HMS Trigger Efficiency

A detailed study

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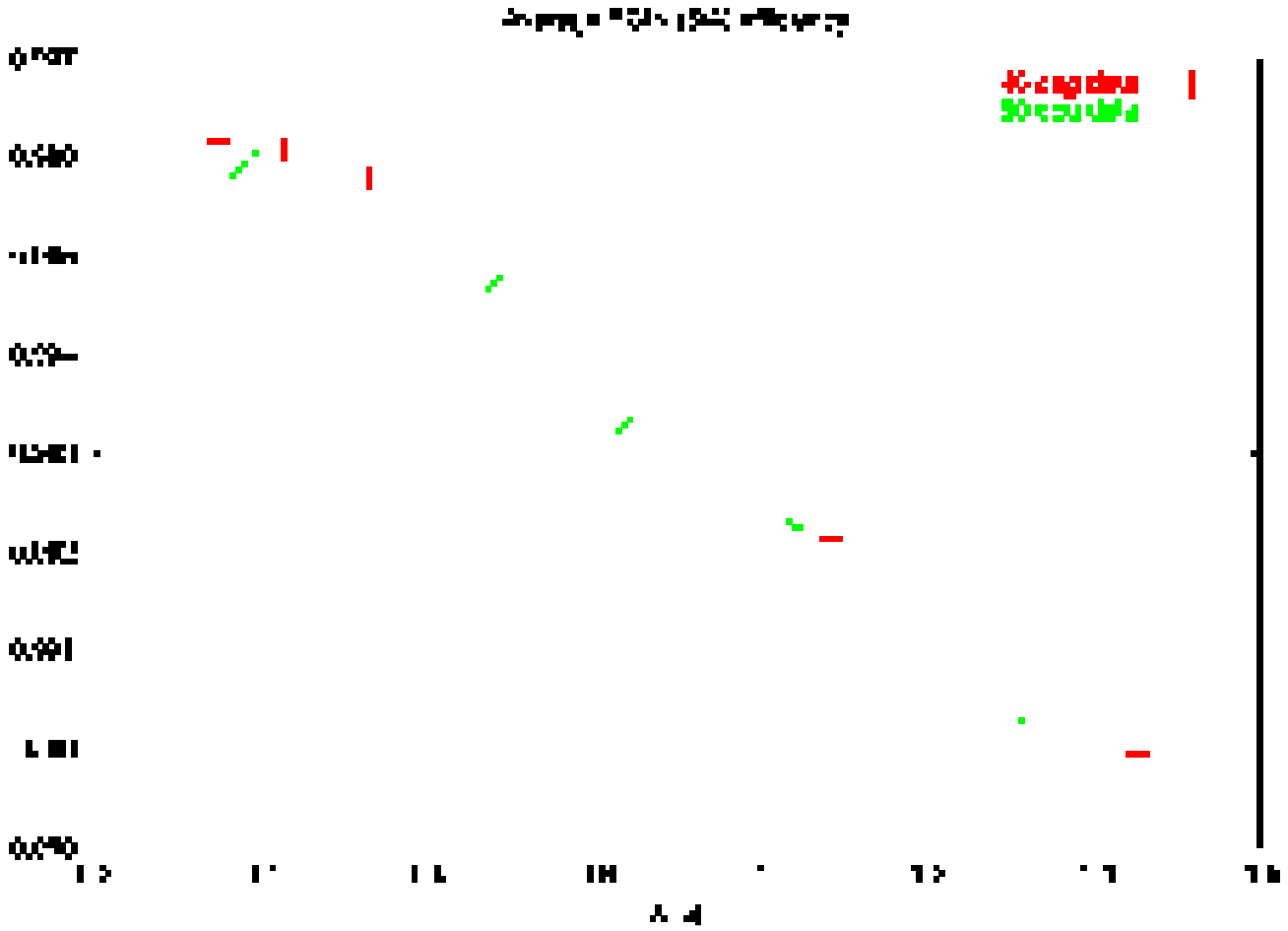
Nadia Fomin
University of Virginia

SCIN (3/4) efficiency (as calculated by the ENGINE)

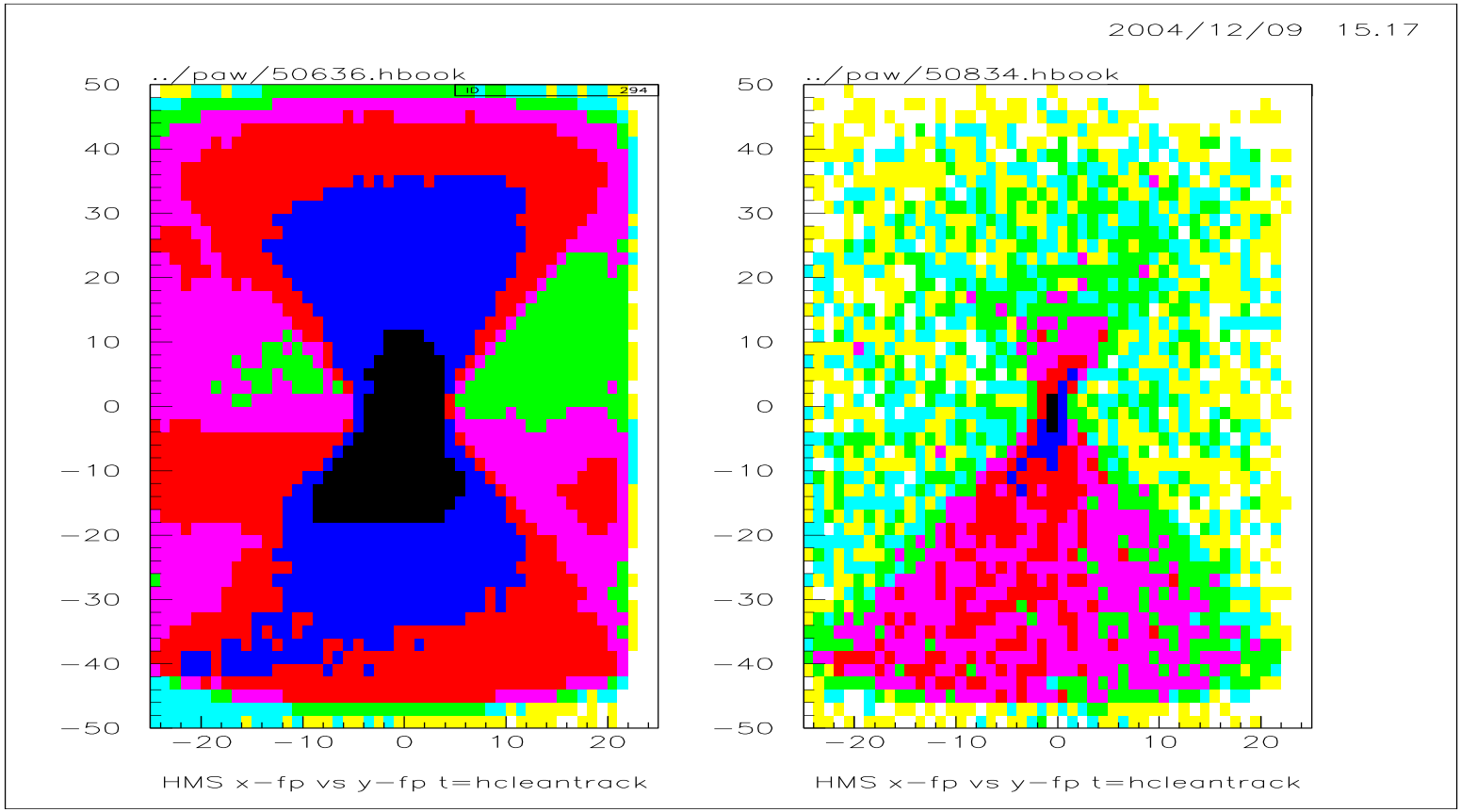


- SCIN Efficiency decreases with increasing momentum

Possible causes for varying SCIN efficiency

P_{hms}=-0.86GeV/c

P_{hms}=-2.17GeV/c



- At higher x_{bj} (higher momentum) most events happen at –x (upper) half of the spectrometer
- Other possibility: low rate → larger fraction of events is junk

