



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 10:17 AM UTC

PDB ID : 6YXJ / pdb_00006yxj
Title : Crystal structure of SARS-CoV macrodomain II in complex with human Paip1
Authors : Lei, J.; Hilgenfeld, R.
Deposited on : 2020-05-02
Resolution : 3.50 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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

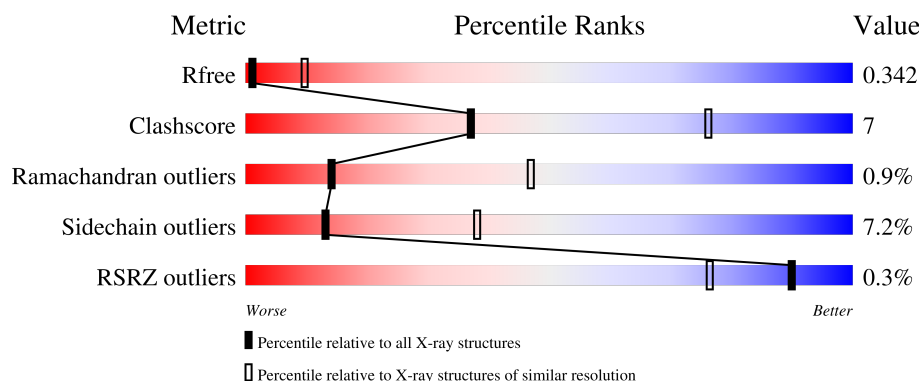
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.50 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	1085 (3.54-3.46)
Clashscore	190562	1140 (3.54-3.46)
Ramachandran outliers	187476	1113 (3.54-3.46)
Sidechain outliers	187428	1114 (3.54-3.46)
RSRZ outliers	180081	1084 (3.54-3.46)

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	142	66% 16% 7% 10%
2	B	236	81% 11% 8%

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 2726 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 Non-structural protein 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	128	Total	C	N	O	S	0	0	0
			982	626	155	193	8			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	385	GLY	-	expression tag	UNP P0C6U8
A	386	SER	-	expression tag	UNP P0C6U8
A	387	HIS	-	expression tag	UNP P0C6U8
A	388	MET	-	expression tag	UNP P0C6U8

- Molecule 2 is a protein called Polyadenylate-binding protein-interacting protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	218	Total	C	N	O	S	0	0	0
			1744	1099	297	338	10			

There are 17 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	61	GLY	-	expression tag	UNP Q9H074
B	62	SER	-	expression tag	UNP Q9H074
B	63	HIS	-	expression tag	UNP Q9H074
B	64	MET	-	expression tag	UNP Q9H074
B	65	ALA	-	expression tag	UNP Q9H074
B	66	SER	-	expression tag	UNP Q9H074
B	67	MET	-	expression tag	UNP Q9H074
B	68	THR	-	expression tag	UNP Q9H074
B	69	GLY	-	expression tag	UNP Q9H074
B	70	GLY	-	expression tag	UNP Q9H074
B	71	GLN	-	expression tag	UNP Q9H074
B	72	GLN	-	expression tag	UNP Q9H074

Continued on next page...

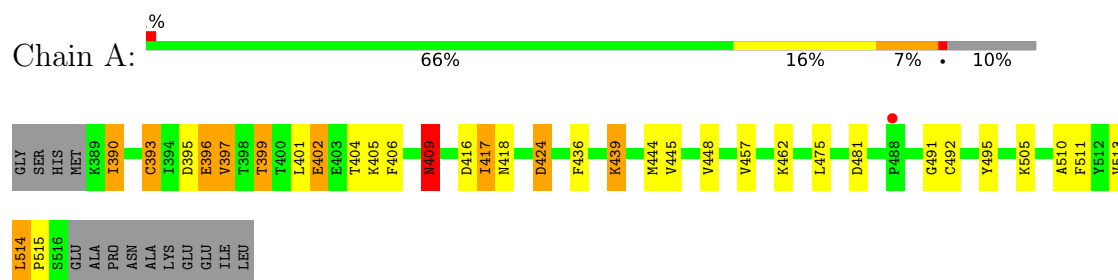
Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	73	MET	-	expression tag	UNP Q9H074
B	74	GLY	-	expression tag	UNP Q9H074
B	75	ARG	-	expression tag	UNP Q9H074
B	76	GLY	-	expression tag	UNP Q9H074
B	77	SER	-	expression tag	UNP Q9H074

