Backward EMC Progress

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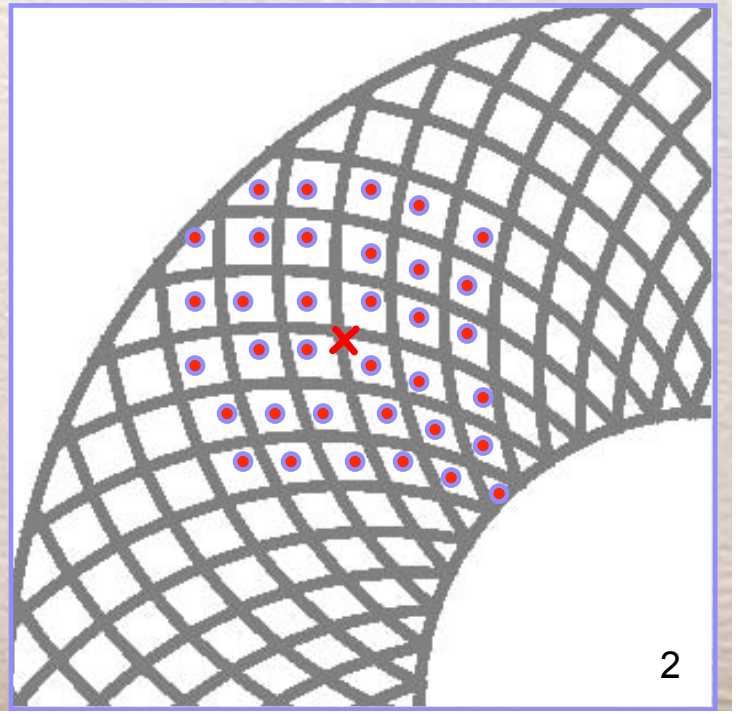
Introduction

- The backward EMC prototype consists of 24-layers of Pb plates and scintillator strips ➔full depth is 12 X_0
- Pb plates are 2.8 mm thick ring segments
- Scintillator strips are 3 mm thick left-handed spirals, right-handed spirals radial segments that alternate eight times
- 6 strips per layer will be read out
  strip sizes vary from 4.1 cm at the inner rim to 9.8 cm at the outer rim
  ➔ total of 144 readout channels
- Each scintillator strip is read out with a Y11 WLS fiber positioned in a groove in the center of the strip and coupled to an MPPC at the outer rim



Status of Spiral Strip Production

- The Bergen workshop cut the first spiral strip

- It is still missing the groove for the fiber and the slots for the MPPC and the mirror

- Pro-Engineer apparently approximates curved surfaces by linear segments
  - ➔ for the present strip the segmentation is much too coarse
  - ➔ need fine tuning, issue is to find the right parameter to adjust

- So main production will start hopefully in January
  - ➔ the 96 strips should be produced in two months (early March)

Manpower Issues

- Steinar Stapnes secured 150k ChF to hire a postdoc for 2 years

- The original idea was to hire a PhD student for three years
  - ➔ We had a good candidate who declined at the last minute
  - ➔ To increase the probability of finding a good candidate, we we reconsidered the postdoc option and prompt found the right person (he is very interested but has not accepted yet)
  - ➔ He would start March 1

- Justas is now my PhD student working on ATLAS data analysis ➔ since he wants to get more training on hardware, he continues to work on the prototype (he is producing the Pro-Engineer drawings and he helps Zhuo with the test stand)

