
Status of energy deposition studies at IR7



Collimation Meeting
20-03-2006



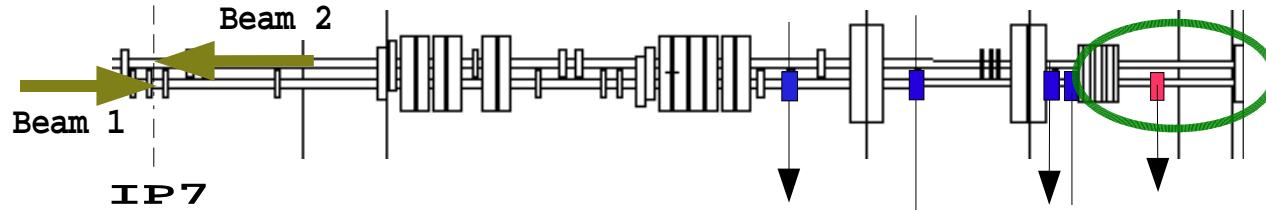
M. Santana, M. Magistris, A. Ferrari, V. Vlachoudis

Outline

- Summary of past activities & results
- Simulation of the cold arc under new conditions
 - Active absorbers on
 - Tertiary halo loss component
 - Case without secondary collimators
 - Vertical beam losses
 - Injection (pending)
- Simulations of doses in warm magnets, new conditions
 - Vertical beam losses
 - Dose in the pipes
 - Correction of position (pending)
- BLM's response
 - Cross-Talk
 - Individual detection spectra