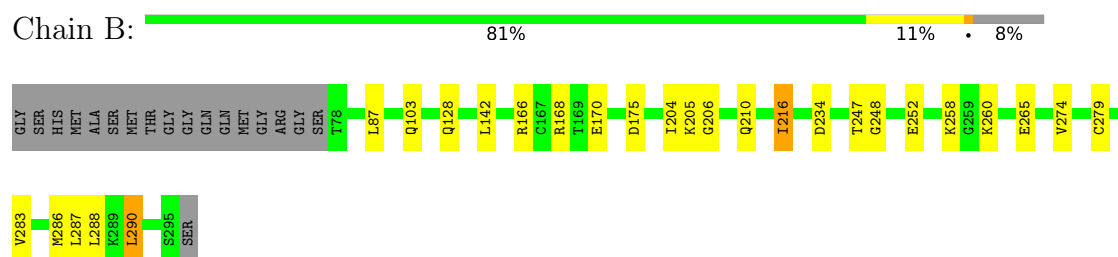
3 Residue-property plots [i](#)

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: Non-structural protein 3



- Molecule 2: Polyadenylate-binding protein-interacting protein 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	92.39Å 92.39Å 166.63Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.94 – 3.50 30.94 – 3.50	Depositor EDS
% Data completeness (in resolution range)	98.3 (30.94-3.50) 98.1 (30.94-3.50)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.15 (at 3.47Å)	Xtriage
Refinement program	BUSTER 2.10.3 (20-MAY-2020)	Depositor
R, R_{free}	0.313 , 0.336 0.302 , 0.342	Depositor DCC
R_{free} test set	746 reflections (6.86%)	wwPDB-VP
Wilson B-factor (Å ²)	131.7	Xtriage
Anisotropy	0.648	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 210.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.076 for -h,-k,l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	2726	wwPDB-VP
Average B, all atoms (Å ²)	255.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.92% 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	0.80	0/997	1.21	6/1345 (0.4%)
2	B	0.64	0/1768	1.14	2/2387 (0.1%)
All	All	0.70	0/2765	1.17	8/3732 (0.2%)

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	409	ASN	CA-CB-CG	6.08	118.68	112.60
1	A	492	CYS	N-CA-C	-5.73	101.15	110.20
1	A	396	GLU	CA-C-N	5.52	131.91	121.97
1	A	396	GLU	C-N-CA	5.52	131.91	121.97
1	A	513	VAL	N-CA-C	5.51	116.33	107.73
2	B	247	THR	CA-C-N	5.14	125.80	119.99
2	B	247	THR	C-N-CA	5.14	125.80	119.99
1	A	424	ASP	CA-CB-CG	5.02	117.62	112.60

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	982	0	1005	27	0
2	B	1744	0	1746	15	0
All	All	2726	0	2751	39	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 7.

