



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:03 AM UTC

PDB ID : 2AZE / pdb_00002aze
Title : Structure of the Rb C-terminal domain bound to an E2F1-DP1 heterodimer
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Deposited on : 2005-09-10
Resolution : 2.55 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

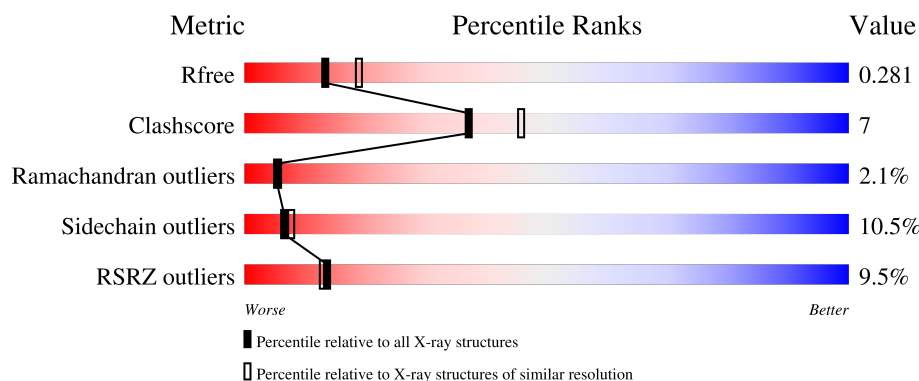
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.55 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}	180053	1091 (2.54-2.54)
Clashscore	190562	1120 (2.54-2.54)
Ramachandran outliers	187476	1106 (2.54-2.54)
Sidechain outliers	187428	1106 (2.54-2.54)
RSRZ outliers	180081	1091 (2.54-2.54)

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 $\leq 5\%$. 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	155	8% 75% 16% 5% .
2	B	106	8% 67% 25% 5% .
3	C	46	15% 80% 15% .

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 2456 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 Transcription factor Dp-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	149	Total	C	N	O	S	0	0	0
			1191	746	212	225	8			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	196	GLY	-	cloning artifact	UNP Q14186
A	197	GLU	-	cloning artifact	UNP Q14186
A	198	PHE	-	cloning artifact	UNP Q14186

- Molecule 2 is a protein called Transcription factor E2F1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	101	Total	C	N	O	S	0	0	0
			796	488	136	166	6			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	196	GLY	-	cloning artifact	UNP Q01094
B	197	SER	-	cloning artifact	UNP Q01094
B	198	HIS	-	cloning artifact	UNP Q01094
B	199	MET	-	cloning artifact	UNP Q01094

- Molecule 3 is a protein called Retinoblastoma-associated protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	44	Total	C	N	O	S	0	0	0
			338	209	62	65	2			

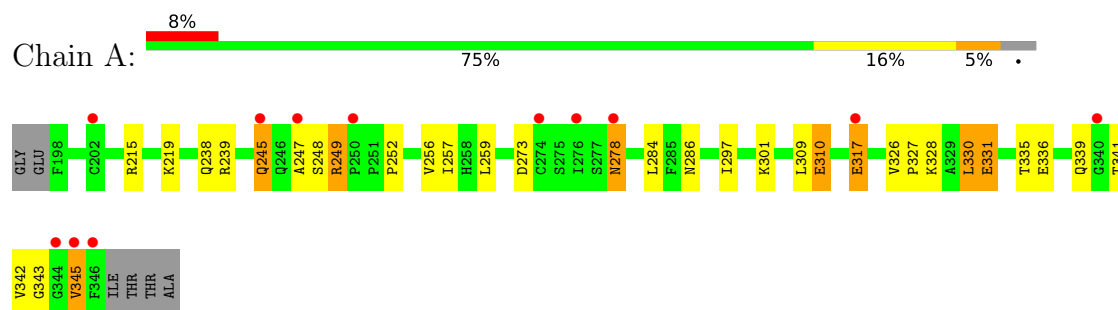
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	70	Total 70	O 70	0	0
4	B	48	Total 48	O 48	0	0
4	C	13	Total 13	O 13	0	0

