



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 09:47 AM UTC

PDB ID : 2BL4 / pdb_00002bl4
Title : Lactaldehyde:1,2-propanediol oxidoreductase of Escherichia coli
Authors : Montella, C.; Bellolell, L.; Perez-Luque, R.; Badia, J.; Baldoma, L.; Coll, M.;
Aguilar, J.
Deposited on : 2005-03-01
Resolution : 2.85 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
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
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

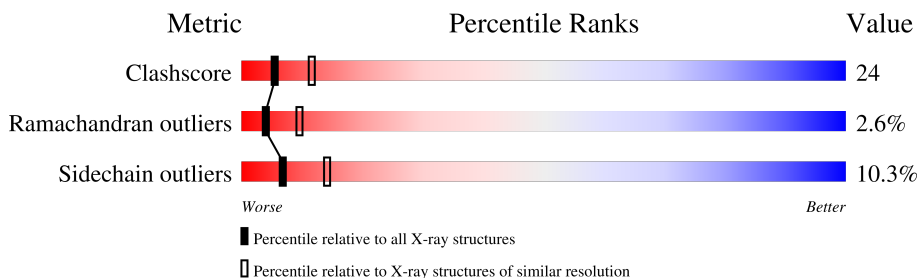
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.85 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	1446 (2.88-2.84)
Ramachandran outliers	187476	1406 (2.88-2.84)
Sidechain outliers	187428	1407 (2.88-2.84)

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	392	
1	B	392	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 5828 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.

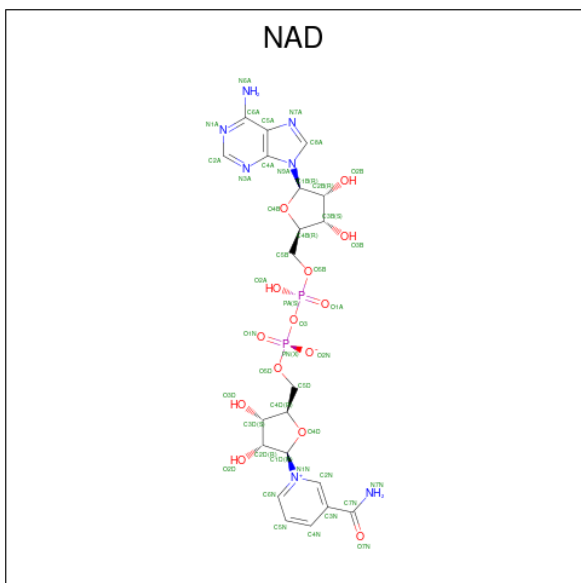
- Molecule 1 is a protein called LACTALDEHYDE REDUCTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	382	Total 2845	C 1795	N 493	O 541	S 16	0	0	0
1	B	382	Total 2845	C 1795	N 493	O 541	S 16	0	0	0

- Molecule 2 is FE (II) ION (CCD ID: FE2) (formula: Fe).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total 1	Fe 1	0
2	B	1	Total 1	Fe 1	0

- Molecule 3 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (CCD ID: NAD) (formula: C₂₁H₂₇N₇O₁₄P₂).



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

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Cl	0	0
			1	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	20	Total	O	0	0
			20	20		
5	B	27	Total	O	0	0
			27	27		

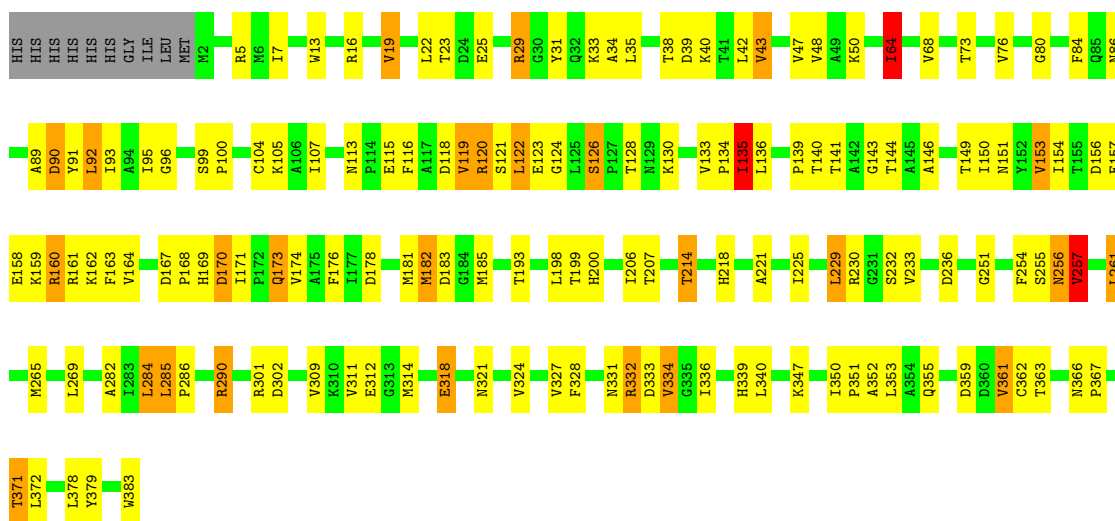
3 Residue-property plots [i](#)

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.

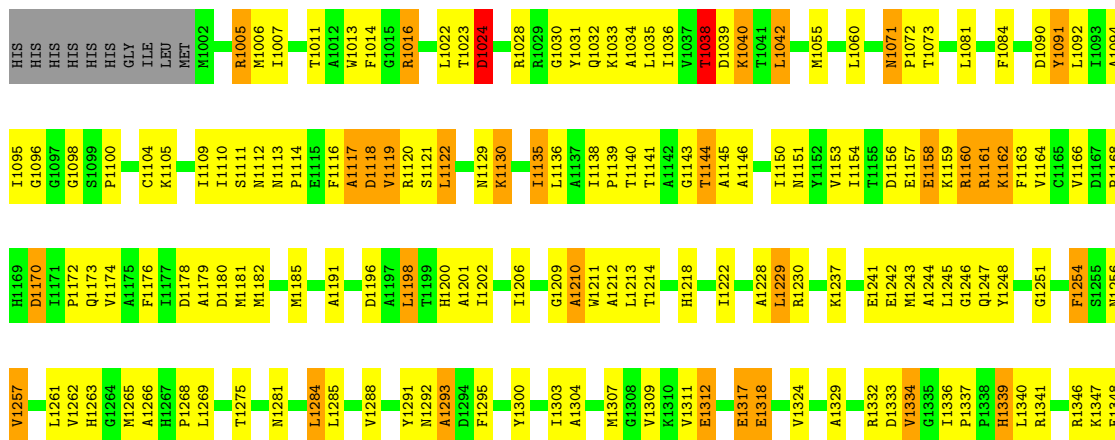
• Molecule 1: LACTALDEHYDE REDUCTASE

Chain A:  58% 32% 7% ..



