1. Problem
(1) Oscillation (4Hz) is still problem.
It has been reduced with dumpers (rubber outside of pipe, which improve vibration outside but not inside). However, noise level is 5,000 electrons at the pre-amplifier, at present. They will try a long pipe between the PT and the test chamber.
(2) It takes three weeks to purify liquid xenon, where the purity is monitored by scintillation lights. They are interested in a heat exchanger of the KEK system (our liquid xenon group). Also, they are interested in visiting to KEK for inspection in this October.

2. Present prototype
use of 1 large anode pad, i.e. 1ch readout
gamma enters from the anode side, so a window of 2mm thick SUS is concerned for strength v.s. material in front. There is one PMT in the prototype. Putting a NaI source (positrons) in vacuum, the two gamma signals are triggered with coincidence between the PMT and additional one inside of vacuum.

3. Future readout
They are studying 16ch ASIC chip (IDEFIX) with bonding to pad (5x5mm^2, 4x4=16ch) , the chip is put in vacuum, i.e. outside of anode-pad. It has charge-amplifier with 500ns integration time. The chip has been developed for CdTe detector by CEA/DAPNIA at Saclay. I asked to send the specification of IDEFIX.

Dominique replied as;
"We are confident for its work with liquid xenon TPC but it will need some modifications, in particular to adapt the dynamics to high energy gamma rays. I will send you a detail data-sheet of the chip, but you can contact directly Eric Delagnes to have details informations about it. Eric is one of the man who developed this product."

The pad is made of multi-layer of ceramics whose total thickness is 2.5mm, i.e. multi-layer for small hole for less leakage of liquid xenon and large hole for bonding. It costs about 200 Euro. (hole for electric contact with indium)
The signals will be transfered by cable with feed-through to a digitizer. They are looking for cable and configuration of signal and ground lines.

The signal will be digitizing with 20MHz ADC, then it has digital filtering to reduce noise, i.e. digital band pass filter. They are simulating the digital processing to estimate the performance.

4. Simulation studies by two students
PhD student in this December;
simulation results of 3 gamma detection, where micro-PET is used to detect 2 gammas from e+ annihilation and a liq.Xe Compton telescope is used for associated third gamma(1.2MeV) . The liq.Xe detector has 12cm depth for detection of 1.2MeV gammas. The micro-PET has 1mm spatial resolution. The telescope provide an very improved position along the LOR, i.e. 1.6cm compared to be one of a few 10 cm by PET-TOF . However, it results "poor" reconstruction of source points. It certainly improve S/N, however it is difficult to show quantitative performance for medical doctors (potential users). Apparently, we need some quantity to compare performance with conventional PET.

Note: Medical doctors demands high intensity PET i.e. fast PET or PET with less radiation dose (several MBq injected in human body at present, while several 100MBq injected in animals) In this respect, the liq.Xe PET is better for the latter demand.

Student ;
simulation results of rectangular pet consisting of 4 blocks; The PET signals are only scintillation lights with GPMT (Gaseous Photomultiplier).
The GPMT is segmented into 2.5cm x 2.5cm. Present size is 22cm x 22cm . They are interested in high intensity PET.

They are interested in 2" square PMT of Hamamatsu. I will contact to the company for present status.

5. Parallel Ionization Multiplier (PIM) use Ne-CO2 mixture gas
PIM consists of 3 layer of micromesh - cathod-plane- micromesh-1- micomeshh-2 - and micromesh-3 - anode (400um x 400um) with stripline readout for reduction of channels.
Actually, they proposed this pad size for the liq.Xe TPC readout based on PIM.
PIM feature
- higher gains and smaller ion feedback as square of suppression factor
They has been working on PIM and its medical application to beta imaging;

- imaging residual radiation in animal's organic slices
- spatial resolution is 20um, while 100um is enough for the imaging, where a distance from cathod to the first micromesh-1 is about 1cm for expanding charge image . Gap betweem micromesh-2 and -3 is 100um and also a distance between micromesh-3 and anode is 100um.

Dominique's comment;
"The targeted resolution for such kind of animal slices is in order of 100 microns 2D (typical resolution obtained with phosphor screens), but more the resolution is high and more details can be investigated."

6. Cyclortron ARRONAX
It is constructed near (about 10km) the Nantes university campus and will complete in this October. It accelerates protons and alphas. Major purpose is to create radio isotopes for medical applications.