



# Full wwPDB/EMDataBank EM Map/Model Validation Report ⓘ

Sep 30, 2019 – 03:32 PM EDT

PDB ID : 6Q0T  
EMDB ID: : EMD-20552  
Title : Structure of a MAPK pathway complex  
Authors : Park, E.; Rawson, S.; Jeon, H.; Eck, M.J.  
Deposited on : 2019-08-02  
Resolution : 5.70 Å(reported)

This is a Full wwPDB/EMDataBank EM Map/Model Validation Report  
for a publicly released PDB/EMDB 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/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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MolProbity : 4.02b-467  
Mogul : 1.8.0 (224370), CSD as540be (2019)  
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.4

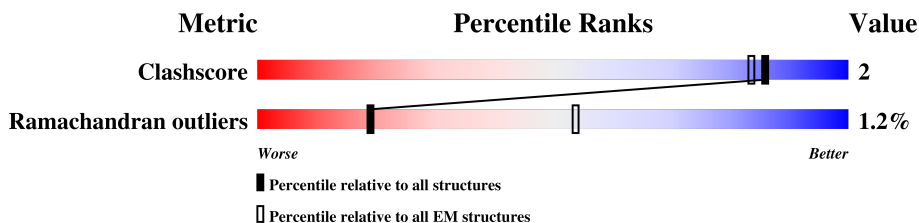
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 5.70 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)	EM structures (#Entries)
Clashscore	136327	1886
Ramachandran outliers	132723	1663

The table below summarises the geometric issues observed across the polymeric chains. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	805	
1	B	805	
2	C	414	
3	X	247	
3	Y	247	

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 6615 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 B-raf.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
1	A	280	1389	824	280	284	1	1	0
1	B	278	1379	818	278	282	1	1	0

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-26	MET	-	expression tag	UNP P15056
A	-25	SER	-	expression tag	UNP P15056
A	-24	TYR	-	expression tag	UNP P15056
A	-23	TYR	-	expression tag	UNP P15056
A	-22	HIS	-	expression tag	UNP P15056
A	-21	HIS	-	expression tag	UNP P15056
A	-20	HIS	-	expression tag	UNP P15056
A	-19	HIS	-	expression tag	UNP P15056
A	-18	HIS	-	expression tag	UNP P15056
A	-17	HIS	-	expression tag	UNP P15056
A	-16	HIS	-	expression tag	UNP P15056
A	-15	HIS	-	expression tag	UNP P15056
A	-14	ASP	-	expression tag	UNP P15056
A	-13	ILE	-	expression tag	UNP P15056
A	-12	PRO	-	expression tag	UNP P15056
A	-11	THR	-	expression tag	UNP P15056
A	-10	THR	-	expression tag	UNP P15056
A	-9	GLU	-	expression tag	UNP P15056
A	-8	ASN	-	expression tag	UNP P15056
A	-7	LEU	-	expression tag	UNP P15056
A	-6	TYR	-	expression tag	UNP P15056
A	-5	PHE	-	expression tag	UNP P15056
A	-4	GLN	-	expression tag	UNP P15056
A	-3	GLY	-	expression tag	UNP P15056
A	-2	ALA	-	expression tag	UNP P15056
A	-1	MET	-	expression tag	UNP P15056

