WORLDWIDE PDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 06:24 PM JST

PDB ID	:	9U39 / pdb_00009u39
Title	:	Crystal structure of Serine Acetyltransferase (SAT) from Planctomyces limnophilus in complex with its substrate serine
Authors	:	Kumar, N.; Kumaran, S.
Deposited on	:	2025-03-18
Resolution	:	2.22 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:
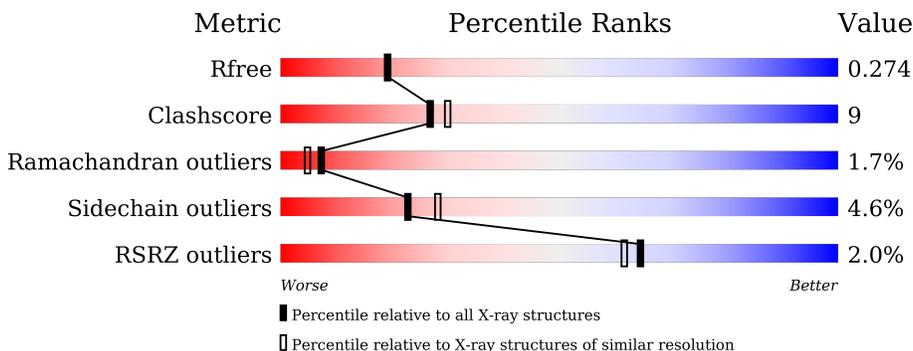
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.22 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	Percentile Ranks	Value
Rfree		0.274
Clashscore		9
Ramachandran outliers		1.7%
Sidechain outliers		4.6%
RSRZ outliers		2.0%

Worse *Better*

▌ Percentile relative to all X-ray structures

❘ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	7167 (2.24-2.20)
Clashscore	180529	8096 (2.24-2.20)
Ramachandran outliers	177936	8010 (2.24-2.20)
Sidechain outliers	177891	8011 (2.24-2.20)
RSRZ outliers	164620	7166 (2.24-2.20)

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 <=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	311	2% 72% 18% · 7%
1	B	311	2% 74% 17% · · ·
1	C	311	2% 76% 17% · ·

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

| Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	GOL	B	402	-	-	X	-
2	GOL	B	405	-	-	X	-
4	SER	B	406	-	-	X	-
4	SER	C	501	-	-	X	-
4	SER	C	502	-	-	X	-

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 7117 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 Serine O-acetyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	290	Total	C	N	O	S	0	0	0
			2250	1420	410	414	6			
1	B	299	Total	C	N	O	S	0	0	0
			2352	1486	426	434	6			
1	C	299	Total	C	N	O	S	0	0	0
			2313	1464	413	430	6			

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$) (labeled as "Ligand of Interest" by depositor).
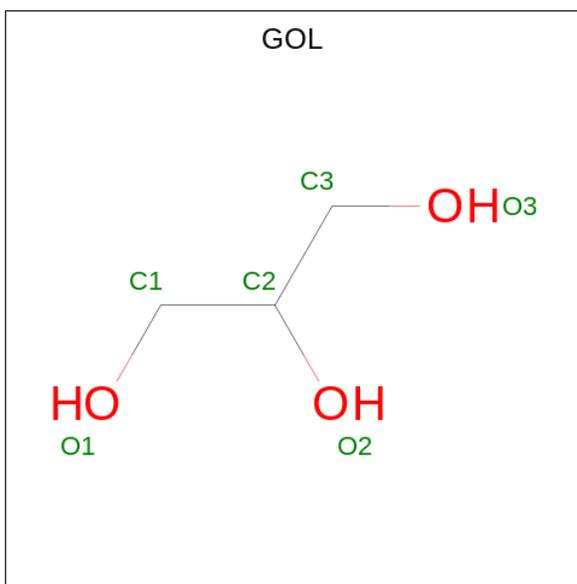
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			6	3	3		
2	A	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total 6	C 3	O 3	0	0
2	B	1	Total 6	C 3	O 3	0	0
2	B	1	Total 6	C 3	O 3	0	0
2	B	1	Total 6	C 3	O 3	0	0

- Molecule 3 is SODIUM ION (CCD ID: NA) (formula: Na) (labeled as "Ligand of Interest" by depositor).

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

- Molecule 4 is SERINE (CCD ID: SER) (formula: $C_3H_7NO_3$).

SER
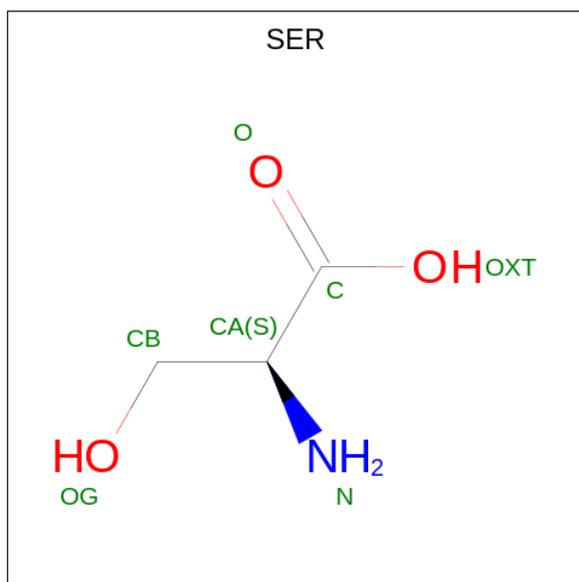
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	B	1	Total 7	C 3	N 1	O 3	0	0
4	C	1	Total 7	C 3	N 1	O 3	0	0
4	C	1	Total 7	C 3	N 1	O 3	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	42	Total 42	O 42	0	0
5	B	61	Total 61	O 61	0	0
5	C	35	Total 35	O 35	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.
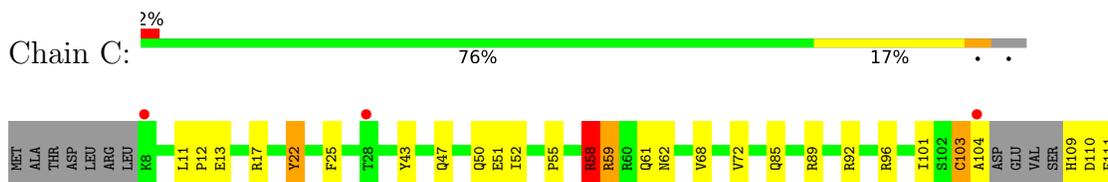
- Molecule 1: Serine O-acetyltransferase
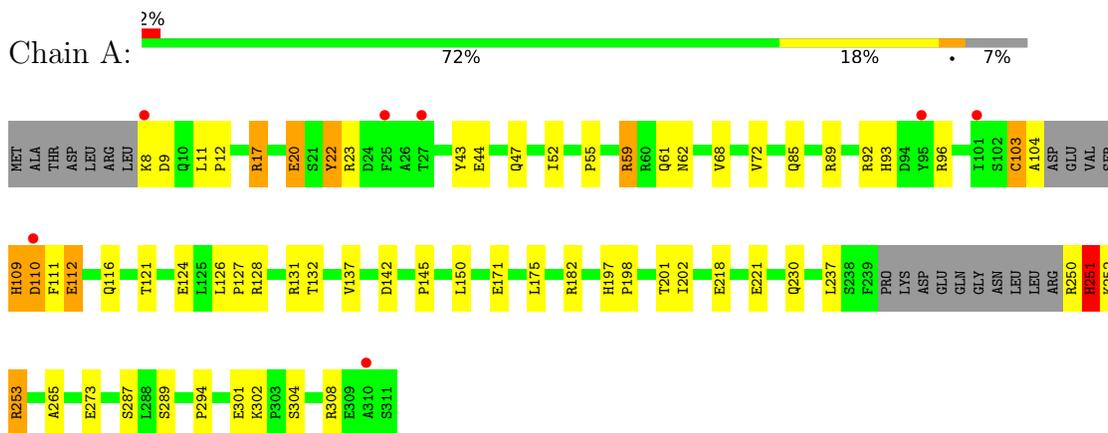
- Molecule 1: Serine O-acetyltransferase
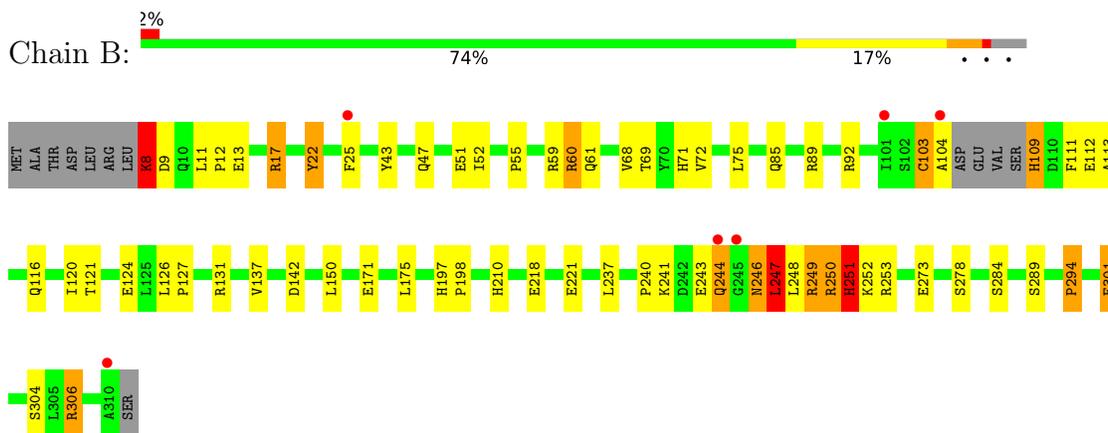
- Molecule 1: Serine O-acetyltransferase

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	104.98Å 90.03Å 122.54Å 90.00° 114.80° 90.00°	Depositor
Resolution (Å)	40.86 – 2.22 40.86 – 2.22	Depositor EDS
% Data completeness (in resolution range)	93.3 (40.86-2.22) 93.2 (40.86-2.22)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	2.12 (at 2.22Å)	Xtriage
Refinement program	REFMAC 5.8.0430 (refmacat 0.4.100)	Depositor
R, R_{free}	0.213 , 0.269 0.216 , 0.274	Depositor DCC
R_{free} test set	2330 reflections (4.51%)	wwPDB-VP
Wilson B-factor (Å^2)	33.5	Xtriage
Anisotropy	0.238	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 43.7	EDS
L-test for twinning[2]	$<\|L\|> = 0.52$, $<L^2> = 0.36$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7117	wwPDB-VP
Average B, all atoms (Å^2)	58.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.22% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $<\|L\|>$, $<L^2>$ 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: GOL, NA

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	0.64	0/2301	1.29	11/3133 (0.4%)
1	B	0.65	0/2407	1.31	10/3276 (0.3%)
1	C	0.62	0/2366	1.31	10/3225 (0.3%)
All	All	0.64	0/7074	1.30	31/9634 (0.3%)

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	2
1	B	0	1
1	C	0	2
All	All	0	5

There are no bond length outliers.

