



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 18, 2024 – 12:51 PM JST

PDB ID : 6IFQ  
Title : Crystal structure of a standalone versatile EAL protein from *Vibrio cholerae* O395 - Apo form  
Authors : Yadav, M.; Pal, K.; Sen, U.  
Deposited on : 2018-09-20  
Resolution : 1.95 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  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

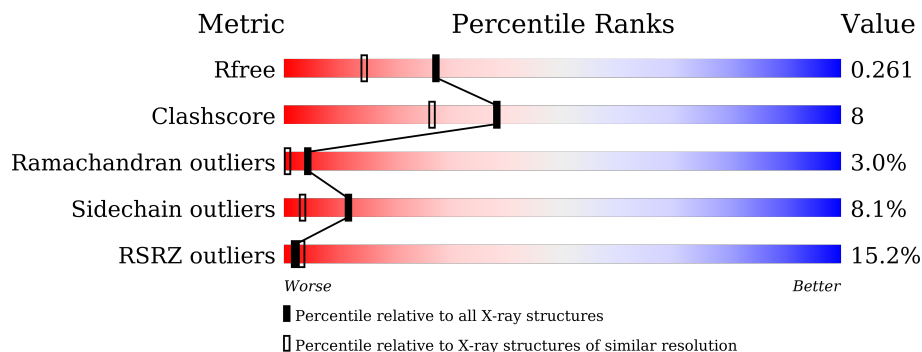
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.95 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	2580 (1.96-1.96)
Clashscore	141614	2705 (1.96-1.96)
Ramachandran outliers	138981	2678 (1.96-1.96)
Sidechain outliers	138945	2678 (1.96-1.96)
RSRZ outliers	127900	2539 (1.96-1.96)

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	257	
1	B	257	

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3844 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 cyclic di nucleotide phosphodiesterase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	237	1895	1215	316	354	10	0	0	0
1	A	237	1895	1215	316	354	10	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	15	SER	CYS	engineered mutation	UNP A0A0H3AJ04
A	15	SER	CYS	engineered mutation	UNP A0A0H3AJ04

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Ca	0	0
			1	1		
2	A	1	Total	Ca	0	0
			1	1		

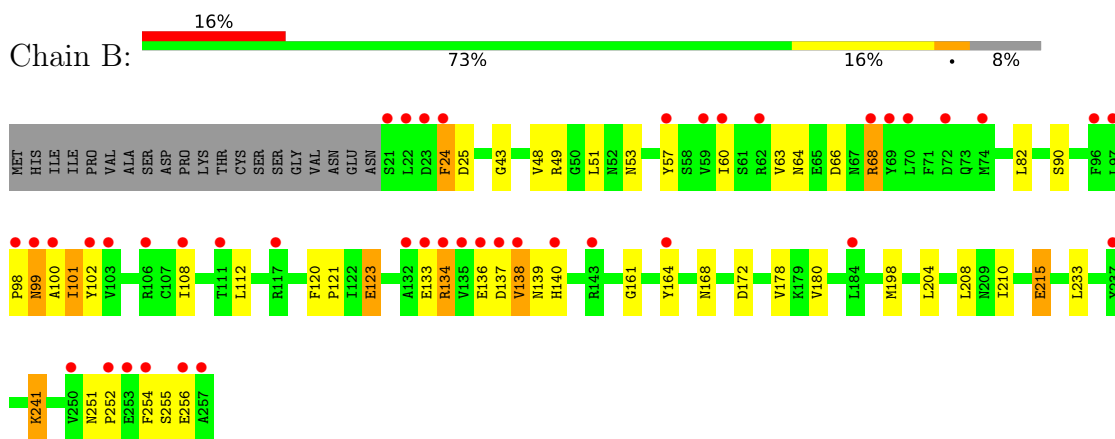
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	29	Total	O	0	0
			29	29		
3	A	23	Total	O	0	0
			23	23		

