



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 03:57 AM UTC

PDB ID : 6U7F / pdb_00006u7f
Title : HCoV-229E RBD Class IV in complex with human APN
Authors : Tomlinson, A.C.A.; Li, Z.; Rini, J.M.
Deposited on : 2019-09-02
Resolution : 2.75 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

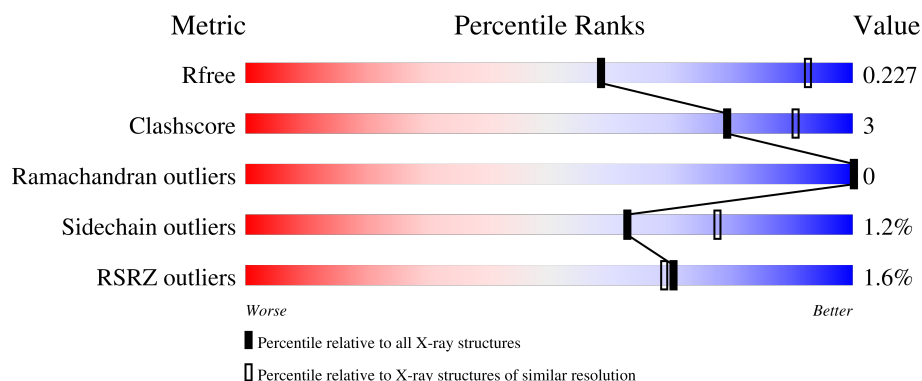
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.75 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	1009 (2.76-2.76)
Clashscore	190562	1044 (2.76-2.76)
Ramachandran outliers	187476	1024 (2.76-2.76)
Sidechain outliers	187428	1024 (2.76-2.76)
RSRZ outliers	180081	1009 (2.76-2.76)

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	906	94%
1	B	906	94%
2	C	145	7% 48% 16% 34%
2	D	145	3% 51% 19% 29%
3	E	2	50% 50%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
3	F	2	 100%
3	G	2	 50%50%
3	H	2	 100%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 16575 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 Aminopeptidase N.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	897	Total	C	N	O	S	0	0	0
			7251	4623	1223	1381	24			
1	B	897	Total	C	N	O	S	0	0	0
			7251	4623	1223	1381	24			

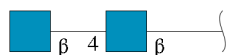
There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	62	GLY	-	expression tag	UNP P15144
A	63	GLY	-	expression tag	UNP P15144
A	64	ARG	-	expression tag	UNP P15144
A	65	PRO	-	expression tag	UNP P15144
B	62	GLY	-	expression tag	UNP P15144
B	63	GLY	-	expression tag	UNP P15144
B	64	ARG	-	expression tag	UNP P15144
B	65	PRO	-	expression tag	UNP P15144

- Molecule 2 is a protein called Spike glycoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	96	Total	C	N	O	S	0	0	0
			736	474	126	129	7			
2	D	103	Total	C	N	O	S	0	0	0
			785	503	136	138	8			

- Molecule 3 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.

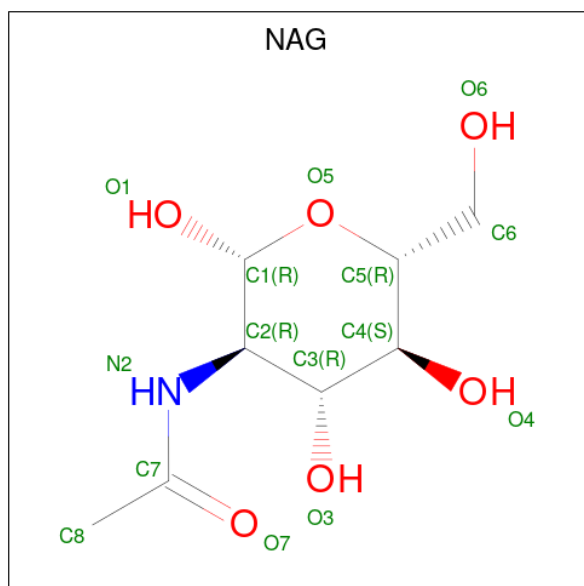


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	E	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	F	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	G	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	H	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Zn	0	0
			1	1		
4	B	1	Total	Zn	0	0
			1	1		

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			14	8	1	5		
5	A	1	Total	C	N	O	0	0
			14	8	1	5		
5	A	1	Total	C	N	O	0	0
			14	8	1	5		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			14	8	1	5		
5	A	1	Total	C	N	O	0	0
			14	8	1	5		
5	A	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	C	1	Total	C	N	O	0	0
			14	8	1	5		
5	C	1	Total	C	N	O	0	0
			14	8	1	5		
5	D	1	Total	C	N	O	0	0
			14	8	1	5		
5	D	1	Total	C	N	O	0	0
			14	8	1	5		

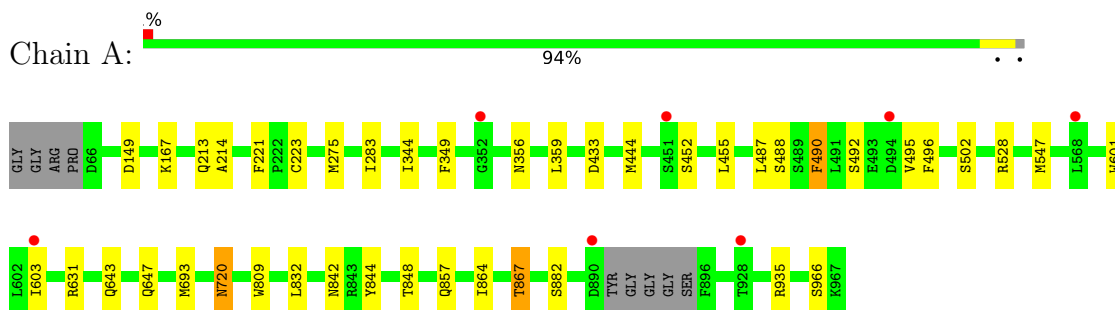
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	126	Total	O	0	0
			126	126		
6	B	97	Total	O	0	0
			97	97		
6	C	1	Total	O	0	0
			1	1		
6	D	4	Total	O	0	0
			4	4		

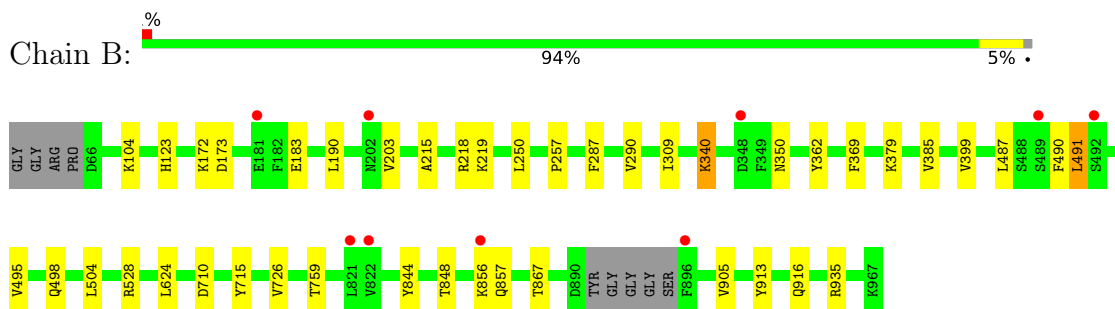
3 Residue-property plots

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.

