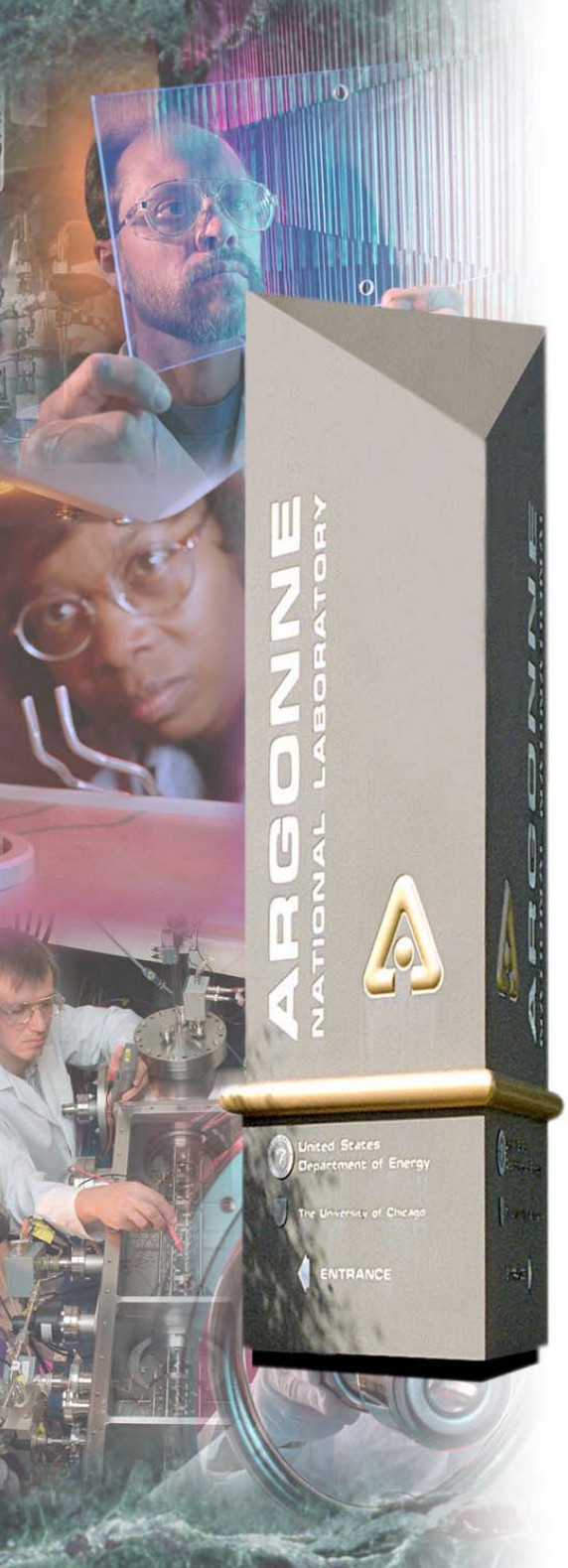

Ridges and Quasicontinuum in ^{152}Dy

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ANL Physics Division

LIMITS'04
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Ver 2; Aug 25 2004

Argonne National Laboratory

Office of Science
U.S. Department of Energy

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Goals

- Experimentally extract Ridges and Quasicontinuum (QC) -- gated on Normal and Superdeformed transitions in ^{152}Dy (i.e., study gamma-gamma correlations at finite temperature). 48Ca(191 MeV)+108Pd
- Understand the feeding (and decay) quasicontinuum with its gamma-gamma correlations
- Extract the Rotational Damping in the Normal (ND)and Superdeformed (SD) wells

Cast of characters

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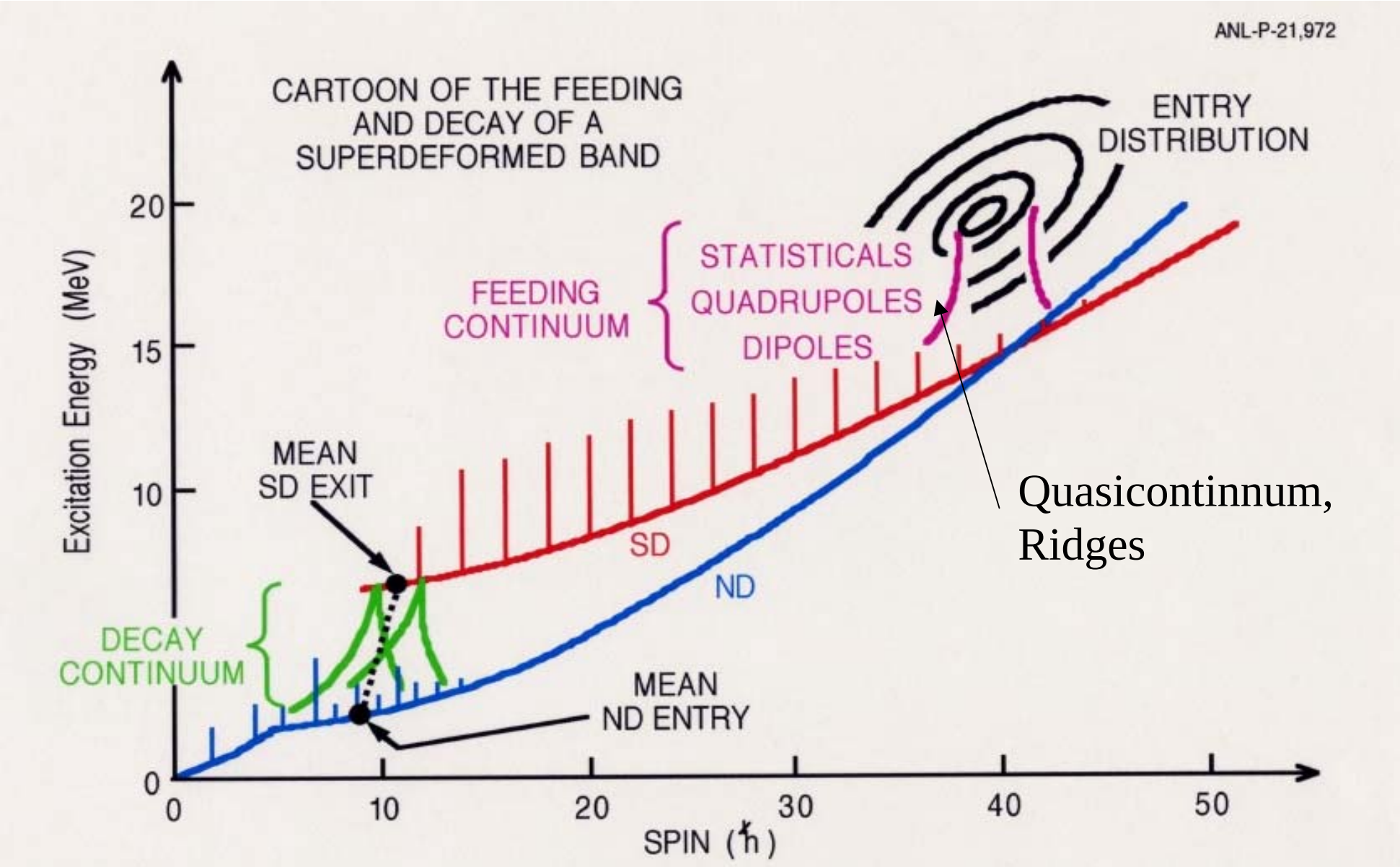
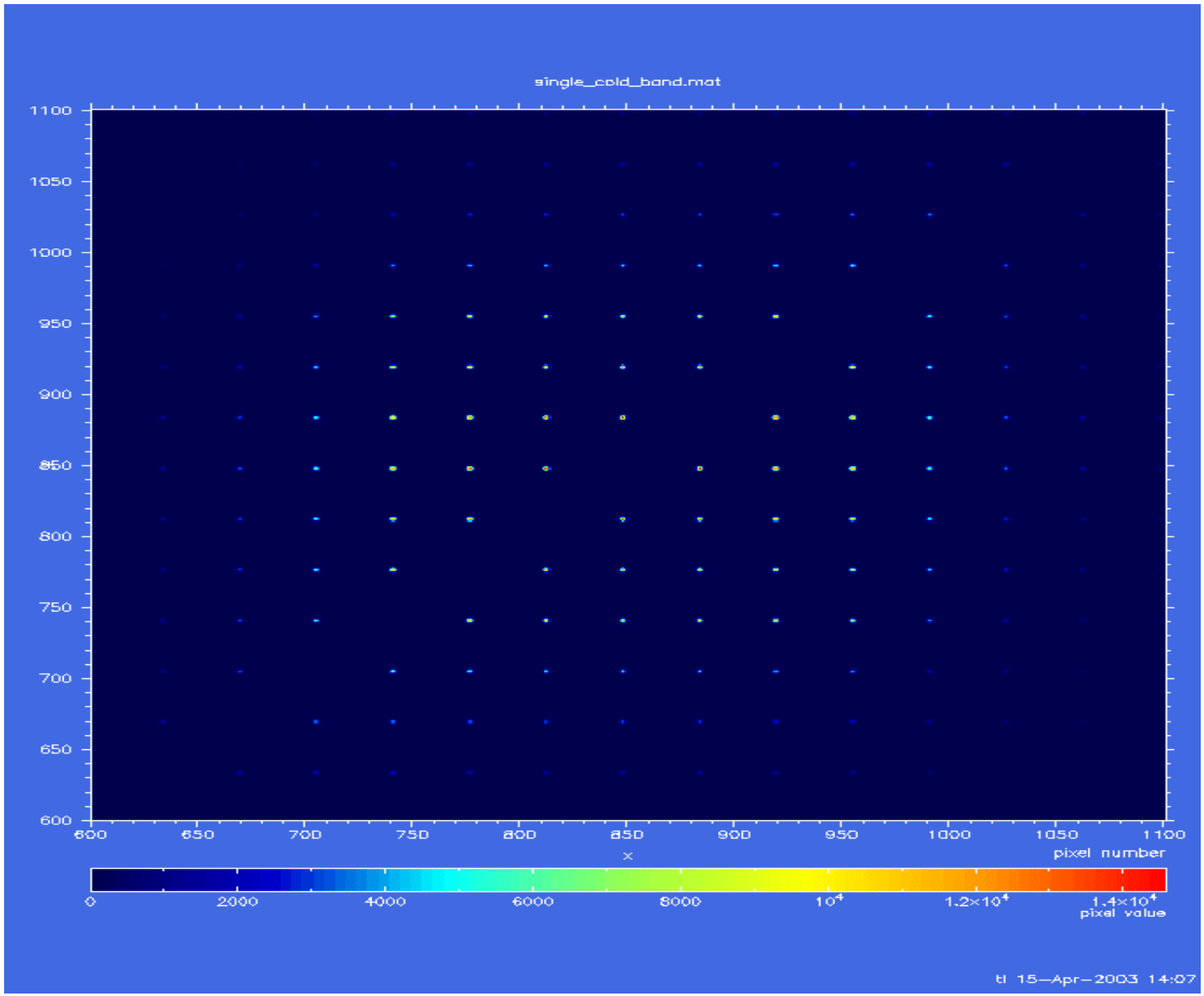
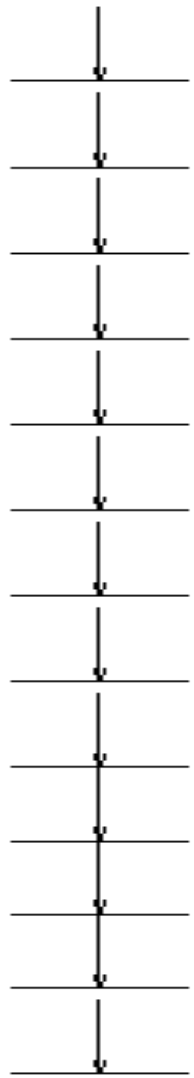
Cartoon of feeding and decay



