



Full wwPDB X-ray Structure Validation Report ⓘ

Sep 29, 2018 – 08:01 PM EDT

PDB ID : 5K4Q
Title : Three-dimensional structure of L-threonine 3-dehydrogenase from *Trypanosoma brucei* bound to NAD⁺ refined to 2.3 angstroms
Authors : Adjogatse, E.K.; Cooper, J.B.; Erskine, P.T.
Deposited on : 2016-05-21
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
Mogul : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : rb-20031633
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20031633

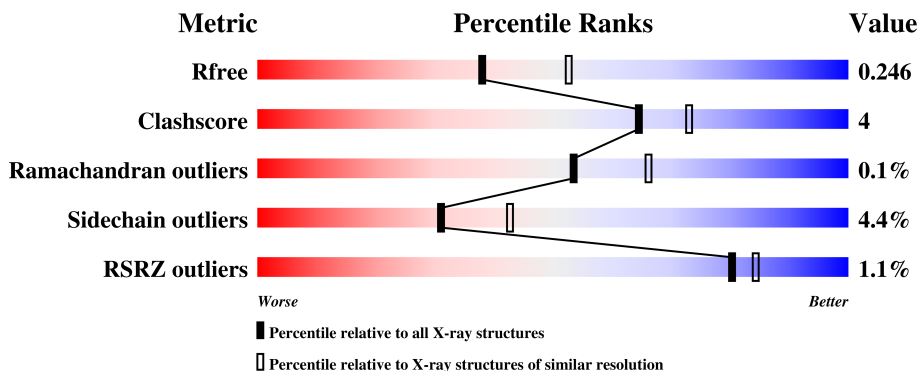
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 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}	111664	4477 (2.30-2.30)
Clashscore	122126	5072 (2.30-2.30)
Ramachandran outliers	120053	5022 (2.30-2.30)
Sidechain outliers	120020	5021 (2.30-2.30)
RSRZ outliers	108989	4374 (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. 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	320	 91% 8%
1	B	320	 90% 9%
1	C	320	 89% 10%
1	D	320	 85% 14%
1	E	320	 86% 12%

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Mol	Chain	Length	Quality of chain
1	F	320	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	GOL	A	1402	-	-	X	-
3	GOL	C	3402	-	-	X	-
3	GOL	E	5402	-	-	X	-

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 16257 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.

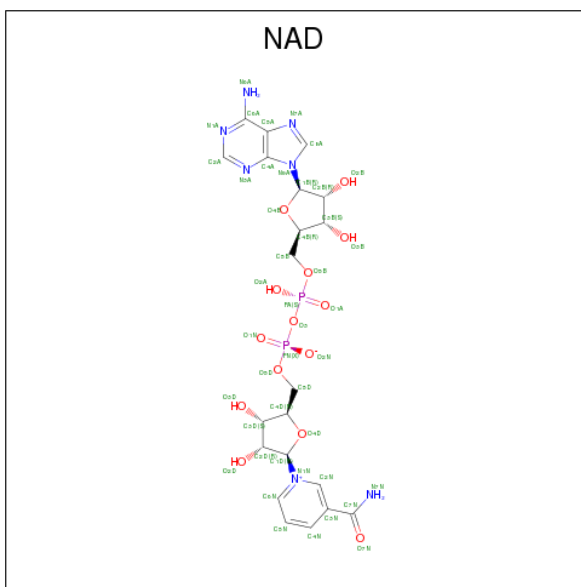
- Molecule 1 is a protein called L-threonine 3-dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	320	2501	1595	416	471	19	0	0	0
1	B	319	2502	1595	417	472	18	0	1	0
1	C	319	2493	1590	415	470	18	0	0	0
1	D	320	2501	1595	416	471	19	0	0	0
1	E	319	2502	1596	417	471	18	0	1	0
1	F	319	2505	1600	417	470	18	0	2	0

There are 6 discrepancies between the modelled and reference sequences:

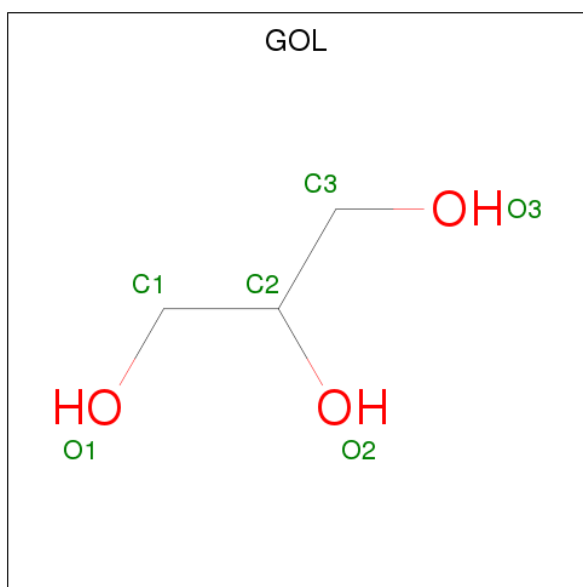
Chain	Residue	Modelled	Actual	Comment	Reference
A	1002	MET	-	initiating methionine	UNP Q7YW97
B	2002	MET	-	initiating methionine	UNP Q7YW97
C	3002	MET	-	initiating methionine	UNP Q7YW97
D	4002	MET	-	initiating methionine	UNP Q7YW97
E	5002	MET	-	initiating methionine	UNP Q7YW97
F	6002	MET	-	initiating methionine	UNP Q7YW97

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: C₂₁H₂₇N₇O₁₄P₂).



