Full wwPDB X-ray Structure Validation Report (i)

Oct 9, 2023 – 06:35 PM EDT

PDB ID	:	7UT3
Title	:	Crystal structure of complex of Fab, G10C with GalNAc-pNP
Authors	:	Li, M.; Wlodawer, A.
Deposited on	:	2022-04-26
Resolution	:	3.00 Å(reported)

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

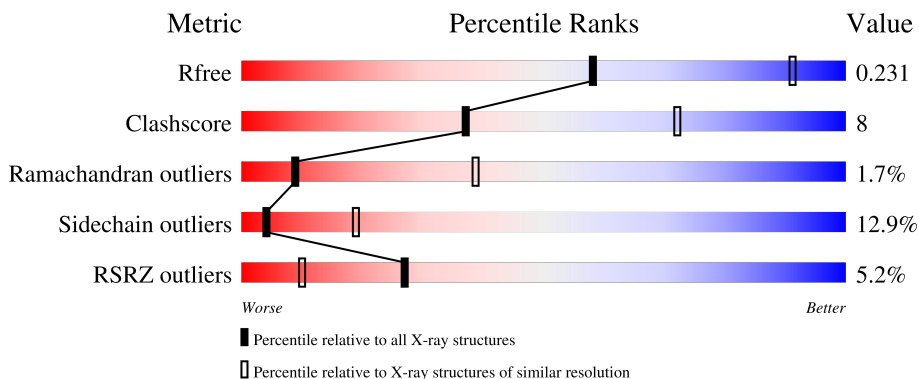|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & 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 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	Percentile Ranks	Value
Rfree		0.231
Clashscore		8
Ramachandran outliers		1.7%
Sidechain outliers		12.9%
RSRZ outliers		5.2%

Worse — *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (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 <=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	H	217	10% — 74% — 22% — ·
2	L	212	77% — 20% — ··

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 3371 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 Fab protein heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	H	217	Total 1667	C 1049	N 281	O 326	S 11	0	1	0

- Molecule 2 is a protein called G10C Light chain.

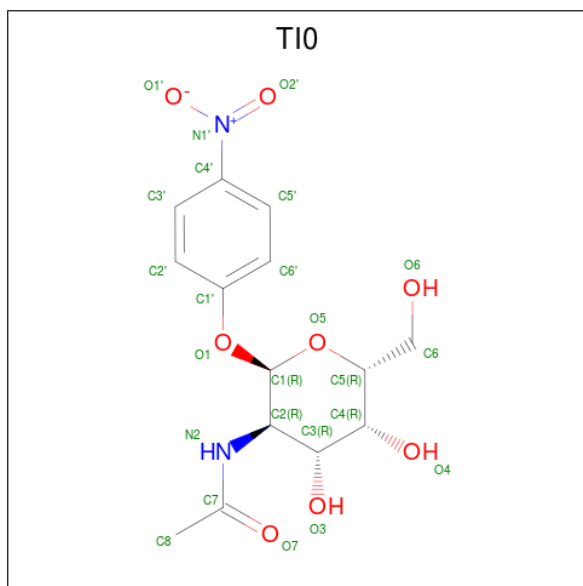| Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	210	Total 1615	C 1009	N 270	O 329	S 7	0	0	0

- Molecule 3 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula: $C_4H_{12}NO_3$).
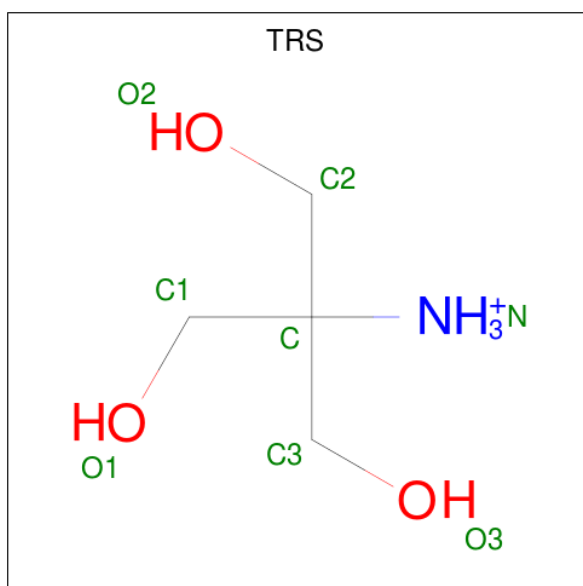
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	H	1	Total 8	C 4	N 1	O 3	0	0

