



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 11, 2024 – 09:14 PM EDT

PDB ID : 6N71
Title : Crystal Structure of ATPase delta1-79 Spa47 R191E
Authors : Morales, Y.; Olsen, K.J.; Johnson, S.J.; Demler, H.J.; Dickenson, N.E.
Deposited on : 2018-11-27
Resolution : 2.45 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 : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.36.2
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36.2

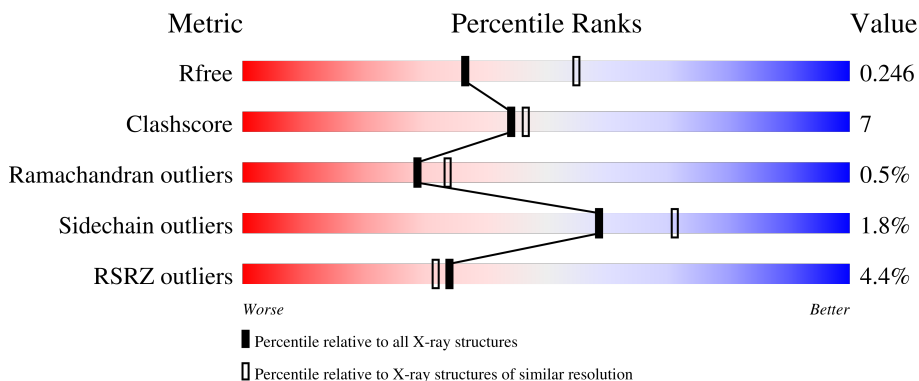
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.45 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}	130704	1544 (2.48-2.44)
Clashscore	141614	1613 (2.48-2.44)
Ramachandran outliers	138981	1598 (2.48-2.44)
Sidechain outliers	138945	1598 (2.48-2.44)
RSRZ outliers	127900	1523 (2.48-2.44)

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	351	 4% 76% 17% • 2%
1	B	351	 5% 82% 12% • 3%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5243 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 Probable ATP synthase SpaL/MxiB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	331	2585	1643	438	495	9	0	0	0
1	B	333	2605	1653	440	503	9	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	191	GLU	ARG	engineered mutation	UNP P0A1C1
B	191	GLU	ARG	engineered mutation	UNP P0A1C1

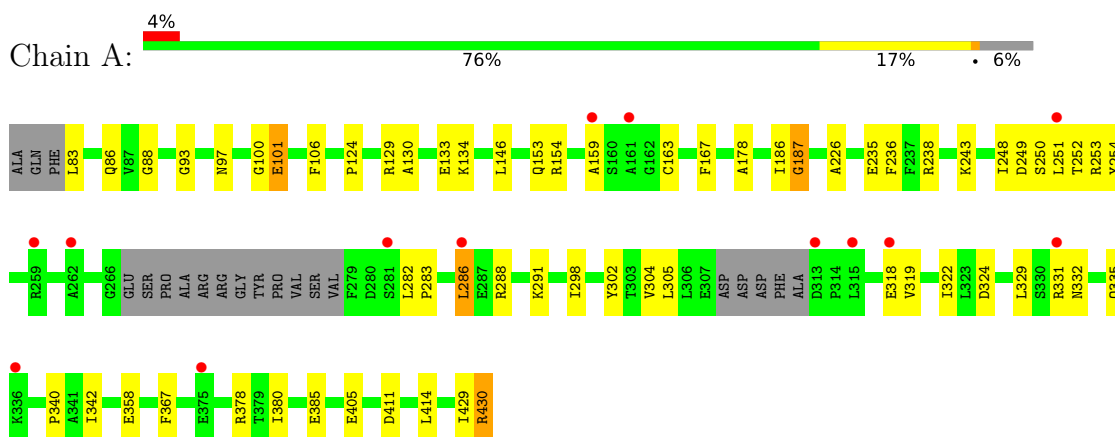
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	27	Total	O	0	0
			27	27		
2	B	26	Total	O	0	0
			26	26		

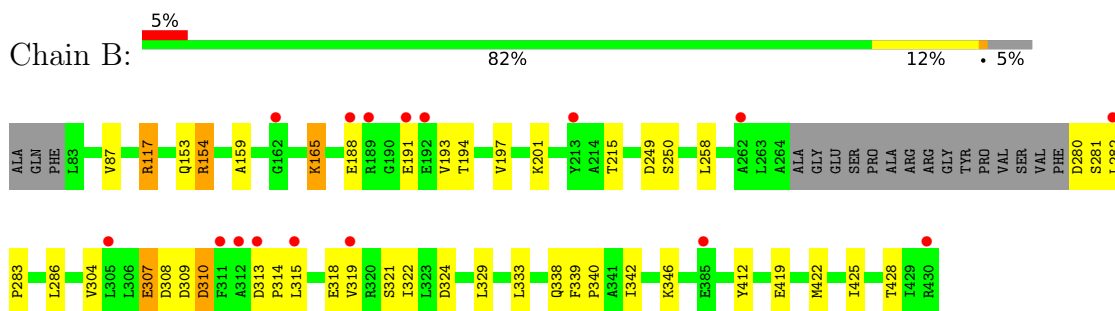
3 Residue-property plots [i](#)

