



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 25, 2025 – 02:07 am BST

PDB ID : 9QAT / pdb_00009qat
Title : Human angiotensin-1 converting enzyme N-domain in complex with quinaprilat
Authors : Gregory, K.S.; Acharya, K.R.
Deposited on : 2025-02-28
Resolution : 2.20 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 Phenix2.0rc1
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 2.0rc1
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.006 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.45.1

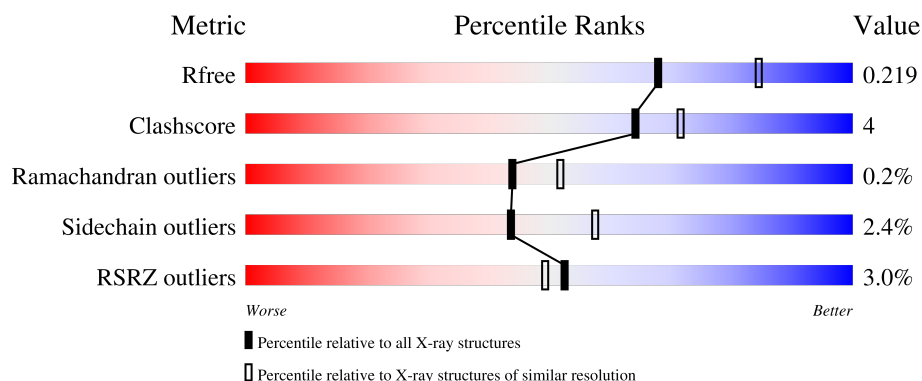
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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.




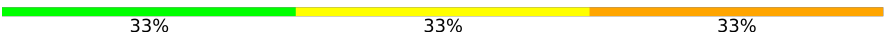
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	5791 (2.20-2.20)
Clashscore	180529	6634 (2.20-2.20)
Ramachandran outliers	177936	6560 (2.20-2.20)
Sidechain outliers	177891	6561 (2.20-2.20)
RSRZ outliers	164620	5791 (2.20-2.20)

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	609	<div> <div>5%</div> <div>91%</div> <div>8%</div> <div>.</div> </div>
1	B	609	<div> <div>5%</div> <div>85%</div> <div>13%</div> <div>..</div> </div>
2	D	2	<div> <div>100%</div> </div>
3	E	4	<div> <div>25%</div> <div>50%</div> <div>25%</div> </div>
4	F	2	<div> <div>100%</div> </div>

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Mol	Chain	Length	Quality of chain
4	H	2	
5	G	3	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
9	EDO	A	705	-	-	X	-

2 Entry composition

There are 18 unique types of molecules in this entry. The entry contains 10846 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 Angiotensin-converting enzyme, soluble form.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	604	Total	C	N	O	S	0	5	0
			4980	3196	856	909	19			
1	B	602	Total	C	N	O	S	0	3	0
			4942	3172	849	902	19			

There are 14 discrepancies between the modelled and reference sequences:

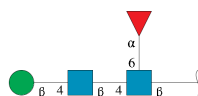
Chain	Residue	Modelled	Actual	Comment	Reference
A	9	GLN	ASN	engineered mutation	UNP P12821
A	25	GLN	ASN	engineered mutation	UNP P12821
A	82	GLN	ASN	engineered mutation	UNP P12821
A	117	GLN	ASN	engineered mutation	UNP P12821
A	289	GLN	ASN	engineered mutation	UNP P12821
A	545	ARG	GLN	engineered mutation	UNP P12821
A	576	LEU	PRO	engineered mutation	UNP P12821
B	9	GLN	ASN	engineered mutation	UNP P12821
B	25	GLN	ASN	engineered mutation	UNP P12821
B	82	GLN	ASN	engineered mutation	UNP P12821
B	117	GLN	ASN	engineered mutation	UNP P12821
B	289	GLN	ASN	engineered mutation	UNP P12821
B	545	ARG	GLN	engineered mutation	UNP P12821
B	576	LEU	PRO	engineered mutation	UNP P12821

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

- Molecule 3 is an oligosaccharide called beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.



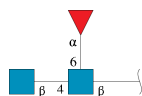
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	E	4	Total	C	N	O	0	0	0
			49	28	2	19			

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



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	F	2	Total	C	N	O	0	0	0
			24	14	1	9			
4	H	2	Total	C	N	O	0	0	0
			24	14	1	9			

- Molecule 5 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
5	G	3	Total	C	N	O	0	0	0
			38	22	2	14			

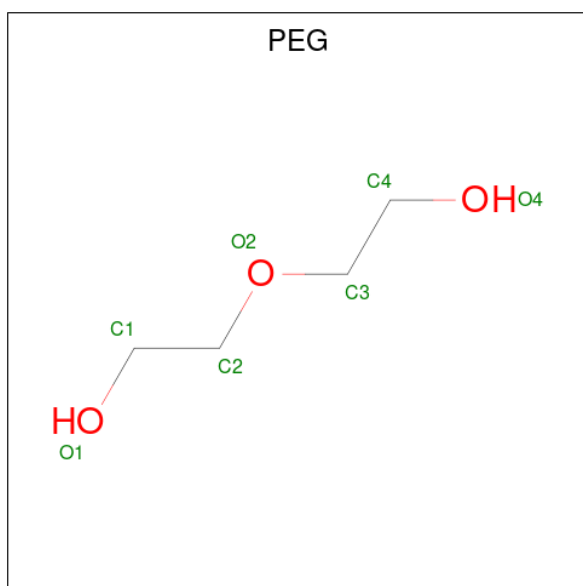
- Molecule 6 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

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

- Molecule 7 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	1	Total	Na	0	0
			1	1		

- Molecule 8 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).



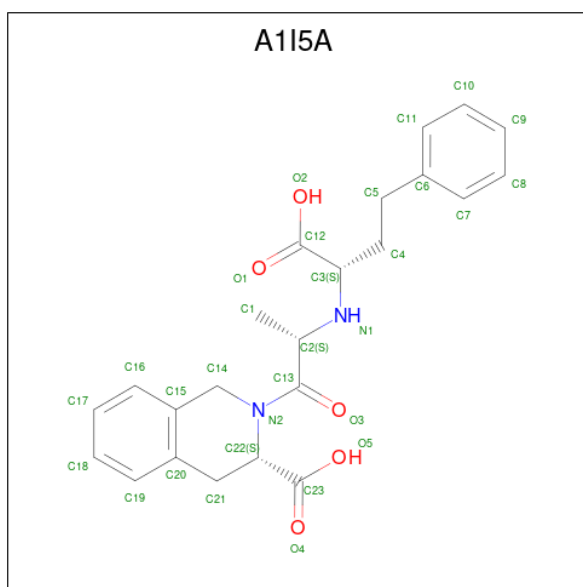
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	A	1	Total	C	O	0	0
			7	4	3		
8	A	1	Total	C	O	0	0
			7	4	3		
8	A	1	Total	C	O	0	0
			7	4	3		
8	A	1	Total	C	O	0	0
			7	4	3		
8	A	1	Total	C	O	0	0
			7	4	3		
8	B	1	Total	C	O	0	0
			7	4	3		

- Molecule 9 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



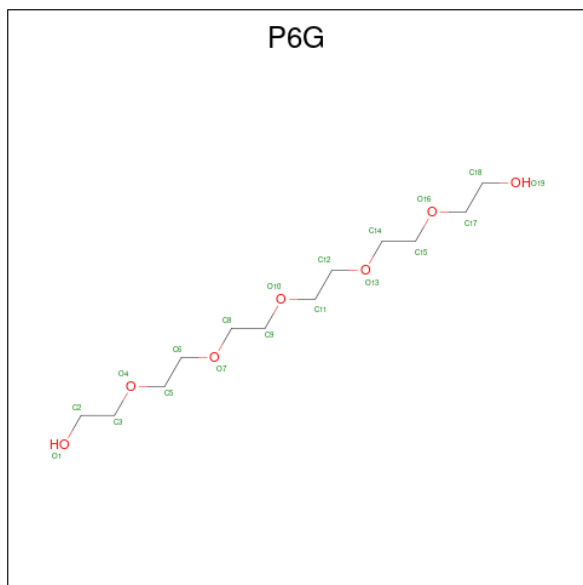
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	A	1	Total	C	O	0	0
			4	2	2		
9	A	1	Total	C	O	0	0
			4	2	2		
9	A	1	Total	C	O	0	0
			4	2	2		

- Molecule 10 is quinaprilat (CCD ID: A1I5A) (formula: $C_{23}H_{26}N_2O_5$) (labeled as "Ligand of Interest" by depositor).



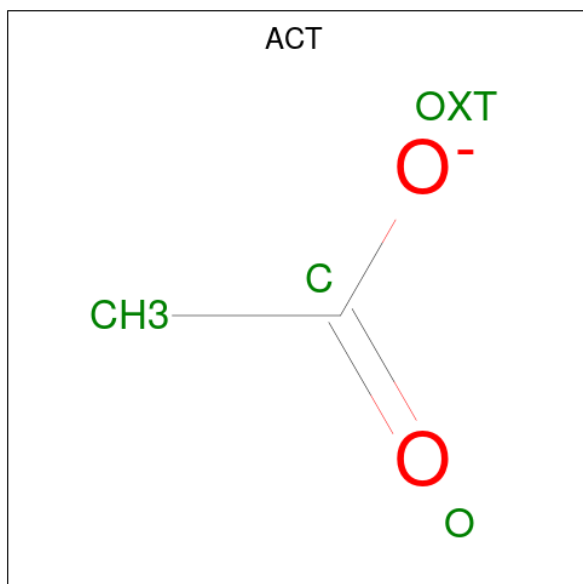
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
10	A	1	Total	C	N	O	0	0
			30	23	2	5		
10	B	1	Total	C	N	O	0	0
			30	23	2	5		

- Molecule 11 is HEXAETHYLENE GLYCOL (CCD ID: P6G) (formula: $C_{12}H_{26}O_7$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
11	A	1	Total	C	O	0	0
			19	12	7		

- Molecule 12 is ACETATE ION (CCD ID: ACT) (formula: $C_2H_3O_2$).

