Full wwPDB X-ray Structure Validation Report (i)

Dec 16, 2024 – 06:19 PM JST

PDB ID	:	8HJ7
Title	:	Crystal structure of barley exohydrolase isoform ExoI E220A mutant in complex with beta-D-glucopyranose.
Authors	:	Luang, S.; Streltsov, V.A.; Hrmova, M.
Deposited on	:	2022-11-22
Resolution	:	1.85 Å(reported)

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

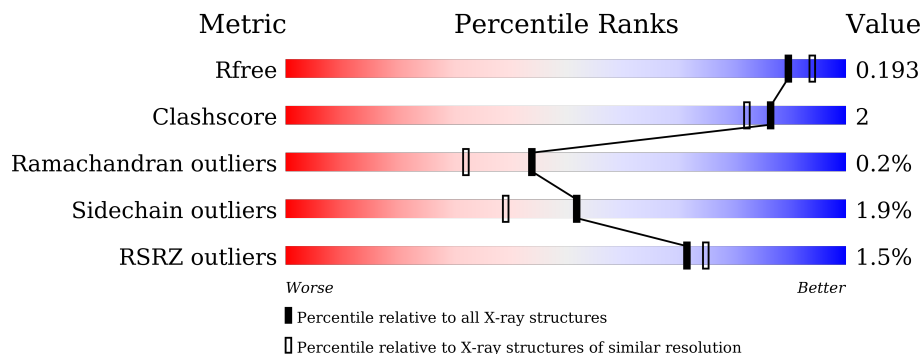|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.21
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.004 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.40

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
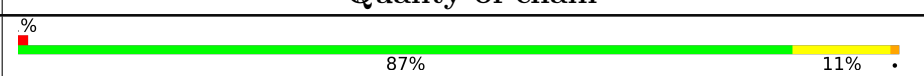*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.85 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	Percentile Ranks	Value
Rfree		0.193
Clashscore		2
Ramachandran outliers		0.2%
Sidechain outliers		1.9%
RSRZ outliers		1.5%

Worse | Better

▌ Percentile relative to all X-ray structures

❚ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	3097 (1.86-1.86)
Clashscore	180529	3359 (1.86-1.86)
Ramachandran outliers	177936	3335 (1.86-1.86)
Sidechain outliers	177891	3335 (1.86-1.86)
RSRZ outliers	164620	3097 (1.86-1.86)

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 <=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	604	.% 87% 11% .

2 Entry composition ⓘ

There are 8 unique types of molecules in this entry. The entry contains 5408 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.
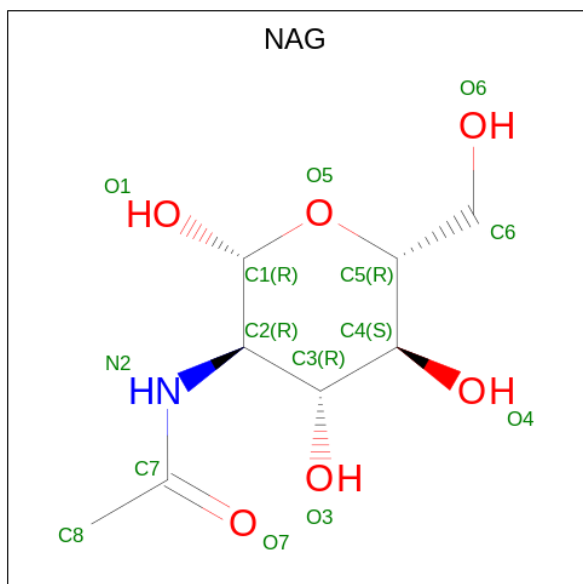
- Molecule 1 is a protein called Beta-D-glucan exohydrolase isoenzyme ExoI.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	604	Total 4576	C 2897	N 790	O 863	S 26	0	3	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	ALA	-	expression tag	UNP Q9XEI3
A	220	ALA	GLU	engineered mutation	UNP Q9XEI3
A	320	LYS	ASN	conflict	UNP Q9XEI3

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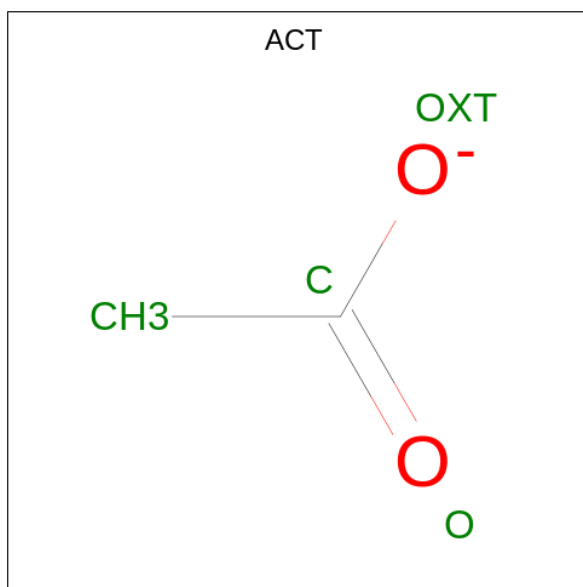

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total 14	C 8	N 1	O 5	0	0

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

- Molecule 3 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).

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

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$) (labeled as "Ligand of Interest" by depositor).

GOL

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total 6	C 3	O 3	0	0

- Molecule 5 is beta-D-glucopyranose (three-letter code: BGC) (formula: $C_6H_{12}O_6$) (labeled as "Ligand of Interest" by depositor).

BGC
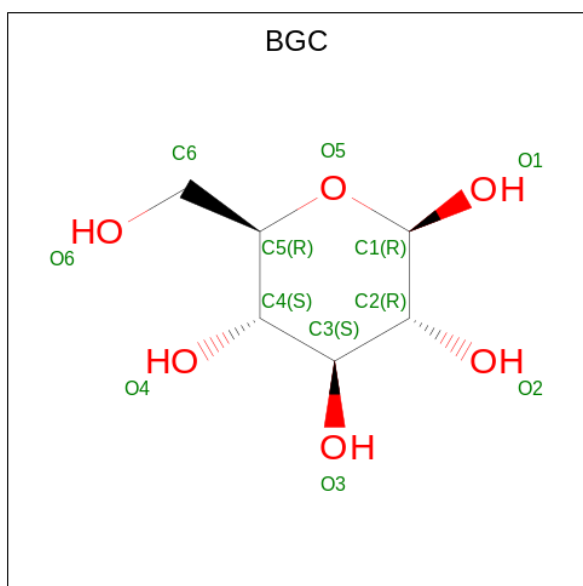
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total 12	C 6	O 6	0	0
5	A	1	Total 12	C 6	O 6	0	0

- Molecule 6 is PENTAETHYLENE GLYCOL (three-letter code: 1PE) (formula: $C_{10}H_{22}O_6$) (labeled as "Ligand of Interest" by depositor).
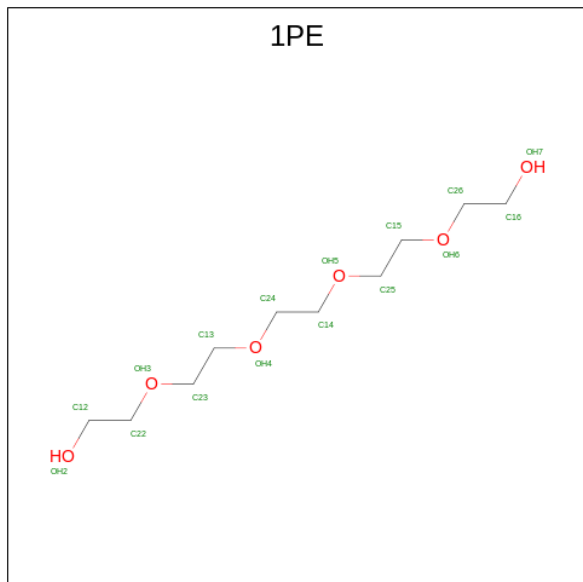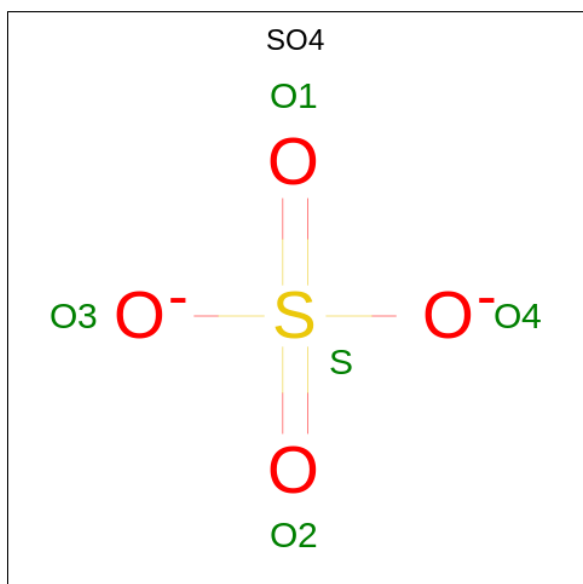

