



# Full wwPDB X-ray Structure Validation Report ⓘ

Dec 12, 2023 – 04:22 pm GMT

PDB ID : 4TVK  
Title : TORPEDO CALIFORNICA ACETYLCHOLINESTERASE IN COMPLEX WITH A CHLOROTACRINE-JUGLONE HYBRID INHIBITOR  
Authors : Pesaresi, A.; Samez, S.; Lamba, D.  
Deposited on : 2014-06-27  
Resolution : 2.30 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

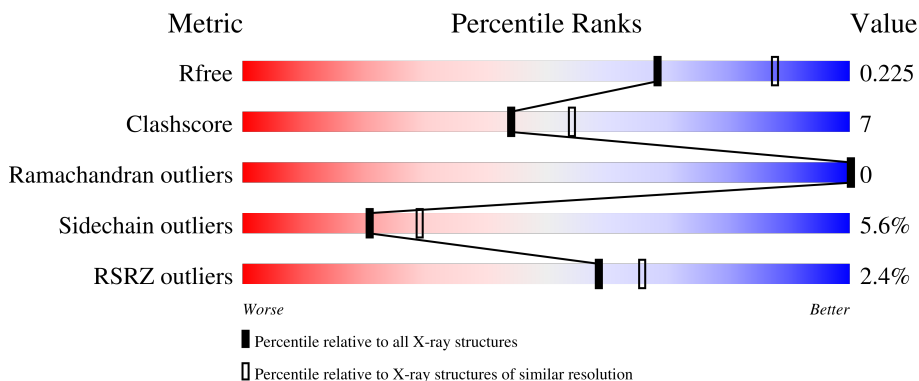
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

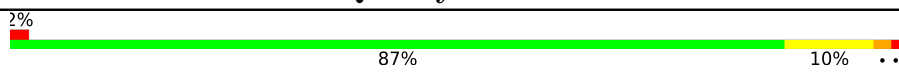
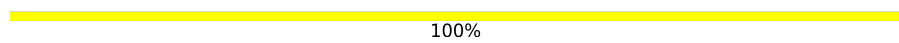
The reported resolution of this entry is 2.30 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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	534	 2% 87% 10% ..
2	B	2	 100%

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
4	TJH	A	605	-	-	X	-

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4627 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 Acetylcholinesterase.

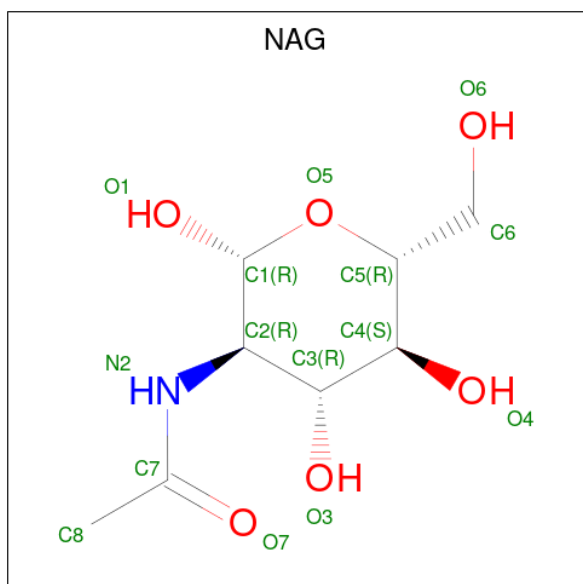
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	534	4263	2731	724	786	22	0	0	0

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



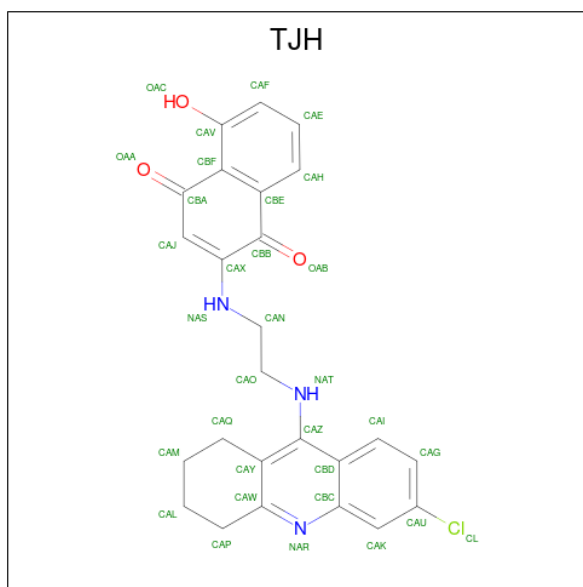
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	B	2	28	16	2	10	0	0	0

- Molecule 3 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
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 4 is 2-({2-[(6-chloro-1,2,3,4-tetrahydroacridin-9-yl)amino]ethyl}amino)-5-hydroxy naphthalene-1,4-dione (three-letter code: TJH) (formula: C<sub>25</sub>H<sub>22</sub>ClN<sub>3</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	Cl	N	O	0	0
			32	25	1	3	3		

