



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 02:29 PM UTC

PDB ID : 9EVL / pdb_00009evl
Title : Crystal Structure of human Collagen Hydroxylysine Galactosyltransferase
GLT25D1/COLGALT1: Hg²⁺ soak for experimental phasing
Authors : De Marco, M.; Scietti, L.; Rai, S.R.; Mattoteia, D.; Pinnola, A.; Forneris, F.
Deposited on : 2024-03-30
Resolution : 2.80 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

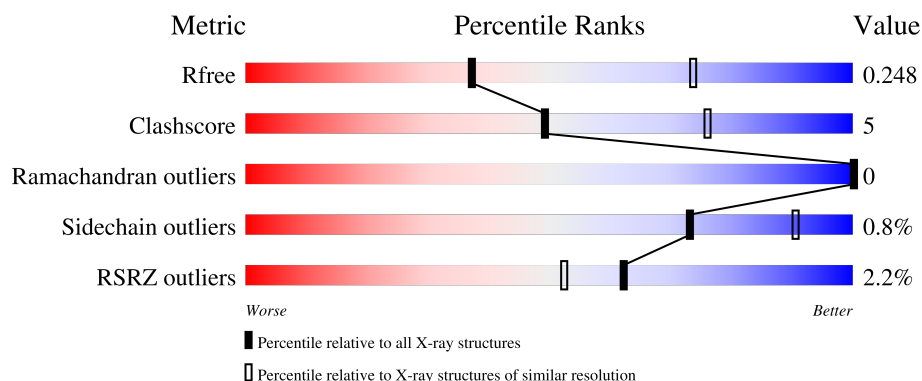
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

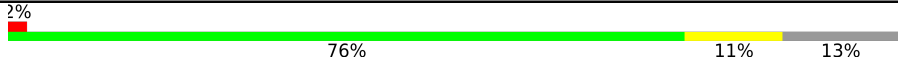
The reported resolution of this entry is 2.80 Å.

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	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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	594	
1	B	594	

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 8621 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 Procollagen galactosyltransferase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	518	Total	C	N	O	S	0	0	0
			4239	2711	750	753	25			
1	B	520	Total	C	N	O	S	0	0	0
			4264	2728	756	755	25			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	28	GLY	-	cloning artifact	UNP Q8NBJ5
A	29	SER	-	cloning artifact	UNP Q8NBJ5
A	619	ALA	-	cloning artifact	UNP Q8NBJ5
A	620	ALA	-	cloning artifact	UNP Q8NBJ5
A	621	ALA	-	cloning artifact	UNP Q8NBJ5
B	28	GLY	-	cloning artifact	UNP Q8NBJ5
B	29	SER	-	cloning artifact	UNP Q8NBJ5
B	619	ALA	-	cloning artifact	UNP Q8NBJ5
B	620	ALA	-	cloning artifact	UNP Q8NBJ5
B	621	ALA	-	cloning artifact	UNP Q8NBJ5

- Molecule 2 is MERCURY (II) ION (CCD ID: HG) (formula: Hg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	5	Total	Hg	0	0
			5	5		
2	B	4	Total	Hg	0	0
			4	4		

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

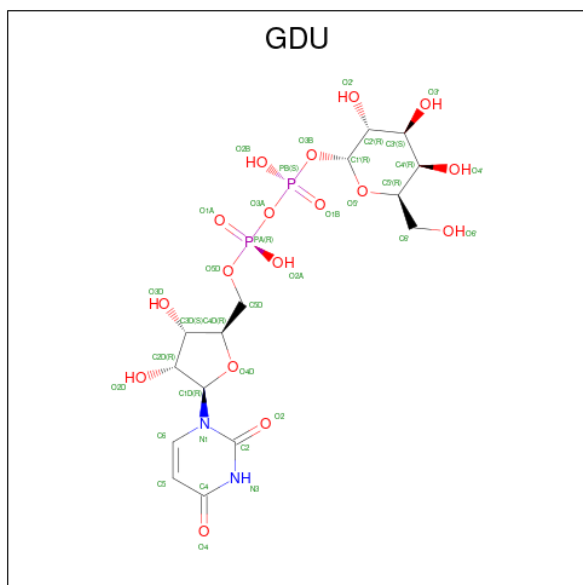
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	4	Total	Cl	0	0
			4	4		

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	3	Total Cl 3 3	0	0

- Molecule 4 is GALACTOSE-URIDINE-5'-DIPHOSPHATE (CCD ID: GDU) (formula: $\text{C}_{15}\text{H}_{24}\text{N}_2\text{O}_{17}\text{P}_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total 36	C 15	N 2	O 17	P 2	0	0
4	B	1	Total 36	C 15	N 2	O 17	P 2	0	0

- Molecule 5 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: $\text{C}_6\text{H}_{13}\text{NO}_4\text{S}$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
5	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 6 is CALCIUM ION (CCD ID: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	Ca	0	0
			1	1		
6	B	1	Total	Ca	0	0
			1	1		

- Molecule 7 is water.

