



Full wwPDB NMR Structure Validation Report ⓘ

Dec 13, 2023 – 11:10 PM EST

PDB ID : 2JO8
Title : Solution structure of C-terminal domain of human mammalian sterile 20-like kinase 1 (MST1)
Authors : Hwang, E.; Ryu, K.-S.; Paakkonen, K.; Guntert, P.; Cheong, H.-K.; Lim, D.-S.; Lee, J.O.; Jeon, Y.H.; Cheong, C.
Deposited on : 2007-02-26

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We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/NMRValidationReportHelp>

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:

Cyrange : Kirchner and Güntert (2011)
NmrClust : Kelley et al. (1996)
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
wwPDB-ShiftChecker : v1.2
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

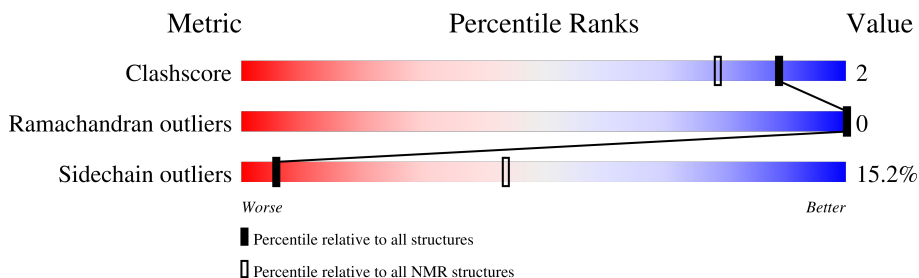
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	51	 78% 12% • 8%
1	B	51	 84% 8% • 6%

2 Ensemble composition and analysis

This entry contains 20 models. Model 1 is the overall representative, medoid model (most similar to other models).

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	Residue range (total)	Backbone RMSD (Å)	Medoid model
1	A:4-A:50, B:104-B:151 (95)	0.44	1

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 3 clusters and 4 single-model clusters were found.

Cluster number	Models
1	1, 2, 5, 6, 8, 12, 16, 18, 20
2	3, 7, 14, 17
3	10, 11, 13
Single-model clusters	4; 9; 15; 19

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1716 atoms, of which 860 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Serine/threonine-protein kinase 4.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	51	858	271	430	71	84	2	0
1	B	51	858	271	430	71	84	2	0

There are 4 discrepancies between the modelled and reference sequences:

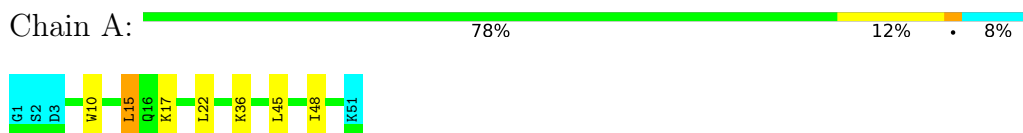
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	cloning artifact	UNP Q13043
A	2	SER	-	cloning artifact	UNP Q13043
B	101	GLY	-	cloning artifact	UNP Q13043
B	102	SER	-	cloning artifact	UNP Q13043

4 Residue-property plots

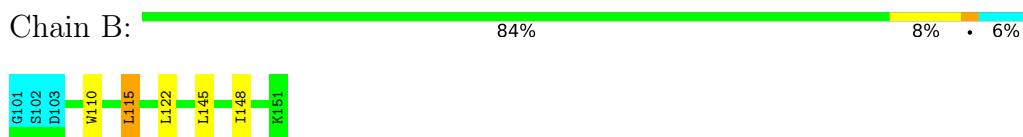
4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: Serine/threonine-protein kinase 4