• Molecule 1: LACTALDEHYDE REDUCTASE

Chain B:  54% 35% 8% ..



V1349	R1368	L1378
I1350	E1369	T1381
P1351	A1370	A1382
V1361	T1371	W1383
	L1372	
	E1373	

4 Data and refinement statistics

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

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	109.42Å 109.42Å 182.46Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	28.00 – 2.85	Depositor
% Data completeness (in resolution range)	88.3 (28.00-2.85)	Depositor
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.251 , 0.303	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	5828	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

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: FE2, CL, 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	0.96	1/2899 (0.0%)	1.22	11/3944 (0.3%)
1	B	0.96	2/2899 (0.1%)	1.17	16/3944 (0.4%)
All	All	0.96	3/5798 (0.1%)	1.20	27/7888 (0.3%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	1040	LYS	CE-NZ	13.28	1.89	1.49
1	B	1040	LYS	CD-CE	6.63	1.72	1.52
1	A	361	VAL	CA-CB	5.70	1.60	1.54

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	1071	ASN	CA-C-N	9.90	130.53	119.93
1	B	1071	ASN	C-N-CA	9.90	130.53	119.93
1	A	362	CYS	N-CA-C	7.92	120.91	111.33
1	B	1024	ASP	N-CA-C	7.47	119.20	111.14
1	A	170	ASP	CB-CA-C	-7.40	98.11	110.68
1	B	1120	ARG	N-CA-C	-7.12	103.22	112.68
1	B	1130	LYS	CA-C-N	7.07	127.11	119.90
1	B	1130	LYS	C-N-CA	7.07	127.11	119.90
1	A	90	ASP	N-CA-C	-6.33	105.57	113.55
1	B	1038	THR	N-CA-C	6.27	116.56	108.34
1	A	135	ILE	N-CA-C	6.25	116.87	108.11
1	B	1254	PHE	N-CA-C	6.15	118.79	111.71
1	A	126	SER	CA-C-N	6.08	127.44	119.84
1	A	126	SER	C-N-CA	6.08	127.44	119.84
1	B	1071	ASN	O-C-N	5.94	124.26	121.53
1	A	120	ARG	N-CA-C	-5.89	105.09	112.93

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	1091	TYR	CA-C-N	-5.85	114.17	122.94
1	B	1091	TYR	C-N-CA	-5.85	114.17	122.94
1	B	1285	LEU	CA-C-N	-5.45	113.42	119.19
1	B	1285	LEU	C-N-CA	-5.45	113.42	119.19
1	A	113	ASN	CA-C-N	5.42	125.09	119.56
1	A	113	ASN	C-N-CA	5.42	125.09	119.56
1	A	256	ASN	N-CA-C	-5.36	106.61	112.72
1	B	1275	THR	N-CA-C	-5.28	101.73	109.50
1	B	1339	HIS	N-CA-C	5.23	117.93	109.40
1	B	1361	VAL	N-CA-CB	5.22	116.99	110.47
1	A	64	ILE	N-CA-C	5.06	115.86	108.53

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	2845	0	2840	131	0
1	B	2845	0	2840	147	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	44	0	26	4	0
3	B	44	0	26	2	0
4	A	1	0	0	1	0
5	A	20	0	0	0	0
5	B	27	0	0	1	0
All	All	5828	0	5732	274	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 24.

