



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 12, 2024 – 06:12 PM EST

PDB ID : 3QBJ  
Title : Crystal structure of dipeptidyl peptidase IV in complex with inhibitor  
Authors : Liu, S.P.  
Deposited on : 2011-01-13  
Resolution : 2.21 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 : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 1.20.1  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

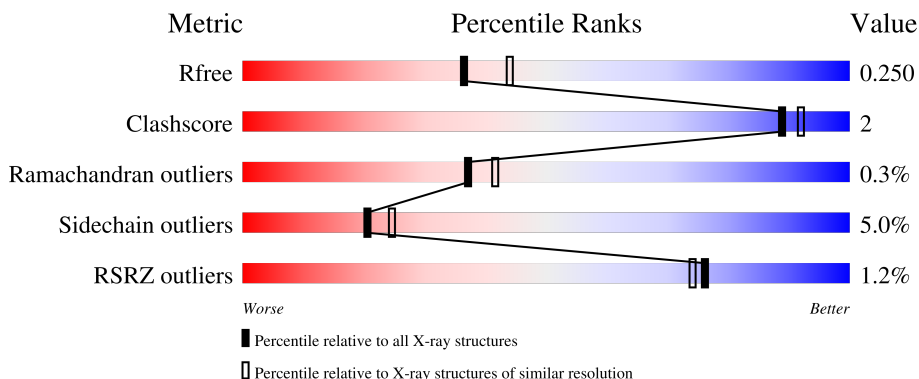
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*


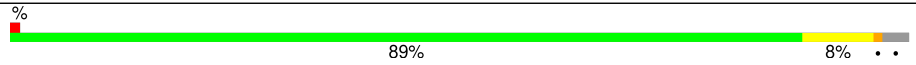
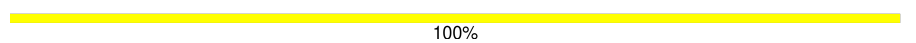
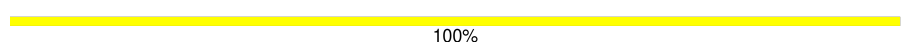
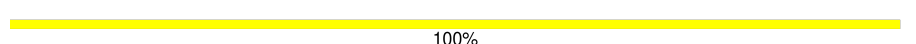
The reported resolution of this entry is 2.21 Å.

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	7167 (2.24-2.20)
Clashscore	180529	8096 (2.24-2.20)
Ramachandran outliers	177936	8010 (2.24-2.20)
Sidechain outliers	177891	8011 (2.24-2.20)
RSRZ outliers	164620	7166 (2.24-2.20)

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  $\geq 3$ , 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	748	 89% 8% ..
1	B	748	 89% 8% ..
2	C	2	 100%
2	E	2	 100%
3	D	4	 100%

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 12183 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 Dipeptidyl peptidase 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	728	5957	3825	980	1126	26	0	0	0
1	B	728	5957	3825	980	1126	26	0	0	0

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	150	ALA	ASN	engineered mutation	UNP P27487
A	520	ALA	ASN	engineered mutation	UNP P27487
A	767	LEU	-	expression tag	UNP P27487
A	768	VAL	-	expression tag	UNP P27487
A	769	PRO	-	expression tag	UNP P27487
A	770	ARG	-	expression tag	UNP P27487
A	771	GLY	-	expression tag	UNP P27487
A	772	SER	-	expression tag	UNP P27487
A	773	HIS	-	expression tag	UNP P27487
A	774	HIS	-	expression tag	UNP P27487
A	775	HIS	-	expression tag	UNP P27487
A	776	HIS	-	expression tag	UNP P27487
A	777	HIS	-	expression tag	UNP P27487
A	778	HIS	-	expression tag	UNP P27487
B	150	ALA	ASN	engineered mutation	UNP P27487
B	520	ALA	ASN	engineered mutation	UNP P27487
B	767	LEU	-	expression tag	UNP P27487
B	768	VAL	-	expression tag	UNP P27487
B	769	PRO	-	expression tag	UNP P27487
B	770	ARG	-	expression tag	UNP P27487
B	771	GLY	-	expression tag	UNP P27487
B	772	SER	-	expression tag	UNP P27487
B	773	HIS	-	expression tag	UNP P27487
B	774	HIS	-	expression tag	UNP P27487
B	775	HIS	-	expression tag	UNP P27487

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Chain	Residue	Modelled	Actual	Comment	Reference
B	776	HIS	-	expression tag	UNP P27487
B	777	HIS	-	expression tag	UNP P27487
B	778	HIS	-	expression tag	UNP P27487

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

- Molecule 3 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.



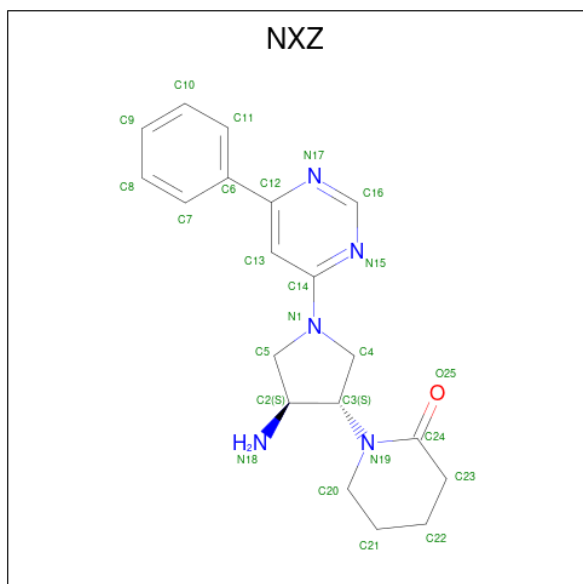
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	D	4	50	28	2	20	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



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

- Molecule 5 is 1-[(3S,4S)-4-amino-1-(6-phenylpyrimidin-4-yl)pyrrolidin-3-yl]piperidin-2-one (three-letter code: NXZ) (formula: C<sub>19</sub>H<sub>23</sub>N<sub>5</sub>O).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			25	19	5	1		
5	B	1	Total	C	N	O	0	0
			25	19	5	1		

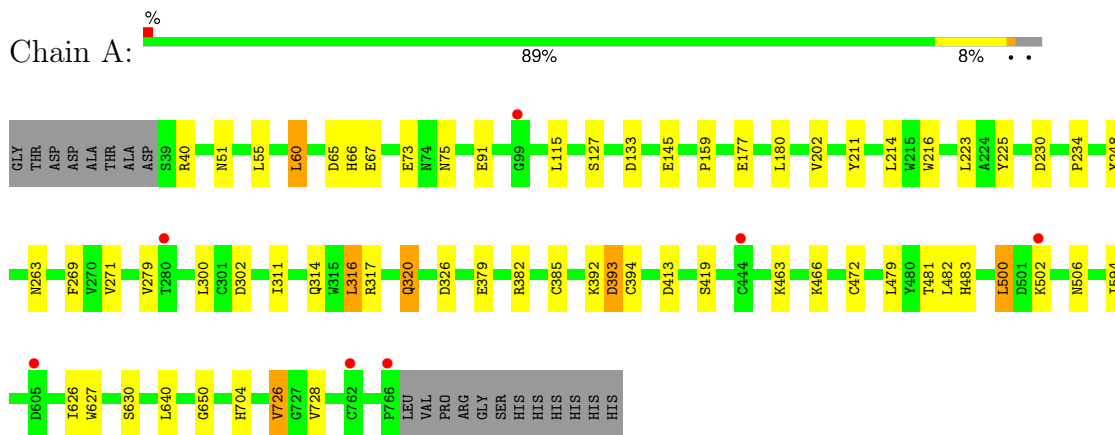
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	28	Total	O	0	0
			28	28		
6	B	43	Total	O	0	0
			43	43		

