



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 09:17 AM UTC

PDB ID : 5NUH / pdb_00005nuh
Title : Crystal structure of SIVmac239 Nef bound to an engineered Hck SH3 domain
Authors : Horenkamp, F.A.; Anand, K.; Geyer, M.
Deposited on : 2017-04-30
Resolution : 2.78 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

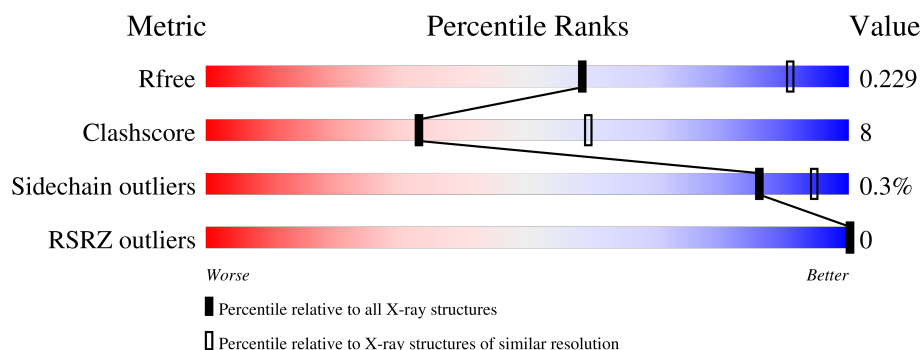
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.78 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	5248 (2.80-2.76)
Clashscore	190562	5693 (2.80-2.76)
Sidechain outliers	187428	5592 (2.80-2.76)
RSRZ outliers	180081	5251 (2.80-2.76)

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	172	 58% 14% • 27%
1	B	172	 58% 17% • 24%
2	C	60	 80% 10% 10%
2	D	60	 80% 12% 8%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3064 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 Nef.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	126	Total	C	N	O	S	0	0	0
			1048	688	165	192	3			
1	B	131	Total	C	N	O	S	0	0	0
			1087	711	172	201	3			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	64	GLY	-	expression tag	UNP Q5QGG3
A	65	ALA	-	expression tag	UNP Q5QGG3
A	66	MET	-	expression tag	UNP Q5QGG3
A	67	ALA	-	expression tag	UNP Q5QGG3
A	93	GLU	GLX	conflict	UNP Q5QGG3
B	64	GLY	-	expression tag	UNP Q5QGG3
B	65	ALA	-	expression tag	UNP Q5QGG3
B	66	MET	-	expression tag	UNP Q5QGG3
B	67	ALA	-	expression tag	UNP Q5QGG3
B	93	GLU	GLX	conflict	UNP Q5QGG3

- Molecule 2 is a protein called Tyrosine-protein kinase HCK, Tyrosine-protein kinase HCK.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	54	Total	C	N	O	S	0	0	0
			435	285	67	82	1			
2	D	55	Total	C	N	O	S	0	0	0
			439	287	68	83	1			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	78	MET	SER	initiating methionine	UNP P08631
C	91	GLY	-	linker	UNP P08631

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Chain	Residue	Modelled	Actual	Comment	Reference
C	92	TRP	-	linker	UNP P08631
C	93	TRP	-	linker	UNP P08631
C	94	GLY	-	linker	UNP P08631
D	78	MET	SER	initiating methionine	UNP P08631
D	91	GLY	-	linker	UNP P08631
D	92	TRP	-	linker	UNP P08631
D	93	TRP	-	linker	UNP P08631
D	94	GLY	-	linker	UNP P08631

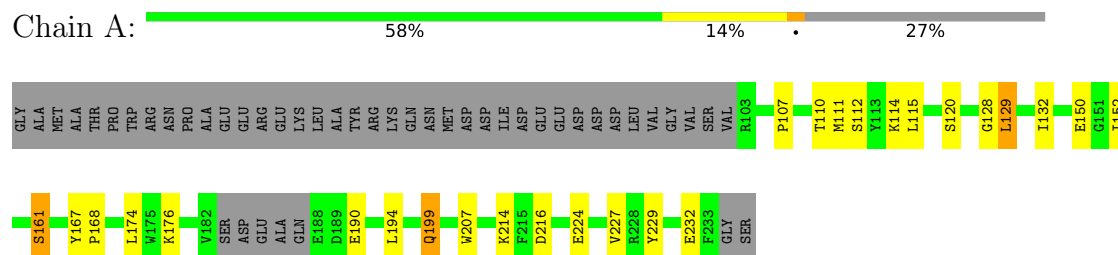
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	18	Total O 18 18	0	0
3	B	32	Total O 32 32	0	0
3	C	3	Total O 3 3	0	0
3	D	2	Total O 2 2	0	0

