



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 18, 2026 – 11:03 PM UTC

PDB ID : 4ZH1 / pdb_00004zh1
Title : Complement factor H in complex with the GM1 glycan
Authors : Blaum, B.S.; Stehle, T.
Deposited on : 2015-04-24
Resolution : 2.24 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
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

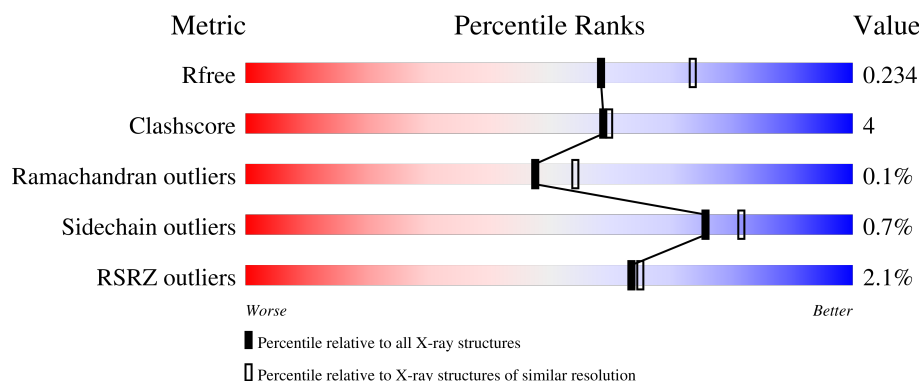
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.24 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	3416 (2.26-2.22)
Clashscore	190562	3556 (2.26-2.22)
Ramachandran outliers	187476	3500 (2.26-2.22)
Sidechain outliers	187428	3501 (2.26-2.22)
RSRZ outliers	180081	3415 (2.26-2.22)

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	317	
1	B	317	
1	C	317	
2	D	129	
2	E	129	

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Mol	Chain	Length	Quality of chain
2	F	129	8% 69% 11% 19%
3	G	2	100%
4	H	5	20% 80%
5	I	4	25% 50% 25%

2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 10322 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 Complement C3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	293	Total	C	N	O	S	0	1	0
			2311	1484	391	427	9			
1	B	292	Total	C	N	O	S	0	1	0
			2295	1473	381	432	9			
1	C	291	Total	C	N	O	S	0	3	0
			2280	1471	378	422	9			

There are 30 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-6	GLY	-	expression tag	UNP P01024
A	-5	PRO	-	expression tag	UNP P01024
A	-4	LEU	-	expression tag	UNP P01024
A	-3	GLY	-	expression tag	UNP P01024
A	-2	SER	-	expression tag	UNP P01024
A	-1	PRO	-	expression tag	UNP P01024
A	0	GLU	-	expression tag	UNP P01024
A	1	PHE	-	expression tag	UNP P01024
A	2	ARG	-	expression tag	UNP P01024
A	17	ALA	CYS	conflict	UNP P01024
B	-6	GLY	-	expression tag	UNP P01024
B	-5	PRO	-	expression tag	UNP P01024
B	-4	LEU	-	expression tag	UNP P01024
B	-3	GLY	-	expression tag	UNP P01024
B	-2	SER	-	expression tag	UNP P01024
B	-1	PRO	-	expression tag	UNP P01024
B	0	GLU	-	expression tag	UNP P01024
B	1	PHE	-	expression tag	UNP P01024
B	2	ARG	-	expression tag	UNP P01024
B	17	ALA	CYS	conflict	UNP P01024
C	-6	GLY	-	expression tag	UNP P01024
C	-5	PRO	-	expression tag	UNP P01024
C	-4	LEU	-	expression tag	UNP P01024

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-3	GLY	-	expression tag	UNP P01024
C	-2	SER	-	expression tag	UNP P01024
C	-1	PRO	-	expression tag	UNP P01024
C	0	GLU	-	expression tag	UNP P01024
C	1	PHE	-	expression tag	UNP P01024
C	2	ARG	-	expression tag	UNP P01024
C	17	ALA	CYS	conflict	UNP P01024

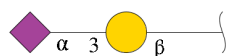
- Molecule 2 is a protein called Complement factor H.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	126	Total	C	N	O	S	0	2	0
			1011	637	176	189	9			
2	E	122	Total	C	N	O	S	0	2	0
			989	620	176	184	9			
2	F	104	Total	C	N	O	S	0	1	0
			807	512	135	153	7			

There are 12 discrepancies between the modelled and reference sequences:

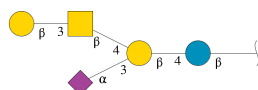
Chain	Residue	Modelled	Actual	Comment	Reference
D	1103	GLU	-	expression tag	UNP P08603
D	1104	ALA	-	expression tag	UNP P08603
D	1105	GLU	-	expression tag	UNP P08603
D	1106	PHE	-	expression tag	UNP P08603
E	1103	GLU	-	expression tag	UNP P08603
E	1104	ALA	-	expression tag	UNP P08603
E	1105	GLU	-	expression tag	UNP P08603
E	1106	PHE	-	expression tag	UNP P08603
F	1103	GLU	-	expression tag	UNP P08603
F	1104	ALA	-	expression tag	UNP P08603
F	1105	GLU	-	expression tag	UNP P08603
F	1106	PHE	-	expression tag	UNP P08603

- Molecule 3 is an oligosaccharide called N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose.



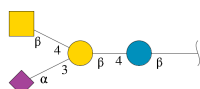
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	G	2	Total	C	N	O	0	0	0
			32	17	1	14			

- Molecule 4 is an oligosaccharide called beta-D-galactopyranose-(1-3)-2-acetamido-2-deoxy-beta-D-galactopyranose-(1-4)-[N-acetyl-alpha-neuraminic acid-(2-3)]beta-D-galactopyranose-(1-4)-beta-D-glucopyranose.



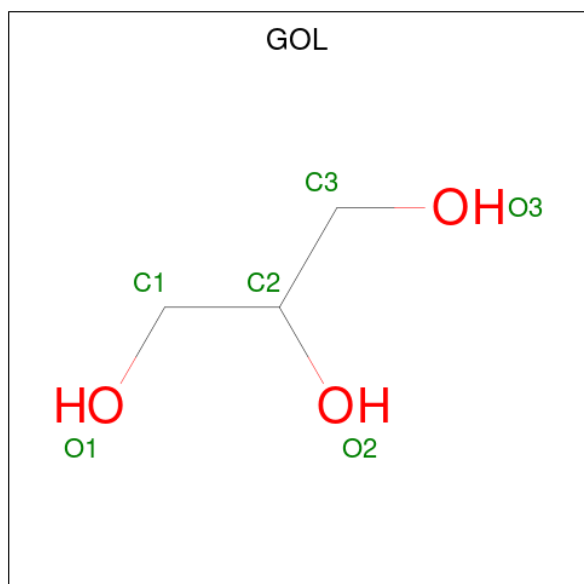
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	H	5	Total	C	N	O	0	0	0
			68	37	2	29			

