MEG - Summary and Prospects

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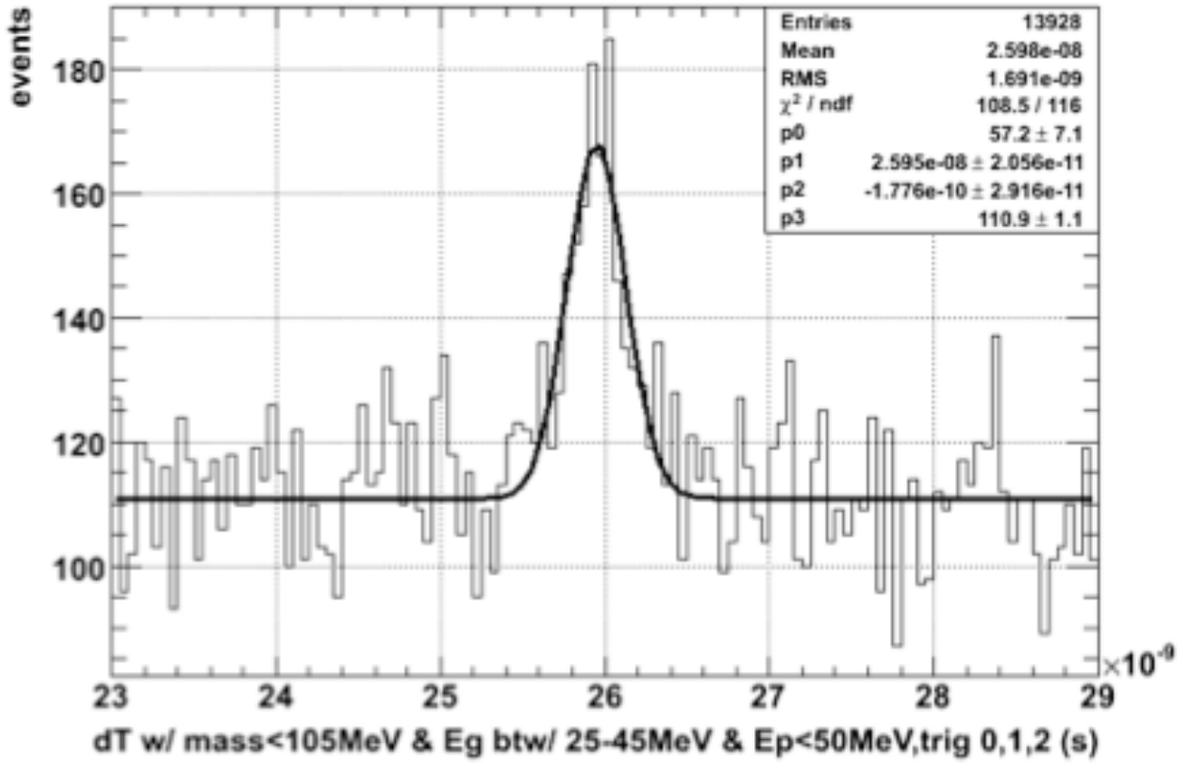
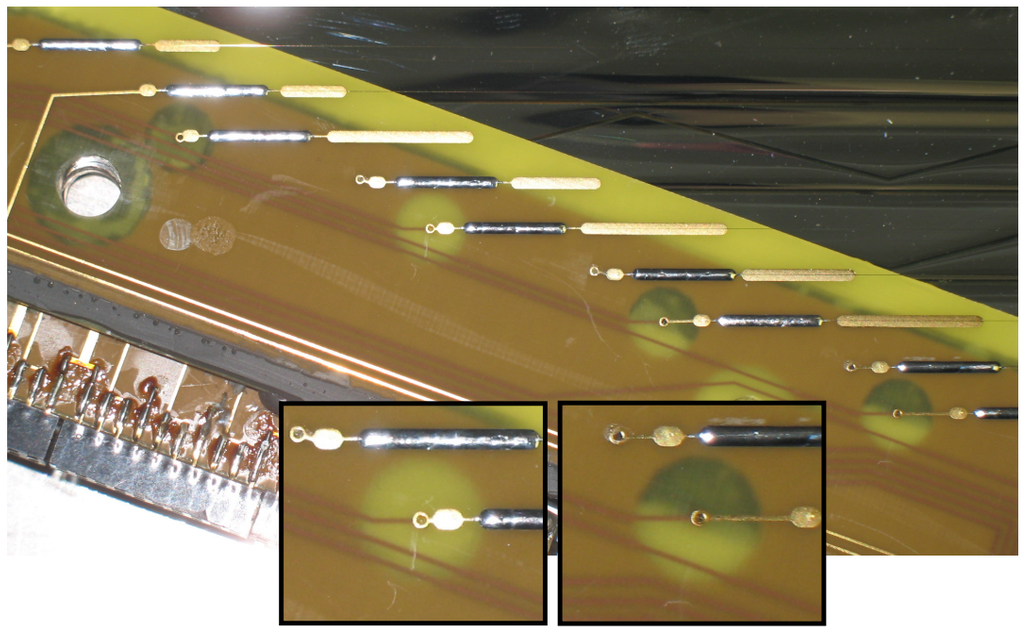
We successfully started taking physics data in 2008