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Chain	Residue	Modelled	Actual	Comment	Reference
A	0	ASP	-	expression tag	UNP P15056
A	365	ALA	SER	engineered mutation	UNP P15056
A	767	GLY	-	expression tag	UNP P15056
A	768	THR	-	expression tag	UNP P15056
A	769	SER	-	expression tag	UNP P15056
A	770	ALA	-	expression tag	UNP P15056
A	771	TRP	-	expression tag	UNP P15056
A	772	SER	-	expression tag	UNP P15056
A	773	HIS	-	expression tag	UNP P15056
A	774	PRO	-	expression tag	UNP P15056
A	775	GLN	-	expression tag	UNP P15056
A	776	PHE	-	expression tag	UNP P15056
A	777	GLU	-	expression tag	UNP P15056
A	778	LYS	-	expression tag	UNP P15056
B	-26	MET	-	expression tag	UNP P15056
B	-25	SER	-	expression tag	UNP P15056
B	-24	TYR	-	expression tag	UNP P15056
B	-23	TYR	-	expression tag	UNP P15056
B	-22	HIS	-	expression tag	UNP P15056
B	-21	HIS	-	expression tag	UNP P15056
B	-20	HIS	-	expression tag	UNP P15056
B	-19	HIS	-	expression tag	UNP P15056
B	-18	HIS	-	expression tag	UNP P15056
B	-17	HIS	-	expression tag	UNP P15056
B	-16	HIS	-	expression tag	UNP P15056
B	-15	HIS	-	expression tag	UNP P15056
B	-14	ASP	-	expression tag	UNP P15056
B	-13	ILE	-	expression tag	UNP P15056
B	-12	PRO	-	expression tag	UNP P15056
B	-11	THR	-	expression tag	UNP P15056
B	-10	THR	-	expression tag	UNP P15056
B	-9	GLU	-	expression tag	UNP P15056
B	-8	ASN	-	expression tag	UNP P15056
B	-7	LEU	-	expression tag	UNP P15056
B	-6	TYR	-	expression tag	UNP P15056
B	-5	PHE	-	expression tag	UNP P15056
B	-4	GLN	-	expression tag	UNP P15056
B	-3	GLY	-	expression tag	UNP P15056
B	-2	ALA	-	expression tag	UNP P15056
B	-1	MET	-	expression tag	UNP P15056
B	0	ASP	-	expression tag	UNP P15056
B	365	ALA	SER	engineered mutation	UNP P15056

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Chain	Residue	Modelled	Actual	Comment	Reference
B	767	GLY	-	expression tag	UNP P15056
B	768	THR	-	expression tag	UNP P15056
B	769	SER	-	expression tag	UNP P15056
B	770	ALA	-	expression tag	UNP P15056
B	771	TRP	-	expression tag	UNP P15056
B	772	SER	-	expression tag	UNP P15056
B	773	HIS	-	expression tag	UNP P15056
B	774	PRO	-	expression tag	UNP P15056
B	775	GLN	-	expression tag	UNP P15056
B	776	PHE	-	expression tag	UNP P15056
B	777	GLU	-	expression tag	UNP P15056
B	778	LYS	-	expression tag	UNP P15056

- Molecule 2 is a protein called Dual specificity mitogen-activated protein kinase kinase 1.

Mol	Chain	Residues	Atoms			AltConf	Trace	
			Total	C	N			O
2	C	306	1514	900	307	307	2	0

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-21	MET	-	expression tag	UNP Q02750
C	-20	GLY	-	expression tag	UNP Q02750
C	-19	SER	-	expression tag	UNP Q02750
C	-18	SER	-	expression tag	UNP Q02750
C	-17	HIS	-	expression tag	UNP Q02750
C	-16	HIS	-	expression tag	UNP Q02750
C	-15	HIS	-	expression tag	UNP Q02750
C	-14	HIS	-	expression tag	UNP Q02750
C	-13	HIS	-	expression tag	UNP Q02750
C	-12	HIS	-	expression tag	UNP Q02750
C	-11	SER	-	expression tag	UNP Q02750
C	-10	ALA	-	expression tag	UNP Q02750
C	-9	VAL	-	expression tag	UNP Q02750
C	-8	ASP	-	expression tag	UNP Q02750
C	-7	GLU	-	expression tag	UNP Q02750
C	-6	ASN	-	expression tag	UNP Q02750
C	-5	LEU	-	expression tag	UNP Q02750
C	-4	TYR	-	expression tag	UNP Q02750
C	-3	PHE	-	expression tag	UNP Q02750
C	-2	GLN	-	expression tag	UNP Q02750

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Chain	Residue	Modelled	Actual	Comment	Reference
C	-1	GLY	-	expression tag	UNP Q02750
C	0	GLY	-	expression tag	UNP Q02750
C	218	ALA	SER	engineered mutation	UNP Q02750
C	222	ALA	SER	engineered mutation	UNP Q02750

