



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 10, 2023 – 01:53 PM EDT

PDB ID : 6WUY  
Title : Crystal Structure of Recombinant Human Acetylcholinesterase In Complex with GA and HI-6  
Authors : McGuire, J.R.; Bester, S.M.; Pegan, S.D.; Height, J.J.  
Deposited on : 2020-05-05  
Resolution : 2.46 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 : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

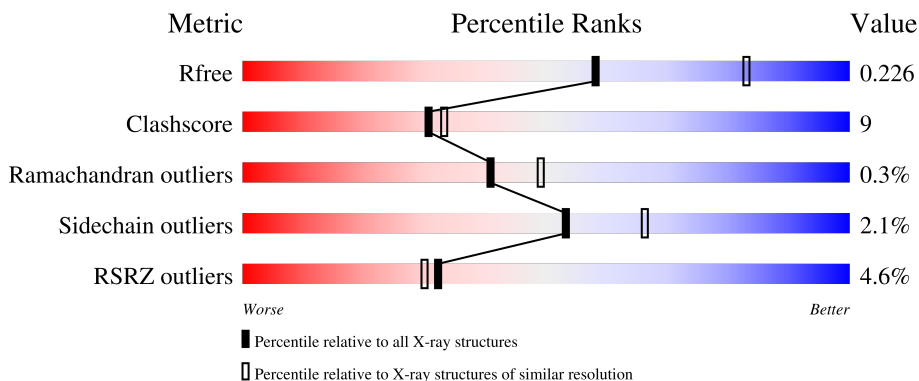
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.46 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	1544 (2.48-2.44)
Clashscore	141614	1613 (2.48-2.44)
Ramachandran outliers	138981	1598 (2.48-2.44)
Sidechain outliers	138945	1598 (2.48-2.44)
RSRZ outliers	127900	1523 (2.48-2.44)

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	542	 4% 83% 14% ..
1	B	542	 5% 82% 15% ..
2	C	3	 100%
2	D	3	 67% 33%
3	E	2	 50% 50%

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:

<b>Mol</b>	<b>Type</b>	<b>Chain</b>	<b>Res</b>	<b>Chirality</b>	<b>Geometry</b>	<b>Clashes</b>	<b>Electron density</b>
2	FUC	C	3	-	-	-	X
3	NAG	E	2	-	-	-	X
4	NAG	A	604	-	-	-	X
6	HI6	B	602[B]	-	-	X	-

## 2 Entry composition [i](#)

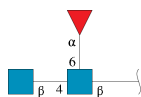
There are 7 unique types of molecules in this entry. The entry contains 8777 atoms, of which 0 are hydrogens and 0 are deuteriums.

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	530	Total 4142	C 2663	N 719	O 747	S 13	0	4	0
1	B	531	Total 4165	C 2677	N 728	O 747	S 13	0	4	0

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



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

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



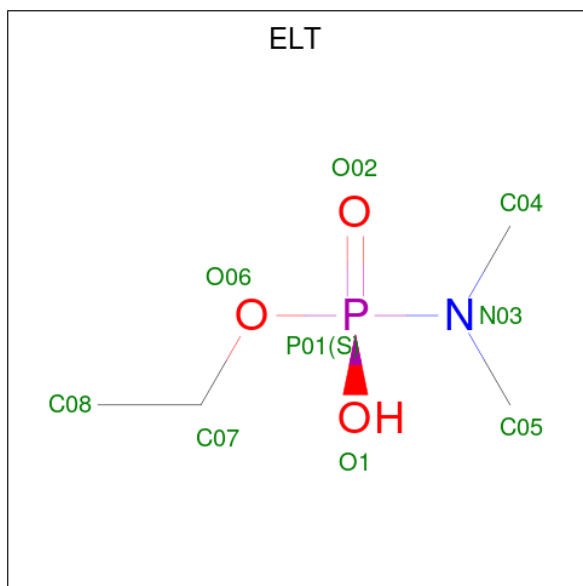
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	E	2	Total 28	C 16	N 2	O 10	0	0	0

- 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>).



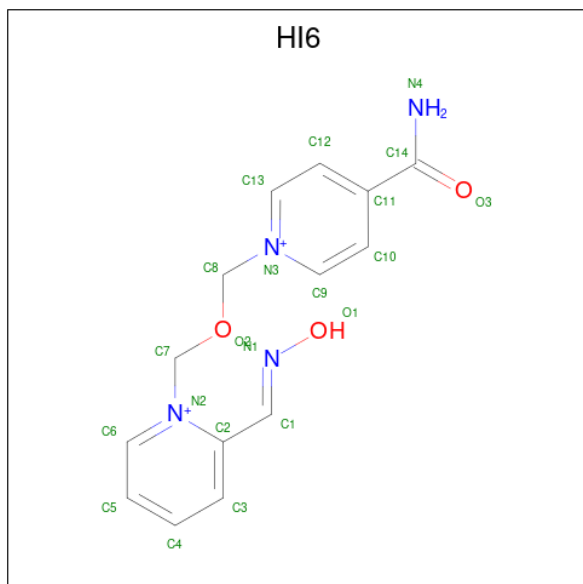
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 5 is ethoxy- {N}, {N}-dimethyl-phosphonamidic acid (three-letter code: ELT) (formula:  $C_4H_{12}NO_3P$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	P	0	0
			8	4	1	2	1		
5	B	1	Total	C	N	O	P	0	0
			8	4	1	2	1		

- Molecule 6 is 4-(AMINOCARBONYL)-1-[(2-[(E)-(HYDROXYIMINO)METHYL]PYRIDINIUM-1-YL)METHOXY]METHYL]PYRIDINIUM (three-letter code: HI6) (formula: C<sub>14</sub>H<sub>16</sub>N<sub>4</sub>O<sub>3</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
6	A	1	Total	C	N	O	0	0
			21	14	4	3		
6	B	1	Total	C	N	O	0	1
			42	28	8	6		

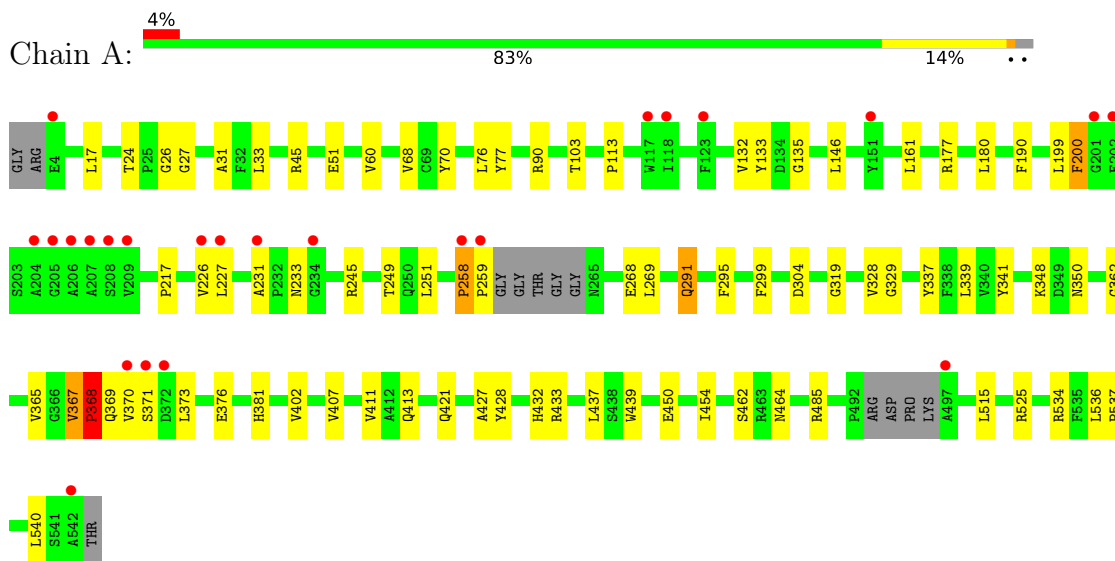
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
7	A	145	Total	O	0	0
			145	145		
7	B	128	Total	O	0	0
			128	128		

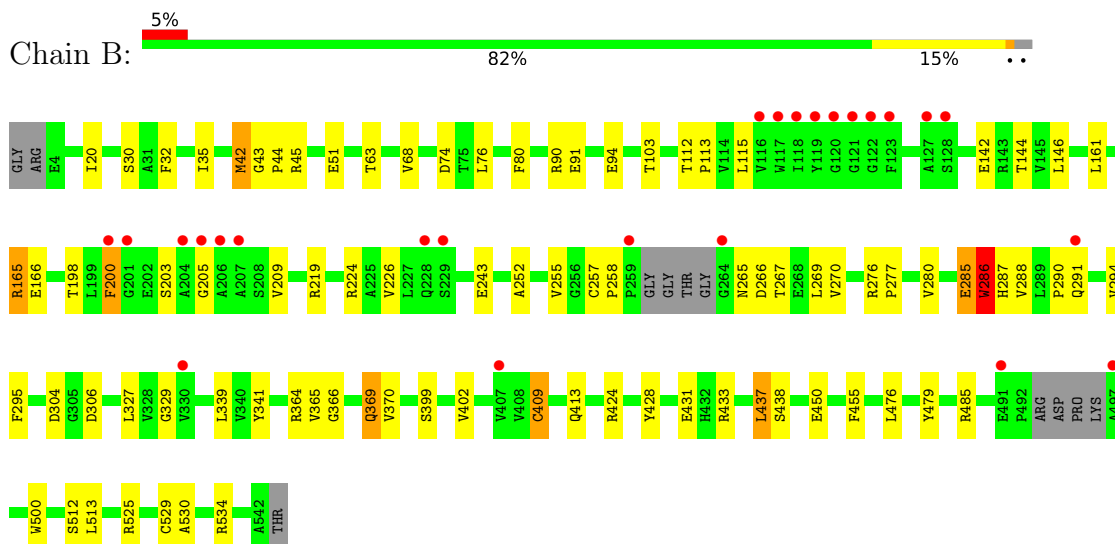
### 3 Residue-property plots [i](#)

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 1: Acetylcholinesterase




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

Chain C:  100%

MAG1  
MAG2  
FUC3

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

Chain D:  67% 33%

MAG1  
MAG2  
FUC3

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

Chain E:  50% 50%

MAG1  
MAG2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	105.33Å 105.33Å 324.87Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	41.36 – 2.46 41.36 – 2.45	Depositor EDS
% Data completeness (in resolution range)	99.5 (41.36-2.46) 99.7 (41.36-2.45)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.25 (at 2.45Å)	Xtrriage
Refinement program	PHENIX 1.17.1-3660	Depositor
R, $R_{free}$	0.179 , 0.214 0.197 , 0.226	Depositor DCC
$R_{free}$ test set	3774 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	55.4	Xtrriage
Anisotropy	0.594	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 43.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	0.018 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	8777	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	66.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.76% 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: FUC, ELT, HI6, 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	0.56	0/4280	0.60	0/5851
1	B	0.51	0/4300	0.62	6/5879 (0.1%)
All	All	0.54	0/8580	0.61	6/11730 (0.1%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	285	GLU	C-N-CA	9.27	144.88	121.70
1	B	286[A]	TRP	CA-C-O	8.11	137.12	120.10
1	B	286[B]	TRP	CA-C-O	8.11	137.12	120.10
1	B	409	CYS	CB-CA-C	7.25	124.89	110.40
1	B	286[A]	TRP	CA-C-N	-6.69	102.48	117.20
1	B	286[B]	TRP	CA-C-N	-6.69	102.48	117.20

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	4142	0	4030	71	0
1	B	4165	0	4043	78	0
2	C	38	0	34	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	38	0	34	1	0
3	E	28	0	25	2	0
4	A	14	0	13	2	0
5	A	8	0	0	1	0
5	B	8	0	0	3	0
6	A	21	0	16	5	0
6	B	42	0	32	16	0
7	A	145	0	0	5	0
7	B	128	0	0	1	0
All	All	8777	0	8227	154	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 9.

