



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 10:53 PM UTC

PDB ID : 4GZ8 / pdb\_00004gz8  
Title : Mouse Semaphorin 3A, domains Sema-PSI-IG  
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Deposited on : 2012-09-06  
Resolution : 3.30 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](mailto: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>.

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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

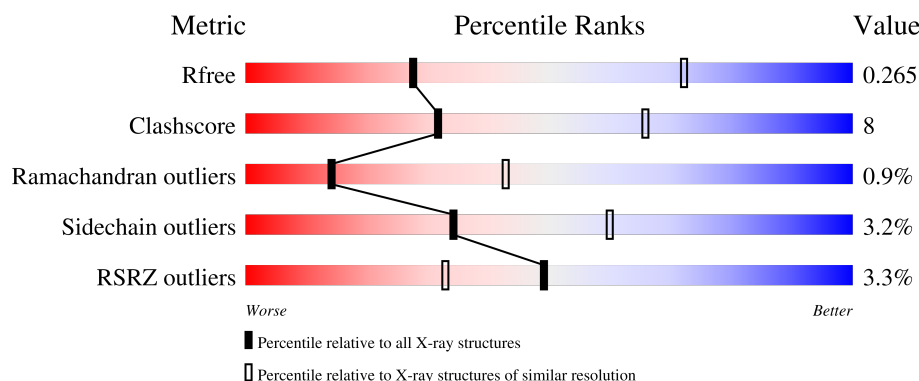
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.30 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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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  $\geq 3$ , 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	667	<div> <div>3%</div> <div> <div></div> <div>66%</div> <div>17%</div> <div>•</div> <div>16%</div> </div> </div>
1	B	667	<div> <div>2%</div> <div> <div></div> <div>65%</div> <div>16%</div> <div>•</div> <div>17%</div> </div> </div>
2	C	4	<div> <div></div> <div> <div>75%</div> <div>25%</div> </div> </div>
3	D	2	<div> <div></div> <div> <div>50%</div> <div>50%</div> </div> </div>
4	E	4	<div> <div></div> <div>100%</div> </div>

## 2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 8886 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 Semaphorin-3A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	557	Total	C	N	O	S	0	0	0
			4367	2766	759	817	25			
1	B	555	Total	C	N	O	S	0	0	0
			4364	2766	757	816	25			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	18	GLU	-	expression tag	UNP O08665
A	19	THR	-	expression tag	UNP O08665
A	20	GLY	-	expression tag	UNP O08665
A	475	VAL	ILE	SEE REMARK 999	UNP O08665
A	551	ALA	ARG	engineered mutation	UNP O08665
A	555	ALA	ARG	engineered mutation	UNP O08665
B	18	GLU	-	expression tag	UNP O08665
B	19	THR	-	expression tag	UNP O08665
B	20	GLY	-	expression tag	UNP O08665
B	475	VAL	ILE	SEE REMARK 999	UNP O08665
B	551	ALA	ARG	engineered mutation	UNP O08665
B	555	ALA	ARG	engineered mutation	UNP O08665

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	4	Total	C	N	O	0	0	0
			50	28	2	20			

- 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	D	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 4 is an oligosaccharide called alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	E	4	Total	C	N	O	0	0	0
			50	28	2	20			

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	3	Total	Ca	0	0
			3	3		
5	B	2	Total	Ca	0	0
			2	2		

- Molecule 6 is ACETATE ION (CCD ID: ACT) (formula: C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 7 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula:  $C_8H_{15}NO_6$ ).

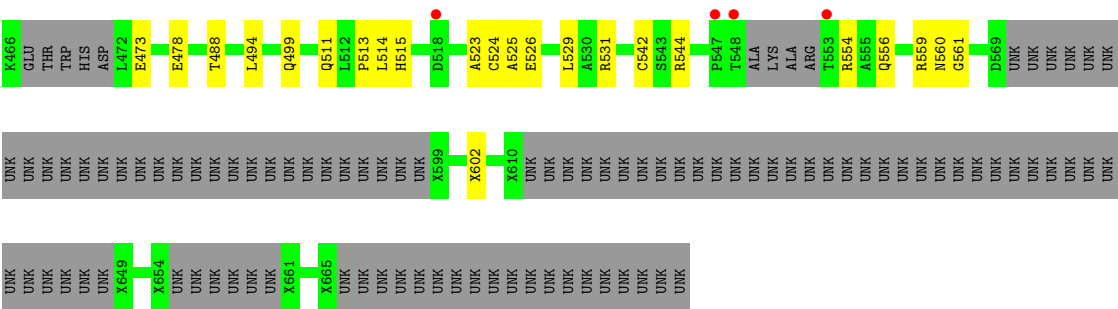


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	B	1	Total	C	N	O	0	0
			14	8	1	5		



- Molecule 1: Semaphorin-3A





• Molecule 2: alpha-D-mannopyranose-(1-3)-beta-D-mannopyranose-(1-4)-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 4: alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-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 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	97.63Å 126.17Å 161.48Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	77.00 – 3.30 77.00 – 3.30	Depositor EDS
% Data completeness (in resolution range)	97.1 (77.00-3.30) 97.3 (77.00-3.30)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.08 (at 3.33Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, $R_{free}$	0.213 , 0.265 0.215 , 0.265	Depositor DCC
$R_{free}$ test set	1505 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	59.4	Xtriage
Anisotropy	0.175	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 32.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.90	EDS
Total number of atoms	8886	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 12.68% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: MAN, NAG, BMA, CA, ACT

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z  > 5$	RMSZ	$\# Z  > 5$
1	A	0.71	0/4352	0.94	1/5905 (0.0%)
1	B	0.72	0/4362	0.97	12/5917 (0.2%)
All	All	0.72	0/8714	0.95	13/11822 (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	4
1	B	0	3
All	All	0	7

There are no bond length outliers.

