



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 23, 2022 – 06:43 PM JST

PDB ID : 7EXF
Title : Crystal structure of wild-type from Arabidopsis thaliana complexed with Galactose
Authors : Chuankhayan, P.; Guan, H.H.; Lin, C.C.; Chen, N.C.; Huang, Y.C.; Yoshimura, M.; Nakagawa, A.; Lee, R.H.; Chen, C.J.
Deposited on : 2021-05-27
Resolution : 2.17 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.31.3
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.3

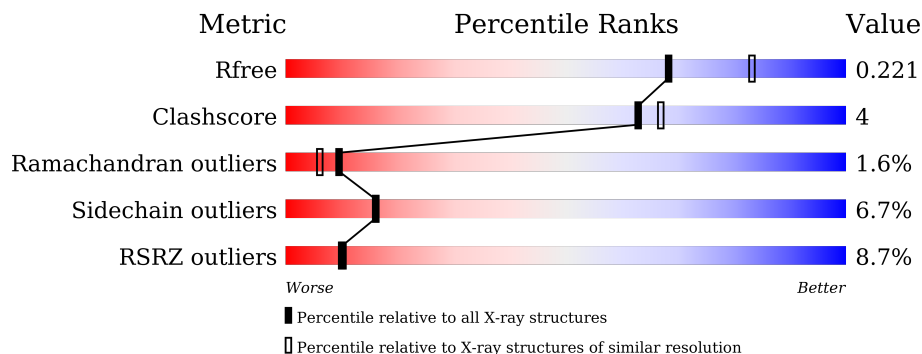
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

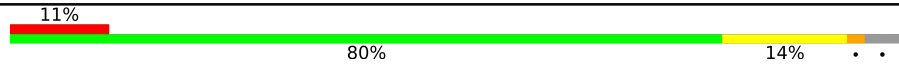

The reported resolution of this entry is 2.17 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	6864 (2.20-2.16)
Clashscore	141614	7689 (2.20-2.16)
Ramachandran outliers	138981	7564 (2.20-2.16)
Sidechain outliers	138945	7564 (2.20-2.16)
RSRZ outliers	127900	6738 (2.20-2.16)

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	749	 11% 80% 14% . .
1	B	749	 6% 81% 13% . .

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 11451 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.

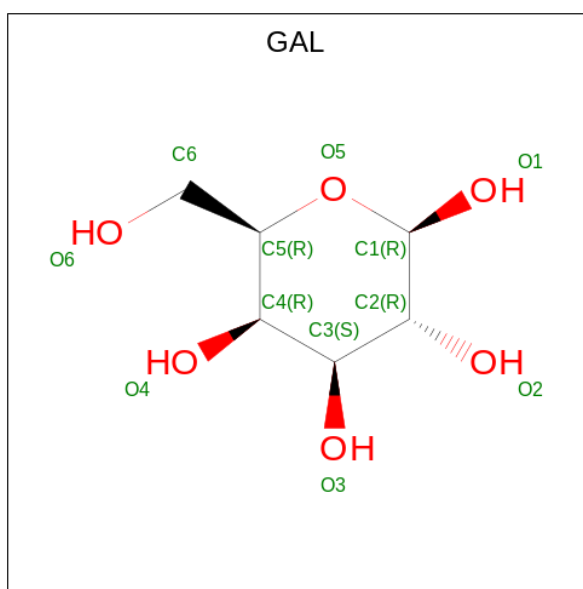
- Molecule 1 is a protein called Probable galactinol–sucrose galactosyltransferase 6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	719	Total 5633	C 3579	N 970	O 1055	S 29	0	0	0
1	A	717	Total 5618	C 3571	N 968	O 1050	S 29	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	302	ARG	LYS	conflict	UNP Q8RX87
A	302	ARG	LYS	conflict	UNP Q8RX87

- Molecule 2 is beta-D-galactopyranose (three-letter code: GAL) (formula: C₆H₁₂O₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	B	1	Total 12	C 6	O 6	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	12	6	6	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	B	136	136	136	0	0
3	A	40	40	40	0	0

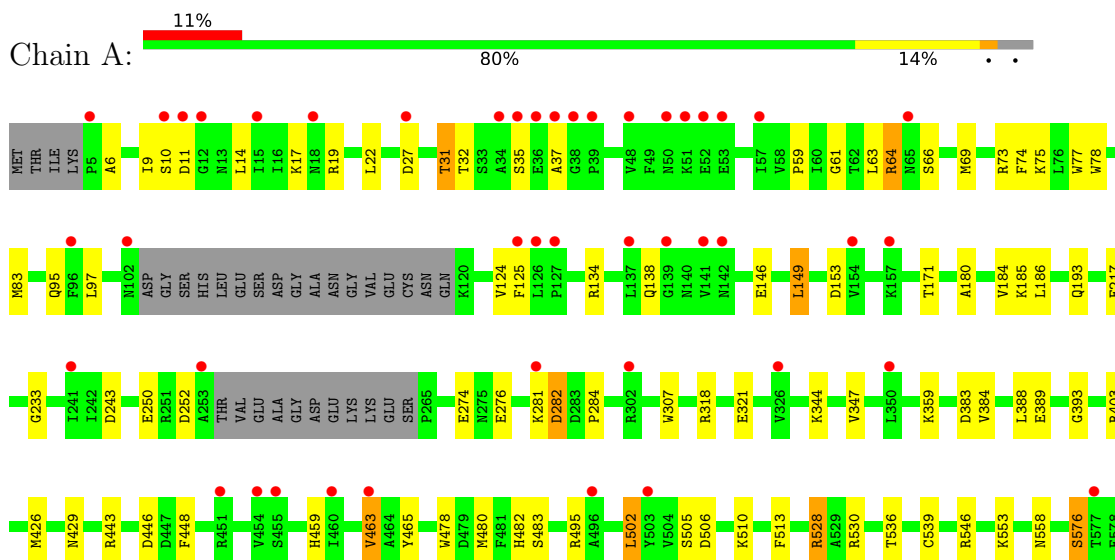
3 Residue-property plots [i](#)