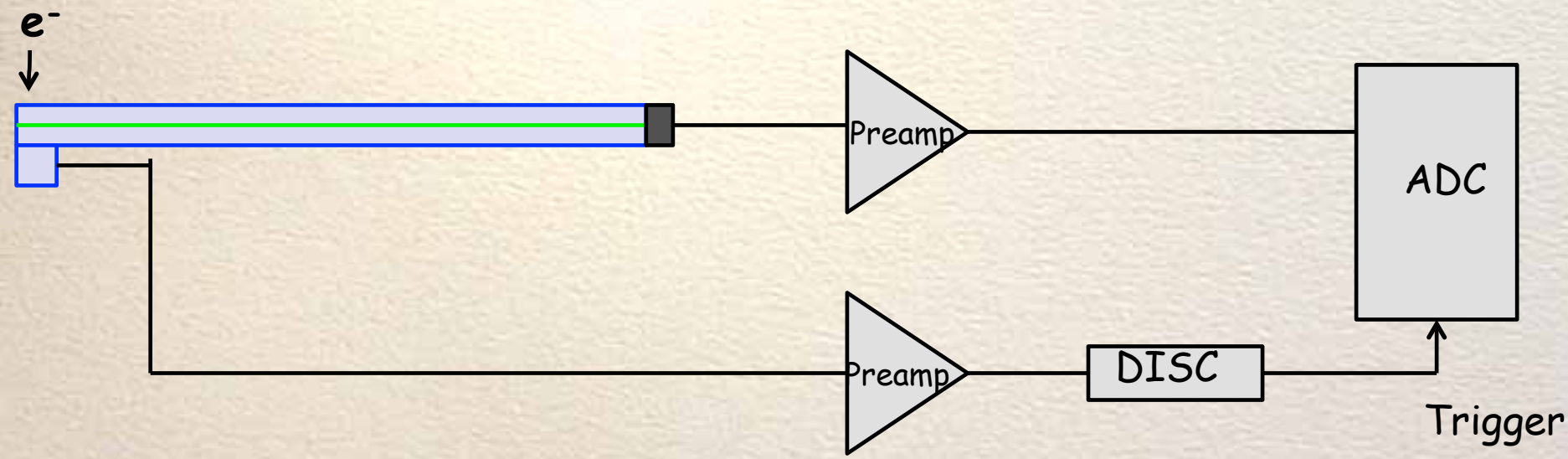
- Zhuo has to finish by summer 2013
  - ➔ he is testing strips and is working on the light yield simulation

Strip Testing

- Strip testing was delayed from September till early December
- When we tried to set up the measurement in the black box, we learned that we had to share the black box and ADC with a student project
- This was not optimal as due to changing setups back and fourth, the preamp broke and Zhou had to make a new one
- So we decided to build a new black box that we do not need to share
- We also installed a trigger counter

Absolute Light Yield Measurements

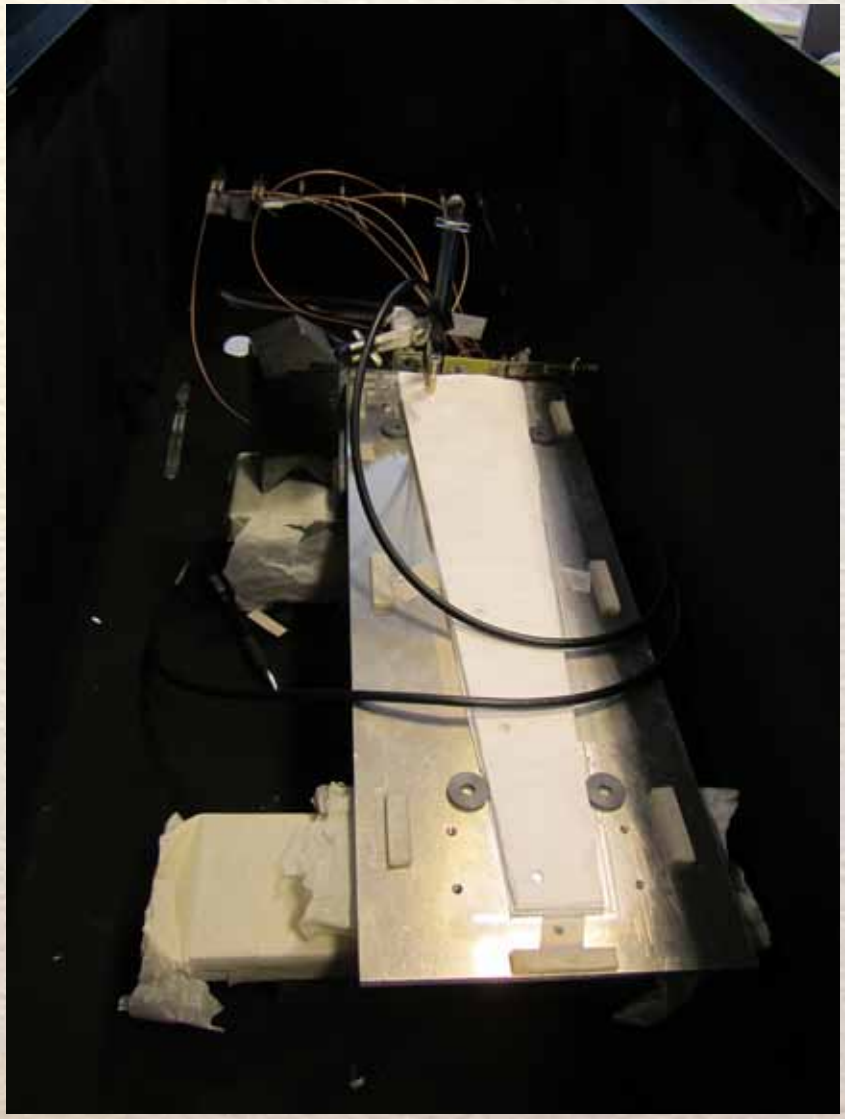
- Place scintillator below strip and use signal as trigger



