



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 6, 2026 – 02:47 PM UTC

PDB ID : 6KIH / pdb_00006kih
Title : Sucrose-phosphate synthase (tll1590) from *Thermosynechococcus elongatus*
Authors : Su, J.
Deposited on : 2019-07-18
Resolution : 3.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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

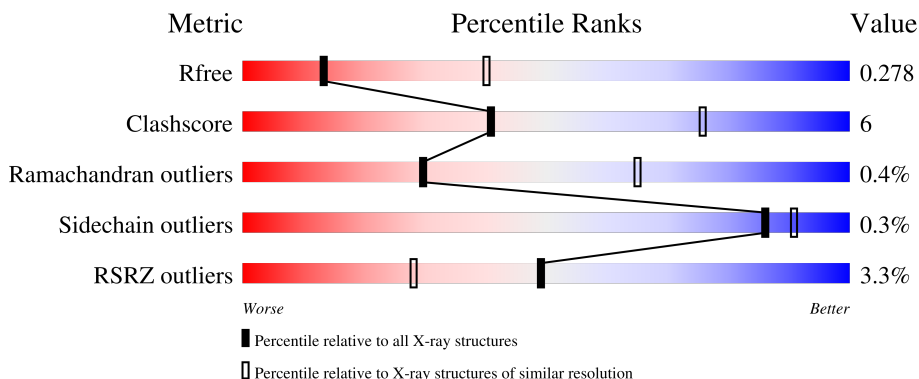
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.00 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	2672 (3.00-3.00)
Clashscore	190562	2977 (3.00-3.00)
Ramachandran outliers	187476	2877 (3.00-3.00)
Sidechain outliers	187428	2880 (3.00-3.00)
RSRZ outliers	180081	2671 (3.00-3.00)

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	455	2% 75% 13% 12%
1	B	455	2% 73% 14% 12%
1	C	455	2% 75% 13% 12%
1	D	455	2% 75% 13% 12%
1	E	455	2% 75% 13% 12%

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Mol	Chain	Length	Quality of chain
1	F	455	
1	G	455	
1	H	455	
1	I	455	
1	J	455	
1	K	455	
1	L	455	
2	M	2	
2	N	2	
2	O	2	
2	P	2	
2	Q	2	
2	R	2	
2	S	2	
2	T	2	
2	U	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
2	GLC	S	1	-	-	X	-

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 38160 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 Tll1590 protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	400	Total	C	N	O	S	0	0	0
			3139	2007	555	567	10			
1	B	399	Total	C	N	O	S	0	0	0
			3132	2001	554	567	10			
1	C	400	Total	C	N	O	S	0	0	0
			3140	2007	555	568	10			
1	D	399	Total	C	N	O	S	0	0	0
			3132	2001	554	567	10			
1	E	400	Total	C	N	O	S	0	0	0
			3139	2007	554	568	10			
1	F	399	Total	C	N	O	S	0	0	0
			3127	1998	553	566	10			
1	G	400	Total	C	N	O	S	0	0	0
			3140	2007	555	568	10			
1	H	399	Total	C	N	O	S	0	0	0
			3131	2001	554	566	10			
1	I	399	Total	C	N	O	S	0	0	0
			3131	2001	553	567	10			
1	J	400	Total	C	N	O	S	0	0	0
			3140	2007	555	568	10			
1	K	399	Total	C	N	O	S	0	0	0
			3130	2001	552	567	10			
1	L	400	Total	C	N	O	S	0	0	0
			3136	2005	555	566	10			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP Q8DIJ5
A	-1	SER	-	expression tag	UNP Q8DIJ5
A	0	HIS	-	expression tag	UNP Q8DIJ5
B	-2	GLY	-	expression tag	UNP Q8DIJ5
B	-1	SER	-	expression tag	UNP Q8DIJ5

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Chain	Residue	Modelled	Actual	Comment	Reference
B	0	HIS	-	expression tag	UNP Q8DIJ5
C	-2	GLY	-	expression tag	UNP Q8DIJ5
C	-1	SER	-	expression tag	UNP Q8DIJ5
C	0	HIS	-	expression tag	UNP Q8DIJ5
D	-2	GLY	-	expression tag	UNP Q8DIJ5
D	-1	SER	-	expression tag	UNP Q8DIJ5
D	0	HIS	-	expression tag	UNP Q8DIJ5
E	-2	GLY	-	expression tag	UNP Q8DIJ5
E	-1	SER	-	expression tag	UNP Q8DIJ5
E	0	HIS	-	expression tag	UNP Q8DIJ5
F	-2	GLY	-	expression tag	UNP Q8DIJ5
F	-1	SER	-	expression tag	UNP Q8DIJ5
F	0	HIS	-	expression tag	UNP Q8DIJ5
G	-2	GLY	-	expression tag	UNP Q8DIJ5
G	-1	SER	-	expression tag	UNP Q8DIJ5
G	0	HIS	-	expression tag	UNP Q8DIJ5
H	-2	GLY	-	expression tag	UNP Q8DIJ5
H	-1	SER	-	expression tag	UNP Q8DIJ5
H	0	HIS	-	expression tag	UNP Q8DIJ5
I	-2	GLY	-	expression tag	UNP Q8DIJ5
I	-1	SER	-	expression tag	UNP Q8DIJ5
I	0	HIS	-	expression tag	UNP Q8DIJ5
J	-2	GLY	-	expression tag	UNP Q8DIJ5
J	-1	SER	-	expression tag	UNP Q8DIJ5
J	0	HIS	-	expression tag	UNP Q8DIJ5
K	-2	GLY	-	expression tag	UNP Q8DIJ5
K	-1	SER	-	expression tag	UNP Q8DIJ5
K	0	HIS	-	expression tag	UNP Q8DIJ5
L	-2	GLY	-	expression tag	UNP Q8DIJ5
L	-1	SER	-	expression tag	UNP Q8DIJ5
L	0	HIS	-	expression tag	UNP Q8DIJ5

- Molecule 2 is an oligosaccharide called 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose.



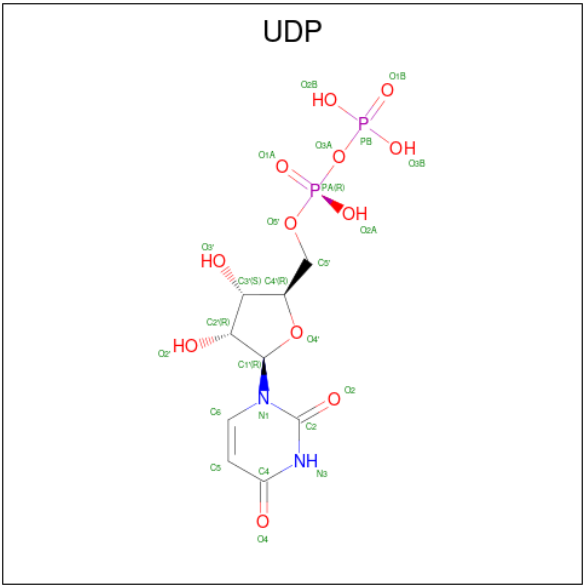
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	M	2	Total	C	O	P	0	0	0
			27	12	14	1			

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	N	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	O	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	P	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	Q	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	R	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	S	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	T	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	U	2	Total	C	O	P	0	0	0
			27	12	14	1			

- Molecule 3 is URIDINE-5'-DIPHOSPHATE (CCD ID: UDP) (formula: C₉H₁₄N₂O₁₂P₂) (labeled as "Ligand of Interest" by depositor).



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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	D	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	E	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	F	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	G	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	H	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	I	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	J	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	K	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
3	L	1	Total	C	N	O	P	0	0
			25	9	2	12	2		

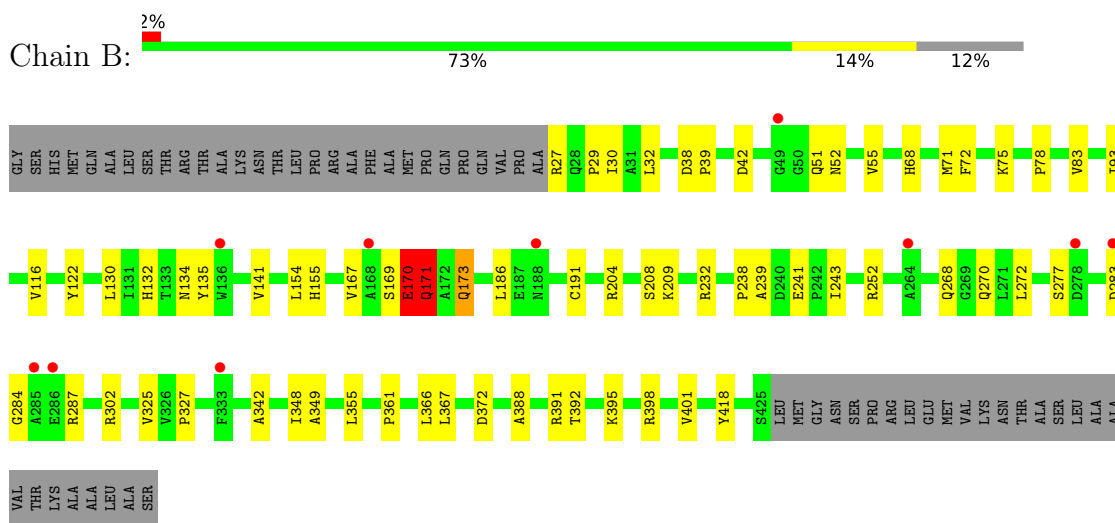
3 Residue-property plots

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.

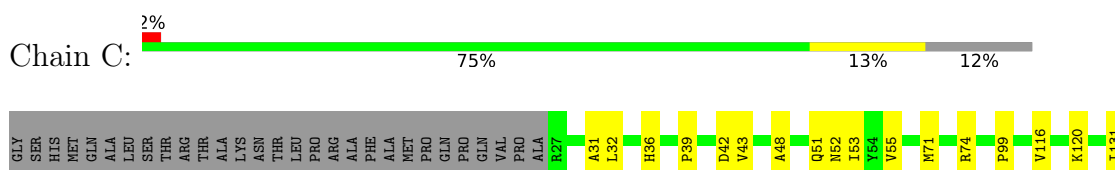
• Molecule 1: Tll1590 protein

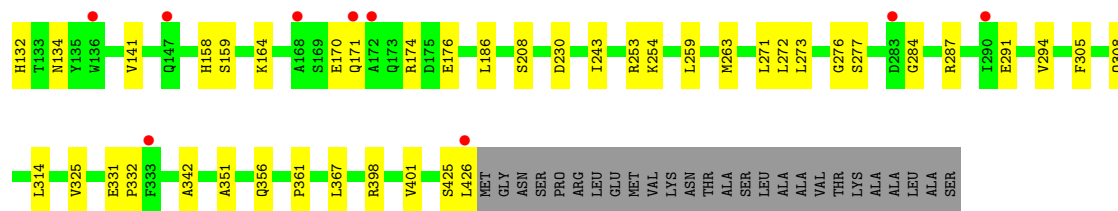


• Molecule 1: Tll1590 protein

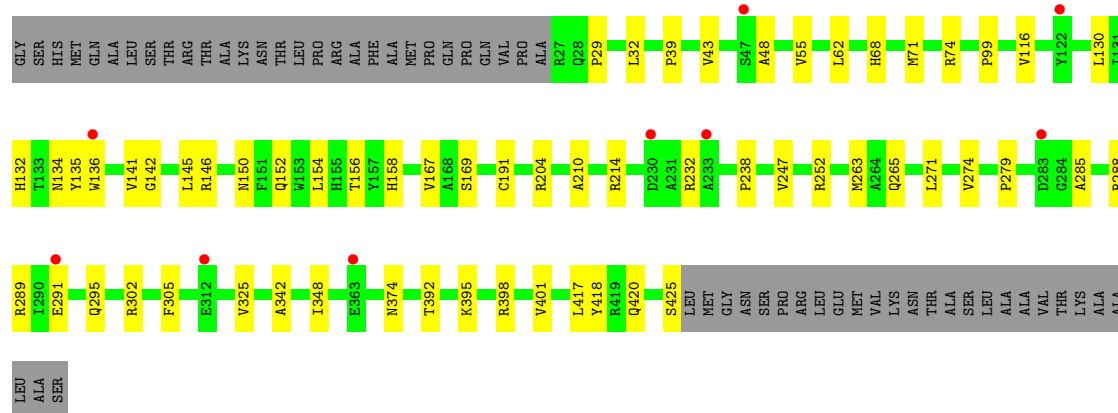
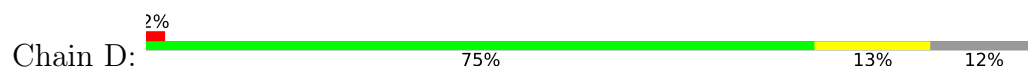


• Molecule 1: Tll1590 protein

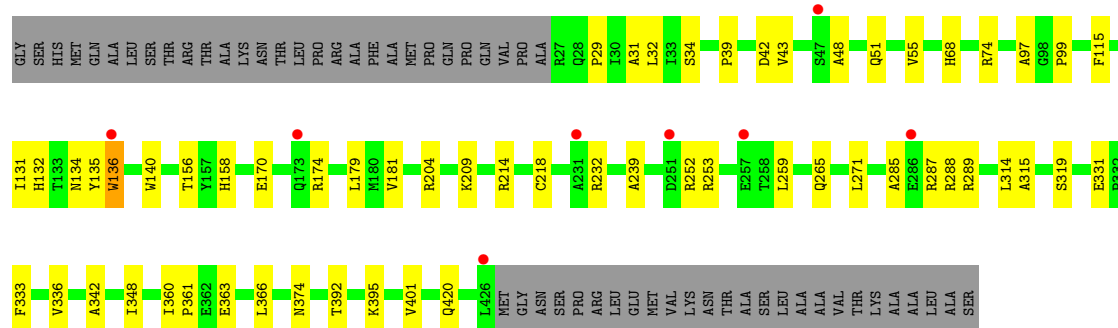
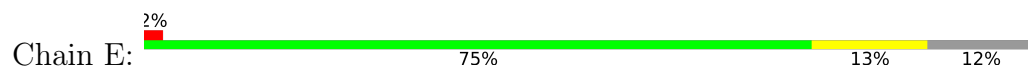




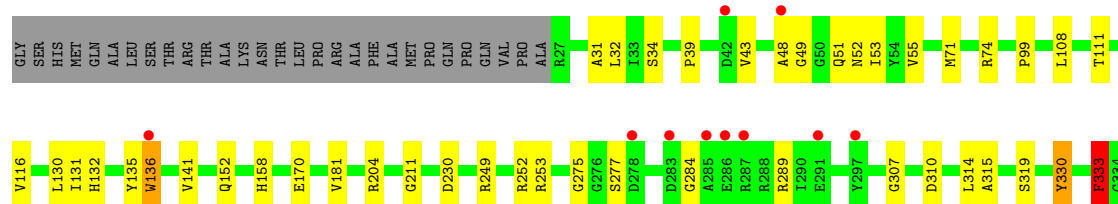
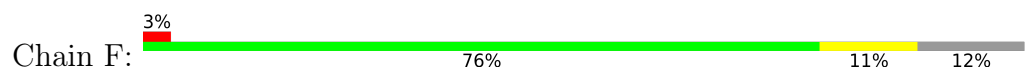
• Molecule 1: Tll1590 protein

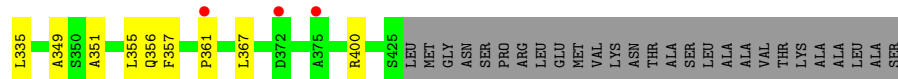


• Molecule 1: Tll1590 protein

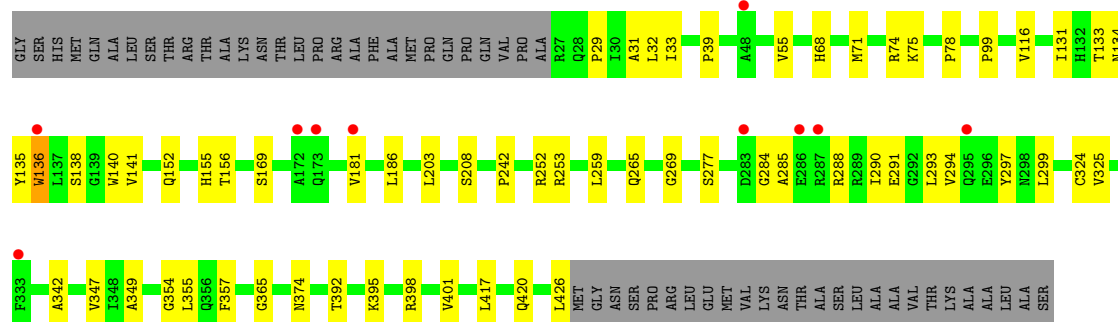
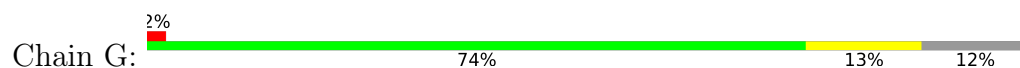


• Molecule 1: Tll1590 protein

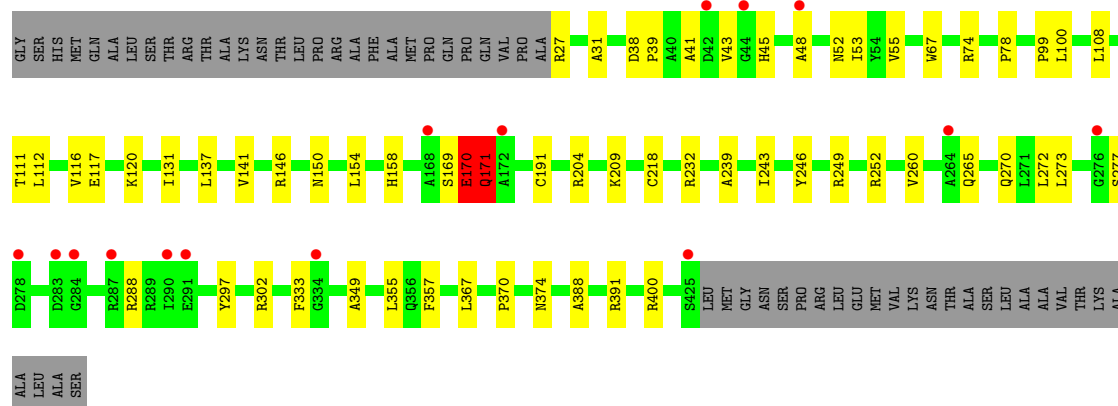
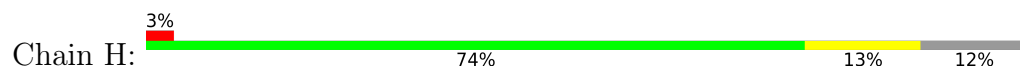