- Clear observation of the radiative decay events in our physics data demonstrates well that we are really sensitive to the μ→eγ events
- Various data samples sufficient to evaluate the detector performance and the background level were also successfully taken
- The LXe light yield continues to increase; the detector performance was accurately monitored by various means
- The TC operated stably with expected resolution ensured by the Dalitz decay and Boron calibrations
- The DC HV problem persists and caused inefficiency and poorer resolutions
- We're blind to the signal events

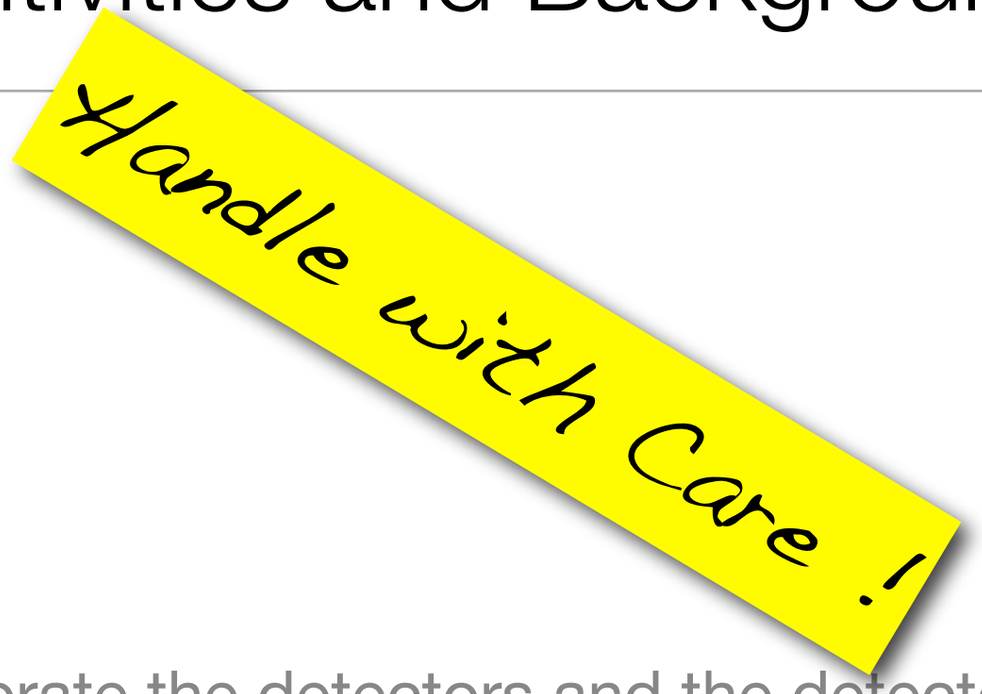


Our Strategy for the DC Problem

- Eliminate all possible causes of the problem
- Build new DC modules immediately and start a long term test
- Carry out further tests to identify the cause of the problem while proceeding with the repair work and construction of the modules in parallel
- Start physics run in time to collect sufficient data this year with successful test results (hopefully)



Provisional Sensitivities and Backgrounds 2008



- We still continue to calibrate the detectors and the detector performances keep improving on a daily basis

- Therefore the numbers given in the following slides are provisional and by no means indicate the final efficiencies and resolutions for the 2008 run