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	152	ASP	N-CA-C	7.38	121.66	111.55
1	B	66	ARG	CA-C-N	-6.73	111.50	122.26
1	B	66	ARG	C-N-CA	-6.73	111.50	122.26
1	B	66	ARG	N-CA-C	-6.64	99.70	110.20
1	B	206	GLY	N-CA-C	6.50	119.48	112.33
1	B	554	ARG	N-CA-C	5.85	119.00	109.59
1	B	402	PHE	N-CA-C	-5.41	102.99	110.35
1	A	108	LYS	N-CA-C	5.25	117.49	110.35
1	B	108	LYS	N-CA-C	5.13	117.33	110.35
1	B	43	ASN	N-CA-C	5.10	118.77	112.24
1	B	138	HIS	CA-C-N	5.09	125.09	119.90
1	B	138	HIS	C-N-CA	5.09	125.09	119.90

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	465	PRO	N-CA-C	5.09	118.72	111.13

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	149	HIS	Peptide
1	A	206	GLY	Peptide
1	A	257	SER	Peptide
1	A	66	ARG	Peptide
1	B	148	HIS	Peptide
1	B	161	HIS	Peptide
1	B	205	LEU	Peptide

## 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	4367	0	4095	73	0
1	B	4364	0	4116	70	0
2	C	50	0	43	1	0
3	D	28	0	25	1	0
4	E	50	0	43	0	0
5	A	3	0	0	0	0
5	B	2	0	0	0	0
6	A	4	0	3	1	0
6	B	4	0	3	0	0
7	B	14	0	13	0	0
All	All	8886	0	8341	140	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 8.

