



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:16 PM UTC

PDB ID : 7KN5 / pdb_00007kn5
Title : Crystal structure of SARS-CoV-2 receptor binding domain complexed with nanobodies VHH E and U
Authors : Liu, H.; Yuan, M.; Zhu, X.; Wu, N.C.; Wilson, I.A.
Deposited on : 2020-11-04
Resolution : 1.87 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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

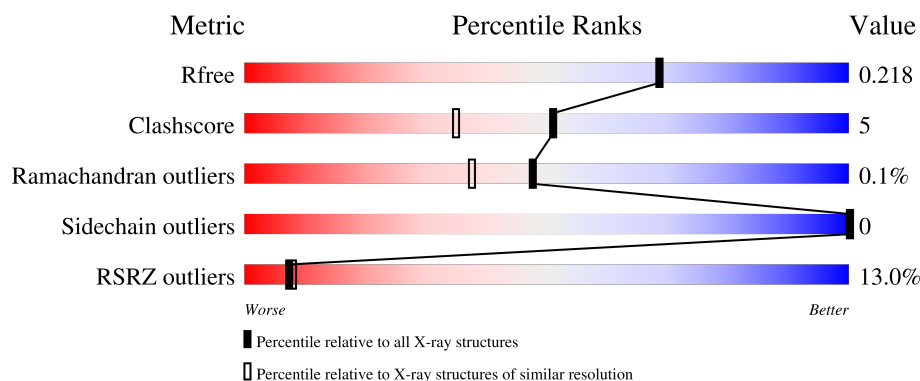
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.87 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1220 (1.88-1.88)
Clashscore	190562	1234 (1.88-1.88)
Ramachandran outliers	187476	1222 (1.88-1.88)
Sidechain outliers	187428	1222 (1.88-1.88)
RSRZ outliers	180081	1220 (1.88-1.88)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	231	4% 80% 5% 16%
1	B	231	4% 77% 7% 16%
2	C	129	6% 91% 9%
2	D	129	3% 98% .
3	E	126	21% 82% 14% .

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Mol	Chain	Length	Quality of chain
3	F	126	
4	G	2	

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
5	EDO	C	201	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 7282 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 Spike protein S1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	195	Total	C	N	O	S	0	0	0
			1530	979	255	288	8			
1	B	195	Total	C	N	O	S	0	0	0
			1528	981	252	287	8			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	542	SER	-	expression tag	UNP P0DTC2
A	543	GLY	-	expression tag	UNP P0DTC2
A	544	HIS	-	expression tag	UNP P0DTC2
A	545	HIS	-	expression tag	UNP P0DTC2
A	546	HIS	-	expression tag	UNP P0DTC2
A	547	HIS	-	expression tag	UNP P0DTC2
A	548	HIS	-	expression tag	UNP P0DTC2
A	549	HIS	-	expression tag	UNP P0DTC2
B	542	SER	-	expression tag	UNP P0DTC2
B	543	GLY	-	expression tag	UNP P0DTC2
B	544	HIS	-	expression tag	UNP P0DTC2
B	545	HIS	-	expression tag	UNP P0DTC2
B	546	HIS	-	expression tag	UNP P0DTC2
B	547	HIS	-	expression tag	UNP P0DTC2
B	548	HIS	-	expression tag	UNP P0DTC2
B	549	HIS	-	expression tag	UNP P0DTC2

- Molecule 2 is a protein called VHH E.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	129	Total	C	N	O	S	0	1	0
			983	617	164	196	6			
2	D	129	Total	C	N	O	S	0	0	0
			980	613	163	198	6			

- Molecule 3 is a protein called VHH U.

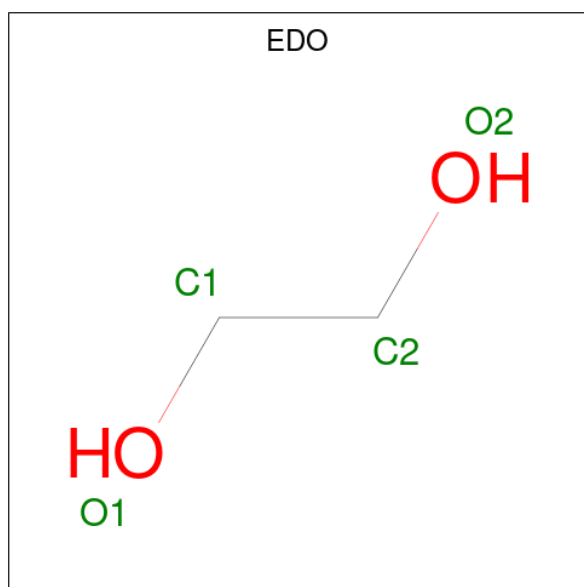
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	E	121	Total	C	N	O	S	0	0	0
			892	563	150	174	5			
3	F	123	Total	C	N	O	S	0	0	0
			892	561	154	173	4			

- Molecule 4 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
4	G	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 5 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂) (labeled as "Ligand of Interest" by depositor).



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

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

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$) (labeled as "Ligand of Interest" by depositor).



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

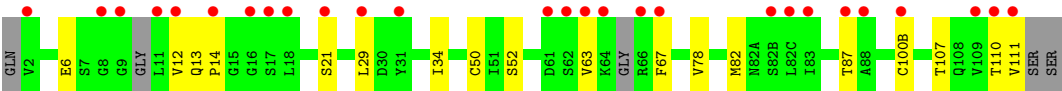
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	127	Total	O	0	0
			127	127		
7	B	114	Total	O	0	0
			114	114		
7	C	51	Total	O	0	0
			51	51		
7	D	102	Total	O	0	0
			102	102		
7	E	13	Total	O	0	0
			13	13		

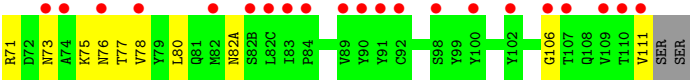
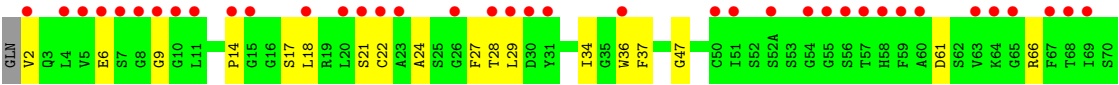
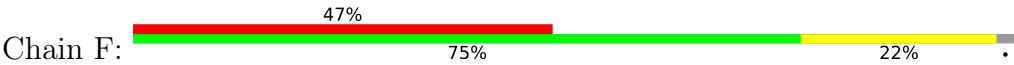
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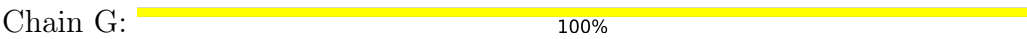
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	F	8	Total	O	0	0
			8	8		



● Molecule 3: VHH U



● Molecule 4: 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 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	80.53Å 91.94Å 85.00Å 90.00° 91.15° 90.00°	Depositor
Resolution (Å)	38.57 – 1.87 38.57 – 1.87	Depositor EDS
% Data completeness (in resolution range)	94.8 (38.57-1.87) 94.8 (38.57-1.87)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.30 (at 1.87Å)	Xtriage
Refinement program	PHENIX 1.16_3549	Depositor
R, R_{free}	0.177 , 0.213 (Not available) , 0.218	Depositor DCC
R_{free} test set	4699 reflections (4.60%)	wwPDB-VP
Wilson B-factor (Å ²)	33.3	Xtriage
Anisotropy	0.210	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 43.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.023 for h,-k,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7282	wwPDB-VP
Average B, all atoms (Å ²)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.03% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

