

First Results from the CMD-3 Detector

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Outline

1. Motivation
2. Experiment
3. First results
4. Conclusions

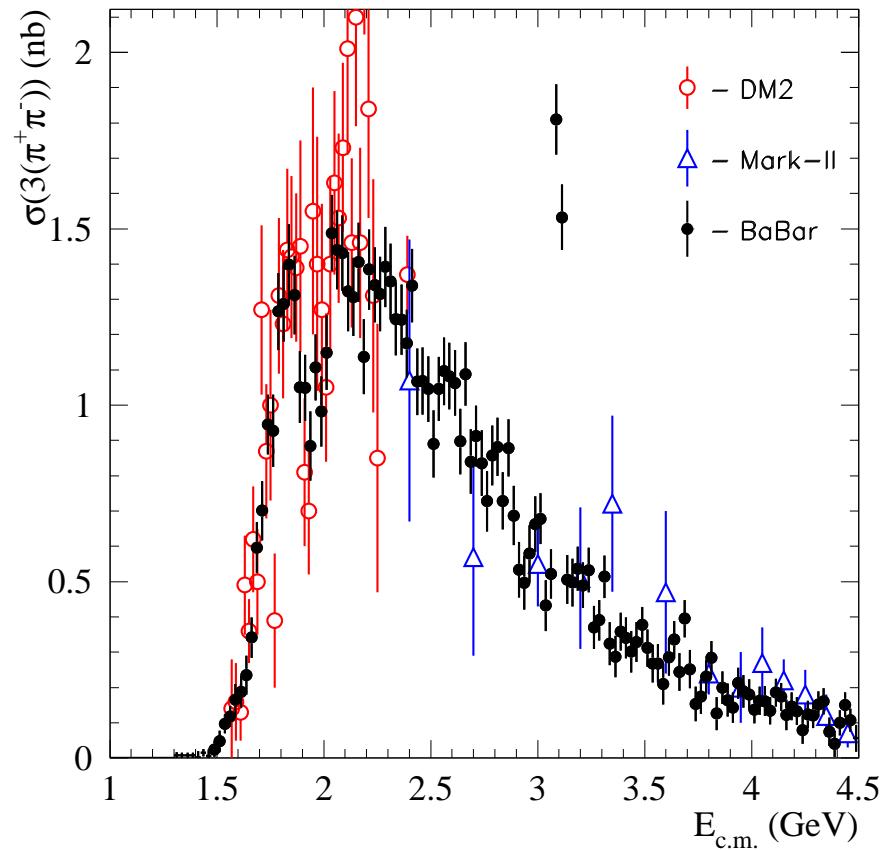
Physics at VEPP-2000 – I

- VEPP-2000 – e^+e^- collider in Novosibirsk, \sqrt{s} from threshold to 2 GeV
- Total and exclusive cross sections of $e^+e^- \rightarrow$ hadrons:
 1. Interactions of light quarks
 2. Spectroscopy of light vector mesons – ρ' , ω' , ϕ'
 3. Study of mesons with other J^{PC}
 4. F/f measurement in various two-body channels
 5. $p\bar{p}$, $n\bar{n}$ production near threshold
 6. Search for various exotics

Physics at VEPP-2000 – II

Implications of low energy cross sections
for various fundamental quantities:

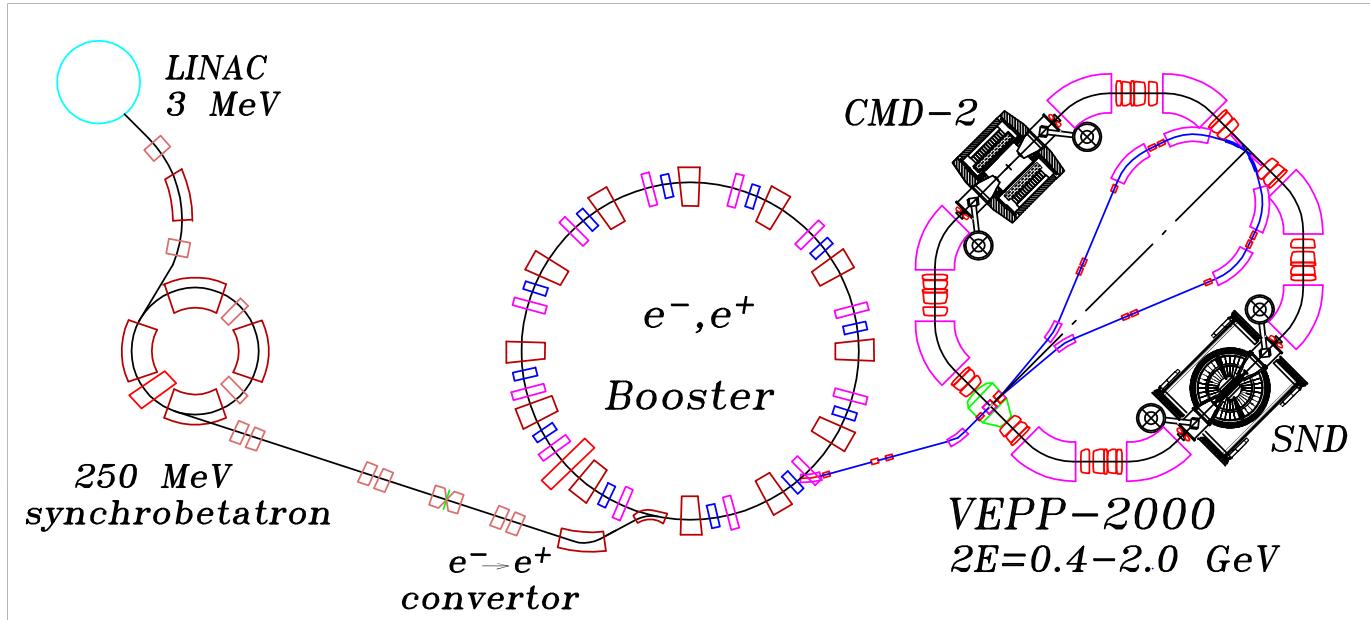
- Muon anomalous magnetic moment, a_μ , where a more than 3.5σ deviation is observed from the SM prediction
- 92% of $a_\mu^{\text{had,LO}}$ is saturated by \sqrt{s} from threshold to 2 GeV
- 73% of $a_\mu^{\text{had,LO}}$ is saturated by $e^+e^- \rightarrow \pi^+\pi^-$ at $\sqrt{s} < 2$ GeV
- $\gamma\gamma \rightarrow \pi^0, \eta, \eta'$ is important for $a_\mu^{\text{had,LBL}}$
- Hadronic contributions to running α
- $m_{u(d)}$ and quark /gluon condensates from QCD sum rules
- Test of CVC by comparing e^+e^- and τ

$e^+e^- \rightarrow 3\pi^+3\pi^-$ 

A new dip structure around 1.9 GeV – baryonium or $\rho(1900)$?