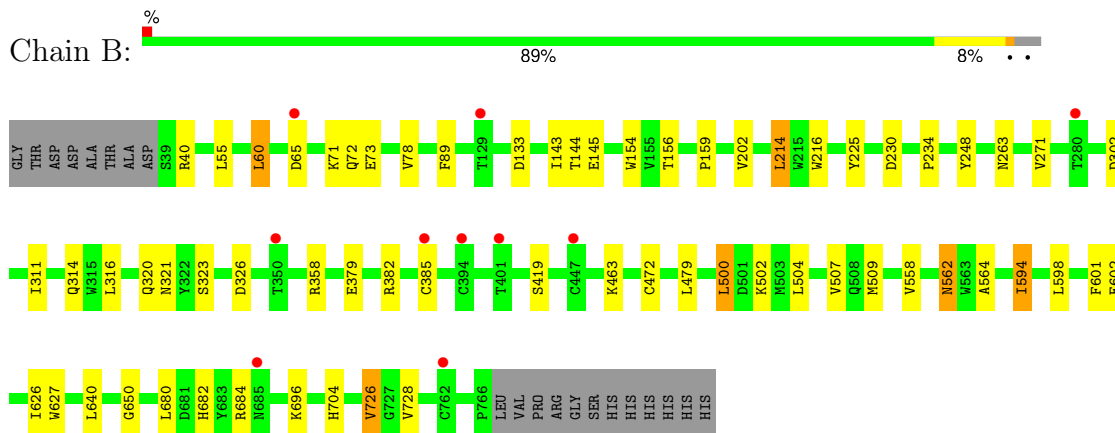
### 3 Residue-property plots [i](#)

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.

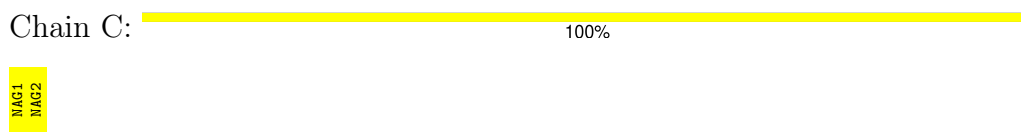
- Molecule 1: Dipeptidyl peptidase 4



- Molecule 1: Dipeptidyl peptidase 4



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



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

Chain E:  100%

MAG1  
MAG2

- Molecule 3: 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

Chain D:  100%

MAG1  
MAG2  
MAG3  
MAG4



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.75Å 69.08Å 424.16Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	18.11 – 2.21 18.11 – 2.21	Depositor EDS
% Data completeness (in resolution range)	80.3 (18.11-2.21) 80.1 (18.11-2.21)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.49 (at 2.21Å)	Xtrriage
Refinement program	BUSTER-TNT, BUSTER 2.9.6	Depositor
R, $R_{free}$	0.202 , 0.235 0.215 , 0.250	Depositor DCC
$R_{free}$ test set	3918 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	39.7	Xtrriage
Anisotropy	0.962	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 49.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	0.024 for k,h,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	12183	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	72.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.00% 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: BMA, NAG, NXZ, MAN

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	0.50	0/6129	0.70	1/8336 (0.0%)
1	B	0.50	0/6129	0.70	1/8336 (0.0%)
All	All	0.50	0/12258	0.70	2/16672 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	60	LEU	CA-CB-CG	5.23	127.33	115.30
1	A	60	LEU	CA-CB-CG	5.08	126.98	115.30

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5957	0	5678	23	0
1	B	5957	0	5681	22	0
2	C	28	0	25	0	0
2	E	28	0	25	0	0
3	D	50	0	43	0	0
4	A	28	0	26	0	0
4	B	14	0	13	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	25	0	23	0	0
5	B	25	0	23	0	0
6	A	28	0	0	0	0
6	B	43	0	0	1	0
All	All	12183	0	11537	43	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 2.

All (43) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:78:VAL:HG23	1:B:89:PHE:HB2	1.73	0.69
1:B:507:VAL:HG13	1:B:509:MET:HG2	1.75	0.69
1:A:225:TYR:CE1	1:A:269:PHE:HD1	2.11	0.68
1:B:504:LEU:HA	1:B:507:VAL:HG12	1.76	0.67
1:B:154:TRP:NE1	1:B:156:THR:OG1	2.29	0.65
1:B:696:LYS:HG2	1:B:728:VAL:HG22	1.78	0.65
1:B:316:LEU:HD13	1:B:323:SER:HB3	1.81	0.62
1:B:562:ASN:HD21	1:B:564:ALA:HB3	1.69	0.58
1:A:302:ASP:HB3	1:A:314:GLN:HB2	1.87	0.56
1:B:640:LEU:HD11	1:B:650:GLY:HA3	1.88	0.56
1:B:626:ILE:O	1:B:650:GLY:HA2	2.06	0.56
1:B:302:ASP:HB3	1:B:314:GLN:HB2	1.88	0.56
1:A:626:ILE:O	1:A:650:GLY:HA2	2.06	0.55
1:A:214:LEU:HD22	1:A:223:LEU:HD11	1.91	0.51
1:A:640:LEU:HD11	1:A:650:GLY:HA3	1.92	0.51
1:B:598:LEU:O	1:B:682:HIS:HE1	1.94	0.51
1:A:316:LEU:HD21	1:A:320:GLN:HA	1.92	0.51
1:A:214:LEU:HD23	1:A:225:TYR:HB3	1.93	0.50
1:A:316:LEU:CD2	1:A:320:GLN:HA	2.43	0.49
1:A:177:GLU:HB2	1:A:180:LEU:HD23	1.95	0.49
1:A:726:VAL:HG13	1:A:728:VAL:HG23	1.95	0.48
1:B:65:ASP:OD1	1:B:463:LYS:O	2.31	0.48
1:B:594:ILE:HD11	1:B:602:GLU:H	1.79	0.47
1:A:65:ASP:HB3	1:A:463:LYS:O	2.15	0.47
1:B:214:LEU:HD12	1:B:225:TYR:HB3	1.97	0.46
1:B:726:VAL:HG13	1:B:728:VAL:HG23	1.96	0.46
1:B:214:LEU:CD1	1:B:225:TYR:HB3	2.47	0.45
1:A:159:PRO:HD3	1:A:216:TRP:HB3	1.98	0.45
1:A:393:ASP:HB2	1:A:394:CYS:H	1.65	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:159:PRO:HD3	1:B:216:TRP:HB3	1.98	0.44
1:A:316:LEU:HD22	1:A:317:ARG:O	2.19	0.43
1:A:234:PRO:HB2	1:B:248:TYR:CZ	2.54	0.43
1:A:248:TYR:CZ	1:B:234:PRO:HB2	2.54	0.42
1:A:66:HIS:CD2	1:A:67:GLU:HG3	2.55	0.42
1:A:177:GLU:CB	1:A:180:LEU:HD23	2.49	0.41
1:A:55:LEU:HD23	1:A:500:LEU:HD12	2.01	0.41
1:A:481:THR:OG1	1:A:483:HIS:HE1	2.03	0.41
1:A:66:HIS:HD2	1:A:67:GLU:HG3	1.86	0.41
1:A:75:ASN:HD22	1:A:91:GLU:HA	1.85	0.41
1:A:127:SER:HB3	1:A:211:TYR:CD1	2.56	0.41
1:B:358:ARG:HD2	6:B:802:HOH:O	2.21	0.41
1:B:594:ILE:HD12	1:B:601:PHE:HB2	2.03	0.40
1:B:55:LEU:HD23	1:B:500:LEU:HD12	2.02	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	726/748 (97%)	692 (95%)	31 (4%)	3 (0%)	30	33
1	B	726/748 (97%)	694 (96%)	30 (4%)	2 (0%)	37	41
All	All	1452/1496 (97%)	1386 (96%)	61 (4%)	5 (0%)	37	41

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	73	GLU
1	B	73	GLU
1	A	320	GLN
1	A	392	LYS

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Mol	Chain	Res	Type
1	B	320	GLN