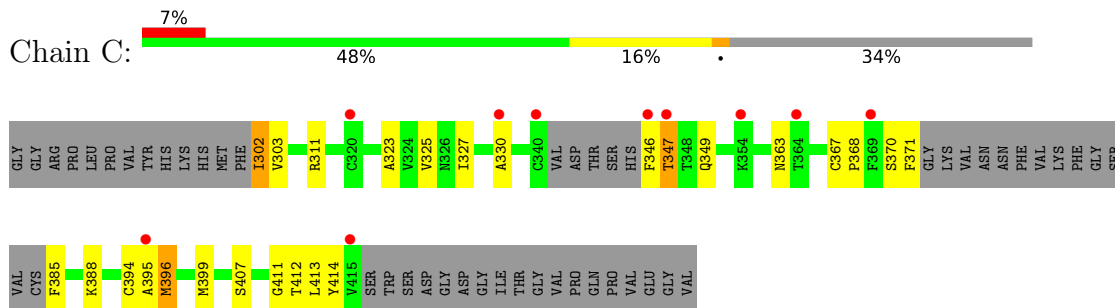
- Molecule 1: Aminopeptidase N



- Molecule 1: Aminopeptidase N

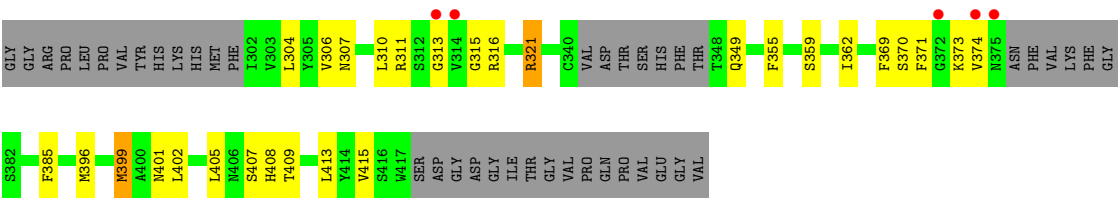


- Molecule 2: Spike glycoprotein



- Molecule 2: Spike glycoprotein





• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



• Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	99.16Å 98.57Å 147.78Å 90.00° 104.42° 90.00°	Depositor
Resolution (Å)	49.38 – 2.75 49.38 – 2.75	Depositor EDS
% Data completeness (in resolution range)	99.9 (49.38-2.75) 95.9 (49.38-2.75)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.71 (at 2.54Å)	Xtriage
Refinement program	PHENIX 1.16rc1_3535	Depositor
R, R_{free}	0.190 , 0.225 0.196 , 0.227	Depositor DCC
R_{free} test set	4497 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	43.6	Xtriage
Anisotropy	0.602	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 38.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	16575	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.83% 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: ZN, NAG

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	0.26	0/7437	0.49	1/10128 (0.0%)
1	B	0.29	0/7437	0.53	0/10128
2	C	0.54	0/752	0.91	1/1018 (0.1%)
2	D	0.82	0/802	0.99	1/1086 (0.1%)
All	All	0.34	0/16428	0.57	3/22360 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	347	THR	CB-CA-C	-7.03	99.98	110.24
1	A	490	PHE	CB-CA-C	5.48	119.48	110.88
2	D	313	GLY	CA-C-O	-5.22	118.56	122.37

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	7251	0	7014	26	0
1	B	7251	0	7015	24	0
2	C	736	0	726	21	0
2	D	785	0	773	18	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	28	0	25	0	0
3	F	28	0	25	0	0
3	G	28	0	25	0	0
3	H	28	0	25	1	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	84	0	78	2	0
5	B	70	0	65	1	0
5	C	28	0	26	0	0
5	D	28	0	26	0	0
6	A	126	0	0	0	0
6	B	97	0	0	0	0
6	C	1	0	0	0	0
6	D	4	0	0	0	0
All	All	16575	0	15823	87	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 3.

