



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 10, 2023 – 09:17 PM EDT

PDB ID : 4KQM  
Title : Crystal structure of yeast glycogen synthase E169Q mutant in complex with glucose and UDP  
Authors : Chikwana, V.M.; Hurley, T.D.  
Deposited on : 2013-05-15  
Resolution : 2.77 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.35.1  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35.1

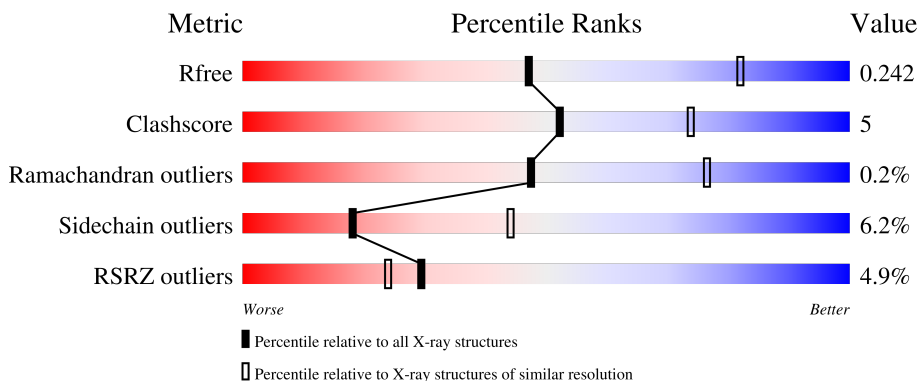
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.77 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	4107 (2.80-2.76)
Clashscore	141614	4575 (2.80-2.76)
Ramachandran outliers	138981	4487 (2.80-2.76)
Sidechain outliers	138945	4489 (2.80-2.76)
RSRZ outliers	127900	4027 (2.80-2.76)

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

Mol	Chain	Length	Quality of chain
1	A	724	 4% 73% 14% • 12%
1	B	724	 2% 72% 15% • 12%
1	C	724	 4% 72% 15% • 12%
1	D	724	 7% 72% 15% • 12%

## 2 Entry composition i

There are 6 unique types of molecules in this entry. The entry contains 20825 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 Gsy2p.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	638	5157	3292	903	943	19	0	0	0
1	B	638	5163	3296	904	944	19	0	1	0
1	C	638	5157	3292	903	943	19	0	0	0
1	D	635	5132	3276	900	937	19	0	0	0

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-18	MET	-	initiating methionine	UNP E7NKU1
A	-17	GLY	-	expression tag	UNP E7NKU1
A	-16	SER	-	expression tag	UNP E7NKU1
A	-15	SER	-	expression tag	UNP E7NKU1
A	-14	HIS	-	expression tag	UNP E7NKU1
A	-13	HIS	-	expression tag	UNP E7NKU1
A	-12	HIS	-	expression tag	UNP E7NKU1
A	-11	HIS	-	expression tag	UNP E7NKU1
A	-10	HIS	-	expression tag	UNP E7NKU1
A	-9	HIS	-	expression tag	UNP E7NKU1
A	-8	SER	-	expression tag	UNP E7NKU1
A	-7	SER	-	expression tag	UNP E7NKU1
A	-6	GLY	-	expression tag	UNP E7NKU1
A	-5	LEU	-	expression tag	UNP E7NKU1
A	-4	VAL	-	expression tag	UNP E7NKU1
A	-3	PRO	-	expression tag	UNP E7NKU1
A	-2	ARG	-	expression tag	UNP E7NKU1
A	-1	GLY	-	expression tag	UNP E7NKU1
A	0	SER	-	expression tag	UNP E7NKU1
A	169	GLN	GLU	engineered mutation	UNP E7NKU1
B	-18	MET	-	initiating methionine	UNP E7NKU1

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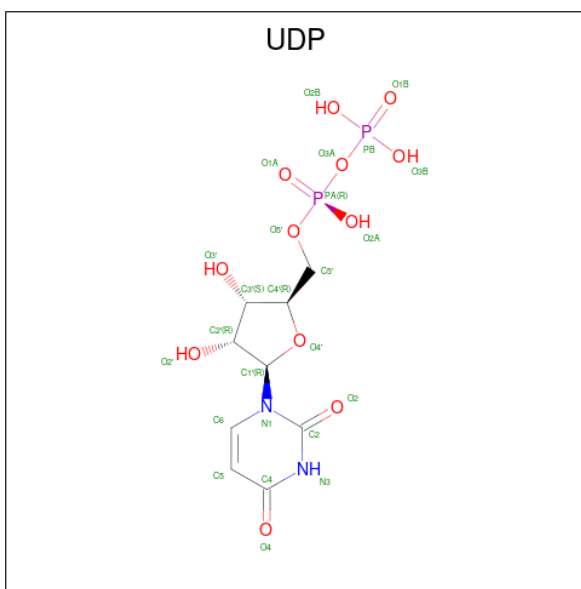
Chain	Residue	Modelled	Actual	Comment	Reference
B	-17	GLY	-	expression tag	UNP E7NKU1
B	-16	SER	-	expression tag	UNP E7NKU1
B	-15	SER	-	expression tag	UNP E7NKU1
B	-14	HIS	-	expression tag	UNP E7NKU1
B	-13	HIS	-	expression tag	UNP E7NKU1
B	-12	HIS	-	expression tag	UNP E7NKU1
B	-11	HIS	-	expression tag	UNP E7NKU1
B	-10	HIS	-	expression tag	UNP E7NKU1
B	-9	HIS	-	expression tag	UNP E7NKU1
B	-8	SER	-	expression tag	UNP E7NKU1
B	-7	SER	-	expression tag	UNP E7NKU1
B	-6	GLY	-	expression tag	UNP E7NKU1
B	-5	LEU	-	expression tag	UNP E7NKU1
B	-4	VAL	-	expression tag	UNP E7NKU1
B	-3	PRO	-	expression tag	UNP E7NKU1
B	-2	ARG	-	expression tag	UNP E7NKU1
B	-1	GLY	-	expression tag	UNP E7NKU1
B	0	SER	-	expression tag	UNP E7NKU1
B	169	GLN	GLU	engineered mutation	UNP E7NKU1
C	-18	MET	-	initiating methionine	UNP E7NKU1
C	-17	GLY	-	expression tag	UNP E7NKU1
C	-16	SER	-	expression tag	UNP E7NKU1
C	-15	SER	-	expression tag	UNP E7NKU1
C	-14	HIS	-	expression tag	UNP E7NKU1
C	-13	HIS	-	expression tag	UNP E7NKU1
C	-12	HIS	-	expression tag	UNP E7NKU1
C	-11	HIS	-	expression tag	UNP E7NKU1
C	-10	HIS	-	expression tag	UNP E7NKU1
C	-9	HIS	-	expression tag	UNP E7NKU1
C	-8	SER	-	expression tag	UNP E7NKU1
C	-7	SER	-	expression tag	UNP E7NKU1
C	-6	GLY	-	expression tag	UNP E7NKU1
C	-5	LEU	-	expression tag	UNP E7NKU1
C	-4	VAL	-	expression tag	UNP E7NKU1
C	-3	PRO	-	expression tag	UNP E7NKU1
C	-2	ARG	-	expression tag	UNP E7NKU1
C	-1	GLY	-	expression tag	UNP E7NKU1
C	0	SER	-	expression tag	UNP E7NKU1
C	169	GLN	GLU	engineered mutation	UNP E7NKU1
D	-18	MET	-	initiating methionine	UNP E7NKU1
D	-17	GLY	-	expression tag	UNP E7NKU1
D	-16	SER	-	expression tag	UNP E7NKU1

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-15	SER	-	expression tag	UNP E7NKU1
D	-14	HIS	-	expression tag	UNP E7NKU1
D	-13	HIS	-	expression tag	UNP E7NKU1
D	-12	HIS	-	expression tag	UNP E7NKU1
D	-11	HIS	-	expression tag	UNP E7NKU1
D	-10	HIS	-	expression tag	UNP E7NKU1
D	-9	HIS	-	expression tag	UNP E7NKU1
D	-8	SER	-	expression tag	UNP E7NKU1
D	-7	SER	-	expression tag	UNP E7NKU1
D	-6	GLY	-	expression tag	UNP E7NKU1
D	-5	LEU	-	expression tag	UNP E7NKU1
D	-4	VAL	-	expression tag	UNP E7NKU1
D	-3	PRO	-	expression tag	UNP E7NKU1
D	-2	ARG	-	expression tag	UNP E7NKU1
D	-1	GLY	-	expression tag	UNP E7NKU1
D	0	SER	-	expression tag	UNP E7NKU1
D	169	GLN	GLU	engineered mutation	UNP E7NKU1

- Molecule 2 is URIDINE-5'-DIPHOSPHATE (three-letter code: UDP) (formula:  $C_9H_{14}N_2O_{12}P_2$ ).



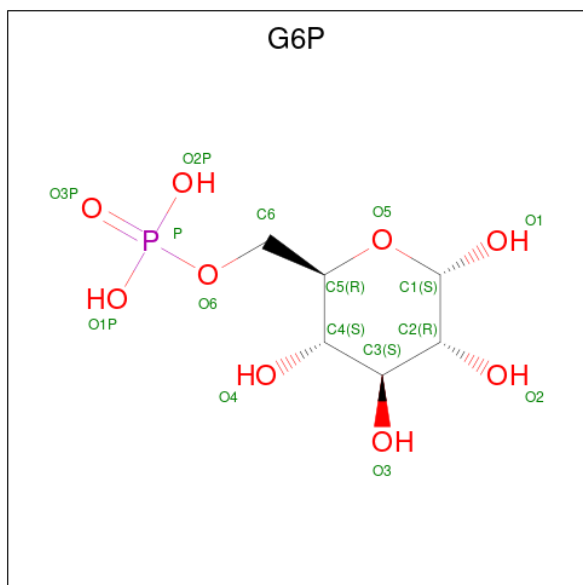
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
2	B	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
2	C	1	Total	C	N	O	P	0	0
			25	9	2	12	2		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	D	1	25	9	2	12	2	0	0

- Molecule 3 is 6-O-phosphono-alpha-D-glucopyranose (three-letter code: G6P) (formula:  $C_6H_{13}O_9P$ ).