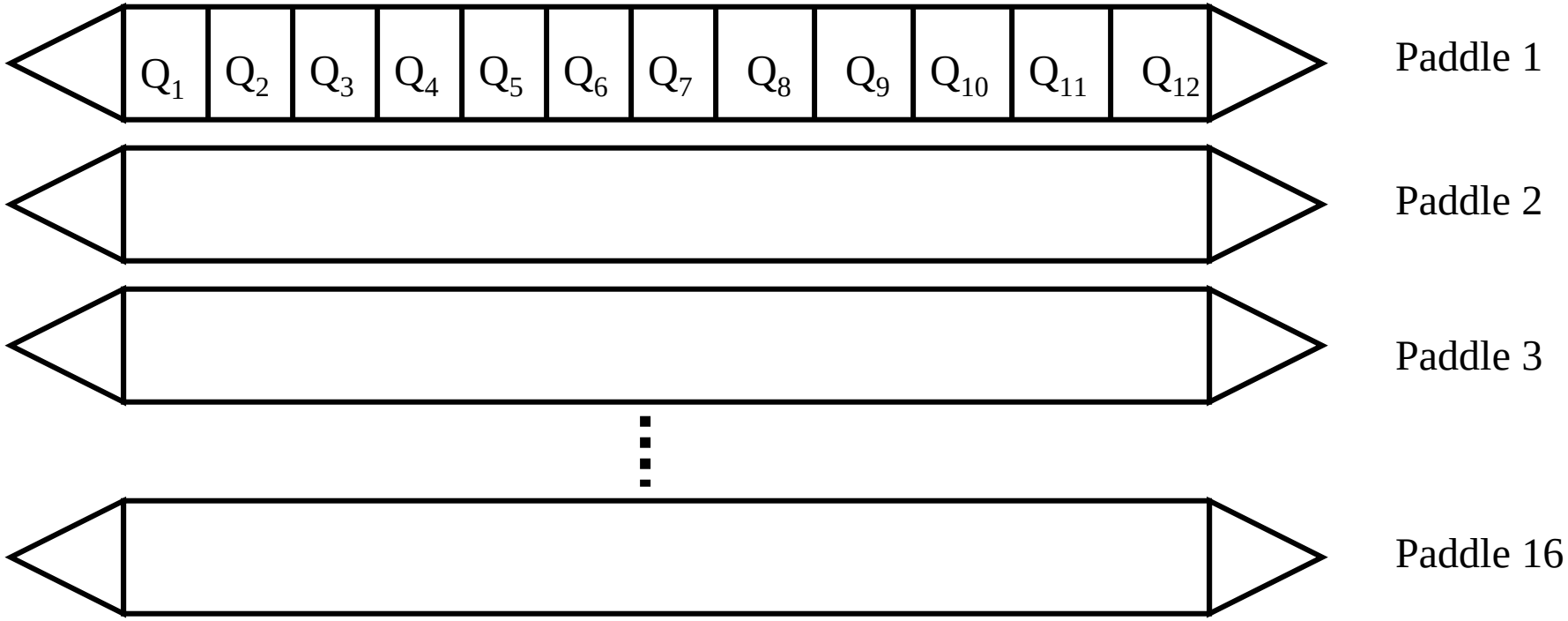
Investigating SCIN efficiency as a function of position

The engine calculates the ¾ efficiency with the following expression:

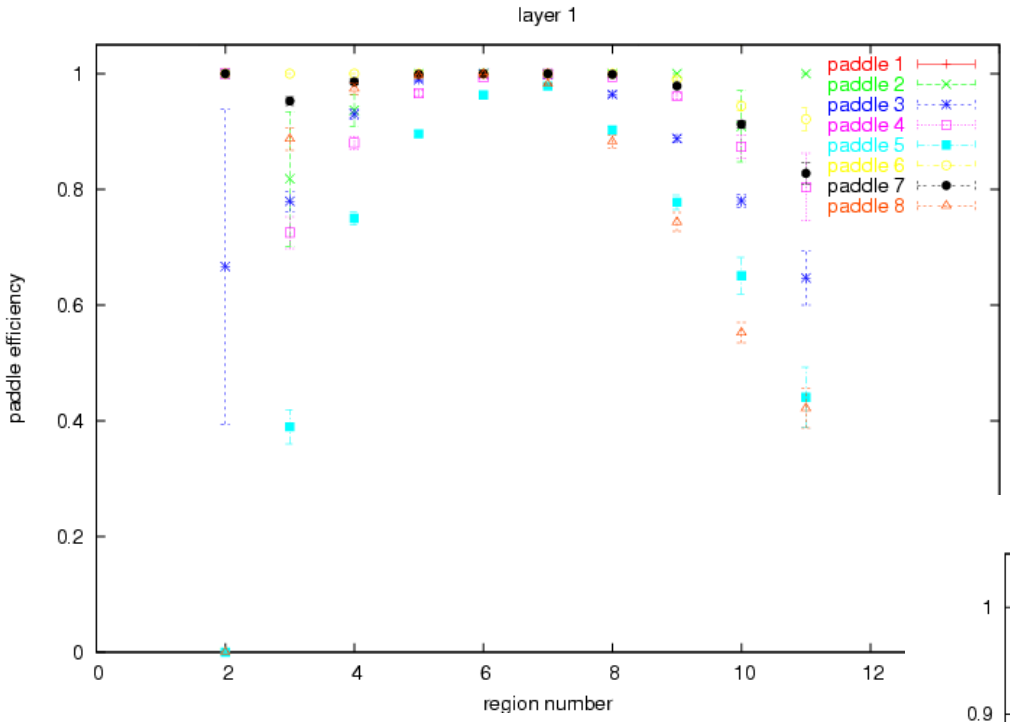
$$P_{1234}+P_{123}+P_{124}+P_{234}+P_{134,} \text{ where } P_i=N_{detected}/N_{should\_have\_detected} \text{ (per plane)}$$

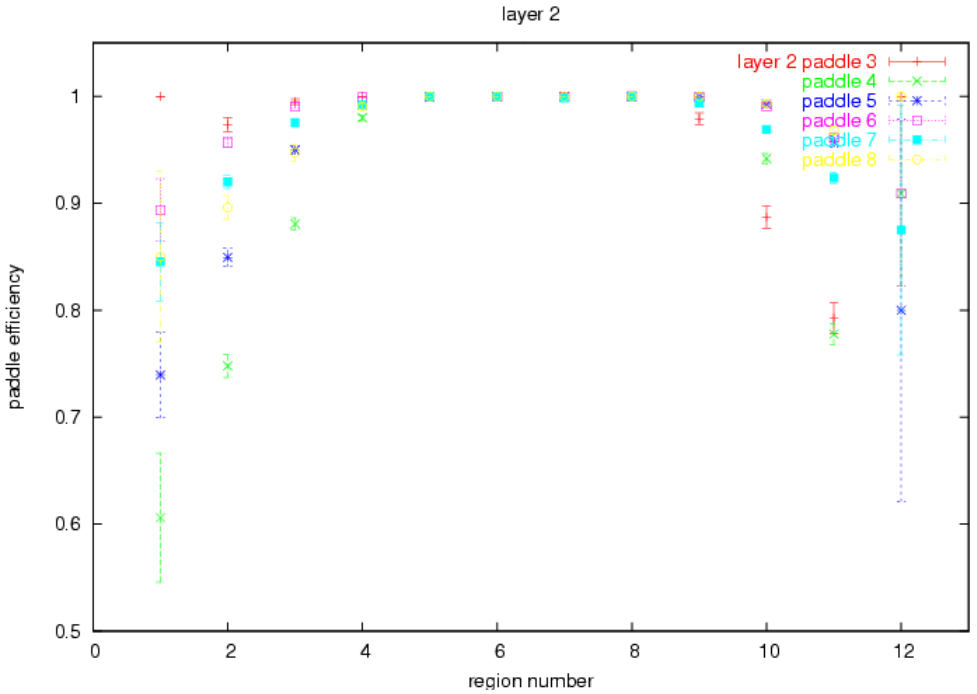
We modified the engine to calculate the ¾ efficiency not for the whole detector, but for individual regions on the scintillator paddles.

Ex: S1X layer



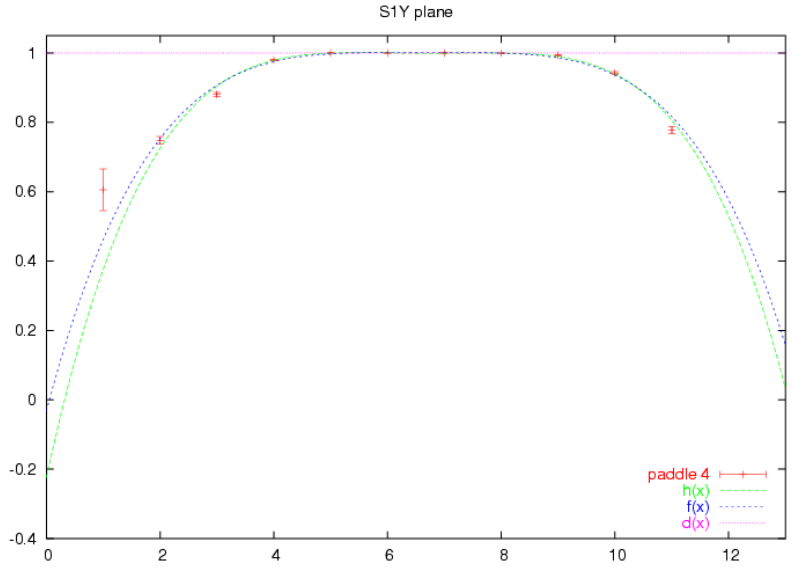
Position based results

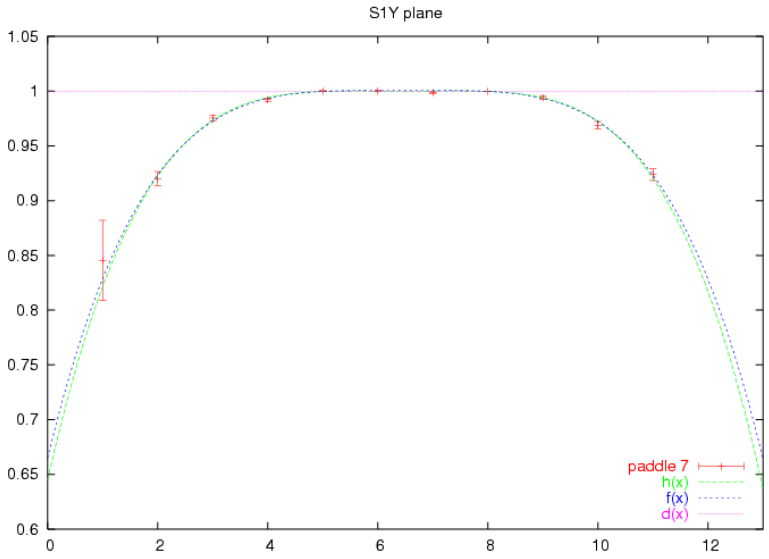


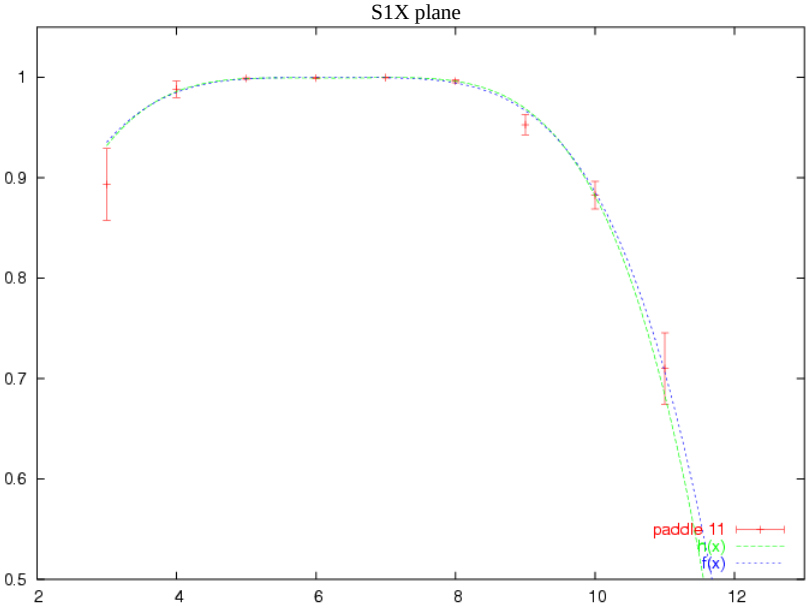


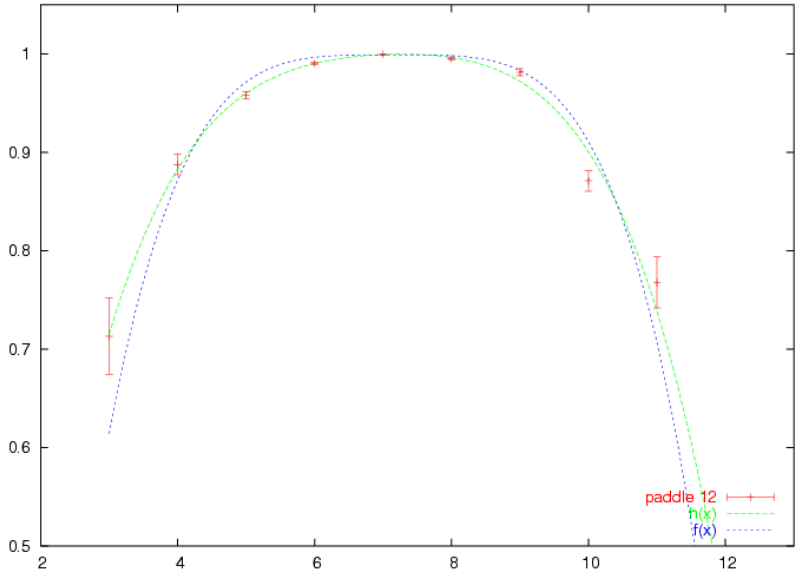
For many of the central paddles, efficiency falls off as one moves away from the center of the paddle

Next step: Parametrize the local efficiency and predict the 3/4 global efficiency



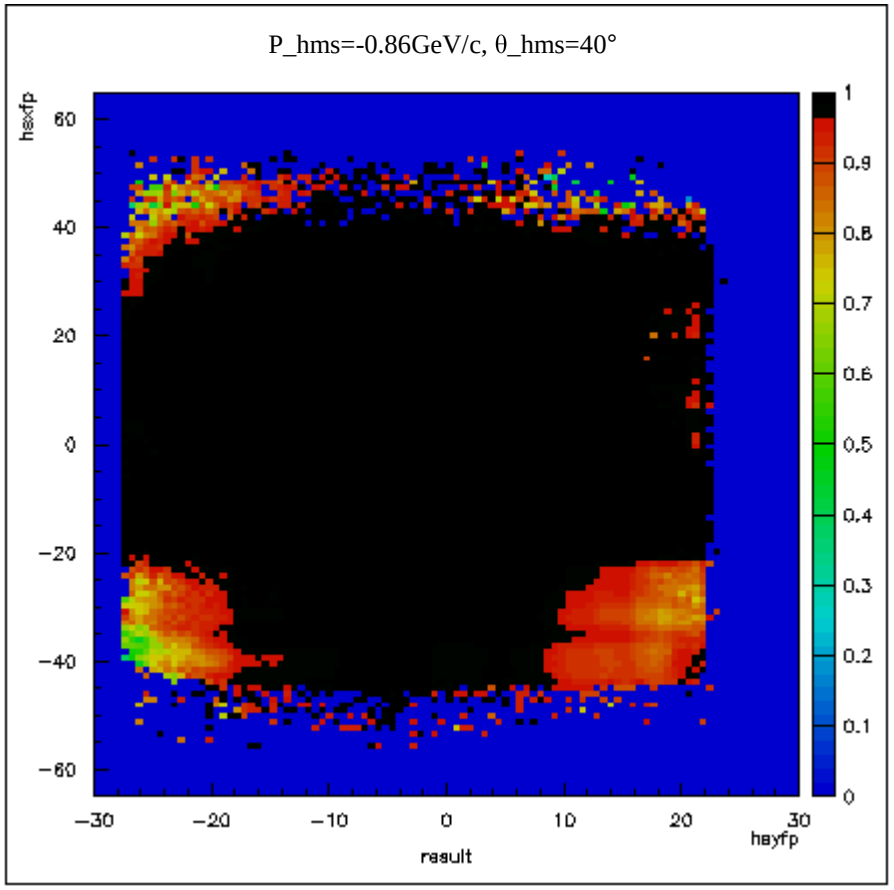






Efficiency Predictor in Action

With a position-based parametrization of the local efficiency in hand, we could look at the predicted ¾ efficiency event by event.

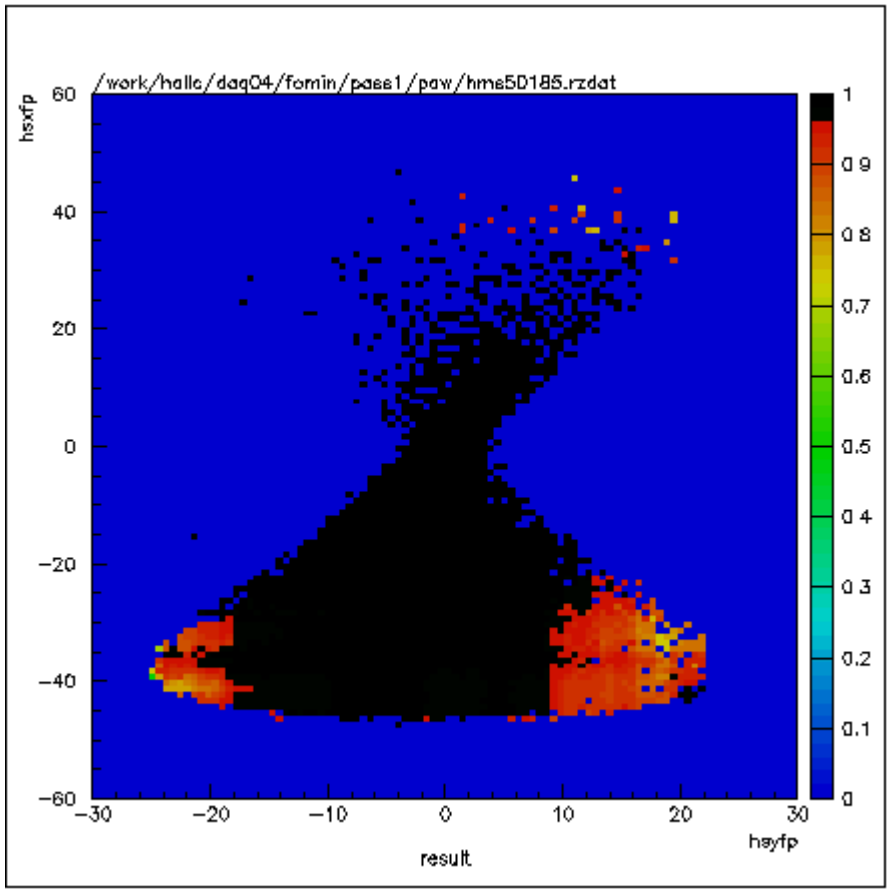


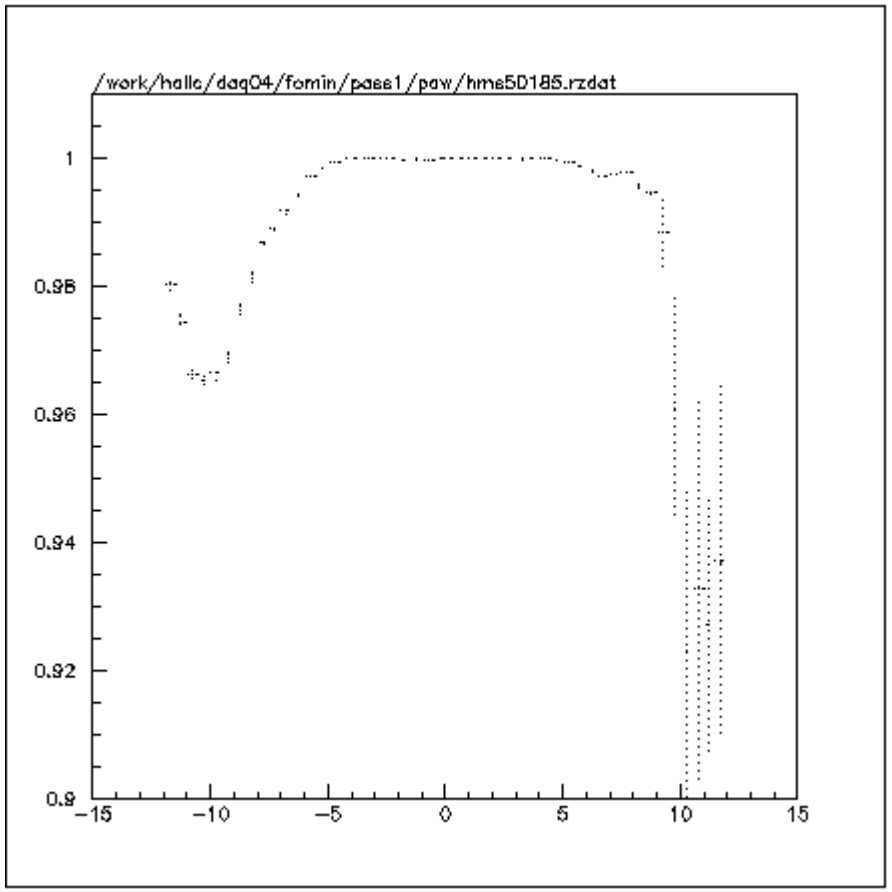
The likelyhood of an event at the edges of the acceptance firing the ¾ trigger is lower than at the center.

Much of the x>1 data lives in the upper half of the focal plane, away from the center.

Efficiency Predictor in Action (continued)

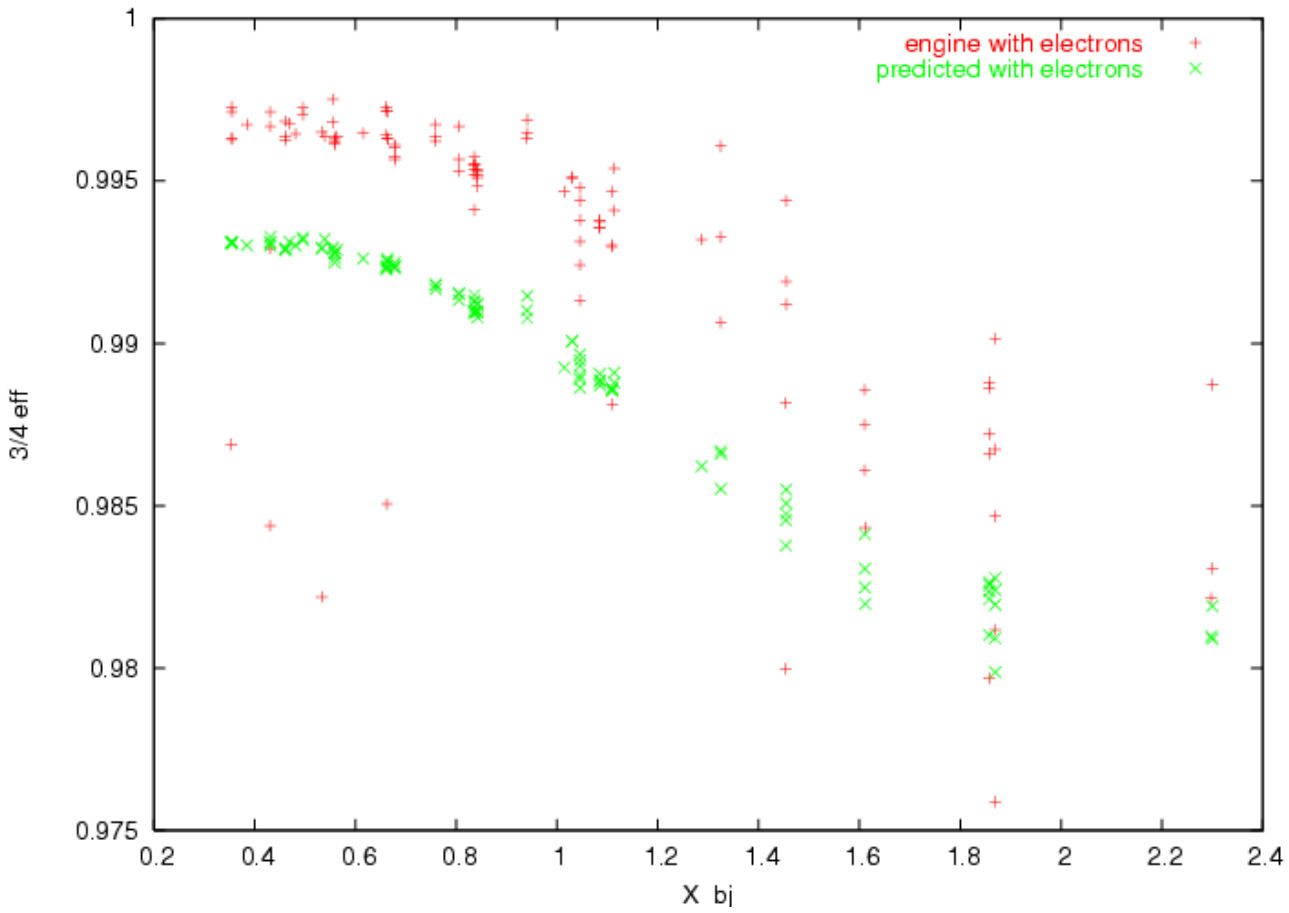
P_hms=-3.13GeV/c, θ_hms=32°





Profile plot in delta

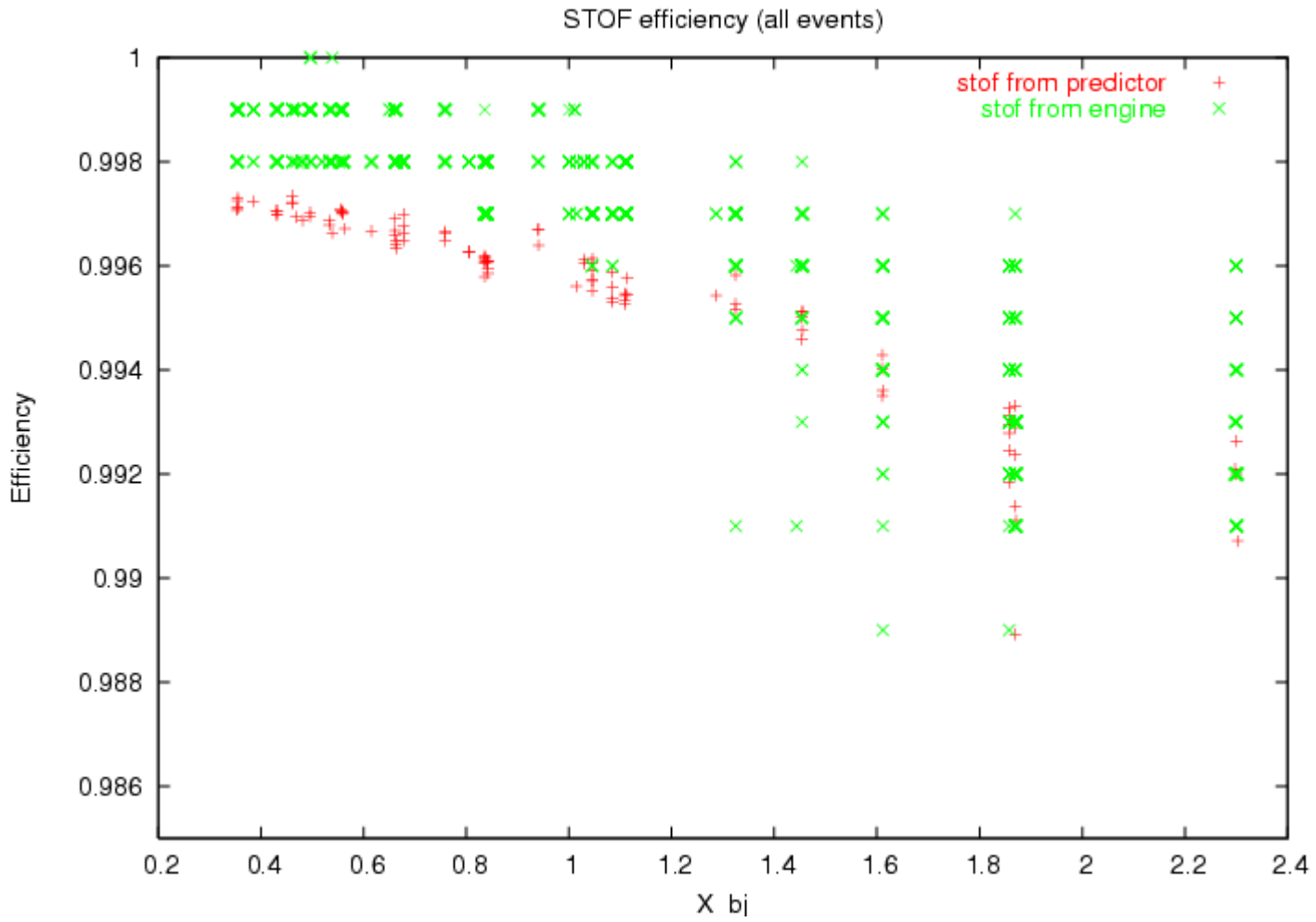
How good is the predictor?



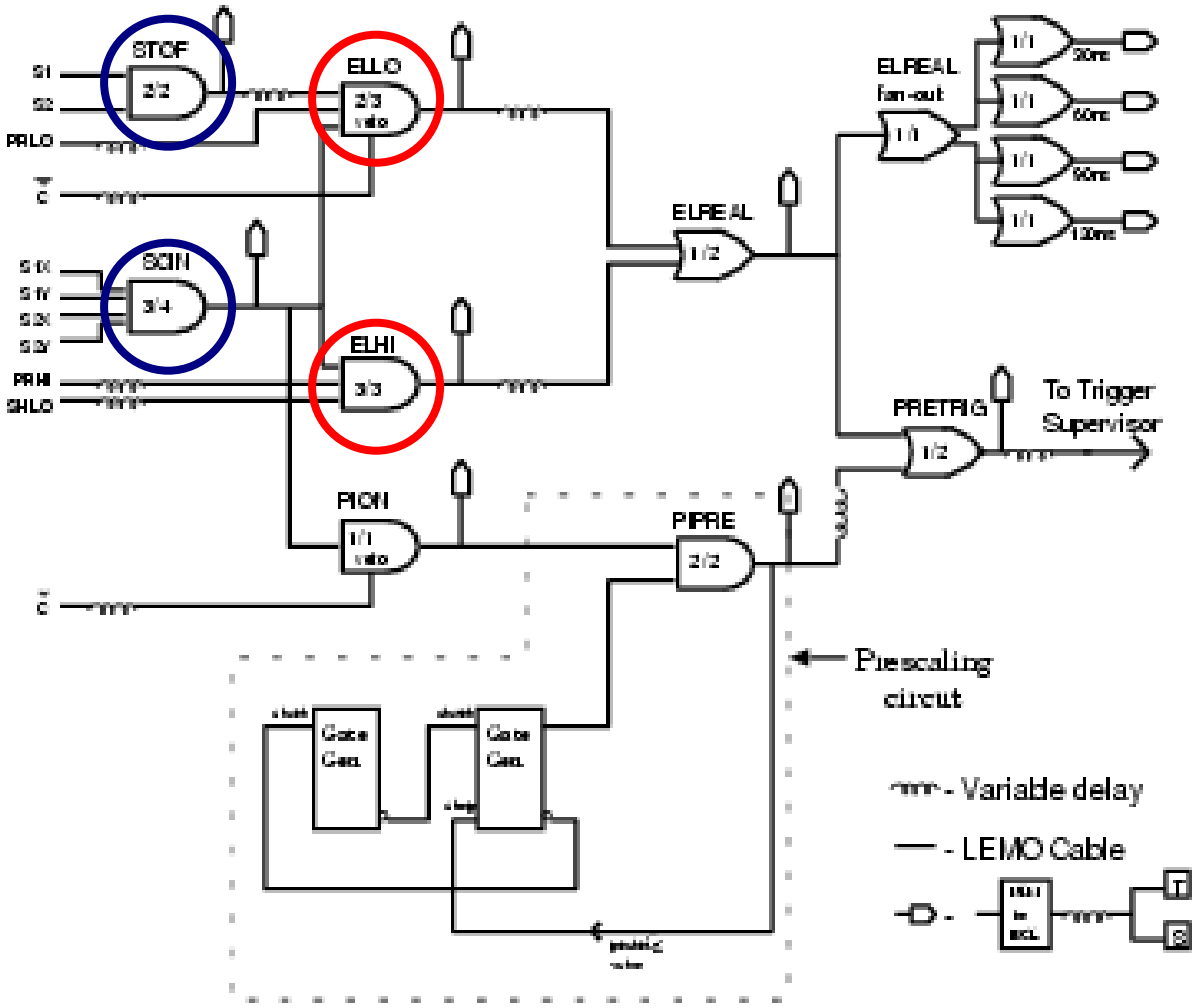
The trends are reproduced, but the predictor is consistently giving a lower efficiency.

The predictor is more “correct” since it contains more information and does not ignore correlations between the planes

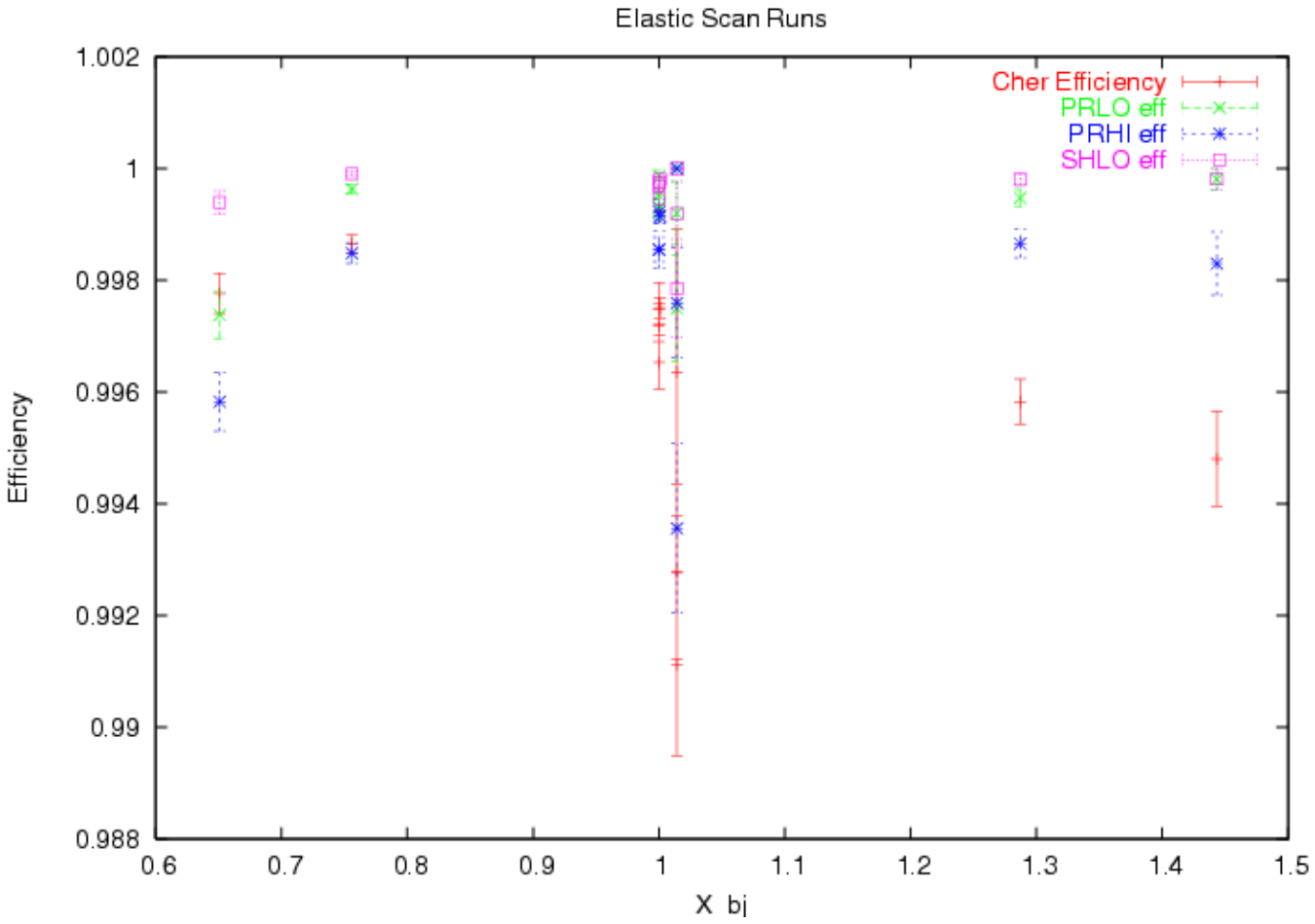
One trigger leg down, several more to go



What about all the other legs?



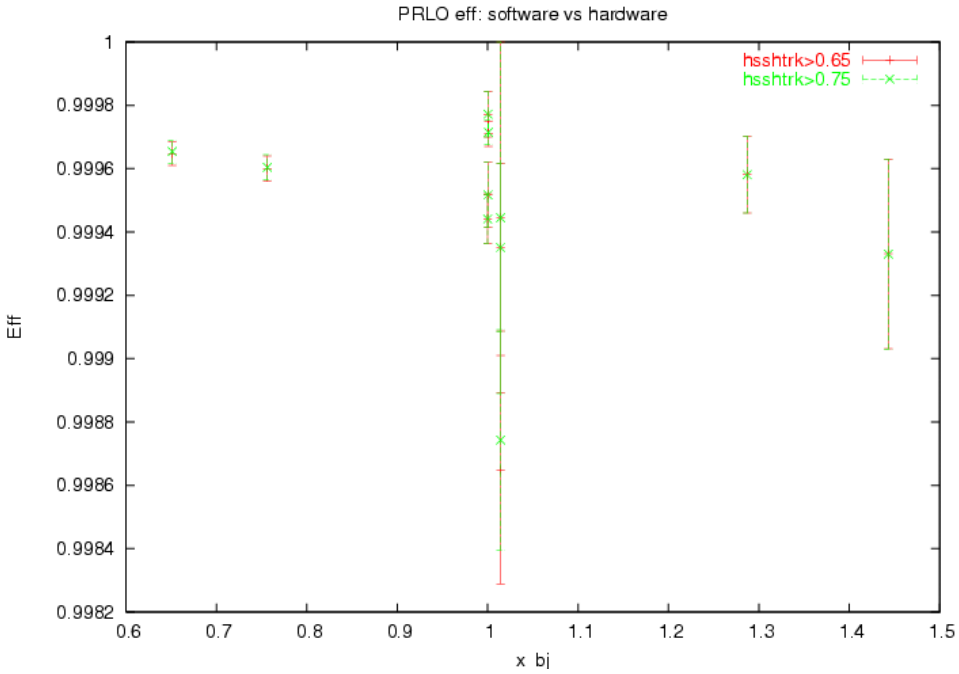
Other legs of ELREAL

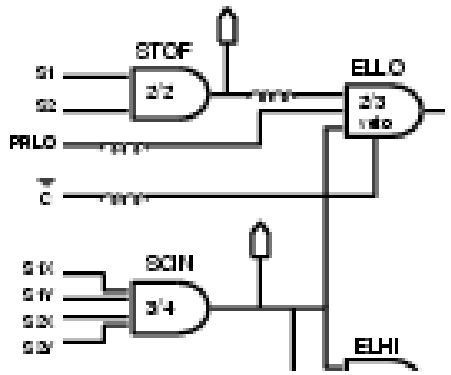


However, when analyzing the data, we'll be applying software cuts on the shower counter and the cherenkov, and correcting for the software inefficiencies.

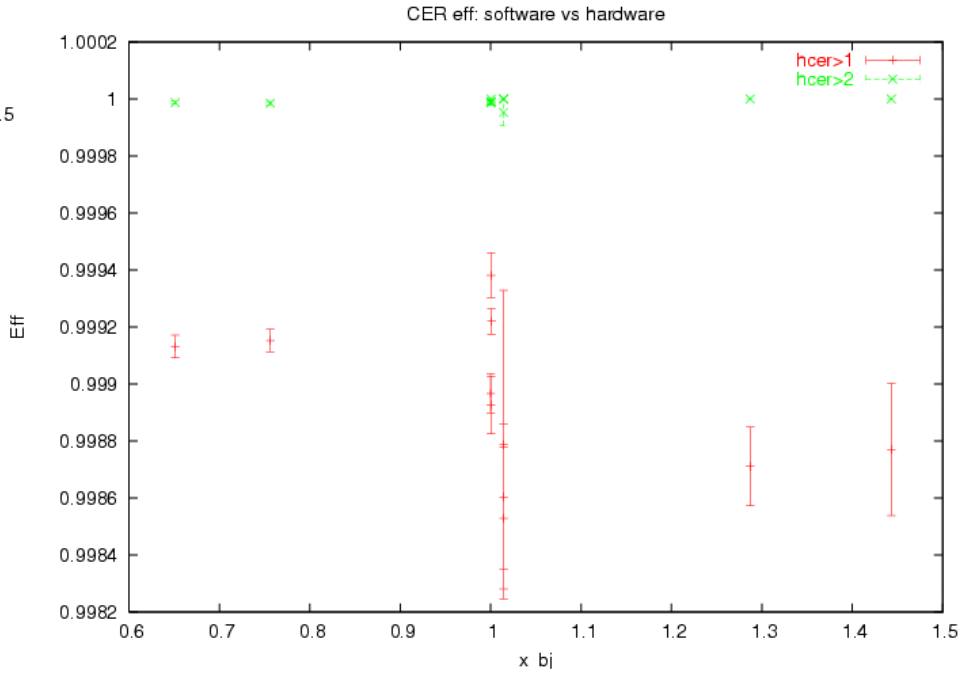
We want to make sure we don't correct for the same thing twice

Software to Hardware Efficiency: ELLO Leg





So, we need to apply an extra correction due to the PRLO leg, but not due to the Cherenkov leg of the electron trigger.



ELLO Leg: Total Efficiency

Eff (ELLO) =PRLO*SCIN*STOF+**PRLO*SCIN*(1-STOF)**+

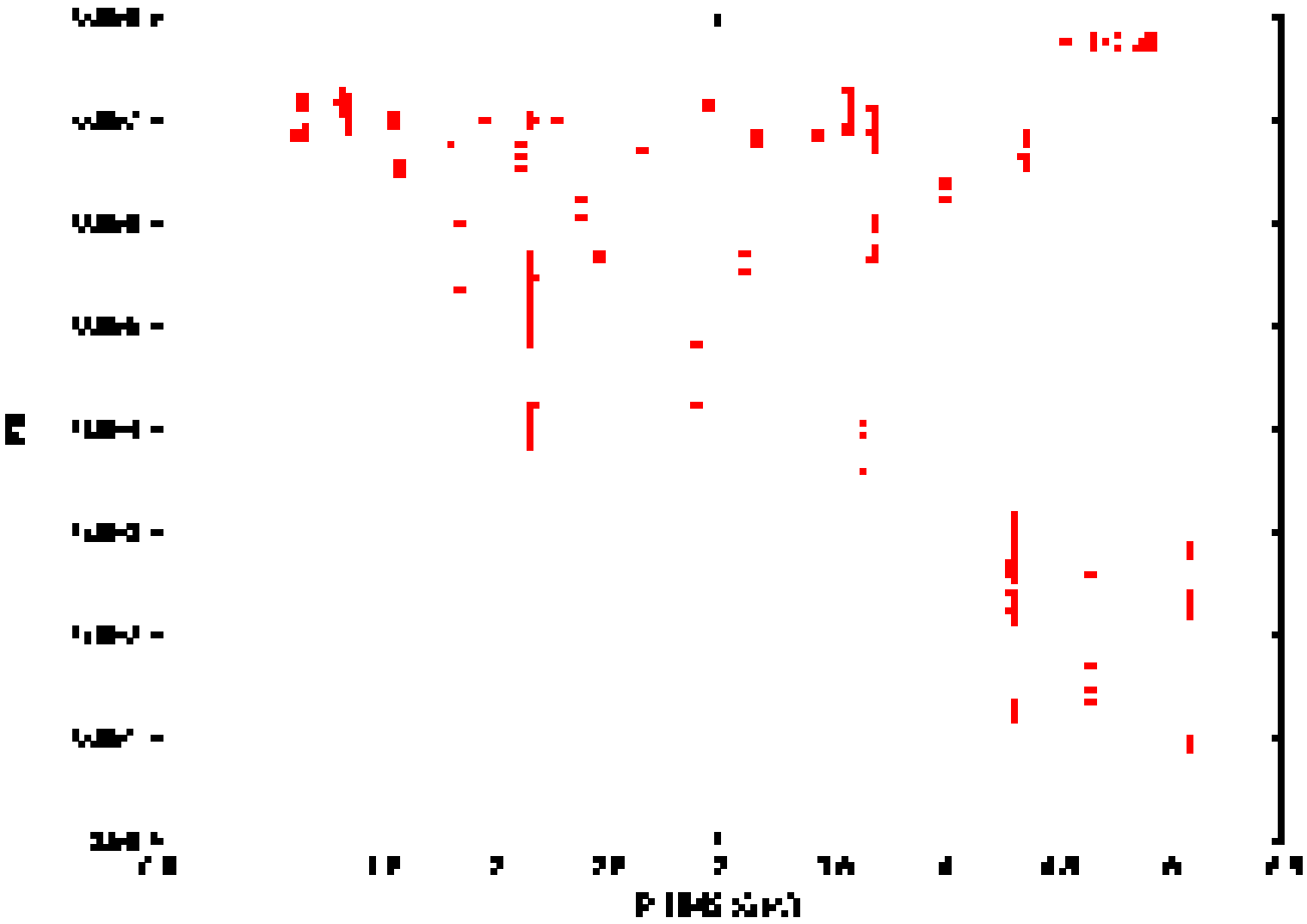
+**PRLO*STOF*(1-SCIN)**+SCIN*STOF*(1-PRLO)

= PRLO***SCIN*STOF**+ **PRLO*STOF**+**SCIN*STOF***(1-PRLO)

= PRLO***SCIN** +**PRLO*STOF**+**SCIN***(1-PRLO)

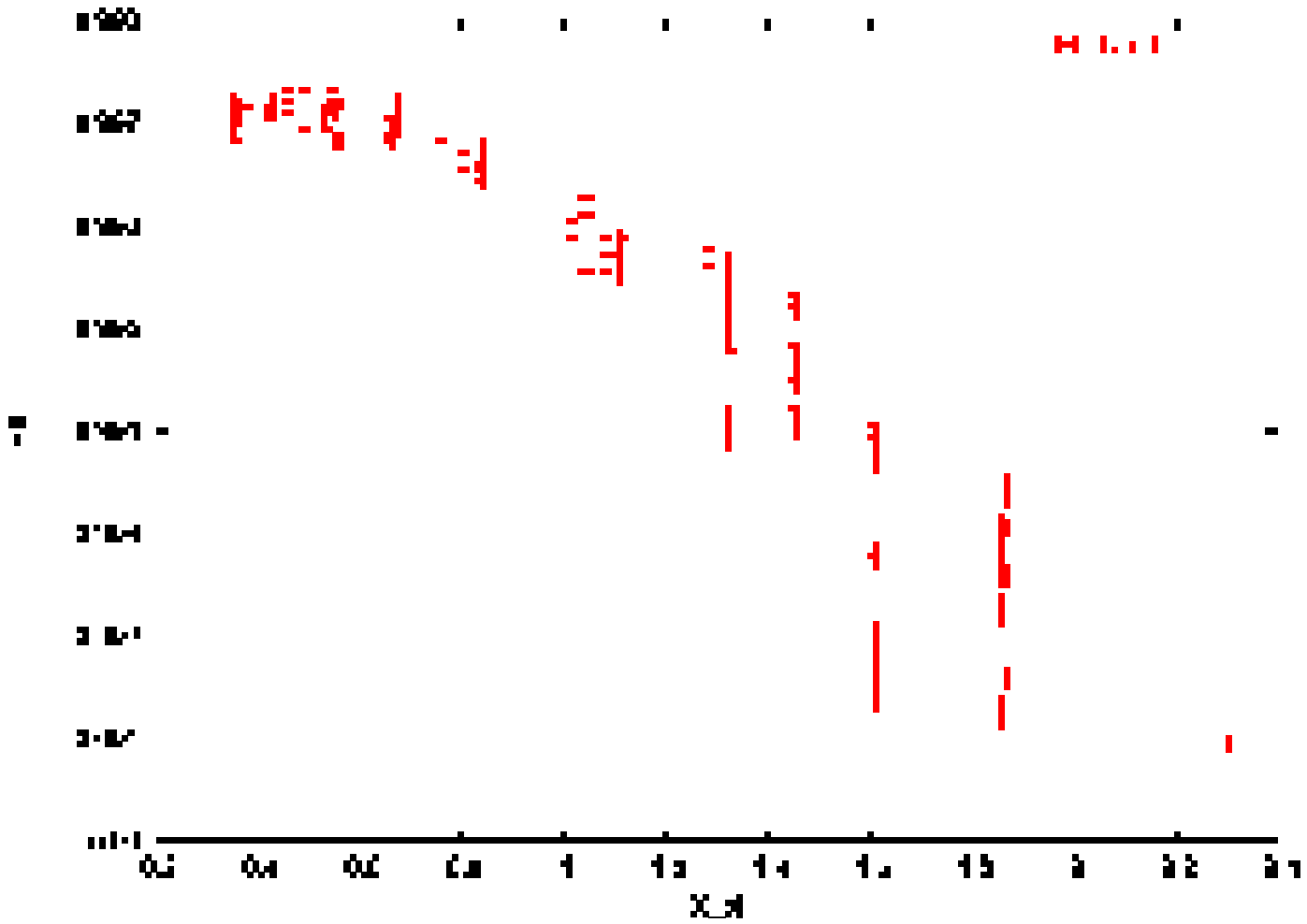
Eff (ELLO) = PRLO*STOF+SCIN*(1-PRLO)

ELLO Leg: Total Efficiency

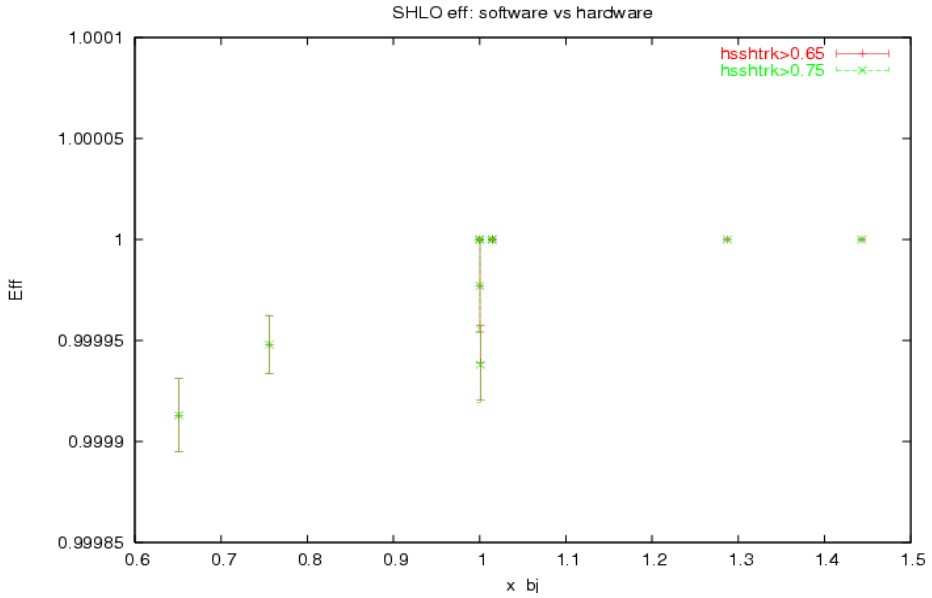


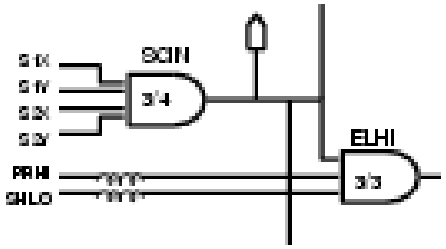
Note: errorbars are only meant to give the reader an idea of the relative error between the points

ELLO Leg: Total Efficiency

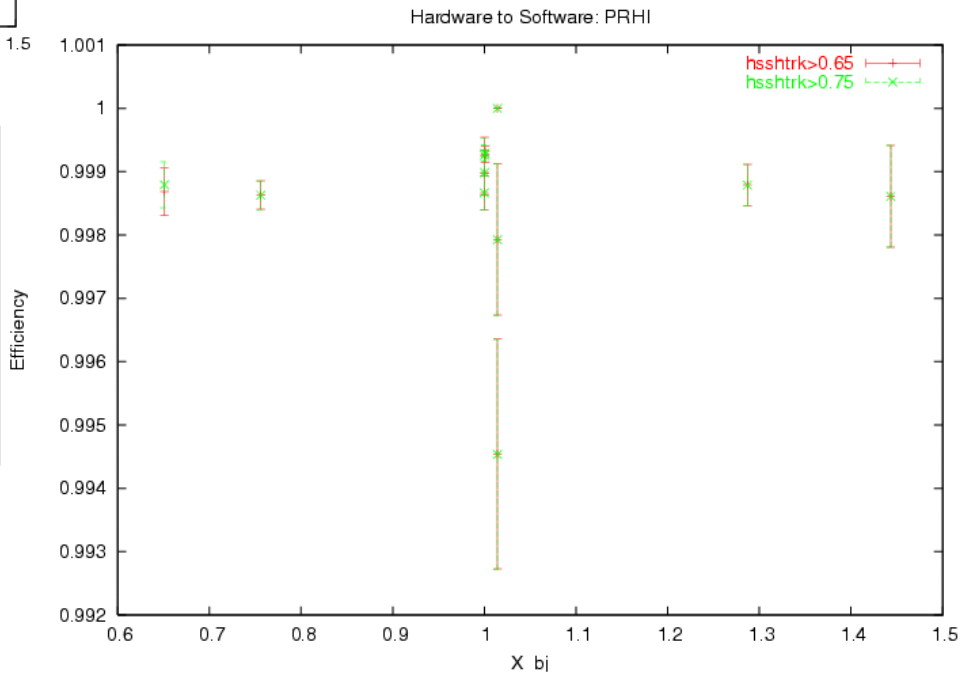


Software to Hardware Efficiency: ELHI Leg

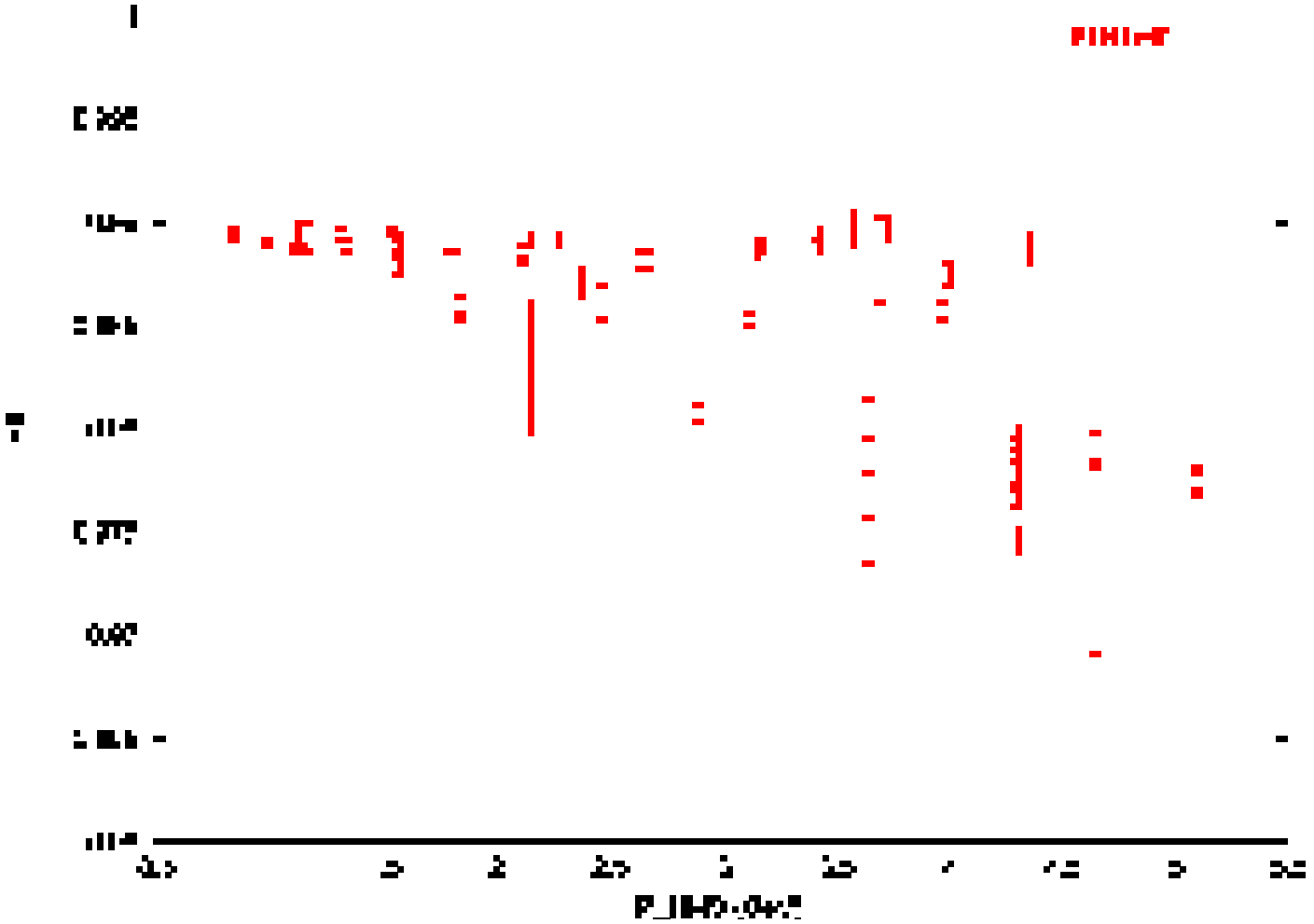




Looks like there's no extra inefficiency associated with the SHLO leg, but we need to apply a small correction for the PRHI leg



ELHI Leg: Total Efficiency



SUMMARY

- ELREAL is the OR of ELHI and ELLO, so it looks like that will always be ELLO.
- There's some x-dependence in the efficiency, coming from the SCIN trigger, so a position-dependent correction may have to be applied.