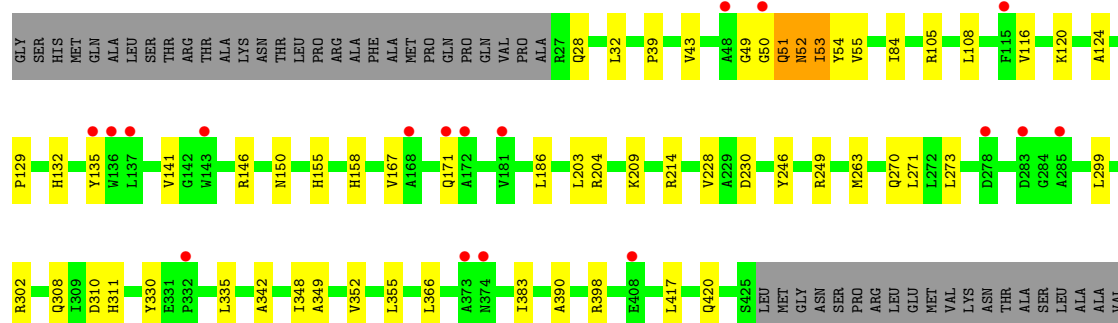
• Molecule 1: Tll1590 protein



• Molecule 1: Tll1590 protein



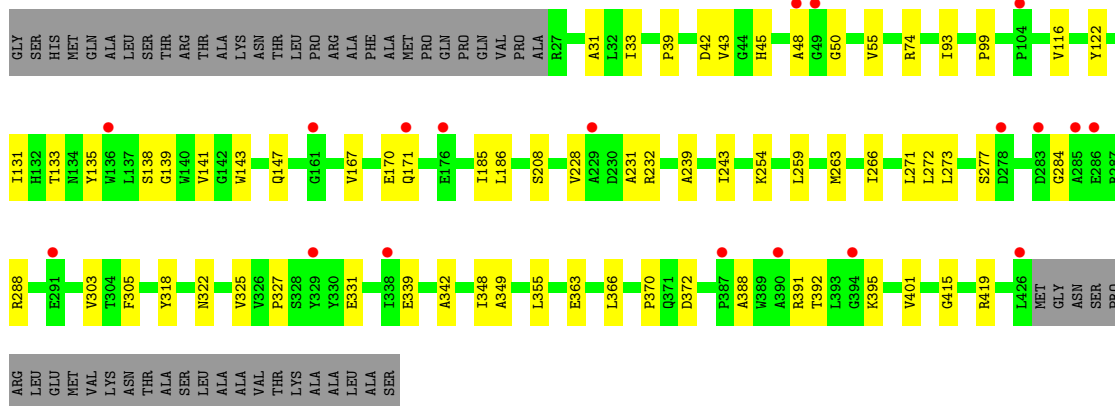
• Molecule 1: Tll1590 protein



THR
LYS
ALA
ALA
LEU
ALA
SER

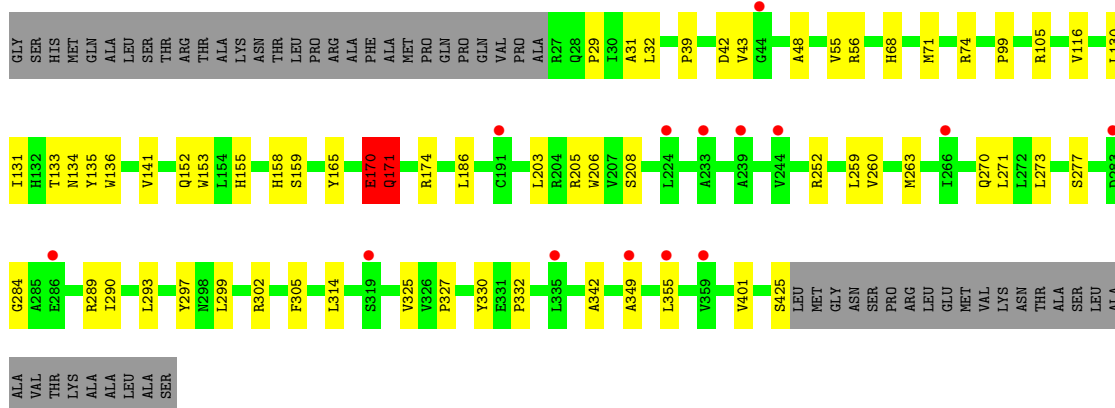
• Molecule 1: Tll1590 protein

Chain J: 



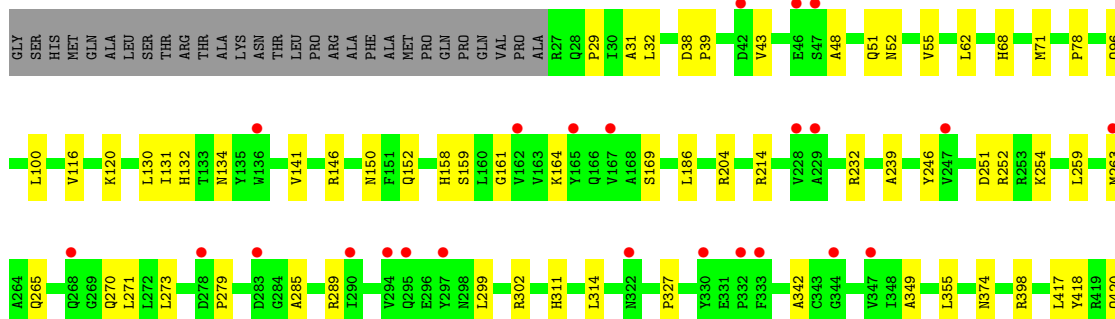
• Molecule 1: Tll1590 protein

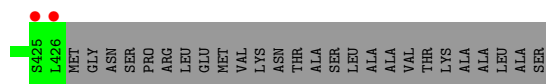
Chain K: 



• Molecule 1: Tll1590 protein

Chain L: 





- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain M:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain N:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain O:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain P:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain Q:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain R:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain S:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain T:  100%

GLC1
F6P2

- Molecule 2: 6-O-phosphono-beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain U:  100%

GLC1
F6P2

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	116.66Å 170.84Å 160.55Å 90.00° 96.43° 90.00°	Depositor
Resolution (Å)	19.90 – 3.00 19.90 – 3.00	Depositor EDS
% Data completeness (in resolution range)	99.0 (19.90-3.00) 98.6 (19.90-3.00)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.27 (at 2.98Å)	Xtriage
Refinement program	PHENIX 1.17_3644	Depositor
R, R_{free}	0.266 , 0.278 0.272 , 0.278	Depositor DCC
R_{free} test set	2000 reflections (1.61%)	wwPDB-VP
Wilson B-factor (Å ²)	72.1	Xtriage
Anisotropy	0.404	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 32.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	38160	wwPDB-VP
Average B, all atoms (Å ²)	80.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.62% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: GLC, UDP, F6P

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	0.34	0/3218	0.63	1/4386 (0.0%)
1	B	0.34	0/3211	0.61	0/4377
1	C	0.32	0/3219	0.59	1/4388 (0.0%)
1	D	0.33	0/3211	0.61	0/4377
1	E	0.33	0/3218	0.61	0/4386
1	F	0.38	1/3206 (0.0%)	0.65	3/4372 (0.1%)
1	G	0.32	0/3219	0.62	0/4388
1	H	0.32	0/3210	0.62	3/4375 (0.1%)
1	I	0.33	0/3210	0.61	2/4375 (0.0%)
1	J	0.31	0/3219	0.57	0/4388
1	K	0.33	0/3209	0.65	1/4373 (0.0%)
1	L	0.29	0/3215	0.58	0/4383
All	All	0.33	1/38565 (0.0%)	0.61	11/52568 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	F	333	PHE	C-O	-5.83	1.16	1.24

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	230	ASP	N-CA-C	-6.42	105.40	112.72
1	H	170	GLU	CA-C-N	6.40	133.77	121.54
1	H	170	GLU	C-N-CA	6.40	133.77	121.54
1	I	51	GLN	N-CA-C	-5.77	105.07	111.36
1	I	52	ASN	N-CA-C	-5.76	104.63	111.03

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3139	0	3095	34	0
1	B	3132	0	3084	47	0
1	C	3140	0	3095	34	0
1	D	3132	0	3084	35	0
1	E	3139	0	3093	33	0
1	F	3127	0	3070	36	0
1	G	3140	0	3095	36	0
1	H	3131	0	3082	40	0
1	I	3131	0	3082	52	0
1	J	3140	0	3095	42	0
1	K	3130	0	3080	45	0
1	L	3136	0	3091	38	0
2	M	27	0	19	4	0
2	N	27	0	20	2	0
2	O	27	0	20	8	0
2	P	27	0	20	5	0
2	Q	27	0	19	5	0
2	R	27	0	20	7	0
2	S	27	0	19	14	0
2	T	27	0	20	6	0
2	U	27	0	20	3	0
3	A	25	0	10	3	0
3	B	25	0	10	0	0
3	C	25	0	10	2	0
3	D	25	0	10	2	0
3	E	25	0	10	3	0
3	F	25	0	10	3	0
3	G	25	0	10	1	0
3	H	25	0	10	2	0
3	I	25	0	10	3	0
3	J	25	0	10	1	0
3	K	25	0	10	3	0
3	L	25	0	10	3	0
All	All	38160	0	37343	487	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 6.

The worst 5 of 487 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:S:2:F6P:O5	2:S:2:F6P:C2	1.63	1.28
2:P:2:F6P:O5	2:P:2:F6P:C2	1.63	1.21
1:B:170:GLU:HG2	1:B:252:ARG:NE	1.70	1.07
1:B:170:GLU:HG2	1:B:252:ARG:CD	1.92	0.99
1:K:170:GLU:HG2	1:K:252:ARG:HD3	1.46	0.97

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	398/455 (88%)	371 (93%)	27 (7%)	0	100	100
1	B	397/455 (87%)	380 (96%)	15 (4%)	2 (0%)	24	60
1	C	398/455 (88%)	376 (94%)	22 (6%)	0	100	100
1	D	397/455 (87%)	377 (95%)	18 (4%)	2 (0%)	24	60
1	E	398/455 (88%)	371 (93%)	25 (6%)	2 (0%)	24	60
1	F	397/455 (87%)	367 (92%)	27 (7%)	3 (1%)	16	50
1	G	398/455 (88%)	373 (94%)	23 (6%)	2 (0%)	24	60
1	H	397/455 (87%)	368 (93%)	26 (6%)	3 (1%)	16	50
1	I	397/455 (87%)	373 (94%)	24 (6%)	0	100	100
1	J	398/455 (88%)	375 (94%)	22 (6%)	1 (0%)	36	70
1	K	397/455 (87%)	379 (96%)	15 (4%)	3 (1%)	16	50
1	L	398/455 (88%)	371 (93%)	27 (7%)	0	100	100
All	All	4770/5460 (87%)	4481 (94%)	271 (6%)	18 (0%)	30	65

5 of 18 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	171	GLN
1	D	136	TRP
1	E	136	TRP
1	F	136	TRP
1	H	171	GLN

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	320/366 (87%)	320 (100%)	0	100	100
1	B	320/366 (87%)	317 (99%)	3 (1%)	70	85
1	C	321/366 (88%)	321 (100%)	0	100	100
1	D	320/366 (87%)	319 (100%)	1 (0%)	86	91
1	E	321/366 (88%)	321 (100%)	0	100	100
1	F	318/366 (87%)	317 (100%)	1 (0%)	86	91
1	G	321/366 (88%)	321 (100%)	0	100	100
1	H	319/366 (87%)	317 (99%)	2 (1%)	78	88
1	I	320/366 (87%)	319 (100%)	1 (0%)	86	91
1	J	321/366 (88%)	320 (100%)	1 (0%)	86	91
1	K	320/366 (87%)	316 (99%)	4 (1%)	61	81
1	L	320/366 (87%)	320 (100%)	0	100	100
All	All	3841/4392 (88%)	3828 (100%)	13 (0%)	86	91

5 of 13 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	I	53	ILE
1	J	363	GLU
1	K	425	SER
1	K	170	GLU
1	K	171	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 81 such sidechains are listed below:

Mol	Chain	Res	Type
1	I	134	ASN
1	K	173	GLN
1	I	158	HIS
1	J	148	GLN
1	L	134	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 ⓘ

18 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	GLC	M	1	2	11,11,12	2.01	4 (36%)	15,15,17	1.61	4 (26%)
2	F6P	M	2	2	15,16,16	3.53	5 (33%)	16,25,25	1.35	2 (12%)
2	GLC	N	1	2	11,11,12	1.79	4 (36%)	15,15,17	1.64	2 (13%)
2	F6P	N	2	2	15,16,16	3.84	5 (33%)	16,25,25	1.09	1 (6%)
2	GLC	O	1	2	11,11,12	1.87	4 (36%)	15,15,17	1.47	2 (13%)
2	F6P	O	2	2	15,16,16	3.64	5 (33%)	16,25,25	1.48	4 (25%)
2	GLC	P	1	2	11,11,12	1.86	4 (36%)	15,15,17	2.36	7 (46%)
2	F6P	P	2	2	15,16,16	3.92	6 (40%)	16,25,25	1.32	2 (12%)
2	GLC	Q	1	2	11,11,12	1.52	2 (18%)	15,15,17	1.29	1 (6%)
2	F6P	Q	2	2	15,16,16	3.84	5 (33%)	16,25,25	0.86	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	GLC	R	1	2	11,11,12	1.83	4 (36%)	15,15,17	1.83	5 (33%)
2	F6P	R	2	2	15,16,16	3.67	6 (40%)	16,25,25	1.57	3 (18%)
2	GLC	S	1	2	11,11,12	1.36	2 (18%)	15,15,17	3.23	7 (46%)
2	F6P	S	2	2	15,16,16	3.90	5 (33%)	16,25,25	1.03	1 (6%)
2	GLC	T	1	2	11,11,12	1.76	4 (36%)	15,15,17	1.30	1 (6%)
2	F6P	T	2	2	15,16,16	3.63	6 (40%)	16,25,25	0.98	1 (6%)
2	GLC	U	1	2	11,11,12	2.11	4 (36%)	15,15,17	1.98	5 (33%)
2	F6P	U	2	2	15,16,16	3.68	5 (33%)	16,25,25	1.01	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	GLC	M	1	2	-	2/2/19/22	0/1/1/1
2	F6P	M	2	2	-	4/9/28/28	0/1/1/1
2	GLC	N	1	2	-	0/2/19/22	0/1/1/1
2	F6P	N	2	2	-	6/9/28/28	0/1/1/1
2	GLC	O	1	2	-	0/2/19/22	0/1/1/1
2	F6P	O	2	2	-	1/9/28/28	0/1/1/1
2	GLC	P	1	2	-	0/2/19/22	0/1/1/1
2	F6P	P	2	2	-	9/9/28/28	0/1/1/1
2	GLC	Q	1	2	-	2/2/19/22	0/1/1/1
2	F6P	Q	2	2	-	3/9/28/28	0/1/1/1
2	GLC	R	1	2	-	0/2/19/22	0/1/1/1
2	F6P	R	2	2	-	5/9/28/28	0/1/1/1
2	GLC	S	1	2	-	2/2/19/22	0/1/1/1
2	F6P	S	2	2	-	8/9/28/28	0/1/1/1
2	GLC	T	1	2	-	2/2/19/22	0/1/1/1
2	F6P	T	2	2	-	4/9/28/28	0/1/1/1
2	GLC	U	1	2	-	0/2/19/22	0/1/1/1
2	F6P	U	2	2	-	0/9/28/28	0/1/1/1

The worst 5 of 80 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	P	2	F6P	O5-C2	12.63	1.63	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	S	2	F6P	O5-C2	12.56	1.63	1.43
2	Q	2	F6P	O5-C2	12.46	1.63	1.43
2	N	2	F6P	O5-C2	12.40	1.63	1.43
2	T	2	F6P	O5-C2	11.79	1.62	1.43

The worst 5 of 48 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	S	1	GLC	O4-C4-C5	-7.29	91.37	109.32
2	S	1	GLC	C1-O5-C5	-6.08	104.04	112.19
2	U	1	GLC	C1-O5-C5	5.65	119.76	112.19
2	N	1	GLC	C1-C2-C3	4.19	115.75	109.64
2	S	1	GLC	O5-C1-C2	-4.18	100.81	110.79

There are no chirality outliers.

5 of 48 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	M	2	F6P	O1-C1-C2-O2
2	M	2	F6P	O1-C1-C2-C3
2	M	2	F6P	O1-C1-C2-O5
2	N	2	F6P	O1-C1-C2-O2
2	N	2	F6P	O1-C1-C2-C3

There are no ring outliers.

18 monomers are involved in 54 short contacts:

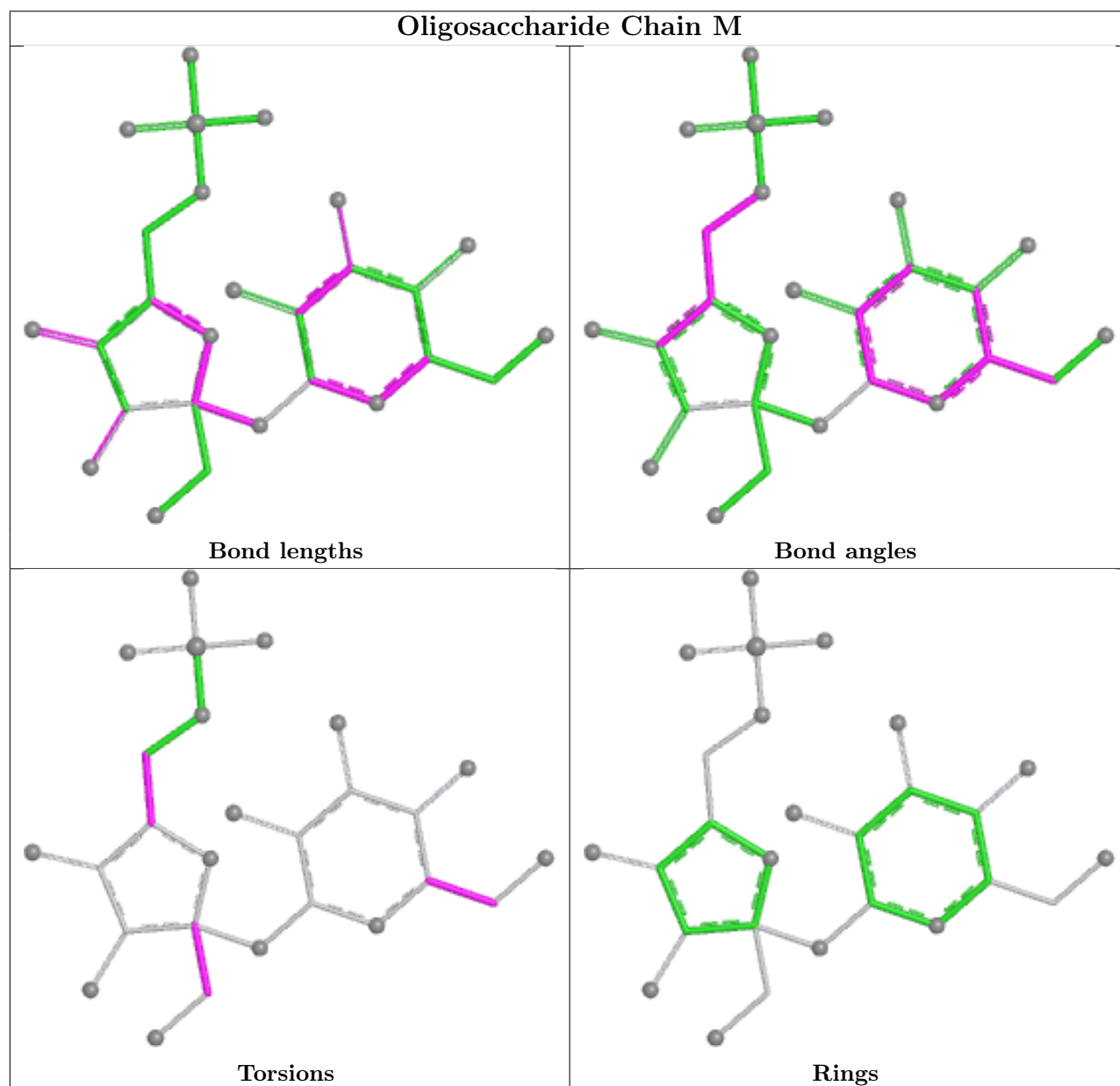
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	Q	1	GLC	1	0
2	N	2	F6P	1	0
2	N	1	GLC	1	0
2	O	1	GLC	5	0
2	T	2	F6P	4	0
2	P	1	GLC	2	0
2	M	2	F6P	2	0
2	S	1	GLC	10	0
2	Q	2	F6P	4	0
2	M	1	GLC	2	0
2	S	2	F6P	4	0
2	T	1	GLC	2	0
2	O	2	F6P	4	0

