



# Full wwPDB X-ray Structure Validation Report ⓘ

May 23, 2020 – 07:59 pm BST

PDB ID : 2IJM  
Title : Crystal Structure of Focal Adhesion Kinase Domain with 2 molecules in the Asymmetric Unit Complexed with ADP and ATP  
Authors : Lee, C.C.  
Deposited on : 2006-09-29  
Resolution : 2.19 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) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11

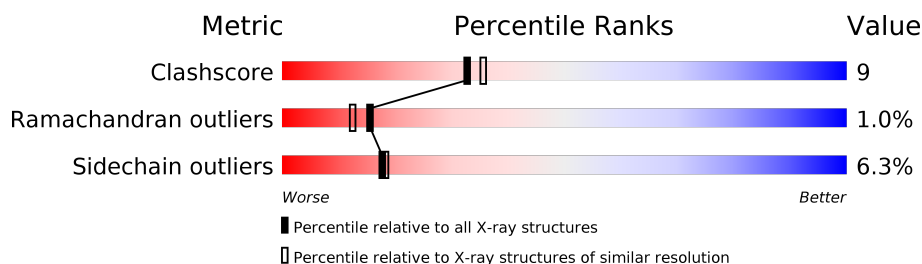
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.19 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))
Clashscore	141614	7689 (2.20-2.16)
Ramachandran outliers	138981	7564 (2.20-2.16)
Sidechain outliers	138945	7564 (2.20-2.16)

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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	281	
1	B	281	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 4445 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.

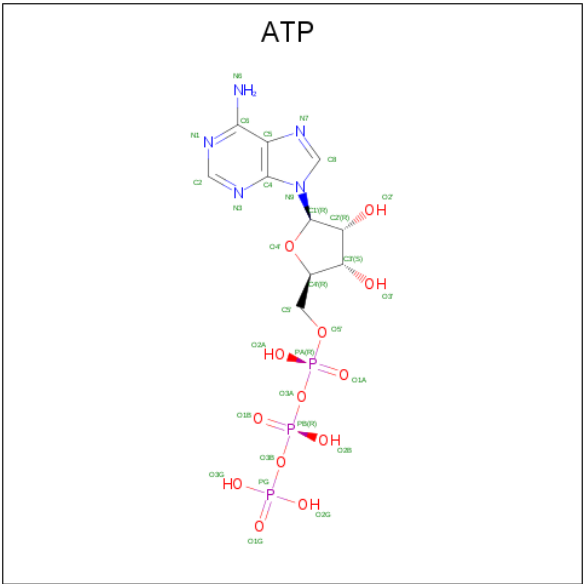
- Molecule 1 is a protein called Focal Adhesion Kinase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	260	2099	1338	364	380	17	0	1	0
1	B	261	2104	1341	365	381	17	0	1	0

There are 4 discrepancies between the modelled and reference sequences:

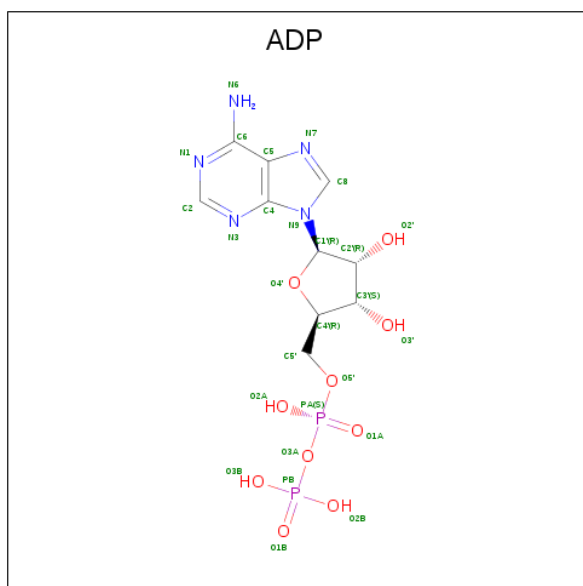
Chain	Residue	Modelled	Actual	Comment	Reference
A	409	GLY	-	CLONING ARTIFACT	UNP Q05397
A	410	ALA	-	CLONING ARTIFACT	UNP Q05397
B	409	GLY	-	CLONING ARTIFACT	UNP Q05397
B	410	ALA	-	CLONING ARTIFACT	UNP Q05397

- Molecule 2 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: C<sub>10</sub>H<sub>16</sub>N<sub>5</sub>O<sub>13</sub>P<sub>3</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			31	10	5	13	3		

- Molecule 3 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula:  $C_{10}H_{15}N_5O_{10}P_2$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

- Molecule 4 is water.