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

4 Data and refinement statistics

Property	Value	Source
Space group	I 2 3	Depositor
Cell constants a, b, c, α , β , γ	220.19Å 220.19Å 220.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.24 – 2.80 49.24 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.9 (49.24-2.80) 99.3 (49.24-2.80)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.94 (at 2.81Å)	Xtriage
Refinement program	PHENIX (1.20_4459: ???)	Depositor
R, R_{free}	0.202 , 0.239 0.214 , 0.248	Depositor DCC
R_{free} test set	2171 reflections (4.05%)	wwPDB-VP
Wilson B-factor (Å ²)	96.1	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 62.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.010 for -l,-k,-h	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	8621	wwPDB-VP
Average B, all atoms (Å ²)	107.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.98% 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: CA, HG, GDU, CL, MES

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	0.12	0/4355	0.28	0/5909
1	B	0.12	0/4382	0.30	0/5946
All	All	0.12	0/8737	0.29	0/11855

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	4239	0	4199	40	0
1	B	4264	0	4222	52	0
2	A	5	0	0	0	0
2	B	4	0	0	0	0
3	A	4	0	0	0	0
3	B	3	0	0	0	0
4	A	36	0	21	6	0
4	B	36	0	21	4	0
5	A	24	0	24	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	2	0	0	1	0
7	B	2	0	0	0	0
All	All	8621	0	8487	92	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

All (92) 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:139:ARG:HE	4:B:708:GDU:H5	1.23	1.01
1:A:139:ARG:HE	4:A:710:GDU:H5	1.37	0.86
1:B:165:VAL:HA	1:B:237:THR:HG22	1.62	0.80
1:B:169:ASN:HD22	1:B:237:THR:HG23	1.52	0.75
1:B:169:ASN:HD21	1:B:236:SER:HB3	1.51	0.74
1:A:458:GLU:OE1	1:A:483:ARG:NH1	2.27	0.67
1:A:75:GLU:O	1:A:81:ARG:NH2	2.28	0.67
1:B:422:GLU:OE2	1:B:426:ARG:NH1	2.31	0.62
1:A:370:ARG:NH1	1:A:422:GLU:OE2	2.33	0.61
1:A:291:LEU:HD23	1:A:292:PRO:HD2	1.83	0.60
1:A:469:ARG:HA	1:A:495:TRP:HB2	1.85	0.58
1:B:392:MET:HA	1:B:518:MET:HB3	1.86	0.58
1:B:438:LEU:HD13	1:B:556:ILE:HD13	1.86	0.58
1:A:161:TYR:HB3	1:A:239:LEU:HD11	1.88	0.55
1:A:335:PRO:HB2	1:A:368:GLU:HB2	1.88	0.54
1:B:139:ARG:NE	4:B:708:GDU:H5	2.08	0.54
1:A:139:ARG:NE	4:A:710:GDU:H5	2.17	0.52
1:B:497:LEU:HD11	1:B:558:PRO:HG3	1.90	0.52
1:A:348:LEU:HB2	1:A:351:ARG:HG2	1.92	0.52
1:B:300:THR:HG23	1:B:303:ASP:H	1.75	0.52
1:A:53:ARG:HG2	1:B:158:TRP:CE2	2.45	0.51
1:B:86:LEU:HB2	1:B:115:VAL:HG22	1.92	0.51
1:A:357:ARG:NH2	1:A:438:LEU:O	2.42	0.51
1:A:352:GLN:HG2	1:A:355:ARG:HH12	1.76	0.51
1:B:259:TYR:OH	1:B:262:SER:O	2.29	0.50
1:B:202:TRP:HB2	1:B:233:MET:HB3	1.92	0.50
1:B:206:THR:C	1:B:208:GLN:H	2.18	0.50
1:A:76:ARG:NH2	1:A:323:GLU:O	2.44	0.50
1:A:287:GLU:OE1	1:A:319:HIS:NE2	2.44	0.50
1:A:333:LYS:HB3	1:A:366:GLU:HG2	1.93	0.50
1:B:69:THR:HG22	1:B:170:LEU:HD13	1.94	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:203:CYS:HB3	1:B:214:THR:OG1	2.12	0.50
