# BACKGROUND SIMULATION + MACHINE DETECTOR INTERFACE

E.P. REPORTING WORK MADE BY M.BOSCOLO,
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MIKE SULLIVAN

WHAT HAPPENED SINCE CALTECH

- ☐ CALTECH BACKGROUND SIMULATIONS SHOWED A SHARP INCREASE IN BACKGROUND RATES

- ☐ SOME DISCREPANCIES FOUND AMONG MIKE LAYOUT AND OUR BRUNO MODEL

- ☐ SEVERAL CHECKS MADE SHOWING THAT: WE REALLY NEED THE FORWARD PLUG TO SHIELD BACKGROUNDS COMING DOWNSTREAM THE HER

- ☐ FIRST LOOK AT CHARM THRESHOLD BACKGROUNDS AND RADIATION MAP OF THE EXPERIMENTAL HALL

ON ENERGY ELECTRON TRACING FINAL FOCUS

ESSENTIAL PARAMETER BEAM RIGIDITY (I.E. MOMENTUM / CHARGE):
THE SOFTER THE PARTICLE, THE BIGGER THE DEFLECTION.
MACHINE CAN TOLERATE A +/- 1% VARIATION OF BEAM RIGIDITY
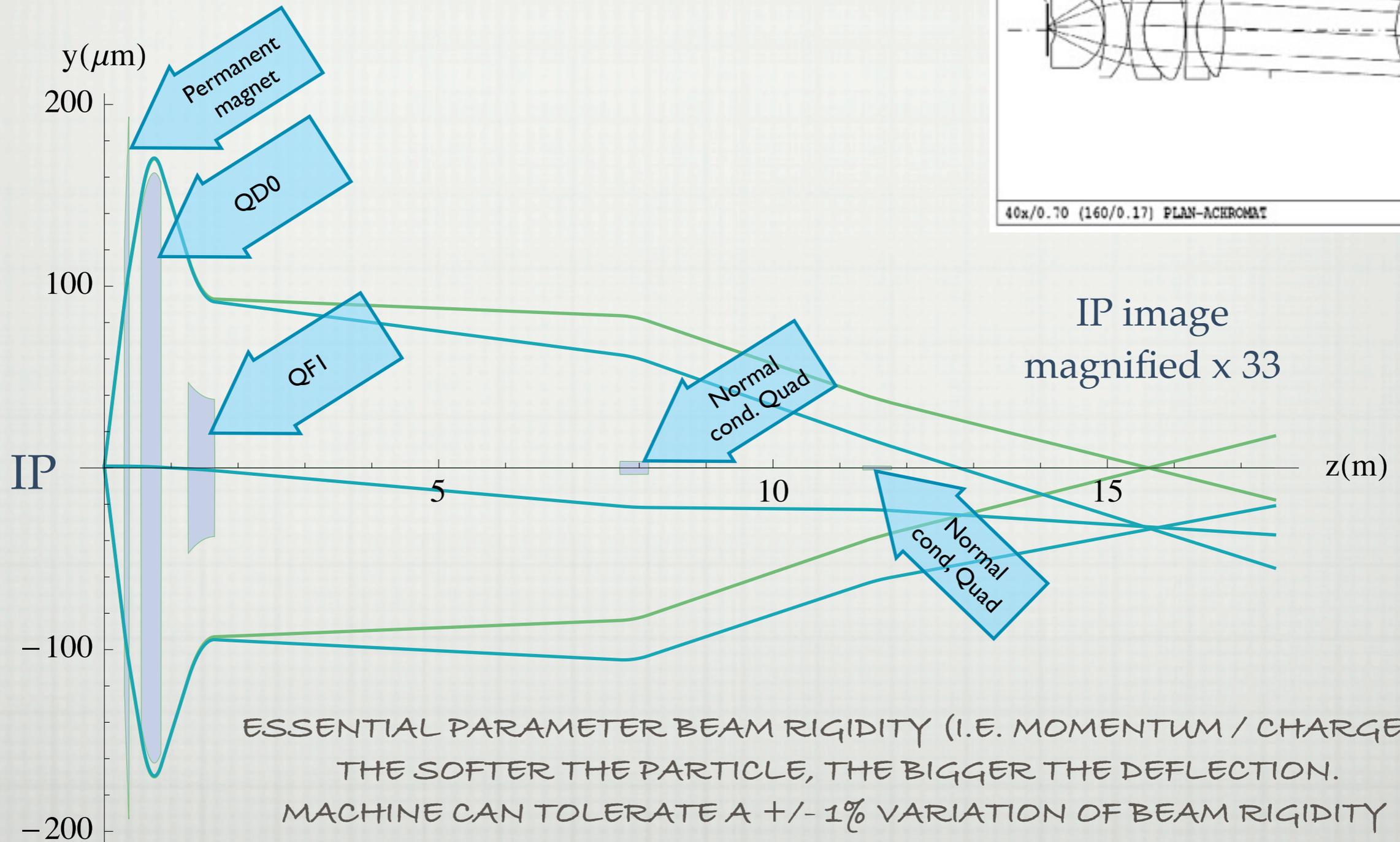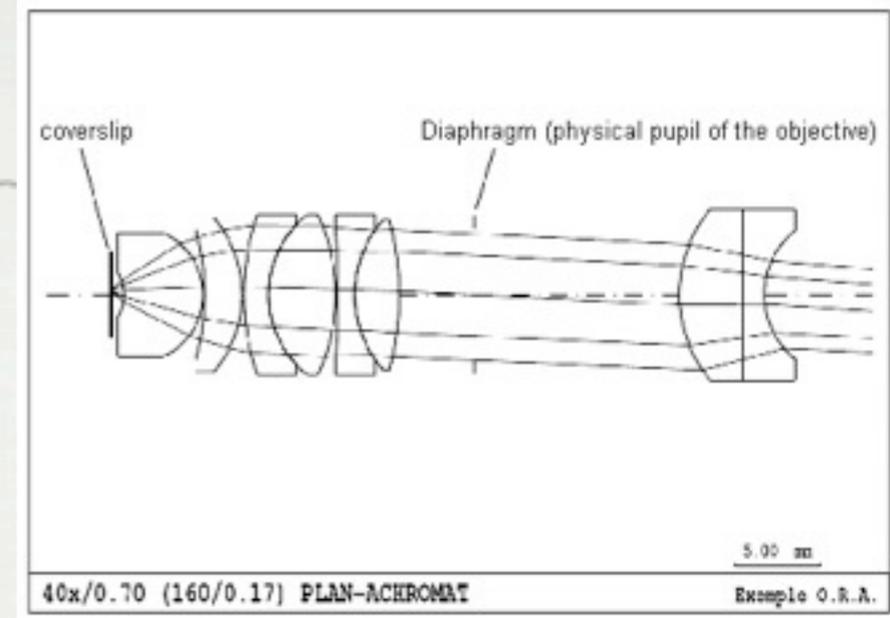
OFF ENERGY TRACKING
(MIKE USING MAGBENDS)

