


# Probes

- **Configuring CMAS Double Resonance Probes**  
User Manual  
Version 001



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# 1 Introduction

With this manual you learn how to configure your CMAS probe (PH) in order to access certain nuclei. There are different possibilities to adjust the frequency range of your PH e.g. changing inserts, capacitors and coils.

In [Options for Modifying the Tuning Range \[ 17\]](#) you learn how to change the different elements and in [Probe Tuning Table \[ 20\]](#) you find the table you need to adjust your probe for the different frequency ranges.

For further information about the magnet or the amplifiers please check the corresponding documentation.



## **Important!**

The probe must only be used inside the magnet.

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## 2 Tuning Accessory

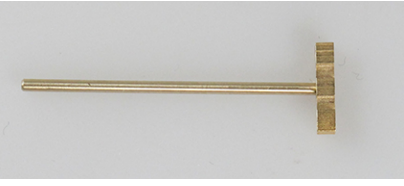

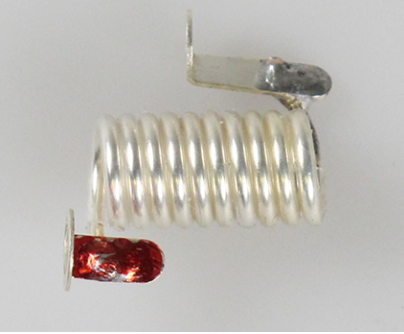
Jumper for serial capacitor and tool	
Shunt capacitors for extending the X-channel tuning range towards lower frequencies	
Range coils for increasing X frequency up to $^{31}\text{P}$	

Table 2.1: Tuning Accessory Parts



### 3 Probe Interfaces



Figure 3.1: HF Connectors

1	<sup>1</sup> H RF Connector	4	Spin Rate
2	X RF Connector	5	Base Heater
3	Y RF Connector (triple resonance probes only)		

