



wwPDB EM Map/Model Validation Report ⓘ

Apr 10, 2016 – 01:46 PM BST

PDB ID : 2C7D
EMDB ID: : EMD-1181
Title : Fitted coordinates for GroEL-ADP7-GroES Cryo-EM complex (EMD-1181)
Authors : Ranson, N.A.; Clare, D.K.; Farr, G.W.; Houldershaw, D.; Horwich, A.L.;
Saibil, H.R.
Deposited on : 2005-11-22
Resolution : 8.70 Å(reported)
Based on PDB ID : 1AON

This is a wwPDB EM Map/Model Validation Report for a publicly released PDB/EMDB entry.
For rigid body fitted models, validation errors reported here could
stem from errors in the original structure(s) used in the fitting.

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

A user guide is available at

<http://wwpdb.org/validation/2016/EMValidationReportHelp>

MolProbity : 4.02b-467
Mogul : unknown
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : trunk27241

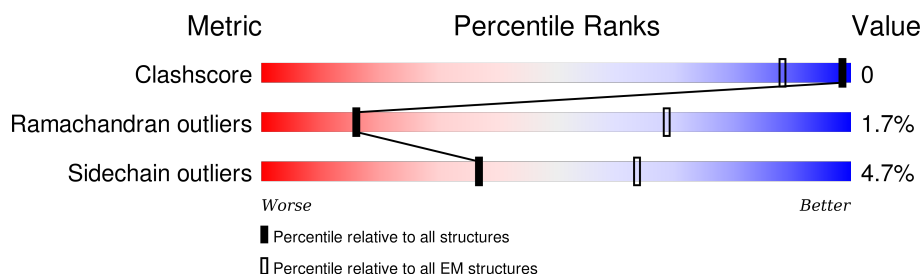
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 8.70 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)	EM structures (#Entries)
Clashscore	114402	924
Ramachandran outliers	111179	726
Sidechain outliers	111093	686

The table below summarises the geometric issues observed across the polymeric chains. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	547	91% 5% .
1	B	547	90% 6% .
1	C	547	92% . .
1	D	547	91% 5% .
1	E	547	90% 6% .
1	F	547	91% 5% .
1	G	547	91% . .
1	H	547	91% 5% .
1	I	547	91% . .

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Mol	Chain	Length	Quality of chain
1	J	547	 91% 5% .
1	K	547	 90% 6% .
1	L	547	 90% 5% . .
1	M	547	 91% 5% .
1	N	547	 90% 5% .
2	O	97	 82% 11% . .
2	P	97	 82% 12% . .
2	Q	97	 81% 13% . .
2	R	97	 80% 14% . .
2	S	97	 77% 18% . .
2	T	97	 81% 13% . .
2	U	97	 77% 16% . .

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 57946 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 60 KDA CHAPERONIN.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	525	Total	C	N	O	S	0	1
			3805	2397	622	766	20		
1	B	525	Total	C	N	O	S	0	1
			3805	2397	622	766	20		
1	C	525	Total	C	N	O	S	0	1
			3805	2397	622	766	20		
1	D	525	Total	C	N	O	S	0	1
			3805	2397	622	766	20		
1	E	525	Total	C	N	O	S	0	1
			3805	2397	622	766	20		
1	F	525	Total	C	N	O	S	0	1
			3805	2397	622	766	20		
1	G	525	Total	C	N	O	S	0	1
			3805	2397	622	766	20		
1	H	523	Total	C	N	O	S	0	1
			3793	2389	620	764	20		
1	I	523	Total	C	N	O	S	0	1
			3793	2389	620	764	20		
1	J	523	Total	C	N	O	S	0	1
			3793	2389	620	764	20		
1	K	523	Total	C	N	O	S	0	1
			3793	2389	620	764	20		
1	L	523	Total	C	N	O	S	0	1
			3793	2389	620	764	20		
1	M	523	Total	C	N	O	S	0	1
			3793	2389	620	764	20		
1	N	523	Total	C	N	O	S	0	1
			3793	2389	620	764	20		

