P-D Identification at Low Energy by PSA

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Outline

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   - Main characteristics of the Preamp & ADC
2. Thermal Study of the Preamp (PACI)
   - Air cooling, just an example
3. Digital Signal Processing
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   - Pulse shape analysis algorithm
4. Proton-Deuterium Separation at low Energy with Si Detector
   - Experimental setup
   - Results
5. Conclusion & Future Work

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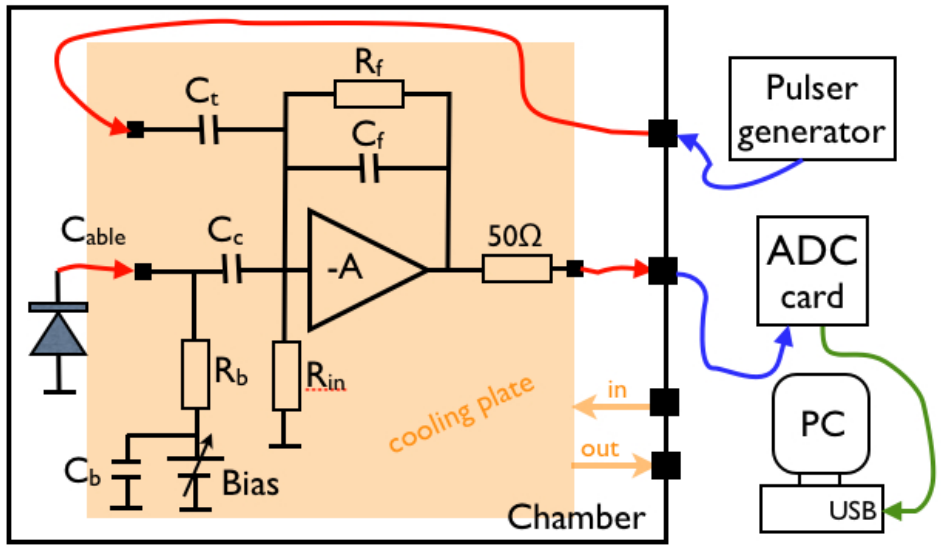
Basic Electronic Chain

General advices

- Preamp in the chamber (EM shield)
- Detector-preamp very close (short cable).
- Pulse generator option (test + calibration).
- Cooling system (stability).



Preamp

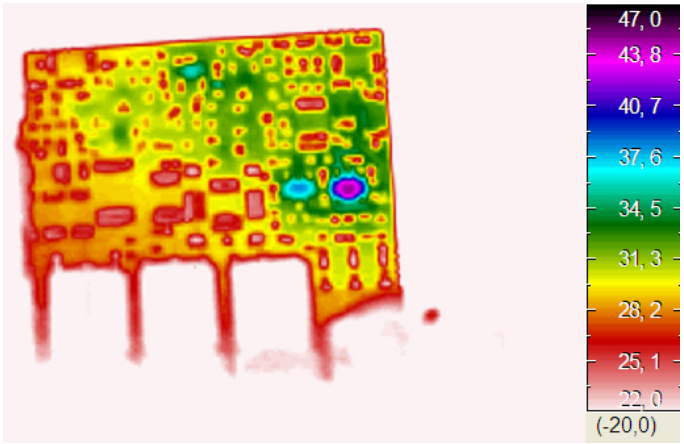
- Charge (E) & Current (t).
- Gain vs Dynamic range compromise.

ADC

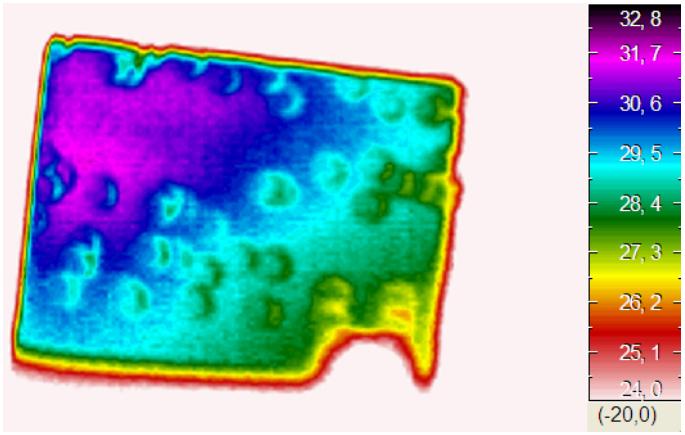
- Number of bits (12 $\surd$).
- Minimum input signal (above noise level).