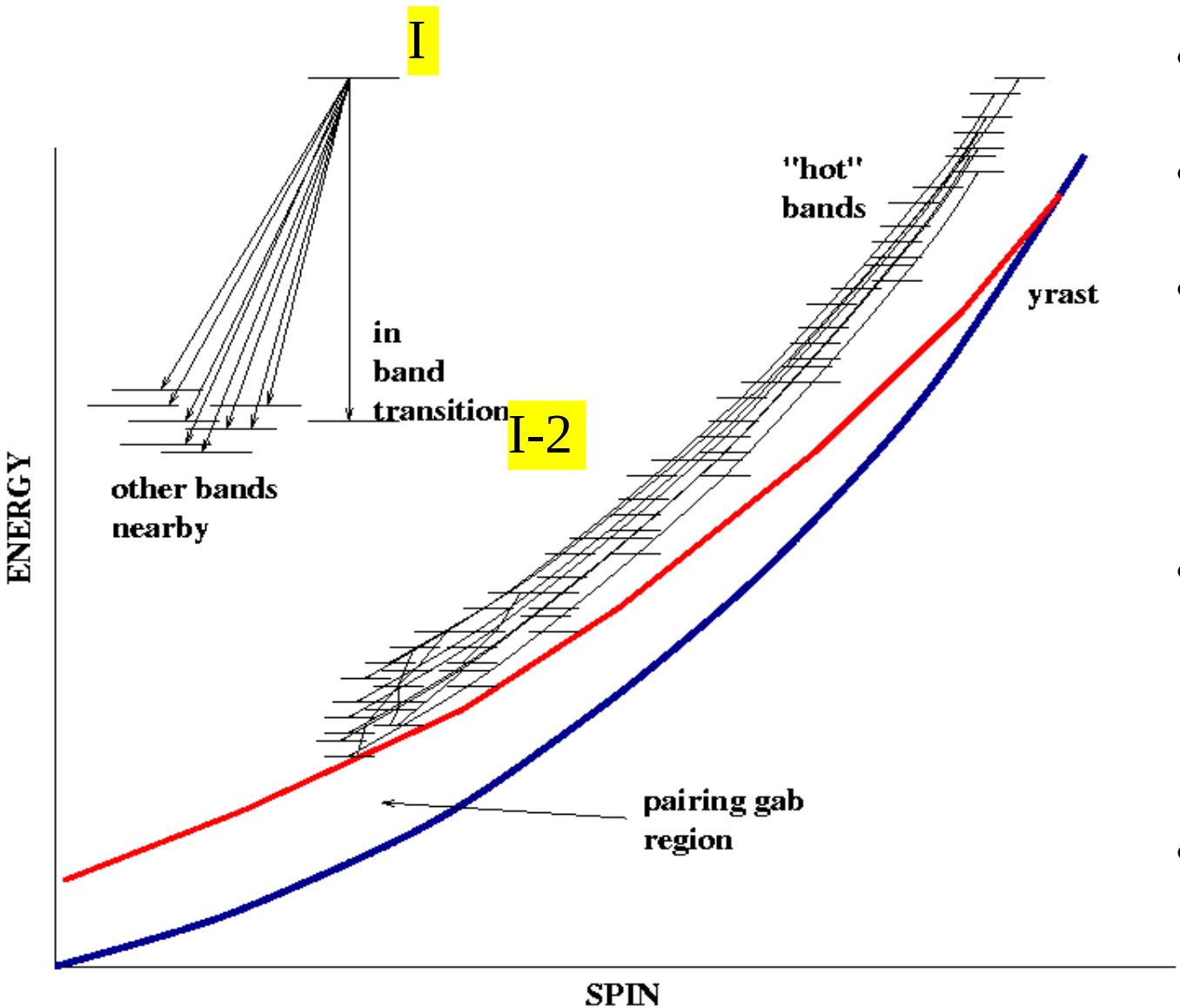
Cold coherent rotational band in 2D





Model illustration

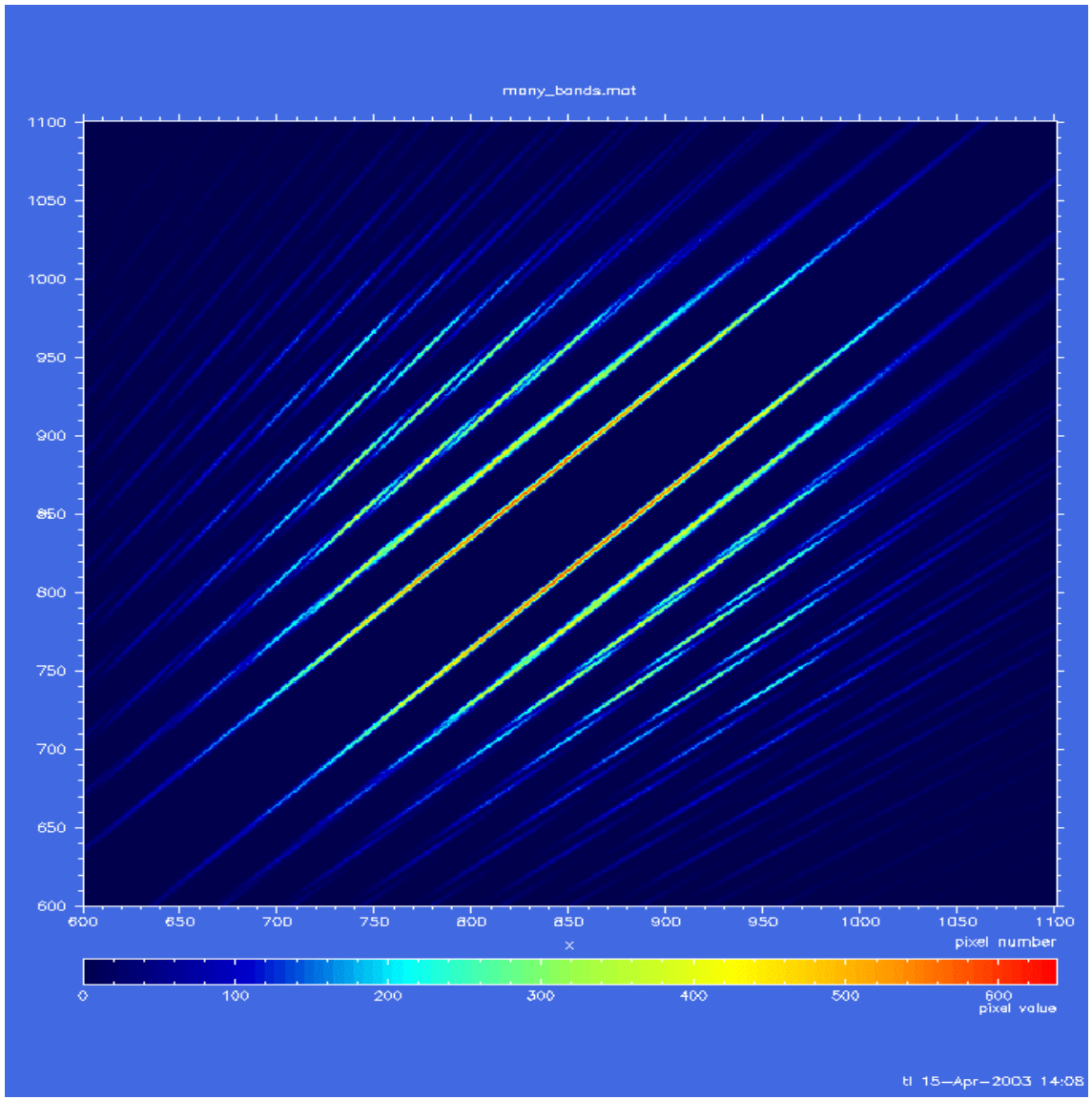
What happens at higher temperatures?

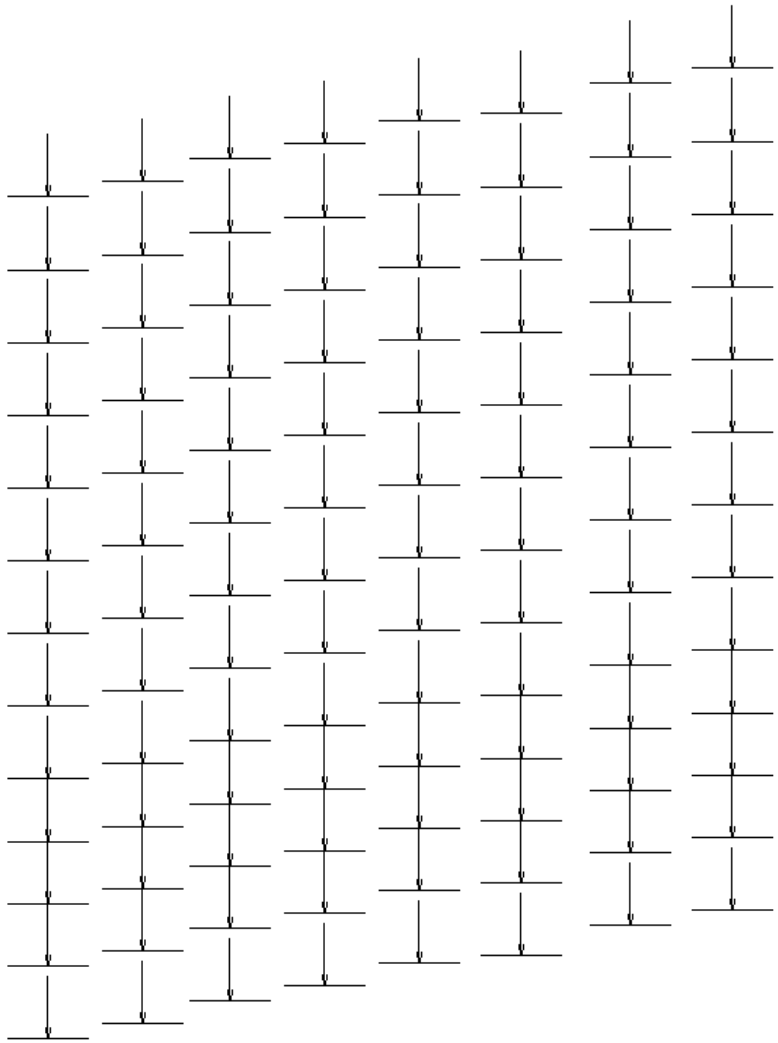


- High level density
- MANY bands
- [effect 1] Spread in moment of inertia over bands
- [effect 2] Bands are mixed: **damping**
- => RIDGES