All (140) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:150:PRO:HG2	1:A:152:ASP:CG	2.08	0.79
1:B:147:GLY:HA3	1:B:152:ASP:HA	1.65	0.79
1:A:170:PRO:HD3	1:A:177:THR:HG21	1.66	0.77
1:B:48:PHE:CZ	1:B:50:GLY:HA2	2.19	0.77
1:A:48:PHE:CZ	1:A:50:GLY:HA2	2.19	0.77
1:A:149:HIS:ND1	1:A:150:PRO:HA	2.01	0.75
1:B:63:ASP:O	1:B:66:ARG:O	2.05	0.74
1:B:274:GLY:O	1:B:392:THR:HG22	1.90	0.72
1:A:559:ARG:O	1:A:561:GLY:N	2.24	0.71
1:B:559:ARG:O	1:B:561:GLY:N	2.24	0.70
1:B:32:LEU:HD22	1:B:602:UNK:CB	2.22	0.70
1:A:195:MET:HE3	1:A:195:MET:HA	1.78	0.66
1:A:63:ASP:OD1	1:A:66:ARG:HG3	1.96	0.65
1:B:158:GLN:O	1:B:161:HIS:NE2	2.27	0.65
1:B:356:TYR:CD2	1:B:409:MET:HE1	2.32	0.65
1:A:356:TYR:CD2	1:A:409:MET:HE1	2.33	0.65
1:B:195:MET:HE3	1:B:195:MET:HA	1.79	0.64
1:A:295:VAL:HG11	1:B:334:ILE:HD11	1.78	0.64
1:A:374:PRO:HB2	1:A:399:VAL:HG12	1.79	0.64
1:B:148:HIS:O	1:B:152:ASP:HB3	1.97	0.64
1:A:292:ILE:O	1:A:415:PRO:HD3	1.99	0.63
1:A:453:THR:HG22	1:A:455:VAL:H	1.63	0.63
1:B:374:PRO:HB2	1:B:399:VAL:HG12	1.79	0.63
1:A:187:TYR:CE2	1:A:203:ARG:HD3	2.34	0.62
1:A:116:ASN:HA	1:A:134:THR:O	1.98	0.62
1:B:292:ILE:O	1:B:415:PRO:HD3	1.99	0.62
1:A:66:ARG:NH2	1:A:147:GLY:O	2.30	0.62
1:B:116:ASN:HA	1:B:134:THR:O	1.99	0.61
1:B:453:THR:HG22	1:B:455:VAL:H	1.65	0.61
1:B:454:ASP:HB2	1:B:488:THR:HG22	1.82	0.60
1:B:455:VAL:HG12	1:B:455:VAL:O	2.01	0.60
1:A:454:ASP:HB2	1:A:488:THR:HG22	1.82	0.60
1:B:382:PRO:HA	1:B:389:PHE:CZ	2.37	0.60
1:B:151:GLU:CG	1:B:151:GLU:O	2.51	0.59
1:B:464:VAL:HG13	1:B:473:GLU:HB3	1.84	0.59
1:A:455:VAL:HG12	1:A:455:VAL:O	2.03	0.59
1:B:203:ARG:NH2	1:B:211:ILE:HD12	2.18	0.59
1:B:187:TYR:CE2	1:B:203:ARG:HD3	2.38	0.58
1:A:39:MET:HB3	1:A:45:VAL:HG23	1.86	0.58
1:A:203:ARG:NH2	1:A:211:ILE:HD12	2.19	0.57
1:B:48:PHE:CE2	1:B:50:GLY:HA2	2.41	0.56
1:B:39:MET:HB3	1:B:45:VAL:HG23	1.88	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:48:PHE:CE2	1:A:50:GLY:HA2	2.40	0.55
1:A:158:GLN:OE1	3:D:2:NAG:O7	2.23	0.55
1:B:32:LEU:CD2	1:B:602:UNK:CB	2.85	0.54
1:A:334:ILE:HD11	1:B:295:VAL:HG11	1.88	0.54
1:A:598:UNK:CB	1:A:650:UNK:CB	2.85	0.54
1:A:66:ARG:O	1:A:68:ARG:N	2.41	0.54
1:B:278:SER:HB3	1:B:400:ILE:HG21	1.90	0.54
1:A:269:CYS:SG	1:A:285:THR:HG21	2.48	0.54
1:B:177:THR:HG23	1:B:190:THR:HB	1.89	0.54
1:B:420:PRO:HG2	1:B:423:ILE:HD11	1.90	0.54
1:B:269:CYS:SG	1:B:285:THR:HG21	2.47	0.54
1:A:277:ARG:HD2	1:A:397:ASP:OD2	2.10	0.52
1:A:499:GLN:HA	1:A:514:LEU:HD12	1.92	0.52
1:A:135:GLY:HA3	1:A:138:HIS:O	2.10	0.51
1:A:494:LEU:CD1	1:A:514:LEU:HD21	2.41	0.51
1:B:135:GLY:HA3	1:B:138:HIS:O	2.11	0.51
1:A:285:THR:HG22	1:A:285:THR:O	2.11	0.51
1:B:494:LEU:CD1	1:B:514:LEU:HD21	2.41	0.51
1:A:523:ALA:HB3	1:A:526:GLU:OE1	2.11	0.50
1:A:31:ARG:NH2	1:A:529:LEU:O	2.44	0.50
1:A:420:PRO:HG2	1:A:423:ILE:HD11	1.93	0.50
1:A:46:ILE:HB	1:A:511:GLN:HB3	1.92	0.50
1:B:523:ALA:HB3	1:B:526:GLU:OE1	2.11	0.50
1:A:524:CYS:O	1:A:525:ALA:C	2.55	0.50
1:B:499:GLN:HA	1:B:514:LEU:HD12	1.92	0.50
1:B:151:GLU:O	1:B:151:GLU:HG3	2.12	0.50
1:B:46:ILE:HB	1:B:511:GLN:HB3	1.92	0.50
1:A:433:GLN:HE21	1:A:491:ALA:HA	1.76	0.49
1:A:177:THR:HG22	1:A:190:THR:OG1	2.12	0.49
1:B:158:GLN:C	1:B:161:HIS:HE2	2.20	0.49
1:B:524:CYS:O	1:B:525:ALA:C	2.55	0.49
1:B:269:CYS:N	1:B:285:THR:HG21	2.28	0.49
1:B:285:THR:O	1:B:285:THR:HG22	2.11	0.49
1:A:330:THR:HG21	1:B:335:PHE:CZ	2.48	0.48
1:A:269:CYS:N	1:A:285:THR:HG21	2.28	0.48
1:A:375:TYR:HA	1:A:376:PRO:C	2.38	0.48
1:B:26:LYS:HB2	1:B:423:ILE:HB	1.96	0.47
1:B:441:ALA:HB1	1:B:556:GLN:OE1	2.13	0.47
1:A:150:PRO:HG2	1:A:152:ASP:CB	2.43	0.47
1:A:120:VAL:HB	1:A:132:CYS:HB2	1.95	0.47
1:B:375:TYR:HA	1:B:376:PRO:C	2.40	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:153:ASN:O	1:A:153:ASN:ND2	2.48	0.47
1:A:44:ASN:ND2	6:A:810:ACT:OXT	2.47	0.47
2:C:3:BMA:O2	2:C:4:MAN:O5	2.30	0.47
1:B:148:HIS:ND1	1:B:149:HIS:N	2.63	0.47
1:B:149:HIS:N	1:B:150:PRO:CD	2.77	0.47
1:B:171:TYR:CD2	1:B:194:PHE:HA	2.49	0.47
1:A:441:ALA:HB1	1:A:556:GLN:OE1	2.13	0.47
1:A:269:CYS:O	1:A:270:LYS:C	2.58	0.46
1:B:244:TYR:HA	1:B:266:GLY:O	2.15	0.46
1:B:278:SER:HB3	1:B:400:ILE:CG2	2.45	0.46
1:B:342:MET:HE2	1:B:421:ILE:HD11	1.98	0.46
1:B:352:PHE:O	1:B:377:ARG:NH1	2.49	0.46
1:A:161:HIS:O	1:A:162:PHE:C	2.59	0.45
1:B:39:MET:HE3	1:B:45:VAL:CG2	2.46	0.45
1:A:39:MET:HE3	1:A:45:VAL:CG2	2.46	0.45
1:A:310:ASP:CG	1:A:433:GLN:OE1	2.59	0.45
1:B:134:THR:HG23	1:B:171:TYR:O	2.17	0.45
1:B:44:ASN:O	1:B:513:PRO:HD3	2.17	0.45
1:A:244:TYR:HA	1:A:266:GLY:O	2.17	0.45
1:A:451:ILE:O	1:A:458:VAL:HA	2.17	0.44
1:B:215:GLN:O	1:B:216:HIS:C	2.60	0.44
1:A:335:PHE:CZ	1:B:330:THR:HG21	2.53	0.44
1:A:342:MET:HE2	1:A:421:ILE:HD11	1.99	0.44
1:A:44:ASN:O	1:A:513:PRO:HD3	2.17	0.44
1:A:134:THR:HG23	1:A:171:TYR:O	2.17	0.44
1:B:120:VAL:HB	1:B:132:CYS:HB2	1.99	0.43
1:A:68:ARG:HD3	1:A:79:SER:OG	2.19	0.43
1:A:352:PHE:O	1:A:377:ARG:NH1	2.52	0.43
1:B:454:ASP:CB	1:B:488:THR:HG22	2.48	0.43
1:A:515:HIS:NE2	1:A:544:ARG:HD3	2.34	0.43
1:B:141:CYS:SG	1:B:168:LYS:HD3	2.59	0.43
1:B:455:VAL:O	1:B:455:VAL:CG1	2.66	0.43
1:B:515:HIS:NE2	1:B:544:ARG:HD3	2.34	0.43
1:A:215:GLN:O	1:A:216:HIS:C	2.62	0.42
1:A:254:GLY:HA2	1:A:359:ARG:NH2	2.34	0.42
1:B:451:ILE:O	1:B:458:VAL:HA	2.19	0.42
1:A:185:GLU:HG2	1:A:206:GLY:HA2	2.01	0.42
1:B:529:LEU:O	1:B:531:ARG:HG2	2.18	0.42
1:A:529:LEU:O	1:A:531:ARG:HG2	2.19	0.42
1:A:272:ASP:OD1	1:A:272:ASP:C	2.62	0.42
1:B:63:ASP:OD1	1:B:66:ARG:HD2	2.20	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:454:ASP:CB	1:A:488:THR:HG22	2.49	0.42
1:A:498:GLN:O	1:A:500:GLN:HG2	2.19	0.42
1:A:141:CYS:SG	1:A:168:LYS:HD3	2.60	0.42
1:A:187:TYR:HA	1:A:202:PHE:O	2.20	0.42
1:A:150:PRO:HG2	1:A:152:ASP:HB2	2.02	0.41
1:A:438:ARG:HD3	1:A:447:ASP:OD1	2.19	0.41
1:A:455:VAL:O	1:A:455:VAL:CG1	2.67	0.41
1:B:263:ALA:C	1:B:264:ARG:HG2	2.44	0.41
1:A:150:PRO:HB2	1:A:151:GLU:C	2.46	0.41
1:A:171:TYR:CD2	1:A:194:PHE:HA	2.54	0.41
1:B:272:ASP:OD1	1:B:272:ASP:C	2.64	0.41
1:B:54:SER:OG	1:B:55:SER:N	2.54	0.41
1:B:187:TYR:HA	1:B:202:PHE:O	2.21	0.41
1:B:269:CYS:O	1:B:270:LYS:C	2.63	0.40
1:B:423:ILE:HD13	1:B:423:ILE:HA	1.90	0.40
1:A:150:PRO:HB2	1:A:152:ASP:OD1	2.21	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	523/667 (78%)	470 (90%)	48 (9%)	5 (1%)	12	40
1	B	524/667 (79%)	474 (90%)	46 (9%)	4 (1%)	16	45
All	All	1047/1334 (78%)	944 (90%)	94 (9%)	9 (1%)	14	43

