



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 08:26 PM UTC

PDB ID : 1NZX / pdb_00001nzx
Title : Human mitochondrial aldehyde dehydrogenase complexed with NAD⁺ in the presence of low Mg²⁺
Authors : Perez-Miller, S.J.; Hurley, T.D.
Deposited on : 2003-02-20
Resolution : 2.45 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
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

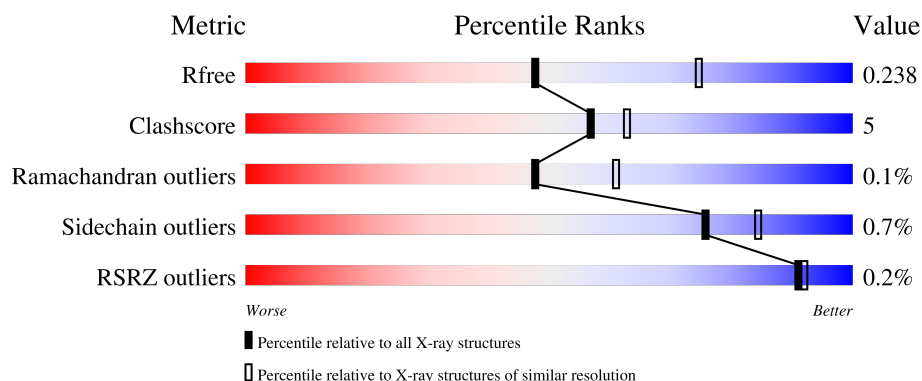
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.45 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	1190 (2.46-2.46)
Clashscore	190562	1229 (2.46-2.46)
Ramachandran outliers	187476	1218 (2.46-2.46)
Sidechain outliers	187428	1218 (2.46-2.46)
RSRZ outliers	180081	1190 (2.46-2.46)

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	500	85% 13% ..
1	B	500	84% 15% .
1	C	500	87% 11% .
1	D	500	% 83% 16% .
1	E	500	86% 13% .

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Mol	Chain	Length	Quality of chain
1	F	500	 84% 14% •
1	G	500	 87% 11% ••
1	H	500	 83% 15% ••

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 32014 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 Aldehyde dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			
1	B	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			
1	C	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			
1	D	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			
1	E	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			
1	F	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			
1	G	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			
1	H	494	Total	C	N	O	S	0	0	0
			3798	2415	648	717	18			

- Molecule 2 is SODIUM ION (CCD ID: NA) (formula: Na).

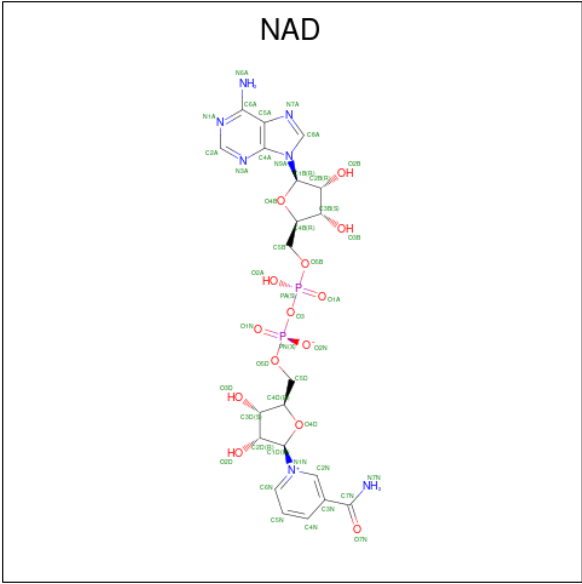
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Na	0	0
			1	1		
2	B	1	Total	Na	0	0
			1	1		
2	C	1	Total	Na	0	0
			1	1		
2	D	1	Total	Na	0	0
			1	1		
2	E	1	Total	Na	0	0
			1	1		
2	F	1	Total	Na	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	G	1	Total	Na	0	0
			1	1		
2	H	1	Total	Na	0	0
			1	1		

- 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
			27	10	5	10	2		
3	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
3	C	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
3	D	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
3	E	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
3	F	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
3	G	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
3	H	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

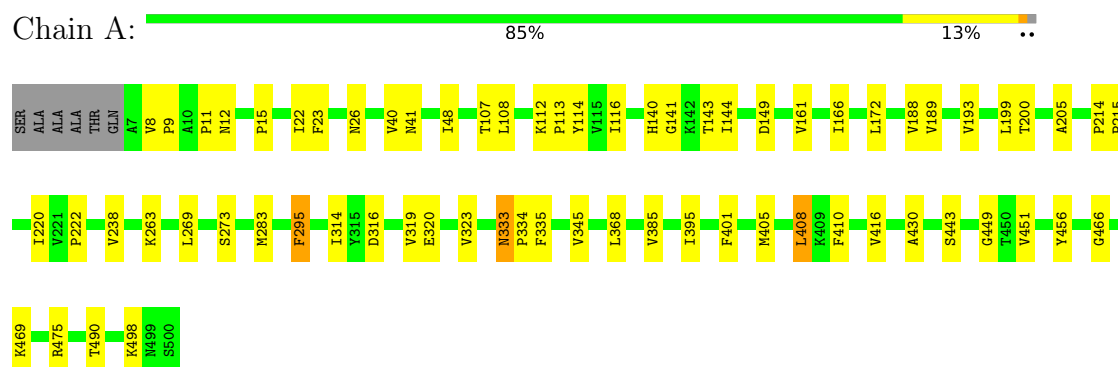
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	164	Total 164	O 164	0	0
4	B	177	Total 177	O 177	0	0
4	C	198	Total 198	O 198	0	0
4	D	118	Total 118	O 118	0	0
4	E	187	Total 187	O 187	0	0
4	F	239	Total 239	O 239	0	0
4	G	187	Total 187	O 187	0	0
4	H	136	Total 136	O 136	0	0

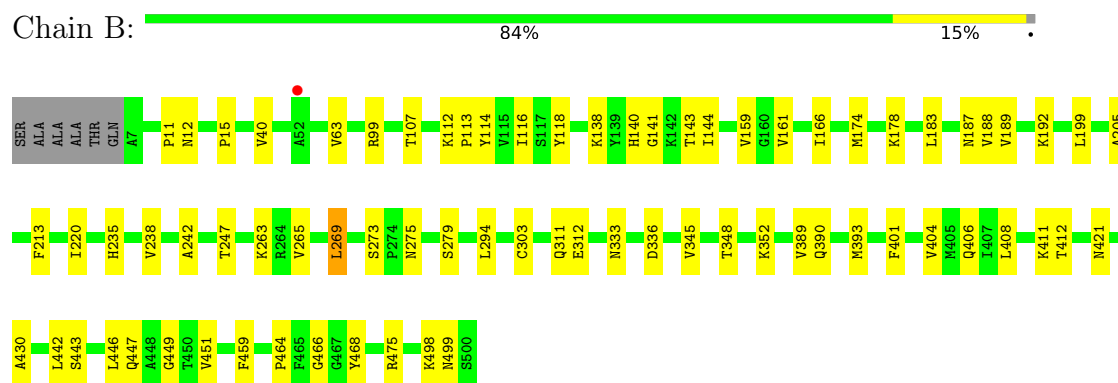
3 Residue-property plots

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.