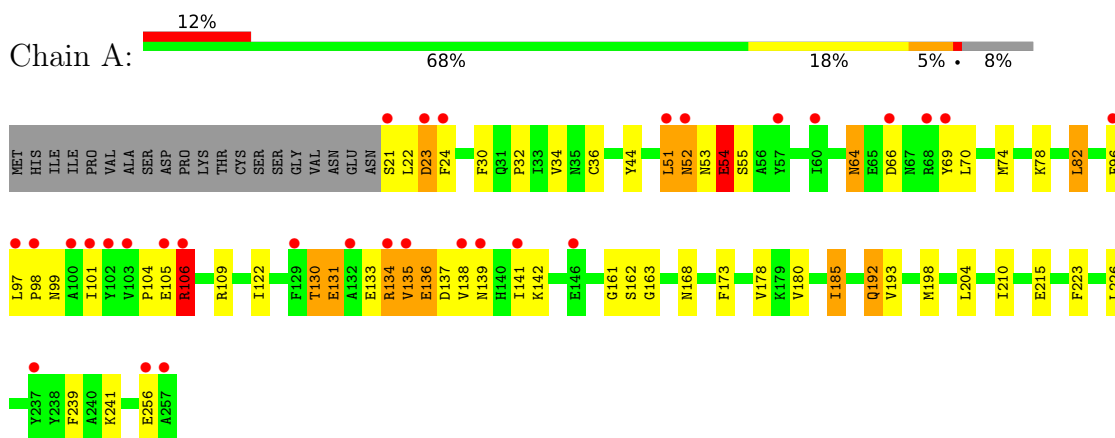
### 3 Residue-property plots [i](#)

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: cyclic di nucleotide phosphodiesterase



- Molecule 1: cyclic di nucleotide phosphodiesterase



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	157.70Å 42.81Å 73.57Å 90.00° 94.61° 90.00°	Depositor
Resolution (Å)	51.59 – 1.95 78.60 – 1.95	Depositor EDS
% Data completeness (in resolution range)	97.8 (51.59-1.95) 98.4 (78.60-1.95)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.26 (at 1.95Å)	Xtrriage
Refinement program	PHENIX 1.9_1692	Depositor
R, $R_{free}$	0.207 , 0.258 0.216 , 0.261	Depositor DCC
$R_{free}$ test set	1838 reflections (5.17%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	39.4	Xtrriage
Anisotropy	0.875	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 62.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	3844	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	83.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.63% 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 [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	A	0.36	0/1934	0.50	0/2613
1	B	0.37	0/1934	0.49	0/2613
All	All	0.37	0/3868	0.49	0/5226

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 [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	A	1895	0	1871	34	0
1	B	1895	0	1871	27	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	23	0	0	0	0
3	B	29	0	0	0	0
All	All	3844	0	3742	57	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 8.

