



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 06:01 PM EDT

PDB ID : 6TLU  
Title : HUMAN CK2 KINASE ALPHA SUBUNIT IN COMPLEX WITH THE ATP-COMPETITIVE INHIBITOR 4,5-DIBROMOBENZOTRIAZOLE  
Authors : Czapinska, H.; Piasecka, A.; Winiewska-Szajewska, M.; Bochtler, M.; Poznanski, J.  
Deposited on : 2019-12-03  
Resolution : 1.81 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.

The types of validation reports are described at

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

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

MolProbity : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 1.20.1  
EDS : 2.37.1  
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) : 2.37.1

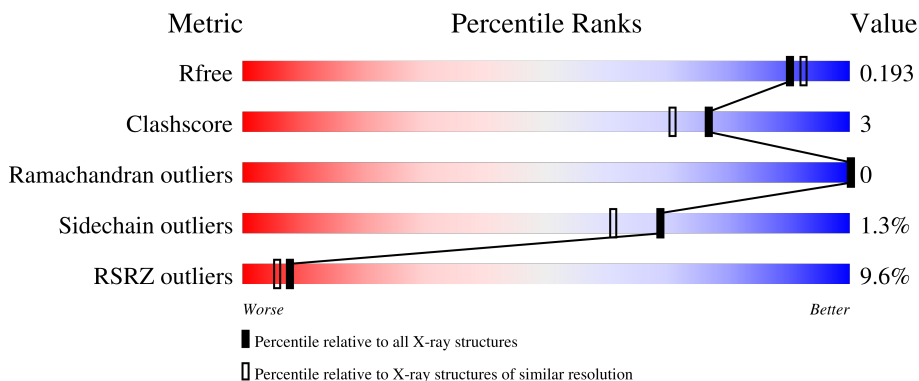
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.81 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	7484 (1.84-1.80)
Clashscore	141614	8401 (1.84-1.80)
Ramachandran outliers	138981	8290 (1.84-1.80)
Sidechain outliers	138945	8290 (1.84-1.80)
RSRZ outliers	127900	7371 (1.84-1.80)

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	AAA	399	

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 3643 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.

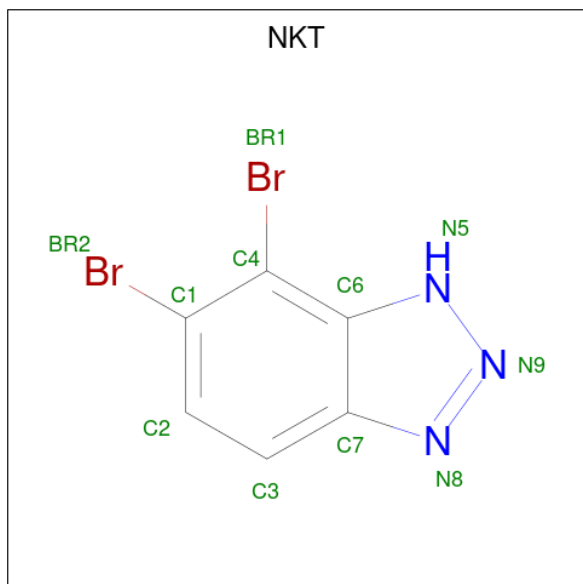
- Molecule 1 is a protein called Casein kinase II subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	AAA	333	3196	2031	575	575	15	0	44	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAA	392	LEU	-	expression tag	UNP P68400
AAA	393	GLU	-	expression tag	UNP P68400
AAA	394	HIS	-	expression tag	UNP P68400
AAA	395	HIS	-	expression tag	UNP P68400
AAA	396	HIS	-	expression tag	UNP P68400
AAA	397	HIS	-	expression tag	UNP P68400
AAA	398	HIS	-	expression tag	UNP P68400
AAA	399	HIS	-	expression tag	UNP P68400

- Molecule 2 is 6,7-bis(bromanyl)-1 {H}-benzotriazole (three-letter code: NKT) (formula: C<sub>6</sub>H<sub>3</sub>Br<sub>2</sub>N<sub>3</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	AAA	1	Total	Br	C	N	0	1
			22	4	12	6		
2	AAA	1	Total	Br	C	N	0	0
			11	2	6	3		

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	AAA	1	Total	Na	0	0
			1	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	AAA	411	Total	O	0	43
			413	413		



