



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 28, 2021 – 01:02 pm GMT

PDB ID : 6YAT  
Title : Crystal structure of STK4 (MST1) in complex with compound 6  
Authors : Chaikuad, A.; Bata, N.; Limpert, A.S.; Lambert, L.J.; Bakas, N.A.; Cosford, N.D.P.; Knapp, S.; Structural Genomics Consortium (SGC)  
Deposited on : 2020-03-13  
Resolution : 2.58 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](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.

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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 : 1.8.4 (270009), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.23.2  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0267  
CCP4 : 7.1.010 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

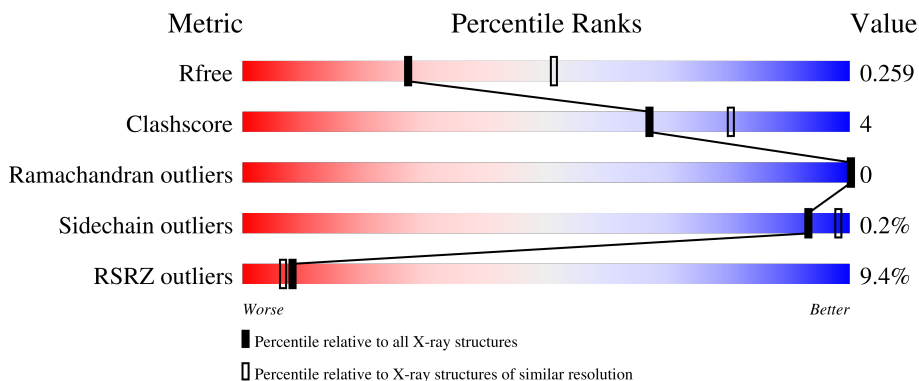
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.58 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	3676 (2.60-2.56)
Clashscore	141614	4049 (2.60-2.56)
Ramachandran outliers	138981	3979 (2.60-2.56)
Sidechain outliers	138945	3979 (2.60-2.56)
RSRZ outliers	127900	3614 (2.60-2.56)

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	314	 2% 83% 10% 7%
1	B	314	 15% 80% 8% 12%

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
3	GOL	A	408	-	-	-	X

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4513 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.

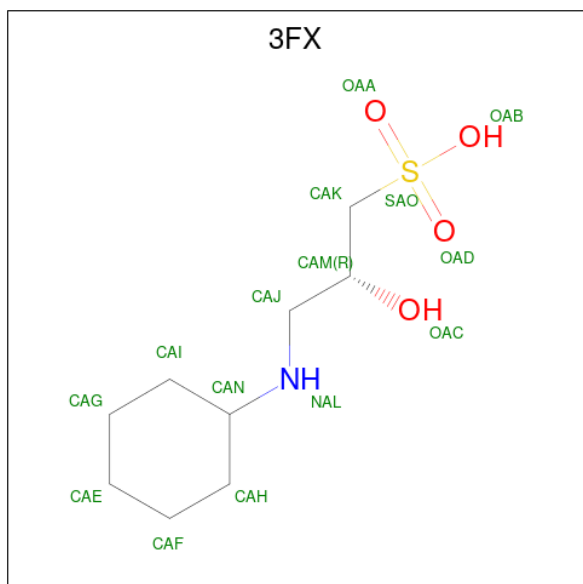
- Molecule 1 is a protein called Serine/threonine-protein kinase 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	N	O	P				S
1	A	291	Total	C	N	O	P	S	0	0	0
			2300	1464	386	435	2	13			
1	B	276	Total	C	N	O	P	S	0	0	0
			2068	1310	349	394	2	13			

There are 6 discrepancies between the modelled and reference sequences:

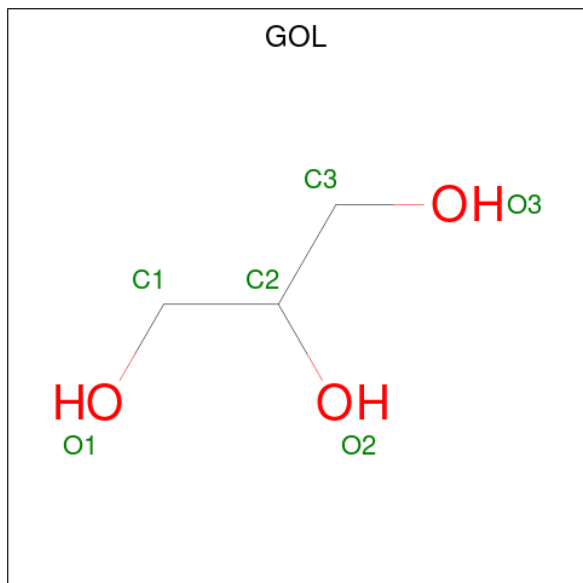
Chain	Residue	Modelled	Actual	Comment	Reference
A	0	SER	-	expression tag	UNP Q13043
A	312	GLU	-	expression tag	UNP Q13043
A	313	GLY	-	expression tag	UNP Q13043
B	0	SER	-	expression tag	UNP Q13043
B	312	GLU	-	expression tag	UNP Q13043
B	313	GLY	-	expression tag	UNP Q13043

- Molecule 2 is (2R)-3-(cyclohexylamino)-2-hydroxypropane-1-sulfonic acid (three-letter code: 3FX) (formula: C<sub>9</sub>H<sub>19</sub>NO<sub>4</sub>S).



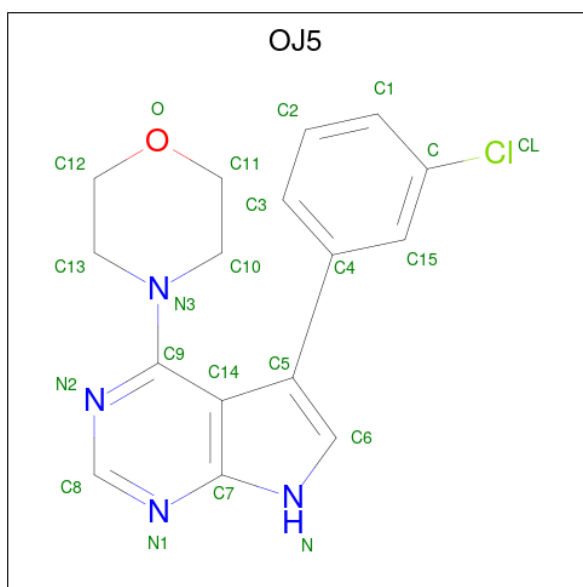
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	A	1	15	9	1	4	1	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



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

- Molecule 4 is 4-[5-(3-chlorophenyl)-7 {H}-pyrrolo[2,3-d]pyrimidin-4-yl]morpholine (three-letter code: OJ5) (formula: C<sub>16</sub>H<sub>15</sub>ClN<sub>4</sub>O) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Cl	N			O
4	A	1	22	16	1	4	1	0	0
4	B	1	22	16	1	4	1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	36	Total 36 O 36	0	0
5	B	8	Total 8 O 8	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	111.68Å 111.68Å 171.49Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.00 – 2.58 47.95 – 2.58	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.00-2.58) 99.9 (47.95-2.58)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.80 (at 2.58Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, $R_{free}$	0.225 , 0.259 0.226 , 0.259	Depositor DCC
$R_{free}$ test set	1727 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	68.2	Xtriage
Anisotropy	0.231	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	(Not available) , (Not available)	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	4513	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	90.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.58% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 3FX, TPO, GOL, OJ5

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	0.71	0/2324	0.67	0/3144
1	B	0.70	0/2083	0.67	0/2829
All	All	0.71	0/4407	0.67	0/5973

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

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	2300	0	2300	21	0
1	B	2068	0	1983	13	0
2	A	15	0	18	0	0
3	A	42	0	56	3	0
4	A	22	0	0	0	0
4	B	22	0	0	0	0
5	A	36	0	0	0	0
5	B	8	0	0	0	0
All	All	4513	0	4357	34	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 4.