Plot shows the
momentum range:
 0.5 - 4 GeV in
0.5 GeV increments

23–Sep–10
M. Sullivan
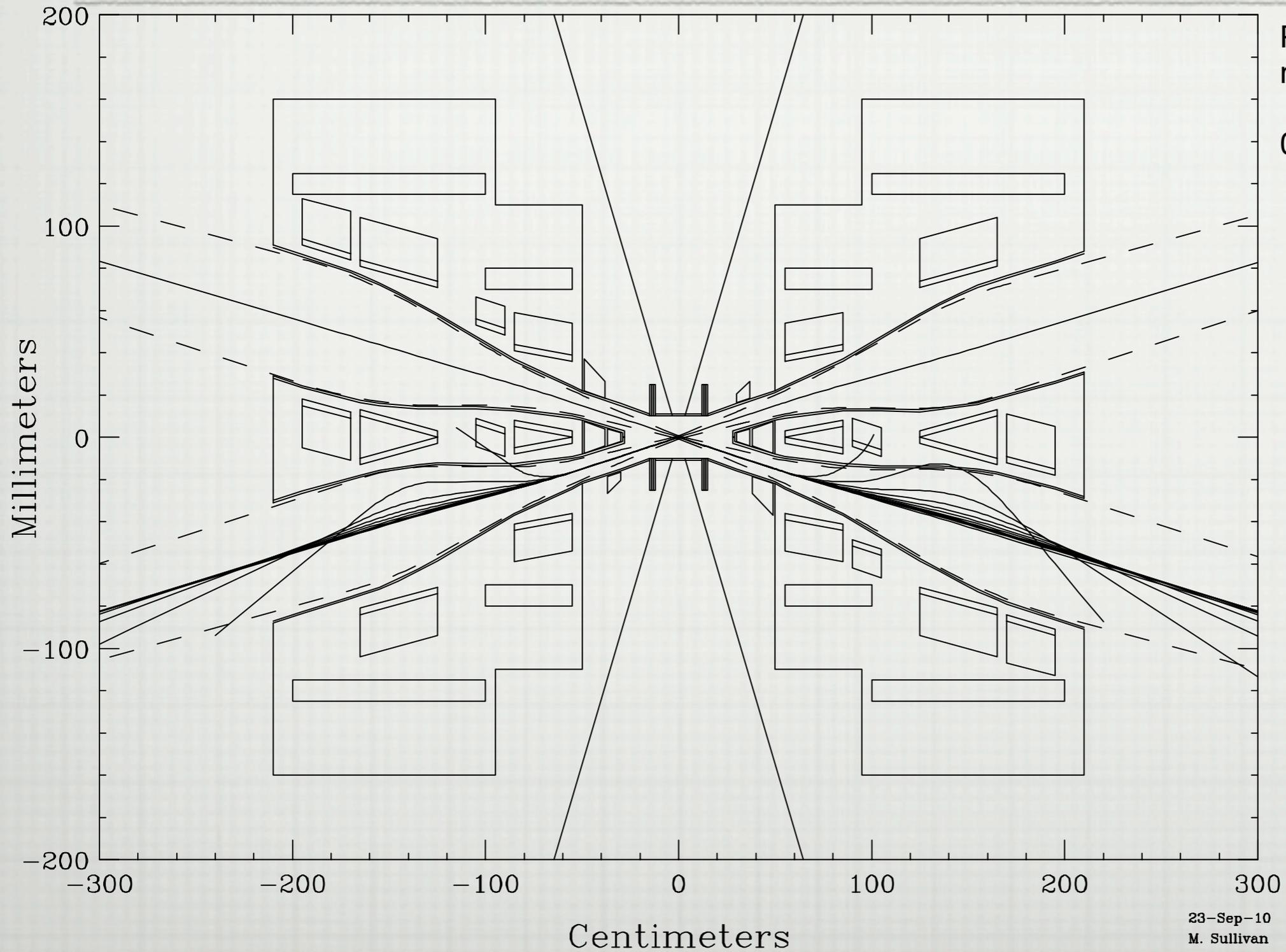
BACKGROUND SOURCES

|	Cross section	Evt/bunch xing		Rate
Radiative Bhabha	~340 mbarn ($E\gamma/Ebeam > 1\%$)	~850	OCCUP. DOSE	0.3THz
e^+e^- pair production	~7.3 mbarn	~18		7GHz
e^+e^- pair (seen by L0 @ 1.5 cm)	~0.3 mbarn	~0.8	L0	0.3GHz
Elastic Bhabha	$O(10^{-4})$ mbarn (Det. acceptance)	~250/Million	FTD	~80KHz
$\Upsilon(4S)$	$O(10^{-6})$ mbarn	~2.5/Million		1 KHz
	Loss rate	Loss/bunch pass		Rate
Touschek (LER)	4.1kHz / bunch (+/- 2 m from IP)	~3/100		~5 MHz
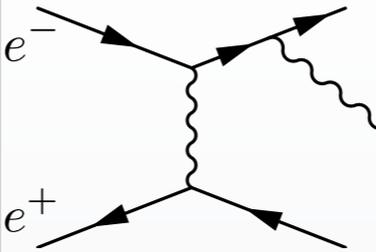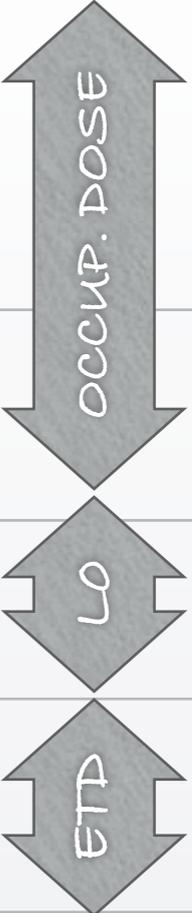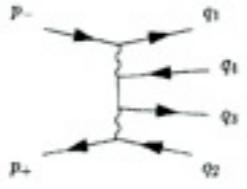
First hit position of all generated Bhabha primaries - new Geom

Colored lines are approximate (and need to be redone to remove curve)