All (87) 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:495:VAL:HG22	1:B:528:ARG:HD3	1.76	0.66
2:C:395:ALA:HB1	2:C:412:THR:HG21	1.76	0.66
2:C:395:ALA:HB1	2:C:412:THR:CG2	2.27	0.65
1:A:349:PHE:H	1:A:857:GLN:NE2	1.96	0.64
1:A:452:SER:HB3	1:A:547:MET:HE3	1.80	0.63
2:D:374:VAL:O	2:D:374:VAL:HG12	2.01	0.61
1:B:624:LEU:HD21	3:H:1:NAG:H82	1.83	0.61
2:C:395:ALA:HB2	2:C:414:TYR:CD1	2.36	0.60
2:C:311:ARG:HG2	2:C:323:ALA:HB2	1.84	0.59
1:B:487:LEU:HA	1:B:490:PHE:CZ	2.37	0.59
1:A:502:SER:HB2	5:A:5007:NAG:H83	1.84	0.59
1:B:487:LEU:HA	1:B:490:PHE:CE1	2.38	0.58
2:D:311:ARG:O	2:D:316:ARG:HD2	2.04	0.57
2:D:371:PHE:HB2	2:D:396:MET:HE1	1.87	0.56
2:C:346:PHE:CD2	2:C:346:PHE:C	2.84	0.55
2:D:321:ARG:NH1	2:D:409:THR:O	2.40	0.55
2:C:363:ASN:O	2:C:396:MET:HB2	2.06	0.54
1:A:492:SER:HB3	1:A:495:VAL:HG23	1.89	0.54
2:C:370:SER:O	2:C:370:SER:OG	2.27	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:303:VAL:HB	2:C:330:ALA:HB2	1.92	0.52
2:D:385:PHE:CD2	2:D:415:VAL:HG22	2.44	0.52
1:B:287:PHE:O	2:D:315:GLY:HA2	2.10	0.51
1:A:643:GLN:O	1:A:647:GLN:HG2	2.11	0.51
2:D:402:LEU:HD23	2:D:405:LEU:HD23	1.93	0.51
1:A:935:ARG:O	1:A:935:ARG:HG3	2.10	0.51
1:B:844:TYR:O	1:B:848:THR:HG23	2.11	0.50
2:C:395:ALA:HB2	2:C:414:TYR:CE1	2.46	0.50
1:A:488:SER:HB2	1:A:496:PHE:CD2	2.47	0.50
2:C:347:THR:O	2:C:347:THR:OG1	2.24	0.49
2:D:370:SER:HB2	2:D:373:LYS:HG2	1.94	0.49
1:B:369:PHE:CZ	1:B:379:LYS:HE3	2.48	0.49
2:C:371:PHE:HB2	2:C:396:MET:HE1	1.94	0.48
1:B:104:LYS:HG2	1:B:183:GLU:HG2	1.93	0.48
1:A:720:ASN:HB3	1:A:966:SER:CB	2.43	0.48
1:B:123:HIS:HB3	1:B:218:ARG:HB3	1.94	0.48
1:A:809:TRP:CE2	1:A:832:LEU:HD22	2.49	0.48
1:B:490:PHE:CD2	1:B:491:LEU:HD13	2.49	0.47
2:C:396:MET:HE2	2:C:413:LEU:HD23	1.96	0.47
1:B:215:ALA:HB1	1:B:218:ARG:CZ	2.44	0.47
1:B:867:THR:HG21	1:B:905:VAL:HA	1.97	0.47
2:D:321:ARG:HA	2:D:408:HIS:CD2	2.50	0.47
2:D:306:VAL:C	2:D:307:ASN:HD22	2.23	0.46
2:C:371:PHE:HB2	2:C:396:MET:CE	2.46	0.46
2:D:362:ILE:O	2:D:362:ILE:HG23	2.16	0.46
2:D:369:PHE:HZ	2:D:415:VAL:HG11	1.81	0.46
1:A:844:TYR:O	1:A:848:THR:HG23	2.15	0.46
2:C:302:ILE:HG12	2:C:385:PHE:CD2	2.51	0.46
2:C:399:MET:HE3	2:C:399:MET:HB3	1.91	0.45
1:B:350:ASN:HD21	1:B:857:GLN:HG2	1.81	0.45
1:A:455:LEU:HD12	1:A:455:LEU:HA	1.79	0.45
1:B:290:VAL:HG13	1:B:309:ILE:HG23	1.98	0.45
1:A:283:ILE:HD13	1:A:344:ILE:HD13	1.98	0.45
1:A:864:ILE:O	1:A:867:THR:HG22	2.16	0.45
1:A:882:SER:HB3	1:B:913:TYR:CD1	2.51	0.45
1:B:498:GLN:OE1	1:B:528:ARG:HD2	2.17	0.45
1:B:257:PRO:HD3	5:B:5005:NAG:H62	1.99	0.44
1:A:487:LEU:HA	1:A:490:PHE:CE1	2.53	0.44
1:B:250:LEU:HG	1:B:340:LYS:HG2	1.99	0.44
2:C:346:PHE:CD2	2:C:346:PHE:O	2.70	0.44
1:A:488:SER:O	1:A:488:SER:OG	2.36	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:913:TYR:O	1:B:916:GLN:HG3	2.18	0.43
1:A:444:MET:HE3	1:A:631:ARG:CZ	2.49	0.43
1:B:362:TYR:HE2	1:B:385:VAL:HG12	1.84	0.43
1:B:726:VAL:HG21	1:B:759:THR:HB	1.99	0.43
2:C:346:PHE:O	2:C:346:PHE:HD2	2.01	0.43
1:A:213:GLN:HA	1:A:214:ALA:HA	1.76	0.43
2:D:304:LEU:HD22	2:D:413:LEU:HD22	2.00	0.43
1:B:172:LYS:HG2	1:B:173:ASP:OD1	2.19	0.43
2:C:349:GLN:O	2:C:371:PHE:HE1	2.01	0.43
2:D:310:LEU:HD21	2:D:355:PHE:HZ	1.83	0.43
2:D:369:PHE:N	2:D:369:PHE:CD2	2.87	0.42
1:A:149:ASP:HB2	1:A:167:LYS:HD2	2.01	0.42
1:A:502:SER:CB	5:A:5007:NAG:H83	2.46	0.42
1:B:399:VAL:HG21	1:B:504:LEU:HD23	2.02	0.42
1:A:433:ASP:HB3	1:A:693:MET:HE1	2.01	0.42
2:D:399:MET:HE3	2:D:399:MET:HB3	1.73	0.42
1:A:356:ASN:HB2	1:A:359:LEU:O	2.19	0.42
1:A:720:ASN:HB3	1:A:966:SER:HB2	2.01	0.42
2:C:327:ILE:HD13	2:C:411:GLY:HA3	2.01	0.42
2:D:371:PHE:HB2	2:D:396:MET:CE	2.50	0.42
1:A:275:MET:HE2	1:A:275:MET:HB3	1.88	0.41
1:A:601:TRP:HB3	1:A:603:ILE:HD11	2.02	0.41
2:D:310:LEU:HD21	2:D:355:PHE:CZ	2.56	0.41
1:A:221:PHE:CE2	1:A:223:CYS:HB3	2.56	0.41
1:B:710:ASP:HA	1:B:715:TYR:CG	2.57	0.40
2:C:367:CYS:HA	2:C:368:PRO:HD3	1.95	0.40
2:C:394:CYS:O	2:C:394:CYS:SG	2.78	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	893/906 (99%)	874 (98%)	19 (2%)	0	100	100
1	B	893/906 (99%)	876 (98%)	17 (2%)	0	100	100
2	C	90/145 (62%)	86 (96%)	4 (4%)	0	100	100
2	D	97/145 (67%)	94 (97%)	3 (3%)	0	100	100
All	All	1973/2102 (94%)	1930 (98%)	43 (2%)	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	798/802 (100%)	794 (100%)	4 (0%)	81	89
1	B	798/802 (100%)	791 (99%)	7 (1%)	70	82
2	C	81/122 (66%)	76 (94%)	5 (6%)	16	31
2	D	87/122 (71%)	81 (93%)	6 (7%)	14	26
All	All	1764/1848 (96%)	1742 (99%)	22 (1%)	63	78

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	528	ARG
1	A	720	ASN
1	A	842	ASN
1	A	867	THR
1	B	190	LEU
1	B	203	VAL
1	B	219	LYS
1	B	340	LYS
1	B	491	LEU
1	B	856	LYS
1	B	935	ARG
2	C	302	ILE
2	C	325	VAL

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	C	388	LYS
2	C	396	MET
2	C	407	SER
2	D	321	ARG
2	D	349	GLN
2	D	359	SER
2	D	399	MET
2	D	401	ASN
2	D	407	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (31) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	135	HIS
1	A	463	ASN
1	A	511	ASN
1	A	598	GLN
1	A	647	GLN
1	A	803	GLN
1	A	815	GLN
1	A	842	ASN
1	A	857	GLN
1	A	883	ASN
1	A	889	ASN
1	A	903	GLN
1	A	960	GLN
1	A	965	ASN
1	B	67	GLN
1	B	175	GLN
1	B	213	GLN
1	B	331	HIS
1	B	350	ASN
1	B	430	ASN
1	B	541	ASN
1	B	643	GLN
1	B	732	HIS
1	B	803	GLN
1	B	881	GLN
1	B	889	ASN
1	B	900	ASN
2	C	349	GLN
2	C	408	HIS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	D	307	ASN
2	D	401	ASN

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 ⓘ

8 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	NAG	E	1	1,3	14,14,15	0.24	0	17,19,21	0.43	0
3	NAG	E	2	3	14,14,15	0.43	0	17,19,21	0.92	1 (5%)
3	NAG	F	1	1,3	14,14,15	0.54	0	17,19,21	1.13	2 (11%)
3	NAG	F	2	3	14,14,15	1.24	2 (14%)	17,19,21	1.25	2 (11%)
3	NAG	G	1	1,3	14,14,15	0.46	0	17,19,21	0.82	0
3	NAG	G	2	3	14,14,15	0.56	0	17,19,21	0.83	1 (5%)
3	NAG	H	1	1,3	14,14,15	0.39	0	17,19,21	0.83	0
3	NAG	H	2	3	14,14,15	0.45	0	17,19,21	0.71	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	NAG	E	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	E	2	3	-	0/6/23/26	0/1/1/1
3	NAG	F	1	1,3	-	3/6/23/26	0/1/1/1
3	NAG	F	2	3	-	2/6/23/26	0/1/1/1
3	NAG	G	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	G	2	3	-	0/6/23/26	0/1/1/1
3	NAG	H	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	H	2	3	-	1/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	F	2	NAG	O5-C1	-2.34	1.39	1.43
3	F	2	NAG	C2-N2	-2.30	1.42	1.46

