Full wwPDB X-ray Structure Validation Report (i)

Feb 19, 2026 – 01:19 AM JST

PDB ID	:	22ZW / pdb_000022zw
Title	:	norovirus GII24 P domain
Authors	:	Duan, Z.J.; Cong, X.
Deposited on	:	2026-01-29
Resolution	:	2.35 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 (i) 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 (i)) were used in the production of this report:

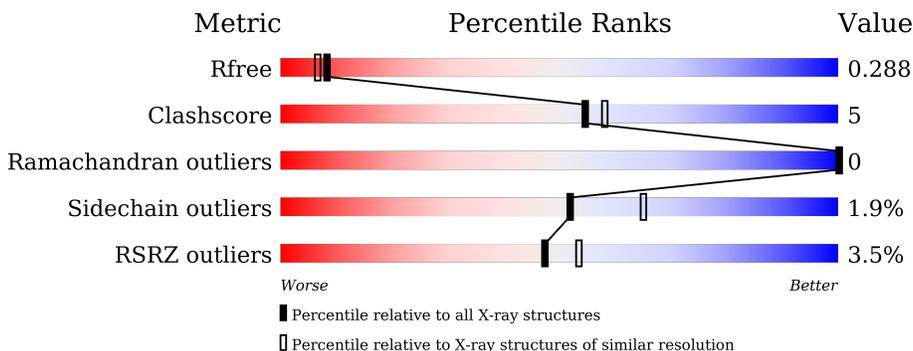|		
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.48

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 2.35 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	Percentile Ranks	Value
Rfree		0.288
Clashscore		5
Ramachandran outliers		0
Sidechain outliers		1.9%
RSRZ outliers		3.5%

Worse ← → Better

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1460 (2.36-2.36)
Clashscore	180529	1571 (2.36-2.36)
Ramachandran outliers	177936	1559 (2.36-2.36)
Sidechain outliers	177891	1559 (2.36-2.36)
RSRZ outliers	164620	1460 (2.36-2.36)

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 <=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	311	3% / 87% / 13%
1	B	311	4% / 90% / 9% ·

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 5085 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 Major capsid protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	311	Total	C	N	O	S	0	1	0
			2438	1543	422	464	9			
1	B	310	Total	C	N	O	S	0	1	0
			2431	1538	421	463	9			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	222	PRO	-	expression tag	UNP A0A1V0QSQ1
A	223	GLY	-	expression tag	UNP A0A1V0QSQ1
A	224	SER	-	expression tag	UNP A0A1V0QSQ1
B	222	PRO	-	expression tag	UNP A0A1V0QSQ1
B	223	GLY	-	expression tag	UNP A0A1V0QSQ1
B	224	SER	-	expression tag	UNP A0A1V0QSQ1

- Molecule 2 is 2'-DEOXY-N1,N2-PROPANO GUANOSINE MONOPHOSPHATE (CCD ID: P) (formula: $C_{13}H_{18}N_5O_7P$).
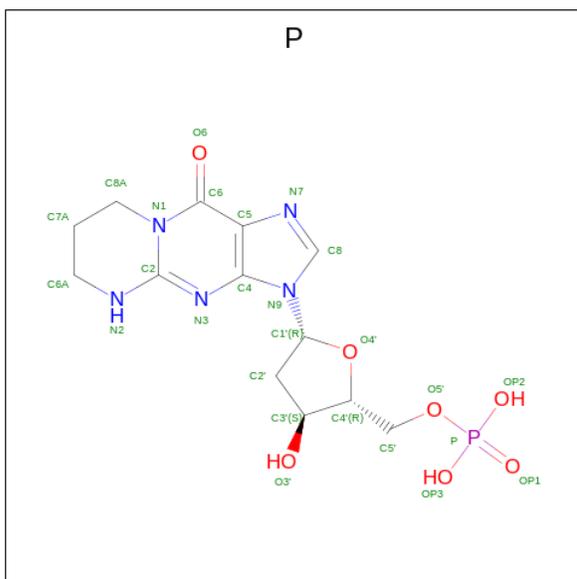
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	P 1	0	0
2	B	1	Total 1	P 1	0	0

• Molecule 3 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	105	Total 105	O 105	0	0
3	B	109	Total 109	O 109	0	0

3 Residue-property plots ⓘ

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: Major capsid protein

Chain A:

