



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 04:05 AM UTC

PDB ID : 4XEF / pdb_00004xef
Title : Pyk2-FAT complexed with Leupaxin LD motif LD1
Authors : Miller, D.J.
Deposited on : 2014-12-23
Resolution : 2.50 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

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>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
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

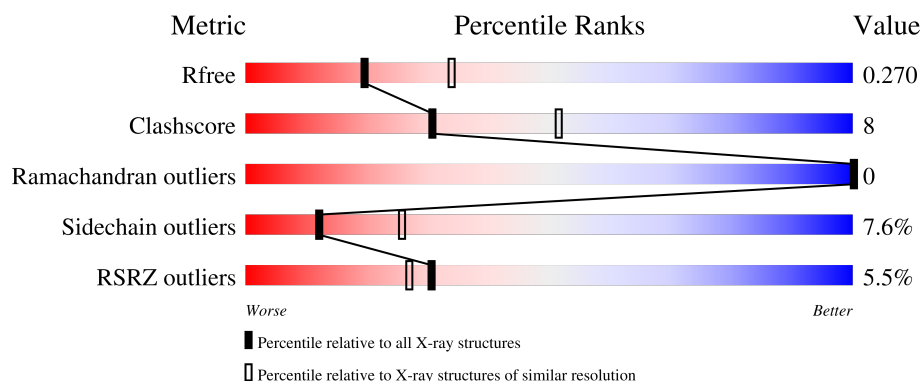
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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 ≥ 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	139	4% 74% 19% • •
1	D	139	4% 75% 19% • •
2	B	20	15% 65% 10% 25%
2	C	20	5% 60% 5% 35%
2	E	20	15% 75% 25%

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Mol	Chain	Length	Quality of chain
2	F	20	5% 45% 15% 40%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2442 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 Protein-tyrosine kinase 2-beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	136	Total	C	N	O	S	0	0	0
			1028	644	179	202	3			
1	D	134	Total	C	N	O	S	0	0	0
			1017	637	177	200	3			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	867	GLY	-	expression tag	UNP Q14289
A	868	SER	-	expression tag	UNP Q14289
A	869	HIS	-	expression tag	UNP Q14289
A	870	MET	-	expression tag	UNP Q14289
A	899	SER	CYS	engineered mutation	UNP Q14289
A	972	ALA	CYS	engineered mutation	UNP Q14289
D	867	GLY	-	expression tag	UNP Q14289
D	868	SER	-	expression tag	UNP Q14289
D	869	HIS	-	expression tag	UNP Q14289
D	870	MET	-	expression tag	UNP Q14289
D	899	SER	CYS	engineered mutation	UNP Q14289
D	972	ALA	CYS	engineered mutation	UNP Q14289

- Molecule 2 is a protein called 20-mer peptide containing LD1 motif of leupaxin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	15	Total	C	N	O	S	0	0	0
			112	69	18	24	1			
2	C	13	Total	C	N	O	S	0	0	0
			82	53	13	15	1			
2	E	15	Total	C	N	O		0	0	0
			108	67	18	23				
2	F	12	Total	C	N	O		0	0	0
			83	53	12	18				

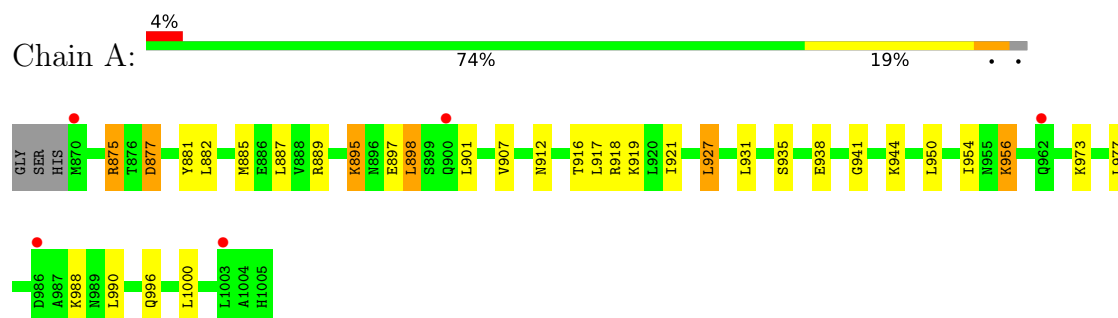
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	6	Total 6	O 6	0	0
3	D	6	Total 6	O 6	0	0