- Molecule 1: Serine/threonine-protein kinase 4

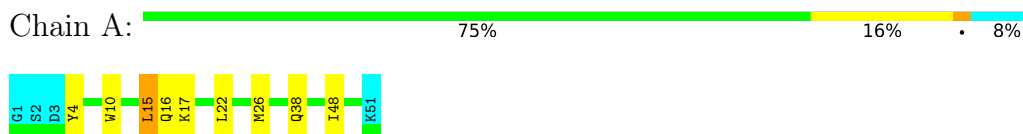


4.2 Scores per residue for each member of the ensemble

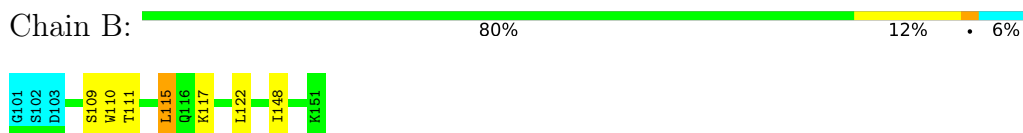
Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1 (medoid)

- Molecule 1: Serine/threonine-protein kinase 4

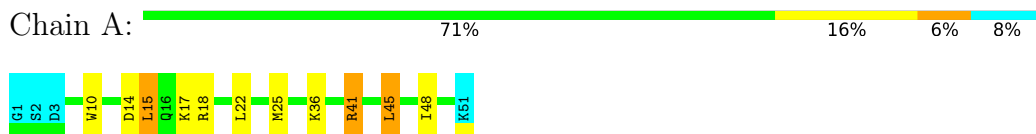


- Molecule 1: Serine/threonine-protein kinase 4

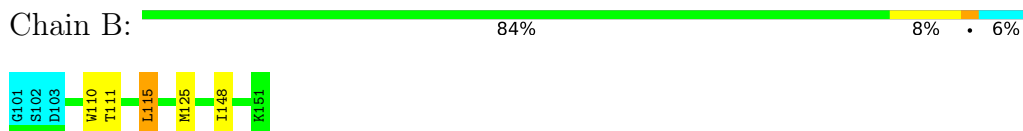


4.2.2 Score per residue for model 2

- Molecule 1: Serine/threonine-protein kinase 4

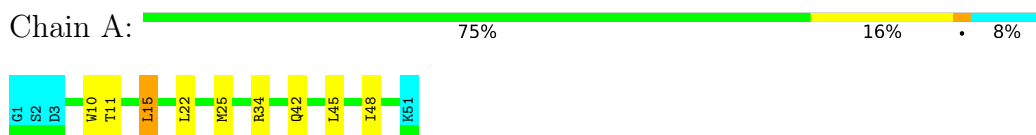


- Molecule 1: Serine/threonine-protein kinase 4

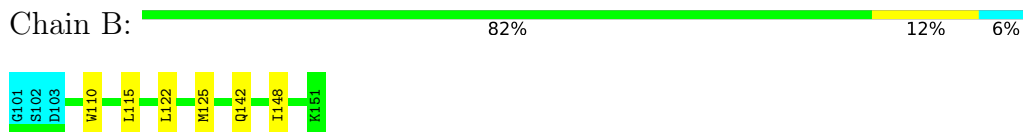


4.2.3 Score per residue for model 3

- Molecule 1: Serine/threonine-protein kinase 4

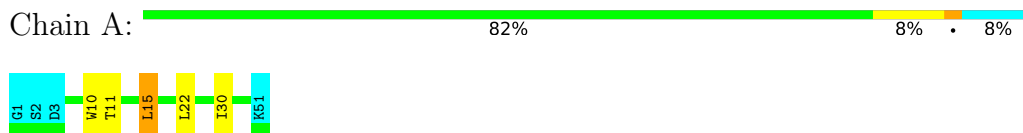


- Molecule 1: Serine/threonine-protein kinase 4

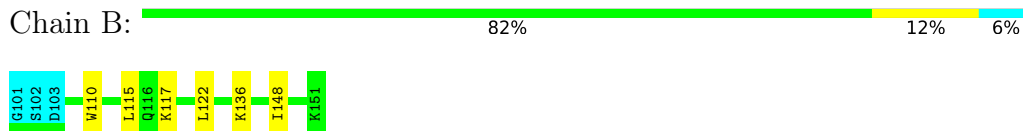


4.2.4 Score per residue for model 4

- Molecule 1: Serine/threonine-protein kinase 4

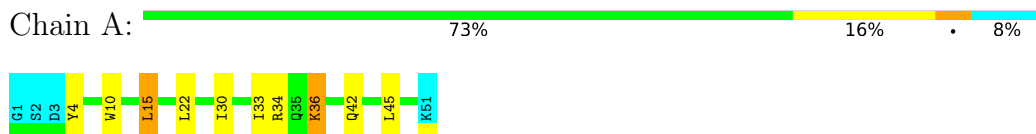


- Molecule 1: Serine/threonine-protein kinase 4

