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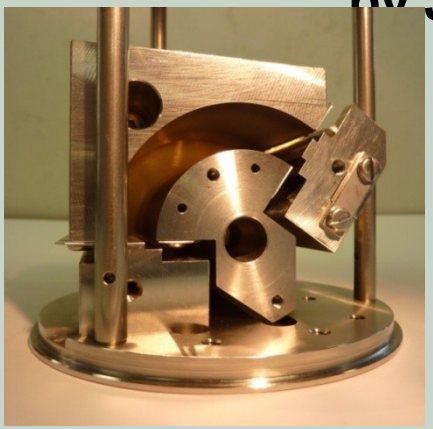
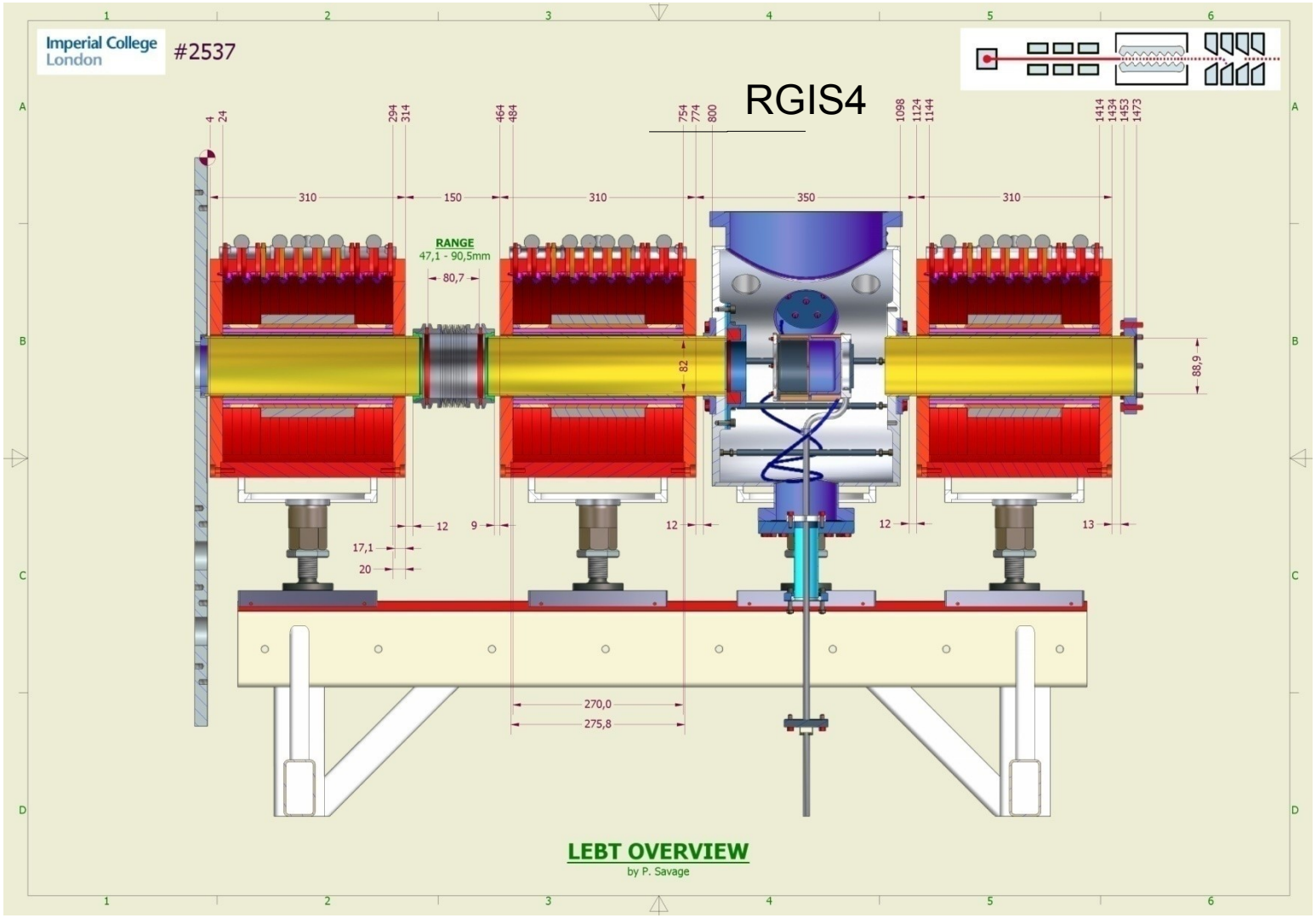
Residual Gas Ion Spectrometer v4 update

