



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 4N8M  
Title : Structural polymorphism in the N-terminal oligomerization domain of NPM1  
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Deposited on : 2013-10-17  
Resolution : 1.80 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  
<http://wwpdb.org/validation/2016/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  
Mogul : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

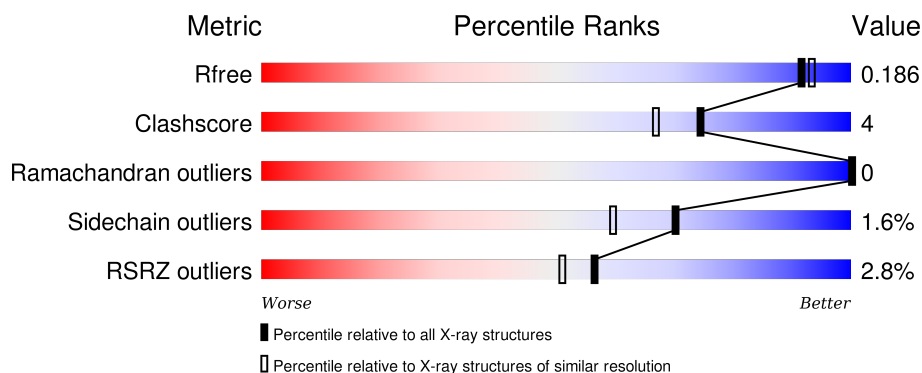
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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))
$R_{free}$	91344	4533 (1.80-1.80)
Clashscore	102246	5383 (1.80-1.80)
Ramachandran outliers	100387	5320 (1.80-1.80)
Sidechain outliers	100360	5319 (1.80-1.80)
RSRZ outliers	91569	4547 (1.80-1.80)

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. 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	133	<div> <div>5%</div> <div> <div></div> <div>75%</div> <div>6%</div> <div>19%</div> </div> </div>
1	B	133	<div> <div>73%</div> <div>8%</div> <div>20%</div> </div>
1	C	133	<div> <div>2%</div> <div> <div></div> <div>73%</div> <div>7%</div> <div>20%</div> </div> </div>
1	D	133	<div> <div>2%</div> <div> <div></div> <div>71%</div> <div>8%</div> <div>21%</div> </div> </div>
1	E	133	<div> <div>2%</div> <div> <div></div> <div>70%</div> <div>10%</div> <div>20%</div> </div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4263 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 Nucleophosmin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	108	Total	C	N	O	S	0	3	0
			824	521	139	159	5			
1	B	107	Total	C	N	O	S	0	1	0
			810	513	138	155	4			
1	C	106	Total	C	N	O	S	0	1	0
			802	509	136	153	4			
1	D	105	Total	C	N	O	S	0	0	0
			787	501	135	147	4			
1	E	106	Total	C	N	O	S	0	2	0
			808	512	137	155	4			

There are 15 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	EXPRESSION TAG	UNP Q61937
A	-1	SER	-	EXPRESSION TAG	UNP Q61937
A	0	HIS	-	EXPRESSION TAG	UNP Q61937
B	-2	GLY	-	EXPRESSION TAG	UNP Q61937
B	-1	SER	-	EXPRESSION TAG	UNP Q61937
B	0	HIS	-	EXPRESSION TAG	UNP Q61937
C	-2	GLY	-	EXPRESSION TAG	UNP Q61937
C	-1	SER	-	EXPRESSION TAG	UNP Q61937
C	0	HIS	-	EXPRESSION TAG	UNP Q61937
D	-2	GLY	-	EXPRESSION TAG	UNP Q61937
D	-1	SER	-	EXPRESSION TAG	UNP Q61937
D	0	HIS	-	EXPRESSION TAG	UNP Q61937
E	-2	GLY	-	EXPRESSION TAG	UNP Q61937
E	-1	SER	-	EXPRESSION TAG	UNP Q61937
E	0	HIS	-	EXPRESSION TAG	UNP Q61937

