



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 15, 2026 – 10:39 AM UTC

PDB ID : 8AAS / pdb_00008aas
Title : Crystal structure of the Pyrococcus abyssi RPA trimerization core bound to poly-dT20 ssDNA
Authors : Madru, C.; Legrand, P.; Sauguet, L.
Deposited on : 2022-07-01
Resolution : 3.20 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
Xtrriage (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

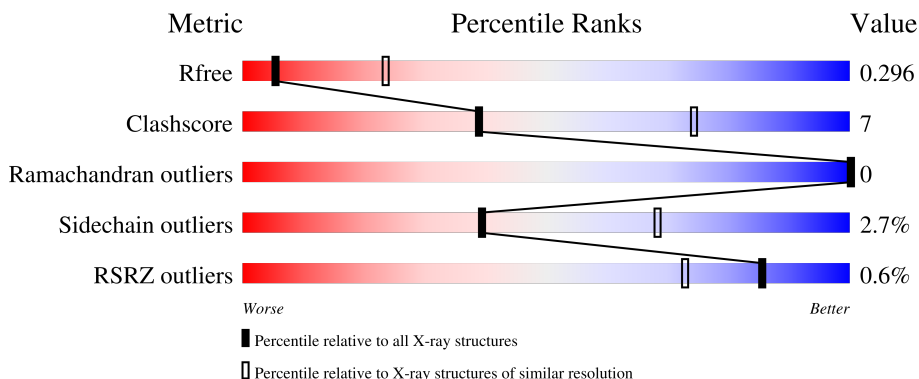
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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	1466 (3.20-3.20)
Clashscore	190562	1573 (3.20-3.20)
Ramachandran outliers	187476	1548 (3.20-3.20)
Sidechain outliers	187428	1547 (3.20-3.20)
RSRZ outliers	180081	1466 (3.20-3.20)

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	A	295	
2	B	183	
3	C	122	
4	F	20	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 4057 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 Replication factor A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	173	1389	879	233	272	5	0	0	0

- Molecule 2 is a protein called RPA32 subunit of the hetero-oligomeric complex involved in homologous recombination.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	178	1457	947	244	263	3	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	initiating methionine	UNP Q9V1Z1
B	1	SER	-	expression tag	UNP Q9V1Z1

- Molecule 3 is a protein called RPA14 subunit of the hetero-oligomeric complex involved in homologous recombination.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	113	925	583	165	175	2	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-4	GLY	-	expression tag	UNP Q9V1Z0
C	-3	THR	-	expression tag	UNP Q9V1Z0
C	-2	GLY	-	expression tag	UNP Q9V1Z0
C	-1	ASP	-	expression tag	UNP Q9V1Z0
C	0	GLY	-	expression tag	UNP Q9V1Z0
C	1	SER	-	expression tag	UNP Q9V1Z0

- Molecule 4 is a DNA chain called DNA (5'-D(P*TP*TP*TP*TP*TP*TP*TP*TP*TP*TP*TP*TP*TP*TP*T)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	F	14	280	140	28	98	14	0	0	0

- Molecule 5 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

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

- Molecule 6 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	3	Total	Ca	0	0
			3	3		
6	B	1	Total	Ca	0	0
			1	1		
6	C	1	Total	Ca	0	0
			1	1		