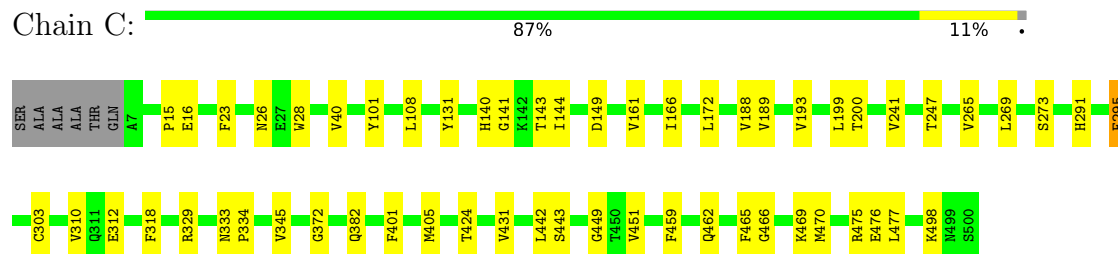
• Molecule 1: Aldehyde dehydrogenase



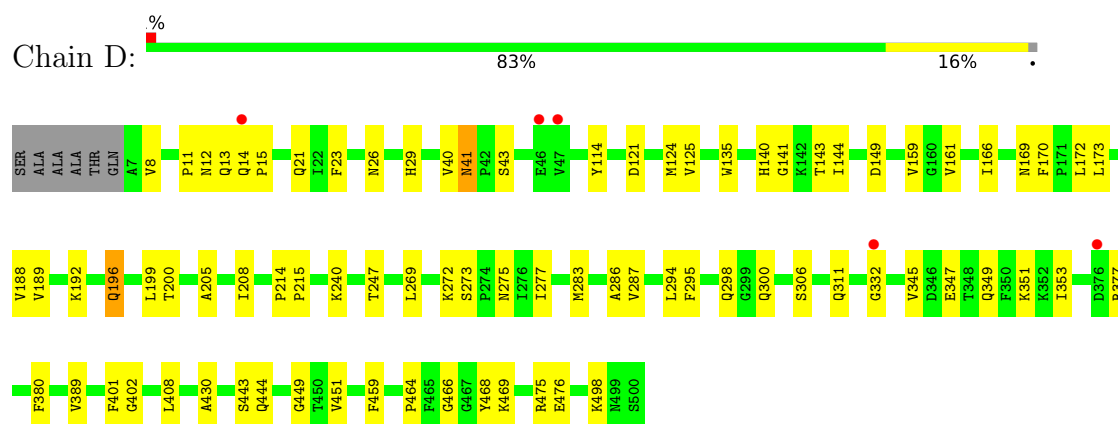
• Molecule 1: Aldehyde dehydrogenase



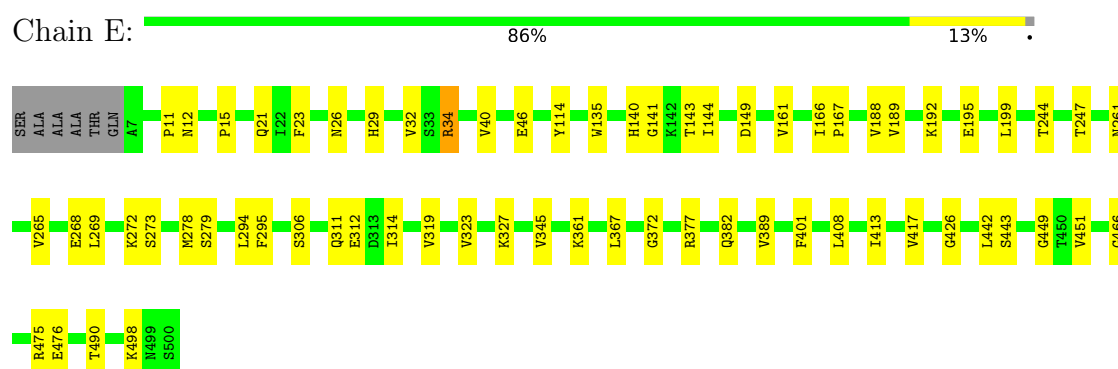
• Molecule 1: Aldehyde dehydrogenase



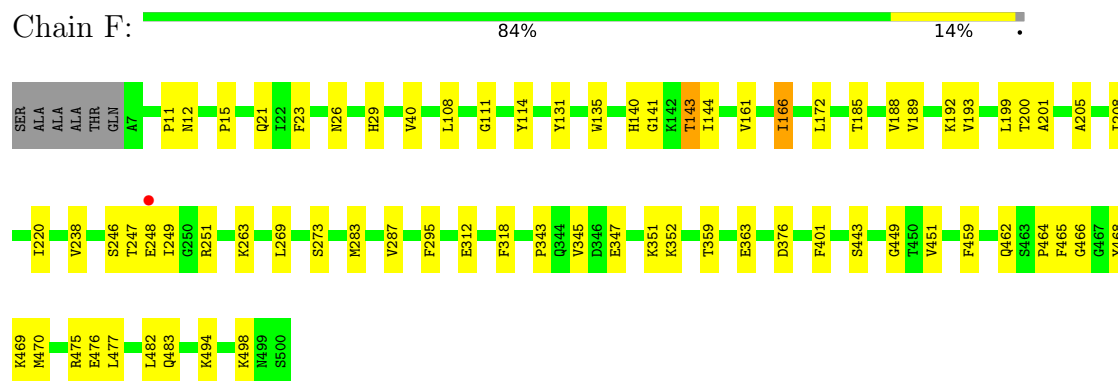
• Molecule 1: Aldehyde dehydrogenase



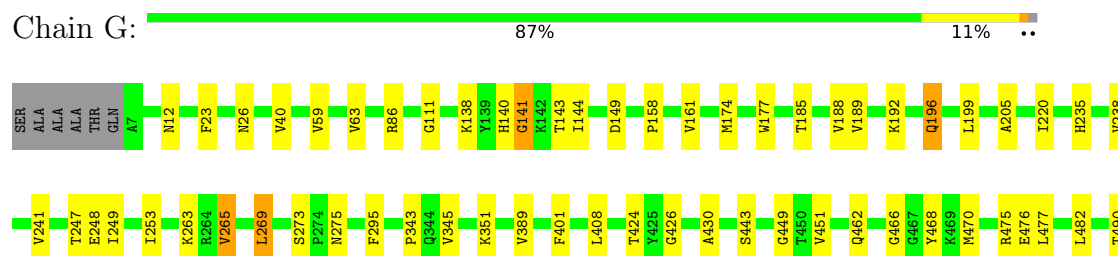
- Molecule 1: Aldehyde dehydrogenase



- Molecule 1: Aldehyde dehydrogenase

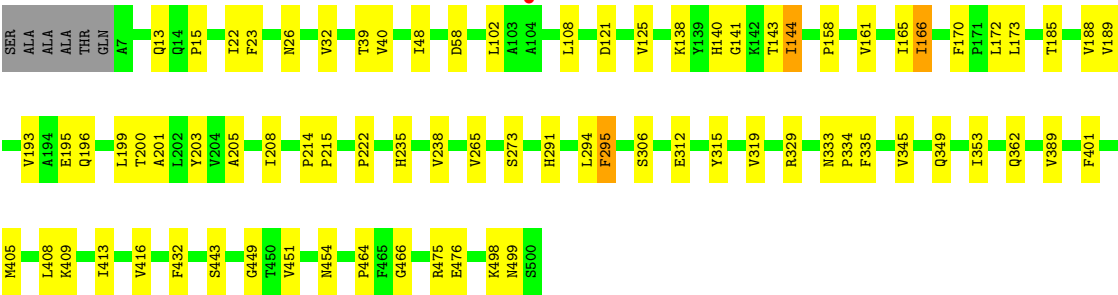
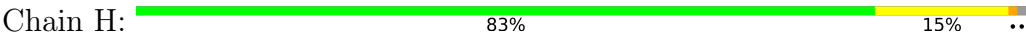


- Molecule 1: Aldehyde dehydrogenase





- Molecule 1: Aldehyde dehydrogenase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	141.31Å 151.10Å 176.95Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.99 – 2.45 19.99 – 2.45	Depositor EDS
% Data completeness (in resolution range)	96.5 (19.99-2.45) 96.4 (19.99-2.45)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.87 (at 2.44Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.209 , 0.245 0.205 , 0.238	Depositor DCC
R_{free} test set	6757 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	28.2	Xtrriage
Anisotropy	0.853	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 35.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	32014	wwPDB-VP
Average B, all atoms (Å ²)	30.0	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 66.13 % 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 6.3490e-06. 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: NA, 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	0.43	0/3882	0.90	13/5267 (0.2%)
1	B	0.42	0/3882	0.92	14/5267 (0.3%)
1	C	0.43	0/3882	0.92	12/5267 (0.2%)
1	D	0.42	0/3882	0.92	14/5267 (0.3%)
1	E	0.43	0/3882	0.92	13/5267 (0.2%)
1	F	0.44	0/3882	0.92	15/5267 (0.3%)
1	G	0.43	0/3882	0.93	14/5267 (0.3%)
1	H	0.43	0/3882	0.92	13/5267 (0.2%)
All	All	0.43	0/31056	0.92	108/42136 (0.3%)

There are no bond length outliers.

All (108) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	199	LEU	N-CA-C	8.72	120.47	110.97
1	H	144	ILE	N-CA-C	8.60	117.26	107.89
1	H	199	LEU	N-CA-C	8.57	120.31	110.97
1	A	199	LEU	N-CA-C	7.96	120.73	111.02
1	F	199	LEU	N-CA-C	7.94	120.70	111.02
1	A	144	ILE	N-CA-C	7.82	117.28	108.05
1	D	144	ILE	N-CA-C	7.74	116.32	107.89
1	C	199	LEU	N-CA-C	7.72	120.44	111.02
1	E	144	ILE	N-CA-C	7.66	116.24	107.89
1	E	189	VAL	N-CA-C	7.60	119.43	108.48
1	G	144	ILE	N-CA-C	7.59	116.16	107.89
1	E	199	LEU	N-CA-C	7.57	120.26	111.02
1	B	199	LEU	N-CA-C	7.53	120.20	111.02
1	F	144	ILE	N-CA-C	7.51	116.92	108.05
1	B	144	ILE	N-CA-C	7.37	115.92	107.89
1	A	189	VAL	N-CA-C	7.36	119.08	108.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	345	VAL	N-CA-C	7.33	118.10	110.62
1	G	189	VAL	N-CA-C	7.33	119.38	108.46
1	B	189	VAL	N-CA-C	7.28	119.31	108.46
1	H	166	ILE	N-CA-C	7.23	115.86	107.84
1	B	166	ILE	N-CA-C	7.23	115.86	107.84
1	C	189	VAL	N-CA-C	7.22	119.22	108.46
1	G	199	LEU	N-CA-C	7.12	119.70	111.02
1	D	141	GLY	N-CA-C	-7.05	102.52	112.60
1	C	345	VAL	N-CA-C	7.00	117.76	110.62
1	C	312	GLU	N-CA-C	6.93	119.72	111.33
1	E	141	GLY	N-CA-C	-6.90	102.74	112.60
1	C	144	ILE	N-CA-C	6.86	116.14	108.05
1	F	345	VAL	N-CA-C	6.84	117.60	110.62
1	B	312	GLU	N-CA-C	6.83	119.59	111.33
1	D	189	VAL	N-CA-C	6.69	118.42	108.46
1	F	189	VAL	N-CA-C	6.68	118.10	108.48
1	D	166	ILE	N-CA-C	6.65	115.22	107.84
1	E	345	VAL	N-CA-C	6.56	118.10	110.62
1	E	166	ILE	N-CA-C	6.55	115.11	107.84
1	F	295	PHE	N-CA-C	6.50	120.94	112.89
1	F	166	ILE	N-CA-C	6.42	114.97	107.84
1	B	345	VAL	N-CA-C	6.35	117.86	110.62
1	H	312	GLU	N-CA-C	6.29	118.94	111.33
1	F	140	HIS	N-CA-C	6.29	118.90	110.35
1	D	345	VAL	N-CA-C	6.22	117.72	110.62
1	A	141	GLY	N-CA-C	-6.22	104.05	112.57
1	H	141	GLY	N-CA-C	-6.20	103.11	112.41
1	C	141	GLY	N-CA-C	-6.16	103.79	112.60
1	F	273	SER	N-CA-C	6.14	118.32	109.48
1	F	312	GLU	N-CA-C	6.13	118.75	111.33
1	H	345	VAL	N-CA-C	6.06	117.53	110.62
1	H	40	VAL	N-CA-C	6.04	117.71	108.71
1	G	295	PHE	N-CA-C	5.94	120.37	113.18
1	B	143	THR	N-CA-C	-5.93	98.86	108.52
1	A	345	VAL	N-CA-C	5.91	117.36	110.62
1	A	295	PHE	N-CA-C	5.89	120.19	112.89
1	H	189	VAL	N-CA-C	5.87	118.42	108.86
1	E	295	PHE	N-CA-C	5.82	120.10	112.89
1	G	140	HIS	N-CA-C	5.79	118.22	110.35
1	D	295	PHE	N-CA-C	5.78	120.17	113.18
1	C	295	PHE	N-CA-C	5.78	120.17	113.18
1	E	273	SER	N-CA-C	5.77	117.79	109.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	40	VAL	N-CA-C	5.76	117.90	108.97
1	C	273	SER	N-CA-C	5.73	117.73	109.48
1	D	8	VAL	N-CA-C	5.71	112.76	107.56
1	E	140	HIS	N-CA-C	5.70	118.10	110.35
1	G	40	VAL	N-CA-C	5.69	117.78	108.97
1	D	140	HIS	N-CA-C	5.68	117.87	110.43
1	D	143	THR	N-CA-C	-5.66	99.29	108.52
1	B	141	GLY	N-CA-C	-5.65	103.93	112.41
1	G	143	THR	N-CA-C	-5.65	99.32	108.52
1	D	273	SER	N-CA-C	5.63	117.70	109.71
1	E	312	GLU	N-CA-C	5.61	118.12	111.33
1	E	143	THR	N-CA-C	-5.57	99.45	108.52
1	F	143	THR	N-CA-C	-5.55	99.47	108.52
1	B	273	SER	N-CA-C	5.49	117.51	109.71
1	C	140	HIS	N-CA-C	5.49	117.82	110.35
1	B	468	TYR	N-CA-C	-5.49	102.34	110.46
1	B	140	HIS	N-CA-C	5.48	117.81	110.35
1	G	468	TYR	N-CA-C	-5.47	102.36	110.46
1	H	295	PHE	N-CA-C	5.47	119.81	113.18
1	C	143	THR	N-CA-C	-5.43	99.67	108.52
1	G	269	LEU	N-CA-C	5.43	117.72	109.63
1	A	143	THR	N-CA-C	-5.42	99.68	108.52
1	D	40	VAL	N-CA-C	5.42	117.37	108.97
1	C	40	VAL	N-CA-C	5.42	117.37	108.97
1	D	468	TYR	N-CA-C	-5.42	102.45	110.46
1	H	140	HIS	N-CA-C	5.41	117.71	110.35
1	A	140	HIS	N-CA-C	5.40	117.69	110.35
1	G	12	ASN	N-CA-C	-5.39	99.74	108.41
1	E	40	VAL	N-CA-C	5.38	117.31	108.97
1	B	265	VAL	N-CA-C	5.34	116.42	108.46
1	F	40	VAL	N-CA-C	5.32	117.22	108.97
1	F	12	ASN	N-CA-C	-5.32	100.42	108.67
1	H	143	THR	N-CA-C	-5.31	99.87	108.52
1	G	273	SER	N-CA-C	5.29	117.09	109.48
1	G	265	VAL	N-CA-C	5.28	116.27	108.45
1	G	141	GLY	N-CA-C	-5.28	104.50	112.41
1	A	12	ASN	N-CA-C	-5.25	99.22	108.20
1	D	469	LYS	CB-CA-C	-5.23	110.52	116.54
1	H	265	VAL	N-CA-C	5.23	116.25	108.46
1	F	469	LYS	CB-CA-C	-5.22	110.53	116.54
1	F	141	GLY	N-CA-C	-5.21	103.37	112.55
1	A	273	SER	N-CA-C	5.17	116.92	109.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	40	VAL	N-CA-C	5.16	116.97	108.97
1	A	469	LYS	CB-CA-C	-5.11	110.67	116.54
1	E	265	VAL	N-CA-C	5.07	116.01	108.46
1	B	269	LEU	N-CA-C	5.06	117.16	109.63
1	F	468	TYR	N-CA-C	-5.05	102.59	110.42
1	H	273	SER	N-CA-C	5.04	118.39	109.58
1	A	269	LEU	N-CA-C	5.04	117.13	109.63
1	C	469	LYS	CB-CA-C	-5.01	110.78	116.54

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	3798	0	3745	34	0
1	B	3798	0	3745	37	0
1	C	3798	0	3745	27	0
1	D	3798	0	3745	45	0
1	E	3798	0	3745	32	0
1	F	3798	0	3745	37	0
1	G	3798	0	3745	34	0
1	H	3798	0	3745	44	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
2	G	1	0	0	0	0
2	H	1	0	0	0	0
3	A	27	0	12	0	0
3	B	27	0	12	0	0
3	C	27	0	12	0	0
3	D	27	0	12	0	0
3	E	27	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	F	27	0	12	0	0
3	G	27	0	12	0	0
3	H	27	0	12	1	0
4	A	164	0	0	1	0
4	B	177	0	0	0	0
4	C	198	0	0	1	0
4	D	118	0	0	1	0
4	E	187	0	0	4	0
4	F	239	0	0	0	0
4	G	187	0	0	2	0
4	H	136	0	0	1	0
All	All	32014	0	30056	278	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 5.