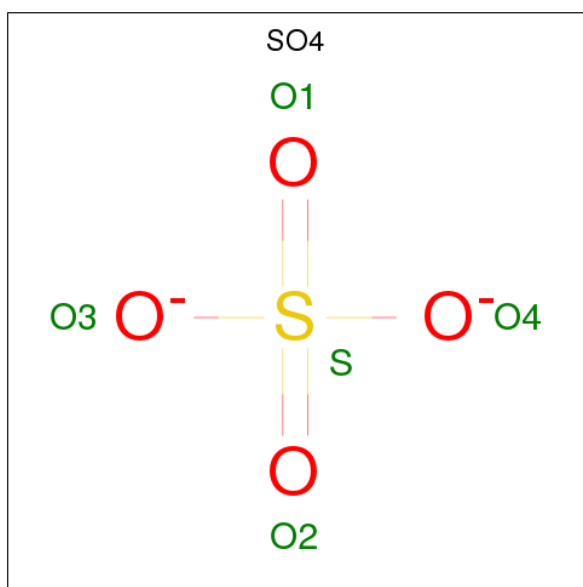
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total 44	21	7	14	2	0	0
2	B	1	Total 44	21	7	14	2	0	0
2	C	1	Total 44	21	7	14	2	0	0
2	D	1	Total 44	21	7	14	2	0	0
2	E	1	Total 44	21	7	14	2	0	0
2	F	1	Total 44	21	7	14	2	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		
3	D	1	Total	C	O	0	0
			6	3	3		
3	E	1	Total	C	O	0	0
			6	3	3		
3	F	1	Total	C	O	0	0
			6	3	3		

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	F	1	Total	O	S	0	0
			5	4	1		

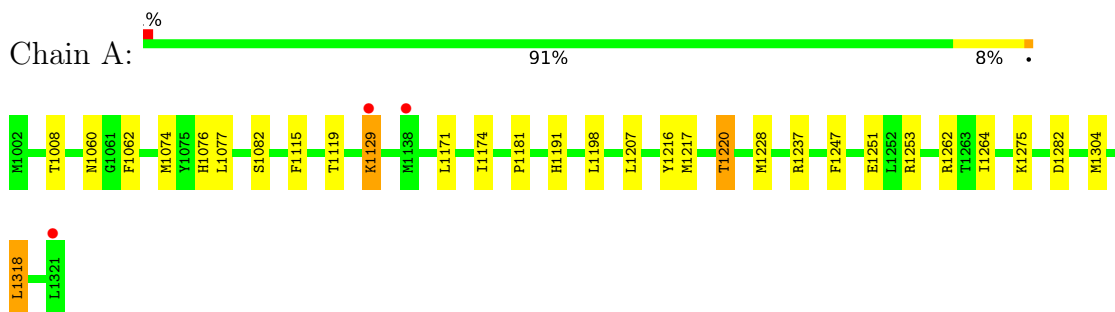
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	161	Total	O	0	0
			161	161		
5	B	168	Total	O	0	0
			168	168		
5	C	174	Total	O	0	0
			174	174		
5	D	143	Total	O	0	0
			143	143		
5	E	131	Total	O	0	0
			131	131		
5	F	151	Total	O	0	0
			151	151		

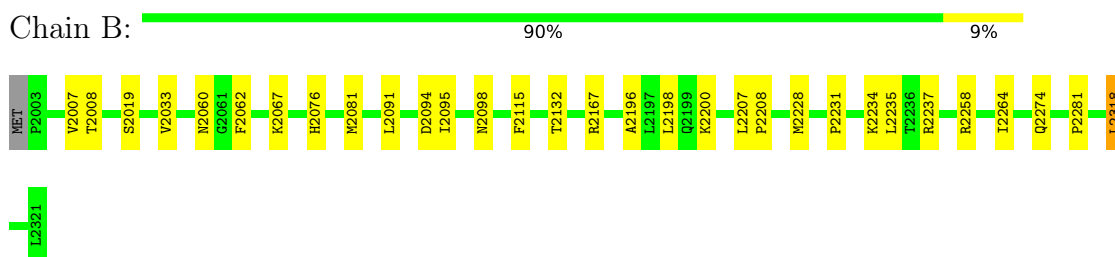
3 Residue-property plots [i](#)

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.

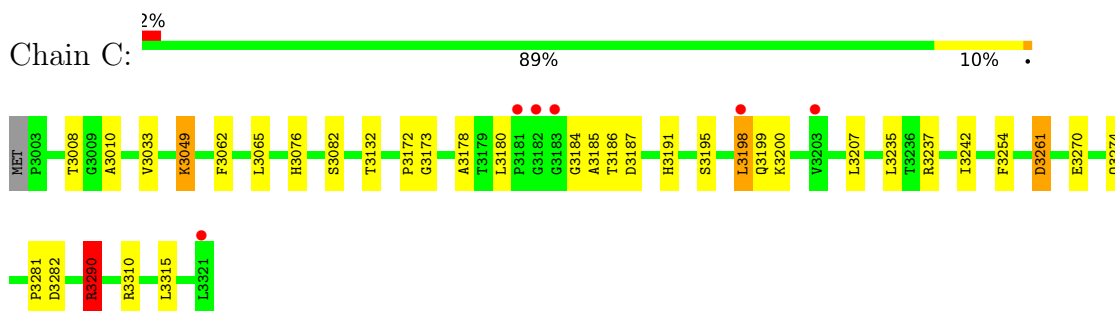
- Molecule 1: L-threonine 3-dehydrogenase