### 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	651/667 (98%)	618 (95%)	33 (5%)	20	24
1	B	651/667 (98%)	619 (95%)	32 (5%)	21	25
All	All	1302/1334 (98%)	1237 (95%)	65 (5%)	20	24

All (65) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	40	ARG
1	A	51	ASN
1	A	60	LEU
1	A	115	LEU
1	A	133	ASP
1	A	145	GLU
1	A	202	VAL
1	A	230	ASP
1	A	263	ASN
1	A	271	VAL
1	A	279	VAL
1	A	300	LEU
1	A	311	ILE
1	A	316	LEU
1	A	326	ASP
1	A	379	GLU
1	A	382	ARG
1	A	385	CYS
1	A	393	ASP
1	A	413	ASP
1	A	419	SER
1	A	466	LYS

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	A	472	CYS
1	A	479	LEU
1	A	482	LEU
1	A	500	LEU
1	A	502	LYS
1	A	506	ASN
1	A	594	ILE
1	A	627	TRP
1	A	630	SER
1	A	704	HIS
1	A	726	VAL
1	B	40	ARG
1	B	60	LEU
1	B	71	LYS
1	B	72	GLN
1	B	133	ASP
1	B	143	ILE
1	B	144	THR
1	B	145	GLU
1	B	202	VAL
1	B	214	LEU
1	B	230	ASP
1	B	263	ASN
1	B	271	VAL
1	B	311	ILE
1	B	321	ASN
1	B	326	ASP
1	B	379	GLU
1	B	382	ARG
1	B	385	CYS
1	B	419	SER
1	B	472	CYS
1	B	479	LEU
1	B	500	LEU
1	B	502	LYS
1	B	558	VAL
1	B	562	ASN
1	B	594	ILE
1	B	627	TRP
1	B	680	LEU
1	B	684	ARG
1	B	704	HIS

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Mol	Chain	Res	Type
1	B	726	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	66	HIS
1	A	75	ASN
1	A	247	GLN
1	A	263	ASN
1	A	298	HIS
1	A	363	HIS
1	A	435	GLN
1	A	483	HIS
1	A	697	GLN
1	B	75	ASN
1	B	263	ASN
1	B	298	HIS
1	B	321	ASN
1	B	383	HIS
1	B	562	ASN
1	B	586	GLN
1	B	682	HIS
1	B	731	GLN

### 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](#)

8 monosaccharides are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond

length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	NAG	C	1	1,2	14,14,15	1.52	2 (14%)	17,19,21	1.68	4 (23%)
2	NAG	C	2	2	14,14,15	1.86	2 (14%)	17,19,21	2.24	4 (23%)
3	NAG	D	1	1,3	14,14,15	1.03	1 (7%)	17,19,21	1.72	3 (17%)
3	NAG	D	2	3	14,14,15	2.12	5 (35%)	17,19,21	1.72	3 (17%)
3	BMA	D	3	3	11,11,12	1.96	4 (36%)	15,15,17	2.13	6 (40%)
3	MAN	D	4	3	11,11,12	1.71	2 (18%)	15,15,17	1.36	2 (13%)
2	NAG	E	1	1,2	14,14,15	1.52	4 (28%)	17,19,21	1.19	1 (5%)
2	NAG	E	2	2	14,14,15	1.49	3 (21%)	17,19,21	2.15	5 (29%)

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	-	0/6/23/26	0/1/1/1
2	NAG	C	2	2	-	0/6/23/26	0/1/1/1
3	NAG	D	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	D	2	3	-	2/6/23/26	0/1/1/1
3	BMA	D	3	3	-	0/2/19/22	0/1/1/1
3	MAN	D	4	3	-	2/2/19/22	0/1/1/1
2	NAG	E	1	1,2	-	0/6/23/26	0/1/1/1
2	NAG	E	2	2	-	0/6/23/26	0/1/1/1

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	2	NAG	C1-C2	4.71	1.58	1.52
3	D	2	NAG	C3-C2	4.21	1.61	1.52
2	C	1	NAG	C1-C2	3.60	1.57	1.52
3	D	2	NAG	C1-C2	3.42	1.57	1.52
3	D	3	BMA	C2-C3	3.42	1.57	1.52
3	D	2	NAG	C4-C3	3.23	1.60	1.52
3	D	4	MAN	C1-C2	3.15	1.59	1.52
3	D	3	BMA	C4-C5	3.07	1.59	1.53
3	D	4	MAN	C2-C3	3.02	1.57	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	2	NAG	C2-N2	2.95	1.51	1.46
2	C	1	NAG	C2-N2	-2.74	1.41	1.46
2	C	2	NAG	O5-C5	2.71	1.48	1.43
2	E	1	NAG	C1-C2	2.50	1.55	1.52
2	E	1	NAG	O5-C1	-2.44	1.39	1.43
3	D	3	BMA	C4-C3	2.33	1.58	1.52
2	E	2	NAG	C1-C2	2.32	1.55	1.52
2	E	2	NAG	O4-C4	2.26	1.48	1.43
2	E	2	NAG	C3-C2	2.23	1.57	1.52
3	D	1	NAG	C1-C2	2.11	1.55	1.52
2	E	1	NAG	C4-C5	2.05	1.57	1.53
3	D	2	NAG	O5-C5	2.03	1.47	1.43
2	E	1	NAG	C3-C2	2.01	1.56	1.52
3	D	3	BMA	C6-C5	2.01	1.58	1.51

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	2	NAG	C1-O5-C5	6.88	121.41	112.19
2	E	2	NAG	C1-O5-C5	6.56	120.98	112.19
3	D	2	NAG	C4-C3-C2	5.05	118.41	111.02
3	D	1	NAG	C1-C2-N2	4.37	117.33	110.43
3	D	3	BMA	C2-C3-C4	4.32	118.46	110.86
3	D	3	BMA	C1-C2-C3	-3.52	104.52	109.64
3	D	3	BMA	O2-C2-C3	3.47	117.33	110.15
2	C	2	NAG	O5-C1-C2	3.37	116.50	111.29
3	D	2	NAG	C3-C4-C5	3.34	116.29	110.23
2	C	1	NAG	C8-C7-N2	-3.29	110.66	116.12
2	E	2	NAG	O5-C1-C2	3.15	116.17	111.29
2	E	1	NAG	O5-C1-C2	-3.11	106.48	111.29
2	C	1	NAG	C3-C4-C5	-3.06	104.68	110.23
2	C	2	NAG	O5-C5-C4	2.93	117.94	110.83
2	E	2	NAG	O5-C5-C4	2.91	117.90	110.83
2	E	2	NAG	C8-C7-N2	-2.63	111.75	116.12
3	D	4	MAN	O4-C4-C3	-2.60	104.25	110.38
3	D	3	BMA	O3-C3-C2	2.35	114.86	110.05
3	D	3	BMA	C3-C4-C5	2.34	114.48	110.23
2	C	1	NAG	C2-N2-C7	2.34	126.03	122.90
3	D	2	NAG	O4-C4-C3	-2.32	104.90	110.38
2	C	2	NAG	C8-C7-N2	-2.29	112.32	116.12
2	C	1	NAG	O5-C1-C2	-2.28	107.76	111.29
3	D	3	BMA	O4-C4-C3	-2.25	105.08	110.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	1	NAG	C4-C3-C2	2.24	114.30	111.02
3	D	4	MAN	C2-C3-C4	2.24	114.80	110.86
3	D	1	NAG	O4-C4-C3	-2.23	105.12	110.38
2	E	2	NAG	O5-C5-C6	2.08	111.71	107.66

There are no chirality outliers.