- Collimate source so that electrons are nearly perpendicular to scintillator ➔ narrows signal
- Trigger helps to reduce number of random events

Light Yield and Uniformity Measurements

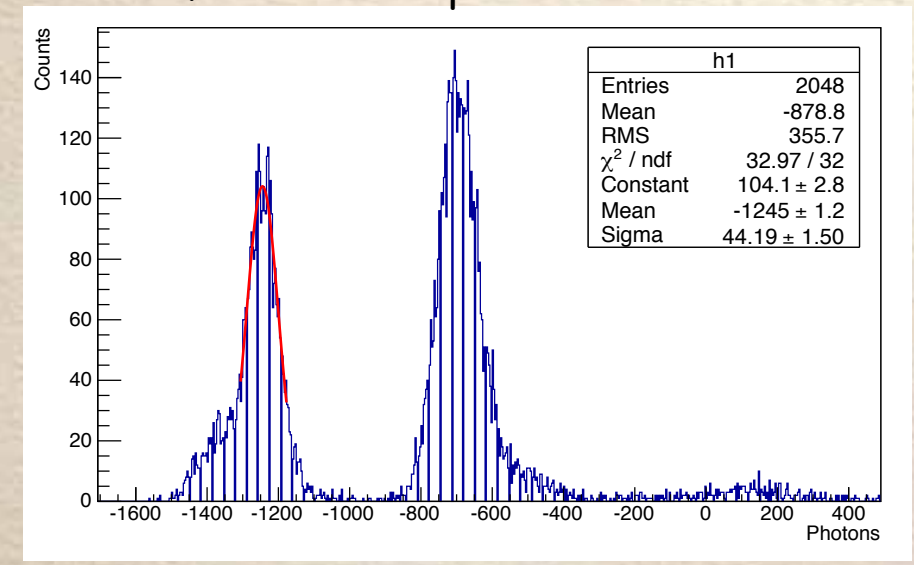
- Setup in the new black box
- MPPC signal plus trigger
  ➔Trigger signal was delayed to match rising edge of MPPC and width was reduced to 100 ns