All (39) 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:436:PHE:HA	1:A:439:LYS:HZ3	1.26	0.98
1:A:406:PHE:HA	2:B:168:ARG:HD3	1.60	0.84
1:A:395:ASP:HA	1:A:511:PHE:O	1.86	0.75
2:B:206:GLY:H	2:B:210:GLN:HA	1.55	0.69
1:A:417:ILE:H	1:A:417:ILE:HD13	1.59	0.67
1:A:417:ILE:H	1:A:417:ILE:CD1	2.09	0.65
1:A:436:PHE:CA	1:A:439:LYS:HZ3	2.08	0.65
1:A:436:PHE:HB2	1:A:439:LYS:HZ1	1.66	0.61
1:A:448:VAL:HG22	1:A:457:VAL:HG23	1.82	0.61
2:B:274:VAL:HG11	2:B:288:LEU:HD21	1.84	0.59
1:A:436:PHE:HA	1:A:439:LYS:NZ	2.10	0.57
1:A:399:THR:HG21	2:B:216:ILE:HD12	1.86	0.57
1:A:405:LYS:HD3	1:A:409:ASN:HA	1.86	0.56
1:A:393:CYS:HA	1:A:510:ALA:HA	1.86	0.56
1:A:514:LEU:HG	1:A:515:PRO:HD2	1.87	0.56
2:B:258:LYS:CB	2:B:260:LYS:HZ2	2.20	0.54
2:B:258:LYS:HB3	2:B:260:LYS:NZ	2.23	0.52
2:B:258:LYS:HB2	2:B:260:LYS:HZ2	1.75	0.52
2:B:87:LEU:HD13	2:B:128:GLN:HG3	1.90	0.52
2:B:287:LEU:HA	2:B:290:LEU:HD12	1.92	0.51
1:A:402:GLU:H	1:A:402:GLU:CD	2.18	0.51
1:A:416:ASP:HB2	1:A:417:ILE:HD13	1.91	0.51
1:A:405:LYS:HZ2	1:A:409:ASN:HB3	1.74	0.50
1:A:417:ILE:HD13	1:A:417:ILE:N	2.26	0.49
2:B:248:GLY:O	2:B:252:GLU:HB2	2.14	0.48
1:A:390:ILE:HD12	1:A:481:ASP:HA	1.95	0.48
2:B:258:LYS:CB	2:B:260:LYS:NZ	2.78	0.47
1:A:436:PHE:CB	1:A:439:LYS:NZ	2.79	0.46
1:A:436:PHE:HB2	1:A:439:LYS:NZ	2.31	0.45
1:A:436:PHE:CB	1:A:439:LYS:HZ1	2.28	0.45
2:B:234:ASP:OD1	2:B:279:CYS:HB2	2.16	0.45
1:A:405:LYS:NZ	1:A:409:ASN:CB	2.80	0.44
1:A:404:THR:HA	2:B:216:ILE:HG21	2.01	0.42
1:A:395:ASP:O	1:A:396:GLU:HB2	2.20	0.42
2:B:204:ILE:HD13	2:B:204:ILE:HA	1.95	0.42
1:A:444:MET:SD	1:A:445:VAL:O	2.78	0.42
1:A:462:LYS:HD3	1:A:495:TYR:HA	2.02	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:405:LYS:NZ	1:A:409:ASN:HB3	2.36	0.41
2:B:283:VAL:O	2:B:286:MET:HB3	2.22	0.40

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	126/142 (89%)	116 (92%)	7 (6%)	3 (2%)	4	29
2	B	216/236 (92%)	213 (99%)	3 (1%)	0	100	100
All	All	342/378 (90%)	329 (96%)	10 (3%)	3 (1%)	14	47

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	491	GLY
1	A	393	CYS
1	A	397	VAL

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	110/121 (91%)	97 (88%)	13 (12%)	5	23

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	195/207 (94%)	186 (95%)	9 (5%)	24	50
All	All	305/328 (93%)	283 (93%)	22 (7%)	13	38

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	390	ILE
1	A	397	VAL
1	A	399	THR
1	A	401	LEU
1	A	402	GLU
1	A	409	ASN
1	A	417	ILE
1	A	418	ASN
1	A	424	ASP
1	A	439	LYS
1	A	475	LEU
1	A	505	LYS
1	A	514	LEU
2	B	103	GLN
2	B	142	LEU
2	B	166	ARG
2	B	170	GLU
2	B	175	ASP
2	B	205	LYS
2	B	216	ILE
2	B	265	GLU
2	B	290	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	103	GLN
2	B	226	ASN

5.3.3 RNA ⓘ

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 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	128/142 (90%)	-0.31	1 (0%) 82 60	185, 248, 293, 300	0
2	B	218/236 (92%)	-0.53	0 100 100	187, 261, 300, 300	0
All	All	346/378 (91%)	-0.45	1 (0%) 90 76	185, 256, 300, 300	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	488	PRO	2.6

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.