4 Data and refinement statistics i

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α , β , γ	75.23Å 75.23Å 215.49Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	48.26 – 3.20 48.26 – 3.20	Depositor EDS
% Data completeness (in resolution range)	81.5 (48.26-3.20) 81.5 (48.26-3.20)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.37 (at 3.19Å)	Xtrriage
Refinement program	BUSTER 2.10.4 (3-FEB-2022)	Depositor
R, R_{free}	0.264 , 0.293 0.269 , 0.296	Depositor DCC
R_{free} test set	621 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	146.9	Xtrriage
Anisotropy	0.060	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 110.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	0.056 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	4057	wwPDB-VP
Average B, all atoms (Å ²)	173.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.12% 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: ZN, 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	0.63	0/1408	0.95	0/1893
2	B	0.68	0/1484	1.01	3/1996 (0.2%)
3	C	0.77	0/936	0.97	1/1259 (0.1%)
4	F	0.44	0/307	0.81	0/472
All	All	0.67	0/4135	0.97	4/5620 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	76	LEU	N-CA-C	5.85	118.94	109.40
2	B	82	THR	CA-C-N	5.72	127.94	120.28
2	B	82	THR	C-N-CA	5.72	127.94	120.28
3	C	46	ASP	CA-CB-CG	5.63	118.23	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	A	1389	0	1393	25	0
2	B	1457	0	1512	18	0
3	C	925	0	948	16	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	F	280	0	169	19	0
5	A	1	0	0	0	0
6	A	3	0	0	0	0
6	B	1	0	0	0	0
6	C	1	0	0	0	0
All	All	4057	0	4022	55	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 7.

All (55) 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:211:ARG:NH2	4:F:3:DT:H3	1.51	1.06
1:A:223:LYS:HG2	4:F:2:DT:H4'	1.52	0.91
1:A:224:LYS:HB2	4:F:3:DT:O5'	1.86	0.75
1:A:223:LYS:HZ2	4:F:2:DT:H5'	1.52	0.74
2:B:9:ARG:NH1	2:B:125:HIS:ND1	2.36	0.73
2:B:29:PRO:HA	4:F:10:DT:OP1	1.89	0.73
2:B:51:ARG:CZ	3:C:8:ARG:HH11	2.03	0.71
3:C:8:ARG:NH2	3:C:25:ARG:HH22	1.89	0.69
2:B:51:ARG:NH2	3:C:8:ARG:NH1	2.43	0.67
1:A:311:ILE:HG22	2:B:113:GLY:HA3	1.76	0.66
1:A:206:ILE:HD13	1:A:310:ILE:HD12	1.79	0.65
2:B:51:ARG:CZ	3:C:8:ARG:NH1	2.60	0.64
2:B:51:ARG:NH2	3:C:8:ARG:HH11	1.94	0.64
1:A:209:VAL:HG12	1:A:303:ALA:HB1	1.79	0.63
2:B:99:LYS:NZ	4:F:10:DT:OP2	2.30	0.62
3:C:15:LYS:HD3	3:C:48:THR:HG21	1.81	0.62
1:A:224:LYS:NZ	4:F:4:DT:OP1	2.33	0.59
1:A:357:VAL:HG13	3:C:107:LEU:HD11	1.84	0.58
3:C:8:ARG:CZ	3:C:25:ARG:HH22	2.16	0.58
2:B:36:TYR:CE2	2:B:133:LYS:NZ	2.73	0.56
1:A:211:ARG:HH22	4:F:3:DT:H3	0.71	0.55
1:A:265:LEU:HD22	1:A:269:ASP:HB3	1.89	0.55
2:B:118:HIS:HE2	3:C:91:ASP:HB2	1.72	0.55
3:C:8:ARG:HH21	3:C:25:ARG:HH22	1.53	0.55
1:A:224:LYS:N	4:F:3:DT:OP1	2.34	0.54
3:C:8:ARG:HE	3:C:25:ARG:NH2	2.08	0.52
1:A:206:ILE:HG21	1:A:310:ILE:HD12	1.92	0.51
3:C:8:ARG:NE	3:C:25:ARG:NH2	2.58	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:288:LEU:HD22	1:A:301:LYS:HD3	1.93	0.50
2:B:46:VAL:HG23	2:B:125:HIS:ND1	2.27	0.50
1:A:210:TYR:HE1	4:F:8:DT:OP1	1.95	0.49
4:F:4:DT:H2''	4:F:5:DT:C4'	2.41	0.49
3:C:73:ILE:CG2	3:C:80:HIS:CE1	2.95	0.49
3:C:73:ILE:HG21	3:C:80:HIS:CE1	2.48	0.48
1:A:223:LYS:HZ2	4:F:2:DT:C5'	2.22	0.47
1:A:224:LYS:H	4:F:3:DT:P	2.36	0.47
1:A:223:LYS:NZ	4:F:2:DT:H5'	2.27	0.47
3:C:8:ARG:NE	3:C:25:ARG:HH22	2.13	0.47
1:A:198:ARG:NH1	1:A:199:PHE:CZ	2.83	0.46
4:F:8:DT:H2''	4:F:9:DT:H5''	1.97	0.46
2:B:23:SER:HB3	2:B:28:GLU:HB2	1.98	0.45
1:A:221:CYS:HB3	1:A:239:HIS:HE1	1.81	0.45
4:F:4:DT:H2''	4:F:5:DT:H4'	2.01	0.43
2:B:55:ILE:HD11	2:B:86:LYS:HG2	1.99	0.43
2:B:54:LEU:HD23	2:B:63:LYS:HE2	2.00	0.43
4:F:12:DT:H2''	4:F:13:DT:OP1	2.19	0.43
1:A:223:LYS:NZ	4:F:2:DT:C5'	2.82	0.43
1:A:225:VAL:HG23	1:A:234:TRP:CE3	2.54	0.43
2:B:36:TYR:CE1	3:C:115:ILE:HD11	2.54	0.43
1:A:191:LYS:HD3	1:A:258:THR:HB	2.02	0.42
1:A:274:LEU:HD22	1:A:307:PHE:CD1	2.55	0.42
2:B:18:GLY:HA3	2:B:32:LEU:HD21	2.02	0.42
1:A:253:GLY:HA3	1:A:260:TYR:OH	2.21	0.41
2:B:76:LEU:CD2	4:F:13:DT:H72	2.50	0.41
2:B:55:ILE:CD1	2:B:86:LYS:HG2	2.51	0.41

