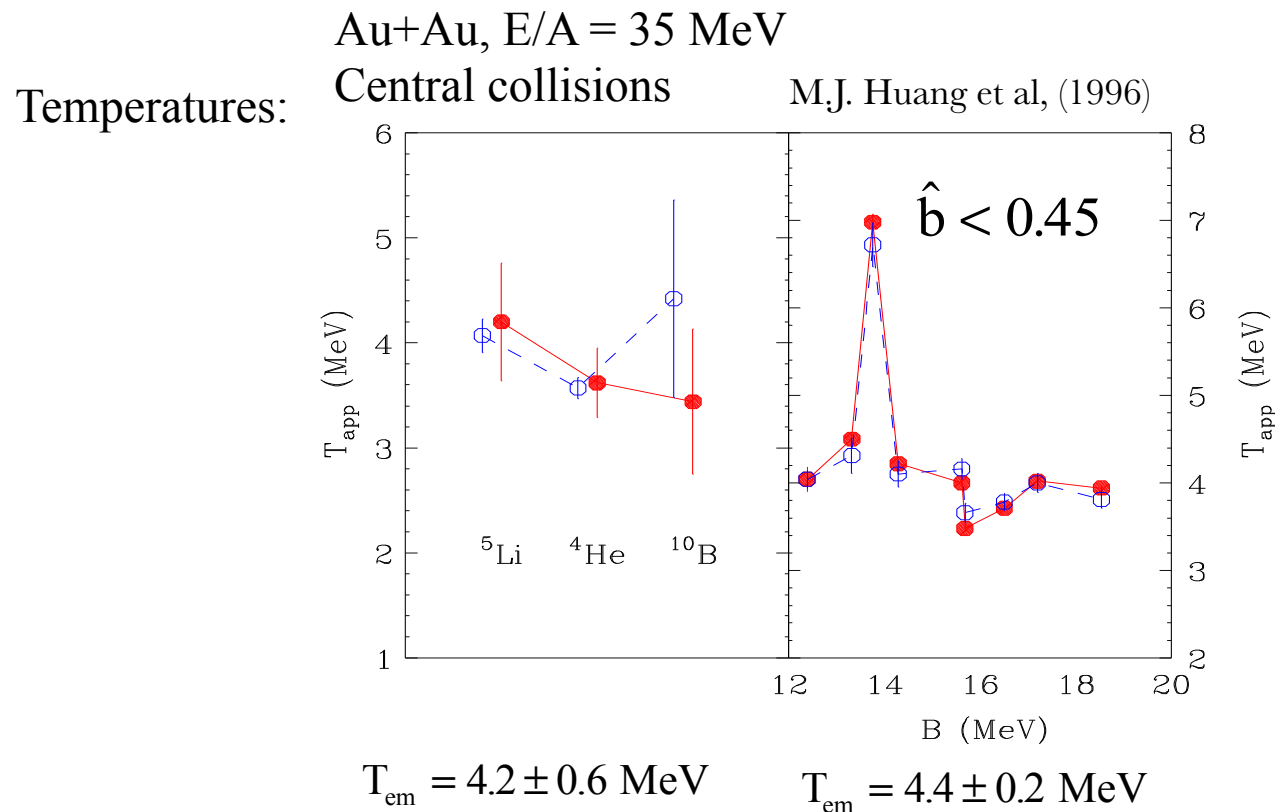
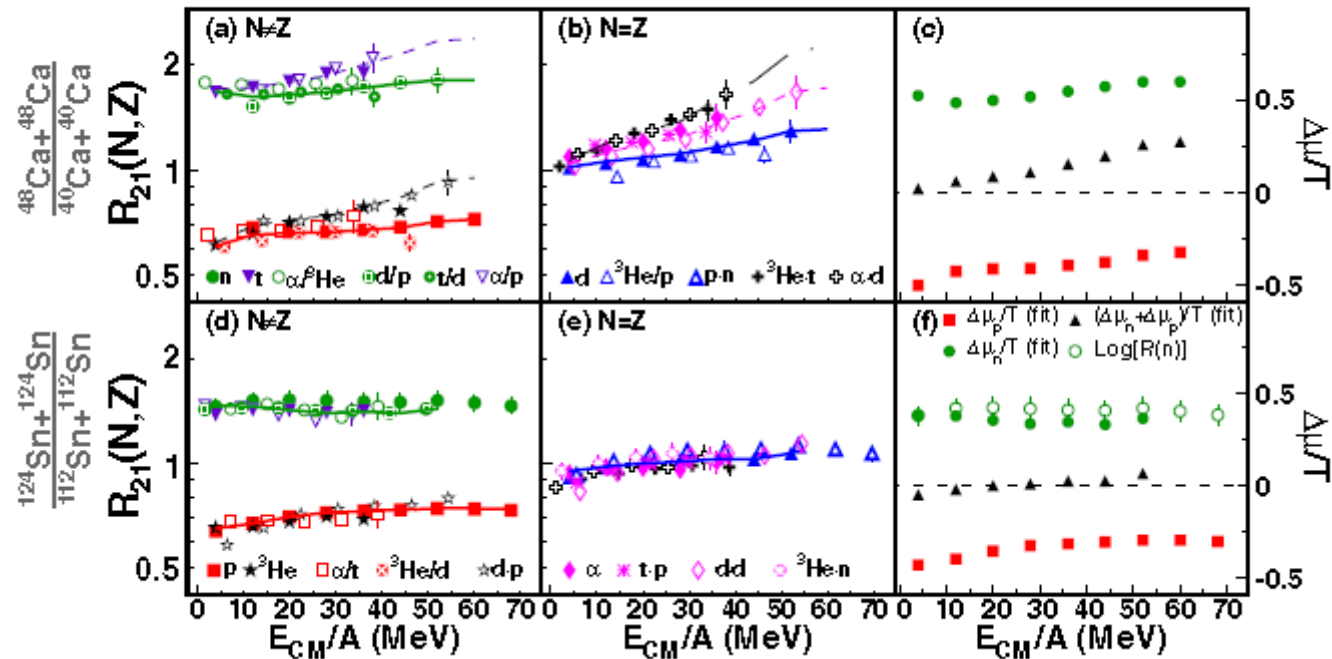