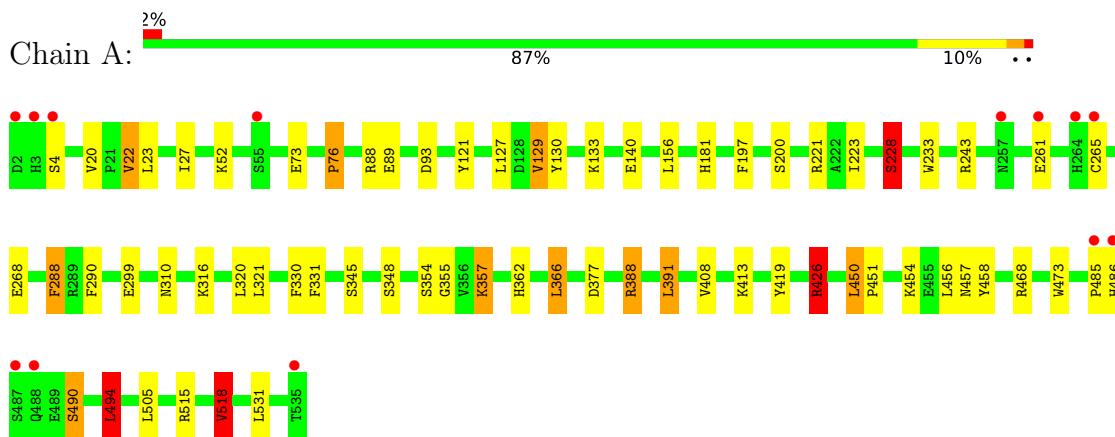
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	276	Total	O	0	0
			276	276		

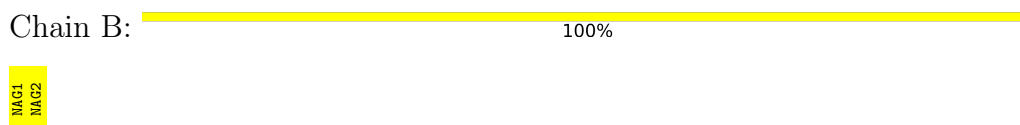
### 3 Residue-property plots [i](#)

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: Acetylcholinesterase



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



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	111.94Å 111.94Å 137.19Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.77 – 2.30 45.73 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.8 (45.77-2.30) 99.9 (45.73-2.30)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.38 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.7.0032	Depositor
R, $R_{free}$	0.185 , 0.225 0.190 , 0.225	Depositor DCC
$R_{free}$ test set	2249 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	39.4	Xtrriage
Anisotropy	0.183	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 42.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.027 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	4627	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	41.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.25% 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: TJH, 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	0.98	3/4387 (0.1%)	0.99	14/5955 (0.2%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	228	SER	CB-OG	-6.57	1.33	1.42
1	A	388	ARG	CD-NE	-6.06	1.36	1.46
1	A	221	ARG	CD-NE	-5.19	1.37	1.46

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	388	ARG	NE-CZ-NH2	-9.91	115.35	120.30
1	A	221	ARG	NE-CZ-NH2	-9.81	115.40	120.30
1	A	426	ARG	NE-CZ-NH1	9.22	124.91	120.30
1	A	388	ARG	NE-CZ-NH1	9.01	124.81	120.30
1	A	93	ASP	CB-CG-OD1	7.63	125.17	118.30
1	A	129	VAL	CB-CA-C	-6.83	98.42	111.40
1	A	518	VAL	CB-CA-C	-6.75	98.58	111.40
1	A	243	ARG	NE-CZ-NH2	-6.52	117.04	120.30
1	A	22	VAL	CB-CA-C	-6.11	99.78	111.40
1	A	518	VAL	CG1-CB-CG2	6.10	120.66	110.90
1	A	494	LEU	CA-CB-CG	6.01	129.12	115.30
1	A	243	ARG	NE-CZ-NH1	5.41	123.00	120.30
1	A	468	ARG	NE-CZ-NH2	-5.27	117.67	120.30
1	A	88	ARG	NE-CZ-NH1	5.20	122.90	120.30

There are no chirality outliers.

There are no planarity outliers.



## 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	4263	0	4106	52	0
2	B	28	0	25	0	0
3	A	28	0	26	0	0
4	A	32	0	21	19	0
5	A	276	0	0	15	0
All	All	4627	0	4178	56	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 7.

