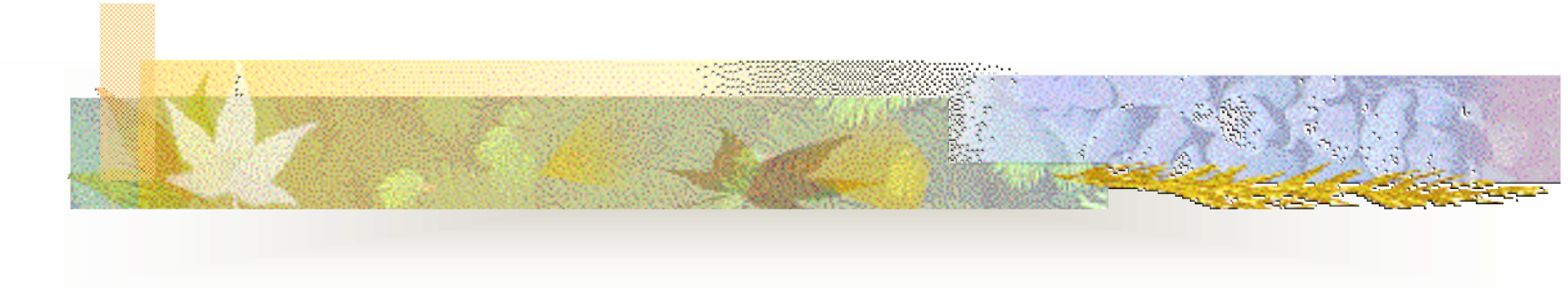
# Λ(1405) production in the π⁻p -> K⁰Σ⁰ reaction

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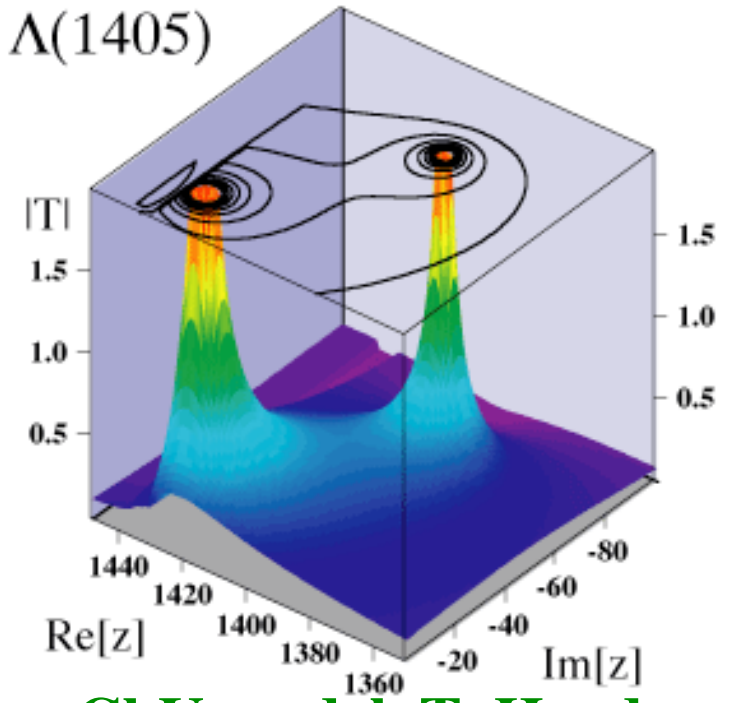
# Motivations : Two poles?

**There are two poles of the scattering amplitude around nominal Λ(1405) energy region.**

- **Cloudy bag model (1990)**
  - Fink *et al.* PRC41, 2720
- **Chiral unitary model (2001~)**
  - Oller *et al.* PLB500, 263
  - Oset *et al.* PLB527, 99
  - Jido *et al.* PRC66, 025203
  - Hyodo *et al.* PRC68, 018201