March 2012

by J. Pozimski, P. Savage, I. Clark & S. Alsari



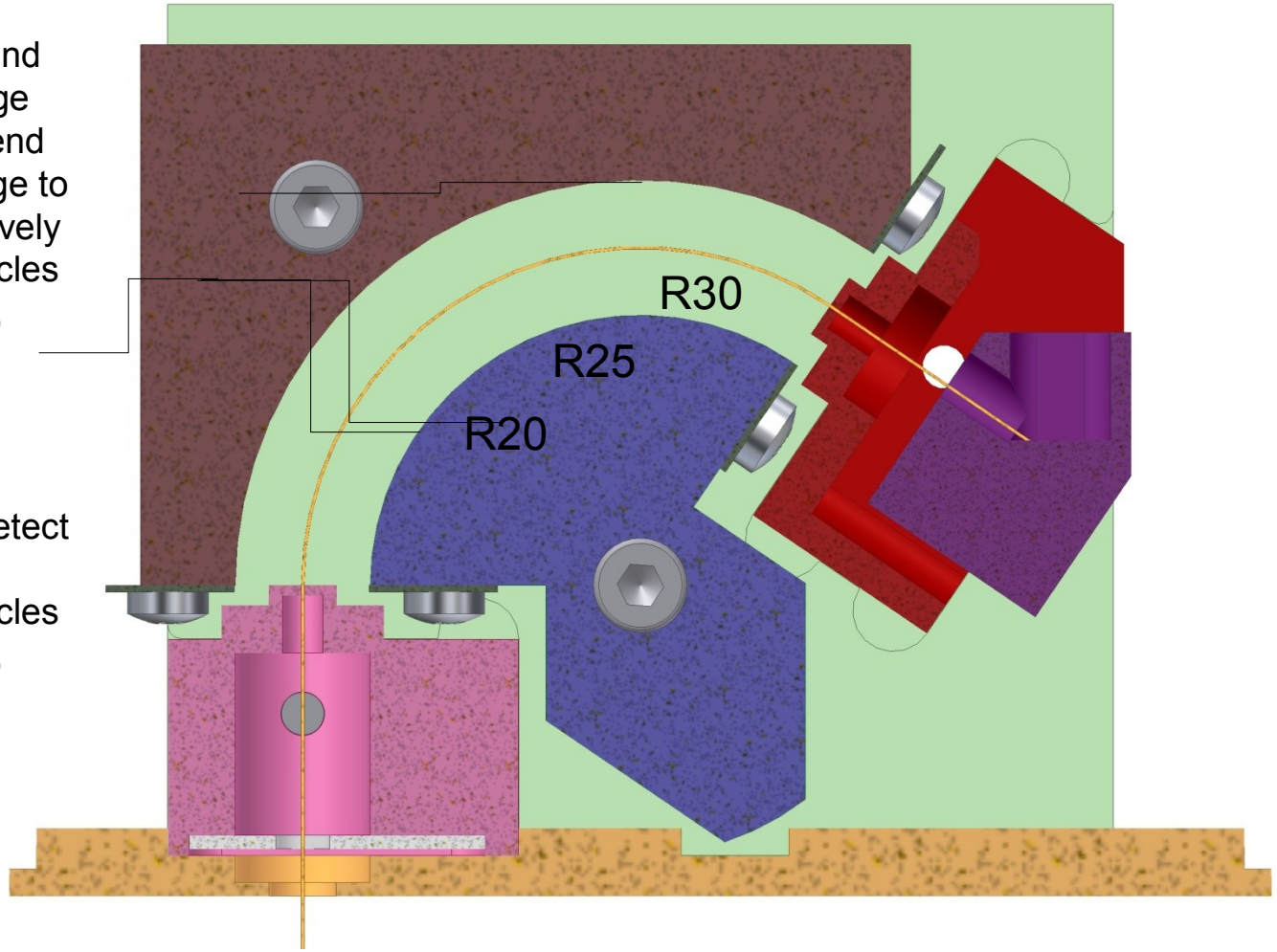
Residual Gas Ion Spectrometer v4 (RGIS4)



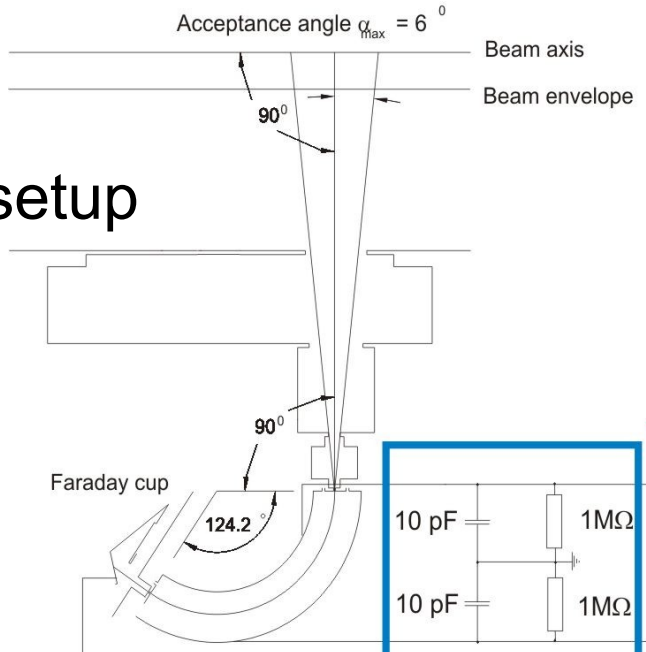
Residual Gas Ion Spectrometer v4 (RGIS4)