All (274) 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:1040:LYS:CE	1:B:1040:LYS:NZ	1.89	1.34
1:A:290:ARG:HG3	1:A:290:ARG:HH11	1.09	1.09
1:B:1104:CYS:SG	1:B:1135:ILE:HD12	2.14	0.88
1:A:265:MET:HE1	1:A:378:LEU:HB3	1.56	0.87
1:A:38:THR:HG22	1:A:39:ASP:H	1.40	0.87
1:B:1024:ASP:HB3	1:B:1028:ARG:HH12	1.41	0.86
1:A:290:ARG:HG3	1:A:290:ARG:NH1	1.84	0.86
1:A:121:SER:O	1:A:122:LEU:HB2	1.78	0.82
1:B:1317:GLU:HA	1:B:1317:GLU:OE1	1.77	0.82
1:B:1214:THR:HG22	5:B:2011:HOH:O	1.80	0.80
1:A:301:ARG:HG3	1:A:311:VAL:HG11	1.63	0.80
1:A:340:LEU:HB2	1:A:383:TRP:HA	1.63	0.78
1:B:1214:THR:HG21	1:B:1257:VAL:HG11	1.66	0.77
1:A:80:GLY:HA3	1:A:107:ILE:HD11	1.68	0.74
1:B:1096:GLY:HA3	1:B:1100:PRO:HG2	1.70	0.72
1:B:1038:THR:HG23	1:B:1095:ILE:O	1.89	0.72
1:B:1007:ILE:CD1	1:B:1168:PRO:HB3	2.19	0.72
1:A:38:THR:HG22	1:A:39:ASP:N	2.03	0.72
1:A:314:MET:HB3	1:A:318:GLU:HB3	1.70	0.71
1:B:1116:PHE:C	1:B:1118:ASP:H	1.98	0.71
1:B:1035:LEU:HD22	1:B:1084:PHE:HB2	1.73	0.70
1:A:355:GLN:NE2	1:A:359:ASP:OD2	2.25	0.69
1:A:141:THR:HB	1:A:193:THR:HG21	1.76	0.67
1:A:92:LEU:N	1:A:92:LEU:HD22	2.10	0.67
1:A:285:LEU:HB3	1:A:286:PRO:HD3	1.78	0.66
1:B:1105:LYS:HD2	1:B:1170:ASP:OD1	1.96	0.66
1:A:105:LYS:HD2	1:A:170:ASP:HB3	1.76	0.66
1:A:92:LEU:N	1:A:92:LEU:CD2	2.60	0.65
1:A:7:ILE:CD1	1:A:168:PRO:HB3	2.26	0.65
1:A:290:ARG:HH11	1:A:290:ARG:CG	1.99	0.65
1:B:1200:HIS:CD2	1:B:1263:HIS:CE1	2.85	0.65
1:B:1055:MET:HG2	1:B:1060:LEU:HD12	1.78	0.64
1:B:1141:THR:O	1:B:1182:MET:HE2	1.98	0.64
1:A:282:ALA:HB1	1:A:336:ILE:HG21	1.81	0.63
1:B:1007:ILE:N	1:B:1256:ASN:OD1	2.22	0.63
1:B:1032:GLN:HB2	1:B:1090:ASP:OD2	1.99	0.63
1:B:1129:ASN:O	1:B:1130:LYS:HD3	1.99	0.63
1:B:1191:ALA:HB1	1:B:1334:VAL:HG13	1.79	0.63
1:B:1178:ASP:OD1	1:B:1181:MET:HG2	1.99	0.63
1:A:139:PRO:HD2	1:A:176:PHE:O	1.99	0.62
1:B:1118:ASP:C	1:B:1118:ASP:OD1	2.41	0.62
1:A:314:MET:HB3	1:A:318:GLU:CB	2.30	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:331:ASN:HB2	1:A:332:ARG:NH2	2.15	0.62
1:B:1071:ASN:HB3	1:B:1162:LYS:HD2	1.80	0.62
1:A:34:ALA:HB2	1:A:91:TYR:CZ	2.35	0.61
1:A:200:HIS:CE1	3:A:1385:NAD:H5N	2.34	0.61
1:A:178:ASP:OD1	1:A:181:MET:HG2	2.00	0.61
1:B:1038:THR:HG22	1:B:1042:LEU:HD23	1.81	0.61
1:A:230:ARG:NH1	1:A:333:ASP:OD2	2.34	0.61
1:B:1140:THR:HG22	1:B:1181:MET:HB3	1.83	0.61
1:A:123:GLU:HG3	1:A:124:GLY:H	1.66	0.60
1:A:25:GLU:O	1:A:29:ARG:HG2	2.02	0.60
1:B:1121:SER:O	1:B:1122:LEU:HB2	2.02	0.60
1:A:33:LYS:H	1:A:90:ASP:HB2	1.68	0.58
1:B:1116:PHE:O	1:B:1118:ASP:N	2.36	0.58
1:A:33:LYS:HB3	1:A:89:ALA:HA	1.86	0.58
1:B:1211:TRP:CH2	1:B:1213:LEU:HB3	2.38	0.58
1:A:80:GLY:HA3	1:A:107:ILE:CD1	2.34	0.58
1:B:1178:ASP:OD1	1:B:1178:ASP:O	2.20	0.58
1:A:13:TRP:CZ2	1:B:1005:ARG:HG3	2.38	0.58
1:B:1200:HIS:HD2	1:B:1263:HIS:CE1	2.22	0.58
1:A:149:THR:HG22	1:A:255:SER:HB2	1.86	0.57
1:A:251:GLY:HA2	1:A:254:PHE:CE2	2.38	0.57
1:B:1311:VAL:HG12	1:B:1311:VAL:O	2.04	0.57
1:B:1071:ASN:N	1:B:1072:PRO:HD3	2.18	0.57
1:B:1116:PHE:HD2	1:B:1121:SER:O	1.87	0.57
1:A:13:TRP:CE2	1:B:1005:ARG:HG3	2.40	0.57
1:A:290:ARG:NH1	1:A:290:ARG:CG	2.63	0.57
1:A:371:THR:HG22	1:A:372:LEU:H	1.69	0.57
1:B:1347:LYS:HA	1:B:1350:ILE:HD12	1.86	0.57
1:A:199:THR:HG23	1:A:285:LEU:HD13	1.87	0.57
1:A:90:ASP:HB3	1:A:91:TYR:HD1	1.70	0.56
1:A:339:HIS:HB3	1:A:383:TRP:O	2.05	0.56
1:B:1150:ILE:C	1:B:1170:ASP:OD2	2.49	0.56
1:B:1265:MET:HE1	1:B:1378:LEU:HB3	1.88	0.56
1:A:96:GLY:HA3	1:A:100:PRO:HG2	1.88	0.56
1:B:1151:ASN:HB3	1:B:1166:VAL:HG22	1.89	0.55
1:A:123:GLU:CG	1:A:124:GLY:N	2.68	0.55
1:A:123:GLU:HG3	1:A:124:GLY:N	2.22	0.55
1:B:1157:GLU:OE1	1:B:1157:GLU:HA	2.07	0.55
1:A:347:LYS:HA	1:A:350:ILE:HG12	1.88	0.55
1:B:1033:LYS:H	1:B:1090:ASP:HB2	1.72	0.54
1:B:1119:VAL:HG12	1:B:1119:VAL:O	2.06	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:153:VAL:HG12	1:A:164:VAL:HG22	1.89	0.54
1:B:1116:PHE:C	1:B:1118:ASP:N	2.62	0.54
1:A:43:VAL:HG12	1:A:48:VAL:HG21	1.90	0.54
1:B:1243:MET:O	1:B:1244:ALA:C	2.51	0.54
1:A:321:ASN:O	1:A:324:VAL:HG12	2.08	0.54
1:B:1007:ILE:HD12	1:B:1168:PRO:HB3	1.88	0.54
1:A:39:ASP:O	1:A:43:VAL:HG13	2.08	0.54
1:B:1144:THR:CG2	1:B:1146:ALA:HB2	2.37	0.54
1:B:1144:THR:HG22	1:B:1146:ALA:N	2.23	0.53