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: Probable ATP synthase SpaL/MxiB



- Molecule 1: Probable ATP synthase SpaL/MxiB



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	44.02Å 152.74Å 54.47Å 90.00° 109.92° 90.00°	Depositor
Resolution (Å)	48.55 – 2.45 48.55 – 2.44	Depositor EDS
% Data completeness (in resolution range)	93.3 (48.55-2.45) 89.5 (48.55-2.44)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.93 (at 2.42Å)	Xtrriage
Refinement program	PHENIX 1.13_2998	Depositor
R, R_{free}	0.205 , 0.247 0.206 , 0.246	Depositor DCC
R_{free} test set	1170 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	44.3	Xtrriage
Anisotropy	0.298	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 44.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5243	wwPDB-VP
Average B, all atoms (Å ²)	59.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.71% 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	0.25	0/2626	0.44	0/3544
1	B	0.25	0/2647	0.43	0/3575
All	All	0.25	0/5273	0.43	0/7119

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	A	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	187	GLY	Peptide

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	2585	0	2601	40	0
1	B	2605	0	2611	29	0
2	A	27	0	0	1	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	26	0	0	0	0
All	All	5243	0	5212	69	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 (69) 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:307:GLU:OE2	1:B:313:ASP:HB3	1.17	1.28
1:B:307:GLU:OE2	1:B:313:ASP:CB	2.02	1.06
1:B:307:GLU:CD	1:B:313:ASP:HB3	2.08	0.74
1:A:186:ILE:HD12	1:A:254:TYR:HB2	1.72	0.72
1:A:411:ASP:HB3	1:A:414:LEU:HG	1.73	0.71
1:B:313:ASP:HB2	1:B:314:PRO:HD2	1.75	0.68
1:B:304:VAL:HG21	1:B:319:VAL:HG21	1.76	0.67
1:A:429:ILE:HG13	1:A:430:ARG:HD3	1.77	0.66
1:B:153:GLN:HG3	1:B:324:ASP:HB2	1.78	0.66
1:A:238:ARG:HD3	1:A:298:ILE:HG13	1.79	0.63
1:A:332:ASN:HA	1:A:335:GLN:NE2	2.16	0.61
1:B:314:PRO:O	1:B:318:GLU:HG2	2.00	0.61
1:A:86:GLN:NE2	1:A:100:GLY:O	2.35	0.60
1:B:419:GLU:N	1:B:419:GLU:OE2	2.33	0.60
1:A:133:GLU:HG3	1:A:134:LYS:HD2	1.86	0.57
1:B:258:LEU:HD21	1:B:281:SER:OG	2.05	0.57
1:A:83:LEU:N	2:A:502:HOH:O	2.37	0.57
1:A:358:GLU:H	1:A:358:GLU:CD	2.07	0.57
1:A:186:ILE:CD1	1:A:254:TYR:HB2	2.36	0.55
1:A:235:GLU:OE2	1:A:288:ARG:NE	2.36	0.54
1:A:153:GLN:HG3	1:A:324:ASP:HB2	1.90	0.53
1:A:380:ILE:HG23	1:A:385:GLU:HG3	1.91	0.53
1:A:283:PRO:HA	1:A:286:LEU:HD11	1.89	0.53
1:B:87:VAL:HG21	1:B:117:ARG:HG2	1.91	0.52
1:A:130:ALA:HB3	1:A:291:LYS:HG3	1.92	0.51
1:A:282:LEU:O	1:A:286:LEU:HG	2.10	0.51
1:B:308:ASP:O	1:B:310:ASP:N	2.44	0.50
1:A:186:ILE:HG22	1:A:226:ALA:HB3	1.93	0.49
1:A:378:ARG:NH2	1:A:405:GLU:OE2	2.45	0.49
1:A:154:ARG:HD2	1:A:286:LEU:O	2.13	0.48
1:A:430:ARG:HD3	1:A:430:ARG:N	2.28	0.48
1:B:159:ALA:HB2	1:B:329:LEU:HB2	1.97	0.46

