



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 04:44 PM UTC

PDB ID : 4F5C / pdb_00004f5c
Title : Crystal structure of the spike receptor binding domain of a porcine respiratory coronavirus in complex with the pig aminopeptidase N ectodomain
Authors : Santiago, C.; Reguera, J.; Gaurav, M.; Ordone, D.; Enjuanes, L.; Casasnovas, J.M.
Deposited on : 2012-05-13
Resolution : 3.20 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 Phenix2.0
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

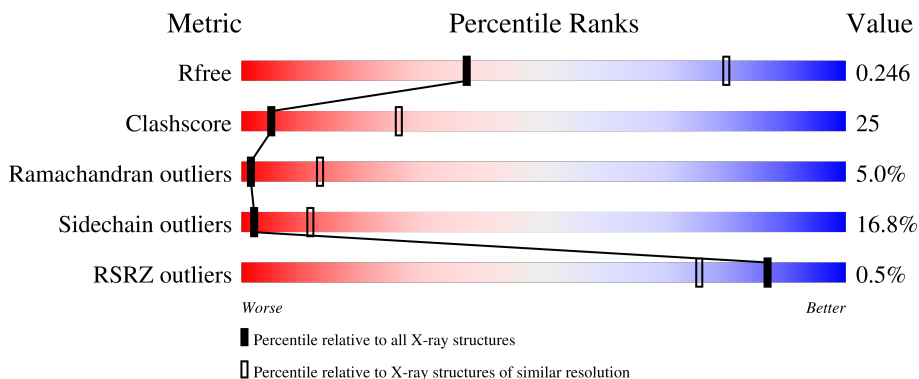
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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.



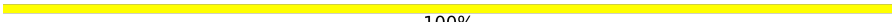
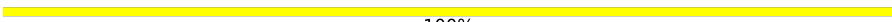
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1466 (3.20-3.20)
Clashscore	190562	1573 (3.20-3.20)
Ramachandran outliers	187476	1548 (3.20-3.20)
Sidechain outliers	187428	1547 (3.20-3.20)
RSRZ outliers	180081	1466 (3.20-3.20)

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	959	 48% 35% 11% • 6%
1	B	959	 49% 34% 10% • 6%
2	E	440	 14% 12% 6% • 67%
2	F	440	 15% 13% • 68%
3	C	2	 100%

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Mol	Chain	Length	Quality of chain
3	D	2	 100%
3	G	2	 100%

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 17067 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Aminopeptidase N.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	901	7245	4629	1208	1378	30	0	0	0
1	B	900	7235	4623	1205	1377	30	0	0	0

There are 68 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	19	TYR	-	expression tag	UNP P15145
A	20	PRO	-	expression tag	UNP P15145
A	21	TYR	-	expression tag	UNP P15145
A	22	ASP	-	expression tag	UNP P15145
A	23	VAL	-	expression tag	UNP P15145
A	24	PRO	-	expression tag	UNP P15145
A	25	ASP	-	expression tag	UNP P15145
A	26	TYR	-	expression tag	UNP P15145
A	27	ALA	-	expression tag	UNP P15145
A	28	GLY	-	expression tag	UNP P15145
A	29	ALA	-	expression tag	UNP P15145
A	30	GLN	-	expression tag	UNP P15145
A	31	PRO	-	expression tag	UNP P15145
A	32	ALA	-	expression tag	UNP P15145
A	33	ARG	-	expression tag	UNP P15145
A	34	SER	-	expression tag	UNP P15145
A	35	PRO	-	expression tag	UNP P15145
A	82	ASN	PHE	conflict	UNP P15145
A	107	PHE	LEU	conflict	UNP P15145
A	108	ILE	LEU	conflict	UNP P15145
A	964	LEU	-	expression tag	UNP P15145
A	965	VAL	-	expression tag	UNP P15145
A	966	PRO	-	expression tag	UNP P15145
A	967	ARG	-	expression tag	UNP P15145
A	968	GLY	-	expression tag	UNP P15145

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Chain	Residue	Modelled	Actual	Comment	Reference
A	969	SER	-	expression tag	UNP P15145
A	970	ASP	-	expression tag	UNP P15145
A	971	TYR	-	expression tag	UNP P15145
A	972	LYS	-	expression tag	UNP P15145
A	973	ASP	-	expression tag	UNP P15145
A	974	ASP	-	expression tag	UNP P15145
A	975	ASP	-	expression tag	UNP P15145
A	976	ASP	-	expression tag	UNP P15145
A	977	LYS	-	expression tag	UNP P15145
B	19	TYR	-	expression tag	UNP P15145
B	20	PRO	-	expression tag	UNP P15145
B	21	TYR	-	expression tag	UNP P15145
B	22	ASP	-	expression tag	UNP P15145
B	23	VAL	-	expression tag	UNP P15145
B	24	PRO	-	expression tag	UNP P15145
B	25	ASP	-	expression tag	UNP P15145
B	26	TYR	-	expression tag	UNP P15145
B	27	ALA	-	expression tag	UNP P15145
B	28	GLY	-	expression tag	UNP P15145
B	29	ALA	-	expression tag	UNP P15145
B	30	GLN	-	expression tag	UNP P15145
B	31	PRO	-	expression tag	UNP P15145
B	32	ALA	-	expression tag	UNP P15145
B	33	ARG	-	expression tag	UNP P15145
B	34	SER	-	expression tag	UNP P15145
B	35	PRO	-	expression tag	UNP P15145
B	82	ASN	PHE	conflict	UNP P15145
B	107	PHE	LEU	conflict	UNP P15145
B	108	ILE	LEU	conflict	UNP P15145
B	964	LEU	-	expression tag	UNP P15145
B	965	VAL	-	expression tag	UNP P15145
B	966	PRO	-	expression tag	UNP P15145
B	967	ARG	-	expression tag	UNP P15145
B	968	GLY	-	expression tag	UNP P15145
B	969	SER	-	expression tag	UNP P15145
B	970	ASP	-	expression tag	UNP P15145
B	971	TYR	-	expression tag	UNP P15145
B	972	LYS	-	expression tag	UNP P15145
B	973	ASP	-	expression tag	UNP P15145
B	974	ASP	-	expression tag	UNP P15145
B	975	ASP	-	expression tag	UNP P15145
B	976	ASP	-	expression tag	UNP P15145