- Molecule 5 is an oligosaccharide called N-acetyl-alpha-neuraminic acid-(2-3)-[2-acetamido-2-deoxy-beta-D-galactopyranose-(1-4)]beta-D-galactopyranose-(1-4)-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
5	I	4	Total	C	N	O	0	0	0
			57	31	2	24			

- Molecule 6 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



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

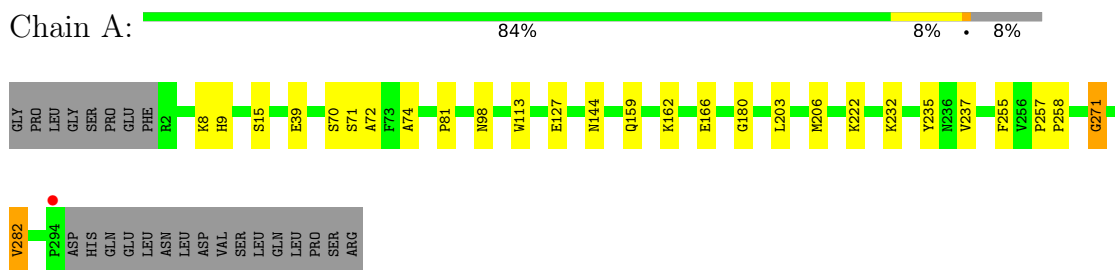
- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	143	Total O 143 143	0	0
7	B	101	Total O 101 101	0	0
7	C	73	Total O 73 73	0	0
7	D	75	Total O 75 75	0	0
7	E	50	Total O 50 50	0	0
7	F	6	Total O 6 6	0	0

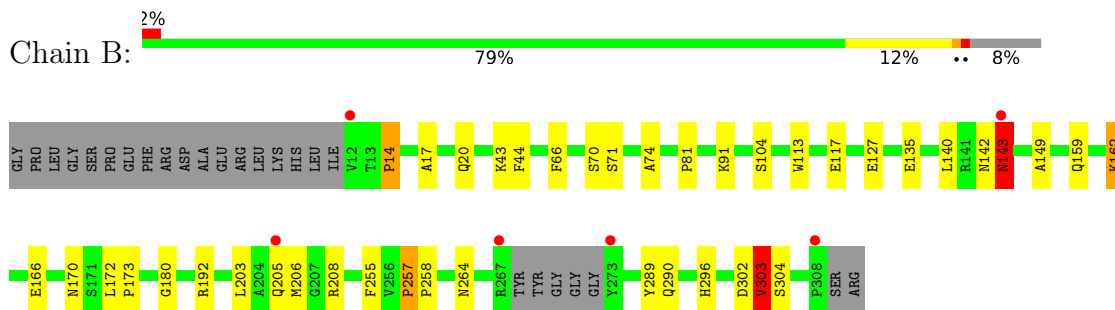
3 Residue-property plots

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

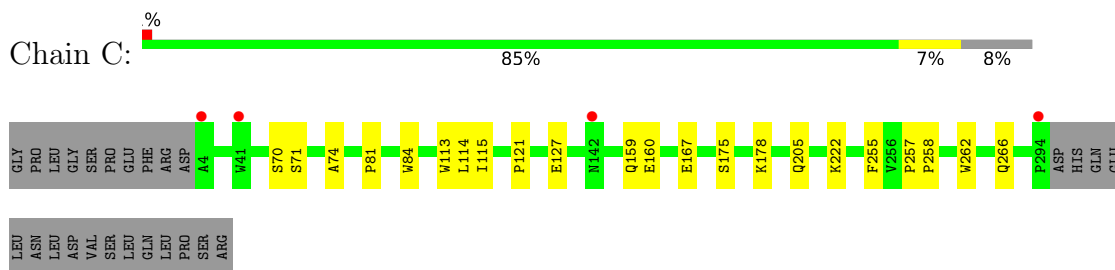
• Molecule 1: Complement C3



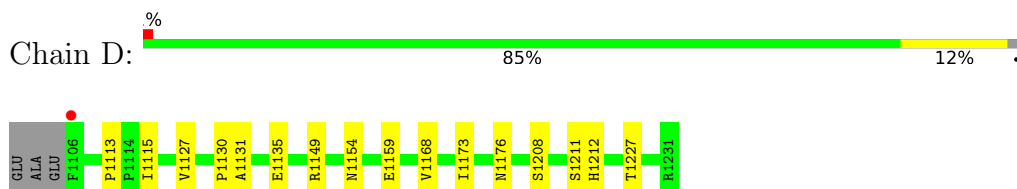
• Molecule 1: Complement C3



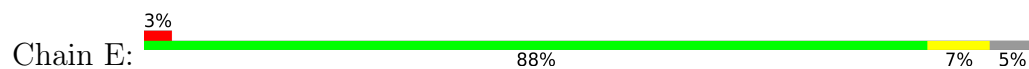
• Molecule 1: Complement C3



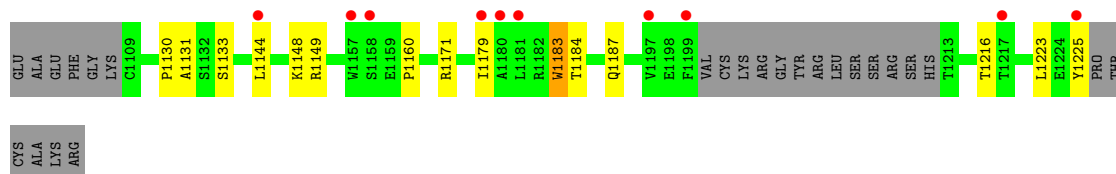
• Molecule 2: Complement factor H



- Molecule 2: Complement factor H



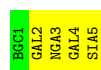
- Molecule 2: Complement factor H



- Molecule 3: N-acetyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose



- Molecule 4: beta-D-galactopyranose-(1-3)-2-acetamido-2-deoxy-beta-D-galactopyranose-(1-4)-[N-acetyl-alpha-neuraminic acid-(2-3)]beta-D-galactopyranose-(1-4)-beta-D-glucopyranose



- Molecule 5: N-acetyl-alpha-neuraminic acid-(2-3)-[2-acetamido-2-deoxy-beta-D-galactopyranose-(1-4)]beta-D-galactopyranose-(1-4)-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	75.77Å 82.86Å 86.57Å 112.97° 111.43° 99.63°	Depositor
Resolution (Å)	46.18 – 2.24 46.18 – 2.24	Depositor EDS
% Data completeness (in resolution range)	98.0 (46.18-2.24) 98.0 (46.18-2.24)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.11 (at 2.24Å)	Xtriage
Refinement program	REFMAC 5.8.0049	Depositor
R, R_{free}	0.181 , 0.228 0.190 , 0.234	Depositor DCC
R_{free} test set	3965 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	42.7	Xtriage
Anisotropy	0.486	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 46.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.009 for -h,-k,h+k+l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	10322	wwPDB-VP
Average B, all atoms (Å ²)	69.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.19% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, GAL, SIA, BGC, NGA