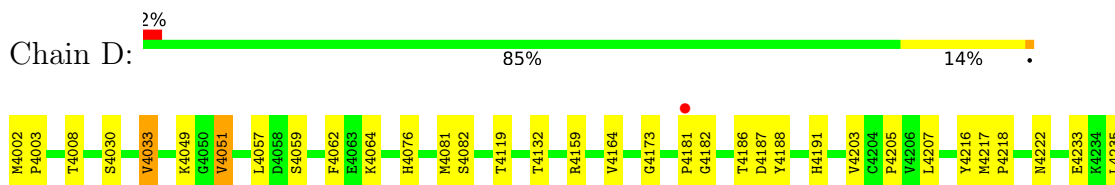
- Molecule 1: L-threonine 3-dehydrogenase



- Molecule 1: L-threonine 3-dehydrogenase



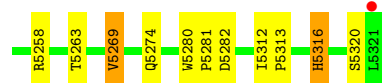
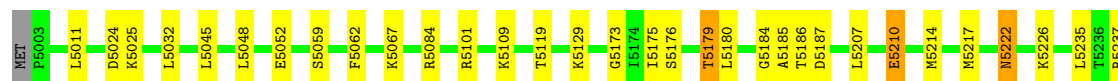
- Molecule 1: L-threonine 3-dehydrogenase





- Molecule 1: L-threonine 3-dehydrogenase

Chain E: 86% 12%



- Molecule 1: L-threonine 3-dehydrogenase

Chain F: 2% 85% 14%



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	133.63Å 277.72Å 56.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.14 – 2.30 48.14 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.2 (48.14-2.30) 99.2 (48.14-2.30)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.91 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.174 , 0.244 0.180 , 0.246	Depositor DCC
R_{free} test set	4653 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	22.4	Xtrriage
Anisotropy	0.228	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 41.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	16257	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 31.63 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.0728e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, SO4, NAD

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	0.74	0/2557	0.90	7/3469 (0.2%)
1	B	0.75	0/2558	0.82	0/3470
1	C	0.69	0/2549	0.87	4/3458 (0.1%)
1	D	0.72	0/2557	0.83	0/3469
1	E	0.68	1/2558 (0.0%)	0.83	4/3469 (0.1%)
1	F	0.74	0/2567	0.85	4/3480 (0.1%)
All	All	0.72	1/15346 (0.0%)	0.85	19/20815 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	5210	GLU	CD-OE2	6.62	1.32	1.25

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1237	ARG	NE-CZ-NH2	-9.64	115.48	120.30
1	C	3290	ARG	NE-CZ-NH1	8.95	124.78	120.30
1	A	1237	ARG	NE-CZ-NH1	7.00	123.80	120.30
1	E	5282	ASP	CB-CG-OD1	6.66	124.30	118.30
1	F	6084	ARG	NE-CZ-NH1	6.26	123.43	120.30
1	A	1282	ASP	CB-CG-OD1	6.25	123.92	118.30
1	A	1077	LEU	C-N-CD	6.09	141.20	128.40
1	A	1264	ILE	CB-CA-C	-6.02	99.55	111.60
1	A	1253	ARG	NE-CZ-NH1	5.94	123.27	120.30
1	E	5237	ARG	NE-CZ-NH2	-5.86	117.37	120.30
1	F	6300	ASP	CB-CG-OD1	5.77	123.49	118.30
1	E	5084	ARG	NE-CZ-NH2	-5.51	117.55	120.30
1	C	3237	ARG	NE-CZ-NH1	5.47	123.04	120.30
1	E	5237	ARG	NE-CZ-NH1	5.45	123.03	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	3282	ASP	CB-CG-OD2	-5.24	113.58	118.30
1	F	6237	ARG	NE-CZ-NH1	5.14	122.87	120.30
1	C	3310	ARG	NE-CZ-NH1	5.13	122.87	120.30
1	A	1253	ARG	NE-CZ-NH2	-5.12	117.74	120.30
1	F	6300	ASP	CB-CG-OD2	-5.12	113.69	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	2501	0	2512	17	0
1	B	2502	0	2511	18	0
1	C	2493	0	2504	20	0
1	D	2501	0	2512	26	0
1	E	2502	0	2516	28	0
1	F	2505	0	2530	26	0
2	A	44	0	26	2	0
2	B	44	0	26	0	0
2	C	44	0	26	0	0
2	D	44	0	26	1	0
2	E	44	0	26	0	0
2	F	44	0	26	1	0
3	A	6	0	8	4	0
3	B	6	0	8	1	0
3	C	6	0	8	7	0
3	D	6	0	8	2	0
3	E	6	0	8	4	0
3	F	6	0	8	0	0
4	B	5	0	0	0	0
4	C	5	0	0	0	0
4	D	10	0	0	0	0
4	F	5	0	0	0	0
5	A	161	0	0	2	0
5	B	168	0	0	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	C	174	0	0	1	0
5	D	143	0	0	3	0
5	E	131	0	0	7	0
5	F	151	0	0	4	0
All	All	16257	0	15289	137	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 4.

