



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 07:05 AM UTC

PDB ID : 5T0E / pdb_00005t0e
Title : Crystal structure of H6 hemagglutinin G225D mutant from Taiwan (2013)
H6N1 influenza virus in complex with LSTa
Authors : Wilson, I.A.; Tzarum, N.; Zhu, X.
Deposited on : 2016-08-15
Resolution : 2.09 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

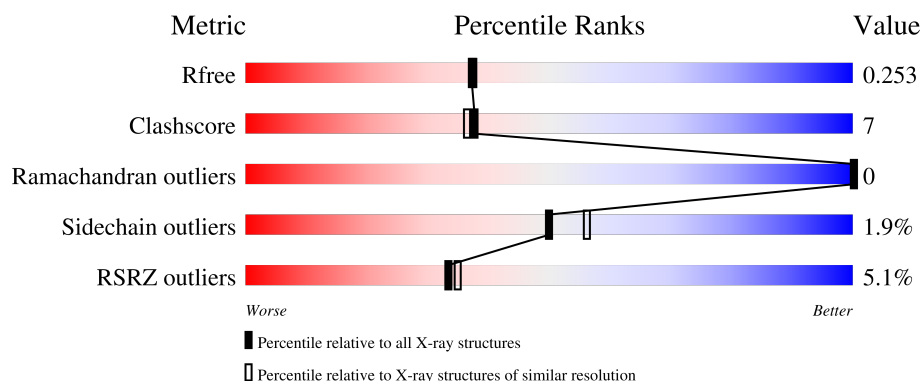
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.09 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	8172 (2.10-2.06)
Clashscore	190562	8714 (2.10-2.06)
Ramachandran outliers	187476	8641 (2.10-2.06)
Sidechain outliers	187428	8642 (2.10-2.06)
RSRZ outliers	180081	8177 (2.10-2.06)

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	333	8% 81%16%..
1	C	333	5% 80%15%..
1	E	333	3% 80%17%..
2	B	180	3% 80%16%..
2	D	180	4% 78%17%..

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Mol	Chain	Length	Quality of chain
2	F	180	4% 84% 12%
3	G	2	100%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12477 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 Hemagglutinin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	330	Total	C	N	O	S	0	0	0
			2604	1650	443	498	13			
1	C	325	Total	C	N	O	S	0	0	0
			2566	1627	436	490	13			
1	E	325	Total	C	N	O	S	0	0	0
			2569	1629	437	490	13			

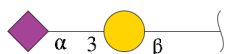
There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	225	ASP	GLY	engineered mutation	UNP A0A0J9X268
C	225	ASP	GLY	engineered mutation	UNP A0A0J9X268
E	225	ASP	GLY	engineered mutation	UNP A0A0J9X268

- Molecule 2 is a protein called Hemagglutinin HA2 chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	173	Total	C	N	O	S	0	0	0
			1393	868	244	274	7			
2	D	173	Total	C	N	O	S	0	0	0
			1393	868	244	274	7			
2	F	172	Total	C	N	O	S	0	0	0
			1385	862	243	273	7			

- 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 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



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

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	92	Total	O	0	0
			92	92		
5	B	67	Total	O	0	0
			67	67		
5	C	118	Total	O	0	0
			118	118		
5	D	56	Total	O	0	0
			56	56		

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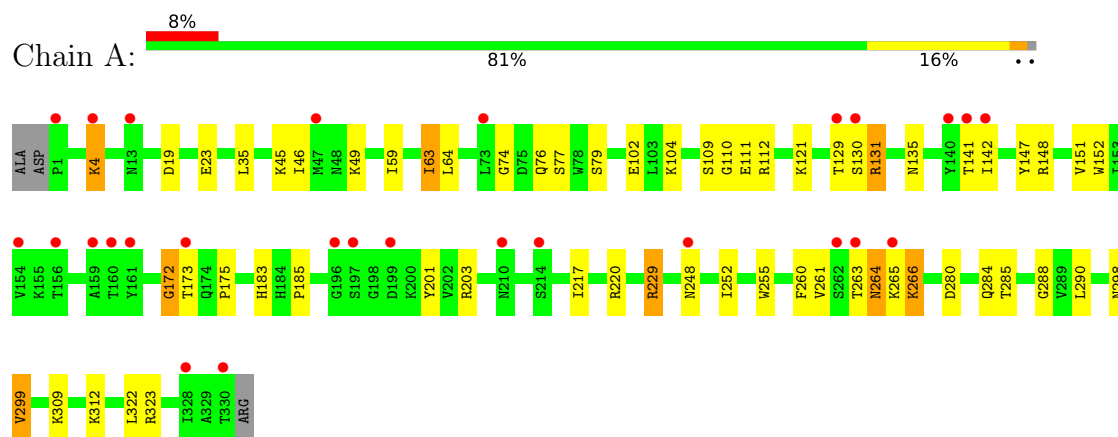
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	E	89	Total	O	0	0
			89	89		
5	F	57	Total	O	0	0
			57	57		

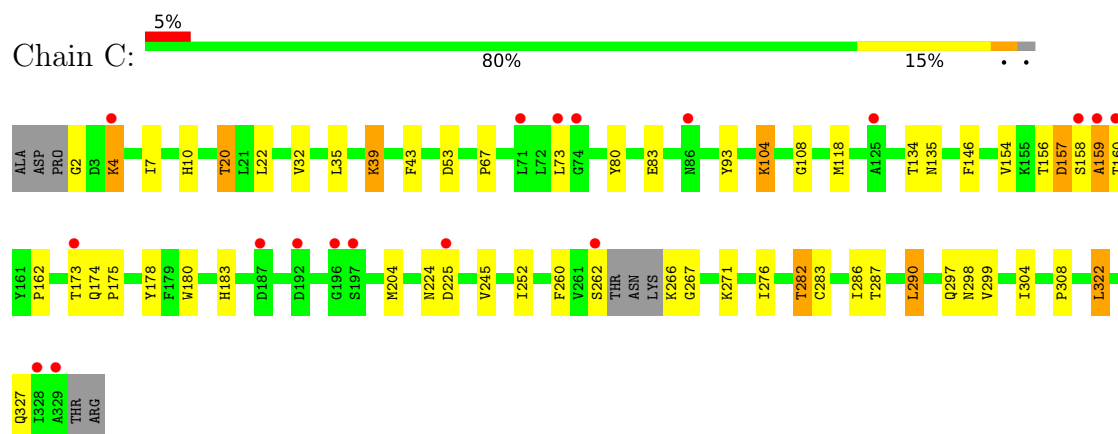
3 Residue-property plots [i](#)

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.

