



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:20 PM UTC

PDB ID : 2A92 / pdb_00002a92
Title : Crystal structure of lactate dehydrogenase from Plasmodium vivax: complex with NADH
Authors : Chaikuad, A.; Fairweather, V.; Connors, R.; Joseph-Horne, T.; Turgut-Balik, D.; Brady, R.L.
Deposited on : 2005-07-11
Resolution : 2.04 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

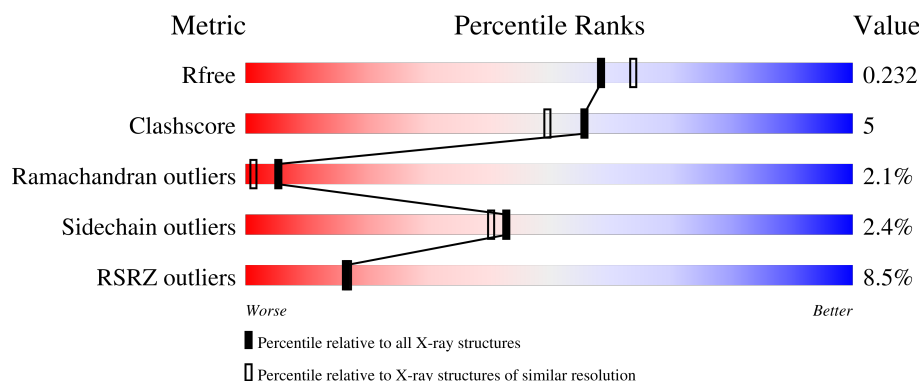
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.04 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	2260 (2.04-2.04)
Clashscore	190562	2333 (2.04-2.04)
Ramachandran outliers	187476	2318 (2.04-2.04)
Sidechain outliers	187428	2318 (2.04-2.04)
RSRZ outliers	180081	2260 (2.04-2.04)

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	321	7% 89% 7% ...
1	B	321	5% 86% 10% ..
1	C	321	10% 88% 11% ..
1	D	321	12% 86% 9% ..

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 10257 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called L-lactate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	316	Total	C	N	O	S	0	4	0
			2404	1535	404	451	14			
1	B	315	Total	C	N	O	S	0	3	0
			2389	1526	400	449	14			
1	C	318	Total	C	N	O	S	0	4	0
			2419	1544	409	452	14			
1	D	315	Total	C	N	O	S	0	3	0
			2389	1526	400	449	14			

There are 24 discrepancies between the modelled and reference sequences:

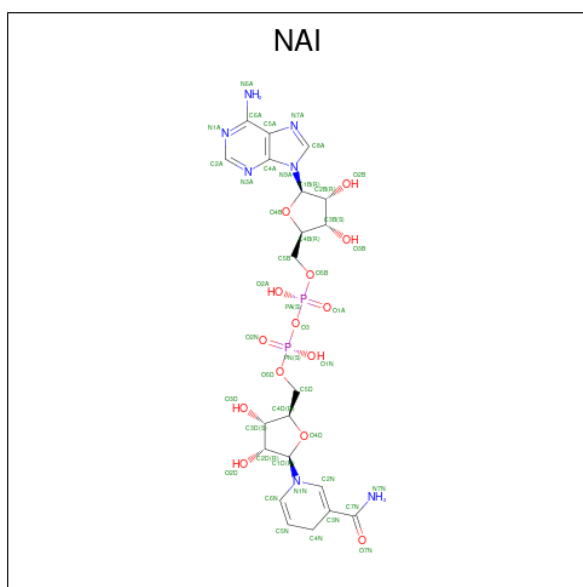
Chain	Residue	Modelled	Actual	Comment	Reference
A	330	HIS	-	expression tag	GB 66967948
A	331	HIS	-	expression tag	GB 66967948
A	332	HIS	-	expression tag	GB 66967948
A	333	HIS	-	expression tag	GB 66967948
A	334	HIS	-	expression tag	GB 66967948
A	335	HIS	-	expression tag	GB 66967948
B	330	HIS	-	expression tag	GB 66967948
B	331	HIS	-	expression tag	GB 66967948
B	332	HIS	-	expression tag	GB 66967948
B	333	HIS	-	expression tag	GB 66967948
B	334	HIS	-	expression tag	GB 66967948
B	335	HIS	-	expression tag	GB 66967948
C	330	HIS	-	expression tag	GB 66967948
C	331	HIS	-	expression tag	GB 66967948
C	332	HIS	-	expression tag	GB 66967948
C	333	HIS	-	expression tag	GB 66967948
C	334	HIS	-	expression tag	GB 66967948
C	335	HIS	-	expression tag	GB 66967948
D	330	HIS	-	expression tag	GB 66967948
D	331	HIS	-	expression tag	GB 66967948
D	332	HIS	-	expression tag	GB 66967948

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
D	333	HIS	-	expression tag	GB 66967948
D	334	HIS	-	expression tag	GB 66967948
D	335	HIS	-	expression tag	GB 66967948

- Molecule 2 is 1,4-DIHYDRONICOTINAMIDE ADENINE DINUCLEOTIDE (CCD ID: NAI) (formula: $C_{21}H_{29}N_7O_{14}P_2$).



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		
2	C	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	D	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	148	Total	O	0	0
			148	148		
3	B	130	Total	O	0	0
			130	130		
3	C	112	Total	O	0	0
			112	112		

Continued on next page...

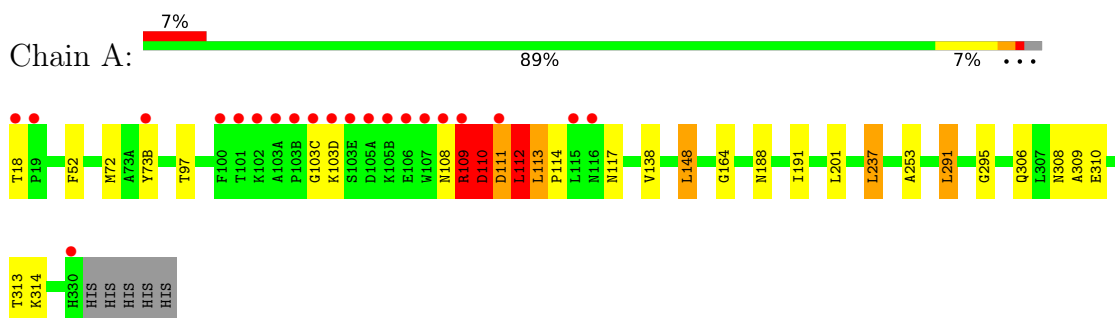
Continued from previous page...

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	D	90	Total	O	0	0
			90	90		

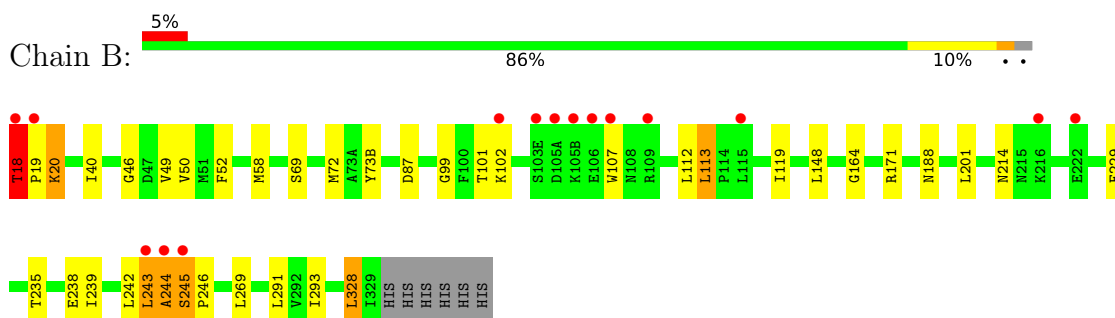
3 Residue-property plots [i](#)

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.