Efficiencies

CAUTION: All 2008 numbers are provisional

Still lots of things to learn from the data

- Blue numbers likely to change - Grey numbers may vanish

(%)	"Goal"	2008 Provisional Lower Limits	2009 Provisional Prospects
Gamma	> 40	> 50 (depth) x (65 x 85) (pileup)	> 50 x 90
e+	65	30 (DC) x 40 (DC-TC)	85 x 50
Trigger	100	100 x 99 (energy, time) x 80 (direction)	> 99
Selection	$90^4 = 66$	90^3 x 95 = 69	69
DAQ	(> 90)	> 80 (live) x 93 (run transition)	> 90 x 99
Calibration Run etc	(> 95)	~70	90
Running Time (week)	100*	11.5**	11.5
Single Event Sensitivity (10^{-13})	0.5	< 30 - 50	< 3 - 5

* 1 week = 4×10^5 sec (66%) ** CEX runs not included

Normalization

$$N(\mu \to \mathrm{e}\gamma) = N_\mu \cdot Br(\mu \to \mathrm{e}\gamma) \cdot (\Omega/4\pi) \cdot \epsilon_\gamma \cdot \epsilon_{e+} \cdot \epsilon_{trig} \cdot \epsilon_{sel}$$

- The number of stopped muons is principally evaluated by counting the high momentum Michel positrons by DC + TC during the physics run

- In the branching ratio calculation, the positron efficiency cancels out to the first order, and a rather precise evaluation should be possible in spite of the varying positron efficiency during the run

- Other methods to estimate the normalization are available and can be cross-checked; Preliminary analyses indicate they reasonably agree

- Systematic checks on correlations need to be carried out

CAUTION: All 2008 numbers are provisional

Resolutions

Resolutions are improving as we understand the detectors better.

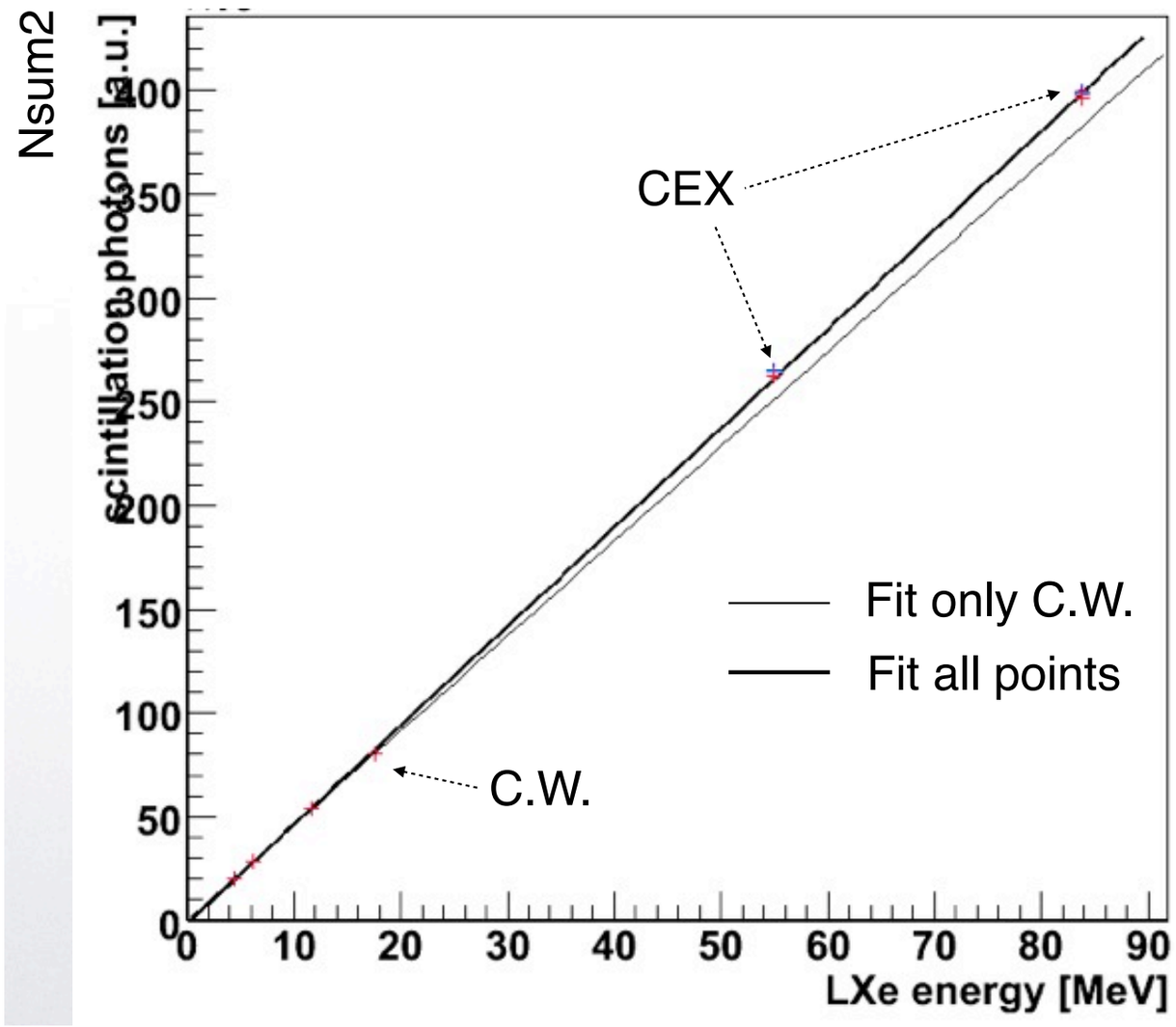
(in sigma)	"Goal"	2008 Provisional	2009 Provisional Prospects
Gamma Energy (%)	1.2 - 1.5	< 2.3	< 1.7
Gamma Timing (ps)	65	< 100*	< 80
Gamma Position (mm)	2 - 4	5 - 6.5	5
e+ Momentum (%)	0.35	1.5 - 2.0	0.7 - 0.8
e+ Timing (ps)	45	< 60 - 90	60
e+ Angle (mrad)	4.5	9 - 18	11
mu Decay Point (mm)	0.9	3 - 4	2
Gamma - e+ Timing (ps)	80	150	100
Background (10^{-13})	0.1 - 0.3	-	< 0.6 - 3