Legend:
- <1 MeV
- 1-10 MeV
- 10-100 MeV
- 1 to .5 GeV
- .5 to 1 GeV
- 1 to 1.5 GeV
- .5 to 2 GeV
- 2.5 GeV
- ≥2 GeV 3 GeV
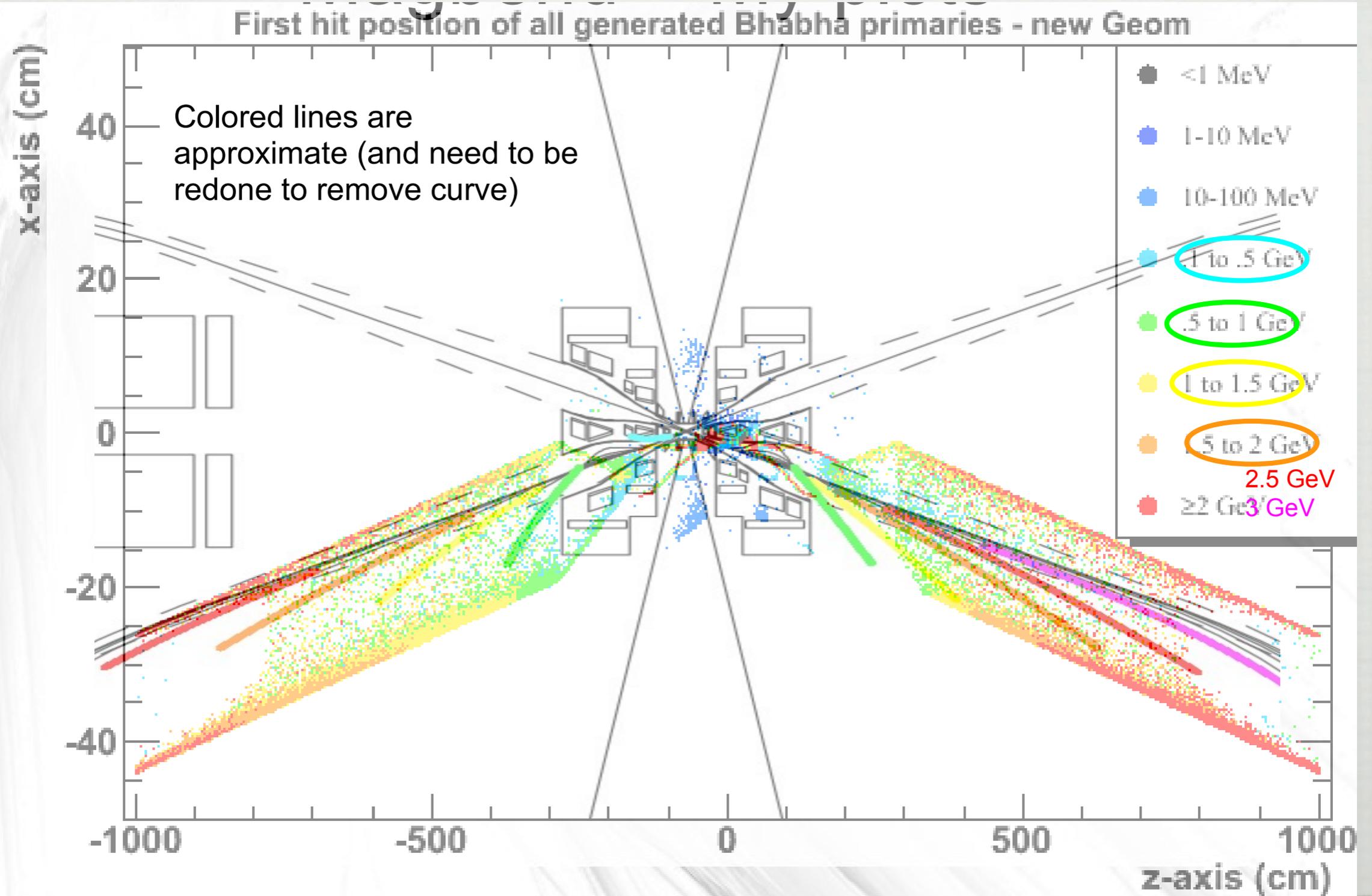
QUANTITAVE STUDY
(ALEJANDRO USING BRUNO)

