



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 03:23 AM UTC

PDB ID : 6BCD / pdb\_00006bcd  
Title : Crystal structure of Rev7-K44A/R124A/A135D in complex with Rev3-RBM2 (residues 1988-2014)  
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Deposited on : 2017-10-20  
Resolution : 1.43 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](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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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

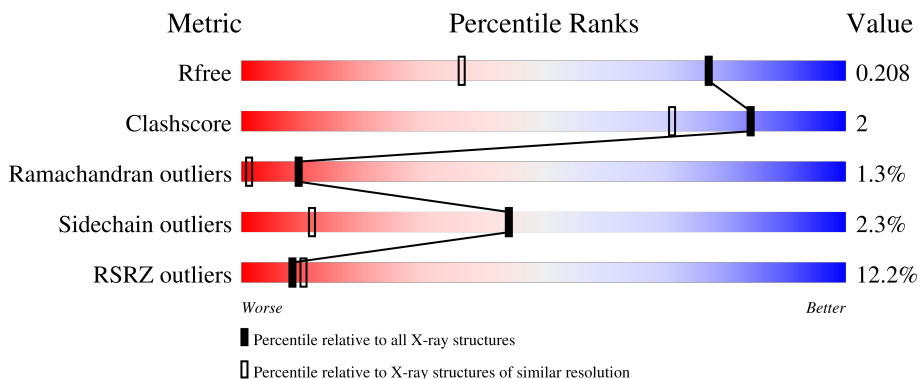
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.43 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	3234 (1.46-1.42)
Clashscore	190562	3289 (1.46-1.42)
Ramachandran outliers	187476	3248 (1.46-1.42)
Sidechain outliers	187428	3248 (1.46-1.42)
RSRZ outliers	180081	3234 (1.46-1.42)

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  $\geq 3$ , 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	227	 11% (red), 75% (green), 13% (yellow), 10% (grey)
2	B	28	 14% (red), 71% (green), 18% (yellow), 11% (grey)

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2086 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 Mitotic spindle assembly checkpoint protein MAD2B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	205	1700	1090	285	314	11	0	6	0

There are 19 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-15	MET	-	initiating methionine	UNP Q9UI95
A	-14	GLY	-	expression tag	UNP Q9UI95
A	-13	SER	-	expression tag	UNP Q9UI95
A	-12	SER	-	expression tag	UNP Q9UI95
A	-11	HIS	-	expression tag	UNP Q9UI95
A	-10	HIS	-	expression tag	UNP Q9UI95
A	-9	HIS	-	expression tag	UNP Q9UI95
A	-8	HIS	-	expression tag	UNP Q9UI95
A	-7	HIS	-	expression tag	UNP Q9UI95
A	-6	HIS	-	expression tag	UNP Q9UI95
A	-5	SER	-	expression tag	UNP Q9UI95
A	-4	GLN	-	expression tag	UNP Q9UI95
A	-3	ASP	-	expression tag	UNP Q9UI95
A	-2	PRO	-	expression tag	UNP Q9UI95
A	-1	ASN	-	expression tag	UNP Q9UI95
A	0	SER	-	expression tag	UNP Q9UI95
A	44	ALA	LYS	engineered mutation	UNP Q9UI95
A	124	ALA	ARG	engineered mutation	UNP Q9UI95
A	135	ASP	ALA	engineered mutation	UNP Q9UI95

- Molecule 2 is a protein called DNA polymerase zeta catalytic subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	25	199	129	36	31	3	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1987	MET	-	initiating methionine	UNP O60673

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	157	Total O 157 157	0	0
3	B	30	Total O 30 30	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	64.58Å 64.58Å 116.55Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	116.55 – 1.43 55.93 – 1.43	Depositor EDS
% Data completeness (in resolution range)	98.5 (116.55-1.43) 98.5 (55.93-1.43)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.01 (at 1.43Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.175 , 0.197 0.183 , 0.208	Depositor DCC
$R_{free}$ test set	2521 reflections (4.64%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.0	Xtrriage
Anisotropy	0.617	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 36.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.024 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	2086	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.65% 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	1.63	14/1739 (0.8%)	1.33	9/2367 (0.4%)
2	B	1.72	4/202 (2.0%)	1.48	0/271
All	All	1.64	18/1941 (0.9%)	1.35	9/2638 (0.3%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	154	GLU	CA-C	-10.90	1.38	1.52
2	B	1992	ILE	CA-CB	-8.26	1.44	1.54
1	A	4	LEU	CA-C	8.19	1.62	1.52
1	A	181	MET	SD-CE	-7.39	1.61	1.79
1	A	122	LEU	N-CA	-7.08	1.37	1.46
1	A	154	GLU	C-O	6.96	1.32	1.24
1	A	189	LEU	CA-C	-6.51	1.46	1.52
2	B	1993	VAL	CA-CB	-6.43	1.46	1.54
1	A	193	THR	CA-C	-5.90	1.45	1.52
1	A	97	LYS	CA-C	-5.64	1.45	1.52
2	B	2003	ARG	CA-C	5.57	1.60	1.52
1	A	95	VAL	CA-C	-5.55	1.46	1.53
1	A	9	LEU	CA-C	-5.33	1.47	1.53
1	A	81	GLU	CA-CB	-5.29	1.45	1.53
1	A	163	ILE	CA-C	-5.26	1.46	1.52
2	B	2002	SER	CA-C	5.23	1.60	1.53
1	A	44	ALA	N-CA	-5.18	1.39	1.46
1	A	156	ALA	CA-CB	-5.13	1.45	1.53

