



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 12:20 PM UTC

PDB ID : 2PHC / pdb_00002phc
Title : Crystal structure of conserved uncharacterized protein PH0987 from *Pyrococcus horikoshii*
Authors : Swindell II, J.T.; Chen, L.; Zhu, J.; Ebihara, A.; Shinkai, A.; Kuramitsu, S.; Yokoyama, S.; Fu, Z.-Q.; Chrzas, J.; Rose, J.P.; Wang, B.-C.; Southeast Collaboratory for Structural Genomics (SECSG); RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on : 2007-04-10
Resolution : 2.29 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

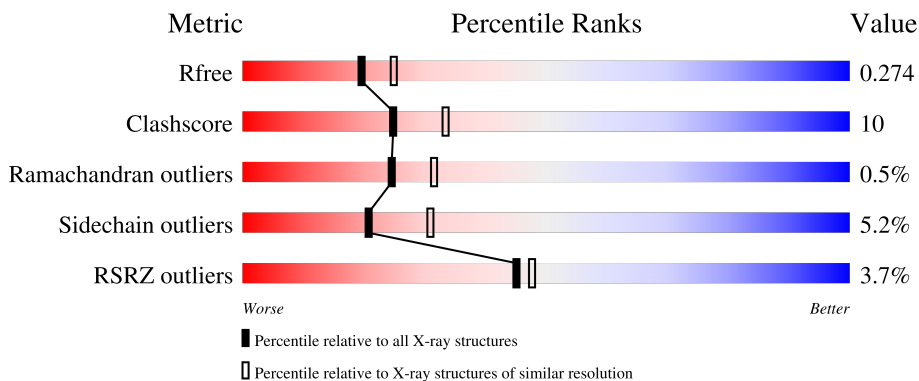
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

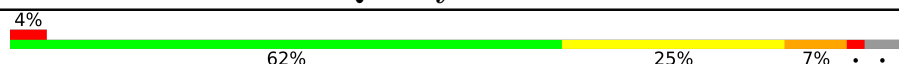
The reported resolution of this entry is 2.29 Å.

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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	B	225	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 1781 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 Uncharacterized protein PH0987.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	216	1690	1108	275	306	1	2	0	0

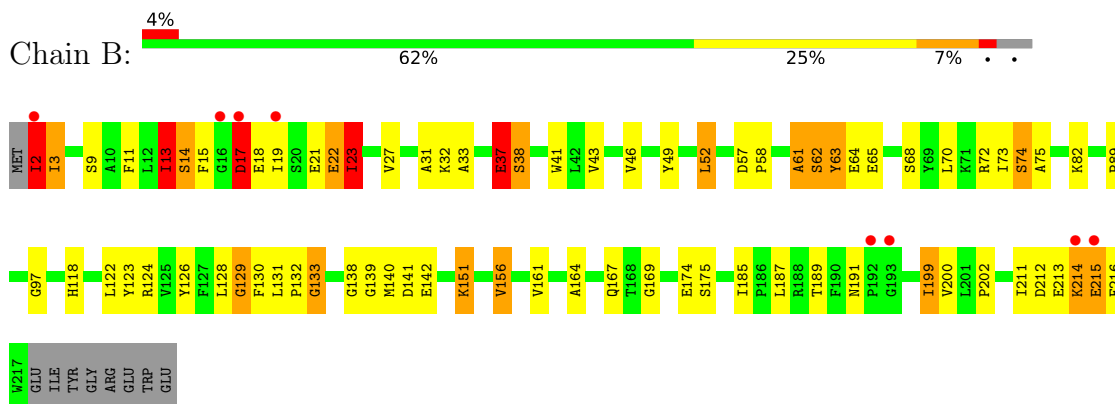
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	91	Total	O	0	0
			91	91		

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: Uncharacterized protein PH0987



4 Data and refinement statistics

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α , β , γ	105.85Å 105.85Å 51.87Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	18.33 – 2.29 18.33 – 2.29	Depositor EDS
% Data completeness (in resolution range)	100.0 (18.33-2.29) 99.7 (18.33-2.29)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	13.16 (at 2.30Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.239 , 0.294 (Not available) , 0.274	Depositor DCC
R_{free} test set	758 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	37.1	Xtrriage
Anisotropy	0.096	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 48.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.045 for h,-h-k,-l	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	1781	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.32% 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	B	1.88	27/1734 (1.6%)	1.95	48/2354 (2.0%)