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	61	GLN	CB-CA-C	-10.36	94.39	110.04
1	C	61	GLN	CB-CA-C	-9.29	95.61	110.85
1	A	61	GLN	CB-CA-C	-8.98	96.48	111.02
1	C	58	ARG	CD-NE-CZ	8.55	136.38	124.40
1	B	61	GLN	N-CA-CB	8.35	127.48	114.45
1	A	111	PHE	N-CA-CB	-8.09	97.22	110.40
1	C	17	ARG	CB-CA-C	6.96	121.81	110.88
1	B	8	LYS	CB-CG-CD	6.91	127.19	111.30
1	A	17	ARG	CA-CB-CG	6.69	127.49	114.10
1	C	58	ARG	NE-CZ-NH1	-6.37	115.14	121.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	109	HIS	CA-CB-CG	6.23	120.03	113.80
1	B	17	ARG	CB-CA-C	6.19	120.61	110.88
1	C	157	TYR	CB-CA-C	6.08	119.85	109.82
1	A	253	ARG	CD-NE-CZ	-6.02	115.97	124.40
1	B	301	GLU	CB-CG-CD	5.87	122.57	112.60
1	C	58	ARG	NE-CZ-NH2	5.79	124.41	119.20
1	C	110	ASP	CA-CB-CG	5.72	118.32	112.60
1	C	109	HIS	CB-CA-C	5.52	120.58	110.10
1	B	142	ASP	CA-CB-CG	5.51	118.11	112.60
1	B	246	ASN	CB-CA-C	5.41	118.55	109.89
1	B	22	TYR	N-CA-CB	5.35	118.07	110.16
1	B	60	ARG	N-CA-C	5.20	121.88	110.80
1	C	110	ASP	CB-CA-C	5.15	120.68	110.42
1	A	132	THR	CA-CB-OG1	-5.13	101.91	109.60
1	A	17	ARG	CB-CG-CD	5.12	123.08	111.30
1	A	142	ASP	CA-CB-CG	5.09	117.69	112.60
1	C	22	TYR	N-CA-CB	5.08	117.77	110.20
1	A	287	SER	CB-CA-C	5.07	118.26	110.14
1	A	22	TYR	N-CA-CB	5.07	117.66	110.16
1	A	20	GLU	CB-CG-CD	5.05	121.18	112.60
1	B	251	HIS	CA-CB-CG	5.02	118.82	113.80

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	182	ARG	Sidechain
1	A	96	ARG	Sidechain
1	B	249	ARG	Sidechain
1	C	58	ARG	Sidechain
1	C	96	ARG	Sidechain

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	2250	0	2205	45	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2352	0	2321	50	0
1	C	2313	0	2257	41	0
2	A	12	0	16	0	0
2	B	30	0	40	9	0
3	A	1	0	0	0	0
4	B	7	0	4	4	0
4	C	14	0	8	8	0
5	A	42	0	0	2	0
5	B	61	0	0	4	0
5	C	35	0	0	2	0
All	All	7117	0	6851	126	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 9.

All (126) 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:221:GLU:OE2	1:B:252:LYS:HE3	1.83	0.77
1:C:221:GLU:OE2	1:C:252:LYS:HE3	1.85	0.77
1:B:250:ARG:HA	5:B:542:HOH:O	1.86	0.75
1:A:221:GLU:OE2	1:A:252:LYS:HE3	1.85	0.75
1:A:116:GLN:HE22	2:B:405:GOL:H11	1.51	0.75
1:C:137:VAL:HG12	1:C:150:LEU:HD22	1.70	0.74
1:B:137:VAL:HG12	1:B:150:LEU:HD22	1.70	0.74
5:B:545:HOH:O	1:C:248:LEU:HD21	1.88	0.72
1:A:250:ARG:HB3	5:A:527:HOH:O	1.91	0.71
1:A:137:VAL:HG12	1:A:150:LEU:HD22	1.71	0.70
1:A:250:ARG:CB	5:A:527:HOH:O	2.41	0.68
1:B:253:ARG:NH1	4:B:406:SER:OXT	2.27	0.67
1:C:253:ARG:NH1	4:C:501:SER:O	2.28	0.67
1:B:250:ARG:O	1:B:251:HIS:ND1	2.31	0.64
1:C:237:LEU:HD11	1:C:289:SER:HB3	1.82	0.61
1:A:68:VAL:O	1:A:72:VAL:HG23	2.01	0.61
1:B:68:VAL:O	1:B:72:VAL:HG23	2.02	0.59
1:C:253:ARG:NH1	4:C:501:SER:C	2.61	0.59
1:A:253:ARG:NH1	4:C:502:SER:OXT	2.35	0.59
1:B:237:LEU:HD11	1:B:289:SER:HB3	1.84	0.59
1:B:253:ARG:HH12	4:B:406:SER:C	2.11	0.59
1:A:59:ARG:HH21	1:A:59:ARG:HG2	1.68	0.58
1:C:249:ARG:O	1:C:250:ARG:C	2.46	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:253:ARG:NH1	4:B:406:SER:C	2.62	0.57
1:C:68:VAL:O	1:C:72:VAL:HG23	2.05	0.57
1:C:290:HIS:HD2	5:C:614:HOH:O	1.87	0.57
1:B:306:ARG:HD2	1:C:301:GLU:HA	1.86	0.56
1:C:250:ARG:O	1:C:251:HIS:C	2.48	0.56
1:A:145:PRO:HB2	1:B:253:ARG:NH1	2.21	0.56
1:B:8:LYS:HB2	2:B:405:GOL:H11	1.87	0.55
1:A:121:THR:HG21	1:A:175:LEU:HD21	1.88	0.54
1:A:253:ARG:HH12	4:C:502:SER:C	2.14	0.54
1:C:253:ARG:HH12	4:C:501:SER:C	2.15	0.54
1:B:109:HIS:HB2	1:B:113:ALA:HB2	1.89	0.54
1:B:301:GLU:HB3	5:B:527:HOH:O	2.07	0.54
1:A:251:HIS:CE1	1:A:253:ARG:HB3	2.43	0.54
1:A:265:ALA:HB2	2:B:402:GOL:C1	2.38	0.53
1:A:124:GLU:O	1:A:127:PRO:HD2	2.09	0.53
1:B:51:GLU:HG3	1:B:59:ARG:HH21	1.74	0.53
1:B:52:ILE:O	1:B:55:PRO:HD3	2.09	0.53
1:B:241:LYS:HA	1:B:247:LEU:H	1.73	0.53
1:C:253:ARG:NH1	4:C:501:SER:OXT	2.38	0.53
1:A:20:GLU:HG3	1:A:23:ARG:NH2	2.24	0.52
1:C:248:LEU:O	1:C:249:ARG:O	2.27	0.52
1:A:52:ILE:O	1:A:55:PRO:HD3	2.09	0.52
1:B:8:LYS:N	2:B:405:GOL:HO2	2.08	0.52
1:A:124:GLU:HG2	1:B:17:ARG:HH22	1.75	0.52
1:C:52:ILE:O	1:C:55:PRO:HD3	2.10	0.52
1:C:124:GLU:O	1:C:127:PRO:HD2	2.10	0.52
1:C:290:HIS:CD2	5:C:614:HOH:O	2.61	0.51
1:B:43:TYR:O	1:B:47:GLN:HG2	2.11	0.51
1:C:43:TYR:O	1:C:47:GLN:HG2	2.11	0.50
1:B:284:SER:H	2:B:403:GOL:H31	1.76	0.50
1:A:253:ARG:NH1	4:C:502:SER:C	2.70	0.50
1:B:250:ARG:HB3	5:B:542:HOH:O	2.11	0.50
1:B:124:GLU:O	1:B:127:PRO:HD2	2.12	0.50
1:A:124:GLU:HG2	1:B:17:ARG:NH2	2.27	0.49
1:B:218:GLU:OE1	1:B:253:ARG:NH2	2.45	0.49
1:C:197:HIS:CG	1:C:198:PRO:HD2	2.47	0.49
1:A:85:GLN:O	1:A:89:ARG:HG3	2.13	0.49
1:B:249:ARG:C	1:B:250:ARG:O	2.54	0.49
1:C:85:GLN:O	1:C:89:ARG:HG3	2.13	0.48
1:C:218:GLU:OE1	1:C:253:ARG:NH2	2.46	0.48
1:A:92:ARG:NH1	1:A:112:GLU:OE1	2.47	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:43:TYR:O	1:A:47:GLN:HG2	2.13	0.48
1:A:265:ALA:HB2	2:B:402:GOL:H12	1.96	0.47
1:C:219:THR:HG21	1:C:250:ARG:O	2.15	0.47
1:A:218:GLU:OE1	1:A:253:ARG:NH2	2.48	0.46
1:B:197:HIS:CG	1:B:198:PRO:HD2	2.51	0.46
1:B:253:ARG:NH1	4:B:406:SER:O	2.47	0.46
1:A:11:LEU:N	1:A:12:PRO:CD	2.79	0.45
1:B:85:GLN:O	1:B:89:ARG:HG3	2.16	0.45
1:A:103:CYS:O	1:A:104:ALA:C	2.59	0.45
1:B:103:CYS:O	1:B:104:ALA:C	2.58	0.45
1:A:55:PRO:HG3	1:B:22:TYR:CZ	2.51	0.45
1:C:128:ARG:NH2	1:C:171:GLU:OE2	2.49	0.45
1:B:92:ARG:HG2	1:B:111:PHE:CD2	2.52	0.45
1:B:240:PRO:HB2	1:B:248:LEU:HD12	1.99	0.45
1:A:197:HIS:CG	1:A:198:PRO:HD2	2.51	0.45
1:C:103:CYS:O	1:C:104:ALA:C	2.59	0.44
1:A:250:ARG:O	1:A:251:HIS:CG	2.70	0.44
1:A:251:HIS:O	1:A:251:HIS:ND1	2.51	0.44
1:C:11:LEU:N	1:C:12:PRO:CD	2.81	0.44
1:C:126:LEU:N	1:C:127:PRO:CD	2.81	0.44
1:A:116:GLN:HE22	2:B:405:GOL:C1	2.27	0.44
1:B:121:THR:HG21	1:B:175:LEU:HD21	2.00	0.44
1:A:126:LEU:N	1:A:127:PRO:CD	2.81	0.44
1:C:230:GLN:O	1:C:230:GLN:HG2	2.18	0.44
1:B:126:LEU:N	1:B:127:PRO:CD	2.81	0.43
1:C:121:THR:HG21	1:C:175:LEU:HD21	1.99	0.43
1:B:55:PRO:HG3	1:C:22:TYR:CZ	2.53	0.43
1:A:93:HIS:HE2	1:C:151:ASP:CG	2.26	0.43
1:C:173:TYR:CE2	1:C:199:GLY:HA2	2.52	0.43
1:A:22:TYR:CZ	1:C:55:PRO:HG3	2.54	0.43
1:B:250:ARG:O	1:B:251:HIS:CB	2.67	0.43
1:C:50:GLN:HB3	1:C:58:ARG:HD2	2.00	0.43
1:B:244:GLN:HA	1:B:244:GLN:OE1	2.19	0.42
1:B:246:ASN:O	1:B:247:LEU:HB2	2.19	0.42
1:A:265:ALA:CB	2:B:402:GOL:H12	2.49	0.42
1:B:11:LEU:N	1:B:12:PRO:CD	2.82	0.42
1:B:131:ARG:HG3	1:C:25:PHE:CZ	2.54	0.42
1:A:230:GLN:O	1:A:230:GLN:HG2	2.20	0.42
1:A:171:GLU:HA	1:A:171:GLU:OE1	2.20	0.42
1:A:301:GLU:O	1:A:302:LYS:C	2.62	0.42
1:B:278:SER:O	1:B:294:PRO:HA	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:171:GLU:HA	1:B:171:GLU:OE1	2.20	0.42
1:A:265:ALA:HB2	2:B:402:GOL:H11	2.02	0.41
1:C:92:ARG:HG2	1:C:111:PHE:CD2	2.55	0.41
1:A:62:ASN:OD1	1:A:62:ASN:N	2.53	0.41
1:A:128:ARG:NH2	1:A:171:GLU:OE2	2.53	0.41
1:B:250:ARG:O	1:B:251:HIS:CG	2.73	0.41
1:A:109:HIS:O	1:A:110:ASP:CB	2.68	0.41
1:A:131:ARG:HG3	1:B:25:PHE:CZ	2.55	0.41
1:C:51:GLU:OE1	1:C:59:ARG:HB2	2.20	0.41
1:B:51:GLU:OE1	1:B:59:ARG:N	2.49	0.41
1:C:171:GLU:HA	1:C:171:GLU:OE1	2.21	0.41
1:B:109:HIS:O	1:B:113:ALA:HB3	2.21	0.41
1:B:116:GLN:O	1:B:120:ILE:HG12	2.20	0.41
1:C:62:ASN:OD1	1:C:62:ASN:N	2.54	0.41
1:C:116:GLN:O	1:C:120:ILE:HG12	2.21	0.41
1:C:197:HIS:ND1	1:C:198:PRO:HD2	2.35	0.41
1:B:71:HIS:CE1	1:B:75:LEU:HD11	2.57	0.40
1:C:243:GLU:O	1:C:244:GLN:CB	2.68	0.40
1:B:243:GLU:HB2	1:B:244:GLN:H	1.74	0.40
1:A:201:THR:C	1:A:202:ILE:HG13	2.47	0.40
1:A:253:ARG:NH1	4:C:502:SER:O	2.49	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	284/311 (91%)	268 (94%)	13 (5%)	3 (1%)	12	10
1	B	295/311 (95%)	272 (92%)	17 (6%)	6 (2%)	6	3
1	C	295/311 (95%)	269 (91%)	20 (7%)	6 (2%)	6	3
All	All	874/933 (94%)	809 (93%)	50 (6%)	15 (2%)	7	5

