Full wwPDB X-ray Structure Validation Report ⓘ

Jun 18, 2024 – 01:09 am BST

PDB ID	:	9FQ2
Title	:	Poliovirus 3C protease in H32 spacegroup
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Deposited on	:	2024-06-14
Resolution	:	2.37 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:

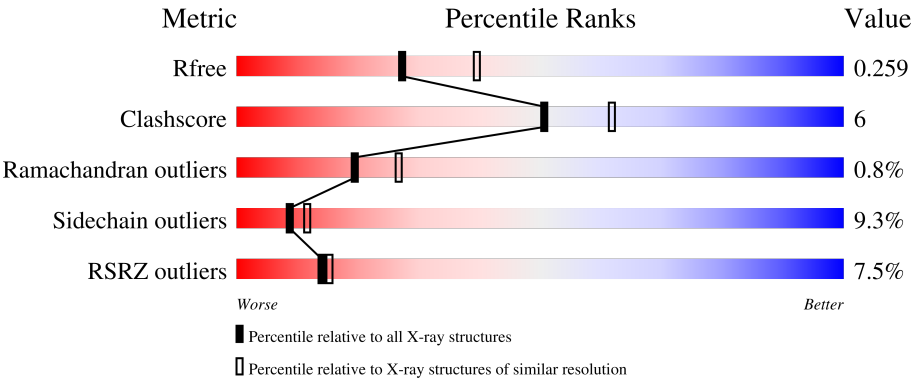
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.37 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	5509 (2.40-2.36)
Clashscore	141614	6082 (2.40-2.36)
Ramachandran outliers	138981	5973 (2.40-2.36)
Sidechain outliers	138945	5975 (2.40-2.36)
RSRZ outliers	127900	5397 (2.40-2.36)

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	183	2% 80% 14%
1	B	183	13% 71% 24%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 5407 atoms, of which 2661 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 Protease 3C.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	182	Total	C	H	N	O	S	0	2	0
			2719	863	1342	242	265	7			
1	B	179	Total	C	H	N	O	S	0	0	0
			2668	848	1319	237	257	7			

- Molecule 2 is water.

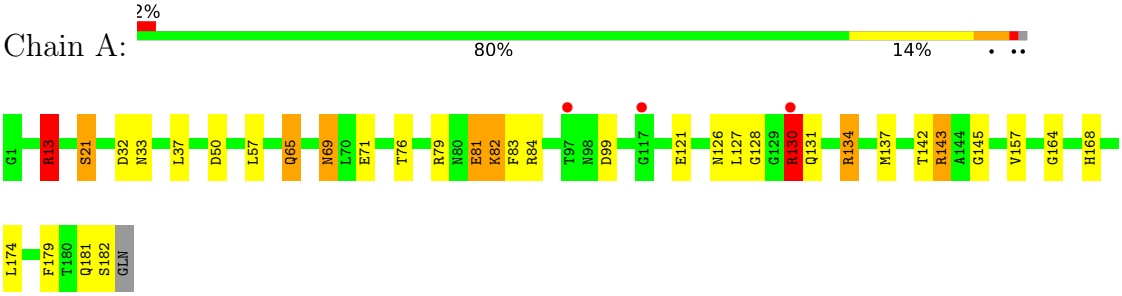
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	16	Total	O	0	0
			16	16		
2	B	4	Total	O	0	0
			4	4		

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.

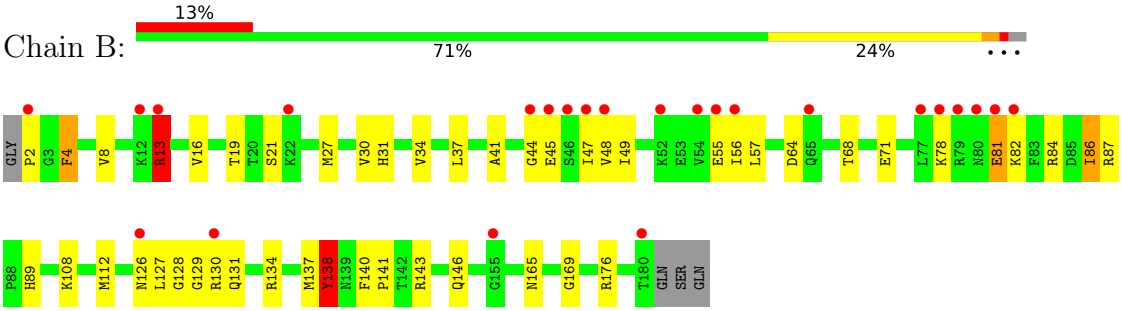
- Molecule 1: Protease 3C

Chain A:



- Molecule 1: Protease 3C

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α, β, γ	122.73Å 122.73Å 158.70Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	63.59 – 2.37 63.59 – 2.37	Depositor EDS
% Data completeness (in resolution range)	100.0 (63.59-2.37) 99.9 (63.59-2.37)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.08 (at 2.37Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.193 , 0.258 0.204 , 0.259	Depositor DCC
R_{free} test set	923 reflections (4.88%)	wwPDB-VP
Wilson B-factor (Å^2)	70.3	Xtriage
Anisotropy	0.031	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 52.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.51$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.023 for -2/3*h-1/3*k+2/3*l,-1/3*h-2/3*k-2/3*l,2/3*h-2/3*k+1/3*l 0.002 for -h,1/3*h-1/3*k+2/3*l,2/3*h+4/3*k+1/3*l 0.000 for -1/3*h+1/3*k-2/3*l,-k,-4/3*h-2/3*k+1/3*l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5407	wwPDB-VP
Average B, all atoms (Å^2)	82.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.21% of the height of the origin peak. No significant pseudotranslation is detected.*

[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

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	0.72	0/1409	1.49	22/1910 (1.2%)
1	B	0.64	0/1373	1.32	9/1861 (0.5%)
All	All	0.68	0/2782	1.41	31/3771 (0.8%)

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	6
1	B	0	2
All	All	0	8

There are no bond length outliers.

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	143	ARG	NE-CZ-NH2	-12.02	114.29	120.30
1	A	131	GLN	CB-CA-C	9.76	129.92	110.40
1	A	134	ARG	CG-CD-NE	9.01	130.72	111.80
1	A	143	ARG	NE-CZ-NH1	7.68	124.14	120.30
1	A	131	GLN	N-CA-CB	-7.03	97.95	110.60
1	A	50	ASP	CB-CA-C	6.54	123.48	110.40
1	A	65	GLN	CB-CA-C	6.45	123.30	110.40
1	B	13	ARG	NE-CZ-NH1	-6.42	117.09	120.30
1	B	176	ARG	NE-CZ-NH1	6.24	123.42	120.30
1	A	143	ARG	CD-NE-CZ	-6.07	115.10	123.60
1	A	130	ARG	CG-CD-NE	6.05	124.51	111.80
1	A	143	ARG	CG-CD-NE	6.00	124.41	111.80
1	B	112	MET	CG-SD-CE	5.95	109.72	100.20
1	B	137	MET	CG-SD-CE	-5.93	90.71	100.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	13	ARG	CB-CA-C	5.89	122.19	110.40
1	A	121	GLU	CB-CA-C	-5.89	98.62	110.40
1	B	165	ASN	C-N-CA	-5.89	109.94	122.30
1	B	138	TYR	N-CA-CB	5.88	121.18	110.60
1	A	76	THR	CA-CB-OG1	-5.86	96.69	109.00
1	A	37	LEU	CB-CA-C	-5.74	99.29	110.20
1	A	71[A]	GLU	CB-CA-C	5.65	121.70	110.40
1	A	71[B]	GLU	CB-CA-C	5.65	121.70	110.40
1	A	99	ASP	CB-CA-C	5.54	121.48	110.40
1	A	83	PHE	CB-CA-C	-5.39	99.62	110.40
1	A	84	ARG	NE-CZ-NH2	5.35	122.97	120.30
1	A	37	LEU	CB-CG-CD1	-5.20	102.16	111.00
1	A	81	GLU	CB-CA-C	5.12	120.63	110.40
1	A	121	GLU	N-CA-CB	5.10	119.78	110.60
1	B	71	GLU	OE1-CD-OE2	5.09	129.41	123.30
1	B	55	GLU	CB-CA-C	5.07	120.54	110.40
1	B	81	GLU	CB-CA-C	5.00	120.40	110.40

There are no chirality outliers.

All (8) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	13	ARG	Sidechain
1	A	130	ARG	Sidechain
1	A	134	ARG	Sidechain
1	A	145	GLY	Peptide
1	A	21	SER	Mainchain
1	A	79	ARG	Sidechain
1	B	13	ARG	Sidechain
1	B	134	ARG	Sidechain

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	1377	1342	1369	13	0
1	B	1349	1319	1356	22	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	16	0	0	2	0
2	B	4	0	0	1	0
All	All	2746	2661	2725	31	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 6.