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Chain	Residue	Modelled	Actual	Comment	Reference
B	977	LYS	-	expression tag	UNP P15145

- Molecule 2 is a protein called PRCV spike protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	146	Total	C	N	O	S	0	0	0
			1138	722	192	216	8			
2	F	139	Total	C	N	O	S	0	0	0
			1079	688	179	204	8			

There are 30 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	409	ASP	GLU	conflict	UNP Q84852
E	427	LEU	-	expression tag	UNP Q84852
E	428	VAL	-	expression tag	UNP Q84852
E	429	PRO	-	expression tag	UNP Q84852
E	430	ARG	-	expression tag	UNP Q84852
E	431	GLY	-	expression tag	UNP Q84852
E	432	SER	-	expression tag	UNP Q84852
E	433	ASP	-	expression tag	UNP Q84852
E	434	TYR	-	expression tag	UNP Q84852
E	435	LYS	-	expression tag	UNP Q84852
E	436	ASP	-	expression tag	UNP Q84852
E	437	ASP	-	expression tag	UNP Q84852
E	438	ASP	-	expression tag	UNP Q84852
E	439	ASP	-	expression tag	UNP Q84852
E	440	LYS	-	expression tag	UNP Q84852
F	409	ASP	GLU	conflict	UNP Q84852
F	427	LEU	-	expression tag	UNP Q84852
F	428	VAL	-	expression tag	UNP Q84852
F	429	PRO	-	expression tag	UNP Q84852
F	430	ARG	-	expression tag	UNP Q84852
F	431	GLY	-	expression tag	UNP Q84852
F	432	SER	-	expression tag	UNP Q84852
F	433	ASP	-	expression tag	UNP Q84852
F	434	TYR	-	expression tag	UNP Q84852
F	435	LYS	-	expression tag	UNP Q84852
F	436	ASP	-	expression tag	UNP Q84852
F	437	ASP	-	expression tag	UNP Q84852
F	438	ASP	-	expression tag	UNP Q84852
F	439	ASP	-	expression tag	UNP Q84852

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Chain	Residue	Modelled	Actual	Comment	Reference
F	440	LYS	-	expression tag	UNP Q84852

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

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

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

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



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

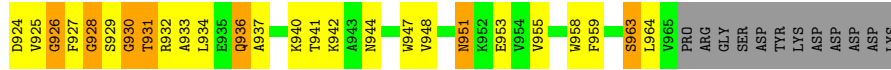
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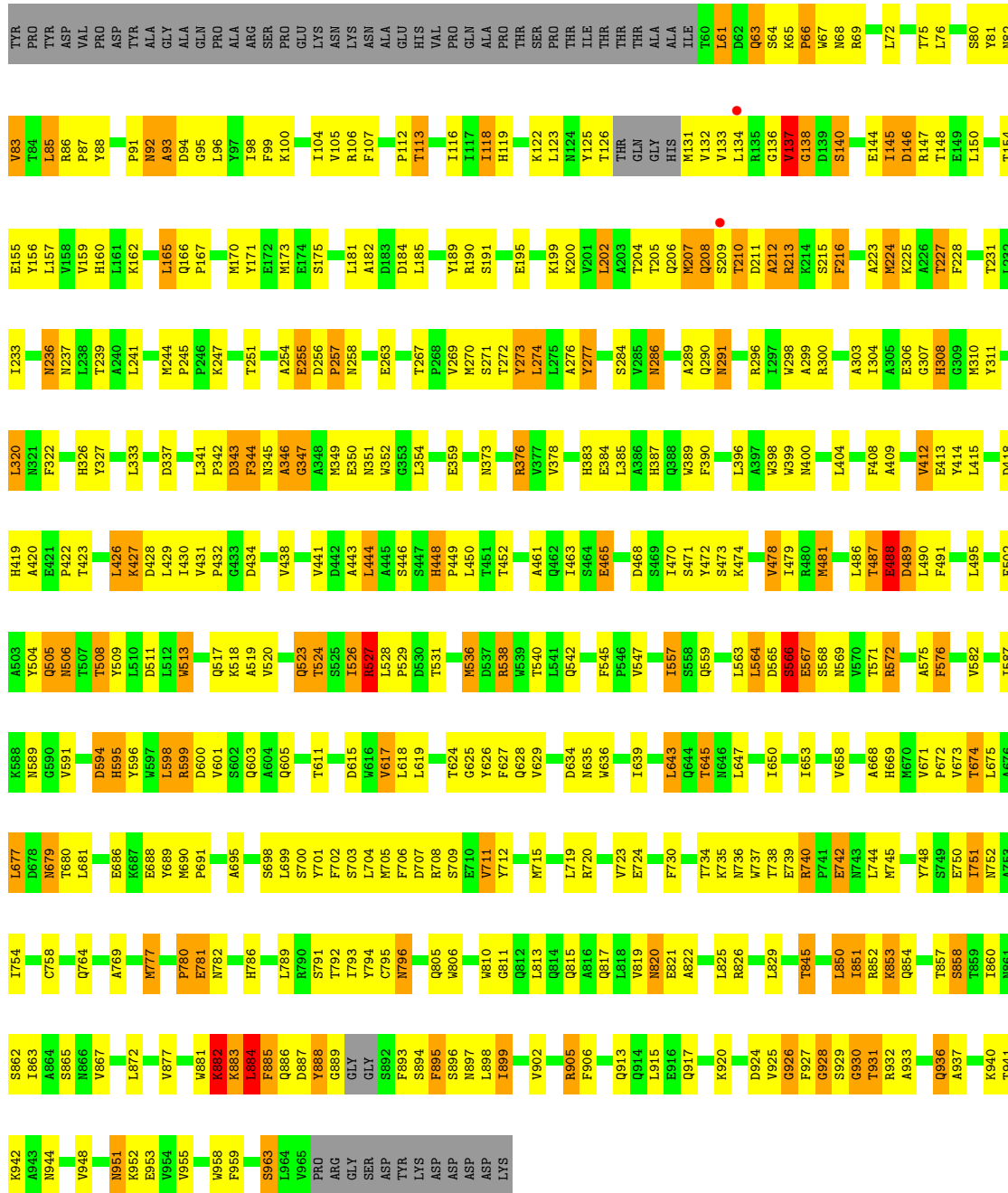
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 6 is water.

