



# wwPDB X-ray Structure Validation Summary Report

Mar 5, 2026 – 06:35 AM UTC

PDB ID : 6EAK / pdb\_00006eak  
Title : CRYSTAL STRUCTURE OF FUSION INHIBITOR JNJ-2408068 IN COMPLEX WITH HUMAN RESPIRATORY SYNCYTIAL VIRUS FUSION GLYCOPROTEIN ESCAPE VARIANT T400A STABILIZED IN THE PREFUSION STATE  
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Deposited on : 2018-08-03  
Resolution : 2.60 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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](#) ①) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Buster-report : wwPDB partial adaption of 1.1.7 (2018)  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

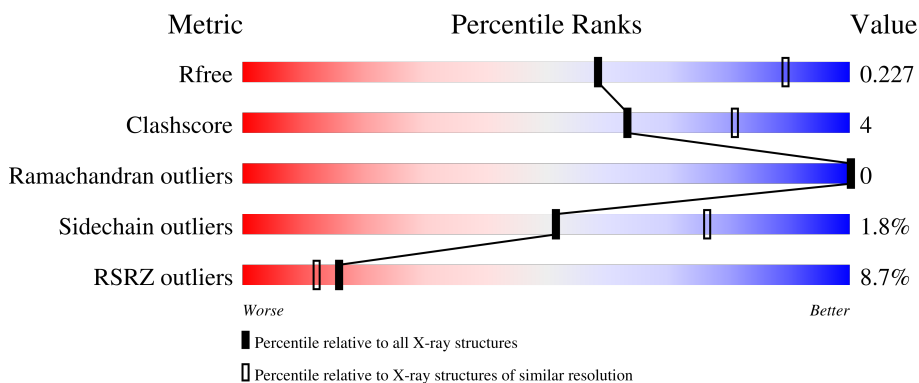
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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))
$R_{free}$	180053	4008 (2.60-2.60)
Clashscore	190562	4347 (2.60-2.60)
Ramachandran outliers	187476	4277 (2.60-2.60)
Sidechain outliers	187428	4277 (2.60-2.60)
RSRZ outliers	180081	4008 (2.60-2.60)

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	F	568	

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 3512 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 Fusion glycoprotein F0.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	F	438	3384	2143	556	664	21	0	0	0

There are 61 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	66	GLU	LYS	conflict	UNP W8RJF9
F	155	CYS	SER	engineered mutation	UNP W8RJF9
F	190	PHE	SER	engineered mutation	UNP W8RJF9
F	207	LEU	VAL	engineered mutation	UNP W8RJF9
F	290	CYS	SER	engineered mutation	UNP W8RJF9
F	400	ALA	THR	engineered mutation	UNP W8RJF9
F	514	SER	-	expression tag	UNP W8RJF9
F	515	ALA	-	expression tag	UNP W8RJF9
F	516	ILE	-	expression tag	UNP W8RJF9
F	517	GLY	-	expression tag	UNP W8RJF9
F	518	GLY	-	expression tag	UNP W8RJF9
F	519	TYR	-	expression tag	UNP W8RJF9
F	520	ILE	-	expression tag	UNP W8RJF9
F	521	PRO	-	expression tag	UNP W8RJF9
F	522	GLU	-	expression tag	UNP W8RJF9
F	523	ALA	-	expression tag	UNP W8RJF9
F	524	PRO	-	expression tag	UNP W8RJF9
F	525	ARG	-	expression tag	UNP W8RJF9
F	526	ASP	-	expression tag	UNP W8RJF9
F	527	GLY	-	expression tag	UNP W8RJF9
F	528	GLN	-	expression tag	UNP W8RJF9
F	529	ALA	-	expression tag	UNP W8RJF9
F	530	TYR	-	expression tag	UNP W8RJF9
F	531	VAL	-	expression tag	UNP W8RJF9
F	532	ARG	-	expression tag	UNP W8RJF9
F	533	LYS	-	expression tag	UNP W8RJF9
F	534	ASP	-	expression tag	UNP W8RJF9