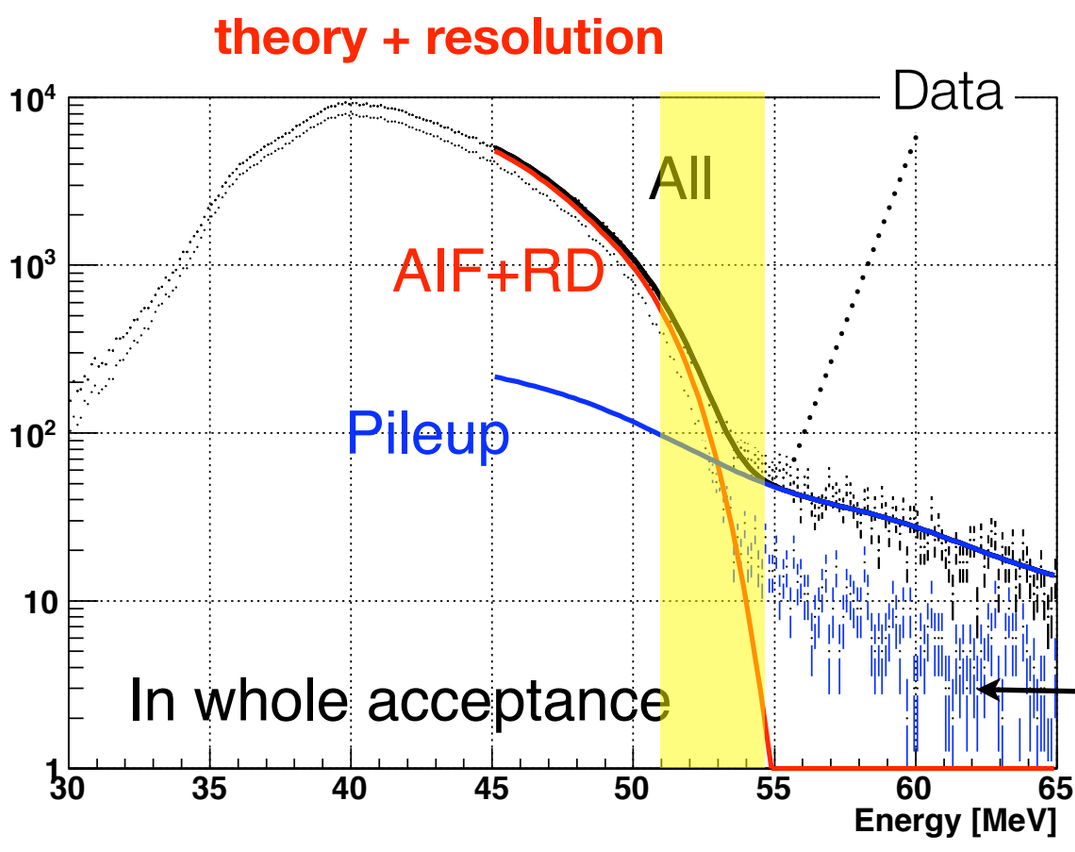
* clock error of ~60ps included

Energy Scale Uncertainty

Non linearity possible due to energy dependent shower development

Position dependence has not been completely corrected





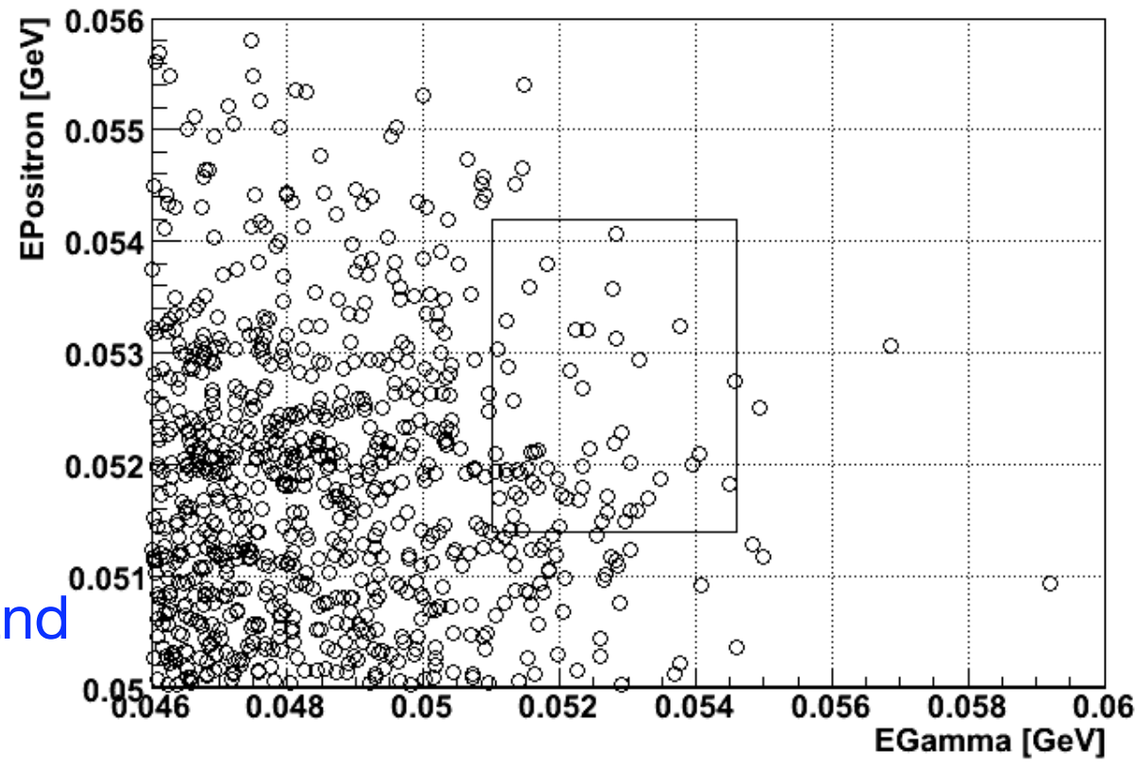
after pileup rejection

“Old” and “New” Background Evaluations

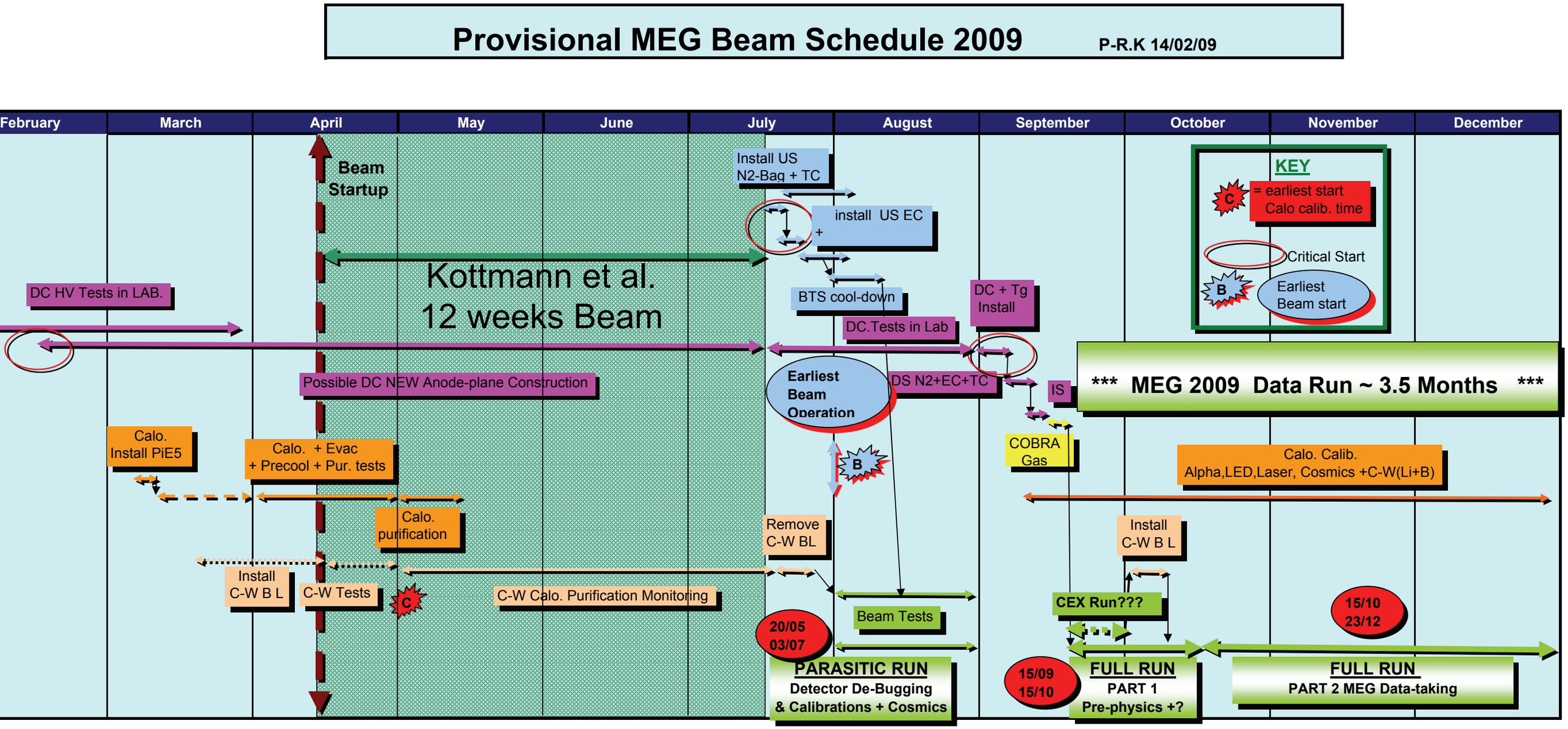
- “Old” evaluation was based on scaling the background estimate from elaborate simulations at a very high rate (10^8/sec) according to the resolutions. It is rather pessimistic concerning the pileup background.

- “New” evaluation is based on the actual distributions of data (“side bands”). Another estimate using the single distributions agree quite well; i.e., the background events look mostly accidental as expected.

Event distribution at side-band



MEG Schedule 2009



2008 physics data analysis

DRS4

Conclusion

- With the data taken last year, we believe we can demonstrate that we are really capable of detecting the μ→eγ events
  - Analysis result of the 2008 data should be ready by the summer
- We make every single effort to eliminate all possible sources of the DC HV problem while preparing carefully for a successful physics run this year; We are confident that this is a most sound and efficient approach to the problem
- We need to continue to run the experiment through to the end of 2011 to achieve the target sensitivity
- The year 2009 will mark a significant step forward toward the goal of the MEG experiment; We are all looking forward to another challenging year!