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	B	0	7

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	200	VAL	C-N	-15.98	1.11	1.33
1	B	14	SER	C-N	10.35	1.49	1.33
1	B	130	PHE	N-CA	-7.26	1.37	1.46
1	B	13	ILE	C-O	-7.16	1.15	1.24
1	B	61	ALA	CA-C	-6.88	1.44	1.52
1	B	140	MET	SD-CE	-6.85	1.62	1.79
1	B	13	ILE	C-N	-6.64	1.24	1.33
1	B	185	ILE	CA-CB	6.48	1.62	1.54
1	B	82	LYS	CG-CD	-6.32	1.33	1.52
1	B	82	LYS	CE-NZ	-6.25	1.30	1.49
1	B	141	ASP	N-CA	6.08	1.53	1.46
1	B	46	VAL	CA-CB	5.95	1.61	1.54
1	B	214	LYS	N-CA	-5.88	1.38	1.46
1	B	123	TYR	C-O	-5.84	1.16	1.23
1	B	52	LEU	C-O	-5.72	1.17	1.24
1	B	43	VAL	CA-C	5.70	1.59	1.52
1	B	139	GLY	C-O	-5.66	1.16	1.24
1	B	132	PRO	C-N	-5.58	1.28	1.33
1	B	11	PHE	C-O	-5.56	1.16	1.23
1	B	19	ILE	CA-CB	5.47	1.61	1.54

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	164	ALA	N-CA	-5.42	1.40	1.46
1	B	75	ALA	CA-CB	5.34	1.61	1.53
1	B	13	ILE	N-CA	-5.31	1.39	1.46
1	B	31	ALA	C-O	-5.29	1.18	1.24
1	B	73	ILE	C-O	-5.25	1.17	1.24
1	B	212	ASP	N-CA	5.25	1.52	1.45
1	B	61	ALA	N-CA	-5.18	1.39	1.46

All (48) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	17	ASP	CA-C-N	23.07	156.17	122.95
1	B	17	ASP	C-N-CA	23.07	156.17	122.95
1	B	17	ASP	N-CA-C	21.64	143.63	113.56
1	B	14	SER	O-C-N	-17.67	100.17	123.14
1	B	199	ILE	O-C-N	-14.52	102.57	122.31
1	B	199	ILE	CA-C-N	11.94	140.25	122.58
1	B	199	ILE	C-N-CA	11.94	140.25	122.58
1	B	214	LYS	CA-C-N	-11.45	99.67	121.54
1	B	214	LYS	C-N-CA	-11.45	99.67	121.54
1	B	18	GLU	N-CA-CB	10.75	128.40	110.87
1	B	33	ALA	N-CA-C	-10.11	99.25	111.69
1	B	23	ILE	N-CA-C	9.67	129.45	109.34
1	B	70	LEU	N-CA-C	-8.10	102.30	112.90
1	B	22	GLU	N-CA-C	8.09	119.87	111.14
1	B	129	GLY	O-C-N	7.47	129.98	123.25
1	B	118	HIS	N-CA-C	7.33	119.91	111.11
1	B	130	PHE	CA-C-O	7.19	128.47	120.70
1	B	64	GLU	N-CA-C	-7.08	103.62	112.90
1	B	161	VAL	CA-C-N	-6.50	116.38	122.17
1	B	161	VAL	C-N-CA	-6.50	116.38	122.17
1	B	200	VAL	O-C-N	-6.39	115.71	123.00
1	B	97	GLY	CA-C-N	6.38	126.07	119.56
1	B	97	GLY	C-N-CA	6.38	126.07	119.56
1	B	37	GLU	N-CA-C	6.35	120.28	112.54
1	B	13	ILE	CA-C-N	5.86	130.94	122.44
1	B	13	ILE	C-N-CA	5.86	130.94	122.44
1	B	82	LYS	CG-CD-CE	-5.86	97.83	111.30
1	B	18	GLU	CA-CB-CG	5.85	125.81	114.10
1	B	151	LYS	CA-C-N	5.76	125.70	119.76
1	B	151	LYS	C-N-CA	5.76	125.70	119.76
1	B	61	ALA	N-CA-C	-5.69	99.39	109.06

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	3	ILE	N-CA-CB	5.62	119.30	112.10
1	B	2	ILE	CB-CA-C	-5.59	100.42	111.60
1	B	15	PHE	N-CA-C	5.53	120.91	113.72
1	B	74	SER	N-CA-C	5.52	118.22	111.82
1	B	156	VAL	CA-C-N	-5.52	114.27	119.85
1	B	156	VAL	C-N-CA	-5.52	114.27	119.85
1	B	138	GLY	N-CA-C	-5.51	102.39	111.38
1	B	175	SER	CA-C-N	-5.51	114.91	120.31
1	B	175	SER	C-N-CA	-5.51	114.91	120.31
1	B	142	GLU	N-CA-C	5.27	118.81	112.38
1	B	49	TYR	N-CA-C	5.27	117.77	111.71
1	B	32	LYS	N-CA-C	5.23	118.45	111.75
1	B	73	ILE	CB-CA-C	5.17	120.17	112.16
1	B	191	ASN	O-C-N	5.13	124.35	121.27
1	B	169	GLY	N-CA-C	-5.05	103.97	110.69
1	B	13	ILE	CA-C-O	5.04	126.41	120.71
1	B	133	GLY	N-CA-C	5.03	117.25	111.36