All (57) 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:137:ASP:O	1:A:139:ASN:N	2.23	0.71
1:A:130:THR:OG1	1:A:131:GLU:N	2.23	0.70
1:A:135:VAL:O	1:A:137:ASP:N	2.24	0.70
1:A:97:LEU:O	1:A:99:ASN:N	2.20	0.69
1:B:178:VAL:HG23	1:B:210:ILE:HG21	1.78	0.65
1:A:52:ASN:O	1:A:54:GLU:N	2.29	0.64
1:B:68:ARG:HD3	1:B:99:ASN:HD22	1.63	0.64
1:B:136:GLU:HB3	1:B:140:HIS:HB3	1.78	0.63
1:B:101:ILE:HG13	1:B:102:TYR:H	1.64	0.62
1:B:25:ASP:HB3	1:B:51:LEU:HD11	1.84	0.60
1:A:139:ASN:HA	1:A:142:LYS:HB3	1.83	0.60
1:A:52:ASN:OD1	1:A:52:ASN:N	2.20	0.60
1:A:162:SER:OG	1:A:163:GLY:N	2.33	0.59
1:A:104:PRO:O	1:A:106:ARG:N	2.35	0.57
1:A:64:ASN:HD22	1:A:66:ASP:H	1.52	0.55
1:B:137:ASP:O	1:B:139:ASN:N	2.34	0.55
1:A:74:MET:HG3	1:A:78:LYS:HE2	1.91	0.52
1:B:64:ASN:HD22	1:B:66:ASP:H	1.56	0.52
1:B:180:VAL:HG11	1:B:198:MET:HE1	1.92	0.50
1:A:178:VAL:HG23	1:A:210:ILE:HG21	1.93	0.49
1:B:134:ARG:HB2	1:B:164:TYR:CE1	2.48	0.49
1:A:130:THR:HG1	1:A:131:GLU:H	1.60	0.49
1:A:133:GLU:O	1:A:136:GLU:HG2	2.13	0.48
1:A:30:PHE:HE2	1:A:82:LEU:HD13	1.79	0.47
1:A:134:ARG:HG3	1:A:135:VAL:N	2.30	0.47
1:B:57:TYR:HA	1:B:60:ILE:HG22	1.97	0.46
1:B:134:ARG:NH1	1:A:131:GLU:OE2	2.44	0.46
1:B:138:VAL:HG11	1:B:172:ASP:HB2	1.98	0.45
1:B:180:VAL:O	1:B:215:GLU:HG3	2.16	0.45
1:A:34:VAL:HG21	1:A:239:PHE:CE1	2.51	0.45
1:A:32:PRO:HB3	1:A:44:TYR:CE2	2.51	0.45
1:B:161:GLY:O	1:A:168:ASN:HB3	2.17	0.45
1:A:51:LEU:H	1:A:51:LEU:HD22	1.81	0.45
1:B:241:LYS:H	1:B:241:LYS:HD2	1.82	0.44
1:A:185:ILE:HG13	1:A:226:LEU:HD11	1.97	0.44
1:A:22:LEU:HD12	1:A:70:LEU:HD22	1.98	0.44
1:A:36:CYS:HG	1:A:223:PHE:HE1	1.65	0.44
1:B:48:VAL:O	1:B:49:ARG:HD2	2.17	0.44
1:B:168:ASN:HB3	1:A:161:GLY:O	2.17	0.44
1:B:108:ILE:O	1:B:112:LEU:HG	2.18	0.44
1:A:22:LEU:HB3	1:A:23:ASP:H	1.58	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:208:LEU:HD23	1:B:208:LEU:HA	1.87	0.43
1:B:24:PHE:HZ	1:B:63:VAL:HG12	1.83	0.42
1:A:69:TYR:HB2	1:A:101:ILE:HG23	2.00	0.42
1:B:252:PRO:HA	1:B:255:SER:OG	2.19	0.42
1:A:192:GLN:CD	1:A:192:GLN:H	2.23	0.42
1:A:52:ASN:HB2	1:A:55:SER:OG	2.20	0.42
1:B:98:PRO:O	1:B:100:ALA:N	2.53	0.42
1:A:180:VAL:HG11	1:A:198:MET:CE	2.50	0.42
1:A:142:LYS:HG3	1:A:173:PHE:HB3	2.01	0.41
1:B:123:GLU:CD	1:B:123:GLU:H	2.24	0.41
1:B:43:GLY:HA2	1:B:90:SER:OG	2.20	0.41
1:A:82:LEU:HD23	1:A:82:LEU:HA	1.86	0.41
1:B:241:LYS:H	1:B:241:LYS:CD	2.34	0.41
1:A:180:VAL:HG11	1:A:198:MET:HE1	2.03	0.40
1:B:208:LEU:HD21	1:A:193:VAL:HG13	2.01	0.40
1:B:120:PHE:HA	1:B:121:PRO:HD3	1.87	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	235/257 (91%)	209 (89%)	15 (6%)	11 (5%)	<b>2</b> <b>0</b>
1	B	235/257 (91%)	218 (93%)	14 (6%)	3 (1%)	<b>12</b> <b>3</b>
All	All	470/514 (91%)	427 (91%)	29 (6%)	14 (3%)	<b>4</b> <b>0</b>

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	101	ILE
1	A	53	ASN

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Mol	Chain	Res	Type
1	A	54	GLU
1	A	136	GLU
1	A	138	VAL
1	A	105	GLU
1	A	131	GLU
1	A	98	PRO
1	A	106	ARG
1	B	99	ASN
1	A	23	ASP
1	A	24	PHE
1	A	135	VAL
1	B	138	VAL

