



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:34 AM UTC

PDB ID : 6L0H / pdb_00006l0h
Title : Crystal structure of dihydroorotase in complex with malate at pH7 from *Saccharomyces cerevisiae*
Authors : Guan, H.H.; Huang, Y.H.; Huang, C.Y.; Chen, C.J.
Deposited on : 2019-09-26
Resolution : 2.05 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

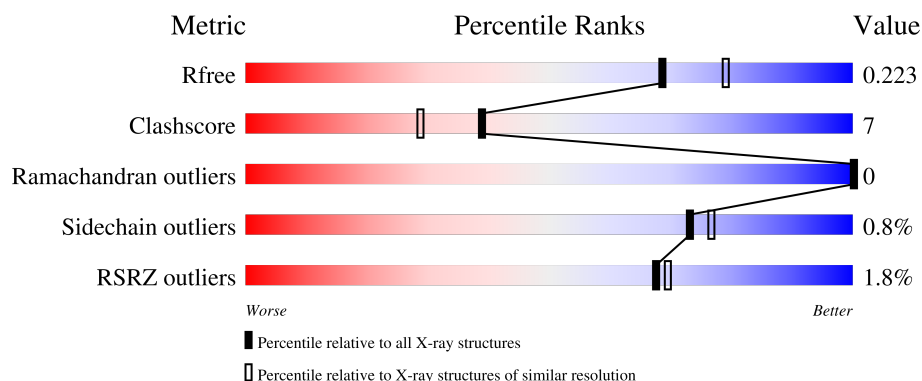
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.05 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	3774 (2.08-2.04)
Clashscore	190562	3883 (2.08-2.04)
Ramachandran outliers	187476	3860 (2.08-2.04)
Sidechain outliers	187428	3860 (2.08-2.04)
RSRZ outliers	180081	3775 (2.08-2.04)

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	372	% 85% 13% .
1	B	372	2% 87% 9% ..
1	C	372	% 84% 13% ..
1	D	372	3% 79% 18% ..

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
3	LMR	B	403	-	X	-	-
3	LMR	C	403	-	X	-	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12430 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 Dihydroorotase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	363	Total	C	N	O	S	0	0	0
			2836	1823	470	532	11			
1	B	363	Total	C	N	O	S	0	0	0
			2836	1823	470	532	11			
1	C	363	Total	C	N	O	S	0	0	0
			2836	1823	470	532	11			
1	D	363	Total	C	N	O	S	0	0	0
			2836	1823	470	532	11			

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	365	LEU	-	expression tag	UNP P20051
A	366	GLU	-	expression tag	UNP P20051
A	367	HIS	-	expression tag	UNP P20051
A	368	HIS	-	expression tag	UNP P20051
A	369	HIS	-	expression tag	UNP P20051
A	370	HIS	-	expression tag	UNP P20051
A	371	HIS	-	expression tag	UNP P20051
A	372	HIS	-	expression tag	UNP P20051
B	365	LEU	-	expression tag	UNP P20051
B	366	GLU	-	expression tag	UNP P20051
B	367	HIS	-	expression tag	UNP P20051
B	368	HIS	-	expression tag	UNP P20051
B	369	HIS	-	expression tag	UNP P20051
B	370	HIS	-	expression tag	UNP P20051
B	371	HIS	-	expression tag	UNP P20051
B	372	HIS	-	expression tag	UNP P20051
C	365	LEU	-	expression tag	UNP P20051
C	366	GLU	-	expression tag	UNP P20051
C	367	HIS	-	expression tag	UNP P20051
C	368	HIS	-	expression tag	UNP P20051
C	369	HIS	-	expression tag	UNP P20051

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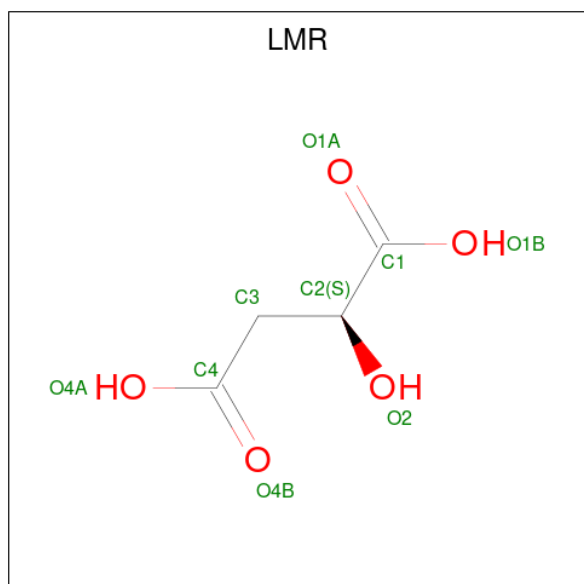
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Chain	Residue	Modelled	Actual	Comment	Reference
C	370	HIS	-	expression tag	UNP P20051
C	371	HIS	-	expression tag	UNP P20051
C	372	HIS	-	expression tag	UNP P20051
D	365	LEU	-	expression tag	UNP P20051
D	366	GLU	-	expression tag	UNP P20051
D	367	HIS	-	expression tag	UNP P20051
D	368	HIS	-	expression tag	UNP P20051
D	369	HIS	-	expression tag	UNP P20051
D	370	HIS	-	expression tag	UNP P20051
D	371	HIS	-	expression tag	UNP P20051
D	372	HIS	-	expression tag	UNP P20051

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total Zn 2 2	0	0
2	B	2	Total Zn 2 2	0	0
2	C	2	Total Zn 2 2	0	0
2	D	2	Total Zn 2 2	0	0

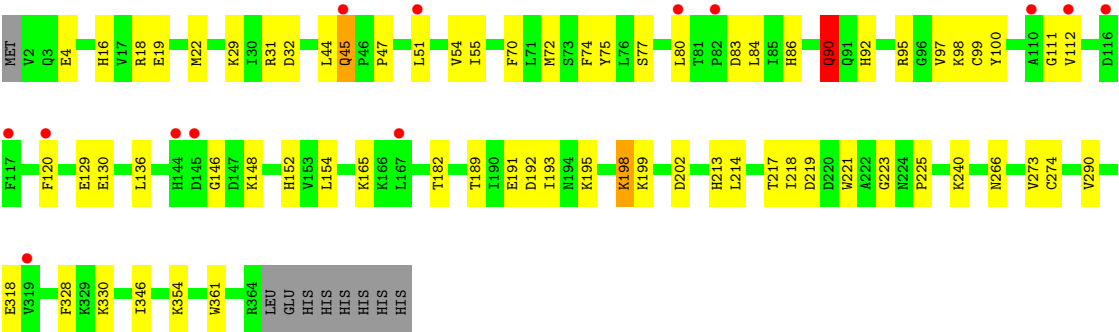
- Molecule 3 is (2S)-2-hydroxybutanedioic acid (CCD ID: LMR) (formula: C₄H₆O₅) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 9 4 5	0	0
3	B	1	Total C O 9 4 5	0	0
3	C	1	Total C O 9 4 5	0	0
3	D	1	Total C O 9 4 5	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	296	Total O 296 296	0	0
4	B	339	Total O 339 339	0	0
4	C	212	Total O 212 212	0	0
4	D	195	Total O 195 195	0	0



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	85.57Å 88.52Å 103.29Å 90.00° 95.42° 90.00°	Depositor
Resolution (Å)	31.96 – 2.05 31.96 – 2.05	Depositor EDS
% Data completeness (in resolution range)	91.6 (31.96-2.05) 91.5 (31.96-2.05)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.09 (at 2.06Å)	Xtriage
Refinement program	PHENIX 1.13_2998	Depositor
R, R_{free}	0.183 , 0.222 0.183 , 0.223	Depositor DCC
R_{free} test set	4396 reflections (4.59%)	wwPDB-VP
Wilson B-factor (Å ²)	25.5	Xtriage
Anisotropy	0.051	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 45.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	12430	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.91% 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: LMR, KCX, ZN

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.43	0/2892	0.66	0/3926
1	B	0.45	0/2892	0.77	13/3926 (0.3%)
1	C	0.39	0/2892	0.71	6/3926 (0.2%)
1	D	0.40	1/2892 (0.0%)	0.67	2/3926 (0.1%)
All	All	0.42	1/11568 (0.0%)	0.70	21/15704 (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	B	0	1
1	C	0	1
1	D	0	3
All	All	0	5

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	198	LYS	CD-CE	7.72	1.75	1.52

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	198	LYS	CB-CG-CD	-9.11	90.34	111.30
1	B	198	LYS	CD-CE-NZ	-8.39	85.06	111.90
1	B	199	LYS	CA-CB-CG	8.18	130.46	114.10
1	C	364	ARG	CG-CD-NE	7.48	128.45	112.00
1	C	354	LYS	CD-CE-NZ	-7.47	87.99	111.90

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	90	GLN	CA-CB-CG	7.38	128.87	114.10
1	B	199	LYS	CB-CG-CD	-7.02	95.15	111.30
1	D	45	GLN	N-CA-CB	6.70	120.81	110.43
1	B	199	LYS	CD-CE-NZ	6.67	133.24	111.90
1	C	342	LYS	CB-CG-CD	6.64	126.58	111.30
1	B	364	ARG	CA-CB-CG	6.64	127.38	114.10
1	B	362	GLU	CA-CB-CG	-6.40	101.30	114.10
1	C	362	GLU	CA-CB-CG	-6.39	101.32	114.10
1	C	59	LYS	CG-CD-CE	6.13	125.40	111.30
1	B	363	PRO	CA-C-N	6.10	132.67	121.70
1	B	363	PRO	C-N-CA	6.10	132.67	121.70
1	B	199	LYS	CB-CA-C	6.01	119.51	109.89
1	B	198	LYS	CA-CB-CG	-5.75	102.59	114.10
1	C	149	GLU	CB-CG-CD	5.34	121.67	112.60
1	B	148	LYS	CB-CG-CD	5.18	123.23	111.30
1	B	198	LYS	N-CA-CB	5.04	117.64	110.98

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	197	VAL	Peptide
1	C	147	ASP	Peptide
1	D	45	GLN	Peptide
1	D	90	GLN	Sidechain
1	D	92	HIS	Sidechain

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	2836	0	2832	32	5
1	B	2836	0	2832	32	0
1	C	2836	0	2832	39	5
1	D	2836	0	2832	57	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	A	9	0	4	0	0
3	B	9	0	4	1	0
3	C	9	0	4	2	0
3	D	9	0	4	2	0
4	A	296	0	0	7	1
4	B	339	0	0	7	1
4	C	212	0	0	9	2
4	D	195	0	0	10	1
All	All	12430	0	11344	154	8

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 7.