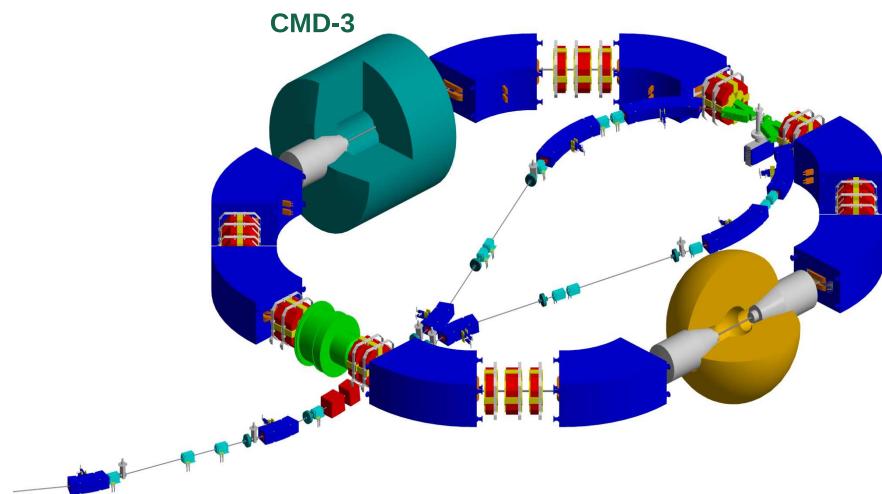
VEPP-2000 Accelerator Complex

Layout of the VEPP-2000 complex



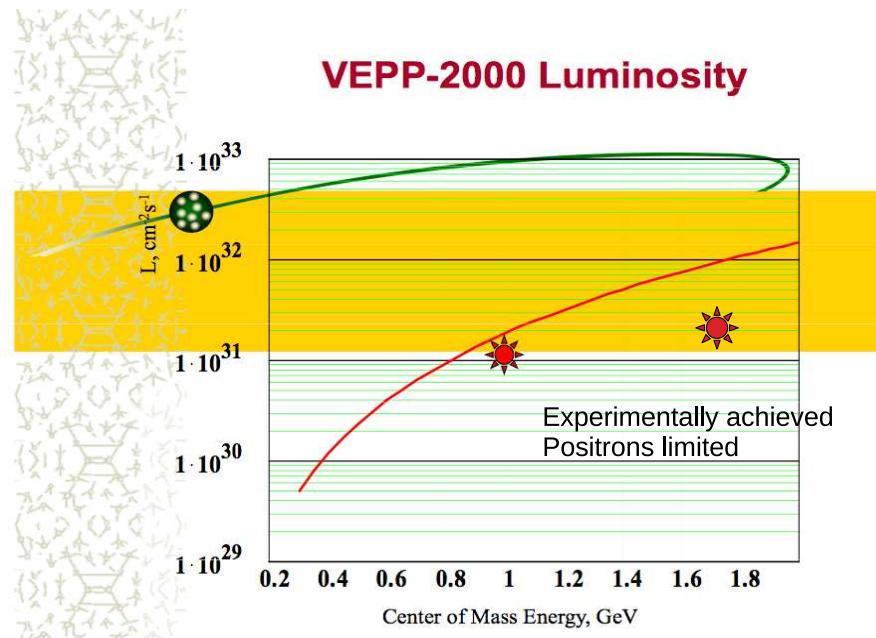
Machine	Physics	\sqrt{s} , MeV	\mathcal{L}_{\max} , $10^{30} \text{cm}^{-2}\text{s}^{-1}$	$\int \mathcal{L} dt$, pb $^{-1}$
VEPP-2M	1975 – 2000	360–1400	3	~ 60
VEPP-2000	2010 – 2020	300–2000	100	~ 3000

VEPP-2000 Collider



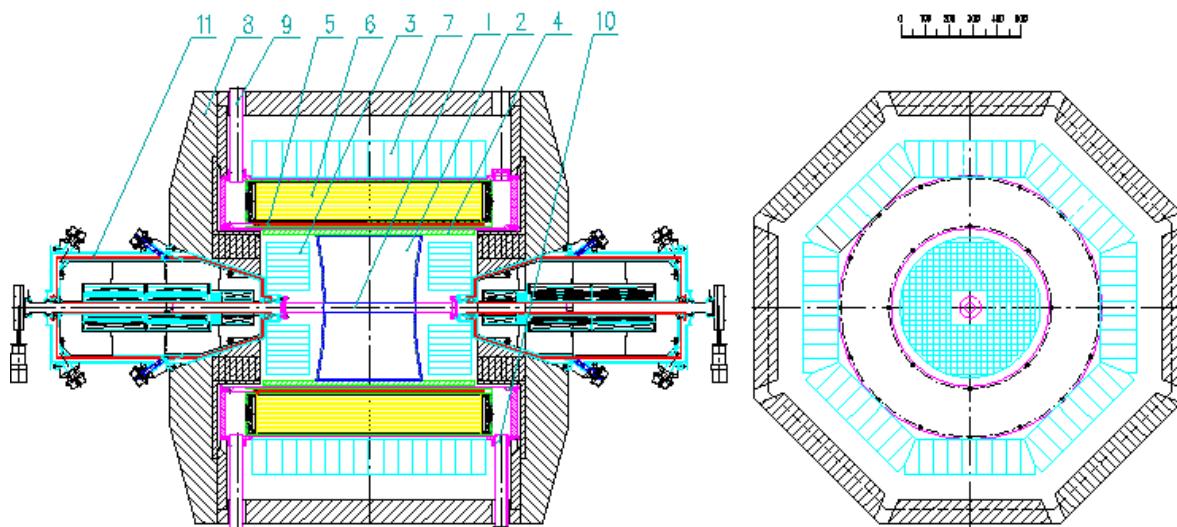
Round beams: 1×1 bunch, $\epsilon_x = \epsilon_y$, $\sigma_x^* = \sigma_y^*$, $\nu_x = \nu_y$

Luminosity at VEPP-2000



Design luminosity should be achieved after
the new injection complex is commissioned in 2012

