



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:37 PM UTC

PDB ID : 3MTG / pdb_00003mtg
Title : Crystal structure of human S-adenosyl homocysteine hydrolase-like 1 protein
Authors : Wisniewska, M.; Siponen, M.I.; Arrowsmith, C.H.; Berglund, H.; Bountra, C.; Collins, R.; Edwards, A.M.; Flodin, S.; Flores, A.; Graslund, S.; Hammarstrom, M.; Johansson, I.; Karlberg, T.; Kotenyova, T.; Moche, M.; Nordlund, P.; Nyman, T.; Persson, C.; Schutz, P.; Thorsell, A.G.; Tresaugues, L.; van der Berg, S.; Wahlberg, E.; Weigelt, J.; Welin, M.; Schuler, H.; Structural Genomics Consortium (SGC)
Deposited on : 2010-04-30
Resolution : 2.64 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)
Xtriage (Phenix)	: 2.0
EDS	: 3.0
Buster-report	: wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	: 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	: 9.0.010 (Gargrove)
Density-Fitness	: 1.0.12

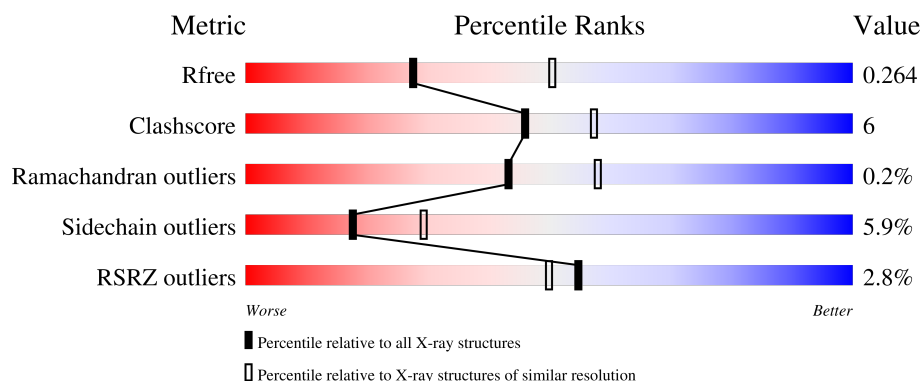
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.64 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}	180053	2053 (2.66-2.62)
Clashscore	190562	2097 (2.66-2.62)
Ramachandran outliers	187476	2066 (2.66-2.62)
Sidechain outliers	187428	2066 (2.66-2.62)
RSRZ outliers	180081	2052 (2.66-2.62)

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 $\leq 5\%$. 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	444	
1	B	444	

Ideal geometry (proteins) : Engh & Huber (2001)
 Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
 Validation Pipeline (wwPDB-VP) : 2.49

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 6792 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.

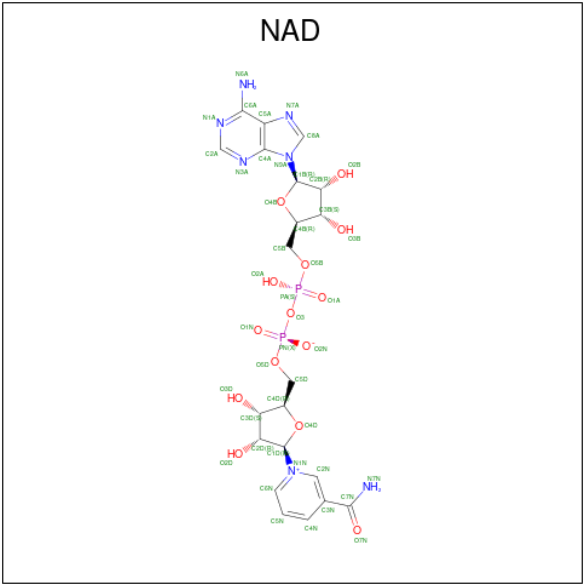
- Molecule 1 is a protein called Putative adenosylhomocysteinase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	430	Total	C	N	O	S	0	0	0
			3322	2095	576	624	27			
1	B	423	Total	C	N	O	S	0	0	0
			3268	2063	566	613	26			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	87	SER	-	expression tag	UNP O43865
A	88	MET	-	expression tag	UNP O43865
A	508	ALA	THR	engineered mutation	UNP O43865
B	87	SER	-	expression tag	UNP O43865
B	88	MET	-	expression tag	UNP O43865
B	508	ALA	THR	engineered mutation	UNP O43865

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (CCD ID: NAD) (formula: C₂₁H₂₇N₇O₁₄P₂).