1:A:150:ILE:O	1:A:170:ASP:OD2	2.26	0.53
1:B:1303:ILE:O	1:B:1307:MET:HG3	2.08	0.53
1:B:1371:THR:CG2	1:B:1373:GLU:OE1	2.56	0.53
1:B:1162:LYS:NZ	3:B:2385:NAD:O2D	2.41	0.53
1:B:1261:LEU:HD22	1:B:1265:MET:HG3	1.89	0.53
1:B:1317:GLU:OE1	1:B:1317:GLU:CA	2.54	0.53
1:B:1329:ALA:HA	1:B:1332:ARG:NH2	2.23	0.53
1:B:1191:ALA:HB1	1:B:1334:VAL:CG1	2.38	0.53
1:B:1116:PHE:CD2	1:B:1121:SER:O	2.62	0.53
1:B:1040:LYS:NZ	1:B:1040:LYS:CD	2.70	0.53
1:A:47:VAL:O	1:A:50:LYS:HB2	2.08	0.52
1:A:182:MET:HB3	1:A:185:MET:HE2	1.89	0.52
1:B:1031:TYR:HB3	1:B:1091:TYR:CD1	2.43	0.52
1:B:1164:VAL:HB	1:B:1361:VAL:CG2	2.39	0.52
1:B:1201:ALA:HB1	1:B:1222:ILE:HG13	1.92	0.52
1:B:1035:LEU:CD2	1:B:1084:PHE:HB2	2.39	0.52
1:B:1182:MET:HB3	1:B:1185:MET:HE2	1.91	0.52
1:B:1090:ASP:HB3	1:B:1091:TYR:HD1	1.74	0.52
1:B:1143:GLY:O	1:B:1145:ALA:N	2.43	0.51
1:B:1022:LEU:HD13	1:B:1138:ILE:HD11	1.92	0.51
1:A:19:VAL:HG22	1:A:178:ASP:OD2	2.10	0.51
1:B:1116:PHE:HB3	1:B:1121:SER:O	2.10	0.51
1:A:150:ILE:CG2	1:A:168:PRO:HA	2.40	0.51
1:A:261:LEU:HG	1:A:363:THR:HG23	1.92	0.51
1:A:48:VAL:HG11	1:A:64:ILE:HD11	1.92	0.51
1:B:1292:ASN:O	1:B:1293:ALA:C	2.53	0.51
1:A:121:SER:O	1:A:122:LEU:CB	2.55	0.50
1:A:233:VAL:HG21	1:A:334:VAL:HG22	1.93	0.50
1:A:31:TYR:HB3	1:A:91:TYR:CD1	2.46	0.50
1:B:1028:ARG:HG3	1:B:1028:ARG:HH11	1.76	0.50
1:B:1144:THR:HG22	1:B:1146:ALA:H	1.77	0.50
1:A:284:LEU:O	1:A:285:LEU:C	2.54	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:99:SER:OG	3:A:1385:NAD:O2A	2.30	0.50
1:B:1036:ILE:HG23	1:B:1095:ILE:HD12	1.93	0.50
1:B:1341:ARG:HB3	1:B:1383:TRP:OXT	2.12	0.50
1:B:1094:ALA:HB2	1:B:1104:CYS:SG	2.51	0.50
1:B:1191:ALA:CB	1:B:1334:VAL:HG13	2.42	0.50
1:B:1156:ASP:O	1:B:1160:ARG:HA	2.12	0.50
1:A:207:THR:HG21	1:A:257:VAL:HG13	1.94	0.50
1:B:1036:ILE:HD12	1:B:1036:ILE:N	2.27	0.50
1:B:1156:ASP:OD1	1:B:1158:GLU:HB2	2.12	0.49
1:A:33:LYS:NZ	4:A:1386:CL:CL	2.70	0.49
1:A:104:CYS:SG	1:A:135:ILE:HD12	2.52	0.49
1:A:350:ILE:HD12	1:A:379:TYR:HB3	1.93	0.49
1:B:1034:ALA:HB2	1:B:1091:TYR:CZ	2.46	0.49
1:B:1291:TYR:CE2	1:B:1368:ARG:HD3	2.48	0.49
1:B:1144:THR:HG21	1:B:1146:ALA:HB2	1.94	0.49
1:A:120:ARG:NH2	1:A:156:ASP:OD1	2.45	0.49
1:A:7:ILE:HD13	1:A:168:PRO:HB3	1.93	0.48
1:A:120:ARG:NH2	1:A:156:ASP:CG	2.70	0.48
1:A:153:VAL:HG21	3:A:1385:NAD:O2D	2.13	0.48
1:B:1110:ILE:HG21	1:B:1117:ALA:HA	1.94	0.48
1:B:1266:ALA:CB	1:B:1281:ASN:ND2	2.76	0.48
1:B:1211:TRP:O	1:B:1212:ALA:C	2.57	0.48
1:A:5:ARG:HB2	1:B:1013:TRP:CZ3	2.49	0.48
1:A:119:VAL:HG12	1:A:119:VAL:O	2.14	0.48
1:A:327:VAL:O	1:A:328:PHE:C	2.55	0.48
1:A:164:VAL:HB	1:A:361:VAL:HG22	1.96	0.48
1:A:366:ASN:CG	1:A:367:PRO:HD2	2.39	0.48
1:A:154:ILE:HB	1:A:163:PHE:CZ	2.49	0.48
1:B:1032:GLN:CB	1:B:1090:ASP:OD2	2.61	0.48
1:A:99:SER:HB2	1:A:100:PRO:CD	2.44	0.47
1:A:265:MET:HE1	1:A:378:LEU:CB	2.36	0.47
1:A:171:ILE:HG23	1:A:171:ILE:O	2.14	0.47
1:A:34:ALA:CB	1:A:93:ILE:HD12	2.43	0.47
1:B:1039:ASP:OD2	1:B:1042:LEU:HD22	2.13	0.47
1:B:1104:CYS:HG	1:B:1135:ILE:HD12	1.77	0.47
1:A:34:ALA:HB1	1:A:93:ILE:HD12	1.96	0.47
1:B:1105:LYS:CD	1:B:1170:ASP:OD1	2.62	0.47
1:B:1139:PRO:HD2	1:B:1176:PHE:O	2.14	0.47
1:B:1164:VAL:HB	1:B:1361:VAL:HG21	1.96	0.47
1:A:96:GLY:HA3	1:A:100:PRO:CG	2.44	0.47
1:B:1209:GLY:O	1:B:1210:ALA:C	2.58	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:301:ARG:NH2	1:A:314:MET:O	2.48	0.47
1:B:1016:ARG:HD3	1:B:1180:ASP:OD1	2.15	0.47
1:A:5:ARG:HD3	1:A:7:ILE:HG13	1.97	0.47
1:B:1218:HIS:NE2	1:B:1254:PHE:N	2.63	0.47
1:A:128:THR:O	1:A:169:HIS:HE1	1.98	0.46
1:A:286:PRO:HG3	1:A:327:VAL:HG12	1.96	0.46
1:B:1153:VAL:O	1:B:1154:ILE:HD13	2.15	0.46
1:A:156:ASP:OD2	1:A:159:LYS:HB2	2.15	0.46
1:B:1262:VAL:HG22	1:B:1288:VAL:HB	1.97	0.46
1:A:96:GLY:O	1:A:139:PRO:HA	2.15	0.46
1:A:229:LEU:HD22	1:A:233:VAL:HG23	1.97	0.46
1:A:144:THR:CG2	1:A:146:ALA:HB2	2.45	0.46
1:B:1339:HIS:HB3	1:B:1383:TRP:OXT	2.15	0.46
1:A:25:GLU:HG3	1:A:174:VAL:HG11	1.96	0.46
1:B:1153:VAL:HG12	1:B:1164:VAL:HG22	1.97	0.46
1:A:159:LYS:O	1:A:160:ARG:C	2.58	0.46
1:A:150:ILE:C	1:A:170:ASP:OD2	2.59	0.45
1:B:1346:ARG:HB3	1:B:1348:GLU:HG2	1.98	0.45
1:A:173:GLN:HB3	1:A:174:VAL:HG23	1.97	0.45
1:B:1036:ILE:N	1:B:1036:ILE:CD1	2.79	0.45