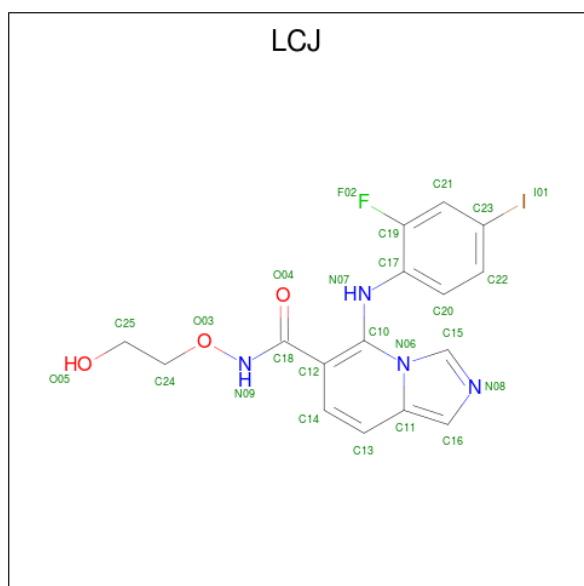
- Molecule 3 is a protein called 14-3-3 protein zeta.

Mol	Chain	Residues	Atoms			AltConf	Trace	
			Total	C	N			O
3	X	229	1138	680	229	229	0	0
3	Y	229	1138	680	229	229	0	0

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
			Total	Mg	
4	C	1	1	1	0

- Molecule 5 is 5-[(2-fluoro-4-iodophenyl)amino]-N-(2-hydroxyethoxy)imidazo[1,5-a]pyridine-6-carboxamide (three-letter code: LCJ) (formula: C<sub>16</sub>H<sub>14</sub>FIN<sub>4</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms					AltConf	
			Total	C	F	I	N		O
5	C	1	25	16	1	1	4	3	0









## 4 Experimental information

Property	Value	Source
Reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	Depositor
Number of particles used	595672	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TALOS ARCTICA	Depositor
Voltage (kV)	200	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	53	Depositor
Minimum defocus (nm)	Not provided	Depositor
Maximum defocus (nm)	Not provided	Depositor
Magnification	Not provided	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor

## 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: AGS, MG, LCJ, SEP

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  >2	RMSZ	# Z  >2
1	A	0.48	0/1379	0.64	0/1915
1	B	0.48	0/1369	0.64	0/1901
2	C	0.43	0/1515	0.60	0/2104
3	X	0.39	0/1137	0.49	0/1586
3	Y	0.63	0/1137	0.68	0/1586
All	All	0.48	0/6537	0.61	0/9092

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	1389	0	611	4	0
1	B	1379	0	609	2	0
2	C	1514	0	674	6	0
3	X	1138	0	522	0	0
3	Y	1138	0	522	14	0
4	C	1	0	0	0	0
5	C	25	0	0	1	0
6	C	31	0	12	0	0
All	All	6615	0	2950	22	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 2.

All (22) 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)
3:Y:162:PRO:O	3:Y:199:ALA:HA	1.54	1.06
3:Y:83:ARG:O	3:Y:87:GLU:CB	2.17	0.93
3:Y:164:HIS:HA	3:Y:209:ASP:CB	2.00	0.91
3:Y:178:TYR:O	3:Y:182:LEU:CB	2.20	0.90
3:Y:162:PRO:O	3:Y:199:ALA:CA	2.35	0.75
3:Y:56:ARG:O	3:Y:60:ARG:CB	2.38	0.72
1:A:660:ASN:HA	2:C:220:ALA:HB1	1.74	0.69
1:B:717:LEU:O	1:B:720:SER:O	2.11	0.68
3:Y:162:PRO:CB	3:Y:198:ASP:O	2.43	0.67
3:Y:178:TYR:HA	3:Y:182:LEU:CB	2.25	0.65
2:C:210:GLY:HA2	5:C:402:LCJ:C16	2.30	0.62
3:Y:210:SER:CB	3:Y:214:SER:CB	2.81	0.58
1:A:660:ASN:CB	2:C:220:ALA:HB2	2.36	0.55
3:Y:179:TYR:O	3:Y:183:ASN:HA	2.07	0.54
3:Y:171:ALA:HB1	3:Y:195:ALA:HB2	1.91	0.53
1:B:712:ALA:O	1:B:716:LEU:CB	2.58	0.52
1:A:660:ASN:HA	2:C:220:ALA:CB	2.39	0.51
2:C:369:VAL:O	2:C:371:PHE:N	2.51	0.43
1:A:660:ASN:CA	2:C:220:ALA:CB	2.97	0.43
3:Y:178:TYR:CA	3:Y:182:LEU:CB	2.95	0.42
3:Y:178:TYR:C	3:Y:182:LEU:CB	2.87	0.41
3:Y:102:ASP:HA	3:Y:106:ILE:CB	2.50	0.41

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 PDB entries followed by that with respect to all EM entries.

