



wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 13, 2024 – 08:23 AM EDT

PDB ID : 2ZBU
Title : Crystal structure of uncharacterized conserved protein from *Thermotoga maritima*
Authors : Ebihara, A.; Fujimoto, Y.; Kagawa, W.; Fujikawa, N.; Yokoyama, S.; Kuramitsu, S.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on : 2007-10-30
Resolution : 2.10 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 ⓘ 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	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

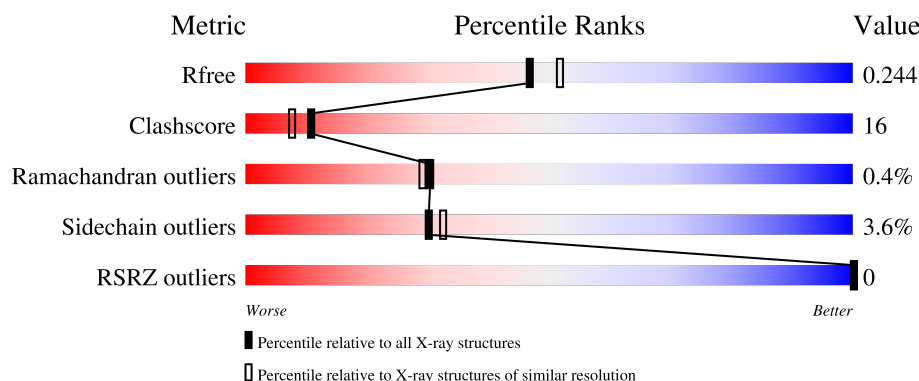
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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}	164625	6234 (2.10-2.10)
Clashscore	180529	6893 (2.10-2.10)
Ramachandran outliers	177936	6839 (2.10-2.10)
Sidechain outliers	177891	6840 (2.10-2.10)
RSRZ outliers	164620	6234 (2.10-2.10)

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	263	
1	B	263	
1	C	263	
1	D	263	

2 Entry composition [i](#)

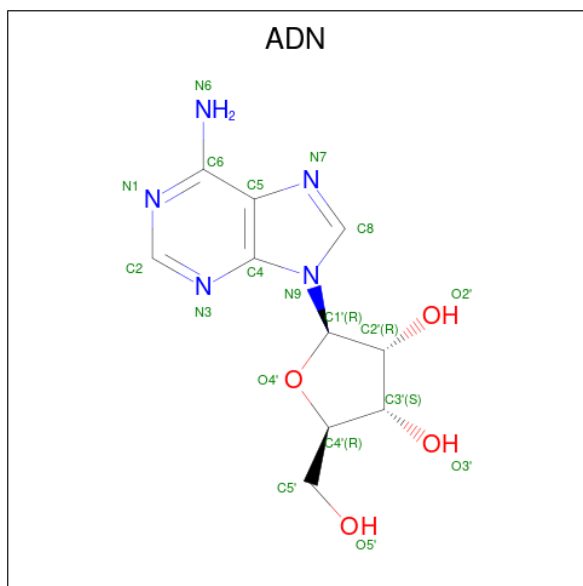
There are 3 unique types of molecules in this entry. The entry contains 8614 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Uncharacterized conserved protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	263	Total	C	N	O	S	Se	0	0	0
			2062	1326	347	384	1	4			
1	B	263	Total	C	N	O	S	Se	0	0	0
			2062	1326	347	384	1	4			
1	C	263	Total	C	N	O	S	Se	0	0	0
			2062	1326	347	384	1	4			
1	D	263	Total	C	N	O	S	Se	0	0	0
			2062	1326	347	384	1	4			

- Molecule 2 is ADENOSINE (three-letter code: ADN) (formula: C₁₀H₁₃N₅O₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			19	10	5	4		
2	B	1	Total	C	N	O	0	0
			19	10	5	4		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	C	1	Total	C	N	O	0	0
			19	10	5	4		
2	D	1	Total	C	N	O	0	0
			19	10	5	4		

