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Upgraded Tagged-photon facility at MAX-lab



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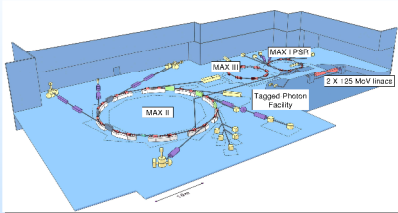
Overview

Within the nuclear physics group at MAX-lab, the properties of nucleons and nuclei are studied with tagged photons ranging from ~18 to 180 MeV.

- Upgraded electron beam, in use since 2005, designed energies up to 250 MeV, current maximum of 200 MeV.
- Two tagging magnets from SAL, installed in 2004, in operation since mid 2005.
- A new focal plane from SAL now in use.
- A new goniometer installed, used for experiments with polarized bremsstrahlung with various types of crystals.
- A next generation focal plane is funded and under construction.

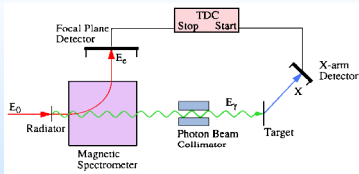
A number of experiments are planned to make use of the upgraded tagging facility.

Experiments at MAX-lab



- Maximum electron energy: 250 MeV (design) ~ 200 MeV (currently)
- Knowledge of electron energy: ~ 0.5%
- Duty Factor: 50-80%
- Current: ~ 20 nA
- Beam emittance at radiator: 0.25 mm mrad

Photon Tagging

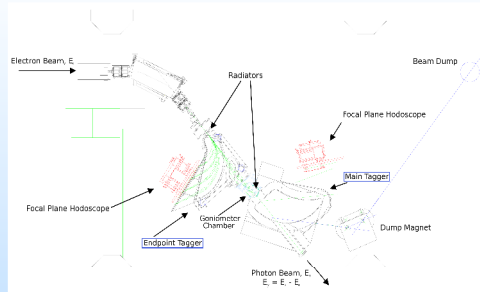


The principal of photon tagging involves an incident electron, with energy E_0 , interacting with a thin radiator, producing bremsstrahlung. By measuring the energy of a post-bremsstrahlung electron, E_e , the photon energy, E_γ is known:

$$E_\gamma = E_0 - E_e$$

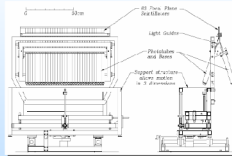
Tagging Facility

Tagging Systems



Current arrangement of the Endpoint Tagger (ET) and Main Tagger (MT), and two possible positions of the focal plane hodoscope (FP). Also shown is the dump magnet and location of the beam dump.

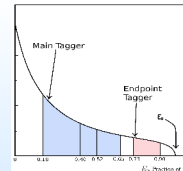
Current Focal Plane Hodoscope



The focal plane consists of 63 plastic scintillators, arranged in two rows with a 50% overlap. Depending on which tagger magnet is in use, ET or MT, the tagger settings, and the electron beam energy, the resolution of the hodoscope is in the range of 0.2 to 1.0 MeV.

Photon Energy Range

Possible energy ranges covered by the current tagger and focal plane hodoscope setup, from ~18 to ~180 MeV.



Examples of possible energy coverage:

Tagger	E_0 (MeV)	E_e (MeV)	$E_{\gamma, \text{tagged}}$ (MeV)	FP range (MeV)	ΔE_γ (keV)
MT	100	18-52	28	450	
MT	100	40-65	20	335	
MT	125	50-81	25	420	
MT	200	80-130	40	672	
ET	125	91-113	16	269	
ET	150	109-135	20	323	
ET	175	127-157	23	376	
ET	200	145-180	27	430	

Goniometer

- A new goniometer and goniometer chamber are now in place
- 5 radiator positions
- Tests performed with diamond and silicon crystals and aluminum



- Coherent bremsstrahlung beam produced
- "Stonehenge" technique of crystal alignment employed

Polarization seen in the coherent peak during a recent test run

Research Program

PAC approved experiments that have recently occurred, or are scheduled:

- The total photoabsorption cross section of ${}^6\text{Li}$ below π -threshold
- Compton scattering from ${}^4\text{He}$ and ${}^{12}\text{C}$
- Measurement of Photoreactions on Helium Isotopes using Gas-Scintillator Active Targets
- Elastic Compton Scattering from Deuterium at 40-110 MeV, 30° - 150° , goal of significantly increasing the world ${}^2\text{H}(\gamma, \gamma)$ data set
- Photofission of Heavy Actinide Nuclei at MAX-Lab
- Initial commissioning of the Ge6 array
- Study of the Halo Nucleus ${}^6\text{He}$ using the ${}^6\text{Li}(\gamma, \pi^-){}^6\text{He}$ Reaction
- Deeply Bound Pionic Atoms from the (γ, π) Reaction
- Charged Pion Photoproduction from Threshold up to the First-Resonance Region

Additional planned experiments:

- Use coherent bremsstrahlung to measure asymmetry of deuteron photodisintegration

Experiments in the MAX-Tagg Collaboration are user driven and PAC administered. Proposals are welcome. The next PAC meeting will be in Lund on October 15 & 16, 2008. Concerning procedures, see www.maxlab.lu.se

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