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

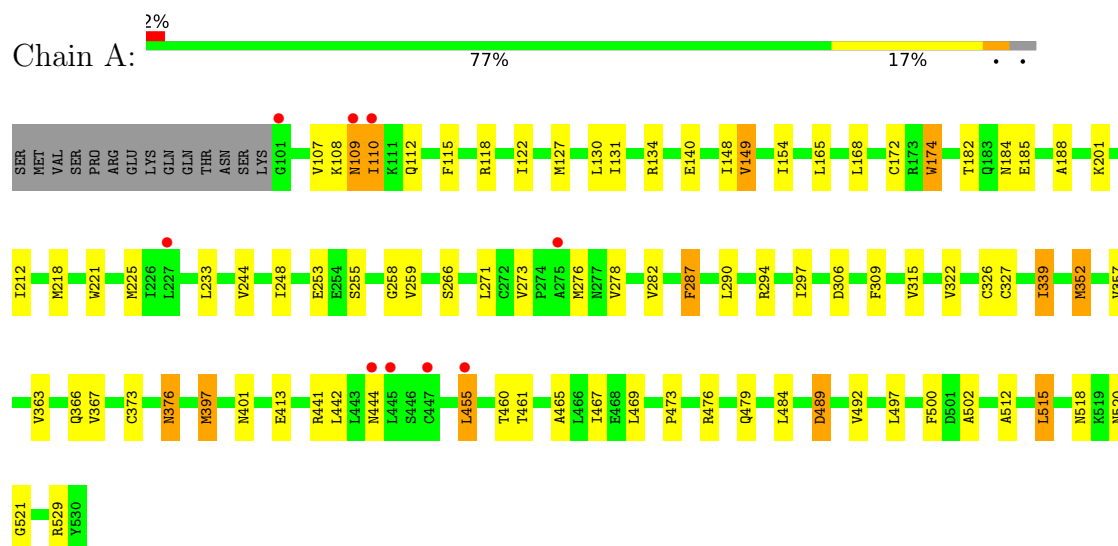
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	55	Total	O	0	0
			55	55		
3	B	59	Total	O	0	0
			59	59		

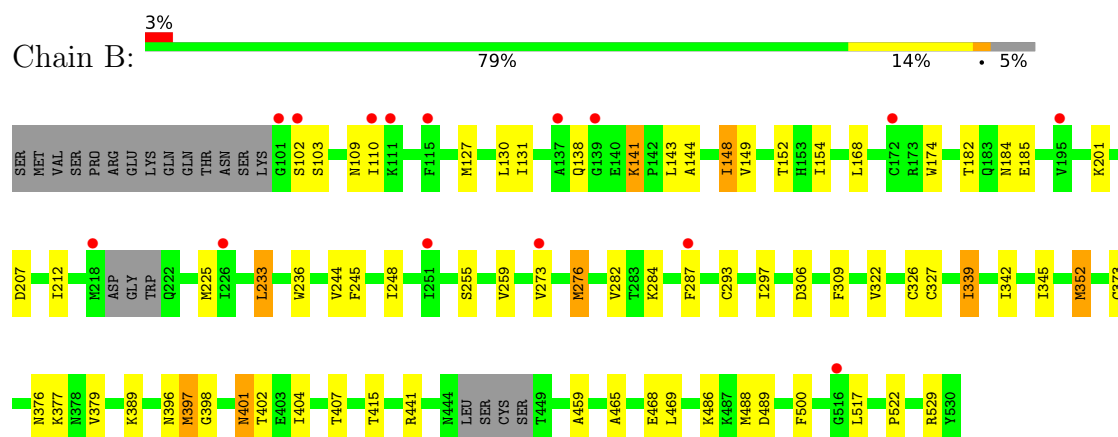
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: Putative adenosylhomocysteinase 2



• Molecule 1: Putative adenosylhomocysteinase 2



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	186.24Å 68.60Å 90.37Å 90.00° 115.27° 90.00°	Depositor
Resolution (Å)	33.59 – 2.64 33.59 – 2.64	Depositor EDS
% Data completeness (in resolution range)	(Not available) (33.59-2.64) 99.0 (33.59-2.64)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.84 (at 2.65Å)	Xtriage
Refinement program	BUSTER 2.9.2	Depositor
R, R_{free}	0.203 , 0.249 0.208 , 0.264	Depositor DCC
R_{free} test set	628 reflections (2.08%)	wwPDB-VP
Wilson B-factor (Å ²)	53.1	Xtriage
Anisotropy	0.494	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 72.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	6792	wwPDB-VP
Average B, all atoms (Å ²)	83.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.66% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section:
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	0.92	3/3383 (0.1%)	1.38	18/4592 (0.4%)
1	B	0.87	3/3325 (0.1%)	1.35	14/4509 (0.3%)
All	All	0.89	6/6708 (0.1%)	1.36	32/9101 (0.4%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	352	MET	SD-CE	-8.59	1.58	1.79
1	A	397	MET	SD-CE	-6.46	1.63	1.79
1	B	352	MET	SD-CE	-6.43	1.63	1.79
1	B	306	ASP	CA-C	6.19	1.61	1.53
1	B	397	MET	SD-CE	-5.98	1.64	1.79
1	A	306	ASP	CA-C	5.63	1.60	1.53