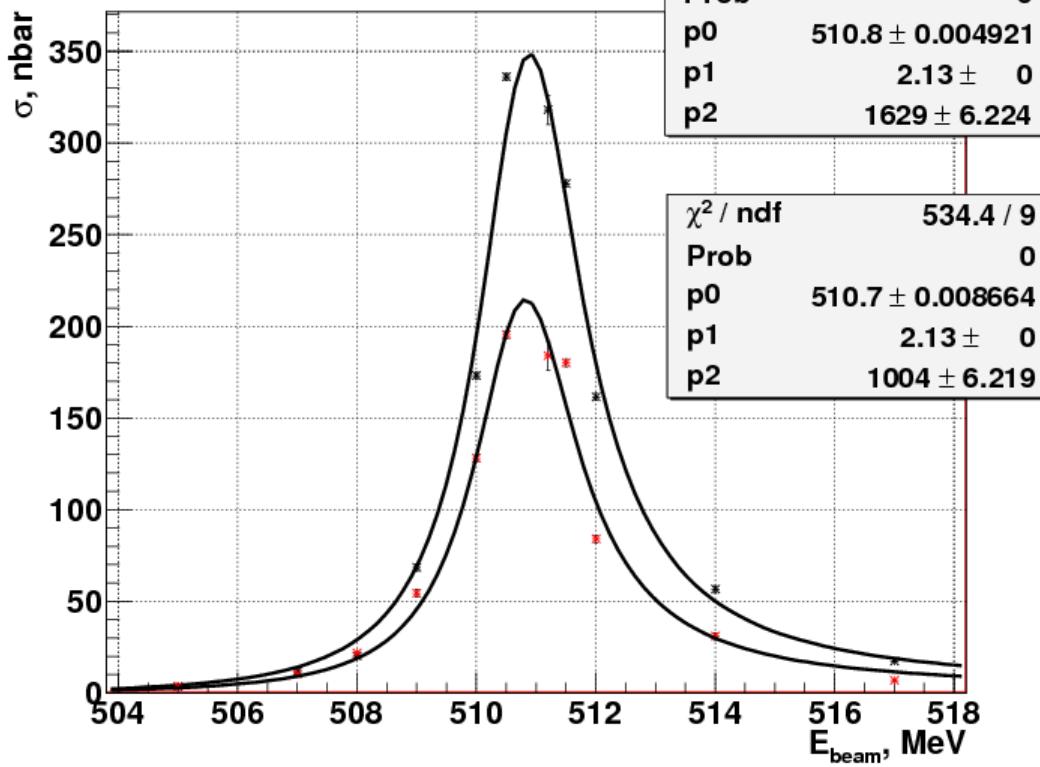
CMD-3 Detector



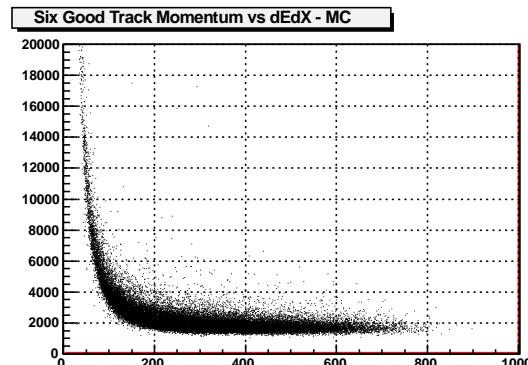
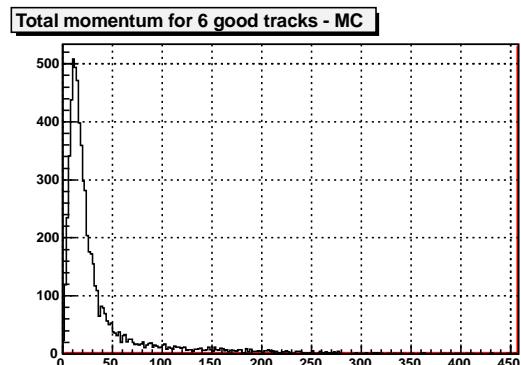
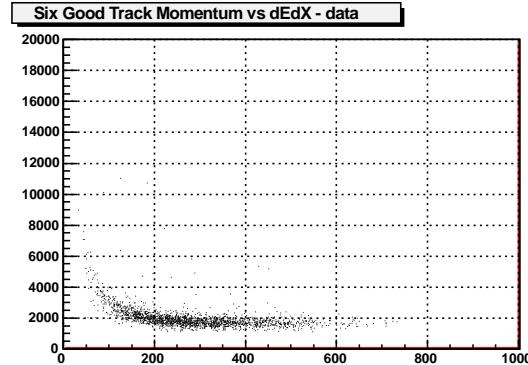
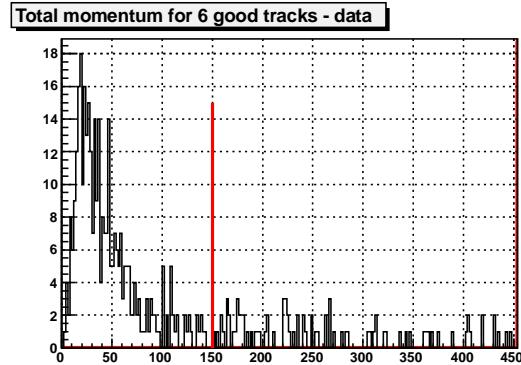
- 1 Beam pipe
- 2 Drift chamber
- 3 BGO calorimeter
- 4 Z chamber
- 5 SC solenoid
- 6 LXe calorimeter
- 7 CsI calorimeter
- 8 Flux return
- 9 LHe supply
- 10 Vacuum pumpdown
- 11 SC focusing magnets

