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APPLICATIONS

EuPRAXIA

A bright gamma ray source by inverse Compton scattering (WP7)

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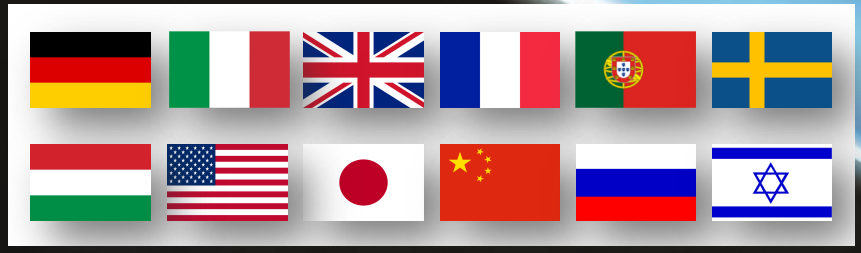
And all in WP7

27th February 2019



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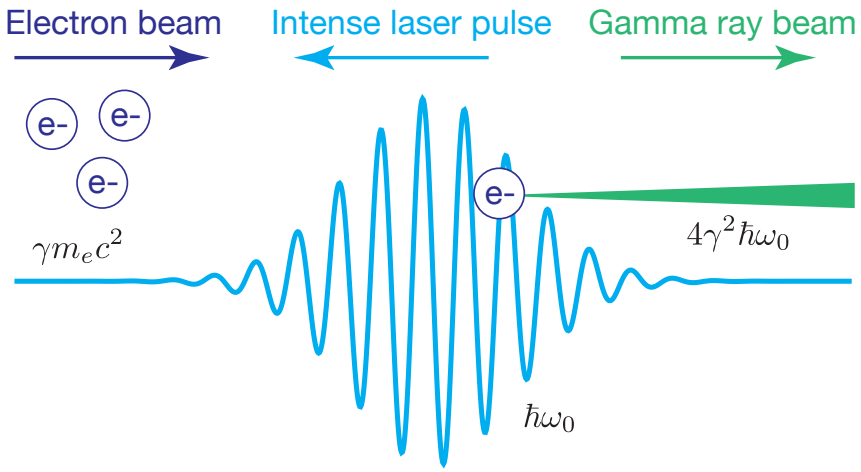
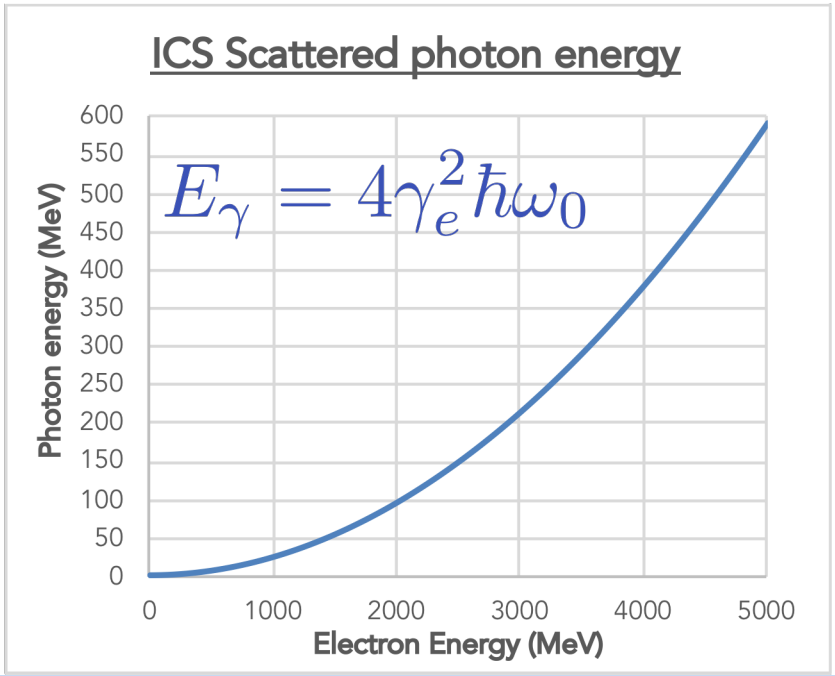
Introduction

- We have seen a coherent and ultra-short but broadband radiation source at 5-20 keV photon energy
- What about MeV?
  - Introduces applications in highly penetrative radiography
- What about mono-energetic?
  - Precision nuclear physics