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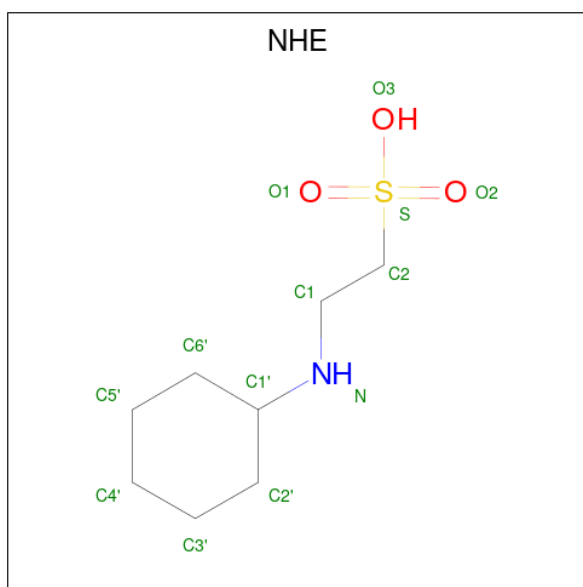
Chain	Residue	Modelled	Actual	Comment	Reference
F	535	GLY	-	expression tag	UNP W8RJF9
F	536	GLU	-	expression tag	UNP W8RJF9
F	537	TRP	-	expression tag	UNP W8RJF9
F	538	VAL	-	expression tag	UNP W8RJF9
F	539	LEU	-	expression tag	UNP W8RJF9
F	540	LEU	-	expression tag	UNP W8RJF9
F	541	SER	-	expression tag	UNP W8RJF9
F	542	THR	-	expression tag	UNP W8RJF9
F	543	PHE	-	expression tag	UNP W8RJF9
F	544	LEU	-	expression tag	UNP W8RJF9
F	545	GLY	-	expression tag	UNP W8RJF9
F	546	GLY	-	expression tag	UNP W8RJF9
F	547	LEU	-	expression tag	UNP W8RJF9
F	548	VAL	-	expression tag	UNP W8RJF9
F	549	PRO	-	expression tag	UNP W8RJF9
F	550	ARG	-	expression tag	UNP W8RJF9
F	551	GLY	-	expression tag	UNP W8RJF9
F	552	SER	-	expression tag	UNP W8RJF9
F	553	HIS	-	expression tag	UNP W8RJF9
F	554	HIS	-	expression tag	UNP W8RJF9
F	555	HIS	-	expression tag	UNP W8RJF9
F	556	HIS	-	expression tag	UNP W8RJF9
F	557	HIS	-	expression tag	UNP W8RJF9
F	558	HIS	-	expression tag	UNP W8RJF9
F	559	SER	-	expression tag	UNP W8RJF9
F	560	ALA	-	expression tag	UNP W8RJF9
F	561	TRP	-	expression tag	UNP W8RJF9
F	562	SER	-	expression tag	UNP W8RJF9
F	563	HIS	-	expression tag	UNP W8RJF9
F	564	PRO	-	expression tag	UNP W8RJF9
F	565	GLN	-	expression tag	UNP W8RJF9
F	566	PHE	-	expression tag	UNP W8RJF9
F	567	GLU	-	expression tag	UNP W8RJF9
F	568	LYS	-	expression tag	UNP W8RJF9

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	F	1	Total	O	S	0	0
			5	4	1		
2	F	1	Total	O	S	0	0
			5	4	1		
2	F	1	Total	O	S	0	0
			5	4	1		
2	F	1	Total	O	S	0	0
			5	4	1		
2	F	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is 2-[N-CYCLOHEXYLAMINO]ETHANE SULFONIC ACID (CCD ID: NHE) (formula: C<sub>8</sub>H<sub>17</sub>NO<sub>3</sub>S).

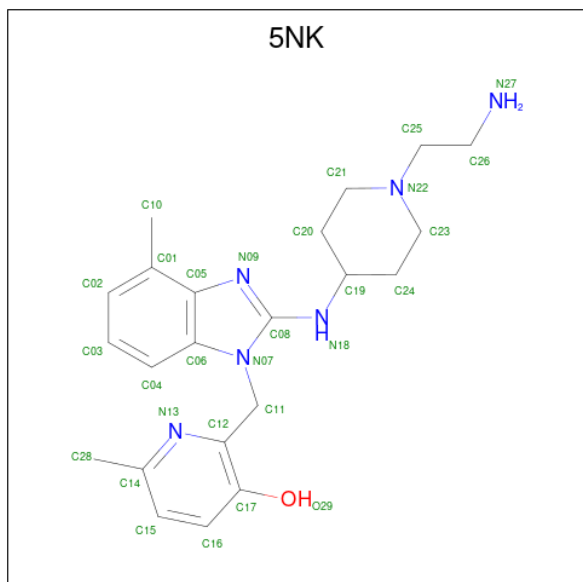


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
3	F	1	13	8	1	3	1	0	0

- Molecule 4 is NICKEL (II) ION (CCD ID: NI) (formula: Ni).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Ni		
4	F	1	1	1	0	0

