



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 2, 2026 – 03:31 AM UTC

PDB ID : 6TMM / pdb_00006tmm
Title : BIL2 domain from T.thermophila BUBL1 locus (C1A-N143A)
Authors : Chiarini, V.; Ilari, A.
Deposited on : 2019-12-04
Resolution : 2.40 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)
Xtriage (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

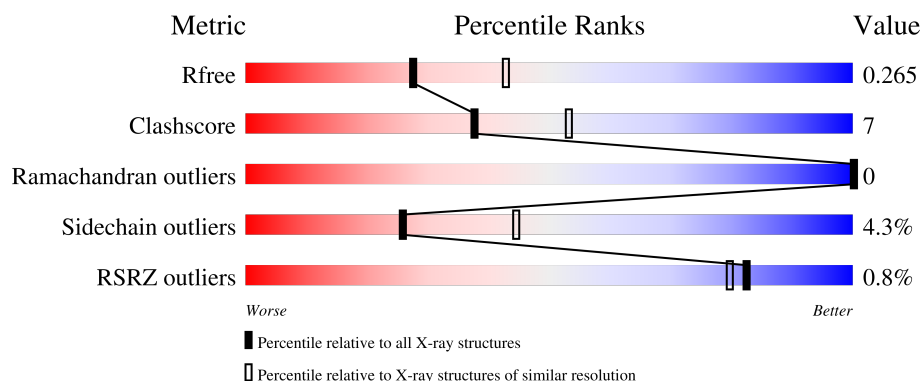
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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	AAA	156	% 86% 13% .
1	CCC	156	% 89% 10% .
2	BBB	155	89% 10% .
2	DDD	155	% 86% 12% .

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
4	PEG	AAA	804	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 5204 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 NAD(P)(+)-arginine ADP-ribosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	AAA	156	Total	C	N	O	S	0	2	0
			1269	809	217	238	5			
1	CCC	156	Total	C	N	O	S	0	0	0
			1256	802	214	235	5			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAA	1	ALA	CYS	engineered mutation	UNP Q236S9
AAA	143	ALA	ASN	engineered mutation	UNP Q236S9
CCC	1	ALA	CYS	engineered mutation	UNP Q236S9
CCC	143	ALA	ASN	engineered mutation	UNP Q236S9

- Molecule 2 is a protein called NAD(P)(+)-arginine ADP-ribosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	BBB	155	Total	C	N	O	S	0	2	0
			1263	803	216	239	5			
2	DDD	155	Total	C	N	O	S	0	0	0
			1248	796	213	234	5			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
BBB	1	ALA	CYS	engineered mutation	UNP Q236S9
BBB	143	ALA	ASN	engineered mutation	UNP Q236S9
DDD	1	ALA	CYS	engineered mutation	UNP Q236S9
DDD	143	ALA	ASN	engineered mutation	UNP Q236S9

- Molecule 3 is FORMIC ACID (CCD ID: FMT) (formula: CH₂O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	AAA	1	Total	C	O	0	0
			3	1	2		
3	AAA	1	Total	C	O	0	0
			3	1	2		
3	AAA	1	Total	C	O	0	0
			3	1	2		
3	AAA	1	Total	C	O	0	0
			3	1	2		
3	BBB	1	Total	C	O	0	0
			3	1	2		
3	BBB	1	Total	C	O	0	0
			3	1	2		
3	BBB	1	Total	C	O	0	0
			3	1	2		
3	CCC	1	Total	C	O	0	0
			3	1	2		
3	CCC	1	Total	C	O	0	0
			3	1	2		
3	DDD	1	Total	C	O	0	0
			3	1	2		
3	DDD	1	Total	C	O	0	0
			3	1	2		

- Molecule 4 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	AAA	1	Total	C	O	0	0
			7	4	3		

- Molecule 5 is MERCURY (II) ION (CCD ID: HG) (formula: Hg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	AAA	1	Total	Hg	0	0
			1	1		
5	BBB	1	Total	Hg	0	0
			1	1		
5	CCC	1	Total	Hg	0	0
			1	1		
5	DDD	1	Total	Hg	0	0
			1	1		

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	AAA	1	Total	Ca	0	0
			1	1		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	AAA	33	Total	O	0	0
			33	33		

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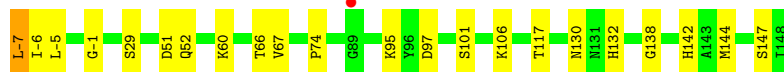
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	BBB	25	Total 25	O 25	0	0
7	CCC	40	Total 40	O 40	0	0
7	DDD	25	Total 25	O 25	0	0

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: NAD(P)(+)-arginine ADP-ribosyltransferase



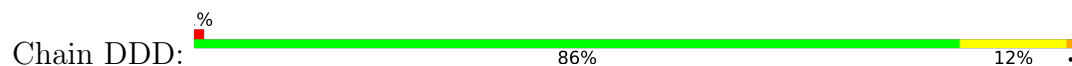
- Molecule 1: NAD(P)(+)-arginine ADP-ribosyltransferase



- Molecule 2: NAD(P)(+)-arginine ADP-ribosyltransferase



- Molecule 2: NAD(P)(+)-arginine ADP-ribosyltransferase



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	133.48Å 72.77Å 70.26Å 90.00° 97.87° 90.00°	Depositor
Resolution (Å)	69.60 – 2.40 69.60 – 2.40	Depositor EDS
% Data completeness (in resolution range)	99.4 (69.60-2.40) 99.4 (69.60-2.40)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.56 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.198 , 0.267 0.204 , 0.265	Depositor DCC
R_{free} test set	1333 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	58.1	Xtriage
Anisotropy	0.339	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 32.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5204	wwPDB-VP
Average B, all atoms (Å ²)	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.48% 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: FMT, CA, HG, PEG

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	AAA	0.97	0/1299	1.26	0/1756
1	CCC	0.98	0/1283	1.26	0/1734
2	BBB	1.00	0/1290	1.23	0/1742
2	DDD	1.00	0/1275	1.29	0/1723
All	All	0.99	0/5147	1.26	0/6955

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	AAA	1269	0	1252	31	0
1	CCC	1256	0	1241	10	0
2	BBB	1263	0	1240	17	0
2	DDD	1248	0	1231	16	0
3	AAA	12	0	4	1	0
3	BBB	9	0	3	0	0
3	CCC	6	0	2	1	0
3	DDD	6	0	2	1	0
4	AAA	7	0	10	27	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	AAA	1	0	0	0	0
5	BBB	1	0	0	0	0
5	CCC	1	0	0	0	0
5	DDD	1	0	0	0	0
6	AAA	1	0	0	0	0
7	AAA	33	0	0	4	0
7	BBB	25	0	0	1	0
7	CCC	40	0	0	1	0
7	DDD	25	0	0	7	0
All	All	5204	0	4985	70	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.

The worst 5 of 70 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:AAA:52:GLN:CB	4:AAA:804:PEG:H42	1.68	1.23
1:AAA:52:GLN:HB2	4:AAA:804:PEG:C4	1.80	1.10
4:AAA:804:PEG:H12	2:BBB:86:PRO:CG	1.82	1.08
4:AAA:804:PEG:H12	2:BBB:86:PRO:HG3	1.13	1.06
1:AAA:52:GLN:HB2	4:AAA:804:PEG:H42	1.09	1.05

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	AAA	156/156 (100%)	150 (96%)	6 (4%)	0	100	100
1	CCC	154/156 (99%)	148 (96%)	6 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	BBB	155/155 (100%)	143 (92%)	12 (8%)	0	100	100
2	DDD	153/155 (99%)	144 (94%)	9 (6%)	0	100	100
All	All	618/622 (99%)	585 (95%)	33 (5%)	0	100	100

There are no Ramachandran outliers to report.

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	AAA	143/141 (101%)	138 (96%)	5 (4%)	32	53
1	CCC	141/141 (100%)	135 (96%)	6 (4%)	26	44
2	BBB	142/140 (101%)	133 (94%)	9 (6%)	16	29
2	DDD	140/140 (100%)	135 (96%)	5 (4%)	31	52
All	All	566/562 (101%)	541 (96%)	25 (4%)	26	43

5 of 25 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	CCC	-7	LEU
1	CCC	75	GLU
2	DDD	43	THR
1	CCC	58	PHE
1	CCC	118	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

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 17 ligands modelled in this entry, 5 are monoatomic - leaving 12 for Mogul analysis.

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	$\# Z > 2$
3	FMT	DDD	602	-	2,2,2	0.29	0	1,1,1	0.17	0
3	FMT	CCC	602	-	2,2,2	0.29	0	1,1,1	0.14	0
3	FMT	AAA	803	-	2,2,2	0.27	0	1,1,1	0.17	0
3	FMT	DDD	601	-	2,2,2	0.25	0	1,1,1	0.14	0
3	FMT	AAA	802	-	2,2,2	0.24	0	1,1,1	0.17	0
3	FMT	AAA	805	-	2,2,2	0.27	0	1,1,1	0.14	0
3	FMT	BBB	402	-	2,2,2	0.29	0	1,1,1	0.12	0
3	FMT	BBB	403	-	2,2,2	0.31	0	1,1,1	0.12	0
3	FMT	AAA	801	-	2,2,2	0.40	0	1,1,1	0.05	0
3	FMT	CCC	601	-	2,2,2	0.36	0	1,1,1	0.05	0
3	FMT	BBB	401	-	2,2,2	0.26	0	1,1,1	0.14	0
4	PEG	AAA	804	-	6,6,6	0.31	0	5,5,5	0.46	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
4	PEG	AAA	804	-	-	4/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	AAA	804	PEG	C1-C2-O2-C3
4	AAA	804	PEG	C4-C3-O2-C2
4	AAA	804	PEG	O2-C3-C4-O4
4	AAA	804	PEG	O1-C1-C2-O2

There are no ring outliers.

4 monomers are involved in 30 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	DDD	602	FMT	1	0
3	AAA	803	FMT	1	0
3	CCC	601	FMT	1	0
4	AAA	804	PEG	27	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	AAA	156/156 (100%)	0.09	1 (0%) 85 83	21, 54, 80, 91	2 (1%)
1	CCC	156/156 (100%)	-0.01	2 (1%) 75 71	37, 55, 80, 106	0
2	BBB	155/155 (100%)	0.20	0 100 100	28, 61, 83, 97	2 (1%)
2	DDD	155/155 (100%)	0.36	2 (1%) 75 71	49, 71, 92, 103	0
All	All	622/622 (100%)	0.16	5 (0%) 82 80	21, 59, 87, 106	4 (0%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	DDD	17	PHE	2.7
1	AAA	89	GLY	2.7
1	CCC	148	ILE	2.5
1	CCC	-7	LEU	2.4
2	DDD	115	PHE	2.2

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
3	FMT	BBB	402	3/3	0.57	0.13	88,88,89,92	0
3	FMT	DDD	602	3/3	0.71	0.13	109,109,109,111	0
3	FMT	AAA	803	3/3	0.75	0.15	84,84,85,88	0
3	FMT	CCC	602	3/3	0.76	0.12	73,73,74,75	0
3	FMT	BBB	401	3/3	0.78	0.11	84,84,89,89	0
3	FMT	DDD	601	3/3	0.83	0.09	77,77,79,83	0
4	PEG	AAA	804	7/7	0.86	0.18	41,42,42,43	7
3	FMT	AAA	802	3/3	0.88	0.09	72,72,76,77	0
3	FMT	BBB	403	3/3	0.90	0.46	90,90,94,98	0
3	FMT	CCC	601	3/3	0.90	0.22	74,74,75,78	0
3	FMT	AAA	805	3/3	0.91	0.11	76,76,77,78	0
3	FMT	AAA	801	3/3	0.95	0.11	47,47,51,54	0
5	HG	BBB	404	1/1	0.98	0.09	82,82,82,82	1
6	CA	AAA	807	1/1	0.98	0.04	74,74,74,74	1
5	HG	DDD	603	1/1	0.99	0.07	65,65,65,65	1
5	HG	CCC	603	1/1	0.99	0.03	61,61,61,61	1
5	HG	AAA	806	1/1	1.00	0.03	47,47,47,47	1

6.5 Other polymers [i](#)

There are no such residues in this entry.