Full wwPDB X-ray Structure Validation Report ⓘ

Oct 16, 2025 – 04:03 PM EDT

PDB ID	:	9PYJ / pdb_00009pyj
Title	:	Crystal Structure of ZETA_2-Apo
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Deposited on	:	2025-08-07
Resolution	:	3.49 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:

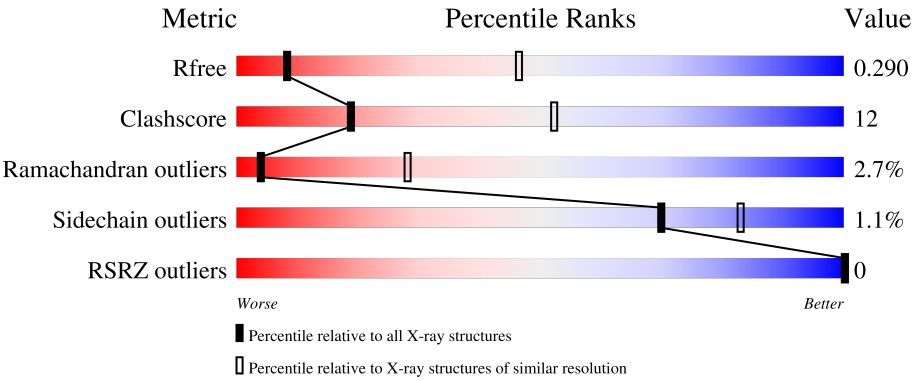
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.46

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 3.49 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}	164625	1094 (3.56-3.44)
Clashscore	180529	1045 (3.54-3.46)
Ramachandran outliers	177936	1032 (3.54-3.46)
Sidechain outliers	177891	1033 (3.54-3.46)
RSRZ outliers	164620	1093 (3.56-3.44)

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	126	70% 27%
1	B	126	66% 29%
1	C	126	63% 32%
1	D	126	70% 24% 5%

2 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 7891 atoms, of which 3938 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 ZETA_2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	123	Total	C	H	N	O	15	0	0
			1992	633	995	180	184			
1	B	122	Total	C	H	N	O	15	0	0
			1968	627	982	176	183			
1	C	123	Total	C	H	N	O	15	0	0
			1992	633	995	180	184			
1	D	120	Total	C	H	N	O	15	0	0
			1939	618	966	174	181			

3 Residue-property plots (i)

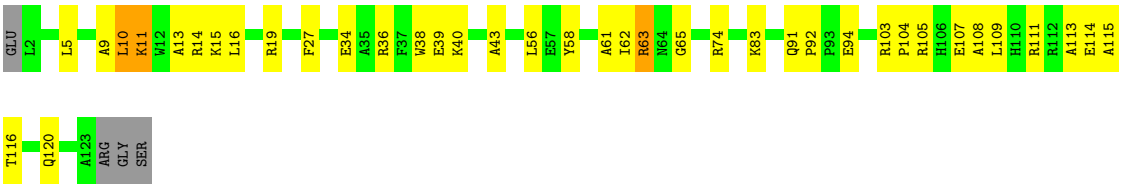
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: ZETA_2

Chain A:

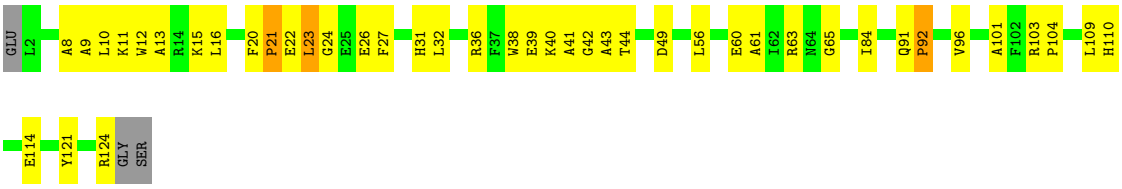
- Molecule 1: ZETA_2

Chain B:



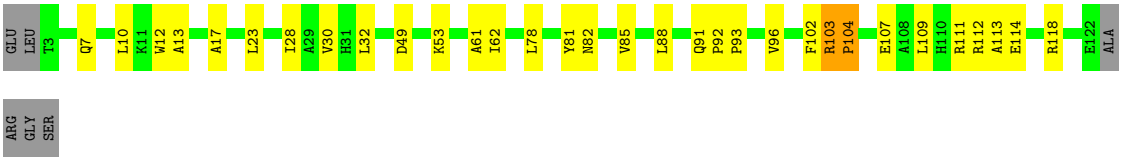
- Molecule 1: ZETA_2

Chain C:



- Molecule 1: ZETA_2

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	42.21Å 94.86Å 50.38Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.43 – 3.49 50.38 – 3.49	Depositor EDS
% Data completeness (in resolution range)	98.9 (50.43-3.49) 98.8 (50.38-3.49)	Depositor EDS
R_{merge}	0.34	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.59 (at 3.48Å)	Xtriage
Refinement program	REFMAC 5.8.0430 (refmacat 0.4.82)	Depositor
R, R_{free}	0.225 , 0.283 0.230 , 0.290	Depositor DCC
R_{free} test set	192 reflections (3.76%)	wwPDB-VP
Wilson B-factor (Å^2)	99.4	Xtriage
Anisotropy	0.094	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.44 , 364.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.39$, $< L^2 > = 0.22$	Xtriage
Estimated twinning fraction	0.167 for h,-k,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7891	wwPDB-VP
Average B, all atoms (Å^2)	86.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.62% 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	0.48	0/1018	1.00	2/1374 (0.1%)
1	B	0.48	0/1007	1.02	0/1360
1	C	0.49	0/1018	1.01	0/1374
1	D	0.48	0/994	1.01	0/1342
All	All	0.48	0/4037	1.01	2/5450 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	116	THR	CA-CB-OG1	-5.24	101.74	109.60
1	A	66	ASP	CA-CB-CG	5.12	117.72	112.60

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	997	995	991	20	0
1	B	986	982	978	24	1
1	C	997	995	991	30	1
1	D	973	966	962	22	0
All	All	3953	3938	3922	92	1

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 12.