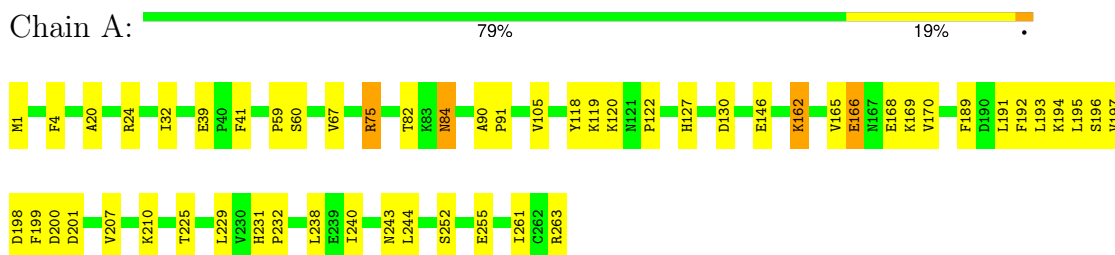
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	124	Total	O	0	0
			124	124		
3	B	20	Total	O	0	0
			20	20		
3	C	126	Total	O	0	0
			126	126		
3	D	20	Total	O	0	0
			20	20		

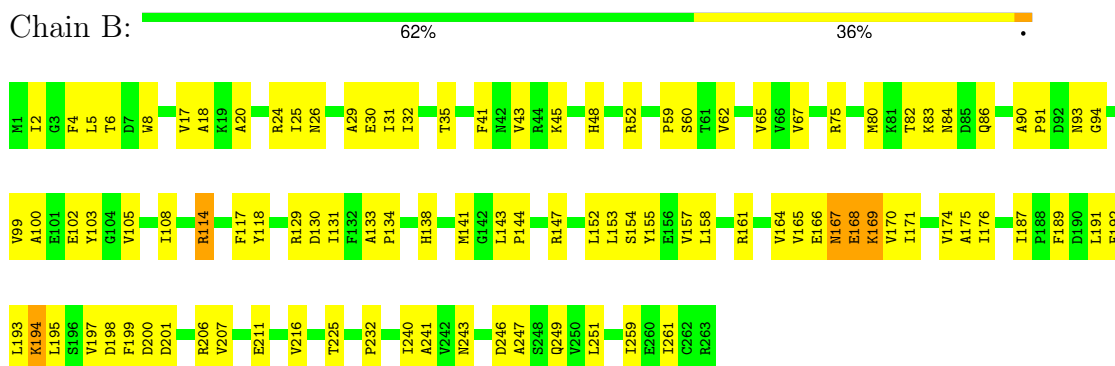
3 Residue-property plots

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.

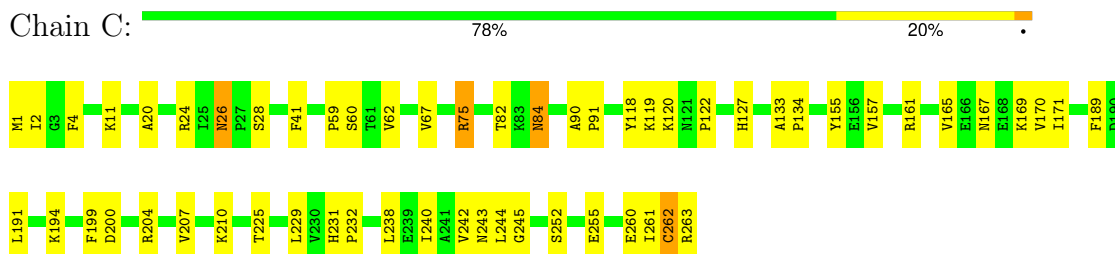
- Molecule 1: Uncharacterized conserved protein



- Molecule 1: Uncharacterized conserved protein



- Molecule 1: Uncharacterized conserved protein



- Molecule 1: Uncharacterized conserved protein



M1	I2	G3	F4	L5	A20	R24	I25	N26	E30	I31	I32	T35	H36	E37	V38	E39	P40	F41	R44	K45	V49	L55	D56	F57	P58	P59	S60	T61	V62	V65	V66	V67	R75	V79	K83	N84	D85	Q86	A90	P91	T97	E102	Y103	G104	V105	
R109	E110	I111	E112	N113	R114	E115	L116	F117	Y118	P122	H127	D130	I131	F132	A133	P134	H138	L143	P144	R147	V148	G149	L152	L153	S154	Y155	E156	V157	L158	K159	M160	V164	V165	E166	R167	E168	K169	V170	I171	L176	V177	D178	T179	F180	F189	L193
S196	V197	D198	F199	D200	D201	R206	V207	K210	V216	L228	L229	V230	H231	P232	D233	F237	L238	E239	I240	A241	V242	A247	L251	S252	E255	E260	I261	C262	R263																	