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 42 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	129.32Å 129.32Å 60.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.52 – 1.81 36.52 – 1.81	Depositor EDS
% Data completeness (in resolution range)	98.9 (36.52-1.81) 98.9 (36.52-1.81)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.00 (at 1.81Å)	Xtrriage
Refinement program	REFMAC 5.8.0257	Depositor
R, $R_{free}$	0.164 , 0.184 0.174 , 0.193	Depositor DCC
$R_{free}$ test set	2331 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	38.0	Xtrriage
Anisotropy	0.322	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 53.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	3643	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	48.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.18% of the height of the origin peak. No significant pseudotranslation is detected.*

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

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

## 5 Model quality [i](#)

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

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

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	AAA	0.65	0/3275	0.77	0/4414

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	AAA	3196	0	3117	19	0
2	AAA	33	0	0	1	0
3	AAA	1	0	0	0	0
4	AAA	413	0	0	2	0
All	All	3643	0	3117	19	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 3.

All (19) 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:AAA:121:PHE:O	1:AAA:125:TYR:HB3	2.06	0.55
1:AAA:121:PHE:CD1	1:AAA:164:ILE:HD12	2.42	0.55
1:AAA:275[A]:ARG:NH1	4:AAA:510:HOH:O	2.39	0.55
1:AAA:35[B]:ASN:O	1:AAA:38[B]:ASP:HB2	2.11	0.51
1:AAA:134:ARG:HG2	1:AAA:323:TYR:CZ	2.51	0.45
1:AAA:35[B]:ASN:OD1	1:AAA:37[B]:ASP:HB2	2.17	0.45
1:AAA:268[B]:ARG:HG3	1:AAA:268[B]:ARG:O	2.17	0.44
1:AAA:257:TYR:OH	4:AAA:501:HOH:O	2.20	0.43
1:AAA:22[B]:GLU:H	1:AAA:22[B]:GLU:CD	2.22	0.43
1:AAA:73:VAL:HG21	1:AAA:77:LYS:HD3	2.00	0.43
1:AAA:114[B]:GLU:O	1:AAA:114[B]:GLU:HG3	2.19	0.43
1:AAA:221[A]:MET:O	1:AAA:225[A]:MET:HG3	2.20	0.42
1:AAA:43:ARG:NE	1:AAA:55:GLU:OE2	2.53	0.42
1:AAA:47:ARG:NE	2:AAA:401[A]:NKT:BR1	3.08	0.41
1:AAA:75[A]:LYS:HE2	1:AAA:75[A]:LYS:HB3	1.89	0.41
1:AAA:33[A]:TRP:CE3	1:AAA:100:ILE:HG22	2.55	0.41
1:AAA:121:PHE:CD1	1:AAA:164:ILE:CD1	3.04	0.41
1:AAA:130:ASP:O	1:AAA:134:ARG:HG3	2.21	0.40
1:AAA:106:SER:HG	1:AAA:108:THR:HG1	1.62	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	AAA	375/399 (94%)	362 (96%)	13 (4%)	0	<a href="#">100</a> <a href="#">100</a>

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	AAA	349/355 (98%)	344 (99%)	5 (1%)	67 58

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	106	SER
1	AAA	125	TYR
1	AAA	180	GLU
1	AAA	268[A]	ARG
1	AAA	268[B]	ARG

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](#)

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 1 is monoatomic - leaving 3 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
2	NKT	AAA	401[A]	-	8,12,12	0.95	1 (12%)	8,17,17	1.01	1 (12%)
2	NKT	AAA	401[B]	-	8,12,12	1.39	1 (12%)	8,17,17	1.04	0
2	NKT	AAA	402	-	8,12,12	1.22	1 (12%)	8,17,17	0.98	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NKT	AAA	401[A]	-	-	-	0/2/2/2
2	NKT	AAA	401[B]	-	-	-	0/2/2/2
2	NKT	AAA	402	-	-	-	0/2/2/2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	AAA	401[A]	NKT	C3-C7	-2.42	1.37	1.41
2	AAA	402	NKT	BR2-C1	2.28	1.95	1.89
2	AAA	401[B]	NKT	C3-C7	-2.06	1.38	1.41

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	AAA	401[A]	NKT	C1-C4-C6	-2.17	118.30	121.17

There are no chirality outliers.