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	0.84	0/2360	0.89	5/3198 (0.2%)
1	B	0.82	0/2342	0.90	8/3179 (0.3%)
1	C	0.72	0/2329	0.84	2/3164 (0.1%)
2	D	0.86	1/1038 (0.1%)	0.85	0/1408
2	E	0.77	0/1015	0.88	3/1376 (0.2%)
2	F	0.69	0/829	0.87	2/1132 (0.2%)
All	All	0.79	1/9913 (0.0%)	0.88	20/13457 (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
2	F	0	1
All	All	0	2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	1113	PRO	CA-C	5.07	1.55	1.52

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	143	ASN	N-CA-C	7.35	120.71	108.73
2	E	1148	LYS	CB-CA-C	-7.17	97.37	110.63
2	E	1111	PRO	O-C-N	5.99	123.97	121.15
1	B	142	ASN	CA-C-N	-5.92	114.90	122.77

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	142	ASN	C-N-CA	-5.92	114.90	122.77
1	A	255	PHE	CA-C-N	5.75	123.86	120.24
1	A	255	PHE	C-N-CA	5.75	123.86	120.24
1	B	255	PHE	CA-C-N	5.74	123.86	120.24
1	B	255	PHE	C-N-CA	5.74	123.86	120.24
1	C	255	PHE	CA-C-N	5.59	123.76	120.24
1	C	255	PHE	C-N-CA	5.59	123.76	120.24
1	A	282	VAL	N-CA-CB	5.44	117.94	110.54
1	A	144	ASN	N-CA-C	5.42	117.94	111.71
1	A	271	GLY	N-CA-C	5.32	121.03	114.69
1	B	257	PRO	N-CA-C	5.29	117.16	110.70
2	E	1148	LYS	CA-CB-CG	5.24	124.57	114.10
1	B	14	PRO	N-CA-C	5.14	118.79	111.13
2	F	1160	PRO	CA-C-N	5.13	126.47	120.98
2	F	1160	PRO	C-N-CA	5.13	126.47	120.98
1	B	162	LYS	N-CA-C	5.08	116.51	110.97

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	143	ASN	Peptide
2	F	1183	TRP	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	2311	0	2306	22	0
1	B	2295	0	2280	25	0
1	C	2280	0	2256	15	0
2	D	1011	0	967	14	0
2	E	989	0	941	6	0
2	F	807	0	744	7	0
3	G	32	0	28	0	0
4	H	68	0	58	0	0
5	I	57	0	49	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	6	0	8	1	0
6	B	6	0	8	1	0
6	C	6	0	8	3	0
6	D	6	0	8	0	0
7	A	143	0	0	5	0
7	B	101	0	0	3	0
7	C	73	0	0	2	0
7	D	75	0	0	5	0
7	E	50	0	0	0	0
7	F	6	0	0	0	0
All	All	10322	0	9661	86	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 (86) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:1168:VAL:HG22	2:E:1190[A]:TYR:CE1	1.93	1.03
1:C:121:PRO:O	1:C:178:LYS:HE3	1.69	0.92
2:E:1168:VAL:HG22	2:E:1190[A]:TYR:CZ	2.06	0.90
1:B:264:ASN:OD1	7:B:501:HOH:O	1.95	0.84
1:A:166:GLU:HG2	7:A:590:HOH:O	1.78	0.82
1:B:159:GLN:NE2	1:B:205:GLN:OE1	2.13	0.82
1:A:98[A]:ASN:ND2	7:A:501:HOH:O	2.15	0.80
2:D:1154:ASN:N	7:D:1402:HOH:O	2.25	0.69
1:C:262:TRP:CZ2	1:C:266:GLN:OE1	2.46	0.69
1:C:121:PRO:O	1:C:178:LYS:CE	2.41	0.68
2:D:1208:SER:O	2:D:1211[B]:SER:OG	2.07	0.68
1:C:159:GLN:OE1	1:C:205[A]:GLN:OE1	2.11	0.66
2:D:1149:ARG:NH1	7:D:1403:HOH:O	2.29	0.66
1:A:9:HIS:O	2:D:1173:ILE:HD11	1.96	0.65
1:A:166:GLU:CG	7:A:590:HOH:O	2.39	0.63
1:C:115[B]:ILE:HD12	1:C:175:SER:OG	2.00	0.61
2:F:1133[B]:SER:OG	2:F:1149:ARG:CG	2.49	0.59
2:F:1216:THR:OG1	2:F:1223:LEU:HD11	2.03	0.58
1:B:70:SER:O	1:B:71:SER:HB2	2.03	0.58
2:F:1144:LEU:HD21	2:F:1148:LYS:HB2	1.86	0.58
1:C:70:SER:O	1:C:71:SER:HB2	2.02	0.58
1:A:39:GLU:C	7:A:532:HOH:O	2.45	0.58
1:A:70:SER:O	1:A:71:SER:HB2	2.05	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:167:GLU:OE1	7:C:501:HOH:O	2.18	0.55
2:D:1212:HIS:HB2	7:D:1401:HOH:O	2.06	0.55
2:F:1171:ARG:CG	2:F:1187:GLN:HB3	2.35	0.55
1:B:127:GLU:HG2	6:B:401:GOL:H2	1.89	0.54
1:A:237:VAL:CG1	1:A:282:VAL:HG11	2.39	0.53
1:C:160:GLU:HG3	7:C:537:HOH:O	2.08	0.52
1:B:135:GLU:HG3	7:B:581:HOH:O	2.11	0.51
1:A:237:VAL:CG1	1:A:282:VAL:CG1	2.90	0.50
2:D:1130:PRO:O	2:D:1131:ALA:HB3	2.12	0.50
2:E:1168:VAL:HG22	2:E:1190[A]:TYR:OH	2.10	0.50
1:A:271:GLY:O	2:D:1176:ASN:HB2	2.11	0.49
1:B:14:PRO:HG2	1:B:20:GLN:OE1	2.12	0.49
1:A:232:LYS:HD3	1:A:235:TYR:CZ	2.48	0.49
1:C:74:ALA:HB2	1:C:81:PRO:HA	1.93	0.49
2:E:1130:PRO:O	2:E:1131:ALA:HB3	2.12	0.49
1:A:180:GLY:HA3	1:A:206:MET:HE1	1.94	0.49
1:B:257:PRO:N	1:B:258:PRO:HD2	2.28	0.49
1:A:237:VAL:HG12	1:A:282:VAL:CG1	2.43	0.49
2:D:1208:SER:OG	2:D:1211[A]:SER:HB2	2.13	0.49
1:A:15:SER:OG	2:D:1227:THR:HG23	2.13	0.48
1:B:74:ALA:HB2	1:B:81:PRO:HA	1.95	0.48
2:E:1208:SER:HB2	2:E:1211:SER:HB2	1.96	0.47
2:D:1135:GLU:OE2	2:D:1149:ARG:NH2	2.48	0.47
1:B:302:ASP:OD1	1:B:304:SER:OG	2.26	0.47
1:B:143:ASN:OD1	1:B:192:ARG:NH1	2.46	0.47
1:B:14:PRO:HG2	1:B:20:GLN:CD	2.40	0.47
1:B:203:LEU:HD23	1:B:206:MET:CE	2.46	0.46
1:C:257:PRO:N	1:C:258:PRO:HD2	2.30	0.46
2:F:1130:PRO:O	2:F:1131:ALA:HB3	2.14	0.46
1:B:289:TYR:CE2	1:B:296:HIS:HB2	2.50	0.46
1:A:203:LEU:HD23	1:A:206:MET:CE	2.46	0.46
2:F:1183:TRP:O	2:F:1184:THR:C	2.59	0.46
1:A:39:GLU:HA	7:A:532:HOH:O	2.15	0.45
1:C:262:TRP:CH2	1:C:266:GLN:OE1	2.69	0.45
1:C:127:GLU:HG2	6:C:401:GOL:C3	2.47	0.45
2:D:1127:VAL:HG12	7:D:1442:HOH:O	2.15	0.45
2:E:1184:THR:O	2:E:1184:THR:HG22	2.16	0.45
1:A:74:ALA:HB2	1:A:81:PRO:HA	1.99	0.44
1:B:91:LYS:CE	7:B:549:HOH:O	2.65	0.44
1:B:143:ASN:OD1	1:B:192:ARG:HD3	2.16	0.44
1:B:206:MET:HE3	1:B:208:ARG:HD3	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:162:LYS:O	1:A:166:GLU:HB2	2.18	0.44
1:A:159:GLN:OE1	1:A:206:MET:HG2	2.18	0.44
2:F:1179:ILE:HD11	2:F:1225:TYR:HD2	1.83	0.43
1:B:140:LEU:CD2	1:B:149:ALA:HB1	2.49	0.43
1:A:257:PRO:N	1:A:258:PRO:HD2	2.33	0.43
1:B:44:PHE:CE2	1:B:303:VAL:HG12	2.54	0.42
1:C:113:TRP:O	1:C:114[B]:LEU:C	2.62	0.42
1:B:17:ALA:HB3	1:B:66:PHE:CZ	2.54	0.42
1:B:180:GLY:HA3	1:B:206:MET:HE1	2.01	0.42
1:A:127:GLU:HG2	6:A:401:GOL:H2	2.01	0.42
1:A:8:LYS:HE3	2:D:1168:VAL:HG21	2.02	0.41
2:D:1135:GLU:OE2	2:D:1149:ARG:NH1	2.53	0.41
2:D:1115:ILE:HG22	7:D:1425:HOH:O	2.20	0.41
1:B:162:LYS:O	1:B:166:GLU:HB2	2.21	0.41
1:B:290:GLN:HG2	1:B:296:HIS:CE1	2.56	0.41
1:B:113:TRP:CD1	1:B:117:GLU:HG3	2.56	0.41
1:B:172:LEU:HB3	1:B:173:PRO:HD3	2.03	0.40
5:I:3:SIA:O1A	5:I:3:SIA:O8	2.37	0.40
1:C:127:GLU:HG2	6:C:401:GOL:H31	2.04	0.40
1:A:72:ALA:HB2	1:A:113:TRP:CD2	2.56	0.40
1:B:203:LEU:HD23	1:B:206:MET:HE2	2.03	0.40
1:C:84:TRP:HB2	6:C:401:GOL:H12	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	292/317 (92%)	285 (98%)	7 (2%)	0	100	100
1	B	289/317 (91%)	279 (96%)	9 (3%)	1 (0%)	36	38
1	C	292/317 (92%)	285 (98%)	7 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	D	126/129 (98%)	124 (98%)	2 (2%)	0	100	100
2	E	120/129 (93%)	119 (99%)	1 (1%)	0	100	100
2	F	101/129 (78%)	97 (96%)	4 (4%)	0	100	100
All	All	1220/1338 (91%)	1189 (98%)	30 (2%)	1 (0%)	48	54