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	149	HIS
1	A	67	SER

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Mol	Chain	Res	Type
1	A	385	THR
1	A	560	ASN
1	B	385	THR
1	B	560	ASN
1	B	162	PHE
1	B	542	CYS
1	A	542	CYS

### 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	467/483 (97%)	453 (97%)	14 (3%)	36	61
1	B	469/483 (97%)	453 (97%)	16 (3%)	32	59
All	All	936/966 (97%)	906 (97%)	30 (3%)	34	60

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	31	ARG
1	A	62	LEU
1	A	66	ARG
1	A	98	THR
1	A	110	ILE
1	A	149	HIS
1	A	160	SER
1	A	176	LEU
1	A	257	SER
1	A	316	SER
1	A	317	LYS
1	A	359	ARG
1	A	478	GLU
1	A	564	LEU
1	B	62	LEU
1	B	98	THR

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Mol	Chain	Res	Type
1	B	110	ILE
1	B	149	HIS
1	B	151	GLU
1	B	160	SER
1	B	161	HIS
1	B	176	LEU
1	B	257	SER
1	B	278	SER
1	B	316	SER
1	B	317	LYS
1	B	359	ARG
1	B	365	GLN
1	B	464	VAL
1	B	478	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	161	HIS
1	A	365	GLN
1	A	430	GLN
1	A	499	GLN
1	A	566	HIS
1	B	281	ASN
1	B	299	ASN
1	B	430	GLN
1	B	566	HIS

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

10 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	$\# Z  > 2$
2	NAG	C	1	1,2	14,14,15	0.64	0	17,19,21	2.68	5 (29%)
2	NAG	C	2	2	14,14,15	0.53	0	17,19,21	3.25	6 (35%)
2	BMA	C	3	2	11,11,12	0.55	0	15,15,17	0.83	0
2	MAN	C	4	2	11,11,12	0.79	0	15,15,17	1.41	2 (13%)
3	NAG	D	1	1,3	14,14,15	0.69	0	17,19,21	1.61	4 (23%)
3	NAG	D	2	3	14,14,15	0.80	0	17,19,21	1.58	2 (11%)
4	NAG	E	1	1,4	14,14,15	0.70	0	17,19,21	2.41	5 (29%)
4	NAG	E	2	4	14,14,15	0.55	0	17,19,21	1.86	6 (35%)
4	BMA	E	3	4	11,11,12	0.87	0	15,15,17	1.88	3 (20%)
4	MAN	E	4	4	11,11,12	0.74	0	15,15,17	1.29	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
2	NAG	C	1	1,2	-	3/6/23/26	0/1/1/1
2	NAG	C	2	2	-	3/6/23/26	0/1/1/1
2	BMA	C	3	2	-	2/2/19/22	0/1/1/1
2	MAN	C	4	2	-	2/2/19/22	0/1/1/1
3	NAG	D	1	1,3	-	4/6/23/26	0/1/1/1
3	NAG	D	2	3	-	2/6/23/26	0/1/1/1
4	NAG	E	1	1,4	-	3/6/23/26	0/1/1/1
4	NAG	E	2	4	-	2/6/23/26	0/1/1/1
4	BMA	E	3	4	-	2/2/19/22	0/1/1/1
4	MAN	E	4	4	-	2/2/19/22	0/1/1/1

There are no bond length outliers.

