



SPHERICAL NEUTRAL DETECTOR

for experiments at VEPP-2000 e^+e^- collider

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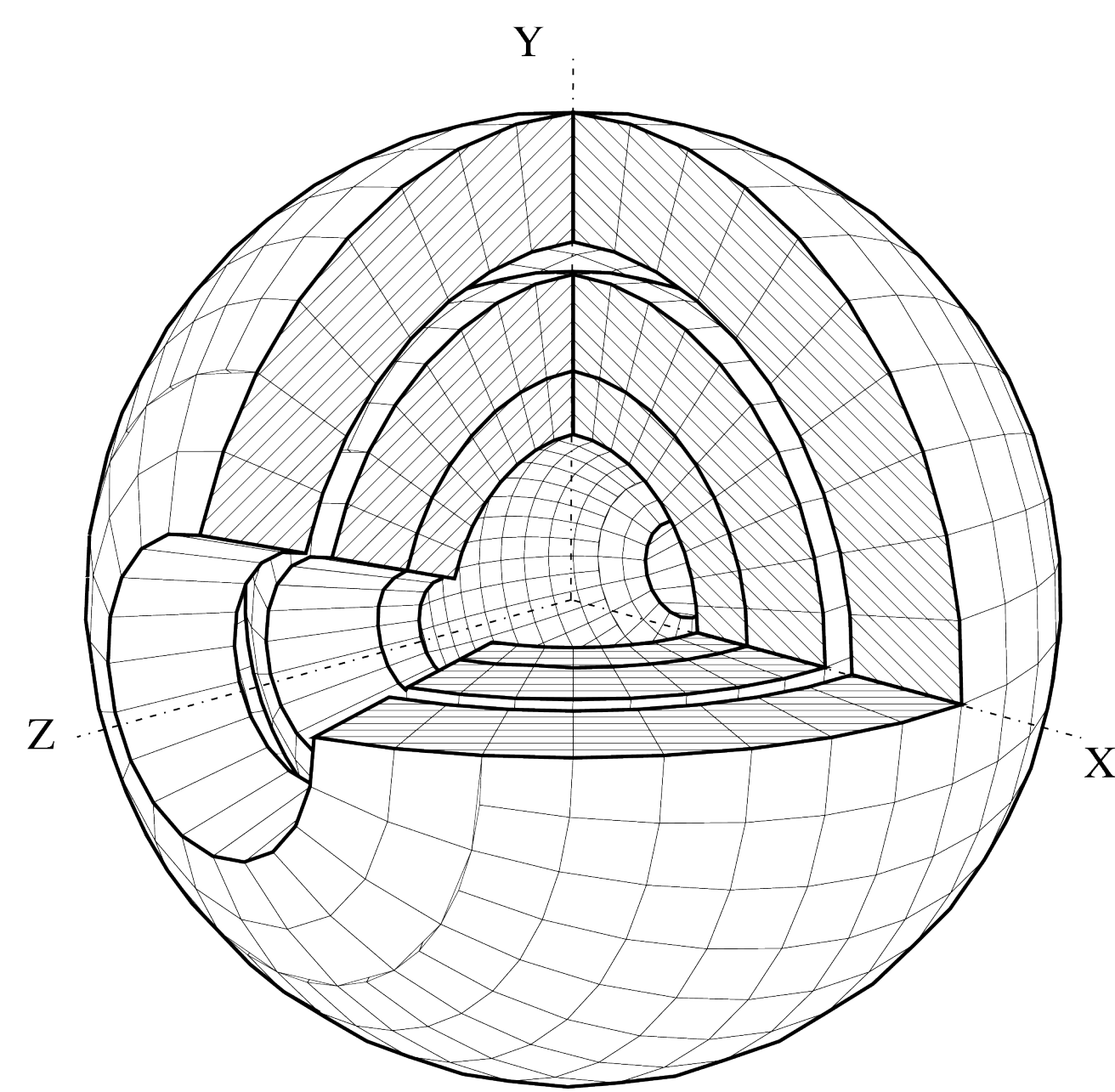
WHAT'S NEW SINCE SND EXPERIMENTS AT VEPP-2M?