4 Data and refinement statistics

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α , β , γ	120.48Å 120.48Å 227.12Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 2.10 50.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.2 (50.00-2.10) 99.3 (50.00-2.10)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.65 (at 2.10Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.222 , 0.257 0.212 , 0.244	Depositor DCC
R_{free} test set	7208 reflections (9.89%)	wwPDB-VP
Wilson B-factor (Å ²)	27.8	Xtriage
Anisotropy	0.226	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 28.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.486 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	8614	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.35% 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

5.1 Standard geometry

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

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	0.40	0/2100	0.65	1/2840 (0.0%)
1	B	0.30	0/2100	0.57	1/2840 (0.0%)
1	C	0.38	0/2100	0.65	1/2840 (0.0%)
1	D	0.30	0/2100	0.56	1/2840 (0.0%)
All	All	0.35	0/8400	0.61	4/11360 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	67	VAL	N-CA-C	-6.77	92.73	111.00
1	A	67	VAL	N-CA-C	-6.75	92.77	111.00
1	B	67	VAL	N-CA-C	-5.49	96.18	111.00
1	D	67	VAL	N-CA-C	-5.49	96.19	111.00

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	2062	0	2083	44	0
1	B	2062	0	2083	93	0
1	C	2062	0	2083	49	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	2062	0	2083	89	0
2	A	19	0	13	0	0
2	B	19	0	13	0	0
2	C	19	0	13	0	0
2	D	19	0	13	0	0
3	A	124	0	0	3	0
3	B	20	0	0	1	0
3	C	126	0	0	2	0
3	D	20	0	0	1	0
All	All	8614	0	8384	274	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 16.

The worst 5 of 274 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:B:168:GLU:CD	1:B:169:LYS:H	1.73	0.91
1:D:1:MSE:HE2	1:D:58:PRO:HD2	1.53	0.90
1:D:144:PRO:HD2	1:D:147:ARG:HD3	1.56	0.87
1:D:1:MSE:HE3	1:D:57:PHE:CD1	2.13	0.83
1:D:1:MSE:CE	1:D:58:PRO:HD2	2.10	0.81

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	261/263 (99%)	251 (96%)	9 (3%)	1 (0%)	30	29
1	B	261/263 (99%)	241 (92%)	18 (7%)	2 (1%)	16	13

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	261/263 (99%)	252 (97%)	8 (3%)	1 (0%)	30	29
1	D	261/263 (99%)	241 (92%)	20 (8%)	0	100	100
All	All	1044/1052 (99%)	985 (94%)	55 (5%)	4 (0%)	30	29

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	167	ASN
1	B	167	ASN
1	B	35	THR
1	A	193	LEU

5.3.2 Protein sidechains ⓘ

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	225/221 (102%)	216 (96%)	9 (4%)	27	28
1	B	225/221 (102%)	218 (97%)	7 (3%)	35	39
1	C	225/221 (102%)	218 (97%)	7 (3%)	35	39
1	D	225/221 (102%)	216 (96%)	9 (4%)	27	28
All	All	900/884 (102%)	868 (96%)	32 (4%)	30	32

5 of 32 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	169	LYS
1	D	170	VAL
1	B	114	ARG
1	B	75	ARG
1	D	229	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	84	ASN
1	C	127	HIS
1	D	243	ASN
1	D	26	ASN
1	D	127	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](#)

4 ligands 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	$\# Z > 2$
2	ADN	A	501	-	17,21,21	1.20	2 (11%)	17,31,31	1.88	2 (11%)
2	ADN	C	503	-	17,21,21	1.30	2 (11%)	17,31,31	1.74	2 (11%)
2	ADN	D	504	-	17,21,21	1.23	2 (11%)	17,31,31	1.81	2 (11%)
2	ADN	B	502	-	17,21,21	1.27	2 (11%)	17,31,31	1.80	2 (11%)

