



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 20, 2026 – 09:47 AM UTC

PDB ID : 5UX7 / pdb_00005ux7
Title : Activated state yeast Glycogen Synthase in complex with UDP-xylose
Authors : Mahalingan, K.K.; Hurley, T.D.
Deposited on : 2017-02-22
Resolution : 2.69 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

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

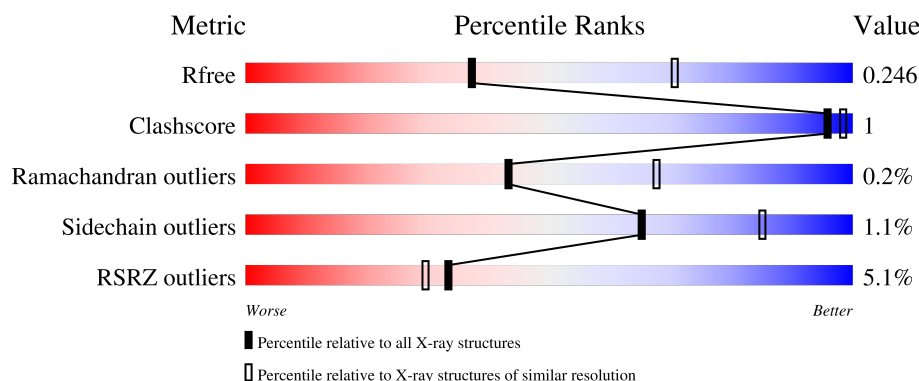
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.69 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	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

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	720	3% 85% • 11%
1	B	720	4% 85% • 11%
1	C	720	3% 85% • 11%
1	D	720	8% 84% • 12%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 20648 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 Glycogen [starch] synthase isoform 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	638	Total	C	N	O	S	0	0	0
			5111	3265	883	944	19			
1	B	638	Total	C	N	O	S	0	0	0
			5131	3278	892	942	19			
1	C	638	Total	C	N	O	S	0	0	0
			5129	3275	893	942	19			
1	D	636	Total	C	N	O	S	0	0	0
			5094	3251	885	939	19			

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP P27472
A	-18	GLY	-	expression tag	UNP P27472
A	-17	SER	-	expression tag	UNP P27472
A	-16	SER	-	expression tag	UNP P27472
A	-15	HIS	-	expression tag	UNP P27472
A	-14	HIS	-	expression tag	UNP P27472
A	-13	HIS	-	expression tag	UNP P27472
A	-12	HIS	-	expression tag	UNP P27472
A	-11	HIS	-	expression tag	UNP P27472
A	-10	HIS	-	expression tag	UNP P27472
A	-9	SER	-	expression tag	UNP P27472
A	-8	SER	-	expression tag	UNP P27472
A	-7	GLY	-	expression tag	UNP P27472
A	-6	LEU	-	expression tag	UNP P27472
A	-5	VAL	-	expression tag	UNP P27472
A	-4	PRO	-	expression tag	UNP P27472
A	-3	ARG	-	expression tag	UNP P27472
A	-2	GLY	-	expression tag	UNP P27472
A	-1	SER	-	expression tag	UNP P27472
A	0	HIS	-	expression tag	UNP P27472
A	535	SER	ALA	conflict	UNP P27472

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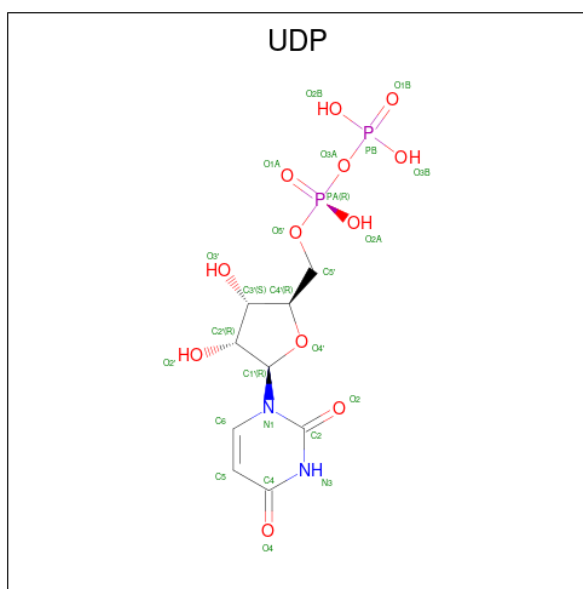
Chain	Residue	Modelled	Actual	Comment	Reference
B	-19	MET	-	initiating methionine	UNP P27472
B	-18	GLY	-	expression tag	UNP P27472
B	-17	SER	-	expression tag	UNP P27472
B	-16	SER	-	expression tag	UNP P27472
B	-15	HIS	-	expression tag	UNP P27472
B	-14	HIS	-	expression tag	UNP P27472
B	-13	HIS	-	expression tag	UNP P27472
B	-12	HIS	-	expression tag	UNP P27472
B	-11	HIS	-	expression tag	UNP P27472
B	-10	HIS	-	expression tag	UNP P27472
B	-9	SER	-	expression tag	UNP P27472
B	-8	SER	-	expression tag	UNP P27472
B	-7	GLY	-	expression tag	UNP P27472
B	-6	LEU	-	expression tag	UNP P27472
B	-5	VAL	-	expression tag	UNP P27472
B	-4	PRO	-	expression tag	UNP P27472
B	-3	ARG	-	expression tag	UNP P27472
B	-2	GLY	-	expression tag	UNP P27472
B	-1	SER	-	expression tag	UNP P27472
B	0	HIS	-	expression tag	UNP P27472
B	535	SER	ALA	conflict	UNP P27472
C	-19	MET	-	initiating methionine	UNP P27472
C	-18	GLY	-	expression tag	UNP P27472
C	-17	SER	-	expression tag	UNP P27472
C	-16	SER	-	expression tag	UNP P27472
C	-15	HIS	-	expression tag	UNP P27472
C	-14	HIS	-	expression tag	UNP P27472
C	-13	HIS	-	expression tag	UNP P27472
C	-12	HIS	-	expression tag	UNP P27472
C	-11	HIS	-	expression tag	UNP P27472
C	-10	HIS	-	expression tag	UNP P27472
C	-9	SER	-	expression tag	UNP P27472
C	-8	SER	-	expression tag	UNP P27472
C	-7	GLY	-	expression tag	UNP P27472
C	-6	LEU	-	expression tag	UNP P27472
C	-5	VAL	-	expression tag	UNP P27472
C	-4	PRO	-	expression tag	UNP P27472
C	-3	ARG	-	expression tag	UNP P27472
C	-2	GLY	-	expression tag	UNP P27472
C	-1	SER	-	expression tag	UNP P27472
C	0	HIS	-	expression tag	UNP P27472
C	535	SER	ALA	conflict	UNP P27472

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-19	MET	-	initiating methionine	UNP P27472
D	-18	GLY	-	expression tag	UNP P27472
D	-17	SER	-	expression tag	UNP P27472
D	-16	SER	-	expression tag	UNP P27472
D	-15	HIS	-	expression tag	UNP P27472
D	-14	HIS	-	expression tag	UNP P27472
D	-13	HIS	-	expression tag	UNP P27472
D	-12	HIS	-	expression tag	UNP P27472
D	-11	HIS	-	expression tag	UNP P27472
D	-10	HIS	-	expression tag	UNP P27472
D	-9	SER	-	expression tag	UNP P27472
D	-8	SER	-	expression tag	UNP P27472
D	-7	GLY	-	expression tag	UNP P27472
D	-6	LEU	-	expression tag	UNP P27472
D	-5	VAL	-	expression tag	UNP P27472
D	-4	PRO	-	expression tag	UNP P27472
D	-3	ARG	-	expression tag	UNP P27472
D	-2	GLY	-	expression tag	UNP P27472
D	-1	SER	-	expression tag	UNP P27472
D	0	HIS	-	expression tag	UNP P27472
D	535	SER	ALA	conflict	UNP P27472

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



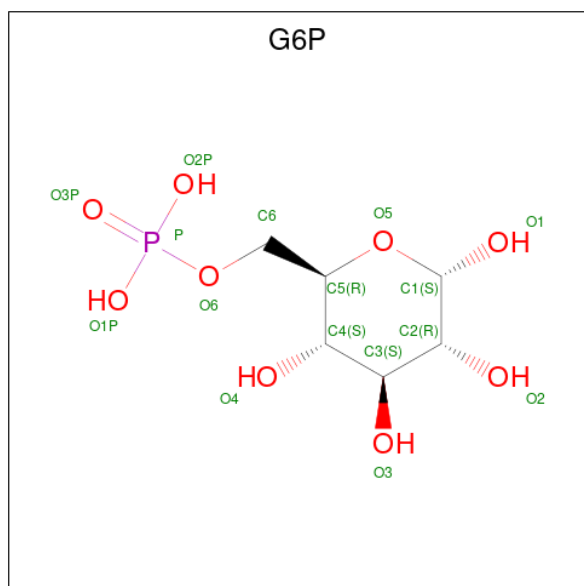
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			25	9	2	12	2		