All (56) 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:290:PHE:HE1	4:A:605:TJH:CAE	1.72	1.01
1:A:121:TYR:OH	4:A:605:TJH:CAX	2.10	0.99
1:A:290:PHE:CE1	4:A:605:TJH:CAE	2.47	0.98
1:A:290:PHE:CE1	4:A:605:TJH:CAH	2.48	0.96
1:A:290:PHE:HE1	4:A:605:TJH:CAH	1.78	0.96
1:A:261:GLU:HG3	5:A:874:HOH:O	1.63	0.95
1:A:268:GLU:HG3	5:A:950:HOH:O	1.78	0.82
1:A:321:LEU:HD11	1:A:408:VAL:HG23	1.69	0.73
1:A:310:ASN:HB3	5:A:873:HOH:O	1.93	0.68
1:A:121:TYR:OH	4:A:605:TJH:CAJ	2.46	0.63
1:A:288:PHE:CE2	1:A:331:PHE:CZ	2.87	0.63
1:A:121:TYR:OH	4:A:605:TJH:CBB	2.48	0.62
1:A:288:PHE:CE2	1:A:331:PHE:CE2	2.88	0.62
1:A:290:PHE:CZ	4:A:605:TJH:H1	2.37	0.60
1:A:486:HIS:CE1	5:A:944:HOH:O	2.55	0.59
1:A:290:PHE:CE1	4:A:605:TJH:H2	2.35	0.58
1:A:290:PHE:CZ	4:A:605:TJH:CAH	2.87	0.57
1:A:73:GLU:O	1:A:76:PRO:HD3	2.05	0.56
1:A:490:SER:HA	5:A:856:HOH:O	2.05	0.56
1:A:419:TYR:CZ	1:A:494:LEU:HD13	2.42	0.55
1:A:223:ILE:HA	1:A:320:LEU:O	2.06	0.55
4:A:605:TJH:OAC	4:A:605:TJH:OAA	2.20	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:121:TYR:HH	4:A:605:TJH:CAX	2.18	0.53
1:A:290:PHE:CZ	4:A:605:TJH:CAE	2.93	0.52
1:A:290:PHE:CZ	4:A:605:TJH:H2	2.45	0.52
4:A:605:TJH:CAO	4:A:605:TJH:H20	2.41	0.51
1:A:127:LEU:HD12	1:A:130:TYR:CE2	2.46	0.51
1:A:426:ARG:HD2	5:A:773:HOH:O	2.09	0.51
1:A:515:ARG:O	1:A:518:VAL:HG22	2.10	0.51
1:A:451:PRO:HA	1:A:458:TYR:CD1	2.46	0.50
1:A:290:PHE:CE1	4:A:605:TJH:H1	2.39	0.50
1:A:233:TRP:CD1	1:A:288:PHE:CE1	2.99	0.49
1:A:310:ASN:CB	5:A:873:HOH:O	2.56	0.49
1:A:265:CYS:HB2	5:A:745:HOH:O	2.13	0.48
1:A:485:PRO:HA	5:A:744:HOH:O	2.14	0.48
1:A:355:GLY:HA3	1:A:391:LEU:HD21	1.96	0.48
1:A:454:LYS:HA	5:A:947:HOH:O	2.14	0.47
1:A:200:SER:OG	5:A:967:HOH:O	2.20	0.46
1:A:377:ASP:OD1	1:A:377:ASP:C	2.54	0.46
1:A:121:TYR:HH	4:A:605:TJH:CAJ	2.28	0.46
4:A:605:TJH:H20	4:A:605:TJH:H10	1.98	0.45
1:A:52:LYS:HA	1:A:52:LYS:HE2	1.99	0.45
1:A:321:LEU:HD11	1:A:408:VAL:CG2	2.43	0.45
1:A:345:SER:O	1:A:388:ARG:HG3	2.17	0.45
1:A:366:LEU:HD13	1:A:531:LEU:HD21	1.99	0.45
1:A:413:LYS:HE3	1:A:413:LYS:HB2	1.86	0.44
1:A:22:VAL:HG13	1:A:133:LYS:HG3	1.99	0.44
1:A:450:LEU:N	1:A:451:PRO:CD	2.80	0.44
1:A:357:LYS:HD3	5:A:857:HOH:O	2.18	0.42
1:A:181:HIS:HD2	5:A:704:HOH:O	2.02	0.42
1:A:22:VAL:HG21	1:A:27:ILE:HG12	2.02	0.41
4:A:605:TJH:H8	5:A:792:HOH:O	2.20	0.41
1:A:228:SER:HB2	5:A:854:HOH:O	2.20	0.40
1:A:456:LEU:O	1:A:457:ASN:HB2	2.21	0.40
1:A:22:VAL:HG12	1:A:23:LEU:HG	2.03	0.40
1:A:233:TRP:CE2	1:A:288:PHE:CE1	3.09	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	532/534 (100%)	504 (95%)	28 (5%)	0	100	100

There are no Ramachandran outliers to report.

