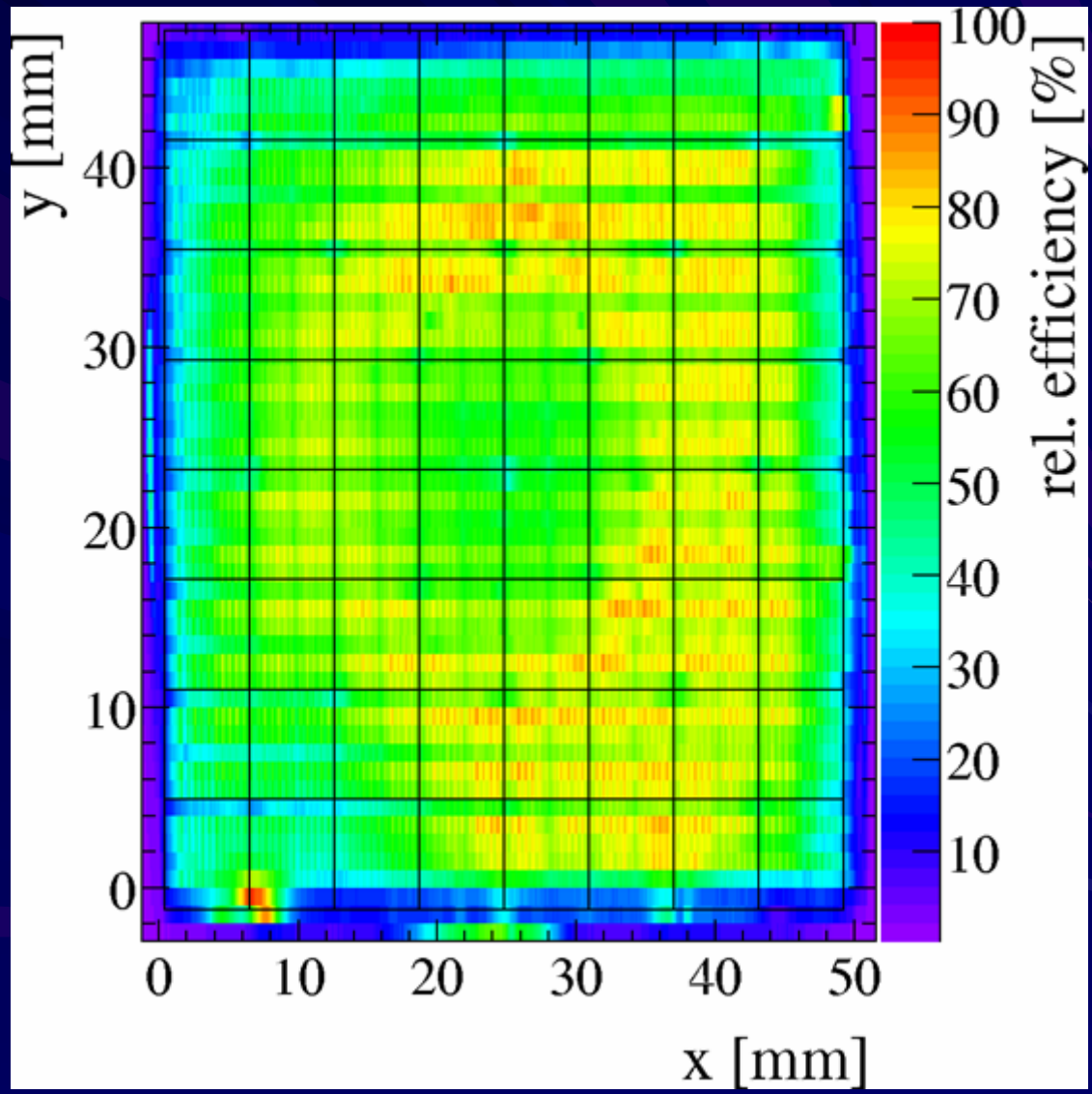
PMT Scanning Setup Progress

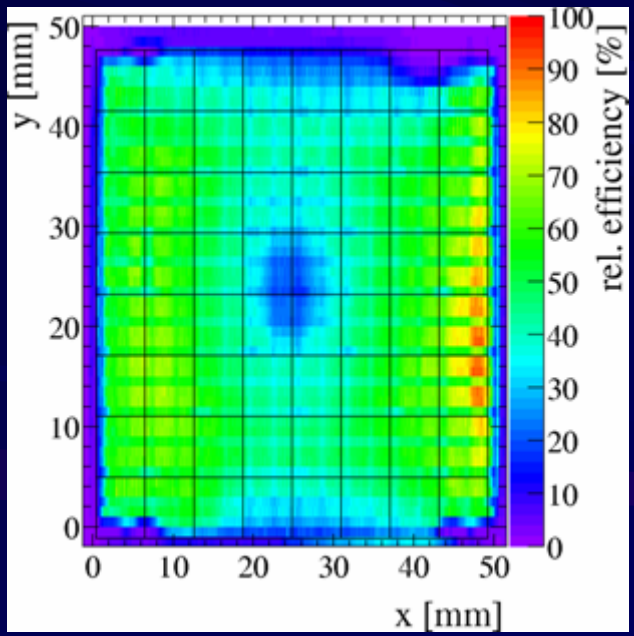
- Last report Nov 12, 2002.
  - measured PMT #1; discussed new faceplate for setup; beam profile studies that suggest beam spot with $\sigma \cong 60\text{-}90\mu m$
- What's new?
  - scans of second and third flat panel PMT
  - photos of PMT surface
  - beam shape progress
  - new "analysis model" (well, if BABAR is doing it…)

