



Full wwPDB X-ray Structure Validation Report ⓘ

May 9, 2022 – 01:06 PM EDT

PDB ID : 7UUT
Title : Ternary complex crystal structure of secondary alcohol dehydrogenases from the *Thermoanaerobacter ethanolicus* mutants C295A and I86A provides better understanding of catalytic mechanism
Authors : Dinh, T.; Phillips, R.; Rahn, K.
Deposited on : 2022-04-28
Resolution : 1.89 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.28.1
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.28.1

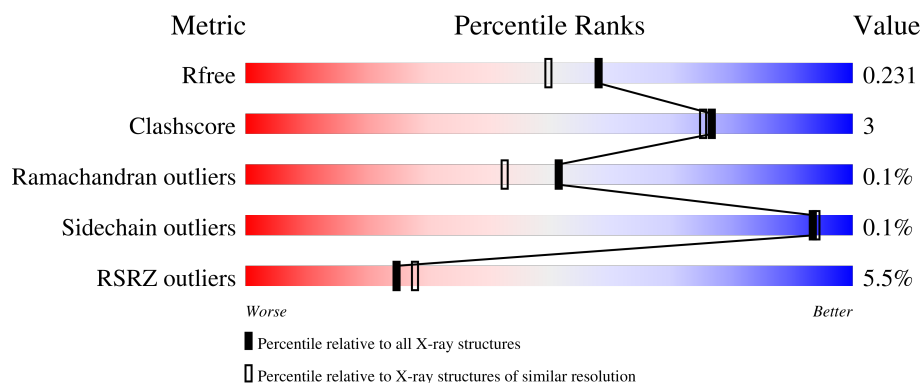
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.89 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}	130704	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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	352	<div> <div>16%</div> <div> <div></div> <div>93%</div> <div>7%</div> </div> </div>
2	B	352	<div> <div>3%</div> <div> <div></div> <div>93%</div> <div>7%</div> </div> </div>
2	C	352	<div> <div>2%</div> <div> <div></div> <div>92%</div> <div>8%</div> </div> </div>
2	D	352	<div> <div>%</div> <div> <div></div> <div>94%</div> <div>6%</div> </div> </div>

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 11273 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 Secondary-alcohol dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	352	Total	C	N	O	S	0	0	0
			2640	1690	455	476	19			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	86	ALA	ILE	engineered mutation	UNP P14941

- Molecule 2 is a protein called Secondary-alcohol dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	352	Total	C	N	O	S	0	7	0
			2688	1724	461	484	19			
2	C	352	Total	C	N	O	S	0	10	0
			2700	1735	463	483	19			
2	D	352	Total	C	N	O	S	0	3	0
			2663	1704	461	479	19			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	86	ALA	ILE	engineered mutation	UNP P14941
C	86	ALA	ILE	engineered mutation	UNP P14941
D	86	ALA	ILE	engineered mutation	UNP P14941

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

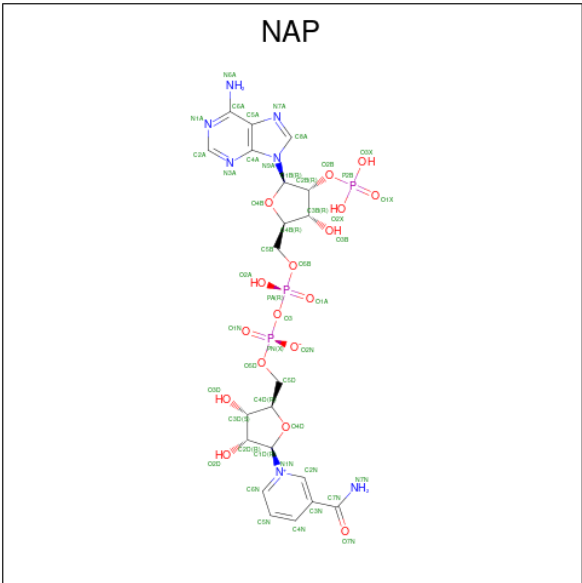
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Zn	0	0
			1	1		

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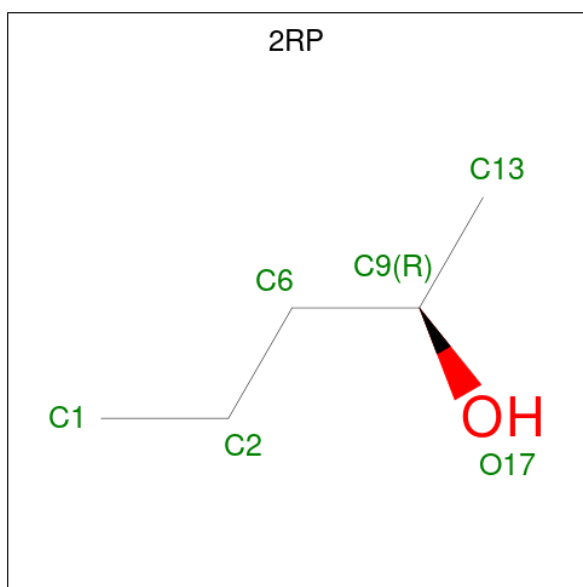
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Zn	0	0
			1	1		
3	C	1	Total	Zn	0	0
			1	1		
3	D	1	Total	Zn	0	0
			1	1		

- Molecule 4 is NADP NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NAP) (formula: C₂₁H₂₈N₇O₁₇P₃) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	B	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	C	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
4	D	1	Total	C	N	O	P	0	0
			48	21	7	17	3		

- Molecule 5 is (2R)-pentan-2-ol (three-letter code: 2RP) (formula: C₅H₁₂O) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 6 5 1	0	0
5	B	1	Total C O 6 5 1	0	0
5	C	1	Total C O 6 5 1	0	0
5	D	1	Total C O 6 5 1	0	0

- Molecule 6 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total K 1 1	0	0
6	B	1	Total K 1 1	0	0
6	C	1	Total K 1 1	0	0
6	D	1	Total K 1 1	0	0

- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	38	Total O 38 38	0	2

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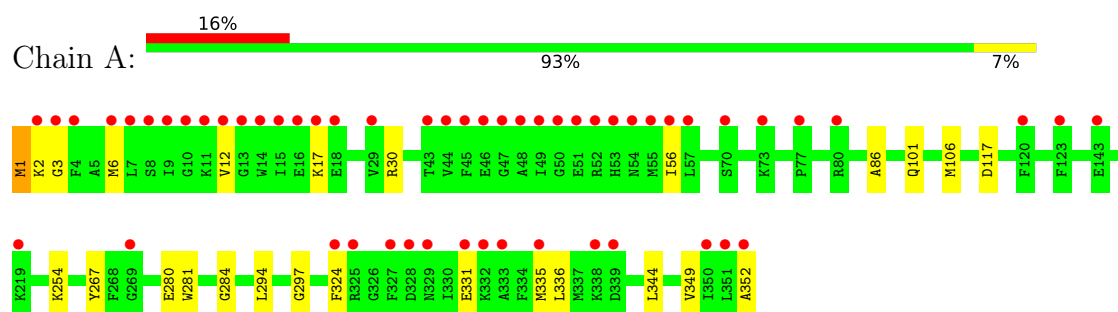
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	B	92	Total 92	O 92	0	0
7	C	113	Total 113	O 113	0	0
7	D	115	Total 115	O 115	0	2

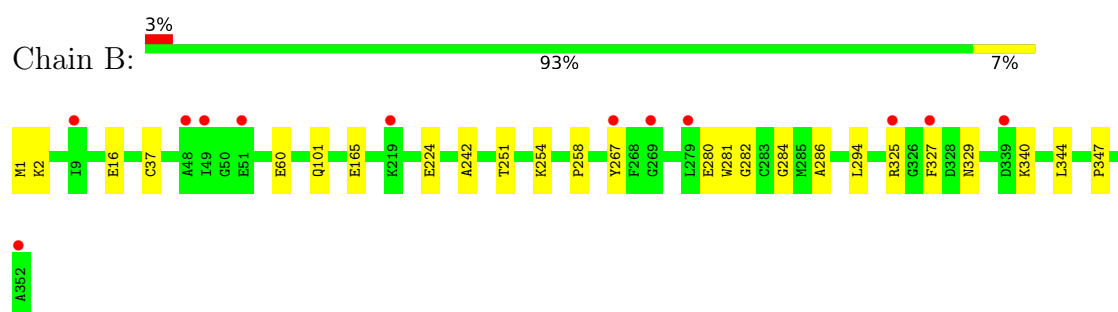
3 Residue-property plots [i](#)

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.

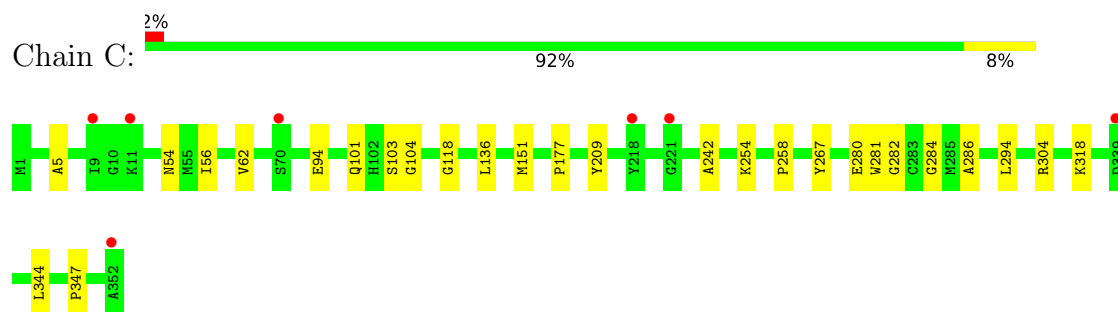
- Molecule 1: Secondary-alcohol dehydrogenase



- Molecule 2: Secondary-alcohol dehydrogenase

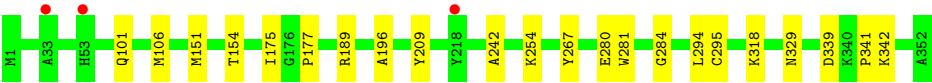


- Molecule 2: Secondary-alcohol dehydrogenase



- Molecule 2: Secondary-alcohol dehydrogenase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	79.87Å 124.56Å 166.47Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.47 – 1.89 39.47 – 1.89	Depositor EDS
% Data completeness (in resolution range)	67.0 (39.47-1.89) 67.0 (39.47-1.89)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	10.61 (at 1.89Å)	Xtriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, R_{free}	0.200 , 0.231 0.200 , 0.231	Depositor DCC
R_{free} test set	1995 reflections (2.24%)	wwPDB-VP
Wilson B-factor (Å ²)	36.4	Xtriage
Anisotropy	0.082	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 35.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	11273	wwPDB-VP
Average B, all atoms (Å ²)	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.24% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, 2RP, K, NAP, FME

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	0.26	0/2698	0.49	0/3650
2	B	0.27	0/2749	0.49	0/3719
2	C	0.27	0/2778	0.50	0/3756
2	D	0.27	0/2720	0.50	0/3679
All	All	0.27	0/10945	0.49	0/14804

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2640	0	2681	18	0
2	B	2688	0	2732	14	0
2	C	2700	0	2776	18	0
2	D	2663	0	2711	15	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	48	0	23	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	48	0	23	4	0
4	C	48	0	23	3	0
4	D	48	0	24	4	0
5	A	6	0	0	0	0
5	B	6	0	0	0	0
5	C	6	0	0	0	0
5	D	6	0	0	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
6	C	1	0	0	0	0
6	D	1	0	0	0	0
7	A	38	0	0	0	0
7	B	92	0	0	0	0
7	C	113	0	0	2	0
7	D	115	0	0	3	0
All	All	11273	0	10993	66	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 3.

