



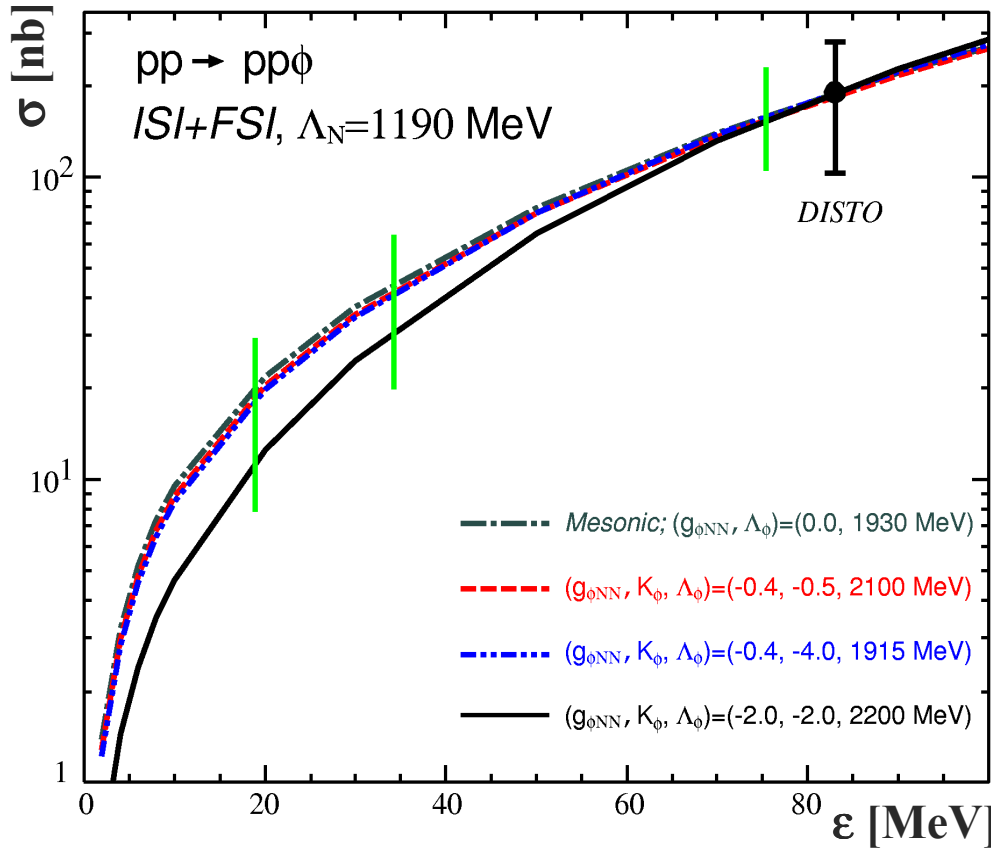
ϕ meson production in pp collision close to threshold region

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(I.Keshelashvili@FZ-Juelich.de)

Outline

- ◆ Physic motivation
- ◆ ANKE @ COSY
- ◆ Data analysis
- ◆ Preliminary result
- ◆ Summary

ϕ meson production in pp collision

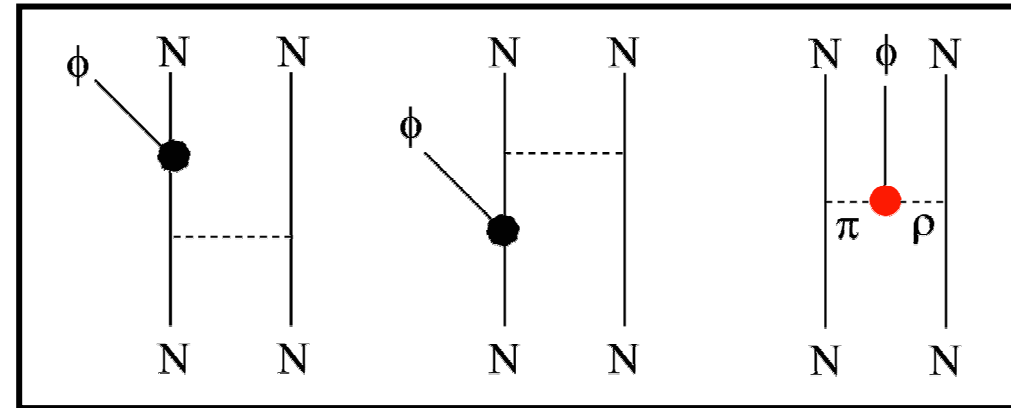


K. Tsushima and K. Nakayama
Phys. Rev. C68(2003) 034612

F. Balesta et al.,
Phys. Rev. C63(2001) 024004

DISTO @ SATURNE (Saclay, France)

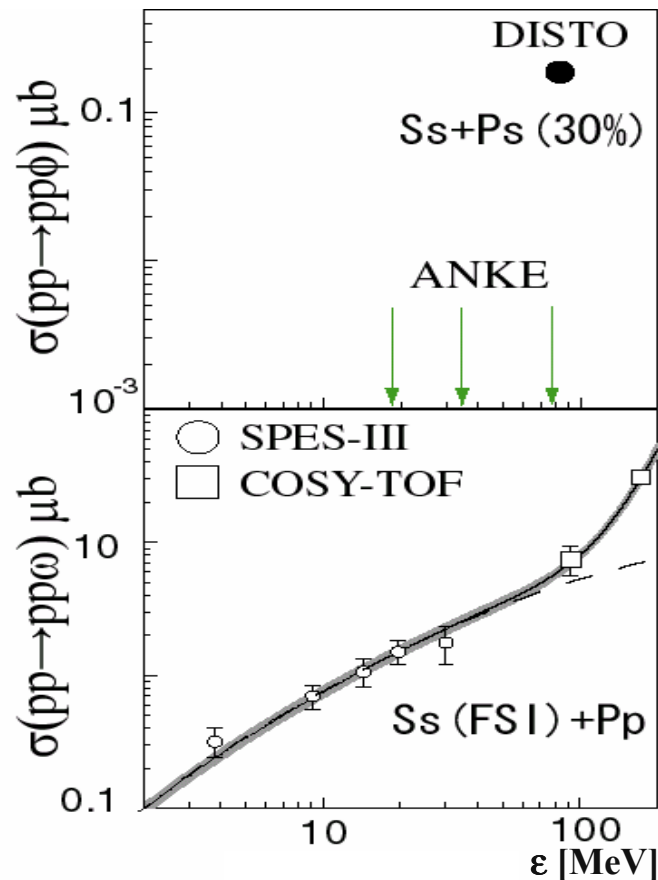
$\sigma_{\text{tot}} = 200 \text{ nb} @ \epsilon = 83 \text{ MeV}$



