

# Beam Studies

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WA105 general meeting

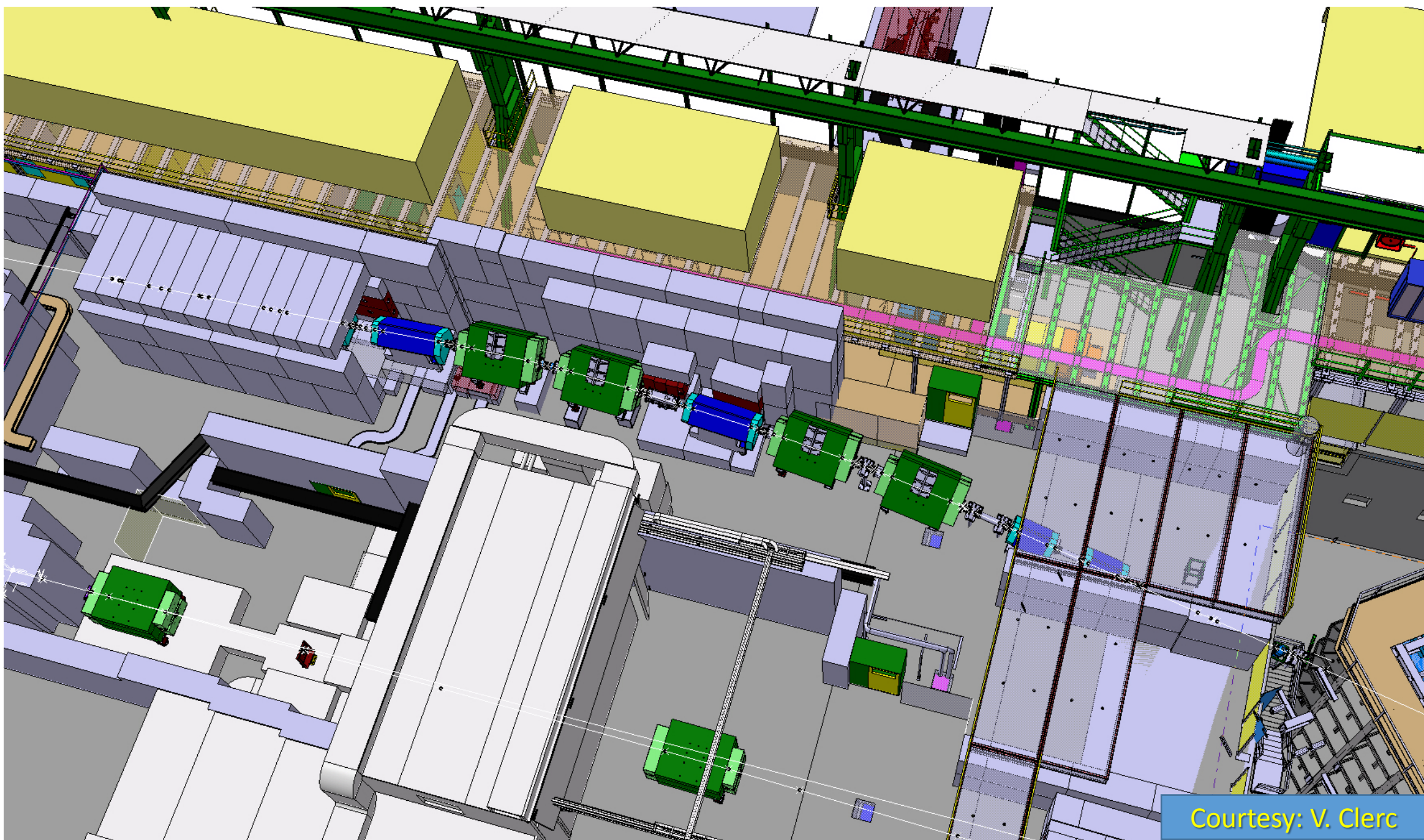
March 22<sup>nd</sup>, 2017



ENGINEERING  
DEPARTMENT

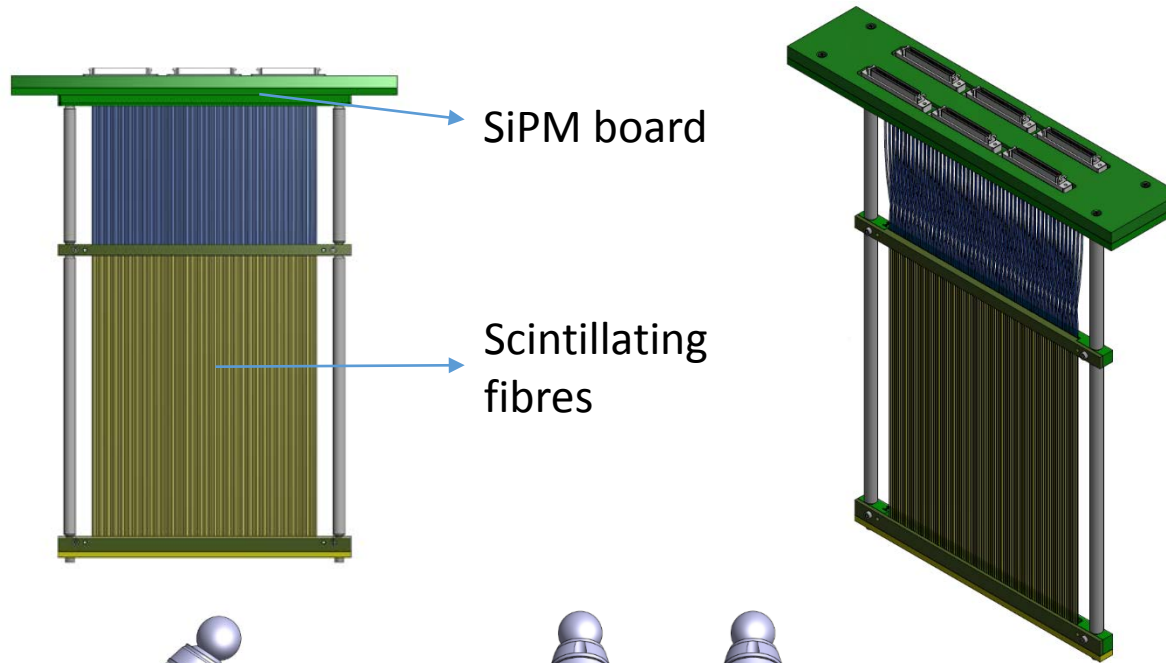
# The beam for WA105

- Requirements / Implementation
  - Beam momentum  $\sim 1\text{GeV}$  to  $12\text{ GeV}/c$ ,  $\pi$ , K, p, e Use a set of dedicated (material and size) targets Cu, W
  - Trigger for WA105 3 Scintillator plates & Cherenkov
  - Particle Id 2 Cherenkov counters and moderate TOF
  - Momentum measurement Spectrometer with 3 position measurements
  - Beam profile for beam tuning x,y position measurements at different z values
  - Log and use off-line beam data Use White Rabbit to synch Lar + Beam data

