



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 9, 2017 – 05:11 PM EDT

PDB ID : 2P9I  
Title : Crystal Structure of bovine Arp2/3 Complex co-crystallized with ADP and crosslinked with gluteraldehyde  
Authors : Nolen, B.J.; Pollard, T.D.  
Deposited on : unknown  
Resolution : 2.46 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

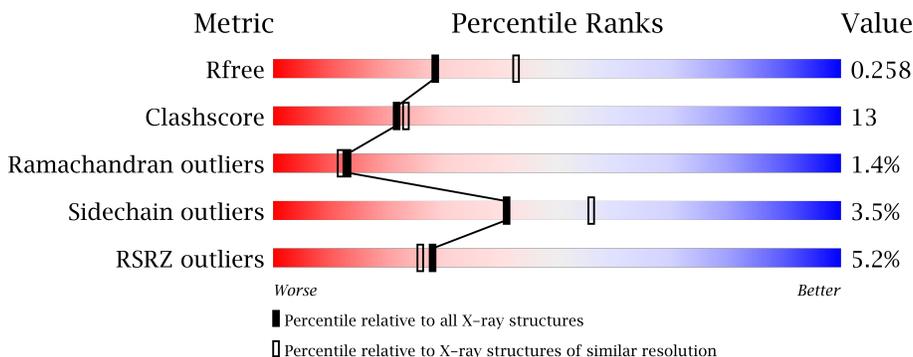
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## X-RAY DIFFRACTION

The reported resolution of this entry is 2.46 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	1119 (2.48-2.44)
Clashscore	112137	1193 (2.48-2.44)
Ramachandran outliers	110173	1185 (2.48-2.44)
Sidechain outliers	110143	1185 (2.48-2.44)
RSRZ outliers	101464	1126 (2.48-2.44)

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	
2	B	394	
3	C	372	
4	D	300	
5	E	178	

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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	B	501	-	-	-	X

## 2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 14311 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
			Total	C	N	O	S			
1	A	393	3151	2022	528	587	14	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	272	2030	1296	350	376	8	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	341	2642	1677	461	485	19	0	0	0

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
			Total	C	N	O	S			
4	D	280	2263	1439	392	424	8	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	E	174	1415	908	236	262	9	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
6	F	167	1371	875	239	248	9	0	0	0

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
7	G	137	1048	655	183	207	3	0	0	0

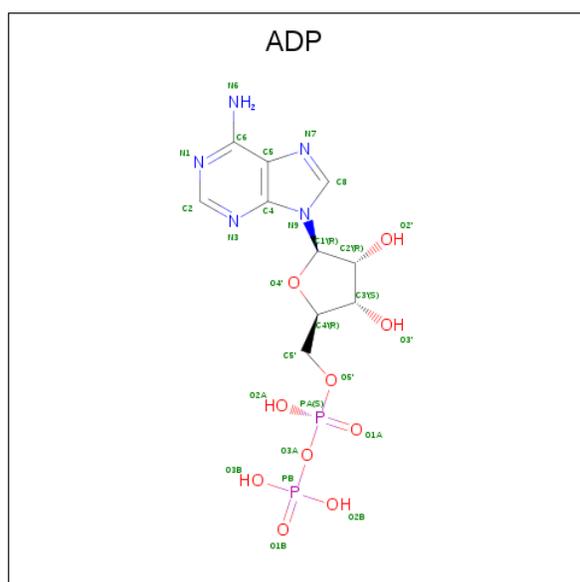
There are 2 discrepancies between the modelled and reference sequences:

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
			Total	Ca		
8	B	1	1	1	0	0
8	A	1	1	1	0	0

- Molecule 9 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula:  $C_{10}H_{15}N_5O_{10}P_2$ ).