All (66) 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)
2:D:254:LYS:HG2	2:D:280:GLU:HG2	1.67	0.75
2:C:254:LYS:HG2	2:C:280:GLU:HG2	1.71	0.73
1:A:1:MET:HE3	1:A:2:LYS:H	1.60	0.67
1:A:254:LYS:HG2	1:A:280:GLU:HG2	1.78	0.65
2:C:94[B]:GLU:HG3	2:C:104:GLY:H	1.62	0.63
2:B:254:LYS:HG2	2:B:280:GLU:HG2	1.83	0.60
2:C:101:GLN:HB3	2:C:294:LEU:HD23	1.84	0.59
1:A:17:LYS:NZ	1:A:117:ASP:OD2	2.34	0.59
2:C:209:TYR:CE2	2:C:318[B]:LYS:HG3	2.40	0.56
2:D:339:ASP:O	2:D:341:PRO:HD3	2.06	0.56
2:B:340:LYS:NZ	4:B:402:NAP:O2A	2.37	0.55
2:B:325:ARG:O	2:B:329:ASN:ND2	2.40	0.55
2:D:281:TRP:CE3	2:D:284:GLY:HA2	2.44	0.53
1:A:30:ARG:HH12	1:A:352:ALA:HB3	1.74	0.52
1:A:6:MET:HA	1:A:12:VAL:HG12	1.90	0.52
2:D:267:TYR:HB3	4:D:402:NAP:H1D	1.91	0.52
2:C:267:TYR:HB3	4:C:402:NAP:H1D	1.92	0.52
2:C:281:TRP:CE3	2:C:284:GLY:HA2	2.45	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:101:GLN:HB3	1:A:294:LEU:HD23	1.91	0.51
2:D:329:ASN:ND2	7:D:504:HOH:O	2.43	0.51
2:C:258:PRO:HG3	2:D:106:MET:HE2	1.91	0.50
1:A:336:LEU:HB3	1:A:344:LEU:HD22	1.93	0.50
2:B:267:TYR:HB3	4:B:402:NAP:H1D	1.94	0.50
2:B:2:LYS:HG2	2:B:16:GLU:OE2	2.12	0.49
2:B:101:GLN:HB3	2:B:294:LEU:HD23	1.93	0.49
2:C:56[B]:ILE:HG12	2:C:118:GLY:N	2.28	0.49
2:B:281:TRP:CE3	2:B:284:GLY:HA2	2.48	0.48
2:D:151:MET:SD	2:D:177:PRO:HB2	2.53	0.48
2:D:242:ALA:O	4:D:402:NAP:H52N	2.14	0.48
2:C:5:ALA:HA	2:C:56[B]:ILE:HA	1.95	0.47
2:C:54:ASN:ND2	7:C:509:HOH:O	2.46	0.47
2:D:189[A]:ARG:HD3	7:D:512:HOH:O	2.15	0.47
1:A:1:MET:O	1:A:17:LYS:N	2.45	0.47
2:C:242:ALA:O	4:C:402:NAP:H52N	2.15	0.46
1:A:324:PHE:HB2	1:A:349:VAL:HG22	1.96	0.46
1:A:281:TRP:CE3	1:A:284:GLY:HA2	2.52	0.45
2:C:344:LEU:HD11	2:C:347:PRO:HD3	1.97	0.45
1:A:267:TYR:HB3	4:A:402:NAP:H1D	1.99	0.45
2:B:224[A]:GLU:HG3	2:B:251:THR:HG23	1.99	0.45
4:A:402:NAP:H2D	4:A:402:NAP:H6N	1.61	0.44
2:D:175:ILE:HG21	2:D:196:ALA:HB1	2.00	0.44
2:D:342:LYS:NZ	7:D:509:HOH:O	2.50	0.44
1:A:17:LYS:NZ	1:A:117:ASP:CG	2.71	0.44
1:A:331:GLU:O	1:A:335:MET:HG2	2.17	0.44
2:C:318[A]:LYS:HG2	7:C:543:HOH:O	2.18	0.44
2:B:282:GLY:HA3	2:B:286:ALA:HB2	2.00	0.44
1:A:106:MET:HE2	2:B:258:PRO:HG3	2.00	0.44
1:A:86:ALA:HB3	1:A:297:GLY:HA3	2.00	0.43
4:B:402:NAP:H6N	4:B:402:NAP:H2D	1.62	0.43
4:C:402:NAP:H2D	4:C:402:NAP:H6N	1.65	0.43
2:D:101:GLN:HB3	2:D:294:LEU:HD23	2.01	0.43
1:A:3:GLY:HA3	1:A:56:ILE:HD11	2.01	0.42
2:B:242:ALA:O	4:B:402:NAP:H52N	2.19	0.42
1:A:1:MET:HE3	1:A:1:MET:HB3	1.75	0.42
2:B:344:LEU:HD11	2:B:347:PRO:HD3	2.01	0.42
1:A:17:LYS:HE2	1:A:17:LYS:HB3	1.72	0.42
2:B:165:GLU:OE1	2:C:304:ARG:NH1	2.46	0.42
2:D:209:TYR:CE2	2:D:318:LYS:HG3	2.55	0.42
2:C:282:GLY:HA3	2:C:286:ALA:HB2	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:154:THR:OG1	2:D:295:CYS:HB3	2.20	0.42
2:D:267:TYR:CB	4:D:402:NAP:H1D	2.50	0.41
2:B:37:CYS:HB2	2:B:60:GLU:OE2	2.21	0.41
2:C:151:MET:SD	2:C:177:PRO:HB2	2.61	0.41
2:C:62[B]:VAL:HG11	2:C:136:LEU:HD22	2.03	0.41
4:D:402:NAP:H6N	4:D:402:NAP:H2D	1.61	0.41
2:C:94[A]:GLU:HB2	2:C:103:SER:HA	2.03	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	350/352 (99%)	338 (97%)	12 (3%)	0	100	100
2	B	357/352 (101%)	339 (95%)	16 (4%)	2 (1%)	25	15
2	C	360/352 (102%)	346 (96%)	14 (4%)	0	100	100
2	D	353/352 (100%)	341 (97%)	12 (3%)	0	100	100
All	All	1420/1408 (101%)	1364 (96%)	54 (4%)	2 (0%)	51	42

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	327[A]	PHE
2	B	327[B]	PHE

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	273/273 (100%)	272 (100%)	1 (0%)	91	91
2	B	278/272 (102%)	278 (100%)	0	100	100
2	C	282/272 (104%)	282 (100%)	0	100	100
2	D	275/272 (101%)	275 (100%)	0	100	100
All	All	1108/1089 (102%)	1107 (100%)	1 (0%)	93	94

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

3 non-standard protein/DNA/RNA residues 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	FME	D	1	2	8,9,10	0.90	0	7,9,11	0.94	0
2	FME	C	1	2	8,9,10	0.94	0	7,9,11	0.89	0
2	FME	B	1	2	8,9,10	0.92	0	7,9,11	1.03	1 (14%)

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	FME	D	1	2	-	1/7/9/11	-
2	FME	C	1	2	-	3/7/9/11	-
2	FME	B	1	2	-	3/7/9/11	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	FME	CA-N-CN	2.04	125.96	122.82

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1	FME	O1-CN-N-CA
2	B	1	FME	CB-CA-N-CN
2	C	1	FME	O1-CN-N-CA
2	C	1	FME	CB-CA-N-CN
2	B	1	FME	CB-CG-SD-CE
2	C	1	FME	CB-CG-SD-CE
2	D	1	FME	CB-CG-SD-CE

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no monosaccharides 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	$\# Z > 2$
5	2RP	C	403	3	5,5,5	0.40	0	5,5,5	0.53	0
5	2RP	B	403	3	5,5,5	0.41	0	5,5,5	0.55	0
5	2RP	D	403	3	5,5,5	0.41	0	5,5,5	0.50	0
4	NAP	A	402	-	45,52,52	4.63	18 (40%)	56,80,80	1.83	8 (14%)
4	NAP	B	402	-	45,52,52	4.63	18 (40%)	56,80,80	1.85	6 (10%)
5	2RP	A	403	3	5,5,5	0.43	0	5,5,5	0.52	0
4	NAP	C	402	-	45,52,52	4.61	17 (37%)	56,80,80	1.83	6 (10%)
4	NAP	D	402	-	45,52,52	4.62	18 (40%)	56,80,80	1.83	7 (12%)

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
5	2RP	C	403	3	-	3/3/3/3	-
5	2RP	B	403	3	-	3/3/3/3	-
5	2RP	D	403	3	-	1/3/3/3	-
4	NAP	A	402	-	-	12/31/67/67	0/5/5/5
4	NAP	B	402	-	-	12/31/67/67	0/5/5/5
5	2RP	A	403	3	-	3/3/3/3	-
4	NAP	C	402	-	-	14/31/67/67	0/5/5/5
4	NAP	D	402	-	-	14/31/67/67	0/5/5/5

All (71) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	C	402	NAP	C2D-C1D	-15.15	1.30	1.53
4	A	402	NAP	O4D-C1D	15.05	1.62	1.41
4	B	402	NAP	O4D-C1D	14.90	1.61	1.41
4	B	402	NAP	C2D-C1D	-14.87	1.31	1.53
4	D	402	NAP	O4D-C1D	14.86	1.61	1.41
4	D	402	NAP	C2D-C1D	-14.79	1.31	1.53
4	A	402	NAP	O4B-C1B	14.76	1.61	1.41
4	B	402	NAP	O4B-C1B	14.75	1.61	1.41
4	A	402	NAP	C2D-C1D	-14.71	1.31	1.53
4	C	402	NAP	O4D-C1D	14.68	1.61	1.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	402	NAP	O4B-C1B	14.68	1.61	1.41
4	C	402	NAP	O4B-C1B	14.53	1.61	1.41
4	C	402	NAP	C7N-N7N	9.28	1.50	1.33
4	D	402	NAP	C7N-N7N	9.12	1.50	1.33
4	B	402	NAP	C7N-N7N	9.10	1.50	1.33
4	A	402	NAP	C7N-N7N	9.03	1.50	1.33
4	A	402	NAP	O4D-C4D	-5.93	1.31	1.45
4	B	402	NAP	O4B-C4B	-5.89	1.31	1.45
4	C	402	NAP	O4B-C4B	-5.87	1.31	1.45
4	D	402	NAP	O4D-C4D	-5.86	1.31	1.45
4	A	402	NAP	O4B-C4B	-5.84	1.31	1.45
4	B	402	NAP	O4D-C4D	-5.82	1.32	1.45
4	C	402	NAP	O4D-C4D	-5.81	1.32	1.45
4	D	402	NAP	O4B-C4B	-5.79	1.32	1.45
4	C	402	NAP	C6A-N6A	5.17	1.53	1.34
4	A	402	NAP	C6A-N6A	5.17	1.52	1.34
4	B	402	NAP	C6A-N6A	5.17	1.52	1.34
4	D	402	NAP	C6A-N6A	5.16	1.52	1.34
4	D	402	NAP	C3N-C7N	4.39	1.57	1.50
4	A	402	NAP	C3N-C7N	4.38	1.57	1.50
4	C	402	NAP	C3N-C7N	4.32	1.57	1.50
4	B	402	NAP	C3N-C7N	4.29	1.57	1.50
4	A	402	NAP	P2B-O2B	4.18	1.67	1.59
4	C	402	NAP	P2B-O2B	4.13	1.67	1.59
4	B	402	NAP	P2B-O2B	4.03	1.66	1.59
4	D	402	NAP	P2B-O2B	4.01	1.66	1.59
4	D	402	NAP	O2D-C2D	3.77	1.51	1.43
4	B	402	NAP	O2D-C2D	3.71	1.51	1.43
4	C	402	NAP	O2D-C2D	3.69	1.51	1.43
4	A	402	NAP	O2D-C2D	3.67	1.51	1.43
4	A	402	NAP	O3D-C3D	-3.23	1.35	1.43
4	C	402	NAP	O3D-C3D	-3.18	1.35	1.43
4	B	402	NAP	O3D-C3D	-3.15	1.35	1.43
4	D	402	NAP	O3D-C3D	-3.14	1.35	1.43
4	D	402	NAP	PA-O5B	2.91	1.71	1.59
4	A	402	NAP	PA-O5B	2.87	1.70	1.59
4	B	402	NAP	PA-O5B	2.78	1.70	1.59
4	C	402	NAP	PA-O5B	2.72	1.70	1.59
4	B	402	NAP	O3B-C3B	-2.70	1.36	1.43
4	C	402	NAP	O3B-C3B	-2.62	1.36	1.43
4	A	402	NAP	O3B-C3B	-2.62	1.36	1.43
4	D	402	NAP	O3B-C3B	-2.61	1.36	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	402	NAP	C2N-N1N	2.45	1.37	1.35
4	C	402	NAP	C5A-C4A	-2.43	1.34	1.40
4	A	402	NAP	C5A-C4A	-2.43	1.34	1.40
4	B	402	NAP	C5A-C4A	-2.42	1.34	1.40
4	D	402	NAP	C2N-N1N	2.42	1.37	1.35
4	D	402	NAP	C5A-C4A	-2.41	1.34	1.40
4	A	402	NAP	C2N-N1N	2.29	1.37	1.35
4	C	402	NAP	C2A-N1A	2.19	1.38	1.33
4	D	402	NAP	C2A-N1A	2.17	1.37	1.33
4	B	402	NAP	C4N-C3N	-2.15	1.35	1.39
4	B	402	NAP	C2A-N1A	2.14	1.37	1.33
4	D	402	NAP	C2A-N3A	2.11	1.35	1.32
4	A	402	NAP	C2A-N1A	2.11	1.37	1.33
4	D	402	NAP	C4N-C3N	-2.09	1.35	1.39
4	C	402	NAP	C2A-N3A	2.08	1.35	1.32
4	B	402	NAP	C2A-N3A	2.06	1.35	1.32
4	A	402	NAP	C2A-N3A	2.06	1.35	1.32
4	A	402	NAP	O2B-C2B	2.03	1.51	1.44
4	C	402	NAP	C4N-C3N	-2.01	1.35	1.39