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

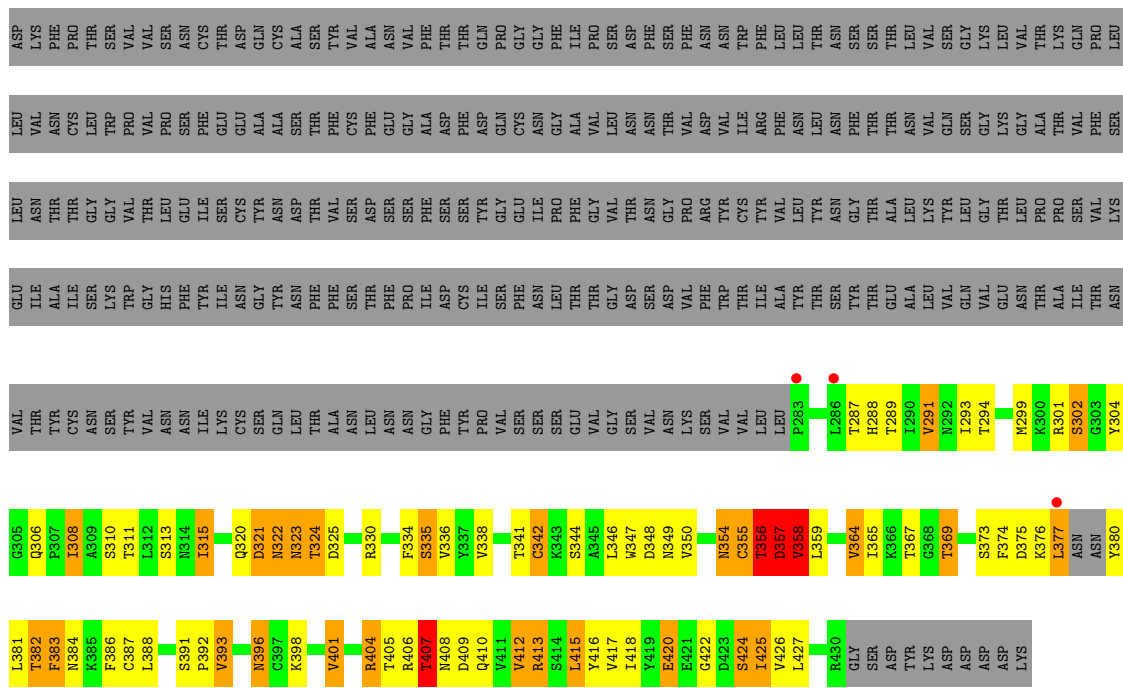


● Molecule 1: Amino peptidase N

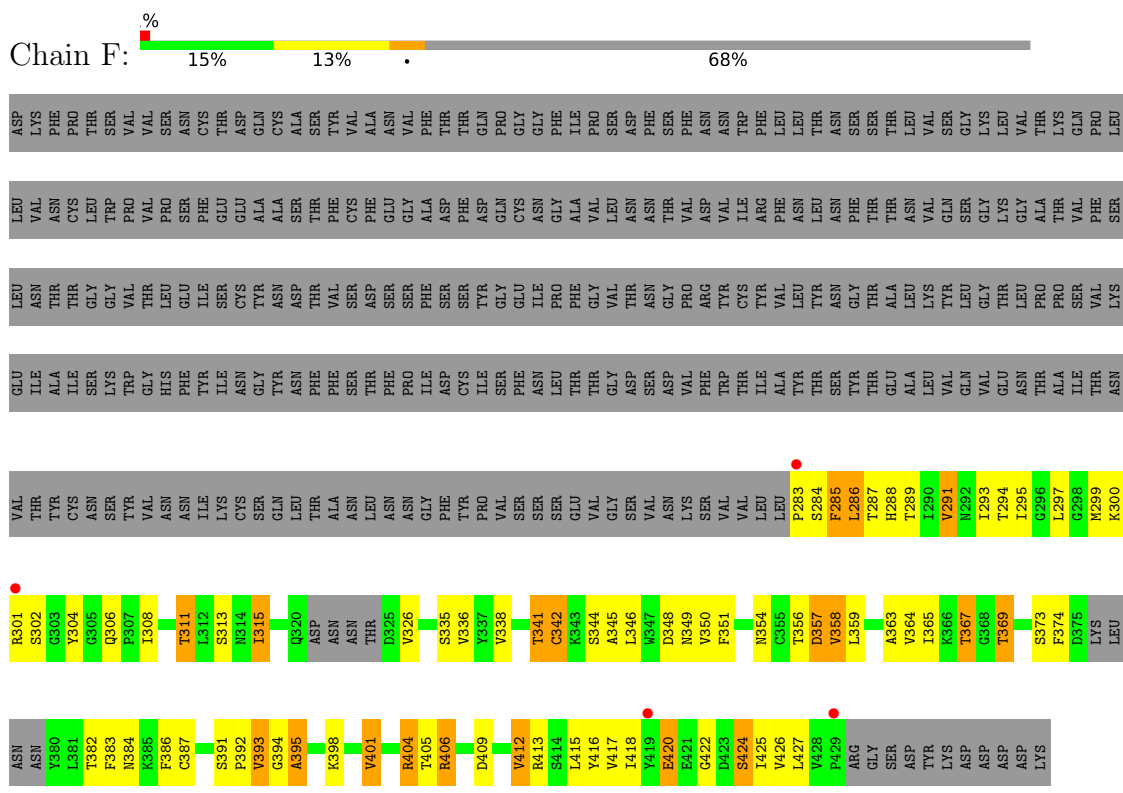


● Molecule 2: PRCV spike protein





• Molecule 2: PRCV spike protein



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



MAG1
MAG2

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

Chain D:  100%MAG1
MAG2

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

Chain G:  100%MAG1
MAG2

4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	220.86Å 87.94Å 176.91Å 90.00° 90.54° 90.00°	Depositor
Resolution (Å)	24.91 – 3.20 24.91 – 3.20	Depositor EDS
% Data completeness (in resolution range)	95.7 (24.91-3.20) 95.5 (24.91-3.20)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.75 (at 3.19Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.7.1_743)	Depositor
R, R_{free}	0.201 , 0.245 0.204 , 0.246	Depositor DCC
R_{free} test set	2744 reflections (4.86%)	wwPDB-VP
Wilson B-factor (Å ²)	85.3	Xtrriage
Anisotropy	0.299	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.27 , 64.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.022 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	17067	wwPDB-VP
Average B, all atoms (Å ²)	95.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.84% 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: ZN, NAG

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.31	0/7431	0.77	15/10126 (0.1%)
1	B	0.30	0/7420	0.76	14/10111 (0.1%)
2	E	0.35	0/1160	0.87	4/1576 (0.3%)
2	F	0.28	0/1100	0.68	1/1494 (0.1%)
All	All	0.31	0/17111	0.77	34/23307 (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
1	B	0	1
2	E	0	1
All	All	0	3

There are no bond length outliers.