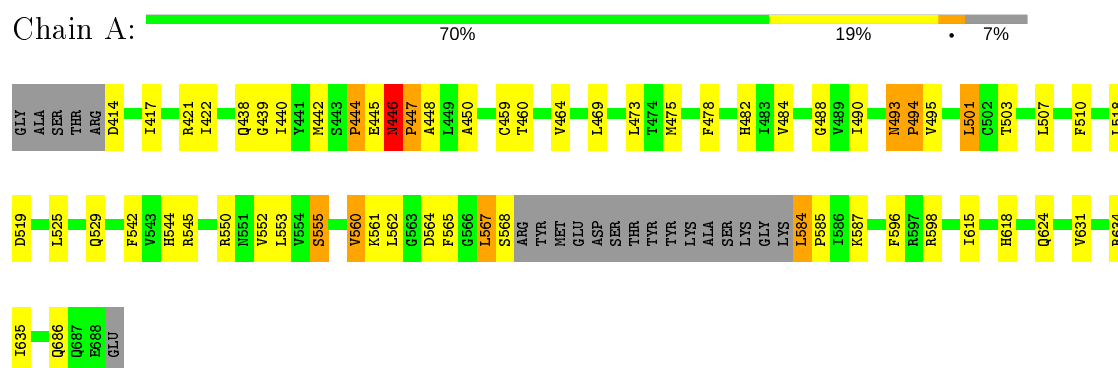
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	79	Total	O	0	0
			79	79		
4	B	105	Total	O	0	0
			105	105		

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

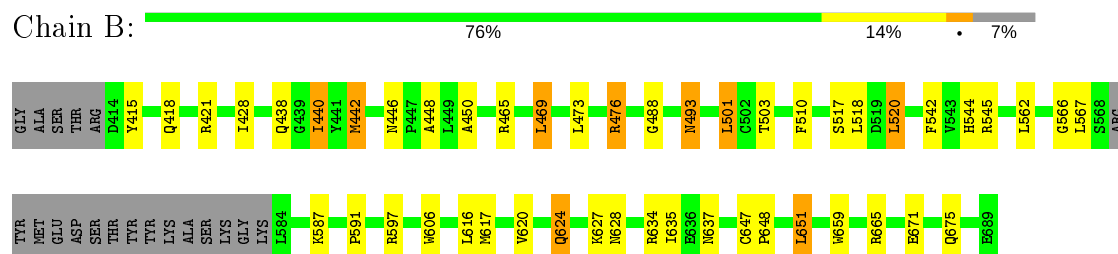
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according 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. 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.

Note EDS was not executed.

#### • Molecule 1: Focal Adhesion Kinase 1



#### • Molecule 1: Focal Adhesion Kinase 1



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	45.43 Å   51.65 Å   66.54 Å 99.81°   103.55°   90.69°	Depositor
Resolution (Å)	34.30 – 2.19	Depositor
% Data completeness (in resolution range)	100.0 (34.30-2.19)	Depositor
$R_{merge}$	0.04	Depositor
$R_{sym}$	0.06	Depositor
Refinement program	REFMAC 5.2	Depositor
R, $R_{free}$	0.207 , 0.271	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4445	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

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

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	0.51	0/2145	0.65	0/2900
1	B	0.49	0/2150	0.65	0/2907
All	All	0.50	0/4295	0.65	0/5807

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	2099	0	2105	46	0
1	B	2104	0	2105	28	0
2	A	31	0	12	1	0
3	B	27	0	12	0	0
4	A	79	0	0	3	0
4	B	105	0	0	3	0
All	All	4445	0	4234	74	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 9.

