



wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 16, 2021 – 11:27 AM EST

PDB ID : 6WJI
Title : 2.05 Angstrom Resolution Crystal Structure of C-terminal Dimerization Domain of Nucleocapsid Phosphoprotein from SARS-CoV-2
Authors : Minasov, G.; Shuvalova, L.; Wiersum, G.; Satchell, K.J.F.; Center for Structural Genomics of Infectious Diseases (CSGID)
Deposited on : 2020-04-13
Resolution : 2.05 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 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	:	2.16
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)	:	2.16

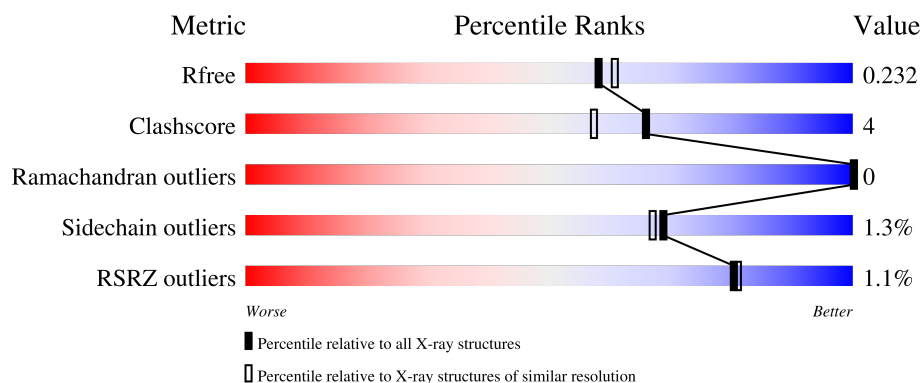
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.05 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	2684 (2.08-2.04)
Clashscore	141614	2801 (2.08-2.04)
Ramachandran outliers	138981	2768 (2.08-2.04)
Sidechain outliers	138945	2768 (2.08-2.04)
RSRZ outliers	127900	2646 (2.08-2.04)

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	121	
1	B	121	
1	C	121	
1	D	121	
1	E	121	

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Mol	Chain	Length	Quality of chain
1	F	121	<div><div><div>%</div><div><div></div></div><div>78%</div><div>11%</div><div>•</div><div>11%</div></div></div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5861 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
1	A	108	Total	C	N	O	S	0	0	0
			866	550	154	160	2			
1	B	108	Total	C	N	O	S	0	0	0
			866	550	154	160	2			
1	C	108	Total	C	N	O	S	0	0	0
			866	550	154	160	2			
1	D	108	Total	C	N	O	S	0	0	0
			866	550	154	160	2			
1	E	108	Total	C	N	O	S	0	1	0
			875	556	156	161	2			
1	F	108	Total	C	N	O	S	0	1	0
			875	556	156	161	2			

There are 78 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	244	SER	-	expression tag	UNP P0DTC9
A	245	ASN	-	expression tag	UNP P0DTC9
A	246	ALA	-	expression tag	UNP P0DTC9
A	247	THR	-	expression tag	UNP P0DTC9
A	248	LYS	-	expression tag	UNP P0DTC9
A	249	LYS	-	expression tag	UNP P0DTC9
A	250	SER	-	expression tag	UNP P0DTC9
A	251	ALA	-	expression tag	UNP P0DTC9
A	252	ALA	-	expression tag	UNP P0DTC9
A	253	GLU	-	expression tag	UNP P0DTC9
A	254	ALA	-	expression tag	UNP P0DTC9
A	255	SER	-	expression tag	UNP P0DTC9
A	256	LYS	-	expression tag	UNP P0DTC9
B	244	SER	-	expression tag	UNP P0DTC9
B	245	ASN	-	expression tag	UNP P0DTC9
B	246	ALA	-	expression tag	UNP P0DTC9
B	247	THR	-	expression tag	UNP P0DTC9

