



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 21, 2020 – 01:46 pm BST

PDB ID : 2FZ1  
Title : Structure of Empty Head Turnip Yellow Mosaic Virus (ATC) at 100 K  
Authors : Larson, S.B.; Lucas, R.W.; McPherson, A.  
Deposited on : 2006-02-08  
Resolution : 2.90 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.

---

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

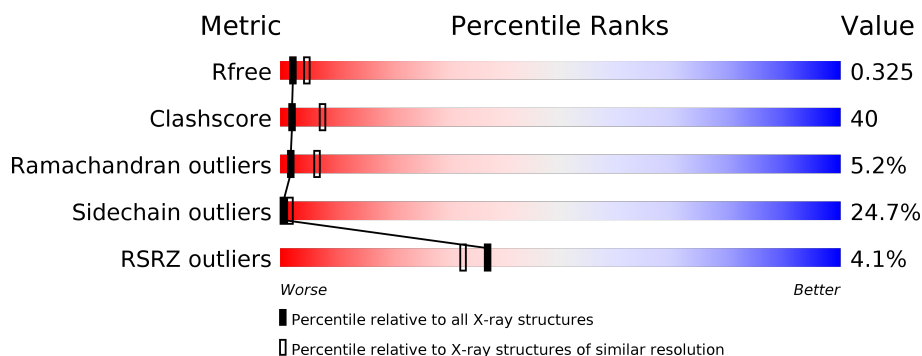
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.90 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	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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	189	<div> <div>5%</div> <div> <div></div> <div>30%</div> <div>37%</div> <div>19%</div> <div>•</div> <div>14%</div> </div> </div>
1	B	189	<div> <div>3%</div> <div> <div></div> <div>40%</div> <div>38%</div> <div>21%</div> <div>•</div> </div> </div>
1	C	189	<div> <div>3%</div> <div> <div></div> <div>37%</div> <div>55%</div> <div>8%</div> <div>•</div> </div> </div>

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 4058 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 Coat protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	163	Total	C	N	O	S	0	0	0
			1224	787	194	236	7			
1	B	189	Total	C	N	O	S	0	0	0
			1417	909	225	275	8			
1	C	189	Total	C	N	O	S	0	0	0
			1417	909	225	275	8			

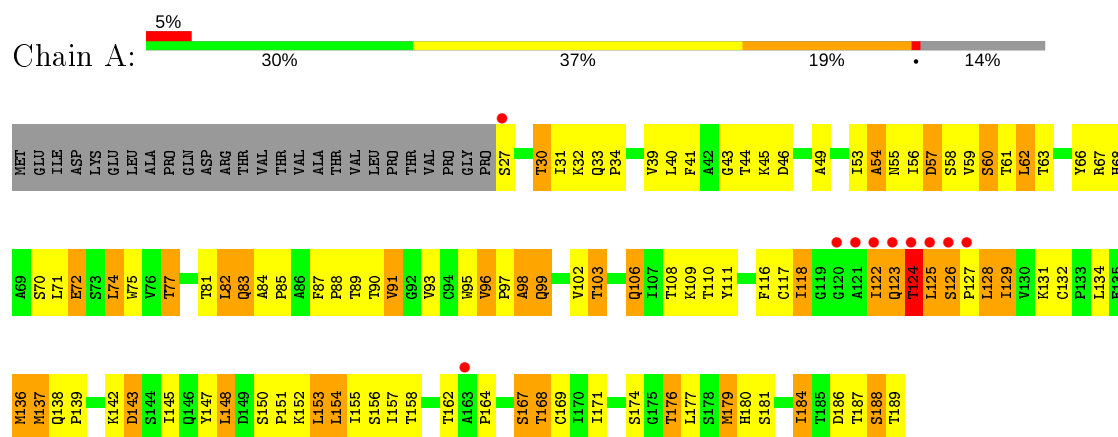
There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	99	GLN	ASN	VARIANT	UNP P20125
A	123	GLN	ASN	VARIANT	UNP P20125
A	138	GLN	ASN	VARIANT	UNP P20125
B	99	GLN	ASN	VARIANT	UNP P20125
B	123	GLN	ASN	VARIANT	UNP P20125
B	138	GLN	ASN	VARIANT	UNP P20125
C	99	GLN	ASN	VARIANT	UNP P20125
C	123	GLN	ASN	VARIANT	UNP P20125
C	138	GLN	ASN	VARIANT	UNP P20125

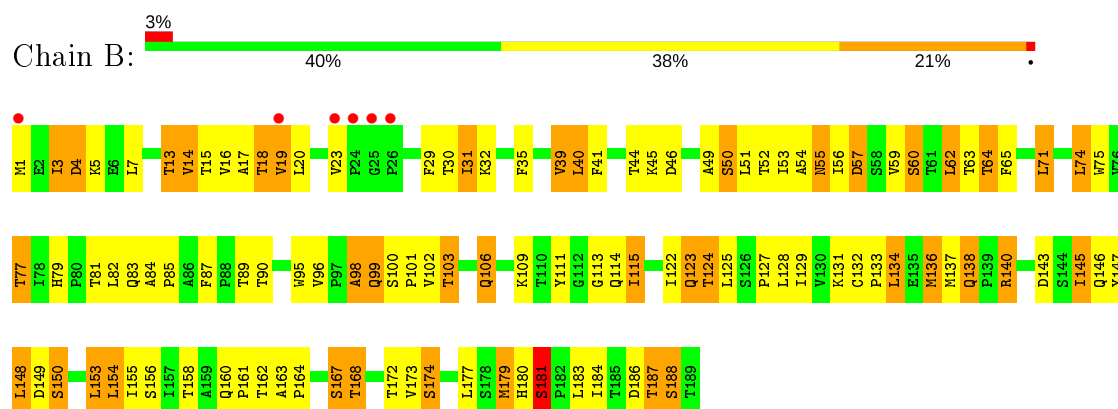
### 3 Residue-property plots

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.

