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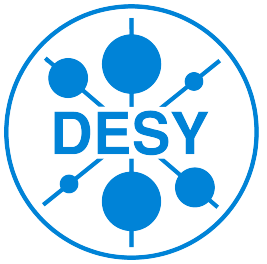


Low – energetic Pions in the Analogue HCAL (FNAL Data)

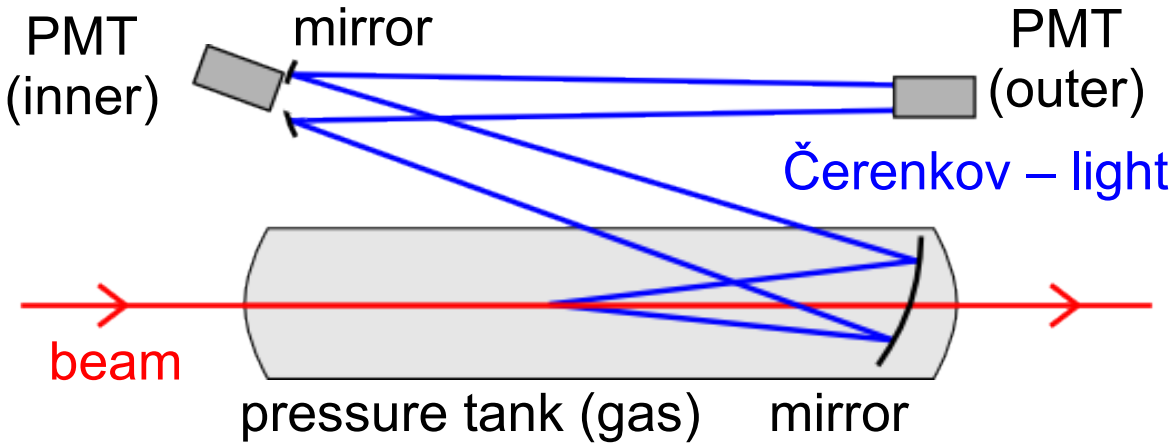
Nils Feege
University of Hamburg

CALICE Analysis Meeting, 27 July 2009

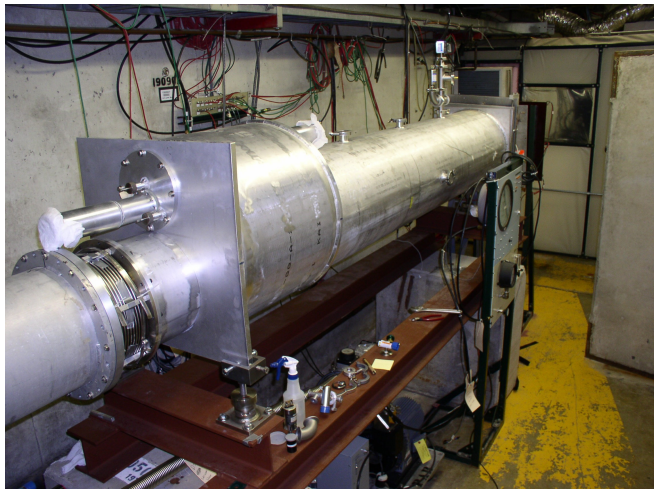
Outline

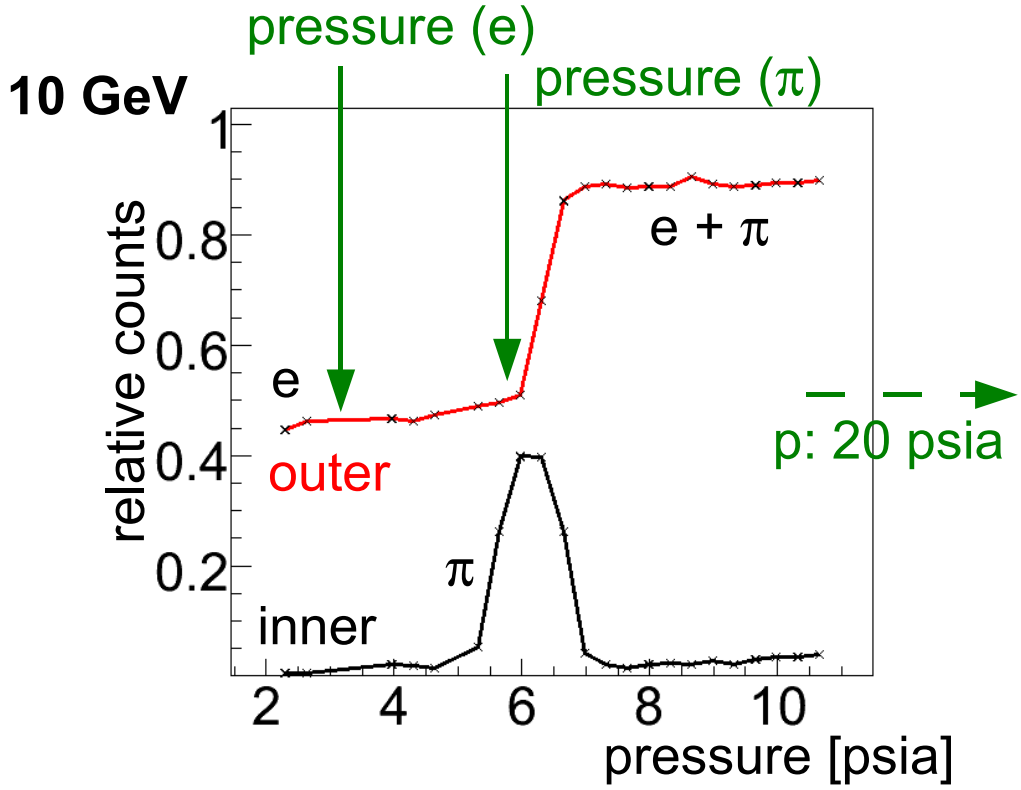
- Reminder: The Čerenkov trigger at FNAL
- e/π separation in the AHCAL (w/o ECAL)
- First look at 1 – 10 GeV AHCAL stand – alone data

Differential Čerenkov – Counter



Triggering on Čerenkov:
enhance π / e / p content
e.g. π content (10 GeV):
~50 % → ~90 %