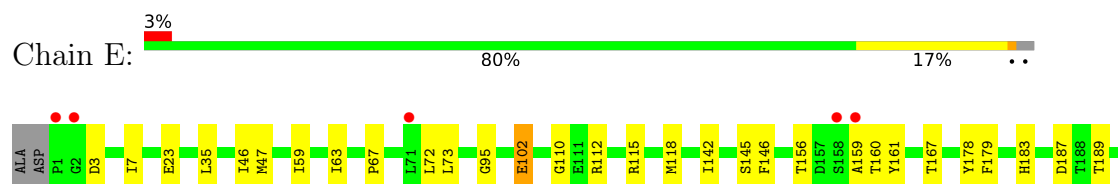
• Molecule 1: Hemagglutinin

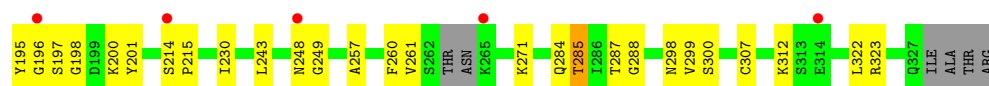


• Molecule 1: Hemagglutinin

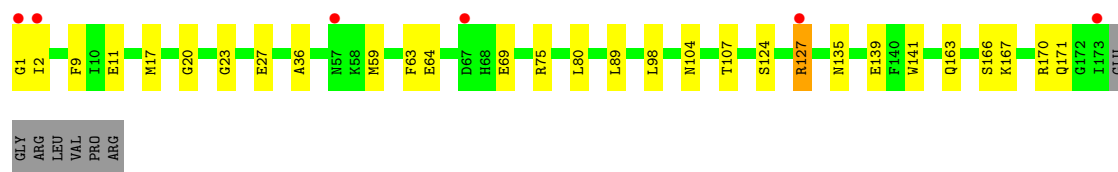
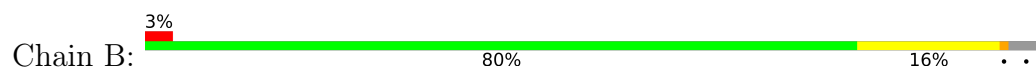


• Molecule 1: Hemagglutinin

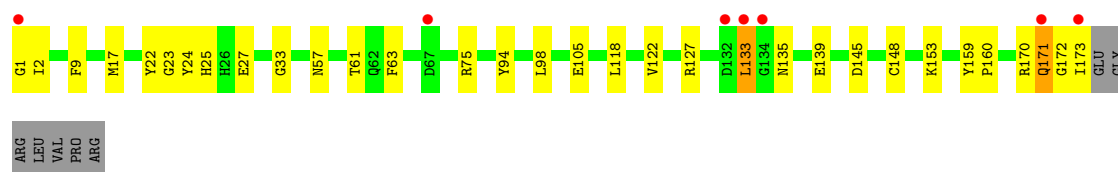
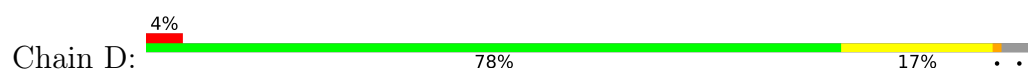




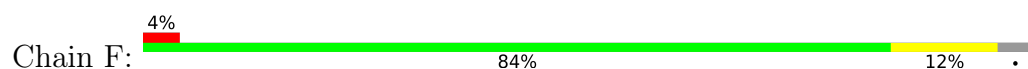
• Molecule 2: Hemagglutinin HA2 chain



• Molecule 2: Hemagglutinin HA2 chain



• Molecule 2: Hemagglutinin HA2 chain



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



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	185.11Å 99.21Å 133.39Å 90.00° 126.34° 90.00°	Depositor
Resolution (Å)	49.44 – 2.09 49.44 – 2.09	Depositor EDS
% Data completeness (in resolution range)	98.4 (49.44-2.09) 95.1 (49.44-2.09)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.78 (at 2.08Å)	Xtriage
Refinement program	PHENIX (1.10.1_2155: ???)	Depositor
R, R_{free}	0.214 , 0.253 0.217 , 0.253	Depositor DCC
R_{free} test set	5701 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	33.4	Xtriage
Anisotropy	0.542	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 51.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	12477	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.68% 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: SIA, GAL, 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	0.67	3/2666 (0.1%)	1.00	7/3628 (0.2%)
1	C	0.70	3/2626 (0.1%)	0.94	6/3572 (0.2%)
1	E	0.64	0/2630	0.94	2/3576 (0.1%)
2	B	0.67	0/1421	0.86	3/1913 (0.2%)
2	D	0.66	0/1421	0.92	5/1913 (0.3%)
2	F	0.64	0/1413	0.88	0/1902
All	All	0.66	6/12177 (0.0%)	0.93	23/16504 (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	A	0	1

