



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 3, 2023 – 11:43 AM EDT

PDB ID : 3S9O  
Title : The Focal Adhesion Targeting (FAT) domain of the Focal Adhesion Kinase showing N-terminal interactions in cis  
Authors : Arold, S.T.  
Deposited on : 2011-06-01  
Resolution : 2.60 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.

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 ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.35  
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) : 2.35

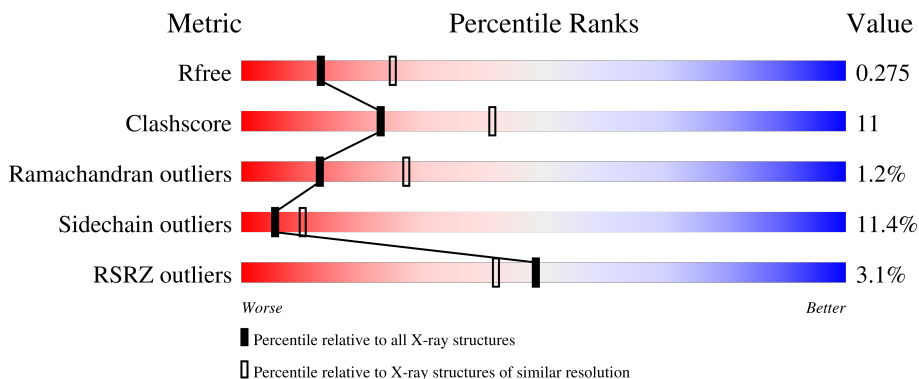
# 1 Overall quality at a glance

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))
$R_{free}$	130704	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (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	A	164	 2% 63% 21% 14%
1	B	164	 % 66% 19% 14%
1	C	164	 4% 59% 23% 5% 14%

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3307 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	141	1089	689	183	210	7	0	0	0
1	B	141	1091	690	183	211	7	0	0	0
1	C	141	1091	690	183	211	7	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	889	GLY	-	expression tag	UNP Q05397
A	890	PRO	-	expression tag	UNP Q05397
B	889	GLY	-	expression tag	UNP Q05397
B	890	PRO	-	expression tag	UNP Q05397
C	889	GLY	-	expression tag	UNP Q05397
C	890	PRO	-	expression tag	UNP Q05397

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Na	0	0
			1	1		
2	C	1	Total	Na	0	0
			1	1		

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Cl	0	0
			1	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	9	Total O 9 9	0	0
4	B	15	Total O 15 15	0	0
4	C	9	Total O 9 9	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	89.92Å 223.98Å 98.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.43 – 2.60 30.15 – 2.60	Depositor EDS
% Data completeness (in resolution range)	84.2 (30.43-2.60) 84.2 (30.15-2.60)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	0.09	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.38 (at 2.61Å)	Xtrriage
Refinement program	REFMAC 5.5.0070	Depositor
R, $R_{free}$	0.233 , 0.287 0.228 , 0.275	Depositor DCC
$R_{free}$ test set	546 reflections (2.10%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	63.6	Xtrriage
Anisotropy	0.328	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 61.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	3307	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	64.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.54% 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: CL, NA

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	1.03	1/1103 (0.1%)	1.01	1/1496 (0.1%)
1	B	0.96	0/1105	0.88	0/1498
1	C	0.98	1/1105 (0.1%)	0.96	0/1498
All	All	0.99	2/3313 (0.1%)	0.95	1/4492 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	925	TYR	CD2-CE2	6.74	1.49	1.39
1	A	943	GLN	CG-CD	5.58	1.63	1.51

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1039	ASP	CB-CG-OD1	6.90	124.51	118.30

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	1089	0	1142	23	0
1	B	1091	0	1141	27	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1091	0	1141	31	0
2	A	1	0	0	0	0
2	C	1	0	0	0	0
3	A	1	0	0	0	0
4	A	9	0	0	0	0
4	B	15	0	0	1	0
4	C	9	0	0	0	0
All	All	3307	0	3424	76	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 11.