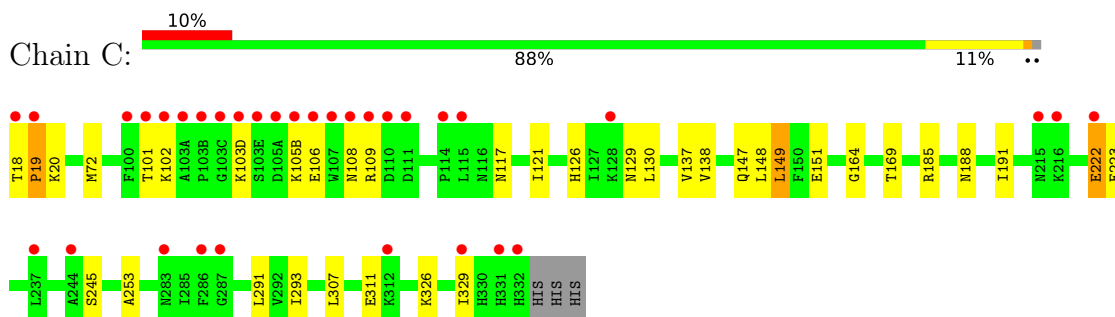
- Molecule 1: L-lactate dehydrogenase



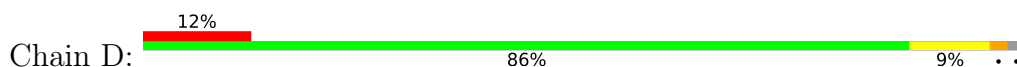
- Molecule 1: L-lactate dehydrogenase

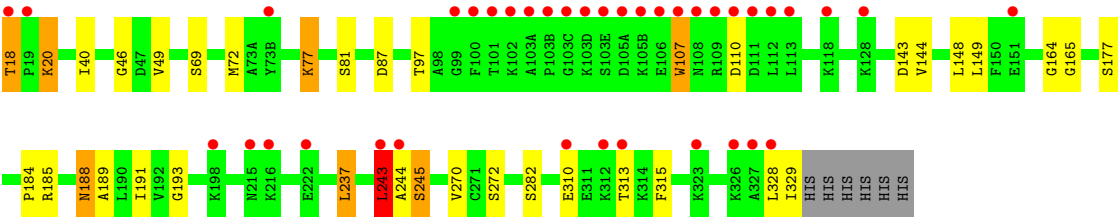


- Molecule 1: L-lactate dehydrogenase



- Molecule 1: L-lactate dehydrogenase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	81.59Å 128.64Å 130.58Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	91.29 – 2.04 91.29 – 2.04	Depositor EDS
% Data completeness (in resolution range)	97.8 (91.29-2.04) 97.8 (91.29-2.04)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.07 (at 2.05Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.194 , 0.236 0.192 , 0.232	Depositor DCC
R_{free} test set	4299 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å ²)	27.1	Xtriage
Anisotropy	0.346	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 47.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.013 for -h,l,k	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	10257	wwPDB-VP
Average B, all atoms (Å ²)	9.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.12% 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: NAI

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	0.93	0/2443	0.99	5/3308 (0.2%)
1	B	0.88	0/2424	0.96	4/3282 (0.1%)
1	C	0.89	0/2457	0.94	2/3327 (0.1%)
1	D	0.80	0/2424	0.94	3/3282 (0.1%)
All	All	0.88	0/9748	0.96	14/13199 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3
1	B	0	2
1	D	0	1
All	All	0	6

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	113	LEU	N-CA-C	-7.91	92.33	109.81
1	B	18	THR	CA-C-N	7.54	129.26	119.84
1	B	18	THR	C-N-CA	7.54	129.26	119.84
1	B	245	SER	CA-C-N	6.39	126.34	119.76
1	B	245	SER	C-N-CA	6.39	126.34	119.76
1	D	165	GLY	N-CA-C	6.30	120.29	112.73
1	D	245	SER	CA-C-N	-6.05	112.96	119.98
1	D	245	SER	C-N-CA	-6.05	112.96	119.98
1	A	291	LEU	CA-CB-CG	5.93	137.06	116.30

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	109	ARG	CA-C-N	5.83	132.19	121.70
1	A	109	ARG	C-N-CA	5.83	132.19	121.70
1	A	112	LEU	N-CA-C	5.63	122.80	110.80
1	C	245	SER	CA-C-N	5.25	125.24	119.89
1	C	245	SER	C-N-CA	5.25	125.24	119.89

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	109	ARG	Peptide
1	A	111	ASP	Peptide
1	A	112	LEU	Peptide
1	B	18	THR	Peptide
1	B	244	ALA	Peptide
1	D	243	LEU	Peptide

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	2404	0	2496	30	0
1	B	2389	0	2483	33	0
1	C	2419	0	2502	19	0
1	D	2389	0	2483	21	0
2	A	44	0	27	3	0
2	B	44	0	27	1	0
2	C	44	0	27	1	0
2	D	44	0	27	1	0
3	A	148	0	0	2	0
3	B	130	0	0	2	0
3	C	112	0	0	1	0
3	D	90	0	0	1	0
All	All	10257	0	10072	94	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 (94) 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:239:ILE:HG22	1:B:244:ALA:HB2	1.14	1.12
1:A:113:LEU:H	1:A:114:PRO:HD2	1.29	0.98
1:D:69:SER:HA	1:D:72[A]:MET:HE2	1.52	0.92
1:B:239:ILE:HG22	1:B:244:ALA:CB	2.00	0.92
1:B:246:PRO:HA	3:B:766:HOH:O	1.75	0.85
1:B:69:SER:HA	1:B:72[A]:MET:HE2	1.60	0.83
1:B:239:ILE:CG2	1:B:244:ALA:HB2	2.06	0.82
1:B:69:SER:HA	1:B:72[A]:MET:CE	2.10	0.81
1:D:69:SER:HA	1:D:72[A]:MET:CE	2.12	0.78
1:B:242:LEU:O	1:B:243:LEU:HB2	1.86	0.74
1:B:244:ALA:HB1	1:B:245:SER:C	2.12	0.73
1:A:113:LEU:H	1:A:114:PRO:CD	2.00	0.73
1:B:58:MET:HG2	1:D:243:LEU:HD22	1.70	0.72
1:D:107:TRP:HE3	1:D:237:LEU:HD12	1.56	0.71
1:B:107:TRP:CH2	1:B:112:LEU:HD11	2.31	0.65
1:C:291:LEU:HD11	1:C:293:ILE:HD11	1.79	0.64
1:C:147:GLN:O	1:C:151:GLU:HG3	1.98	0.64
1:A:309:ALA:O	1:A:313:THR:HG23	2.00	0.62
1:B:244:ALA:HB1	1:B:245:SER:CA	2.30	0.61
1:A:72[A]:MET:HE3	1:C:253:ALA:HB2	1.82	0.60
1:A:113:LEU:N	1:A:114:PRO:HD2	2.10	0.60
1:A:113:LEU:N	1:A:114:PRO:CD	2.65	0.59
1:B:107:TRP:HH2	1:B:112:LEU:HD11	1.66	0.59
1:C:222:GLU:HG2	1:C:223:GLU:N	2.18	0.59
1:B:101:THR:HG23	1:B:102:LYS:HG2	1.84	0.58
1:A:109:ARG:O	1:A:112:LEU:HB2	2.05	0.57
1:A:111:ASP:HA	1:A:114:PRO:HD2	1.87	0.57
1:A:306:GLN:HE22	1:B:214:ASN:HD22	1.52	0.57
1:A:295:GLY:HA2	1:D:18:THR:HB	1.87	0.57
1:B:99:GLY:HA2	1:B:119:ILE:HD13	1.86	0.57
1:A:108:ASN:CG	1:A:109:ARG:H	2.14	0.56
1:A:295:GLY:CA	1:D:18:THR:HB	2.36	0.56
1:D:143:ASP:OD1	1:D:272:SER:OG	2.22	0.56
1:A:308:ASN:OD1	1:A:310:GLU:HG2	2.07	0.55
1:B:238:GLU:O	1:B:242:LEU:HD23	2.07	0.55
1:B:113:LEU:HD23	1:B:328:LEU:HD23	1.90	0.54
1:C:291:LEU:CD1	1:C:293:ILE:HD11	2.37	0.54
1:A:237:LEU:O	1:A:237:LEU:HD23	2.08	0.52
1:C:291:LEU:CD1	1:C:293:ILE:CD1	2.88	0.52
1:C:126:HIS:HE1	3:C:564:HOH:O	1.94	0.51

