SUMMARY 2007
AND
PROSPECTS 2008

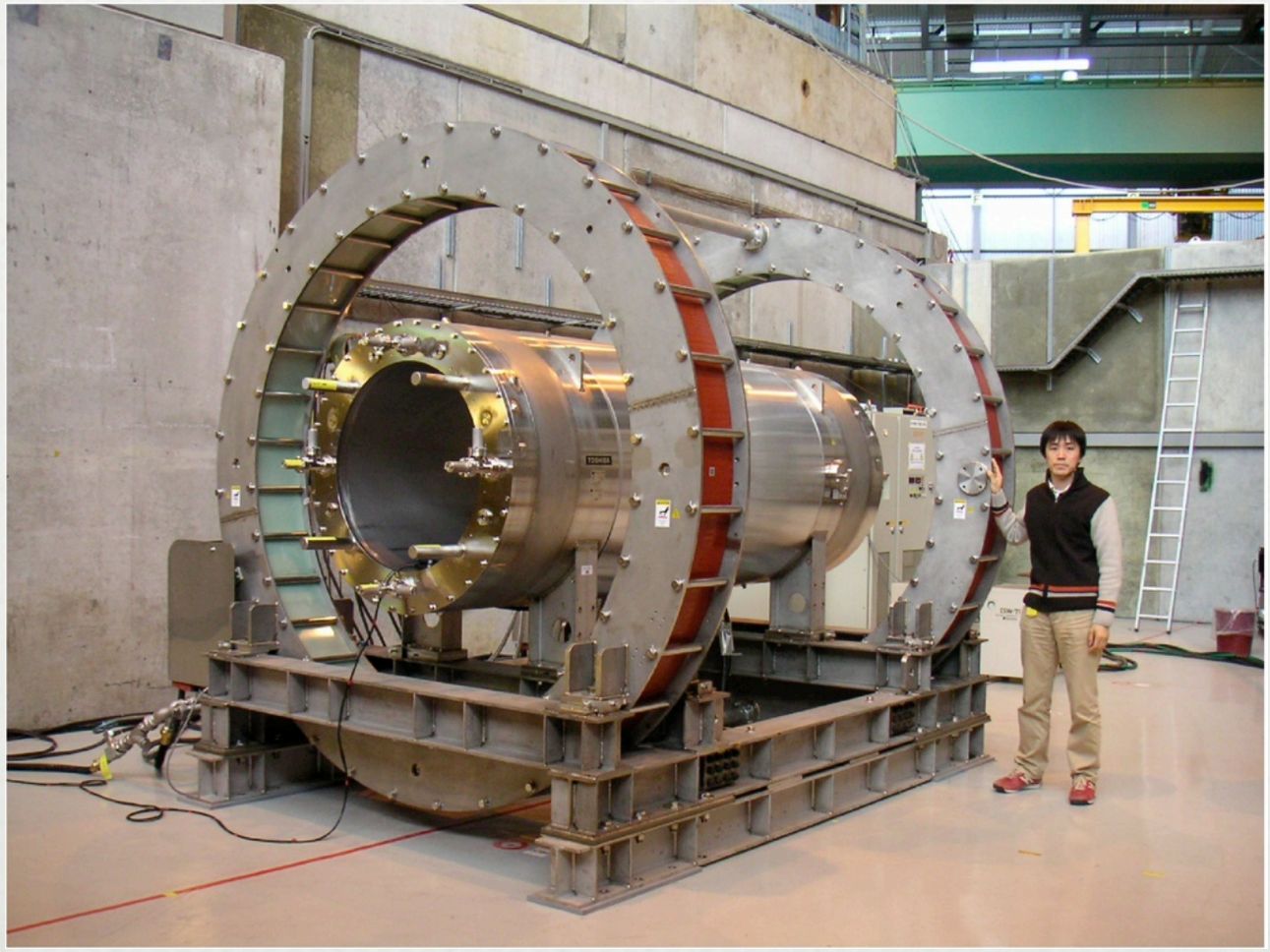
T. MORI

SUMMARY 2007

WE SUCCESSFULLY RAN
THE WHOLE EXPERIMENT
IN 2007

- ALL THE DETECTORS INSTALLED & OPERATED
- TRIGGERS IMPLEMENTED & WORKED AT EXPECTED RATES
- A FULL SET OF CALIBRATION & PHYSICS DATA TAKEN