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	276/805 (34%)	260 (94%)	12 (4%)	4 (1%)	12	52
1	B	274/805 (34%)	254 (93%)	15 (6%)	5 (2%)	9	47
2	C	304/414 (73%)	282 (93%)	17 (6%)	5 (2%)	11	49
3	X	227/247 (92%)	222 (98%)	5 (2%)	0	100	100
3	Y	227/247 (92%)	215 (95%)	10 (4%)	2 (1%)	19	61
All	All	1308/2518 (52%)	1233 (94%)	59 (4%)	16 (1%)	19	56

All (16) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	721	LEU
1	B	707	PHE
1	B	722	PRO
2	C	264	PRO
2	C	265	PRO
2	C	266	PRO
2	C	136	ASP
1	A	594	ASP
1	A	727	SER
1	B	594	ASP
2	C	189	ARG
1	B	723	LYS
1	A	523	PRO
1	B	523	PRO
3	Y	132	VAL
3	Y	185	PRO

### 5.3.2 Protein sidechains [i](#)

There are no protein residues with a non-rotameric sidechain to report in this entry.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues 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
1	SEP	A	729	1	9,9,10	1.12	1 (11%)	9,12,14	0.97	1 (11%)
1	SEP	B	729	1	9,9,10	1.07	1 (11%)	9,12,14	1.00	1 (11%)

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
1	SEP	A	729	1	-	0/5/8/10	-
1	SEP	B	729	1	-	3/5/8/10	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	729	SEP	CA-C	2.79	1.53	1.50
1	B	729	SEP	CA-C	2.64	1.53	1.50

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	729	SEP	O-C-CA	-2.47	118.35	124.98
1	A	729	SEP	O-C-CA	-2.37	118.62	124.98

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	729	SEP	N-CA-CB-OG
1	B	729	SEP	CB-OG-P-O1P
1	B	729	SEP	CB-OG-P-O3P

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 for Mogul analysis.

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
5	LCJ	C	402	4	24,27,27	2.36	5 (20%)	26,37,37	1.68	7 (26%)
6	AGS	C	403	4	25,33,33	3.76	11 (44%)	24,52,52	1.97	6 (25%)

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
5	LCJ	C	402	4	-	5/13/13/13	0/3/3/3
6	AGS	C	403	4	-	0/17/38/38	0/3/3/3

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	C	403	AGS	O4'-C1'	11.53	1.57	1.41
6	C	403	AGS	C3'-C4'	-9.63	1.28	1.53
5	C	402	LCJ	C18-N09	8.55	1.45	1.34
5	C	402	LCJ	C10-N07	5.40	1.46	1.36
6	C	403	AGS	C2'-C3'	5.14	1.66	1.53
6	C	403	AGS	O4'-C4'	4.53	1.55	1.45
6	C	403	AGS	PG-O2G	3.77	1.67	1.54
6	C	403	AGS	PG-O3G	3.35	1.65	1.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	C	403	AGS	C6-N6	3.02	1.45	1.34
6	C	403	AGS	O2'-C2'	2.94	1.49	1.43
6	C	403	AGS	C5-C4	-2.91	1.33	1.40
6	C	403	AGS	C2-N3	2.87	1.36	1.32
5	C	402	LCJ	C12-C10	-2.77	1.39	1.43
6	C	403	AGS	C5'-C4'	2.65	1.60	1.51
5	C	402	LCJ	C17-N07	2.33	1.46	1.39
5	C	402	LCJ	O04-C18	-2.11	1.19	1.23