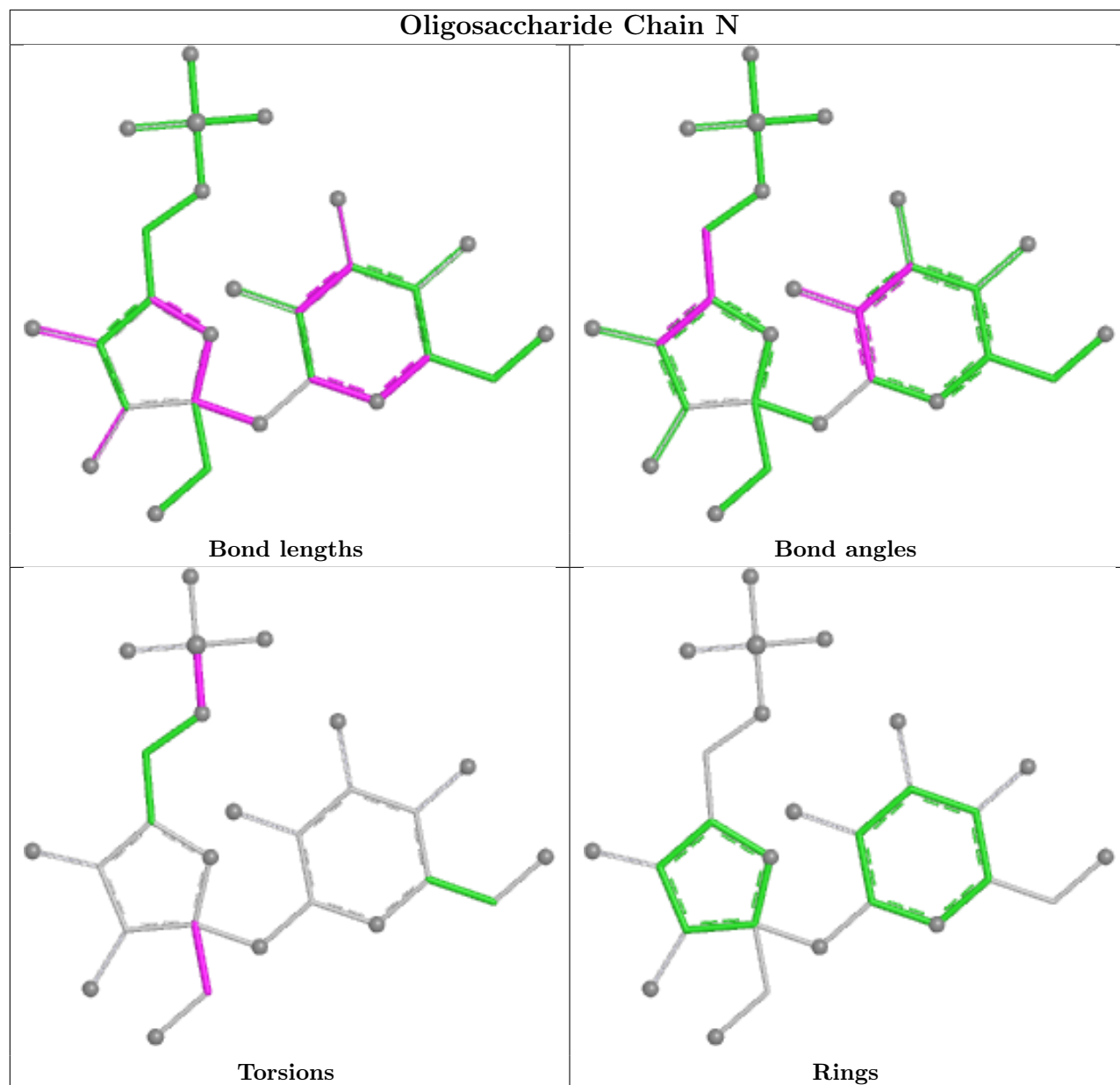
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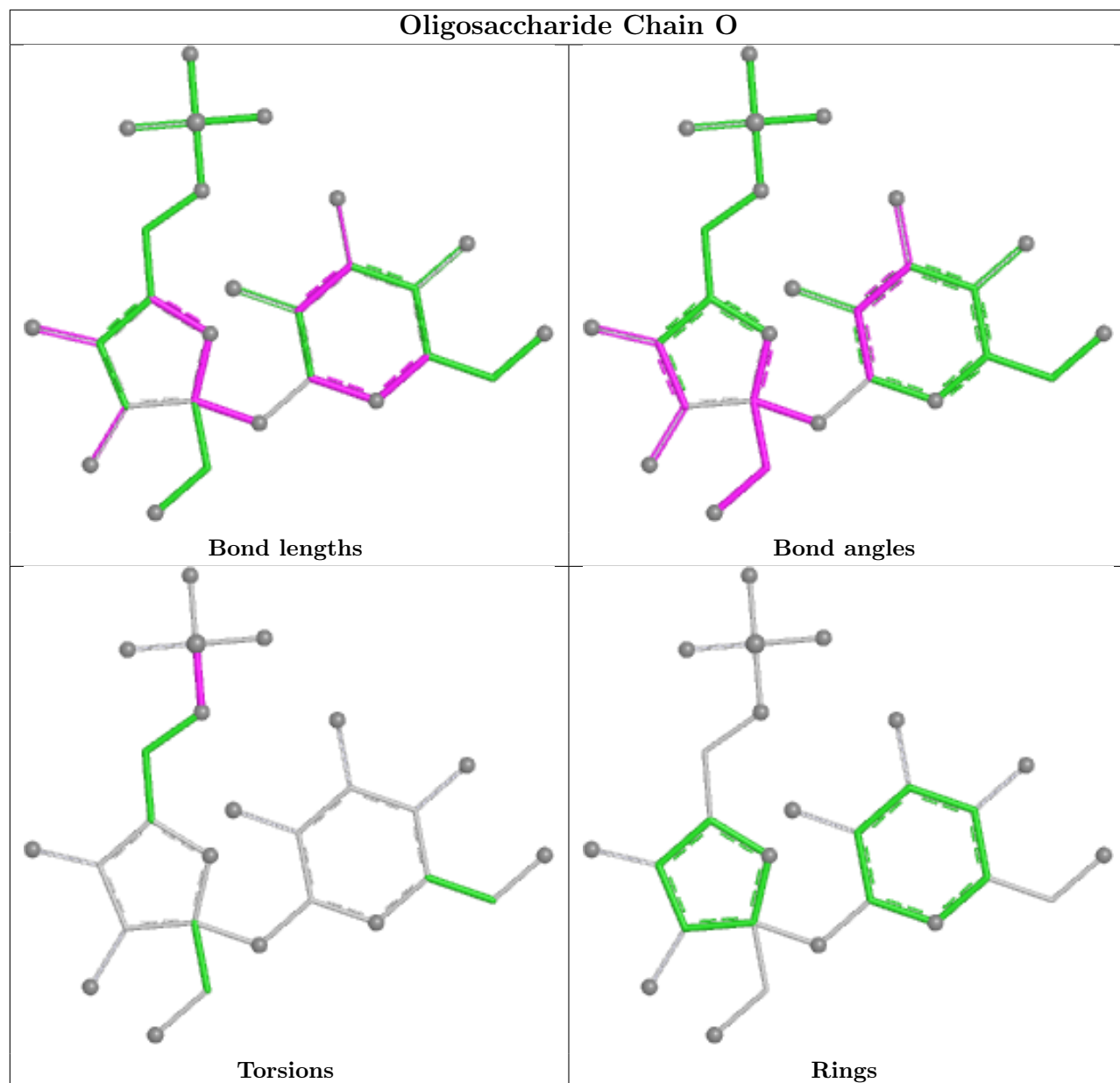
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	R	1	GLC	5	0
2	U	2	F6P	2	0
2	P	2	F6P	3	0
2	U	1	GLC	1	0
2	R	2	F6P	2	0

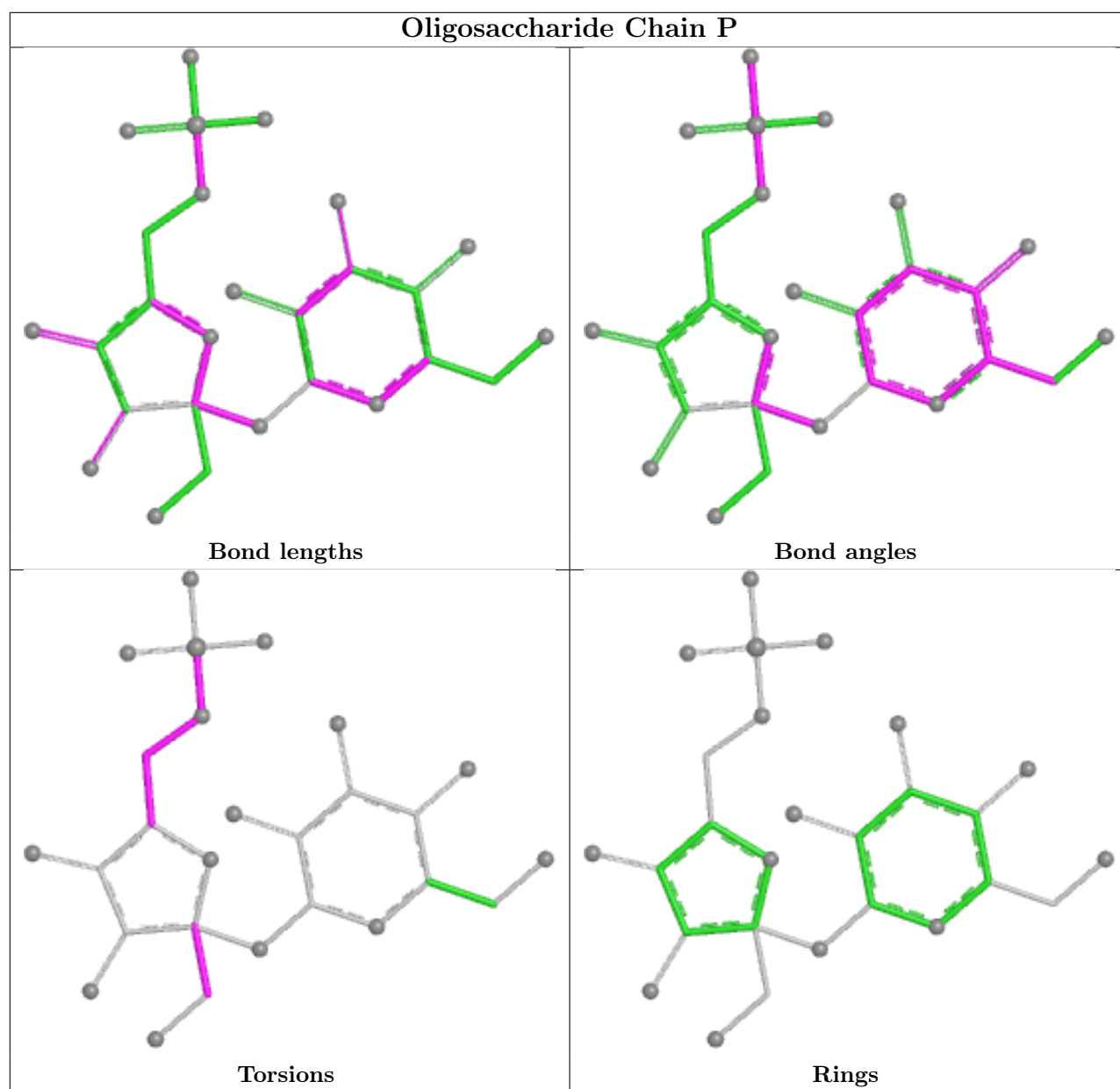
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