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	2	NAG	C1-O5-C5	3.45	116.81	112.19
3	G	2	NAG	C1-O5-C5	3.19	116.45	112.19
3	F	2	NAG	C2-N2-C7	-3.07	118.79	122.90
3	F	1	NAG	O5-C1-C2	-2.49	107.44	111.29
3	H	2	NAG	C1-O5-C5	2.46	115.49	112.19
3	F	1	NAG	C3-C4-C5	2.26	114.33	110.23
3	F	2	NAG	C1-O5-C5	2.09	114.98	112.19

There are no chirality outliers.

All (10) torsion outliers are listed below:

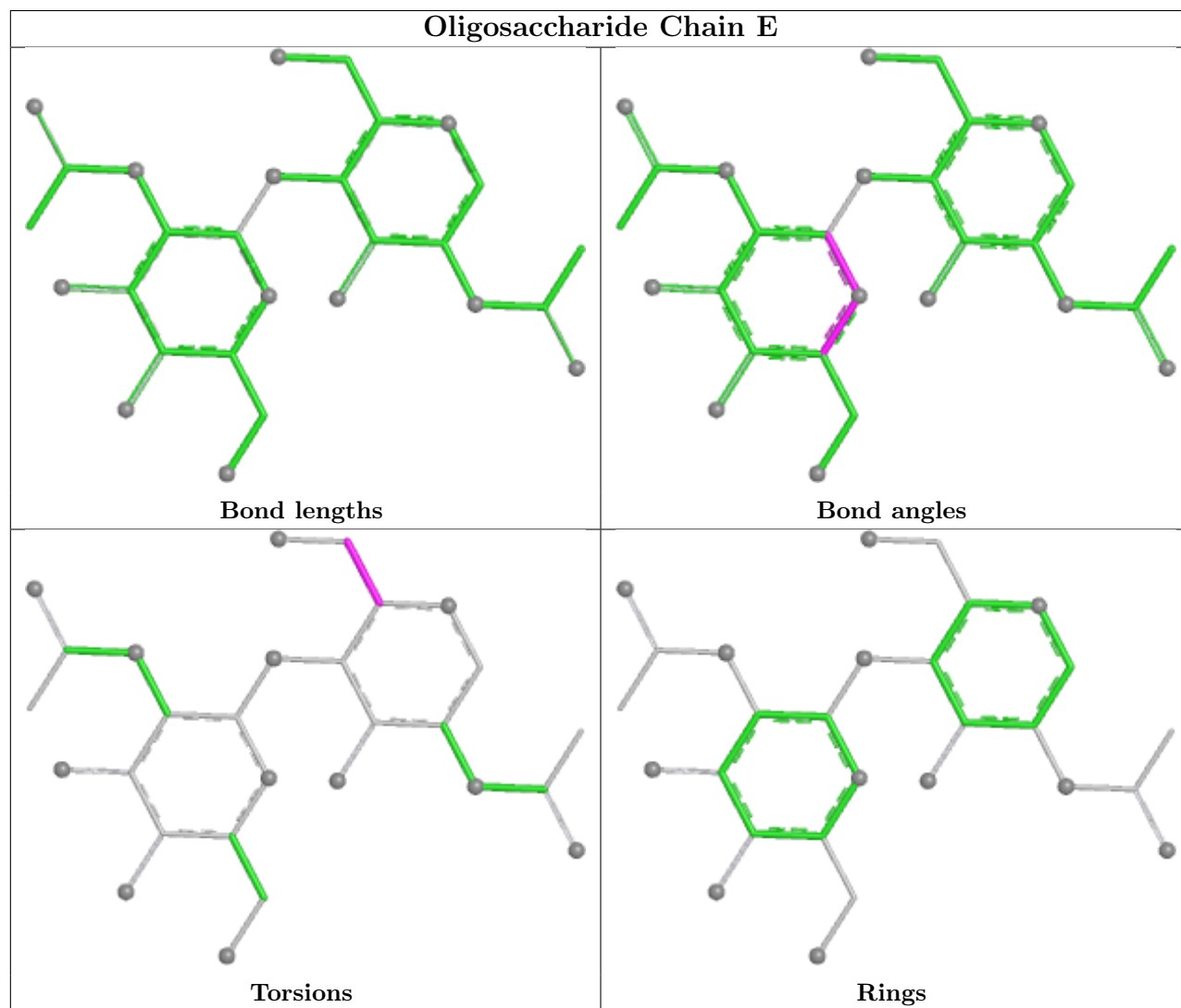
Mol	Chain	Res	Type	Atoms
3	F	1	NAG	C8-C7-N2-C2
3	E	1	NAG	O5-C5-C6-O6
3	E	1	NAG	C4-C5-C6-O6
3	F	1	NAG	O7-C7-N2-C2
3	F	2	NAG	O5-C5-C6-O6
3	F	2	NAG	C4-C5-C6-O6
3	H	2	NAG	C1-C2-N2-C7
3	G	1	NAG	O5-C5-C6-O6
3	F	1	NAG	C4-C5-C6-O6
3	G	1	NAG	C4-C5-C6-O6

