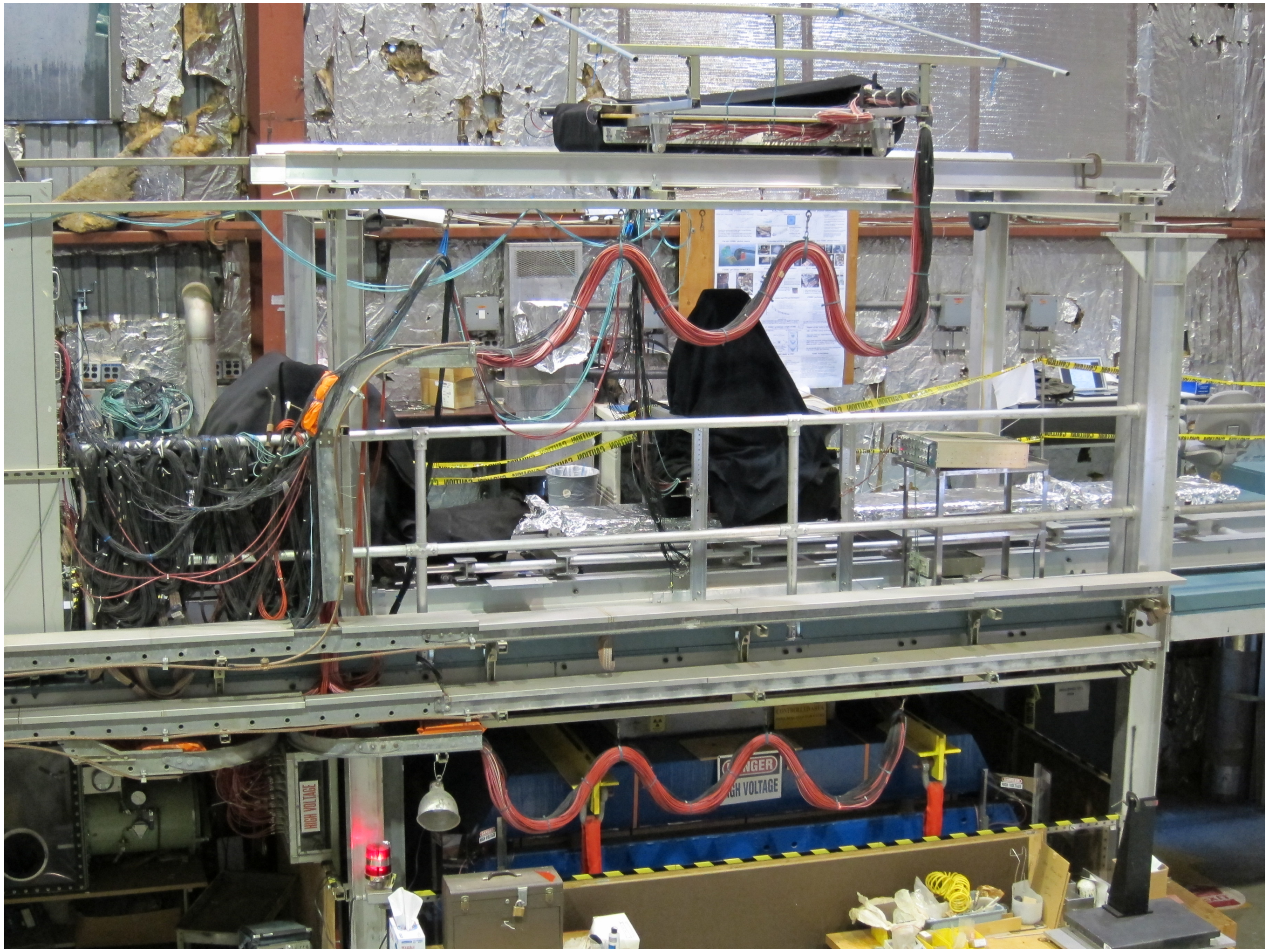
Dec. 8, 2012

Status of FDIRC prototype

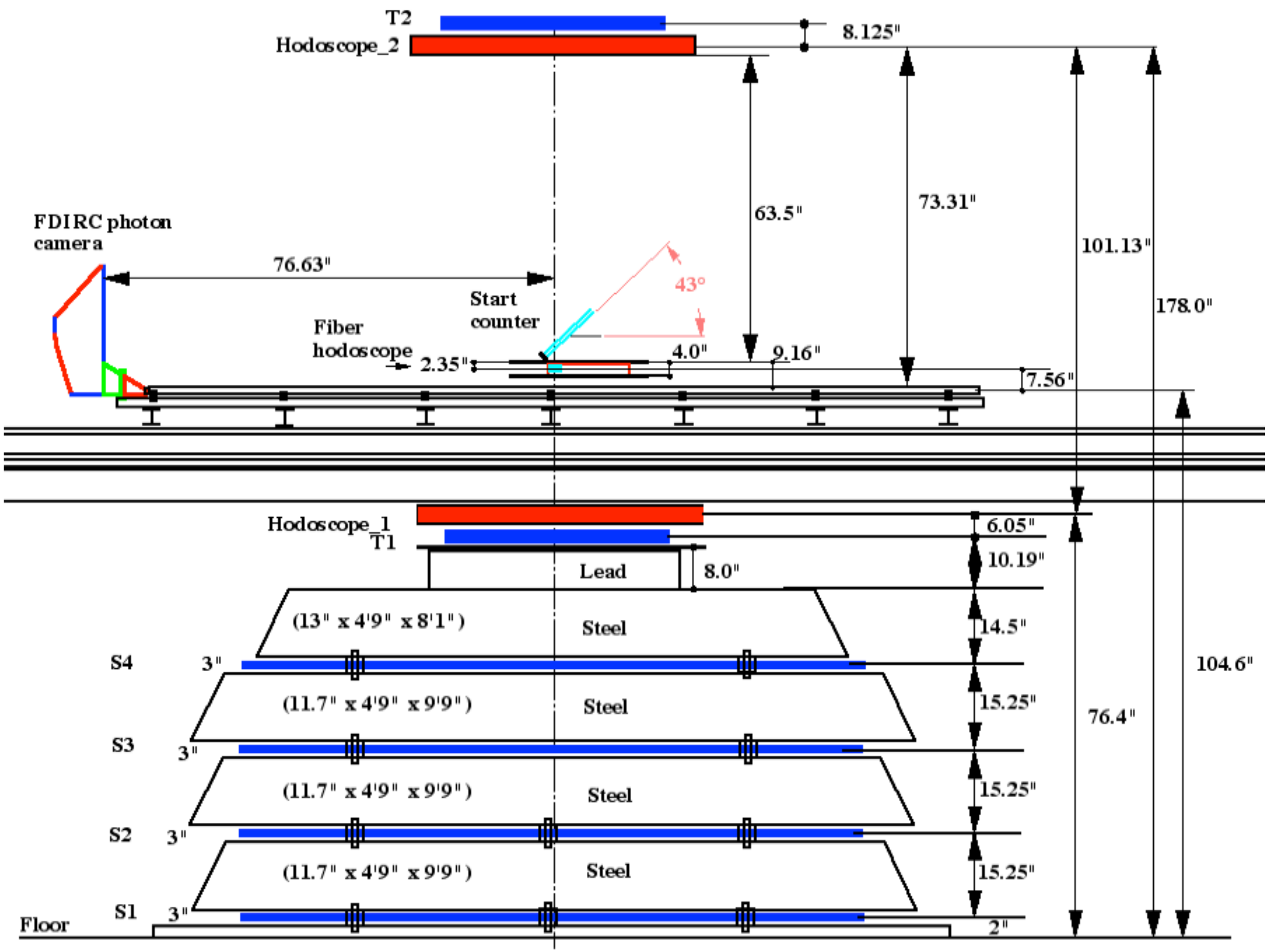
J. Va'vra

FDIRC prototype in CRT



The FDIRC prototype in CRT, taking data.

FDIRC prototype in CRT



Status of data analysis

- The prototype is finally taking data after a long period of debugging of Hawaii IRS-2 electronics, problems with Camac, laser triggering, early confusion with dst file format, etc. We are still discovering problems such as that only 40% of events do contain the IRS-2 electronics information due to problems of trigger distribution box for this electronics. System has now 8 H-8500 instrumented tubes; expect to add 4 more tubes by the end of this year. This will complete the system for total of 768 pixels.
- **People who are working on this part: Kurtis Nishimura and Jerry Va'vra:**
  - Kurtis maintains DAQ, and works on waveform analysis, converts raw files into dst format, helped to debug many puzzles in early stages.
  - Jerry works on data analysis to provide a feedback to Kurtis, checks if data makes sense, and maintains the FDIRC prototype and CRT setup hardware.
  - Also a help of Hawaii technician Matt Andrew to test IRS-2 electronics.
- We are starting data analysis:

a) MC work: Doug Roberts, Biplab Day and Martino Borsato:

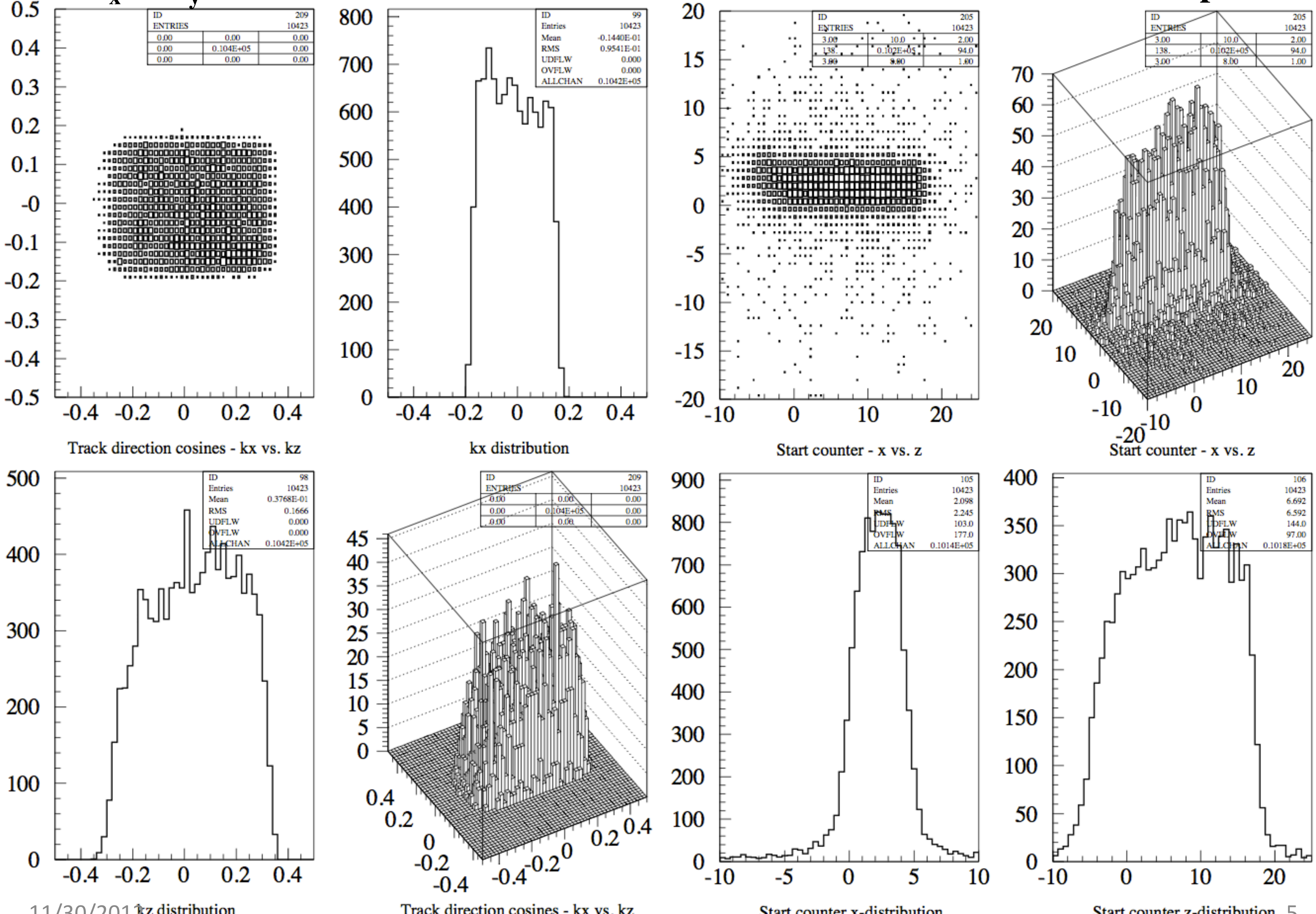
- Biplab put FDIRC prototype pixel geometry into the code and produced the first pixel constants. He also produced the first prediction of FDIRC prototype performance (see Pisa meeting)
- Martino started to work also on constants.
- Doug maintaing the overall code; added recently additions to speed up generation of the generation of photon dictionary.

b) Data analysis: Jerry Va'vra, Martino Borsato, Doug Roberts and Biplab Day:

- Jerry made the initial version of the code based on his work with the previous prototype. This is written in Fortran. This code provides the initial knowledge how the prototype performs.
- Martino is starting to convert Jerry's code into C^{++} code (this is helped by previous similar work of Ellie Twedt, Maryland).
- Doug, Biplab and Nicolas are thinking to join the data analysis as well.
- In addition, Gary Varner tells me that Hawaii wants to contribute a postdoc as well.
- I understand from Fabio that Italians might also contribute one postdoc at some point.

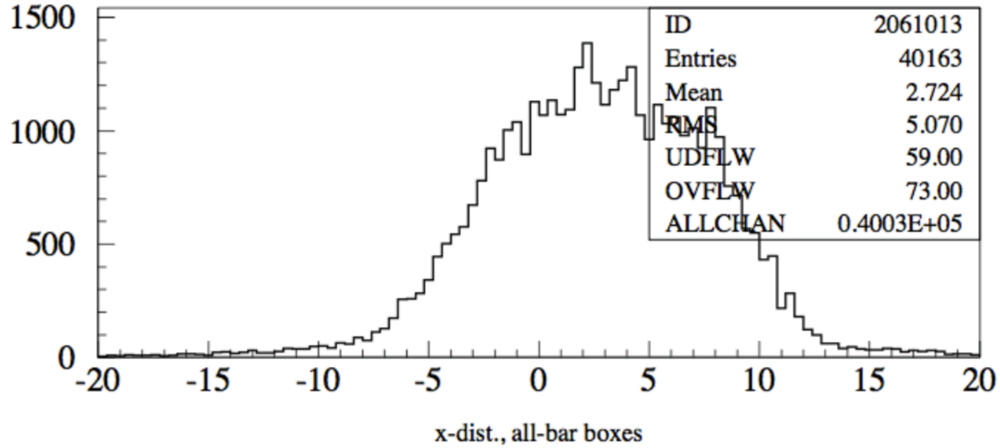
CRT Tracking

k_x & k_y distribution **Start counter footprint**

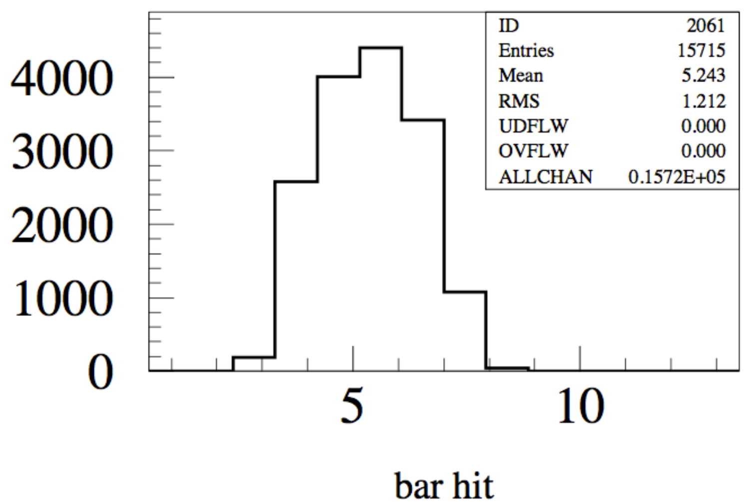


CRT Tracking: one has to find the right bar

x-distribution in bar box plane :