V12-sf10 layout: HER = e$^+$ (6.69 GeV) and LER = e$^-$ (4.18 GeV)
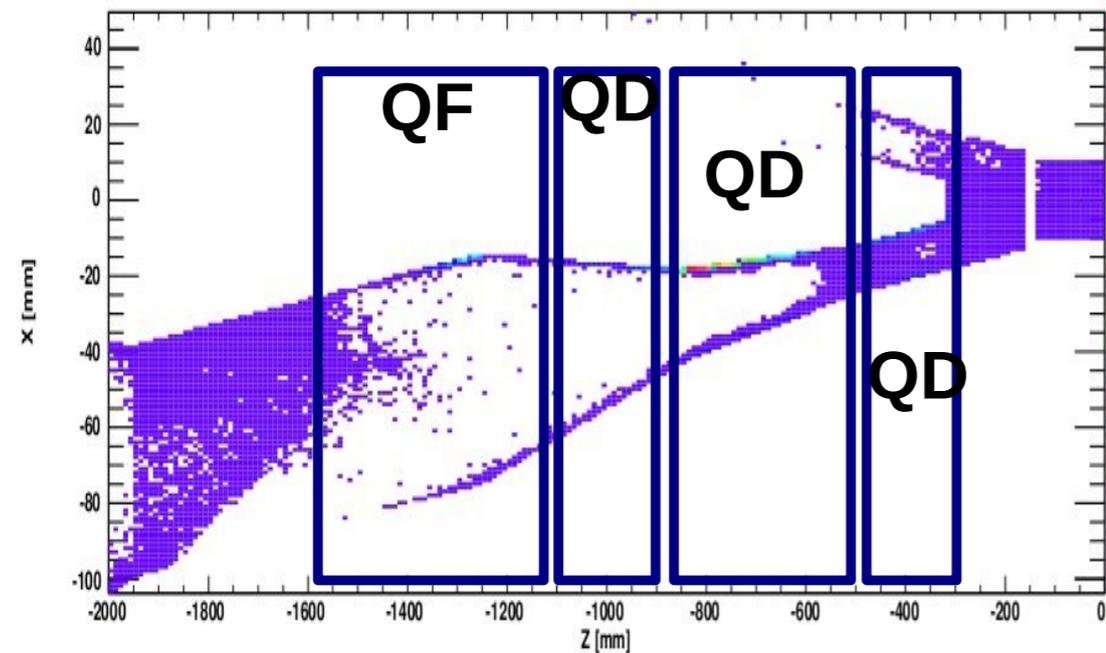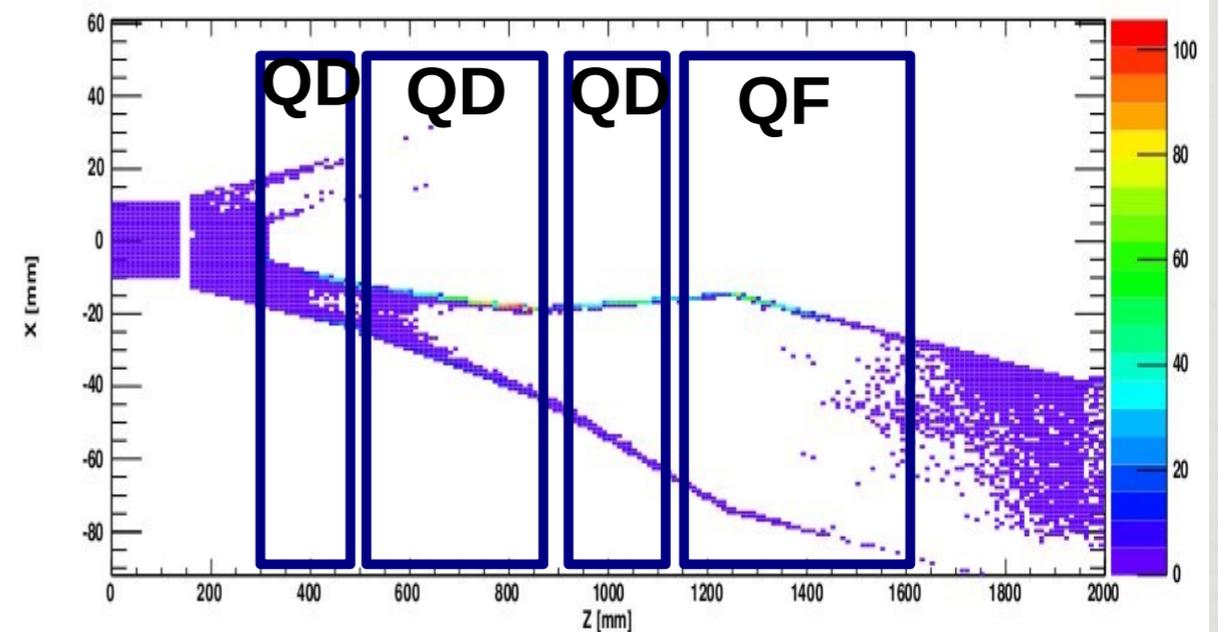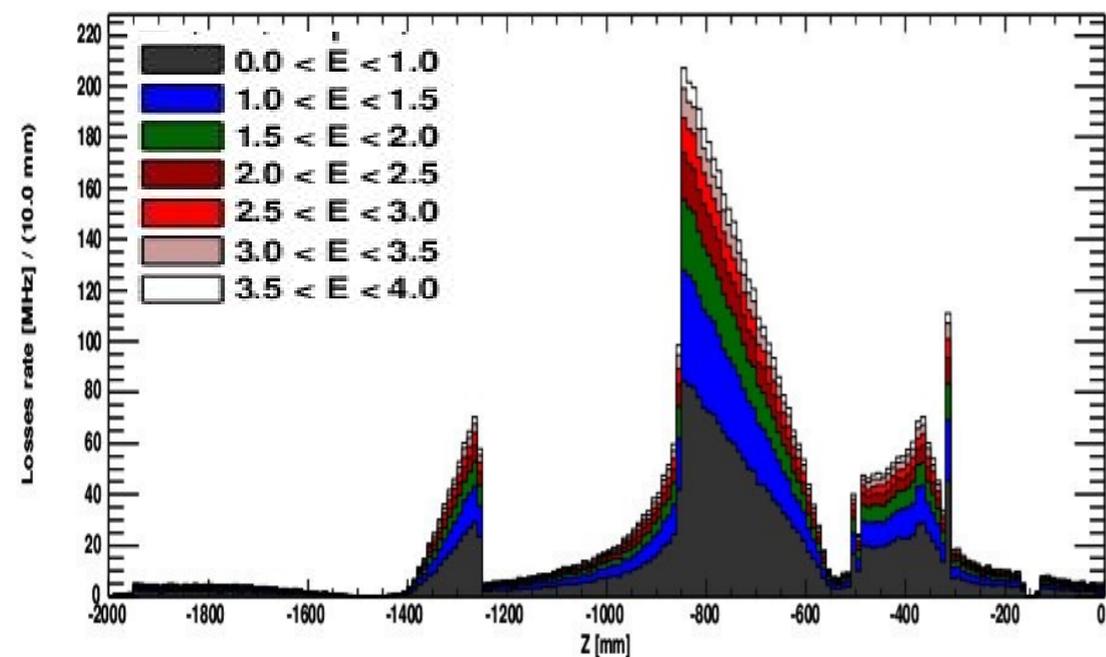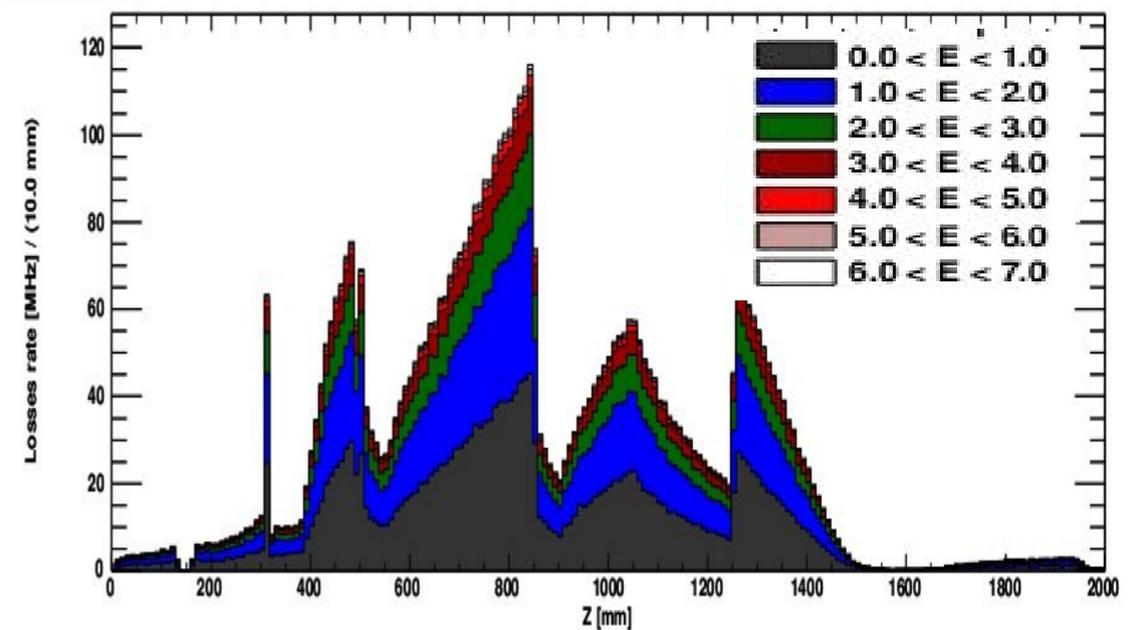
ARE WE FORGETTING TOUSCHEK, AREN'T WE?

Comparing the total rates

- **Total rates around the IP**

### LER rates (MHz) around the IP (-2.0,2.0) m

E range (GeV)	P3	v12 sf10 (WT)	v12 sf10 (RT)
(0.0,1.0)	1875.37	2586.18	2241.46
(1.0,1.5)	889.42	1320.92	1041.08
(1.5,2.0)	543.82	839.86	710.47
(2.0,2.5)	391.81	563.10	522.05
(2.5,3.0)	290.18	420.40	391.23
(3.0,3.5)	230.75	345.94	297.84
(3.5,4.0)	181.75	251.13	200.04
all	4403.11	6327.53	5404.16

HER rates (MHz) around the IP (-2.0,2.0) m

E range (GeV)	P3	v12 sf10 (WT)	v12 sf10 (RT)
(0.0,1.0)	1442.98	2173.10	1866.82
(1.0,2.0)	1132.13	1823.08	1452.75
(2.0,3.0)	535.29	826.46	753.86
(3.0,4.0)	309.06	501.69	413.07
(4.0,5.0)	76.38	154.31	141.79
(5.0,6.0)	58.22	66.58	87.40
(6.0,7.0)	39.09	40.93	47.86
all	3593.15	5586.14	4763.55