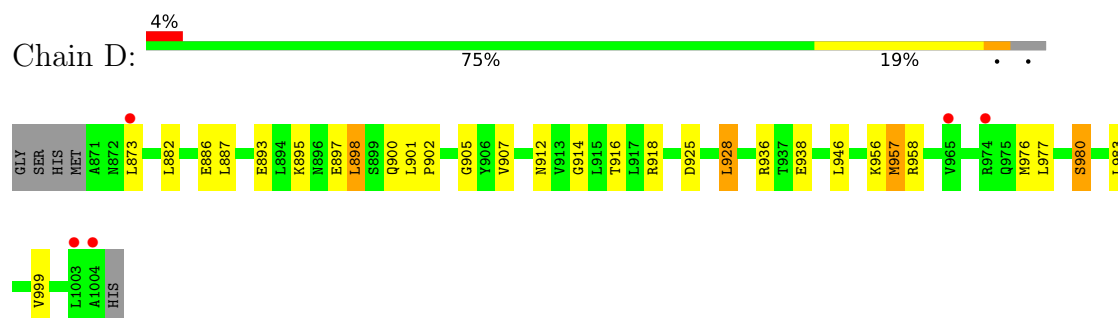
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

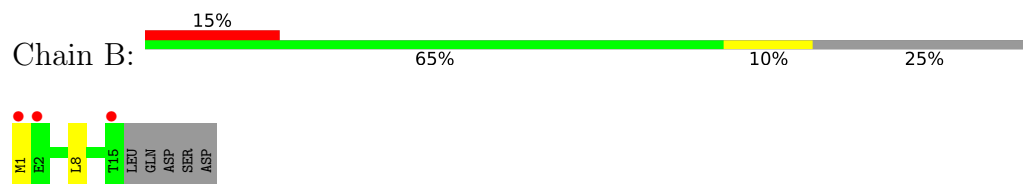
- Molecule 1: Protein-tyrosine kinase 2-beta



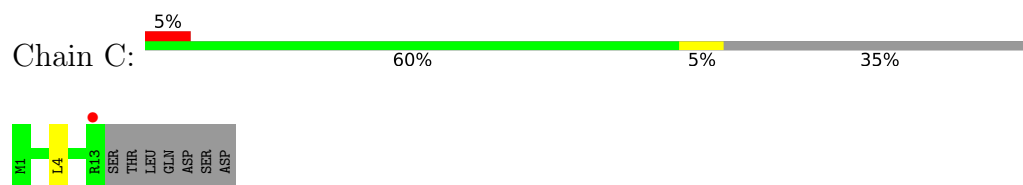
- Molecule 1: Protein-tyrosine kinase 2-beta



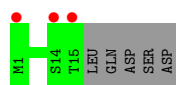
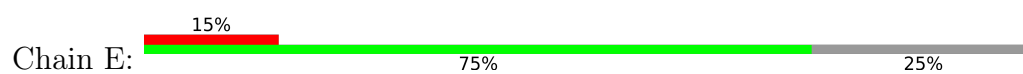
- Molecule 2: 20-mer peptide containing LD1 motif of leupaxin



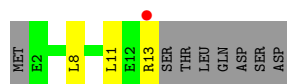
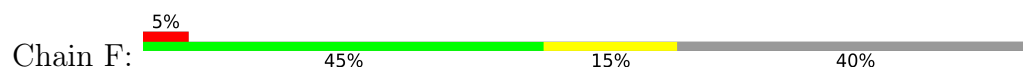
- Molecule 2: 20-mer peptide containing LD1 motif of leupaxin