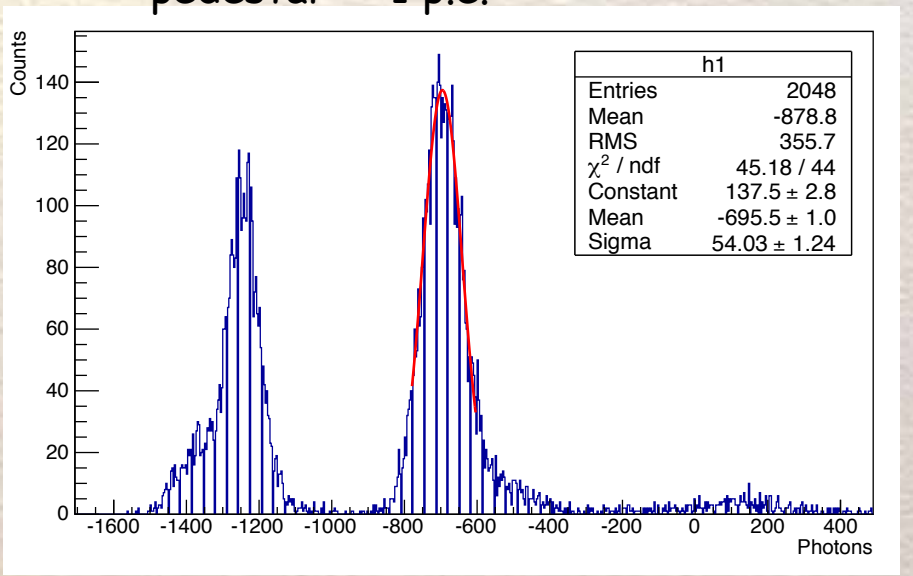
Calibration

- Use random triggers to calibrate the system
- Need to check pedestal since shape looks strange
- Calibration yields 550 bins/pe (low?), needs checking

pedestal 1 p.e.



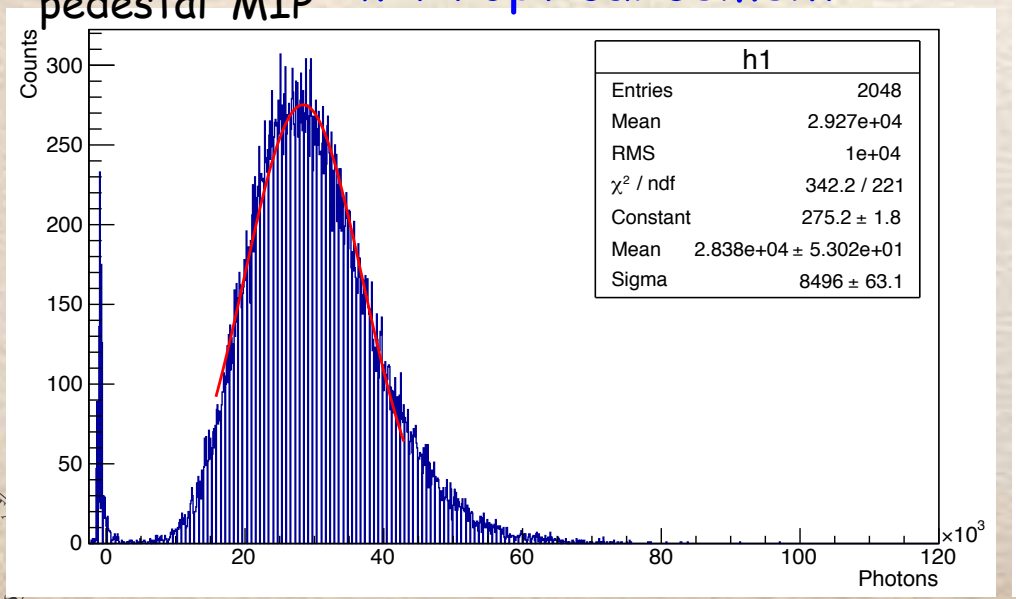
pedestal 1 p.e.