All (34) 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:40:SER:OG	1:A:169:GLY:HA3	1.90	0.71
1:A:90:GLY:HA3	3:A:403:GOL:H2	1.74	0.70
1:A:251:SER:HB2	3:A:407:GOL:H2	1.74	0.70
1:A:188:PRO:HB3	1:A:233:ILE:HG13	1.76	0.67
1:A:188:PRO:HG3	1:A:233:ILE:HD11	1.82	0.61
1:A:41:TYR:HB2	1:A:70:ILE:HD11	1.83	0.61
1:A:113:ILE:HG21	1:A:293:LEU:HD21	1.85	0.58
1:B:77:MET:HB3	1:B:88:TYR:HB2	1.85	0.57
1:A:121:LEU:HD22	1:A:293:LEU:HD11	1.87	0.55
1:A:67:LEU:O	1:A:71:ILE:HG12	2.07	0.54
1:A:121:LEU:HD22	1:A:293:LEU:CD1	2.38	0.54
1:A:59:LYS:NZ	1:A:73:GLU:OE1	2.40	0.53
1:B:150:ILE:HB	1:B:209:SER:HB2	1.92	0.52
1:A:299:ASP:O	1:A:303:LYS:HG2	2.09	0.51
1:A:141:HIS:CG	1:A:203:CYS:HB3	2.46	0.51
1:A:251:SER:CB	3:A:407:GOL:H2	2.42	0.49
1:B:141:HIS:CG	1:B:203:CYS:HB3	2.47	0.49
1:B:236:ILE:HB	1:B:237:PRO:HD3	1.94	0.49
1:A:236:ILE:HB	1:A:237:PRO:HD3	1.95	0.48
1:A:156:LEU:O	1:A:163:ALA:HA	2.13	0.48
1:B:113:ILE:HG21	1:B:293:LEU:HD21	1.96	0.47
1:A:219:GLU:OE1	1:A:245:ARG:NH1	2.44	0.46
1:B:156:LEU:O	1:B:163:ALA:HA	2.17	0.45
1:A:188:PRO:HB3	1:A:233:ILE:CG1	2.45	0.44
1:B:78:GLN:HE21	1:B:88:TYR:HE2	1.66	0.44
1:B:190:TRP:CH2	1:B:222:PRO:HG3	2.54	0.43
1:B:290:LEU:O	1:B:294:ILE:HG12	2.18	0.43
1:B:219:GLU:OE1	1:B:245:ARG:NH1	2.47	0.42
1:A:290:LEU:O	1:A:294:ILE:HG12	2.19	0.41
1:B:202:ASN:OD1	1:B:204:VAL:HG22	2.21	0.41
1:B:121:LEU:HD22	1:B:293:LEU:HD11	2.03	0.41
1:A:236:ILE:N	1:A:237:PRO:CD	2.84	0.41
1:B:146:ILE:HG22	1:B:148:ARG:CG	2.51	0.41
1:A:256:ASP:O	1:A:260:GLN:HG2	2.21	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	A	287/314 (91%)	275 (96%)	12 (4%)	0	100	100
1	B	270/314 (86%)	260 (96%)	10 (4%)	0	100	100
All	All	557/628 (89%)	535 (96%)	22 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 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	249/275 (90%)	248 (100%)	1 (0%)	91	97
1	B	208/275 (76%)	208 (100%)	0	100	100
All	All	457/550 (83%)	456 (100%)	1 (0%)	93	98

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	124	ASP

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

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

4 non-standard protein/DNA/RNA residues are modelled in this entry.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

10 ligands are modelled in this entry.

There are no bond length outliers.

There are no bond angle outliers.