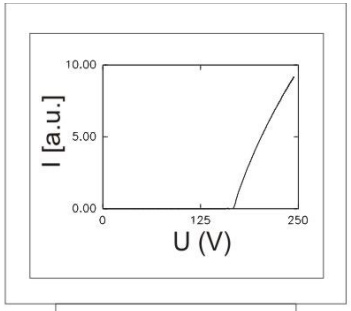
Set outer bend to +ve voltage and inner bend to –ve voltage to detect positively charge particles (in our case, residual gas ions)

Reverse the polarity to detect negatively charge particles (in our case, electrons)



Wiring of experimental setup





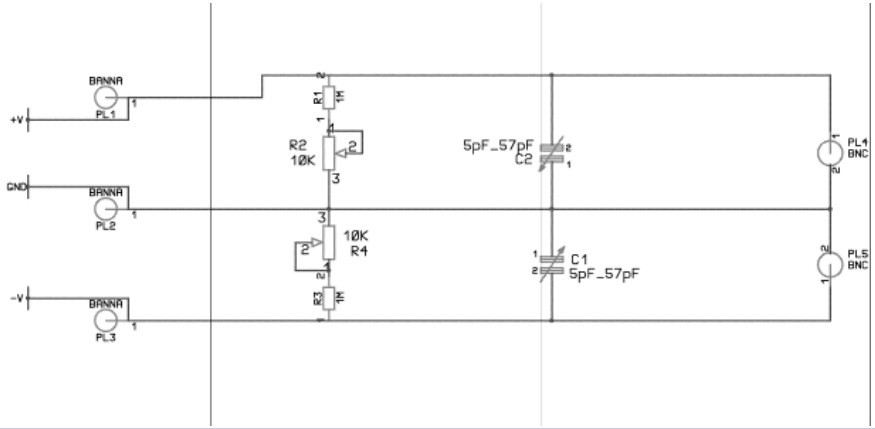
Data aquisation