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
6	A	1	8	5	3	0	0

- Molecule 7 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
7	A	1	5	4	1	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total 5	O 4	S 1	0	0
7	A	1	Total 5	O 4	S 1	0	0
7	A	1	Total 5	O 4	S 1	0	0
7	A	1	Total 5	O 4	S 1	0	0

- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	699	Total 699	O 699	0	0

3 Residue-property plots ⓘ

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: Beta-D-glucan exohydrolase isoenzyme ExoI
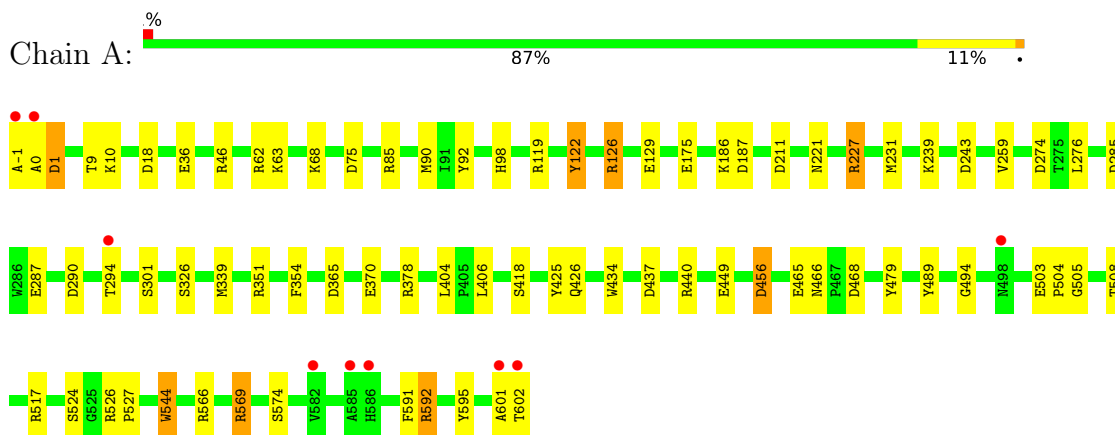
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	100.63Å 100.63Å 182.32Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	88.10 – 1.85 88.10 – 1.85	Depositor EDS
% Data completeness (in resolution range)	97.6 (88.10-1.85) 97.8 (88.10-1.85)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.89 (at 1.84Å)	Xtriage
Refinement program	REFMAC 7.0.005	Depositor
R, R_{free}	0.143 , 0.184 0.157 , 0.193	Depositor DCC
R_{free} test set	4041 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	34.0	Xtriage
Anisotropy	0.158	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 56.5	EDS
L-test for twinning[2]	$< \lvert L \rvert > = 0.50, < L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	5408	wwPDB-VP
Average B, all atoms (Å^2)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.96% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< \lvert L \rvert >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5　Model quality ⓘ

5.1　Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: NAG, 1PE, ACT, SO4, BGC, GOL

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	1.49	32/4677 (0.7%)	1.39	42/6355 (0.7%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3

All (32) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	503	GLU	CD-OE2	15.88	1.43	1.25
1	A	440	ARG	CZ-NH1	12.23	1.49	1.33
1	A	370	GLU	CD-OE2	8.57	1.35	1.25
1	A	126	ARG	CD-NE	-8.56	1.31	1.46
1	A	517[A]	ARG	CZ-NH1	7.64	1.43	1.33
1	A	503	GLU	CG-CD	7.63	1.63	1.51
1	A	122	TYR	CG-CD2	7.46	1.48	1.39
1	A	479	TYR	CG-CD2	7.35	1.48	1.39
1	A	287	GLU	CD-OE2	-6.86	1.18	1.25
1	A	378	ARG	CZ-NH2	-6.84	1.24	1.33
1	A	574	SER	CB-OG	6.79	1.51	1.42
1	A	287	GLU	CD-OE1	-6.55	1.18	1.25
1	A	301	SER	CA-CB	6.23	1.62	1.52
1	A	418	SER	CA-CB	6.15	1.62	1.52
1	A	354	PHE	CG-CD1	6.13	1.48	1.38
1	A	326	SER	CB-OG	6.11	1.50	1.42
1	A	517[A]	ARG	CG-CD	5.88	1.66	1.51
1	A	504	PRO	CA-C	5.80	1.64	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	175	GLU	CD-OE1	-5.67	1.19	1.25
1	A	574	SER	CA-CB	5.52	1.61	1.52
1	A	592	ARG	NE-CZ	5.46	1.40	1.33
1	A	62	ARG	CA-CB	-5.45	1.42	1.53
1	A	122	TYR	CE1-CZ	5.41	1.45	1.38
1	A	426	GLN	CB-CG	-5.38	1.38	1.52
1	A	440	ARG	CZ-NH2	5.29	1.40	1.33
1	A	544	TRP	CB-CG	-5.26	1.40	1.50
1	A	259	VAL	CB-CG2	5.23	1.63	1.52
1	A	440	ARG	NE-CZ	5.17	1.39	1.33
1	A	595	TYR	CG-CD1	5.05	1.45	1.39
1	A	504	PRO	N-CA	-5.04	1.38	1.47
1	A	129	GLU	CG-CD	5.01	1.59	1.51
1	A	434	TRP	CG-CD1	-5.00	1.29	1.36

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	440	ARG	NE-CZ-NH2	-23.64	108.48	120.30
1	A	126	ARG	NE-CZ-NH1	21.05	130.82	120.30
1	A	440	ARG	NE-CZ-NH1	19.79	130.19	120.30
1	A	126	ARG	NE-CZ-NH2	-17.93	111.33	120.30
1	A	46	ARG	NE-CZ-NH2	14.20	127.40	120.30
1	A	351	ARG	NE-CZ-NH1	12.57	126.59	120.30
1	A	227[A]	ARG	NE-CZ-NH2	-11.46	114.57	120.30
1	A	339	MET	CG-SD-CE	-9.70	84.68	100.20
1	A	18	ASP	CB-CG-OD2	9.33	126.70	118.30
1	A	456	ASP	CB-CG-OD2	-9.32	109.91	118.30
1	A	46	ARG	NE-CZ-NH1	-9.21	115.69	120.30
1	A	62	ARG	NE-CZ-NH2	-8.72	115.94	120.30
1	A	440	ARG	CD-NE-CZ	8.23	135.13	123.60
1	A	211	ASP	CB-CG-OD1	8.13	125.61	118.30
1	A	592	ARG	NE-CZ-NH2	8.05	124.33	120.30
1	A	456	ASP	CB-CG-OD1	8.04	125.54	118.30
1	A	468	ASP	CB-CG-OD1	7.33	124.89	118.30
1	A	75	ASP	CB-CG-OD1	7.16	124.74	118.30
1	A	465	GLU	OE1-CD-OE2	6.95	131.64	123.30
1	A	517[A]	ARG	NE-CZ-NH1	6.60	123.60	120.30
1	A	437	ASP	CB-CG-OD1	6.54	124.19	118.30
1	A	378	ARG	NE-CZ-NH1	6.36	123.48	120.30
1	A	602	THR	N-CA-CB	6.22	122.12	110.30
1	A	92	TYR	CB-CG-CD1	6.16	124.70	121.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	440	ARG	CG-CD-NE	-6.15	98.89	111.80
1	A	46	ARG	CD-NE-CZ	6.10	132.14	123.60
1	A	231	MET	CG-SD-CE	5.97	109.75	100.20
1	A	274	ASP	CB-CG-OD1	5.90	123.61	118.30
1	A	119	ARG	NE-CZ-NH2	-5.87	117.37	120.30
1	A	365	ASP	CB-CG-OD2	-5.76	113.12	118.30
1	A	243	ASP	CB-CG-OD2	-5.72	113.15	118.30
1	A	75	ASP	CB-CG-OD2	-5.65	113.22	118.30
1	A	526	ARG	NE-CZ-NH1	5.58	123.09	120.30
1	A	449	GLU	OE1-CD-OE2	-5.55	116.64	123.30
1	A	18	ASP	CB-CG-OD1	-5.48	113.37	118.30
1	A	9	THR	CA-CB-CG2	-5.47	104.74	112.40
1	A	569	ARG	NE-CZ-NH1	5.46	123.03	120.30
1	A	126	ARG	CD-NE-CZ	5.35	131.09	123.60
1	A	592	ARG	CG-CD-NE	-5.27	100.73	111.80
1	A	425	TYR	CB-CG-CD2	-5.26	117.84	121.00
1	A	85	ARG	NE-CZ-NH1	5.23	122.91	120.30
1	A	10	LYS	CD-CE-NZ	-5.04	100.12	111.70

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	0	ALA	Peptide
1	A	187	ASP	Peptide
1	A	601	ALA	Peptide

5.2 Too-close contacts ⓘ

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4576	0	4558	17	0
2	A	42	0	39	2	0
3	A	28	0	21	0	0
4	A	6	0	8	0	0
5	A	24	0	23	1	0
6	A	8	0	9	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	25	0	0	0	0
8	A	699	0	0	4	0
All	All	5408	0	4658	18	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 2.