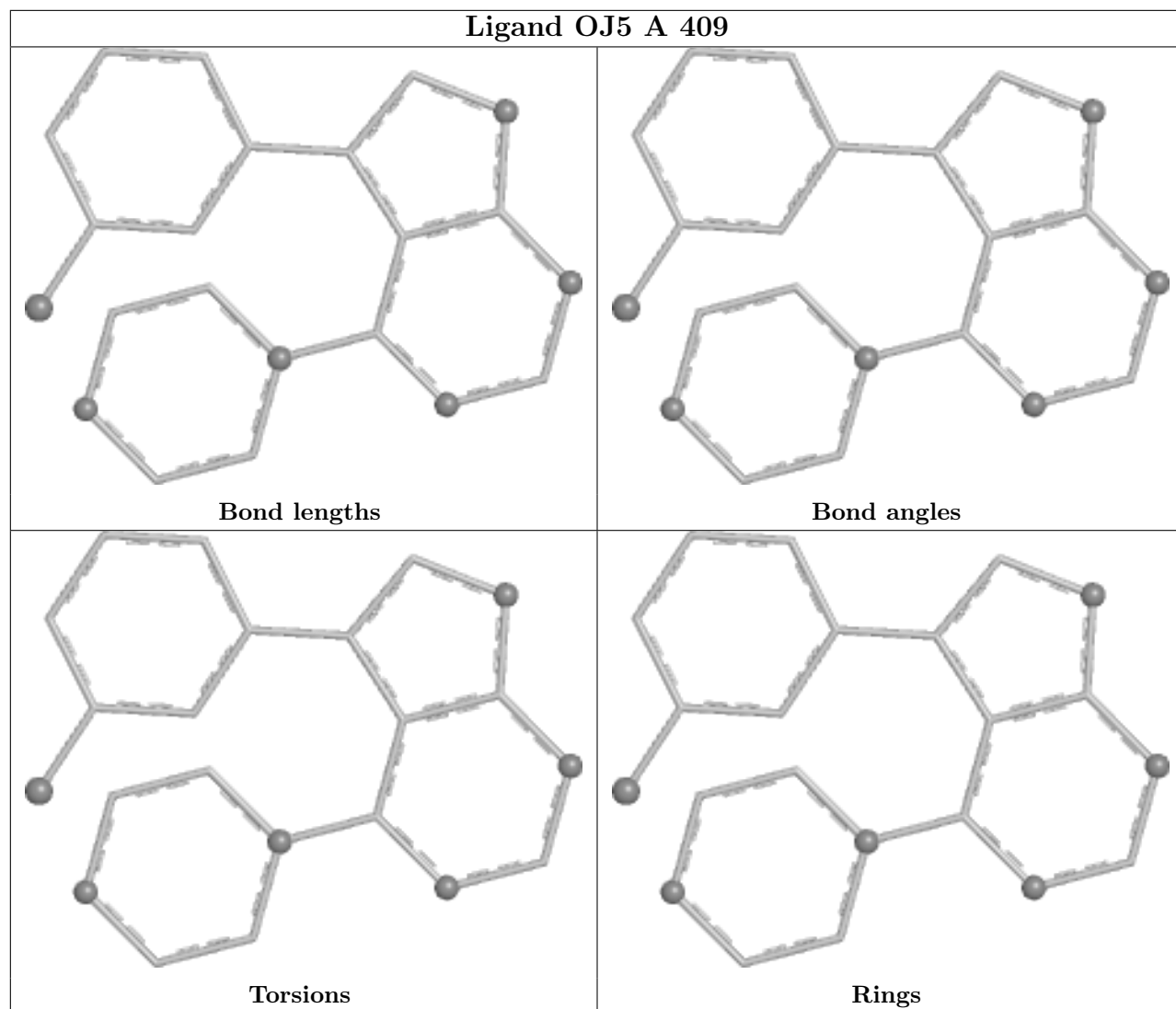
There are no chirality outliers.