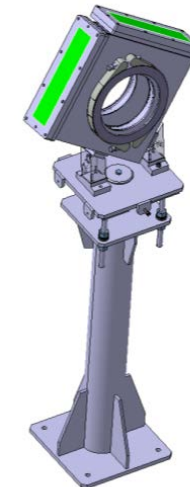
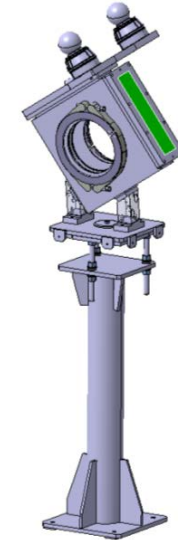
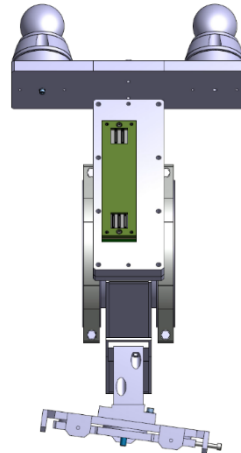
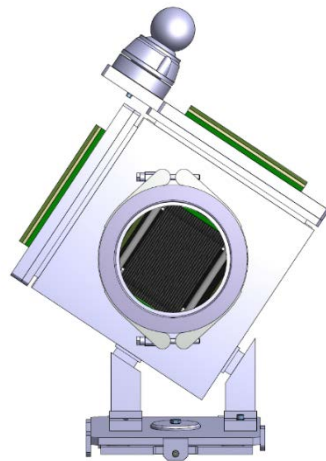
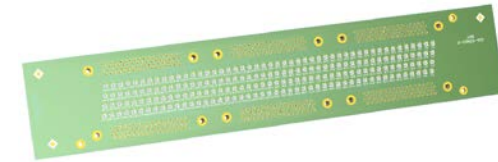


Courtesy: V. Clerc

# Position detectors based on scintillating fibres read out with silicon photomultipliers.



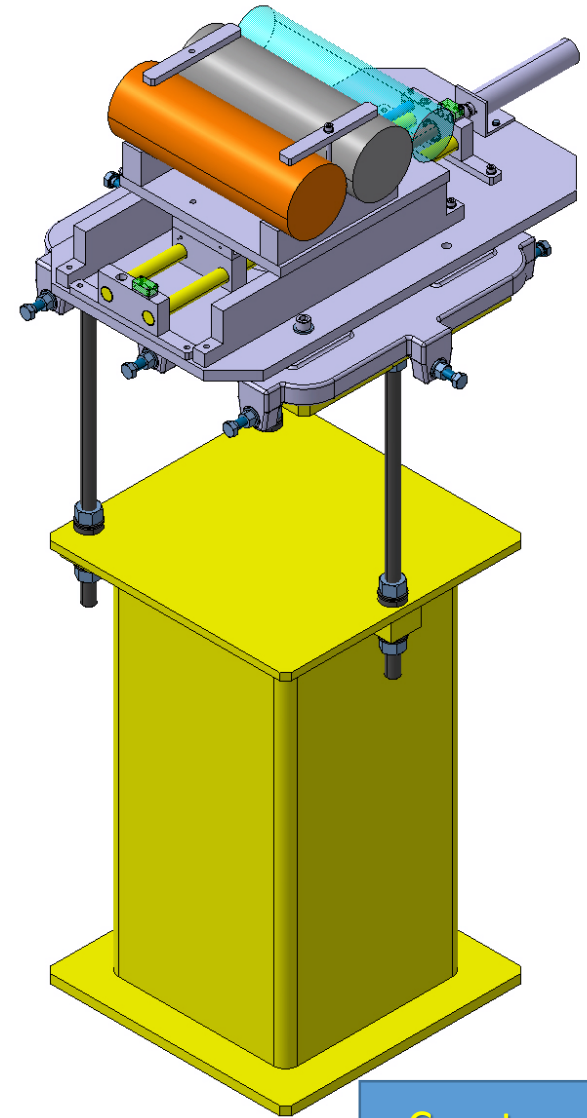
- One layer of 1mm square fibres.
- 200 channels.
- Individual MPPC for every fibre.



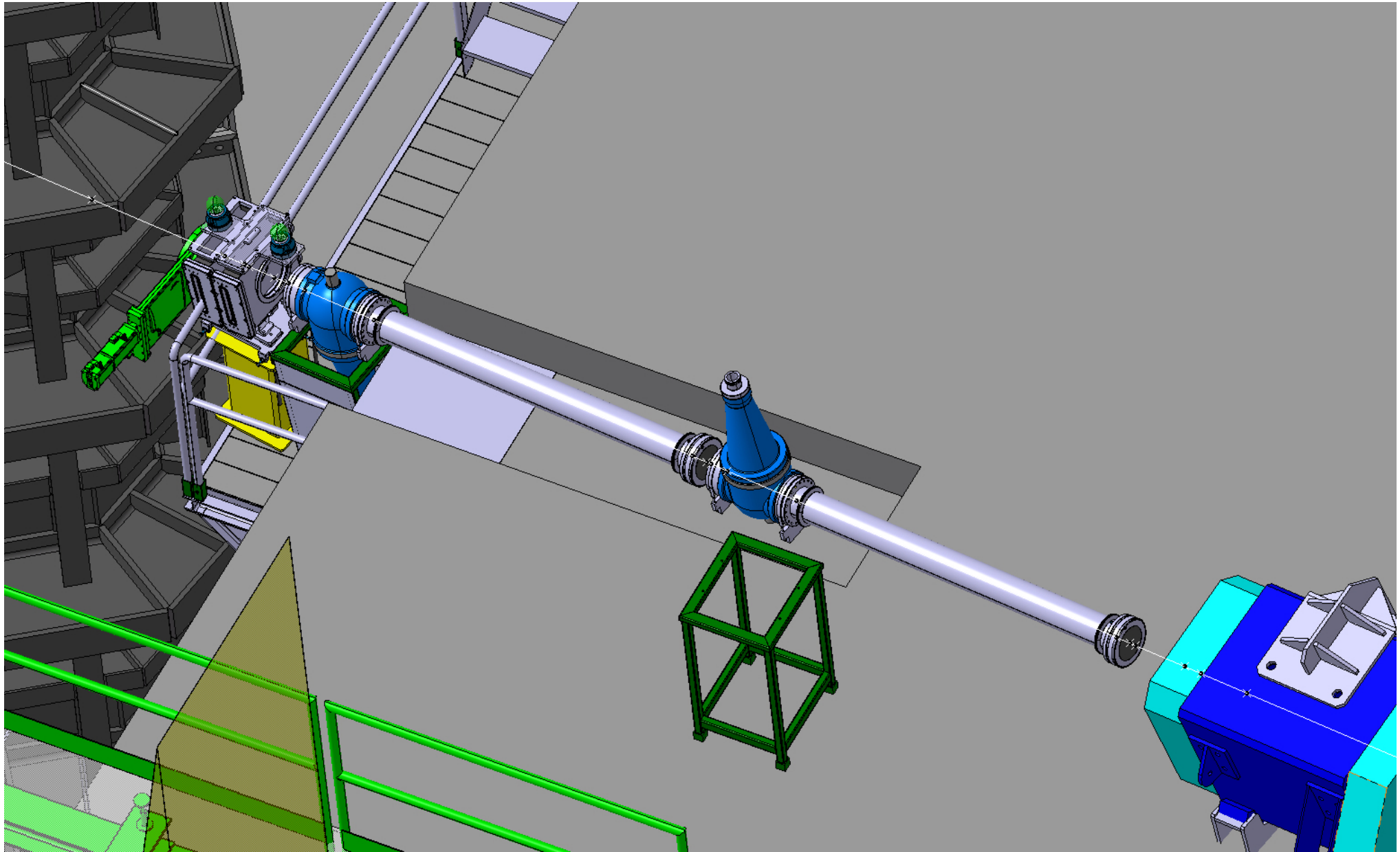


# Target station

- 3 targets (2 hadron and one electron targets)  
→ Implementation under study
- Horizontal remote configuration
- Table / design/ integration by EN/EA, adjusted to the dimensions of the targets for H2/H4.
- One of the two targets easily removable if needed (1/2h intervention)
- Targets cut in order to easily change the length in order to enhance/suppress several particles if needed.