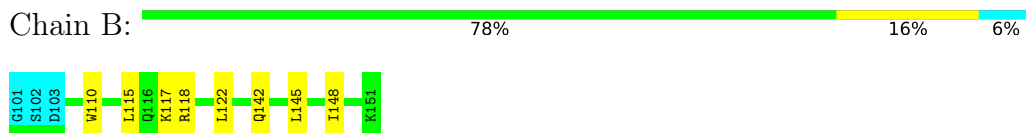


4.2.5 Score per residue for model 5

- Molecule 1: Serine/threonine-protein kinase 4

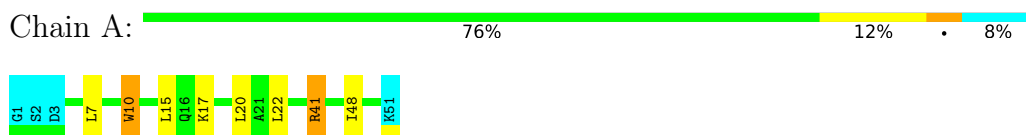


- Molecule 1: Serine/threonine-protein kinase 4

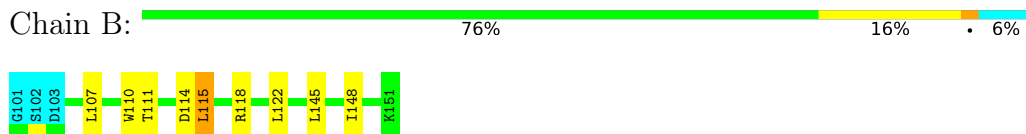


4.2.6 Score per residue for model 6

- Molecule 1: Serine/threonine-protein kinase 4

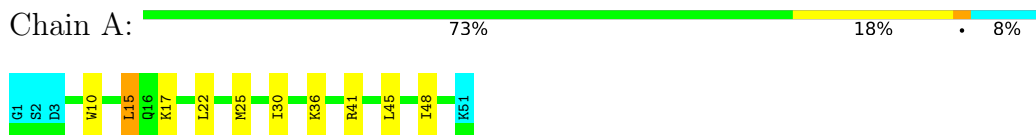


- Molecule 1: Serine/threonine-protein kinase 4

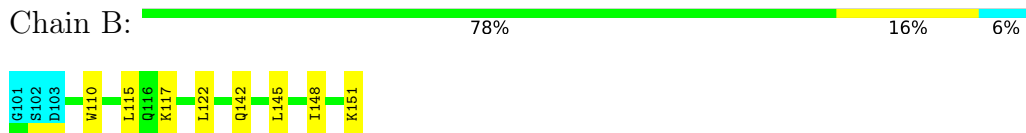


4.2.7 Score per residue for model 7

- Molecule 1: Serine/threonine-protein kinase 4

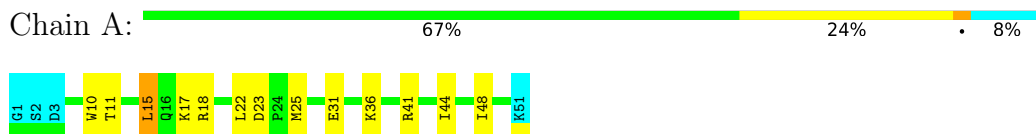


- Molecule 1: Serine/threonine-protein kinase 4

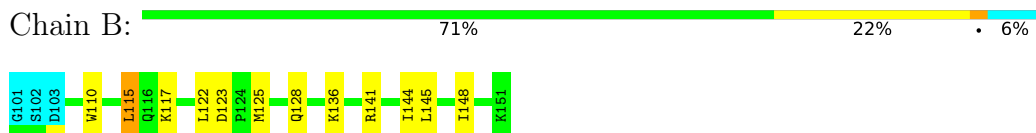


4.2.8 Score per residue for model 8

- Molecule 1: Serine/threonine-protein kinase 4

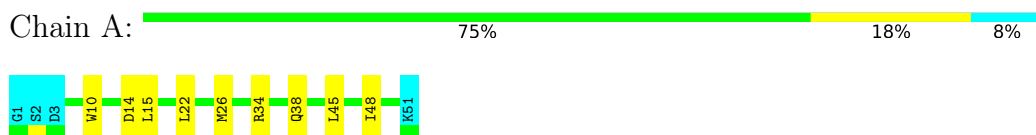


- Molecule 1: Serine/threonine-protein kinase 4

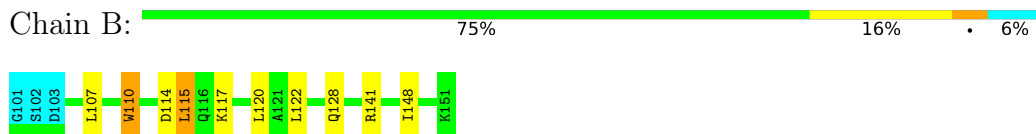


4.2.9 Score per residue for model 9

- Molecule 1: Serine/threonine-protein kinase 4

