



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 07:05 AM UTC

PDB ID : 1U0T / pdb_00001u0t
Title : Crystal structure of Mycobacterium tuberculosis NAD kinase
Authors : Garavaglia, S.; Raffaelli, N.; Finaurini, L.; Magni, G.; Rizzi, M.; TB Structural Genomics Consortium (TBSGC)
Deposited on : 2004-07-14
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) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

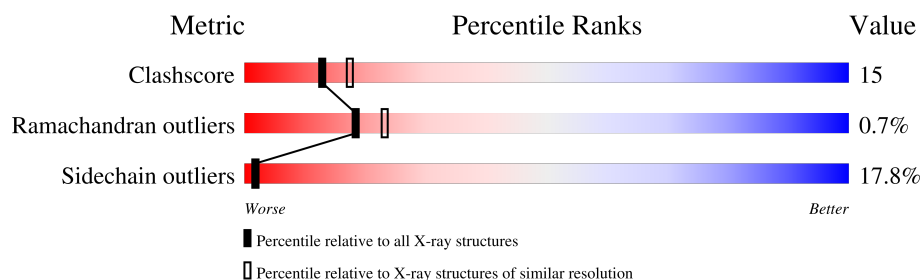
1 Overall quality at a glance

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))
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (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 $\leq 5\%$

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	307	
1	B	307	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4364 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 Inorganic polyphosphate/ATP-NAD kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	267	Total	C	N	O	S	0	0	0
			2010	1270	368	366	6			
1	B	276	Total	C	N	O	S	0	0	0
			2078	1308	380	384	6			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	122	Total	O	0	0
			122	122		
2	B	154	Total	O	0	0
			154	154		

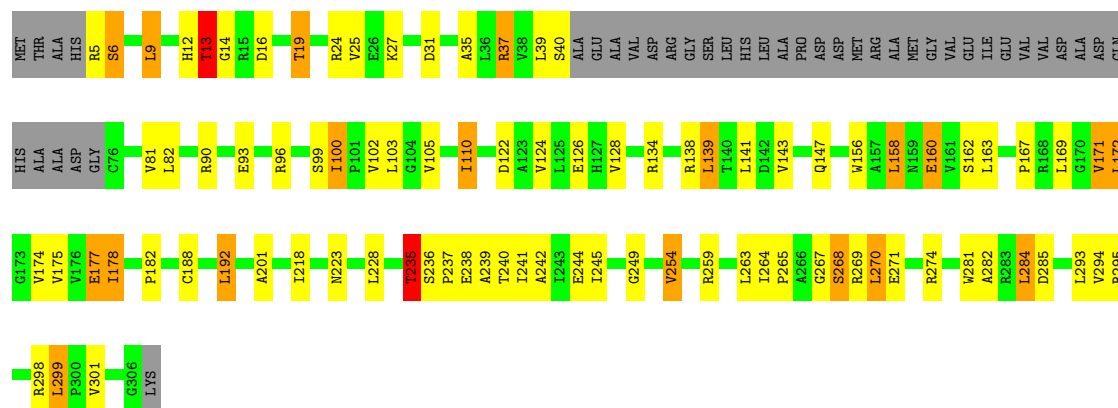
3 Residue-property plots [i](#)

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. 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. 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.

Note EDS was not executed.

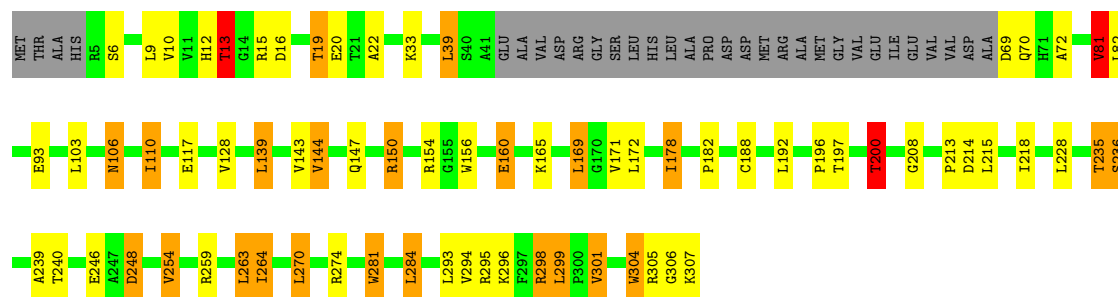
- Molecule 1: Inorganic polyphosphate/ATP-NAD kinase