### 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	467/467 (100%)	441 (94%)	26 (6%)	21	29

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	SER
1	A	20	VAL
1	A	76	PRO
1	A	89	GLU
1	A	129	VAL
1	A	140	GLU
1	A	156	LEU
1	A	197	PHE
1	A	228	SER
1	A	288	PHE
1	A	299	GLU
1	A	316	LYS
1	A	330	PHE

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Mol	Chain	Res	Type
1	A	348	SER
1	A	354	SER
1	A	357	LYS
1	A	362	HIS
1	A	366	LEU
1	A	391	LEU
1	A	426	ARG
1	A	450	LEU
1	A	473	TRP
1	A	490	SER
1	A	494	LEU
1	A	505	LEU
1	A	518	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	181	HIS

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

4 non-standard protein/DNA/RNA residues 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	B	1	2,1	14,14,15	0.69	0	17,19,21	1.67	4 (23%)
3	NAG	A	604	1	14,14,15	0.76	0	17,19,21	2.27	4 (23%)
3	NAG	A	601	1	14,14,15	0.86	0	17,19,21	2.43	8 (47%)
2	NAG	B	2	2	14,14,15	0.94	0	17,19,21	1.54	4 (23%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	B	1	2,1	-	1/6/23/26	0/1/1/1
3	NAG	A	604	1	-	0/6/23/26	0/1/1/1
3	NAG	A	601	1	-	2/6/23/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	604	NAG	C1-O5-C5	5.62	119.81	112.19
3	A	601	NAG	C1-O5-C5	4.85	118.77	112.19
3	A	601	NAG	O5-C1-C2	-4.75	103.79	111.29
3	A	604	NAG	O5-C5-C6	4.53	114.30	107.20
3	A	601	NAG	C1-C2-N2	-4.06	103.55	110.49
2	B	1	NAG	O3-C3-C2	-3.54	102.13	109.47
2	B	1	NAG	C1-O5-C5	3.33	116.70	112.19
2	B	2	NAG	O4-C4-C5	3.24	117.34	109.30
3	A	604	NAG	O4-C4-C5	2.98	116.71	109.30
2	B	2	NAG	C4-C3-C2	2.91	115.28	111.02
2	B	2	NAG	O5-C1-C2	-2.73	106.98	111.29
3	A	601	NAG	C3-C4-C5	2.63	114.93	110.24
3	A	601	NAG	O5-C5-C4	-2.52	104.69	110.83
2	B	1	NAG	C1-C2-N2	2.39	114.57	110.49
2	B	2	NAG	O3-C3-C4	-2.38	104.86	110.35
3	A	601	NAG	O5-C5-C6	2.15	110.57	107.20
2	B	1	NAG	O5-C1-C2	-2.11	107.95	111.29
3	A	601	NAG	O4-C4-C3	2.08	115.17	110.35
3	A	601	NAG	O6-C6-C5	2.06	118.37	111.29
3	A	604	NAG	O5-C1-C2	-2.01	108.11	111.29

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	601	NAG	C4-C5-C6-O6
3	A	601	NAG	O5-C5-C6-O6
2	B	1	NAG	O5-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates

2 monosaccharides are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	NAG	B	1	2,1	14,14,15	0.69	0	17,19,21	1.67	4 (23%)
2	NAG	B	2	2	14,14,15	0.94	0	17,19,21	1.54	4 (23%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	B	1	2,1	-	1/6/23/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	B	1	NAG	O3-C3-C2	-3.54	102.13	109.47
2	B	1	NAG	C1-O5-C5	3.33	116.70	112.19
2	B	2	NAG	O4-C4-C5	3.24	117.34	109.30
2	B	2	NAG	C4-C3-C2	2.91	115.28	111.02
2	B	2	NAG	O5-C1-C2	-2.73	106.98	111.29
2	B	1	NAG	C1-C2-N2	2.39	114.57	110.49
2	B	2	NAG	O3-C3-C4	-2.38	104.86	110.35
2	B	1	NAG	O5-C1-C2	-2.11	107.95	111.29

There are no chirality outliers.