All (92) 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:C:27:PHE:HA	1:C:109:LEU:HD21	1.67	0.77
1:B:10:LEU:HD11	1:D:118:ARG:HH21	1.49	0.76
1:C:41:ALA:HB2	1:C:91:GLN:OE1	1.88	0.73
1:A:27:PHE:HA	1:A:109:LEU:HD11	1.74	0.69
1:C:121:TYR:HA	1:C:124:ARG:HH21	1.58	0.69
1:D:17:ALA:HB2	1:D:28:ILE:HD11	1.77	0.66
1:A:93:PRO:HA	1:A:96:VAL:HB	1.78	0.65
1:B:92:PRO:HB2	1:B:94:GLU:HG2	1.79	0.64
1:C:36:ARG:O	1:C:40:LYS:HG2	1.98	0.63
1:B:91:GLN:HB3	1:B:92:PRO:HD2	1.83	0.61
1:C:101:ALA:O	1:C:104:PRO:HG2	2.03	0.59
1:B:113:ALA:O	1:B:114:GLU:C	2.45	0.58
1:D:102:PHE:O	1:D:103:ARG:C	2.46	0.58
1:C:8:ALA:O	1:C:11:LYS:HB3	2.05	0.57
1:D:78:LEU:O	1:D:82:ASN:ND2	2.38	0.56
1:C:103:ARG:N	1:C:104:PRO:HD2	2.20	0.56
1:B:103:ARG:N	1:B:104:PRO:HD2	2.21	0.56
1:B:113:ALA:O	1:B:116:THR:N	2.40	0.54
1:C:20:PHE:HB3	1:C:21:PRO:HD2	1.90	0.53
1:B:9:ALA:O	1:B:10:LEU:C	2.52	0.53
1:B:62:ILE:O	1:B:63:ARG:HB2	2.08	0.53
1:B:10:LEU:O	1:B:11:LYS:C	2.51	0.53
1:D:91:GLN:HB3	1:D:92:PRO:HD2	1.90	0.53
1:B:27:PHE:HA	1:B:109:LEU:HD11	1.89	0.53
1:C:21:PRO:HD3	1:C:63:ARG:HH12	1.73	0.53
1:A:114:GLU:OE1	1:C:36:ARG:NH1	2.43	0.52
1:C:12:TRP:HA	1:C:15:LYS:HD2	1.92	0.52
1:C:38:TRP:CD1	1:C:84:ILE:HG21	2.44	0.51
1:B:58:TYR:OH	1:B:74:ARG:NH2	2.43	0.51
1:D:30:VAL:HB	1:D:109:LEU:HD22	1.93	0.51
1:D:85:VAL:HA	1:D:88:LEU:HD12	1.93	0.51
1:B:38:TRP:C	1:B:40:LYS:H	2.18	0.51
1:A:113:ALA:O	1:A:114:GLU:C	2.53	0.50
1:B:36:ARG:HD3	1:D:111:ARG:HG3	1.92	0.50
1:C:31:HIS:NE2	1:C:110:HIS:NE2	2.54	0.50
1:A:85:VAL:HG12	1:A:89:LYS:HE2	1.94	0.50
1:A:50:ALA:O	1:A:53:LYS:HG2	2.13	0.49
1:B:36:ARG:HD3	1:D:111:ARG:CG	2.42	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:16:LEU:HD21	1:C:56:LEU:HA	1.94	0.49
1:C:20:PHE:HB3	1:C:23:LEU:HD12	1.95	0.48
1:D:93:PRO:HA	1:D:96:VAL:HB	1.95	0.48
1:D:107:GLU:O	1:D:111:ARG:HB2	2.13	0.48
1:C:32:LEU:O	1:C:32:LEU:HD23	2.14	0.48
1:A:102:PHE:O	1:A:103:ARG:C	2.58	0.47
1:D:12:TRP:HE1	1:D:53:LYS:HA	1.80	0.47
1:D:107:GLU:HB3	1:D:111:ARG:NH2	2.30	0.47
1:B:61:ALA:O	1:B:65:GLY:N	2.48	0.47
1:B:13:ALA:HA	1:B:16:LEU:HD12	1.96	0.46
1:B:15:LYS:O	1:B:19:ARG:HG2	2.15	0.46
1:A:33:GLU:OE1	1:A:105:ARG:NH2	2.48	0.46
1:B:108:ALA:HA	1:B:111:ARG:HG2	1.98	0.46
1:A:34:GLU:OE1	1:A:106:HIS:CE1	2.69	0.46
1:A:48:VAL:O	1:A:49:ASP:C	2.59	0.46
1:B:113:ALA:O	1:B:115:ALA:N	2.49	0.46
1:D:103:ARG:O	1:D:104:PRO:C	2.59	0.46
1:A:91:GLN:HB3	1:A:92:PRO:HD2	1.98	0.45
1:B:5:LEU:HD21	1:B:43:ALA:HB3	1.99	0.45
1:D:78:LEU:HA	1:D:81:TYR:CE1	2.51	0.45
1:A:39:GLU:C	1:A:41:ALA:H	2.23	0.45
1:C:27:PHE:HD1	1:C:109:LEU:HD21	1.80	0.45
1:C:92:PRO:HA	1:C:96:VAL:HG23	1.97	0.45
1:A:92:PRO:C	1:A:94:GLU:H	2.25	0.45
1:C:61:ALA:O	1:C:65:GLY:N	2.50	0.45
1:C:121:TYR:CA	1:C:124:ARG:HH21	2.29	0.45
1:C:26:GLU:O	1:C:27:PHE:C	2.58	0.45
1:C:9:ALA:O	1:C:10:LEU:C	2.60	0.44
1:B:105:ARG:O	1:B:109:LEU:N	2.45	0.44
1:D:113:ALA:O	1:D:114:GLU:C	2.60	0.44
1:C:10:LEU:HA	1:C:13:ALA:HB3	2.00	0.44
1:C:23:LEU:HD13	1:C:27:PHE:CE2	2.52	0.44
1:D:7:GLN:O	1:D:10:LEU:HB3	2.19	0.43
1:A:103:ARG:N	1:A:104:PRO:HD2	2.33	0.43
1:A:34:GLU:HG2	1:A:38:TRP:CD1	2.54	0.43
1:B:63:ARG:NH2	1:B:120:GLN:CD	2.77	0.43
1:C:22:GLU:C	1:C:24:GLY:N	2.75	0.43
1:C:27:PHE:HA	1:C:109:LEU:CD2	2.44	0.43
1:C:10:LEU:O	1:C:11:LYS:C	2.62	0.43
1:C:39:GLU:C	1:C:41:ALA:N	2.78	0.42
1:B:107:GLU:OE2	1:B:107:GLU:HA	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:28:ILE:O	1:D:32:LEU:HD23	2.20	0.42
1:A:32:LEU:HD23	1:A:32:LEU:HA	1.89	0.42
1:C:41:ALA:O	1:C:43:ALA:N	2.52	0.41
1:A:29:ALA:O	1:A:32:LEU:N	2.53	0.41
1:D:61:ALA:O	1:D:62:ILE:C	2.63	0.41
1:B:62:ILE:O	1:B:63:ARG:CB	2.69	0.41
1:D:10:LEU:O	1:D:13:ALA:HB3	2.19	0.41
1:A:56:LEU:O	1:A:57:GLU:C	2.63	0.41
1:D:12:TRP:CZ3	1:D:49:ASP:HA	2.55	0.41
1:C:16:LEU:HD23	1:C:20:PHE:CE2	2.56	0.41
1:A:22:GLU:CD	1:A:120:GLN:HE22	2.30	0.40
1:A:63:ARG:HH12	1:A:121:TYR:HB3	1.87	0.40
1:D:23:LEU:HD11	1:D:112:ARG:CD	2.51	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:14:ARG:HH22	1:C:60:GLU:OE1[2_556]	1.50	0.10