PMT Scan Results

- Scanned PMT #2

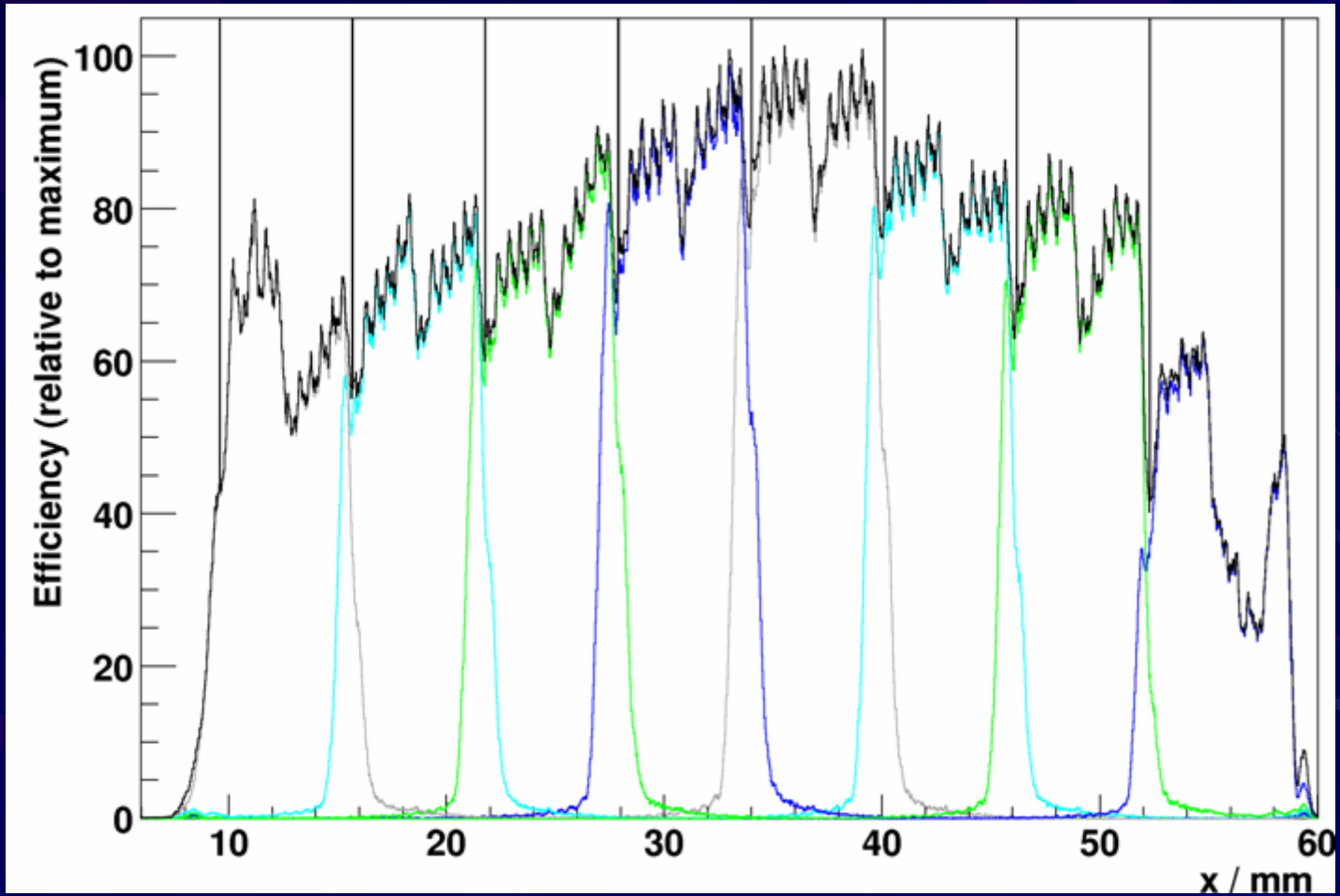


Reminder: PMT #1



PMT Scan Results

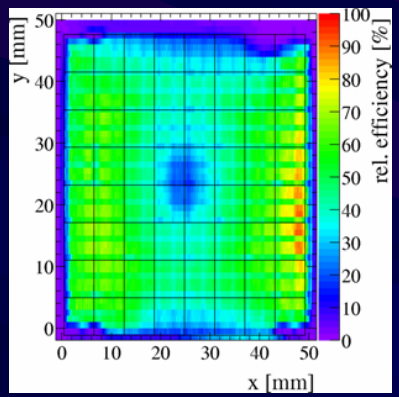
With new optics setup, smaller beam spot, we see micro (dynode) structure very well.



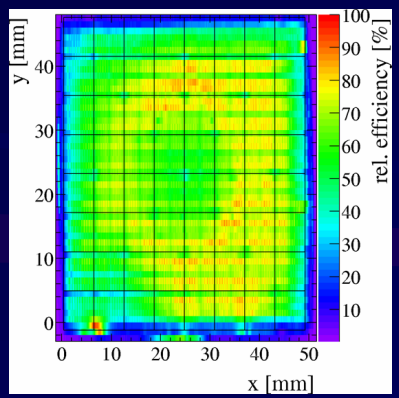
PMT Scan Results

- Scanned PMT #3

Reminder: PMT #1



Reminder: PMT #2



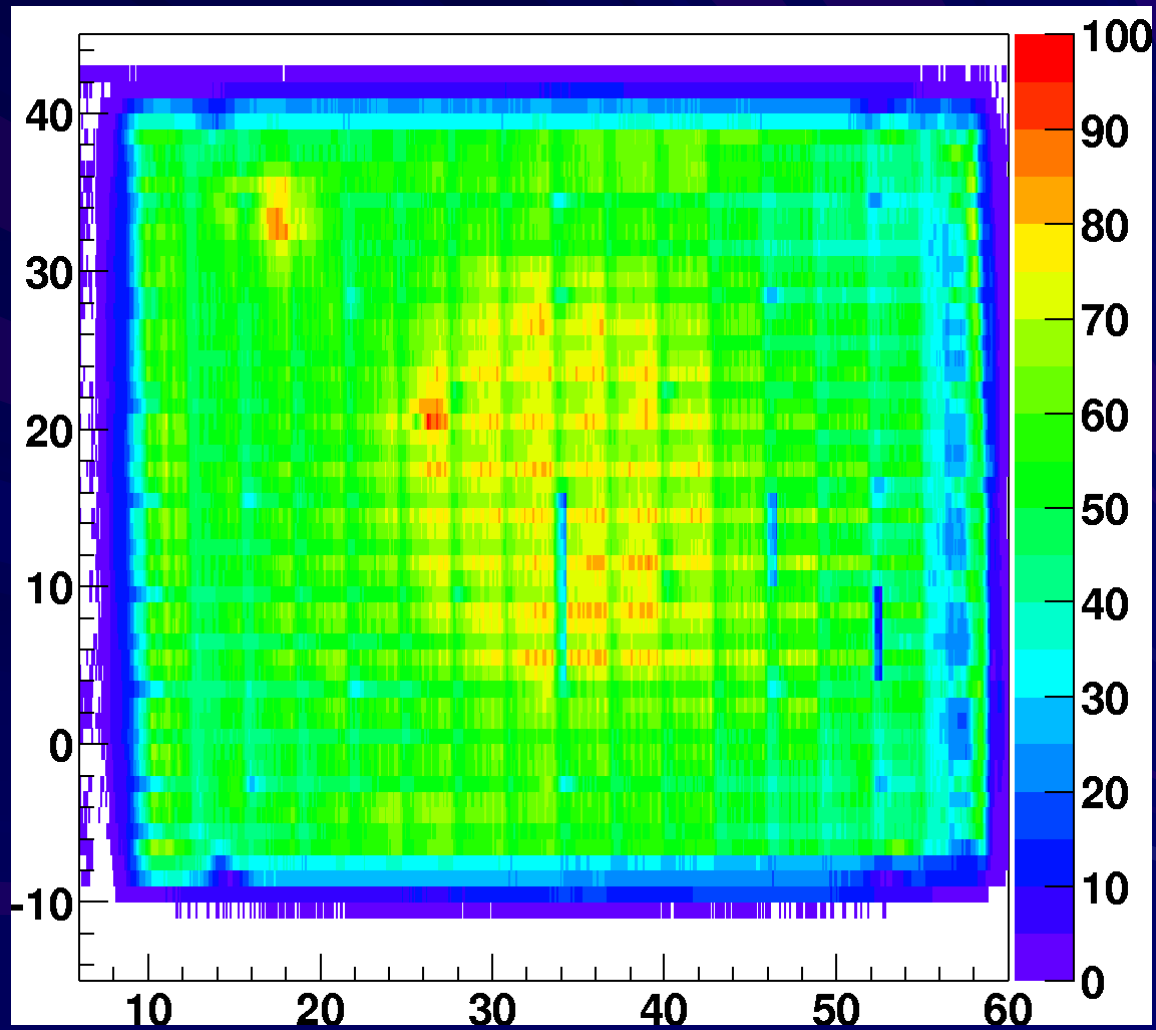
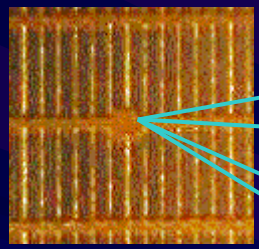