All (74) 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:447:PRO:HA	1:A:448:ALA:HB3	1.51	0.91
1:B:616:LEU:HD11	1:B:651:LEU:HD13	1.58	0.84
1:A:459:CYS:SG	1:A:493:ASN:HB2	2.23	0.79
1:B:440:ILE:HD11	1:B:448:ALA:HB1	1.66	0.74
1:A:447:PRO:HA	1:A:448:ALA:CB	2.19	0.73
1:A:596:PHE:HB2	1:A:598:ARG:HG2	1.71	0.72
1:A:634:ARG:HG3	1:A:634:ARG:HH11	1.54	0.72
1:A:447:PRO:CA	1:A:448:ALA:HB3	2.21	0.70
1:B:440:ILE:CD1	1:B:448:ALA:HB1	2.24	0.68
1:A:460:THR:HG23	4:A:205:HOH:O	1.95	0.65
1:A:564:ASP:OD1	2:A:690:ATP:PG	2.57	0.62
1:A:544:HIS:O	1:A:545:ARG:HB2	2.00	0.61
1:A:624:GLN:HA	1:A:624:GLN:HE21	1.66	0.60
1:A:555:SER:OG	4:A:294:HOH:O	2.17	0.58
1:A:450:ALA:HB1	1:A:501:LEU:HD12	1.87	0.56
1:A:624:GLN:HA	1:A:624:GLN:NE2	2.20	0.56
1:A:484:VAL:HG21	1:A:553:LEU:HD12	1.88	0.55
1:B:624:GLN:HE21	1:B:624:GLN:HA	1.71	0.55
1:A:501:LEU:HD13	1:A:503:THR:HG22	1.89	0.55
1:A:446:ASN:HD22	1:A:446:ASN:C	2.10	0.55
1:B:415:TYR:CE2	1:B:476:ARG:HG2	2.42	0.54
1:B:501:LEU:HD13	1:B:503:THR:HG22	1.89	0.54
1:B:542:PHE:HZ	1:B:566:GLY:HA2	1.72	0.54
1:B:428:ILE:HG21	1:B:438:GLN:HB3	1.91	0.53
1:B:544:HIS:O	1:B:545:ARG:HB2	2.08	0.52
1:A:438:GLN:HG2	1:A:439:GLY:N	2.24	0.52
1:B:418:GLN:HG3	1:B:421:ARG:HG3	1.91	0.52
1:A:438:GLN:HG3	1:A:501:LEU:HD11	1.92	0.52
1:B:465:ARG:HH12	1:B:493:ASN:HD21	1.58	0.51
1:A:446:ASN:ND2	1:A:447:PRO:O	2.44	0.51
1:A:475:MET:HG2	1:A:565:PHE:CD1	2.45	0.51
1:B:520:LEU:HD11	1:B:648:PRO:HD3	1.91	0.51
1:A:552:VAL:CG1	1:A:560:VAL:HG22	2.42	0.50
1:A:618:HIS:CE1	4:A:328:HOH:O	2.64	0.50
1:A:417:ILE:HD11	1:A:488:GLY:HA3	1.94	0.49
1:A:482:HIS:HA	1:A:561:LYS:HG2	1.95	0.49
1:B:465:ARG:HG2	1:B:469:LEU:HD22	1.95	0.49
1:B:591:PRO:HG3	1:B:635:ILE:HG21	1.94	0.48
1:B:421:ARG:HB3	1:B:442:MET:O	2.13	0.48
1:A:624:GLN:HE21	1:A:624:GLN:CA	2.28	0.47
1:B:415:TYR:HB3	1:B:488:GLY:HA2	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:525:LEU:O	1:A:529:GLN:HG3	2.14	0.47
1:B:450:ALA:HB1	1:B:501:LEU:HD12	1.96	0.47
1:A:421:ARG:NH2	1:A:444:PRO:HD2	2.29	0.47
1:A:493:ASN:HA	1:A:494:PRO:C	2.34	0.47
1:B:616:LEU:HD13	1:B:647:CYS:SG	2.55	0.47
1:A:493:ASN:HA	1:A:495:VAL:N	2.30	0.47
1:A:519:ASP:OD2	1:A:519:ASP:N	2.48	0.46
1:A:469:LEU:O	1:A:473:LEU:HG	2.15	0.46
1:A:631:VAL:O	1:A:635:ILE:HG12	2.16	0.45
1:A:634:ARG:CG	1:A:634:ARG:HH11	2.26	0.45
1:A:510:PHE:CE2	1:A:518:LEU:HD11	2.51	0.45
1:B:587:LYS:HE3	1:B:628:ASN:OD1	2.18	0.44
1:B:617:MET:HB3	1:B:620:VAL:HB	1.99	0.44
1:A:552:VAL:HG12	1:A:560:VAL:HG22	1.99	0.43
1:B:637:ASN:ND2	4:B:241:HOH:O	2.52	0.43
1:B:597:ARG:NH1	4:B:302:HOH:O	2.50	0.42
1:A:584:LEU:N	1:A:585:PRO:HD2	2.34	0.42
1:A:587:LYS:HG2	1:A:631:VAL:HG21	2.00	0.42
1:A:417:ILE:HG21	1:A:422:ILE:HD11	2.00	0.42
1:A:422:ILE:HD13	1:A:490:ILE:HD11	2.01	0.42
1:A:475:MET:CE	1:A:484:VAL:HG12	2.50	0.42
1:B:542:PHE:HZ	1:B:566:GLY:CA	2.33	0.42
1:A:567:LEU:HB3	1:A:568:SER:H	1.49	0.42
1:B:671:GLU:O	1:B:675:GLN:HG2	2.20	0.42
1:A:445:GLU:O	1:A:446:ASN:CG	2.58	0.41
1:A:475:MET:HE1	1:A:484:VAL:HG12	2.01	0.41
1:A:507:LEU:HD21	1:A:615:ILE:HG12	2.02	0.41
1:B:510:PHE:CE2	1:B:518:LEU:HD11	2.56	0.41
1:B:616:LEU:HD11	1:B:651:LEU:CD1	2.40	0.41
1:A:634:ARG:NH1	1:A:634:ARG:HG3	2.28	0.41
1:A:478:PHE:HZ	1:A:542:PHE:CD1	2.39	0.41
1:B:634:ARG:NH1	4:B:233:HOH:O	2.54	0.40
1:B:606:TRP:CE3	1:B:659:TRP:HA	2.56	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	257/281 (92%)	246 (96%)	7 (3%)	4 (2%)	9	6
1	B	258/281 (92%)	247 (96%)	10 (4%)	1 (0%)	34	35
All	All	515/562 (92%)	493 (96%)	17 (3%)	5 (1%)	15	12