All (154) 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:203:SER:OG	5:B:601:ELT:P01	1.11	1.48
1:B:265:ASN:HD21	3:E:1:NAG:C1	1.40	1.34
1:A:350:ASN:HD21	2:C:1:NAG:C1	1.40	1.32
1:B:203:SER:HG	5:B:601:ELT:P01	1.01	1.32
1:B:409:CYS:SG	1:B:529:CYS:CB	2.15	1.32
1:A:464:ASN:HD21	4:A:604:NAG:C1	1.57	1.16
1:B:203:SER:CB	5:B:601:ELT:P01	2.32	1.16
1:A:350:ASN:ND2	2:C:1:NAG:C1	2.09	1.16
1:B:265:ASN:ND2	3:E:1:NAG:C1	2.25	0.98
1:B:290:PRO:O	1:B:291:GLN:HG2	1.67	0.94
1:B:286[B]:TRP:CZ2	6:B:602[B]:HI6:C13	2.52	0.93
1:A:24:THR:HG22	1:A:26:GLY:H	1.31	0.92
1:B:409:CYS:SG	1:B:529:CYS:SG	0.95	0.92
1:A:464:ASN:ND2	4:A:604:NAG:C1	2.32	0.91
1:B:409:CYS:CB	1:B:529:CYS:SG	2.61	0.88
1:B:286[B]:TRP:CH2	6:B:602[B]:HI6:C13	2.63	0.82
2:C:1:NAG:H61	2:C:2:NAG:HN2	1.44	0.81
1:B:409:CYS:SG	1:B:529:CYS:CA	2.69	0.79
1:B:286[B]:TRP:CH2	6:B:602[B]:HI6:H13	2.20	0.77
1:B:286[B]:TRP:CE3	6:B:602[B]:HI6:C12	2.69	0.75
1:A:370:VAL:CG2	1:A:540:LEU:CD2	2.66	0.73
1:B:198:THR:HG23	1:B:224:ARG:HB2	1.70	0.72
1:B:115:LEU:HD12	1:B:144:THR:HG21	1.71	0.72
1:A:525:ARG:HD3	7:A:817:HOH:O	1.90	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:362:GLY:O	1:A:365:VAL:HG12	1.91	0.71
1:A:24:THR:HB	1:A:27:GLY:O	1.92	0.70
1:B:286[B]:TRP:CZ3	6:B:602[B]:HI6:C12	2.75	0.70
1:A:369:GLN:HB3	1:A:370:VAL:HA	1.73	0.69
1:A:370:VAL:HG12	1:A:371:SER:N	2.08	0.68
1:B:286[A]:TRP:CH2	6:B:602[A]:HI6:H81	2.31	0.65
1:A:304:ASP:OD1	7:A:701:HOH:O	2.14	0.65
1:B:286[B]:TRP:CZ3	6:B:602[B]:HI6:H12	2.32	0.65
1:B:476:LEU:HD21	1:B:513:LEU:HD13	1.79	0.64
1:B:290:PRO:CG	1:B:369:GLN:HE22	2.10	0.63
1:B:68:VAL:HG23	1:B:90:ARG:HB2	1.79	0.63
1:B:409:CYS:SG	1:B:529:CYS:HA	2.38	0.63
1:A:245:ARG:O	1:A:249:THR:HG23	2.01	0.61
1:B:286[B]:TRP:CE2	6:B:602[B]:HI6:C13	2.83	0.61
1:A:407:VAL:O	1:A:411:VAL:HG23	2.01	0.60
1:A:341:TYR:CD2	6:A:606:HI6:H71	2.36	0.60
1:A:17:LEU:HD23	1:A:60:VAL:HB	1.84	0.60
1:A:103:THR:HG21	1:A:190:PHE:HB3	1.84	0.59
1:B:161:LEU:HD11	1:B:269:LEU:HD12	1.83	0.59
1:B:525[B]:ARG:NH2	7:B:703:HOH:O	2.36	0.59
1:A:370:VAL:CG2	1:A:540:LEU:HD21	2.33	0.58
1:A:76:LEU:CD1	1:A:77:TYR:CE2	2.87	0.58
1:B:142:GLU:OE2	1:B:485:ARG:NH2	2.37	0.57
1:B:243:GLU:HA	1:B:243:GLU:OE1	2.04	0.57
1:B:286[B]:TRP:CD2	6:B:602[B]:HI6:C12	2.87	0.56
1:A:45:ARG:HH21	1:A:51:GLU:HG3	1.70	0.56
1:A:291:GLN:NE2	1:A:368:PRO:O	2.37	0.56
1:A:161:LEU:HD11	1:A:269:LEU:HD22	1.87	0.56
1:A:251:LEU:HD22	1:A:299:PHE:CZ	2.41	0.56
1:A:450:GLU:O	1:A:454:ILE:HG13	2.06	0.56
1:A:362:GLY:HA2	1:A:365:VAL:HG12	1.88	0.55
1:A:370:VAL:HG12	1:A:371:SER:H	1.71	0.55
1:B:74:ASP:HB2	6:B:602[A]:HI6:H1	1.89	0.54
1:A:200:PHE:HB2	1:A:226:VAL:HB	1.88	0.54
1:B:42:MET:HE3	1:B:94:GLU:HB2	1.87	0.54
1:B:205:GLY:O	1:B:209:VAL:HG23	2.08	0.54
1:B:166:GLU:HB2	1:B:270:VAL:HG21	1.89	0.54
1:B:286[A]:TRP:CZ2	6:B:602[A]:HI6:C13	2.91	0.54
5:A:605:ELT:C04	5:A:605:ELT:C08	2.85	0.53
1:B:433:ARG:HG3	1:B:437:LEU:HD12	1.91	0.53
1:B:286[B]:TRP:CE3	6:B:602[B]:HI6:H12	2.44	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:45:ARG:NH1	1:B:51:GLU:OE2	2.40	0.53
1:A:367:VAL:HG22	1:A:367:VAL:O	2.09	0.53
1:B:364:ARG:NH2	1:B:370:VAL:O	2.43	0.52
1:A:370:VAL:CG1	1:A:371:SER:N	2.73	0.51
1:A:180:LEU:HD21	1:A:199:LEU:HD21	1.91	0.51
1:A:367:VAL:O	1:A:369:GLN:N	2.44	0.51
1:B:286[B]:TRP:CZ2	6:B:602[B]:HI6:H13	2.35	0.51
1:B:290:PRO:HG3	1:B:369:GLN:HE22	1.76	0.51
1:A:536:LEU:HB3	1:A:537:PRO:HD3	1.94	0.50
1:A:200:PHE:CB	1:A:226:VAL:HB	2.41	0.50
1:B:252:ALA:HB1	1:B:257:CYS:HB2	1.93	0.50
1:A:368:PRO:O	1:A:369:GLN:HG3	2.11	0.50
1:A:534:ARG:HD3	7:A:707:HOH:O	2.12	0.50
1:A:135:GLY:HA3	1:A:146:LEU:HD23	1.95	0.49
1:B:200:PHE:CB	1:B:226:VAL:HB	2.42	0.49
1:A:362:GLY:C	1:A:365:VAL:HG12	2.32	0.49
1:B:304:ASP:OD1	1:B:306:ASP:HB3	2.14	0.48
1:A:370:VAL:HG22	1:A:540:LEU:CD2	2.44	0.48
1:B:200:PHE:HB2	1:B:226:VAL:HB	1.94	0.48
1:A:337:TYR:HE2	6:A:606:HI6:C4	2.27	0.48
1:B:294:VAL:HG22	1:B:365:VAL:HG12	1.95	0.48
1:B:530:ALA:O	1:B:534:ARG:HB2	2.13	0.48
1:A:370:VAL:CG1	1:A:371:SER:H	2.27	0.47
1:B:476:LEU:HD23	1:B:479:TYR:HD2	1.79	0.47
1:A:370:VAL:HG21	1:A:540:LEU:CD2	2.44	0.47
1:B:226:VAL:HG22	1:B:327:LEU:HB3	1.97	0.47
1:B:91:GLU:OE2	1:B:91:GLU:N	2.33	0.47
1:A:413[A]:GLN:OE1	7:A:702:HOH:O	2.20	0.46
1:B:166:GLU:HG3	1:B:267:THR:HG22	1.97	0.46
1:A:433:ARG:NH2	1:A:439:TRP:O	2.44	0.46
1:A:68:VAL:HG23	1:A:90:ARG:HB2	1.97	0.46
1:B:424:ARG:CZ	1:B:424:ARG:HB2	2.45	0.46
1:A:77:TYR:CZ	1:A:348:LYS:HG2	2.51	0.46
1:A:381:HIS:NE2	7:A:705:HOH:O	2.36	0.46
1:A:76:LEU:CD1	1:A:77:TYR:CD2	2.99	0.46
1:A:76:LEU:HD13	1:A:77:TYR:CD2	2.51	0.46
1:B:428:TYR:HB3	1:B:500:TRP:CZ2	2.51	0.45
1:A:328:VAL:O	1:A:427:ALA:HA	2.17	0.45
1:A:337:TYR:HE2	6:A:606:HI6:H4	1.81	0.45
1:A:362:GLY:CA	1:A:365:VAL:HG12	2.48	0.44
1:B:80:PHE:CE2	1:B:438:SER:HB2	2.53	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:1:NAG:H62	2:D:3:FUC:H2	1.81	0.44
1:A:113:PRO:HG3	1:A:485:ARG:HG2	1.98	0.44
1:A:227:LEU:HB2	1:A:328:VAL:HG12	1.99	0.44
1:B:30:SER:HB2	1:B:103:THR:HG22	1.99	0.44
1:B:112:THR:CG2	1:B:113:PRO:HD2	2.48	0.43
1:B:285:GLU:HB3	6:B:602[B]:HI6:HN41	1.83	0.43
1:B:285:GLU:HB3	6:B:602[B]:HI6:N4	2.34	0.43
1:B:219:ARG:NH1	1:B:219:ARG:HG3	2.34	0.43
2:C:1:NAG:H61	2:C:2:NAG:N2	2.24	0.43
1:A:132:VAL:HG13	1:A:133:TYR:CD1	2.53	0.43
1:B:113:PRO:HG3	1:B:485:ARG:HG2	2.01	0.43
1:B:450:GLU:OE1	1:B:450:GLU:N	2.41	0.43
1:A:177:ARG:CZ	1:A:217:PRO:HB2	2.49	0.43
1:B:329:GLY:HA3	1:B:428:TYR:CE2	2.54	0.43
1:B:255:VAL:CG1	1:B:276:ARG:HG3	2.48	0.43
1:B:266:ASP:O	1:B:270:VAL:HG22	2.19	0.43
1:B:339:LEU:HD11	1:B:399:SER:HA	2.01	0.42
1:B:32:PHE:HB3	1:B:35:ILE:HD11	2.01	0.42
1:A:231:ALA:HB1	1:A:233:ASN:OD1	2.19	0.42
1:A:362:GLY:HA2	1:A:365:VAL:CG1	2.49	0.42
1:A:24:THR:HG22	1:A:26:GLY:N	2.15	0.42
1:A:304:ASP:OD1	1:A:304:ASP:N	2.49	0.42
1:A:373:LEU:HD12	1:A:376:GLU:HB2	2.01	0.42
1:A:376:GLU:OE2	1:A:376:GLU:HA	2.20	0.42
1:A:319:GLY:O	1:A:421:GLN:NE2	2.51	0.42
1:A:258:PRO:HA	1:A:259:PRO:HA	1.53	0.41
1:A:370:VAL:HG23	1:A:540:LEU:HD21	2.01	0.41
1:A:432:HIS:CE1	1:A:515:LEU:HD11	2.55	0.41
1:A:536:LEU:N	1:A:537:PRO:CD	2.83	0.41
6:A:606:HI6:H1	6:A:606:HI6:H72	1.85	0.41
1:B:277:PRO:HG2	1:B:280:VAL:CG2	2.50	0.41
1:A:329:GLY:HA3	1:A:428:TYR:CE2	2.55	0.41
1:B:20:ILE:HG23	1:B:63:THR:HG22	2.01	0.41
1:B:76:LEU:HD22	1:B:341:TYR:CD1	2.56	0.41
1:B:366:GLY:HA3	1:B:402:VAL:HG12	2.02	0.41
1:A:339:LEU:HD21	1:A:402:VAL:HG21	2.02	0.41
1:B:165:ARG:HH21	1:B:165:ARG:CG	2.34	0.41
1:B:146:LEU:HD21	1:B:455:PHE:HE2	1.86	0.40
1:A:433:ARG:CZ	1:A:437:LEU:HD23	2.52	0.40
1:B:43:GLY:HA3	1:B:44:PRO:HD2	1.92	0.40
1:B:286[A]:TRP:CE2	6:B:602[A]:HI6:C13	3.05	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:341:TYR:CD2	6:A:606:HI6:C7	3.04	0.40
1:B:219:ARG:HG3	1:B:219:ARG:HH11	1.85	0.40
1:B:257:CYS:HA	1:B:258:PRO:HA	1.91	0.40
1:A:31:ALA:HB1	1:A:33:LEU:HD21	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	528/542 (97%)	511 (97%)	15 (3%)	2 (0%)	34 41
1	B	529/542 (98%)	508 (96%)	20 (4%)	1 (0%)	47 57
All	All	1057/1084 (98%)	1019 (96%)	35 (3%)	3 (0%)	41 49