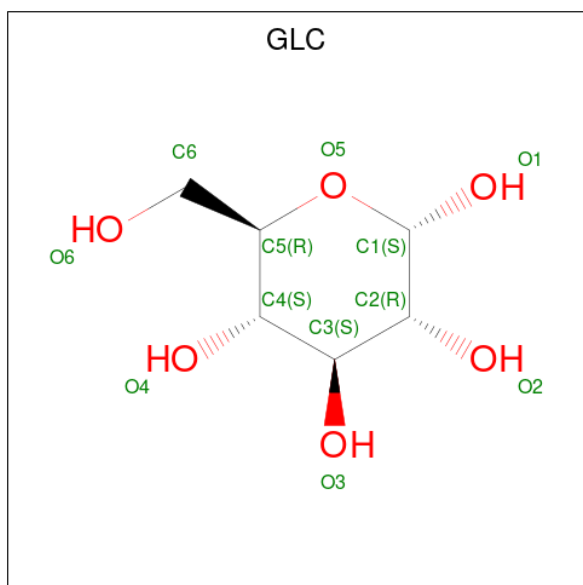
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	P		
3	A	1	16	6	9	1	0	0
3	B	1	16	6	9	1	0	0
3	C	1	16	6	9	1	0	0
3	D	1	16	6	9	1	0	0

- Molecule 4 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula:  $C_4H_{10}O_3$ ).



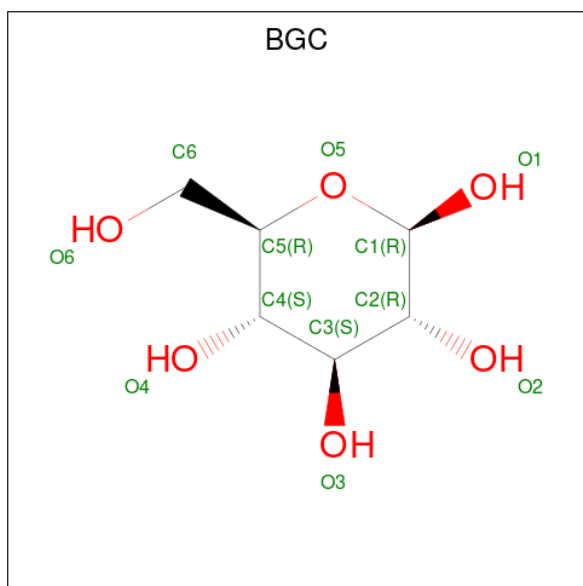
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 7 4 3	0	0
4	B	1	Total C O 7 4 3	0	0
4	C	1	Total C O 7 4 3	0	0
4	D	1	Total C O 7 4 3	0	0

- Molecule 5 is alpha-D-glucopyranose (three-letter code: GLC) (formula: C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>).



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

- Molecule 6 is beta-D-glucopyranose (three-letter code: BGC) (formula: C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>).



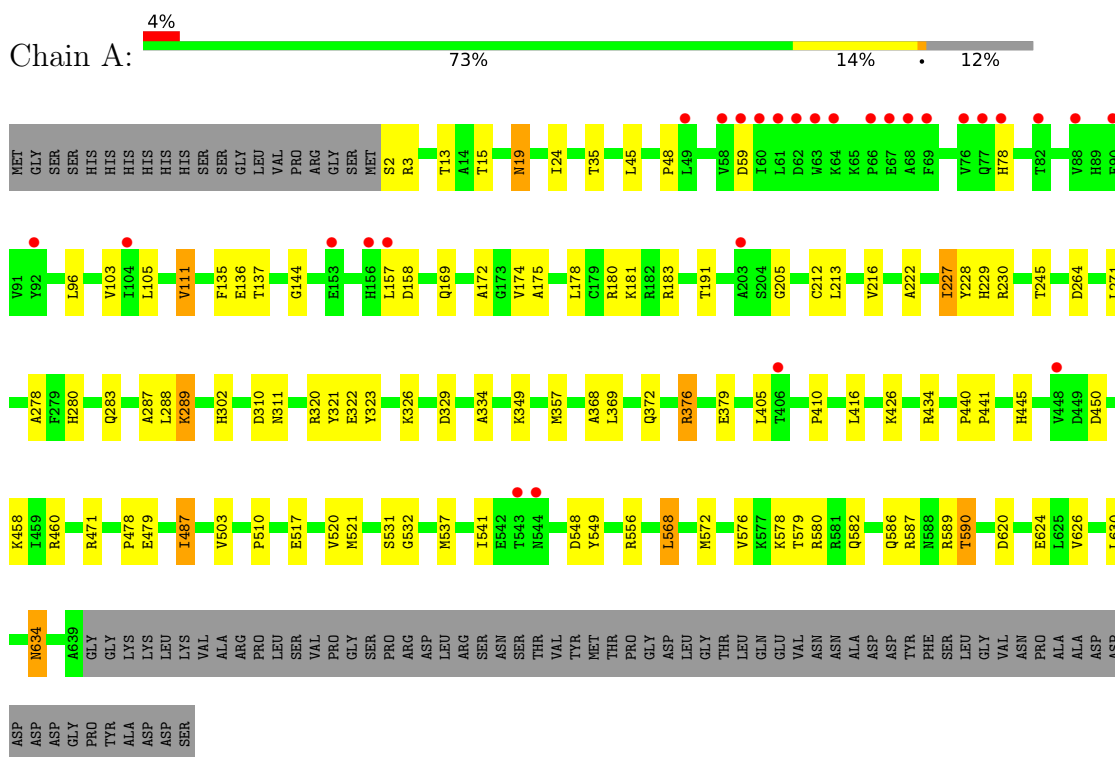
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	C	1	Total	C	O	0	0
			12	6	6		



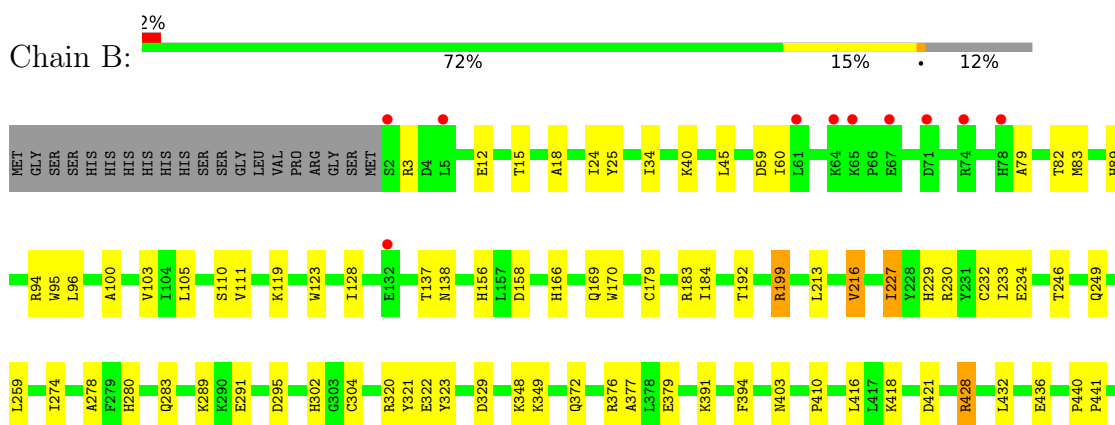
### 3 Residue-property plots

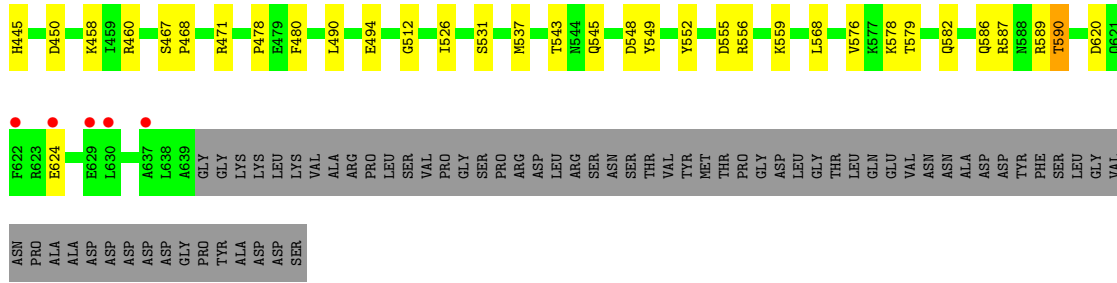
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Gsy2p

