

wwPDB EM Validation Summary Report (i)

Feb 24, 2024 – 03:04 PM EST

PDB ID	:	7JU4
EMDB ID	:	EMD-22481
Title	:	Radial spoke 2 stalk, IDAc, and N-DRC attached with doublet microtubule
Authors	:	Gui, M.; Ma, M.; Sze-Tu, E.; Wang, X.; Koh, F.; Zhong, E.; Berger, B.; Davis,
		J.; Dutcher, S.; Zhang, R.; Brown, A.
Deposited on	:	2020-08-19
Resolution	:	3.40 Å(reported)

This is a wwPDB EM Validation Summary 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/EMValidationReportHelp with specific help available everywhere you see the (i) 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 (1)) were used in the production of this report:

EMDB validation analysis	:	0.0.1. dev 70
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4.02b-467
buster-report	:	1.1.7(2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ	:	1.9.13
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 (i)

The following experimental techniques were used to determine the structure: $ELECTRON\ MICROSCOPY$

The reported resolution of this entry is 3.40 Å.

Ramachandran outliers

Sidechain outliers

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	Percentile Ranks	Value						
Ramachandran outliers		0						
Sidechain outliers		0.3%						
Worse	Worse							
Percentile rela	tive to all structures							
Percentile relative to all EM structures								
Metric	Whole archive (#Entries)	EM structures (#Entries)						

154571

154315

The table below summarises the geometric issues observed across the polymeric chains and their fit
to the map. The red, orange, yellow and green segments of the 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 $<\!\!=\!5\%$
The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM
map (all-atom inclusion $< 40\%$). The numeric value is given above the bar.

4023

3826

Mol	Chain	Length		Quality of chain	
1	0	471	37%	63%	_
1	4	471	33%	67%	-
2	1	698	24%	76%	-
3	2	573	• 32%	68%	-
4	3	72		100%	
5	6	443	—	96%	•
5	8	443	–	96%	•
5	С	443	5%	96%	•
5	G	443	—	96%	•



Continued from previous page... Chain Length Quality of chain Mol Ι 544396% • <u>.</u> 5Κ 44396% • i. 5Ο 443 • 96% Q 544396% • <u>.</u> \mathbf{S} • 5443 96% 12% W 5443 96% • 5% 5Υ 443 96% • 5i 443• 96% ÷ k 443 596% • ÷ • 5443у 96% i 76 451• 5% 94% • 9 4516 94% 5% ÷. . 6 D 45196% ÷ 6Η 45196% • J 6 45197% • ÷. • 6 L 45197% Ė Р 645196% • ÷ • • R 4516 96% Т • 6 45196% • 6Х 4515% 94% 5% Ζ 6 4515% 94% 5% 6 4515% j 94% 6 451 \mathbf{t} 95% 5% 4516 \mathbf{Z} 94% 5% 6% 7925 А 53% 47%



Chain Length Quality of chain Mol 7% 8 В 904 48% 52% 9 Е 51683% 17% 9 F 51622% 77% М 50010 9% 91% 10 Ν 5008% 92% 11 U 20424% 76% ÷ V 11 20478% 22% 1291 \mathbf{a} 92% 8% 91 12b 92% 8% 1291 \mathbf{c} 92% 8% 12 \mathbf{d} 91 92% 8% 1291е 92% 8% 12f 91 92% 8% 12g 91 92% 8% 12h 91 91% 8% 1291 0 8% 92% 7% 1291 р 92% 8% 8% 1291q 92% 8% 8% 1291 r • 8% 91% ••• 1 1333198% 14256m 20% 80% 37815n 81% 19% 6821626% \mathbf{S} 74% i 37717u 98% • 18 253v 60% 40%

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Mol	Chain	Length	Quality of chain						
18	W	253	•	56%		43%			
19	x	1298	17%		83%				



2 Entry composition (i)

There are 23 unique types of molecules in this entry. The entry contains 133504 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Dynein regulatory complex subunit 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
1 0	173	Total	С	Ν	0	S	0	0	
	0	115	1364	858	235	270	1	0	0
1 4	15/	Total	С	Ν	0	S	0	0	
	4	4 104	1246	788	214	243	1		0

• Molecule 2 is a protein called Dynein regulatory complex protein 1.

Mol	Chain	Residues		At	oms	AltConf	Trace		
2	1	168	Total 1431	C 896	N 265	O 267	${ m S} { m 3}$	0	0

• Molecule 3 is a protein called Dynein regulatory complex subunit 2.

Mol	Chain	Residues		At	oms	AltConf	Trace		
3	2	183	Total 1497	C 933	N 281	O 279	${S \atop 4}$	0	0

• Molecule 4 is a protein called Unknown protein.

Mol	Chain	Residues		Aton	ıs	AltConf	Trace	
4	3	72	Total 360	C 216	N 72	O 72	0	0

• Molecule 5 is a protein called Tubulin beta.

Mol	Chain	Residues		At		AltConf	Trace		
5 6	6	496	Total	С	Ν	Ο	S	0	0
	0	420	3346	2103	574	639	30		0
5 8	0	496	Total	С	Ν	Ο	S	0	0
	0	420	3346	2103	574	639	30		0
5	С	496	Total	С	Ν	0	S	0	0
		0 420	3346	2103	574	639	30		U



Mol	Chain	Residues		At	oms			AltConf	Trace
5	С	496	Total	С	Ν	0	S	0	0
0	G	420	3346	2103	574	639	30	0	0
5	т	496	Total	С	Ν	0	S	0	0
0		420	3346	2103	574	639	30	0	0
5	5 K	496	Total	С	Ν	0	\mathbf{S}	0	0
0		420	3346	2103	574	639	30		0
5	5 O	496	Total	С	Ν	0	\mathbf{S}	0	0
0		420	3346	2103	574	639	30		0
5	0	426	Total	С	Ν	0	\mathbf{S}	0	0
0	J Q		3346	2103	574	639	30		0
5	S	426	Total	С	Ν	0	\mathbf{S}	0	0
0	U U		3346	2103	574	639	30	0	0
5	W	496	Total	\mathbf{C}	Ν	Ο	\mathbf{S}	0	0
0	vv	420	3346	2103	574	639	30		0
5	v	426	Total	С	Ν	Ο	\mathbf{S}	0	0
0	T	420	3346	2103	574	639	30	0	0
5	i	426	Total	\mathbf{C}	Ν	Ο	\mathbf{S}	0	0
0	I	420	3346	2103	574	639	30	0	0
5 k	426	Total	\mathbf{C}	Ν	Ο	\mathbf{S}	0	0	
		3346	2103	574	639	30	0	0	
5	V	426	Total	С	Ν	0	S	0	0
D Y	426	3346	2103	574	639	30	0		

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• Molecule 6 is a protein called Tubulin alpha.