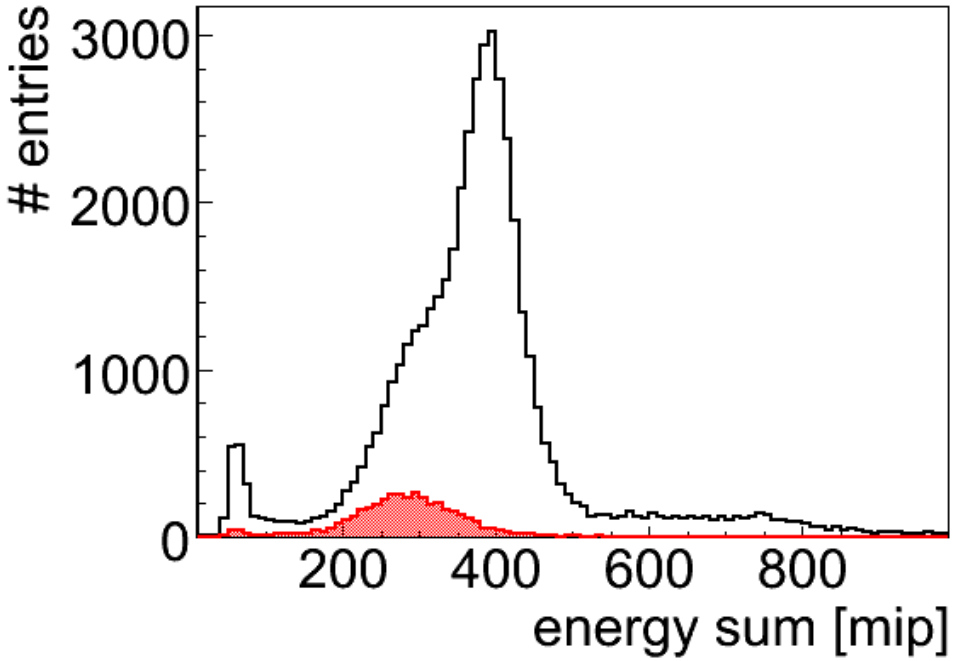




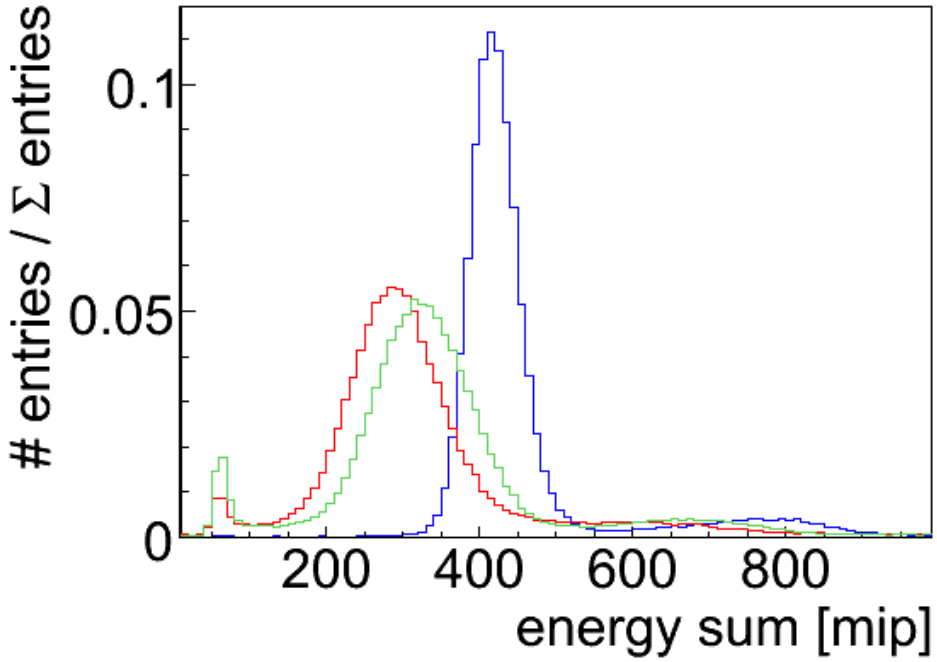
Example: Enhancing p / π / e Content

Beam energy: 10 GeV

1 run: 'mixed' data



3 different runs: p, π and e enhanced



- mixed → 10x10
- offline selection of p:
  - 10x10 && !C_{inner} && !C_{outer}
  - < 10 % of collected events

p → 20 psia, 10x10 && !C_{inner} && !C_{outer}

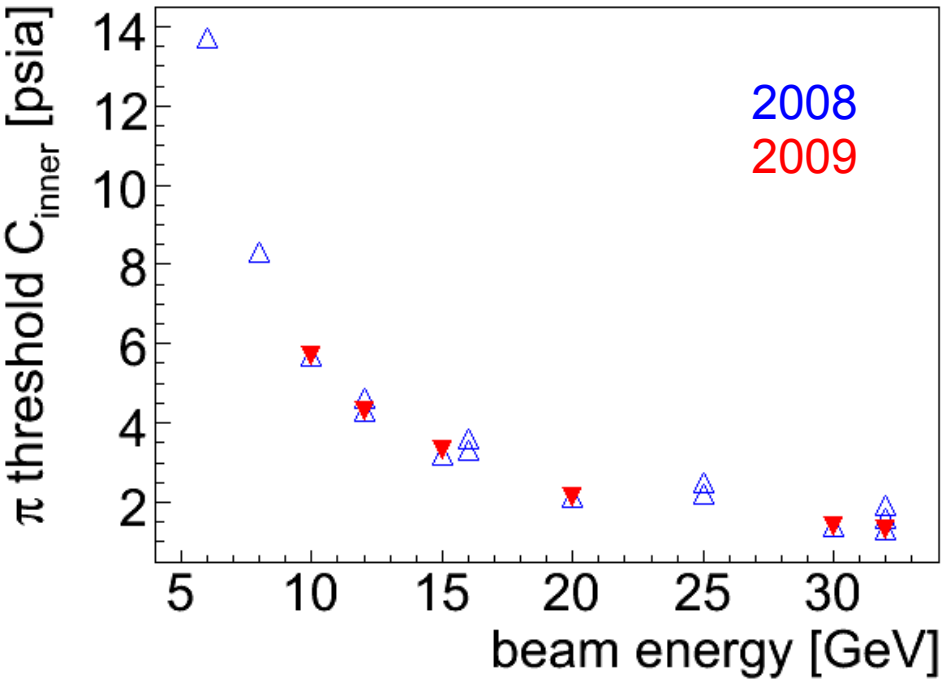
π → 5.7 psia, 10x10 && C_{inner}

e → 3 psia, 10x10 && C_{outer}

Čerenkov Operating Pressure

π (6 – 32 GeV)