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	287	HIS
1	A	368	PRO
1	A	258	PRO

### 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	434/437 (99%)	426 (98%)	8 (2%)	59	71
1	B	434/437 (99%)	423 (98%)	11 (2%)	47	60
All	All	868/874 (99%)	849 (98%)	19 (2%)	53	64

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	70	TYR
1	A	200	PHE
1	A	268	GLU
1	A	291	GLN
1	A	295	PHE
1	A	367	VAL
1	A	368	PRO
1	A	462	SER
1	B	42	MET
1	B	165	ARG
1	B	200	PHE
1	B	286[A]	TRP
1	B	286[B]	TRP
1	B	295	PHE
1	B	369	GLN
1	B	413	GLN
1	B	431	GLU
1	B	437	LEU
1	B	512	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	464	ASN
1	B	265	ASN
1	B	369	GLN

### 5.3.3 RNA

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	2	14,14,15	0.30	0	17,19,21	0.62	0
2	NAG	C	2	2	14,14,15	0.30	0	17,19,21	0.61	0
2	FUC	C	3	2	10,10,11	0.53	0	14,14,16	1.64	4 (28%)
2	NAG	D	1	2,1	14,14,15	0.39	0	17,19,21	0.57	0
2	NAG	D	2	2	14,14,15	0.35	0	17,19,21	0.76	1 (5%)
2	FUC	D	3	2	10,10,11	0.93	0	14,14,16	1.35	2 (14%)
3	NAG	E	1	3	14,14,15	0.37	0	17,19,21	0.77	1 (5%)
3	NAG	E	2	3	14,14,15	0.30	0	17,19,21	0.62	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	C	1	2	-	2/6/23/26	0/1/1/1
2	NAG	C	2	2	-	1/6/23/26	0/1/1/1
2	FUC	C	3	2	-	-	0/1/1/1
2	NAG	D	1	2,1	-	4/6/23/26	0/1/1/1
2	NAG	D	2	2	-	2/6/23/26	0/1/1/1
2	FUC	D	3	2	-	-	0/1/1/1
3	NAG	E	1	3	-	3/6/23/26	0/1/1/1
3	NAG	E	2	3	-	4/6/23/26	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(°)	Ideal(°)
2	C	3	FUC	C1-O5-C5	3.29	120.25	112.78
2	D	3	FUC	C1-O5-C5	2.72	118.95	112.78
2	C	3	FUC	C2-C3-C4	2.49	115.21	110.89
2	C	3	FUC	C1-C2-C3	2.43	112.66	109.67
2	D	3	FUC	O2-C2-C1	2.26	113.79	109.15
2	C	3	FUC	O5-C1-C2	2.16	114.11	110.77
2	D	2	NAG	C1-O5-C5	2.01	114.92	112.19
3	E	1	NAG	C3-C4-C5	2.01	113.82	110.24

There are no chirality outliers.

All (16) torsion outliers are listed below:

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

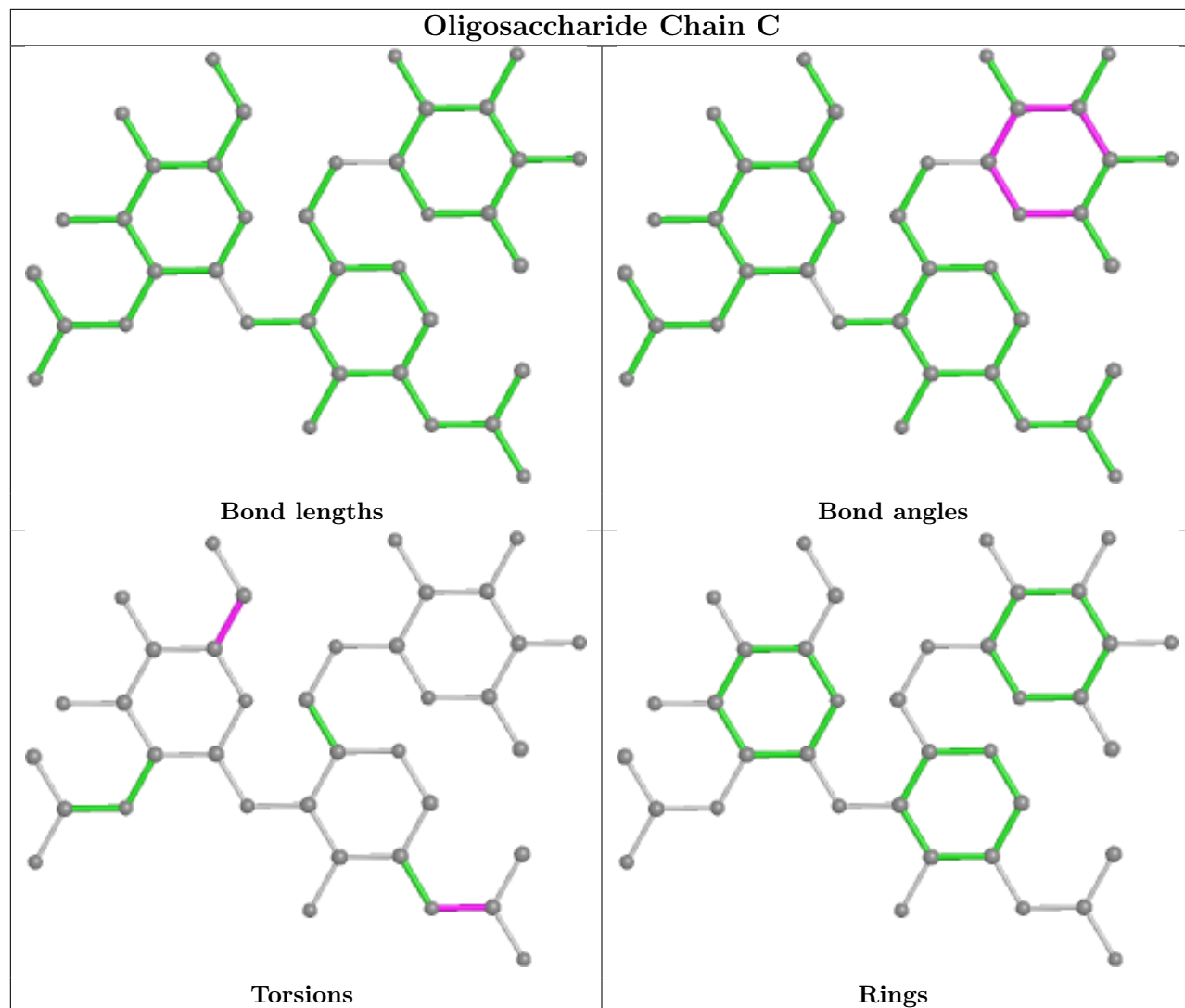
There are no ring outliers.