All (15) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	110	ASP
1	C	244	GLN
1	B	60	ARG
1	B	247	LEU
1	C	249	ARG
1	C	251	HIS
1	C	250	ARG
1	A	251	HIS
1	B	250	ARG
1	B	251	HIS
1	C	294	PRO
1	B	294	PRO
1	A	294	PRO
1	B	210	HIS
1	C	210	HIS

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	239/265 (90%)	226 (95%)	13 (5%)	18	21
1	B	254/265 (96%)	242 (95%)	12 (5%)	22	27
1	C	245/265 (92%)	236 (96%)	9 (4%)	29	37
All	All	738/795 (93%)	704 (95%)	34 (5%)	23	28

All (34) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	LYS
1	A	9	ASP
1	A	17	ARG
1	A	44	GLU
1	A	59	ARG
1	A	103	CYS

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Mol	Chain	Res	Type
1	A	112	GLU
1	A	237	LEU
1	A	251	HIS
1	A	273	GLU
1	A	289	SER
1	A	304	SER
1	A	308	ARG
1	B	8	LYS
1	B	9	ASP
1	B	13	GLU
1	B	69	THR
1	B	103	CYS
1	B	109	HIS
1	B	112	GLU
1	B	244	GLN
1	B	247	LEU
1	B	273	GLU
1	B	304	SER
1	B	306	ARG
1	C	13	GLU
1	C	58	ARG
1	C	59	ARG
1	C	101	ILE
1	C	103	CYS
1	C	120	ILE
1	C	128	ARG
1	C	243	GLU
1	C	304	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	61	GLN
1	A	71	HIS
1	A	99	HIS
1	A	116	GLN
1	B	61	GLN
1	B	71	HIS
1	B	98	GLN
1	B	99	HIS
1	B	266	ASN
1	C	61	GLN

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Mol	Chain	Res	Type
1	C	99	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 11 ligands modelled in this entry, 1 is monoatomic - leaving 10 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).

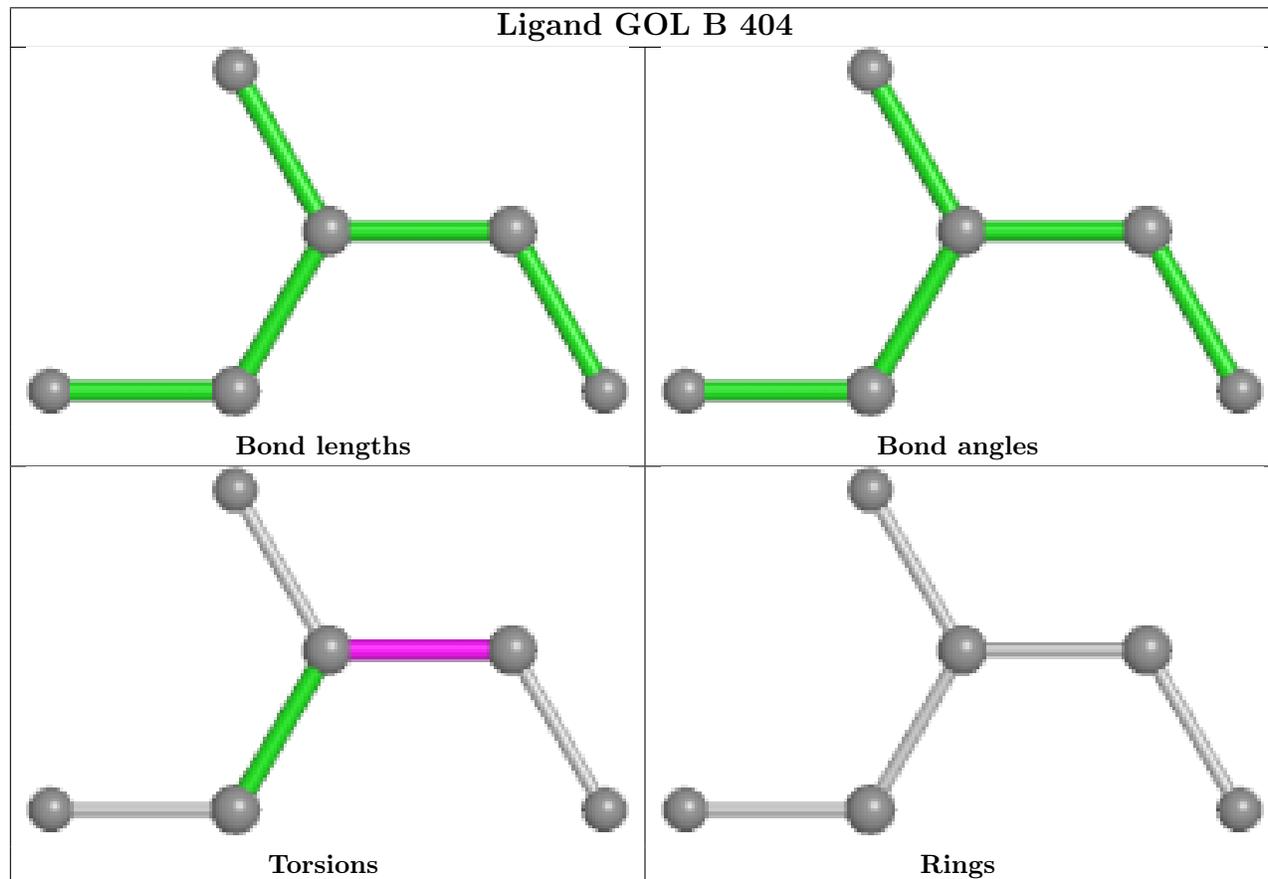| Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	GOL	B	402	-	5,5,5	0.23	0	5,5,5	0.53	0
2	GOL	B	403	-	5,5,5	0.13	0	5,5,5	0.55	0
2	GOL	B	404	-	5,5,5	0.20	0	5,5,5	0.58	0
2	GOL	B	401	-	5,5,5	0.12	0	5,5,5	0.36	0
4	SER	C	502	-	5,6,6	1.08	0	5,7,7	0.88	0
2	GOL	A	402	-	5,5,5	0.14	0	5,5,5	0.45	0
2	GOL	B	405	-	5,5,5	0.07	0	5,5,5	0.40	0
4	SER	B	406	-	5,6,6	1.48	1 (20%)	5,7,7	0.84	0
4	SER	C	501	-	5,6,6	0.59	0	5,7,7	1.34	0
2	GOL	A	401	-	5,5,5	0.19	0	5,5,5	0.53	0

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	GOL	B	402	-	-	3/4/4/4	-
2	GOL	B	403	-	-	2/4/4/4	-
2	GOL	B	404	-	-	1/4/4/4	-
2	GOL	B	401	-	-	0/4/4/4	-
4	SER	C	502	-	-	0/6/6/6	-
2	GOL	A	402	-	-	2/4/4/4	-
2	GOL	B	405	-	-	2/4/4/4	-
4	SER	B	406	-	-	0/6/6/6	-
4	SER	C	501	-	-	0/6/6/6	-
2	GOL	A	401	-	-	0/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	406	SER	O-C	2.28	1.29	1.22

There are no bond angle outliers.