All (137) 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:E:5210:GLU:HG3	5:E:5502:HOH:O	1.52	1.08
1:E:5175:ILE:HD11	1:E:5214:MET:CE	2.01	0.89
1:E:5175:ILE:HD11	1:E:5214:MET:HE3	1.55	0.86
1:D:4181:PRO:HB2	1:D:4191:HIS:CE1	2.11	0.84
1:E:5179:THR:OG1	5:E:5501:HOH:O	1.93	0.84
1:D:4233:GLU:OE2	5:D:4501:HOH:O	2.06	0.73
1:A:1217:MET:HA	1:A:1220:THR:HG23	1.70	0.72
1:C:3184:GLY:CA	3:C:3402:GOL:H12	2.21	0.70
1:E:5185:ALA:H	3:E:5402:GOL:H12	1.58	0.68
1:C:3184:GLY:HA2	3:C:3402:GOL:H12	1.75	0.67
1:D:4207:LEU:H	1:D:4274:GLN:NE2	1.92	0.67
1:C:3082:SER:OG	3:C:3402:GOL:H31	1.95	0.66
1:B:2264:ILE:HD12	5:B:2593:HOH:O	1.96	0.66
1:D:4082:SER:H	3:D:4402:GOL:H11	1.62	0.65
1:B:2258:ARG:NH1	5:B:2503:HOH:O	2.30	0.65
1:E:5175:ILE:CD1	1:E:5214:MET:HE3	2.27	0.64
1:D:4182:GLY:O	1:D:4191:HIS:HE1	1.81	0.63
1:E:5101:ARG:CZ	5:E:5505:HOH:O	2.46	0.63
1:D:4002:MET:HB2	1:D:4003:PRO:HD2	1.81	0.62
1:C:3184:GLY:HA2	3:C:3402:GOL:C1	2.30	0.61
1:A:1181:PRO:HB2	1:A:1191:HIS:CE1	2.36	0.60
1:D:4257:GLU:OE1	5:D:4502:HOH:O	2.15	0.60
1:F:6084:ARG:HD2	1:F:6088:GLU:OE1	2.03	0.59
1:A:1082:SER:HB3	3:A:1402:GOL:O2	2.03	0.58
1:C:3198:LEU:HB3	1:C:3200:LYS:HG3	1.85	0.58
1:F:6033:VAL:CG2	1:F:6051:VAL:HG22	2.33	0.58
1:E:5210:GLU:CG	5:E:5502:HOH:O	2.27	0.57
1:C:3172:PRO:HD3	1:C:3242:ILE:O	2.05	0.57
1:D:4187:ASP:HB2	5:D:4594:HOH:O	2.05	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:2007:VAL:HB	1:B:2033:VAL:HG22	1.87	0.57
1:F:6074:MET:HE2	1:F:6076:HIS:HB2	1.87	0.57
1:B:2198:LEU:HD21	1:B:2318:LEU:HD13	1.86	0.56
1:E:5101:ARG:NE	5:E:5505:HOH:O	2.39	0.56
1:A:1129:LYS:H	1:A:1129:LYS:HD2	1.71	0.56
1:B:2081:MET:HB3	3:B:2402:GOL:H12	1.88	0.55
1:C:3184:GLY:HA3	3:C:3402:GOL:H12	1.87	0.55
1:F:6194:HIS:CD2	1:F:6312:ILE:HD13	2.42	0.55
1:E:5184:GLY:O	1:E:5187:ASP:HB2	2.06	0.54
1:B:2091:LEU:HD11	1:B:2095:ILE:HD11	1.89	0.54
1:A:1082:SER:CB	3:A:1402:GOL:O2	2.55	0.54
1:C:3207:LEU:H	1:C:3274:GLN:NE2	2.06	0.52
1:B:2132:THR:OG1	1:B:2281:PRO:HB3	2.09	0.52
1:F:6033:VAL:HG22	1:F:6051:VAL:HG22	1.91	0.52
1:F:6181:PRO:HB2	1:F:6191:HIS:NE2	2.26	0.51
1:E:5207:LEU:H	1:E:5274:GLN:NE2	2.09	0.51
1:A:1198:LEU:HD21	1:A:1318:LEU:HD13	1.93	0.51
1:B:2198:LEU:CD2	1:B:2318:LEU:HD13	2.41	0.51
1:C:3185:ALA:HB3	3:C:3402:GOL:H32	1.92	0.51
1:D:4216:TYR:CD1	1:D:4304:MET:HG3	2.46	0.51
1:B:2196:ALA:HA	1:B:2264:ILE:HD13	1.93	0.50
1:D:4309:LEU:HB3	1:D:4321:LEU:HD11	1.94	0.50
1:F:6074:MET:CE	1:F:6076:HIS:HB2	2.42	0.50
1:C:3173:GLY:HA3	1:C:3186:THR:HG21	1.93	0.50
1:E:5175:ILE:HD11	1:E:5214:MET:HE1	1.91	0.50
1:F:6187:ASP:HB2	5:F:6560:HOH:O	2.11	0.50
1:D:4081:MET:HE1	2:D:4401:NAD:C2N	2.42	0.50
1:C:3290:ARG:CG	1:C:3290:ARG:HH11	2.25	0.49
1:E:5180:LEU:HD23	1:E:5316:HIS:CD2	2.47	0.49
1:E:5045:LEU:HA	1:E:5048:LEU:HD12	1.94	0.49
1:B:2008:THR:OG1	1:B:2076:HIS:HA	2.12	0.49
1:F:6280:TRP:HB3	1:F:6281:PRO:HD2	1.94	0.49
1:C:3270:GLU:HG3	1:C:3274:GLN:CB	2.43	0.48
1:E:5210:GLU:CD	5:E:5502:HOH:O	2.49	0.48
1:F:6115:PHE:CZ	1:F:6224:LEU:CD2	2.97	0.48
1:D:4217:MET:N	1:D:4218:PRO:CD	2.77	0.48
1:F:6298:LYS:NZ	5:F:6508:HOH:O	2.47	0.48
1:F:6187:ASP:CB	5:F:6560:HOH:O	2.63	0.47
1:C:3290:ARG:NH2	5:C:3509:HOH:O	2.47	0.46
1:F:6132:THR:OG1	1:F:6281:PRO:HB3	2.15	0.46
1:D:4082:SER:N	3:D:4402:GOL:H11	2.28	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:2207:LEU:HB3	1:B:2208:PRO:HD2	1.97	0.46