COBRA

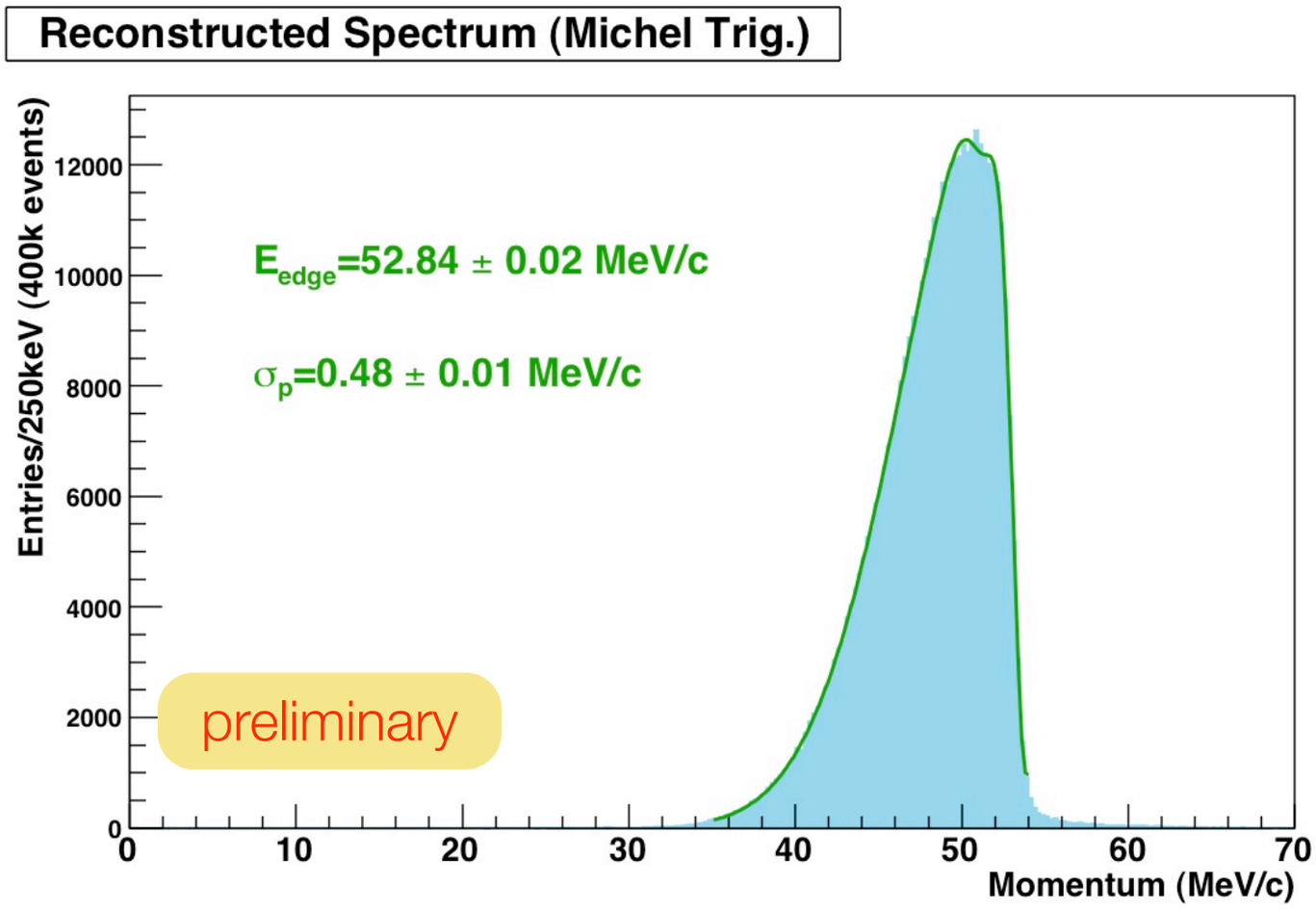


NEVER QUENCHED DURING WHOLE PERIOD

ANALYSIS IN PROGRESS AT FULL THROTTLE

IN PARALLEL WITH HARDWARE PREPARATION FOR THE 2008 RUN

Drift chamber

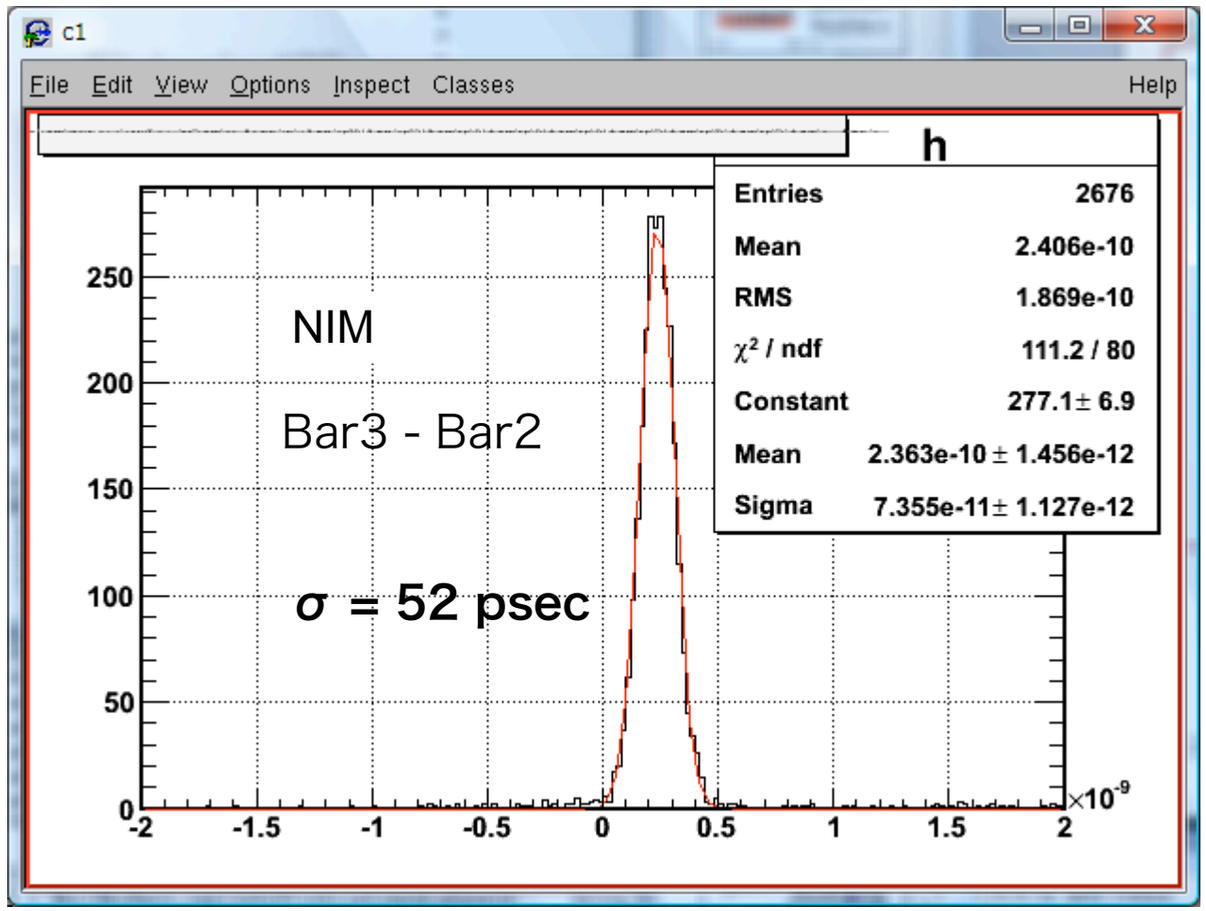


- $\sigma_p = 0.9\%$
- 1 mm vertex resolution

The main issues:

the dead/bad channels (HV problem); electronics calibration/noise

Timing Counter



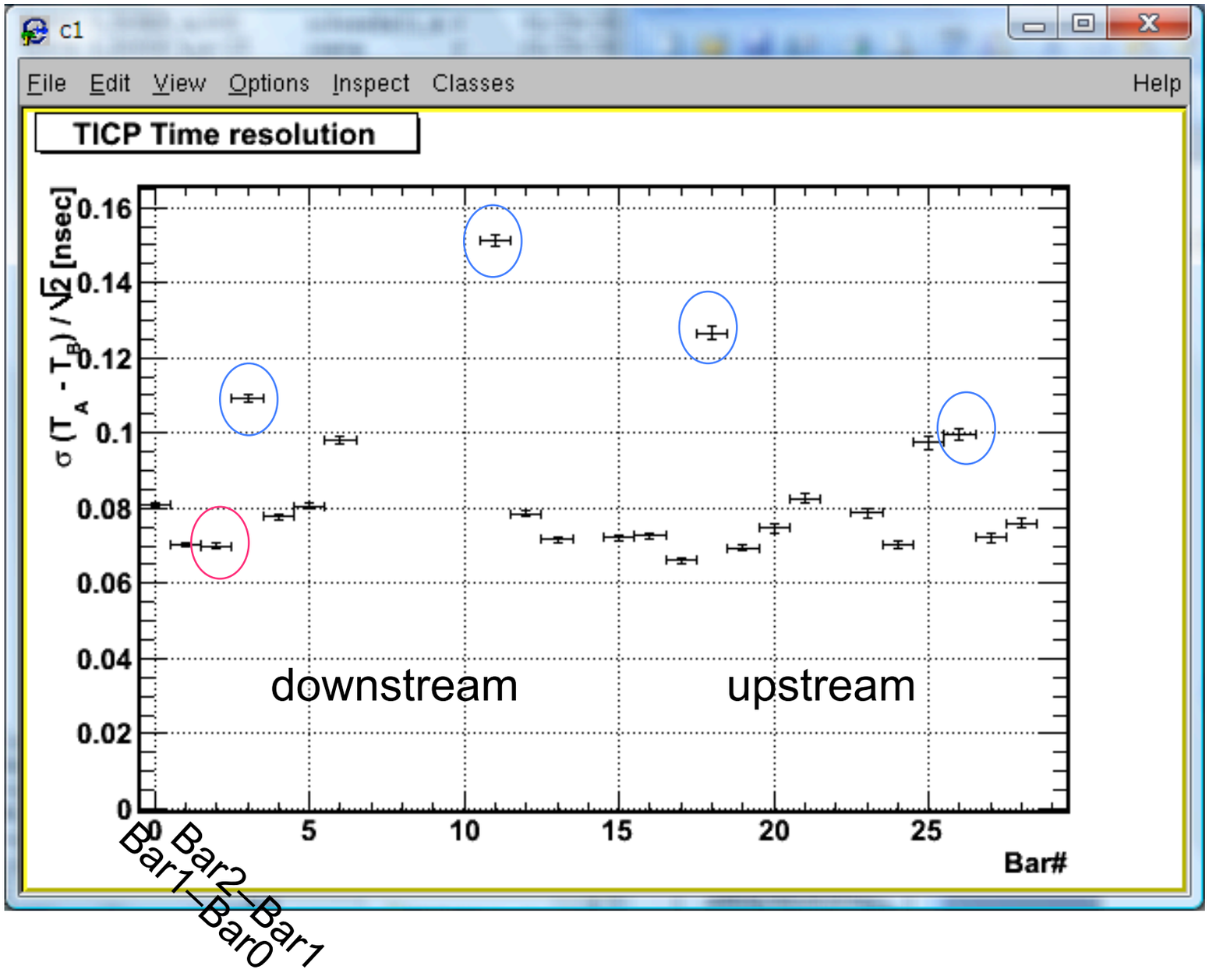
Electronics/algorithm jitter = 27 psec

No PMT lifetime problem!

The main issues:

Clock calibration; commissioning of the fiber DAQ; the fiber trigger

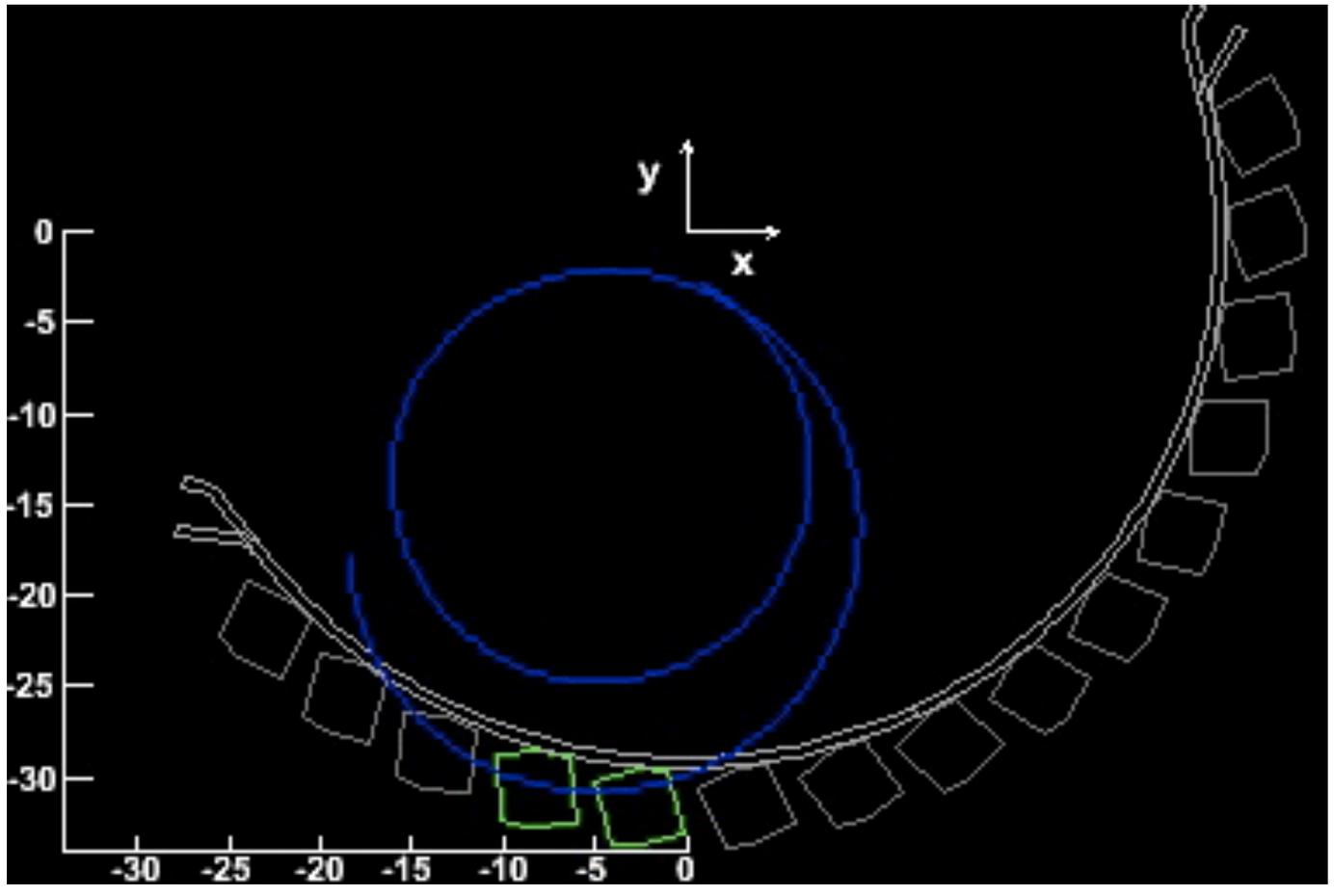
Clock calibration



Different chip

==> DRS4

DC - TC matching

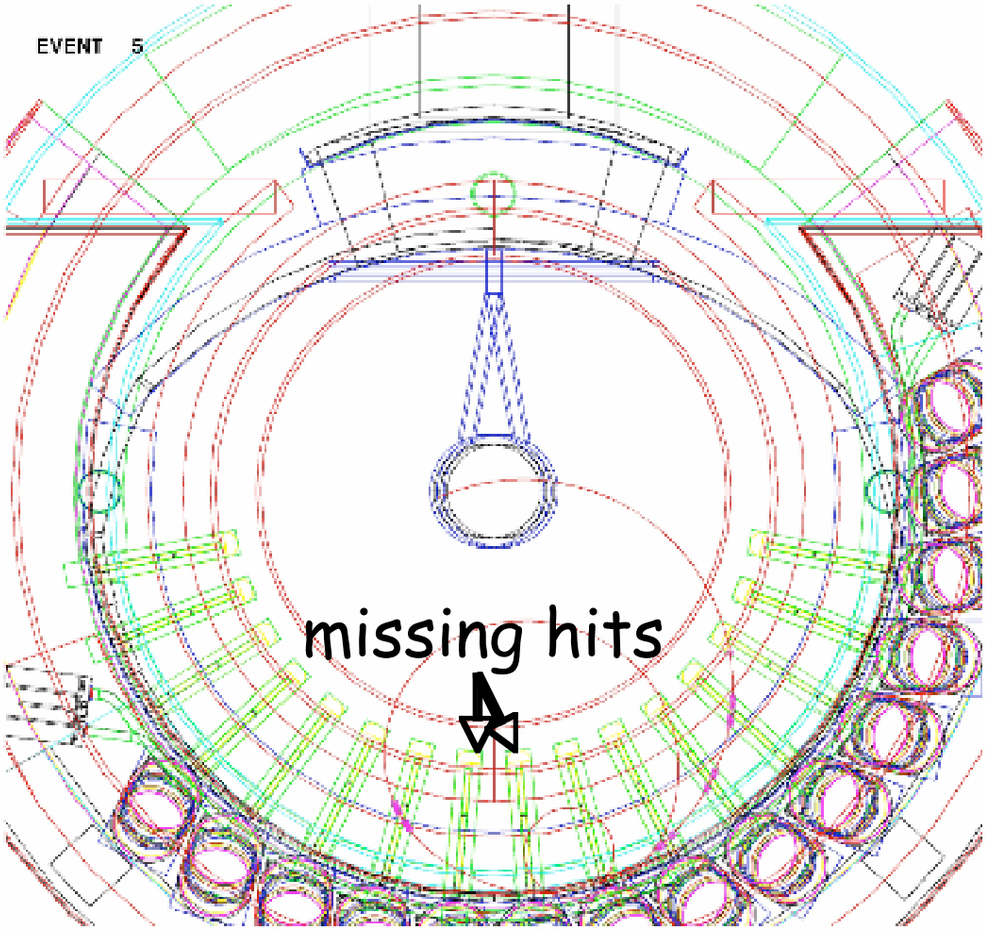


- Work in progress
- ToF corrections

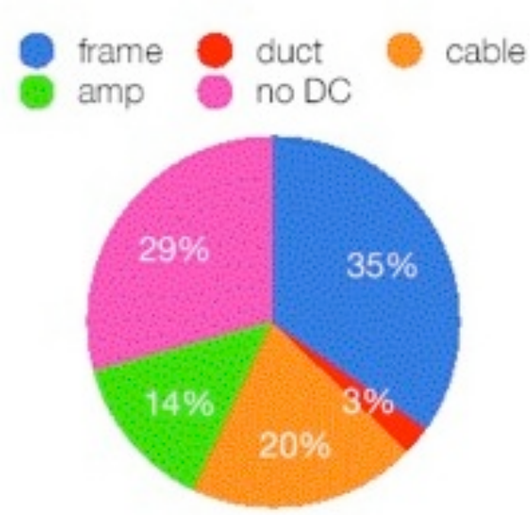
The main issues:

The DC - TC positron detection efficiency (next slide)

The positron efficiency



- Positrons missed on the way to TC
  - “Off center” decays
  - Positrons hitting the DC frame etc
- 90% ==> 65% (28% reduction)

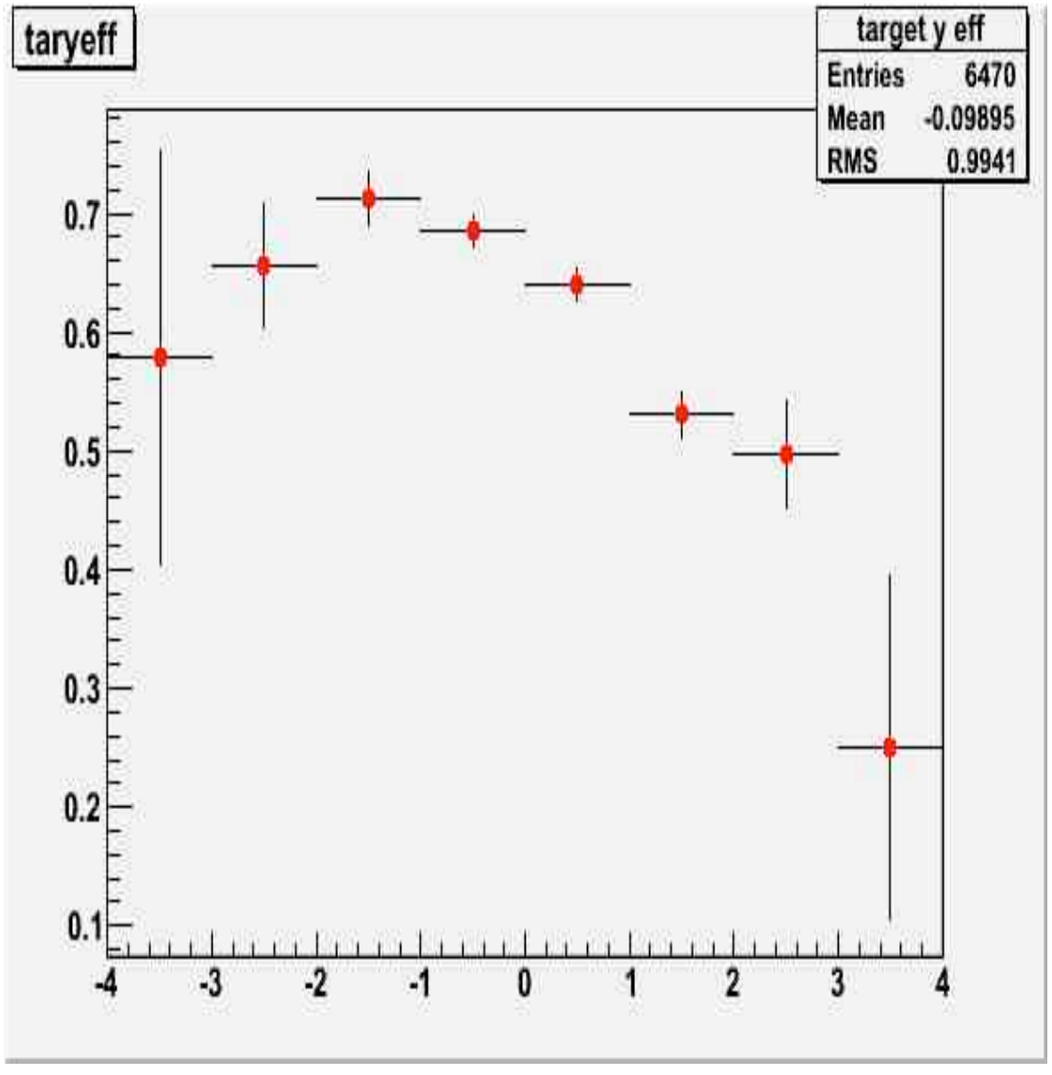


No solution found yet:

increase of COBRA field by 7% - risk of quench

reduction of beam size (or target size)