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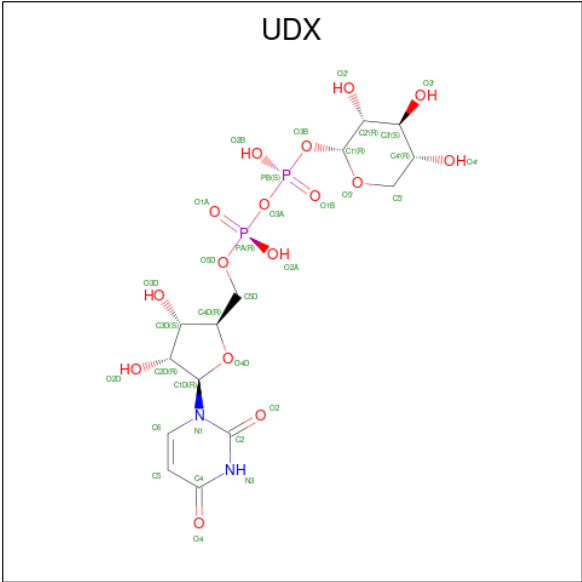
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	D	1	Total	C	N	O	P	0	0
			25	9	2	12	2		

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



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

- Molecule 4 is URIDINE-5'-DIPHOSPHATE-XYLOPYRANOSE (CCD ID: UDX) (formula: $C_{14}H_{22}N_2O_{16}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	B	1	Total	C	N	O	P	0	0
			34	14	2	16	2		
4	C	1	Total	C	N	O	P	0	0
			34	14	2	16	2		

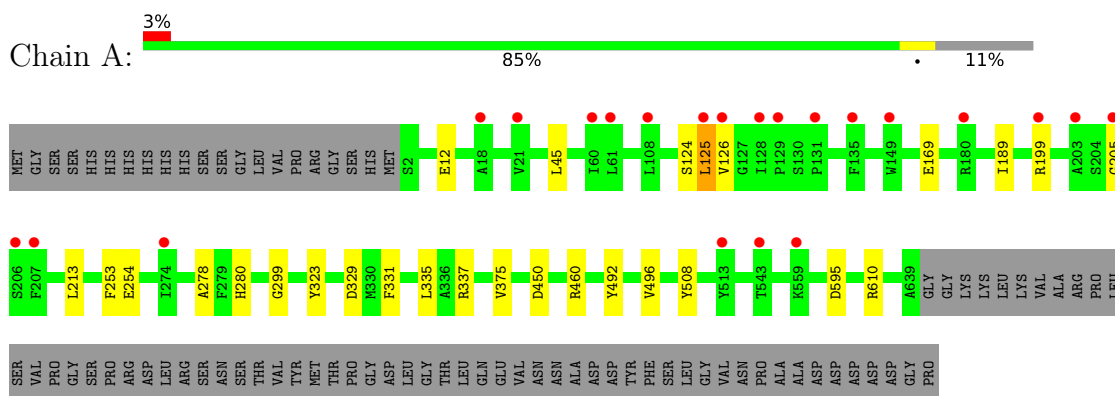
- Molecule 5 is water.

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

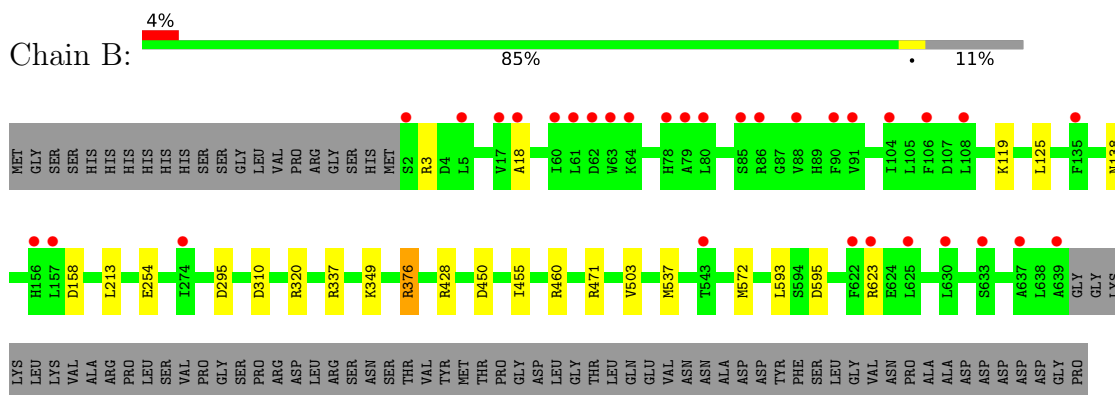
3 Residue-property plots

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.

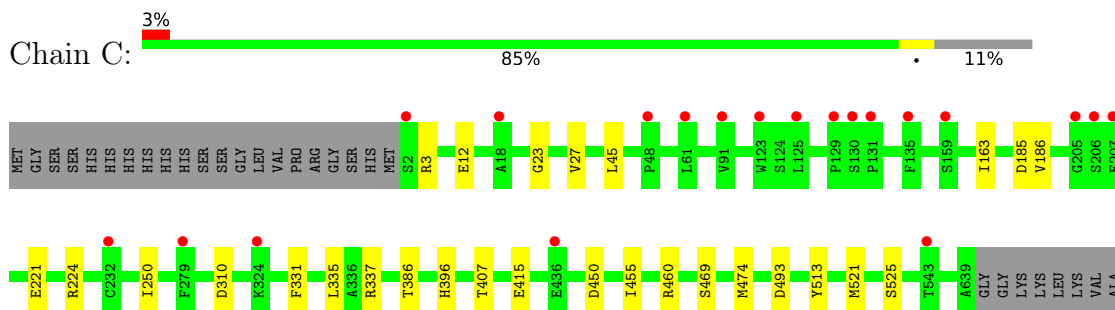
• Molecule 1: Glycogen [starch] synthase isoform 2



• Molecule 1: Glycogen [starch] synthase isoform 2

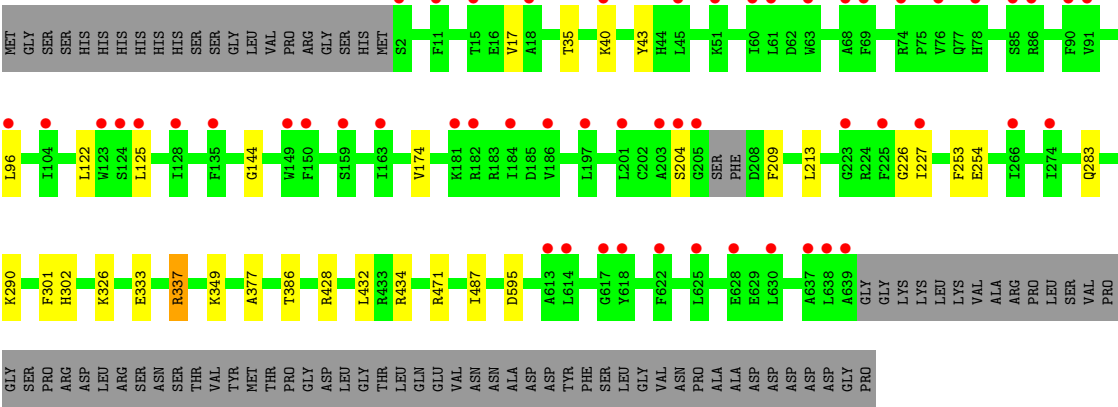
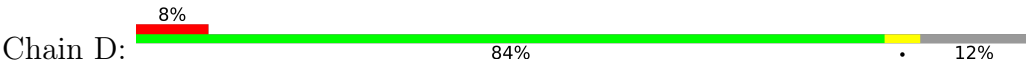


• Molecule 1: Glycogen [starch] synthase isoform 2



ARG
PRO
LEU
SER
SER
VAL
PRO
GLY
SER
PRO
ASP
ARG
LEU
ARG
SER
ASN
SER
THR
VAL
TYR
MET
THR
GLY
PRO
ASP
LEU
GLY
THR
LEU
LEU
GLN
GLU
VAL
ASN
ASN
ALA
ALA
ASP
ASP
TYR
PHE
SER
LEU
GLY
VAL
ASN
PRO
ALA
ALA
ASP
ASP
ASP
ASP
GLY
PRO

● Molecule 1: Glycogen [starch] synthase isoform 2



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	192.99Å 204.32Å 206.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	145.30 – 2.69 145.30 – 2.69	Depositor EDS
% Data completeness (in resolution range)	98.3 (145.30-2.69) 98.3 (145.30-2.69)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.62 (at 2.69Å)	Xtriage
Refinement program	REFMAC 5.8.0155	Depositor
R, R_{free}	0.207 , 0.246 0.209 , 0.246	Depositor DCC
R_{free} test set	5560 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	59.1	Xtriage
Anisotropy	0.308	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 42.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.008 for -h,-l,-k	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	20648	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 2.22% 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: UDP, G6P, UDX

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	0.61	0/5236	0.85	0/7104
1	B	0.65	0/5256	0.87	0/7125
1	C	0.64	0/5254	0.86	0/7124
1	D	0.64	0/5216	0.88	3/7074 (0.0%)
All	All	0.63	0/20962	0.87	3/28427 (0.0%)

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	B	0	1
1	D	0	1
All	All	0	2

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	487	ILE	N-CA-C	5.55	116.40	111.90
1	D	434	ARG	CB-CA-C	5.43	117.04	108.84
1	D	17	VAL	N-CA-C	5.28	115.49	110.42

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	18	ALA	Peptide

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Mol	Chain	Res	Type	Group
1	D	226	GLY	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	5111	0	4971	13	0
1	B	5131	0	5022	10	0
1	C	5129	0	5011	12	0
1	D	5094	0	4967	13	0
2	A	25	0	11	0	0
2	D	25	0	11	0	0
3	A	16	0	11	0	0
3	B	16	0	11	0	0
3	C	16	0	11	0	0
3	D	16	0	11	1	0
4	B	34	0	20	1	0
4	C	34	0	20	0	0
5	C	1	0	0	0	0
All	All	20648	0	20077	46	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 1.

