



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:26 PM UTC

PDB ID : 6MRP / pdb_00006mrp
Title : Structure of the Bovine p85a BH domain R228E mutant
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Deposited on : 2018-10-15
Resolution : 2.40 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
Mogul	:	2022.3.0, CSD as543be (2022)
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

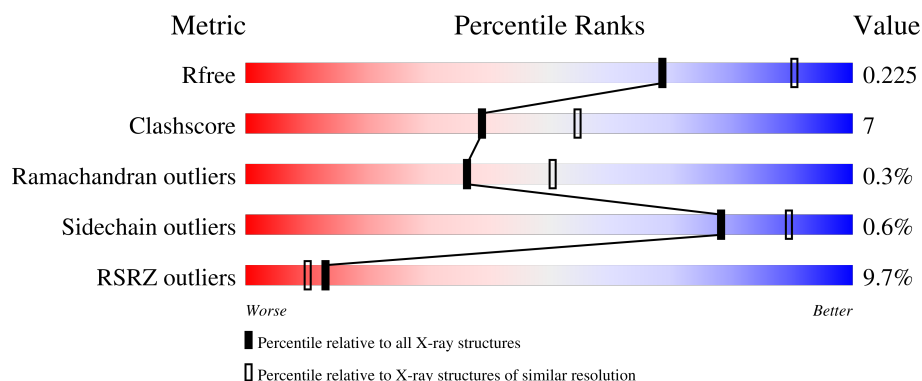
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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	220	7% 73% 9% 17%
1	B	220	9% 71% 10% 19%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5874 atoms, of which 2920 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 Phosphatidylinositol 3-kinase regulatory subunit alpha.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	B	179	Total	C	H	N	O	S	0	0	0
			2864	922	1448	224	268	2			
1	A	182	Total	C	H	N	O	S	0	0	0
			2904	932	1472	228	269	3			

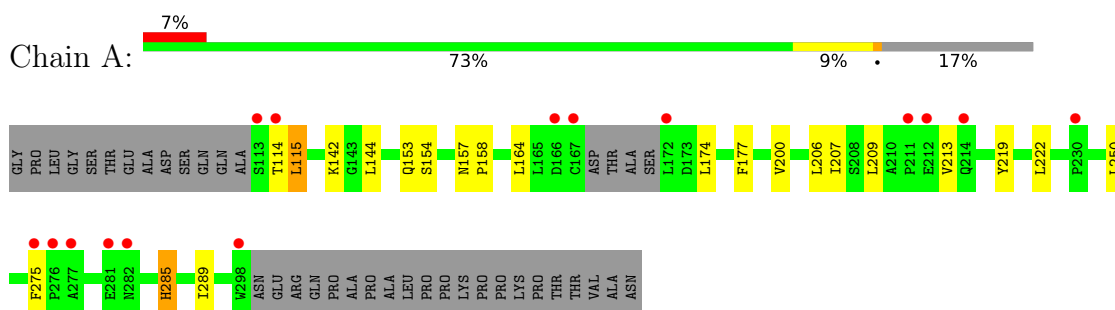
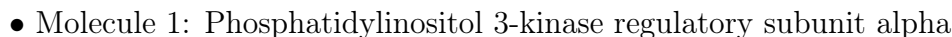
There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	100	GLY	-	expression tag	UNP P23727
B	101	PRO	-	expression tag	UNP P23727
B	102	LEU	-	expression tag	UNP P23727
B	103	GLY	-	expression tag	UNP P23727
B	104	SER	-	expression tag	UNP P23727
B	105	THR	-	expression tag	UNP P23727
B	106	GLU	-	expression tag	UNP P23727
B	107	ALA	-	expression tag	UNP P23727
B	108	ASP	-	expression tag	UNP P23727
B	109	SER	-	expression tag	UNP P23727
B	228	GLU	ARG	engineered mutation	UNP P23727
A	100	GLY	-	expression tag	UNP P23727
A	101	PRO	-	expression tag	UNP P23727
A	102	LEU	-	expression tag	UNP P23727
A	103	GLY	-	expression tag	UNP P23727
A	104	SER	-	expression tag	UNP P23727
A	105	THR	-	expression tag	UNP P23727
A	106	GLU	-	expression tag	UNP P23727
A	107	ALA	-	expression tag	UNP P23727
A	108	ASP	-	expression tag	UNP P23727
A	109	SER	-	expression tag	UNP P23727
A	228	GLU	ARG	engineered mutation	UNP P23727

