



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 9, 2017 – 05:28 PM EDT

PDB ID : 2P9P  
Title : Crystal Structure of bovine Arp2/3 complex co-crystallized with ADP  
Authors : Nolen, B.J.; Pollard, T.D.  
Deposited on : unknown  
Resolution : 2.90 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

<http://wwpdb.org/validation/2016/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	:	1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20030345
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20030345



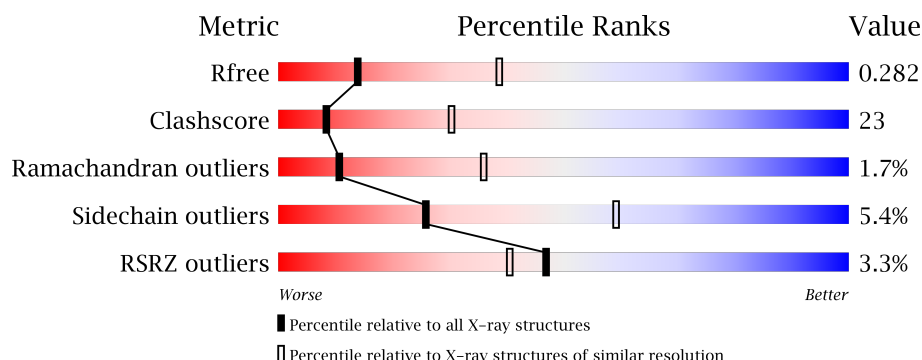
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.90 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))
$R_{free}$	100719	1586 (2.90-2.90)
Clashscore	112137	1807 (2.90-2.90)
Ramachandran outliers	110173	1768 (2.90-2.90)
Sidechain outliers	110143	1770 (2.90-2.90)
RSRZ outliers	101464	1596 (2.90-2.90)



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. 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	418	<div> <div>0.5%</div> <div> <div></div> <div>55%</div> <div>34%</div> <div>7%</div> </div> </div>
2	B	394	<div> <div>7%</div> <div> <div></div> <div>27%</div> <div>17%</div> <div>53%</div> </div> </div>
3	C	372	<div> <div>0.5%</div> <div> <div></div> <div>53%</div> <div>34%</div> <div>8%</div> </div> </div>
4	D	300	<div> <div></div> <div> <div></div> <div>59%</div> <div>31%</div> <div>9%</div> </div> </div>
5	E	178	<div> <div>6%</div> <div> <div></div> <div>56%</div> <div>37%</div> <div>5%</div> </div> </div>

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Mol	Chain	Length	Quality of chain
6	F	168	
7	G	151	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
8	CA	A	500	-	-	-	X



## 2 Entry composition

There are 9 unique types of molecules in this entry. The entry contains 13192 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 Actin-like protein 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	388	Total	C	N	O	S	0	0	0
			3078	1980	509	574	15			

- Molecule 2 is a protein called Actin-like protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	184	Total	C	N	O	S	0	0	0
			1451	931	248	268	4			

- Molecule 3 is a protein called Actin-related protein 2/3 complex subunit 1B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	341	Total	C	N	O	S	0	0	0
			2648	1680	464	485	19			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	58	VAL	ILE	CONFLICT	UNP Q58CQ2

- Molecule 4 is a protein called Actin-related protein 2/3 complex subunit 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	273	Total	C	N	O	S	0	0	0
			2213	1407	385	413	8			

- Molecule 5 is a protein called Actin-related protein 2/3 complex subunit 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	174	Total	C	N	O	S	0	0	0
			1406	903	235	259	9			



- Molecule 6 is a protein called Actin-related protein 2/3 complex subunit 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	165	Total	C	N	O	S	0	0	0
			1359	868	237	245	9			

- Molecule 7 is a protein called Actin-related protein 2/3 complex subunit 5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	G	128	Total	C	N	O	S	0	0	0
			982	619	173	187	3			

