Magnetic field measurements
Status report: 4.1.04

As I mentioned in my talk on one of the last meetings there are two possibilities to measure the field direction: One can measure it directly with a 2– or 3–axis probe or one can determine the minimum field perpendicular to the main field direction. These two methods will be referred as direct and zero field measurements respectively. After some investigation and contacts to several companies I found two probes which might fulfill the requirement of an angle measurement with an accuracy better than 0.2^o at an absolute field of 30 G. Both probes are shortly decribed below. The full data sheet is attached.

Bartington Mag D probe

This probe could be used for zero field measurement.
The probe is an axial one, i.e. measures the field along its axis.
Price: 825 GBP
It comes with an alignment accuracy of 0.2^o but for an extra charge of 80 GBP an accuracy of 0.1^o is garanteed. The calibration accuracy for the magnetic field measurement is 1 % which is not the best but sufficient for a zero field measurement. Offset error is less than 20 nT. (Example: A 0.1^o change in a 30 G field corresponds to 5μT.)
The maximum field which can be measured is 20 G. This allows to measure a wide range of $\pm\ 40^o$ around the minimum and to fit then these data with a sinus.

electronic unit Mag-01H:
price: 1390 GBP
It contains the power supply for the probe (a battery), the readout electronics as well as a digital voltmeter to display the readout (4 1/2 digit). Its calibration accuracy is 0.1 % and the highest resolution 0.1 nT.
The maximum distance between the probe and the this unit is 25 m. The price per meter is around 8 \$. A 5m cable is delivered together with the probe.
Further a mains adapter/battery charger is recommended (110 V). I don't know the price yet.
Delivery charge + insurance: 100 GBP

Note:
1 \$ $\approx$ 1.9 GBP.
The prices I found on the GMW homepage are a few 100 \$ cheaper. It would be nice if you could get a complete offer from them and ask if they can provide a probe with 0.1^o alignment. I don't want to ask myself because I am sure that they will contact Bartington and figure out that this is the same business...

Hall probe 3M15-3-2-002T from Senis

Could be used for direct method.
It is an axial probe which can measure the field in 3 axis at a maximum field of 200 G. The calibration accuracy is 0.1 % (this makes the price!) which is sufficient for our purpose. In my talk I mentioned an example of a required accuracy of 0.3 % for 0.1^o error. The offset is less than 10 μT. The angular accuracy between the axis is better than 0.1^o but the alignment to the reference axis is only 0.5^o. To get a better alignment the company suggest to give it to the magnetic measurement group at Cern (contact Mr. F. Bergsma). I did not contact him yet but wanted to wait for your opinion how we should proceed further.
Price for the probe: 4950 $ if buying it at GMW in USA. Buying it in Switzerland at Senis cost 5175 CHF which is 4312 $ at the moment[1] In this case it has to be shipped to Switzerland first. Anyway one would have to calibrate it at Cern to get an useful probe. This might cost extra charge.
Power supply S12-5: 380 $. It comes with a 2m cable between probe and power supply but it could be made "somewhat" longer. The output cable C050 (5m) costs 150 $.

What is needed is a good digital voltmeter (better 2). But I think that there will be some around.
They provide also an unmagnetic holder for the probe which might be useful. I don't know the price for it yet.

[1] In this case the unusual event occurs that it is cheaper in Switzerland compared to USA. The reason is that this probe comes from Switzerland.