All (46) 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:280:HIS:CE1	1:D:283:GLN:HG2	2.20	0.77
1:C:450:ASP:OD1	1:C:460:ARG:NH2	2.29	0.66
1:A:450:ASP:OD1	1:A:460:ARG:NH2	2.35	0.60
1:B:213:LEU:HD21	1:B:254:GLU:HA	1.87	0.57
1:C:493:ASP:HB2	1:C:521:MET:HE1	1.86	0.56
1:B:349:LYS:O	1:B:471:ARG:HD3	2.06	0.56
1:C:335:LEU:HD13	1:C:474:MET:HE1	1.88	0.55
1:B:450:ASP:OD1	1:B:460:ARG:NH2	2.43	0.52
1:C:331:PHE:CZ	1:C:335:LEU:HD11	2.44	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:3:ARG:NH2	1:B:158:ASP:O	2.43	0.51
1:C:221:GLU:HA	1:C:224:ARG:HG2	1.91	0.51
1:C:396:HIS:HE1	1:C:407:THR:O	1.93	0.51
1:A:12:GLU:HB3	1:A:45:LEU:HD23	1.92	0.50
1:D:227:ILE:HG22	1:D:227:ILE:O	2.12	0.50
1:C:396:HIS:HD2	1:C:415:GLU:OE2	1.96	0.48
1:B:119:LYS:NZ	1:B:138:ASN:OD1	2.47	0.47
1:B:320:ARG:HH21	4:B:801:UDX:C1'	2.28	0.47
1:D:290:LYS:HE2	3:D:802:G6P:O3P	2.14	0.47
1:A:331:PHE:CZ	1:A:335:LEU:HD11	2.50	0.47
1:C:12:GLU:HB3	1:C:45:LEU:HD23	1.96	0.47
1:C:386:THR:HB	1:D:386:THR:HB	1.98	0.46
1:D:302:HIS:HD2	1:D:432:LEU:O	2.00	0.45
1:B:537:MET:CE	1:B:593:LEU:HD21	2.47	0.45
1:A:278:ALA:HB1	1:A:280:HIS:CE1	2.52	0.44
1:D:35:THR:HG21	1:D:43:TYR:CE1	2.53	0.44
1:A:213:LEU:HD21	1:A:254:GLU:HA	1.98	0.44
1:D:209:PHE:O	1:D:213:LEU:HB2	2.18	0.44
1:C:3:ARG:NH1	1:C:185:ASP:OD2	2.51	0.43
1:D:349:LYS:O	1:D:471:ARG:HD3	2.18	0.43
1:D:333:GLU:OE2	1:D:337:ARG:HD2	2.19	0.43
1:A:189:ILE:HD11	1:A:610:ARG:HA	2.00	0.43
1:B:295:ASP:CG	1:B:376:ARG:HH22	2.27	0.43
1:D:213:LEU:HD23	1:D:253:PHE:CE2	2.54	0.42
1:A:213:LEU:HD23	1:A:253:PHE:CE2	2.55	0.42
1:A:323:TYR:CZ	1:A:329:ASP:HB3	2.54	0.42
1:D:144:GLY:HA3	1:D:174:VAL:HB	2.01	0.41
1:D:301:PHE:O	1:D:302:HIS:C	2.63	0.41
1:C:163:ILE:HB	1:C:186:VAL:HG12	2.03	0.41
1:B:623:ARG:CZ	1:B:623:ARG:HB2	2.50	0.41
1:A:124:SER:O	1:A:125:LEU:HB2	2.21	0.41
1:A:199:ARG:HG2	1:A:508:TYR:CE2	2.55	0.41
1:A:492:TYR:O	1:A:496:VAL:HG23	2.21	0.41
1:D:377:ALA:HB1	1:D:428:ARG:HE	1.85	0.41
1:A:299:GLY:HA2	1:A:375:VAL:HG21	2.02	0.40
1:B:503:VAL:HG11	1:B:572:MET:HE3	2.04	0.40
1:C:23:GLY:O	1:C:27:VAL:HG23	2.22	0.40

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	636/720 (88%)	605 (95%)	27 (4%)	4 (1%)	21	44
1	B	636/720 (88%)	614 (96%)	22 (4%)	0	100	100
1	C	636/720 (88%)	614 (96%)	22 (4%)	0	100	100
1	D	632/720 (88%)	616 (98%)	14 (2%)	2 (0%)	36	60
All	All	2540/2880 (88%)	2449 (96%)	85 (3%)	6 (0%)	43	68

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	125	LEU
1	A	126	VAL
1	D	204	SER
1	A	205	GLY
1	D	40	LYS
1	A	169	GLU

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	544/621 (88%)	542 (100%)	2 (0%)	84	93
1	B	548/621 (88%)	541 (99%)	7 (1%)	61	83
1	C	547/621 (88%)	540 (99%)	7 (1%)	61	83
1	D	542/621 (87%)	535 (99%)	7 (1%)	61	83

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	2181/2484 (88%)	2158 (99%)	23 (1%)	65 85

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	337	ARG
1	A	595	ASP
1	B	125	LEU
1	B	310	ASP
1	B	337	ARG
1	B	376	ARG
1	B	428	ARG
1	B	455	ILE
1	B	595	ASP
1	C	250	ILE
1	C	310	ASP
1	C	337	ARG
1	C	455	ILE
1	C	469	SER
1	C	513	TYR
1	C	525	SER
1	D	96	LEU
1	D	122	LEU
1	D	125	LEU
1	D	254	GLU
1	D	326	LYS
1	D	337	ARG
1	D	595	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	277	GLN
1	A	325	ASN
1	A	362	ASN
1	A	477	HIS
1	B	38	GLN
1	B	249	GLN
1	C	38	GLN
1	C	396	HIS
1	C	452	ASN

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Mol	Chain	Res	Type
1	C	585	ASN
1	D	19	ASN
1	D	38	GLN
1	D	44	HIS
1	D	484	ASN
1	D	634	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

8 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	$\# Z > 2$
4	UDX	C	801	-	35,36,36	1.09	3 (8%)	52,55,55	1.63	6 (11%)
3	G6P	B	802	-	16,16,16	0.55	0	23,24,24	0.92	1 (4%)
3	G6P	D	802	-	16,16,16	0.60	0	23,24,24	1.07	2 (8%)
4	UDX	B	801	-	35,36,36	1.12	4 (11%)	52,55,55	1.53	8 (15%)
3	G6P	A	802	-	16,16,16	0.59	0	23,24,24	0.78	0
2	UDP	A	801	-	25,26,26	1.37	5 (20%)	38,40,40	1.68	7 (18%)
3	G6P	C	802	-	16,16,16	0.52	0	23,24,24	0.86	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	UDP	D	801	-	25,26,26	1.18	3 (12%)	38,40,40	1.60	7 (18%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	UDX	C	801	-	-	6/21/54/54	0/3/3/3
3	G6P	B	802	-	-	1/6/26/26	0/1/1/1
3	G6P	D	802	-	-	1/6/26/26	0/1/1/1
4	UDX	B	801	-	-	5/21/54/54	0/3/3/3
3	G6P	A	802	-	-	0/6/26/26	0/1/1/1
2	UDP	A	801	-	-	7/16/32/32	0/2/2/2
3	G6P	C	802	-	-	1/6/26/26	0/1/1/1
2	UDP	D	801	-	-	1/16/32/32	0/2/2/2

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	UDP	PB-O1B	3.61	1.61	1.50
4	C	801	UDX	C2-N1	3.04	1.43	1.38
4	B	801	UDX	C2-N1	2.76	1.42	1.38
4	B	801	UDX	PA-O3A	2.63	1.62	1.59
2	D	801	UDP	C2-N1	2.59	1.42	1.38
2	A	801	UDP	C2-N1	2.50	1.42	1.38
2	A	801	UDP	PA-O3A	2.43	1.62	1.59
4	B	801	UDX	C6-C5	2.40	1.40	1.35
2	D	801	UDP	C6-C5	2.36	1.40	1.35
2	A	801	UDP	C6-C5	2.24	1.40	1.35
4	C	801	UDX	C6-C5	2.12	1.40	1.35
2	D	801	UDP	C4-N3	-2.09	1.35	1.38
2	A	801	UDP	C4-N3	-2.07	1.35	1.38
4	C	801	UDX	PA-O3A	2.03	1.61	1.59
4	B	801	UDX	C4-N3	-2.02	1.35	1.38

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	801	UDP	N3-C2-N1	4.72	121.04	114.89
4	B	801	UDX	C4-N3-C2	-4.64	120.85	126.61