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	51	Total 51	O 51	0	0
2	A	55	Total 55	O 55	0	0

- Molecule 1: Phosphatidylinositol 3-kinase regulatory subunit alpha



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	85.19Å 92.70Å 93.12Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.56 – 2.40 46.56 – 2.40	Depositor EDS
% Data completeness (in resolution range)	99.8 (46.56-2.40) 99.8 (46.56-2.40)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.77 (at 2.39Å)	Xtriage
Refinement program	PHENIX (1.13_2998)	Depositor
R, R_{free}	0.184 , 0.225 0.185 , 0.225	Depositor DCC
R_{free} test set	1434 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	40.4	Xtriage
Anisotropy	0.168	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 43.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.016 for -h,l,k	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5874	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.45% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CSO

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	0.54	0/1455	0.68	0/1981
1	B	0.54	0/1438	0.70	0/1957
All	All	0.54	0/2893	0.69	0/3938

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	1432	1472	1461	15	0
1	B	1416	1448	1438	24	0
2	A	55	0	0	4	0
2	B	51	0	0	1	0
All	All	2954	2920	2899	39	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 (39) 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:207:ILE:O	1:B:282:ASN:ND2	1.83	1.11
1:B:281:GLU:O	1:B:285:HIS:ND1	2.11	0.83
1:B:210:ALA:HA	1:B:219:TYR:OH	1.88	0.74
1:A:153:GLN:NE2	2:A:401:HOH:O	2.20	0.73
1:B:124:PRO:O	2:B:401:HOH:O	2.15	0.64
1:B:154:SER:HA	1:B:184:ASP:OD2	1.97	0.64
1:B:210:ALA:CB	1:B:282:ASN:ND2	2.68	0.57
1:A:285:HIS:HD2	2:A:405:HOH:O	1.87	0.57
1:A:200:VAL:HG12	2:A:409:HOH:O	2.05	0.57
1:B:210:ALA:HB3	1:B:282:ASN:CG	2.32	0.55
1:B:280:SER:OG	1:B:282:ASN:HB2	2.07	0.54
1:B:210:ALA:HB3	1:B:282:ASN:ND2	2.22	0.54
1:B:207:ILE:HA	1:B:282:ASN:HD22	1.75	0.52
1:B:262:ARG:NE	1:B:266:GLU:OE2	2.37	0.52
1:A:209:LEU:HD12	1:A:219:TYR:CE1	2.45	0.51
1:A:114:THR:O	1:A:115:LEU:O	2.29	0.50
1:B:210:ALA:N	1:B:211:PRO:HD2	2.26	0.50
1:A:207:ILE:HD12	1:A:275:PHE:CE2	2.46	0.49
1:A:213:VAL:HG13	2:A:403:HOH:O	2.11	0.49
1:A:164:LEU:HD21	1:A:174:LEU:HD22	1.94	0.49
1:A:157:ASN:HB2	1:A:158:PRO:HD2	1.95	0.48
1:B:281:GLU:HG3	1:B:285:HIS:CE1	2.49	0.47
1:B:164:LEU:C	1:B:164:LEU:HD23	2.40	0.47
1:A:144:LEU:HD12	1:A:250:LEU:HD23	1.97	0.46
1:B:281:GLU:O	1:B:285:HIS:CE1	2.69	0.45
1:B:282:ASN:O	1:B:285:HIS:N	2.48	0.45
1:A:206:LEU:HD23	1:A:222:LEU:HD23	1.99	0.45
1:A:153:GLN:HG3	1:A:154:SER:O	2.17	0.45
1:B:275:PHE:CD1	1:B:275:PHE:O	2.71	0.44
1:A:164:LEU:HD23	1:A:164:LEU:O	2.18	0.43
1:B:149:LEU:O	1:B:150:TYR:HB2	2.18	0.43
1:B:286:LEU:HA	1:B:289:ILE:HD12	1.99	0.43
1:A:142:LYS:NZ	1:A:177:PHE:O	2.49	0.43
1:B:210:ALA:HB2	1:B:282:ASN:ND2	2.33	0.43
1:A:219:TYR:HB3	1:A:289:ILE:HG21	2.00	0.42
1:B:207:ILE:C	1:B:282:ASN:ND2	2.71	0.42
1:B:210:ALA:HA	1:B:219:TYR:HH	1.82	0.42
1:B:223:LEU:HD23	1:B:293:LEU:HD11	2.02	0.41
1:B:275:PHE:CD1	1:B:275:PHE:C	2.99	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	177/220 (80%)	169 (96%)	7 (4%)	1 (1%)	21	32
1	B	172/220 (78%)	168 (98%)	4 (2%)	0	100	100
All	All	349/440 (79%)	337 (97%)	11 (3%)	1 (0%)	36	50