The positron efficiency

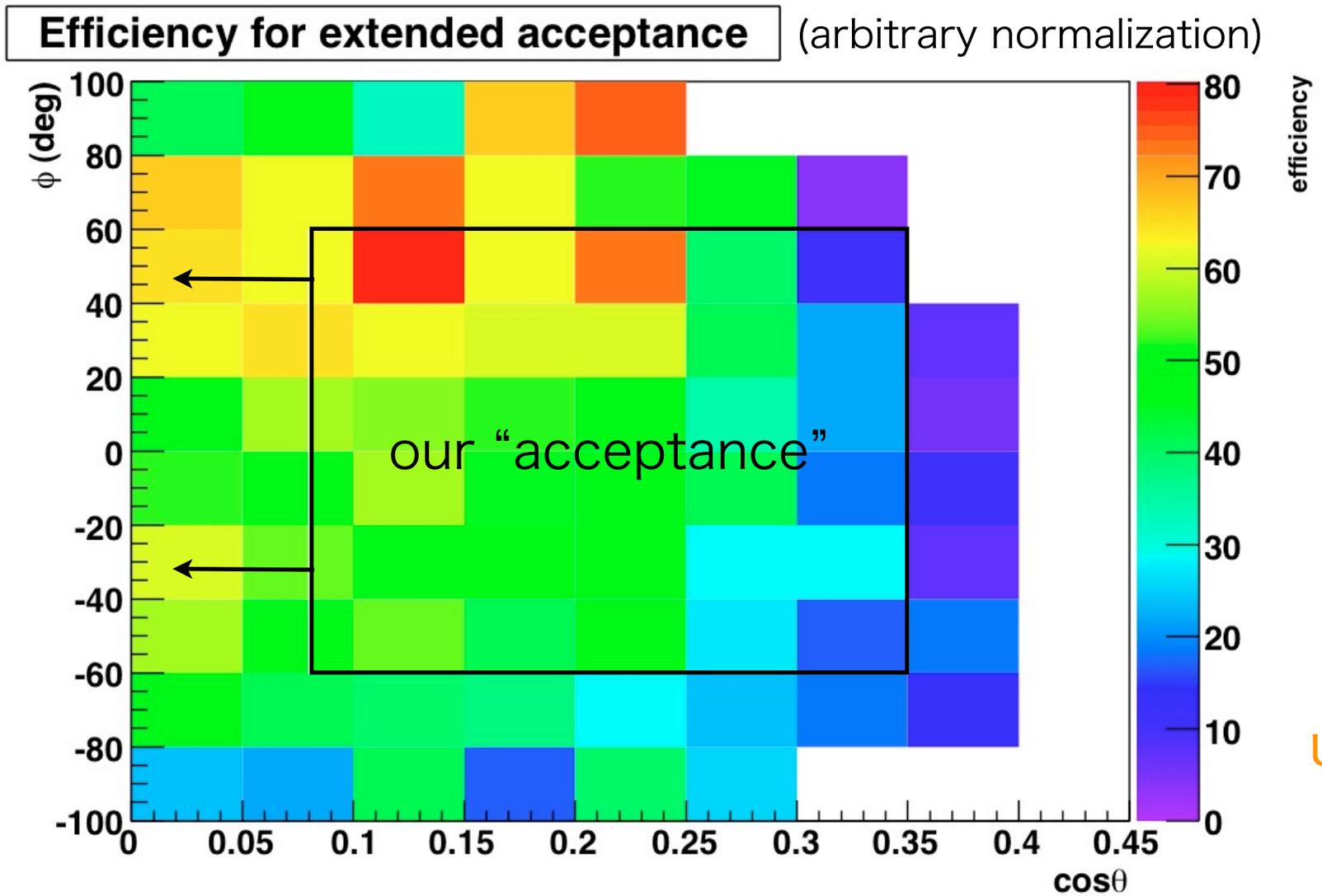


Short axis (y) (cm)

Efficiency as a function of decay position on the target

A smaller target size does not seem to help much - background issues important

The positron efficiency

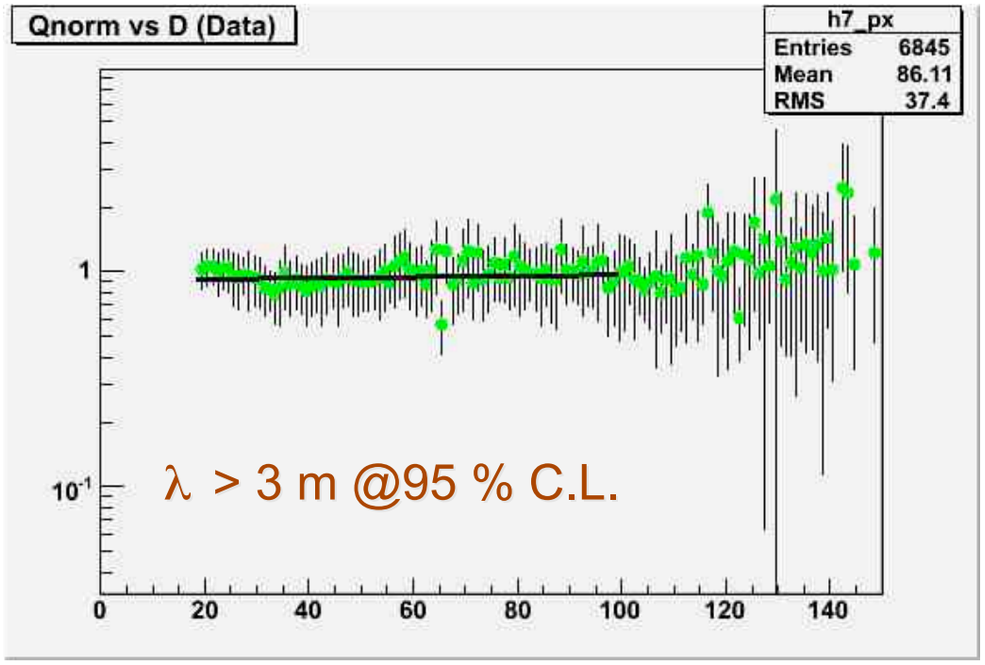


under study

Our standard “acceptance” excludes $\cos\theta$ ~0 region
to avoid multiple turns of positrons inside DC

