



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 12, 2020 – 11:55 pm BST

PDB ID : 4IDX  
Title : hexameric crystal structure of Schmallenberg virus nucleoprotein  
Authors : Dong, H.; Dong, C.  
Deposited on : 2012-12-13  
Resolution : 3.21 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

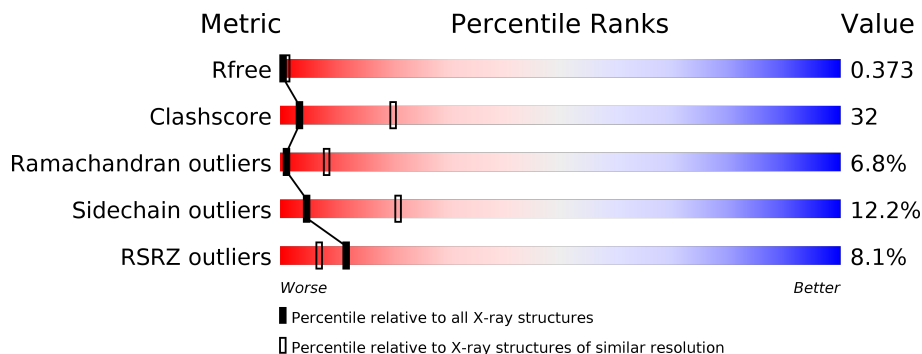
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.21 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	1335 (3.24-3.20)
Clashscore	141614	1460 (3.24-3.20)
Ramachandran outliers	138981	1437 (3.24-3.20)
Sidechain outliers	138945	1436 (3.24-3.20)
RSRZ outliers	127900	1291 (3.24-3.20)

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	233	 10% 58% 28% 6% • 6%
1	B	233	 3% 49% 29% 9% • 10%
1	C	233	 10% 56% 24% 8% • 9%

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5072 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 Nucleocapsid protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	209	Total 1651	C 1074	N 276	O 289	S 12	0	0	0
1	A	218	Total 1722	C 1116	N 292	O 302	S 12	0	0	0
1	C	213	Total 1682	C 1093	N 282	O 295	S 12	0	0	0

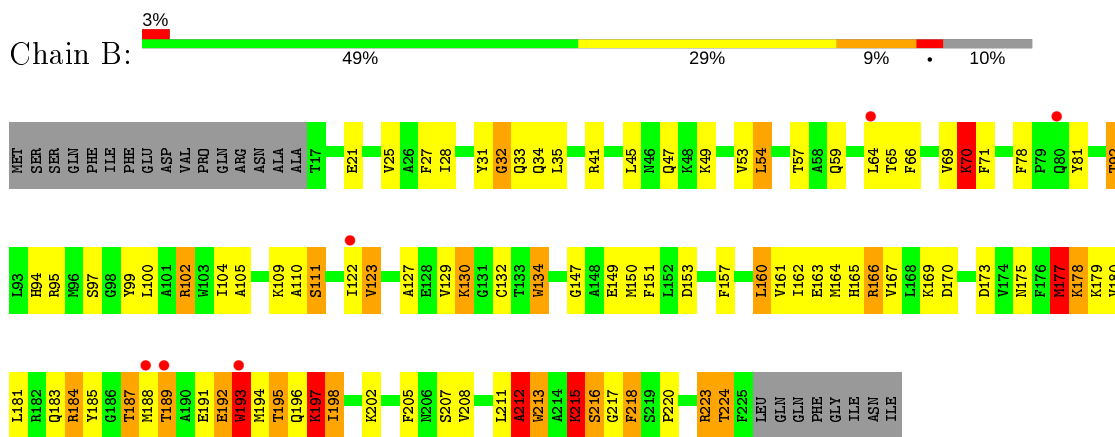
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	3	Total 3	O 3	0
2	A	7	Total 7	O 7	0
2	C	7	Total 7	O 7	0