All (32) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	379	VAL	N-CA-C	-7.61	104.37	111.45
1	A	287	PHE	CA-CB-CG	-7.44	106.36	113.80
1	B	255	SER	CA-C-N	6.66	128.95	120.56
1	B	255	SER	C-N-CA	6.66	128.95	120.56
1	A	109	ASN	N-CA-C	6.41	119.25	108.23
1	A	255	SER	CA-C-N	5.90	128.11	120.56
1	A	255	SER	C-N-CA	5.90	128.11	120.56
1	A	444	ASN	CA-CB-CG	5.81	118.41	112.60
1	B	401	ASN	CA-CB-CG	5.76	118.36	112.60
1	A	455	LEU	CA-C-N	5.58	127.70	120.44
1	A	455	LEU	C-N-CA	5.58	127.70	120.44
1	A	309	PHE	CA-CB-CG	-5.57	108.23	113.80
1	A	134	ARG	CA-C-N	5.46	127.86	120.38

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	134	ARG	C-N-CA	5.46	127.86	120.38
1	B	244	VAL	CA-C-N	5.44	127.57	120.28
1	B	244	VAL	C-N-CA	5.44	127.57	120.28
1	B	309	PHE	CA-CB-CG	-5.42	108.38	113.80
1	B	109	ASN	CA-CB-CG	5.42	118.02	112.60
1	B	376	ASN	CA-CB-CG	5.38	117.98	112.60
1	B	207	ASP	CA-CB-CG	5.29	117.89	112.60
1	A	376	ASN	CA-CB-CG	5.26	117.86	112.60
1	A	244	VAL	CA-C-N	5.22	127.28	120.28
1	A	244	VAL	C-N-CA	5.22	127.28	120.28
1	A	258	GLY	CA-C-N	5.15	127.73	120.42
1	A	258	GLY	C-N-CA	5.15	127.73	120.42
1	A	306	ASP	CA-C-N	5.14	129.99	122.69
1	A	306	ASP	C-N-CA	5.14	129.99	122.69
1	B	402	THR	CA-C-N	5.13	127.15	120.28
1	B	402	THR	C-N-CA	5.13	127.15	120.28
1	B	293	CYS	CA-C-N	-5.08	114.54	122.42
1	B	293	CYS	C-N-CA	-5.08	114.54	122.42
1	A	174	TRP	N-CA-C	5.06	118.31	110.17

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	3322	0	3288	53	0
1	B	3268	0	3243	31	0
2	A	44	0	26	1	0
2	B	44	0	26	1	0
3	A	55	0	0	0	0
3	B	59	0	0	1	0
All	All	6792	0	6583	77	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 6.

All (77) 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:110:ILE:HG22	1:A:110:ILE:O	1.58	1.01
1:A:109:ASN:HD21	1:A:184:ASN:HB3	1.32	0.92
1:A:148:ILE:HG22	1:A:225:MET:HB2	1.67	0.77
1:A:110:ILE:O	1:A:110:ILE:CG2	2.30	0.75
1:A:109:ASN:ND2	1:A:112:GLN:OE1	2.22	0.72
1:A:352:MET:HE3	1:B:500:PHE:CZ	2.25	0.71
1:B:327:CYS:SG	1:B:339:ILE:HD11	2.32	0.70
1:B:245:PHE:HA	1:B:248:ILE:HD12	1.78	0.65
1:A:352:MET:HE3	1:B:500:PHE:HZ	1.62	0.65
1:B:149:VAL:HG12	1:B:233:LEU:HD21	1.77	0.65
1:A:500:PHE:CZ	1:B:352:MET:HE3	2.33	0.64
1:A:109:ASN:HB3	1:A:112:GLN:HB2	1.83	0.61
1:B:152:THR:HG22	1:B:174:TRP:HE1	1.66	0.60
1:A:127:MET:HE3	1:A:130:LEU:HD12	1.83	0.60
1:A:109:ASN:ND2	1:A:184:ASN:HB3	2.12	0.60
1:A:109:ASN:CB	1:A:188:ALA:HB2	2.33	0.58
1:A:518:ASN:HB2	1:A:521:GLY:HA3	1.86	0.57
1:A:148:ILE:HD12	1:A:174:TRP:HZ3	1.70	0.56
1:B:225:MET:HE1	1:B:469:LEU:HB2	1.86	0.56
1:B:212:ILE:HG23	1:B:233:LEU:HD12	1.87	0.56
1:A:401:ASN:HB3	1:A:441:ARG:HG2	1.87	0.55
1:A:148:ILE:HD11	1:A:172:CYS:SG	2.47	0.54
1:A:326:CYS:SG	1:A:397:MET:HE1	2.48	0.54
1:A:327:CYS:SG	1:A:339:ILE:HD11	2.47	0.54
1:A:149:VAL:HG12	1:A:233:LEU:HD21	1.91	0.52
1:A:271:LEU:O	1:A:479:GLN:HB3	2.09	0.52
1:A:276:MET:HB2	1:A:469:LEU:HD11	1.91	0.52
1:A:276:MET:HG2	1:A:465:ALA:HB1	1.94	0.50
1:A:148:ILE:HD13	1:A:165:LEU:HD13	1.93	0.50
1:A:185:GLU:H	1:A:185:GLU:CD	2.20	0.50
1:A:109:ASN:HB3	1:A:188:ALA:HB2	1.94	0.50
1:B:276:MET:HB2	1:B:469:LEU:HD11	1.94	0.49
1:A:212:ILE:HG23	1:A:233:LEU:HD12	1.94	0.49
1:B:352:MET:HA	1:B:352:MET:HE2	1.95	0.49
1:A:297:ILE:HD11	1:A:322:VAL:HG13	1.94	0.49
1:B:130:LEU:HD11	1:B:459:ALA:HB1	1.95	0.48
1:A:107:VAL:HB	1:A:109:ASN:OD1	2.12	0.48
1:A:115:PHE:CE2	1:A:185:GLU:HG2	2.48	0.48
1:B:154:ILE:HB	1:B:182:THR:HG23	1.94	0.47
1:A:118:ARG:O	1:A:122:ILE:HG12	2.14	0.47