All (278) 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:41:ASN:HB2	1:A:48:ILE:HD11	1.43	1.00
1:E:247:THR:HA	1:E:269:LEU:HD13	1.58	0.86
1:G:196:GLN:H	1:G:196:GLN:HE21	1.28	0.82
1:F:283:MET:HE3	1:F:283:MET:HA	1.60	0.82
1:D:196:GLN:H	1:D:196:GLN:HE21	1.35	0.74
1:A:333:ASN:ND2	1:A:335:PHE:H	1.87	0.73
1:A:205:ALA:HB2	1:A:220:ILE:HD12	1.74	0.69
1:B:205:ALA:HB2	1:B:220:ILE:HD12	1.74	0.69
1:B:390:GLN:HG2	1:B:393:MET:HE3	1.75	0.69
1:A:283:MET:HE1	1:A:314:ILE:HB	1.77	0.67
1:D:247:THR:HA	1:D:269:LEU:HD13	1.78	0.66
1:D:277:ILE:HD12	1:D:286:ALA:HB1	1.79	0.64
1:F:283:MET:HE1	1:F:318:PHE:HD1	1.62	0.64
1:A:333:ASN:HD22	1:A:335:PHE:H	1.45	0.63
1:C:241:VAL:CG1	1:C:265:VAL:HG22	2.30	0.62
1:C:161:VAL:HA	1:C:188:VAL:HG23	1.82	0.62
1:C:166:ILE:HD11	1:C:193:VAL:HG12	1.82	0.62
1:G:161:VAL:HA	1:G:188:VAL:HG23	1.82	0.62
1:E:361:LYS:HE2	1:E:367:LEU:HD22	1.82	0.62
1:F:161:VAL:HA	1:F:188:VAL:HG23	1.81	0.62
1:C:172:LEU:HD21	1:C:200:THR:HB	1.82	0.61
1:D:41:ASN:ND2	1:D:43:SER:H	1.98	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:102:LEU:HD21	1:H:203:TYR:HD2	1.64	0.61
1:B:411:LYS:HG2	1:B:412:THR:HG23	1.82	0.60
1:A:333:ASN:HD22	1:A:333:ASN:C	2.09	0.60
1:D:349:GLN:O	1:D:353:ILE:HG13	2.02	0.60
1:H:23:PHE:CZ	1:H:26:ASN:HA	2.36	0.60
1:H:315:TYR:CG	1:H:409:LYS:HE2	2.37	0.60
1:D:41:ASN:C	1:D:41:ASN:HD22	2.10	0.60
1:B:466:GLY:HA3	1:B:475:ARG:HD3	1.82	0.59
1:A:23:PHE:CZ	1:A:26:ASN:HA	2.37	0.59
1:B:275:ASN:ND2	1:B:430:ALA:HB3	2.17	0.59
1:H:295:PHE:CE1	1:H:405:MET:HE3	2.37	0.59
1:B:138:LYS:HD3	1:D:135:TRP:CE2	2.38	0.58
1:D:283:MET:O	1:D:287:VAL:HG23	2.04	0.57
1:E:466:GLY:HA3	1:E:475:ARG:HD3	1.86	0.57
1:F:247:THR:HA	1:F:269:LEU:HD13	1.86	0.57
1:D:353:ILE:HD13	1:D:402:GLY:HA3	1.85	0.57
1:G:23:PHE:CZ	1:G:26:ASN:HA	2.39	0.57
1:B:303:CYS:SG	1:B:459:PHE:HZ	2.28	0.57
1:C:424:THR:HB	1:C:470:MET:HE2	1.86	0.57
1:F:185:THR:HG23	1:F:482:LEU:HD22	1.86	0.57
1:D:205:ALA:HA	1:D:208:ILE:HD12	1.87	0.56
1:C:295:PHE:CE1	1:C:405:MET:HE3	2.40	0.56
1:A:107:THR:HG23	1:A:112:LYS:O	2.05	0.56
1:A:22:ILE:HG12	1:A:222:PRO:HD2	1.87	0.55
1:G:275:ASN:ND2	1:G:430:ALA:HB3	2.21	0.55
1:B:275:ASN:HD22	1:B:430:ALA:HB3	1.71	0.55
1:B:247:THR:HA	1:B:269:LEU:HD13	1.87	0.55
1:D:124:MET:HE1	1:D:459:PHE:HB2	1.88	0.55
1:B:238:VAL:O	1:B:263:LYS:HE3	2.07	0.55
1:A:443:SER:HA	1:A:451:VAL:HG11	1.89	0.55
1:G:241:VAL:CG1	1:G:265:VAL:HG22	2.37	0.55
1:D:11:PRO:HB3	1:D:114:TYR:CZ	2.42	0.54
1:F:23:PHE:CZ	1:F:26:ASN:HA	2.42	0.54
1:C:23:PHE:CZ	1:C:26:ASN:HA	2.42	0.54
1:F:466:GLY:HA3	1:F:475:ARG:HD3	1.88	0.54
1:H:443:SER:HA	1:H:451:VAL:HG11	1.89	0.54
1:D:121:ASP:O	1:D:125:VAL:HG23	2.07	0.54
1:E:261:ASN:HA	1:F:470:MET:HE3	1.89	0.54
1:F:205:ALA:HB2	1:F:220:ILE:HD12	1.90	0.54
1:B:12:ASN:O	1:B:15:PRO:HD3	2.07	0.54
1:D:466:GLY:HA3	1:D:475:ARG:HD3	1.90	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:149:ASP:HA	1:C:498:LYS:HB2	1.89	0.53
1:F:131:TYR:CE1	1:F:462:GLN:HG3	2.44	0.53
1:D:161:VAL:HA	1:D:188:VAL:HG23	1.91	0.53
1:G:408:LEU:N	1:G:408:LEU:HD12	2.24	0.53
1:A:316:ASP:O	1:A:320:GLU:HG3	2.09	0.53
1:F:283:MET:HE2	1:F:287:VAL:HG23	1.91	0.52
1:H:195:GLU:HG2	1:H:196:GLN:OE1	2.09	0.52
1:B:161:VAL:HA	1:B:188:VAL:HG23	1.92	0.52
1:C:15:PRO:HG2	1:C:108:LEU:HD22	1.92	0.52
1:A:161:VAL:HA	1:A:188:VAL:HG23	1.92	0.52
1:E:161:VAL:HA	1:E:188:VAL:HG23	1.92	0.52
1:H:161:VAL:HA	1:H:188:VAL:HG23	1.91	0.52
1:G:205:ALA:HB2	1:G:220:ILE:HD12	1.92	0.52
1:A:172:LEU:HD21	1:A:200:THR:HB	1.91	0.52
1:A:319:VAL:O	1:A:323:VAL:HG23	2.11	0.51
1:B:107:THR:HG23	1:B:112:LYS:O	2.11	0.51
1:C:291:HIS:HE1	1:C:329:ARG:HH11	1.59	0.51
1:F:11:PRO:HB3	1:F:114:TYR:CE2	2.45	0.51
1:F:205:ALA:HA	1:F:208:ILE:HD12	1.92	0.51
1:E:311:GLN:HG3	4:E:5667:HOH:O	2.10	0.51
1:E:319:VAL:O	1:E:323:VAL:HG23	2.10	0.51
1:G:241:VAL:HG12	1:G:265:VAL:HG22	1.94	0.50
1:E:135:TRP:CE2	1:G:138:LYS:HD3	2.47	0.50
1:G:149:ASP:HA	1:G:498:LYS:HB2	1.94	0.50
1:H:121:ASP:O	1:H:125:VAL:HG23	2.11	0.50
1:F:166:ILE:HD11	1:F:193:VAL:HG12	1.94	0.50
1:G:466:GLY:HA3	1:G:475:ARG:HD3	1.94	0.50
1:A:11:PRO:HB3	1:A:114:TYR:CZ	2.47	0.49
1:B:63:VAL:HG21	1:B:235:HIS:CD2	2.47	0.49
1:C:247:THR:HA	1:C:269:LEU:HD13	1.93	0.49
1:H:295:PHE:HE1	1:H:405:MET:HE3	1.76	0.49
1:D:11:PRO:HB3	1:D:114:TYR:CE1	2.47	0.49
1:B:498:LYS:HG2	1:B:499:ASN:N	2.28	0.49
1:G:389:VAL:HB	1:G:408:LEU:HG	1.94	0.49
1:A:333:ASN:HD22	1:A:334:PRO:N	2.11	0.48
1:B:11:PRO:HB3	1:B:114:TYR:CE1	2.48	0.48
1:B:174:MET:HE2	1:B:174:MET:HA	1.95	0.48
1:F:172:LEU:HD21	1:F:200:THR:HB	1.95	0.48
1:H:315:TYR:CE1	1:H:319:VAL:HG21	2.48	0.48
1:G:63:VAL:HG11	1:G:235:HIS:CE1	2.48	0.48
1:A:490:THR:OG1	1:B:464:PRO:HG2	2.14	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:246:SER:OG	1:F:248:GLU:HG2	2.13	0.48
1:D:347:GLU:CG	1:D:351:LYS:HE3	2.44	0.48
1:F:251:ARG:HH21	1:F:470:MET:HE1	1.79	0.48
1:B:389:VAL:HB	1:B:408:LEU:HG	1.95	0.48
1:D:311:GLN:HG3	4:D:4569:HOH:O	2.13	0.48
1:F:248:GLU:HG3	1:F:249:ILE:N	2.28	0.48
1:H:362:GLN:OE1	1:H:362:GLN:HA	2.14	0.48
1:B:138:LYS:HE3	1:D:135:TRP:CD1	2.49	0.48
1:B:279:SER:HB3	1:B:311:GLN:OE1	2.14	0.47
4:E:5689:HOH:O	1:F:483:GLN:HB3	2.13	0.47
1:A:15:PRO:HG2	1:A:108:LEU:HD22	1.95	0.47
1:F:449:GLY:HA3	1:F:466:GLY:O	2.14	0.47
1:C:459:PHE:HE2	1:C:465:PHE:CE1	2.32	0.47
1:C:466:GLY:HA3	1:C:475:ARG:HD3	1.95	0.47
1:B:499:ASN:H	1:D:444:GLN:HE22	1.63	0.47
1:E:268:GLU:OE2	1:E:476:GLU:HG3	2.14	0.47
1:F:11:PRO:HB3	1:F:114:TYR:CZ	2.49	0.47
1:E:11:PRO:HB3	1:E:114:TYR:CE1	2.49	0.47
1:D:298:GLN:HB2	1:D:300:GLN:NE2	2.30	0.47
1:E:12:ASN:O	1:E:15:PRO:HD3	2.14	0.47
1:B:99:ARG:HG2	1:B:118:TYR:CE1	2.50	0.46
1:D:23:PHE:CZ	1:D:26:ASN:HA	2.50	0.46
1:E:23:PHE:CZ	1:E:26:ASN:HA	2.50	0.46
1:D:26:ASN:HD22	1:D:215:PRO:HG3	1.79	0.46
1:D:125:VAL:HG22	1:D:173:LEU:HA	1.98	0.46
1:D:196:GLN:H	1:D:196:GLN:NE2	2.10	0.46
1:B:404:VAL:HG12	1:B:406:GLN:OE1	2.15	0.46
1:H:39:THR:HG23	1:H:48:ILE:HB	1.98	0.46
1:H:205:ALA:HA	1:H:208:ILE:HD12	1.96	0.46
1:H:235:HIS:HB3	1:H:238:VAL:HG23	1.97	0.46
1:F:443:SER:HA	1:F:451:VAL:HG11	1.96	0.46
1:B:178:LYS:HE3	1:B:242:ALA:HB1	1.98	0.46
1:E:46:GLU:CD	1:E:377:ARG:NH2	2.73	0.46
1:E:294:LEU:HD23	1:E:306:SER:HA	1.98	0.46
1:G:443:SER:HA	1:G:451:VAL:HG11	1.98	0.46
1:H:389:VAL:HB	1:H:408:LEU:HG	1.98	0.46
1:B:421:ASN:CG	1:B:447:GLN:HG3	2.40	0.46
1:H:498:LYS:HG2	1:H:499:ASN:N	2.30	0.46
1:A:498:LYS:C	1:A:498:LYS:HD2	2.42	0.45
1:E:413:ILE:O	1:E:417:VAL:HG23	2.16	0.45
1:F:347:GLU:HG2	1:F:351:LYS:HE2	1.98	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:359:THR:O	1:F:363:GLU:HG2	2.17	0.45
1:F:459:PHE:HE2	1:F:465:PHE:CE1	2.34	0.45
1:G:275:ASN:HD22	1:G:430:ALA:HB3	1.81	0.45
1:D:149:ASP:HA	1:D:498:LYS:HB2	1.98	0.45
1:E:195:GLU:HG2	4:E:5575:HOH:O	2.15	0.45
1:D:159:VAL:HG11	1:D:240:LYS:HB2	1.99	0.45
1:D:449:GLY:HA3	1:D:466:GLY:O	2.17	0.45
1:D:275:ASN:ND2	1:D:430:ALA:HB3	2.32	0.45
1:B:443:SER:HA	1:B:451:VAL:HG11	1.97	0.45
1:D:41:ASN:ND2	1:D:41:ASN:C	2.75	0.45
1:D:498:LYS:HD2	1:D:498:LYS:C	2.41	0.45
1:H:172:LEU:HD21	1:H:200:THR:HB	1.98	0.45
1:H:432:PHE:HA	1:H:454:ASN:OD1	2.17	0.45
1:A:449:GLY:HA3	1:A:466:GLY:O	2.17	0.45
1:C:131:TYR:CE1	1:C:462:GLN:HG3	2.51	0.45
1:E:21:GLN:HB3	1:E:29:HIS:O	2.17	0.45
1:G:196:GLN:HE21	1:G:196:GLN:N	2.06	0.45
1:A:466:GLY:HA3	1:A:475:ARG:HD3	1.98	0.44
1:A:395:ILE:HG12	4:A:1754:HOH:O	2.17	0.44
1:D:272:LYS:HD2	1:D:306:SER:OG	2.17	0.44
1:E:449:GLY:HA3	1:E:466:GLY:O	2.17	0.44
1:H:170:PHE:HB3	1:H:173:LEU:HB3	1.99	0.44
1:F:143:THR:OG1	1:G:141:GLY:HA3	2.17	0.44
1:H:166:ILE:HD11	1:H:193:VAL:HG12	1.99	0.44
1:C:498:LYS:C	1:C:498:LYS:HD2	2.43	0.44
1:E:149:ASP:HA	1:E:498:LYS:HB2	2.00	0.44
1:E:417:VAL:HG22	1:E:442:LEU:HD23	1.98	0.44
1:G:158:PRO:HG3	1:G:185:THR:O	2.18	0.44
1:H:291:HIS:CE1	1:H:329:ARG:HD2	2.52	0.44
1:A:295:PHE:HE1	1:A:405:MET:CE	2.31	0.44
1:B:499:ASN:H	1:D:444:GLN:NE2	2.15	0.44
1:G:449:GLY:HA3	1:G:466:GLY:O	2.17	0.44
1:G:462:GLN:HB3	1:H:144:ILE:CG2	2.48	0.44
1:E:272:LYS:HD2	1:E:306:SER:OG	2.17	0.44
1:E:490:THR:OG1	1:F:464:PRO:HG2	2.18	0.44
1:H:165:ILE:HG22	3:H:8502:NAD:H4B	1.99	0.44
1:A:166:ILE:HD11	1:A:193:VAL:HG12	2.00	0.43
1:D:389:VAL:HB	1:D:408:LEU:HG	1.99	0.43
1:D:443:SER:HA	1:D:451:VAL:HG11	1.99	0.43
1:E:443:SER:HA	1:E:451:VAL:HG11	2.00	0.43
1:H:22:ILE:HG12	1:H:222:PRO:HD2	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:102:LEU:HD21	1:H:203:TYR:CD2	2.49	0.43
1:A:238:VAL:O	1:A:263:LYS:HE3	2.17	0.43
1:B:205:ALA:HB2	1:B:220:ILE:CD1	2.47	0.43
1:C:310:VAL:HG21	1:C:318:PHE:CD2	2.53	0.43
1:D:294:LEU:HD23	1:D:306:SER:HA	1.99	0.43
1:E:278:MET:HE3	4:E:5667:HOH:O	2.17	0.43
1:H:408:LEU:HD12	1:H:408:LEU:N	2.33	0.43
1:A:214:PRO:HA	1:A:215:PRO:HD3	1.89	0.43
1:G:174:MET:HE2	1:G:174:MET:HA	2.00	0.43
1:F:15:PRO:HG2	1:F:108:LEU:HD22	2.01	0.43
1:H:193:VAL:HG11	1:H:201:ALA:CB	2.49	0.43
1:A:149:ASP:HA	1:A:498:LYS:HB2	2.00	0.43
1:B:348:THR:O	1:B:352:LYS:HG3	2.19	0.43
1:D:12:ASN:O	1:D:15:PRO:HD3	2.18	0.43
1:F:494:LYS:HE3	4:H:8619:HOH:O	2.19	0.43
1:B:449:GLY:HA3	1:B:466:GLY:O	2.19	0.43
1:F:498:LYS:HE2	1:F:498:LYS:HB3	1.84	0.43
1:G:424:THR:HB	1:G:470:MET:HE3	2.00	0.43
1:D:332:GLY:O	1:D:380:PHE:HE2	2.02	0.43
1:F:135:TRP:CD1	1:H:138:LYS:HE3	2.54	0.43
1:E:323:VAL:O	1:E:327:LYS:HG3	2.18	0.43
1:H:15:PRO:HG2	1:H:108:LEU:HD22	2.01	0.43
1:A:410:PHE:CD1	1:A:416:VAL:HB	2.54	0.42
1:E:408:LEU:N	1:E:408:LEU:HD12	2.34	0.42
1:H:294:LEU:HD23	1:H:306:SER:HA	2.00	0.42
1:B:113:PRO:HB2	1:B:116:ILE:HG12	2.01	0.42
1:B:159:VAL:HG12	1:B:187:ASN:OD1	2.19	0.42
1:B:183:LEU:HD13	1:B:213:PHE:CE2	2.53	0.42
1:G:248:GLU:HG3	4:G:7603:HOH:O	2.19	0.42
1:G:249:ILE:O	1:G:253:ILE:HG12	2.19	0.42
1:H:214:PRO:HA	1:H:215:PRO:HD3	1.88	0.42
1:H:449:GLY:HA3	1:H:466:GLY:O	2.19	0.42
1:C:449:GLY:HA3	1:C:466:GLY:O	2.19	0.42
1:E:389:VAL:HB	1:E:408:LEU:HG	2.01	0.42
1:H:13:GLN:HA	1:H:335:PHE:CZ	2.55	0.42
1:D:21:GLN:HB3	1:D:29:HIS:O	2.19	0.42
1:E:34:ARG:HE	1:E:34:ARG:HB3	1.27	0.42
1:G:238:VAL:O	1:G:263:LYS:HE3	2.18	0.42
1:H:349:GLN:O	1:H:353:ILE:HG13	2.19	0.42
1:B:442:LEU:O	1:B:446:LEU:HG	2.19	0.42
1:C:241:VAL:HG13	1:C:265:VAL:HG22	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:G:247:THR:HA	1:G:269:LEU:HD13	2.01	0.42
1:H:466:GLY:HA3	1:H:475:ARG:HD3	2.01	0.42
1:A:113:PRO:HB2	1:A:116:ILE:HG12	2.01	0.42
1:A:430:ALA:HB2	1:A:456:TYR:CD1	2.55	0.42
1:C:291:HIS:HD2	4:C:3594:HOH:O	2.02	0.42
1:C:303:CYS:SG	1:C:459:PHE:HZ	2.42	0.42
1:E:372:GLY:O	1:E:382:GLN:HG3	2.20	0.42
1:G:490:THR:OG1	1:H:464:PRO:HG2	2.19	0.42
1:H:413:ILE:O	1:H:416:VAL:HG12	2.19	0.42
1:B:333:ASN:HB3	1:B:336:ASP:OD2	2.20	0.42
1:C:443:SER:HA	1:C:451:VAL:HG11	2.02	0.42
1:E:167:PRO:HD3	1:E:244:THR:HB	2.02	0.42
1:G:86:ARG:HD2	4:G:7619:HOH:O	2.19	0.42
1:C:372:GLY:O	1:C:382:GLN:HG3	2.20	0.41
1:D:12:ASN:C	1:D:14:GLN:H	2.28	0.41
1:G:59:VAL:O	1:G:63:VAL:HG23	2.20	0.41
1:A:368:LEU:HD12	1:A:385:VAL:HG12	2.02	0.41
1:E:279:SER:HA	1:E:314:ILE:HD13	2.03	0.41
1:H:32:VAL:HG23	1:H:58:ASP:OD1	2.20	0.41
1:H:158:PRO:HG3	1:H:185:THR:O	2.20	0.41
1:B:294:LEU:C	1:B:294:LEU:HD13	2.45	0.41
1:D:41:ASN:HD22	1:D:43:SER:H	1.66	0.41
1:H:333:ASN:HA	1:H:334:PRO:HD2	1.94	0.41
1:C:333:ASN:HA	1:C:334:PRO:HD2	1.95	0.41
1:D:464:PRO:HA	1:D:476:GLU:O	2.20	0.41
1:F:352:LYS:HB2	1:F:352:LYS:HE3	1.76	0.41
1:G:111:GLY:O	1:G:343:PRO:HD2	2.20	0.41
1:F:111:GLY:O	1:F:343:PRO:HD2	2.21	0.41
1:G:476:GLU:O	1:G:477:LEU:HB2	2.20	0.41
1:A:8:VAL:HA	1:A:9:PRO:HD3	1.94	0.41
1:C:16:GLU:O	1:C:101:TYR:OH	2.38	0.41
1:F:193:VAL:HG11	1:F:201:ALA:CB	2.51	0.41
1:G:174:MET:HE1	1:G:177:TRP:CE3	2.56	0.41
1:G:351:LYS:HB3	1:G:351:LYS:HE2	1.90	0.41
1:E:294:LEU:C	1:E:294:LEU:HD13	2.46	0.41
1:F:21:GLN:HB3	1:F:29:HIS:O	2.21	0.41
1:C:476:GLU:O	1:C:477:LEU:HB2	2.21	0.40
1:D:214:PRO:HA	1:D:215:PRO:HD3	1.91	0.40
1:F:238:VAL:O	1:F:263:LYS:HE3	2.20	0.40
1:F:476:GLU:O	1:F:477:LEU:HB2	2.21	0.40
1:H:464:PRO:HA	1:H:476:GLU:O	2.21	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:498:LYS:HE2	1:H:498:LYS:HB3	1.95	0.40
1:A:408:LEU:HD12	1:A:408:LEU:N	2.36	0.40
1:C:431:VAL:HG21	1:C:442:LEU:HB3	2.03	0.40
1:D:169:ASN:ND2	1:D:170:PHE:CD1	2.88	0.40
1:G:185:THR:HG23	1:G:482:LEU:HD22	2.02	0.40
1:A:295:PHE:HE1	1:A:405:MET:HE3	1.86	0.40
1:C:23:PHE:HB2	1:C:28:TRP:CZ3	2.56	0.40
1:D:172:LEU:HD21	1:D:200:THR:HB	2.02	0.40
1:H:196:GLN:OE1	1:H:196:GLN:N	2.54	0.40
1:H:294:LEU:HD13	1:H:294:LEU:C	2.47	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	492/500 (98%)	475 (96%)	17 (4%)	0	100	100
1	B	492/500 (98%)	476 (97%)	16 (3%)	0	100	100
1	C	492/500 (98%)	475 (96%)	17 (4%)	0	100	100
1	D	492/500 (98%)	475 (96%)	16 (3%)	1 (0%)	43	54
1	E	492/500 (98%)	474 (96%)	17 (4%)	1 (0%)	43	54
1	F	492/500 (98%)	476 (97%)	16 (3%)	0	100	100
1	G	492/500 (98%)	478 (97%)	13 (3%)	1 (0%)	43	54
1	H	492/500 (98%)	473 (96%)	19 (4%)	0	100	100
All	All	3936/4000 (98%)	3802 (97%)	131 (3%)	3 (0%)	48	61