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	4	LYS	CG-CD	6.57	1.72	1.52
1	C	39	LYS	C-N	-6.14	1.24	1.33
1	A	104	LYS	CE-NZ	6.01	1.67	1.49
1	C	104	LYS	CE-NZ	5.99	1.67	1.49
1	C	4	LYS	CG-CD	5.82	1.69	1.52
1	A	4	LYS	CD-CE	5.38	1.68	1.52

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	130	SER	N-CA-C	10.68	122.92	111.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	299	VAL	N-CA-C	9.78	119.72	110.53
1	A	74	GLY	N-CA-C	9.62	123.28	111.45
1	C	73	LEU	N-CA-C	8.88	120.96	111.28
1	A	172	GLY	N-CA-C	8.42	128.80	115.66
2	D	1	GLY	N-CA-C	-6.72	93.80	113.30
1	C	39	LYS	O-C-N	-6.60	115.34	123.33
1	A	288	GLY	N-CA-C	6.52	118.72	110.96
1	C	159	ALA	N-CA-C	6.42	119.01	110.53
2	B	127	ARG	CB-CA-C	-6.36	109.23	116.54
1	A	4	LYS	CD-CE-NZ	6.24	131.88	111.90
1	E	102	GLU	CA-CB-CG	5.98	126.06	114.10
2	B	1	GLY	N-CA-C	-5.89	96.22	113.30
2	B	63	PHE	N-CA-C	-5.72	102.43	110.50
1	C	4	LYS	CD-CE-NZ	5.71	130.16	111.90
1	C	322	LEU	N-CA-C	5.65	118.79	110.59
1	E	197	SER	N-CA-C	-5.64	102.41	110.59
2	D	172	GLY	N-CA-C	-5.60	106.01	112.73
1	C	282	THR	N-CA-C	-5.48	107.23	114.31
1	A	131	ARG	N-CA-C	5.36	119.45	113.01
2	D	133	LEU	N-CA-C	-5.24	103.11	110.35
2	D	127	ARG	CB-CA-C	-5.22	110.53	116.54
2	D	63	PHE	N-CA-C	-5.17	101.27	109.96

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	266	LYS	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	2604	0	2551	43	0
1	C	2566	0	2510	42	0
1	E	2569	0	2513	38	0
2	B	1393	0	1309	19	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	1393	0	1311	21	0
2	F	1385	0	1298	18	0
3	G	32	0	28	2	0
4	A	28	0	26	3	0
4	E	28	0	26	1	0
5	A	92	0	0	4	0
5	B	67	0	0	3	0
5	C	118	0	0	7	0
5	D	56	0	0	1	0
5	E	89	0	0	4	0
5	F	57	0	0	1	0
All	All	12477	0	11572	165	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 7.

