Energy depositions in materials

Requirements?

- From Donna's requirement table:
- Protons from 0.7 GeV/c
- Pions+- from 0.2 GeV/c
- Electrons from 0.2 GeV/c
- Kaons+- from 1 GeV/c *

- Absolute momentum scale : <= 1% How to quantify?
- What on angular resolution? Assume 10 or 20 mrad? Needed at all energies, or enough to measure at high E?

*why the same? They have VERY different interactions. In any case..they decay in the beam line!

Materials in the beam line (unavoidable)

- Preliminary guess:
- Position/tof monitors: a total of 10 mm plastic
- Cerenkov : 1-2 m of CO_2 at 0.5-0.8 atm
- Beam windows + cerrenkov mirror: 1mm mylar
- SS membrane and its strengthening

- I kept those in all simulations

Cases

- (similar, not equal to Thomas requests..)

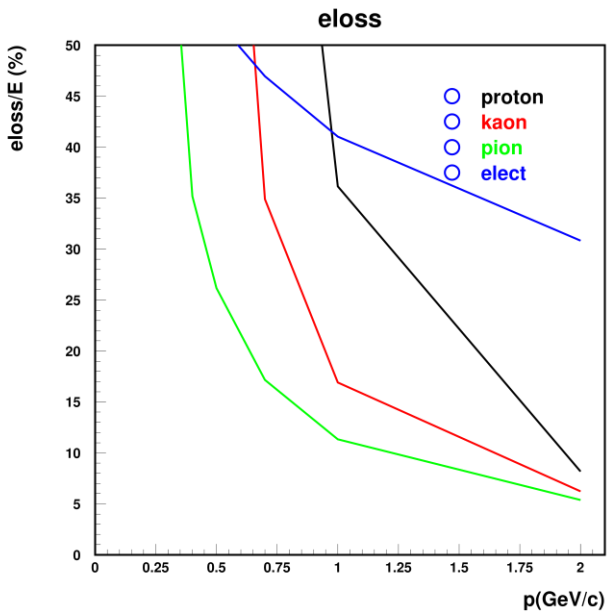
1. Beam line and SS membrane, plug up to active LAr
2. Same, plug up to field cage, 5 cm inactive Lar
3. Same, no plug, 45 cm inactive Lar
4. As 1, keep also secondary membrane and 40 cm foam in between the two membranes

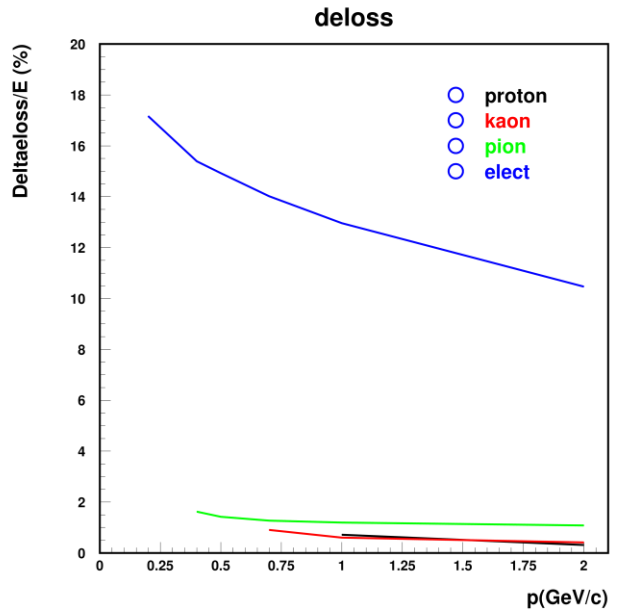
- Energy loss
- Straggling of energy loss (as simulated)
- Angular deflection