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	303	VAL

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	240/264 (91%)	239 (100%)	1 (0%)	84	88
1	B	243/264 (92%)	238 (98%)	5 (2%)	47	56
1	C	234/264 (89%)	233 (100%)	1 (0%)	84	88
2	D	111/115 (96%)	110 (99%)	1 (1%)	70	78
2	E	109/115 (95%)	109 (100%)	0	100	100
2	F	86/115 (75%)	86 (100%)	0	100	100
All	All	1023/1137 (90%)	1015 (99%)	8 (1%)	76	80

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	222	LYS
1	B	43	LYS
1	B	104[A]	SER
1	B	104[B]	SER
1	B	170	ASN
1	B	303	VAL
1	C	222	LYS

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Mol	Chain	Res	Type
2	D	1159	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	62	GLN
1	A	168	GLN
1	A	205	GLN
1	A	264	ASN
1	B	40	GLN
1	B	159	GLN
1	B	215	ASN
1	B	284	GLN
1	B	290	GLN
1	C	40	GLN
1	C	62	GLN
1	C	215	ASN
1	C	284	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	$\# Z > 2$
4	GAL	H	4	4	11,11,12	0.56	0	15,15,17	1.07	1 (6%)

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
4	GAL	H	4	4	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	H	4	GAL	C1-O5-C5	2.85	116.00	112.19

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

11 monosaccharides 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
3	GAL	G	1	3	12,12,12	0.91	0	17,17,17	1.35	2 (11%)
3	SIA	G	2	3	20,20,21	0.79	0	21,28,31	1.37	3 (14%)
4	BGC	H	1	4	12,12,12	0.51	0	17,17,17	0.73	0
4	GAL	H	2	4	11,11,12	0.60	0	15,15,17	1.51	3 (20%)
4	NGA	H	3	4	14,14,15	0.59	0	17,19,21	1.43	1 (5%)
4	GAL	H	4	4	11,11,12	0.56	0	15,15,17	1.07	1 (6%)
4	SIA	H	5	4	20,20,21	0.82	0	21,28,31	1.49	4 (19%)
5	BGC	I	1	5	12,12,12	0.85	0	17,17,17	0.96	0
5	GAL	I	2	5	11,11,12	0.42	0	15,15,17	1.57	3 (20%)
5	SIA	I	3	5	20,20,21	0.72	0	21,28,31	1.07	2 (9%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	NGA	I	4	5	14,14,15	0.47	0	17,19,21	1.26	1 (5%)