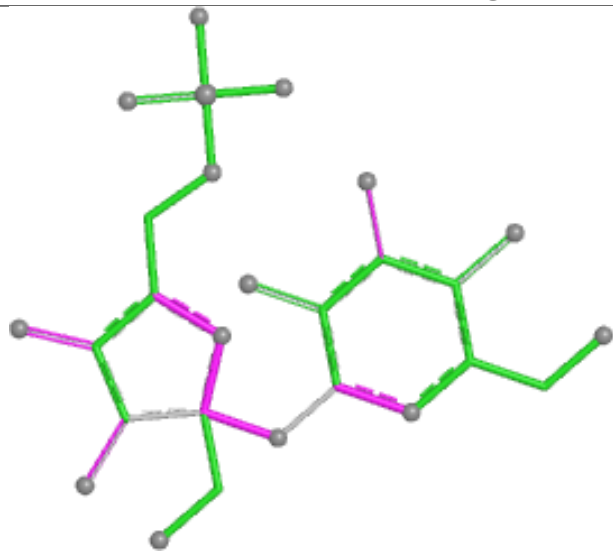


Oligosaccharide Chain O

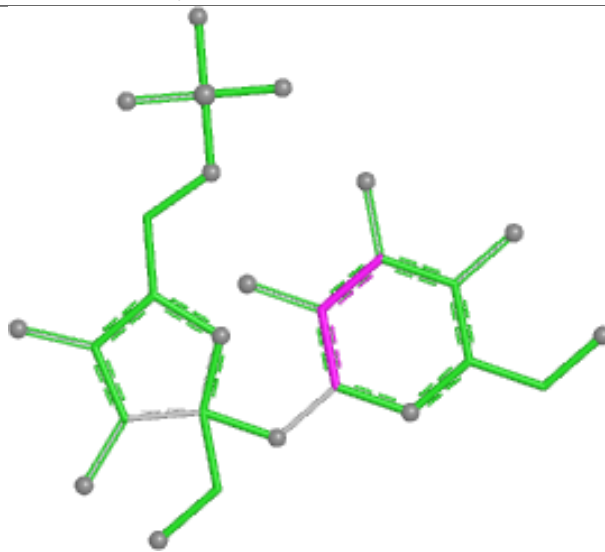




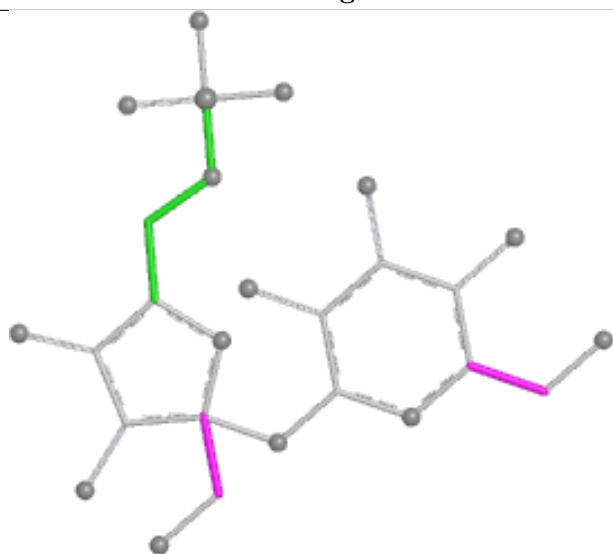
Oligosaccharide Chain Q



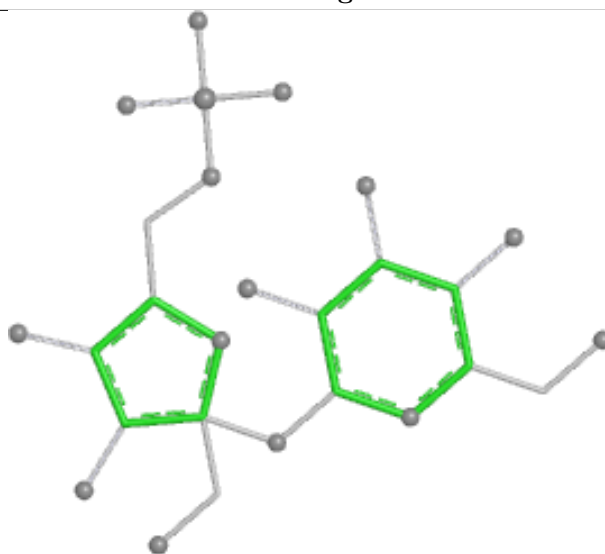
Bond lengths



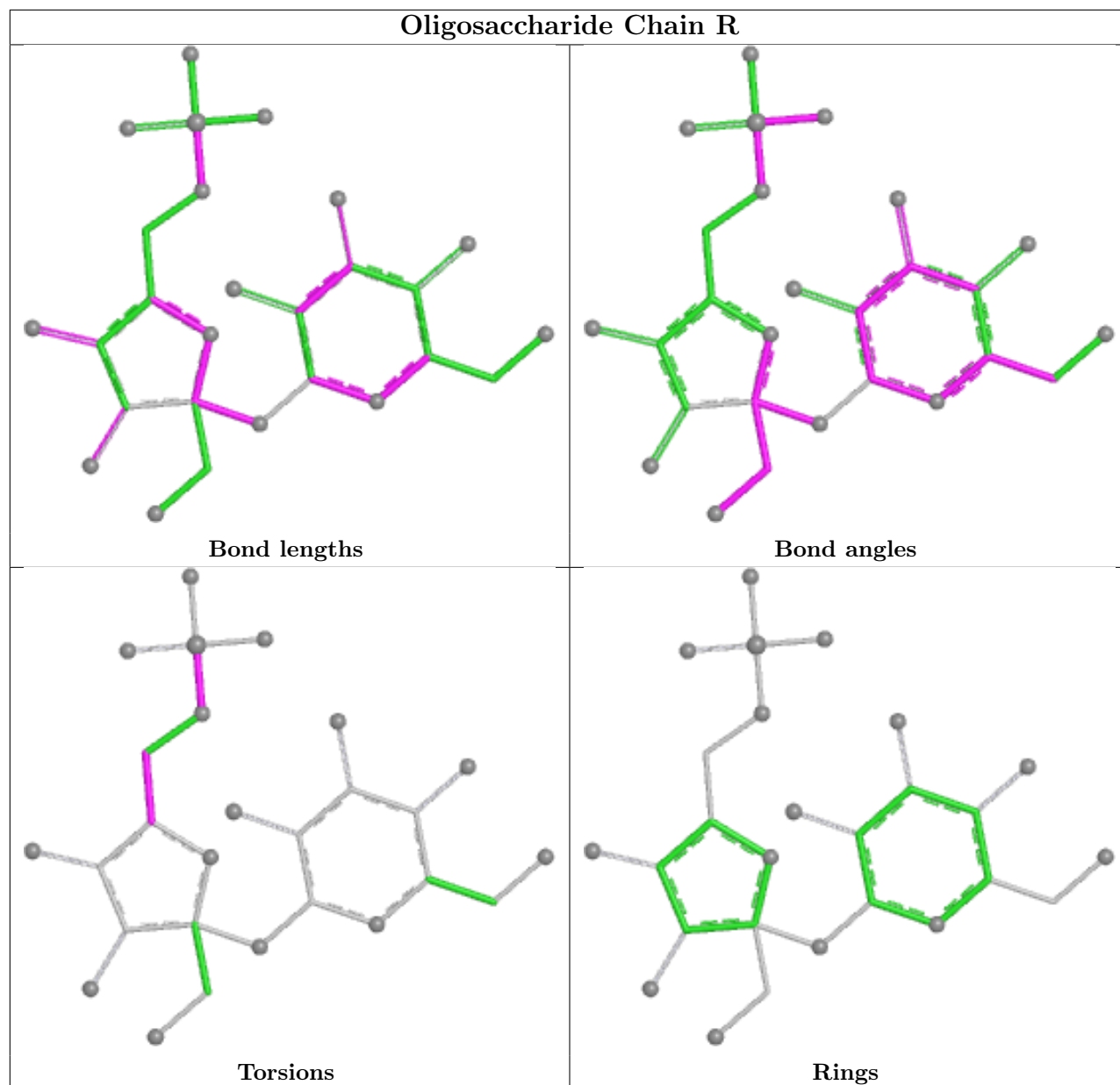
Bond angles



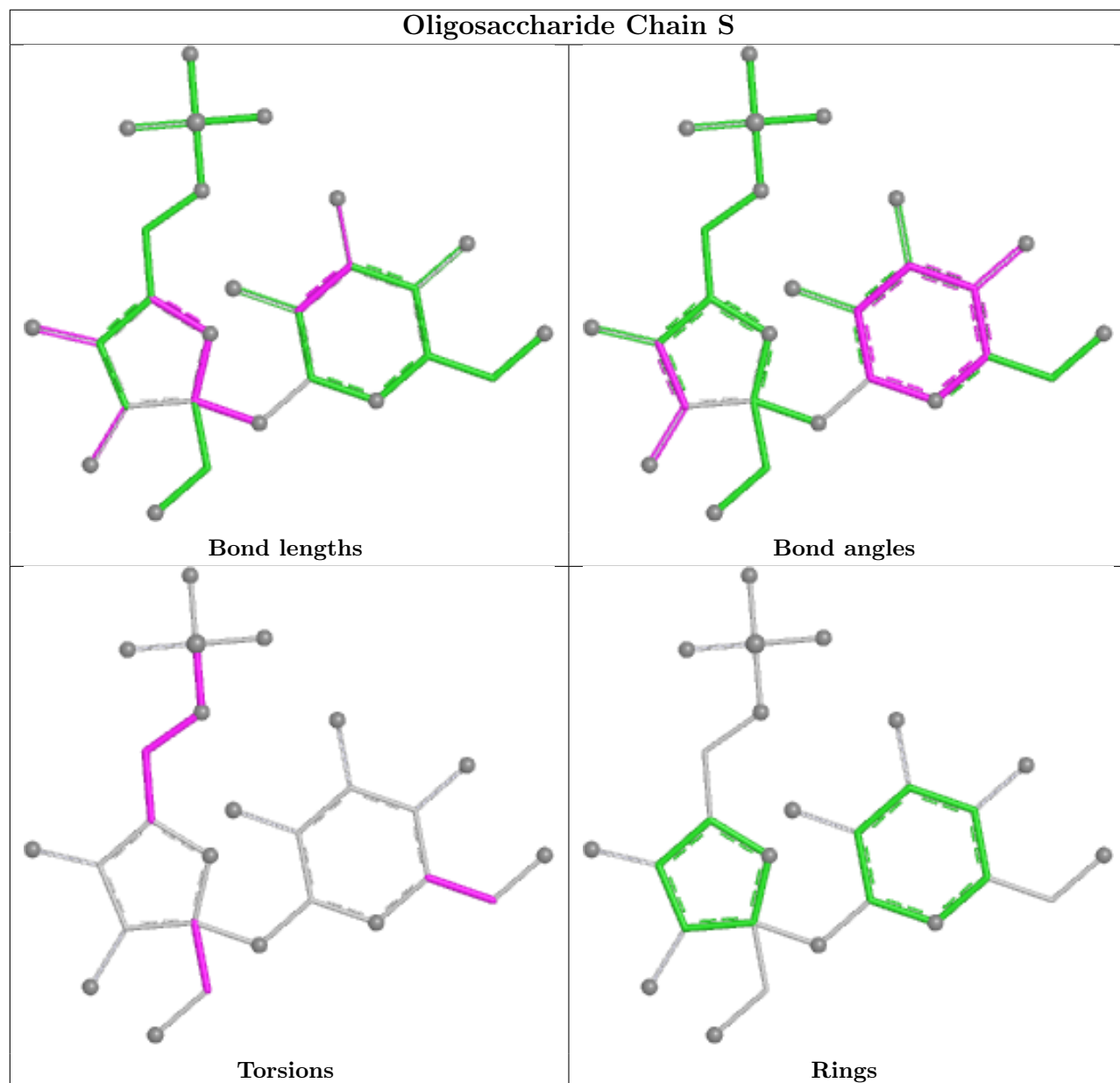
Torsions

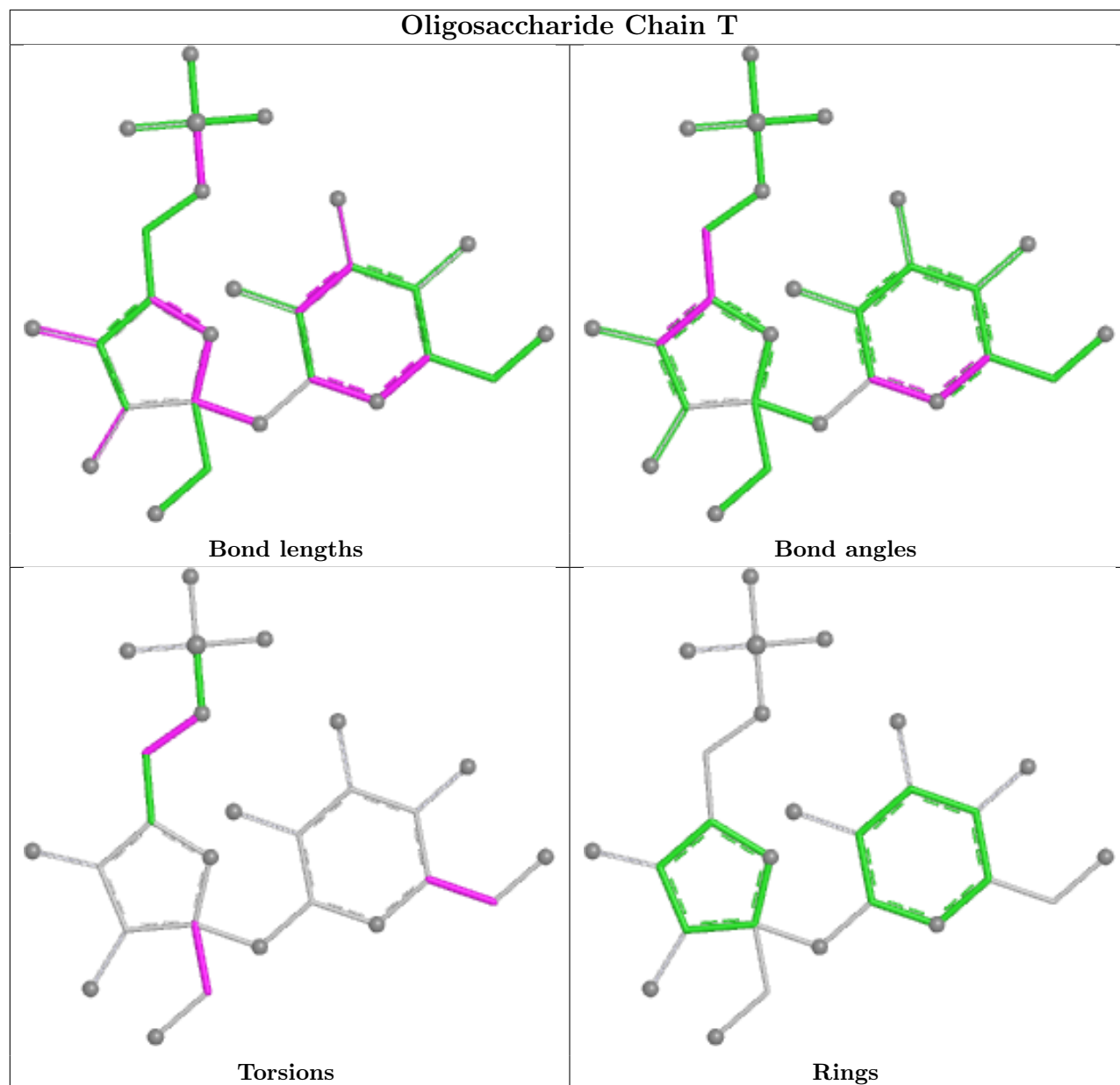


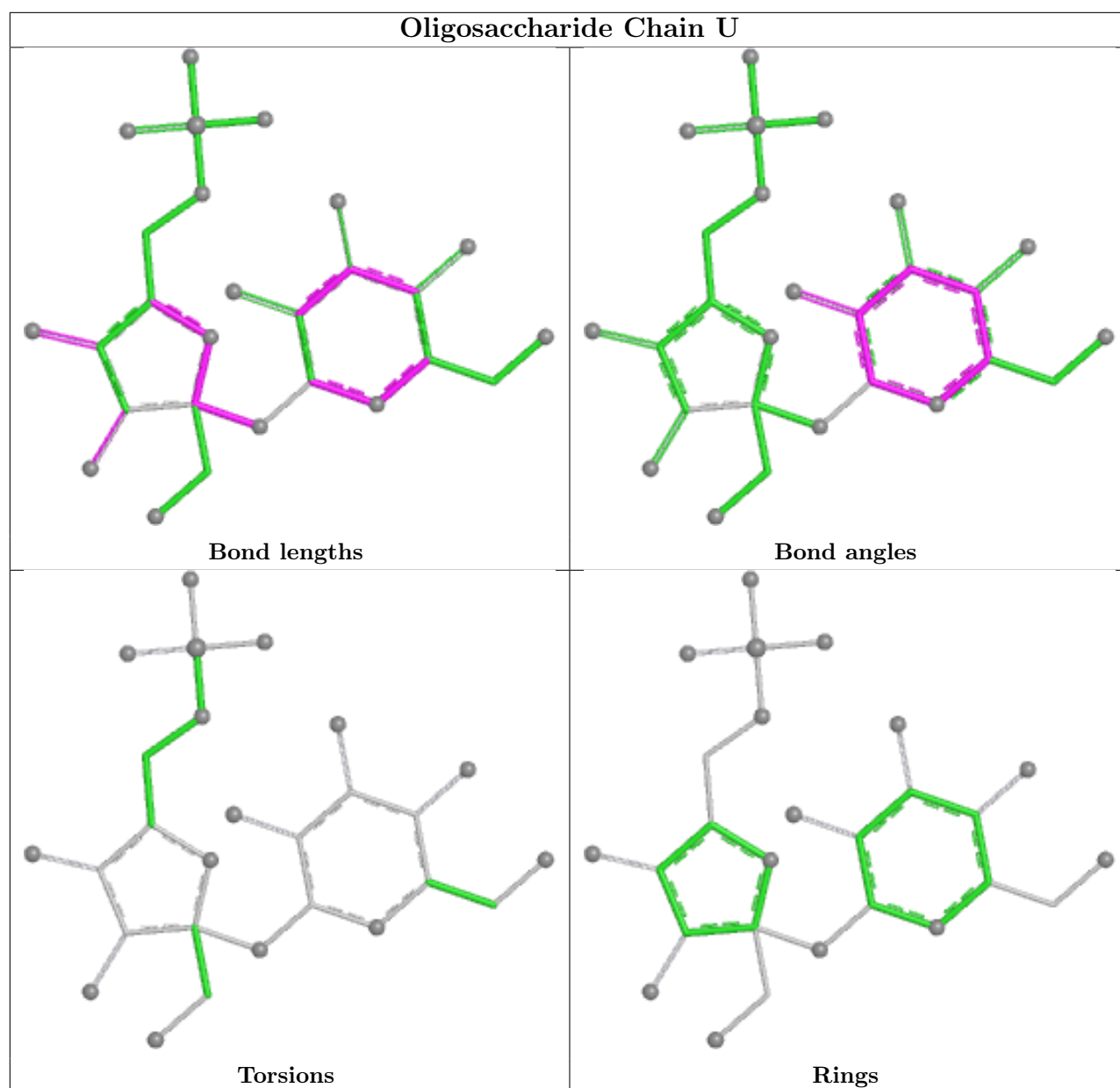
Rings



Oligosaccharide Chain S







5.6 Ligand geometry [i](#)

12 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
3	UDP	F	602	-	25,26,26	3.65	15 (60%)	38,40,40	2.77	13 (34%)
3	UDP	L	602	-	25,26,26	3.61	13 (52%)	38,40,40	3.08	13 (34%)
3	UDP	A	602	-	25,26,26	3.46	16 (64%)	38,40,40	2.81	10 (26%)
3	UDP	G	701	-	25,26,26	3.24	14 (56%)	38,40,40	2.71	11 (28%)
3	UDP	D	602	-	25,26,26	3.64	16 (64%)	38,40,40	2.95	11 (28%)
3	UDP	C	602	-	25,26,26	3.35	13 (52%)	38,40,40	2.80	11 (28%)
3	UDP	E	602	-	25,26,26	3.48	15 (60%)	38,40,40	2.93	14 (36%)
3	UDP	I	602	-	25,26,26	3.31	13 (52%)	38,40,40	2.79	12 (31%)
3	UDP	H	602	-	25,26,26	3.45	14 (56%)	38,40,40	2.77	12 (31%)
3	UDP	B	701	-	25,26,26	3.48	14 (56%)	38,40,40	2.68	11 (28%)
3	UDP	J	701	-	25,26,26	3.42	14 (56%)	38,40,40	2.61	13 (34%)
3	UDP	K	602	-	25,26,26	3.54	14 (56%)	38,40,40	2.86	13 (34%)

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
3	UDP	F	602	-	-	5/16/32/32	0/2/2/2
3	UDP	L	602	-	-	2/16/32/32	0/2/2/2
3	UDP	A	602	-	-	4/16/32/32	0/2/2/2
3	UDP	G	701	-	-	2/16/32/32	0/2/2/2
3	UDP	D	602	-	-	6/16/32/32	0/2/2/2
3	UDP	C	602	-	-	3/16/32/32	0/2/2/2
3	UDP	E	602	-	-	3/16/32/32	0/2/2/2
3	UDP	I	602	-	-	4/16/32/32	0/2/2/2
3	UDP	H	602	-	-	5/16/32/32	0/2/2/2
3	UDP	B	701	-	-	6/16/32/32	0/2/2/2
3	UDP	J	701	-	-	4/16/32/32	0/2/2/2
3	UDP	K	602	-	-	3/16/32/32	0/2/2/2

The worst 5 of 171 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	L	602	UDP	C4-N3	-10.02	1.21	1.38
3	F	602	UDP	C4-N3	-9.94	1.21	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	K	602	UDP	C4-N3	-9.72	1.22	1.38
3	D	602	UDP	C4-N3	-9.41	1.22	1.38
3	J	701	UDP	C4-N3	-9.29	1.22	1.38

The worst 5 of 144 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	602	UDP	C6-N1-C2	-9.98	108.86	121.00
3	L	602	UDP	C6-N1-C2	-9.83	109.04	121.00
3	E	602	UDP	C6-N1-C2	-9.38	109.58	121.00
3	H	602	UDP	C6-N1-C2	-9.00	110.05	121.00
3	F	602	UDP	C6-N1-C2	-8.83	110.25	121.00

There are no chirality outliers.

5 of 47 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	602	UDP	PA-O3A-PB-O3B
3	B	701	UDP	C5'-O5'-PA-O1A
3	C	602	UDP	PB-O3A-PA-O5'
3	D	602	UDP	C5'-O5'-PA-O2A
3	D	602	UDP	C5'-O5'-PA-O3A

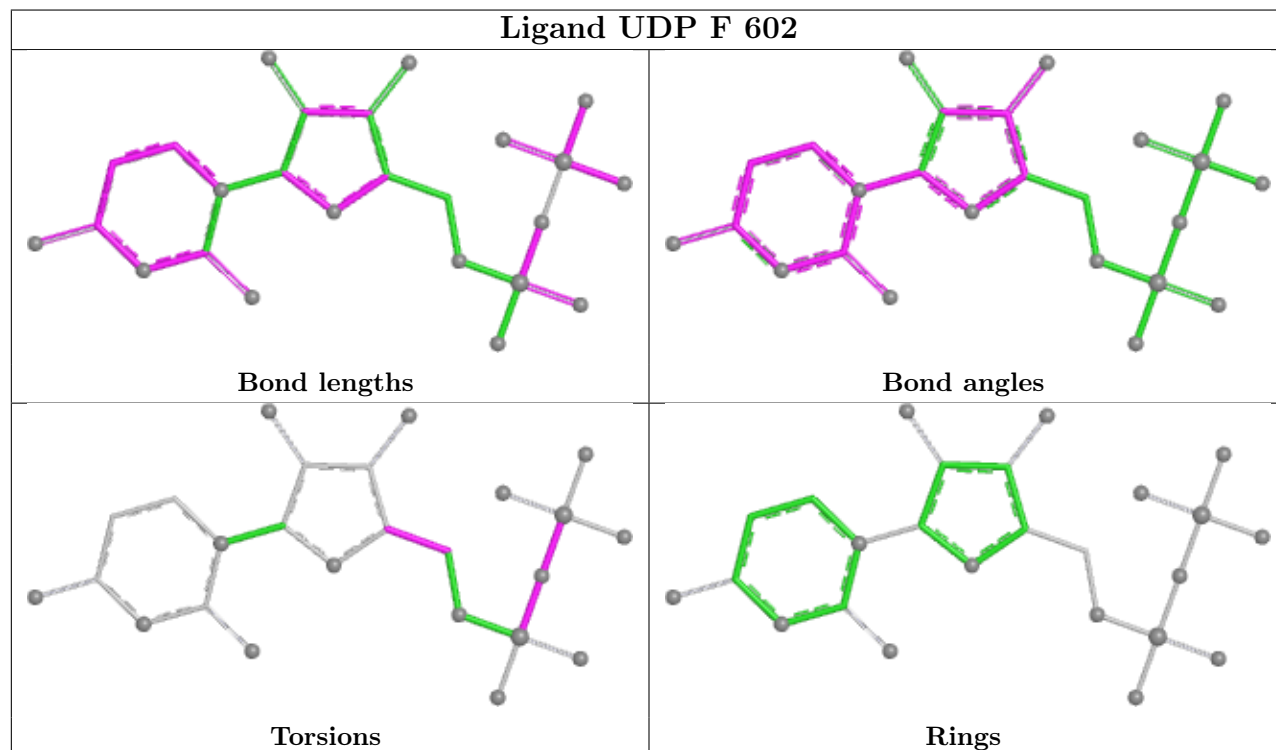
There are no ring outliers.