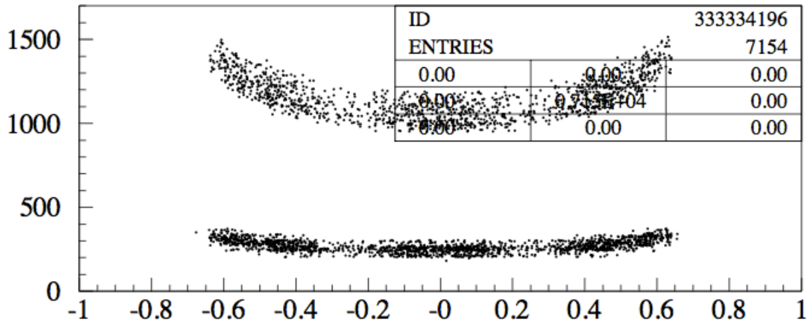
Bar selection:



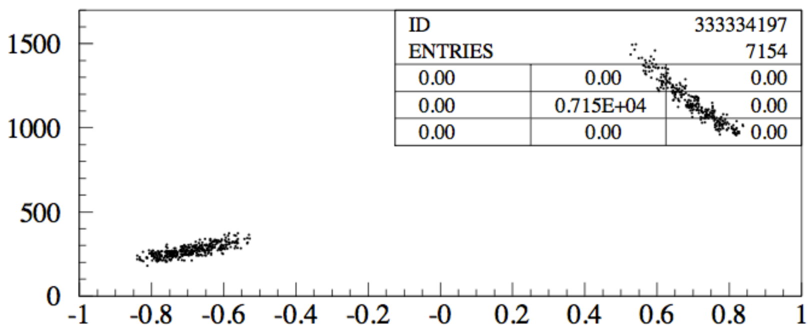
As expected, the x-distribution is asymmetric and most populated bars are # 4, 5, 6, 7

Photon k-vector reach and number of bounces

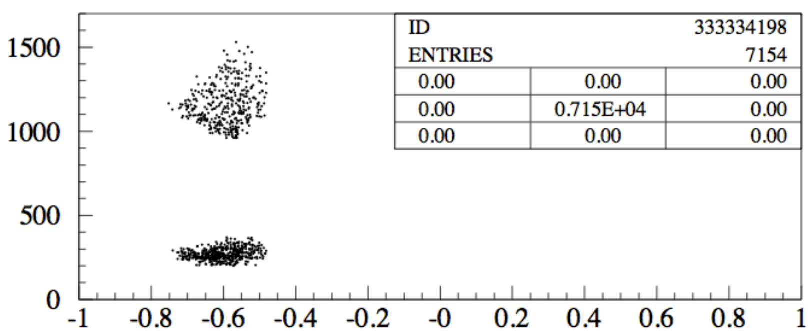
Dependence on k_x-pix, k_y-pix, k_z-pix:



Photon path length (cm) vs kx_pix

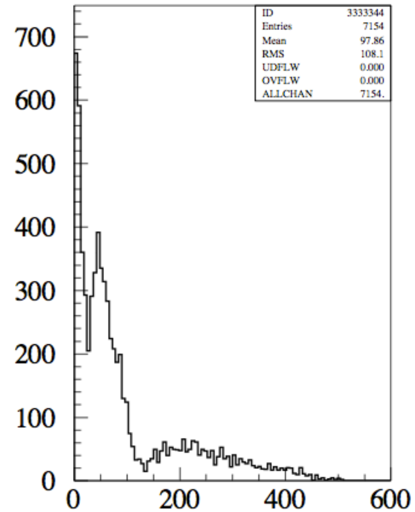


Photon path length (cm) vs kz_pix

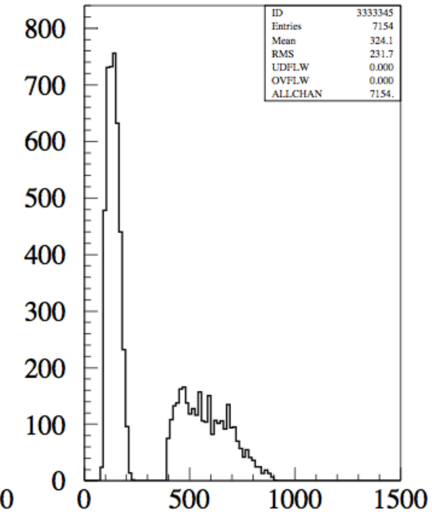


Photon path length (cm) vs ky_pix

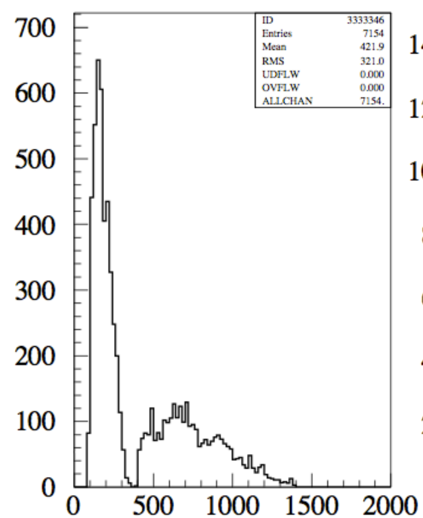
Number of bounces:



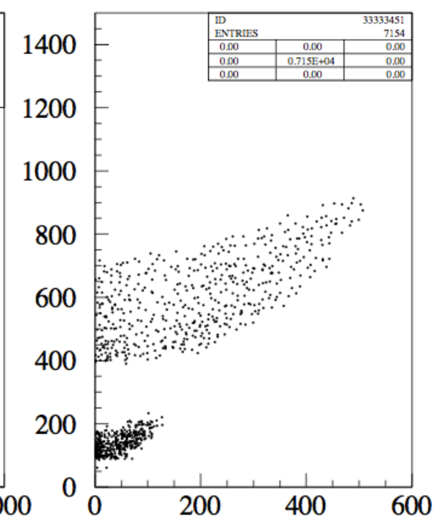
Number of x-bounces



Number of y-bounces



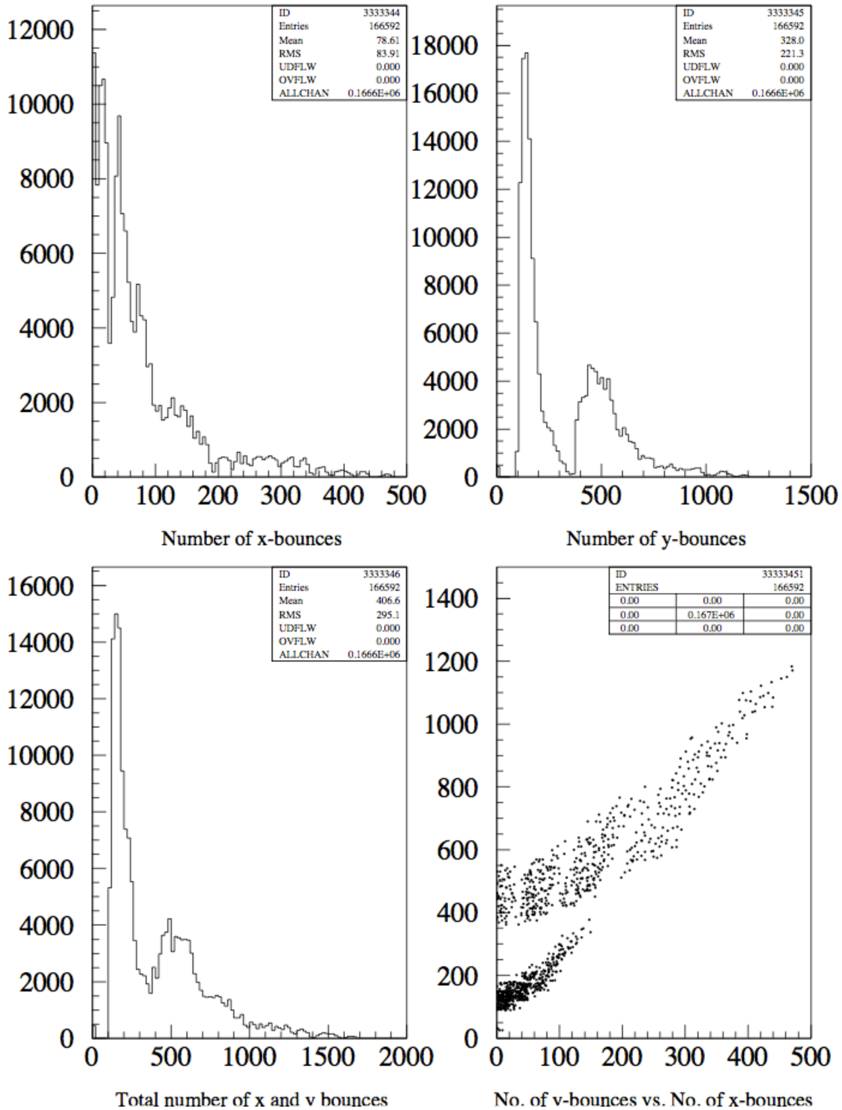
Total number of x and y bounces



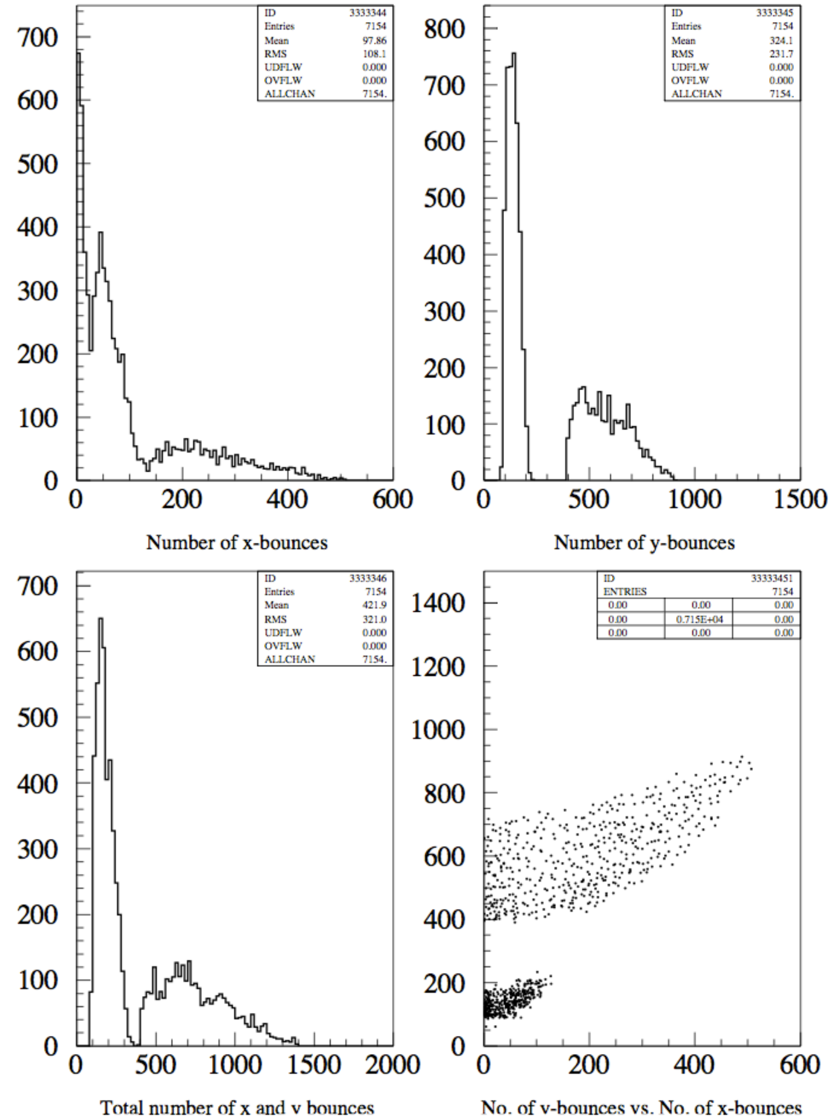