Courtesy: D. Brethoux



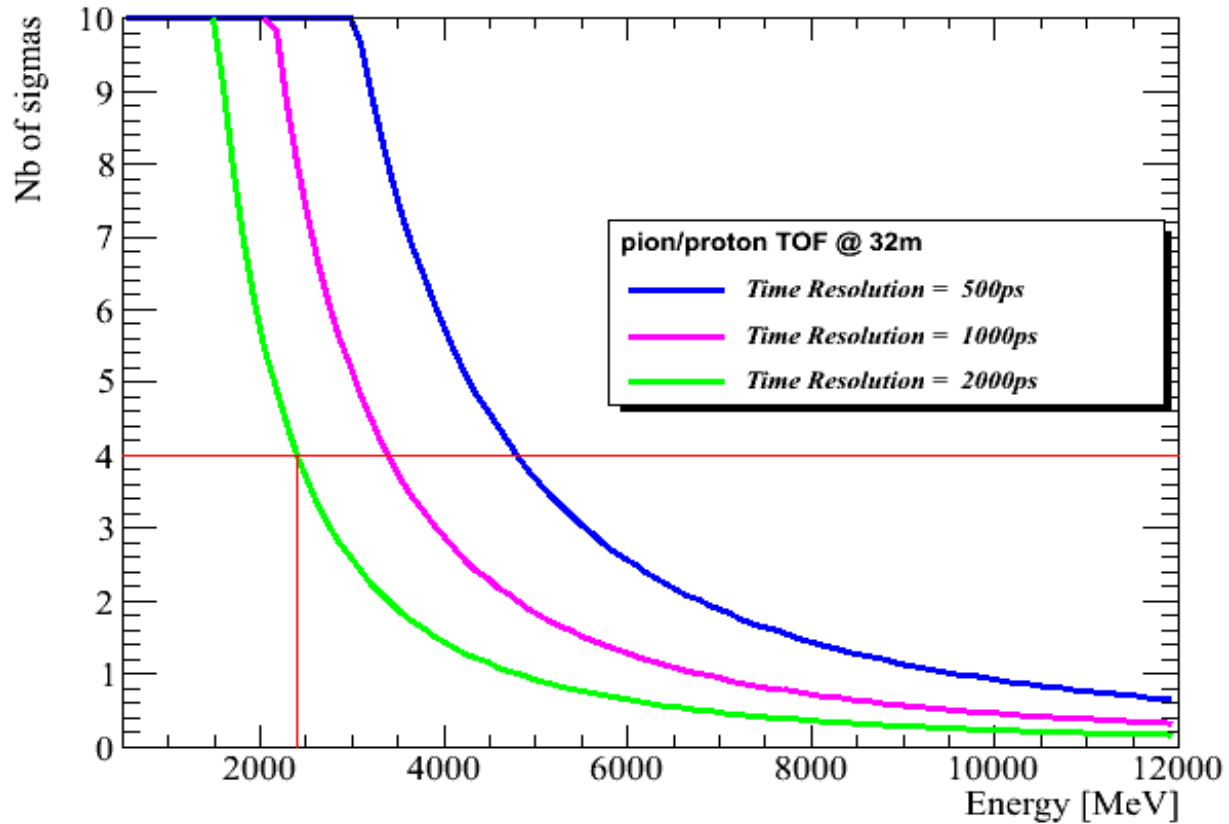
## H2 Final PID Schema

- TOF with BPROF's – distance  $\sim 32$  m
- 1 “low pressure” XCET -  $< 3$  bar pressure (“C1”)
- 1 “high pressure” XCET -  $\geq 15$  bar pressure (“C2”)

Momentum (GeV/c) / Particle	e	$\pi$	K	p
0.4 - 3.0	C1 CO2 @ 1bar	TOF	0	TOF
3.0 - 5	C1 CO2 @ 1bar	C2 CO2 @ 3.5 bar	No C2	No C2
5.0 - 12.0		C1 CO2 @ 1bar	C2 CO2 @ $\leq 14$ bar	No C1 No C2

No K/p separation between 3 - 5 GeV  
No e- tagging in the ‘high energy’ regime 5-12 GeV