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	C	403	AGS	N3-C2-N1	-5.37	120.03	128.68
6	C	403	AGS	C4'-O4'-C1'	-4.44	105.20	109.83
5	C	402	LCJ	N08-C15-N06	-4.33	107.96	112.73
6	C	403	AGS	C1'-N9-C4	3.29	132.31	126.64
6	C	403	AGS	PA-O3A-PB	-3.11	122.69	132.57
5	C	402	LCJ	C21-C19-C17	-3.06	120.54	123.44
5	C	402	LCJ	C14-C13-C11	-2.92	119.36	121.79
6	C	403	AGS	C5-C6-N6	2.86	124.87	120.38
5	C	402	LCJ	C19-C21-C23	2.35	120.11	117.65
5	C	402	LCJ	C20-C17-C19	2.27	119.40	117.17
5	C	402	LCJ	O03-N09-C18	2.25	121.33	118.57
5	C	402	LCJ	C12-C18-N09	2.20	119.18	114.90
6	C	403	AGS	C2'-C3'-C4'	2.12	106.67	102.60

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	C	402	LCJ	C12-C10-N07-C17
5	C	402	LCJ	N06-C10-N07-C17
5	C	402	LCJ	C25-C24-O03-N09
5	C	402	LCJ	O03-C24-C25-O05
5	C	402	LCJ	C14-C12-C18-N09

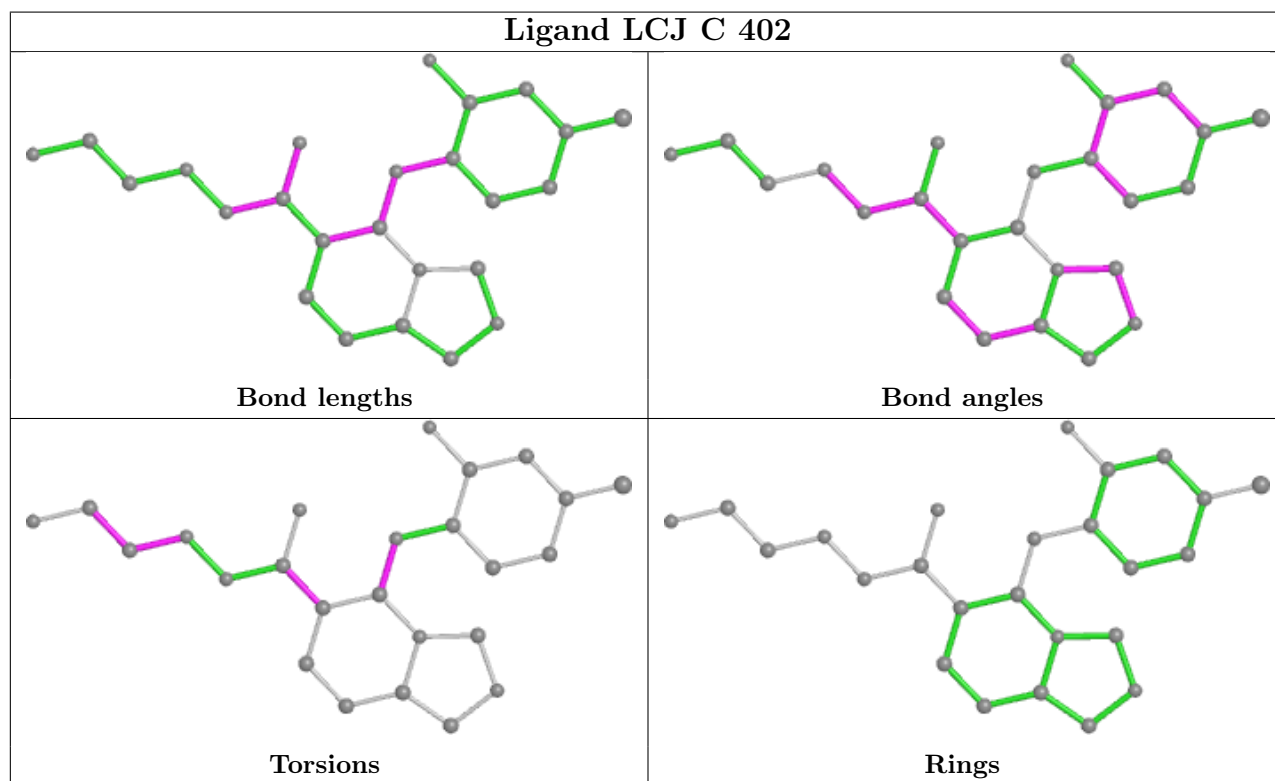
There are no ring outliers.