### 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	204/222 (92%)	185 (91%)	19 (9%)	9	2
1	B	204/222 (92%)	190 (93%)	14 (7%)	15	5
All	All	408/444 (92%)	375 (92%)	33 (8%)	11	3

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	24	PHE
1	B	53	ASN
1	B	68	ARG
1	B	82	LEU
1	B	123	GLU
1	B	133	GLU
1	B	134	ARG
1	B	204	LEU
1	B	215	GLU
1	B	233	LEU
1	B	241	LYS

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Mol	Chain	Res	Type
1	B	251	ASN
1	B	254	PHE
1	B	256	GLU
1	A	21	SER
1	A	51	LEU
1	A	52	ASN
1	A	54	GLU
1	A	64	ASN
1	A	82	LEU
1	A	96	PHE
1	A	106	ARG
1	A	109	ARG
1	A	122	ILE
1	A	130	THR
1	A	134	ARG
1	A	141	ILE
1	A	185	ILE
1	A	192	GLN
1	A	204	LEU
1	A	215	GLU
1	A	241	LYS
1	A	256	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	64	ASN
1	B	99	ASN
1	B	174	GLN
1	B	251	ASN
1	A	64	ASN
1	A	192	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](#)

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	237/257 (92%)	0.86	30 (12%) <b>3</b> <b>6</b>	41, 70, 157, 175	0
1	B	237/257 (92%)	0.94	42 (17%) <b>1</b> <b>1</b>	40, 68, 152, 180	0
All	All	474/514 (92%)	0.90	72 (15%) <b>2</b> <b>3</b>	40, 70, 155, 180	0

All (72) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	257	ALA	9.5
1	B	135	VAL	8.0
1	A	132	ALA	7.4
1	A	101	ILE	7.3
1	A	103	VAL	6.6
1	B	69	TYR	6.3
1	B	23	ASP	6.1
1	B	70	LEU	6.1
1	A	69	TYR	6.0
1	A	237	TYR	5.8
1	B	138	VAL	5.7
1	A	139	ASN	5.0
1	A	24	PHE	4.8
1	B	136	GLU	4.8
1	B	103	VAL	4.7
1	B	102	TYR	4.6
1	B	106	ARG	4.5
1	A	23	ASP	4.3
1	B	24	PHE	4.3
1	A	98	PRO	4.3
1	A	100	ALA	3.8
1	A	134	ARG	3.8
1	B	98	PRO	3.7
1	B	97	LEU	3.7

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	B	132	ALA	3.6
1	B	22	LEU	3.5
1	A	141	ILE	3.4
1	A	68	ARG	3.4
1	A	96	PHE	3.4
1	B	21	SER	3.4
1	B	62	ARG	3.4
1	A	138	VAL	3.3
1	A	257	ALA	3.3
1	A	66	ASP	3.2
1	A	106	ARG	3.2
1	A	57	TYR	3.2
1	B	57	TYR	3.1
1	A	97	LEU	3.0
1	A	52	ASN	3.0
1	B	68	ARG	3.0
1	B	256	GLU	2.9
1	A	105	GLU	2.9
1	B	250	VAL	2.9
1	B	74	MET	2.8
1	B	143	ARG	2.8
1	A	102	TYR	2.7
1	B	117	ARG	2.7
1	B	254	PHE	2.5
1	B	253	GLU	2.5
1	A	60	ILE	2.5
1	A	129	PHE	2.5
1	B	111	THR	2.5
1	B	252	PRO	2.4
1	A	146	GLU	2.4
1	B	184	LEU	2.4
1	A	21	SER	2.3
1	B	99	ASN	2.3
1	B	237	TYR	2.3
1	B	60	ILE	2.3
1	A	256	GLU	2.3
1	B	164	TYR	2.3
1	B	59	VAL	2.2
1	B	72	ASP	2.2
1	B	96	PHE	2.2
1	B	134	ARG	2.2
1	B	108	ILE	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	133	GLU	2.1
1	A	51	LEU	2.1
1	B	137	ASP	2.1
1	B	140	HIS	2.1
1	A	135	VAL	2.0
1	B	100	ALA	2.0