The worst 5 of 34 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	357	ASP	N-CA-C	13.90	126.13	108.19
1	B	720	ARG	NE-CZ-NH2	7.79	126.21	119.20
1	A	538	ARG	NE-CZ-NH2	7.72	126.15	119.20
1	A	538	ARG	NE-CZ-NH1	-7.54	113.97	121.50
1	A	376	ARG	NE-CZ-NH2	7.31	125.78	119.20

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	208	GLN	Peptide
1	B	208	GLN	Peptide
2	E	357	ASP	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	7245	0	7006	356	0
1	B	7235	0	6998	346	2
2	E	1138	0	1126	84	2
2	F	1079	0	1065	70	0
3	C	28	0	25	0	0
3	D	28	0	25	0	0
3	G	28	0	25	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	126	0	117	0	0
5	B	154	0	143	7	0
6	A	2	0	0	0	0
6	B	2	0	0	0	0
All	All	17067	0	16530	846	2

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 25.

The worst 5 of 846 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:324:THR:HG22	2:E:325:ASP:H	1.09	1.09
1:B:272:THR:O	1:B:274:LEU:N	1.87	1.07
1:A:272:THR:O	1:A:274:LEU:N	1.87	1.06
2:E:357:ASP:HB2	2:E:406:ARG:HH12	1.16	1.05
1:B:928:GLY:O	1:B:930:GLY:N	1.94	1.01

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:527:ARG:NH1	2:E:396:ASN:OD1[3_545]	1.91	0.29
1:B:527:ARG:NH1	2:E:396:ASN:CG[3_545]	2.05	0.15

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	895/959 (93%)	766 (86%)	84 (9%)	45 (5%)	1	13
1	B	894/959 (93%)	768 (86%)	82 (9%)	44 (5%)	1	13
2	E	142/440 (32%)	111 (78%)	22 (16%)	9 (6%)	1	8
2	F	133/440 (30%)	107 (80%)	20 (15%)	6 (4%)	2	15
All	All	2064/2798 (74%)	1752 (85%)	208 (10%)	104 (5%)	1	13

5 of 104 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	146	ASP
1	A	155	GLU
1	A	273	TYR
1	A	290	GLN
1	A	344	PHE

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	799/845 (95%)	673 (84%)	126 (16%)	2	13
1	B	798/845 (94%)	674 (84%)	124 (16%)	2	14
2	E	132/393 (34%)	99 (75%)	33 (25%)	0	3
2	F	125/393 (32%)	97 (78%)	28 (22%)	1	5
All	All	1854/2476 (75%)	1543 (83%)	311 (17%)	2	11

5 of 311 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	853	LYS
2	F	291	VAL
1	B	886	GLN
2	E	330	ARG
2	F	401	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 18 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	814	GLN
1	B	962	HIS
1	B	951	ASN
1	A	962	HIS
1	B	679	ASN

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](#)

6 monosaccharides are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The

Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	NAG	C	1	3,1	14,14,15	0.62	0	17,19,21	1.04	1 (5%)
3	NAG	C	2	3	14,14,15	0.70	0	17,19,21	0.84	1 (5%)
3	NAG	D	1	3,2	14,14,15	0.60	0	17,19,21	1.13	1 (5%)
3	NAG	D	2	3	14,14,15	0.48	0	17,19,21	1.12	1 (5%)
3	NAG	G	1	3,2	14,14,15	0.65	0	17,19,21	1.06	1 (5%)
3	NAG	G	2	3	14,14,15	0.45	0	17,19,21	1.09	1 (5%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	C	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	C	2	3	-	0/6/23/26	0/1/1/1
3	NAG	D	1	3,2	-	0/6/23/26	0/1/1/1
3	NAG	D	2	3	-	1/6/23/26	0/1/1/1
3	NAG	G	1	3,2	-	0/6/23/26	0/1/1/1
3	NAG	G	2	3	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	2	NAG	C1-O5-C5	3.43	116.78	112.19
3	G	2	NAG	C1-O5-C5	3.42	116.77	112.19
3	D	1	NAG	C3-C4-C5	2.86	115.41	110.23
3	C	1	NAG	C4-C3-C2	2.56	114.77	111.02
3	G	1	NAG	C3-C4-C5	2.42	114.63	110.23

There are no chirality outliers.