- New drift and proportional chambers placed in common gas volume
- Muon system based on proportional tubes instead of streamer ones
- New particle identification system based on aerogel Cherenkov counters

SND PHYSICAL PROGRAM AT VEPP-2000

- Precise measurement of hadronic cross sections in the energy range $2E = 0.4 - 2$ GeV
- Study of vector mesons: $\rho, \omega, \phi, \rho', \omega', \dots$
- Study of nucleon formfactors in $e^+e^- \rightarrow N\bar{N}$ near the threshold
- Two-photon physics: $\gamma\gamma \rightarrow \pi^0, \eta, \eta', \pi^0\pi^0, \dots$

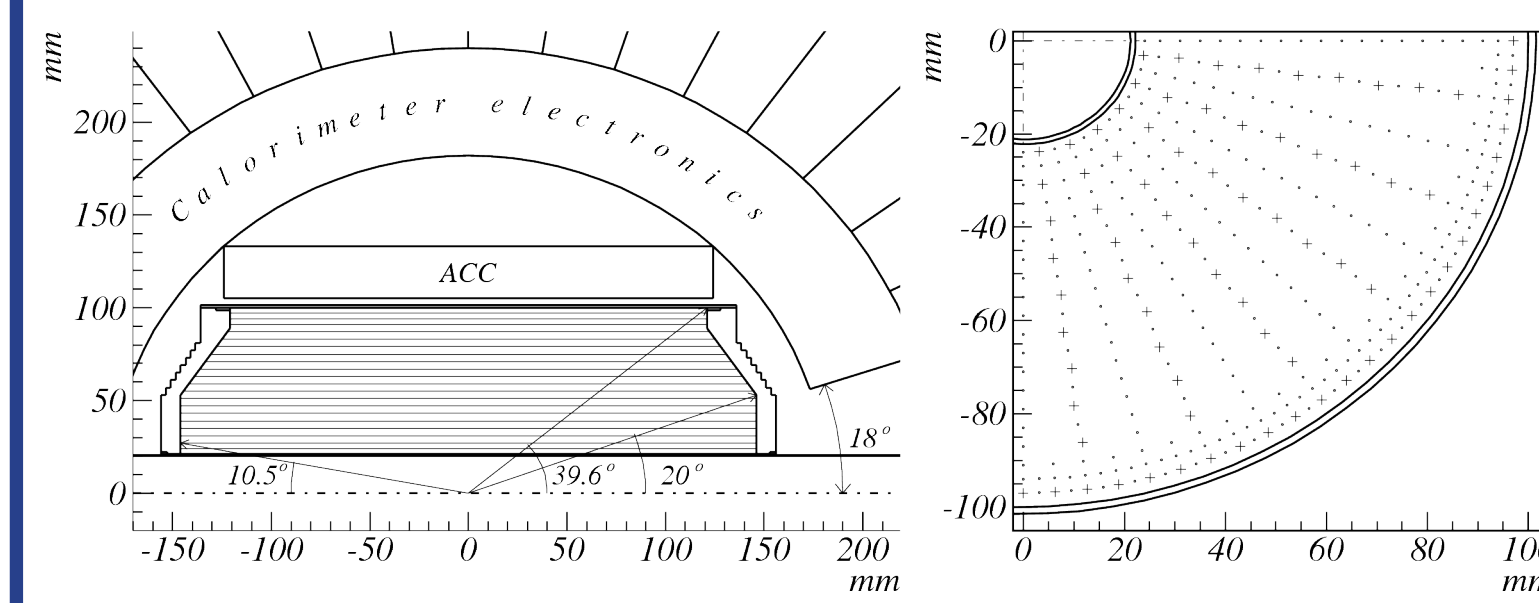
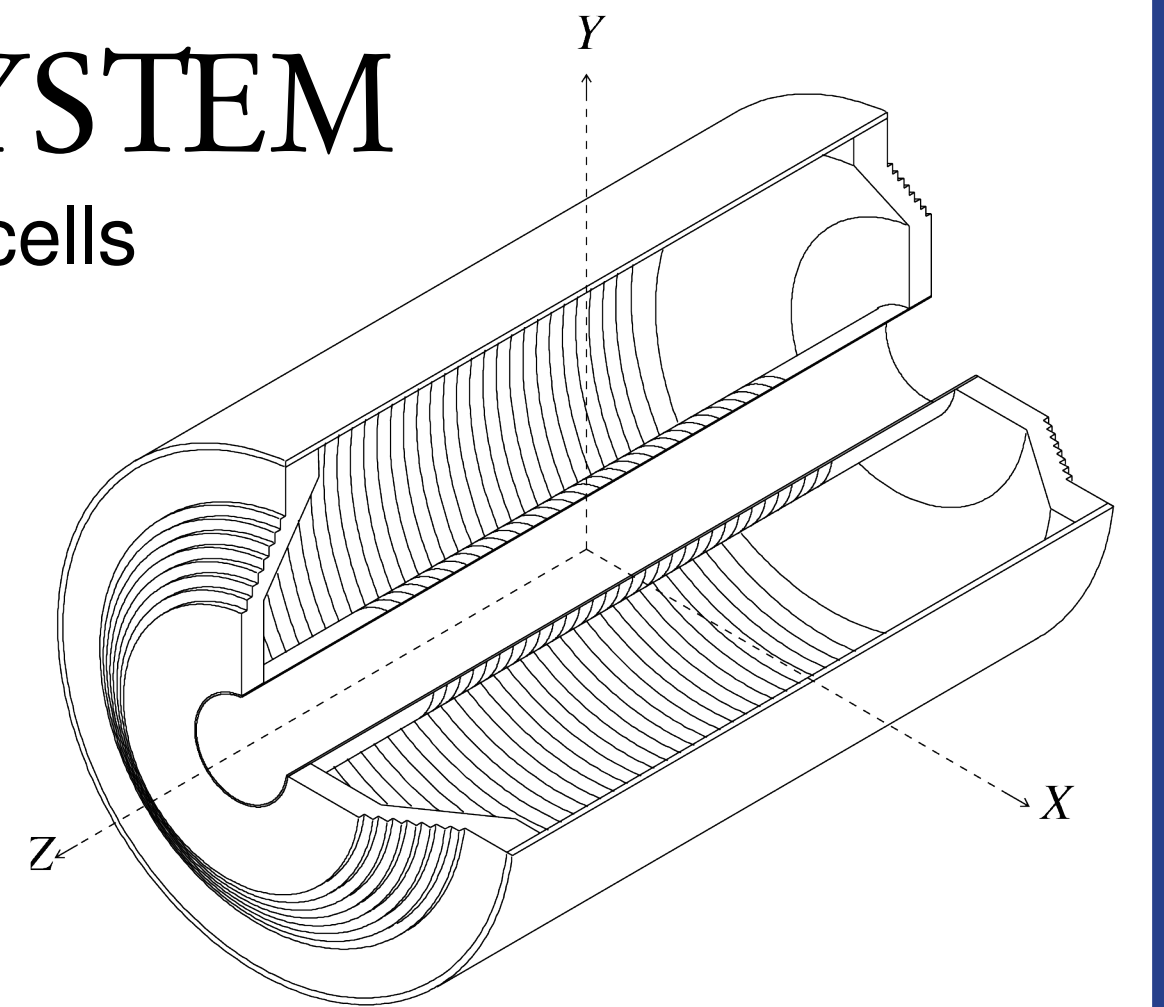
ELECTROMAGNETIC CALORIMETER