Effect 1

Many bands, spread in $J^{(2)}$

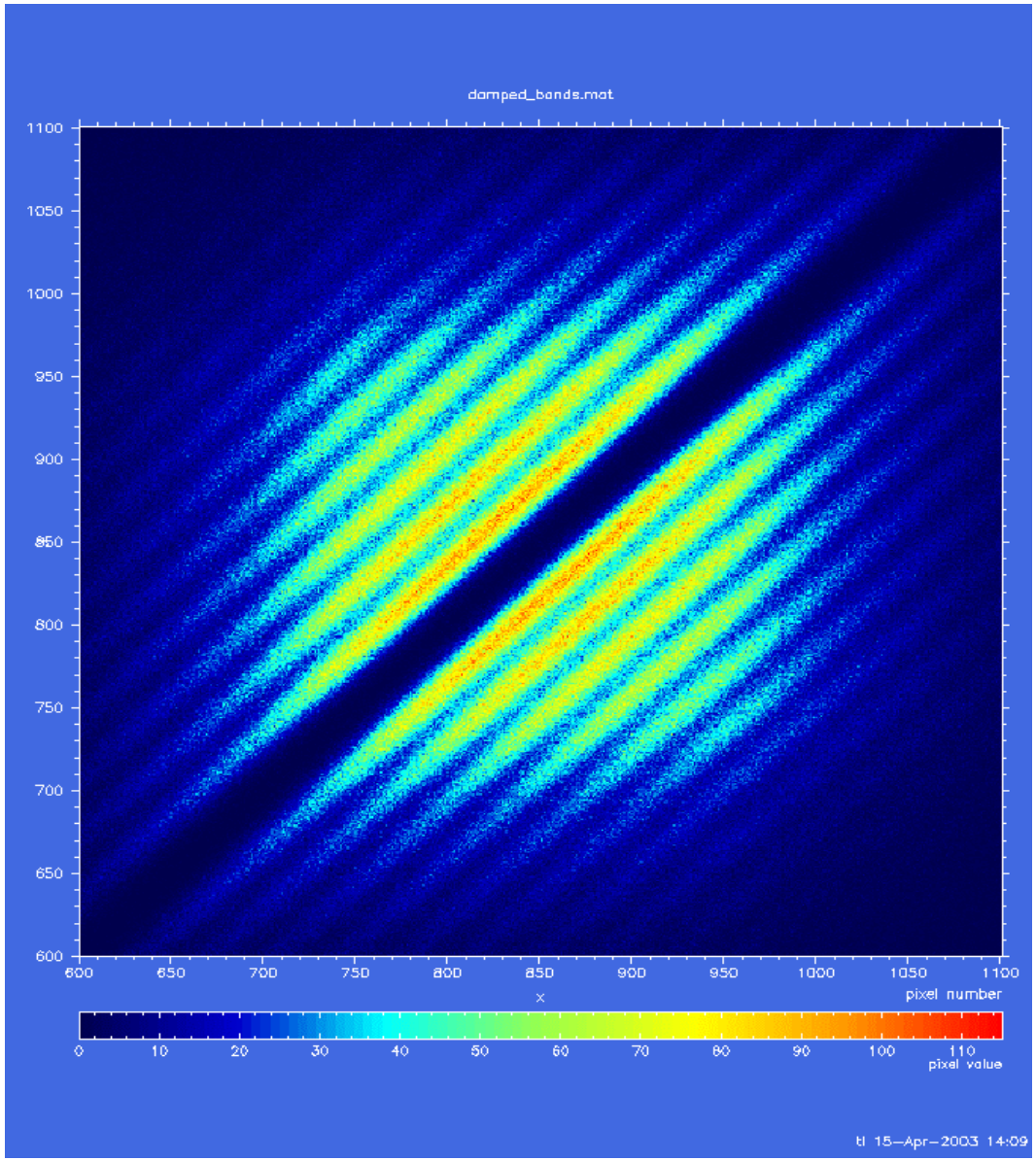


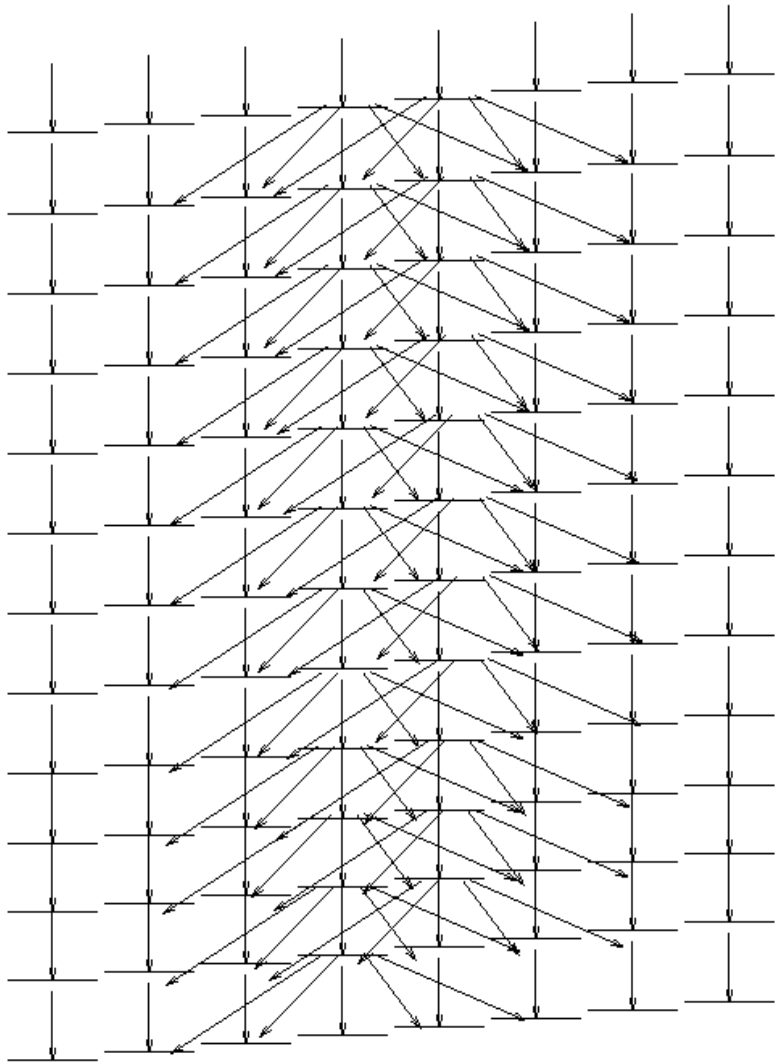


Model illustration

Effect 2

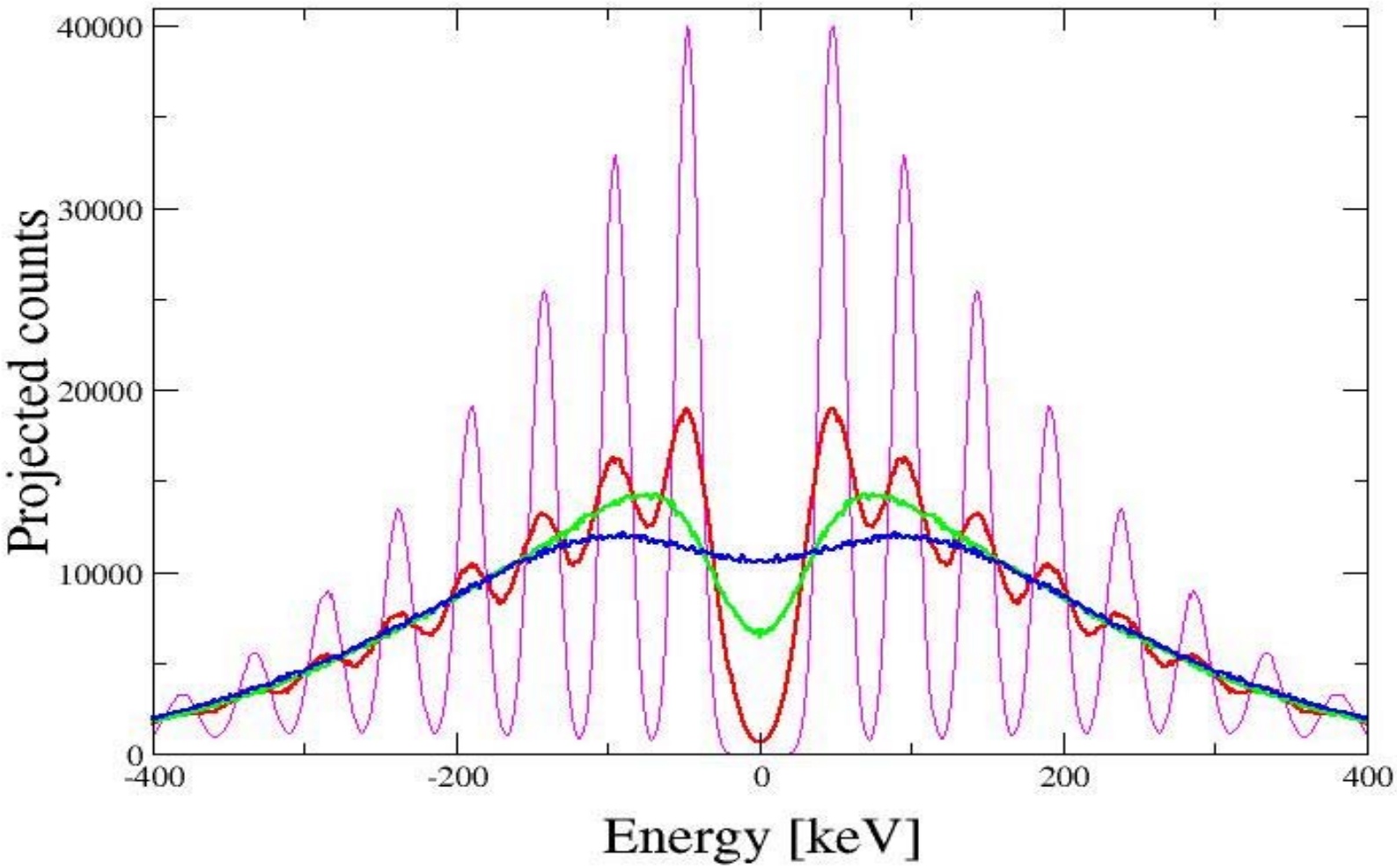
Hot Rotationally Damped bands





Model illustration

Project onto cross-diagonal