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Mol	Chain	Residues		At	oms			AltConf	Trace		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	7	497	Total	С	Ν	0	S	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	(421	3318	2103	565	629	21	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	0	497	Total	С	Ν	0	S	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	9	421	3318	2103	565	629	21	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	Л	436	Total	С	Ν	0	S	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	D	430	3376	2136	575	644	21	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	ц	436	Total	С	Ν	0	S	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	П	11	11	400	3376	2136	575	644	21	0	0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	т	426	Total	С	Ν	0	S	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	J	430	3376	2136	575	644	21	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	т	426	Total	С	Ν	0	S	0	0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0		430	3376	2136	575	644	21	0	0		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	D	426	Total	С	Ν	0	S	0	0		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	0	Г	430	3376	2136	575	644	21	0	0		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	6	D	426	Total	С	Ν	0	S	0	0		
	0	R 43	436	3376	2136	575	644	21		0		



Mol	Chain	Residues		At	oms			AltConf	Trace
6	т	436	Total	С	Ν	0	\mathbf{S}	0	0
0	L	430	3376	2136	575	644	21	0	0
6	v	497	Total	С	Ν	0	\mathbf{S}	0	0
0	Λ	421	3318	2103	565	629	21	0	0
6	7	497	Total	С	Ν	0	\mathbf{S}	0	0
0		421	3318	2103	565	629	21	0	0
6	i	497	Total	С	Ν	0	\mathbf{S}	0	0
0	J	421	3318	2103	565	629	21	0	0
6	+	497	Total	С	Ν	0	\mathbf{S}	0	0
0	U	421	3318	2103	565	629	21	0	0
6	7	497	Total	С	Ν	0	S	0	0
0		421	3318	2103	565	629	21	0	0

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• Molecule 7 is a protein called Flagellar-associated protein 59.

Mol	Chain	Residues		At	AltConf	Trace			
7	А	435	Total 3535	C 2170	N 665	O 686	S 14	0	0

• Molecule 8 is a protein called Flagellar-associated protein 172.

Mol	Chain	Residues		At	AltConf	Trace			
8	В	435	Total 3479	C 2134	N 655	0 674	S 16	0	0

• Molecule 9 is a protein called Radial spoke protein 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
0	F	86	Total	С	Ν	0	S	0	0
9	9 E	80	685	432	109	142	2	0	
0	Б	117	Total	С	Ν	0	S	0	0
9	Г	117	931	583	150	195	3		0

• Molecule 10 is a protein called Radial spoke protein 7.

Mol	Chain	Residues	Atoms	AltConf	Trace
10	М	44	Total C N Q 353 232 59 6	$\begin{array}{c c} D \\ D \\ D \end{array} = 0$	0
10	Ν	40	Total C N Q 316 208 53 5	$\begin{bmatrix} 0\\ 5 \end{bmatrix} = \begin{bmatrix} 0\\ \end{bmatrix}$	0

• Molecule 11 is a protein called Radial spoke protein 11.



Mol	Chain	Residues	Atoms	AltConf	Trace
11	U	49	Total C N O S 391 255 65 70 1	0	0
11	V	160	Total C N O 891 544 172 175	0	0

• Molecule 12 is a protein called Dynein 8 kDa light chain, flagellar outer arm.

Mol	Chain	Residues		At	oms			AltConf	Trace
19	0	Q 1	Total	С	Ν	0	S	0	0
12	a	04	686	442	115	125	4	0	0
19	h	81	Total	С	Ν	0	S	0	0
12	D	04	686	442	115	125	4	0	0
19	0	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12	C	04	686	442	115	125	4	0	0
12	d	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12	u	04	686	442	115	125	4	0	0
12	ρ	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12	C	04	686	442	115	125	4	0	0
12	f	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12	1	04	686	442	115	125	4	0	0
12	o	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12	5	04	686	442	115	125	4	0	0
12	h	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12		04	686	442	115	125	4	0	0
12	0	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12	0	04	686	442	115	125	4	0	0
12	n	84	Total	С	Ν	Ο	\mathbf{S}	0	0
12	Р	04	686	442	115	125	4	0	0
12	a	84	Total	С	Ν	Ο	\mathbf{S}	0	0
	Ч		686	442	115	125	4	0	0
12	r	84	Total	\mathbf{C}	Ν	0	S	0	0
14	L	04	686	442	115	125	4		

• Molecule 13 is a protein called Radial spoke protein 15.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	1	327	Total 2438	C 1529	N 434	0 465	S 10	0	0

• Molecule 14 is a protein called FAP207.



Mol	Chain	Residues		At	AltConf	Trace			
14	m	204	Total 1639	C 1029	N 294	O 310	S 6	0	0

• Molecule 15 is a protein called Radial spike protein 8.

Mol	Chain	Residues		Ato	ms	AltConf	Trace	
15	n	307	Total 1516	C 902	N 307	O 307	0	0

• Molecule 16 is a protein called FAP253.

Mol	Chain	Residues	Atoms					AltConf	Trace
16	S	176	Total 1465	C 924	N 265	0 273	${ m S} { m 3}$	0	0

• Molecule 17 is a protein called Actin.

Mol	Chain	Residues		At	oms			AltConf	Trace
17	u	370	Total 2880	C 1828	N 487	0 542	S 23	0	0

• Molecule 18 is a protein called 28 kDa inner dynein arm light chain, axonemal.

Mol	Chain	Residues		At	oms			AltConf	Trace
10	17	159	Total	С	Ν	0	S	0	0
10	V	152	1256	776	229	245 6	0	0	
19	18 w	1/12	Total	С	Ν	0	S	0	0
10		140	1186	736	213	232	5	0	0

• Molecule 19 is a protein called CFAP91 domain-containing protein.

Mol	Chain	Residues		Ate	oms			AltConf	Trace
19	х	224	Total 1826	C 1135	N 343	0 343	$\frac{\mathrm{S}}{5}$	0	0

• Molecule 20 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$).





Mol	Chain	Residues		Ate	oms			AltConf	
20	C	1	Total	С	Ν	Ο	Р	0	
20	0	1	28	10	5	11	2	0	
- 20	0	1	Total	С	Ν	Ο	Р	0	
20	8	1	28	10	5	11	2	0	
20	C	1	Total	С	Ν	0	Р	0	
20	0	L	28	10	5	11	2	0	
20	С	1	Total	С	Ν	Ο	Р	0	
20	G	L	28	10	5	11	2	0	
20	т	1	Total	С	Ν	0	Р	0	
20	1	L	28	10	5	11	2	0	
20	V	1	Total	С	Ν	0	Р	0	
20	Λ	L	28	10	5	11	2		
20	0	1	Total	С	Ν	0	Р	0	
20	0	L	28	10	5	11	2	0	
20	0	0	1	Total	С	Ν	Ο	Р	0
20	Q	L	28	10	5	11	2	0	
20	C	1	Total	С	Ν	Ο	Р	0	
20	G	L	28	10	5	11	2	0	
20	W	1	Total	С	Ν	Ο	Р	0	
20	vv	T	28	10	5	11	2	0	
20	V	1	Total	С	Ν	Ο	Р	0	
20	I	L	28	10	5	11	2	0	
20	;	1	Total	С	Ν	Ο	Р	0	
20	1	1	28	10	5	11	2	U	
20	k	1	Total	С	N	Ο	Р	0	
20	ĸ	1	28	10	5	11	2	0	
20	V	y 1	Total	С	Ν	Ο	Р	0	
20	У		28	10	5	11	2	U	



• Molecule 21 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula: $\rm C_{10}H_{16}N_5O_{14}P_3).$