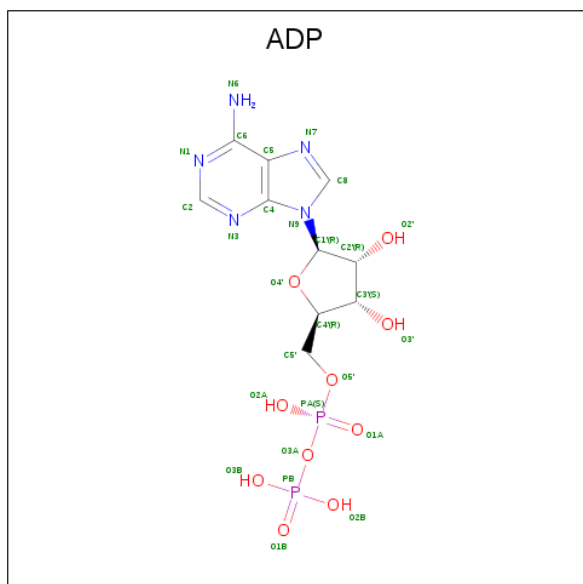
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	17	ASP	GLY	CONFLICT	UNP Q3SYX9
G	28	ASP	GLU	CONFLICT	UNP Q3SYX9

- Molecule 8 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	1	Total	Ca	0	0
			1	1		

- Molecule 9 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: C<sub>10</sub>H<sub>15</sub>N<sub>5</sub>O<sub>10</sub>P<sub>2</sub>).