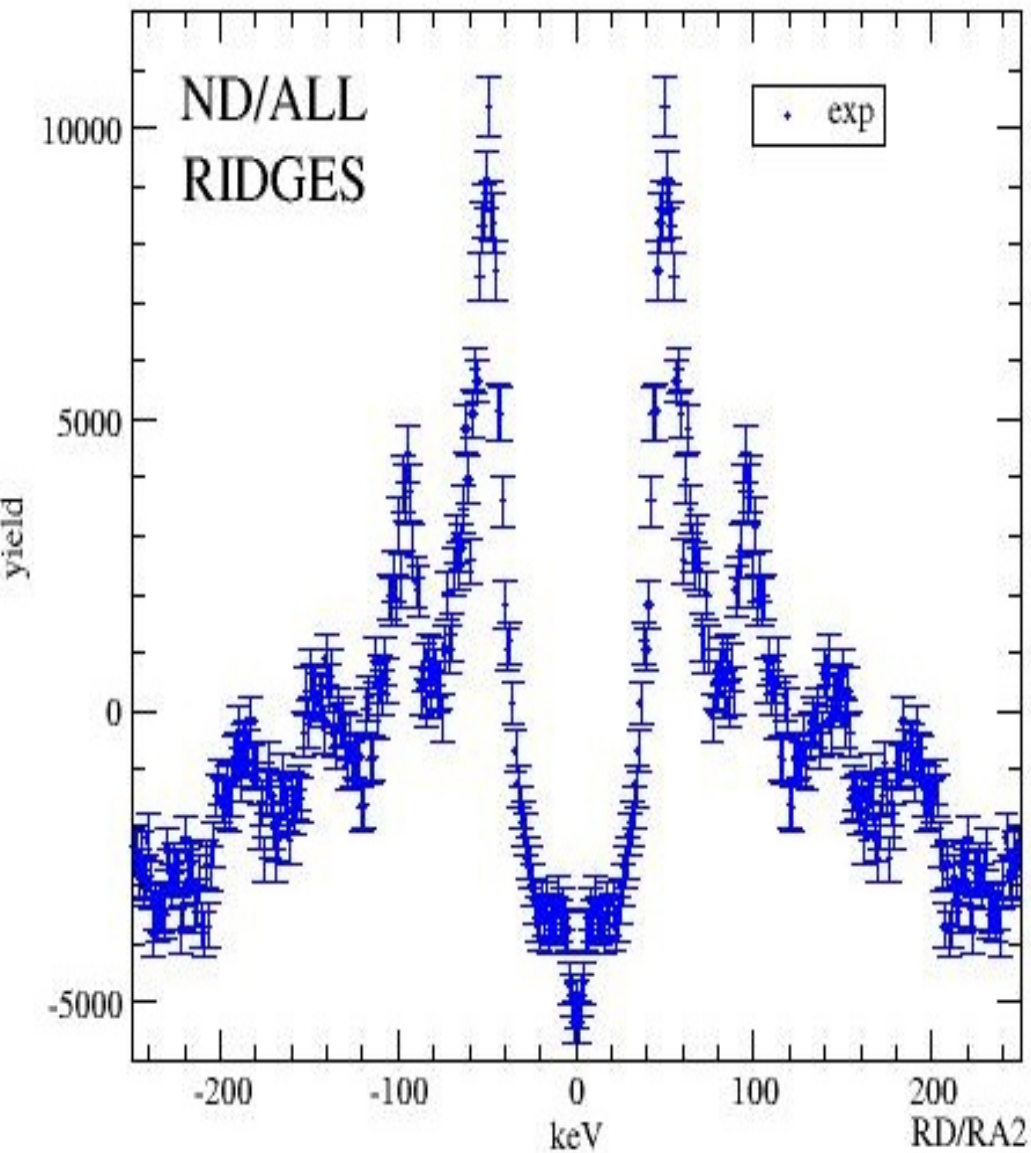


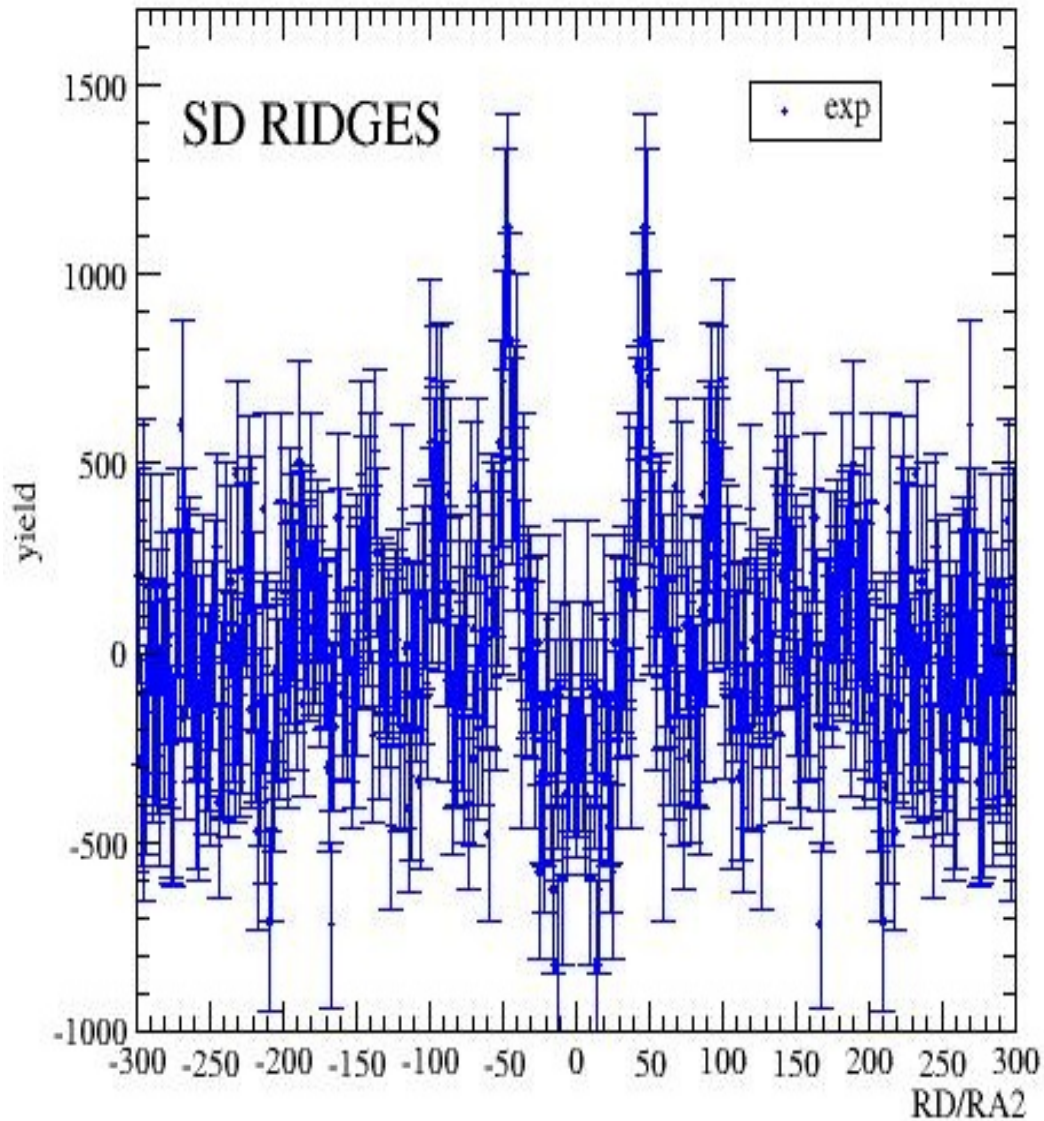
Model illustration

End of illustrations!

How does the real experimental data for ^{152}Dy look like?

ND and SD gated ridges, corrected for efficiency, unfolded, 'destriped', core subtracted, etc...