Mol	Chain	Residues		Ate	oms			AltConf	
01	7	1	Total	С	Ν	0	Р	0	
21	1	1	32	10	5	14	3	0	
-01	0	1	Total	С	Ν	0	Р	0	
	9	1	32	10	5	14	3	0	
91	Л	1	Total	С	Ν	Ο	Р	0	
	D	1	32	10	5	14	3	0	
91	Ц	1	Total	С	Ν	Ο	Р	0	
21	11	1	32	10	5	14	3	0	
91	T	1	Total	С	Ν	Ο	Р	0	
21	J	T	32	10	5	14	3	0	
91	T.	1	Total	С	Ν	Ο	Р	0	
21	Ľ	1	32	10	5	14	3	0	
21	Р	1	Total	\mathbf{C}	Ν	Ο	Р	0	
21	I	1	32	10	5	14	3	0	
21	B	1	Total	\mathbf{C}	Ν	Ο	Р	0	
21	10	1	32	10	5	14	3	0	
21	Т	1	Total	С	Ν	Ο	Р	0	
21	1	1	32	10	5	14	3	0	
21	X	1	Total	С	Ν	Ο	Р	0	
21		1	32	10	5	14	3	U	
21	Z	1	Total	С	Ν	Ο	Р	0	
		Ĩ	32	10	5	14	3		
21	i	1	Total	С	Ν	Ο	Р	0	
41	J		32	10	5	14	3	Ŭ	



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Mol	Chain	Residues		At	oms			AltConf	
21	17	1	Total	С	Ν	Ο	Р	0	
	У		32	10	5	14	3	0	
21	Z	Z	1	Total	С	Ν	Ο	Р	0
			Z		32	10	5	14	3

• Molecule 22 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	AltConf
22	7	1	Total Mg 1 1	0
22	9	1	Total Mg 1 1	0
22	D	1	Total Mg 1 1	0
22	Н	1	Total Mg 1 1	0
22	J	1	Total Mg 1 1	0
22	L	1	Total Mg 1 1	0
22	Р	1	Total Mg 1 1	0
22	R	1	Total Mg 1 1	0
22	Т	1	Total Mg 1 1	0
22	Х	1	Total Mg 1 1	0
22	Z	1	Total Mg 1 1	0
22	j	1	Total Mg 1 1	0
22	t	1	Total Mg 1 1	0
22	Z	1	Total Mg 1 1	0

• Molecule 23 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).





Mol	Chain	Residues	Atoms					AltConf
93	.,,	1	Total	С	Ν	Ο	Р	0
23	u	L	31	10	5	13	3	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 atom inclusion in map 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 diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). 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: Dynein regulatory complex subunit 4















M D31 (333 (333 (103 (111 (111) (112) (112) (115)	S176 ← D177 ← F212 ← A248 ← A248 ← A283 ← P306 ← P306 ← P305 ← B355 ← B355 ← B355 ← B416 ←	ASP ASP ALA ALA ALA ALA ALA GLU GLU GLU GLU ALA ALA
• Molecule 5: Tubulin beta		
Chain i:	96%	·
M G56 B88 E111 D114 0118 D203 D209 M283 M283	b304 b305 b305 b355 b355 b355 b355 b355 b355	
• Molecule 5: Tubulin beta		
Chain k:	96%	<u>.</u>
M1 G17 G17 G16 G16 M73 M73 M74 K174 H227 H227 E405	ALA ALA ALA ALA ALA ALA ALA ALA ALA ALA	
• Molecule 5: Tubulin beta		
Chain y:	96%	·
M1 E45 410 4110 9131 9131 8176 9223 9223 4227 1250 4283	R306 B327 B327 B327 B327 C402 C402 C402 C412 C412 C412 C412 C412 C412 C412 C41	
• Molecule 6: Tubulin alpha		
Chain 7:	94%	• 5%
MET R2 SER A35 A35 A35 A15 A15 A55 A55 A55 A55 A55 A55 A55 A5	N329 1340 6565 6565 6565 6565 6565 6565 647 617 617 617 617 617 617 77 77 77 77 77 77 77 77 77	
• Molecule 6: Tubulin alpha		
Chain 9:	94%	5%
MET R2 P37 P37 ASP ASP L17 L17 L17 G17 G17 G17 G17 G17 ASP ASP ASP ASP ASP ASP ASP ASP ASP ASP	N128 G144 + G162 + S174 + S174 + S174 + S129 F255 + F255 + F255 + F255 + F255 + F255 + F255 + F255 +	6416 6417 6417 6417 6433 6437 6437 610 610 617 617 617 617
61.Y 61.V 61.Y 61.V 61.U 61.U 77R 77Y		
• Molecule 6: Tubulin alpha		
Chain D:	96%	
MET R2 644 645 946 947 645 645 645 645 746 8192 8211 8221	K430 B327 K430 K430 A137 A137 A137 A137 A137 A137 G1U G1U G1U G1U G1U G1U G1U G1U G1U G1U	
	PROTEIN DATA BANK	

• Molecule 6: Tubulin alpha













HALA HALA
V678 V678 A680 E581 E684 K684 K684 K684 H687 H687 H687 H6896 H687 H6896 H691 H687 H6896 H691 H687 H6896 H691 H691 H691 H696 H691 H696 H691 H696 H691 H696 H696
SER VAL ALA SER SER SER SER SER SER SER ALA ASP CLU ASP CLU ALA ALA ALA ALA ALA ALA ALA ALA ALA A
LEU ALA ALA ALA ALA ALA ALA ALA ALA ALA AL
ALA ASP CLU CTS CLU CLU CLU CLU CLU CLU CLU CLU CLU CLU
• Molecule 9: Radial spoke protein 3
Chain E: 17% 83%
MET VAL VAL ALA ALA ALA ALA GLN GLN GLN GLN ALA ALA ALA ALA ALA ALA ALA ALA ALA A
ASP THR THR CLIN CLIN CLIN CLIN CLIN CLIV CLIV CLIV CLIV CLIV CLIV CLIV CLIV
THR ARG ARG ARG ARG ARG ARG ARG ARG ARG CLU ARG C A A C A A A C A C A C A C A C C A C
111 112 112 112 112 112 112 112 112 112
SER THR ALA ALA ALA ALA ALA ALA ALA ALA ALA AL
GLU ALA ALA ALA ALA ALA ALA ALA ALA ALA A
ASP VAL VAL VAL VAL VAL VAL VAL VAL VAL VAL
TTR THR ASN ALA ALA GLU GLU GLU ALA ALA
• Molecule 9: Radial spoke protein 3
Chain F: 22% 77%
MET VALL ALA ALA ALA ALA ALA ALA ALA ALA AL
ASP THR THR GLN GLN GLN FRO FRO FRO FRO FRO FRO FRO FRO FRO FRO
ARG VAL VAL VAL VAL VAL VAL ARG CJN ALA ALA ALA ALA ALA ALA ALA ALA ALA AL