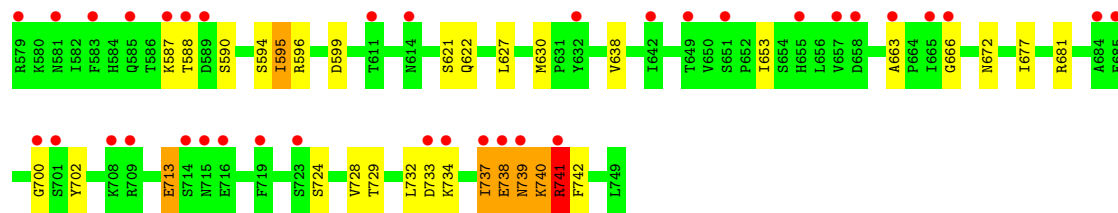
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Probable galactinol–sucrose galactosyltransferase 6



- Molecule 1: Probable galactinol–sucrose galactosyltransferase 6





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	94.94Å 103.64Å 181.21Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.17 29.00 – 2.17	Depositor EDS
% Data completeness (in resolution range)	99.6 (30.00-2.17) 99.6 (29.00-2.17)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.91 (at 2.18Å)	Xtrriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.208 , 0.267 0.223 , 0.221	Depositor DCC
R_{free} test set	4731 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	48.6	Xtrriage
Anisotropy	0.032	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 33.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	11451	wwPDB-VP
Average B, all atoms (Å ²)	60.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.95% 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: GAL

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	0.71	0/5752	0.88	13/7789 (0.2%)
1	B	0.84	2/5767 (0.0%)	0.96	15/7810 (0.2%)
All	All	0.78	2/11519 (0.0%)	0.92	28/15599 (0.2%)

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	1
1	B	0	1
All	All	0	2

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	165	LEU	C-N	-5.23	1.22	1.34
1	B	434	TYR	CE1-CZ	-5.10	1.31	1.38

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	B	530	ARG	NE-CZ-NH1	10.36	125.48	120.30
1	B	530	ARG	NE-CZ-NH2	-8.49	116.06	120.30
1	B	463	VAL	CG1-CB-CG2	7.37	122.69	110.90
1	B	124	VAL	CB-CA-C	-7.21	97.69	111.40
1	A	528	ARG	NE-CZ-NH1	6.93	123.77	120.30
1	B	643	ARG	NE-CZ-NH1	6.84	123.72	120.30
1	B	387	VAL	CB-CA-C	-6.81	98.46	111.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	528	ARG	NE-CZ-NH2	-6.67	116.97	120.30
1	B	451	ARG	NE-CZ-NH2	-6.65	116.97	120.30
1	B	194	ARG	NE-CZ-NH1	6.53	123.57	120.30
1	B	67	ARG	NE-CZ-NH1	5.92	123.26	120.30
1	A	530	ARG	NE-CZ-NH1	5.88	123.24	120.30
1	B	410	ASP	CB-CG-OD1	5.86	123.58	118.30
1	A	318	ARG	NE-CZ-NH1	5.74	123.17	120.30
1	A	446	ASP	CB-CG-OD1	5.64	123.38	118.30
1	A	124	VAL	CB-CA-C	-5.59	100.78	111.40
1	B	403	ARG	NE-CZ-NH1	5.50	123.05	120.30
1	A	149	LEU	CA-CB-CG	5.49	127.93	115.30
1	A	443	ARG	NE-CZ-NH1	5.46	123.03	120.30
1	B	204	ASP	CB-CG-OD1	5.44	123.20	118.30
1	A	403	ARG	NE-CZ-NH1	5.42	123.01	120.30
1	B	528	ARG	NE-CZ-NH1	5.07	122.83	120.30
1	A	741	ARG	NE-CZ-NH1	5.04	122.82	120.30
1	B	741	ARG	N-CA-C	5.04	124.60	111.00
1	B	194	ARG	NE-CZ-NH2	-5.03	117.79	120.30
1	A	681	ARG	NE-CZ-NH1	5.02	122.81	120.30
1	A	546	ARG	NE-CZ-NH1	5.00	122.80	120.30
1	A	318	ARG	NE-CZ-NH2	-5.00	117.80	120.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	11	ASP	Peptide
1	B	394	GLY	Peptide

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	5618	0	5537	48	0
1	B	5633	0	5547	51	0
2	A	12	0	12	1	0
2	B	12	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	40	0	0	0	0
3	B	136	0	0	2	0
All	All	11451	0	11108	97	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 4.