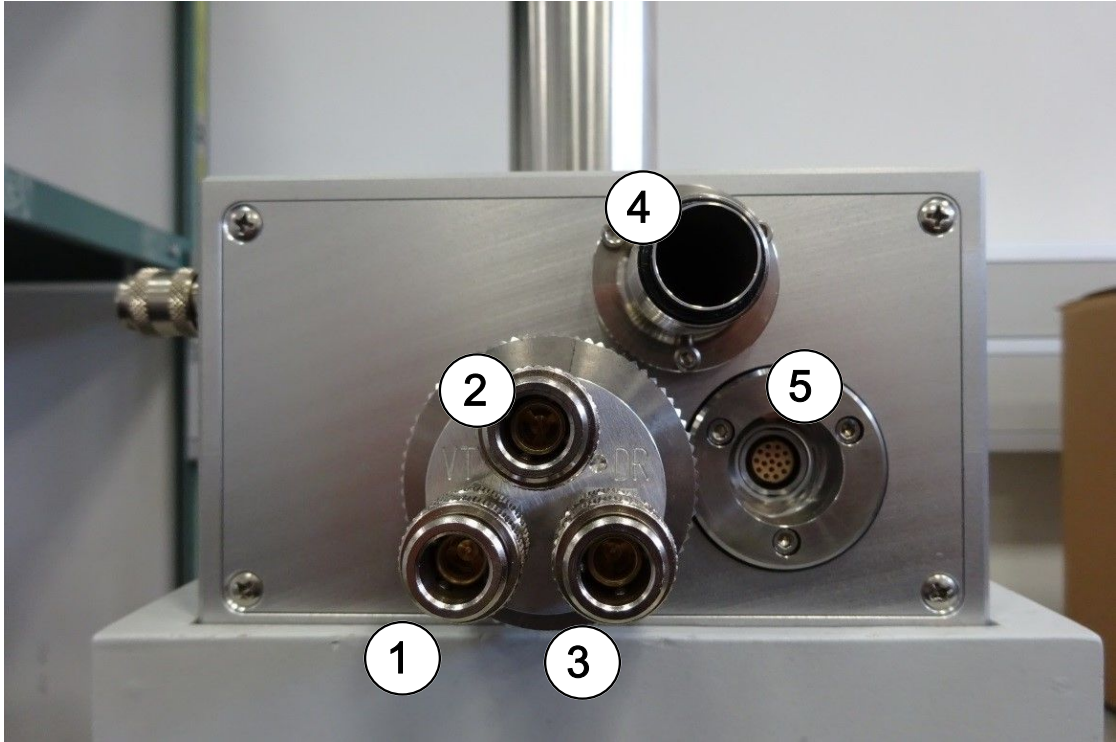


Figure 3.2: ITL Connector

1	Variable Temperature	4	Gas Return Line
2	Bearing	5	ITL Connector
3	Drive		
1-3: Room temperature adapter mounted on the MAS gas interface.			