electronically controled power supply

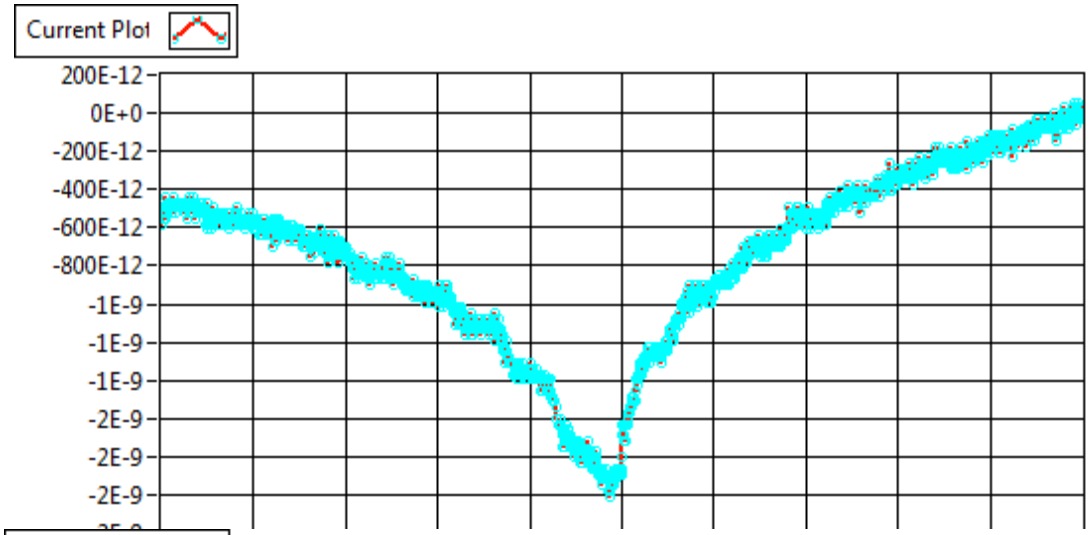
Keithley 6487

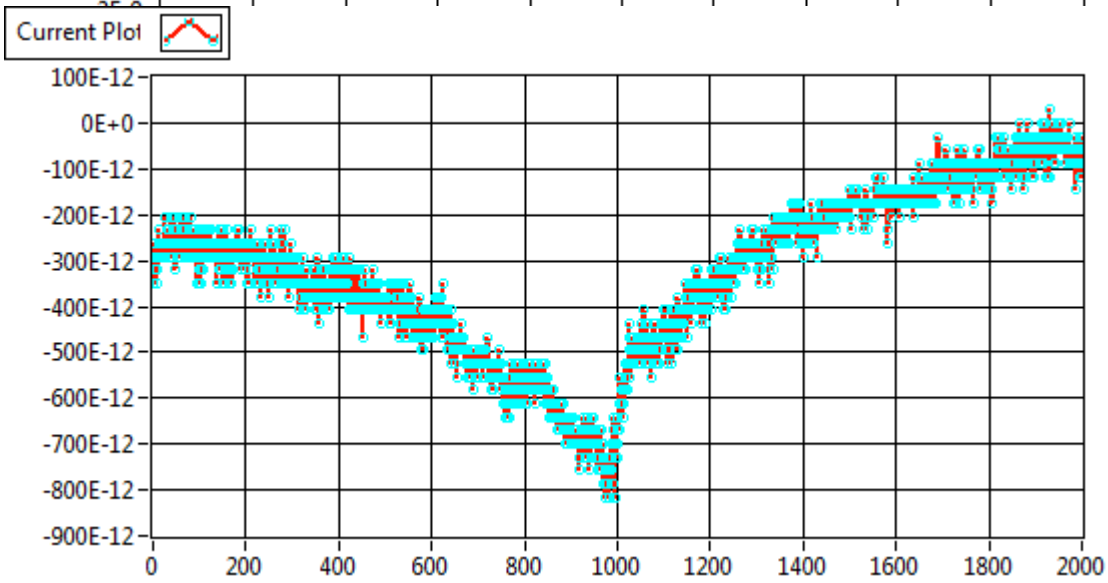
current amplifier

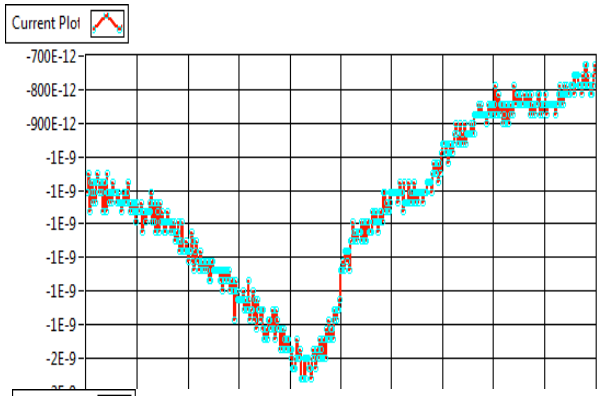
AD-Converter

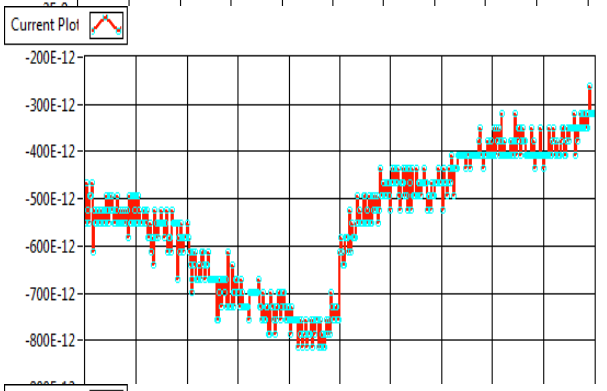


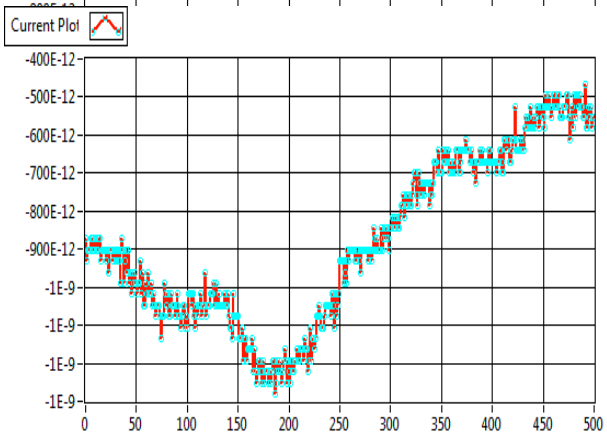
First set of measurements : 22. Feb 2012