- Molecule 2: 20-mer peptide containing LD1 motif of leupaxin



- Molecule 2: 20-mer peptide containing LD1 motif of leupaxin



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	27.48Å 78.09Å 165.42Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	24.83 – 2.50 24.83 – 2.50	Depositor EDS
% Data completeness (in resolution range)	98.1 (24.83-2.50) 98.3 (24.83-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.76 (at 2.50Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE: 1.8.4_1496)	Depositor
R, R_{free}	0.224 , 0.266 0.234 , 0.270	Depositor DCC
R_{free} test set	691 reflections (5.25%)	wwPDB-VP
Wilson B-factor (Å ²)	42.8	Xtriage
Anisotropy	0.304	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 45.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	2442	wwPDB-VP
Average B, all atoms (Å ²)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.89% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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](#)

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	0.61	0/1034	0.84	0/1403
1	D	0.62	0/1023	0.84	0/1387
2	B	0.58	0/111	0.82	0/148
2	C	0.46	0/81	0.96	0/109
2	E	0.45	0/107	0.74	0/144
2	F	0.52	0/82	0.73	0/111
All	All	0.60	0/2438	0.83	0/3302

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	A	1028	0	1076	22	0
1	D	1017	0	1067	18	0
2	B	112	0	106	3	0
2	C	82	0	75	1	0
2	E	108	0	96	0	0
2	F	83	0	72	3	0
3	A	6	0	0	0	0
3	D	6	0	0	0	0
All	All	2442	0	2492	41	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 8.

All (41) 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:D:907:VAL:HA	1:D:957:MET:HE2	1.69	0.75
1:D:957:MET:HE1	2:F:11:LEU:HD11	1.69	0.73
1:D:901:LEU:HD22	1:D:905:GLY:HA3	1.71	0.71
1:D:928:LEU:HG	1:D:936:ARG:HG3	1.75	0.68
1:A:988:LYS:HE3	2:B:1:MET:SD	2.38	0.63
1:A:912:ASN:O	1:A:916:THR:HG23	2.00	0.61
1:D:895:LYS:HG2	1:D:977:LEU:HD22	1.85	0.58
1:D:912:ASN:O	1:D:916:THR:HG23	2.03	0.58
1:A:918:ARG:HA	2:C:4:LEU:HD21	1.85	0.58
1:A:898:LEU:HD22	1:A:973:LYS:HD2	1.88	0.55
1:D:882:LEU:O	1:D:886:GLU:HG2	2.06	0.55
1:A:877:ASP:OD1	1:A:877:ASP:N	2.42	0.52
1:A:988:LYS:HD3	2:B:8:LEU:HD11	1.91	0.51
1:D:887:LEU:HD21	1:D:983:LEU:HD23	1.92	0.51
1:A:881:TYR:HE1	2:B:1:MET:HG3	1.76	0.51
1:A:996:GLN:O	1:A:1000:LEU:HG	2.10	0.51
1:A:897:GLU:HG3	1:A:901:LEU:HD11	1.94	0.50
1:A:897:GLU:O	1:A:901:LEU:HG	2.12	0.49
1:D:976:MET:O	1:D:980:SER:HB3	2.13	0.49
1:A:917:LEU:HG	1:A:921:ILE:HD12	1.96	0.48
1:A:956:LYS:HD2	1:A:956:LYS:N	2.29	0.48
2:F:11:LEU:C	2:F:13:ARG:H	2.20	0.47
1:A:941:GLY:O	1:A:944:LYS:HG3	2.14	0.47
1:D:887:LEU:HD21	1:D:983:LEU:CD2	2.44	0.46
1:D:914:GLY:HA3	2:F:8:LEU:HD21	1.98	0.45
1:D:925:ASP:HA	1:D:928:LEU:HD22	1.99	0.45
1:D:956:LYS:N	1:D:956:LYS:HD2	2.31	0.44
1:D:901:LEU:HD23	1:D:902:PRO:HD2	1.98	0.44
1:A:931:LEU:HD13	1:A:935:SER:HB2	1.99	0.44
1:A:875:ARG:HD3	1:A:881:TYR:CE1	2.53	0.44
1:A:895:LYS:HD2	1:A:977:LEU:HD22	2.00	0.43
1:A:887:LEU:C	1:A:887:LEU:HD23	2.44	0.42
1:A:950:LEU:O	1:A:954:ILE:HG13	2.18	0.42
1:D:893:GLU:O	1:D:897:GLU:HG2	2.19	0.42
1:A:898:LEU:HD13	1:A:973:LYS:HB3	2.00	0.42
1:A:885:MET:O	1:A:889:ARG:HG3	2.19	0.42
1:A:990:LEU:HD23	1:A:990:LEU:C	2.44	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:887:LEU:C	1:D:887:LEU:HD23	2.45	0.42
1:D:946:LEU:HD23	1:D:946:LEU:HA	1.91	0.41
1:A:927:LEU:HD12	1:A:931:LEU:HD23	2.03	0.40
1:D:898:LEU:HD11	1:D:976:MET:HE2	2.03	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	134/139 (96%)	132 (98%)	2 (2%)	0	100	100
1	D	132/139 (95%)	130 (98%)	2 (2%)	0	100	100
2	B	13/20 (65%)	13 (100%)	0	0	100	100
2	C	11/20 (55%)	11 (100%)	0	0	100	100
2	E	13/20 (65%)	13 (100%)	0	0	100	100
2	F	10/20 (50%)	9 (90%)	1 (10%)	0	100	100
All	All	313/358 (87%)	308 (98%)	5 (2%)	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	A	115/121 (95%)	105 (91%)	10 (9%)	9	21
1	D	114/121 (94%)	104 (91%)	10 (9%)	9	20
2	B	11/19 (58%)	11 (100%)	0	100	100
2	C	6/19 (32%)	6 (100%)	0	100	100
2	E	9/19 (47%)	9 (100%)	0	100	100
2	F	7/19 (37%)	7 (100%)	0	100	100
All	All	262/318 (82%)	242 (92%)	20 (8%)	12	26