• Molecule 12: Dynein 8 kDa light chain, flagellar outer arm



Chain c:	92%	8%
MET ALA SER GLY SER K7 K7 SER	CPK -	
• Molecule 1	12: Dynein 8 kDa light chain, flagellar outer arm	
Chain d:	92%	8%
MET ALA SER GLY SER SER SER S90	GLY	
• Molecule 1	12: Dynein 8 kDa light chain, flagellar outer arm	
Chain e:	92%	8%
MET ALA SER SER SER SER S90	GLY	
• Molecule 1	12: Dynein 8 kDa light chain, flagellar outer arm	
Chain f:	92%	8%
MET ALA SER SER SER SER S90	duy	
• Molecule 1	12: Dynein 8 kDa light chain, flagellar outer arm	
Chain g:	92%	8%
MET ALA SER GLY SER SER K7 S90	6LY	
• Molecule 1	12: Dynein 8 kDa light chain, flagellar outer arm	
Chain h:	91%	• 8%
MET ALA SER GLY SER SER K7 N35		
• Molecule 1	12: Dynein 8 kDa light chain, flagellar outer arm	
Chain o:	92%	8%
MET ALA SER GLY SER SER SER S90	AT9	

 \bullet Molecule 12: Dynein 8 kDa light chain, flagellar outer arm



Chain p:	92%	8%	
	• • • • • • _		
MET ALA SER GLY SER SER SER K7	A8 E118 131 143 143 143 143 143 143 143		
• Molecul	e 12: Dynein 8 kDa light chain, flagellar outer arm		
Chain q:	<u>8%</u> 92%	8%	
_	* * * * ** *		
MET ALA SER GLY SER SER SER K7	A23 P54 P54 F59 C65 S66 S66 C12 C12		
• Molecul	e 12: Dynein 8 kDa light chain, flagellar outer arm		
Chain r:	91%	• 8%	
MET ALA SER GLY SER SER K7	A13 A13 K33 F54 F54 F54 F54 F54 F56 F58 F56 F58 F54 F56 F56 F56 F56 F56 F57 F56 F57 F57 F57 F57 F57 F57 F57 F57 F57 F57		
• Molecul	e 13: Radial spoke protein 15		
Chain l:	98%	••	
	*		
MET GLN VAL PHE A5 A5 R36			
• Molecul	e 14: FAP207		
Chain m:	80%	20%	
MET PRO PRO ASN ILE PRO GLY	THR THR THE THE THE THE THE THE THE THE THE THE	LEU ALA GLU ALA MET MET	GLU ALA SER GLU ALA ALA THR
GLU ALA ALA ALA ALA GLY CLY LEU			
• Molecul	e 15: Radial spike protein 8		
Chain n:	81%	19%	
MET GLN SER HIS SER SER ARG	HIS VAL VAL VAL VAL VAL HIS CLU ASP PRO ASP PRO ASP VAL VAL VAL ASP ASP ASP ASP ASP ASP ASP ASP ASP ASP	T178	R221 E231 V291 K296
A328 A329 A330 E331 E331	R5-4/ R5-4/ LEU LEU LEU LEU LEU TRP PRO PRO PRO PRO PRO PRO PRO PRO PRO LIV ALA ALA ALA LYS		





• Molecule 18: 28 kDa inner dynein arm light chain, axonemal



Chai	n w:	-				56%					-	4	3%	-	-			
MET ILE PRO PBO	LEU SER	LEU VAL ARG	TYR ASP	PRO VAL LEU	VAL SER THR SFR	LYS ASP LYS	CTY CLY GLY GLY	ALA LYS GLY THR	PRO GLY LYS	LT S GLY ALA LEU	PRO PRO VAL	GLN LYS PRO	GLY LEU THR GLN	THR GLU ASP	LEU ASN SEP	ILE LEU PRO	PRO ARG	
GLU TRP THR	ASP GLY GL	LEU TRP VAL	GLN TYR	VAL SER SER THR	PRO A78 T79	K80 L81 D82	L94 Q95	<mark>q96</mark> ARG GLN ALA	ARG GLU THR	GLY ILE CYS P106	R161	4229 LEU LYS GLN	GLU GLU THR	PHE LEU VAL	PRO ALA LYS	LTS GLY ALA PRO	GLY ALA PRO	
ALA ALA ALA TUP	WITT																	
• Mo	olecu	le 19	9: C	FAP	91 do	omaiı	n-con	ntaini	ng pi	roteir	1							
Chai	n x:	—	17%							83%								
MET ALA GLN DDO	GLN GLN ARG	TYR ASP ALA	LEU TYR	ASP PRO ASN PHE	THR VAL ALA CI V	PRO ARG ASP	HIS TYR ARG	GLN GLN MET	ALA GLY GLY	ARN ASN ILE GLU	ARG ALA PRO	VAL TYR ASN ASN	PHE PHE SER GLU	LEU PRO HIS	PRO PRO SER	THR LEU ARG	LYS	
ASN ALA ASP	VAL PRO	PHE VAL ASP	ARG ASN	I TR ARG PRO ALA	ALA ASN ASP DRO	ASN ASP THR	ARG GLN ARG	SER ASP ALA LEU	ALA VAL SER	PRO ASN ARG	PRO LYS TYR	PRG ARG PRO	MET LEU ALA ALA	ALA GLU ILE	ILE CIN	ALA PRO PRO	GLN	
LEU PRO TEU	PR0 SER	GLN ASP LEU	ALA	IHR ALA PRO ALA	ALA MET GLY CI V	ALA GLY GLY	GL Y GL Y	PRU ARG SER LYS	THR ILE GLY	LHR GLN SER ASP	TYR ARG GLU	GLU GLU GLN GLN	THR ALA PRO TRP	GLU GLY	LT R VAL LEU PRO	ALA PRO GLY	ALA LEU	
T181 Q200	LYS ASP	ALA PHE PRO	ASP GLY	LEU PRO G213 G213	P234 PRO TIF	ASP ASP VAL	ALA ARG LEU	PRU L244 B247	E259	E273 L274 L275	D288	R305 A306 G307	A310 D311	V312 Q313	R327 L336	H337	S350 G351	Q357
P363 E364 S365	K366	L368 G369 K370	E371	E373 T374 E375	E389	P393	PRO ARG VAL	ALA PRO GLN	LYS PRO ALA ARG	LEU ASP TYR	HIS Q414	4421 R422	T437	R440 GLY PHE	GLY ASP CYS	TKP PRO ALA PRO	LEU GLN ASP	GLY GLY ALA
GLY GLY ASN	GLY THR LEII	GLY ARG ALA	THR SER	UAL GLY LYS	GLY THR LEU CI V	ALA GLY GLY	SER ALA GLY	GLY ALA ALA PRO	GLY GLY ALA	SER MET ALA LEU	GLY GLY	SER THR ALA	ALA ALA SER ALA	MET GLY PRO	ALA SER GI V	VAL SER GLY	PRO	
SER ARG ARG VAT	VAL VAL ARG	ILE GLU ARG	PRO PRO	PRO GLU LEU	PRO GLN PRO PRO	ALA VAL THR	ALA PRO GLN	HIS ALA ALA VAL	VAL LEU LEU	GLN LEU LEU	ARG GLY ARG	ALA ALA GLN ASN	ILE MET TYR GLU	GLY ARG VAL	ARG GLN GT II	LEU LEU ASP	GLU	
ARG LEU GLU	VAL VAL	ALA ASP GLY	THR LYS	ASP GLY GLN	PRO ILE ARG	PRO GLU HIS	ARG ASP THR	ALA THR LEU ARG	ILE ASP ALA	LEU VAL GLY SER	ALA VAL ALA	VAL VAL ALA ALA	ILEU LEU GLU	THR ASP PRO	ARG ARG GITT	THR LEU LEU	ALA GLY	
LEU ASP VAL SFP	ALA ALA UTS	ALA ALA ALA	ALA ALA	VAL ALA ALA ALA	ALA ALA ASP TIF	ASN ALA SER	ALA ARG ALA	GLU GLU GLU	ALA ALA ALA ALA	I HHK ALA MET ALA	GLU ALA ALA	ALA ALA ALA ALA	ALA ALA ALA ALA	ALA ALA ALA	ALA GLU ASP	GLY GLY ALA	GLY GLU	
ALA ALA GLU SFP	ALA ALA	ALA ALA ALA	ALA ALA	ALA ALA ALA ALA	SER ALA ALA CT II	GLU ALA TYR	ALA GLY ALA	VAL ALA ALA ALA	ALA ALA PRO	ALA ARG ALA ALA	ALA LEU ASN	GLU GLU LEU	GLY ILE SER PRO	GLU GLU ALA	GLU ALA AT A	VAL VAL ARG ILE	GLN	
ALA PHE LYS	HIS UTA	ARG LYS GLU	VAL ALA	ALA MET ARG ALA	ARG GLY GLU MET	LEU ARG ASN	ILE MET ALA	ASN GLY ASP GLU	ALA LYS VAL	VAL THR CYS GLN	ALA ALA TLE	ALC GLY HIS LEU	ALA ARG LYS ARG	VAL ARG GLN	ALA ALA SER	GLN GLY GLY	GLU	
GLY PHE ALA CT V	ALA PRO SEP	ALA SER PRO	GLU PRO	ALA ALA PRO LEU	PRO ALA LEU	GLU GLN GLN	ASP GLN GLN	GLU PRO GLN PRO	GLN PRO GLN	PRU SER SER	SER GLY ALA	ASP LEU ALA	ASP TYR ASP ASP	HIS HIS VAL	ALA ALA VAL THR	ARG ILE GLN	ALA ALA	
GLN ARG GLY APC	ALA	LYS ARG ALA	ALA ALA	ARG THR GLU	CLU GLU GLU	LEU ALA THR	ALA ALA ALA	LEU VAL ALA THR	SER ALA ALA	GLU GLY THR	ARG LEU ALA	SER GLY ARG SER	GLU PRO ASN SER	GLU GLY ARG	ASP GLY GLY	SER ALA ARG	GLY GLY	
ALA SER ARG	PRO PRO PBO	THR ALA ALA	VAL ASN	ASP ALA PHE	GLN GLN GLN	THR ALA GLU	GLN GLU ALA	ALA VAL ILE LYS	ILE GLN ALA	CLY GLY GLY GLY	MET ILE ALA	ARG LYS ARG VAL	GLY ARG LEU LYS	GLY ARG SER	A ID CI N CI N	ALA GLY ASP	VAL LEU	