All (18) 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:227[A]:ARG:NH1	8:A:802:HOH:O	2.16	0.78
1:A:122:TYR:CE2	1:A:126:ARG:HD2	2.21	0.75
1:A:466[A]:ASN:OD1	1:A:508:THR:OG1	2.09	0.69
1:A:566:ARG:NH2	8:A:801:HOH:O	2.11	0.67
1:A:456:ASP:HB2	8:A:1021:HOH:O	1.96	0.65
1:A:285:ASP:OD1	5:A:712:BGC:H1	2.00	0.60
1:A:221:ASN:HA	2:A:701:NAG:H83	1.84	0.59
1:A:592:ARG:NH2	6:A:714:1PE:H162	2.20	0.56
1:A:-1:ALA:HB3	1:A:1:ASP:OD1	2.09	0.53
1:A:239:LYS:HD3	1:A:276:LEU:HD22	1.94	0.50
2:A:701:NAG:H81	8:A:898:HOH:O	2.13	0.49
1:A:524:SER:O	1:A:544:TRP:HA	2.16	0.46
1:A:527:PRO:HD3	1:A:569:ARG:HD3	1.98	0.45
1:A:592:ARG:HH21	6:A:714:1PE:H162	1.81	0.45
1:A:404:LEU:HD23	1:A:406:LEU:HG	1.99	0.44
1:A:489:TYR:CD1	1:A:494:GLY:HA3	2.52	0.43
1:A:591:PHE:HA	6:A:714:1PE:H161	2.02	0.42
1:A:122:TYR:CZ	1:A:126:ARG:HD2	2.55	0.41

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	603/604 (100%)	579 (96%)	23 (4%)	1 (0%)	44	32

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	505	GLY

5.3.2 Protein sidechains ⓘ

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	485/484 (100%)	476 (98%)	9 (2%)	52	39

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	ASP
1	A	36	GLU
1	A	63	LYS
1	A	68	LYS
1	A	90	MET
1	A	98	HIS
1	A	186	LYS
1	A	290	ASP
1	A	294	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

19 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	#$|Z| > 2$
2	NAG	A	703	1	14,14,15	1.05	2 (14%)	17,19,21	2.15	6 (35%)
5	BGC	A	712	-	12,12,12	1.17	2 (16%)	17,17,17	1.20	1 (5%)
7	SO4	A	717	-	4,4,4	0.80	0	6,6,6	1.14	1 (16%)
7	SO4	A	715	-	4,4,4	0.30	0	6,6,6	0.92	0
3	ACT	A	710	-	3,3,3	0.80	0	3,3,3	0.67	0
3	ACT	A	707	-	3,3,3	0.80	0	3,3,3	1.45	1 (33%)
2	NAG	A	701	1	14,14,15	0.98	1 (7%)	17,19,21	2.20	7 (41%)
5	BGC	A	713	-	12,12,12	1.73	3 (25%)	17,17,17	3.22	6 (35%)
4	GOL	A	711	-	5,5,5	0.50	0	5,5,5	0.22	0
3	ACT	A	709	-	3,3,3	1.00	0	3,3,3	2.12	2 (66%)
3	ACT	A	705	-	3,3,3	0.77	0	3,3,3	0.81	0
3	ACT	A	706	-	3,3,3	0.61	0	3,3,3	1.68	1 (33%)
3	ACT	A	708	-	3,3,3	0.74	0	3,3,3	1.05	0
2	NAG	A	702	1	14,14,15	0.98	0	17,19,21	2.64	8 (47%)
6	1PE	A	714	-	7,7,15	0.78	0	6,6,14	1.48	1 (16%)
3	ACT	A	704	-	3,3,3	0.86	0	3,3,3	0.86	0
7	SO4	A	718	-	4,4,4	0.67	0	6,6,6	0.56	0
7	SO4	A	716	-	4,4,4	0.65	0	6,6,6	1.01	0
7	SO4	A	719	-	4,4,4	0.45	0	6,6,6	0.43	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	A	701	1	-	2/6/23/26	0/1/1/1
2	NAG	A	703	1	-	1/6/23/26	0/1/1/1
2	NAG	A	702	1	-	4/6/23/26	0/1/1/1
5	BGC	A	712	-	-	0/2/22/22	0/1/1/1
5	BGC	A	713	-	-	0/2/22/22	0/1/1/1
6	1PE	A	714	-	-	1/5/5/13	-
4	GOL	A	711	-	-	0/4/4/4	-

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	713	BGC	O2-C2	-3.06	1.35	1.43
5	A	713	BGC	C4-C5	2.92	1.59	1.53
5	A	713	BGC	O3-C3	2.91	1.49	1.43
2	A	701	NAG	C8-C7	-2.69	1.44	1.50
2	A	703	NAG	C1-C2	2.47	1.56	1.52
5	A	712	BGC	C1-C2	2.26	1.57	1.52
2	A	703	NAG	C2-N2	2.25	1.50	1.46
5	A	712	BGC	C4-C5	2.00	1.57	1.53

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	A	713	BGC	C4-C3-C2	-7.45	97.82	110.82
5	A	713	BGC	O3-C3-C4	6.53	125.45	110.35
2	A	702	NAG	C4-C3-C2	-5.75	102.60	111.02
5	A	713	BGC	O5-C5-C4	5.50	119.69	109.69
2	A	702	NAG	O5-C1-C2	-4.80	103.71	111.29
5	A	713	BGC	O2-C2-C3	-4.53	99.88	110.35
2	A	703	NAG	C8-C7-N2	4.45	123.64	116.10
2	A	701	NAG	O5-C1-C2	-4.44	104.28	111.29
2	A	702	NAG	C8-C7-N2	4.18	123.18	116.10
2	A	702	NAG	O5-C5-C6	3.70	113.01	107.20
2	A	701	NAG	C2-N2-C7	3.63	128.07	122.90
6	A	714	1PE	OH7-C16-C26	-3.45	91.81	111.81
2	A	701	NAG	O5-C5-C4	-3.43	102.49	110.83
5	A	713	BGC	C3-C4-C5	3.42	116.34	110.24
2	A	703	NAG	C1-C2-N2	3.33	116.17	110.49

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	703	NAG	C4-C3-C2	-3.27	106.22	111.02
2	A	703	NAG	O7-C7-C8	-3.26	116.00	122.06
5	A	712	BGC	O1-C1-O5	-3.07	101.17	110.38
2	A	702	NAG	O3-C3-C2	3.04	115.76	109.47
2	A	701	NAG	O4-C4-C5	2.95	116.63	109.30
5	A	713	BGC	O5-C5-C6	-2.70	99.72	106.44
2	A	701	NAG	C4-C3-C2	-2.69	107.08	111.02
3	A	709	ACT	OXT-C-CH3	2.67	126.20	115.18
2	A	701	NAG	C3-C4-C5	-2.59	105.62	110.24
2	A	702	NAG	C1-C2-N2	2.52	114.80	110.49
2	A	703	NAG	O5-C1-C2	-2.50	107.33	111.29
3	A	709	ACT	OXT-C-O	-2.50	112.83	122.05
7	A	717	SO4	O4-S-O3	2.41	119.33	109.06
2	A	703	NAG	O3-C3-C2	2.32	114.26	109.47
2	A	702	NAG	O7-C7-C8	-2.28	117.83	122.06
3	A	706	ACT	OXT-C-CH3	2.26	124.54	115.18
2	A	702	NAG	C1-O5-C5	2.05	114.97	112.19
2	A	701	NAG	C6-C5-C4	2.03	117.77	113.00
3	A	707	ACT	OXT-C-CH3	2.03	123.56	115.18

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	702	NAG	O5-C5-C6-O6
6	A	714	1PE	OH6-C15-C25-OH5
2	A	702	NAG	C4-C5-C6-O6
2	A	701	NAG	C8-C7-N2-C2
2	A	701	NAG	O7-C7-N2-C2
2	A	702	NAG	C8-C7-N2-C2
2	A	702	NAG	O7-C7-N2-C2
2	A	703	NAG	O5-C5-C6-O6

There are no ring outliers.

3 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	712	BGC	1	0
2	A	701	NAG	2	0
6	A	714	1PE	3	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 then 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.