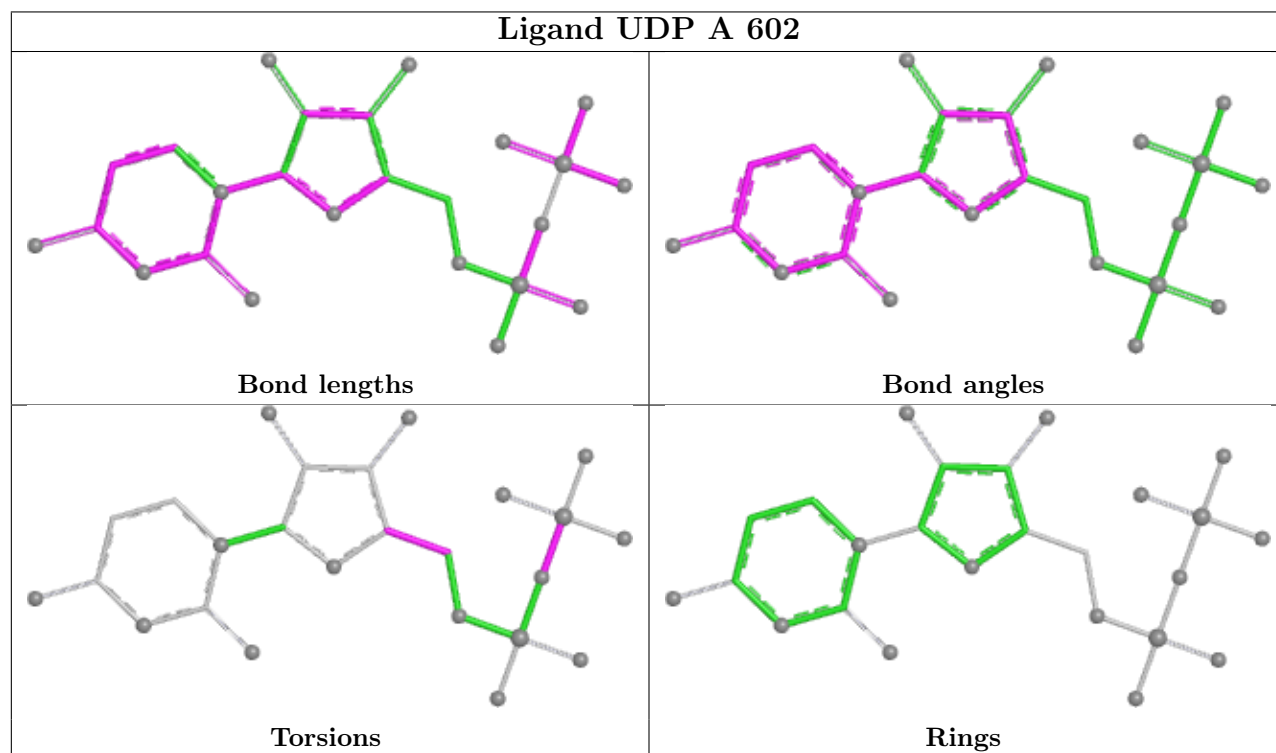
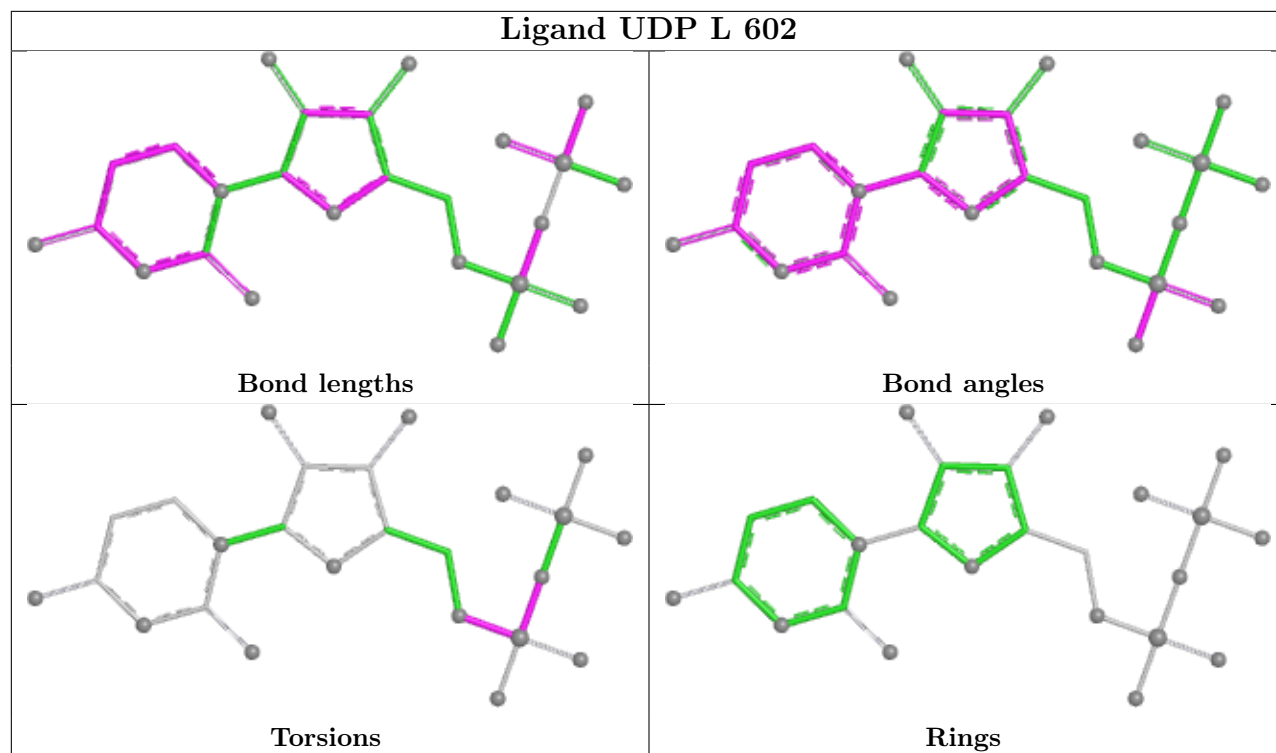
11 monomers are involved in 26 short contacts:

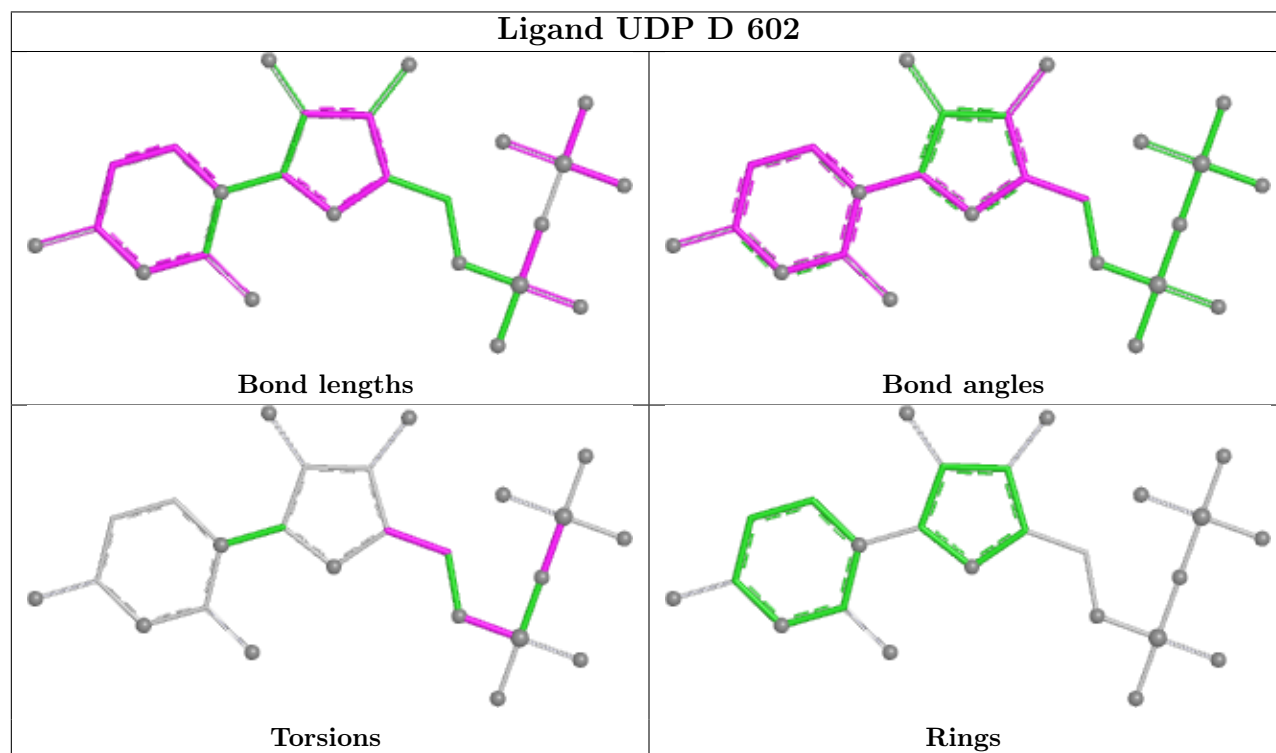
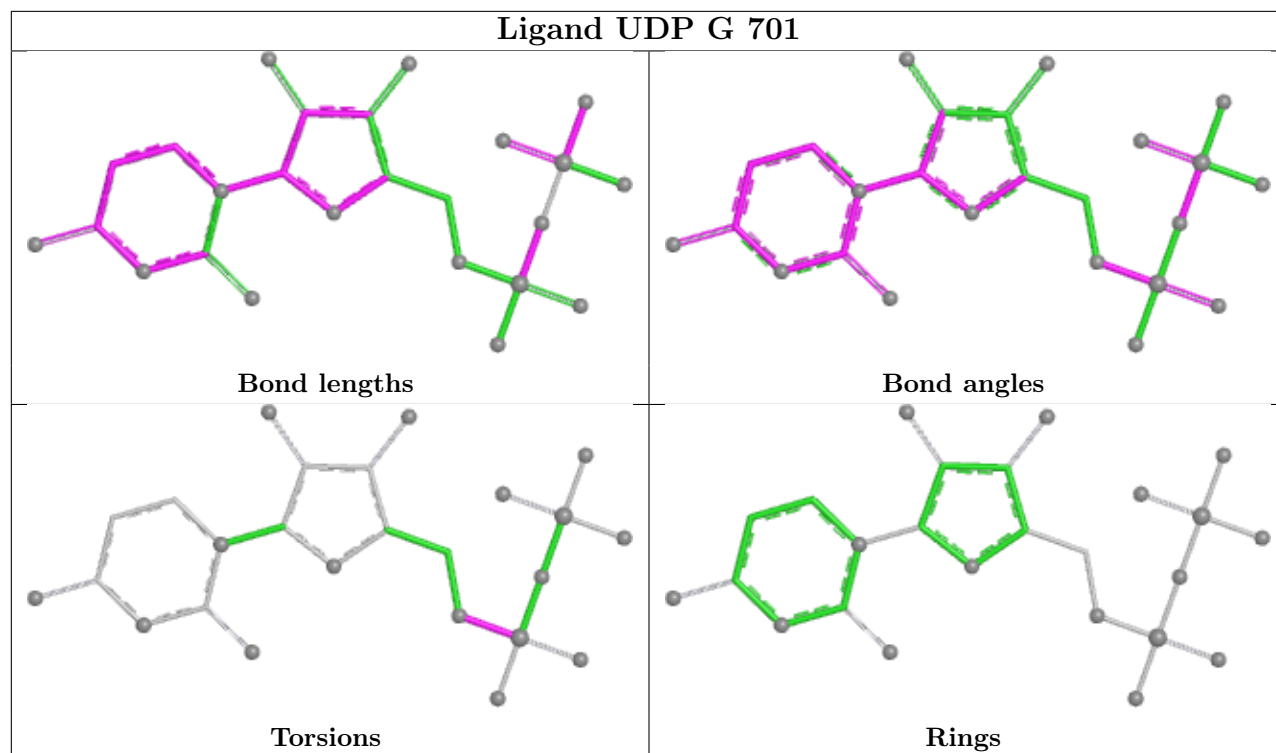
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	F	602	UDP	3	0
3	L	602	UDP	3	0
3	A	602	UDP	3	0
3	G	701	UDP	1	0
3	D	602	UDP	2	0
3	C	602	UDP	2	0
3	E	602	UDP	3	0
3	I	602	UDP	3	0
3	H	602	UDP	2	0
3	J	701	UDP	1	0
3	K	602	UDP	3	0

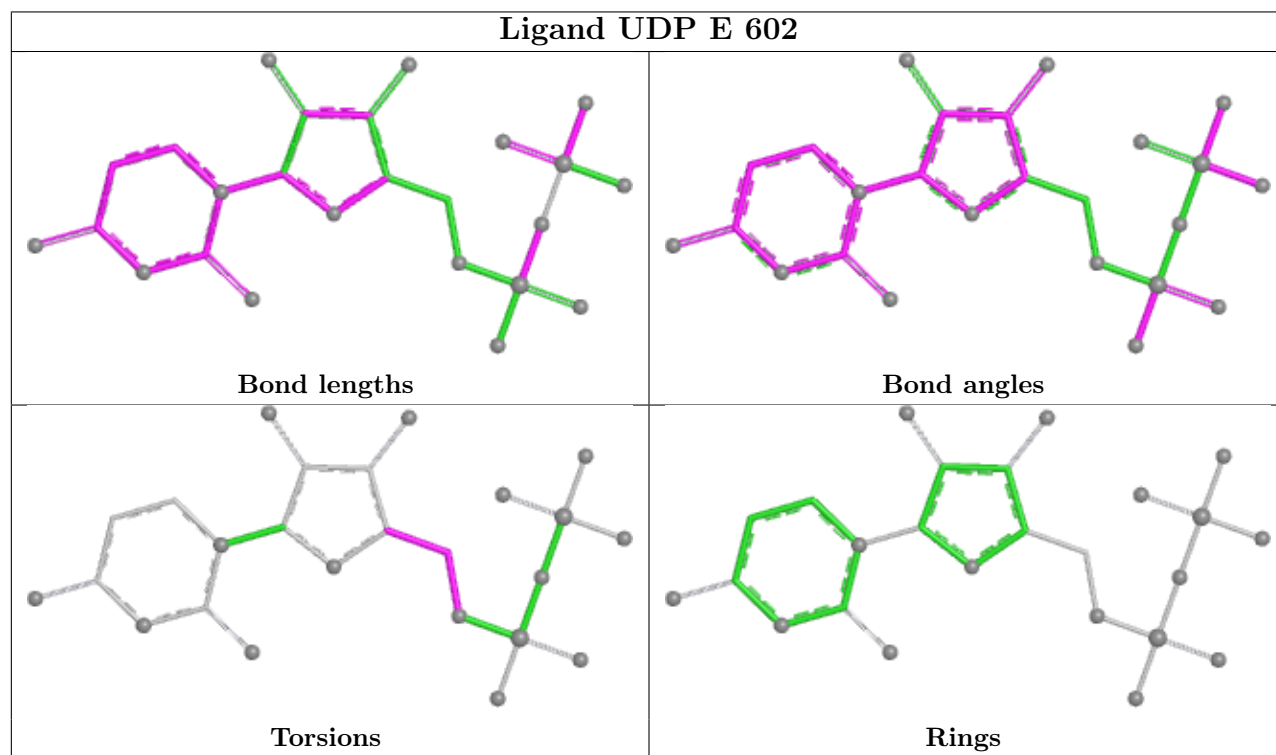
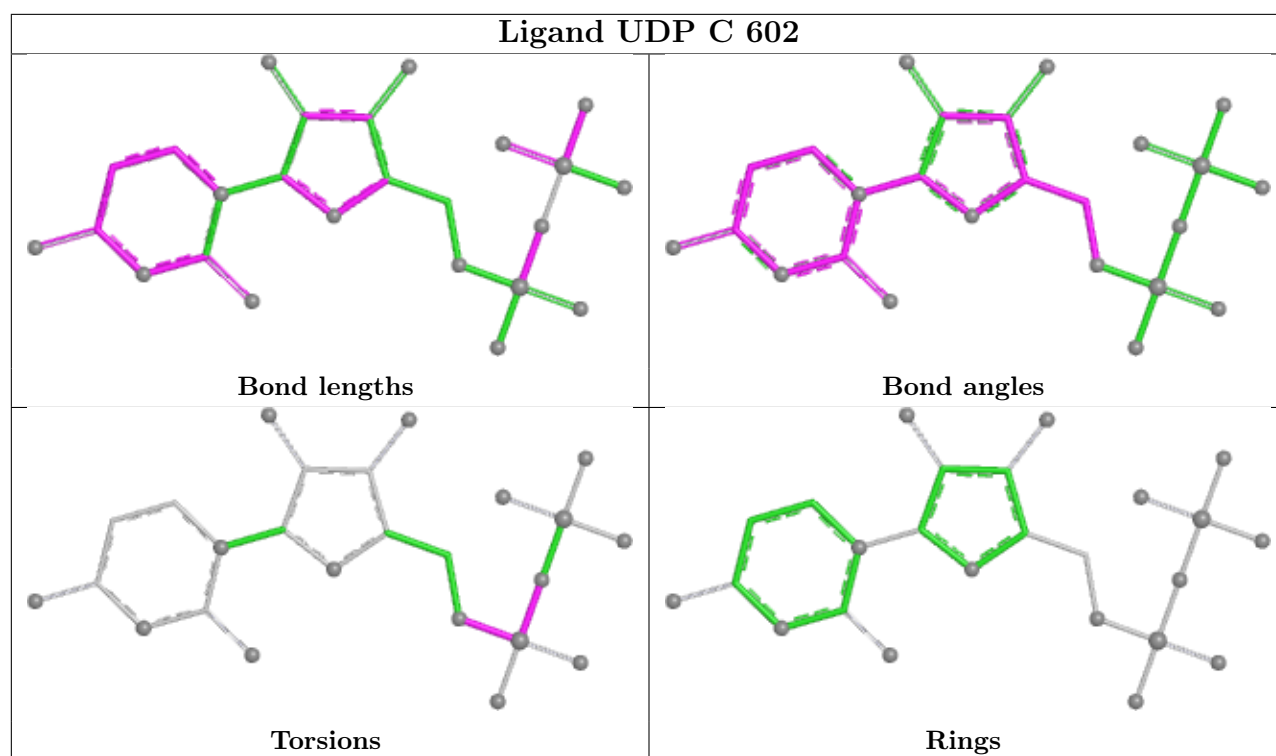
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In

addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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.