1:A:214:THR:HG23	1:A:218:HIS:CE1	2.52	0.45
1:B:1135:ILE:HG23	1:B:1172:PRO:HA	1.98	0.45
1:B:1254:PHE:HA	1:B:1257:VAL:HG12	1.99	0.45
1:A:133:VAL:O	1:A:134:PRO:C	2.58	0.45
1:B:1011:THR:HB	1:B:1174:VAL:HG13	1.98	0.45
1:B:1016:ARG:NH2	1:B:1237:LYS:HB3	2.31	0.45
1:B:1112:ASN:C	1:B:1114:PRO:HD3	2.42	0.45
1:A:149:THR:HG21	1:A:254:PHE:CZ	2.52	0.45
1:B:1098:GLY:HA2	1:B:1144:THR:HG21	1.98	0.45
1:B:1112:ASN:O	1:B:1114:PRO:HD3	2.17	0.45
1:B:1350:ILE:N	1:B:1351:PRO:HD2	2.32	0.45
1:A:122:LEU:O	1:A:126:SER:HB3	2.17	0.45
1:B:1143:GLY:O	1:B:1247:GLN:OE1	2.34	0.45
1:B:1196:ASP:OD2	3:B:2385:NAD:H5N	2.17	0.45
1:A:232:SER:O	1:A:233:VAL:C	2.57	0.45
1:B:1311:VAL:O	1:B:1311:VAL:CG1	2.65	0.45
1:A:350:ILE:HB	1:A:351:PRO:HD3	1.99	0.44
1:B:1340:LEU:HB2	1:B:1383:TRP:HA	2.00	0.44
1:A:5:ARG:HB2	1:B:1013:TRP:CH2	2.53	0.44
1:A:140:THR:HG22	1:A:181:MET:HB3	2.00	0.44
1:A:143:GLY:HA3	1:A:193:THR:HB	2.00	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1023:THR:HA	1:B:1060:LEU:HD11	1.99	0.44
1:B:1371:THR:HG21	1:B:1373:GLU:OE1	2.17	0.44
1:A:150:ILE:HG21	1:A:168:PRO:HA	1.99	0.44
1:B:1251:GLY:HA2	1:B:1254:PHE:CE2	2.52	0.44
1:B:1154:ILE:HB	1:B:1163:PHE:CZ	2.53	0.44
1:A:31:TYR:HB3	1:A:91:TYR:CE1	2.53	0.43
1:B:1109:ILE:HG23	1:B:1113:ASN:HD22	1.83	0.43
1:B:1262:VAL:HG13	1:B:1284:LEU:HB3	1.99	0.43
1:B:1265:MET:C	1:B:1268:PRO:HD2	2.43	0.43
1:B:1311:VAL:O	1:B:1312:GLU:C	2.61	0.43
1:A:157:GLU:O	1:A:158:GLU:C	2.60	0.43
1:B:1371:THR:HG22	1:B:1372:LEU:N	2.34	0.43
1:B:1035:LEU:HD22	1:B:1084:PHE:CB	2.44	0.43
1:B:1071:ASN:ND2	1:B:1162:LYS:HE2	2.34	0.43
1:B:1317:GLU:O	1:B:1318:GLU:C	2.59	0.43
1:A:265:MET:HG2	1:A:379:TYR:CZ	2.53	0.43
1:B:1229:LEU:HD13	1:B:1334:VAL:HG21	2.01	0.43
1:A:5:ARG:HD3	1:A:7:ILE:CG1	2.49	0.43
1:A:144:THR:HG22	1:A:146:ALA:HB2	2.01	0.43
1:A:7:ILE:N	1:A:256:ASN:OD1	2.32	0.43
1:A:352:ALA:O	1:A:353:LEU:C	2.62	0.43
1:B:1293:ALA:HA	1:B:1300:TYR:CE2	2.53	0.43
1:A:116:PHE:HB3	1:A:122:LEU:HD13	2.00	0.43
1:B:1295:PHE:CD1	1:B:1295:PHE:N	2.87	0.42
1:B:1336:ILE:HA	1:B:1337:PRO:HD2	1.87	0.42
1:B:1038:THR:HG22	1:B:1039:ASP:H	1.85	0.42
1:B:1081:LEU:CD1	1:B:1111:SER:HB2	2.49	0.42
1:A:16:ARG:NH1	1:A:183:ASP:OD2	2.52	0.42
1:A:153:VAL:CG1	3:A:1385:NAD:H2N	2.50	0.42
1:B:1007:ILE:HD13	1:B:1168:PRO:HB3	1.99	0.42
1:B:1245:LEU:O	1:B:1246:GLY:C	2.63	0.42
1:B:1266:ALA:HB2	1:B:1281:ASN:HD22	1.84	0.42
1:B:1304:ALA:O	1:B:1309:VAL:HB	2.20	0.42
1:B:1071:ASN:N	1:B:1072:PRO:CD	2.83	0.42
1:A:340:LEU:HD23	1:A:340:LEU:HA	1.86	0.42
1:A:73:THR:O	1:A:76:VAL:HB	2.20	0.42
1:A:38:THR:HG23	1:A:95:ILE:O	2.20	0.42
1:A:311:VAL:O	1:A:312:GLU:C	2.63	0.42
1:A:221:ALA:O	1:A:225:ILE:HG13	2.20	0.41
1:A:261:LEU:HD22	1:A:265:MET:HG3	2.02	0.41
1:B:1198:LEU:HD21	1:B:1222:ILE:HG23	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:218:HIS:NE2	1:A:254:PHE:N	2.68	0.41
1:B:1081:LEU:HD11	1:B:1111:SER:HB2	2.03	0.41
1:B:1096:GLY:HA2	1:B:1140:THR:OG1	2.19	0.41
1:A:86:ASN:N	1:A:86:ASN:HD22	2.19	0.41
1:A:35:LEU:HD22	1:A:84:PHE:HA	2.02	0.41
1:B:1006:MET:HE3	1:B:1213:LEU:HG	2.01	0.41
1:B:1118:ASP:O	1:B:1119:VAL:HB	2.21	0.41
1:A:68:VAL:HG21	1:A:100:PRO:HA	2.01	0.41
1:A:91:TYR:HA	1:A:133:VAL:CG1	2.51	0.41
1:A:120:ARG:HH21	1:A:156:ASP:CG	2.29	0.41
1:A:159:LYS:O	1:A:161:ARG:HG2	2.20	0.41
1:A:167:ASP:HA	1:A:168:PRO:HD2	1.86	0.41
1:A:347:LYS:HE2	1:A:383:TRP:CH2	2.56	0.41
1:B:1014:PHE:HZ	1:B:1248:TYR:CE2	2.39	0.41
1:B:1159:LYS:O	1:B:1161:ARG:HG2	2.21	0.41
1:B:1170:ASP:OD1	1:B:1170:ASP:C	2.63	0.41
1:A:16:ARG:HH12	1:A:183:ASP:CG	2.29	0.41
1:B:1006:MET:HA	1:B:1256:ASN:OD1	2.21	0.41
1:B:1178:ASP:C	1:B:1180:ASP:N	2.78	0.40
1:B:1241:GLU:O	1:B:1242:GLU:C	2.63	0.40
1:A:164:VAL:HB	1:A:361:VAL:CG2	2.50	0.40
1:A:214:THR:HG23	1:A:218:HIS:ND1	2.37	0.40
1:B:1110:ILE:CG2	1:B:1117:ALA:HA	2.52	0.40
1:B:1228:ALA:O	1:B:1229:LEU:C	2.65	0.40
1:B:1230:ARG:NH1	1:B:1333:ASP:OD2	2.55	0.40
1:A:92:LEU:CD2	1:A:92:LEU:H	2.33	0.40
1:B:1198:LEU:O	1:B:1202:ILE:HG13	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	270/392 (69%)	243 (90%)	22 (8%)	5 (2%)	6	14
1	B	380/392 (97%)	342 (90%)	26 (7%)	12 (3%)	3	7
All	All	650/784 (83%)	585 (90%)	48 (7%)	17 (3%)	4	9