All (165) 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:E:307:CYS:O	2:F:62:GLN:NE2	2.02	0.91
2:D:17:MET:SD	2:D:23:GLY:HA3	2.13	0.89
1:A:109:SER:O	1:A:263:THR:HG22	1.75	0.87
1:C:20:THR:HG22	1:C:22:LEU:H	1.41	0.84
2:B:170:ARG:NH2	5:B:201:HOH:O	2.05	0.82
1:A:111:GLU:HB3	1:A:263:THR:HB	1.60	0.81
1:E:198:GLY:O	5:E:501:HOH:O	1.98	0.81
2:B:17:MET:SD	2:B:23:GLY:HA3	2.23	0.78
1:C:156:THR:CG2	1:C:159:ALA:HB3	2.15	0.76
1:E:35:LEU:HD21	1:E:298:ASN:ND2	2.01	0.76
1:E:285:THR:HG22	1:E:287:THR:H	1.49	0.76
2:F:2:ILE:HD13	2:F:109:ASP:OD1	1.87	0.74
1:E:214:SER:OG	1:E:215:PRO:HD2	1.90	0.72
2:D:170:ARG:O	2:D:173:ILE:HG22	1.92	0.70
1:E:47:MET:SD	5:E:561:HOH:O	2.49	0.70
1:A:23:GLU:OE1	5:A:501:HOH:O	2.10	0.69
1:A:35:LEU:HD21	1:A:298:ASN:ND2	2.07	0.69
1:A:263:THR:OG1	1:A:265:LYS:HG2	1.93	0.68
1:A:183:HIS:HB2	1:A:252:ILE:HD11	1.75	0.67
2:B:139:GLU:OE2	5:B:202:HOH:O	2.13	0.66
2:D:171:GLN:HA	2:D:171:GLN:OE1	1.95	0.65
1:E:285:THR:HB	1:E:288:GLY:O	1.97	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:280:ASP:OD2	5:A:502:HOH:O	2.14	0.64
2:D:133:LEU:HD11	2:D:139:GLU:HB2	1.81	0.63
2:B:167:LYS:O	2:B:171:GLN:HG2	1.99	0.63
1:C:327:GLN:HG2	5:C:418:HOH:O	1.99	0.63
1:A:141:THR:HG23	1:A:142:ILE:HG13	1.80	0.62
1:E:118:MET:HE1	1:E:178:TYR:HB2	1.82	0.62
1:C:156:THR:HG21	1:C:159:ALA:HB3	1.83	0.61
2:B:69:GLU:OE1	5:B:203:HOH:O	2.17	0.60
1:C:156:THR:HG22	1:C:159:ALA:HB3	1.84	0.60
1:C:20:THR:HG22	1:C:22:LEU:N	2.15	0.59
1:A:102:GLU:OE2	2:D:75:ARG:N	2.29	0.59
1:C:67:PRO:HG3	1:C:146:PHE:O	2.03	0.59
2:D:57:ASN:ND2	5:D:203:HOH:O	2.36	0.59
1:A:102:GLU:HG3	5:A:525:HOH:O	2.02	0.58
2:D:17:MET:CE	2:D:23:GLY:HA3	2.32	0.58
1:A:77:SER:OG	5:A:503:HOH:O	2.17	0.58
2:F:3:PHE:CE1	2:F:113:ALA:HB2	2.39	0.58
1:C:4:LYS:NZ	2:D:25:HIS:NE2	2.49	0.57
1:C:4:LYS:HG2	2:D:27:GLU:HB3	1.87	0.57
1:C:266:LYS:O	1:C:304:ILE:HD11	2.05	0.57
1:A:152:TRP:CH2	3:G:2:SIA:H7	2.39	0.57
2:F:128:ASP:OD1	2:F:159:TYR:OH	2.16	0.56
1:A:121:LYS:HB3	1:A:129:THR:HG21	1.87	0.55
2:D:145:ASP:HB3	2:D:148:CYS:H	1.72	0.55
1:C:2:GLY:N	5:C:411:HOH:O	2.40	0.55
1:E:187:ASP:HB3	1:E:189:THR:H	1.72	0.55
1:A:23:GLU:CD	1:A:323:ARG:HH22	2.14	0.54
1:C:183:HIS:HB2	1:C:252:ILE:HD11	1.89	0.54
1:E:46:ILE:HD11	1:E:284:GLN:HB2	1.90	0.54
1:E:285:THR:HG23	1:E:300:SER:HB3	1.89	0.54
2:F:145:ASP:HB3	2:F:148:CYS:H	1.73	0.53
1:A:172:GLY:O	1:A:173:THR:OG1	2.24	0.53
1:E:7:ILE:HD11	2:F:122:VAL:HG21	1.90	0.53
2:B:11:GLU:HG3	2:B:135:ASN:OD1	2.08	0.53
1:E:285:THR:HG22	1:E:287:THR:N	2.21	0.53
1:A:201:TYR:CE2	1:A:248:ASN:HB2	2.44	0.53
1:E:63:ILE:HD13	1:E:179:PHE:CZ	2.45	0.52
1:E:102:GLU:HB2	5:E:550:HOH:O	2.09	0.52
1:E:23:GLU:CD	1:E:323:ARG:HH22	2.18	0.52
1:A:121:LYS:CG	1:A:129:THR:HG21	2.39	0.52
1:E:183:HIS:ND1	1:E:195:TYR:OH	2.42	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:46:ILE:HD11	1:A:284:GLN:HB2	1.92	0.51
1:E:118:MET:HE2	1:E:257:ALA:HB2	1.91	0.51
1:C:135:ASN:OD1	1:C:135:ASN:N	2.43	0.51
2:D:61:THR:HG21	2:F:90:ASP:CG	2.35	0.51
1:E:285:THR:HG21	1:E:299:VAL:HG12	1.91	0.51
1:A:151:VAL:HG23	1:A:255:TRP:HB2	1.91	0.51
1:E:142:ILE:HD11	1:E:145:SER:HB2	1.93	0.50
2:B:124:SER:O	2:B:127:ARG:NE	2.43	0.50
2:F:57:ASN:O	2:F:60:ASN:HB2	2.10	0.50
1:C:39:LYS:HD3	1:C:299:VAL:HG13	1.93	0.50
1:A:185:PRO:HD2	1:A:217:ILE:HG12	1.94	0.50
1:A:19:ASP:OD2	4:A:401:NAG:C8	2.60	0.50
1:A:309:LYS:NZ	2:B:59:MET:SD	2.84	0.50
2:D:24:TYR:HB2	2:D:153:LYS:HE2	1.93	0.49
1:A:112:ARG:HB3	1:A:261:VAL:CG1	2.42	0.49
1:A:110:GLY:HA3	1:A:260:PHE:CZ	2.47	0.49
1:E:161:TYR:CZ	1:E:249:GLY:HA2	2.46	0.49
1:C:156:THR:HG23	1:C:159:ALA:H	1.78	0.49
1:C:32:VAL:HG23	1:C:32:VAL:O	2.13	0.49
1:C:224:ASN:O	1:C:225:ASP:HB3	2.13	0.48
1:E:95:GLY:HA3	1:E:230:ILE:O	2.13	0.48
1:E:159:ALA:HB1	1:E:160:THR:HA	1.96	0.48
1:A:121:LYS:CD	1:A:129:THR:HG21	2.44	0.48
1:C:104:LYS:HD3	5:C:416:HOH:O	2.14	0.47
1:E:73:LEU:HD11	1:E:115:ARG:CZ	2.43	0.47
2:F:143:LYS:NZ	5:F:206:HOH:O	2.47	0.47
2:B:9:PHE:O	2:B:135:ASN:HA	2.14	0.47
1:A:64:LEU:O	1:A:147:TYR:HB3	2.14	0.47