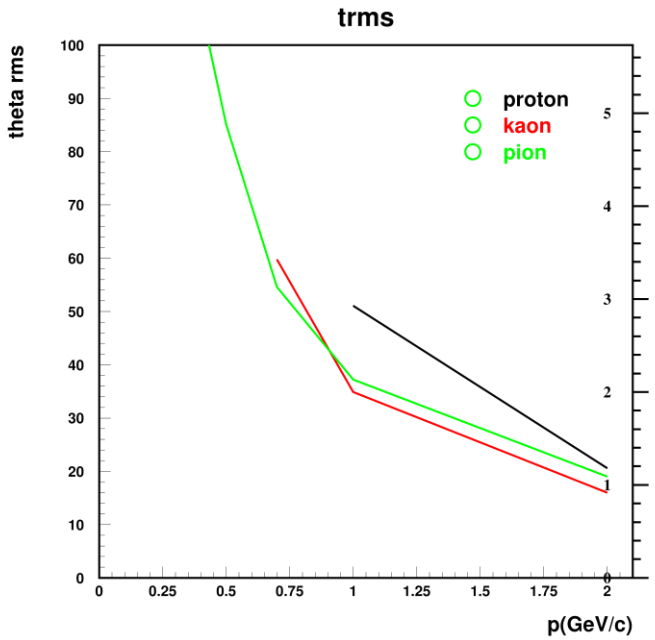
(for hadrons: only uncollided particles included)