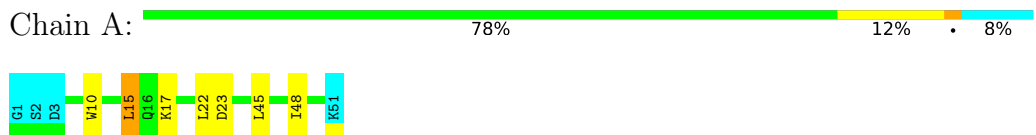


- Molecule 1: Serine/threonine-protein kinase 4

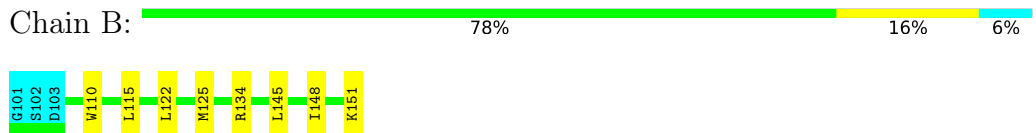


4.2.10 Score per residue for model 10

- Molecule 1: Serine/threonine-protein kinase 4

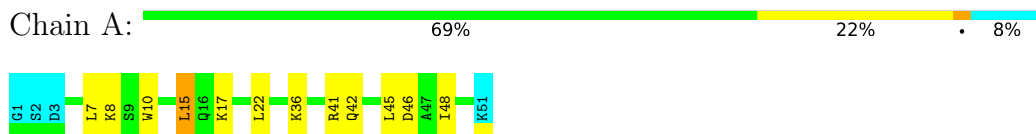


- Molecule 1: Serine/threonine-protein kinase 4

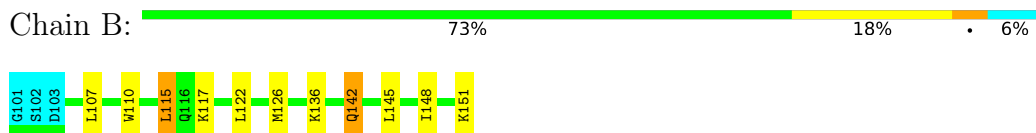


4.2.11 Score per residue for model 11

- Molecule 1: Serine/threonine-protein kinase 4

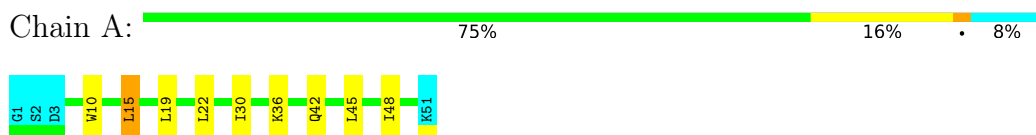


- Molecule 1: Serine/threonine-protein kinase 4

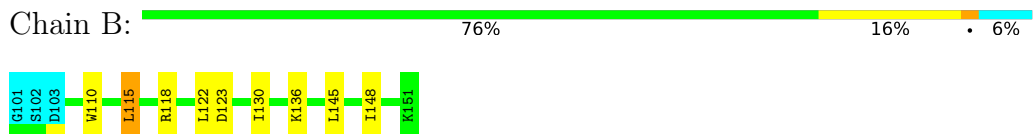


4.2.12 Score per residue for model 12

- Molecule 1: Serine/threonine-protein kinase 4

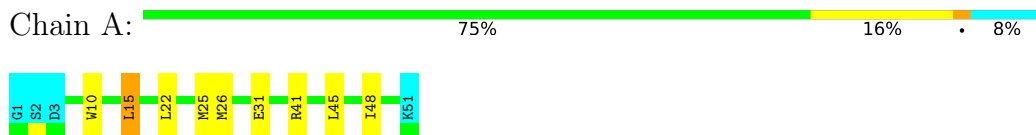


- Molecule 1: Serine/threonine-protein kinase 4

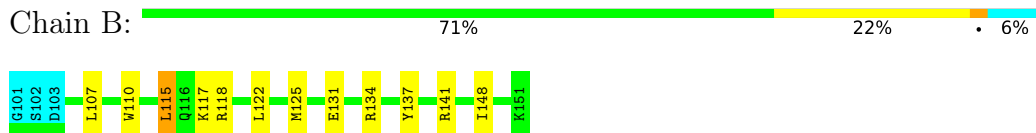


4.2.13 Score per residue for model 13

- Molecule 1: Serine/threonine-protein kinase 4

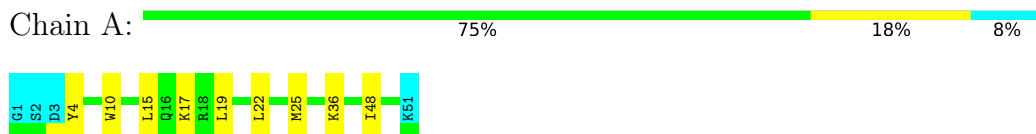


- Molecule 1: Serine/threonine-protein kinase 4

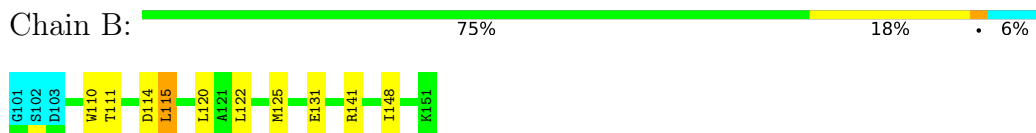