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	1	NAG	C1-O5-C5	8.65	123.78	112.19
2	C	2	NAG	C1-C2-N2	8.21	123.38	110.43
4	E	1	NAG	C1-O5-C5	6.79	121.29	112.19
2	C	2	NAG	C2-N2-C7	5.46	130.22	122.90
2	C	2	NAG	C1-O5-C5	5.22	119.18	112.19
2	C	2	NAG	O5-C1-C2	-4.68	104.04	111.29
3	D	2	NAG	C4-C3-C2	4.46	117.55	111.02
4	E	1	NAG	C8-C7-N2	4.03	122.80	116.12
4	E	3	BMA	C2-C3-C4	4.00	117.90	110.86
2	C	1	NAG	C8-C7-N2	3.81	122.44	116.12
3	D	1	NAG	C8-C7-N2	3.68	122.23	116.12
4	E	2	NAG	C1-C2-N2	3.62	116.13	110.43
2	C	2	NAG	C4-C3-C2	-3.57	105.78	111.02
4	E	3	BMA	C3-C4-C5	3.45	116.48	110.23
4	E	3	BMA	C1-O5-C5	-3.41	107.61	112.19
4	E	4	MAN	C1-O5-C5	3.18	116.45	112.19
3	D	1	NAG	O7-C7-C8	-3.13	116.48	122.05
2	C	4	MAN	C3-C4-C5	3.08	115.81	110.23
4	E	1	NAG	O5-C5-C4	2.87	117.80	110.83
2	C	4	MAN	C2-C3-C4	2.83	115.83	110.86
2	C	1	NAG	O5-C5-C4	2.74	117.50	110.83
4	E	2	NAG	O3-C3-C2	-2.71	103.77	109.40
2	C	1	NAG	O5-C5-C6	-2.63	102.54	107.66
4	E	2	NAG	C1-O5-C5	2.63	115.71	112.19
4	E	1	NAG	O7-C7-N2	-2.60	117.39	121.98
3	D	1	NAG	C2-N2-C7	2.52	126.27	122.90
4	E	1	NAG	O5-C1-C2	-2.45	107.50	111.29
3	D	1	NAG	C1-C2-N2	-2.44	106.59	110.43
2	C	2	NAG	O4-C4-C3	2.34	115.89	110.38
4	E	2	NAG	C4-C3-C2	2.33	114.44	111.02
4	E	2	NAG	C2-N2-C7	2.25	125.92	122.90
4	E	2	NAG	O4-C4-C3	2.24	115.67	110.38
2	C	1	NAG	O3-C3-C2	-2.04	105.16	109.40
3	D	2	NAG	C1-O5-C5	-2.01	109.49	112.19

There are no chirality outliers.

All (25) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	2	NAG	C1-C2-N2-C7
3	D	2	NAG	C1-C2-N2-C7
3	D	2	NAG	C3-C2-N2-C7
2	C	2	NAG	O5-C5-C6-O6

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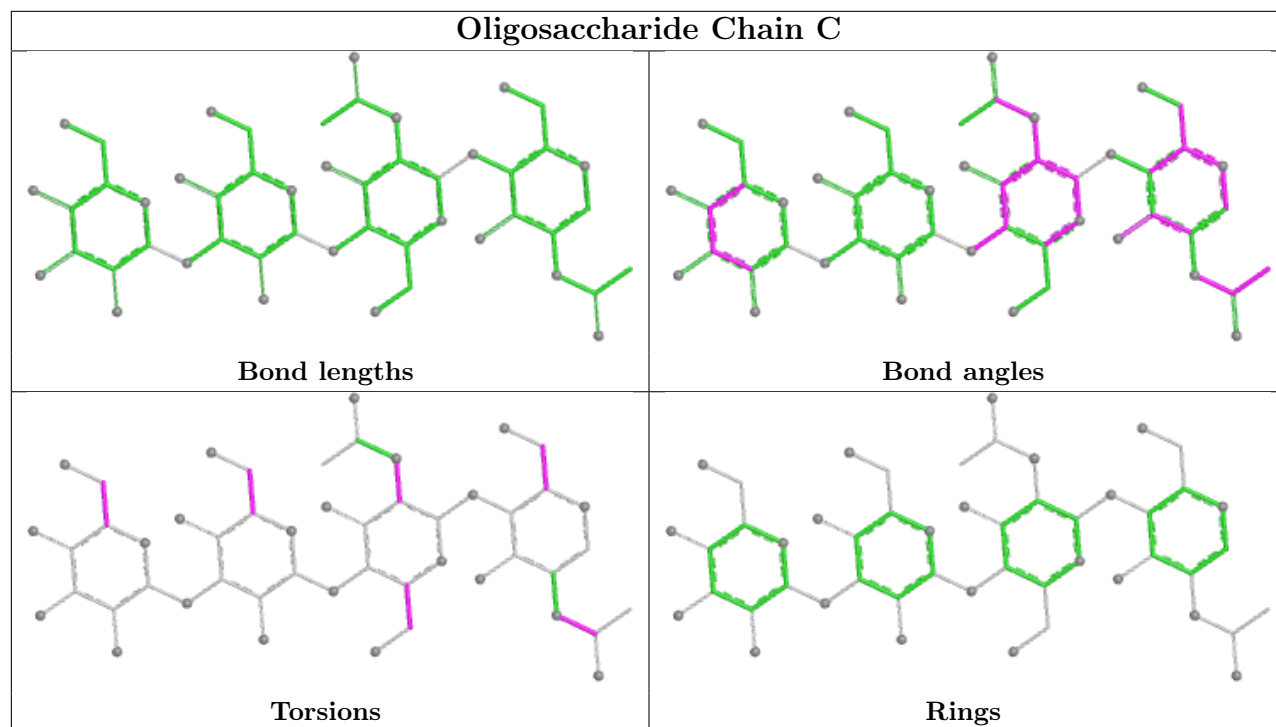
Mol	Chain	Res	Type	Atoms
4	E	2	NAG	O5-C5-C6-O6
2	C	3	BMA	O5-C5-C6-O6
2	C	3	BMA	C4-C5-C6-O6
2	C	2	NAG	C4-C5-C6-O6
4	E	2	NAG	C4-C5-C6-O6
2	C	4	MAN	O5-C5-C6-O6
4	E	4	MAN	C4-C5-C6-O6
4	E	3	BMA	O5-C5-C6-O6
2	C	1	NAG	C8-C7-N2-C2
2	C	1	NAG	O7-C7-N2-C2
3	D	1	NAG	C8-C7-N2-C2
3	D	1	NAG	O7-C7-N2-C2
4	E	1	NAG	C8-C7-N2-C2
4	E	1	NAG	O7-C7-N2-C2
2	C	4	MAN	C4-C5-C6-O6
4	E	4	MAN	O5-C5-C6-O6
4	E	3	BMA	C4-C5-C6-O6
3	D	1	NAG	O5-C5-C6-O6
3	D	1	NAG	C4-C5-C6-O6
2	C	1	NAG	C4-C5-C6-O6
4	E	1	NAG	C4-C5-C6-O6