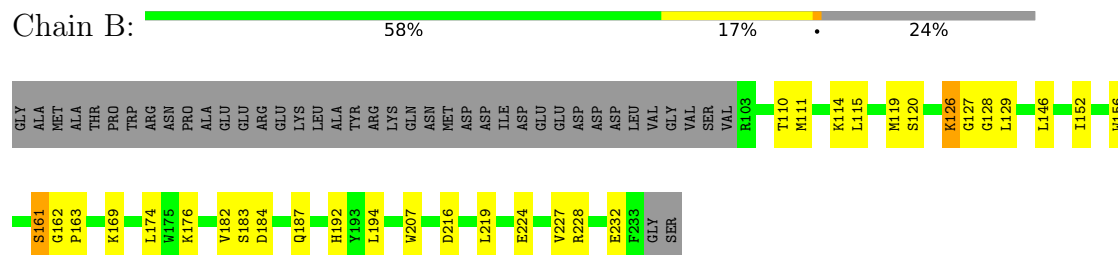
3 Residue-property plots [i](#)

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.

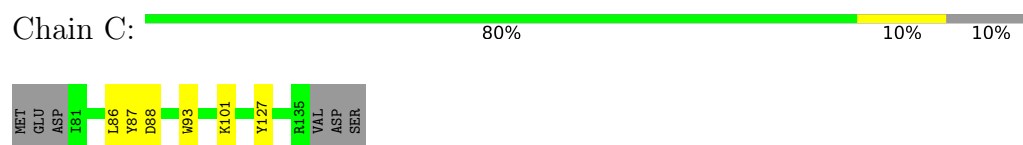
- Molecule 1: Protein Nef



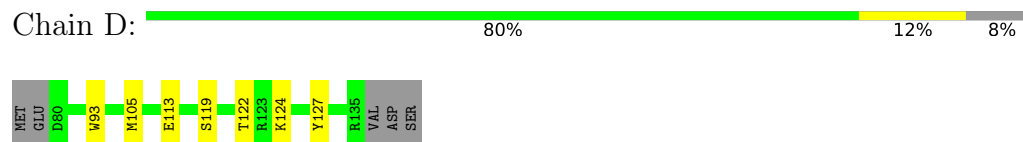
- Molecule 1: Protein Nef



- Molecule 2: Tyrosine-protein kinase HCK, Tyrosine-protein kinase HCK



- Molecule 2: Tyrosine-protein kinase HCK, Tyrosine-protein kinase HCK



4 Data and refinement statistics

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α , β , γ	104.00Å 104.00Å 53.00Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.68 – 2.78 45.68 – 2.78	Depositor EDS
% Data completeness (in resolution range)	100.0 (45.68-2.78) 100.0 (45.68-2.78)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.05 (at 2.77Å)	Xtriage
Refinement program	PHENIX (1.10_2155: ???)	Depositor
R, R_{free}	0.192 , 0.229 0.200 , 0.229	Depositor DCC
R_{free} test set	806 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	55.4	Xtriage
Anisotropy	0.016	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 30.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	0.045 for -h,-k,l 0.116 for h,-h-k,-l 0.047 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3064	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.57% 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

5.1 Standard geometry

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	0.73	0/1087	0.89	4/1484 (0.3%)
1	B	0.70	0/1127	0.83	4/1539 (0.3%)
2	C	0.46	0/448	0.57	0/610
2	D	0.52	0/452	0.62	0/616
All	All	0.66	0/3114	0.79	8/4249 (0.2%)

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	161	SER	N-CA-C	18.59	131.22	111.14
1	B	161	SER	N-CA-C	10.57	126.33	113.12
1	B	127	GLY	N-CA-C	-9.29	91.16	113.18
1	B	129	LEU	N-CA-C	-5.77	106.10	114.12
1	A	199	GLN	N-CA-C	5.34	117.24	109.71
1	A	161	SER	CB-CA-C	-5.26	102.59	110.90
1	A	129	LEU	N-CA-C	5.04	121.55	110.80
1	B	126	LYS	N-CA-C	5.04	119.07	113.02

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	1048	0	969	17	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1087	0	1012	21	1
2	C	435	0	404	7	0
2	D	439	0	404	5	0
3	A	18	0	0	1	0
3	B	32	0	0	2	0
3	C	3	0	0	0	0
3	D	2	0	0	0	0
All	All	3064	0	2789	45	2