Clusters:Lynch

- Clusters have been a challenge to transport theory:
 - Cluster yield calculations require transport theories to reproduce cluster binding energies. This is currently best done by AMD.
 - This is an important problem.
- In experiments, it appears possible to produce systems at well defined “freezeout” temperatures and chemical potentials.



Chemical potentials



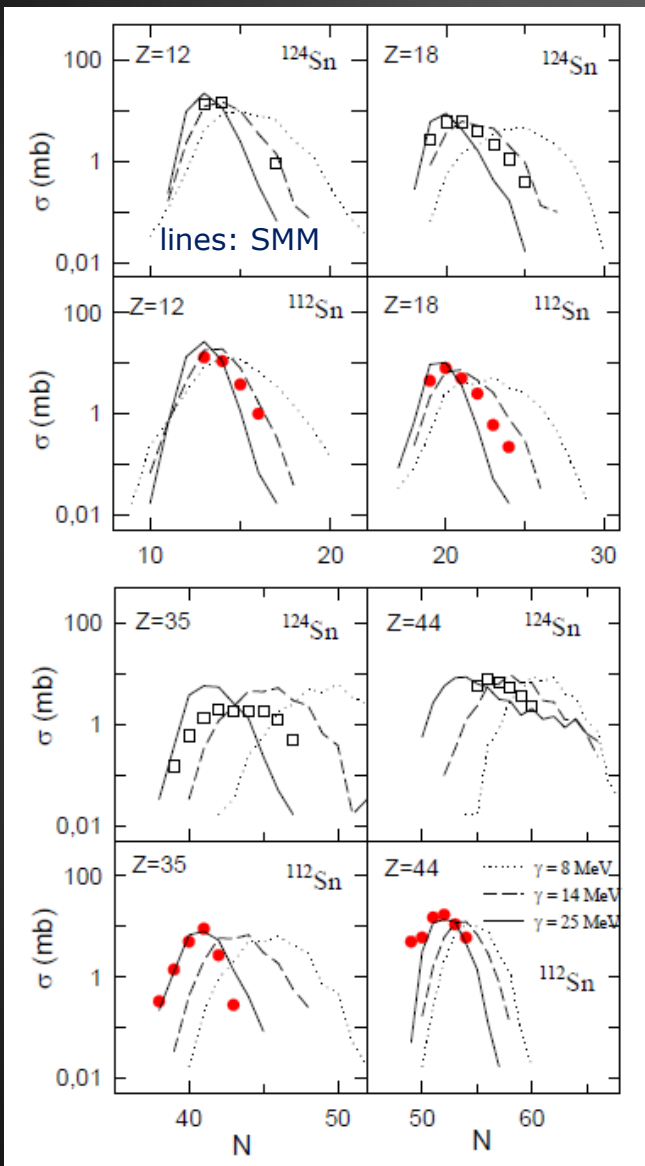
- Illustration of basic idea:

$$\begin{aligned}
 R_{21}(^3\text{He}) &= \frac{Y(^3\text{He}, 124)}{Y(^3\text{He}, 112)} \\
 &\approx \exp\left(\left(2\mu_{p,124} + \mu_{n,124} - 2\mu_{p,112} - \mu_{n,112}\right)/T\right) \\
 &= \exp\left(\left(\Delta\mu_p + \Delta\mu_p + \Delta\mu_n\right)/T\right)
 \end{aligned}$$