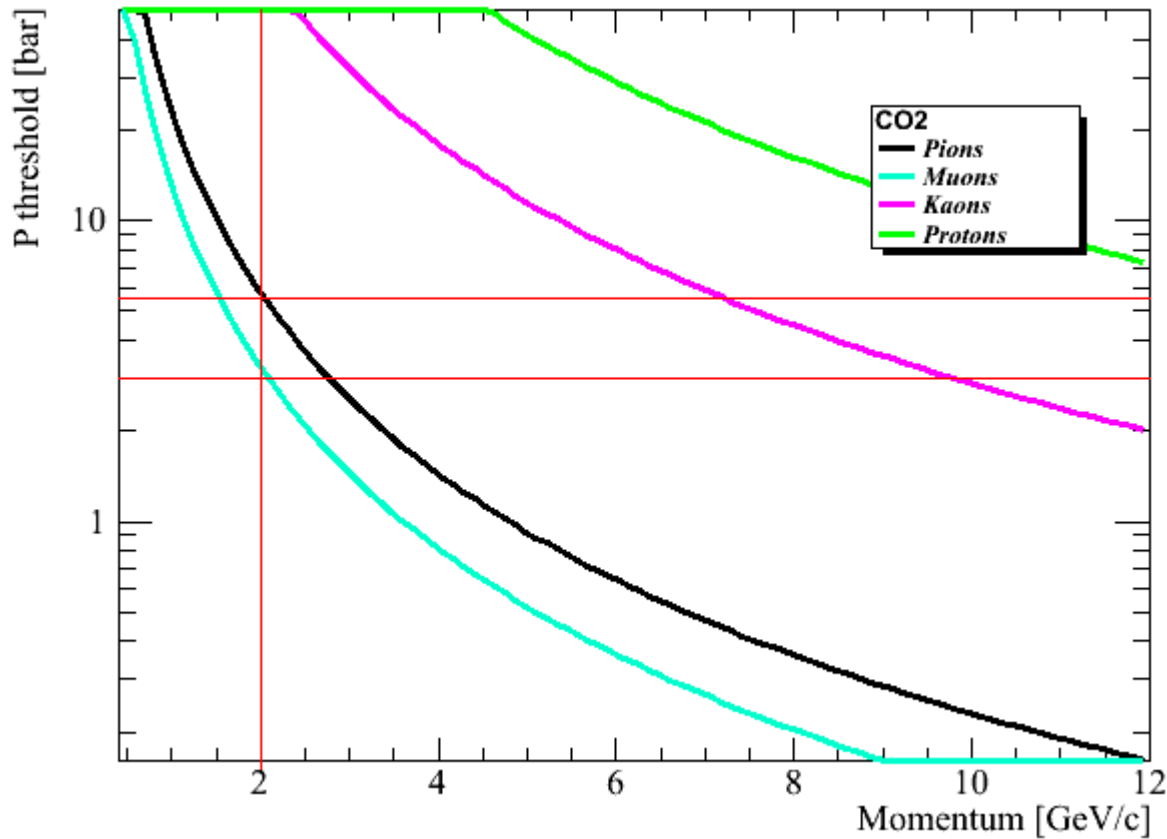
# H2 PID Schema – TOF



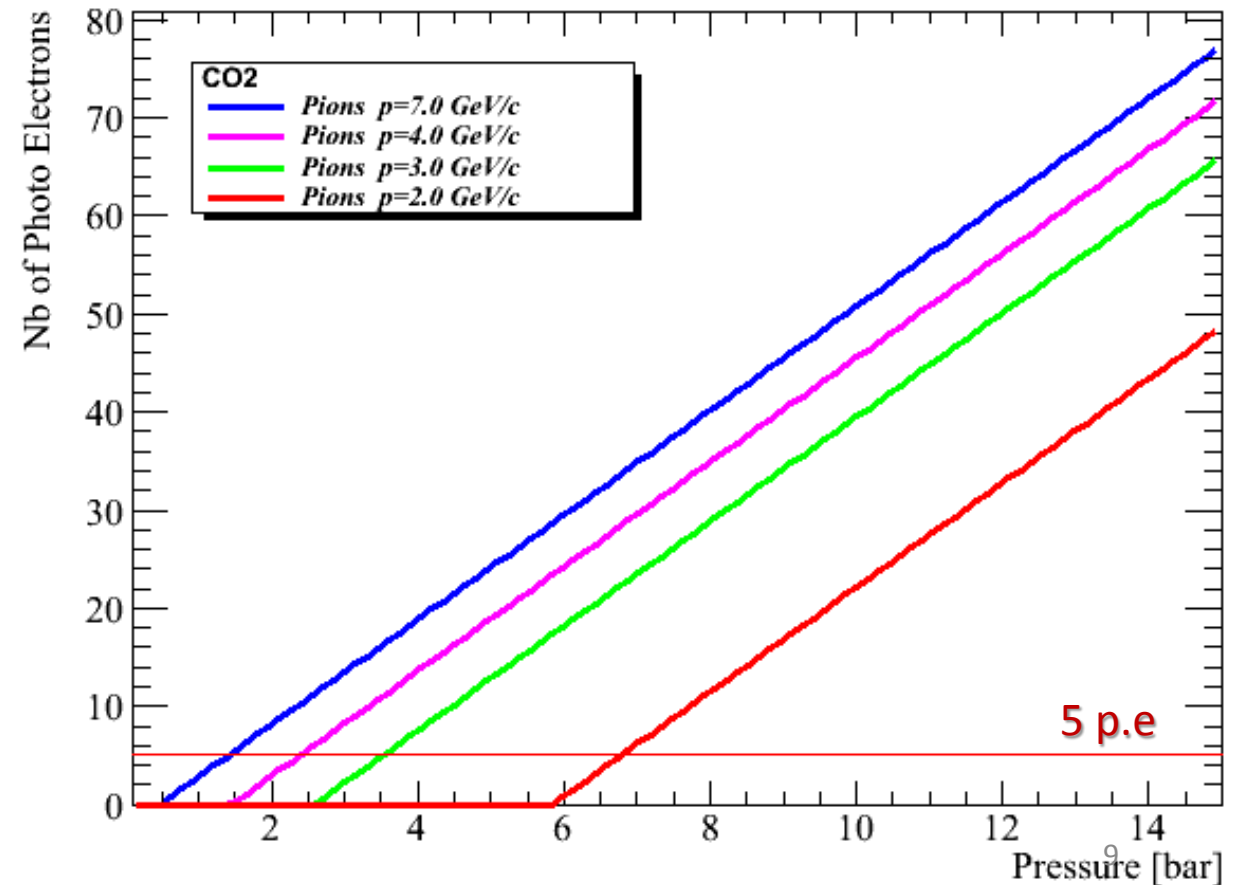
- ‘Moderate’ TOF needed
  - If  $\sigma = 2\text{ns}$   $\rightarrow$   $p/\pi$  up to 2 GeV
  - If  $\sigma = 0.5\text{ ns}$   $\rightarrow$   $p/\pi$  up to 4.5 GeV



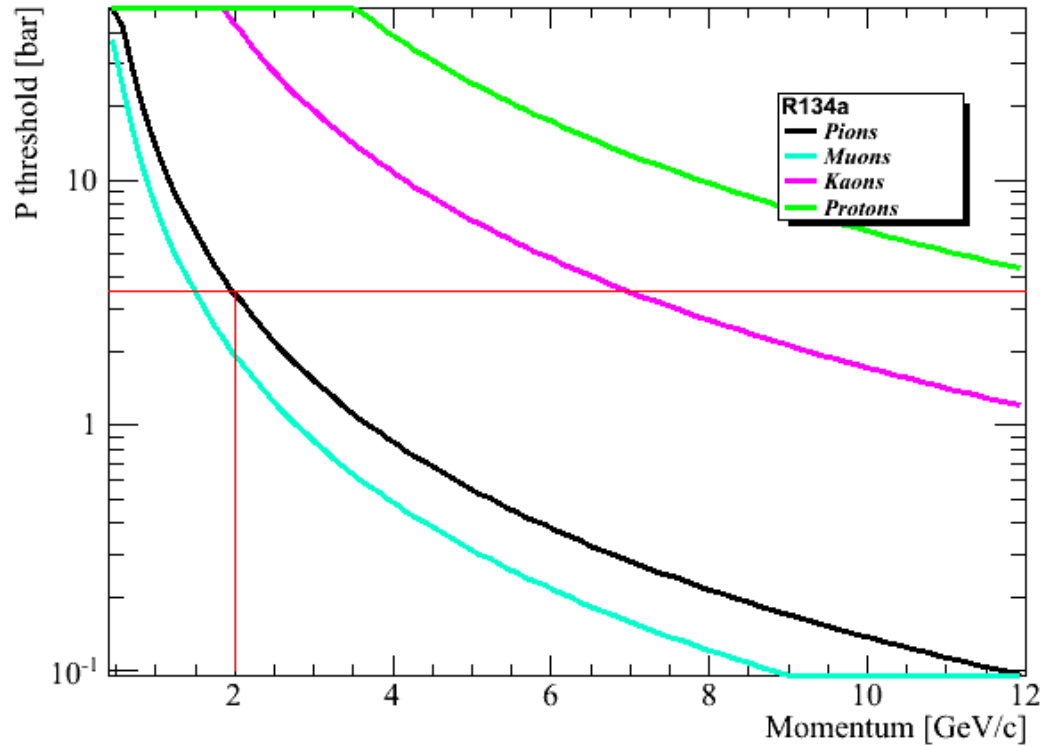
# H2 PID Schema – XCET – Only CO<sub>2</sub>



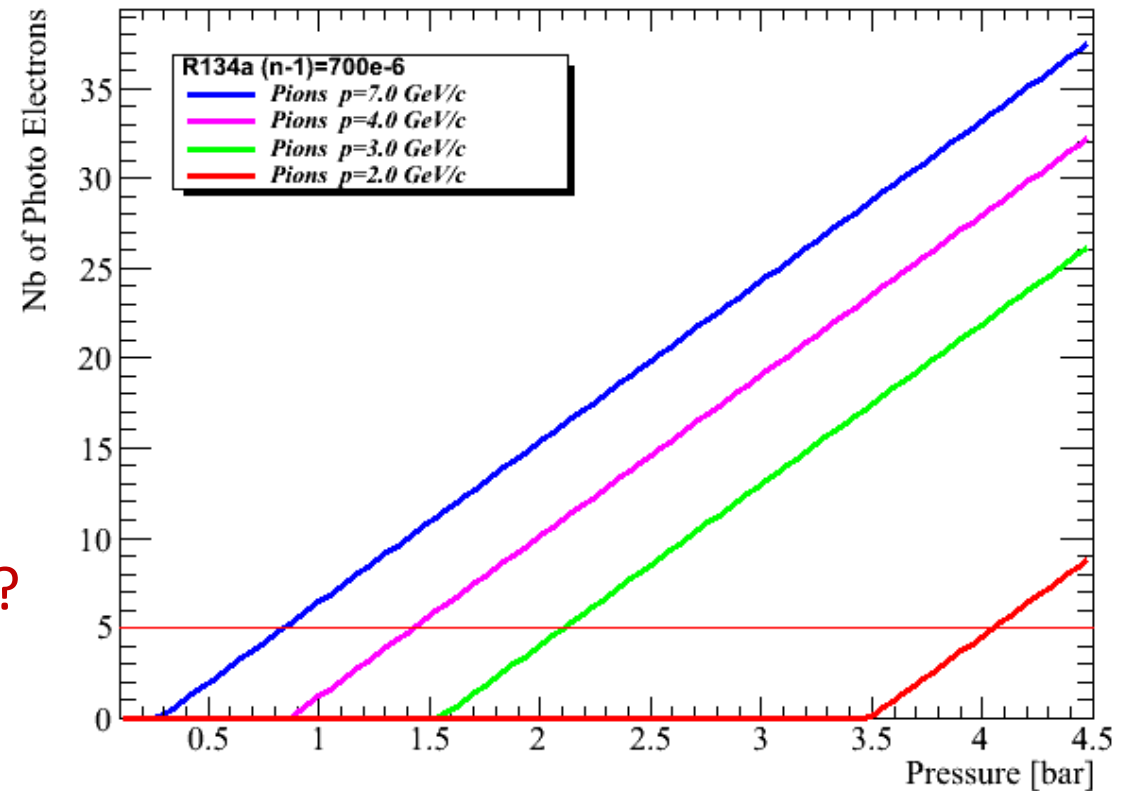
- 1 high and 1 low pressure XCET
- $p/\pi$  from 2 GeV – C2 @ 6-7 bar
- $p/\pi$  from 3 GeV – C2 @ 3.5-5 bar