Data Taking

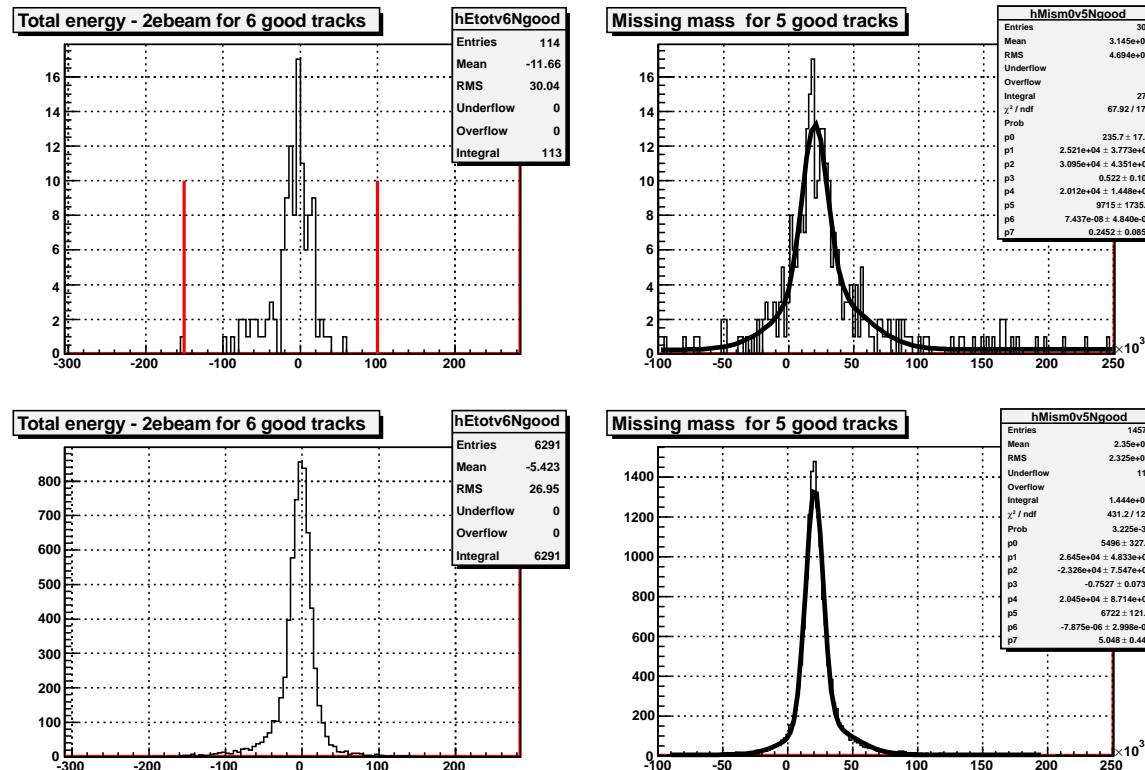
- Two scans (up and down) were performed from the ϕ meson to 2 GeV with a step of 25 MeV and $\sim 500 \text{ nb}^{-1}$ per point
- A step was smaller near the $p\bar{p}$ threshold
- ϕ meson, 1050, 1075, 1100, 1125, ..., 1800, 1825, 1850, 1870, 1890, 1900, 1925, 1950, 1975, 2000
- 56 points $\Rightarrow \sim 22 \text{ pb}^{-1}$
- 15 points at the ϕ meson from 1010 to 1034 MeV, 1.9 pb^{-1} in total for detector studies and software tests