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	13	GLN
1	E	426	GLY
1	G	426	GLY

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	399/402 (99%)	396 (99%)	3 (1%)	73	83
1	B	399/402 (99%)	397 (100%)	2 (0%)	81	87
1	C	399/402 (99%)	398 (100%)	1 (0%)	86	91
1	D	399/402 (99%)	394 (99%)	5 (1%)	61	73
1	E	399/402 (99%)	395 (99%)	4 (1%)	68	77
1	F	399/402 (99%)	396 (99%)	3 (1%)	73	83
1	G	399/402 (99%)	396 (99%)	3 (1%)	73	83
1	H	399/402 (99%)	398 (100%)	1 (0%)	86	91
All	All	3192/3216 (99%)	3170 (99%)	22 (1%)	76	84

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

Mol	Chain	Res	Type
1	A	333	ASN
1	A	401	PHE
1	A	408	LEU
1	B	192	LYS
1	B	401	PHE
1	C	401	PHE
1	D	41	ASN
1	D	192	LYS
1	D	196	GLN
1	D	377	ARG
1	D	401	PHE
1	E	32	VAL
1	E	34	ARG

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Mol	Chain	Res	Type
1	E	192	LYS
1	E	401	PHE
1	F	192	LYS
1	F	376	ASP
1	F	401	PHE
1	G	192	LYS
1	G	196	GLN
1	G	401	PHE
1	H	401	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (49) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	13	GLN
1	A	50	GLN
1	A	275	ASN
1	A	333	ASN
1	A	341	GLN
1	A	483	GLN
1	B	71	GLN
1	B	83	HIS
1	B	175	GLN
1	B	275	ASN
1	B	422	ASN
1	B	440	ASN
1	C	13	GLN
1	C	29	HIS
1	C	175	GLN
1	C	291	HIS
1	C	483	GLN
1	D	13	GLN
1	D	26	ASN
1	D	41	ASN
1	D	71	GLN
1	D	89	ASN
1	D	140	HIS
1	D	196	GLN
1	D	275	ASN
1	D	289	GLN
1	D	444	GLN
1	E	83	HIS
1	E	164	GLN