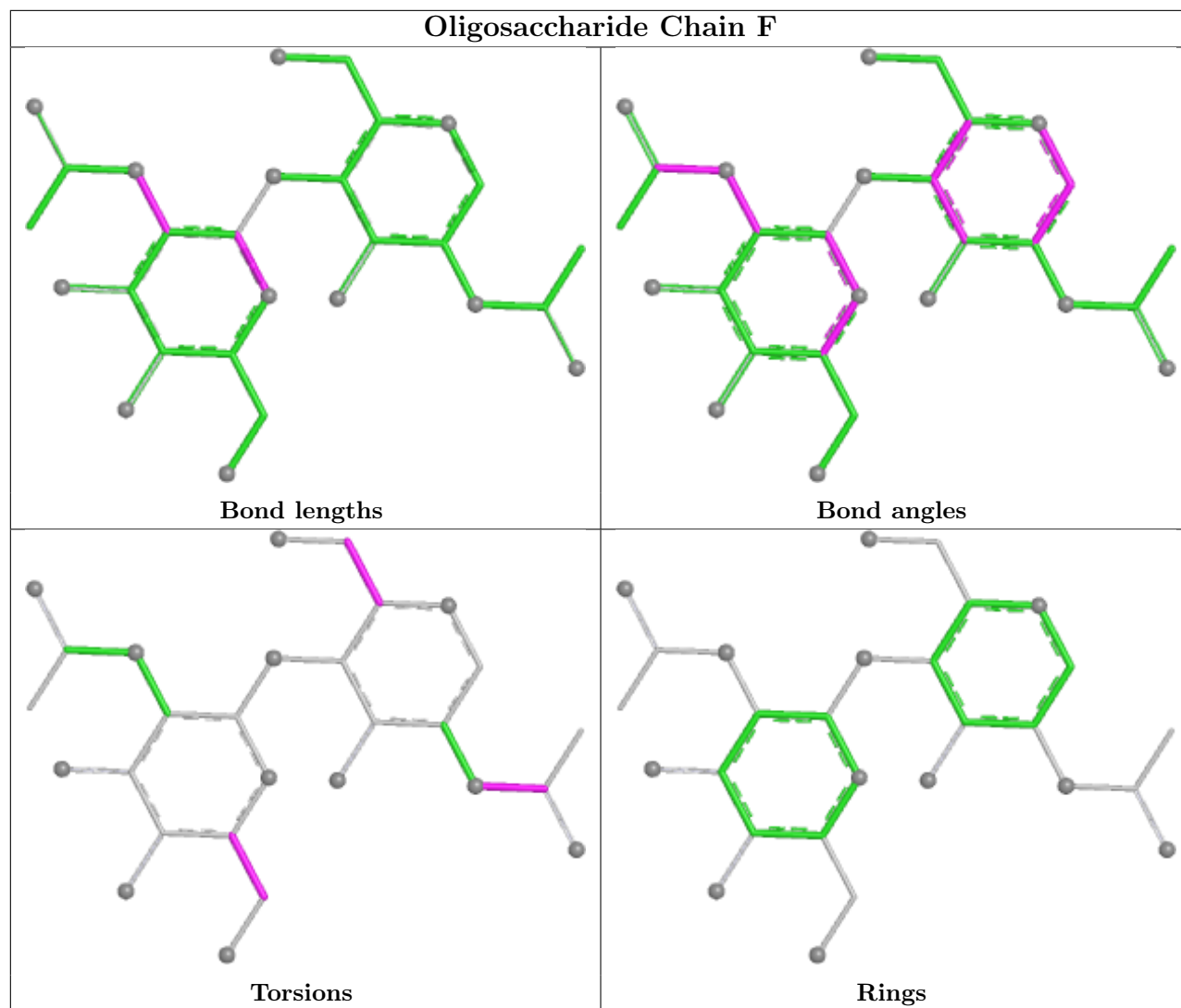
There are no ring outliers.

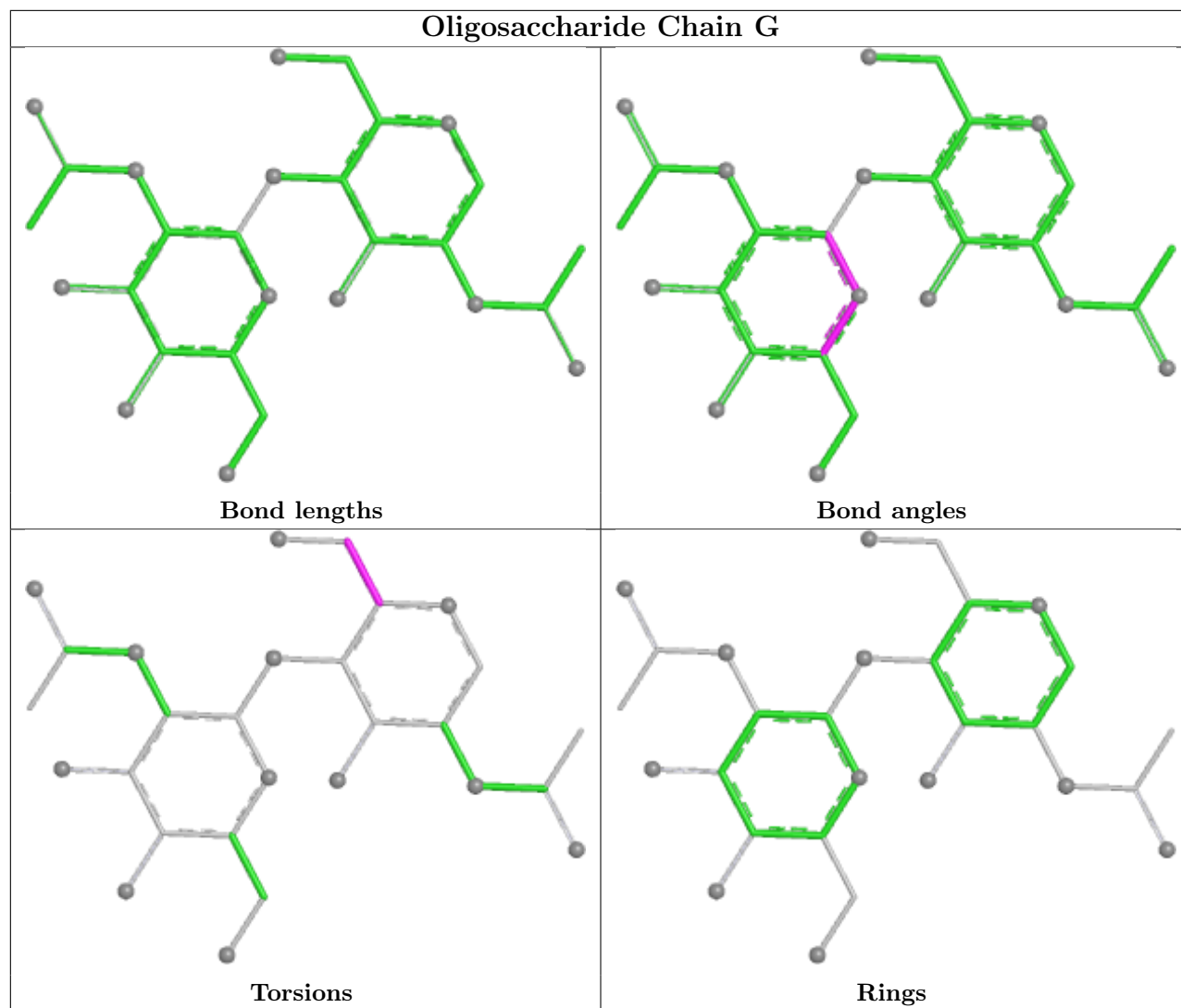
1 monomer is involved in 1 short contact:

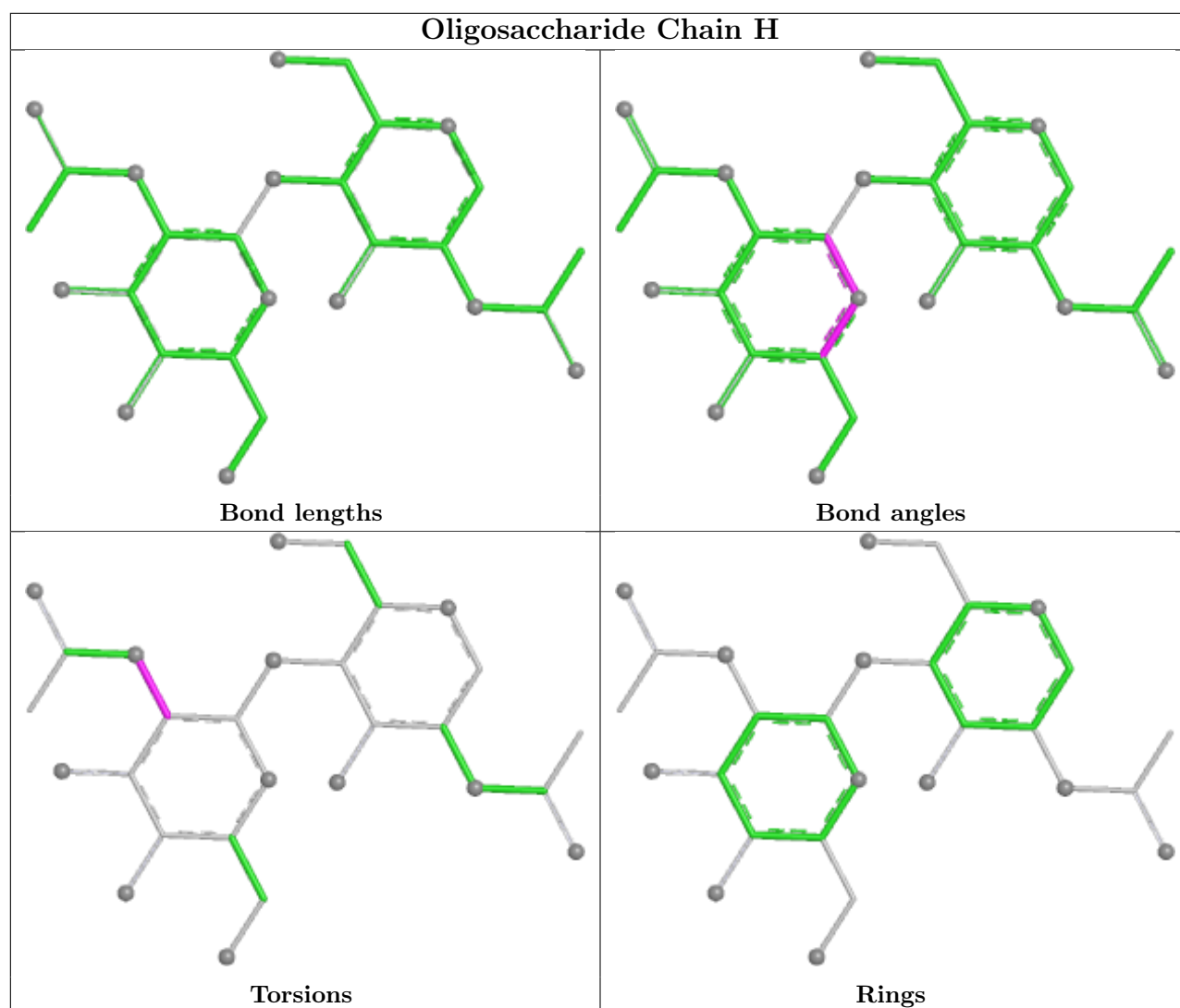
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	H	1	NAG	1	0

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](#)

Of 17 ligands modelled in this entry, 2 are monoatomic - leaving 15 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	NAG	A	5002	1	14,14,15	0.16	0	17,19,21	0.43	0
5	NAG	A	5006	1	14,14,15	0.22	0	17,19,21	0.69	1 (5%)
5	NAG	B	5010	1	14,14,15	0.38	0	17,19,21	1.05	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	NAG	B	5005	1	14,14,15	0.32	0	17,19,21	0.82	1 (5%)
5	NAG	B	5006	1	14,14,15	0.46	0	17,19,21	0.71	0
5	NAG	D	2002	2	14,14,15	0.41	0	17,19,21	1.16	2 (11%)
5	NAG	B	5002	1	14,14,15	0.18	0	17,19,21	0.55	0
5	NAG	A	5011	1	14,14,15	0.38	0	17,19,21	0.65	0
5	NAG	A	5007	1	14,14,15	0.36	0	17,19,21	0.87	1 (5%)
5	NAG	A	5010	1	14,14,15	0.35	0	17,19,21	0.77	0
5	NAG	A	5005	1	14,14,15	0.38	0	17,19,21	0.65	0
5	NAG	D	2001	2	14,14,15	0.38	0	17,19,21	0.74	0
5	NAG	C	2001	2	14,14,15	0.32	0	17,19,21	0.48	0
5	NAG	C	2002	2	14,14,15	1.33	2 (14%)	17,19,21	2.26	8 (47%)
5	NAG	B	5007	1	14,14,15	0.38	0	17,19,21	0.64	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	NAG	A	5002	1	-	0/6/23/26	0/1/1/1
5	NAG	A	5006	1	-	0/6/23/26	0/1/1/1
5	NAG	B	5010	1	-	2/6/23/26	0/1/1/1
5	NAG	B	5005	1	-	0/6/23/26	0/1/1/1
5	NAG	B	5006	1	-	1/6/23/26	0/1/1/1
5	NAG	D	2002	2	-	4/6/23/26	0/1/1/1
5	NAG	B	5002	1	-	0/6/23/26	0/1/1/1
5	NAG	A	5011	1	-	4/6/23/26	0/1/1/1
5	NAG	A	5007	1	-	0/6/23/26	0/1/1/1
5	NAG	A	5010	1	-	4/6/23/26	0/1/1/1
5	NAG	A	5005	1	-	0/6/23/26	0/1/1/1
5	NAG	D	2001	2	-	2/6/23/26	0/1/1/1
5	NAG	C	2001	2	-	0/6/23/26	0/1/1/1
5	NAG	C	2002	2	-	0/6/23/26	0/1/1/1
5	NAG	B	5007	1	-	2/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	C	2002	NAG	C2-N2	-2.14	1.42	1.46
5	C	2002	NAG	O5-C1	-2.10	1.40	1.43

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	C	2002	NAG	O5-C1-C2	-4.84	103.80	111.29
5	C	2002	NAG	C4-C3-C2	-3.28	106.21	111.02
5	B	5010	NAG	O5-C1-C2	-3.17	106.38	111.29
5	C	2002	NAG	O6-C6-C5	-2.99	101.15	111.33
5	A	5007	NAG	C1-O5-C5	2.89	116.06	112.19
5	C	2002	NAG	C6-C5-C4	-2.81	106.11	113.02
5	B	5005	NAG	C1-O5-C5	2.60	115.66	112.19
5	D	2002	NAG	O5-C1-C2	-2.43	107.54	111.29
5	C	2002	NAG	C1-O5-C5	2.35	115.34	112.19
5	C	2002	NAG	C2-N2-C7	-2.32	119.79	122.90
5	A	5006	NAG	C1-O5-C5	2.31	115.28	112.19
5	C	2002	NAG	O4-C4-C5	-2.28	103.72	109.32
5	C	2002	NAG	O5-C5-C6	-2.24	103.30	107.66
5	D	2002	NAG	C2-N2-C7	-2.07	120.13	122.90

There are no chirality outliers.