4.2.14 Score per residue for model 14

- Molecule 1: Serine/threonine-protein kinase 4

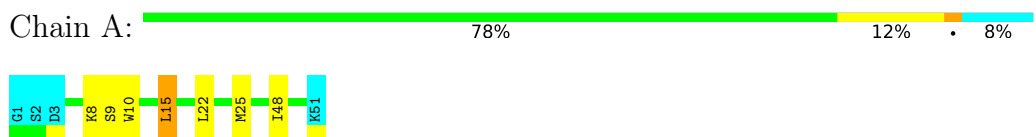


- Molecule 1: Serine/threonine-protein kinase 4

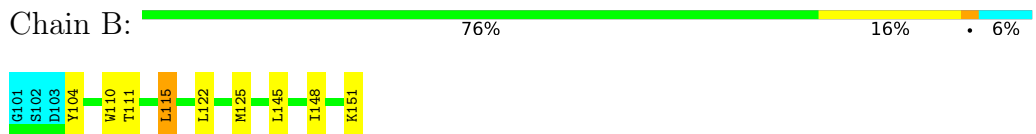


4.2.15 Score per residue for model 15

- Molecule 1: Serine/threonine-protein kinase 4

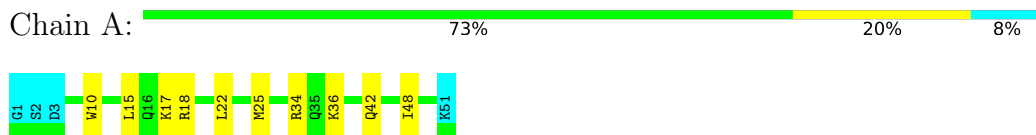


- Molecule 1: Serine/threonine-protein kinase 4

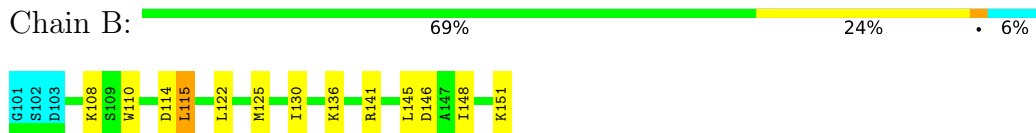


4.2.16 Score per residue for model 16

- Molecule 1: Serine/threonine-protein kinase 4

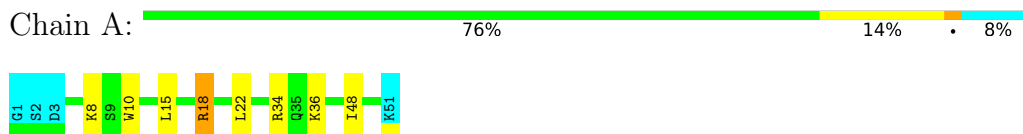


- Molecule 1: Serine/threonine-protein kinase 4

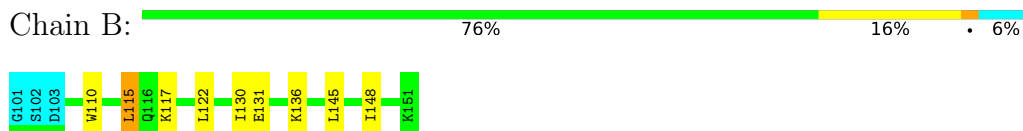


4.2.17 Score per residue for model 17

- Molecule 1: Serine/threonine-protein kinase 4

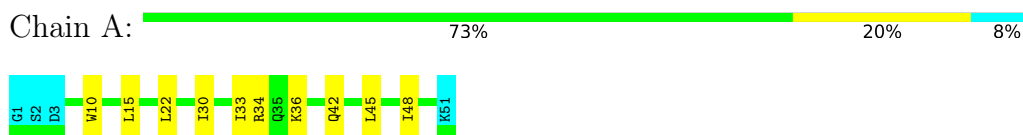


- Molecule 1: Serine/threonine-protein kinase 4

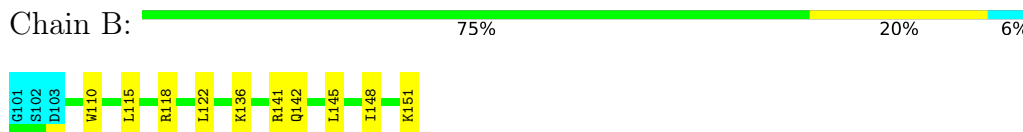


4.2.18 Score per residue for model 18

- Molecule 1: Serine/threonine-protein kinase 4

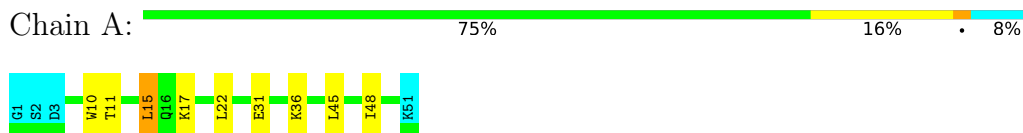


- Molecule 1: Serine/threonine-protein kinase 4