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Mol	Chain	Res	Type
1	E	254	GLN
1	E	390	GLN
1	E	440	ASN
1	E	444	GLN
1	E	483	GLN
1	F	175	GLN
1	F	406	GLN
1	G	13	GLN
1	G	50	GLN
1	G	89	ASN
1	G	196	GLN
1	G	275	ASN
1	G	422	ASN
1	H	13	GLN
1	H	29	HIS
1	H	50	GLN
1	H	71	GLN
1	H	291	HIS
1	H	390	GLN
1	H	483	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](#)

Of 16 ligands modelled in this entry, 8 are monoatomic - leaving 8 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	D	4502	-	28,29,48	1.53	4 (14%)	43,45,73	1.47	7 (16%)
3	NAD	C	3502	-	28,29,48	1.47	4 (14%)	43,45,73	1.40	6 (13%)
3	NAD	E	5502	-	28,29,48	1.53	4 (14%)	43,45,73	1.61	8 (18%)
3	NAD	H	8502	-	28,29,48	1.59	5 (17%)	43,45,73	1.54	9 (20%)
3	NAD	F	6502	-	28,29,48	1.52	4 (14%)	43,45,73	1.47	7 (16%)
3	NAD	B	2502	-	28,29,48	1.54	4 (14%)	43,45,73	1.47	7 (16%)
3	NAD	A	1502	-	28,29,48	1.56	5 (17%)	43,45,73	1.41	7 (16%)
3	NAD	G	7502	-	28,29,48	1.49	4 (14%)	43,45,73	1.42	8 (18%)

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	D	4502	-	-	4/16/32/62	0/3/3/5
3	NAD	C	3502	-	-	4/16/32/62	0/3/3/5
3	NAD	E	5502	-	-	4/16/32/62	0/3/3/5
3	NAD	H	8502	-	-	4/16/32/62	0/3/3/5
3	NAD	F	6502	-	-	4/16/32/62	0/3/3/5
3	NAD	B	2502	-	-	4/16/32/62	0/3/3/5
3	NAD	A	1502	-	-	4/16/32/62	0/3/3/5
3	NAD	G	7502	-	-	4/16/32/62	0/3/3/5

All (34) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	5502	NAD	C8A-N7A	4.70	1.40	1.31
3	F	6502	NAD	C8A-N7A	4.44	1.40	1.31
3	H	8502	NAD	C8A-N7A	4.34	1.40	1.31
3	B	2502	NAD	C8A-N7A	4.30	1.39	1.31
3	A	1502	NAD	C8A-N7A	4.25	1.39	1.31
3	D	4502	NAD	C8A-N7A	4.22	1.39	1.31
3	C	3502	NAD	C8A-N7A	4.21	1.39	1.31
3	G	7502	NAD	C8A-N7A	3.94	1.39	1.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	G	7502	NAD	C2A-N1A	3.51	1.40	1.33
3	F	6502	NAD	C2A-N1A	3.44	1.40	1.33
3	H	8502	NAD	C2A-N1A	3.32	1.39	1.33
3	H	8502	NAD	C2A-N3A	3.32	1.39	1.33
3	A	1502	NAD	C2A-N1A	3.30	1.39	1.33
3	A	1502	NAD	C2A-N3A	3.26	1.39	1.33
3	F	6502	NAD	C2A-N3A	3.18	1.39	1.33
3	B	2502	NAD	C2A-N3A	3.18	1.39	1.33
3	E	5502	NAD	C2A-N3A	3.11	1.39	1.33
3	H	8502	NAD	PN-O5D	3.08	1.66	1.54
3	B	2502	NAD	C2A-N1A	3.07	1.39	1.33
3	D	4502	NAD	C2A-N1A	3.05	1.39	1.33
3	E	5502	NAD	C2A-N1A	2.98	1.39	1.33
3	D	4502	NAD	C2A-N3A	2.97	1.39	1.33
3	B	2502	NAD	PN-O5D	2.97	1.65	1.54
3	C	3502	NAD	C2A-N3A	2.93	1.39	1.33
3	C	3502	NAD	C2A-N1A	2.81	1.38	1.33
3	G	7502	NAD	C2A-N3A	2.80	1.38	1.33
3	F	6502	NAD	PN-O5D	2.65	1.64	1.54
3	C	3502	NAD	PN-O5D	2.64	1.64	1.54
3	E	5502	NAD	PN-O5D	2.55	1.64	1.54
3	G	7502	NAD	PN-O5D	2.51	1.64	1.54
3	A	1502	NAD	PN-O5D	2.50	1.64	1.54
3	H	8502	NAD	C4A-N3A	2.47	1.39	1.34
3	D	4502	NAD	PN-O5D	2.43	1.63	1.54
3	A	1502	NAD	C4A-N3A	2.41	1.38	1.34

All (59) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	5502	NAD	C5A-C4A-N9A	4.54	110.76	105.81
3	F	6502	NAD	C5A-C4A-N9A	4.25	110.44	105.81
3	B	2502	NAD	C5A-C4A-N9A	4.18	110.37	105.81
3	D	4502	NAD	C5A-C4A-N9A	4.13	110.32	105.81
3	H	8502	NAD	N3A-C2A-N1A	-4.07	122.42	128.58
3	E	5502	NAD	N3A-C2A-N1A	-4.07	122.42	128.58
3	C	3502	NAD	C5A-C4A-N9A	3.98	110.15	105.81
3	A	1502	NAD	N3A-C2A-N1A	-3.93	122.64	128.58
3	G	7502	NAD	N3A-C2A-N1A	-3.84	122.77	128.58
3	H	8502	NAD	C2B-C3B-C4B	-3.81	95.25	102.61
3	D	4502	NAD	N3A-C2A-N1A	-3.79	122.85	128.58
3	H	8502	NAD	C5A-C4A-N9A	3.76	109.91	105.81

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	2502	NAD	N3A-C2A-N1A	-3.75	122.91	128.58
3	C	3502	NAD	N3A-C2A-N1A	-3.69	123.00	128.58
3	G	7502	NAD	C5A-C4A-N9A	3.66	109.80	105.81
3	F	6502	NAD	N3A-C2A-N1A	-3.60	123.13	128.58
3	A	1502	NAD	C5A-C4A-N9A	3.59	109.73	105.81
3	E	5502	NAD	C2B-C3B-C4B	-3.45	95.95	102.61
3	A	1502	NAD	C2B-C3B-C4B	-3.35	96.13	102.61
3	H	8502	NAD	O4B-C1B-C2B	-3.28	99.61	106.62
3	D	4502	NAD	C2B-C3B-C4B	-3.16	96.50	102.61
3	F	6502	NAD	C2B-C3B-C4B	-3.07	96.67	102.61
3	G	7502	NAD	C2B-C3B-C4B	-3.07	96.68	102.61
3	B	2502	NAD	C2B-C3B-C4B	-3.05	96.71	102.61
3	G	7502	NAD	O4B-C1B-C2B	-3.01	100.18	106.62
3	E	5502	NAD	C4A-N9A-C8A	-2.98	102.61	105.74
3	E	5502	NAD	O4B-C1B-C2B	-2.89	100.43	106.62
3	F	6502	NAD	O4B-C1B-C2B	-2.88	100.44	106.62
3	E	5502	NAD	C5A-C4A-N3A	-2.82	122.83	126.72
3	A	1502	NAD	O4B-C1B-C2B	-2.73	100.77	106.62
3	E	5502	NAD	C6A-C5A-C4A	2.67	120.83	117.18
3	H	8502	NAD	C6A-C5A-C4A	2.67	120.83	117.18
3	C	3502	NAD	O4B-C1B-C2B	-2.66	100.93	106.62
3	D	4502	NAD	O4B-C1B-C2B	-2.66	100.93	106.62
3	D	4502	NAD	C6A-C5A-C4A	2.62	120.76	117.18
3	F	6502	NAD	C6A-C5A-C4A	2.61	120.74	117.18
3	C	3502	NAD	C6A-C5A-C4A	2.54	120.65	117.18
3	B	2502	NAD	C6A-C5A-C4A	2.54	120.65	117.18
3	C	3502	NAD	C5A-C4A-N3A	-2.53	123.23	126.72
3	F	6502	NAD	C4A-N9A-C8A	-2.50	103.12	105.74
3	A	1502	NAD	C6A-C5A-C4A	2.47	120.55	117.18
3	G	7502	NAD	C6A-C5A-C4A	2.44	120.51	117.18
3	H	8502	NAD	C5A-C4A-N3A	-2.43	123.37	126.72
3	D	4502	NAD	C5A-C4A-N3A	-2.43	123.37	126.72
3	B	2502	NAD	O4B-C1B-C2B	-2.40	101.48	106.62
3	D	4502	NAD	C4A-N9A-C8A	-2.38	103.24	105.74
3	B	2502	NAD	C4A-N9A-C8A	-2.36	103.26	105.74
3	B	2502	NAD	C5A-C4A-N3A	-2.36	123.47	126.72
3	H	8502	NAD	C4A-N9A-C8A	-2.27	103.36	105.74
3	E	5502	NAD	O2A-PA-O3	2.26	113.38	107.27
3	F	6502	NAD	C5A-C4A-N3A	-2.22	123.66	126.72
3	C	3502	NAD	O5B-C5B-C4B	2.18	116.40	108.99
3	A	1502	NAD	C4A-N9A-C8A	-2.16	103.47	105.74
3	G	7502	NAD	C4A-N9A-C8A	-2.08	103.55	105.74

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	G	7502	NAD	C6A-C5A-N7A	-2.08	128.08	132.09
3	H	8502	NAD	O4B-C4B-C3B	2.07	109.25	105.15
3	A	1502	NAD	C5A-C4A-N3A	-2.05	123.89	126.72
3	G	7502	NAD	C5A-C4A-N3A	-2.04	123.90	126.72
3	H	8502	NAD	C6A-C5A-N7A	-2.03	128.18	132.09

There are no chirality outliers.

All (32) torsion outliers are listed below:

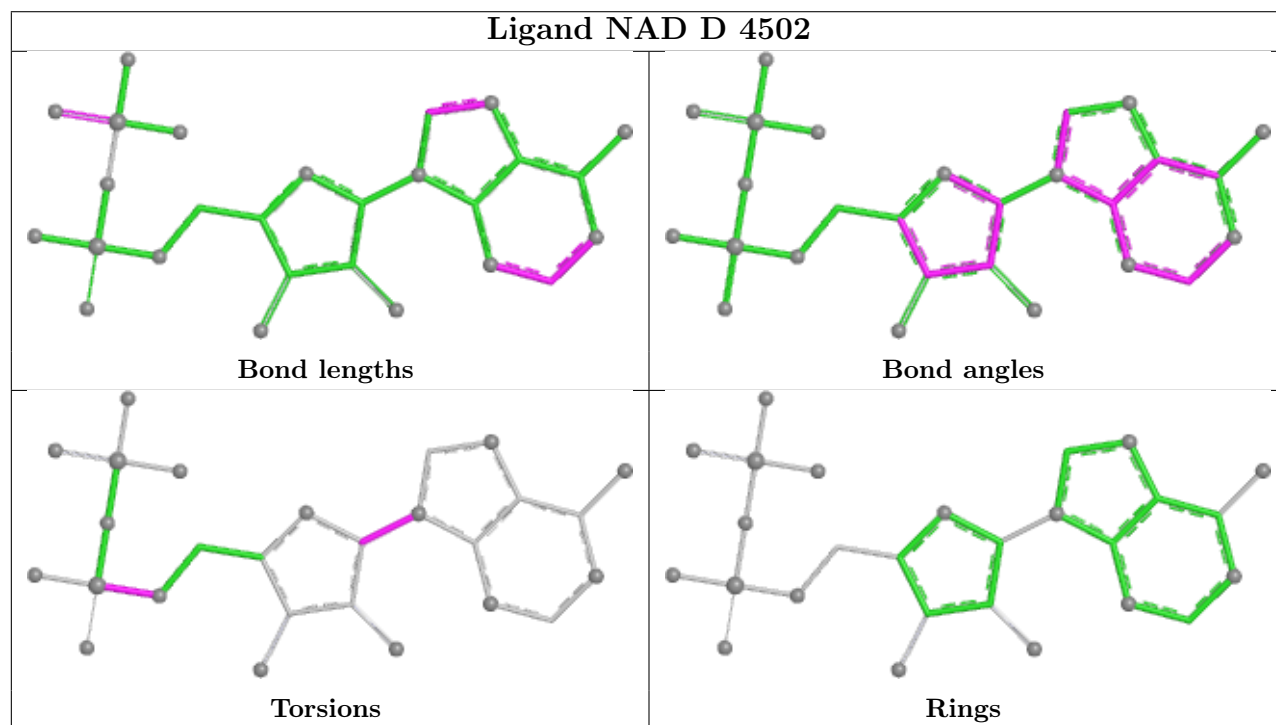
Mol	Chain	Res	Type	Atoms
3	G	7502	NAD	C5B-O5B-PA-O1A
3	A	1502	NAD	C2B-C1B-N9A-C8A
3	B	2502	NAD	C2B-C1B-N9A-C8A
3	C	3502	NAD	C2B-C1B-N9A-C8A
3	D	4502	NAD	C2B-C1B-N9A-C8A
3	E	5502	NAD	C2B-C1B-N9A-C8A
3	F	6502	NAD	C2B-C1B-N9A-C8A
3	G	7502	NAD	C2B-C1B-N9A-C8A
3	H	8502	NAD	C2B-C1B-N9A-C8A
3	A	1502	NAD	C5B-O5B-PA-O1A
3	B	2502	NAD	C5B-O5B-PA-O1A
3	C	3502	NAD	C5B-O5B-PA-O1A
3	D	4502	NAD	C5B-O5B-PA-O1A
3	E	5502	NAD	C5B-O5B-PA-O1A
3	F	6502	NAD	C5B-O5B-PA-O1A
3	H	8502	NAD	C5B-O5B-PA-O1A
3	B	2502	NAD	O4B-C1B-N9A-C8A
3	C	3502	NAD	C2B-C1B-N9A-C4A
3	F	6502	NAD	C2B-C1B-N9A-C4A
3	A	1502	NAD	O4B-C1B-N9A-C8A
3	C	3502	NAD	O4B-C1B-N9A-C8A
3	D	4502	NAD	O4B-C1B-N9A-C8A
3	E	5502	NAD	O4B-C1B-N9A-C8A
3	F	6502	NAD	O4B-C1B-N9A-C8A
3	G	7502	NAD	O4B-C1B-N9A-C8A
3	H	8502	NAD	O4B-C1B-N9A-C8A
3	A	1502	NAD	C2B-C1B-N9A-C4A
3	B	2502	NAD	C2B-C1B-N9A-C4A
3	D	4502	NAD	C2B-C1B-N9A-C4A
3	G	7502	NAD	C2B-C1B-N9A-C4A
3	H	8502	NAD	C2B-C1B-N9A-C4A
3	E	5502	NAD	C2B-C1B-N9A-C4A