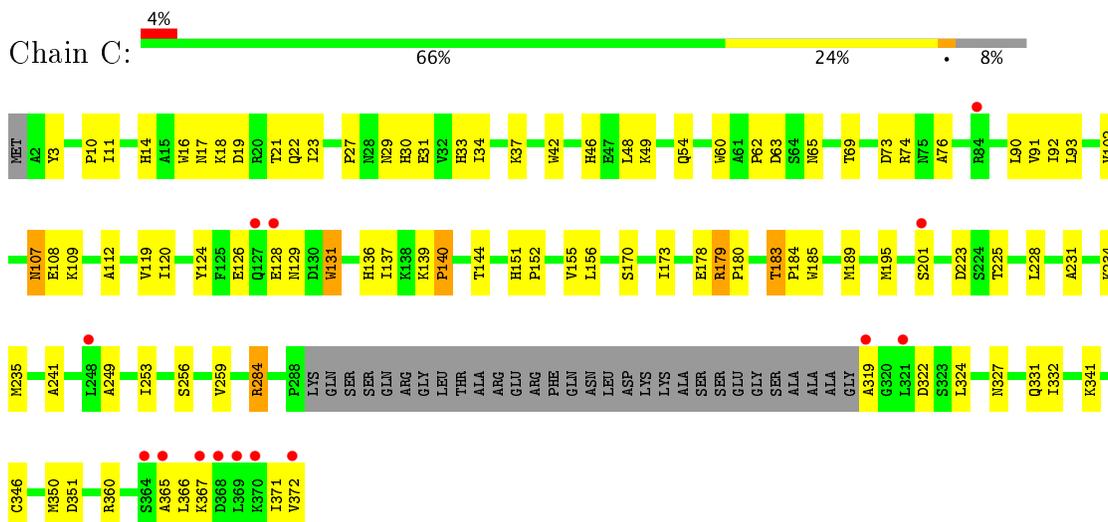


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
9	A	1	27	10	5	10	2	0	0
9	B	1	27	10	5	10	2	0	0

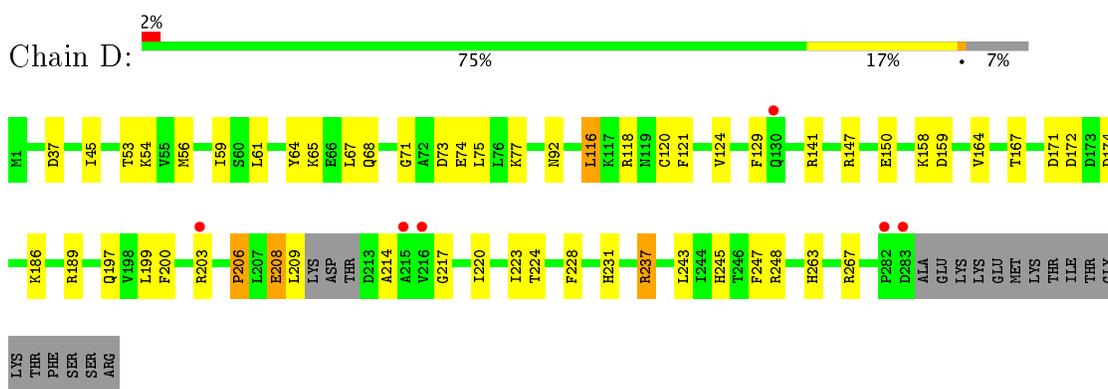
- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	75	Total 75	O 75	0	0
10	B	32	Total 32	O 32	0	0
10	C	64	Total 64	O 64	0	0
10	D	72	Total 72	O 72	0	0
10	E	17	Total 17	O 17	0	0
10	F	66	Total 66	O 66	0	0
10	G	9	Total 9	O 9	0	0

