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FEASIBILITY STUDY II

S. Ozaki and R.B. Palmer

6/15/00

- Requested by BNL Director
- In Cooperation with Collaboration

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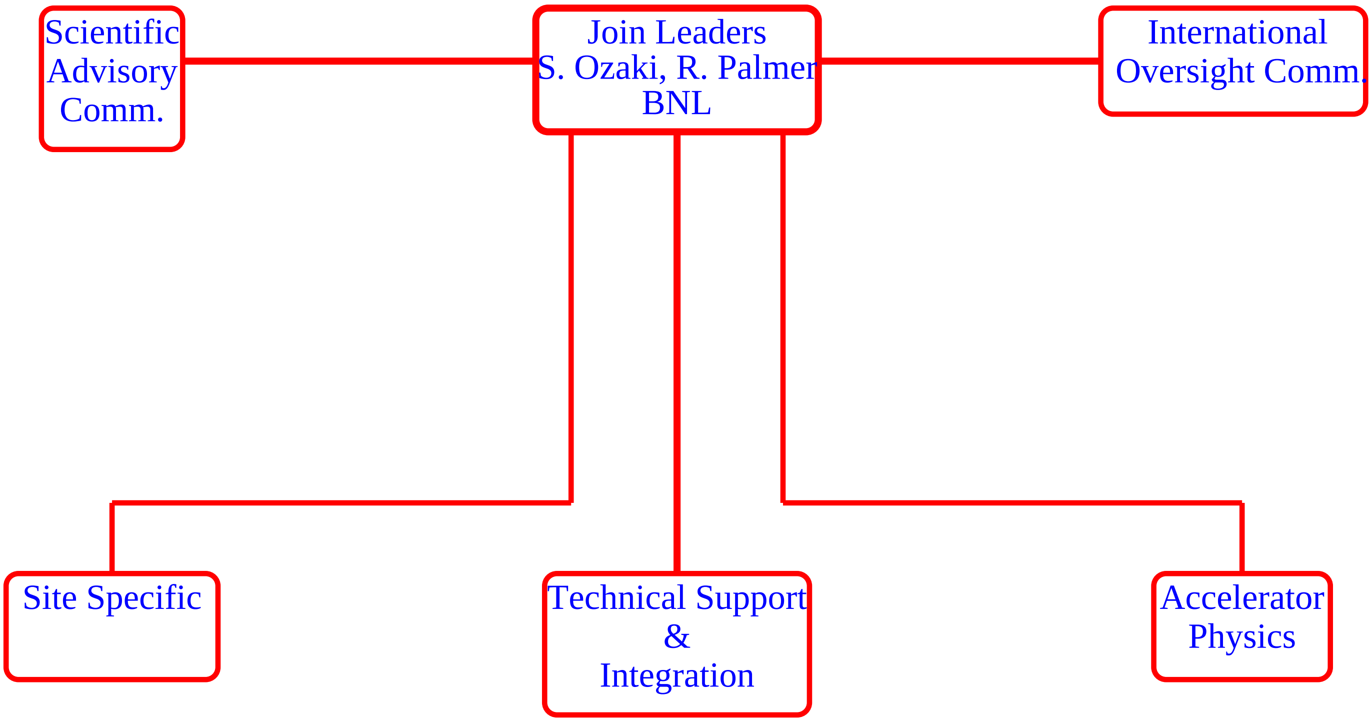
ORGANIZATION CHART



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DATE: May 12, 2000
TO: Robert Palmer, Satoshi Ozaki
CC: Thomas Kirk, Peter Paul, Andrew Sessler
FROM: John Marburger
SUBJECT: Muon device studies

I am writing to request that you organize, in cooperation with the Muon Collider Collaboration, a BNL site-specific study on the feasibility of a 'high performance' muon storage ring neutrino source. The study would complement the recently completed 'entry level' study commissioned by the Fermilab director and carried out together with the Muon Collider Collaboration.

The scope and parameters for this study have been developed and approved by the Muon Collider Collaboration Spokesperson, Andy Sessler, and Project Manager, Mike Zisman. The Muon Collaboration will participate in the study. The study will also complement the AGS Targetry Experiment, E951, that will study two crucial components of the high performance version of the muon storage ring. The study should consist of two components:

A. A BNL site specific part, led by S. Ozaki and including:
1. a technical description of upgrades to the AGS to reach an average beam power of 1 MW (e.g. 1014 pps at 24 GeV at 2.5 Hz), together with a preliminary cost estimate for this upgrade;
2. a design, layout and preliminary cost estimate for a muon storage ring with the requirement that it be sufficiently above the water table to minimize environmental impacts;
3. magnet studies for the above ring.

B. A generic part, led by the collaboration management, funded by DOE MCC Collaboration funds, and including:
1. the design and technical description of the non-AGS components of a high performance muon storage ring neutrino source, including liquid metal target,

muon capture, cooling, acceleration and storage;
2. determination of cost drivers in these systems where not already covered in the Fermilab study;
3. areas for potential cost reduction;
4. continued physics and detector studies as needed.

The study should consider a facility with the following characteristics:
1. a muon storage ring energy of approximately 20 GeV;
2. a neutrino beam aimed at an optimized 50 kT detector located approximately 1800 km from BNL;
3. 2 10^{20} muons per (10^7 sec) year decaying in the detector direction; this is approximately one order of magnitude higher than the 'entry level' machine.

The written report on this new study should be submitted to me by April 30, 2001.

Thank you for agreeing to undertake this important project.