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	C	801	UDX	C4-N3-C2	-4.62	120.87	126.61
4	B	801	UDX	N3-C2-N1	4.60	120.88	114.89
2	A	801	UDP	C4-N3-C2	-4.55	120.97	126.61
2	D	801	UDP	N3-C2-N1	4.52	120.78	114.89
2	D	801	UDP	C4-N3-C2	-4.45	121.08	126.61
4	C	801	UDX	C5'-C4'-C3'	4.37	116.00	109.64
4	C	801	UDX	N3-C2-N1	4.15	120.29	114.89
4	C	801	UDX	O5'-C1'-C2'	-3.67	104.39	109.99
4	C	801	UDX	C5-C4-N3	3.55	119.78	114.80
4	B	801	UDX	C5-C4-N3	3.51	119.72	114.80
2	A	801	UDP	C5-C4-N3	3.32	119.44	114.80
2	A	801	UDP	O3B-PB-O2B	3.27	120.08	107.80
2	D	801	UDP	C5-C4-N3	3.24	119.34	114.80
4	C	801	UDX	O4-C4-C5	-3.09	119.83	125.16
2	D	801	UDP	O4-C4-C5	-2.95	120.08	125.16
3	D	802	G6P	O2P-P-O1P	2.74	118.08	107.80
2	A	801	UDP	O4-C4-C5	-2.64	120.61	125.16
4	B	801	UDX	O4-C4-C5	-2.61	120.66	125.16
4	B	801	UDX	C3D-C2D-C1D	2.55	106.29	101.46
3	D	802	G6P	O6-P-O3P	-2.43	99.88	106.44
2	D	801	UDP	O2-C2-N1	-2.30	119.80	122.80
3	B	802	G6P	O2P-P-O6	-2.28	100.73	106.67
4	B	801	UDX	O3B-C1'-C2'	2.26	112.53	108.38
4	B	801	UDX	O5'-C1'-C2'	-2.25	106.56	109.99
2	A	801	UDP	C6-N1-C2	-2.18	118.34	121.00
2	D	801	UDP	C4'-O4'-C1'	-2.13	104.76	109.47
2	D	801	UDP	O2B-PB-O1B	2.07	118.92	110.83
2	A	801	UDP	C1'-N1-C2	2.01	121.20	117.59
4	B	801	UDX	C5'-O5'-C1'	2.00	116.28	112.21

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	801	UDP	C5'-O5'-PA-O2A
2	A	801	UDP	C5'-O5'-PA-O3A
3	D	802	G6P	C6-O6-P-O3P
4	B	801	UDX	C5D-O5D-PA-O1A
4	C	801	UDX	C1'-O3B-PB-O3A
4	C	801	UDX	C2'-C1'-O3B-PB
2	A	801	UDP	C3'-C4'-C5'-O5'
4	B	801	UDX	C4D-C5D-O5D-PA

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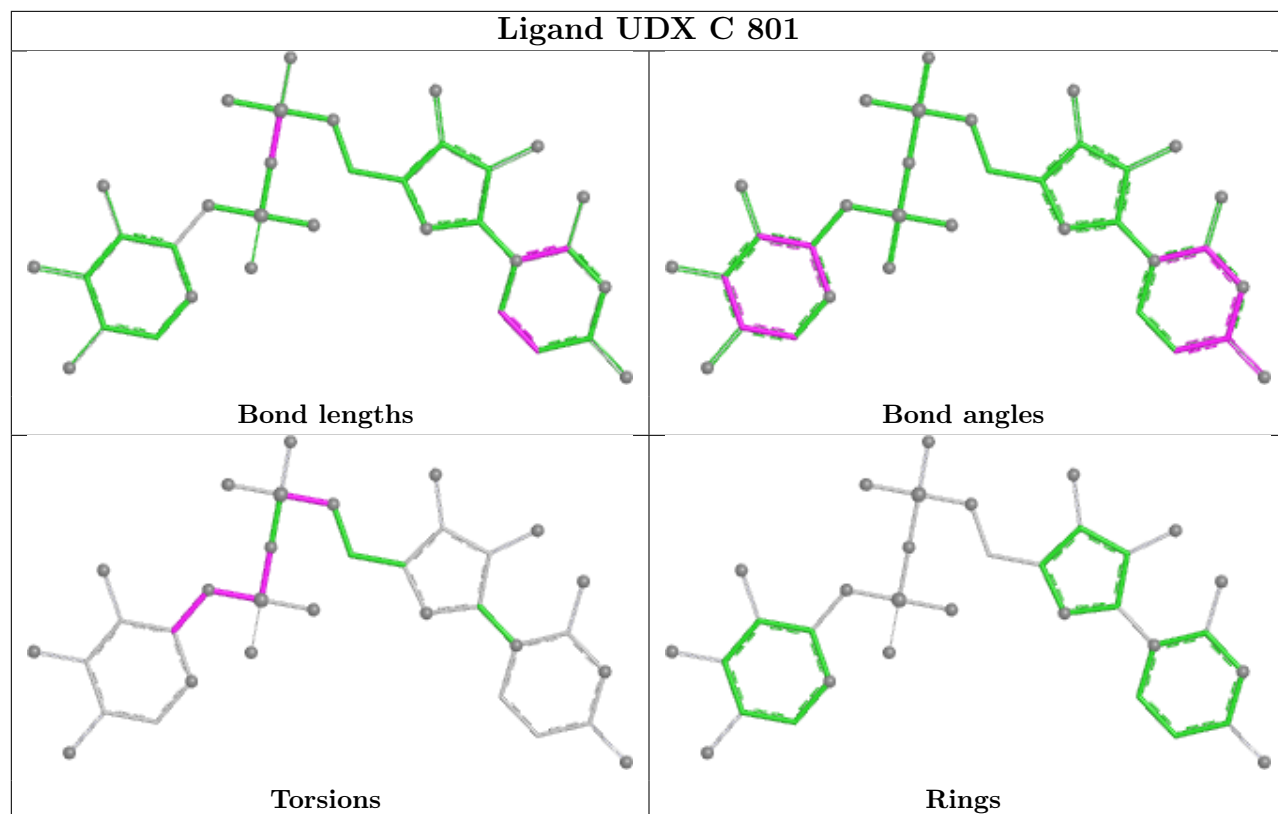
Mol	Chain	Res	Type	Atoms
2	A	801	UDP	PB-O3A-PA-O1A
2	A	801	UDP	C5'-O5'-PA-O1A
4	B	801	UDX	C5D-O5D-PA-O3A
4	B	801	UDX	C5D-O5D-PA-O2A
4	C	801	UDX	C5D-O5D-PA-O3A
2	A	801	UDP	PB-O3A-PA-O2A
4	C	801	UDX	PA-O3A-PB-O1B
4	C	801	UDX	PA-O3A-PB-O2B
3	C	802	G6P	C4-C5-C6-O6
4	B	801	UDX	PB-O3A-PA-O2A
2	A	801	UDP	O4'-C4'-C5'-O5'
3	B	802	G6P	C6-O6-P-O1P
4	C	801	UDX	C1'-O3B-PB-O1B
2	D	801	UDP	PA-O3A-PB-O3B

There are no ring outliers.

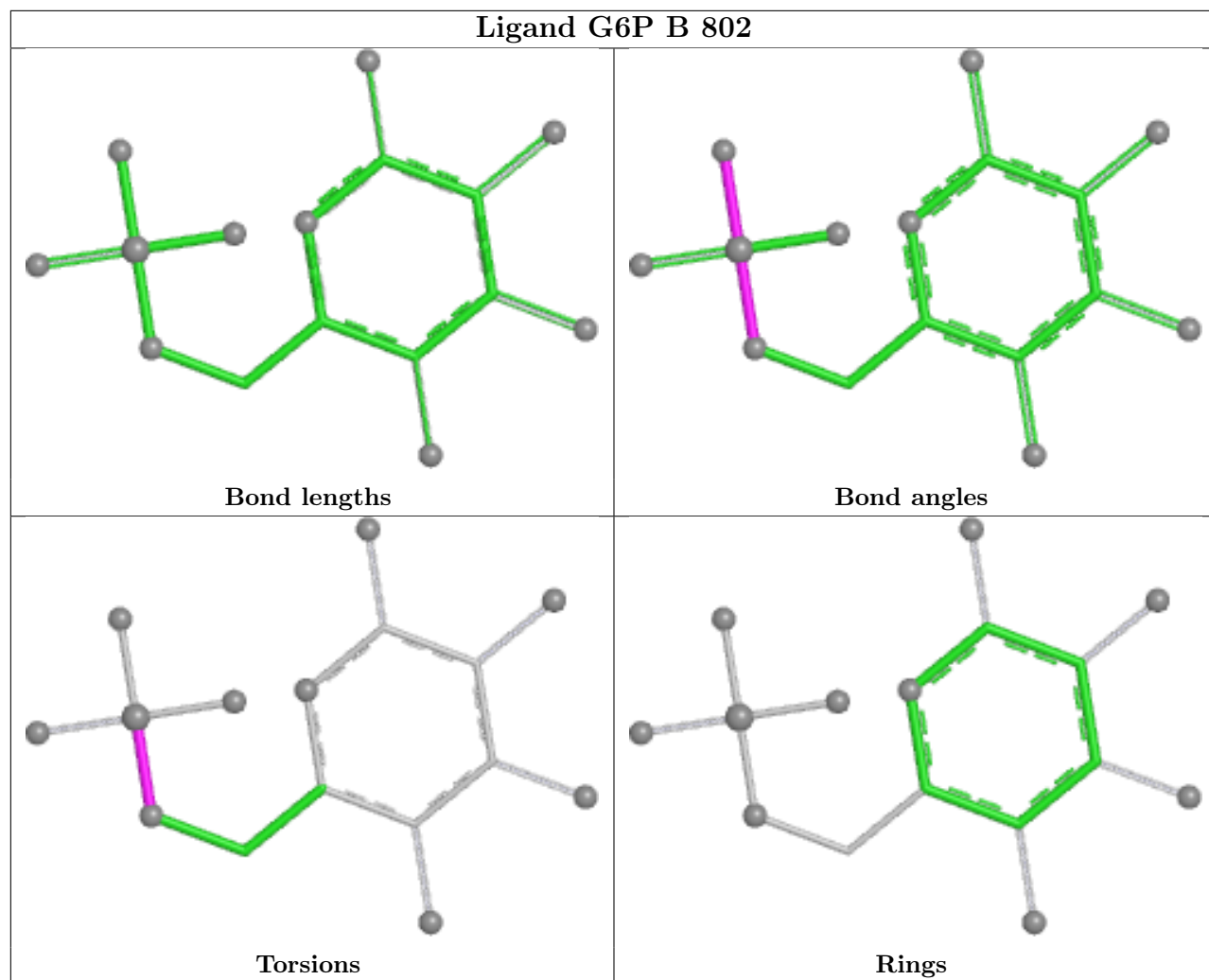
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	802	G6P	1	0
4	B	801	UDX	1	0