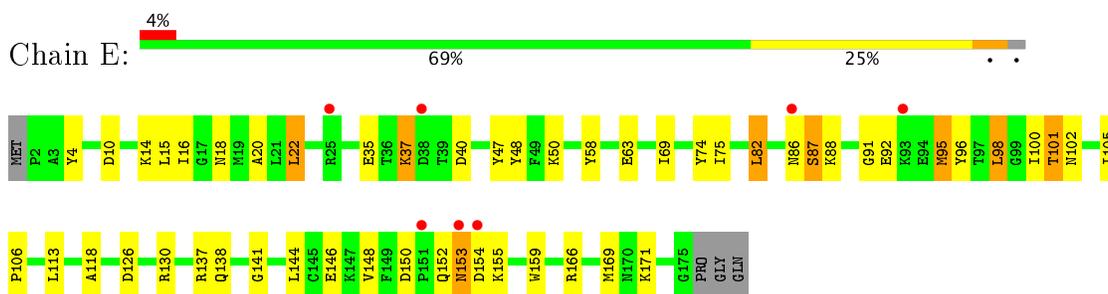




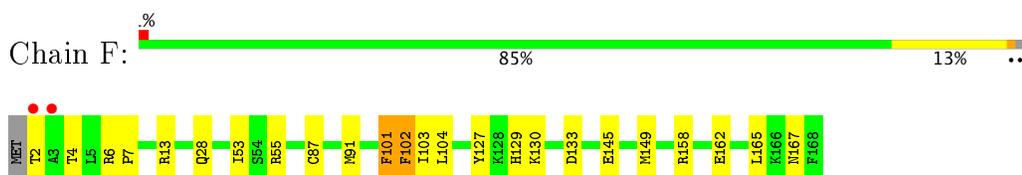
- Molecule 4: Actin-related protein 2/3 complex subunit 2



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

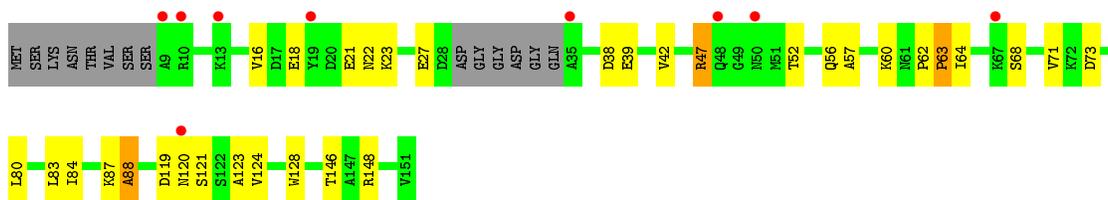


- Molecule 6: Actin-related protein 2/3 complex subunit 4



- 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, $\alpha$ , $\beta$ , $\gamma$	110.61Å 128.18Å 198.29Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.46 45.24 – 2.43	Depositor EDS
% Data completeness (in resolution range)	95.0 (50.00-2.46) 94.2 (45.24-2.43)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.04 (at 2.42Å)	Xtrriage
Refinement program	CNS	Depositor
R, $R_{free}$	0.217 , 0.261 0.215 , 0.258	Depositor DCC
$R_{free}$ test set	4915 reflections (5.03%)	DCC
Wilson B-factor (Å <sup>2</sup> )	42.4	Xtrriage
Anisotropy	0.314	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 41.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	14311	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 2.19% 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: 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	0.36	0/3231	0.58	0/4384
2	B	0.33	0/2071	0.56	1/2813 (0.0%)
3	C	0.37	0/2711	0.64	1/3681 (0.0%)
4	D	0.37	0/2311	0.56	0/3119
5	E	0.34	0/1449	0.58	0/1954
6	F	0.40	0/1393	0.61	0/1868
7	G	0.32	0/1060	0.53	0/1426
All	All	0.36	0/14226	0.59	2/19245 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	B	112	PRO	N-CA-CB	5.55	109.96	103.30
3	C	11	ILE	N-CA-C	-5.53	96.08	111.00

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	A	3151	0	3097	75	0
2	B	2030	0	1915	93	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	2642	0	2591	81	0
4	D	2263	0	2227	48	0
5	E	1415	0	1416	51	0
6	F	1371	0	1410	18	0
7	G	1048	0	1058	25	0
8	A	1	0	0	0	0
8	B	1	0	0	0	0
9	A	27	0	12	1	0
9	B	27	0	12	2	0
10	A	75	0	0	1	0
10	B	32	0	0	0	0
10	C	64	0	0	2	0
10	D	72	0	0	1	0
10	E	17	0	0	0	0
10	F	66	0	0	0	0
10	G	9	0	0	0	0
All	All	14311	0	13738	370	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 13.