$$\sigma(\epsilon) \rightarrow g_{\phi NN}$$

ϕ/ω ratio and OZI rule

$$\text{OZI rule } R_{\phi/\omega} = 4.2 \times 10^{-3}$$



$\bar{p}p$ annihilation

$$R_{\phi/\omega} \approx 30 \div 70 \times R_{\text{OZI}}$$

C. Amster, Rev. Mod. Phys. 70 (1998)

A. Sibirtsev, W. Cassing Eur. Phys. J. A7 (2000)

- Mesonic and radiative decay

$$R_{\phi/\omega} \leq 3 \times R_{\text{OZI}}$$

- pp collision at $\epsilon \geq 100$ MeV and πN

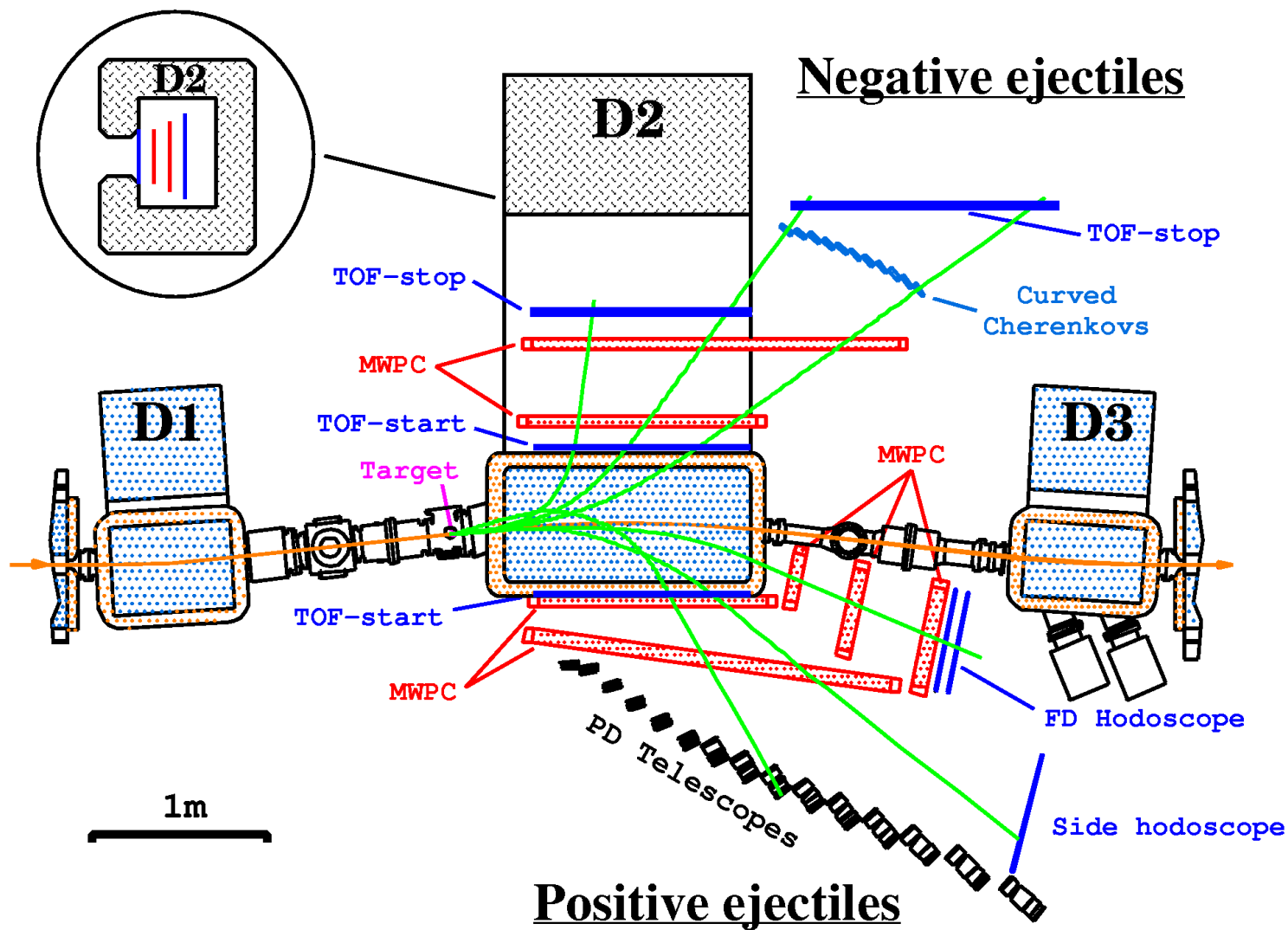
$$R_{\phi/\omega} \approx 3 \times R_{\text{OZI}}$$