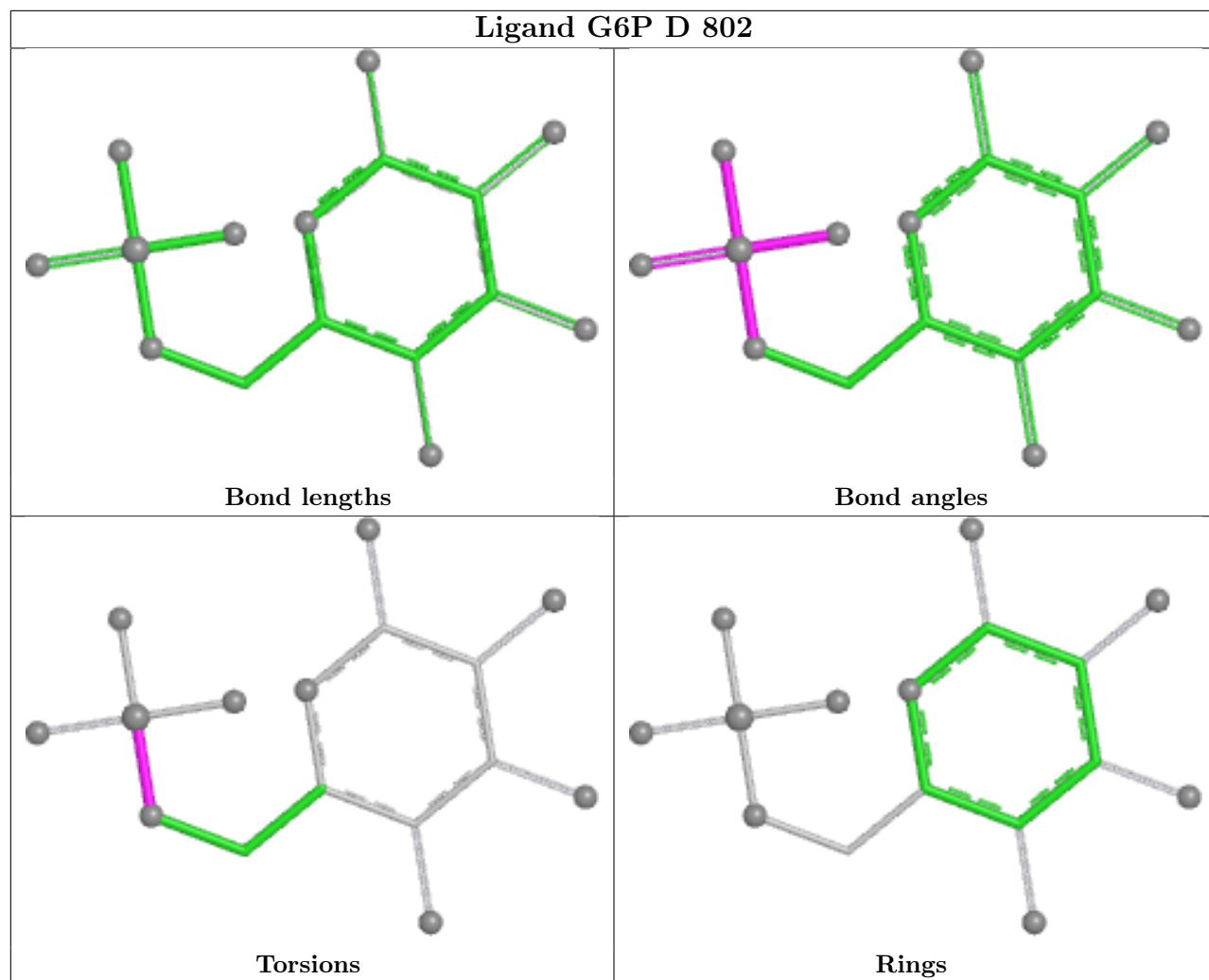
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

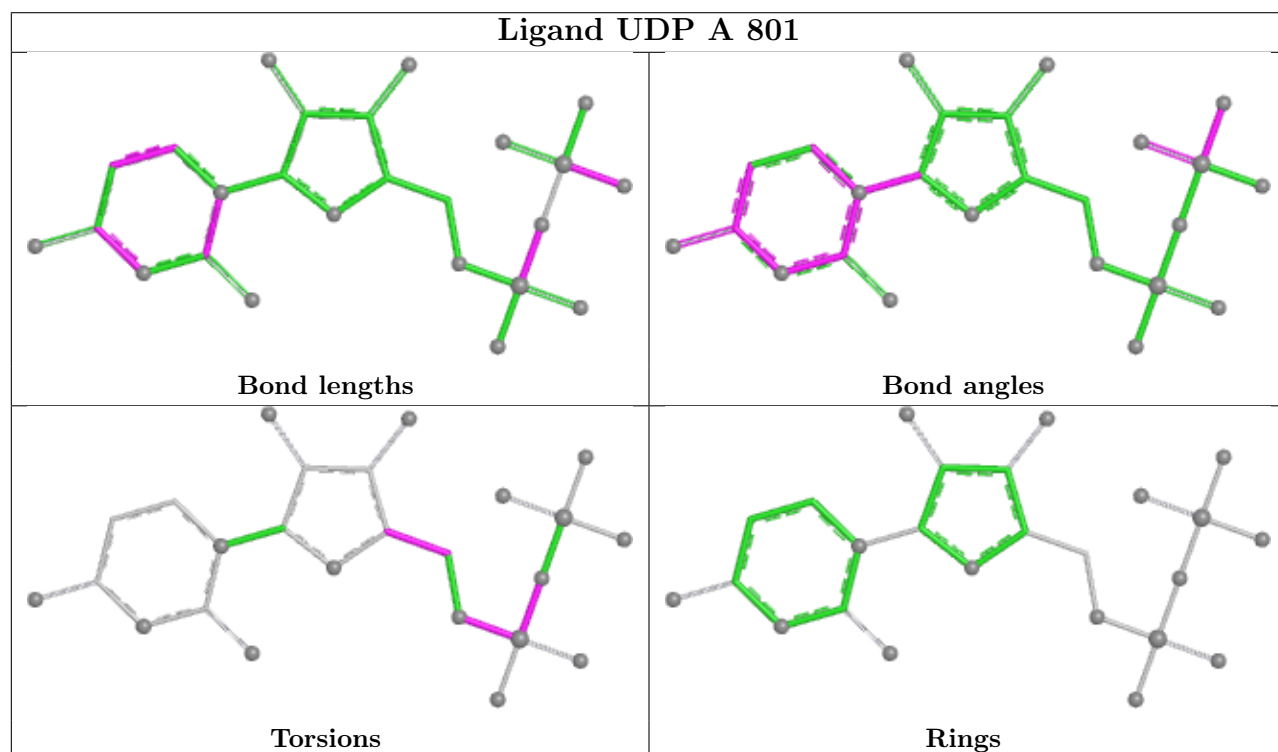
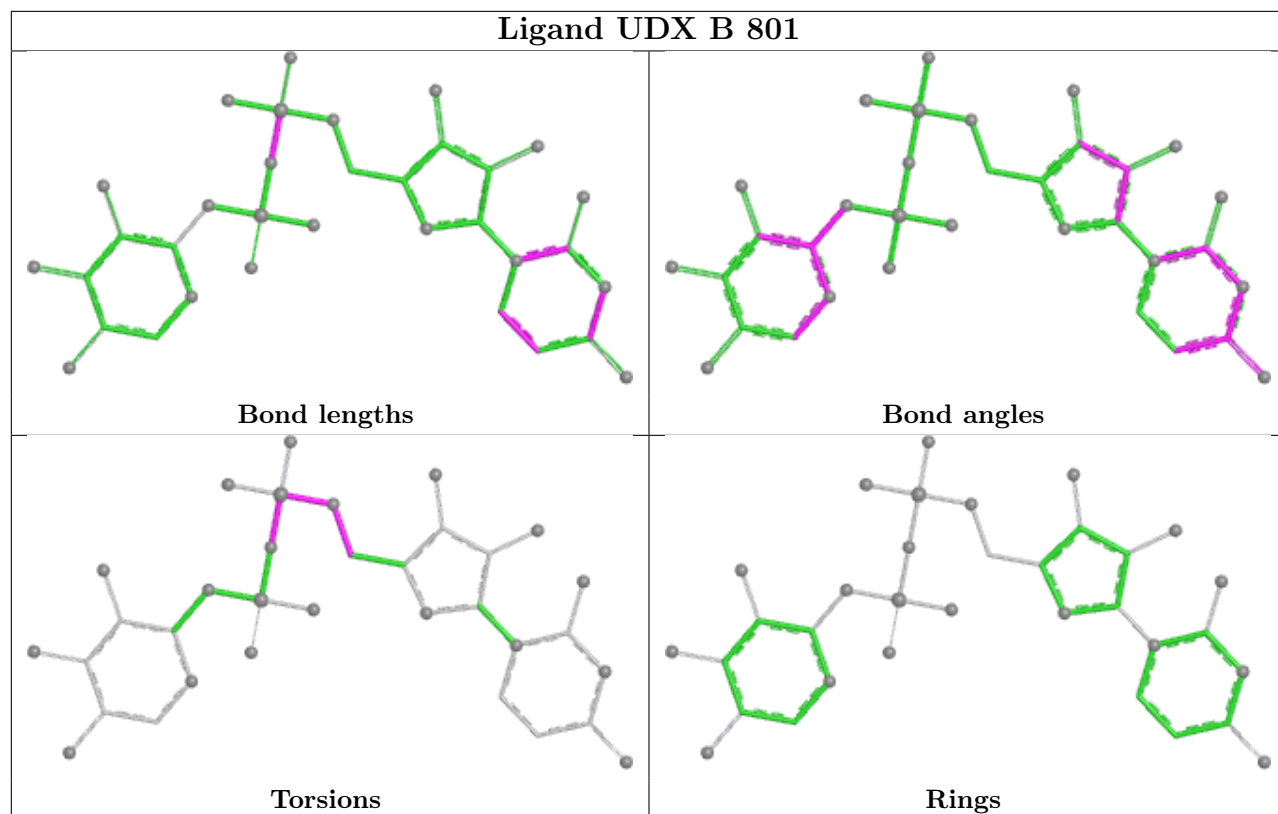