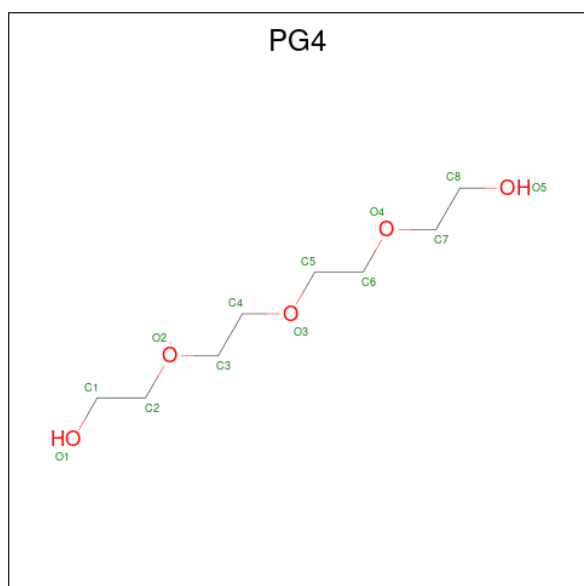


Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
12	A	1	Total C O 4 2 2	0	0
12	A	1	Total C O 4 2 2	0	0
12	A	1	Total C O 4 2 2	0	0
12	B	1	Total C O 4 2 2	0	0

- Molecule 13 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
13	A	1	Total Cl 1 1	0	0
13	B	1	Total Cl 1 1	0	0

- Molecule 14 is TETRAETHYLENE GLYCOL (CCD ID: PG4) (formula: C₈H₁₈O₅).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
14	B	1	Total C O 13 8 5	0	0
14	B	1	Total C O 13 8 5	0	0

- Molecule 15 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).

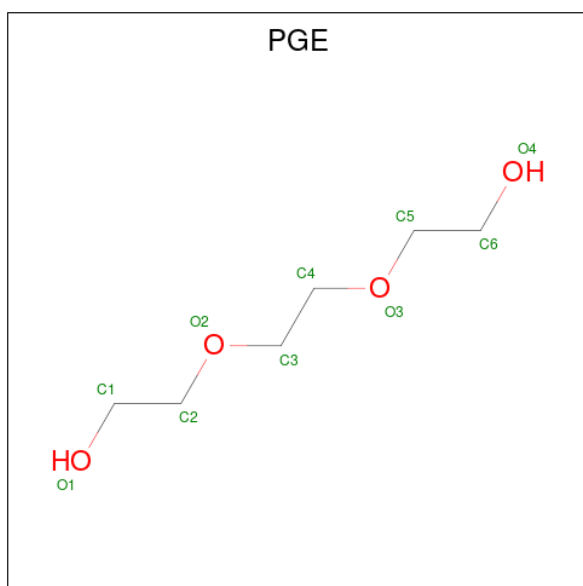


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
15	B	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 16 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
16	B	1	Total	Ca	0	0
			1	1		

- Molecule 17 is TRIETHYLENE GLYCOL (CCD ID: PGE) (formula: C₆H₁₄O₄).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
17	B	1	Total	C	O	0	0
			10	6	4		

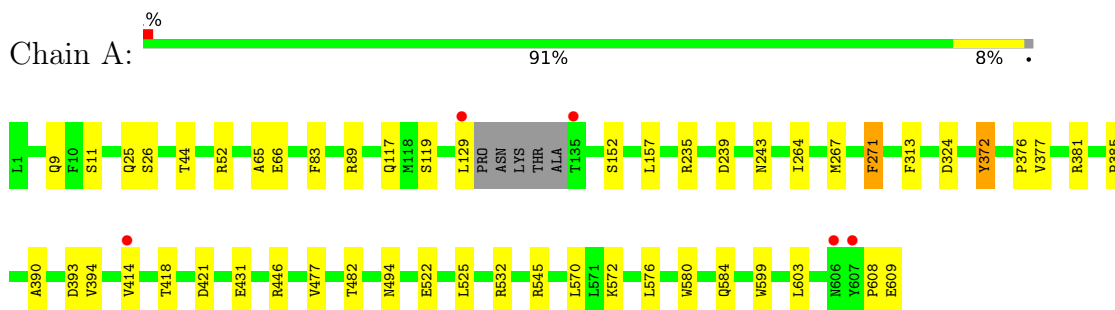
- Molecule 18 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
18	A	313	Total	O	0	0
			313	313		
18	B	236	Total	O	0	0
			236	236		

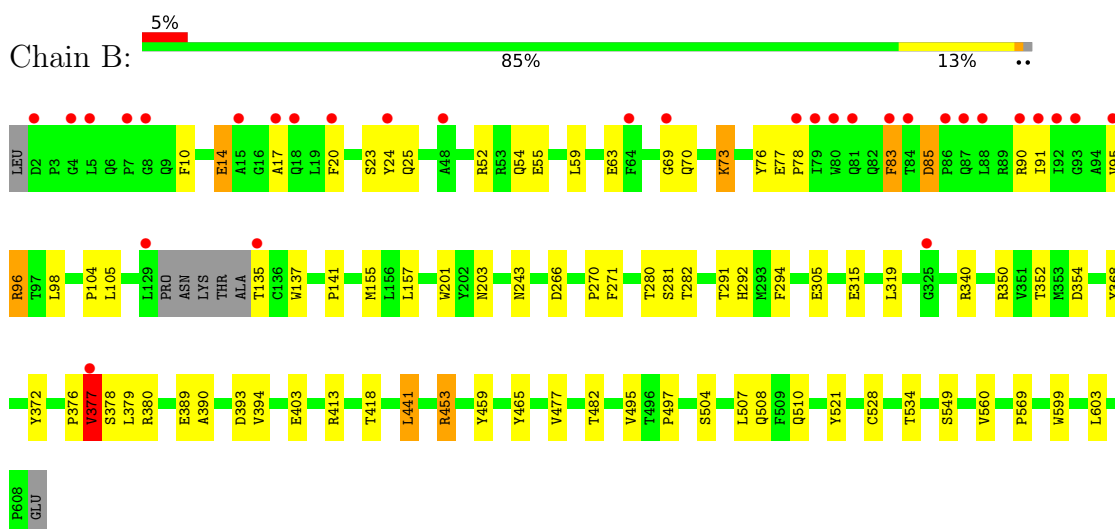
3 Residue-property plots [i](#)

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.

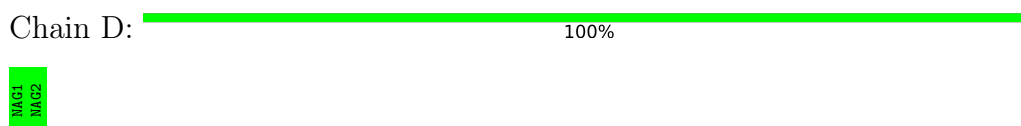
- Molecule 1: Angiotensin-converting enzyme, soluble form



- Molecule 1: Angiotensin-converting enzyme, soluble form



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



- Molecule 3: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose

Chain E:  25% 50% 25%



- Molecule 4: alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain F:  100%



- Molecule 4: alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain H:  50% 50%



- Molecule 5: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose

Chain G:  33% 33% 33%



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	72.84Å 78.00Å 81.71Å 88.45° 64.62° 74.70°	Depositor
Resolution (Å)	74.86 – 2.20 74.86 – 2.20	Depositor EDS
% Data completeness (in resolution range)	98.5 (74.86-2.20) 97.7 (74.86-2.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.19 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.8.0430 (refmacat 0.4.100)	Depositor
R, R_{free}	0.166 , 0.210 0.175 , 0.219	Depositor DCC
R_{free} test set	3864 reflections (4.88%)	wwPDB-VP
Wilson B-factor (Å ²)	28.3	Xtriage
Anisotropy	0.314	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 44.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	10846	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.75% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NAG, ZN, CL, PGE, PG4, NA, P6G, EDO, FUC, PEG, ACT, CA, BMA, A1I5A

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	0.63	0/5135	1.12	10/6994 (0.1%)
1	B	0.59	0/5097	1.14	16/6942 (0.2%)
All	All	0.61	0/10232	1.13	26/13936 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3
1	B	0	1
All	All	0	4

There are no bond length outliers.

The worst 5 of 26 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	85	ASP	CA-CB-CG	9.28	121.88	112.60
1	B	85	ASP	CB-CA-C	8.38	123.34	109.85
1	B	418	THR	CA-CB-OG1	-8.29	97.17	109.60
1	B	282	THR	CA-CB-OG1	-7.22	98.77	109.60
1	B	354	ASP	CA-CB-CG	6.54	119.14	112.60

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	52	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	A	532	ARG	Sidechain
1	A	545	ARG	Sidechain
1	B	453	ARG	Sidechain

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	4980	0	4753	25	0
1	B	4942	0	4711	40	0
2	D	28	0	25	0	0
3	E	49	0	43	2	0
4	F	24	0	22	1	0
4	H	24	0	22	1	0
5	G	38	0	34	1	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
7	A	1	0	0	0	0
8	A	42	0	60	5	0
8	B	7	0	10	0	0
9	A	12	0	18	5	0
10	A	30	0	0	0	0
10	B	30	0	0	0	0
11	A	19	0	26	1	0
12	A	12	0	9	1	0
12	B	4	0	3	0	0
13	A	1	0	0	0	0
13	B	1	0	0	0	0
14	B	26	0	36	7	0
15	B	14	0	13	0	0
16	B	1	0	0	0	0
17	B	10	0	14	2	0
18	A	313	0	0	5	0
18	B	236	0	0	6	0
All	All	10846	0	9799	76	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

The worst 5 of 76 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:385:PRO:HA	9:A:705:EDO:H11	1.64	0.79
1:B:91:ILE:O	1:B:95:VAL:HG23	1.84	0.77
1:B:379:LEU:HD13	1:B:549:SER:OG	1.87	0.74
1:B:55:GLU:OE2	18:B:801:HOH:O	2.13	0.67
1:B:453:ARG:NH1	14:B:701:PG4:O1	2.28	0.66

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	605/609 (99%)	595 (98%)	9 (2%)	1 (0%)	44	52
1	B	601/609 (99%)	585 (97%)	15 (2%)	1 (0%)	44	52
All	All	1206/1218 (99%)	1180 (98%)	24 (2%)	2 (0%)	44	52

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	324	ASP
1	B	377	VAL

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	525/524 (100%)	510 (97%)	15 (3%)	37	50
1	B	521/524 (99%)	508 (98%)	13 (2%)	42	56
All	All	1046/1048 (100%)	1018 (97%)	28 (3%)	44	53