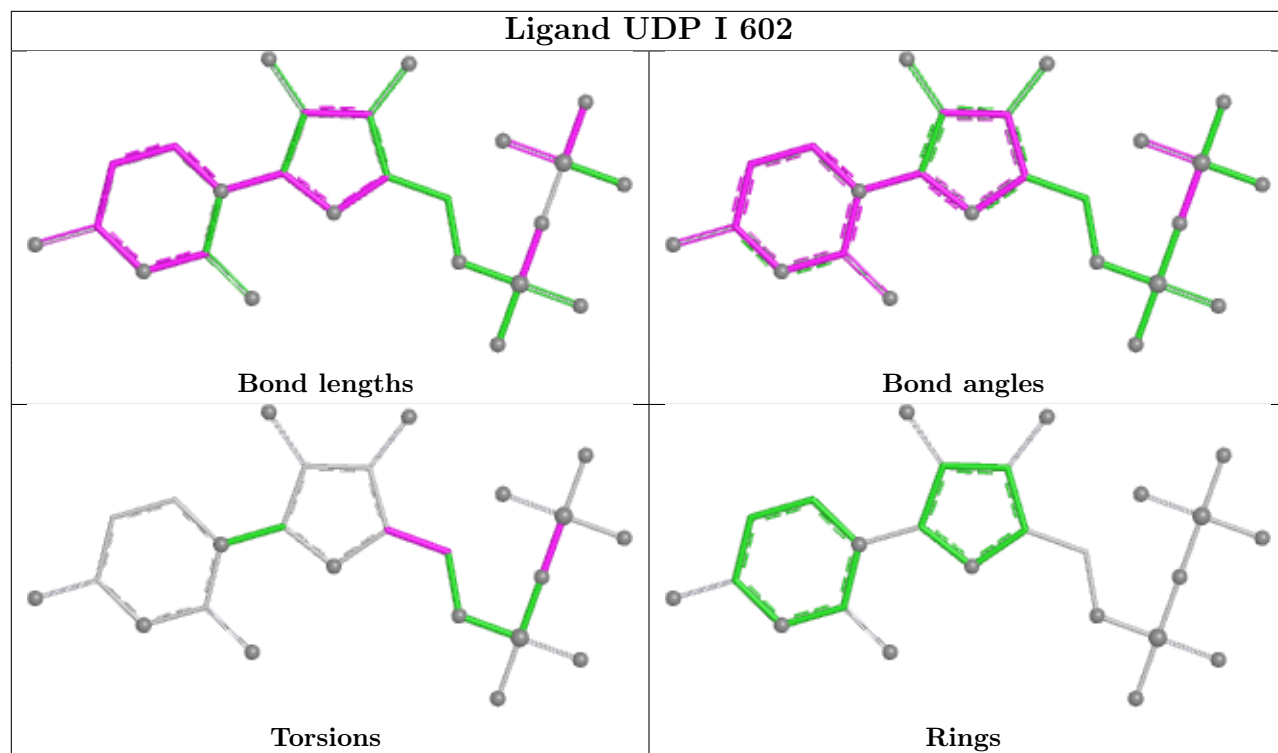




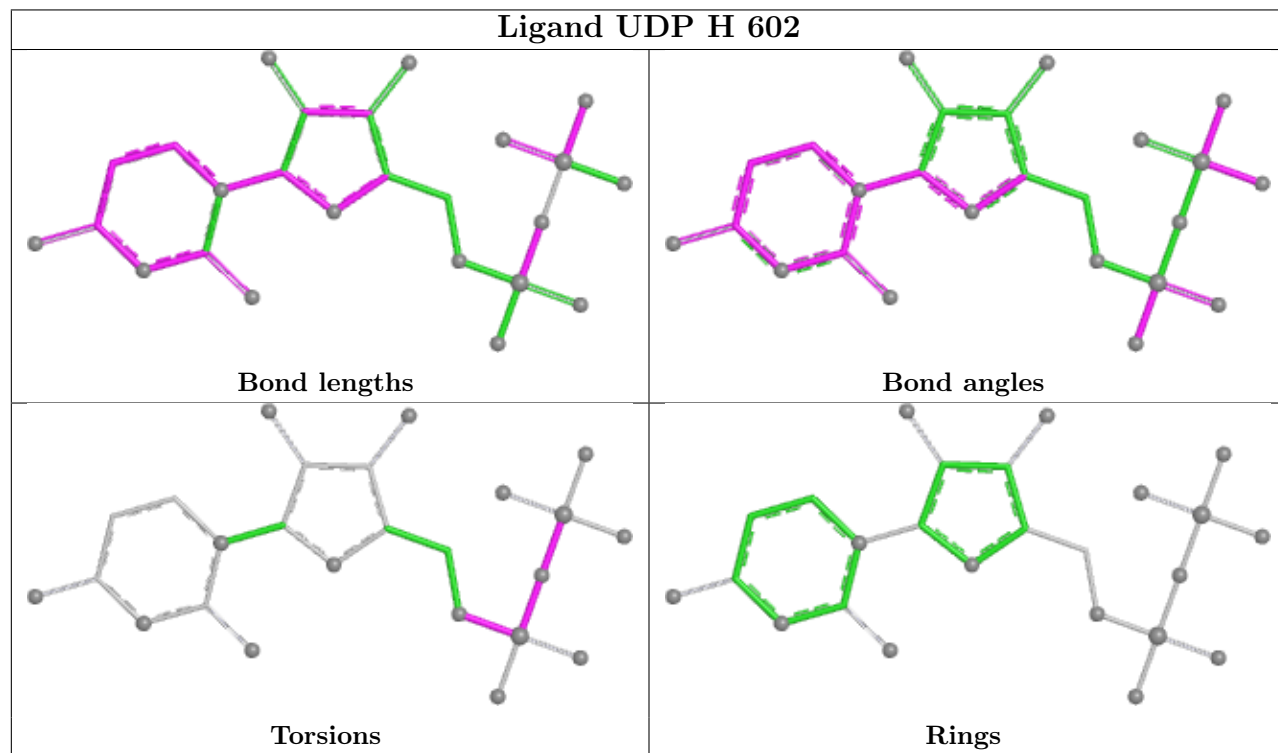


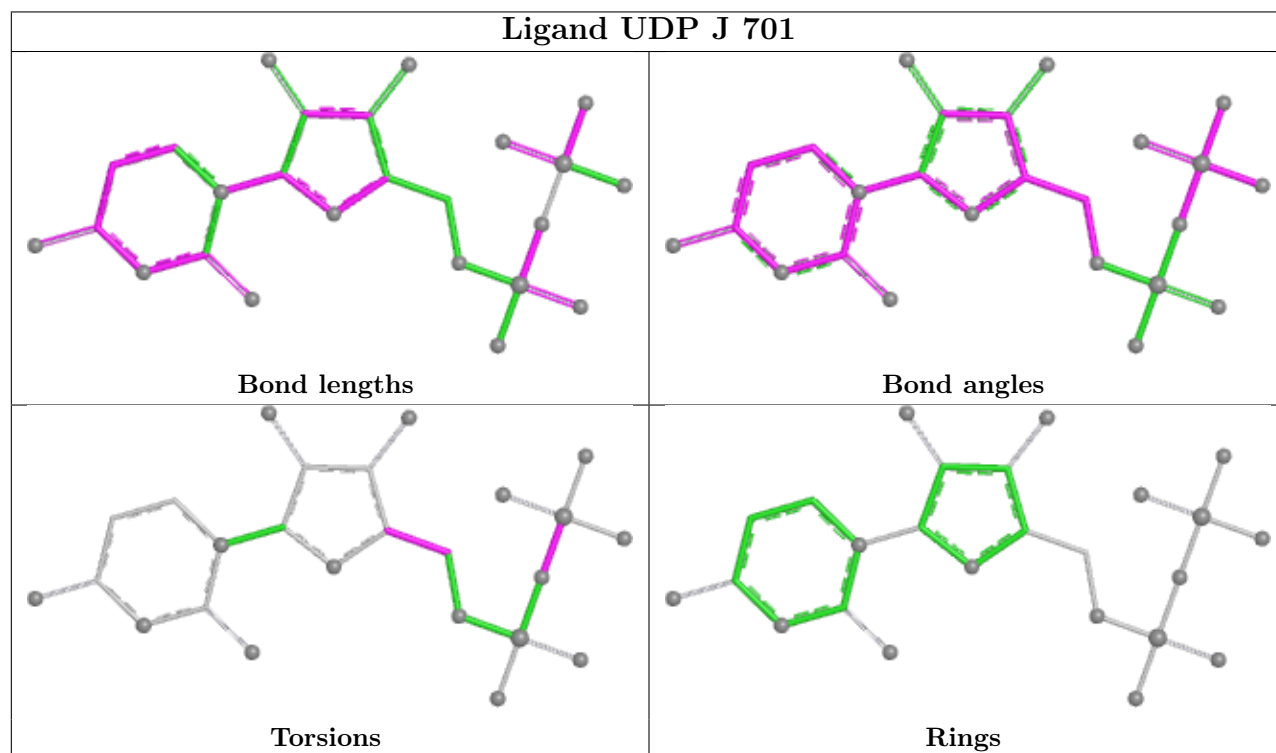
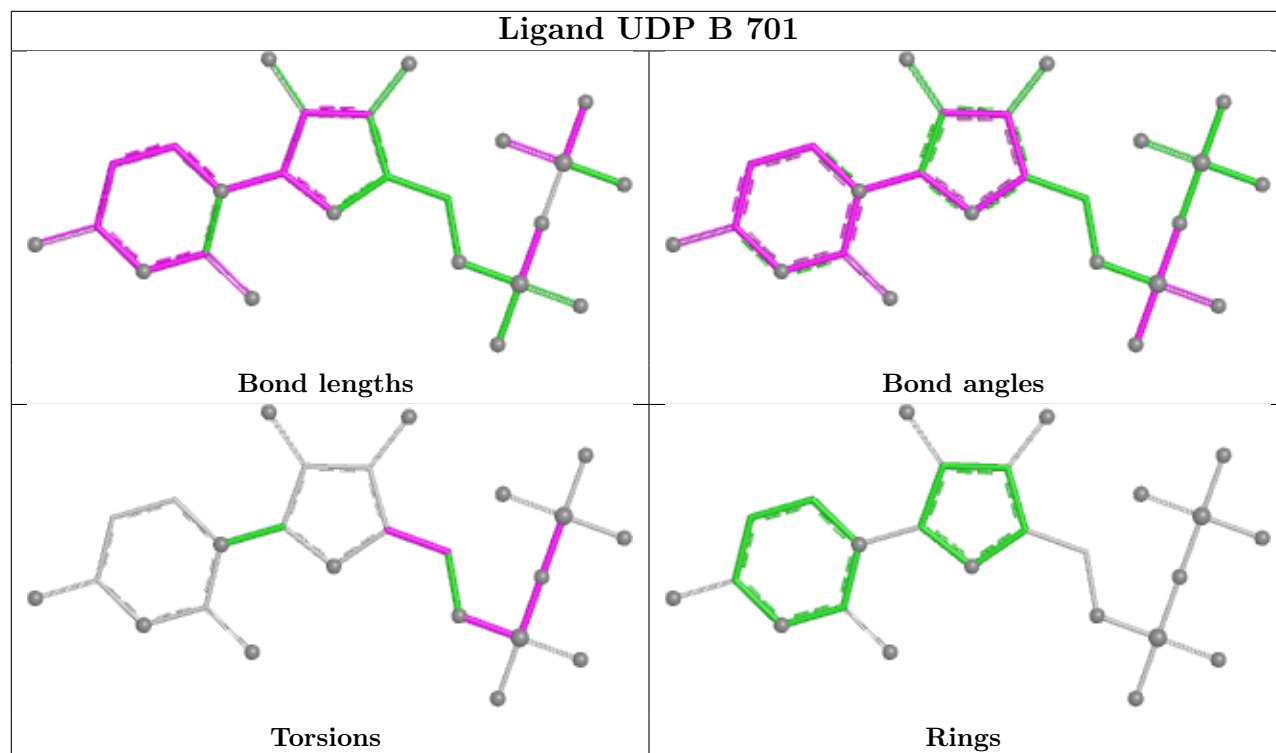


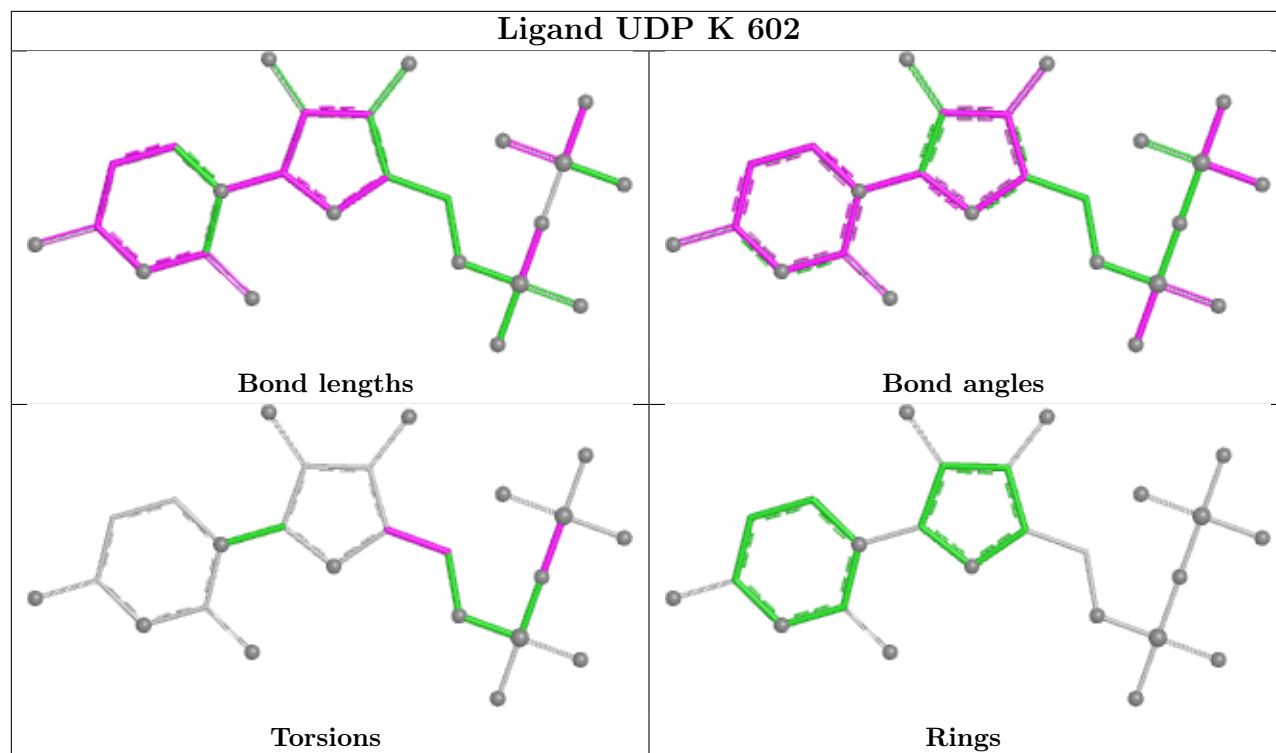
Ligand UDP I 602



Ligand UDP H 602







5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	400/455 (87%)	0.36	8 (2%) 65 41	50, 66, 87, 99	0
1	B	399/455 (87%)	0.40	10 (2%) 58 35	52, 73, 100, 107	0
1	C	400/455 (87%)	0.41	9 (2%) 61 38	51, 77, 110, 118	0
1	D	399/455 (87%)	0.49	9 (2%) 61 38	50, 73, 99, 109	0
1	E	400/455 (87%)	0.41	8 (2%) 65 41	48, 76, 107, 113	0
1	F	399/455 (87%)	0.38	13 (3%) 49 28	30, 73, 97, 111	0
1	G	400/455 (87%)	0.53	10 (2%) 58 35	57, 78, 100, 108	0
1	H	399/455 (87%)	0.63	15 (3%) 44 24	58, 85, 119, 125	0
1	I	399/455 (87%)	0.61	18 (4%) 38 20	30, 83, 108, 116	0
1	J	400/455 (87%)	0.72	19 (4%) 35 19	60, 88, 112, 118	0
1	K	399/455 (87%)	0.73	14 (3%) 47 27	61, 90, 123, 131	0
1	L	400/455 (87%)	0.79	26 (6%) 25 13	63, 91, 126, 131	0
All	All	4794/5460 (87%)	0.54	159 (3%) 49 28	30, 79, 111, 131	0

The worst 5 of 159 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	283	ASP	6.1
1	E	136	TRP	5.2
1	A	285	ALA	4.6
1	A	283	ASP	4.5
1	F	136	TRP	4.0

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

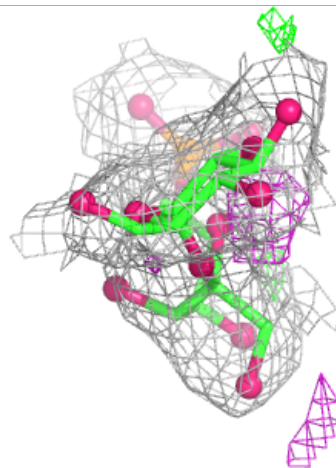
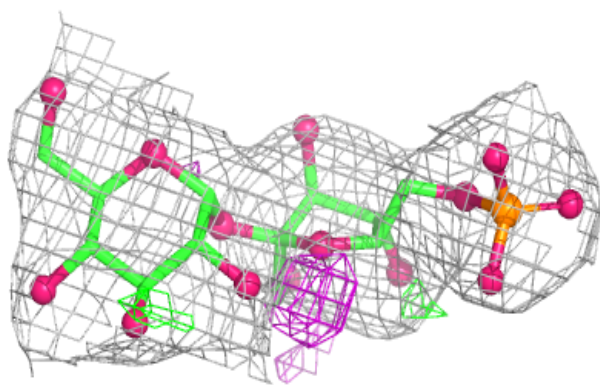
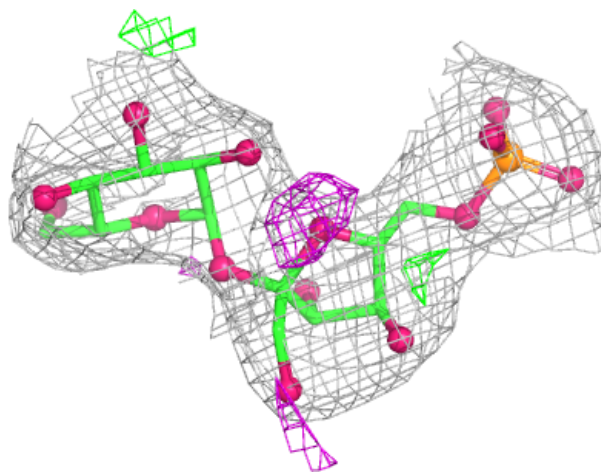
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	F6P	U	2	16/16	0.69	0.18	103,135,158,176	0
2	GLC	T	1	11/12	0.73	0.15	96,102,110,113	0
2	GLC	S	1	11/12	0.77	0.24	66,107,137,166	0
2	F6P	R	2	16/16	0.79	0.14	82,92,106,109	0
2	GLC	U	1	11/12	0.80	0.14	103,113,128,134	0
2	F6P	S	2	16/16	0.80	0.18	73,113,134,135	0
2	F6P	T	2	16/16	0.82	0.14	88,102,123,130	0
2	F6P	P	2	16/16	0.83	0.15	67,78,95,95	0
2	GLC	N	1	11/12	0.83	0.11	67,75,84,87	0
2	GLC	O	1	11/12	0.84	0.10	57,64,74,74	0
2	F6P	N	2	16/16	0.85	0.12	66,83,96,101	0
2	F6P	Q	2	16/16	0.86	0.12	69,87,94,97	0
2	F6P	O	2	16/16	0.86	0.12	59,78,91,93	0
2	GLC	P	1	11/12	0.88	0.10	51,61,66,71	0
2	GLC	R	1	11/12	0.88	0.08	52,77,87,87	0
2	F6P	M	2	16/16	0.88	0.11	55,62,70,71	0
2	GLC	Q	1	11/12	0.89	0.09	60,62,68,69	0
2	GLC	M	1	11/12	0.89	0.09	49,53,58,60	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.