1:A:1008:THR:OG1	1:A:1076:HIS:HA	2.16	0.46
1:B:2115:PHE:HA	1:B:2167:ARG:O	2.16	0.46
1:E:5185:ALA:HB3	3:E:5402:GOL:O2	2.16	0.46
1:C:3132:THR:OG1	1:C:3281:PRO:HB3	2.16	0.45
1:E:5269:VAL:O	1:E:5269:VAL:CG2	2.64	0.45
1:A:1174:ILE:HD12	1:A:1220:THR:HG21	1.98	0.45
1:B:2094:ASP:O	1:B:2098:ASN:HB2	2.16	0.45
1:E:5280:TRP:HH2	3:E:5402:GOL:H31	1.82	0.45
3:A:1402:GOL:C3	5:A:1571:HOH:O	2.65	0.45
1:A:1207:LEU:HD23	1:A:1207:LEU:HA	1.85	0.45
1:F:6207:LEU:H	1:F:6274:GLN:NE2	2.15	0.45
1:D:4205:PRO:HA	1:D:4269:VAL:O	2.17	0.44
1:F:6181:PRO:HB2	1:F:6191:HIS:CD2	2.51	0.44
1:A:1129:LYS:CD	1:A:1129:LYS:H	2.29	0.44
1:B:2115:PHE:HB2	1:B:2228:MET:SD	2.57	0.44
1:F:6258:ARG:NH1	5:F:6511:HOH:O	2.48	0.44
1:B:2207:LEU:H	1:B:2274:GLN:NE2	2.16	0.44
1:A:1198:LEU:HG	1:A:1318:LEU:HD12	2.00	0.44
1:D:4260:THR:HG22	1:D:4321:LEU:CD2	2.48	0.44
1:F:6033:VAL:O	1:F:6051:VAL:HA	2.18	0.44
1:E:5173:GLY:HA3	1:E:5186:THR:HG21	2.00	0.44
1:D:4203:VAL:HG23	1:D:4203:VAL:O	2.18	0.43
1:E:5185:ALA:N	3:E:5402:GOL:H12	2.29	0.43
1:D:4008:THR:OG1	1:D:4076:HIS:HA	2.18	0.43
1:D:4262:ARG:HA	1:D:4262:ARG:HE	1.83	0.43
1:E:5175:ILE:CD1	1:E:5214:MET:CE	2.86	0.43
1:E:5210:GLU:OE1	5:E:5502:HOH:O	2.21	0.43
1:A:1216:TYR:CD1	1:A:1304:MET:HG3	2.54	0.43
1:D:4033:VAL:HG22	1:D:4051:VAL:HB	2.00	0.43
1:C:3008:THR:OG1	1:C:3076:HIS:HA	2.19	0.43
1:F:6312:ILE:HB	1:F:6313:PRO:HD3	2.01	0.43
1:F:6175:ILE:HG21	1:F:6304:MET:SD	2.58	0.43
1:C:3270:GLU:HG3	1:C:3274:GLN:HB3	2.00	0.42
1:D:4258:ARG:NH1	1:D:4302:ASP:OD2	2.52	0.42
1:D:4312:ILE:HB	1:D:4313:PRO:HD3	2.01	0.42
1:E:5207:LEU:HG	1:E:5274:GLN:HG2	2.00	0.42
1:F:6188:TYR:CD1	1:F:6188:TYR:C	2.93	0.42
1:C:3010:ALA:CB	1:C:3033:VAL:HG13	2.50	0.42
1:F:6077:LEU:N	1:F:6078:PRO:HD3	2.34	0.42
1:F:6171:LEU:HB2	2:F:6401:NAD:C5N	2.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:6236:THR:OG1	1:F:6292:ASP:OD2	2.31	0.42
1:E:5312:ILE:N	1:E:5313:PRO:CD	2.83	0.42
1:F:6173:GLY:HA3	1:F:6186:THR:HG21	2.02	0.42
1:E:5222:ASN:O	1:E:5226:LYS:HB2	2.19	0.42
1:A:1181:PRO:HG2	1:A:1191:HIS:CD2	2.54	0.42
2:A:1401:NAD:H2A	5:A:1583:HOH:O	2.19	0.42
1:D:4033:VAL:O	1:D:4051:VAL:HA	2.20	0.42
1:C:3178:ALA:HA	1:C:3315:LEU:HD13	2.02	0.41
1:F:6320:SER:O	1:F:6321:LEU:C	2.58	0.41
1:A:1082:SER:HB3	3:A:1402:GOL:HO2	1.83	0.41
1:A:1247:PHE:HA	1:A:1251:GLU:OE2	2.20	0.41
1:C:3049:LYS:HE2	1:C:3049:LYS:O	2.20	0.41
1:A:1115:PHE:HB2	1:A:1228:MET:SD	2.61	0.41
1:B:2019:SER:OG	1:B:2033:VAL:HG21	2.20	0.41
1:E:5032:LEU:HD11	1:E:5052:GLU:HG2	2.03	0.41
1:E:5280:TRP:HB3	1:E:5281:PRO:HD2	2.01	0.41
1:A:1171:LEU:HB2	2:A:1401:NAD:C5N	2.51	0.41
1:F:6034:SER:HA	1:F:6052:GLU:O	2.20	0.41
1:D:4260:THR:HG22	1:D:4321:LEU:HD22	2.02	0.41
1:B:2115:PHE:C	1:B:2115:PHE:CD1	2.95	0.41
1:E:5176:SER:OG	1:E:5217:MET:HB2	2.20	0.41
1:C:3082:SER:OG	3:C:3402:GOL:C3	2.66	0.40
1:D:4159:ARG:HA	1:D:4164:VAL:O	2.21	0.40
1:D:4173:GLY:HA3	1:D:4186:THR:HG21	2.03	0.40
1:B:2231:PRO:HD2	1:B:2234:LYS:HE3	2.03	0.40
1:D:4132:THR:OG1	1:D:4281:PRO:HB3	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	318/320 (99%)	312 (98%)	6 (2%)	0	100	100
1	B	318/320 (99%)	311 (98%)	7 (2%)	0	100	100
1	C	317/320 (99%)	308 (97%)	8 (2%)	1 (0%)	43	53
1	D	318/320 (99%)	309 (97%)	9 (3%)	0	100	100
1	E	318/320 (99%)	304 (96%)	13 (4%)	1 (0%)	43	53
1	F	319/320 (100%)	313 (98%)	6 (2%)	0	100	100
All	All	1908/1920 (99%)	1857 (97%)	49 (3%)	2 (0%)	53	66