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
2	ADN	A	501	-	-	0/2/22/22	0/3/3/3
2	ADN	C	503	-	-	0/2/22/22	0/3/3/3
2	ADN	D	504	-	-	0/2/22/22	0/3/3/3
2	ADN	B	502	-	-	0/2/22/22	0/3/3/3

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	503	ADN	O4'-C1'	4.25	1.46	1.40
2	B	502	ADN	O4'-C1'	3.82	1.45	1.40
2	A	501	ADN	O4'-C1'	3.73	1.45	1.40
2	D	504	ADN	O4'-C1'	3.70	1.45	1.40
2	B	502	ADN	C8-N7	-2.27	1.30	1.34

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	502	ADN	N3-C2-N1	-5.37	121.39	128.67
2	D	504	ADN	N3-C2-N1	-5.36	121.39	128.67
2	C	503	ADN	N3-C2-N1	-5.32	121.45	128.67
2	A	501	ADN	N3-C2-N1	-5.24	121.56	128.67
2	A	501	ADN	C4'-O4'-C1'	-4.50	105.80	109.92

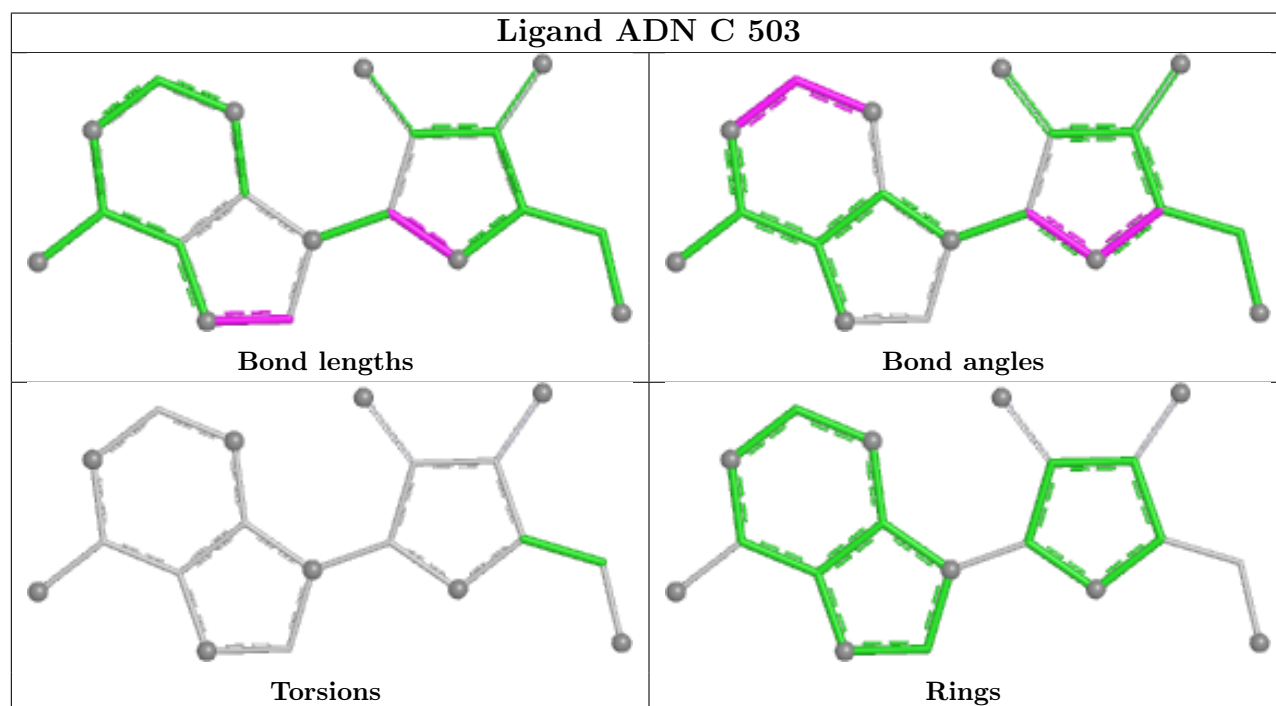
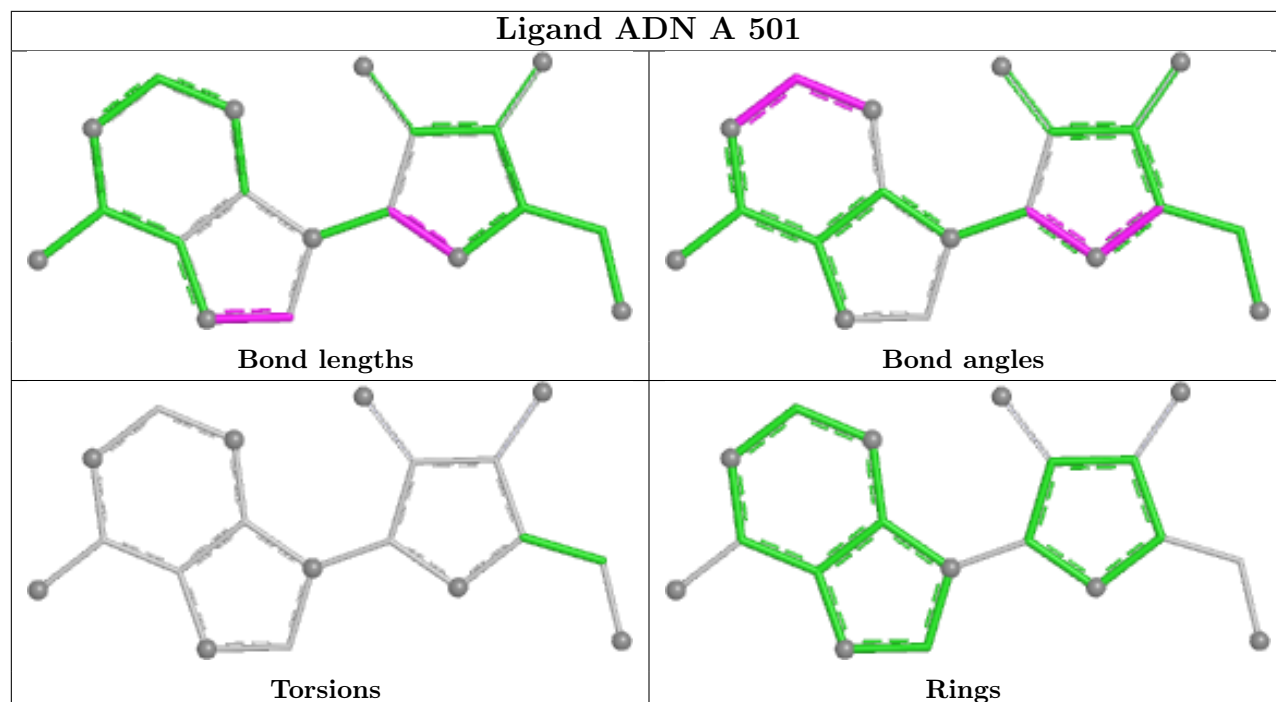
There are no chirality outliers.