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	GAL	G	1	3	-	1/2/22/22	0/1/1/1
3	SIA	G	2	3	-	0/18/34/38	0/1/1/1
4	BGC	H	1	4	-	0/2/22/22	0/1/1/1
4	GAL	H	2	4	-	2/2/19/22	0/1/1/1
4	NGA	H	3	4	-	2/6/23/26	0/1/1/1
4	GAL	H	4	4	-	0/2/19/22	0/1/1/1
4	SIA	H	5	4	-	1/18/34/38	0/1/1/1
5	BGC	I	1	5	-	2/2/22/22	0/1/1/1
5	GAL	I	2	5	-	1/2/19/22	0/1/1/1
5	SIA	I	3	5	-	6/18/34/38	0/1/1/1
5	NGA	I	4	5	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	I	2	GAL	C1-O5-C5	4.10	117.69	112.19
4	H	3	NGA	O5-C5-C6	4.05	115.56	107.66
5	I	4	NGA	C1-C2-N2	-3.33	105.19	110.43
4	H	2	GAL	O3-C3-C2	-3.23	103.46	110.05
4	H	5	SIA	O8-C8-C9	3.05	115.97	109.03
4	H	4	GAL	C1-O5-C5	2.85	116.00	112.19
3	G	2	SIA	O1B-C1-C2	2.80	119.99	112.71
3	G	1	GAL	O1-C1-C2	2.66	116.71	108.98
4	H	5	SIA	O6-C2-C1	2.65	112.72	107.72
4	H	2	GAL	O5-C5-C4	-2.58	104.55	110.83
5	I	3	SIA	O1A-C1-C2	-2.49	117.48	122.85
4	H	2	GAL	O4-C4-C5	-2.32	103.62	109.32
4	H	5	SIA	O1B-C1-C2	2.29	118.67	112.71
4	H	5	SIA	O7-C7-C6	-2.26	104.55	109.44
5	I	3	SIA	O1B-C1-C2	2.24	118.54	112.71
3	G	2	SIA	O9-C9-C8	-2.23	106.46	111.16
3	G	2	SIA	C8-C7-C6	-2.22	108.88	113.05

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	I	2	GAL	O5-C5-C6	2.20	111.95	107.66
3	G	1	GAL	C4-C3-C2	2.09	114.49	110.83
5	I	2	GAL	C2-C3-C4	-2.04	107.27	110.86

There are no chirality outliers.

All (15) torsion outliers are listed below:

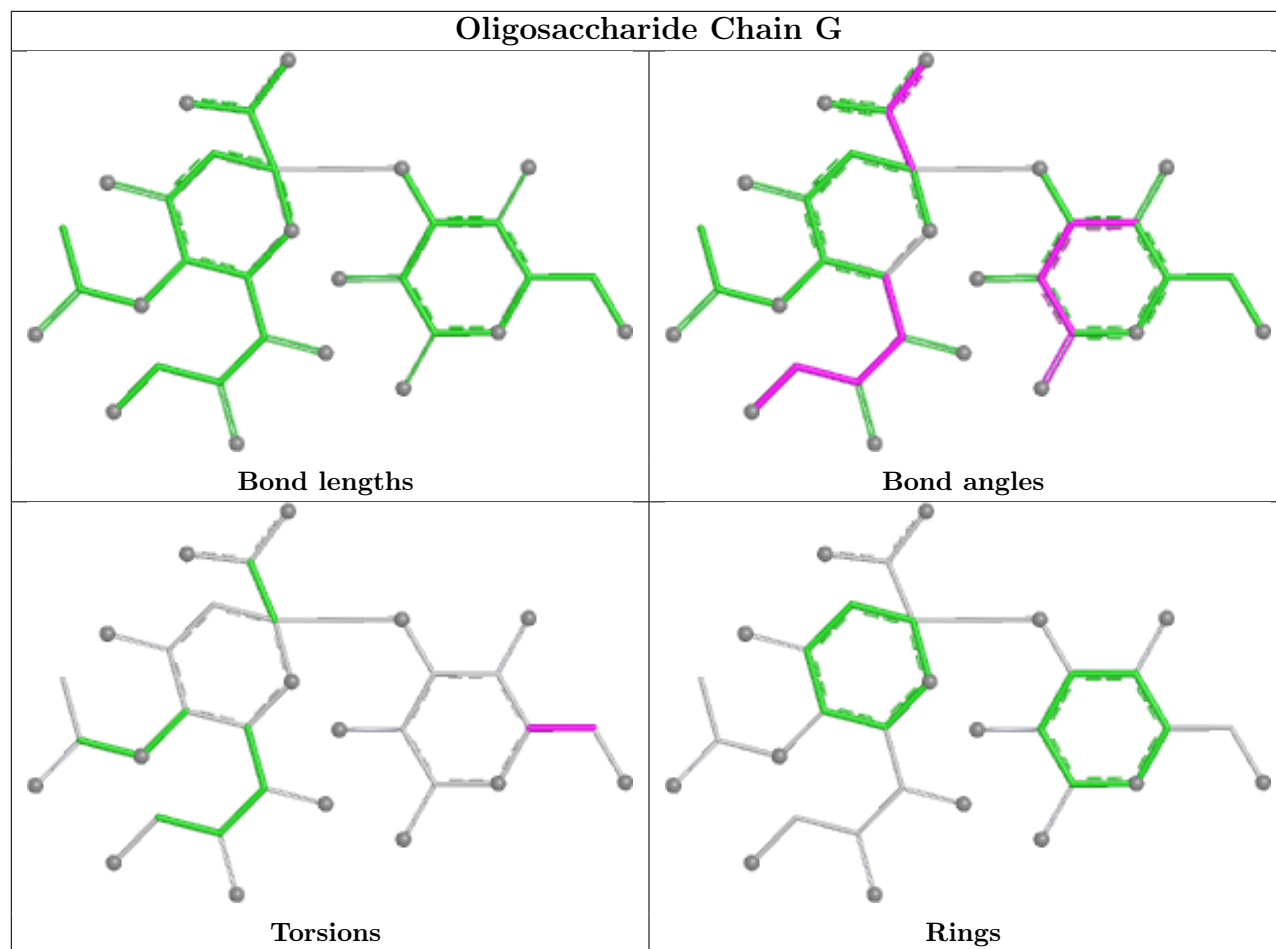
Mol	Chain	Res	Type	Atoms
5	I	3	SIA	O7-C7-C8-C9
5	I	3	SIA	O7-C7-C8-O8
5	I	1	BGC	O5-C5-C6-O6
5	I	1	BGC	C4-C5-C6-O6
5	I	3	SIA	C6-C7-C8-O8
4	H	3	NGA	O5-C5-C6-O6
5	I	3	SIA	C6-C7-C8-C9
4	H	2	GAL	O5-C5-C6-O6
4	H	2	GAL	C4-C5-C6-O6
4	H	3	NGA	C4-C5-C6-O6
5	I	2	GAL	O5-C5-C6-O6
5	I	3	SIA	C7-C8-C9-O9
3	G	1	GAL	O5-C5-C6-O6
5	I	3	SIA	O8-C8-C9-O9
4	H	5	SIA	O7-C7-C8-O8