medium modifications

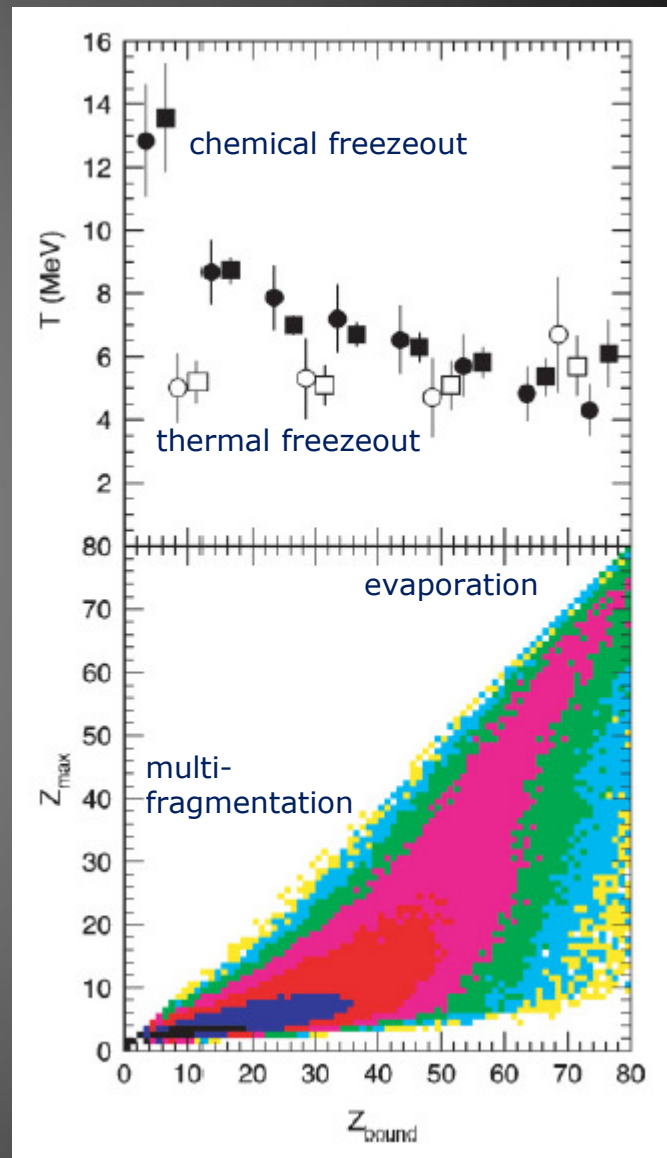
FRS data (Föhr et al.) 1 AGeV
H. Imal et al., arXiv: 1403.4786

ALADIN data, 197Au 1AGeV
W. Trautmann et al., PRC76 (2007)

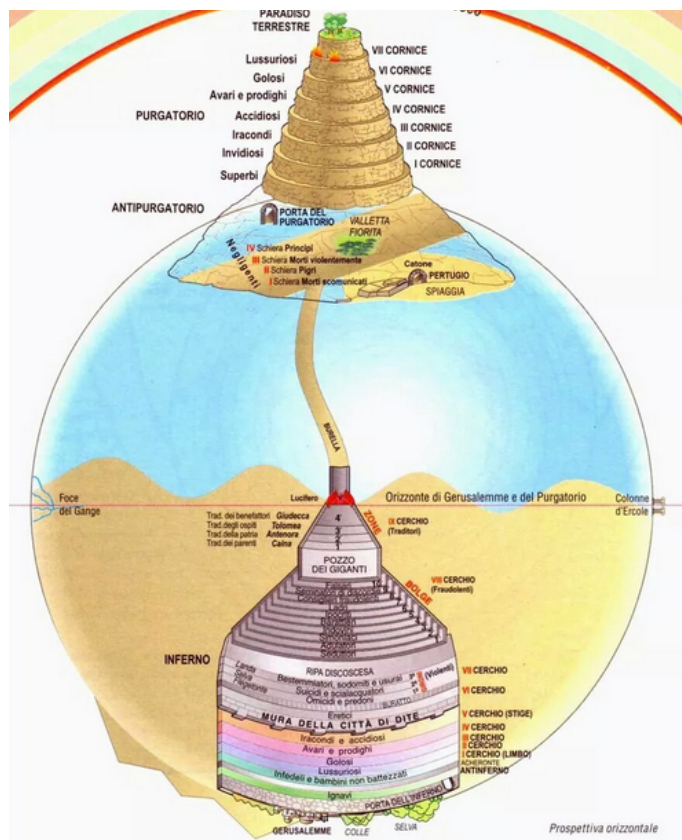


examples of observed medium modifications in projectile fragmentation:

symmetry term in the hot environment (left) and quantum structure before emission (right)



