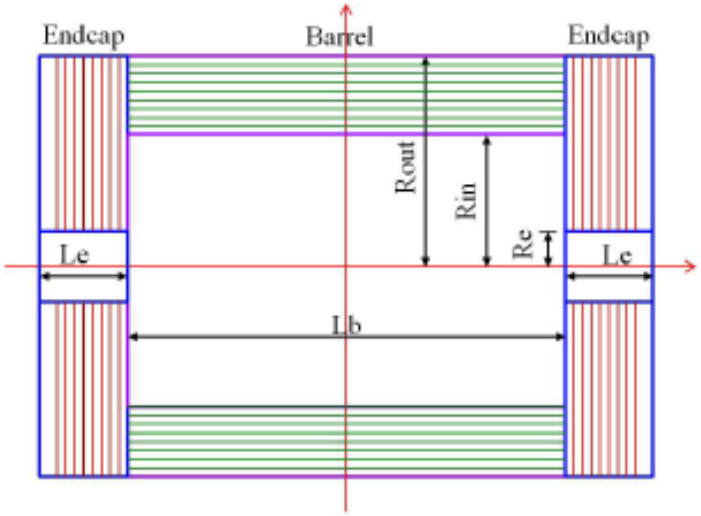
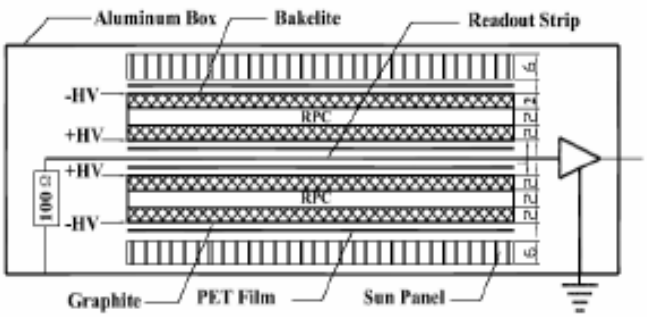
Muon System

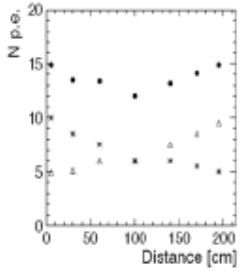
Liang Li

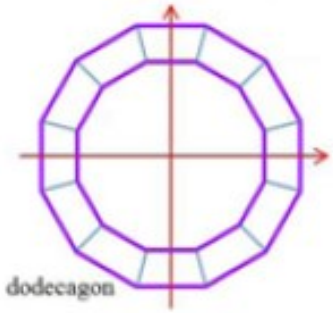
Shanghai Jiao Tong University

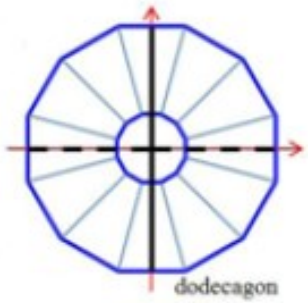
Pre-CDR Status











Structure:

- Between magnet iron yoke, outside HCAL
- Cylindrical barrel & two endcap system
- Solid angle coverage: 0.98 * 4π

Technology:

- Bakelite/glass RPC
- Scintillator strip

Performance:

- PFA lepton ID efficiency > 99% using baseline (ILD) configuration with full simulation
- Verified RPC performance using standalone simulation for RPC only

CDR Plan

Due to limit of funding and manpower, recent progress mostly on the software side. CDR will mainly list current technology options, discuss their strengths/shortcomings, performance studies will be included if ready but mostly it will be discussed at physics performance chapter instead.

Possible outlines are:

- **Muon System Chapter**
- **1. Introduction and system requirements (design goal)**
- **2. Conceptual design of muon system**
  - **1.1 Baseline configuration**
  - **1.2 Technology survey and discussions**
  - **1.3 Future R&D**
- **Physics Performance Chapter**
  - **Muon reconstruction algorithm and system performance including possible effects on jet energy measurement**

CDR Plan

Very limited manpower, INFN (and other international or domestic) participations very welcome!

List of participants:

- Shanghai Jiao Tong University: Liang Li, Jifeng Hu
- University of Science and Technology: Jianbei Liu
- INFN: Paolo Giacomelli, Franco Bedeschi
- IHEP: ???
- Other: ???
- Proposed Outlines: will have to split the workload
- 1. Introduction
- 2. Conceptual design of muon system:
  - 1.1 Baseline configuration
  - 1.2 Technology survey and discussions
  - 1.3 Future R&D