- Trigger: 10x10 && C_{inner}



π (1 – 4 GeV)

- Trigger: 10x10 && ! C_{inner} && ! C_{outer}

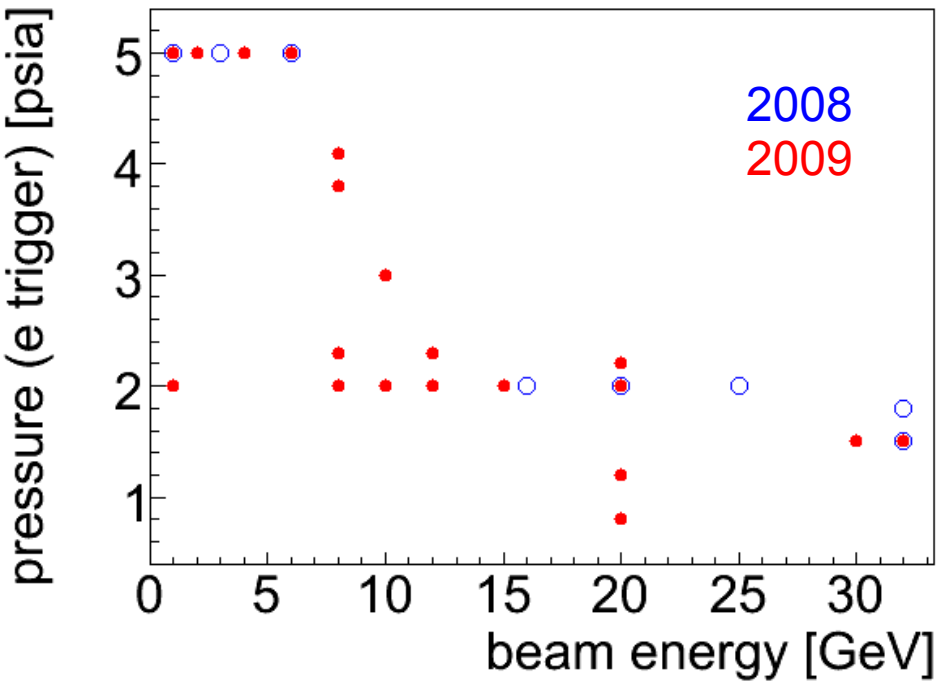
- **2008**: maximise e detection / rejection efficiency
  → operate at 20 psia

- **2009**: minimise material (gas), multiple scattering and generation of knock – on electrons in Čerenkov to maximise π rate
  → operate at 2-5 psia

- 2009 rates for 2 Gev:
  20 psia → 320 events/spill
  5 psia → 520 events/spill

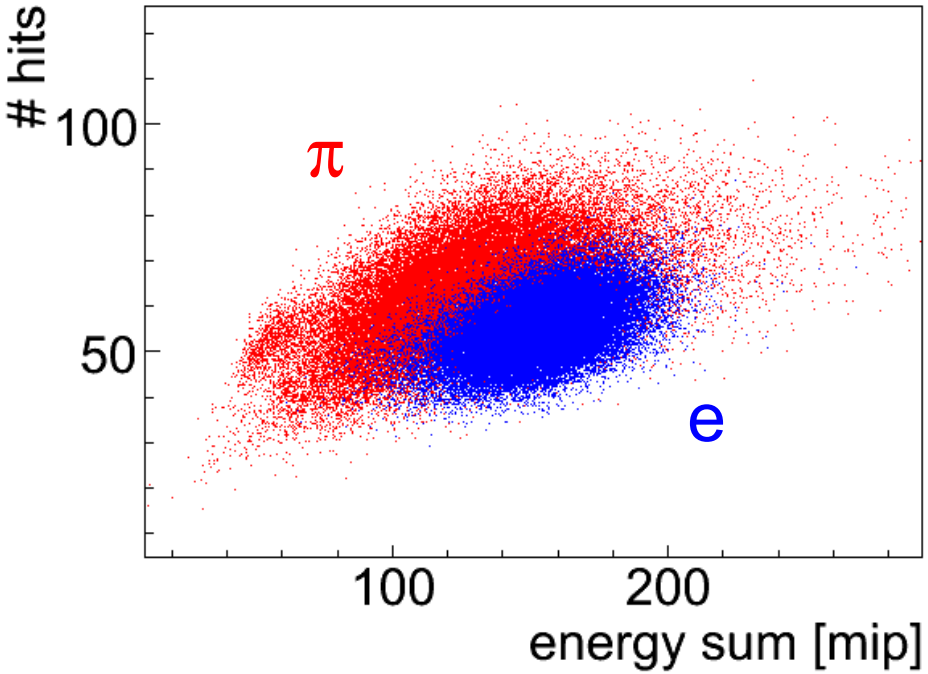
Čerenkov Operating Pressure

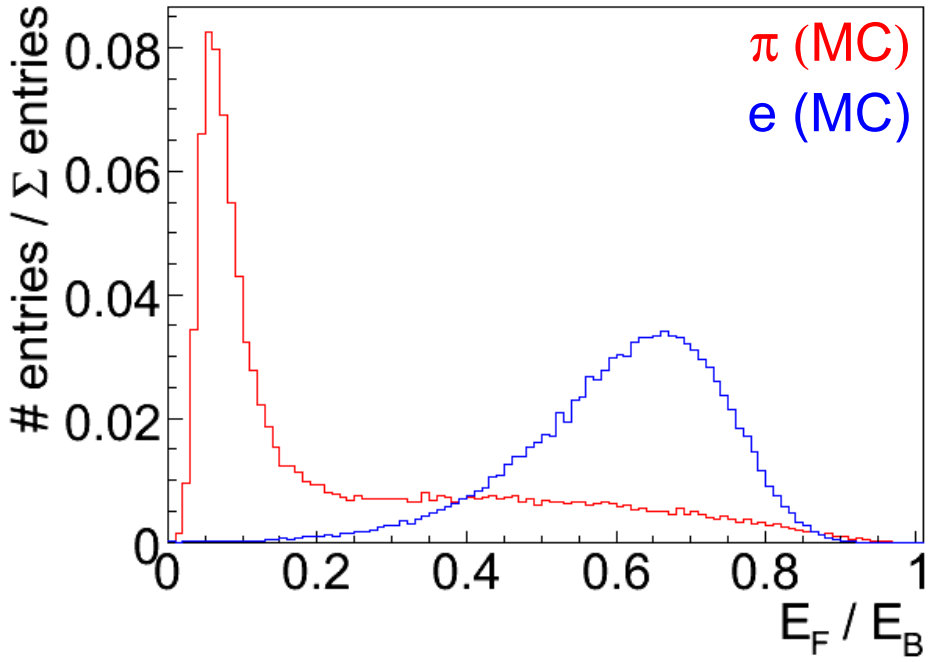
e (1 – 32 GeV)