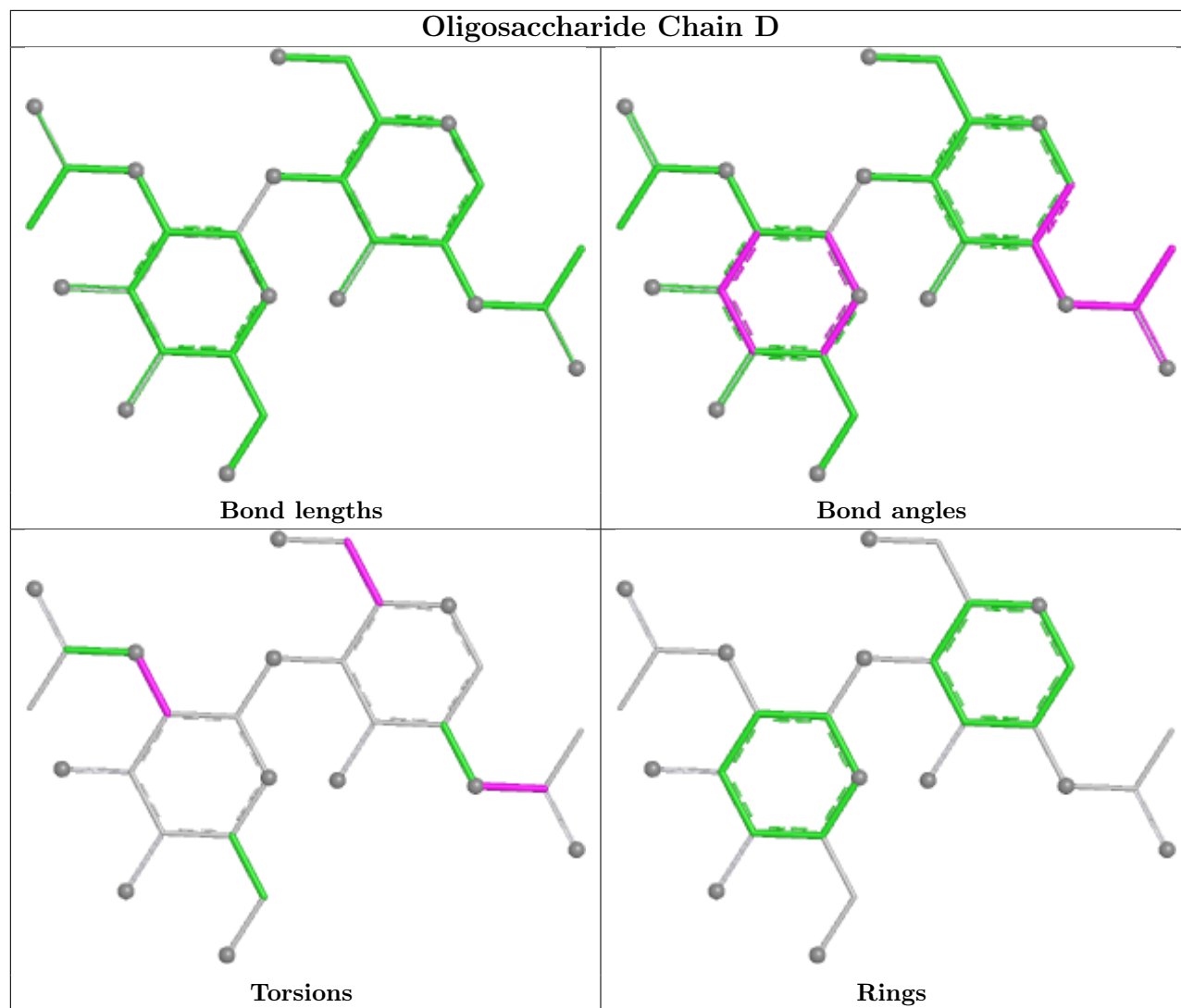
There are no ring outliers.

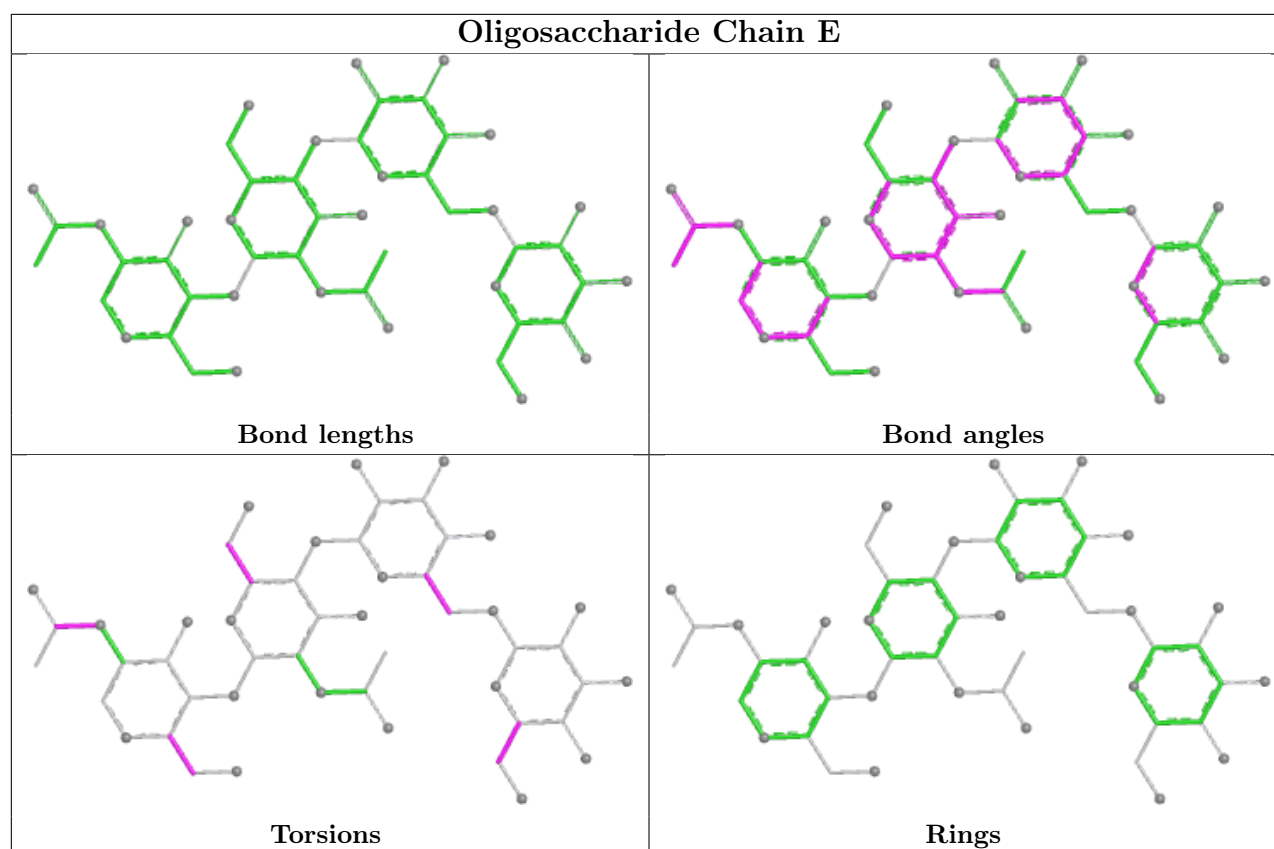
3 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	3	BMA	1	0
2	C	4	MAN	1	0
3	D	2	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 8 ligands modelled in this entry, 5 are monoatomic - leaving 3 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	$\# Z  > 2$
6	ACT	B	808	-	3,3,3	0.82	0	3,3,3	0.79	0
6	ACT	A	810	-	3,3,3	1.01	0	3,3,3	0.24	0
7	NAG	B	807	1	14,14,15	0.66	0	17,19,21	2.67	6 (35%)