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	402	NAP	C5A-C6A-N6A	8.12	132.69	120.35
4	C	402	NAP	C5A-C6A-N6A	8.00	132.51	120.35
4	D	402	NAP	C5A-C6A-N6A	7.97	132.47	120.35
4	A	402	NAP	C5A-C6A-N6A	7.97	132.46	120.35
4	B	402	NAP	N3A-C2A-N1A	-5.57	119.97	128.68
4	C	402	NAP	N3A-C2A-N1A	-5.55	120.00	128.68
4	A	402	NAP	N3A-C2A-N1A	-5.51	120.07	128.68
4	D	402	NAP	N3A-C2A-N1A	-5.45	120.15	128.68
4	B	402	NAP	N6A-C6A-N1A	-5.45	107.25	118.57
4	C	402	NAP	N6A-C6A-N1A	-5.36	107.45	118.57
4	A	402	NAP	N6A-C6A-N1A	-5.36	107.45	118.57
4	D	402	NAP	N6A-C6A-N1A	-5.35	107.47	118.57
4	C	402	NAP	C1B-N9A-C4A	-5.19	117.53	126.64
4	B	402	NAP	C1B-N9A-C4A	-5.11	117.67	126.64
4	D	402	NAP	C1B-N9A-C4A	-5.09	117.69	126.64
4	A	402	NAP	C1B-N9A-C4A	-4.95	117.94	126.64
4	B	402	NAP	PN-O3-PA	-2.72	123.50	132.83
4	A	402	NAP	PN-O3-PA	-2.69	123.61	132.83
4	D	402	NAP	C3N-C7N-N7N	2.64	120.92	117.75

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	D	402	NAP	PN-O3-PA	-2.59	123.95	132.83
4	C	402	NAP	C3N-C7N-N7N	2.57	120.83	117.75
4	C	402	NAP	PN-O3-PA	-2.55	124.07	132.83
4	B	402	NAP	C3N-C7N-N7N	2.35	120.57	117.75
4	A	402	NAP	C3N-C7N-N7N	2.34	120.55	117.75
4	A	402	NAP	C6N-N1N-C2N	-2.05	120.10	121.97
4	A	402	NAP	O7N-C7N-N7N	-2.04	119.68	122.58
4	D	402	NAP	O7N-C7N-N7N	-2.01	119.72	122.58

There are no chirality outliers.

All (62) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	402	NAP	O4B-C4B-C5B-O5B
4	A	402	NAP	O4D-C1D-N1N-C2N
4	A	402	NAP	C2D-C1D-N1N-C2N
4	B	402	NAP	C5D-O5D-PN-O1N
4	B	402	NAP	O4D-C1D-N1N-C2N
4	B	402	NAP	O4D-C1D-N1N-C6N
4	B	402	NAP	C2D-C1D-N1N-C2N
4	B	402	NAP	C2D-C1D-N1N-C6N
4	C	402	NAP	O4D-C1D-N1N-C2N
4	C	402	NAP	O4D-C1D-N1N-C6N
4	C	402	NAP	C2D-C1D-N1N-C2N
4	C	402	NAP	C2D-C1D-N1N-C6N
4	D	402	NAP	O4B-C4B-C5B-O5B
4	D	402	NAP	O4D-C4D-C5D-O5D
4	D	402	NAP	O4D-C1D-N1N-C2N
4	D	402	NAP	O4D-C1D-N1N-C6N
4	D	402	NAP	C2D-C1D-N1N-C2N
4	D	402	NAP	C2D-C1D-N1N-C6N
5	A	403	2RP	C2-C6-C9-C13
4	B	402	NAP	O4B-C4B-C5B-O5B
4	B	402	NAP	C3B-C4B-C5B-O5B
4	B	402	NAP	O4D-C4D-C5D-O5D
4	C	402	NAP	O4B-C4B-C5B-O5B
4	C	402	NAP	C3B-C4B-C5B-O5B
4	C	402	NAP	O4D-C4D-C5D-O5D
4	D	402	NAP	C3B-C4B-C5B-O5B
4	A	402	NAP	C3B-C4B-C5B-O5B
5	B	403	2RP	C1-C2-C6-C9
4	A	402	NAP	C3B-C2B-O2B-P2B

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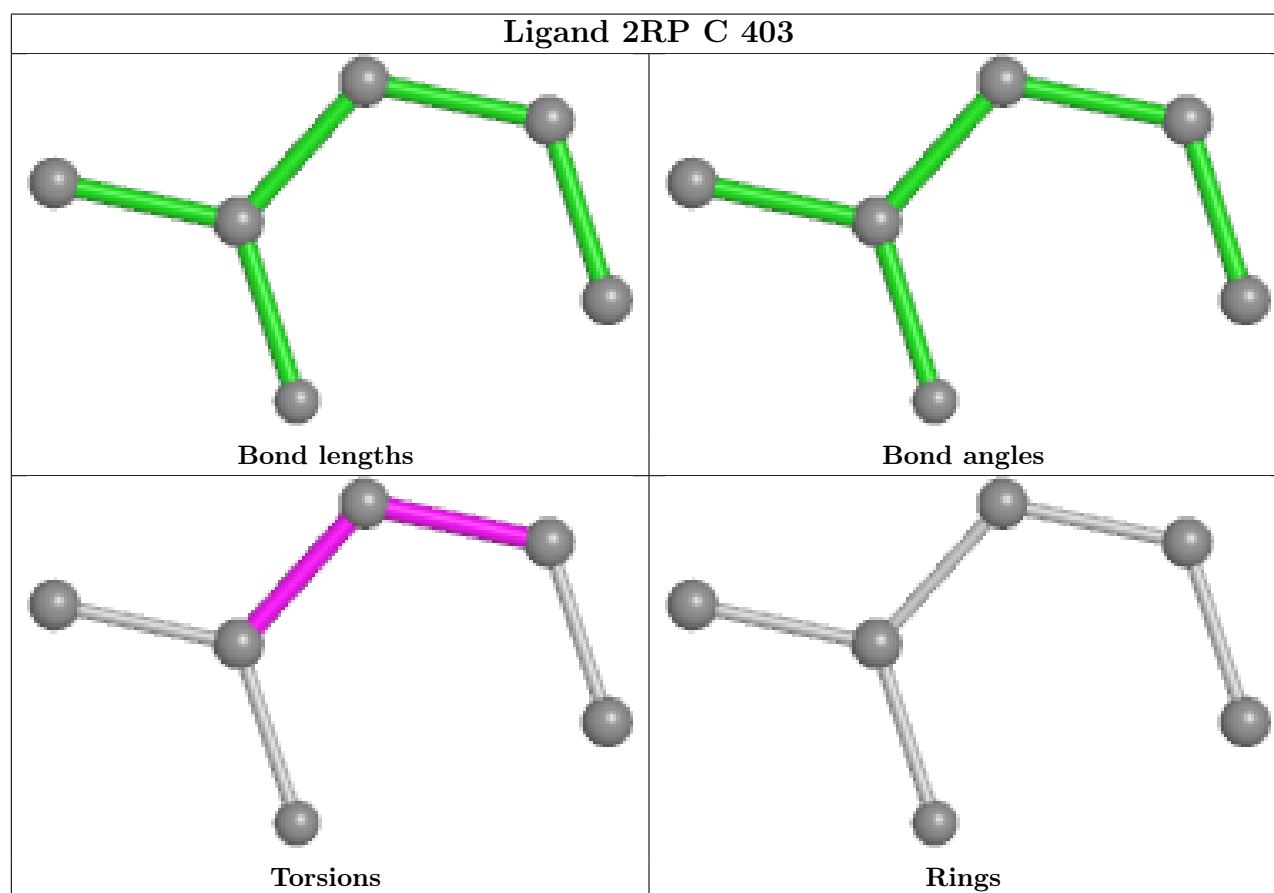
Mol	Chain	Res	Type	Atoms
5	A	403	2RP	C1-C2-C6-C9
5	C	403	2RP	C1-C2-C6-C9
5	D	403	2RP	C1-C2-C6-C9
4	A	402	NAP	C1B-C2B-O2B-P2B
4	B	402	NAP	C3D-C4D-C5D-O5D
5	A	403	2RP	C2-C6-C9-O17
5	B	403	2RP	C2-C6-C9-C13
5	C	403	2RP	C2-C6-C9-C13
4	A	402	NAP	PN-O3-PA-O5B
4	B	402	NAP	PN-O3-PA-O5B
4	C	402	NAP	PN-O3-PA-O5B
4	C	402	NAP	PA-O3-PN-O5D
4	D	402	NAP	PN-O3-PA-O5B
4	C	402	NAP	C3D-C4D-C5D-O5D
4	A	402	NAP	O4D-C4D-C5D-O5D
5	B	403	2RP	C2-C6-C9-O17
5	C	403	2RP	C2-C6-C9-O17
4	C	402	NAP	C1B-C2B-O2B-P2B
4	D	402	NAP	C1B-C2B-O2B-P2B
4	A	402	NAP	PA-O3-PN-O1N
4	B	402	NAP	PA-O3-PN-O1N
4	C	402	NAP	PA-O3-PN-O1N
4	D	402	NAP	PA-O3-PN-O1N
4	C	402	NAP	C3B-C2B-O2B-P2B
4	D	402	NAP	C3B-C2B-O2B-P2B
4	A	402	NAP	PA-O3-PN-O5D
4	B	402	NAP	PA-O3-PN-O5D
4	D	402	NAP	PA-O3-PN-O5D
4	D	402	NAP	C3D-C4D-C5D-O5D
4	A	402	NAP	C5D-O5D-PN-O3
4	A	402	NAP	C2D-C1D-N1N-C6N
4	C	402	NAP	C5D-O5D-PN-O1N
4	D	402	NAP	C5D-O5D-PN-O1N

There are no ring outliers.