# H2 - If TOF fails – Backup solution with R134a



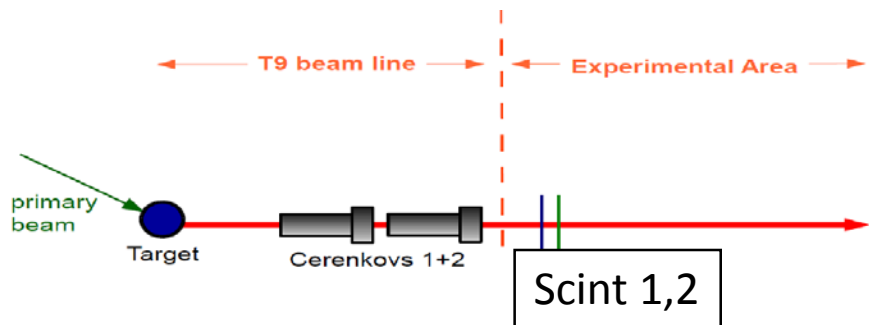
- If TOF fails then we can ‘salvage’ with R134a :
  - $p/\pi$  from 2 GeV – C2 @ 3.5 – 4 bar
  - $T > 30$  deg (cover of the gas system)



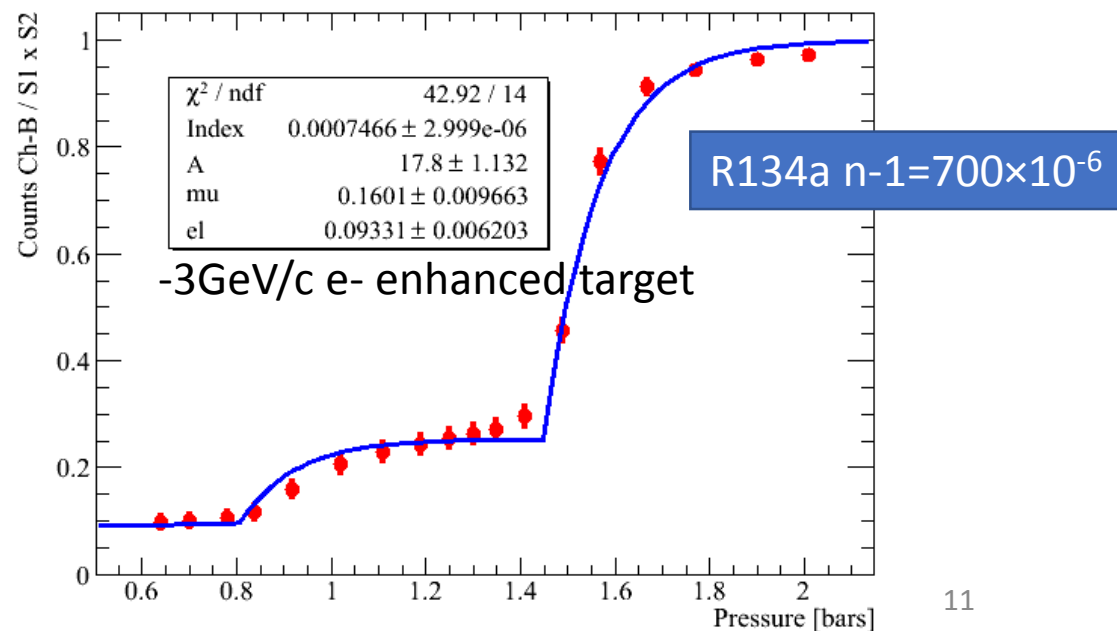
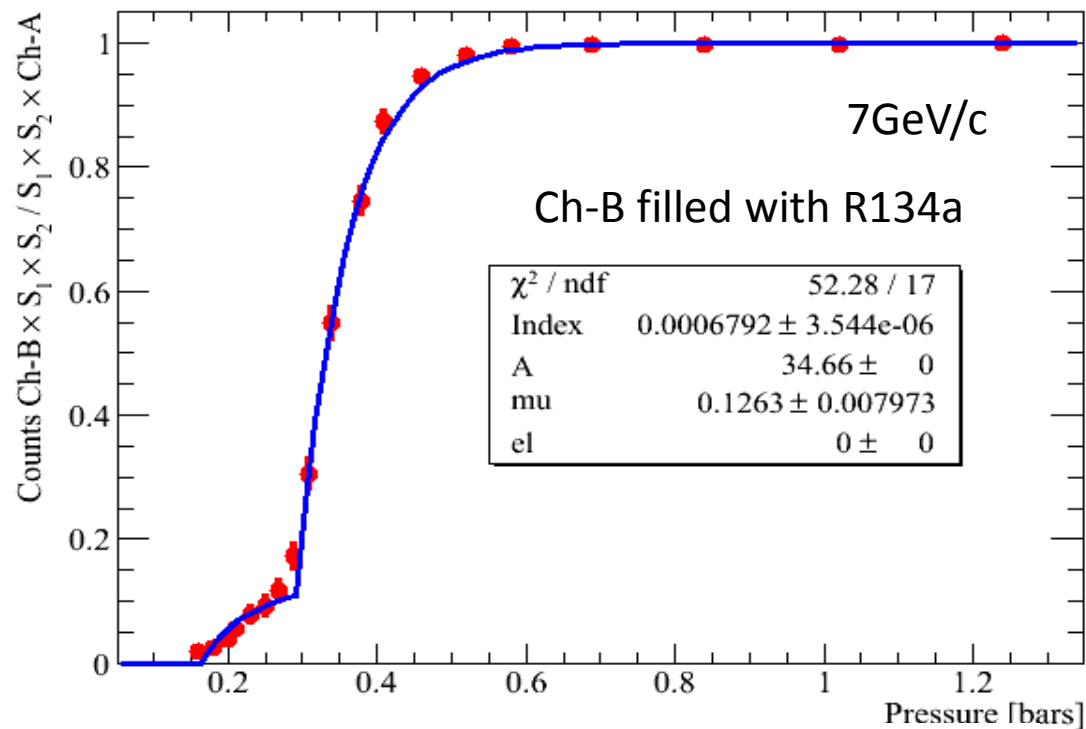
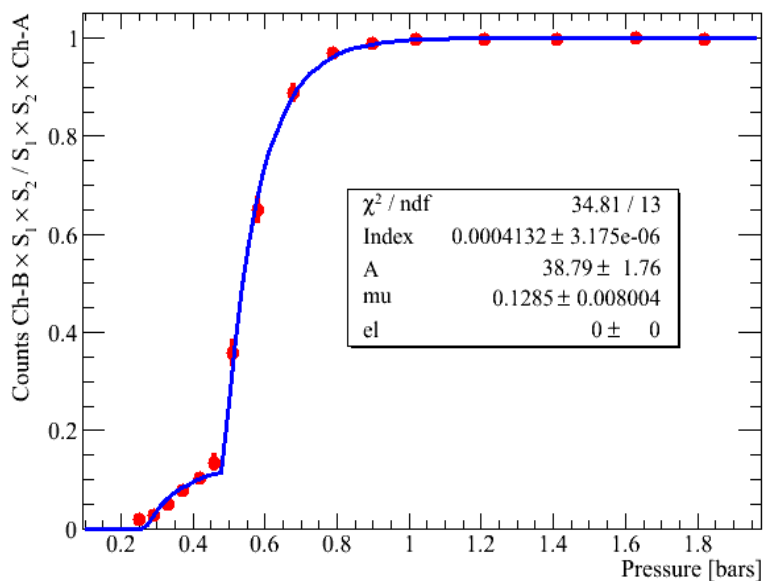
Maybe R134 (not “a”) could be tested in May @ T9 ?

