wwPDB X-ray Structure Validation Summary Report (i)

May 19, 2022 – 04:11 pm BST

PDB ID	:	7NQF
Title	:	Prim-Pol Domain of CRISPR-associated Prim-Pol (CAPP) from Marinitoga sp. 1137 with dsDNA
Authors	:	Li, A.W.H.; Doherty, A.J.
Deposited on	:	2021-03-01
Resolution	:	2.02 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

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

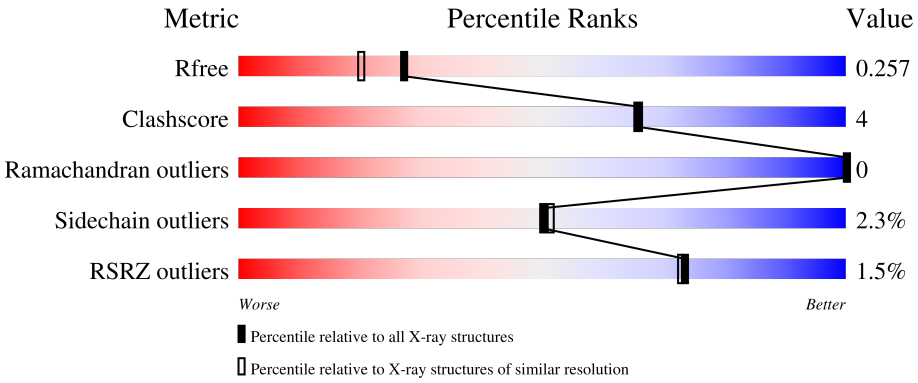
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.28.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.28.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.02 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	10434 (2.04-2.00)
Clashscore	141614	11643 (2.04-2.00)
Ramachandran outliers	138981	11493 (2.04-2.00)
Sidechain outliers	138945	11492 (2.04-2.00)
RSRZ outliers	127900	10220 (2.04-2.00)

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	219	85% 15%
1	B	219	% 88% 12%
2	C	6	83% 17%
2	D	6	100%
2	E	6	50% 33% 50% 17%

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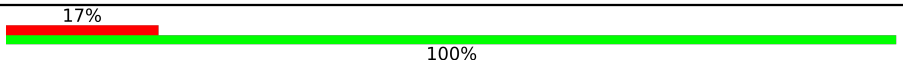
Mol	Chain	Length	Quality of chain
2	F	6	

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 4291 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 TPR_REGION domain-containing protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	218	Total	C	N	O	S	0	2	0
			1826	1180	313	330	3			
1	B	219	Total	C	N	O	S	0	0	0
			1807	1169	309	326	3			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	110	GLY	ALA	variant	UNP H2J4R1
A	148	GLN	HIS	variant	UNP H2J4R1
A	152	ASN	ASP	variant	UNP H2J4R1
A	214	THR	ILE	variant	UNP H2J4R1
A	319	ASN	ASP	variant	UNP H2J4R1
B	110	GLY	ALA	variant	UNP H2J4R1
B	148	GLN	HIS	variant	UNP H2J4R1
B	152	ASN	ASP	variant	UNP H2J4R1
B	214	THR	ILE	variant	UNP H2J4R1
B	319	ASN	ASP	variant	UNP H2J4R1

- Molecule 2 is a DNA chain called DNA(CGTGDG).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	6	Total	C	N	O	P	0	0	0
			121	58	23	35	5			
2	D	6	Total	C	N	O	P	0	0	0
			121	58	23	35	5			
2	E	6	Total	C	N	O	P	0	0	0
			121	58	23	35	5			
2	F	6	Total	C	N	O	P	0	0	0
			121	58	23	35	5			

- Molecule 3 is COBALT (II) ION (three-letter code: CO) (formula: Co) (labeled as "Ligand

of Interest" by depositor).

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

- Molecule 4 is water.