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	13	ILE	Peptide
1	B	131	LEU	Peptide
1	B	14	SER	Mainchain
1	B	17	ASP	Peptide
1	B	2	ILE	Peptide
1	B	215	GLU	Peptide
1	B	22	GLU	Peptide

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.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1690	0	1668	33	0
2	B	91	0	0	0	0
All	All	1781	0	1668	33	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 10.

All (33) 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:215:GLU:CA	1:B:215:GLU:CG	2.57	0.83
1:B:9:SER:OG	1:B:58:PRO:HG3	1.81	0.80
1:B:151:LYS:CB	1:B:151:LYS:CD	2.67	0.72
1:B:68:SER:O	1:B:72:ARG:HG3	1.90	0.72
1:B:2:ILE:N	1:B:2:ILE:HD13	2.06	0.70
1:B:124:ARG:O	1:B:124:ARG:HG3	1.91	0.69
1:B:21:GLU:OE2	1:B:124:ARG:NH1	2.27	0.67
1:B:63:TYR:CD2	1:B:63:TYR:C	2.75	0.64
1:B:129:GLY:O	1:B:133:GLY:HA2	1.97	0.63
1:B:21:GLU:OE2	1:B:124:ARG:NH2	2.30	0.63
1:B:62:SER:HB3	1:B:65:GLU:OE1	2.01	0.61
1:B:189:THR:HG22	1:B:199:ILE:HD11	1.85	0.58
1:B:213:GLU:HB3	1:B:214:LYS:HE3	1.85	0.57
1:B:211:ILE:HD12	1:B:215:GLU:C	2.30	0.56
1:B:13:ILE:O	1:B:52:LEU:N	2.36	0.54
1:B:89:PRO:HD2	1:B:187:LEU:HD11	1.90	0.52
1:B:156:VAL:O	1:B:174:GLU:HA	2.08	0.52
1:B:214:LYS:CB	1:B:214:LYS:CD	2.88	0.52
1:B:216:PHE:CD1	1:B:216:PHE:C	2.88	0.50
1:B:41:TRP:CB	1:B:61:ALA:HB2	2.44	0.47
1:B:126:TYR:OH	1:B:167:GLN:OE1	2.25	0.47
1:B:63:TYR:C	1:B:63:TYR:HD2	2.24	0.46
1:B:128:LEU:HD12	1:B:202:PRO:HD3	1.98	0.45
1:B:89:PRO:HB2	1:B:211:ILE:HD13	1.99	0.45
1:B:23:ILE:O	1:B:27:VAL:HG23	2.17	0.44
1:B:41:TRP:HB3	1:B:61:ALA:HB2	2.00	0.44
1:B:124:ARG:O	1:B:124:ARG:CG	2.64	0.44
1:B:57:ASP:OD2	1:B:57:ASP:C	2.59	0.43
1:B:21:GLU:OE2	1:B:124:ARG:CZ	2.67	0.42
1:B:199:ILE:HD13	1:B:199:ILE:HG21	1.75	0.42
1:B:37:GLU:O	1:B:38:SER:C	2.61	0.42
1:B:128:LEU:CD1	1:B:202:PRO:HD3	2.50	0.41
1:B:122:LEU:HD12	1:B:122:LEU:HA	1.83	0.41

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	B	214/225 (95%)	204 (95%)	9 (4%)	1 (0%)	24 31

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	23	ILE

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	B	174/190 (92%)	165 (95%)	9 (5%)	21 31

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	2	ILE
1	B	3	ILE
1	B	13	ILE
1	B	17	ASP
1	B	37	GLU
1	B	38	SER
1	B	62	SER
1	B	63	TYR
1	B	74	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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](#)

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	200:VAL	C	201:LEU	N	1.11

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	B	216/225 (96%)	0.21	8 (3%) 45 48	16, 32, 48, 60	1 (0%)

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	17	ASP	5.3
1	B	2	ILE	4.0
1	B	193	GLY	3.0
1	B	215	GLU	2.8
1	B	19	ILE	2.6
1	B	214	LYS	2.3
1	B	16	GLY	2.1
1	B	192	PRO	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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.