All (97) 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:A:739:ASN:C	1:A:741:ARG:H	1.82	0.82
1:A:558:ASN:HD21	1:A:672:ASN:HD21	1.29	0.80
1:A:95:GLN:HE21	1:A:134:ARG:HH21	1.31	0.77
1:B:558:ASN:HD21	1:B:672:ASN:HD21	1.34	0.75
1:A:738:GLU:C	1:A:740:LYS:H	1.87	0.74
1:A:738:GLU:C	1:A:740:LYS:N	2.37	0.74
1:B:738:GLU:O	1:B:740:LYS:N	2.24	0.71
1:A:740:LYS:O	1:A:742:PHE:N	2.24	0.70
1:B:95:GLN:HE21	1:B:134:ARG:HH21	1.41	0.68
1:A:738:GLU:O	1:A:740:LYS:N	2.27	0.67
1:A:739:ASN:C	1:A:741:ARG:N	2.47	0.67
1:B:738:GLU:C	1:B:740:LYS:H	1.98	0.67
1:B:95:GLN:HE22	1:B:429:ASN:HA	1.59	0.66
1:B:7:VAL:HG13	1:B:16:ILE:CD1	2.27	0.65
1:A:737:ILE:O	1:A:738:GLU:HB2	1.98	0.62
1:A:495:ARG:HB3	1:A:502:LEU:HD22	1.83	0.61
1:A:95:GLN:HE22	1:A:429:ASN:HA	1.68	0.58
1:B:489:GLU:OE1	1:B:671:TYR:OH	2.21	0.57
1:B:135:SER:OG	1:B:149:LEU:HD13	2.06	0.56
1:B:456:HIS:HE1	3:B:936:HOH:O	1.88	0.56
1:A:738:GLU:O	1:A:739:ASN:C	2.46	0.53
1:A:22:LEU:HB3	1:A:61:GLY:HA3	1.91	0.52
1:A:653:ILE:HA	1:A:663:ALA:HB2	1.90	0.52
1:B:491:HIS:HD1	1:B:495:ARG:HH12	1.59	0.51
1:B:463:VAL:HG13	1:B:478:TRP:CE2	2.46	0.51
1:A:383:ASP:HB3	1:A:384:VAL:HG23	1.94	0.50
1:B:83:MET:SD	1:B:83:MET:N	2.85	0.50
1:B:699:PHE:HB2	1:B:732:LEU:HD22	1.93	0.50
1:A:463:VAL:HG13	1:A:478:TRP:CE2	2.47	0.50
1:A:627:LEU:HD21	1:A:702:TYR:HB2	1.94	0.50
1:B:384:VAL:O	1:B:387:VAL:HG22	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:666:GLY:CA	1:A:677:ILE:HD11	2.42	0.49
1:B:664:PRO:HB2	1:B:677:ILE:HD13	1.94	0.49
1:A:558:ASN:ND2	1:A:672:ASN:HD21	2.05	0.49
1:B:208:TRP:CH2	1:B:226:GLY:HA3	2.48	0.49
1:B:192:ARG:O	1:B:197:LYS:HE3	2.13	0.49
1:B:238:LYS:HD2	1:B:302:ARG:HH21	1.77	0.48
1:B:463:VAL:HG13	1:B:478:TRP:CD2	2.49	0.48
1:B:482:HIS:HD2	3:B:999:HOH:O	1.97	0.47
1:A:95:GLN:HE21	1:A:134:ARG:NH2	2.06	0.47
1:B:738:GLU:O	1:B:738:GLU:HG2	2.15	0.47
1:A:483:SER:OG	1:A:506:ASP:OD2	2.30	0.47
1:A:153:ASP:OD1	1:A:393:GLY:O	2.33	0.47
1:B:58:VAL:HG22	1:B:59:PRO:O	2.14	0.47
1:B:92:TYR:CE2	1:B:338:GLU:HG2	2.50	0.47
1:B:492:ALA:HB1	1:B:519:LEU:HD11	1.96	0.46
1:B:166:TYR:CE2	1:B:168:HIS:HB2	2.50	0.46
1:B:185:LYS:NZ	1:B:193:GLN:HE21	2.14	0.46
1:B:194:ARG:HD3	1:B:471:GLY:O	2.16	0.46
1:B:678:GLU:HG3	1:B:742:PHE:CE1	2.52	0.45
1:B:124:VAL:CG2	1:B:176:THR:HG22	2.47	0.45
1:A:9:ILE:HD12	1:A:31:THR:HG21	1.99	0.45
1:B:739:ASN:HD22	1:A:741:ARG:NH1	2.13	0.45
1:B:307:TRP:CE3	1:B:308:HIS:HA	2.52	0.45
1:B:63:LEU:CD1	1:B:66:SER:HB2	2.47	0.45
1:B:738:GLU:C	1:B:740:LYS:N	2.65	0.45
1:A:243:ASP:HA	1:A:307:TRP:HB2	1.99	0.45
1:B:739:ASN:HD22	1:A:741:ARG:HH12	1.64	0.45
1:A:63:LEU:HD11	1:A:66:SER:HB2	1.98	0.45
1:A:77:TRP:HB2	1:A:78:TRP:CD1	2.51	0.45
1:B:153:ASP:OD1	1:B:393:GLY:O	2.36	0.44
1:B:693:VAL:HG21	1:B:745:ILE:HD12	1.98	0.44
1:A:465:TYR:OH	1:A:539:CYS:O	2.34	0.43
1:A:97:LEU:HB3	1:A:125:PHE:HB2	2.00	0.43
1:A:276:GLU:H	1:A:276:GLU:CD	2.21	0.43
1:A:63:LEU:HD12	1:A:64:ARG:N	2.34	0.43
1:A:138:GLN:O	1:A:146:GLU:HB2	2.18	0.43
1:B:238:LYS:HD2	1:B:302:ARG:NH2	2.33	0.43
1:A:536:THR:HG21	1:A:599:ASP:HB3	2.00	0.43
1:A:426:MET:SD	2:A:801:GAL:O1	2.77	0.43
1:A:480:MET:SD	1:A:505:SER:HB3	2.59	0.43
1:B:263:GLU:O	1:B:264:SER:C	2.58	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:317:VAL:O	1:B:354:GLY:HA3	2.19	0.42
1:B:495:ARG:HB3	1:B:502:LEU:CD2	2.50	0.42
1:A:73:ARG:NH1	1:A:389:GLU:OE1	2.47	0.42
1:B:739:ASN:O	1:B:741:ARG:N	2.52	0.42
1:A:553:LYS:HD3	1:A:595:ILE:HD12	2.02	0.42
1:A:463:VAL:HG13	1:A:478:TRP:CD2	2.55	0.42
1:B:276:GLU:CD	1:B:276:GLU:H	2.23	0.41
1:B:243:ASP:HA	1:B:307:TRP:HB2	2.02	0.41
1:A:233:GLY:HA3	1:A:513:PHE:CE1	2.56	0.41
1:A:740:LYS:HA	1:A:740:LYS:HD3	1.56	0.41
1:B:266:ILE:HD12	1:B:347:VAL:HG12	2.02	0.41
1:A:700:GLY:HA2	1:A:728:VAL:O	2.21	0.41
1:B:626:GLU:OE1	1:B:628:ILE:HD11	2.21	0.41
1:B:738:GLU:O	1:B:738:GLU:CG	2.69	0.41
1:B:442:ILE:O	1:B:442:ILE:HG23	2.21	0.41
1:A:9:ILE:HD12	1:A:31:THR:CG2	2.51	0.41
1:A:59:PRO:HA	1:A:146:GLU:HA	2.03	0.41
1:A:185:LYS:NZ	1:A:193:GLN:HE21	2.18	0.41
1:B:311:THR:O	1:B:316:GLY:HA2	2.21	0.40
1:B:741:ARG:CZ	1:B:741:ARG:HB2	2.51	0.40
1:A:74:PHE:CD1	1:A:75:LYS:HG3	2.57	0.40
1:A:459:HIS:O	1:A:463:VAL:HB	2.21	0.40
1:A:180:ALA:O	1:A:184:VAL:HG23	2.20	0.40
1:B:566:VAL:O	1:B:645:HIS:HA	2.20	0.40
1:B:130:GLU:OE1	1:B:161:PHE:HB3	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	711/749 (95%)	659 (93%)	40 (6%)	12 (2%)	9 5

