



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 19, 2016 – 11:25 PM GMT

PDB ID : 5DLJ  
Title : Crystal Structure of Cas-DNA-N1 complex  
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Deposited on : 2015-09-05  
Resolution : 2.60 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](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : unknown  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026982  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20026982

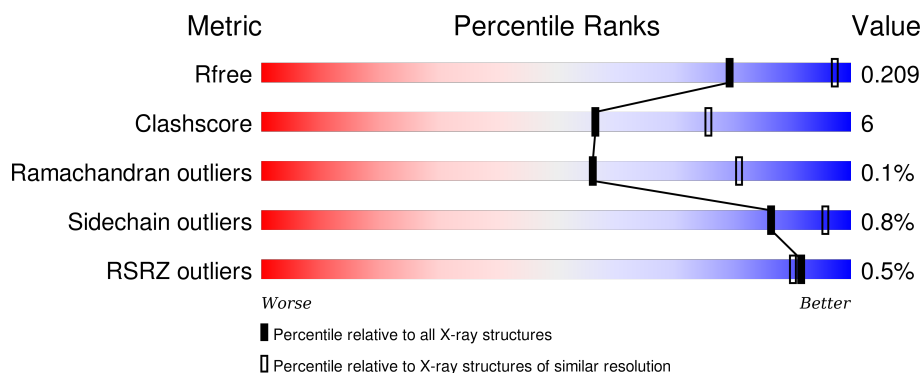
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*


The reported resolution of this entry is 2.60 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))
$R_{free}$	91344	2328 (2.60-2.60)
Clashscore	102246	2679 (2.60-2.60)
Ramachandran outliers	100387	2635 (2.60-2.60)
Sidechain outliers	100360	2635 (2.60-2.60)
RSRZ outliers	91569	2334 (2.60-2.60)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	280	 86% 9% 5%
1	B	280	 83% 16%
1	C	280	 83% 17%
1	D	280	 84% 11% 5%
2	G	39	 5% 67% 28% 5%

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Mol	Chain	Length	Quality of chain
3	H	39	<div><div></div><div>5%</div><div>69%</div><div>31%</div></div>
4	E	78	<div><div></div><div>%</div><div>86%</div><div>14%</div></div>
4	F	78	<div><div></div><div>77%</div><div>23%</div></div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 11444 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called CRISPR-associated endonuclease Cas1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	D	267	Total	C	N	O	S	0	0	0
			2052	1311	364	370	7			
1	C	280	Total	C	N	O	S	0	0	0
			2162	1385	383	387	7			
1	A	267	Total	C	N	O	S	0	0	0
			2052	1311	364	370	7			
1	B	280	Total	C	N	O	S	0	0	0
			2162	1385	383	387	7			

- Molecule 2 is a DNA chain called 39-mer DNA N1-F.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	G	39	Total	C	N	O	P	0	0	0
			790	383	121	248	38			

- Molecule 3 is a DNA chain called 39-mer DNA N1-R.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	H	39	Total	C	N	O	P	0	0	0
			787	382	119	248	38			

- Molecule 4 is a protein called CRISPR-associated endoribonuclease Cas2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	F	78	Total	C	N	O	S	0	0	0
			617	394	109	110	4			
4	E	78	Total	C	N	O	S	0	0	0
			617	394	109	110	4			


- Molecule 5 is water.

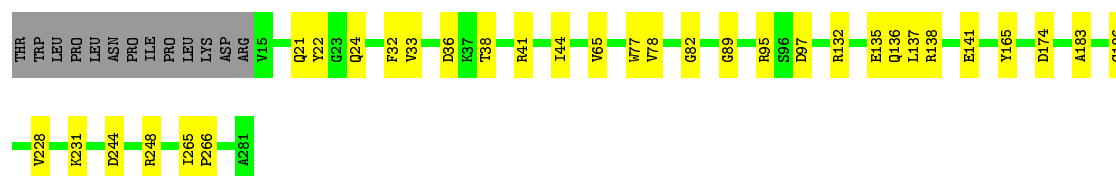
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	D	2	Total 2	O 2	0	0
5	C	30	Total 30	O 30	0	0
5	A	53	Total 53	O 53	0	0
5	B	64	Total 64	O 64	0	0
5	G	15	Total 15	O 15	0	0
5	H	18	Total 18	O 18	0	0
5	F	16	Total 16	O 16	0	0
5	E	7	Total 7	O 7	0	0