Chain A: 



- Molecule 1: Inorganic polyphosphate/ATP-NAD kinase

Chain B: 



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	64.76Å 145.66Å 68.71Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.30	Depositor
% Data completeness (in resolution range)	(Not available) (50.00-2.30)	Depositor
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.226 , 0.289	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4364	wwPDB-VP
Average B, all atoms (Å ²)	35.0	wwPDB-VP

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	1.04	4/2042 (0.2%)	1.22	8/2777 (0.3%)
1	B	1.11	5/2111 (0.2%)	1.23	11/2869 (0.4%)
All	All	1.07	9/4153 (0.2%)	1.23	19/5646 (0.3%)

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	13	THR	CB-OG1	6.94	1.54	1.43
1	B	13	THR	CB-OG1	6.64	1.54	1.43
1	B	144	VAL	CA-CB	6.60	1.63	1.54
1	A	100	ILE	CA-CB	5.56	1.61	1.55
1	A	100	ILE	CA-C	5.55	1.57	1.52
1	A	13	THR	CA-CB	5.30	1.61	1.53
1	B	264	ILE	CA-CB	5.29	1.59	1.53
1	B	150	ARG	CA-C	5.21	1.58	1.52
1	B	128	VAL	CA-C	5.05	1.59	1.52

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	178	ILE	CA-C-N	-7.98	106.30	121.54
1	A	178	ILE	C-N-CA	-7.98	106.30	121.54
1	A	235	THR	N-CA-CB	-7.41	98.66	111.55
1	A	201	ALA	N-CA-C	6.74	114.31	108.78
1	B	178	ILE	CA-C-N	-6.56	114.14	123.20
1	B	178	ILE	C-N-CA	-6.56	114.14	123.20
1	B	213	PRO	CA-C-N	6.28	129.32	120.28
1	B	213	PRO	C-N-CA	6.28	129.32	120.28
1	B	81	VAL	CB-CA-C	-6.17	101.42	110.62
1	B	150	ARG	N-CA-C	6.09	119.12	109.50
1	B	200	THR	N-CA-CB	-6.06	100.94	110.46
1	B	6	SER	N-CA-C	5.94	118.21	109.24
1	A	178	ILE	O-C-N	-5.84	115.28	122.57

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	106	ASN	CB-CA-C	5.58	119.59	109.83
1	A	192	LEU	CA-CB-CG	5.24	134.65	116.30
1	B	214	ASP	N-CA-CB	-5.20	102.21	110.22
1	A	249	GLY	N-CA-C	-5.17	106.59	112.79
1	A	139	LEU	CA-CB-CG	5.16	134.37	116.30
1	B	197	THR	N-CA-C	5.06	116.80	111.28

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	2010	0	2056	62	0
1	B	2078	0	2113	72	0
2	A	122	0	0	7	0
2	B	154	0	0	15	0
All	All	4364	0	4169	125	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 15.

All (125) 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:165:LYS:HA	1:B:172:LEU:CD1	1.46	1.44
1:B:165:LYS:CA	1:B:172:LEU:HD11	1.74	1.16
1:A:177:GLU:OE1	1:A:242:ALA:HB3	1.49	1.10
1:B:263:LEU:HB3	2:B:376:HOH:O	1.54	1.06
1:B:165:LYS:CA	1:B:172:LEU:CD1	2.34	1.03
1:B:160:GLU:HG2	2:B:321:HOH:O	1.58	1.02
1:B:172:LEU:CD2	2:B:375:HOH:O	2.09	1.01
1:B:281:TRP:HZ3	2:B:337:HOH:O	1.44	1.00
1:A:188:CYS:SG	2:A:423:HOH:O	1.98	0.97
1:B:165:LYS:HB3	1:B:172:LEU:HG	1.48	0.94