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:489:ASP:HB3	1:B:345:ILE:HD11	1.95	0.47
1:A:115:PHE:HE2	1:A:185:GLU:HG2	1.80	0.47
1:B:143:LEU:HD12	1:B:168:LEU:HB2	1.97	0.46
1:A:352:MET:CE	1:B:500:PHE:CZ	2.97	0.45
1:A:512:ALA:O	1:A:515:LEU:O	2.34	0.45
1:A:168:LEU:HD13	1:A:467:ILE:HD11	1.97	0.45
1:A:290:LEU:HD22	1:A:294:ARG:CZ	2.46	0.45
1:A:109:ASN:HD22	1:A:112:GLN:CD	2.24	0.44
1:B:141:LYS:HB3	1:B:144:ALA:HB2	1.98	0.44
1:A:109:ASN:HD21	1:A:184:ASN:CB	2.16	0.44
1:A:500:PHE:CE1	1:B:352:MET:HE3	2.53	0.44
1:A:460:THR:HG22	1:A:492:VAL:HG22	2.00	0.44
1:B:297:ILE:HD11	1:B:322:VAL:HG13	2.00	0.44
1:A:461:THR:HG23	1:A:484:LEU:HD22	1.99	0.44
1:A:154:ILE:HB	1:A:182:THR:HG23	1.99	0.43
1:B:148:ILE:HD12	1:B:174:TRP:HZ3	1.83	0.43
1:B:401:ASN:HB3	1:B:441:ARG:HG3	2.01	0.43
1:B:396:ASN:HB2	1:B:404:ILE:HD12	2.00	0.42
1:A:363:VAL:O	1:A:366:GLN:HG2	2.18	0.42
1:B:184:ASN:ND2	1:B:201:LYS:H	2.18	0.42
1:A:184:ASN:HD21	1:A:201:LYS:H	1.68	0.42
1:A:148:ILE:HG13	1:A:172:CYS:HA	2.02	0.42
1:A:473:PRO:HD2	1:A:476:ARG:HD2	2.02	0.42
1:B:486:LYS:HB3	1:B:522:PRO:HB3	2.01	0.42
1:B:127:MET:HE2	1:B:130:LEU:HD12	2.01	0.41
1:B:398:GLY:HA2	2:B:1:NAD:O4D	2.21	0.41
1:A:397:MET:O	2:A:1:NAD:H2N	2.21	0.41
1:A:315:VAL:HG12	1:A:367:VAL:HG21	2.01	0.41
1:A:339:ILE:O	1:A:357:VAL:HA	2.21	0.41
1:A:497:LEU:HB3	1:A:502:ALA:HB3	2.01	0.41
1:A:529:ARG:HG2	1:B:529:ARG:HA	2.03	0.41
1:B:276:MET:HG2	1:B:465:ALA:HB1	2.02	0.41
1:B:468:GLU:HB2	1:B:488:MET:HE2	2.03	0.41
1:A:218:MET:HB3	1:A:221:TRP:HB3	2.01	0.41
1:B:326:CYS:SG	1:B:397:MET:HE1	2.60	0.40
1:B:389:LYS:HG2	3:B:59:HOH:O	2.20	0.40
1:A:253:GLU:O	1:A:278:VAL:HG22	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	428/444 (96%)	406 (95%)	21 (5%)	1 (0%)	43	58
1	B	417/444 (94%)	389 (93%)	27 (6%)	1 (0%)	43	58
All	All	845/888 (95%)	795 (94%)	48 (6%)	2 (0%)	43	58