LER Touschek Losses

Total rate
@ IP ~ 14.2MHz

HER Touschek Losses

Total rate
@ IP ~ 0.4MHz

MANUELA IS KEEPING TOUSCHEK LOSSES WELL OUTSIDE FROM THE DETECTOR
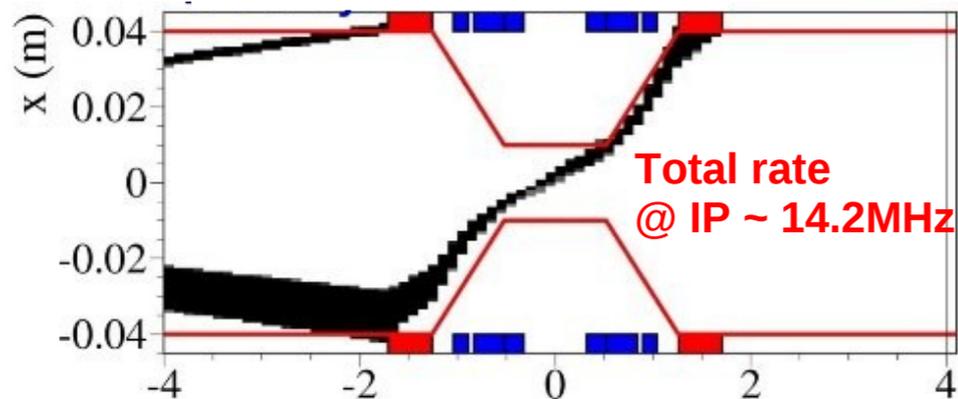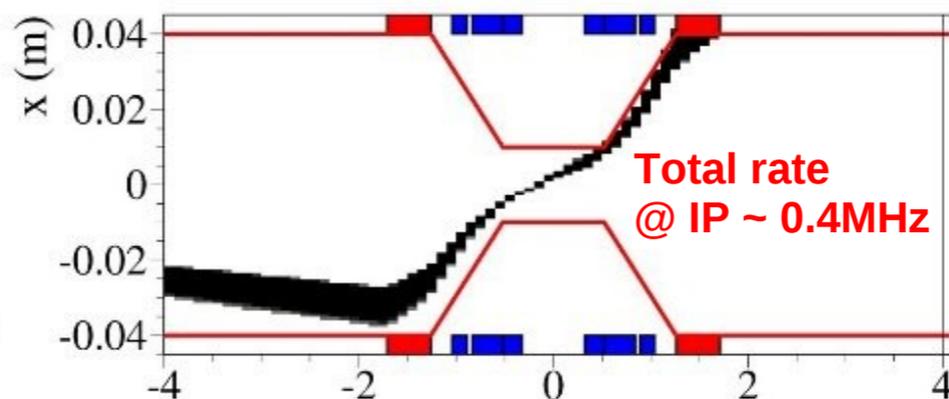
FROM THE LOSSES (I.E PRIMARIES HITTING THE VACUUM CHAMBER) TO THE OCCUPANCIES
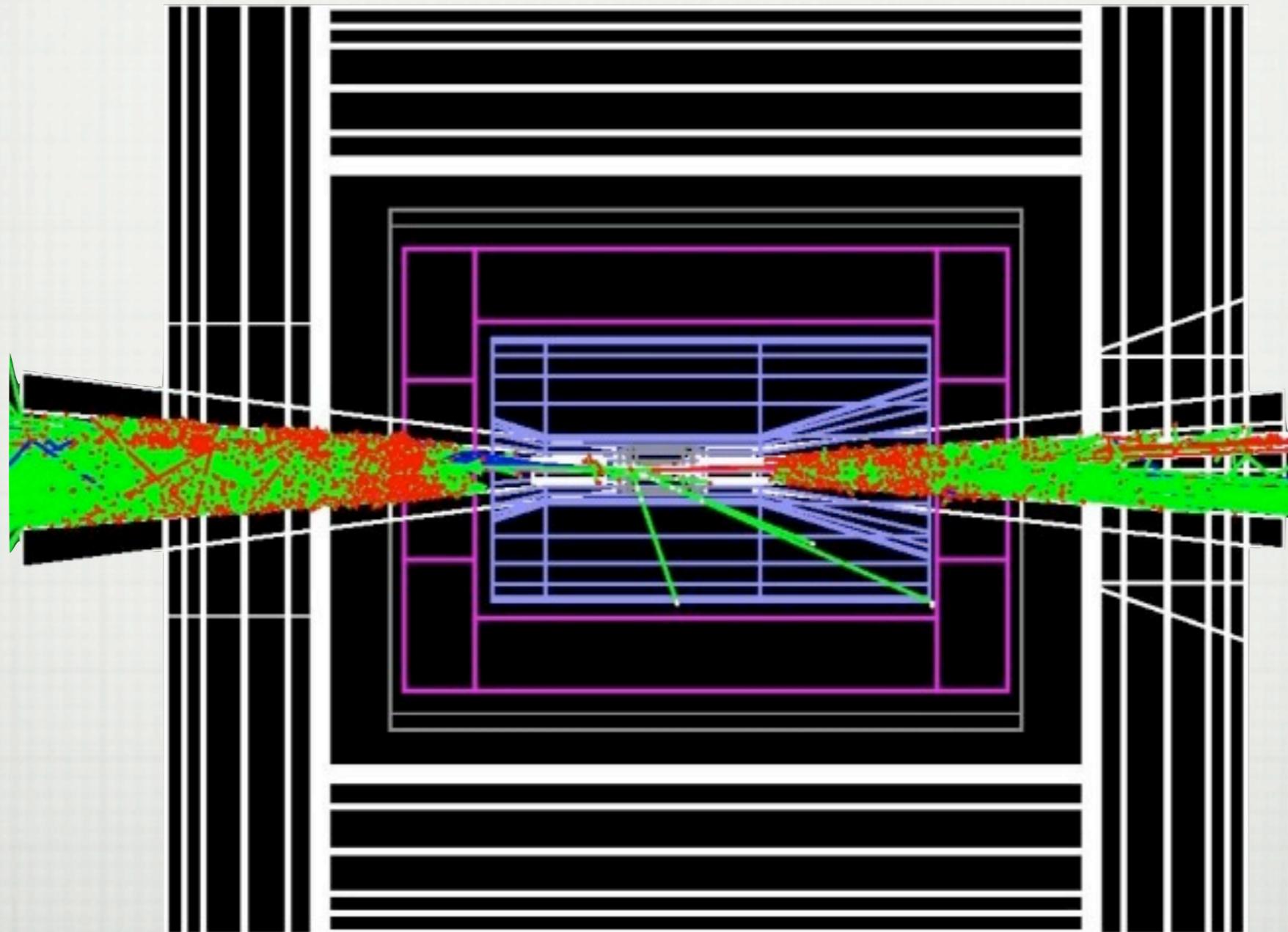
V12 SF11 beam pipes profile (I)