1:C:286:ILE:HG23	1:C:287:THR:HG23	1.96	0.47
1:A:266:LYS:HE3	2:B:64:GLU:OE1	2.15	0.47
1:C:10:HIS:O	1:C:322:LEU:HD11	2.15	0.47
1:E:67:PRO:HG3	1:E:146:PHE:O	2.15	0.47
1:C:173:THR:HG23	1:C:174:GLN:HG3	1.98	0.46
1:C:157:ASP:OD1	1:C:157:ASP:N	2.37	0.46
2:F:145:ASP:N	2:F:148:CYS:HB3	2.30	0.46
2:D:173:ILE:HG23	2:D:173:ILE:O	2.15	0.46
1:A:201:TYR:CD1	1:A:203:ARG:HG3	2.51	0.46
1:C:282:THR:HG22	5:C:443:HOH:O	2.16	0.46
1:E:285:THR:CG2	1:E:287:THR:H	2.23	0.46
1:C:157:ASP:OD2	5:C:402:HOH:O	2.21	0.45
2:B:141:TRP:HB2	2:B:166:SER:HB2	1.98	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:83:GLU:O	1:C:271:LYS:HA	2.16	0.45
1:E:118:MET:HE1	1:E:178:TYR:CB	2.47	0.45
1:A:19:ASP:OD2	4:A:401:NAG:H81	2.17	0.45
1:E:271:LYS:NZ	2:F:69:GLU:OE2	2.26	0.45
2:F:38:ARG:NH1	2:F:42:GLN:OE1	2.47	0.45
1:C:35:LEU:HD21	1:C:298:ASN:ND2	2.31	0.45
1:A:49:LYS:HB2	1:A:79:SER:HB3	1.98	0.45
2:D:17:MET:HE1	2:D:23:GLY:C	2.43	0.44
1:C:175:PRO:HD2	1:C:260:PHE:O	2.16	0.44
1:E:201:TYR:CE1	1:E:248:ASN:HB2	2.52	0.44
1:C:283:CYS:SG	1:C:290:LEU:HB2	2.58	0.44
1:C:20:THR:HG23	2:D:105:GLU:HB2	1.98	0.44
1:A:264:ASN:OD1	1:A:264:ASN:N	2.35	0.44
2:B:104:ASN:HA	2:B:107:THR:HG22	2.00	0.44
1:C:7:ILE:HD11	2:D:122:VAL:HG21	2.00	0.43
1:C:53:ASP:HB2	1:C:276:ILE:HD12	2.00	0.43
1:E:59:ILE:O	1:E:63:ILE:HG13	2.18	0.43
1:A:23:GLU:OE2	1:A:323:ARG:NH2	2.51	0.43
2:D:17:MET:HE1	2:D:23:GLY:HA3	1.99	0.43
2:F:2:ILE:HD13	2:F:109:ASP:CG	2.43	0.43
1:C:271:LYS:NZ	5:C:416:HOH:O	2.51	0.43
1:C:262:SER:O	5:C:403:HOH:O	2.21	0.43
2:F:3:PHE:CD1	2:F:113:ALA:HB2	2.54	0.43
1:A:59:ILE:O	1:A:63:ILE:HG13	2.18	0.43
1:A:111:GLU:HG2	1:A:261:VAL:HG13	2.00	0.43
1:A:121:LYS:HD3	1:A:129:THR:HG21	2.01	0.43
4:A:401:NAG:O3	4:A:401:NAG:H82	2.19	0.42
1:C:160:THR:O	1:C:162:PRO:HD3	2.19	0.42
1:E:3:ASP:OD2	2:F:143:LYS:HD2	2.18	0.42
1:C:43:PHE:HB3	1:C:80:TYR:OH	2.19	0.42
1:E:112:ARG:HB3	1:E:261:VAL:CG1	2.50	0.42
2:B:20:GLY:HA3	2:B:36:ALA:CB	2.49	0.42
2:B:75:ARG:N	1:E:102:GLU:OE2	2.39	0.42
1:C:180:TRP:CD2	1:C:204:MET:HE1	2.55	0.42
2:D:25:HIS:ND1	2:D:33:GLY:O	2.51	0.42
2:D:9:PHE:O	2:D:135:ASN:HA	2.20	0.42
1:A:4:LYS:HG2	2:B:27:GLU:HB3	2.01	0.42
1:A:121:LYS:CB	1:A:129:THR:HG21	2.47	0.42
1:C:225:ASP:O	1:C:225:ASP:CG	2.62	0.42
4:E:402:NAG:O4	5:E:502:HOH:O	2.15	0.41
1:A:135:ASN:HD21	3:G:1:GAL:H4	1.85	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:201:TYR:HD1	1:A:203:ARG:HG3	1.86	0.41
1:C:204:MET:HG2	1:C:245:VAL:HG22	2.02	0.41
1:A:220:ARG:HB3	1:A:229:ARG:NH1	2.36	0.41
2:B:80:LEU:HD23	2:F:84:MET:HE2	2.01	0.41
1:C:108:GLY:O	1:C:267:GLY:HA3	2.20	0.41
2:D:94:TYR:OH	2:D:98:LEU:HD22	2.21	0.41
1:A:312:LYS:HE2	2:B:89:LEU:HD21	2.03	0.41
1:E:196:GLY:H	1:E:200:LYS:NZ	2.19	0.41
1:A:175:PRO:HD2	1:A:260:PHE:O	2.21	0.41
1:E:167:THR:HA	1:E:243:LEU:O	2.21	0.41
2:B:98:LEU:HD21	2:F:99:LEU:HD13	2.03	0.41
1:E:110:GLY:HA3	1:E:260:PHE:CZ	2.56	0.41
1:A:290:LEU:HD21	1:A:299:VAL:HG21	2.02	0.41
1:C:93:TYR:HD2	1:C:134:THR:HG21	1.85	0.41
1:E:46:ILE:HG22	1:E:47:MET:N	2.36	0.40
1:C:118:MET:HE1	1:C:178:TYR:HB2	2.03	0.40
1:E:312:LYS:HG3	2:F:89:LEU:HD11	2.02	0.40
2:B:20:GLY:HA3	2:B:36:ALA:HB1	2.03	0.40
1:C:297:GLN:HG2	1:C:308:PRO:HG2	2.03	0.40
2:D:159:TYR:HB3	2:D:160:PRO:HD3	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	328/333 (98%)	320 (98%)	8 (2%)	0	100	100
1	C	321/333 (96%)	312 (97%)	9 (3%)	0	100	100
1	E	321/333 (96%)	314 (98%)	7 (2%)	0	100	100
2	B	171/180 (95%)	169 (99%)	2 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	D	171/180 (95%)	168 (98%)	3 (2%)	0	100	100
2	F	170/180 (94%)	168 (99%)	2 (1%)	0	100	100
All	All	1482/1539 (96%)	1451 (98%)	31 (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	290/292 (99%)	281 (97%)	9 (3%)	35	38
1	C	285/292 (98%)	280 (98%)	5 (2%)	51	58
1	E	286/292 (98%)	282 (99%)	4 (1%)	59	66
2	B	147/153 (96%)	145 (99%)	2 (1%)	59	66
2	D	147/153 (96%)	143 (97%)	4 (3%)	39	43
2	F	146/153 (95%)	145 (99%)	1 (1%)	76	82
All	All	1301/1335 (98%)	1276 (98%)	25 (2%)	50	56