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:254:VAL:HG12	1:B:264:ILE:HD11	1.53	0.90
1:A:177:GLU:OE1	1:A:242:ALA:CB	2.19	0.90
1:B:254:VAL:CG1	1:B:264:ILE:HD11	2.02	0.89
1:A:19:THR:HB	2:A:388:HOH:O	1.72	0.88
1:B:165:LYS:CB	1:B:172:LEU:HG	2.03	0.88
1:B:200:THR:HG23	2:B:342:HOH:O	1.73	0.88
1:A:254:VAL:CG1	1:A:264:ILE:HD11	2.03	0.88
1:B:165:LYS:HA	1:B:172:LEU:HD12	1.53	0.88
1:B:178:ILE:O	1:B:240:THR:O	1.91	0.87
1:B:165:LYS:HA	1:B:172:LEU:HD11	0.88	0.87
1:A:160:GLU:HG2	2:A:309:HOH:O	1.78	0.83
1:B:200:THR:CG2	2:B:342:HOH:O	2.27	0.83
1:B:172:LEU:HD21	2:B:375:HOH:O	1.70	0.82
1:A:96:ARG:HD2	2:A:349:HOH:O	1.88	0.74
1:A:13:THR:HG22	1:A:16:ASP:OD2	1.91	0.71
1:A:301:VAL:HG12	1:A:301:VAL:O	1.90	0.70
1:B:165:LYS:CB	1:B:172:LEU:CG	2.71	0.69
1:B:235:THR:CG2	1:B:239:ALA:HB3	2.22	0.69
1:B:298:ARG:HA	1:B:298:ARG:HH11	1.57	0.68
1:A:301:VAL:O	1:A:301:VAL:CG1	2.41	0.67
1:A:254:VAL:HG11	1:A:264:ILE:HD11	1.75	0.66
1:B:19:THR:HG22	1:B:22:ALA:H	1.61	0.66
1:A:172:LEU:HB3	2:A:423:HOH:O	1.95	0.66
1:A:254:VAL:HG12	1:A:264:ILE:CG1	2.25	0.65
1:A:301:VAL:HG13	1:B:182:PRO:HB2	1.77	0.65
1:A:143:VAL:CG2	1:A:270:LEU:HD22	2.26	0.65
1:B:254:VAL:HG11	1:B:264:ILE:HD11	1.80	0.64
1:A:122:ASP:O	1:A:126:GLU:HG3	1.97	0.63
1:A:244:GLU:OE1	1:B:304:TRP:O	2.15	0.63
1:B:235:THR:HG23	1:B:239:ALA:CB	2.27	0.63
1:B:19:THR:HG23	2:B:404:HOH:O	2.00	0.62
1:A:163:LEU:HD21	1:A:245:ILE:HD11	1.83	0.61
1:B:306:GLY:O	1:B:307:LYS:HB2	2.00	0.61
1:A:182:PRO:HB2	1:B:301:VAL:HG22	1.83	0.61
1:B:235:THR:HG23	1:B:239:ALA:HB3	1.84	0.60
1:A:9:LEU:HD13	1:A:25:VAL:HG11	1.83	0.59
1:A:178:ILE:O	1:A:240:THR:O	2.20	0.59
1:B:143:VAL:CG2	1:B:270:LEU:HD22	2.33	0.59
1:B:254:VAL:HG12	1:B:264:ILE:CD1	2.31	0.59
1:A:141:LEU:O	1:A:156:TRP:HA	2.02	0.58
1:B:172:LEU:HD23	1:B:172:LEU:N	2.19	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:9:LEU:CD1	1:A:25:VAL:HG11	2.35	0.57
1:B:298:ARG:HA	1:B:298:ARG:NH1	2.17	0.57
1:A:143:VAL:HG23	1:A:270:LEU:HD22	1.86	0.56
1:A:236:SER:HB2	1:A:237:PRO:HD2	1.86	0.56
1:A:294:VAL:HA	1:A:299:LEU:HB2	1.87	0.56
1:B:69:ASP:HB2	1:B:72:ALA:HB2	1.88	0.55
1:A:90:ARG:O	1:A:93:GLU:HB3	2.06	0.55
1:A:110:ILE:HD13	1:A:295:ARG:HG2	1.88	0.55
1:A:301:VAL:CG1	1:B:182:PRO:HB2	2.36	0.54
1:B:165:LYS:CB	1:B:172:LEU:CD1	2.85	0.54
1:B:110:ILE:HD11	1:B:295:ARG:HH21	1.72	0.54
1:A:218:ILE:HB	1:A:235:THR:HG22	1.89	0.54
1:B:171:VAL:C	1:B:172:LEU:HD23	2.33	0.54
1:A:103:LEU:HB2	1:A:282:ALA:HB3	1.90	0.54
1:A:235:THR:HG23	1:A:239:ALA:HB3	1.90	0.54
1:B:235:THR:CG2	1:B:239:ALA:CB	2.86	0.54
1:B:259:ARG:CD	2:B:343:HOH:O	2.56	0.53
1:A:103:LEU:HD11	1:A:284:LEU:HD22	1.89	0.53