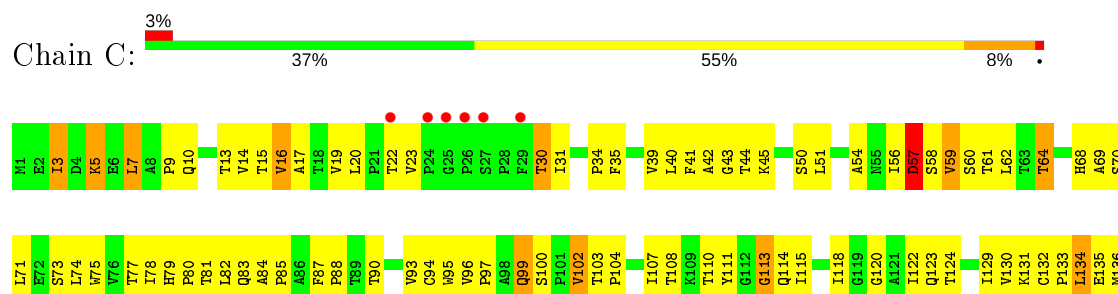
#### • Molecule 1: Coat protein



#### • Molecule 1: Coat protein



#### • Molecule 1: Coat protein



K137	Q138	P139	R140	V141	K142	D143	S144	I145		L148	D149	S150	P151	K152	L153		S156	I157	T158	A159	Q160	P161	T162	A163	P164		S167	T168		I171	T172	V173	S174	G175	T176	L177	S178	M179	H180	S181	P182	L183	I184	T185	D186	T187	S188	T189
------	------	------	------	------	------	------	------	------	--	------	------	------	------	------	------	--	------	------	------	------	------	------	------	------	------	--	------	------	--	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	511.36Å 511.36Å 304.31Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	48.64 – 2.90 49.53 – 2.89	Depositor EDS
% Data completeness (in resolution range)	49.2 (48.64-2.90) 55.2 (49.53-2.89)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.12	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	0.48 (at 2.91Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.309 , 0.315 0.321 , 0.325	Depositor DCC
$R_{free}$ test set	14121 reflections (4.37%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	49.7	Xtriage
Anisotropy	0.267	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 47.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.78	EDS
Total number of atoms	4058	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.83% 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

### 5.1 Standard geometry

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	0.60	0/1255	0.82	0/1724
1	B	0.57	0/1452	0.84	0/1997
1	C	0.29	0/1452	0.60	0/1997
All	All	0.50	0/4159	0.76	0/5718

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 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	1224	0	1250	106	0
1	B	1417	0	1454	125	0
1	C	1417	0	1454	113	0
All	All	4058	0	4158	329	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 40.

The worst 5 of 329 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:B:153:LEU:HD13	1:B:155:ILE:HD11	1.30	1.06

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:81:THR:HG23	1:B:83:GLN:H	1.20	1.05
1:A:30:THR:HG23	1:A:180:HIS:HB3	1.34	1.03
1:B:30:THR:HG22	1:B:180:HIS:HB3	1.42	1.01
1:C:184:ILE:HD12	1:C:184:ILE:H	1.23	0.99

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	161/189 (85%)	129 (80%)	23 (14%)	9 (6%)	2	5
1	B	187/189 (99%)	158 (84%)	19 (10%)	10 (5%)	2	6
1	C	187/189 (99%)	164 (88%)	14 (8%)	9 (5%)	2	8
All	All	535/567 (94%)	451 (84%)	56 (10%)	28 (5%)	2	6

5 of 28 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	98	ALA
1	B	64	THR
1	B	188	SER
1	B	54	ALA
1	B	111	TYR

### 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	144/167 (86%)	97 (67%)	47 (33%)	0	0
1	B	167/167 (100%)	118 (71%)	49 (29%)	0	1
1	C	167/167 (100%)	145 (87%)	22 (13%)	4	12
All	All	478/501 (95%)	360 (75%)	118 (25%)	0	2

5 of 118 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	23	VAL
1	B	71	LEU
1	C	108	THR
1	B	29	PHE
1	B	45	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 19 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	79	HIS
1	B	106	GLN
1	C	99	GLN
1	B	68	HIS
1	C	106	GLN

### 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	163/189 (86%)	0.22	10 (6%) 21 17	19, 37, 112, 177	0
1	B	189/189 (100%)	0.30	6 (3%) 47 43	20, 38, 89, 153	0
1	C	189/189 (100%)	0.27	6 (3%) 47 43	20, 38, 83, 109	0
All	All	541/567 (95%)	0.27	22 (4%) 37 32	19, 37, 96, 177	0

The worst 5 of 22 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	123	GLN	8.1
1	B	25	GLY	7.6
1	B	24	PRO	6.3
1	A	125	LEU	5.3
1	B	23	VAL	5.2

### 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.