



Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 11:34 pm BST

PDB ID : 4NNH
Title : Structural basis for targeting the ribosomal protein S1 of Mycobacterium tuberculosis by pyrazinamide
Authors : Yang, J.; Liu, Y.; Cai, Q.; Lin, D.
Deposited on : 2013-11-18
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 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	:	2.11
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)	:	2.11

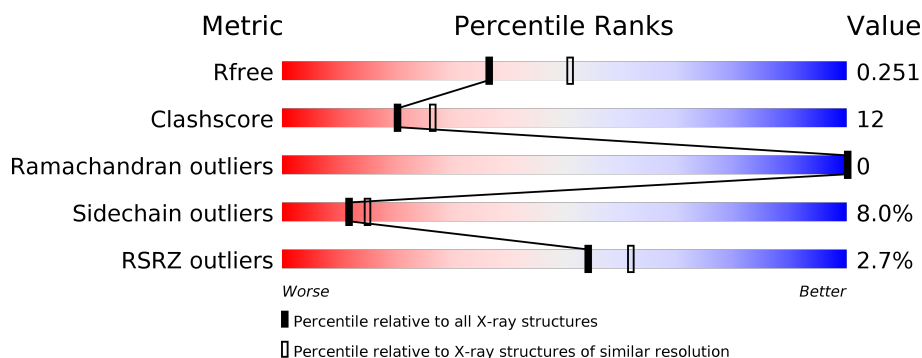
1 Overall quality at a glance

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}	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (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 on 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	168	<div> <div>4%</div> <div> <div></div> <div>77%</div> <div>16%</div> <div>• •</div> </div> </div>
1	B	168	<div> <div>2%</div> <div> <div></div> <div>78%</div> <div>17%</div> <div>• •</div> </div> </div>

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 2797 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 30S ribosomal protein S1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	164	Total	C	N	O	S	0	0	0
			1335	838	232	260	5			
1	B	164	Total	C	N	O	S	0	0	0
			1333	836	232	260	5			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	278	ASN	-	EXPRESSION TAG	UNP A0QYY6
A	279	LEU	-	EXPRESSION TAG	UNP A0QYY6
A	280	TYR	-	EXPRESSION TAG	UNP A0QYY6
A	281	PHE	-	EXPRESSION TAG	UNP A0QYY6
A	282	GLN	-	EXPRESSION TAG	UNP A0QYY6
A	283	HIS	-	EXPRESSION TAG	UNP A0QYY6
A	284	MET	-	EXPRESSION TAG	UNP A0QYY6
B	278	ASN	-	EXPRESSION TAG	UNP A0QYY6
B	279	LEU	-	EXPRESSION TAG	UNP A0QYY6
B	280	TYR	-	EXPRESSION TAG	UNP A0QYY6
B	281	PHE	-	EXPRESSION TAG	UNP A0QYY6
B	282	GLN	-	EXPRESSION TAG	UNP A0QYY6
B	283	HIS	-	EXPRESSION TAG	UNP A0QYY6
B	284	MET	-	EXPRESSION TAG	UNP A0QYY6

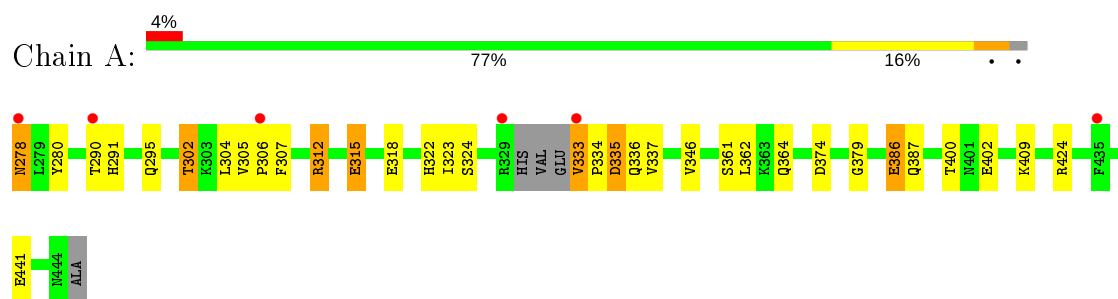
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	67	Total	O	0	0
			67	67		
2	B	62	Total	O	0	0
			62	62		