5 of 28 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	576	LEU
1	B	560	VAL
1	B	85	ASP
1	B	372	TYR
1	B	70	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	263	ASN
1	B	188	GLN
1	B	371	GLN
1	B	575	GLN

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 ⓘ

13 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	D	1	2,1	14,14,15	0.33	0	17,19,21	0.71	0
2	NAG	D	2	2	14,14,15	0.39	0	17,19,21	0.66	0
3	NAG	E	1	1,3	14,14,15	0.45	0	17,19,21	0.97	1 (5%)
3	NAG	E	2	3	14,14,15	0.45	0	17,19,21	0.99	0
3	BMA	E	3	3	11,11,12	0.37	0	15,15,17	0.79	0
3	FUC	E	4	3	10,10,11	0.33	0	14,14,16	0.80	0
4	NAG	F	1	1,4	14,14,15	0.47	0	17,19,21	1.40	3 (17%)
4	FUC	F	2	4	10,10,11	0.54	0	14,14,16	1.18	2 (14%)
5	NAG	G	1	1,5	14,14,15	0.43	0	17,19,21	1.22	2 (11%)
5	NAG	G	2	5	14,14,15	0.33	0	17,19,21	0.85	0
5	FUC	G	3	5	10,10,11	0.35	0	14,14,16	0.67	0
4	NAG	H	1	1,4	14,14,15	0.41	0	17,19,21	1.15	2 (11%)
4	FUC	H	2	4	10,10,11	0.36	0	14,14,16	0.81	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
2	NAG	D	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	D	2	2	-	0/6/23/26	0/1/1/1
3	NAG	E	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	E	2	3	-	4/6/23/26	0/1/1/1
3	BMA	E	3	3	-	0/2/19/22	0/1/1/1
3	FUC	E	4	3	-	-	0/1/1/1
4	NAG	F	1	1,4	-	1/6/23/26	0/1/1/1
4	FUC	F	2	4	-	-	0/1/1/1
5	NAG	G	1	1,5	-	0/6/23/26	0/1/1/1
5	NAG	G	2	5	-	2/6/23/26	0/1/1/1
5	FUC	G	3	5	-	-	0/1/1/1
4	NAG	H	1	1,4	-	1/6/23/26	0/1/1/1
4	FUC	H	2	4	-	-	0/1/1/1

There are no bond length outliers.

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	H	1	NAG	C1-C2-N2	3.22	115.98	110.49
5	G	1	NAG	C1-C2-N2	3.17	115.90	110.49

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	G	1	NAG	C2-N2-C7	3.10	127.32	122.90
4	F	2	FUC	O2-C2-C3	2.96	116.07	110.14
4	F	1	NAG	C1-C2-N2	2.68	115.07	110.49

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

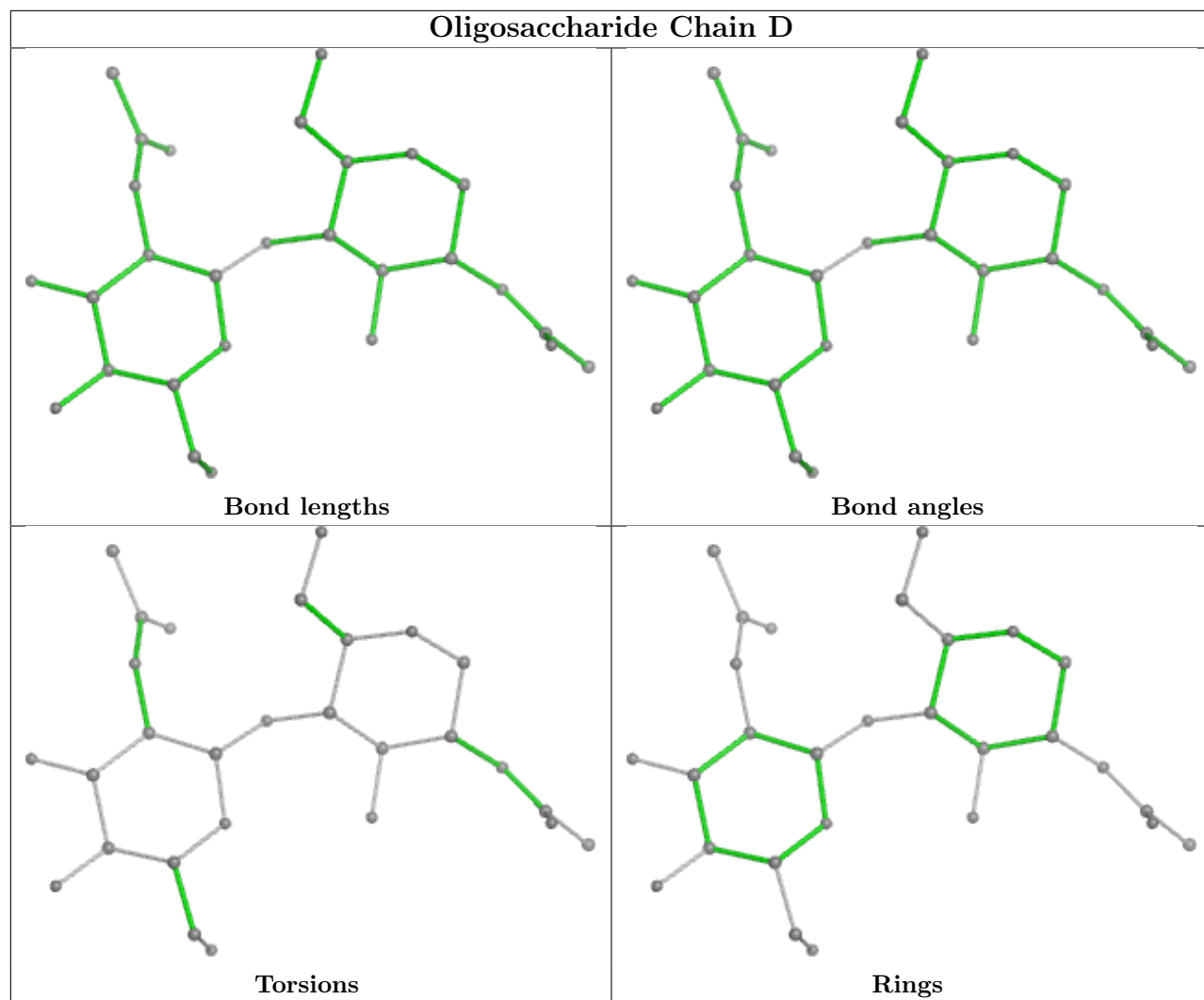
Mol	Chain	Res	Type	Atoms
3	E	2	NAG	C8-C7-N2-C2
5	G	2	NAG	C8-C7-N2-C2
5	G	2	NAG	O7-C7-N2-C2
3	E	2	NAG	O7-C7-N2-C2
3	E	2	NAG	O5-C5-C6-O6

There are no ring outliers.

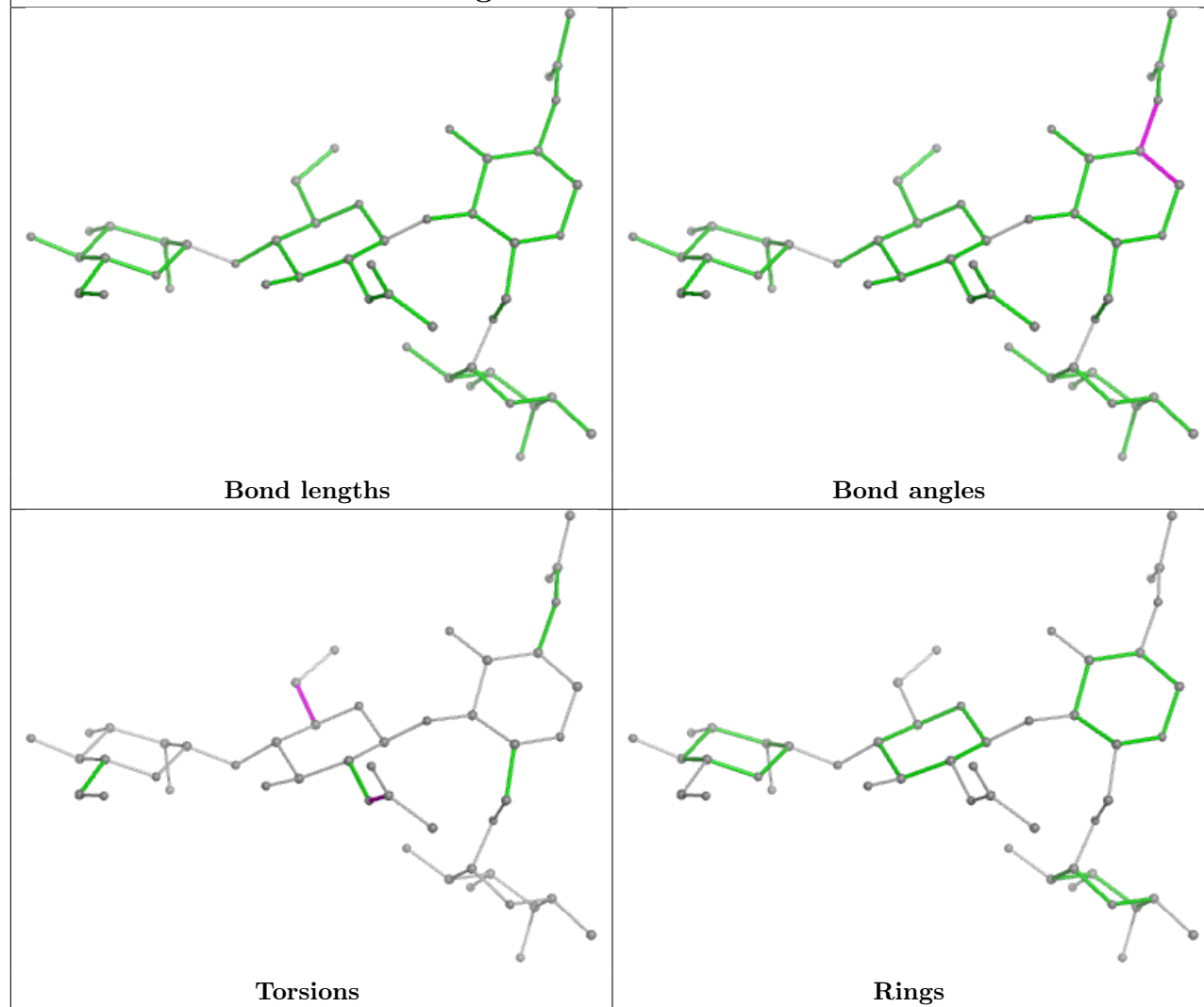
8 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	G	1	NAG	1	0
4	F	2	FUC	1	0
3	E	1	NAG	1	0
3	E	2	NAG	1	0
5	G	2	NAG	1	0
3	E	3	BMA	1	0
4	H	1	NAG	1	0
4	F	1	NAG	1	0