- Molecule 4 is 4-nitrophenyl 2-acetamido-2-deoxy-alpha-D-galactopyranoside (three-letter

code: TI0) (formula: $C_{14}H_{18}N_2O_8$) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	L	1	Total	C	N	O	0	0
			24	14	2	8		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	H	18	Total	O	0	0
			18	18		
5	L	39	Total	O	0	0
			39	39		

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: Fab protein heavy chain
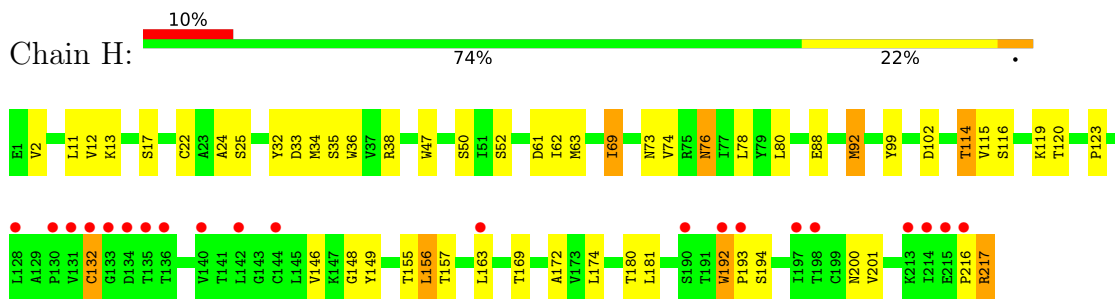
Chain H:

• Molecule 2: G10C Light chain

Chain L:
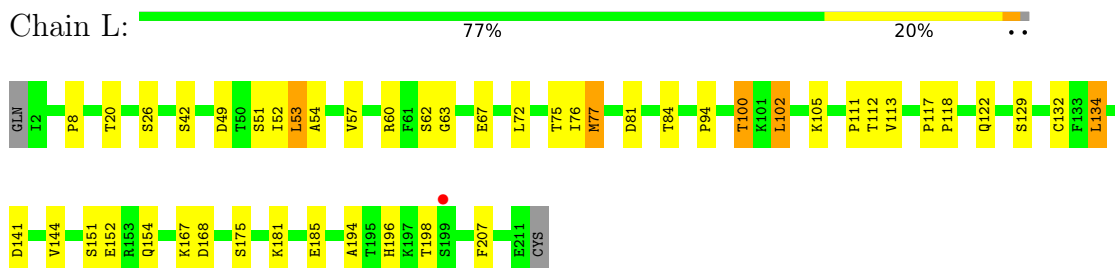
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, α, β, γ	132.59Å 132.59Å 169.05Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	47.54 – 3.00 47.49 – 3.00	Depositor EDS
% Data completeness (in resolution range)	80.6 (47.54-3.00) 80.7 (47.49-3.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$< I/\sigma(I) >$ [1]	3.68 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.186 , 0.240 0.187 , 0.231	Depositor DCC
R_{free} test set	588 reflections (4.00%)	wwPDB-VP
Wilson B-factor (Å^2)	54.8	Xtriage
Anisotropy	0.165	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 59.2	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	3371	wwPDB-VP
Average B, all atoms (Å^2)	95.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.71% of the height of the origin peak. No significant pseudotranslation is detected.*

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

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: TRS, TI0

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	H	0.68	1/1708 (0.1%)	0.75	0/2328
2	L	0.64	0/1654	0.77	0/2248
All	All	0.66	1/3362 (0.0%)	0.76	0/4576

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	H	217	ARG	C-O	9.18	1.40	1.23

There are no bond angle outliers.

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	H	1667	0	1628	23	0
2	L	1615	0	1548	29	0
3	H	8	0	12	0	0
4	L	24	0	0	0	0
5	H	18	0	0	2	0
5	L	39	0	0	11	0
All	All	3371	0	3188	51	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 8.