Summary of past activities 1/2

cold magnets: active absorbers



TCL.A6R7.B1
s = 20148.33

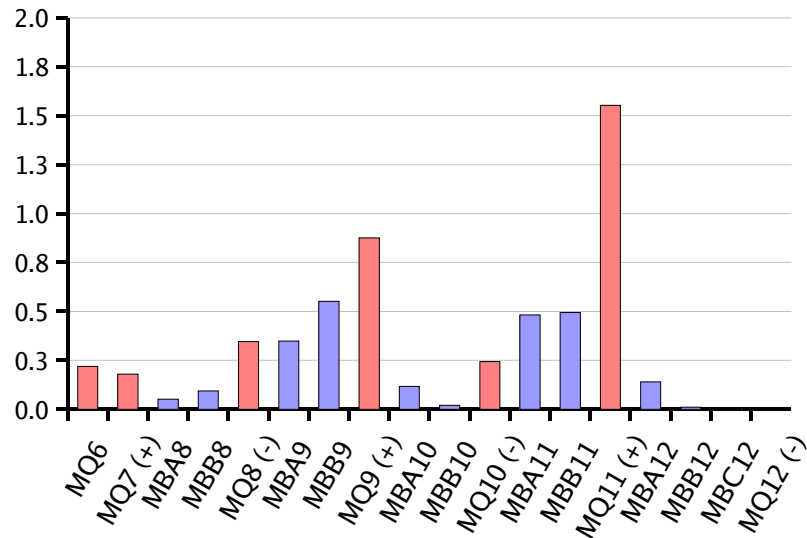
TCL.E6R7.B1
s = 20213

TCL.A7R7.B1
s = 20232.10

TCL.C6R7.B1
s = 20179.29

TCL.F6R7.B1
s = 20216.0741

Peak energy densities [mW/cm³] in cold elements

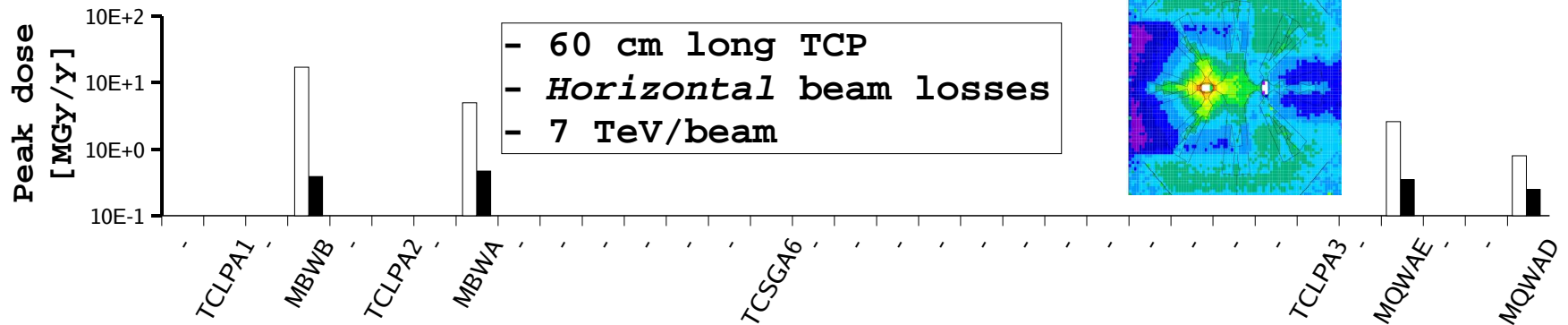
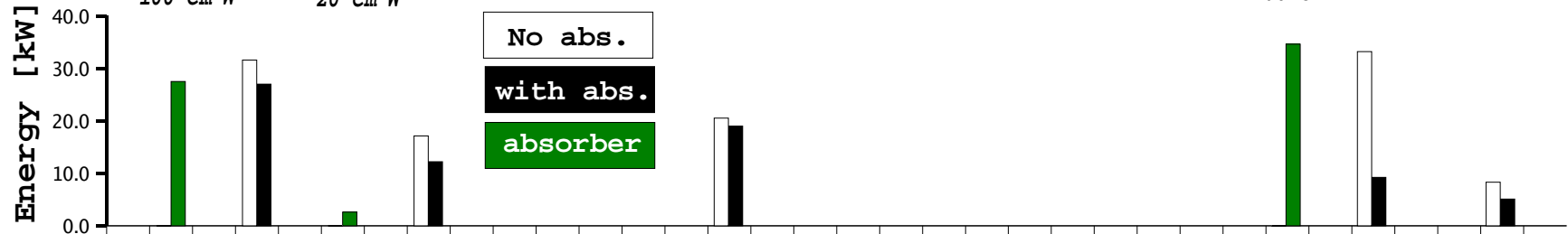
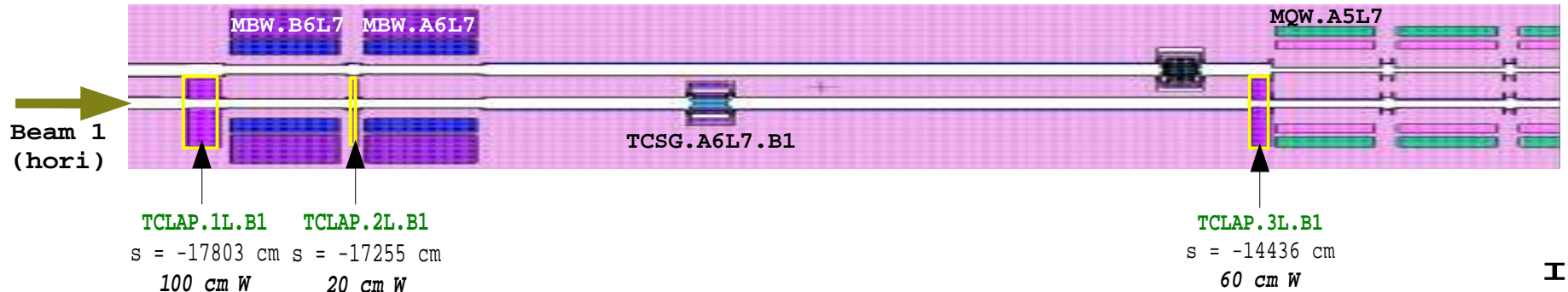


- 20 cm long TCP active jaws
- No tertiary halo
- No passive absorbers
- Horizontal beam losses at 7 TeV
- 12 min accident scenario