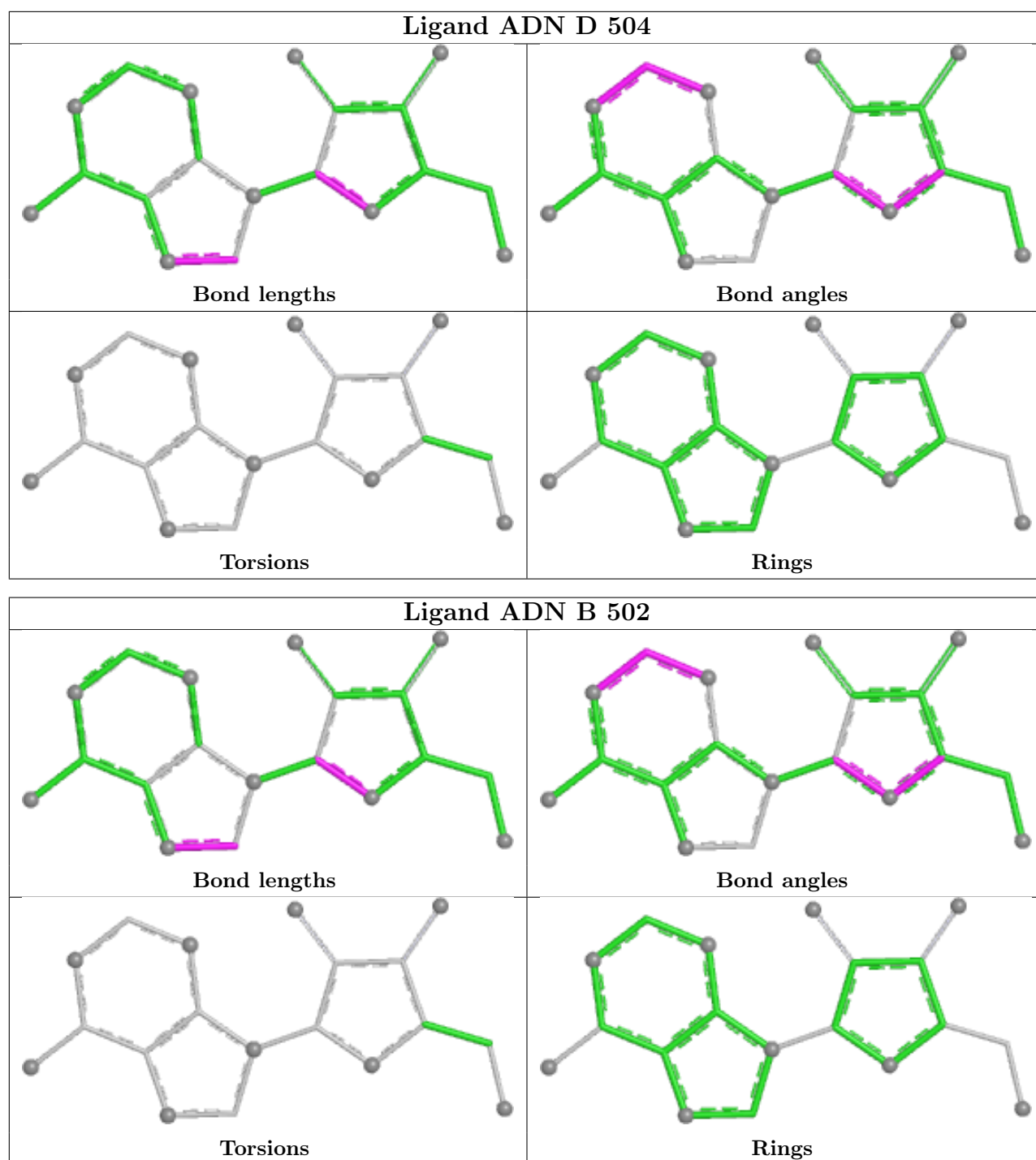
There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





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	259/263 (98%)	-1.50	0 100 100	14, 23, 49, 67	0
1	B	259/263 (98%)	-1.03	0 100 100	33, 49, 70, 77	0
1	C	259/263 (98%)	-1.51	0 100 100	12, 23, 51, 66	0
1	D	259/263 (98%)	-1.01	0 100 100	34, 49, 69, 75	0
All	All	1036/1052 (98%)	-1.26	0 100 100	12, 40, 66, 77	0

There are no RSRZ outliers to report.

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](#)

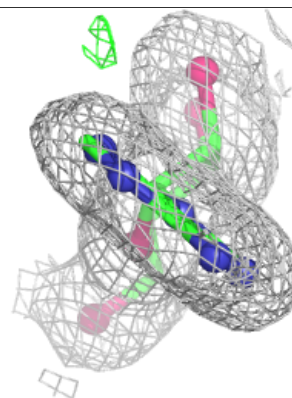
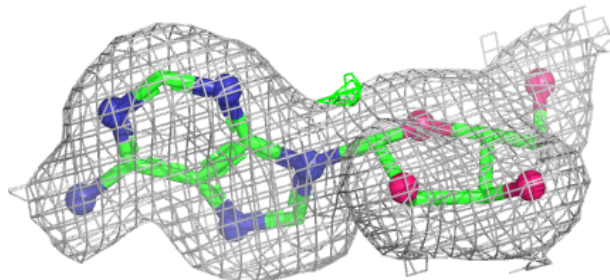
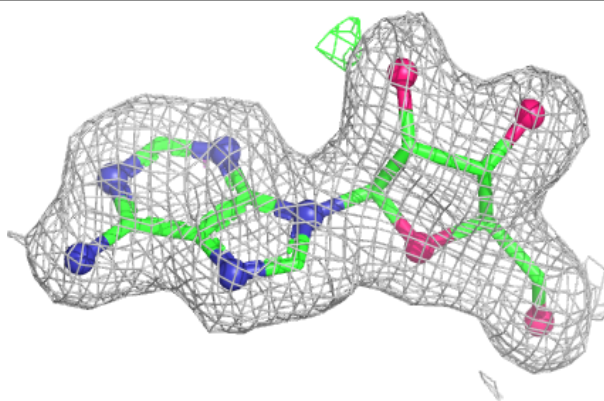
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	ADN	A	501	19/19	0.99	0.03	17,20,23,24	0
2	ADN	B	502	19/19	0.99	0.04	41,42,43,44	0
2	ADN	D	504	19/19	0.99	0.03	37,39,40,40	0
2	ADN	C	503	19/19	1.00	0.02	12,20,22,23	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.