All (17) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	122	LEU
1	A	160	ARG
1	B	1119	VAL
1	B	1122	LEU
1	B	1144	THR
1	B	1160	ARG
1	B	1030	GLY
1	B	1117	ALA
1	B	1179	ALA
1	B	1257	VAL
1	B	1293	ALA
1	A	285	LEU
1	A	257	VAL
1	B	1016	ARG
1	B	1210	ALA
1	B	1312	GLU
1	A	119	VAL

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	291/300 (97%)	256 (88%)	35 (12%)	5	9
1	B	291/300 (97%)	266 (91%)	25 (9%)	10	21
All	All	582/600 (97%)	522 (90%)	60 (10%)	7	14

All (60) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	19	VAL
1	A	22	LEU
1	A	23	THR
1	A	29	ARG
1	A	40	LYS
1	A	42	LEU
1	A	43	VAL
1	A	64	ILE
1	A	92	LEU
1	A	115	GLU
1	A	118	ASP
1	A	130	LYS
1	A	135	ILE
1	A	136	LEU
1	A	151	ASN
1	A	153	VAL
1	A	162	LYS
1	A	173	GLN
1	A	182	MET
1	A	198	LEU
1	A	206	ILE
1	A	214	THR
1	A	229	LEU
1	A	236	ASP
1	A	257	VAL
1	A	261	LEU
1	A	269	LEU
1	A	284	LEU
1	A	290	ARG
1	A	302	ASP
1	A	309	VAL
1	A	318	GLU
1	A	332	ARG
1	A	334	VAL
1	A	371	THR
1	B	1005	ARG
1	B	1024	ASP
1	B	1038	THR
1	B	1042	LEU
1	B	1073	THR
1	B	1092	LEU
1	B	1118	ASP
1	B	1135	ILE

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Mol	Chain	Res	Type
1	B	1136	LEU
1	B	1158	GLU
1	B	1161	ARG
1	B	1162	LYS
1	B	1170	ASP
1	B	1173	GLN
1	B	1198	LEU
1	B	1206	ILE
1	B	1229	LEU
1	B	1269	LEU
1	B	1284	LEU
1	B	1317	GLU
1	B	1318	GLU
1	B	1324	VAL
1	B	1334	VAL
1	B	1369	GLU
1	B	1381	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	32	GLN
1	A	86	ASN
1	A	101	GLN
1	A	112	ASN
1	A	281	ASN
1	A	380	HIS
1	B	1044	GLN
1	B	1071	ASN
1	B	1086	ASN
1	B	1112	ASN
1	B	1173	GLN
1	B	1247	GLN
1	B	1267	HIS
1	B	1281	ASN
1	B	1331	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](#)

Of 5 ligands modelled in this entry, 3 are monoatomic - leaving 2 for Mogul analysis.