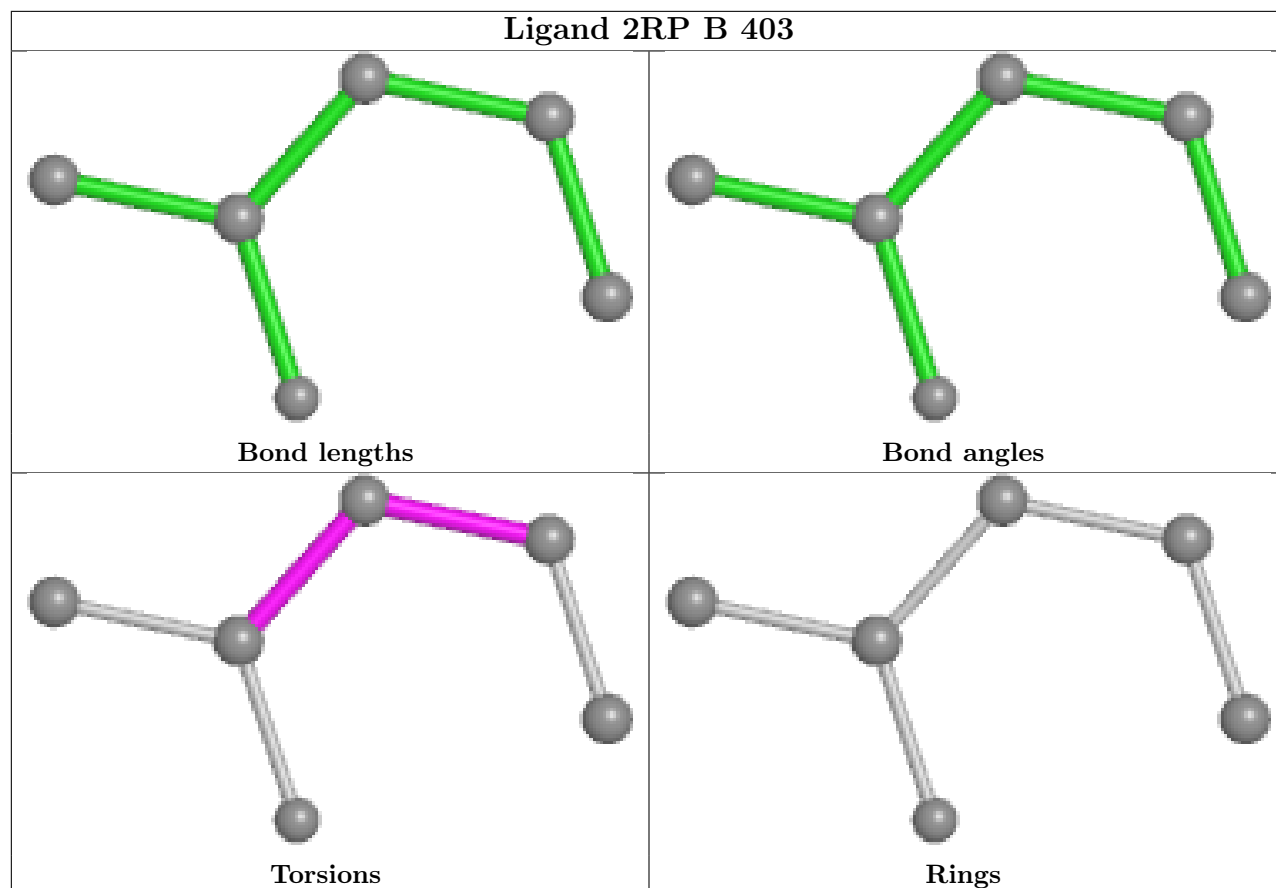
4 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	402	NAP	2	0
4	B	402	NAP	4	0
4	C	402	NAP	3	0
4	D	402	NAP	4	0

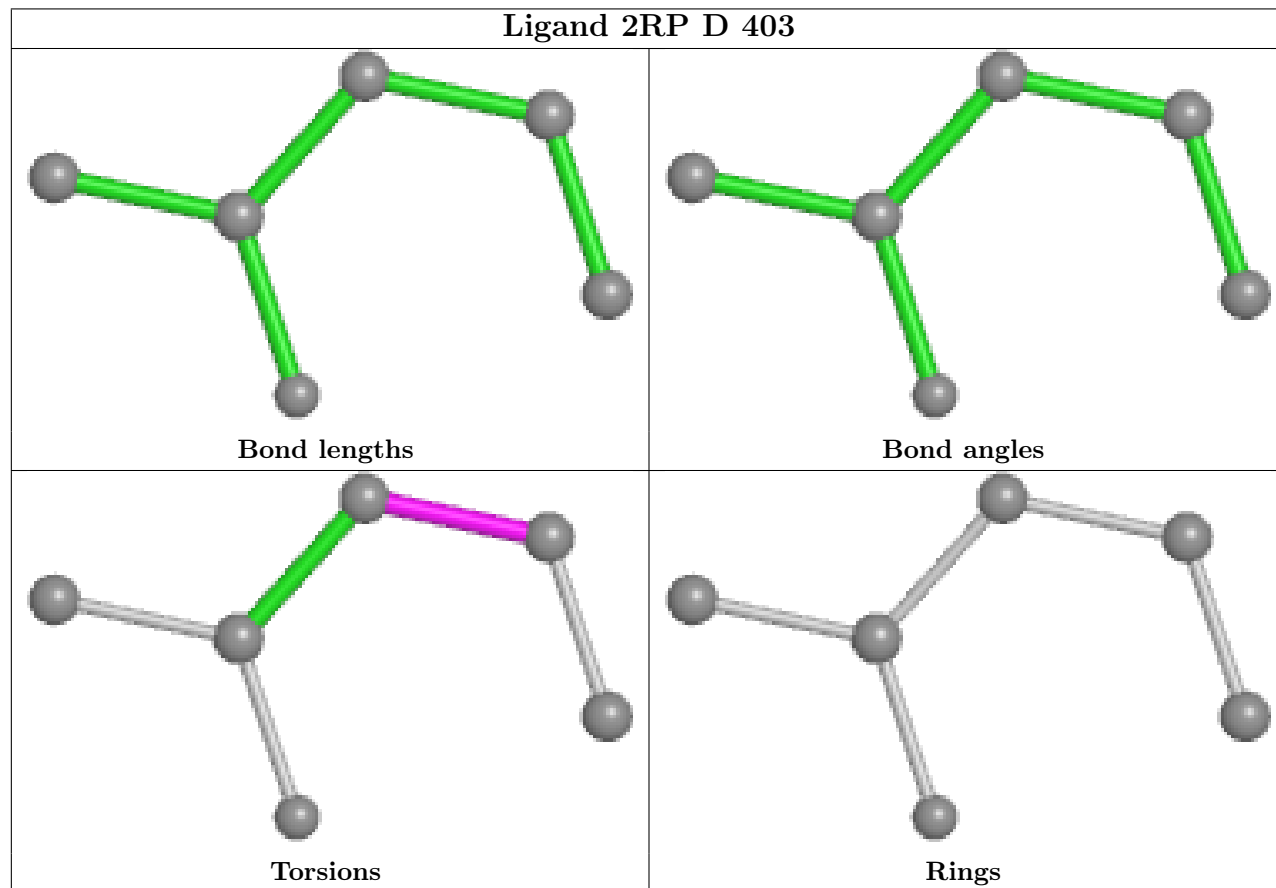
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