All (154) 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:D:198:LYS:CD	1:D:198:LYS:CE	1.75	1.65
1:D:51:LEU:CD2	1:D:55:ILE:HD11	1.89	1.02
1:C:168:HIS:ND1	4:C:501:HOH:O	1.99	0.93
1:C:180:HIS:H	1:C:208:THR:HG22	1.36	0.90
1:D:192:ASP:O	1:D:195:LYS:HE3	1.72	0.90
1:C:62:GLN:HG3	4:C:636:HOH:O	1.70	0.89
1:D:111:GLY:O	4:D:501:HOH:O	1.94	0.86
1:C:125:LYS:HG3	1:C:171:PHE:HE2	1.40	0.85
1:D:95:ARG:NH2	1:D:318:GLU:OE1	2.11	0.83
1:B:95:ARG:NH2	1:B:318:GLU:OE1	2.15	0.80
1:B:31:ARG:NH2	4:B:502:HOH:O	2.15	0.79
1:A:154:LEU:HD11	1:C:154:LEU:HD11	1.70	0.74
1:B:197:VAL:O	1:B:198:LYS:HD3	1.88	0.73
1:D:51:LEU:O	1:D:55:ILE:HD12	1.88	0.73
1:D:51:LEU:CD2	1:D:55:ILE:CD1	2.66	0.72
1:A:338:ILE:HD12	1:A:348:PRO:HB3	1.74	0.70
1:C:146:GLY:O	1:C:148:LYS:N	2.26	0.68
1:A:78:LYS:HG2	4:A:687:HOH:O	1.92	0.68
1:D:191:GLU:OE2	4:D:503:HOH:O	2.11	0.67
1:C:125:LYS:HG3	1:C:171:PHE:CE2	2.28	0.67
1:D:70:PHE:HB3	1:D:72:MET:CE	2.25	0.66
1:D:86:HIS:NE2	1:D:129:GLU:OE2	2.25	0.66
1:D:223:GLY:N	4:D:502:HOH:O	1.96	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:44:LEU:HD12	1:A:48:ILE:HD11	1.78	0.66
1:D:51:LEU:HD23	1:D:55:ILE:CD1	2.27	0.65
1:C:19:GLU:OE2	4:C:502:HOH:O	2.15	0.64
1:C:180:HIS:N	1:C:208:THR:HG22	2.11	0.64
1:D:51:LEU:HD23	1:D:55:ILE:HD11	1.77	0.64
1:C:95:ARG:NH2	1:C:318:GLU:OE1	2.31	0.64
1:C:361:TRP:C	1:C:362:GLU:HG2	2.22	0.64
1:B:44:LEU:HD12	1:B:48:ILE:HD11	1.81	0.62
1:B:364:ARG:HG2	1:B:364:ARG:HH11	1.65	0.61
1:A:237:ASN:HD21	1:B:188:LYS:HZ2	1.47	0.61
1:A:237:ASN:HD21	1:B:188:LYS:NZ	2.00	0.60
1:B:191:GLU:OE2	1:B:250:LYS:NZ	2.30	0.60
1:A:95:ARG:HG3	4:A:685:HOH:O	2.01	0.59
1:C:4:GLU:OE2	1:C:360:ARG:NH1	2.33	0.59
1:C:165:LYS:NZ	4:C:507:HOH:O	2.31	0.59
1:A:29:LYS:NZ	4:A:507:HOH:O	2.35	0.58
1:A:180:HIS:CE1	1:A:231:PRO:HD3	2.38	0.58
1:D:70:PHE:HB3	1:D:72:MET:HE3	1.84	0.58
1:D:354:LYS:NZ	4:D:513:HOH:O	2.36	0.58
1:B:62:GLN:HG3	4:B:580:HOH:O	2.04	0.57
1:D:77:SER:H	1:D:80:LEU:HD12	1.69	0.57
1:D:225:PRO:HB3	1:D:273:VAL:HG11	1.87	0.57
1:D:51:LEU:HD22	1:D:55:ILE:HD11	1.79	0.57
1:B:326:ILE:HG13	1:B:362:GLU:HG3	1.86	0.56
1:D:31:ARG:HD3	1:D:361:TRP:NE1	2.19	0.56
1:C:95:ARG:HH22	1:C:318:GLU:CD	2.13	0.56
1:D:165:LYS:HE3	1:D:189:THR:HG23	1.86	0.56
1:A:225:PRO:HB3	1:A:273:VAL:HG11	1.88	0.56
1:B:154:LEU:HD11	1:D:154:LEU:HD11	1.88	0.56
1:C:141:PRO:O	1:C:151:ILE:HD11	2.05	0.55
1:D:75:TYR:O	1:D:80:LEU:HD11	2.07	0.55
1:A:11:CYS:SG	1:A:309:ILE:HG13	2.47	0.54
1:B:305:SER:O	1:B:309:ILE:HG12	2.07	0.54
1:D:83:ASP:OD1	4:D:504:HOH:O	2.18	0.54
1:C:217:THR:HB	4:C:562:HOH:O	2.06	0.54
1:C:360:ARG:NE	1:C:362:GLU:OE2	2.30	0.54
1:D:217:THR:HG22	1:D:219:ASP:H	1.73	0.54
1:B:45:GLN:NE2	4:B:510:HOH:O	2.41	0.53
1:A:17:VAL:HG22	1:A:26:VAL:HG23	1.89	0.53
1:A:4:GLU:OE1	4:A:502:HOH:O	2.19	0.53
1:B:198:LYS:N	4:B:506:HOH:O	2.37	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:51:LEU:O	1:D:54:VAL:HG12	2.09	0.53
1:D:330:LYS:NZ	4:D:512:HOH:O	2.35	0.51
1:A:44:LEU:CD1	1:A:48:ILE:HD11	2.40	0.51
1:B:197:VAL:C	1:B:198:LYS:HG2	2.35	0.51
1:C:86:HIS:O	1:C:90:GLN:HG2	2.10	0.51
1:B:197:VAL:O	1:B:198:LYS:NZ	2.39	0.50
1:D:19:GLU:HG3	1:D:44:LEU:HD22	1.93	0.50
1:D:31:ARG:HD3	1:D:361:TRP:CE2	2.47	0.50
1:D:16:HIS:CE1	3:D:403:LMR:H3	2.47	0.50
1:A:95:ARG:NH1	1:A:318:GLU:OE1	2.39	0.50
1:C:142:SER:HA	1:C:151:ILE:HG13	1.94	0.50
1:C:250:LYS:HG2	1:C:252:TYR:CZ	2.46	0.50
1:B:364:ARG:HG2	1:B:364:ARG:NH1	2.27	0.50
1:C:145:ASP:CG	1:C:146:GLY:H	2.19	0.50
1:C:59:LYS:HE2	4:C:637:HOH:O	2.12	0.49
1:A:152:HIS:CE1	1:A:154:LEU:HB2	2.47	0.49
1:D:44:LEU:HB3	4:D:586:HOH:O	2.12	0.49
1:D:86:HIS:HD2	1:D:130:GLU:OE2	1.96	0.49
1:B:16:HIS:NE2	3:B:403:LMR:H3	2.28	0.48
1:B:95:ARG:HH22	1:B:318:GLU:CD	2.18	0.48
1:D:198:LYS:CD	1:D:198:LYS:NZ	2.72	0.48
1:A:107:ASN:HA	4:A:722:HOH:O	2.14	0.48
1:A:288:ALA:HB2	1:A:327:LEU:HD21	1.93	0.48
1:D:29:LYS:NZ	4:D:506:HOH:O	2.24	0.48
1:A:123:ILE:O	1:A:127:MET:HG3	2.13	0.48
1:D:240:LYS:HE3	4:D:577:HOH:O	2.13	0.47
1:B:218:ILE:HA	1:B:221:TRP:NE1	2.29	0.47
1:B:354:LYS:HE3	1:B:355:LEU:C	2.40	0.47
1:C:194:ASN:O	1:C:197:VAL:HG22	2.14	0.47
1:A:208:THR:HA	1:A:254:PHE:O	2.15	0.47
1:D:100:TYR:O	1:D:112:VAL:HG12	2.15	0.47
1:C:333:VAL:HG22	1:C:354:LYS:HG3	1.98	0.46
1:D:29:LYS:HA	1:D:32:ASP:HB2	1.97	0.46
1:D:47:PRO:HB3	1:D:75:TYR:CD2	2.50	0.46
1:B:250:LYS:HD2	1:B:252:TYR:OH	2.16	0.46
1:D:77:SER:H	1:D:80:LEU:CD1	2.29	0.46
1:A:47:PRO:HB3	1:A:75:TYR:CD1	2.51	0.46
1:D:86:HIS:O	1:D:90:GLN:HG2	2.15	0.46
1:B:316:ASP:O	1:B:319:VAL:HG22	2.16	0.46
1:D:95:ARG:HH22	1:D:318:GLU:CD	2.20	0.46
1:B:17:VAL:HG13	1:B:23:CYS:SG	2.56	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:18:ARG:NH1	3:D:403:LMR:O4A	2.29	0.45
1:D:22:MET:SD	1:D:346:ILE:HD11	2.56	0.45
1:C:17:VAL:HG12	1:C:26:VAL:HG12	1.99	0.45
1:D:199:LYS:HG2	1:D:202:ASP:OD2	2.17	0.45
1:B:267:LYS:HE2	4:B:565:HOH:O	2.16	0.45
1:C:145:ASP:CG	1:C:146:GLY:N	2.75	0.45
1:A:362:GLU:HA	1:A:363:PRO:HD3	1.86	0.45
1:D:330:LYS:HD3	4:D:512:HOH:O	2.17	0.44
1:B:169:ASN:HB2	4:B:668:HOH:O	2.18	0.44
1:A:102:ALA:HA	1:A:108:SER:O	2.18	0.44
1:C:62:GLN:NE2	4:C:517:HOH:O	2.51	0.44
1:A:235:LEU:HD21	1:C:154:LEU:HD12	1.99	0.44
1:A:288:ALA:CB	1:A:327:LEU:HD21	2.48	0.44
1:B:315:LYS:HA	1:B:315:LYS:HD3	1.77	0.44
1:A:115:ASN:OD1	1:A:140:LYS:NZ	2.38	0.44
1:D:99:CYS:HB3	1:D:136:LEU:HD23	1.99	0.44
1:C:115:ASN:OD1	1:C:140:LYS:HE3	2.18	0.43
1:C:330:LYS:HD2	1:C:331:GLU:N	2.34	0.43
1:D:198:LYS:CE	1:D:198:LYS:CG	2.82	0.43
1:A:154:LEU:CD1	1:C:154:LEU:HD11	2.45	0.43
1:B:225:PRO:HB3	1:B:273:VAL:HG11	2.00	0.43
1:C:217:THR:HG22	1:C:219:ASP:H	1.83	0.43
1:C:16:HIS:NE2	3:C:403:LMR:H3	2.34	0.43
1:C:217:THR:HG22	1:C:219:ASP:HB2	2.01	0.43
1:A:337:VAL:HG21	1:A:345:SER:HB3	2.00	0.42
1:D:112:VAL:HG23	1:D:120:PHE:CE2	2.54	0.42
1:C:267:LYS:HE3	4:C:643:HOH:O	2.19	0.42
1:A:184:GLU:OE2	4:A:503:HOH:O	2.21	0.42
1:A:218:ILE:HA	1:A:221:TRP:NE1	2.35	0.42
1:B:95:ARG:O	1:B:95:ARG:HG3	2.20	0.42
1:B:362:GLU:HA	1:B:363:PRO:HD3	1.88	0.42
1:A:175:LYS:NZ	4:A:501:HOH:O	1.93	0.41
1:D:74:PHE:HB2	1:D:97:VAL:HG22	2.02	0.41
1:D:4:GLU:HG2	1:D:328:PHE:HB3	2.02	0.41
1:A:17:VAL:HG13	1:A:23:CYS:SG	2.61	0.41
1:C:16:HIS:CE1	3:C:403:LMR:H3	2.55	0.41
1:D:146:GLY:HA3	1:D:148:LYS:N	2.35	0.41
1:D:152:HIS:CE1	1:D:154:LEU:HB2	2.56	0.41
1:D:214:LEU:HD13	1:D:290:VAL:HG11	2.02	0.41
1:D:192:ASP:O	1:D:193:ILE:C	2.63	0.41
1:D:218:ILE:HA	1:D:221:TRP:NE1	2.35	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:182:THR:HG22	1:D:213:HIS:CD2	2.55	0.41
1:C:78:LYS:HD3	4:C:609:HOH:O	2.19	0.41
1:D:51:LEU:HB2	1:D:84:LEU:HD11	2.02	0.41
1:B:150:PRO:HA	4:B:505:HOH:O	2.21	0.41
1:D:266:ASN:HB3	1:D:274:CYS:SG	2.61	0.40
1:C:225:PRO:HB3	1:C:273:VAL:HG11	2.03	0.40
1:B:336:GLN:HA	1:B:351:ALA:HB1	2.04	0.40
1:C:179:GLU:OE1	1:C:208:THR:HG21	2.21	0.40