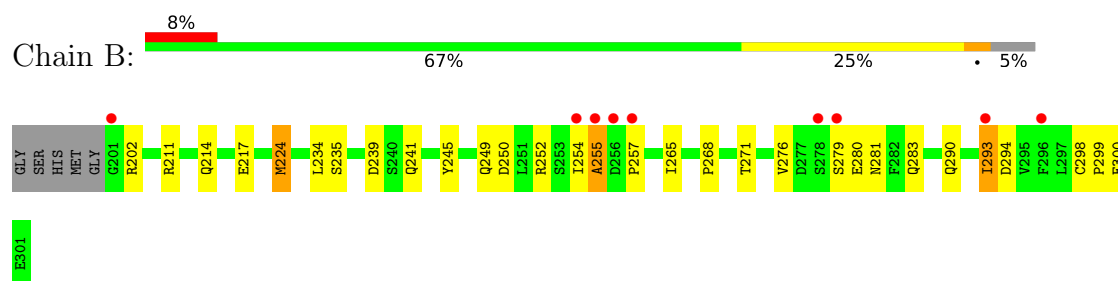
3 Residue-property plots

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.

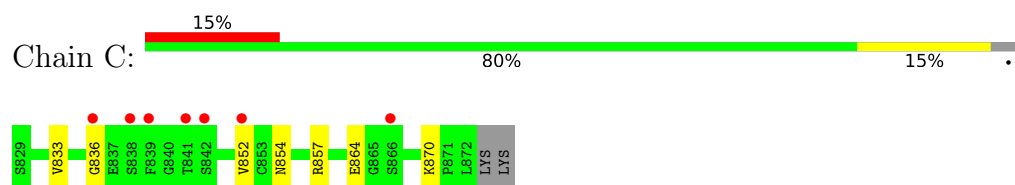
• Molecule 1: Transcription factor Dp-1



• Molecule 2: Transcription factor E2F1



• Molecule 3: Retinoblastoma-associated protein



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	146.80Å 168.60Å 48.30Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 2.55 15.00 – 2.56	Depositor EDS
% Data completeness (in resolution range)	93.6 (15.00-2.55) 92.9 (15.00-2.56)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.02 (at 2.56Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.221 , 0.262 0.241 , 0.281	Depositor DCC
R_{free} test set	993 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	64.9	Xtriage
Anisotropy	0.457	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 58.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	2456	wwPDB-VP
Average B, all atoms (Å ²)	82.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.24% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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	A	0.59	0/1210	0.91	2/1629 (0.1%)
2	B	0.57	0/804	0.87	0/1086
3	C	0.51	0/342	0.84	0/457
All	All	0.57	0/2356	0.89	2/3172 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	252	PRO	CA-C-N	6.02	127.37	119.84
1	A	252	PRO	C-N-CA	6.02	127.37	119.84

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	1191	0	1194	17	0
2	B	796	0	786	18	0
3	C	338	0	348	1	0
4	A	70	0	0	0	0
4	B	48	0	0	1	0
4	C	13	0	0	0	0
All	All	2456	0	2328	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 7.

All (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)
2:B:268:PRO:O	2:B:271:THR:HG23	1.98	0.62
2:B:239:ASP:HB2	4:B:130:HOH:O	2.00	0.61
2:B:202:ARG:HD3	2:B:202:ARG:H	1.65	0.61
1:A:245:GLN:HE21	1:A:245:GLN:HA	1.67	0.59
2:B:265:ILE:HG23	2:B:293:ILE:CD1	2.35	0.56
1:A:248:SER:O	1:A:249:ARG:HB2	2.09	0.53
1:A:327:PRO:HG2	1:A:330:LEU:HD22	1.92	0.52
2:B:249:GLN:HE21	2:B:252:ARG:HH21	1.58	0.51
1:A:219:LYS:HB3	2:B:224:MET:HE1	1.94	0.50
2:B:276:VAL:HB	2:B:283:GLN:HG2	1.93	0.50
2:B:276:VAL:HB	2:B:283:GLN:CG	2.43	0.49
1:A:310:GLU:H	1:A:310:GLU:CD	2.20	0.48
2:B:235:SER:HA	2:B:241:GLN:NE2	2.28	0.48
1:A:343:GLY:C	1:A:345:VAL:H	2.21	0.48
3:C:864:GLU:H	3:C:864:GLU:CD	2.22	0.47
2:B:293:ILE:HD12	2:B:294:ASP:N	2.29	0.47
1:A:297:ILE:HG22	1:A:301:LYS:HE3	1.96	0.47
1:A:317:GLU:H	1:A:317:GLU:CD	2.23	0.47
1:A:336:GLU:HG3	1:A:341:THR:O	2.16	0.46
1:A:273:ASP:HB2	1:A:286:ASN:HB2	1.97	0.46
1:A:215:ARG:HD2	2:B:217:GLU:OE2	2.16	0.46
1:A:278:ASN:OD1	1:A:278:ASN:N	2.45	0.45
1:A:245:GLN:HE21	1:A:245:GLN:CA	2.27	0.44
1:A:335:THR:O	1:A:339:GLN:HG3	2.16	0.44
2:B:265:ILE:HG23	2:B:293:ILE:HD13	2.00	0.44
2:B:298:CYS:HA	2:B:299:PRO:HD3	1.88	0.44
1:A:297:ILE:H	1:A:297:ILE:HG13	1.67	0.44
2:B:254:ILE:O	2:B:255:ALA:HB2	2.17	0.43
1:A:328:LYS:O	1:A:331:GLU:HB2	2.20	0.41
1:A:239:ARG:HH12	2:B:250:ASP:CG	2.29	0.41
2:B:252:ARG:HG2	2:B:257:PRO:CD	2.50	0.41
2:B:265:ILE:HG23	2:B:293:ILE:HD11	2.02	0.41
2:B:245:TYR:CD1	2:B:245:TYR:C	2.99	0.40