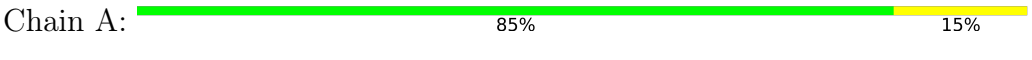
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	76	Total O 76 76	0	0
4	B	67	Total O 67 67	0	0
4	C	12	Total O 12 12	0	0
4	D	9	Total O 9 9	0	0
4	E	5	Total O 5 5	0	0
4	F	1	Total O 1 1	0	0

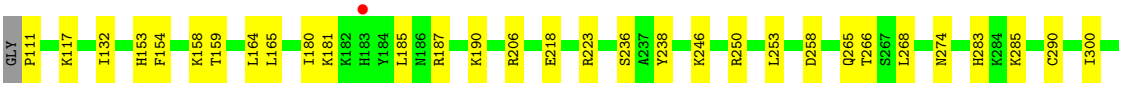
3 Residue-property plots (i)

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: TPR_REGION domain-containing protein

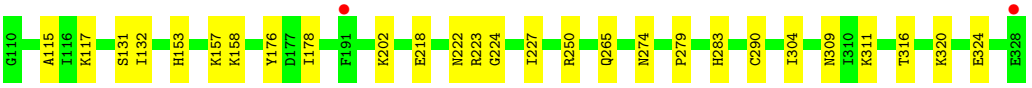
Chain A:





• Molecule 1: TPR_REGION domain-containing protein

Chain B:

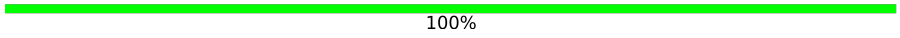


• Molecule 2: DNA(CGTGDG)

Chain C:

• Molecule 2: DNA(CGTGDG)

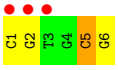
Chain D:



There are no outlier residues recorded for this chain.

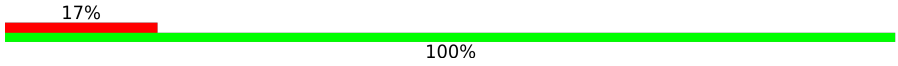
• Molecule 2: DNA(CGTGDG)

Chain E:



• Molecule 2: DNA(CGTGDG)

Chain F:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	77.04Å 160.36Å 39.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	69.44 – 2.02 69.44 – 2.02	Depositor EDS
% Data completeness (in resolution range)	99.4 (69.44-2.02) 99.4 (69.44-2.02)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.04 (at 2.02Å)	Xtriage
Refinement program	PHENIX 1.19.1_4122	Depositor
R, R_{free}	0.212 , 0.259 0.210 , 0.257	Depositor DCC
R_{free} test set	1557 reflections (4.73%)	wwPDB-VP
Wilson B-factor (Å^2)	34.3	Xtriage
Anisotropy	0.449	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< \|L\| > = 0.51$, $< L^2 > = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	4291	wwPDB-VP
Average B, all atoms (Å^2)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.87% 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: CO, MLZ

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	0.44	0/1854	0.61	0/2489
1	B	0.44	0/1835	0.60	0/2465
2	C	0.88	0/135	1.11	1/207 (0.5%)
2	D	0.77	0/135	1.02	0/207
2	E	0.68	0/135	0.99	1/207 (0.5%)
2	F	0.64	0/135	0.82	0/207
All	All	0.49	0/4229	0.67	2/5782 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	E	5	DC	OP2-P-O3'	6.61	119.75	105.20
2	C	3	DT	O4'-C1'-N1	6.07	112.25	108.00

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	1826	0	1821	16	0
1	B	1807	0	1798	16	0
2	C	121	0	69	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	121	0	69	0	0
2	E	121	0	69	2	0
2	F	121	0	69	0	0
3	A	2	0	0	0	0
3	B	2	0	0	0	0
4	A	76	0	0	1	0
4	B	67	0	0	1	0
4	C	12	0	0	0	0
4	D	9	0	0	0	0
4	E	5	0	0	0	0
4	F	1	0	0	0	0
All	All	4291	0	3895	32	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.