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

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

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

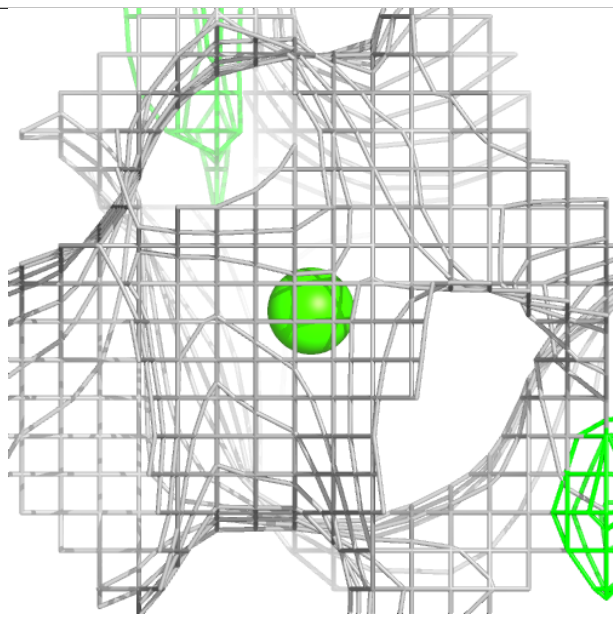
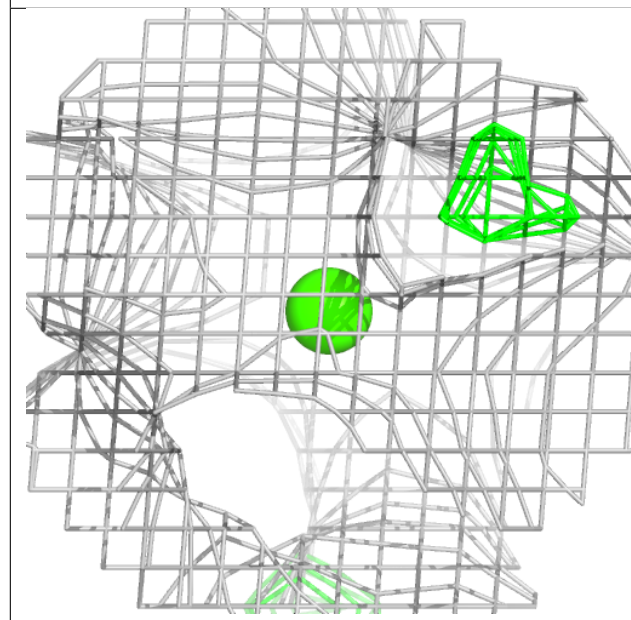
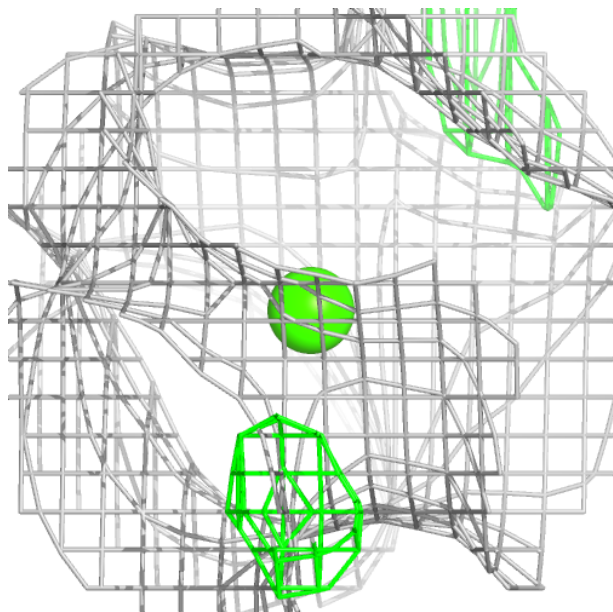
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