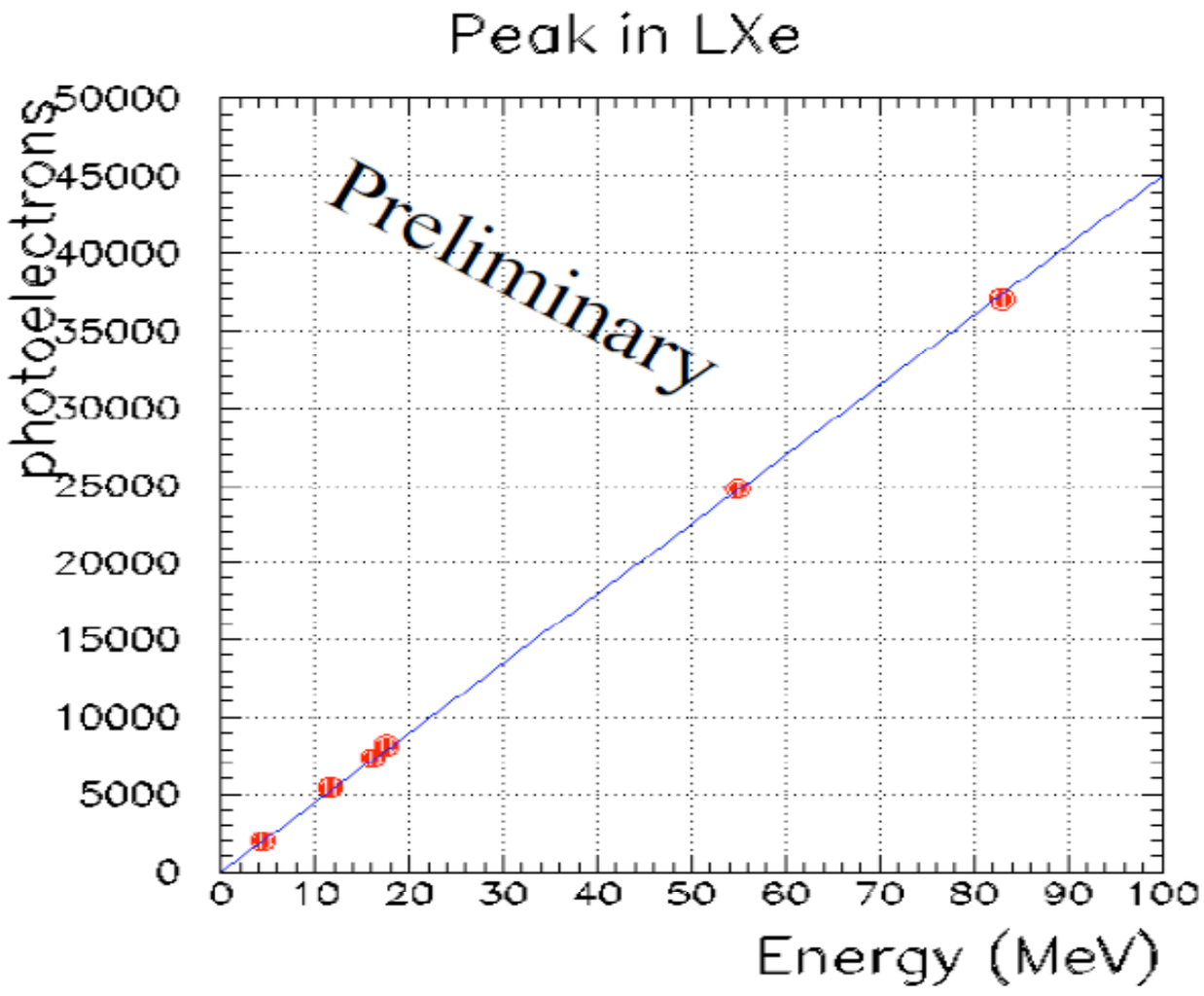
==> possible recovery up to 10%

Liquid xenon detector

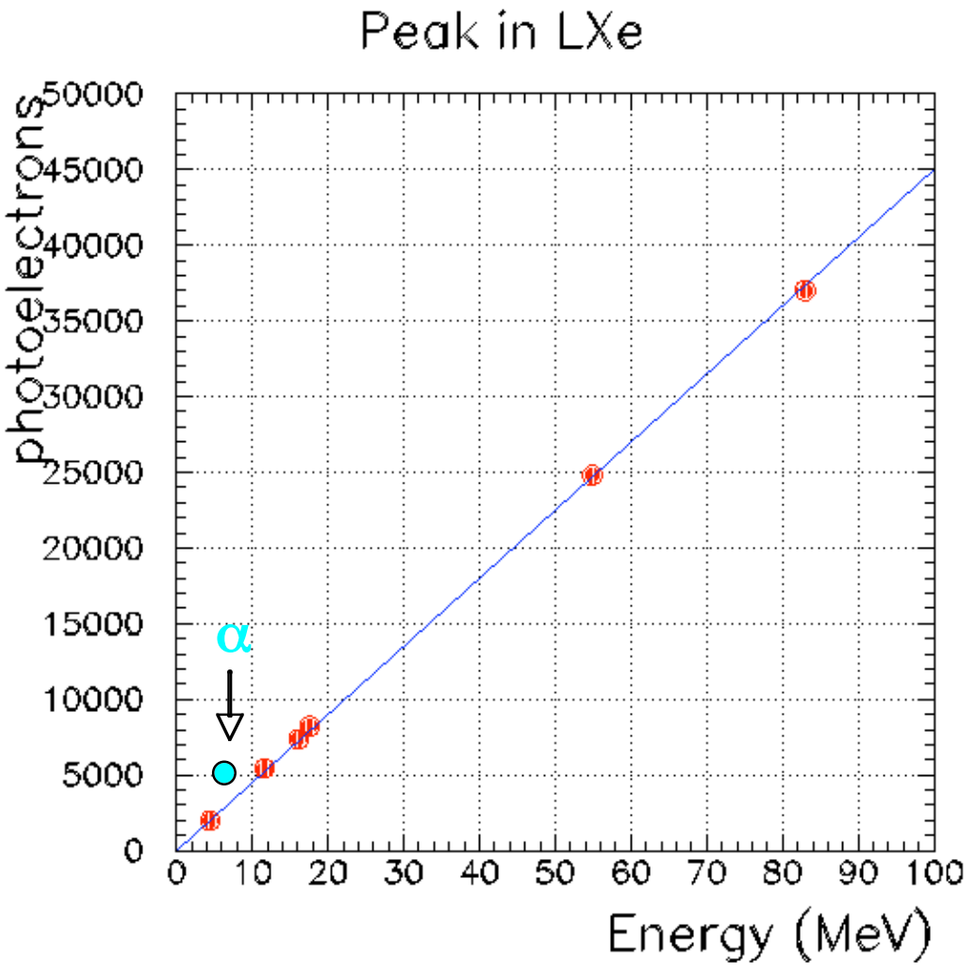


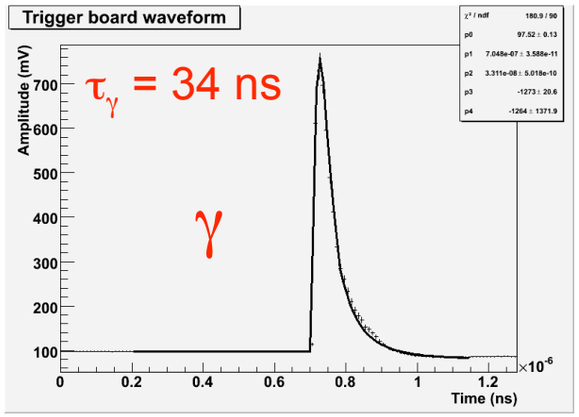
Liquid circulation & purification works and long absorption length realized in a short time (~180h)

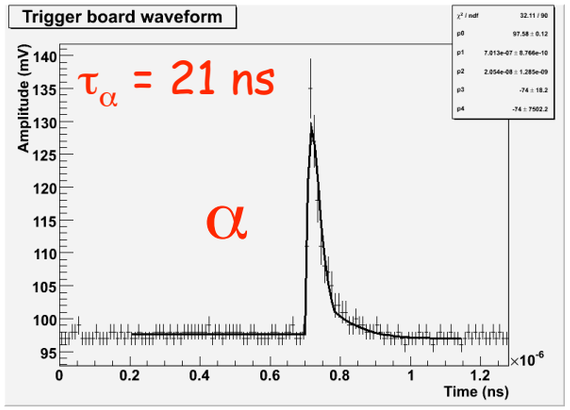
Linearity of gamma ray energy in a broad energy range



Low light yield

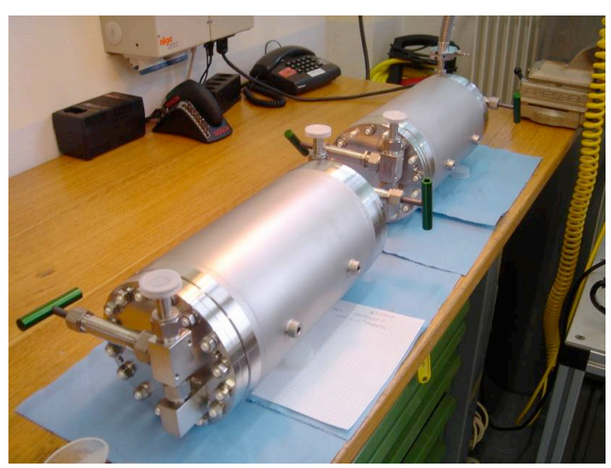






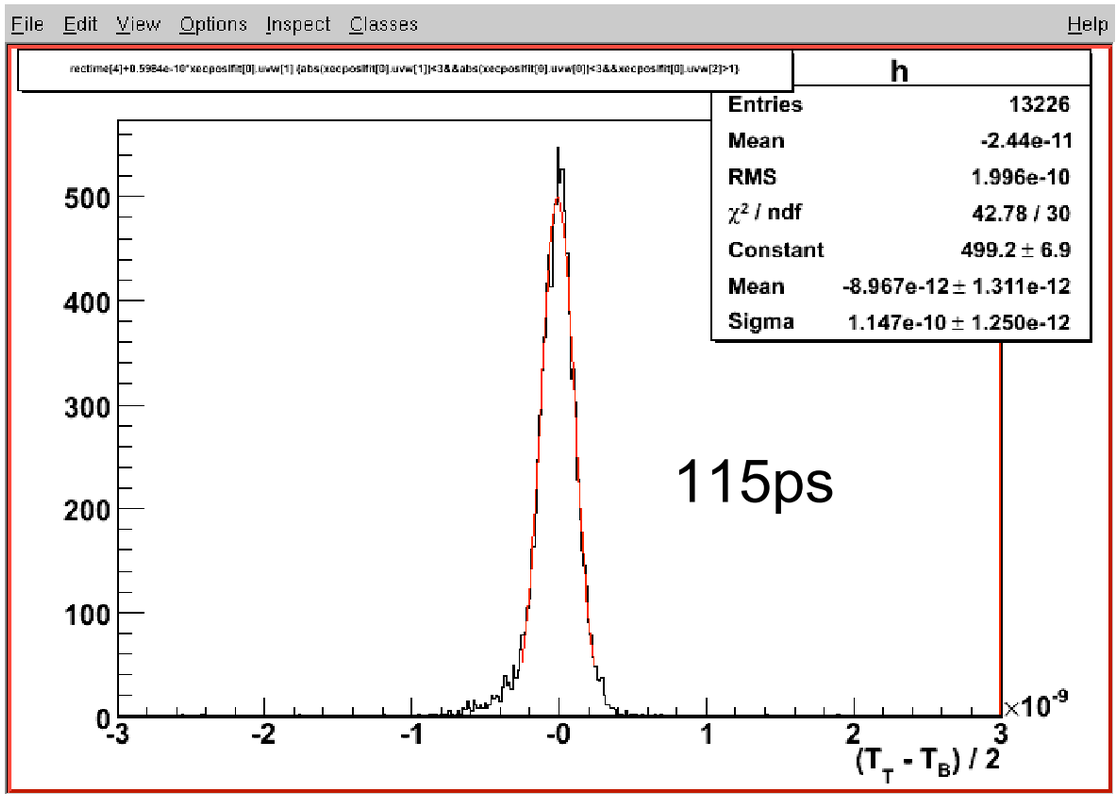
... but much smaller (~1/2) light yield
for gamma rays
and possibly shorter waveforms