All (19) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	5011	NAG	C8-C7-N2-C2
5	A	5011	NAG	O7-C7-N2-C2
5	D	2002	NAG	O7-C7-N2-C2
5	D	2001	NAG	O5-C5-C6-O6
5	D	2001	NAG	C4-C5-C6-O6
5	A	5010	NAG	C8-C7-N2-C2
5	D	2002	NAG	C8-C7-N2-C2
5	B	5010	NAG	C8-C7-N2-C2
5	A	5010	NAG	O7-C7-N2-C2
5	B	5010	NAG	O7-C7-N2-C2
5	D	2002	NAG	O5-C5-C6-O6
5	D	2002	NAG	C4-C5-C6-O6
5	A	5010	NAG	C4-C5-C6-O6
5	B	5007	NAG	O5-C5-C6-O6
5	A	5011	NAG	C4-C5-C6-O6
5	A	5010	NAG	O5-C5-C6-O6
5	B	5006	NAG	O5-C5-C6-O6
5	A	5011	NAG	O5-C5-C6-O6
5	B	5007	NAG	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	5005	NAG	1	0
5	A	5007	NAG	2	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	897/906 (99%)	-0.25	7 (0%)	82 82	28, 47, 73, 98	0
1	B	897/906 (99%)	-0.15	9 (1%)	79 79	29, 50, 77, 102	0
2	C	96/145 (66%)	0.54	10 (10%)	11 11	40, 68, 97, 121	0
2	D	103/145 (71%)	0.37	5 (4%)	35 34	48, 66, 91, 113	0
All	All	1993/2102 (94%)	-0.13	31 (1%)	70 69	28, 50, 78, 121	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	374	VAL	5.6
1	B	821	LEU	4.2
2	C	369	PHE	3.6
1	B	202	ASN	3.4
2	D	375	ASN	3.4
2	C	346	PHE	3.2
1	B	492	SER	3.1
2	C	347	THR	3.0
1	B	489	SER	2.8
1	B	348	ASP	2.8
1	B	181	GLU	2.8
2	C	330	ALA	2.7
2	C	364	THR	2.6
2	D	314	VAL	2.6
1	A	451	SER	2.5
1	B	896	PHE	2.4
1	A	890	ASP	2.4
1	B	822	VAL	2.3
2	C	340	CYS	2.3
1	B	856	LYS	2.3
2	C	415	VAL	2.2

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	494	ASP	2.2
1	A	928	THR	2.2
2	C	320	CYS	2.2
2	C	395	ALA	2.1
2	C	354	LYS	2.1
1	A	352	GLY	2.1
1	A	568	LEU	2.1
2	D	372	GLY	2.0
1	A	603	ILE	2.0
2	D	313	GLY	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](#)

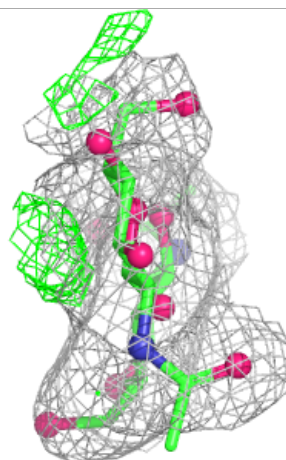
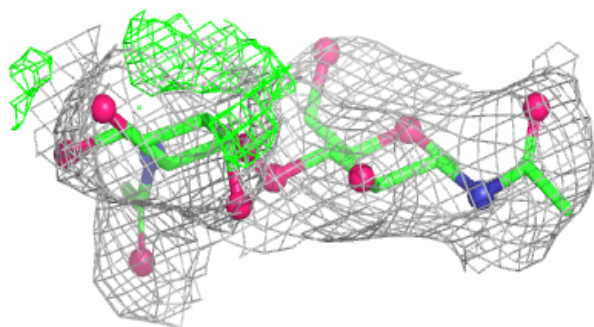
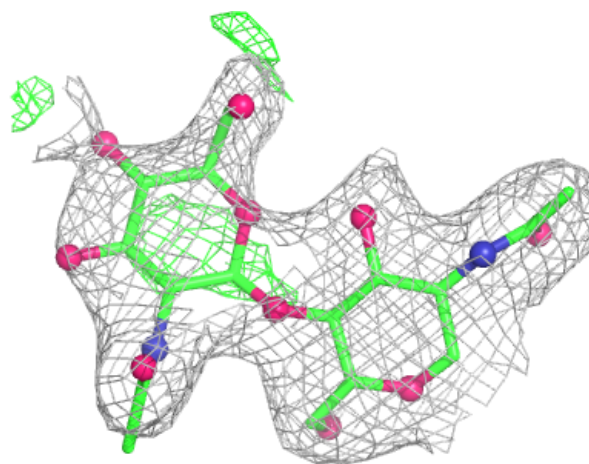
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	NAG	H	2	14/15	0.68	0.16	74,104,110,110	0
3	NAG	E	2	14/15	0.71	0.15	72,85,89,91	0
3	NAG	F	2	14/15	0.73	0.15	82,92,98,101	0
3	NAG	G	2	14/15	0.75	0.14	84,91,97,99	0
3	NAG	F	1	14/15	0.89	0.10	61,66,71,82	0
3	NAG	H	1	14/15	0.90	0.09	57,65,76,89	0
3	NAG	G	1	14/15	0.91	0.09	43,61,66,76	0
3	NAG	E	1	14/15	0.93	0.09	47,53,65,69	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.

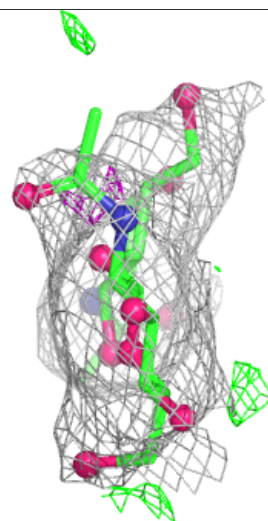
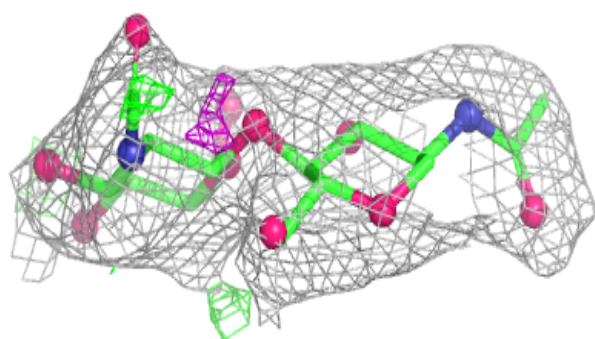
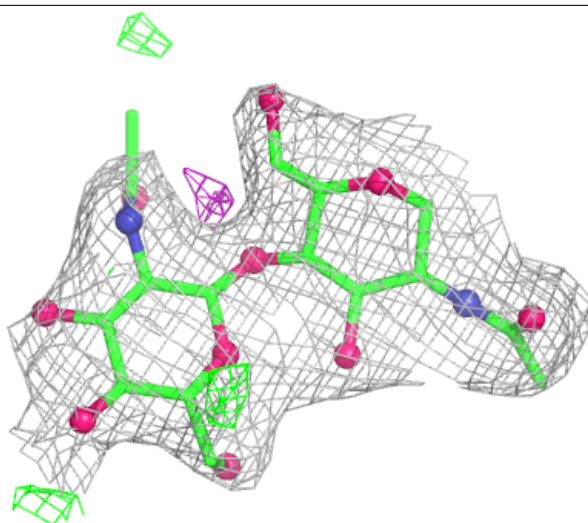
Electron density around Chain E:

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



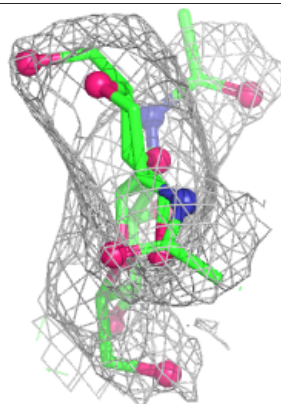
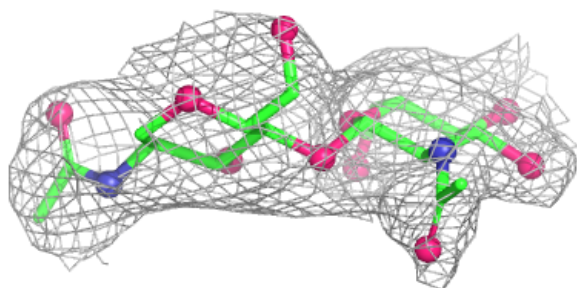
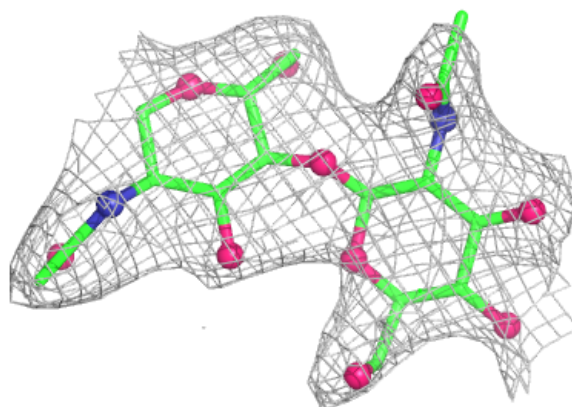
Electron density around Chain F:

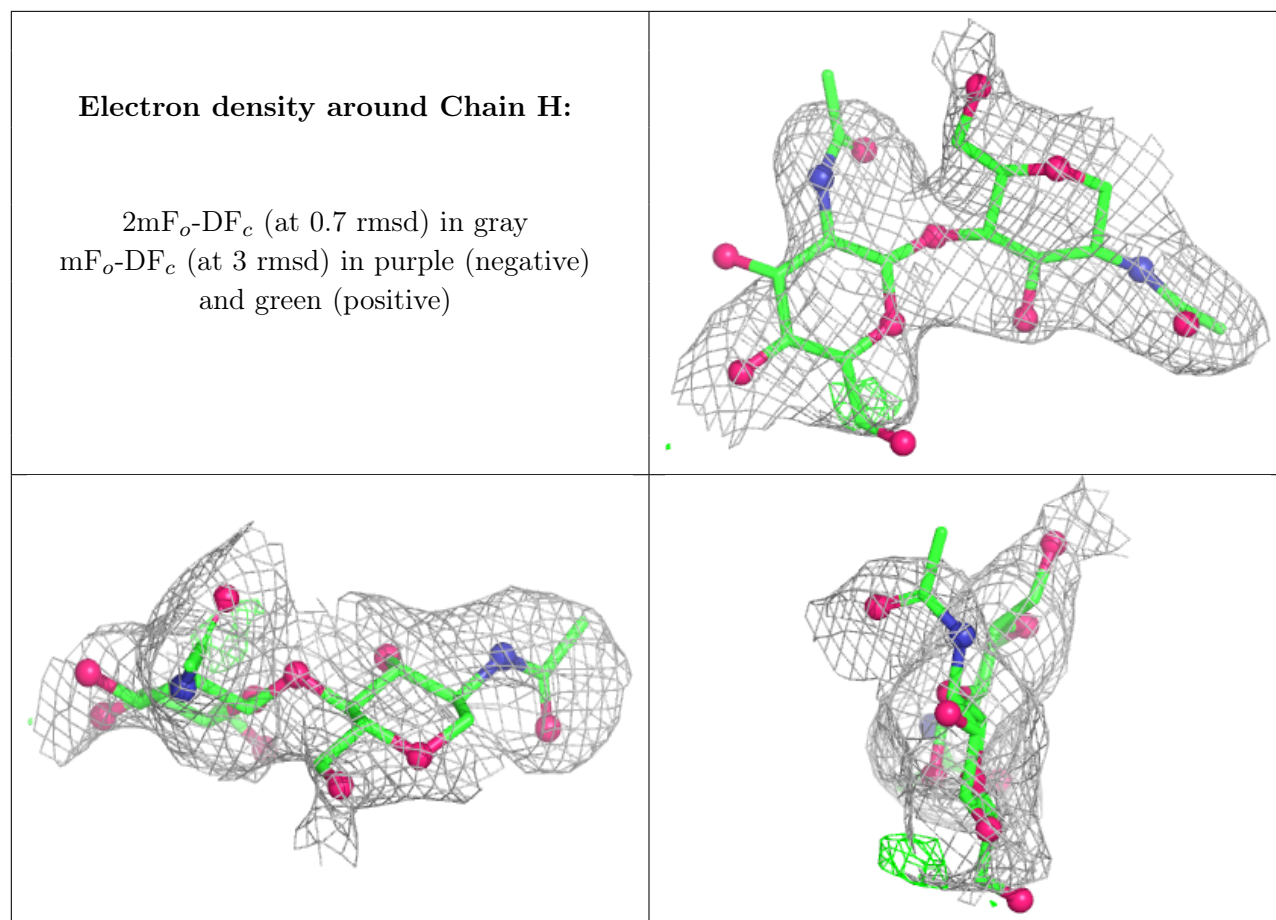
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain G:

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





6.4 Ligands [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	NAG	A	5010	14/15	0.68	0.18	89,99,107,108	0
5	NAG	A	5011	14/15	0.76	0.18	95,100,105,107	0
5	NAG	B	5005	14/15	0.83	0.12	77,87,89,89	0
5	NAG	D	2001	14/15	0.83	0.12	75,81,89,94	0
5	NAG	B	5007	14/15	0.84	0.13	83,90,98,100	0
5	NAG	B	5002	14/15	0.84	0.12	59,76,85,86	0
5	NAG	C	2001	14/15	0.85	0.12	65,73,75,76	0
5	NAG	B	5010	14/15	0.85	0.12	72,77,83,84	0
5	NAG	A	5005	14/15	0.86	0.12	70,79,84,85	0
5	NAG	A	5006	14/15	0.87	0.11	51,57,61,65	0
5	NAG	D	2002	14/15	0.88	0.10	63,72,77,77	0
5	NAG	A	5007	14/15	0.90	0.09	55,65,69,73	0

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	NAG	C	2002	14/15	0.90	0.12	55,65,72,76	0
5	NAG	A	5002	14/15	0.93	0.10	41,47,53,57	0
5	NAG	B	5006	14/15	0.93	0.08	48,57,63,64	0
4	ZN	B	5001	1/1	0.99	0.02	41,41,41,41	0
4	ZN	A	5001	1/1	0.99	0.04	43,43,43,43	0

6.5 Other polymers [i](#)

There are no such residues in this entry.