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	115	LEU

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	163/198 (82%)	162 (99%)	1 (1%)	78	89
1	B	162/198 (82%)	161 (99%)	1 (1%)	78	89
All	All	325/396 (82%)	323 (99%)	2 (1%)	78	89

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	214	GLN
1	A	285	HIS

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

Mol	Chain	Res	Type
1	B	252	GLN
1	B	282	ASN
1	A	234	HIS
1	A	252	GLN
1	A	285	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues 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	$\# Z > 2$
1	CSO	B	146	1	3,6,7	0.87	0	1,6,8	0.57	0
1	CSO	A	146	1	3,6,7	1.09	0	1,6,8	0.55	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	CSO	B	146	1	-	0/1/5/7	-
1	CSO	A	146	1	-	0/1/5/7	-

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.

5.5 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	181/220 (82%)	0.14	15 (8%) 17 14	30, 48, 85, 95	0
1	B	178/220 (80%)	0.29	20 (11%) 10 7	30, 49, 100, 146	0
All	All	359/440 (81%)	0.22	35 (9%) 13 10	30, 48, 88, 146	0

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	282	ASN	8.9
1	B	167	CYS	6.7
1	A	298	TRP	6.6
1	B	276	PRO	6.2
1	B	153	GLN	5.7
1	B	279	SER	5.5
1	B	172	LEU	5.2
1	B	281	GLU	5.2
1	A	172	LEU	5.2
1	B	283	THR	4.6
1	B	280	SER	4.5
1	B	211	PRO	4.5
1	A	281	GLU	4.5
1	A	113	SER	4.4
1	A	211	PRO	4.1
1	A	214	GLN	4.0
1	B	155	SER	4.0
1	B	154	SER	4.0
1	A	167	CYS	4.0
1	B	212	GLU	3.7
1	B	297	GLU	3.6
1	A	230	PRO	3.2
1	B	288	LYS	3.1
1	B	163	GLN	3.0

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Mol	Chain	Res	Type	RSRZ
1	A	282	ASN	2.9
1	A	277	ALA	2.9
1	A	114	THR	2.8
1	B	285	HIS	2.7
1	A	276	PRO	2.7
1	A	166	ASP	2.5
1	A	275	PHE	2.5
1	B	214	GLN	2.5
1	B	113	SER	2.2
1	B	284	GLU	2.1
1	A	212	GLU	2.1

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	CSO	B	146	7/8	0.94	0.09	39,49,64,77	0
1	CSO	A	146	7/8	0.96	0.08	33,41,60,72	0

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.