There are no ring outliers.

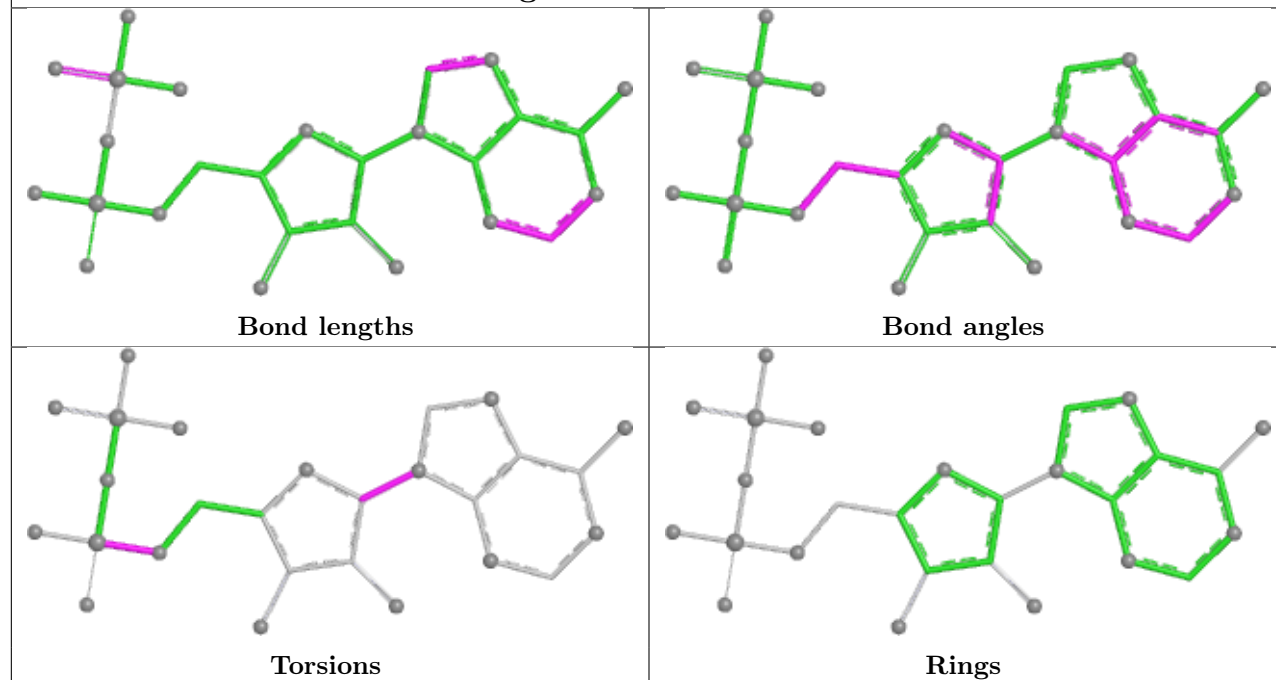
1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	H	8502	NAD	1	0

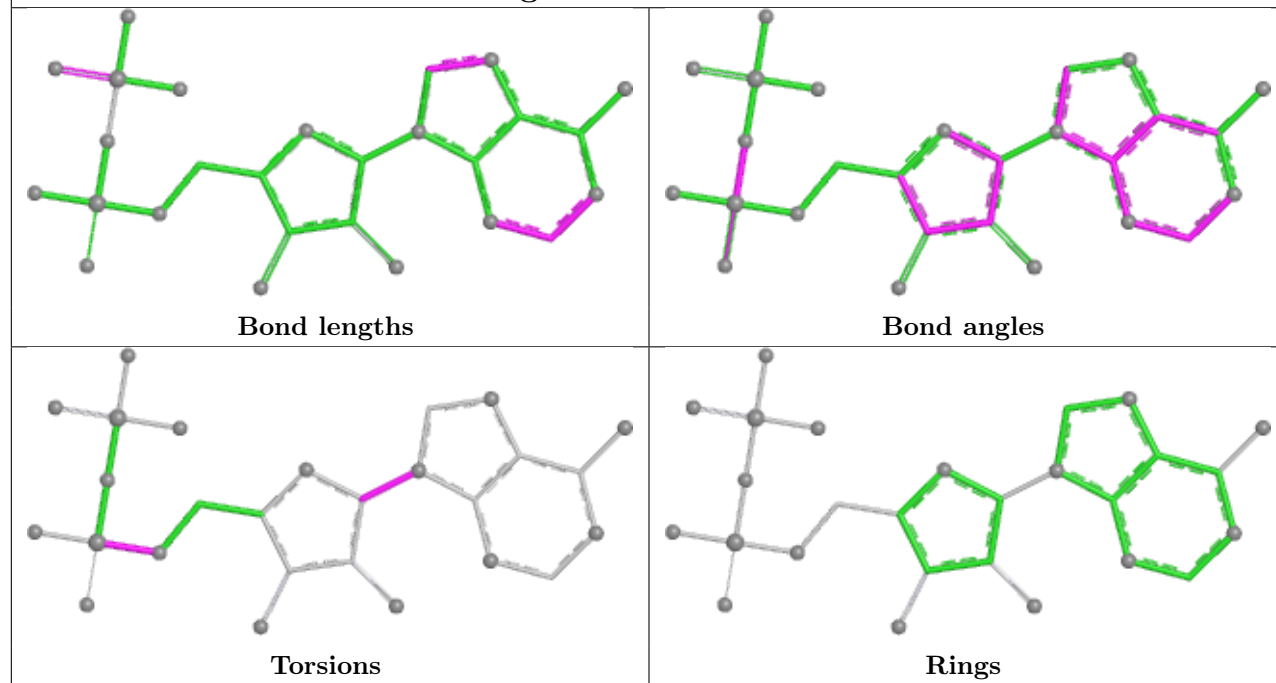
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.