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	282	VAL
1	A	282	VAL

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	357/378 (94%)	338 (95%)	19 (5%)	20	34
1	B	351/378 (93%)	328 (93%)	23 (7%)	15	25
All	All	708/756 (94%)	666 (94%)	42 (6%)	18	29

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	108	LYS
1	A	110	ILE
1	A	131	ILE
1	A	140	GLU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	149	VAL
1	A	248	ILE
1	A	259	VAL
1	A	266	SER
1	A	273	VAL
1	A	287	PHE
1	A	339	ILE
1	A	373	CYS
1	A	376	ASN
1	A	413	GLU
1	A	442	LEU
1	A	455	LEU
1	A	489	ASP
1	A	515	LEU
1	A	520	ASN
1	B	102	SER
1	B	103	SER
1	B	110	ILE
1	B	131	ILE
1	B	138	GLN
1	B	141	LYS
1	B	148	ILE
1	B	185	GLU
1	B	233	LEU
1	B	236	TRP
1	B	259	VAL
1	B	273	VAL
1	B	276	MET
1	B	284	LYS
1	B	287	PHE
1	B	339	ILE
1	B	342	ILE
1	B	373	CYS
1	B	377	LYS
1	B	407	THR
1	B	415	THR
1	B	489	ASP
1	B	517	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	183	GLN
1	A	184	ASN
1	A	217	ASN
1	A	224	ASN
1	A	289	ASN
1	A	313	GLN
1	A	366	GLN
1	A	376	ASN
1	A	479	GLN
1	B	104	ASN
1	B	112	GLN
1	B	224	ASN
1	B	289	ASN
1	B	313	GLN
1	B	366	GLN
1	B	376	ASN
1	B	390	ASN
1	B	422	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 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	B	1	-	46,48,48	1.73	5 (10%)	64,73,73	1.70	12 (18%)
2	NAD	A	1	-	46,48,48	1.73	5 (10%)	64,73,73	1.67	11 (17%)

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	B	1	-	-	4/30/62/62	0/5/5/5
2	NAD	A	1	-	-	4/30/62/62	0/5/5/5

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1	NAD	O7N-C7N	9.16	1.41	1.24
2	A	1	NAD	O7N-C7N	9.05	1.41	1.24
2	A	1	NAD	C2A-N1A	3.05	1.39	1.33
2	B	1	NAD	C2A-N1A	3.04	1.39	1.33
2	A	1	NAD	C2A-N3A	2.82	1.39	1.33
2	B	1	NAD	C2A-N3A	2.80	1.38	1.33
2	A	1	NAD	C2N-N1N	2.73	1.38	1.35
2	A	1	NAD	C8A-N7A	2.43	1.36	1.31
2	B	1	NAD	C2N-N1N	2.36	1.37	1.35
2	B	1	NAD	C8A-N7A	2.11	1.35	1.31

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1	NAD	N3A-C2A-N1A	-6.24	119.13	128.58
2	B	1	NAD	N3A-C2A-N1A	-5.78	119.84	128.58
2	A	1	NAD	C5A-C4A-N3A	-4.75	120.18	126.72
2	B	1	NAD	C5A-C4A-N3A	-4.54	120.46	126.72
2	A	1	NAD	N9A-C8A-N7A	-4.08	108.15	113.94
2	B	1	NAD	N9A-C8A-N7A	-4.06	108.18	113.94
2	A	1	NAD	C2A-N3A-C4A	3.83	121.18	111.83
2	B	1	NAD	C2A-N3A-C4A	3.49	120.36	111.83
2	B	1	NAD	N3A-C4A-N9A	3.40	132.95	127.17
2	A	1	NAD	N3A-C4A-N9A	3.34	132.84	127.17
2	B	1	NAD	C5A-N7A-C8A	3.24	108.55	103.45
2	A	1	NAD	C5A-N7A-C8A	3.20	108.47	103.45

