Calibration of LOW.ICT1 at ADC

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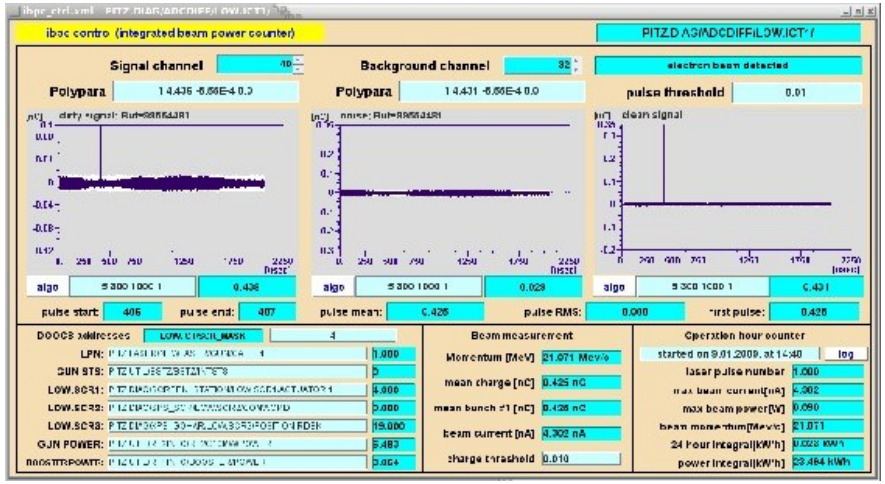
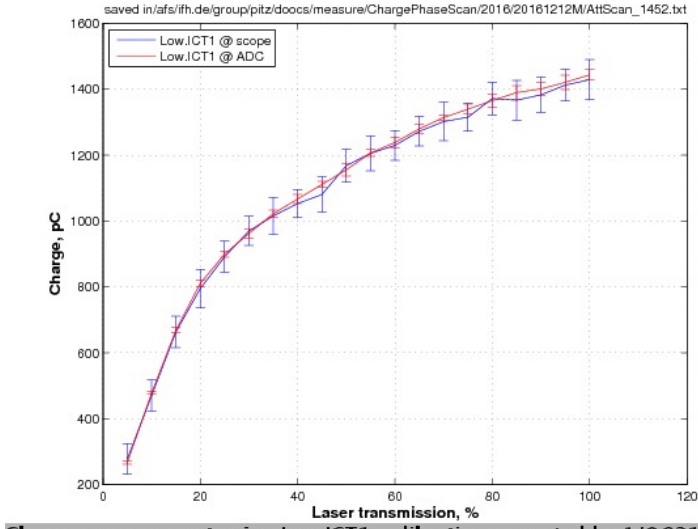




Charge measurement using Low.ICT1; calibration corrected by 1/0.921.