- Molecule 5 is 2-[[2-[[1-(2-azanylethyl)piperidin-4-yl]amino]-4-methyl-benzimidazol-1-yl]methyl]-6-methyl-pyridin-3-ol (CCD ID: 5NK) (formula: C<sub>22</sub>H<sub>30</sub>N<sub>6</sub>O) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
5	F	1	29	22	6	1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	F	55	55	55	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 3 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	168.45Å 168.45Å 168.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	59.56 – 2.60 59.56 – 2.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (59.56-2.60) 99.9 (59.56-2.60)	Depositor EDS
$R_{merge}$	0.13	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.38 (at 2.61Å)	Xtrriage
Refinement program	PHENIX 1.13_2998	Depositor
R, $R_{free}$	0.191 , 0.221 0.197 , 0.227	Depositor DCC
$R_{free}$ test set	1288 reflections (3.50%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	55.2	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 46.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	3512	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	62.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.03% 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: NHE, SO4, 5NK, NI

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	F	0.24	0/3433	0.44	0/4654

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	F	3384	0	3420	27	0
2	F	30	0	0	2	0
3	F	13	0	17	1	0
4	F	1	0	0	0	0
5	F	29	0	30	1	0
6	F	55	0	0	2	0
All	All	3512	0	3467	28	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.

The worst 5 of 28 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:F:602:SO4:O1	6:F:701:HOH:O	1.96	0.82
1:F:374:THR:OG1	6:F:702:HOH:O	2.02	0.77
1:F:75:LYS:NZ	2:F:605:SO4:O1	2.25	0.69
1:F:246:PRO:HB3	1:F:283:GLN:HA	1.76	0.67
1:F:321:LEU:HD11	1:F:473:PRO:HB3	1.77	0.66

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	F	430/568 (76%)	416 (97%)	14 (3%)	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	F	396/509 (78%)	389 (98%)	7 (2%)	51 76

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	292	ILE
1	F	327	LYS

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Mol	Chain	Res	Type
1	F	450	VAL
1	F	429	ARG
1	F	206	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	F	81	GLN
1	F	227	ASN
1	F	254	ASN
1	F	354	GLN
1	F	428	ASN

### 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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 1 is monoatomic - leaving 8 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	SO4	F	605	-	4,4,4	0.24	0	6,6,6	0.08	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	SO4	F	606	-	4,4,4	0.22	0	6,6,6	0.10	0
2	SO4	F	602	-	4,4,4	0.25	0	6,6,6	0.14	0
2	SO4	F	601	-	4,4,4	0.22	0	6,6,6	0.14	0
5	5NK	F	609	-	31,32,32	5.55	18 (58%)	35,45,45	1.38	4 (11%)
3	NHE	F	607	-	13,13,13	1.35	2 (15%)	16,17,17	1.69	5 (31%)
2	SO4	F	603	-	4,4,4	0.24	0	6,6,6	0.08	0
2	SO4	F	604	-	4,4,4	0.23	0	6,6,6	0.11	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
5	5NK	F	609	-	-	3/11/21/21	0/4/4/4
3	NHE	F	607	-	-	3/7/15/15	0/1/1/1

The worst 5 of 20 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	F	609	5NK	C05-C01	12.44	1.57	1.40
5	F	609	5NK	C25-N22	-12.13	1.19	1.47
5	F	609	5NK	C04-C06	11.99	1.58	1.39
5	F	609	5NK	C12-N13	8.46	1.48	1.34
5	F	609	5NK	C14-N13	7.78	1.48	1.34

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	F	607	NHE	O2-S-O1	-3.93	101.03	113.82
3	F	607	NHE	O1-S-C2	3.14	111.47	106.73
5	F	609	5NK	C05-C06-N07	3.07	107.46	105.22
5	F	609	5NK	C24-C19-N18	-2.43	105.71	110.57
3	F	607	NHE	C1-N-C1'	-2.41	109.54	114.18

There are no chirality outliers.