- An **inverse Compton** user area has been proposed

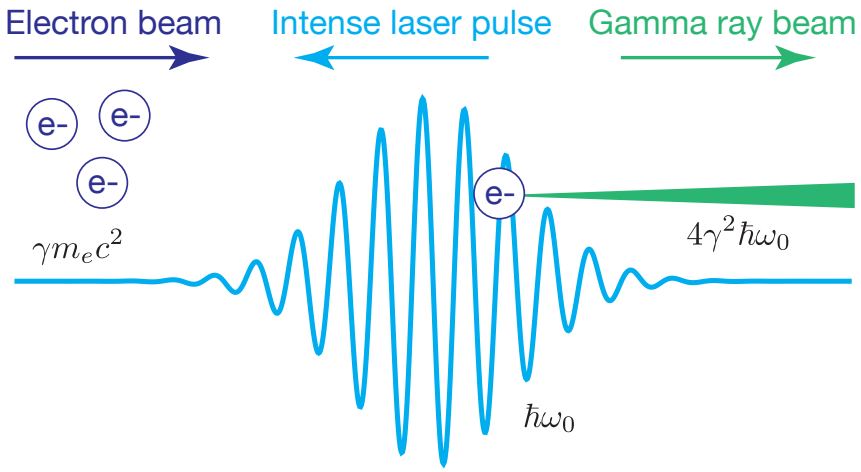
Inverse Compton Scattering





- Laser light scatters from relativistic electrons and experiences a relativistic Doppler upshift
- Scattered light can be monoenergetic if:
  - Electrons (and laser) are monoenergetic
  - Compton is in the linear regime