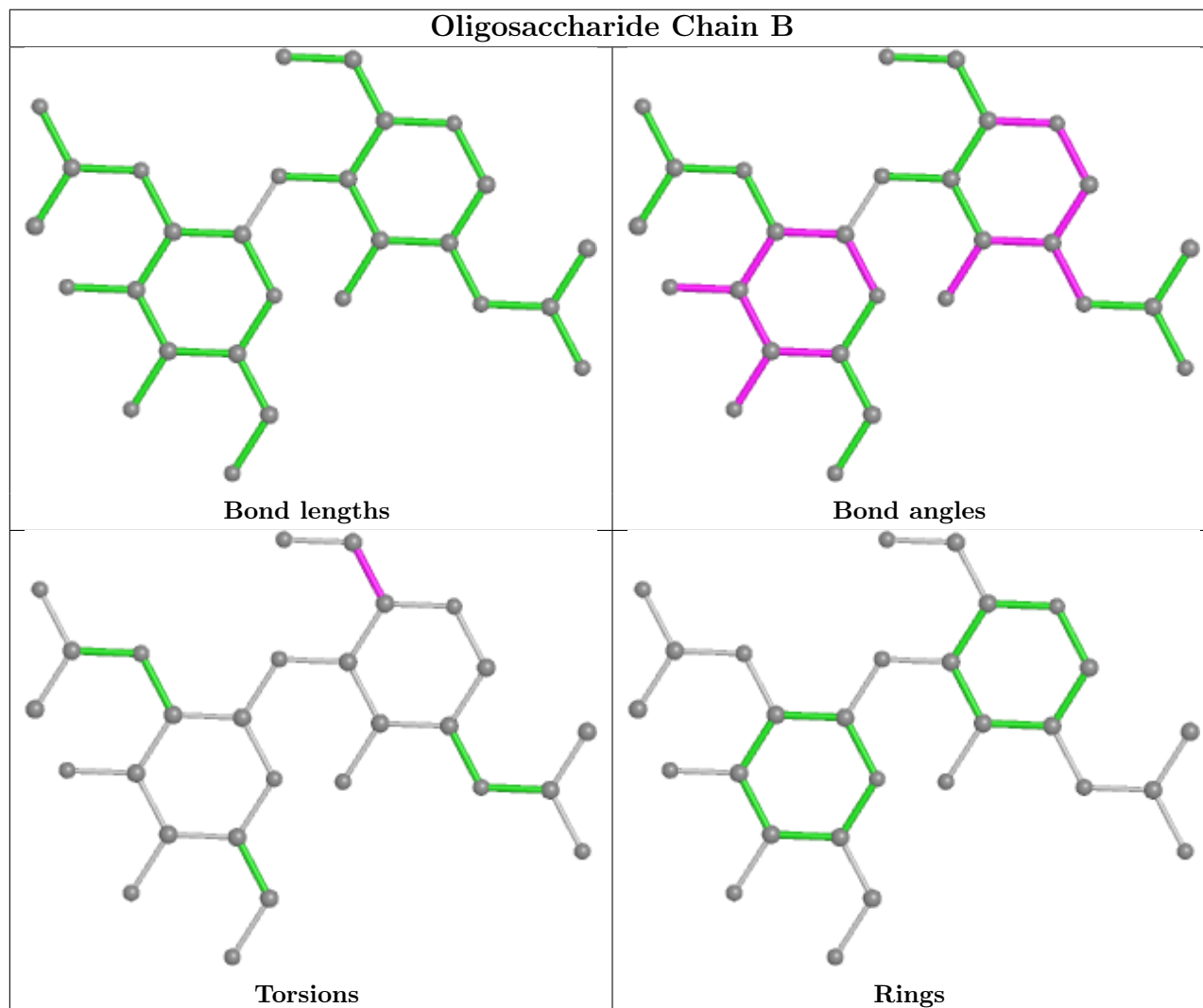
All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1	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](#)

3 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	TJH	A	605	-	36,36,36	2.01	10 (27%)	49,52,52	2.22	14 (28%)
3	NAG	A	604	1	14,14,15	0.76	0	17,19,21	2.27	4 (23%)
3	NAG	A	601	1	14,14,15	0.86	0	17,19,21	2.43	8 (47%)

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	TJH	A	605	-	-	4/7/30/30	0/5/5/5
3	NAG	A	604	1	-	0/6/23/26	0/1/1/1
3	NAG	A	601	1	-	2/6/23/26	0/1/1/1

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	605	TJH	CAX-CBB	-4.59	1.43	1.50
4	A	605	TJH	CAQ-CAY	-4.44	1.44	1.51
4	A	605	TJH	CAU-CL	-4.33	1.65	1.74
4	A	605	TJH	CBF-CBA	-3.52	1.37	1.46
4	A	605	TJH	CBE-CBB	-3.46	1.41	1.48
4	A	605	TJH	CAJ-CAX	3.20	1.43	1.36
4	A	605	TJH	CAK-CAU	2.94	1.42	1.36
4	A	605	TJH	CAP-CAW	-2.72	1.46	1.50
4	A	605	TJH	CBD-CBC	-2.63	1.38	1.42
4	A	605	TJH	CAJ-CBA	-2.14	1.40	1.44

