



# wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 18, 2026 – 12:22 PM UTC

PDB ID : 2E32 / pdb\_00002e32  
Title : Structural basis for selection of glycosylated substrate by SCFFbs1 ubiquitin ligase  
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Deposited on : 2006-11-20  
Resolution : 3.52 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

<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>.

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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

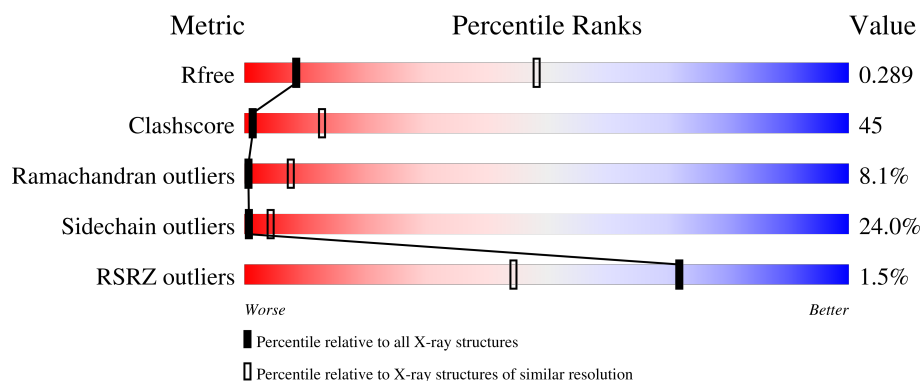
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.52 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	1025 (3.56-3.48)
Clashscore	190562	1079 (3.56-3.48)
Ramachandran outliers	187476	1052 (3.56-3.48)
Sidechain outliers	187428	1053 (3.56-3.48)
RSRZ outliers	180081	1024 (3.56-3.48)

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  $\geq 3$ , 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	297	<div> <div>0.2%</div> <div>30% 32% 17% 19%</div> </div>
1	C	297	<div> <div>26% 39% 14% 19%</div> </div>
2	B	166	<div> <div>2%</div> <div>14% 41% 19% 22%</div> </div>
2	D	166	<div> <div>2%</div> <div>11% 43% 21% 22%</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5970 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 F-box only protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	240	Total	C	N	O	S	0	0	0
			1948	1249	324	369	6			
1	C	240	Total	C	N	O	S	0	0	0
			1948	1249	324	369	6			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	151	LYS	ARG	SEE REMARK 999	UNP Q80UW2
C	151	LYS	ARG	SEE REMARK 999	UNP Q80UW2

- Molecule 2 is a protein called S-phase kinase-associated protein 1A.

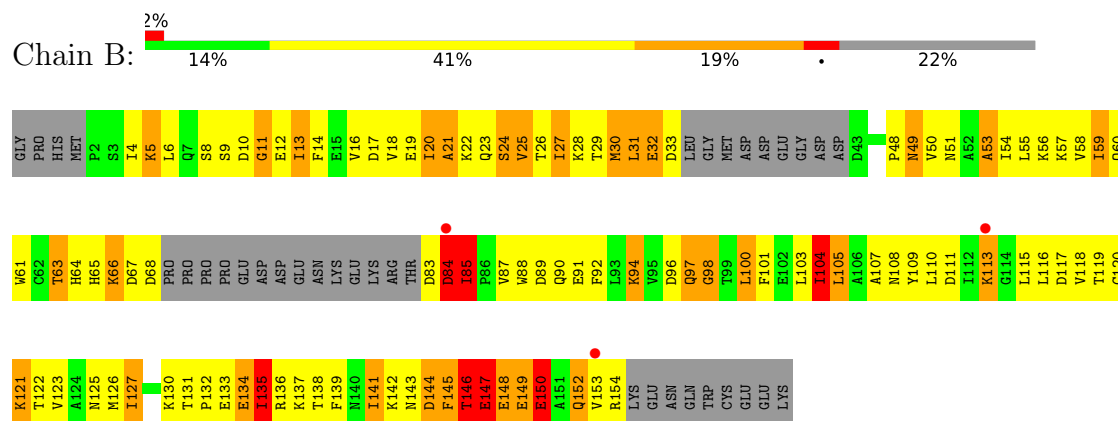
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	130	Total	C	N	O	S	0	0	0
			1037	660	167	206	4			
2	D	130	Total	C	N	O	S	0	0	0
			1037	660	167	206	4			

There are 6 discrepancies between the modelled and reference sequences:

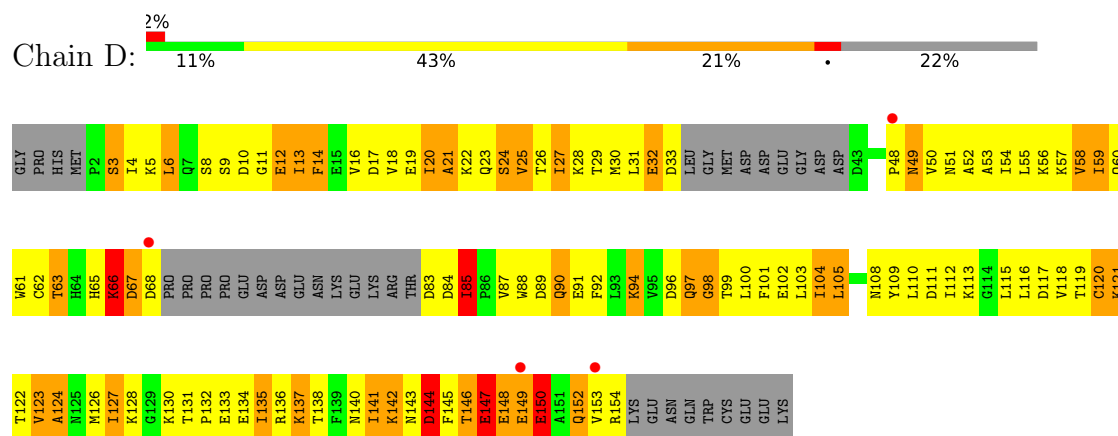
Chain	Residue	Modelled	Actual	Comment	Reference
B	-2	GLY	-	cloning artifact	UNP P63208
B	-1	PRO	-	cloning artifact	UNP P63208
B	0	HIS	-	cloning artifact	UNP P63208
D	-2	GLY	-	cloning artifact	UNP P63208
D	-1	PRO	-	cloning artifact	UNP P63208
D	0	HIS	-	cloning artifact	UNP P63208