ARG G GLY G GLY ALLA ALLA

ALA GLU



4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	202168	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE	Depositor
	CORRECTION	
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{\AA}^2)$	38.9	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT $(4k \ge 4k)$	Depositor
Maximum map value	0.173	Depositor
Minimum map value	0.000	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.001	Depositor
Recommended contour level	0.018	Depositor
Map size (Å)	1167.296, 1167.296, 1167.296	wwPDB
Map dimensions	832, 832, 832	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.403, 1.403, 1.403	Depositor



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: GDP, ATP, MG, GTP

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).

Mal	Chain	Bond	lengths	Bond	l angles
	Ullaili	RMSZ	# Z > 5	RMSZ	# Z > 5
1	0	0.28	0/1379	0.50	0/1860
1	4	0.27	0/1258	0.49	0/1690
2	1	0.27	0/1458	0.45	0/1962
3	2	0.33	0/1517	0.51	0/2038
5	6	0.28	0/3420	0.47	0/4628
5	8	0.29	0/3420	0.47	0/4628
5	С	0.28	0/3420	0.46	0/4628
5	G	0.29	0/3420	0.46	0/4628
5	Ι	0.29	0/3420	0.47	0/4628
5	K	0.32	0/3420	0.47	0/4628
5	0	0.30	0/3420	0.48	0/4628
5	Q	0.29	0/3420	0.47	0/4628
5	S	0.29	0/3420	0.47	0/4628
5	W	0.27	0/3420	0.46	0/4628
5	Y	0.28	0/3420	0.47	0/4628
5	i	0.28	0/3420	0.45	0/4628
5	k	0.29	0/3420	0.46	0/4628
5	у	0.29	0/3420	0.47	0/4628
6	7	0.29	0/3389	0.48	0/4595
6	9	0.28	0/3389	0.47	0/4595
6	D	0.30	0/3448	0.47	0/4675
6	Н	0.30	0/3448	0.48	0/4675
6	J	0.29	0/3448	0.48	0/4675
6	L	0.31	0/3448	0.49	0/4675
6	Р	0.29	0/3448	0.46	0/4675
6	R	0.29	0/3448	0.48	0/4675
6	Т	0.28	0/3448	0.47	0/4675
6	Х	0.29	0/3389	0.47	0/4595
6	Ζ	0.28	0/3389	0.46	0/4595
6	j	0.28	0/3389	0.48	0/4595
6	t	0.28	0/3389	0.49	0/4595
6	Z	0.30	0/3389	0.49	0/4595



Mal	Chain	Bond	lengths	Bond angles		
	Unam	RMSZ	# Z > 5	RMSZ	# Z > 5	
7	А	0.28	0/3562	0.42	0/4763	
8	В	0.29	0/3499	0.46	0/4674	
9	Е	0.32	0/698	0.54	0/948	
9	F	0.30	0/946	0.56	0/1287	
10	М	0.33	0/363	0.48	0/491	
10	N	0.29	0/325	0.46	0/439	
11	U	0.29	0/399	0.48	0/543	
11	V	0.27	0/891	0.43	0/1221	
12	a	0.35	0/702	0.48	0/945	
12	b	0.36	0/702	0.52	0/945	
12	с	0.36	0/702	0.54	0/945	
12	d	0.35	0/702	0.51	0/945	
12	е	0.33	0/702	0.50	0/945	
12	f	0.38	0/702	0.53	0/945	
12	g	0.33	0/702	0.50	0/945	
12	h	0.32	0/702	0.49	0/945	
12	0	0.27	0/702	0.47	0/945	
12	р	0.27	0/702	0.49	0/945	
12	q	0.25	0/702	0.46	0/945	
12	r	0.27	0/702	0.50	0/945	
13	1	0.28	0/2469	0.54	0/3363	
14	m	0.32	0/1688	0.54	0/2273	
15	n	0.24	0/1515	0.39	0/2108	
16	s	0.24	0/1487	0.41	0/2004	
17	u	0.27	0/2942	0.48	0/3985	
18	V	0.27	0/1267	0.48	0/1696	
18	W	0.27	0/1196	0.42	0/1599	
19	Х	0.28	0/1847	0.43	0/2473	
All	All	0.29	0/134869	0.47	0/182439	

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)

Due to software issues we are unable to calculate clashes - this section is therefore empty.



