Full wwPDB X-ray Structure Validation Report ⓘ

Feb 6, 2024 – 12:08 PM JST

PDB ID	:	8WO8
Title	:	Crystal Structure of an RNA-binding protein, FAU-1, from Pyrococcus furiosus
Authors	:	Kawai, G.; Okada, K.; Baba, S.; Sato, A.; Sakamoto, T.; Kanai, A.
Deposited on	:	2023-10-06
Resolution	:	2.78 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:

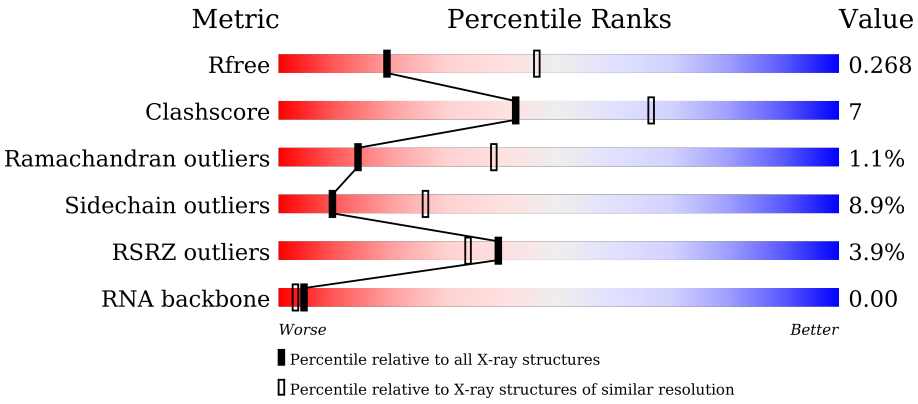
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.78 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	4107 (2.80-2.76)
Clashscore	141614	4575 (2.80-2.76)
Ramachandran outliers	138981	4487 (2.80-2.76)
Sidechain outliers	138945	4489 (2.80-2.76)
RSRZ outliers	127900	4027 (2.80-2.76)
RNA backbone	3102	1092 (3.06-2.50)

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	479	4% 73% 21%
2	B	3	33% 33% 33%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 3827 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 Probable ribonuclease FAU-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	463	3757	2434	629	693	1	0	0	0

- Molecule 2 is a RNA chain called RNA (5'-R(P*AP*UP*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	B	3	47	19	7	18	3	0	0	0

- Molecule 3 is water.

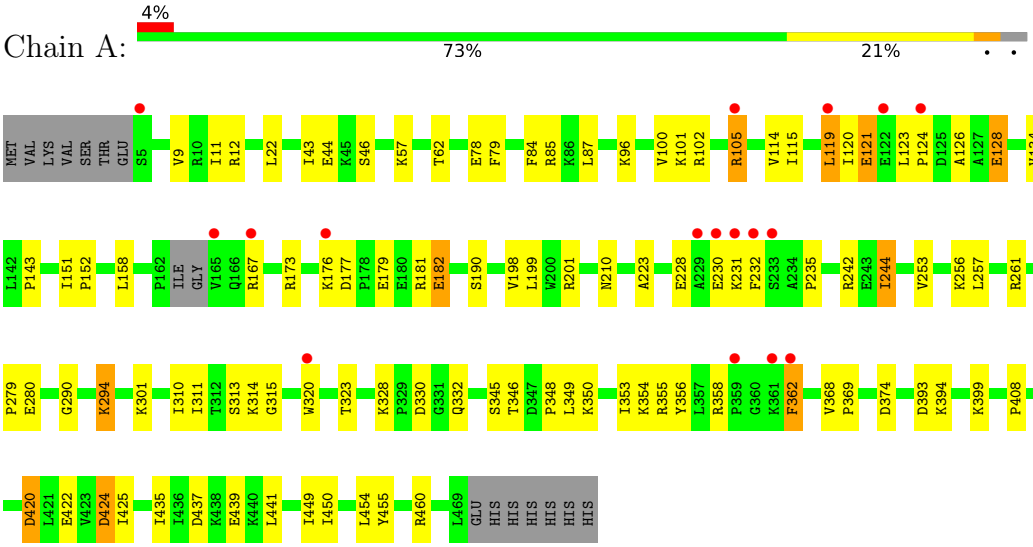
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	23	23	23	0	0

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.

