wwPDB X-ray Structure Validation Summary Report (i)

Feb 5, 2024 – 10:30 PM EST

PDB ID	:	1ZS4
Title	:	Structure of bacteriophage lambda cII protein in complex with DNA
Authors	:	Jain, D.; Kim, Y.; Maxwell, K.L.; Beasley, S.; Gussin, G.N.; Edwards, A.M.; Darst, S.A.
Deposited on	:	2005-05-23
Resolution	:	1.70 Å(reported)

This is a wwPDB X-ray Structure 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/XrayValidationReportHelp
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:

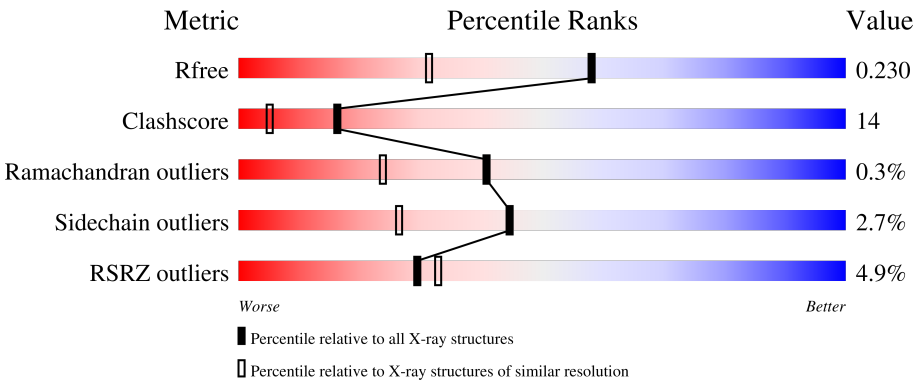
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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 <=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	U	27	7%, 59%, 37%, •
2	T	27	4%, 26%, 67%, 7%
3	A	83	2%, 89%, 7%, • •
3	B	83	5%, 76%, 19%, • •
3	C	83	7%, 77%, 16%, • 5%

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Mol	Chain	Length	Quality of chain
3	D	83	4% 77% 11% 12%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 4012 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 DNA chain called DNA - 27mer.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	U	27	547	264	90	167	26	17	0	0

- Molecule 2 is a DNA chain called DNA - 27mer.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	T	27	553	264	108	155	26	0	0	0

- Molecule 3 is a protein called Regulatory protein CII.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	A	82	642	404	118	116	4	0	0	0
3	B	82	642	404	118	116	4	0	0	0
3	C	79	631	398	117	113	3	0	3	0
3	D	73	580	367	106	104	3	0	1	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	GLY	-	cloning artifact	UNP P03042
A	1	SER	-	cloning artifact	UNP P03042
A	2	HIS	-	cloning artifact	UNP P03042
A	3	MET	-	cloning artifact	UNP P03042
B	0	GLY	-	cloning artifact	UNP P03042
B	1	SER	-	cloning artifact	UNP P03042
B	2	HIS	-	cloning artifact	UNP P03042
B	3	MET	-	cloning artifact	UNP P03042

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Chain	Residue	Modelled	Actual	Comment	Reference
C	0	GLY	-	cloning artifact	UNP P03042
C	1	SER	-	cloning artifact	UNP P03042
C	2	HIS	-	cloning artifact	UNP P03042
C	3	MET	-	cloning artifact	UNP P03042
D	0	GLY	-	cloning artifact	UNP P03042
D	1	SER	-	cloning artifact	UNP P03042
D	2	HIS	-	cloning artifact	UNP P03042
D	3	MET	-	cloning artifact	UNP P03042

- Molecule 4 is water.

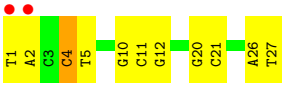
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	U	75	75	75	0	0
			Total	O		
4	T	90	90	90	0	0
			Total	O		
4	A	69	69	69	0	0
			Total	O		
4	B	61	61	61	0	0
			Total	O		
4	C	71	71	71	0	0
			Total	O		
4	D	51	51	51	0	0

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: DNA - 27mer

Chain U:

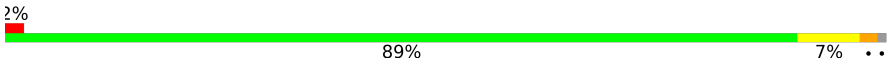


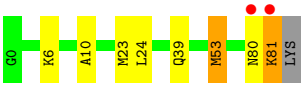
• Molecule 2: DNA - 27mer

Chain T:

• Molecule 3: Regulatory protein CII

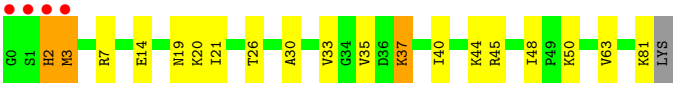
Chain A:





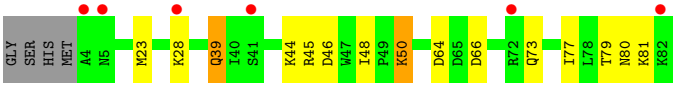
• Molecule 3: Regulatory protein CII

Chain B:



• Molecule 3: Regulatory protein CII

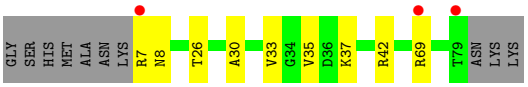
Chain C:



• Molecule 3: Regulatory protein CII

Chain D:

4%
77%
11%
12%


GLY
SER
HIS
MET
ALA
ASN
LYS
R7
N8
T26
A30
V33
G34
V35
D36
K37
R42
R69
T79
ASN
LYS
LYS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	44.77Å 97.13Å 59.87Å 90.00° 105.36° 90.00°	Depositor
Resolution (Å)	50.00 – 1.70 30.89 – 1.70	Depositor EDS
% Data completeness (in resolution range)	(Not available) (50.00-1.70) 94.8 (30.89-1.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	2.15 (at 1.70Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.209 , 0.228 0.214 , 0.230	Depositor DCC
R_{free} test set	2745 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å^2)	16.2	Xtriage
Anisotropy	0.113	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 51.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	4012	wwPDB-VP
Average B, all atoms (Å^2)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.31% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\|>5$	RMSZ	$\#\|Z\|>5$
1	U	0.50	0/610	0.90	0/940
2	T	0.58	0/622	0.95	1/958 (0.1%)
3	A	0.43	0/650	0.62	0/874
3	B	0.40	0/650	0.65	0/874
3	C	0.42	0/656	0.65	0/880
3	D	0.45	0/593	0.59	0/799
All	All	0.47	0/3781	0.75	1/5325 (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	U	0	1
2	T	1	2
All	All	1	3

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	T	17	DC	C5'-C4'-O4'	-5.73	98.42	109.30

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	T	27	DT	C3'

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	T	16	DA	Sidechain
2	T	27	DT	Sidechain
1	U	4	DC	Sidechain

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	U	547	0	310	17	0
2	T	553	0	304	36	0
3	A	642	0	671	9	0
3	B	642	0	671	20	0
3	C	631	0	664	14	0
3	D	580	0	606	7	0
4	A	69	0	0	1	0
4	B	61	0	0	3	0
4	C	71	0	0	2	0
4	D	51	0	0	2	0
4	T	90	0	0	4	0
4	U	75	0	0	1	0
All	All	4012	0	3226	98	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 14.

The worst 5 of 98 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)
3:A:10:ALA:HB2	3:A:53:MET:HE2	1.37	1.06
3:A:23:MET:HG3	4:A:98:HOH:O	1.59	1.00
3:A:10:ALA:HB2	3:A:53:MET:CE	1.90	1.00
1:U:4:DC:H2"	1:U:5:DT:H5'	1.55	0.88
1:U:1:DT:H2"	1:U:2:DA:OP1	1.77	0.85

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	A	80/83 (96%)	80 (100%)	0	0	100	100
3	B	80/83 (96%)	77 (96%)	2 (2%)	1 (1%)	12	2
3	C	80/83 (96%)	80 (100%)	0	0	100	100
3	D	72/83 (87%)	72 (100%)	0	0	100	100
All	All	312/332 (94%)	309 (99%)	2 (1%)	1 (0%)	41	24

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	B	2	HIS

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	
3	A	67/68 (98%)	64 (96%)	3 (4%)	27	10
3	B	67/68 (98%)	65 (97%)	2 (3%)	41	22
3	C	68/68 (100%)	66 (97%)	2 (3%)	42	23
3	D	61/68 (90%)	61 (100%)	0	100	100
All	All	263/272 (97%)	256 (97%)	7 (3%)	44	26

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	B	3	MET
3	B	37	LYS
3	C	50	LYS
3	C	39	GLN
3	A	81	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
3	C	39	GLN
3	C	73	GLN
3	C	80	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)

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	U	27/27 (100%)	0.26	2 (7%)	14	16	14, 21, 26, 52	2 (7%)
2	T	27/27 (100%)	0.15	1 (3%)	41	46	12, 21, 36, 54	0
3	A	82/83 (98%)	-0.04	2 (2%)	59	63	8, 14, 26, 53	0
3	B	82/83 (98%)	0.39	4 (4%)	29	33	12, 20, 34, 48	0
3	C	79/83 (95%)	0.25	6 (7%)	13	16	9, 15, 33, 45	3 (3%)
3	D	73/83 (87%)	0.20	3 (4%)	37	41	9, 16, 26, 42	1 (1%)
All	All	370/386 (95%)	0.20	18 (4%)	29	33	8, 17, 33, 54	6 (1%)

The worst 5 of 18 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	U	1	DT	12.2
3	C	4	ALA	9.1
3	B	0	GLY	8.6
3	A	81	LYS	7.0
3	B	1	SER	6.1

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 monosaccharides 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.