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	45	LYS
1	A	63	ILE
1	A	76	GLN
1	A	131	ARG
1	A	148	ARG
1	A	229	ARG
1	A	264	ASN
1	A	285	THR
1	A	322	LEU
2	B	2	ILE
2	B	163	GLN
1	C	20	THR

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Mol	Chain	Res	Type
1	C	154	VAL
1	C	157	ASP
1	C	158	SER
1	C	290	LEU
2	D	2	ILE
2	D	22	TYR
2	D	118	LEU
2	D	171	GLN
1	E	72	LEU
1	E	156	THR
1	E	285	THR
1	E	322	LEU
2	F	64	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	210	ASN
2	B	68	HIS
1	C	38	GLN
1	C	89	ASN
2	D	163	GLN
2	D	169	ASN
1	E	244	ASN
2	F	169	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 ⓘ

2 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	0.80	0	17,17,17	1.68	3 (17%)
3	SIA	G	2	3	20,20,21	1.08	2 (10%)	21,28,31	1.71	7 (33%)

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	-	2/2/22/22	0/1/1/1
3	SIA	G	2	3	-	4/18/34/38	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	G	2	SIA	C5-N5	-2.15	1.42	1.45
3	G	2	SIA	O1B-C1	-2.07	1.24	1.30

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	G	1	GAL	C1-C2-C3	3.91	118.34	110.36
3	G	2	SIA	O9-C9-C8	-3.41	104.00	111.16
3	G	2	SIA	C6-C5-N5	-3.07	106.01	110.91
3	G	1	GAL	O1-C1-C2	2.87	117.32	108.98
3	G	2	SIA	O8-C8-C9	2.69	115.15	109.03
3	G	2	SIA	O1B-C1-C2	2.61	119.50	112.71
3	G	2	SIA	O4-C4-C5	2.54	115.61	109.84
3	G	2	SIA	O7-C7-C6	-2.23	104.62	109.44
3	G	2	SIA	C9-C8-C7	2.07	116.39	112.17
3	G	1	GAL	C4-C3-C2	-2.02	107.28	110.83

There are no chirality outliers.

All (6) torsion outliers are listed below:

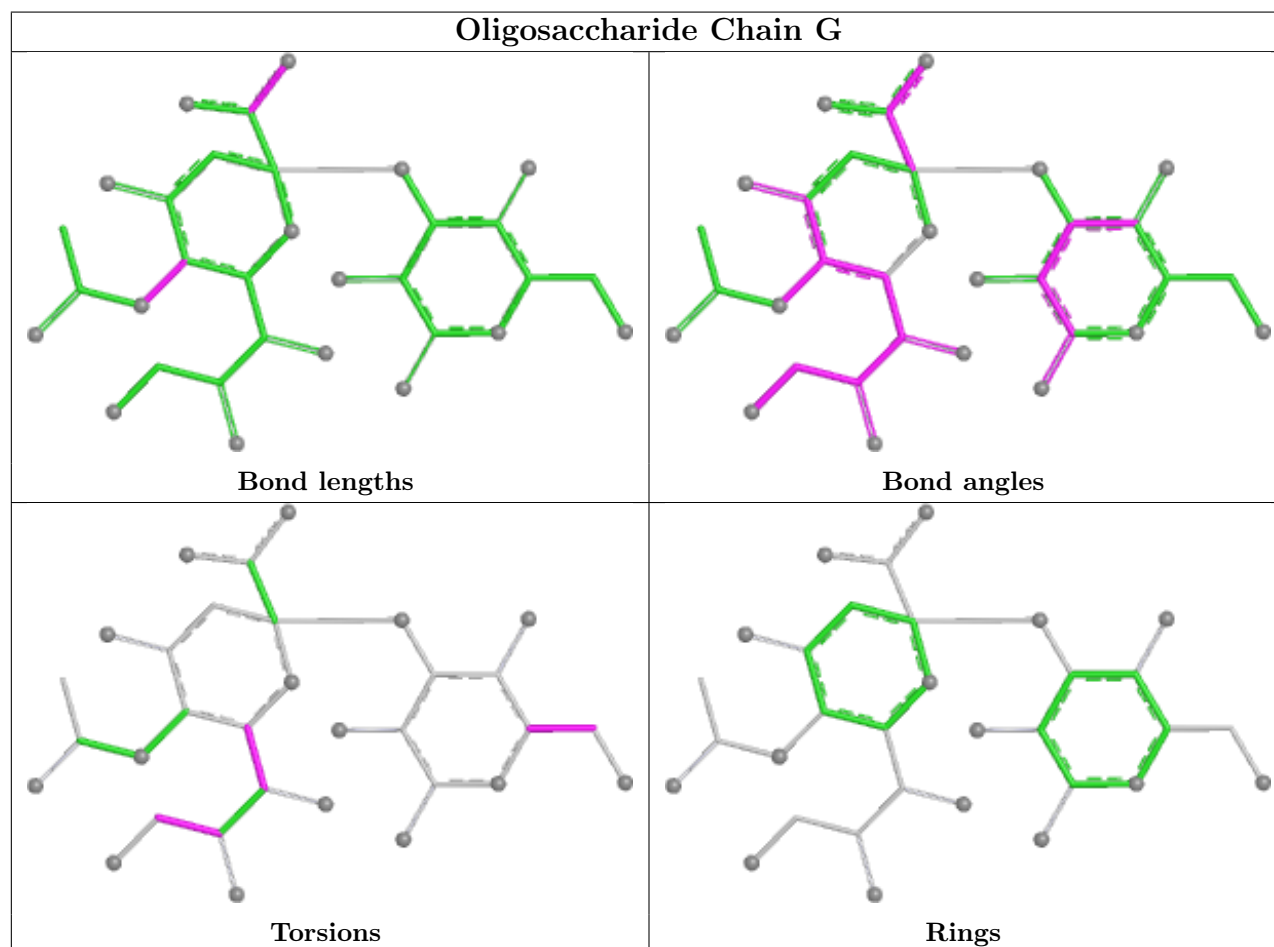
Mol	Chain	Res	Type	Atoms
3	G	2	SIA	C7-C8-C9-O9
3	G	1	GAL	O5-C5-C6-O6
3	G	2	SIA	O8-C8-C9-O9
3	G	1	GAL	C4-C5-C6-O6
3	G	2	SIA	O6-C6-C7-C8
3	G	2	SIA	O6-C6-C7-O7