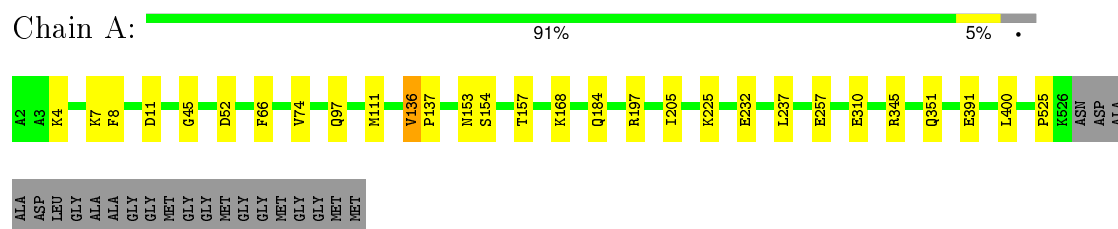
- Molecule 2 is a protein called 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	O	93	Total	C	N	O	S	0	1
			680	432	112	135	1		
2	P	93	Total	C	N	O	S	0	1
			680	432	112	135	1		
2	Q	93	Total	C	N	O	S	0	1
			680	432	112	135	1		
2	R	93	Total	C	N	O	S	0	1
			680	432	112	135	1		
2	S	93	Total	C	N	O	S	0	1
			680	432	112	135	1		
2	T	93	Total	C	N	O	S	0	1
			680	432	112	135	1		
2	U	93	Total	C	N	O	S	0	1
			680	432	112	135	1		

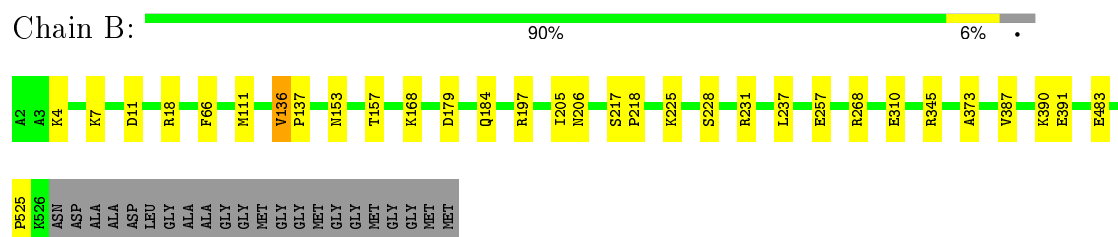
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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.

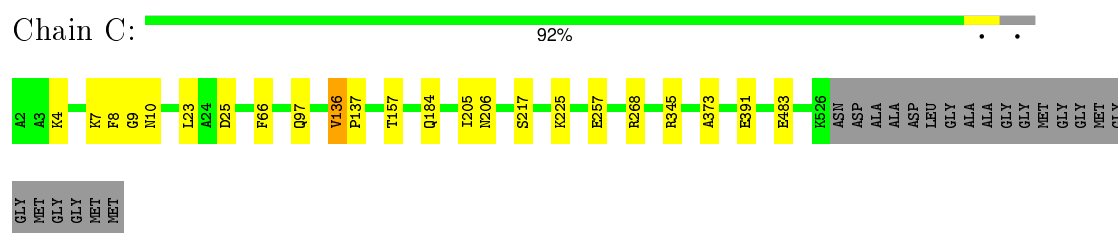
- Molecule 1: 60 KDA CHAPERONIN



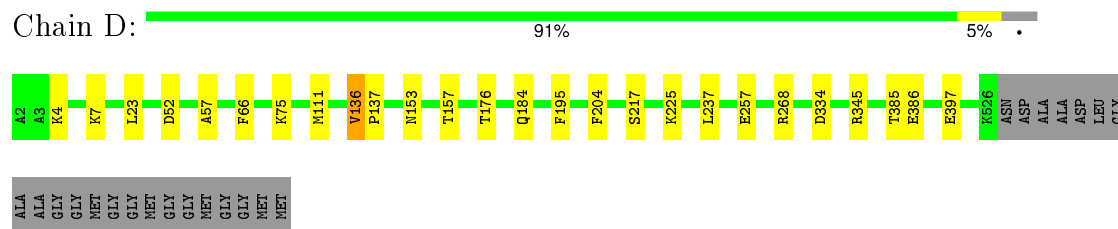
- Molecule 1: 60 KDA CHAPERONIN



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- Molecule 1: 60 KDA CHAPERONIN

- Molecule 1: 60 KDA CHAPERONIN

- Molecule 1: 60 KDA CHAPERONIN

- Molecule 2: 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN

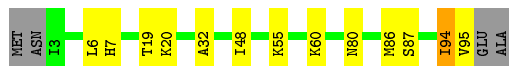
WORLDWIDE
PDB
PROTEIN DATA BANK

 **EMDataBank**
Unified Data Resource for 3DEM



- Molecule 2: 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN

Chain P: 82% 12% . .



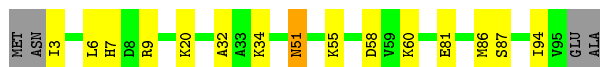
- Molecule 2: 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN

Chain Q: 81% 13% . .