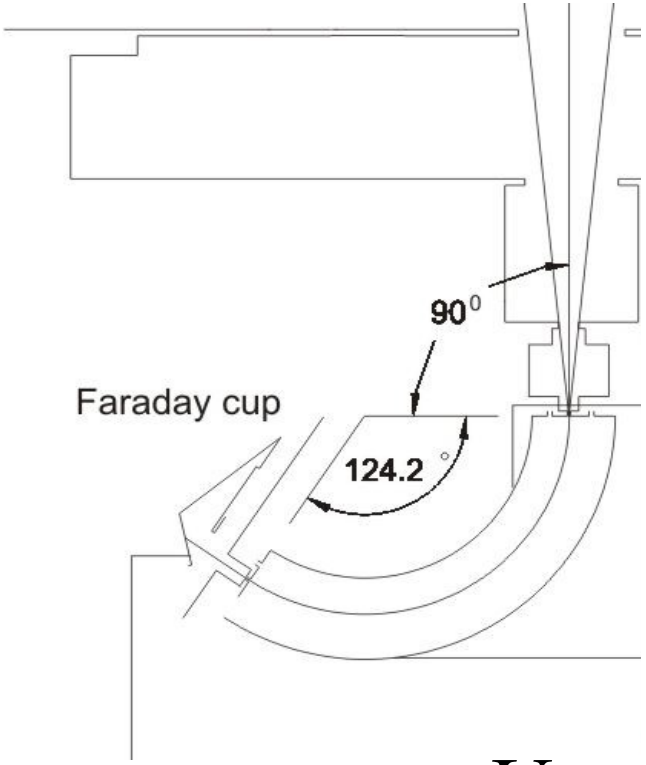








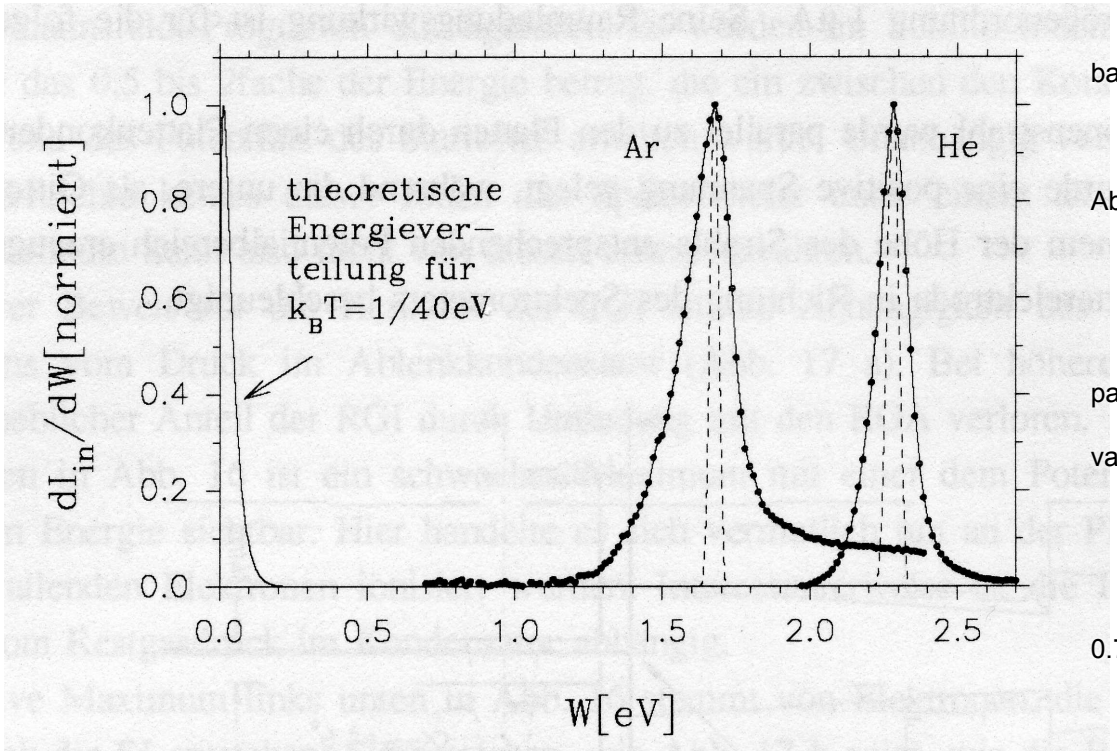
Relation between particles energies detected and voltage on electrodes




```
Rem Offset correction might be required for data analyses in step 3

    INPUT "Offset : "; Offset

    Rem or an automatic offset

    OFMAX = 1E+25

    For M = 1 To NumberofDatapoints
      If OFMAX > Abs(Voltage(M)) Then OFMAX = Abs(Voltage(M)) : Offset
= Current(M)
    Next

    Rem Step 1 reducing measured current by offset

    For M = 1 To NumberofDatapoints
      Current(M) = Current(M) - Offset
    Next

    Rem Step 2 Relation between voltage on electrode

    For M = 1 To NumberofDatapoints
        Particleenergy(M) = Voltage(M) * 1.233
    Next
```

$$W_{particle} = \frac{q \cdot U_{spectrometer}}{2 \cdot \ln \frac{r_{out}}{r_{in}}} = 1.233 \cdot q \cdot U_{spectrometer}$$

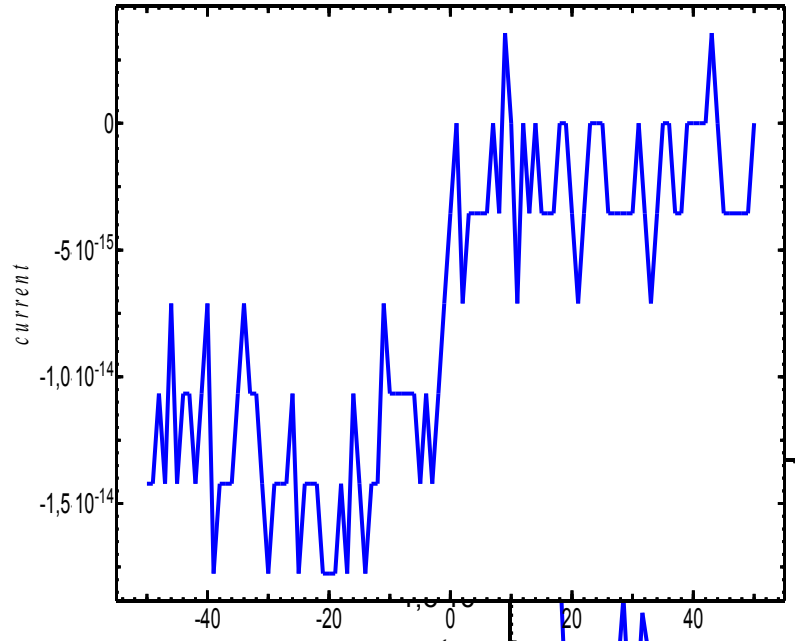
Resolution of spectrometer and transfer function

