Full wwPDB X-ray Structure Validation Report (i)

May 24, 2020 – 10:22 pm BST

PDB ID	:	1F9F
Title	:	CRYSTAL STRUCTURE OF THE HPV-18 E2 DNA-BINDING DOMAIN
Authors	:	Kim, S.S.; Tam, J.; Wang, A.F.; Hegde, R.
Deposited on	:	2000-07-10
Resolution	:	1.90 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 following versions of software and data (see references (i)) were used in the production of this report:

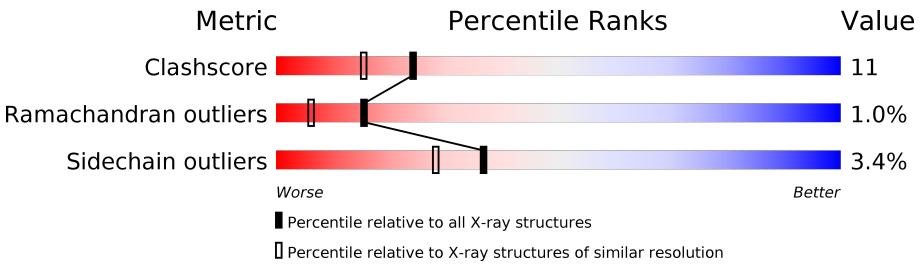
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 1.90 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))
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)

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 >=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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	83	63% 25% • 8%
1	B	83	72% 17% • 7%
1	C	83	69% 19% • 8%
1	D	83	75% 22% • •

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 2560 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.

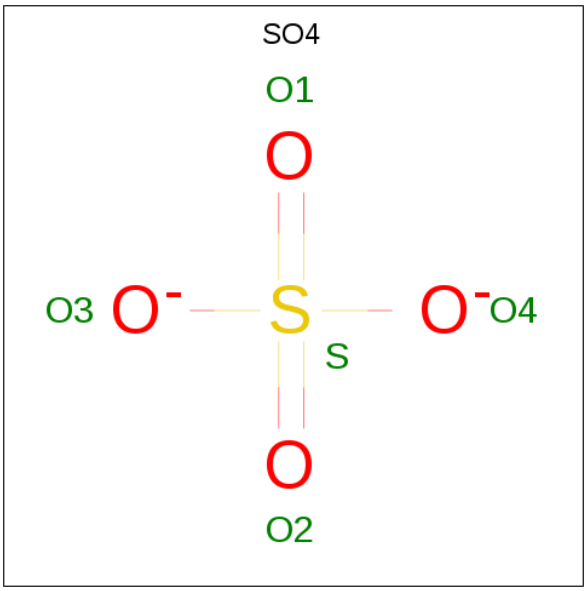
- Molecule 1 is a protein called Regulatory protein E2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	76	605	380	112	109	4	0	0	0
1	B	77	592	375	106	108	3	0	0	0
1	C	76	597	377	108	108	4	0	0	0
1	D	82	657	413	121	119	4	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	283	GLY	-	expression tag	UNP P06790
A	284	SER	-	expression tag	UNP P06790
A	285	HIS	-	expression tag	UNP P06790
A	286	MET	-	expression tag	UNP P06790
B	283	GLY	-	expression tag	UNP P06790
B	284	SER	-	expression tag	UNP P06790
B	285	HIS	-	expression tag	UNP P06790
B	286	MET	-	expression tag	UNP P06790
C	283	GLY	-	expression tag	UNP P06790
C	284	SER	-	expression tag	UNP P06790
C	285	HIS	-	expression tag	UNP P06790
C	286	MET	-	expression tag	UNP P06790
D	283	GLY	-	expression tag	UNP P06790
D	284	SER	-	expression tag	UNP P06790
D	285	HIS	-	expression tag	UNP P06790
D	286	MET	-	expression tag	UNP P06790

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	C	1	Total O S 5 4 1	0	0
2	D	1	Total O S 5 4 1	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	21	Total O 21 21	0	0
3	B	12	Total O 12 12	0	0
3	C	23	Total O 23 23	0	0
3	D	43	Total O 43 43	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 the various outlier classes 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.

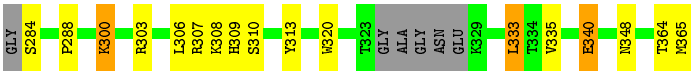
Note EDS was not executed.