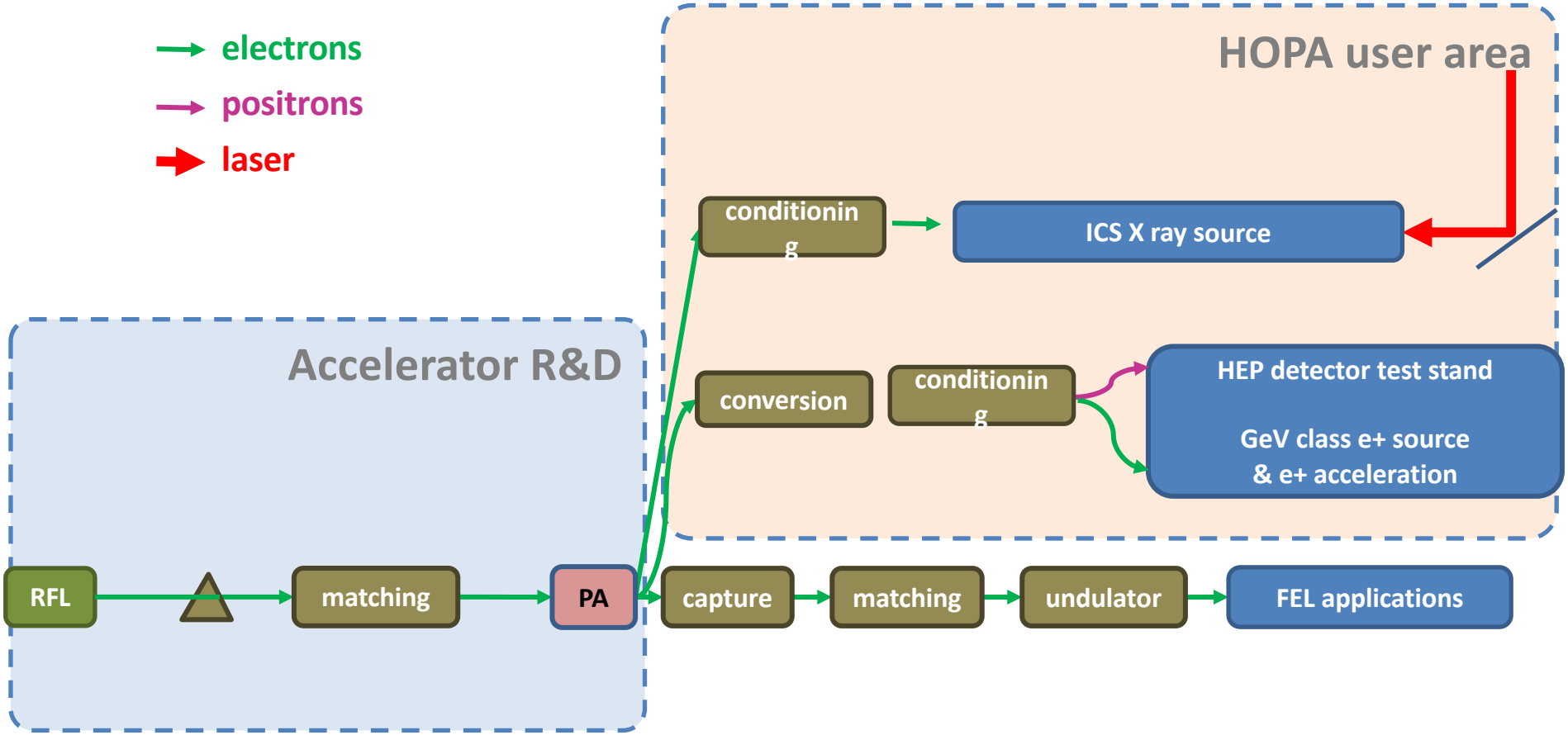
Inverse Compton Scattering



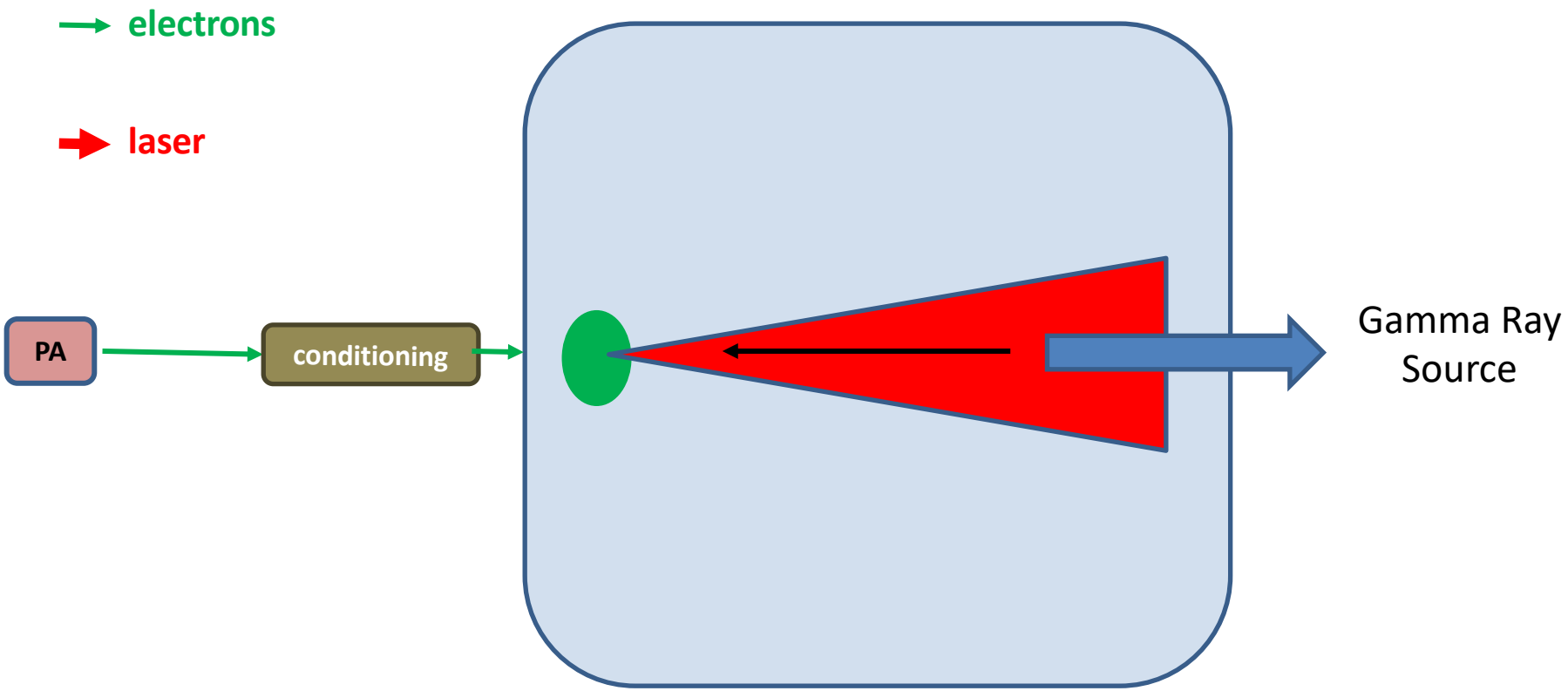
$$\chi = 0.1 \left(\frac{\gamma}{1000}\right) \left(\frac{I}{10^{21}\mathrm{Wcm}^{-2}}\right)$$

- Accessible Parameters:
  - Micron source size: electron beam or laser spot
  - Tunable narrowband: 1 - 600 MeV from 0.2 – 5 GeV e^- (linear)
  - Brighter broadband: up to GeV (nonlinear)
- Flux increases with laser intensity
- Average photon energy is 0.44χ E_e
- Broadband approaches a synchrotron spectrum for high χ

Baseline design functional layout : INFN



Plan for User Area



- Can be very compact:
  - Short focal length for small source and high brightness
  - Photon energy is unlikely to need to be in vacuum
  - For absorption imaging and NRF, no drift distance required

Ongoing Preparation

- Several experiments by various groups (QUB, Nebraska, LBNL etc…) with publications to help inform direction
- Upcoming experiments to look at
  - stability, flux and experimental source size
  - detectors able to fully exploit beam parameters