MACHINE INDUCED BACKGROUND:*

- Muon Halo

- Muon Decay

- Beam-Beam Interaction

Calculations are done with

GEANT and MARS

Study is just beginning†

†

BACKGROUND FROM μ HALO : Muon halo refers to μ's lost from main bunches but manage to appear at the detector(full energy)

Passing through the calorimeter undergo Deep Inelastic Scattering and deposit clumps of energy (constraints on calorimeter)

SOLUTION: careful injection and collimation

BACKGROUND FROM μ DECAY :[‡]

$$\mu^- \rightarrow e^- + \nu_\mu + \overline{\nu_e}$$

$2 \times 10^{12} \times 2$ decays in 10^3 turns

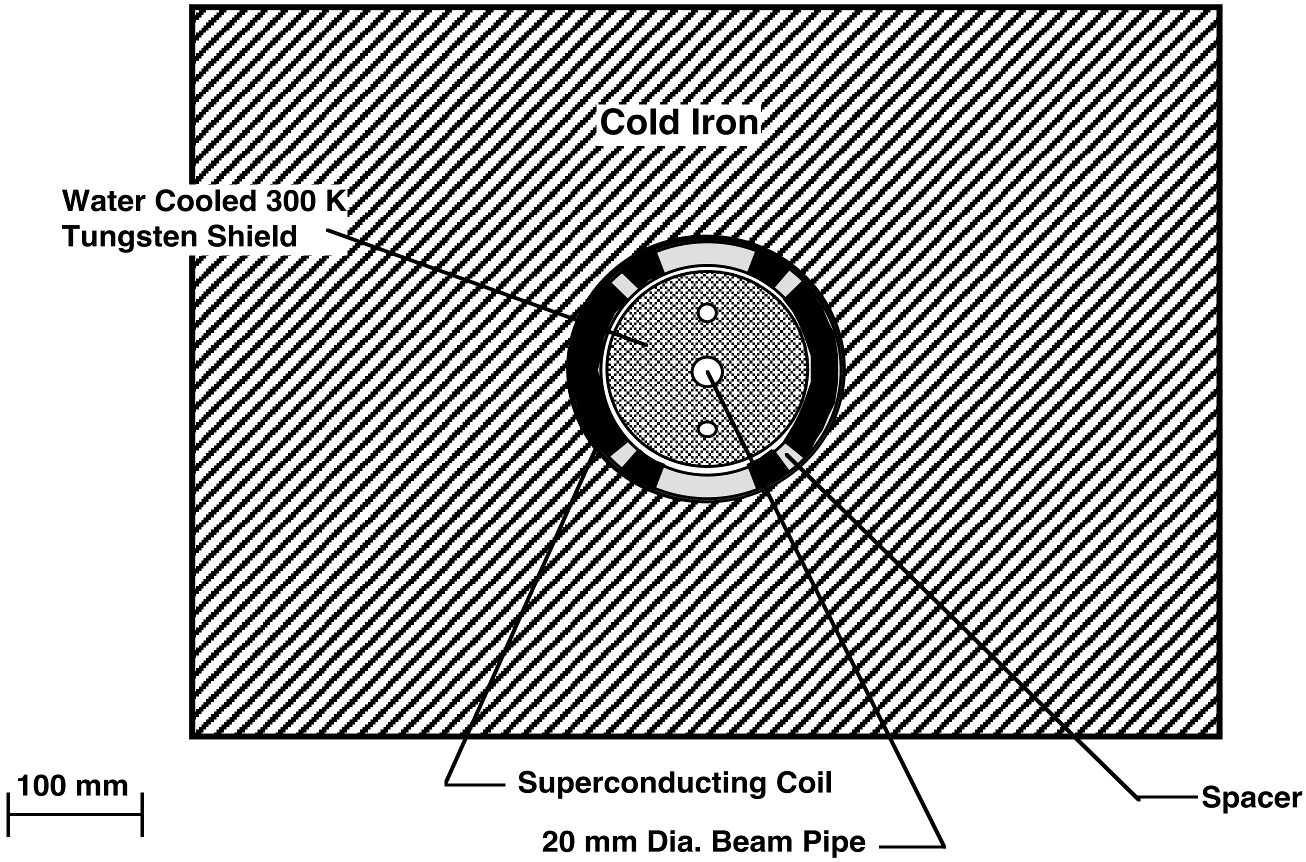
$2 \times 10^9 \times 2$ decays per turn

5×10^5 decays per m

electron synchrotron radiation
High energy electromagnetic
showers (e,γ, neutrons and
charged hadrons)

- Heating of beam pipe $\rightarrow$ 6 cm of Tungsten liner

- background at detector $\rightarrow$ design of W nose cone



Beam Power 38 MW 6 kW/m

Power →pipe 12 MW 2 kW/m

Power → Cold Fe 30 kW 6 W/m

Radiation (after 1 day) on outside of W 100 mR/hr

Radiation (after 1 day) on outside of Fe 1 mR/hr

- Incoherent pair creation e^+e^- due to beam beam interaction ($\sigma \approx 10\,mb \rightarrow 3 10^4\,e^+e^-$ per crossing). 90% trapped in tungsten nose cone; only pairs with $30 < E < 100\,MeV$ will enter detector (20° shielding cone angle).
  Solution: Design of nose cone; Skrinsky and P. Chen has suggested plasma (Li jet) at IP ($\sigma \approx 90\,mb$ but most pairs move along beam pipe)