Ligand G6P B 802

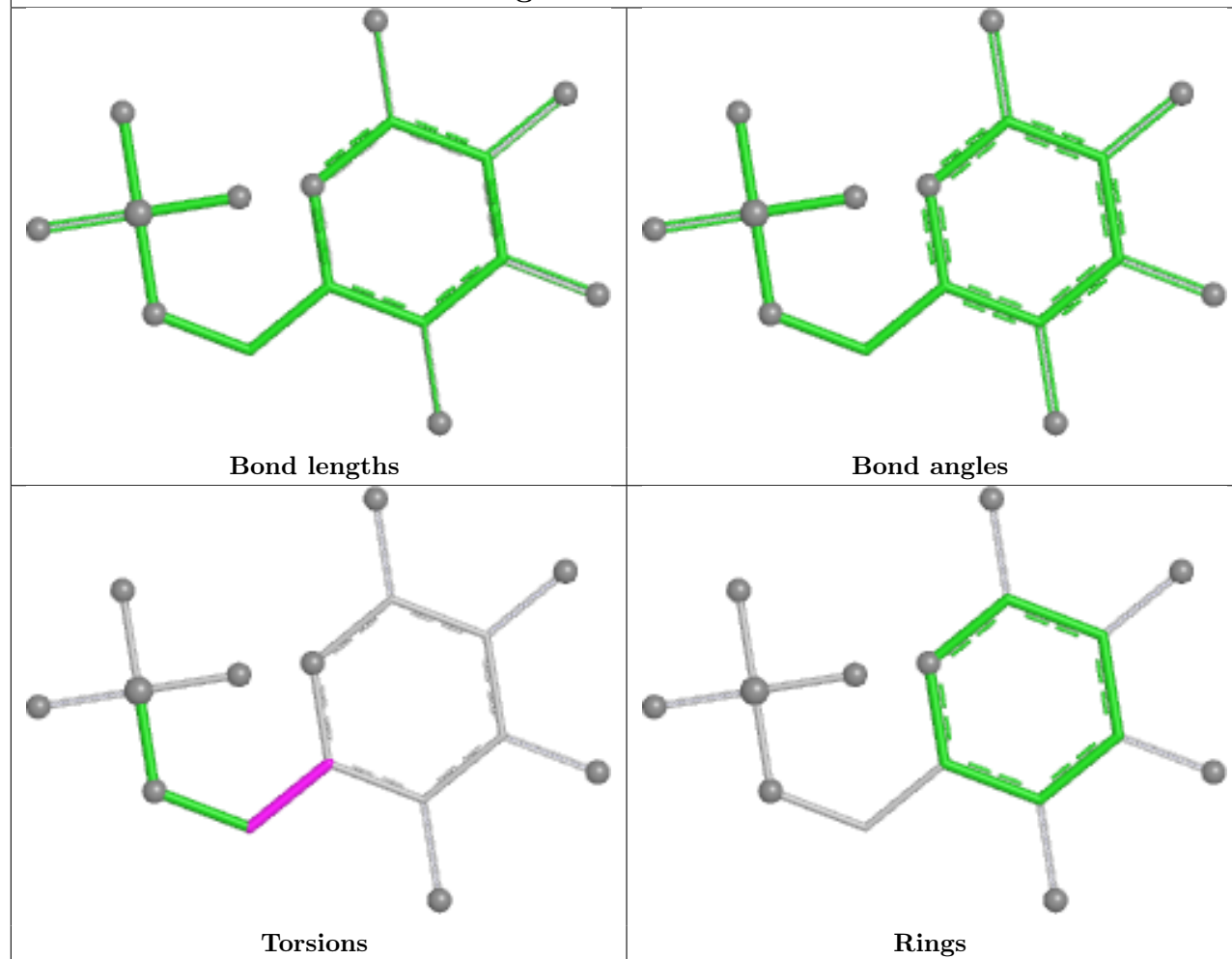


Ligand G6P D 802

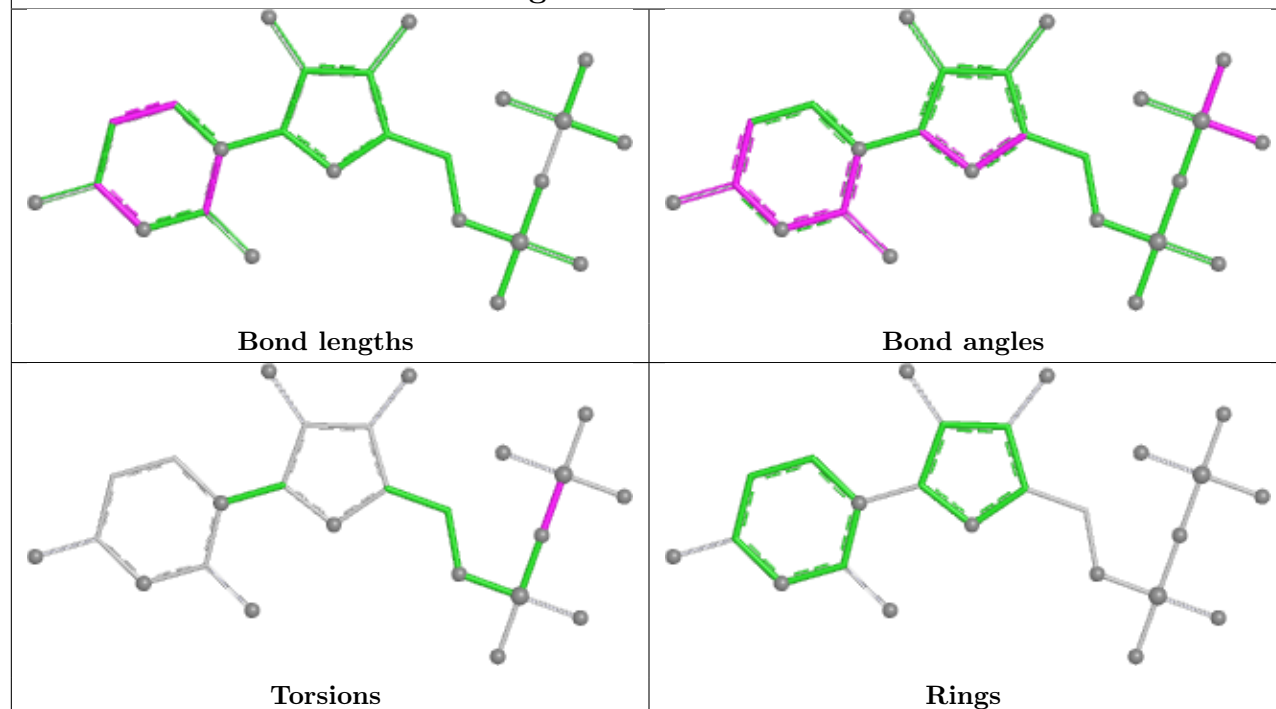




Ligand G6P C 802



Ligand UDP D 801



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	638/720 (88%)	0.27	22 (3%)	48	44	41, 73, 140, 168	0
1	B	638/720 (88%)	0.15	32 (5%)	34	30	30, 61, 142, 185	2 (0%)
1	C	638/720 (88%)	0.26	20 (3%)	51	48	39, 70, 130, 178	0
1	D	636/720 (88%)	0.48	55 (8%)	16	13	34, 77, 178, 203	0
All	All	2550/2880 (88%)	0.29	129 (5%)	33	29	30, 70, 151, 203	2 (0%)

All (129) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	205	GLY	4.8
1	D	149	TRP	4.6
1	D	60	ILE	4.5
1	A	207	PHE	4.2
1	C	125	LEU	4.2
1	D	639	ALA	4.2
1	C	543	THR	4.0
1	A	18	ALA	3.9
1	B	543	THR	3.9
1	A	149	TRP	3.9
1	C	129	PRO	3.7
1	D	91	VAL	3.7
1	B	61	LEU	3.7
1	B	625	LEU	3.7
1	A	199	ARG	3.6
1	D	630	LEU	3.6
1	A	543	THR	3.5
1	A	203	ALA	3.5
1	B	86	ARG	3.5
1	D	197	LEU	3.5
1	C	206	SER	3.4