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	0.69	0/1573	0.73	1/2142 (0.0%)
1	B	0.57	0/1572	0.69	0/2143
2	C	0.58	0/1005	0.73	0/1364
2	D	0.67	0/1002	0.78	0/1361
3	E	0.44	0/915	0.66	0/1245
3	F	0.40	0/917	0.65	0/1250
All	All	0.58	0/6984	0.71	1/9505 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	346	ARG	NE-CZ-NH2	5.29	123.96	119.20

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	1530	0	1431	10	0
1	B	1528	0	1419	10	0
2	C	983	0	906	12	0
2	D	980	0	904	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	892	0	774	12	0
3	F	892	0	752	20	0
4	G	28	0	25	0	0
5	A	12	0	18	5	0
5	C	4	0	6	7	0
5	E	4	0	6	0	0
6	B	14	0	13	0	0
7	A	127	0	0	2	0
7	B	114	0	0	1	0
7	C	51	0	0	1	0
7	D	102	0	0	0	0
7	E	13	0	0	0	0
7	F	8	0	0	0	0
All	All	7282	0	6254	67	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 5.

All (67) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:66:ARG:HH22	2:C:86:ASP:CG	1.79	0.90
3:F:34:ILE:HG21	3:F:78:VAL:HG21	1.57	0.86
2:C:66:ARG:NH2	2:C:86:ASP:OD2	2.09	0.83
1:B:391:CYS:O	7:B:1101:HOH:O	1.96	0.82
1:A:403:ARG:HH21	5:A:601:EDO:H11	1.54	0.73
3:E:29:LEU:HD22	3:E:34:ILE:HD11	1.72	0.70
2:C:28:THR:HB	5:C:201:EDO:H22	1.81	0.63
3:F:29:LEU:O	3:F:71:ARG:NH2	2.33	0.61
1:B:516:GLU:O	1:B:517:LEU:HD23	2.01	0.60
3:F:22:CYS:HB3	3:F:78:VAL:HG23	1.82	0.60
3:E:6:GLU:HB2	3:E:107:THR:HG23	1.83	0.59
3:E:67:PHE:CE2	3:E:82:MET:HG2	2.38	0.59
2:C:20:LEU:HG	2:C:82:MET:HE2	1.86	0.58
3:F:28:THR:HA	3:F:76:ASN:HD21	1.68	0.57
1:A:403:ARG:NH1	7:A:702:HOH:O	2.38	0.56
1:A:403:ARG:NH2	5:A:601:EDO:H11	2.22	0.54
3:F:9:GLY:HA2	3:F:18:LEU:HD13	1.88	0.54
2:C:28:THR:CB	5:C:201:EDO:H22	2.37	0.54
2:C:28:THR:CA	5:C:201:EDO:H22	2.38	0.53
7:A:709:HOH:O	5:C:201:EDO:H11	2.07	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:E:12:VAL:O	3:E:111:VAL:HA	2.09	0.53
3:F:6:GLU:CD	3:F:106:GLY:H	2.19	0.51
3:E:87:THR:HG23	3:E:110:THR:HA	1.92	0.50
3:E:50:CYS:HG	3:E:100(B):CYS:CB	2.20	0.49
3:E:6:GLU:HA	3:E:21:SER:O	2.13	0.49
1:B:388:ASN:O	1:B:526:GLY:HA3	2.12	0.49
3:F:71:ARG:HB3	3:F:78:VAL:HG12	1.94	0.49
1:B:376:THR:HB	1:B:435:ALA:HB3	1.95	0.48
3:F:17:SER:HB2	3:F:82(A):ASN:OD1	2.14	0.48
3:F:75:LYS:O	3:F:77:THR:HG23	2.14	0.47
3:E:52:SER:N	3:E:100(B):CYS:SG	2.88	0.47
1:A:364:ASP:O	1:A:367:VAL:HG12	2.15	0.47
1:B:364:ASP:O	1:B:367:VAL:HG12	2.15	0.47
1:A:436:TRP:CZ2	5:A:603:EDO:H22	2.50	0.47
3:F:34:ILE:HG13	3:F:78:VAL:HG11	1.96	0.46
3:F:73:ASN:ND2	3:F:73:ASN:H	2.14	0.46
1:A:354:ASN:O	1:A:398:ASP:HA	2.16	0.46
3:E:63:VAL:HB	3:E:67:PHE:CG	2.51	0.45
1:B:340:GLU:OE2	1:B:356:LYS:NZ	2.51	0.44
1:B:354:ASN:O	1:B:398:ASP:HA	2.17	0.44
1:A:436:TRP:HZ2	5:A:603:EDO:H22	1.82	0.44
5:A:602:EDO:H12	5:A:603:EDO:O1	2.17	0.44
2:C:28:THR:O	5:C:201:EDO:H22	2.18	0.44
3:F:61:ASP:OD1	3:F:61:ASP:N	2.50	0.44
1:A:445:VAL:HG13	5:C:201:EDO:C1	2.48	0.43
3:E:34:ILE:HG13	3:E:78:VAL:HG21	2.00	0.43
3:E:50:CYS:SG	3:E:100(B):CYS:CB	3.06	0.43
3:F:14:PRO:HD3	3:F:111:VAL:HG11	1.99	0.43
3:F:37:PHE:CD1	3:F:47:GLY:HA2	2.53	0.43
3:E:13:GLN:HB3	3:E:14:PRO:HD2	2.00	0.43
3:F:6:GLU:HA	3:F:21:SER:O	2.19	0.43
1:A:445:VAL:HG13	5:C:201:EDO:H12	2.01	0.42
3:F:2:VAL:HG13	3:F:27:PHE:CD1	2.53	0.42
1:B:431:GLY:HA2	1:B:515:PHE:CD2	2.54	0.42
2:C:73:ASN:HB2	7:C:345:HOH:O	2.19	0.42
2:D:20:LEU:HG	2:D:82:MET:HE2	2.00	0.42
3:F:24:ALA:HB1	3:F:27:PHE:CE1	2.54	0.42
3:F:66:ARG:HB3	3:F:82(A):ASN:O	2.19	0.42
1:B:392:PHE:CE1	1:B:515:PHE:HB3	2.55	0.42
2:C:63:VAL:O	2:C:66:ARG:CG	2.68	0.42
1:B:517:LEU:HD23	1:B:517:LEU:HA	1.42	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:F:22:CYS:HB3	3:F:78:VAL:CG2	2.50	0.41
2:C:61:ASP:O	2:C:64:LYS:HG2	2.20	0.41
1:A:359:SER:OG	1:A:394:ASN:OD1	2.39	0.41
2:C:99:TYR:OH	2:C:100(B):GLY:HA2	2.21	0.40
3:F:36:TRP:CG	3:F:80:LEU:HD22	2.56	0.40
2:C:63:VAL:O	2:C:66:ARG:HG3	2.21	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	193/231 (84%)	187 (97%)	5 (3%)	1 (0%)	24	13
1	B	193/231 (84%)	187 (97%)	6 (3%)	0	100	100
2	C	128/129 (99%)	126 (98%)	2 (2%)	0	100	100
2	D	127/129 (98%)	125 (98%)	2 (2%)	0	100	100
3	E	115/126 (91%)	113 (98%)	2 (2%)	0	100	100
3	F	121/126 (96%)	119 (98%)	2 (2%)	0	100	100
All	All	877/972 (90%)	857 (98%)	19 (2%)	1 (0%)	48	37