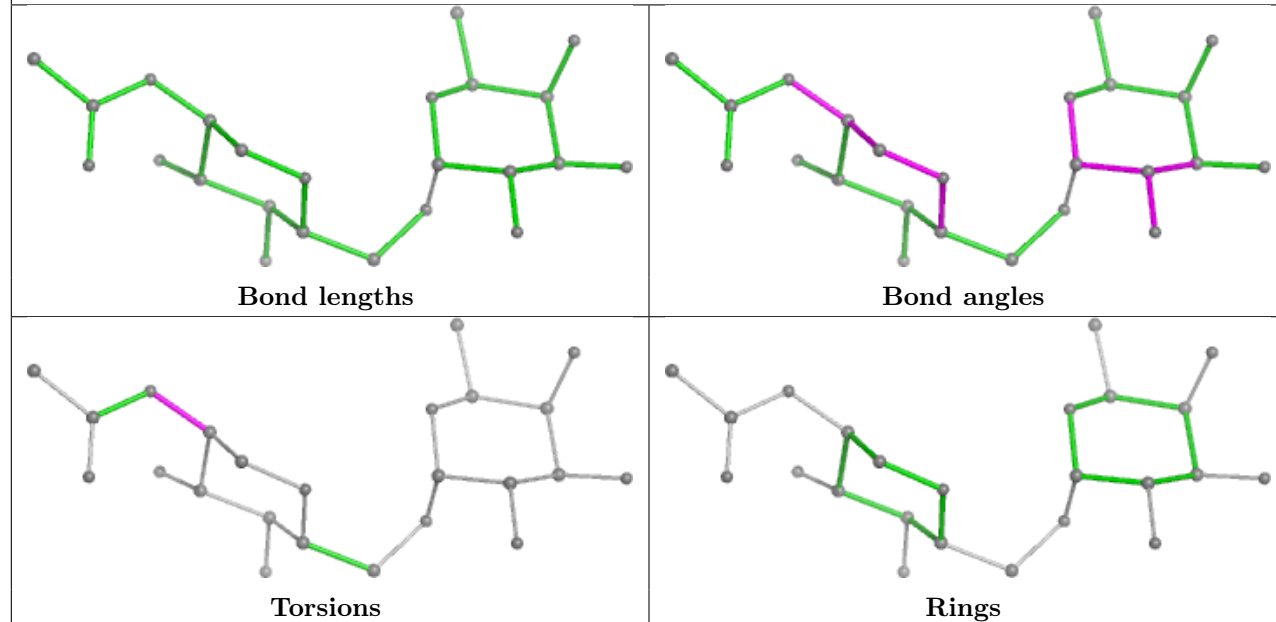
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