For electrons : "still mip" fraction

No plug


eloss
eloss/E (%)
p(GeV/c)
proton
kaon
pion
elect


deloss
Deltaeloss/E (%)
p(GeV/c)
proton
kaon
pion
elect


trms
theta rms
p(GeV/c)
proton
kaon
pion

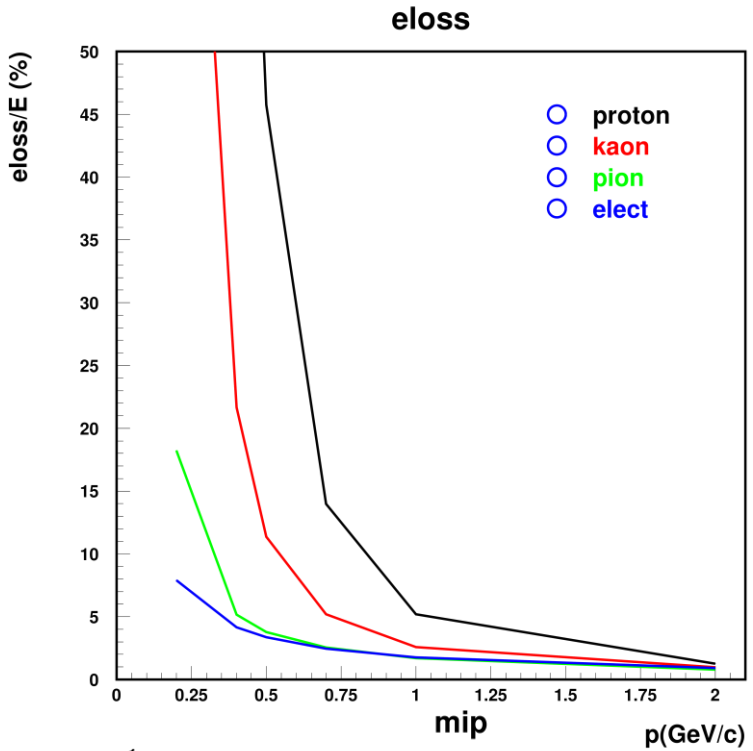
No plug

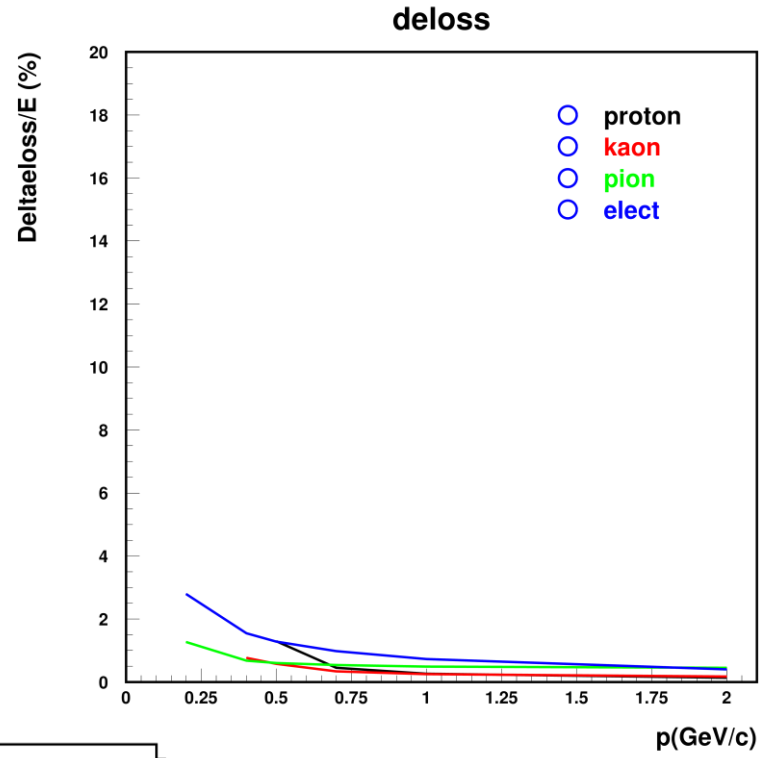
- Electrons loose on average > 35% of their energy at 2 GeV, 65% at 200 MeV
- No electron survives as mip
- Electron energy loss spread : from 10 to 20%
- ➔ The "no plug"condition does not allow to measure electrons

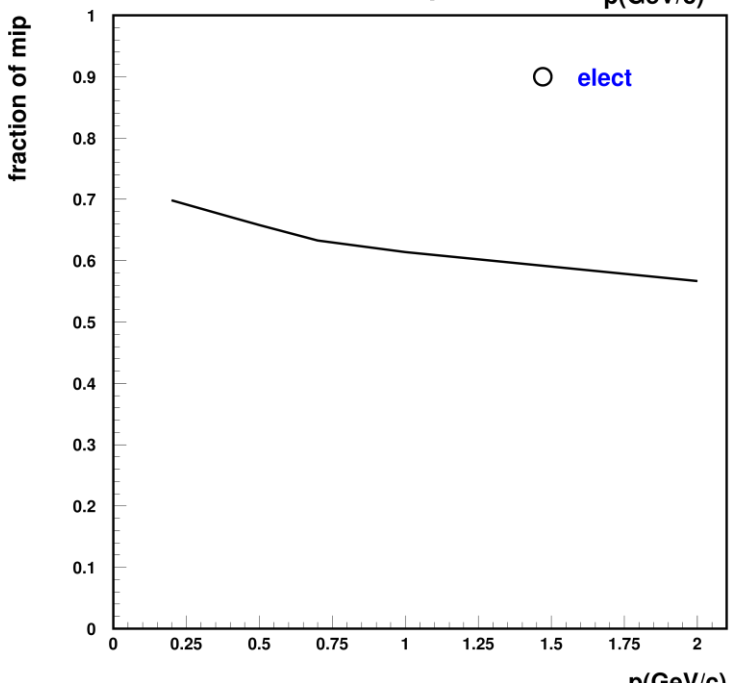
- Protons survive only if p>1 GeV/c
- Pions, kaons Energy loss >15% for p<1 GeV/c
- Deflections > 30 mrad rms for p<1 GeV/c