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Mol	Chain	Res	Type	RSRZ
1	D	227	ILE	3.4
1	D	274	ILE	3.4
1	C	207	PHE	3.3
1	C	91	VAL	3.2
1	D	159	SER	3.1
1	D	204	SER	3.1
1	A	135	PHE	3.1
1	A	61	LEU	3.1
1	D	625	LEU	3.1
1	A	60	ILE	3.0
1	D	150	PHE	3.0
1	D	96	LEU	3.0
1	A	21	VAL	3.0
1	B	2	SER	2.9
1	D	40	LYS	2.9
1	A	180	ARG	2.9
1	D	223	GLY	2.9
1	D	76	VAL	2.9
1	B	60	ILE	2.9
1	D	638	LEU	2.9
1	A	125	LEU	2.8
1	B	630	LEU	2.8
1	D	61	LEU	2.8
1	B	156	HIS	2.8
1	A	108	LEU	2.7
1	B	106	PHE	2.7
1	A	129	PRO	2.7
1	D	628	GLU	2.7
1	B	64	LYS	2.7
1	B	135	PHE	2.7
1	B	639	ALA	2.7
1	D	186	VAL	2.7
1	D	203	ALA	2.7
1	A	205	GLY	2.6
1	B	91	VAL	2.6
1	A	131	PRO	2.6
1	C	18	ALA	2.6
1	A	206	SER	2.6
1	C	123	TRP	2.5
1	D	78	HIS	2.5
1	B	79	ALA	2.5
1	D	11	PHE	2.5

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Mol	Chain	Res	Type	RSRZ
1	D	123	TRP	2.5
1	D	618	TYR	2.5
1	D	63	TRP	2.5
1	D	86	ARG	2.5
1	D	622	PHE	2.5
1	A	274	ILE	2.5
1	B	157	LEU	2.5
1	D	104	ILE	2.5
1	D	2	SER	2.4
1	C	205	GLY	2.4
1	B	85	SER	2.4
1	B	90	PHE	2.4
1	B	637	ALA	2.4
1	D	125	LEU	2.4
1	D	18	ALA	2.4
1	D	225	PHE	2.3
1	D	45	LEU	2.3
1	D	184	ILE	2.3
1	D	135	PHE	2.3
1	D	68	ALA	2.3
1	D	613	ALA	2.3
1	D	637	ALA	2.3
1	B	88	VAL	2.3
1	C	279	PHE	2.3
1	D	90	PHE	2.3
1	B	623	ARG	2.3
1	C	48	PRO	2.3
1	B	63	TRP	2.3
1	D	15	THR	2.2
1	B	62	ASP	2.2
1	B	633	SER	2.2
1	D	124	SER	2.2
1	B	5	LEU	2.2
1	D	614	LEU	2.2
1	B	622	PHE	2.2
1	B	18	ALA	2.2
1	B	78	HIS	2.2
1	D	85	SER	2.2
1	A	126	VAL	2.2
1	D	182	ARG	2.2
1	C	2	SER	2.2
1	C	61	LEU	2.2

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Mol	Chain	Res	Type	RSRZ
1	D	617	GLY	2.2
1	C	135	PHE	2.2
1	C	159	SER	2.2
1	D	69	PHE	2.1
1	D	74	ARG	2.1
1	A	559	LYS	2.1
1	C	131	PRO	2.1
1	D	201	LEU	2.1
1	D	163	ILE	2.1
1	C	436	GLU	2.1
1	D	181	LYS	2.1
1	B	274	ILE	2.1
1	B	80	LEU	2.1
1	B	17	VAL	2.1
1	D	51	LYS	2.0
1	B	108	LEU	2.0
1	D	266	ILE	2.0
1	C	232	CYS	2.0
1	C	324	LYS	2.0
1	C	130	SER	2.0
1	A	128	ILE	2.0
1	B	104	ILE	2.0
1	D	128	ILE	2.0
1	A	513	TYR	2.0

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

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

6.3 Carbohydrates [i](#)

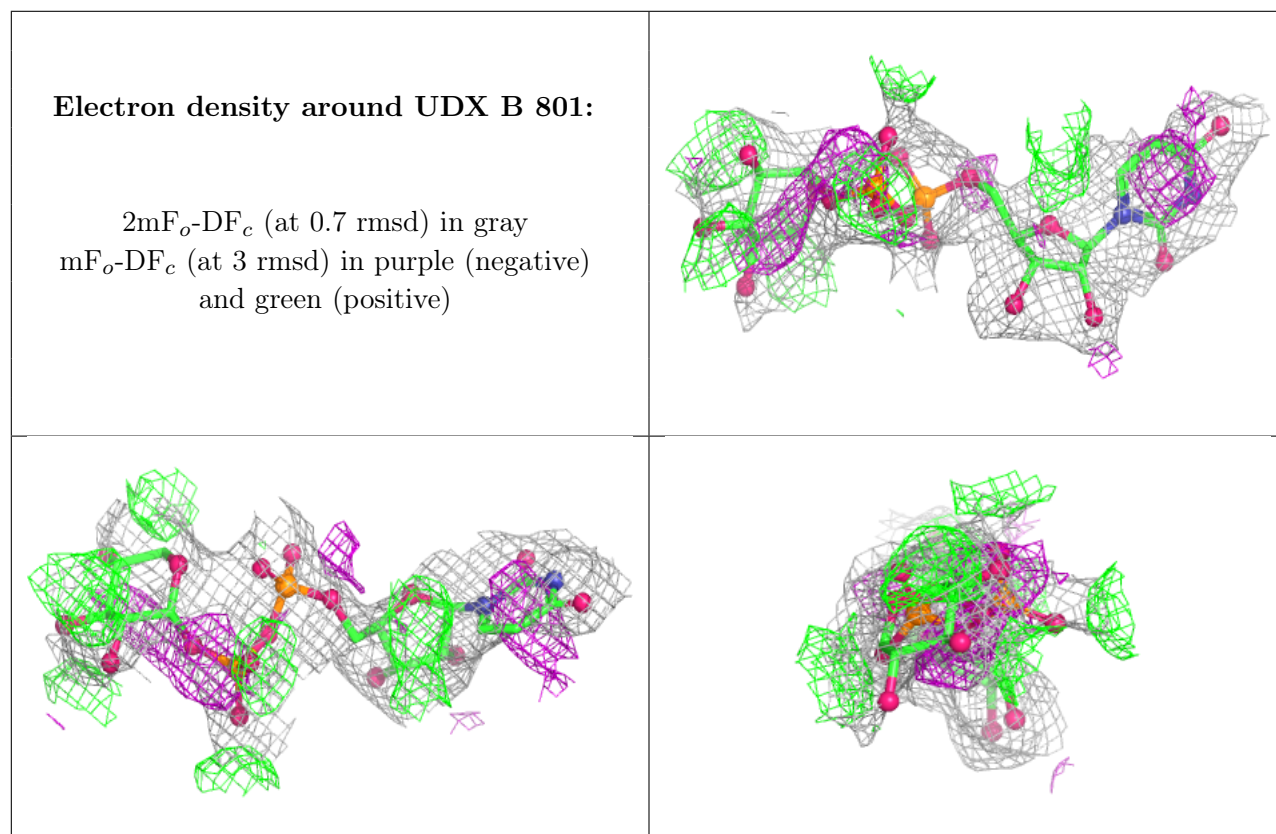
There are no oligosaccharides in this entry.

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, 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.

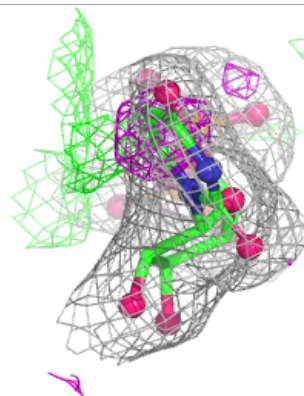
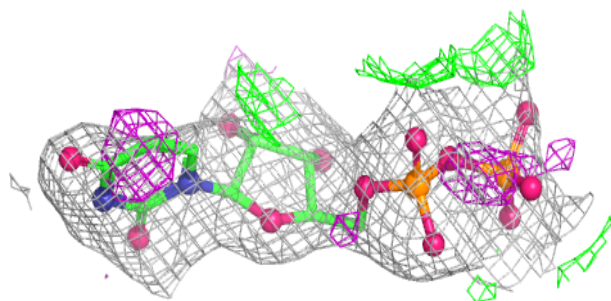
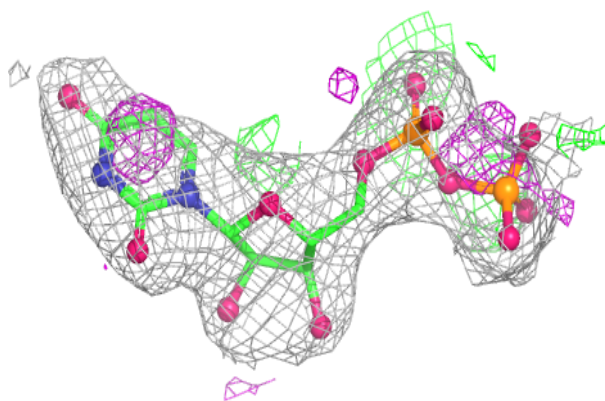
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	UDX	B	801	34/34	0.71	0.22	59,99,116,119	0
2	UDP	D	801	25/25	0.79	0.15	52,69,115,121	0
2	UDP	A	801	25/25	0.82	0.13	56,63,88,95	0
4	UDX	C	801	34/34	0.82	0.14	54,71,82,84	0
3	G6P	B	802	16/16	0.96	0.07	22,23,26,27	0
3	G6P	D	802	16/16	0.97	0.07	23,25,31,32	0
3	G6P	A	802	16/16	0.97	0.06	36,40,41,41	0
3	G6P	C	802	16/16	0.97	0.06	33,36,37,38	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.