1:A:259:TYR:CZ	1:A:261:TRP:HB2	2.47	0.49
1:B:91:ASP:HB3	1:B:120:ALA:HB3	1.92	0.49
1:B:422:GLU:HG3	1:B:426:ARG:HD3	1.95	0.49
1:B:522:ASP:OD1	1:B:522:ASP:N	2.45	0.49
1:A:55:LEU:HD11	1:A:87:TRP:HB2	1.95	0.49
1:A:202:TRP:HB2	1:A:233:MET:HB3	1.94	0.49
4:A:710:GDU:N3	7:A:801:HOH:O	2.27	0.48
1:A:135:TRP:HA	1:A:139:ARG:HD3	1.96	0.48
1:A:435:GLU:H	1:A:438:LEU:HD11	1.79	0.48
1:B:194:SER:OG	1:B:198:TYR:O	2.26	0.48
1:B:259:TYR:CZ	1:B:261:TRP:HB2	2.48	0.47
1:A:358:MET:HG3	1:A:436:ASP:HA	1.96	0.47
1:B:194:SER:H	1:B:221:ARG:NH2	2.12	0.47
1:A:133:LYS:HE3	1:A:304:GLU:HB2	1.97	0.47
1:B:390:ILE:HD13	1:B:410:LEU:HD11	1.97	0.46
1:B:71:LEU:HD13	1:B:104:TRP:CD2	2.51	0.46
1:B:405:LEU:HD13	1:B:518:MET:HG3	1.96	0.46
1:B:489:GLU:HA	1:B:549:PHE:HD1	1.81	0.46
1:A:69:THR:HG22	1:A:170:LEU:HD13	1.97	0.45
1:A:91:ASP:HB3	1:A:120:ALA:HB3	1.99	0.45
1:A:266:ILE:HG23	4:A:710:GDU:H4'	1.99	0.45
1:B:75:GLU:OE2	1:B:104:TRP:NE1	2.42	0.45
1:A:398:ASP:N	1:A:403:ARG:O	2.48	0.44
1:A:525:LEU:HB2	1:A:526:PRO:HD3	1.99	0.44
1:B:417:TYR:CZ	1:B:421:LYS:HE3	2.52	0.44
1:B:471:ARG:NH2	1:B:477:PRO:HA	2.33	0.44
1:A:55:LEU:HD23	1:A:154:ALA:HB2	1.99	0.44
1:B:171:ILE:HD11	1:B:237:THR:HG21	2.00	0.44
1:A:192:LEU:HB2	1:A:291:LEU:HD12	2.00	0.43
1:A:398:ASP:HB3	1:A:403:ARG:H	1.83	0.43
1:A:166:ASP:OD2	4:A:710:GDU:O6'	2.33	0.43
1:B:310:HIS:NE2	1:B:440:PHE:O	2.43	0.42
1:A:527:VAL:O	1:A:544:ARG:HD2	2.19	0.42
1:B:211:TYR:HE2	1:B:213:ARG:HD3	1.83	0.42
1:B:147:ARG:HH22	4:B:708:GDU:H6'2	1.85	0.42
1:B:405:LEU:HD12	1:B:520:PRO:HD3	2.01	0.42
1:B:81:ARG:HH22	1:B:326:ARG:HH22	1.68	0.42
1:A:141:GLU:O	1:A:145:LYS:HG3	2.20	0.42
1:B:126:TYR:HB2	1:B:129:GLU:HB3	2.01	0.42
1:B:333:LYS:HB2	1:B:366:GLU:HG2	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:470:LYS:HB2	1:B:495:TRP:CE3	2.55	0.42
1:B:147:ARG:NH2	4:B:708:GDU:H6'2	2.34	0.41
1:B:164:PHE:O	1:B:237:THR:HA	2.19	0.41
1:B:341:ASP:HB3	1:B:428:LEU:HD22	2.02	0.41
1:B:526:PRO:HA	1:B:529:PHE:CE2	2.55	0.41
1:A:61:ARG:HD2	4:A:710:GDU:C4	2.50	0.41
1:A:104:TRP:HB2	1:A:328:ILE:HD11	2.03	0.41
1:A:194:SER:H	1:A:221:ARG:NH2	2.18	0.41
1:B:133:LYS:HE3	1:B:304:GLU:HB2	2.03	0.41
1:B:432:LEU:HD13	1:B:500:VAL:HG22	2.02	0.41
1:B:55:LEU:HD11	1:B:87:TRP:HB2	2.03	0.41
1:B:414:LEU:HA	1:B:417:TYR:HB3	2.02	0.41
1:B:525:LEU:HB2	1:B:526:PRO:HD3	2.03	0.41
1:A:517:LYS:NZ	1:A:540:HIS:O	2.34	0.41
1:B:470:LYS:HD2	1:B:495:TRP:CZ2	2.56	0.41
1:A:172:LEU:HD23	1:A:172:LEU:HA	1.96	0.40
1:B:166:ASP:HB2	1:B:169:ASN:CG	2.47	0.40
1:B:333:LYS:HE2	1:B:333:LYS:HB3	1.80	0.40
1:A:173:ASN:HB3	1:A:176:THR:OG1	2.21	0.40
1:B:346:ILE:HG12	1:B:419:ILE:HD11	2.04	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	516/594 (87%)	493 (96%)	23 (4%)	0	100	100
1	B	518/594 (87%)	497 (96%)	21 (4%)	0	100	100
All	All	1034/1188 (87%)	990 (96%)	44 (4%)	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	457/518 (88%)	453 (99%)	4 (1%)	70	89
1	B	459/518 (89%)	456 (99%)	3 (1%)	76	91
All	All	916/1036 (88%)	909 (99%)	7 (1%)	73	90