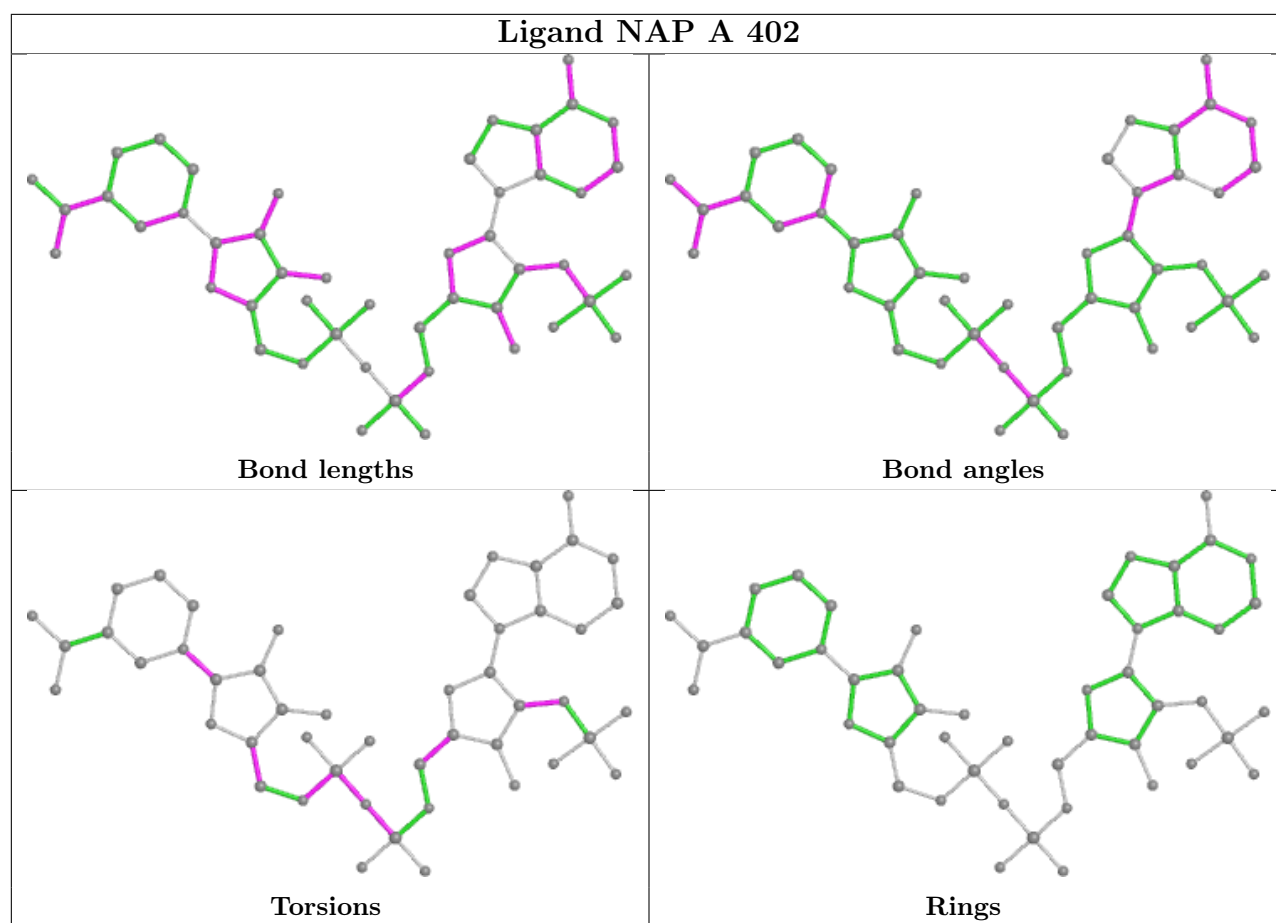


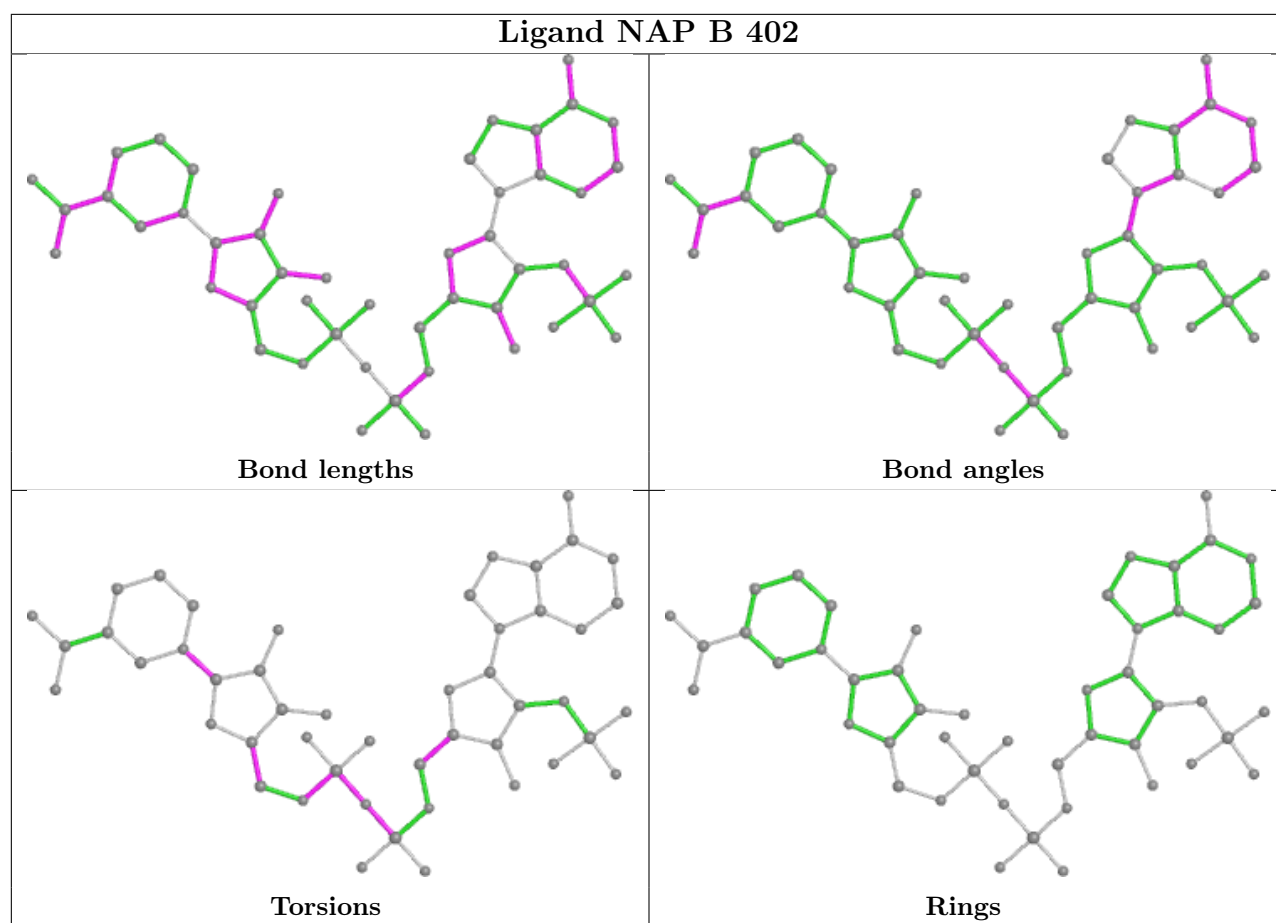
Ligand 2RP B 403

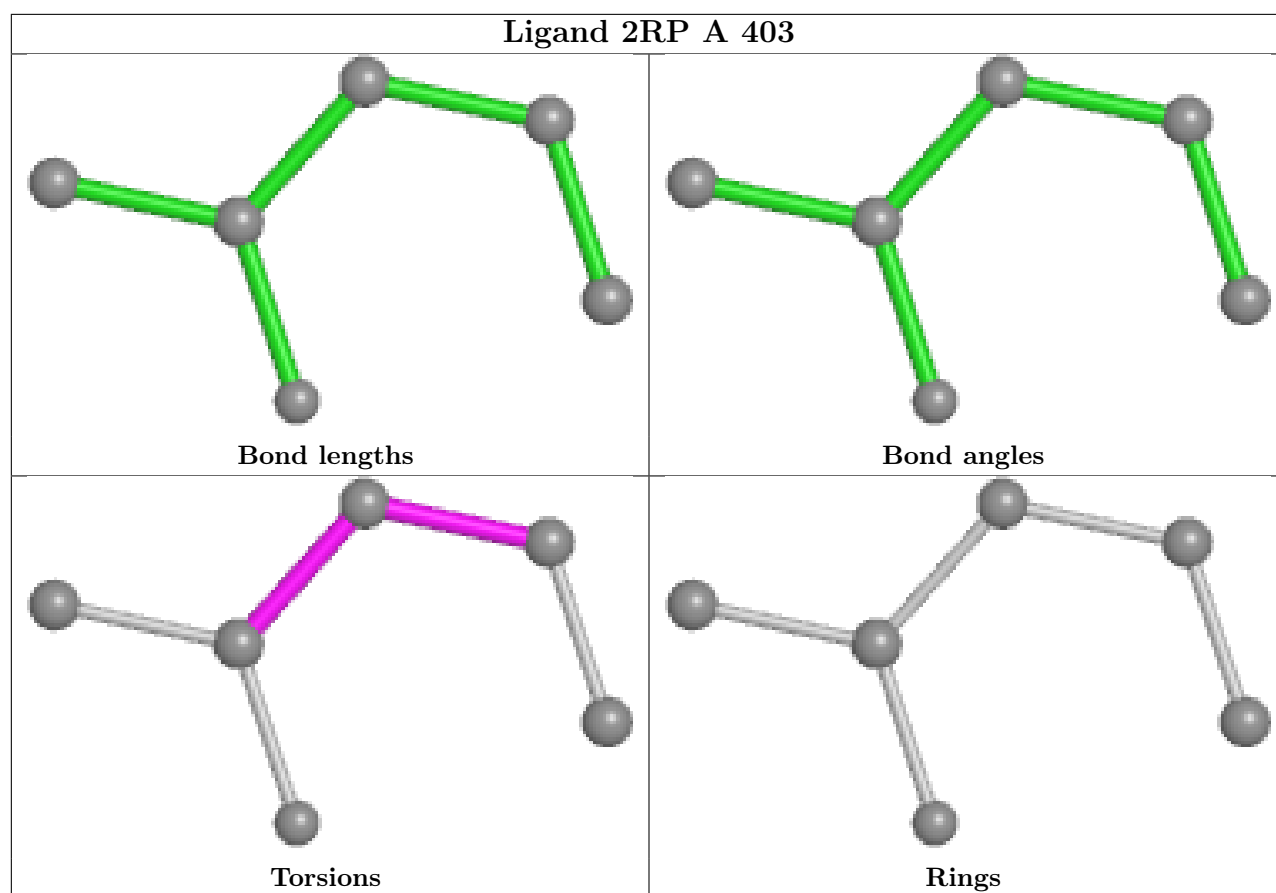


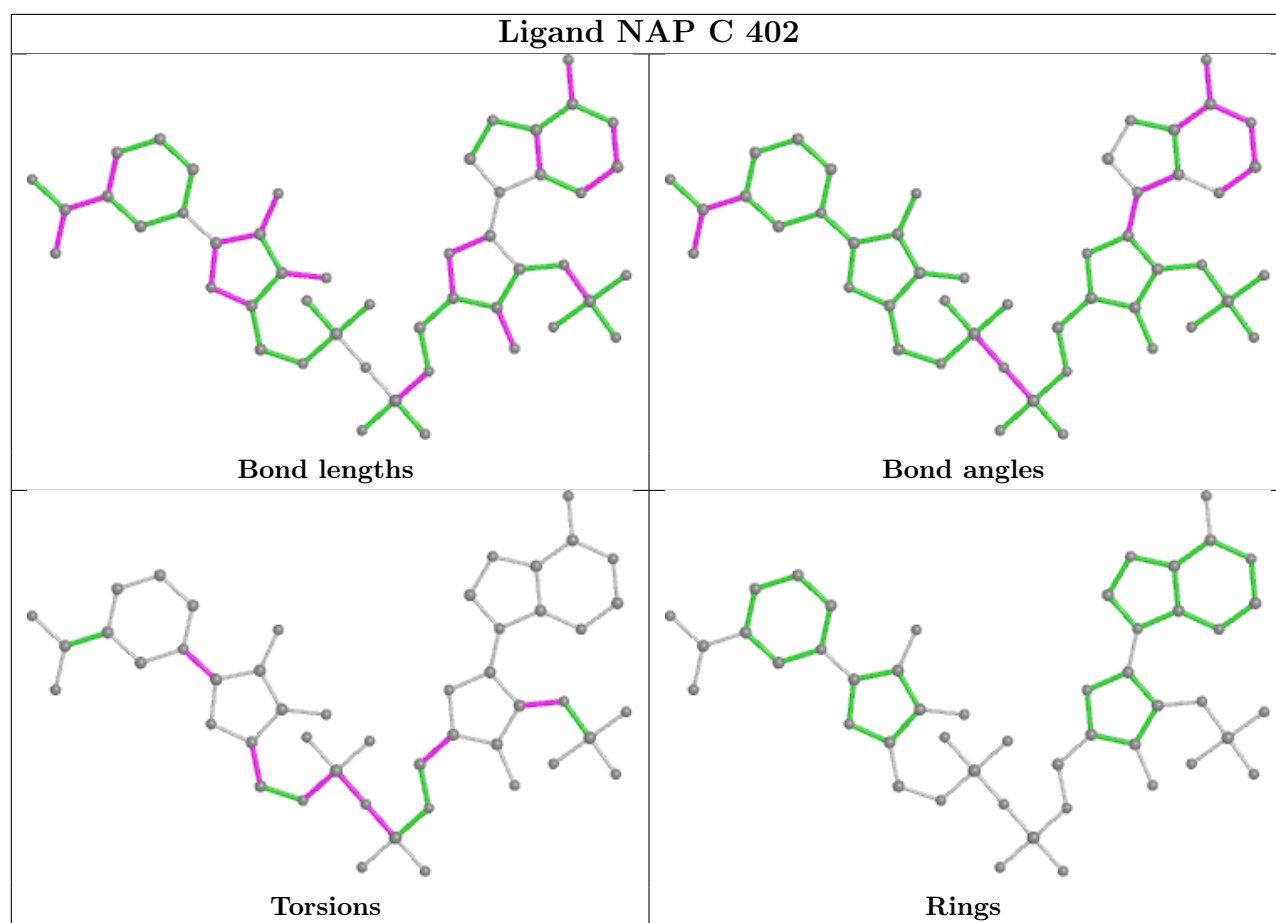
Ligand 2RP D 403

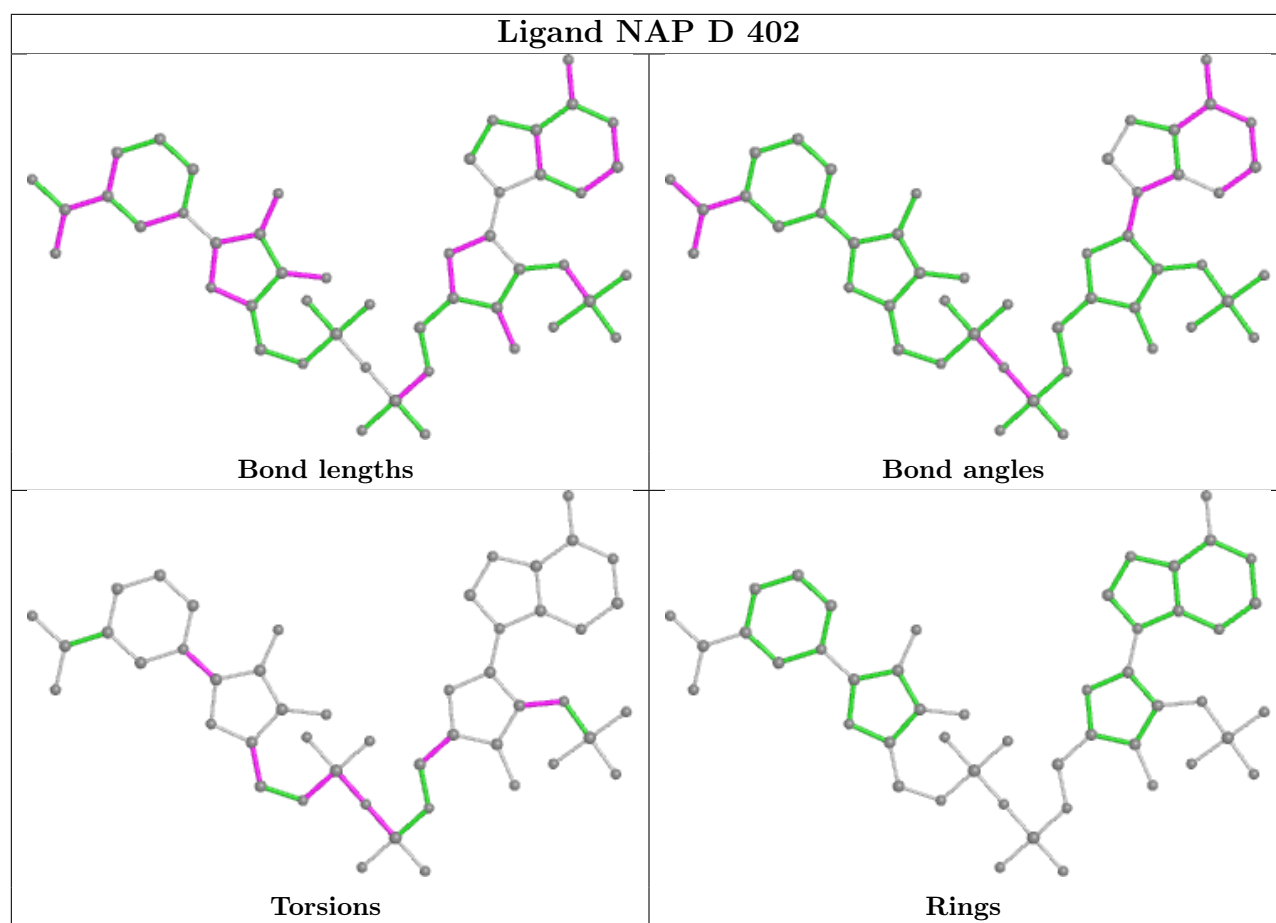












5.7 Other polymers [i](#)

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	352/352 (100%)	1.01	55 (15%) 2 2	35, 71, 137, 187	0
2	B	351/352 (99%)	0.02	12 (3%) 45 48	29, 50, 90, 116	0
2	C	351/352 (99%)	0.12	7 (1%) 65 68	25, 45, 78, 104	0
2	D	351/352 (99%)	0.02	3 (0%) 84 85	29, 43, 72, 94	0
All	All	1405/1408 (99%)	0.29	77 (5%) 25 28	25, 50, 103, 187	0

All (77) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	9	ILE	14.1
1	A	53	HIS	10.4
1	A	352	ALA	9.5
1	A	7	LEU	8.8
1	A	47	GLY	7.8
1	A	50	GLY	7.7
1	A	51	GLU	7.2
1	A	17	LYS	6.7
1	A	49	ILE	6.6
1	A	48	ALA	6.4
1	A	335	MET	6.4
1	A	14	TRP	6.1
1	A	4	PHE	5.8
1	A	15	ILE	5.6
1	A	44	VAL	5.6
1	A	324	PHE	5.5
1	A	57	LEU	5.3
1	A	12	VAL	5.1
1	A	8	SER	5.1
1	A	16	GLU	5.0
1	A	13	GLY	4.9

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Mol	Chain	Res	Type	RSRZ
1	A	328	ASP	4.7
1	A	46	GLU	4.6
1	A	327	PHE	4.6
1	A	18	GLU	4.5
2	C	218	TYR	4.5
1	A	351	LEU	4.4
2	B	352	ALA	4.4
2	B	9	ILE	4.2
1	A	6	MET	4.1
1	A	45	PHE	4.0
1	A	55	MET	4.0
1	A	331	GLU	4.0
1	A	52	ARG	3.8
2	C	352	ALA	3.8
1	A	10	GLY	3.8
1	A	325	ARG	3.7
1	A	2	LYS	3.7
1	A	43	THR	3.4
1	A	11	LYS	3.4
1	A	120	PHE	3.4
2	C	339[A]	ASP	3.2
2	B	325	ARG	3.2
1	A	123	PHE	3.2
1	A	29	VAL	3.1
1	A	339	ASP	3.1
1	A	332	LYS	3.0
2	B	48	ALA	2.9
2	C	221	GLY	2.9
2	B	339	ASP	2.9
2	B	279	LEU	2.8
2	D	218	TYR	2.8
1	A	54	ASN	2.8
1	A	3	GLY	2.8
2	B	51	GLU	2.7
2	B	269	GLY	2.7
1	A	80	ARG	2.6
1	A	329	ASN	2.6
1	A	56	ILE	2.6
1	A	338	LYS	2.5