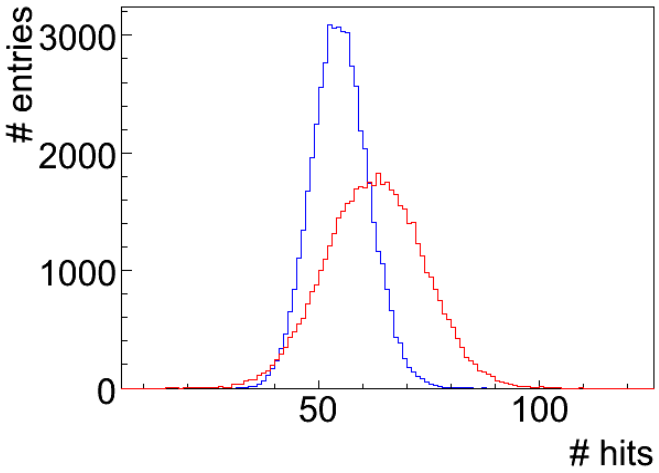


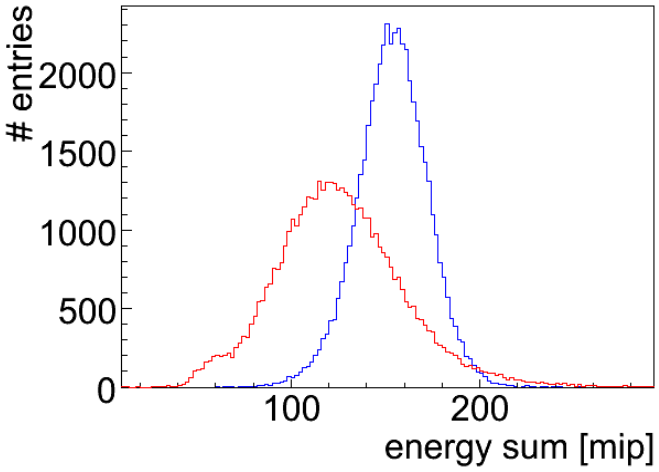
- Trigger: 10x10 && C_{outer}

e / π Separation (AHCAL)





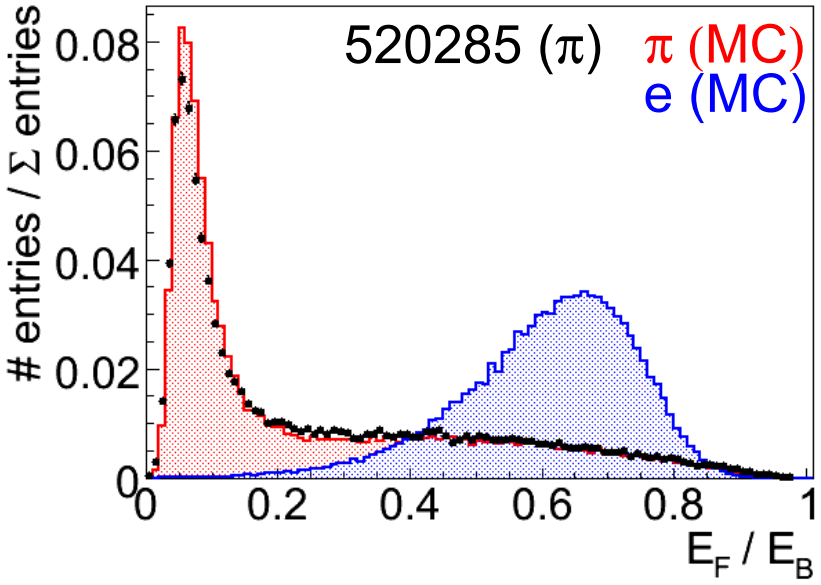


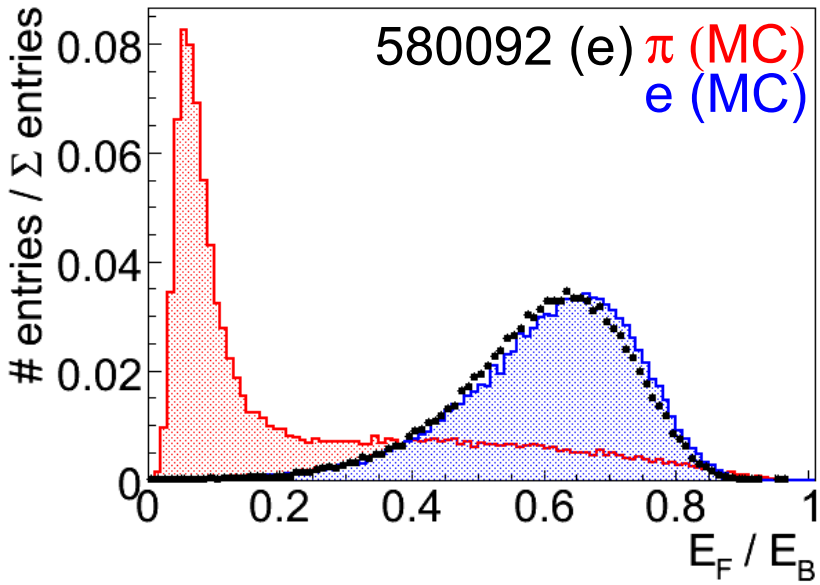


- E_F = energy sum layers 1 – 5
- E_B = energy sum layers 1 – 38
- MC based on run 520285 (4 GeV)