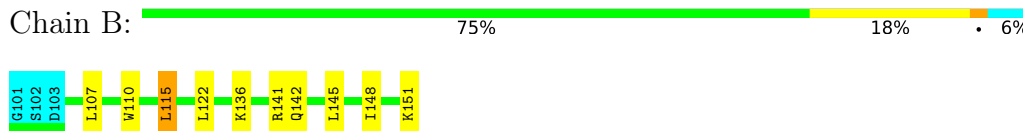


4.2.19 Score per residue for model 19

- Molecule 1: Serine/threonine-protein kinase 4



- Molecule 1: Serine/threonine-protein kinase 4




4.2.20 Score per residue for model 20

- Molecule 1: Serine/threonine-protein kinase 4

Chain A:  71% 20% 8%



- Molecule 1: Serine/threonine-protein kinase 4

Chain B:  78% 14% 6%



5 Refinement protocol and experimental data overview

The models were refined using the following method: *torsion angle dynamics*.

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *target function*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
CYANA	structure solution	2.1
OPAL	refinement	

No chemical shift data was provided.

6 Model quality i

6.1 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 (average) 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	0.60±0.01	0±0/408 (0.0± 0.0%)	1.04±0.04	0±1/549 (0.1± 0.1%)
1	B	0.60±0.01	0±0/416 (0.0± 0.0%)	1.04±0.03	0±1/557 (0.1± 0.1%)
All	All	0.60	0/16480 (0.0%)	1.04	16/22120 (0.1%)