1:A:171:VAL:HG22	1:A:188:CYS:N	2.24	0.53
1:A:265:PRO:O	1:A:268:SER:OG	2.24	0.53
1:B:235:THR:HG21	1:B:239:ALA:HB3	1.91	0.52
1:A:254:VAL:CG1	1:A:264:ILE:CD1	2.83	0.52
1:A:167:PRO:HD2	2:A:417:HOH:O	2.10	0.52
1:B:301:VAL:HG13	2:B:325:HOH:O	2.11	0.51
1:B:304:TRP:O	1:B:306:GLY:N	2.44	0.51
1:B:259:ARG:HD3	2:B:343:HOH:O	2.10	0.50
1:A:124:VAL:O	1:A:128:VAL:HG23	2.11	0.50
1:B:165:LYS:HB2	1:B:172:LEU:CG	2.41	0.50
1:B:171:VAL:HG22	1:B:188:CYS:N	2.27	0.50
1:A:175:VAL:HG11	1:B:304:TRP:HA	1.95	0.49
1:B:263:LEU:HD12	2:B:376:HOH:O	2.13	0.48
1:B:196:PRO:HG2	1:B:215:LEU:O	2.14	0.48
1:A:13:THR:HG23	1:A:14:GLY:N	2.29	0.48
1:B:10:VAL:HB	1:B:81:VAL:HG13	1.95	0.48
1:A:162:SER:O	1:A:254:VAL:HA	2.13	0.47
1:A:110:ILE:H	1:A:110:ILE:HG13	1.51	0.47
1:A:138:ARG:HB3	1:A:281:TRP:NE1	2.29	0.47
1:A:223:ASN:C	1:A:223:ASN:HD22	2.23	0.46
1:B:39:LEU:C	1:B:39:LEU:HD12	2.39	0.46
1:A:171:VAL:HG22	1:A:188:CYS:H	1.81	0.46
1:A:235:THR:HG21	1:A:241:ILE:HD11	1.97	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:218:ILE:HB	1:B:235:THR:HG22	1.96	0.46
1:A:269:ARG:HD3	1:A:271:GLU:OE2	2.16	0.46
1:A:235:THR:HG23	1:A:236:SER:O	2.16	0.46
1:B:139:LEU:HD12	1:B:139:LEU:C	2.42	0.45
1:B:12:HIS:HB3	1:B:16:ASP:OD2	2.17	0.45
1:B:248:ASP:OD2	1:B:248:ASP:C	2.59	0.45
1:A:82:LEU:HD23	1:A:105:VAL:HB	1.98	0.45
1:A:6:SER:HB3	1:A:35:ALA:HB3	1.99	0.44
1:A:267:GLY:O	1:B:307:LYS:HB3	2.17	0.44
1:B:117:GLU:OE2	1:B:295:ARG:NH2	2.50	0.44
1:A:158:LEU:C	1:A:158:LEU:HD12	2.43	0.44
1:A:143:VAL:CG2	1:A:270:LEU:CD2	2.94	0.44
1:B:235:THR:HG23	1:B:239:ALA:HB2	2.00	0.44
1:B:13:THR:O	1:B:16:ASP:HB2	2.19	0.43
1:B:259:ARG:HD2	2:B:343:HOH:O	2.18	0.43
1:A:254:VAL:HG12	1:A:264:ILE:HG13	1.98	0.43
1:A:37:ARG:H	1:A:37:ARG:HG2	1.68	0.43
1:A:177:GLU:OE2	1:A:244:GLU:CD	2.62	0.43
1:B:103:LEU:HD11	1:B:284:LEU:HD22	2.01	0.42
1:A:172:LEU:HD21	1:A:245:ILE:HD12	2.01	0.42
1:B:304:TRP:C	1:B:306:GLY:H	2.28	0.42
1:B:294:VAL:HA	1:B:299:LEU:HB2	2.01	0.42
1:B:93:GLU:HG3	1:B:156:TRP:HZ2	1.83	0.42
1:A:160:GLU:CG	2:A:309:HOH:O	2.53	0.42
1:B:9:LEU:HD11	1:B:82:LEU:HG	2.01	0.41
1:B:165:LYS:CB	1:B:172:LEU:HD11	2.44	0.41
1:A:244:GLU:HG2	1:B:307:LYS:HA	2.02	0.41
1:A:158:LEU:HD13	1:A:281:TRP:HZ2	1.86	0.41
1:B:259:ARG:HD2	2:B:387:HOH:O	2.19	0.41
1:A:177:GLU:HG2	1:B:304:TRP:HE1	1.85	0.40
1:A:301:VAL:HG11	1:B:182:PRO:CG	2.51	0.40
1:B:235:THR:CG2	1:B:236:SER:O	2.69	0.40
1:B:208:GLY:HA3	2:B:315:HOH:O	2.21	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	263/307 (86%)	249 (95%)	12 (5%)	2 (1%)	16	20
1	B	272/307 (89%)	254 (93%)	16 (6%)	2 (1%)	18	23
All	All	535/614 (87%)	503 (94%)	28 (5%)	4 (1%)	18	23