The worst 5 of 32 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:180:ILE:O	1:A:223:ARG:NH1	2.16	0.79
1:B:265:GLN:NE2	1:B:274:ASN:HD22	1.87	0.72
1:A:265:GLN:HE22	1:A:274:ASN:H	1.45	0.64
1:A:165:LEU:HB3	1:A:268:LEU:HD21	1.86	0.56
1:A:283:HIS:CE1	1:A:285:LYS:HB2	2.40	0.56

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	217/219 (99%)	214 (99%)	3 (1%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	216/219 (99%)	210 (97%)	6 (3%)	0	100	100
All	All	433/438 (99%)	424 (98%)	9 (2%)	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	A	196/198 (99%)	190 (97%)	6 (3%)	40	38
1	B	193/198 (98%)	189 (98%)	4 (2%)	53	55
All	All	389/396 (98%)	379 (97%)	10 (3%)	50	46

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	202	LYS
1	B	223	ARG
1	B	290	CYS
1	A	159[B]	THR
1	A	236	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	265	GLN
1	B	265	GLN
1	B	283	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues are 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	MLZ	B	277	1	8,9,10	0.84	0	4,9,11	0.70	0
1	MLZ	A	277	1	8,9,10	0.71	0	4,9,11	0.91	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	MLZ	B	277	1	-	3/7/8/10	-
1	MLZ	A	277	1	-	0/7/8/10	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	277	MLZ	CD-CE-NZ-CM
1	B	277	MLZ	CE-CD-CG-CB
1	B	277	MLZ	CG-CD-CE-NZ

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 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, 95^{th} 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	217/219 (99%)	-0.02	1 (0%) 91 91	25, 38, 53, 67	0
1	B	218/219 (99%)	-0.03	2 (0%) 84 83	28, 38, 57, 91	0
2	C	6/6 (100%)	-0.44	0 100 100	33, 35, 43, 47	0
2	D	6/6 (100%)	-0.39	0 100 100	34, 41, 47, 56	0
2	E	6/6 (100%)	1.66	3 (50%) 0 0	50, 102, 161, 172	0
2	F	6/6 (100%)	0.58	1 (16%) 1 1	65, 72, 114, 133	0
All	All	459/462 (99%)	-0.01	7 (1%) 73 73	25, 39, 61, 172	0

The worst 5 of 7 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	328	GLU	4.6
2	E	1	DC	4.5
1	B	191	PHE	2.8
2	E	2	DG	2.8
2	F	6	DG	2.6

6.2 Non-standard residues in protein, DNA, RNA chains

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^{th} 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
1	MLZ	A	277	10/11	0.92	0.13	22,29,45,47	0
1	MLZ	B	277	10/11	0.93	0.12	30,35,52,55	0