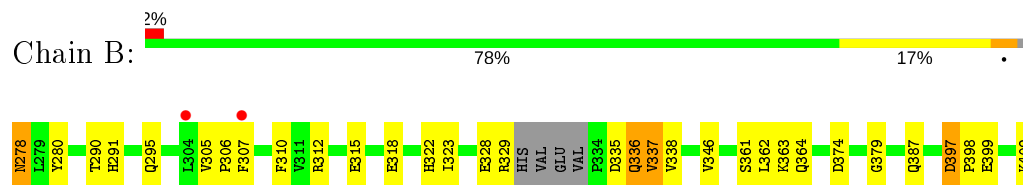
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: 30S ribosomal protein S1



- Molecule 1: 30S ribosomal protein S1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	67.25Å 67.12Å 115.69Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.48 – 2.30 33.45 – 2.30	Depositor EDS
% Data completeness (in resolution range)	98.5 (33.48-2.30) 98.4 (33.45-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	9.07 (at 2.29Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.207 , 0.252 0.214 , 0.251	Depositor DCC
R_{free} test set	1207 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å ²)	35.0	Xtriage
Anisotropy	0.202	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 29.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.467 for k,h,-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	2797	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.96% 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	A	1.01	0/1364	0.88	2/1838 (0.1%)
1	B	0.97	0/1362	0.86	2/1834 (0.1%)
All	All	0.99	0/2726	0.87	4/3672 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	397	ASP	CB-CG-OD1	5.97	123.67	118.30
1	A	424	ARG	NE-CZ-NH1	5.78	123.19	120.30
1	A	374	ASP	CB-CG-OD1	5.32	123.08	118.30
1	B	374	ASP	CB-CG-OD1	5.24	123.02	118.30

There are no chirality outliers.

There are no planarity outliers.

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	1335	0	1258	36	0
1	B	1333	0	1255	28	0
2	A	67	0	0	1	0
2	B	62	0	0	0	0
All	All	2797	0	2513	64	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 12.