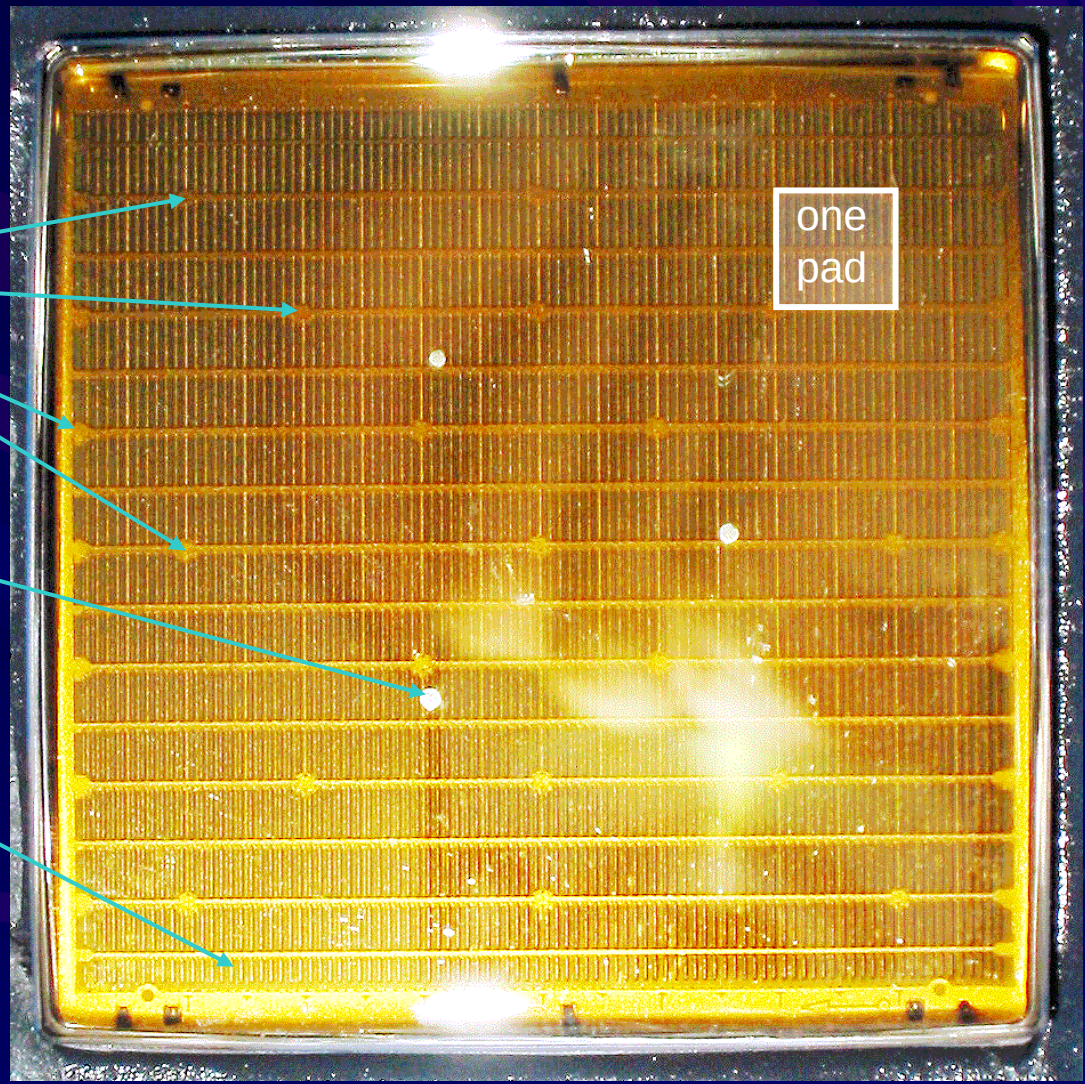
Photo of PMT #2

Interesting features:

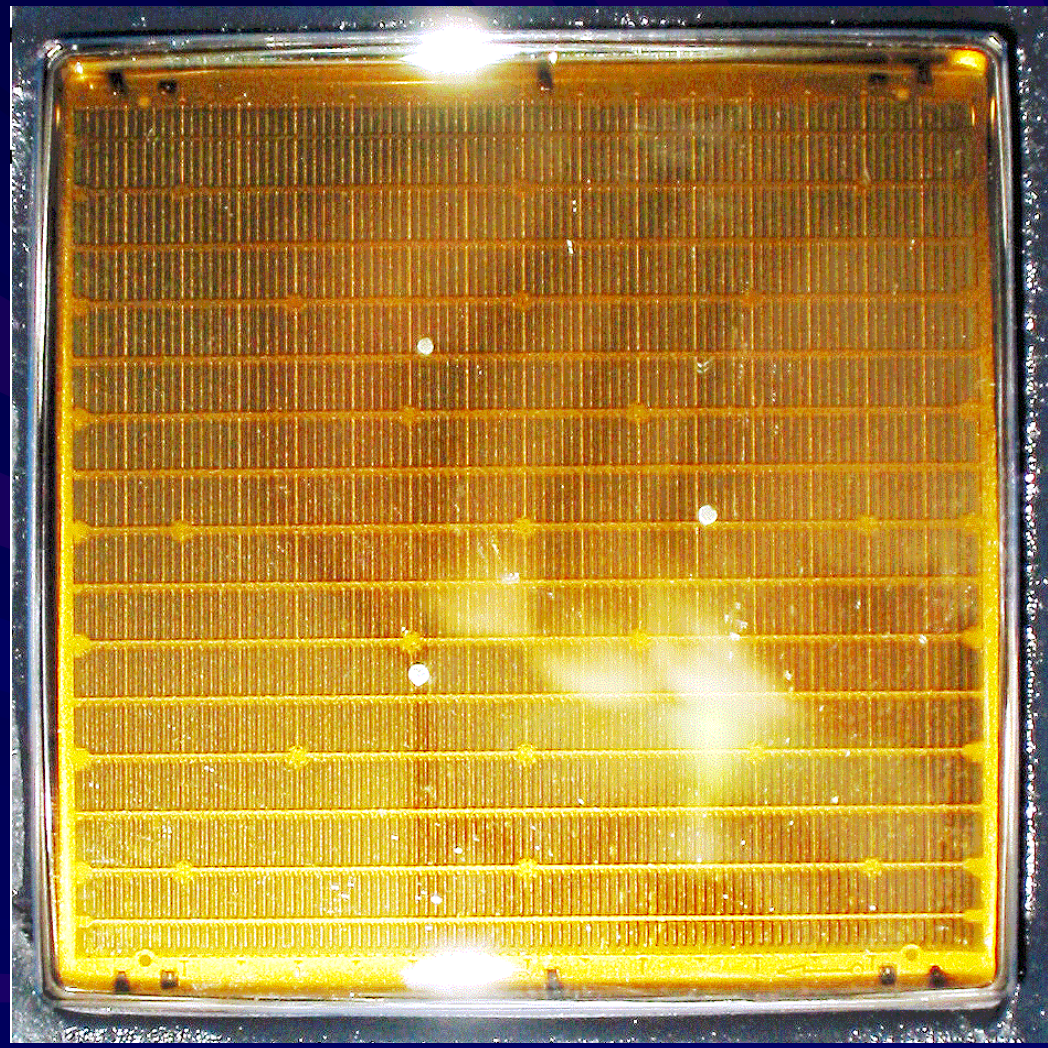
- slots
- round flat areas – “blobs”