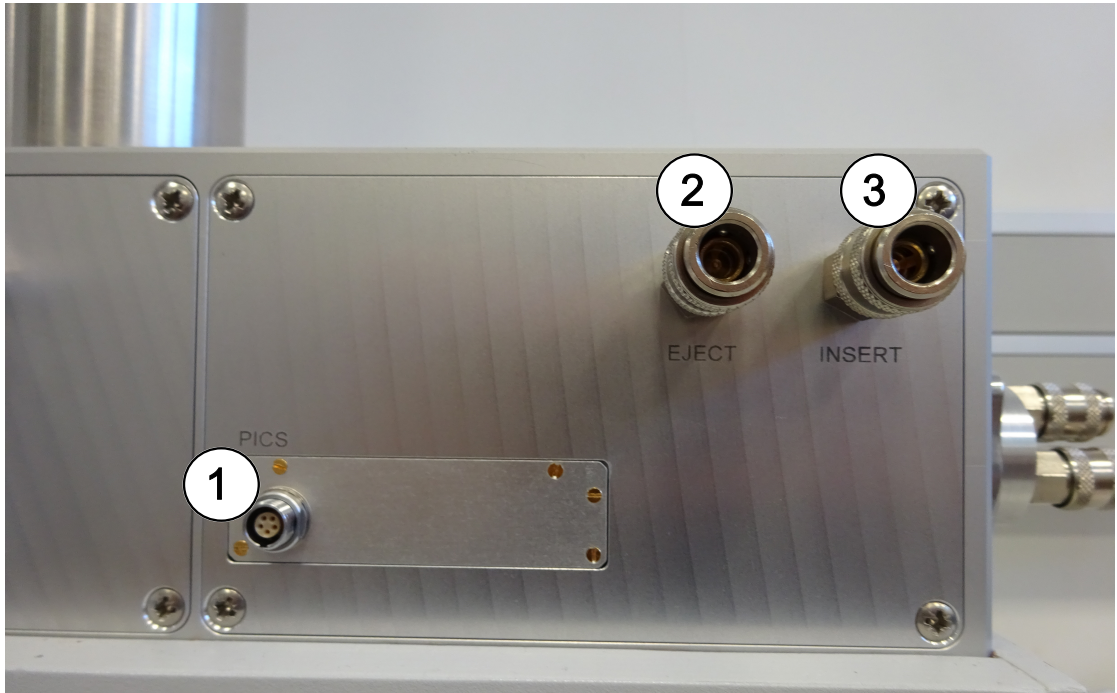


Figure 3.3: PICS and Eject\_Insert

1	PICS	3	Insert
2	Eject		

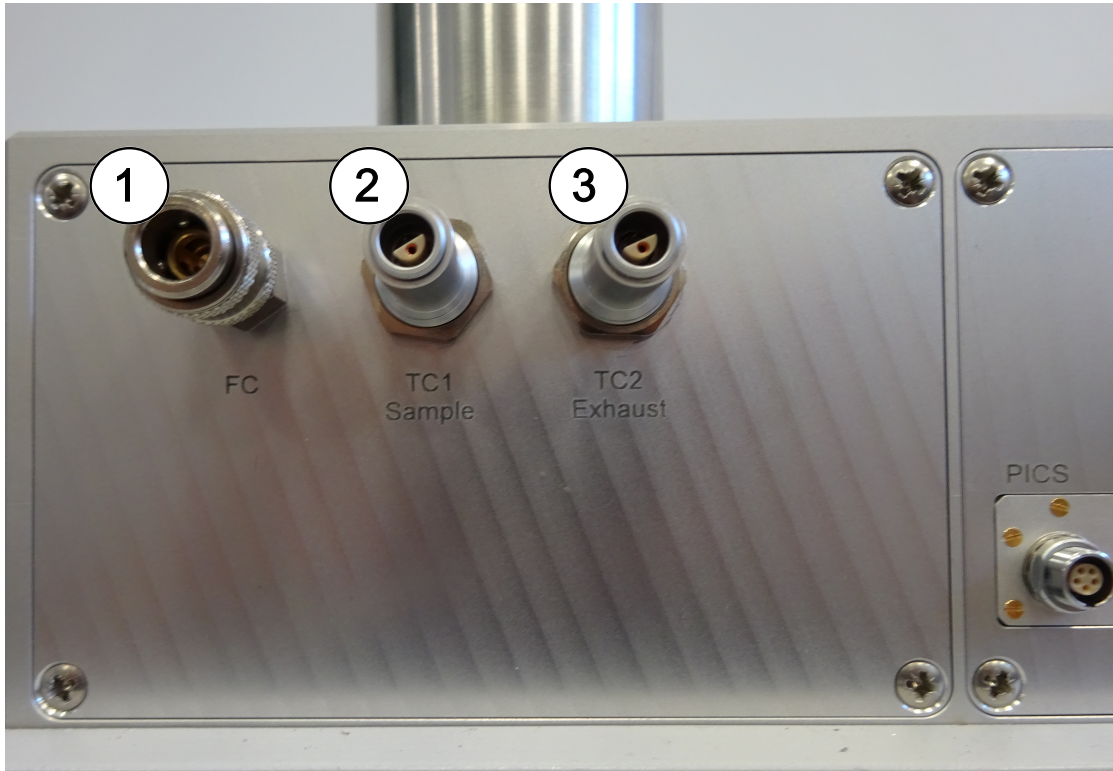


Figure 3.4: Frame Flush and Temperatur Sensors

1	Frame cooling (flush) Venturi*	3	Thermocouple Exhaust
2	Thermocouple Sample		
* Venturi is only for probes with BL 1.9 mm and smaller.			