A_{6v}C_{6h}E_{6v}F_{6h}A_{7h}

Summary of past activities 2/2

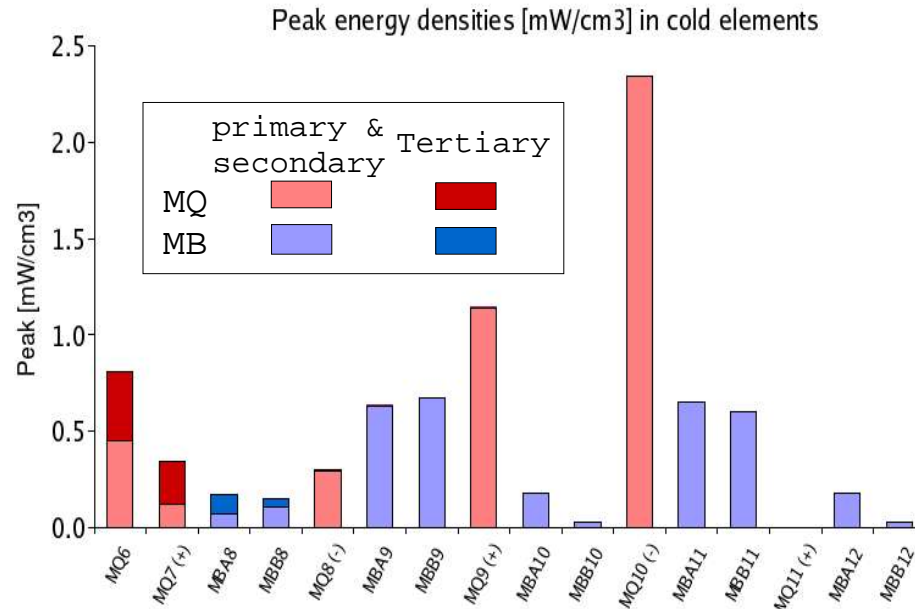
Warm magnets: passive absorbers



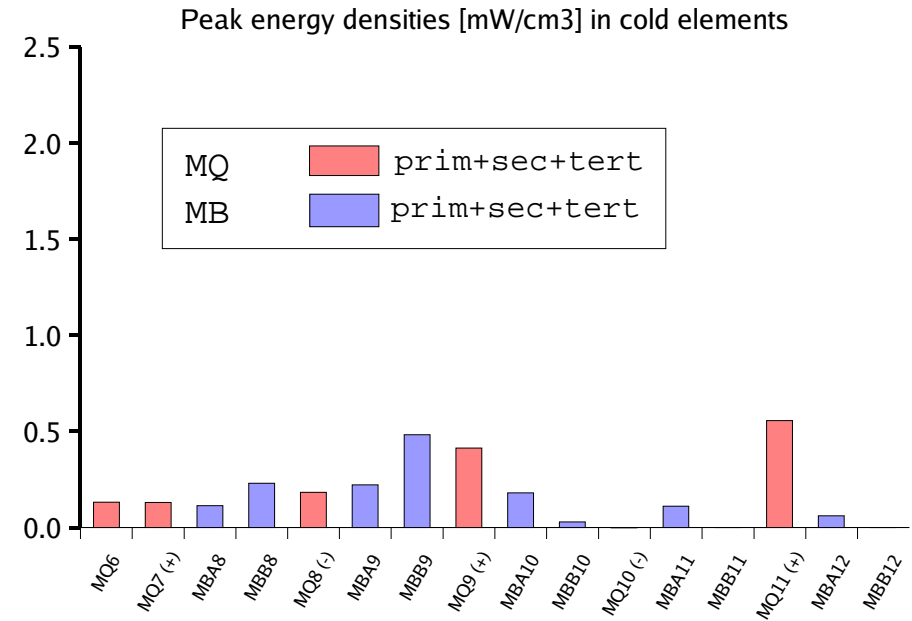
New simulation of the cold arc

Active absorbers + Tertiary halo + 60 cm TCP jaws + vert.

Horizontal losses



Vertical losses



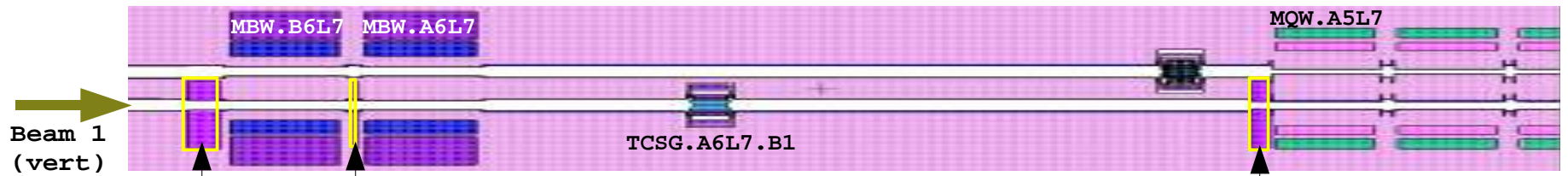
REMARKS:

- Hottest element MQ10
- Tertiary halo contributes 50% to the first elements

- Vertical losses less harmful
- Hottest element MQ11

Pending: Injection

New simulation of the warm magnets vertical vs. horizontal beam loss scenario

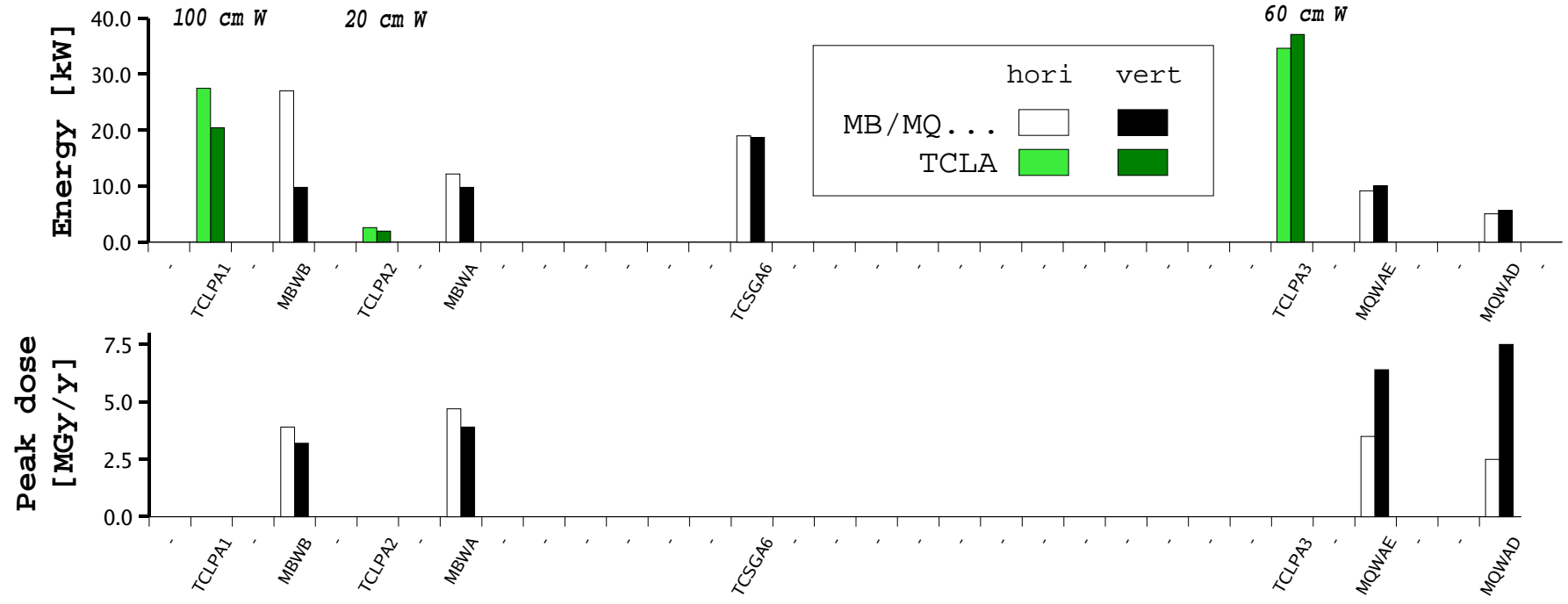