The worst 5 of 370 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:223:ASP:HB3	7:G:146:THR:HG21	1.31	1.11
6:F:4:THR:HG23	6:F:55:ARG:HH21	1.20	1.04
3:C:183:THR:HG22	3:C:185:TRP:H	1.28	0.97
2:B:309:MET:HE1	2:B:350:ARG:HG3	1.43	0.97
3:C:319:ALA:HB2	6:F:130:LYS:HD2	1.50	0.92

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	387/418 (93%)	367 (95%)	17 (4%)	3 (1%)	22	26
2	B	264/394 (67%)	237 (90%)	18 (7%)	9 (3%)	4	2
3	C	337/372 (91%)	321 (95%)	14 (4%)	2 (1%)	28	34
4	D	276/300 (92%)	265 (96%)	9 (3%)	2 (1%)	25	30
5	E	172/178 (97%)	166 (96%)	3 (2%)	3 (2%)	11	9
6	F	165/168 (98%)	157 (95%)	7 (4%)	1 (1%)	28	34
7	G	133/151 (88%)	122 (92%)	7 (5%)	4 (3%)	5	2
All	All	1734/1981 (88%)	1635 (94%)	75 (4%)	24 (1%)	13	12

5 of 24 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	263	SER
2	B	25	SER
2	B	290	ASP
5	E	153	ASN
6	F	102	PHE

### 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	344/363 (95%)	333 (97%)	11 (3%)	44	58
2	B	198/345 (57%)	185 (93%)	13 (7%)	19	25
3	C	289/313 (92%)	282 (98%)	7 (2%)	54	69
4	D	246/264 (93%)	241 (98%)	5 (2%)	60	74
5	E	156/159 (98%)	148 (95%)	8 (5%)	28	37
6	F	154/155 (99%)	150 (97%)	4 (3%)	51	66
7	G	113/124 (91%)	108 (96%)	5 (4%)	33	45

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1500/1723 (87%)	1447 (96%)	53 (4%)	41 56

5 of 53 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	303	LEU
3	C	284	ARG
7	G	18	GLU
3	C	30	HIS
3	C	131	TRP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 33 such sidechains are listed below:

Mol	Chain	Res	Type
3	C	44	GLN
3	C	331	GLN
7	G	69	GLN
3	C	46	HIS
3	C	65	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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 2 are 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	1.26	2 (8%)	24,45,45	2.26	2 (8%)
9	ADP	B	402	8	25,29,29	1.29	3 (12%)	24,45,45	2.20	1 (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
9	ADP	A	501	8	-	0/12/32/32	0/3/3/3
9	ADP	B	402	8	-	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	402	ADP	O4'-C1'	2.06	1.44	1.41
9	A	501	ADP	PB-O1B	3.12	1.61	1.50
9	B	402	ADP	PB-O1B	3.16	1.61	1.50
9	A	501	ADP	C2-N1	3.52	1.40	1.33
9	B	402	ADP	C2-N1	3.55	1.40	1.33

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	A	501	ADP	N3-C2-N1	-9.98	120.17	128.86
9	B	402	ADP	N3-C2-N1	-9.98	120.17	128.86
9	A	501	ADP	C4'-O4'-C1'	-2.92	106.66	109.77

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	A	501	ADP	1	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	B	402	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	393/418 (94%)	0.12	27 (6%) 18 15	20, 42, 93, 118	0
2	B	272/394 (69%)	0.28	26 (9%) 9 7	24, 61, 95, 104	0
3	C	341/372 (91%)	-0.08	14 (4%) 38 35	25, 39, 82, 104	0
4	D	280/300 (93%)	-0.11	6 (2%) 64 60	22, 40, 73, 95	0
5	E	174/178 (97%)	-0.20	7 (4%) 39 36	32, 49, 73, 94	0
6	F	167/168 (99%)	-0.29	2 (1%) 79 78	22, 32, 50, 88	0
7	G	137/151 (90%)	0.21	9 (6%) 19 16	27, 62, 88, 96	0
All	All	1764/1981 (89%)	0.01	91 (5%) 28 26	20, 43, 89, 118	0

The worst 5 of 91 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	156	ARG	7.8
1	A	157	GLN	6.7
4	D	215	ALA	6.3
1	A	408	CYS	6.2
1	A	403	ILE	5.5

### 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 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	B	501	1/1	0.90	0.30	3.38	78,78,78,78	0
9	ADP	A	501	27/27	0.98	0.14	-0.01	33,36,40,40	0
9	ADP	B	402	27/27	0.97	0.12	-0.93	29,41,46,48	0
8	CA	A	500	1/1	0.98	0.23	-	43,43,43,43	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.