**Λ(1405) : $J^P=1/2^-$, I=0**




ChU model, T. Hyodo

# Chiral unitary model

## Flavor SU(3) meson-baryon scatterings (s-wave)

**Chiral symmetry**

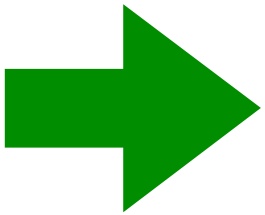
**Low energy behavior**

+

**Unitarity of S-matrix**

**Non-perturbative resummation**

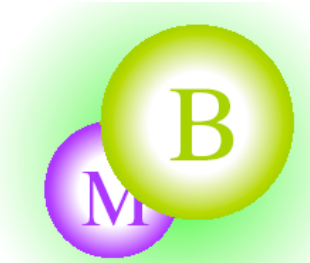
**Dynamical generation**



$J^P = 1/2^-$

**Resonances**

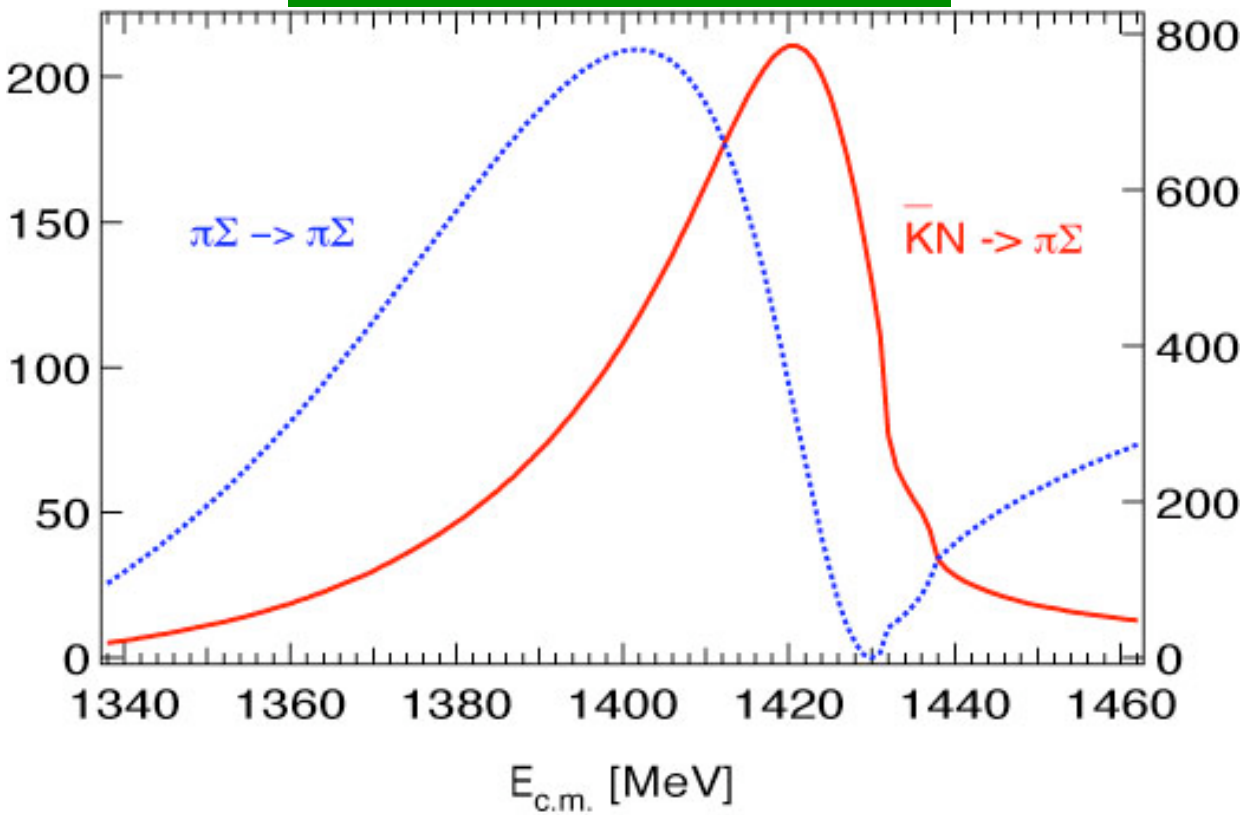
□(1405), □(1670), N(1535), □(1620), □(1620)



# □(1405) in the chiral unitary model

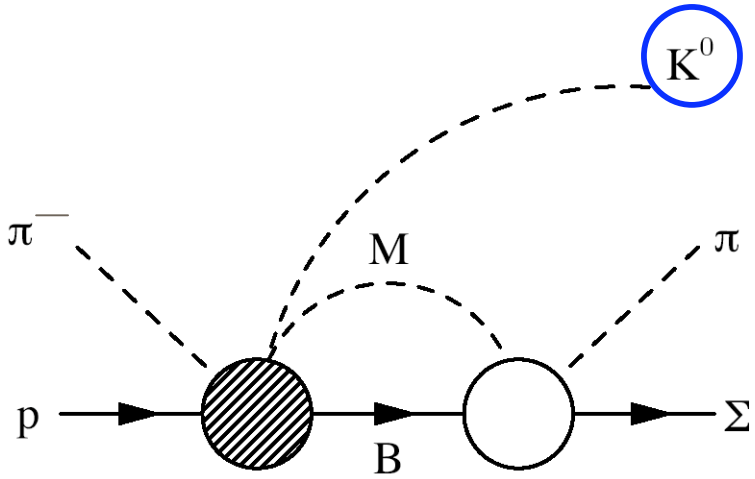
**Two poles : 1390 + 66i (□□), 1426 + 16i ($\bar{K}$N)**