# Estimating the R134a index

Dedicated experiment at PS, T9, November 2016



Both Cherenkovs filled with  $\text{CO}_2$   $n-1=425 \times 10^{-6}$

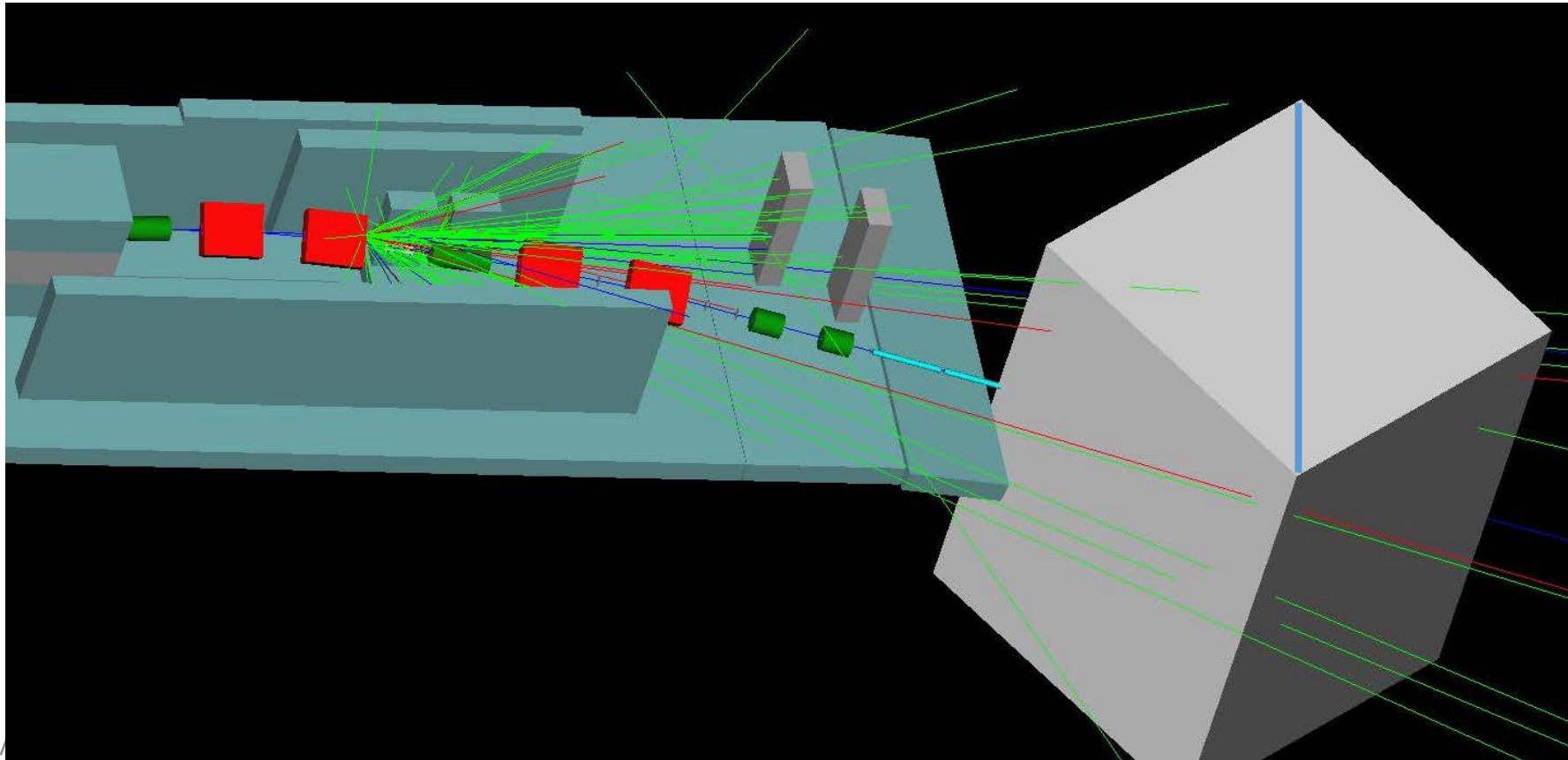


# Hardware status

- CERN BE-BI and EN-EA groups are responsible to produce the detectors, and provide the data
  - ✓ Cherenkov needs all decided, green light to produce and install
  - Position monitors : mechanics ok, electronics under development, 1<sup>st</sup> prototype Sept 2017, test on beam Oct 2017.
  - TOF same mechanics as position monitors, dedicated electronics and DAQ
  - Install electronics barrack
- WA105 responsibility
  - Build the trigger
  - Install a dedicated TOF electronics
  - Beam data handling
  - Aim to install the system by fall 2017 for a fake beam test