All (51) 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:L:84:THR:HG22	5:L:420:HOH:O	1.84	0.78
2:L:57:VAL:HB	5:L:402:HOH:O	1.93	0.68
2:L:54:ALA:N	5:L:402:HOH:O	2.27	0.67
2:L:53:LEU:CA	5:L:402:HOH:O	2.42	0.67
1:H:156:LEU:HD22	1:H:169:THR:HG21	1.79	0.64
1:H:34:MET:HB3	1:H:78:LEU:HD22	1.80	0.64
1:H:69:ILE:HD11	1:H:78:LEU:HD11	1.81	0.62
2:L:134:LEU:HD13	2:L:134:LEU:N	2.16	0.61
2:L:60:ARG:HB2	2:L:75:THR:HG22	1.86	0.58
2:L:77:MET:CE	2:L:102:LEU:HD13	2.35	0.56
2:L:111:PRO:HD3	5:L:427:HOH:O	2.03	0.56
1:H:33:ASP:OD2	1:H:52:SER:HA	2.06	0.55
2:L:72:LEU:C	2:L:72:LEU:HD23	2.27	0.55
1:H:11:LEU:HA	1:H:114:THR:O	2.08	0.53
2:L:117:PRO:HB3	2:L:207:PHE:CE2	2.43	0.53
1:H:76:ASN:C	5:H:701:HOH:O	2.47	0.53
2:L:194:ALA:N	5:L:401:HOH:O	2.26	0.53
2:L:53:LEU:CB	5:L:402:HOH:O	2.58	0.52
2:L:113:VAL:HG12	2:L:134:LEU:HD12	1.93	0.51
1:H:36:TRP:CD1	1:H:69:ILE:HD13	2.46	0.51
2:L:77:MET:HE2	2:L:102:LEU:HD13	1.93	0.49
1:H:99:TYR:O	1:H:102:ASP:HB2	2.13	0.49
1:H:192:TRP:CD2	1:H:193:PRO:HA	2.46	0.49
2:L:49:ASP:HB2	2:L:52:ILE:HD12	1.94	0.49
1:H:192:TRP:CG	1:H:193:PRO:HA	2.47	0.49
2:L:53:LEU:HA	5:L:402:HOH:O	2.11	0.49
1:H:47:TRP:CZ3	2:L:94:PRO:HD2	2.47	0.49
2:L:53:LEU:C	5:L:402:HOH:O	2.48	0.48
1:H:156:LEU:HG	1:H:157:THR:N	2.28	0.48
2:L:122:GLN:OE1	2:L:129:SER:N	2.47	0.47
2:L:196:HIS:CG	5:L:427:HOH:O	2.68	0.46
1:H:132:CYS:HA	1:H:217:ARG:HD3	1.97	0.45
1:H:149:TYR:OH	1:H:172:ALA:HB2	2.16	0.45
2:L:53:LEU:HB3	5:L:402:HOH:O	2.17	0.45
2:L:60:ARG:NH1	2:L:81:ASP:OD1	2.49	0.45
2:L:76:ILE:O	2:L:76:ILE:HG22	2.15	0.45
2:L:8:PRO:O	2:L:100:THR:HB	2.16	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:32:TYR:CE1	1:H:99:TYR:HB2	2.52	0.44
2:L:152:GLU:OE2	2:L:154:GLN:NE2	2.50	0.43
2:L:134:LEU:HD21	2:L:144:VAL:HG21	2.00	0.43
1:H:24:ALA:HB3	5:H:701:HOH:O	2.18	0.43
1:H:38:ARG:HA	1:H:92:MET:O	2.19	0.43
1:H:123:PRO:HB2	1:H:146:VAL:HG13	2.01	0.42
1:H:36:TRP:NE1	1:H:80:LEU:HB2	2.34	0.42
1:H:156:LEU:HB2	1:H:201:VAL:HG22	2.01	0.42
1:H:156:LEU:C	1:H:156:LEU:HD23	2.40	0.42
2:L:102:LEU:HD23	2:L:102:LEU:HA	1.81	0.41
2:L:51:SER:HA	2:L:63:GLY:O	2.20	0.41
1:H:174:LEU:HD12	1:H:174:LEU:HA	1.97	0.40
2:L:77:MET:HE3	2:L:102:LEU:HD13	2.03	0.40
1:H:69:ILE:CD1	1:H:78:LEU:HD11	2.50	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	H	216/217 (100%)	187 (87%)	24 (11%)	5 (2%)	6	30
2	L	208/212 (98%)	181 (87%)	25 (12%)	2 (1%)	15	53
All	All	424/429 (99%)	368 (87%)	49 (12%)	7 (2%)	9	39

