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MASTER

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SOLENOID SPECTROMETER MAGNETS*

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This committee considered three solenoid detectors that were described during the Summer Study and could be thought of as candidates for ISABELLE detectors. They are roughly characterized by their diameters: 3, 5, and 8 m. The committee then attempted to estimate the required size of an experimental hall considering likely physics goals, detector and return yoke geometries, thickness of superconducting coils, necessary space for detector repair, etc. This exercise then allows the sizes of the detectors to be compared with the sizes of the large facility halls in the ISABELLE proposal, our major goal. The three detectors are sketched in Figs. 1 to 3; Table 1 contains our major conclusions. Some comments follow.

1. The small 3-m-diameter solenoid can be made thin (≤1 radiation length) so that e and hadron calorimeters can be placed outside it. We therefore chose the flux return yoke to be "in the floor" so that we have a very open geometry. Since the calorimeters outside the solenoid leave no convenient room for muon detection, this detector is more suitable for $e^{\pm}$ and hadron detection.

2. On the large 5- and 8-m-diameter solenoids, the coils are probably >1 radiation length thick so that all track chambers and calorimeters should go inside the solenoid. The flux return yoke then can be a "snug pipe" outside the coils and can also serve as the absorber for the muon detector. These detectors can have good resolution for μ pairs from the magnetic field as well as e pairs from both field and calorimetry. (They can also do μ-e pairs for the heavy lepton search.) Hadron shields on axis may be needed to go to highest luminosities for μ pair search.

3. The field in the small 3-m diameter solenoid was kept low, 20 kG, to keep the end caps and return yoke a reasonable size.

4. If the entire detector can be moved out of the beam on some sort of track arrangement, the size of the experimental hall which is radiation shielded can be reduced from the sizes given in Table 1.

5. The superconducting coils with their vacuum cans can be built in segments (two for the 5-m solenoid, four for the 8-m solenoid) for ease of handling and to keep the door sizes reasonable.

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Table 1

Summary of Solenoid Spectrometer Parameters

	Small	Large	Giant economy size
Diam (m)	31	5	8
Length (m)	3	5	8
Field (kG)	20	20	15
Physics usefulness	e^+e^- single e jets large $p_\perp$ hadrons	$\mu^+\mu^-$, e^+e^- single μ single e μe jets of large $p_\perp$ hadrons	$\mu^+\mu^-$, e^+e^- single μ single e μe jets of large $p_\perp$ hadrons
Detector placement	track det. inside + outside e, hadron calorim. outside	track det. inside calorimeter inside μ dec. outside	track det. inside calorimeter inside μ dec. outside
Supercond. coil			
Thickness (rad. length)	≤1	~1	2-3
Constr.: No. pieces	one	two	four
Length per piece (m)		2½	2
Iron			
End caps (tapered)			
Diam (m)	3	7	11
Thickness (m)	2	1	1½
Field return yoke	in floor, 3x3 m	snug pipe	snug pipe
Thickness (m)	2	1	1½
Weight Fe (tons)	800	1200 +1200 μ dec.	4400
Experimental hall			
Size (m)	11x15	16x21	18x28
Beam ht. above floor (m)	4 with 2-m pit	5½	6½
Door size (ft)	12x12	12x20	12x30

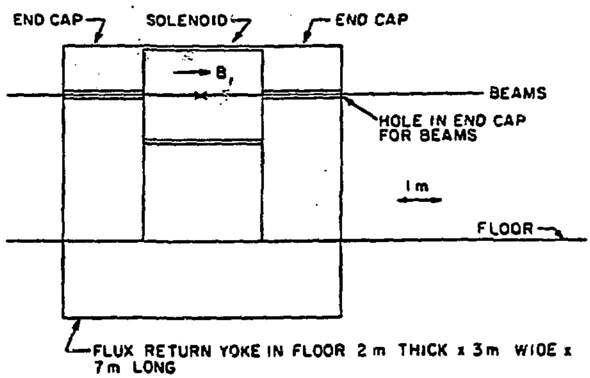

Fig. 1. Small solenoid spectrometer, 3-m diam, 3 m long, 20-kG field. Track chambers inside and outside solenoid; calorimeters outside solenoid coils; solenoid ≤1 radiation length thick.

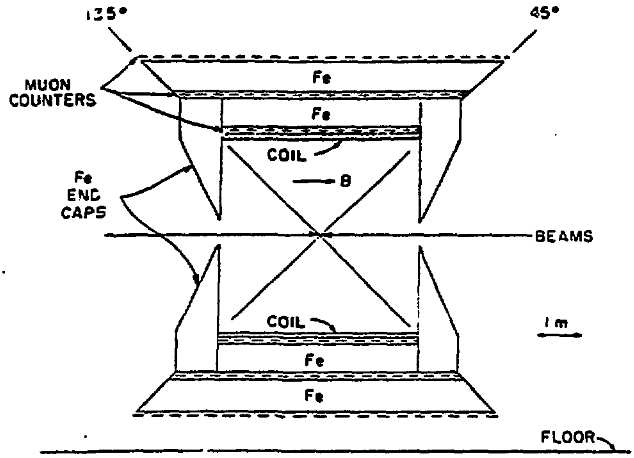

Fig. 2. Medium solenoid spectrometer, 5-m diam, 5-m long, 20-kG field. Track chambers and calorimeters inside solenoid.

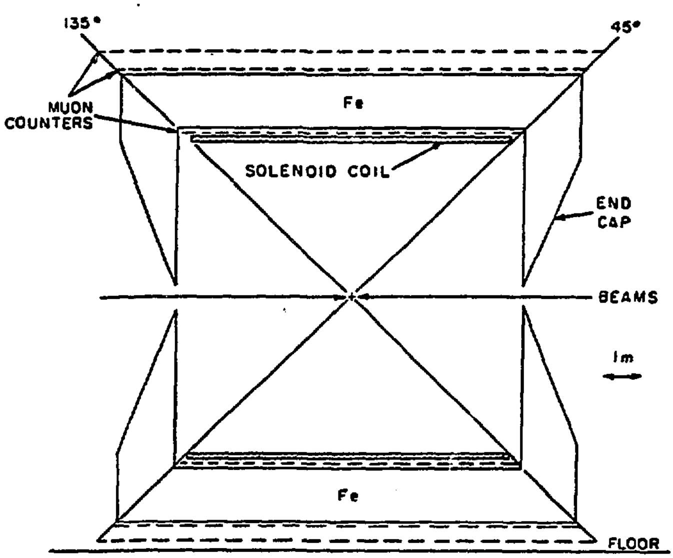

Fig. 3. Giant solenoid spectrometer, 8-m diam, 8 m long, 15-kG field. Track chambers and calorimeter inside solenoid coil.