- DISTO at $\epsilon = 83$ MeV in pp collision

$$R_{\phi/\omega} \approx 7 \times R_{\text{OZI}}$$

At ANKE $\epsilon = 18.5, 34.6, 76.0$ MeV

ANKE spectrometer at COSY



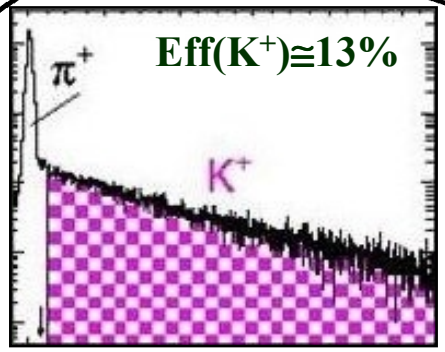
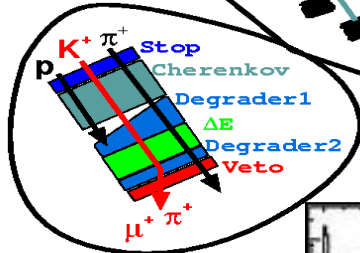
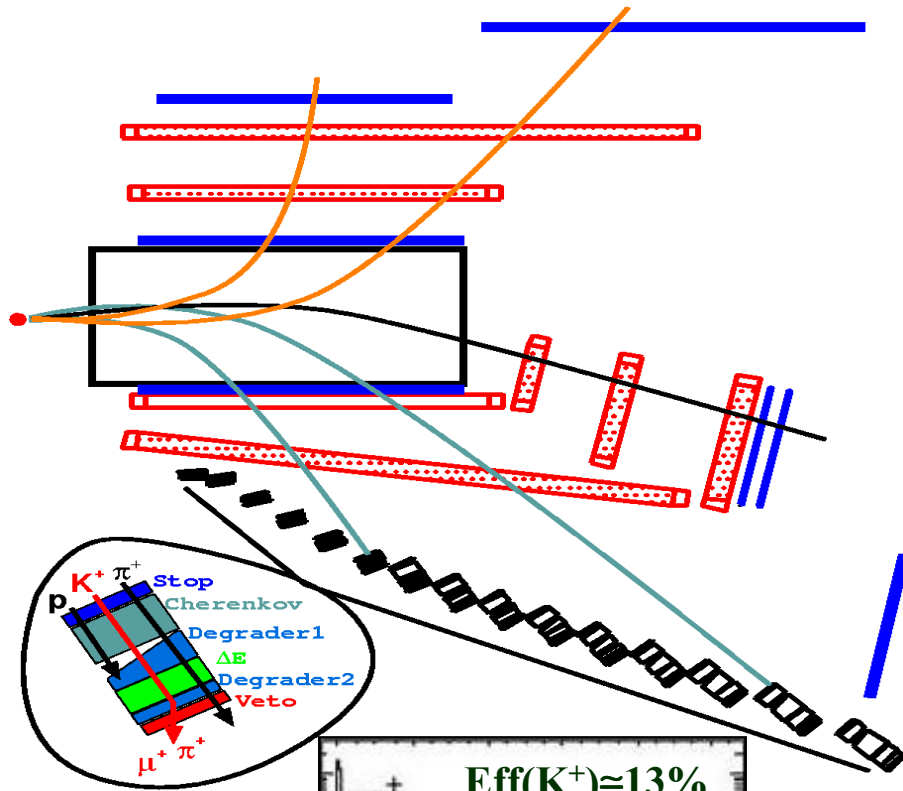
Detector system

- ✓ FD for p
- ✓ PD for K^+
- ✓ ND for K^-

Beam time

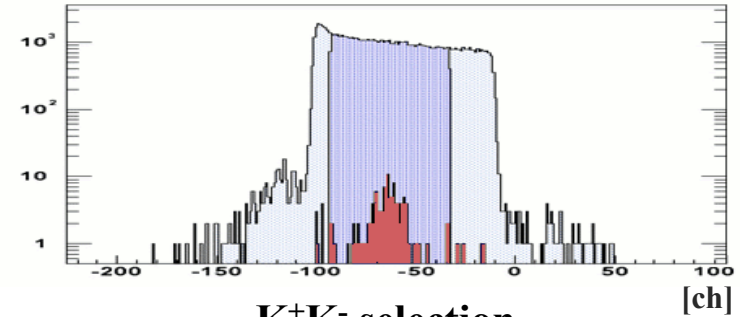
- ⇒ 1 we. 2.83 GeV (winter'02)
- ⇒ 1 we. 2.70 GeV (spring'02)
- ⇒ 3 we. 2.65 GeV (winter'04)