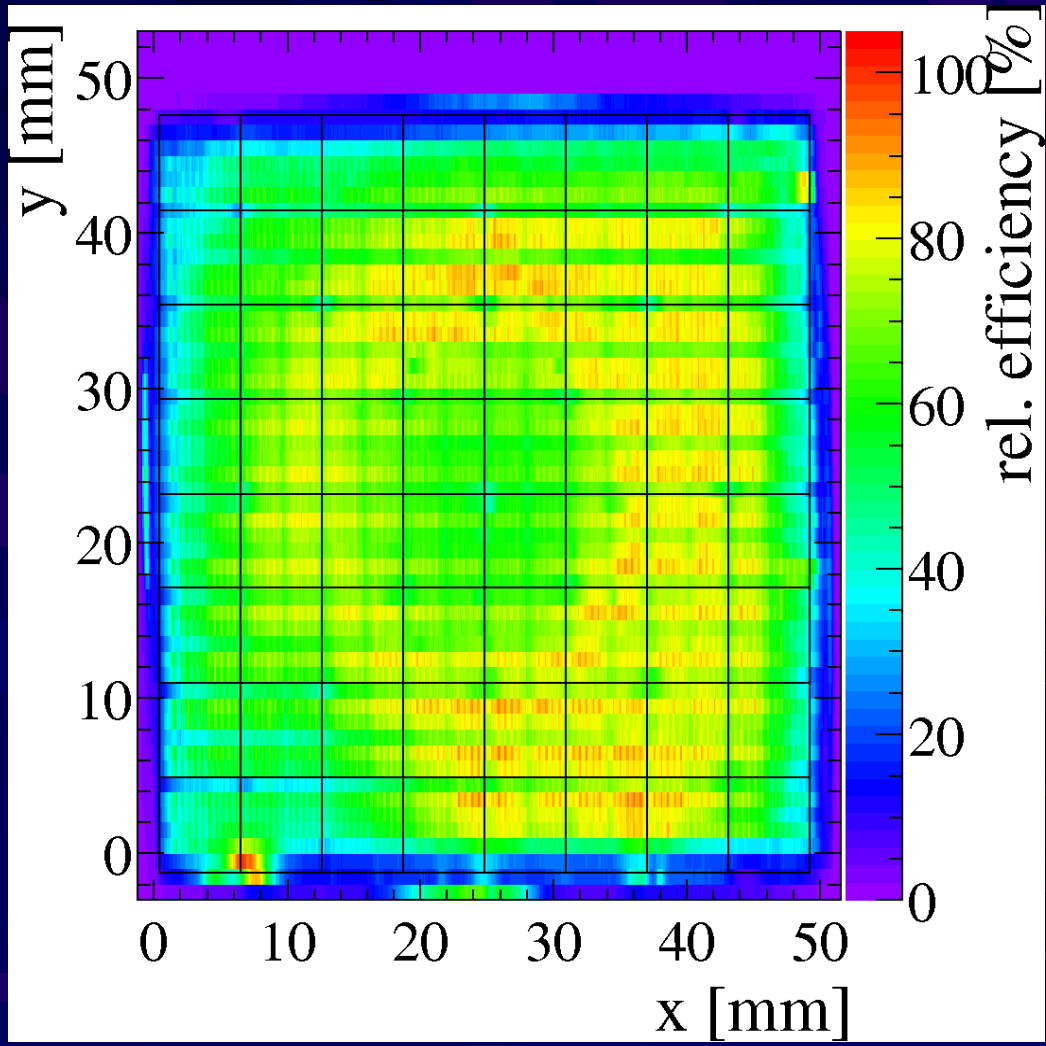
- structures in front glass
- “half” row at top&bottom



Match Photo and Scan?



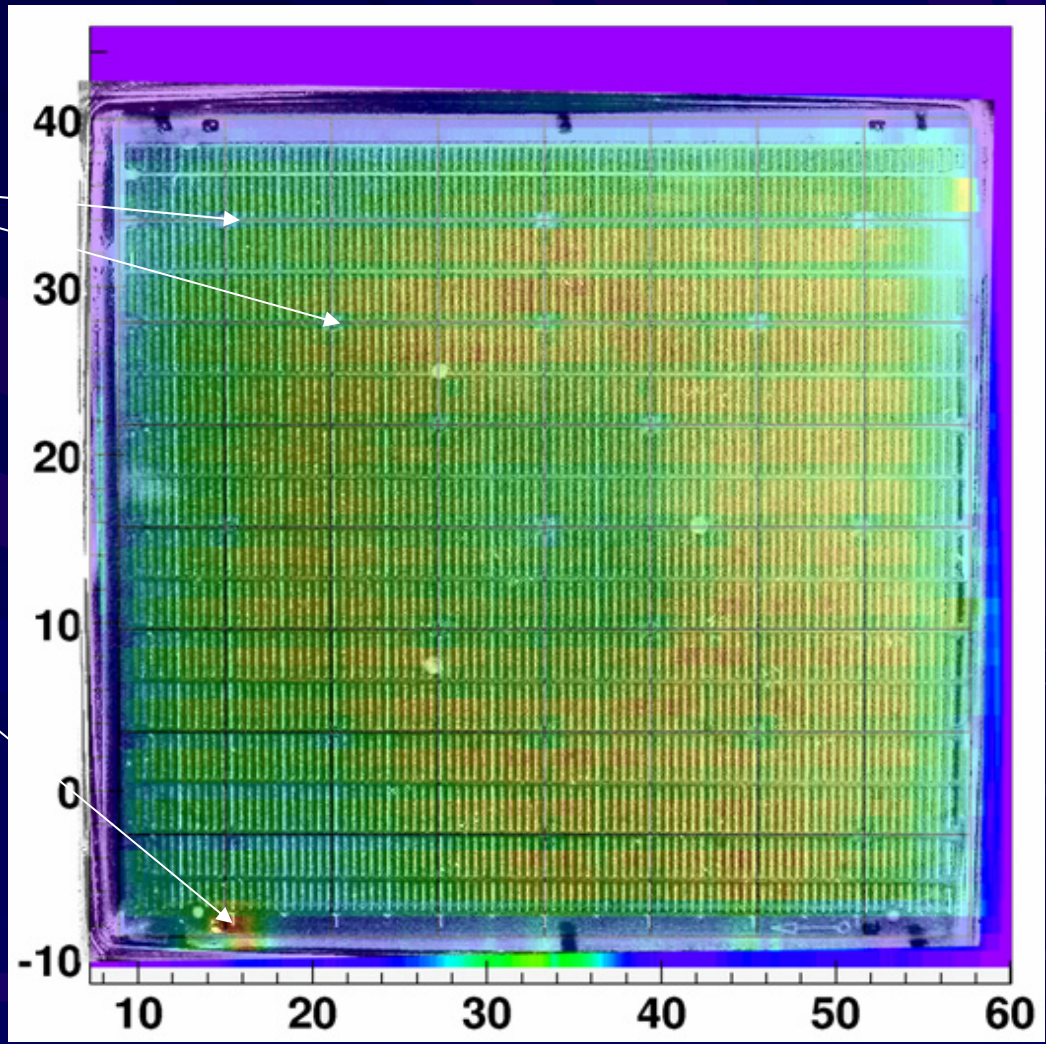
Match Photo and Scan?



Overlay Photo and Scan

"blobs" match low efficiency areas in scan

highest effi point outside slot structure



➔ take PMT to digital (DIRC QA setup)

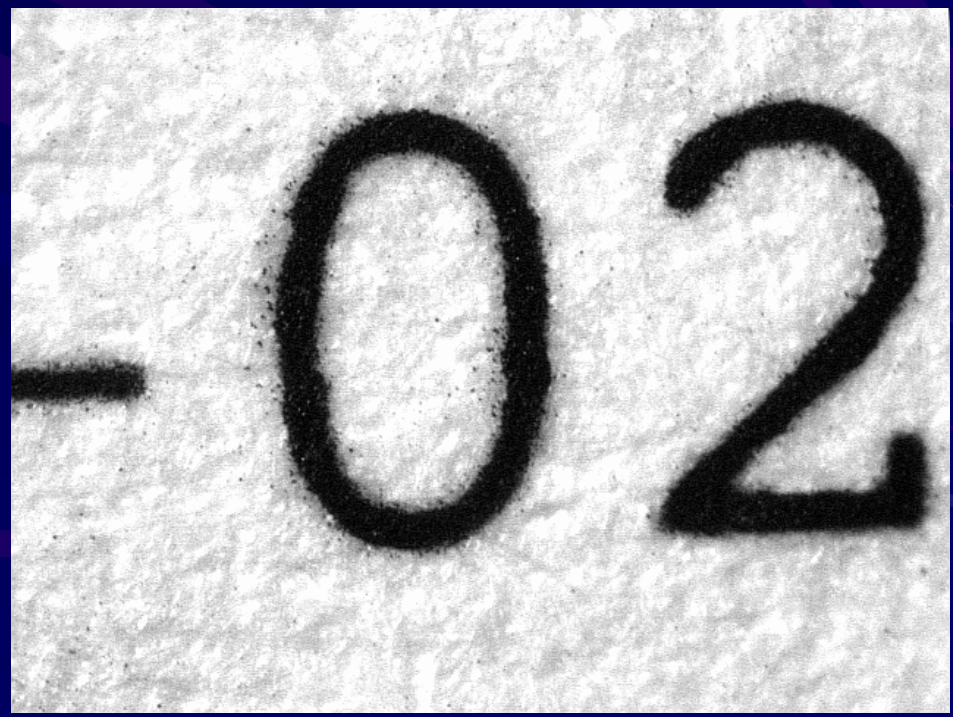
PMT Photos

Digital microscope, used for DIRC QA

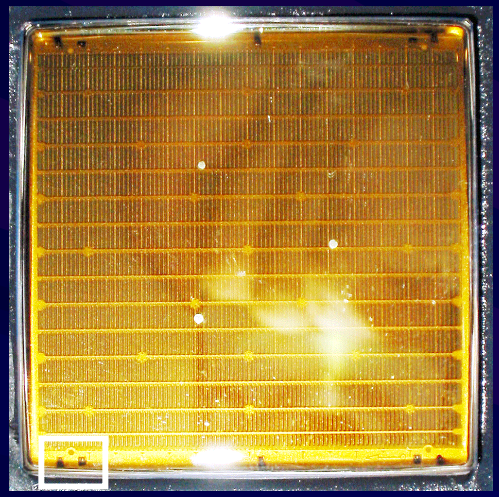
(Jerry, Mark, Johann, Bob, Matt, JS)