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	446	ASN
1	A	444	PRO
1	A	447	PRO
1	B	446	ASN
1	A	494	PRO

### 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	232/248 (94%)	217 (94%)	15 (6%)	17	17
1	B	232/248 (94%)	217 (94%)	15 (6%)	17	17
All	All	464/496 (94%)	434 (94%)	30 (6%)	18	17

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	414	ASP

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Mol	Chain	Res	Type
1	A	440	ILE
1	A	442	MET
1	A	446	ASN
1	A	464	VAL
1	A	493	ASN
1	A	501	LEU
1	A	550[A]	ARG
1	A	550[B]	ARG
1	A	555	SER
1	A	560	VAL
1	A	562	LEU
1	A	567	LEU
1	A	584	LEU
1	A	686	GLN
1	B	440	ILE
1	B	442	MET
1	B	469	LEU
1	B	473	LEU
1	B	476	ARG
1	B	493	ASN
1	B	501	LEU
1	B	517	SER
1	B	520	LEU
1	B	562	LEU
1	B	567	LEU
1	B	624	GLN
1	B	627	LYS
1	B	651	LEU
1	B	665	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	446	ASN
1	A	458	ASN
1	A	624	GLN
1	A	637	ASN
1	A	686	GLN
1	B	624	GLN
1	B	629	ASN
1	B	637	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

2 ligands 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
2	ATP	A	690	-	26,33,33	0.93	1 (3%)	31,52,52	1.57	6 (19%)
3	ADP	B	800	-	24,29,29	0.98	2 (8%)	29,45,45	1.25	4 (13%)