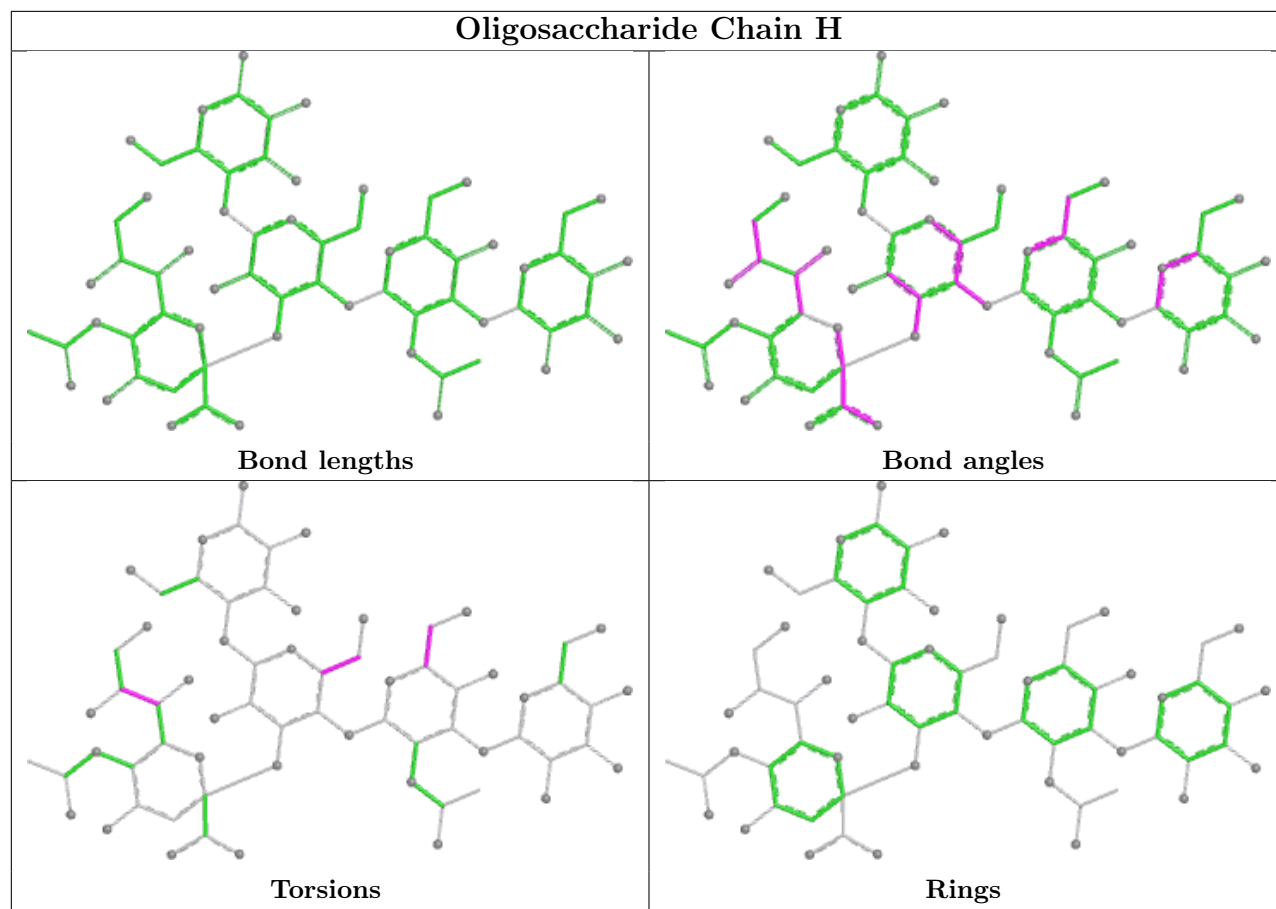
There are no ring outliers.

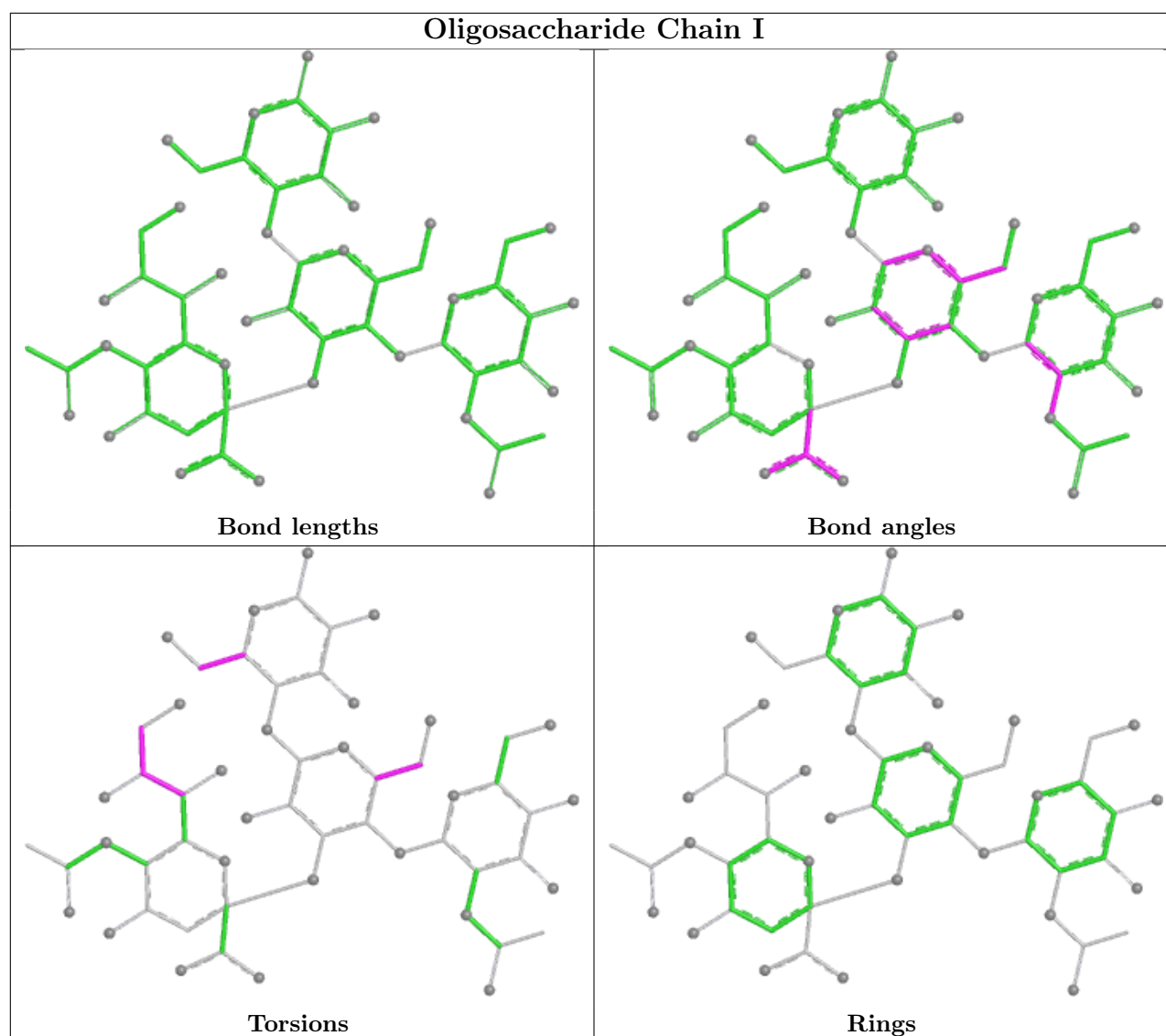
1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	I	3	SIA	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 oligosaccharide.