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 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	147/155 (95%)	136 (92%)	8 (5%)	3 (2%)	6	6
2	B	99/106 (93%)	92 (93%)	5 (5%)	2 (2%)	6	6
3	C	42/46 (91%)	37 (88%)	4 (10%)	1 (2%)	4	4
All	All	288/307 (94%)	265 (92%)	17 (6%)	6 (2%)	5	5

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	255	ALA
1	A	247	ALA
2	B	300	GLU
3	C	836	GLY
1	A	249	ARG
1	A	345	VAL

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 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	134/138 (97%)	120 (90%)	14 (10%)	7	8
2	B	93/96 (97%)	84 (90%)	9 (10%)	8	9
3	C	40/42 (95%)	35 (88%)	5 (12%)	4	4
All	All	267/276 (97%)	239 (90%)	28 (10%)	6	8

All (28) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	238	GLN
1	A	245	GLN
1	A	256	VAL
1	A	257	ILE
1	A	259	LEU
1	A	278	ASN
1	A	284	LEU
1	A	309	LEU
1	A	310	GLU
1	A	317	GLU
1	A	326	VAL
1	A	330	LEU
1	A	331	GLU
1	A	342	VAL
2	B	211	ARG
2	B	214	GLN
2	B	224	MET
2	B	234	LEU
2	B	279	SER
2	B	280	GLU
2	B	281	ASN
2	B	290	GLN
2	B	293	ILE
3	C	833	VAL
3	C	852	VAL
3	C	854	ASN
3	C	857	ARG
3	C	870	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	200	GLN
1	A	245	GLN
2	B	214	GLN
2	B	241	GLN
2	B	249	GLN
2	B	274	GLN
2	B	281	ASN
3	C	846	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 oligosaccharides 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 ⓘ

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, 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	A	149/155 (96%)	0.47	12 (8%) 18 17	43, 74, 113, 137	0
2	B	101/106 (95%)	0.77	9 (8%) 15 14	46, 85, 115, 132	0
3	C	44/46 (95%)	1.23	7 (15%) 5 4	95, 108, 123, 126	0
All	All	294/307 (95%)	0.69	28 (9%) 14 13	43, 82, 120, 137	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	279	SER	4.7
1	A	247	ALA	3.8
3	C	842	SER	3.6
3	C	841	THR	3.4
3	C	838	SER	3.4
2	B	293	ILE	3.2
1	A	340	GLY	3.0
1	A	345	VAL	2.9
1	A	245	GLN	2.9
1	A	317	GLU	2.8
1	A	346	PHE	2.7
2	B	201	GLY	2.7
1	A	344	GLY	2.5
1	A	274	CYS	2.5
1	A	278	ASN	2.5
3	C	839	PHE	2.4
2	B	254	ILE	2.4
2	B	256	ASP	2.3
1	A	250	PRO	2.3
2	B	255	ALA	2.3
2	B	257	PRO	2.3
2	B	278	SER	2.2
1	A	202	CYS	2.2

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Mol	Chain	Res	Type	RSRZ
2	B	296	PHE	2.2
3	C	866	SER	2.1
3	C	852	VAL	2.0
1	A	276	ILE	2.0
3	C	836	GLY	2.0

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 oligosaccharides 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.