



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 23, 2020 – 04:57 am BST

PDB ID : 4I2O  
Title : The Structure of FixK2 from Bradyrhizobium japonicum  
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Deposited on : 2012-11-22  
Resolution : 1.77 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](mailto: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.

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

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

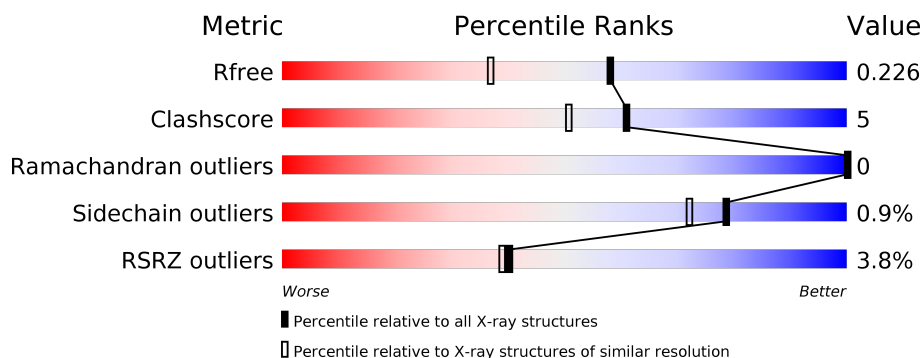
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.77 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	9185 (1.80-1.76)
Clashscore	141614	10184 (1.80-1.76)
Ramachandran outliers	138981	10051 (1.80-1.76)
Sidechain outliers	138945	10050 (1.80-1.76)
RSRZ outliers	127900	9032 (1.80-1.76)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	243	<div> <div>3%</div> <div> <div></div> <div>76%</div> <div>5%</div> <div>19%</div> </div> </div>
1	B	243	<div> <div>2%</div> <div> <div></div> <div>76%</div> <div>5%</div> <div>19%</div> </div> </div>
2	W	30	<div> <div>10%</div> <div> <div>23%</div> <div>47%</div> <div>13%</div> <div>17%</div> </div> </div>
3	X	30	<div> <div>3%</div> <div> <div>17%</div> <div>40%</div> <div>23%</div> <div>20%</div> </div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4578 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 FixK2 protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	198	Total	C	N	O	S	14	0	0
			1541	964	286	284	7			
1	B	198	Total	C	N	O	S	8	0	0
			1541	964	286	284	7			

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	183	SER	CYS	ENGINEERED MUTATION	UNP O69245
A	233	ALA	-	EXPRESSION TAG	UNP O69245
A	234	ALA	-	EXPRESSION TAG	UNP O69245
A	235	ALA	-	EXPRESSION TAG	UNP O69245
A	236	LEU	-	EXPRESSION TAG	UNP O69245
A	237	GLU	-	EXPRESSION TAG	UNP O69245
A	238	HIS	-	EXPRESSION TAG	UNP O69245
A	239	HIS	-	EXPRESSION TAG	UNP O69245
A	240	HIS	-	EXPRESSION TAG	UNP O69245
A	241	HIS	-	EXPRESSION TAG	UNP O69245
A	242	HIS	-	EXPRESSION TAG	UNP O69245
A	243	HIS	-	EXPRESSION TAG	UNP O69245
B	183	SER	CYS	ENGINEERED MUTATION	UNP O69245
B	233	ALA	-	EXPRESSION TAG	UNP O69245
B	234	ALA	-	EXPRESSION TAG	UNP O69245
B	235	ALA	-	EXPRESSION TAG	UNP O69245
B	236	LEU	-	EXPRESSION TAG	UNP O69245
B	237	GLU	-	EXPRESSION TAG	UNP O69245
B	238	HIS	-	EXPRESSION TAG	UNP O69245
B	239	HIS	-	EXPRESSION TAG	UNP O69245
B	240	HIS	-	EXPRESSION TAG	UNP O69245
B	241	HIS	-	EXPRESSION TAG	UNP O69245
B	242	HIS	-	EXPRESSION TAG	UNP O69245
B	243	HIS	-	EXPRESSION TAG	UNP O69245