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	B	713/749 (95%)	670 (94%)	32 (4%)	11 (2%)	10 7
All	All	1424/1498 (95%)	1329 (93%)	72 (5%)	23 (2%)	9 6

All (23) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	538	ASP
1	A	738	GLU
1	A	739	ASN
1	A	741	ARG
1	B	38	GLY
1	B	39	PRO
1	B	282	ASP
1	B	739	ASN
1	B	741	ARG
1	A	6	ALA
1	A	282	ASP
1	A	713	GLU
1	A	17	LYS
1	A	37	ALA
1	A	576	SER
1	B	264	SER
1	B	420	ASN
1	B	6	ALA
1	B	36	GLU
1	A	284	PRO
1	A	724	SER
1	B	393	GLY
1	A	347	VAL

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	615/641 (96%)	567 (92%)	48 (8%)	12 11

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	617/641 (96%)	583 (94%)	34 (6%)	21	23
All	All	1232/1282 (96%)	1150 (93%)	82 (7%)	16	16

All (82) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	36	GLU
1	B	43	VAL
1	B	48	VAL
1	B	52	GLU
1	B	56	HIS
1	B	57	ILE
1	B	69	MET
1	B	83	MET
1	B	124	VAL
1	B	149	LEU
1	B	186	LEU
1	B	243	ASP
1	B	264	SER
1	B	280	LYS
1	B	301	LEU
1	B	330	PRO
1	B	357	SER
1	B	359	LYS
1	B	387	VAL
1	B	388	LEU
1	B	460	ILE
1	B	463	VAL
1	B	538	ASP
1	B	587	LYS
1	B	588	THR
1	B	622	GLN
1	B	633	ASN
1	B	729	THR
1	B	732	LEU
1	B	733	ASP
1	B	737	ILE
1	B	738	GLU
1	B	739	ASN
1	B	741	ARG
1	A	10	SER
1	A	14	LEU