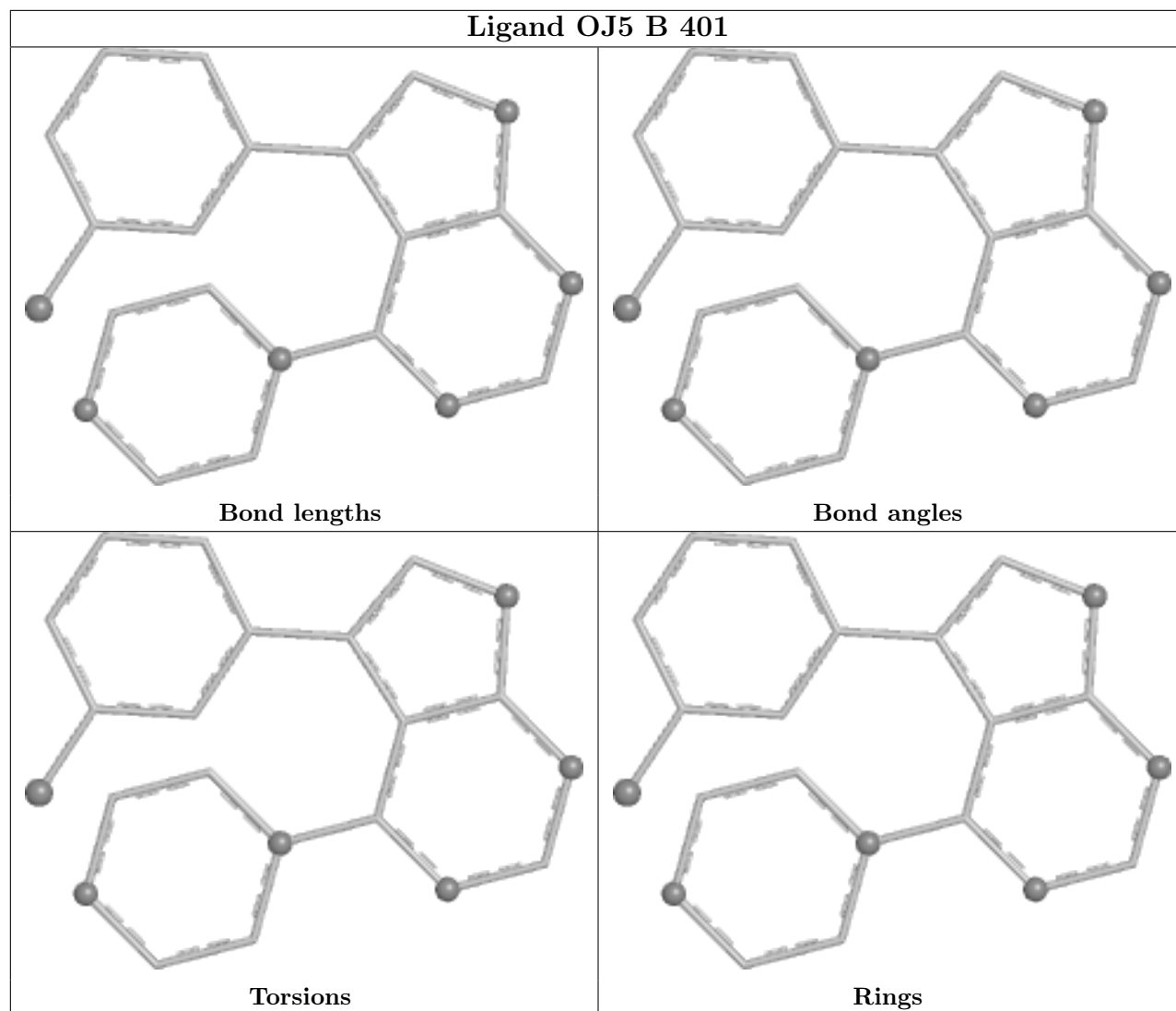
There are no torsion outliers.

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 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

### 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, 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	289/314 (92%)	0.42	7 (2%) 59 55	47, 67, 105, 167	0
1	B	274/314 (87%)	0.94	46 (16%) 1 1	59, 111, 176, 191	0
All	All	563/628 (89%)	0.67	53 (9%) 8 7	47, 81, 164, 191	0

All (53) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	31	ASP	5.9
1	B	48	ILE	5.9
1	B	100	ILE	5.8
1	B	288	SER	5.8
1	B	91	SER	5.0
1	A	18	ASP	5.0
1	B	289	ILE	4.8
1	B	294	ILE	4.3
1	B	106	GLY	4.2
1	B	57	ALA	4.2
1	B	297	ALA	4.2
1	B	50	LYS	4.0
1	B	215	ILE	4.0
1	A	302	LEU	3.9
1	B	55	ILE	3.9
1	B	32	VAL	3.9
1	B	30	PHE	3.8
1	B	52	THR	3.7
1	A	308	GLN	3.5
1	B	107	ALA	3.5
1	B	92	TYR	3.3
1	B	295	ASN	3.3
1	B	113	ILE	3.2
1	B	53	GLY	3.1

