



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:00 PM UTC

PDB ID : 2XIC / pdb_00002xic
Title : Pilus-presented adhesin, Spy0125 (Cpa), P212121 form (ESRF data)
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Deposited on : 2010-06-28
Resolution : 2.90 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 ⓘ 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

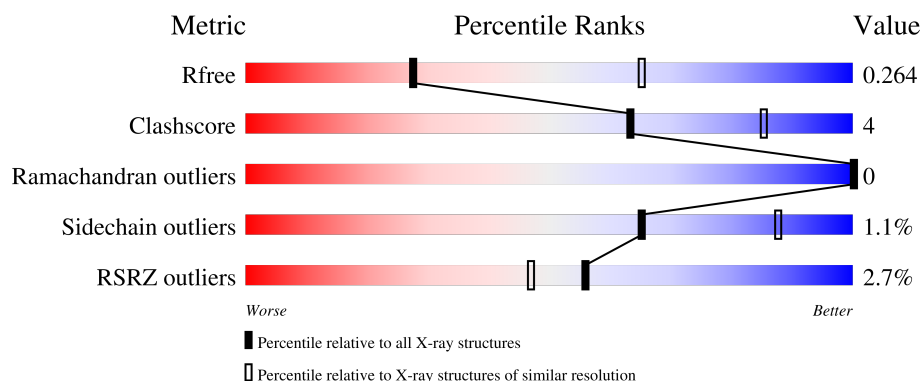
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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))
R_{free}	180053	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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 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	457	
1	B	457	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 6742 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 ANCILLARY PROTEIN 1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	422	Total	C	N	O	S	Se	0	0	0
			3350	2122	543	681	1	3			
1	B	425	Total	C	N	O	S	Se	0	0	0
			3371	2136	547	684	1	3			

There are 38 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	267	MSE	-	expression tag	UNP Q8GRA2
A	268	GLY	-	expression tag	UNP Q8GRA2
A	269	SER	-	expression tag	UNP Q8GRA2
A	270	SER	-	expression tag	UNP Q8GRA2
A	271	HIS	-	expression tag	UNP Q8GRA2
A	272	HIS	-	expression tag	UNP Q8GRA2
A	273	HIS	-	expression tag	UNP Q8GRA2
A	274	HIS	-	expression tag	UNP Q8GRA2
A	275	HIS	-	expression tag	UNP Q8GRA2
A	276	HIS	-	expression tag	UNP Q8GRA2
A	277	SER	-	expression tag	UNP Q8GRA2
A	278	SER	-	expression tag	UNP Q8GRA2
A	279	GLY	-	expression tag	UNP Q8GRA2
A	280	LEU	-	expression tag	UNP Q8GRA2
A	281	VAL	-	expression tag	UNP Q8GRA2
A	282	PRO	-	expression tag	UNP Q8GRA2
A	283	ARG	-	expression tag	UNP Q8GRA2
A	284	GLY	-	expression tag	UNP Q8GRA2
A	285	SER	-	expression tag	UNP Q8GRA2
B	267	MSE	-	expression tag	UNP Q8GRA2
B	268	GLY	-	expression tag	UNP Q8GRA2
B	269	SER	-	expression tag	UNP Q8GRA2
B	270	SER	-	expression tag	UNP Q8GRA2
B	271	HIS	-	expression tag	UNP Q8GRA2
B	272	HIS	-	expression tag	UNP Q8GRA2

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Chain	Residue	Modelled	Actual	Comment	Reference
B	273	HIS	-	expression tag	UNP Q8GRA2
B	274	HIS	-	expression tag	UNP Q8GRA2
B	275	HIS	-	expression tag	UNP Q8GRA2
B	276	HIS	-	expression tag	UNP Q8GRA2
B	277	SER	-	expression tag	UNP Q8GRA2
B	278	SER	-	expression tag	UNP Q8GRA2
B	279	GLY	-	expression tag	UNP Q8GRA2
B	280	LEU	-	expression tag	UNP Q8GRA2
B	281	VAL	-	expression tag	UNP Q8GRA2
B	282	PRO	-	expression tag	UNP Q8GRA2
B	283	ARG	-	expression tag	UNP Q8GRA2
B	284	GLY	-	expression tag	UNP Q8GRA2
B	285	SER	-	expression tag	UNP Q8GRA2

- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	15	Total O 15 15	0	0
2	B	6	Total O 6 6	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	43.10Å 113.32Å 175.36Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	95.18 – 2.90 95.18 – 2.90	Depositor EDS
% Data completeness (in resolution range)	100.0 (95.18-2.90) 100.0 (95.18-2.90)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.16 (at 2.91Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.231 , 0.274 0.231 , 0.264	Depositor DCC
R_{free} test set	1016 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å ²)	41.6	Xtriage
Anisotropy	0.237	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 35.4	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	0.90	EDS
Total number of atoms	6742	wwPDB-VP
Average B, all atoms (Å ²)	47.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.90% 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

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	0.41	0/3410	0.63	0/4608
1	B	0.41	0/3432	0.63	0/4638
All	All	0.41	0/6842	0.63	0/9246

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	3350	0	3272	24	0
1	B	3371	0	3298	30	0
2	A	15	0	0	1	0
2	B	6	0	0	0	0
All	All	6742	0	6570	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 4.

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)
1:B:658:ASN:O	1:B:659:LEU:HD13	1.86	0.76

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:665:LEU:HD13	1:A:667:LEU:HD12	1.73	0.70
1:A:561:LEU:HD13	1:A:564:LEU:HD21	1.74	0.68
1:B:561:LEU:HD13	1:B:564:LEU:HD21	1.75	0.68
1:B:627:ILE:HG22	1:B:629:LEU:HD13	1.79	0.64
1:B:627:ILE:HG22	1:B:629:LEU:CD1	2.29	0.62
1:B:403:LEU:HD11	1:B:509:ALA:CB	2.31	0.61
1:A:403:LEU:HD11	1:A:509:ALA:CB	2.33	0.58
1:B:524:LEU:HD11	1:B:550:VAL:HG21	1.84	0.58
1:A:302:ASP:CG	1:A:572:ASN:HD22	2.12	0.57
1:A:561:LEU:CD1	1:A:564:LEU:HD21	2.36	0.55
1:A:524:LEU:HD11	1:A:550:VAL:HG21	1.87	0.55
1:B:561:LEU:CD1	1:B:564:LEU:HD21	2.38	0.54
1:B:362:PHE:HB3	1:B:371:THR:HG22	1.91	0.52
1:A:596:LYS:HD3	1:A:602:VAL:HG13	1.91	0.52
1:A:665:LEU:HD13	1:A:667:LEU:CD1	2.39	0.52
1:B:658:ASN:C	1:B:659:LEU:HD13	2.35	0.51
1:A:467:THR:HG21	1:A:478:PHE:CZ	2.47	0.50
1:B:467:THR:HG21	1:B:478:PHE:CZ	2.47	0.50
1:B:477:THR:HG22	1:B:481:HIS:CE1	2.48	0.48
1:A:555:ASP:OD1	1:A:555:ASP:C	2.56	0.48
1:B:630:LYS:HG2	1:B:636:LEU:HD13	1.96	0.48
1:A:477:THR:HG22	1:A:481:HIS:CE1	2.49	0.47
1:A:695:VAL:HG12	1:A:698:ALA:N	2.30	0.46
1:A:596:LYS:CD	1:A:602:VAL:HG13	2.44	0.46
1:B:422:GLN:HB2	1:B:581:GLN:HG3	1.98	0.46
1:B:555:ASP:C	1:B:555:ASP:OD1	2.58	0.46
1:B:629:LEU:HB3	1:B:637:LEU:HD12	1.98	0.46
1:A:631:ASN:HB3	1:A:637:LEU:HD21	1.98	0.45
1:B:463:LEU:HD22	1:B:566:PHE:CD2	2.52	0.45
1:B:631:ASN:HB3	1:B:637:LEU:HD21	1.98	0.44
1:A:608:LEU:N	1:A:608:LEU:HD12	2.31	0.44
1:B:695:VAL:HG12	1:B:698:ALA:N	2.33	0.44
1:B:369:VAL:HG11	1:B:591:ILE:HD11	2.00	0.44
1:A:400:PHE:CE2	1:A:407:ASN:HB2	2.53	0.44
1:A:502:LEU:HD22	1:A:545:VAL:HG21	2.00	0.44
1:A:463:LEU:HD22	1:A:566:PHE:CD2	2.53	0.43
1:B:608:LEU:HD12	1:B:608:LEU:N	2.33	0.43
1:B:695:VAL:HG12	1:B:698:ALA:H	1.82	0.43
1:A:463:LEU:HD22	1:A:566:PHE:CE2	2.52	0.43
1:B:400:PHE:CE2	1:B:407:ASN:HB2	2.53	0.43
1:A:449:THR:HB	1:B:309:GLY:HA2	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:463:LEU:HD22	1:B:566:PHE:CE2	2.53	0.42
1:B:381:PRO:HA	1:B:461:ARG:HD3	2.01	0.42
1:B:502:LEU:HD22	1:B:545:VAL:HG21	2.00	0.42
1:A:481:HIS:O	1:A:485:VAL:HG23	2.19	0.42
1:A:484:LYS:HE3	1:A:553:ALA:HA	2.01	0.42
1:A:616:ALA:HB1	2:A:2012:HOH:O	2.19	0.42
1:B:362:PHE:CB	1:B:371:THR:HG22	2.49	0.42
1:B:481:HIS:O	1:B:485:VAL:HG23	2.20	0.41
1:A:369:VAL:HG11	1:A:591:ILE:HD11	2.02	0.41
1:B:460:GLY:HA2	1:B:463:LEU:HD21	2.03	0.40
1:B:484:LYS:HE3	1:B:553:ALA:HA	2.04	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	416/457 (91%)	405 (97%)	11 (3%)	0	100	100
1	B	419/457 (92%)	408 (97%)	11 (3%)	0	100	100
All	All	835/914 (91%)	813 (97%)	22 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	372/399 (93%)	368 (99%)	4 (1%)	65	88
1	B	375/399 (94%)	371 (99%)	4 (1%)	65	88
All	All	747/798 (94%)	739 (99%)	8 (1%)	65	88

