



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 20, 2020 – 02:28 PM BST

PDB ID : 5H0E  
Title : Crystal structure of HCK complexed with a pyrrolo-pyrimidine inhibitor (S)-2-(((1r,4S)-4-(4-amino-5-(4-phenoxyphenyl)-7H-pyrrolo[2,3-d]pyrimidin-7-yl)cyclohexyl)amino)-4-methylpentanamide  
Authors : Tomabechi, Y.; Kukimoto-Niino, M.; Shirouzu, M.  
Deposited on : 2016-10-04  
Resolution : 2.10 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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.13.1  
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) : 2.13.1

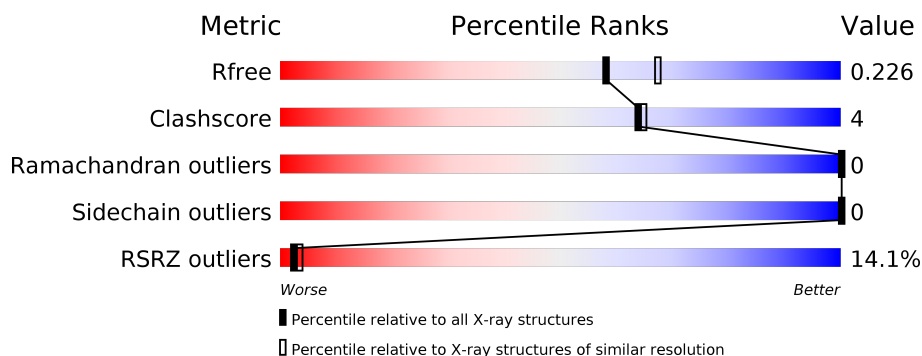
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.10 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	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

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 on 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	454	<div> <div>14%</div> <div>90%</div> <div>9%</div> <div>.</div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3847 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.

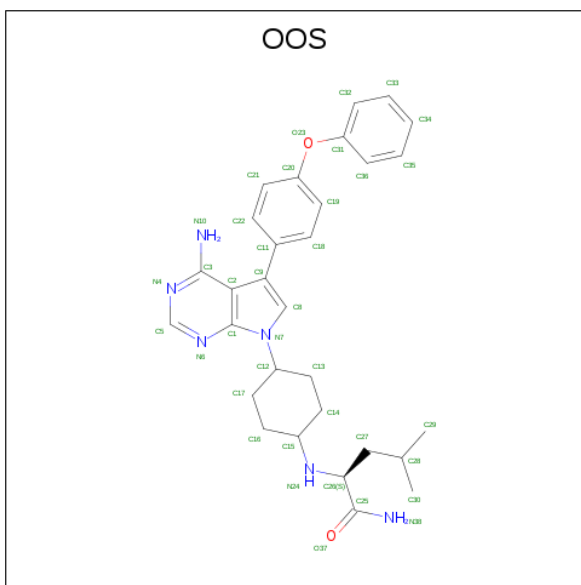
- Molecule 1 is a protein called Tyrosine-protein kinase HCK.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	447	Total	C	N	O	P	S	0	0	0
			3613	2306	609	677	1	20			

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	78	GLY	-	expression tag	UNP P08631
A	79	ALA	-	expression tag	UNP P08631
A	80	MET	-	expression tag	UNP P08631
A	81	GLY	-	expression tag	UNP P08631
A	82	SER	-	expression tag	UNP P08631
A	83	GLY	-	expression tag	UNP P08631
A	84	ILE	-	expression tag	UNP P08631
A	85	ARG	-	linker	UNP P08631
A	528	GLU	GLN	engineered mutation	UNP P08631
A	529	GLU	GLN	engineered mutation	UNP P08631
A	530	ILE	GLN	engineered mutation	UNP P08631

- Molecule 2 is (2 {S})-2-[[4-[4-azanyl-5-(4-phenoxyphenyl)pyrrolo[2,3-d]pyrimidin-7-yl]cyclohexyl]amino]-4-methyl-pentanamide (three-letter code: OOS) (formula: C<sub>30</sub>H<sub>36</sub>N<sub>6</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			38	30	6	2		