Selection of $K^+ K^-$ and p

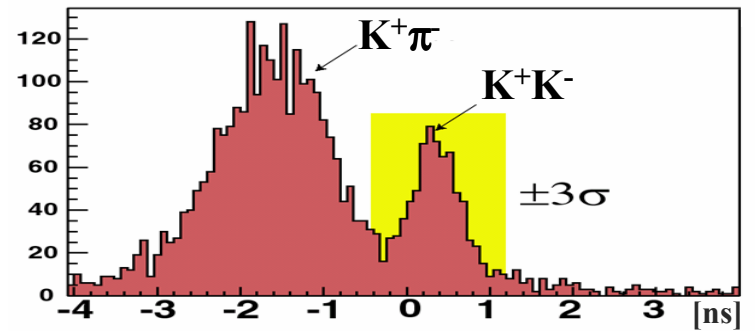


$\Delta t(\text{Veto-Stop})[\text{ch}]$

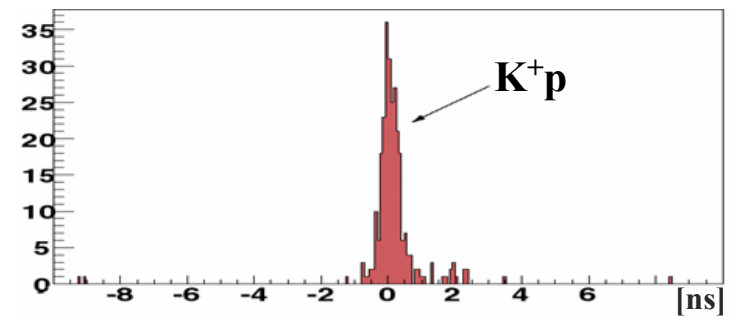
K^+ selection via Sa-So TOF



$K^+ K^-$ selection

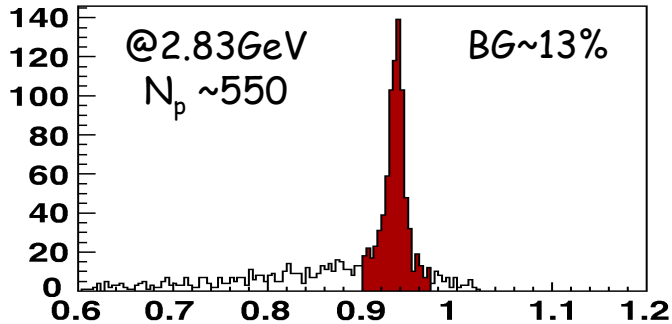


K^+ p selection

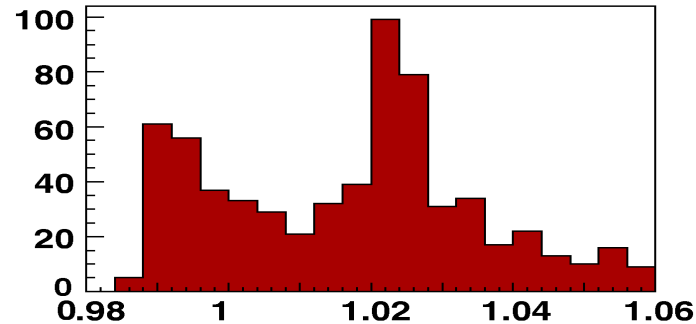


Identification of the $pp \rightarrow pp\phi$ event

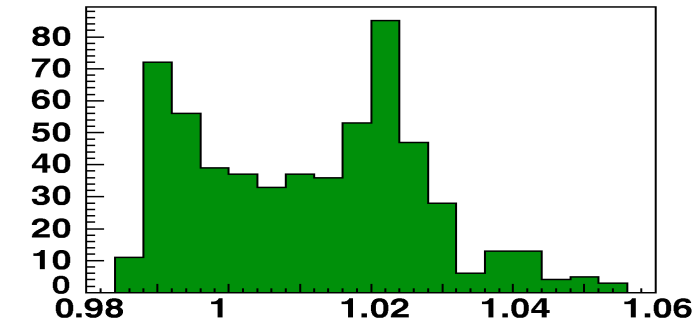
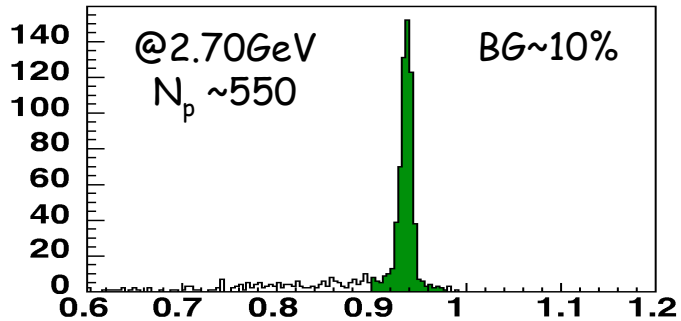
K⁺K⁻p missing mass



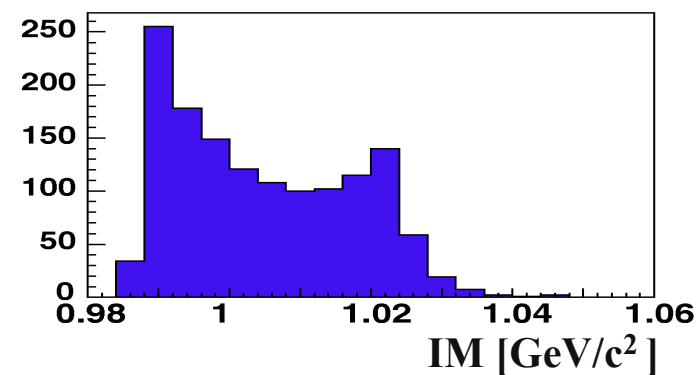
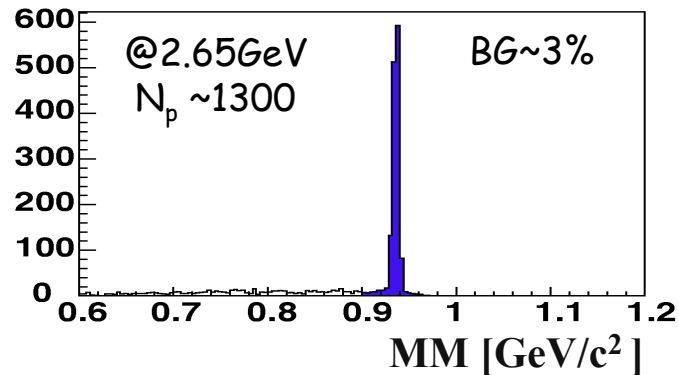
Invariant K⁺K⁻ mass