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Mol	Chain	Res	Type
1	A	19	ARG
1	A	27	ASP
1	A	31	THR
1	A	32	THR
1	A	35	SER
1	A	64	ARG
1	A	69	MET
1	A	83	MET
1	A	149	LEU
1	A	171	THR
1	A	186	LEU
1	A	217	GLU
1	A	250	GLU
1	A	252	ASP
1	A	274	GLU
1	A	281	LYS
1	A	282	ASP
1	A	321	GLU
1	A	344	LYS
1	A	359	LYS
1	A	388	LEU
1	A	448	PHE
1	A	463	VAL
1	A	482	HIS
1	A	502	LEU
1	A	510	LYS
1	A	528	ARG
1	A	576	SER
1	A	587	LYS
1	A	588	THR
1	A	590	SER
1	A	594	SER
1	A	595	ILE
1	A	596	ARG
1	A	621	SER
1	A	622	GLN
1	A	630	MET
1	A	638	VAL
1	A	713	GLU
1	A	729	THR
1	A	732	LEU
1	A	733	ASP

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Mol	Chain	Res	Type
1	A	734	LYS
1	A	737	ILE
1	A	740	LYS
1	A	741	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	95	GLN
1	B	175	GLN
1	B	193	GLN
1	B	385	GLN
1	B	406	HIS
1	B	456	HIS
1	B	482	HIS
1	B	558	ASN
1	B	622	GLN
1	B	633	ASN
1	B	739	ASN
1	A	95	GLN
1	A	175	GLN
1	A	193	GLN
1	A	385	GLN
1	A	456	HIS
1	A	558	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	GAL	B	801	-	12,12,12	0.82	0	17,17,17	1.48	3 (17%)
2	GAL	A	801	-	12,12,12	0.81	1 (8%)	17,17,17	1.21	3 (17%)

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	GAL	B	801	-	-	0/2/22/22	0/1/1/1
2	GAL	A	801	-	-	0/2/22/22	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	GAL	O1-C1	2.07	1.46	1.39

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	801	GAL	O5-C1-C2	-3.46	104.12	110.28
2	B	801	GAL	C4-C3-C2	-2.41	106.62	110.82
2	B	801	GAL	O3-C3-C4	2.41	115.92	110.35
2	A	801	GAL	O3-C3-C4	2.31	115.69	110.35
2	A	801	GAL	C1-O5-C5	2.28	117.96	113.66
2	A	801	GAL	C3-C4-C5	-2.08	106.54	110.24

There are no chirality outliers.

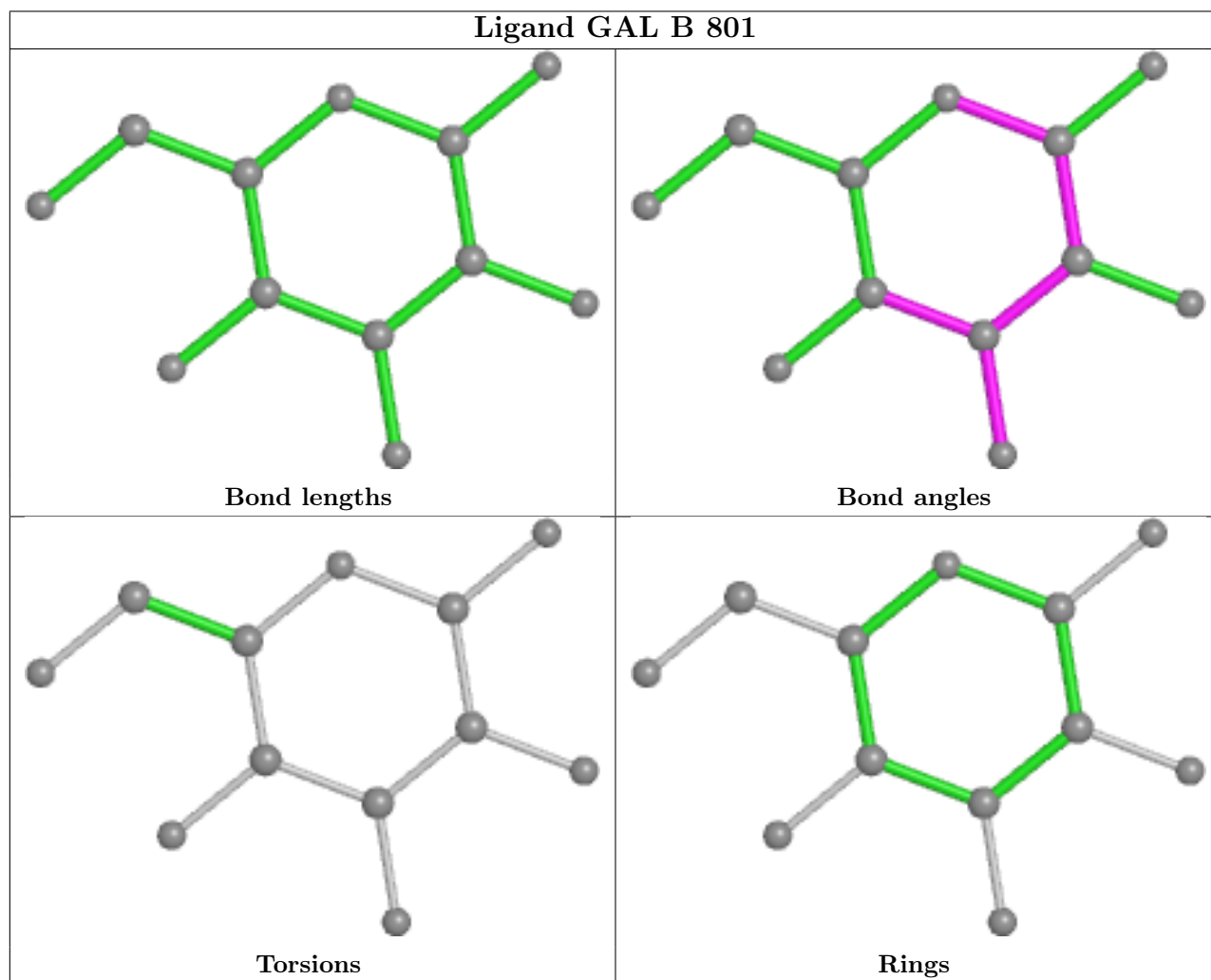
There are no torsion outliers.