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 PDB entries followed by that with respect to all EM 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	Perce	ntiles
1	0	171/471~(36%)	166 (97%)	5 (3%)	0	100	100
1	4	150/471~(32%)	148 (99%)	2(1%)	0	100	100
2	1	164/698~(24%)	157~(96%)	7 (4%)	0	100	100
3	2	179/573~(31%)	176 (98%)	3 (2%)	0	100	100
5	6	424/443~(96%)	398 (94%)	26 (6%)	0	100	100
5	8	424/443~(96%)	399~(94%)	25~(6%)	0	100	100
5	С	424/443~(96%)	410 (97%)	14 (3%)	0	100	100
5	G	424/443~(96%)	393~(93%)	31 (7%)	0	100	100
5	Ι	424/443~(96%)	398 (94%)	26 (6%)	0	100	100
5	K	424/443~(96%)	396 (93%)	28 (7%)	0	100	100
5	Ο	424/443~(96%)	401 (95%)	23 (5%)	0	100	100
5	Q	424/443~(96%)	396 (93%)	28 (7%)	0	100	100
5	S	424/443~(96%)	398 (94%)	26 (6%)	0	100	100
5	W	424/443~(96%)	405 (96%)	19 (4%)	0	100	100
5	Y	424/443~(96%)	405 (96%)	19 (4%)	0	100	100
5	i	424/443~(96%)	404 (95%)	20 (5%)	0	100	100
5	k	424/443~(96%)	398 (94%)	26 (6%)	0	100	100
5	У	424/443~(96%)	400 (94%)	24 (6%)	0	100	100
6	7	423/451~(94%)	396 (94%)	27 (6%)	0	100	100
6	9	423/451~(94%)	393~(93%)	30 (7%)	0	100	100
6	D	434/451~(96%)	413 (95%)	21 (5%)	0	100	100
6	Н	$\overline{434/451}~(96\%)$	410 (94%)	24 (6%)	0	100	100
6	J	$\overline{434/451}\ (96\%)$	402 (93%)	32 (7%)	0	100	100
6	L	$\overline{434/451}~(96\%)$	404 (93%)	30 (7%)	0	100	100
6	Р	434/451~(96%)	405 (93%)	29 (7%)	0	100	100



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Continuea	l trom	previous	<i>paae</i>
0 0 1 0 0 0 0 0 0 0 0 0	<i>.</i>	proceed as	P ~ 9 ~

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Perce	ntiles
6	R	434/451~(96%)	410 (94%)	24 (6%)	0	100	100
6	Т	434/451~(96%)	410 (94%)	24 (6%)	0	100	100
6	Х	423/451~(94%)	407 (96%)	16 (4%)	0	100	100
6	Ζ	423/451~(94%)	401 (95%)	22 (5%)	0	100	100
6	j	423/451~(94%)	402 (95%)	21 (5%)	0	100	100
6	t	423/451~(94%)	399 (94%)	24 (6%)	0	100	100
6	Z	423/451~(94%)	398 (94%)	25~(6%)	0	100	100
7	А	429/925~(46%)	428 (100%)	1 (0%)	0	100	100
8	В	429/904 (48%)	428 (100%)	1 (0%)	0	100	100
9	Ε	84/516~(16%)	81 (96%)	3 (4%)	0	100	100
9	F	115/516~(22%)	105 (91%)	10 (9%)	0	100	100
10	М	42/500 (8%)	38 (90%)	4 (10%)	0	100	100
10	Ν	38/500~(8%)	33 (87%)	5 (13%)	0	100	100
11	U	47/204~(23%)	42 (89%)	5 (11%)	0	100	100
11	V	150/204~(74%)	133 (89%)	17 (11%)	0	100	100
12	a	82/91~(90%)	72 (88%)	10 (12%)	0	100	100
12	b	82/91~(90%)	76 (93%)	6 (7%)	0	100	100
12	с	82/91~(90%)	79 (96%)	3 (4%)	0	100	100
12	d	82/91~(90%)	76 (93%)	6 (7%)	0	100	100
12	е	82/91~(90%)	76 (93%)	6 (7%)	0	100	100
12	f	82/91~(90%)	75 (92%)	7 (8%)	0	100	100
12	g	82/91~(90%)	77 (94%)	5 (6%)	0	100	100
12	h	82/91~(90%)	79~(96%)	3 (4%)	0	100	100
12	О	82/91~(90%)	73 (89%)	9 (11%)	0	100	100
12	р	82/91~(90%)	73 (89%)	9 (11%)	0	100	100
12	q	82/91~(90%)	73 (89%)	9 (11%)	0	100	100
12	r	$82/\overline{91}\ (90\%)$	78 (95%)	4(5%)	0	100	100
13	1	325/331~(98%)	285 (88%)	40 (12%)	0	100	100
14	m	$202/25\overline{6}\ (79\%)$	174 (86%)	28 (14%)	0	100	100
15	n	305/378~(81%)	270 (88%)	35 (12%)	0	100	100
16	s	$172/682~(\overline{25\%})$	160 (93%)	12 (7%)	0	100	100



Mol	Chain	Analysed	Favoured	Allowed	Outliers	Perce	ntiles
17	u	368/377~(98%)	350~(95%)	18~(5%)	0	100	100
18	v	150/253~(59%)	144 (96%)	6 (4%)	0	100	100
18	W	139/253~(55%)	138 (99%)	1 (1%)	0	100	100
19	х	216/1298~(17%)	206~(95%)	10~(5%)	0	100	100
All	All	16794/23918~(70%)	15820 (94%)	974 (6%)	0	100	100

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There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent side chain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM 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	Perce	ntiles
1	0	146/418~(35%)	145~(99%)	1 (1%)	84	92
1	4	135/418~(32%)	135~(100%)	0	100	100
2	1	153/573~(27%)	153~(100%)	0	100	100
3	2	158/470~(34%)	156~(99%)	2(1%)	69	84
5	6	367/379~(97%)	365~(100%)	2~(0%)	88	94
5	8	367/379~(97%)	367~(100%)	0	100	100
5	С	367/379~(97%)	367~(100%)	0	100	100
5	G	367/379~(97%)	366 (100%)	1 (0%)	92	97
5	Ι	367/379~(97%)	367~(100%)	0	100	100
5	Κ	367/379~(97%)	366~(100%)	1 (0%)	92	97
5	Ο	367/379~(97%)	367~(100%)	0	100	100
5	Q	367/379~(97%)	367~(100%)	0	100	100
5	S	367/379~(97%)	366~(100%)	1 (0%)	92	97
5	W	367/379~(97%)	366~(100%)	1 (0%)	92	97
5	Y	367/379~(97%)	366~(100%)	1 (0%)	92	97
5	i	367/379~(97%)	367~(100%)	0	100	100
5	k	367/379~(97%)	366~(100%)	1 (0%)	92	97