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	Planarity
1	A	0.0±0.0	0.5±0.6
1	B	0.0±0.0	0.2±0.6
All	All	0	14

There are no bond-length outliers.

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	B	141	ARG	NE-CZ-NH2	-6.46	117.07	120.30	19	3
1	A	18	ARG	NE-CZ-NH2	-6.29	117.16	120.30	2	2
1	B	134	ARG	NE-CZ-NH2	-6.18	117.21	120.30	10	1
1	A	18	ARG	NE-CZ-NH1	6.14	123.37	120.30	2	1
1	B	141	ARG	NE-CZ-NH1	5.87	123.24	120.30	13	2
1	A	41	ARG	NE-CZ-NH2	-5.73	117.43	120.30	13	1
1	B	118	ARG	NE-CZ-NH1	5.62	123.11	120.30	12	1
1	A	41	ARG	NE-CZ-NH1	5.51	123.05	120.30	7	3
1	A	34	ARG	NE-CZ-NH1	5.08	122.84	120.30	3	2

There are no chirality outliers.

All unique planar outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Group	Models (Total)
1	A	34	ARG	Sidechain	5
1	A	4	TYR	Sidechain	3
1	B	118	ARG	Sidechain	2
1	A	41	ARG	Sidechain	1
1	B	134	ARG	Sidechain	1
1	B	104	TYR	Sidechain	1
1	B	141	ARG	Sidechain	1

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	401	405	405	2±1
1	B	410	418	418	2±1
All	All	16220	16460	16460	59