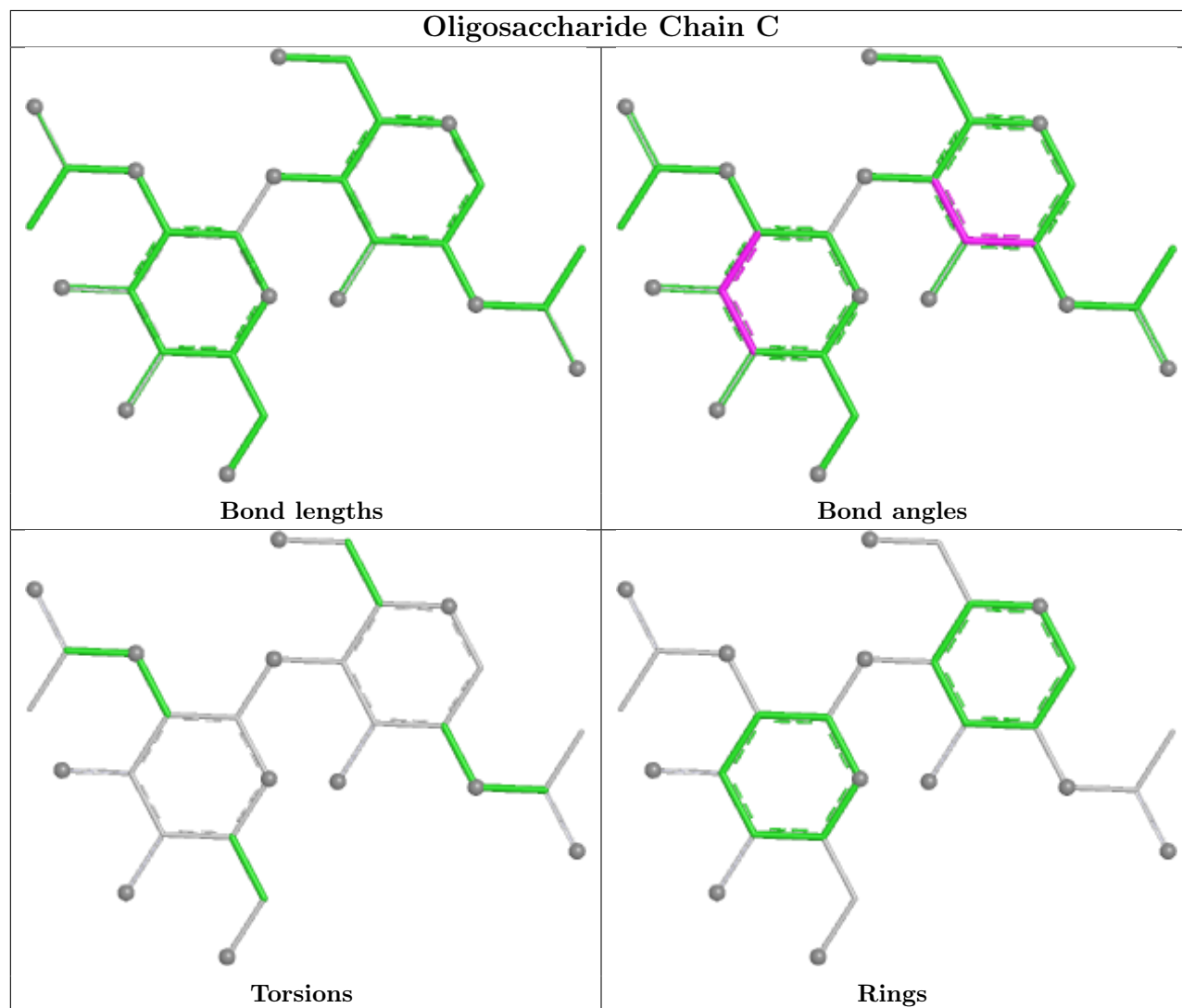
All (1) torsion outliers are listed below:

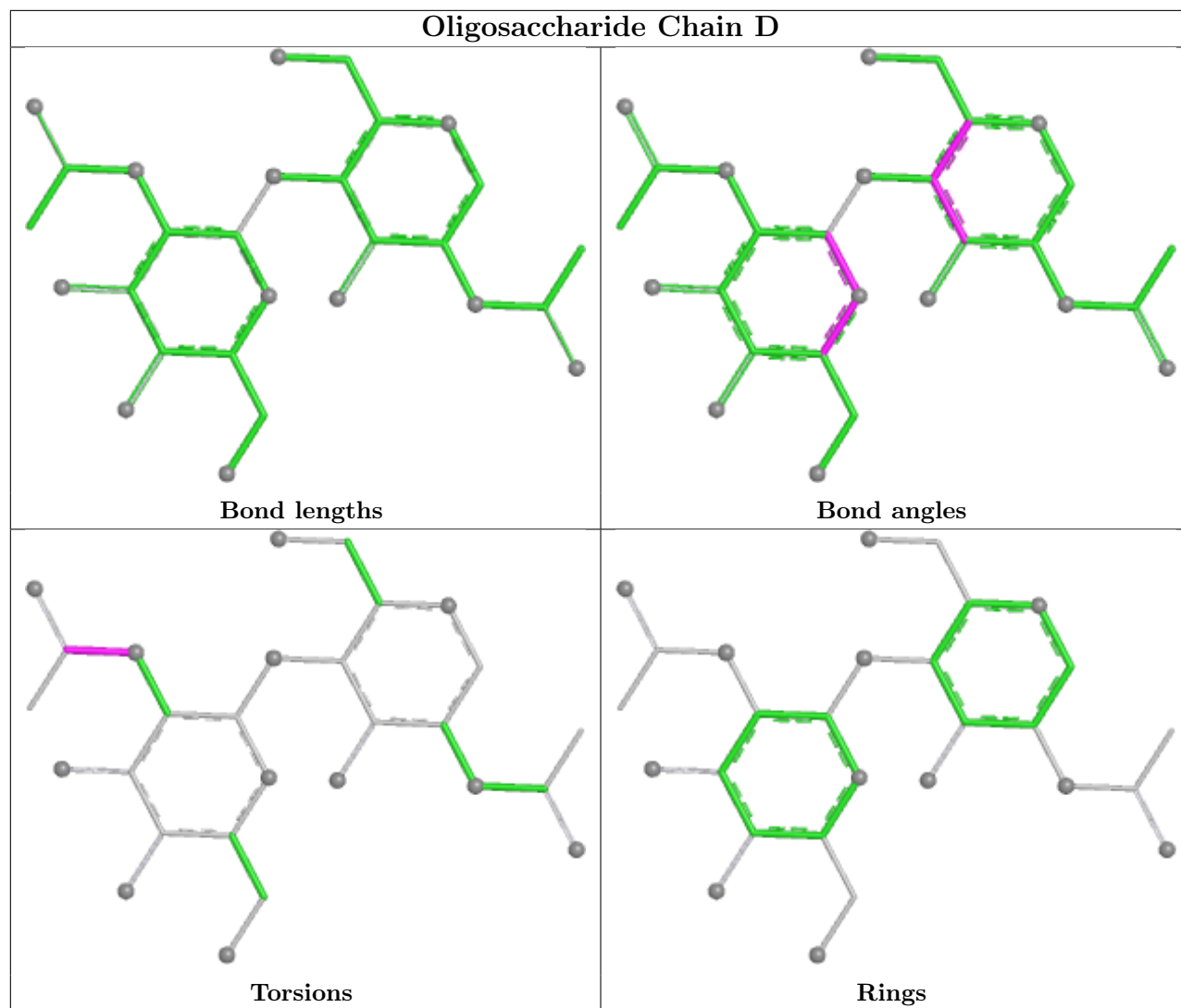
Mol	Chain	Res	Type	Atoms
3	D	2	NAG	C8-C7-N2-C2