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	120	THR
1	H	76	ASN
1	H	216	PRO
2	L	67	GLU

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Mol	Chain	Res	Type
1	H	194	SER
2	L	118	PRO
1	H	148	GLY

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	H	189/188 (100%)	161 (85%)	28 (15%)	3	14
2	L	183/185 (99%)	163 (89%)	20 (11%)	6	25
All	All	372/373 (100%)	324 (87%)	48 (13%)	4	19

All (48) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	2	VAL
1	H	12	VAL
1	H	13	LYS
1	H	17	SER
1	H	22	CYS
1	H	25	SER
1	H	35	SER
1	H	50	SER
1	H	61	ASP
1	H	62	ILE
1	H	63	MET
1	H	69	ILE
1	H	73	ASN
1	H	74	VAL
1	H	88	GLU
1	H	92	MET
1	H	114	THR
1	H	115	VAL
1	H	116	SER
1	H	119	LYS

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Mol	Chain	Res	Type
1	H	132	CYS
1	H	155	THR
1	H	156	LEU
1	H	163	LEU
1	H	180	THR
1	H	181	LEU
1	H	192	TRP
1	H	200	ASN
2	L	20	THR
2	L	26	SER
2	L	42	SER
2	L	53	LEU
2	L	62	SER
2	L	77	MET
2	L	100	THR
2	L	102	LEU
2	L	105	LYS
2	L	112	THR
2	L	132	CYS
2	L	134	LEU
2	L	141	ASP
2	L	151	SER
2	L	167	LYS
2	L	168	ASP
2	L	175	SER
2	L	181	LYS
2	L	185	GLU
2	L	198	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	H	73	ASN
1	H	168	HIS
1	H	200	ASN
2	L	188	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 ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

2 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	TRS	H	601	-	7,7,7	0.38	0	9,9,9	0.58	0
4	TI0	L	301	-	24,25,25	2.12	2 (8%)	33,35,35	0.91	1 (3%)

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	TRS	H	601	-	-	9/9/9/9	-
4	TI0	L	301	-	-	4/12/34/34	0/2/2/2

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	L	301	TI0	O2'-N1'	9.93	1.39	1.22
4	L	301	TI0	C4'-N1'	-2.21	1.39	1.45

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	L	301	TI0	C1'-O1-C1	4.12	123.83	117.79

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	H	601	TRS	C2-C-C1-O1
3	H	601	TRS	C3-C-C1-O1
3	H	601	TRS	N-C-C1-O1
3	H	601	TRS	C3-C-C2-O2
3	H	601	TRS	C2-C-C3-O3
3	H	601	TRS	N-C-C3-O3
4	L	301	TI0	C3-C2-N2-C7
3	H	601	TRS	C1-C-C2-O2
3	H	601	TRS	C1-C-C3-O3
4	L	301	TI0	C4-C5-C6-O6
4	L	301	TI0	O5-C5-C6-O6
3	H	601	TRS	N-C-C2-O2
4	L	301	TI0	C1-C2-N2-C7