Possible electronegative impurity? ==>

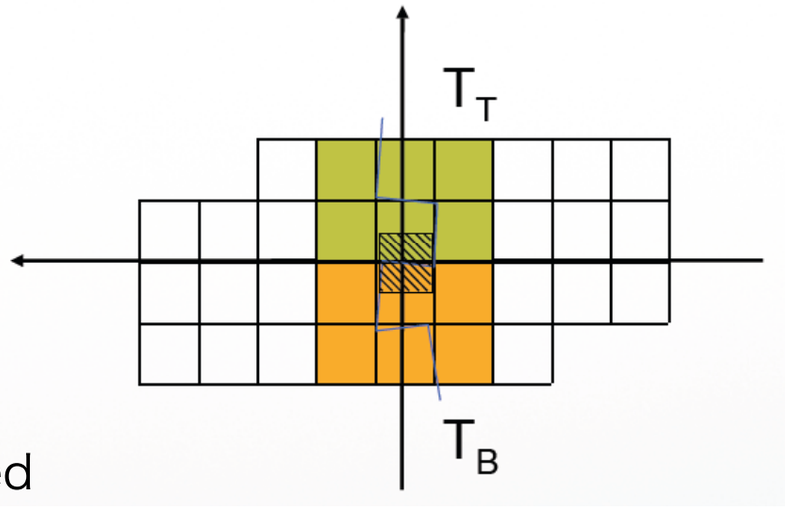


Oxygen
getter

Timing resolution

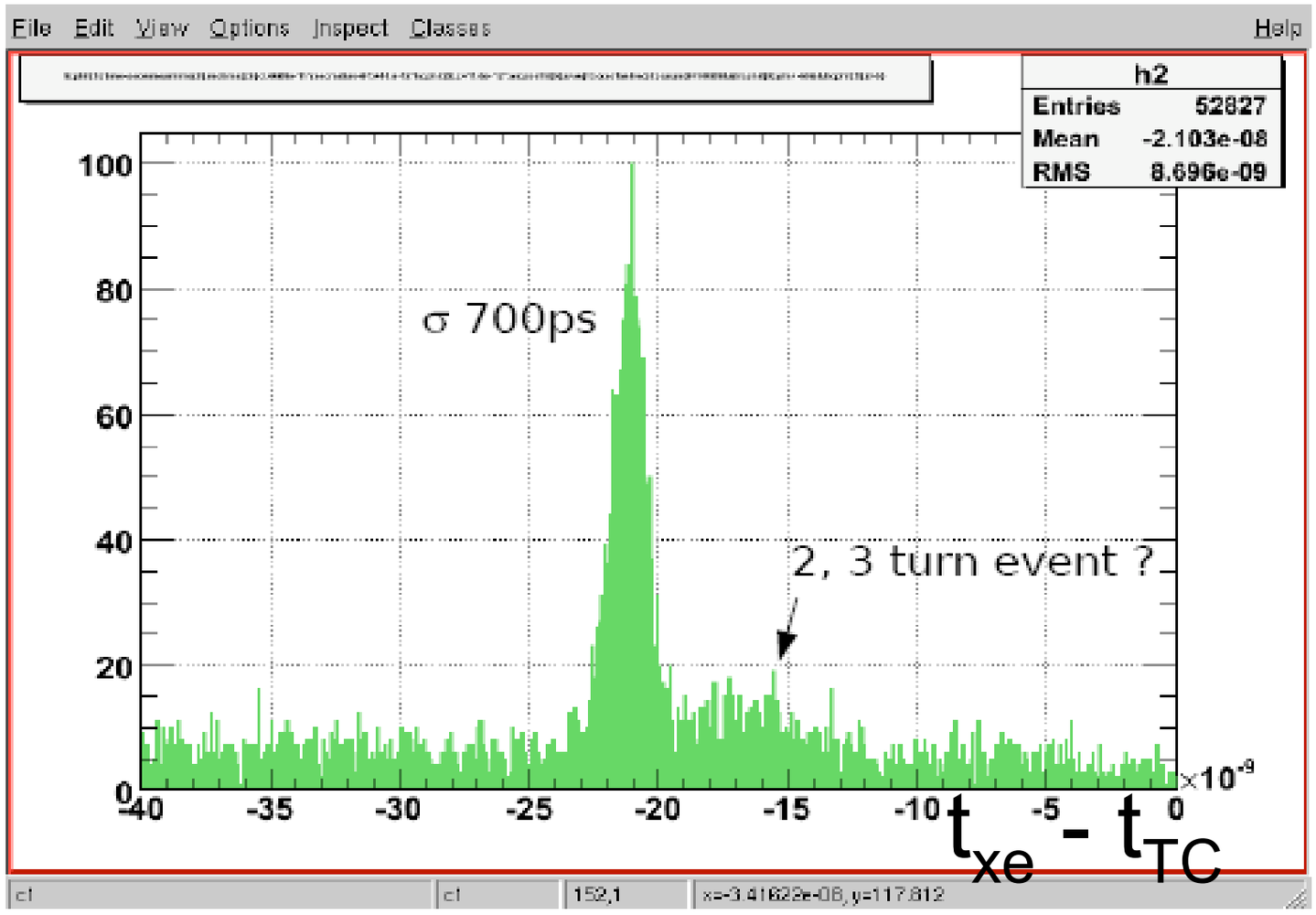


Intrinsic time resolution worse than the prototype;
but seems consistent with the present level of light yield



12 PMTs at the center used

LXe - TC timing

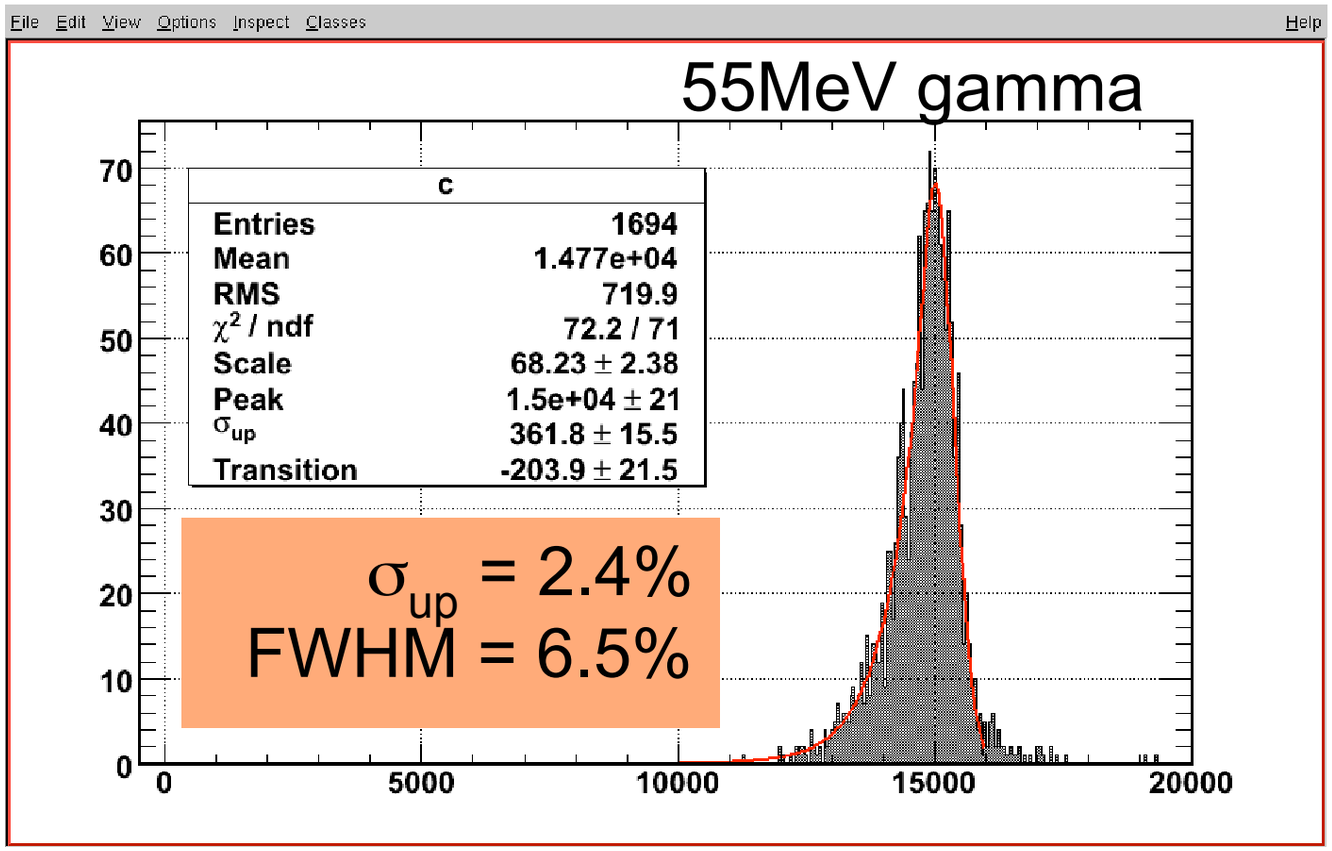


- A clear peak of radiative events at Ultra-Low rate (x1/6)

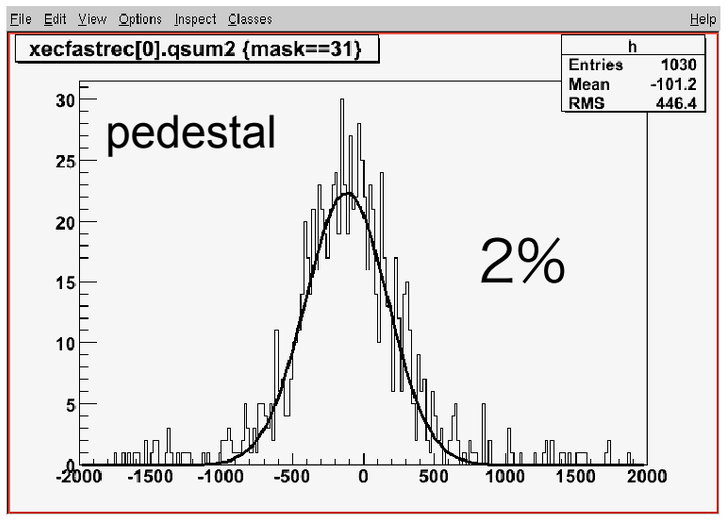
- Crude analysis only; time offset correction; no correction for track length etc

The main issues:
the low light yield of liquid xenon; clock calibration

Energy resolution



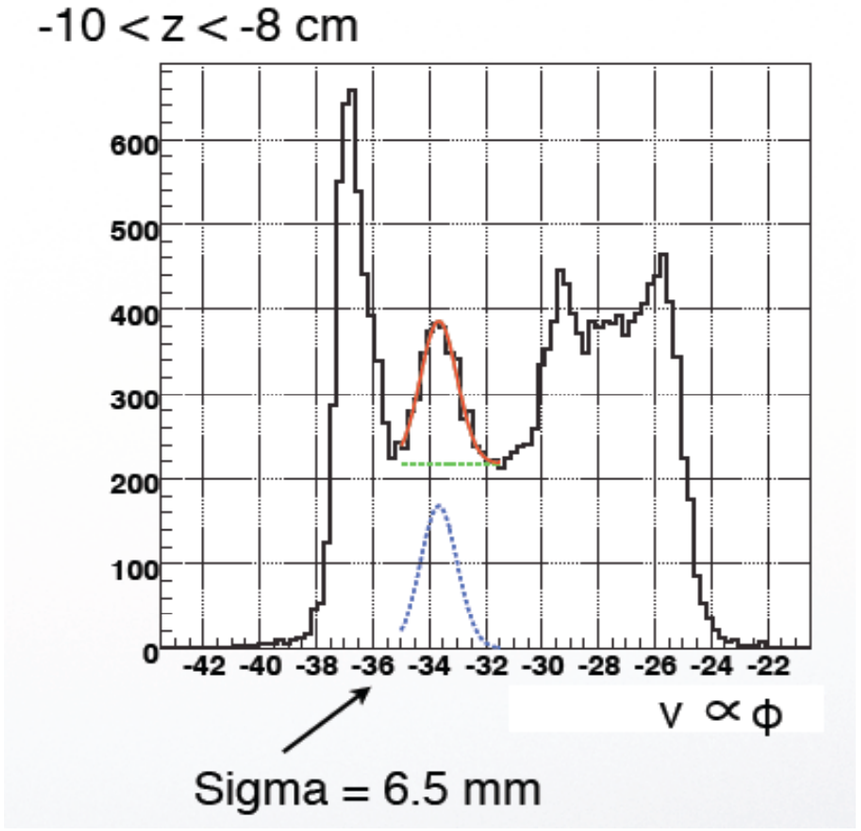
- CEX run
- worse resolution than the prototype
- mostly explained by the pedestal spread