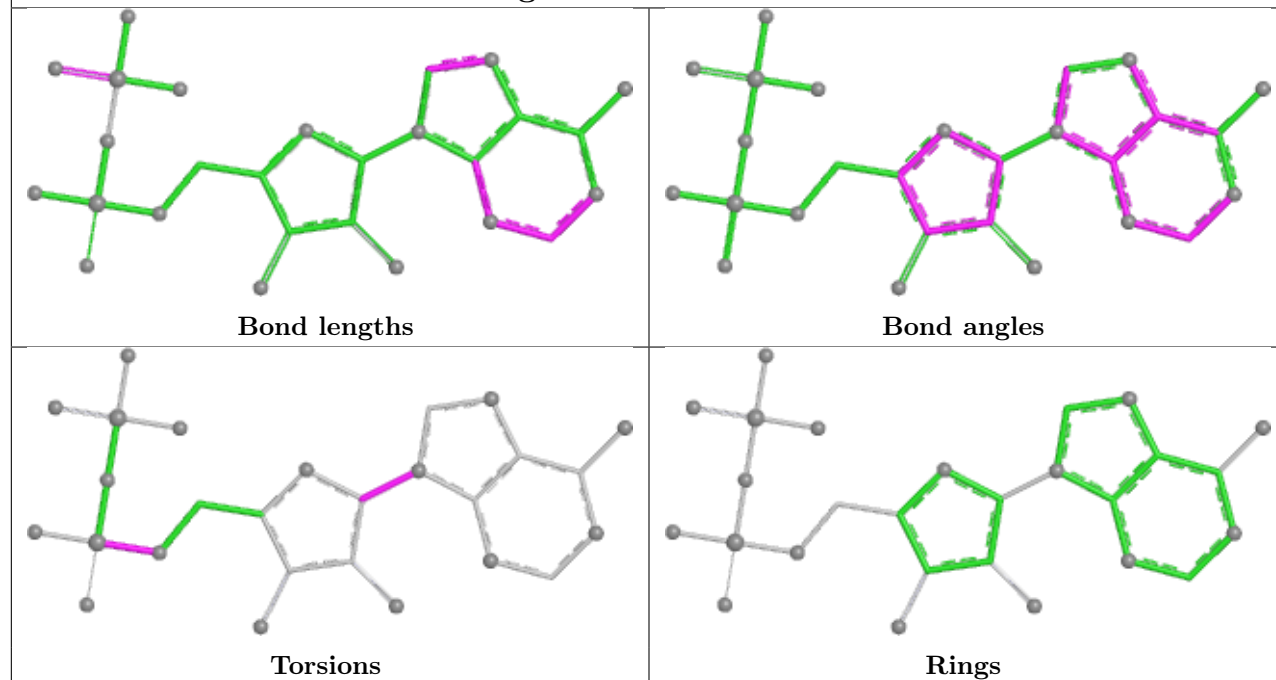
Ligand NAD C 3502



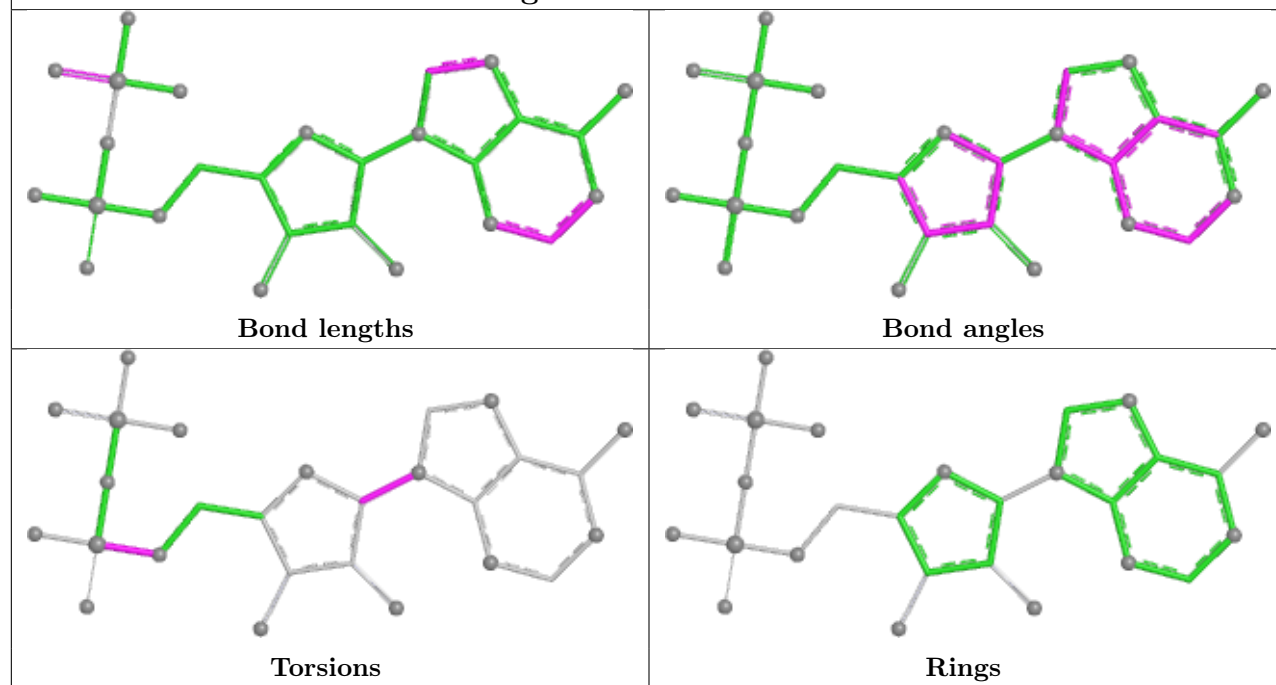
Ligand NAD E 5502



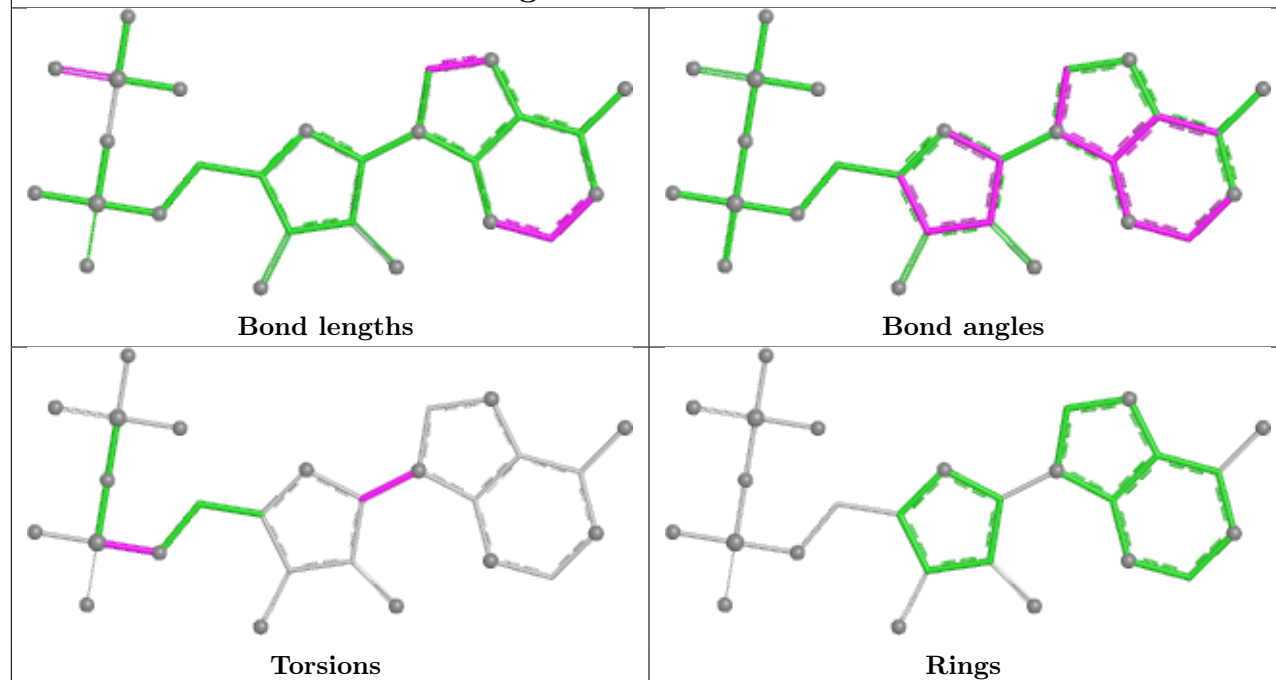
Ligand NAD H 8502



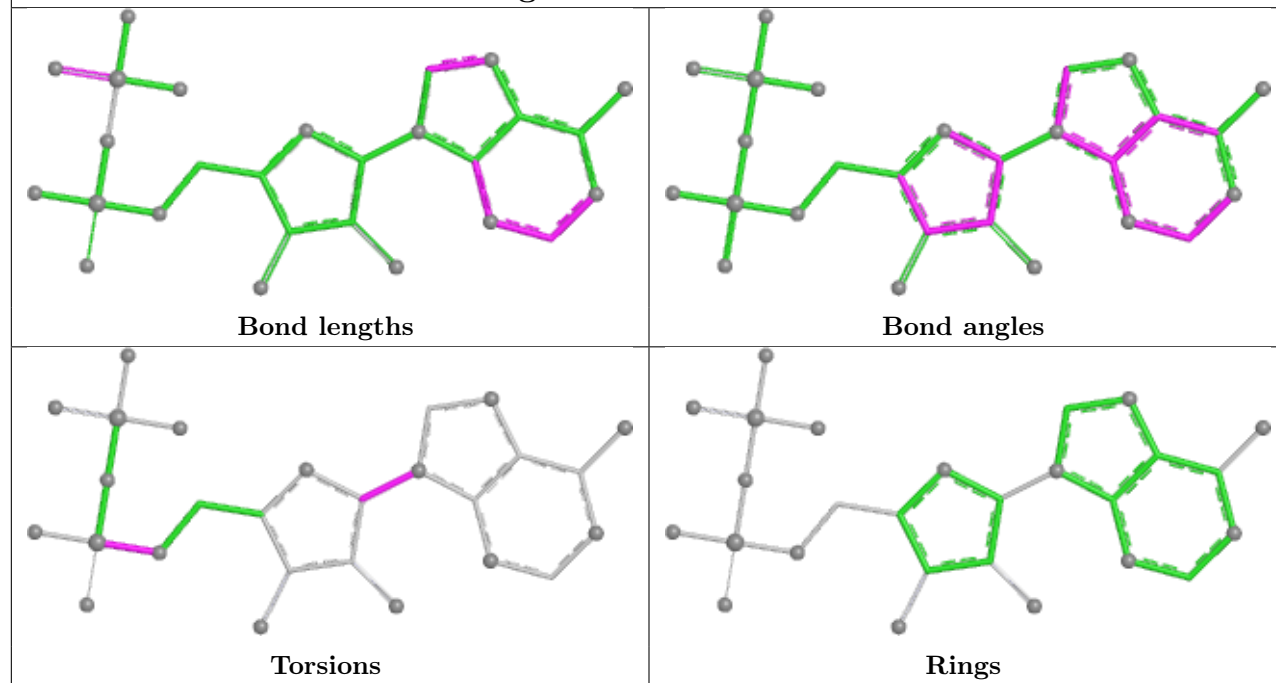
Ligand NAD F 6502

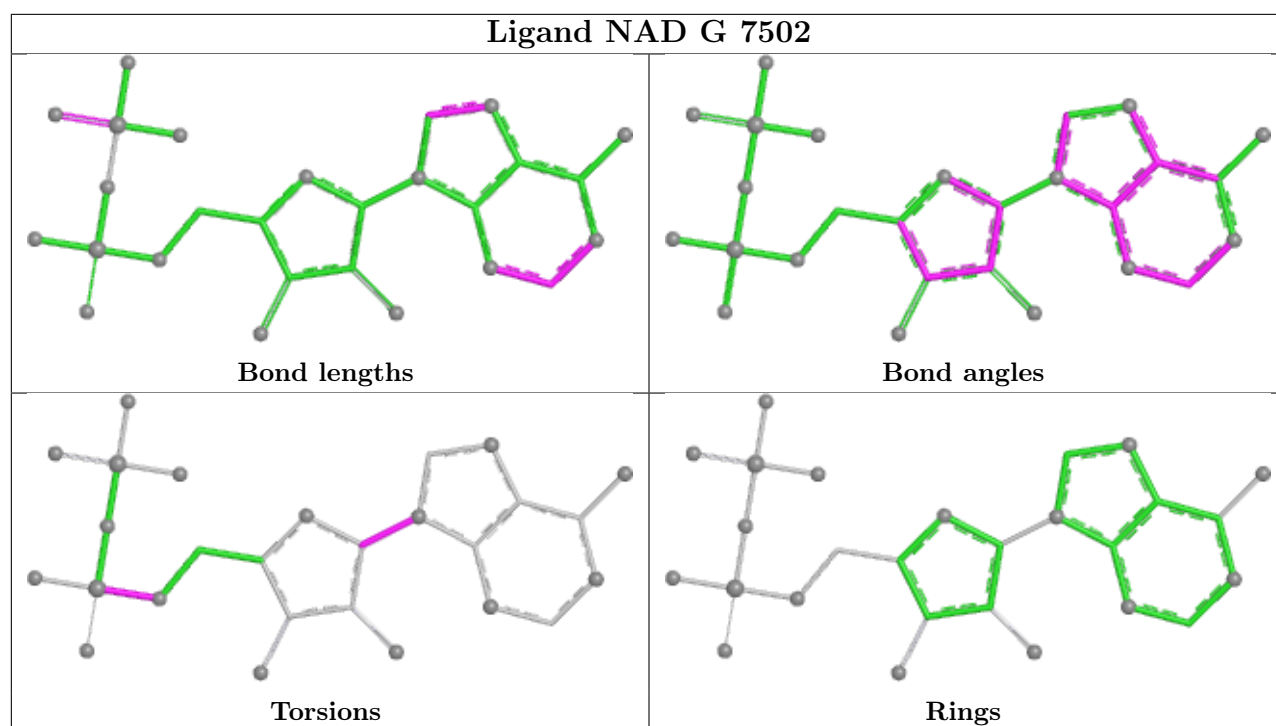


Ligand NAD B 2502



Ligand NAD A 1502





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	494/500 (98%)	-0.29	0 100 100	14, 33, 47, 59	0
1	B	494/500 (98%)	-0.46	1 (0%) 91 92	16, 29, 42, 52	0
1	C	494/500 (98%)	-0.55	0 100 100	13, 26, 38, 48	0
1	D	494/500 (98%)	0.06	5 (1%) 79 80	16, 38, 53, 60	0
1	E	494/500 (98%)	-0.51	0 100 100	13, 28, 42, 56	0
1	F	494/500 (98%)	-0.67	1 (0%) 91 92	14, 24, 35, 48	0
1	G	494/500 (98%)	-0.45	0 100 100	15, 29, 41, 52	0
1	H	494/500 (98%)	-0.09	1 (0%) 91 92	14, 36, 49, 66	0
All	All	3952/4000 (98%)	-0.37	8 (0%) 91 92	13, 29, 47, 66	0

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	332	GLY	2.2
1	H	104	ALA	2.2
1	D	46	GLU	2.1
1	F	248	GLU	2.1
1	D	376	ASP	2.1
1	D	14	GLN	2.0
1	D	47	VAL	2.0
1	B	52	ALA	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

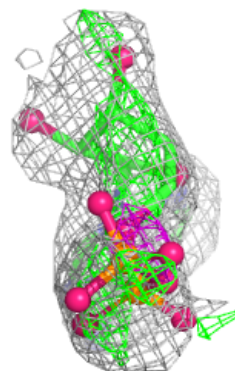
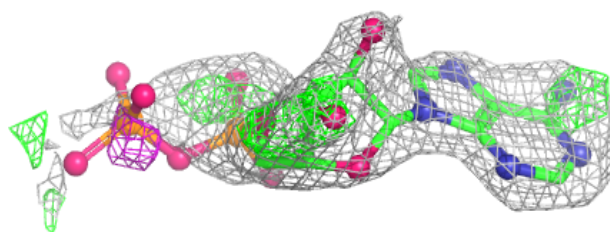
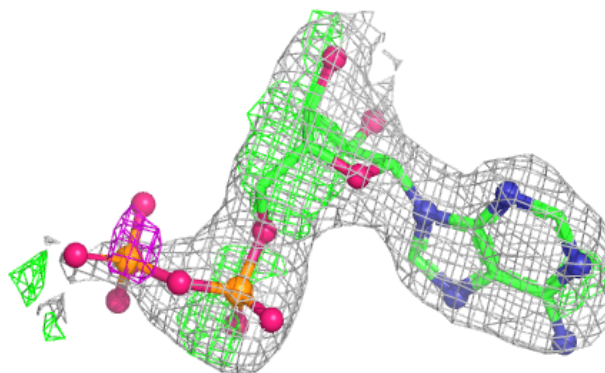
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	NA	D	1704	1/1	0.32	0.24	95,95,95,95	0
2	NA	C	1703	1/1	0.52	0.21	55,55,55,55	0
2	NA	H	1708	1/1	0.61	0.17	55,55,55,55	0
2	NA	A	1701	1/1	0.69	0.08	50,50,50,50	0
3	NAD	H	8502	27/44	0.75	0.22	26,28,45,45	27
3	NAD	A	1502	27/44	0.78	0.17	21,25,38,38	26
3	NAD	G	7502	27/44	0.79	0.20	20,23,35,36	27
3	NAD	B	2502	27/44	0.80	0.19	21,23,37,38	27
2	NA	F	1706	1/1	0.83	0.12	39,39,39,39	0
3	NAD	C	3502	27/44	0.83	0.15	9,15,34,35	27
2	NA	G	1707	1/1	0.85	0.08	33,33,33,33	0
2	NA	B	1702	1/1	0.86	0.14	44,44,44,44	0
3	NAD	E	5502	27/44	0.87	0.16	8,15,32,32	27
3	NAD	F	6502	27/44	0.87	0.14	5,11,27,28	27
2	NA	E	1705	1/1	0.87	0.14	52,52,52,52	0
3	NAD	D	4502	27/44	0.87	0.19	19,27,36,38	27