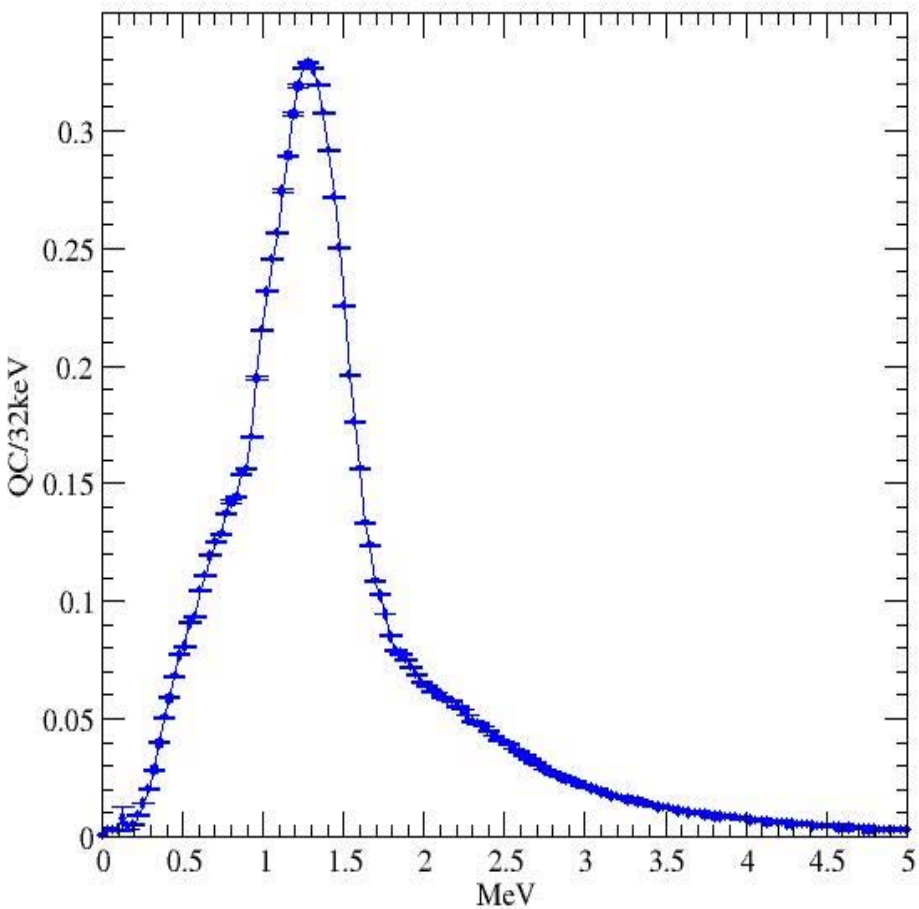


Preliminary analysis

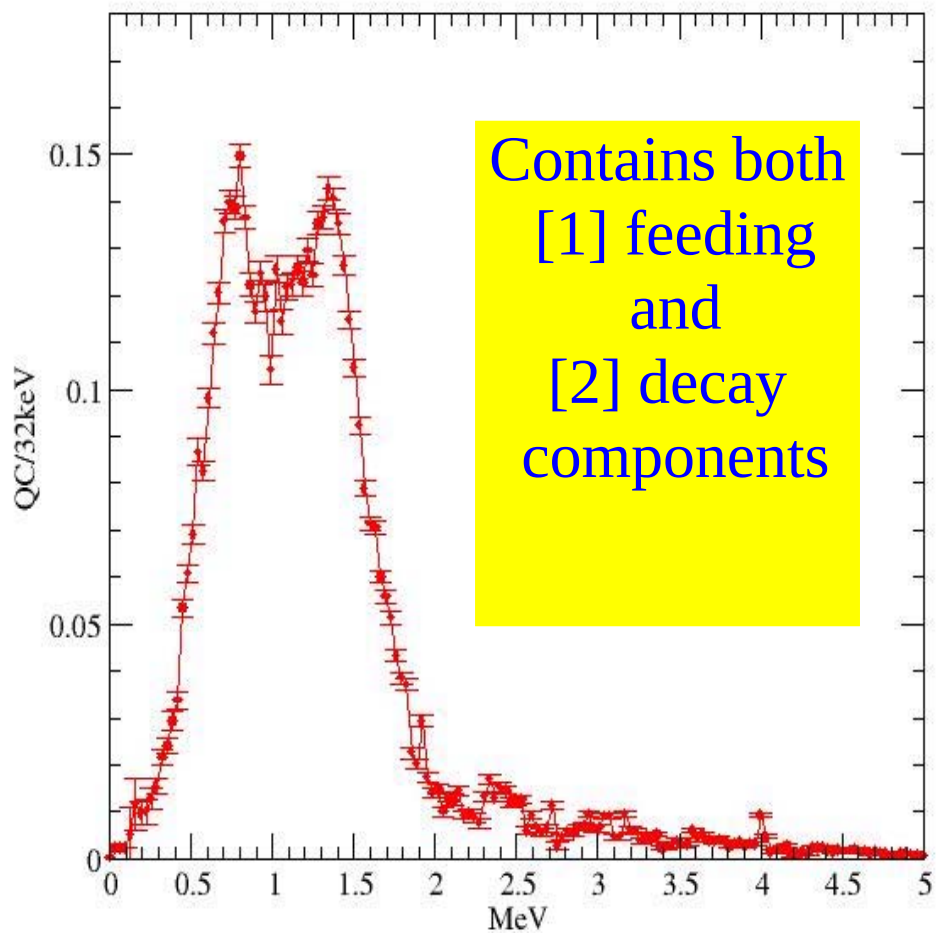
ND and SD Quasicontinuum

Preliminary analysis

ND==ALL



SD



Contains both [1] feeding and [2] decay components

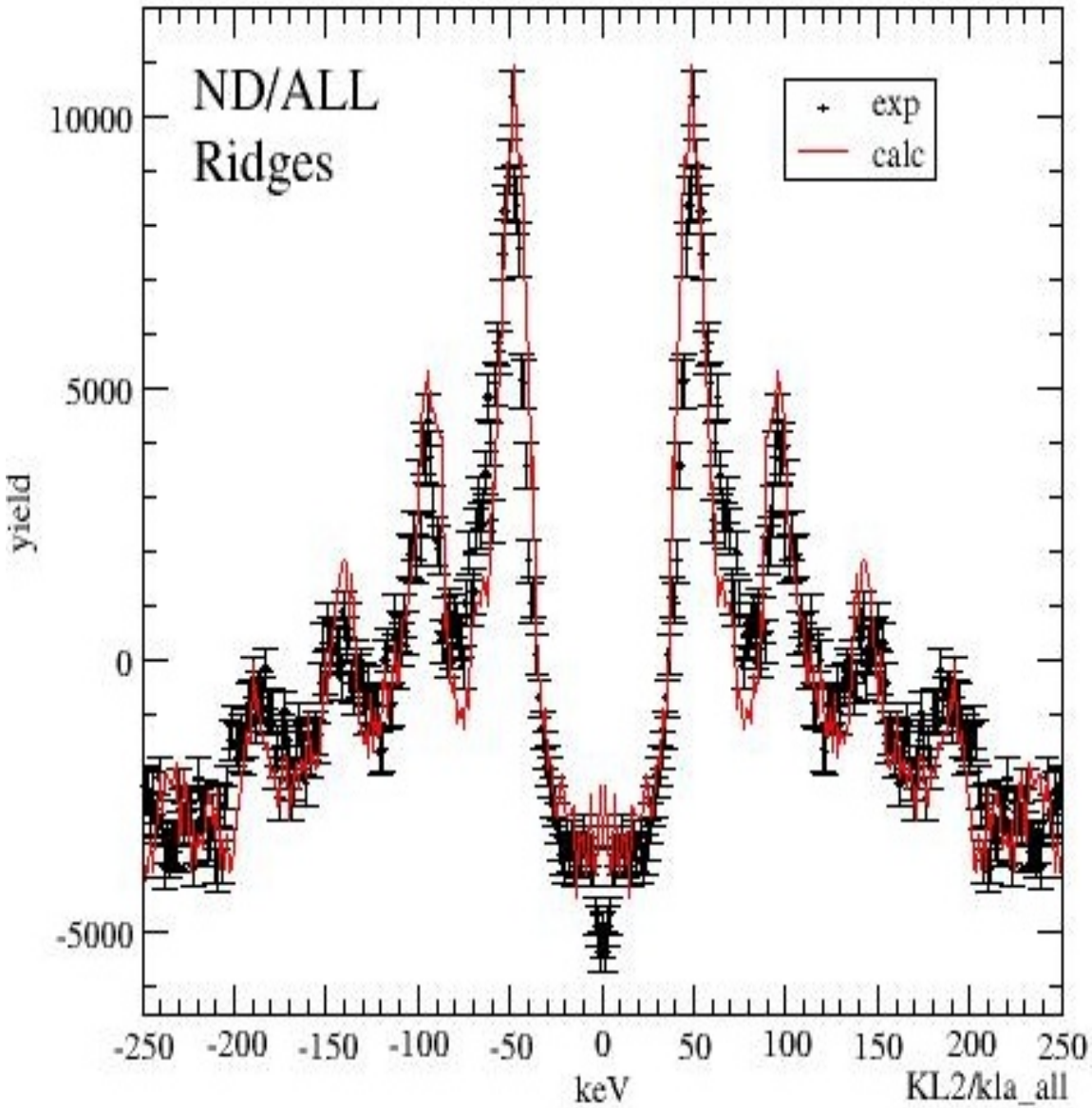
Unfolded, discrete peaks removed....

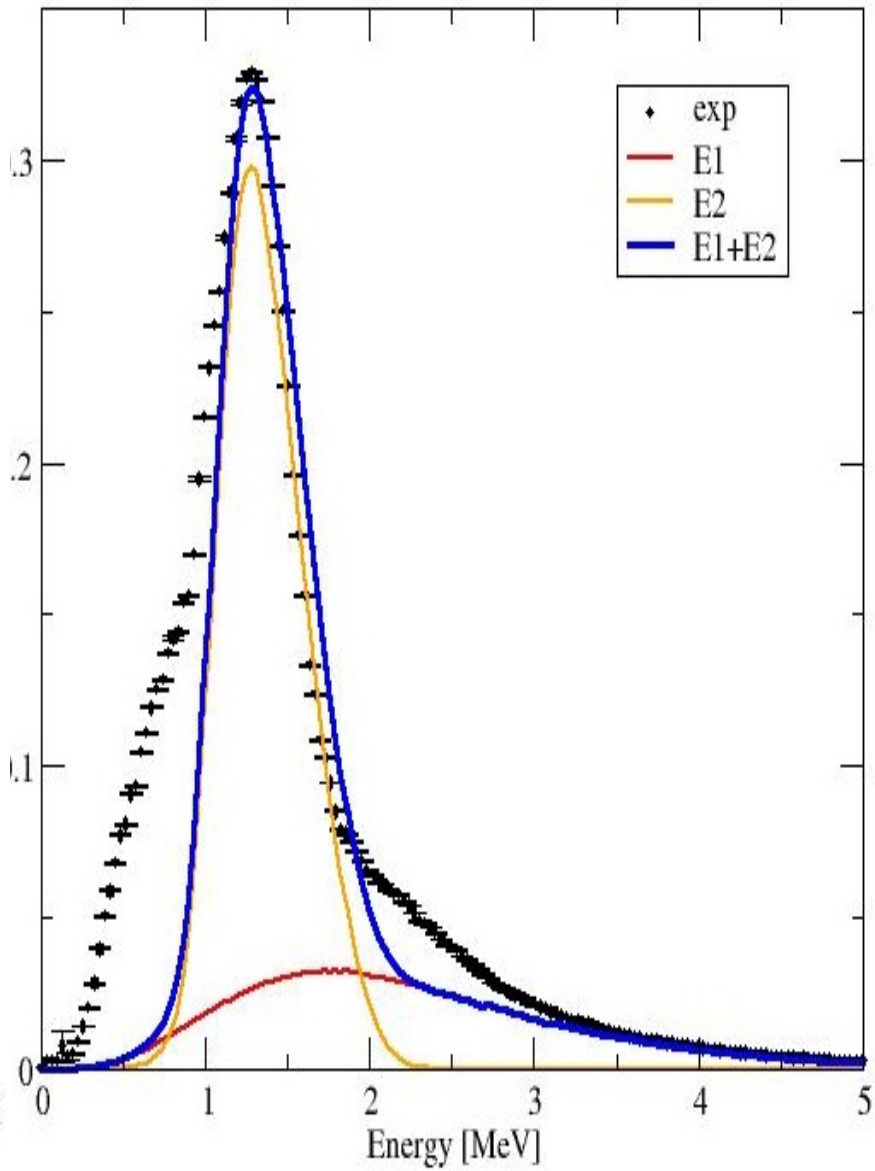
Calculation:

- Perform Monte Carlo Calculations (kl/kla) of gamma cascades from entry distribution to discrete bands
- Very successful in the A=190 mass region
- Added two rotational damping widths (New!).