- Molecule 1: Regulatory protein E2

Chain A:

- Molecule 1: Regulatory protein E2

Chain B:

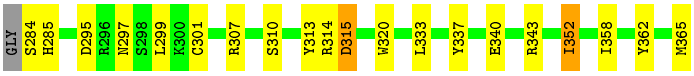


- Molecule 1: Regulatory protein E2

Chain C:

- Molecule 1: Regulatory protein E2

Chain D:



4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	41.50Å 46.80Å 161.06Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.52 – 1.90	Depositor
% Data completeness (in resolution range)	94.3 (30.52-1.90)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.237 , 0.294	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2560	wwPDB-VP
Average B, all atoms (Å^2)	29.0	wwPDB-VP

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: SO4

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	1.23	2/619 (0.3%)	1.17	1/836 (0.1%)
1	B	1.12	1/604 (0.2%)	1.11	1/819 (0.1%)
1	C	1.27	0/609	1.26	7/824 (0.8%)
1	D	1.38	3/672 (0.4%)	1.25	5/909 (0.6%)
All	All	1.26	6/2504 (0.2%)	1.20	14/3388 (0.4%)

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	C	0	1

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	335	VAL	CB-CG1	6.26	1.66	1.52
1	D	337	TYR	CZ-OH	6.17	1.48	1.37
1	A	337	TYR	CE1-CZ	6.04	1.46	1.38
1	D	320	TRP	CE3-CZ3	5.78	1.48	1.38
1	D	337	TYR	CD1-CE1	5.53	1.47	1.39
1	A	343	ARG	CZ-NH2	5.33	1.40	1.33

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	315	ASP	CB-CG-OD2	-9.91	109.38	118.30
1	C	311	ASP	CA-C-N	-7.11	101.57	117.20
1	D	314	ARG	NE-CZ-NH1	-7.08	116.76	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	333	LEU	CA-CB-CG	6.82	130.98	115.30
1	A	296	ARG	NE-CZ-NH1	-6.62	116.99	120.30
1	D	333	LEU	CA-CB-CG	6.61	130.50	115.30
1	D	315	ASP	CB-CG-OD1	6.58	124.22	118.30
1	C	314	ARG	NE-CZ-NH1	6.35	123.47	120.30
1	C	315	ASP	CB-CG-OD1	5.72	123.45	118.30
1	C	312	HIS	N-CA-C	-5.42	96.35	111.00
1	C	286	MET	CG-SD-CE	5.39	108.82	100.20
1	B	333	LEU	CA-CB-CG	5.36	127.63	115.30
1	D	343	ARG	NE-CZ-NH1	-5.18	117.71	120.30
1	C	365	MET	CA-CB-CG	5.08	121.93	113.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	362	TYR	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	A	605	0	582	20	0
1	B	592	0	559	12	0
1	C	597	0	583	12	0
1	D	657	0	648	11	0
2	C	5	0	0	0	0
2	D	5	0	0	0	0
3	A	21	0	0	2	0
3	B	12	0	0	0	0
3	C	23	0	0	2	0
3	D	43	0	0	0	0
All	All	2560	0	2372	53	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 11.