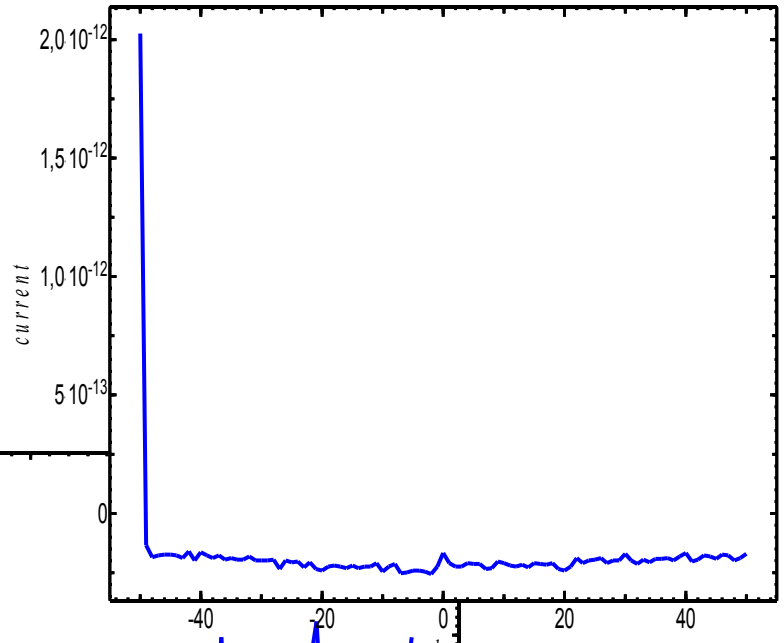


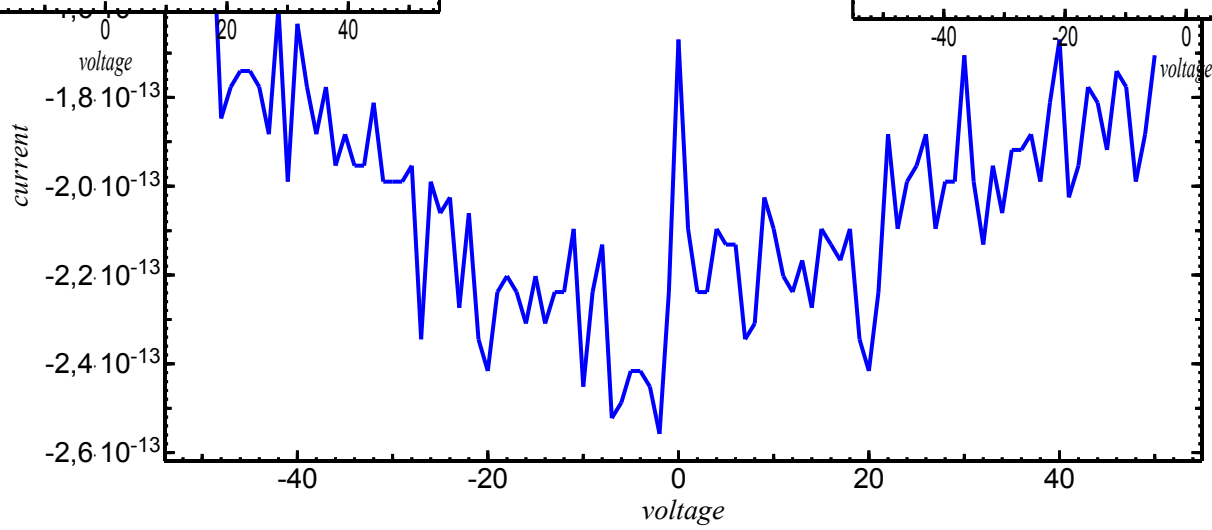

```
Rem Step 3 correction of current by sensitity function for basewidth of 1.2 %
    For M = 1 To NumberofDatapoints
      If 0.05 < Abs(Particleenergy(M))) Then
        Normalizedparticlerate(M) = (Current(M) * 83.33) / Abs(Particleenergy(M))
      Else
        Normalizedparticlerate(M) = 0
      End If

      REM not sure what this correction is for (only "positive" particles ?) but it was in the
      REM code, surely comes from Rudolph (names of variables ;-)) looks like a Taylorexpansion...

      If 0.05 < Particleenergy(M)) Then
        A = (0.6611 * Sqr(Particleenergy(M)))
        X = 1 / (1 + 0.47047 * A)
        UWERT = 1 - (0.3480242 * X - 0.0958798 * X * X + 0.7478556 * X * X * X) * Exp(-A * A)
        Current(M) = Current(M) / UWERT
      End If
Next
```

$$2 \cdot \Delta W_{particle} = W_{particle} \frac{d_{slit,in} + d_{slit,out}}{r_{slit}} = \pm 1{,}2\%$$