Mikes drawings

Old pipes
Mikes design

Straight lines:
**30 mrad (Z < 0.6m)**
27 mrad (Z > 0.6m)
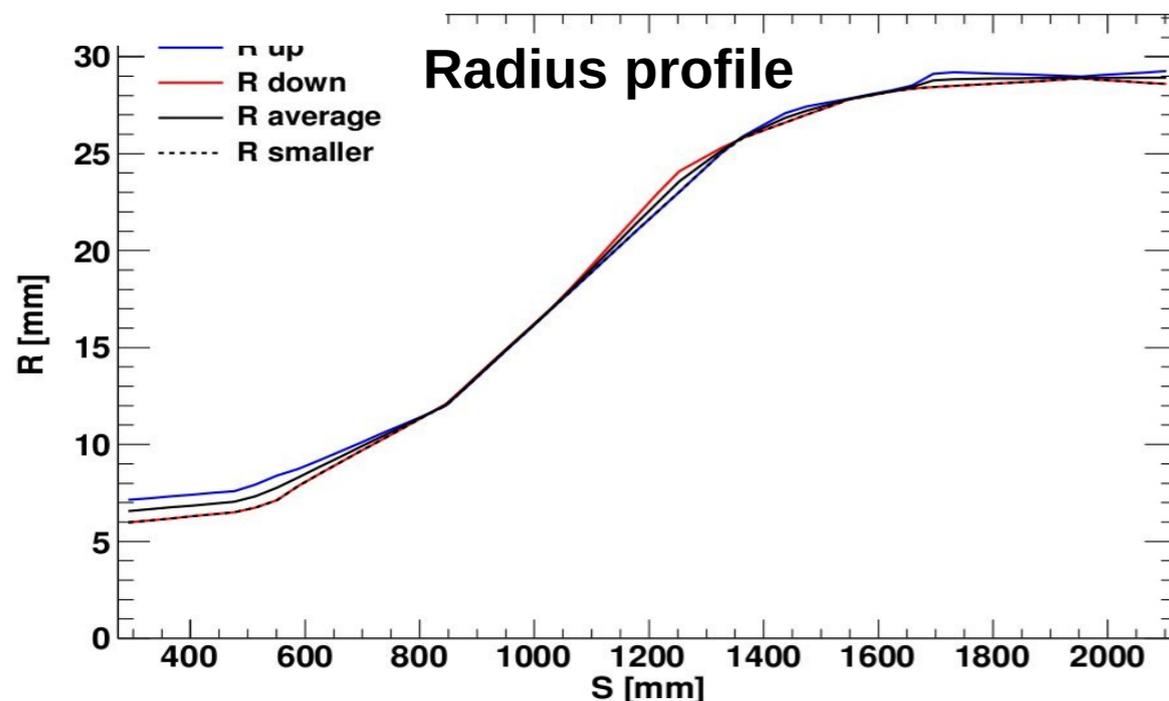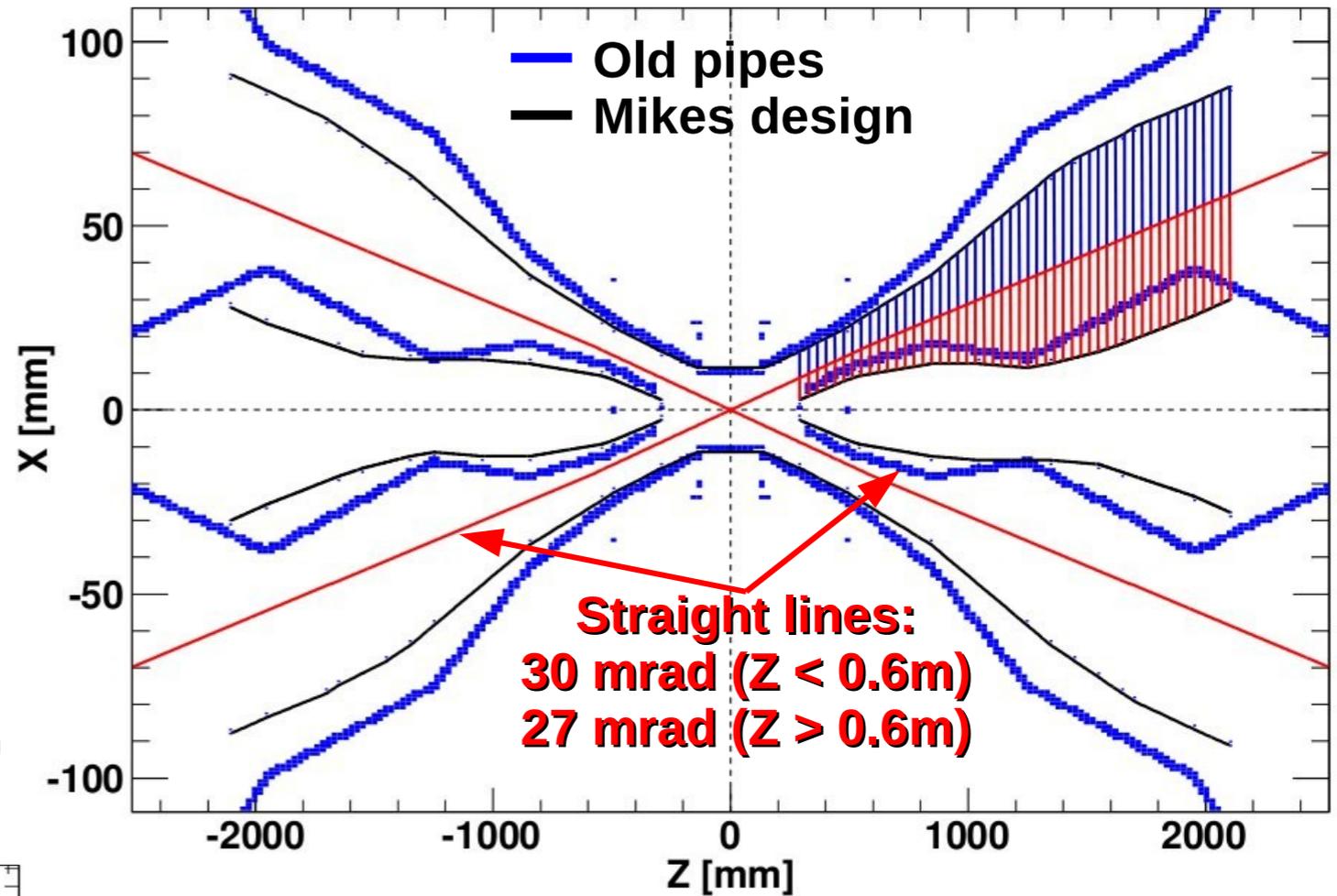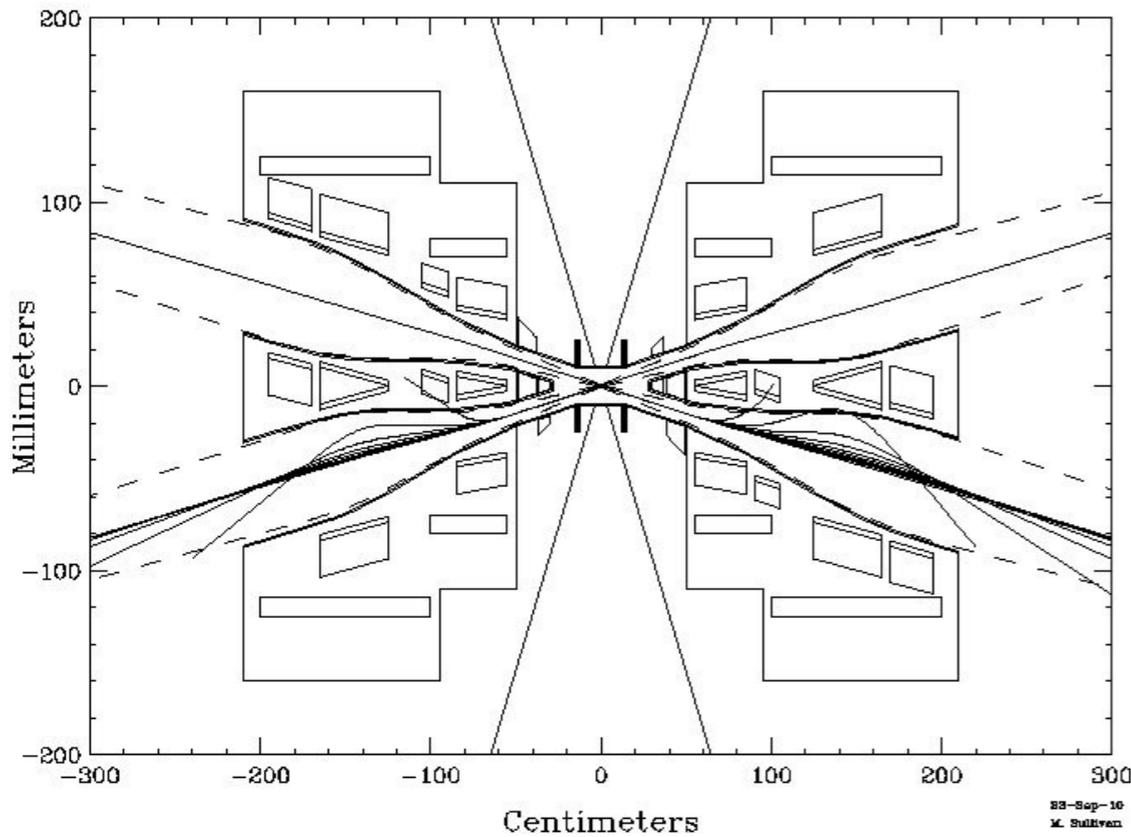
**Radius profile**

