



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 08:22 PM UTC

PDB ID : 7C53 / pdb_00007c53
Title : Crystal Structure of SARS-CoV-2 HR1 motif in complex with pan-CoVs inhibitor EK1
Authors : Zhu, Y.; Yang, X.; Sun, F.
Deposited on : 2020-05-19
Resolution : 2.28 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
Xtrriage (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

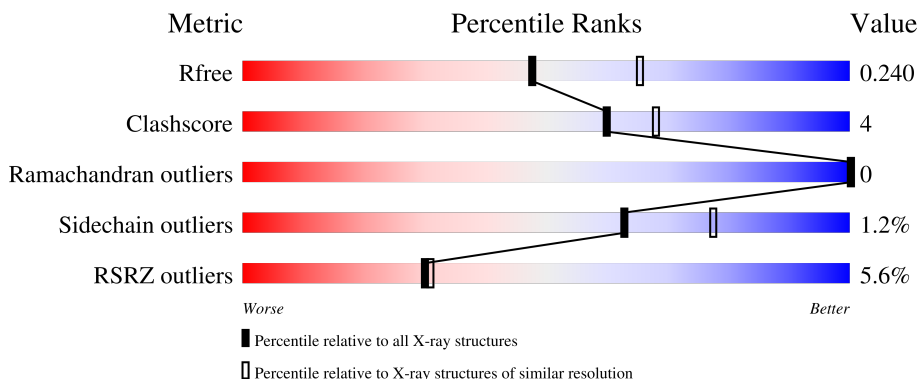
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.28 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.



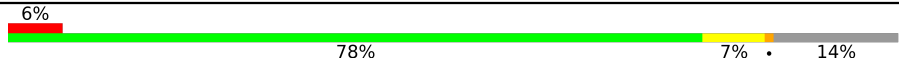
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	9078 (2.30-2.26)
Clashscore	190562	9802 (2.30-2.26)
Ramachandran outliers	187476	9690 (2.30-2.26)
Sidechain outliers	187428	9691 (2.30-2.26)
RSRZ outliers	180081	9085 (2.30-2.26)

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	107	<div style="display: flex; align-items: center;"> <div style="width: 4%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 80%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 5%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 13%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">4% 80% 5% 13%</p>
1	B	107	<div style="display: flex; align-items: center;"> <div style="width: 7%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 79%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 7%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 13%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">7% 79% 7% 13%</p>
1	C	107	<div style="display: flex; align-items: center;"> <div style="width: 5%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 75%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 8%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 15%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">5% 75% 8% 15%</p>
1	D	107	<div style="display: flex; align-items: center;"> <div style="width: 3%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 75%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 8%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 17%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">3% 75% 8% 17%</p>
1	E	107	<div style="display: flex; align-items: center;"> <div style="width: 6%; height: 10px; background-color: red; margin-right: 5px;"></div> <div style="width: 74%; height: 10px; background-color: green; margin-right: 5px;"></div> <div style="width: 13%; height: 10px; background-color: orange; margin-right: 5px;"></div> <div style="width: 13%; height: 10px; background-color: grey;"></div> </div> <p style="text-align: center;">6% 74% 13% 13%</p>

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Mol	Chain	Length	Quality of chain
1	F	107	 <p>6% 78% 7% 14%</p>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4504 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 Spike protein S2',pan-CoVs inhibitor EK1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	93	734	461	120	152	1	0	0	0
1	B	93	733	460	120	152	1	0	0	0
1	C	91	717	450	118	148	1	0	0	0
1	D	89	700	438	115	146	1	0	0	0
1	E	93	736	463	120	152	1	0	0	0
1	F	92	726	455	119	151	1	0	0	0

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	D	1	Total	Ca	0	0
			1	1		
2	E	1	Total	Ca	0	0
			1	1		

- Molecule 3 is water.