CCD, Image has 640*480 pixels
pixel size ~5mu
-> Image ~ 2.5*3.5mm

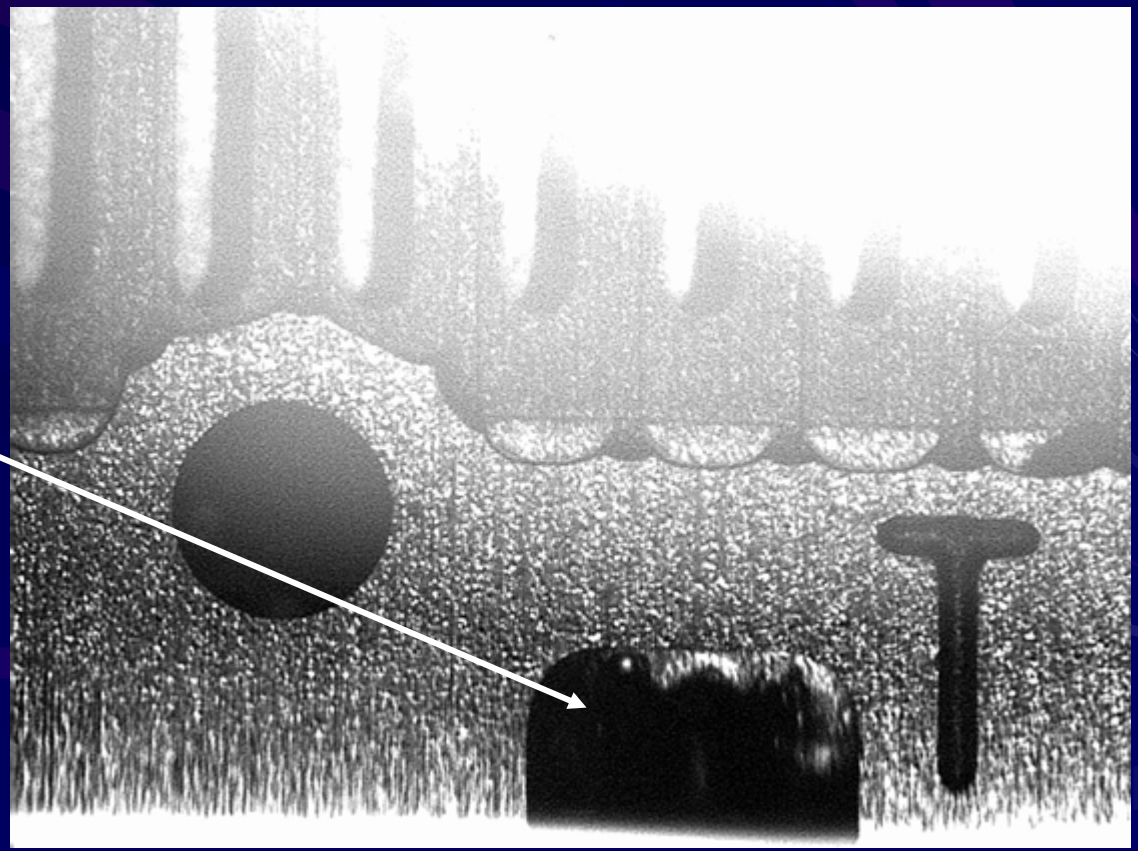
Example: snapshot of text on paper



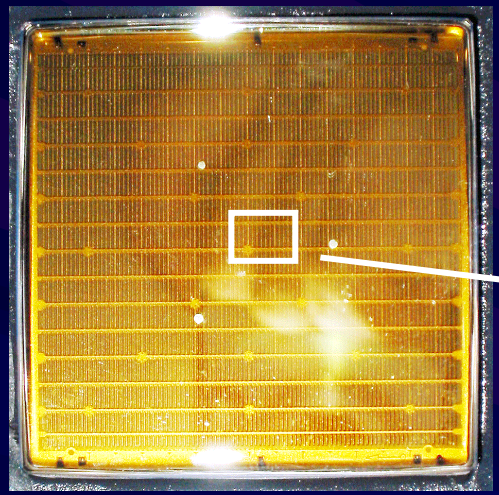
PMT Photos



Highest “efficiency” point outside PMT
– wide opening in metal structure

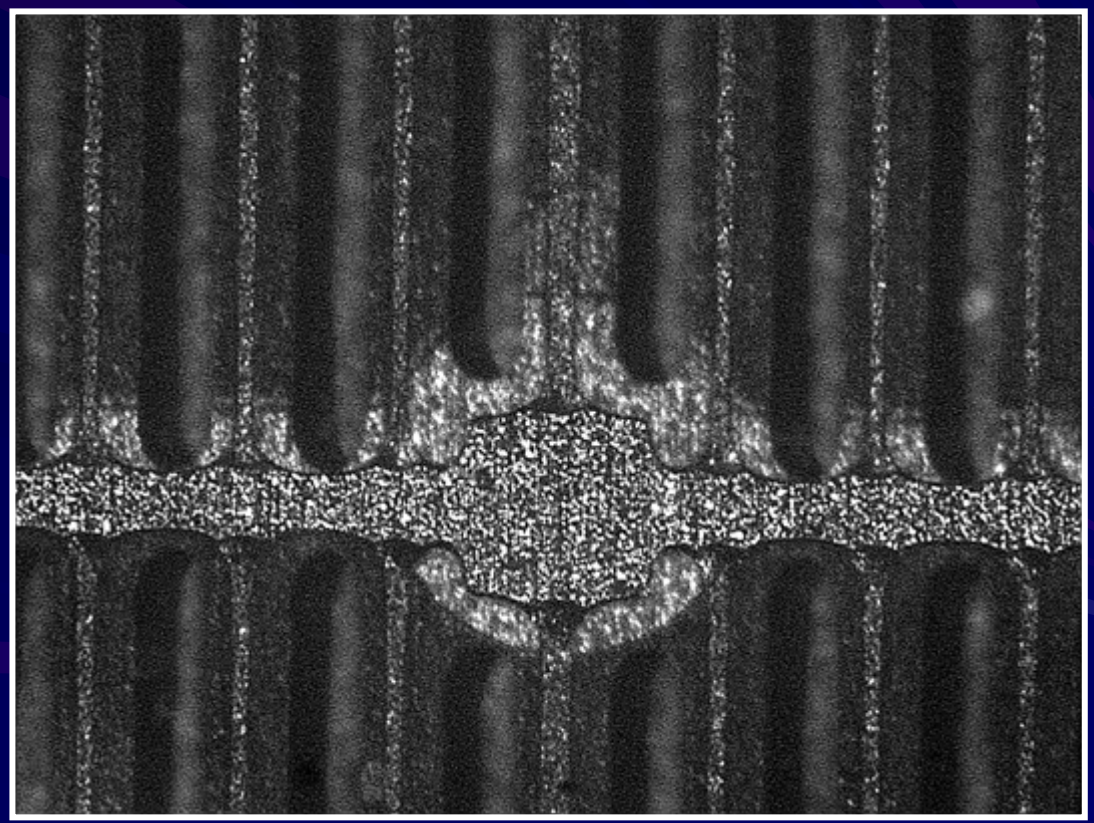