All (76) 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:C:943:GLN:HB3	1:C:944:PRO:HD3	1.43	0.98
1:A:918:ASP:HB3	1:B:1045:MET:CE	1.98	0.93
1:B:943:GLN:HB2	1:B:944:PRO:HD3	1.48	0.91
1:C:943:GLN:HB3	1:C:944:PRO:CD	2.14	0.78
1:B:951:VAL:HB	1:B:952:PRO:HD3	1.73	0.71
1:C:943:GLN:CB	1:C:944:PRO:HD3	2.19	0.70
1:A:918:ASP:HB3	1:B:1045:MET:HE1	1.74	0.69
1:B:939:SER:HB2	1:B:1021:LEU:HD22	1.74	0.69
1:C:1010:THR:CG2	1:C:1012:LEU:HB2	2.24	0.67
1:B:943:GLN:HB2	1:B:944:PRO:CD	2.24	0.67
1:C:1010:THR:CG2	1:C:1012:LEU:H	2.10	0.65
1:C:972:ILE:HG23	1:C:980:HIS:CD2	2.32	0.63
1:C:942:ILE:HD11	1:C:950:TYR:HD2	1.63	0.63
1:A:964:LEU:O	1:A:968:VAL:HG23	2.00	0.62
1:C:949:GLU:O	1:C:953:MET:HG3	1.98	0.62
1:C:951:VAL:HB	1:C:952:PRO:HD3	1.81	0.62
1:C:974:LEU:H	1:C:974:LEU:HD23	1.63	0.61
1:C:1047:GLY:O	1:C:1048:GLN:HB2	2.03	0.57
1:C:936:ILE:O	1:C:940:SER:HB2	2.05	0.56
1:C:942:ILE:HD11	1:C:950:TYR:CD2	2.41	0.55
1:A:961:LEU:O	1:A:961:LEU:HD12	2.06	0.55
1:B:1045:MET:O	1:B:1045:MET:HE2	2.06	0.55
1:C:1010:THR:HG23	1:C:1012:LEU:H	1.72	0.54
1:B:909:ILE:HD12	1:B:910:SER:H	1.71	0.54
1:A:1015:GLU:HG3	1:A:1019:GLN:HE21	1.73	0.54
1:B:1007:TYR:OH	1:C:988:LYS:HE2	2.09	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:938:MET:CE	1:C:954:VAL:HG22	2.39	0.53
1:C:942:ILE:HD11	1:C:950:TYR:HB3	1.91	0.53
1:B:914:THR:HG21	1:B:917:LEU:HD12	1.91	0.52
1:C:938:MET:HE2	1:C:954:VAL:HG22	1.90	0.52
1:A:910:SER:O	1:A:1032:LYS:HE3	2.09	0.52
1:B:1045:MET:CE	1:B:1045:MET:HA	2.40	0.52
1:A:1015:GLU:HG3	1:A:1019:GLN:NE2	2.26	0.51
1:C:974:LEU:HD23	1:C:974:LEU:N	2.24	0.51
1:C:1010:THR:HG22	1:C:1012:LEU:H	1.75	0.51
1:A:918:ASP:HB3	1:B:1045:MET:HE3	1.86	0.50
1:B:982:GLU:HB2	4:B:12:HOH:O	2.12	0.50
1:C:1010:THR:HG21	1:C:1012:LEU:HB2	1.94	0.50
1:C:942:ILE:CD1	1:C:950:TYR:HB3	2.43	0.49
1:B:1017:LYS:O	1:B:1020:MET:HB2	2.12	0.49
1:A:972:ILE:HB	1:A:973:PRO:HD3	1.93	0.49
1:C:1010:THR:HG22	1:C:1012:LEU:N	2.28	0.49
1:B:1045:MET:HA	1:B:1045:MET:HE3	1.94	0.48
1:C:908:GLU:HA	1:C:908:GLU:OE2	2.12	0.48
1:C:989:LEU:O	1:C:989:LEU:HD12	2.14	0.47
1:A:935:VAL:HG13	1:A:1024:ALA:HB1	1.95	0.47
1:A:990:LEU:HD22	1:A:1027:LEU:HD12	1.97	0.47
1:A:1012:LEU:HD23	1:A:1012:LEU:N	2.29	0.47
1:C:950:TYR:HA	1:C:953:MET:HB2	1.97	0.47
1:C:981:ARG:HA	1:C:981:ARG:HD2	1.68	0.47
1:A:1001:MET:O	1:A:1005:GLN:HG2	2.15	0.47
1:C:972:ILE:N	1:C:973:PRO:HD2	2.30	0.46
1:B:942:ILE:O	1:B:943:GLN:C	2.54	0.46
1:B:939:SER:CB	1:B:1021:LEU:HD22	2.43	0.46
1:A:918:ASP:CB	1:B:1045:MET:HE1	2.42	0.46
1:B:951:VAL:HB	1:B:952:PRO:CD	2.43	0.46
1:A:951:VAL:HB	1:A:952:PRO:HD3	1.98	0.45
1:B:1008:VAL:O	1:B:1009:MET:HB2	2.18	0.44
1:B:971:THR:O	1:B:972:ILE:C	2.56	0.44
1:C:985:MET:CE	1:C:985:MET:HA	2.48	0.43
1:B:947:PRO:O	1:B:951:VAL:HG23	2.18	0.43
1:A:945:ALA:HA	1:A:946:PRO:HD2	1.90	0.43
1:B:942:ILE:HG21	1:B:1021:LEU:HD21	1.99	0.43
1:B:946:PRO:HD2	1:B:949:GLU:HB2	2.01	0.42
1:A:1043:LEU:HD23	1:A:1043:LEU:HA	1.78	0.42
1:A:923:LYS:HA	1:A:923:LYS:HD3	1.44	0.42
1:A:968:VAL:O	1:A:969:ASP:C	2.59	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1008:VAL:O	1:B:1009:MET:CB	2.68	0.41
1:A:951:VAL:HG12	1:A:955:LYS:HE3	2.02	0.41
1:B:942:ILE:HG12	1:B:1017:LYS:HD3	2.03	0.41
1:C:946:PRO:HB2	1:C:947:PRO:HD2	2.01	0.41
1:A:938:MET:HG3	1:A:953:MET:HB3	2.03	0.41
1:A:990:LEU:HD21	1:A:1031:ALA:N	2.35	0.41
1:B:972:ILE:HB	1:B:973:PRO:HD3	2.02	0.40
1:A:947:PRO:O	1:A:951:VAL:HG23	2.21	0.40
1:C:972:ILE:N	1:C:973:PRO:CD	2.85	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	139/164 (85%)	130 (94%)	8 (6%)	1 (1%)	22	43
1	B	139/164 (85%)	128 (92%)	11 (8%)	0	100	100
1	C	139/164 (85%)	124 (89%)	11 (8%)	4 (3%)	4	7
All	All	417/492 (85%)	382 (92%)	30 (7%)	5 (1%)	13	27