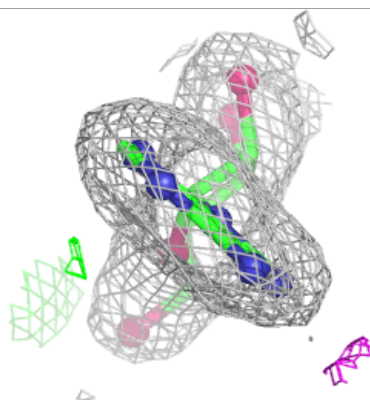
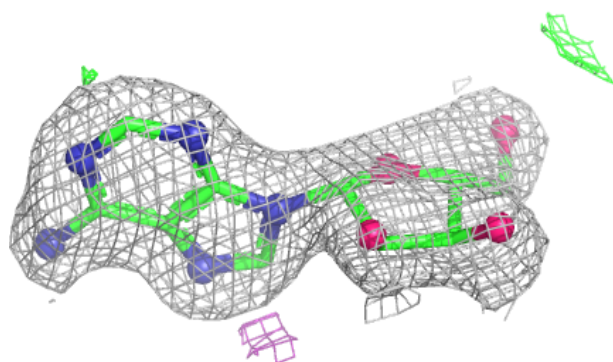
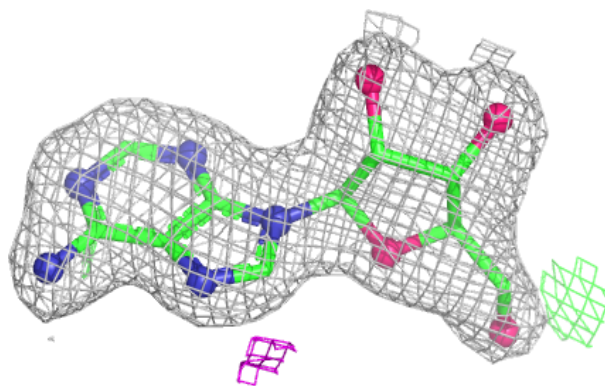
Electron density around ADN A 501:

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

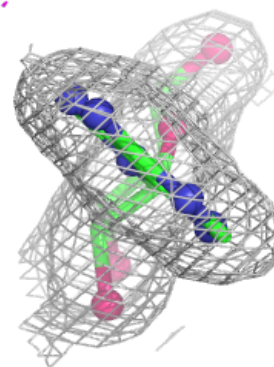
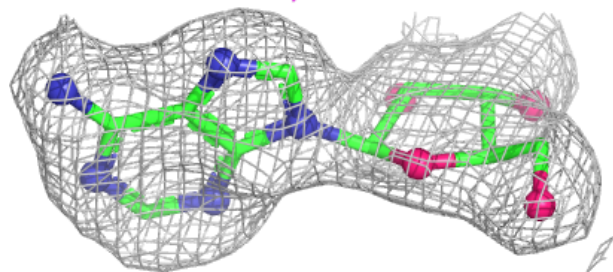
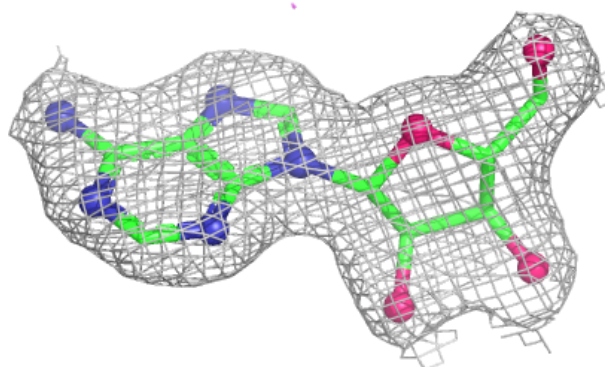


