



wwPDB X-ray Structure Validation Summary Report

Mar 12, 2026 – 10:57 PM UTC

PDB ID : 5IP2 / pdb_00005ip2
Title : Tomato spotted wilt tospovirus nucleocapsid protein-ssRNA complex
Authors : Komoda, K.; Narita, M.; Yamashita, K.; Tanaka, I.; Yao, M.
Deposited on : 2016-03-09
Resolution : 3.30 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

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>.

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

MolProbity : 4-5-2 with Phenix2.0
Xtriage (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

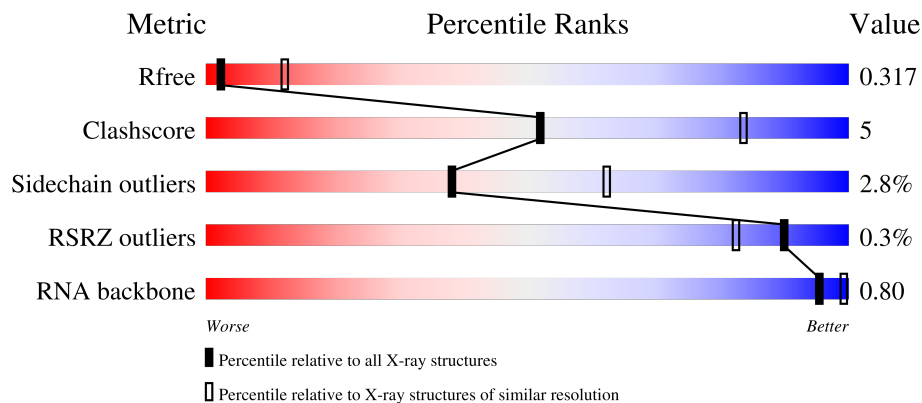
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.30 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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)
RNA backbone	3983	1048 (3.60-3.00)

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 ≥ 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	279	 67% 14% 18%
1	B	279	 71% 12% 16%
1	C	279	 68% 14% 18%
2	E	19	 11% 16% 74%
3	D	3	 33% 67%

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Mol	Chain	Length	Quality of chain
3	F	3	 100%

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 5659 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 Nucleoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	233	Total 1833	C 1171	N 303	O 348	S 11	0	0	0
1	C	229	Total 1803	C 1150	N 299	O 344	S 10	0	0	0
1	A	229	Total 1803	C 1150	N 299	O 344	S 10	0	0	0

There are 63 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-20	MET	-	expression tag	UNP F4ZD19
B	-19	ASN	-	expression tag	UNP F4ZD19
B	-18	HIS	-	expression tag	UNP F4ZD19
B	-17	LYS	-	expression tag	UNP F4ZD19
B	-16	HIS	-	expression tag	UNP F4ZD19
B	-15	HIS	-	expression tag	UNP F4ZD19
B	-14	HIS	-	expression tag	UNP F4ZD19
B	-13	HIS	-	expression tag	UNP F4ZD19
B	-12	HIS	-	expression tag	UNP F4ZD19
B	-11	HIS	-	expression tag	UNP F4ZD19
B	-10	SER	-	expression tag	UNP F4ZD19
B	-9	SER	-	expression tag	UNP F4ZD19
B	-8	GLY	-	expression tag	UNP F4ZD19
B	-7	GLU	-	expression tag	UNP F4ZD19
B	-6	ASN	-	expression tag	UNP F4ZD19
B	-5	LEU	-	expression tag	UNP F4ZD19
B	-4	TYR	-	expression tag	UNP F4ZD19
B	-3	PHE	-	expression tag	UNP F4ZD19
B	-2	GLN	-	expression tag	UNP F4ZD19
B	-1	GLY	-	expression tag	UNP F4ZD19
B	0	HIS	-	expression tag	UNP F4ZD19
C	-20	MET	-	expression tag	UNP F4ZD19
C	-19	ASN	-	expression tag	UNP F4ZD19