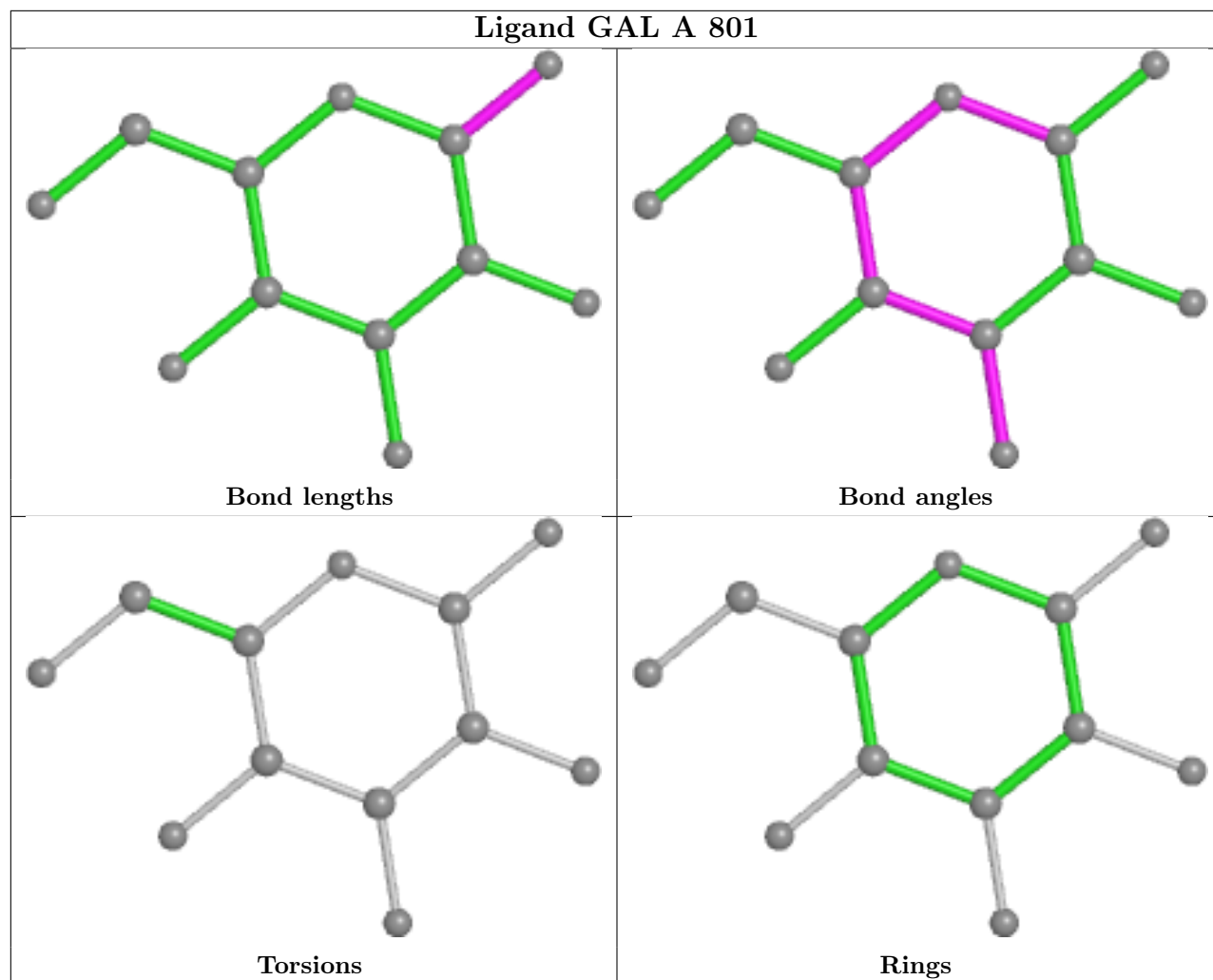
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	801	GAL	1	0

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





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

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	717/749 (95%)	0.61	81 (11%) 5 5	30, 67, 108, 136	0
1	B	719/749 (95%)	0.22	44 (6%) 21 22	30, 46, 82, 132	0
All	All	1436/1498 (95%)	0.41	125 (8%) 10 10	30, 57, 101, 136	0