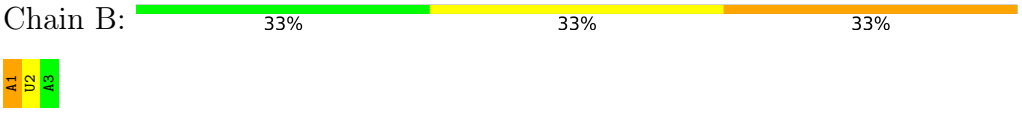
• Molecule 1: Probable ribonuclease FAU-1

Chain A:



• Molecule 2: RNA (5'-R(P*AP*UP*A)-3')

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 3 2 1	Depositor
Cell constants a, b, c, α, β, γ	119.57Å 119.57Å 93.47Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.01 – 2.78 30.01 – 2.78	Depositor EDS
% Data completeness (in resolution range)	99.2 (30.01-2.78) 99.3 (30.01-2.78)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.95 (at 2.76Å)	Xtriage
Refinement program	REFMAC 5.8.0415	Depositor
R, R_{free}	0.206 , 0.268 0.213 , 0.268	Depositor DCC
R_{free} test set	1043 reflections (5.31%)	wwPDB-VP
Wilson B-factor (Å^2)	54.0	Xtriage
Anisotropy	0.022	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 48.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.019 for -h,-k,l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	3827	wwPDB-VP
Average B, all atoms (Å^2)	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.07% 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	0.47	0/3838	0.91	2/5186 (0.0%)
2	B	1.25	1/51 (2.0%)	1.95	3/76 (3.9%)
All	All	0.49	1/3889 (0.0%)	0.93	5/5262 (0.1%)

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	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1	A	OP3-P	-5.62	1.54	1.61

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	1	A	O4'-C1'-N9	6.75	113.60	108.20
2	B	1	A	OP1-P-OP2	-6.55	109.77	119.60
1	A	424	ASP	CB-CA-C	5.44	121.28	110.40
2	B	1	A	C1'-O4'-C4'	-5.10	105.82	109.90
1	A	420	ASP	CB-CG-OD2	5.02	122.82	118.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	173	ARG	Sidechain
1	A	261	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	A	460	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	3757	0	3830	53	0
2	B	47	0	21	3	0
3	A	23	0	0	1	0
All	All	3827	0	3851	53	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 (53) 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:311:ILE:HA	1:A:315:GLY:HA3	1.64	0.79
1:A:152:PRO:HB3	2:B:1:A:N6	2.12	0.65
1:A:328:LYS:HE3	1:A:422:GLU:OE2	1.97	0.65
1:A:345:SER:O	1:A:349:LEU:HA	1.99	0.63
1:A:280:GLU:HB2	3:A:507:HOH:O	1.99	0.63
1:A:201:ARG:HH12	1:A:242:ARG:HH21	1.50	0.60
1:A:105:ARG:O	1:A:120:ILE:HG22	2.03	0.58
1:A:278:ASP:OD1	1:A:278:ASP:C	2.41	0.58
1:A:119:LEU:HD22	1:A:121:GLU:OE2	2.05	0.56
1:A:177:ASP:O	1:A:181:ARG:HG3	2.07	0.54
1:A:102:ARG:NH2	1:A:126:ALA:O	2.40	0.54
1:A:368:VAL:HG13	1:A:369:PRO:HD2	1.91	0.52
1:A:79:PHE:CE1	1:A:256:LYS:HG2	2.45	0.52
1:A:424:ASP:OD2	1:A:437:ASP:OD1	2.28	0.51
1:A:374:ASP:OD1	1:A:393:ASP:HA	2.11	0.50
1:A:152:PRO:HB3	2:B:1:A:H61	1.75	0.50
1:A:96:LYS:HE3	1:A:232:PHE:O	2.12	0.49
1:A:179:GLU:O	1:A:182:GLU:HB3	2.12	0.49
1:A:199:LEU:HD21	2:B:1:A:H1'	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:84:PHE:O	1:A:449:ILE:HA	2.13	0.48
1:A:290:GLY:O	1:A:294:LYS:HD2	2.14	0.48
1:A:368:VAL:CG1	1:A:369:PRO:HD2	2.44	0.47
1:A:128:GLU:H	1:A:128:GLU:HG2	1.49	0.47
1:A:310:ILE:O	1:A:315:GLY:N	2.42	0.47
1:A:151:ILE:CD1	1:A:223:ALA:HB2	2.45	0.46
1:A:62:THR:HG21	1:A:139:HIS:CE1	2.51	0.46
1:A:362:PHE:HA	1:A:368:VAL:O	2.16	0.46
1:A:11:ILE:O	1:A:12:ARG:NH1	2.47	0.45
1:A:201:ARG:HH12	1:A:242:ARG:NH2	2.13	0.45
1:A:374:ASP:OD2	1:A:399:LYS:NZ	2.49	0.45
1:A:441:LEU:HG	1:A:455:TYR:CD1	2.52	0.44
1:A:450:ILE:HB	1:A:454:LEU:HD23	1.99	0.44
1:A:100:VAL:O	1:A:101:LYS:HB2	2.17	0.44
1:A:265:VAL:HG22	1:A:266:PRO:HD2	1.99	0.44
1:A:123:LEU:N	1:A:124:PRO:HD3	2.33	0.44
1:A:139:HIS:O	1:A:140:ASN:HB2	2.18	0.43
1:A:425:ILE:HG12	1:A:435:ILE:HG12	2.01	0.43
1:A:139:HIS:CD2	1:A:139:HIS:H	2.37	0.43
1:A:314:LYS:O	1:A:320:TRP:CZ3	2.72	0.43
1:A:280:GLU:OE1	1:A:314:LYS:HE3	2.19	0.42
1:A:412:TYR:HB3	1:A:413:PRO:CD	2.49	0.42
1:A:87:LEU:HD12	1:A:244:ILE:HD12	2.01	0.42
1:A:328:LYS:HB3	1:A:330:ASP:OD1	2.20	0.42
1:A:151:ILE:HB	1:A:158:LEU:HB2	2.01	0.42
1:A:114:VAL:HG22	1:A:115:ILE:N	2.35	0.42
1:A:22:LEU:HD11	1:A:78:GLU:HG2	2.01	0.41
1:A:114:VAL:HG11	1:A:143:PRO:HG3	2.02	0.41
1:A:253:VAL:HG12	1:A:257:LEU:HD12	2.03	0.41
1:A:119:LEU:HD22	1:A:121:GLU:CD	2.40	0.41
1:A:96:LYS:O	1:A:235:PRO:HA	2.21	0.41
1:A:228:GLU:HB3	1:A:231:LYS:HG3	2.03	0.40
1:A:79:PHE:HE1	1:A:256:LYS:HG2	1.84	0.40
1:A:314:LYS:O	1:A:320:TRP:HZ3	2.04	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	459/479 (96%)	429 (94%)	25 (5%)	5 (1%)	14 38