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	NAD	C3N-C7N-N7N	2.86	121.26	117.74
2	A	1	NAD	C3N-C7N-N7N	2.80	121.19	117.74
2	A	1	NAD	C5A-C6A-N6A	-2.58	116.89	123.29
2	B	1	NAD	C5A-C6A-N6A	-2.39	117.36	123.29
2	B	1	NAD	C4A-N9A-C8A	2.30	108.16	105.74
2	A	1	NAD	O7N-C7N-C3N	-2.26	116.83	119.60
2	A	1	NAD	O2N-PN-O1N	2.23	122.82	112.44
2	B	1	NAD	O5B-C5B-C4B	-2.12	101.78	108.99
2	B	1	NAD	O2N-PN-O1N	2.09	122.18	112.44
2	B	1	NAD	C6N-N1N-C2N	-2.06	120.13	121.88
2	A	1	NAD	C4A-N9A-C8A	2.01	107.85	105.74

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1	NAD	C2D-C1D-N1N-C2N
2	A	1	NAD	C2D-C1D-N1N-C6N
2	B	1	NAD	C2D-C1D-N1N-C2N
2	B	1	NAD	C2D-C1D-N1N-C6N
2	A	1	NAD	O4B-C4B-C5B-O5B
2	A	1	NAD	C3B-C4B-C5B-O5B
2	B	1	NAD	O4B-C4B-C5B-O5B
2	B	1	NAD	C2B-C1B-N9A-C8A

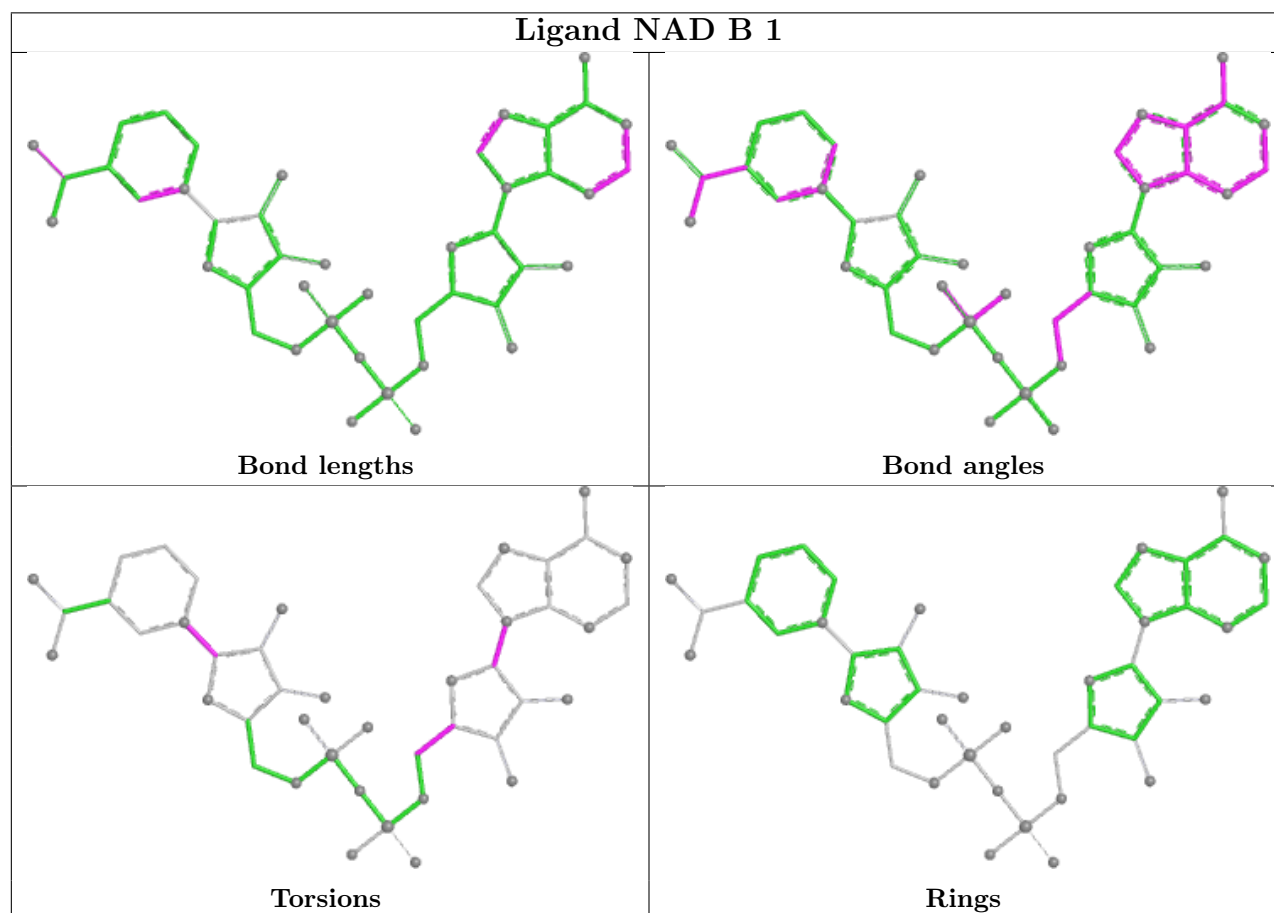
There are no ring outliers.