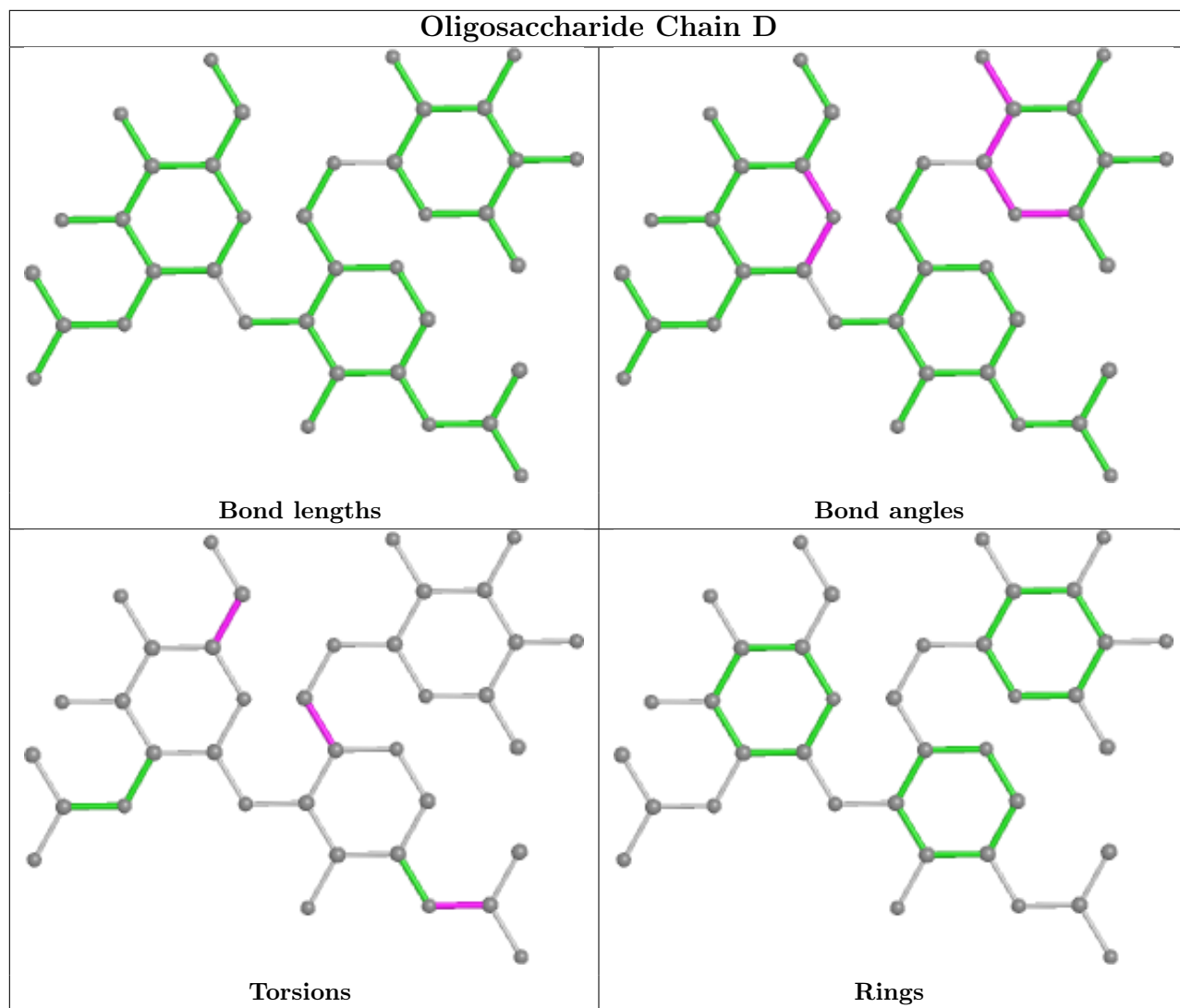
5 monomers are involved in 7 short contacts:

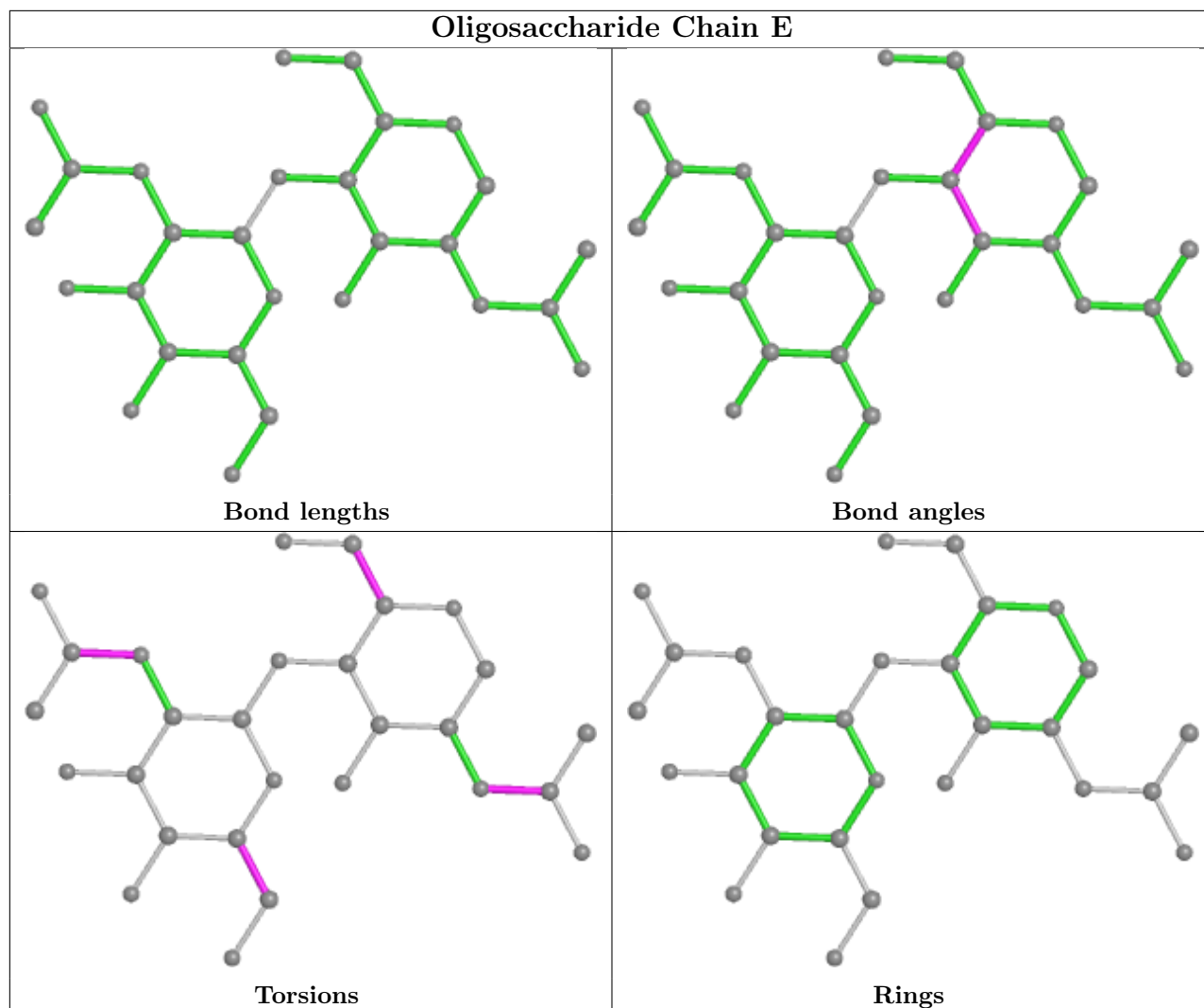
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	E	1	NAG	2	0
2	C	2	NAG	2	0
2	D	1	NAG	1	0
2	D	3	FUC	1	0
2	C	1	NAG	4	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,

bond angles, torsion angles, and ring geometry for oligosaccharide.







## 5.6 Ligand geometry [i](#)

6 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$
6	HI6	B	602[A]	-	18,22,22	4.47	5 (27%)	19,28,28	2.48	5 (26%)
4	NAG	A	604	-	14,14,15	0.28	0	17,19,21	0.60	0
5	ELT	B	601	-	4,7,8	2.47	3 (75%)	4,8,11	1.09	1 (25%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
6	HI6	B	602[B]	-	18,22,22	3.95	5 (27%)	19,28,28	2.24	7 (36%)
5	ELT	A	605	-	4,7,8	2.43	3 (75%)	4,8,11	0.57	0
6	HI6	A	606	-	18,22,22	4.37	7 (38%)	19,28,28	1.51	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
6	HI6	B	602[A]	-	-	9/12/13/13	0/2/2/2
4	NAG	A	604	-	-	1/6/23/26	0/1/1/1
5	ELT	B	601	-	-	0/1/7/10	-
6	HI6	B	602[B]	-	-	3/12/13/13	0/2/2/2
5	ELT	A	605	-	-	0/1/7/10	-
6	HI6	A	606	-	-	5/12/13/13	0/2/2/2

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	B	602[A]	HI6	C11-C14	-14.60	1.28	1.50
6	A	606	HI6	C11-C14	-12.29	1.32	1.50
6	B	602[B]	HI6	C11-C14	-10.71	1.34	1.50
6	A	606	HI6	C1-N1	9.48	1.45	1.27
6	B	602[B]	HI6	C1-N1	8.24	1.43	1.27
6	B	602[A]	HI6	C1-N1	7.99	1.43	1.27
6	B	602[B]	HI6	C14-N4	6.65	1.45	1.33
6	A	606	HI6	C14-N4	6.61	1.45	1.33
6	B	602[B]	HI6	C2-C1	-6.16	1.30	1.46
6	B	602[A]	HI6	C2-C1	-5.97	1.30	1.46
6	A	606	HI6	C2-C1	-5.34	1.32	1.46
6	B	602[A]	HI6	O3-C14	-4.58	1.15	1.24
6	B	602[A]	HI6	C14-N4	4.34	1.41	1.33
6	A	606	HI6	C2-N2	-3.91	1.33	1.37
5	B	601	ELT	O06-C07	-3.50	1.36	1.44
5	A	605	ELT	O06-C07	-3.37	1.36	1.44
6	A	606	HI6	O3-C14	-2.89	1.18	1.24
6	B	602[B]	HI6	O3-C14	-2.76	1.18	1.24
5	B	601	ELT	C04-N03	-2.59	1.41	1.45
5	A	605	ELT	C04-N03	-2.56	1.41	1.45
5	A	605	ELT	C05-N03	-2.33	1.42	1.45

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	601	ELT	C05-N03	-2.29	1.42	1.45
6	A	606	HI6	C6-N2	-2.22	1.32	1.35

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	602[A]	HI6	C12-C11-C10	5.73	126.75	118.59
6	B	602[B]	HI6	O1-N1-C1	5.05	120.78	111.86
6	A	606	HI6	O1-N1-C1	4.95	120.60	111.86
6	B	602[A]	HI6	C13-N3-C9	4.43	127.58	120.30
6	B	602[A]	HI6	O1-N1-C1	4.25	119.36	111.86
6	B	602[B]	HI6	O3-C14-N4	-4.11	116.73	122.58
6	B	602[B]	HI6	C13-N3-C9	3.59	126.20	120.30
6	B	602[A]	HI6	C13-C12-C11	-3.35	114.67	119.44
6	B	602[A]	HI6	C9-C10-C11	-3.09	115.03	119.44
6	B	602[B]	HI6	O3-C14-C11	2.59	122.73	119.63
6	B	602[B]	HI6	C12-C11-C10	2.52	122.17	118.59
6	B	602[B]	HI6	C11-C14-N4	2.32	120.53	117.75
6	B	602[B]	HI6	C3-C2-C1	-2.02	116.78	121.24
5	B	601	ELT	C05-N03-C04	2.00	116.87	113.62

There are no chirality outliers.