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	315	THR
1	A	332	ILE
1	A	398	GLU
1	A	665	LEU
1	B	332	ILE
1	B	502	LEU
1	B	629	LEU
1	B	659	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	395	ASN
1	A	416	ASN
1	A	422	GLN
1	A	572	ASN
1	A	716	ASN
1	B	377	GLN
1	B	716	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

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	419/457 (91%)	-0.05	2 (0%) 87 83	17, 37, 64, 90	0
1	B	422/457 (92%)	0.40	21 (4%) 34 27	22, 51, 106, 143	0
All	All	841/914 (92%)	0.17	23 (2%) 56 47	17, 42, 94, 143	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	720	VAL	4.2
1	B	497	ILE	3.6
1	B	561	LEU	3.2
1	B	559	PRO	3.1
1	B	500	SER	2.8
1	B	548	ILE	2.7
1	B	288	PRO	2.7
1	B	542	THR	2.7
1	B	549	LEU	2.7
1	A	665	LEU	2.6
1	B	501	GLY	2.6
1	B	316	GLY	2.6
1	B	491	ARG	2.5
1	A	498	GLU	2.5
1	B	553	ALA	2.5
1	B	404	THR	2.5
1	B	615	LEU	2.4
1	B	556	SER	2.4
1	B	499	TYR	2.3
1	B	419	GLY	2.3
1	B	494	GLY	2.1
1	B	403	LEU	2.1
1	B	545	VAL	2.1

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.