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	3261	ASP
1	E	5320	SER

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	277/277 (100%)	268 (97%)	9 (3%)	42	58
1	B	277/277 (100%)	270 (98%)	7 (2%)	50	68
1	C	276/277 (100%)	263 (95%)	13 (5%)	29	40
1	D	277/277 (100%)	263 (95%)	14 (5%)	26	36
1	E	277/277 (100%)	261 (94%)	16 (6%)	22	30
1	F	278/277 (100%)	264 (95%)	14 (5%)	27	37
All	All	1662/1662 (100%)	1589 (96%)	73 (4%)	31	43

All (73) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1060	ASN
1	A	1062	PHE
1	A	1074	MET

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Mol	Chain	Res	Type
1	A	1119	THR
1	A	1129	LYS
1	A	1220	THR
1	A	1262	ARG
1	A	1275	LYS
1	A	1318	LEU
1	B	2060	ASN
1	B	2062	PHE
1	B	2067	LYS
1	B	2200	LYS
1	B	2235	LEU
1	B	2237	ARG
1	B	2318	LEU
1	C	3049	LYS
1	C	3062	PHE
1	C	3065	LEU
1	C	3180	LEU
1	C	3187	ASP
1	C	3191	HIS
1	C	3195	SER
1	C	3198	LEU
1	C	3199	GLN
1	C	3235	LEU
1	C	3254	PHE
1	C	3261	ASP
1	C	3290	ARG
1	D	4030	SER
1	D	4033	VAL
1	D	4049	LYS
1	D	4051	VAL
1	D	4057	LEU
1	D	4059	SER
1	D	4062	PHE
1	D	4064	LYS
1	D	4119	THR
1	D	4188	TYR
1	D	4222	ASN
1	D	4235	LEU
1	D	4261	ASP
1	D	4262	ARG
1	E	5011	LEU
1	E	5024	ASP

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Mol	Chain	Res	Type
1	E	5025	LYS
1	E	5059	SER
1	E	5062	PHE
1	E	5067	LYS
1	E	5109	LYS
1	E	5119	THR
1	E	5129	LYS
1	E	5179	THR
1	E	5222	ASN
1	E	5235	LEU
1	E	5258	ARG
1	E	5263	THR
1	E	5269	VAL
1	E	5316	HIS
1	F	6029	ASP
1	F	6033	VAL
1	F	6042	LYS
1	F	6049	LYS
1	F	6053	LYS
1	F	6062	PHE
1	F	6067	LYS
1	F	6188	TYR
1	F	6199	GLN
1	F	6252	LEU
1	F	6263	THR
1	F	6264	ILE
1	F	6318	LEU
1	F	6321	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1191	HIS
1	A	1222	ASN
1	B	2013	GLN
1	B	2274	GLN
1	C	3199	GLN
1	C	3274	GLN
1	D	4191	HIS
1	D	4274	GLN
1	E	5278	ASN
1	F	6199	GLN

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Mol	Chain	Res	Type
1	F	6274	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](#)