1	A	77	PRO	2.4
1	A	143	GLU	2.4
2	B	219	LYS	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	219	LYS	2.3
2	C	11	LYS	2.2
1	A	350	ILE	2.2
1	A	333	ALA	2.2
2	C	9	ILE	2.2
2	D	53	HIS	2.2
1	A	269	GLY	2.2
1	A	70	SER	2.1
2	B	327[A]	PHE	2.1
2	D	33	ALA	2.1
2	B	267	TYR	2.1
2	B	49	ILE	2.1
2	C	70	SER	2.1
1	A	73	LYS	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [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(Å ²)	Q<0.9
2	FME	B	1	10/11	0.96	0.08	40,52,64,69	0
2	FME	C	1	10/11	0.96	0.15	55,63,76,78	0
2	FME	D	1	10/11	0.98	0.10	43,55,74,80	0

6.3 Carbohydrates [i](#)

There are no monosaccharides 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.

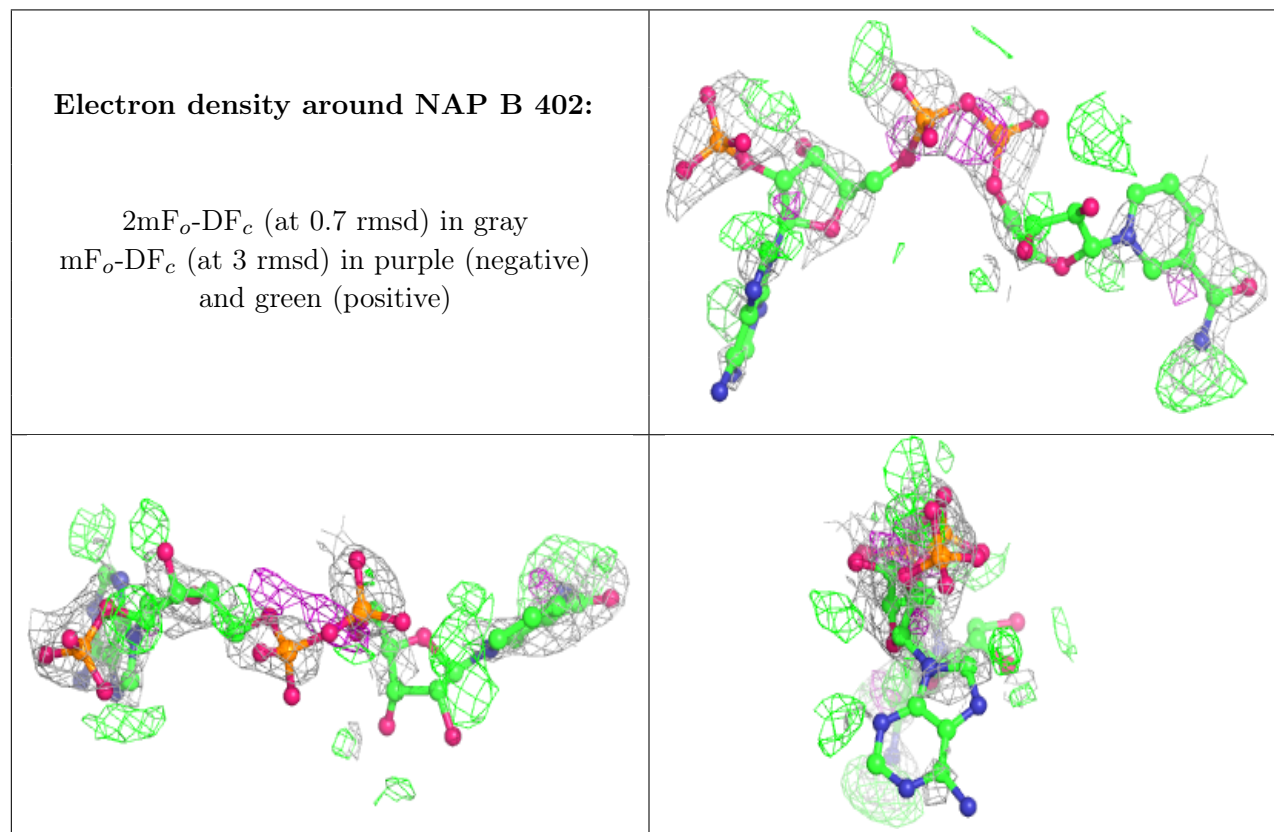
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	NAP	B	402	48/48	0.66	0.39	48,74,84,92	48

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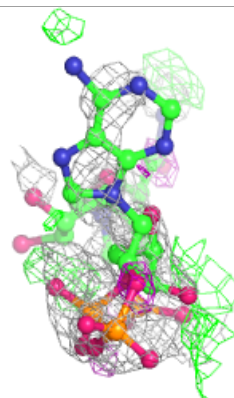
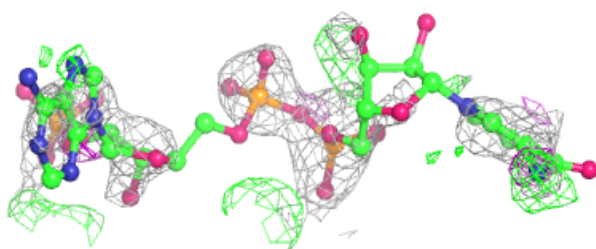
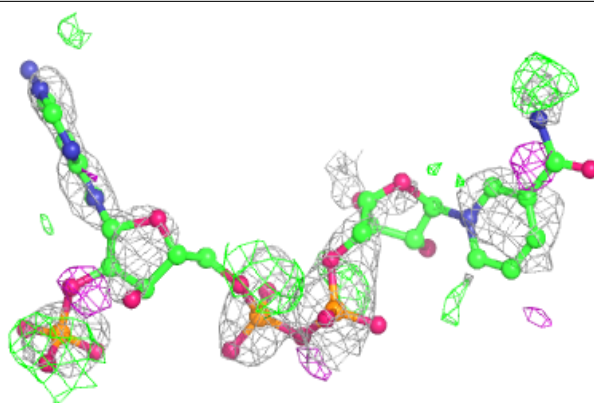
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	NAP	A	402	48/48	0.72	0.35	60,81,92,100	48
4	NAP	D	402	48/48	0.77	0.29	34,59,72,75	48
4	NAP	C	402	48/48	0.84	0.21	30,55,70,77	48
3	ZN	A	401	1/1	0.84	0.10	122,122,122,122	0
5	2RP	A	403	6/6	0.88	0.30	82,87,91,92	0
5	2RP	C	403	6/6	0.91	0.28	45,50,57,60	6
5	2RP	B	403	6/6	0.92	0.18	55,59,62,64	0
5	2RP	D	403	6/6	0.93	0.21	41,52,56,61	0
6	K	A	404	1/1	0.95	0.06	65,65,65,65	0
6	K	B	404	1/1	0.96	0.11	67,67,67,67	0
3	ZN	D	401	1/1	0.97	0.12	51,51,51,51	1
6	K	D	404	1/1	0.97	0.07	55,55,55,55	0
3	ZN	B	401	1/1	0.98	0.12	50,50,50,50	1
6	K	C	404	1/1	0.98	0.05	51,51,51,51	0
3	ZN	C	401	1/1	0.98	0.13	42,42,42,42	1

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.