# Improved G4BeamLine simulation

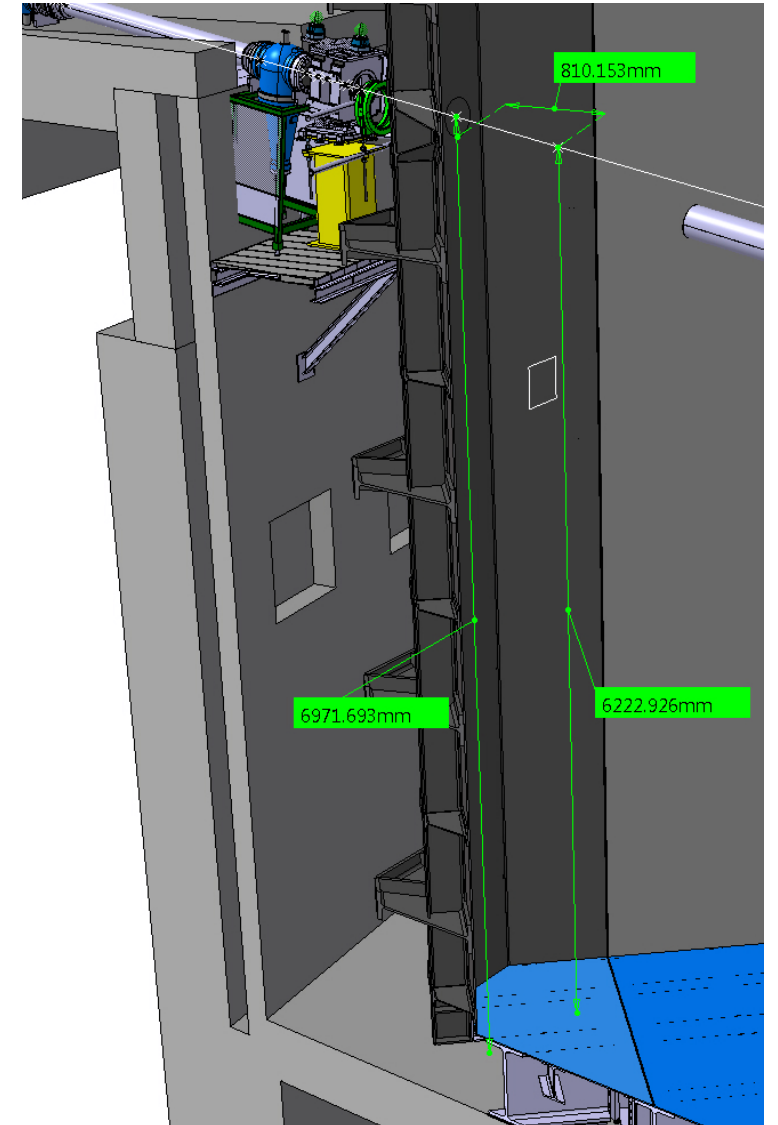
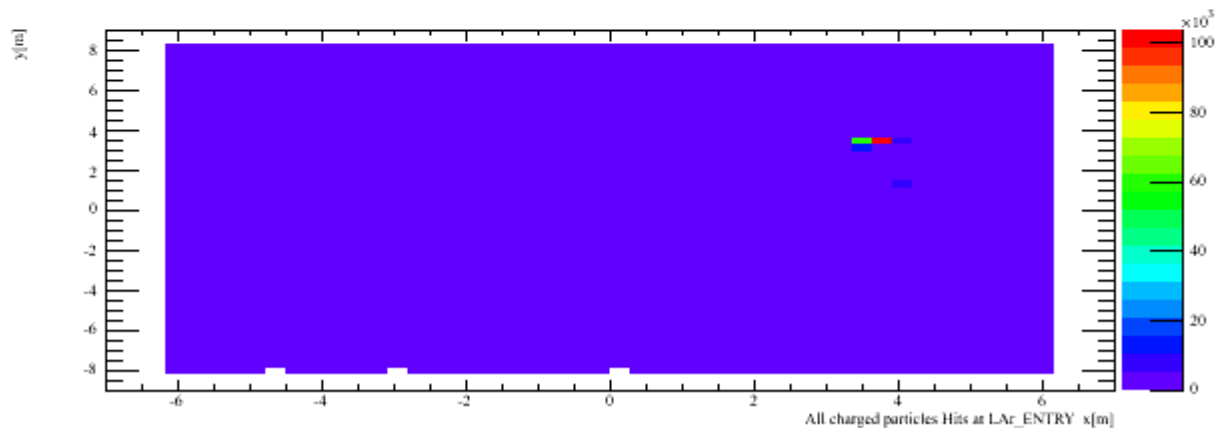
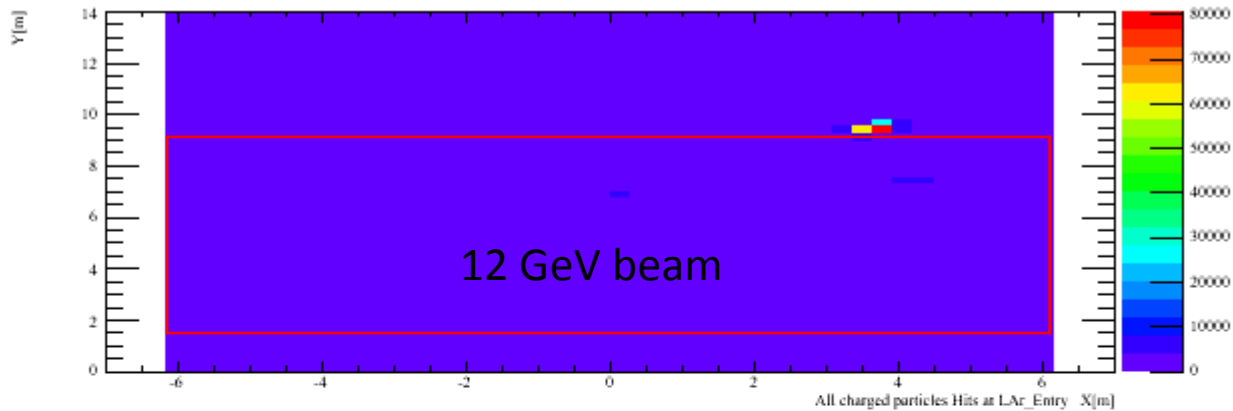
- Exact beam layout implemented, tilted magnets, .....
- Included all shielding in place
- Background characterization and shielding

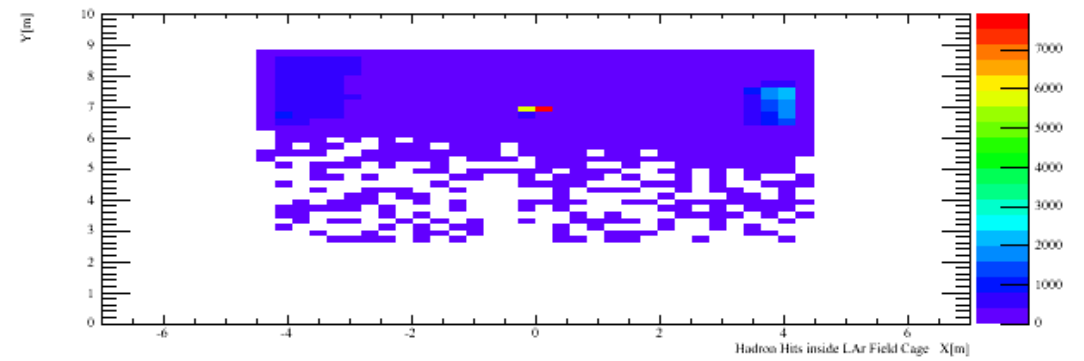
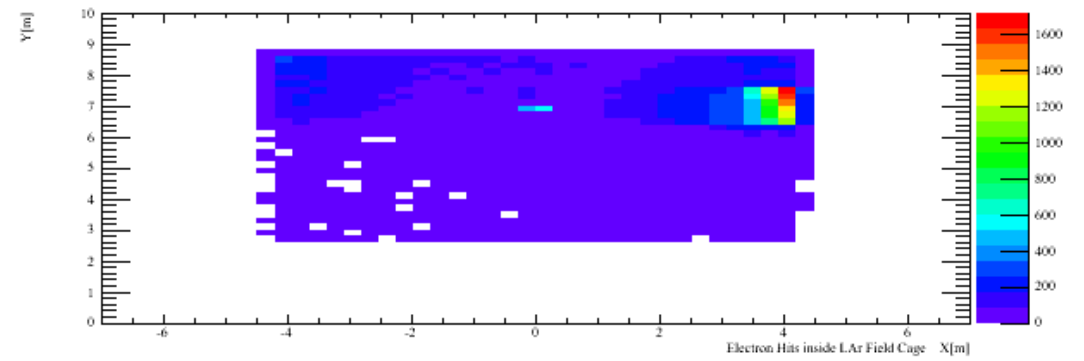
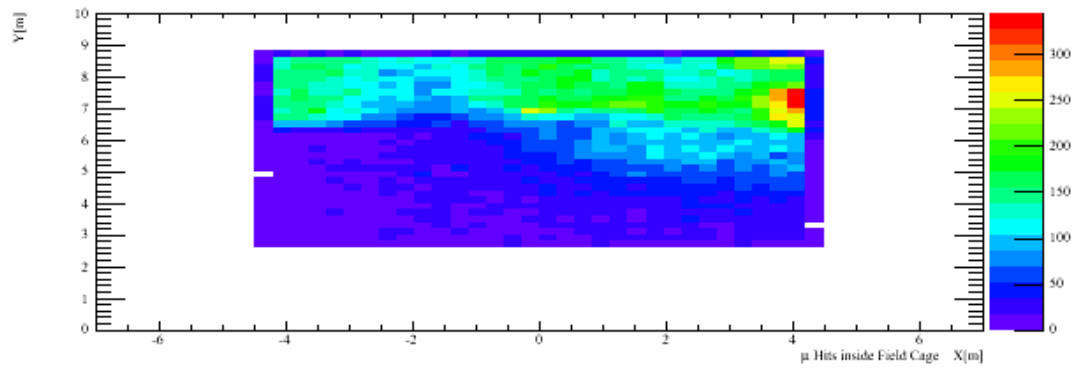
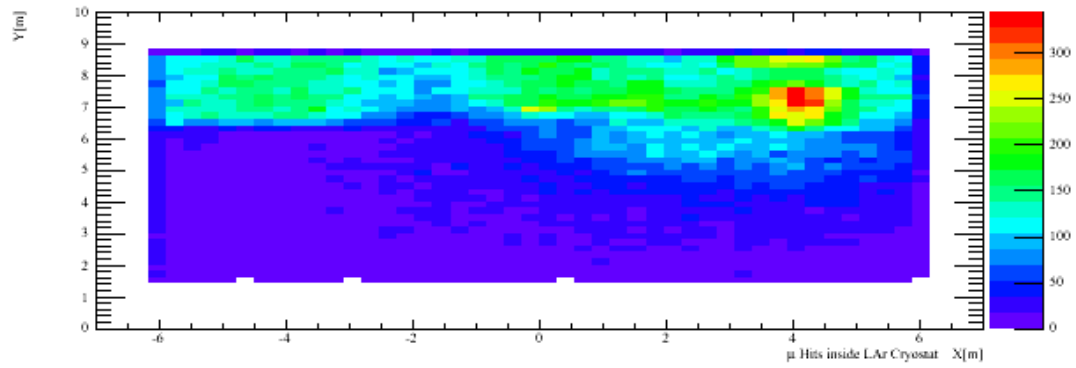




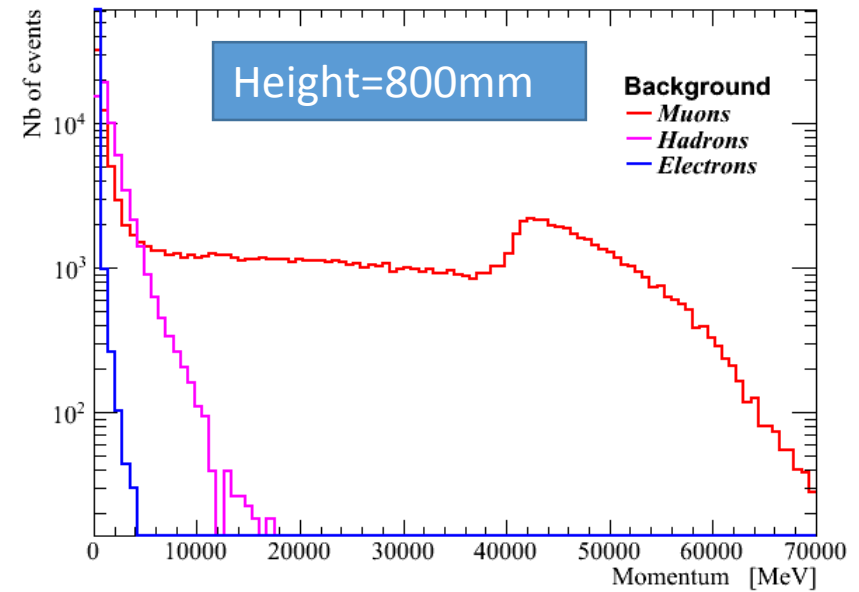
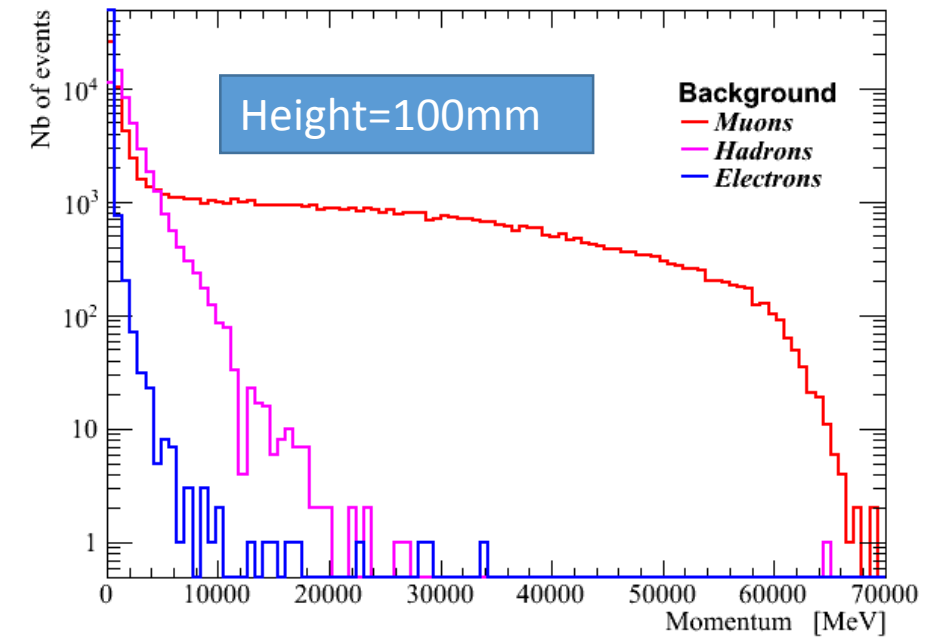
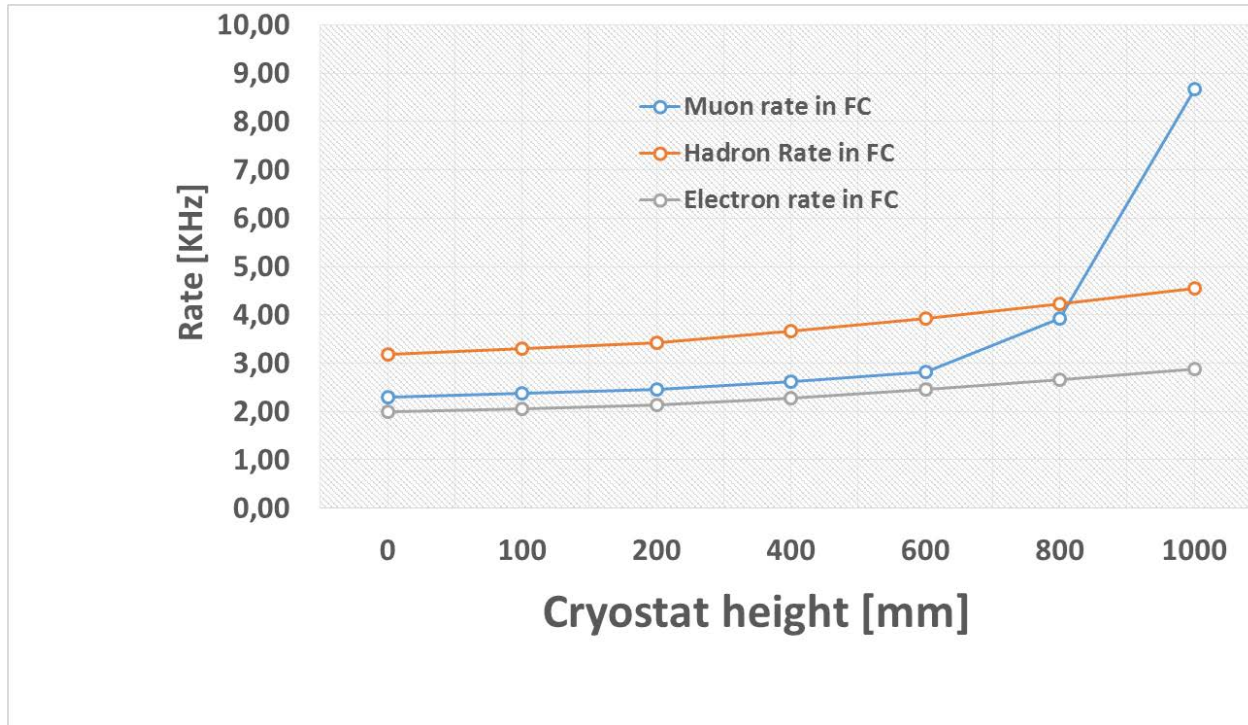
# Muons and other Background

- High energy muons from primary/secondary target and other beams
- Low energy muons, hadrons and electrons
- Updated numbers for the LAr position, survey is coming soon





Background for cryostat height = 100mm  
 $\sim 2.2\text{KHz } \mu, e \pi \sim 3\text{ KHz}$ , Total  $\sim 7.5\text{KHz}$



More detailed simulations to follow soon (+ electron beams)

# Conclusion

- Beam instrumentation well defined
- Next priorities
  - Follow up construction
  - Integrate beam signals to WA105 control room
  - Integrate Beam Data to LAr data
  - Continue background studies