A. SITE SPECIFIC PART

- **24 GeV AGS Upgrade to 1 MW**
  - 10^{14} **ppp**
  - **Superconducting Linac**
  - **rep rate $\rightarrow$ 2.5 Hz**
  - **6 bunches separated by 15 msec**
- **Storage Ring**
  - **Aim for 40 % straight**
  - **Aim, as example, at Soudan**
  - $\approx$ **1700 km**
  - **7.7 degrees dip angle**
  - **circa. 40 m vertical difference**
  - **locate above water table**
  - **in man made hill ?**

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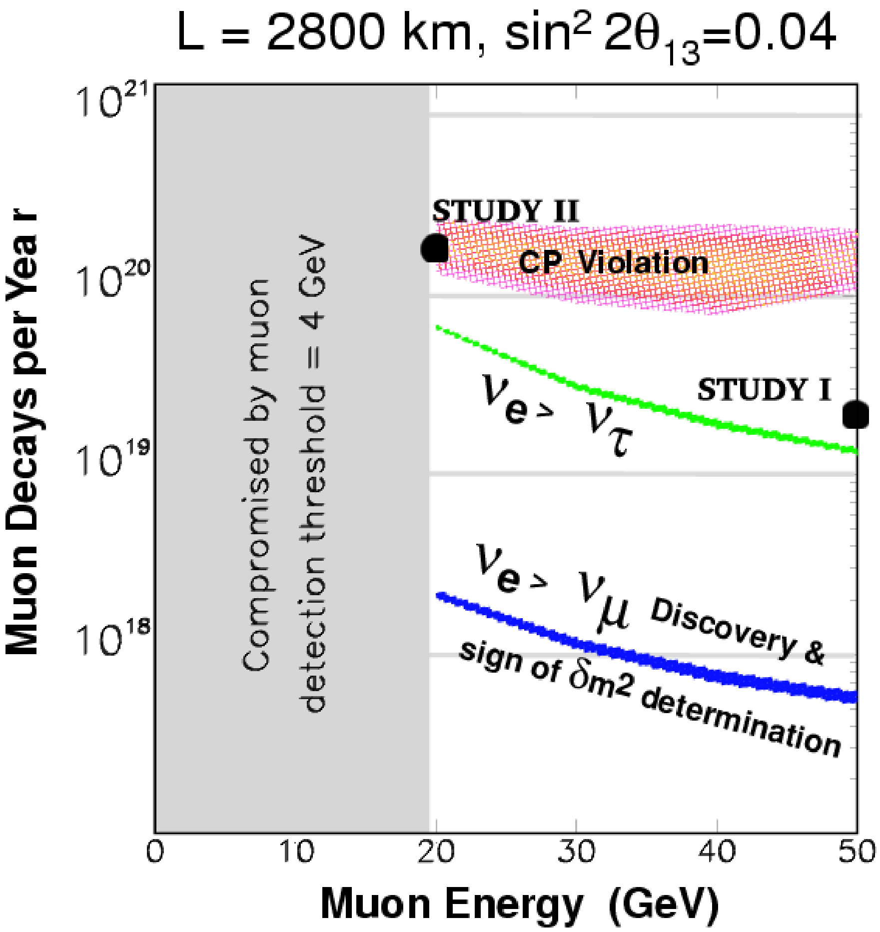
B. GENERIC PART

Higher Intensity, but Lower Energy ?

Cost(E) vs. Physics(CP)



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Performance Required by Charge

- **AGS Driver 1 MW at 24 GeV**
- **20 GeV storage ring**
- $2\ 10^{20} \mu$**'s per** $(10^{7}$ **sec) year**

- **If 20 % loss in acceleration, and**
- **If 40 % straight, then**
- $\approx$ **0.24** μ**/p at 24 GeV**
- **Need gain of** $\approx$ **10** $\times$

Higher μ's per MW

WARNING Factors given depend on system studied and criteria used, which varied. They do not commute and their product will not give total gain.

1. High Z Target
   - 1.7 (simulated)
2. Shorter p pulse
   - 1 ns vs. 3 ns
   - ≈ 1.2 (simulated)
3. RF near target
   - 6 m vs. 50 m
   - ≈ 1.4 (simulated)
4. Non-distorting 2nd Phase Rotation
   - Two Induction Linacs
   - ≈ 1.5 ??
5. Matching mom-amp Correlation
   - 1.15 (simulated)
6. Increased Acceptance in Acceleration
   - e.g. 15 mm rad (vs. 9.375)
   - ≈ 1.15 (simulated)

Lower Costs ?

1. **Super FOFO Cooling Lattice**
   - $\approx$ **1/2 Amp Turns**
   - $\approx$ **1/2 Peak Fields on Coils**
2. **Study New Power Sources**
   - **Clustered Tetrodes**
   - **Hobotron**
3. **Study RF Power Reduction**
   - **SLED ?**
   - **Nitrogen Temperature Cavities ?**

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Tasks

- Lattice Design and Simulation
- Engineering of Improvements
  No Duplication of Study I
- Costs Estimates

Use of this Study

- Upgrade, Alternative, or Merging ?
  will depend on
  - Time scale
  - Physics need
  - Cost

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MILESTONES

Due date: Baseline design parameters	Aug. 9
Mini-workshop on simulations (front end)	Oct.
Due date: Simulation sections reports	Nov. 15
Mini-workshop on technical issues and Joint Meeting of editors	Jan.
Due date: Technical sections reports	Feb. 15
Due date: Introduction, Conclusions, Executive Summary reports	Mar. 15
Overall editing and corrections	Apr. 15