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	970	GLU
1	A	915	ALA
1	C	1014	GLN
1	C	969	ASP
1	C	943	GLN

### 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	123/143 (86%)	113 (92%)	10 (8%)	11	23
1	B	123/143 (86%)	112 (91%)	11 (9%)	9	19
1	C	123/143 (86%)	102 (83%)	21 (17%)	2	3
All	All	369/429 (86%)	327 (89%)	42 (11%)	5	10

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	909	ILE
1	A	923	LYS
1	A	953	MET
1	A	996	GLU
1	A	1005	GLN
1	A	1012	LEU
1	A	1021	LEU
1	A	1035	LEU
1	A	1045	MET
1	A	1049	THR
1	B	907	GLN
1	B	908	GLU
1	B	923	LYS
1	B	941	LYS
1	B	948	GLU
1	B	952	PRO
1	B	981	ARG
1	B	984	GLU
1	B	1013	GLN
1	B	1044	LYS
1	B	1045	MET
1	C	909	ILE
1	C	910	SER
1	C	916	ASN
1	C	920	SER
1	C	938	MET

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Mol	Chain	Res	Type
1	C	940	SER
1	C	941	LYS
1	C	948	GLU
1	C	959	LEU
1	C	974	LEU
1	C	975	LEU
1	C	981	ARG
1	C	984	GLU
1	C	987	GLN
1	C	988	LYS
1	C	992	SER
1	C	1010	THR
1	C	1013	GLN
1	C	1018	LYS
1	C	1035	LEU
1	C	1048	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	916	ASN
1	A	1005	GLN
1	A	1014	GLN

### 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 monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 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	141/164 (85%)	-0.22	4 (2%) 53 46	39, 60, 105, 133	0
1	B	141/164 (85%)	-0.46	2 (1%) 75 71	38, 55, 73, 101	0
1	C	141/164 (85%)	-0.12	7 (4%) 28 23	42, 68, 118, 131	0
All	All	423/492 (85%)	-0.27	13 (3%) 49 42	38, 60, 105, 133	0

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	1009	MET	4.5
1	C	948	GLU	4.2
1	C	941	LYS	4.1
1	A	981	ARG	3.6
1	A	910	SER	3.4
1	C	949	GLU	3.2
1	A	914	THR	2.9
1	B	907	GLN	2.8
1	C	944	PRO	2.8
1	B	943	GLN	2.6
1	C	1048	GLN	2.3
1	A	913	PRO	2.1
1	C	942	ILE	2.1

### 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 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(Å <sup>2</sup> )	Q<0.9
2	NA	A	34	1/1	0.86	0.26	76,76,76,76	0
2	NA	C	35	1/1	0.94	0.12	16,16,16,16	1
3	CL	A	36	1/1	0.95	0.10	69,69,69,69	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.