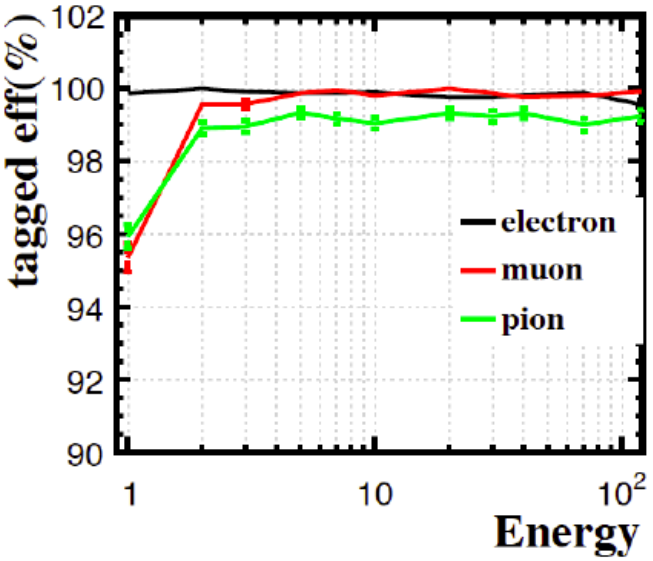
Backup

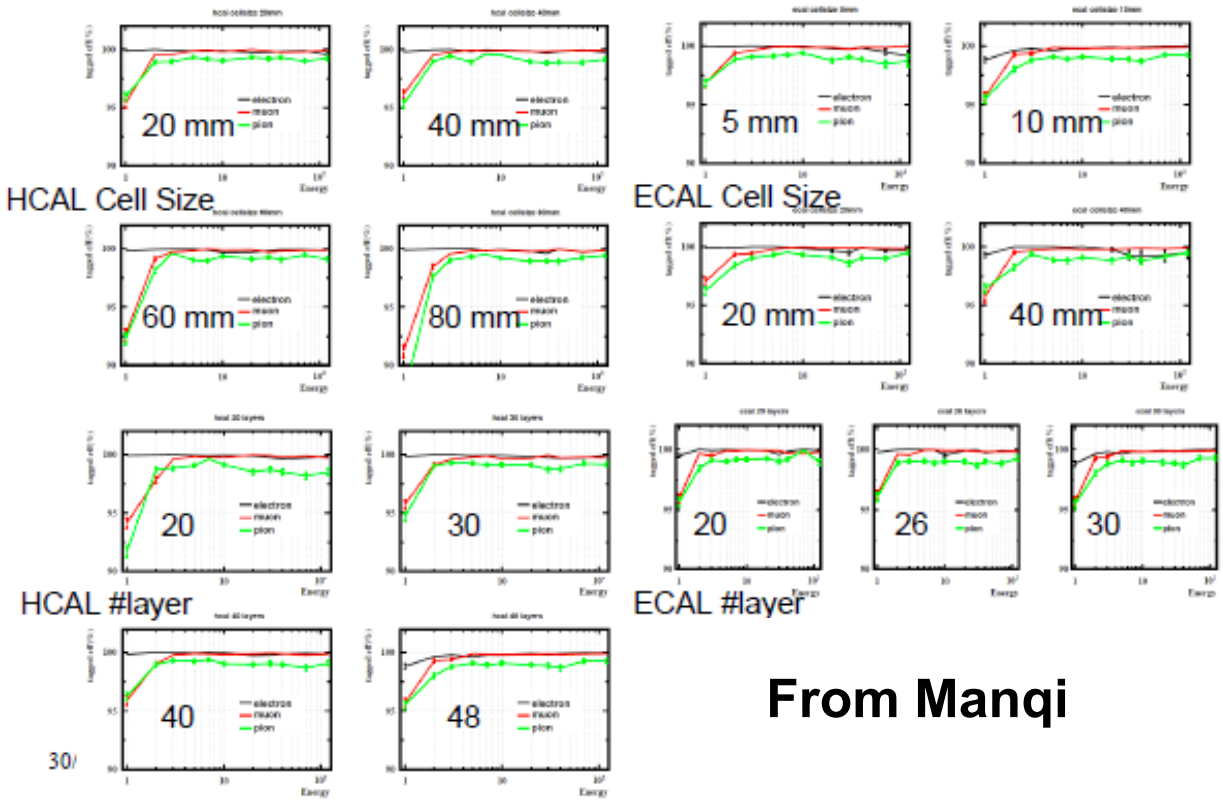
Muon Detector Technology

Muon Chamber Technology	Deployment	Comments
Drift Tubes with field shaper electrodes	Barrel Tracking & Triggering Cell resol'n ($r\phi$) < 250 μm	CMS
MDT (Monitored Drift Tubes) 3 cm dia.	Barrel Tracking Tube resol'n ($r\theta$) ~ 150 μm resolution	ATLAS
Small Diameter MDT 1.5 cm dia.	Tracking in some special regions of barrel	ATLAS
Cathode Strip Chambers (CSC)	Endcaps Tracking & CMS Triggering ATLAS: η strip pitch 5.5 mm, ϕ strip pitch 13 - 21 mm	CMS and ATLAS ($2<\|\eta\|<2.7$)
Micromegas	Endcaps Tracking & Triggering Readout pitch ~ 0.4 mm	ATLAS Phase I Upgrade New Small Wheel
Thin Gap Chambers (TGC)	Endcaps Triggering & Tracking 2nd coordinate	ATLAS 1st and 2nd stations Endcap
Small-strip Thin Gap Chambers (sTGC)	Endcaps Triggering & Tracking Fast enough for BC tagging 95% τ < 25 ns; 3 mm strip-pitch	ATLAS Phase I Upgrade New Small Wheel
Resistive Plate Chambers (RPC)	Barrel and Endcaps Triggering Fast τ ~ 3ns ATLAS: η strip pitch ~ 30 mm, ϕ strip pitch ~ 30 mm	ATLAS and CMS
Low Resistivity RPC	Higher rate capability 10^{10} Ωcm	R&D
Multi-gap Resistive Plate Chamber	Very fast τ ~ 50 ps	ALICE and R&D
GEMs (3 layer)	Endcaps Rate ~ 10^5Hz/cm^2 Fast τ ~ 4-5 ns	CMS Phase I Test & Phase II

From F. E. Taylor

Muon ID Performance: PFA & calorimeter alone





From Manqi

- PFA has done a terrific job in terms of Lepton ID
- No significant degradation for E > 2 GeV charged particles