All (18) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	606	HI6	O2-C7-N2-C6
6	A	606	HI6	N1-C1-C2-N2
6	A	606	HI6	C2-C1-N1-O1
6	B	602[A]	HI6	O2-C8-N3-C9
6	B	602[A]	HI6	O2-C8-N3-C13
6	B	602[A]	HI6	O2-C7-N2-C6
6	B	602[A]	HI6	N1-C1-C2-N2
6	B	602[A]	HI6	N1-C1-C2-C3
6	B	602[B]	HI6	O2-C8-N3-C9
6	B	602[A]	HI6	C12-C11-C14-O3
6	B	602[A]	HI6	C12-C11-C14-N4
6	B	602[A]	HI6	C10-C11-C14-O3
6	B	602[B]	HI6	N3-C8-O2-C7
6	B	602[A]	HI6	C10-C11-C14-N4
4	A	604	NAG	O5-C5-C6-O6
6	A	606	HI6	N2-C7-O2-C8
6	A	606	HI6	N1-C1-C2-C3

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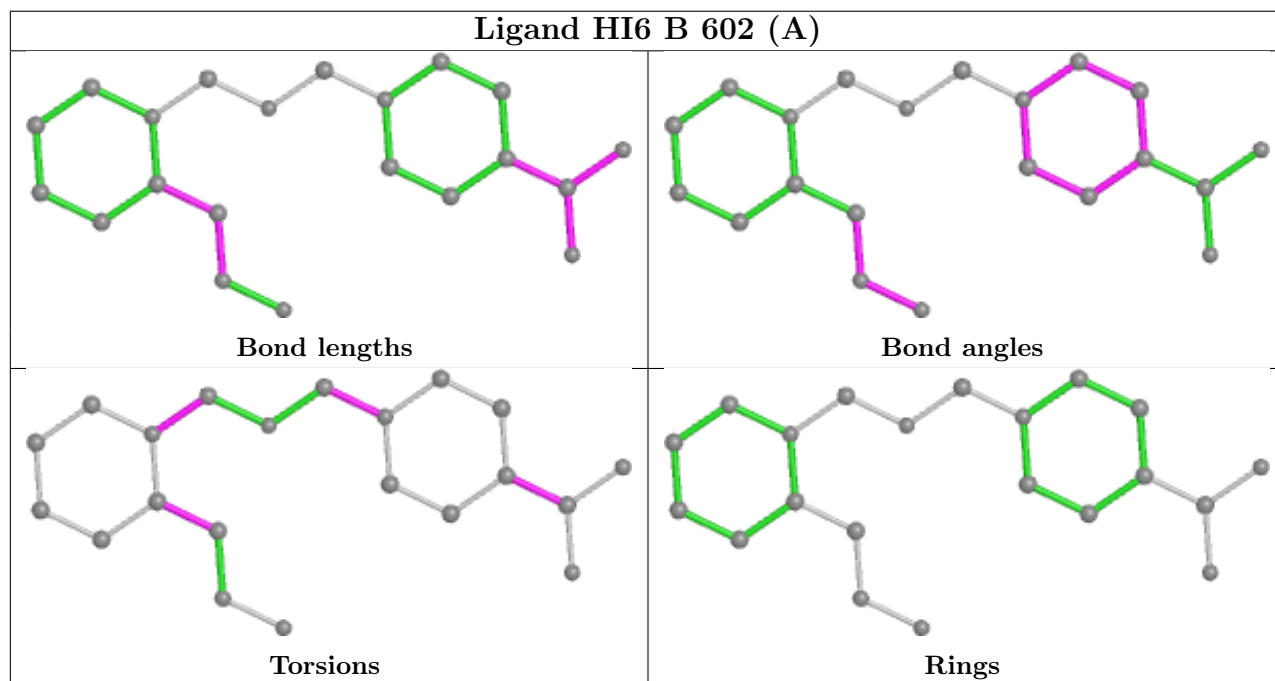
Mol	Chain	Res	Type	Atoms
6	B	602[B]	HI6	N1-C1-C2-N2

There are no ring outliers.

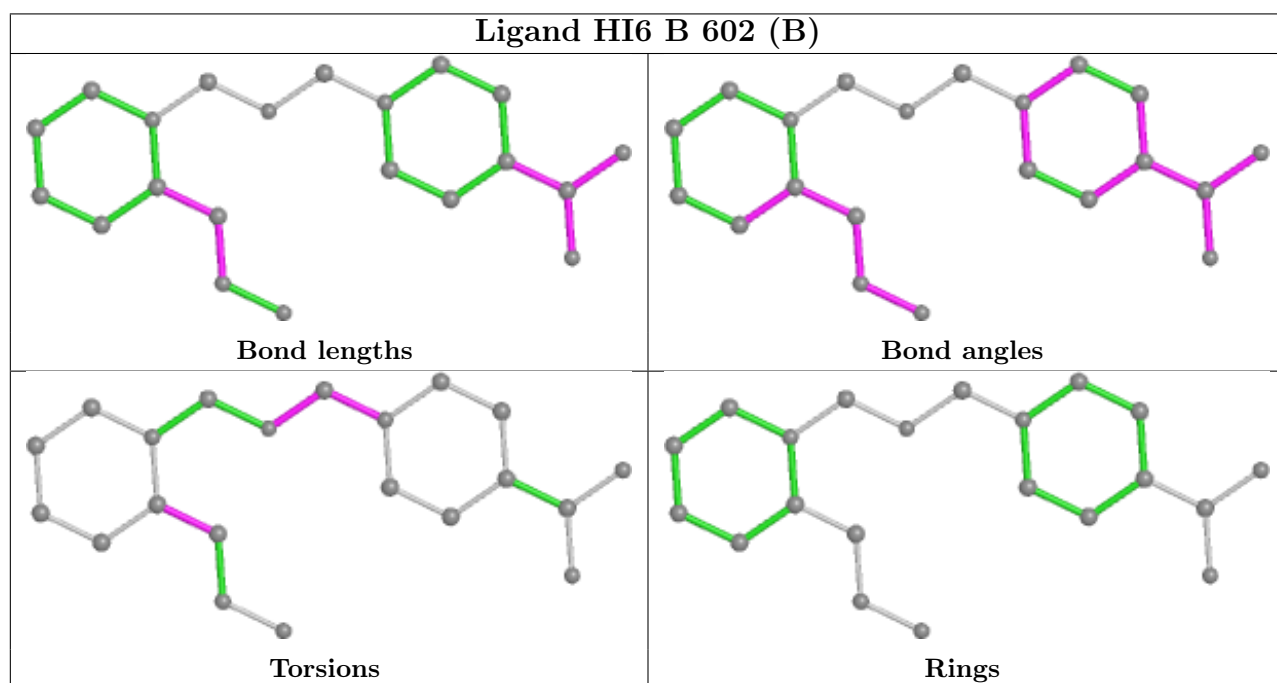
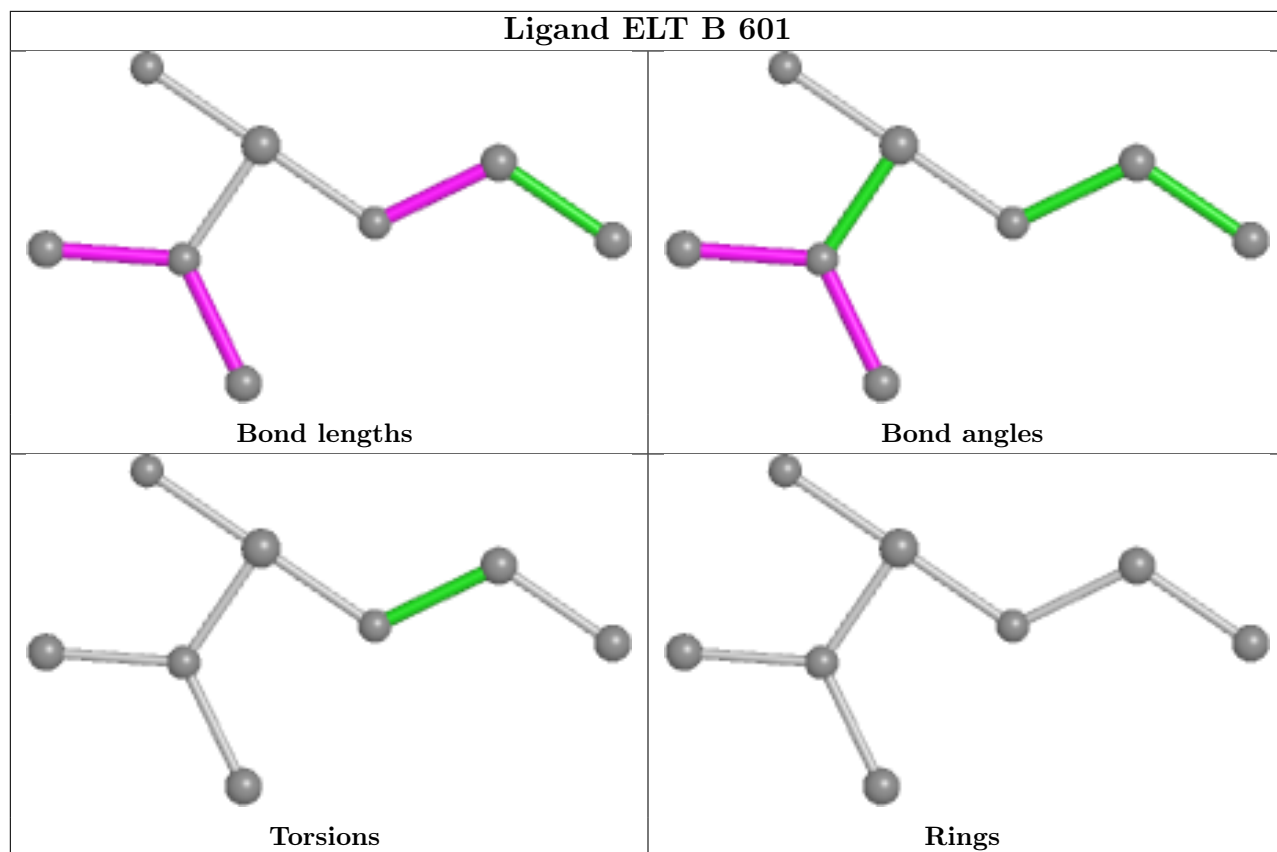
6 monomers are involved in 27 short contacts:

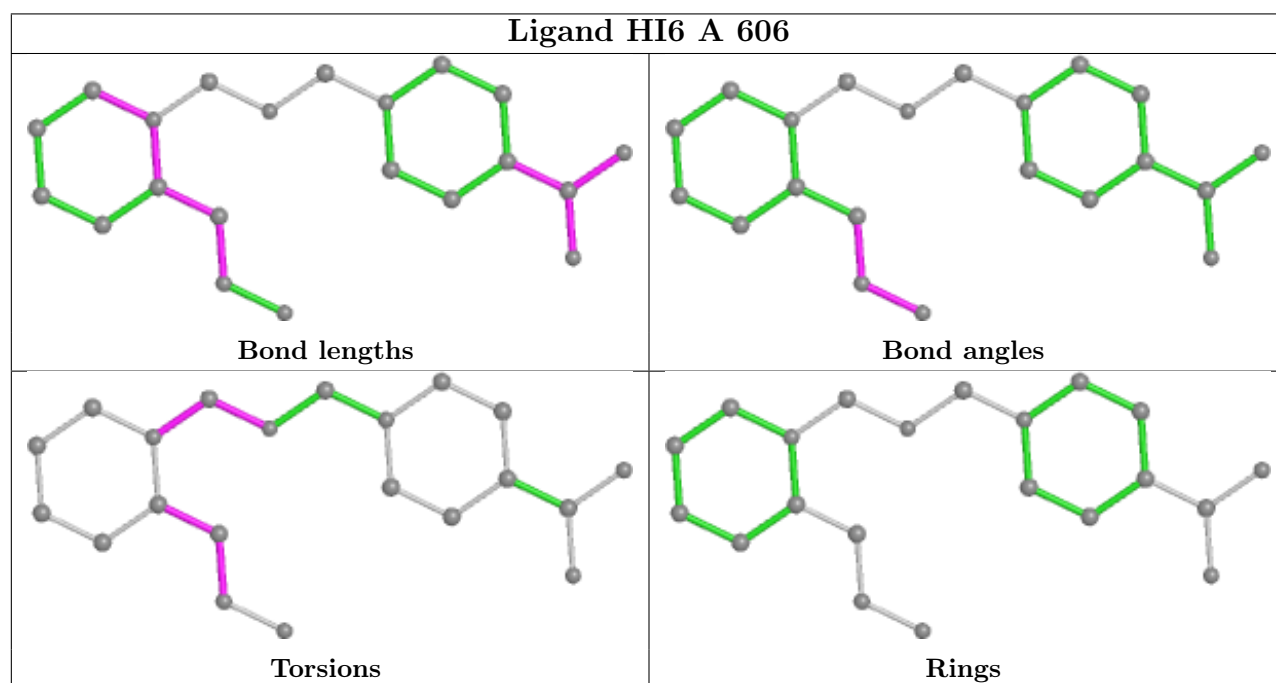
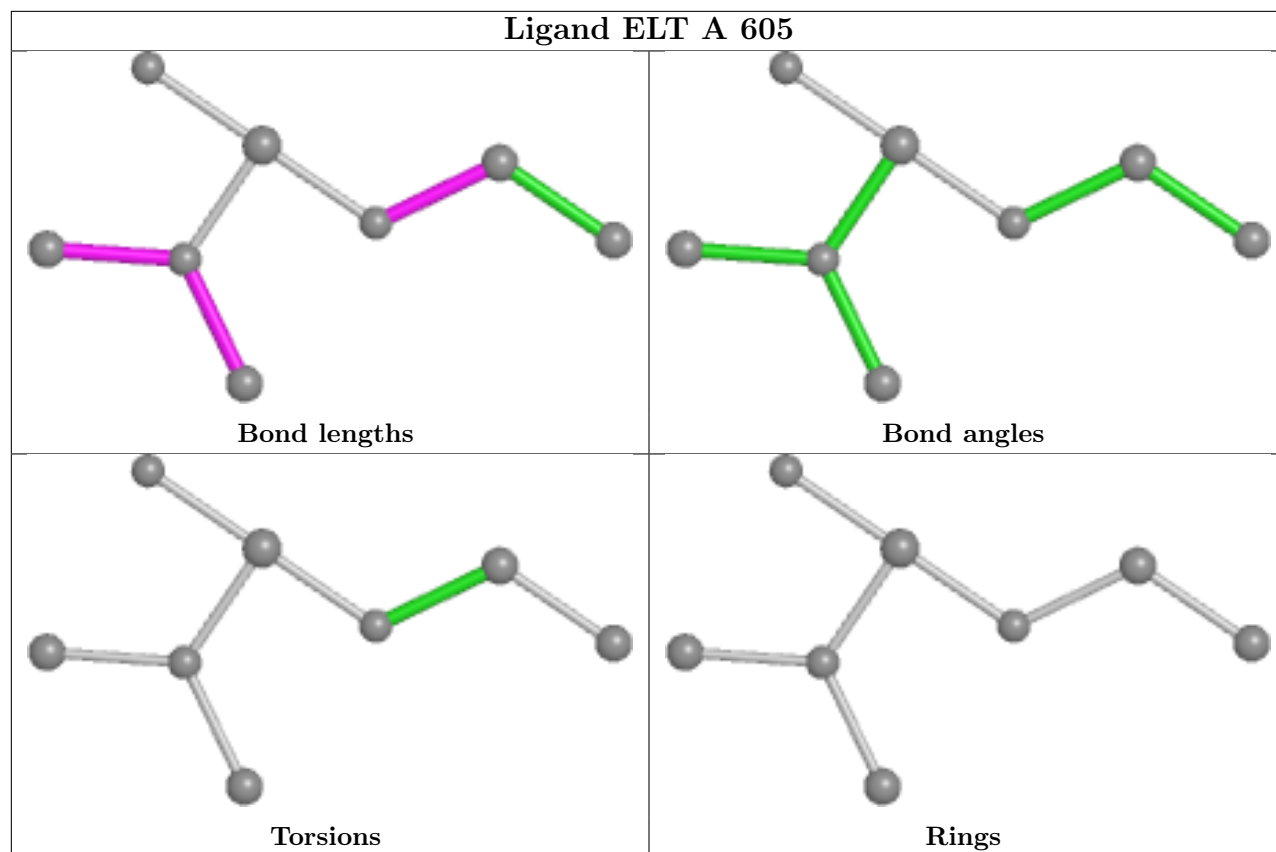
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	B	602[A]	HI6	4	0
4	A	604	NAG	2	0
5	B	601	ELT	3	0
6	B	602[B]	HI6	12	0
5	A	605	ELT	1	0
6	A	606	HI6	5	0

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









## 5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	530/542 (97%)	-0.05	24 (4%) 33 30	44, 61, 86, 125	0
1	B	531/542 (97%)	0.06	25 (4%) 31 29	44, 64, 94, 132	0
All	All	1061/1084 (97%)	0.01	49 (4%) 32 30	44, 63, 90, 132	0

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	371	SER	11.8
1	B	118	ILE	4.7
1	A	372	ASP	4.5
1	A	204	ALA	4.5
1	B	259	PRO	4.2
1	B	204	ALA	4.2
1	B	120	GLY	4.0
1	A	206	ALA	3.7
1	B	264	GLY	3.3
1	A	542	ALA	3.2
1	A	118	ILE	3.2
1	B	207	ALA	3.1
1	A	259	PRO	3.1
1	B	117	TRP	3.1
1	B	497	ALA	3.0
1	A	208	SER	3.0
1	B	119	TYR	3.0
1	A	207	ALA	2.9
1	B	121	GLY	2.8
1	A	370	VAL	2.8
1	B	205	GLY	2.8
1	A	205	GLY	2.8
1	A	497	ALA	2.7
1	B	291	GLN	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	229	SER	2.7
1	B	407	VAL	2.6
1	B	491	GLU	2.5
1	A	209	VAL	2.5
1	B	116	VAL	2.5
1	A	4	GLU	2.4
1	A	151	TYR	2.4
1	A	226	VAL	2.4
1	B	123	PHE	2.3
1	A	227	LEU	2.3
1	B	330	VAL	2.3
1	B	122	GLY	2.3
1	A	123	PHE	2.3
1	B	128	SER	2.3
1	A	201	GLY	2.2
1	A	231	ALA	2.2
1	A	202	GLU	2.2
1	B	228	GLN	2.1
1	A	117	TRP	2.1
1	B	206	ALA	2.1
1	B	201	GLY	2.1
1	B	127	ALA	2.1
1	A	234	GLY	2.1
1	A	258	PRO	2.0
1	B	200	PHE	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.

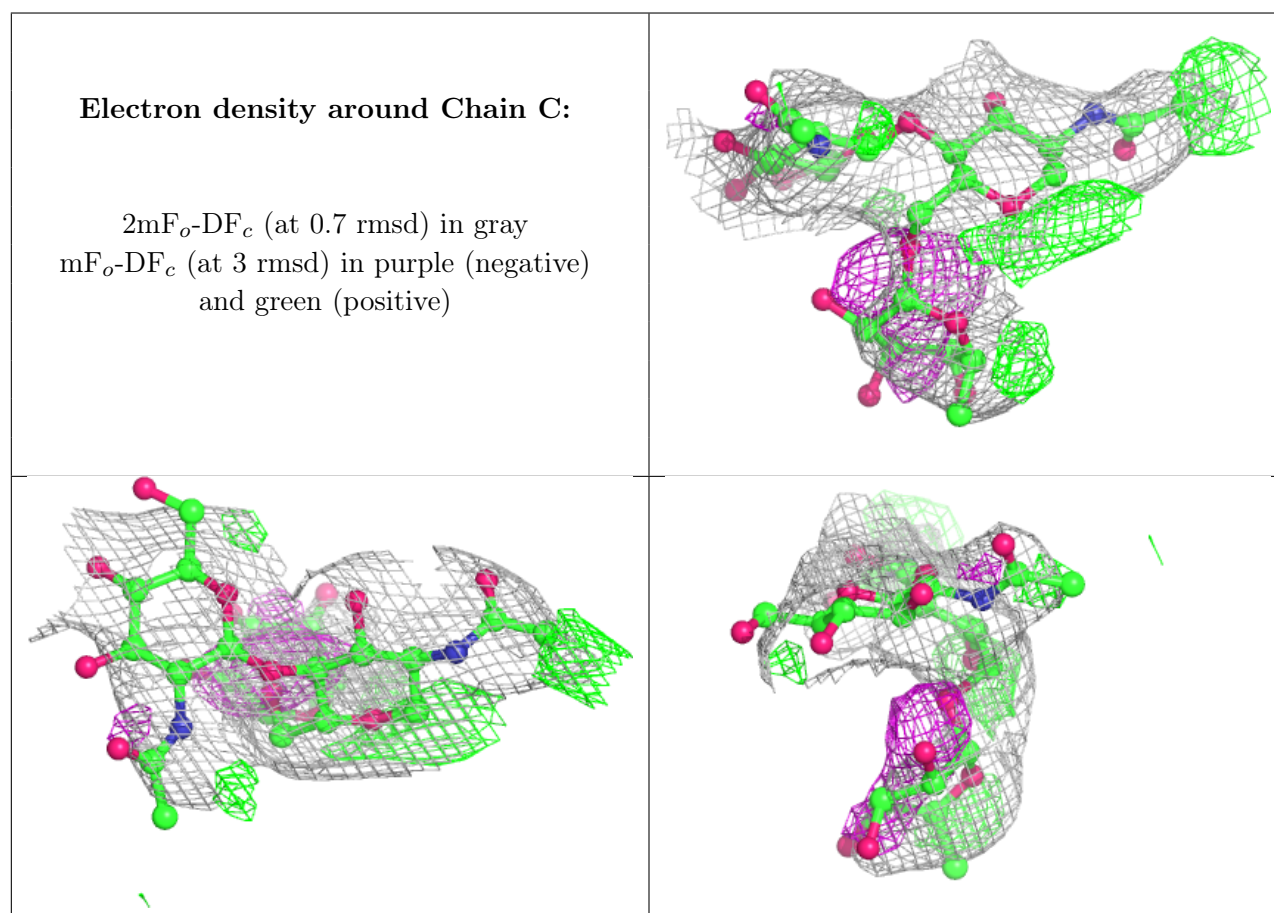
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	NAG	E	2	14/15	0.60	0.58	124,139,149,152	0
2	FUC	C	3	10/11	0.66	0.57	105,117,132,135	0
2	NAG	C	1	14/15	0.72	0.29	83,118,120,123	0

