



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 07:03 AM GMT

PDB ID : 2ZCF  
Title : Mutational study on Alpha-Gln90 of Fe-type nitrile hydratase from *Rhodococcus* sp. N771  
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Deposited on : 2007-11-08  
Resolution : 1.43 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](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	<b>NOT EXECUTED</b>
EDS	:	<b>NOT EXECUTED</b>
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

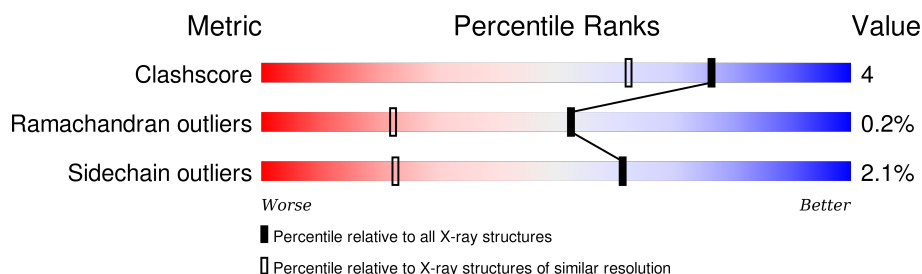
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.43 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))
Clashscore	102246	1219 (1.46-1.42)
Ramachandran outliers	100387	1200 (1.46-1.42)
Sidechain outliers	100360	1200 (1.46-1.42)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	206	
2	B	212	

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3867 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 Nitrile hydratase subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	198	Total	C	N	O	S	0	0	0
			1553	988	261	298	6			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	90	ASN	GLN	ENGINEERED	UNP P13448

- Molecule 2 is a protein called Nitrile hydratase subunit beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	212	Total	C	N	O	S	0	0	0
			1657	1050	283	316	8			

- Molecule 3 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Fe	0	0
			1	1		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Mg	0	0
			1	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	316	Total	O	0	0
			316	316		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	339	Total 339	O 339	0	0

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.


Note EDS was not executed.

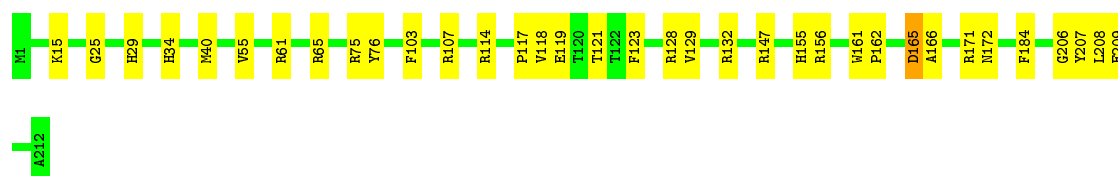
- Molecule 1: Nitrile hydratase subunit alpha

Chain A: 



- Molecule 2: Nitrile hydratase subunit beta

Chain B: 



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	114.84Å 60.55Å 82.19Å 90.00° 125.05° 90.00°	Depositor
Resolution (Å)	8.00 – 1.43	Depositor
% Data completeness (in resolution range)	87.4 (8.00-1.43)	Depositor
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	SHELXL-97	Depositor
R, $R_{free}$	0.169 , 0.211	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3867	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	14.0	wwPDB-VP

## 5 Model quality

### 5.1 Standard geometry

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

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	0/1576	1.24	6/2153 (0.3%)
2	B	0.59	0/1705	1.34	18/2318 (0.8%)
All	All	0.57	0/3281	1.29	24/4471 (0.5%)

There are no bond length outliers.

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	65	ARG	NE-CZ-NH1	-13.86	113.37	120.30
2	B	61	ARG	NE-CZ-NH1	11.36	125.98	120.30
2	B	65	ARG	NE-CZ-NH2	11.31	125.95	120.30
2	B	61	ARG	NE-CZ-NH2	-10.85	114.88	120.30
1	A	138	ARG	NE-CZ-NH2	-10.73	114.94	120.30
1	A	174	ARG	NE-CZ-NH2	-10.15	115.23	120.30
2	B	75	ARG	NE-CZ-NH2	9.07	124.83	120.30
2	B	207	TYR	CB-CG-CD2	-8.63	115.82	121.00
2	B	76	TYR	CB-CG-CD2	-7.84	116.30	121.00
2	B	107	ARG	NE-CZ-NH1	7.39	123.99	120.30
2	B	184	PHE	CB-CG-CD2	6.89	125.62	120.80
2	B	114	ARG	NE-CZ-NH2	6.72	123.66	120.30
2	B	156	ARG	NE-CZ-NH1	6.57	123.59	120.30
2	B	165	ASP	CB-CG-OD1	6.36	124.02	118.30
2	B	76	TYR	CG-CD2-CE2	-6.33	116.24	121.30
2	B	65	ARG	CD-NE-CZ	6.33	132.46	123.60
1	A	130	PHE	CB-CG-CD1	6.26	125.18	120.80
1	A	167	ARG	NE-CZ-NH2	-5.99	117.31	120.30
2	B	207	TYR	CB-CG-CD1	5.69	124.41	121.00
2	B	76	TYR	CA-CB-CG	-5.57	102.81	113.40
1	A	21	ARG	NE-CZ-NH2	-5.46	117.57	120.30
2	B	132	ARG	NE-CZ-NH1	5.43	123.01	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	62	ARG	NE-CZ-NH1	5.31	122.95	120.30
2	B	147	ARG	NE-CZ-NH2	-5.30	117.65	120.30