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	121/126 (96%)	103 (85%)	17 (14%)	1 (1%)	16 51
1	B	120/126 (95%)	101 (84%)	14 (12%)	5 (4%)	2 19
1	C	121/126 (96%)	94 (78%)	22 (18%)	5 (4%)	2 20
1	D	118/126 (94%)	103 (87%)	13 (11%)	2 (2%)	7 36
All	All	480/504 (95%)	401 (84%)	66 (14%)	13 (3%)	4 28

All (13) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	10	LEU
1	C	92	PRO
1	B	63	ARG
1	C	21	PRO
1	B	11	LYS
1	C	23	LEU
1	C	44	THR
1	B	83	LYS
1	B	39	GLU
1	D	103	ARG
1	C	42	GLY
1	D	104	PRO
1	A	93	PRO

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	95/97 (98%)	95 (100%)	0	100	100
1	B	94/97 (97%)	92 (98%)	2 (2%)	48	71
1	C	95/97 (98%)	93 (98%)	2 (2%)	48	71
1	D	93/97 (96%)	93 (100%)	0	100	100
All	All	377/388 (97%)	373 (99%)	4 (1%)	70	83

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	34	GLU
1	B	56	LEU
1	C	49	ASP
1	C	114	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	91	GLN
1	A	120	GLN
1	C	6	GLN
1	D	6	GLN
1	D	64	ASN

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

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

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	123/126 (97%)	-1.85	0	100	100	42, 74, 105, 125	0
1	B	122/126 (96%)	-1.84	0	100	100	50, 82, 107, 114	0
1	C	123/126 (97%)	-1.81	0	100	100	53, 82, 111, 134	0
1	D	120/126 (95%)	-1.80	0	100	100	62, 96, 119, 130	0
All	All	488/504 (96%)	-1.83	0	100	100	42, 83, 112, 134	0

There are no RSRZ outliers to report.

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

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.