All (125) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	739	ASN	9.5
1	A	737	ILE	9.4
1	A	37	ALA	6.8
1	B	737	ILE	6.6
1	B	739	ASN	6.4
1	B	39	PRO	6.3
1	B	37	ALA	6.2
1	B	738	GLU	5.8
1	A	18	ASN	5.3
1	A	658	ASP	5.0
1	A	39	PRO	5.0
1	A	36	GLU	4.8
1	A	154	VAL	4.8
1	A	27	ASP	4.8
1	B	380	VAL	4.5
1	A	35	SER	4.4
1	B	141	VAL	4.4
1	B	36	GLU	4.4
1	A	657	VAL	4.3
1	A	102	ASN	4.3
1	A	34	ALA	4.3
1	A	700	GLY	4.2
1	A	253	ALA	4.1
1	A	577	THR	3.9

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Mol	Chain	Res	Type	RSRZ
1	A	589	ASP	3.9
1	B	49	PHE	3.8
1	B	264	SER	3.8
1	A	48	VAL	3.8
1	B	263	GLU	3.7
1	A	11	ASP	3.6
1	A	741	ARG	3.6
1	A	141	VAL	3.6
1	A	10	SER	3.5
1	A	663	ALA	3.5
1	B	382	VAL	3.4
1	A	734	LYS	3.4
1	A	350	LEU	3.3
1	A	614	ASN	3.3
1	A	96	PHE	3.3
1	A	503	TYR	3.2
1	B	137	LEU	3.2
1	A	583	PHE	3.2
1	B	35	SER	3.2
1	B	34	ALA	3.2
1	A	665	ILE	3.1
1	B	127	PRO	3.1
1	B	125	PHE	3.1
1	A	716	GLU	3.1
1	A	496	ALA	3.1
1	B	587	LYS	3.0
1	A	738	GLU	3.0
1	A	579	ARG	3.0
1	A	139	GLY	3.0
1	A	611	THR	2.9
1	B	136	CYS	2.9
1	A	50	ASN	2.9
1	A	701	SER	2.9
1	A	666	GLY	2.9
1	B	241	ILE	2.9
1	A	649	THR	2.9
1	B	302	ARG	2.8
1	A	38	GLY	2.8
1	A	281	LYS	2.8
1	A	12	GLY	2.8
1	B	155	ASP	2.8
1	A	65	ASN	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	741	ARG	2.7
1	A	51	LYS	2.7
1	A	587	LYS	2.7
1	A	655	HIS	2.7
1	A	632	TYR	2.7
1	B	51	LYS	2.6
1	A	53	GLU	2.6
1	A	127	PRO	2.6
1	A	719	PHE	2.6
1	B	281	LYS	2.6
1	A	126	LEU	2.6
1	A	15	ILE	2.6
1	A	708	LYS	2.5
1	A	454	VAL	2.5
1	A	142	ASN	2.5
1	A	463	VAL	2.5
1	B	306	VAL	2.5
1	A	157	LYS	2.4
1	A	57	ILE	2.4
1	A	733	ASP	2.4
1	B	310	ILE	2.4
1	B	588	THR	2.4
1	B	563	VAL	2.4
1	B	48	VAL	2.3
1	B	154	VAL	2.3
1	B	554	ILE	2.3
1	A	715	ASN	2.3
1	A	714	SER	2.3
1	A	642	ILE	2.3
1	A	651	SER	2.3
1	A	125	PHE	2.3
1	B	633	ASN	2.3
1	B	665	ILE	2.3
1	B	126	LEU	2.3
1	A	302	ARG	2.3
1	B	97	LEU	2.2
1	A	684	ALA	2.2
1	A	326	VAL	2.2
1	B	284	PRO	2.2
1	A	451	ARG	2.2
1	A	685	GLU	2.2
1	A	241	ILE	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	581	ASN	2.1
1	B	242	ILE	2.1
1	A	455	SER	2.1
1	A	585	GLN	2.1
1	B	394	GLY	2.1
1	A	5	PRO	2.1
1	B	165	LEU	2.0
1	B	585	GLN	2.0
1	B	282	ASP	2.0
1	A	137	LEU	2.0
1	B	308	HIS	2.0
1	A	52	GLU	2.0
1	A	709	ARG	2.0
1	A	723	SER	2.0
1	B	307	TRP	2.0
1	A	460	ILE	2.0
1	A	588	THR	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