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	604	NAG	C1-O5-C5	5.62	119.81	112.19
4	A	605	TJH	CBB-CAX-NAS	5.56	118.83	114.17
4	A	605	TJH	CAY-CAW-NAR	-5.08	119.34	123.68
4	A	605	TJH	CBE-CBF-CAV	4.99	123.05	118.41
3	A	601	NAG	C1-O5-C5	4.85	118.77	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	601	NAG	O5-C1-C2	-4.75	103.79	111.29
4	A	605	TJH	CAW-NAR-CBC	4.56	123.30	117.67
3	A	604	NAG	O5-C5-C6	4.53	114.30	107.20
4	A	605	TJH	OAB-CBB-CAX	4.41	123.97	119.59
3	A	601	NAG	C1-C2-N2	-4.06	103.55	110.49
4	A	605	TJH	CBE-CBB-CAX	-4.02	113.74	117.86
4	A	605	TJH	CAV-CBF-CBA	-3.72	115.89	121.89
4	A	605	TJH	CAJ-CAX-NAS	-3.43	119.31	124.88
3	A	604	NAG	O4-C4-C5	2.98	116.71	109.30
4	A	605	TJH	CAH-CBE-CBF	-2.73	116.26	120.19
3	A	601	NAG	C3-C4-C5	2.63	114.93	110.24
4	A	605	TJH	CAE-CAF-CAV	-2.61	116.75	120.05
4	A	605	TJH	CAL-CAP-CAW	-2.53	109.36	113.53
3	A	601	NAG	O5-C5-C4	-2.52	104.69	110.83
4	A	605	TJH	CBF-CBE-CBB	2.26	124.02	120.45
4	A	605	TJH	CAF-CAE-CAH	2.26	123.45	120.25
3	A	601	NAG	O5-C5-C6	2.15	110.57	107.20
3	A	601	NAG	O4-C4-C3	2.08	115.17	110.35
3	A	601	NAG	O6-C6-C5	2.06	118.37	111.29
4	A	605	TJH	CAG-CAI-CBD	2.06	124.00	121.13
3	A	604	NAG	O5-C1-C2	-2.01	108.11	111.29

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	601	NAG	C4-C5-C6-O6
3	A	601	NAG	O5-C5-C6-O6
4	A	605	TJH	CAY-CAZ-NAT-CAO
4	A	605	TJH	CBD-CAZ-NAT-CAO
4	A	605	TJH	CAN-CAO-NAT-CAZ
4	A	605	TJH	CBB-CAX-NAS-CAN

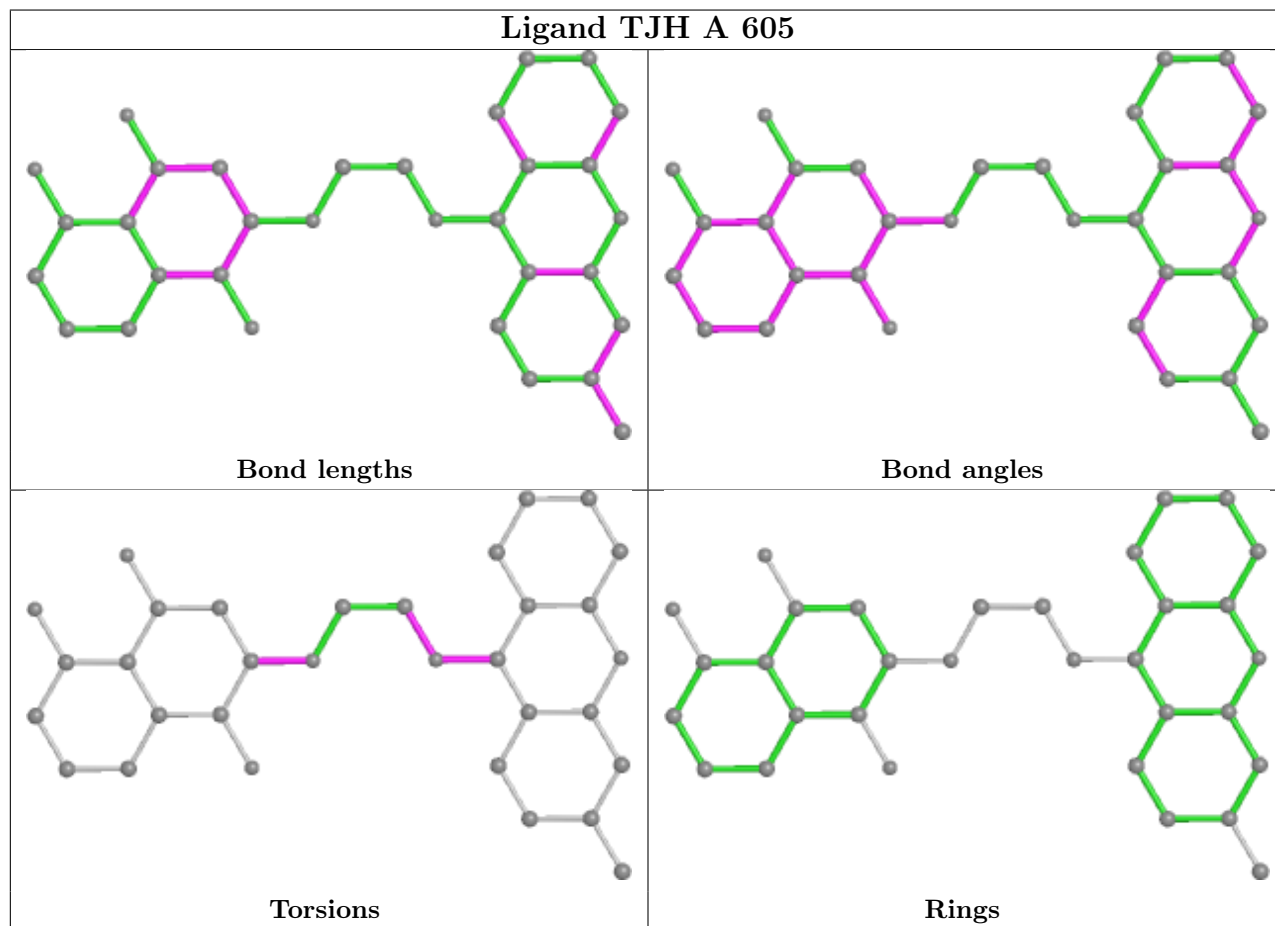
There are no ring outliers.