• Molecule 1: Major capsid protein

Chain B:
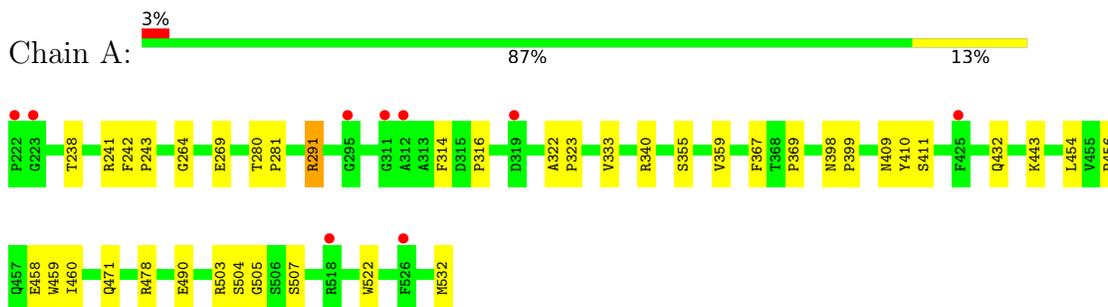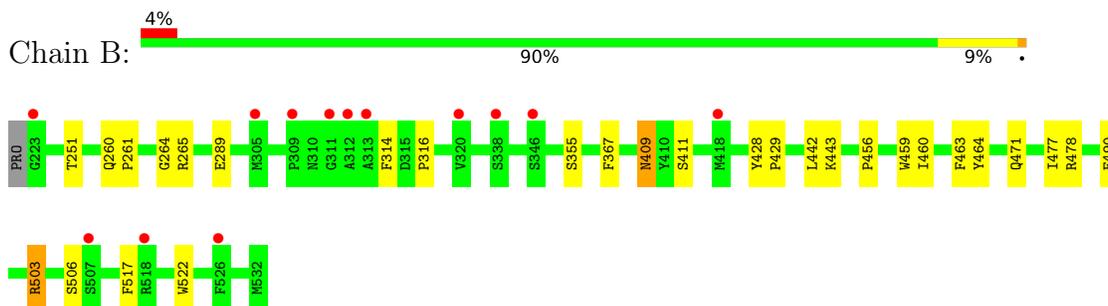
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	73.63Å 80.30Å 134.29Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.28 – 2.35 38.28 – 2.35	Depositor EDS
% Data completeness (in resolution range)	99.4 (38.28-2.35) 99.4 (38.28-2.35)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	2.55 (at 2.34Å)	Xtriage
Refinement program	REFMAC 5.8.0415	Depositor
R, R_{free}	0.232 , 0.286 0.242 , 0.288	Depositor DCC
R_{free} test set	1662 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å^2)	35.8	Xtriage
Anisotropy	0.240	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 32.2	EDS
L-test for twinning [2]	$<|L|> = 0.54, <L^2> = 0.39$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5085	wwPDB-VP
Average B, all atoms (Å^2)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 47.90 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.2906e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $<|L|>$, $<L^2>$ 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 ⓘ

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

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	0.57	0/2514	0.97	0/3433
1	B	0.57	0/2506	0.96	0/3422
All	All	0.57	0/5020	0.97	0/6855

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	241	ARG	Sidechain
1	A	340	ARG	Sidechain

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.

WORLDWIDE
wwPDB
PROTEIN DATA BANK

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2438	0	2335	25	0
1	B	2431	0	2327	18	0
2	A	1	0	0	5	0
2	B	1	0	0	5	0
3	A	105	0	0	3	0
3	B	109	0	0	3	0
All	All	5085	0	4662	45	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 5.

All (45) 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:411:SER:O	2:B:601:P:P	2.13	1.07
1:A:409:ASN:O	2:A:601:P:P	2.33	0.86
2:A:601:P:P	3:A:762:HOH:O	2.36	0.83
1:A:367:PHE:O	2:A:601:P:P	2.38	0.82
1:B:409:ASN:O	2:B:601:P:P	2.38	0.81
1:A:411:SER:O	2:A:601:P:P	2.40	0.80
2:B:601:P:P	3:B:710:HOH:O	2.46	0.73
1:A:291:ARG:HH11	1:A:291:ARG:CG	2.06	0.69
2:B:601:P:P	3:B:782:HOH:O	2.50	0.69
1:A:478:ARG:HD3	1:A:490:GLU:HB3	1.76	0.68
1:B:367:PHE:O	2:B:601:P:P	2.54	0.66
1:A:269:GLU:HG3	3:A:751:HOH:O	2.01	0.59
1:A:291:ARG:HH11	1:A:291:ARG:HG3	1.68	0.59
1:B:251:THR:HG21	1:B:503:ARG:HG2	1.86	0.58
1:A:314:PHE:O	1:A:316:PRO:HD3	2.04	0.57
1:A:432:GLN:NE2	1:A:504:SER:HA	2.21	0.56
1:A:322:ALA:HB1	1:A:323:PRO:HD2	1.88	0.54
1:B:478:ARG:HD3	1:B:490:GLU:HB3	1.90	0.54
1:A:456:PRO:HD2	1:A:459:TRP:CG	2.43	0.53
1:A:264:GLY:HA2	1:A:460:ILE:CD1	2.39	0.52
2:A:601:P:P	3:A:744:HOH:O	2.70	0.48
1:B:456:PRO:HD2	1:B:459:TRP:CG	2.49	0.48
1:A:443:LYS:HA	1:B:355:SER:HB2	1.96	0.48
1:B:478:ARG:HH11	1:B:478:ARG:HG3	1.79	0.47
1:B:428:TYR:CD2	1:B:429:PRO:HD2	2.50	0.47
1:A:471:GLN:HG3	1:A:522:TRP:CD1	2.50	0.46
1:B:265:ARG:HA	3:B:734:HOH:O	2.16	0.46
1:A:478:ARG:HD3	1:A:490:GLU:CB	2.45	0.45