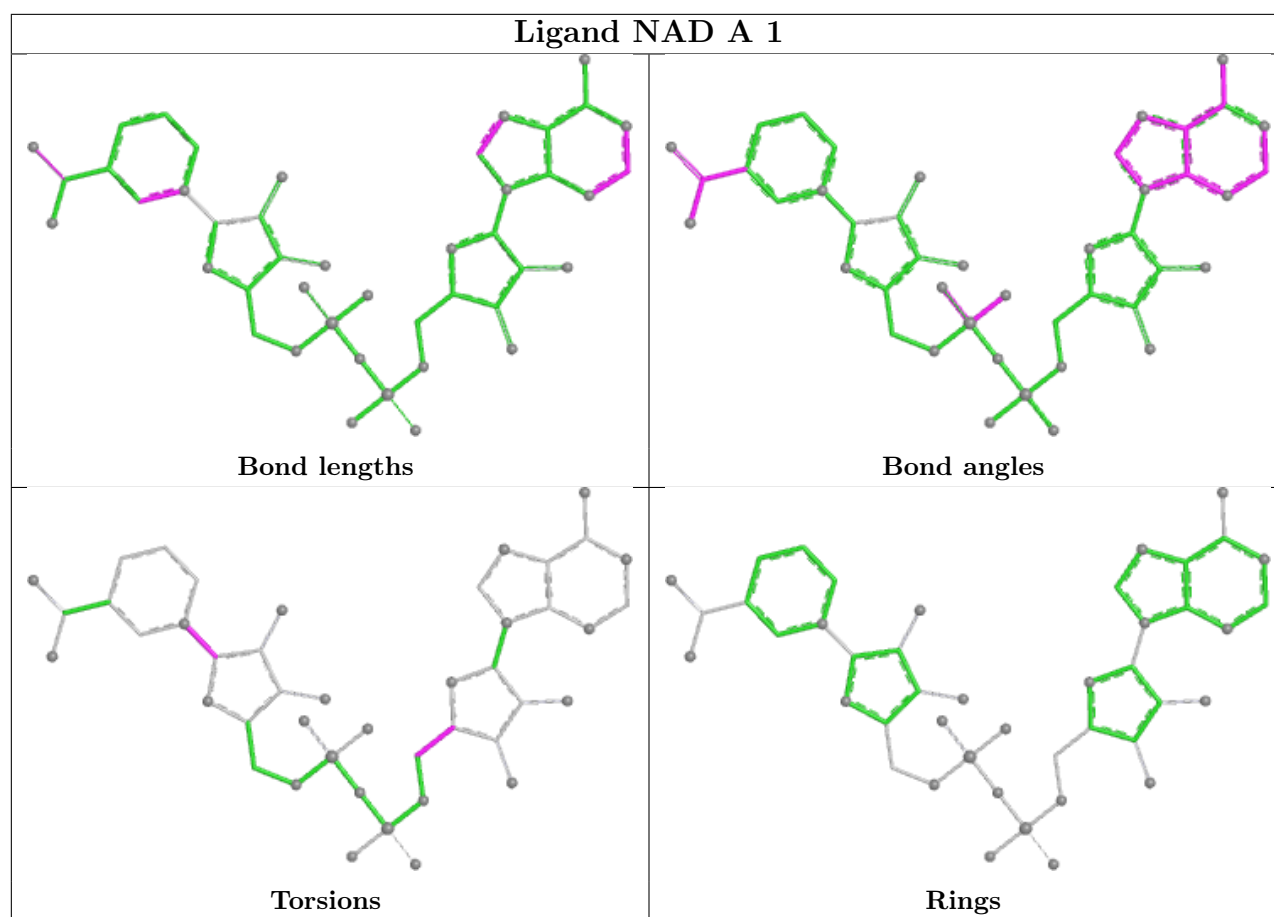
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1	NAD	1	0
2	A	1	NAD	1	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

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	430/444 (96%)	0.14	9 (2%) 63 59	30, 84, 127, 149	0
1	B	423/444 (95%)	0.21	15 (3%) 47 41	28, 81, 139, 170	0
All	All	853/888 (96%)	0.18	24 (2%) 55 50	28, 82, 134, 170	0

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	101	GLY	3.9
1	A	444	ASN	3.7
1	B	102	SER	3.7
1	B	110	ILE	3.4
1	B	226	ILE	3.4
1	A	109	ASN	3.3
1	B	218	MET	3.3
1	A	445	LEU	3.2
1	A	110	ILE	2.7
1	A	101	GLY	2.7
1	B	137	ALA	2.7
1	B	195	VAL	2.7
1	B	251	ILE	2.6
1	A	275	ALA	2.4
1	B	516	GLY	2.3
1	B	287	PHE	2.3
1	A	227	LEU	2.3
1	A	455	LEU	2.2
1	B	273	VAL	2.2
1	A	447	CYS	2.1
1	B	139	GLY	2.1
1	B	172	CYS	2.1
1	B	115	PHE	2.1
1	B	111	LYS	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 oligosaccharides in this entry.