$N_\phi \approx 200$ event
 $\mathcal{E} = 76.0$ MeV



$N_\phi \approx 200$ event
 $\mathcal{E} = 34.6$ MeV



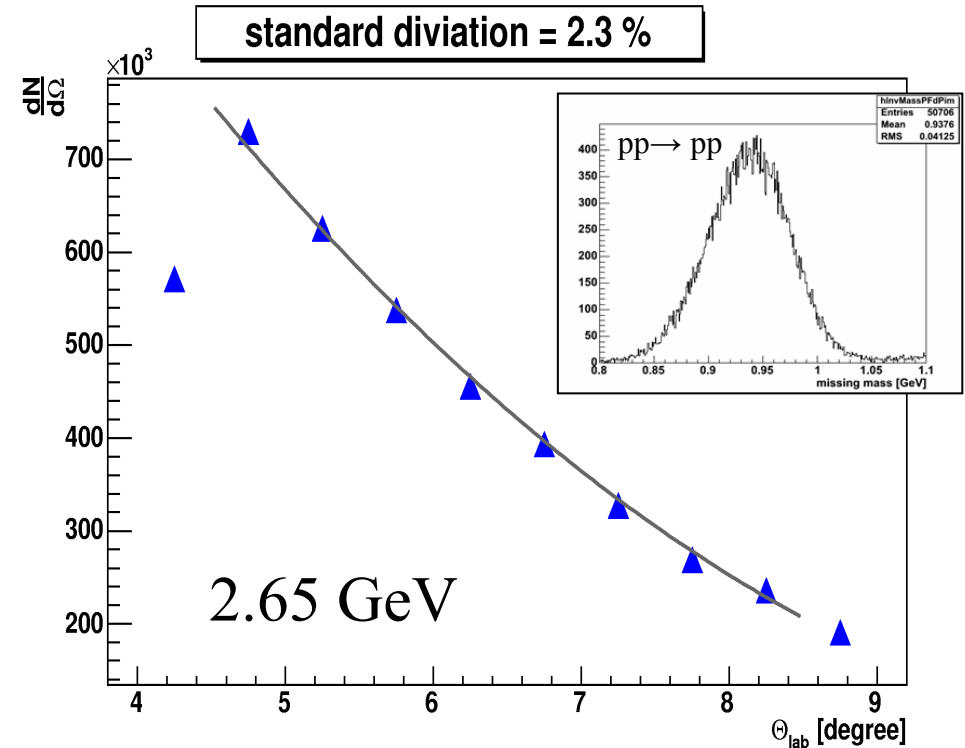
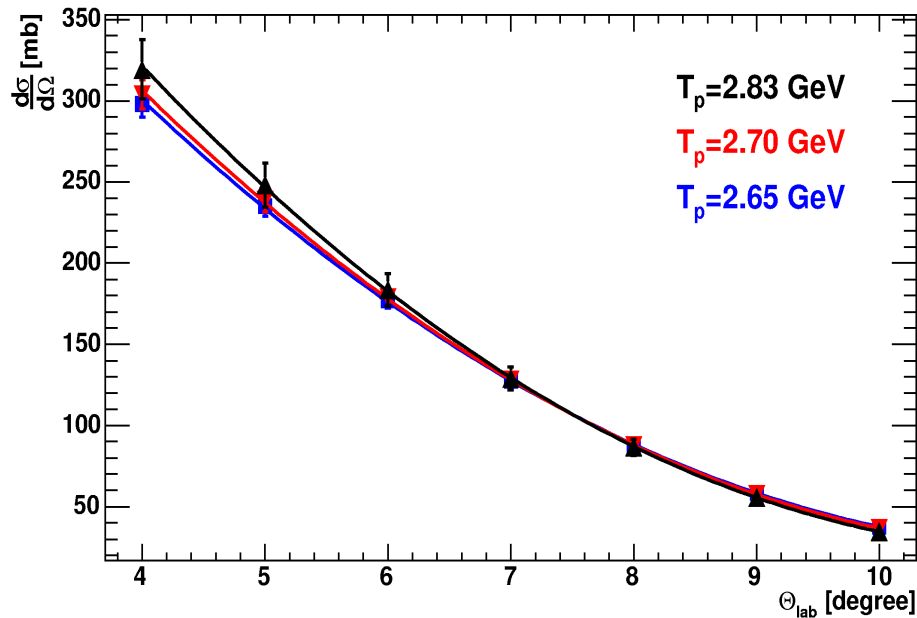
$N_\phi \approx 250$ event
 $\mathcal{E} = 18.5$ MeV

Normalization

Luminosity

⇒ pp elastic, SAID

data points: SAID database SP04 0-3.0
error bars: Richard Arndt (private communication)

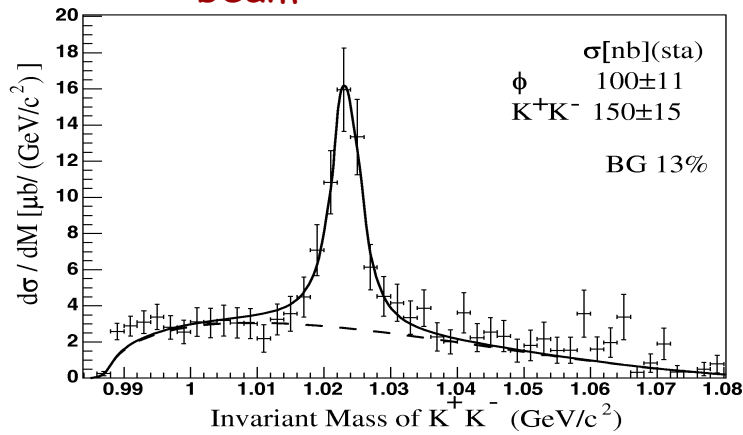


Run number 7247(2.65 GeV):