- Molecule 2 is a DNA chain called Promoter of fixK2 direct target, fixN, upstream.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	W	25	Total	C	N	O	P	0	0	0
			522	249	105	144	24			

- Molecule 3 is a DNA chain called Promoter of fixK2 direct target, fixN, downstream.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	X	24	Total	C	N	O	P	0	0	0
			478	233	76	146	23			

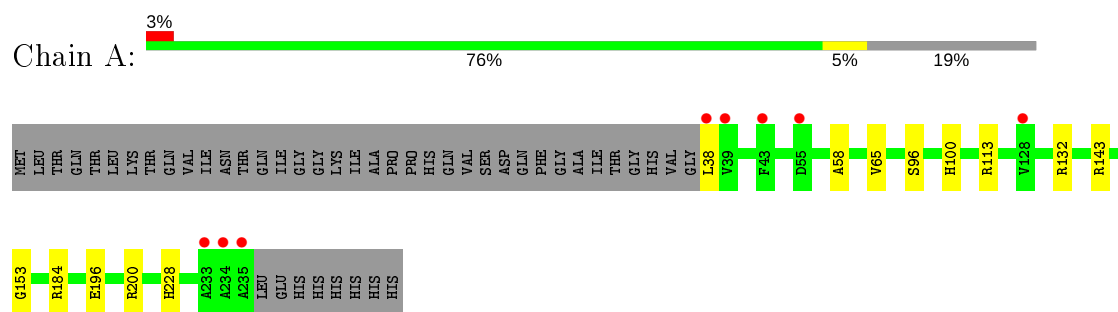
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	182	Total	O	0	0
			182	182		
4	B	187	Total	O	0	0
			187	187		
4	W	59	Total	O	0	0
			59	59		
4	X	68	Total	O	0	0
			68	68		

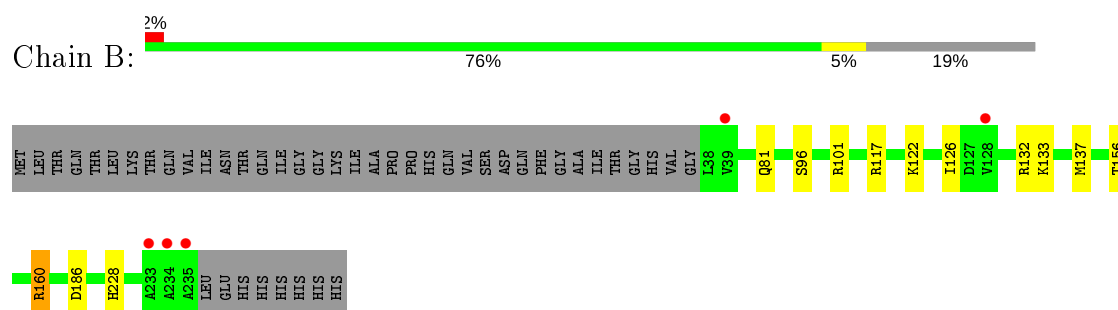
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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.