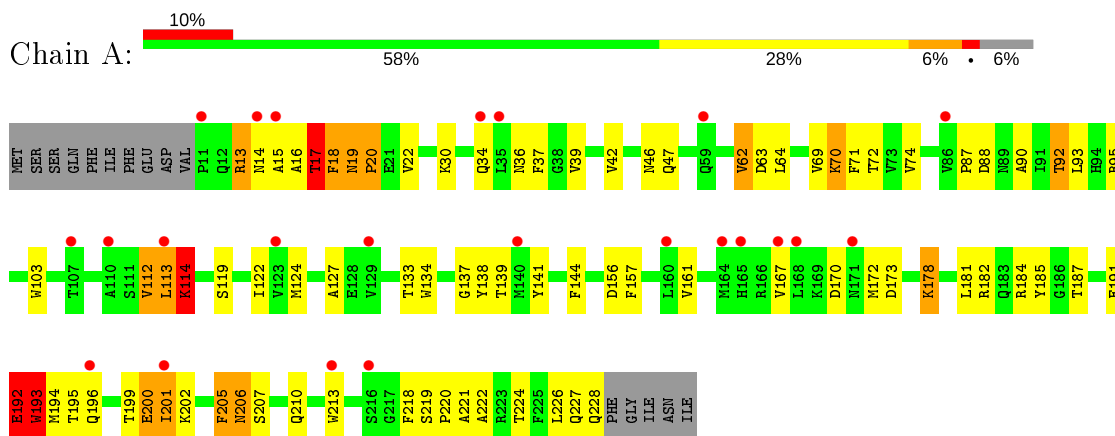
### 3 Residue-property plots [i](#)

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.

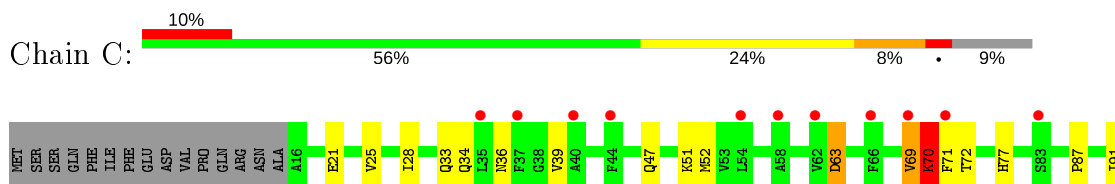
- Molecule 1: Nucleocapsid protein

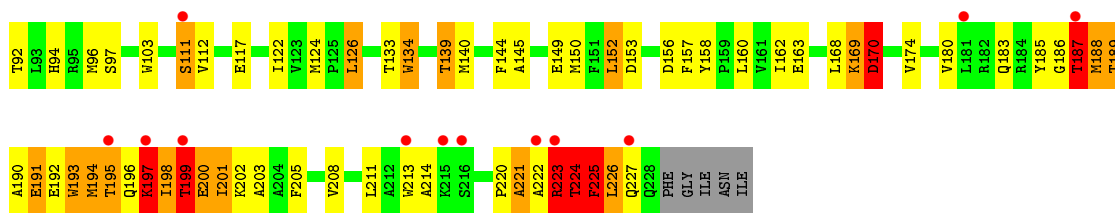


- Molecule 1: Nucleocapsid protein



- Molecule 1: Nucleocapsid protein





## 4 Data and refinement statistics

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	159.20Å 159.20Å 157.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.94 – 3.21 49.94 – 3.21	Depositor EDS
% Data completeness (in resolution range)	99.8 (49.94-3.21) 100.0 (49.94-3.21)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	0.07	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	5.26 (at 3.19Å)	Xtrriage
Refinement program	REFMAC 5.6.0117	Depositor
R, $R_{free}$	0.321 , 0.374 0.319 , 0.373	Depositor DCC
$R_{free}$ test set	853 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	94.5	Xtrriage
Anisotropy	0.165	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 75.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.42$ , $\langle L^2 \rangle = 0.24$	Xtrriage
Estimated twinning fraction	0.056 for l,-k,h 0.070 for -h,-l,-k	Xtrriage
$F_o, F_c$ correlation	0.83	EDS
Total number of atoms	5072	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	92.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.43% 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	0.53	2/1767 (0.1%)	0.82	6/2392 (0.3%)
1	B	0.51	2/1695 (0.1%)	0.75	7/2295 (0.3%)
1	C	0.52	2/1726 (0.1%)	0.81	11/2337 (0.5%)
All	All	0.52	6/5188 (0.1%)	0.79	24/7024 (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	C	0	1