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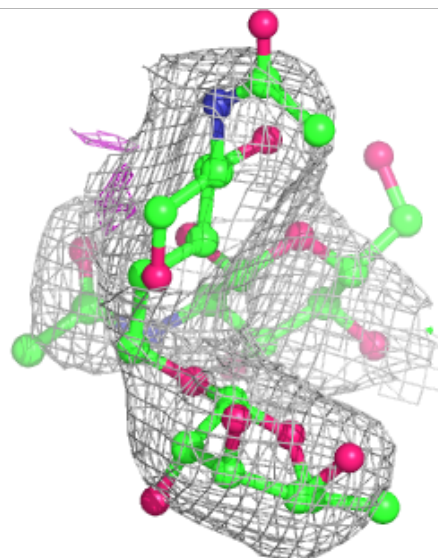
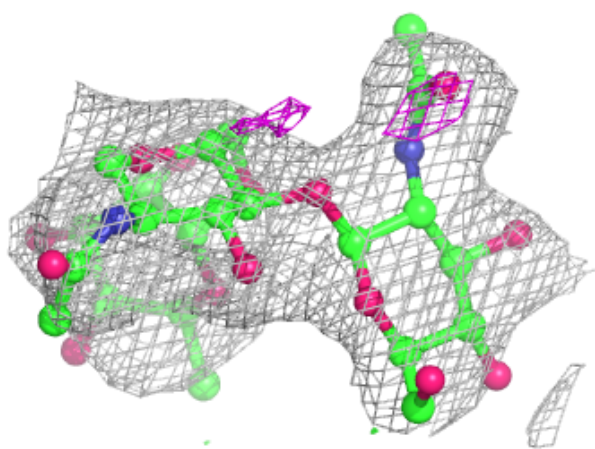
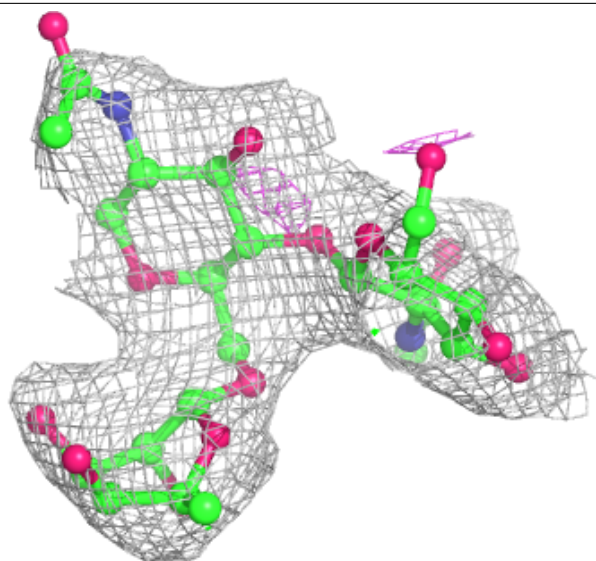
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	NAG	E	1	14/15	0.79	0.31	106,131,143,146	0
2	NAG	D	2	14/15	0.80	0.36	102,137,147,148	0
2	NAG	C	2	14/15	0.81	0.43	105,127,140,141	0
2	NAG	D	1	14/15	0.94	0.25	99,110,131,133	0
2	FUC	D	3	10/11	0.94	0.34	110,131,140,141	0

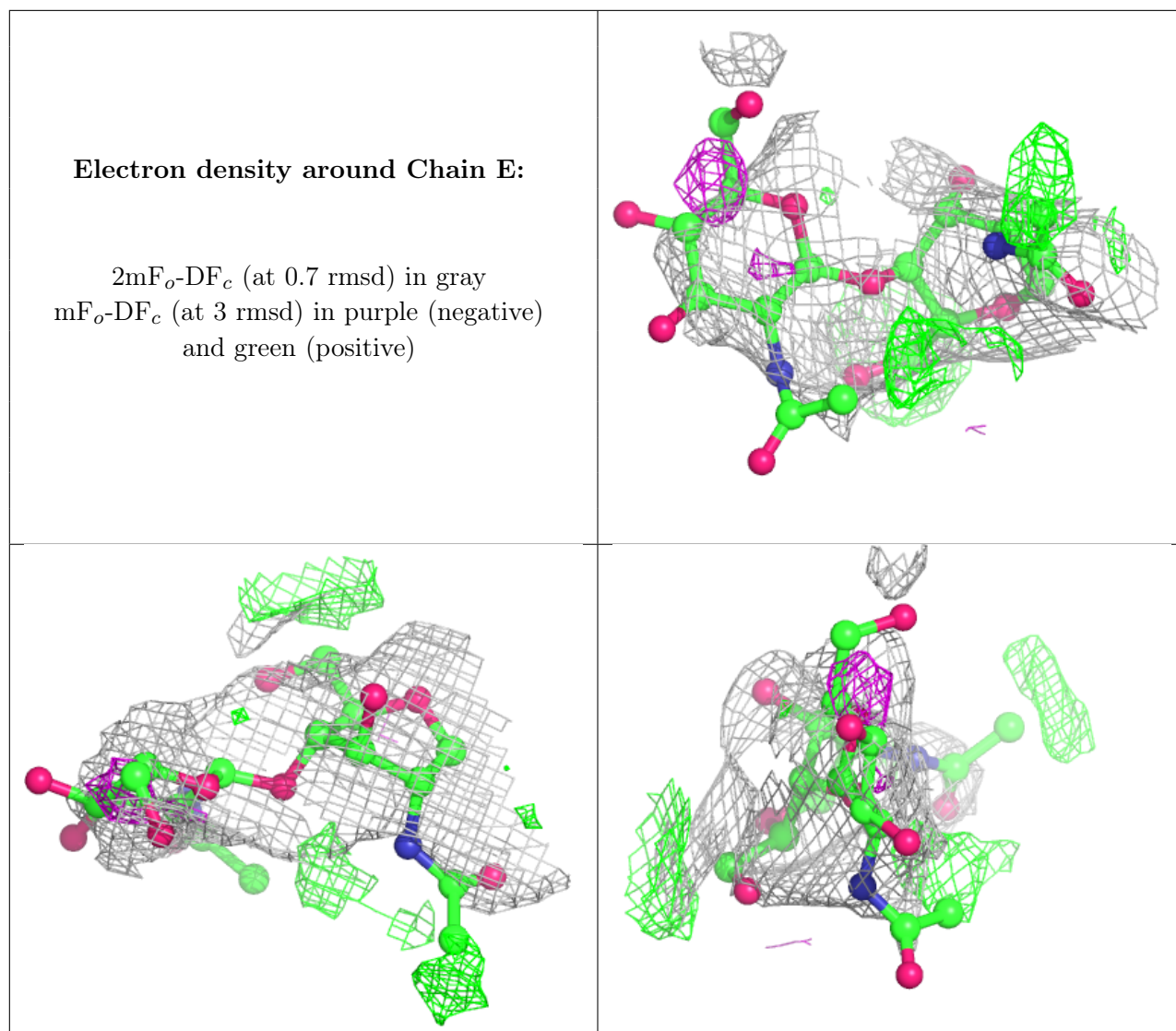
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



**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)





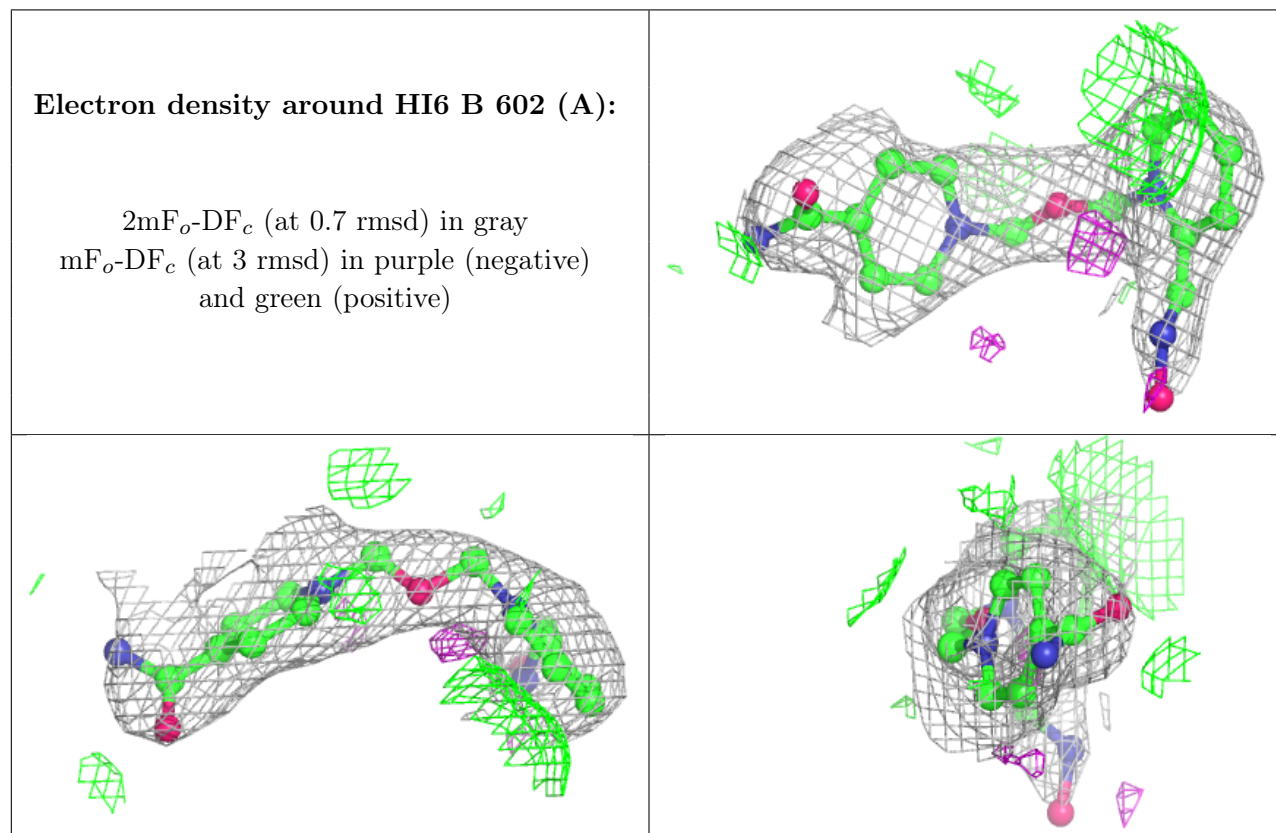
## 6.4 Ligands [i](#)