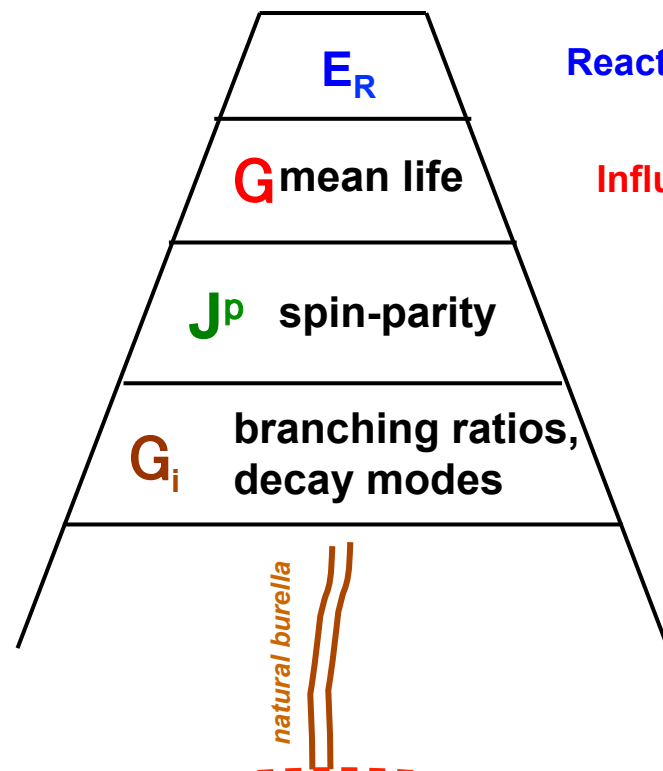
Effect of the Medium in Nuclear Structure



Dante's world

Experimental probes:

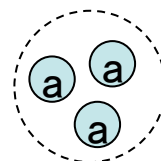
- position of E_R (*excellent resolution*) with *in vacuum* and *in medium* experiments
- angular correlations $\rightarrow J^P$
- *mean life*



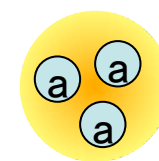
Reaction rate

Influence on r – process?

Interference of states?