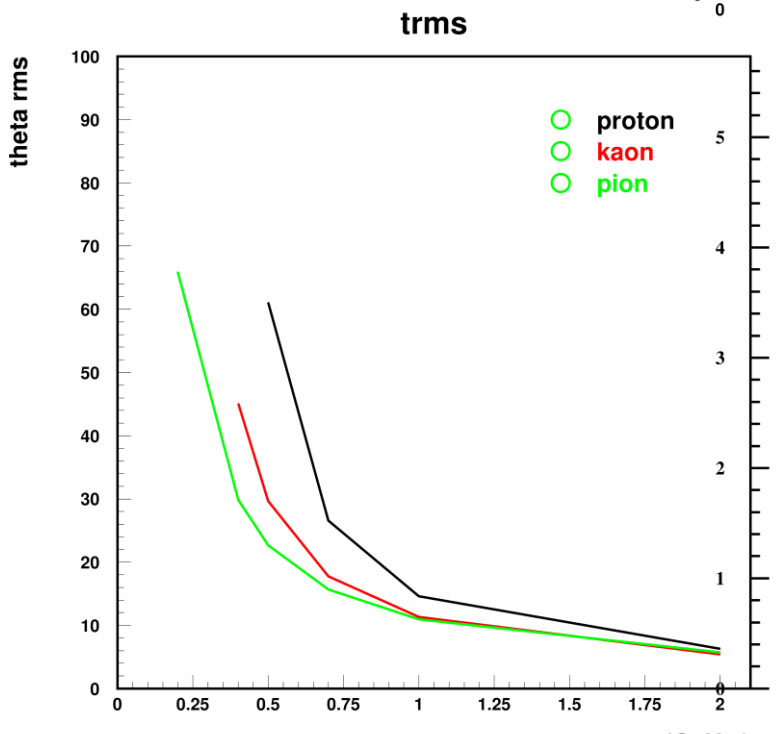
- ➔ The "no plug"condition does not allow to measure hadrons below 1 GeV/c or more, unless one relies on tagging /simulations

Partial plug









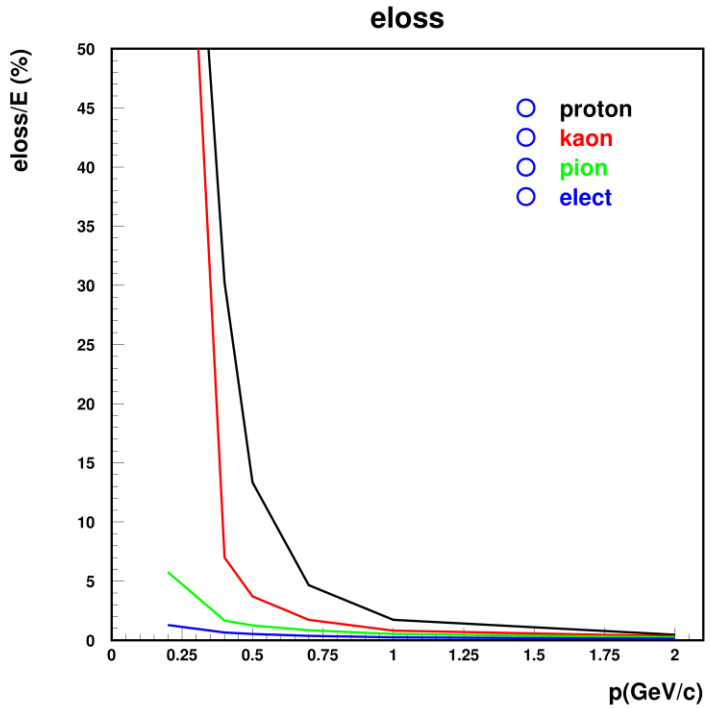
Partial plug (no field cage penetration)