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	527	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	164/203 (81%)	164 (100%)	0	100	100
1	B	162/203 (80%)	162 (100%)	0	100	100
2	C	100/106 (94%)	100 (100%)	0	100	100
2	D	102/106 (96%)	102 (100%)	0	100	100
3	E	84/101 (83%)	84 (100%)	0	100	100
3	F	78/101 (77%)	78 (100%)	0	100	100
All	All	690/820 (84%)	690 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	360	ASN
1	A	414	GLN
1	B	334	ASN
1	B	493	GLN
1	B	501	ASN
3	F	73	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

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
4	NAG	G	1	1,4	14,14,15	1.12	1 (7%)	17,19,21	1.95	1 (5%)
4	NAG	G	2	4	14,14,15	0.59	0	17,19,21	1.36	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
4	NAG	G	1	1,4	-	4/6/23/26	0/1/1/1
4	NAG	G	2	4	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	G	1	NAG	O5-C1	4.10	1.50	1.43

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	G	1	NAG	C1-O5-C5	7.81	122.65	112.19
4	G	2	NAG	C1-O5-C5	5.20	119.15	112.19

There are no chirality outliers.

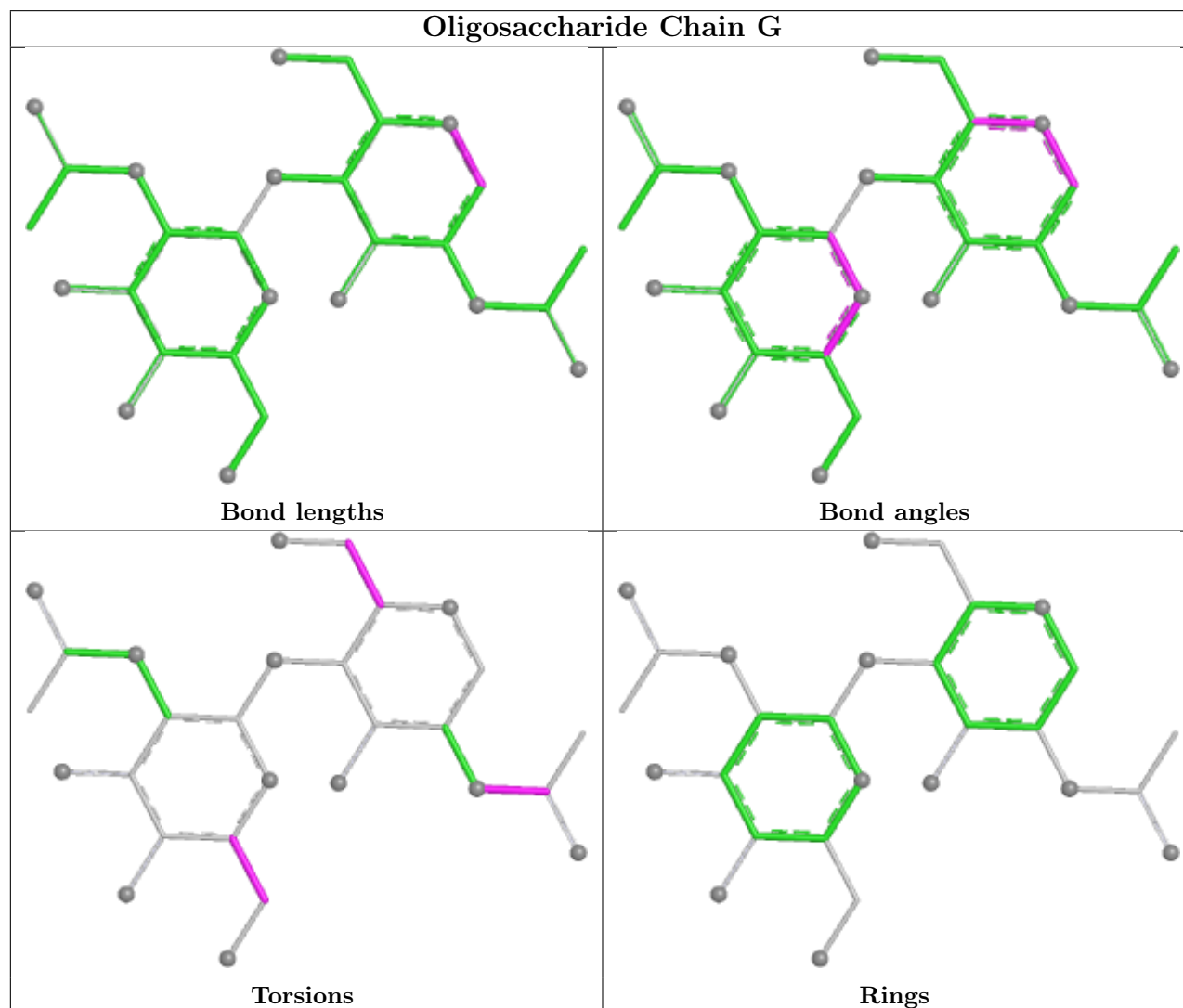
All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	G	2	NAG	C4-C5-C6-O6
4	G	2	NAG	O5-C5-C6-O6
4	G	1	NAG	O5-C5-C6-O6
4	G	1	NAG	C4-C5-C6-O6
4	G	1	NAG	C8-C7-N2-C2
4	G	1	NAG	O7-C7-N2-C2

There are no ring outliers.

No monomer is involved in short contacts.

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



5.6 Ligand geometry [i](#)

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
5	EDO	A	603	-	3,3,3	0.56	0	2,2,2	0.46	0
5	EDO	A	601	-	3,3,3	0.30	0	2,2,2	1.02	0
5	EDO	C	201	-	3,3,3	0.26	0	2,2,2	0.51	0
5	EDO	E	201	-	3,3,3	0.43	0	2,2,2	0.35	0
5	EDO	A	602	-	3,3,3	0.30	0	2,2,2	0.72	0
6	NAG	B	1001	1	14,14,15	1.25	1 (7%)	17,19,21	1.87	1 (5%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	EDO	A	603	-	-	0/1/1/1	-
5	EDO	A	601	-	-	1/1/1/1	-
5	EDO	C	201	-	-	0/1/1/1	-
5	EDO	E	201	-	-	0/1/1/1	-
5	EDO	A	602	-	-	1/1/1/1	-
6	NAG	B	1001	1	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	B	1001	NAG	O5-C1	4.58	1.51	1.43

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	1001	NAG	C1-O5-C5	7.53	122.28	112.19

There are no chirality outliers.