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:107:TRP:CE3	1:D:237:LEU:HD12	2.43	0.51
1:B:244:ALA:HB1	1:B:245:SER:HA	1.92	0.51
1:A:314:LYS:HE3	3:A:709:HOH:O	2.10	0.50
1:D:81:SER:OG	1:D:87:ASP:OD2	2.23	0.50
1:A:109:ARG:CA	1:A:110:ASP:HB2	2.41	0.50
1:D:20:LYS:CD	1:D:46:GLY:HA2	2.42	0.49
1:A:117:ASN:HD22	1:A:148:LEU:HG	1.77	0.49
1:C:129:ASN:OD1	1:C:130:LEU:HG	2.12	0.49
1:B:101:THR:HG22	3:B:753:HOH:O	2.13	0.49
1:A:72[A]:MET:CE	1:C:253:ALA:HB2	2.43	0.48
1:B:242:LEU:O	1:B:243:LEU:CB	2.60	0.48
1:C:326:LYS:O	1:C:329:ILE:HG12	2.13	0.48
1:B:73(B)[A]:TYR:CD1	1:D:185:ARG:HD3	2.49	0.48
1:A:138:VAL:O	2:A:601:NAI:H2N	2.13	0.47
1:B:113:LEU:CD2	1:B:328:LEU:HD23	2.45	0.47
1:D:77:LYS:HE3	3:D:891:HOH:O	2.13	0.47
1:C:137:VAL:HG22	1:C:149:LEU:HD12	1.97	0.47
1:B:40:ILE:HG21	1:B:49:VAL:CG2	2.46	0.46
1:A:117:ASN:ND2	1:A:148:LEU:HG	2.30	0.46
1:A:253:ALA:HB2	1:C:72[A]:MET:HE3	1.97	0.46
1:A:191:ILE:HG12	1:A:201:LEU:HG	1.98	0.45
1:D:20:LYS:HD3	1:D:46:GLY:HA2	1.98	0.45
1:D:193:GLY:HA2	1:D:315:PHE:CE1	2.52	0.45
1:D:310:GLU:O	1:D:313:THR:HG22	2.17	0.45
1:D:97:THR:HB	2:D:801:NAI:H51N	1.99	0.44
1:A:237:LEU:CD2	1:A:237:LEU:C	2.91	0.44
1:A:97:THR:HB	2:A:601:NAI:H51N	1.99	0.44
1:B:52:PHE:CE2	2:B:701:NAI:H2A	2.52	0.44
1:D:144:VAL:O	1:D:148:LEU:HD13	2.18	0.44
1:B:69:SER:HA	1:B:72[A]:MET:HE1	1.96	0.43
1:B:244:ALA:HB1	1:B:246:PRO:N	2.33	0.43
1:B:244:ALA:CB	1:B:245:SER:CA	2.95	0.43
1:A:18:THR:N	3:A:711:HOH:O	2.52	0.43
1:C:307:LEU:HB3	1:C:311:GLU:HB2	2.01	0.42
1:D:40:ILE:HG21	1:D:49:VAL:CG2	2.49	0.42
1:C:138:VAL:O	2:C:501:NAI:H2N	2.20	0.42
1:C:169:THR:HG22	1:C:191:ILE:HG13	2.01	0.42
1:B:238:GLU:O	1:B:242:LEU:CD2	2.68	0.42
1:A:108:ASN:ND2	1:A:109:ARG:H	2.18	0.41
1:A:237:LEU:HD23	1:A:237:LEU:C	2.46	0.41
1:C:117:ASN:O	1:C:121:ILE:HG13	2.21	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:171:ARG:HG2	1:B:235:THR:HG21	2.03	0.41
1:D:177:SER:CB	1:D:184:PRO:HA	2.50	0.41
1:B:201:LEU:HD23	1:B:229:PHE:CD1	2.55	0.41
1:B:50:VAL:HG11	1:B:87:ASP:HB3	2.03	0.41
1:D:188:ASN:HD22	1:D:189:ALA:H	1.68	0.41
1:A:52:PHE:CE2	2:A:601:NAI:H2A	2.56	0.41
1:A:73(B)[A]:TYR:CD1	1:C:185:ARG:HD3	2.56	0.41
1:A:112:LEU:HA	1:A:112:LEU:HD12	1.85	0.40
1:D:191:ILE:O	1:D:270:VAL:HG11	2.22	0.40
1:B:269:LEU:HD12	1:B:293:ILE:HD12	2.03	0.40
1:B:20:LYS:HE3	1:B:46:GLY:HA2	2.02	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	315/321 (98%)	297 (94%)	12 (4%)	6 (2%)	6	2
1	B	313/321 (98%)	304 (97%)	6 (2%)	3 (1%)	12	6
1	C	316/321 (98%)	294 (93%)	13 (4%)	9 (3%)	4	0
1	D	313/321 (98%)	295 (94%)	10 (3%)	8 (3%)	4	0
All	All	1257/1284 (98%)	1190 (95%)	41 (3%)	26 (2%)	5	1

All (26) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	103(C)	GLY
1	A	103(D)	LYS
1	A	110	ASP
1	A	112	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	243	LEU
1	C	103(D)	LYS
1	C	109	ARG
1	D	20	LYS
1	D	110	ASP
1	D	243	LEU
1	D	328	LEU
1	C	101	THR
1	C	105(B)	LYS
1	C	108	ASN
1	D	244	ALA
1	A	164	GLY
1	C	20[A]	LYS
1	D	107	TRP
1	B	19	PRO
1	B	164	GLY
1	D	245	SER
1	A	109	ARG
1	C	106	GLU
1	C	164	GLY
1	D	164	GLY
1	C	19	PRO