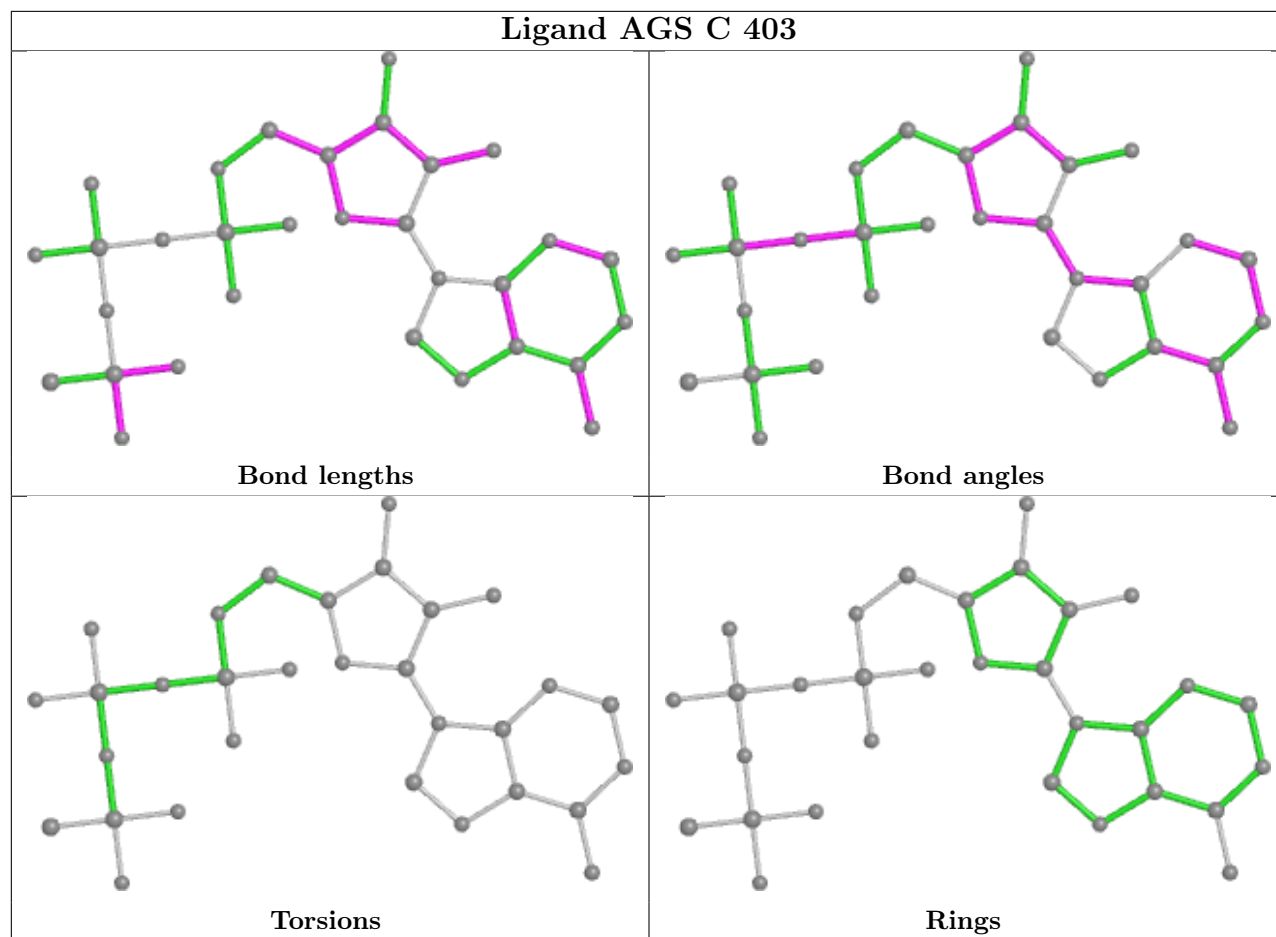
1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	C	402	LCJ	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.