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
3	NAD	B	2385	-	46,48,48	2.27	9 (19%)	64,73,73	2.22	16 (25%)
3	NAD	A	1385	-	46,48,48	2.18	9 (19%)	64,73,73	2.21	16 (25%)

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
3	NAD	B	2385	-	-	12/30/62/62	0/5/5/5
3	NAD	A	1385	-	-	9/30/62/62	0/5/5/5

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1385	NAD	O7N-C7N	8.96	1.40	1.24
3	B	2385	NAD	O7N-C7N	8.89	1.40	1.24
3	A	1385	NAD	C2N-N1N	6.25	1.41	1.35
3	B	2385	NAD	C2N-N1N	6.13	1.41	1.35
3	B	2385	NAD	PA-O3	4.93	1.64	1.59
3	A	1385	NAD	PA-O3	3.82	1.63	1.59

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	2385	NAD	C2N-C3N	3.77	1.45	1.39
3	B	2385	NAD	PN-O3	3.61	1.63	1.59
3	A	1385	NAD	C2N-C3N	3.56	1.44	1.39
3	A	1385	NAD	C2A-N3A	3.38	1.39	1.33
3	B	2385	NAD	C2A-N3A	3.37	1.39	1.33
3	B	2385	NAD	C2A-N1A	3.24	1.39	1.33
3	A	1385	NAD	C2A-N1A	2.99	1.39	1.33
3	B	2385	NAD	C3N-C7N	2.92	1.54	1.50
3	A	1385	NAD	PN-O3	2.76	1.62	1.59
3	A	1385	NAD	C3N-C7N	2.65	1.54	1.50
3	B	2385	NAD	C6N-N1N	2.31	1.40	1.35
3	A	1385	NAD	O4D-C1D	2.09	1.43	1.40

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	2385	NAD	C6N-N1N-C2N	-6.77	116.12	121.88
3	B	2385	NAD	O7N-C7N-N7N	-6.15	113.72	122.62
3	A	1385	NAD	C5A-C4A-N3A	-5.59	119.02	126.72
3	B	2385	NAD	N3A-C2A-N1A	-5.54	120.20	128.58
3	A	1385	NAD	O7N-C7N-N7N	-5.47	114.71	122.62
3	A	1385	NAD	C6N-N1N-C2N	-5.45	117.24	121.88
3	A	1385	NAD	N3A-C2A-N1A	-5.40	120.41	128.58
3	A	1385	NAD	C3N-C7N-N7N	5.19	124.13	117.74
3	B	2385	NAD	C3N-C7N-N7N	4.89	123.77	117.74
3	B	2385	NAD	C5A-C4A-N3A	-4.66	120.30	126.72
3	B	2385	NAD	C4D-O4D-C1D	4.59	114.12	109.92
3	A	1385	NAD	C4D-O4D-C1D	4.19	113.76	109.92
3	A	1385	NAD	C5A-N7A-C8A	4.10	109.89	103.45
3	A	1385	NAD	N9A-C8A-N7A	-3.94	108.35	113.94
3	A	1385	NAD	N3A-C4A-N9A	3.89	133.78	127.17
3	A	1385	NAD	C2A-N3A-C4A	3.74	120.97	111.83
3	B	2385	NAD	C5A-N7A-C8A	3.73	109.31	103.45
3	B	2385	NAD	N9A-C8A-N7A	-3.65	108.76	113.94
3	B	2385	NAD	C2A-N3A-C4A	3.53	120.46	111.83
3	A	1385	NAD	C4A-C5A-N7A	-3.40	106.69	110.58
3	B	2385	NAD	C4A-C5A-N7A	-3.16	106.97	110.58
3	A	1385	NAD	O2A-PA-O3	2.91	115.14	107.27
3	A	1385	NAD	C4B-O4B-C1B	2.88	115.82	109.47
3	B	2385	NAD	O4B-C1B-N9A	2.78	113.43	108.09
3	B	2385	NAD	C5D-C4D-C3D	-2.72	105.43	115.21
3	B	2385	NAD	N3A-C4A-N9A	2.69	131.74	127.17

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1385	NAD	C6A-C5A-C4A	2.44	120.51	117.18
3	B	2385	NAD	O7N-C7N-C3N	2.37	122.50	119.60
3	B	2385	NAD	C4N-C3N-C7N	-2.24	114.95	121.06
3	A	1385	NAD	C6N-C5N-C4N	2.07	122.44	119.45
3	A	1385	NAD	C4A-N9A-C8A	2.04	107.88	105.74
3	B	2385	NAD	O2D-C2D-C3D	-2.02	105.33	111.82

There are no chirality outliers.

All (21) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1385	NAD	C5B-O5B-PA-O2A
3	A	1385	NAD	C5B-O5B-PA-O3
3	A	1385	NAD	C5D-O5D-PN-O1N
3	B	2385	NAD	C5B-O5B-PA-O1A
3	B	2385	NAD	C5B-O5B-PA-O2A
3	B	2385	NAD	C5D-O5D-PN-O3
3	B	2385	NAD	C5D-O5D-PN-O1N
3	B	2385	NAD	C5D-O5D-PN-O2N
3	B	2385	NAD	O4D-C4D-C5D-O5D
3	B	2385	NAD	C3D-C4D-C5D-O5D
3	A	1385	NAD	O4B-C4B-C5B-O5B
3	B	2385	NAD	O4B-C4B-C5B-O5B
3	B	2385	NAD	C3B-C4B-C5B-O5B
3	A	1385	NAD	C3B-C4B-C5B-O5B
3	B	2385	NAD	PA-O3-PN-O1N
3	A	1385	NAD	PA-O3-PN-O5D
3	A	1385	NAD	C2N-C3N-C7N-O7N
3	A	1385	NAD	C5B-O5B-PA-O1A
3	B	2385	NAD	C5B-O5B-PA-O3
3	A	1385	NAD	C2N-C3N-C7N-N7N
3	B	2385	NAD	PA-O3-PN-O5D