5.6 Ligand geometry [i](#)

4 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	$\# Z > 2$
6	GOL	A	401	-	5,5,5	0.39	0	5,5,5	0.46	0
6	GOL	D	1303	-	5,5,5	0.58	0	5,5,5	0.99	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
6	GOL	B	401	-	5,5,5	0.49	0	5,5,5	0.62	0
6	GOL	C	401	-	5,5,5	0.42	0	5,5,5	1.52	1 (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
6	GOL	A	401	-	-	2/4/4/4	-
6	GOL	D	1303	-	-	1/4/4/4	-
6	GOL	B	401	-	-	4/4/4/4	-
6	GOL	C	401	-	-	3/4/4/4	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	C	401	GOL	C3-C2-C1	-2.80	101.52	111.80

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	B	401	GOL	O1-C1-C2-O2
6	B	401	GOL	O1-C1-C2-C3
6	A	401	GOL	C1-C2-C3-O3
6	B	401	GOL	C1-C2-C3-O3
6	C	401	GOL	C1-C2-C3-O3
6	C	401	GOL	O2-C2-C3-O3
6	B	401	GOL	O2-C2-C3-O3
6	C	401	GOL	O1-C1-C2-C3
6	A	401	GOL	O2-C2-C3-O3
6	D	1303	GOL	O1-C1-C2-O2

There are no ring outliers.

3 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	401	GOL	1	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	B	401	GOL	1	0
6	C	401	GOL	3	0

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	293/317 (92%)	-0.29	1 (0%)	90 91	31, 54, 85, 124	1 (0%)
1	B	292/317 (92%)	-0.08	6 (2%)	63 65	27, 58, 94, 130	1 (0%)
1	C	291/317 (91%)	0.09	4 (1%)	73 75	23, 71, 117, 135	3 (1%)
2	D	126/129 (97%)	-0.09	1 (0%)	82 84	24, 56, 92, 131	2 (1%)
2	E	122/129 (94%)	0.09	4 (3%)	49 49	30, 68, 96, 121	2 (1%)
2	F	104/129 (80%)	0.81	10 (9%)	13 12	54, 107, 152, 170	1 (0%)
All	All	1228/1338 (91%)	0.00	26 (2%)	63 65	23, 63, 117, 170	10 (0%)

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	1106	PHE	4.4
2	E	1189	LEU	3.1
2	F	1181	LEU	3.1
1	B	12	VAL	3.1
2	E	1184	THR	3.0
1	B	273	TYR	2.9
2	E	1107	GLY	2.9
1	B	143	ASN	2.8
2	F	1157	TRP	2.8
2	F	1180	ALA	2.8
2	F	1217	THR	2.6
2	F	1199	PHE	2.6
1	B	267	ARG	2.5
1	B	308	PRO	2.5
2	F	1179	ILE	2.4
1	A	294	PRO	2.4
2	E	1190[A]	TYR	2.2
2	F	1225	TYR	2.2
2	F	1144	LEU	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	205	GLN	2.1
1	C	294	PRO	2.1
2	F	1158	SER	2.1
2	F	1197	VAL	2.1
1	C	4	ALA	2.1
1	C	142	ASN	2.1
1	C	41	TRP	2.1

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

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	GAL	H	4	11/12	0.82	0.09	89,95,103,116	0

6.3 Carbohydrates [i](#)

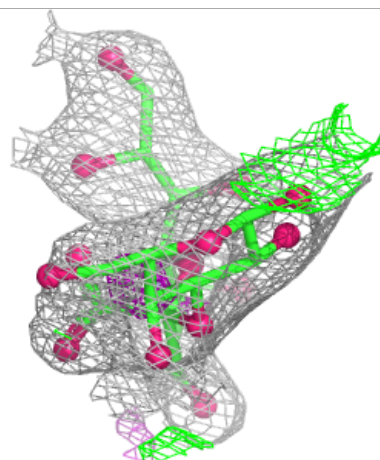
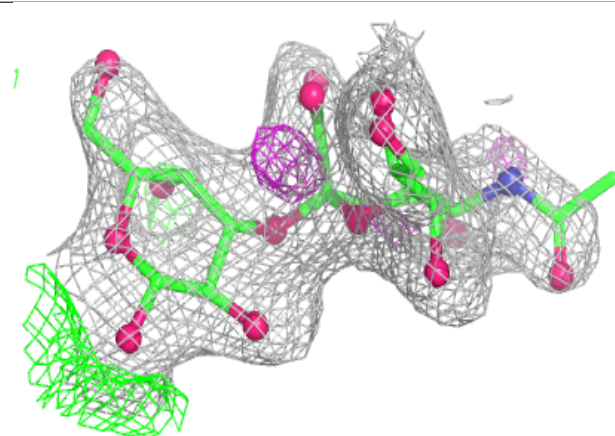
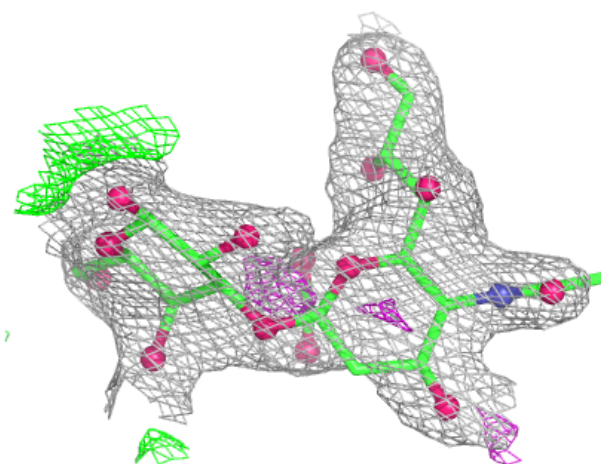
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	BGC	I	1	12/12	0.67	0.11	121,134,140,143	0
3	GAL	G	1	12/12	0.74	0.11	78,98,101,105	0
5	NGA	I	4	14/15	0.78	0.10	97,109,112,120	0
4	GAL	H	4	11/12	0.82	0.09	89,95,103,116	0
5	GAL	I	2	11/12	0.88	0.07	93,107,121,126	0
5	SIA	I	3	20/21	0.90	0.10	93,105,123,125	0
4	BGC	H	1	12/12	0.91	0.09	66,72,80,87	0
4	NGA	H	3	14/15	0.92	0.09	70,83,90,98	0
3	SIA	G	2	20/21	0.94	0.10	52,88,104,109	0
4	GAL	H	2	11/12	0.94	0.07	58,68,78,96	0
4	SIA	H	5	20/21	0.95	0.08	52,59,82,91	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