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-18	HIS	-	expression tag	UNP F4ZD19
C	-17	LYS	-	expression tag	UNP F4ZD19
C	-16	HIS	-	expression tag	UNP F4ZD19
C	-15	HIS	-	expression tag	UNP F4ZD19
C	-14	HIS	-	expression tag	UNP F4ZD19
C	-13	HIS	-	expression tag	UNP F4ZD19
C	-12	HIS	-	expression tag	UNP F4ZD19
C	-11	HIS	-	expression tag	UNP F4ZD19
C	-10	SER	-	expression tag	UNP F4ZD19
C	-9	SER	-	expression tag	UNP F4ZD19
C	-8	GLY	-	expression tag	UNP F4ZD19
C	-7	GLU	-	expression tag	UNP F4ZD19
C	-6	ASN	-	expression tag	UNP F4ZD19
C	-5	LEU	-	expression tag	UNP F4ZD19
C	-4	TYR	-	expression tag	UNP F4ZD19
C	-3	PHE	-	expression tag	UNP F4ZD19
C	-2	GLN	-	expression tag	UNP F4ZD19
C	-1	GLY	-	expression tag	UNP F4ZD19
C	0	HIS	-	expression tag	UNP F4ZD19
A	-20	MET	-	expression tag	UNP F4ZD19
A	-19	ASN	-	expression tag	UNP F4ZD19
A	-18	HIS	-	expression tag	UNP F4ZD19
A	-17	LYS	-	expression tag	UNP F4ZD19
A	-16	HIS	-	expression tag	UNP F4ZD19
A	-15	HIS	-	expression tag	UNP F4ZD19
A	-14	HIS	-	expression tag	UNP F4ZD19
A	-13	HIS	-	expression tag	UNP F4ZD19
A	-12	HIS	-	expression tag	UNP F4ZD19
A	-11	HIS	-	expression tag	UNP F4ZD19
A	-10	SER	-	expression tag	UNP F4ZD19
A	-9	SER	-	expression tag	UNP F4ZD19
A	-8	GLY	-	expression tag	UNP F4ZD19
A	-7	GLU	-	expression tag	UNP F4ZD19
A	-6	ASN	-	expression tag	UNP F4ZD19
A	-5	LEU	-	expression tag	UNP F4ZD19
A	-4	TYR	-	expression tag	UNP F4ZD19
A	-3	PHE	-	expression tag	UNP F4ZD19
A	-2	GLN	-	expression tag	UNP F4ZD19
A	-1	GLY	-	expression tag	UNP F4ZD19
A	0	HIS	-	expression tag	UNP F4ZD19

- Molecule 2 is a RNA chain called RNA (5'-R(P*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*U)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	E	5	100	45	10	40	5	0	0	0

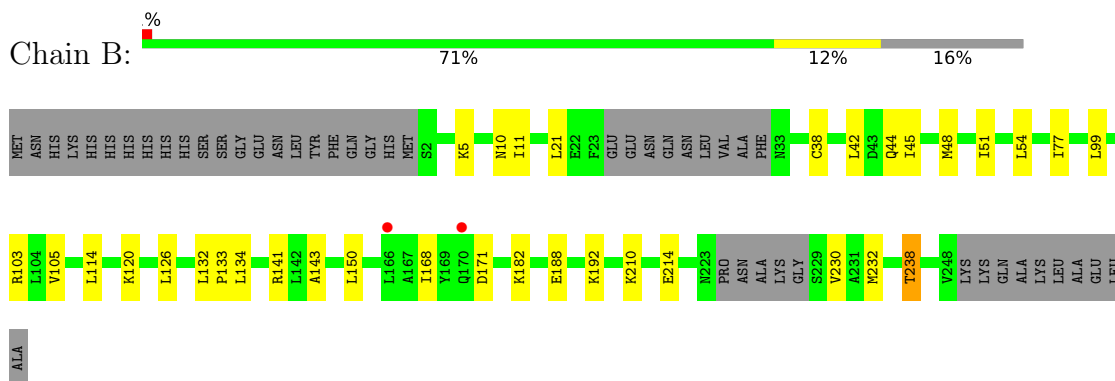
- Molecule 3 is a RNA chain called RNA (5'-D(P*UP*UP*U)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	F	3	60	27	6	24	3	0	0	0
3	D	3	60	27	6	24	3	0	0	0

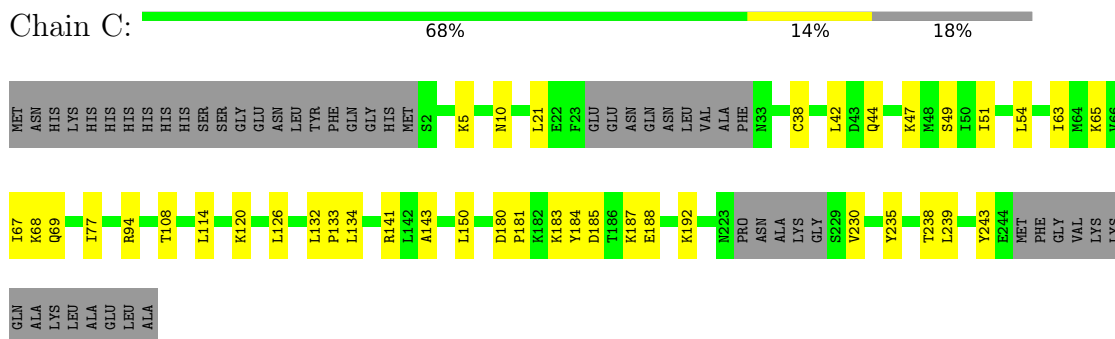
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