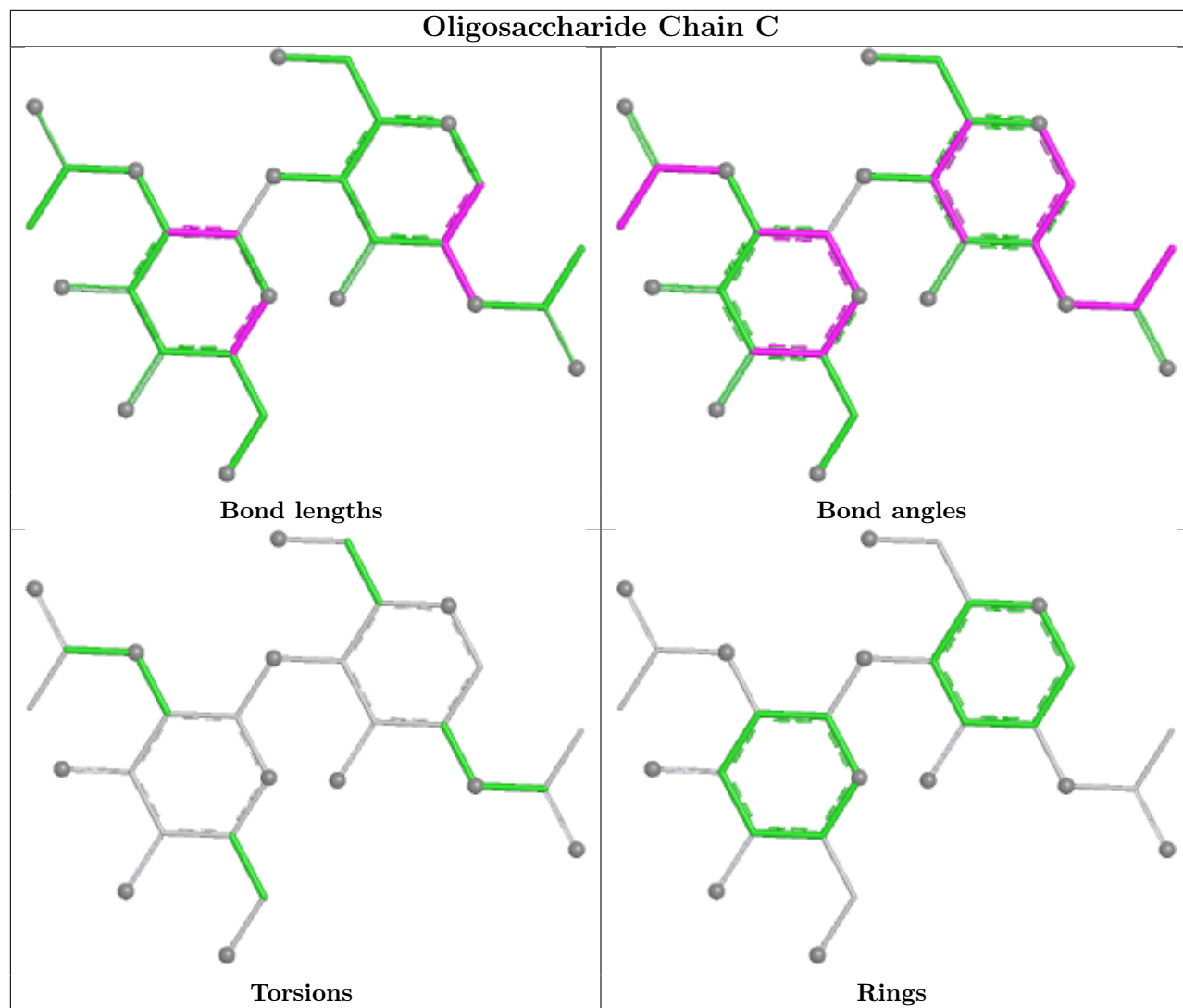
All (4) torsion outliers are listed below:

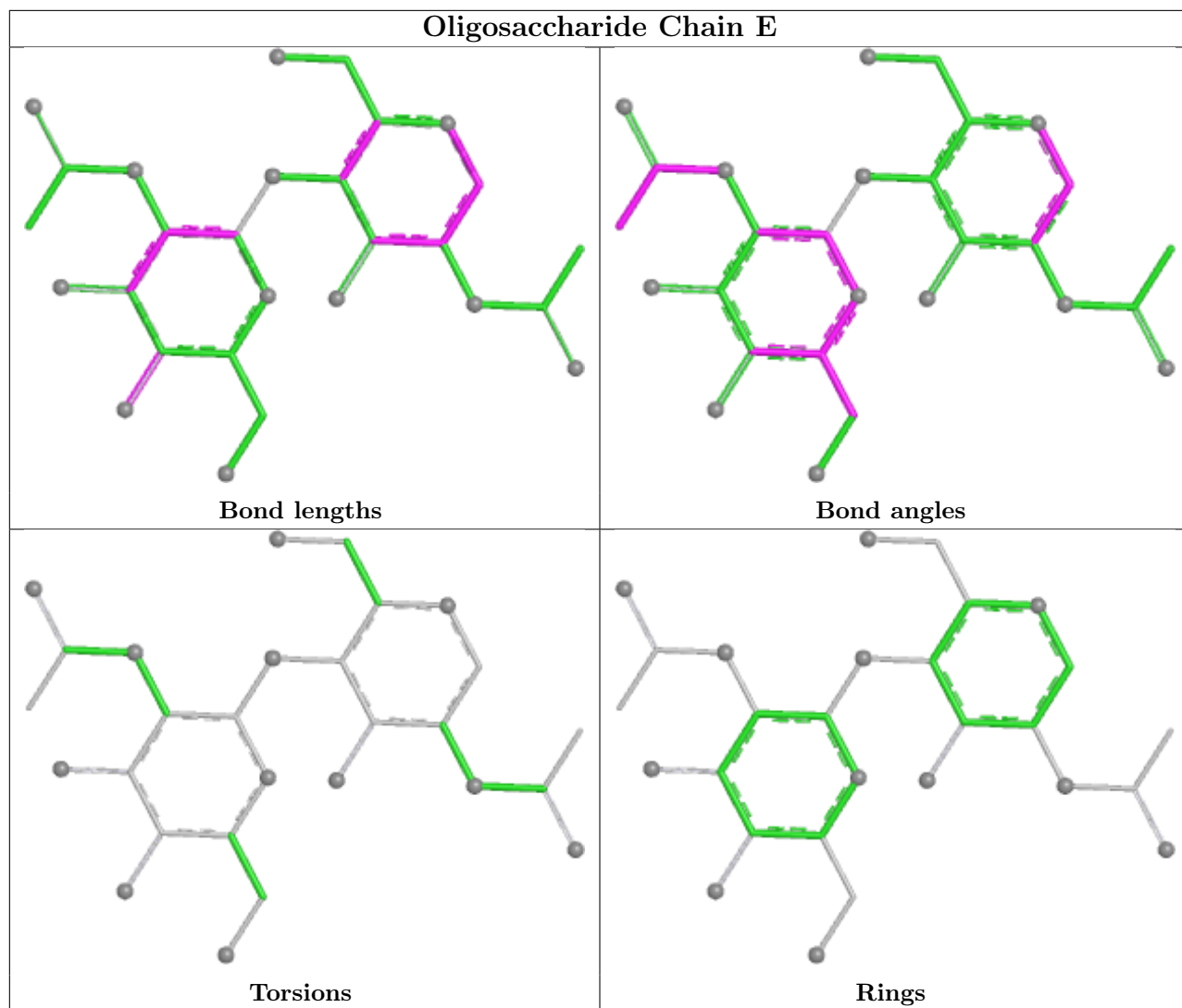
Mol	Chain	Res	Type	Atoms
3	D	4	MAN	O5-C5-C6-O6
3	D	4	MAN	C4-C5-C6-O6
3	D	2	NAG	C4-C5-C6-O6
3	D	2	NAG	O5-C5-C6-O6