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	212	ALA	CA-CB	5.33	1.63	1.52
1	A	103	TRP	CD2-CE2	5.12	1.47	1.41
1	A	213	TRP	CD2-CE2	5.05	1.47	1.41
1	B	193	TRP	CD2-CE2	5.02	1.47	1.41
1	C	103	TRP	CD2-CE2	5.00	1.47	1.41

The worst 5 of 24 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	194	MET	CB-CA-C	-16.41	77.58	110.40
1	B	177	MET	N-CA-C	-13.97	73.28	111.00
1	A	193	TRP	N-CA-C	-13.29	75.12	111.00
1	C	186	GLY	N-CA-C	-12.30	82.36	113.10
1	A	194	MET	N-CA-C	10.95	140.56	111.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	197	LYS	Peptide

## 5.2 Too-close contacts

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	1722	0	1717	87	2
1	B	1651	0	1645	124	0
1	C	1682	0	1677	119	2
2	A	7	0	0	0	0
2	B	3	0	0	0	0
2	C	7	0	0	0	0
All	All	5072	0	5039	326	2

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 32.

The worst 5 of 326 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:69:VAL:CG1	1:A:70:LYS:HB3	1.53	1.36
1:C:220:PRO:HA	1:C:221:ALA:CB	1.54	1.33
1:A:69:VAL:HA	1:A:70:LYS:CB	1.63	1.28
1:A:17:THR:CA	1:A:18:PHE:HB3	1.68	1.23
1:C:189:THR:HG23	1:C:190:ALA:N	1.49	1.20

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:220:PRO:O	1:C:193:TRP:CH2[11_444]	2.04	0.16
1:A:221:ALA:N	1:C:193:TRP:CH2[11_444]	2.16	0.04



## 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	216/233 (93%)	164 (76%)	37 (17%)	15 (7%)	1	8
1	B	207/233 (89%)	169 (82%)	24 (12%)	14 (7%)	1	8
1	C	211/233 (91%)	168 (80%)	29 (14%)	14 (7%)	1	9
All	All	634/699 (91%)	501 (79%)	90 (14%)	43 (7%)	1	8

5 of 43 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	70	LYS
1	B	215	LYS
1	B	216	SER
1	B	218	PHE
1	A	70	LYS

### 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	179/193 (93%)	164 (92%)	15 (8%)	11	38
1	B	172/193 (89%)	147 (86%)	25 (14%)	3	14
1	C	175/193 (91%)	151 (86%)	24 (14%)	3	16
All	All	526/579 (91%)	462 (88%)	64 (12%)	5	21

5 of 64 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	GLN
1	A	178	LYS
1	C	197	LYS
1	A	62	VAL
1	A	113	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 11 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	94	HIS
1	B	165	HIS
1	C	46	ASN
1	B	55	HIS
1	C	34	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 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	218/233 (93%)	0.77	23 (10%) 6 4	71, 101, 130, 137	0
1	B	209/233 (89%)	0.36	6 (2%) 51 37	55, 69, 94, 120	0
1	C	213/233 (91%)	0.70	23 (10%) 5 4	73, 98, 141, 172	0
All	All	640/699 (91%)	0.61	52 (8%) 12 7	55, 89, 131, 172	0

The worst 5 of 52 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	11	PRO	4.4
1	C	222	ALA	4.1
1	A	15	ALA	4.0
1	A	164	MET	3.8
1	A	34	GLN	3.8

### 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

There are no such residues in this entry.