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	ATP	A	690	-	-	1/18/38/38	0/3/3/3
3	ADP	B	800	-	-	0/12/32/32	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	800	ADP	C5-C4	2.44	1.47	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	690	ATP	C5-C4	2.39	1.47	1.40
3	B	800	ADP	O4'-C1'	2.05	1.43	1.41

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	690	ATP	PA-O3A-PB	-4.58	117.10	132.83
2	A	690	ATP	N3-C2-N1	-3.31	123.51	128.68
3	B	800	ADP	N3-C2-N1	-3.05	123.91	128.68
2	A	690	ATP	PB-O3B-PG	-2.72	123.48	132.83
3	B	800	ADP	PA-O3A-PB	-2.66	123.68	132.83
3	B	800	ADP	C4-C5-N7	-2.54	106.76	109.40
2	A	690	ATP	C4-C5-N7	-2.37	106.93	109.40
3	B	800	ADP	O3B-PB-O2B	2.27	116.32	107.64
2	A	690	ATP	O3G-PG-O2G	2.25	116.24	107.64
2	A	690	ATP	O2'-C2'-C3'	-2.01	105.32	111.82

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	690	ATP	C3'-C4'-C5'-O5'

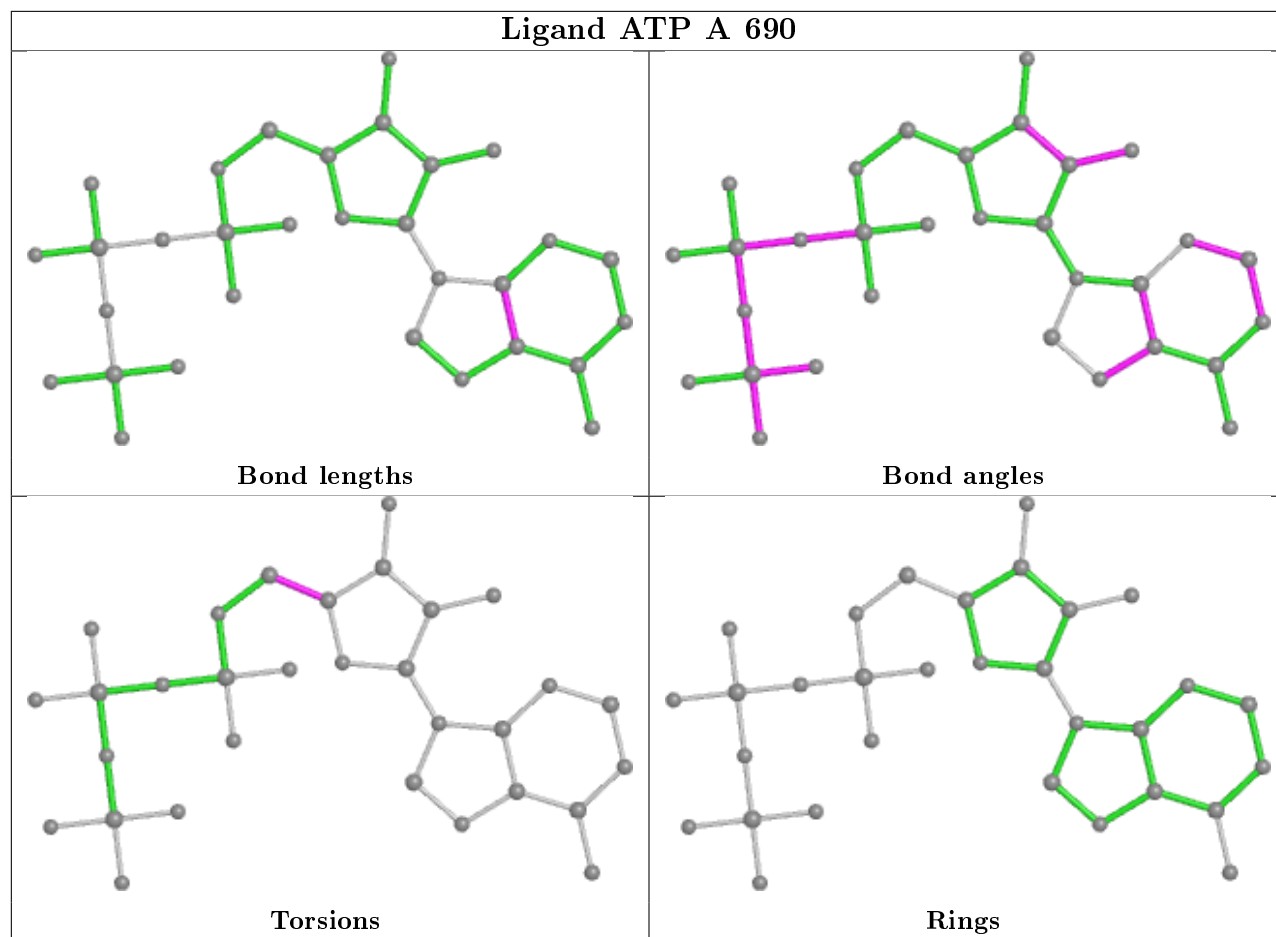
There are no ring outliers.