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Mol	Chain	Res	Type	RSRZ
1	B	291	ARG	3.1
1	B	49	HIS	3.1
1	B	54	GLN	3.0
1	B	155	ILE	3.0
1	B	99	TRP	3.0
1	A	305	GLN	3.0
1	B	34	GLU	2.9
1	B	47	ALA	2.9
1	B	110	VAL	2.8
1	B	160	GLU	2.7
1	B	210	LEU	2.5
1	B	51	GLU	2.5
1	B	214	ALA	2.5
1	B	299	ASP	2.5
1	B	292	ASP	2.5
1	A	306	GLU	2.5
1	B	293	LEU	2.4
1	B	45	TYR	2.4
1	B	56	VAL	2.4
1	B	298	MET	2.4
1	B	244	PHE	2.4
1	B	95	ASN	2.3
1	B	114	ILE	2.3
1	B	126	ILE	2.2
1	B	108	GLY	2.2
1	B	159	THR	2.1
1	A	234	PHE	2.1
1	A	48	ILE	2.0
1	B	104	TYR	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [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(Å <sup>2</sup> )	Q<0.9
1	TPO	A	177	11/12	0.94	0.12	87,96,108,110	0
1	TPO	B	177	11/12	0.94	0.12	92,107,115,117	0
1	TPO	B	183	11/12	0.94	0.16	78,82,85,89	0
1	TPO	A	183	11/12	0.97	0.16	64,66,69,70	0



### 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 6.4 Ligands [i](#)

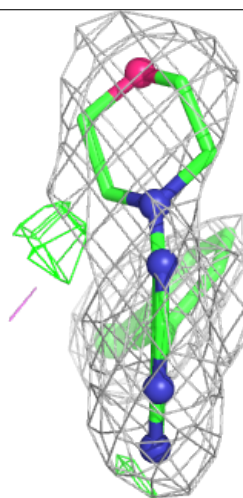
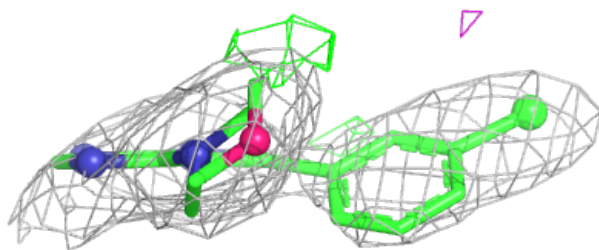
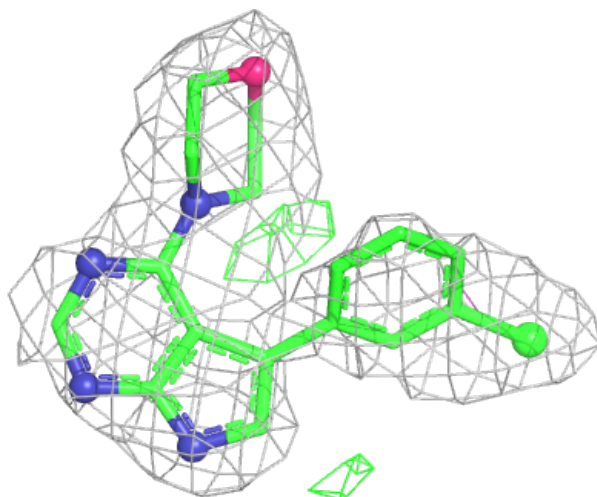
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