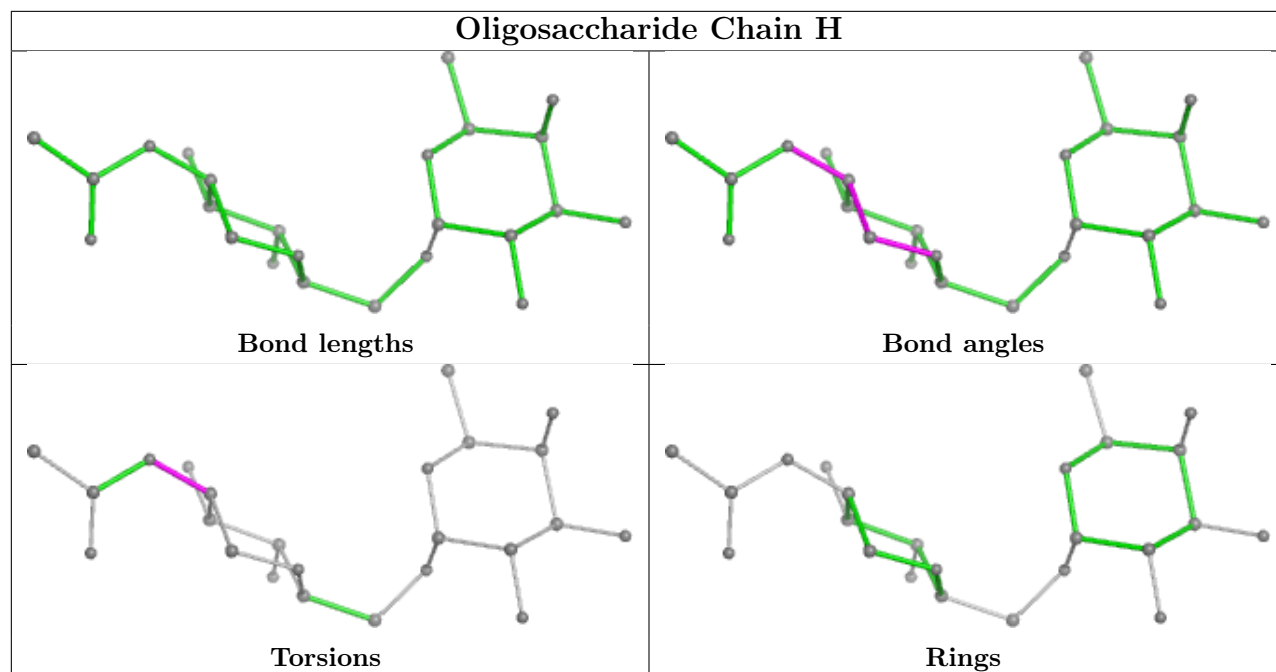
Oligosaccharide Chain E



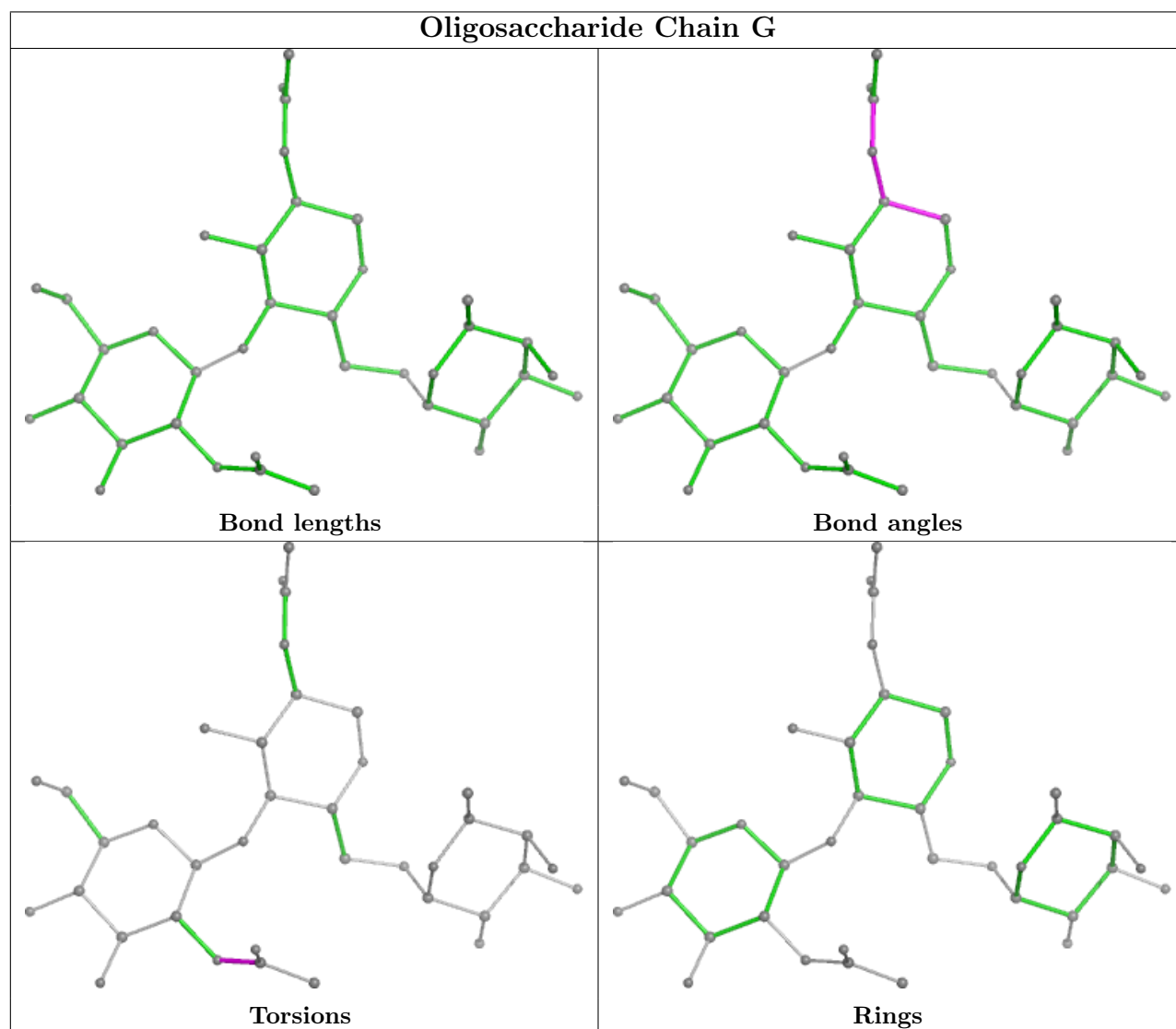
Oligosaccharide Chain F



Oligosaccharide Chain H



Oligosaccharide Chain G



5.6 Ligand geometry

Of 27 ligands modelled in this entry, 6 are monoatomic - leaving 21 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	$\# Z > 2$
10	A1I5A	A	706	6	32,32,32	0.65	0	41,44,44	1.04	3 (7%)
12	ACT	B	709	-	3,3,3	1.04	0	3,3,3	0.81	0
15	NAG	B	702	1	14,14,15	0.34	0	17,19,21	0.80	1 (5%)
8	PEG	A	716	-	6,6,6	0.21	0	5,5,5	0.22	0
8	PEG	A	707	-	6,6,6	0.22	0	5,5,5	0.24	0
14	PG4	B	708	-	12,12,12	0.32	0	11,11,11	0.33	0
8	PEG	A	715	-	6,6,6	0.23	0	5,5,5	0.21	0
11	P6G	A	711	-	18,18,18	0.24	0	17,17,17	0.30	0
12	ACT	A	712	-	3,3,3	1.09	0	3,3,3	0.74	0
8	PEG	A	703	-	6,6,6	0.15	0	5,5,5	0.06	0
12	ACT	A	714	-	3,3,3	1.02	0	3,3,3	0.95	0
12	ACT	A	713	-	3,3,3	1.00	0	3,3,3	0.84	0
8	PEG	A	709	-	6,6,6	0.19	0	5,5,5	0.13	0
9	EDO	A	710	-	3,3,3	0.11	0	2,2,2	0.16	0
8	PEG	A	704	-	6,6,6	0.30	0	5,5,5	0.27	0
9	EDO	A	708	-	3,3,3	0.07	0	2,2,2	0.18	0
17	PGE	B	706	-	9,9,9	0.69	0	8,8,8	0.61	0
10	A1I5A	B	707	6	32,32,32	0.59	0	41,44,44	1.12	4 (9%)
8	PEG	B	705	-	6,6,6	0.20	0	5,5,5	0.50	0
14	PG4	B	701	-	12,12,12	0.19	0	11,11,11	0.17	0
9	EDO	A	705	-	3,3,3	0.59	0	2,2,2	0.26	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
11	P6G	A	711	-	-	10/16/16/16	-
10	A1I5A	A	706	6	-	6/25/37/37	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
8	PEG	A	704	-	-	3/4/4/4	-
8	PEG	A	703	-	-	2/4/4/4	-
8	PEG	A	716	-	-	1/4/4/4	-
9	EDO	A	708	-	-	1/1/1/1	-
15	NAG	B	702	1	-	0/6/23/26	0/1/1/1
8	PEG	A	709	-	-	1/4/4/4	-
17	PGE	B	706	-	-	5/7/7/7	-
10	A1I5A	B	707	6	-	3/25/37/37	0/3/3/3
8	PEG	B	705	-	-	2/4/4/4	-
8	PEG	A	707	-	-	4/4/4/4	-
14	PG4	B	708	-	-	4/10/10/10	-
14	PG4	B	701	-	-	8/10/10/10	-
9	EDO	A	705	-	-	1/1/1/1	-
8	PEG	A	715	-	-	2/4/4/4	-
9	EDO	A	710	-	-	0/1/1/1	-

There are no bond length outliers.

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	A	706	A1I5A	C21-C22-N2	3.53	113.42	109.91
10	B	707	A1I5A	C21-C22-N2	2.74	112.63	109.91
10	B	707	A1I5A	O4-C23-C22	-2.67	114.08	122.48
10	A	706	A1I5A	C1-C2-C13	2.58	114.42	109.73
10	B	707	A1I5A	O2-C12-C3	2.57	121.94	113.40

There are no chirality outliers.

5 of 53 torsion outliers are listed below:

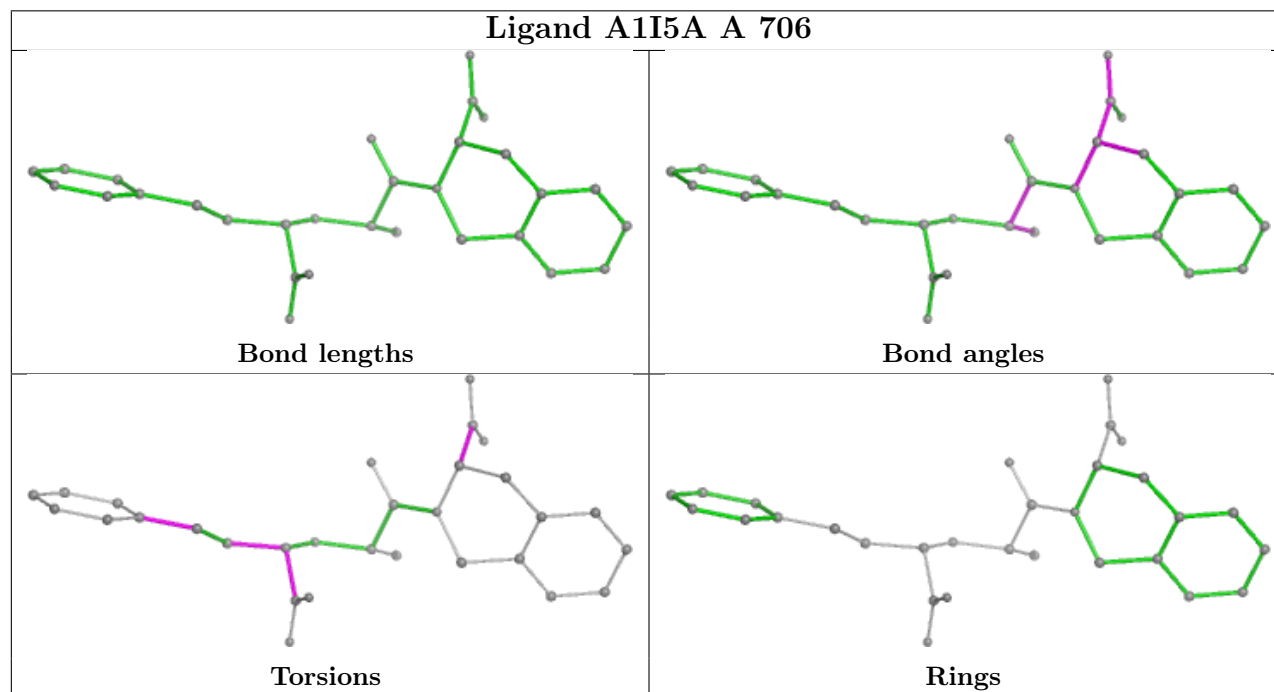
Mol	Chain	Res	Type	Atoms
17	B	706	PGE	C6-C5-O3-C4
8	A	707	PEG	O1-C1-C2-O2
14	B	708	PG4	O1-C1-C2-O2
11	A	711	P6G	O4-C5-C6-O7
11	A	711	P6G	O13-C14-C15-O16

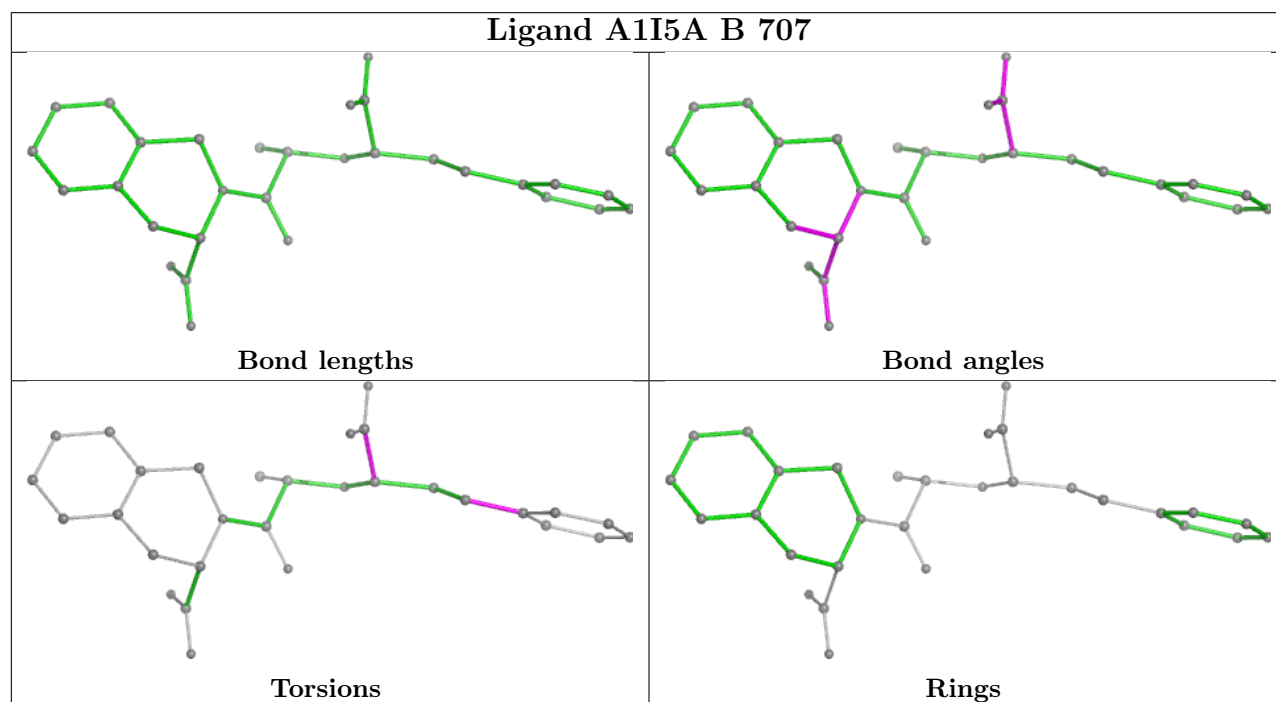
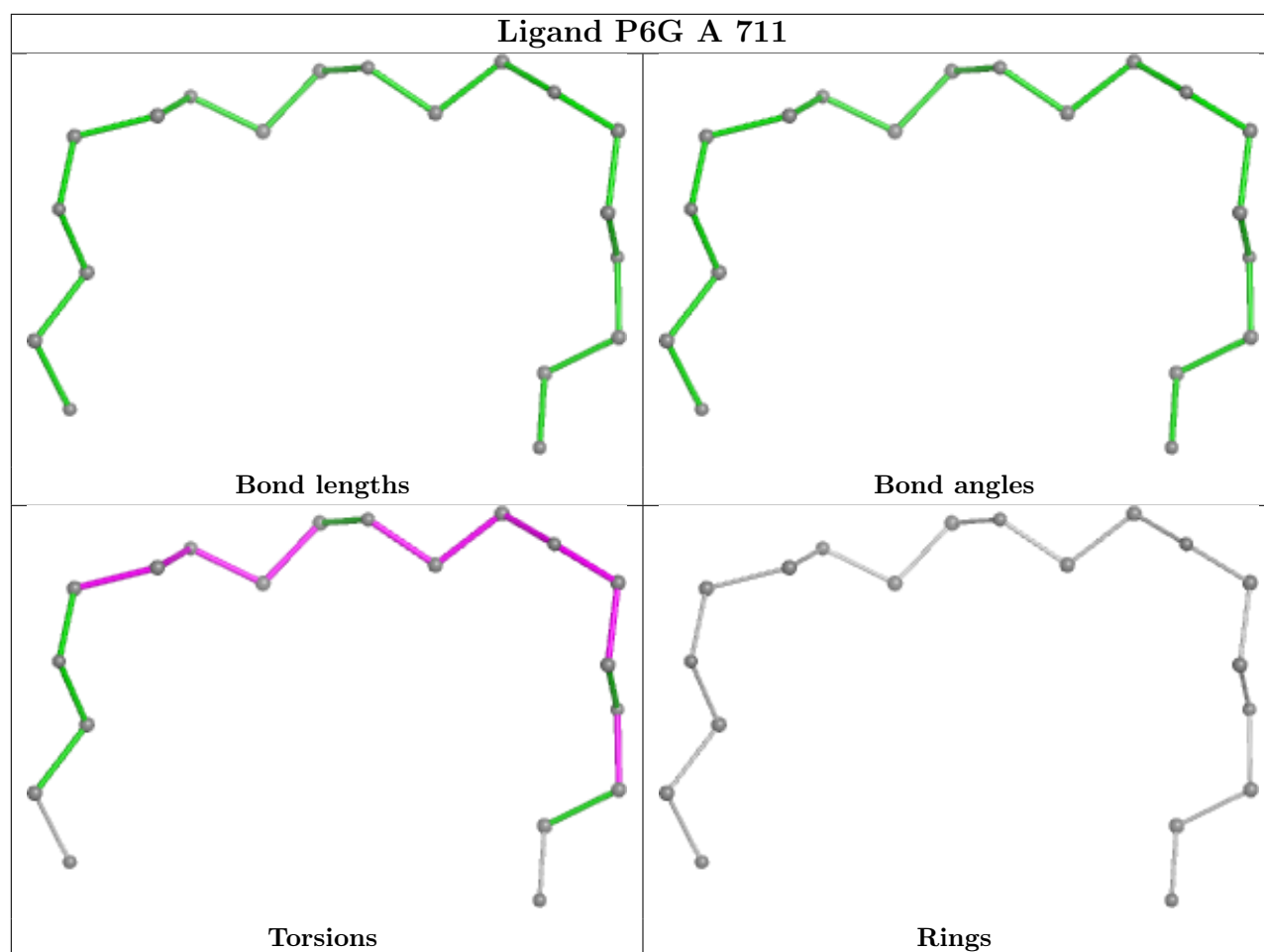
There are no ring outliers.