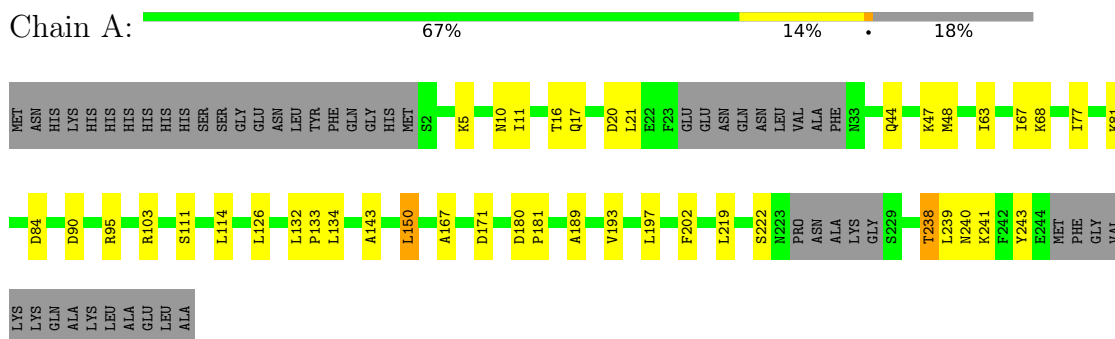
- Molecule 1: Nucleoprotein



- Molecule 1: Nucleoprotein



- Molecule 1: Nucleoprotein



- Molecule 2: RNA (5'-R(P*U P*UP*UP*U)-3')



- Molecule 3: RNA (5'-D(P*UP*UP*U)-3')



There are no outlier residues recorded for this chain.

- Molecule 3: RNA (5'-D(P*UP*UP*U)-3')



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	68.21Å 94.73Å 70.92Å 90.00° 112.60° 90.00°	Depositor
Resolution (Å)	38.58 – 3.30 38.58 – 3.30	Depositor EDS
% Data completeness (in resolution range)	99.4 (38.58-3.30) 99.4 (38.58-3.30)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.61 (at 3.32Å)	Xtrriage
Refinement program	PHENIX dev_1426	Depositor
R, R_{free}	0.282 , 0.317 0.288 , 0.317	Depositor DCC
R_{free} test set	919 reflections (7.25%)	wwPDB-VP
Wilson B-factor (Å ²)	134.8	Xtrriage
Anisotropy	0.416	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 81.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	0.039 for l,-k,h	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	5659	wwPDB-VP
Average B, all atoms (Å ²)	139.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.59% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	0.27	0/1823	0.70	0/2441
1	B	0.26	0/1854	0.69	0/2482
1	C	0.26	0/1823	0.69	0/2441
2	E	0.06	0/109	0.16	0/166
3	D	0.06	0/65	0.10	0/98
3	F	0.08	0/65	0.23	0/98
All	All	0.26	0/5739	0.68	0/7726

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 [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	1803	0	1885	24	1
1	B	1833	0	1915	18	0
1	C	1803	0	1885	25	0
2	E	100	0	51	4	0
3	D	60	0	31	2	0
3	F	60	0	31	0	0
All	All	5659	0	5798	58	1

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 5.

The worst 5 of 58 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:5:LYS:O	1:A:10:ASN:ND2	2.30	0.63
1:C:184:TYR:HD1	2:E:4:U:H3	1.48	0.60
1:C:68:LYS:NZ	2:E:4:U:OP1	2.36	0.58
1:B:5:LYS:O	1:B:10:ASN:ND2	2.32	0.57
1:B:171:ASP:OD2	1:A:243:TYR:OH	2.22	0.57

All (1) 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:17:GLN:NE2	1:A:111:SER:OG[2_546]	2.19	0.01

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

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	205/246 (83%)	200 (98%)	5 (2%)	43	65
1	B	208/246 (85%)	202 (97%)	6 (3%)	37	62
1	C	205/246 (83%)	199 (97%)	6 (3%)	37	62
All	All	618/738 (84%)	601 (97%)	17 (3%)	38	62

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	126	LEU

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Mol	Chain	Res	Type
1	A	238	THR
1	C	114	LEU
1	C	126	LEU
1	C	150	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	208	GLN
1	A	41	ASN
1	A	59	ASN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	E	4/19 (21%)	0	0
3	D	2/3 (66%)	0	0
3	F	2/3 (66%)	0	0
All	All	8/25 (32%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

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, 95th 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 ²)	Q<0.9
1	A	229/279 (82%)	-0.59	0 100 100	100, 129, 163, 184	0
1	B	233/279 (83%)	-0.37	2 (0%) 81 65	117, 138, 179, 201	0
1	C	229/279 (82%)	-0.54	0 100 100	88, 124, 194, 225	0
2	E	5/19 (26%)	-0.23	0 100 100	203, 212, 214, 217	0
3	D	3/3 (100%)	-0.51	0 100 100	254, 254, 261, 263	0
3	F	3/3 (100%)	-0.40	0 100 100	205, 205, 229, 235	0
All	All	702/862 (81%)	-0.50	2 (0%) 90 82	88, 132, 184, 263	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	166	LEU	2.8
1	B	170	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.