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Chain	Residue	Modelled	Actual	Comment	Reference
B	248	LYS	-	expression tag	UNP P0DTC9
B	249	LYS	-	expression tag	UNP P0DTC9
B	250	SER	-	expression tag	UNP P0DTC9
B	251	ALA	-	expression tag	UNP P0DTC9
B	252	ALA	-	expression tag	UNP P0DTC9
B	253	GLU	-	expression tag	UNP P0DTC9
B	254	ALA	-	expression tag	UNP P0DTC9
B	255	SER	-	expression tag	UNP P0DTC9
B	256	LYS	-	expression tag	UNP P0DTC9
C	244	SER	-	expression tag	UNP P0DTC9
C	245	ASN	-	expression tag	UNP P0DTC9
C	246	ALA	-	expression tag	UNP P0DTC9
C	247	THR	-	expression tag	UNP P0DTC9
C	248	LYS	-	expression tag	UNP P0DTC9
C	249	LYS	-	expression tag	UNP P0DTC9
C	250	SER	-	expression tag	UNP P0DTC9
C	251	ALA	-	expression tag	UNP P0DTC9
C	252	ALA	-	expression tag	UNP P0DTC9
C	253	GLU	-	expression tag	UNP P0DTC9
C	254	ALA	-	expression tag	UNP P0DTC9
C	255	SER	-	expression tag	UNP P0DTC9
C	256	LYS	-	expression tag	UNP P0DTC9
D	244	SER	-	expression tag	UNP P0DTC9
D	245	ASN	-	expression tag	UNP P0DTC9
D	246	ALA	-	expression tag	UNP P0DTC9
D	247	THR	-	expression tag	UNP P0DTC9
D	248	LYS	-	expression tag	UNP P0DTC9
D	249	LYS	-	expression tag	UNP P0DTC9
D	250	SER	-	expression tag	UNP P0DTC9
D	251	ALA	-	expression tag	UNP P0DTC9
D	252	ALA	-	expression tag	UNP P0DTC9
D	253	GLU	-	expression tag	UNP P0DTC9
D	254	ALA	-	expression tag	UNP P0DTC9
D	255	SER	-	expression tag	UNP P0DTC9
D	256	LYS	-	expression tag	UNP P0DTC9
E	244	SER	-	expression tag	UNP P0DTC9
E	245	ASN	-	expression tag	UNP P0DTC9
E	246	ALA	-	expression tag	UNP P0DTC9
E	247	THR	-	expression tag	UNP P0DTC9
E	248	LYS	-	expression tag	UNP P0DTC9
E	249	LYS	-	expression tag	UNP P0DTC9
E	250	SER	-	expression tag	UNP P0DTC9

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Chain	Residue	Modelled	Actual	Comment	Reference
E	251	ALA	-	expression tag	UNP P0DTC9
E	252	ALA	-	expression tag	UNP P0DTC9
E	253	GLU	-	expression tag	UNP P0DTC9
E	254	ALA	-	expression tag	UNP P0DTC9
E	255	SER	-	expression tag	UNP P0DTC9
E	256	LYS	-	expression tag	UNP P0DTC9
F	244	SER	-	expression tag	UNP P0DTC9
F	245	ASN	-	expression tag	UNP P0DTC9
F	246	ALA	-	expression tag	UNP P0DTC9
F	247	THR	-	expression tag	UNP P0DTC9
F	248	LYS	-	expression tag	UNP P0DTC9
F	249	LYS	-	expression tag	UNP P0DTC9
F	250	SER	-	expression tag	UNP P0DTC9
F	251	ALA	-	expression tag	UNP P0DTC9
F	252	ALA	-	expression tag	UNP P0DTC9
F	253	GLU	-	expression tag	UNP P0DTC9
F	254	ALA	-	expression tag	UNP P0DTC9
F	255	SER	-	expression tag	UNP P0DTC9
F	256	LYS	-	expression tag	UNP P0DTC9

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	D	2	Total Cl 3 3	0	1
2	E	2	Total Cl 3 3	0	1
2	B	1	Total Cl 2 2	0	1
2	C	1	Total Cl 1 1	0	0
2	A	1	Total Cl 1 1	0	0
2	F	2	Total Cl 3 3	0	1

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	99	Total O 103 103	0	4
3	B	97	Total O 98 98	0	1

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	108	Total 109	O 109	0	1
3	D	99	Total 100	O 100	0	1
3	E	110	Total 112	O 112	0	2
3	F	109	Total 112	O 112	0	3

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.

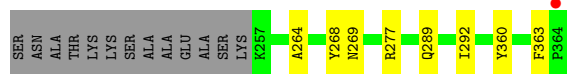
- Molecule 1: Nucleoprotein

Chain A: 




- Molecule 1: Nucleoprotein

Chain B: 




- Molecule 1: Nucleoprotein

Chain C: 




- Molecule 1: Nucleoprotein

Chain D: 

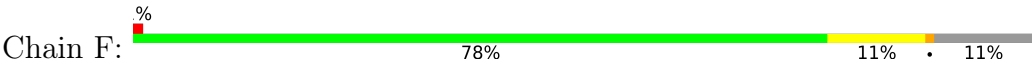


- Molecule 1: Nucleoprotein

Chain E: 



- Molecule 1: Nucleoprotein



SER	ASN	ALA	THR	LYS	SER	ALA	ALA	GLU	SER	LYS	K257	N269	R277	Q289	E290	L291	I292	K299	H300	T325	P326	S327	D341	K342	F346	L353	F363	P364
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4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	43.61Å 122.32Å 130.63Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.88 – 2.05 29.88 – 2.05	Depositor EDS
% Data completeness (in resolution range)	96.9 (29.88-2.05) 96.9 (29.88-2.05)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	0.17	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.59 (at 2.04Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.187 , 0.228 0.193 , 0.232	Depositor DCC
R_{free} test set	2192 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	17.1	Xtriage
Anisotropy	0.056	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 46.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5861	wwPDB-VP
Average B, all atoms (Å ²)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.44% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section:
CL