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	269/273 (98%)	263 (98%)	6 (2%)	45	44
1	B	267/273 (98%)	260 (97%)	7 (3%)	40	37
1	C	270/273 (99%)	265 (98%)	5 (2%)	50	50
1	D	267/273 (98%)	259 (97%)	8 (3%)	36	32
All	All	1073/1092 (98%)	1047 (98%)	26 (2%)	43	40

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	110	ASP
1	A	112	LEU
1	A	148	LEU
1	A	188	ASN
1	A	237	LEU
1	A	291	LEU
1	B	18	THR
1	B	20	LYS
1	B	113	LEU
1	B	148	LEU
1	B	188	ASN
1	B	291	LEU
1	B	328	LEU
1	C	102	LYS
1	C	148	LEU
1	C	149	LEU
1	C	188	ASN
1	C	222	GLU
1	D	18	THR
1	D	77	LYS
1	D	149	LEU
1	D	188	ASN
1	D	237	LEU
1	D	243	LEU
1	D	282	SER
1	D	329	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	83	ASN
1	A	108	ASN
1	A	117	ASN
1	A	126	HIS
1	A	152	HIS
1	A	178	GLN
1	A	188	ASN
1	A	306	GLN
1	B	152	HIS
1	B	178	GLN
1	B	188	ASN
1	B	234	ASN
1	C	108	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	C	126	HIS
1	C	152	HIS
1	C	188	ASN
1	C	210(B)	GLN
1	D	188	ASN
1	D	214	ASN
1	D	234	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](#)

4 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	NAI	A	601	-	47,48,48	1.87	9 (19%)	64,73,73	1.74	14 (21%)
2	NAI	B	701	-	47,48,48	1.81	9 (19%)	64,73,73	1.57	10 (15%)
2	NAI	D	801	-	47,48,48	1.73	8 (17%)	64,73,73	1.63	12 (18%)
2	NAI	C	501	-	47,48,48	1.80	9 (19%)	64,73,73	1.72	12 (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
2	NAI	A	601	-	-	7/29/72/72	0/5/5/5
2	NAI	B	701	-	-	3/29/72/72	0/5/5/5
2	NAI	D	801	-	-	5/29/72/72	0/5/5/5
2	NAI	C	501	-	-	6/29/72/72	0/5/5/5

All (35) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	501	NAI	O7N-C7N	7.06	1.41	1.24
2	A	601	NAI	O7N-C7N	6.95	1.40	1.24
2	D	801	NAI	O7N-C7N	6.60	1.39	1.24
2	B	701	NAI	O7N-C7N	6.43	1.39	1.24
2	D	801	NAI	C4N-C3N	-5.34	1.39	1.50
2	C	501	NAI	C4N-C3N	-5.04	1.40	1.50
2	A	601	NAI	C4N-C3N	-4.92	1.40	1.50
2	B	701	NAI	C4N-C3N	-4.82	1.40	1.50
2	B	701	NAI	PN-O3	3.71	1.63	1.59
2	B	701	NAI	PA-O3	3.67	1.63	1.59
2	A	601	NAI	PN-O3	3.63	1.63	1.59
2	A	601	NAI	C4N-C5N	-3.45	1.40	1.49
2	A	601	NAI	C2A-N1A	3.44	1.40	1.33
2	D	801	NAI	C4N-C5N	-3.38	1.40	1.49
2	B	701	NAI	C4N-C5N	-3.31	1.40	1.49
2	B	701	NAI	C2A-N1A	3.10	1.39	1.33
2	D	801	NAI	C2A-N1A	3.05	1.39	1.33
2	C	501	NAI	C4N-C5N	-3.01	1.41	1.49
2	A	601	NAI	C2A-N3A	2.80	1.38	1.33
2	C	501	NAI	C2A-N1A	2.70	1.38	1.33
2	C	501	NAI	PA-O3	2.68	1.62	1.59
2	C	501	NAI	C8A-N7A	2.64	1.36	1.31
2	A	601	NAI	C8A-N7A	2.63	1.36	1.31
2	C	501	NAI	PN-O3	2.61	1.62	1.59
2	A	601	NAI	PA-O3	2.57	1.62	1.59
2	B	701	NAI	C6N-C5N	2.49	1.40	1.33
2	B	701	NAI	C2A-N3A	2.48	1.38	1.33
2	C	501	NAI	C2A-N3A	2.47	1.38	1.33
2	A	601	NAI	C6N-C5N	2.45	1.40	1.33
2	D	801	NAI	C6N-C5N	2.38	1.40	1.33
2	B	701	NAI	C8A-N7A	2.38	1.36	1.31

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	801	NAI	C8A-N7A	2.36	1.36	1.31
2	D	801	NAI	C2A-N3A	2.32	1.38	1.33
2	C	501	NAI	C6N-C5N	2.25	1.39	1.33
2	D	801	NAI	PN-O3	2.07	1.61	1.59

All (48) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	501	NAI	N3A-C2A-N1A	-6.18	119.22	128.58
2	A	601	NAI	N3A-C2A-N1A	-5.38	120.44	128.58
2	D	801	NAI	N3A-C2A-N1A	-5.35	120.48	128.58
2	B	701	NAI	N3A-C2A-N1A	-4.92	121.13	128.58
2	A	601	NAI	N9A-C8A-N7A	-4.80	107.12	113.94
2	C	501	NAI	N9A-C8A-N7A	-4.32	107.81	113.94
2	D	801	NAI	C5A-C4A-N3A	-4.11	121.06	126.72
2	A	601	NAI	C5A-N7A-C8A	4.05	109.81	103.45
2	B	701	NAI	N9A-C8A-N7A	-4.04	108.20	113.94
2	B	701	NAI	C1D-N1N-C2N	-3.96	114.61	121.14
2	C	501	NAI	C5A-C4A-N3A	-3.96	121.26	126.72
2	C	501	NAI	C5A-N7A-C8A	3.89	109.56	103.45
2	D	801	NAI	N9A-C8A-N7A	-3.85	108.47	113.94
2	C	501	NAI	C2A-N3A-C4A	3.66	120.76	111.83
2	A	601	NAI	C1D-N1N-C2N	-3.60	115.21	121.14
2	A	601	NAI	C5A-C4A-N3A	-3.41	122.03	126.72
2	D	801	NAI	C5A-N7A-C8A	3.33	108.68	103.45
2	B	701	NAI	C5A-C4A-N3A	-3.29	122.18	126.72
2	C	501	NAI	C4A-C5A-N7A	-3.28	106.83	110.58
2	B	701	NAI	C5A-N7A-C8A	3.27	108.59	103.45
2	D	801	NAI	C2A-N3A-C4A	3.14	119.51	111.83
2	D	801	NAI	C1D-N1N-C2N	-2.95	116.28	121.14
2	A	601	NAI	C4A-N9A-C8A	2.92	108.80	105.74
2	A	601	NAI	C4A-C5A-N7A	-2.90	107.27	110.58
2	D	801	NAI	N3A-C4A-N9A	2.75	131.85	127.17
2	A	601	NAI	C4A-N9A-C1B	-2.72	120.28	126.63
2	B	701	NAI	C2A-N3A-C4A	2.69	118.39	111.83
2	B	701	NAI	C4A-N9A-C8A	2.64	108.52	105.74
2	A	601	NAI	C2A-N3A-C4A	2.64	118.28	111.83
2	C	501	NAI	C4A-N9A-C1B	-2.43	120.95	126.63
2	C	501	NAI	C1D-N1N-C2N	-2.40	117.18	121.14
2	B	701	NAI	N3A-C4A-N9A	2.39	131.23	127.17
2	A	601	NAI	O7N-C7N-C3N	-2.38	116.42	120.90
2	D	801	NAI	O4B-C1B-N9A	2.25	112.41	108.09