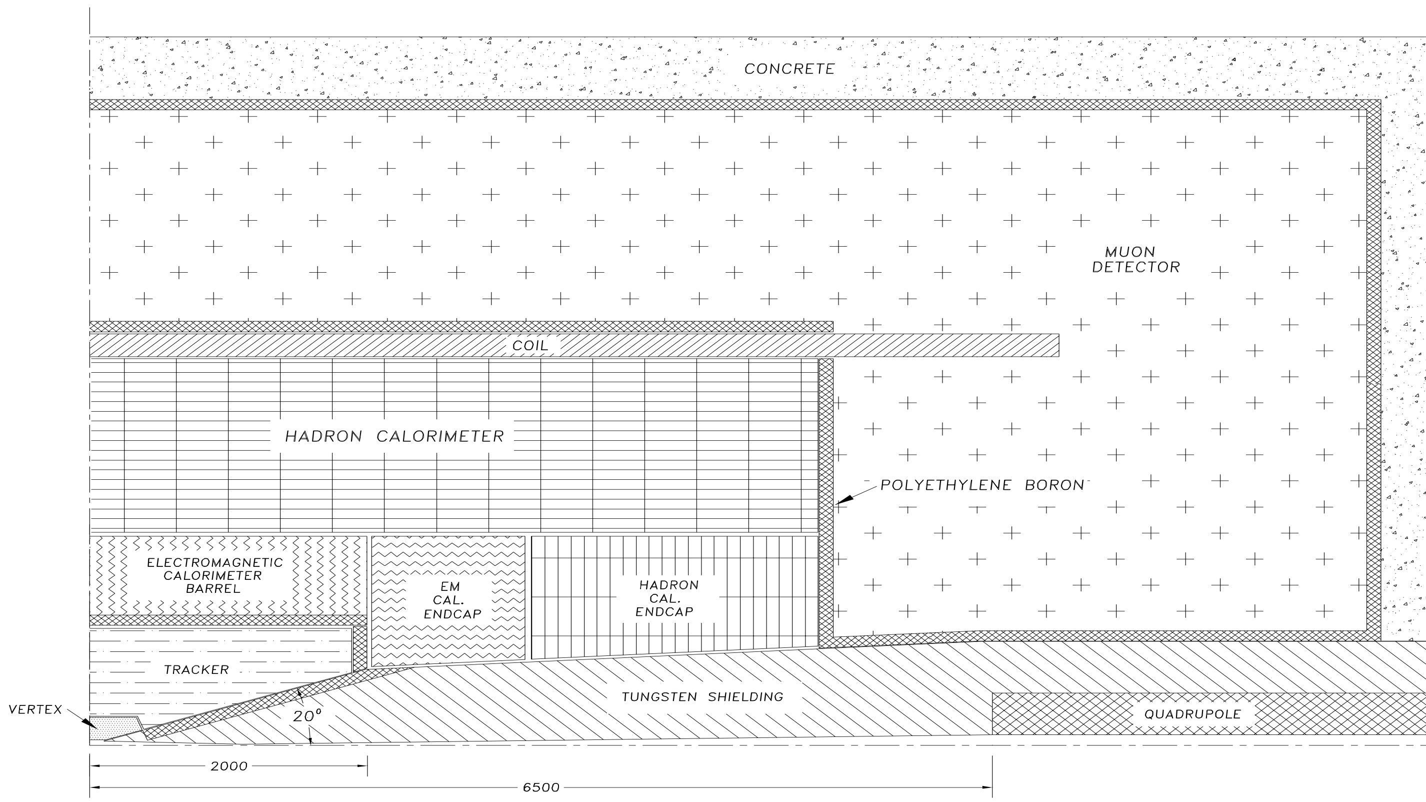
- Electrons generate Bethe-Heitler muon pairs, Deep Inelastic Scattering cause spikes of energy distribution

- hadron background (neutrons) due to photo-production

STRAWMAN DETECTOR:§

Present state-of-the-art technologies seems to be sufficient to build a detector which will meet the requirements (background: large number of soft particles)

§


CONCRETE
MUON DETECTOR
COIL
HADRON CALORIMETER
POLYETHYLENE BORON
ELECTROMAGNETIC CALORIMETER BARREL
EM CAL. ENDCAP
HADRON CAL. ENDCAP
TRACKER
VERTEX
20°
TUNGSTEN SHIELDING
QUADRUPOLE
2000
6500

DetectorComponent	MinimumResolution/Characteristics
Magnetic Field	Solenoid; $B \geq 2T$
Vertex Detector	b – tagging, smallpixels
Tracking	$\Delta p/p^2 \sim 1 \times 10^{-3} (GeV)^{-1}$ at large p
	High granularity
EM Calorimeter	$\Delta E/E \sim 10\%/\sqrt{E} \oplus 0.7\%$
	Granularity : longitudinal and transverse
	Active depth : $24X_0$
Hadron Calorimeter	$\Delta E/E \sim 50\%/\sqrt{E} \oplus 2\%$
	Granularity : longitudinal and transverse
	Total depth (EM + HAD) $\sim 7\lambda$
Muon Spectrometer	$\Delta p/p \sim 20\% at 1\, TeV$

Detector Performance Requirements¶

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