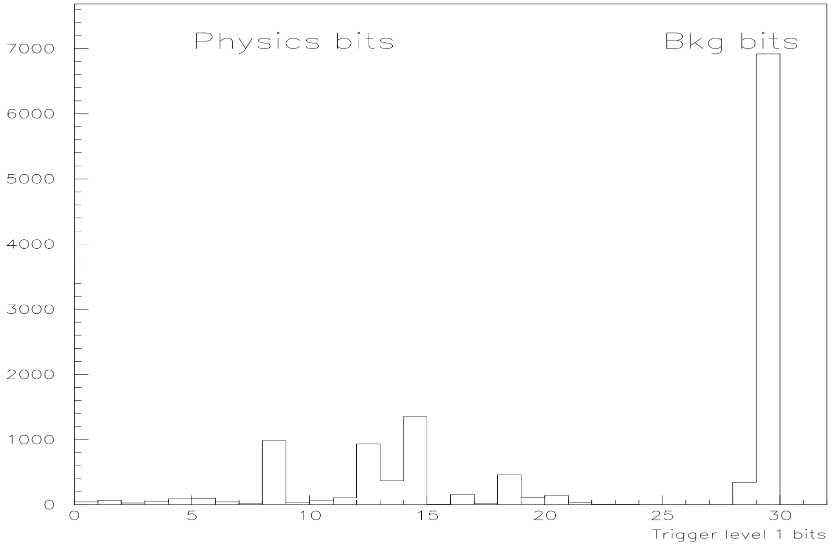
Status of DCH Background Study

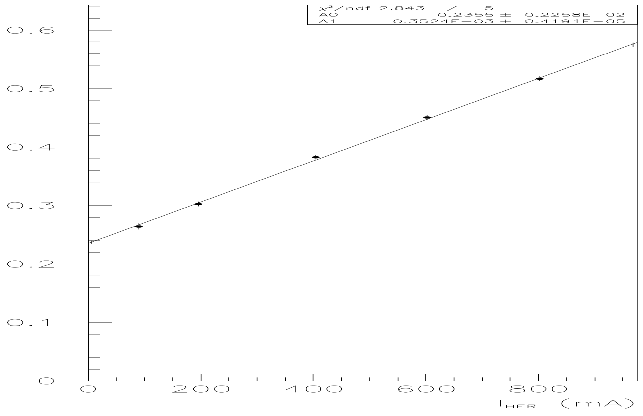
- Goal: Obtain a Background description in terms of $Ndigis/event$ vs (I_{HER}, I_{LER}) in order to extrapolate the DCH occupancy to high luminosity.

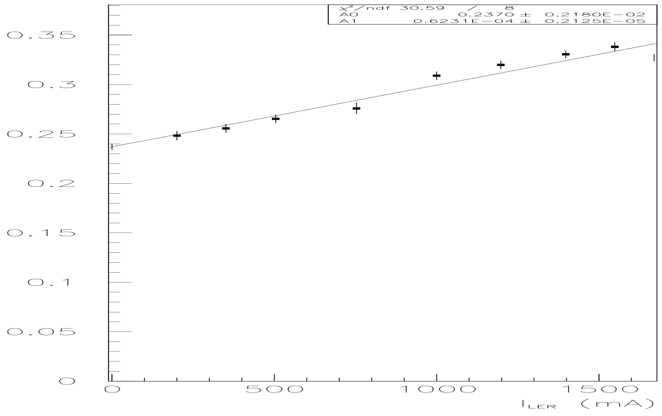
- Strategy: Use the "Background Runs" with varying beam currents and only one (both) beam(s) in the machine. Use trigger information to discriminate between Bkg/Physics events.



DCH Background

- Background events often mimic the physics ones: it is not correct to use only the "Bkg Trigger" subsample. Fraction of "Physics Trigger" vs I in single beam runs (at $I = 0$, 25% are cosmics):





- With two circulating beams the total background is not simply the sum of the two "single beam" contributions:

  BKG(tot)=BKG(HER)+BKG(LER)+BKG(HER-LER inter.).