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	0.63	0/889	0.78	0/1200
1	B	0.63	0/889	0.80	0/1200
1	C	0.63	0/889	0.80	0/1200
1	D	0.63	0/889	0.78	0/1200
1	E	0.63	0/898	0.78	0/1211
1	F	0.64	0/898	0.79	0/1211
All	All	0.63	0/5352	0.79	0/7222

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	866	0	846	3	0
1	B	866	0	846	4	0
1	C	866	0	846	11	0
1	D	866	0	846	10	0
1	E	875	0	858	8	0
1	F	875	0	858	11	0
2	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	2	0	0	0	0
2	C	1	0	0	0	0
2	D	3	0	0	0	0
2	E	3	0	0	0	0
2	F	3	0	0	0	0
3	A	103	0	0	0	0
3	B	98	0	0	0	0
3	C	109	0	0	1	0
3	D	100	0	0	1	0
3	E	112	0	0	1	0
3	F	112	0	0	1	0
All	All	5861	0	5100	41	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.

The worst 5 of 41 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:F:290:GLU:OE2	1:F:299[A]:LYS:HE3	1.94	0.67
1:E:331:LEU:HD23	1:E:331:LEU:C	2.20	0.62
1:C:269:ASN:HB2	1:C:292:ILE:O	1.99	0.62
1:D:289:GLN:HG3	1:D:363:PHE:CE1	2.35	0.61
1:E:360:TYR:HA	1:E:363:PHE:CE2	2.37	0.60

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	106/121 (88%)	106 (100%)	0	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	106/121 (88%)	105 (99%)	1 (1%)	0	100	100
1	C	106/121 (88%)	104 (98%)	2 (2%)	0	100	100
1	D	106/121 (88%)	105 (99%)	1 (1%)	0	100	100
1	E	107/121 (88%)	105 (98%)	2 (2%)	0	100	100
1	F	107/121 (88%)	105 (98%)	2 (2%)	0	100	100
All	All	638/726 (88%)	630 (99%)	8 (1%)	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	90/99 (91%)	89 (99%)	1 (1%)	73	72
1	B	90/99 (91%)	89 (99%)	1 (1%)	73	72
1	C	90/99 (91%)	89 (99%)	1 (1%)	73	72
1	D	90/99 (91%)	89 (99%)	1 (1%)	73	72
1	E	91/99 (92%)	90 (99%)	1 (1%)	73	72
1	F	91/99 (92%)	88 (97%)	3 (3%)	38	31
All	All	542/594 (91%)	534 (98%)	8 (2%)	69	62

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	277	ARG
1	F	299[B]	LYS
1	F	277	ARG
1	C	277	ARG
1	E	277	ARG

Sometimes 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 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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 13 ligands modelled in this entry, 13 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, 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	108/121 (89%)	-0.23	0	100	100	10, 17, 26, 40	0
1	B	108/121 (89%)	-0.18	1 (0%)	84	85	10, 16, 30, 43	0
1	C	108/121 (89%)	-0.14	2 (1%)	66	68	12, 17, 28, 42	0
1	D	108/121 (89%)	-0.09	1 (0%)	84	85	11, 17, 34, 47	0
1	E	108/121 (89%)	-0.11	2 (1%)	66	68	11, 17, 34, 55	0
1	F	108/121 (89%)	-0.21	1 (0%)	84	85	11, 17, 33, 45	0
All	All	648/726 (89%)	-0.16	7 (1%)	80	81	10, 17, 32, 55	0

The worst 5 of 7 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	364	PRO	6.1
1	D	364	PRO	4.5
1	B	364	PRO	4.3
1	C	342	LYS	3.1
1	F	342	LYS	2.4

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 monosaccharides in this entry.

6.4 Ligands

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. The B-factors column lists the minimum, median, 95th 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	B-factors(Å ²)	Q<0.9
2	CL	B	401[A]	1/1	0.87	0.13	28,28,28,28	1
2	CL	B	401[B]	1/1	0.87	0.13	30,30,30,30	1
2	CL	F	402	1/1	0.89	0.14	29,29,29,29	1
2	CL	F	401[B]	1/1	0.90	0.14	24,24,24,24	1
2	CL	F	401[A]	1/1	0.90	0.14	23,23,23,23	1
2	CL	C	401	1/1	0.91	0.10	41,41,41,41	0
2	CL	D	401	1/1	0.91	0.18	19,19,19,19	1
2	CL	A	401	1/1	0.92	0.08	35,35,35,35	0
2	CL	D	402[B]	1/1	0.94	0.11	28,28,28,28	1
2	CL	D	402[A]	1/1	0.94	0.11	23,23,23,23	1
2	CL	E	402	1/1	0.96	0.08	39,39,39,39	0
2	CL	E	401[A]	1/1	0.96	0.08	18,18,18,18	1
2	CL	E	401[B]	1/1	0.96	0.08	26,26,26,26	1

6.5 Other polymers

There are no such residues in this entry.