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	402	GOL	O1-C1-C2-C3
2	B	402	GOL	O1-C1-C2-O2
2	B	403	GOL	C1-C2-C3-O3
2	B	404	GOL	O1-C1-C2-C3
2	B	405	GOL	C1-C2-C3-O3
2	B	405	GOL	O2-C2-C3-O3
2	B	403	GOL	O2-C2-C3-O3
2	A	402	GOL	O2-C2-C3-O3
2	B	402	GOL	O2-C2-C3-O3
2	A	402	GOL	C1-C2-C3-O3

There are no ring outliers.

6 monomers are involved in 21 short contacts:

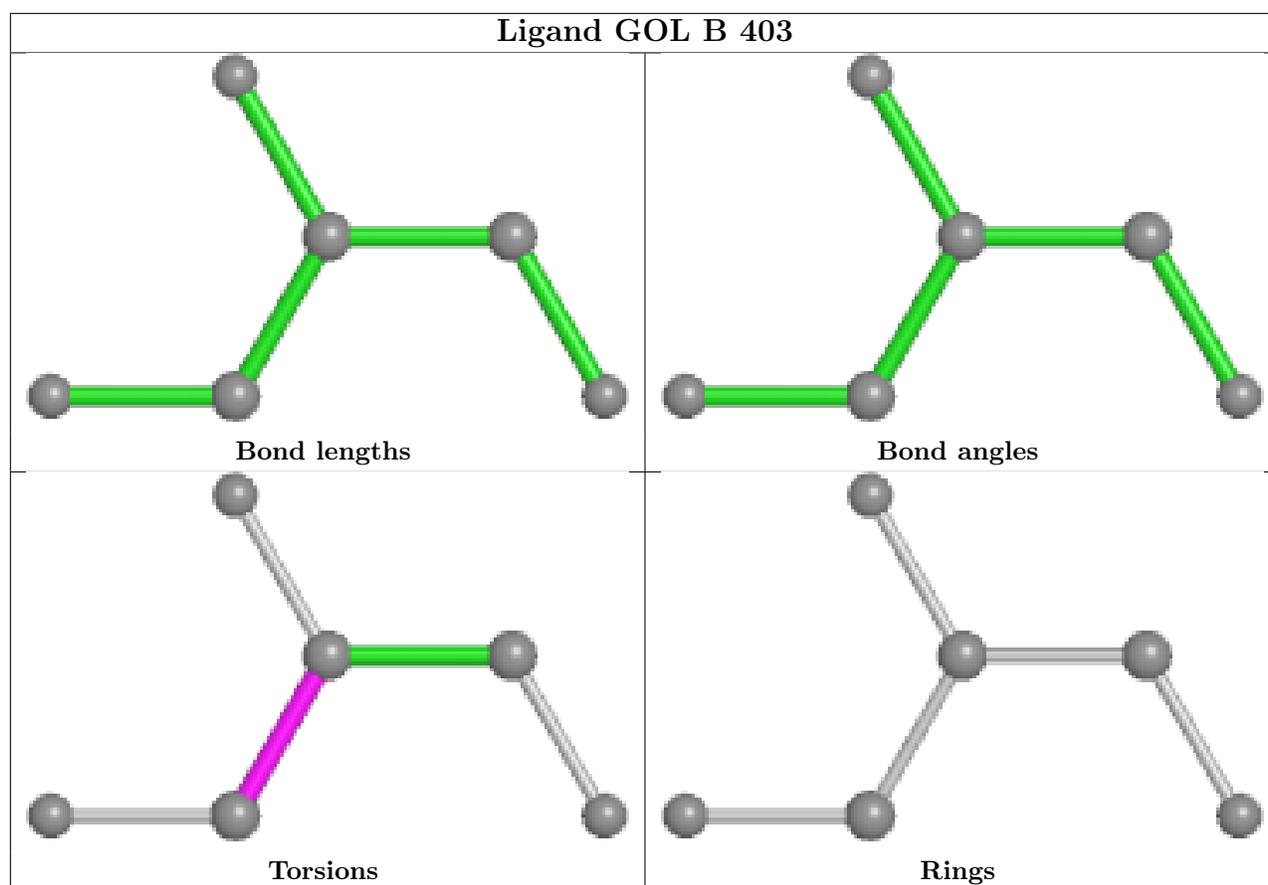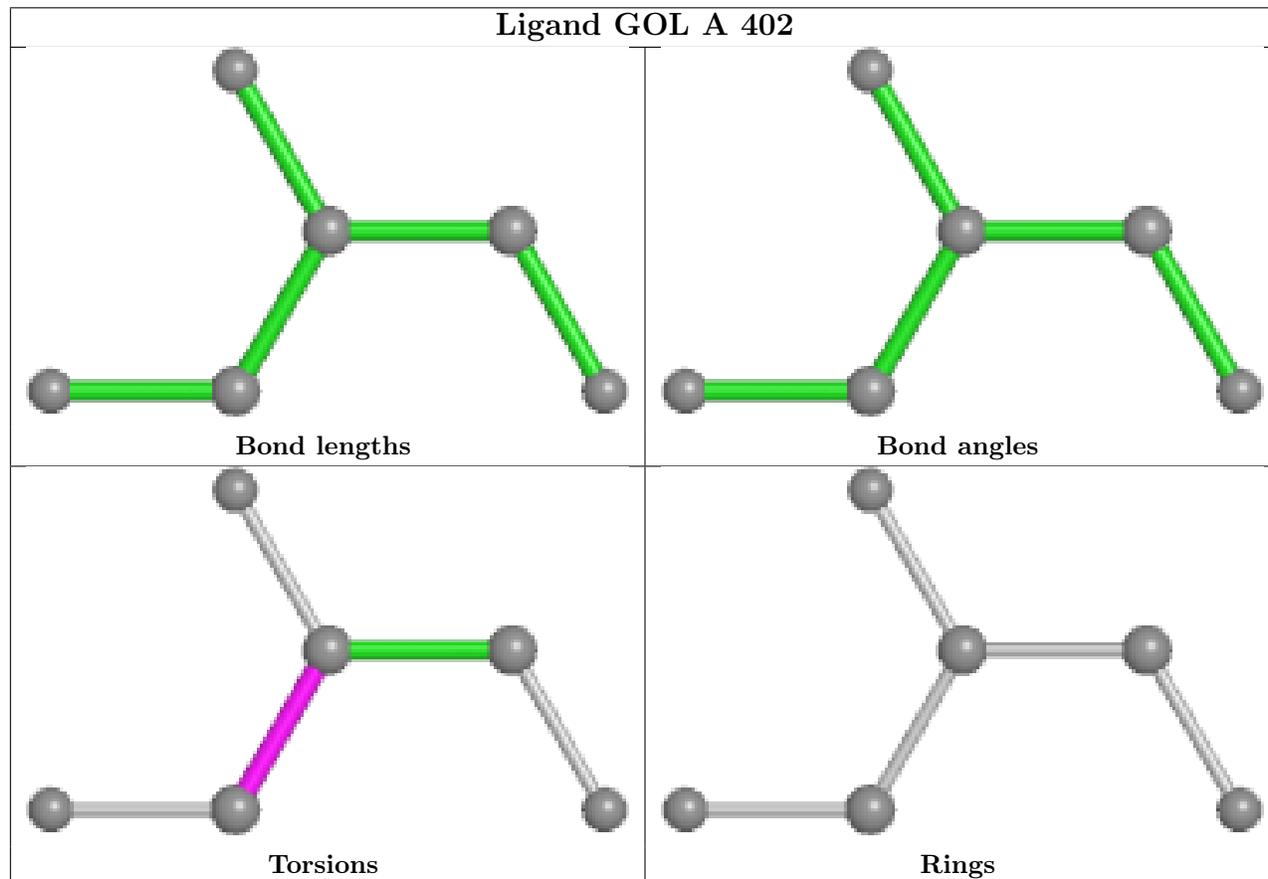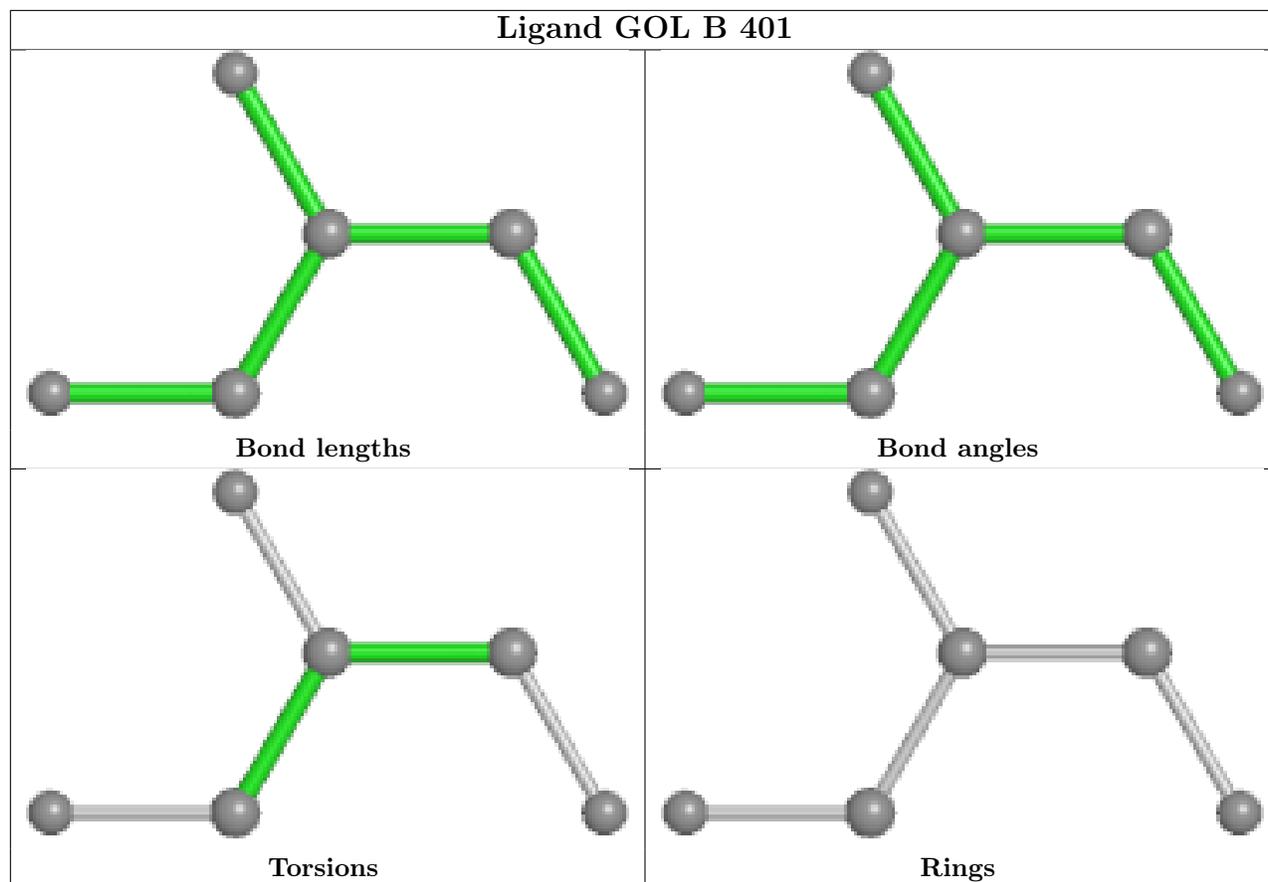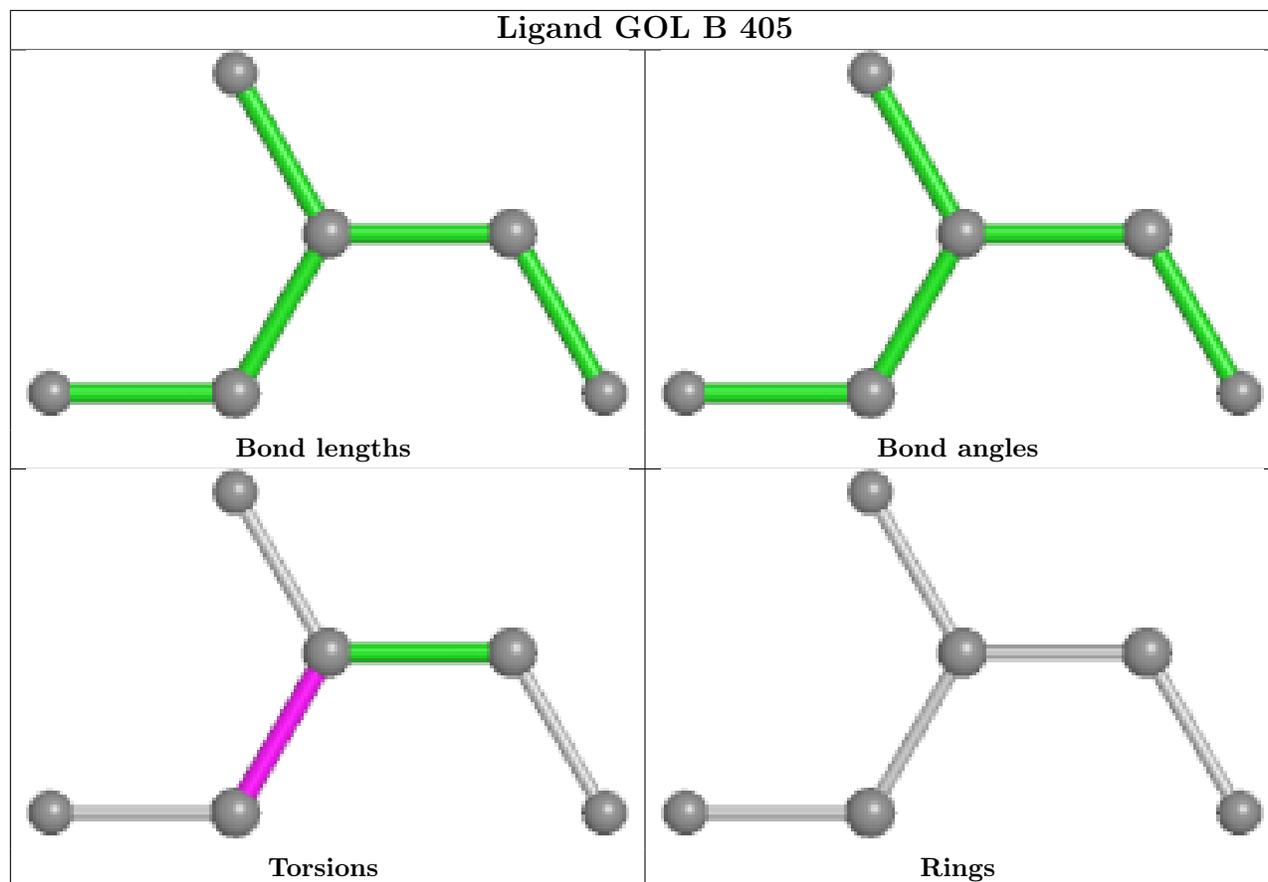| Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	402	GOL	4	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	403	GOL	1	0
4	C	502	SER	4	0
2	B	405	GOL	4	0
4	B	406	SER	4	0
4	C	501	SER	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 then 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 GOL B 402