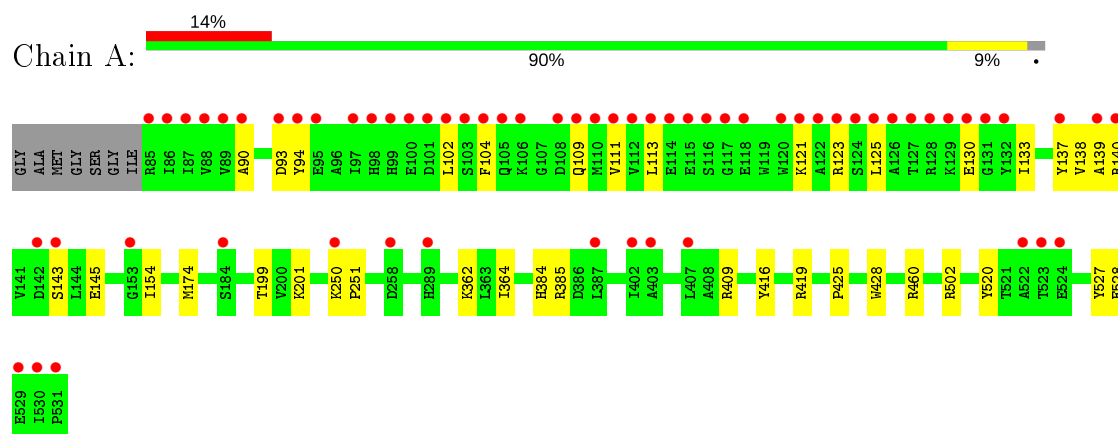
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	196	Total O 196 196	0	0

### 3 Residue-property plots [i](#)

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: Tyrosine-protein kinase HCK



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	43.06 Å 85.35 Å 129.09 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.30 – 2.10 30.30 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.8 (30.30-2.10) 99.8 (30.30-2.10)	Depositor EDS
$R_{merge}$	0.13	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.82 (at 2.10 Å)	Xtriage
Refinement program	PHENIX 1.9_1690	Depositor
R, $R_{free}$	0.185 , 0.226 0.190 , 0.226	Depositor DCC
$R_{free}$ test set	2000 reflections (6.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	35.3	Xtriage
Anisotropy	0.417	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 52.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	3847	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.38% 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: PTR, OOS

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	0.39	0/3682	0.50	0/4972

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	3613	0	3574	30	0
2	A	38	0	0	0	0
3	A	196	0	0	4	1
All	All	3847	0	3574	30	1

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 (30) 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:460:ARG:NH1	3:A:702:HOH:O	2.11	0.79

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:199:THR:OG1	3:A:701:HOH:O	2.02	0.78
1:A:93:ASP:O	1:A:250:LYS:NZ	2.18	0.71
1:A:94:TYR:HB3	1:A:104:PHE:HD2	1.64	0.61
1:A:409:ARG:NH2	3:A:708:HOH:O	2.37	0.58
1:A:113:LEU:HD13	1:A:121:LYS:HG2	1.87	0.56
1:A:154:ILE:HD11	1:A:174:MET:SD	2.46	0.55
1:A:113:LEU:HD11	1:A:123:ARG:HG3	1.89	0.54
1:A:111:VAL:HB	1:A:123:ARG:HB2	1.89	0.54
1:A:94:TYR:H	1:A:104:PHE:HB2	1.72	0.54
1:A:111:VAL:N	1:A:123:ARG:O	2.40	0.52
1:A:137:TYR:HE1	1:A:251:PRO:HG2	1.74	0.52
1:A:123:ARG:HA	1:A:130:GLU:HG2	1.91	0.51
1:A:139:ALA:HB1	1:A:145:GLU:HB2	1.94	0.49
1:A:425:PRO:HB2	1:A:428:TRP:HE3	1.78	0.48
1:A:137:TYR:CE1	1:A:251:PRO:HG2	2.49	0.47
1:A:502:ARG:NE	3:A:716:HOH:O	2.46	0.47
1:A:102:LEU:HD11	1:A:130:GLU:HA	1.95	0.47
1:A:364:ILE:HD12	1:A:520:TYR:OH	2.14	0.47
1:A:384:HIS:O	1:A:385:ARG:HB2	2.14	0.47
1:A:425:PRO:HB2	1:A:428:TRP:CE3	2.50	0.47
1:A:137:TYR:CZ	1:A:250:LYS:HE2	2.51	0.46
1:A:201:LYS:HD2	1:A:528:GLU:CD	2.37	0.46
1:A:140:ARG:NE	1:A:143:SER:OG	2.50	0.44
1:A:109:GLN:HB2	1:A:125:LEU:HD22	1.99	0.44
1:A:111:VAL:O	1:A:123:ARG:N	2.30	0.43
1:A:104:PHE:HZ	1:A:133:ILE:HB	1.84	0.43
1:A:90:ALA:HA	1:A:138:VAL:HG12	2.01	0.42
1:A:362:LYS:HA	1:A:362:LYS:HD2	1.85	0.40
1:A:416:TYR:O	1:A:419:ARG:HG2	2.21	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:792:HOH:O	3:A:858:HOH:O[4_555]	2.17	0.03



## 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	444/454 (98%)	422 (95%)	22 (5%)	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	390/393 (99%)	390 (100%)	0	100	100

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

Some 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](#)

1 non-standard protein/DNA/RNA residue is 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	PTR	A	527	1	15,16,17	1.21	1 (6%)	19,22,24	0.67	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 Torsions and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	PTR	A	527	1	-	1/10/11/13	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	527	PTR	OH-CZ	-4.08	1.31	1.40

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	527	PTR	CZ-OH-P-O3P

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](#)

1 ligand is 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
2	OOS	A	601	-	40,42,42	2.22	7 (17%)	45,59,59	1.84	2 (4%)

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	OOS	A	601	-	-	5/20/46/46	0/5/5/5

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	601	OOS	C8-N7	-8.71	1.25	1.38
2	A	601	OOS	C9-C2	5.78	1.51	1.41
2	A	601	OOS	C25-N38	5.75	1.47	1.32
2	A	601	OOS	C9-C11	3.74	1.56	1.49
2	A	601	OOS	C5-N6	2.43	1.36	1.32
2	A	601	OOS	C26-C25	-2.38	1.48	1.52
2	A	601	OOS	C5-N4	2.34	1.38	1.33

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	601	OOS	C8-N7-C12	-7.95	118.44	125.48
2	A	601	OOS	C9-C2-C1	-7.48	101.57	107.54

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	OOS	C26-C27-C28-C30
2	A	601	OOS	O37-C25-C26-N24
2	A	601	OOS	C26-C27-C28-C29
2	A	601	OOS	O37-C25-C26-C27

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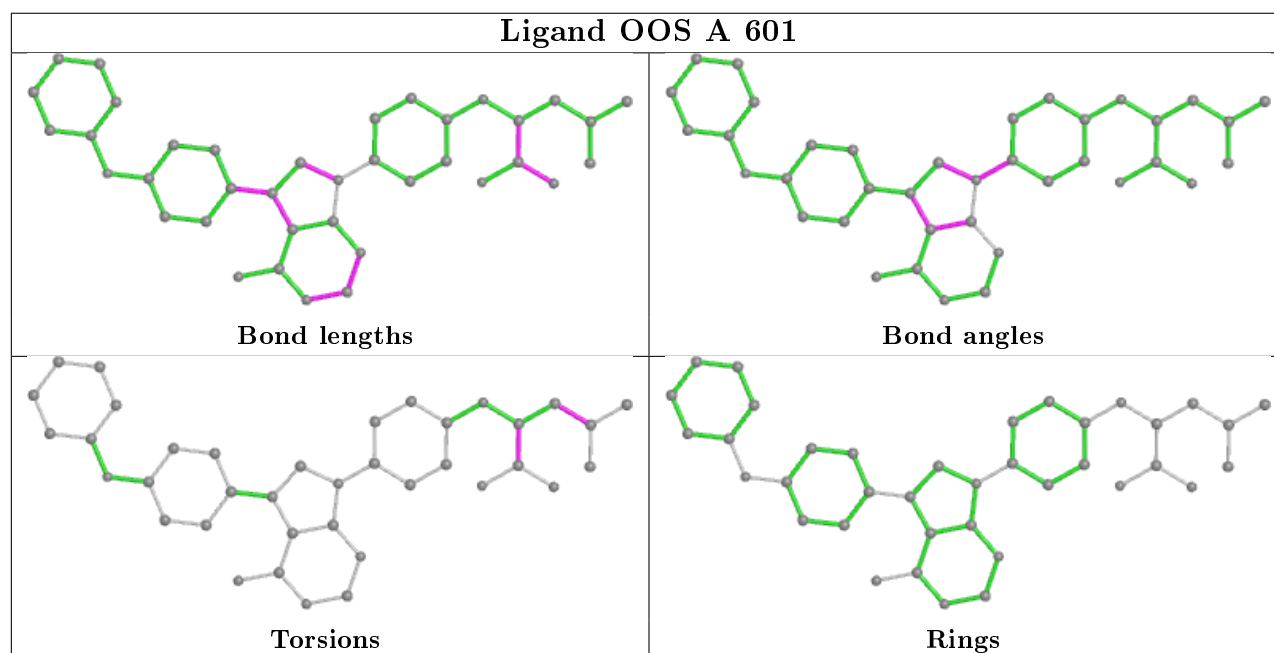
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Mol	Chain	Res	Type	Atoms
2	A	601	OOS	N38-C25-C26-N24

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	446/454 (98%)	0.71	63 (14%) 2 3	23, 40, 110, 132	0

All (63) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	127	THR	12.7
1	A	128	ARG	9.3
1	A	116	SER	8.8
1	A	112	VAL	8.8
1	A	125	LEU	8.6
1	A	130	GLU	7.8
1	A	122	ALA	7.5
1	A	105	GLN	6.9
1	A	117	GLY	6.5
1	A	129	LYS	6.3
1	A	86	ILE	6.2
1	A	114	GLU	6.2
1	A	142	ASP	6.1
1	A	523	THR	6.0
1	A	143	SER	6.0
1	A	121	LYS	5.9
1	A	123	ARG	5.7
1	A	106	LYS	5.6
1	A	126	ALA	5.6
1	A	103	SER	5.5
1	A	124	SER	5.4
1	A	531	PRO	5.4
1	A	111	VAL	5.3
1	A	97	ILE	5.3
1	A	530	ILE	5.3
1	A	85	ARG	5.1
1	A	99	HIS	5.1

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Mol	Chain	Res	Type	RSRZ
1	A	88	VAL	4.9
1	A	93	ASP	4.9
1	A	104	PHE	4.7
1	A	131	GLY	4.5
1	A	100	GLU	4.5
1	A	87	ILE	4.4
1	A	524	GLU	4.4
1	A	522	ALA	4.2
1	A	94	TYR	4.2
1	A	102	LEU	4.2
1	A	132	TYR	4.2
1	A	113	LEU	4.1
1	A	109	GLN	3.9
1	A	139	ALA	3.9
1	A	101	ASP	3.8
1	A	110	MET	3.6
1	A	118	GLU	3.5
1	A	115	GLU	3.5
1	A	529	GLU	3.3
1	A	120	TRP	3.0
1	A	89	VAL	3.0
1	A	108	ASP	3.0
1	A	258	ASP	2.7
1	A	407	LEU	2.7
1	A	387	LEU	2.6
1	A	140	ARG	2.6
1	A	95	GLU	2.5
1	A	402	ILE	2.5
1	A	98	HIS	2.3
1	A	289	HIS	2.3
1	A	250	LYS	2.2
1	A	184	SER	2.2
1	A	90	ALA	2.1
1	A	403	ALA	2.1
1	A	137	TYR	2.1
1	A	153	GLY	2.1