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	G	1	GAL	1	0
3	G	2	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

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
4	NAG	E	401	1	14,14,15	0.50	0	17,19,21	1.54	3 (17%)
4	NAG	A	401	1	14,14,15	0.55	0	17,19,21	1.53	2 (11%)
4	NAG	A	402	1	14,14,15	0.66	0	17,19,21	1.84	5 (29%)
4	NAG	E	402	1	14,14,15	0.76	0	17,19,21	1.59	4 (23%)

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	NAG	E	401	1	-	4/6/23/26	0/1/1/1
4	NAG	A	401	1	-	4/6/23/26	0/1/1/1
4	NAG	A	402	1	-	0/6/23/26	0/1/1/1
4	NAG	E	402	1	-	4/6/23/26	0/1/1/1

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	401	NAG	C1-C2-N2	-5.23	102.19	110.43
4	A	402	NAG	C1-C2-N2	4.65	117.76	110.43
4	E	401	NAG	C2-N2-C7	3.72	127.88	122.90
4	A	402	NAG	C6-C5-C4	-3.71	103.91	113.02
4	E	402	NAG	C6-C5-C4	-3.57	104.26	113.02
4	E	402	NAG	O3-C3-C2	-3.05	103.07	109.40
4	E	401	NAG	C1-C2-N2	-2.93	105.82	110.43
4	E	401	NAG	C1-O5-C5	2.82	115.97	112.19
4	A	402	NAG	C1-O5-C5	2.75	115.87	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	E	402	NAG	C1-O5-C5	2.74	115.86	112.19
4	E	402	NAG	O5-C5-C6	2.74	113.00	107.66
4	A	402	NAG	C2-N2-C7	-2.33	119.78	122.90
4	A	402	NAG	O5-C5-C6	-2.28	103.22	107.66
4	A	401	NAG	C2-N2-C7	2.08	125.68	122.90

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	401	NAG	C8-C7-N2-C2
4	A	401	NAG	O7-C7-N2-C2
4	E	401	NAG	C8-C7-N2-C2
4	E	401	NAG	O7-C7-N2-C2
4	E	402	NAG	C8-C7-N2-C2
4	E	402	NAG	O7-C7-N2-C2
4	A	401	NAG	O5-C5-C6-O6
4	A	401	NAG	C4-C5-C6-O6
4	E	402	NAG	O5-C5-C6-O6
4	E	402	NAG	C4-C5-C6-O6
4	E	401	NAG	O5-C5-C6-O6
4	E	401	NAG	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	401	NAG	3	0
4	E	402	NAG	1	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	330/333 (99%)	0.58	27 (8%)	17 18	28, 44, 62, 75	0
1	C	325/333 (97%)	0.31	18 (5%)	30 32	30, 39, 55, 79	0
1	E	325/333 (97%)	0.33	10 (3%)	51 53	29, 40, 54, 75	0
2	B	173/180 (96%)	0.20	6 (3%)	47 49	26, 35, 52, 72	0
2	D	173/180 (96%)	0.34	7 (4%)	42 44	28, 37, 56, 76	0
2	F	172/180 (95%)	0.30	8 (4%)	36 38	28, 37, 53, 76	0
All	All	1498/1539 (97%)	0.37	76 (5%)	33 35	26, 39, 57, 79	0

All (76) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	F	1	GLY	7.4
1	A	1	PRO	7.2
2	D	1	GLY	7.1
2	B	1	GLY	6.7
1	C	196	GLY	5.1
1	A	159	ALA	4.9
1	C	74	GLY	4.9
2	F	2	ILE	4.6
1	C	160	THR	4.3
2	D	67	ASP	4.1
1	A	196	GLY	3.9
2	D	173	ILE	3.7
1	C	73	LEU	3.7
1	C	4	LYS	3.7
1	C	159	ALA	3.7
1	C	197	SER	3.6
2	B	173	ILE	3.4
1	E	159	ALA	3.4
1	E	71	LEU	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	248	ASN	3.3
1	C	86	ASN	3.3
1	A	160	THR	3.3
2	F	66	VAL	3.3
1	A	4	LYS	3.3
1	E	1	PRO	3.2
1	C	71	LEU	3.1
1	A	214	SER	3.1
1	A	129	THR	3.1
1	A	197	SER	3.1
1	A	47	MET	3.0
1	C	329	ALA	2.9
1	A	141	THR	2.8
1	C	328	ILE	2.8
1	A	210	ASN	2.8
2	D	133	LEU	2.7
2	D	171	GLN	2.7
1	C	225	ASP	2.7
1	A	262	SER	2.6
1	C	187	ASP	2.6
1	C	158	SER	2.6
1	A	140	TYR	2.6
1	A	142	ILE	2.6
1	A	161	TYR	2.6
1	E	158	SER	2.5
2	B	67	ASP	2.5
2	F	18	ILE	2.5
1	E	2	GLY	2.4
1	A	199	ASP	2.4
1	A	154	VAL	2.4
1	E	248	ASN	2.3
2	B	2	ILE	2.3
1	A	330	THR	2.3
1	C	192	ASP	2.3
1	E	265	LYS	2.3
1	E	314	GLU	2.2
2	F	164	LYS	2.2
1	A	73	LEU	2.2
2	D	132	ASP	2.2
2	F	145	ASP	2.2
2	F	133	LEU	2.1
1	A	173	THR	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	265	LYS	2.1
1	A	263	THR	2.1
1	C	173	THR	2.1
2	F	134	GLY	2.1
1	A	130	SER	2.1
2	B	57	ASN	2.1
1	A	328	ILE	2.1
1	A	13	ASN	2.0
2	B	127	ARG	2.0
1	E	196	GLY	2.0
1	C	262	SER	2.0
1	E	214	SER	2.0
1	C	125	ALA	2.0
1	A	156	THR	2.0
2	D	134	GLY	2.0