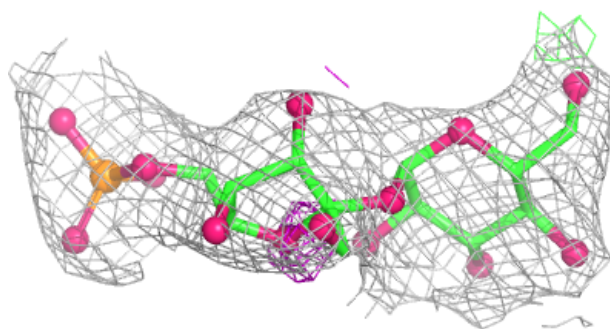
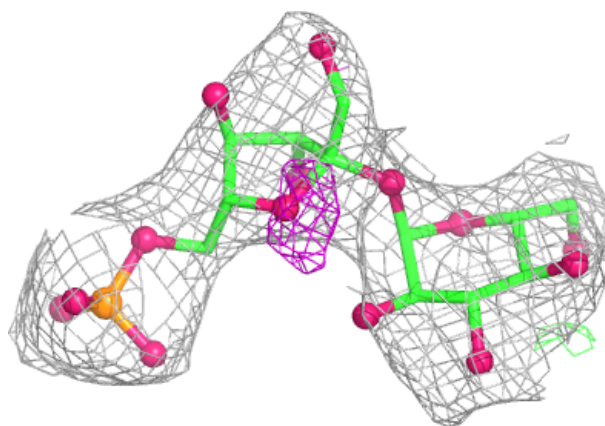
Electron density around Chain M:

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



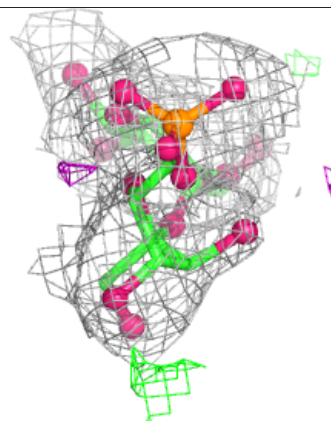
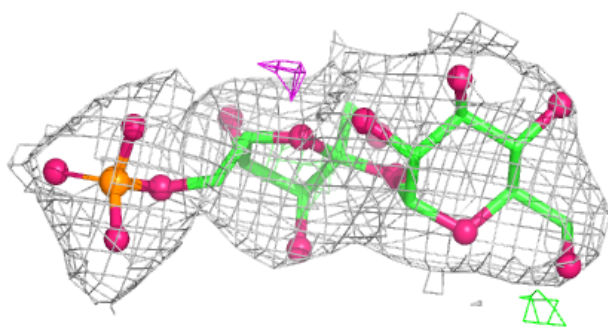
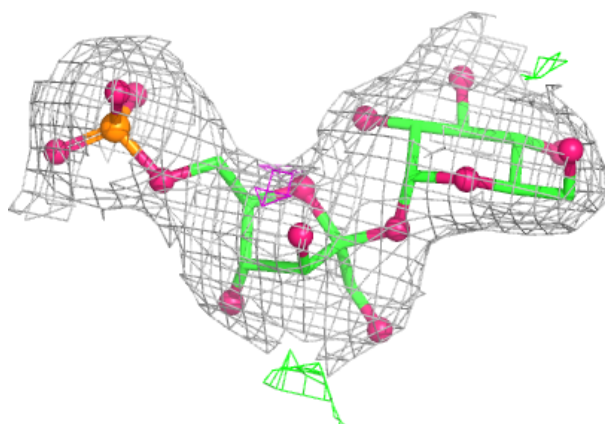
Electron density around Chain N:

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



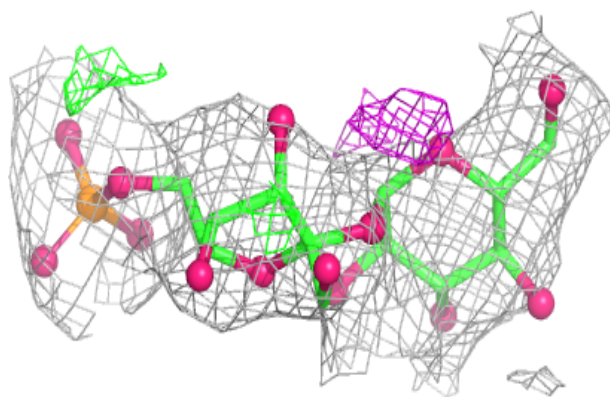
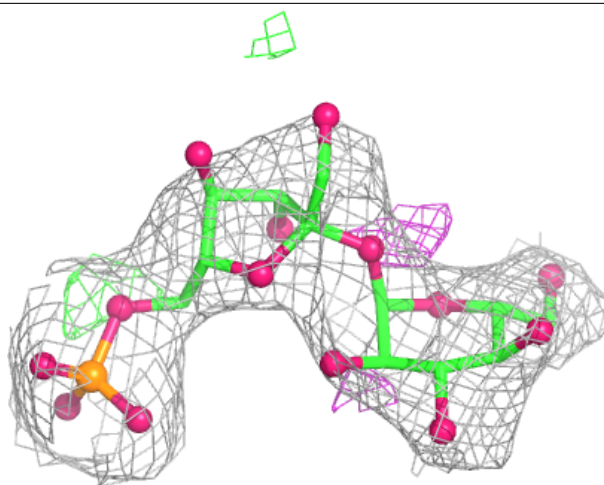
Electron density around Chain O:

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



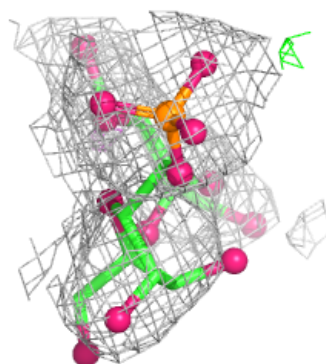
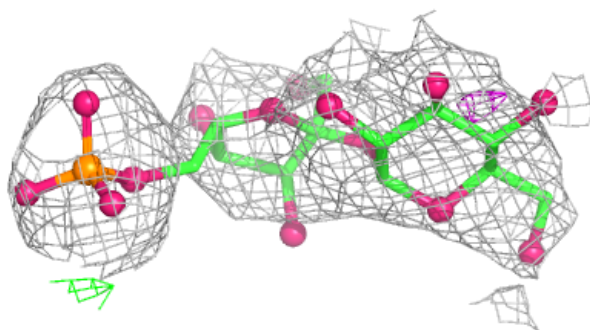
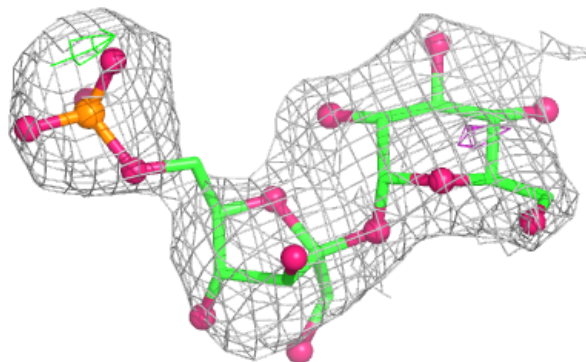
Electron density around Chain P:

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

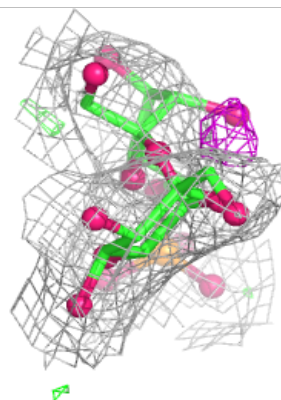
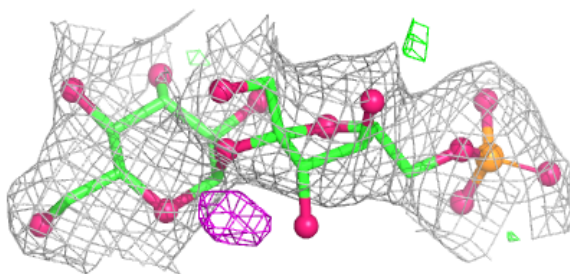
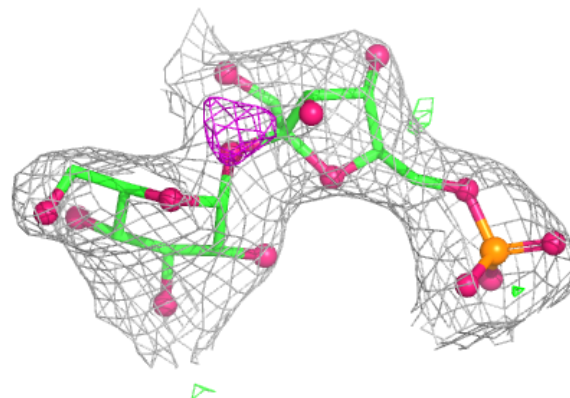


Electron density around Chain Q:

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

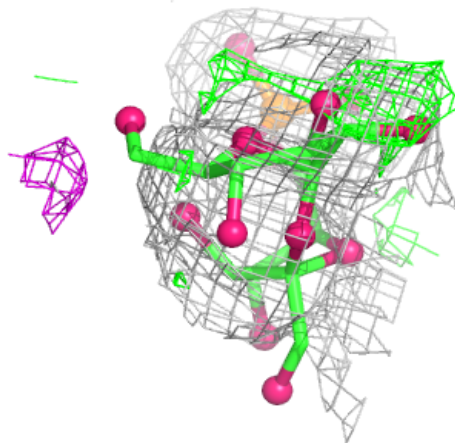
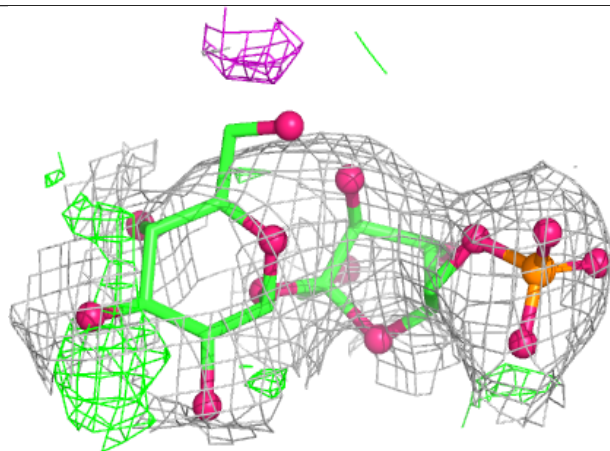
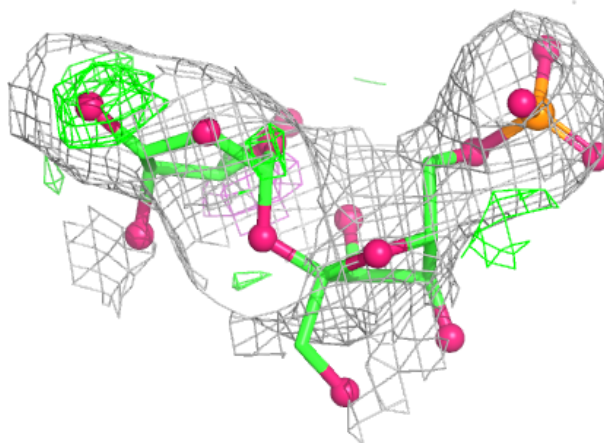
**Electron density around Chain R:**

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



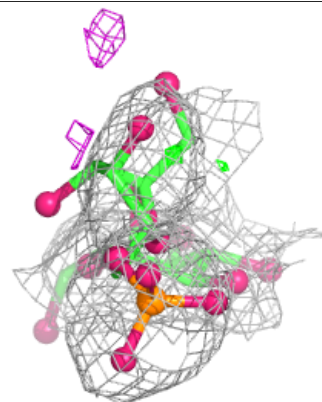
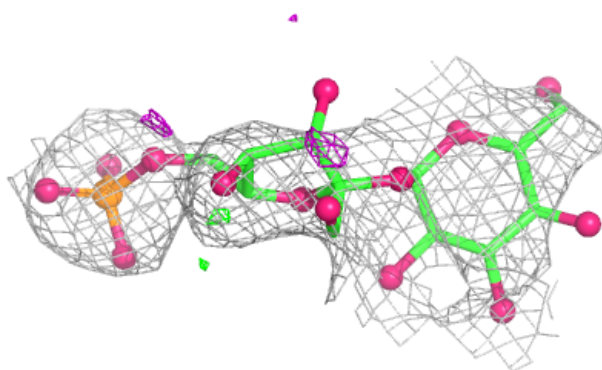
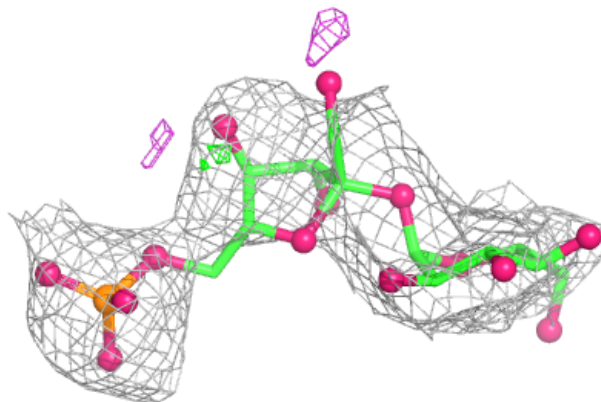
Electron density around Chain S:

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

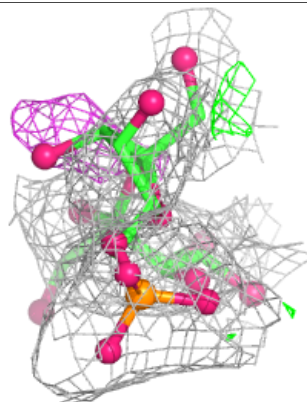
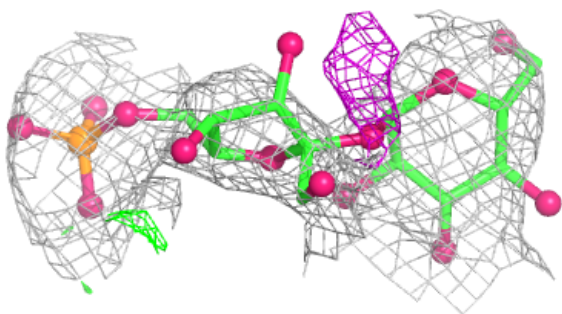
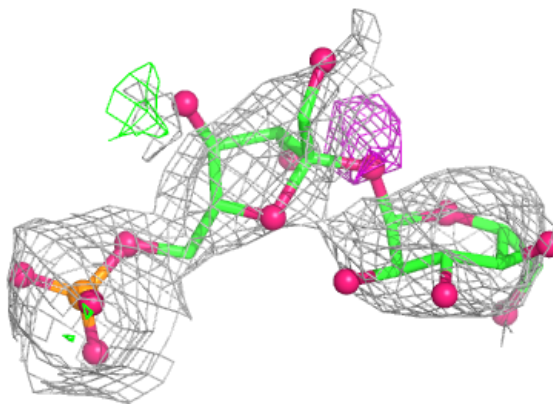


Electron density around Chain T:

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

**Electron density around Chain U:**

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



6.4 Ligands

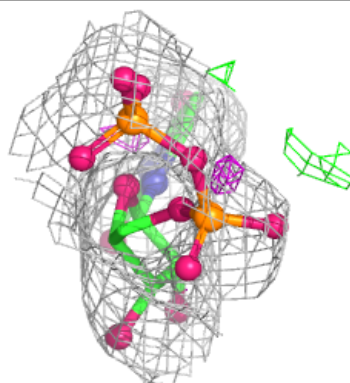
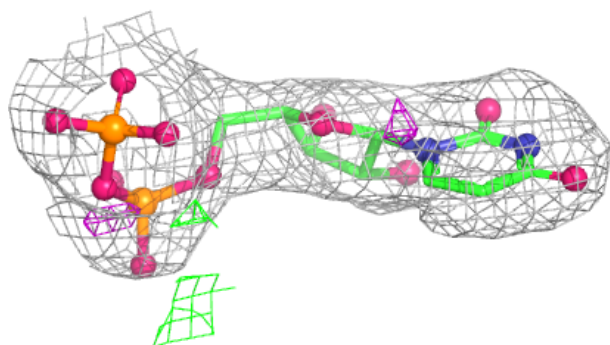
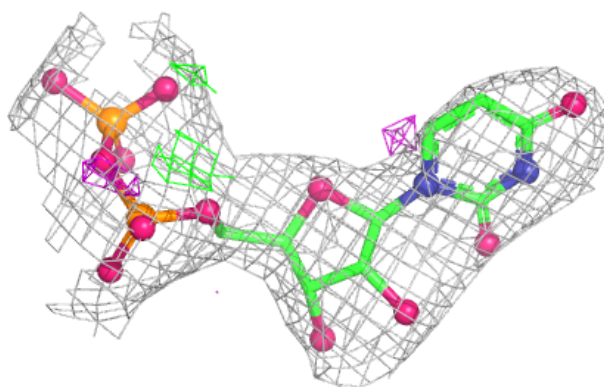
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	UDP	L	602	25/25	0.84	0.14	83,97,108,118	0
3	UDP	J	701	25/25	0.86	0.11	68,75,82,84	0
3	UDP	I	602	25/25	0.90	0.09	59,70,79,91	0
3	UDP	H	602	25/25	0.91	0.09	60,68,86,89	0
3	UDP	K	602	25/25	0.92	0.09	66,74,88,95	0
3	UDP	D	602	25/25	0.92	0.09	43,56,64,71	0
3	UDP	A	602	25/25	0.94	0.08	43,48,56,63	0
3	UDP	F	602	25/25	0.94	0.08	54,60,69,78	0
3	UDP	G	701	25/25	0.94	0.08	53,62,71,72	0
3	UDP	B	701	25/25	0.94	0.07	45,57,65,67	0
3	UDP	E	602	25/25	0.95	0.07	56,63,70,70	0
3	UDP	C	602	25/25	0.95	0.07	49,62,70,73	0