1 monomer is involved in 1 short contact:

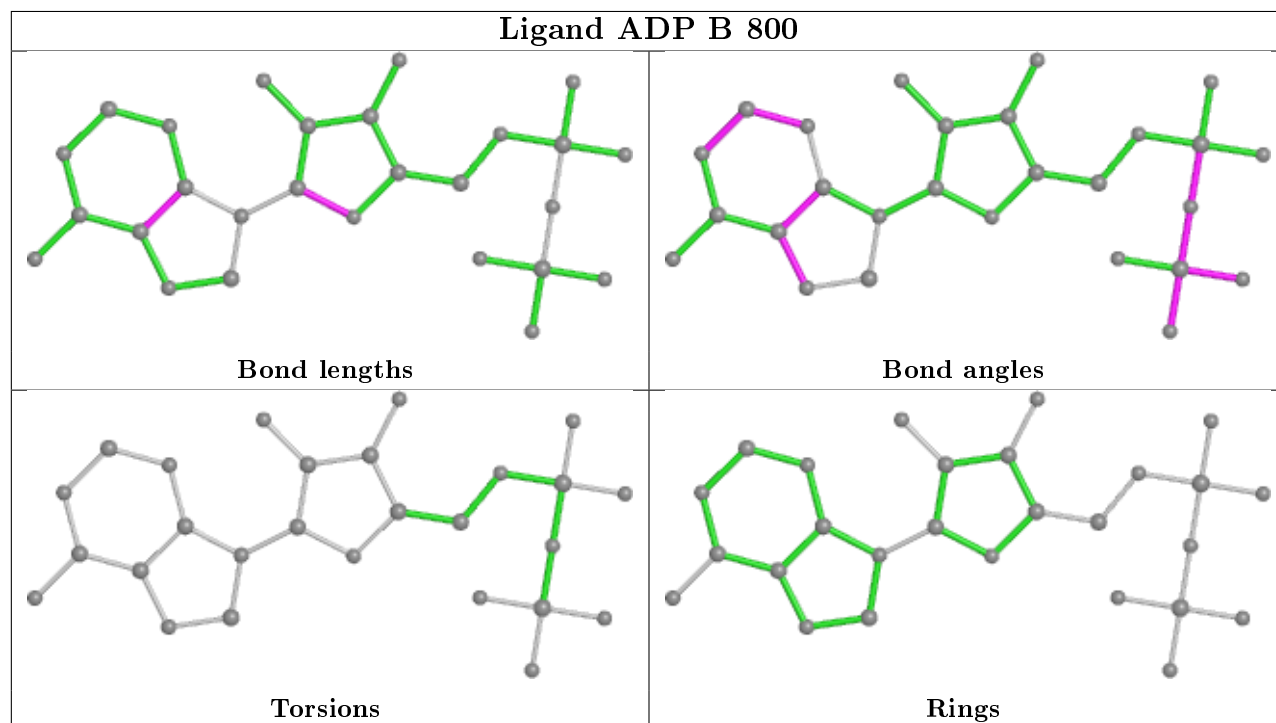
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	690	ATP	1	0

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.

## Ligand ATP A 690



## Ligand ADP B 800



## 5.7 Other polymers

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.

## 6 Fit of model and data ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

### 6.4 Ligands ⓘ

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers ⓘ

EDS was not executed - this section is therefore empty.