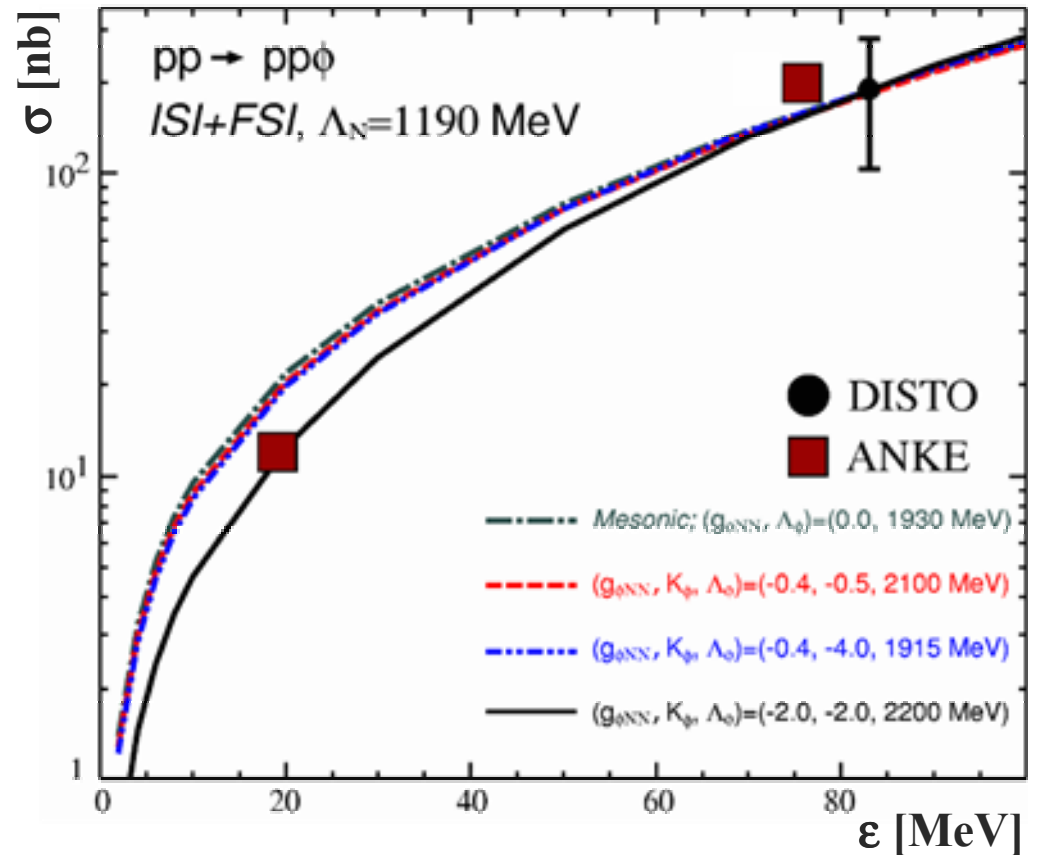
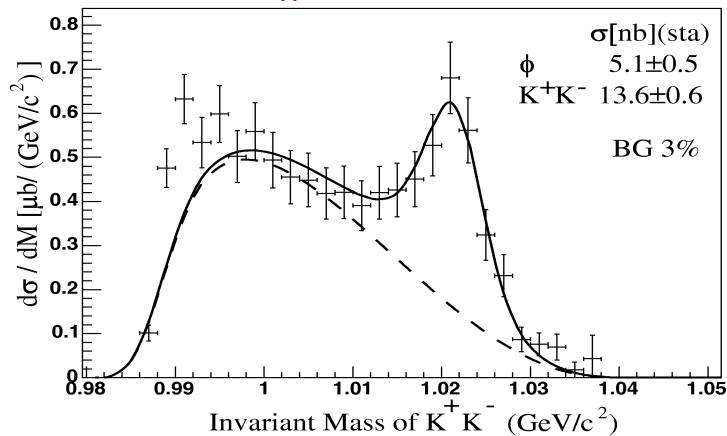
- ⇒ pp elastic: average luminosity:
 $\langle L \rangle = 1.09 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ (<10%)
- ⇒ ΔE loss: average luminosity:
 $\langle L \rangle = 1.22 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ (<10%)

Preliminary result

$T_{\text{beam}} = 2.83 \text{ GeV}$

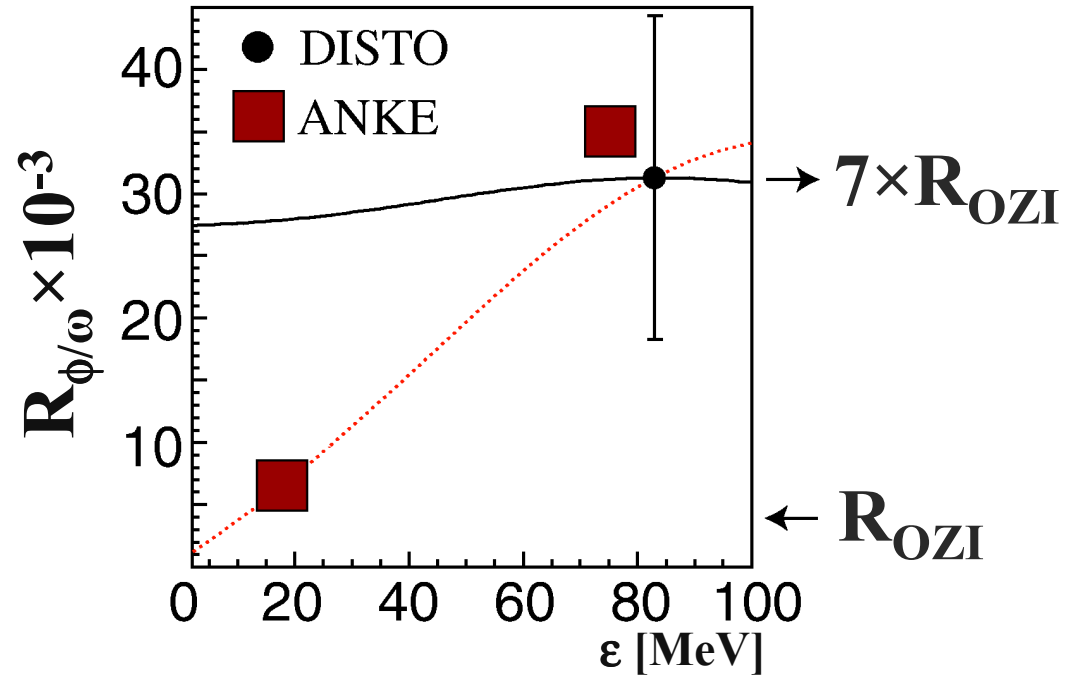
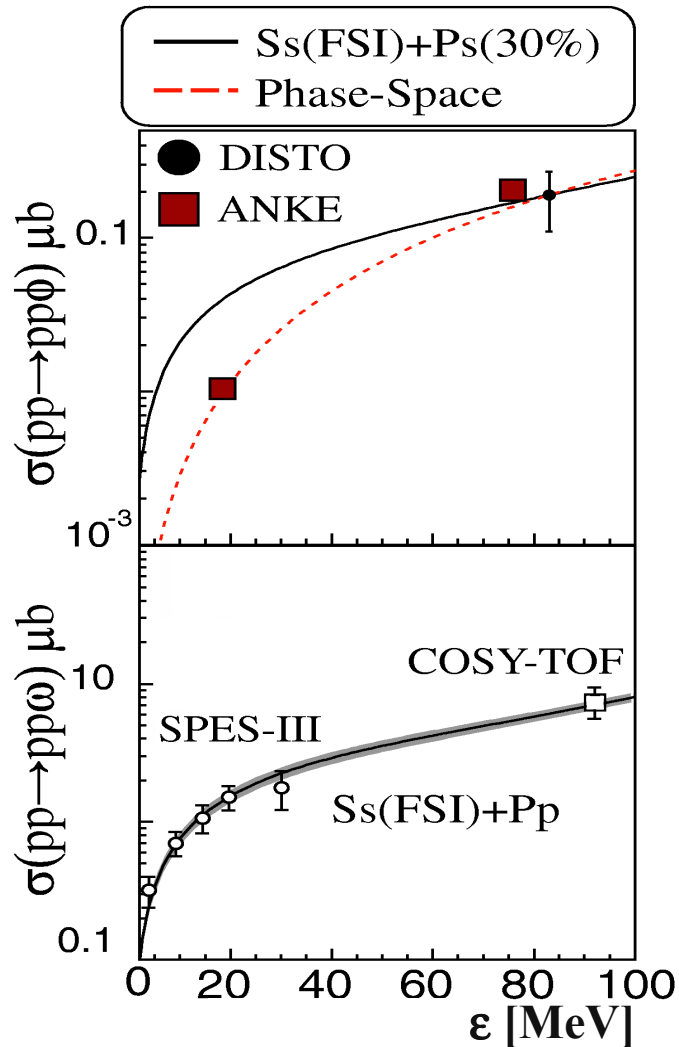