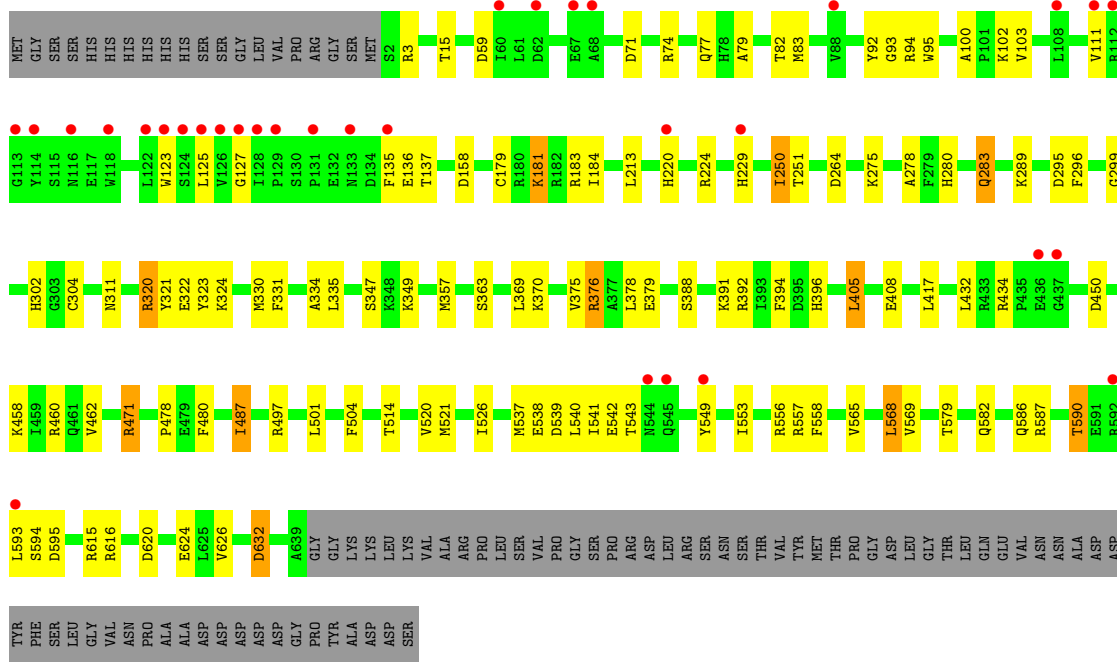


- Molecule 1: Gsy2p

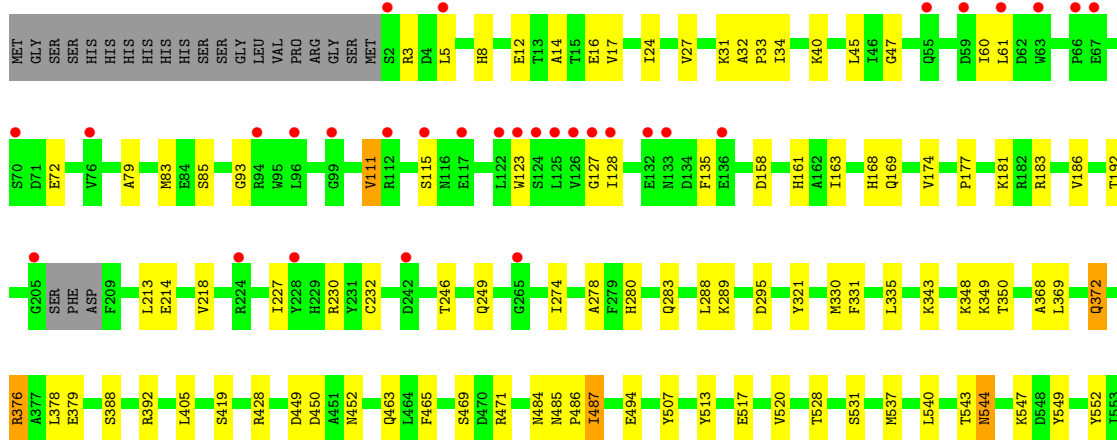




• Molecule 1: Gsy2p



• Molecule 1: Gsy2p



V554	ARG	
D555	PRO	
R556	LEU	
V565	SER	
V565	VAL	
L568	PRO	
L568	GLY	
T579	SER	
T579	PRO	
Q582	ARG	
Q582	ASP	
Q586	LEU	
R587	ARG	
R587	SER	
T590	ASN	
T590	SER	
S594	THR	
S594	VAL	
D598	TYR	
W599	MET	
W599	THR	
K600	PRO	
K600	THR	
L604	GLY	
L604	ASP	
L604	LEU	
V607	GLY	
V607	THR	
Q611	LEU	
Q611	LEU	
L614	GLN	
L614	GLU	
R615	VAL	
R615	VAL	
R615	ASN	
Y618	ASN	
P619	ALA	
D620	ALA	
D620	ASP	
Q621	ASP	
F622	TYR	
F622	TYR	
R623	PHE	
E624	SER	
E624	SER	
L625	LEU	
V626	LEU	
G627	GLY	
G627	VAL	
E628	ASN	
E628	ASN	
E629	PRO	
L630	ALA	
L630	ALA	
R631	ALA	
D632	ASP	
D632	ASP	
D636	ASP	
A637	ASP	
L638	ASP	
A639	GLY	
A639	GLY	
A639	PRO	
A639	TYR	
A639	ALA	
A639	ALA	
A639	LYS	
A639	LYS	
A639	LEU	
A639	LEU	
A639	LYS	
A639	LYS	
A639	VAL	
A639	VAL	
A639	ALA	

## 4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	192.71Å 204.44Å 206.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.41 – 2.77 48.41 – 2.77	Depositor EDS
% Data completeness (in resolution range)	98.7 (48.41-2.77) 98.7 (48.41-2.77)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.69 (at 2.77Å)	Xtrriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.201 , 0.241 0.201 , 0.242	Depositor DCC
$R_{free}$ test set	5074 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	53.7	Xtrriage
Anisotropy	0.616	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 35.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.005 for -h,-l,-k	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	20825	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	68.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.33% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

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

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GLC, BGC, PEG, UDP, G6P

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	0.42	0/5282	0.59	0/7155
1	B	0.51	0/5291	0.67	0/7167
1	C	0.44	0/5282	0.61	0/7155
1	D	0.45	0/5255	0.59	0/7117
All	All	0.46	0/21110	0.62	0/28594

There are no bond length outliers.

There are no bond angle outliers.

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	5157	0	5072	60	0
1	B	5163	0	5080	57	0
1	C	5157	0	5072	64	0
1	D	5132	0	5053	54	1
2	A	25	0	11	0	0
2	B	25	0	11	1	0
2	C	25	0	11	3	0
2	D	25	0	11	0	0
3	A	16	0	11	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	16	0	11	1	0
3	C	16	0	11	0	0
3	D	16	0	11	0	0
4	A	7	0	10	1	0
4	B	7	0	10	1	0
4	C	7	0	10	2	0
4	D	7	0	10	1	0
5	C	12	0	6	0	0
6	C	12	0	6	0	0
All	All	20825	0	20417	226	1

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.

The worst 5 of 226 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:283:GLN:HG2	1:C:280:HIS:CE1	2.00	0.96
1:A:280:HIS:CE1	1:D:283:GLN:HG2	2.07	0.88
1:B:280:HIS:CE1	1:C:283:GLN:HG2	2.10	0.86
1:A:379:GLU:HG2	4:B:803:PEG:H41	1.65	0.78
1:B:349:LYS:HE2	1:B:576:VAL:O	1.85	0.77

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:85:SER:OG	1:D:85:SER:OG[2_555]	1.92	0.28

## 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	636/724 (88%)	610 (96%)	24 (4%)	2 (0%)	41	70
1	B	637/724 (88%)	620 (97%)	16 (2%)	1 (0%)	47	76
1	C	636/724 (88%)	611 (96%)	25 (4%)	0	100	100
1	D	631/724 (87%)	600 (95%)	29 (5%)	2 (0%)	41	70
All	All	2540/2896 (88%)	2441 (96%)	94 (4%)	5 (0%)	47	76

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	205	GLY
1	D	111	VAL
1	D	544	ASN
1	A	111	VAL
1	B	512	GLY

### 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	553/624 (89%)	523 (95%)	30 (5%)	22	50
1	B	554/624 (89%)	519 (94%)	35 (6%)	18	43
1	C	553/624 (89%)	516 (93%)	37 (7%)	16	40
1	D	550/624 (88%)	514 (94%)	36 (6%)	17	41
All	All	2210/2496 (88%)	2072 (94%)	138 (6%)	18	44

5 of 138 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	249	GLN
1	D	321	TYR
1	D	531	SER
1	B	321	TYR
1	B	295	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	8	HIS
1	D	582	GLN
1	D	631	ASN
1	D	611	GLN
1	B	19	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

### 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

14 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	UDP	B	801	-	24,26,26	0.93	1 (4%)	37,40,40	1.76	7 (18%)
5	GLC	C	801	-	12,12,12	0.53	0	17,17,17	0.83	0
3	G6P	B	802	-	16,16,16	0.49	0	24,24,24	0.71	0
2	UDP	A	801	-	24,26,26	1.02	2 (8%)	37,40,40	1.81	6 (16%)
4	PEG	B	803	-	6,6,6	0.45	0	5,5,5	0.42	0
6	BGC	C	802	-	12,12,12	0.49	0	17,17,17	0.84	0



Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	UDP	C	803	-	24,26,26	0.99	0	37,40,40	1.73	7 (18%)
3	G6P	A	802	-	16,16,16	0.52	0	24,24,24	0.88	2 (8%)
4	PEG	A	803	-	6,6,6	0.48	0	5,5,5	0.28	0
2	UDP	D	801	-	24,26,26	0.92	1 (4%)	37,40,40	1.69	6 (16%)
3	G6P	C	804	-	16,16,16	0.58	0	24,24,24	0.87	1 (4%)
3	G6P	D	802	-	16,16,16	0.50	0	24,24,24	0.98	1 (4%)
4	PEG	C	805	-	6,6,6	0.39	0	5,5,5	0.38	0
4	PEG	D	803	-	6,6,6	0.42	0	5,5,5	0.37	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	UDP	B	801	-	-	3/16/32/32	0/2/2/2
5	GLC	C	801	-	-	0/2/22/22	0/1/1/1
3	G6P	B	802	-	-	2/6/26/26	0/1/1/1
2	UDP	A	801	-	-	7/16/32/32	0/2/2/2
4	PEG	B	803	-	-	3/4/4/4	-
6	BGC	C	802	-	-	0/2/22/22	0/1/1/1
2	UDP	C	803	-	-	6/16/32/32	0/2/2/2
3	G6P	A	802	-	-	1/6/26/26	0/1/1/1
4	PEG	A	803	-	-	3/4/4/4	-
2	UDP	D	801	-	-	3/16/32/32	0/2/2/2
3	G6P	C	804	-	-	0/6/26/26	0/1/1/1
3	G6P	D	802	-	-	0/6/26/26	0/1/1/1
4	PEG	C	805	-	-	3/4/4/4	-
4	PEG	D	803	-	-	3/4/4/4	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	UDP	C6-C5	2.23	1.40	1.35
2	A	801	UDP	C2-N1	2.19	1.42	1.38
2	D	801	UDP	C6-C5	2.13	1.40	1.35
2	B	801	UDP	C6-C5	2.09	1.39	1.35

The worst 5 of 30 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	801	UDP	N3-C2-N1	5.37	122.02	114.89
2	A	801	UDP	C4-N3-C2	-5.33	119.54	126.58
2	B	801	UDP	C4-N3-C2	-4.96	120.04	126.58
2	C	803	UDP	C4-N3-C2	-4.93	120.08	126.58
2	B	801	UDP	N3-C2-N1	4.86	121.34	114.89

There are no chirality outliers.