$\phi \rightarrow K^+K^-, K_SK_L$ **Graph**

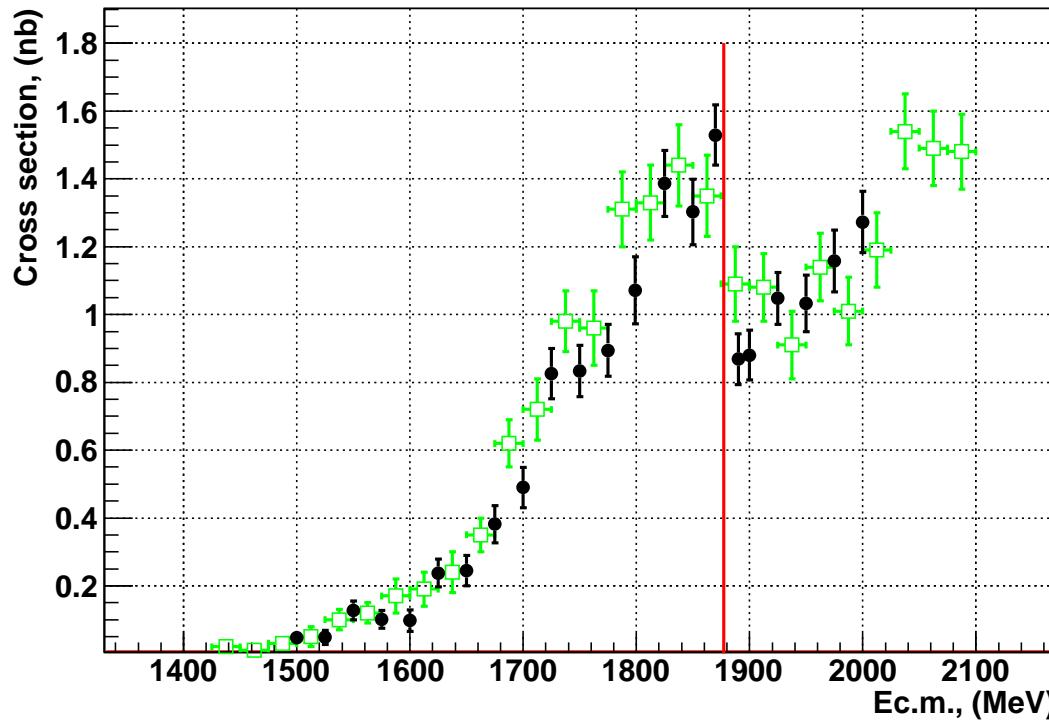
Selection of $3\pi^+3\pi^-$ Events – I



Selection of $3\pi^+3\pi^-$ Events – II

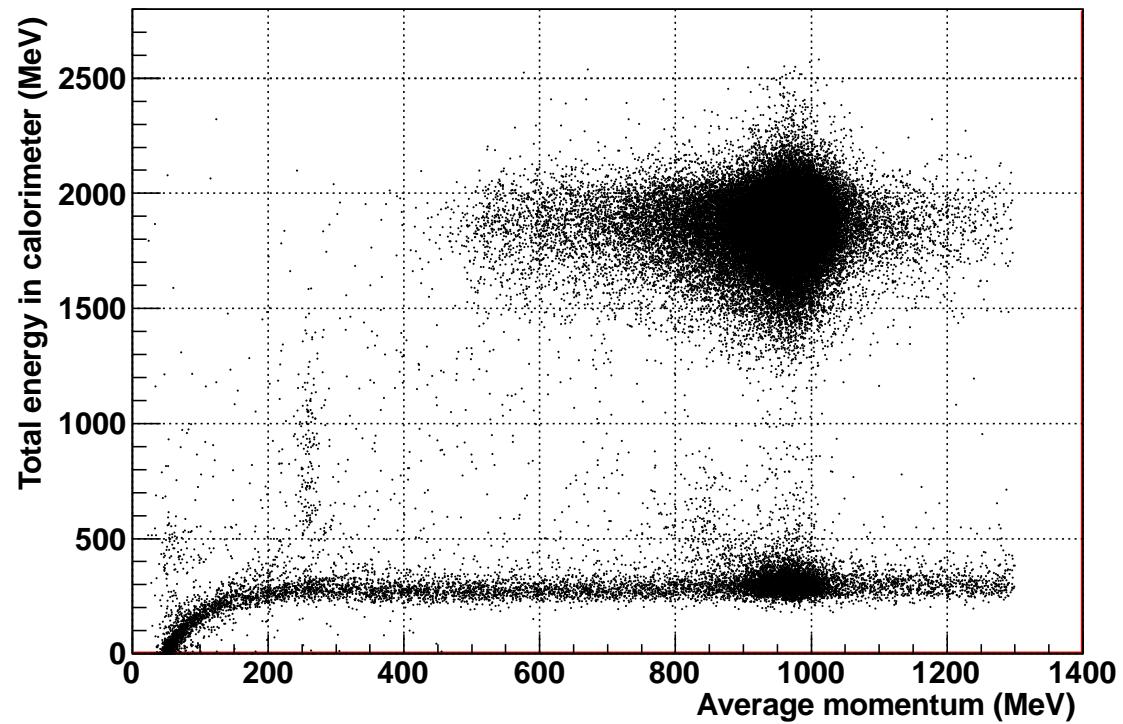