There are no torsion outliers.

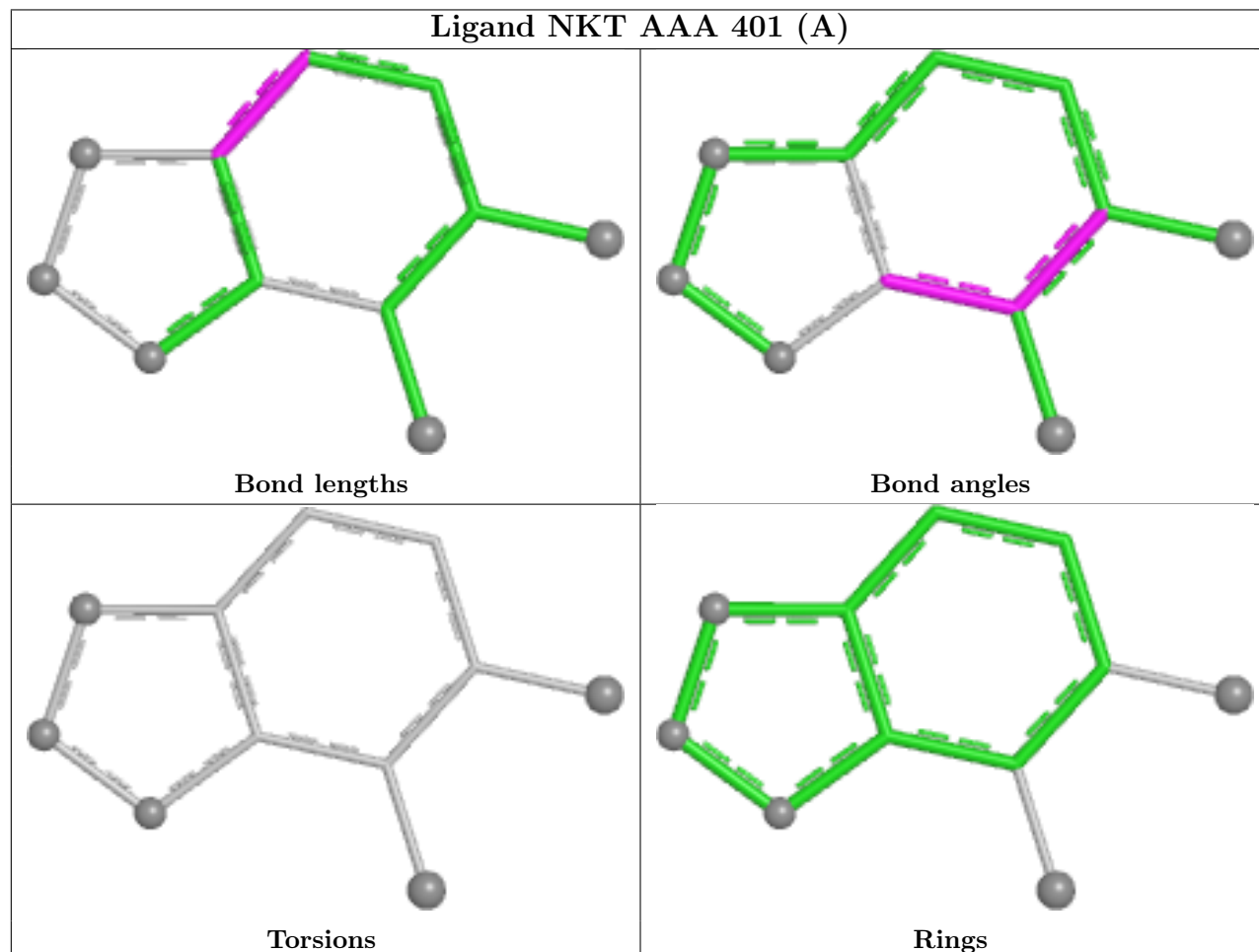
There are no ring outliers.