**□□ mass distribution**



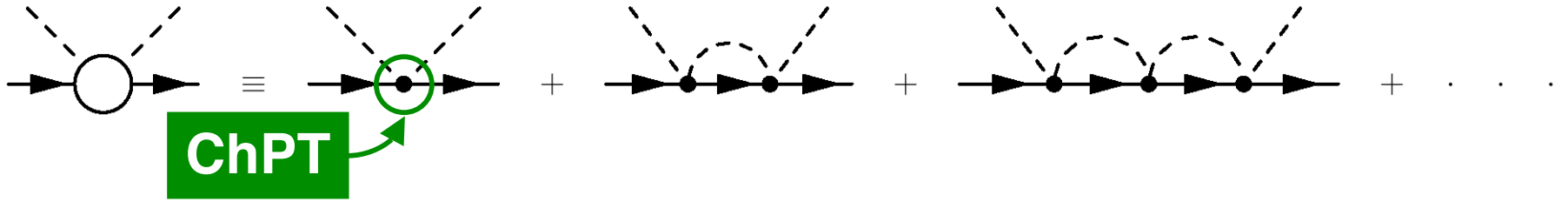

D. Jido, *et al.*, nucl-th/0303062

# Mechanism of □□p -> K$^0$□□




~ at rest

□□p c.m. frame ~ □□ c.m. frame



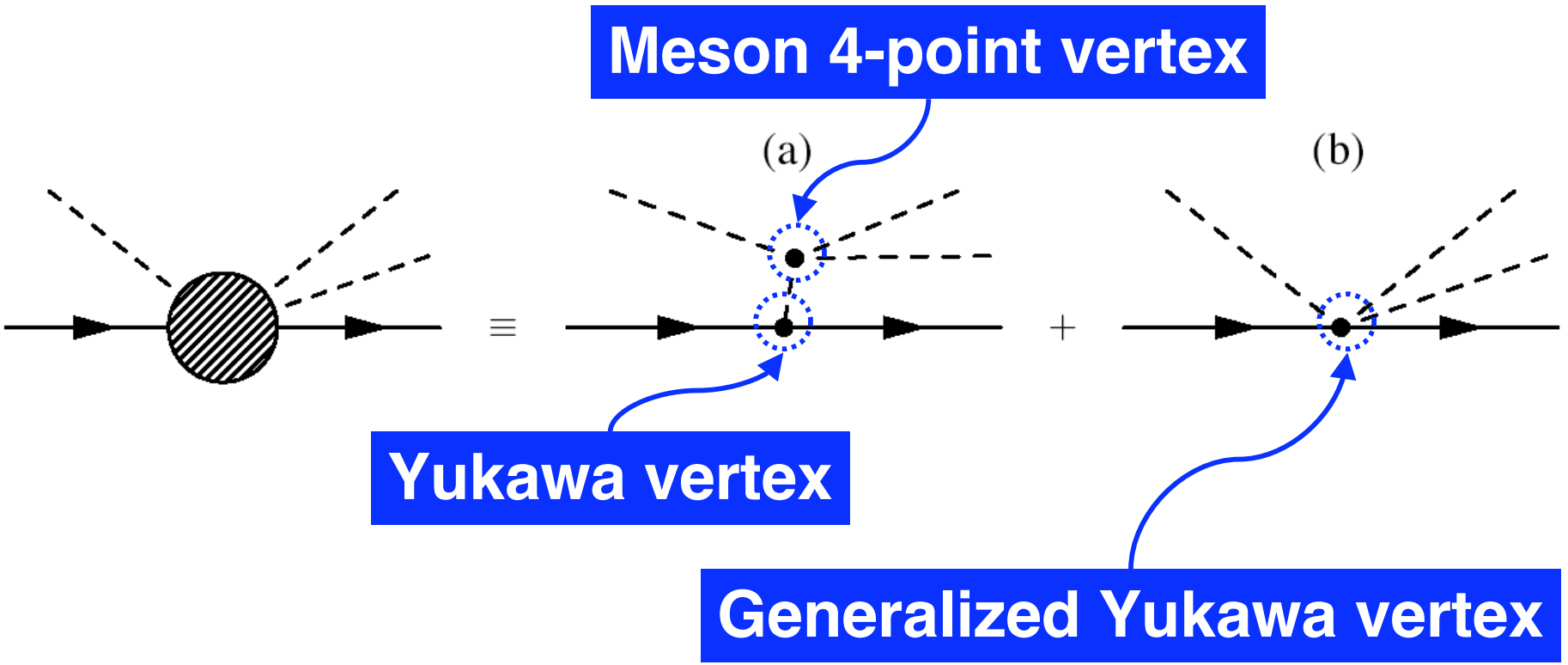

Channel MB = $\bar{K}$N, □□, □□, □□, □□, K□

Chiral unitary model

□□ invariant mass distribution -> □(1405)