## 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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( $\text{\AA}^2$ )	Q<0.9
1	PTR	A	527	16/17	0.96	0.10	42,50,59,59	0

### 6.3 Carbohydrates [i](#)

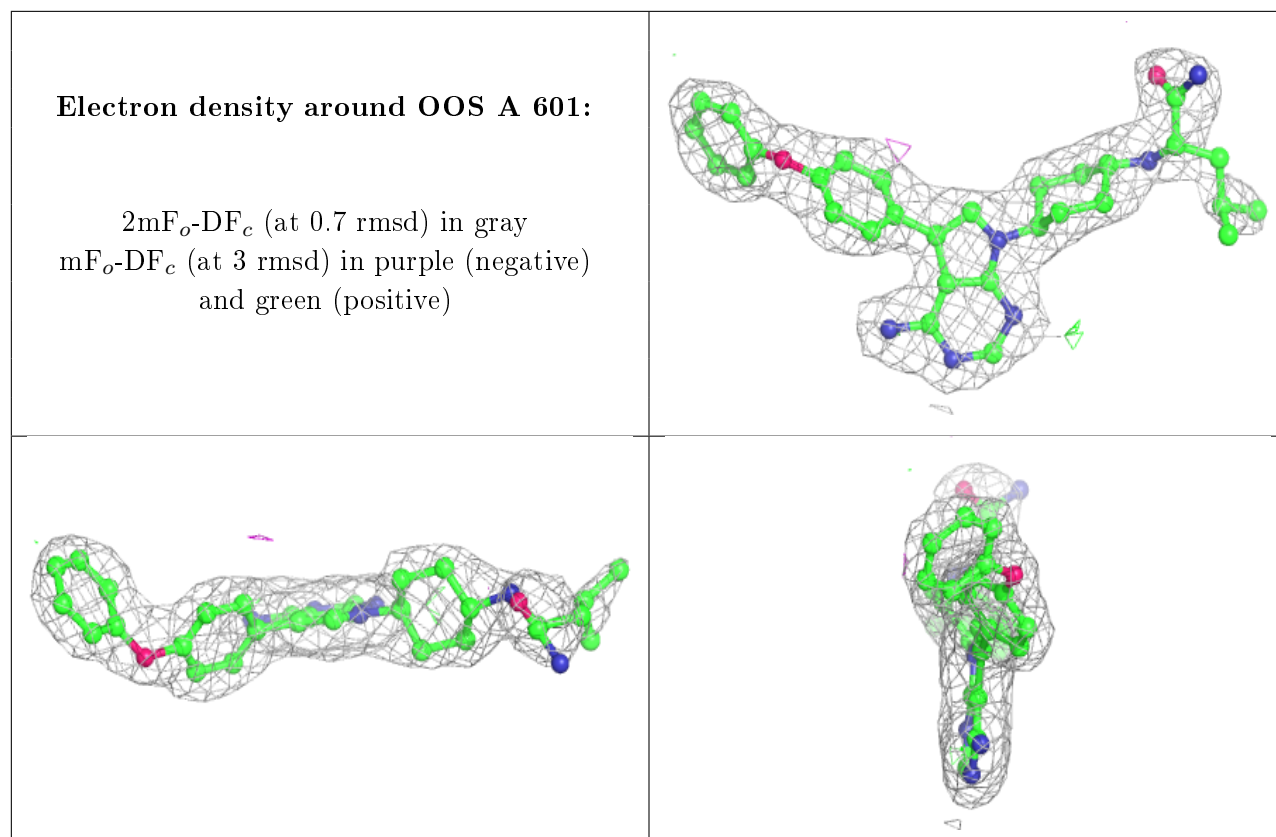
There are no monosaccharides in this entry.

### 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( $\text{\AA}^2$ )	Q<0.9
2	OOS	A	601	38/38	0.92	0.14	26,35,64,68	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.



## 6.5 Other polymers [i](#)

There are no such residues in this entry.