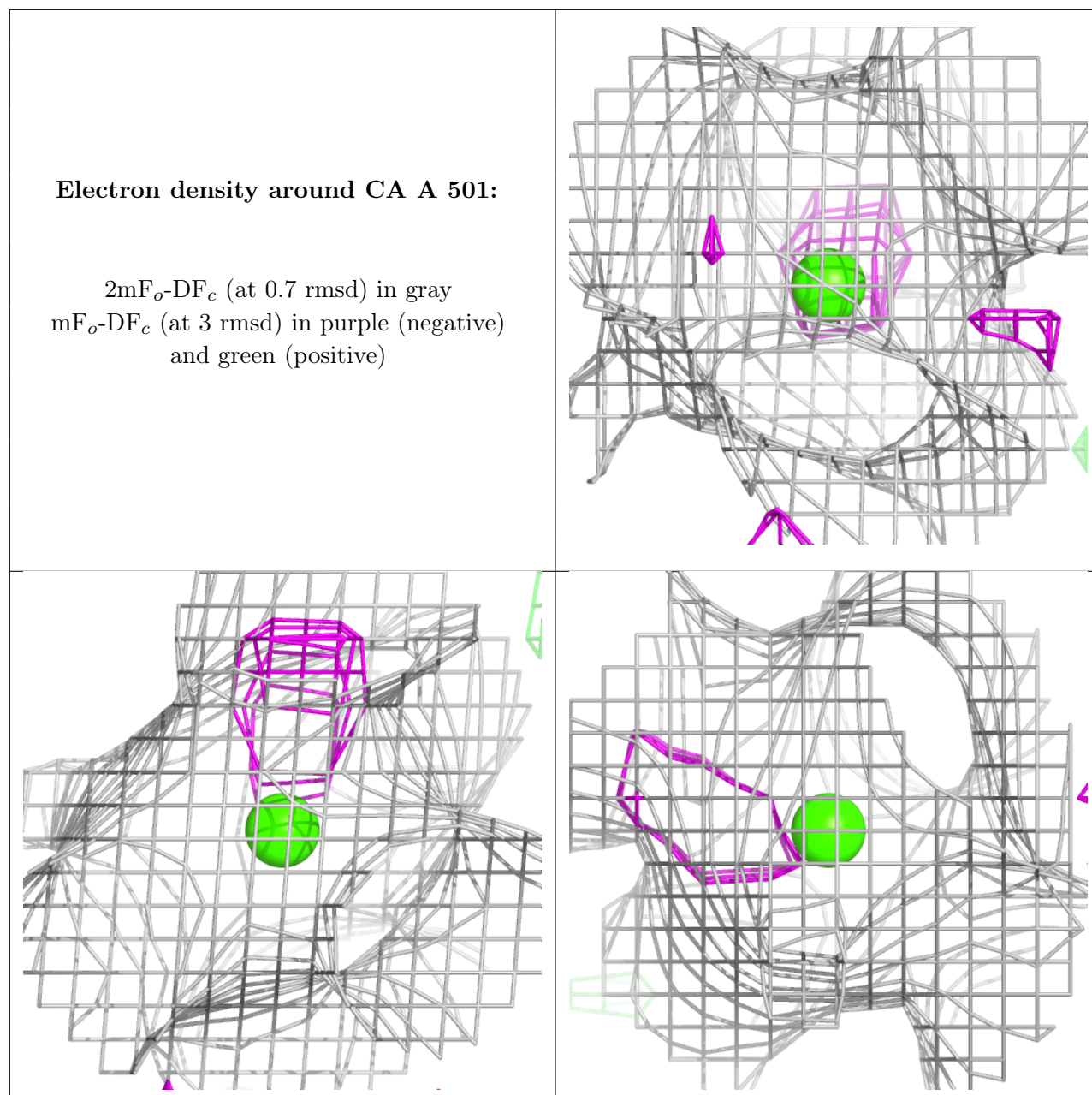
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	CA	B	301	1/1	0.94	0.06	59,59,59,59	0
2	CA	A	501	1/1	0.94	0.04	64,64,64,64	0

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 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)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.