5 of 34 torsion outliers are listed below:

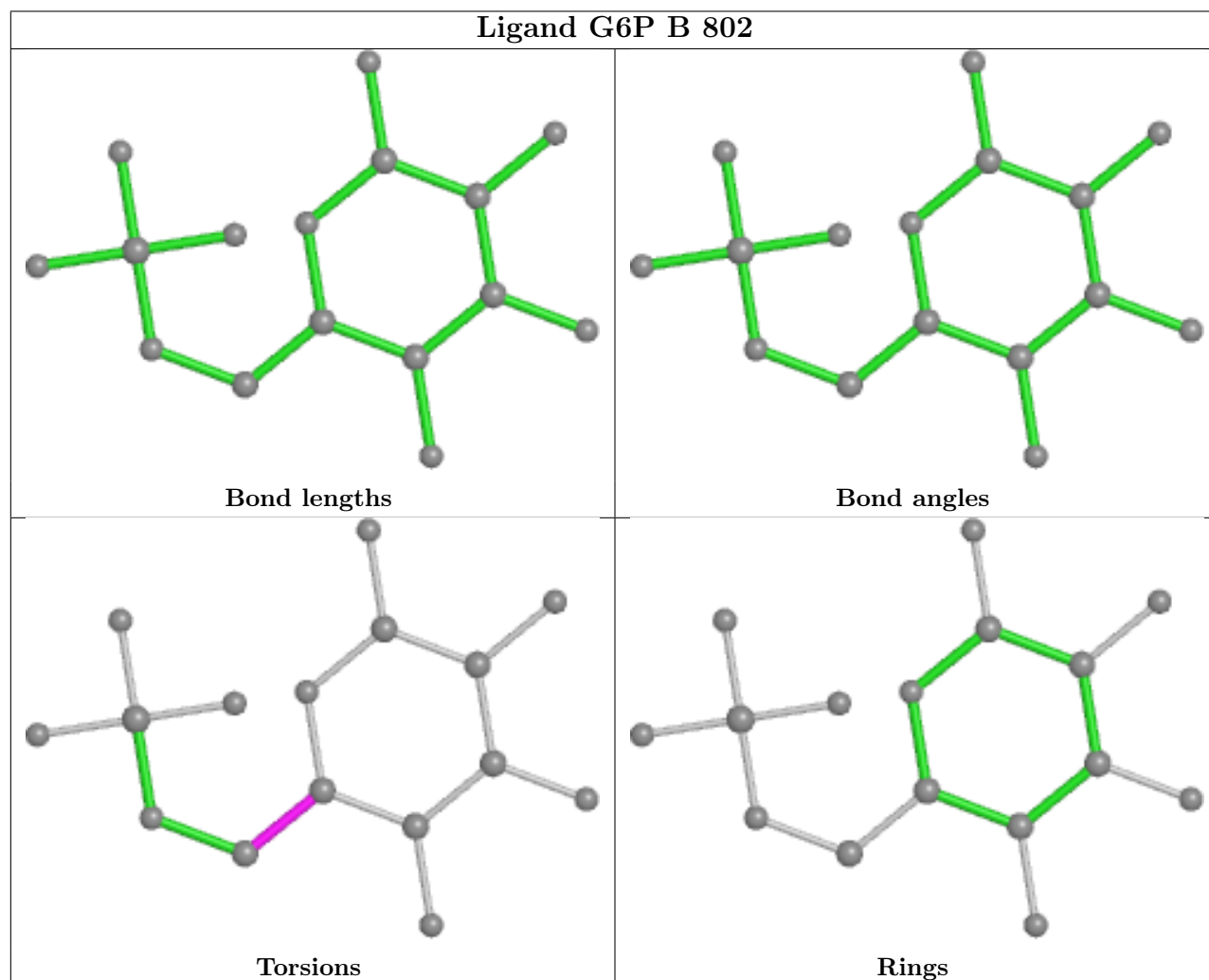
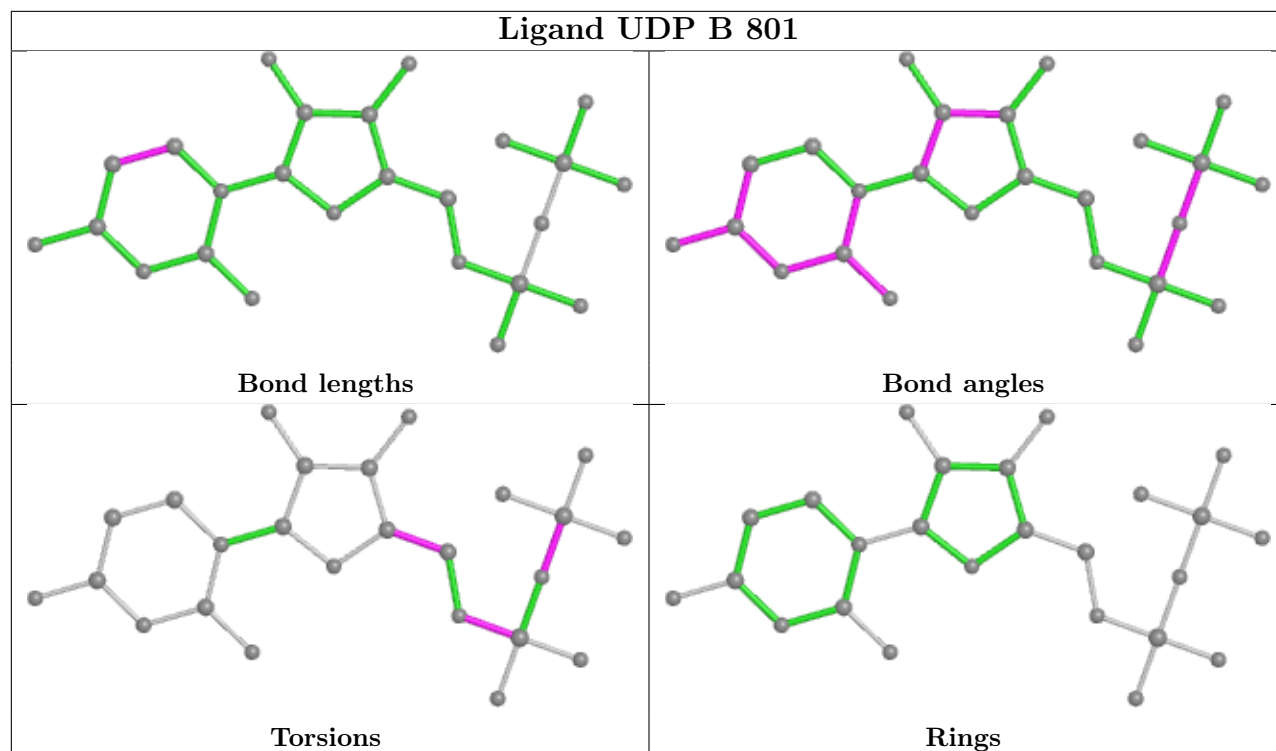
Mol	Chain	Res	Type	Atoms
2	A	801	UDP	C3'-C4'-C5'-O5'
2	A	801	UDP	C5'-O5'-PA-O2A
2	A	801	UDP	C5'-O5'-PA-O3A
2	A	801	UDP	PA-O3A-PB-O3B
2	C	803	UDP	C5'-O5'-PA-O2A