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	601	NAI	N3A-C4A-N9A	2.23	130.97	127.17
2	A	601	NAI	C3N-C7N-N7N	2.22	121.61	117.67
2	B	701	NAI	C4A-N9A-C1B	-2.21	121.47	126.63
2	C	501	NAI	O4B-C1B-N9A	2.20	112.32	108.09
2	B	701	NAI	C4A-C5A-N7A	-2.16	108.11	110.58
2	C	501	NAI	N3A-C4A-N9A	2.14	130.80	127.17
2	D	801	NAI	C3N-C7N-N7N	2.12	121.42	117.67
2	D	801	NAI	C3N-C2N-N1N	-2.10	120.12	123.20
2	D	801	NAI	C4A-C5A-N7A	-2.09	108.19	110.58
2	D	801	NAI	O7N-C7N-C3N	-2.09	116.97	120.90
2	A	601	NAI	O3D-C3D-C2D	-2.07	105.17	111.82
2	C	501	NAI	C2D-C1D-N1N	2.05	118.36	113.31
2	A	601	NAI	O1N-PN-O2N	2.03	121.90	112.44
2	C	501	NAI	C4A-N9A-C8A	2.01	107.85	105.74

There are no chirality outliers.

All (21) torsion outliers are listed below:

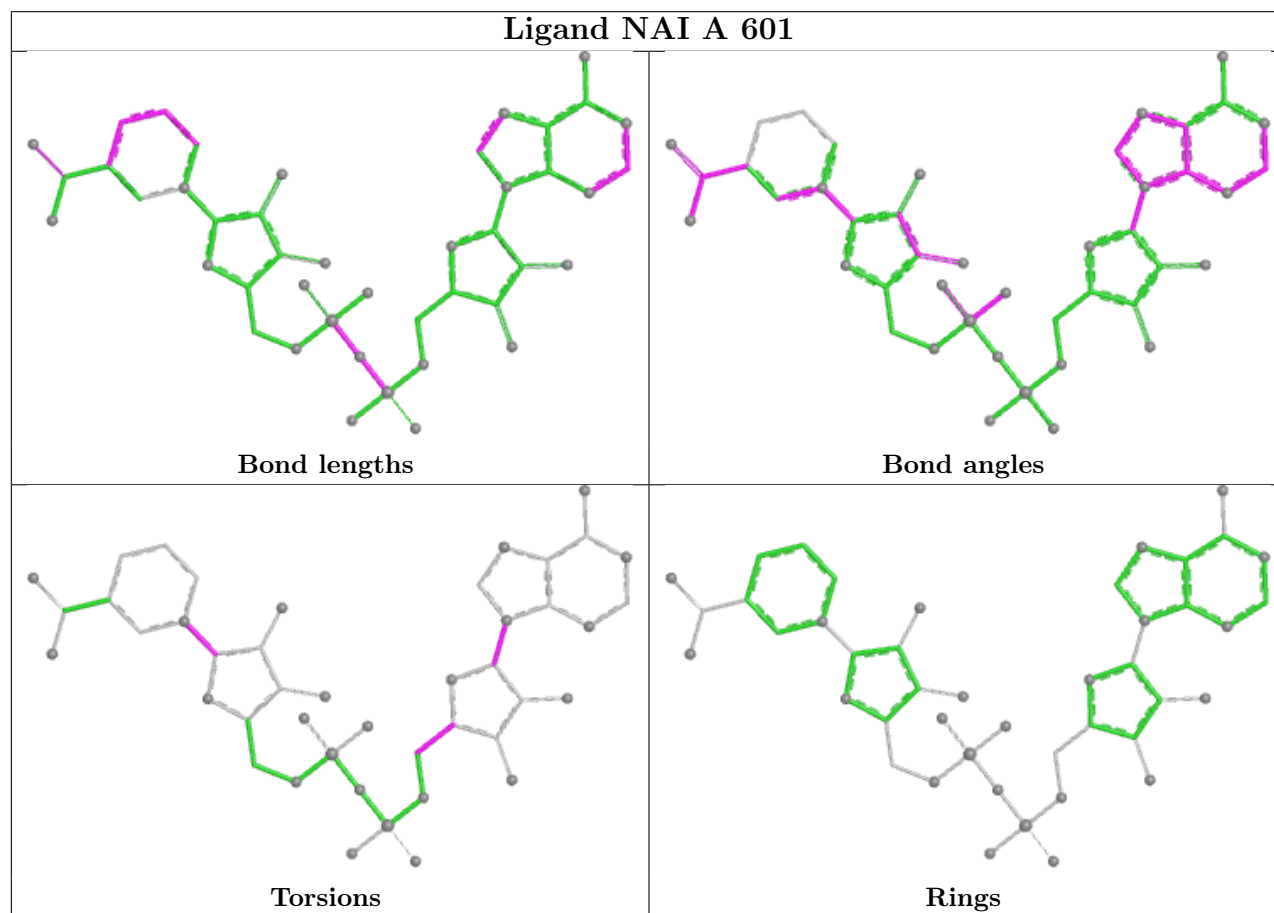
Mol	Chain	Res	Type	Atoms
2	D	801	NAI	C2D-C1D-N1N-C2N
2	D	801	NAI	C2D-C1D-N1N-C6N
2	A	601	NAI	C2D-C1D-N1N-C2N
2	A	601	NAI	C2B-C1B-N9A-C8A
2	D	801	NAI	O4D-C1D-N1N-C6N
2	C	501	NAI	C2D-C1D-N1N-C2N
2	D	801	NAI	O4D-C1D-N1N-C2N
2	A	601	NAI	O4D-C1D-N1N-C2N
2	C	501	NAI	O4D-C1D-N1N-C2N
2	A	601	NAI	C2D-C1D-N1N-C6N
2	B	701	NAI	O4D-C1D-N1N-C2N
2	B	701	NAI	C2D-C1D-N1N-C2N
2	C	501	NAI	O4D-C1D-N1N-C6N
2	C	501	NAI	C2B-C1B-N9A-C8A
2	C	501	NAI	C2D-C1D-N1N-C6N
2	A	601	NAI	O4B-C1B-N9A-C8A
2	A	601	NAI	O4D-C1D-N1N-C6N
2	D	801	NAI	C2B-C1B-N9A-C8A
2	A	601	NAI	O4B-C4B-C5B-O5B
2	B	701	NAI	O4D-C1D-N1N-C6N
2	C	501	NAI	O4B-C4B-C5B-O5B