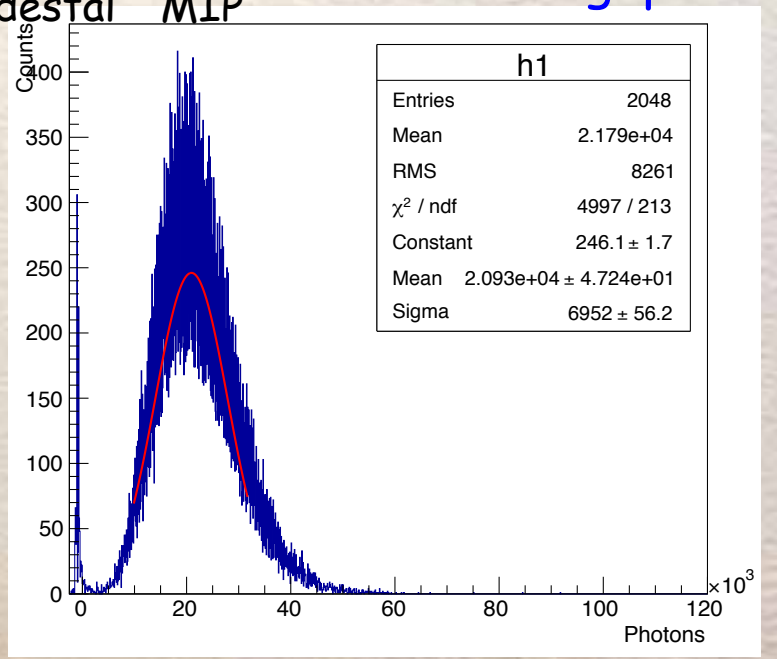
Absolute MIP Yields

- Measure MIP peak position of the ^{90}Sr electrons with two couplings
  - with air gap ➔ see 40 p.e. (width: 15.5 p.e.)
  - with optical cement ➔ see 54 p.e. (width: 12.7 p.e.)
- Include random triggers to see pedestal
- Absolute LY seems to be rather large, need to check calibration

with optical cement

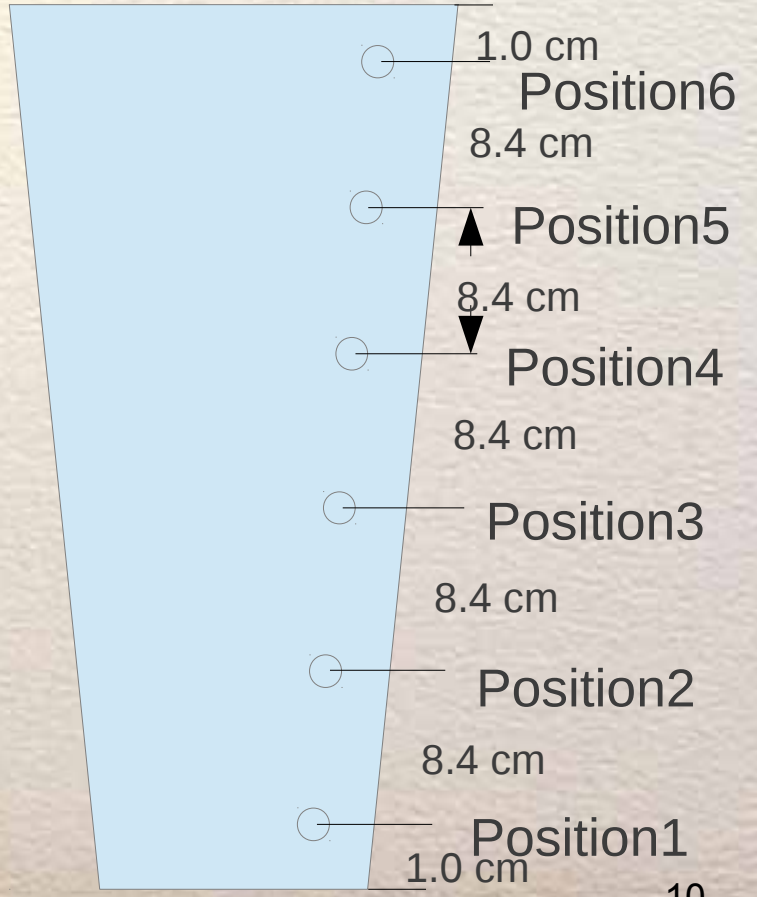


with air gap



Uniformity Measurements

- Due to the unexpectedly high light yields at the far strip end measured with the UV LED, we remeasured the non-uniformity with a ^{90}Sr source
- Top and bottom faces are covered with TYVEC
- Side faces are covered with Teflon tape
- We measure the MIP distributions at at six locations and normalize the the light yield to that at position 6
- We trigger with a 3×3 cm^2 tile read out with an MPPC
- I ordered a 5 μCi strong ^{106}RU source that should arrive before the end of the year