- 1632 NaI(Tl) crystals in 3 layers
- $0.9 \cdot 4\pi$ solid angle
- $\Delta\phi = \Delta\theta = 9^\circ$
- $13.4 X_0 = (2.3 + 4.5 + 5.6) X_0$
- VPT readout
- Energy and angular resolution
 $\frac{\sigma_E}{E} = \frac{4.2\%}{\sqrt{E(\text{GeV})}}$ $\sigma_\varphi = \frac{0.82^\circ}{\sqrt{E(\text{GeV})}} \oplus 0.63^\circ$
- Main instrument for VEPP-2000 luminosity measurements in 2007-2009
- Future plans: flash-ADC readout for TOF detection of $e^+e^- \rightarrow n\bar{n}$ events

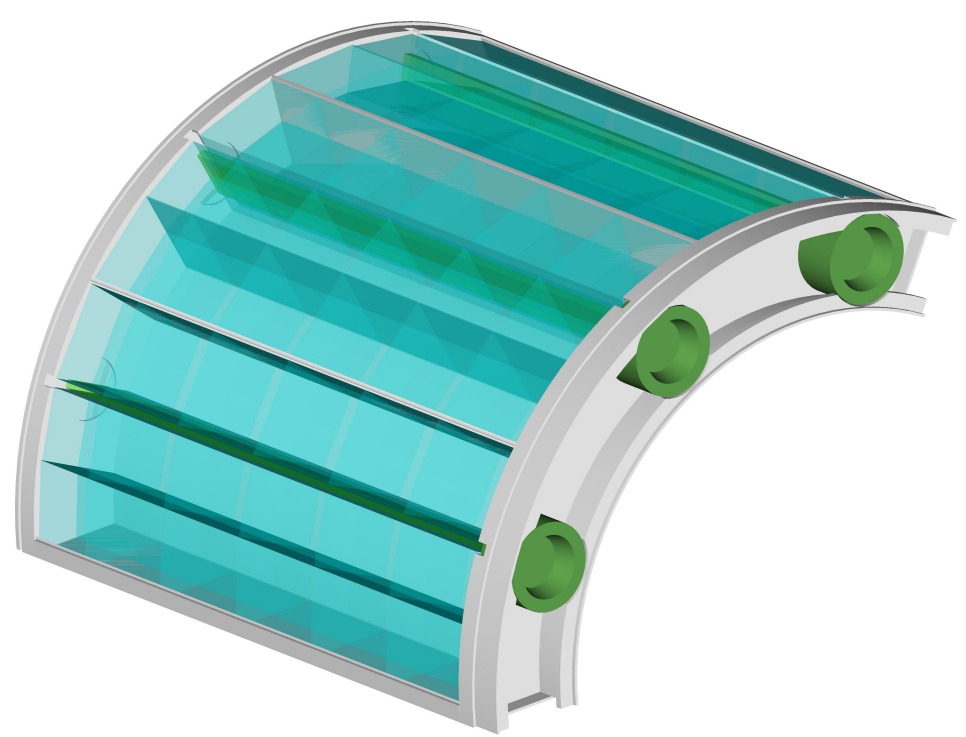
TRACKING SYSTEM

- 9-layer cylindrical drift chamber with 24 jet-type cells
- Proportional chamber near outer wall
- Cathode strips on inner and outer walls
- $0.94 \cdot 4\pi$ solid angle, $0.038 X_0$ thickness
- 90 % Ar + 10 % CO_2 gas mixture, $5 \cdot 10^5$ gain
- Particle identification at $p < 300$ MeV/c using dE/dx

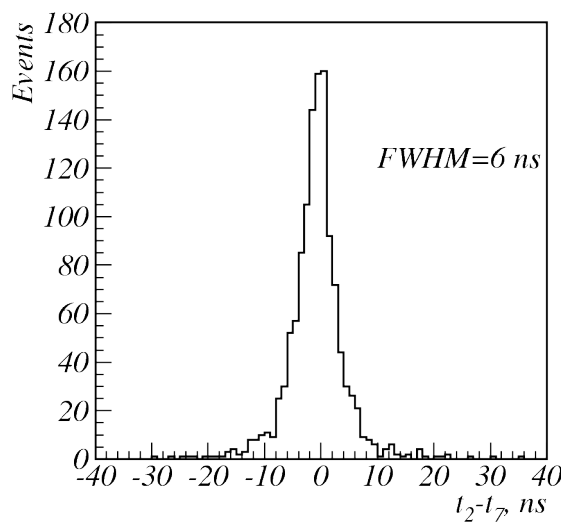


e^+e^- scattering events with two tracks and $30^\circ < \theta < 150^\circ$ after reconstruction:
 $\sigma_R = 0.12$ cm, $\sigma_{|\Delta\theta|} = 4.7^\circ$, $\sigma_{|\Delta\phi|} = 2.2^\circ$
 $\sigma_{|\Delta z|}$ (charge division) = 1.3 cm