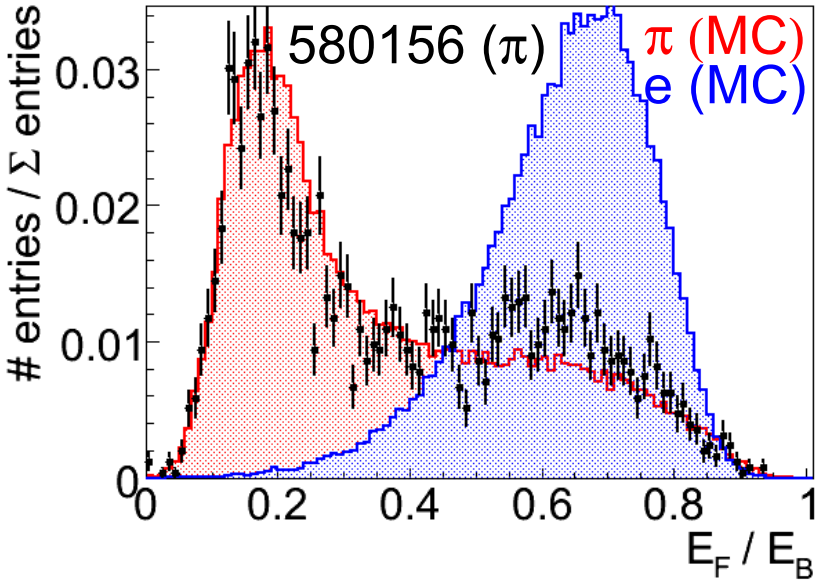
e / π Separation (AHCAL)