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	25	Total	O	0	0
			25	25		
3	B	22	Total	O	0	0
			22	22		
3	C	38	Total	O	0	0
			38	38		
3	D	19	Total	O	0	0
			19	19		

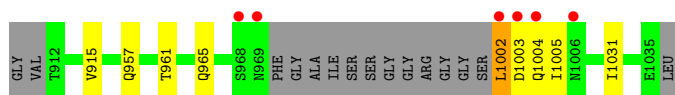
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	E	31	Total	O	0	0
			31	31		
3	F	21	Total	O	0	0
			21	21		

- Molecule 1: Spike protein S2',pan-CoVs inhibitor EK1

Chain F:  6% 78% 7% 14%



4 Data and refinement statistics i

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	133.81Å 138.14Å 71.46Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.06 – 2.28 48.06 – 2.28	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.06-2.28) 99.9 (48.06-2.28)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.05 (at 2.27Å)	Xtrriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.195 , 0.242 0.196 , 0.240	Depositor DCC
R_{free} test set	1492 reflections (4.86%)	wwPDB-VP
Wilson B-factor (Å ²)	34.4	Xtrriage
Anisotropy	0.267	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 57.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.032 for -k,-h,-l	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4504	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.87% 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:
CA

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	0.56	3/737 (0.4%)	0.49	0/991
1	B	0.26	0/736	0.42	0/990
1	C	0.30	0/720	0.41	0/968
1	D	0.39	0/703	0.55	0/946
1	E	0.35	0/740	0.50	0/995
1	F	0.27	0/729	0.39	0/980
All	All	0.37	3/4365 (0.1%)	0.46	0/5870

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	915	VAL	C-O	-7.25	1.15	1.24
1	A	913	GLN	C-O	-6.18	1.16	1.24
1	A	914	ASN	C-O	-5.08	1.18	1.24

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	734	0	748	4	0
1	B	733	0	746	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	717	0	731	7	0
1	D	700	0	707	6	0
1	E	736	0	744	14	0
1	F	726	0	737	7	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
3	A	25	0	0	0	0
3	B	22	0	0	0	0
3	C	38	0	0	0	0
3	D	19	0	0	0	0
3	E	31	0	0	0	0
3	F	21	0	0	0	0
All	All	4504	0	4413	38	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.

All (38) 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:E:1004:GLN:HG3	1:F:965:GLN:HE22	1.50	0.76
1:A:912:THR:HA	1:A:915:VAL:HG22	1.74	0.69
1:F:1002:LEU:HA	1:F:1004:GLN:HE22	1.62	0.64
1:D:950:ASP:O	1:D:954:GLN:HG3	1.98	0.63
1:A:951:VAL:HG13	1:C:1008:THR:HG23	1.84	0.60
1:B:1033:LEU:O	1:B:1034:LYS:NZ	2.23	0.59
1:E:1004:GLN:HG2	1:E:1005:ILE:HG12	1.85	0.58
1:E:969:ASN:O	1:E:970:PHE:HD1	1.89	0.56
1:E:969:ASN:C	1:E:970:PHE:CD1	2.85	0.54
1:F:957:GLN:O	1:F:961:THR:HG23	2.07	0.53
1:E:954:GLN:O	1:E:957:GLN:HG3	2.08	0.53
1:A:933:LYS:HE2	1:C:1025:LYS:HB3	1.91	0.53
1:B:1013:GLU:O	1:B:1017:LYS:HG2	2.12	0.50
1:E:1034:LYS:HE2	1:F:915:VAL:HG22	1.95	0.49
1:D:912:THR:HG22	1:D:915:VAL:H	1.77	0.49
1:C:1024:LYS:O	1:C:1027:GLU:HB2	2.13	0.48
1:D:956:ALA:O	1:D:1007:VAL:HG11	2.13	0.48
1:B:912:THR:HG23	1:B:915:VAL:H	1.79	0.47
1:E:1004:GLN:HG3	1:F:965:GLN:NE2	2.25	0.47
1:E:1034:LYS:HB3	1:E:1034:LYS:HE3	1.58	0.47
1:A:1025:LYS:HB3	1:B:933:LYS:HE2	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:968:SER:OG	1:C:969:ASN:OD1	2.23	0.47
1:D:923:ILE:HG12	1:F:1031:ILE:HD13	1.97	0.46
1:F:1004:GLN:HE21	1:F:1005:ILE:HG13	1.80	0.46
1:E:949:GLN:HA	1:E:1010:LEU:HD23	1.98	0.45
1:B:912:THR:HG22	1:B:915:VAL:HB	1.99	0.45
1:C:912:THR:HG22	1:C:915:VAL:H	1.81	0.45
1:D:1003:ASP:HB3	1:D:1004:GLN:H	1.52	0.45
1:D:1004:GLN:HA	1:D:1004:GLN:OE1	2.16	0.45
1:E:1013:GLU:HA	1:E:1016:MET:HE3	1.98	0.45
1:E:969:ASN:O	1:E:970:PHE:CD1	2.70	0.43
1:C:1020:GLU:O	1:C:1024:LYS:HD2	2.18	0.43
1:E:970:PHE:CD1	1:E:970:PHE:N	2.80	0.42
1:C:1034:LYS:O	1:C:1035:GLU:HB2	2.20	0.41
1:B:1034:LYS:HD3	1:B:1034:LYS:HA	1.86	0.41
1:E:1014:TYR:O	1:E:1018:LYS:HG2	2.20	0.41
1:E:1014:TYR:CZ	1:E:1018:LYS:HD3	2.56	0.40
1:B:1018:LYS:HB3	1:B:1018:LYS:HE3	1.68	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	89/107 (83%)	89 (100%)	0	0	100	100
1	B	89/107 (83%)	89 (100%)	0	0	100	100
1	C	87/107 (81%)	87 (100%)	0	0	100	100
1	D	85/107 (79%)	85 (100%)	0	0	100	100
1	E	89/107 (83%)	89 (100%)	0	0	100	100
1	F	88/107 (82%)	85 (97%)	3 (3%)	0	100	100
All	All	527/642 (82%)	524 (99%)	3 (1%)	0	100	100