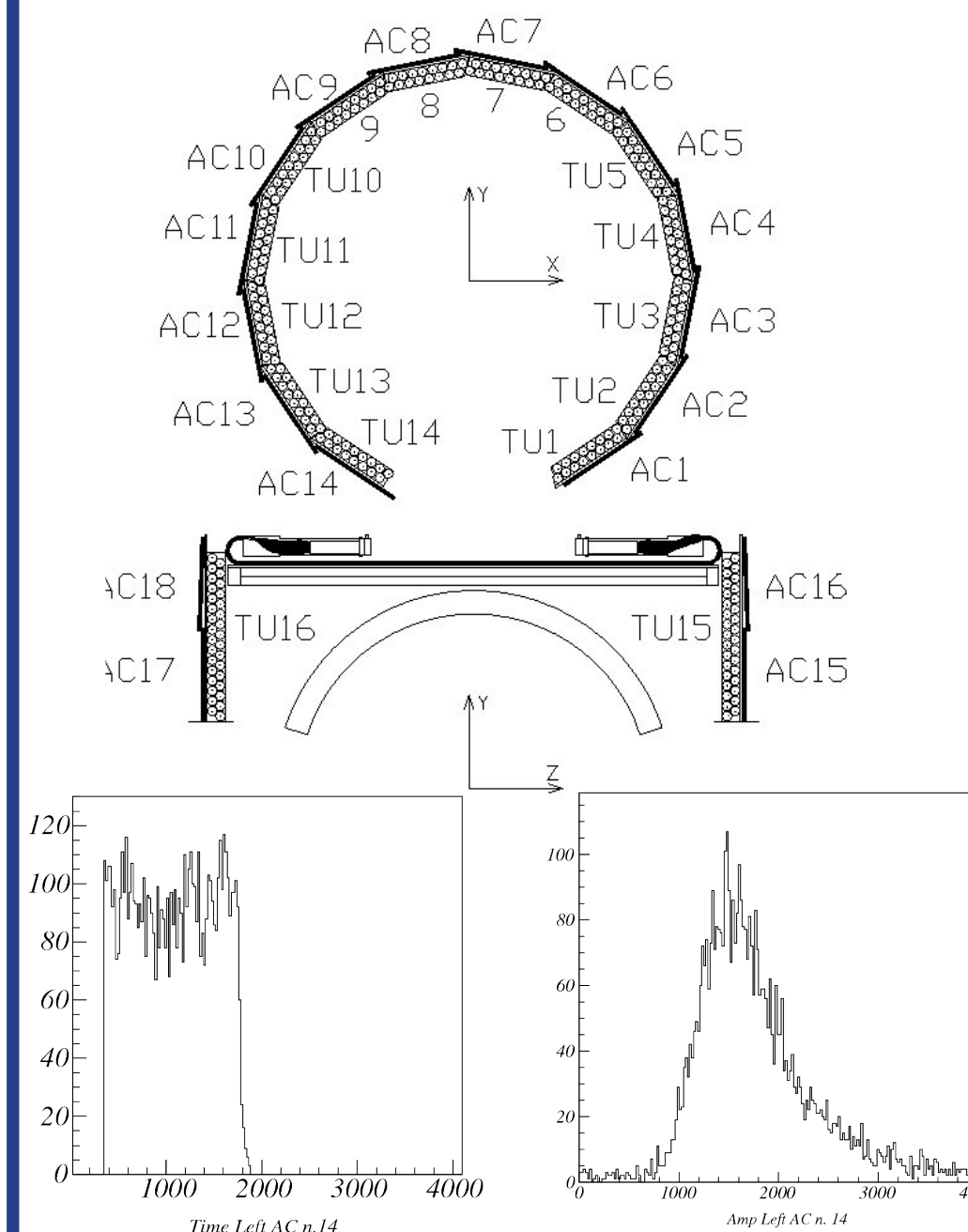
PARTICLE IDENTIFICATION SYSTEM



- π/K separation in the momentum range $300 \text{ MeV}/c < p < 870 \text{ MeV}/c$
- 9 threshold aerogel Cherenkov counters
- $0.6 \cdot 4\pi$ solid angle, $0.09 X_0$ thickness
- ASHIPH: Aerogel, wavelength SHifter, PHotomultiplier tube
- Refractive index $n=1.13 \pm 0.01$, density $\rho=0.65 \text{ g/cm}^3$
- PMT with microchannel plates
- Time resolution $\sigma_t = 2.6$ ns (determined by WLS fluorescence time)