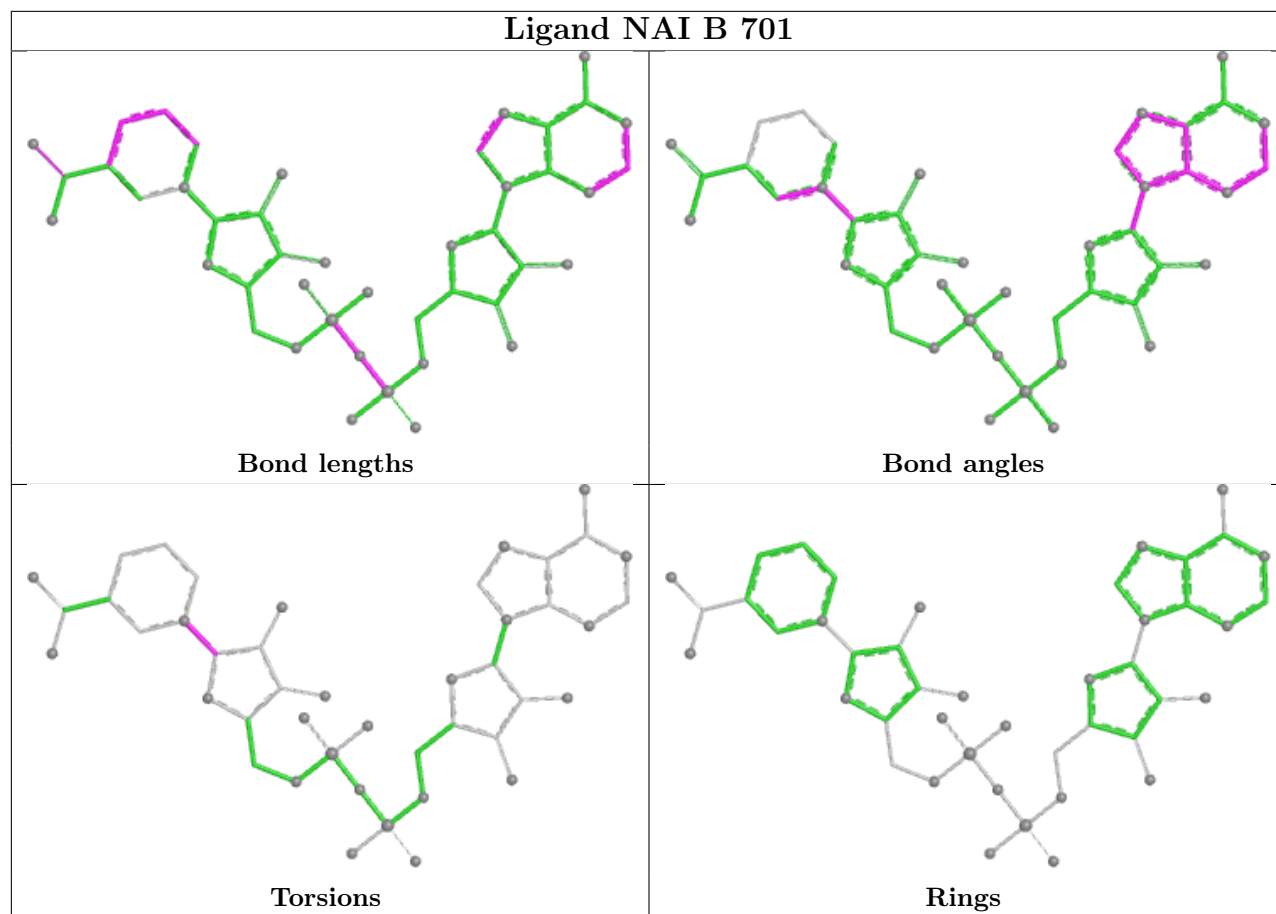
There are no ring outliers.

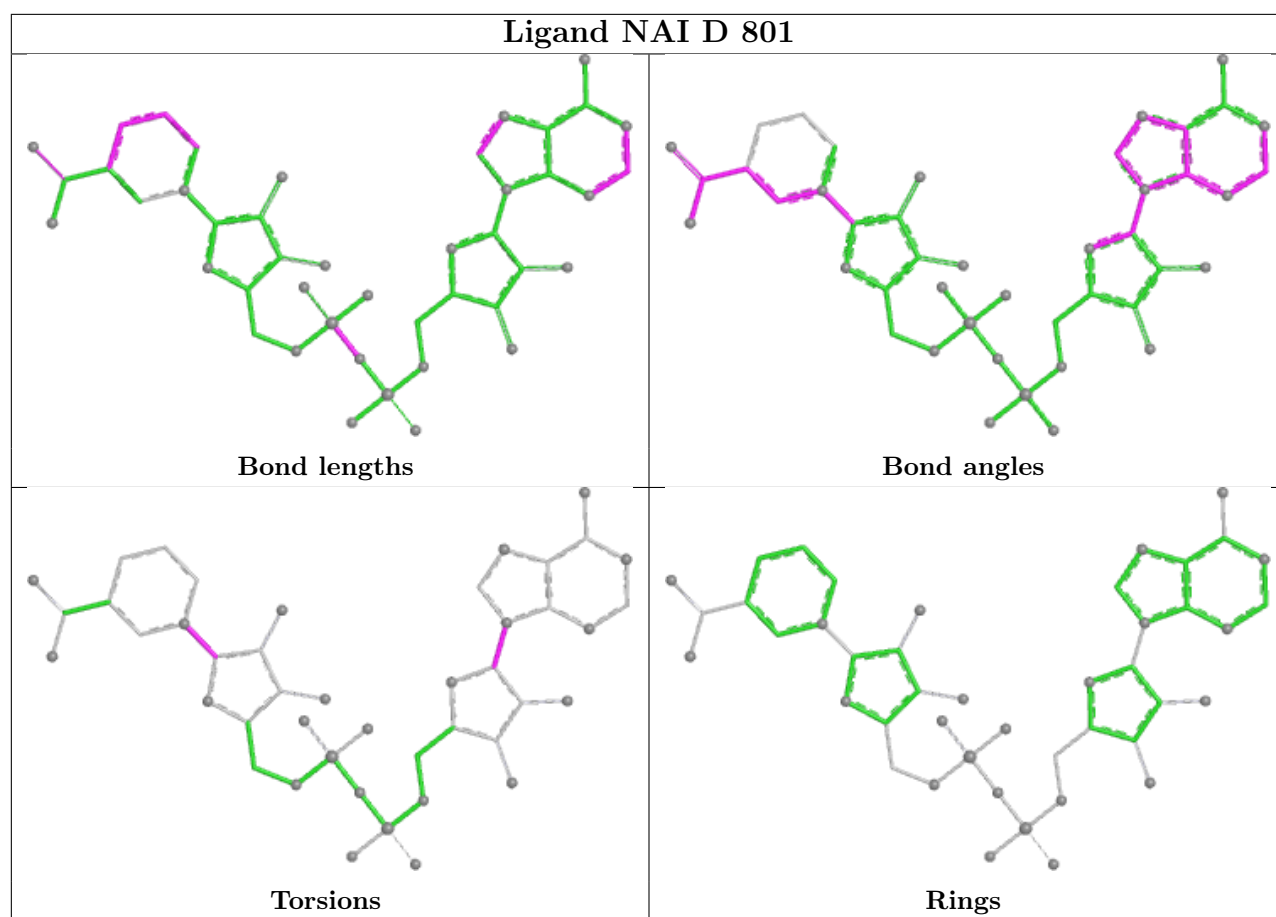
4 monomers are involved in 6 short contacts:

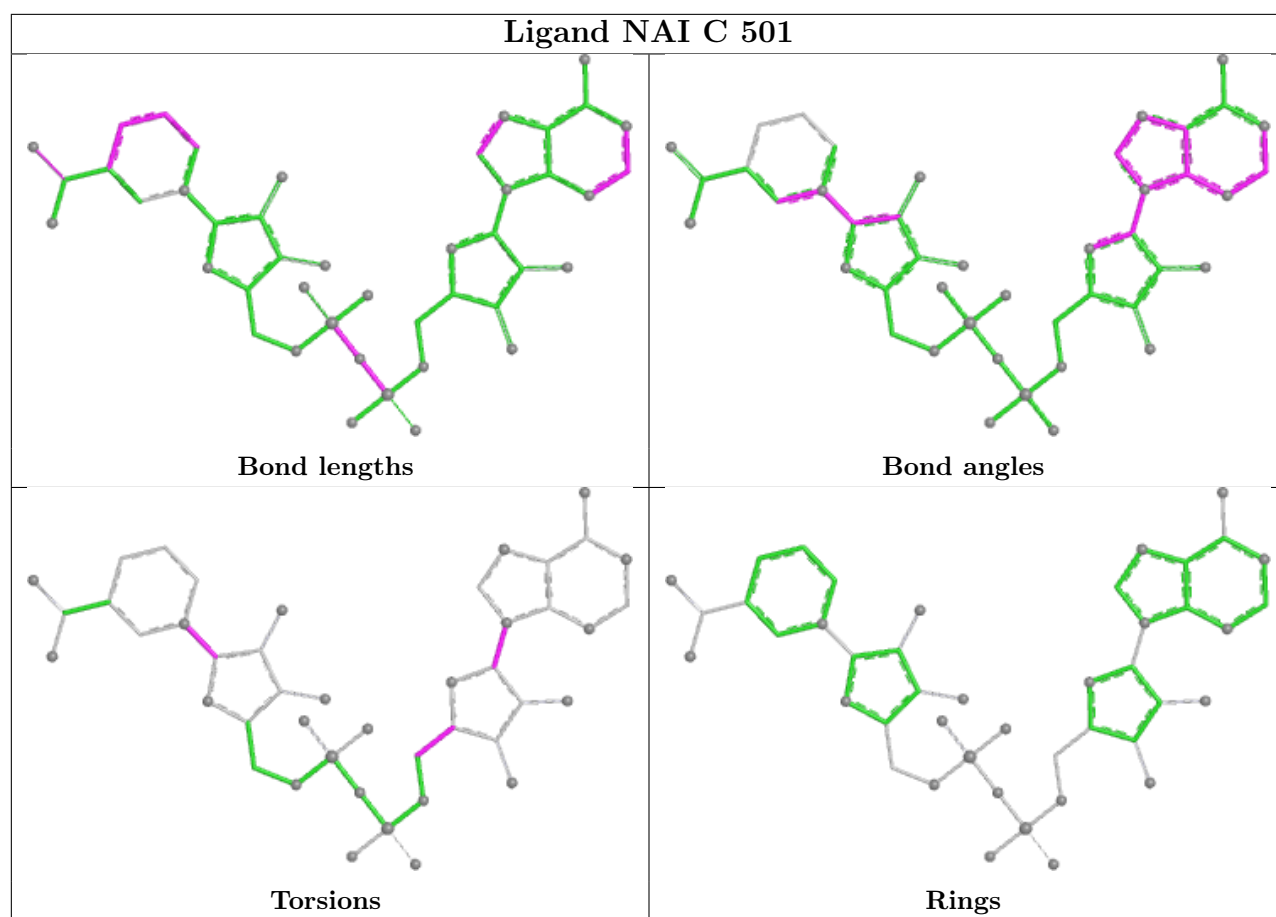
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	601	NAI	3	0
2	B	701	NAI	1	0
2	D	801	NAI	1	0
2	C	501	NAI	1	0

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	316/321 (98%)	0.40	21 (6%) 24 24	1, 8, 14, 20	32 (10%)
1	B	315/321 (98%)	0.13	15 (4%) 35 36	3, 8, 13, 22	34 (10%)
1	C	318/321 (99%)	0.85	33 (10%) 11 11	0, 9, 14, 20	52 (16%)
1	D	315/321 (98%)	0.80	38 (12%) 8 8	0, 9, 15, 22	55 (17%)
All	All	1264/1284 (98%)	0.55	107 (8%) 16 17	0, 9, 14, 22	173 (13%)

All (107) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	101	THR	23.9
1	A	103(A)	ALA	15.5
1	A	103(E)	SER	14.4
1	A	101	THR	13.8
1	D	101	THR	13.7
1	D	111	ASP	13.4
1	D	100	PHE	12.5
1	C	109	ARG	12.4
1	C	110	ASP	12.4
1	A	103(C)	GLY	12.1
1	C	108	ASN	12.0
1	D	103(C)	GLY	11.9
1	A	102	LYS	11.8
1	A	105(B)	LYS	11.6
1	C	105(A)	ASP	11.4
1	C	103(C)	GLY	10.8
1	C	105(B)	LYS	10.7
1	A	100	PHE	10.5
1	C	18	THR	10.4
1	D	109	ARG	10.1
1	C	107	TRP	9.9

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	D	112	LEU	9.6
1	D	105(A)	ASP	9.6
1	C	111	ASP	9.5
1	D	107	TRP	9.4
1	A	107	TRP	9.4
1	C	103(A)	ALA	9.2
1	C	103(D)	LYS	9.0
1	D	108	ASN	8.9
1	C	103(B)	PRO	8.6
1	C	100	PHE	8.4
1	D	103(E)	SER	8.2
1	A	103(D)	LYS	8.2
1	D	18	THR	8.0
1	D	106	GLU	7.9
1	D	103(B)	PRO	7.9
1	D	110	ASP	7.8
1	A	18	THR	7.7
1	D	105(B)	LYS	7.7
1	D	103(A)	ALA	7.3
1	A	103(B)	PRO	7.2
1	C	102	LYS	7.0
1	C	19	PRO	6.8
1	A	105(A)	ASP	6.7
1	C	103(E)	SER	6.6
1	A	106	GLU	6.0
1	C	215	ASN	5.6
1	D	118	LYS	5.5
1	B	19	PRO	5.1
1	B	107	TRP	5.1
1	B	244	ALA	5.0
1	D	102	LYS	4.7
1	B	105(B)	LYS	4.6
1	A	109	ARG	4.6
1	B	102	LYS	4.3
1	B	243	LEU	4.2
1	C	106	GLU	4.2
1	B	18	THR	4.2
1	B	245	SER	4.1
1	B	115	LEU	4.1
1	A	19	PRO	4.1
1	D	216	LYS	3.9
1	B	216	LYS	3.8

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	106	GLU	3.8
1	D	19	PRO	3.7
1	D	326	LYS	3.6
1	D	328	LEU	3.6
1	C	115	LEU	3.5
1	A	108	ASN	3.5
1	D	215	ASN	3.5
1	D	103(D)	LYS	3.5
1	A	115	LEU	3.4
1	D	243	LEU	3.4
1	D	113	LEU	3.3
1	C	329	ILE	3.3
1	C	331	HIS	3.2
1	C	222	GLU	3.2
1	C	287	GLY	3.1
1	D	312	LYS	3.1
1	A	111	ASP	3.0
1	B	222	GLU	2.9
1	B	103(E)	SER	2.9
1	D	244	ALA	2.9
1	C	216	LYS	2.9
1	D	99	GLY	2.9
1	D	327	ALA	2.9
1	D	222	GLU	2.8
1	C	128	LYS	2.7
1	C	237	LEU	2.5
1	C	244	ALA	2.5
1	A	73(B)[A]	TYR	2.4
1	C	286	PHE	2.4
1	D	151	GLU	2.4
1	D	198	LYS	2.4
1	D	313	THR	2.4
1	D	128	LYS	2.4
1	D	310	GLU	2.2
1	A	330	HIS	2.2
1	C	332	HIS	2.2
1	C	114	PRO	2.2
1	B	105(A)	ASP	2.2
1	A	116	ASN	2.1
1	D	73(B)[A]	TYR	2.1
1	D	323	LYS	2.1
1	C	283	ASN	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	109	ARG	2.0
1	C	312	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](#)