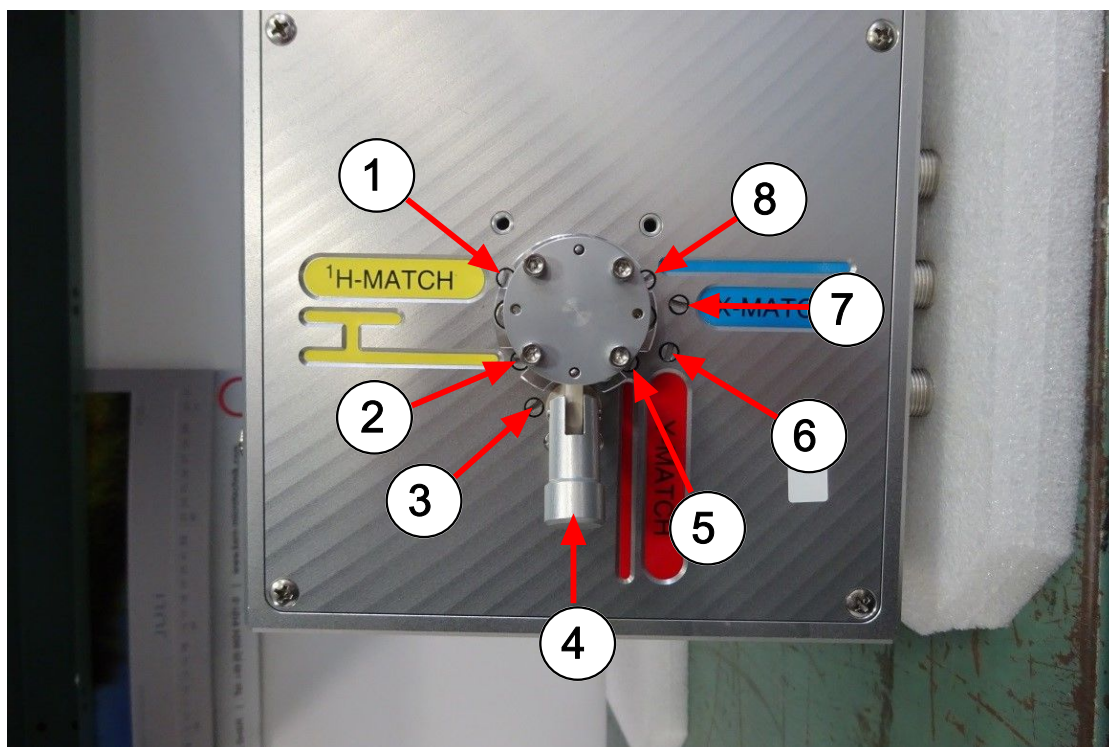


Figure 3.5: Tuning and Matching Elements

1	$^1\text{H}$ Matching	5	Y Tuning (triple resonance probes only)
2	$^1\text{H}$ Tuning	6	Y Matching (triple resonance probes only)
3	Magic Angle Adjustment	7	X Matching
4	Rotor Catcher	8	X Tuning

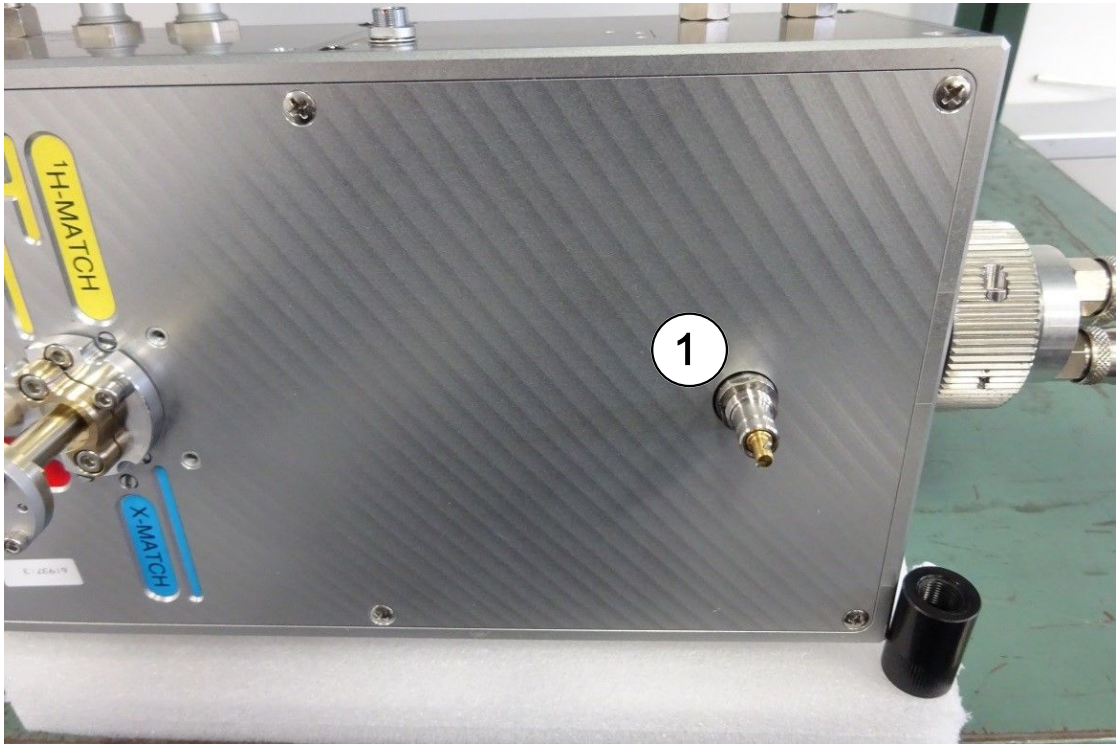
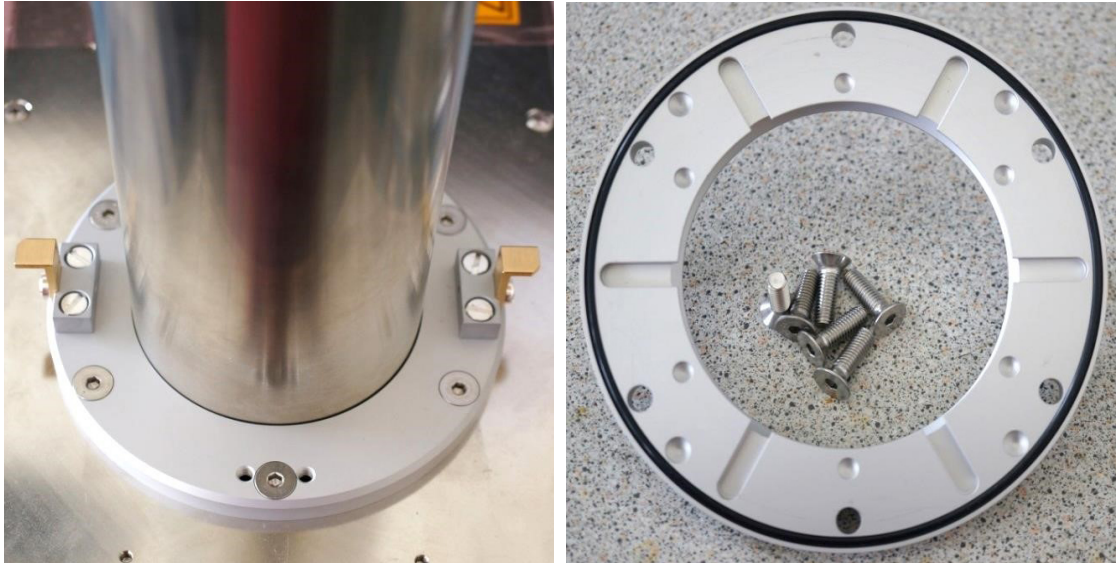


