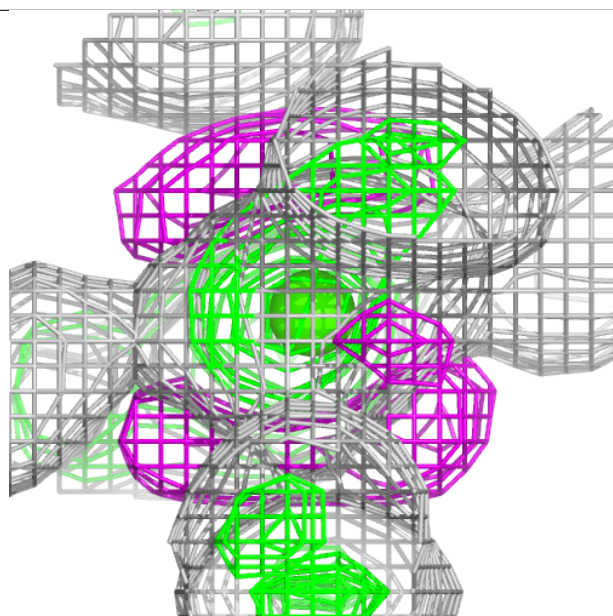
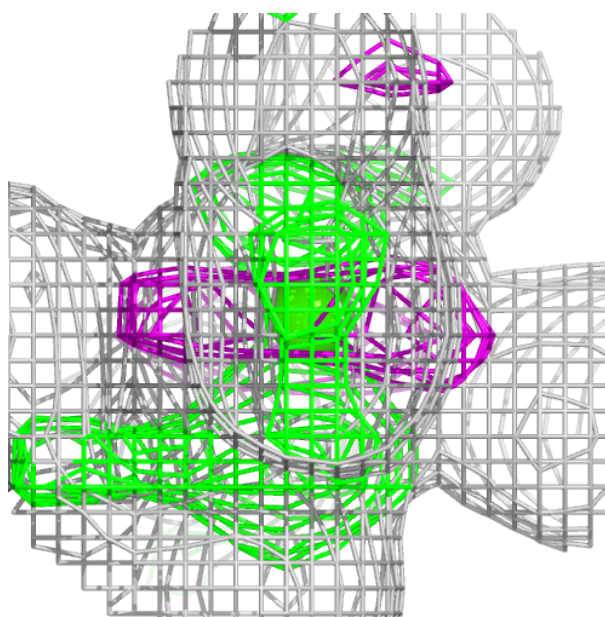
Electron density around CA AAA 202:

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



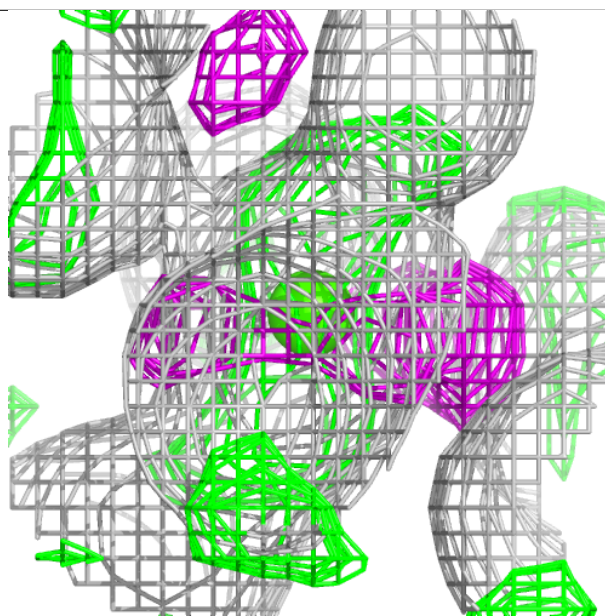
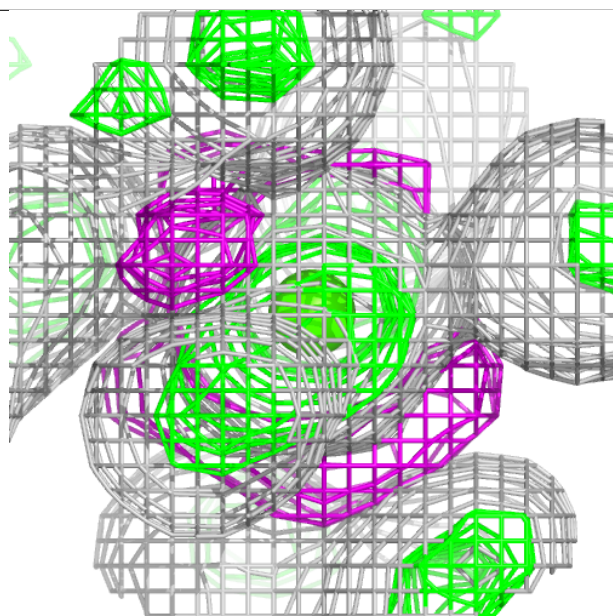
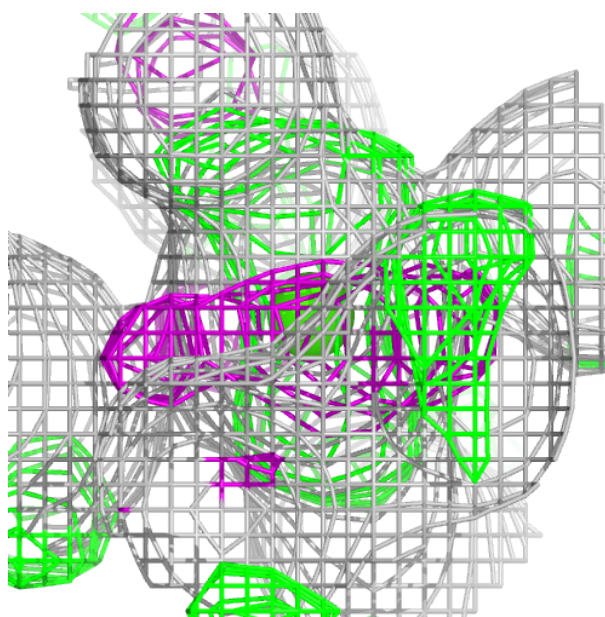
Electron density around CA AAA 201:

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



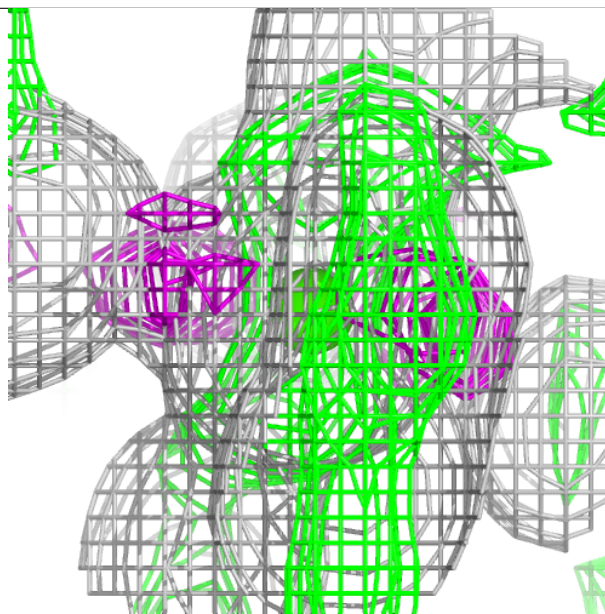
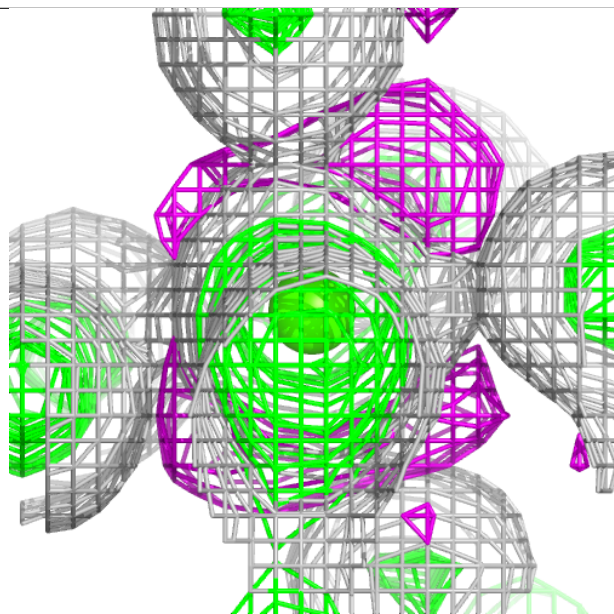
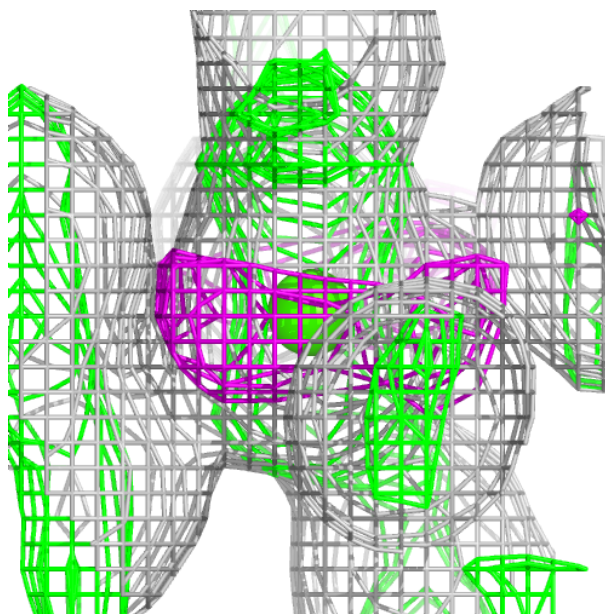
Electron density around CA AAA 204:

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



Electron density around CA AAA 203:

$2mF_o-DF_c$ (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.