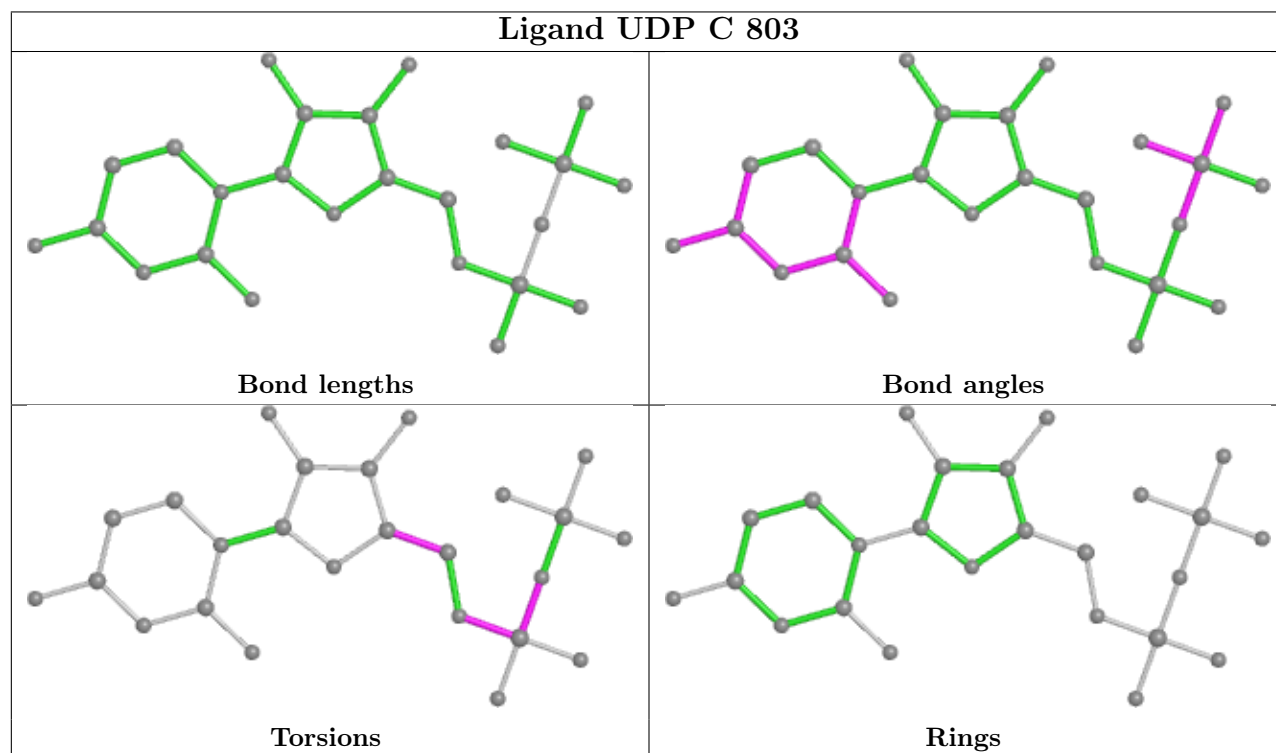
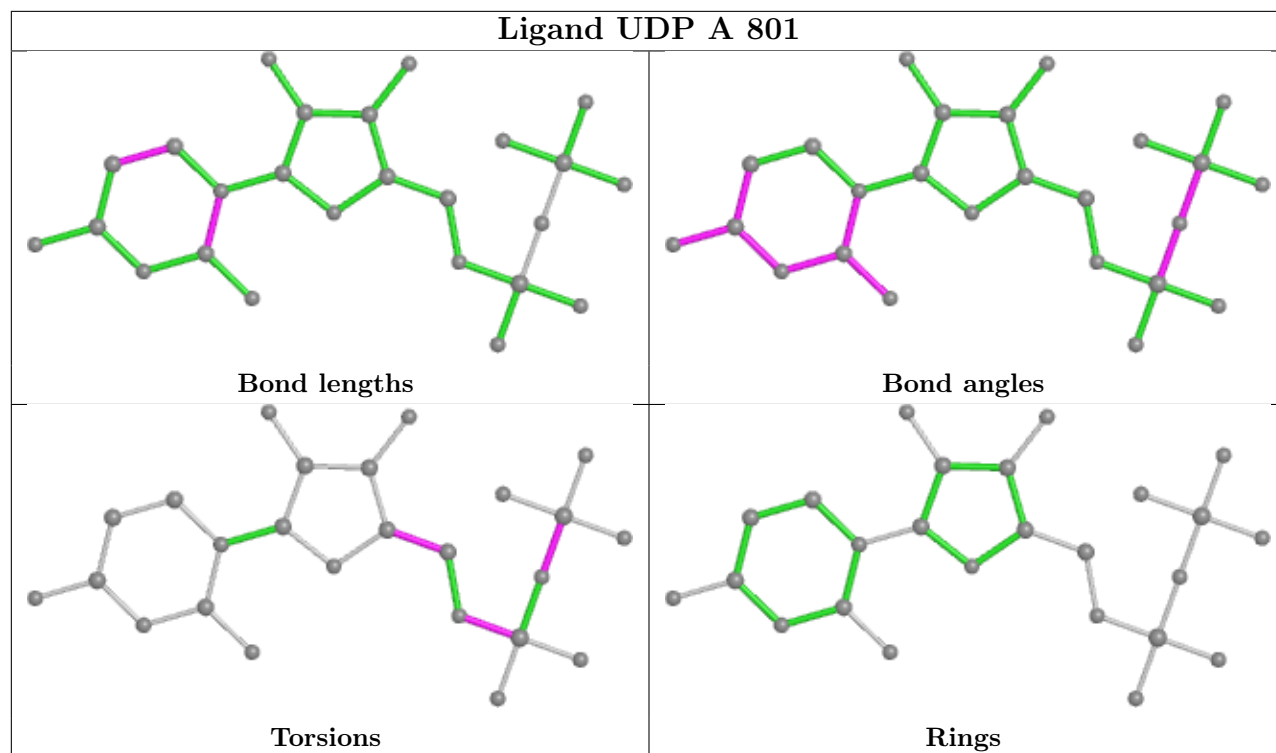
There are no ring outliers.

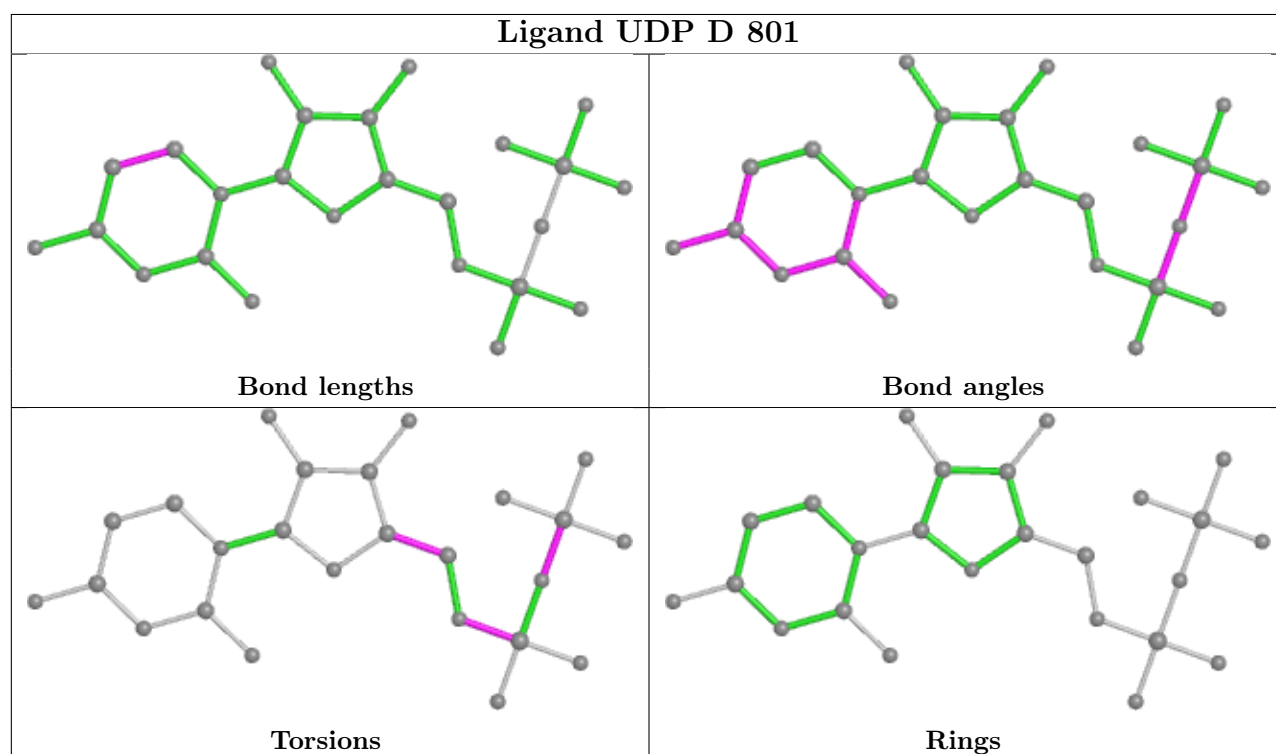
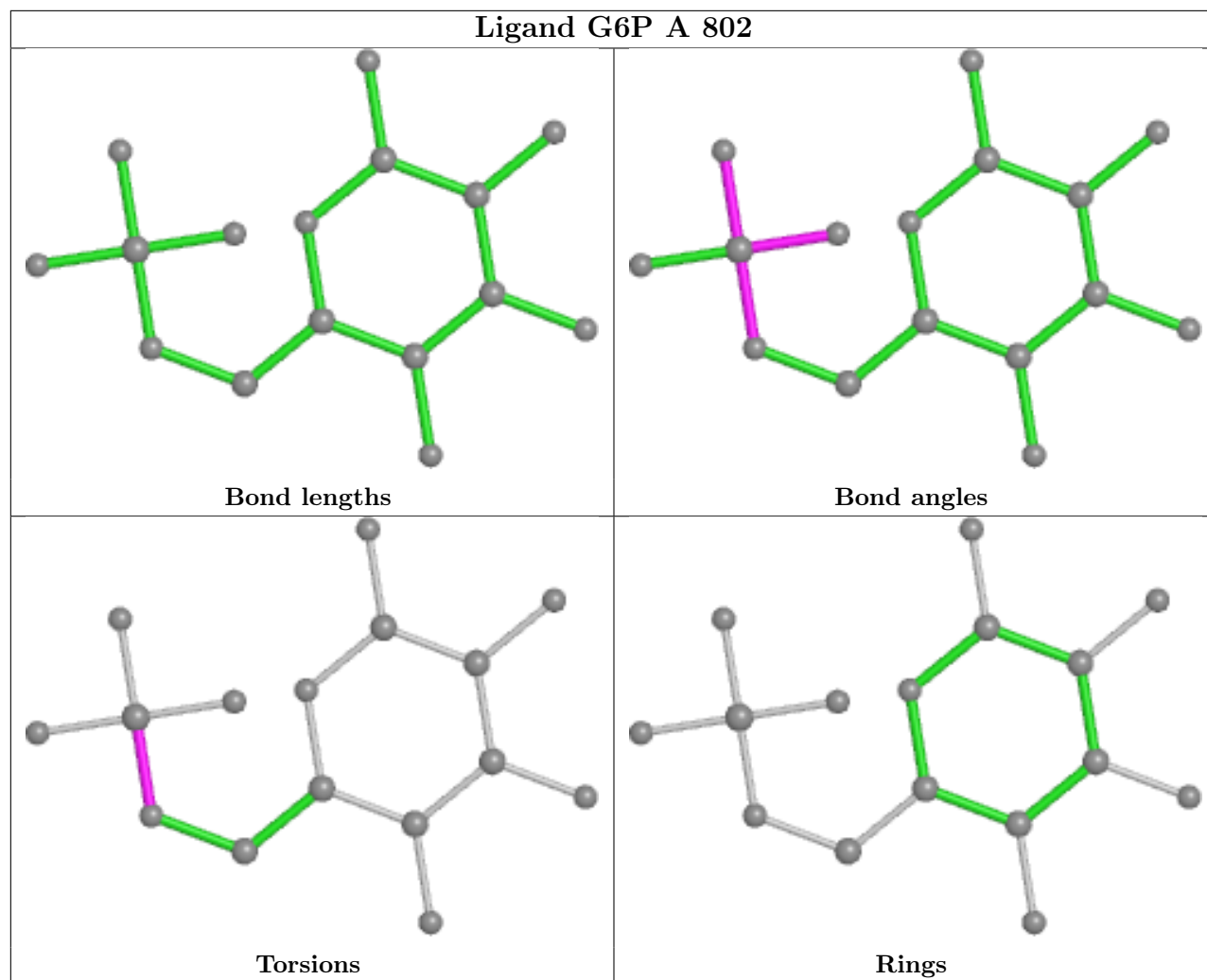
8 monomers are involved in 13 short contacts:

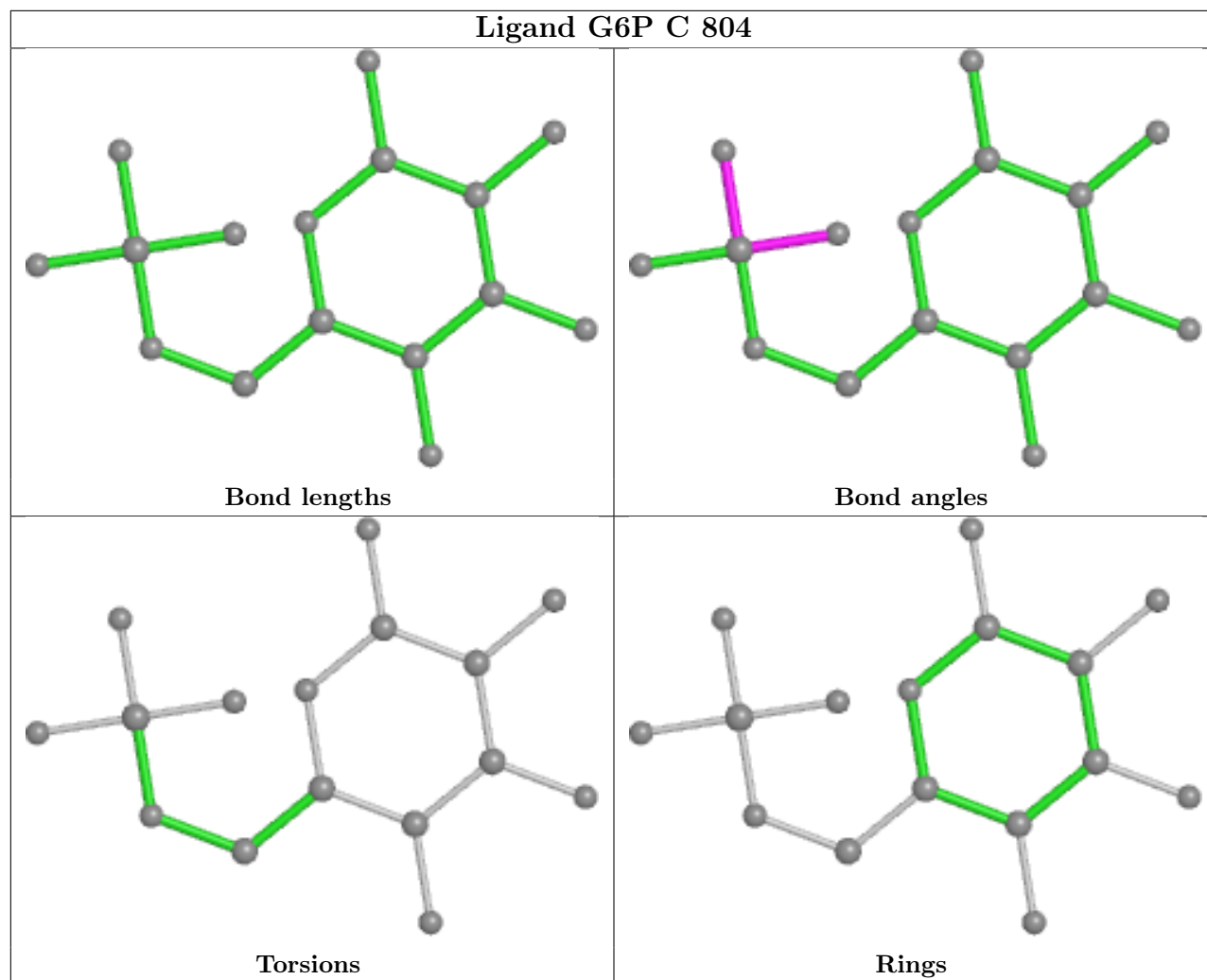
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	801	UDP	1	0
3	B	802	G6P	1	0
4	B	803	PEG	1	0
2	C	803	UDP	3	0
3	A	802	G6P	3	0
4	A	803	PEG	1	0
4	C	805	PEG	2	0
4	D	803	PEG	1	0

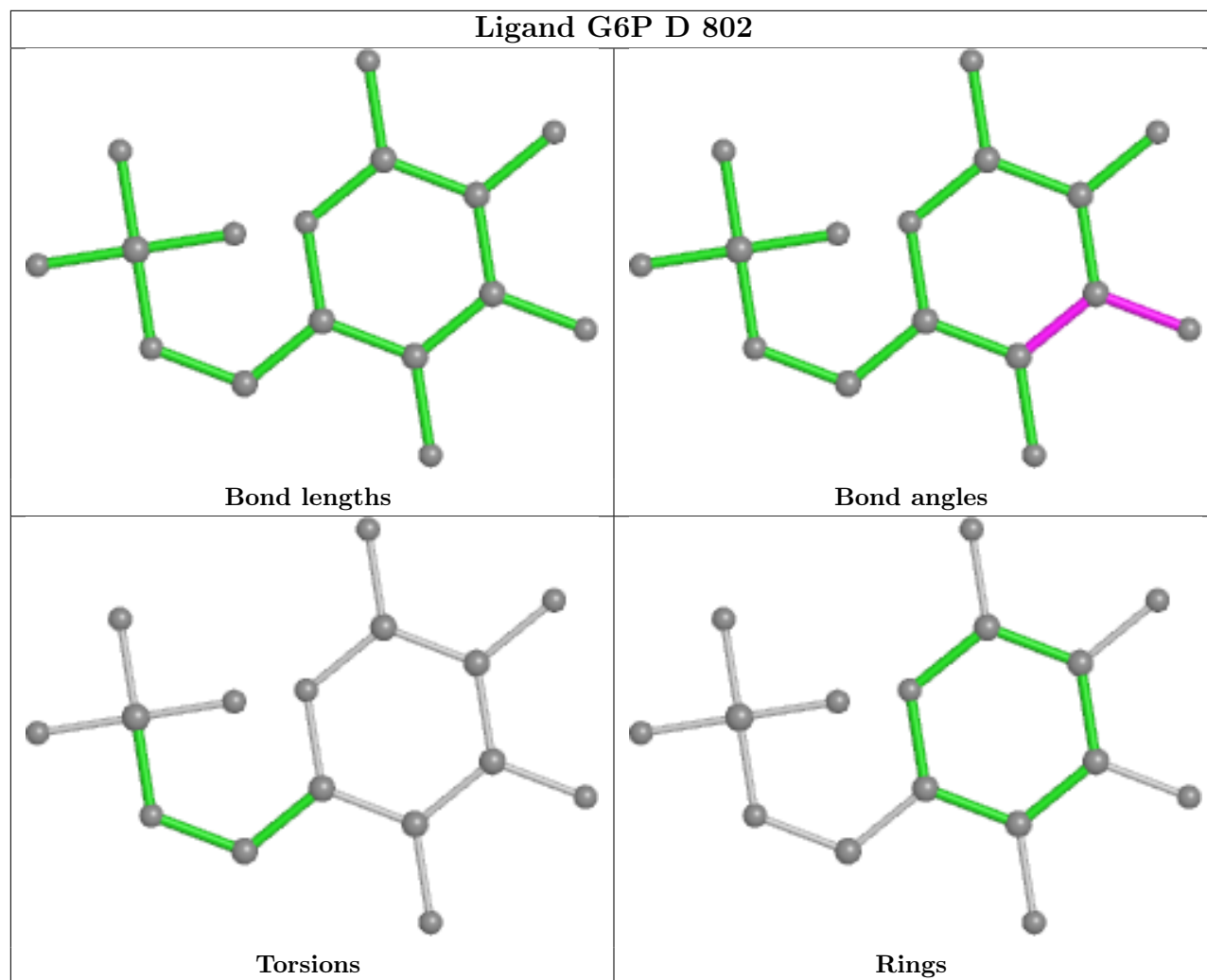
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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 [i](#)