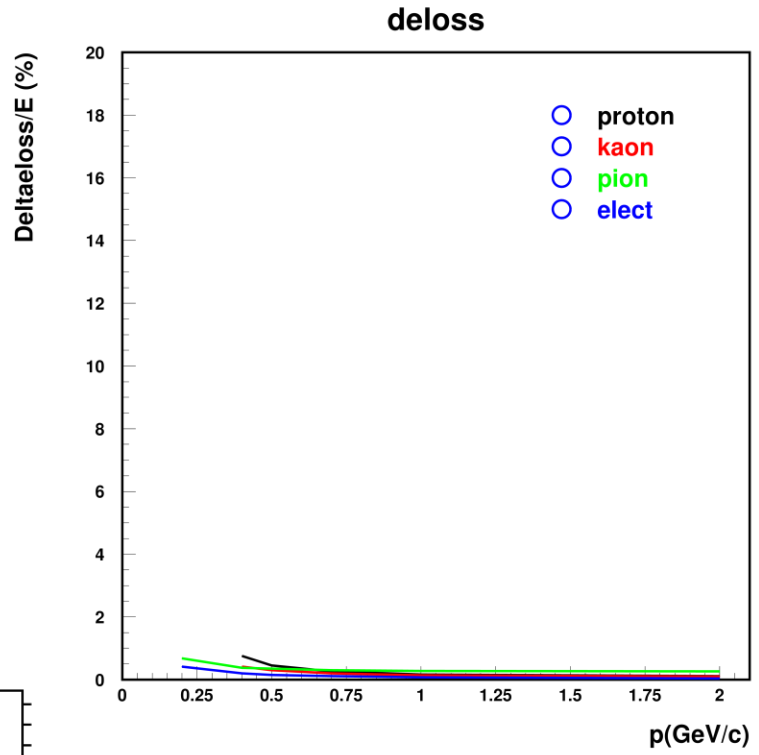
At lower wished momentum	Eloss/e	Deloss/E	Theta rms mrad	mip
proton	14%	0.5%	25	
pion	18%	1.3%	65	
kaon	2.5%	0.5%	10	
electron	8 %	3%		70%

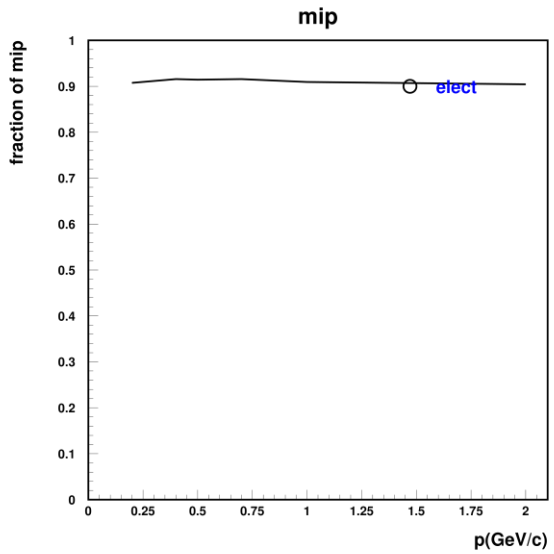
Minimum measurable p ?	Eloss/E < 15%	Deloss/E <2%	Theta rms< 20mrad	Mip >50%
proton	.7	0.7	1	
pion	.4	0.2	0.7	
kaon	.5	0.4	0.7	
electron	.2	0.4		.2