All (4) torsion outliers are listed below:

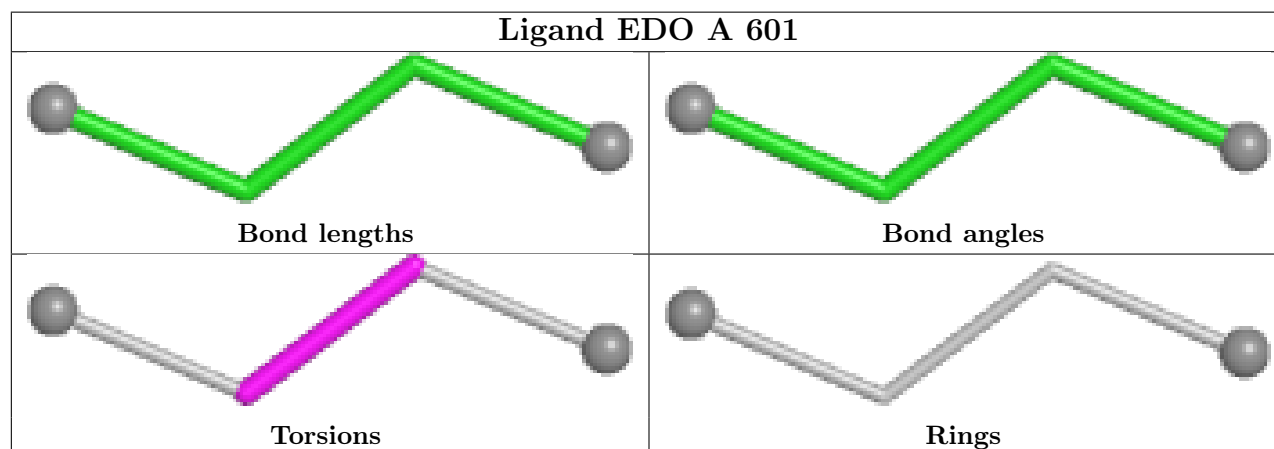
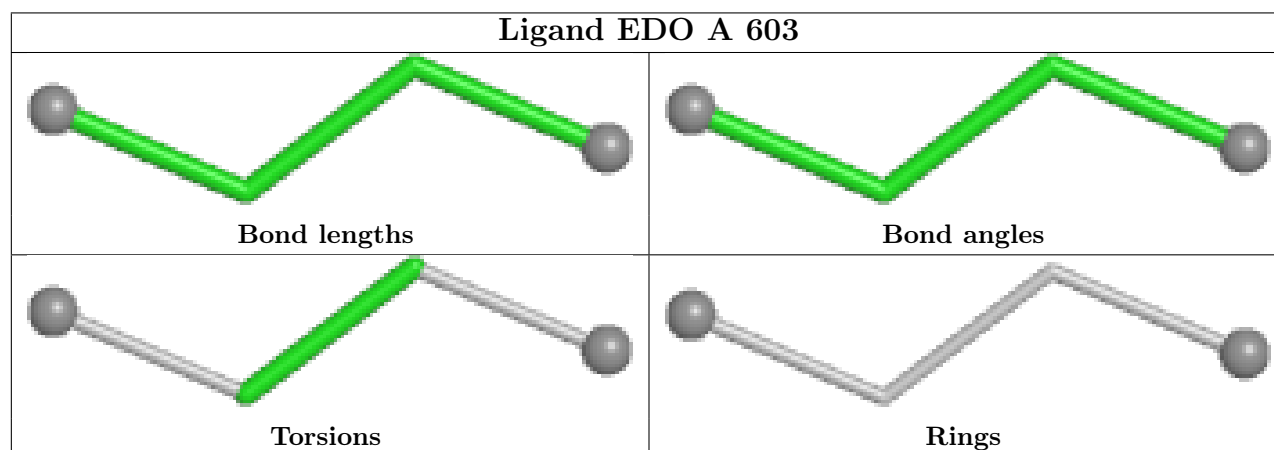
Mol	Chain	Res	Type	Atoms
6	B	1001	NAG	O5-C5-C6-O6
5	A	601	EDO	O1-C1-C2-O2
5	A	602	EDO	O1-C1-C2-O2
6	B	1001	NAG	C4-C5-C6-O6

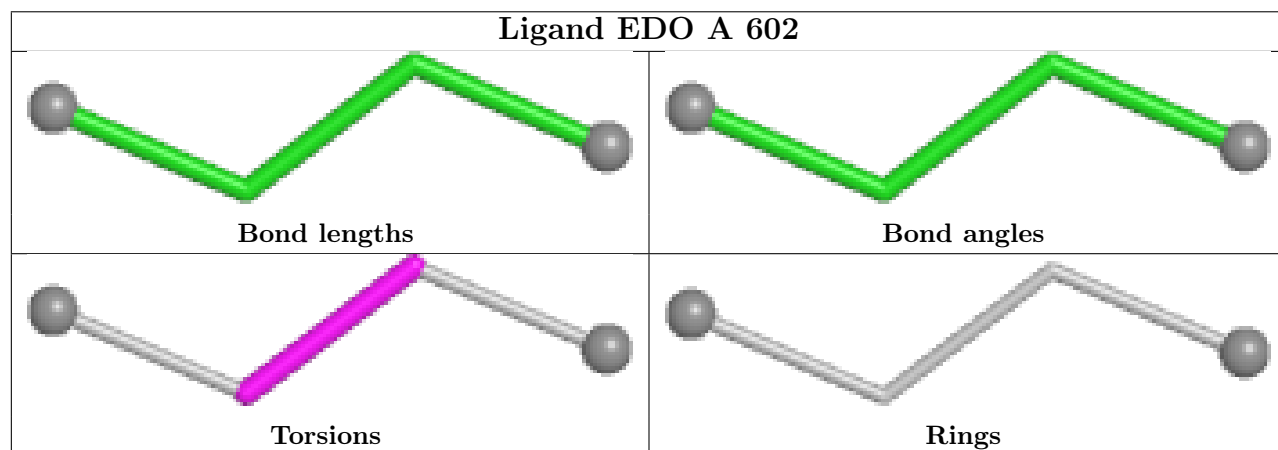
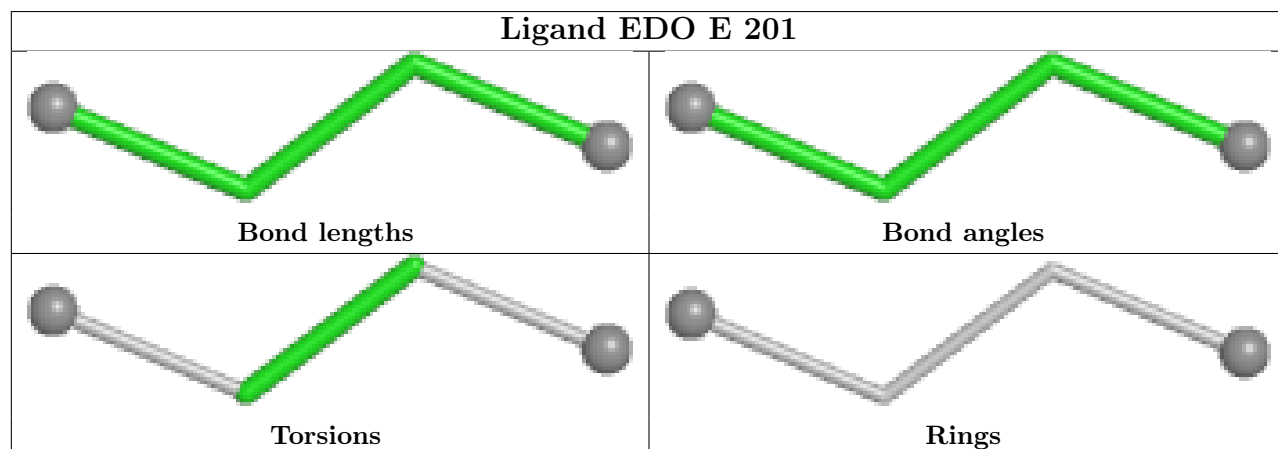
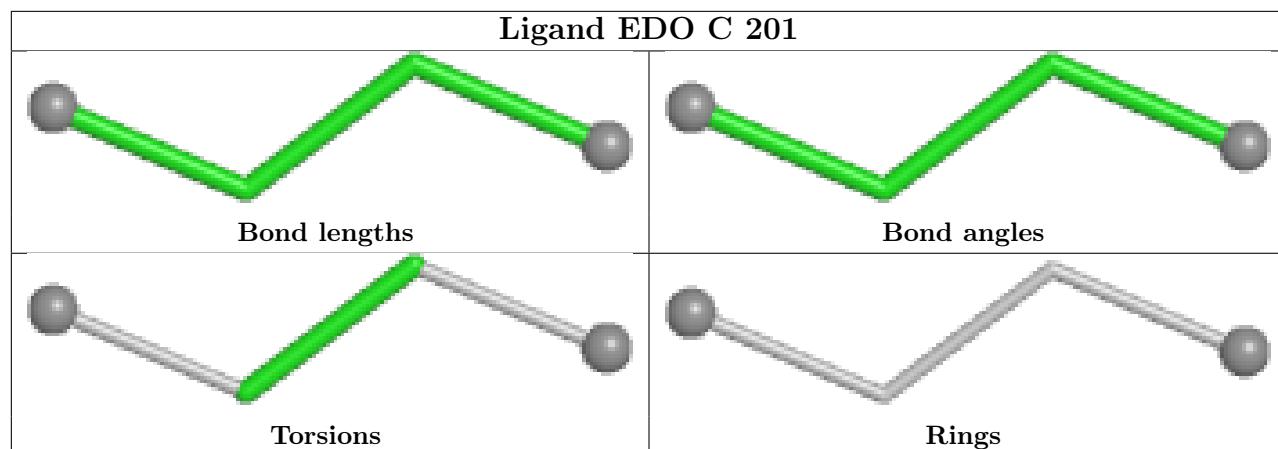
There are no ring outliers.