There are no Ramachandran outliers to report.

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	84/91 (92%)	83 (99%)	1 (1%)	63	77
1	B	84/91 (92%)	84 (100%)	0	100	100
1	C	82/91 (90%)	80 (98%)	2 (2%)	43	59
1	D	80/91 (88%)	80 (100%)	0	100	100
1	E	84/91 (92%)	83 (99%)	1 (1%)	63	77
1	F	83/91 (91%)	81 (98%)	2 (2%)	43	59
All	All	497/546 (91%)	491 (99%)	6 (1%)	63	77

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	913	GLN
1	C	968	SER
1	C	969	ASN
1	E	968	SER
1	F	1002	LEU
1	F	1003	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	926	GLN
1	A	969	ASN
1	B	914	ASN
1	B	925	ASN
1	B	960	ASN
1	B	1006	ASN
1	C	954	GLN
1	C	960	ASN

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Mol	Chain	Res	Type
1	D	960	ASN
1	F	914	ASN
1	F	920	GLN
1	F	965	GLN
1	F	969	ASN
1	F	1004	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 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

6.1 Protein, DNA and RNA chains

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	93/107 (86%)	-0.09	4 (4%) 40 41	24, 36, 80, 101	0
1	B	93/107 (86%)	0.06	7 (7%) 20 21	25, 39, 88, 104	0
1	C	91/107 (85%)	-0.04	5 (5%) 30 31	25, 39, 85, 120	0
1	D	89/107 (83%)	0.13	3 (3%) 48 50	27, 41, 86, 103	0
1	E	93/107 (86%)	0.02	6 (6%) 25 26	25, 39, 97, 118	0
1	F	92/107 (85%)	0.05	6 (6%) 25 26	24, 40, 97, 112	0
All	All	551/642 (85%)	0.02	31 (5%) 30 31	24, 39, 90, 120	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	911	VAL	4.9
1	B	911	VAL	4.6
1	F	1002	LEU	4.0
1	A	1002	LEU	3.8
1	A	912	THR	3.6
1	B	1035	GLU	3.6
1	E	911	VAL	3.5
1	B	1034	LYS	3.4
1	C	1004	GLN	3.3
1	E	970	PHE	3.3
1	F	1003	ASP	2.8
1	A	966	LEU	2.6
1	D	1033	LEU	2.5
1	B	1033	LEU	2.5
1	D	1004	GLN	2.5
1	A	968	SER	2.4
1	F	1006	ASN	2.3
1	C	1017	LYS	2.3
1	F	1004	GLN	2.3

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Mol	Chain	Res	Type	RSRZ
1	E	1005	ILE	2.3
1	F	969	ASN	2.2
1	E	1004	GLN	2.2
1	F	968	SER	2.2
1	C	966	LEU	2.1
1	E	1028	GLU	2.1
1	C	969	ASN	2.1
1	B	968	SER	2.0
1	B	969	ASN	2.0
1	B	1002	LEU	2.0
1	D	1006	ASN	2.0
1	E	1003	ASP	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](#)

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	CA	D	1101	1/1	0.94	0.06	82,82,82,82	0
2	CA	E	1101	1/1	0.94	0.07	97,97,97,97	0

6.5 Other polymers [i](#)

There are no such residues in this entry.