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

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	638/724 (88%)	0.25	28 (4%) 34 28	41, 61, 110, 139	0
1	B	638/724 (88%)	0.04	15 (2%) 59 54	33, 53, 106, 139	0
1	C	638/724 (88%)	0.22	32 (5%) 28 23	40, 59, 111, 142	1 (0%)
1	D	635/724 (87%)	0.38	50 (7%) 12 9	35, 72, 137, 165	0
All	All	2549/2896 (88%)	0.22	125 (4%) 29 24	33, 59, 123, 165	1 (0%)

The worst 5 of 125 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	630	LEU	7.2
1	D	637	ALA	6.5
1	D	626	VAL	6.1
1	D	627	GLY	5.5
1	C	128	ILE	5.5

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

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

### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

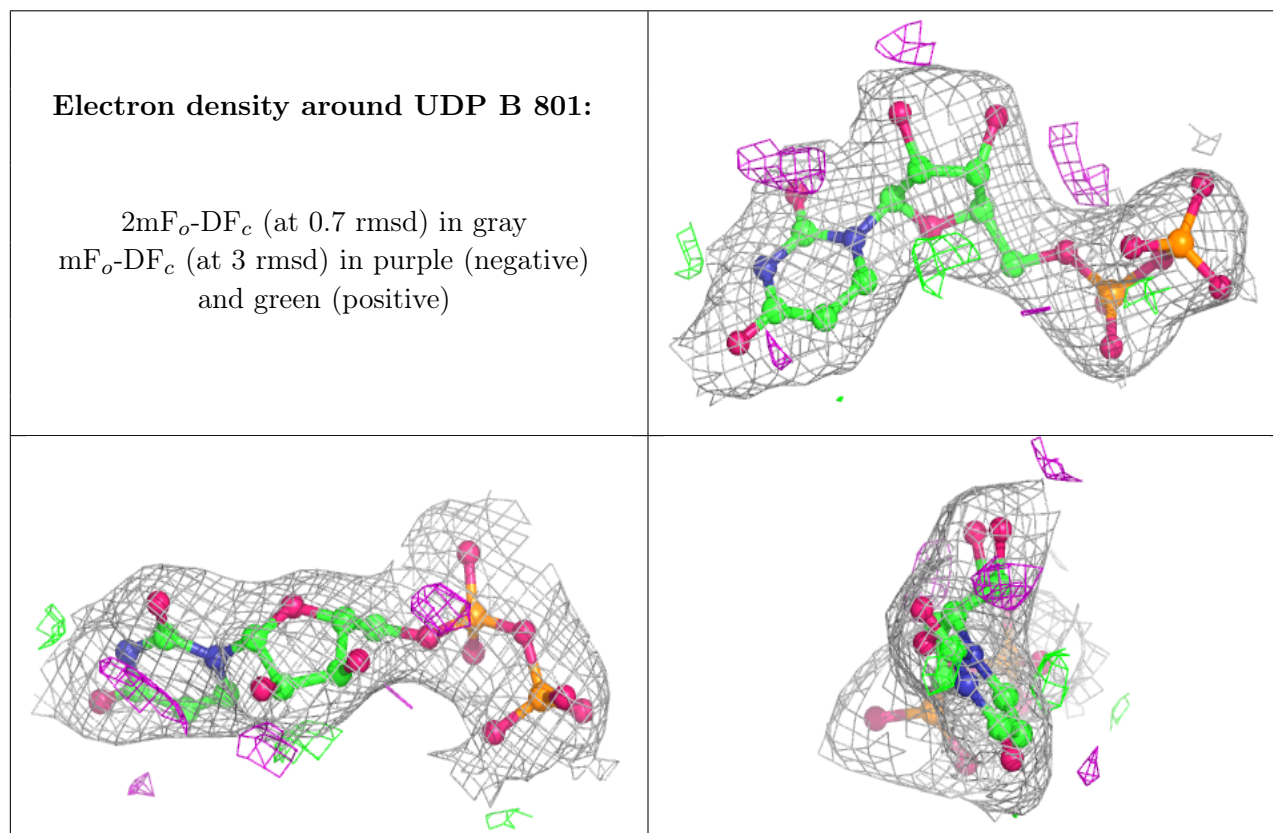
### 6.4 Ligands [i](#)

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



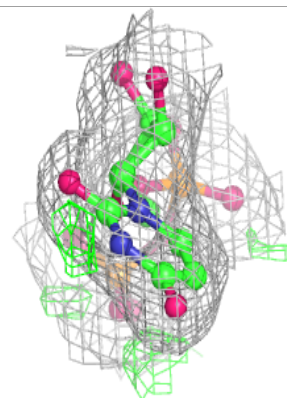
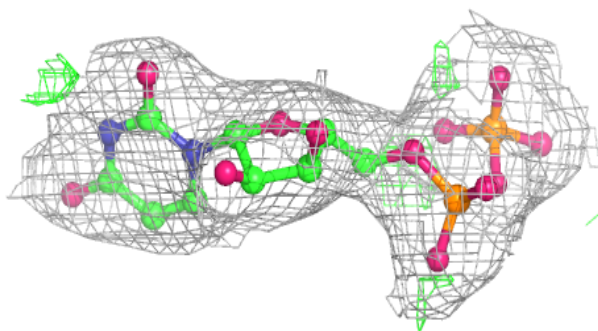
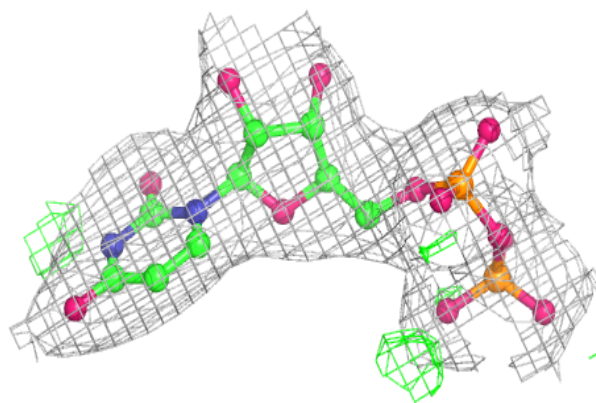
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	PEG	A	803	7/7	0.86	0.18	73,77,85,85	0
4	PEG	B	803	7/7	0.91	0.26	68,69,76,76	0
4	PEG	D	803	7/7	0.93	0.21	55,65,75,78	0
4	PEG	C	805	7/7	0.94	0.13	62,69,77,78	0
2	UDP	B	801	25/25	0.97	0.15	46,57,85,89	0
2	UDP	C	803	25/25	0.97	0.19	39,51,55,59	0
2	UDP	A	801	25/25	0.97	0.14	47,59,72,73	0
3	G6P	B	802	16/16	0.98	0.17	36,41,45,47	0
3	G6P	C	804	16/16	0.98	0.14	43,47,49,52	0
2	UDP	D	801	25/25	0.98	0.12	48,58,70,71	0
5	GLC	C	801	12/12	0.98	0.15	46,49,51,53	12
6	BGC	C	802	12/12	0.98	0.16	53,57,59,60	12
3	G6P	A	802	16/16	0.99	0.17	42,48,52,52	0
3	G6P	D	802	16/16	0.99	0.16	35,40,44,46	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.

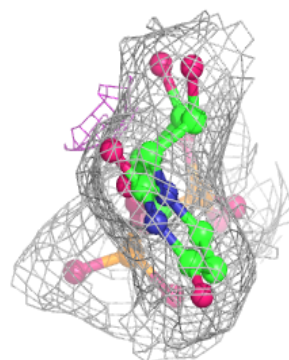
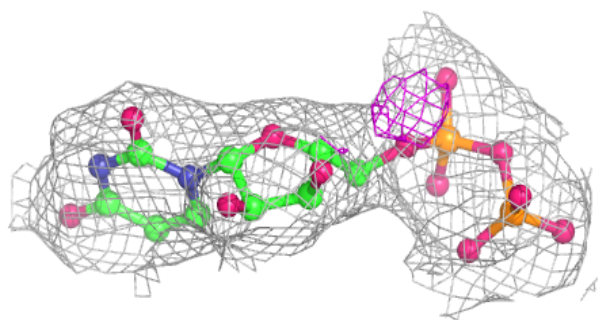
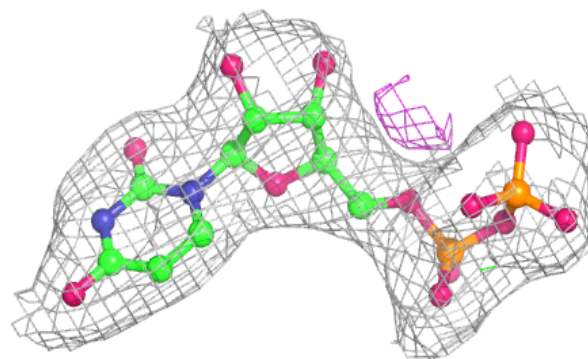


**Electron density around UDP C 803:**

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

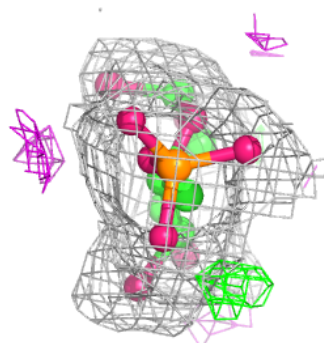
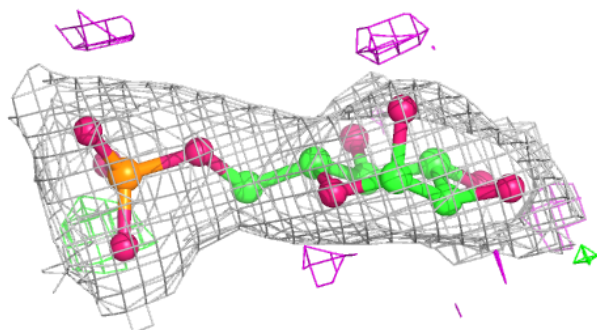
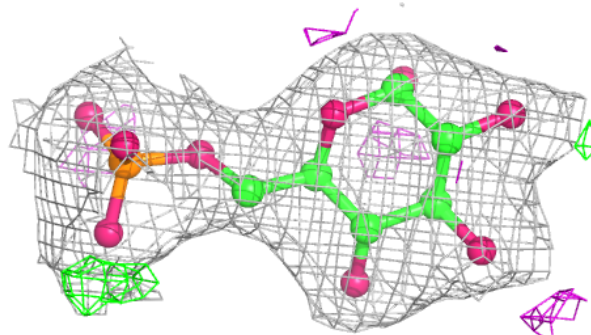
**Electron density around UDP A 801:**