PMT Photos

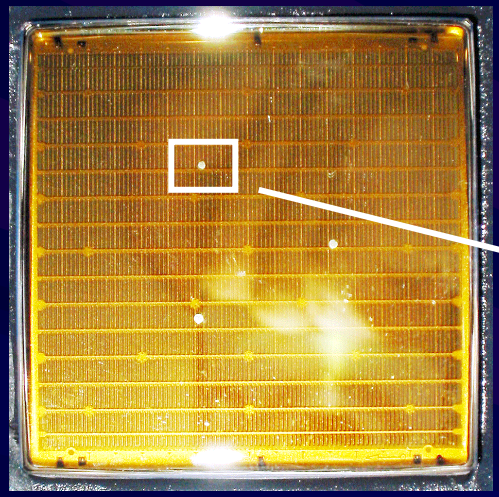


"blob" structures

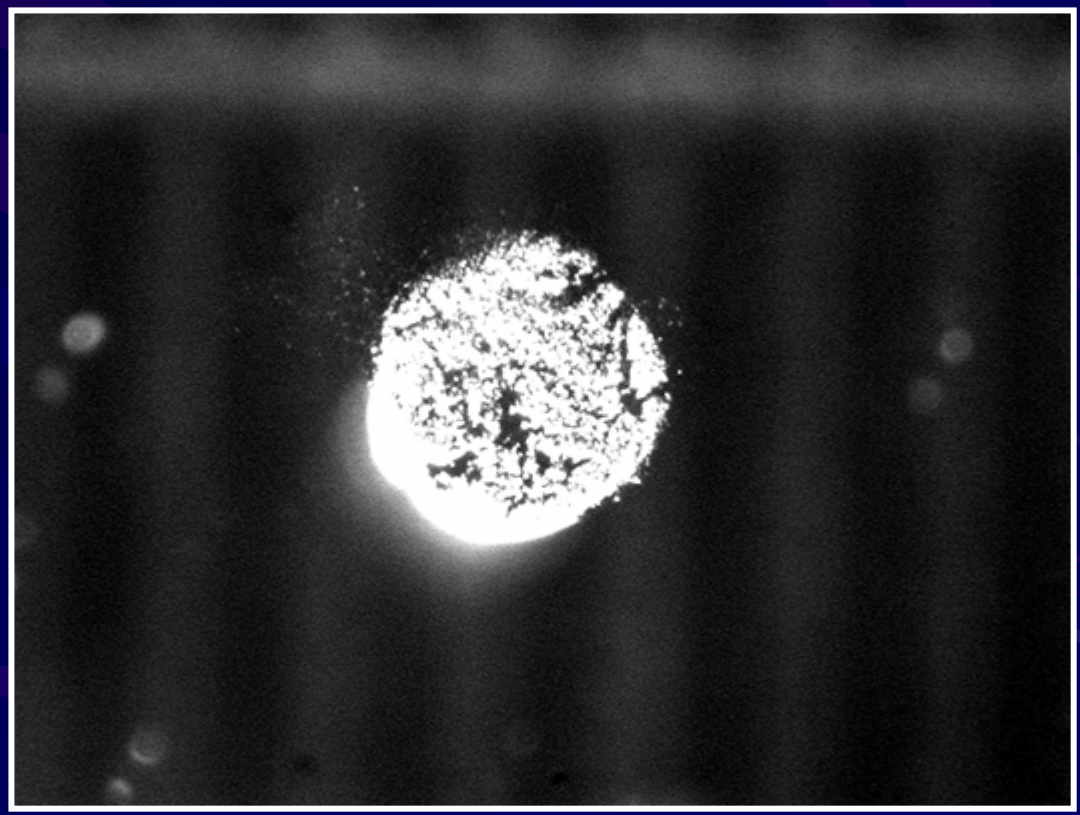
– intersection of boundaries in metal structure



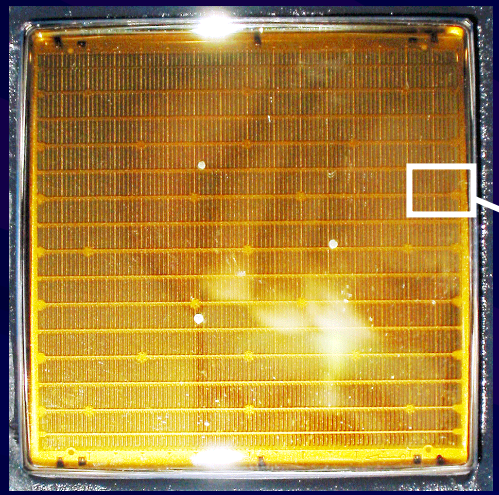
PMT Photos



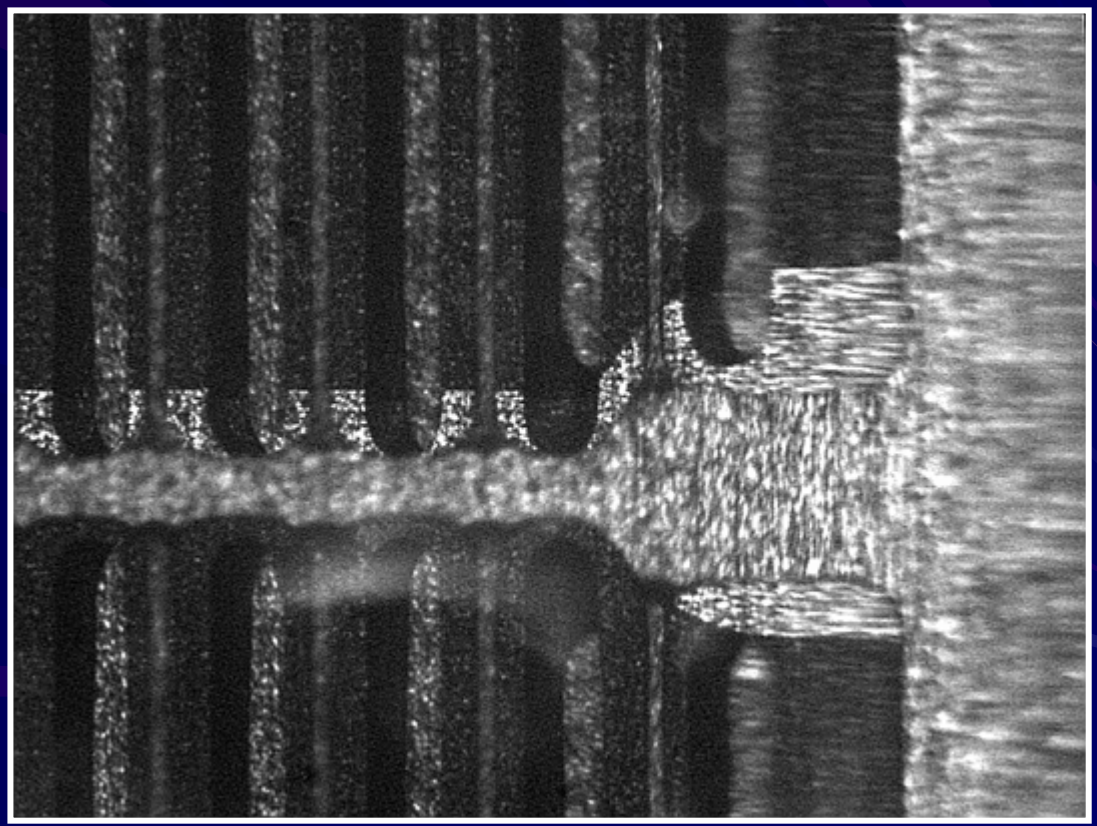
Bright spots are imperfections in front glass.