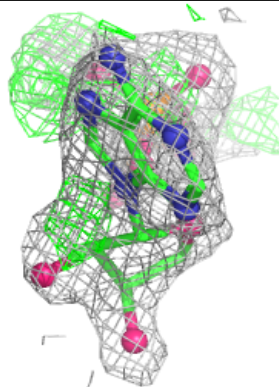
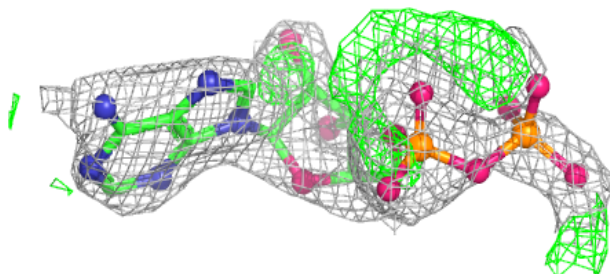
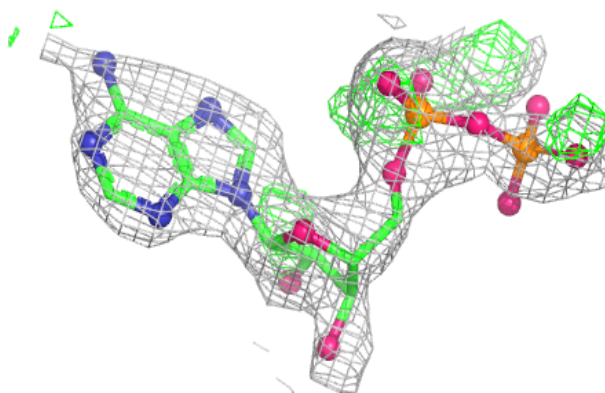
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around NAD H 8502:

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

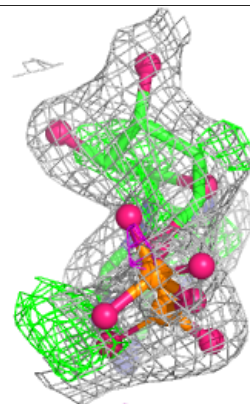
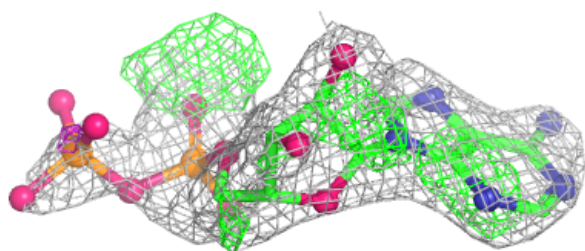
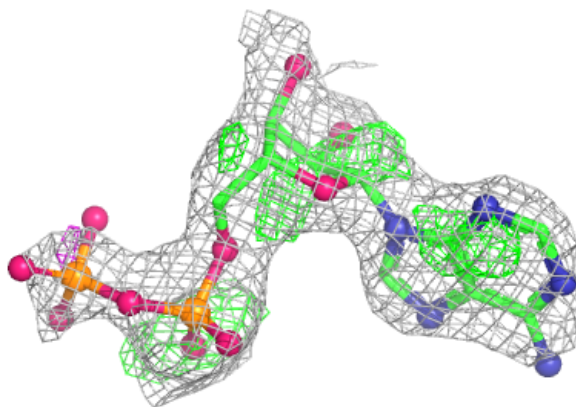
**Electron density around NAD A 1502:**

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

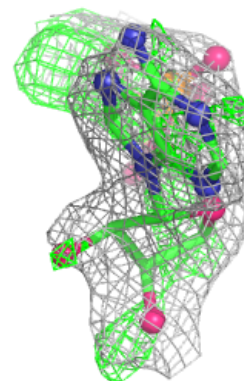
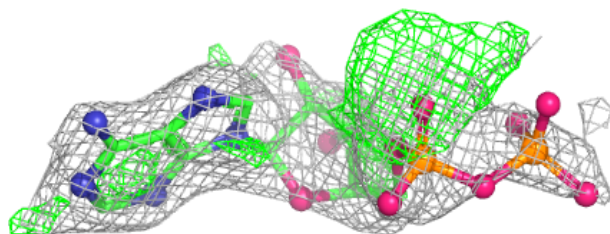
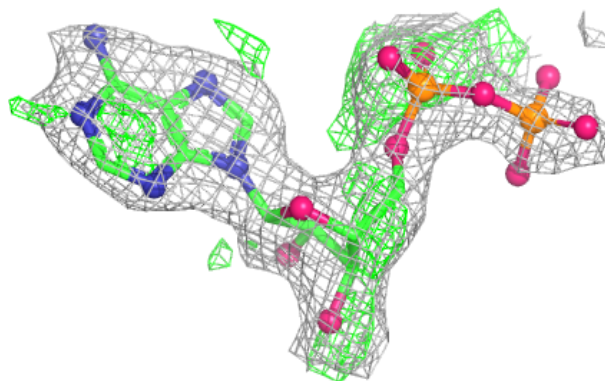


Electron density around NAD G 7502:

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

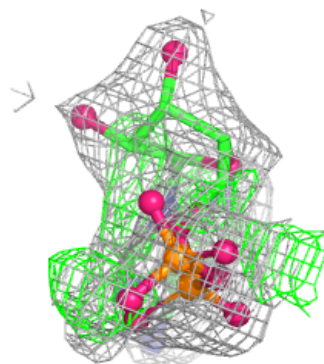
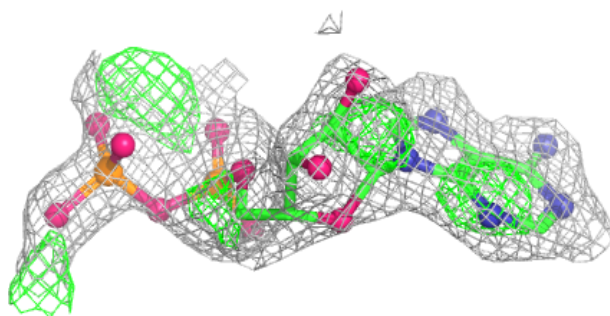
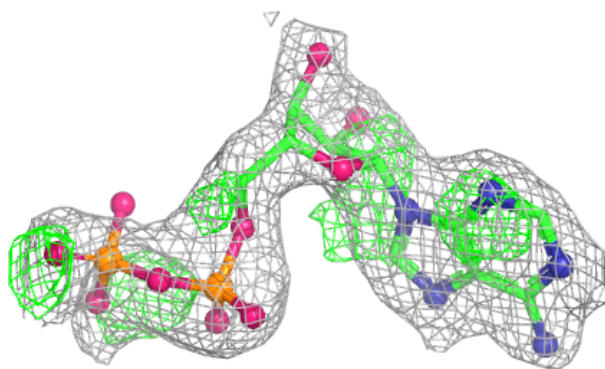
**Electron density around NAD B 2502:**

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

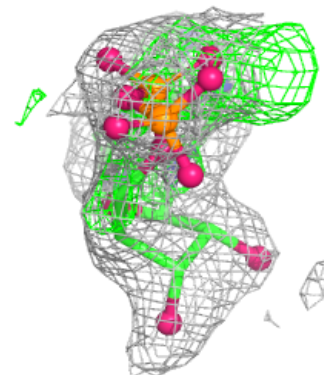
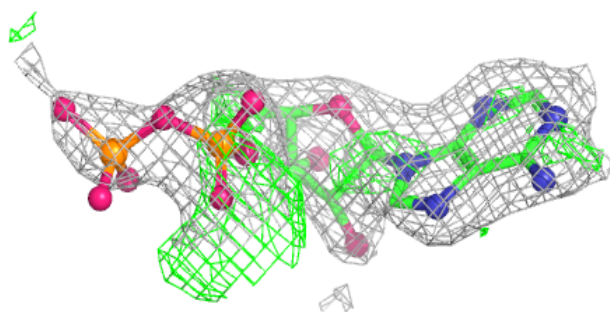
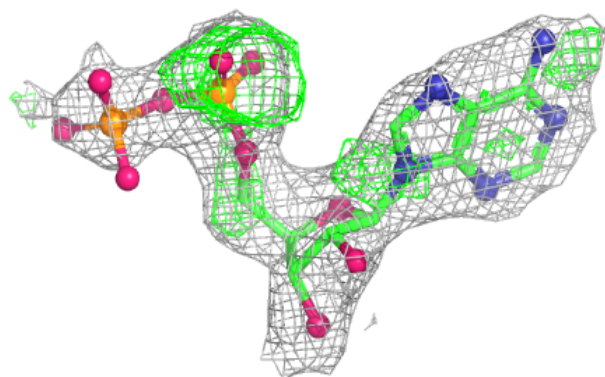


Electron density around NAD C 3502:

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

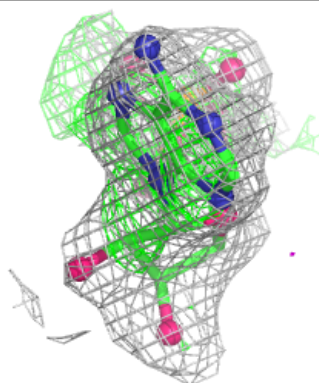
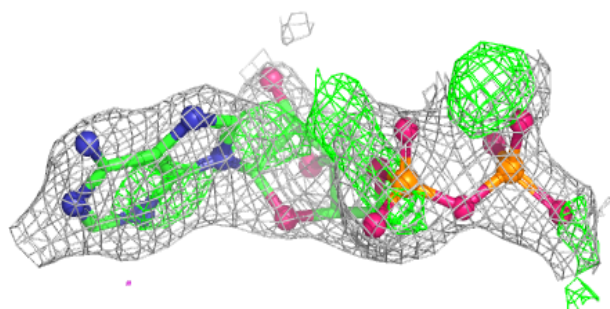
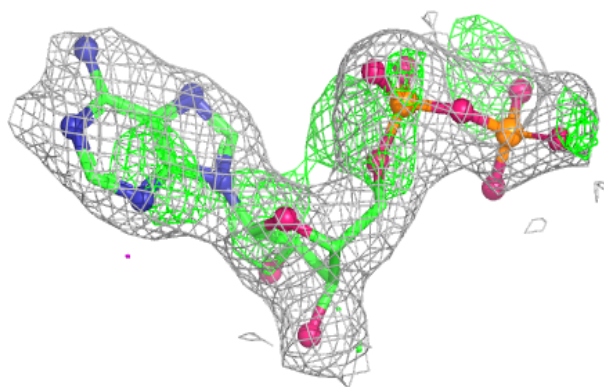
**Electron density around NAD E 5502:**

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

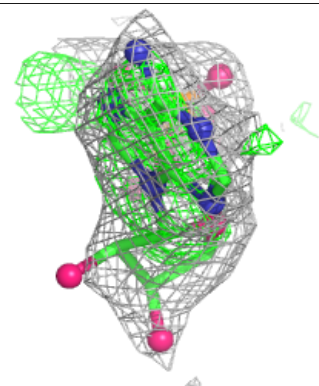
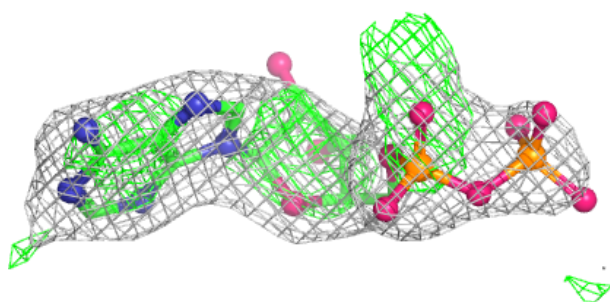
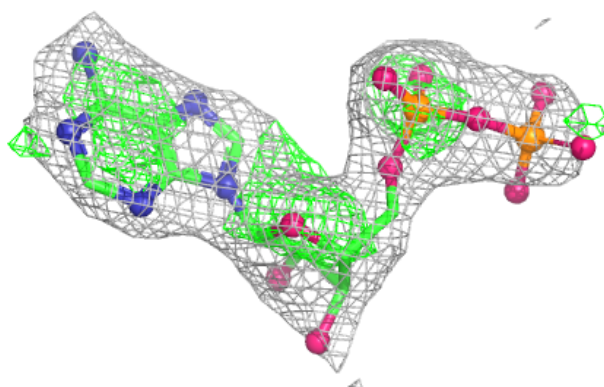


Electron density around NAD F 6502:

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

**Electron density around NAD D 4502:**

$2mF_o-DF_c$ (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.