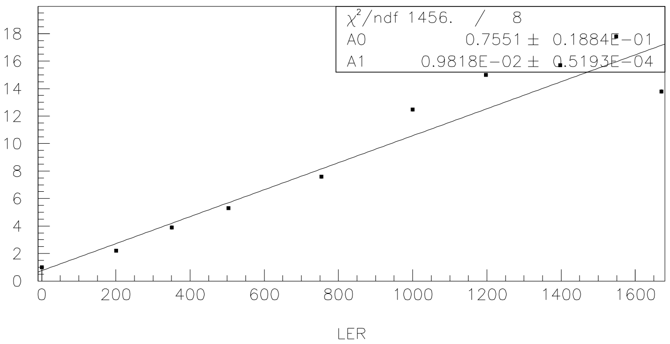
- How can we discriminate between the "interaction" Bkg component and the "genuine physics" one?

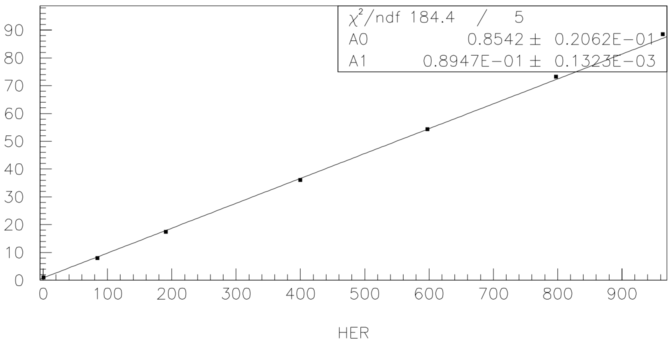
DCH Background

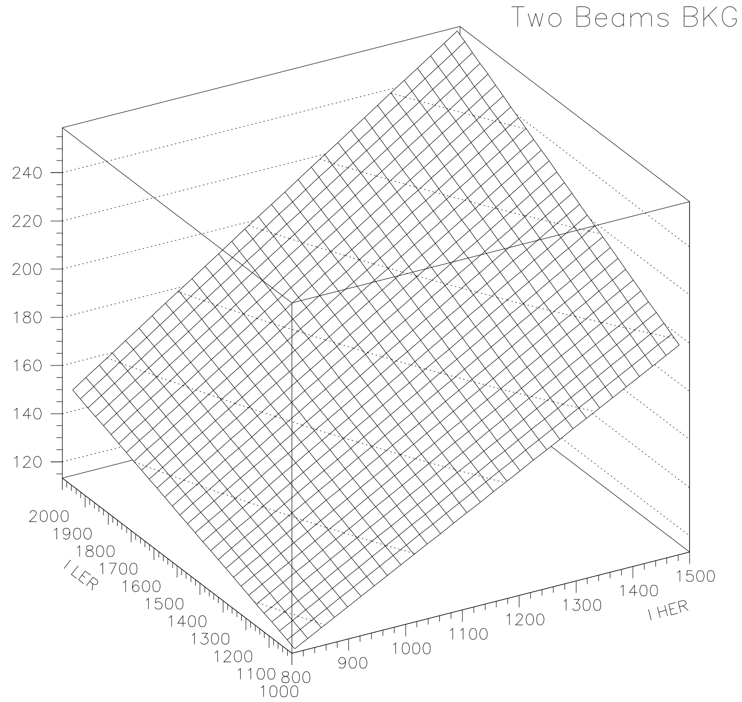
Recipe for the Background Evaluation:1

- $n_{digi} = Ndigis/event$ in the "BKG Trigger" subsample:
- Single beam: $n_{digi} = p1 + p2 * I$
- Two beams:

  $n_{digi} = p1 + p2 * I_{HER} + p3 * I_{LER} + p4 * I_{HER} * I_{LER}$



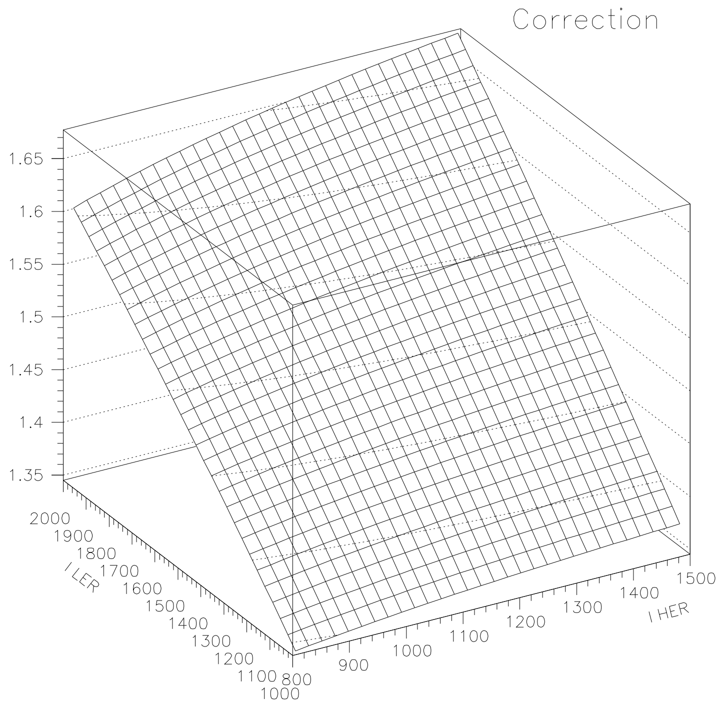




DCH Background

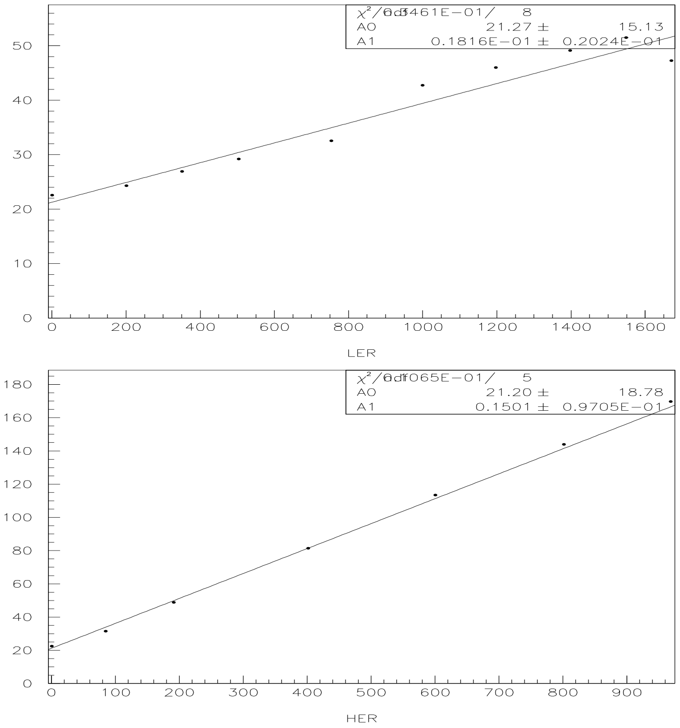
Recipe for the Background Evaluation:2

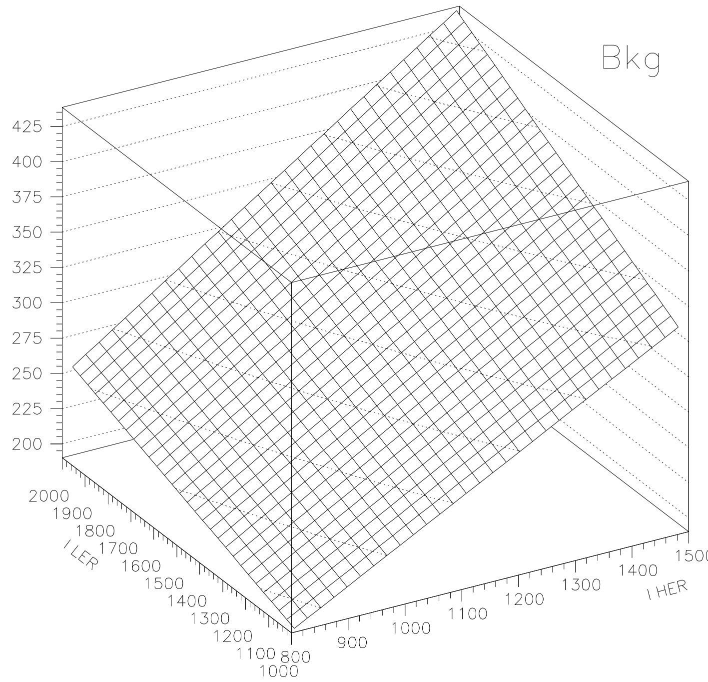
- The ratio $R = \frac{n_{digi}(2Beams)}{n_{digi}(I_{LER})+n_{digi}(I_{HER})}$, which accounts for the $I_{HER} - I_{LER}$ interaction, is computed in the "Bkg Trigger" subsample and then applied as a correction to the sum of the two "single beam" components in the total sample after the subtraction of cosmics events.