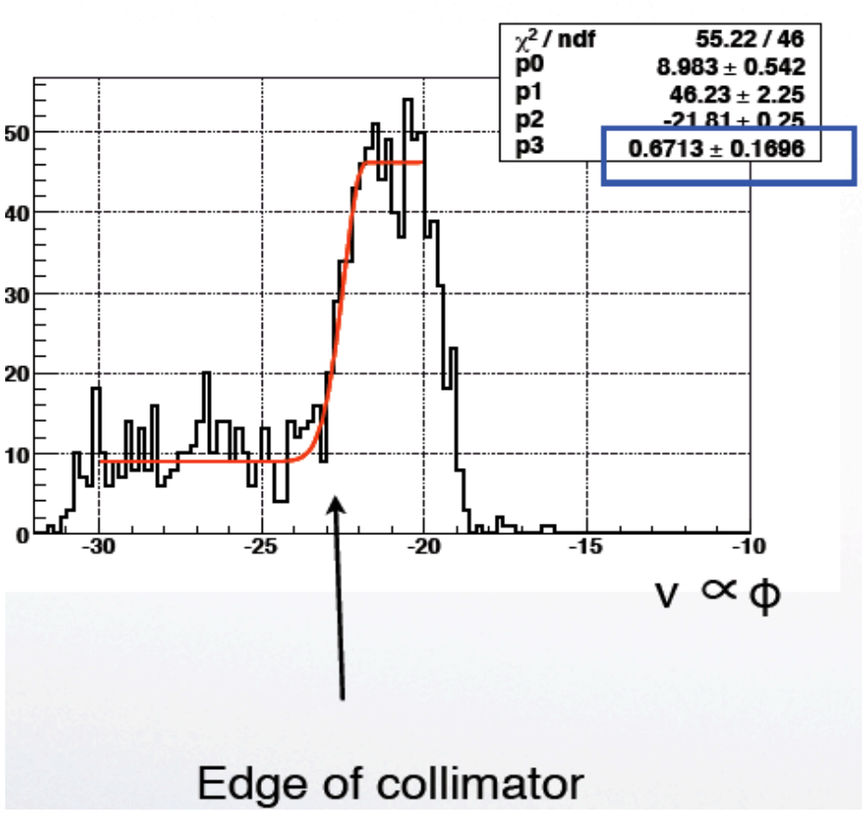


The main issues:

the low light yield; pedestal evaluation (noise)

Position resolution





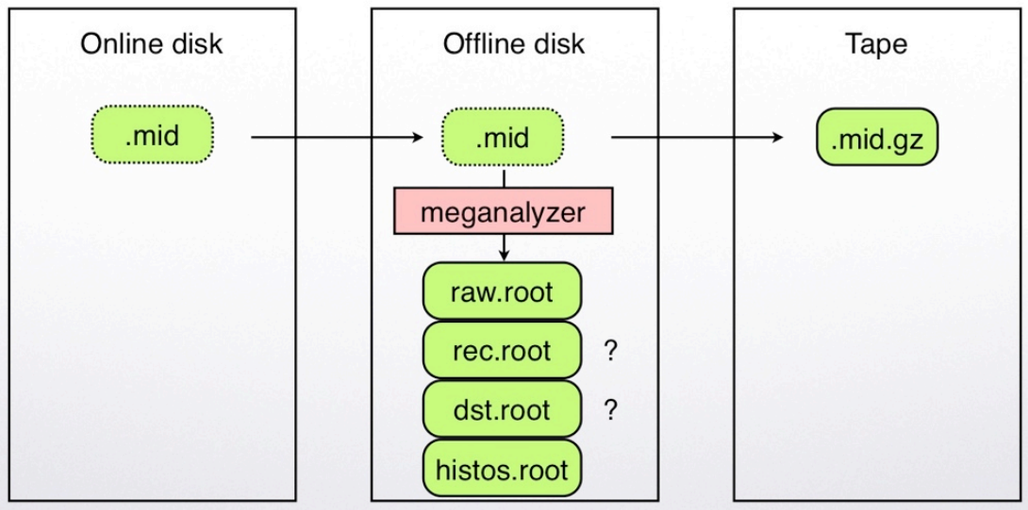
- Analysis using the Pb collimator holes and edges
- worse resolution than the prototype - needs further study

Offline analysis for 2008 run

2008 model (proposal)

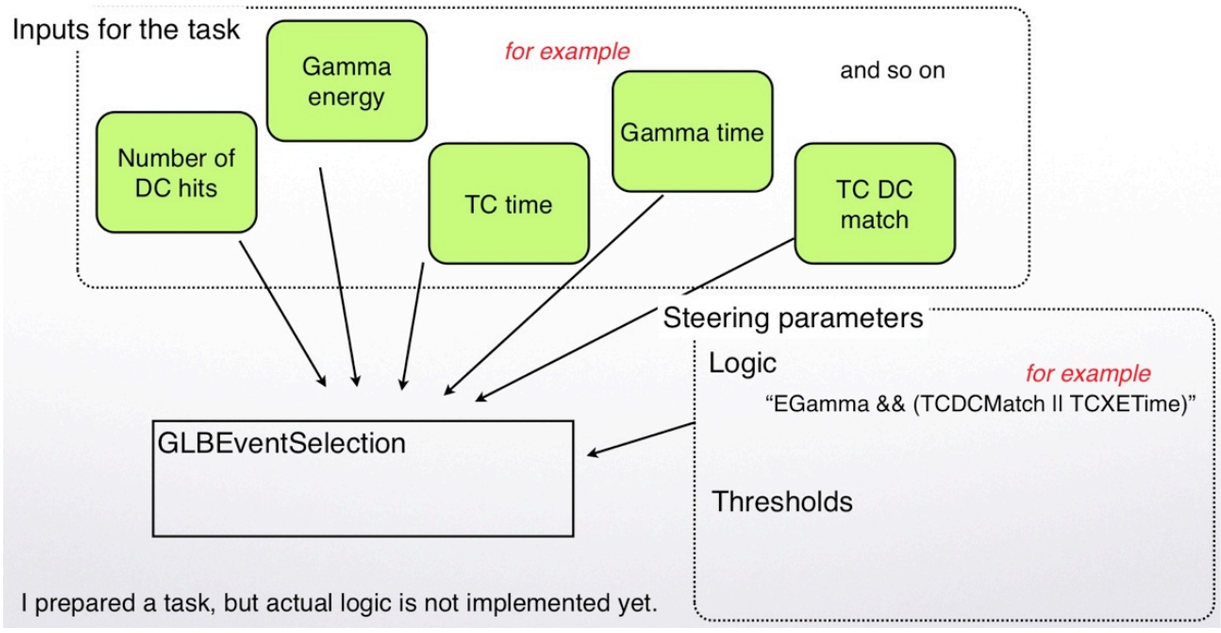
For 2008 run data. Amount of offline disk may not be enough to store all raw data.

It is not very efficient that each persons analyze all evens far from signal.



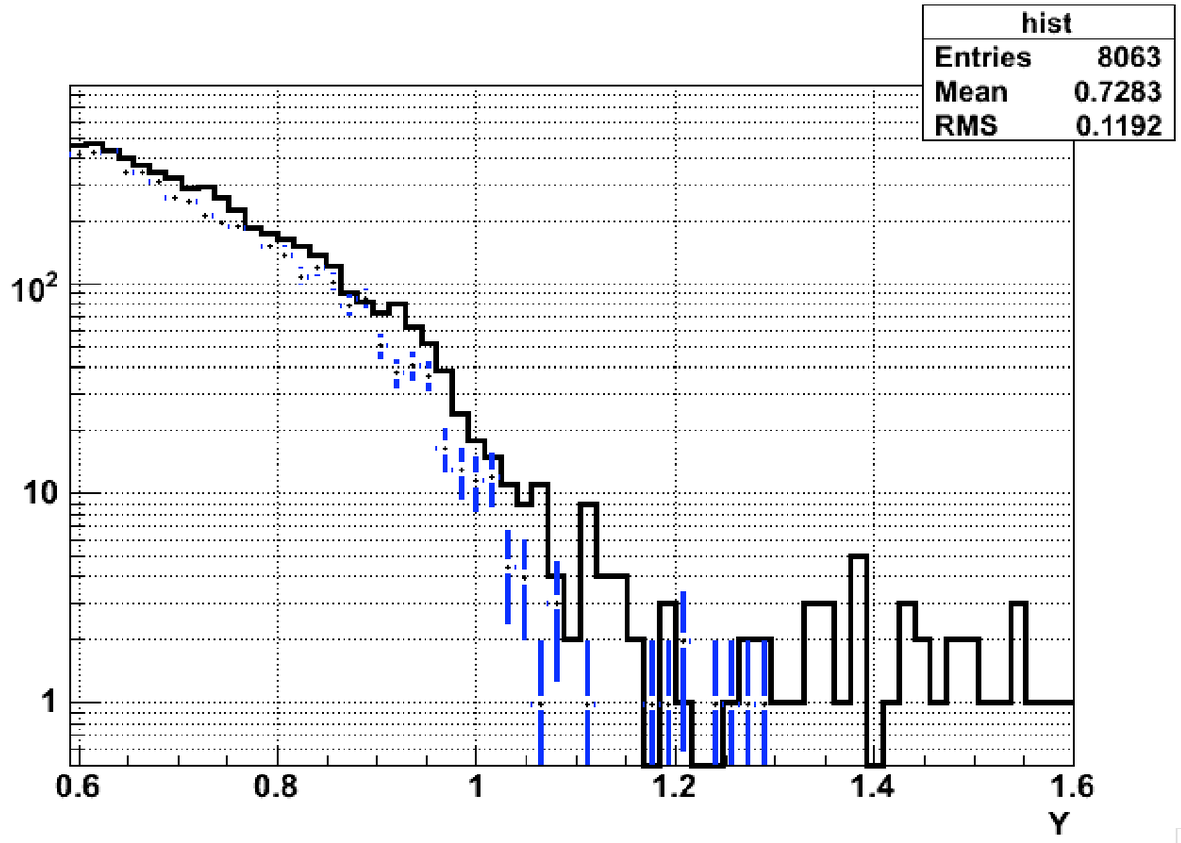
A task for event selection

A task for event selection was added (GLBEventSelection).
This is just an interface to choose event selection criteria by steering parameters.