- Molecule 2 is COBALT (II) ION (three-letter code: CO) (formula: Co).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total Co 1 1	0	0
2	A	1	Total Co 1 1	0	0
2	D	1	Total Co 1 1	0	0
2	C	1	Total Co 1 1	0	0
2	E	1	Total Co 1 1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	42	Total O 42 42	0	0
3	B	58	Total O 58 58	0	0
3	C	48	Total O 48 48	0	0
3	D	40	Total O 40 40	0	0
3	E	39	Total O 39 39	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	90.67Å 69.79Å 88.63Å 90.00° 99.87° 90.00°	Depositor
Resolution (Å)	37.26 – 1.80 44.47 – 1.80	Depositor EDS
% Data completeness (in resolution range)	97.2 (37.26-1.80) 97.2 (44.47-1.80)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.07	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.12 (at 1.81Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7_650)	Depositor
R, $R_{free}$	0.163 , 0.190 0.157 , 0.186	Depositor DCC
$R_{free}$ test set	2494 reflections (5.09%)	DCC
Wilson B-factor (Å <sup>2</sup> )	20.1	Xtriage
Anisotropy	0.474	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 52.3	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	3 of 49024 reflections (0.006%)	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	4263	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.99% 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, 0.375 respectively for untwinned datasets, and 0.333, 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:  
CO

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	0.39	0/849	0.61	0/1151
1	B	0.45	0/829	0.66	0/1124
1	C	0.48	1/821 (0.1%)	0.60	0/1113
1	D	0.39	0/803	0.62	1/1088 (0.1%)
1	E	0.36	0/830	0.57	0/1124
All	All	0.42	1/4132 (0.0%)	0.61	1/5600 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	104	CYS	CB-SG	-6.57	1.71	1.82

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	53	ALA	N-CA-C	-5.20	96.95	111.00

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	824	0	818	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	810	0	804	7	0
1	C	802	0	799	6	0
1	D	787	0	786	6	0
1	E	808	0	808	8	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
3	A	42	0	0	0	0
3	B	58	0	0	0	0
3	C	48	0	0	1	0
3	D	40	0	0	0	0
3	E	39	0	0	0	0
All	All	4263	0	4015	32	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 4.