Bond lengths

Bond angles

Torsions

Rings

Ligand GOL B 403

Bond lengths

Bond angles

Torsions

Rings

Ligand GOL B 404

Bond lengths

Bond angles

Torsions

Rings

Ligand GOL B 401

Bond lengths

Bond angles

Torsions

Rings

Ligand GOL A 402

Bond lengths

Bond angles

Torsions

Rings

Ligand GOL B 405

Bond lengths

Bond angles

Torsions

Rings

Ligand GOL A 401

Bond lengths

Bond angles

Torsions

Rings
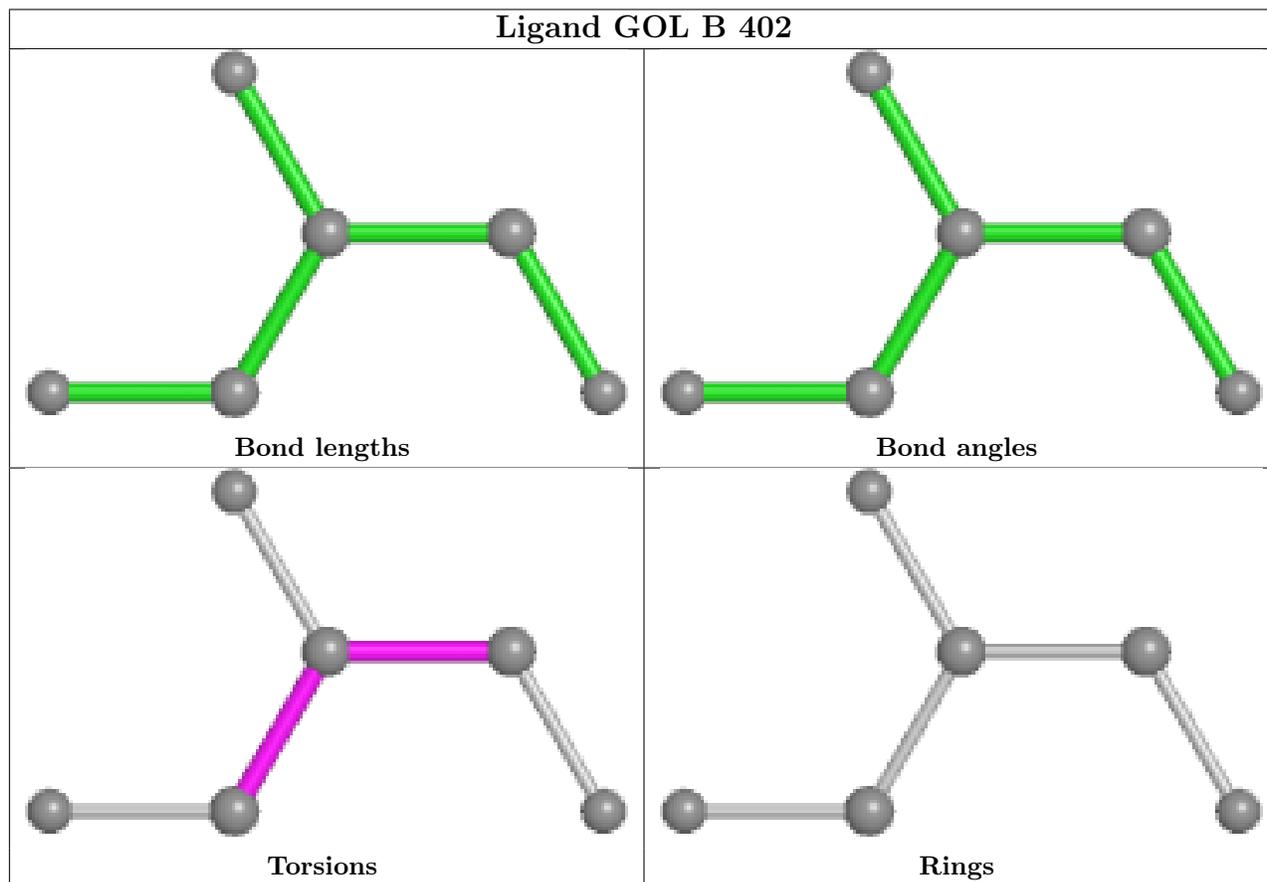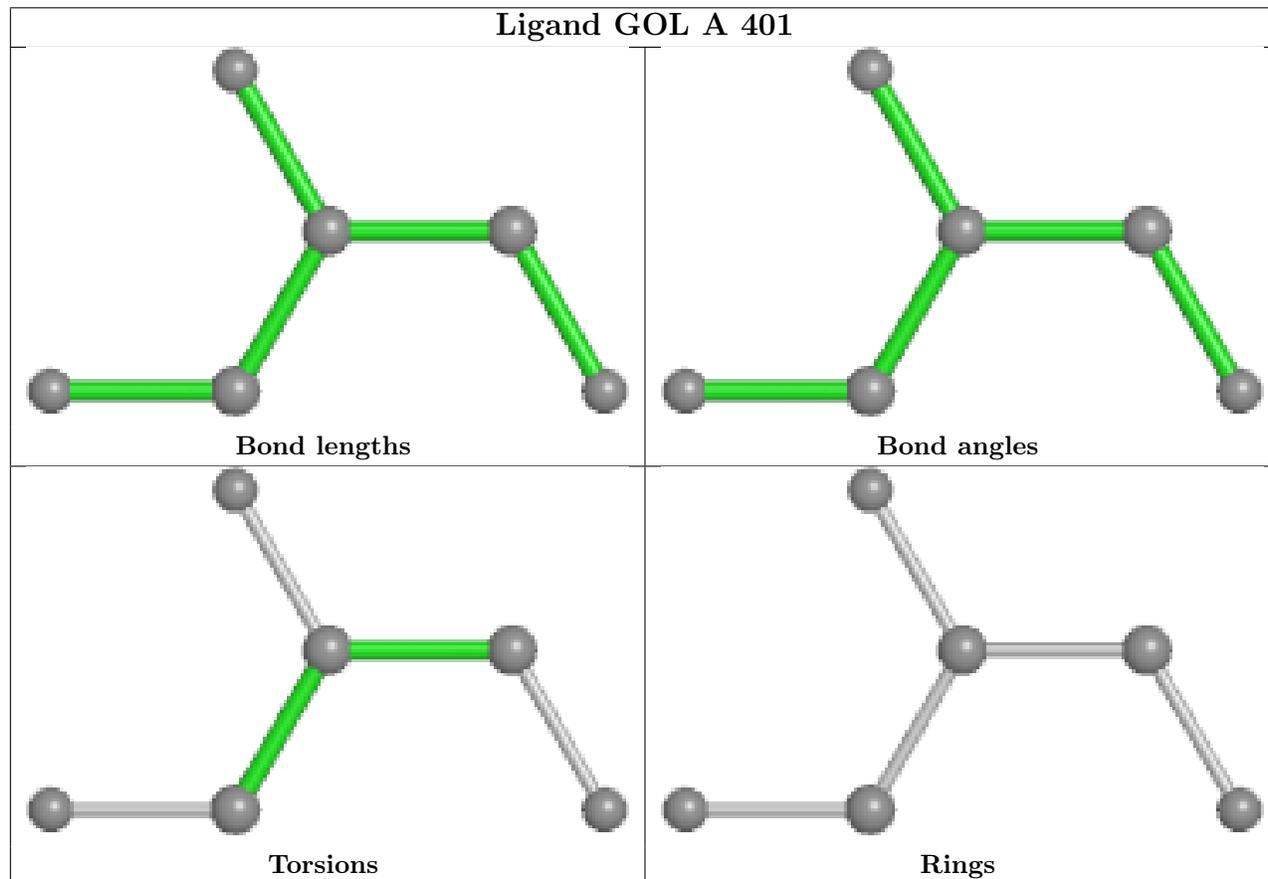
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	290/311 (93%)	-0.04	7 (2%)	59	57	31, 51, 99, 138	0
1	B	299/311 (96%)	-0.19	6 (2%)	64	61	30, 48, 101, 148	0
1	C	299/311 (96%)	0.20	5 (1%)	69	66	32, 56, 102, 152	0
All	All	888/933 (95%)	-0.01	18 (2%)	64	61	30, 52, 102, 152	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	104	ALA	4.1
1	C	310	ALA	3.9
1	B	101	ILE	3.6
1	C	250	ARG	3.2
1	C	104	ALA	3.2
1	A	8	LYS	3.1
1	B	310	ALA	2.8
1	A	110	ASP	2.6
1	A	95	TYR	2.6
1	A	27	THR	2.6
1	C	8	LYS	2.4
1	A	25	PHE	2.2
1	C	28	THR	2.2
1	B	25	PHE	2.2
1	B	244	GLN	2.2
1	A	101	ILE	2.2
1	A	310	ALA	2.1
1	B	245	GLY	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 (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(Å^2)	Q<0.9
2	GOL	B	405	6/6	0.49	0.15	90,92,97,109	0
2	GOL	A	401	6/6	0.69	0.19	63,73,93,108	0
2	GOL	B	401	6/6	0.83	0.19	65,77,80,83	0
3	NA	A	403	1/1	0.86	0.10	60,60,60,60	0
2	GOL	B	402	6/6	0.90	0.14	44,51,57,64	0
2	GOL	A	402	6/6	0.92	0.14	70,71,84,84	0
2	GOL	B	403	6/6	0.93	0.09	52,59,64,67	0
2	GOL	B	404	6/6	0.93	0.12	53,61,65,71	0
4	SER	C	502	7/7	0.94	0.07	31,41,46,47	0
4	SER	C	501	7/7	0.95	0.06	25,40,49,51	0
4	SER	B	406	7/7	0.96	0.06	24,38,44,47	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 GOL B 405:

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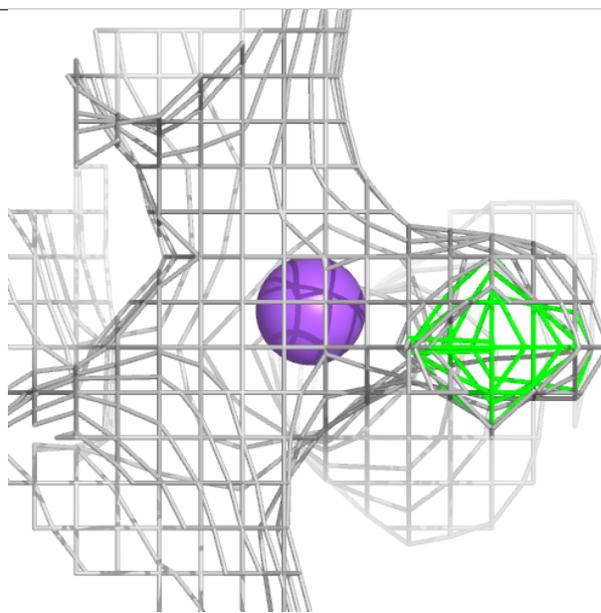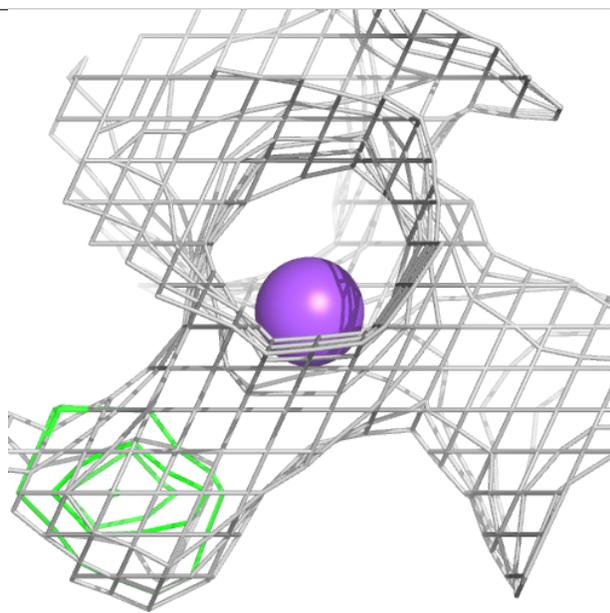mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around GOL A 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 GOL B 401:

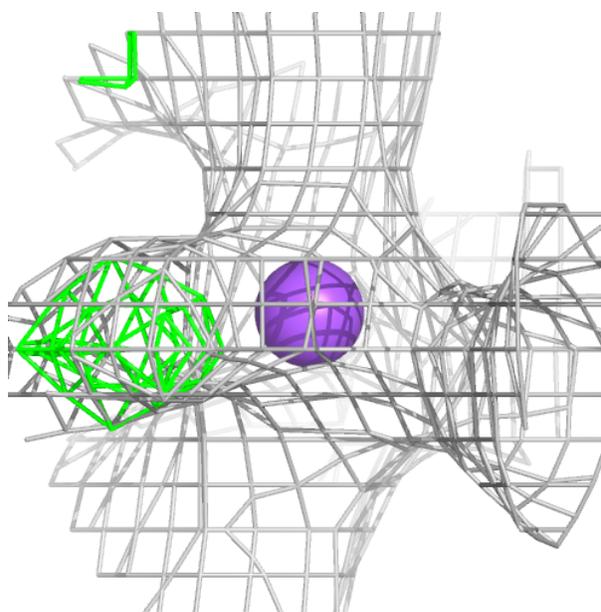2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
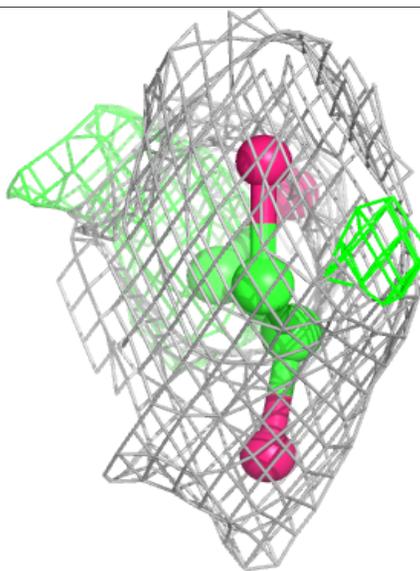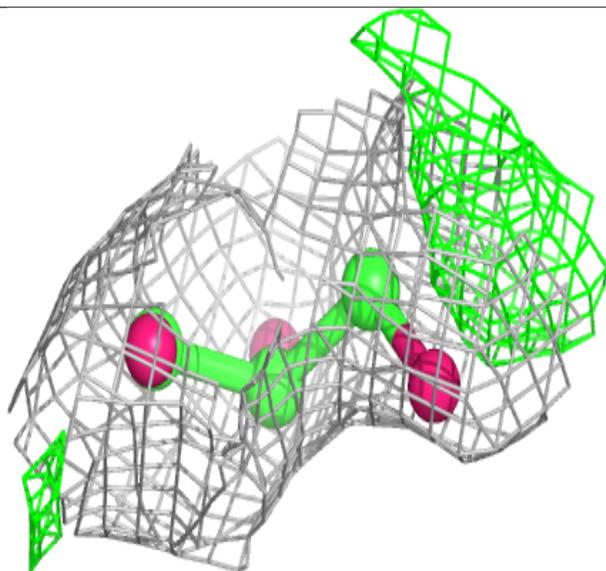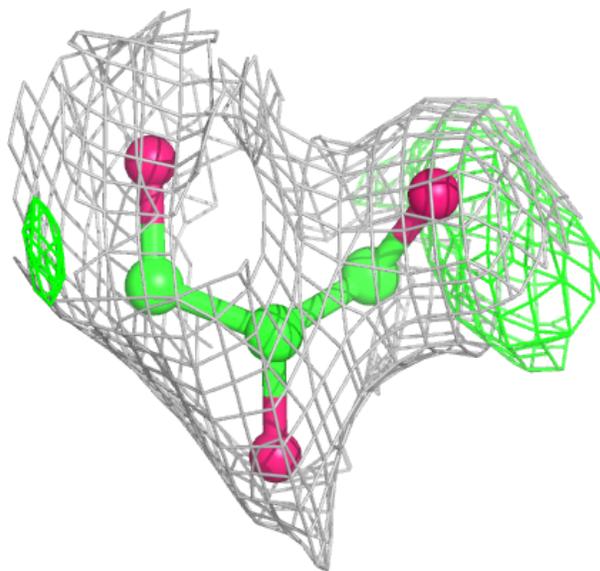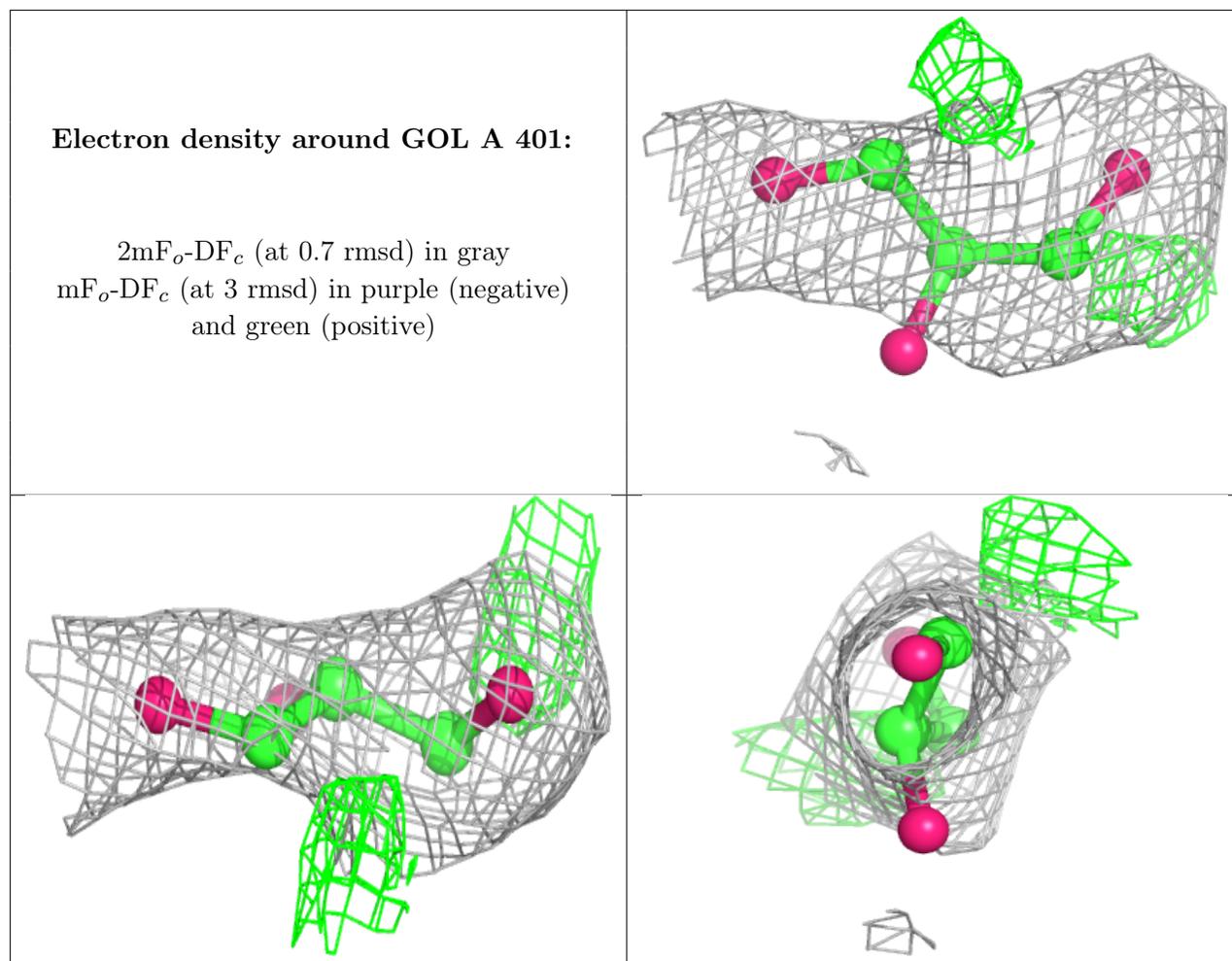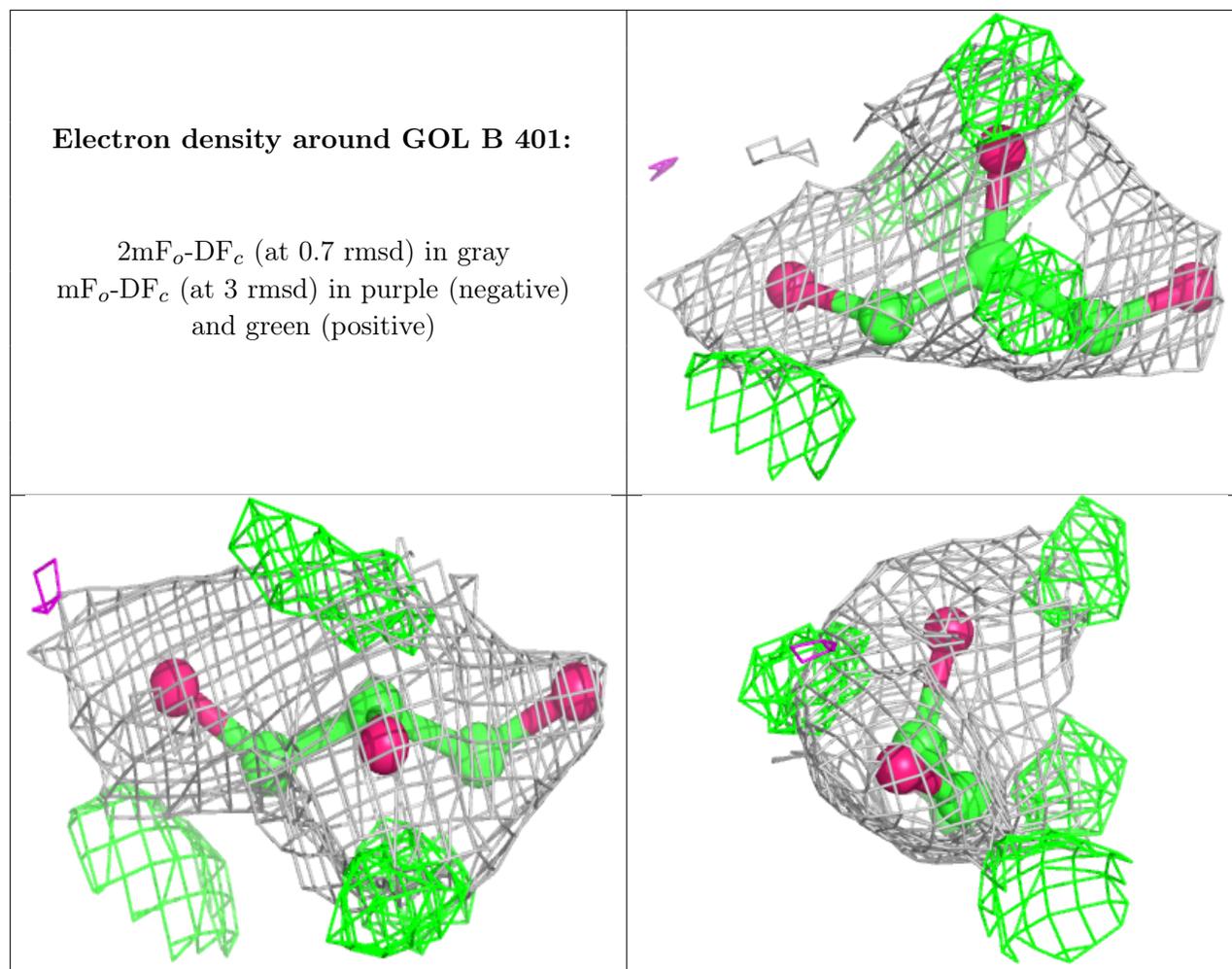
Electron density around NA A 403:

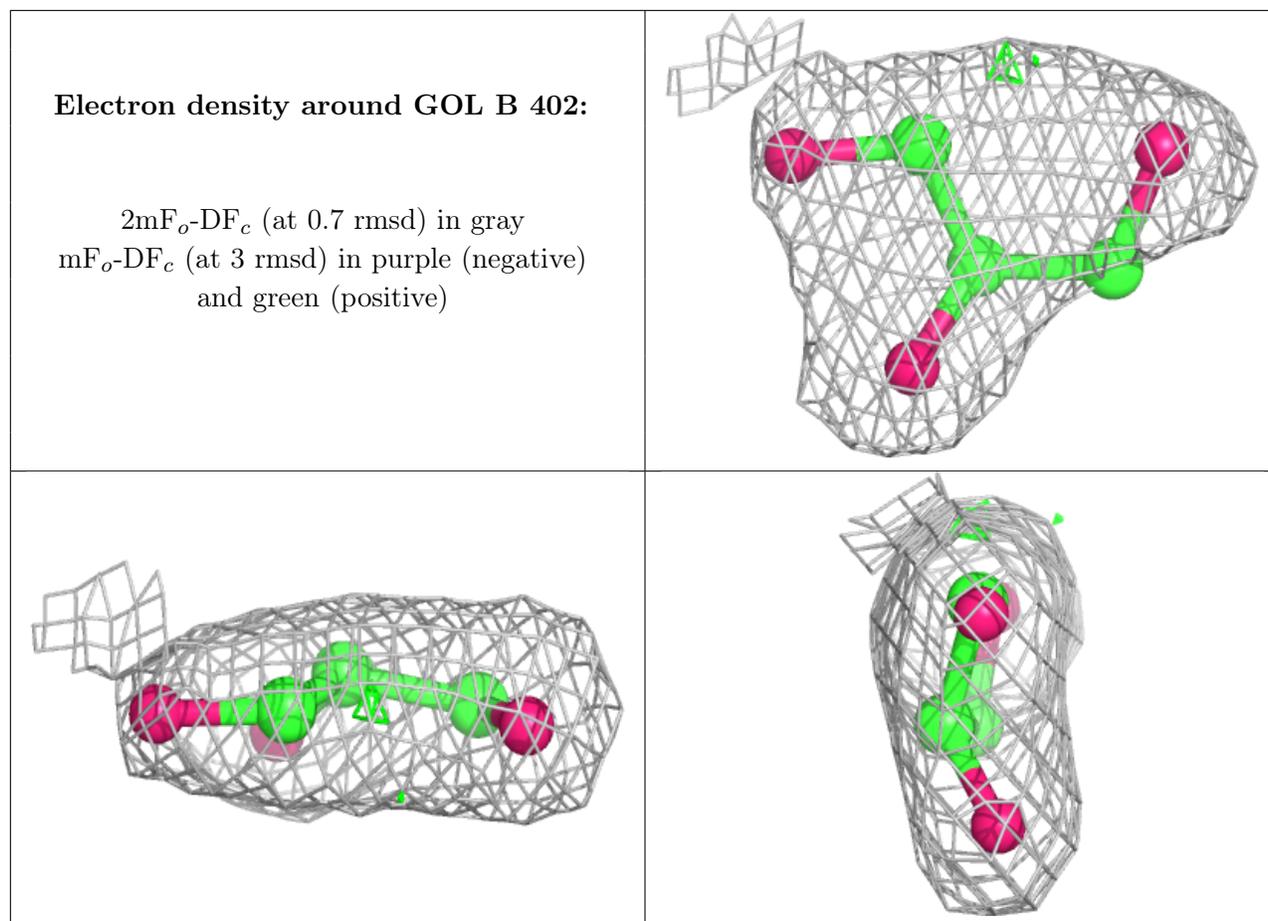$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around GOL B 402:

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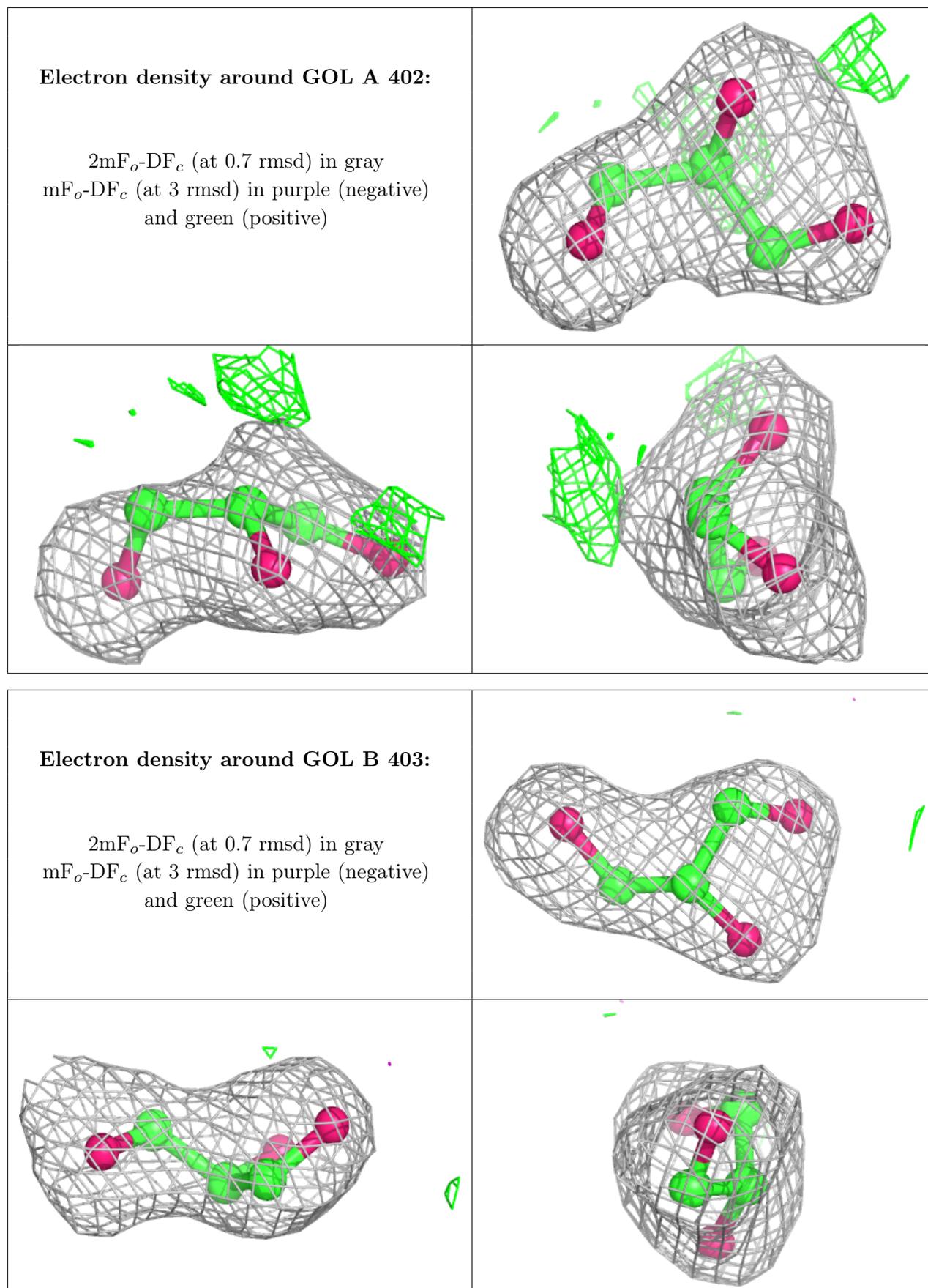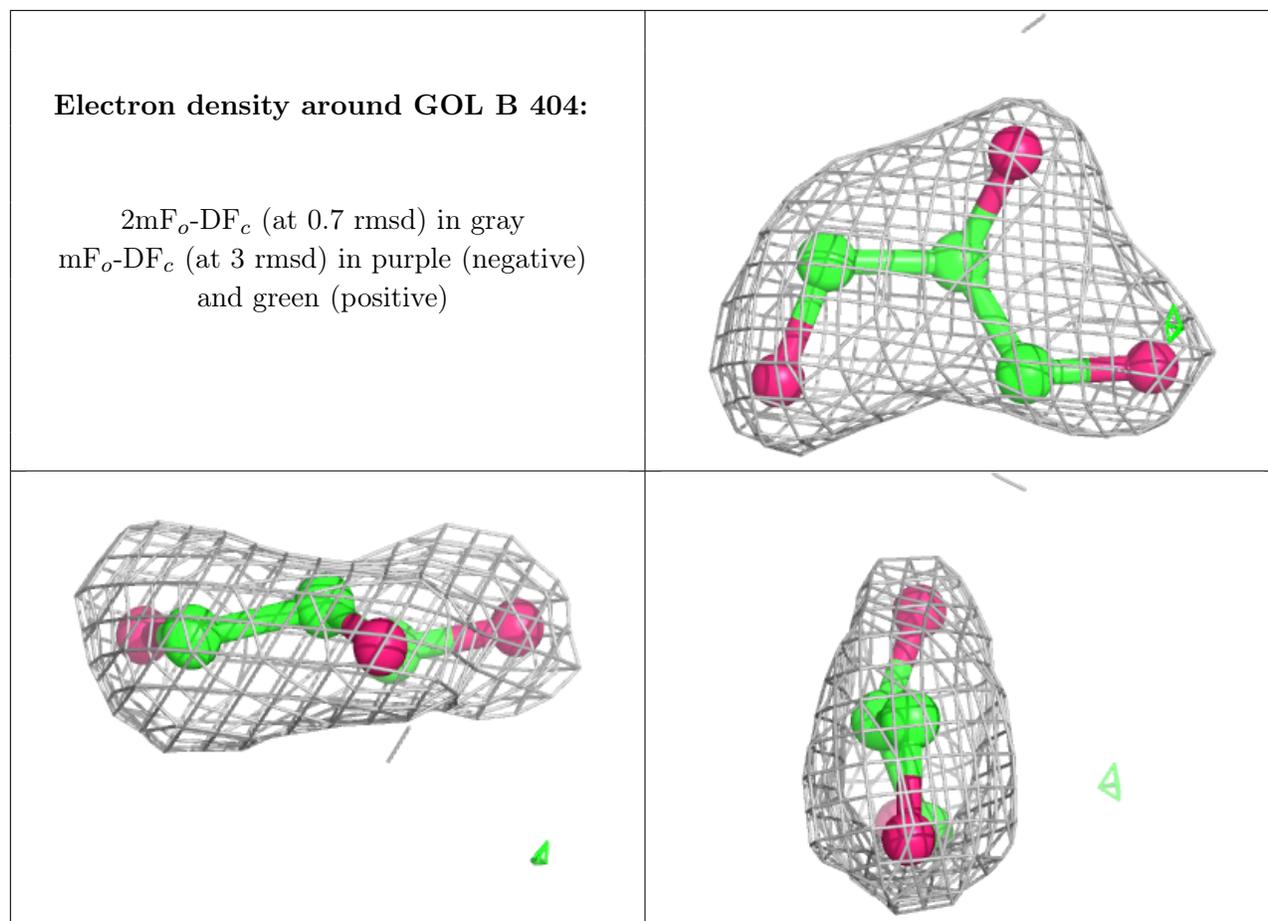$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around GOL 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 GOL B 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 GOL B 404:

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

6.5 Other polymers (i)

There are no such residues in this entry.