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand TI0 L 301

Bond lengths

Bond angles

Torsions

Rings
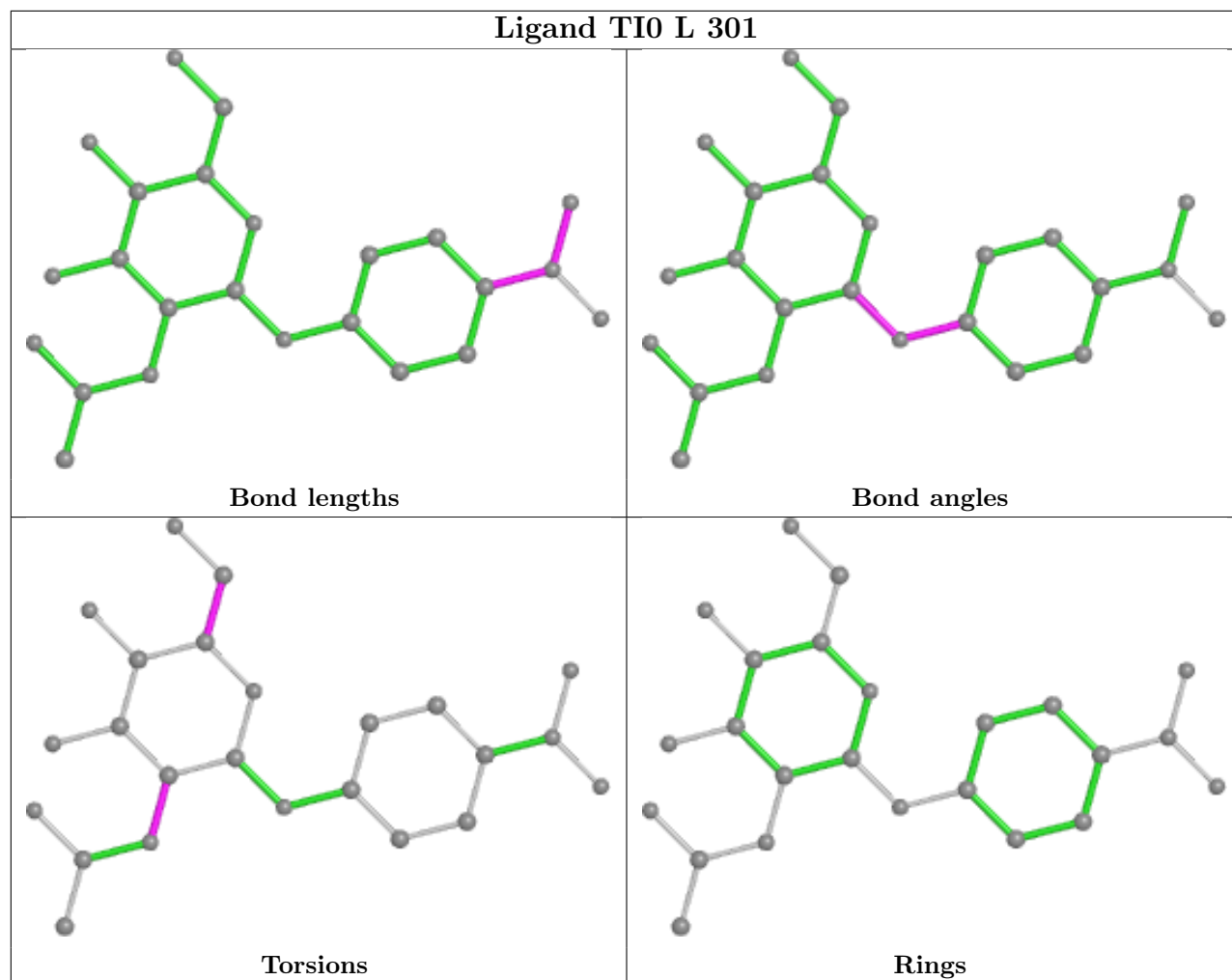
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	H	217/217 (100%)	0.14	21 (9%)	7	2	31, 104, 199, 248	0
2	L	210/212 (99%)	-0.45	1 (0%)	91	75	28, 91, 156, 177	0
All	All	427/429 (99%)	-0.15	22 (5%)	27	10	28, 98, 180, 248	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	H	131	VAL	7.8
1	H	134	ASP	5.9
1	H	135	THR	5.8
1	H	133	GLY	4.9
1	H	132	CYS	4.5
1	H	215	GLU	4.0
1	H	192	TRP	3.5
1	H	197	ILE	3.4
1	H	144[A]	CYS	3.2
1	H	140	VAL	2.8
1	H	193	PRO	2.8
1	H	214	ILE	2.8
1	H	198	THR	2.6
1	H	142	LEU	2.5
1	H	136	THR	2.4
2	L	199	SER	2.4
1	H	216	PRO	2.4
1	H	128	LEU	2.1
1	H	130	PRO	2.1
1	H	190	SER	2.1
1	H	163	LEU	2.0
1	H	213	LYS	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 monosaccharides in this entry.