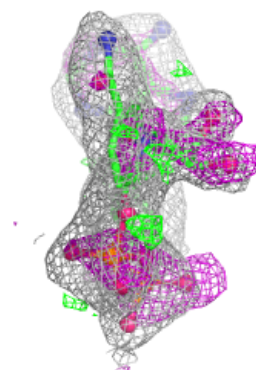
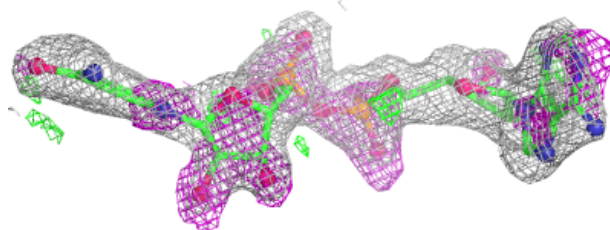
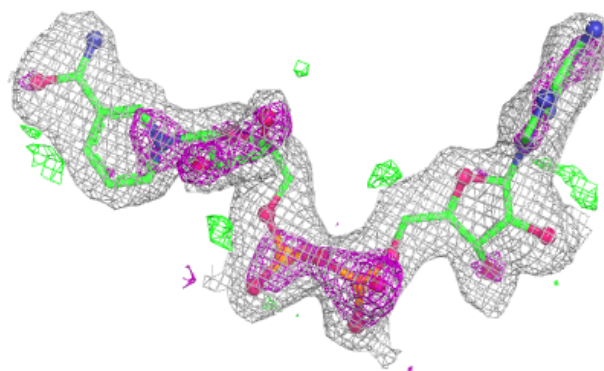
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	NAI	D	801	44/44	0.88	0.11	12,17,22,25	0
2	NAI	B	701	44/44	0.91	0.10	8,13,22,25	0
2	NAI	C	501	44/44	0.93	0.08	2,6,9,11	0
2	NAI	A	601	44/44	0.93	0.09	3,7,12,17	0

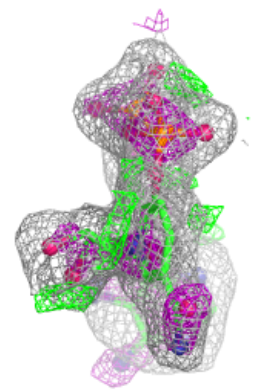
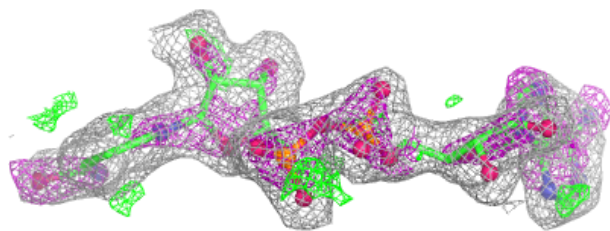
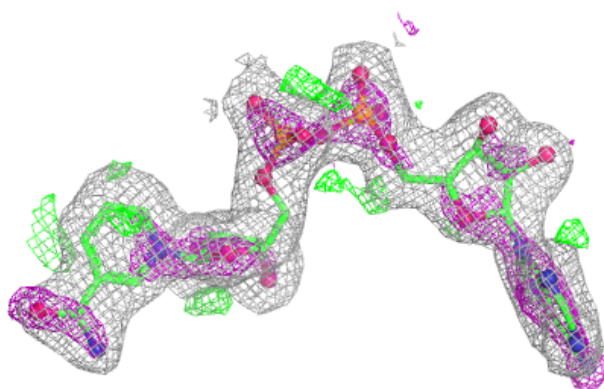
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around NAI D 801:

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

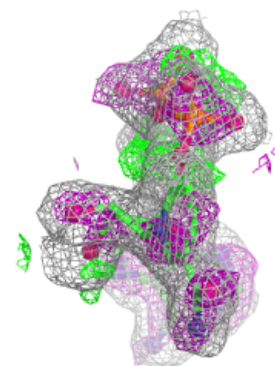
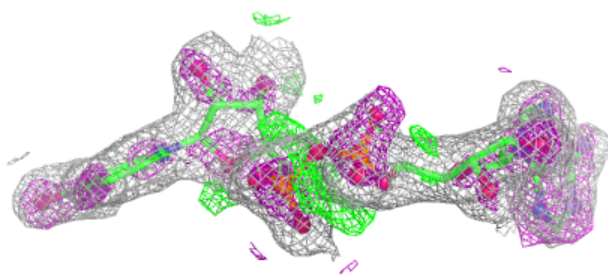
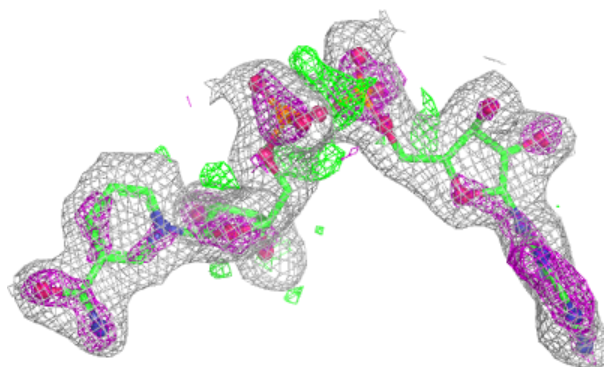
**Electron density around NAI B 701:**

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

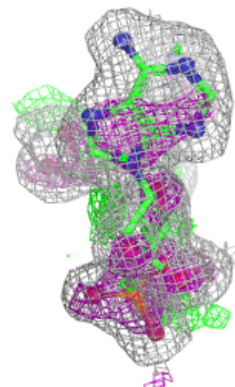
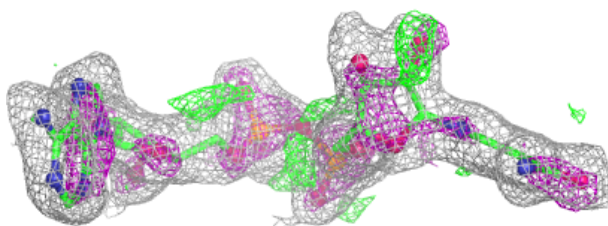
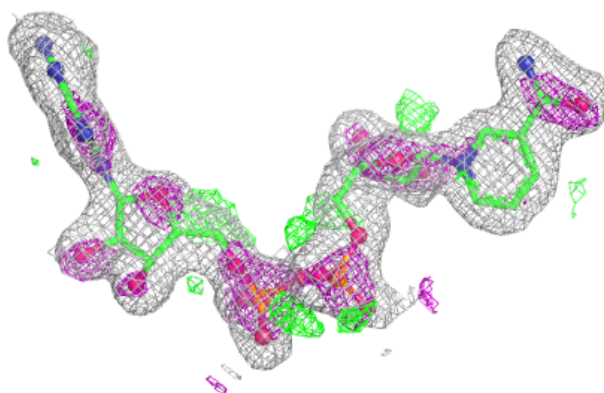


Electron density around NAI C 501:

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

**Electron density around NAI A 601:**

$2mF_o-DF_c$ (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.