All (32) 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:79:LEU:HD21	1:C:87:VAL:HG23	1.59	0.85
1:C:36:ASP:HB3	1:C:39:GLU:HG2	1.67	0.76
1:D:79:LEU:HD21	1:D:87:VAL:HG23	1.67	0.74
1:C:79:LEU:CD2	1:C:87:VAL:HG23	2.17	0.73
1:B:79:LEU:CD2	1:B:87:VAL:HG23	2.24	0.67
1:A:79:LEU:CD2	1:A:87:VAL:HG23	2.28	0.64
1:C:79:LEU:HD21	1:C:87:VAL:CG2	2.28	0.63
1:E:102:LEU:HD21	1:E:109:VAL:HG21	1.80	0.62
1:B:102:LEU:HD21	1:B:109:VAL:HG21	1.79	0.62
1:D:79:LEU:HD21	1:D:87:VAL:CG2	2.29	0.61
1:A:31:PHE:HB3	1:A:98:VAL:HG13	1.82	0.61
1:E:79:LEU:CD2	1:E:87:VAL:HG23	2.31	0.60
1:D:79:LEU:CD2	1:D:87:VAL:HG23	2.33	0.59
1:B:79:LEU:HD23	1:B:87:VAL:HG23	1.86	0.56
1:A:79:LEU:HD21	1:A:87:VAL:HG23	1.89	0.53
1:C:102:LEU:HD21	1:C:109:VAL:HG21	1.89	0.52
1:E:28:ASP:HB2	1:E:100:LEU:O	2.11	0.51
1:A:61:GLU:OE1	1:A:101:ARG:HD2	2.12	0.50
1:E:54:LYS:HB2	1:E:56:GLU:OE1	2.13	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:72:ILE:HD11	1:E:18:LEU:O	2.13	0.49
1:D:102:LEU:HD21	1:D:109:VAL:HG21	1.96	0.48
1:E:100:LEU:HD13	1:E:111:ILE:HD12	1.97	0.46
1:B:49:LEU:HD23	1:B:109:VAL:HG22	2.00	0.43
1:E:79:LEU:HD21	1:E:87:VAL:HG23	1.98	0.43
1:E:63:GLU:HA	1:E:72:ILE:O	2.18	0.43
1:B:47:VAL:HG12	1:B:79:LEU:HD11	2.02	0.42
1:D:78:THR:O	1:D:79:LEU:HD23	2.20	0.41
1:D:56:GLU:HG3	1:D:58:HIS:CE1	2.55	0.41
1:C:65:MET:HG2	3:C:309:HOH:O	2.20	0.41
1:A:79:LEU:HD23	1:A:87:VAL:HG23	2.01	0.41
1:B:79:LEU:HD21	1:B:87:VAL:HG23	2.02	0.40
1:B:22:GLU:OE2	1:B:24:LYS:HE3	2.21	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	109/133 (82%)	104 (95%)	5 (5%)	0	100	100
1	B	106/133 (80%)	102 (96%)	4 (4%)	0	100	100
1	C	105/133 (79%)	99 (94%)	6 (6%)	0	100	100
1	D	103/133 (77%)	98 (95%)	5 (5%)	0	100	100
1	E	106/133 (80%)	103 (97%)	3 (3%)	0	100	100
All	All	529/665 (80%)	506 (96%)	23 (4%)	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	92/115 (80%)	91 (99%)	1 (1%)	80	74
1	B	89/115 (77%)	87 (98%)	2 (2%)	60	45
1	C	88/115 (76%)	87 (99%)	1 (1%)	80	74
1	D	85/115 (74%)	83 (98%)	2 (2%)	57	41
1	E	90/115 (78%)	89 (99%)	1 (1%)	80	74
All	All	444/575 (77%)	437 (98%)	7 (2%)	70	59

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	92	PHE
1	B	92	PHE
1	B	101	ARG
1	C	92	PHE
1	D	61	GLU
1	D	92	PHE
1	E	92	PHE

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 [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 5 ligands modelled in this entry, 5 are monoatomic - leaving 0 for Mogul analysis.

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.

No monomer is involved in short contacts.

## 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	108/133 (81%)	0.03	7 (6%) 22 18	12, 24, 55, 71	0
1	B	107/133 (80%)	-0.13	0 100 100	10, 20, 47, 57	0
1	C	106/133 (79%)	-0.24	2 (1%) 70 66	13, 22, 53, 78	0
1	D	105/133 (78%)	-0.13	3 (2%) 55 49	15, 26, 65, 95	0
1	E	106/133 (79%)	-0.17	3 (2%) 56 51	17, 30, 60, 73	0
All	All	532/665 (80%)	-0.13	15 (2%) 56 51	10, 24, 56, 95	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	37	GLU	5.9
1	E	33	VAL	4.8
1	E	26	ASP	3.9
1	A	119	VAL	3.5
1	A	68	GLU	3.0
1	C	14	PRO	2.9
1	A	120	GLU	2.9
1	D	38	ASN	2.9
1	C	26	ASP	2.8
1	A	70	SER	2.7
1	E	34	ASP	2.6
1	A	26	ASP	2.6
1	A	71	PRO	2.3
1	A	72	ILE	2.2
1	D	39	GLU	2.1

### 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](#)

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> 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	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	CO	B	201	1/1	0.96	0.04	-	39,39,39,39	0
2	CO	E	201	1/1	0.91	0.19	-	85,85,85,85	0
2	CO	A	601	1/1	0.87	0.16	-	76,76,76,76	0
2	CO	D	201	1/1	0.94	0.04	-	64,64,64,64	0
2	CO	C	201	1/1	0.94	0.13	-	58,58,58,58	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.