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	70	THR
1	A	203	CYS
1	A	291	LEU
1	A	334	THR
1	B	70	THR
1	B	203	CYS
1	B	348	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	312	GLN
1	A	381	ASN
1	B	169	ASN
1	B	401	HIS
1	B	504	GLN

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 [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 22 ligands modelled in this entry, 18 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
5	MES	A	712	-	12,12,12	2.29	1 (8%)	15,16,16	2.15	6 (40%)
5	MES	A	711	-	12,12,12	2.32	1 (8%)	15,16,16	1.91	1 (6%)
4	GDU	B	708	6	37,38,38	3.50	16 (43%)	55,58,58	1.60	7 (12%)
4	GDU	A	710	6	37,38,38	3.45	16 (43%)	55,58,58	1.67	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	MES	A	712	-	-	4/6/14/14	0/1/1/1
5	MES	A	711	-	-	2/6/14/14	0/1/1/1
4	GDU	B	708	6	-	8/23/59/59	0/3/3/3
4	GDU	A	710	6	-	8/23/59/59	0/3/3/3

All (34) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	710	GDU	C2-N1	8.25	1.51	1.38
4	B	708	GDU	C2-N1	7.98	1.51	1.38
5	A	711	MES	C8-S	-7.79	1.66	1.77
4	B	708	GDU	C3D-C4D	-7.66	1.33	1.53
5	A	712	MES	C8-S	-7.62	1.66	1.77
4	A	710	GDU	C3D-C4D	-7.36	1.34	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	710	GDU	O4D-C4D	7.25	1.61	1.45
4	B	708	GDU	O4D-C4D	7.03	1.60	1.45
4	A	710	GDU	C2-N3	6.98	1.50	1.38
4	B	708	GDU	C2-N3	6.81	1.49	1.38
4	B	708	GDU	PA-O3A	6.74	1.66	1.59
4	B	708	GDU	PB-O3A	6.63	1.66	1.59
4	A	710	GDU	C6-C5	6.23	1.49	1.35
4	B	708	GDU	C6-C5	5.98	1.48	1.35
4	A	710	GDU	PA-O3A	5.85	1.65	1.59
4	A	710	GDU	PB-O3A	5.37	1.65	1.59
4	A	710	GDU	C4-N3	4.75	1.46	1.38
4	B	708	GDU	C4-N3	4.73	1.46	1.38
4	A	710	GDU	O4D-C1D	-4.65	1.31	1.42
4	B	708	GDU	O4D-C1D	-4.55	1.31	1.42
4	A	710	GDU	O5'-C1'	3.26	1.50	1.41
4	B	708	GDU	O5'-C1'	3.14	1.49	1.41
4	A	710	GDU	C6-N1	3.04	1.45	1.38
4	B	708	GDU	C6-N1	2.90	1.45	1.38
4	A	710	GDU	PB-O3B	2.81	1.67	1.59
4	A	710	GDU	C5-C4	2.74	1.49	1.43
4	B	708	GDU	PB-O3B	2.66	1.67	1.59
4	B	708	GDU	O3D-C3D	2.63	1.49	1.43
4	A	710	GDU	O2D-C2D	-2.62	1.36	1.43
4	A	710	GDU	O3D-C3D	2.58	1.49	1.43
4	B	708	GDU	C5-C4	2.53	1.49	1.43
4	B	708	GDU	O2D-C2D	-2.50	1.36	1.43
4	A	710	GDU	O4-C4	-2.37	1.19	1.24
4	B	708	GDU	O4-C4	-2.33	1.20	1.24

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	708	GDU	C4-N3-C2	-6.67	118.33	126.61
4	A	710	GDU	C4-N3-C2	-6.34	118.74	126.61
5	A	711	MES	C5-N4-C3	5.73	121.19	108.84
5	A	712	MES	C5-N4-C3	5.03	119.68	108.84
4	B	708	GDU	N3-C2-N1	4.82	121.16	114.89
4	A	710	GDU	N3-C2-N1	4.73	121.04	114.89
4	B	708	GDU	C5-C4-N3	3.75	120.06	114.80
4	A	710	GDU	C5-C4-N3	3.70	119.99	114.80
4	A	710	GDU	O5'-C1'-O3B	-3.33	107.01	111.36
4	B	708	GDU	O4-C4-C5	-2.94	120.09	125.16

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	710	GDU	O3B-C1'-C2'	2.91	113.71	108.38
5	A	712	MES	C7-N4-C3	2.79	118.69	111.24
5	A	712	MES	C7-N4-C5	2.76	118.61	111.24
4	A	710	GDU	O4-C4-C5	-2.70	120.51	125.16
4	B	708	GDU	C1'-O5'-C5'	-2.39	109.05	113.72
4	B	708	GDU	O5'-C1'-O3B	-2.27	108.39	111.36
5	A	712	MES	C6-C5-N4	-2.26	106.68	110.12
5	A	712	MES	C2-C3-N4	-2.22	106.75	110.12
4	B	708	GDU	C6'-C5'-C4'	-2.19	107.65	113.02
5	A	712	MES	O2S-S-C8	2.13	109.95	106.73
4	A	710	GDU	C4'-C3'-C2'	2.04	114.41	110.83

There are no chirality outliers.

All (22) torsion outliers are listed below:

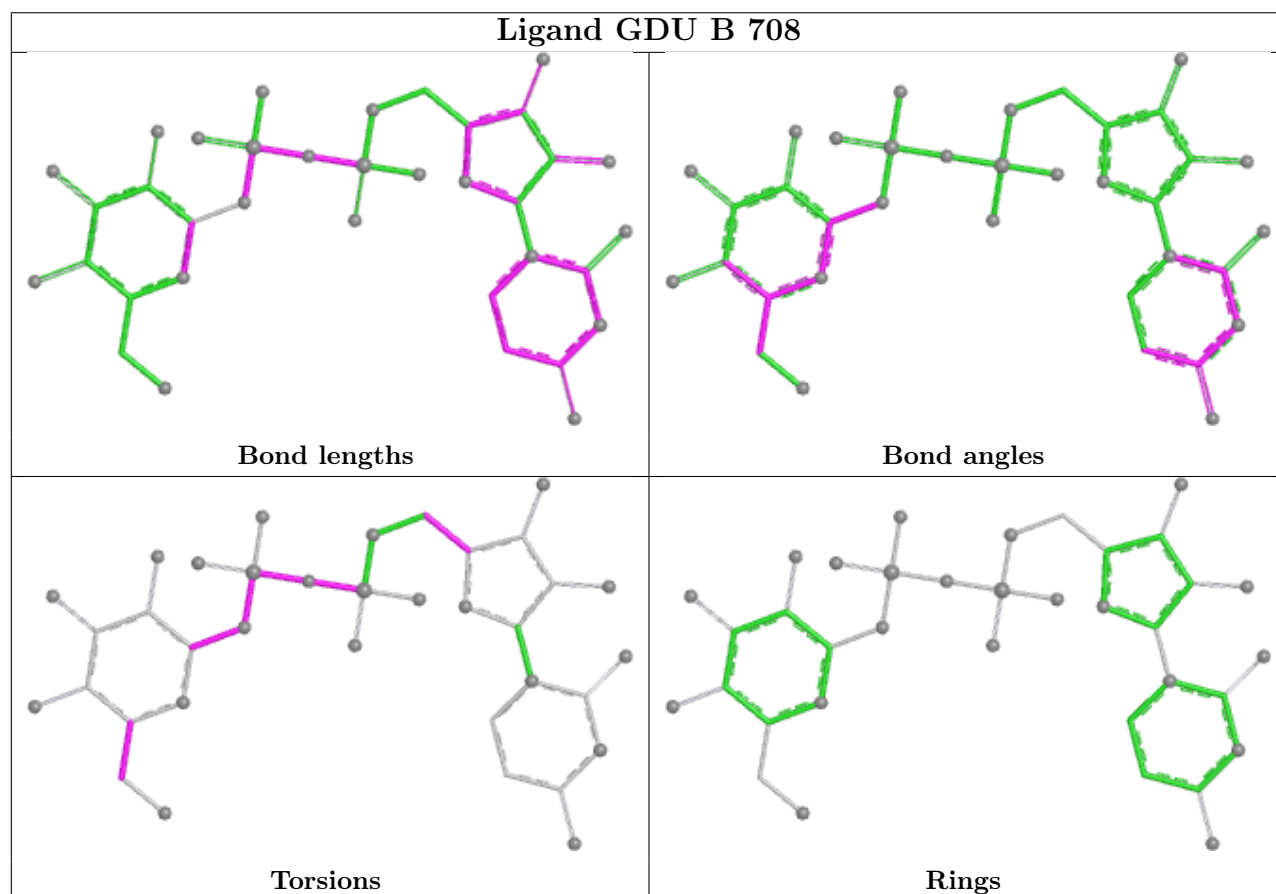
Mol	Chain	Res	Type	Atoms
4	A	710	GDU	C5D-O5D-PA-O1A
4	A	710	GDU	C5D-O5D-PA-O3A
4	A	710	GDU	C1'-O3B-PB-O3A
4	A	710	GDU	C2'-C1'-O3B-PB
4	A	710	GDU	O5'-C1'-O3B-PB
4	B	708	GDU	C1'-O3B-PB-O3A
4	B	708	GDU	O5'-C1'-O3B-PB
5	A	712	MES	C7-C8-S-O3S
4	B	708	GDU	C4'-C5'-C6'-O6'
4	B	708	GDU	O5'-C5'-C6'-O6'
5	A	711	MES	C8-C7-N4-C3
5	A	711	MES	C8-C7-N4-C5
5	A	712	MES	C8-C7-N4-C3
4	B	708	GDU	O4D-C4D-C5D-O5D
5	A	712	MES	C7-C8-S-O1S
5	A	712	MES	C7-C8-S-O2S
4	A	710	GDU	C5D-O5D-PA-O2A
4	A	710	GDU	PB-O3A-PA-O1A
4	B	708	GDU	PA-O3A-PB-O2B
4	B	708	GDU	PB-O3A-PA-O2A
4	B	708	GDU	PA-O3A-PB-O1B
4	A	710	GDU	PB-O3A-PA-O2A

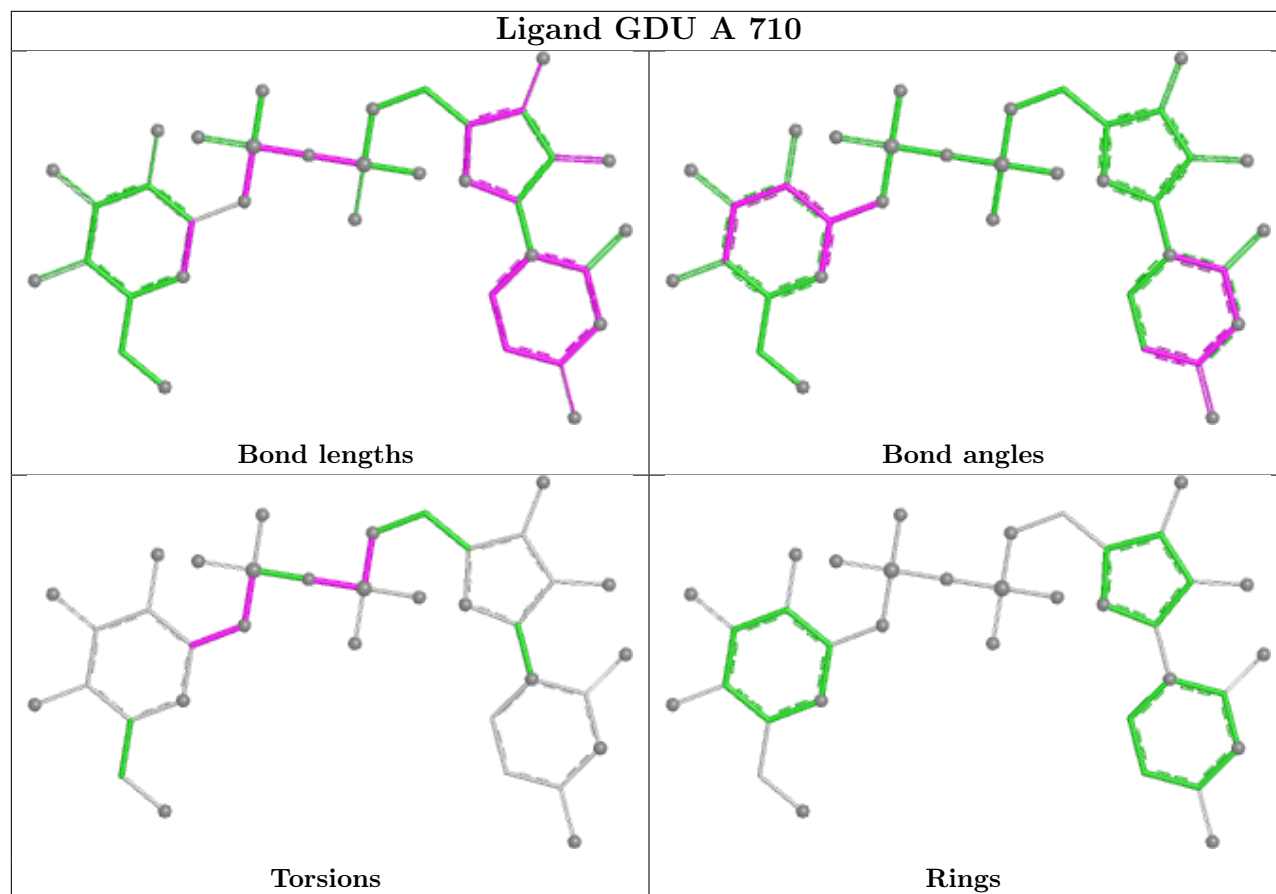
There are no ring outliers.