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 (45) 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:B:224:GLU:OE1	1:B:228:ARG:NE	2.10	0.85
1:B:161:SER:O	1:B:162:GLY:O	1.98	0.82
1:A:161:SER:O	1:A:207:TRP:NE1	2.24	0.70
2:C:88:ASP:OD1	2:C:101:LYS:N	2.24	0.64
1:B:184:ASP:HA	1:B:187:GLN:HG3	1.80	0.64
1:A:176:LYS:HE2	1:A:216:ASP:HB2	1.79	0.64
1:B:161:SER:O	1:B:162:GLY:C	2.41	0.61
2:C:87:TYR:HA	2:C:101:LYS:HG3	1.81	0.61
1:B:176:LYS:HE2	1:B:216:ASP:HB2	1.83	0.60
1:A:224:GLU:HA	1:A:227:VAL:HG12	1.84	0.59
1:B:126:LYS:NZ	3:B:302:HOH:O	2.36	0.59
1:B:163:PRO:HG3	1:B:207:TRP:CE3	2.42	0.55
1:B:224:GLU:HA	1:B:227:VAL:HG12	1.89	0.55
2:C:86:LEU:C	2:C:101:LYS:HG2	2.32	0.54
1:A:114:LYS:HD3	2:D:93:TRP:CE2	2.42	0.54
2:C:86:LEU:O	2:C:101:LYS:HE3	2.07	0.53
1:A:112:SER:H	1:A:115:LEU:HD12	1.73	0.53
2:D:105:MET:HB3	2:D:119:SER:HA	1.90	0.53
1:B:114:LYS:HD3	2:C:93:TRP:CE2	2.44	0.53
1:B:161:SER:C	1:B:162:GLY:O	2.51	0.52
2:C:87:TYR:HA	2:C:101:LYS:CG	2.39	0.52
1:A:128:GLY:O	1:A:129:LEU:HB2	2.10	0.51
1:A:214:LYS:NZ	3:A:301:HOH:O	2.16	0.49
1:A:150:GLU:HB2	1:A:152:ILE:HG12	1.94	0.49
1:B:111:MET:HE3	1:B:152:ILE:HG21	1.95	0.49
1:B:110:THR:HG22	2:D:127:TYR:OH	2.13	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:176:LYS:HE3	1:A:214:LYS:HE2	1.95	0.47
1:B:115:LEU:HD22	1:B:119:MET:HE2	1.97	0.46
1:B:194:LEU:HD23	1:B:194:LEU:HA	1.73	0.46
1:B:120:SER:HB3	1:B:174:LEU:HB2	1.97	0.46
1:A:111:MET:HE3	1:A:152:ILE:HG21	1.97	0.46
1:A:120:SER:HB3	1:A:174:LEU:HB2	1.98	0.45
1:B:182:VAL:HG13	1:B:187:GLN:HG2	1.99	0.45
1:B:146:LEU:HD12	1:B:156:TRP:CZ2	2.52	0.45
2:D:122:THR:OG1	2:D:124:LYS:HB2	2.17	0.45
1:A:110:THR:HG22	2:C:127:TYR:OH	2.17	0.45
1:A:107:PRO:HB3	2:D:113:GLU:OE1	2.18	0.44
1:B:192:HIS:HD2	3:B:301:HOH:O	2.01	0.44
1:A:129:LEU:HA	1:A:132:ILE:HD12	2.01	0.43
1:B:227:VAL:HG13	1:B:228:ARG:HG3	2.01	0.43
1:A:229:TYR:HB3	1:A:232:GLU:HG3	2.01	0.42
1:B:169:LYS:NZ	1:B:232:GLU:HB3	2.35	0.41
1:B:219:LEU:HD23	1:B:219:LEU:HA	1.91	0.41
1:A:167:TYR:HA	1:A:168:PRO:HD3	1.94	0.41
1:A:194:LEU:HD23	1:A:194:LEU:HA	1.93	0.40

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:128:GLY:O	1:B:194:LEU:O[2_654]	1.98	0.22
1:A:190:GLU:OE1	1:A:199:GLN:NE2[2_544]	2.02	0.18

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

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	107/150 (71%)	107 (100%)	0	100	100
1	B	112/150 (75%)	111 (99%)	1 (1%)	70	87
2	C	43/51 (84%)	43 (100%)	0	100	100
2	D	43/51 (84%)	43 (100%)	0	100	100
All	All	305/402 (76%)	304 (100%)	1 (0%)	86	94

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	183	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	199	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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 [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, 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	126/172 (73%)	-1.49	0 100 100	36, 49, 66, 81	0
1	B	131/172 (76%)	-1.47	0 100 100	35, 44, 69, 79	0
2	C	54/60 (90%)	-1.32	0 100 100	42, 62, 74, 76	0
2	D	55/60 (91%)	-1.30	0 100 100	46, 63, 81, 93	0
All	All	366/464 (78%)	-1.43	0 100 100	35, 50, 73, 93	0

There are no RSRZ outliers to report.

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.