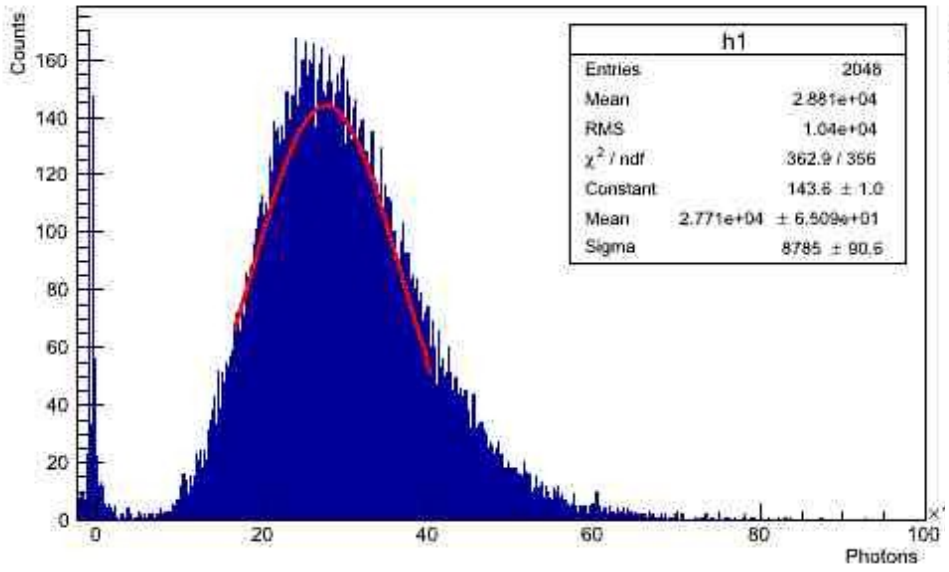


Non-Uniformity Measurements

- Examples of ^{90}Sr MIP distributions for different source positions

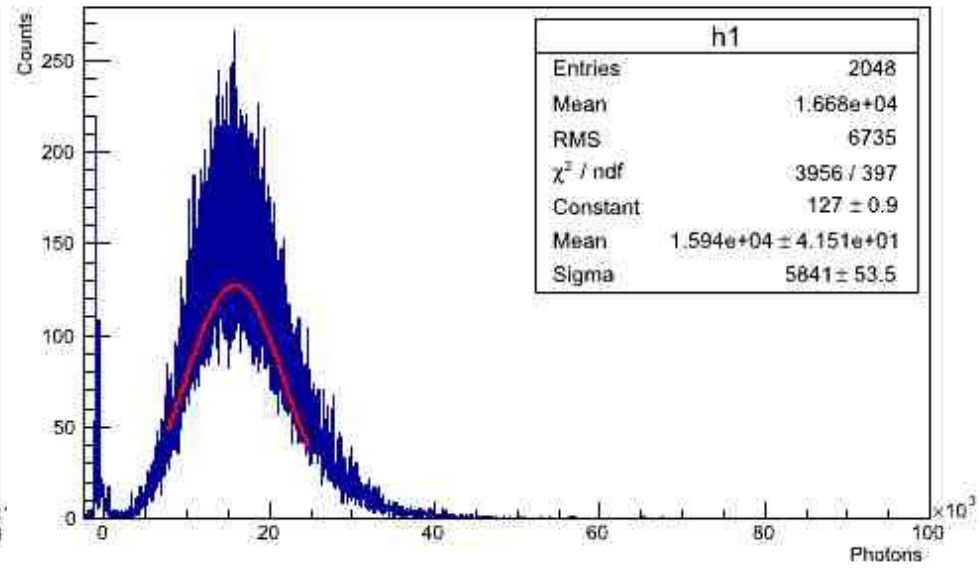
Close to the MPPC

pedestal MIP



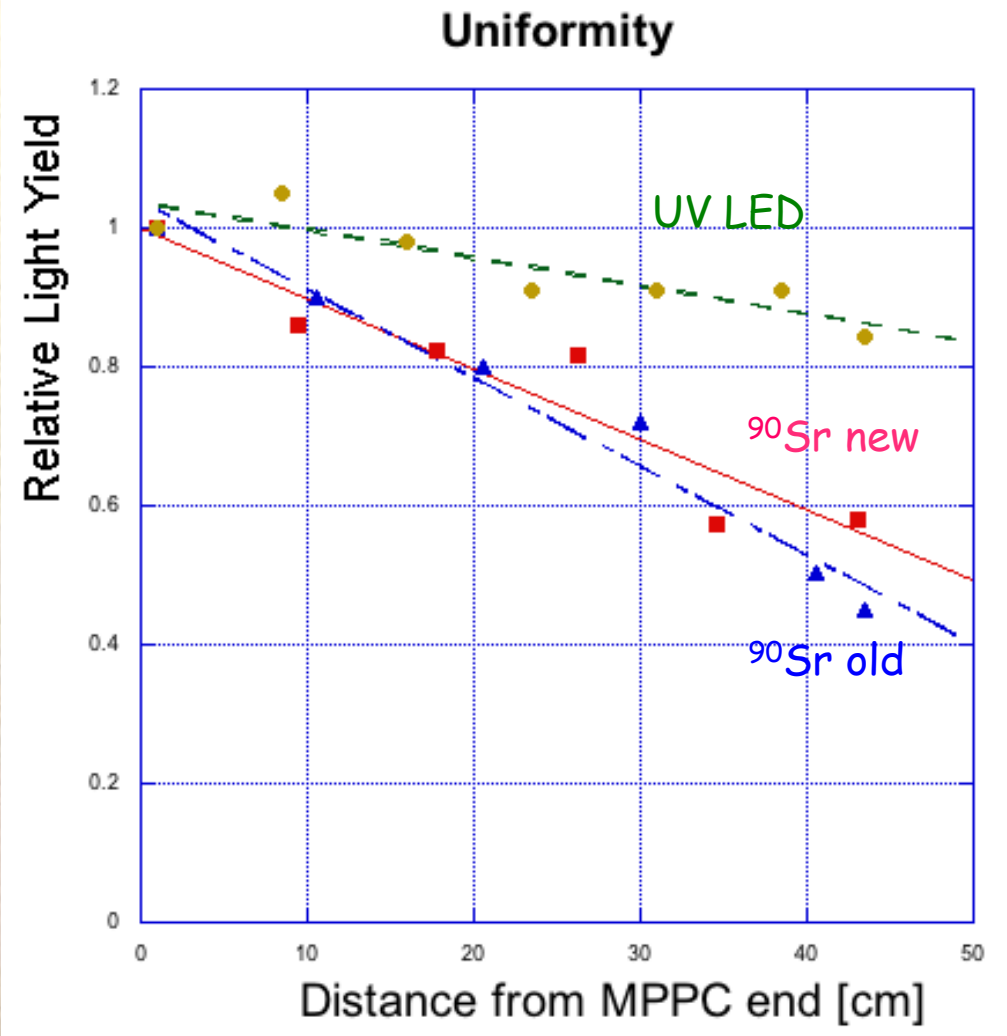
~9 cm from far end

pedestal MIP



Uniformity Measurements

- Compare new uniformity measurement with previous results
- The remeasured uniformity distribution with the ^{90}Sr source is consistent with the measurement I made a year ago and does not confirm the result obtained with the UV LED
- Naively expected ratio is ~0.41 (ratio of areas) ➔ Need simulations for a more accurate estimate
- Statistical errors are small, Systematic errors?
- We will check this with the ordered ^{106}Ru source



R&D Activities

- Within the European AIDA project I have to test an automatic adjustment of the bias voltage due to temperature changes to keep the gain constant
  ➔ get special power supply that I will use for the prototype
- Next week, I will receive complementary samples of new Hamamatsu MPPCs (15×15 μ^2, 20×20 μ^2 pixels, 2 each for 2 layouts) ➔ these are the detectors CMS showed to be radiation harder
- The new ^{106}Ru source will make tests much easier
- I will try to order remaining items starting next week
  - 30m Y11 fiber
  - five thermo sensors
  - Reflector sheets for strip top and bottom faces
  - White reflector for strip sides
  - Development of dot pattern on reflector to restore uniformity
    ➔ develop Geant 4 simulation package

Conclusions

- The first spiral strip has been produced
  - ➔ this is real progress for a long time
  - ➔ I expect production will start soon and finish early March
- It looks like we may finally get a postdoc (unless he decides otherwise)
  - ➔ He would start March 1 but is based at CERN
- We have built a new black box to be independent of other tests and have set up a working test stand
- We are ready for characterizing the 48 sector strips and then start with the spiral strips as soon as they are finished
  - ➔ we will store LY, linearity and non-uniformity in a data base for each strip