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	604	14/15	0.57	0.41	95,128,135,143	0
6	HI6	B	602[A]	21/21	0.85	0.20	74,82,86,89	21
6	HI6	B	602[B]	21/21	0.85	0.20	70,81,86,90	21
6	HI6	A	606	21/21	0.94	0.15	62,82,96,103	0
5	ELT	A	605	8/9	0.97	0.25	50,62,67,69	0
5	ELT	B	601	8/9	0.98	0.28	49,59,70,70	0

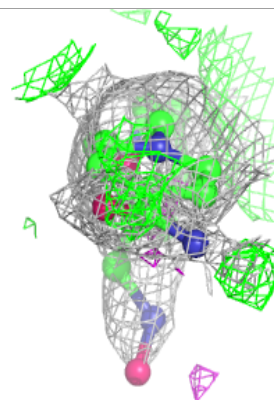
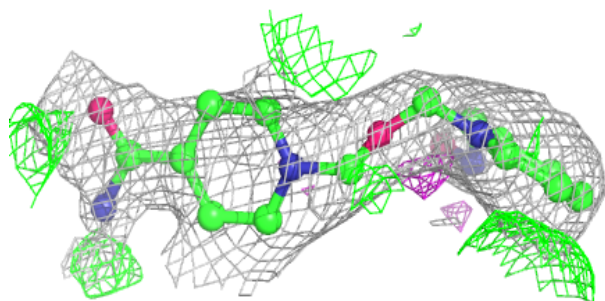
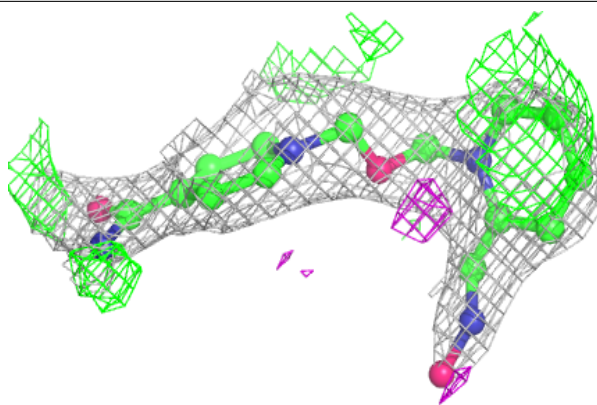


The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

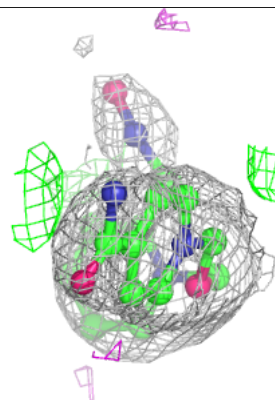
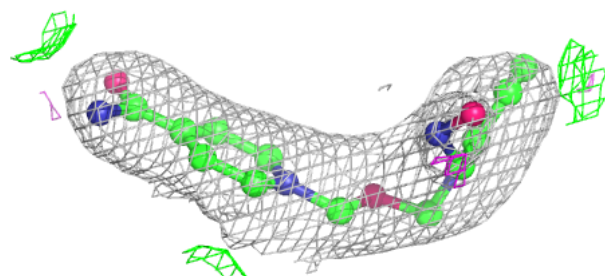
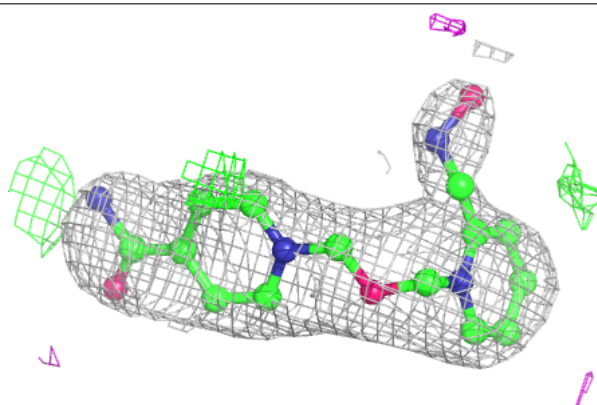


**Electron density around HI6 B 602 (B):**

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

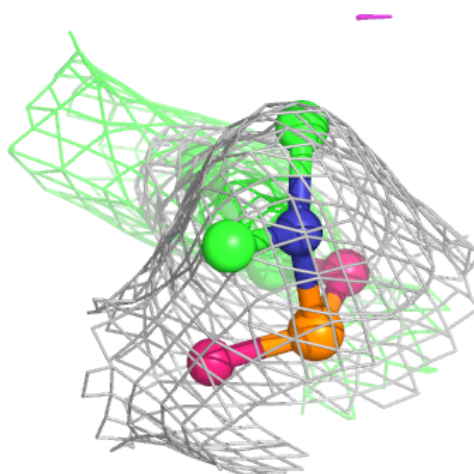
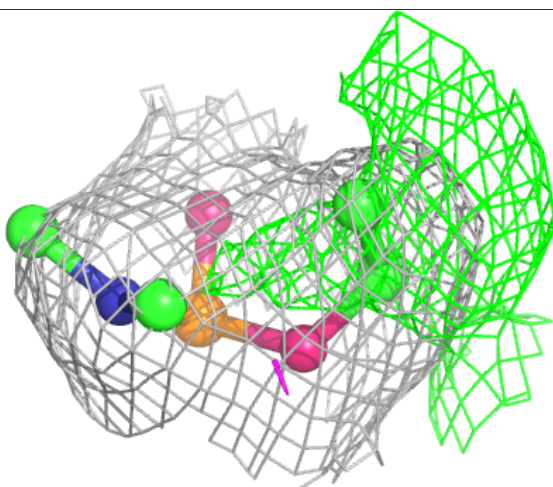
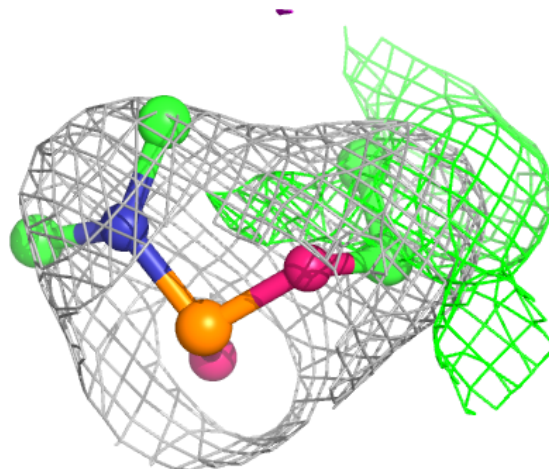
**Electron density around HI6 A 606:**

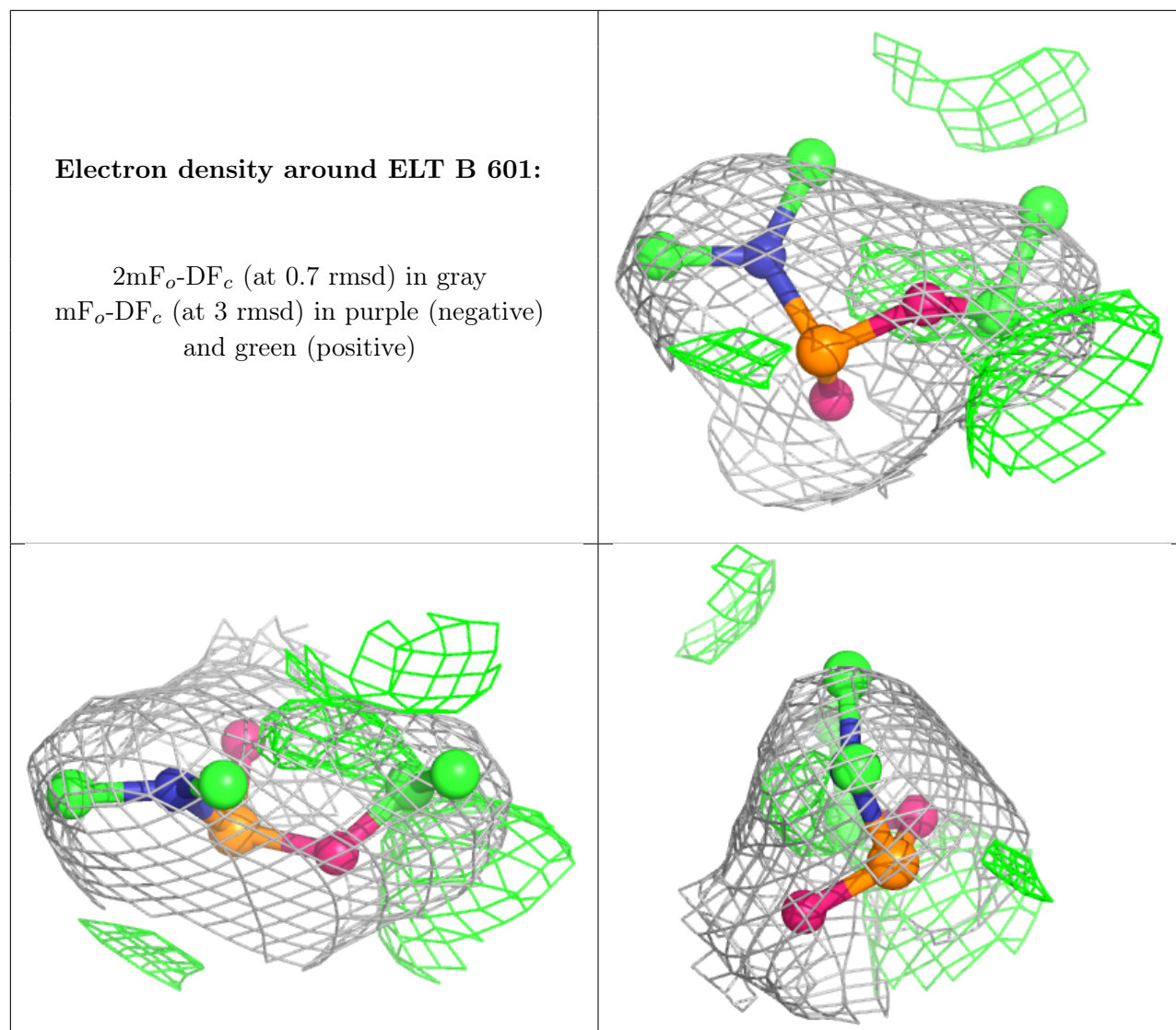
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around ELT A 605:**

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





## 6.5 Other polymers [i](#)

There are no such residues in this entry.