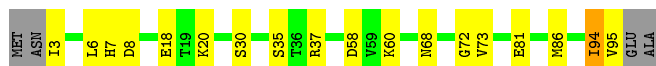
- Molecule 2: 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN

Chain R: 80% 14% . .



- Molecule 2: 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN

Chain S: 77% 18% . .



- Molecule 2: 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN

Chain T: 81% 13% . .



- Molecule 2: 10 KDA CHAPERONIN MOLECULE: GROES, PROTEIN CPN10, GROES PROTEIN

Chain U: 77% 16% . .



4 Experimental information

Property	Value	Source
Reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	Depositor
Number of images	Not provided	Depositor
Resolution determination method	Not provided	Depositor
CTF correction method	FULL CORRECTION ON 2D CLASS AVERAGES	Depositor
Microscope	FEI TECNAI F20	Depositor
Voltage (kV)	200	Depositor
Electron dose ($e^-/\text{\AA}^2$)	Not provided	Depositor
Minimum defocus (nm)	1400	Depositor
Maximum defocus (nm)	3300	Depositor
Magnification	50000	Depositor
Image detector	KODAK SO-163 FILM	Depositor

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 >2	RMSZ	# Z >2
1	A	0.60	0/3833	0.91	0/5165
1	B	0.60	0/3833	0.92	0/5165
1	C	0.60	0/3833	0.91	0/5165
1	D	0.60	0/3833	0.89	0/5165
1	E	0.60	0/3833	0.92	0/5165
1	F	0.59	0/3833	0.91	0/5165
1	G	0.60	0/3833	0.90	0/5165
1	H	0.60	0/3820	0.91	1/5146 (0.0%)
1	I	0.60	0/3820	0.92	0/5146
1	J	0.60	0/3820	0.90	0/5146
1	K	0.60	0/3820	0.91	0/5146
1	L	0.60	0/3820	0.92	0/5146
1	M	0.61	0/3820	0.91	0/5146
1	N	0.60	0/3820	0.92	2/5146 (0.0%)
2	O	0.64	0/684	0.99	1/918 (0.1%)
2	P	0.63	0/684	1.01	0/918
2	Q	0.64	0/684	1.01	1/918 (0.1%)
2	R	0.64	0/684	1.03	0/918
2	S	0.63	0/684	1.02	0/918
2	T	0.62	0/684	1.04	1/918 (0.1%)
2	U	0.63	0/684	1.00	0/918
All	All	0.60	0/58359	0.92	6/78603 (0.0%)

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 outliers	#Planarity outliers
1	A	2	3
1	B	2	3
1	C	2	3
1	D	2	3

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Mol	Chain	#Chirality outliers	#Planarity outliers
1	E	2	3
1	F	2	3
1	G	2	5
1	J	0	1
1	K	0	1
1	L	0	4
1	N	0	3
2	P	0	1
2	T	0	1
2	U	0	1
All	All	14	35

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	T	50	GLU	C-N-CA	5.40	135.21	121.70
1	N	186	GLU	OE1-CD-OE2	-5.34	116.89	123.30
1	H	404	ARG	CD-NE-CZ	5.18	130.86	123.60
1	N	506	TYR	CB-CG-CD2	-5.05	117.97	121.00
2	O	79	ASP	C-N-CA	5.05	134.32	121.70

5 of 14 chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	136	VAL	CA
1	A	137	PRO	CA
1	B	136	VAL	CA
1	B	137	PRO	CA
1	C	136	VAL	CA

5 of 35 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	136	VAL	Peptide
1	A	4	LYS	Peptide
1	A	8	PHE	Peptide
1	B	136	VAL	Peptide
1	B	4	LYS	Peptide

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	3805	0	3881	1	0
1	B	3805	0	3881	2	0
1	C	3805	0	3881	1	0
1	D	3805	0	3881	3	0
1	E	3805	0	3881	3	0
1	F	3805	0	3881	2	0
1	G	3805	0	3881	3	0
1	H	3793	0	3869	2	0
1	I	3793	0	3869	1	0
1	J	3793	0	3869	1	0
1	K	3793	0	3869	3	0
1	L	3793	0	3869	2	0
1	M	3793	0	3869	2	0
1	N	3793	0	3869	1	0
2	O	680	0	703	2	0
2	P	680	0	703	1	0
2	Q	680	0	703	1	0
2	R	680	0	703	3	0
2	S	680	0	703	3	0
2	T	680	0	703	3	0
2	U	680	0	703	2	0
All	All	57946	0	59171	33	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 0.