All (64) 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:333:VAL:N	1:A:334:PRO:CD	2.33	0.91
1:A:333:VAL:N	1:A:334:PRO:HD3	1.89	0.87
1:B:336:GLN:HE21	1:B:336:GLN:C	1.82	0.83
1:A:305:VAL:HG21	1:A:307:PHE:CE1	2.13	0.83
1:B:305:VAL:HG21	1:B:307:PHE:CE1	2.18	0.79
1:A:290:THR:HG22	1:A:291:HIS:CE1	2.18	0.77
1:A:302:THR:HG21	1:A:318:GLU:OE1	1.85	0.76
1:B:346:VAL:HG12	1:B:362:LEU:HD12	1.68	0.75
1:A:387:GLN:NE2	2:A:559:HOH:O	2.22	0.73
1:A:346:VAL:HG12	1:A:362:LEU:HD12	1.69	0.72
1:A:295:GLN:HE22	1:A:379:GLY:H	1.37	0.72
1:B:295:GLN:HE22	1:B:379:GLY:H	1.38	0.70
1:A:323:ILE:HD11	1:A:333:VAL:HG22	1.72	0.70
1:B:278:ASN:HD22	1:B:280:TYR:H	1.42	0.67
1:A:278:ASN:HD22	1:A:280:TYR:H	1.43	0.67
1:A:290:THR:HG22	1:A:291:HIS:ND1	2.12	0.64
1:B:336:GLN:NE2	1:B:336:GLN:C	2.51	0.64
1:A:333:VAL:HB	1:A:336:GLN:OE1	1.99	0.61
1:A:335:ASP:N	1:A:335:ASP:OD1	2.34	0.61
1:A:305:VAL:CG2	1:A:307:PHE:CE1	2.84	0.60
1:A:322:HIS:CE1	1:A:323:ILE:HG22	2.37	0.60
1:A:386:GLU:HG2	1:A:387:GLN:NE2	2.18	0.59
1:B:310:PHE:CD1	1:B:318:GLU:OE2	2.56	0.59
1:A:278:ASN:ND2	1:A:280:TYR:H	2.01	0.59
1:B:278:ASN:ND2	1:B:280:TYR:H	2.00	0.59
1:B:290:THR:HG22	1:B:291:HIS:CE1	2.40	0.56
1:A:333:VAL:O	1:A:336:GLN:HB2	2.05	0.56
1:B:336:GLN:NE2	1:B:336:GLN:O	2.33	0.55
1:B:387:GLN:OE1	1:B:387:GLN:N	2.39	0.55
1:B:305:VAL:CG2	1:B:306:PRO:HD2	2.38	0.54
1:B:305:VAL:CG2	1:B:307:PHE:CE1	2.90	0.54
1:A:387:GLN:N	1:A:387:GLN:OE1	2.40	0.54
1:A:305:VAL:CG2	1:A:306:PRO:HD2	2.38	0.53
1:A:312:ARG:NH2	1:A:315:GLU:HG3	2.24	0.52
1:B:329:ARG:HG3	1:B:329:ARG:O	2.08	0.52
1:B:322:HIS:CE1	1:B:323:ILE:HG22	2.47	0.49
1:A:305:VAL:HG22	1:A:306:PRO:HD2	1.93	0.49
1:B:336:GLN:HG3	1:B:337:VAL:N	2.26	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:295:GLN:NE2	1:A:379:GLY:H	2.07	0.48
1:A:302:THR:HG21	1:A:318:GLU:CD	2.33	0.47
1:A:386:GLU:HG2	1:A:387:GLN:CD	2.34	0.47
1:B:295:GLN:NE2	1:B:379:GLY:H	2.08	0.47
1:A:305:VAL:CG2	1:A:306:PRO:CD	2.93	0.47
1:B:305:VAL:CG2	1:B:306:PRO:CD	2.92	0.47
1:B:441:GLU:HA	1:B:441:GLU:OE1	2.15	0.46
1:B:305:VAL:HG23	1:B:306:PRO:HD2	1.97	0.46
1:A:305:VAL:HG22	1:A:306:PRO:CD	2.46	0.45
1:B:305:VAL:HG22	1:B:306:PRO:N	2.32	0.45
1:B:305:VAL:HG22	1:B:306:PRO:HD2	2.00	0.44
1:A:295:GLN:NE2	1:A:379:GLY:N	2.65	0.43
1:B:295:GLN:HE22	1:B:379:GLY:N	2.11	0.43
1:B:361:SER:OG	1:B:364:GLN:HB2	2.19	0.42
1:B:295:GLN:NE2	1:B:379:GLY:N	2.66	0.42
1:A:305:VAL:HG22	1:A:306:PRO:N	2.34	0.42
1:A:441:GLU:HA	1:A:441:GLU:OE2	2.17	0.42
1:A:323:ILE:HG23	1:A:324:SER:N	2.35	0.42
1:B:397:ASP:HA	1:B:398:PRO:HD3	1.72	0.42
1:A:361:SER:OG	1:A:364:GLN:HB2	2.20	0.42
1:A:400:THR:CG2	1:A:402:GLU:HB2	2.50	0.42
1:B:346:VAL:CG1	1:B:362:LEU:HD12	2.45	0.41
1:B:305:VAL:HG22	1:B:306:PRO:CD	2.51	0.41
1:A:333:VAL:HG23	1:A:333:VAL:O	2.19	0.41
1:A:346:VAL:CG1	1:A:362:LEU:HD12	2.45	0.41
1:A:386:GLU:HG2	1:A:387:GLN:HE22	1.86	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	A	160/168 (95%)	158 (99%)	2 (1%)	0	100	100
1	B	160/168 (95%)	158 (99%)	2 (1%)	0	100	100
All	All	320/336 (95%)	316 (99%)	4 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	138/141 (98%)	128 (93%)	10 (7%)	14	18
1	B	137/141 (97%)	125 (91%)	12 (9%)	10	12
All	All	275/282 (98%)	253 (92%)	22 (8%)	12	15

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	278	ASN
1	A	302	THR
1	A	304	LEU
1	A	312	ARG
1	A	315	GLU
1	A	333	VAL
1	A	335	ASP
1	A	337	VAL
1	A	386	GLU
1	A	409	LYS
1	B	278	ASN
1	B	312	ARG
1	B	315	GLU
1	B	328	GLU
1	B	335	ASP
1	B	336	GLN
1	B	337	VAL
1	B	338	VAL

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Mol	Chain	Res	Type
1	B	363	LYS
1	B	399	GLU
1	B	409	LYS
1	B	441	GLU

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

Mol	Chain	Res	Type
1	A	278	ASN
1	A	295	GLN
1	B	278	ASN
1	B	295	GLN
1	B	336	GLN

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 carbohydrates 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 [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	164/168 (97%)	0.32	6 (3%) 41 48	20, 41, 79, 102	0
1	B	164/168 (97%)	0.26	3 (1%) 68 74	20, 41, 80, 96	0
All	All	328/336 (97%)	0.29	9 (2%) 54 62	20, 41, 80, 102	0

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	329	ARG	4.6
1	A	333	VAL	2.8
1	B	307	PHE	2.8
1	A	278	ASN	2.5
1	A	290	THR	2.5
1	A	306	PRO	2.3
1	B	304	LEU	2.2
1	B	445	ALA	2.1
1	A	435	PHE	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 carbohydrates 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.