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

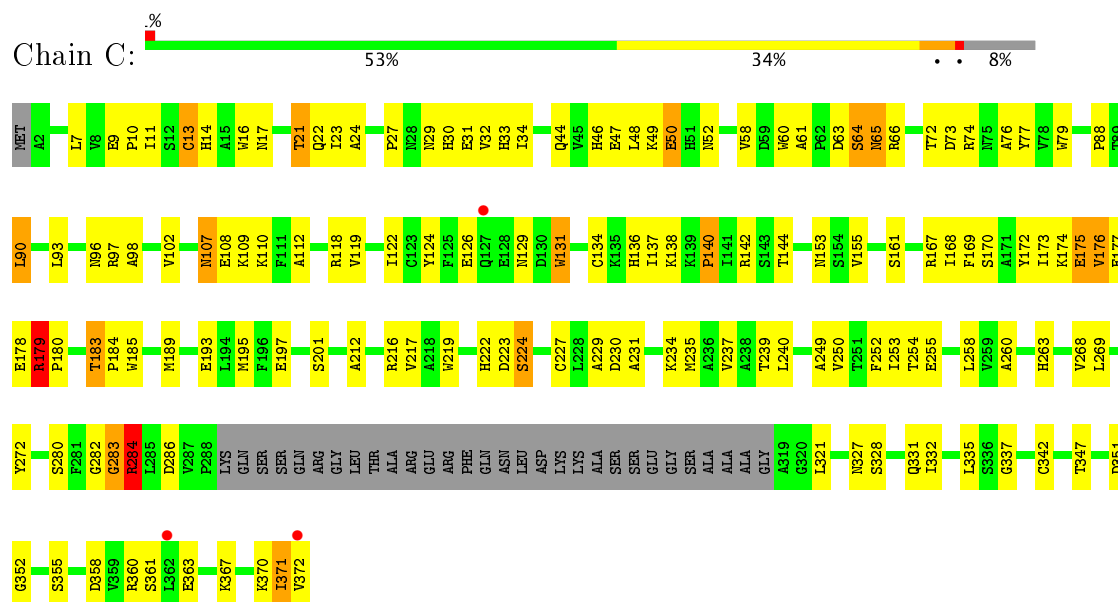




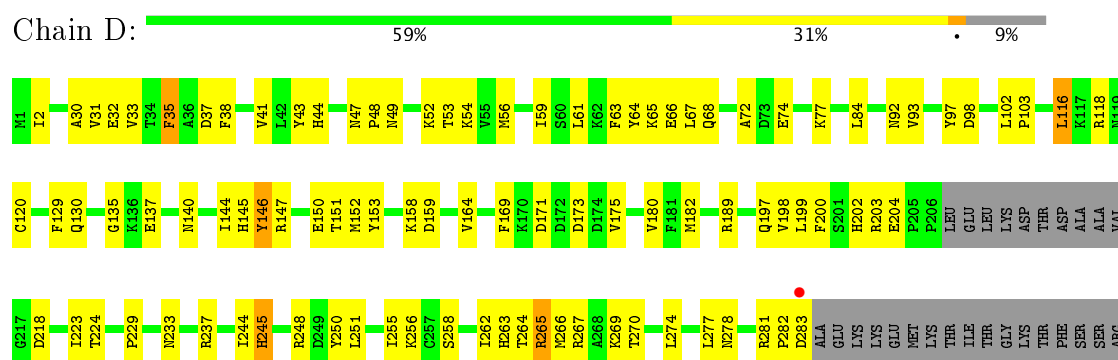


ALA  
VAL  
LEU  
LEU  
ASP  
ASP  
MET  
LYS  
ASP  
LYS  
ASP  
ASN  
PHE  
TRP  
MET  
THR  
ARG  
GLN  
GLN  
TYR  
GLN  
GLY  
LYS  
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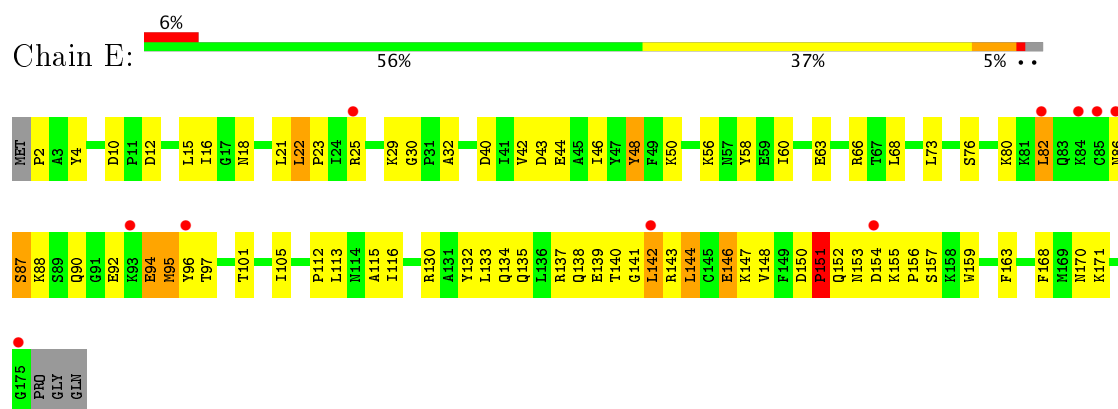
• Molecule 3: Actin-related protein 2/3 complex subunit 1B