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
7	NAG	B	807	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	807	NAG	C1-O5-C5	6.26	120.58	112.19
7	B	807	NAG	O5-C1-C2	-5.71	102.46	111.29
7	B	807	NAG	C8-C7-N2	3.87	122.54	116.12
7	B	807	NAG	O7-C7-N2	-3.27	116.20	121.98
7	B	807	NAG	C6-C5-C4	-2.72	106.35	113.02
7	B	807	NAG	O5-C5-C4	2.11	115.95	110.83

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	B	807	NAG	C8-C7-N2-C2
7	B	807	NAG	O7-C7-N2-C2

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	810	ACT	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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	531/667 (79%)	0.13	20 (3%)	44 30	24, 50, 102, 174	0
1	B	532/667 (79%)	0.10	15 (2%)	55 36	29, 49, 93, 147	0
All	All	1063/1334 (79%)	0.12	35 (3%)	49 33	24, 49, 97, 174	0

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	386	PHE	6.0
1	A	386	PHE	5.4
1	A	256	HIS	5.3
1	B	253	ASP	4.6
1	B	388	GLY	3.9
1	B	387	GLY	3.7
1	A	389	PHE	3.5
1	A	547	PRO	3.3
1	B	518	ASP	3.2
1	B	26	LYS	3.2
1	B	257	SER	3.2
1	B	553	THR	3.2
1	A	254	GLY	3.2
1	B	548	THR	3.1
1	A	153	ASN	3.0
1	A	472	LEU	2.9
1	A	388	GLY	2.9
1	B	299	ASN	2.9
1	A	387	GLY	2.8
1	A	150	PRO	2.7
1	A	27	ASN	2.7
1	B	389	PHE	2.6
1	A	148	HIS	2.5
1	B	547	PRO	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	299	ASN	2.4
1	A	257	SER	2.3
1	A	553	THR	2.3
1	B	403	ALA	2.2
1	B	176	LEU	2.2
1	A	363	ASN	2.2
1	B	417	ASN	2.2
1	A	385	THR	2.1
1	A	568	SER	2.1
1	A	161	HIS	2.0
1	A	253	ASP	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](#)

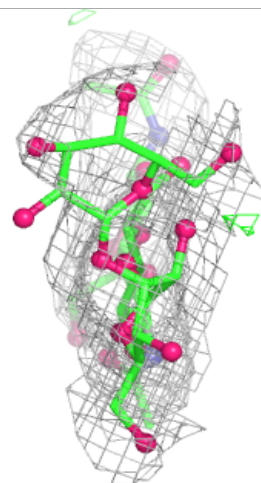
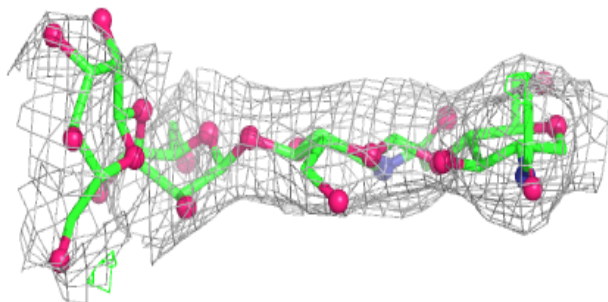
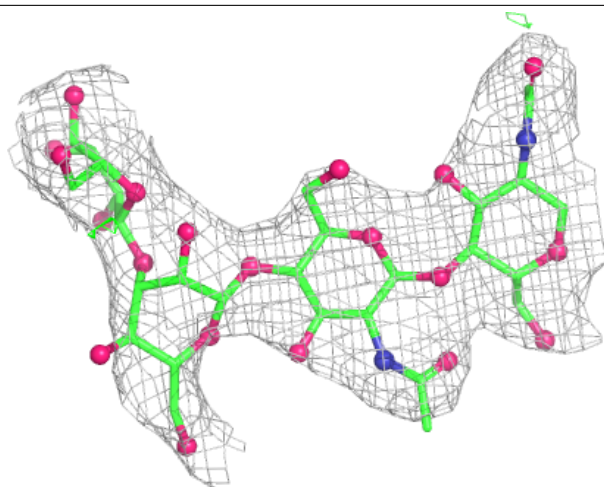
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 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
2	MAN	C	4	11/12	0.51	0.14	86,96,107,111	0
4	MAN	E	4	11/12	0.56	0.20	78,102,107,111	0
2	BMA	C	3	11/12	0.61	0.15	97,103,110,113	0
3	NAG	D	2	14/15	0.81	0.14	82,103,112,118	0
4	BMA	E	3	11/12	0.86	0.09	69,74,84,86	0
2	NAG	C	1	14/15	0.88	0.12	43,51,59,62	0
2	NAG	C	2	14/15	0.89	0.11	55,64,73,86	0
3	NAG	D	1	14/15	0.90	0.14	62,73,86,95	0
4	NAG	E	1	14/15	0.90	0.12	46,48,58,61	0
4	NAG	E	2	14/15	0.93	0.11	53,67,71,72	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.

