



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 03:14 AM UTC

PDB ID : 2HZ7 / pdb_00002hz7
Title : Crystal structure of the Glutaminyl-tRNA synthetase from *Deinococcus radiodurans*
Authors : Deniziak, M.; Sauter, C.; Becker, H.D.; Paulus, C.; Giege, R.; Kern, D.
Deposited on : 2006-08-08
Resolution : 2.30 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

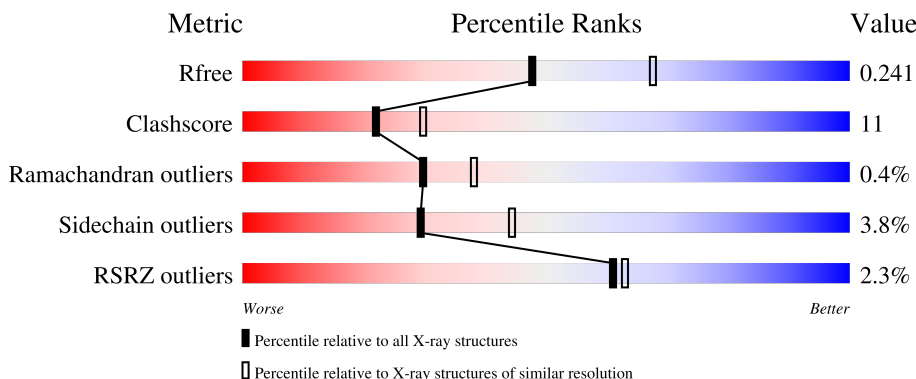
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	A	851	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4648 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 Glutaminyl-tRNA synthetase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	556	Total	C	N	O	S	0	0	0
			4488	2841	807	830	10			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	160	Total	O	0	0
			160	160		

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	74.10Å 95.90Å 115.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.67 – 2.30 29.67 – 2.30	Depositor EDS
% Data completeness (in resolution range)	98.2 (29.67-2.30) 98.1 (29.67-2.30)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.44 (at 2.31Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.200 , 0.242 0.200 , 0.241	Depositor DCC
R_{free} test set	2612 reflections (7.13%)	wwPDB-VP
Wilson B-factor (Å ²)	38.7	Xtriage
Anisotropy	0.503	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 30.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4648	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.53% 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

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	0.55	2/4606 (0.0%)	1.00	23/6261 (0.4%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	384	MET	SD-CE	-7.14	1.61	1.79
1	A	331	MET	SD-CE	-5.13	1.66	1.79

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	596	GLN	OE1-CD-NE2	-10.36	112.24	122.60
1	A	389	PRO	N-CA-C	7.56	122.68	111.03
1	A	534	GLY	N-CA-C	-7.09	104.81	112.04
1	A	455	PRO	N-CA-C	6.99	119.22	110.70
1	A	589	ASP	N-CA-C	6.94	119.49	109.84
1	A	596	GLN	CG-CD-NE2	6.75	126.52	116.40
1	A	73	PRO	CA-C-N	-6.61	113.49	120.03
1	A	73	PRO	C-N-CA	-6.61	113.49	120.03
1	A	408	TRP	N-CA-C	6.38	119.78	110.14
1	A	568	ARG	N-CA-C	-6.33	105.41	113.01
1	A	289	ASN	N-CA-C	6.16	119.91	111.54
1	A	528	ARG	N-CA-C	6.12	120.88	113.17
1	A	388	ASP	CA-C-N	5.95	126.25	119.83
1	A	388	ASP	C-N-CA	5.95	126.25	119.83
1	A	422	GLY	N-CA-C	5.92	119.78	112.14
1	A	405	LEU	CA-C-N	5.71	125.47	119.76
1	A	405	LEU	C-N-CA	5.71	125.47	119.76
1	A	395	THR	N-CA-C	5.19	118.39	111.75
1	A	621	VAL	N-CA-C	5.17	115.29	107.80
1	A	255	GLU	N-CA-C	5.08	116.90	111.36
1	A	201	MET	N-CA-C	-5.07	105.84	111.36
1	A	243	SER	CB-CA-C	-5.03	110.38	117.23

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	215	ALA	N-CA-C	-5.01	103.43	110.50

There are no chirality outliers.

There are no planarity outliers.

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	A	4488	0	4357	95	0
2	A	160	0	0	5	0
All	All	4648	0	4357	95	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 11.