17 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	NAD	A	1401	-	40,48,48	1.58	4 (10%)	44,73,73	1.92	6 (13%)
3	GOL	A	1402	-	5,5,5	0.72	0	5,5,5	0.84	0
2	NAD	B	2401	-	40,48,48	1.66	4 (10%)	44,73,73	1.86	7 (15%)
3	GOL	B	2402	-	5,5,5	0.92	0	5,5,5	1.91	3 (60%)
4	SO4	B	2403	-	4,4,4	0.55	0	6,6,6	0.23	0
2	NAD	C	3401	-	40,48,48	1.45	4 (10%)	44,73,73	1.69	3 (6%)
3	GOL	C	3402	-	5,5,5	0.93	0	5,5,5	2.01	2 (40%)
4	SO4	C	3403	-	4,4,4	0.45	0	6,6,6	0.14	0
2	NAD	D	4401	-	40,48,48	1.65	6 (15%)	44,73,73	1.56	10 (22%)
3	GOL	D	4402	-	5,5,5	0.78	0	5,5,5	1.42	1 (20%)
4	SO4	D	4403	-	4,4,4	0.46	0	6,6,6	0.29	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	SO4	D	4404	-	4,4,4	0.50	0	6,6,6	0.22	0
2	NAD	E	5401	-	40,48,48	1.62	6 (15%)	44,73,73	2.12	7 (15%)
3	GOL	E	5402	-	5,5,5	0.22	0	5,5,5	1.20	0
2	NAD	F	6401	-	40,48,48	1.55	2 (5%)	44,73,73	1.98	6 (13%)
3	GOL	F	6402	-	5,5,5	0.35	0	5,5,5	0.98	0
4	SO4	F	6403	-	4,4,4	0.47	0	6,6,6	0.20	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAD	A	1401	-	-	0/22/62/62	0/5/5/5
3	GOL	A	1402	-	-	0/4/4/4	0/0/0/0
2	NAD	B	2401	-	-	0/22/62/62	0/5/5/5
3	GOL	B	2402	-	-	0/4/4/4	0/0/0/0
4	SO4	B	2403	-	-	0/0/0/0	0/0/0/0
2	NAD	C	3401	-	-	0/22/62/62	0/5/5/5
3	GOL	C	3402	-	-	0/4/4/4	0/0/0/0
4	SO4	C	3403	-	-	0/0/0/0	0/0/0/0
2	NAD	D	4401	-	-	0/22/62/62	0/5/5/5
3	GOL	D	4402	-	-	0/4/4/4	0/0/0/0
4	SO4	D	4403	-	-	0/0/0/0	0/0/0/0
4	SO4	D	4404	-	-	0/0/0/0	0/0/0/0
2	NAD	E	5401	-	-	0/22/62/62	0/5/5/5
3	GOL	E	5402	-	-	0/4/4/4	0/0/0/0
2	NAD	F	6401	-	-	0/22/62/62	0/5/5/5
3	GOL	F	6402	-	-	0/4/4/4	0/0/0/0
4	SO4	F	6403	-	-	0/0/0/0	0/0/0/0

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	4401	NAD	C8A-N9A	-3.72	1.32	1.36
2	D	4401	NAD	O4B-C1B	-3.23	1.36	1.41
2	C	3401	NAD	C8A-N9A	-2.55	1.33	1.36
2	D	4401	NAD	C5A-N7A	-2.01	1.32	1.39
2	E	5401	NAD	O4B-C1B	2.26	1.44	1.41
2	D	4401	NAD	C2N-C3N	2.35	1.42	1.39
2	E	5401	NAD	C3B-C4B	2.36	1.59	1.53
2	E	5401	NAD	C6N-N1N	2.37	1.41	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1401	NAD	C5D-C4D	2.50	1.59	1.51
2	B	2401	NAD	O4D-C1D	2.81	1.45	1.41
2	A	1401	NAD	C3N-C7N	2.92	1.55	1.50
2	B	2401	NAD	C6N-N1N	2.96	1.43	1.35
2	C	3401	NAD	O4B-C1B	3.39	1.46	1.41
2	E	5401	NAD	O4D-C1D	3.70	1.46	1.41
2	D	4401	NAD	O4D-C1D	3.80	1.46	1.41
2	E	5401	NAD	C3N-C7N	3.92	1.56	1.50
2	A	1401	NAD	O4B-C1B	4.04	1.46	1.41
2	C	3401	NAD	O4D-C1D	4.29	1.47	1.41
2	B	2401	NAD	O4B-C1B	4.37	1.47	1.41
2	F	6401	NAD	O4B-C1B	4.87	1.48	1.41
2	C	3401	NAD	O7N-C7N	4.95	1.34	1.24
2	E	5401	NAD	O7N-C7N	5.30	1.34	1.24
2	D	4401	NAD	O7N-C7N	5.98	1.36	1.24
2	A	1401	NAD	O7N-C7N	5.99	1.36	1.24
2	F	6401	NAD	O7N-C7N	6.41	1.37	1.24
2	B	2401	NAD	O7N-C7N	6.41	1.37	1.24

All (45) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	5401	NAD	N3A-C2A-N1A	-10.86	119.56	128.86
2	A	1401	NAD	N3A-C2A-N1A	-9.55	120.69	128.86
2	F	6401	NAD	N3A-C2A-N1A	-8.94	121.21	128.86
2	C	3401	NAD	N3A-C2A-N1A	-7.87	122.13	128.86
2	B	2401	NAD	N3A-C2A-N1A	-7.70	122.28	128.86
2	F	6401	NAD	C4B-O4B-C1B	-5.64	103.95	109.83
2	D	4401	NAD	N3A-C2A-N1A	-5.11	124.49	128.86
2	B	2401	NAD	C3N-C7N-N7N	-4.73	112.26	117.76
2	C	3401	NAD	C4B-O4B-C1B	-3.82	105.84	109.83
2	A	1401	NAD	C4B-O4B-C1B	-3.44	106.24	109.83
2	E	5401	NAD	C4B-O4B-C1B	-3.35	106.34	109.83
2	D	4401	NAD	C4B-O4B-C1B	-3.17	106.53	109.83
2	D	4401	NAD	C4A-C5A-N7A	-3.04	106.48	109.41
3	C	3402	GOL	O2-C2-C3	-2.97	95.41	109.00
2	F	6401	NAD	C5B-C4B-C3B	-2.97	104.10	115.29
2	E	5401	NAD	C1B-N9A-C4A	-2.82	121.77	126.64
2	E	5401	NAD	PN-O3-PA	-2.54	124.10	132.63
2	B	2401	NAD	C4B-O4B-C1B	-2.51	107.21	109.83
2	F	6401	NAD	C5N-C4N-C3N	-2.47	117.44	120.35
2	B	2401	NAD	PN-O3-PA	-2.45	124.41	132.63