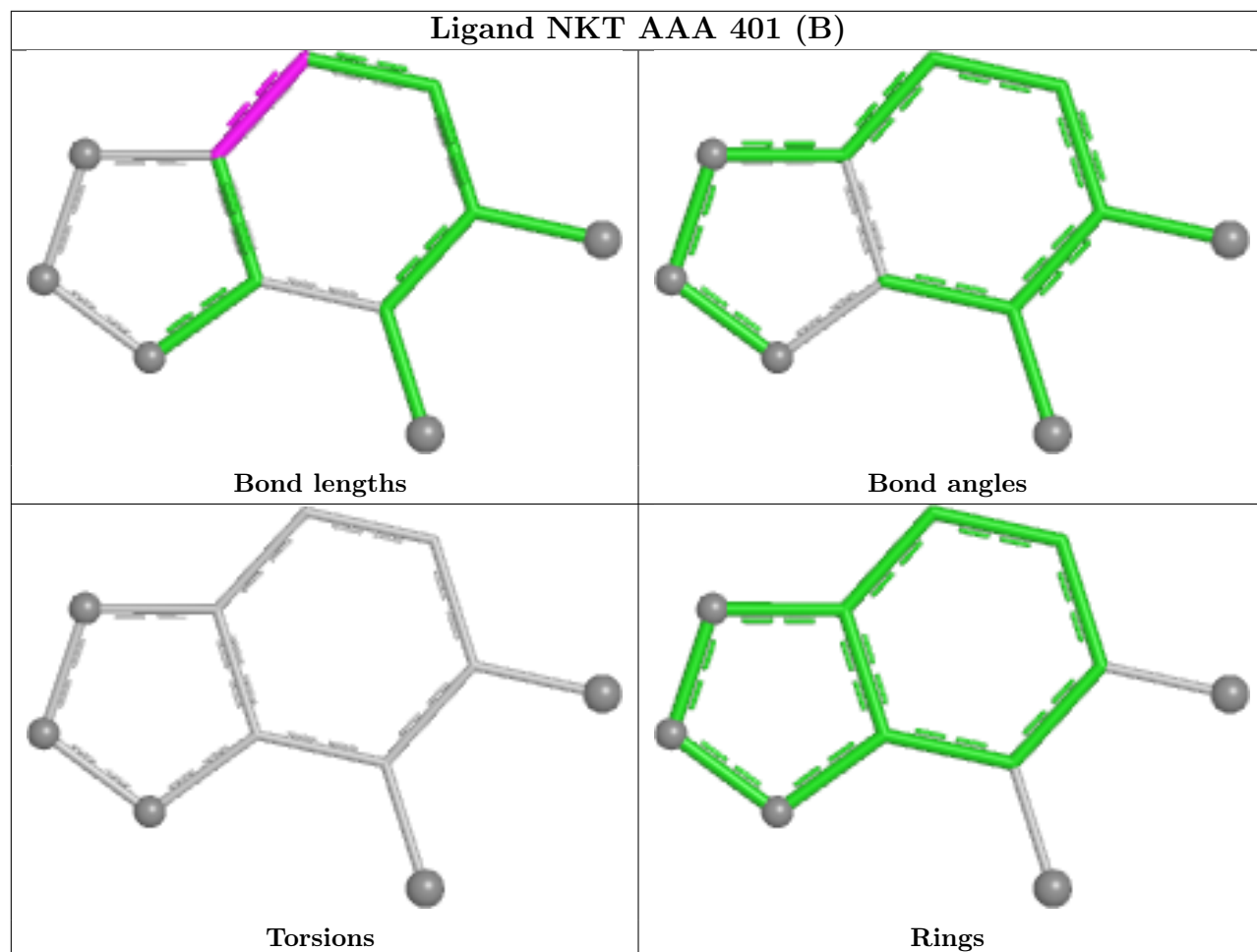
1 monomer is involved in 1 short contact:

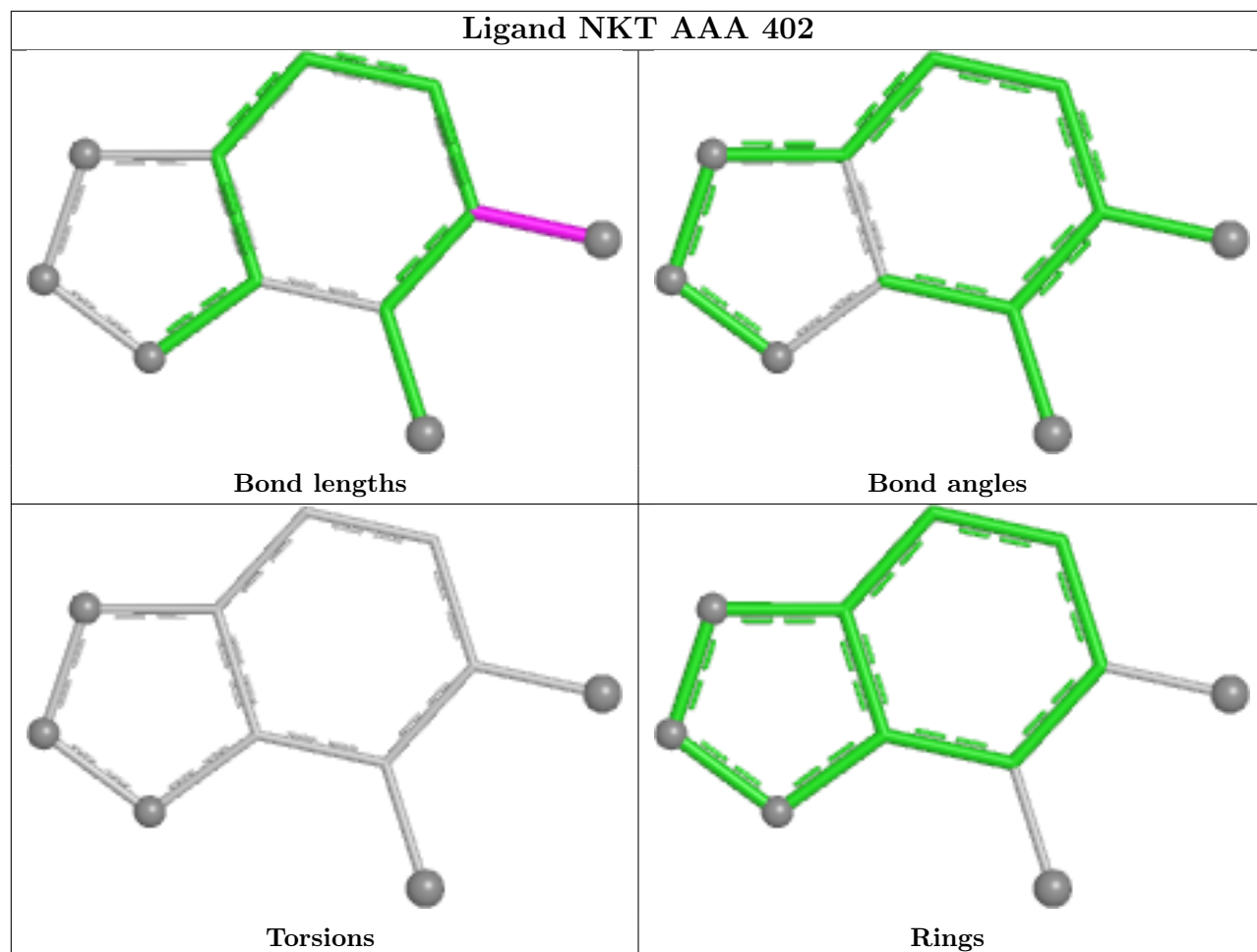
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	AAA	401[A]	NKT	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be

highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.







## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 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	AAA	333/399 (83%)	0.44	32 (9%) <b>8</b> <b>6</b>	28, 43, 79, 120	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	AAA	72	PRO	13.7
1	AAA	50	TYR	9.3
1	AAA	2	SER	5.0
1	AAA	49	LYS	4.9
1	AAA	51	SER	4.9
1	AAA	270	ASN	4.6
1	AAA	334	MET	4.2
1	AAA	73	VAL	4.2
1	AAA	333	ARG	4.1
1	AAA	71	LYS	3.9
1	AAA	74	LYS	3.7
1	AAA	218	LEU	3.7
1	AAA	264[A]	GLU	3.7
1	AAA	267	PRO	3.5
1	AAA	140	ILE	3.4
1	AAA	37[A]	ASP	3.2
1	AAA	259[A]	ASP	3.2
1	AAA	332	ALA	3.1
1	AAA	157	VAL	2.8
1	AAA	271	ASP	2.8
1	AAA	144	LEU	2.6
1	AAA	304	LEU	2.6
1	AAA	287	SER	2.4
1	AAA	222	LEU	2.4
1	AAA	3	GLY	2.4
1	AAA	220	CYS	2.4
1	AAA	301	LEU	2.3