All (95) 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:323:VAL:HG21	1:A:331:MET:HE3	1.40	1.00
1:A:384:MET:HE1	1:A:471:ARG:HB3	1.54	0.89
1:A:153:GLN:HE21	1:A:157:GLN:NE2	1.77	0.83
1:A:110:ASN:HD22	1:A:110:ASN:C	1.94	0.75
1:A:384:MET:HE2	1:A:508:HIS:CB	2.17	0.74
1:A:245:GLU:HG3	1:A:246:TRP:CD1	2.24	0.73
1:A:176:ASN:HD22	1:A:179:THR:HG23	1.53	0.72
1:A:256:HIS:HB3	1:A:257:PRO:HD3	1.72	0.72
1:A:407:TYR:CZ	1:A:436:ARG:HG2	2.27	0.70
1:A:471:ARG:HG3	1:A:471:ARG:HH11	1.56	0.69
1:A:384:MET:HE1	1:A:471:ARG:CB	2.23	0.68
1:A:176:ASN:HD22	1:A:179:THR:CG2	2.08	0.65
1:A:631:THR:HG22	1:A:631:THR:O	1.97	0.65
1:A:384:MET:HE2	1:A:508:HIS:HA	1.80	0.64
1:A:516:LEU:HD11	1:A:587:ALA:HB2	1.78	0.64
1:A:384:MET:CE	1:A:508:HIS:HA	2.29	0.62
1:A:295:HIS:HB2	2:A:1159:HOH:O	1.98	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:153:GLN:HE21	1:A:157:GLN:HE22	1.48	0.62
1:A:245:GLU:CG	1:A:246:TRP:CD1	2.82	0.62
1:A:273:GLU:HG2	2:A:1104:HOH:O	2.00	0.62
1:A:49:PRO:HA	1:A:53:THR:HG21	1.82	0.61
1:A:192:GLU:CD	1:A:192:GLU:H	2.09	0.60
1:A:170:LEU:C	1:A:170:LEU:HD23	2.27	0.59
1:A:334:LEU:O	1:A:338:ARG:HG3	2.03	0.59
1:A:383:VAL:HG13	1:A:583:GLU:HG2	1.85	0.58
1:A:471:ARG:HG3	1:A:471:ARG:NH1	2.15	0.57
1:A:265:VAL:O	1:A:294:PRO:HB3	2.04	0.56
1:A:71:ARG:HH21	1:A:256:HIS:HE1	1.52	0.56
1:A:577:VAL:O	1:A:578:LEU:HD23	2.06	0.56
1:A:186:TYR:O	1:A:189:ARG:HG3	2.06	0.55
1:A:110:ASN:C	1:A:110:ASN:ND2	2.61	0.55
1:A:384:MET:HE2	1:A:508:HIS:HB2	1.88	0.55
1:A:384:MET:HE2	1:A:508:HIS:CA	2.36	0.55
1:A:384:MET:HE3	1:A:471:ARG:HG2	1.89	0.54
1:A:185:PRO:HG2	1:A:186:TYR:CE1	2.43	0.53
1:A:306:TYR:CG	1:A:365:ILE:HD11	2.43	0.53
1:A:71:ARG:HH21	1:A:256:HIS:CE1	2.26	0.53
1:A:85:VAL:HG13	1:A:89:LEU:HD12	1.92	0.52
1:A:189:ARG:HD2	1:A:193:GLU:CD	2.34	0.52
1:A:121:SER:HA	1:A:335:ARG:HH21	1.75	0.51
1:A:55:ILE:HD13	1:A:297:TYR:CE2	2.46	0.50
1:A:407:TYR:CE2	1:A:436:ARG:HG2	2.46	0.50
1:A:165:VAL:HG22	1:A:169:GLU:CB	2.42	0.50
1:A:72:PHE:CD2	1:A:74:PRO:HD3	2.48	0.49
1:A:192:GLU:CD	1:A:192:GLU:N	2.70	0.49
1:A:128:TRP:CE2	1:A:338:ARG:HG2	2.48	0.49
1:A:165:VAL:HG22	1:A:169:GLU:HB3	1.95	0.48
1:A:364:ASP:OD2	1:A:366:ALA:HB3	2.13	0.48
1:A:55:ILE:HD13	1:A:297:TYR:CD2	2.49	0.48
1:A:382:ARG:HG2	1:A:407:TYR:O	2.14	0.48
1:A:90:LEU:HG	1:A:269:MET:CE	2.44	0.47
1:A:110:ASN:HD22	1:A:111:PRO:N	2.12	0.47
1:A:323:VAL:HG13	1:A:328:ASP:CB	2.44	0.47
1:A:425:GLY:HA2	1:A:590:PRO:HG2	1.97	0.47
1:A:96:ARG:HD3	2:A:1123:HOH:O	2.14	0.46
1:A:331:MET:HE2	1:A:526:LEU:CD2	2.44	0.46
1:A:257:PRO:HG3	1:A:281:TYR:CD1	2.50	0.46
1:A:272:LEU:HD11	1:A:358:ARG:O	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:308:ILE:HG12	1:A:533:GLU:HG3	1.97	0.46
1:A:601:GLY:HA2	1:A:628:LEU:CD2	2.45	0.46
1:A:90:LEU:HG	1:A:269:MET:HE1	1.96	0.46
1:A:305:GLU:HG3	1:A:363:VAL:O	2.15	0.46
1:A:523:TYR:HA	1:A:574:SER:O	2.16	0.45
1:A:377:ASN:O	1:A:382:ARG:NH2	2.45	0.45
1:A:269:MET:HB3	1:A:299:PHE:HE1	1.81	0.45
1:A:165:VAL:CG2	1:A:169:GLU:HB3	2.46	0.45
1:A:245:GLU:CG	1:A:246:TRP:NE1	2.79	0.45
1:A:169:GLU:OE2	1:A:172:ARG:NE	2.44	0.44
1:A:331:MET:HE2	1:A:526:LEU:HD22	1.99	0.44
1:A:447:GLU:HG3	2:A:1118:HOH:O	2.17	0.44
1:A:381:PRO:HD2	1:A:594:ARG:O	2.16	0.44
1:A:387:LEU:N	1:A:387:LEU:HD23	2.33	0.44
1:A:110:ASN:ND2	1:A:112:GLU:H	2.14	0.44
1:A:245:GLU:HG3	1:A:246:TRP:NE1	2.33	0.44
1:A:184:SER:HB2	1:A:185:PRO:HD2	1.99	0.43
1:A:224:MET:HE1	1:A:227:ARG:CZ	2.48	0.43
1:A:163:GLU:HB3	1:A:212:VAL:HG23	1.99	0.43
1:A:315:ARG:NH2	1:A:319:GLN:HE21	2.17	0.43
1:A:528:ARG:HG2	1:A:569:TYR:O	2.19	0.43
1:A:306:TYR:CD1	1:A:365:ILE:HD11	2.54	0.43
1:A:118:TYR:O	1:A:122:ILE:HG13	2.20	0.42
1:A:50:ASN:H	1:A:53:THR:HB	1.85	0.42
1:A:383:VAL:CG1	1:A:384:MET:N	2.83	0.42
1:A:384:MET:HE1	1:A:508:HIS:HA	2.02	0.41
1:A:383:VAL:HG13	1:A:583:GLU:CG	2.50	0.41
1:A:601:GLY:HA2	1:A:628:LEU:HD23	2.02	0.41
1:A:274:PHE:HA	1:A:277:ASN:ND2	2.35	0.41
1:A:335:ARG:HG2	2:A:1026:HOH:O	2.21	0.41
1:A:631:THR:O	1:A:631:THR:CG2	2.68	0.41
1:A:425:GLY:HA2	1:A:590:PRO:CG	2.51	0.41
1:A:179:THR:HA	1:A:180:PRO:HD2	1.89	0.41
1:A:306:TYR:HB2	1:A:365:ILE:CD1	2.50	0.41
1:A:46:LEU:HD12	1:A:46:LEU:HA	1.91	0.40
1:A:471:ARG:NH1	1:A:471:ARG:CG	2.82	0.40
1:A:408:TRP:HA	1:A:409:PRO:HD3	1.81	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	550/851 (65%)	536 (98%)	12 (2%)	2 (0%)	30	38