No. of y-bounces vs. No. of x-bounces

Number of bounces - compare with the previous prototype

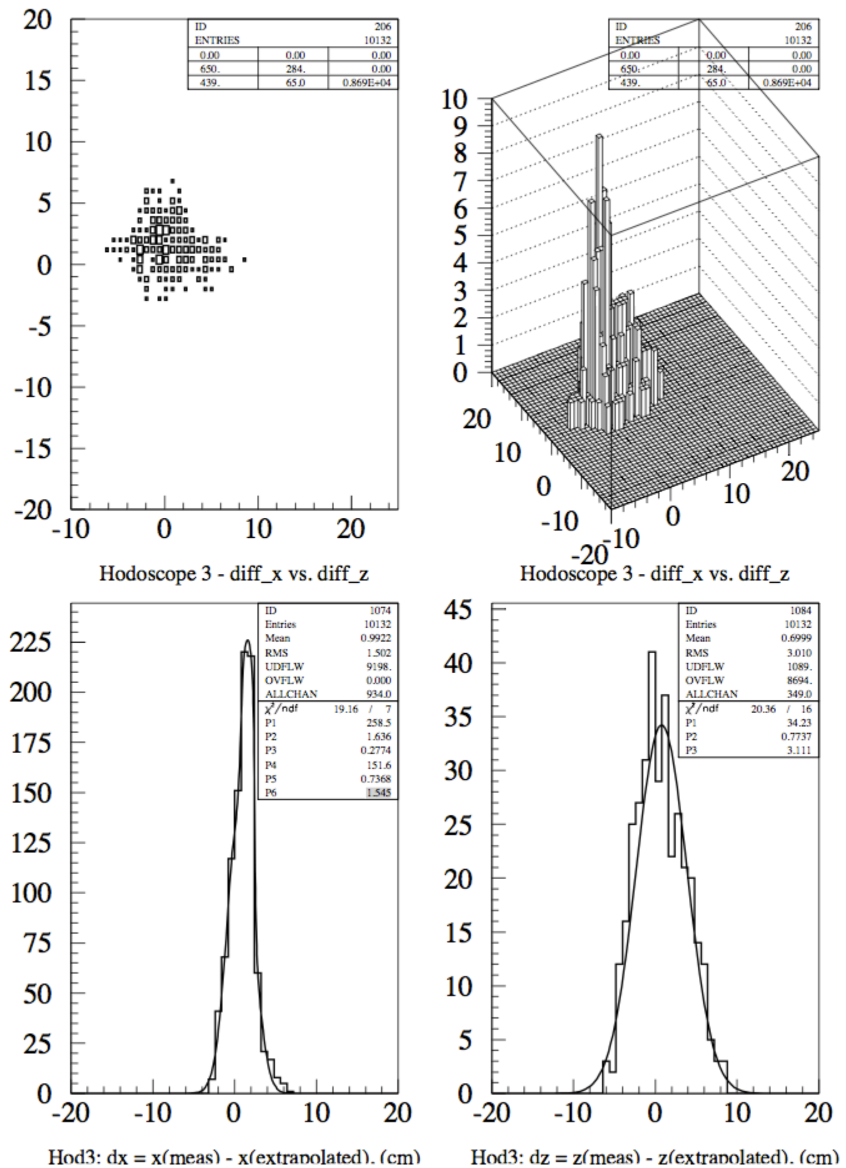
Previous prototype (NIM):