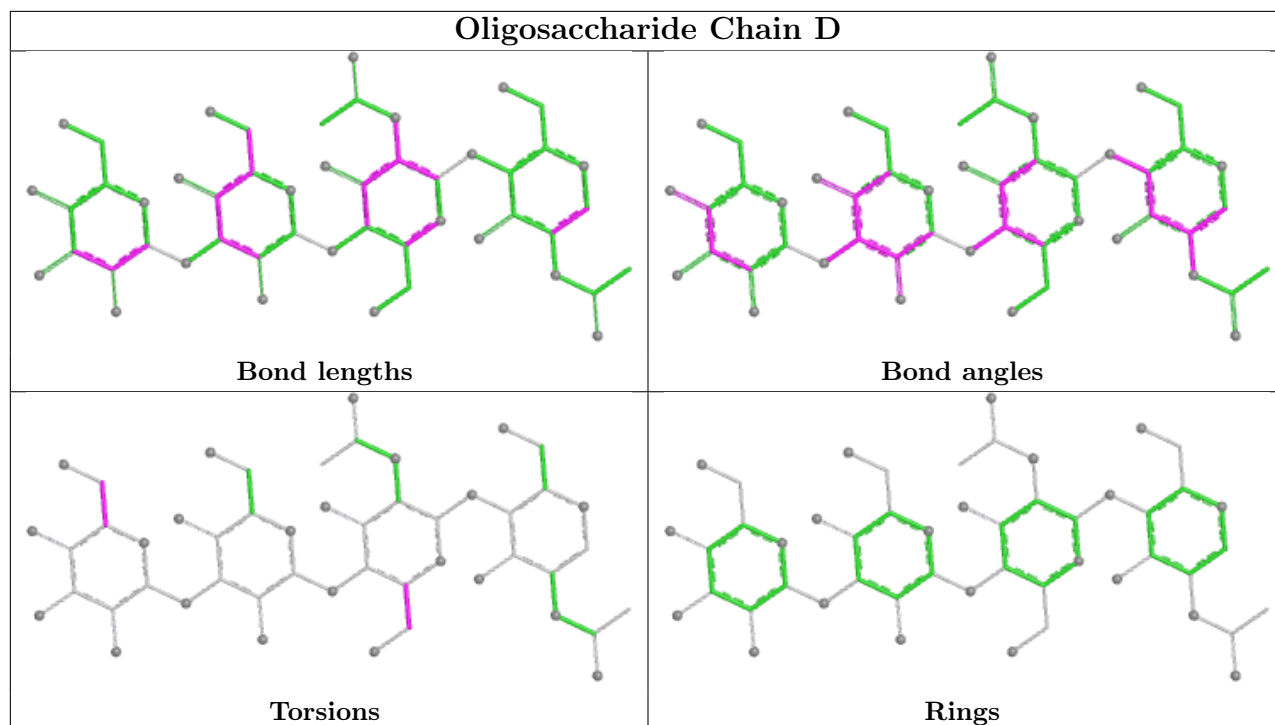
There are no ring outliers.

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](#)

5 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	NAG	B	796	1	14,14,15	1.24	2 (14%)	17,19,21	1.43	2 (11%)
5	NXZ	B	900	-	27,28,28	2.34	14 (51%)	26,39,39	3.89	11 (42%)
4	NAG	A	800	1	14,14,15	2.28	5 (35%)	17,19,21	1.61	3 (17%)
4	NAG	A	799	1	14,14,15	1.90	4 (28%)	17,19,21	2.65	7 (41%)
5	NXZ	A	900	-	27,28,28	2.09	11 (40%)	26,39,39	4.05	11 (42%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	B	796	1	-	0/6/23/26	0/1/1/1
5	NXZ	B	900	-	-	0/8/35/35	0/4/4/4
4	NAG	A	800	1	-	0/6/23/26	0/1/1/1
4	NAG	A	799	1	-	4/6/23/26	0/1/1/1
5	NXZ	A	900	-	-	0/8/35/35	0/4/4/4

All (36) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	800	NAG	C1-C2	4.94	1.59	1.52
5	B	900	NXZ	C14-N15	4.44	1.43	1.34
4	A	799	NAG	C1-C2	3.81	1.57	1.52
5	A	900	NXZ	C10-C11	3.81	1.44	1.36
5	B	900	NXZ	C10-C9	3.81	1.46	1.38
5	B	900	NXZ	C10-C11	3.70	1.44	1.36
4	A	800	NAG	C3-C2	3.67	1.60	1.52
5	A	900	NXZ	C14-N15	3.58	1.42	1.34
5	B	900	NXZ	C8-C7	3.53	1.44	1.36
5	A	900	NXZ	C8-C7	3.50	1.44	1.36
5	B	900	NXZ	C24-N19	3.39	1.40	1.35
5	A	900	NXZ	C7-C6	3.34	1.49	1.42
5	A	900	NXZ	C9-C8	3.29	1.45	1.38
4	A	800	NAG	C4-C3	3.25	1.60	1.52
5	B	900	NXZ	C20-N19	3.24	1.52	1.47
5	B	900	NXZ	C7-C6	3.03	1.48	1.42
4	B	796	NAG	C1-C2	2.91	1.56	1.52
5	B	900	NXZ	C12-N17	2.82	1.42	1.37
5	A	900	NXZ	C10-C9	2.66	1.44	1.38
5	B	900	NXZ	C4-N1	2.56	1.50	1.46
5	A	900	NXZ	C5-N1	2.56	1.50	1.46
4	A	800	NAG	O4-C4	2.42	1.48	1.43
5	B	900	NXZ	C5-C2	2.41	1.57	1.52
4	B	796	NAG	C3-C2	2.39	1.57	1.52
4	A	799	NAG	C4-C5	2.39	1.58	1.53
4	A	800	NAG	C2-N2	2.37	1.50	1.46
5	B	900	NXZ	C23-C24	2.34	1.55	1.51
5	B	900	NXZ	C22-C21	2.33	1.60	1.51
5	A	900	NXZ	C24-N19	2.29	1.38	1.35
4	A	799	NAG	C7-N2	2.21	1.41	1.34
4	A	799	NAG	O5-C5	2.20	1.47	1.43
5	B	900	NXZ	C9-C8	2.16	1.43	1.38
5	A	900	NXZ	C20-N19	2.13	1.50	1.47
5	A	900	NXZ	C11-C6	2.12	1.46	1.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	900	NXZ	C16-N17	2.07	1.35	1.32
5	A	900	NXZ	C23-C24	2.02	1.55	1.51

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	900	NXZ	C16-N15-C14	13.07	125.92	114.95
5	B	900	NXZ	C16-N15-C14	12.21	125.19	114.95
5	A	900	NXZ	N17-C16-N15	-9.51	115.76	128.67
5	B	900	NXZ	N17-C16-N15	-8.74	116.81	128.67
5	A	900	NXZ	C16-N17-C12	7.64	124.11	115.43
4	A	799	NAG	C1-O5-C5	6.83	121.34	112.19
5	B	900	NXZ	C16-N17-C12	6.57	122.90	115.43
5	B	900	NXZ	C4-N1-C14	-5.45	116.98	123.58
5	B	900	NXZ	C5-N1-C4	4.78	118.57	111.64
4	A	800	NAG	C1-O5-C5	4.58	118.33	112.19
5	A	900	NXZ	C4-N1-C14	-4.58	118.04	123.58
5	A	900	NXZ	C3-N19-C24	-4.23	114.95	119.33
5	B	900	NXZ	C3-N19-C24	-4.22	114.96	119.33
4	A	799	NAG	C4-C3-C2	-4.09	105.03	111.02
5	A	900	NXZ	C5-N1-C4	4.06	117.53	111.64
4	A	799	NAG	O5-C1-C2	3.84	117.22	111.29
4	B	796	NAG	C1-C2-N2	3.72	116.29	110.43
5	B	900	NXZ	C21-C20-N19	3.28	115.72	110.65
4	A	799	NAG	C1-C2-N2	3.13	115.36	110.43
4	A	799	NAG	O3-C3-C4	3.06	117.59	110.38
5	B	900	NXZ	C10-C9-C8	2.96	123.92	119.87
4	A	799	NAG	O5-C5-C4	2.91	117.91	110.83
5	B	900	NXZ	C13-C14-N15	-2.87	118.05	122.82
5	A	900	NXZ	C13-C14-N15	-2.78	118.20	122.82
5	A	900	NXZ	C21-C20-N19	2.76	114.91	110.65
5	A	900	NXZ	C7-C6-C11	2.59	121.14	118.81
5	A	900	NXZ	C10-C9-C8	2.55	123.36	119.87
4	B	796	NAG	C4-C3-C2	2.41	114.55	111.02
4	A	800	NAG	C8-C7-N2	-2.28	112.33	116.12
5	A	900	NXZ	C22-C21-C20	2.26	115.37	111.19
4	A	800	NAG	O4-C4-C3	2.25	115.67	110.38
5	B	900	NXZ	N15-C14-N1	2.13	119.80	116.76
5	B	900	NXZ	C7-C6-C11	2.13	120.73	118.81
4	A	799	NAG	O3-C3-C2	2.02	113.59	109.40

There are no chirality outliers.