All (8) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:364:ARG:NH2	1:C:83:ASP:OD1[2_555]	1.75	0.45
1:A:364:ARG:NH1	1:C:83:ASP:OD2[2_555]	1.90	0.30
4:A:698:HOH:O	4:C:558:HOH:O[1_455]	1.91	0.29
4:D:553:HOH:O	4:D:675:HOH:O[2_656]	2.06	0.14
4:B:782:HOH:O	4:C:700:HOH:O[2_545]	2.08	0.12
1:A:364:ARG:CZ	1:C:83:ASP:OD2[2_555]	2.11	0.09
1:A:364:ARG:NH2	1:C:83:ASP:CG[2_555]	2.11	0.09
1:A:364:ARG:NH2	1:C:83:ASP:OD2[2_555]	2.17	0.03

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	360/372 (97%)	349 (97%)	11 (3%)	0	100	100
1	B	360/372 (97%)	350 (97%)	10 (3%)	0	100	100
1	C	360/372 (97%)	346 (96%)	14 (4%)	0	100	100
1	D	360/372 (97%)	347 (96%)	13 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	1440/1488 (97%)	1392 (97%)	48 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	311/320 (97%)	307 (99%)	4 (1%)	61	62
1	B	311/320 (97%)	309 (99%)	2 (1%)	78	82
1	C	311/320 (97%)	307 (99%)	4 (1%)	61	62
1	D	311/320 (97%)	311 (100%)	0	100	100
All	All	1244/1280 (97%)	1234 (99%)	10 (1%)	73	77

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	17	VAL
1	A	45	GLN
1	A	217	THR
1	A	232	VAL
1	B	17	VAL
1	B	232	VAL
1	C	104	VAL
1	C	208	THR
1	C	217	THR
1	C	359	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	62	GLN
1	A	135	ASN

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Mol	Chain	Res	Type
1	A	237	ASN
1	A	336	GLN
1	B	45	GLN
1	B	169	ASN
1	B	332	GLN
1	B	336	GLN
1	C	62	GLN
1	C	90	GLN
1	C	128	GLN
1	C	144	HIS
1	C	168	HIS
1	C	196	ASN
1	C	262	HIS
1	C	295	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

4 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	$\# Z > 2$
1	KCX	B	98	1,2	10,11,12	1.00	1 (10%)	6,12,14	1.53	1 (16%)
1	KCX	A	98	1,2	10,11,12	0.89	0	6,12,14	1.53	1 (16%)
1	KCX	C	98	1,2	10,11,12	0.84	0	6,12,14	1.38	1 (16%)
1	KCX	D	98	1,2	10,11,12	0.94	0	6,12,14	1.62	1 (16%)

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
1	KCX	B	98	1,2	-	0/9/10/12	-
1	KCX	A	98	1,2	-	0/9/10/12	-
1	KCX	C	98	1,2	-	0/9/10/12	-
1	KCX	D	98	1,2	-	0/9/10/12	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	98	KCX	OQ1-CX	2.38	1.26	1.21

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	98	KCX	OQ1-CX-NZ	-3.49	119.62	124.92
1	A	98	KCX	OQ1-CX-NZ	-3.43	119.71	124.92
1	B	98	KCX	OQ1-CX-NZ	-3.10	120.21	124.92
1	C	98	KCX	OQ1-CX-NZ	-3.01	120.35	124.92

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 12 ligands modelled in this entry, 8 are monoatomic - leaving 4 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	LMR	C	403	2	8,8,8	1.29	1 (12%)	10,10,10	2.59	7 (70%)
3	LMR	B	403	2	8,8,8	1.54	1 (12%)	10,10,10	2.93	7 (70%)
3	LMR	A	403	2	8,8,8	1.05	0	10,10,10	1.63	2 (20%)
3	LMR	D	403	2	8,8,8	1.27	1 (12%)	10,10,10	2.21	2 (20%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	LMR	C	403	2	-	4/8/8/8	-
3	LMR	B	403	2	-	5/8/8/8	-
3	LMR	A	403	2	-	2/8/8/8	-
3	LMR	D	403	2	-	4/8/8/8	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	403	LMR	C2-C1	2.99	1.56	1.52
3	C	403	LMR	C2-C1	2.23	1.55	1.52
3	D	403	LMR	C2-C1	2.03	1.55	1.52

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	403	LMR	O1B-C1-C2	5.09	123.51	112.74
3	B	403	LMR	C2-C3-C4	-4.36	100.69	112.08
3	C	403	LMR	C2-C3-C4	-4.00	101.63	112.08
3	B	403	LMR	O1B-C1-O1A	-3.78	115.51	124.08
3	C	403	LMR	O1B-C1-O1A	-3.67	115.75	124.08
3	C	403	LMR	O1B-C1-C2	3.62	120.39	112.74
3	B	403	LMR	O2-C2-C1	3.46	119.15	110.36
3	B	403	LMR	O4A-C4-C3	3.21	123.99	114.00
3	B	403	LMR	O2-C2-C3	-3.21	102.22	109.96
3	A	403	LMR	O1B-C1-C2	3.18	119.46	112.74
3	D	403	LMR	O1B-C1-O1A	-3.09	117.06	124.08
3	B	403	LMR	O1B-C1-C2	3.05	119.18	112.74
3	B	403	LMR	O4B-C4-C3	-2.90	113.93	122.84
3	C	403	LMR	O2-C2-C3	-2.69	103.48	109.96

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	403	LMR	C3-C2-C1	-2.52	104.35	110.53
3	C	403	LMR	O2-C2-C1	2.44	116.56	110.36
3	C	403	LMR	O4B-C4-C3	-2.37	115.57	122.84
3	C	403	LMR	O4A-C4-C3	2.24	120.96	114.00

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	D	403	LMR	O1A-C1-C2-O2
3	D	403	LMR	O1B-C1-C2-O2
3	D	403	LMR	O1B-C1-C2-C3
3	B	403	LMR	O1A-C1-C2-O2
3	B	403	LMR	O1B-C1-C2-O2
3	C	403	LMR	O1A-C1-C2-O2
3	C	403	LMR	O1B-C1-C2-O2
3	B	403	LMR	O1A-C1-C2-C3
3	C	403	LMR	O1A-C1-C2-C3
3	D	403	LMR	O1A-C1-C2-C3
3	B	403	LMR	O1B-C1-C2-C3
3	C	403	LMR	O1B-C1-C2-C3
3	B	403	LMR	C1-C2-C3-C4
3	A	403	LMR	C2-C3-C4-O4B
3	A	403	LMR	C2-C3-C4-O4A

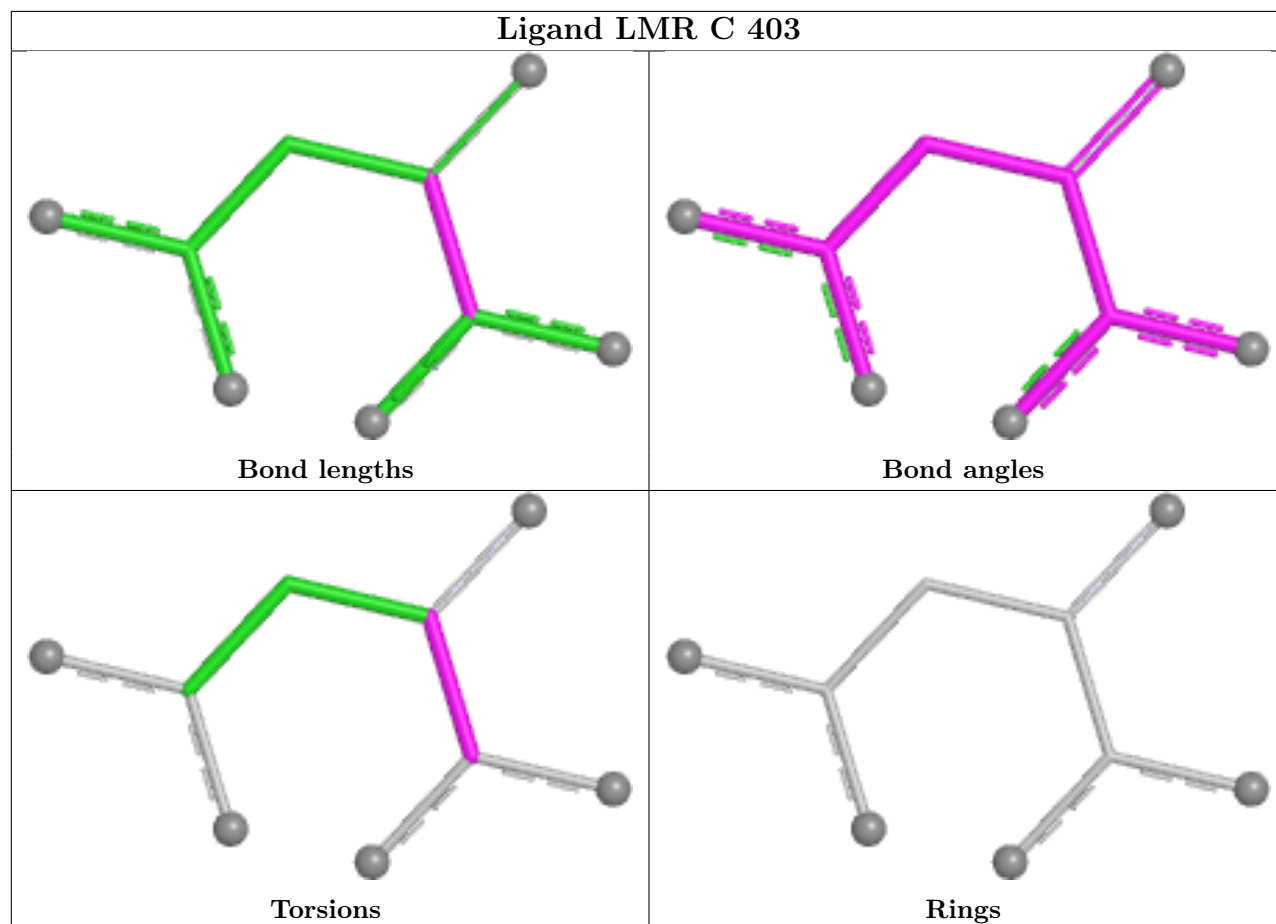
There are no ring outliers.