Ligand NAG A 703

Bond lengths

Bond angles

Torsions

Rings

Ligand BGC A 712

Bond lengths

Bond angles

Torsions

Rings

Ligand NAG A 701

Bond lengths

Bond angles

Torsions

Rings

Ligand BGC A 713

Bond lengths

Bond angles

Torsions

Rings

Ligand GOL A 711

Bond lengths

Bond angles

Torsions

Rings

Ligand NAG A 702

Bond lengths

Bond angles

Torsions

Rings

Ligand 1PE A 714	
Bond lengths	Bond angles
Torsions	Rings
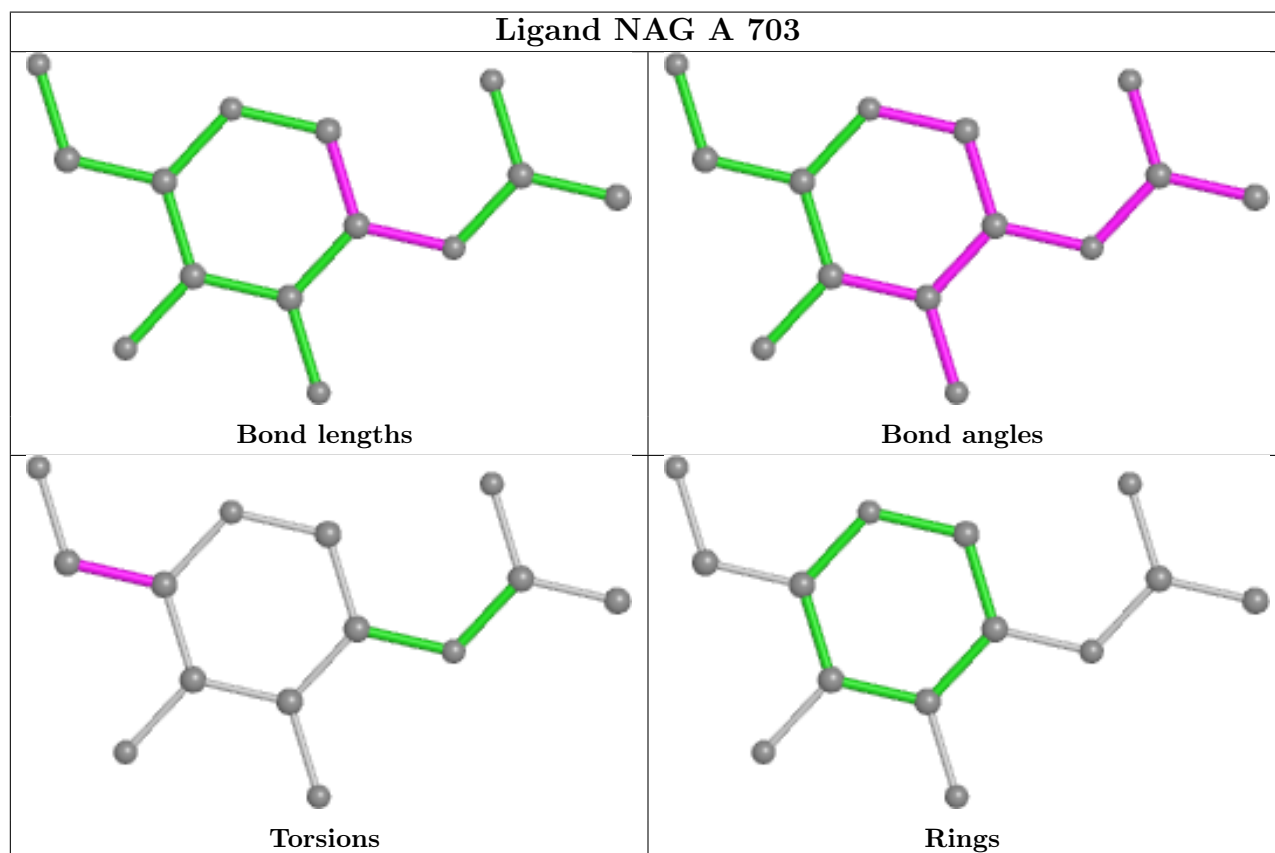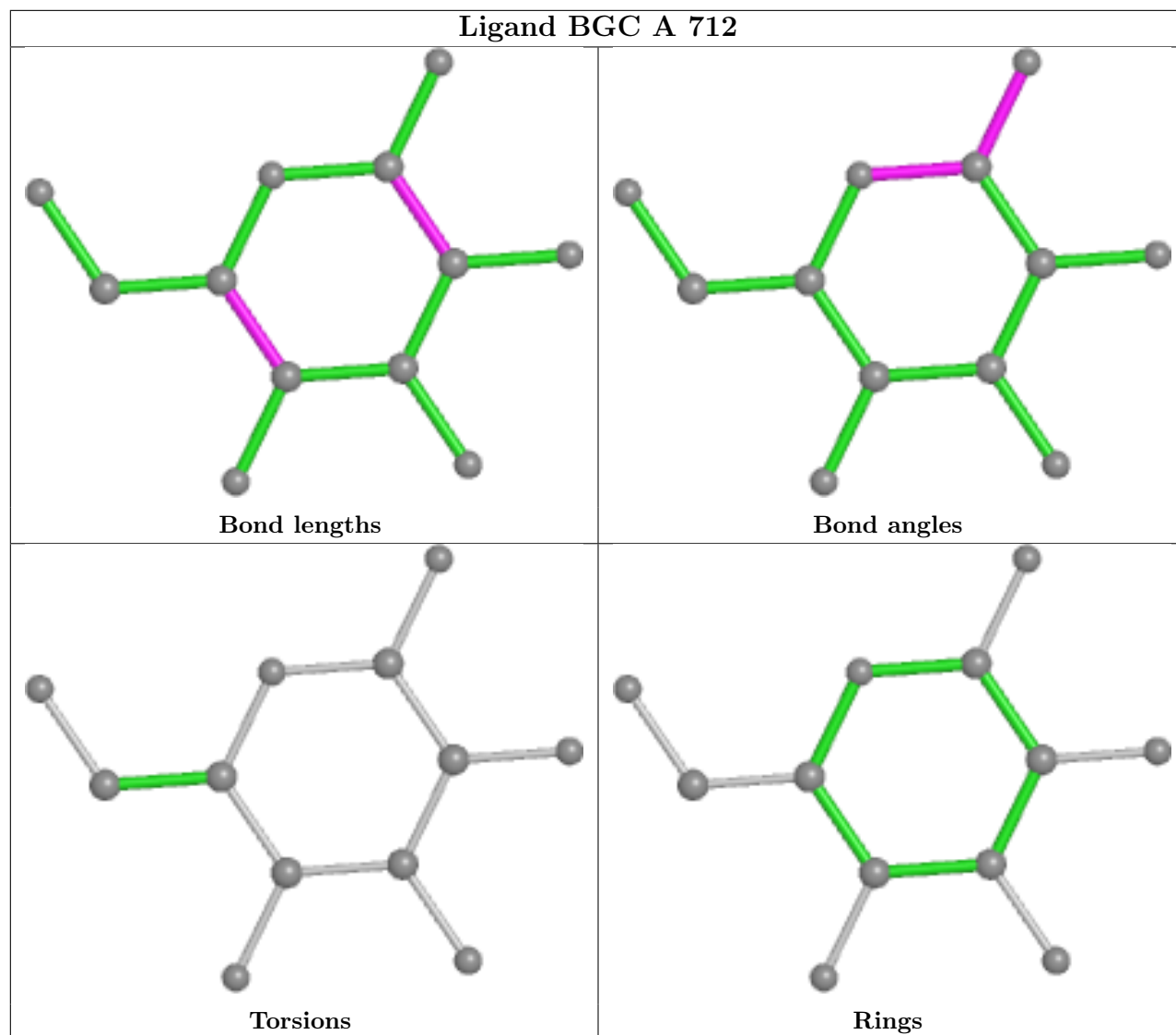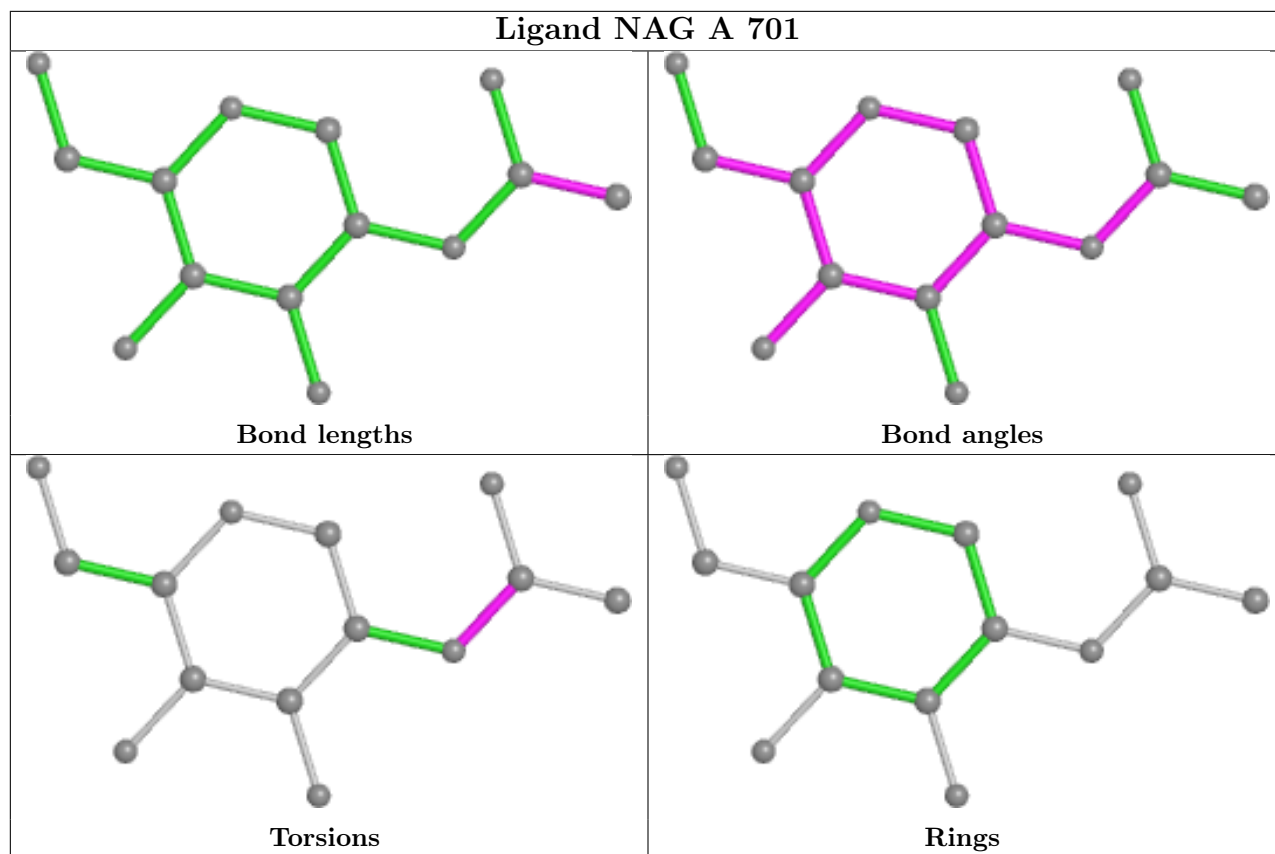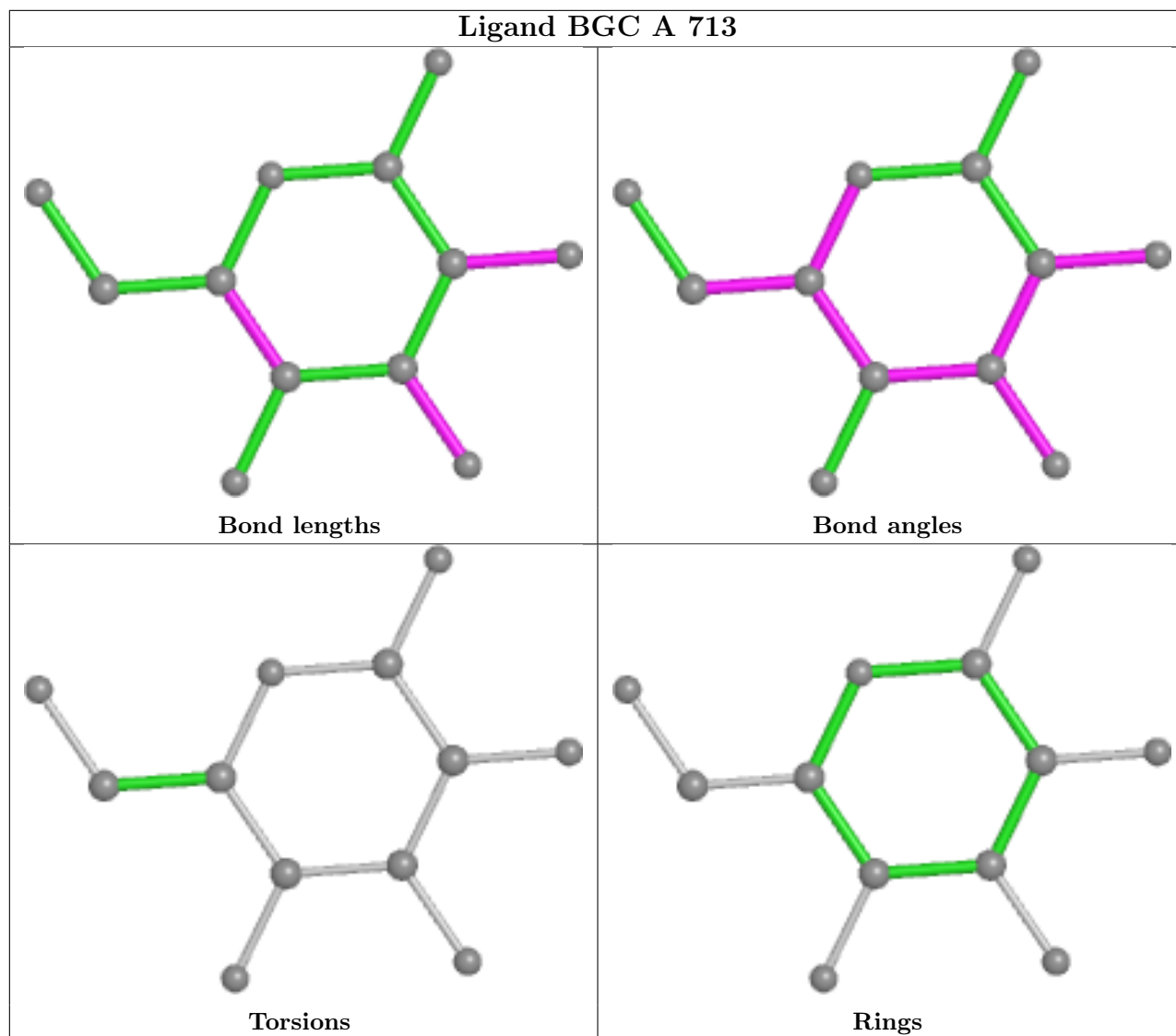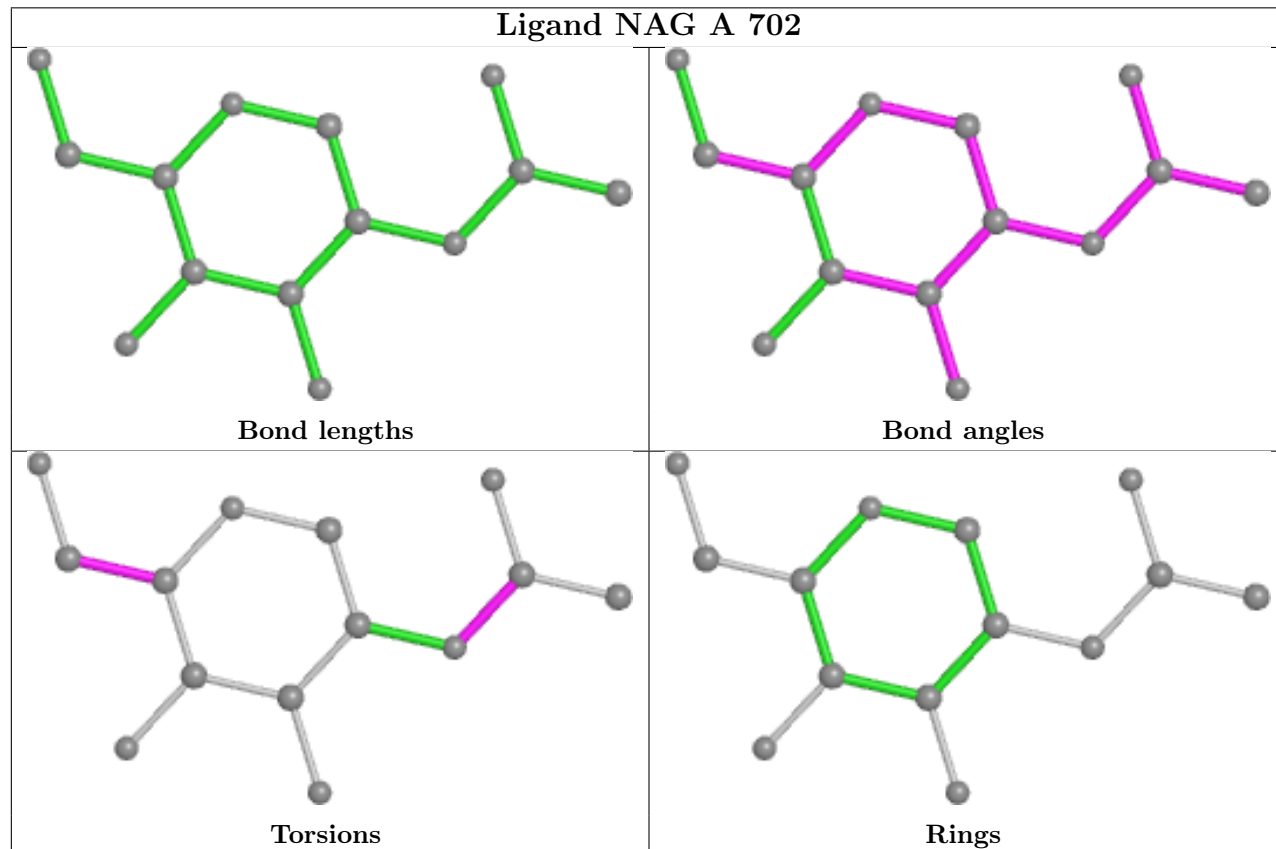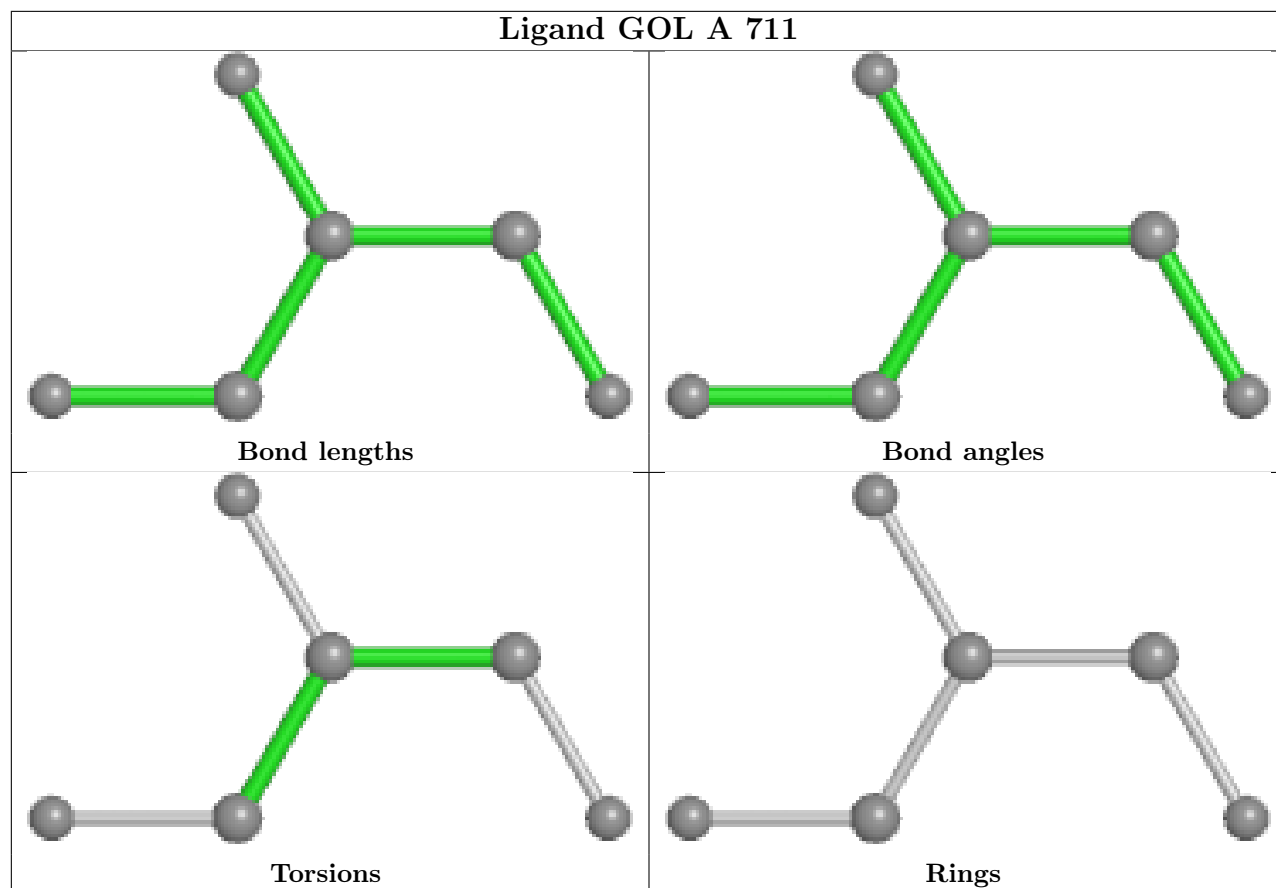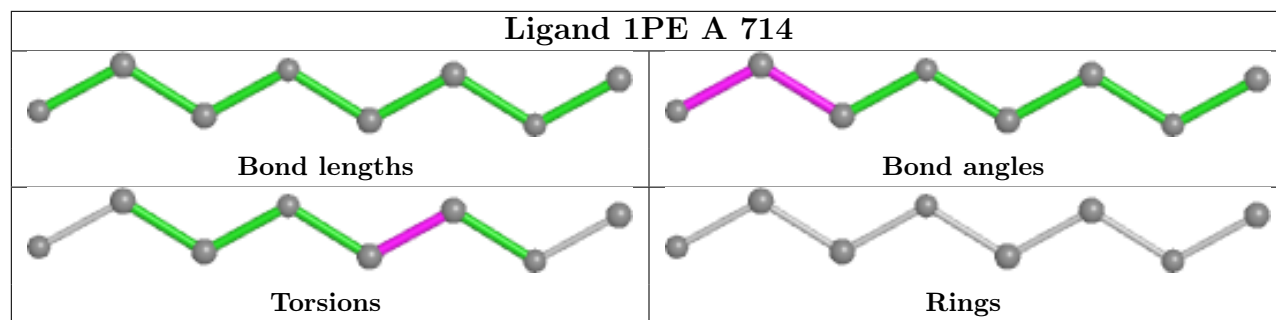
5.7 Other polymers ⓘ