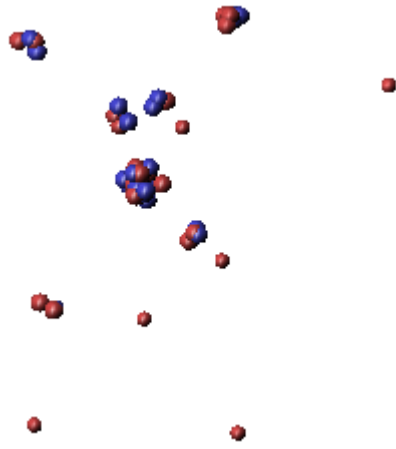
vacuum



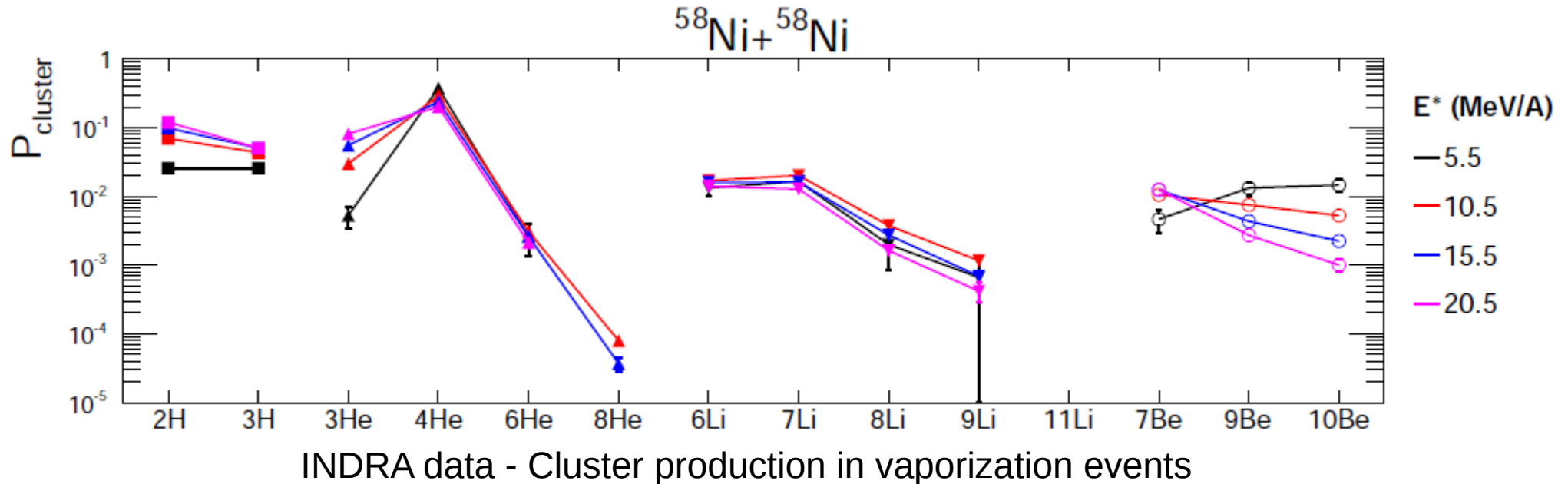
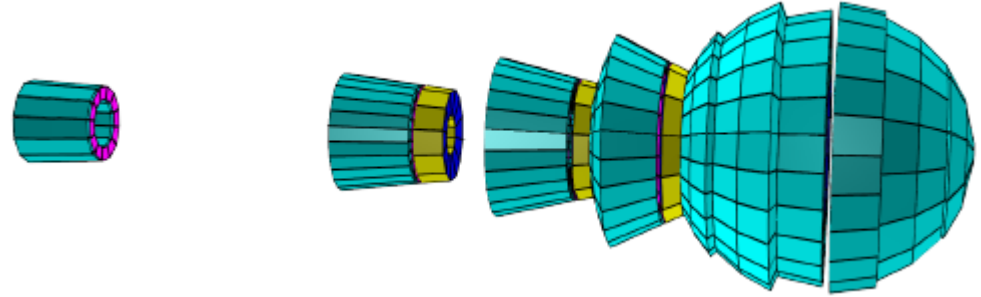
medium

The **HELL** of *nuclear reactions!*
direct, CN, heavy ion...

Experimental event in p-space



INDRA 4π charged particles array



When you have experimental data and you want to bring constraints on theory, you can feel sometimes a little lost ...

BEGINING OF STATEMENT

Results related to clusters production in HIC :
practical point of view from experimental side
and specially on the data analysis part ...

This statement is not only dedicated to
clusters ...

Le grand BAZAR



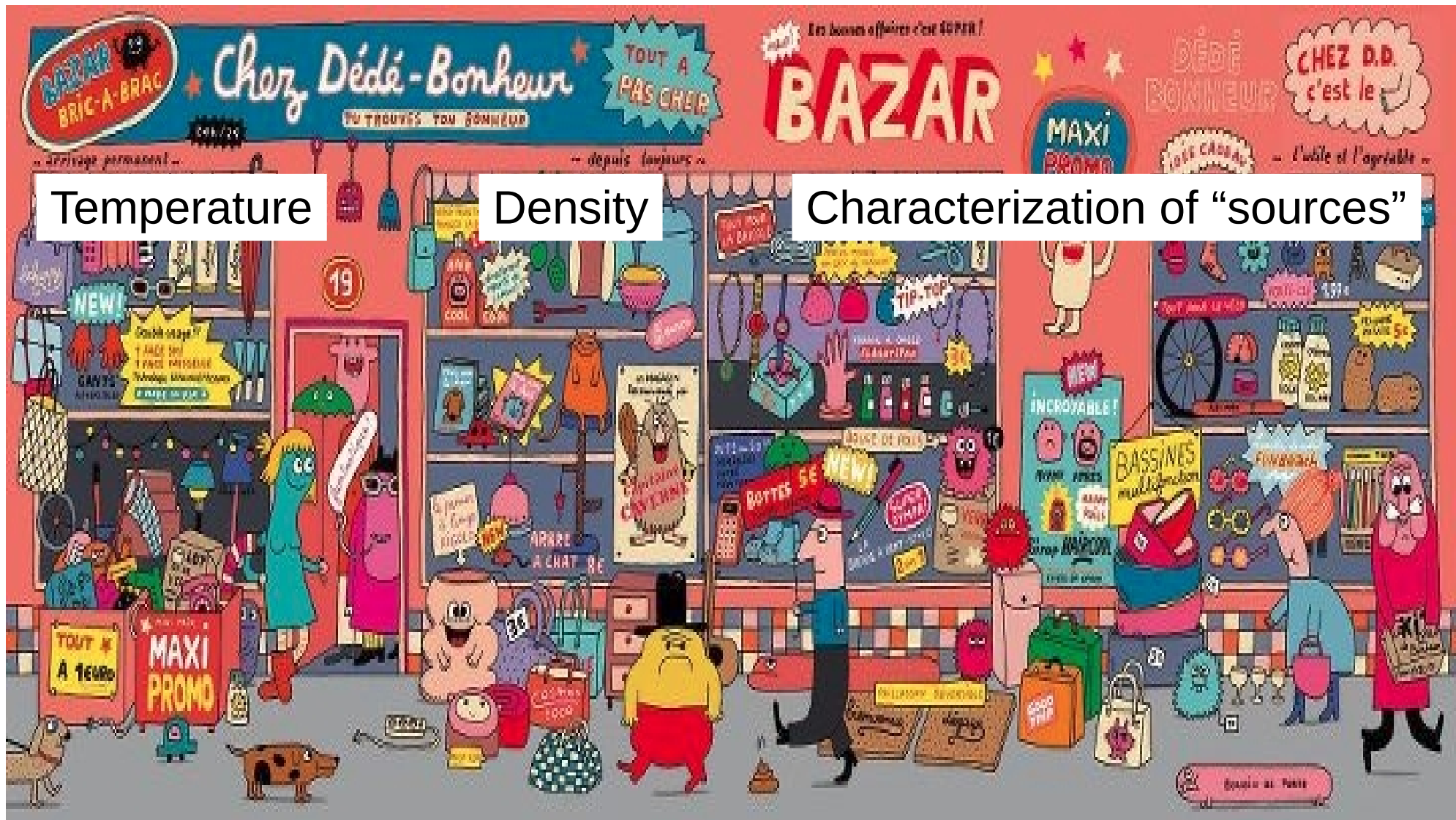
When you have experimental data and you want to bring constraints on theory, you can feel sometimes a little lost ...