$T_{\text{beam}} = 2.65 \text{ GeV}$



K. Tsushima and K. Nakayama
Phys.Rev. C68(2003) 034612

ϕ/ω ratio



preliminary ratio $\epsilon=18.5$ MeV

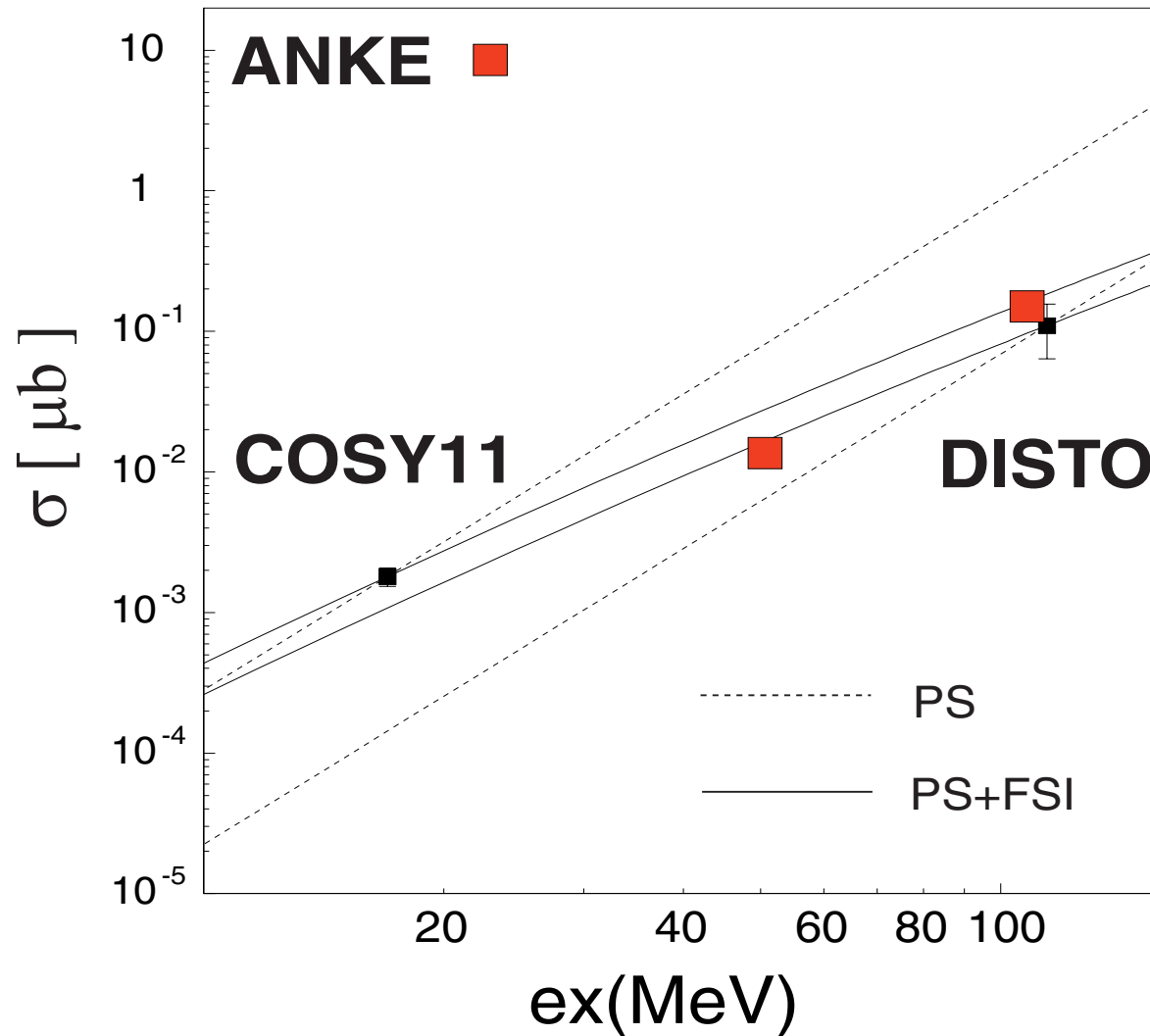
$R_{\phi/\omega} \approx 1.6 \times R_{OZI}$