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	12	HIS
1	B	304	TRP
1	A	31	ASP
1	B	169	LEU

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	210/242 (87%)	170 (81%)	40 (19%)	1	1
1	B	216/242 (89%)	180 (83%)	36 (17%)	2	2
All	All	426/484 (88%)	350 (82%)	76 (18%)	2	2

All (76) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	5	ARG
1	A	6	SER

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Mol	Chain	Res	Type
1	A	9	LEU
1	A	13	THR
1	A	19	THR
1	A	24	ARG
1	A	27	LYS
1	A	37	ARG
1	A	39	LEU
1	A	40	SER
1	A	81	VAL
1	A	99	SER
1	A	100	ILE
1	A	102	VAL
1	A	110	ILE
1	A	134	ARG
1	A	139	LEU
1	A	147	GLN
1	A	158	LEU
1	A	160	GLU
1	A	169	LEU
1	A	171	VAL
1	A	172	LEU
1	A	174	VAL
1	A	177	GLU
1	A	192	LEU
1	A	228	LEU
1	A	235	THR
1	A	238	GLU
1	A	254	VAL
1	A	259	ARG
1	A	263	LEU
1	A	268	SER
1	A	270	LEU
1	A	274	ARG
1	A	284	LEU
1	A	285	ASP
1	A	293	LEU
1	A	298	ARG
1	A	299	LEU
1	B	13	THR
1	B	15	ARG
1	B	19	THR
1	B	20	GLU

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Mol	Chain	Res	Type
1	B	33	LYS
1	B	39	LEU
1	B	70	GLN
1	B	81	VAL
1	B	106	ASN
1	B	110	ILE
1	B	139	LEU
1	B	144	VAL
1	B	147	GLN
1	B	150	ARG
1	B	154	ARG
1	B	160	GLU
1	B	169	LEU
1	B	192	LEU
1	B	200	THR
1	B	228	LEU
1	B	235	THR
1	B	236	SER
1	B	246	GLU
1	B	248	ASP
1	B	254	VAL
1	B	263	LEU
1	B	270	LEU
1	B	274	ARG
1	B	281	TRP
1	B	284	LEU
1	B	293	LEU
1	B	296	LYS
1	B	298	ARG
1	B	299	LEU
1	B	301	VAL
1	B	305	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	223	ASN
1	B	223	ASN
1	B	226	HIS

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](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.