Le grand BAZAR



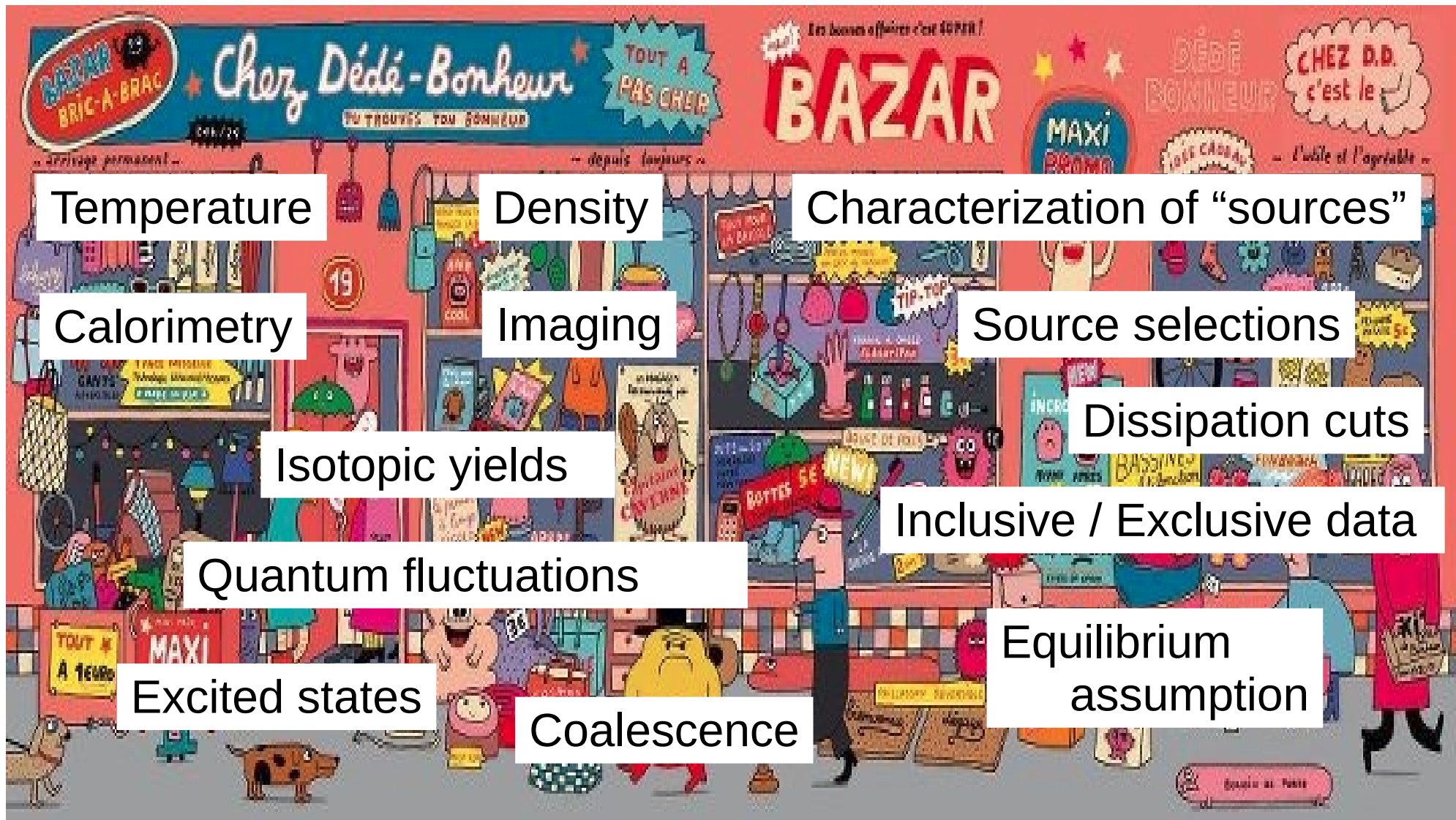
If you want your results to be useful to constrain EOS, you have to “localize” them in phase diagram