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

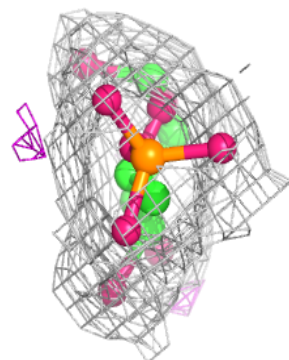
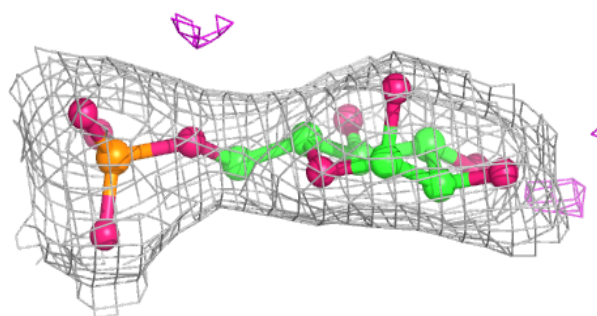
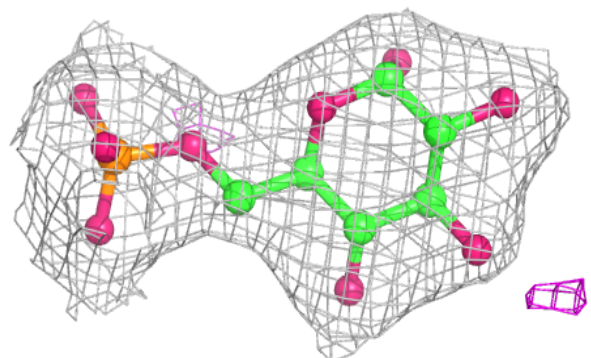


**Electron density around G6P B 802:**

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

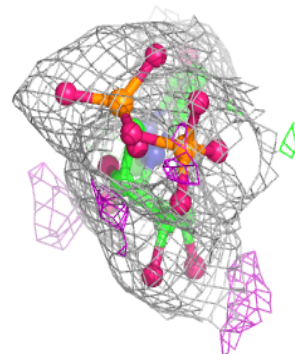
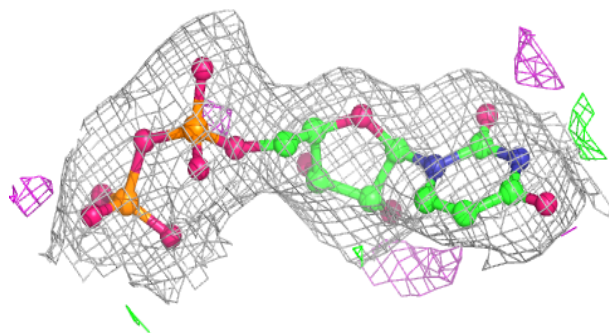
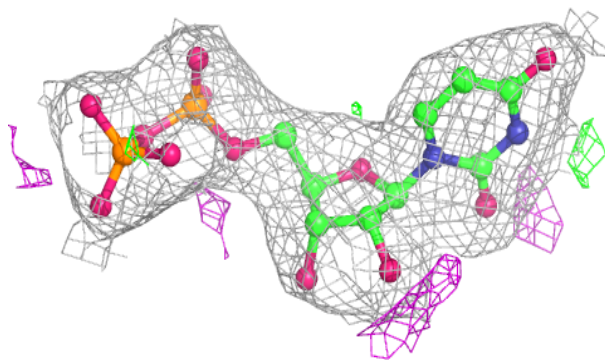
**Electron density around G6P C 804:**

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

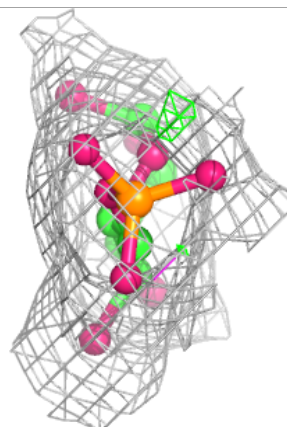
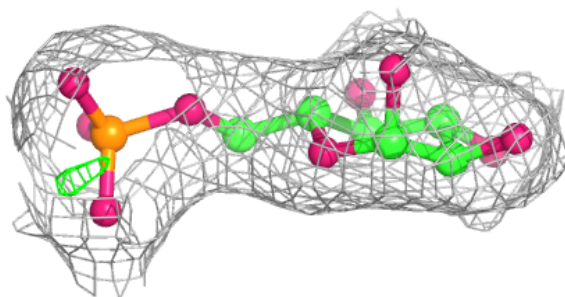
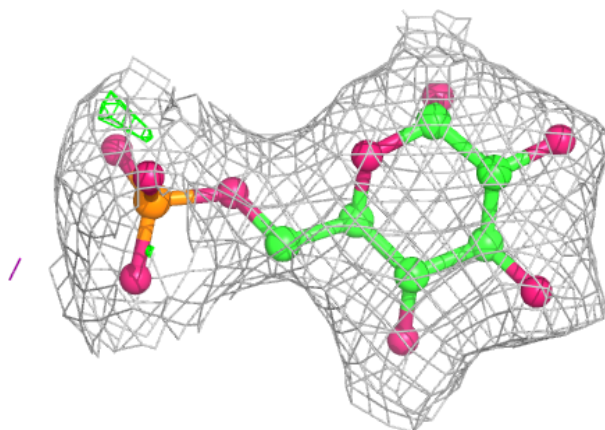


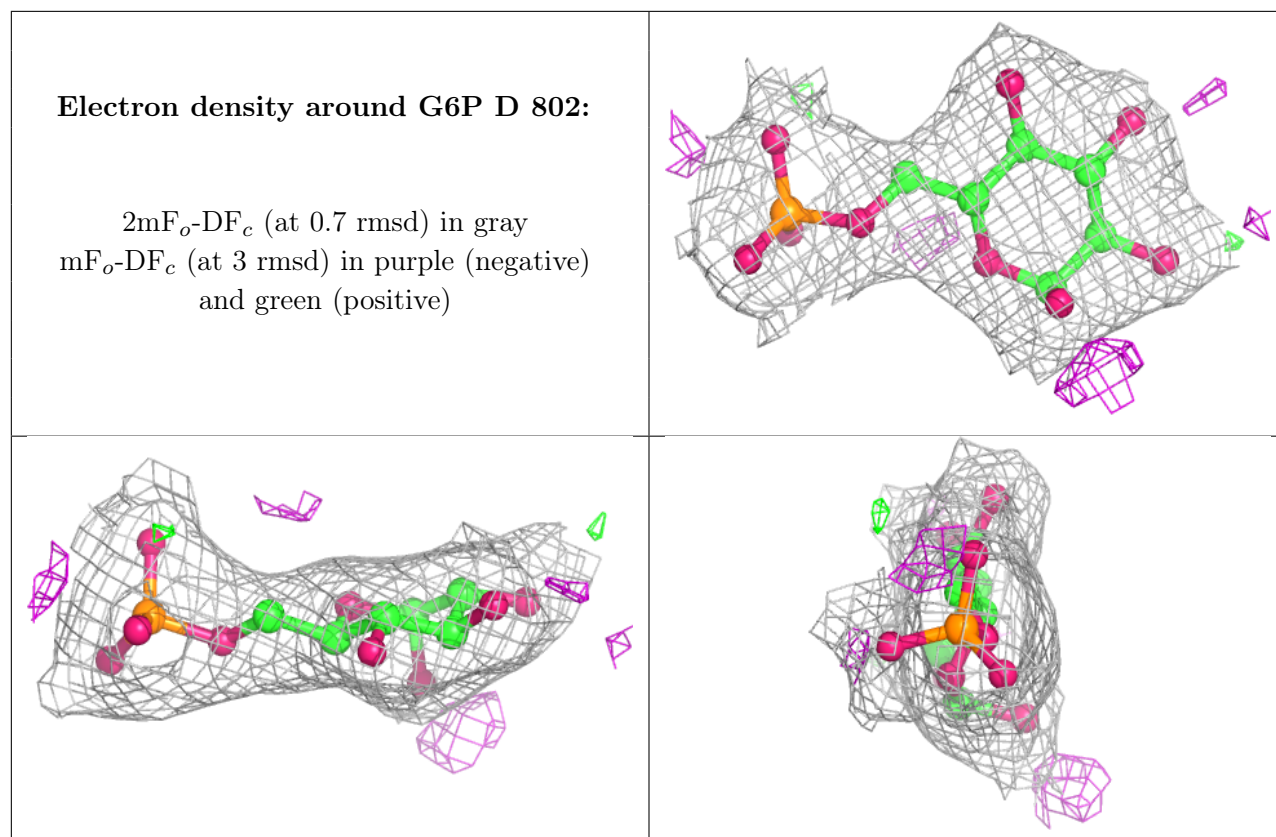
**Electron density around UDP D 801:**

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

**Electron density around G6P A 802:**

$2mF_o-DF_c$  (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.