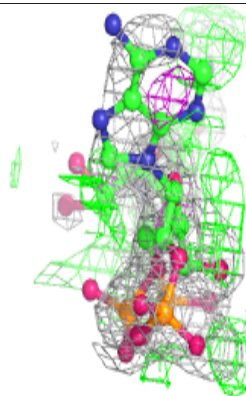
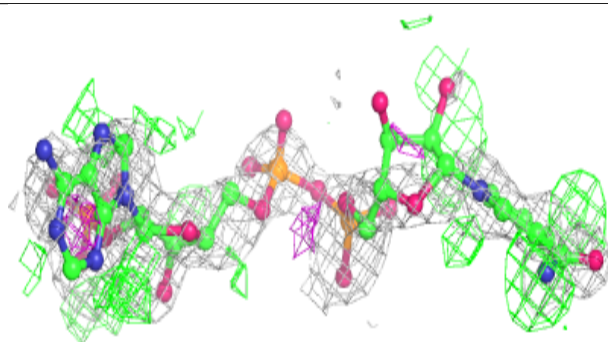
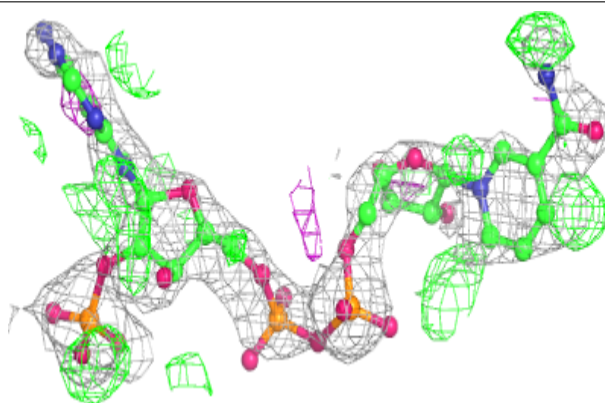


Electron density around NAP A 402:

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

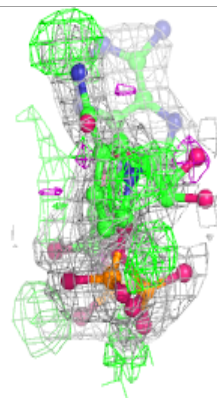
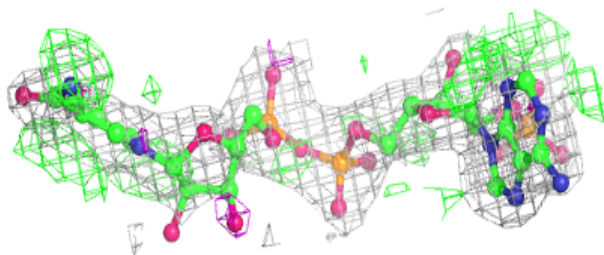
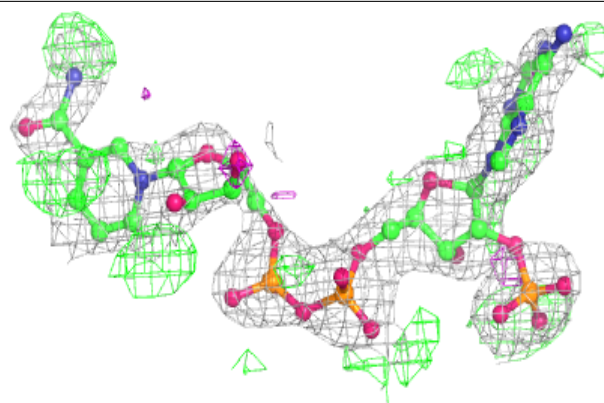
**Electron density around NAP D 402:**

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



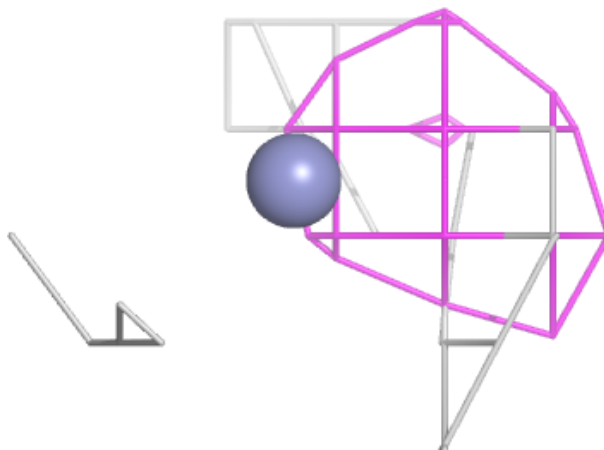
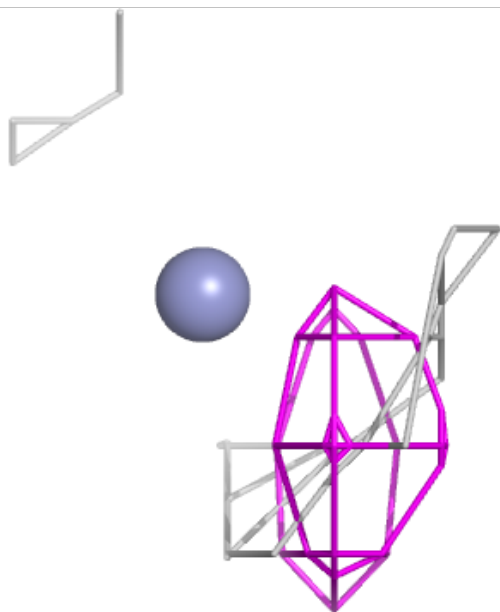
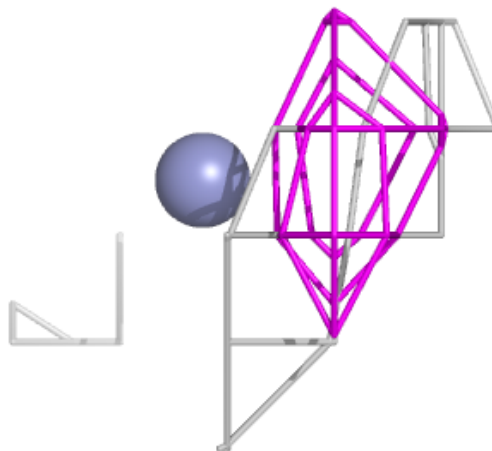
Electron density around NAP C 402:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



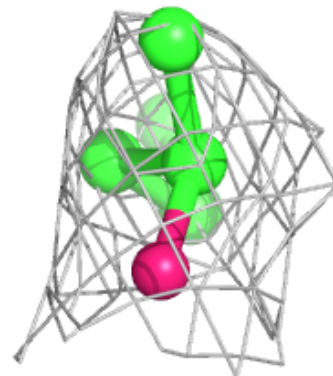
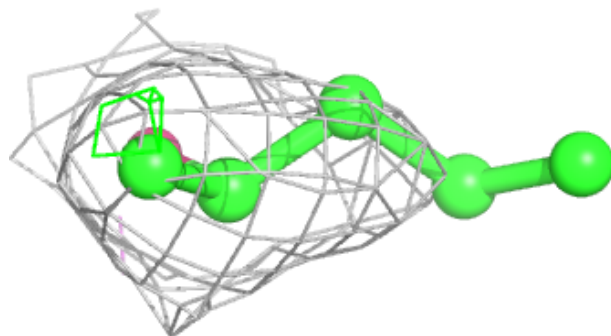
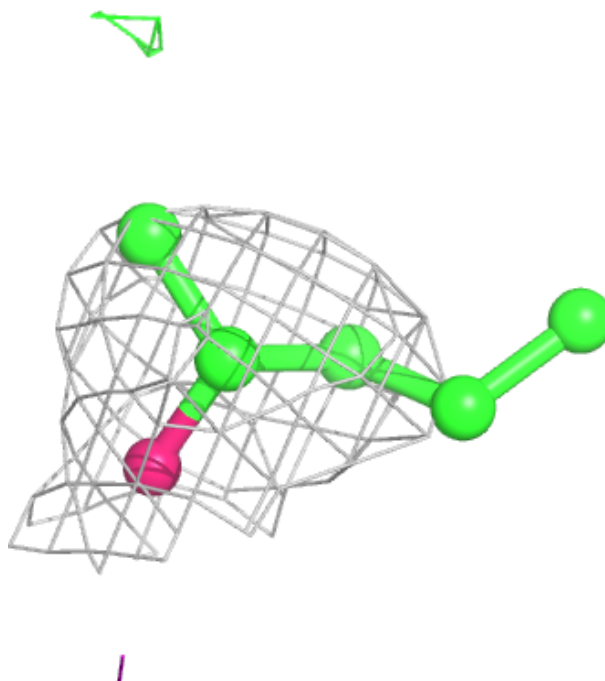
Electron density around ZN A 401:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



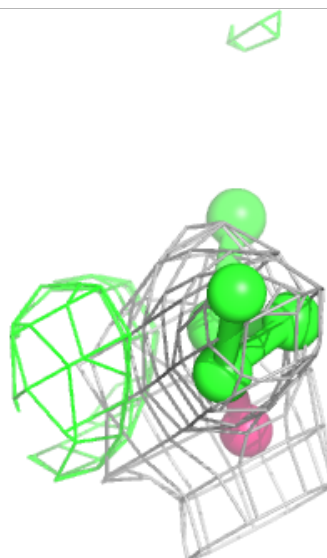
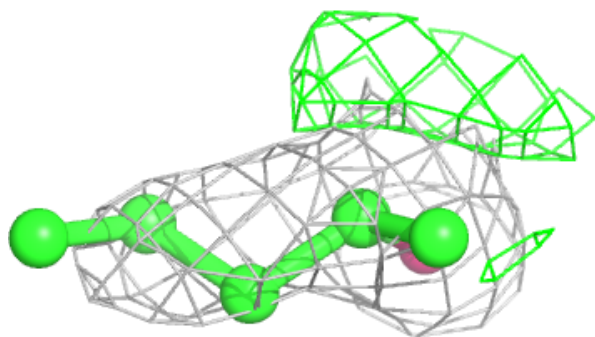
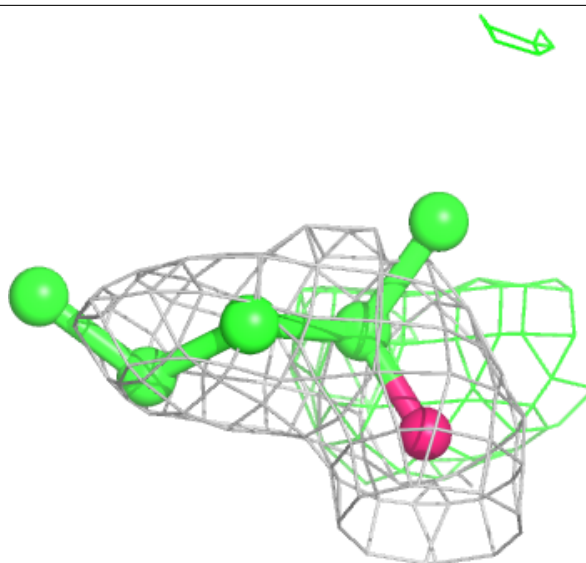
Electron density around 2RP A 403:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



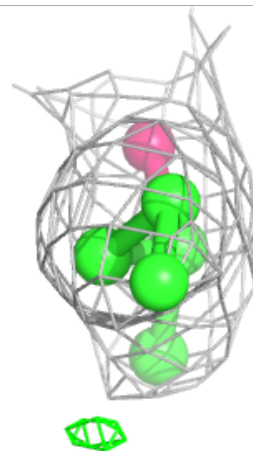
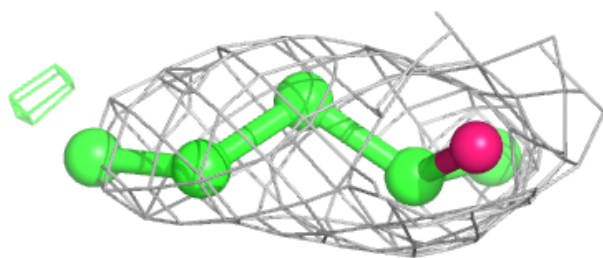
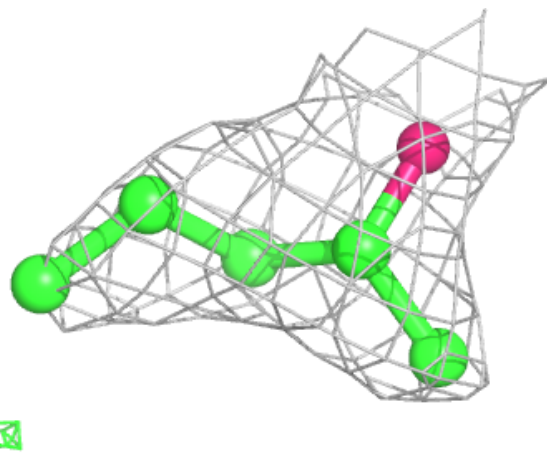
Electron density around 2RP C 403:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