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, 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	604/604 (100%)	-0.04	9 (1%)	71	75	31, 42, 58, 102	1 (0%)

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	586	HIS	4.5
1	A	582	VAL	4.3
1	A	-1	ALA	4.1
1	A	0	ALA	3.5
1	A	602	THR	3.0
1	A	294	THR	2.5
1	A	585	ALA	2.5
1	A	601	ALA	2.0
1	A	498	ASN	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 ⓘ

There are no monosaccharides in this entry.

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
2	NAG	A	702	14/15	0.52	0.18	70,112,125,126	0
7	SO4	A	719	5/5	0.64	0.11	106,117,123,124	0
3	ACT	A	709	4/4	0.74	0.23	57,78,80,84	0
3	ACT	A	706	4/4	0.74	0.16	74,86,91,102	0
7	SO4	A	718	5/5	0.76	0.14	68,102,119,122	0
3	ACT	A	708	4/4	0.77	0.18	63,78,84,92	0
2	NAG	A	703	14/15	0.78	0.14	73,90,111,116	0
3	ACT	A	704	4/4	0.81	0.18	80,81,88,91	0
3	ACT	A	710	4/4	0.82	0.16	83,87,90,95	0
3	ACT	A	707	4/4	0.85	0.15	73,75,75,78	0
7	SO4	A	715	5/5	0.87	0.12	68,72,74,81	5
2	NAG	A	701	14/15	0.87	0.12	56,71,85,90	0
6	1PE	A	714	8/16	0.87	0.17	45,71,81,81	0
3	ACT	A	705	4/4	0.88	0.15	67,69,80,84	0
7	SO4	A	717	5/5	0.89	0.12	35,51,66,70	5
5	BGC	A	713	12/12	0.90	0.16	41,70,89,95	1
4	GOL	A	711	6/6	0.91	0.13	69,74,81,85	0