• Molecule 4: Actin-related protein 2/3 complex subunit 2

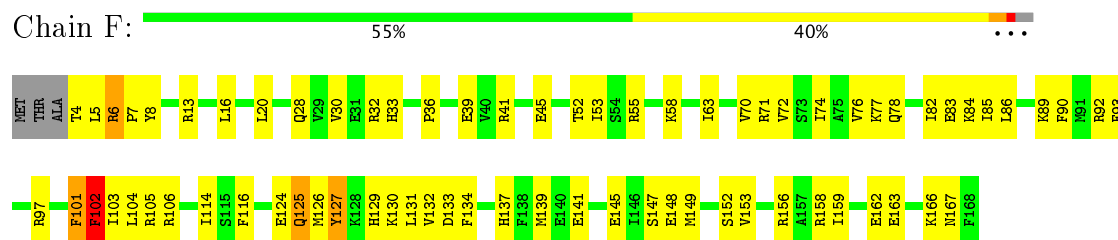


• Molecule 5: Actin-related protein 2/3 complex subunit 3

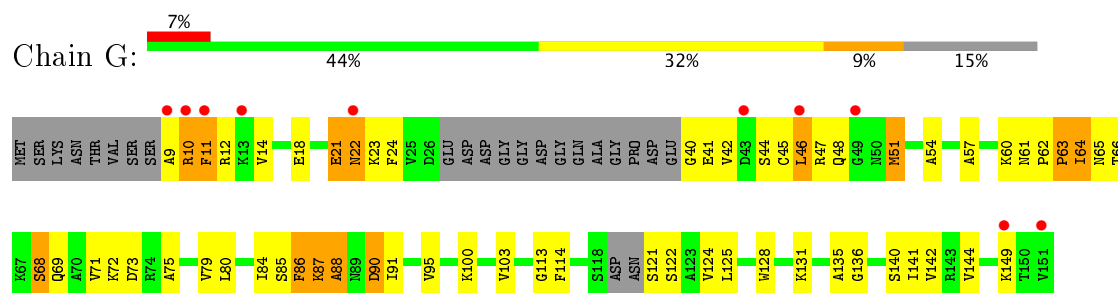


• Molecule 6: Actin-related protein 2/3 complex subunit 4





• Molecule 7: Actin-related protein 2/3 complex subunit 5





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	110.97Å 128.93Å 202.29Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.90 46.02 – 2.90	Depositor EDS
% Data completeness (in resolution range)	82.4 (50.00-2.90) 82.7 (46.02-2.90)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.07 (at 2.91Å)	Xtriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.234 , 0.288 0.233 , 0.282	Depositor DCC
$R_{free}$ test set	2686 reflections (5.01%)	DCC
Wilson B-factor (Å <sup>2</sup> )	56.2	Xtriage
Anisotropy	0.694	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 45.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.91	EDS
Total number of atoms	13192	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.93% 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: CA, 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	0.47	0/3156	0.67	0/4287
2	B	0.43	0/1473	0.64	0/1986
3	C	0.44	0/2717	0.72	1/3688 (0.0%)
4	D	0.43	0/2261	0.64	0/3050
5	E	0.40	0/1440	0.69	0/1943
6	F	0.45	0/1381	0.66	0/1851
7	G	0.38	0/992	0.62	0/1331
All	All	0.44	0/13420	0.67	1/18136 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
4	D	0	1
5	E	0	1
All	All	0	2

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	283	GLY	N-CA-C	6.65	129.73	113.10

There are no chirality outliers.

All (2) planarity outliers are listed below:



Mol	Chain	Res	Type	Group
4	D	97	TYR	Sidechain
5	E	48	TYR	Sidechain

## 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	3078	0	2970	143	0
2	B	1451	0	1474	75	0
3	C	2648	0	2602	127	0
4	D	2213	0	2176	89	0
5	E	1406	0	1398	86	0
6	F	1359	0	1398	67	0
7	G	982	0	1012	58	0
8	A	1	0	0	0	0
9	A	27	0	12	3	0
9	B	27	0	12	2	0
All	All	13192	0	13054	607	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 23.

The worst 5 of 607 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:C:282:GLY:HA3	3:C:370:LYS:HE3	1.34	1.08
2:B:166:ILE:HD12	2:B:281:LEU:HD22	1.41	0.99
1:A:191:LYS:HE2	1:A:303:VAL:HG22	1.46	0.97
6:F:130:LYS:HE2	6:F:130:LYS:HA	1.48	0.92
6:F:20:LEU:HD23	6:F:70:VAL:HG21	1.53	0.91

There are no symmetry-related clashes.



## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	376/418 (90%)	345 (92%)	29 (8%)	2 (0%)	32	68
2	B	176/394 (45%)	149 (85%)	22 (12%)	5 (3%)	6	22
3	C	337/372 (91%)	306 (91%)	24 (7%)	7 (2%)	8	30
4	D	269/300 (90%)	251 (93%)	17 (6%)	1 (0%)	38	72
5	E	172/178 (97%)	147 (86%)	23 (13%)	2 (1%)	15	46
6	F	163/168 (97%)	150 (92%)	9 (6%)	4 (2%)	6	25
7	G	122/151 (81%)	101 (83%)	14 (12%)	7 (6%)	2	6
All	All	1615/1981 (82%)	1449 (90%)	138 (8%)	28 (2%)	11	36

5 of 28 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	331	LYS
2	B	336	LYS
3	C	65	ASN
6	F	102	PHE
7	G	10	ARG

### 5.3.2 Protein sidechains

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	330/363 (91%)	307 (93%)	23 (7%)	18	45
2	B	157/345 (46%)	148 (94%)	9 (6%)	24	56

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	C	290/313 (93%)	276 (95%)	14 (5%)	30	64
4	D	241/264 (91%)	235 (98%)	6 (2%)	53	83
5	E	153/159 (96%)	144 (94%)	9 (6%)	23	55
6	F	153/155 (99%)	147 (96%)	6 (4%)	37	72
7	G	106/124 (86%)	96 (91%)	10 (9%)	10	30
All	All	1430/1723 (83%)	1353 (95%)	77 (5%)	26	59

5 of 77 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	C	30	HIS
3	C	280	SER
7	G	64	ILE
3	C	90	LEU
3	C	175	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 36 such sidechains are listed below:

Mol	Chain	Res	Type
3	C	46	HIS
3	C	331	GLN
7	G	56	GLN
3	C	107	ASN
4	D	140	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

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
9	ADP	A	501	8	25,29,29	1.22	2 (8%)	24,45,45	2.26	2 (8%)
9	ADP	B	395	-	25,29,29	1.28	3 (12%)	24,45,45	2.22	2 (8%)

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
9	ADP	A	501	8	-	0/12/32/32	0/3/3/3
9	ADP	B	395	-	-	0/12/32/32	0/3/3/3

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	B	395	ADP	O4'-C1'	2.29	1.44	1.41
9	A	501	ADP	PB-O1B	2.96	1.60	1.50
9	B	395	ADP	PB-O1B	3.07	1.61	1.50
9	A	501	ADP	C2-N1	3.44	1.40	1.33
9	B	395	ADP	C2-N1	3.66	1.40	1.33

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	B	395	ADP	N3-C2-N1	-10.02	120.13	128.86
9	A	501	ADP	N3-C2-N1	-9.89	120.24	128.86
9	A	501	ADP	C4'-O4'-C1'	-3.42	106.13	109.77
9	B	395	ADP	C4-C5-N7	-2.37	107.12	109.41

There are no chirality outliers.



There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	A	501	ADP	3	0
9	B	395	ADP	2	0

## 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	A	388/418 (92%)	-0.02	5 (1%) 77 76	30, 56, 84, 103	0
2	B	184/394 (46%)	0.43	26 (14%) 3 2	34, 64, 113, 121	0
3	C	341/372 (91%)	-0.06	3 (0%) 84 83	30, 47, 80, 103	0
4	D	273/300 (91%)	-0.09	1 (0%) 92 92	33, 53, 81, 95	0
5	E	174/178 (97%)	0.31	10 (5%) 24 19	42, 70, 96, 105	0
6	F	165/168 (98%)	-0.13	0 100 100	37, 52, 68, 79	0
7	G	128/151 (84%)	0.43	10 (7%) 14 10	42, 80, 106, 118	0
All	All	1653/1981 (83%)	0.07	55 (3%) 47 40	30, 56, 94, 121	0

The worst 5 of 55 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
7	G	10	ARG	4.9
2	B	337	LEU	3.8
2	B	176	PRO	3.7
5	E	175	GLY	3.6
2	B	278	VAL	3.6

### 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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
8	CA	A	500	1/1	0.97	0.38	15.34	73,73,73,73	0
9	ADP	A	501	27/27	0.92	0.20	0.21	50,56,68,70	0
9	ADP	B	395	27/27	0.94	0.12	-0.84	59,64,77,78	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.