- **Use Mike Sullivan's drawings as inputs (no information on the vertical dimensions)**
- **Out of that get:**
  - Curves with the pipes walls
  - Calculate pipes radius profile as a function of distance to IP
- **Use straight pipes with constant radius from 2.4 m on until 1st bend**

Comparison of Samples (Bruno only)

- New Final Focus design shows great improvement in occupancy – almost half!
- More studies necessary, using Truth info, to understand exactly why...

vs New/Old Geometries

Occupied cells (%)/ μ second

- SuperB prod - old geom
- my Feb 2011 Geom - with Plug/Horseshoe
- my Old Geom (1mm steps)
- SuperB CIPE prod
- SuperB CIPE prod, 1mm

Wire Layer, increasing with radius

Thursday, April 7, 2011
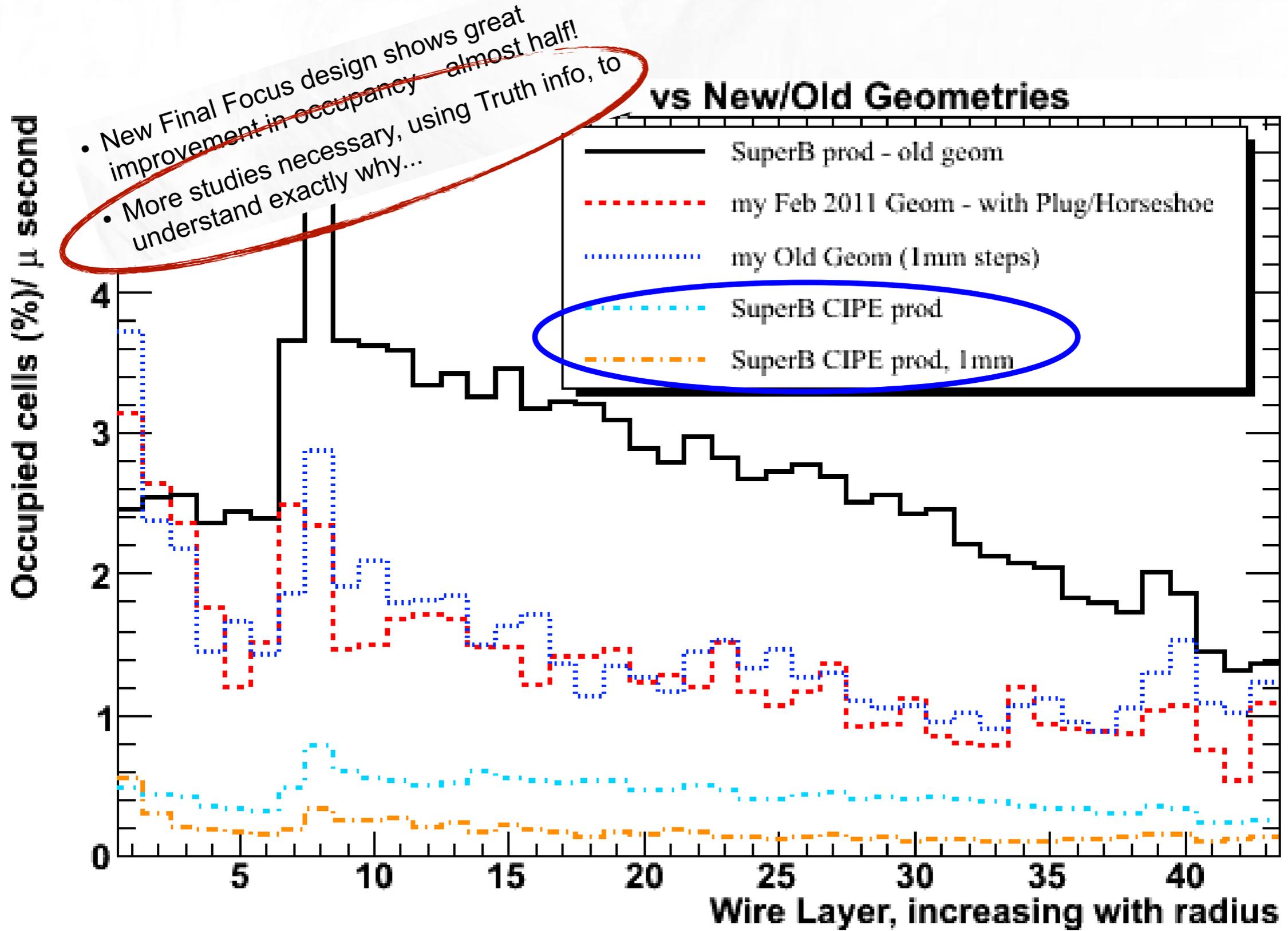
LATEST BRUNO MODEL:
BEAM PIPES UP TO THE FIRST BENDS + SCORING PLANES FOR ETD STUDIES + SUPERB