7	SO4	A	716	5/5	0.94	0.08	54,56,66,68	0
5	BGC	A	712	12/12	0.97	0.06	36,37,39,43	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.
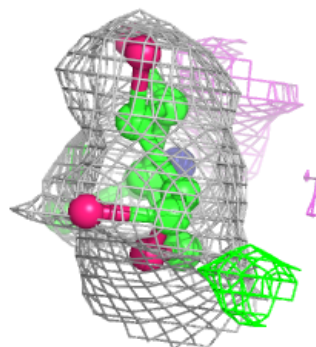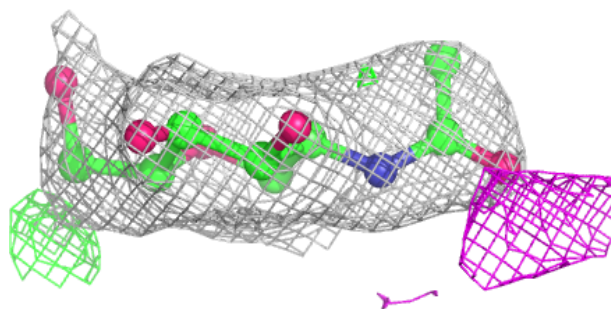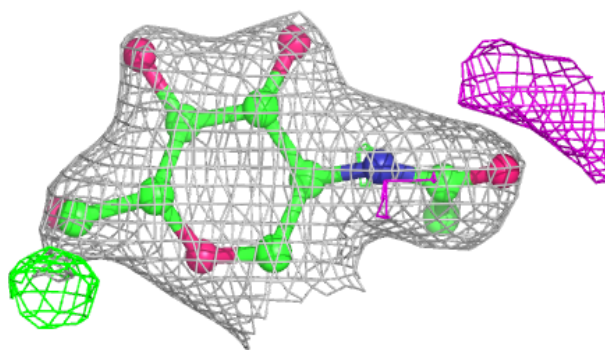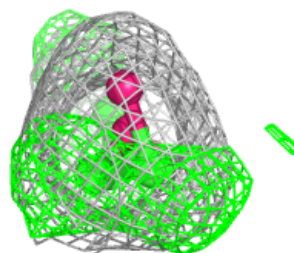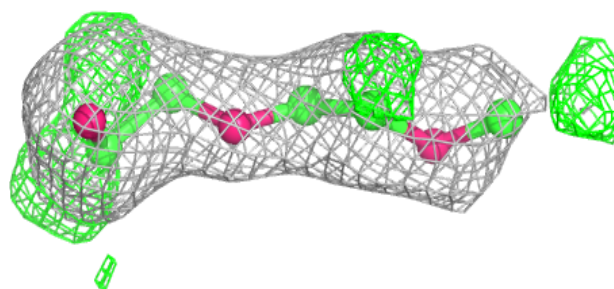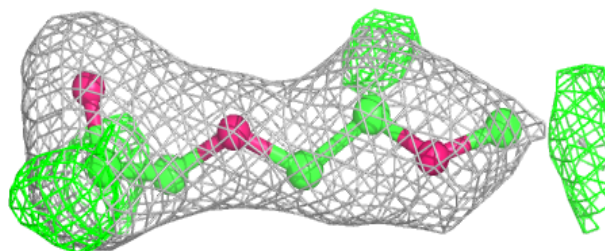
Electron density around NAG A 702:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
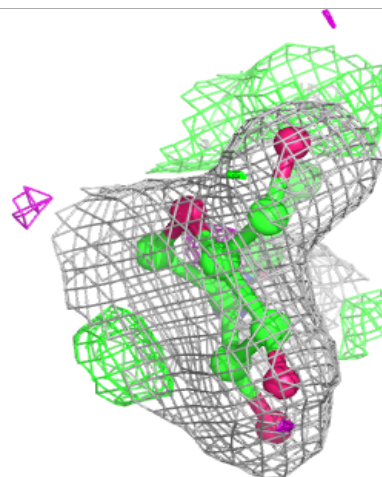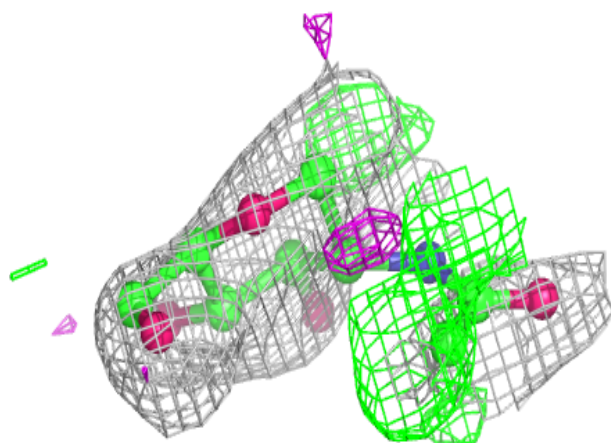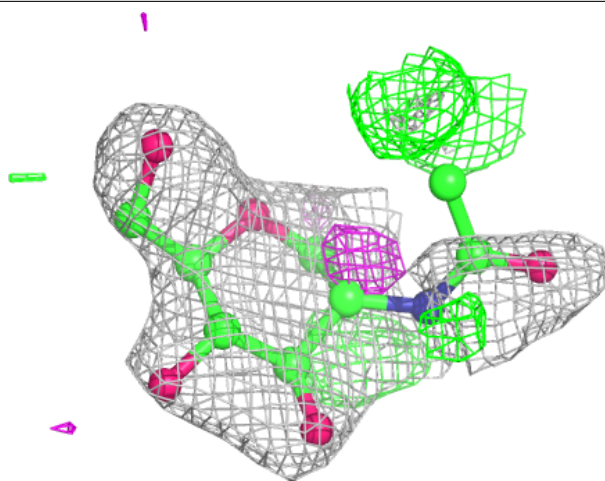
Electron density around NAG A 703:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
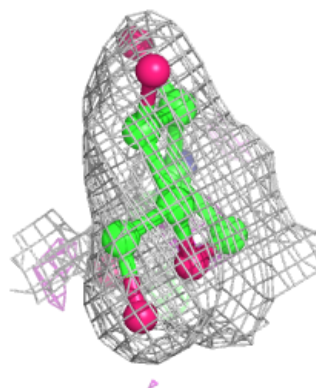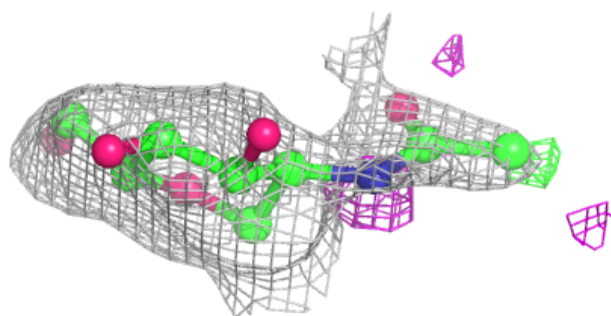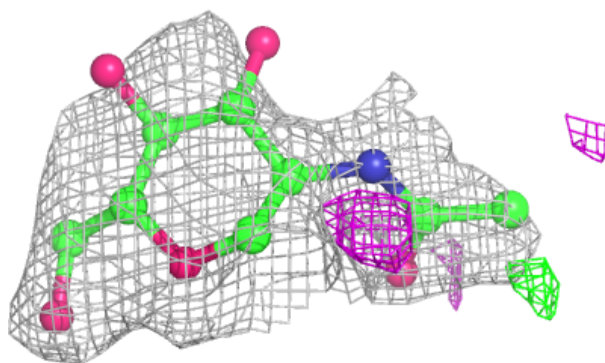
Electron density around NAG A 701:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
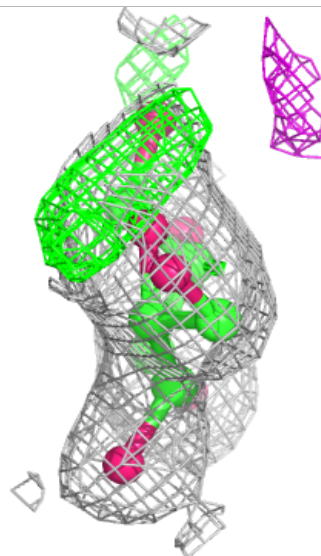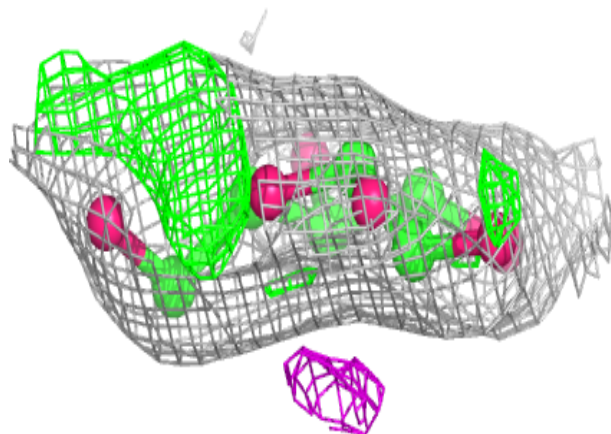mF_o-DF_c (at 3 rmsd) in purple (negative)
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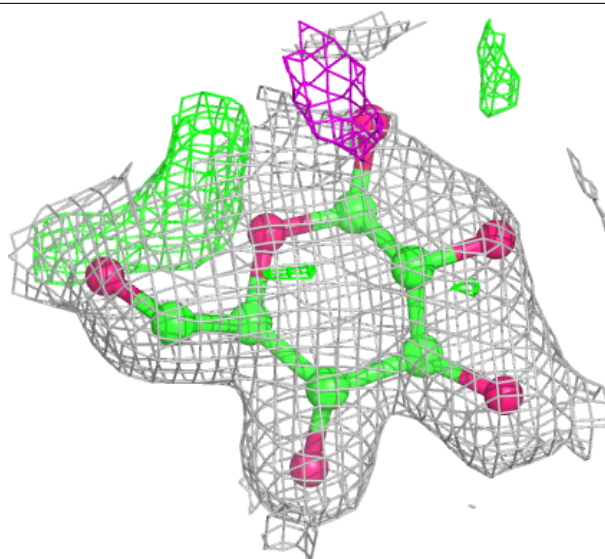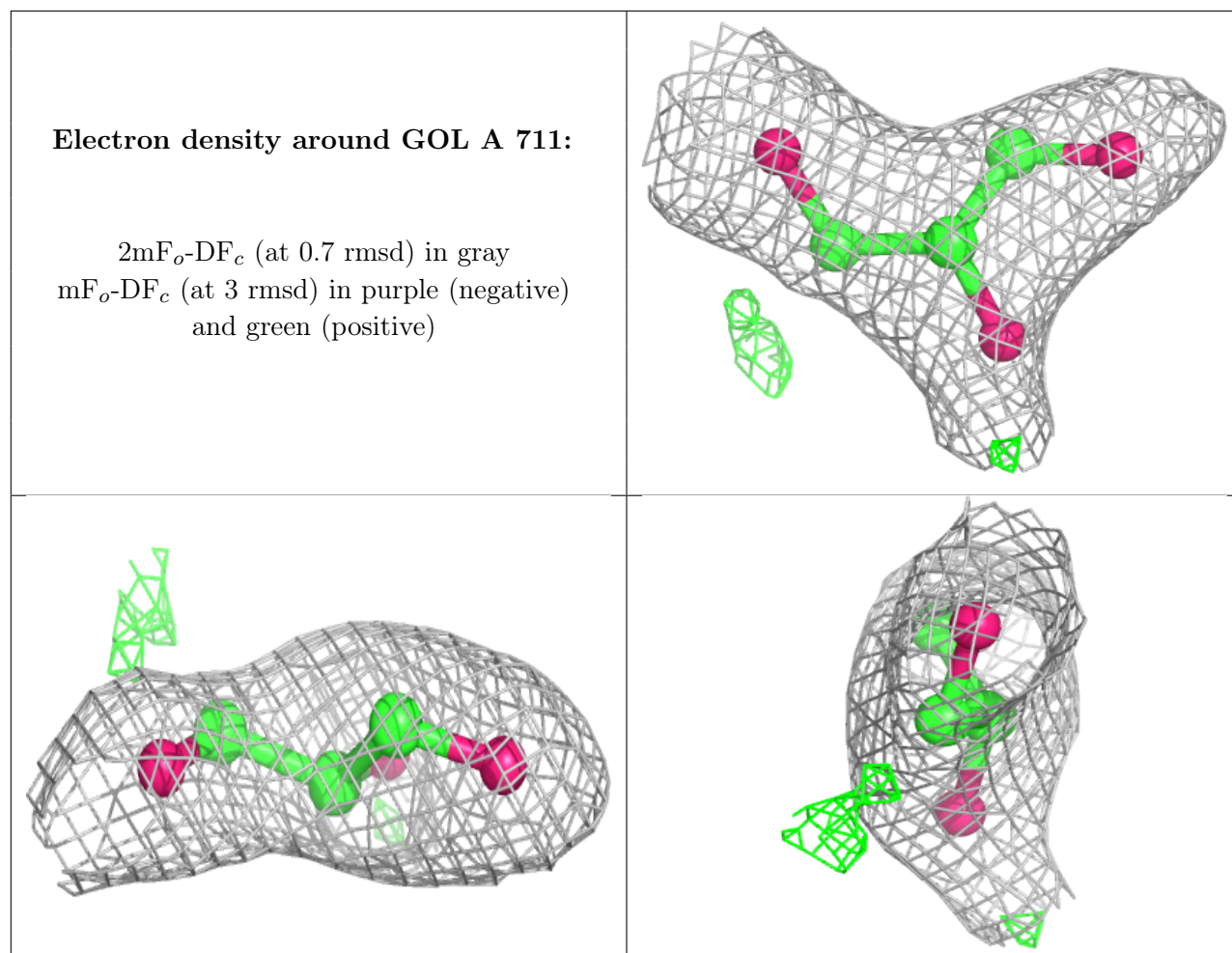
Electron density around 1PE A 714:

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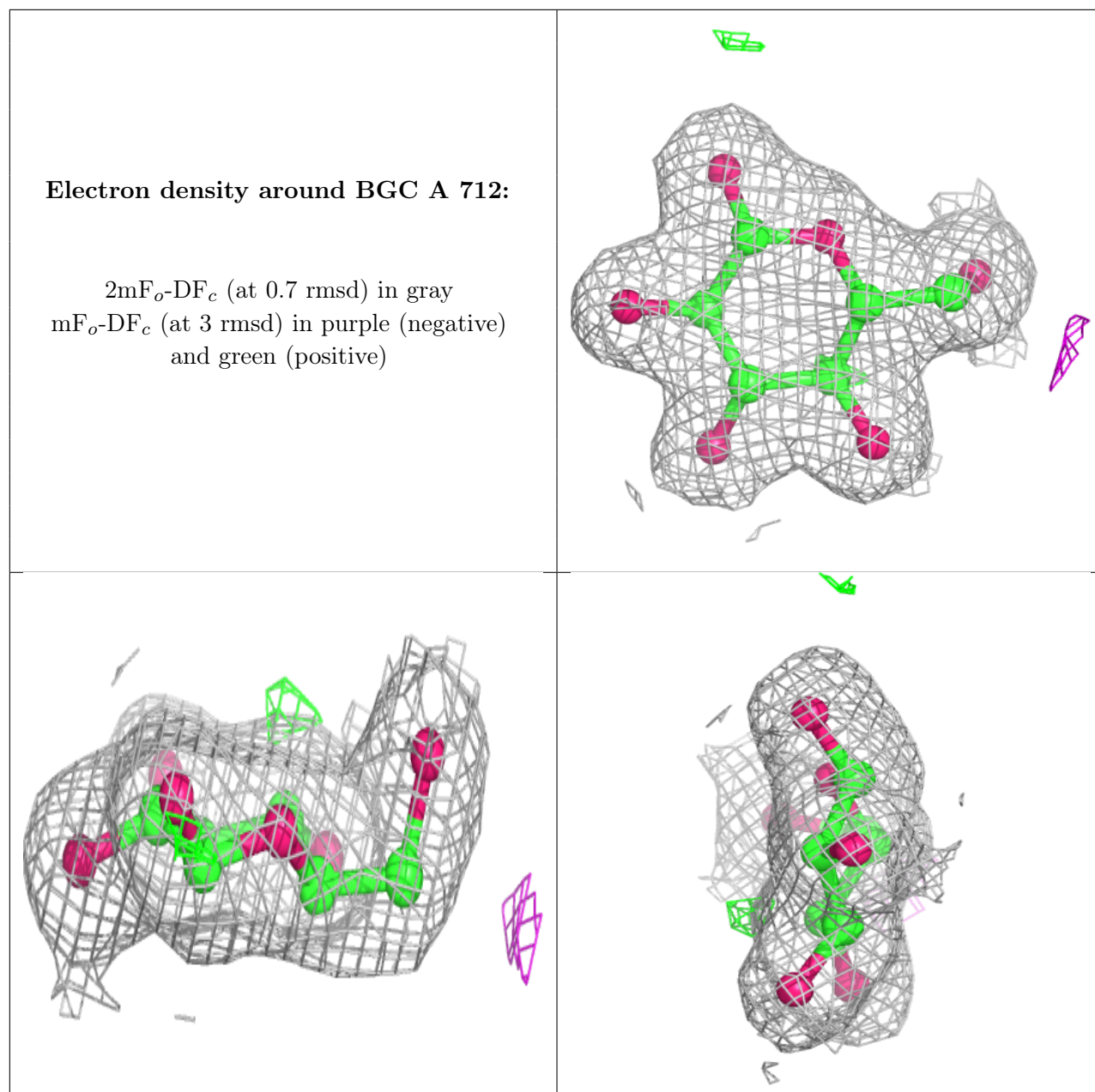mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around BGC A 713:

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

Electron density around GOL A 711:

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

Electron density around BGC A 712:

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

6.5   Other polymers ⓘ

There are no such residues in this entry.