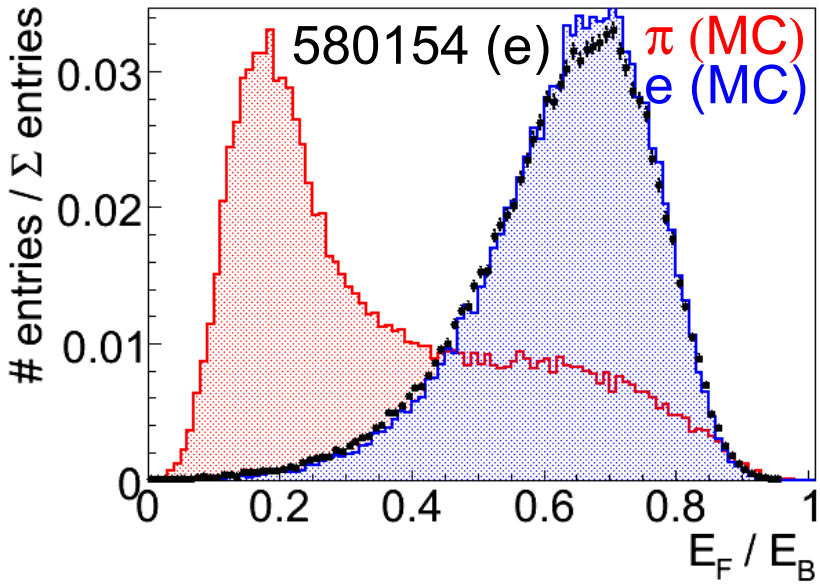
4 GeV





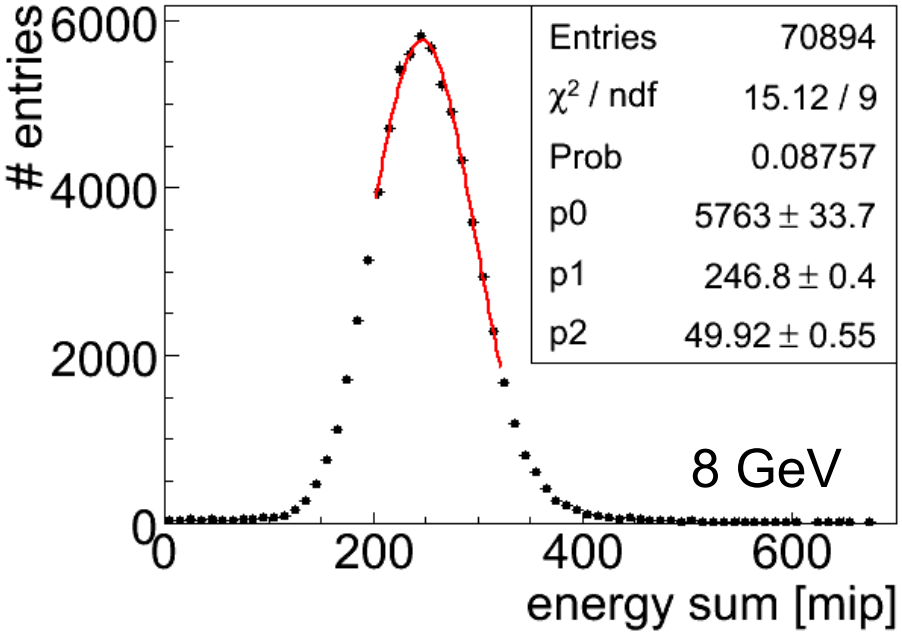
1 GeV

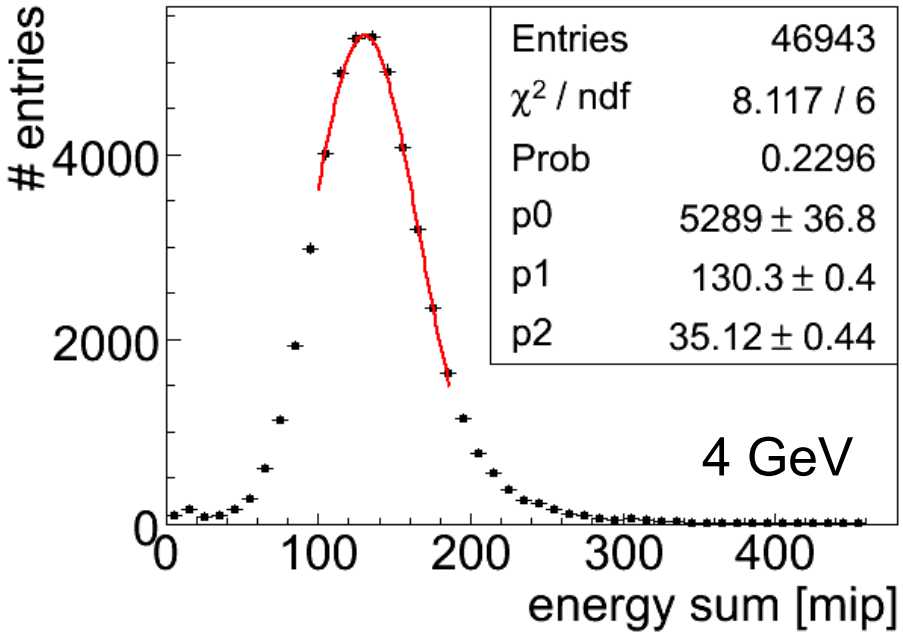


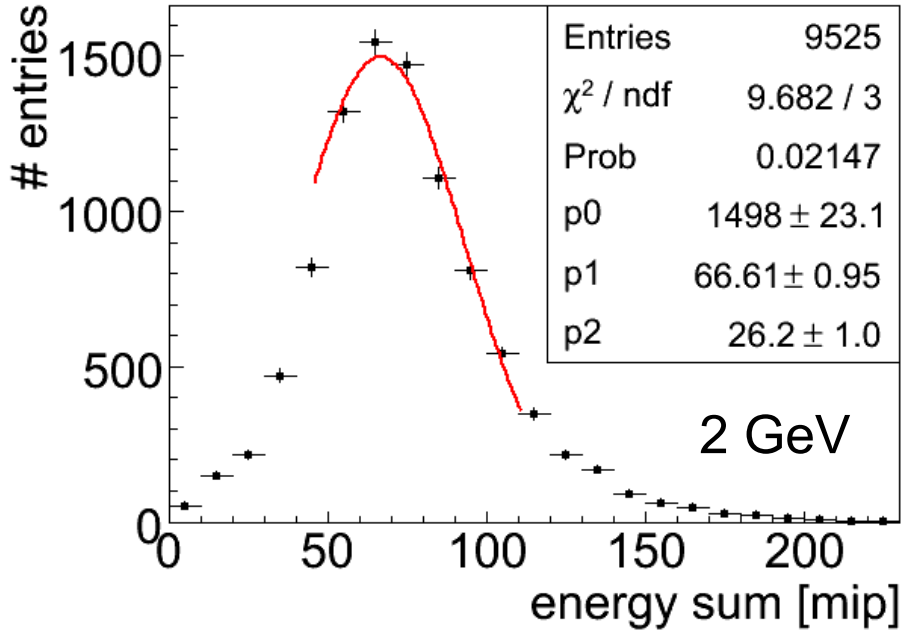


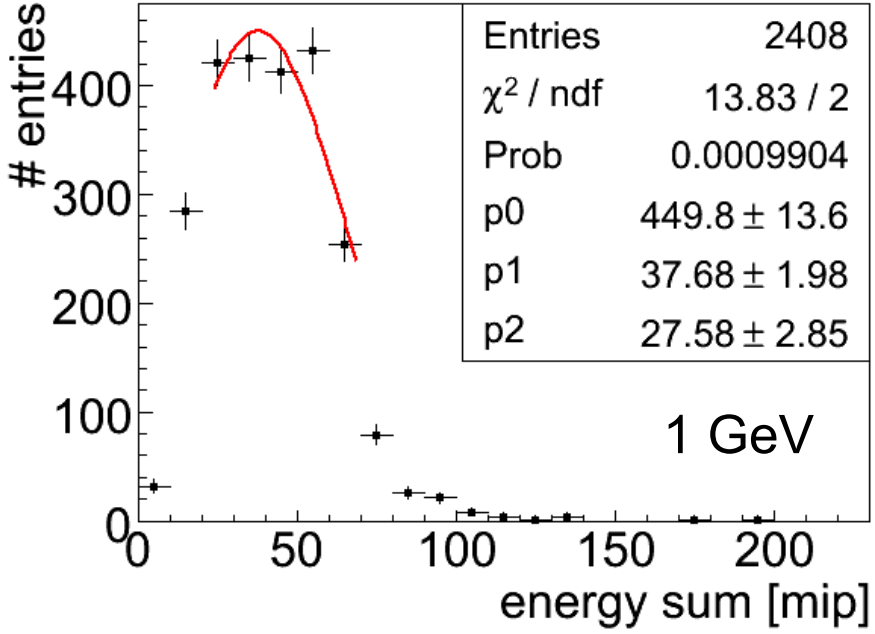
→ assume pure pion data

Energy Sum (Data)