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Mol	Chain	Res	Type	RSRZ
1	AAA	35[A]	ASN	2.3
1	AAA	193	ALA	2.2
1	AAA	245	ILE	2.1
1	AAA	290[A]	GLN	2.1
1	AAA	221[A]	MET	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](#)

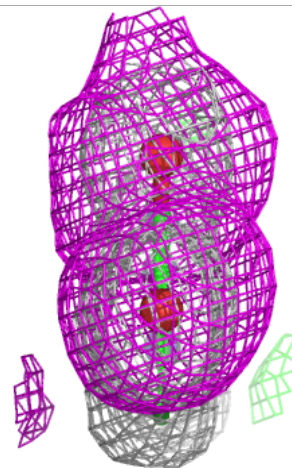
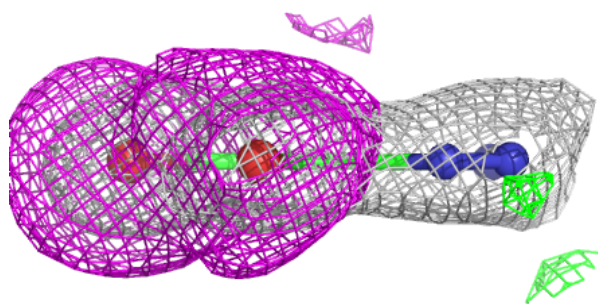
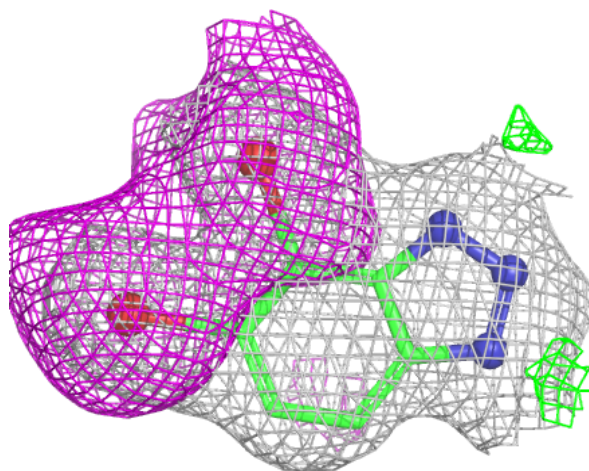
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 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	NA	AAA	403	1/1	0.86	0.25	68,68,68,68	0
2	NKT	AAA	402	11/11	0.89	0.22	60,63,66,77	0
2	NKT	AAA	401[A]	11/11	0.93	0.18	33,37,48,59	11
2	NKT	AAA	401[B]	11/11	0.93	0.18	56,60,62,70	11

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 NKT AAA 402:**

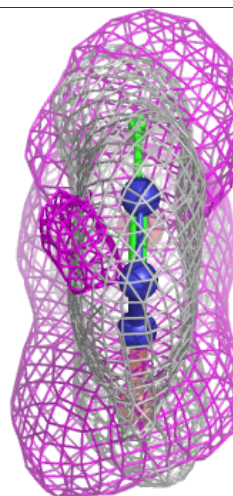
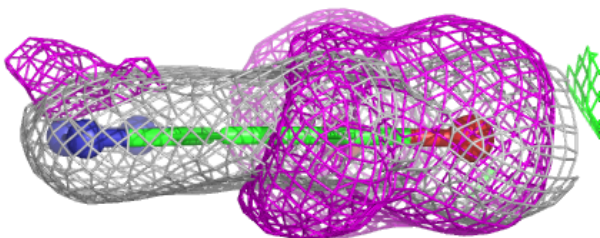
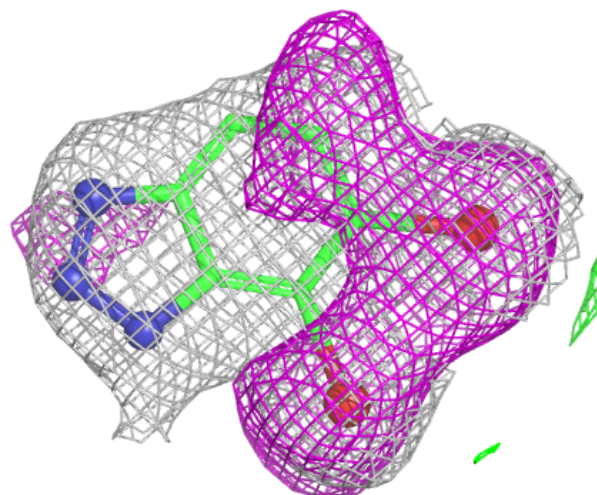
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