### 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 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.

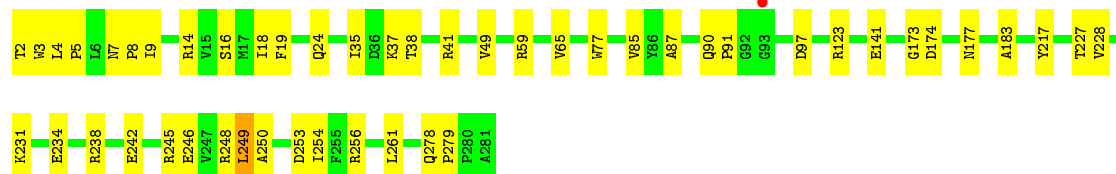
- Molecule 1: CRISPR-associated endonuclease Cas1

Chain D: 




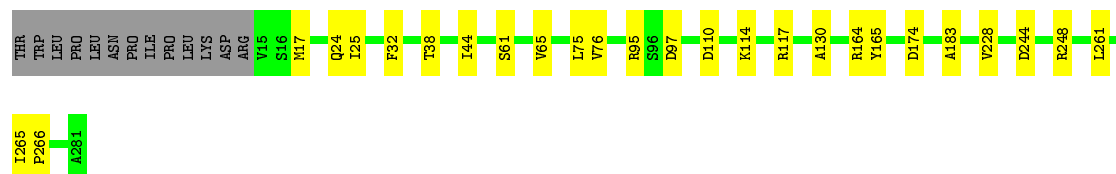
- Molecule 1: CRISPR-associated endonuclease Cas1

Chain C: 




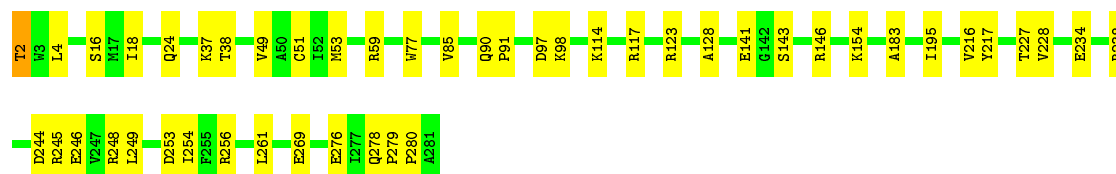
- Molecule 1: CRISPR-associated endonuclease Cas1

Chain A: 

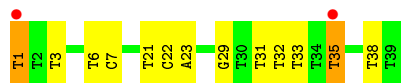


- Molecule 1: CRISPR-associated endonuclease Cas1

Chain B: 



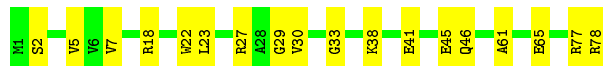
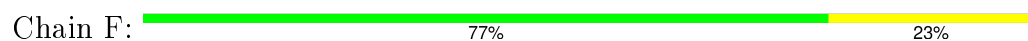
- Molecule 2: 39-mer DNA N1-F



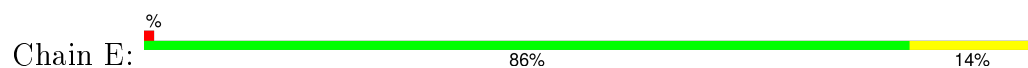
- Molecule 3: 39-mer DNA N1-R



- Molecule 4: CRISPR-associated endoribonuclease Cas2



- Molecule 4: CRISPR-associated endoribonuclease Cas2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	69.89Å 193.65Å 193.92Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.84 – 2.60 48.93 – 2.60	Depositor EDS
% Data completeness (in resolution range)	89.1 (39.84-2.60) 89.0 (48.93-2.60)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.99 (at 2.61Å)	Xtriage
Refinement program	PHENIX	Depositor
R, $R_{free}$	0.179 , 0.207 0.182 , 0.209	Depositor DCC
$R_{free}$ test set	3596 reflections (4.92%)	DCC
Wilson B-factor (Å <sup>2</sup> )	38.3	Xtriage
Anisotropy	0.161	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 20.6	EDS
Estimated twinning fraction	0.477 for -h,l,k	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 73158 reflections	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	11444	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.40% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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	A	0.35	0/2092	0.55	0/2837
1	B	0.37	0/2207	0.54	0/2997
1	C	0.39	0/2207	0.59	1/2997 (0.0%)
1	D	0.41	0/2092	0.59	0/2837
2	G	0.69	0/879	1.08	2/1356 (0.1%)
3	H	0.67	0/875	1.05	0/1349
4	E	0.33	0/628	0.50	0/851
4	F	0.40	0/628	0.55	0/851
All	All	0.44	0/11608	0.68	3/16075 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	G	35	DT	O4'-C4'-C3'	-5.76	102.20	104.50
1	C	248	ARG	NE-CZ-NH1	-5.38	117.61	120.30
2	G	1	DT	N3-C4-O4	5.18	123.01	119.90

There are no chirality outliers.