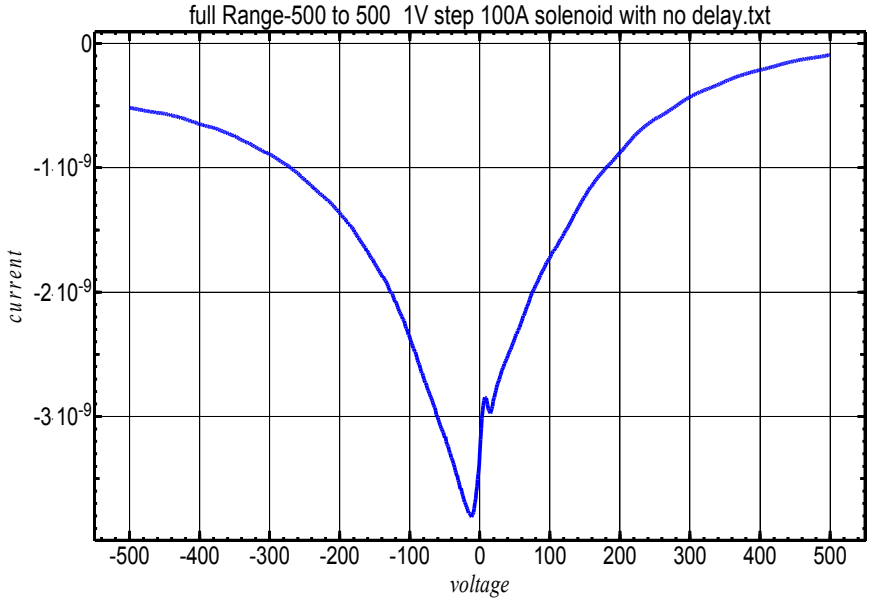
Second set of measurements : 1st March 2012 - zero check