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	875	ARG
1	A	877	ASP
1	A	882	LEU
1	A	895	LYS
1	A	898	LEU
1	A	907	VAL
1	A	919	LYS
1	A	927	LEU
1	A	938	GLU
1	A	956	LYS
1	D	873	LEU
1	D	898	LEU
1	D	900	GLN
1	D	918	ARG
1	D	928	LEU
1	D	938	GLU
1	D	957	MET
1	D	958	ARG
1	D	980	SER
1	D	999	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	872	ASN
1	A	883	ASN
1	A	896	ASN
1	A	1002	ASN
1	D	883	ASN

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Mol	Chain	Res	Type
1	D	943	GLN
1	D	961	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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

6.1 Protein, DNA and RNA chains

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, 95th 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 ²)	Q<0.9
1	A	136/139 (97%)	0.44	5 (3%) 45 40	29, 49, 78, 94	0
1	D	134/139 (96%)	0.33	5 (3%) 45 40	27, 43, 73, 80	0
2	B	15/20 (75%)	0.71	3 (20%) 3 2	47, 57, 76, 76	0
2	C	13/20 (65%)	0.90	1 (7%) 19 17	66, 76, 84, 86	0
2	E	15/20 (75%)	1.26	3 (20%) 3 2	67, 76, 90, 91	0
2	F	12/20 (60%)	0.56	1 (8%) 17 15	36, 46, 66, 69	0
All	All	325/358 (90%)	0.47	18 (5%) 30 27	27, 49, 79, 94	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	F	13	ARG	3.3
1	D	1003	LEU	3.3
2	E	15	THR	3.1
1	A	900	GLN	3.0
2	B	1	MET	3.0
1	A	870	MET	2.8
2	E	1	MET	2.7
2	C	13	ARG	2.5
1	D	974	ARG	2.5
1	A	962	GLN	2.5
2	E	14	SER	2.5
1	D	965	VAL	2.3
1	D	873	LEU	2.2
2	B	2	GLU	2.2
2	B	15	THR	2.1
1	A	986	ASP	2.1
1	A	1003	LEU	2.0
1	D	1004	ALA	2.0

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.