$e^+e^- \rightarrow 3\pi^+3\pi^-$ at CMD-3

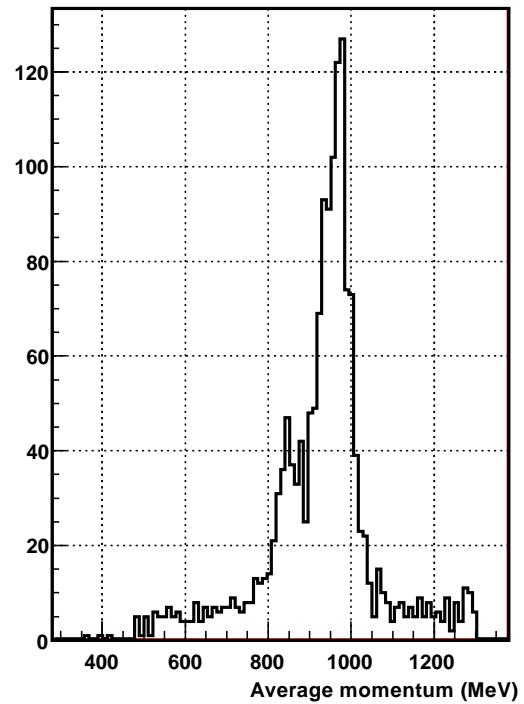
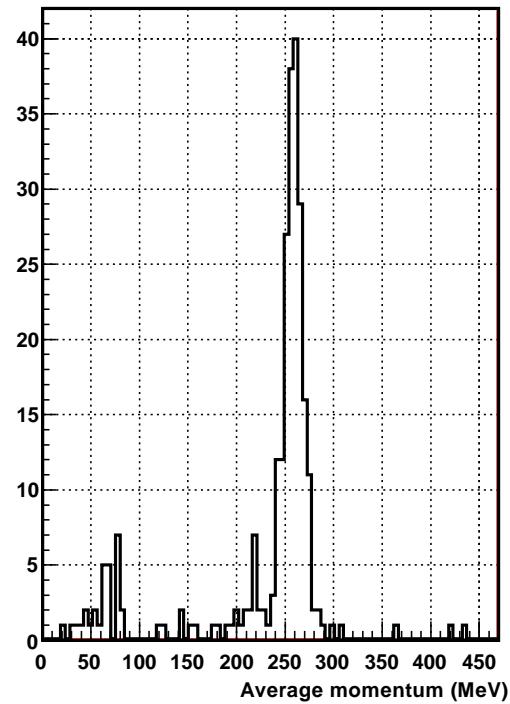


Good agreement and comparable precision to BABAR,
A dip at 1900 MeV confirmed, baryonium or $\rho(1900)$?