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	154	GLU	CA-C-O	8.63	130.53	120.69
1	A	181	MET	CG-SD-CE	-7.34	84.76	100.90
1	A	50	VAL	N-CA-CB	5.88	118.31	111.85
1	A	196	ILE	N-CA-C	-5.81	107.15	112.96
1	A	200	GLN	CA-CB-CG	5.75	125.59	114.10
1	A	4	LEU	CA-C-O	5.46	126.71	120.54
1	A	160	MET	N-CA-C	5.46	117.99	108.76
1	A	196	ILE	CB-CA-C	5.07	115.52	111.06
1	A	173	LEU	O-C-N	-5.01	117.04	123.06

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	109	SER	Peptide

## 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	1700	0	1715	9	0
2	B	199	0	221	0	0
3	A	157	0	0	2	0
3	B	30	0	0	0	0
All	All	2086	0	1936	9	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 2.

All (9) 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:191:THR:HG22	1:A:200:GLN:HG3	1.51	0.92
1:A:175[B]:ASP:OD1	3:A:301:HOH:O	2.04	0.76
1:A:49[B]:ASN:ND2	1:A:120:GLU:OE1	2.32	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:138:ASP:OD2	1:A:185:ARG:NH2	2.34	0.59
1:A:43:GLN:CD	1:A:56[B]:CYS:SG	2.90	0.55
1:A:115:LEU:HB3	1:A:196:ILE:HD11	1.88	0.54
1:A:39:VAL:HG12	3:A:389:HOH:O	2.16	0.46
1:A:186:LEU:CD2	1:A:204:GLU:HG2	2.49	0.43
1:A:185:ARG:HH11	1:A:185:ARG:HB2	1.85	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	209/227 (92%)	204 (98%)	2 (1%)	3 (1%)	9	1
2	B	23/28 (82%)	23 (100%)	0	0	100	100
All	All	232/255 (91%)	227 (98%)	2 (1%)	3 (1%)	9	1

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	110	ILE
1	A	182	HIS
1	A	158	ARG

### 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	199/213 (93%)	195 (98%)	4 (2%)	48	15
2	B	23/26 (88%)	22 (96%)	1 (4%)	26	2
All	All	222/239 (93%)	217 (98%)	5 (2%)	44	12

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	LEU
1	A	95	VAL
1	A	96	GLU
1	A	110	ILE
2	B	2011	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	7	GLN
1	A	43	GLN
1	A	53	GLN
1	A	65	GLN
2	B	2007	GLN
2	B	2011	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](#)

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	205/227 (90%)	0.58	24 (11%) 9 11	11, 24, 55, 102	6 (2%)
2	B	25/28 (89%)	0.62	4 (16%) 5 6	18, 26, 51, 56	0
All	All	230/255 (90%)	0.59	28 (12%) 8 10	11, 24, 55, 102	6 (2%)

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	110	ILE	7.5
1	A	179	VAL	6.1
1	A	159	ASN	5.4
1	A	156	ALA	5.2
1	A	155	ALA	5.0
1	A	207	ALA	4.1
1	A	182	HIS	3.9
1	A	196	ILE	3.8
1	A	160	MET	3.7
1	A	3	THR	3.7
1	A	158	ARG	3.4
1	A	157	THR	3.3
1	A	178	ASP	3.2
1	A	206	ARG	3.1
1	A	177	GLN	3.1
1	A	175[A]	ASP	3.0
1	A	180	HIS	2.8
1	A	117	SER	2.7
2	B	1989	ASP	2.6
1	A	183	ASP	2.6
2	B	1990	LYS	2.5
1	A	4	LEU	2.5
2	B	2013	LYS	2.4
1	A	139	HIS	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	90	LYS	2.2
1	A	176	GLU	2.2
2	B	2011	GLN	2.1
1	A	121	GLN	2.0

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.