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	4401	NAD	C1B-N9A-C4A	-2.39	122.51	126.64
2	D	4401	NAD	C5N-C4N-C3N	-2.34	117.61	120.35
2	D	4401	NAD	PN-O3-PA	-2.29	124.94	132.63
3	B	2402	GOL	O3-C3-C2	-2.27	99.11	110.11
2	F	6401	NAD	O4D-C4D-C5D	-2.26	101.86	109.39
2	B	2401	NAD	C1B-N9A-C4A	-2.26	122.73	126.64
2	A	1401	NAD	C1B-N9A-C4A	-2.24	122.76	126.64
2	D	4401	NAD	O4B-C4B-C5B	-2.22	101.99	109.39
3	B	2402	GOL	O2-C2-C3	-2.14	99.21	109.00
2	C	3401	NAD	C1B-N9A-C4A	-2.10	123.01	126.64
2	A	1401	NAD	C4D-O4D-C1D	-2.05	107.69	109.83
2	D	4401	NAD	C3N-C2N-N1N	2.01	122.43	120.41
2	A	1401	NAD	O4B-C4B-C3B	2.04	109.18	105.15
3	D	4402	GOL	O3-C3-C2	2.04	120.00	110.11
2	E	5401	NAD	C6N-C5N-C4N	2.15	122.65	119.43
2	E	5401	NAD	C3N-C2N-N1N	2.20	122.62	120.41
3	B	2402	GOL	O2-C2-C1	2.25	119.30	109.00
2	D	4401	NAD	C6N-C5N-C4N	2.27	122.83	119.43
2	A	1401	NAD	O7N-C7N-C3N	2.30	122.51	119.62
2	B	2401	NAD	C2N-C3N-C4N	2.35	120.97	118.26
2	F	6401	NAD	C6N-C5N-C4N	2.36	122.95	119.43
2	D	4401	NAD	O7N-C7N-C3N	2.41	122.64	119.62
2	E	5401	NAD	O7N-C7N-C3N	2.53	122.80	119.62
3	C	3402	GOL	O1-C1-C2	2.74	123.42	110.11
2	B	2401	NAD	O7N-C7N-C3N	3.89	124.50	119.62

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

8 monomers are involved in 22 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1401	NAD	2	0
3	A	1402	GOL	4	0
3	B	2402	GOL	1	0
3	C	3402	GOL	7	0
2	D	4401	NAD	1	0
3	D	4402	GOL	2	0
3	E	5402	GOL	4	0
2	F	6401	NAD	1	0

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

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	320/320 (100%)	-0.45	3 (0%) 84 87	9, 19, 39, 66	4 (1%)
1	B	319/320 (99%)	-0.44	0 100 100	9, 20, 38, 55	1 (0%)
1	C	319/320 (99%)	-0.39	6 (1%) 66 73	10, 20, 46, 70	0
1	D	320/320 (100%)	-0.31	6 (1%) 66 73	10, 20, 45, 71	0
1	E	319/320 (99%)	-0.27	1 (0%) 93 96	8, 23, 50, 65	0
1	F	319/320 (99%)	-0.31	6 (1%) 66 73	9, 20, 43, 67	1 (0%)
All	All	1916/1920 (99%)	-0.36	22 (1%) 80 84	8, 20, 44, 71	6 (0%)

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	6321	LEU	5.6
1	D	4321	LEU	4.4
1	A	1129	LYS	4.0
1	C	3203	VAL	4.0
1	D	4181	PRO	3.4
1	D	4264	ILE	3.3
1	A	1321	LEU	3.2
1	E	5321	LEU	3.2
1	C	3198	LEU	2.8
1	C	3321	LEU	2.7
1	F	6262	ARG	2.7
1	F	6261	ASP	2.7
1	D	4261	ASP	2.6
1	F	6317	GLY	2.6
1	D	4317	GLY	2.4
1	C	3181	PRO	2.3
1	C	3182	GLY	2.2
1	A	1138	MET	2.1
1	D	4260	THR	2.1

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Mol	Chain	Res	Type	RSRZ
1	F	6254	PHE	2.1
1	F	6264	ILE	2.0
1	C	3183	GLY	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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	GOL	A	1402	6/6	0.81	0.25	23,31,34,35	0
3	GOL	D	4402	6/6	0.83	0.20	25,30,35,36	0
3	GOL	B	2402	6/6	0.83	0.22	27,31,32,39	0
4	SO4	C	3403	5/5	0.86	0.24	83,88,88,88	0
3	GOL	E	5402	6/6	0.87	0.21	31,35,35,36	0
3	GOL	C	3402	6/6	0.90	0.19	27,29,30,34	0
3	GOL	F	6402	6/6	0.92	0.17	31,33,37,40	0
4	SO4	D	4404	5/5	0.93	0.27	63,64,68,75	0
4	SO4	F	6403	5/5	0.94	0.29	83,84,86,86	0
4	SO4	B	2403	5/5	0.95	0.17	59,59,63,65	0
4	SO4	D	4403	5/5	0.95	0.12	57,58,65,68	0
2	NAD	F	6401	44/44	0.97	0.09	10,17,19,20	0
2	NAD	B	2401	44/44	0.97	0.11	17,23,26,27	0
2	NAD	A	1401	44/44	0.97	0.10	17,20,24,27	0
2	NAD	E	5401	44/44	0.97	0.12	18,21,25,26	0
2	NAD	D	4401	44/44	0.98	0.09	10,15,16,18	0
2	NAD	C	3401	44/44	0.98	0.08	16,18,19,22	0

6.5 Other polymers [i](#)

There are no such residues in this entry.