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

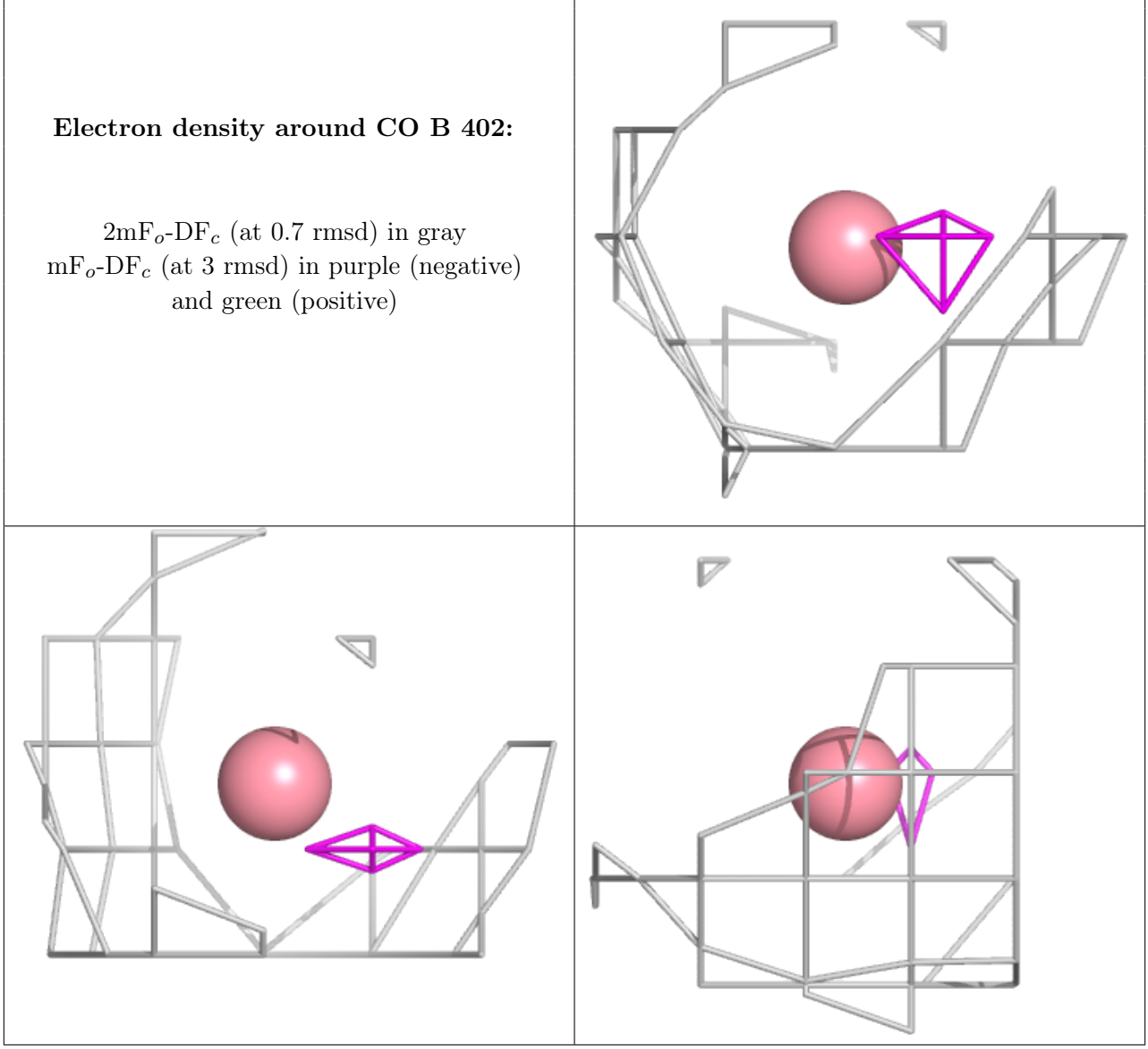
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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
3	CO	B	402	1/1	0.87	0.09	76,76,76,76	0
3	CO	A	401	1/1	0.92	0.12	68,68,68,68	0
3	CO	B	401	1/1	0.98	0.12	43,43,43,43	0
3	CO	A	402	1/1	0.98	0.10	53,53,53,53	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.

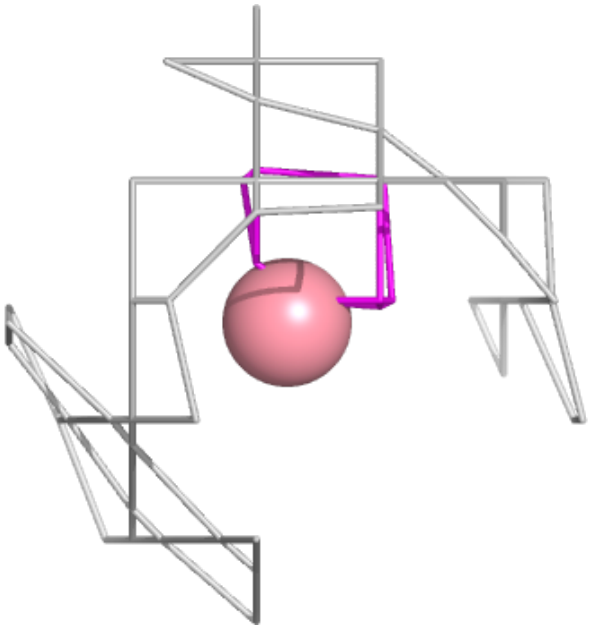
Electron density around CO B 402:

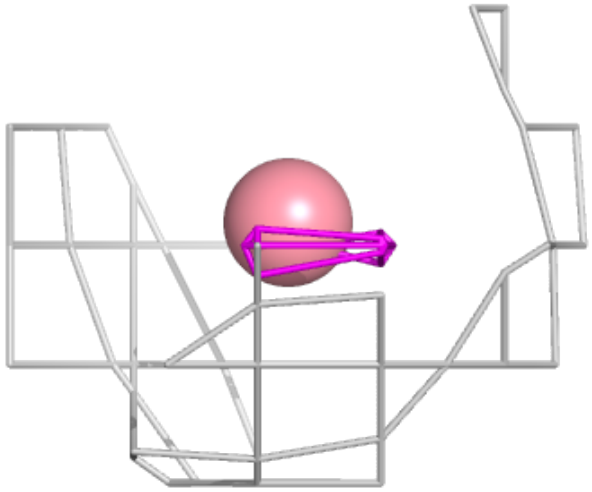
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