Present FDIRC prototype:



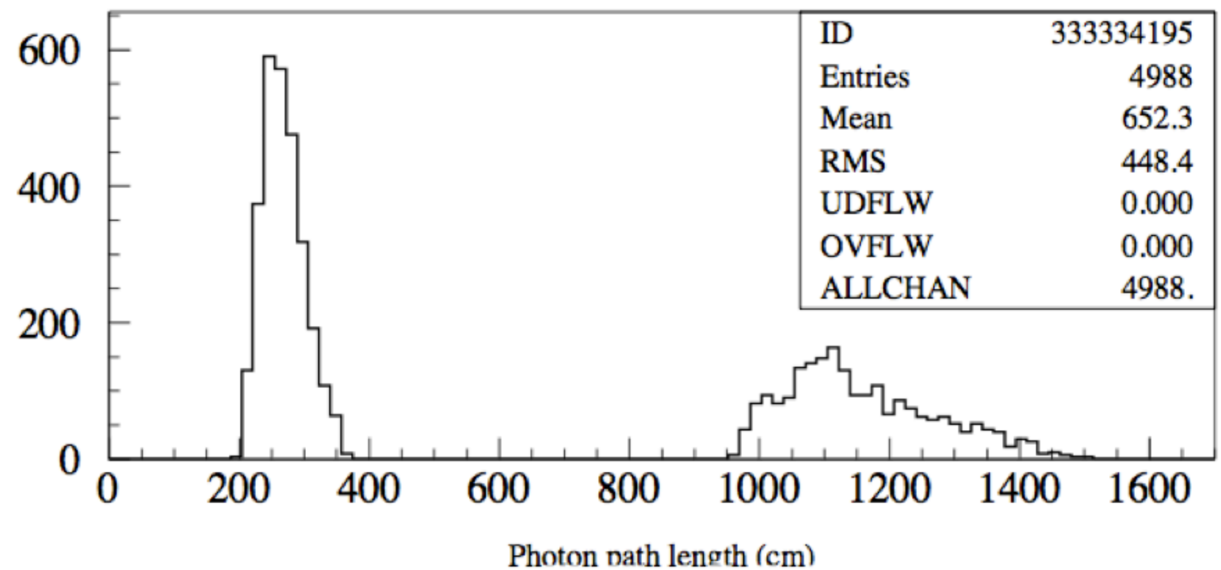
Check of the tracking resolution with a fiber hodoscope #3



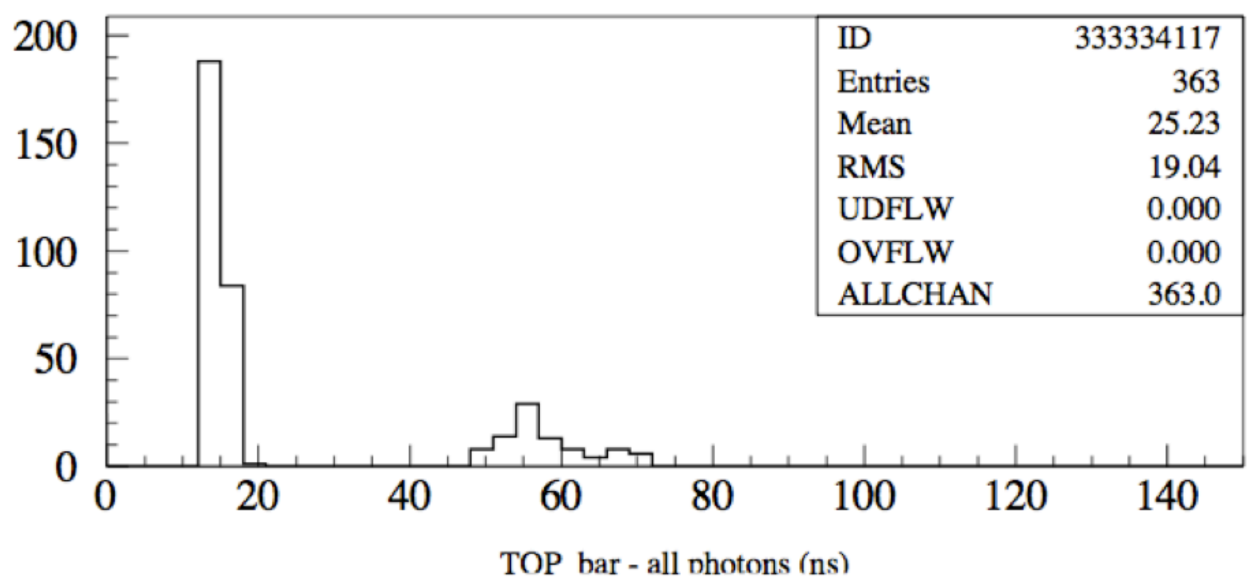
- 2mm x 2mm scintillating fibers read out by H-8500 tube.
- Both distributions are not exactly Gaussian. There seems to be a shoulder both in x & y directions.
- Need more statistics to understand this.
- This will give us a tracking resolution, which we put into MC simulation.