Figure 3.6: Vacuum Port

1	Vacuum Port		
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## 4 Opening the Probe

In order to change the probe's tuning range the shielding/dewar has to be removed. This can be done by unscrewing the holding ring and pulling the dewar off the probe. Turning the dewar clockwise while pulling makes it easier to remove it and reduces scuffing of the tube's inner plating. When getting everything assembled again, keep in mind that the orientation of the hooks for latching the probe to the shim system should be the same as before and the O-ring has to be in position like illustrated below.



*Figure 4.1: Dewar Holding Ring with Latching Hooks Mounted and Unmounted*



## 5 Options for Modifying the Tuning Range

This chapter discusses the options available for modifying the tuning range.

### 5.1 Serial Capacitor $C_s$

#### Handling

The ceramic capacitor at the upper end of the  $^1\text{H}$  transmission line can be shortened by setting a jumper onto the dedicated pins with the corresponding tool. An attached jumper is indicated by **Yes** in the [tuning table \[ 20\]](#), while **No** means the jumper must be removed.

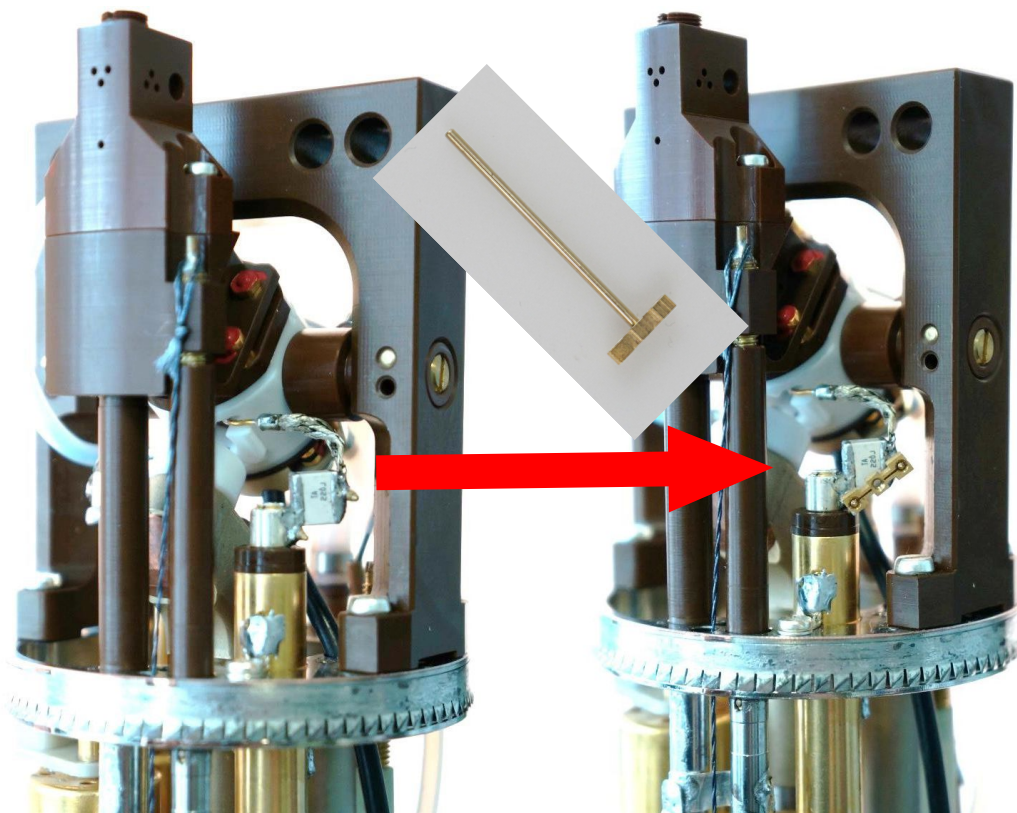


Figure 5.1: Serial Capacitor Active (left) and Shortened by the Jumper (right)

#### Additional Information

$C_s$  is the small ceramic capacitor between the  $\lambda/4$ -transmission line and the NMR-coil. It has two functions. First, it raises the frequency of the X channel and secondly it helps to balance the X-channel thus increasing its sensitivity. In order to tune frequencies below  $^{13}\text{C}$  it usually is necessary to short the capacitor. No matter if  $C_s$  is active or not the  $^1\text{H}$  frequency won't be affected as the capacitance value is large compared to other parts of the  $^1\text{H}$  circuit.

### 5.2 Shunt Capacitor

#### Handling

Shunt capacitors are used to lower the frequency of the X-channel in order to tune low gamma nuclei. The capacitors can be attached in parallel to the X-tuning capacitor with two screws as illustrated below:

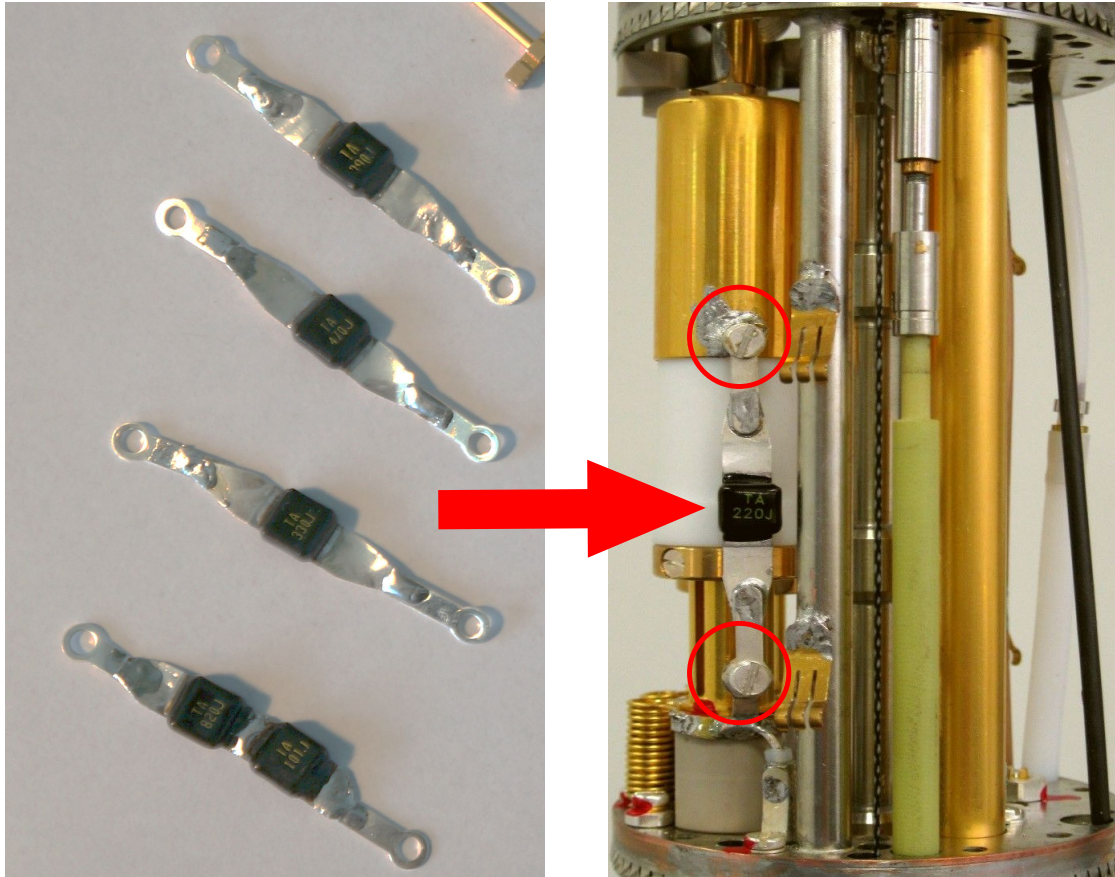


Figure 5.2: Shunt Capacitors (left) and How They are Connected to the X-Tuning Trimmer (right)

#### Additional Information

The imprinted code on the shunts reads as follows. The first two digits give the number and the third indicates the power of ten. All values are in pF. For values below 10 pF there is an R between the first two digits. For better understanding some examples are listed below.

2R7 → 2.7 pF

270 → 27 pF

271 → 270 pF

### 5.3 Range Coil

#### Handling

To connect the range coil remove the screw that is used to attach the  $^1\text{H}$  stop to the X-tuning trimmer and add one end of the coil to this joint. The second, larger solder flange must be connected to the probe frame.