TCLAP.1L.B1 s = -17803 cm
100 cm W

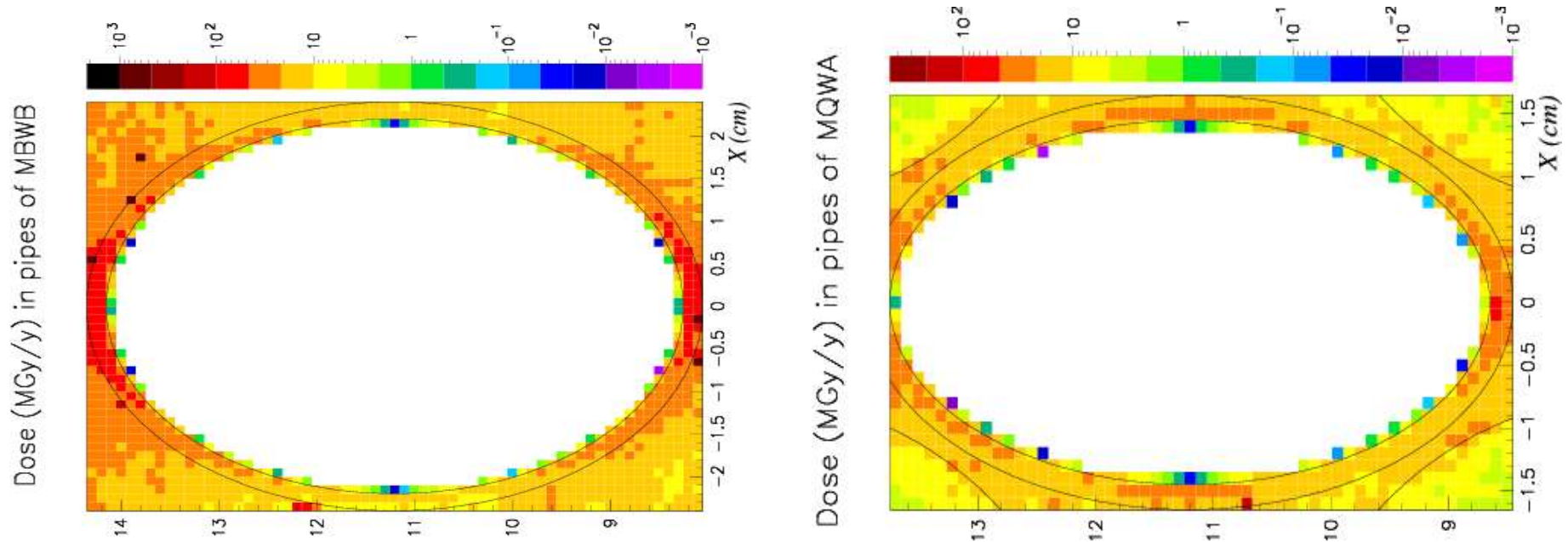
TCLAP.2L.B1 s = -17255 cm
20 cm W

TCLAP.3L.B1 s = -14436 cm
60 cm W

IP7



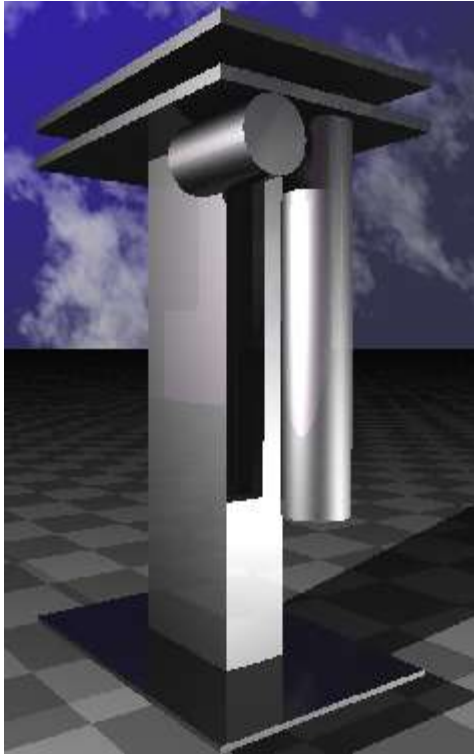
New simulation of the warm magnets dose in the pipes (horizontal loss scenario)