Recipe for the Background Evaluation:3

- $n_{digi} = Ndigis/event$ in the BKG total sample:
- Single beam: $n_{digi} = p1 + p2 * I$
- Two beams: $n_{digi} = R \times (n_{digi}(I_{LER}) + n_{digi}(I_{HER}))$



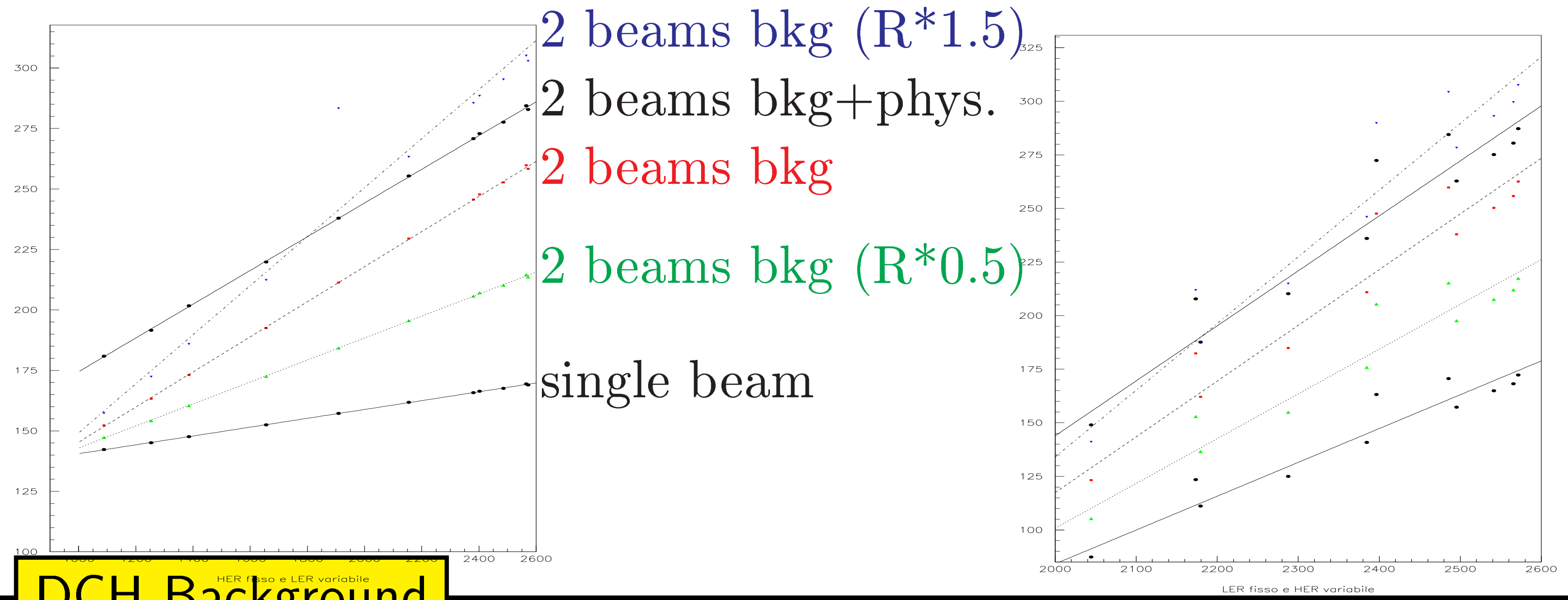


DCH Background

Preliminary Results

- *Ndigis/event* versus the sum of the two currents: Different HER, LER dependence (Left: Fixed $I_{HER} \sim 920mA$, Right: Fixed $I_{LER} \sim 1600mA$)

- Assumption: the "Bkg Trigger" and the "Physics Trigger" events can be corrected with the same R coefficient: $\pm 50\%$ uncertainty on R.