Le grand BAZAR



If you want your results to be useful to constrain EOS, you have to “localize” them in phase diagram

Le grand BAZAR



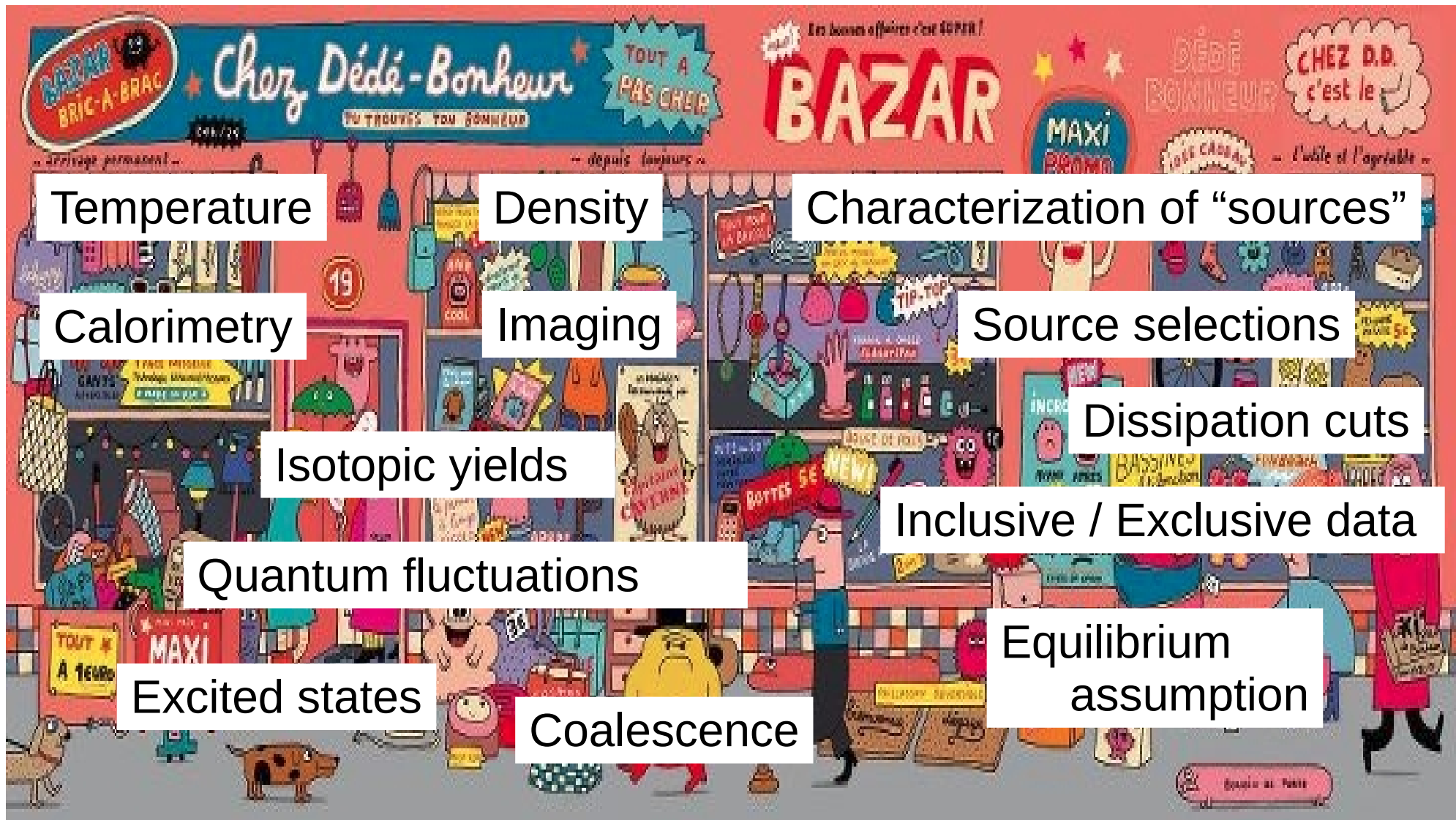
But, it exists many methods/techniques to do this ...