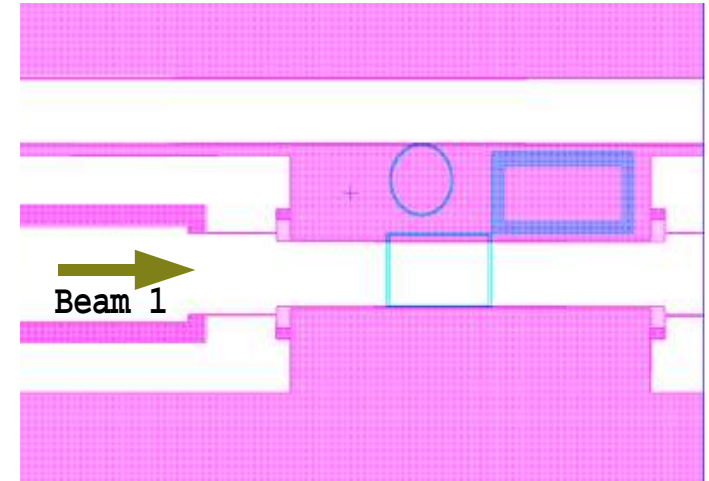
The heating film that wraps the pipes inside the MBW/MQW could be damaged...?

Simulation of Beam Loss monitors 1/3

Introduction



- BLM blocks **after each collimator** (TCP/TCS), **below** the beam line plane
- BLM twiss file created
- Each BLM contains **2 detectors**
- Each detector measures:
 - Fluence**: protons, neutrons, photons, muons (+/-), e-e+, pions
 - Energy deposition**
- Each measurement made for a different beam source (loss in collimators)



Simulation of Beam Loss monitors 2/3

Cross-talk Matrices (vertical detector), 7 TeV/beam

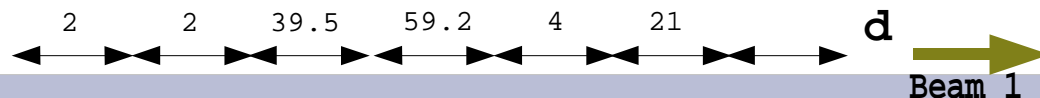
Horizontal beam loss scenario

	L1									R1	
	C6	B6	A6	B5	A5	D4	B4	A4		A4	B5
TCPC6	0.991 ₇	0.693 ₅	0.307 _{4.7}	0.068 _{9.9}	0.046 _{8.3}	0.013 ₁₂	0.007 ₁₇	0.009 ₁₈		0.019 ₁₈	0.065 ₄₀
TCPB6	0.009 ₁₄	0.307 ₅	0.386 _{5.6}	0.054 _{8.2}	0.053 ₁₂	0.014 ₁₄	0.008 ₂₅	0.008 ₁₈		0.015 ₂₄	0.106 ₆₃
TCPA6	0 ₅	1.4E-5 ₉₆	0.308 _{3.9}	0.223 _{7.3}	0.159 _{4.5}	0.053 _{7.6}	0.044 ₁₆	0.032 ₁₆		0.057 ₂₆	0.029 ₄₃
TCSGB5	0 ₅	0 ₃	0 _{2.5}	0.653 _{7.3}	0.6 _{3.7}	0.344 _{5.8}	0.29 ₁₁	0.266 ₁₁		0.254 ₁₁	0.101 ₃₈
TCSGA5	0 ₅	0 ₃	0 _{2.5}	0.002 ₇₆	0.141 _{3.7}	0.576 _{4.9}	0.65 _{5.6}	0.685 ₁₄		0.655 _{6.7}	0.699 ₅₃

- Cross talk $\sim 1/d$
--> big cross-talk between primaries
- Little backscattering
- Similar picture for horizontal and vertical beam
- Similar cross-talk for the 2 detectors
- Loss estimation
 $L = (M^T M)^{-1} M R$