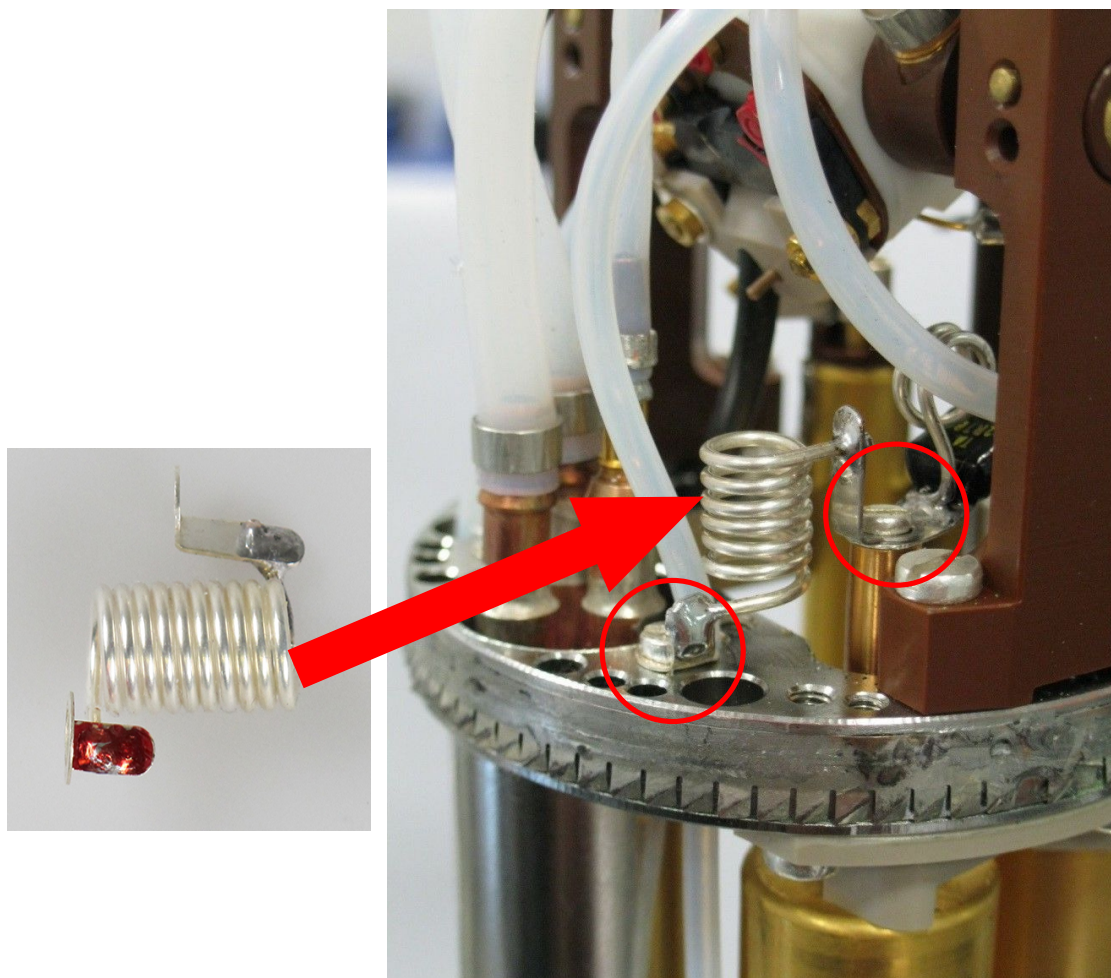


Figure 5.3: Range Coil (left) and How it's Built In (right)

#### Additional Information

The range coil is an inductor parallel to the NMR-coil that reduces the overall inductance of the X circuit. With the reduced inductance it is possible to tune up to  $^{31}\text{P}$ . The magnetic field generated in the circuit now is distributed to two coils, the NMR coil and the range coil. Only the  $B_1$  of the NMR coil is relevant to NMR performance, therefore a range coil should always have as much windings as possible, in order to not lower the sensitivity too much.

## 6 Probe Tuning Table

This table gives an overview of what tuning ranges are feasible with the inserts, shunts and range coils shipped with this probe.

X-Nucleus	Tuning Range X (MHz)	Jumper for C <sub>s</sub>	Shunt (imprint)	Range Coil
	Contact Bruker for probe tuning information.			

Table 6.1: Probe Tuning Table



# 7 Contact

## Manufacturer

Bruker BioSpin GmbH  
Silberstreifen 4  
D-76287 Rheinstetten  
Germany

E-Mail: [nmr-support@bruker.com](mailto:nmr-support@bruker.com)

<http://www.bruker.com>

WEEE DE43181702

## Bruker BioSpin Hotlines

Contact our Bruker BioSpin service centers.

Bruker BioSpin provides dedicated hotlines and service centers, so that our specialists can respond as quickly as possible to all your service requests, applications questions, software or technical needs.

Please select the service center or hotline you wish to contact from our list available at:

<https://www.bruker.com/service/information-communication/helpdesk.html>



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