2 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	708	GDU	4	0
4	A	710	GDU	6	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	518/594 (87%)	-0.03	9 (1%) 69 60	62, 99, 173, 198	0
1	B	520/594 (87%)	-0.01	14 (2%) 56 46	58, 96, 175, 229	0
All	All	1038/1188 (87%)	-0.02	23 (2%) 62 52	58, 98, 173, 229	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	560	HIS	4.9
1	B	536	GLU	3.4
1	A	44	SER	3.3
1	A	561	TYR	3.3
1	B	437	ASP	3.1
1	B	434	PHE	2.8
1	A	295	LEU	2.7
1	B	540	HIS	2.7
1	B	561	TYR	2.6
1	B	394	PRO	2.6
1	A	560	HIS	2.5
1	B	300	THR	2.5
1	B	542	SER	2.4
1	B	299	SER	2.4
1	A	547	HIS	2.2
1	B	439	ARG	2.2
1	B	412	CYS	2.2
1	A	45	PRO	2.1
1	B	395	GLY	2.1
1	B	290	PHE	2.1
1	A	519	LEU	2.1
1	A	246	ALA	2.1
1	A	330	ALA	2.0

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

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

6.3 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

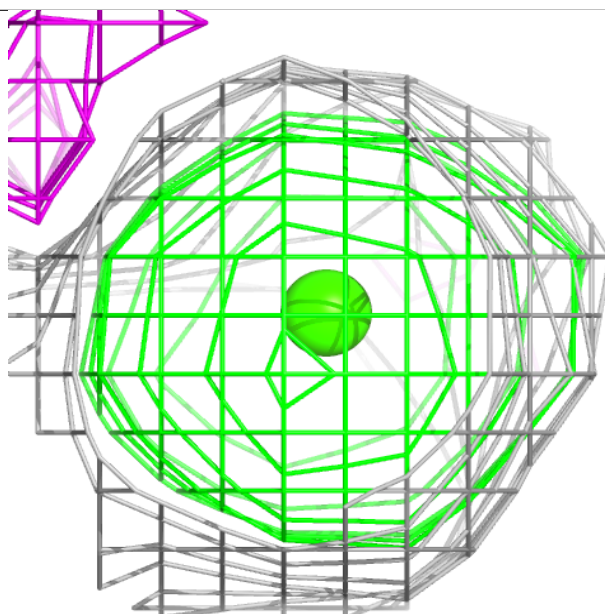
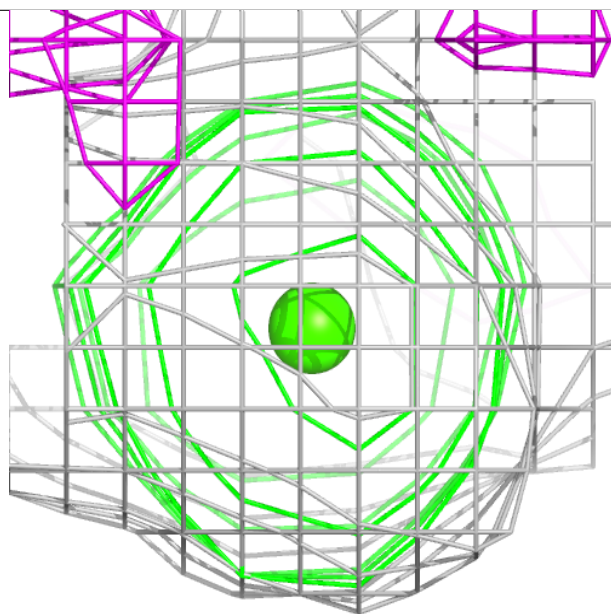
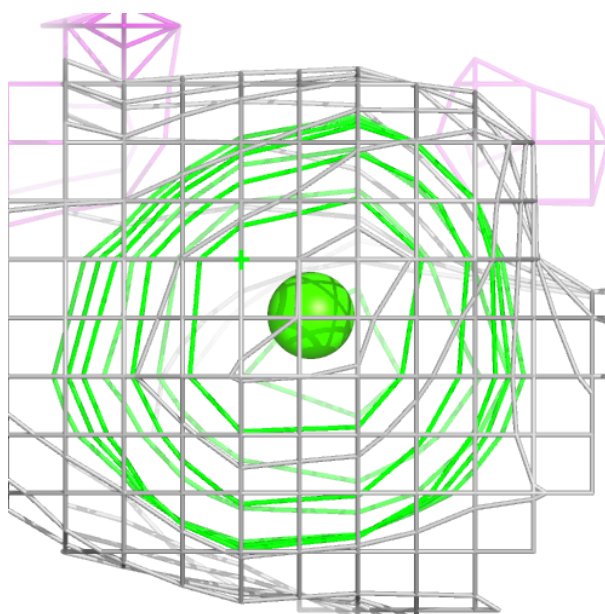
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	MES	A	712	12/12	0.71	0.23	122,142,161,172	0
2	HG	A	703	1/1	0.77	0.13	308,308,308,308	1
6	CA	B	709	1/1	0.77	0.27	185,185,185,185	0
2	HG	A	702	1/1	0.79	0.30	314,314,314,314	1
3	CL	B	706	1/1	0.80	0.12	137,137,137,137	0
2	HG	A	705	1/1	0.87	0.11	351,351,351,351	0
5	MES	A	711	12/12	0.88	0.17	93,100,126,151	0
2	HG	B	703	1/1	0.89	0.15	339,339,339,339	1
3	CL	B	707	1/1	0.91	0.10	141,141,141,141	0
3	CL	A	708	1/1	0.91	0.13	108,108,108,108	0
4	GDU	B	708	36/36	0.92	0.12	55,80,99,125	0
3	CL	A	707	1/1	0.93	0.12	116,116,116,116	0
2	HG	B	701	1/1	0.93	0.19	211,211,211,211	1
3	CL	A	706	1/1	0.94	0.22	107,107,107,107	0
4	GDU	A	710	36/36	0.94	0.10	53,75,94,103	0
2	HG	A	704	1/1	0.94	0.12	163,163,163,163	1
3	CL	B	705	1/1	0.95	0.08	123,123,123,123	0
6	CA	A	713	1/1	0.95	0.18	109,109,109,109	0
2	HG	B	704	1/1	0.95	0.11	185,185,185,185	1
3	CL	A	709	1/1	0.96	0.09	101,101,101,101	0
2	HG	B	702	1/1	0.98	0.11	188,188,188,188	1
2	HG	A	701	1/1	0.98	0.10	166,166,166,166	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.