1 monomer is involved in 19 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	605	TJH	19	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, 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	534/534 (100%)	-0.17	13 (2%) 59 66	24, 37, 64, 120	0

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	3	HIS	6.0
1	A	2	ASP	5.5
1	A	486	HIS	4.2
1	A	485	PRO	4.0
1	A	265	CYS	4.0
1	A	535	THR	3.3
1	A	488	GLN	2.9
1	A	257	ASN	2.8
1	A	55	SER	2.5
1	A	264	HIS	2.5
1	A	261	GLU	2.4
1	A	487	SER	2.2
1	A	4	SER	2.0

### 6.2 Non-standard residues in protein, DNA, RNA chains [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.

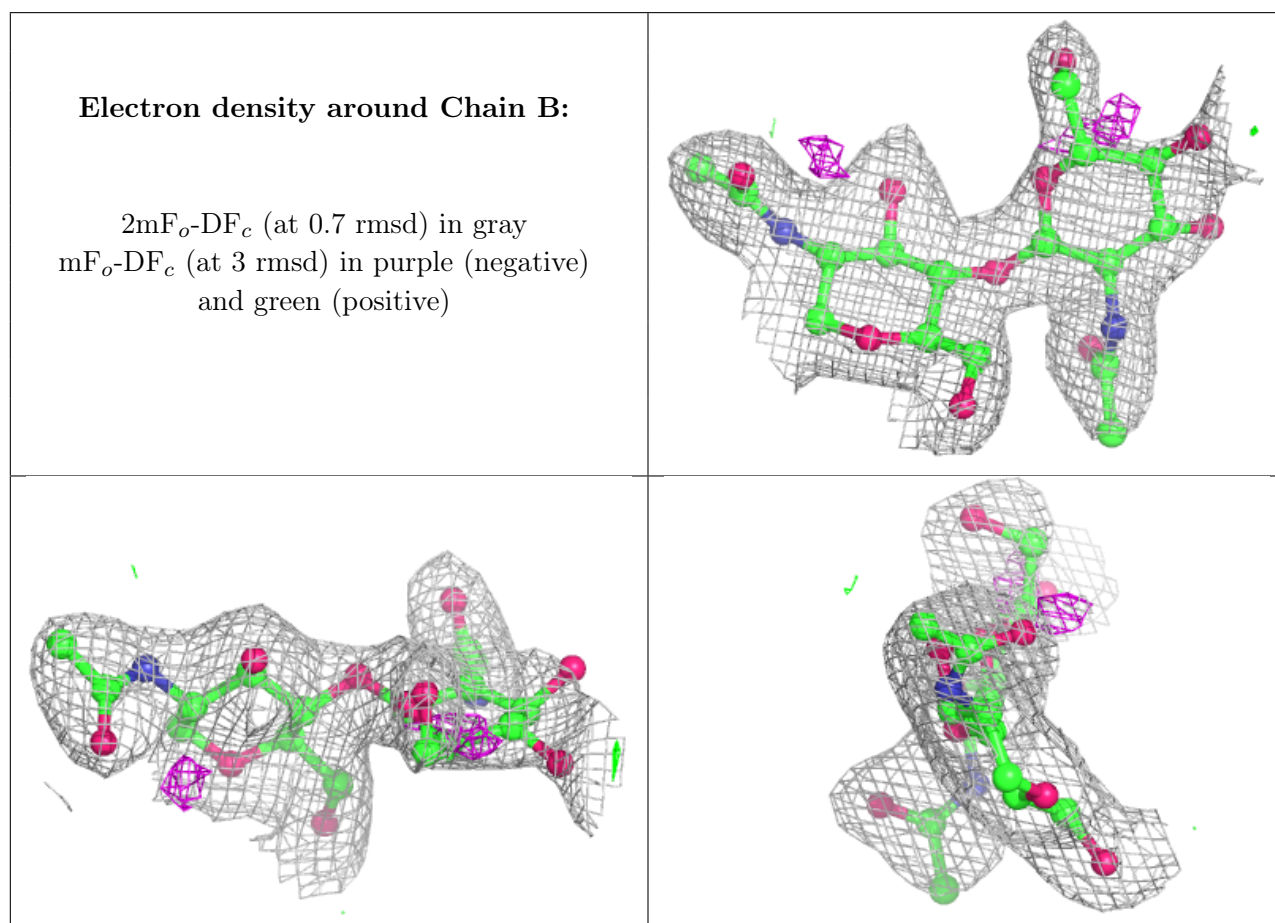
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	NAG	A	601	14/15	0.78	0.23	69,82,89,90	0
2	NAG	B	2	14/15	0.84	0.32	60,74,88,91	0
3	NAG	A	604	14/15	0.87	0.27	66,72,80,84	0
2	NAG	B	1	14/15	0.93	0.11	46,53,59,68	0