Photon path length and time-of-propagation (TOP)

Photon path length:

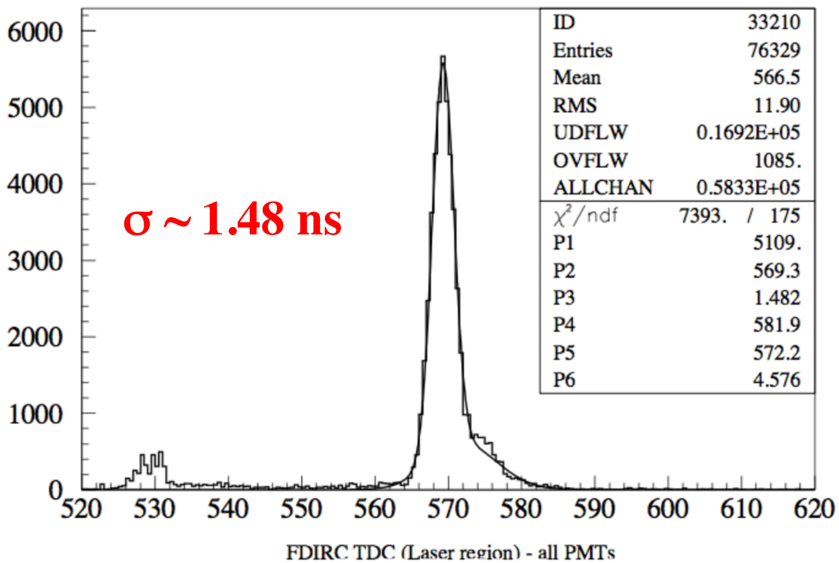


TOP:

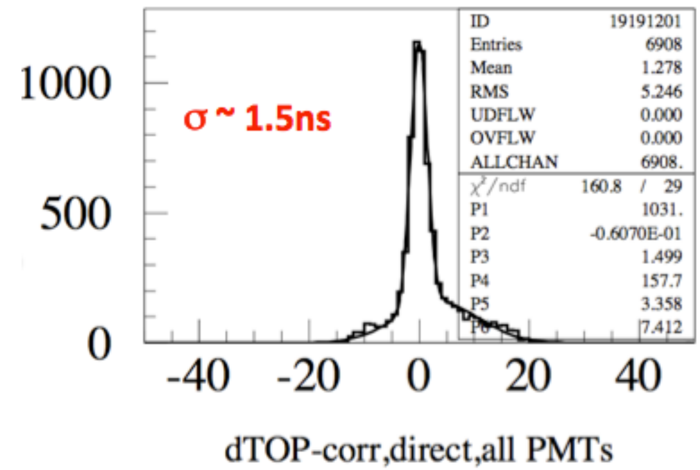


Laser and dTOP = “$TOP_{measured} - TOP_{expected}$” resolution

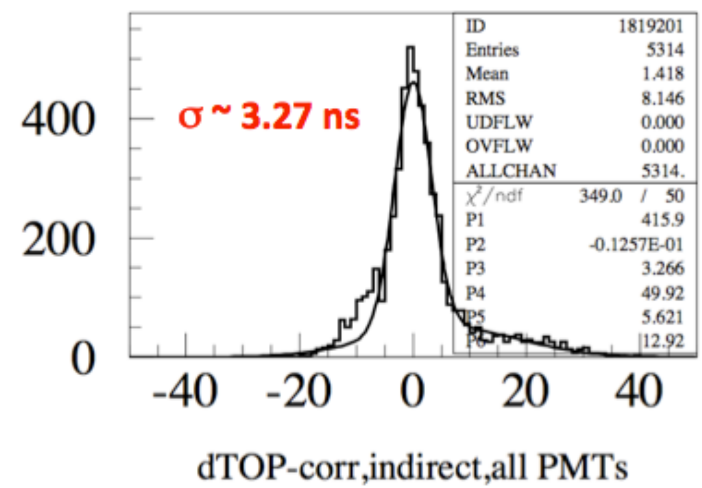
Laser TDC resolution for all tubes & pixels:



dTOP (forward photons) for all tubes & pixels:



dTOP backward photons) for all tubes & pixels:



- **See chromatic broadening for backward going photons**
- **To improve laser timing resolution need to go to individual pixels.**
- **To improve dTOP resolution we need to improve the IRS-2 pulse finding algorithm, work out inner pixel-to-pixel time offsets, track intersection with a bar, etc.**

Conclusion

- A clear progress in MC studies.
- Also a progres in the data analysis. Many plots make sense.
- Work on the Cherenkov angle resolution in progress. It is more complicated than the previous prototype, where we had only 2 ambiguities. In the present protype we have to deal with 4-8 ambiguities. We need a help from MC to work out the right strategy. The Biplab's presentation in Pisa had artificially good timing & tracking MC resolution. This needs to be made more realistic.
- We need work on improving dTOP resolution. Here I mean to improve the IRS-2 pulse finding algorithm, work out inner pixel-to-pixel time offsets, track intersection with a bar. Here a possible new Hawaii postdoc could help.
- Need more data with fully instrumented system (altogether 12 H-8500 tubes). This will help the analysis significantly.

Plans for next year

- There is a discussion to add French electronics.
- There was also a talk to add a TOP counter on top of FDIRC prototype. In this way we would compare FDIRC & TOP. Might be interesting.
- SLAC will support this R&D project "nominally" until September 2013. But I am getting drawn into other things, so cannot work full time.