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 2.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:B:142:GLN:HE22	1:B:145:LEU:HD11	0.65	1.51	20	1
1:A:15:LEU:HD11	1:B:148:ILE:HB	0.62	1.70	9	20
1:A:48:ILE:HB	1:B:115:LEU:HD11	0.61	1.72	17	18
1:B:142:GLN:NE2	1:B:145:LEU:HD11	0.47	2.24	11	2
1:A:19:LEU:HD23	1:A:19:LEU:C	0.47	2.30	14	1
1:B:141:ARG:HA	1:B:144:ILE:HD12	0.46	1.87	8	1
1:B:141:ARG:HG2	1:B:145:LEU:HD21	0.46	1.88	16	1
1:A:33:ILE:HA	1:A:36:LYS:HE3	0.46	1.86	18	1
1:A:41:ARG:HA	1:A:44:ILE:HD12	0.44	1.89	8	1
1:B:142:GLN:HE21	1:B:145:LEU:HD11	0.44	1.73	11	1
1:A:42:GLN:HE22	1:A:45:LEU:HD11	0.44	1.71	12	1
1:A:41:ARG:HG2	1:A:45:LEU:HD21	0.43	1.91	2	1
1:A:7:LEU:HD23	1:A:10:TRP:CD1	0.42	2.50	6	1
1:A:15:LEU:HD12	1:A:15:LEU:C	0.42	2.35	11	1
1:B:115:LEU:HD12	1:B:115:LEU:C	0.42	2.35	19	2
1:B:107:LEU:HD11	1:B:118:ARG:HH21	0.41	1.75	6	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:B:107:LEU:HD23	1:B:110:TRP:CD1	0.41	2.51	9	1
1:A:33:ILE:HA	1:A:36:LYS:CD	0.41	2.45	5	1
1:B:115:LEU:C	1:B:115:LEU:HD12	0.40	2.37	6	1
1:A:15:LEU:C	1:A:15:LEU:HD12	0.40	2.37	13	1
1:A:26:MET:HG2	1:B:137:TYR:CD2	0.40	2.51	13	1

6.3 Torsion angles [i](#)

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	47/51 (92%)	47±1 (99±1%)	0±1 (1±1%)	0±0 (0±0%)	100	100
1	B	47/51 (92%)	47±0 (99±1%)	0±0 (1±1%)	0±0 (0±0%)	100	100
All	All	1880/2040 (92%)	1866 (99%)	14 (1%)	0 (0%)	100	100

There are no Ramachandran outliers.

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	44/47 (94%)	37±2 (84±4%)	7±2 (16±4%)	5	43
1	B	45/47 (96%)	38±2 (85±4%)	7±2 (15±4%)	6	44
All	All	1780/1880 (95%)	1509 (85%)	271 (15%)	6	44

All 46 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	10	TRP	20
1	A	22	LEU	20
1	B	110	TRP	20
1	B	122	LEU	19
1	B	115	LEU	16
1	A	15	LEU	14
1	A	17	LYS	11
1	A	36	LYS	11
1	A	45	LEU	10
1	B	145	LEU	10
1	B	117	LYS	9
1	A	25	MET	8
1	B	125	MET	8
1	B	136	LYS	8
1	B	151	LYS	7
1	A	42	GLN	6
1	B	142	GLN	6
1	A	30	ILE	6
1	B	111	THR	5
1	B	114	ASP	5
1	A	11	THR	4
1	A	31	GLU	4
1	A	18	ARG	3
1	A	8	LYS	3
1	B	107	LEU	3
1	B	130	ILE	3
1	B	131	GLU	3
1	A	26	MET	2
1	A	38	GLN	2
1	A	14	ASP	2
1	A	41	ARG	2
1	A	23	ASP	2
1	B	123	ASP	2
1	B	128	GLN	2
1	B	120	LEU	2
1	A	46	ASP	2
1	B	108	LYS	2
1	A	16	GLN	1
1	B	109	SER	1
1	B	118	ARG	1
1	A	20	LEU	1
1	A	7	LEU	1
1	B	126	MET	1

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Mol	Chain	Res	Type	Models (Total)
1	A	19	LEU	1
1	A	9	SER	1
1	B	146	ASP	1

6.3.3 RNA [i](#)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.6 Ligand geometry [i](#)

There are no ligands in this entry.

6.7 Other polymers [i](#)

There are no such molecules in this entry.

6.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided