Simulations and 2008 SPS Test

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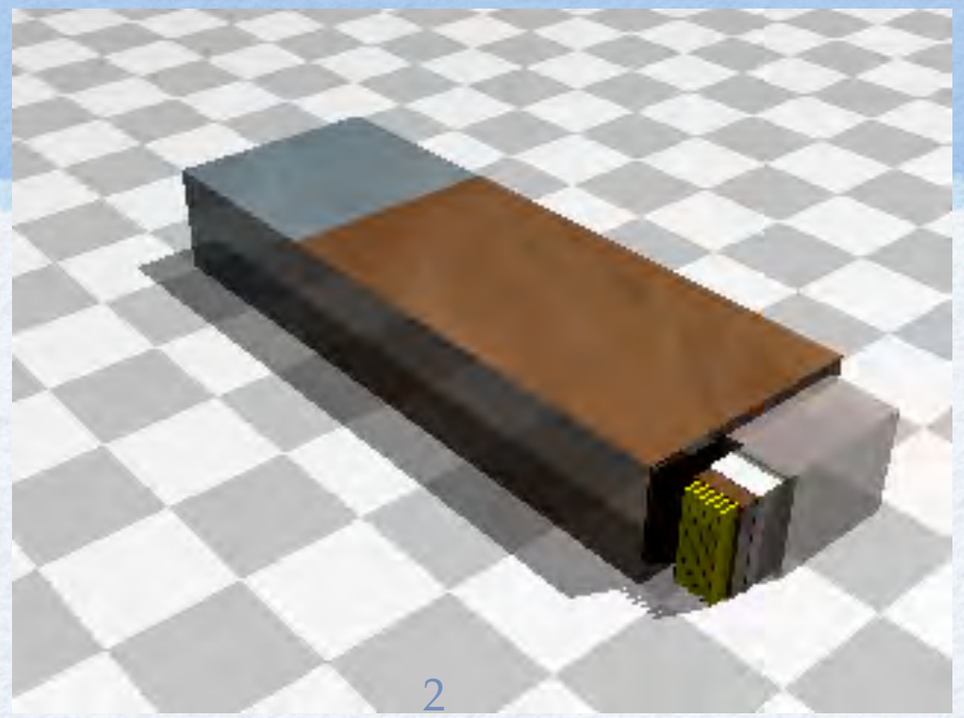
October 13, 2008

SIMULATIONS



NEUTRALS ON THE TAN

From Baseline and Requirements for a Luminosity Monitoring at the LHC.

- Crossing Angle – 300 μrad
- Luminosity – 10^{34} $cm^{-2}s^{-1}$
- Mars Calculation

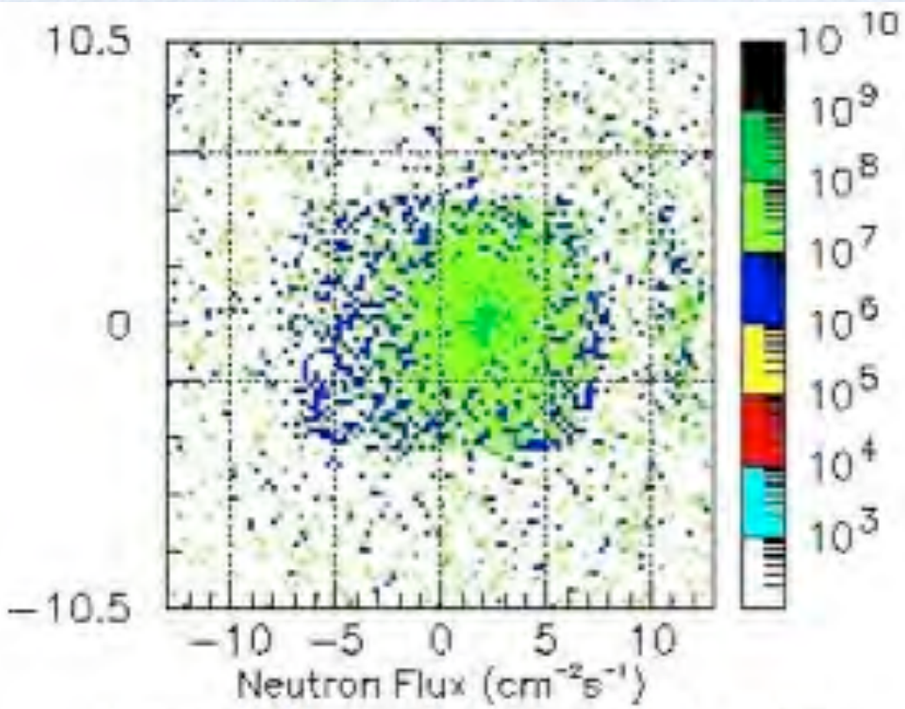


Figure 2: *Neutron flux at the TAN surface.*

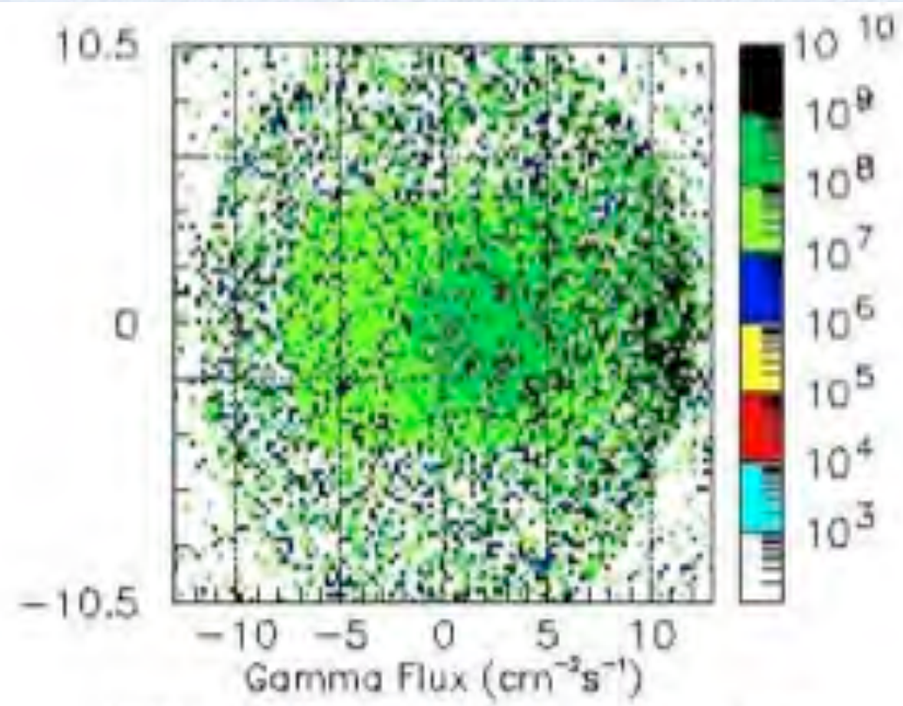


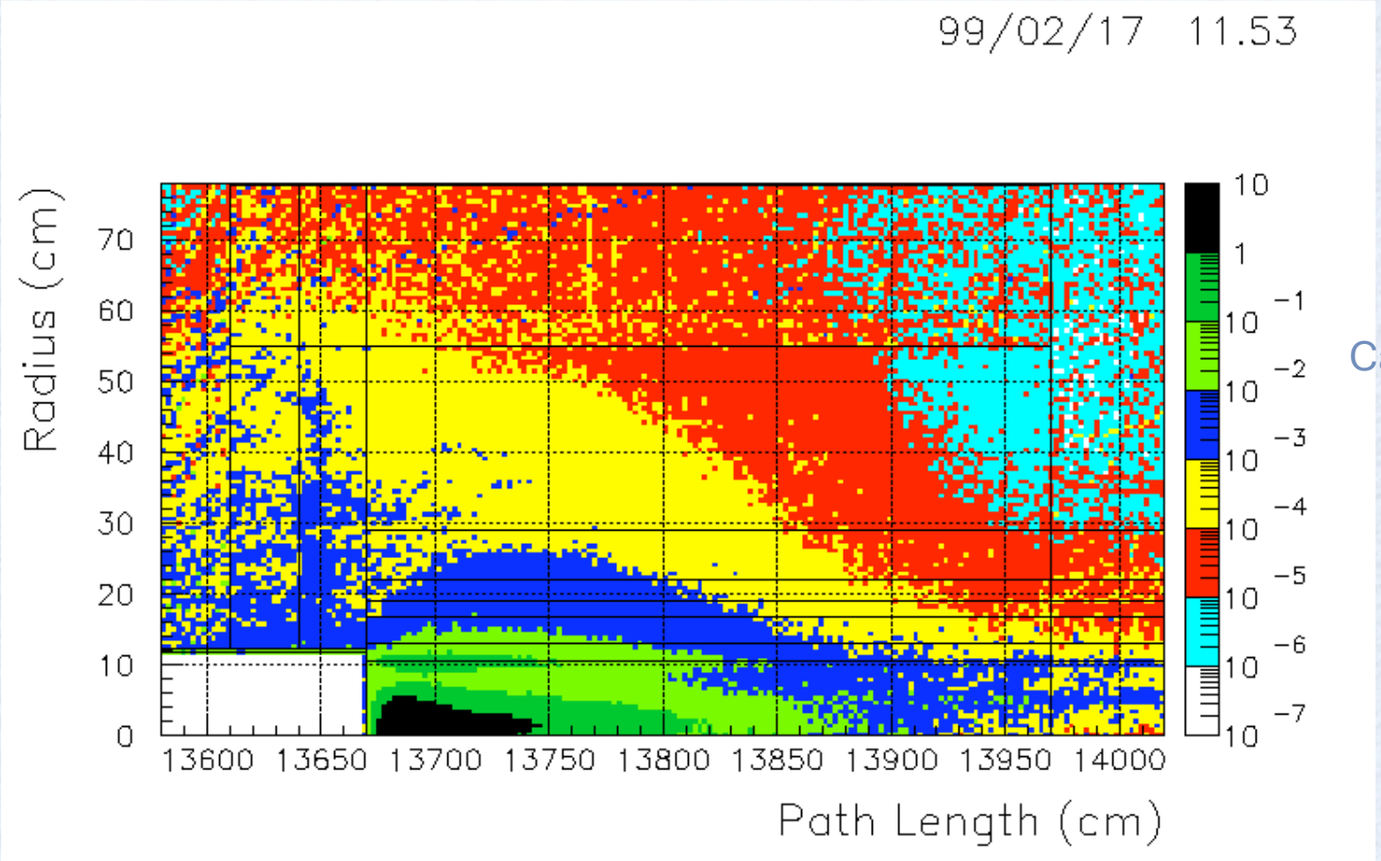
Figure 3: *Photon flux at the TAN surface.*

PARTICLES INCIDENT ON TAN

Table 3: *Average number of particles $\langle N \rangle$, particle energy $\langle E \rangle$ and total energy $\langle N \rangle \times \langle E \rangle$ per ppi incident on the IP5 TAN absorbers [12]. The total particle flux ϕ_{tot} at $8 \cdot 10^8$ ppi/s is also shown.*

particle	$\langle N \rangle$	$\langle E \rangle$ [GeV]	$\langle N \rangle \times \langle E \rangle$ [GeV]	ϕ_{tot} [$cm^{-2}s^{-1}$]
n	0.479	1516	726	$1.2 \cdot 10^6$
γ	301	2.20	662	$6.8 \cdot 10^8$
p	0.109	938	102	$2.5 \cdot 10^5$
$\pi^{\pm} K^{\pm}$	0.875	64.8	56.8	$1.8 \cdot 10^6$
$e^{\pm}$	24.5	0.294	7.2	$5.3 \cdot 10^7$
$\mu^{\pm}$	0.006	4.87	0.031	$1.4 \cdot 10^4$

TAN power deposition (W/kgm)

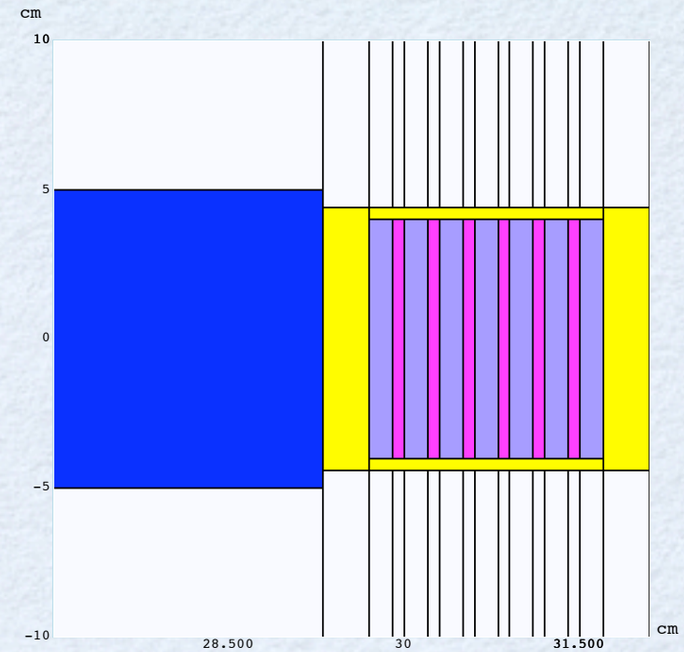


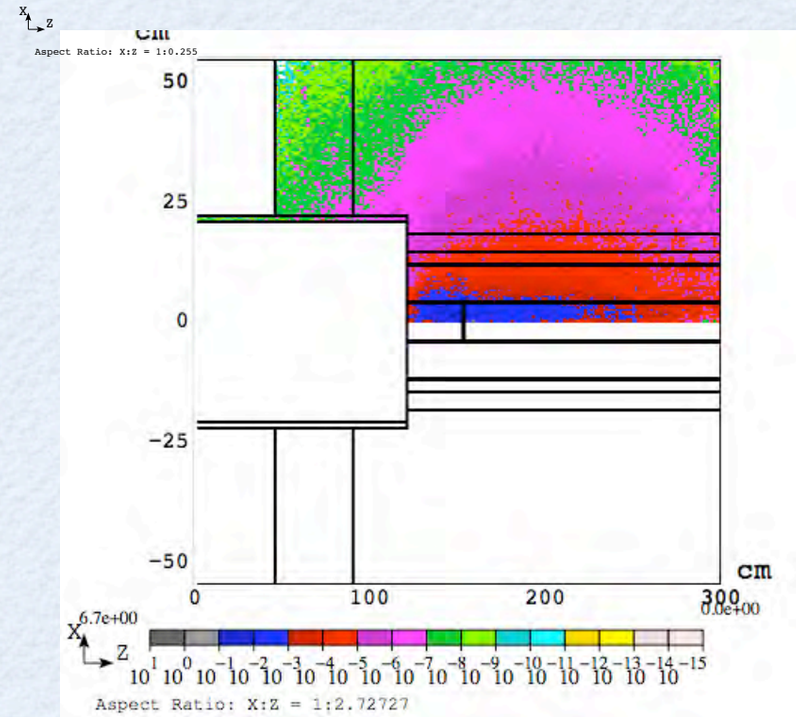
Calculation by N. Mokhov

- Peak power density 1-10 W/kg×m (location of ionization chamber)
- Located in high radiation area (100 Gy/oper yr)

SIMULATIONS

- FLUKA and MARS running on our computer lumi.lbl.gov
- Want to do detailed shower calculations in BRAN
- Intend to pursue a collaborative approach to model TAN detectors
- Summer students working on MARS and FLUKA simulations
  - Cory Fantasia - Northeastern (last year)
  - Johannes Stiller - Heidleburg (this year)





Have prototype particle files

- Vadim Talanov generated a set of particles from p-p events for IR5
  - 7 TeV
    - Crossing angle 285 μrad
  - 450 Gev
- Used by experimenters with detectors in the TAN
  - Cross check results
- File limitation
  - Not decayed to final states
  - No interactions in upstream material
  - No model of beam background
  - Need them at all CERN energies

```
25 93 7 ! Event No., N_tot, N_final_state
 8  1  0.183973306604E-03  0.247751800125E-04  0.517128155761E+04
23  1 -0.155325222794E-03  0.406376086292E-03  0.405663086248E+03
15  1  0.535811477948E-03 -0.142392838037E-03  0.225543042826E+03
15 -1  0.234322479101E-03  0.152241941041E-03  0.196284954630E+04
14 -1 -0.183516130010E-03  0.157082379796E-03  0.964152295086E+03
17 -1  0.280746099534E-03  0.162109034533E-03  0.256312640588E+04
23 -1  0.228731692705E-03  0.176233074520E-03  0.120028134998E+04
26 124 10 ! Event No., N_tot, N_final_state
 1 -1 -0.172474748208E-03  0.469470900729E-04  0.629644882568E+04
 7  1 -0.515929555257E-03 -0.527647695893E-03  0.470595005240E+03
23  1  0.473701835404E-03  0.145747626902E-03  0.868111819420E+03
 1  1 -0.335575358091E-03 -0.384542838725E-03  0.885221518324E+03
13  1 -0.501718521355E-03 -0.507251122603E-04  0.536621086941E+03
14  1 -0.666031462414E-04 -0.314638452091E-03  0.482653775782E+03
13  1  0.471235990849E-03  0.377949073251E-03  0.376003403622E+03
23  1  0.669748771951E-03  0.182323166507E-03  0.734271066534E+03
14  1  0.142333240081E-03  0.289639827211E-03  0.171460221915E+04
23  1 -0.124880104966E-03 -0.643676492367E-03  0.355640678326E+03
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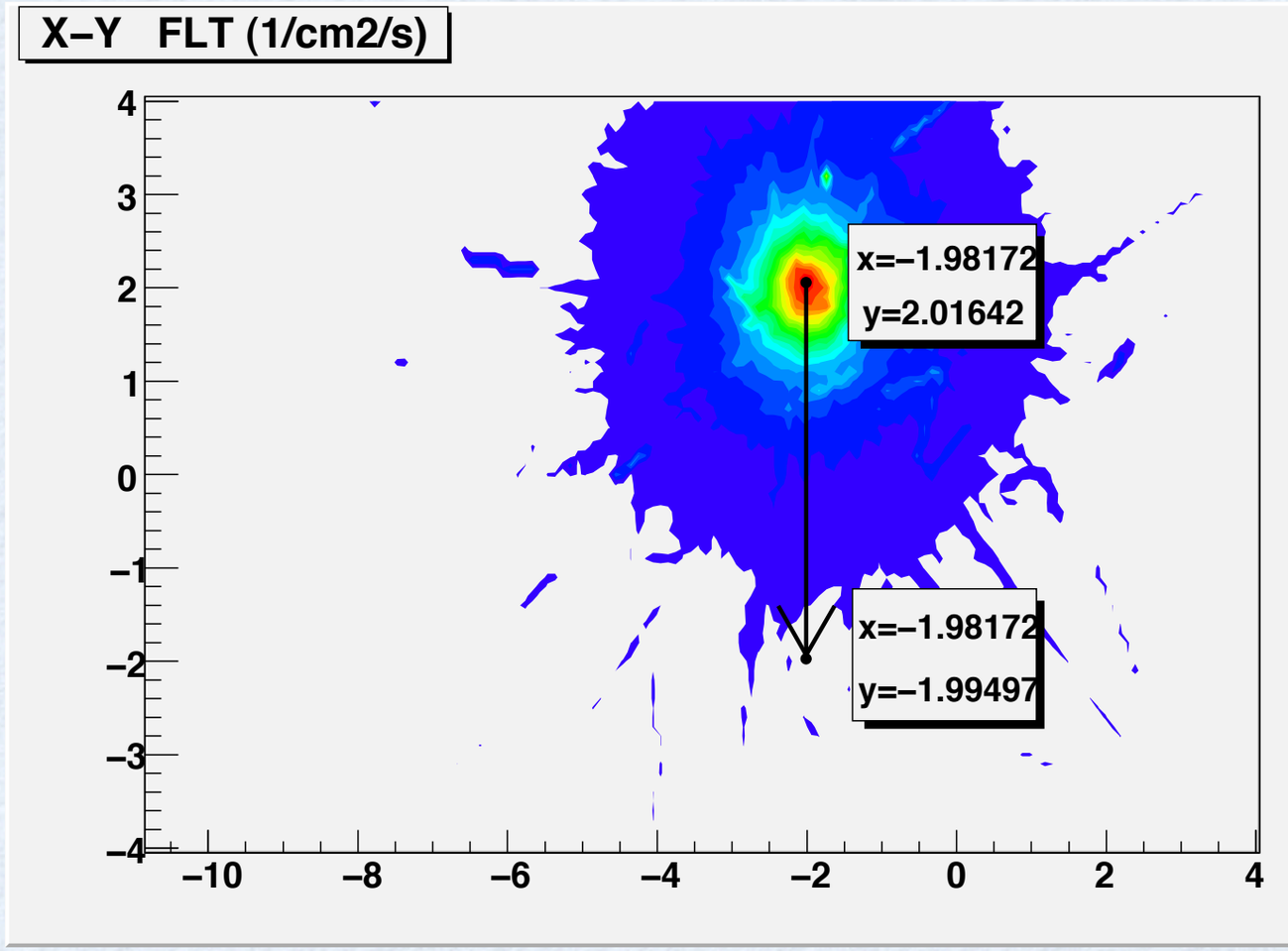
CURRENT STUDIES

- Beam size
- Chamber pulse height
- Cross talk
- **Need this information at all energies that CERN collides**

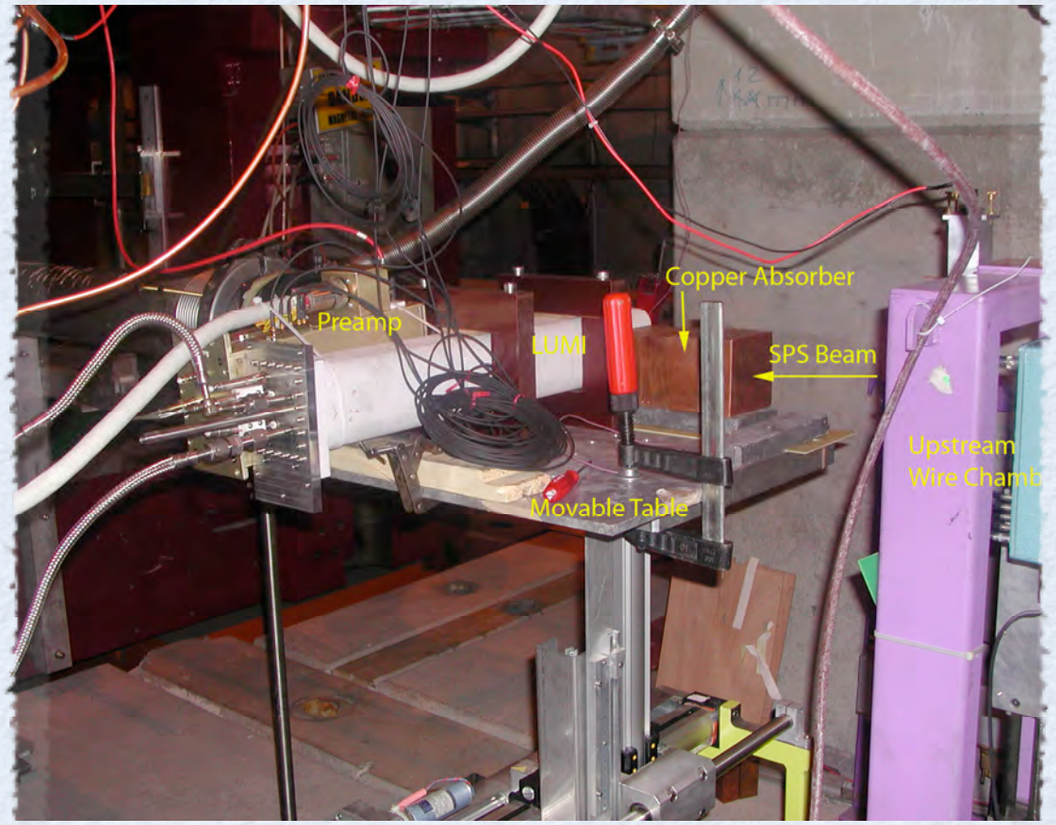


7 TeV Protons

SPS TEST 2008

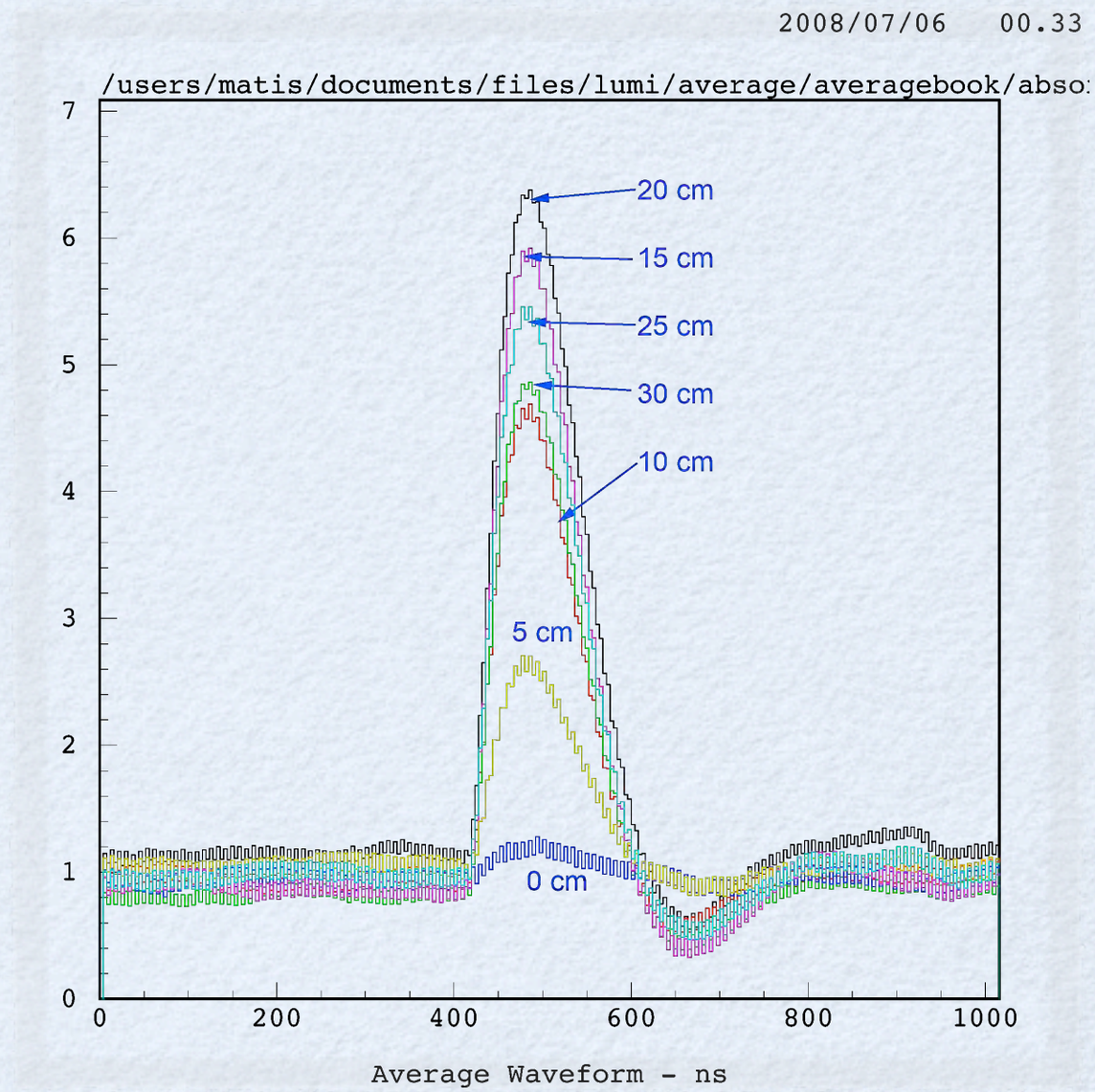
SPS TEST 2008

- 350 GeV protons
- Final prototype analog electronics
- Method
  - Trigger on incoming proton
  - Study BRAN responce



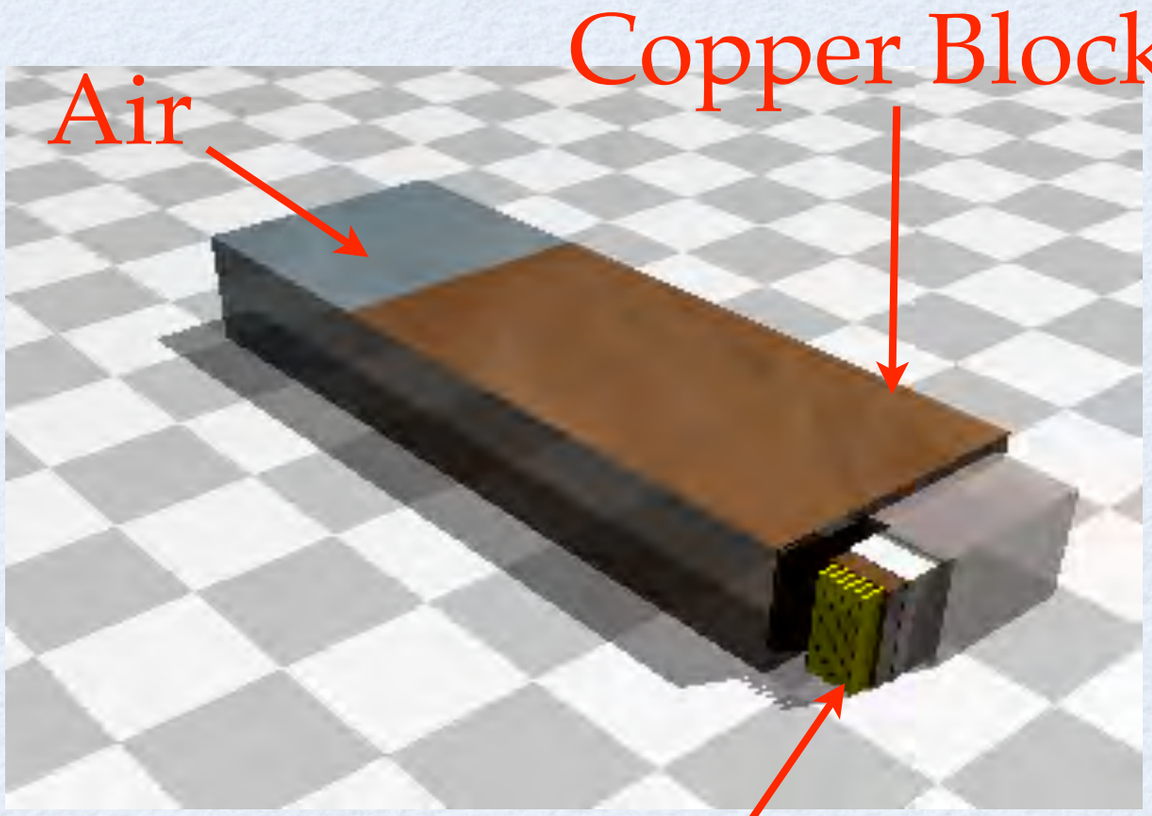
Absorber Scan

- Measured average pulse height with a scope
- Units are mV
- Used different thickness of copper absorber



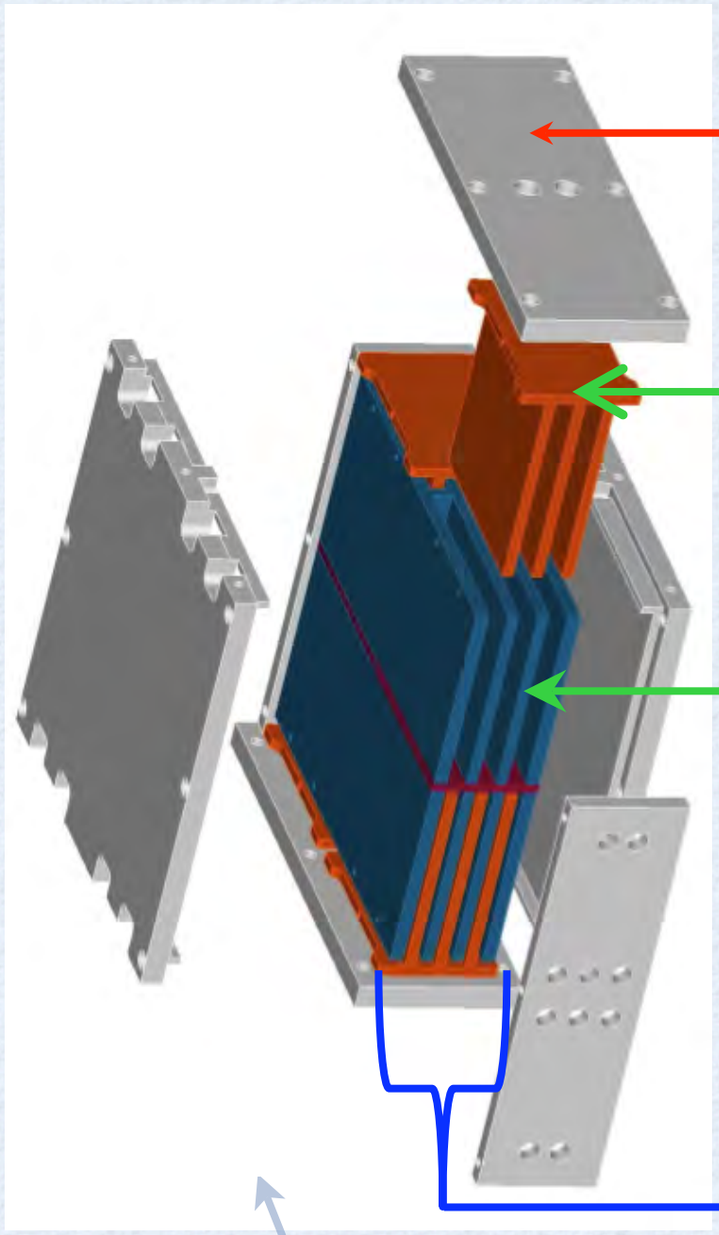
Model Study of SPS Test

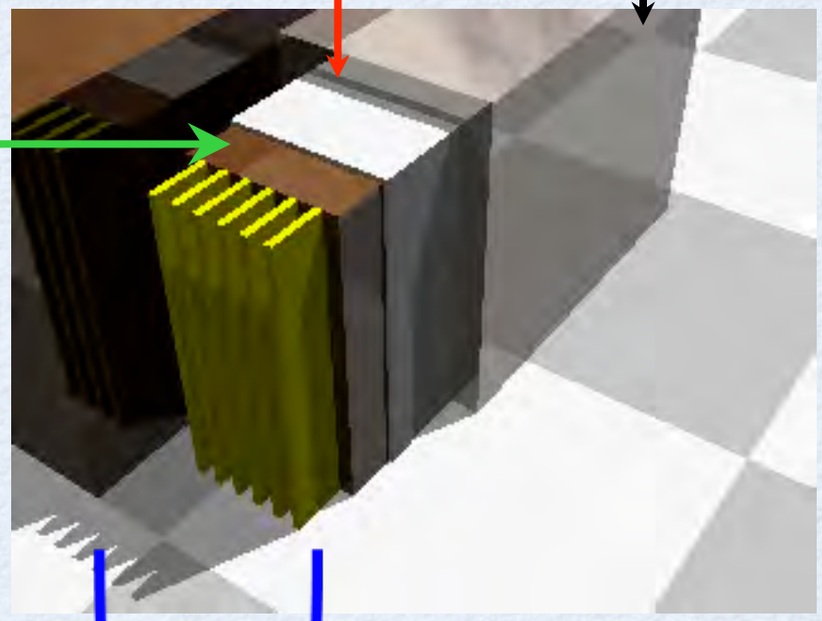
- Done by Johannes Stiller (Undergraduate for the Summer/Fall)
- Compare with MARS and FLUKA



FLUKA Simulation

DETAILED SIMULATION





Ceramic Cover

Stainless Steel Housing

Copper

6 Gaps

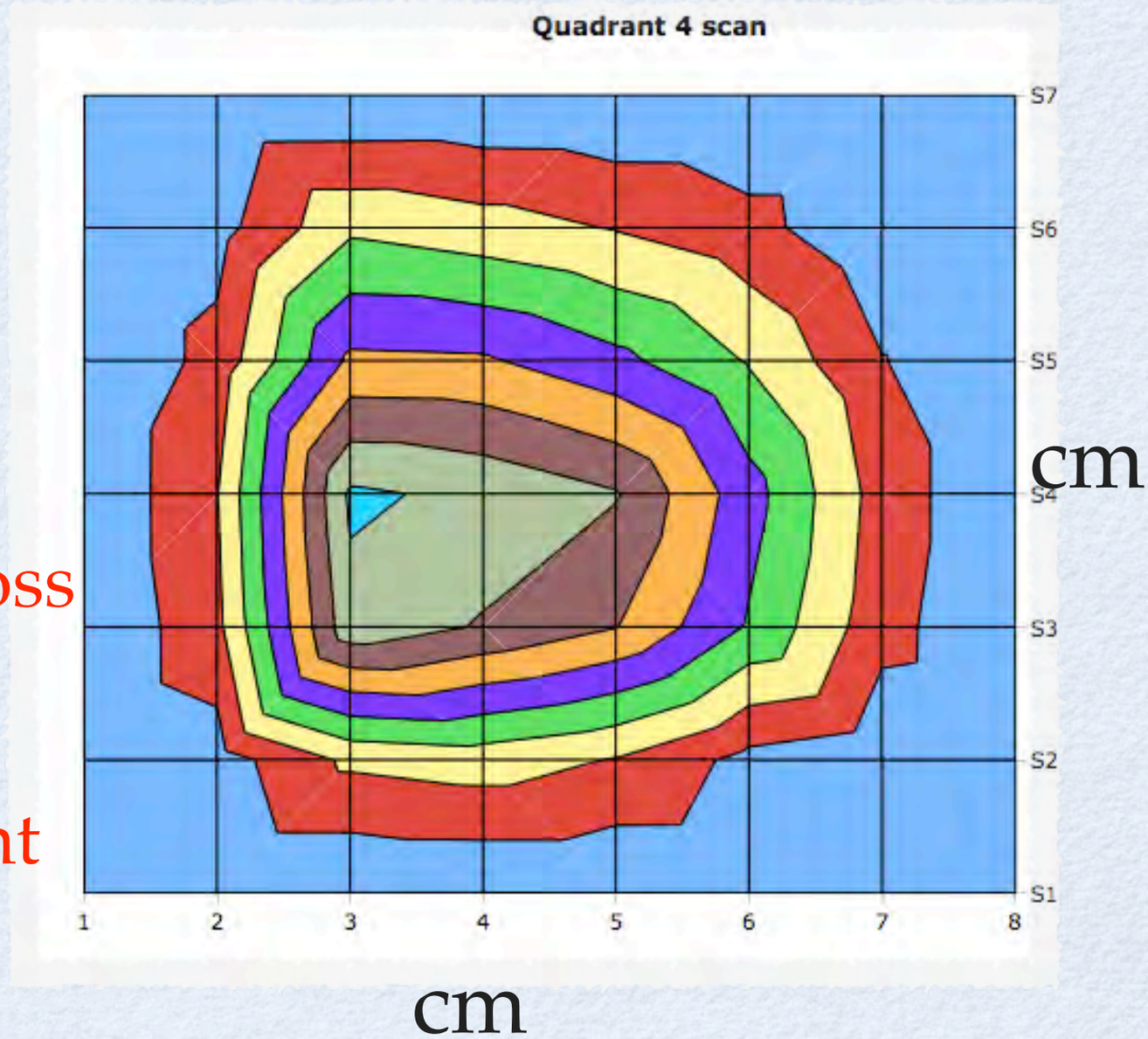
CAD

FLUKA

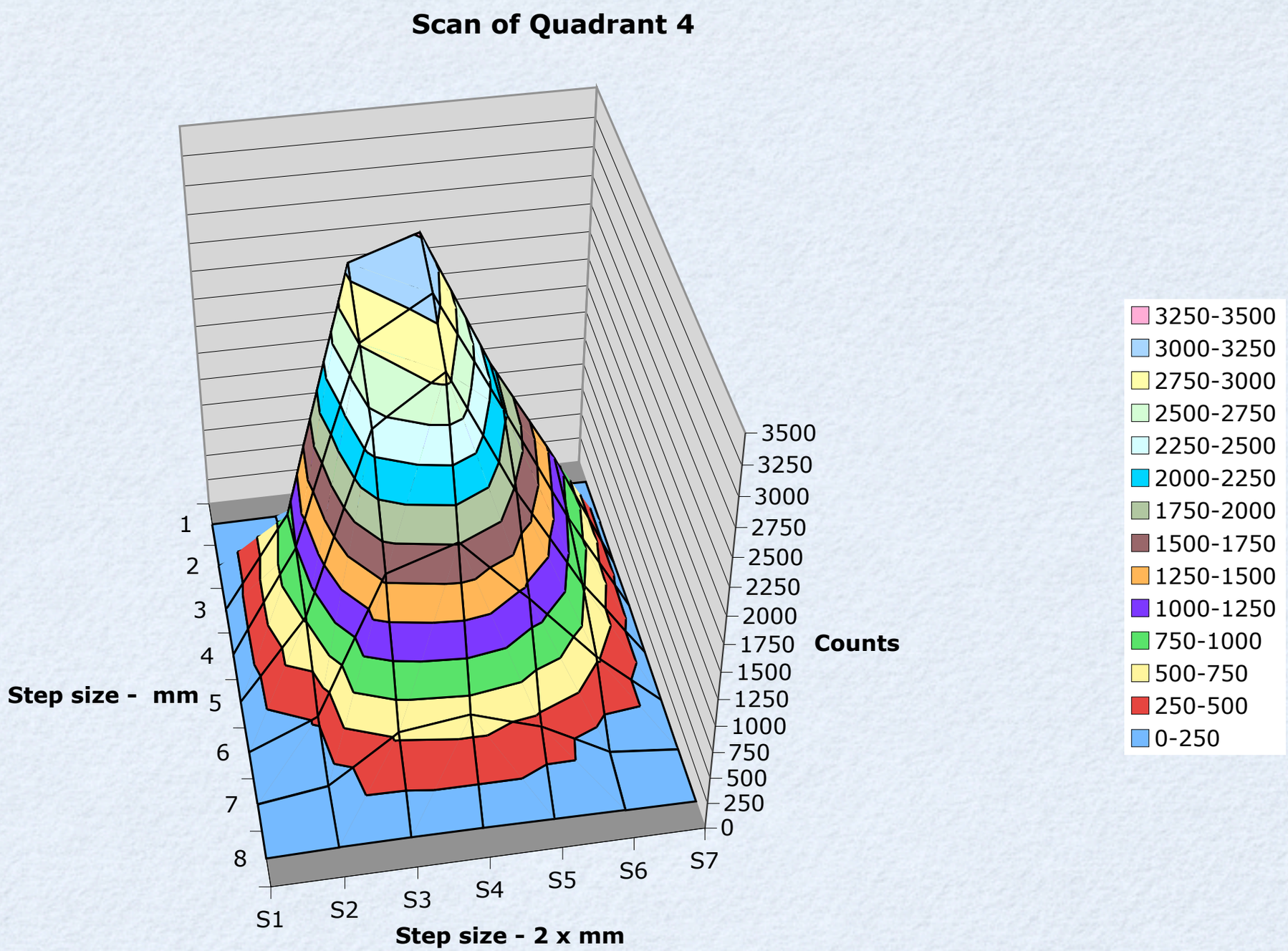
COMPARE TO MODELS

Position scan

- Keep beam steady
- Move chamber
- Study shower sharing
- Scan of one quadrant
- Data available to study cross talk, cable pickup, charge sharing
- Also data for four quadrant scan



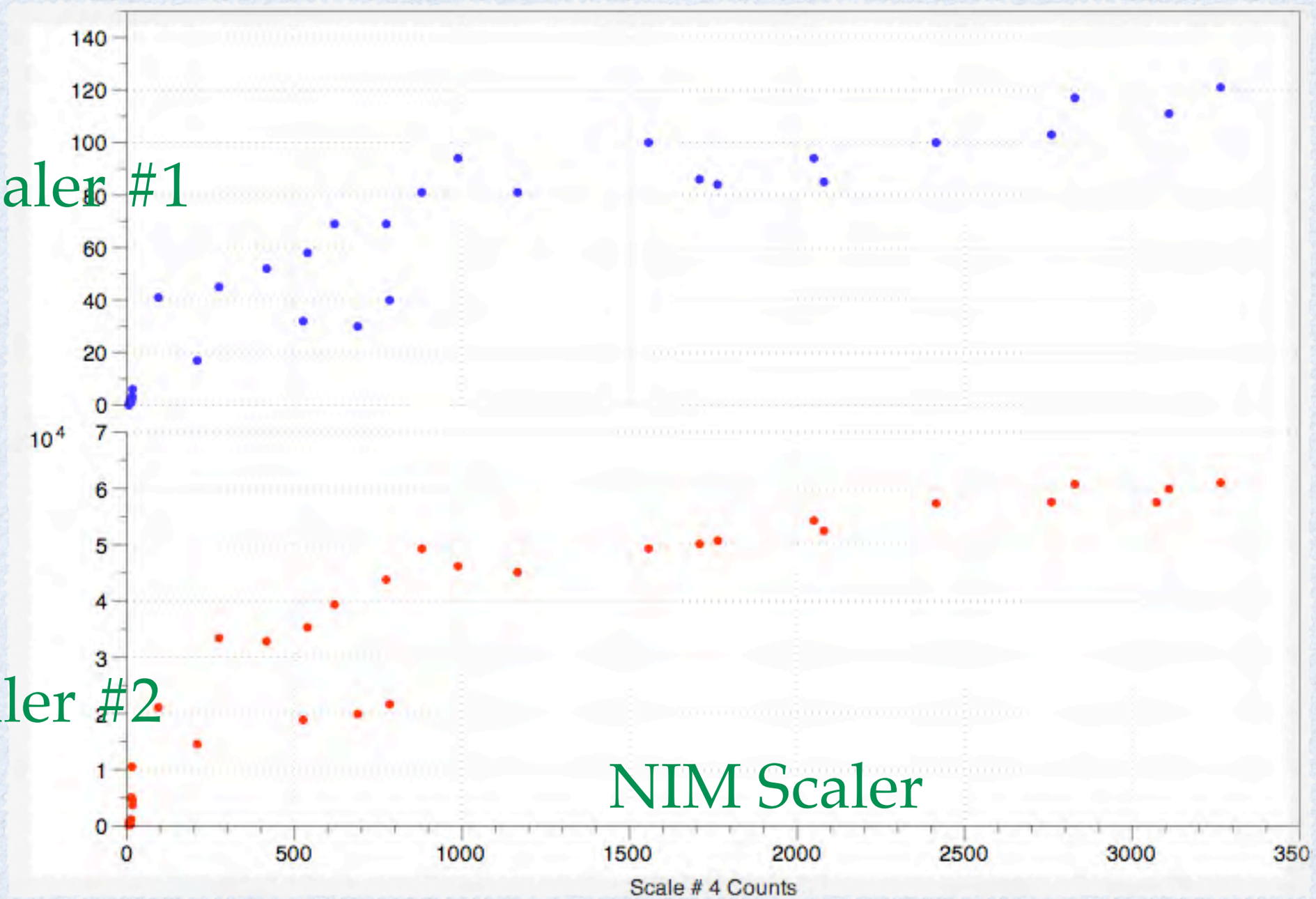
DIFFERENT PERSCEPTIVE



Method to test DAQ

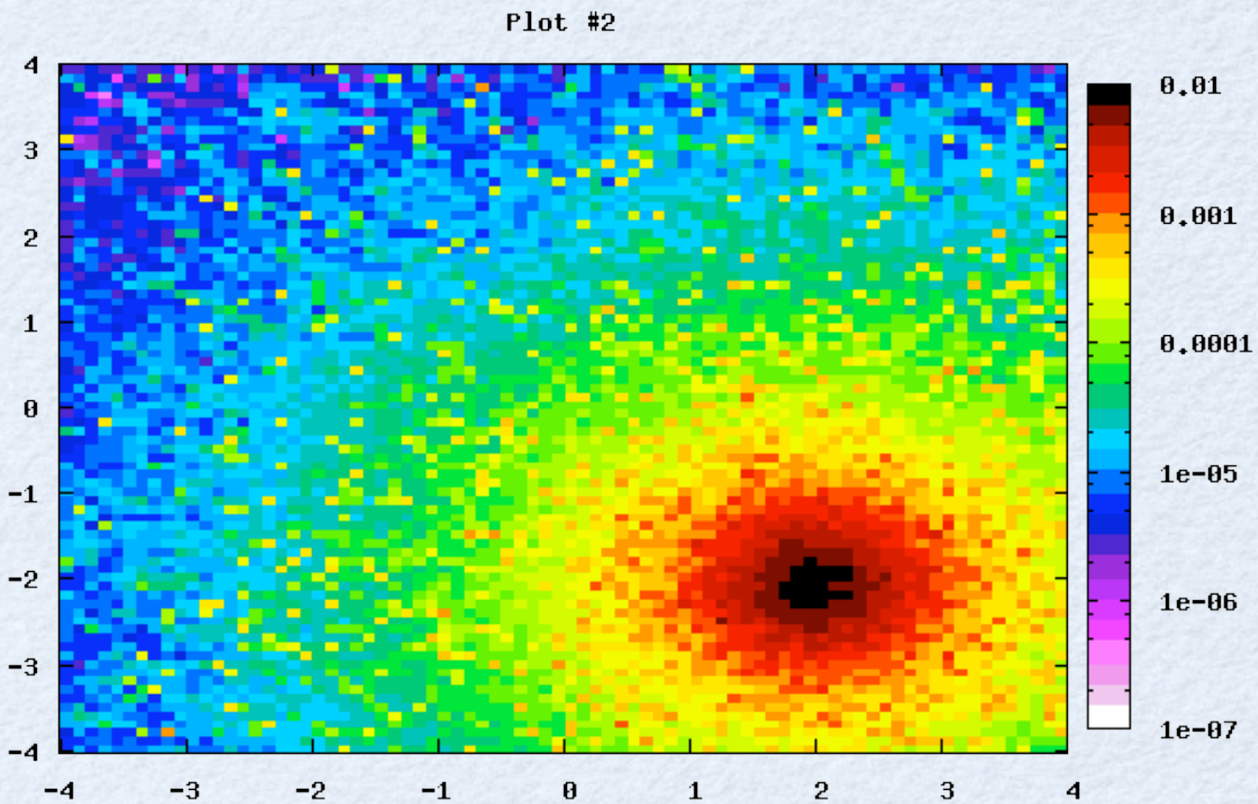
- NIM Scaler
  - Traditional scaler with 30 mV threshold
- BRAN Scaler
  - Use BRAN DAQ
  - Digitize same data with two different thresholds
- Take a beam scan (get different intensities)
- Plot BRAN vs. NIM

First Test of DAQ



SPS 2008 SUMMARY

- Chamber electronics works in hadronic environment
- Final gas system
  - Worked
  - Simple readout - reliable
- Energy Scan
  - Absolute normalization agrees
  - Understand model
- DAQ monotonic relationship with NIM
- More data to be analyzed

FUTURE SIMULATION

- Document Summer / Fall simulation
- Transfer simulation work from Johannes to me
- Obtain CERN data files at different energies
- Understand CERN modes of operation other than 7 TeV