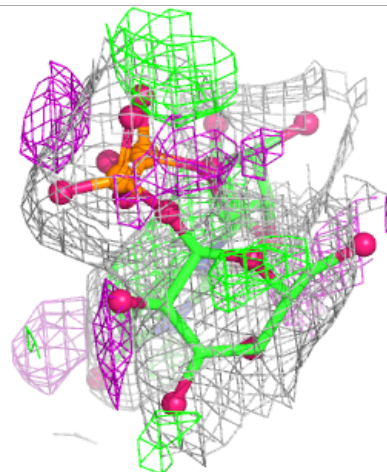
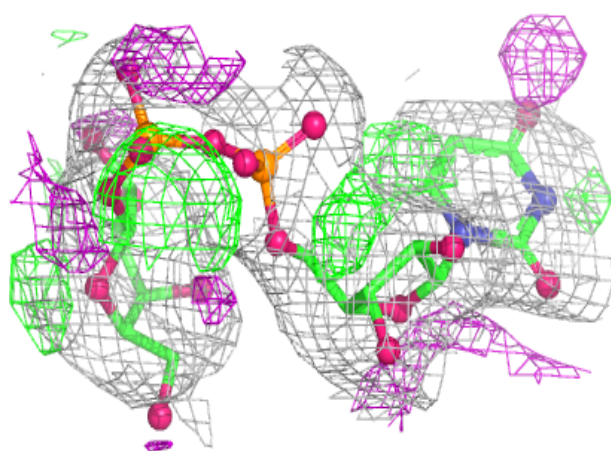
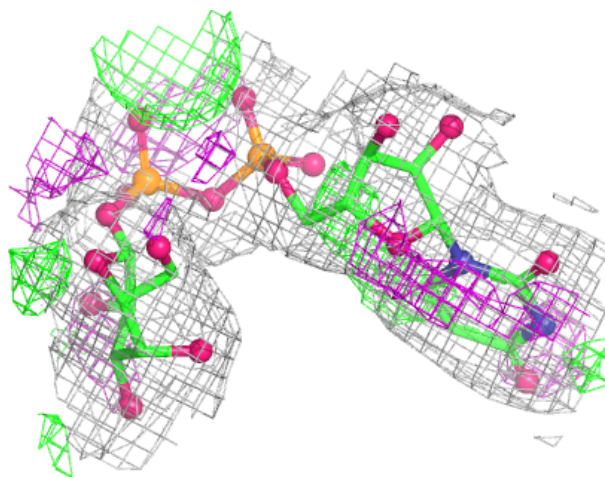
Electron density around CA B 709:

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



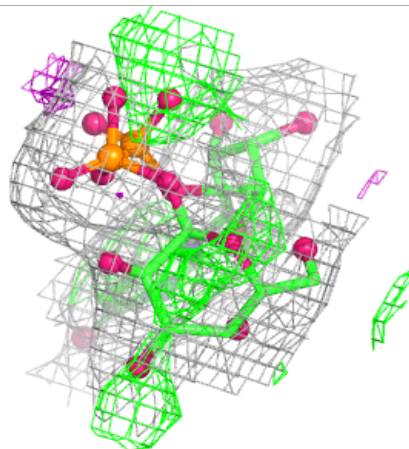
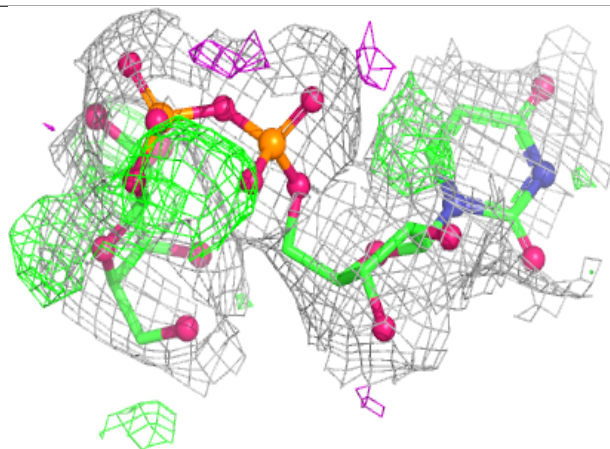
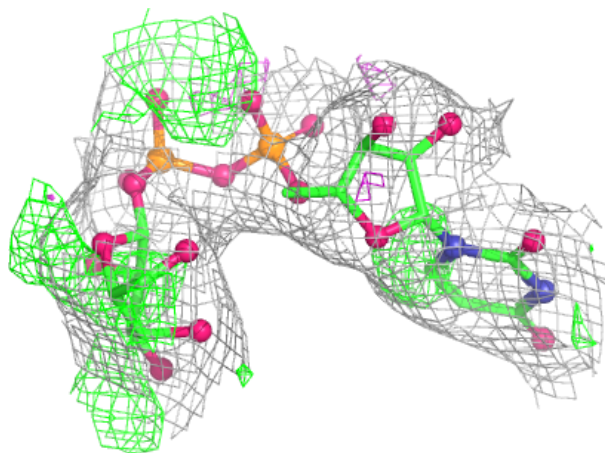
Electron density around GDU B 708:

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



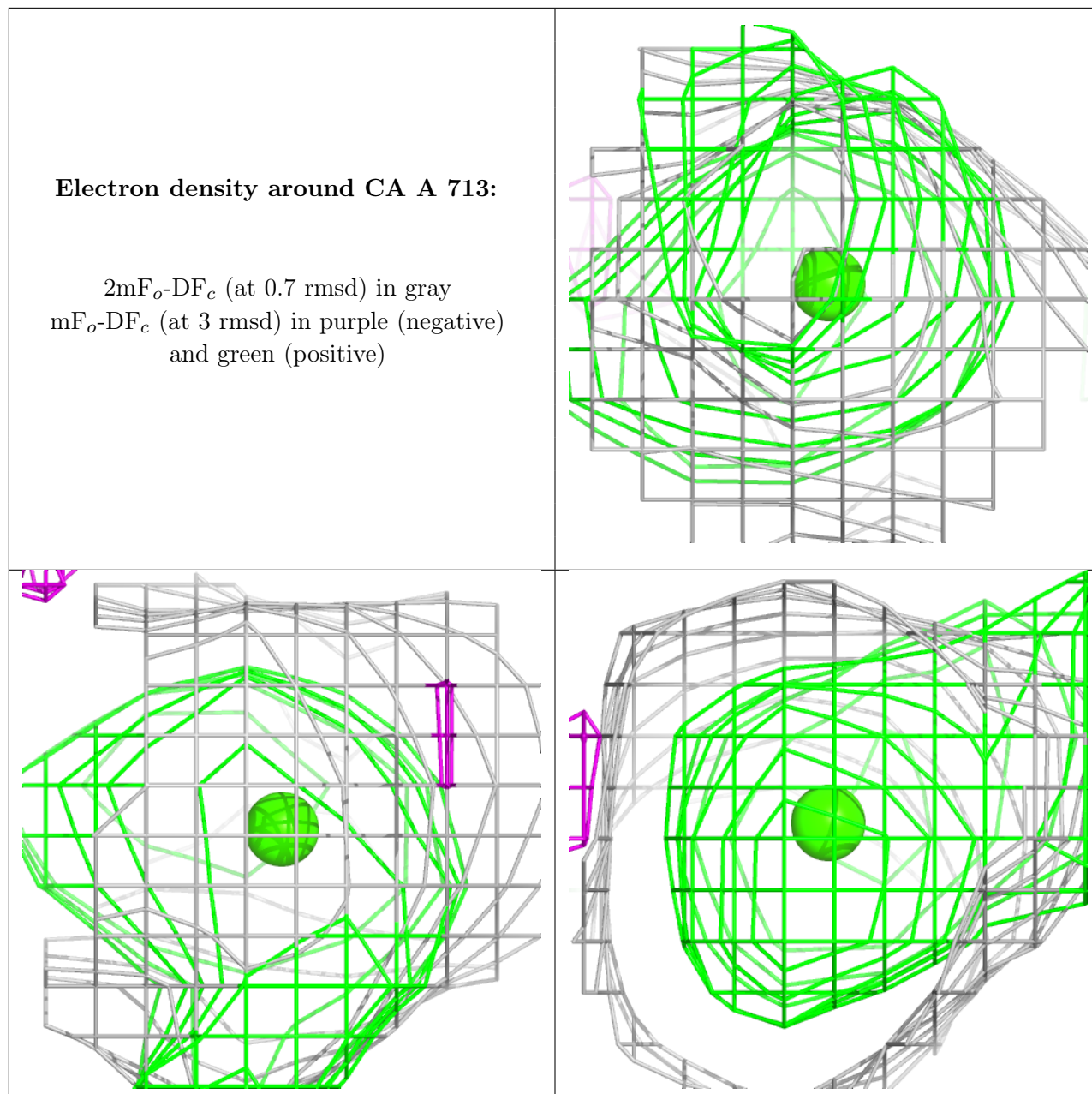
Electron density around GDU A 710:

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



Electron density around CA A 713:

$2mF_o-DF_c$ (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.