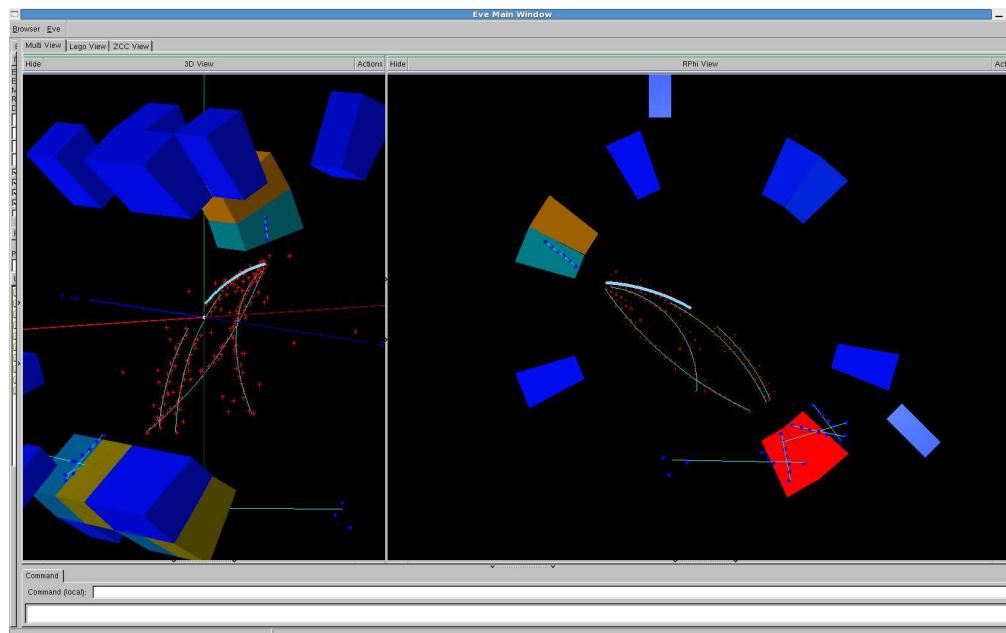
Selection of $e^+e^- \rightarrow p\bar{p}$ Events – I

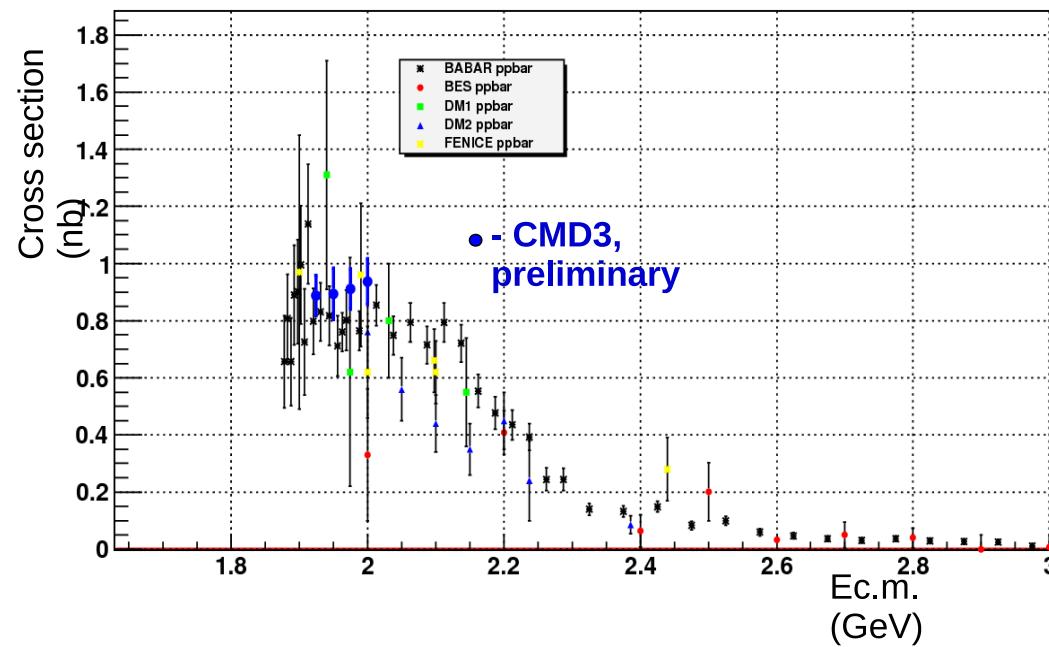


Selection of $e^+e^- \rightarrow p\bar{p}$ Events – II



Example of an $e^+e^- \rightarrow p\bar{p}$ Event





$\sigma(e^+e^- \rightarrow p\bar{p})$ is consistent with that of BABR and older measurements

Conclusions

- VEPP-2000 has been successfully commissioned with a luminosity of $2 \cdot 10^{31} \text{ cm}^{-2}\text{s}^{-1}$ achieved
- Two detectors, SND and CMD-3, are taking data, we start understanding their performance
- The integrated luminosity collected between 1 and 2 GeV already exceeds the one previously achieved in direct scans with precision close to BABAR
- CMD-3 measures $\sigma(3\pi^+3\pi^-)$ and confirms a dip at 1900 MeV
- About 2000 events of $e^+e^- \rightarrow p\bar{p}$ near threshold observed
- In a few years we hope to measure $\sigma(e^+e^- \rightarrow \text{hadrons})$ with high accuracy and significantly improve the precision of $a_\mu^{\text{had,LO}}$

Back-up Slides

Cross Sections with CMD-2 at VEPP-2M