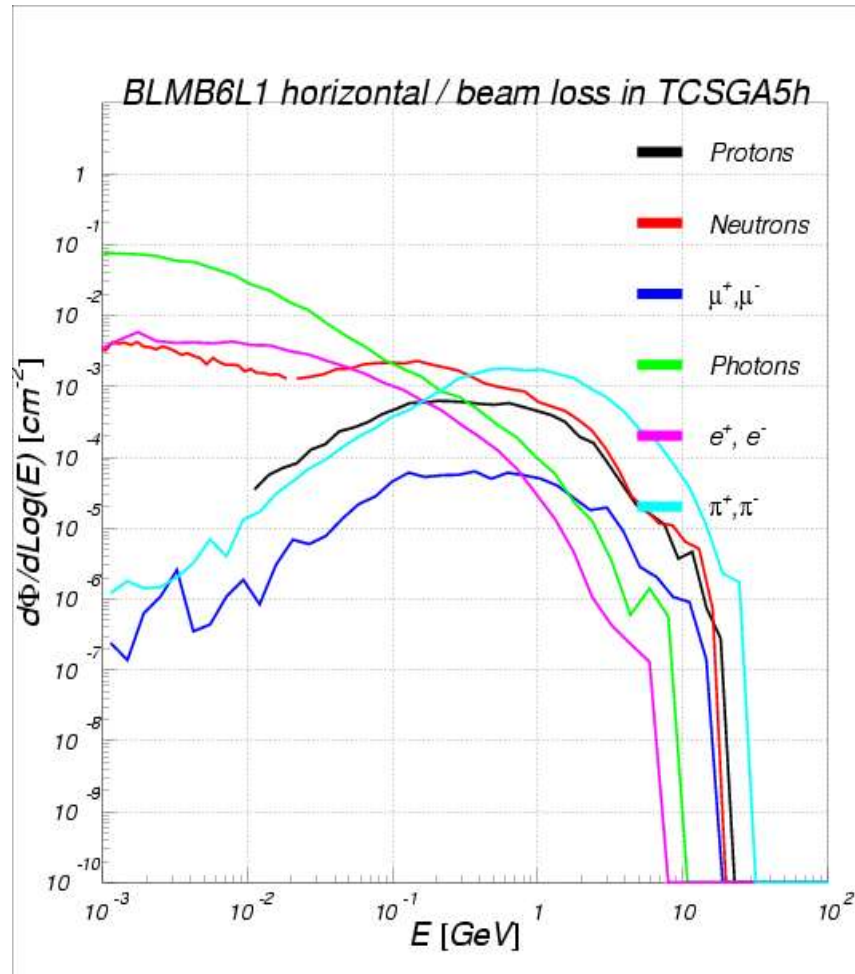
Vertical beam loss scenario

	L1									R1	
	D6	C6	B6	A6	B5	A5	D4	B4	A4	A4	
	0.962 _{8.3}	0.578 _{4.9}	0.338 ₅	0.247 _{7.7}	0.071 ₁₂	0.054 _{7.3}	0.017 ₂₁	0.037 ₇₁	0.015 ₂₃	0.026 ₂₈	TCPD6
	0.038 ₁₃	0.419 _{4.9}	0.499 _{5.8}	0.22 ₆	0.036 ₁₁	0.028 _{8.3}	0.008 ₂₅	0.003 ₂₉	0.073 ₉₄	0.003 ₂₀	TCPC6
	5.5E-4 ₃₉	0.003 ₁₀	0.163 _{5.8}	0.292 _{7.7}	0.066 ₁₆	0.041 _{7.3}	0.013 ₁₆	0.004 ₁₈	0.007 ₂₂	0.020 ₄₁	TCPB6
	0 _{5.8}	0 _{2.9}	0 ₃	0.241 _{6.8}	0.204 _{7.6}	0.144 _{4.5}	0.053 ₁₄	0.039 ₄₁	0.052 ₅₂	0.034 ₁₅	TCPA6
	0 _{5.8}	0 _{2.9}	0 ₃	0 _{3.2}	0.622 _{8.4}	0.595 _{3.6}	0.322 _{5.9}	0.258 _{8.5}	0.252 ₁₂	0.23 _{8.3}	TCSGB5
	0 _{5.8}	0 _{2.9}	0 ₃	0 _{3.2}	3.6E-4 ₂₆	0.139 _{4.5}	0.588 _{8.3}	0.659 ₇	0.6 ₁₃	0.681 _{9.9}	TCSGA5



Simulation of Beam Loss monitors 3/3

Predicted response of every BLM



- Detected particles
 - Protons
 - Neutrons
 - Muons (+/-)
 - Photons
 - Electrons/positrons
 - Pions (+/-)
- Loss scenarios (7TeV)
 - Horizontal
 - Vertical
 - Full losses
- 2 detectors/BLM
- Injection not analyzed

Future outlook

- Cold section: Injection
- Warm magnets:
 - Correct position
 - Heat load during injection
 - Vertical case...
- Reports
 - IR7-FLUKA techniques
 - Optimization of the active absorber scheme for the protection of the dispensor supressor
 - Protection of warm elements at IR7, passive absorbers and collimators
 - FLUKA simulations for the optimization of beam loss monitors
- ...