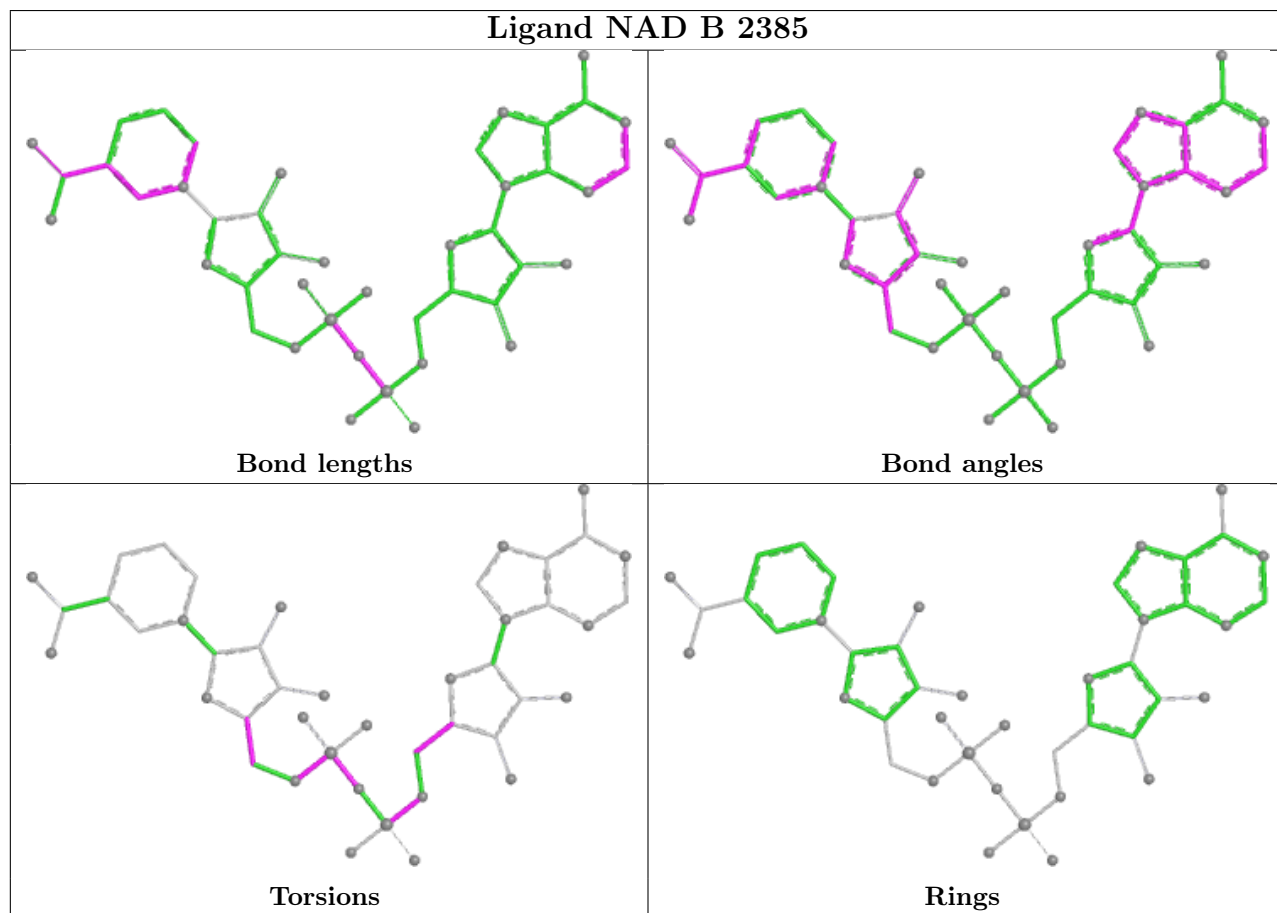
There are no ring outliers.

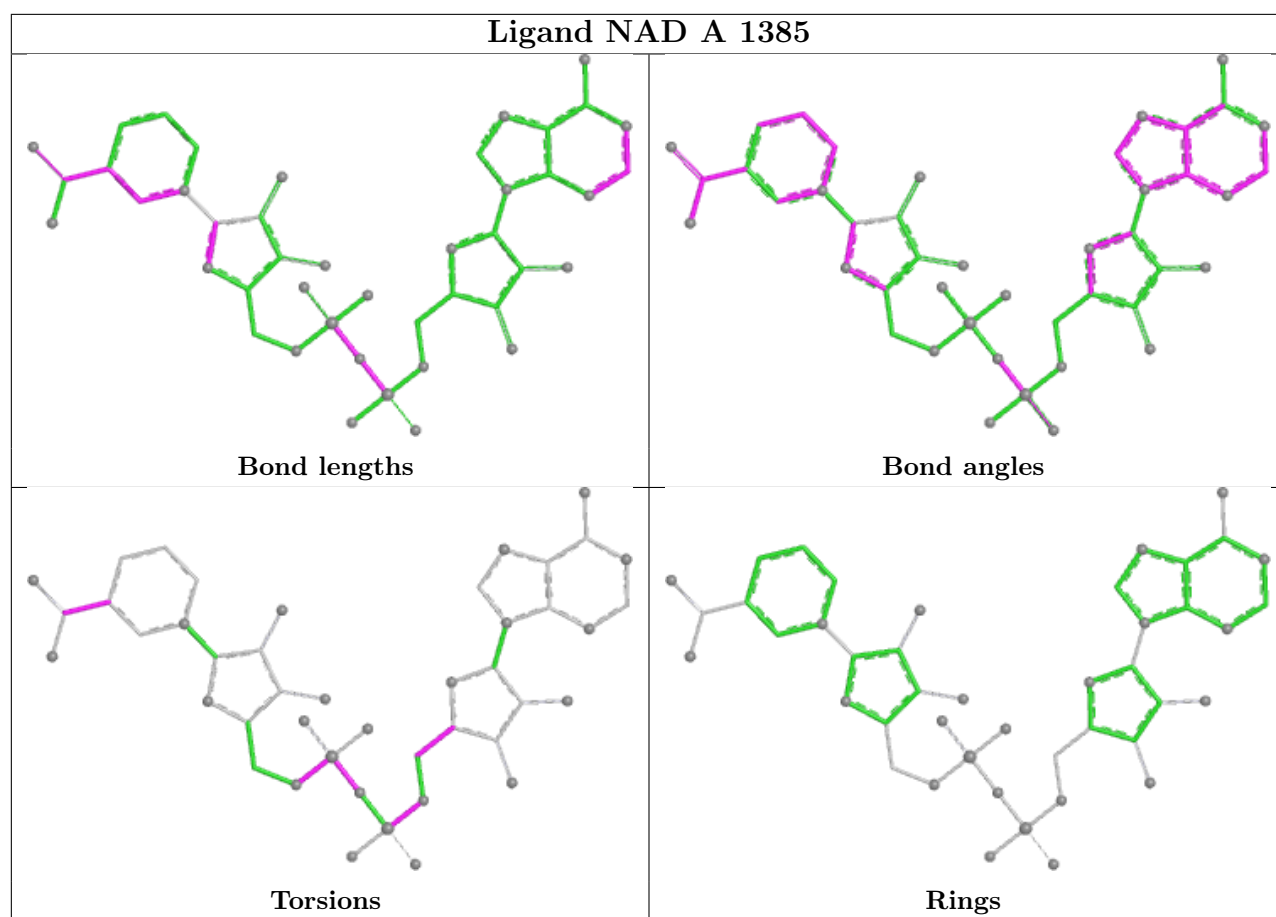
2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	2385	NAD	2	0
3	A	1385	NAD	4	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,

bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





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.