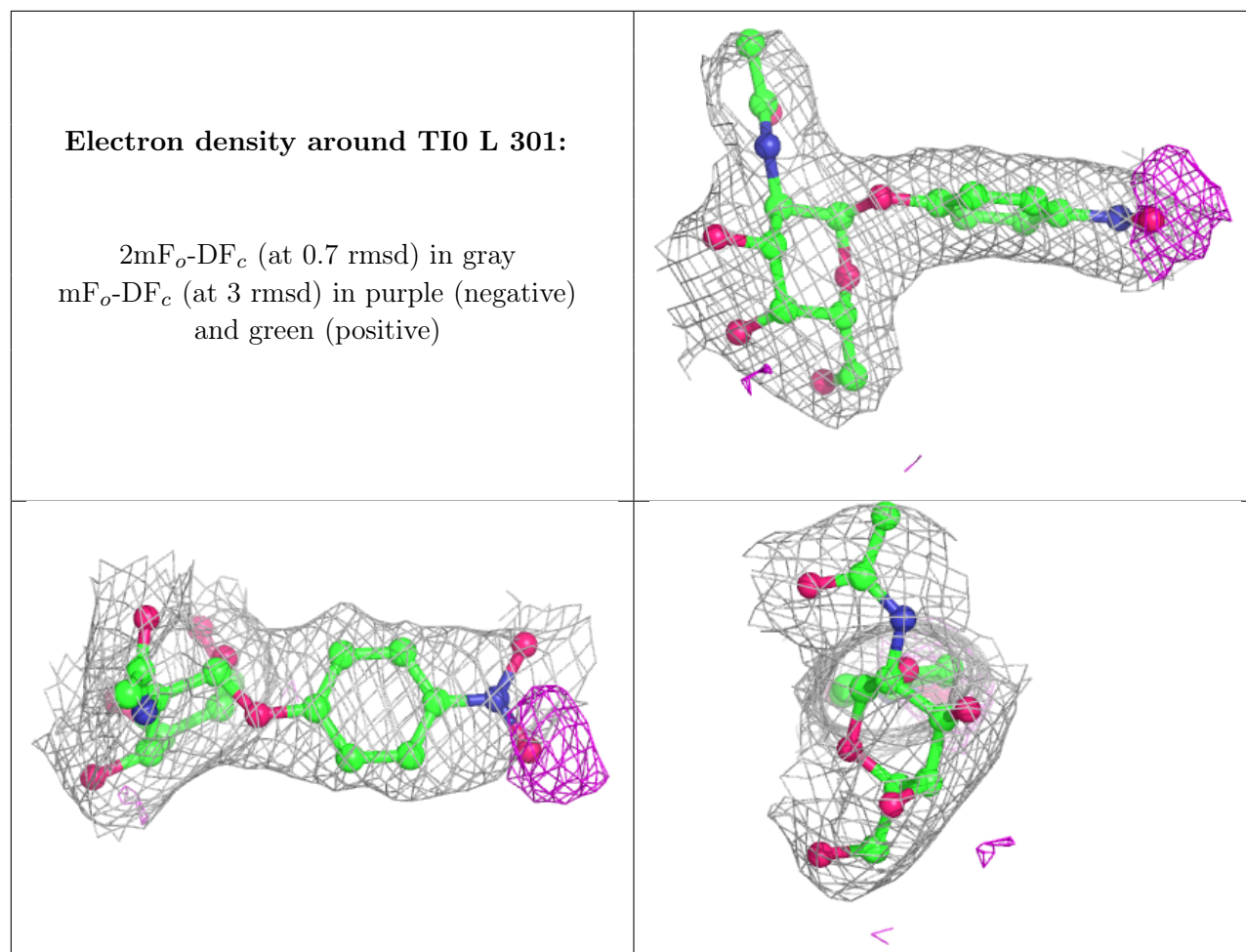## 6.4 Ligands (i)

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, 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	TRS	H	601	8/8	0.97	0.15	35,42,45,46	8
4	TI0	L	301	24/24	0.99	0.16	24,31,43,53	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 TI0 L 301:

$2mF_o$-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 ⓘ

There are no such residues in this entry.