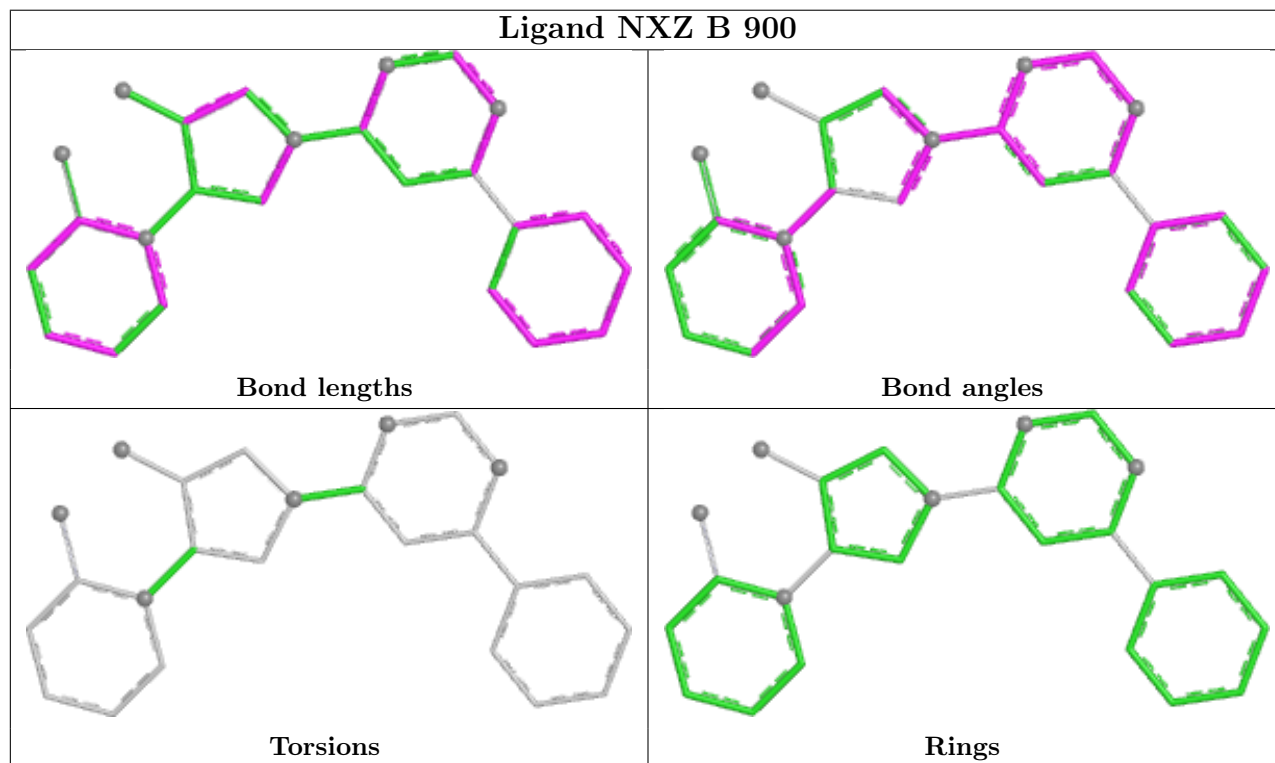
All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	799	NAG	O5-C5-C6-O6
4	A	799	NAG	C8-C7-N2-C2
4	A	799	NAG	O7-C7-N2-C2
4	A	799	NAG	C4-C5-C6-O6

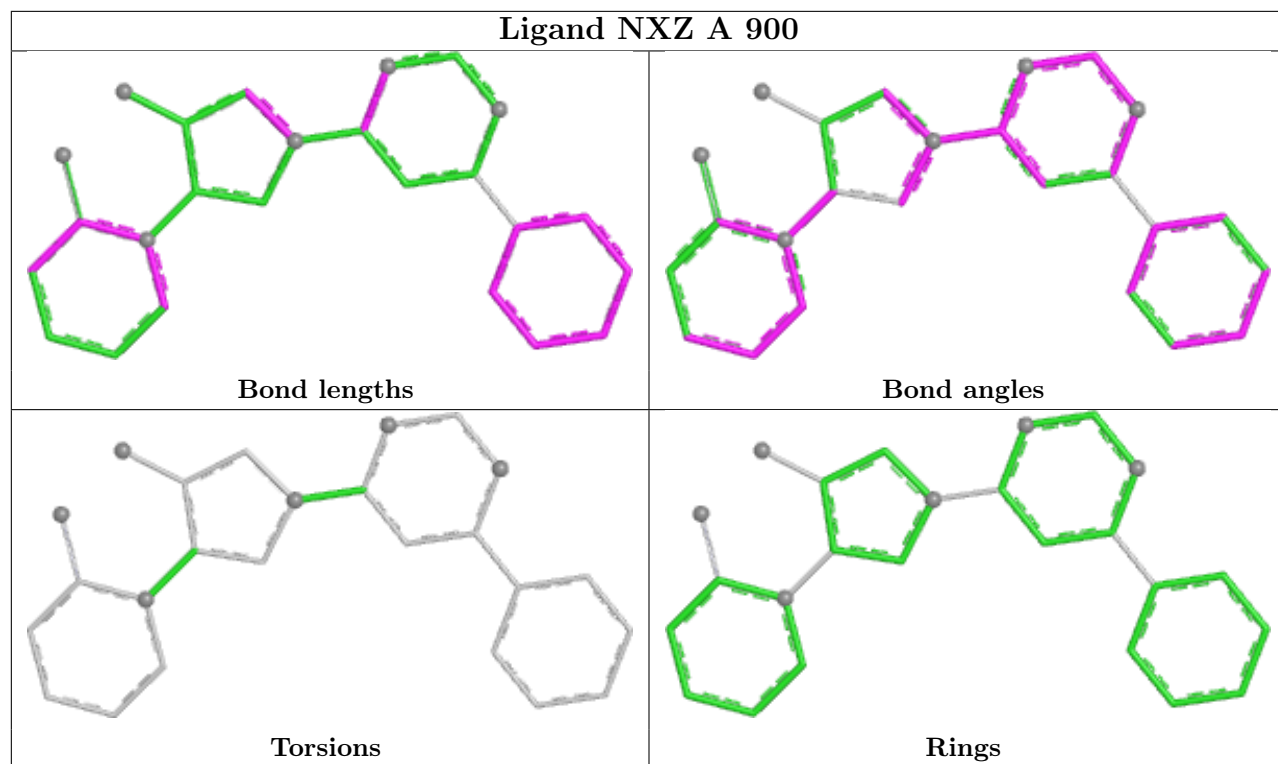
There are no ring outliers.