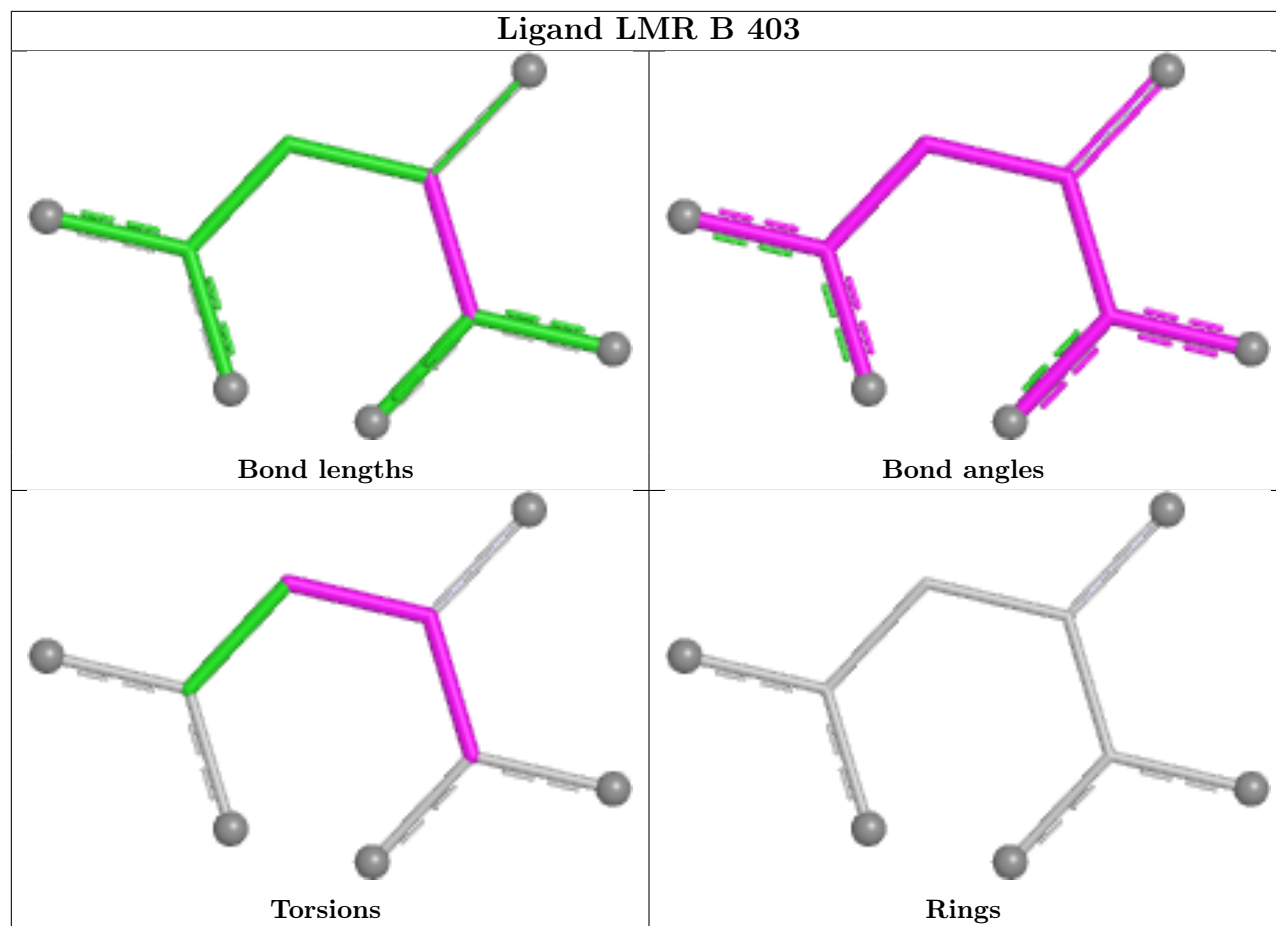
3 monomers are involved in 5 short contacts:

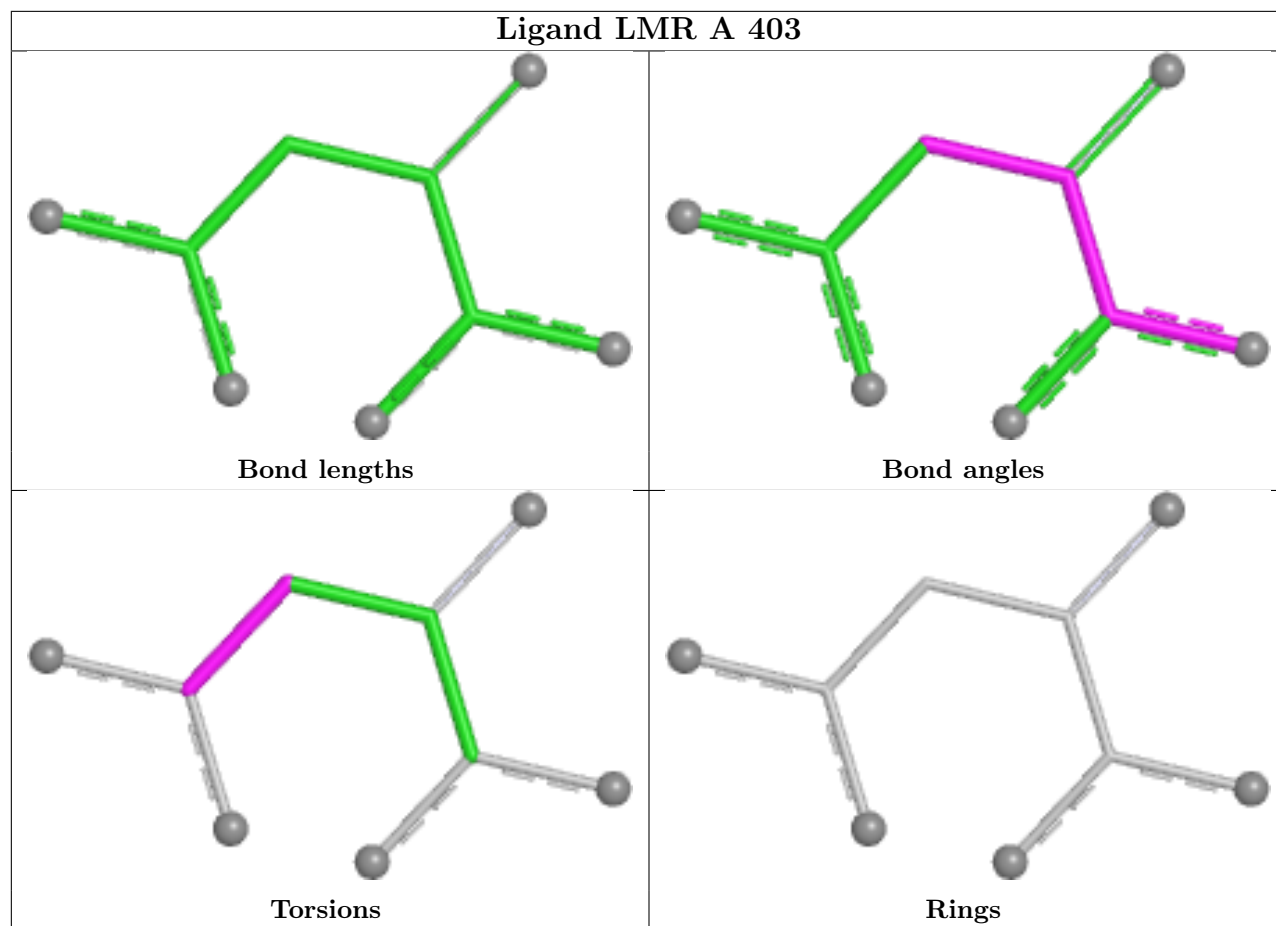
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	403	LMR	2	0
3	B	403	LMR	1	0
3	D	403	LMR	2	0