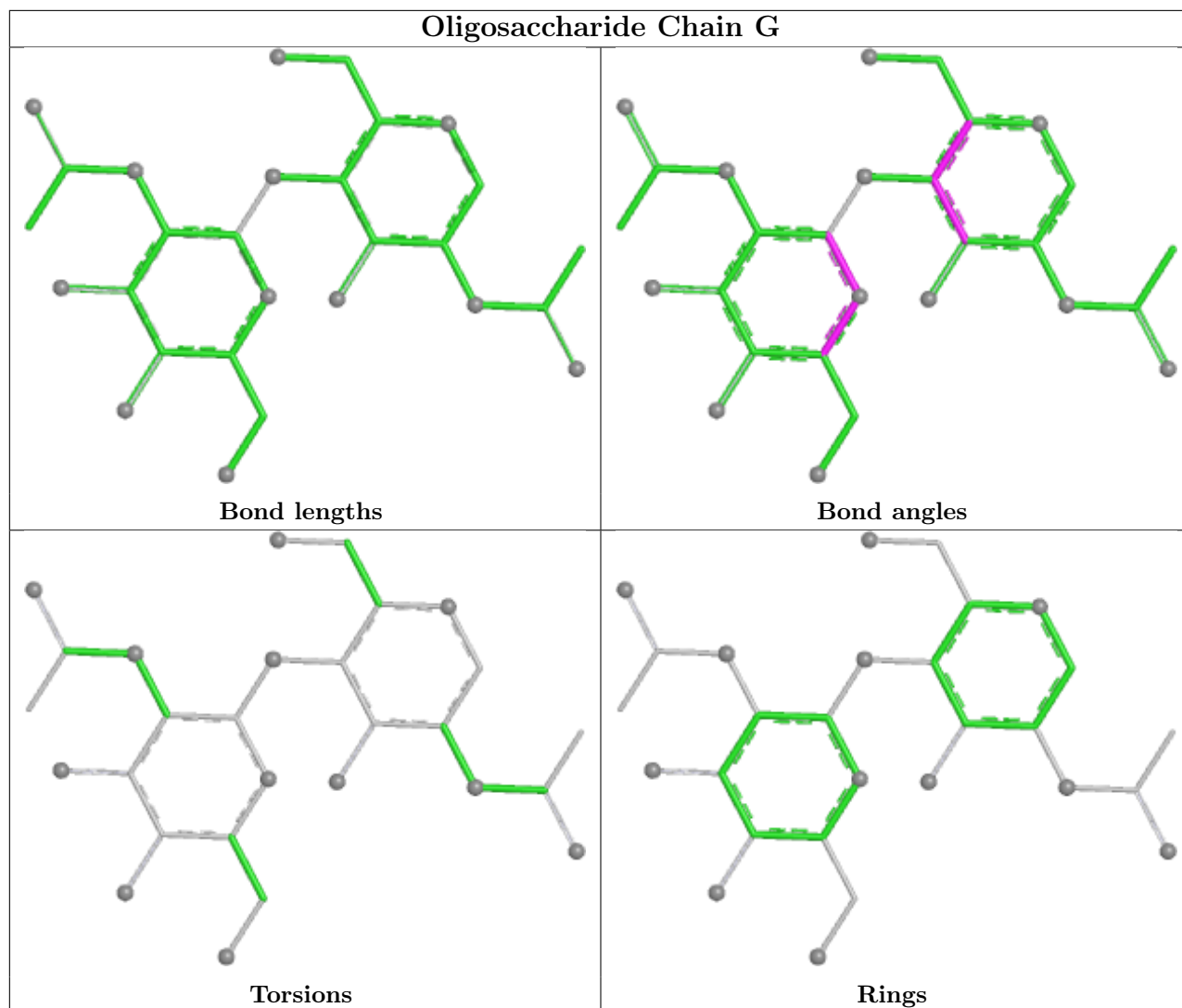
There are no ring outliers.

No monomer is involved in short contacts.

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 22 ligands modelled in this entry, 2 are monoatomic - leaving 20 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
5	NAG	B	1004	1	14,14,15	0.51	0	17,19,21	0.97	2 (11%)
5	NAG	A	1006	1	14,14,15	0.51	0	17,19,21	0.55	0
5	NAG	B	1011	1	14,14,15	0.50	0	17,19,21	0.96	2 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	NAG	B	1007	1	14,14,15	0.71	0	17,19,21	1.08	1 (5%)
5	NAG	A	1004	1	14,14,15	0.47	0	17,19,21	1.26	1 (5%)
5	NAG	A	1003	1	14,14,15	0.41	0	17,19,21	0.95	0
5	NAG	A	1005	1	14,14,15	0.50	0	17,19,21	0.80	1 (5%)
5	NAG	A	1011	1	14,14,15	0.54	0	17,19,21	0.79	0
5	NAG	B	1003	1	14,14,15	0.48	0	17,19,21	1.24	2 (11%)
5	NAG	A	1002	1	14,14,15	0.53	0	17,19,21	0.77	0
5	NAG	B	1005	1	14,14,15	0.72	0	17,19,21	0.84	1 (5%)
5	NAG	B	1012	1	14,14,15	0.56	0	17,19,21	0.92	0
5	NAG	B	1010	1	14,14,15	0.43	0	17,19,21	1.04	2 (11%)
5	NAG	B	1002	1	14,14,15	0.44	0	17,19,21	1.25	1 (5%)
5	NAG	B	1009	1	14,14,15	0.66	0	17,19,21	0.86	1 (5%)
5	NAG	B	1008	1	14,14,15	0.43	0	17,19,21	1.24	1 (5%)
5	NAG	A	1007	1	14,14,15	0.57	0	17,19,21	0.78	0
5	NAG	A	1010	1	14,14,15	0.49	0	17,19,21	0.83	1 (5%)
5	NAG	B	1006	1	14,14,15	0.56	0	17,19,21	0.56	0
5	NAG	A	1012	1	14,14,15	0.48	0	17,19,21	0.87	1 (5%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	NAG	B	1004	1	-	2/6/23/26	0/1/1/1
5	NAG	A	1006	1	-	0/6/23/26	0/1/1/1
5	NAG	B	1011	1	-	0/6/23/26	0/1/1/1
5	NAG	B	1007	1	-	2/6/23/26	0/1/1/1
5	NAG	A	1004	1	-	1/6/23/26	0/1/1/1
5	NAG	A	1003	1	-	0/6/23/26	0/1/1/1
5	NAG	A	1005	1	-	2/6/23/26	0/1/1/1
5	NAG	A	1011	1	-	1/6/23/26	0/1/1/1
5	NAG	B	1003	1	-	1/6/23/26	0/1/1/1
5	NAG	A	1002	1	-	2/6/23/26	0/1/1/1
5	NAG	B	1005	1	-	2/6/23/26	0/1/1/1
5	NAG	B	1012	1	-	3/6/23/26	0/1/1/1
5	NAG	B	1010	1	-	0/6/23/26	0/1/1/1
5	NAG	B	1002	1	-	0/6/23/26	0/1/1/1
5	NAG	B	1009	1	-	4/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	NAG	B	1008	1	-	2/6/23/26	0/1/1/1
5	NAG	A	1007	1	-	0/6/23/26	0/1/1/1
5	NAG	A	1010	1	-	1/6/23/26	0/1/1/1
5	NAG	B	1006	1	-	2/6/23/26	0/1/1/1
5	NAG	A	1012	1	-	3/6/23/26	0/1/1/1