### 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
2	NAG	B	2	14/15	0.84	0.32	60,74,88,91	0
2	NAG	B	1	14/15	0.93	0.11	46,53,59,68	0

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

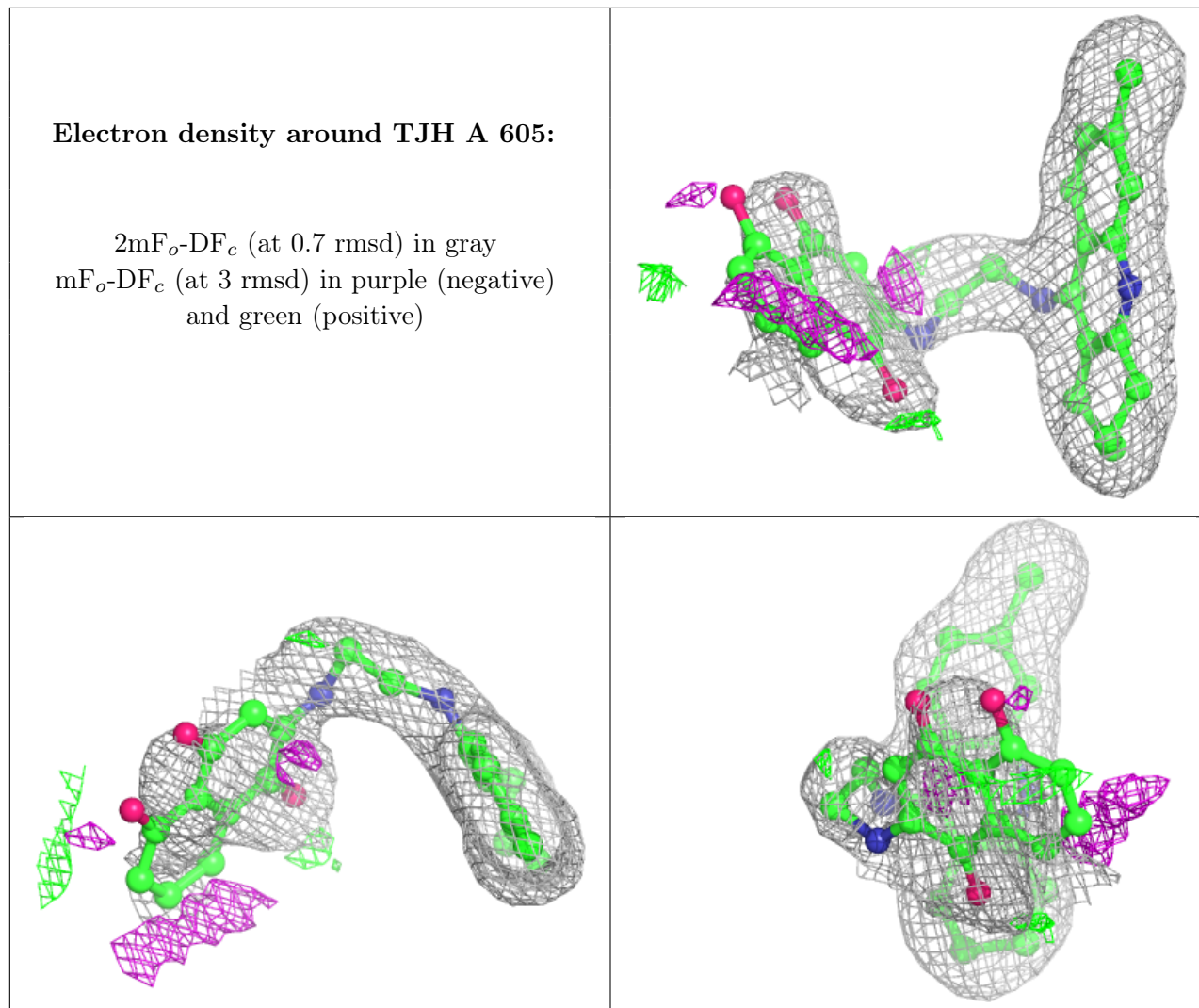


### 6.4 Ligands [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	NAG	A	601	14/15	0.78	0.23	69,82,89,90	0
3	NAG	A	604	14/15	0.87	0.27	66,72,80,84	0
4	TJH	A	605	32/32	0.93	0.20	32,41,107,130	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.