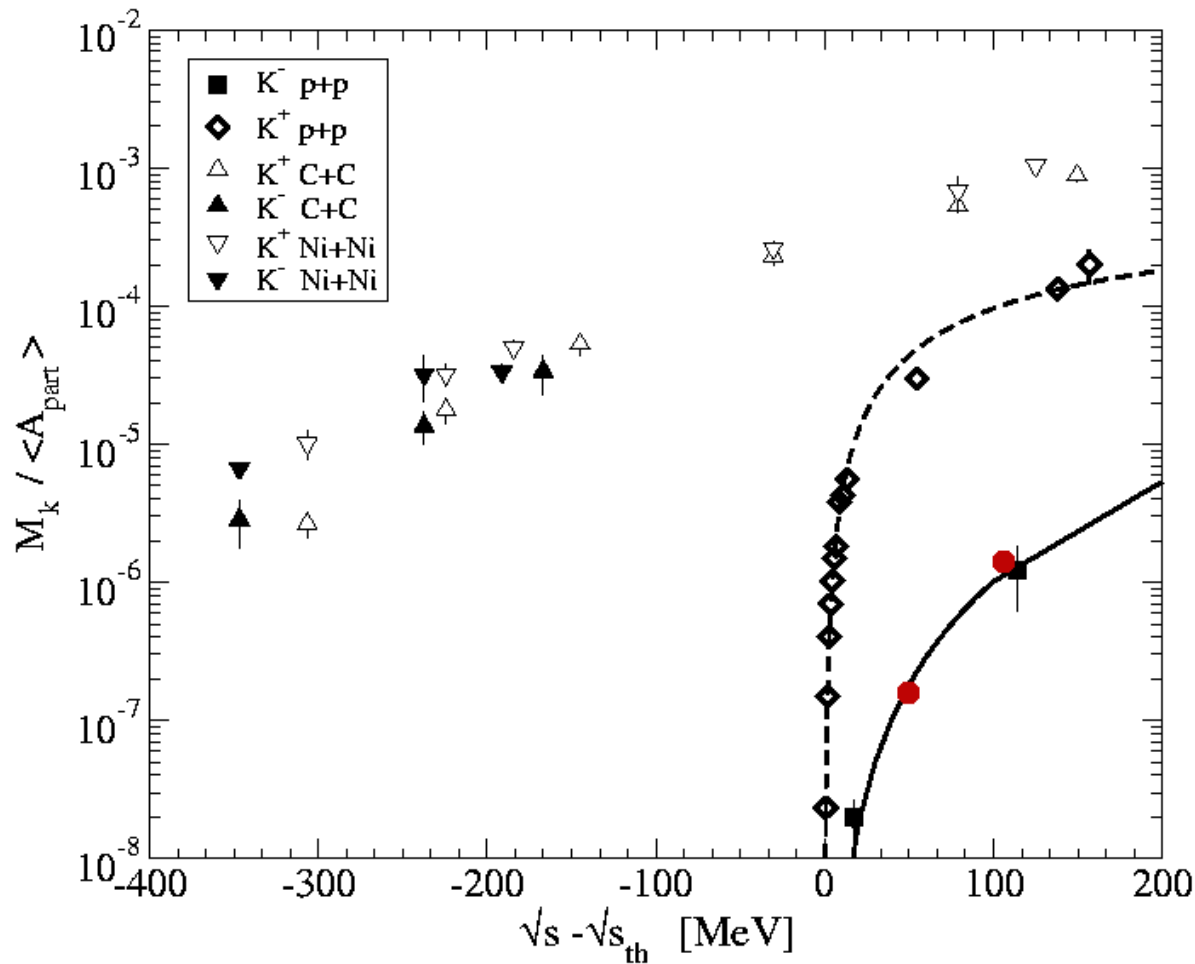
Summary

- $pp \rightarrow pp\phi$ at 2.65, 2.70 and 2.83 GeV.
- Very preliminary $\sigma_{\text{ANKE}}(2.83 \text{ GeV}) \approx \sigma_{\text{DISTO}}(2.85 \text{ GeV})$ {sys. error}.
- Accuracy of L: at 2.65 GeV $\approx 10\%$
- Theoretical calculation ($g_{\phi NN} \approx -2$) is close to our results at 2.65 GeV.
- $R_{\phi/\omega}(2.65 \text{ GeV}) \approx 1.6 \times R_{\text{OZI}}$
- $R_{\phi/\omega}(2.65 \text{ GeV}) \approx 4 \times R_{\phi/\omega}(2.85 \text{ GeV})$

$pp \rightarrow ppK^+K^-$



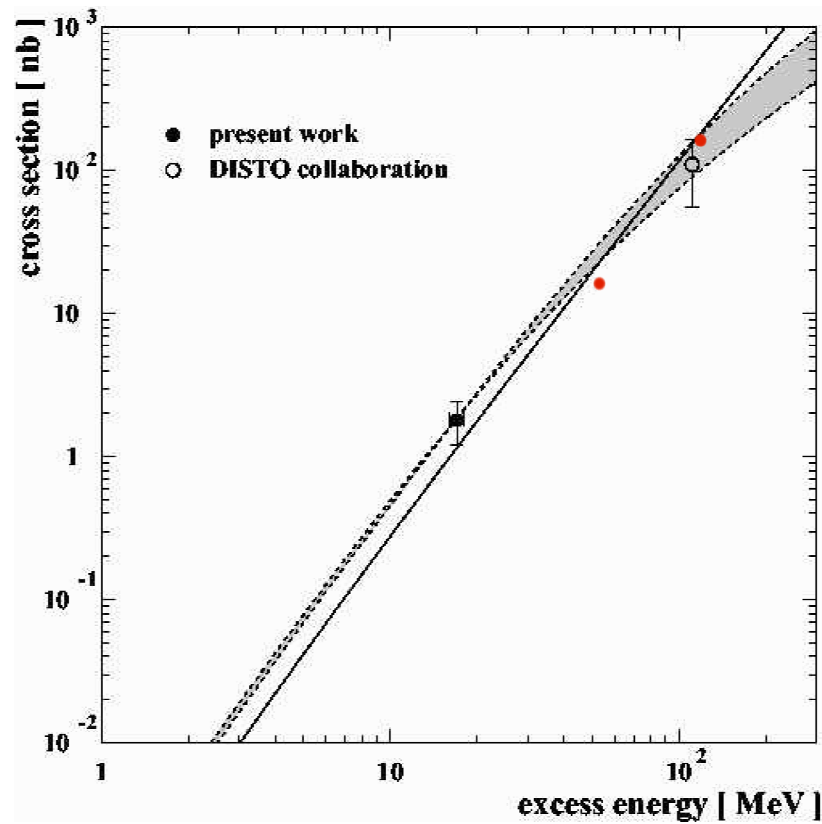
$pp \rightarrow ppK^+K^-$



A.Sibirtsev, W.Cassing
Eur.Phys.J.A7(2000)

P.Moskal et al.
Nucl.Phys. V49, 1(2002)

$pp \rightarrow ppX$



Prog.Part.Nucl.Phys. 49 (2002) 1

108MeV
50.6MeV