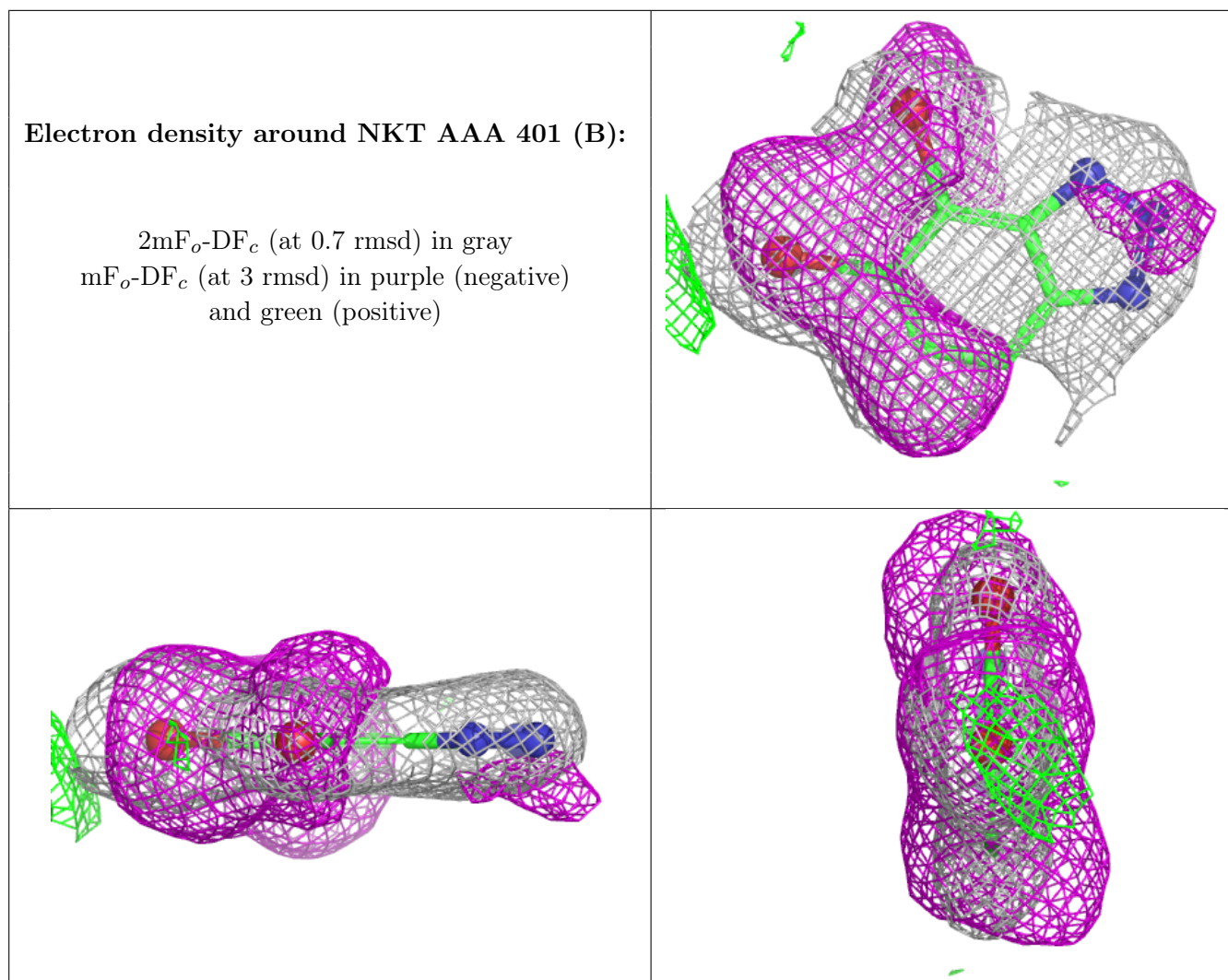




**Electron density around NKT AAA 401 (A):**

$2mF_o-DF_c$  (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.