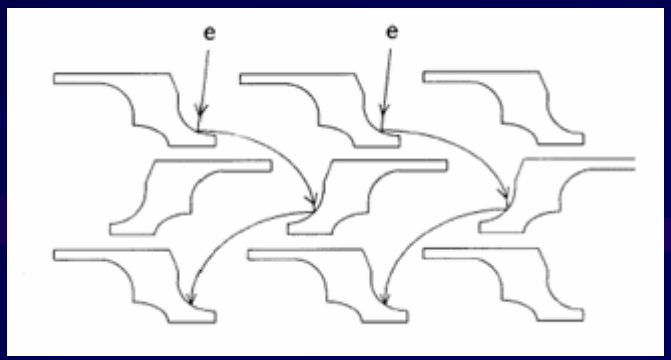


PMT Photos



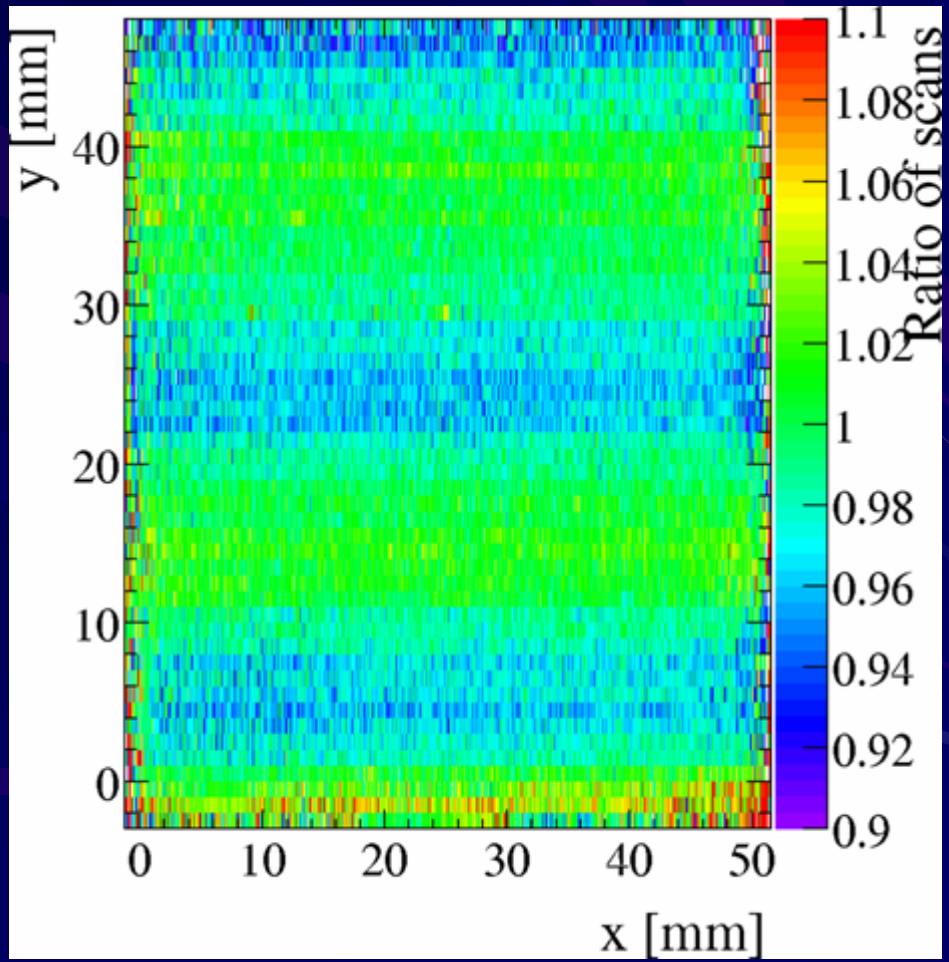
Can almost “see” dynode structure





Systematic Studies

Two scans of PMT #2 with identical configuration.
Ratio of rel. intensities is a measure of systematic uncertainties.



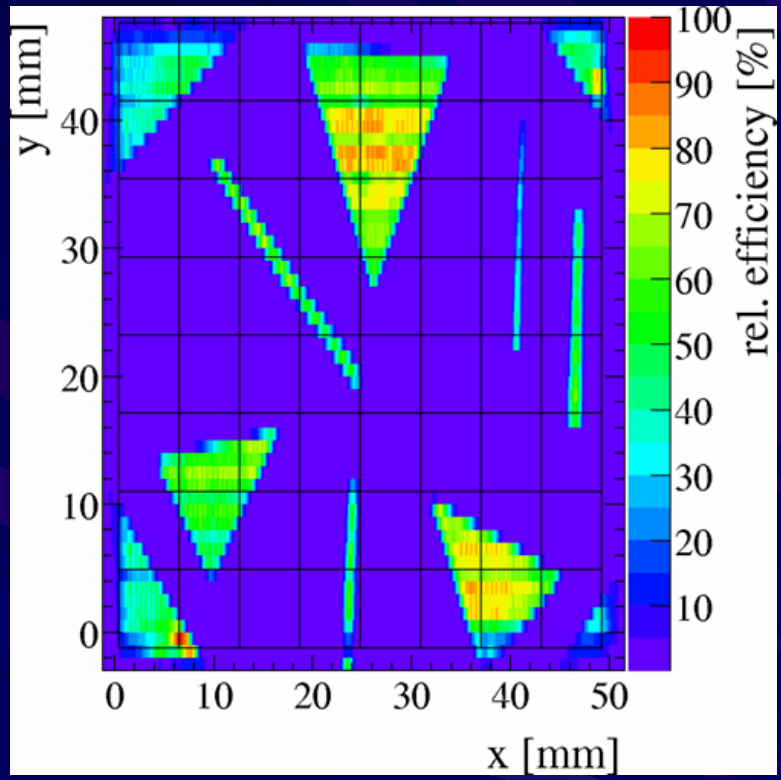
The two scans agree within ±3%

Clear systematic variation.

Variations not quite diurnal, source under study.

Systematic Studies

Scanned PMT #2 with mask made from paper



Made scans with pads #5,7,8 connected to hi-res Phillips 7186 TDC for detailed x,y crosstalk studies.

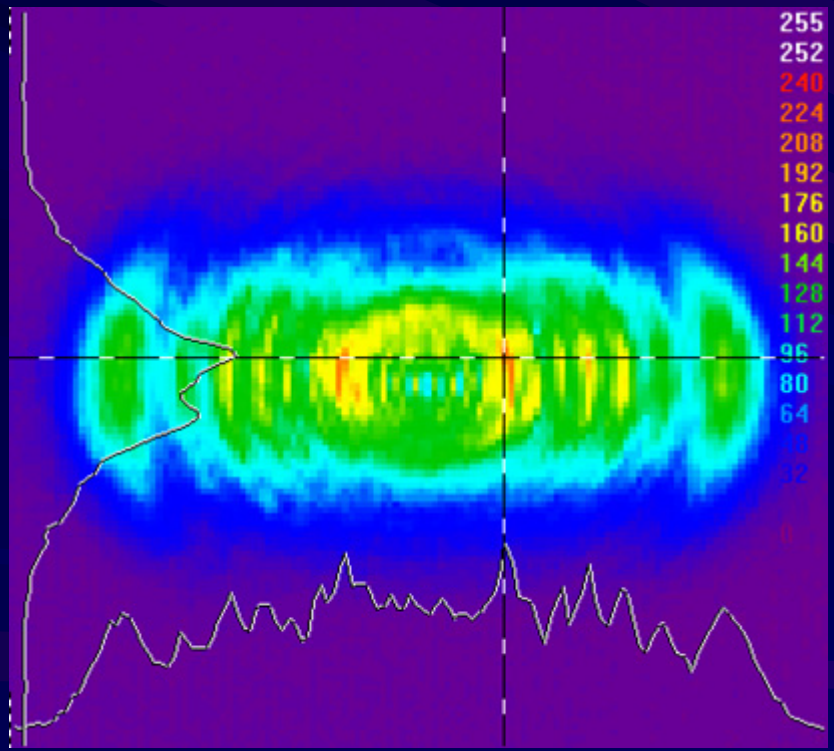
Made detailed 100mu*100mu scans of several pads.