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	171/295 (58%)	169 (99%)	2 (1%)	0	100	100
2	B	176/183 (96%)	172 (98%)	4 (2%)	0	100	100
3	C	111/122 (91%)	109 (98%)	2 (2%)	0	100	100
All	All	458/600 (76%)	450 (98%)	8 (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	149/258 (58%)	146 (98%)	3 (2%)	48	72
2	B	155/160 (97%)	149 (96%)	6 (4%)	28	62
3	C	101/107 (94%)	99 (98%)	2 (2%)	48	72
All	All	405/525 (77%)	394 (97%)	11 (3%)	39	68

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	199	PHE
1	A	297	GLU
1	A	310	ILE
2	B	3	LYS
2	B	22	LYS
2	B	57	GLU
2	B	89	ARG
2	B	97	ILE
2	B	169	LEU
3	C	38	MET
3	C	56	GLU

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

Mol	Chain	Res	Type
2	B	149	GLN
3	C	75	ASN
3	C	80	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](#)

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 6 ligands modelled in this entry, 6 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, 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	173/295 (58%)	-0.30	0 100 100	129, 182, 230, 238	0
2	B	178/183 (97%)	-0.22	3 (1%) 69 49	105, 152, 244, 251	0
3	C	113/122 (92%)	-0.36	0 100 100	118, 143, 214, 233	0
4	F	14/20 (70%)	-0.14	0 100 100	183, 200, 234, 237	0
All	All	478/620 (77%)	-0.28	3 (0%) 85 73	105, 168, 237, 251	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	37	ALA	2.7
2	B	43	ALA	2.6
2	B	100	ILE	2.5

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](#)