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	1553	0	1521	11	0
2	B	1657	0	1572	15	0
3	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	316	0	0	4	0
5	B	339	0	0	3	0
All	All	3867	0	3093	24	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 (24) 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:118:VAL:HG13	2:B:119:GLU:HG2	1.59	0.83
2:B:129:VAL:HG21	2:B:208:LEU:HB3	1.72	0.71
2:B:129:VAL:HG23	2:B:209:GLU:O	1.99	0.63
2:B:129:VAL:CG2	2:B:208:LEU:HB3	2.35	0.57
1:A:137:VAL:HG23	5:A:497:HOH:O	2.08	0.53
1:A:71:GLN:HG3	5:A:467:HOH:O	2.09	0.52
2:B:40:MET:HG3	2:B:55:VAL:HG21	1.92	0.52
1:A:93:TYR:OH	2:B:155:HIS:HE1	1.93	0.52
1:A:44:LYS:HE2	1:A:48:GLU:OE1	2.09	0.52
1:A:175:PRO:HB3	5:A:443:HOH:O	2.10	0.51
2:B:34:HIS:CD2	2:B:34:HIS:H	2.31	0.49
2:B:29:HIS:HD2	5:B:623:HOH:O	1.97	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:185:GLN:HA	1:A:188:GLU:OE2	2.15	0.47
2:B:29:HIS:HE1	5:B:796:HOH:O	1.97	0.47
2:B:25:GLY:HA3	5:B:796:HOH:O	2.15	0.45
2:B:166:ALA:HA	2:B:171:ARG:HD3	2.00	0.43
1:A:45:LYS:HE3	1:A:45:LYS:HB2	1.58	0.43
2:B:121:THR:HB	2:B:123:PHE:CZ	2.54	0.42
1:A:117:TRP:HB2	1:A:118:PRO:HD3	2.00	0.42
1:A:83:GLN:NE2	5:A:278:HOH:O	2.50	0.42
2:B:117:PRO:HG2	2:B:206:GLY:HA3	2.02	0.42
2:B:161:TRP:HB3	2:B:162:PRO:HD2	2.02	0.41
1:A:203:VAL:HG23	1:A:204:PRO:O	2.22	0.40
1:A:146:GLU:HB3	2:B:15:LYS:HE3	2.04	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	194/206 (94%)	189 (97%)	4 (2%)	1 (0%)	34	8
2	B	210/212 (99%)	207 (99%)	3 (1%)	0	100	100
All	All	404/418 (97%)	396 (98%)	7 (2%)	1 (0%)	52	22

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	113	SER

### 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	162/170 (95%)	159 (98%)	3 (2%)	65	27
2	B	173/173 (100%)	169 (98%)	4 (2%)	58	19
All	All	335/343 (98%)	328 (98%)	7 (2%)	61	23

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	45	LYS
1	A	154	ASP
1	A	184	GLU
2	B	103	PHE
2	B	128	ARG
2	B	165	ASP
2	B	172	ASN

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

Mol	Chain	Res	Type
1	A	83	GLN
1	A	105	ASN
2	B	21	ASN
2	B	29	HIS
2	B	34	HIS
2	B	155	HIS
2	B	172	ASN

### 5.3.3 RNA [i](#)

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	CSD	A	112	1,3	3,7,8	0.63	0	3,8,10	2.36	1 (33%)
1	CSO	A	114	1,3	3,6,7	0.78	0	1,6,8	0.67	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	CSD	A	112	1,3	-	1/2/6/8	0/0/0/0
1	CSO	A	114	1,3	-	0/1/5/7	0/0/0/0

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	112	CSD	O-C-CA	-3.98	115.13	125.49

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	112	CSD	CA-CB-SG-OD1

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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.

## 5.7 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 ⓘ

EDS was not executed - this section will therefore be empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.