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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
5	У	367/379~(97%)	365~(100%)	2 (0%)	88	94
6	7	359/374~(96%)	356~(99%)	3~(1%)	81	91
6	9	359/374~(96%)	358~(100%)	1 (0%)	92	97
6	D	365/374~(98%)	363~(100%)	2 (0%)	88	94
6	Η	365/374~(98%)	364~(100%)	1 (0%)	92	97
6	J	365/374~(98%)	365~(100%)	0	100	100
6	L	365/374~(98%)	365~(100%)	0	100	100
6	Р	365/374~(98%)	363~(100%)	2 (0%)	88	94
6	R	365/374~(98%)	360~(99%)	5 (1%)	67	83
6	Т	365/374~(98%)	364 (100%)	1 (0%)	92	97
6	Х	359/374~(96%)	358 (100%)	1 (0%)	92	97
6	Ζ	359/374~(96%)	358 (100%)	1 (0%)	92	97
6	j	359/374~(96%)	358 (100%)	1 (0%)	92	97
6	t	359/374~(96%)	359 (100%)	0	100	100
6	Z	359/374~(96%)	358 (100%)	1 (0%)	92	97
7	А	368/766~(48%)	367 (100%)	1 (0%)	92	97
8	В	362/742~(49%)	361 (100%)	1 (0%)	92	97
9	Е	76/406~(19%)	76 (100%)	0	100	100
9	F	102/406~(25%)	101 (99%)	1 (1%)	76	88
10	М	36/406~(9%)	36 (100%)	0	100	100
10	Ν	32/406~(8%)	32 (100%)	0	100	100
11	U	42/162~(26%)	42 (100%)	0	100	100
11	V	28/162~(17%)	28 (100%)	0	100	100
12	a	72/76~(95%)	72 (100%)	0	100	100
12	b	72/76~(95%)	72 (100%)	0	100	100
12	с	72/76~(95%)	72 (100%)	0	100	100
12	d	72/76~(95%)	72 (100%)	0	100	100
12	е	72/76~(95%)	72 (100%)	0	100	100
12	f	72/76~(95%)	72 (100%)	0	100	100
12	g	72/76~(95%)	72 (100%)	0	100	100
12	h	72/76~(95%)	71 (99%)	1 (1%)	67	83



Mol	Chain	Analysed	Rotameric	Outliers	Perce	entiles
12	О	72/76~(95%)	72~(100%)	0	100	100
12	р	72/76~(95%)	72 (100%)	0	100	100
12	q	72/76~(95%)	72 (100%)	0	100	100
12	r	72/76~(95%)	71 (99%)	1 (1%)	67	83
13	1	259/263~(98%)	256~(99%)	3~(1%)	71	85
14	m	159/197~(81%)	159 (100%)	0	100	100
16	S	162/553~(29%)	162 (100%)	0	100	100
17	u	313/318~(98%)	313 (100%)	0	100	100
18	v	134/218~(62%)	133 (99%)	1 (1%)	84	92
18	W	127/218~(58%)	126 (99%)	1 (1%)	81	91
19	х	191/884~(22%)	190 (100%)	1 (0%)	88	94
All	All	14053/19440 (72%)	14010 (100%)	43 (0%)	92	97

Continued from previous page...

5 of 43 residues with a non-rotameric sidechain are listed below:

Mol	Chain	\mathbf{Res}	Type
5	Y	306	ARG
13	l	309	ARG
6	Ζ	308	ARG
5	k	227	HIS
18	V	215	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 59 such sidechains are listed below:

Mol	Chain	Res	Type
6	Т	176	GLN
6	Z	11	GLN
12	d	70	HIS
5	у	414	ASN
6	t	258	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 43 ligands modelled in this entry, 14 are monoatomic - leaving 29 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).

Mal	Type	Chain	Dog	Link	Bo	ond leng	ths	Bond angles		
	туре	Unam	nes	LIIIK	Counts	RMSZ	# Z >2	Counts	RMSZ	# Z > 2
21	GTP	D	501	22	26,34,34	1.20	2 (7%)	32,54,54	1.65	7 (21%)
20	GDP	i	501	-	24,30,30	0.93	1 (4%)	30,47,47	1.44	4 (13%)
20	GDP	k	501	-	24,30,30	0.89	1 (4%)	30,47,47	1.50	6 (20%)
21	GTP	L	501	22	26,34,34	1.09	1 (3%)	32,54,54	1.55	6 (18%)
21	GTP	Т	501	22	26,34,34	1.19	2 (7%)	32,54,54	1.70	7 (21%)
21	GTP	j	501	22	26,34,34	1.16	2 (7%)	32,54,54	1.67	7 (21%)
21	GTP	Р	501	22	26,34,34	1.19	2 (7%)	32,54,54	1.52	7 (21%)
20	GDP	С	501	-	24,30,30	0.96	1 (4%)	30,47,47	1.36	5 (16%)
20	GDP	Ι	501	-	24,30,30	0.98	1 (4%)	30,47,47	1.40	5 (16%)
21	GTP	Х	501	22	26,34,34	1.21	2 (7%)	32,54,54	1.69	7 (21%)
20	GDP	У	502	-	24,30,30	0.95	1 (4%)	30,47,47	1.34	4 (13%)
20	GDP	W	501	-	24,30,30	0.94	1 (4%)	30,47,47	1.42	5 (16%)
21	GTP	J	501	22	26,34,34	1.17	2 (7%)	32,54,54	1.79	7 (21%)
21	GTP	Z	501	22	26,34,34	1.18	2 (7%)	32,54,54	1.69	7 (21%)
20	GDP	8	501	-	24,30,30	0.96	1 (4%)	30,47,47	1.42	4 (13%)
20	GDP	Q	501	-	24,30,30	0.95	1 (4%)	30,47,47	1.39	4 (13%)
21	GTP	Н	501	22	26,34,34	1.19	1 (3%)	32,54,54	1.59	8 (25%)
21	GTP	у	501	22	26,34,34	1.17	2 (7%)	32,54,54	1.61	7 (21%)



Mal	Turne	Chain	Dec	Tink	Bo	ond leng	ths	B	ond ang	les
INIOI	туре	Unam	nes		Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
21	GTP	9	501	22	26,34,34	1.17	2 (7%)	32,54,54	1.77	7 (21%)
20	GDP	K	501	-	24,30,30	1.01	1 (4%)	30,47,47	1.22	2 (6%)
23	ATP	u	401	-	26,33,33	0.92	1 (3%)	31,52,52	1.49	5 (16%)
21	GTP	7	501	22	26,34,34	1.16	2 (7%)	32,54,54	1.62	7 (21%)
21	GTP	R	501	22	26,34,34	1.21	2 (7%)	32,54,54	1.74	7 (21%)
20	GDP	0	501	-	24,30,30	0.98	1 (4%)	30,47,47	1.41	4 (13%)
20	GDP	G	501	-	24,30,30	0.95	1 (4%)	30,47,47	1.36	4 (13%)
20	GDP	6	501	-	24,30,30	0.93	1 (4%)	30,47,47	1.42	4 (13%)
20	GDP	Y	501	-	24,30,30	0.94	1 (4%)	30,47,47	1.36	4 (13%)
20	GDP	S	501	-	24,30,30	0.96	1 (4%)	30,47,47	1.39	4 (13%)
21	GTP	Z	501	22	26,34,34	1.14	2 (7%)	32,54,54	1.61	8 (25%)