Thermal Study of the PACI

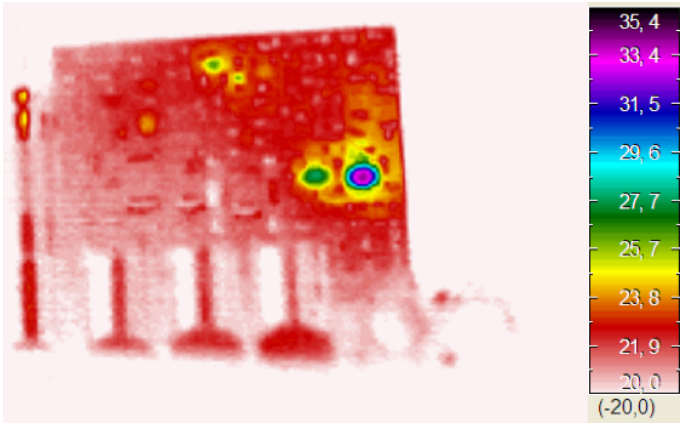
PACI-front after 5 h (open space)



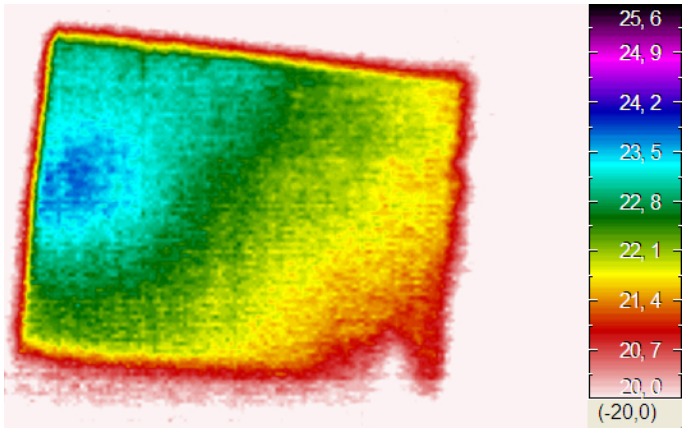
PACI-rear after 5 h



PACI-front cooled down (using fan)