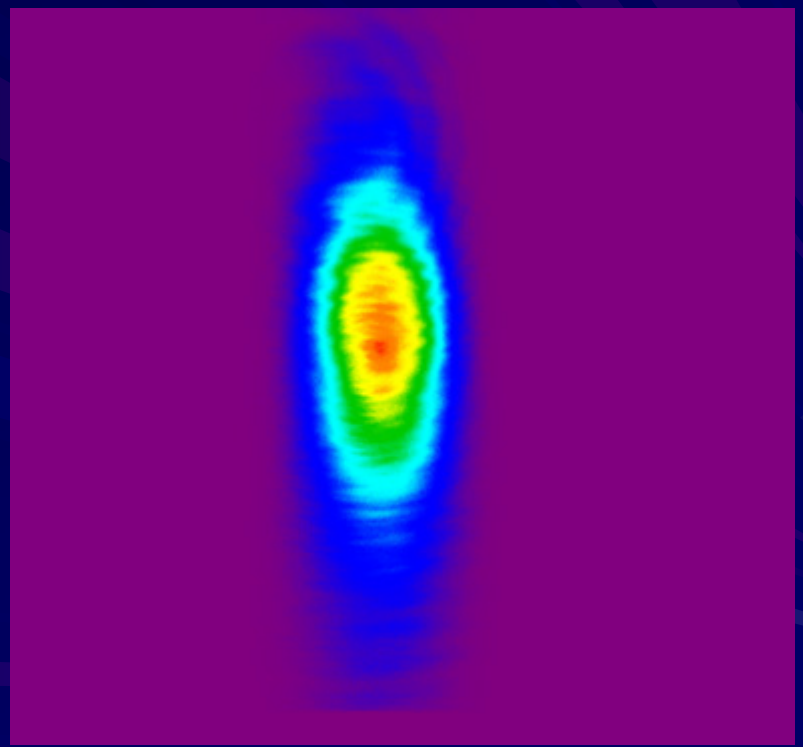
Beam Profile

Exchanged some e-mails with Advanced Photonics, PiLas manufacturer.

Typical beam spot at exit of laser optics:
2mm*5.5mm (0.3 mrad divergence) – not really Gaussian…

Examples for lasers similar to ours:





Very complicated to predict beam shape after our optics, 50-100mu seem reasonable.

Analysis Model

Current (old) analysis model:

write data using ROOT I/O to file = our raw data
use C++ program to produce human-readable plots, ROOT files, etc.
advantage: very compact, small files.
disadvantage: have to re-analyze every time – takes very long;
writing code requires intimate knowledge of raw data structure - no quick & dirty PAW-style analysis possible.

New model:

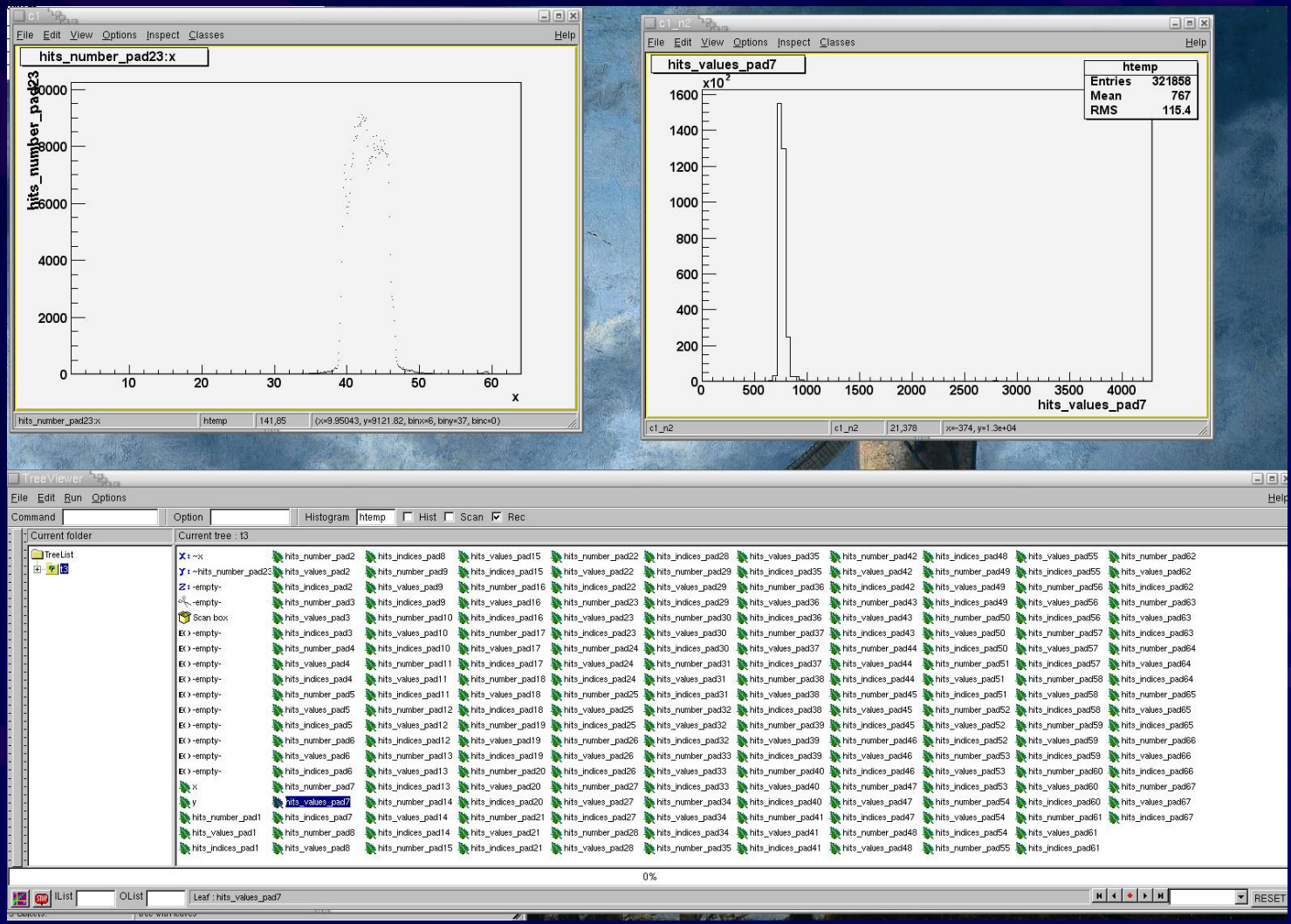
create “micro” from raw data – ROOT ntuple format that allows users to read file with ROOT and analyze data, even in GUI mode.

“inter_file” format, currently being tested.

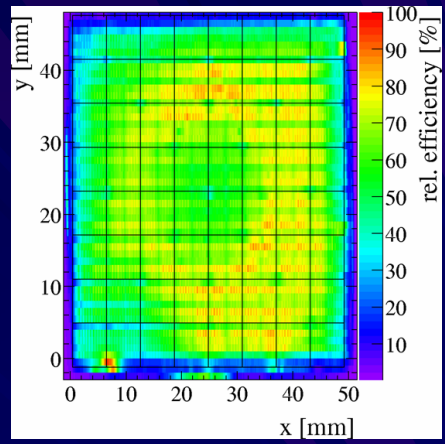
```
x coord.
y coord.
number of hits for every pad
TDC time for every hit/pad
index of hit/event
```

Analysis Model

New micro allows GUI analysis in ROOT as well as conventional macro-based analysis. Thomas will give us introduction to ROOT data analysis in Jan 03.



Summary and Outlook



- Scanned PMTs #2 and #3
- PMTs look better than #1
- Took a lot of data, systematic studies.

- Only just begun analysis of new scan data
  much is left to do – will be easier with new micro format
  - timing
  - crosstalk …

- Thomas is designing new DAQ software for CRT and PMT scanning setup. Will convert current code to new DAQ model starting January. Maybe higher rates possible.