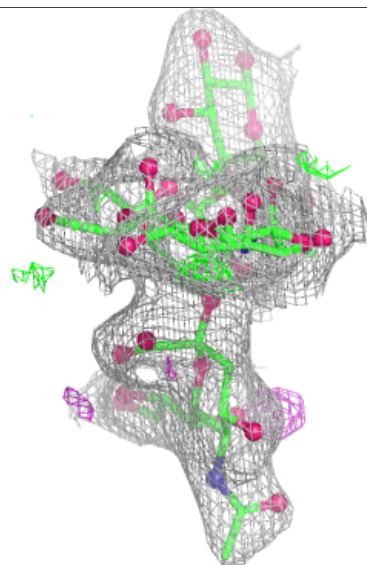
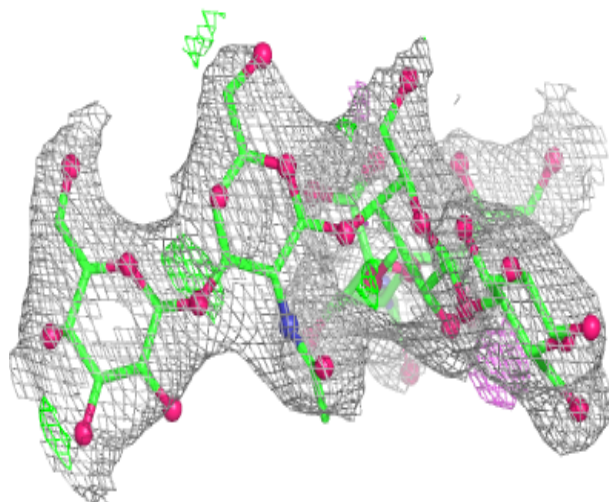
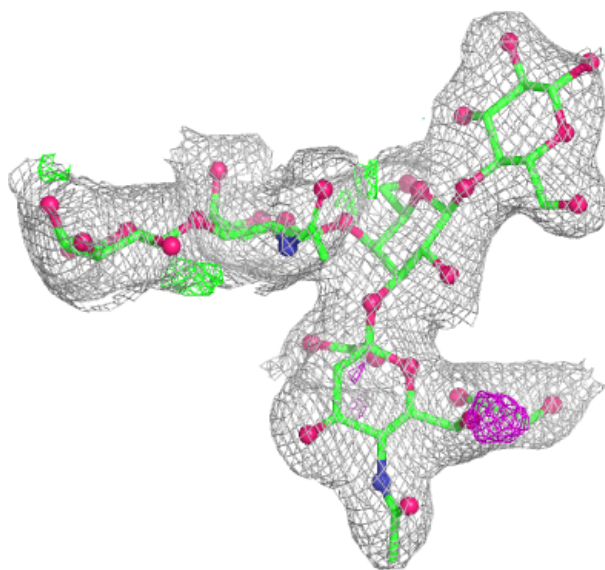
Electron density around Chain G:

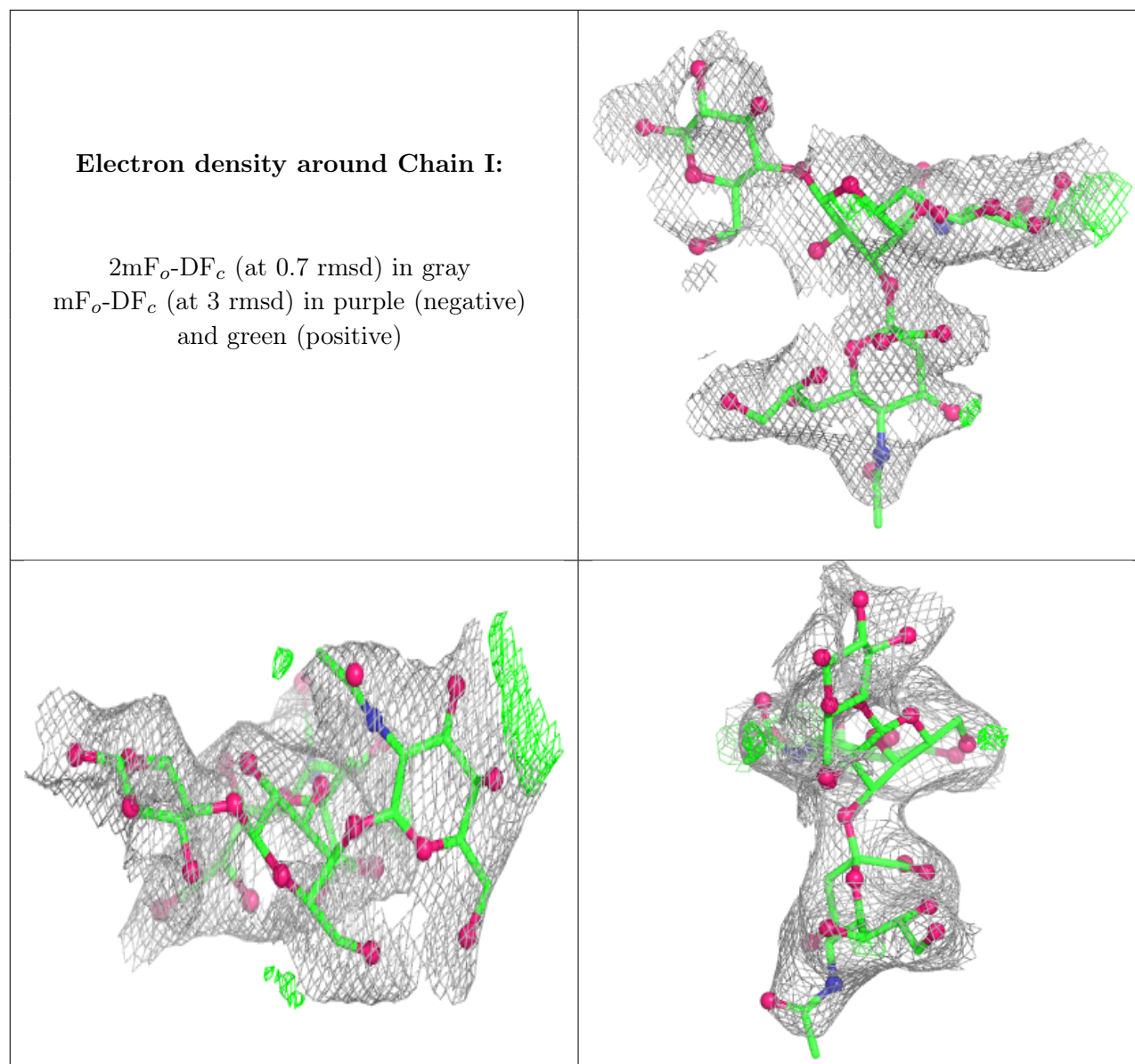
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain H:

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





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
6	GOL	D	1303	6/6	0.93	0.16	78,86,91,97	0
6	GOL	C	401	6/6	0.96	0.09	53,72,73,84	0
6	GOL	A	401	6/6	0.97	0.07	52,58,61,71	0
6	GOL	B	401	6/6	0.97	0.12	40,53,64,64	0

6.5 Other polymers [i](#)

There are no such residues in this entry.