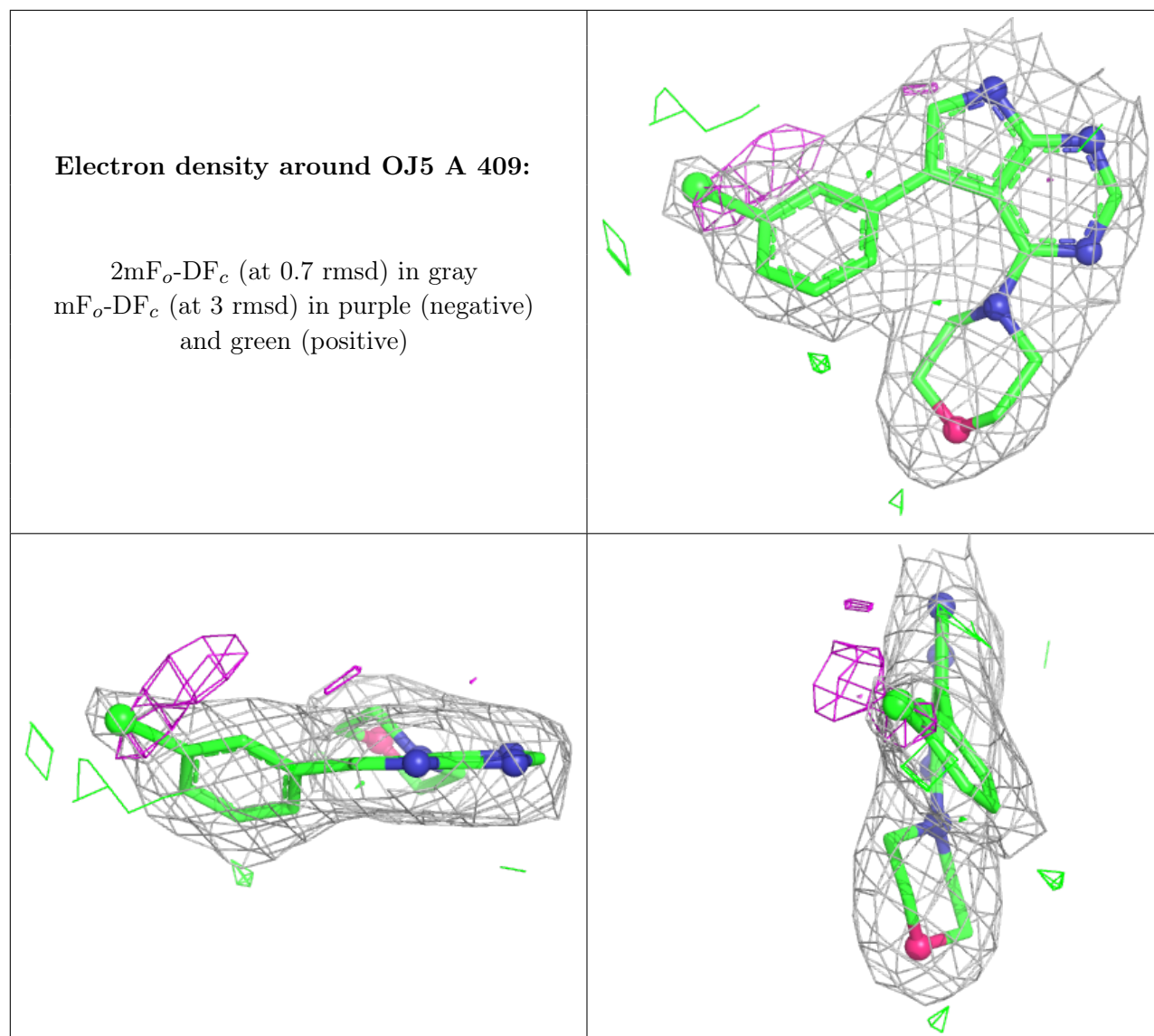
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	GOL	A	408	6/6	0.67	0.42	73,86,92,92	0
3	GOL	A	405	6/6	0.78	0.28	99,102,105,106	0
4	OJ5	B	401	22/22	0.79	0.24	105,120,129,132	0
3	GOL	A	406	6/6	0.80	0.21	92,102,103,104	0
3	GOL	A	407	6/6	0.81	0.18	89,95,96,96	0
3	GOL	A	403	6/6	0.83	0.33	78,90,93,104	0
3	GOL	A	404	6/6	0.84	0.28	97,100,102,102	0
3	GOL	A	402	6/6	0.91	0.33	83,92,97,103	0
4	OJ5	A	409	22/22	0.94	0.18	49,61,67,106	0
2	3FX	A	401	15/15	0.94	0.21	84,92,103,110	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 OJ5 B 401:**

$2mF_o-DF_c$  (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.