# Chiral amplitude for □□p -> K$^0$□□

**Construct the initial stage interaction from ChPT.**




**At low energies, these two diagrams are relevant.**

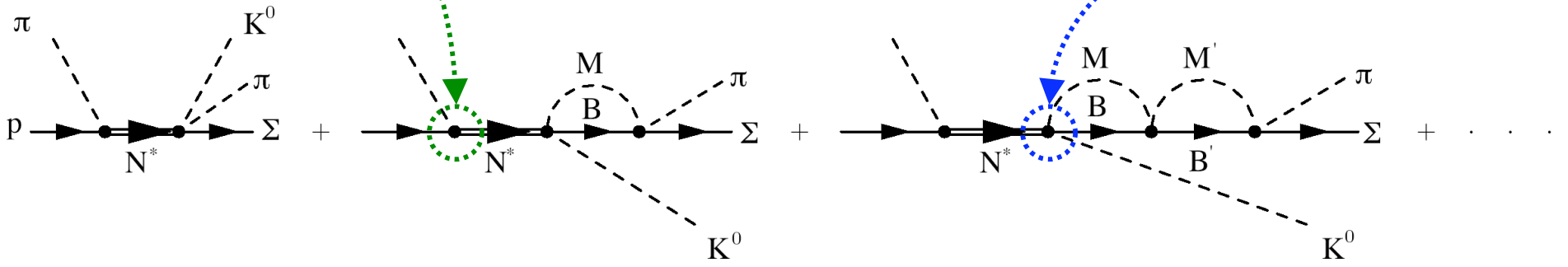
# N(1710) contribution for □□p -> K$^0$□□

**Initial c.m. energy of □□p system ～ 1.9GeV**
**-> resonance excitation in the initial stage**
**$P_{11}$ resonance : s-wave coupling to MMB**