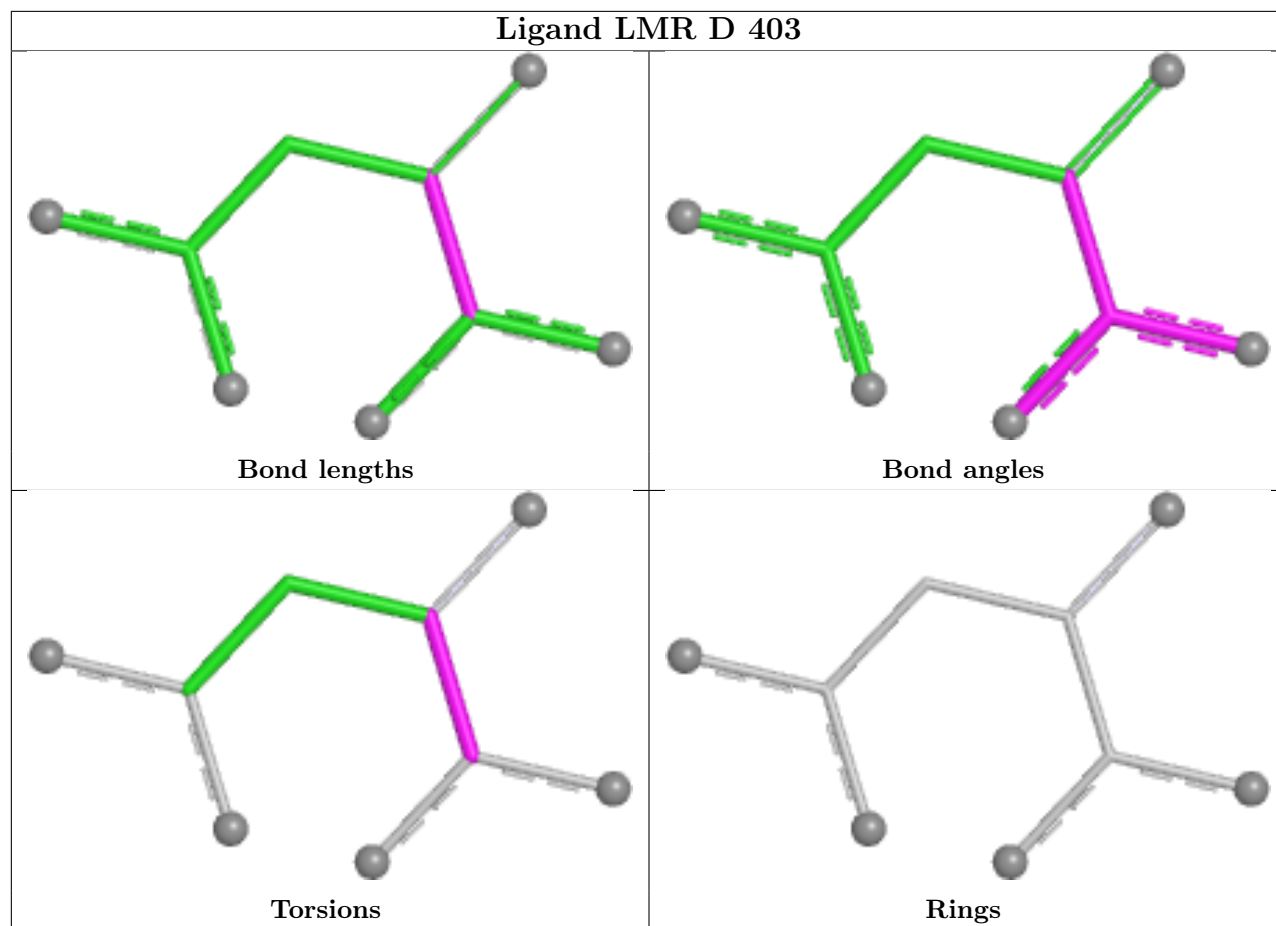
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and

any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	362/372 (97%)	-0.33	5 (1%) 73 75	12, 23, 42, 72	0
1	B	362/372 (97%)	-0.35	6 (1%) 69 71	13, 23, 41, 71	0
1	C	362/372 (97%)	0.11	2 (0%) 85 88	17, 32, 54, 82	0
1	D	362/372 (97%)	0.36	13 (3%) 46 47	18, 36, 59, 93	0
All	All	1448/1488 (97%)	-0.05	26 (1%) 67 69	12, 28, 53, 93	0

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	319	VAL	3.8
1	B	148	LYS	3.4
1	C	319	VAL	3.1
1	B	2	VAL	2.9
1	A	319	VAL	2.9
1	D	145	ASP	2.9
1	D	116	ASP	2.7
1	B	362	GLU	2.7
1	D	144	HIS	2.6
1	D	117	PHE	2.6
1	B	198	LYS	2.5
1	A	144	HIS	2.5
1	A	2	VAL	2.3
1	A	362	GLU	2.2
1	D	51	LEU	2.2
1	D	110	ALA	2.2
1	D	120	PHE	2.2
1	B	147	ASP	2.2
1	D	80	LEU	2.1
1	D	167	LEU	2.1
1	A	364	ARG	2.1

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Mol	Chain	Res	Type	RSRZ
1	D	45	GLN	2.1
1	C	144	HIS	2.1
1	B	319	VAL	2.1
1	D	112	VAL	2.1
1	D	82	PRO	2.0

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
1	KCX	D	98	12/13	0.91	0.11	29,36,37,38	0
1	KCX	C	98	12/13	0.94	0.07	22,24,25,27	0
1	KCX	A	98	12/13	0.96	0.05	13,17,18,19	0
1	KCX	B	98	12/13	0.96	0.06	12,15,17,18	0

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
3	LMR	B	403	9/9	0.91	0.10	16,20,22,24	0
3	LMR	C	403	9/9	0.92	0.08	18,24,26,26	0
3	LMR	D	403	9/9	0.93	0.07	26,32,34,35	0
3	LMR	A	403	9/9	0.97	0.07	15,18,20,21	0
2	ZN	A	402	1/1	0.99	0.02	27,27,27,27	0
2	ZN	C	401	1/1	0.99	0.04	27,27,27,27	0
2	ZN	C	402	1/1	0.99	0.02	27,27,27,27	0
2	ZN	D	402	1/1	0.99	0.03	33,33,33,33	0
2	ZN	A	401	1/1	1.00	0.01	21,21,21,21	0

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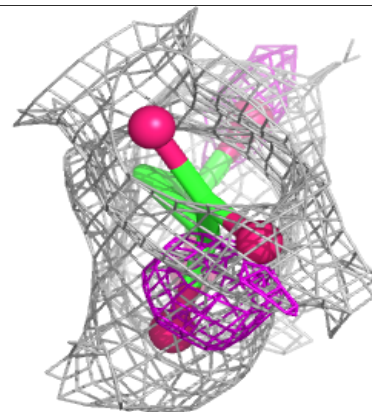
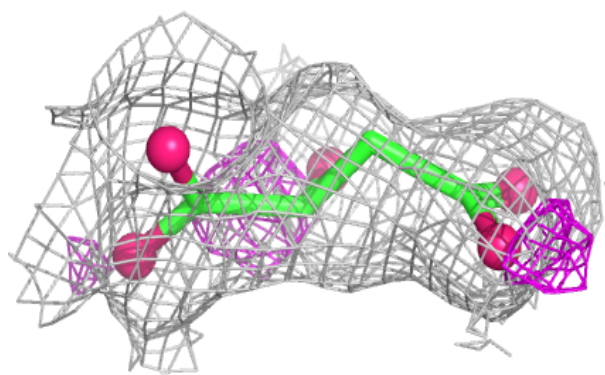
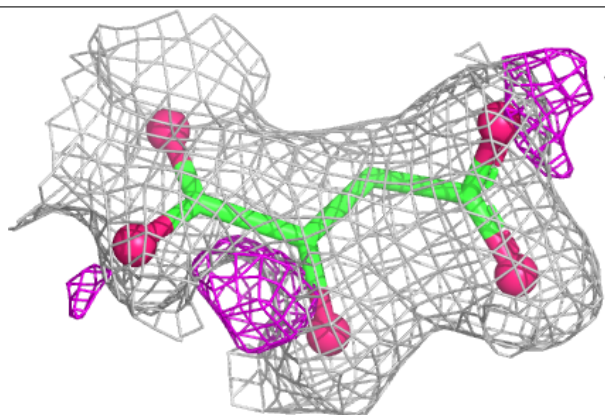
Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	ZN	B	401	1/1	1.00	0.02	25,25,25,25	0
2	ZN	D	401	1/1	1.00	0.04	34,34,34,34	0
2	ZN	B	402	1/1	1.00	0.03	22,22,22,22	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.

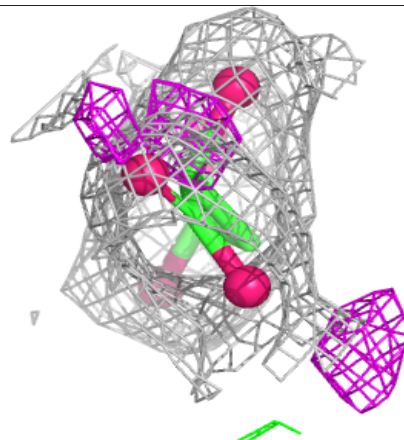
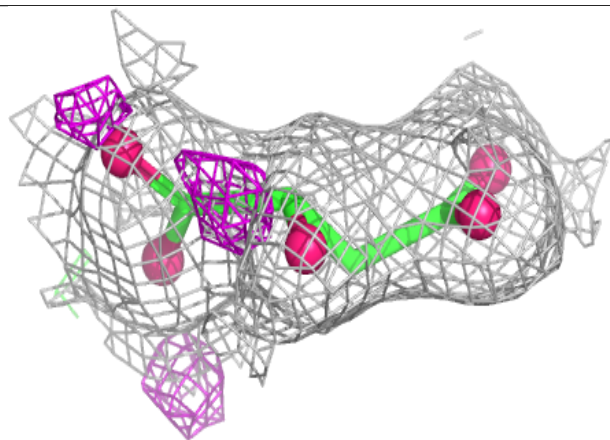
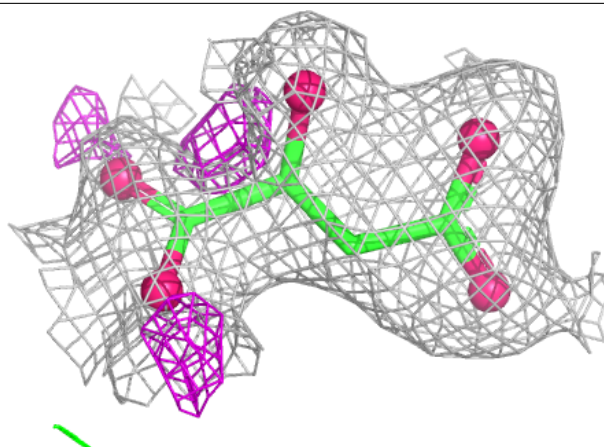
Electron density around LMR B 403:

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



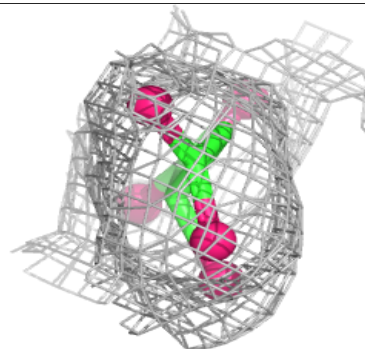
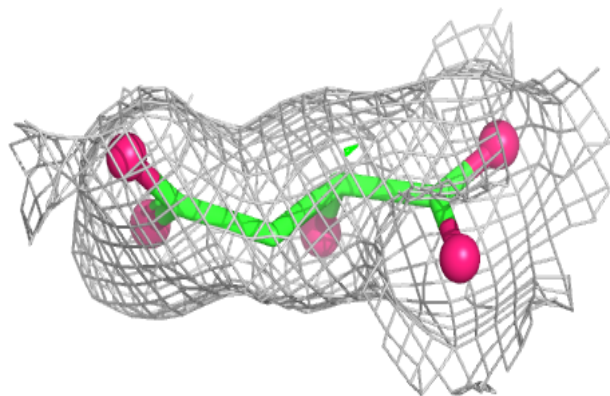
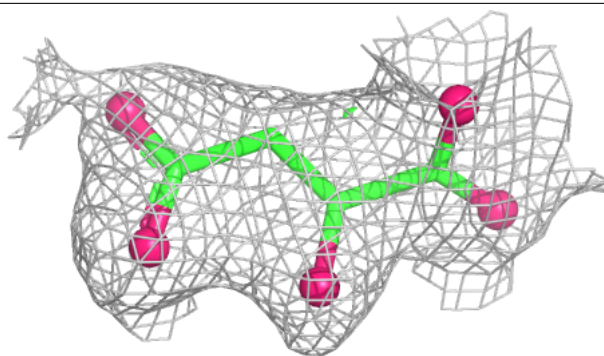
Electron density around LMR C 403:

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



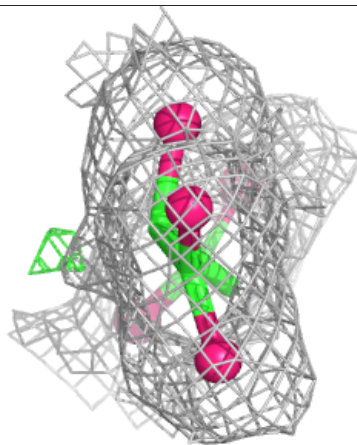
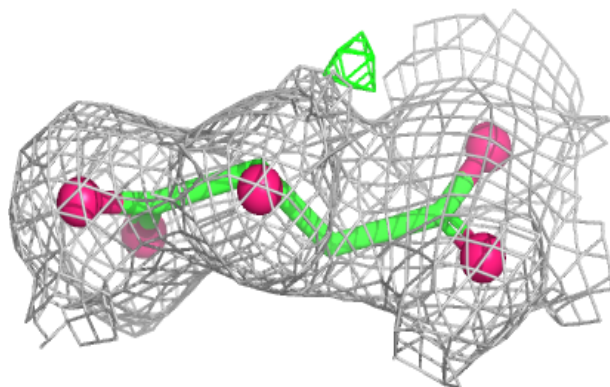
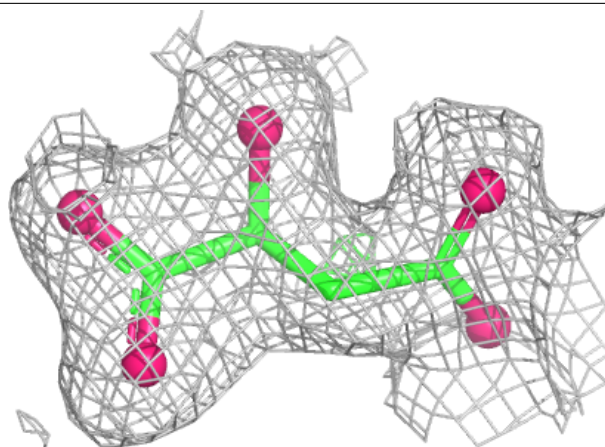
Electron density around LMR D 403:

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



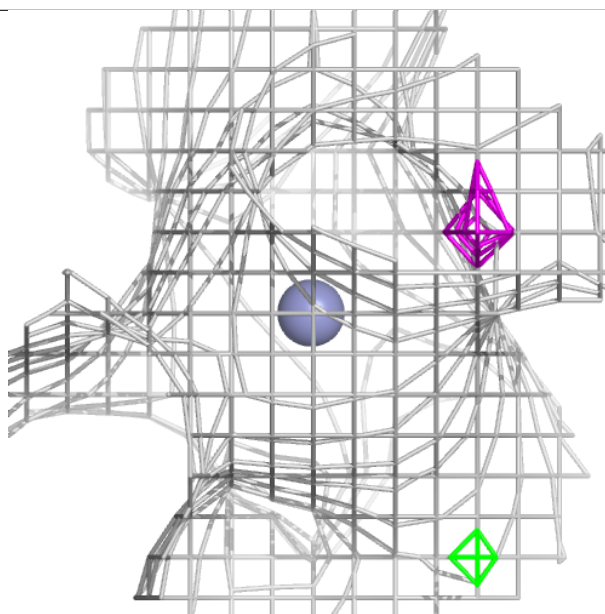
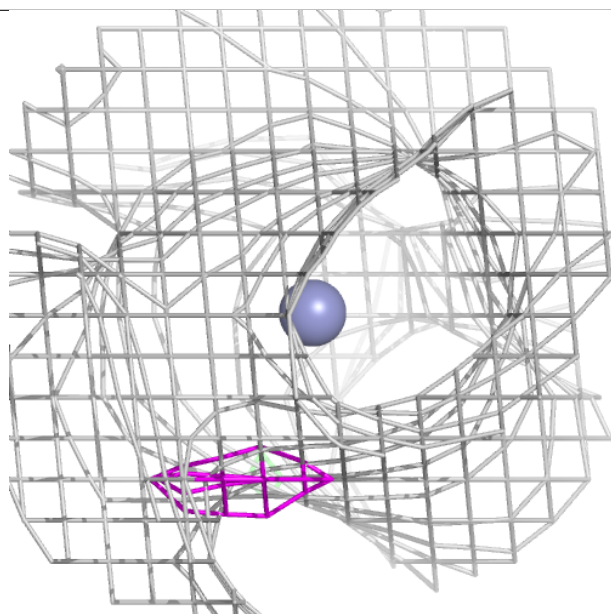
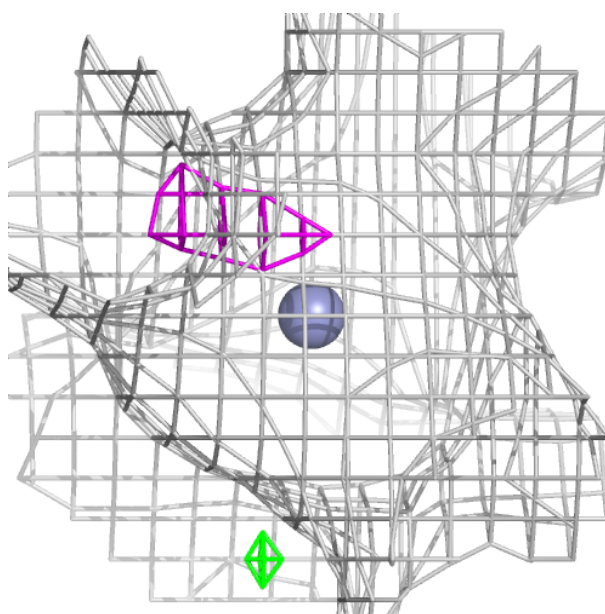
Electron density around LMR A 403:

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



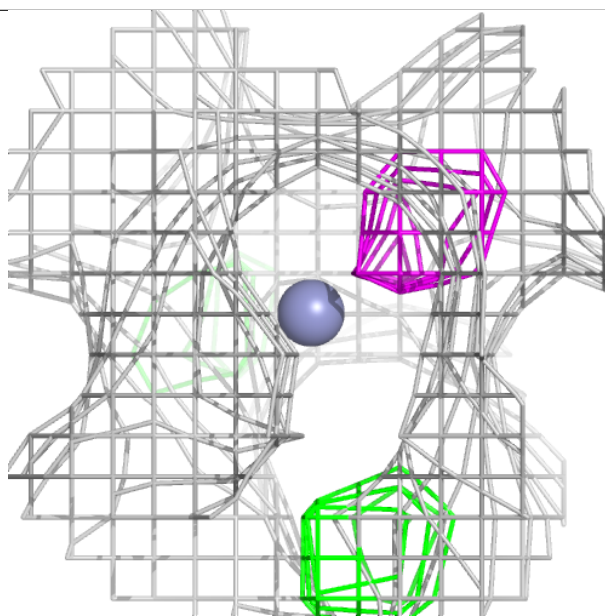
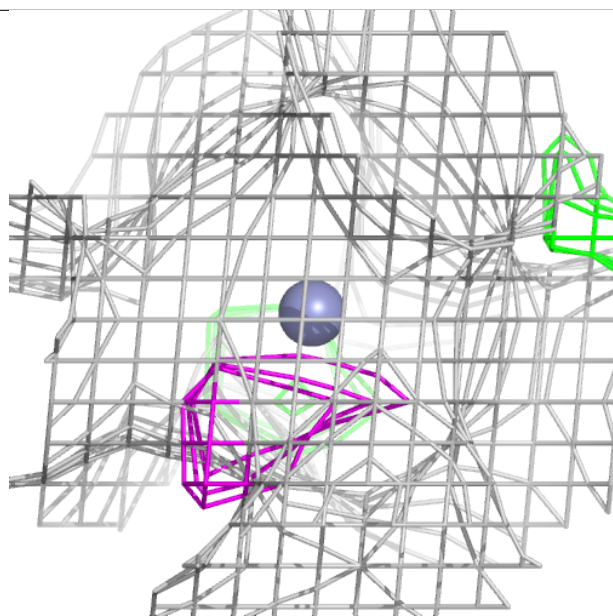
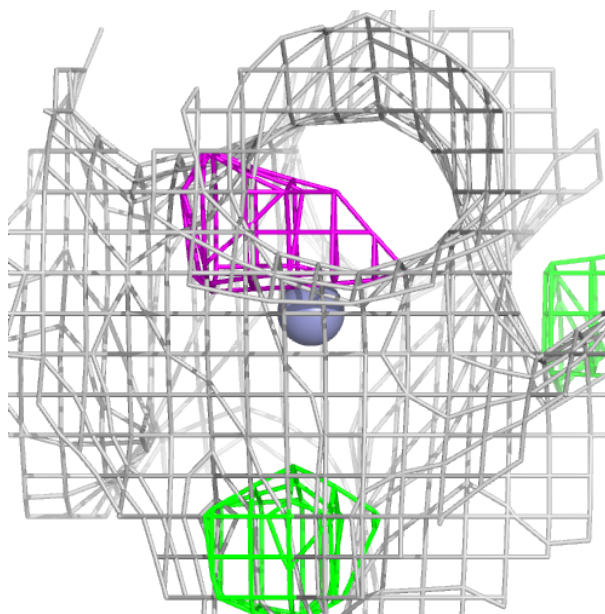
Electron density around ZN A 402:

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



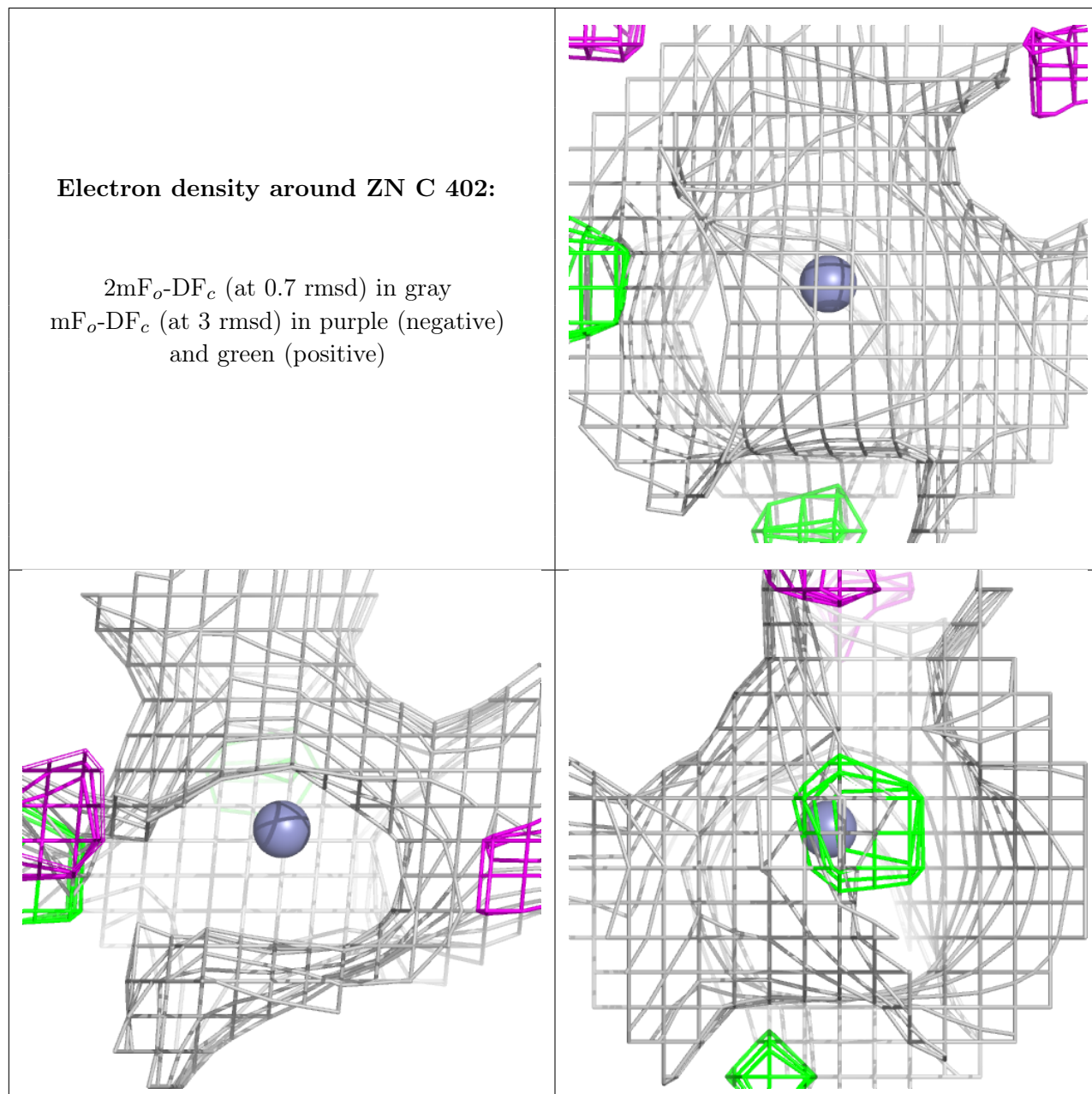
Electron density around ZN C 401:

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



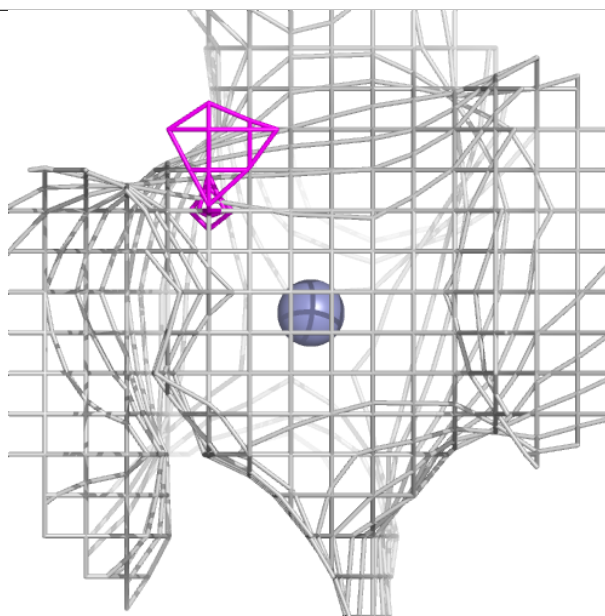
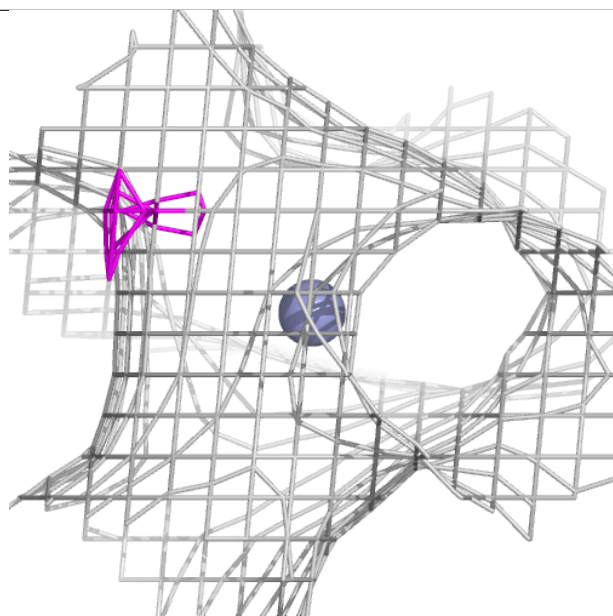
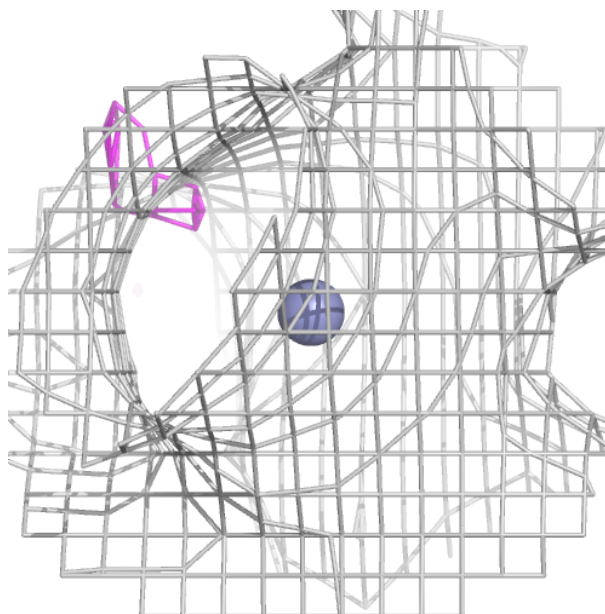
Electron density around ZN C 402:

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



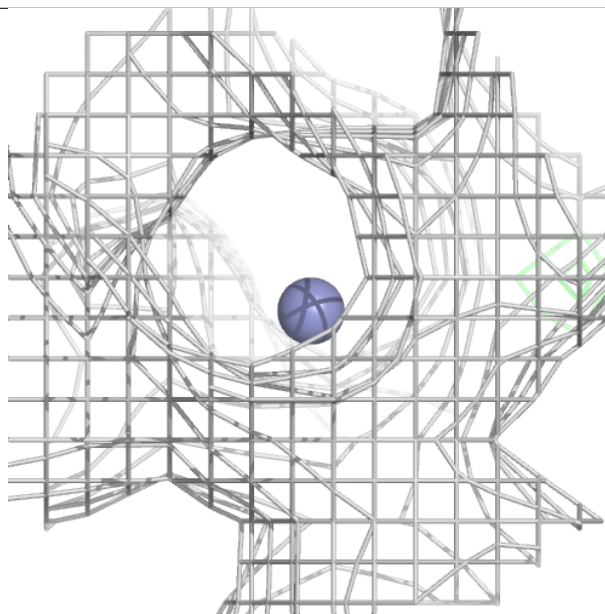
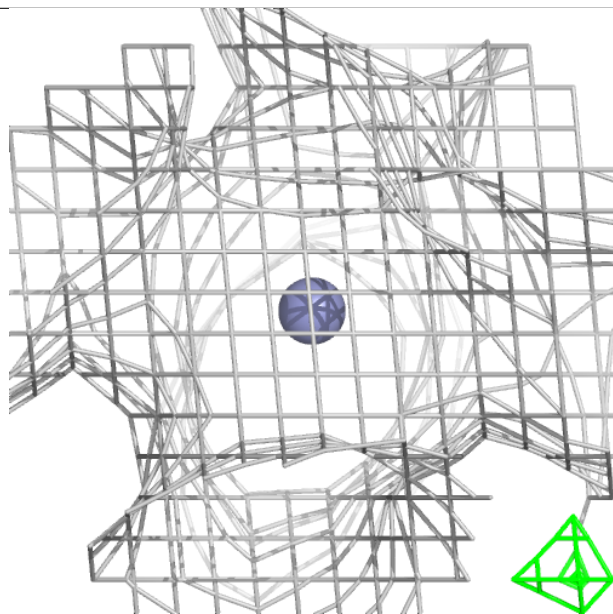
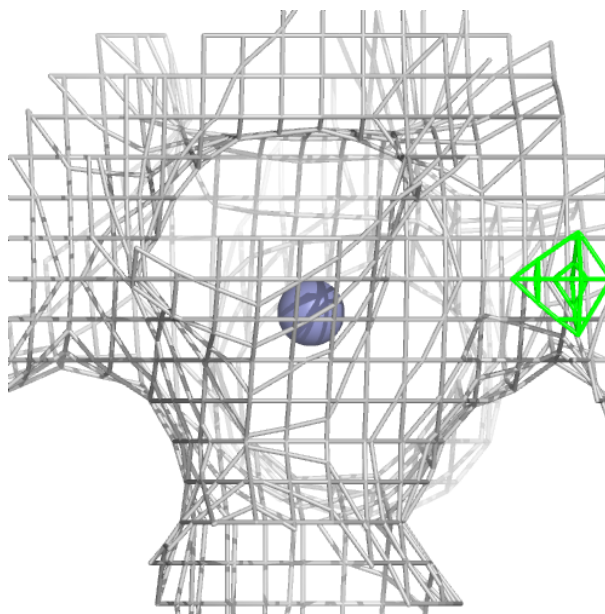
Electron density around ZN D 402:

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



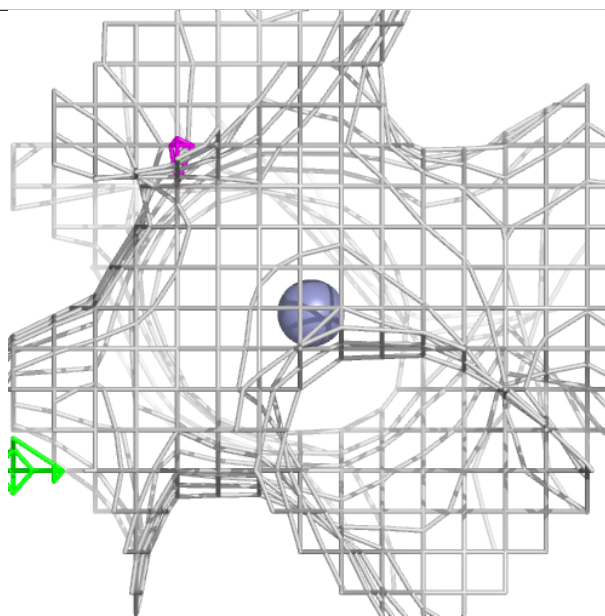
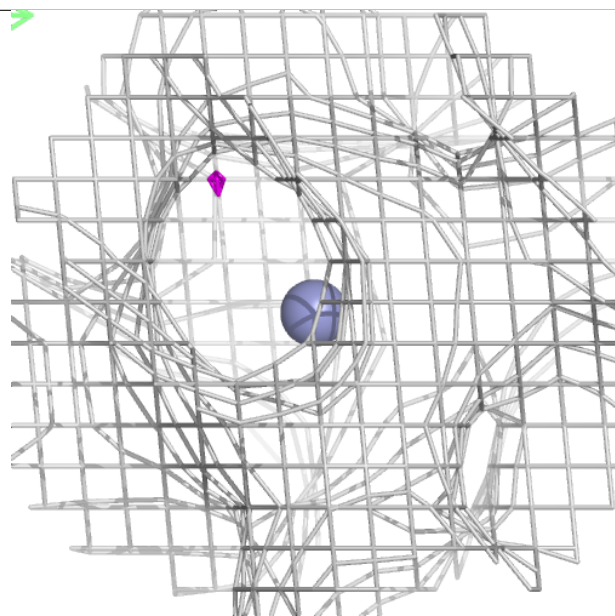
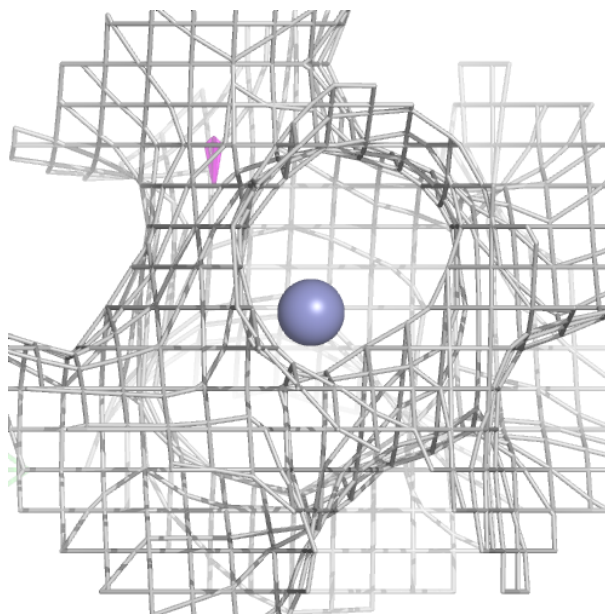
Electron density around ZN A 401:

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



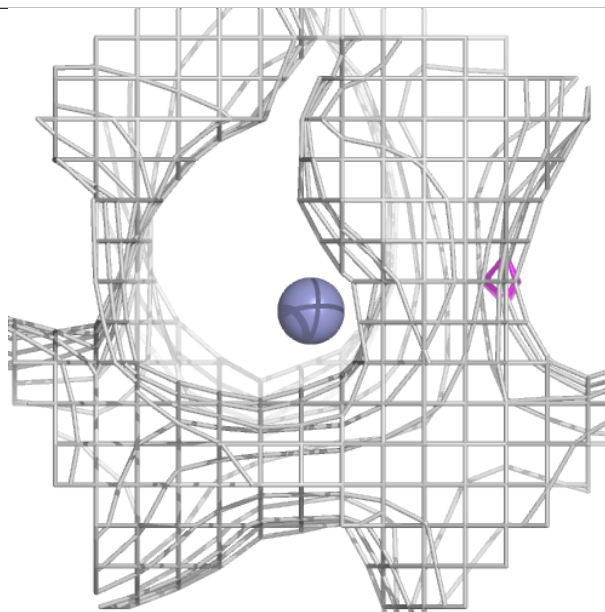
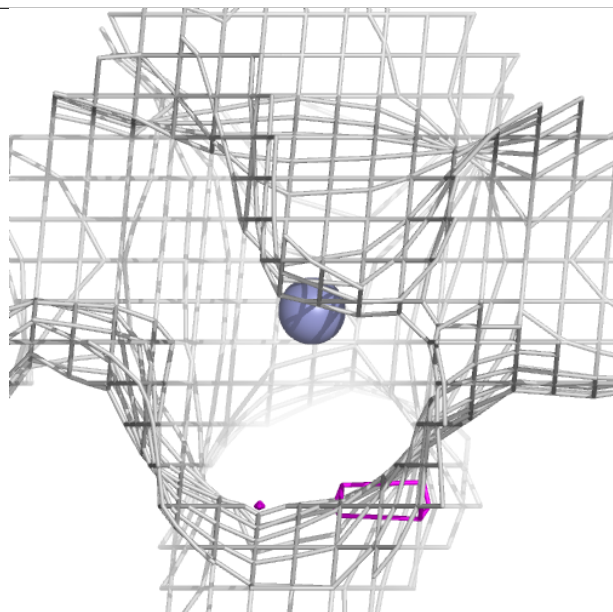
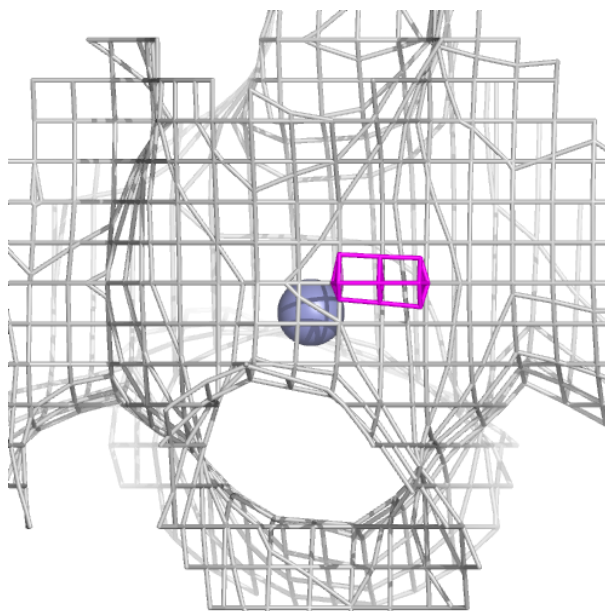
Electron density around ZN B 401:

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



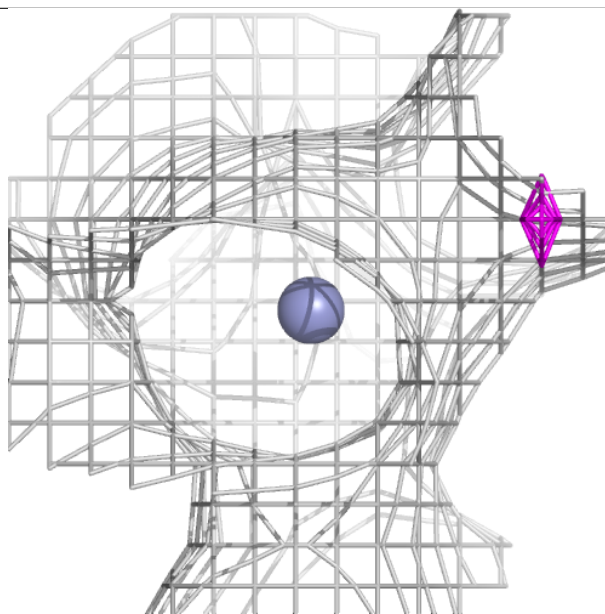
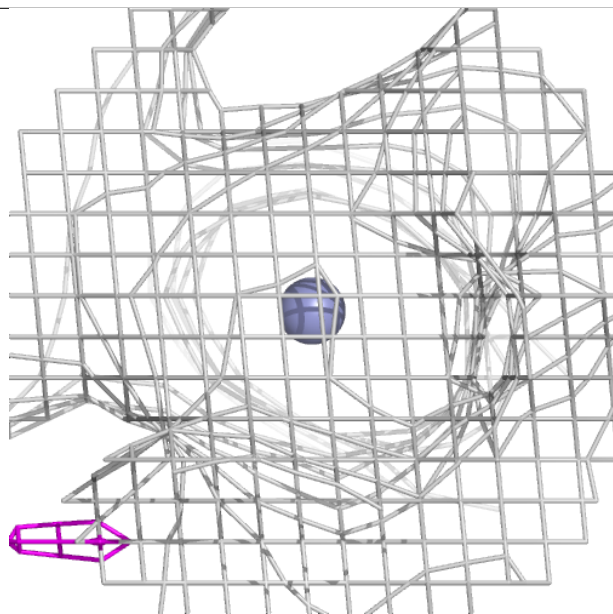
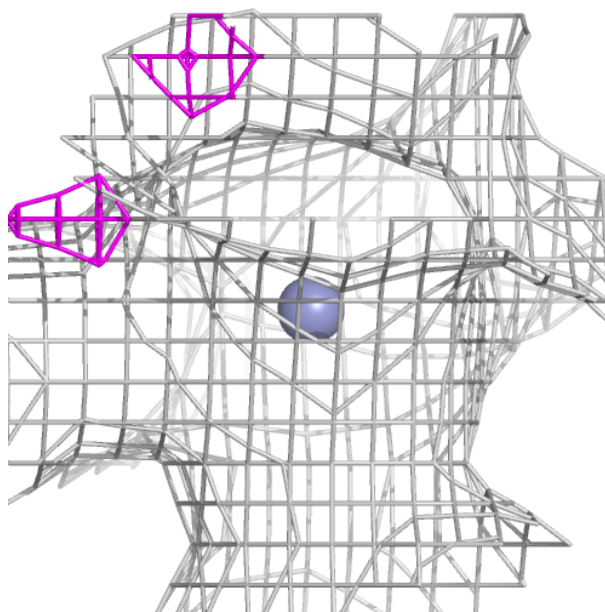
Electron density around ZN D 401:

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



Electron density around ZN B 402:

$2mF_o-DF_c$ (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.