6.4 Ligands [i](#)

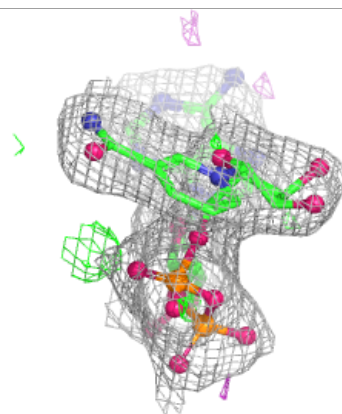
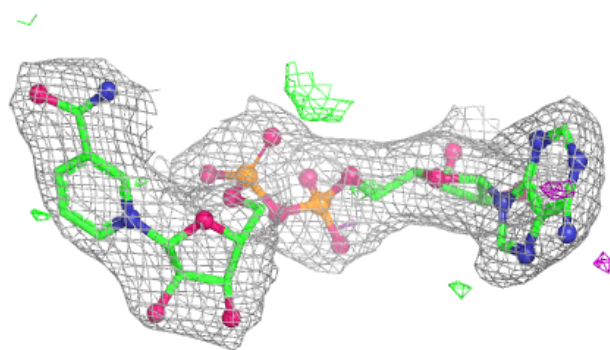
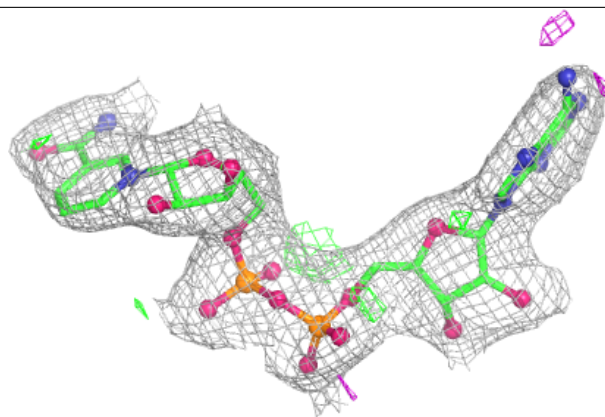
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	NAD	A	1	44/44	0.95	0.08	47,55,65,67	0
2	NAD	B	1	44/44	0.96	0.07	42,52,59,60	0

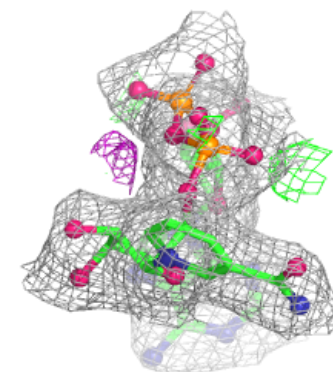
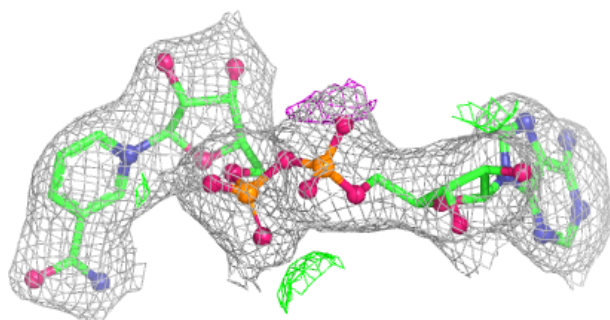
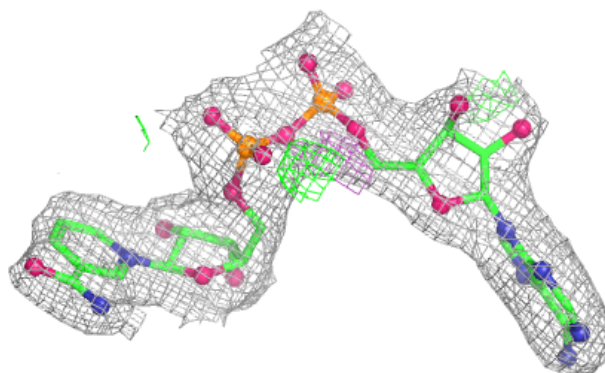
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around NAD A 1:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

**Electron density around NAD B 1:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers [i](#)

There are no such residues in this entry.