- Theory says: There are two rotational damping width components:
  - Narrow: doorway states rotational damping
  - Wide: rotational damping, from mixed states
  - try to extract them

Calculations

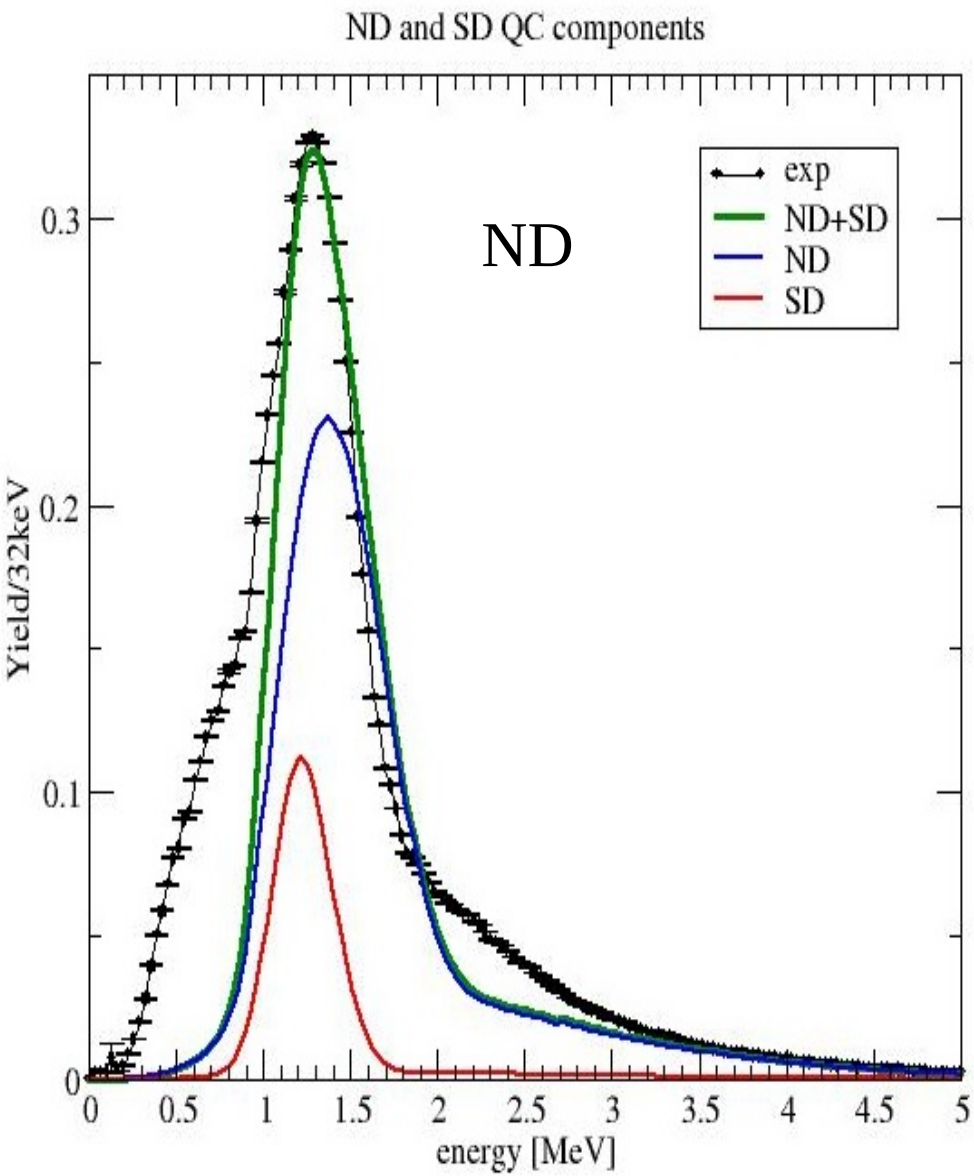


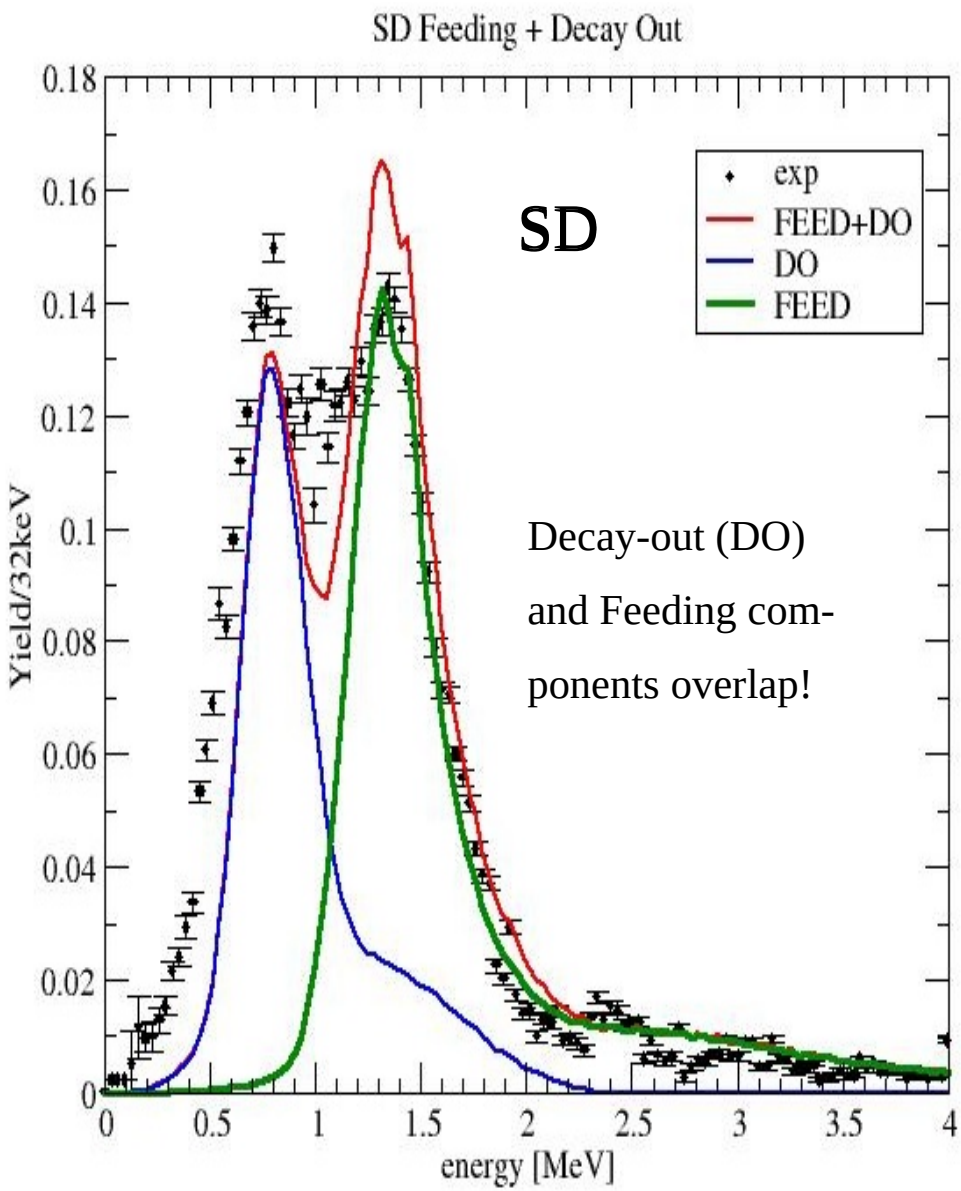


Preliminary analysis

Calculations:

Preliminary analysis

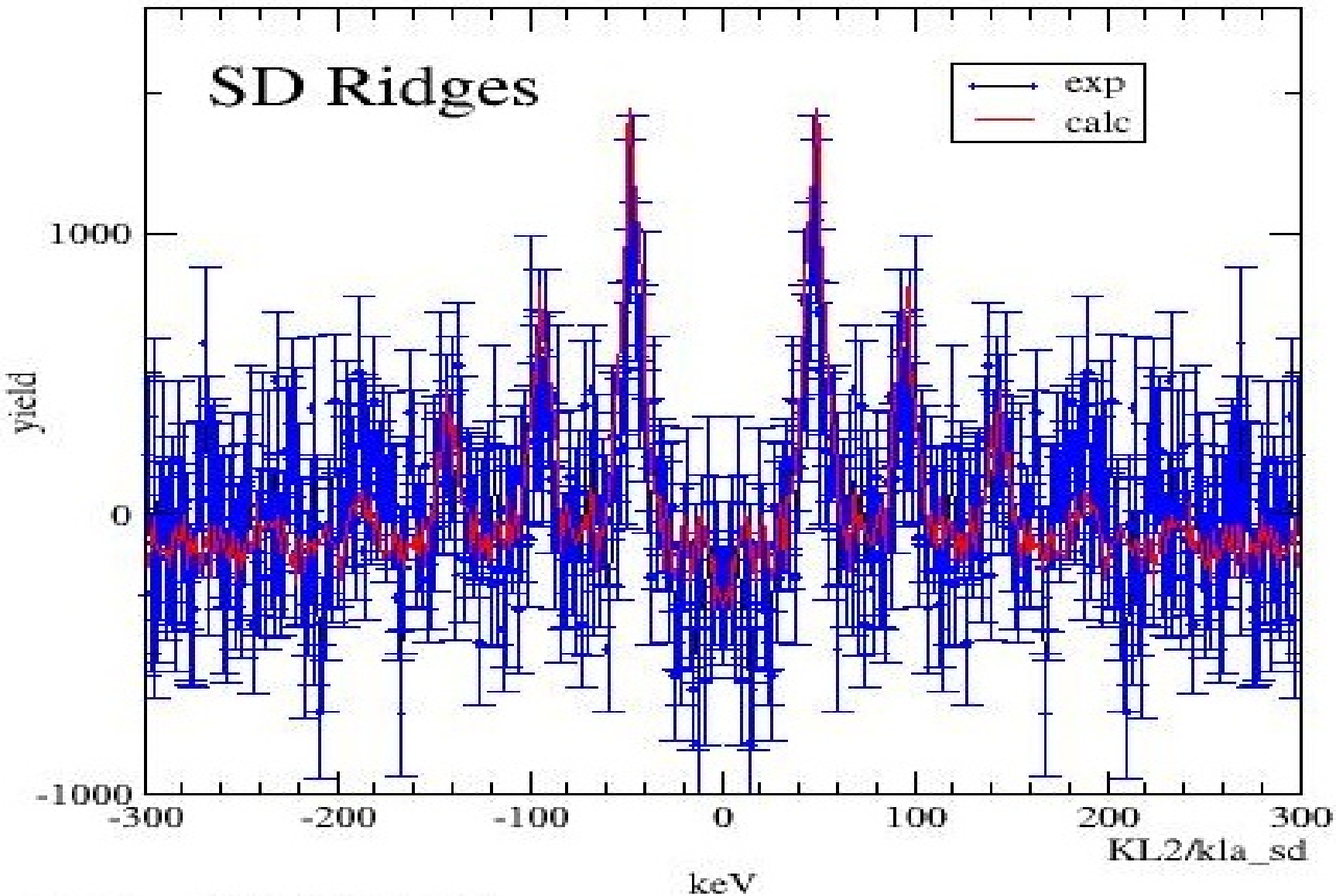




Decay-out (DO) and Feeding components overlap!