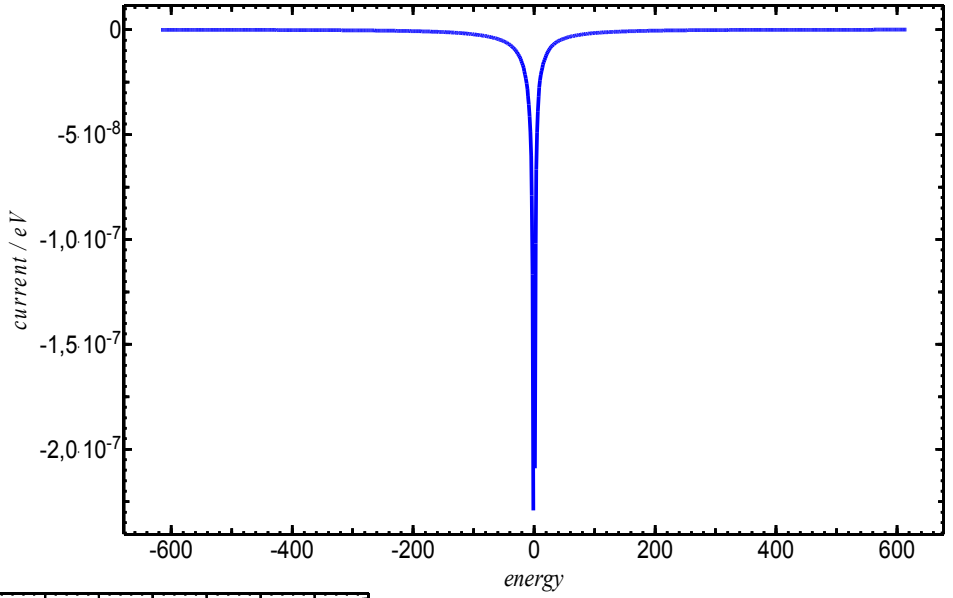


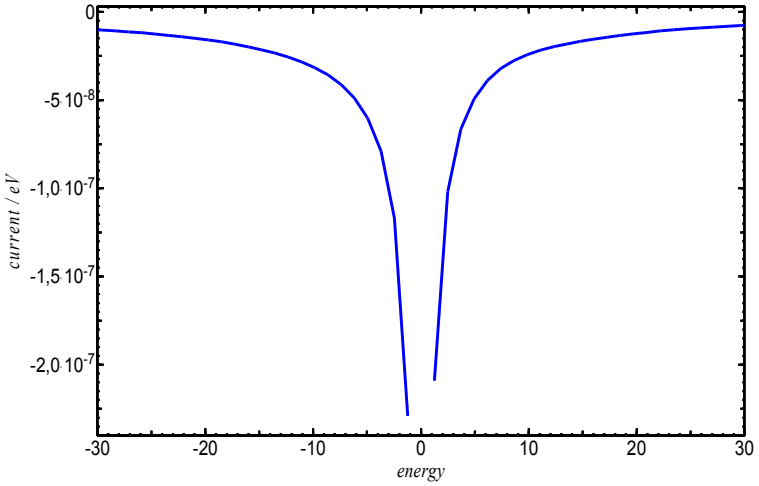




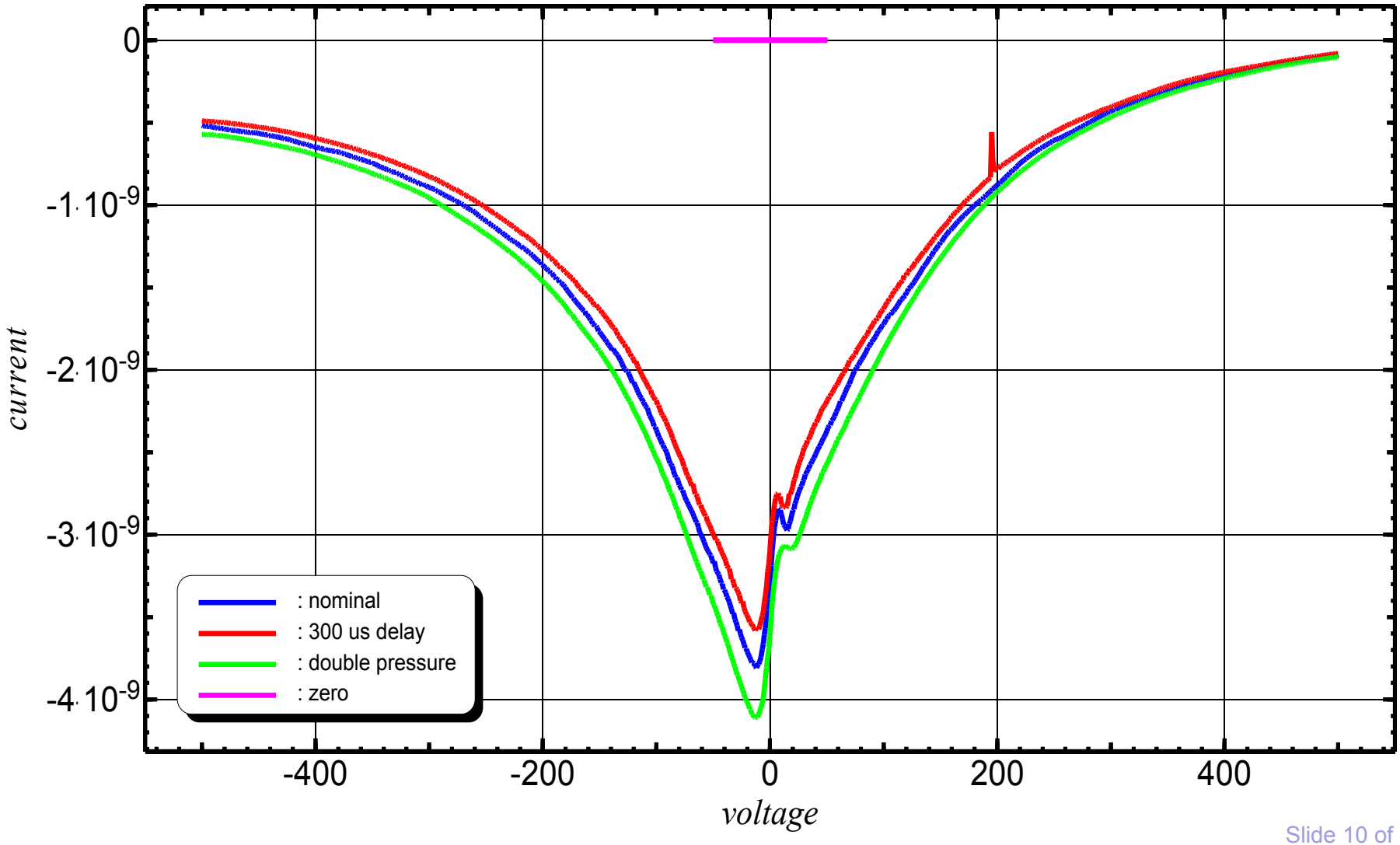
Second set of measurements : 1st March 2012 – measurements 1







Second set of measurements : 1st March 2012 – measurements 2



Summary

- Zero – measurements with satisfactory results
- Range programming now adjustable to requirements
- Output resolution corrected to allow for data analysis
- Timing details still unresolved
- Pressure issues prevented further measurements / pressure check ok
- Decompensation electrode should be installed in April latest
- If Keithley ammeter is not sufficient
    - Attach DDC 112 setup to FDC or Upgrade to Channeltron
- Second set of compensation measurements April / May