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

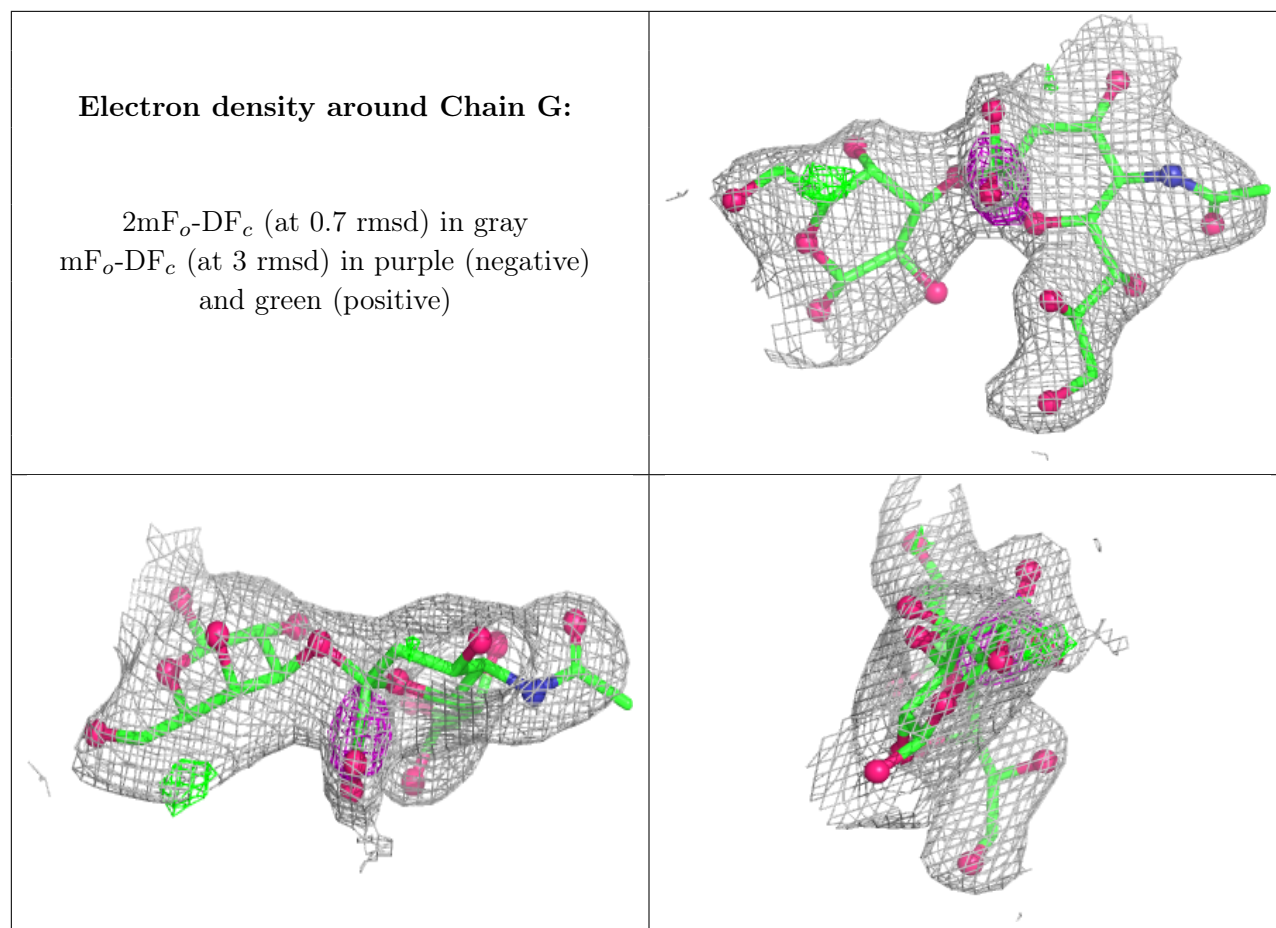
There are no non-standard protein/DNA/RNA residues in this entry.

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(Å ²)	Q<0.9
3	GAL	G	1	12/12	0.66	0.14	65,69,74,75	0
3	SIA	G	2	20/21	0.86	0.12	53,60,64,66	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.



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($\text{\AA}^2$)	Q<0.9
4	NAG	E	401	14/15	0.44	0.18	72,80,85,89	0
4	NAG	A	401	14/15	0.55	0.16	56,67,74,78	0
4	NAG	E	402	14/15	0.80	0.11	64,72,77,78	0
4	NAG	A	402	14/15	0.82	0.11	62,71,72,73	0

6.5 Other polymers [i](#)

There are no such residues in this entry.