The worst 5 of 33 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:J:314:LEU:H	1:J:314:LEU:HD12	1.69	0.56
2:R:3:ILE:HA	2:S:95:VAL:N	2.23	0.53
1:D:385:THR:HG21	1:E:510:VAL:HG23	1.92	0.52
1:E:7:LYS:HE2	1:E:66:PHE:CE2	2.45	0.52
1:B:387:VAL:HA	1:B:390:LYS:HE3	1.91	0.52

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	Percentiles	
1	A	523/547 (96%)	488 (93%)	28 (5%)	7 (1%)	15	60
1	B	523/547 (96%)	490 (94%)	25 (5%)	8 (2%)	13	57
1	C	523/547 (96%)	486 (93%)	30 (6%)	7 (1%)	15	60
1	D	523/547 (96%)	491 (94%)	28 (5%)	4 (1%)	24	69
1	E	523/547 (96%)	483 (92%)	32 (6%)	8 (2%)	13	57
1	F	523/547 (96%)	485 (93%)	30 (6%)	8 (2%)	13	57
1	G	523/547 (96%)	488 (93%)	31 (6%)	4 (1%)	24	69
1	H	521/547 (95%)	476 (91%)	38 (7%)	7 (1%)	15	60
1	I	521/547 (95%)	486 (93%)	29 (6%)	6 (1%)	16	61
1	J	521/547 (95%)	489 (94%)	23 (4%)	9 (2%)	11	55
1	K	521/547 (95%)	477 (92%)	33 (6%)	11 (2%)	9	50
1	L	521/547 (95%)	473 (91%)	39 (8%)	9 (2%)	11	55
1	M	521/547 (95%)	486 (93%)	29 (6%)	6 (1%)	16	61
1	N	521/547 (95%)	478 (92%)	36 (7%)	7 (1%)	15	60
2	O	91/97 (94%)	65 (71%)	21 (23%)	5 (6%)	2	29
2	P	91/97 (94%)	70 (77%)	16 (18%)	5 (6%)	2	29
2	Q	91/97 (94%)	70 (77%)	16 (18%)	5 (6%)	2	29
2	R	91/97 (94%)	70 (77%)	18 (20%)	3 (3%)	5	40
2	S	91/97 (94%)	70 (77%)	15 (16%)	6 (7%)	1	24
2	T	91/97 (94%)	71 (78%)	15 (16%)	5 (6%)	2	29
2	U	91/97 (94%)	70 (77%)	15 (16%)	6 (7%)	1	24
All	All	7945/8337 (95%)	7262 (91%)	547 (7%)	136 (2%)	16	55

5 of 136 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	137	PRO
1	B	137	PRO
1	C	137	PRO
1	C	483	GLU
1	D	137	PRO

5.3.2 Protein sidechains ⓘ

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 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	Percentiles	
1	A	404/414 (98%)	386 (96%)	18 (4%)	34	69
1	B	404/414 (98%)	386 (96%)	18 (4%)	34	69
1	C	404/414 (98%)	392 (97%)	12 (3%)	48	77
1	D	404/414 (98%)	389 (96%)	15 (4%)	41	73
1	E	404/414 (98%)	383 (95%)	21 (5%)	29	65
1	F	404/414 (98%)	390 (96%)	14 (4%)	43	74
1	G	404/414 (98%)	391 (97%)	13 (3%)	46	76
1	H	403/414 (97%)	387 (96%)	16 (4%)	38	71
1	I	403/414 (97%)	387 (96%)	16 (4%)	38	71
1	J	403/414 (97%)	387 (96%)	16 (4%)	38	71
1	K	403/414 (97%)	386 (96%)	17 (4%)	36	70
1	L	403/414 (97%)	385 (96%)	18 (4%)	34	69
1	M	403/414 (97%)	385 (96%)	18 (4%)	34	69
1	N	403/414 (97%)	384 (95%)	19 (5%)	32	68
2	O	76/80 (95%)	69 (91%)	7 (9%)	11	43
2	P	76/80 (95%)	69 (91%)	7 (9%)	11	43
2	Q	76/80 (95%)	68 (90%)	8 (10%)	8	36
2	R	76/80 (95%)	65 (86%)	11 (14%)	4	24
2	S	76/80 (95%)	66 (87%)	10 (13%)	5	28

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	T	76/80 (95%)	70 (92%)	6 (8%)	15	51
2	U	76/80 (95%)	65 (86%)	11 (14%)	4	24
All	All	6181/6356 (97%)	5890 (95%)	291 (5%)	37	68

5 of 291 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	I	132	LYS
1	K	97	GLN
2	S	58	ASP
1	I	233	MET
1	J	111	MET

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	184	GLN
1	I	194	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 carbohydrates 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.