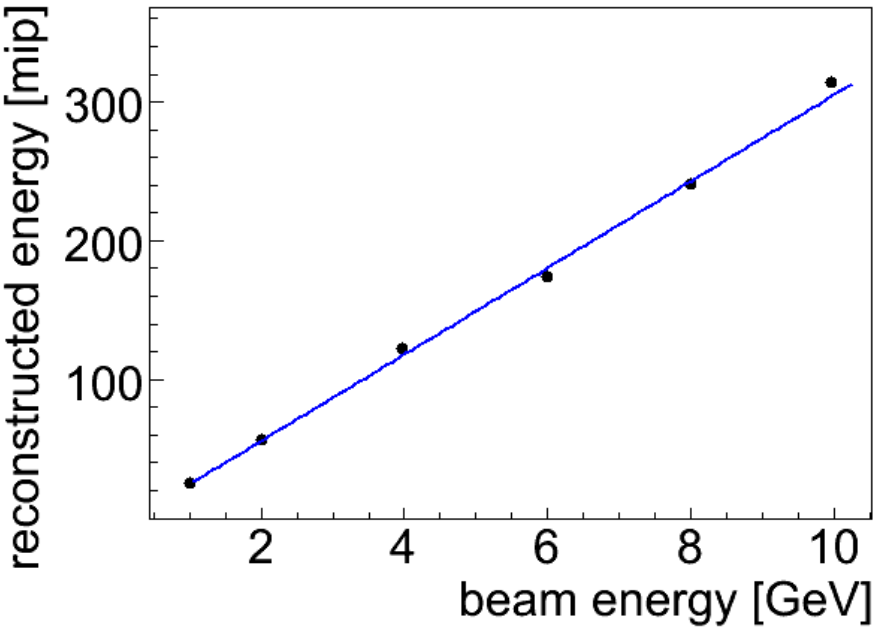


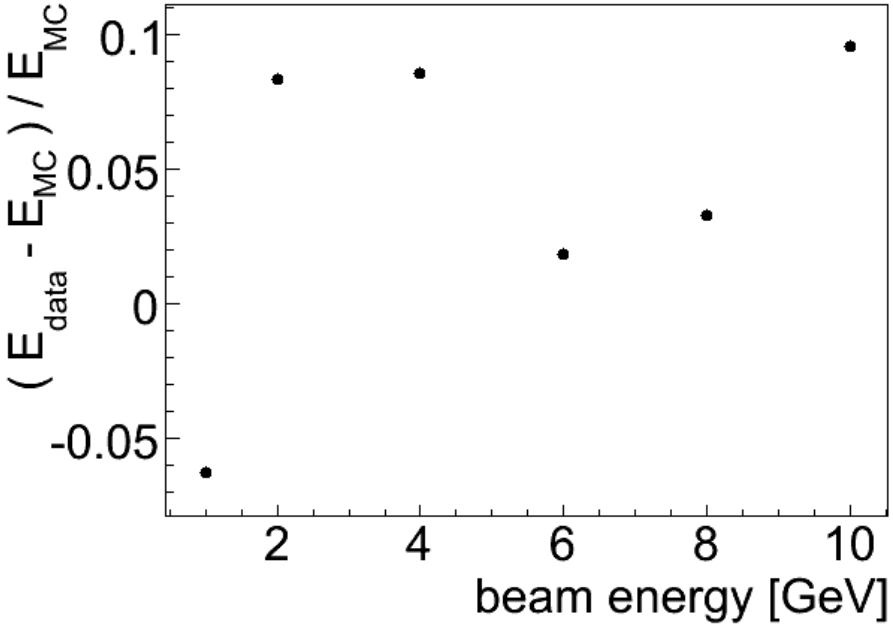




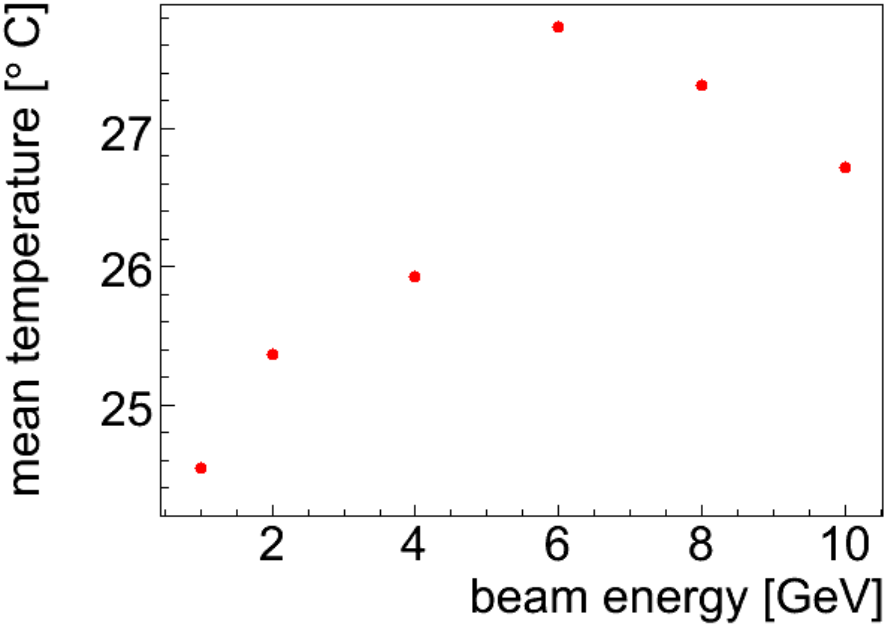


Reconstructed Energy

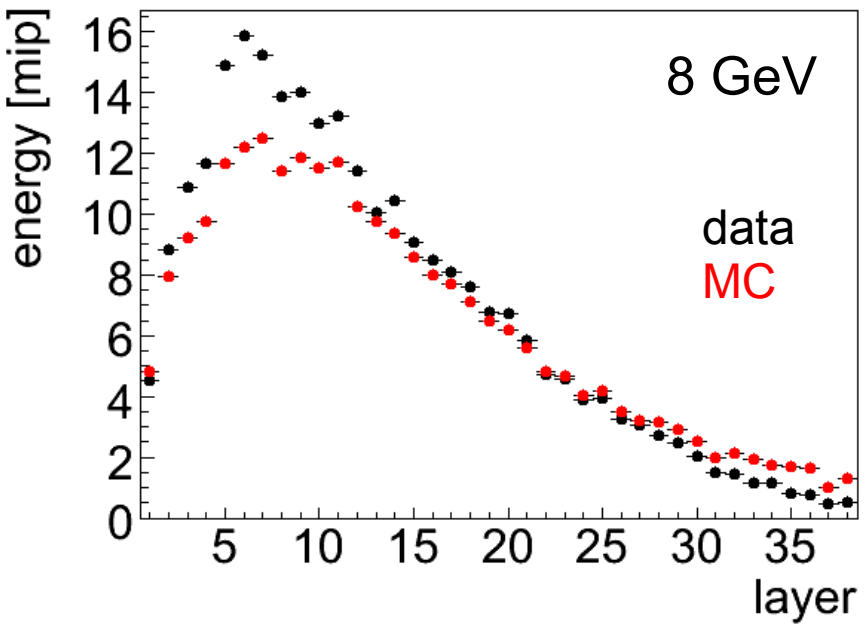


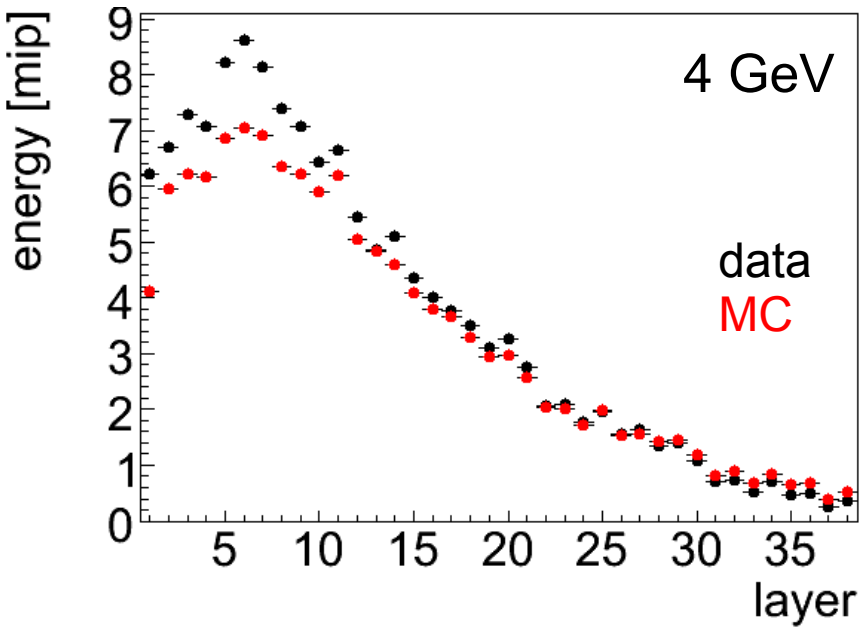


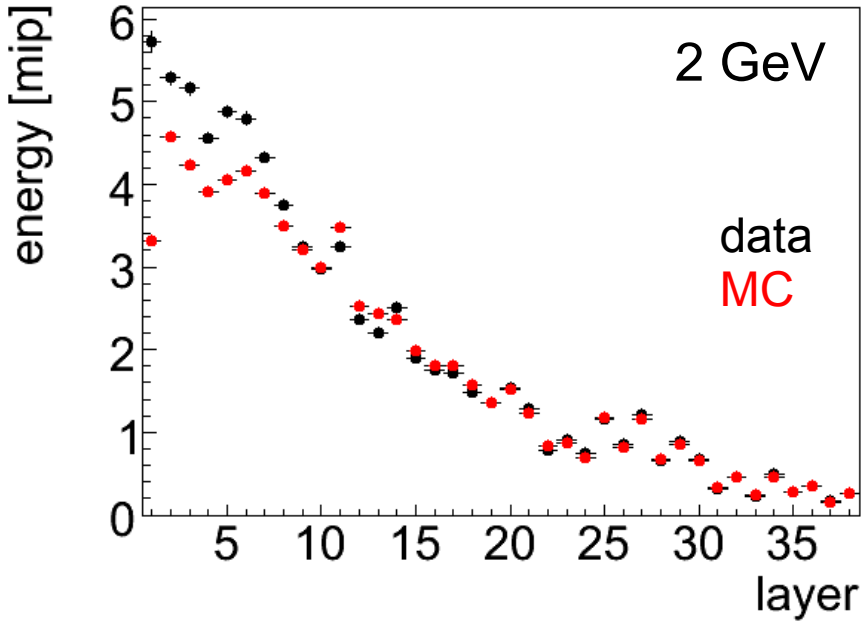
- preliminary calibration
- no temperature corrections applied

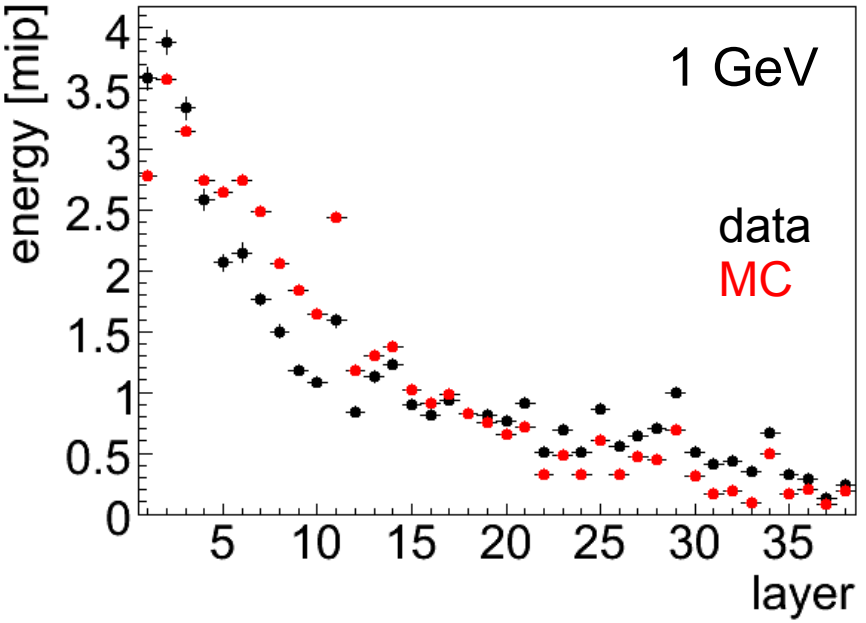


Longitudinal Profiles









Data Sets

-1 GeV

run	# evts	# evts (cut)
580050	21662	788
580116	10460	516
580155	21620	1811
580156	41703	3482
	95445	**6597**

-2 GeV

run	# evts	# evts (cut)
520291	96438	12587
520299	38898	5109
520300	26342	2700
520361	42841	5319
520365	11480	1235
520369	35904	3423
580024	92168	19091
580044	107233	31075
580051	9280	1981
580058	100100	23135
580100	6240	572
580101	23797	7350
	590721	**113577**

-4 GeV

run	# evts	# evts (cut)
520283	34568	14667
520284	241029	104833
520285	135477	58738
580012	26449	14253
580019	160803	88076
580020	5581	768
580021	200284	99115
	1092268	**558688**

-6 GeV

run	# evts	# evts (cut)
520305	**203325**	**95868**

-8 GeV

run	# evts	# evts (cut)
520306	25160	11855
520307	254077	127613
	279237	**139468**

+8 GeV

run	# evts	# evts (cut)
520349	76780	45727
520351	180861	96573
	257641	**142300**

-10 GeV

run	# evts	# evts (cut)
520308	**253584**	**118735**

(+ several runs at different positions)

cut: beamBit == 1 && tcm_nHits<10 (muon veto)

Summary & Outlook

- π enhancement via Čerenkov trigger worked
- First look at AHCAL stand – alone data in the range 1 – 10 GeV promising
- Many things to do:
  - Calibration (temperature correction)
  - Include FNAL beam line in MC
  - Check μ/π and e/π ratio
  - Compare different MCs
  - ...