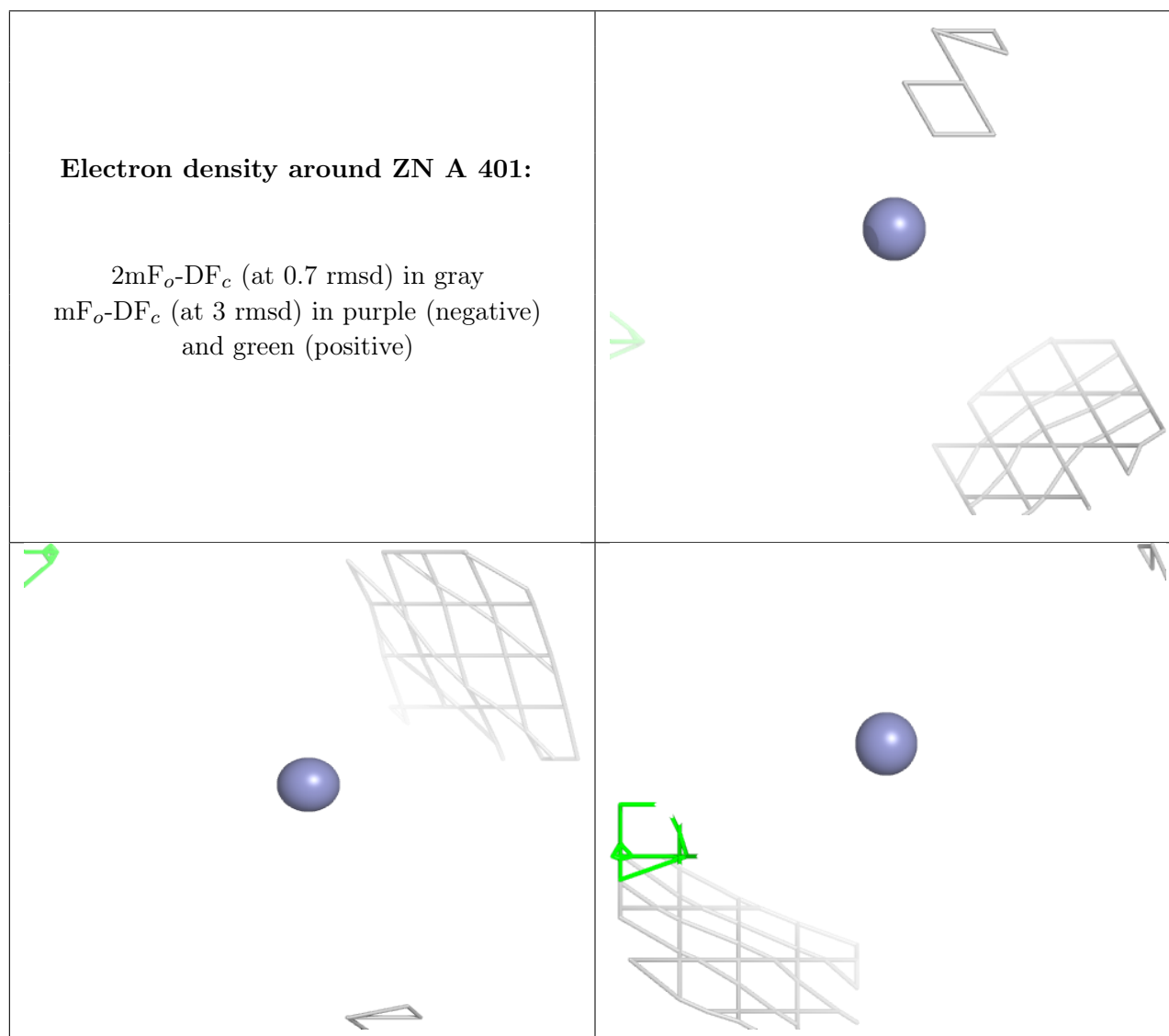
There are no oligosaccharides in this entry.

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, 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(\AA^2)	Q<0.9
6	CA	A	402	1/1	0.63	0.07	174,174,174,174	0
6	CA	A	403	1/1	0.76	0.08	180,180,180,180	0
6	CA	A	404	1/1	0.91	0.03	169,169,169,169	0
6	CA	B	201	1/1	0.91	0.09	121,121,121,121	0
5	ZN	A	401	1/1	0.96	0.04	255,255,255,255	0
6	CA	C	201	1/1	0.96	0.06	151,151,151,151	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.



6.5 Other polymers [\(i\)](#)

There are no such residues in this entry.