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 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, 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	728/748 (97%)	0.04	7 (0%) 79 77	50, 72, 105, 128	0
1	B	728/748 (97%)	0.04	10 (1%) 73 71	46, 66, 99, 124	0
All	All	1456/1496 (97%)	0.04	17 (1%) 76 74	46, 69, 102, 128	0

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	762	CYS	4.4
1	B	280	THR	3.2
1	A	502	LYS	2.4
1	B	685	ASN	2.3
1	B	762	CYS	2.3
1	A	280	THR	2.3
1	B	65	ASP	2.3
1	A	766	PRO	2.3
1	A	605	ASP	2.3
1	A	444	CYS	2.2
1	A	99	GLY	2.2
1	B	394	CYS	2.1
1	B	385	CYS	2.1
1	B	350	THR	2.1
1	B	129	THR	2.1
1	B	401	THR	2.1
1	B	447	CYS	2.0

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

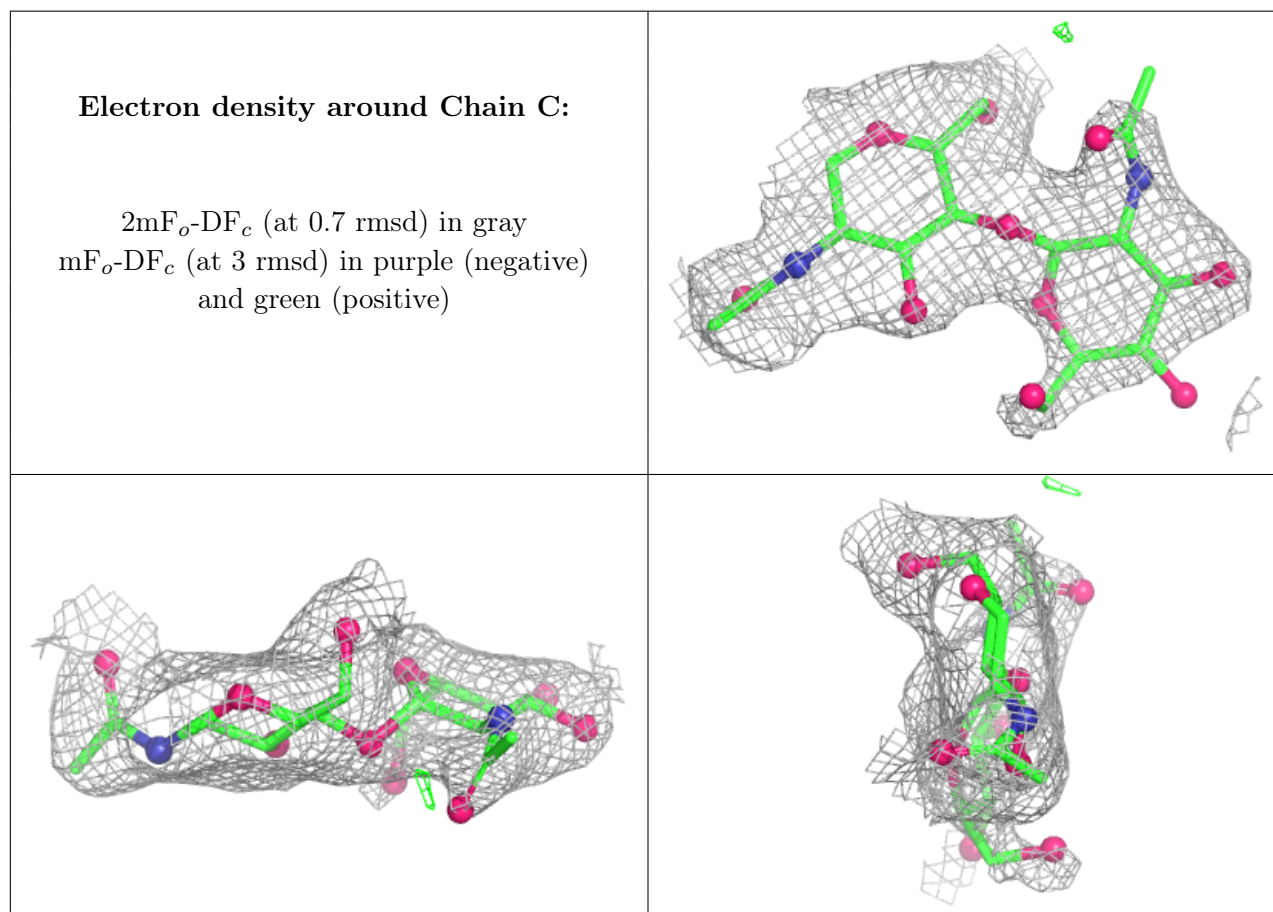
There are no non-standard protein/DNA/RNA residues in this entry.

### 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.

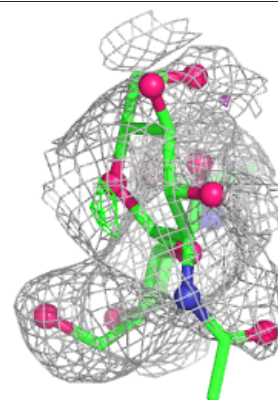
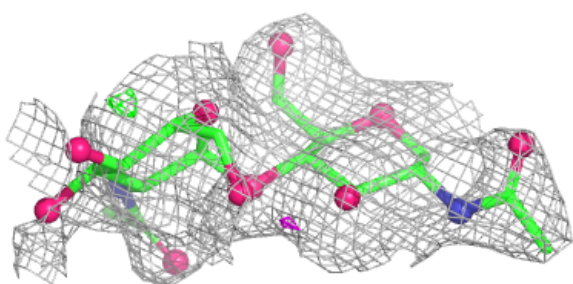
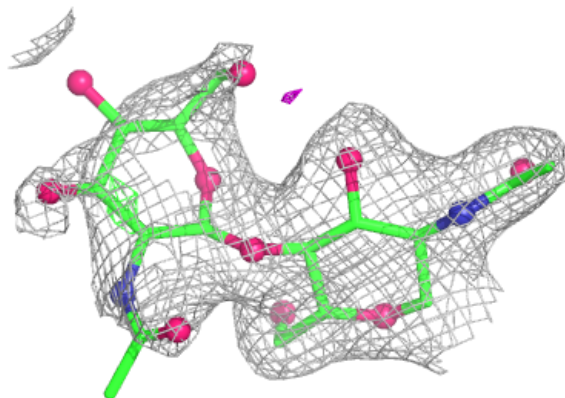
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	BMA	D	3	11/12	0.75	0.11	96,99,101,102	0
3	MAN	D	4	11/12	0.76	0.12	106,108,111,112	0
3	NAG	D	2	14/15	0.78	0.13	77,81,83,83	0
2	NAG	E	2	14/15	0.80	0.12	94,98,101,101	0
2	NAG	C	2	14/15	0.87	0.12	87,91,94,94	0
2	NAG	E	1	14/15	0.92	0.08	63,66,72,72	0
3	NAG	D	1	14/15	0.93	0.10	68,74,77,78	0
2	NAG	C	1	14/15	0.93	0.08	75,79,84,85	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

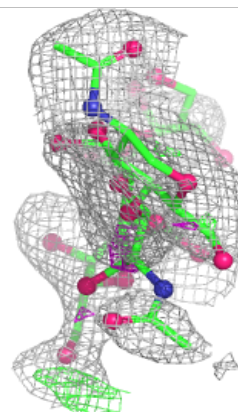
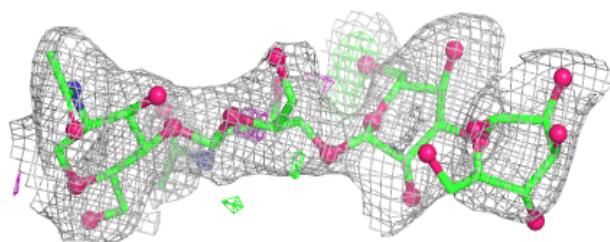
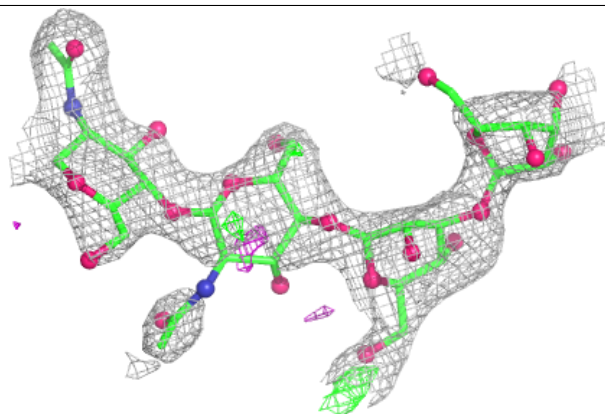