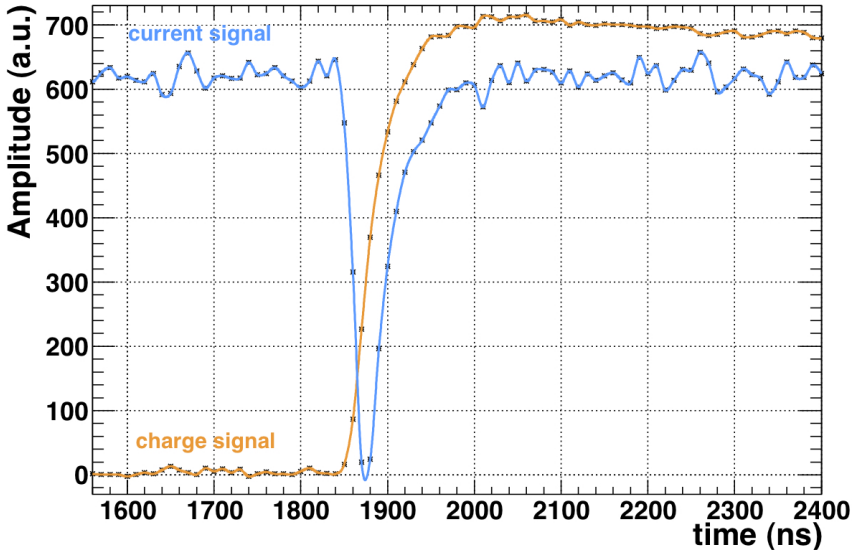


PACI-rear cooled down



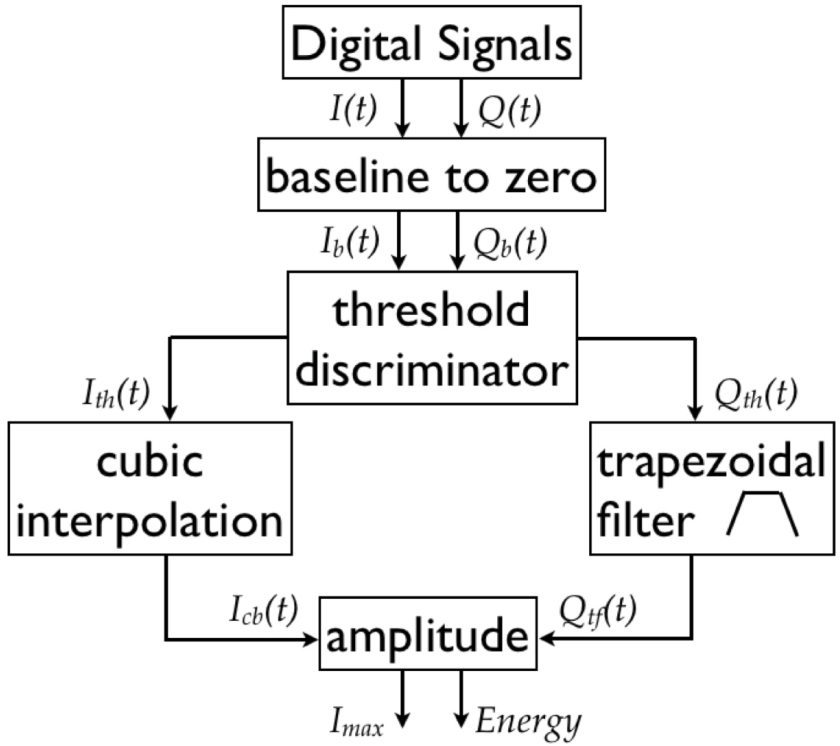
Digital Signal Procesing

Sampling the preamp outputs



- Q does NOT require high sampling.
- I, high sampling or interpol.
- Computing time vs ADC freq.