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	230	GLU
1	A	279	PRO
1	A	46	SER
1	A	362	PHE
1	A	140	ASN

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	406/421 (96%)	370 (91%)	36 (9%)	9 26

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	VAL
1	A	43	ILE
1	A	44	GLU
1	A	57	LYS
1	A	85	ARG
1	A	105	ARG

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Mol	Chain	Res	Type
1	A	119	LEU
1	A	121	GLU
1	A	128	GLU
1	A	134	VAL
1	A	167	ARG
1	A	176	LYS
1	A	182	GLU
1	A	190	SER
1	A	198	VAL
1	A	210	ASN
1	A	244	ILE
1	A	278	ASP
1	A	294	LYS
1	A	301	LYS
1	A	313	SER
1	A	323	THR
1	A	332	GLN
1	A	346	THR
1	A	348	PRO
1	A	350	LYS
1	A	353	ILE
1	A	354	LYS
1	A	355	ARG
1	A	356	TYR
1	A	358	ARG
1	A	394	LYS
1	A	408	PRO
1	A	415	LYS
1	A	420	ASP
1	A	439	GLU

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

Mol	Chain	Res	Type
1	A	139	HIS
1	A	144	HIS

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	B	1/3 (33%)	1 (100%)	1 (100%)

All (1) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	B	2	U

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
2	B	2	U

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	463/479 (96%)	0.03	18 (3%) 39 34	27, 51, 89, 114	0
2	B	3/3 (100%)	-0.20	0 100 100	49, 49, 70, 73	0
All	All	466/482 (96%)	0.03	18 (3%) 39 34	27, 51, 89, 114	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	232	PHE	4.2
1	A	105	ARG	3.3
1	A	231	LYS	3.2
1	A	5	SER	3.2
1	A	141	VAL	3.0
1	A	229	ALA	3.0
1	A	230	GLU	3.0
1	A	167	ARG	2.7
1	A	359	PRO	2.6
1	A	122	GLU	2.6
1	A	233	SER	2.4
1	A	361	LYS	2.4
1	A	362	PHE	2.4
1	A	320	TRP	2.2
1	A	165	VAL	2.1
1	A	176	LYS	2.1
1	A	119	LEU	2.1
1	A	124	PRO	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 (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.