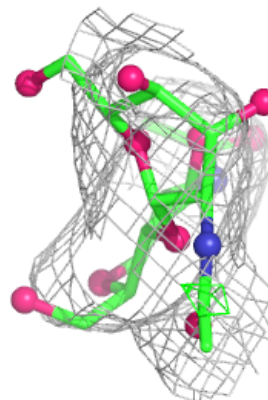
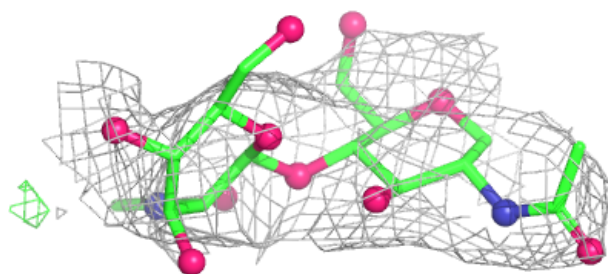
**Electron density around Chain C:**

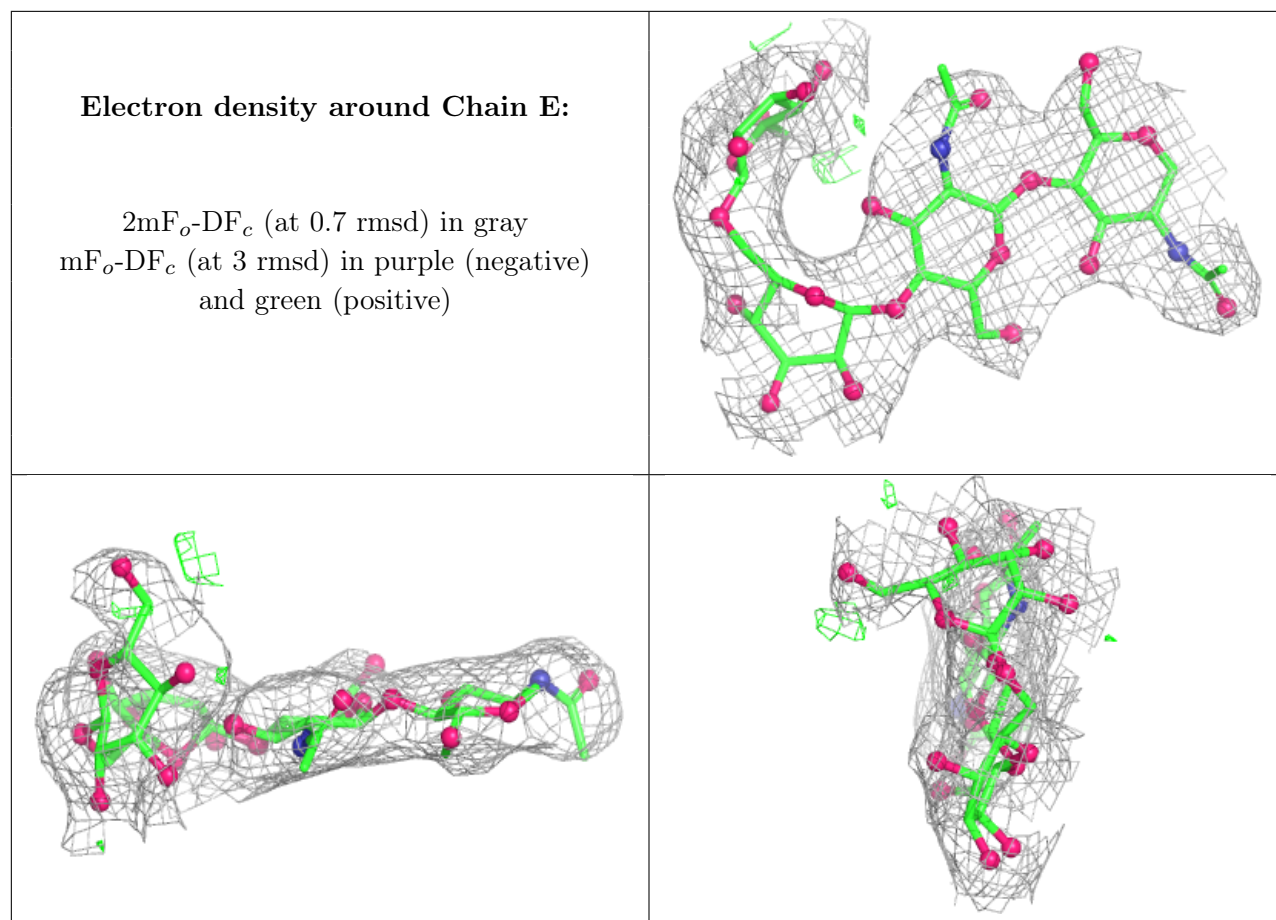
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around Chain D:**

$2mF_o - DF_c$  (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, 95<sup>th</sup> 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
7	NAG	B	807	14/15	0.84	0.15	49,56,65,69	0
6	ACT	A	810	4/4	0.89	0.19	53,56,56,58	0
6	ACT	B	808	4/4	0.94	0.14	54,55,55,56	0
5	CA	B	802	1/1	0.97	0.10	49,49,49,49	0
5	CA	B	801	1/1	0.97	0.10	30,30,30,30	0
5	CA	A	809	1/1	0.98	0.06	68,68,68,68	0
5	CA	A	807	1/1	0.98	0.09	28,28,28,28	0
5	CA	A	808	1/1	0.99	0.07	42,42,42,42	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.