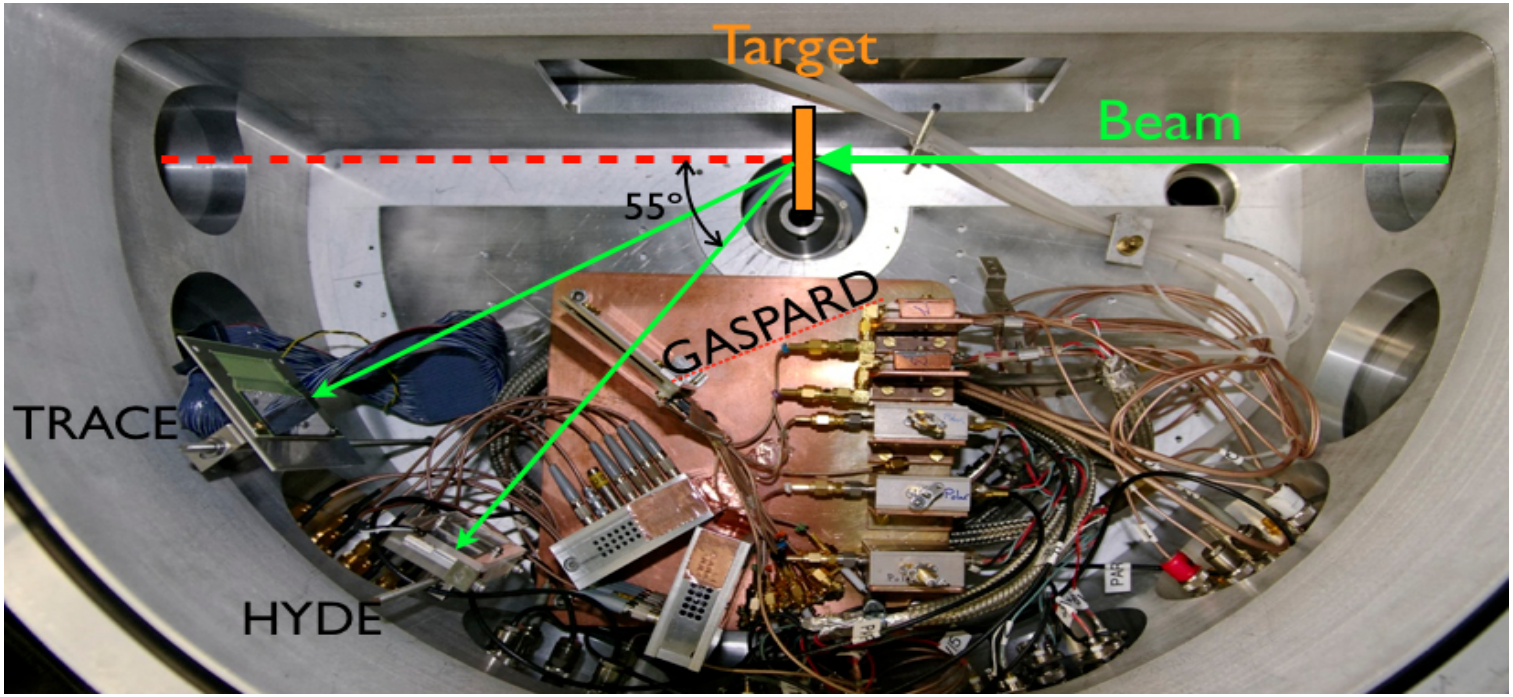
Pulse shape analysis algorithm



- There is NOT a universal algorithm.
- Implemented in a FPGA.

Proton-Deuterium Separation at 2 MeV with Si Detector

Setup at Tandem Alto, Orsay



- Joint experiment: GASPARD, TRACE & HYDE.
- NTD detector borrowed from FAZIA collaboration.

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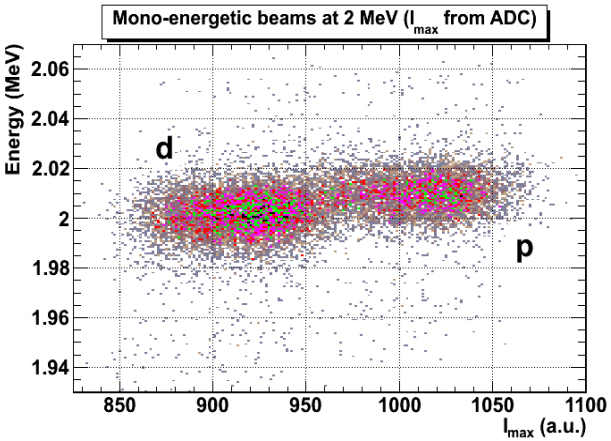
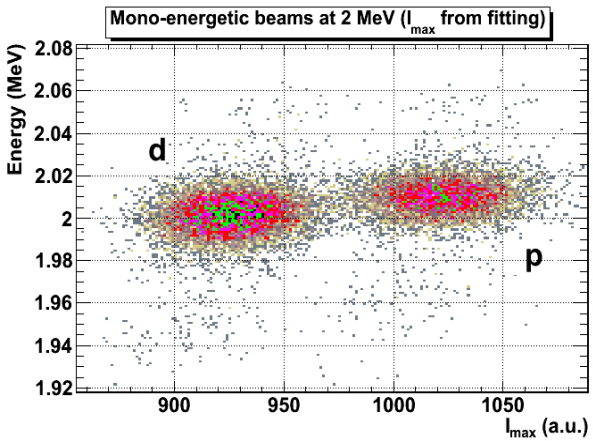
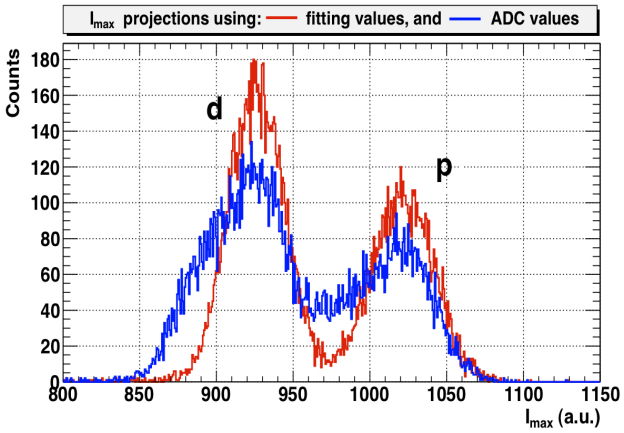
Proton-Deuterium Separation at 2 MeV with Si Detector (Mono-energetic Beams)