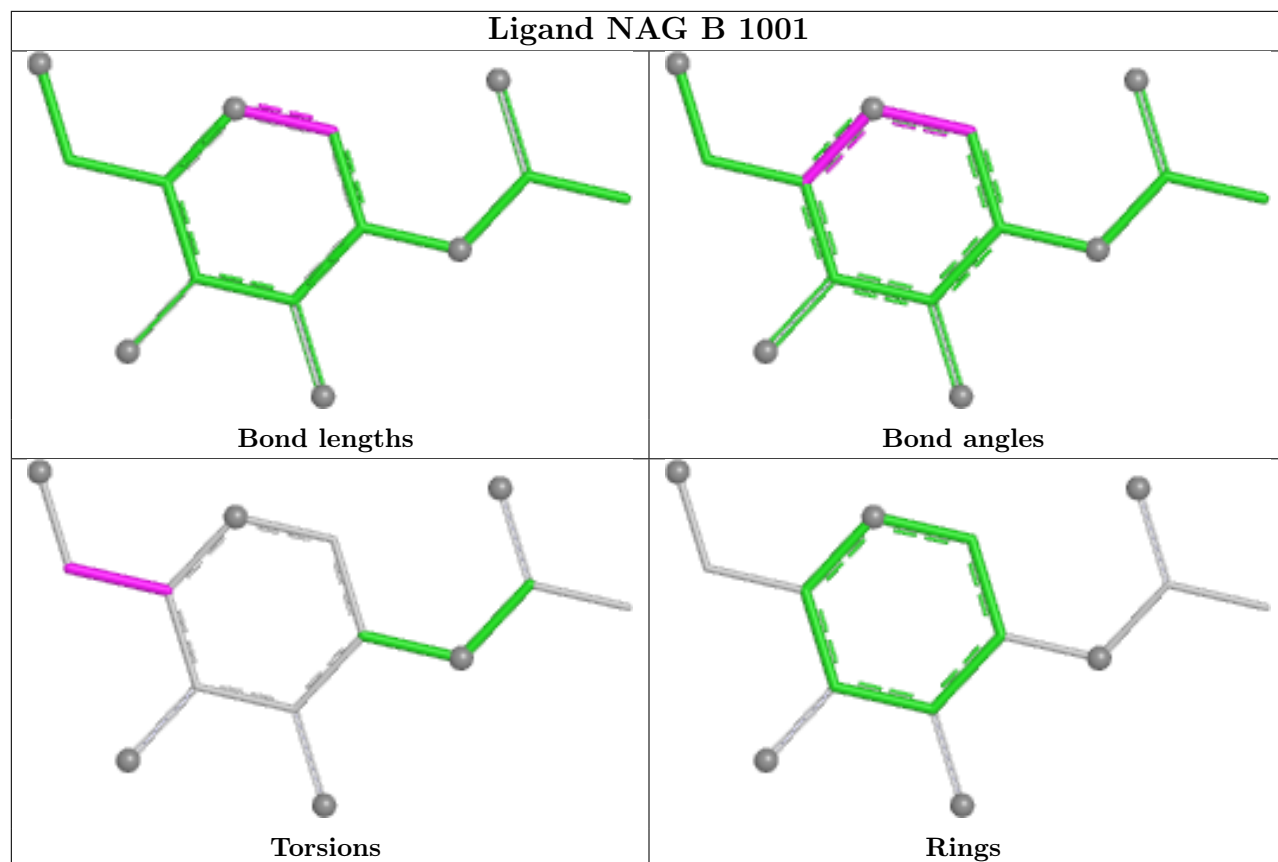
4 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	603	EDO	3	0
5	A	601	EDO	2	0
5	C	201	EDO	7	0
5	A	602	EDO	1	0

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

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, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ > 2			OWAB(Å ²)	Q < 0.9
1	A	195/231 (84%)	-0.07	9 (4%)	37	40	21, 33, 58, 92	0
1	B	195/231 (84%)	0.24	9 (4%)	37	40	23, 41, 70, 107	0
2	C	129/129 (100%)	0.35	8 (6%)	26	29	22, 42, 66, 87	1 (0%)
2	D	129/129 (100%)	0.10	4 (3%)	51	56	23, 35, 56, 78	0
3	E	121/126 (96%)	1.20	27 (22%)	2	2	35, 71, 107, 120	0
3	F	123/126 (97%)	1.93	59 (47%)	0	0	52, 88, 117, 133	0
All	All	892/972 (91%)	0.53	116 (13%)	7	8	21, 44, 103, 133	1 (0%)