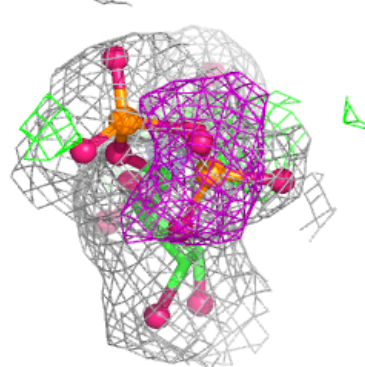
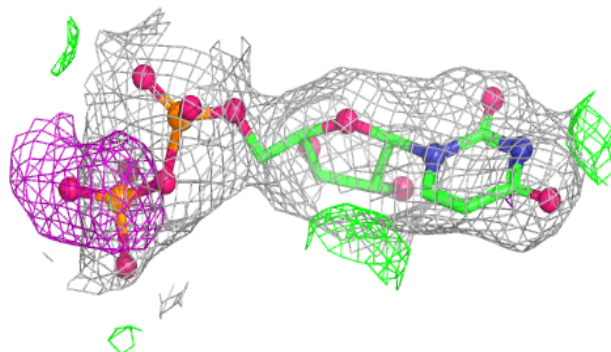
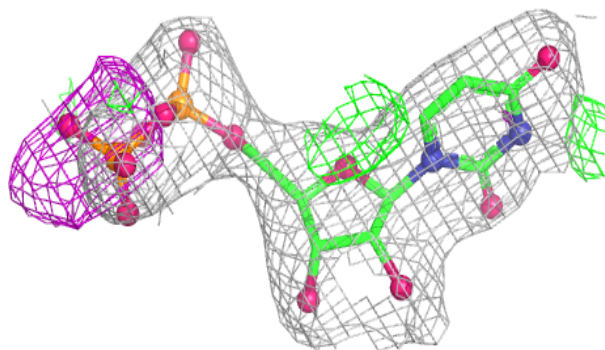


Electron density around UDP D 801:

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

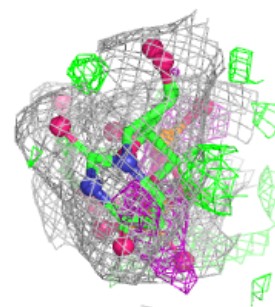
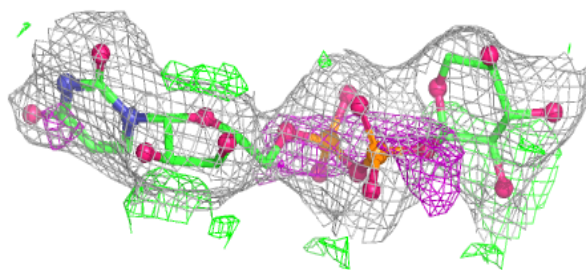
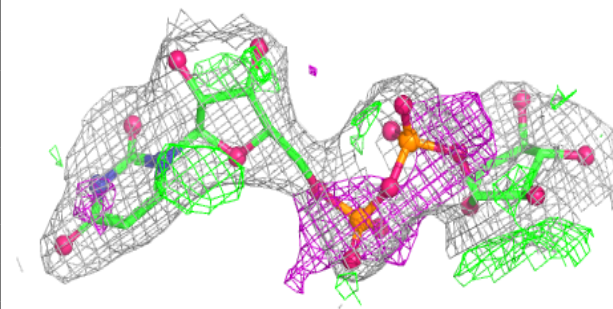
**Electron density around UDP A 801:**

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

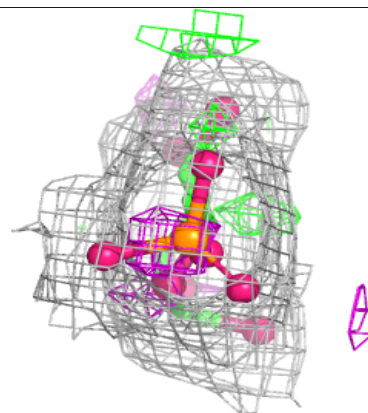
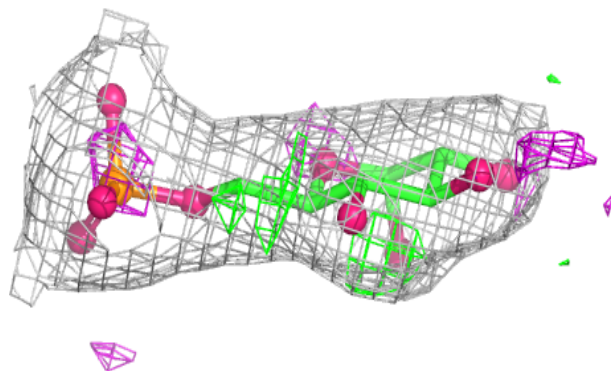
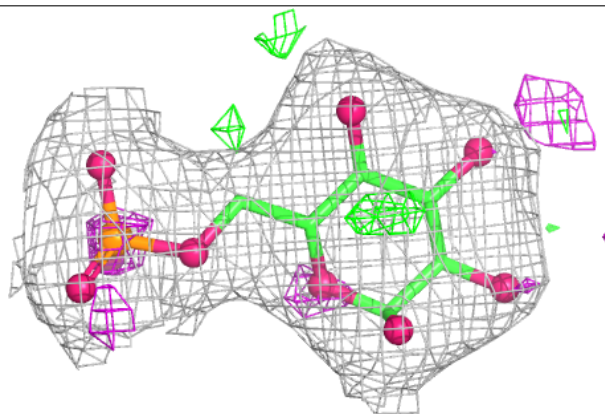


Electron density around UDX C 801:

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

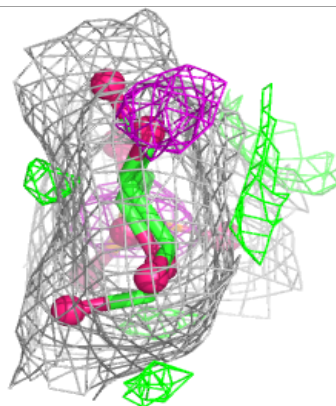
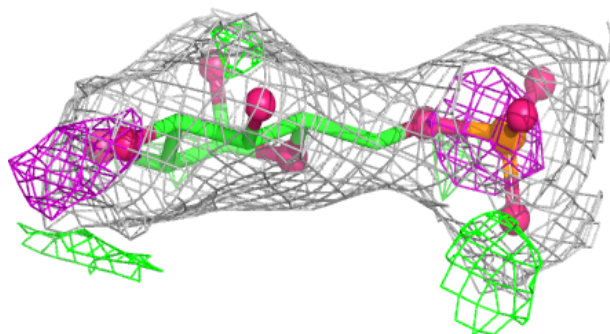
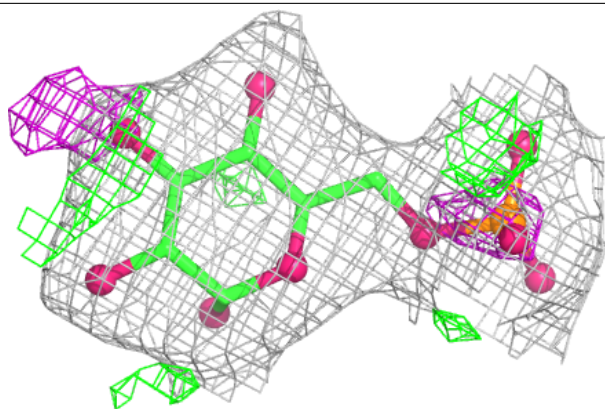
**Electron density around G6P B 802:**

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

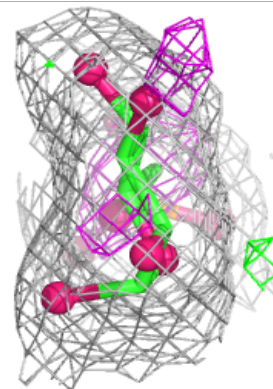
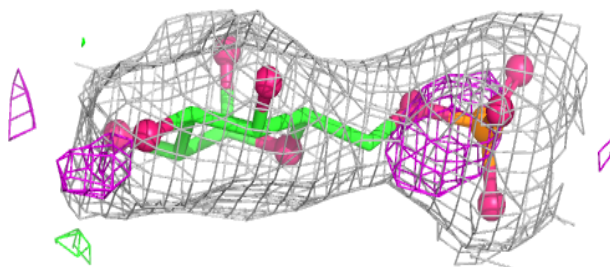
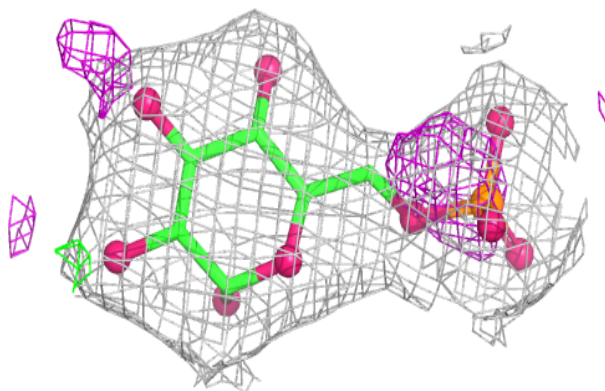


Electron density around G6P D 802:

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

**Electron density around G6P C 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.