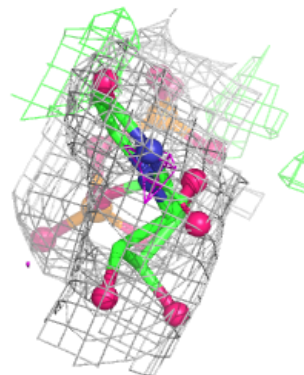
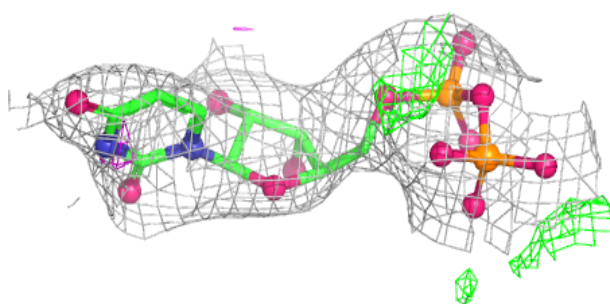
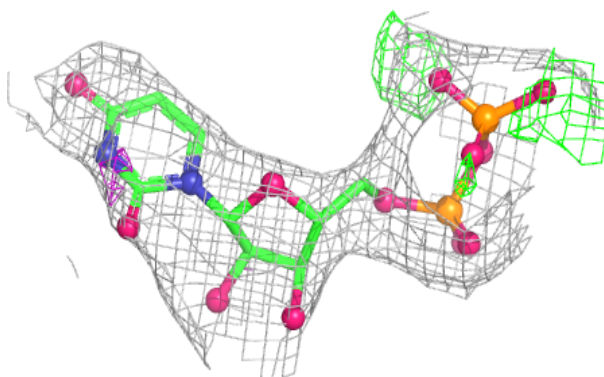
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around UDP L 602:

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

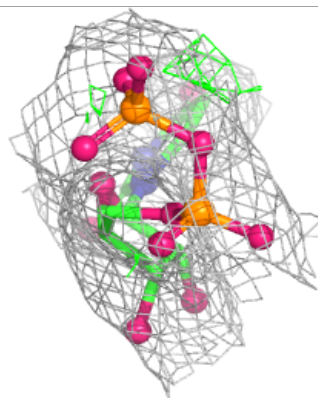
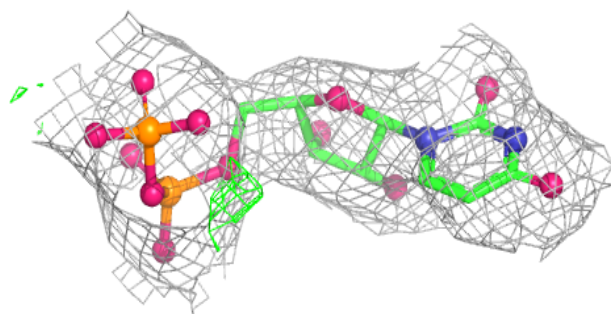
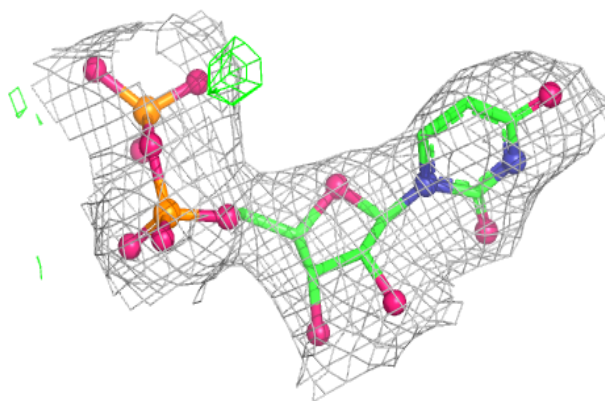
**Electron density around UDP J 701:**

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

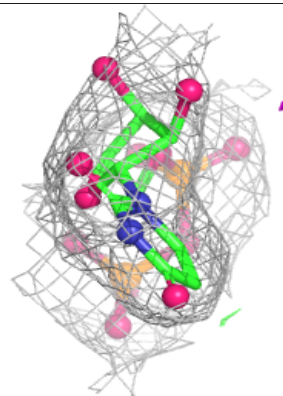
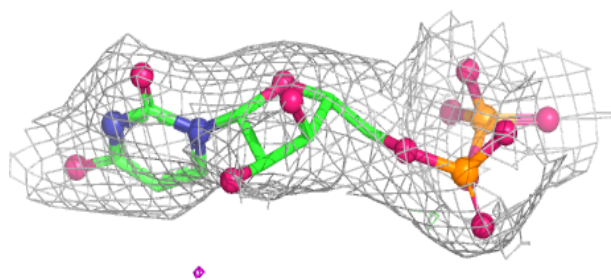
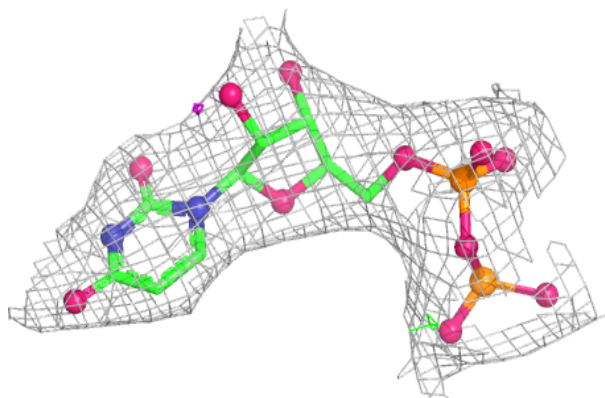


Electron density around UDP I 602:

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and green (positive)

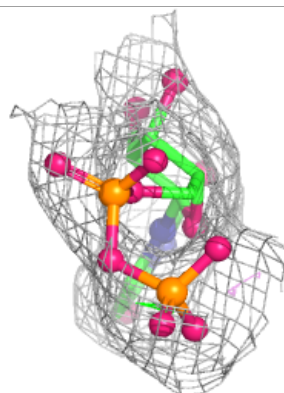
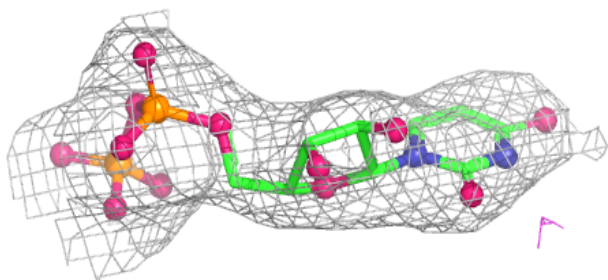
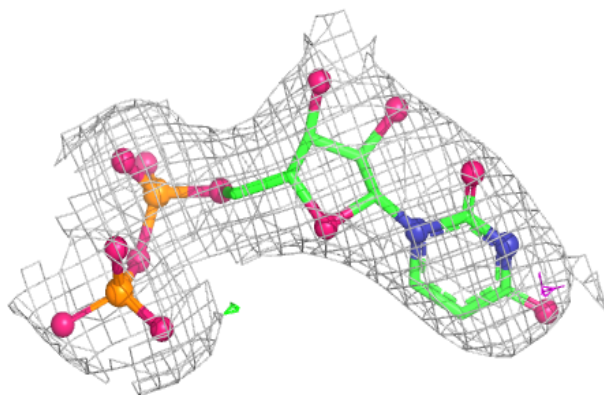
**Electron density around UDP H 602:**

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and green (positive)

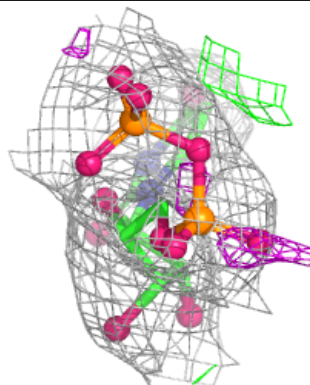
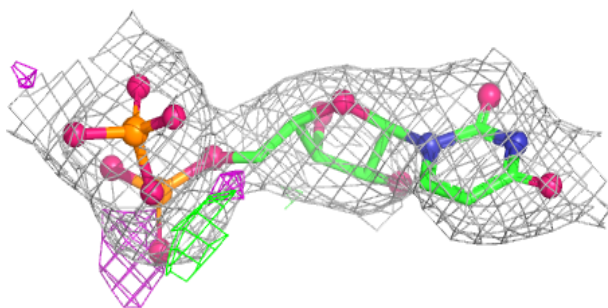
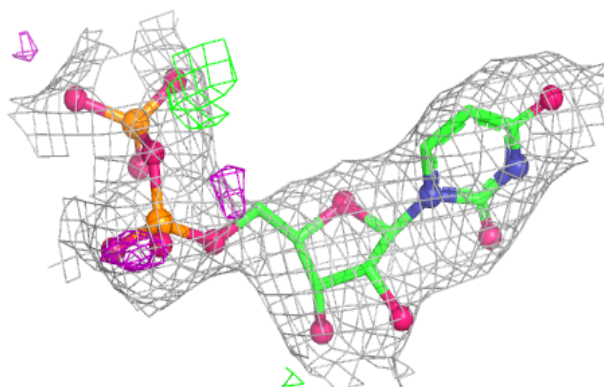


Electron density around UDP K 602:

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

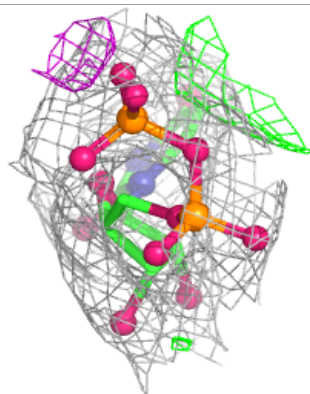
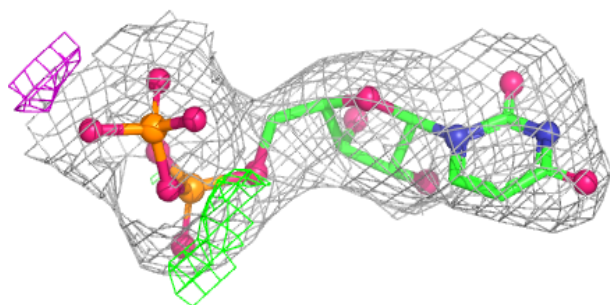
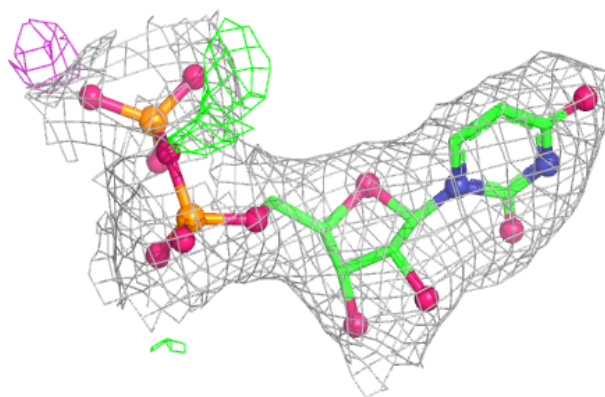
**Electron density around UDP D 602:**

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

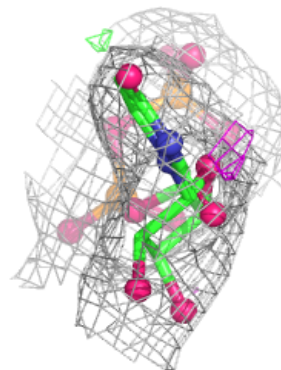
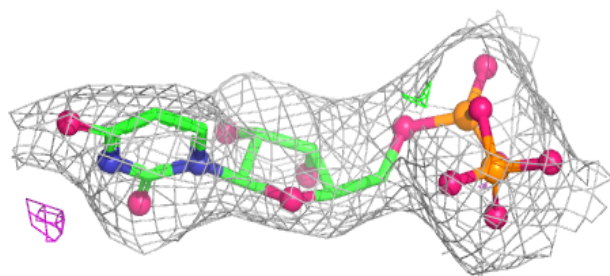
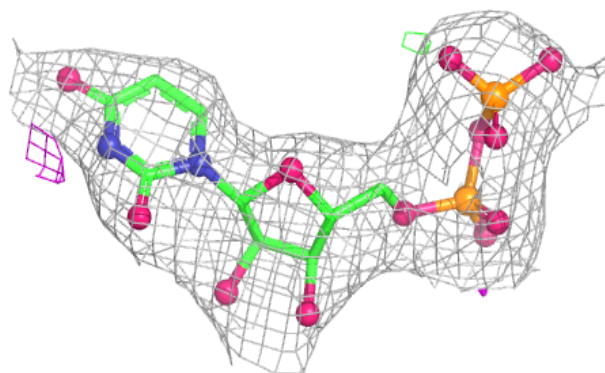


Electron density around UDP A 602:

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and green (positive)

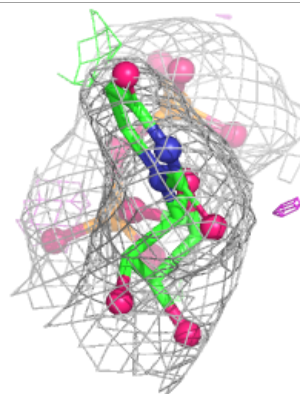
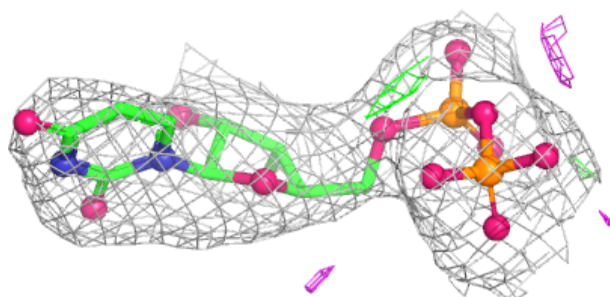
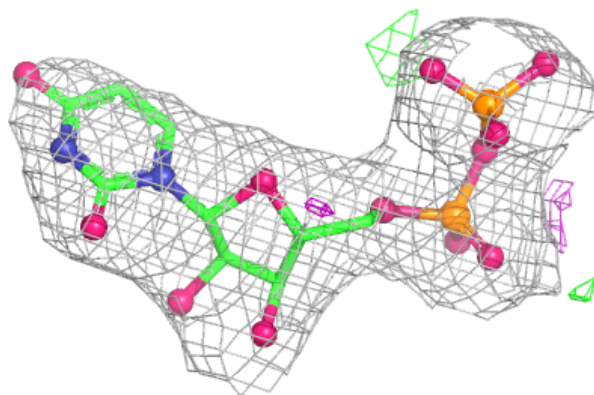
**Electron density around UDP F 602:**

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

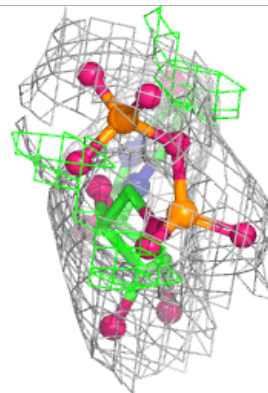
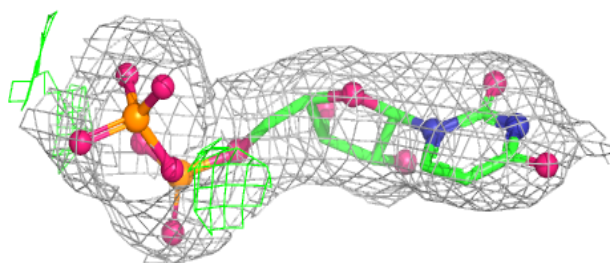
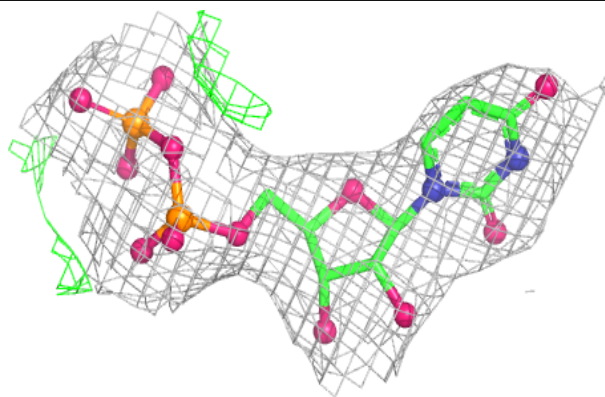


Electron density around UDP G 701:

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

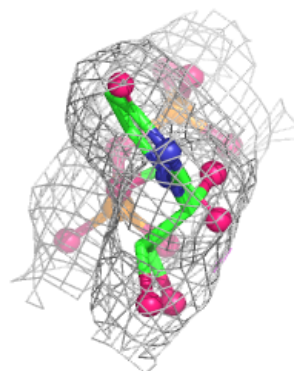
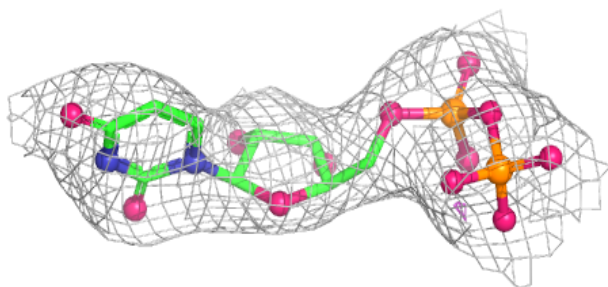
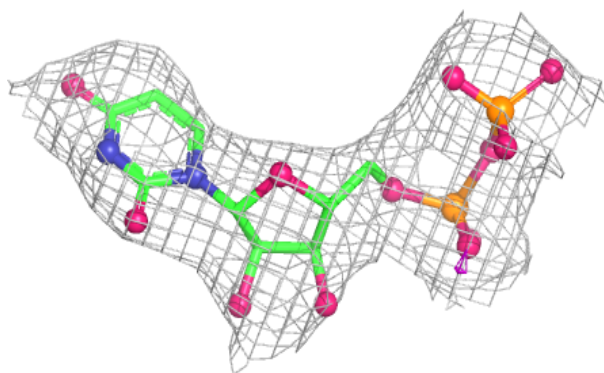
**Electron density around UDP B 701:**

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

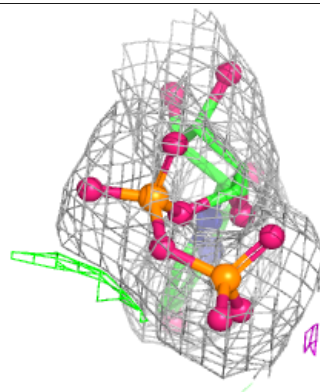
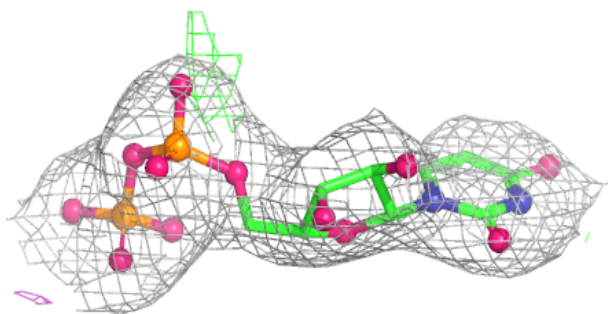
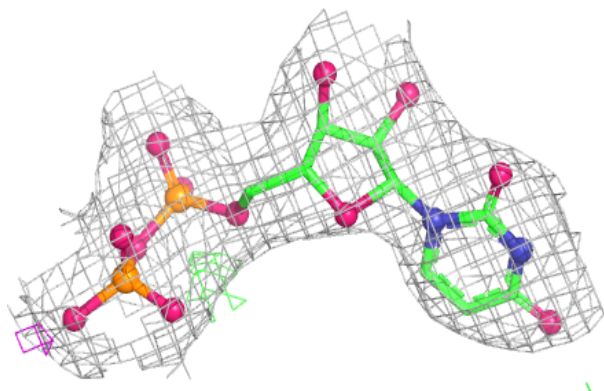


Electron density around UDP E 602:

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

**Electron density around UDP C 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.