All (116) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	F	83	ILE	4.9
3	F	107	THR	4.8
1	B	517	LEU	4.8
2	D	113	SER	4.5
3	E	11	LEU	4.2
3	F	68	THR	4.2
3	F	14	PRO	4.1
3	E	67	PHE	4.0
1	B	519	HIS	3.7
3	E	12	VAL	3.7
2	C	113	SER	3.7
3	E	111	VAL	3.7
3	F	28	THR	3.7
3	F	111	VAL	3.6
3	F	11	LEU	3.6
3	F	2	VAL	3.5
1	A	518	LEU	3.5
3	F	5	VAL	3.5
3	E	110	THR	3.4

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Mol	Chain	Res	Type	RSRZ
3	F	26	GLY	3.4
3	F	63	VAL	3.4
3	F	92	CYS	3.3
2	C	73	ASN	3.3
3	F	82(C)	LEU	3.3
3	F	57	THR	3.2
2	D	74	ALA	3.1
3	E	66	ARG	3.1
3	E	2	VAL	3.1
3	E	63	VAL	3.0
1	A	519	HIS	3.0
3	E	14	PRO	3.0
3	F	23	ALA	3.0
3	F	73	ASN	3.0
3	F	29	LEU	3.0
3	F	10	GLY	2.9
3	F	15	GLY	2.9
1	B	372	ALA	2.9
3	E	64	LYS	2.9
3	F	7	SER	2.9
3	F	82(B)	SER	2.9
1	A	517	LEU	2.9
3	F	18	LEU	2.9
3	F	60	ALA	2.9
1	A	528	LYS	2.9
3	E	82(C)	LEU	2.9
3	F	82	MET	2.8
3	F	78	VAL	2.8
2	C	74	ALA	2.8
3	E	62	SER	2.7
3	F	67	PHE	2.7
3	F	8	GLY	2.7
3	F	9	GLY	2.7
1	B	518	LEU	2.7
3	F	54	GLY	2.7
3	F	65	GLY	2.7
3	F	102	TYR	2.7
1	B	480	CYS	2.7
3	E	100(B)	CYS	2.7
3	F	22	CYS	2.7
1	A	405	ASP	2.7
3	F	84	PRO	2.7

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Mol	Chain	Res	Type	RSRZ
3	F	6	GLU	2.7
3	F	100	TYR	2.6
1	B	367	VAL	2.6
1	A	336	CYS	2.6
2	C	100(J)	ASP	2.6
3	E	18	LEU	2.6
3	E	29	LEU	2.6
3	F	20	LEU	2.6
3	F	74	ALA	2.6
3	E	109	VAL	2.5
1	A	525	CYS	2.5
3	F	31	TYR	2.5
1	A	334	ASN	2.5
3	E	9	GLY	2.4
3	F	4	LEU	2.4
3	E	21	SER	2.4
2	C	64	LYS	2.4
3	F	89	VAL	2.4
3	F	109	VAL	2.4
3	F	64	LYS	2.4
3	F	91	TYR	2.3
2	D	73	ASN	2.3
1	B	336	CYS	2.3
3	F	110	THR	2.3
3	F	51	ILE	2.3
3	F	69	ILE	2.3
3	F	55	GLY	2.3
3	F	59	PHE	2.2
3	F	52(A)	SER	2.2
2	C	66	ARG	2.2
3	E	82(B)	SER	2.2
2	D	75	LYS	2.2
3	F	50	CYS	2.2
1	A	335	LEU	2.2
3	F	98	SER	2.2
3	F	30	ASP	2.1
3	E	17	SER	2.1
1	B	528	LYS	2.1
2	C	11	PHE	2.1
3	E	61	ASP	2.1
3	F	56	SER	2.1
3	E	16	GLY	2.1

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Mol	Chain	Res	Type	RSRZ
2	C	1	GLN	2.1
3	E	31	TYR	2.1
3	F	90	TYR	2.1
3	F	21	SER	2.1
3	E	8	GLY	2.1
3	F	58	HIS	2.1
3	F	76	ASN	2.1
1	B	405	ASP	2.1
3	F	106	GLY	2.0
3	F	36	TRP	2.0
3	E	88	ALA	2.0
3	E	83	ILE	2.0
3	E	87	THR	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

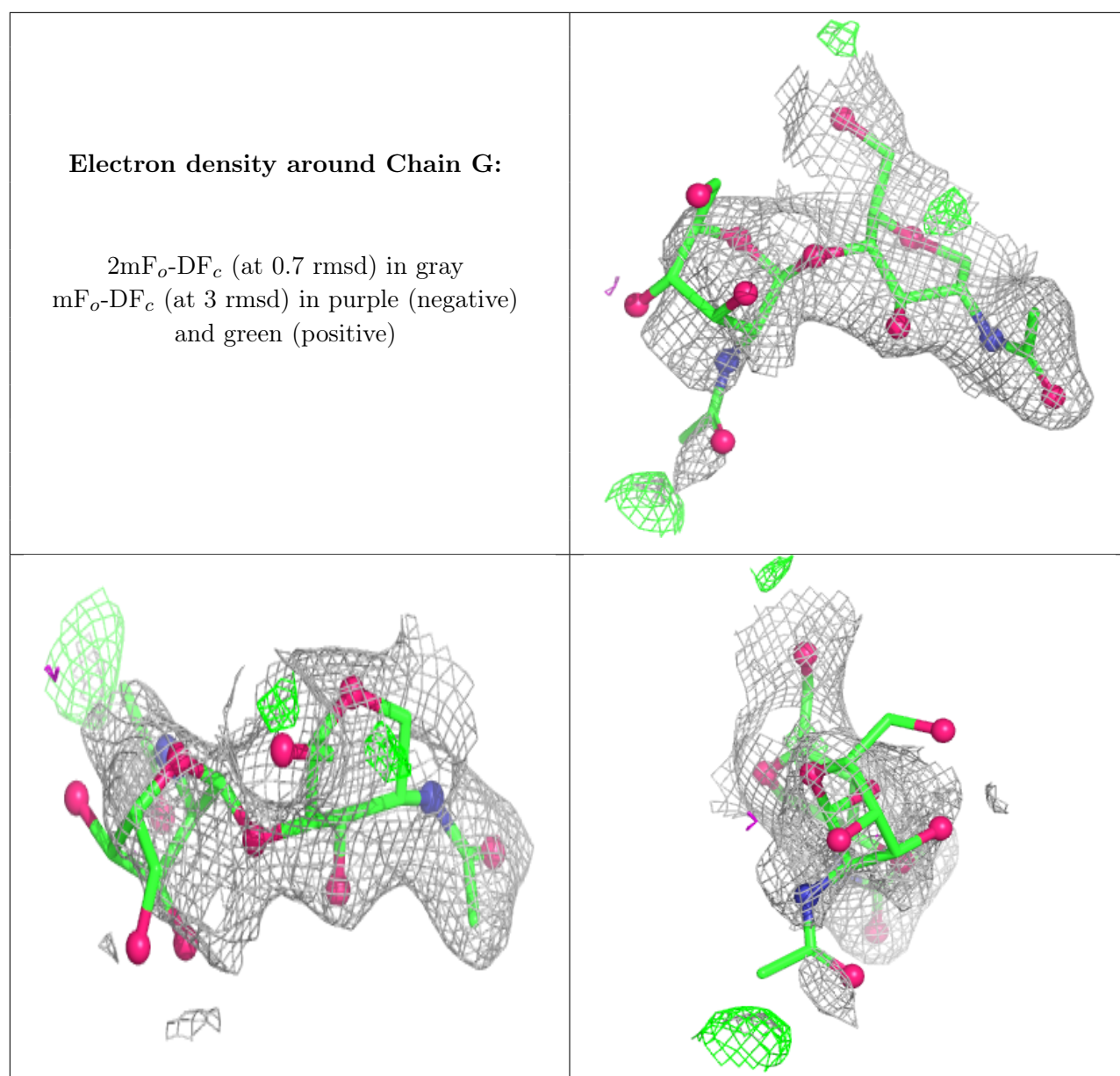
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	NAG	G	2	14/15	0.53	0.18	123,135,145,148	0
4	NAG	G	1	14/15	0.87	0.12	52,64,83,105	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 ⓘ