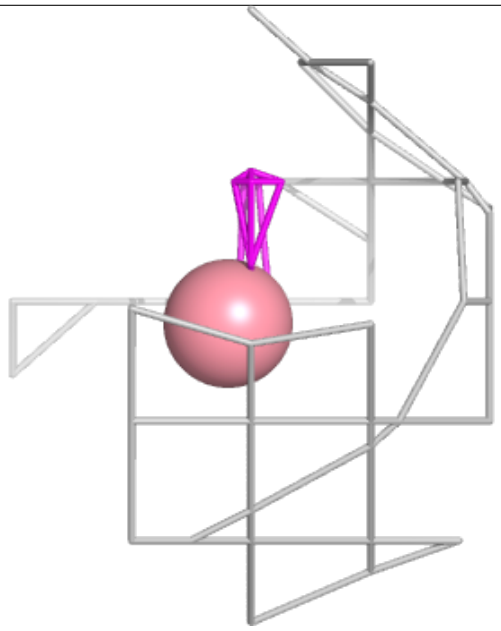


Electron density around CO A 401:

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

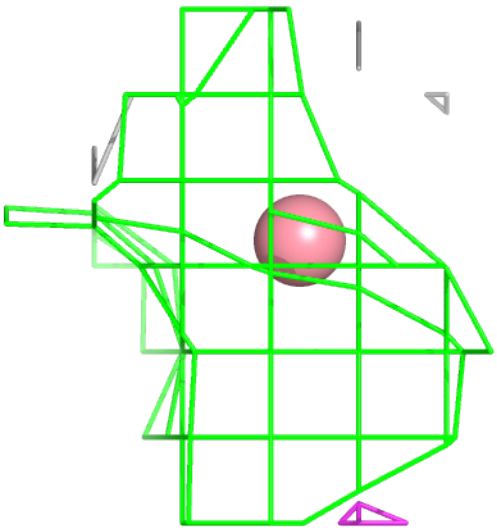


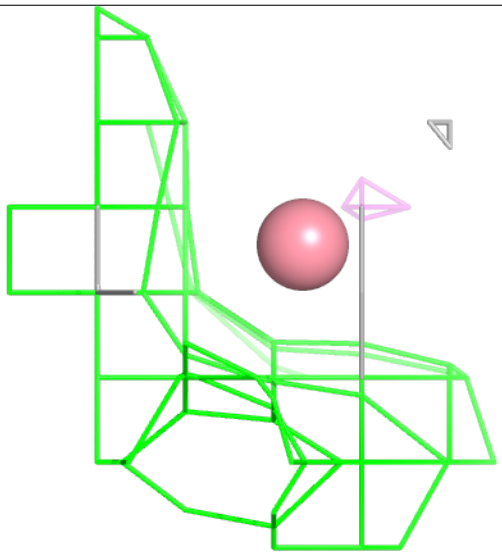


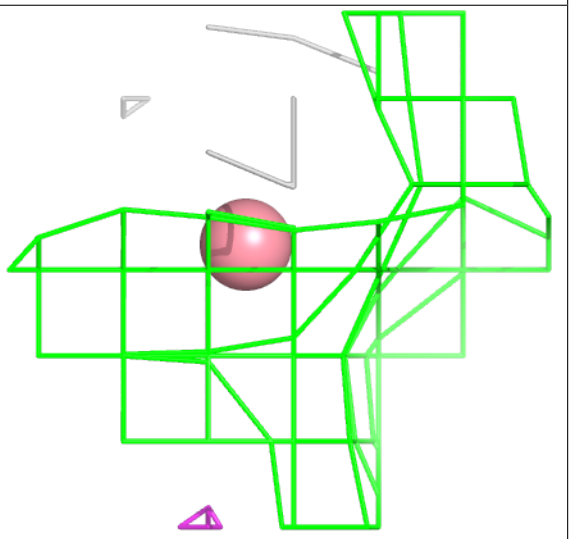


Electron density around CO B 401:

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

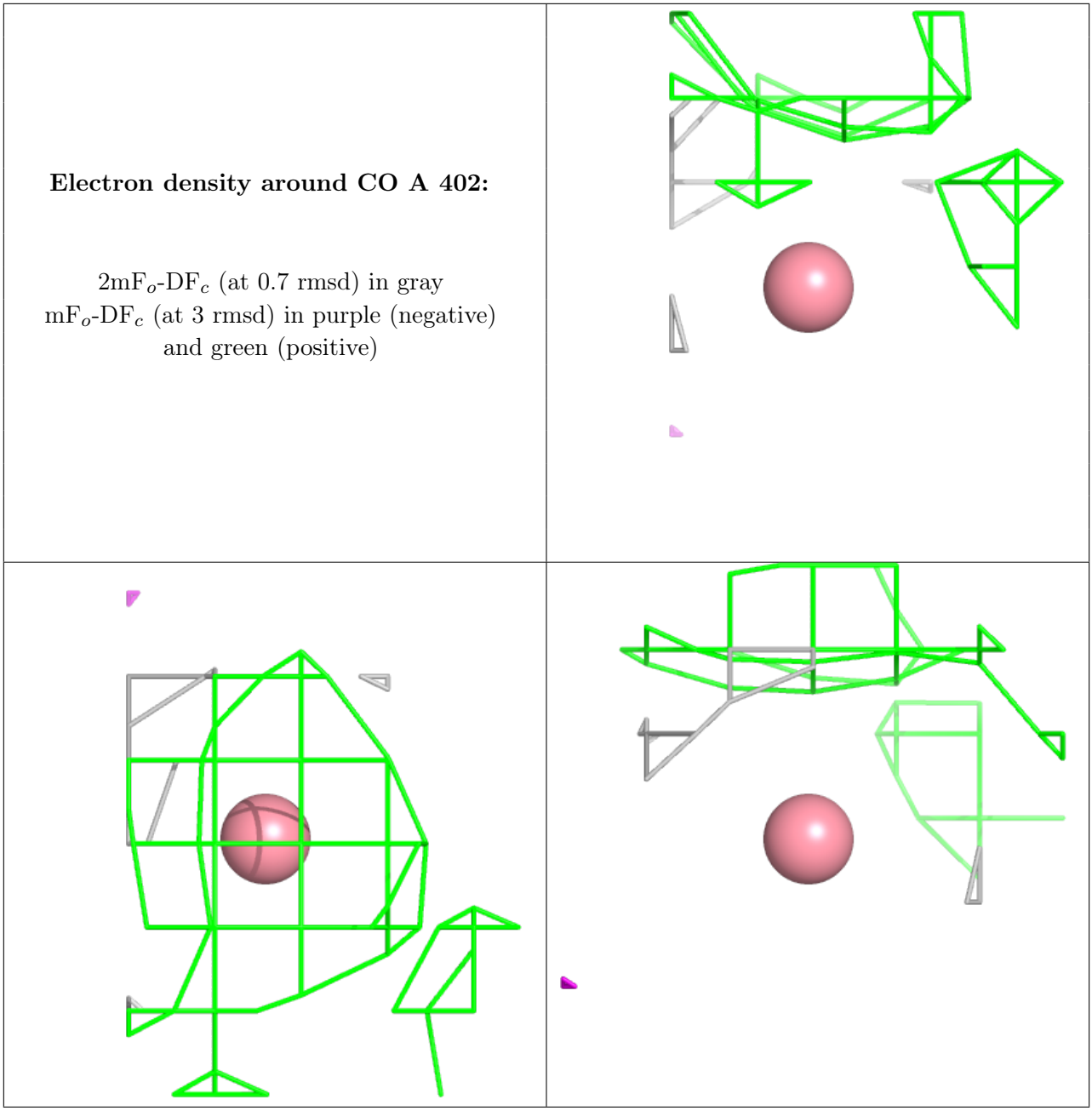






Electron density around CO A 402:

$2mF_o$-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.