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
21	GTP	D	501	22	-	6/18/38/38	0/3/3/3
20	GDP	i	501	-	-	3/12/32/32	0/3/3/3
20	GDP	k	501	-	-	1/12/32/32	0/3/3/3
21	GTP	L	501	22	-	5/18/38/38	0/3/3/3
21	GTP	Т	501	22	-	4/18/38/38	0/3/3/3
21	GTP	j	501	22	-	4/18/38/38	0/3/3/3
21	GTP	Р	501	22	-	4/18/38/38	0/3/3/3
20	GDP	С	501	-	-	2/12/32/32	0/3/3/3
20	GDP	Ι	501	-	-	5/12/32/32	0/3/3/3
21	GTP	Х	501	22	-	5/18/38/38	0/3/3/3
20	GDP	У	502	-	-	4/12/32/32	0/3/3/3
20	GDP	W	501	-	-	7/12/32/32	0/3/3/3
21	GTP	J	501	22	-	9/18/38/38	0/3/3/3
21	GTP	Ζ	501	22	-	4/18/38/38	0/3/3/3
20	GDP	8	501	-	-	4/12/32/32	0/3/3/3
20	GDP	Q	501	-	-	7/12/32/32	0/3/3/3
21	GTP	Н	501	22	-	5/18/38/38	0/3/3/3
21	GTP	У	501	22	-	4/18/38/38	0/3/3/3



Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
21	GTP	9	501	22	-	6/18/38/38	0/3/3/3
20	GDP	К	501	-	-	4/12/32/32	0/3/3/3
23	ATP	u	401	-	-	4/18/38/38	0/3/3/3
21	GTP	7	501	22	-	4/18/38/38	0/3/3/3
21	GTP	R	501	22	-	6/18/38/38	0/3/3/3
20	GDP	Ο	501	-	-	3/12/32/32	0/3/3/3
20	GDP	G	501	-	-	5/12/32/32	0/3/3/3
20	GDP	6	501	-	-	3/12/32/32	0/3/3/3
20	GDP	Y	501	-	-	1/12/32/32	0/3/3/3
20	GDP	S	501	-	-	0/12/32/32	0/3/3/3
21	GTP	Z	501	22	-	8/18/38/38	0/3/3/3

Continued from previous page...

The worst 5 of 41 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
21	Х	501	GTP	C5-C6	-4.33	1.38	1.47
21	D	501	GTP	C5-C6	-4.31	1.38	1.47
21	у	501	GTP	C5-C6	-4.28	1.38	1.47
21	Р	501	GTP	C5-C6	-4.27	1.38	1.47
21	R	501	GTP	C5-C6	-4.25	1.38	1.47

The worst 5 of 163 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	$Observed(^{o})$	$Ideal(^{o})$
21	J	501	GTP	PA-O3A-PB	-4.53	117.28	132.83
20	8	501	GDP	PA-O3A-PB	-4.53	117.29	132.83
21	R	501	GTP	PA-O3A-PB	-4.49	117.41	132.83
21	9	501	GTP	PA-O3A-PB	-4.46	117.52	132.83
20	6	501	GDP	PA-O3A-PB	-4.44	117.61	132.83

There are no chirality outliers.

5	of	127	torsion	outliers	are	listed	below:
~	~ -						

Mol	Chain	Res	Type	Atoms
20	6	501	GDP	C5'-O5'-PA-O2A
20	8	501	GDP	C5'-O5'-PA-O3A
20	8	501	GDP	C5'-O5'-PA-O1A
20	С	501	GDP	C5'-O5'-PA-O3A
20	С	501	GDP	C5'-O5'-PA-O1A



There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



























































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 Map visualisation (i)

This section contains visualisations of the EMDB entry EMD-22481. These allow visual inspection of the internal detail of the map and identification of artifacts.

No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections (i)

6.1.1 Primary map



The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

6.2.1 Primary map



The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

6.3.1 Primary map



X Index: 339

Y Index: 341

Z Index: 493

The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) (i)

6.4.1 Primary map



The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.



6.5 Orthogonal surface views (i)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.018. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.



Mask visualisation (i) 6.6

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

$emd_{22481}msk_{2.map}$ (i) 6.6.1



emd 22481 msk 3.map (i) 6.6.2



Υ



6.6.3 emd_22481_msk_4.map (i)



$6.6.4 \quad \mathrm{emd}_22481_\mathrm{msk}_1.\mathrm{map}~(\mathrm{i})$





Y

Ζ



7 Map analysis (i)

This section contains the results of statistical analysis of the map.

7.1 Map-value distribution (i)



The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.



7.2 Volume estimate (i)



The volume at the recommended contour level is 2099 nm^3 ; this corresponds to an approximate mass of 1896 kDa.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.



7.3 Rotationally averaged power spectrum (i)



*Reported resolution corresponds to spatial frequency of 0.294 $\rm \AA^{-1}$



8 Fourier-Shell correlation (i)

This section was not generated. No FSC curve or half-maps provided.



9 Map-model fit (i)

This section contains information regarding the fit between EMDB map EMD-22481 and PDB model 7JU4. Per-residue inclusion information can be found in section 3 on page 15.

9.1 Map-model overlay (i)



The images above show the 3D surface view of the map at the recommended contour level 0.018 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.



9.2 Q-score mapped to coordinate model (i)



The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

9.3 Atom inclusion mapped to coordinate model (i)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.018).



9.4 Atom inclusion (i)



At the recommended contour level, 88% of all backbone atoms, 75% of all non-hydrogen atoms, are inside the map.



1.0

0.0 <0.0

9.5 Map-model fit summary (i)

The table lists the average atom inclusion at the recommended contour level (0.018) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7480	0.4310
0	0.5410	0.3280
1	0.6790	0.3800
2	0.6780	0.3860
3	0.9560	0.4160
4	0.5790	0.3550
6	0.7420	0.4630
7	0.7480	0.4560
8	0.7740	0.4700
9	0.7400	0.4460
A	0.6540	0.3750
В	0.6570	0.3750
C	0.6760	0.4300
D	0.7410	0.4660
E	0.8650	0.3800
F	0.8590	0.3670
G	0.7310	0.4520
H	0.7320	0.4540
I	0.7700	0.4590
J	0.7450	0.4560
K	0.7860	0.4650
	0.7710	0.4640
M	0.7960	0.3180
N	0.8730	0.3470
0	0.7970	0.4670
P	0.7880	0.4500
Q	0.7640	0.4640
R	0.7560	0.4540
S	0.7640	0.4510
	0.7310	0.4300
	0.7900	0.3230
	0.8940	0.3330
W	0.6210	0.4210
	0.6740	0.4510
Y	0.6880	0.4530



Continued from previous page...

Chain	Atom inclusion	Q-score
Z	0.6920	0.4540
a	0.9250	0.4470
b	0.9260	0.4580
с	0.8930	0.4580
d	0.9070	0.4780
е	0.9440	0.4800
f	0.9570	0.4840
g	0.9230	0.4330
h	0.9330	0.4500
i	0.7420	0.4600
j	0.7160	0.4490
k	0.7710	0.4640
1	0.8870	0.4600
m	0.8670	0.3880
n	0.8770	0.3060
0	0.8430	0.2920
р	0.7800	0.2620
q	0.7680	0.2610
r	0.7510	0.2900
S	0.6480	0.3910
t	0.7390	0.4610
u	0.7870	0.3610
V	0.7460	0.3090
W	0.7070	0.2910
X	0.6420	0.3750
У	0.7700	0.4650
Z	0.7630	0.4540