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

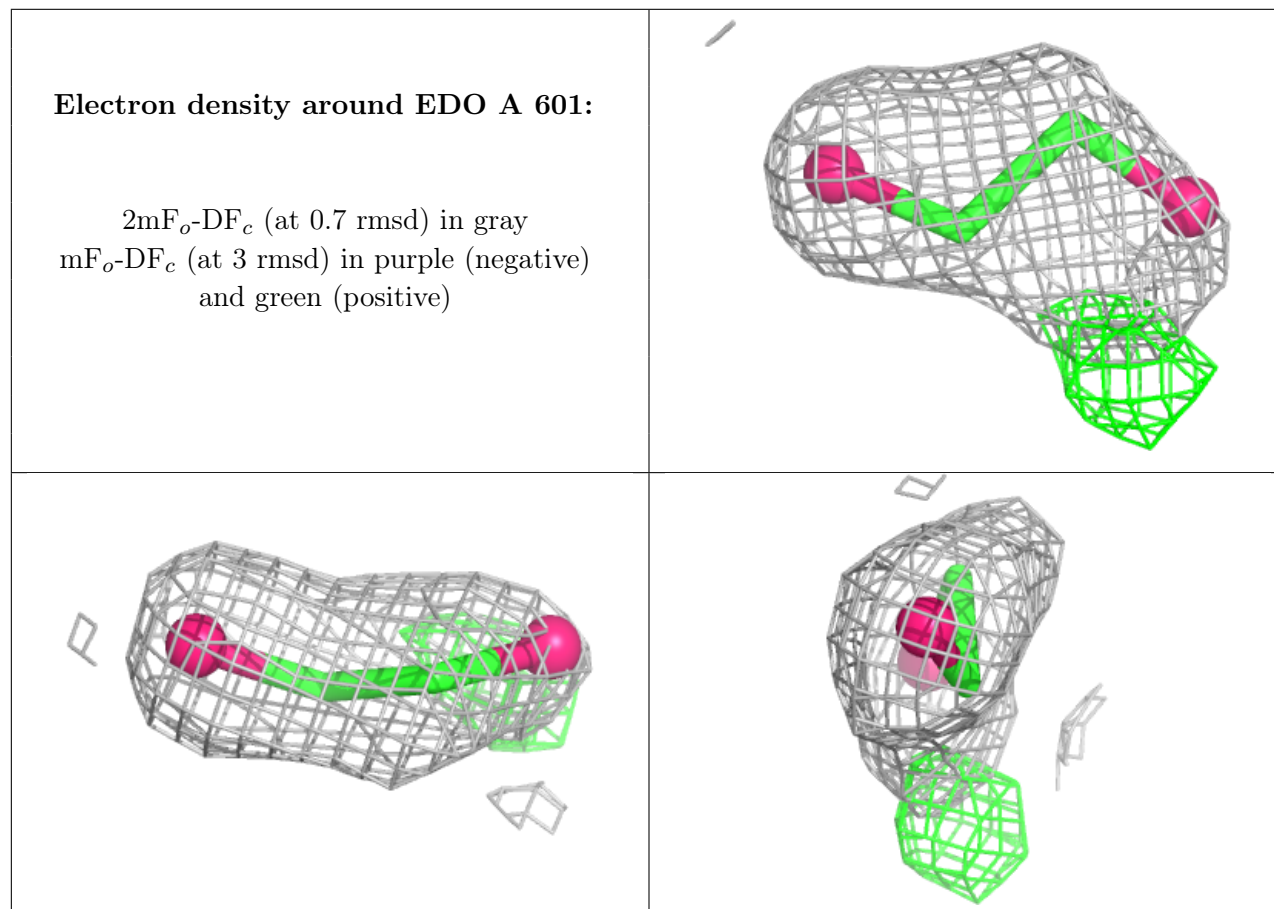
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	EDO	A	601	4/4	0.85	0.17	33,47,53,61	4
6	NAG	B	1001	14/15	0.85	0.11	73,80,89,90	0
5	EDO	E	201	4/4	0.86	0.20	52,52,56,61	4
5	EDO	A	603	4/4	0.88	0.15	34,35,42,46	4

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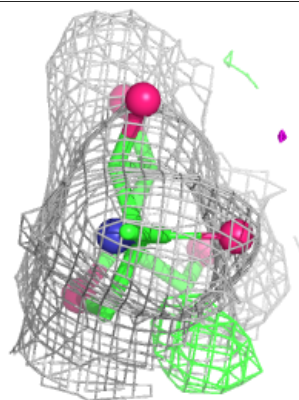
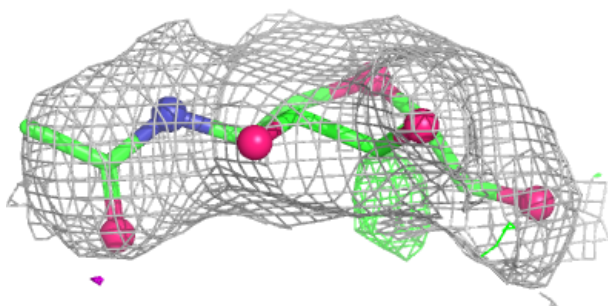
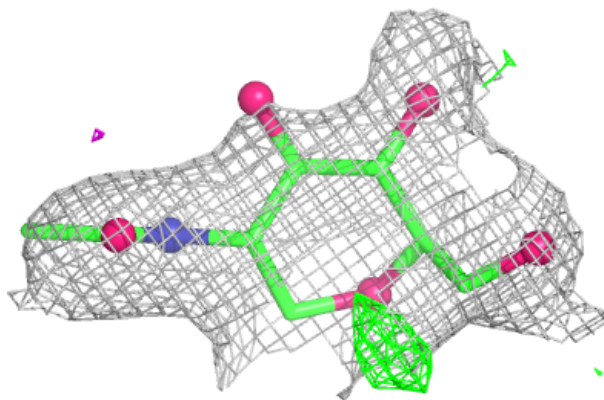
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	EDO	C	201	4/4	0.90	0.18	30,36,37,37	4
5	EDO	A	602	4/4	0.92	0.12	41,41,49,55	0

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.