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:252:THR:HG21	1:A:305:LEU:H	1.81	0.46
1:A:88:GLY:HA2	1:A:236:PHE:CE2	2.50	0.46
1:A:146:LEU:HD11	1:A:367:PHE:CD1	2.50	0.46
1:B:422:MET:HA	1:B:425:ILE:HG22	1.98	0.45
1:A:178:ALA:HA	1:A:243:LYS:HD3	1.97	0.45
1:B:193:VAL:O	1:B:197:VAL:HG23	2.16	0.45
1:A:159:ALA:HB2	1:A:329:LEU:HB2	1.99	0.45
1:A:249:ASP:HA	1:A:250:SER:HA	1.58	0.45
1:B:154:ARG:HD2	1:B:286:LEU:O	2.17	0.44
1:A:332:ASN:HA	1:A:335:GLN:HE21	1.79	0.44
1:B:165:LYS:NZ	1:B:249:ASP:OD1	2.51	0.44
1:B:333:LEU:HD22	1:B:338:GLN:OE1	2.17	0.44
1:A:97:ASN:OD1	1:A:101:GLU:HG3	2.18	0.44
1:B:282:LEU:HB3	1:B:283:PRO:HD3	2.00	0.43
1:A:124:PRO:O	1:A:129:ARG:NH1	2.36	0.43
1:A:304:VAL:HG11	1:A:319:VAL:HG21	2.00	0.43
1:B:188:GLU:O	1:B:215:THR:HA	2.18	0.43
1:B:249:ASP:HA	1:B:250:SER:HA	1.52	0.43
1:A:340:PRO:HB2	1:A:342:ILE:HG13	2.00	0.43
1:B:197:VAL:O	1:B:201:LYS:HE3	2.19	0.43
1:A:335:GLN:HE21	1:A:335:GLN:HB2	1.62	0.42
1:B:318:GLU:O	1:B:322:ILE:HD12	2.19	0.42
1:B:191:GLU:HG3	1:B:194:THR:OG1	2.19	0.42
1:A:248:ILE:HB	1:A:302:TYR:HD1	1.83	0.42
1:B:340:PRO:HB2	1:B:342:ILE:HG13	2.01	0.42
1:B:339:PHE:CE2	1:B:412:TYR:HB3	2.55	0.42
1:B:339:PHE:HE2	1:B:412:TYR:HB3	1.84	0.42
1:A:93:GLY:HA2	1:A:106:PHE:CE1	2.54	0.42
1:B:117:ARG:HD2	1:B:117:ARG:HA	1.86	0.42
1:B:425:ILE:O	1:B:428:THR:HG22	2.20	0.41
1:A:163:CYS:SG	1:A:331:ARG:HB2	2.59	0.41
1:A:187:GLY:HA2	1:A:253:ARG:HD3	2.02	0.41
1:A:282:LEU:HB3	1:A:283:PRO:HD3	2.02	0.41
1:A:154:ARG:NH2	1:A:324:ASP:OD1	2.54	0.41
1:A:318:GLU:O	1:A:322:ILE:HG13	2.21	0.41
1:B:280:ASP:O	1:B:283:PRO:HD2	2.21	0.41
1:A:251:LEU:HD23	1:A:251:LEU:HA	1.94	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	325/351 (93%)	317 (98%)	8 (2%)	0	100	100
1	B	329/351 (94%)	319 (97%)	7 (2%)	3 (1%)	17	19
All	All	654/702 (93%)	636 (97%)	15 (2%)	3 (0%)	29	34

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	310	ASP
1	B	309	ASP
1	B	307	GLU

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	277/293 (94%)	273 (99%)	4 (1%)	67	77
1	B	280/293 (96%)	274 (98%)	6 (2%)	53	66
All	All	557/586 (95%)	547 (98%)	10 (2%)	59	71

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	101	GLU
1	A	167	PHE
1	A	286	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	430	ARG
1	B	117	ARG
1	B	154	ARG
1	B	165	LYS
1	B	315	LEU
1	B	321	SER
1	B	346	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	335	GLN
1	B	332	ASN

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 monosaccharides 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	331/351 (94%)	0.20	13 (3%) 39 36	28, 56, 102, 121	0
1	B	333/351 (94%)	0.21	16 (4%) 30 28	31, 52, 101, 167	0
All	All	664/702 (94%)	0.21	29 (4%) 34 32	28, 54, 102, 167	0

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	312	ALA	7.7
1	B	262	ALA	5.5
1	A	318	GLU	5.3
1	B	311	PHE	3.7
1	A	315	LEU	3.2
1	A	281	SER	3.1
1	B	430	ARG	3.0
1	B	189	ARG	2.8
1	A	161	ALA	2.8
1	A	286	LEU	2.8
1	A	336	LYS	2.7
1	B	282	LEU	2.6
1	B	313	ASP	2.6
1	B	315	LEU	2.6
1	A	331	ARG	2.6
1	B	213	TYR	2.5
1	B	319	VAL	2.5
1	A	262	ALA	2.3
1	A	375	GLU	2.3
1	A	313	ASP	2.3
1	B	191	GLU	2.2
1	A	159	ALA	2.2
1	B	385	GLU	2.2
1	B	192	GLU	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	305	LEU	2.1
1	B	188	GLU	2.1
1	B	162	GLY	2.0
1	A	251	LEU	2.0
1	A	259	ARG	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 monosaccharides 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.