There are no bond length outliers.

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	1004	NAG	C1-O5-C5	4.30	117.95	112.19
5	B	1008	NAG	C1-O5-C5	3.70	117.14	112.19
5	B	1002	NAG	C1-O5-C5	3.21	116.49	112.19
5	B	1003	NAG	C1-O5-C5	2.96	116.15	112.19
5	A	1012	NAG	C1-O5-C5	2.91	116.09	112.19

There are no chirality outliers.

5 of 28 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	1008	NAG	C8-C7-N2-C2
5	B	1008	NAG	O7-C7-N2-C2
5	B	1004	NAG	O5-C5-C6-O6
5	B	1006	NAG	O5-C5-C6-O6
5	B	1005	NAG	O5-C5-C6-O6

There are no ring outliers.

3 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	1011	NAG	2	0
5	B	1009	NAG	3	0
5	B	1008	NAG	2	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues

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	901/959 (93%)	-0.25	1 (0%) 92 89	50, 84, 143, 186	0
1	B	900/959 (93%)	-0.24	2 (0%) 91 85	48, 86, 154, 203	0
2	E	146/440 (33%)	-0.10	3 (2%) 63 43	66, 96, 148, 188	0
2	F	139/440 (31%)	0.02	4 (2%) 53 35	75, 127, 162, 185	0
All	All	2086/2798 (74%)	-0.22	10 (0%) 87 76	48, 88, 153, 203	0

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	F	419	TYR	3.3
1	A	614	ASP	2.7
2	E	283	PRO	2.6
2	F	283	PRO	2.6
2	F	301	ARG	2.3

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.

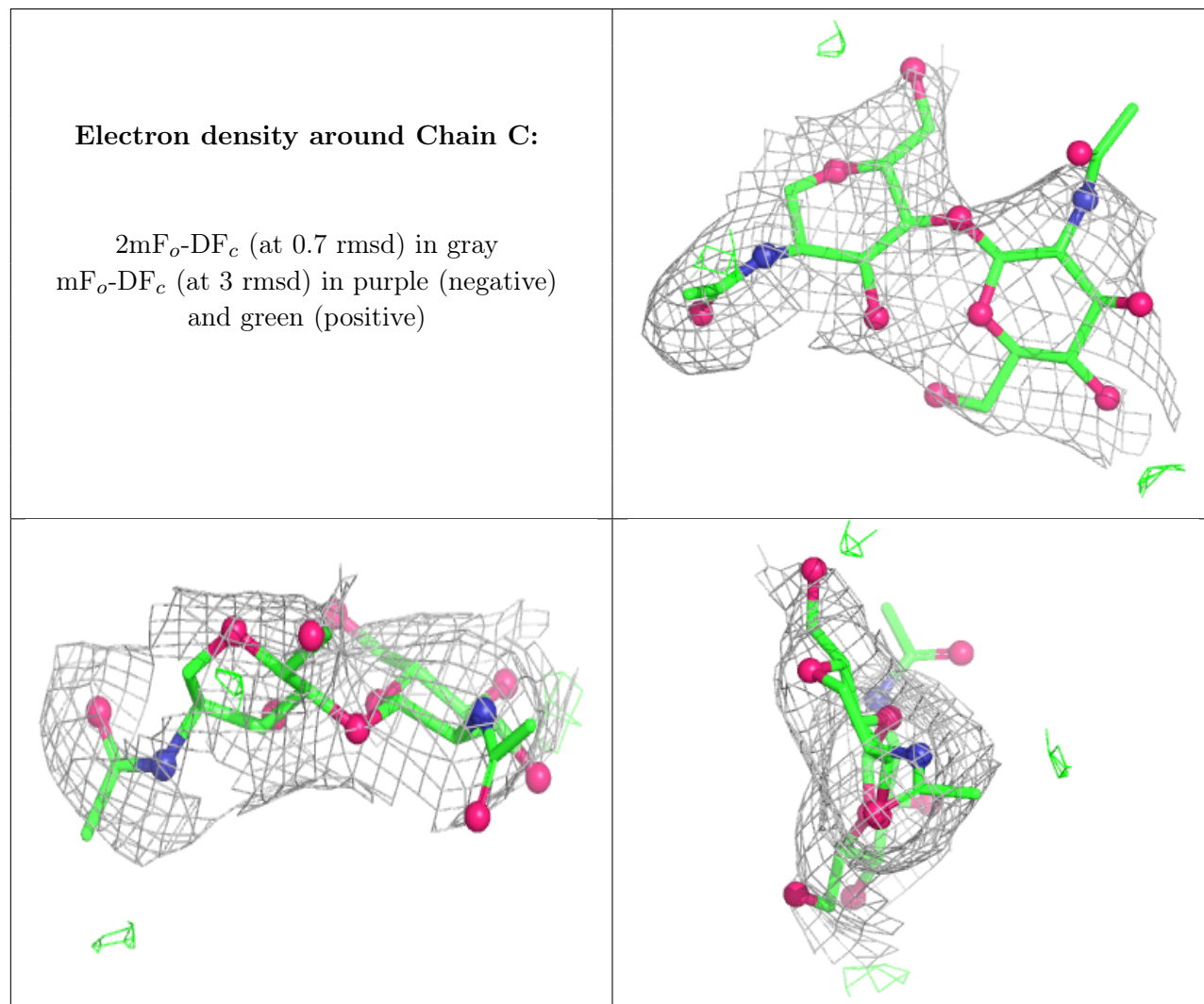
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	NAG	C	1	14/15	-	-	65,95,112,120	0
3	NAG	C	2	14/15	-	-	104,125,171,174	0