NO last step transitions in calculations yet!!!

Experimental and Calculated SD ridges in ^{152}Dy



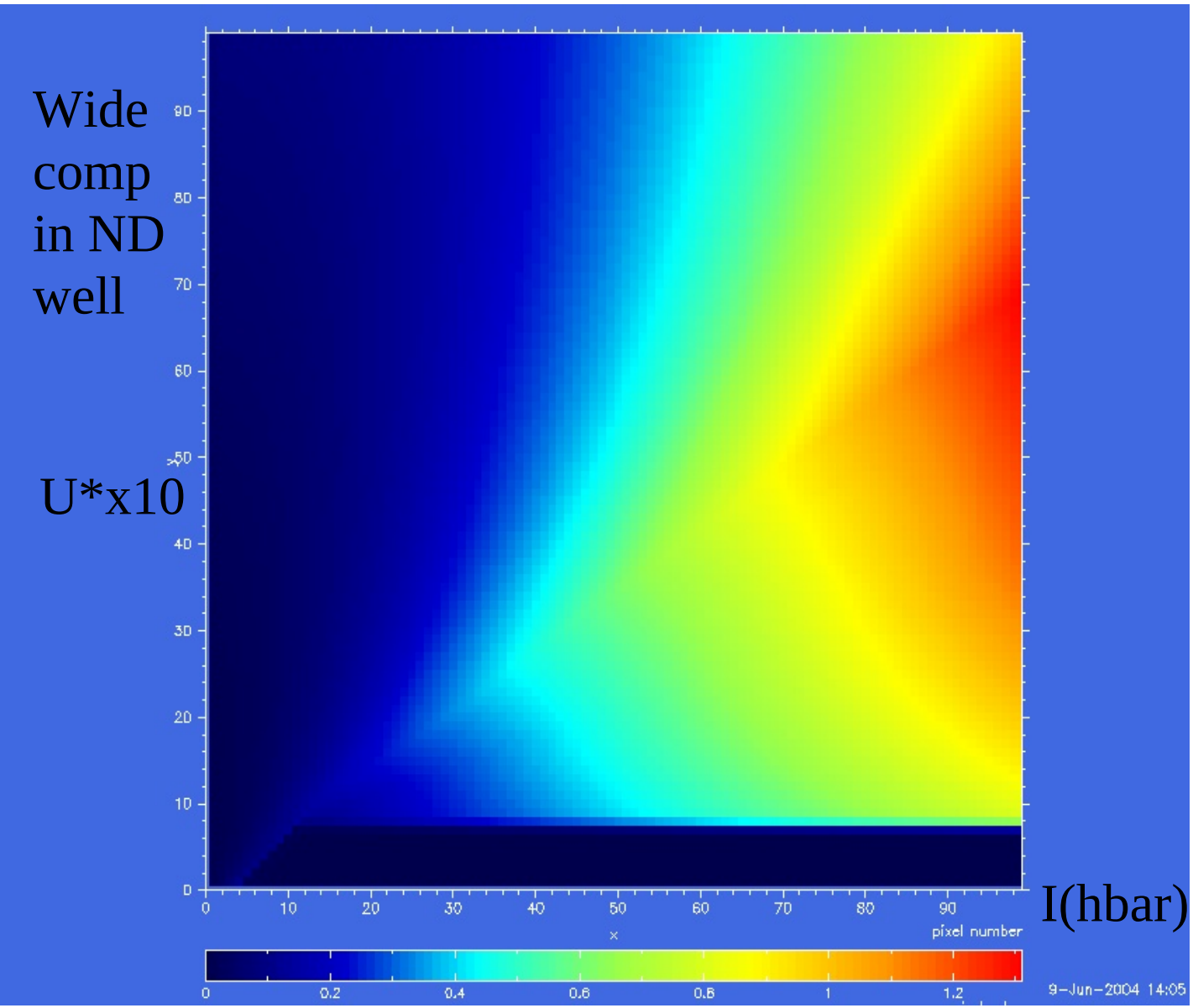
Preliminary analysis

Results so far:

- Can calculate both the QC and Ridges (and ~1.3% SD feeding) with simple 'two well' Monte Carlo code and two rotational damping width components!
- [1] used calculated entry distribution from EvapOR
- [2] used *fixed* rotational damping width parameters

- Extract: SD rot. damp. of: 5keV(30%)/170keV
- Extract: ND rot. damp. of: ~28keV(17%)/305keV
- Extract: in SD decay out region: ND rotational damping is about 150keV
- <u>Pairing strong in decay-out QC calculation!!!!</u>
- About 25% of ALL gamma rays emitted in SD well in this reaction