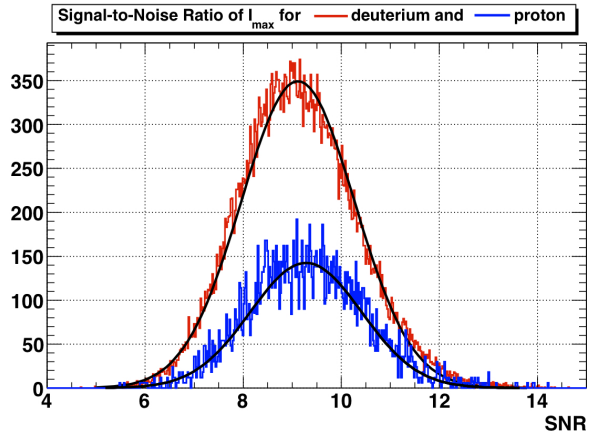
Correlation between *Energy* & I_{max}





- 100 MHz not enough.
- Interpolation works.
- I_{max} method.
- *Risetime* not good.

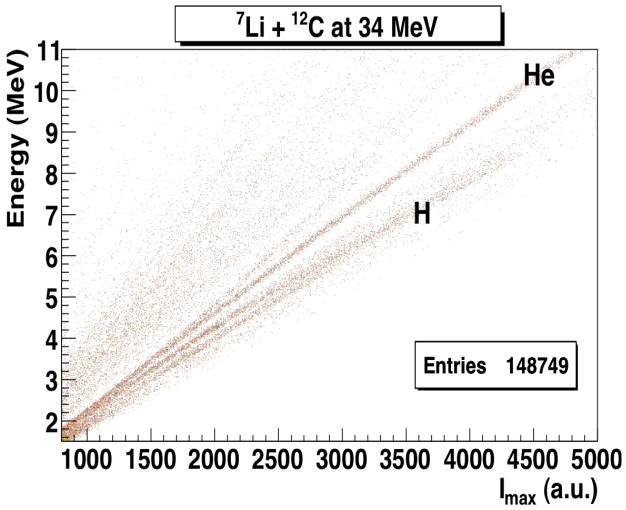


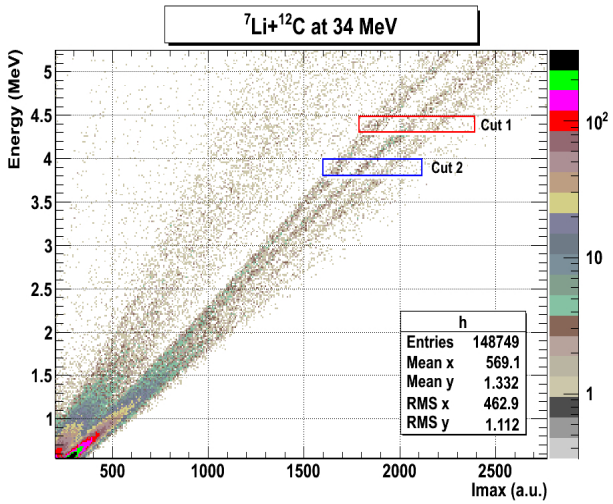


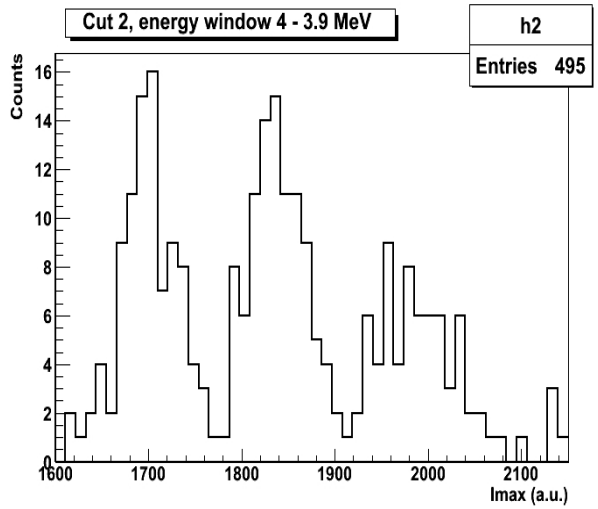
PACI preamp

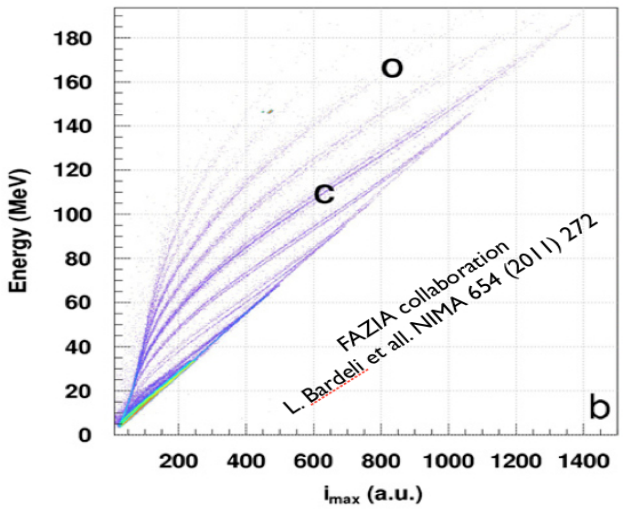
- SNR very good.
- I_{gain} 7000 V/A.
- Q_{gain} 32 mV/MeV.

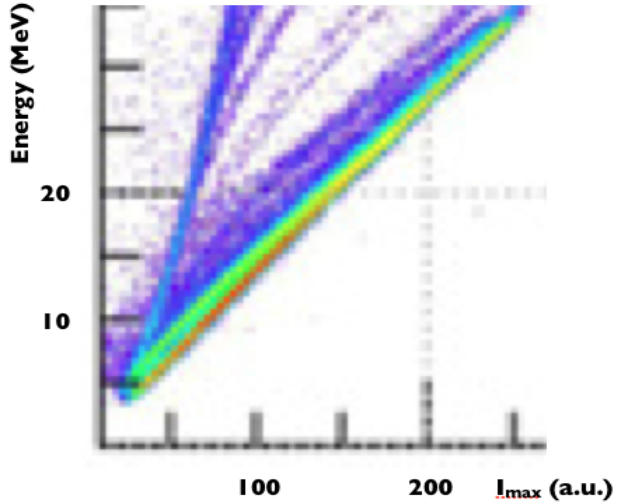
Reaction scenario ($^{7}Li + {}^{12}C$)











- Need to be undestood.
- Very low energy for reaction.
- High gain reduces dynamic range.

Conclusions & Future Work

Conclusions

- Proton-Deuterium separation below 2 MeV has been achieved for Mono-energetic beams.
- This threshold sure can be brought down to 1 MeV.
- Interpolation is needed for low sampling rate.

Future work

- Modify preamp gains to the limits.
- Long run experiment to gather more statistics.
- Go down in energy with mono-energetic beams.

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