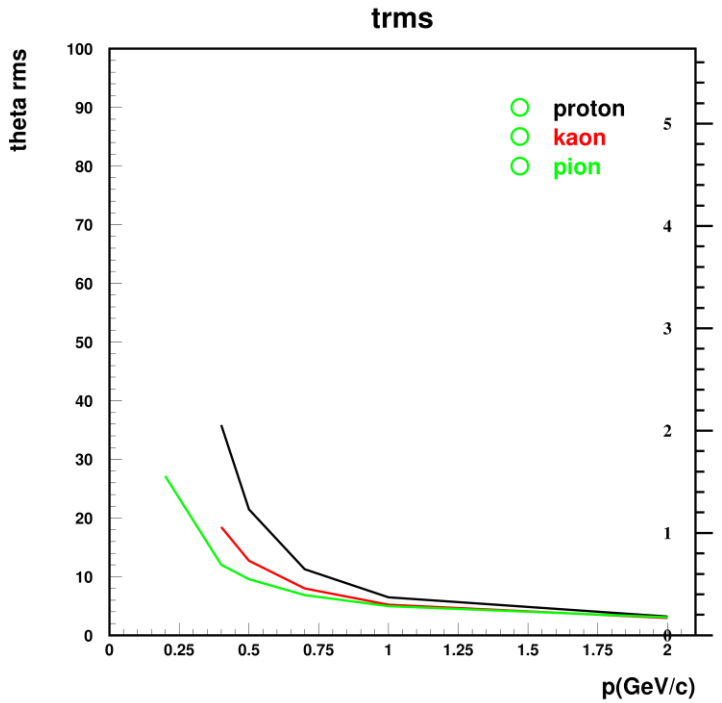
Questionable at low energies: high energy loss and deflection.
Also, would need more insight on the residual ability to reconstruct "mip"electrons
Also: first part of the tracks in non-uniform Efield. Backscatter to be assessed

Total plug


eloss
eloss/E (%)
proton
kaon
pion
elect
p(GeV/c)


deloss
Deltaeloss/E (%)
proton
kaon
pion
elect
p(GeV/c)


mip
fraction of mip
elect
p(GeV/c)


trms
theta rms
proton
kaon
pion
p(GeV/c)

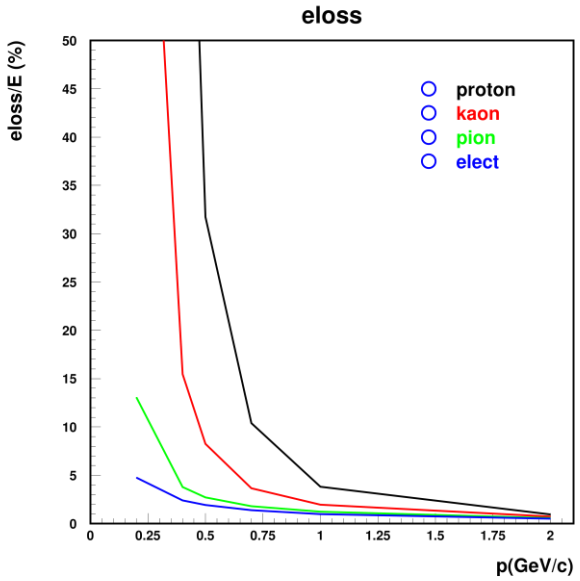
Total plug : no inactive LAr

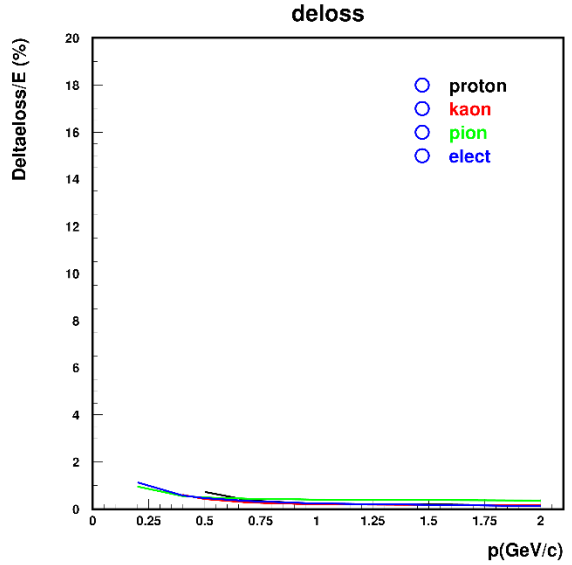
At lower wished momentum	Eloss/e	Deloss/E	Theta rms mrad	mip
proton	4.5%	0.25%	6	
pion	5.8%	0.7%	28	
kaon	.8%	0.14%	5	
electron	1.3 %	0.4%		90%