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:264:GLY:O	1:B:265:ARG:HD2	2.18	0.44
1:B:260:GLN:N	1:B:261:PRO:CD	2.82	0.43
1:A:238:THR:HG21	1:A:280:THR:CG2	2.49	0.43
1:A:333:VAL:O	1:A:359:VAL:HA	2.19	0.43
1:A:242:PHE:CD2	1:A:243:PRO:HD2	2.54	0.42
1:B:463:PHE:O	1:B:464:TYR:C	2.62	0.42
1:A:355:SER:HB2	1:B:443:LYS:HA	2.00	0.42
1:A:458:GLU:OE1	1:A:458:GLU:N	2.53	0.42
1:B:471:GLN:HB2	1:B:522:TRP:CG	2.55	0.42
1:A:398:ASN:HB2	1:A:399:PRO:CD	2.50	0.42
1:B:314:PHE:O	1:B:316:PRO:HD3	2.20	0.42
1:B:264:GLY:HA2	1:B:460:ILE:CD1	2.49	0.41
1:A:369:PRO:HD2	1:A:410:TYR:O	2.21	0.41
1:B:477:ILE:HD12	1:B:517:PHE:CD1	2.56	0.41
1:A:264:GLY:HA2	1:A:460:ILE:HD11	2.03	0.40
1:A:280:THR:HB	1:A:281:PRO:HD3	2.03	0.40
1:A:432:GLN:HE22	1:A:505:GLY:H	1.68	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	310/311 (100%)	293 (94%)	17 (6%)	0	100	100
1	B	309/311 (99%)	296 (96%)	13 (4%)	0	100	100
All	All	619/622 (100%)	589 (95%)	30 (5%)	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	270/269 (100%)	265 (98%)	5 (2%)	52	65
1	B	269/269 (100%)	264 (98%)	5 (2%)	52	65
All	All	539/538 (100%)	529 (98%)	10 (2%)	52	65

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	291	ARG
1	A	454	LEU
1	A	503	ARG
1	A	507	SER
1	A	532	MET
1	B	289	GLU
1	B	409	ASN
1	B	442	LEU
1	B	503	ARG
1	B	506	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	256	ASN
1	A	401	HIS
1	A	432	GLN
1	A	496	GLN
1	A	510	ASN
1	A	525	GLN
1	B	263	ASN
1	B	293	HIS
1	B	401	HIS
1	B	432	GLN
1	B	450	HIS

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 2 ligands modelled in this entry, 2 are modelled with single atom - 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 ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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(Å²)	Q<0.9
1	A	311/311 (100%)	0.36	9 (2%)	54	60	17, 39, 69, 98	1 (0%)
1	B	310/311 (99%)	0.35	13 (4%)	41	48	18, 39, 69, 86	1 (0%)
All	All	621/622 (99%)	0.36	22 (3%)	47	53	17, 39, 69, 98	2 (0%)

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	222	PRO	4.7
1	B	223	GLY	3.4
1	B	313	ALA	3.2
1	A	526	PHE	3.0
1	A	311	GLY	2.9
1	B	311	GLY	2.8
1	A	223	GLY	2.7
1	B	507	SER	2.7
1	A	312	ALA	2.7
1	B	338	SER	2.5
1	B	309	PRO	2.5
1	A	295	GLY	2.4
1	B	312	ALA	2.4
1	B	320	VAL	2.3
1	A	518	ARG	2.3
1	A	425	PHE	2.2
1	B	418	MET	2.2
1	A	319	ASP	2.2
1	B	518	ARG	2.1
1	B	526	PHE	2.1
1	B	346	SER	2.1
1	B	305	MET	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no oligosaccharides 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	P	A	601	1/26	0.93	0.10	62,62,62,62	0
2	P	B	601	1/26	0.98	0.04	45,45,45,45	0

6.5 Other polymers ⓘ

There are no such residues in this entry.