9 monomers are involved in 20 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	A	707	PEG	2	0
14	B	708	PG4	3	0
8	A	715	PEG	1	0
11	A	711	P6G	1	0
12	A	713	ACT	1	0
8	A	704	PEG	2	0
17	B	706	PGE	2	0
14	B	701	PG4	4	0
9	A	705	EDO	5	0

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





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	604/609 (99%)	-0.43	5 (0%) 82 80	10, 23, 44, 86	5 (0%)
1	B	602/609 (98%)	0.00	31 (5%) 34 31	10, 30, 60, 89	3 (0%)
All	All	1206/1218 (99%)	-0.22	36 (2%) 52 49	10, 26, 55, 89	8 (0%)

The worst 5 of 36 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	15	ALA	4.2
1	B	129	LEU	3.7
1	B	93	GLY	3.5
1	A	129	LEU	3.2
1	B	64	PHE	3.1

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
4	NAG	F	1	14/15	0.83	0.10	28,37,46,57	0
2	NAG	D	2	14/15	0.86	0.12	54,68,76,81	0
5	NAG	G	1	14/15	0.87	0.11	47,54,64,71	0
3	NAG	E	2	14/15	-	-	51,56,72,72	0
3	BMA	E	3	11/12	-	-	74,82,89,94	0

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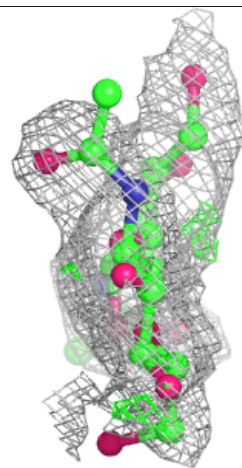
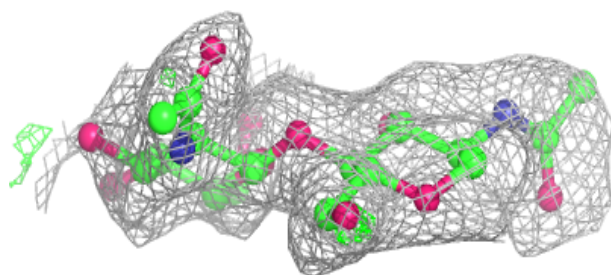
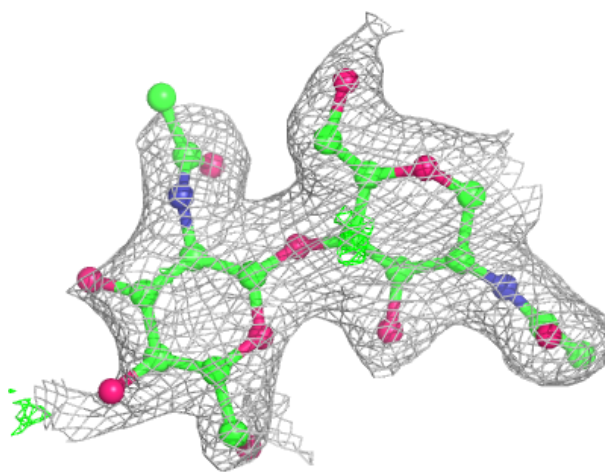
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	FUC	E	4	10/11	-	-	49,52,57,58	0
2	NAG	D	1	14/15	0.88	0.09	34,41,46,51	0
4	FUC	F	2	10/11	-	-	62,77,80,81	0
4	NAG	H	1	14/15	-	-	27,39,47,50	0
4	FUC	H	2	10/11	-	-	59,66,73,74	0
3	NAG	E	1	14/15	0.90	0.10	34,41,49,49	0
5	NAG	G	2	14/15	-	-	53,58,63,64	0
5	FUC	G	3	10/11	-	-	76,79,84,89	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.

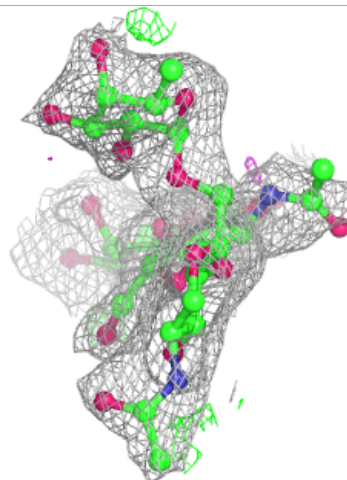
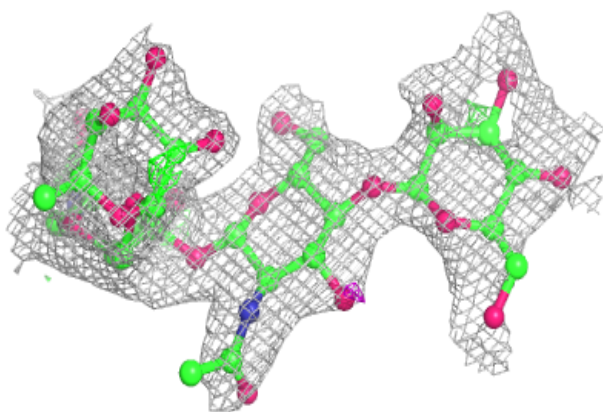
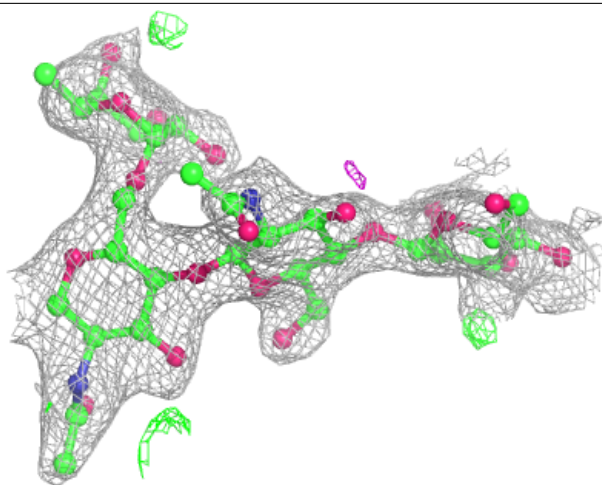
Electron density around Chain D:

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



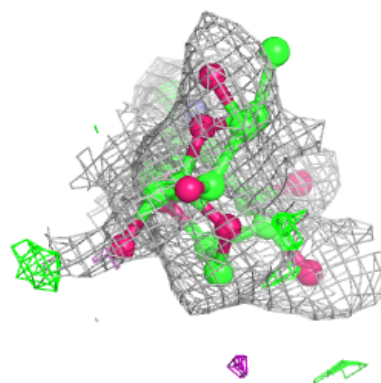
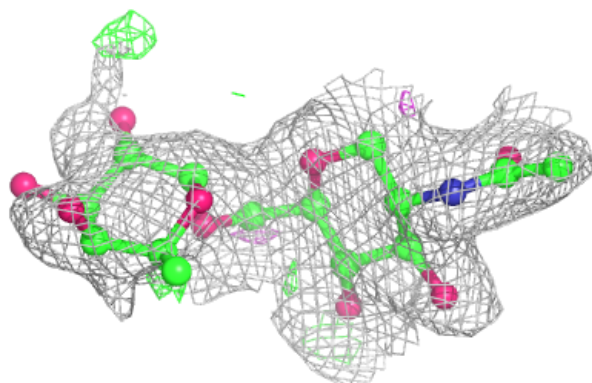
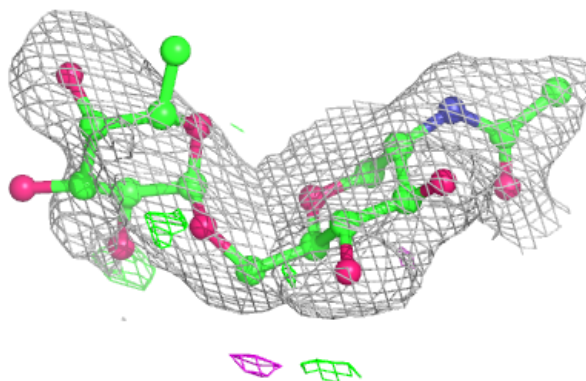
Electron density around Chain E:

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

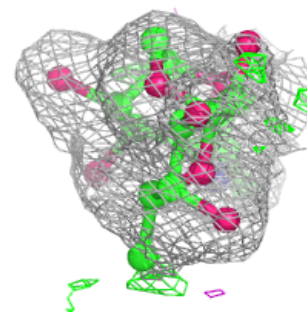
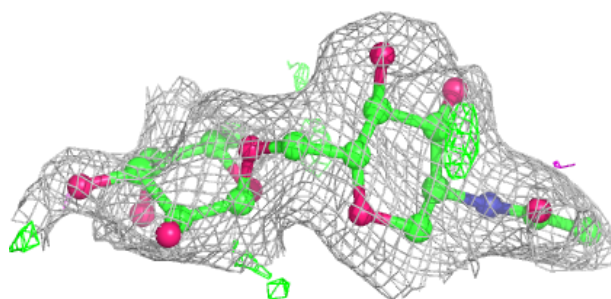
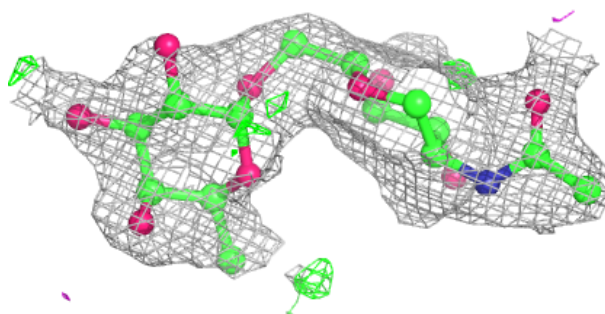


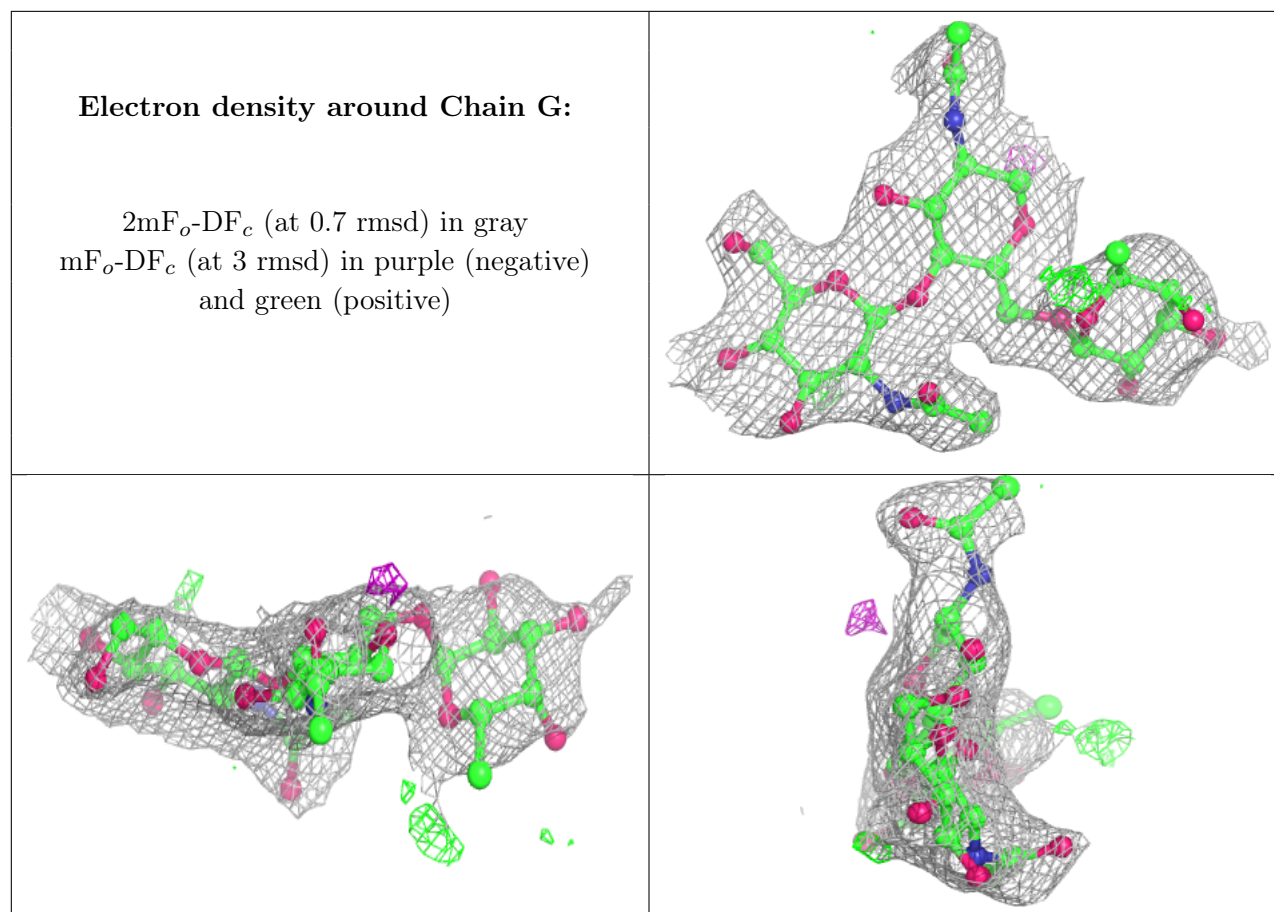
Electron density around Chain F:

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

**Electron density around Chain H:**

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





6.4 Ligands [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
12	ACT	A	714	4/4	0.63	0.21	46,57,63,64	0
12	ACT	B	709	4/4	0.67	0.19	46,60,61,64	0
15	NAG	B	702	14/15	0.69	0.17	59,74,80,85	0
12	ACT	A	713	4/4	0.70	0.18	57,60,60,63	0
12	ACT	A	712	4/4	0.72	0.19	56,64,64,64	0
17	PGE	B	706	10/10	0.81	0.14	32,41,47,48	0
8	PEG	A	707	7/7	0.82	0.17	49,51,56,56	0
8	PEG	A	709	7/7	0.82	0.18	51,71,76,77	0
8	PEG	A	704	7/7	0.83	0.17	47,49,58,59	0
8	PEG	A	715	7/7	0.83	0.17	57,59,62,65	0
9	EDO	A	708	4/4	0.86	0.14	45,46,46,49	0
9	EDO	A	710	4/4	0.86	0.16	59,60,63,66	0

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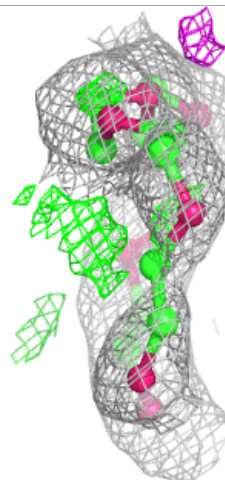
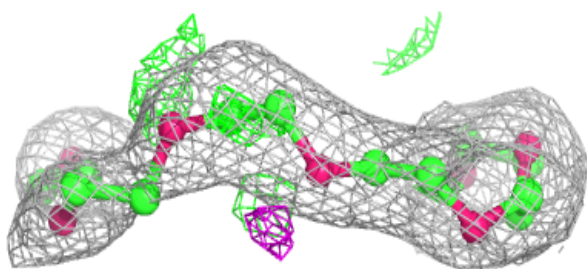
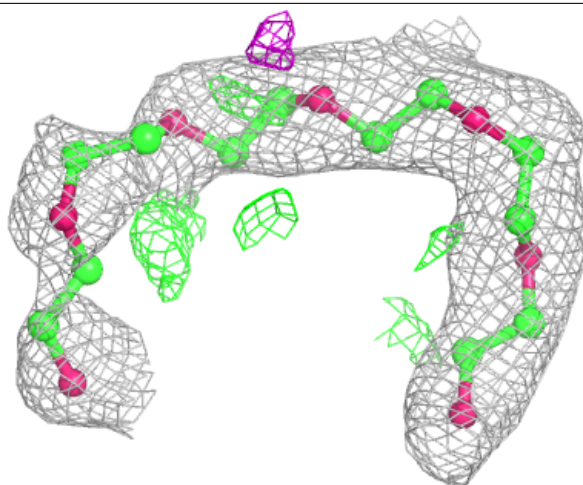
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
14	PG4	B	701	13/13	0.89	0.12	47,48,55,56	0
8	PEG	A	703	7/7	0.90	0.10	40,41,43,45	0
14	PG4	B	708	13/13	0.90	0.11	28,33,48,55	0
11	P6G	A	711	19/19	0.92	0.13	28,35,63,64	0
8	PEG	B	705	7/7	0.93	0.09	36,38,42,44	0
8	PEG	A	716	7/7	0.93	0.10	37,40,41,48	0
7	NA	A	702	1/1	0.95	0.09	30,30,30,30	0
10	A1I5A	A	706	30/30	0.96	0.07	14,21,31,32	0
9	EDO	A	705	4/4	0.96	0.16	26,30,31,32	0
10	A1I5A	B	707	30/30	0.97	0.06	18,20,27,28	0
6	ZN	B	703	1/1	0.98	0.02	18,18,18,18	0
13	CL	A	717	1/1	0.99	0.06	16,16,16,16	0
13	CL	B	710	1/1	0.99	0.03	21,21,21,21	0
16	CA	B	704	1/1	0.99	0.03	28,28,28,28	0
6	ZN	A	701	1/1	0.99	0.01	15,15,15,15	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