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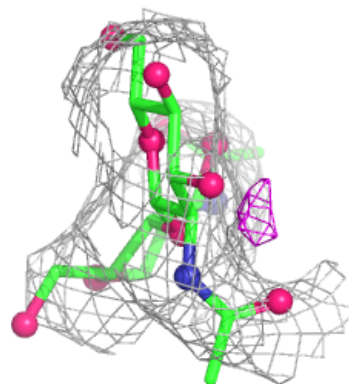
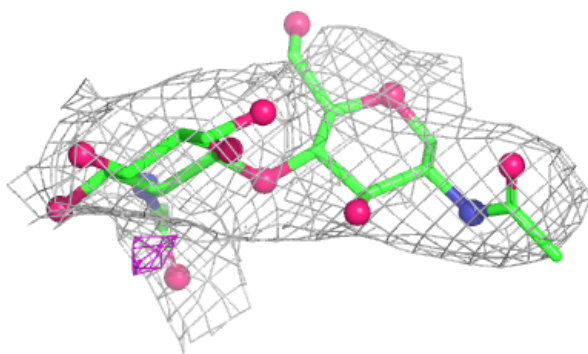
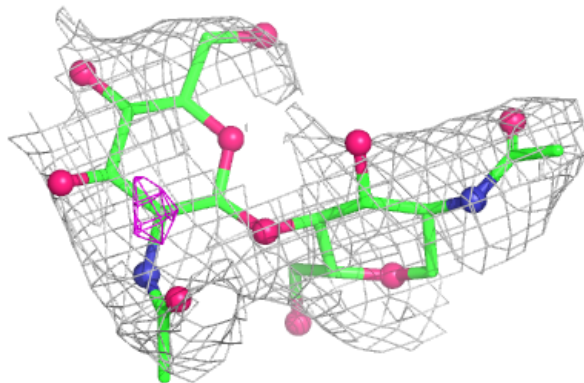
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	NAG	D	1	14/15	-	-	88,117,142,149	0
3	NAG	D	2	14/15	-	-	126,140,146,149	0
3	NAG	G	2	14/15	0.59	0.12	144,150,156,159	0
3	NAG	G	1	14/15	0.88	0.08	97,120,144,146	0

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.

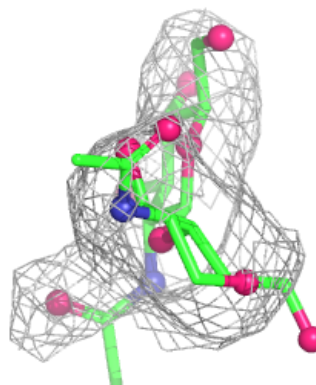
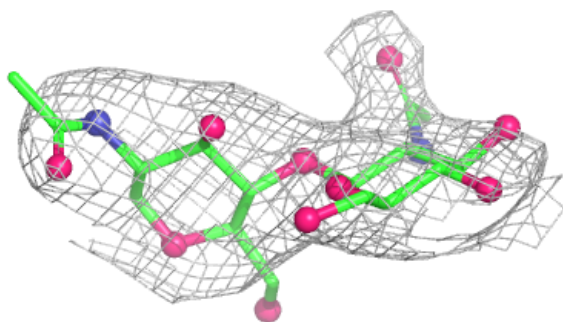
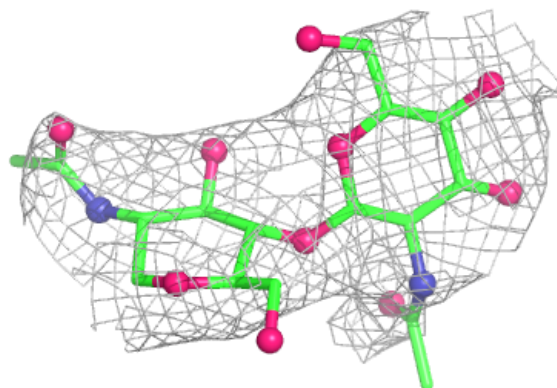


Electron density around Chain D:

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

**Electron density around Chain G:**

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



6.4 Ligands [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	NAG	B	1004	14/15	0.41	0.13	130,164,186,189	0
5	NAG	A	1006	14/15	0.48	0.15	138,158,186,192	0
5	NAG	B	1010	14/15	0.61	0.14	127,145,159,164	0
5	NAG	B	1005	14/15	0.68	0.13	123,148,157,159	0
5	NAG	A	1004	14/15	0.73	0.14	125,149,160,160	0
5	NAG	A	1005	14/15	0.74	0.12	135,142,162,163	0
5	NAG	B	1003	14/15	0.79	0.09	75,88,102,106	0
5	NAG	B	1009	14/15	0.80	0.13	125,143,149,155	0
5	NAG	B	1006	14/15	0.80	0.12	117,129,135,140	0
5	NAG	B	1011	14/15	0.80	0.14	114,128,147,148	0
5	NAG	A	1010	14/15	0.81	0.09	106,121,131,137	0
5	NAG	A	1011	14/15	0.81	0.12	84,95,117,134	0
5	NAG	A	1007	14/15	0.81	0.12	92,117,143,146	0
5	NAG	B	1002	14/15	0.85	0.11	107,137,154,158	0
5	NAG	A	1002	14/15	0.86	0.09	107,119,135,139	0
5	NAG	B	1007	14/15	0.87	0.08	90,99,133,141	0
5	NAG	A	1012	14/15	0.91	0.10	58,80,99,100	0
5	NAG	A	1003	14/15	0.91	0.07	51,79,92,96	0
5	NAG	B	1008	14/15	0.92	0.11	73,97,115,119	0
5	NAG	B	1012	14/15	0.92	0.07	74,87,113,124	0
4	ZN	B	1001	1/1	0.98	0.04	83,83,83,83	0
4	ZN	A	1001	1/1	0.99	0.02	75,75,75,75	0

6.5 Other polymers [i](#)

There are no such residues in this entry.