All (31) 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:143:ARG:HH22	1:B:4:PHE:HB2	1.15	1.03
1:A:143:ARG:HH22	1:B:4:PHE:CB	1.89	0.85
1:B:143:ARG:N	1:B:146:GLN:OE1	2.26	0.67
1:B:4:PHE:O	1:B:8:VAL:HG23	2.00	0.62
1:B:30:VAL:HA	1:B:86:ILE:CD1	2.33	0.59
1:B:64:ASP:OD1	1:B:68:THR:OG1	2.19	0.58
1:A:69:ASN:ND2	2:A:201:HOH:O	2.39	0.56
1:B:138:TYR:CE2	1:B:169:GLY:HA3	2.45	0.52
1:B:44:GLY:O	1:B:56:ILE:HD12	2.09	0.52
1:B:131:GLN:HB3	2:B:201:HOH:O	2.11	0.51
1:B:27:MET:SD	1:B:37:LEU:CD1	3.00	0.50
1:B:31:HIS:CD2	1:B:87:ARG:HH11	2.29	0.50
1:A:137:MET:HE2	1:A:168:HIS:CD2	2.47	0.50
1:A:143:ARG:NH2	1:B:4:PHE:HB2	2.01	0.50
1:B:37:LEU:HD23	1:B:41:ALA:CB	2.43	0.48
1:A:143:ARG:NH2	1:B:4:PHE:CB	2.69	0.48
1:B:140:PHE:CD1	1:B:141:PRO:HD2	2.48	0.48
1:B:27:MET:SD	1:B:37:LEU:HD11	2.55	0.47
1:B:19:THR:O	1:B:47:ILE:HD12	2.14	0.47
1:A:33:ASN:HA	2:A:202:HOH:O	2.15	0.47
1:B:37:LEU:HD23	1:B:41:ALA:HB3	1.98	0.46
1:B:48:VAL:C	1:B:49:ILE:HD12	2.36	0.46
1:B:127:LEU:HD13	1:B:128:GLY:N	2.31	0.46
1:B:129:GLY:O	1:B:131:GLN:HG3	2.17	0.45
1:A:142:THR:HG21	1:A:164:GLY:HA3	1.99	0.43
1:A:137:MET:CE	1:A:168:HIS:CD2	3.01	0.42
1:A:32:ASP:HA	1:A:82:LYS:HG3	2.02	0.41
1:A:157:VAL:HG12	1:A:174:LEU:HD12	2.01	0.41
1:A:179:PHE:CD1	1:A:179:PHE:N	2.88	0.41
1:B:86:ILE:HB	1:B:89:HIS:HD2	1.85	0.40
1:A:143:ARG:HD2	1:A:143:ARG:N	2.36	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	182/183 (100%)	168 (92%)	12 (7%)	2 (1%)	14 18
1	B	177/183 (97%)	164 (93%)	12 (7%)	1 (1%)	25 34
All	All	359/366 (98%)	332 (92%)	24 (7%)	3 (1%)	19 27

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	57	LEU
1	A	57	LEU
1	A	128	GLY

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	148/147 (101%)	137 (93%)	11 (7%)	13 19
1	B	144/147 (98%)	128 (89%)	16 (11%)	6 7
All	All	292/294 (99%)	265 (91%)	27 (9%)	9 12

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	ARG
1	A	21	SER
1	A	65	GLN
1	A	69	ASN
1	A	81	GLU
1	A	82	LYS
1	A	126	ASN
1	A	127	LEU
1	A	130	ARG
1	A	181	GLN
1	A	182	SER
1	B	2	PRO
1	B	4	PHE
1	B	13	ARG
1	B	16	VAL
1	B	21	SER
1	B	34	VAL
1	B	45	GLU
1	B	78	LYS
1	B	81	GLU
1	B	82	LYS
1	B	84	ARG
1	B	86	ILE
1	B	108	LYS
1	B	126	ASN
1	B	130	ARG
1	B	138	TYR

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

Mol	Chain	Res	Type
1	A	69	ASN
1	A	122	GLN
1	B	122	GLN

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 monosaccharides 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

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, 95^{th} 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	182/183 (99%)	0.50	3 (1%) 72 73	48, 68, 108, 150	0
1	B	179/183 (97%)	0.84	24 (13%) 3 3	50, 82, 130, 157	0
All	All	361/366 (98%)	0.67	27 (7%) 14 15	48, 74, 122, 157	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	52	LYS	8.3
1	B	80	ASN	5.1
1	A	130	ARG	5.0
1	B	48	VAL	4.3
1	B	47	ILE	4.3
1	B	77	LEU	4.1
1	B	13	ARG	4.0
1	B	78	LYS	4.0
1	B	55	GLU	3.6
1	B	82	LYS	3.6
1	B	45	GLU	3.4
1	B	81	GLU	3.2
1	B	130	ARG	3.2
1	B	46	SER	3.2
1	B	155	GLY	3.1
1	B	22	LYS	2.8
1	B	56	ILE	2.7
1	B	79	ARG	2.6
1	B	44	GLY	2.5
1	B	12	LYS	2.5
1	B	126	ASN	2.3
1	A	97	THR	2.3
1	B	2	PRO	2.2
1	B	65	GLN	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	54	VAL	2.1
1	A	117	GLY	2.0
1	B	180	THR	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 monosaccharides 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.