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	73	PRO
1	A	217	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	A	470/668 (70%)	452 (96%)	18 (4%)	29	44

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	53	THR
1	A	73	PRO
1	A	75	ASP
1	A	110	ASN
1	A	127	LYS
1	A	146	ARG
1	A	179	THR
1	A	323	VAL
1	A	365	ILE

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Mol	Chain	Res	Type
1	A	382	ARG
1	A	383	VAL
1	A	387	LEU
1	A	392	VAL
1	A	436	ARG
1	A	440	LEU
1	A	506	VAL
1	A	586	VAL
1	A	604	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	110	ASN
1	A	116	GLN
1	A	157	GLN
1	A	176	ASN
1	A	256	HIS
1	A	277	ASN
1	A	296	GLN
1	A	319	GLN
1	A	337	GLN
1	A	370	ASN

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

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 [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	A	556/851 (65%)	-0.01	13 (2%) 61 63	24, 39, 63, 88	0

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	613	VAL	4.8
1	A	612	ARG	3.4
1	A	43	ALA	3.0
1	A	244	ASP	2.9
1	A	398	ASP	2.8
1	A	176	ASN	2.6
1	A	611	GLU	2.5
1	A	245	GLU	2.4
1	A	178	THR	2.3
1	A	364	ASP	2.1
1	A	536	ASN	2.1
1	A	174	ARG	2.1
1	A	365	ILE	2.1

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 ⓘ

There are no such residues in this entry.