**N(1710) -> □ N (10-20 %)**
**-> □ □ N (40-90 %)**
**-> □ □ N (no)**

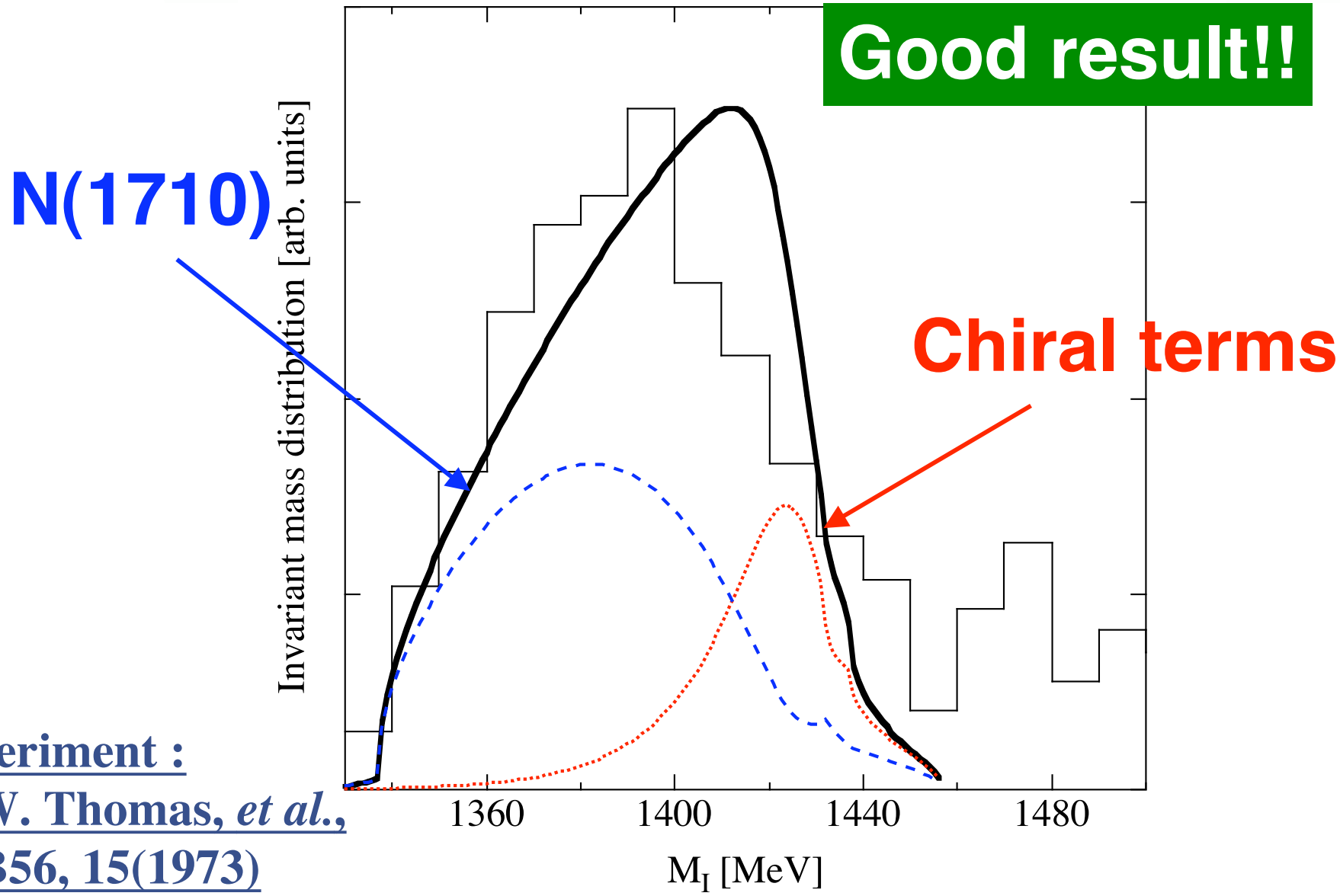
**□N decay**

**Extrapolation of □□N decay**



# Final results for □□p -> K$^0$□□

**Good result!!**




**Experiment :**
**D. W. Thomas, *et al.*,**
**NPB56, 15(1973)**

# Conclusions

We calculate the □⁻p -> K⁰□□ reaction using the chiral unitary model.

- There are two mechanisms in the initial stage interaction.
- They filter each one of the resonances.

  chiral term : higher pole (1426+16i)

  N(1710) contribution : lower pole (1390+66i)

- Combination of the two mechanisms gives a good description of data.

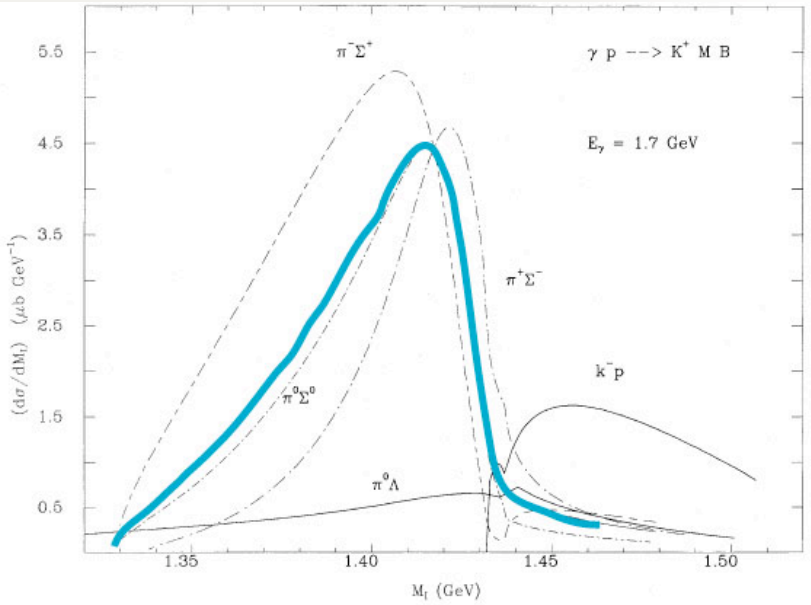
T. Hyodo, *et al.*, nucl-th/0307005

# Experiments : □□ mass distribution

## □p -> K□□□

J.C. Nacher, *et al.*, PLB445, 55(1999)

**Spring-8**




## □□p -> □□□

J.C. Nacher, *et al.*, PLB461, 299(1999)

**J-PARC?**