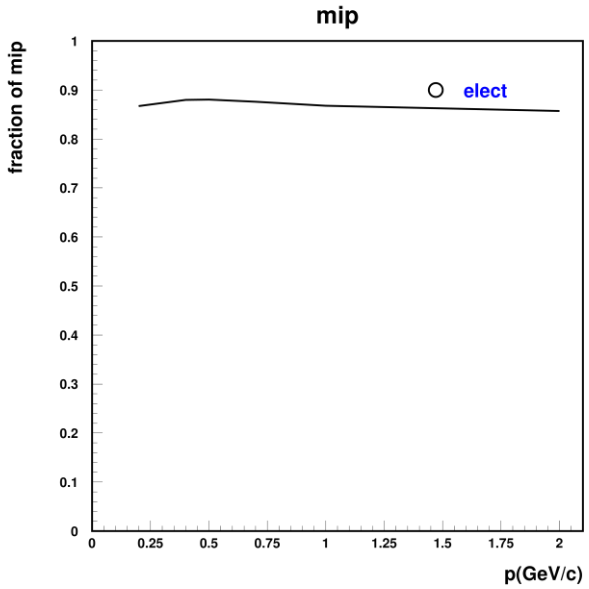
Minimum measurable p ?	Eloss/E < 15%	Deloss/E <2%	Theta rms< 20mrad	Mip >50%
proton	.5	0.4	0.7	
pion	.2	0.2	0.4	
kaon	.4	0.4	0.4	
electron	.2	0.2		.2

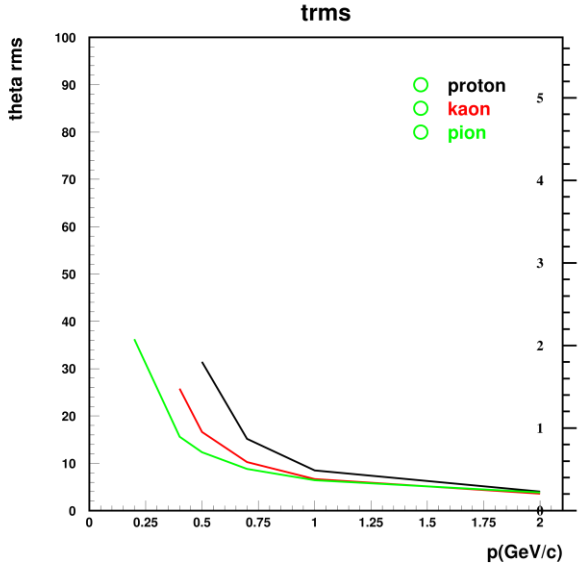
Only concern: deflection of low energy pions

all plug, with secondary membrane and 40 cm foam









Total plug, +secondary membrane and foam

At lower wished momentum	Eloss/E	Deloss/E	Theta rms mrad	mip
proton	10%	0.4%	15	
pion	13%	1.0%	36	
kaon	1.9%	0.2%	6	
electron	4.8 %	1.1%		87%

Minimum measurable p ?	Eloss/E < 15%	Deloss/E <2%	Theta rms< 20mrad	Mip >50%
proton	.7	0.5	0.7	
pion	.2	0.2	0.4	
kaon	.5	0.4	0.5	
electron	.2	0.2		.2

Some concern at low energies

Summary

- The full 45 cm LAr (no plug) would kill the measurement for all electrons. Same for all hadrons <1 GeV , unless one relies heavily on MC and/or reconstruction
- Plug ending before field cage (5 cm inactive Lar): Questionable at low energies: high energy loss and deflection. Also, would need more insight on the residual ability to reconstruct "mip"electrons. Also: first part of the tracks in non-uniform Efield. Backscatter to be assessed
- Full plug, no inactive Lar, always keeping the SS membrane: GOOD. The only concern might be the deflection of very low energy pions
- Full plug, no inactive Lar, always keeping both primary and secondary membrane, 40 cm of foam: some concern at low energies, better than 5~cm LAr