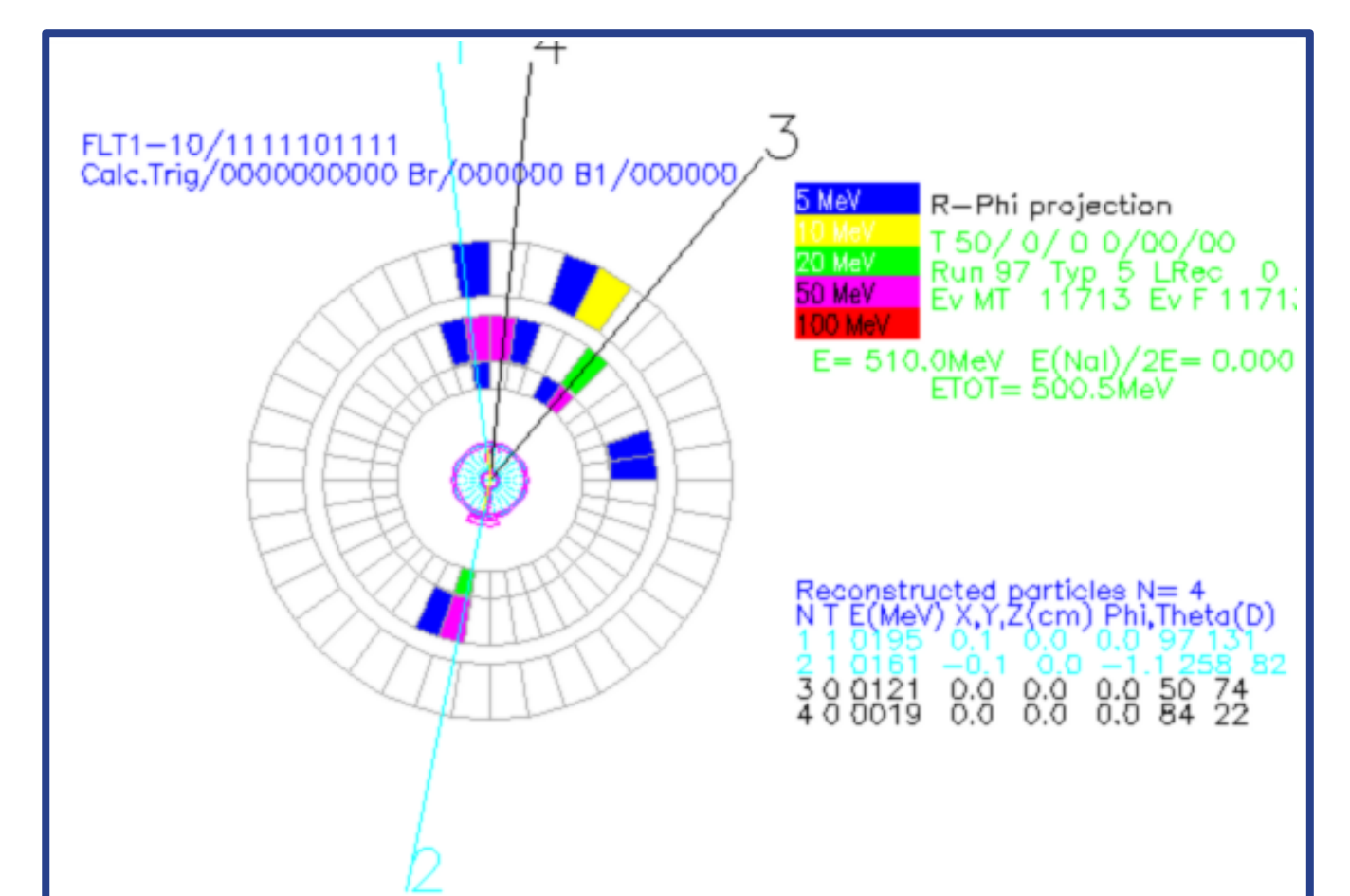
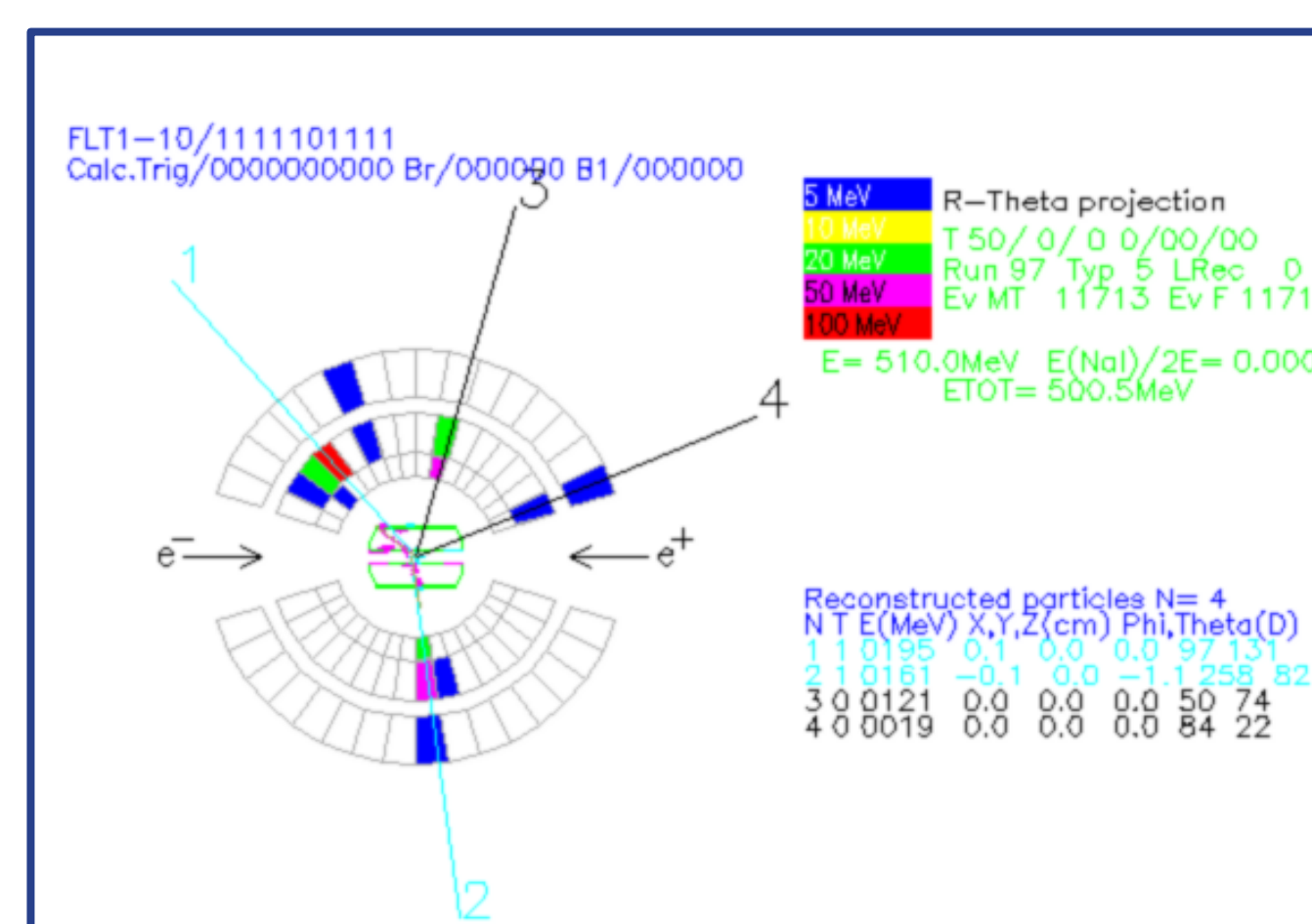
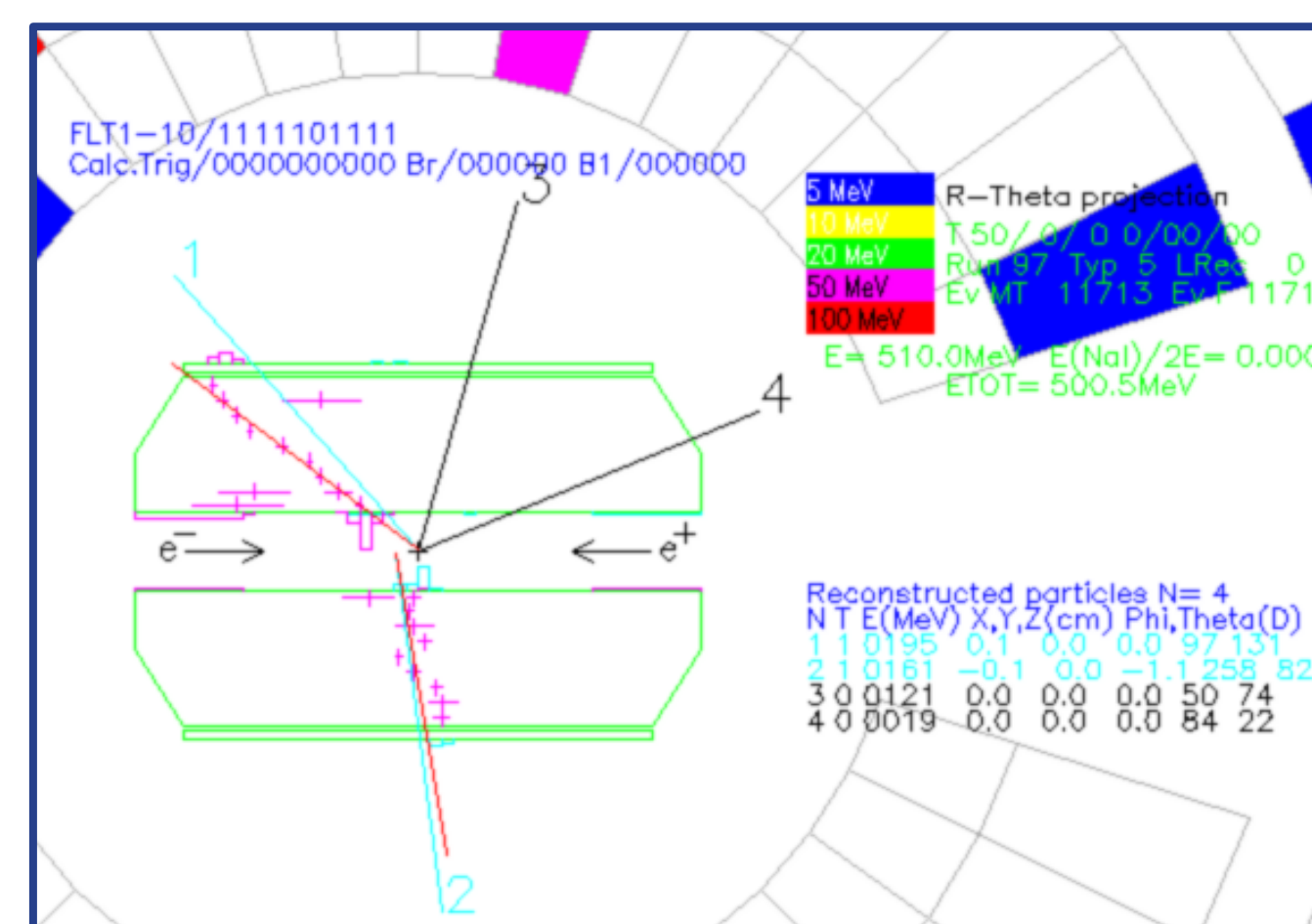
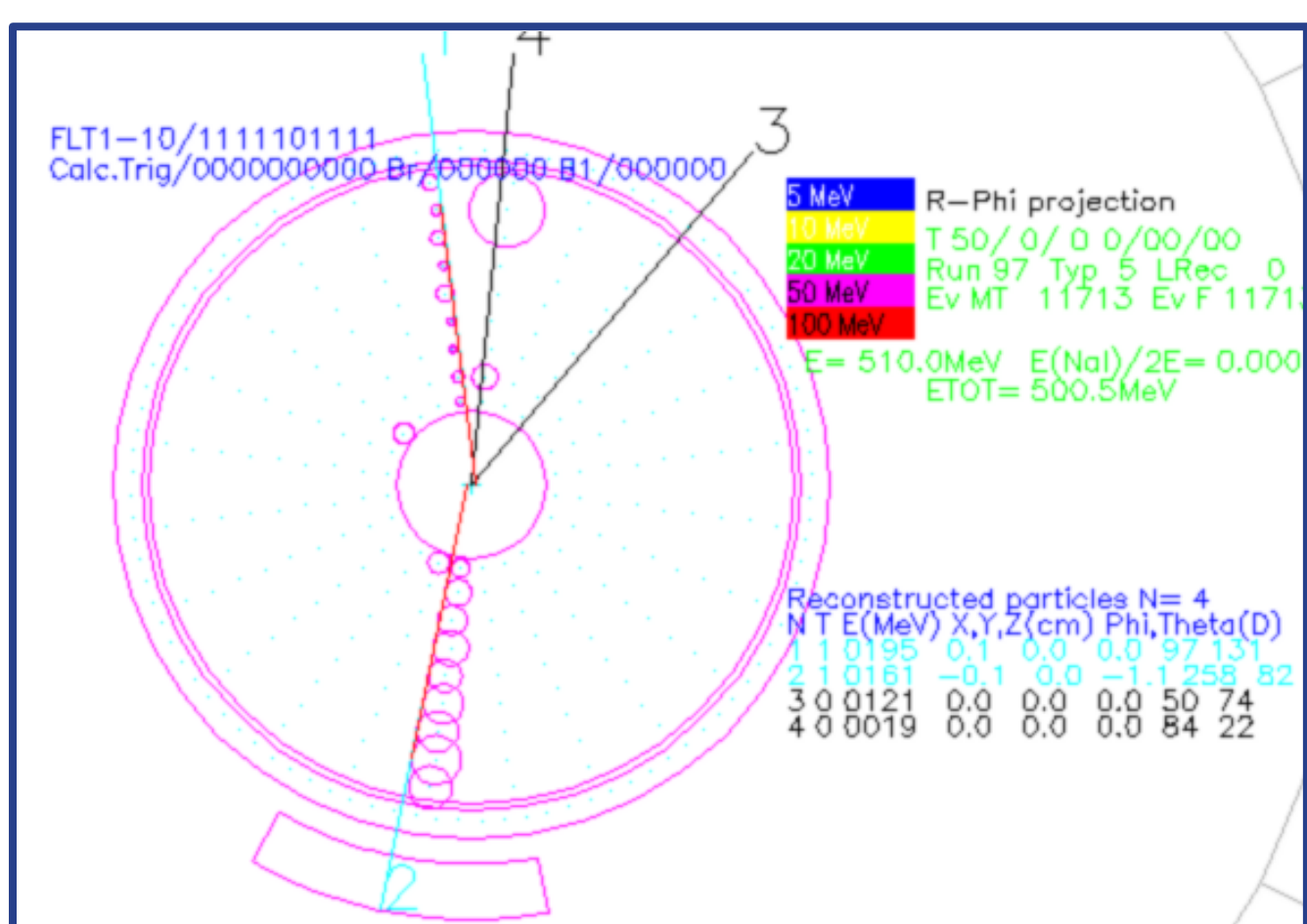


MUON SYSTEM



- Detection of muons penetrating the SND
- Suppression of cosmic background
- 14 barrel and 2 endcap modules
- Barrel module: 16 proportional tubes and plastic scintillator counter with PMT readout
- Endcap module: 32 tubes and 2 counters
- Proportional tubes: 95.5 % Ar + 4.5 % CO_2 gas mixture, $7 \cdot 10^4$ gain

$e^+e^- \rightarrow \pi^+\pi^-\pi^0$ EVENT CANDIDATE AT VEPP-2000



- Two central tracks in drift chamber, strip hits in proportional chamber
- One hit in Cherenkov counter (the second charged particle missed the counter)

- Four clusters in calorimeter, sum of photon energies is greater than π^0 mass
- No hits in muon system

CURRENT STATUS AND FUTURE PLANS

- All subsystems are operating properly
- Development and support of calibration and reconstruction software
- At present: test runs at VEPP-2000 together with CMD-3 at ϕ peak
- This year: scan of ρ', ω', ϕ' energy range ($2E = 1.4 - 1.8$ GeV)