Allow rotational damping to vary with spin, I, and excitation energy, U*

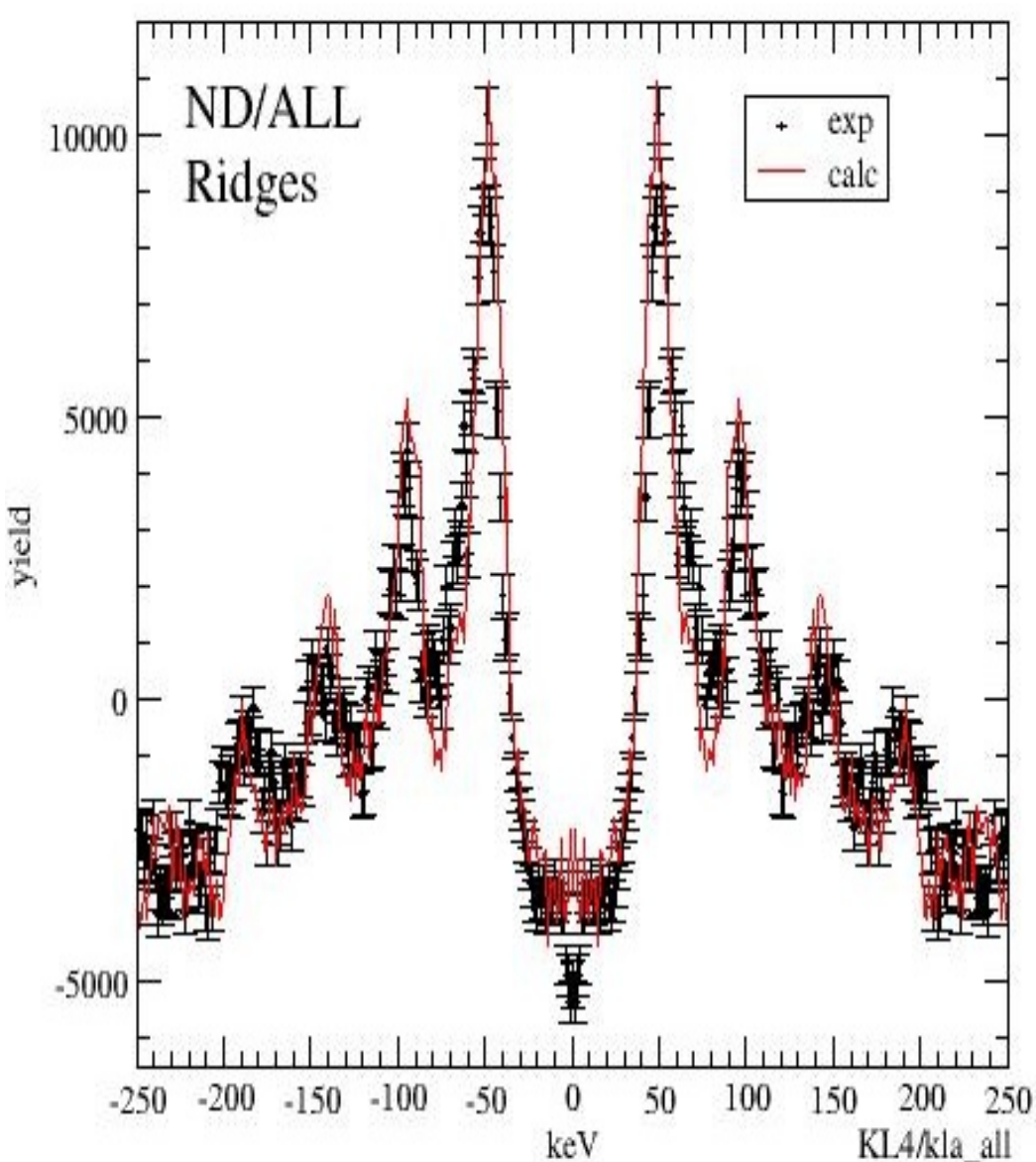


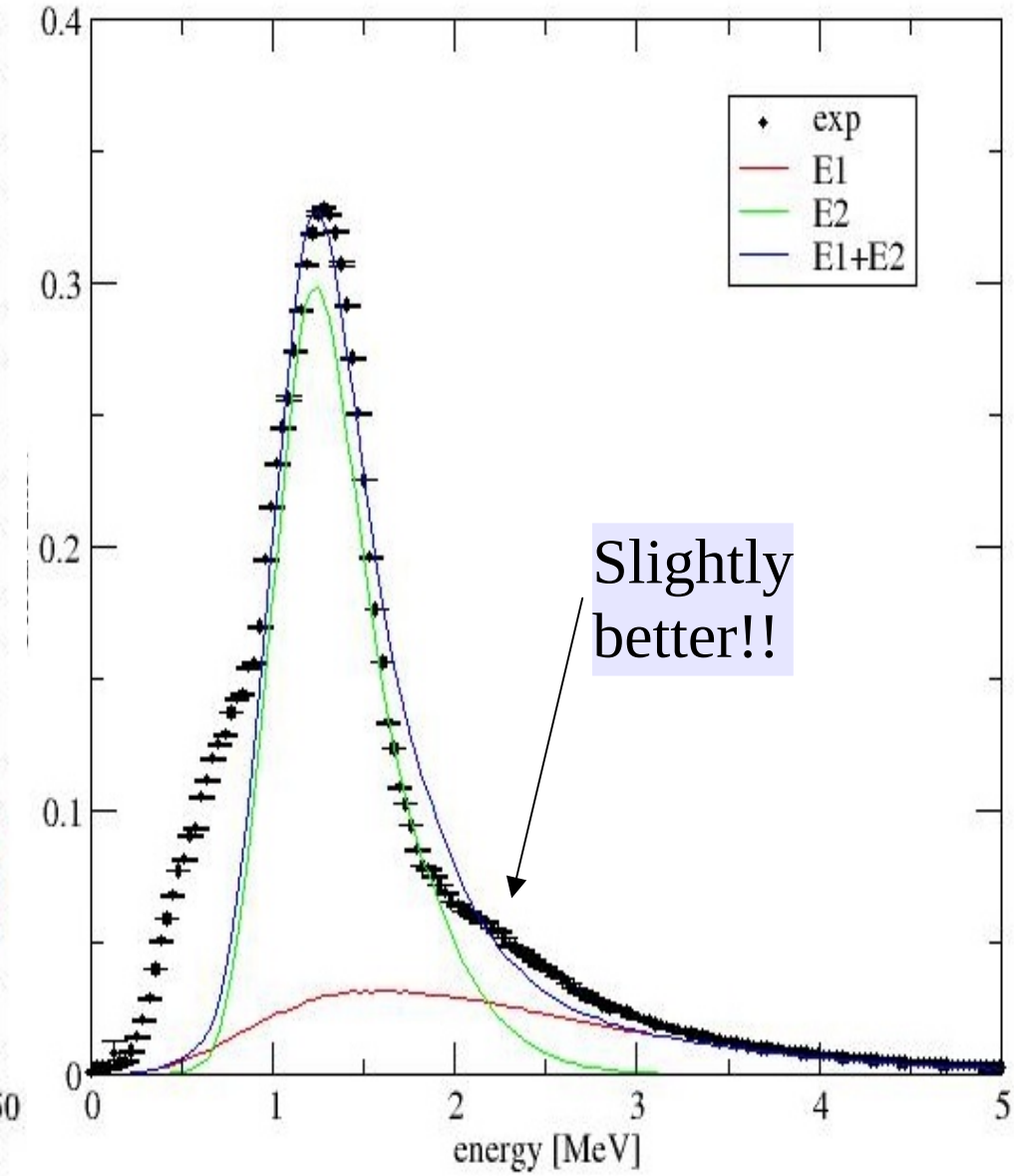
Theory by B. Lauritzen, Dossing, Broglia Nucl. Phy. A457 (1986) 61

Dependence:
0: mass, A
1: spin, I
2: temperature, U*
3: deformation, $beta_2$

With $beta_2$~0.15, use for wide rot. Damp. component in ND well

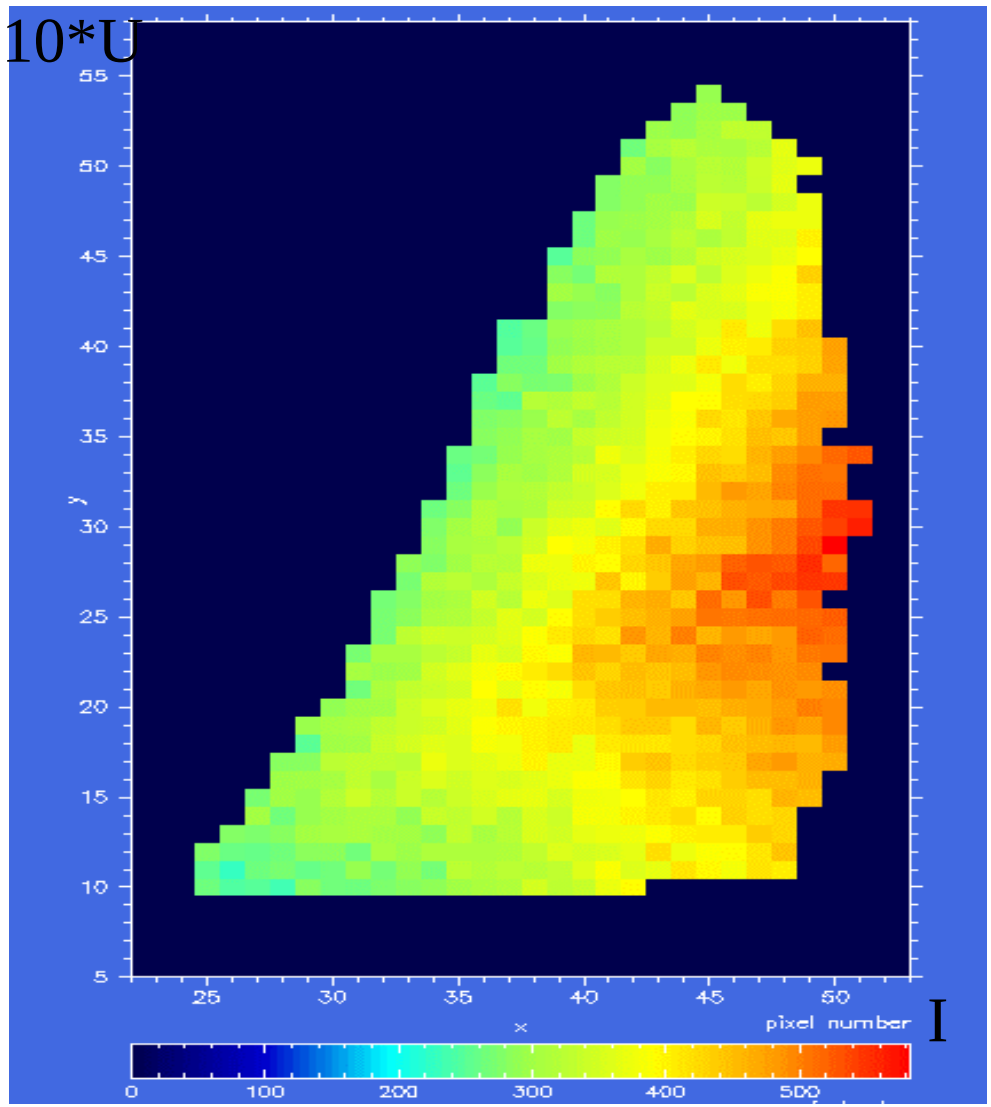
New calculation: ND wide component, rotational damping 'distribution'

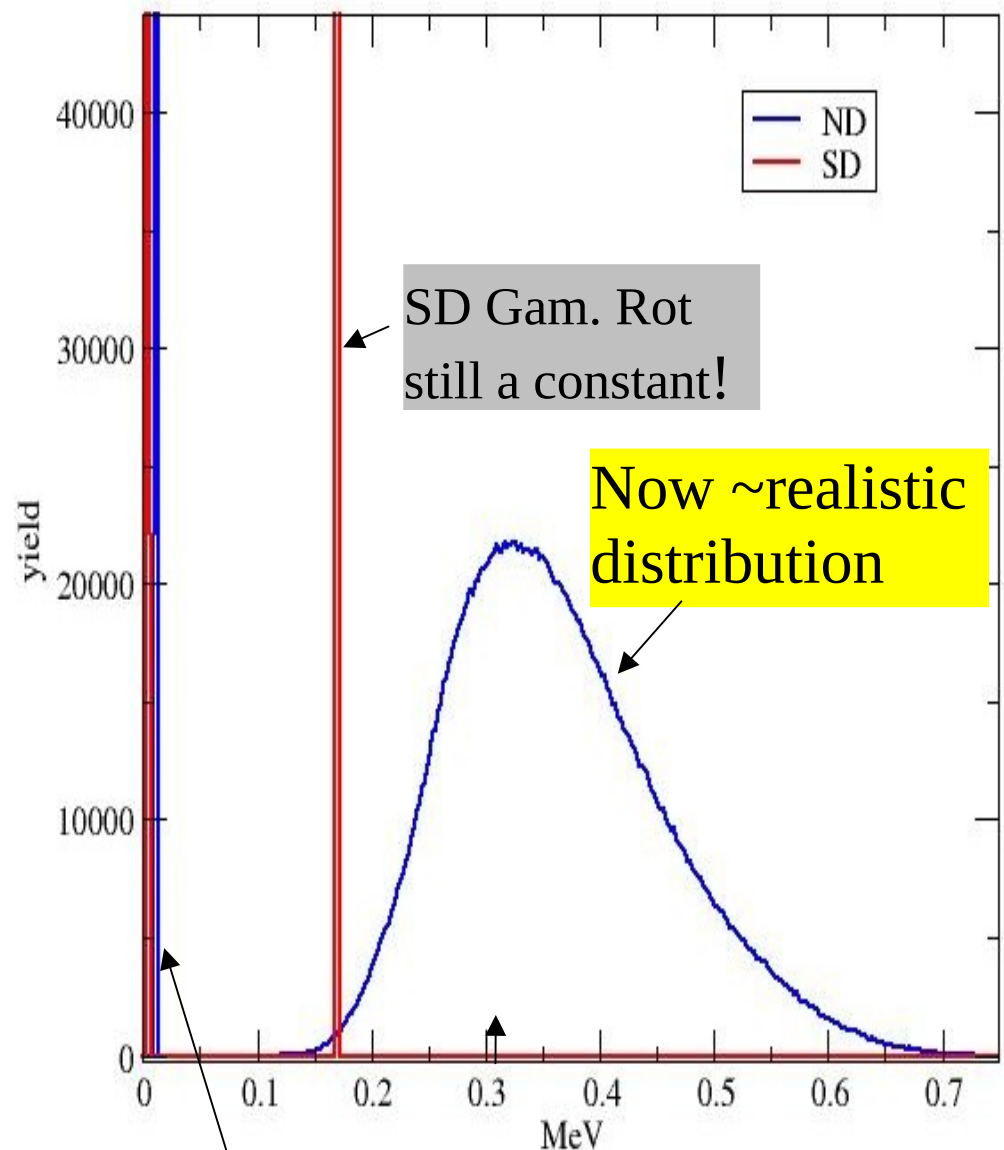




Preliminary analysis!

Sampled Rotational Damping values in 2D and 1D





Narrow components

Improvements &Future

- Use measured Entry Distribution for $^{108}Pd(^{48}Ca[197Mev],4n)^{152}Dy$ reaction (analysis is in progress -- 110 data tapes to process...)
- Let SD wide Rotational Damping width vary with spin, excitation energy and deformation
- Narrow/wide fraction dependence? Need theoretical help! (Dependence on I and U*?)
- Extract ridge intensities
- Ridge analysis in higher dimensions and fluctuation analysis