- A model for offline analysis procedures (calibration, reconstruction, event selection) are being discussed for a year-long DAQ period

Physics analysis strategy



- PDFs for background are being constructed from the data

- Need to learn the tails and biases of the data distributions

- Physics analysis tools are being developed using the last year's data

- Analysis strategy is being formed based on this practice

Accidental BG PDF

- $B = B_1B_2B_3B_4\,\varepsilon$
  - $B_1(E_\gamma, \cos\theta_\gamma, \phi_\gamma, x, y)$
    - Probability for BG-γ energy measurement
    - BG single spectrum at each point ($\cos\theta_\gamma$, ϕ_γ, x, y)
    - Equal normalization at each point
  - $B_2(E_e, \cos\theta_e, \phi_e, x, y)$
    - Probability for BG-e^+ energy measurement
    - BG Michel spectrum at each point ($\cos\theta_e$, ϕ_e, x, y)
    - Equal normalization at each point
  - $B_3(\cos\theta_\gamma, \phi_\gamma, \cos\theta_e, \phi_e, x, y)$
    - Probability for angle measurement
    - Uniform if BG is uniform. may not be necessary.
    - Equal normalization at each point

- We have clues and handles for all the present important problems (liquid xenon impurity, drift chamber HV, electronics calibration/noise) and will straighten them out for this year's run.

PROSPECTS 2008

ARE WE REALLY READY FOR THE 2008 RUN

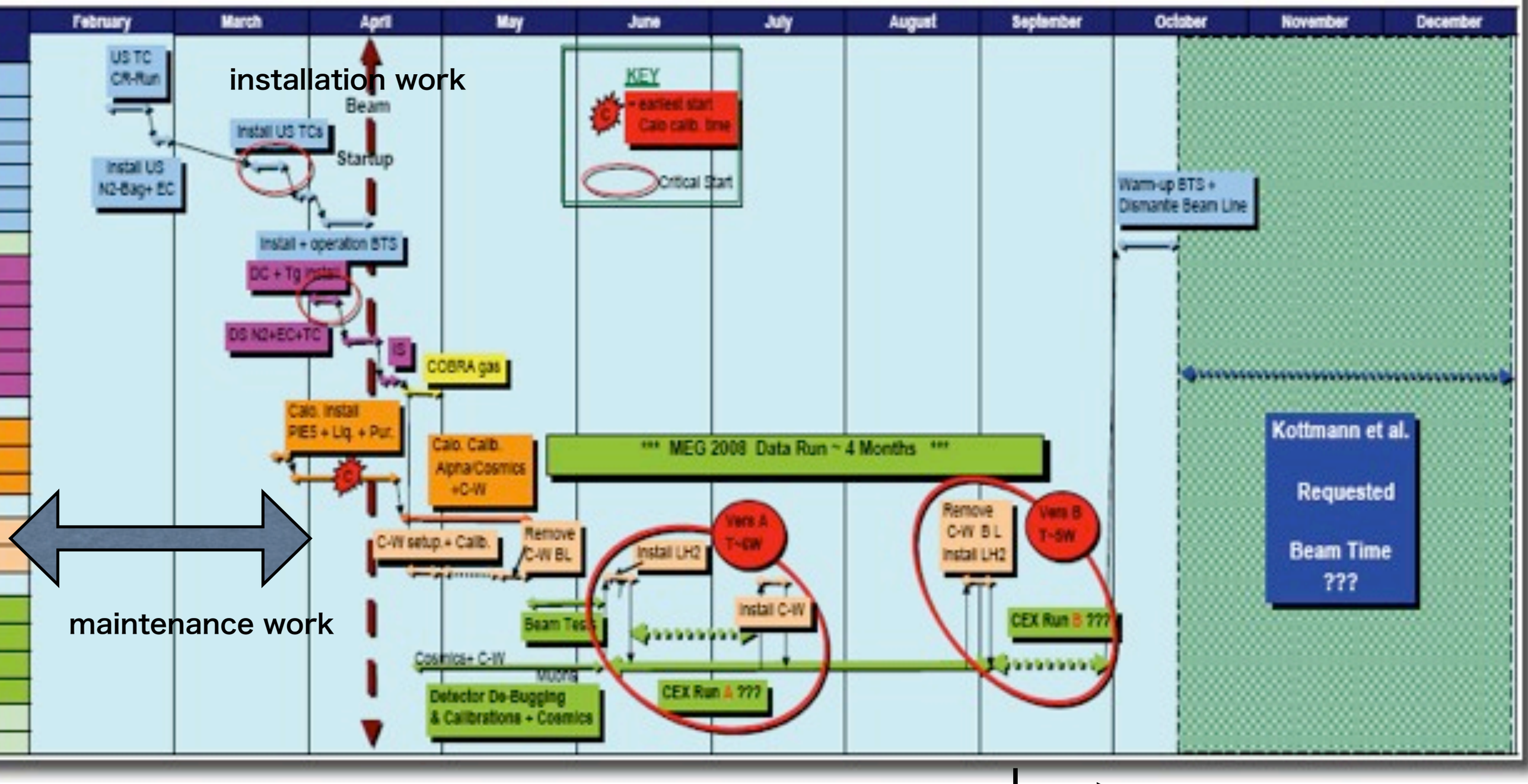
Background and Sensitivity

	Measured	Simulation	2007 Measured	2008 Prospects
Gamma Energy (%)	4.5-5.0		6.5	5.0
Gamma Timing (nsec)	0.15		0.27*	0.15*
Gamma Position (mm)	4.5-9.0		15.	9.0
Gamma Efficiency (%)	>40		>40	>40
e+ Timing (nsec)	0.1		0.12*	0.12*
e+ Momentum (%)		0.8	2.1	1.1
e+ Angle (mrad)		10.5	[17.]	[17.]**
e+ Efficiency (%)		65	65	65
Muon Decay Point (mm)		2.1	3.	3.**
Muon Rate (10^8/sec)	0.3			
Running Time (week*)	100			
Single Event Sens (10^{-13})	0.5			
Accidental Rate (10^{-13})	0.1-0.3			
# Accidental Events	0.2-0.5			
90% CL Limit (10^{-13})	1.7			

* "1 week" is defined to be 4×10^5 sec

** Very pessimistic

Provisional MEG Beam Schedule 2008 P-R.K 06/02/08



Only ~2 months of physics DAQ w/o DRS4

Background and Sensitivity

	"Goal" Measured	"Goal" Simulation	2007 Measured	2008 Prospects
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e+ Angle (mrad)		10.5	[17.]	[17.]**
e+ Efficiency (%)		65	65	65
Muon Decay Point (mm)		2.1	3.	3.**
Muon Rate (10^8/sec)	0.3		0.3***	
Running Time (week*)	100		8	
Single Event Sens (10^{-13})	0.5		6.7	
Accidental Rate (10^{-13})	0.1-0.3		6.0*	
# Accidental Events	0.2-0.5		0.9	
90% CL Limit (10^{-13})	1.7		23.	

* additional contribution of 250psec added for background evaluation

* "1 week" is defined to be 4×10^5 sec ** Very pessimistic

*** Muon rate can be further optimized to obtain the best limit

- IF THE OTHER EXPERIMENT SHOULD MOVE TO THE BEGINNING OF NEXT YEAR, WE COULD RUN PHYSICS DAQ FOR ~5 MONTHS, USE DRS4 FOR THE LAST HALF, AND HAVE A LONG SHUT DOWN PERIOD TO COMPLETE PHYSICS ANALYSIS.

Background and Sensitivity

	"Goal" Measured	"Goal" Simulation	2007 Measured	2008 Prospects
Gamma Energy (%)	4.5-5.0		6.5	5.0
Gamma Timing (nsec)	0.15		0.27*	0.15*
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Gamma Efficiency (%)	>40		>40	>40
e+ Timing (nsec)	0.1		0.12*	0.12*
e+ Momentum (%)		0.8	2.1	1.1
e+ Angle (mrad)		10.5	[17.]	[17.]**
e+ Efficiency (%)		65	65	65
Muon Decay Point (mm)		2.1	3.	3.**
Muon Rate (10^8/sec)	0.3		0.3***	0.3***
Running Time (week*)	100		8	24
Single Event Sens (10^{-13})	0.5		6.7	2.2
Accidental Rate (10^{-13})	0.1-0.3		6.0*	1.0*
# Accidental Events	0.2-0.5		0.9	0.5
90% CL Limit (10^{-13})	1.7		23.	6.9

* additional contribution of 250psec added for background evaluation

* "1 week" is defined to be 4×10^5 sec ** Very pessimistic

*** Muon rate can be further optimized to obtain the best limit

CONCLUSION

WE ARE DETERMINED TO
RUN THIS YEAR
FOR PHYSICS RESULT