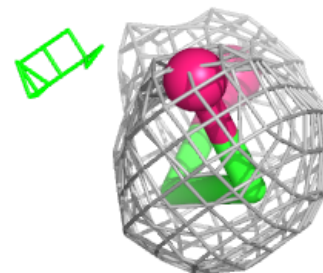
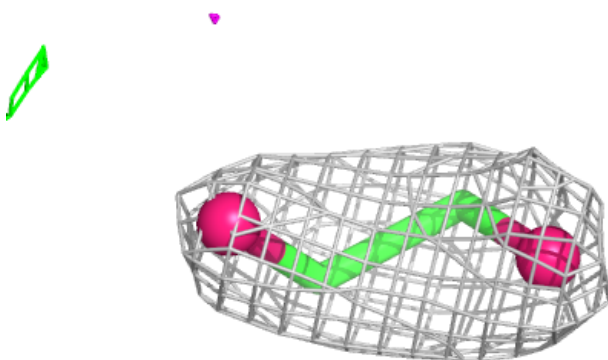
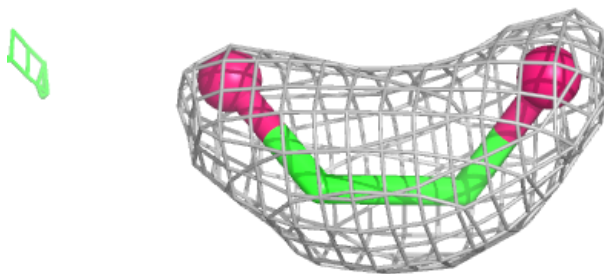


Electron density around NAG B 1001:

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

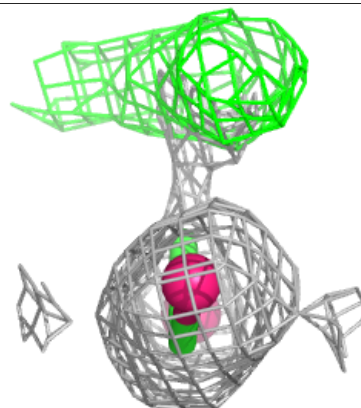
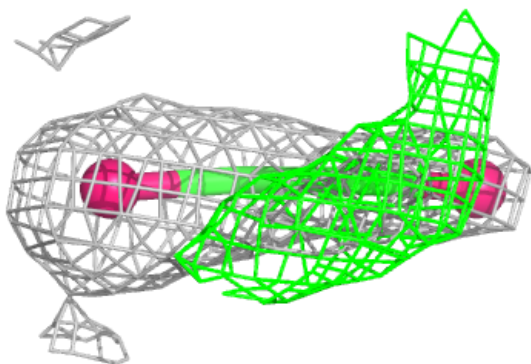
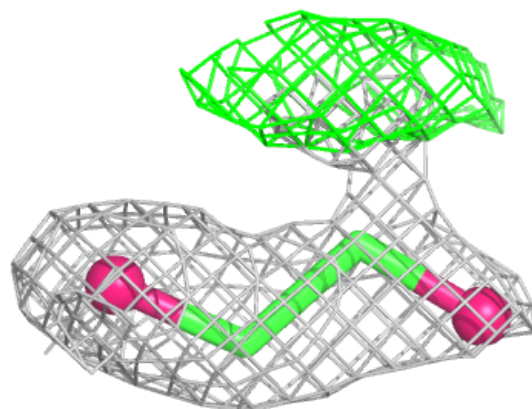
**Electron density around EDO E 201:**

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

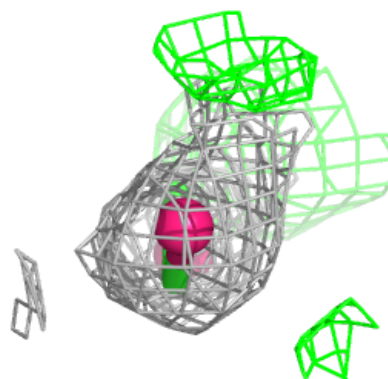
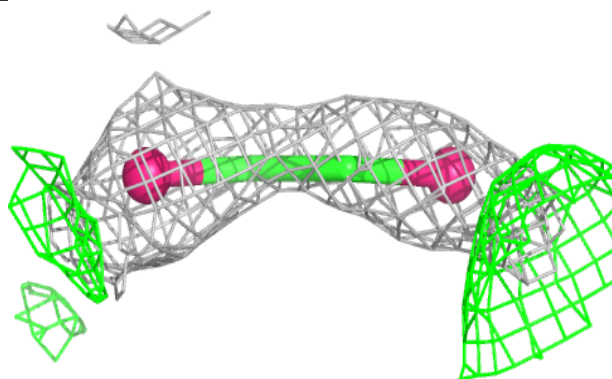
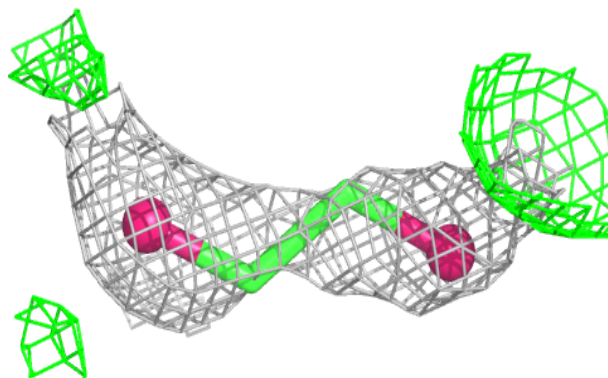


Electron density around EDO A 603:

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

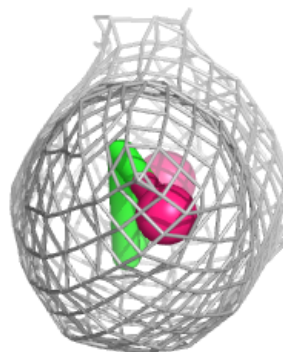
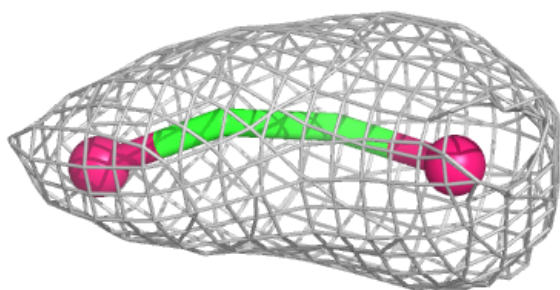
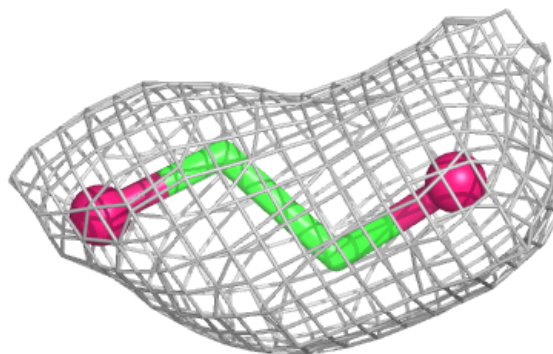
**Electron density around EDO C 201:**

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



Electron density around EDO A 602:

$2mF_o-DF_c$ (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.