Horseshoe

Plug

Bending magnets
(straight cylinders
made of IRON)
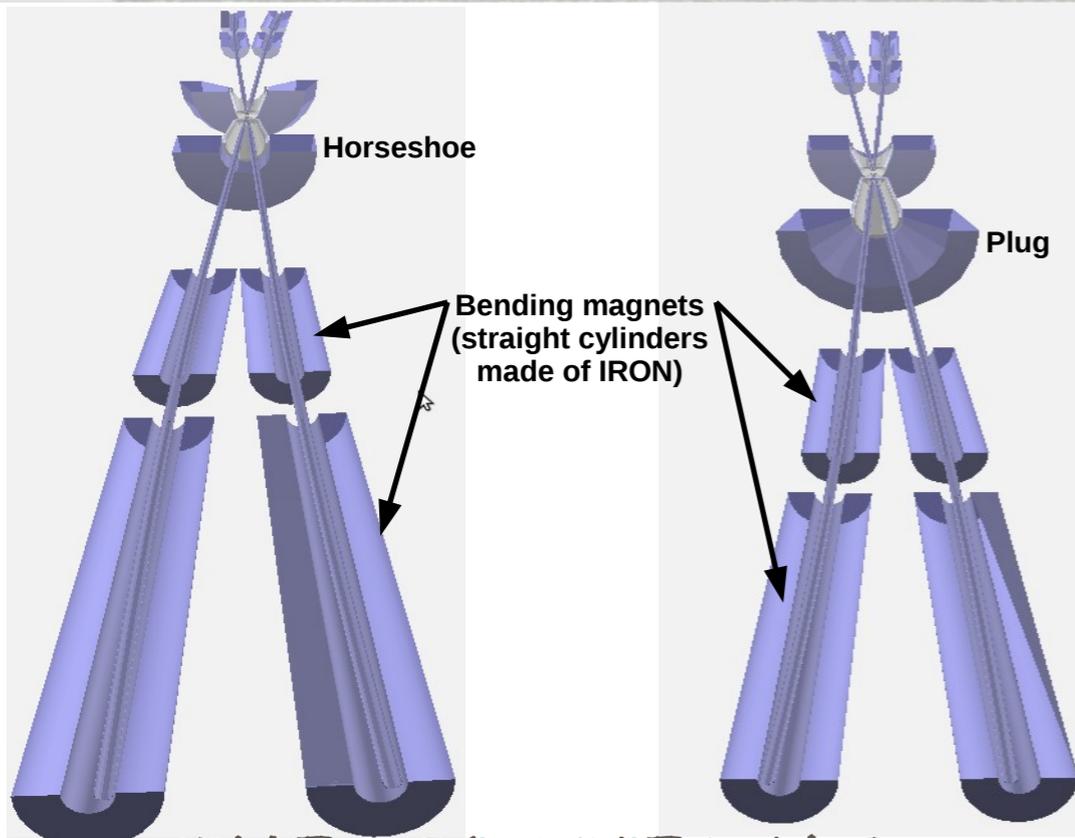
THE PRELIMINARY MAP
SHOWED
@ ETD MAP WAS WRONG

THE VOLUME WAS
UNDERESTIMATED, AND
THE DOSE WAS
OVERESTIMATED: NOW
WE ARE IN TOUHC WITH
THE ETD GROUP

20m

Concrete
(0.5m thick)

20m

SuperB
Detector

Silicon scoring planes for FEE
studies on:
• Radiation dose
• Single events upset
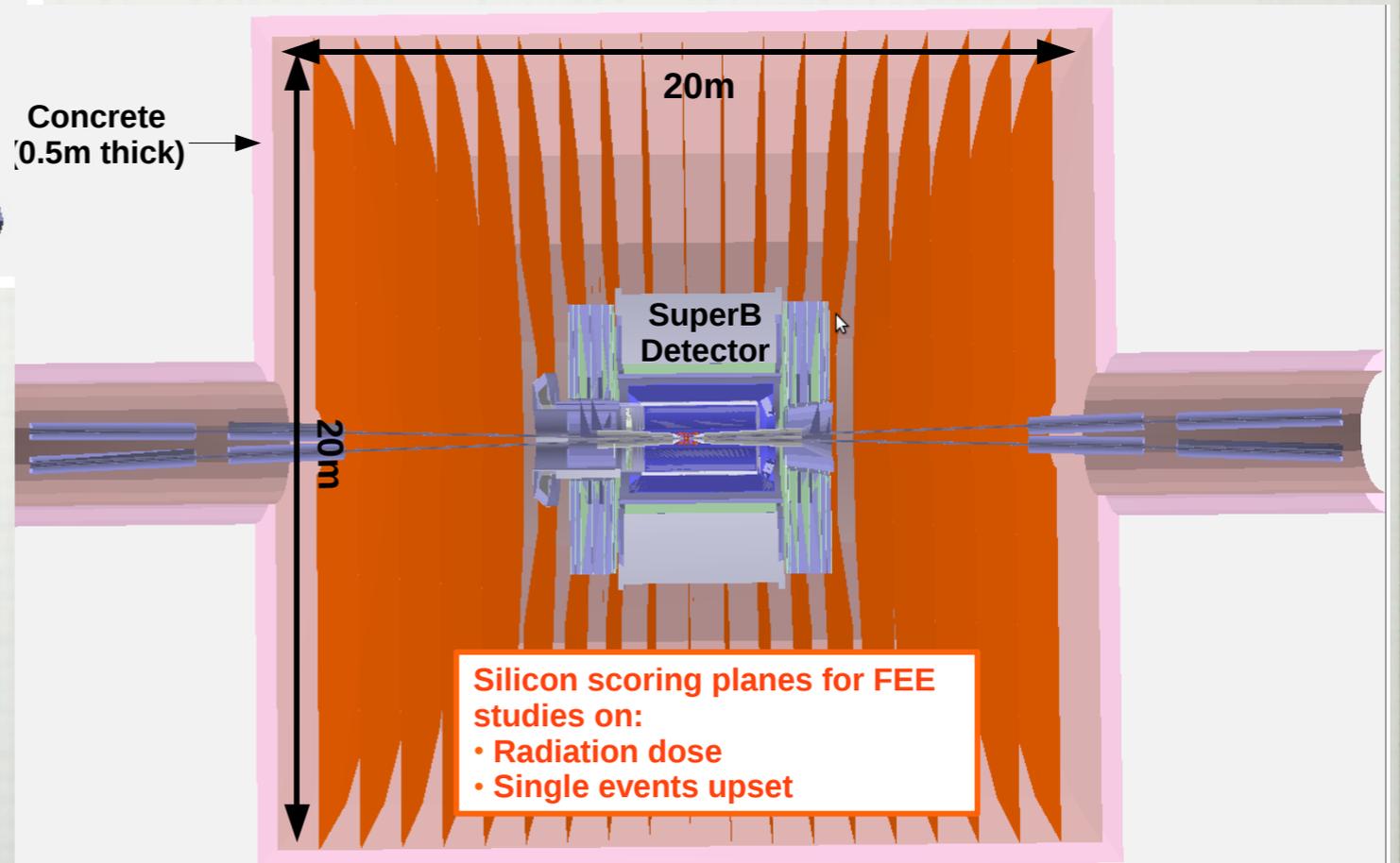
CONCLUSIONS

- [ ] SEVERAL CROSS CHECKS MADE

- [ ] DCH OCCUPANCIES WENT BACK TO THE PRE-CALTECH LEVEL: FORWARD PLUG + BEAM PIPE GEOMETRY

- [ ] DCH GEANT4 SIMULATION BETTER UNDERSTOOD (MORE ON GIUSEPPE TALK)

- [ ] FIRST LOOK AT RADIATION MAP, FIRST MESSAGE AS A CONSEQUENCE OF A TYPO IN THE CODE WAS FRIGHTENING, WE WILL UPDATE THE MA REALLY SOON