Le grand BAZAR



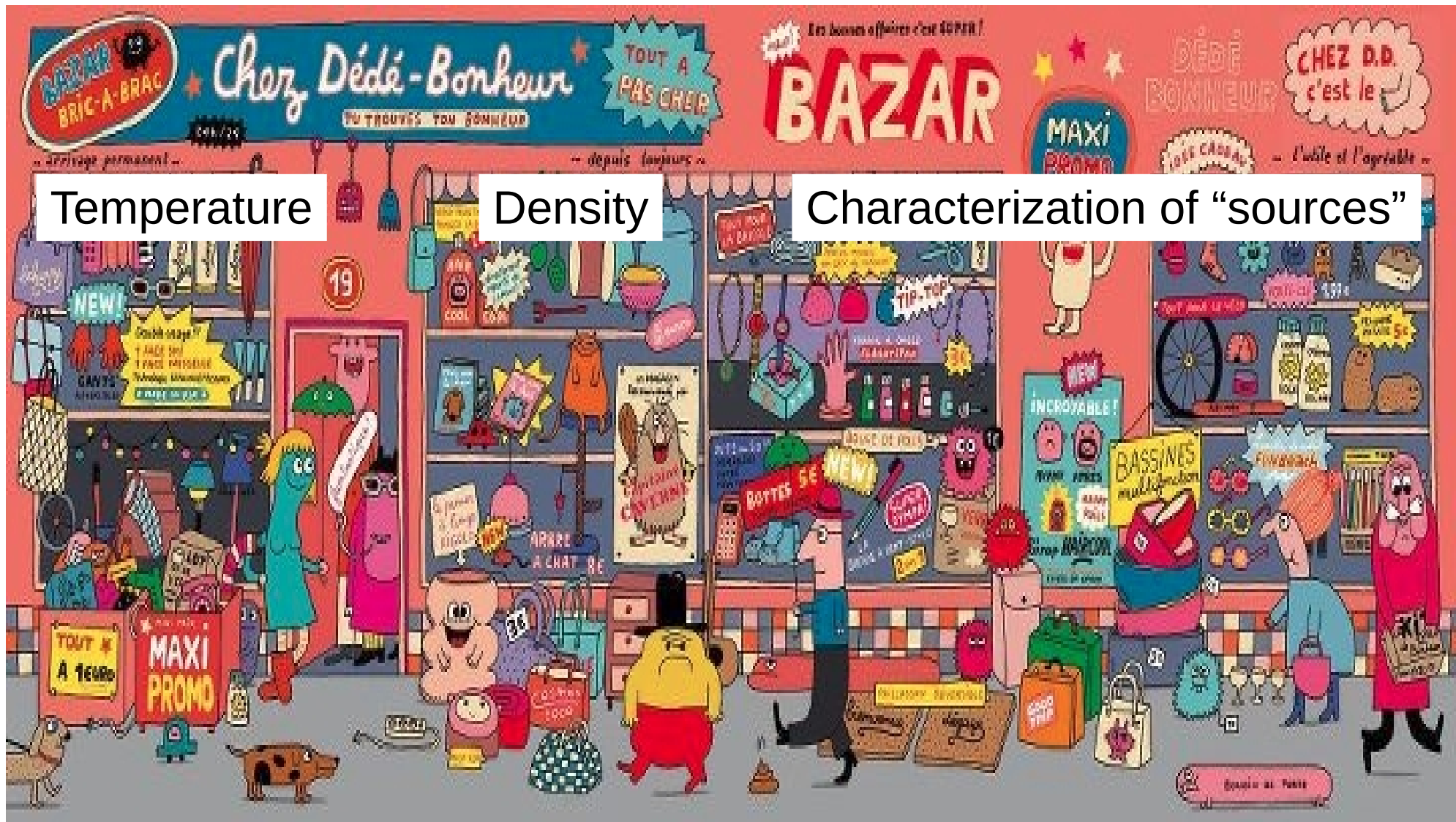
So the localization will depend of the chosen techniques to extract density, temperature, ...

Le grand BAZAR



Cross-checks of these techniques should be made and common analysis and procedure should be defined ...

Le grand BAZAR



Finally, we have to validate the reliability of these “estimations” respect to the control parameters of NSE models

END OF STATEMENT