All (53) 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:62:HOH:O	1:D:301:CYS:HB2	1.26	1.28
1:A:357:GLN:NE2	1:A:359:LEU:HD21	1.62	1.11
1:B:310:SER:HA	1:B:313:TYR:CE2	1.93	1.03
1:D:352:ILE:HG12	1:D:358:ILE:HD11	1.41	0.97
1:D:340:GLU:OE2	1:D:362:TYR:OH	1.91	0.89
1:C:332:ILE:HG22	3:C:99:HOH:O	1.73	0.86
1:A:303:ARG:NH2	1:A:319:THR:H	1.75	0.84
1:C:309:HIS:O	1:C:310:SER:O	1.99	0.80
1:A:303:ARG:HH21	1:A:318:SER:HA	1.55	0.72
1:A:296:ARG:O	1:A:300:LYS:HG3	1.91	0.70
1:A:357:GLN:HE21	1:A:359:LEU:HD21	1.60	0.66
1:A:295:ASP:HB3	1:A:298:SER:OG	1.97	0.65
1:D:352:ILE:CG1	1:D:358:ILE:HD11	2.23	0.64
1:B:303:ARG:HB2	1:B:333:LEU:HD21	1.80	0.63
1:A:316:ILE:HD11	1:A:333:LEU:HD22	1.81	0.62
1:B:310:SER:HA	1:B:313:TYR:CZ	2.33	0.61
1:A:334:THR:HG21	1:A:363:MET:HE1	1.84	0.60
1:B:300:LYS:HE3	1:B:300:LYS:C	2.23	0.59
1:A:303:ARG:HH21	1:A:318:SER:CA	2.16	0.58
1:A:303:ARG:NH2	1:A:319:THR:N	2.49	0.57
1:A:293:LYS:HG2	1:A:332:ILE:HG12	1.88	0.56
1:B:364:THR:O	1:B:365:MET:HB3	2.06	0.56
1:D:295:ASP:OD2	1:D:297:ASN:HB2	2.06	0.55
1:B:306:LEU:O	1:B:308:LYS:N	2.41	0.54
1:A:315:ASP:OD1	3:A:80:HOH:O	2.19	0.53
1:A:352:ILE:HD12	1:A:358:ILE:HD13	1.91	0.53
1:B:288:PRO:HG3	1:B:340:GLU:OE1	2.10	0.52
1:C:332:ILE:CG2	3:C:99:HOH:O	2.47	0.51
1:C:314:ARG:HH21	1:C:338:HIS:CB	2.24	0.50
1:A:357:GLN:NE2	1:A:359:LEU:CD2	2.55	0.50
1:B:306:LEU:C	1:B:308:LYS:N	2.65	0.50
1:D:310:SER:HA	1:D:313:TYR:CE2	2.46	0.50
1:A:334:THR:HG21	1:A:363:MET:CE	2.42	0.49
1:C:359:LEU:HD22	1:C:359:LEU:N	2.29	0.48
1:B:300:LYS:HE3	1:B:300:LYS:O	2.15	0.47
1:C:314:ARG:HH21	1:C:338:HIS:HB2	1.79	0.46
1:D:299:LEU:HD23	1:D:299:LEU:HA	1.82	0.46
1:C:289:ILE:HG22	1:C:336:THR:HG22	1.98	0.45
1:A:303:ARG:HH22	1:A:319:THR:H	1.59	0.45
1:C:284:SER:HA	1:C:365:MET:OXT	2.17	0.44
1:D:284:SER:OG	1:D:285:HIS:N	2.51	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:306:LEU:C	1:B:308:LYS:H	2.21	0.44
1:A:352:ILE:HD12	1:A:358:ILE:CD1	2.48	0.44
1:C:309:HIS:O	1:C:310:SER:C	2.56	0.44
1:A:293:LYS:HB2	1:A:357:GLN:HG3	2.00	0.43
1:A:289:ILE:HG21	1:A:363:MET:HE3	2.01	0.43
1:C:293:LYS:HG2	1:C:332:ILE:HG12	2.02	0.42
1:C:323:THR:HG21	1:D:307:ARG:NE	2.34	0.41
1:D:284:SER:OG	1:D:365:MET:O	2.34	0.41
1:B:284:SER:HA	1:B:365:MET:OXT	2.21	0.41
1:D:310:SER:HA	1:D:313:TYR:CZ	2.56	0.41
1:A:320:TRP:HB3	1:B:320:TRP:HB3	2.02	0.40
1:C:322:TRP:HA	1:C:322:TRP:CE3	2.56	0.40

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
1	A	72/83 (87%)	70 (97%)	2 (3%)	0	100 100
1	B	73/83 (88%)	66 (90%)	5 (7%)	2 (3%)	5 1
1	C	72/83 (87%)	69 (96%)	2 (3%)	1 (1%)	11 3
1	D	80/83 (96%)	79 (99%)	1 (1%)	0	100 100
All	All	297/332 (90%)	284 (96%)	10 (3%)	3 (1%)	15 6

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	309	HIS
1	C	310	SER
1	B	307	ARG

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	66/75 (88%)	62 (94%)	4 (6%)	18 9
1	B	61/75 (81%)	58 (95%)	3 (5%)	25 15
1	C	65/75 (87%)	65 (100%)	0	100 100
1	D	72/75 (96%)	70 (97%)	2 (3%)	43 36
All	All	264/300 (88%)	255 (97%)	9 (3%)	37 28

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	293	LYS
1	A	315	ASP
1	A	345	LYS
1	A	355	SER
1	B	300	LYS
1	B	340	GLU
1	B	348	ASN
1	D	315	ASP
1	D	352	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	357	GLN
1	B	348	ASN
1	C	338	HIS
1	D	338	HIS
1	D	357	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry (i)

2 ligands are modelled in this entry.

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).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	SO4	D	901	-	4,4,4	0.31	0	6,6,6	0.67	0
2	SO4	C	902	-	4,4,4	0.34	0	6,6,6	0.21	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.