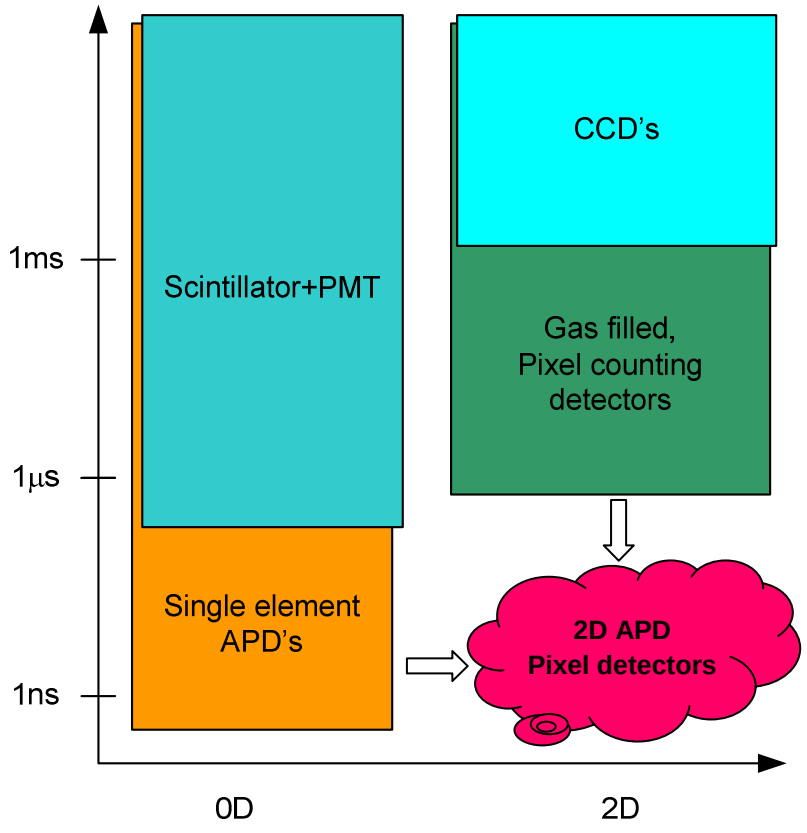
2D APD pilot project

- Motivation
- Goal specifications
- Pilot project vs. JRA

2D APD pixel detector project

- 2D X-ray detector with ns time resolution for SR applications
- Adapted to Nuclear Resonant X-ray Scattering and to a diversity of elastic scattering experiments (time-resolved diffraction, photon correlation spectroscopy, …).
- Linked to the ESRF long term strategy. Time-resolved experiments are a key goal for the ESRF Upgrade Program.



Types of experiments considered

- Nuclear resonant scattering.

  X-ray flash (prompt) + decay of excited states in the nanosecond range

  - In use: fast 0D with < 1ns time resolution
  - In development: 1D arrays with discrete electronics

- Elastic scattering – time structure given by the storage ring.

  Bunch spacing 2 – 3ns (2.84 ns @ ESRF)

  - 2D detectors:
    - In use: CCD based (few frames/sec in integration mode) or gas-filled (µs resolution but strongly count rate limited)
    - In development: Si PIN pixel detectors (ex. MAXIPIX = MEDIPIX2 based @ 1 Kframe/sec)

Sensor specifications

Sensor:

- pixellated Si APD operating in linear mode
- thickness: 100 μm (and 200μm)
- active area: 10 × 10 mm^2
- pixel size: ~ 300μm × 300μm
- number of pixels: 1024 (32 × 32)
- detection efficiency:

@ 5 keV > 50%

@ 15 keV 20% (100μm sensors)

37% (200μm sensors)

Readout specifications

Readout ASIC

- 4 chips per sensor: 256 (16 × 16) pixels each
- Technology: 0.18μm CMOS
- Timing specifications:
  - photon pair discrimination: < 2 ns
  - recovery time after veto < 2 ns
  - time resolution:

    (event-by-event readout) < 1 ns (for 100μm sensors)

    (framing mode) < 10 ns (limited by framing time)
  - max count rate:

    (event-by-event readout) > 10^7 ph/sec (whole detector)

    (framing mode) ~ 10^8 ph/sec/pixel

Pilot project

The project is already starting:

- DESY and ESRF will provide the basic funding
- Sensor and ASIC development done by “external” experts
- Assembly, readout electronics and software will be developed by DESY and ESRF

And the JRA?

- Initially (June 97) submitted with the aim of expanding the scope of the project.

- Now (september 97), the JRA is seen as a way of alleviating the manpower effort from DESY and ESRF.

Project budget:

manpower:	970 k€
other:	370 k€
Total:	**1.34M€**

400 k€ requested for manpower through JRA#5