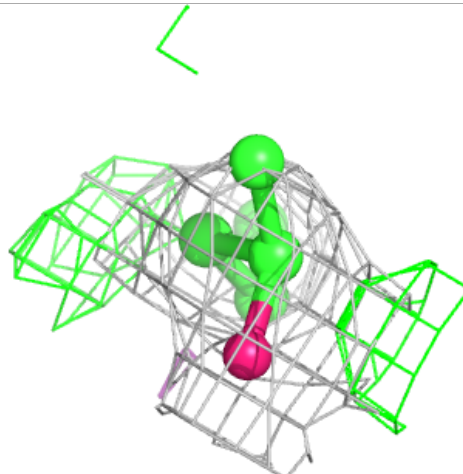
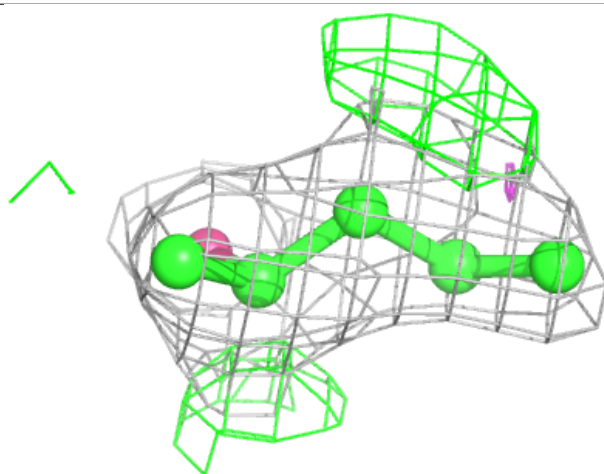
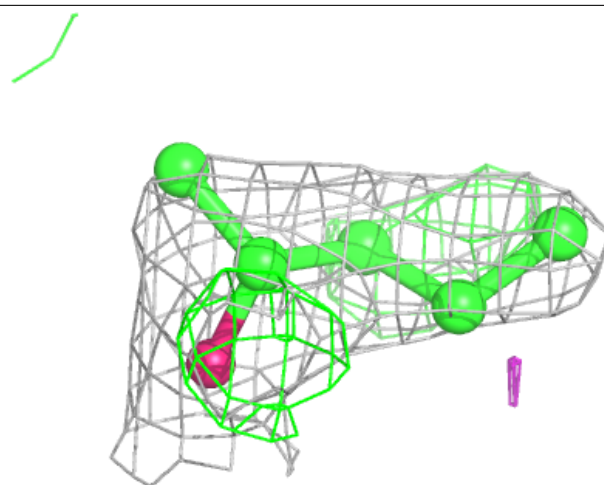
Electron density around 2RP B 403:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



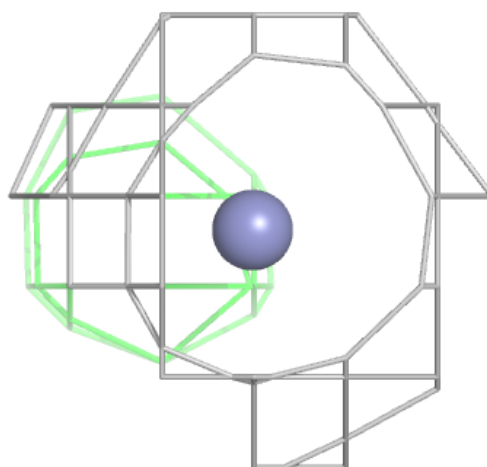
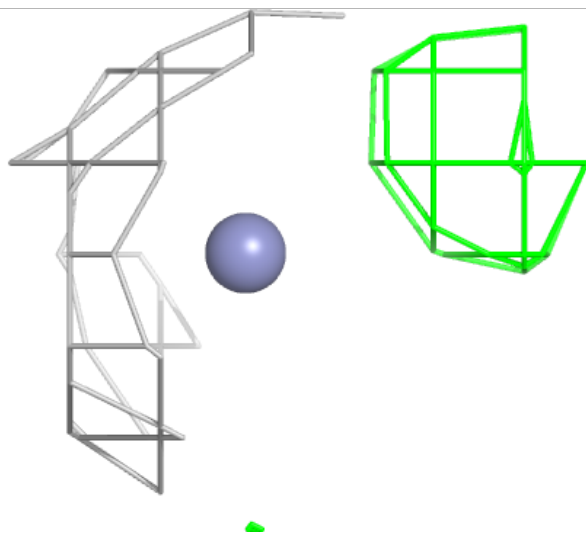
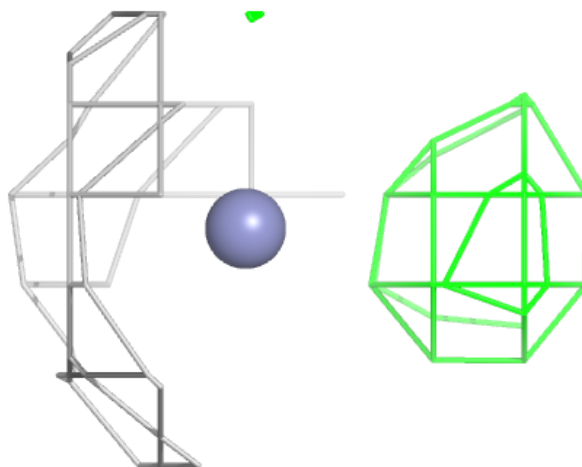
Electron density around 2RP D 403:

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



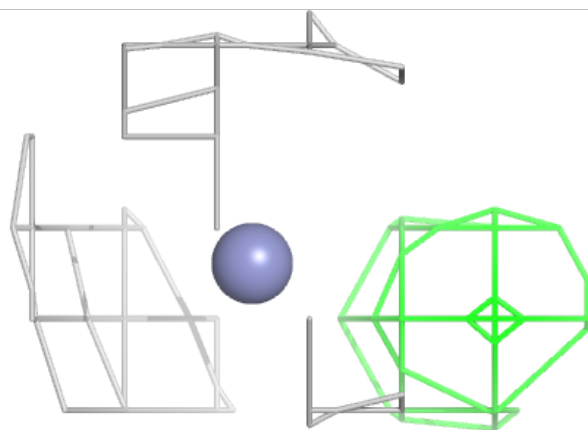
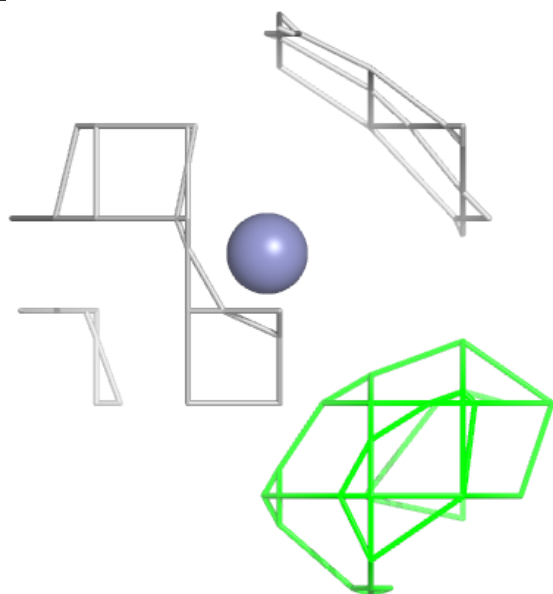
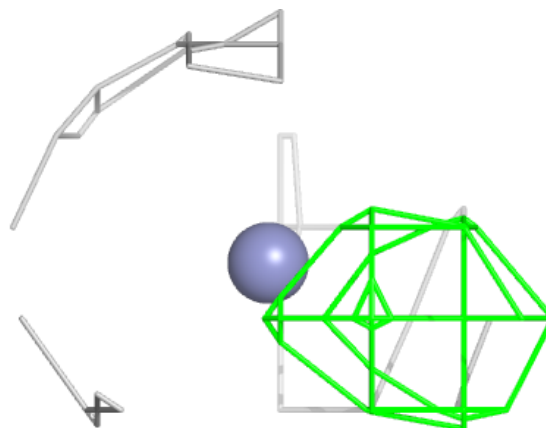
Electron density around ZN D 401:

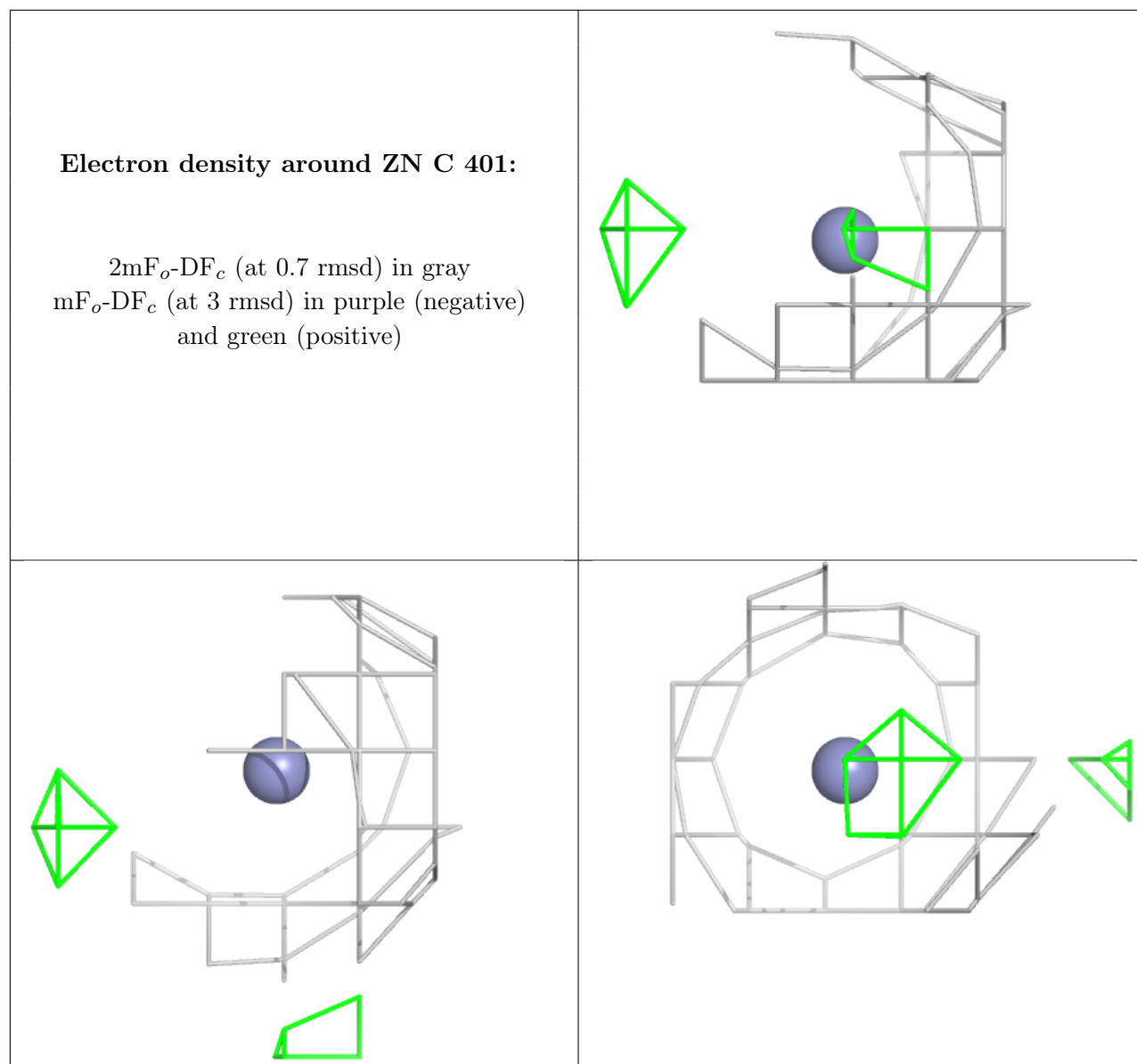
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around ZN B 401:

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





6.5 Other polymers ⓘ

There are no such residues in this entry.