



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 04:27 AM UTC

PDB ID : 4IPA / pdb_00004ipa
Title : Structure of a thermophilic Arx1
Authors : Bange, G.; Sinning, I.
Deposited on : 2013-01-09
Resolution : 2.30 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
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

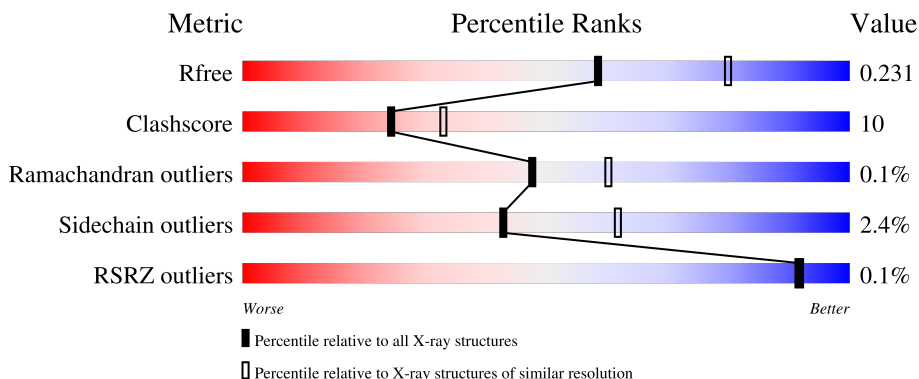
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	423	
1	B	423	
1	C	423	
1	D	423	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	SO4	A	501	-	-	X	-

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 12448 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 Putative curved DNA-binding protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	372	2873	1818	487	559	9	0	2	0
1	B	373	2871	1816	487	559	9	0	2	0
1	C	376	2902	1835	492	566	9	0	2	0
1	D	371	2865	1813	486	557	9	0	2	0

There are 32 discrepancies between the modelled and reference sequences:

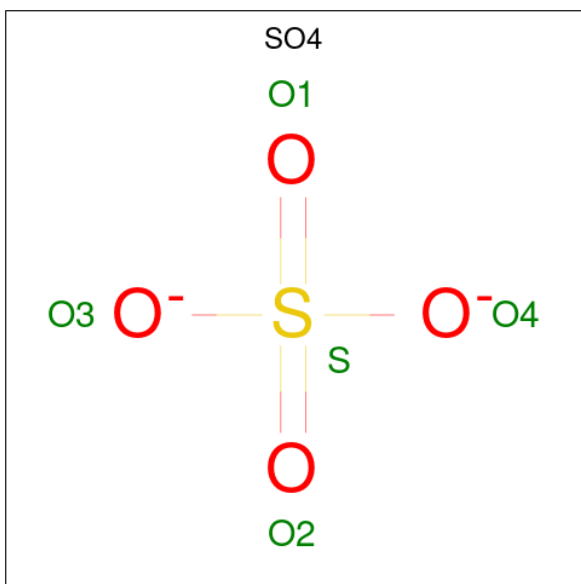
Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	MET	-	expression tag	UNP G0S4S7
A	-6	GLY	-	expression tag	UNP G0S4S7
A	-5	HIS	-	expression tag	UNP G0S4S7
A	-4	HIS	-	expression tag	UNP G0S4S7
A	-3	HIS	-	expression tag	UNP G0S4S7
A	-2	HIS	-	expression tag	UNP G0S4S7
A	-1	HIS	-	expression tag	UNP G0S4S7
A	0	HIS	-	expression tag	UNP G0S4S7
B	-7	MET	-	expression tag	UNP G0S4S7
B	-6	GLY	-	expression tag	UNP G0S4S7
B	-5	HIS	-	expression tag	UNP G0S4S7
B	-4	HIS	-	expression tag	UNP G0S4S7
B	-3	HIS	-	expression tag	UNP G0S4S7
B	-2	HIS	-	expression tag	UNP G0S4S7
B	-1	HIS	-	expression tag	UNP G0S4S7
B	0	HIS	-	expression tag	UNP G0S4S7
C	-7	MET	-	expression tag	UNP G0S4S7
C	-6	GLY	-	expression tag	UNP G0S4S7
C	-5	HIS	-	expression tag	UNP G0S4S7
C	-4	HIS	-	expression tag	UNP G0S4S7
C	-3	HIS	-	expression tag	UNP G0S4S7

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-2	HIS	-	expression tag	UNP G0S4S7
C	-1	HIS	-	expression tag	UNP G0S4S7
C	0	HIS	-	expression tag	UNP G0S4S7
D	-7	MET	-	expression tag	UNP G0S4S7
D	-6	GLY	-	expression tag	UNP G0S4S7
D	-5	HIS	-	expression tag	UNP G0S4S7
D	-4	HIS	-	expression tag	UNP G0S4S7
D	-3	HIS	-	expression tag	UNP G0S4S7
D	-2	HIS	-	expression tag	UNP G0S4S7
D	-1	HIS	-	expression tag	UNP G0S4S7
D	0	HIS	-	expression tag	UNP G0S4S7

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O S 5 4 1	0	0
2	A	1	Total O S 5 4 1	0	0
2	B	1	Total O S 5 4 1	0	0
2	C	1	Total O S 5 4 1	0	0
2	C	1	Total O S 5 4 1	0	0
2	D	1	Total O S 5 4 1	0	0

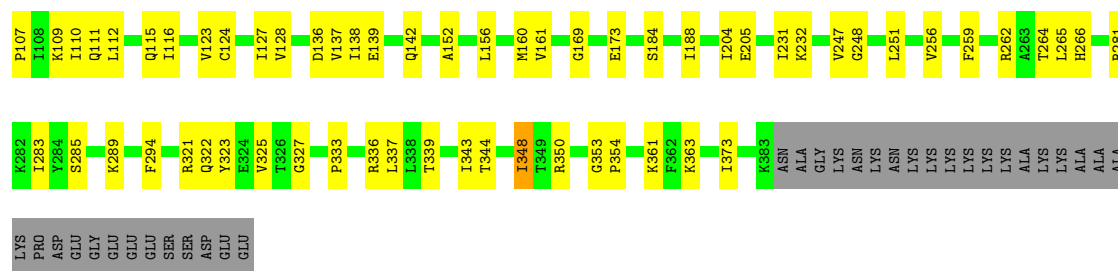
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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	D	1	Total	O	S	0	0
			5	4	1		

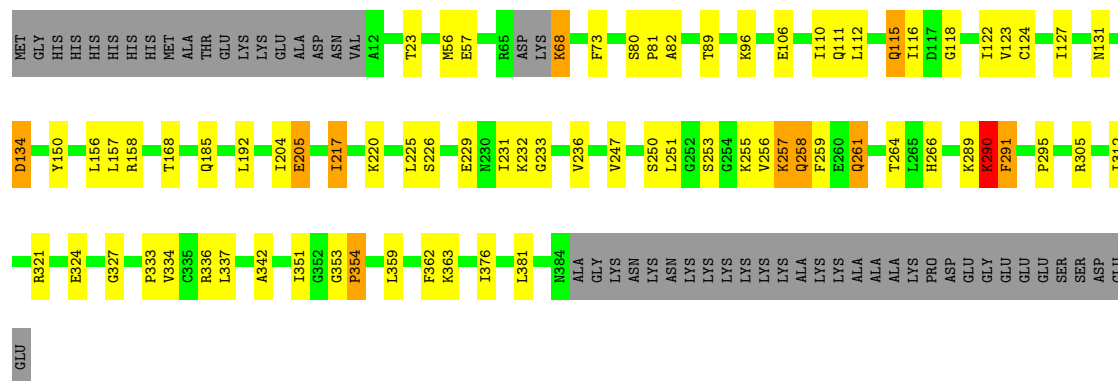
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	274	Total	O	0	0
			274	274		
3	B	230	Total	O	0	0
			230	230		
3	C	130	Total	O	0	0
			130	130		
3	D	268	Total	O	0	0
			268	268		



- Molecule 1: Putative curved DNA-binding protein

Chain D: 70% 15% 12%



4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	192.00Å 193.32Å 70.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	57.18 – 2.30 57.18 – 2.30	Depositor EDS
% Data completeness (in resolution range)	100.0 (57.18-2.30) 98.0 (57.18-2.30)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.32 (at 2.29Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.6.4_486)	Depositor
R, R_{free}	0.199 , 0.236 0.195 , 0.231	Depositor DCC
R_{free} test set	5918 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	27.7	Xtrriage
Anisotropy	0.073	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 23.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtrriage
Estimated twinning fraction	0.167 for k,h,-l	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	12448	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.88% 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: SO4

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	0.56	1/2920 (0.0%)	0.79	2/3945 (0.1%)
1	B	0.61	5/2916 (0.2%)	0.85	6/3941 (0.2%)
1	C	0.49	0/2949	0.80	0/3986
1	D	0.60	6/2911 (0.2%)	0.84	5/3933 (0.1%)
All	All	0.57	12/11696 (0.1%)	0.82	13/15805 (0.1%)

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	256	VAL	C-O	-7.04	1.16	1.24
1	B	358	ASP	C-O	-6.72	1.15	1.24
1	B	89	THR	C-N	6.20	1.41	1.33
1	B	89	THR	C-O	-5.97	1.17	1.24
1	D	257	LYS	C-O	-5.91	1.16	1.23

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	135	PRO	N-CA-CB	8.12	110.51	103.36
1	B	231	ILE	N-CA-C	6.72	120.44	111.17
1	B	277	ARG	CA-C-N	6.54	126.05	119.24
1	B	277	ARG	C-N-CA	6.54	126.05	119.24
1	D	134	ASP	N-CA-C	-5.88	101.97	110.08

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	2873	0	2936	49	0
1	B	2871	0	2925	69	0
1	C	2902	0	2964	64	0
1	D	2865	0	2928	56	0
2	A	10	0	0	2	0
2	B	5	0	0	0	0
2	C	10	0	0	1	0
2	D	10	0	0	0	0
3	A	274	0	0	3	0
3	B	230	0	0	4	0
3	C	130	0	0	4	0
3	D	268	0	0	3	0
All	All	12448	0	11753	230	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 10.

The worst 5 of 230 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:C:66:ASP:H	1:C:67:LYS:HA	1.14	1.13
1:A:136:ASP:HB3	1:A:361:LYS:HE2	1.25	1.12
1:B:342:ALA:HB2	1:B:351:ILE:HD11	1.46	0.98
1:A:232:LYS:NZ	1:D:324:GLU:OE1	2.01	0.94
1:C:66:ASP:N	1:C:67:LYS:HA	1.79	0.93

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	370/423 (88%)	359 (97%)	11 (3%)	0	100	100
1	B	369/423 (87%)	358 (97%)	10 (3%)	1 (0%)	36	46
1	C	374/423 (88%)	365 (98%)	9 (2%)	0	100	100
1	D	367/423 (87%)	359 (98%)	7 (2%)	1 (0%)	36	46
All	All	1480/1692 (88%)	1441 (97%)	37 (2%)	2 (0%)	48	60

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	230	ASN
1	D	229	GLU

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	316/357 (88%)	312 (99%)	4 (1%)	61	77
1	B	314/357 (88%)	307 (98%)	7 (2%)	45	65
1	C	319/357 (89%)	310 (97%)	9 (3%)	38	56
1	D	315/357 (88%)	305 (97%)	10 (3%)	34	51
All	All	1264/1428 (88%)	1234 (98%)	30 (2%)	43	62

5 of 30 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	89	THR
1	D	257	LYS
1	C	348	ILE
1	D	290	LYS
1	D	217	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 27 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	322	GLN
1	D	111	GLN
1	D	270	ASN
1	C	379	GLN
1	D	115	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

7 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	SO4	C	502	-	4,4,4	0.31	0	6,6,6	0.20	0
2	SO4	D	501	-	4,4,4	0.24	0	6,6,6	0.25	0
2	SO4	A	501	-	4,4,4	0.22	0	6,6,6	0.08	0
2	SO4	C	501	-	4,4,4	0.28	0	6,6,6	0.13	0
2	SO4	B	501	-	4,4,4	0.26	0	6,6,6	0.20	0
2	SO4	A	502	-	4,4,4	0.27	0	6,6,6	0.14	0
2	SO4	D	502	-	4,4,4	0.28	0	6,6,6	0.05	0

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.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	502	SO4	1	0
2	A	501	SO4	2	0

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	372/423 (87%)	-1.47	0 100 100	14, 24, 42, 72	0
1	B	373/423 (88%)	-1.35	1 (0%) 90 90	19, 29, 47, 79	0
1	C	376/423 (88%)	-1.42	0 100 100	16, 26, 47, 80	0
1	D	371/423 (87%)	-1.44	0 100 100	16, 25, 44, 68	0
All	All	1492/1692 (88%)	-1.42	1 (0%) 92 91	14, 26, 45, 80	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	67	LYS	2.3

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(Å ²)	Q<0.9
2	SO4	C	502	5/5	0.98	0.07	45,46,55,57	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	SO4	A	502	5/5	0.99	0.04	47,54,59,62	0
2	SO4	B	501	5/5	0.99	0.07	52,53,64,65	0
2	SO4	C	501	5/5	0.99	0.08	48,52,62,65	0
2	SO4	A	501	5/5	0.99	0.06	40,47,58,63	0
2	SO4	D	501	5/5	0.99	0.04	44,45,54,54	0
2	SO4	D	502	5/5	0.99	0.03	48,56,70,73	0

6.5 Other polymers [i](#)

There are no such residues in this entry.