There are no planarity outliers.

### 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	A	2052	0	2106	23	0
1	B	2162	0	2224	28	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	2162	0	2224	31	3
1	D	2052	0	2106	24	1
2	G	790	0	451	14	2
3	H	787	0	451	11	1
4	E	617	0	626	12	0
4	F	617	0	626	16	0
5	A	53	0	0	6	0
5	B	64	0	0	6	0
5	C	30	0	0	2	0
5	D	2	0	0	0	0
5	E	7	0	0	0	0
5	F	16	0	0	1	0
5	G	15	0	0	1	0
5	H	18	0	0	0	0
All	All	11444	0	10814	134	4

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 6.

The worst 5 of 134 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:2:THR:CG2	5:B:363:HOH:O	1.84	1.22
4:F:5:VAL:HG21	4:E:5:VAL:HG21	1.38	1.06
1:B:2:THR:HG21	5:B:363:HOH:O	1.51	0.95
1:A:25:ILE:O	5:A:301:HOH:O	1.95	0.84
1:C:238:ARG:NH1	1:C:246:GLU:OE2	2.17	0.78

All (4) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:132:ARG:NH1	1:C:173:GLY:O[1_455]	1.94	0.26
1:C:217:TYR:OH	2:G:3:DT:OP1[3_445]	2.16	0.04
1:B:217:TYR:OH	3:H:3:DT:OP1[2_344]	2.18	0.02
1:C:37:LYS:NZ	2:G:38:DT:O4[1_655]	2.18	0.02

## 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	
1	A	265/280 (95%)	262 (99%)	3 (1%)	0	100	100
1	B	278/280 (99%)	272 (98%)	5 (2%)	1 (0%)	39	65
1	C	278/280 (99%)	271 (98%)	7 (2%)	0	100	100
1	D	265/280 (95%)	261 (98%)	4 (2%)	0	100	100
4	E	76/78 (97%)	74 (97%)	2 (3%)	0	100	100
4	F	76/78 (97%)	74 (97%)	2 (3%)	0	100	100
All	All	1238/1276 (97%)	1214 (98%)	23 (2%)	1 (0%)	56	81

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	280	PRO

### 5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	212/225 (94%)	212 (100%)	0	100	100
1	B	225/225 (100%)	222 (99%)	3 (1%)	76	91
1	C	225/225 (100%)	222 (99%)	3 (1%)	76	91
1	D	212/225 (94%)	210 (99%)	2 (1%)	84	95
4	E	64/64 (100%)	64 (100%)	0	100	100
4	F	64/64 (100%)	64 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1002/1028 (98%)	994 (99%)	8 (1%)	86 95

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	242	GLU
1	B	154	LYS
1	B	2	THR
1	C	85	VAL
1	C	249	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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 ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

## 6 Fit of model and data ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	267/280 (95%)	-0.27	0 100 100	17, 42, 75, 102	0
1	B	280/280 (100%)	-0.21	0 100 100	19, 41, 78, 116	0
1	C	280/280 (100%)	-0.18	1 (0%) 93 91	18, 40, 74, 101	0
1	D	267/280 (95%)	-0.25	0 100 100	17, 40, 76, 98	0
2	G	39/39 (100%)	-0.21	2 (5%) 32 25	30, 61, 129, 141	0
3	H	39/39 (100%)	-0.20	2 (5%) 32 25	28, 61, 133, 148	0
4	E	78/78 (100%)	-0.19	1 (1%) 79 75	24, 43, 84, 109	0
4	F	78/78 (100%)	-0.15	0 100 100	24, 42, 80, 107	0
All	All	1328/1354 (98%)	-0.22	6 (0%) 91 90	17, 42, 80, 148	0

The worst 5 of 6 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	G	1	DT	3.2
3	H	35	DT	3.1
3	H	1	DT	3.0
4	E	77	ARG	2.5
2	G	35	DT	2.5

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands

There are no ligands in this entry.

## 6.5 Other polymers

There are no such residues in this entry.