5 of 6 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	F	607	NHE	C1-C2-S-O3
5	F	609	5NK	C26-C25-N22-C21

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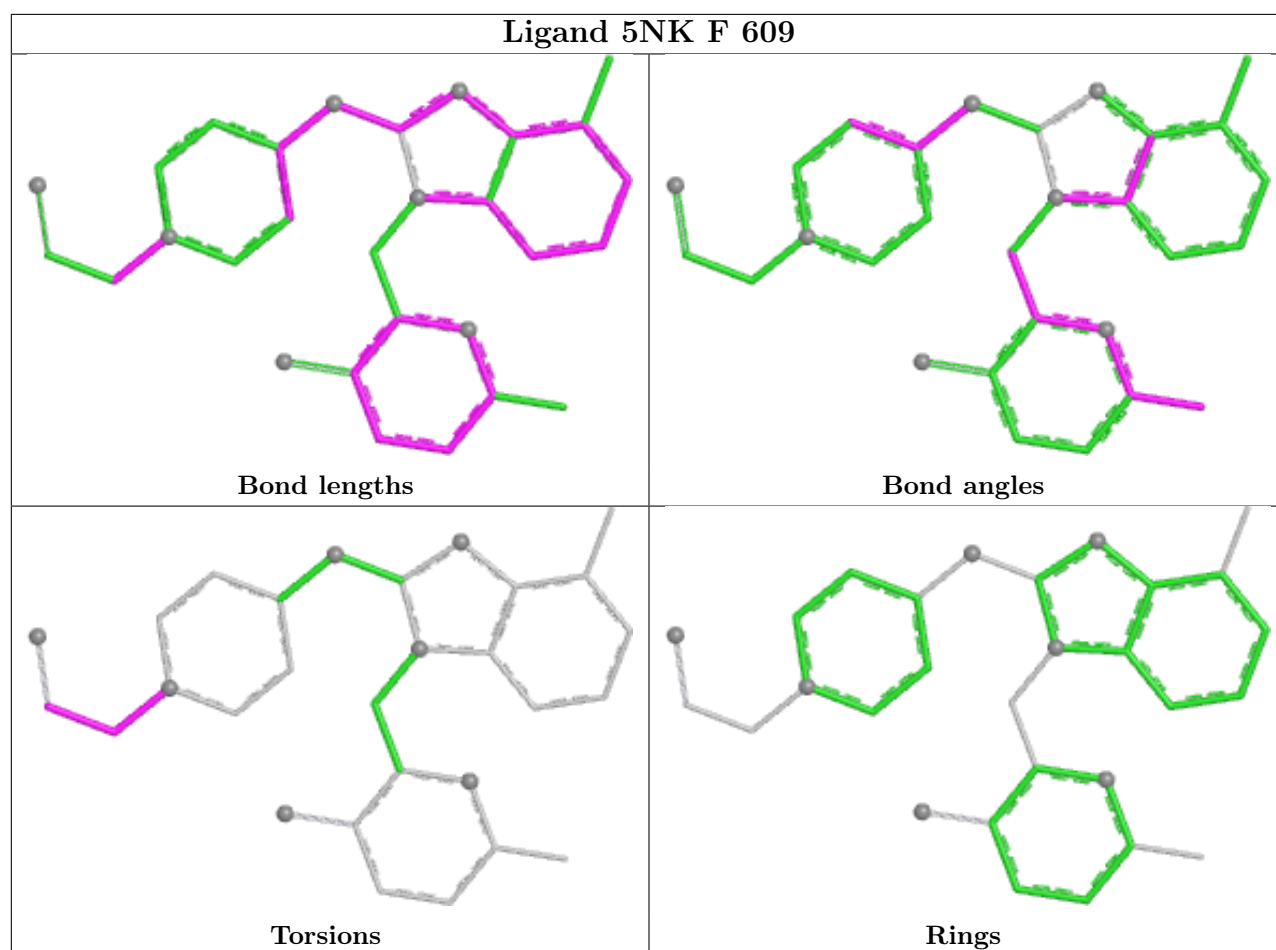
Mol	Chain	Res	Type	Atoms
5	F	609	5NK	N22-C25-C26-N27
5	F	609	5NK	C26-C25-N22-C23
3	F	607	NHE	C1-C2-S-O1

There are no ring outliers.

4 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	F	605	SO4	1	0
2	F	602	SO4	1	0
5	F	609	5NK	1	0
3	F	607	NHE	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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	F	438/568 (77%)	0.25	38 (8%) <b>16</b> <b>12</b>	33, 54, 107, 146	0

The worst 5 of 38 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	214	ILE	6.8
1	F	506	ILE	6.0
1	F	107	ALA	5.0
1	F	505	PHE	4.8
1	F	106	ARG	4.5

### 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 oligosaccharides 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.