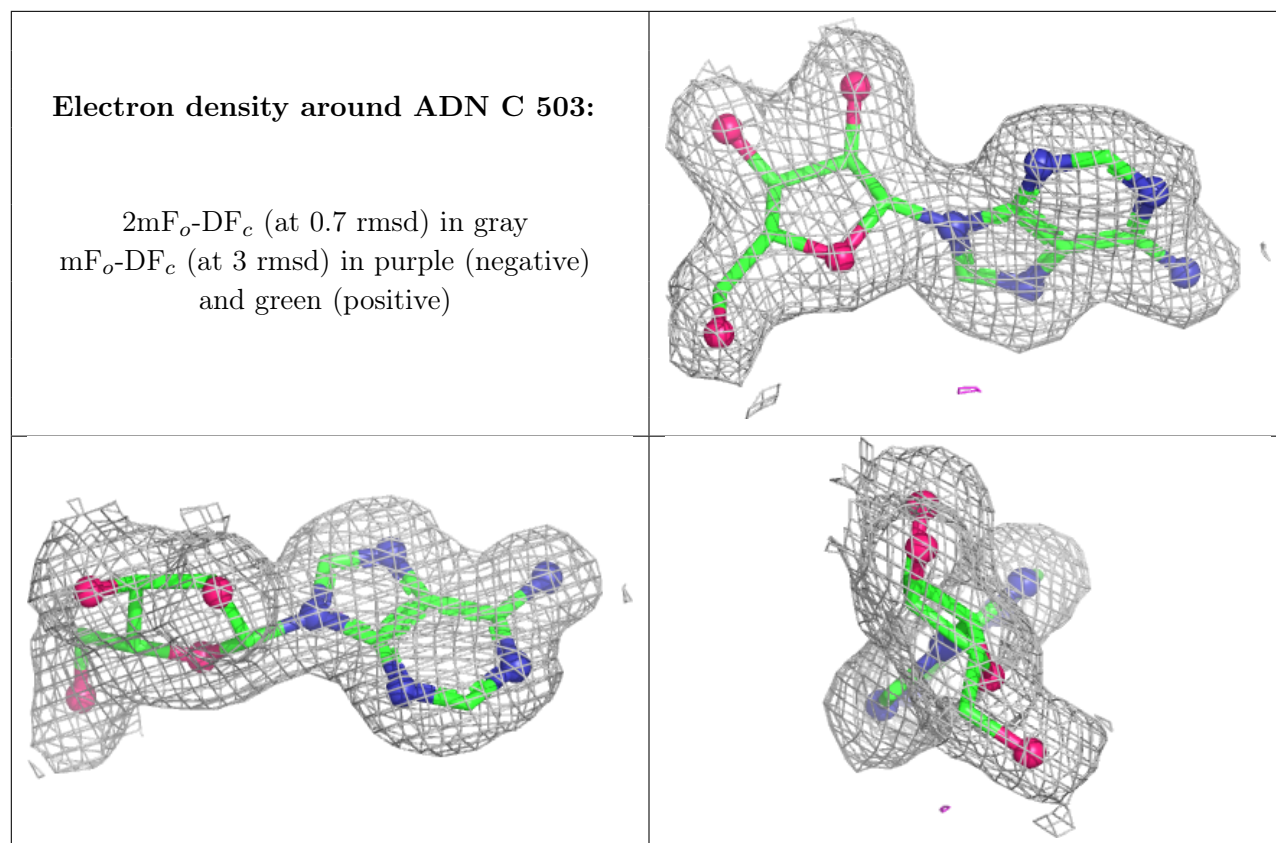
Electron density around ADN B 502:

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

**Electron density around ADN D 504:**

$2mF_o-DF_c$ (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.