• Molecule 2: S-phase kinase-associated protein 1A



• Molecule 2: S-phase kinase-associated protein 1A



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.94Å 109.82Å 153.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	56.53 – 3.52 56.53 – 3.52	Depositor EDS
% Data completeness (in resolution range)	89.7 (56.53-3.52) 89.9 (56.53-3.52)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	5.13 (at 3.49Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.223 , 0.299 0.218 , 0.289	Depositor DCC
$R_{free}$ test set	651 reflections (4.52%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	68.3	Xtriage
Anisotropy	0.052	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 46.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.44$ , $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	5970	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.56% 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, 0.333 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	1.24	4/2003 (0.2%)	1.32	15/2725 (0.6%)
1	C	1.18	4/2003 (0.2%)	1.27	16/2725 (0.6%)
2	B	1.38	7/1052 (0.7%)	1.48	12/1422 (0.8%)
2	D	1.35	7/1052 (0.7%)	1.48	17/1422 (1.2%)
All	All	1.27	22/6110 (0.4%)	1.36	60/8294 (0.7%)

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
2	B	0	2
2	D	0	1
All	All	0	4

The worst 5 of 22 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	85	ILE	CA-CB	7.06	1.63	1.54
2	B	107	ALA	CA-CB	-6.90	1.42	1.53
2	B	113	LYS	CD-CE	6.86	1.73	1.52
2	D	113	LYS	CG-CD	6.55	1.72	1.52
1	C	137	LEU	CA-C	-6.53	1.44	1.52

The worst 5 of 60 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	145	PHE	N-CA-C	7.69	121.18	108.96
1	A	66	LEU	CA-C-N	7.68	129.44	119.84
1	A	66	LEU	C-N-CA	7.68	129.44	119.84
2	B	113	LYS	N-CA-C	-7.46	102.20	111.75

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Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	140	TRP	N-CA-C	-7.28	99.69	110.46

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	146	THR	Peptide
2	B	83	ASP	Peptide
1	C	165	GLN	Peptide
2	D	83	ASP	Peptide

## 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	1948	0	1847	145	1
1	C	1948	0	1847	144	0
2	B	1037	0	1041	131	1
2	D	1037	0	1041	131	0
All	All	5970	0	5776	534	1

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 45.

The worst 5 of 534 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:D:148:GLU:O	2:D:149:GLU:HG3	1.41	1.19
2:B:64:HIS:CE1	2:D:128:LYS:HE2	1.81	1.16
2:B:64:HIS:HE1	2:D:128:LYS:HE2	1.05	1.15
2:B:148:GLU:O	2:B:149:GLU:HG3	1.57	1.03
2:B:64:HIS:HE1	2:D:128:LYS:CE	1.72	1.01

All (1) 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:A:165:GLN:NE2	2:B:33:ASP:O[4_455]	2.09	0.11

### 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	236/297 (80%)	188 (80%)	32 (14%)	16 (7%)	1	10
1	C	236/297 (80%)	185 (78%)	36 (15%)	15 (6%)	1	11
2	B	124/166 (75%)	90 (73%)	21 (17%)	13 (10%)	0	5
2	D	124/166 (75%)	90 (73%)	20 (16%)	14 (11%)	0	4
All	All	720/926 (78%)	553 (77%)	109 (15%)	58 (8%)	1	8

5 of 58 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	101	LEU
1	A	136	ASP
1	A	143	VAL
1	A	230	GLU
1	A	260	ASP

#### 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	206/250 (82%)	159 (77%)	47 (23%)	1 5

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	206/250 (82%)	162 (79%)	44 (21%)	1	6
2	B	119/152 (78%)	87 (73%)	32 (27%)	0	3
2	D	119/152 (78%)	86 (72%)	33 (28%)	0	3
All	All	650/804 (81%)	494 (76%)	156 (24%)	1	4

5 of 156 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	247	GLU
2	D	120	CYS
1	C	259	ILE
2	D	30	MET
2	D	142	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	97	GLN
1	C	130	ASN
2	D	108	ASN
1	C	113	HIS
1	C	159	ASN

### 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 oligosaccharides 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 [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, 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	240/297 (80%)	-0.10	4 (1%) 69 41	31, 50, 66, 71	0
1	C	240/297 (80%)	-0.09	0 100 100	31, 49, 67, 71	0
2	B	130/166 (78%)	-0.07	3 (2%) 61 35	31, 52, 70, 82	0
2	D	130/166 (78%)	0.03	4 (3%) 51 29	31, 52, 70, 82	0
All	All	740/926 (79%)	-0.07	11 (1%) 72 44	31, 51, 67, 82	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	52	ALA	2.9
2	B	153	VAL	2.8
2	D	68	ASP	2.5
2	D	153	VAL	2.5
2	D	149	GLU	2.3

### 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.