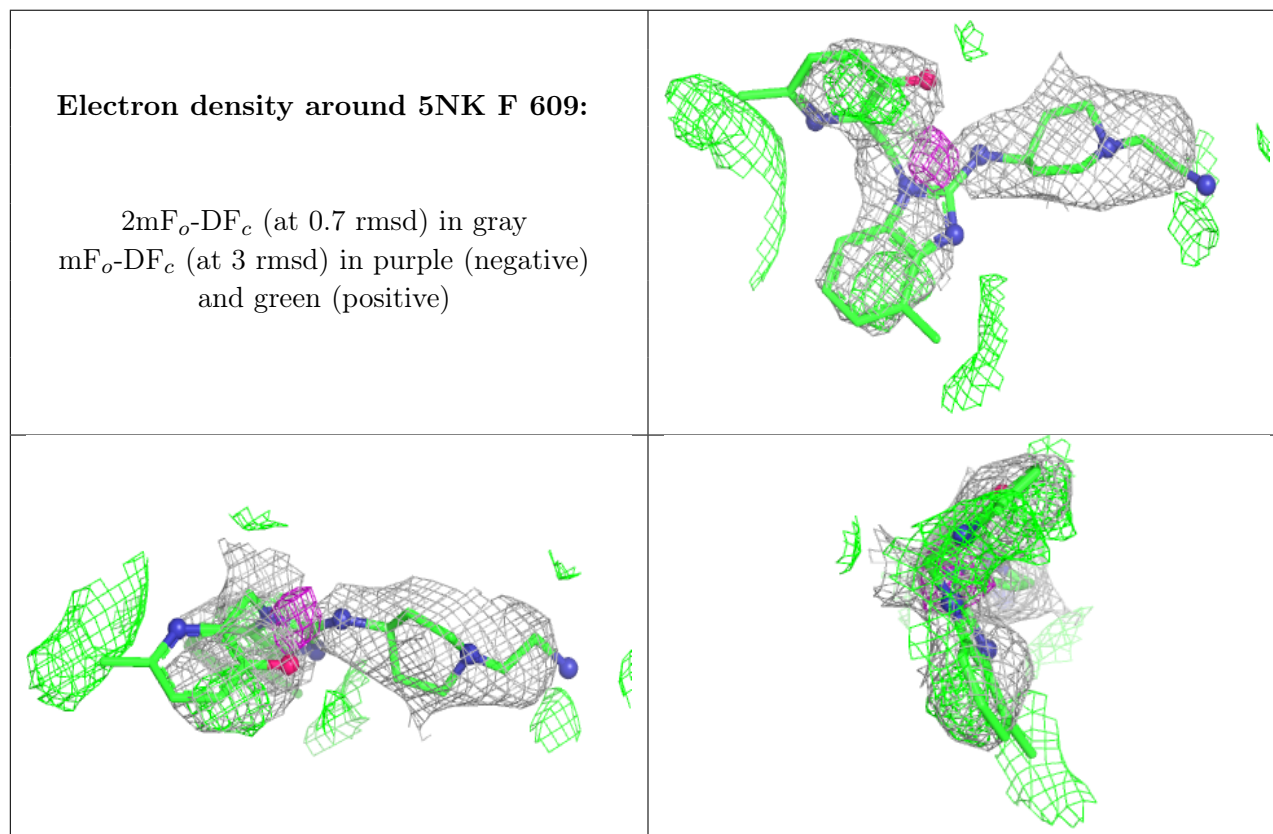
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	SO4	F	603	5/5	0.72	0.13	128,130,132,134	0
2	SO4	F	605	5/5	0.76	0.13	142,142,143,146	5

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
2	SO4	F	604	5/5	0.82	0.11	121,122,132,140	0
5	5NK	F	609	29/29	0.85	0.27	67,72,77,78	29
3	NHE	F	607	13/13	0.87	0.18	78,94,126,151	0
2	SO4	F	602	5/5	0.87	0.10	76,96,98,99	0
2	SO4	F	606	5/5	0.90	0.16	88,109,113,118	0
2	SO4	F	601	5/5	0.91	0.10	79,82,96,118	0
4	NI	F	608	1/1	0.99	0.10	80,80,80,80	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.