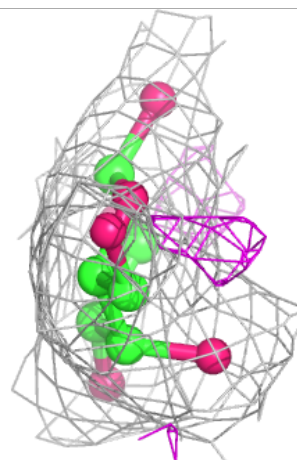
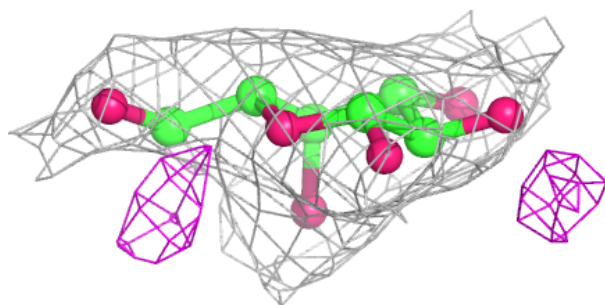
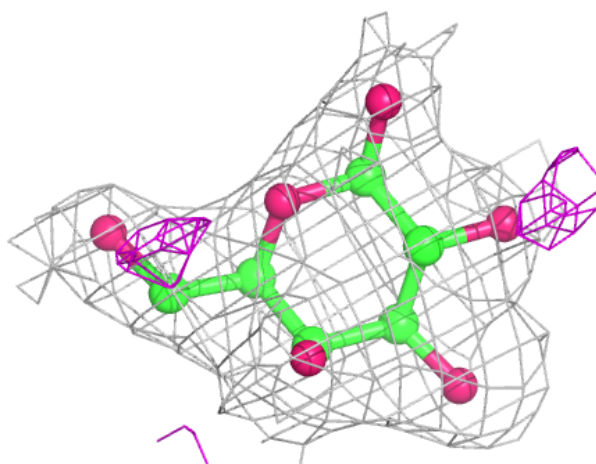
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

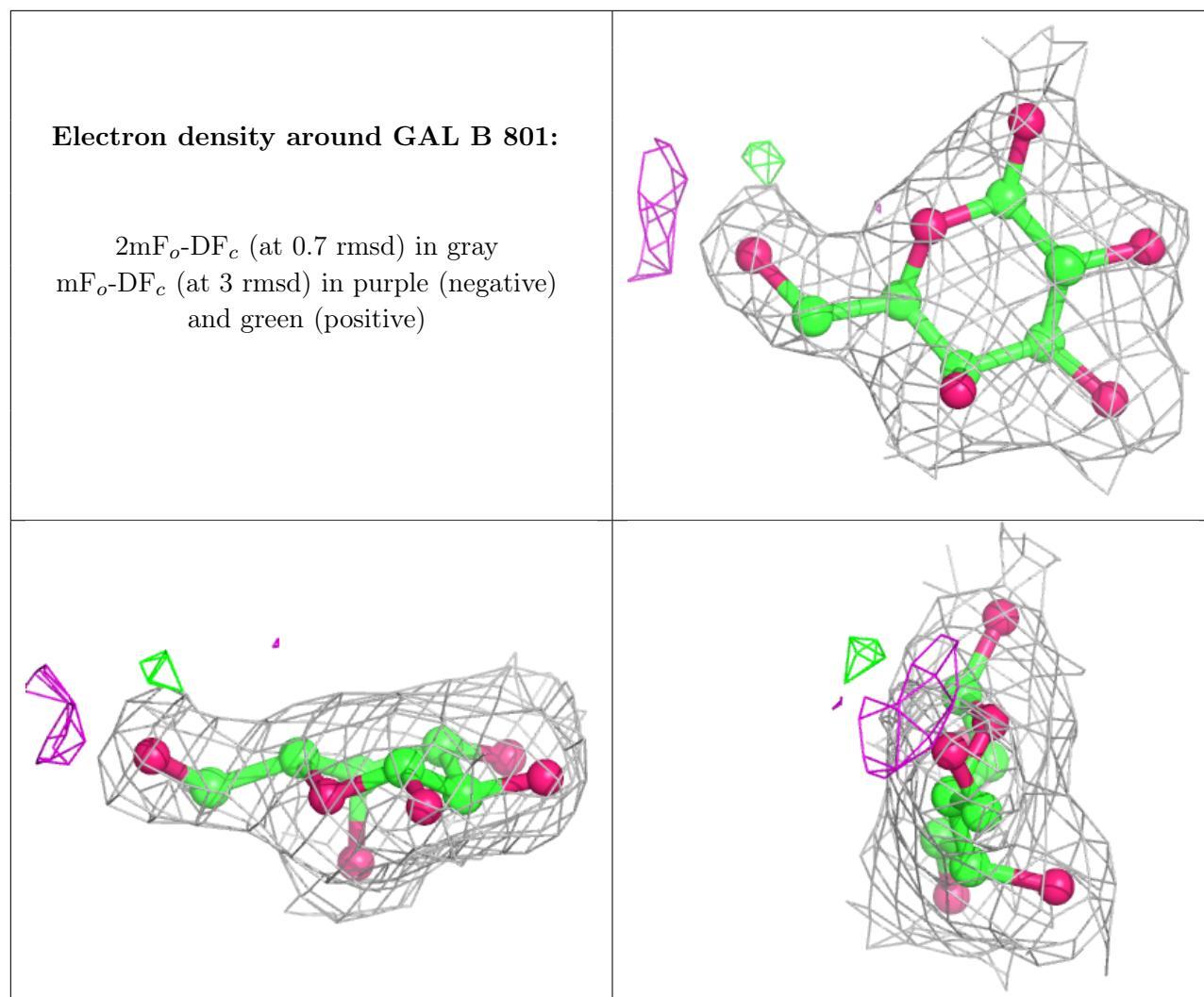
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	GAL	A	801	12/12	0.88	0.13	52,60,64,64	0
2	GAL	B	801	12/12	0.96	0.13	36,46,52,55	0

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 GAL A 801:

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





6.5 Other polymers [i](#)

There are no such residues in this entry.