Different Approach: fit to the total sample

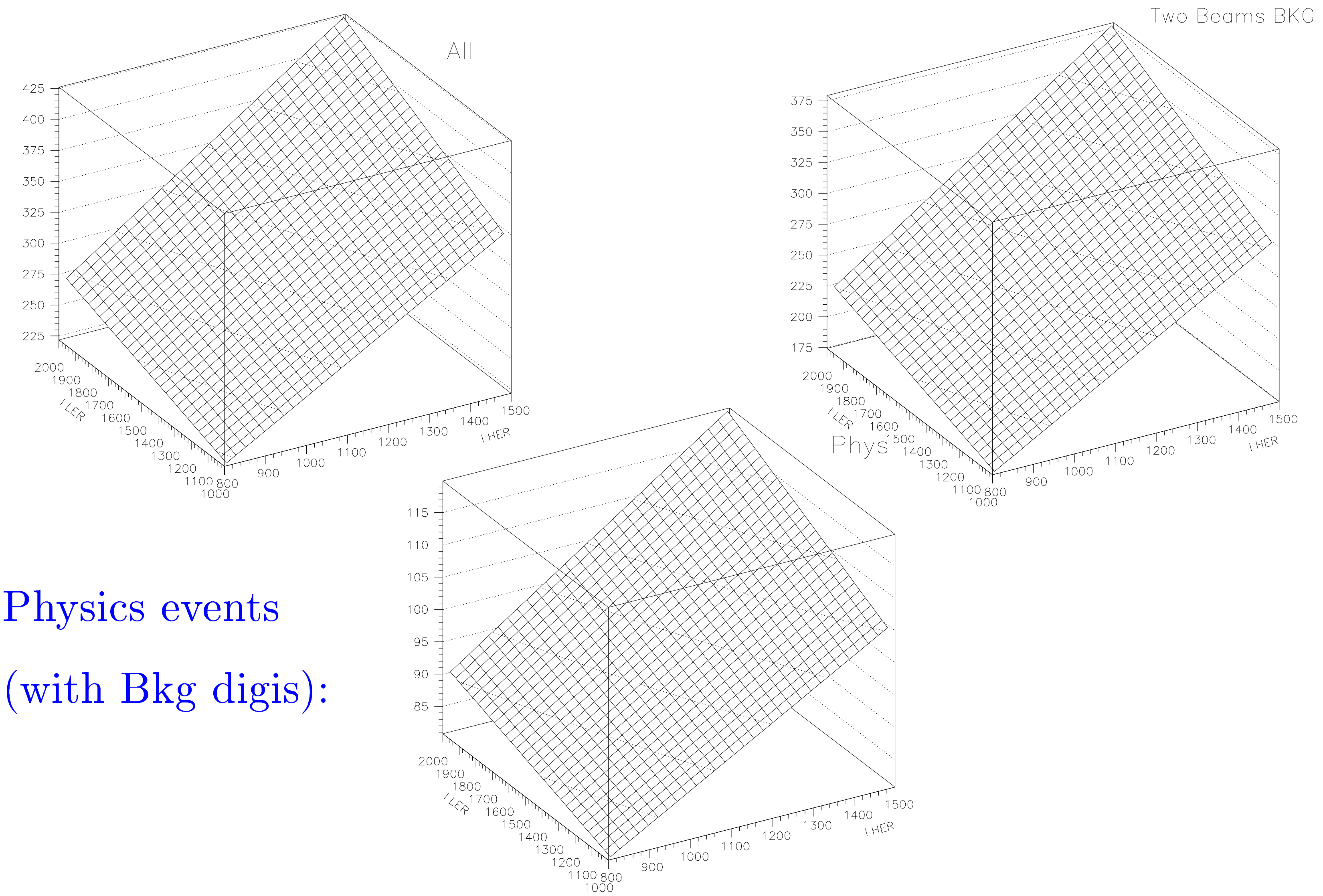
- Bkg component obtained from a fit to $n = Ndigis/event$ vs (I_{HER}, I_{LER}) assuming empirical parameterizations of the different components.

- $n = f_{bkg} \times n_{bkg} + f_{phy} \times (n_{phy} + n_{bkg}) + f_{cosm} \times (n_{cosm} + n_{bkg})$
  - $f_i = \frac{R_i}{\sum R_i}$ fraction of class i events (bkg, cosmics, physics) in terms of the event rates R_i
  - n_i average number of digis/event for the different classes

Class	Cosmics	Background	Physics
Rate	Const.	$A * I_H + B * I_L + C * I_H * I_L$	$D * I_H * I_L$
n	Const.	$E * I_H + F * I_L + G * I_H * I_L$	Const.

- Purple: from the previous study; Black: to be changed for systematics evaluation; Blue: from general principles.

Preliminary Results



Physics events

(with Bkg digis):

DCH Background

Preliminary Results

- Results to be compared with the previous method ones

  (ex.: $I_{HER} = 1500\ mA$; $I_{LER} = 2000\ mA$: ~ 2 times the current luminosity):

	Method 1	Method 2
n_{all}	464	431
n_{bkg}	444 ± 90	383

- The first method seems to prefer higher "interaction" component for the Background;
- Error due to the Bkg events rate parameterization in the second method has to be evaluated;
- Next steps: use a combination of the two determinations to fix the Bkg amount in the MC study