HELMHOLTZ ASSOCIATION

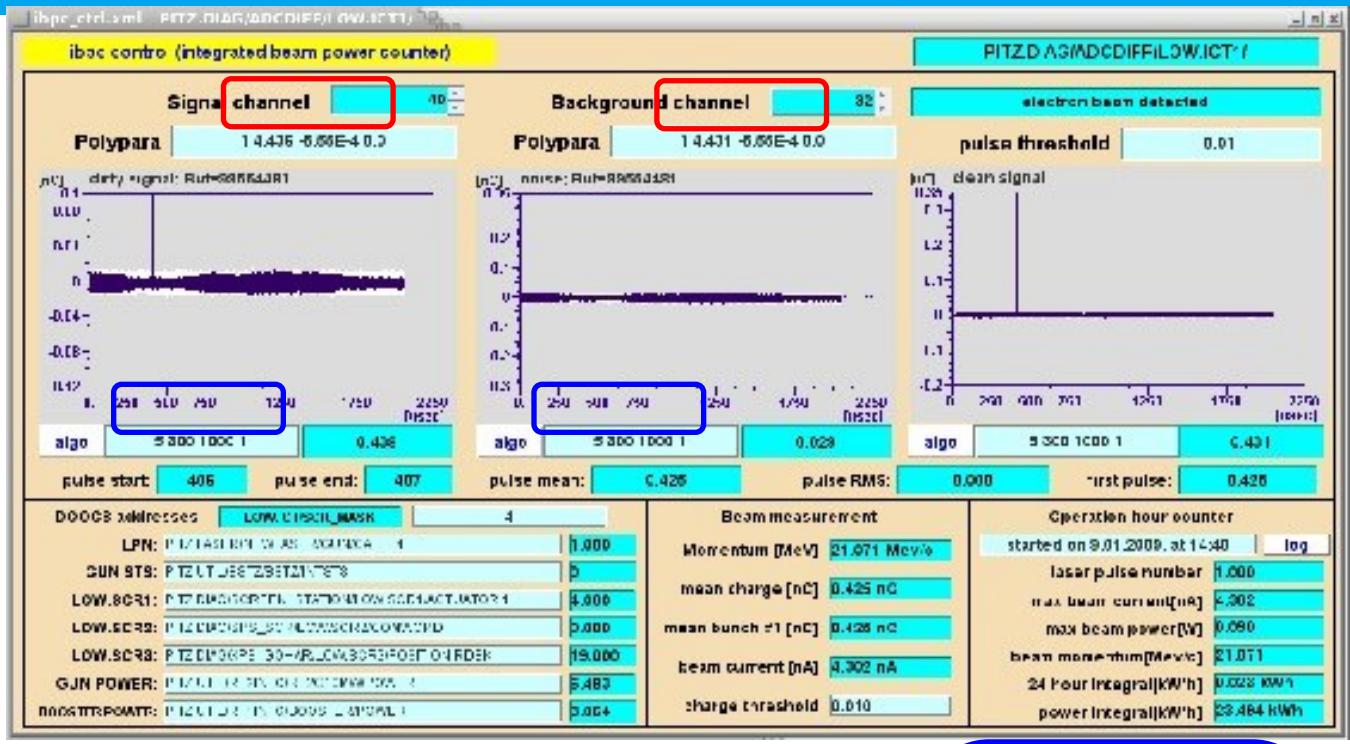
DESY

Calibration of LOW.ICT1 at ADC

$A0_{raw} = 4.436$
$A1_{raw} = -5.56E-4$

$A0_{bkg} = 4.431$
$A1_{bkg} = -5.56E-4$

Polyparameters:
p1 p2 p3 p4:
p1=1 → linear
p2=A0
p3=A1



Signal channel: $Q_{raw} = A0_{raw} + A1_{raw} \cdot s_{raw}$

Background channel: $Q_{bkg} = A0_{bkg} + A1_{bkg} \cdot s_{bkg}$

Resulting charge: $Q = Q_{raw} - Q_{bkg}$

Algorithm:
a1 a2 a3 a4
a1=0(off);1(mean);
2(min); 3(max);
4(rms);
5(amplitude)
a2: channel1
a3: channelN
a3: channel-step

Upto now:
$A1_{raw} = A1_{bkg}$; $A0_{raw}$ and $A0_{bkg}$ ➔ zero background at the resulting signal + cross-check with scope

Calibration of LOW.ICT1 at ADC, proposals

4 constants → 4 conditions

w/o beam (shutter closed) →noise only ➔ ~

1) Signal channel: $\langle \tilde{Q}_{raw} \rangle = A0_{raw} + A1_{raw} \cdot \langle \tilde{s}_{raw} \rangle = 0$

2) Background channel: $\langle \tilde{Q}_{bkg} \rangle = A0_{bkg} + A1_{bkg} \cdot \langle \tilde{s}_{bkg} \rangle = 0$

3) Signal channel: $\sigma_{\tilde{Q}raw} = \sigma_{\tilde{Q}bkg}$ ←→ $A1_{raw}\sigma_{\tilde{s}raw} = A1_{bkg}\sigma_{\tilde{s}bkg}$

w/ beam (shutter open)

4) Cross-check with scope

Resulting charge: $Q = Q_{raw}\text{-}Q_{bkg} = A1_{raw}\left\{s_{raw} - \langle \tilde{s}_{raw} \rangle + \frac{\sigma_{\tilde{s}raw}}{\sigma_{\tilde{s}bkg}} \cdot \left[\langle \tilde{s}_{bkg} \rangle - s_{bkg}\right]\right\}$

Calibration of LOW.ICT1 at ADC, procedure

1. Record (backup) polyparameters $A0_{raw}, A1_{raw}, A0_{bkg}, A1_{bkg}$
2. Set $A0_{raw} = A0_{bkg} = 0;\ A1_{raw} = A1_{bkg} = 1$
3. Open shutter, scan ADC timing for the maximum amplitude
4. Close shutter → noise measurements:

   4.1 Algo:(a1=1) $\langle \tilde{s}_{raw} \rangle = \langle \tilde{Q}_{raw} \rangle;\ \langle \tilde{s}_{bkg} \rangle = \langle \tilde{Q}_{bkg} \rangle$

   4.2 Algo:(a1=4) $\sigma_{\tilde{s}raw} = \sigma_{\tilde{Q}raw};\ \sigma_{\tilde{s}bkg} = \sigma_{\tilde{Q}bkg}$
5. Cross-check with scope [Raw algo:(a1=5); Bkg algo:(a1=1)]??

$$A1_{raw} = \frac{Q_{scope}[nC]}{s_{raw} - \langle \tilde{s}_{raw} \rangle + \frac{\sigma_{\tilde{s}raw}}{\sigma_{\tilde{s}bkg}} \cdot \left[\langle \tilde{s}_{bkg} \rangle - s_{bkg} \right]}$$

6. Calculate other polyparameters:

$$A0_{raw} = -A1_{raw} \langle \tilde{s}_{raw} \rangle$$

$$A1_{bkg} = A1_{raw} \frac{\sigma_{\tilde{s}raw}}{\sigma_{\tilde{s}bkg}}$$

$$A0_{bkg} = -A1_{bkg} \langle \tilde{s}_{bkg} \rangle$$

7. Set all 4 polyparameters: $A0_{raw}, A1_{raw}, A0_{bkg}, A1_{bkg}$
8. Final cross-check with scope (e.g. LT-scan)