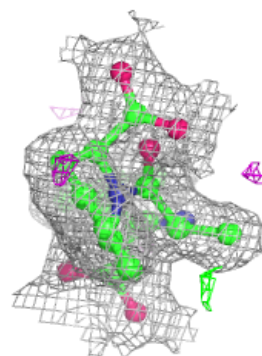
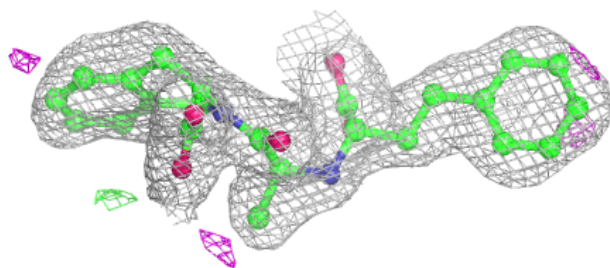
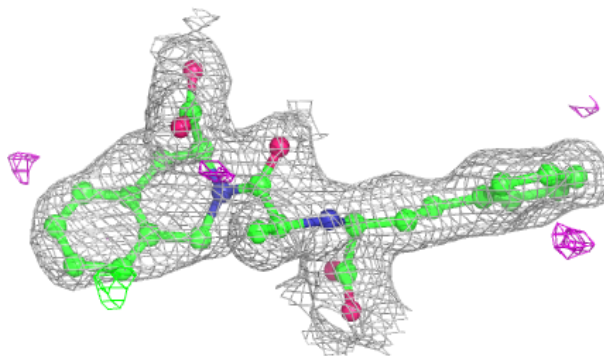
Electron density around P6G A 711:

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

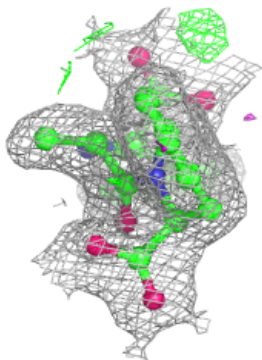
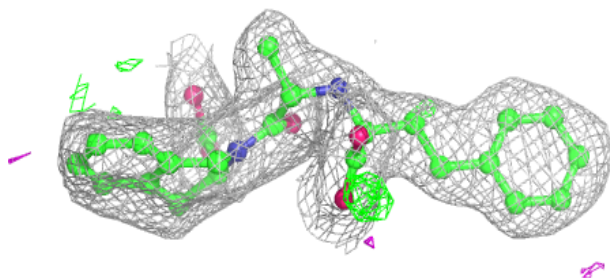
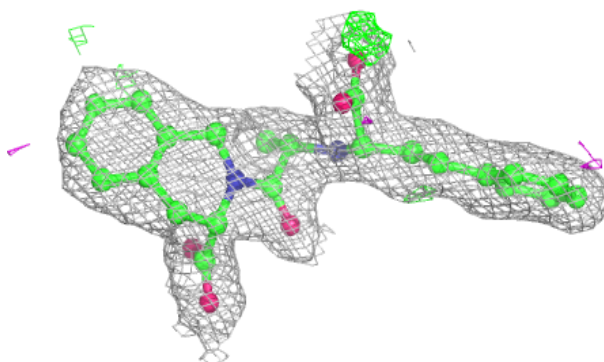


Electron density around A1I5A A 706:

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

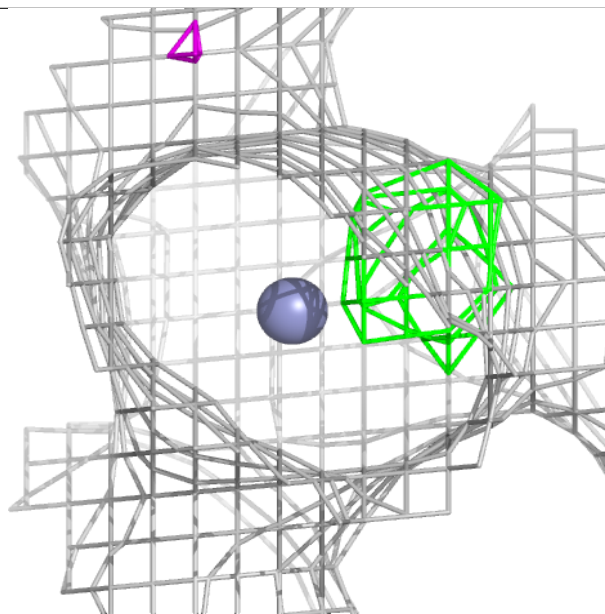
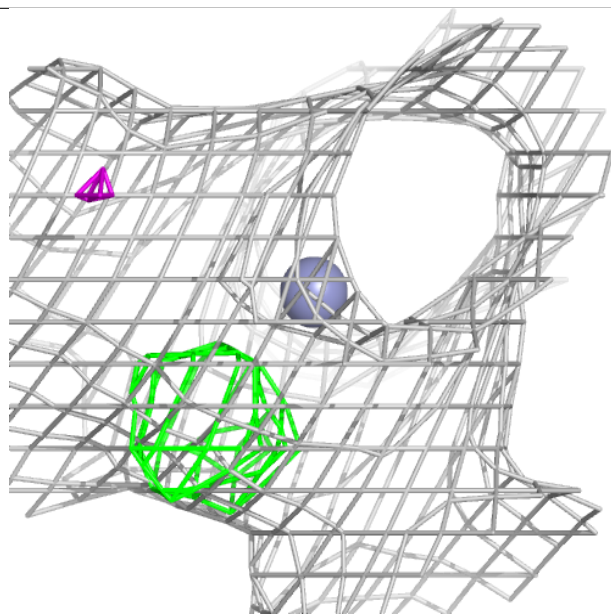
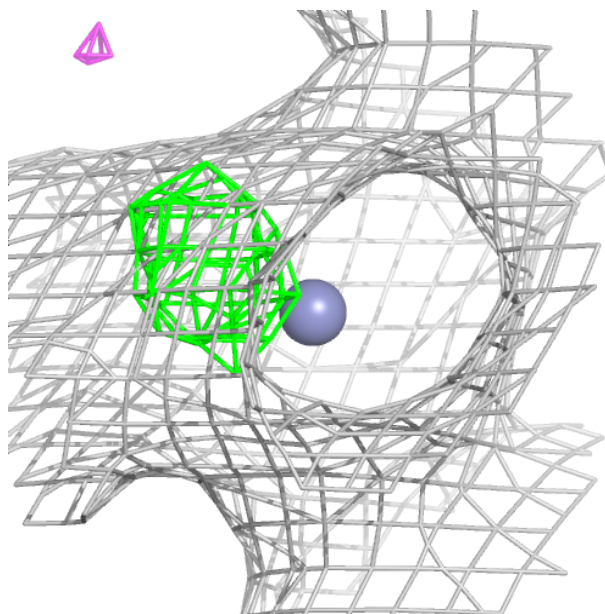
**Electron density around A1I5A B 707:**

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



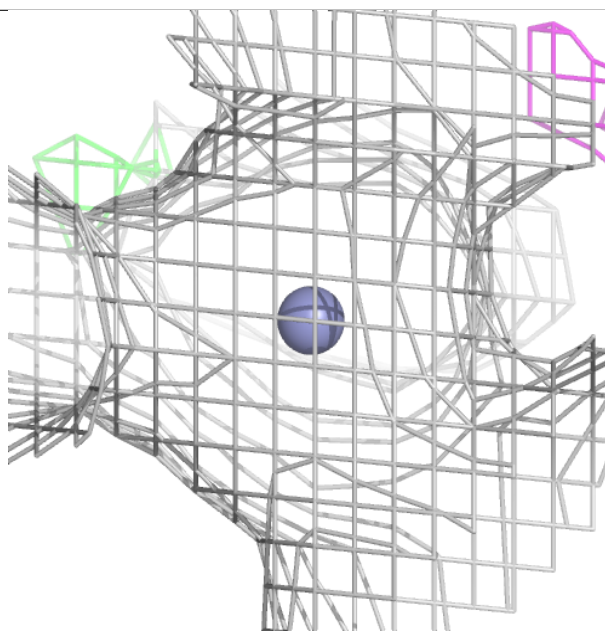
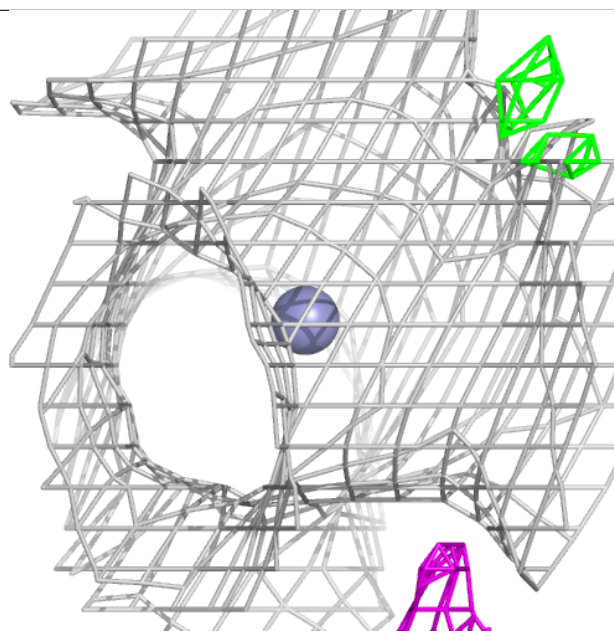
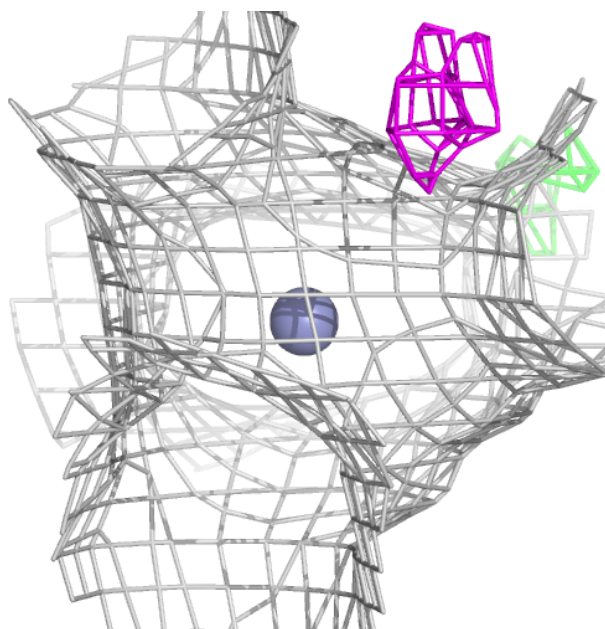
Electron density around ZN B 703:

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



Electron density around ZN A 701:

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



6.5 Other polymers ⓘ

There are no such residues in this entry.