**Electron density around Chain E:**

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

**Electron density around Chain D:**

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

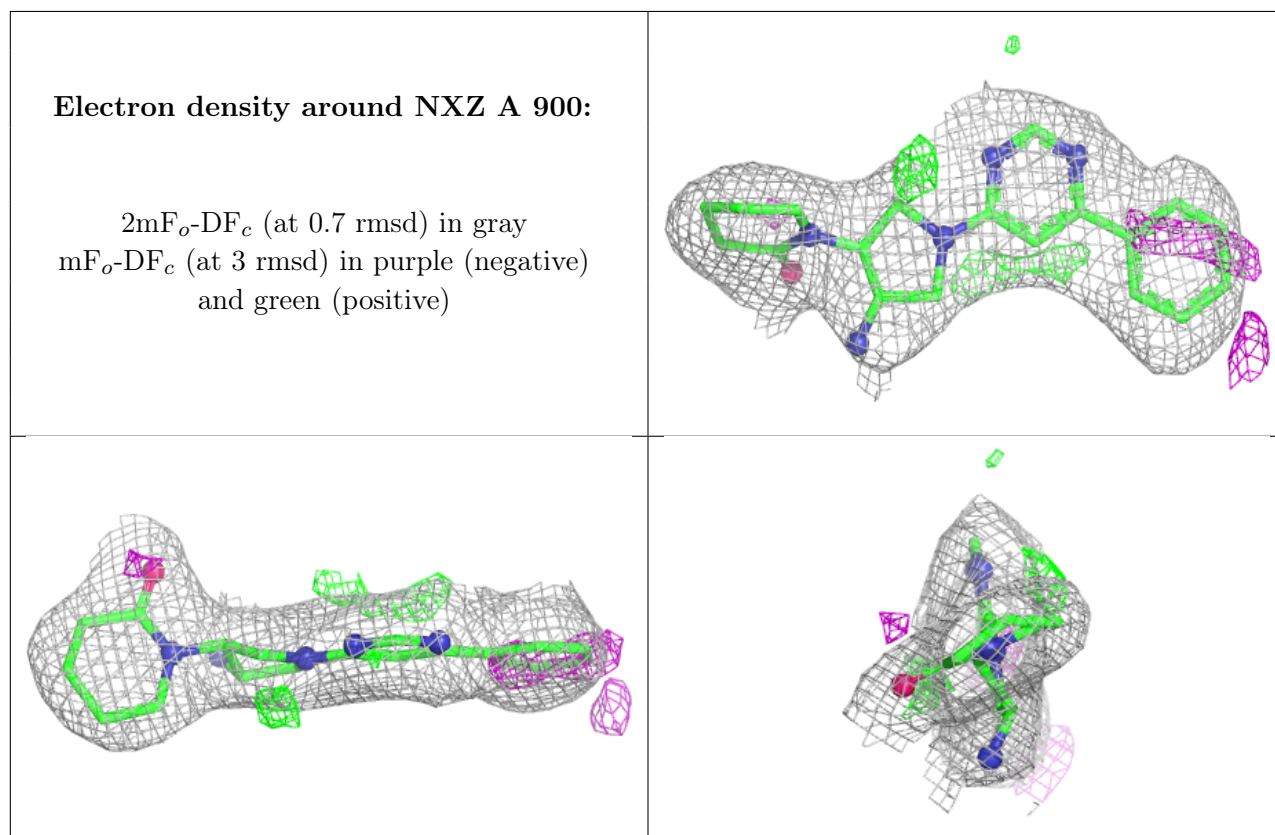


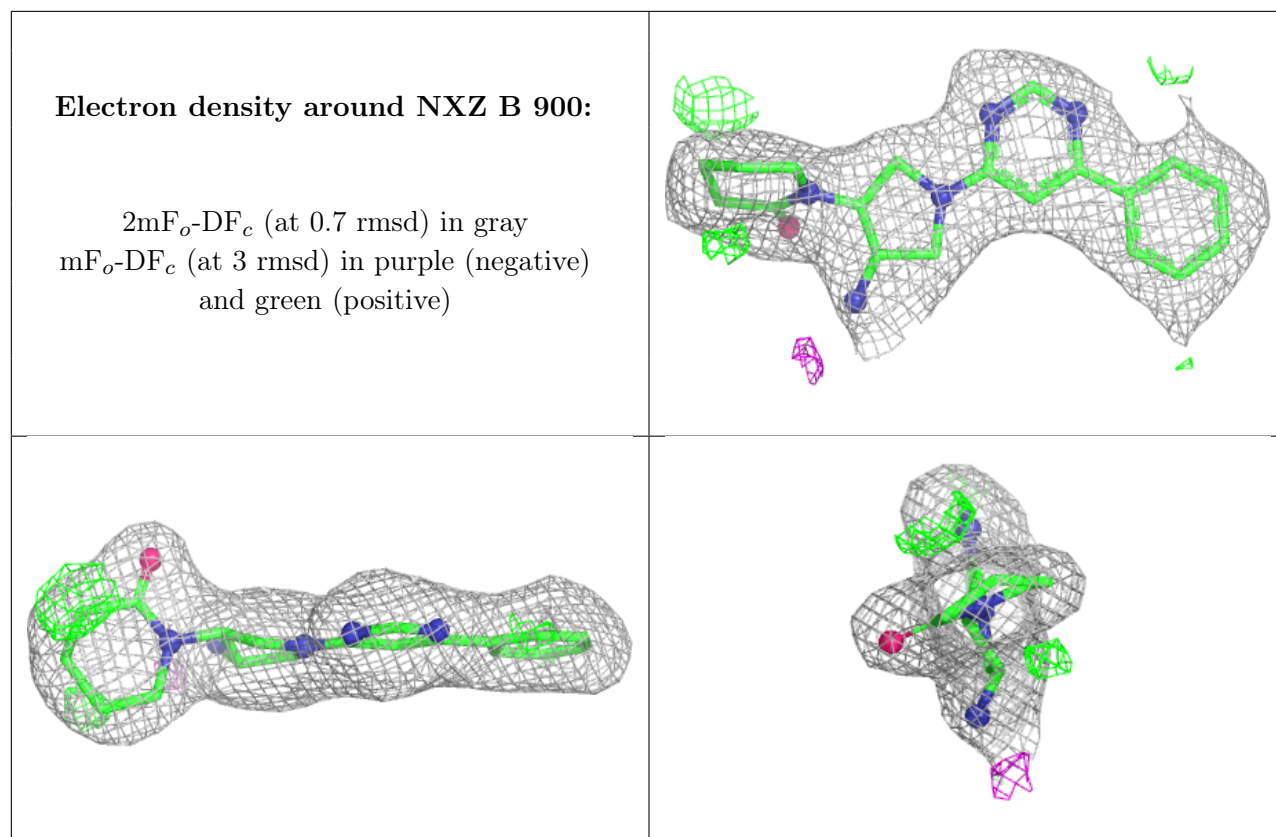
## 6.4 Ligands [i](#)

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(Å <sup>2</sup> )	Q<0.9
4	NAG	A	799	14/15	0.77	0.11	99,103,105,106	0
4	NAG	A	800	14/15	0.80	0.10	89,93,95,95	0
4	NAG	B	796	14/15	0.87	0.10	70,76,80,81	0
5	NXZ	A	900	25/25	0.87	0.09	46,54,76,78	0
5	NXZ	B	900	25/25	0.92	0.07	41,49,69,70	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.





## 6.5 Other polymers [i](#)

There are no such residues in this entry.