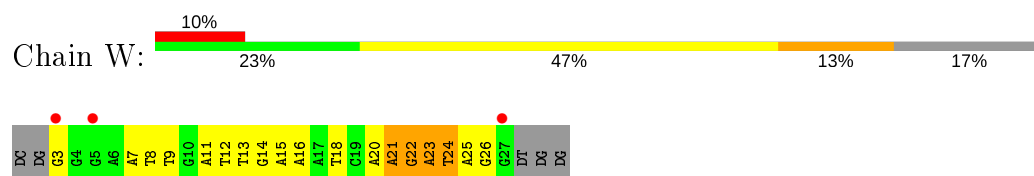
- Molecule 1: FixK2 protein



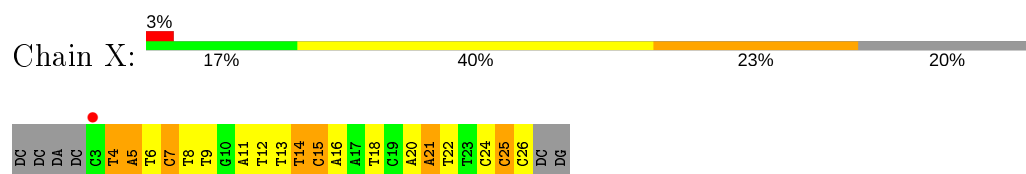
- Molecule 1: FixK2 protein



- Molecule 2: Promoter of fixK2 direct target, fixN, upstream



- Molecule 3: Promoter of fixK2 direct target, fixN, downstream



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	111.33Å 43.88Å 70.11Å 90.00° 90.04° 90.00°	Depositor
Resolution (Å)	43.58 – 1.77 43.58 – 1.77	Depositor EDS
% Data completeness (in resolution range)	99.7 (43.58-1.77) 99.6 (43.58-1.77)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.63 (at 1.77Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7.3_928)	Depositor
R, $R_{free}$	0.183 , 0.227 0.180 , 0.226	Depositor DCC
$R_{free}$ test set	3315 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	23.8	Xtriage
Anisotropy	0.801	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 43.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.477 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	4578	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.75% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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](#)

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	0.89	0/1563	0.90	1/2105 (0.0%)
1	B	0.88	0/1563	0.93	2/2105 (0.1%)
2	W	1.70	11/589 (1.9%)	2.26	39/910 (4.3%)
3	X	1.69	14/532 (2.6%)	2.51	53/817 (6.5%)
All	All	1.15	25/4247 (0.6%)	1.50	95/5937 (1.6%)

The worst 5 of 25 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	X	9	DT	C5-C7	8.49	1.55	1.50
2	W	7	DA	N3-C4	-7.55	1.30	1.34
3	X	15	DC	N3-C4	-7.16	1.28	1.33
3	X	13	DT	P-O5'	7.01	1.66	1.59
3	X	15	DC	C1'-N1	6.85	1.58	1.49

The worst 5 of 95 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	X	14	DT	C6-C5-C7	-11.87	115.78	122.90
2	W	15	DA	N1-C6-N6	11.79	125.67	118.60
2	W	23	DA	O4'-C1'-N9	-11.04	100.27	108.00
3	X	18	DT	C5-C4-O4	-10.61	117.47	124.90
2	W	15	DA	O4'-C1'-N9	-10.51	100.65	108.00

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	1541	0	1566	7	0
1	B	1541	0	1566	8	0
2	W	522	0	283	11	0
3	X	478	0	275	13	0
4	A	182	0	0	0	0
4	B	187	0	0	1	0
4	W	59	0	0	0	0
4	X	68	0	0	0	0
All	All	4578	0	3690	27	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 5.

The worst 5 of 27 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)
2:W:24:DT:H3	3:X:5:DA:H62	1.12	0.97
2:W:22:DG:H1	3:X:7:DC:H42	1.16	0.93
2:W:25:DA:N6	3:X:4:DT:O4	2.15	0.80
3:X:24:DC:H2''	3:X:25:DC:H5''	1.73	0.70
2:W:22:DG:H2''	2:W:23:DA:C8	2.35	0.61

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	196/243 (81%)	195 (100%)	1 (0%)	0	100	100
1	B	196/243 (81%)	194 (99%)	2 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	392/486 (81%)	389 (99%)	3 (1%)	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	A	158/196 (81%)	156 (99%)	2 (1%)	69	59
1	B	158/196 (81%)	157 (99%)	1 (1%)	86	82
All	All	316/392 (81%)	313 (99%)	3 (1%)	78	72

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	38	LEU
1	A	228	HIS
1	B	228	HIS

Some 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 ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	198/243 (81%)	0.00	8 (4%) 38 36	14, 28, 52, 81	4 (2%)
1	B	198/243 (81%)	-0.01	5 (2%) 57 56	14, 28, 50, 83	3 (1%)
2	W	25/30 (83%)	0.30	3 (12%) 4 4	23, 37, 108, 131	0
3	X	24/30 (80%)	0.16	1 (4%) 36 34	23, 38, 102, 112	0
All	All	445/546 (81%)	0.02	17 (3%) 40 39	14, 29, 66, 131	7 (1%)

The worst 5 of 17 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	39	VAL	5.2
1	A	234	ALA	5.0
1	A	235	ALA	4.2
1	A	39	VAL	4.2
3	X	3	DC	3.4

### 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 carbohydrates in this entry.

### 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.