



# wwPDB X-ray Structure Validation Summary Report i

Feb 28, 2014 – 10:47 AM GMT

PDB ID : 4H5Q  
Title : Crystal Structure of Rift Valley Fever Virus Nucleocapsid Protein Hexamer Bound to Single-stranded DNA  
Authors : Raymond, D.D.; Smith, J.L.  
Deposited on : 2012-09-18  
Resolution : 2.70 Å (reported)

This is a wwPDB 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 <http://wwpdb.org/ValidationPDFNotes.html>

---

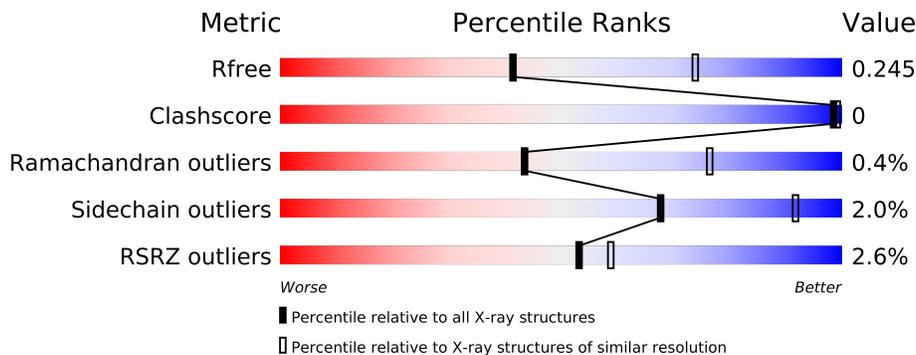
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 2.70 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))
$R_{free}$	66092	1557 (2.70-2.70)
Clashscore	79885	1939 (2.70-2.70)
Ramachandran outliers	78287	1905 (2.70-2.70)
Sidechain outliers	78261	1905 (2.70-2.70)
RSRZ outliers	66119	1559 (2.70-2.70)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	245	
1	B	245	
1	C	245	
2	D	14	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6031 atoms, of which 0 are hydrogen and 0 are deuterium.

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	A	242	Total 1894	C 1197	N 340	O 345	S 12	0	0	0
1	B	243	Total 1902	C 1201	N 342	O 347	S 12	0	0	0
1	C	243	Total 1902	C 1201	N 342	O 347	S 12	0	0	0

- Molecule 2 is a DNA chain called 30-mer poly(T) DNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	D	14	Total 277	C 140	N 28	O 96	P 13	0	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	15	Total 15	O 15	0	0
3	B	19	Total 19	O 19	0	0
3	C	18	Total 18	O 18	0	0
3	D	4	Total 4	O 4	0	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 errors 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

Chain A: 



- Molecule 1: Nucleocapsid protein

Chain B: 



- Molecule 1: Nucleocapsid protein

Chain C: 



- Molecule 2: 30-mer poly(T) DNA

Chain D: 



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	108.64Å 108.64Å 261.29Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	53.66 – 2.70 53.66 – 2.70	Depositor EDS
% Data completeness (in resolution range)	99.3 (53.66-2.70) 99.3 (53.66-2.70)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.11	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.79 (at 2.69Å)	Xtrriage
Refinement program	BUSTER 2.10	Depositor
R, $R_{free}$	0.189 , 0.230 0.197 , 0.245	Depositor DCC
$R_{free}$ test set	1313 reflections (5.37%)	DCC
Wilson B-factor (Å <sup>2</sup> )	54.9	Xtrriage
Anisotropy	0.097	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 40.6	EDS
Estimated twinning fraction	No twinning to report.	Xtrriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Outliers	0 of 25749 reflections	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6031	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	61.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.09% of the height of the origin peak. No significant pseudotranslation is detected.*

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

## 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	0.51	0/1931	0.65	0/2604
1	B	0.50	0/1939	0.64	0/2615
1	C	0.49	0/1939	0.62	0/2615
2	D	1.35	1/304 (0.3%)	2.16	20/468 (4.3%)
All	All	0.57	1/6113 (0.0%)	0.81	20/8302 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	14	DT	C1'-N1	5.43	1.56	1.49

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	DT	P-O3'-C3'	11.23	133.18	119.70
2	D	7	DT	C4-C5-C7	7.33	123.40	119.00
2	D	3	DT	O4'-C1'-N1	6.67	112.67	108.00
2	D	14	DT	O4'-C1'-N1	6.58	112.60	108.00
2	D	10	DT	C4-C5-C7	6.45	122.87	119.00

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1894	0	0	0	0
1	B	1902	0	40	1	0
1	C	1902	0	5	1	0
2	D	277	0	170	1	0
3	A	15	0	0	0	0
3	B	19	0	0	1	0
3	C	18	0	0	0	0
3	D	4	0	0	0	0
All	All	6031	0	215	3	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 0.

All (3) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:C:178:ARG:NH1	1:C:187:ARG:O	2.52	0.42
2:D:7:DT:H2'	2:D:7:DT:H6	1.70	0.42
1:B:89:LYS:NZ	3:B:314:HOH:O	2.54	0.41

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 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	240/245 (98%)	232 (97%)	7 (3%)	1 (0%)	43	76
1	B	241/245 (98%)	234 (97%)	6 (2%)	1 (0%)	43	76
1	C	241/245 (98%)	235 (98%)	5 (2%)	1 (0%)	43	76
All	All	722/735 (98%)	701 (97%)	18 (2%)	3 (0%)	43	76

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	209	ILE

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	B	209	ILE
1	C	209	ILE

### 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	195/198 (98%)	190 (97%)	5 (3%)	59	88
1	B	196/198 (99%)	194 (99%)	2 (1%)	85	97
1	C	196/198 (99%)	191 (97%)	5 (3%)	59	88
All	All	587/594 (99%)	575 (98%)	12 (2%)	68	92

5 of 12 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	19	ASN
1	B	117	GLN
1	C	117	GLN
1	A	180	ILE
1	C	114	ARG

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

### 5.3.3 RNA [i](#)

There are no RNA chains 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

There are no ligands in this entry.

## 5.7 Other polymers

There are no such residues in this entry.

## 5.8 Polymer linkage issues

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	242/245 (98%)	0.06	2 (0%) 83 87	39, 55, 92, 116	0
1	B	243/245 (99%)	0.12	7 (2%) 49 55	33, 51, 88, 115	0
1	C	243/245 (99%)	0.16	10 (4%) 35 40	40, 59, 87, 109	0
2	D	14/14 (100%)	0.09	0 100 100	53, 76, 117, 117	0
All	All	742/749 (99%)	0.11	19 (2%) 53 59	33, 55, 91, 117	0

The worst 5 of 19 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	3	ASN	4.5
1	B	12	ALA	3.4
1	C	16	VAL	3.4
1	C	4	TYR	3.2
1	C	18	ARG	3.0

### 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 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.