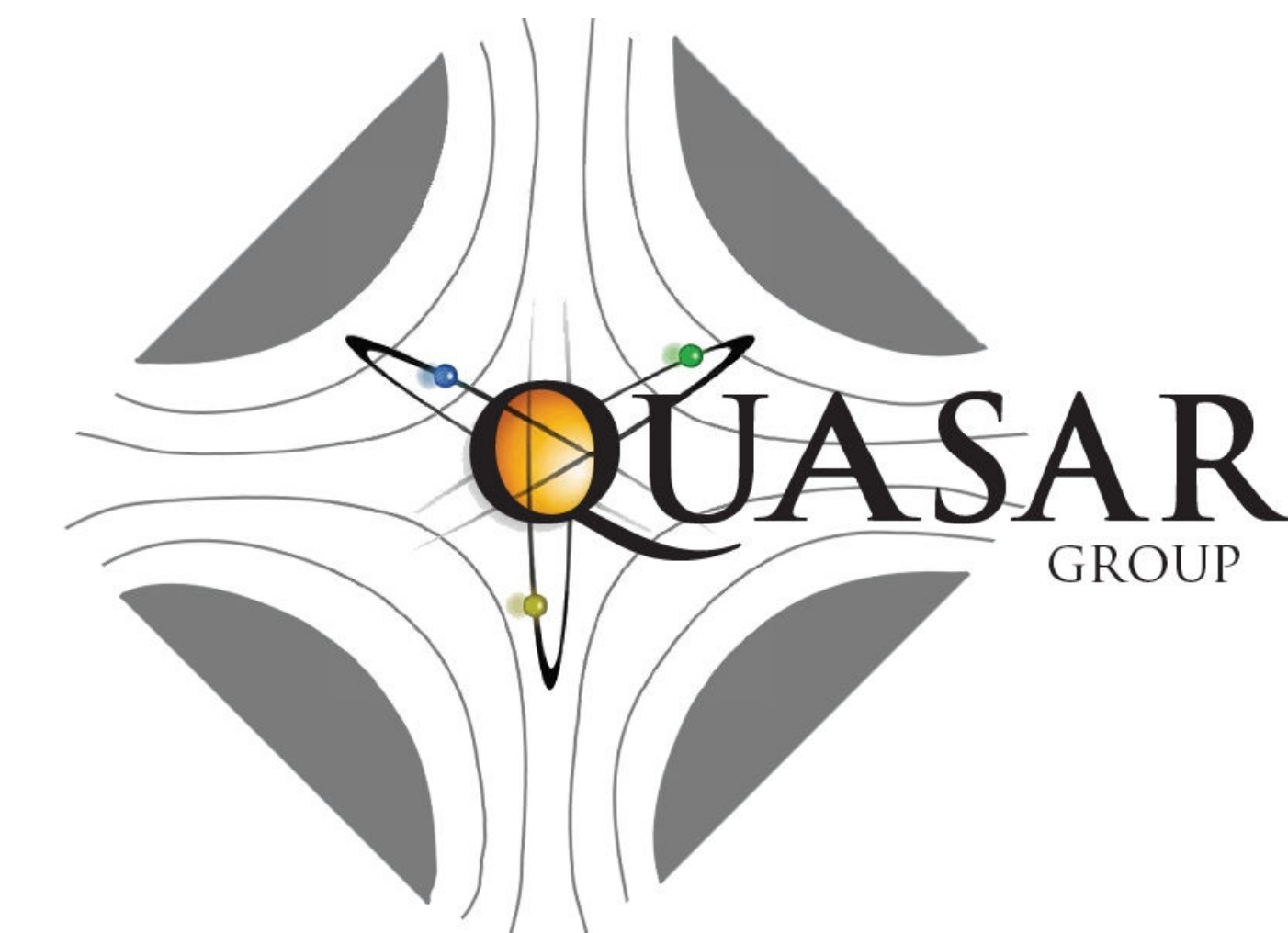


Joint QUASAR and THz Group Workshop on Accelerator Science and Technology



Beam Halo Monitoring and Simulation

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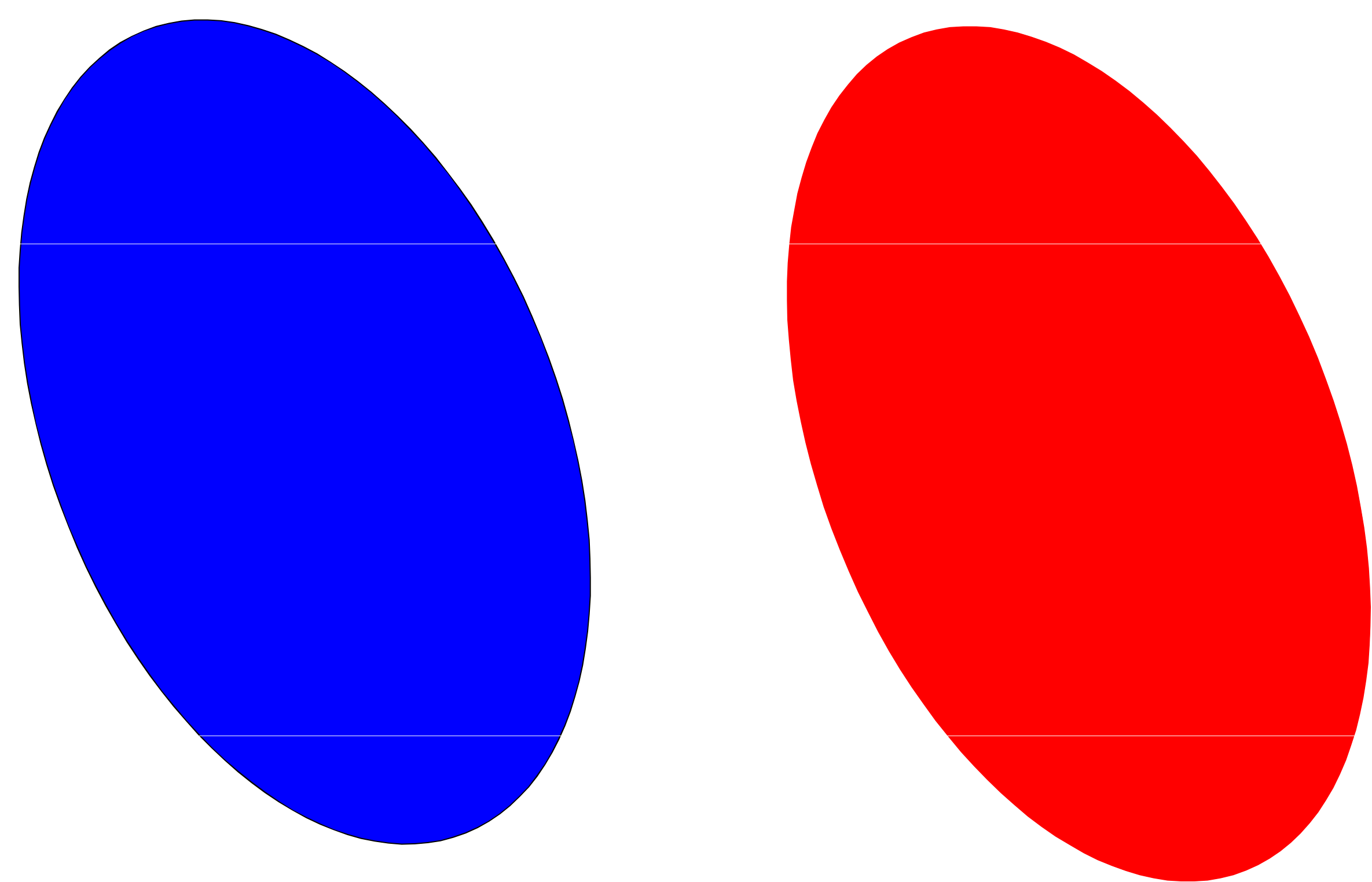
- *Problem Definition:* Halo Particles
- *Motivation:* Beam Halo Monitor (BHM)
- *The scientific purpose & Applications of BHM*
- CLIC/CTF3
- The technique
- Numerical estimations
- Current status

Problem Definition: Halo Particles

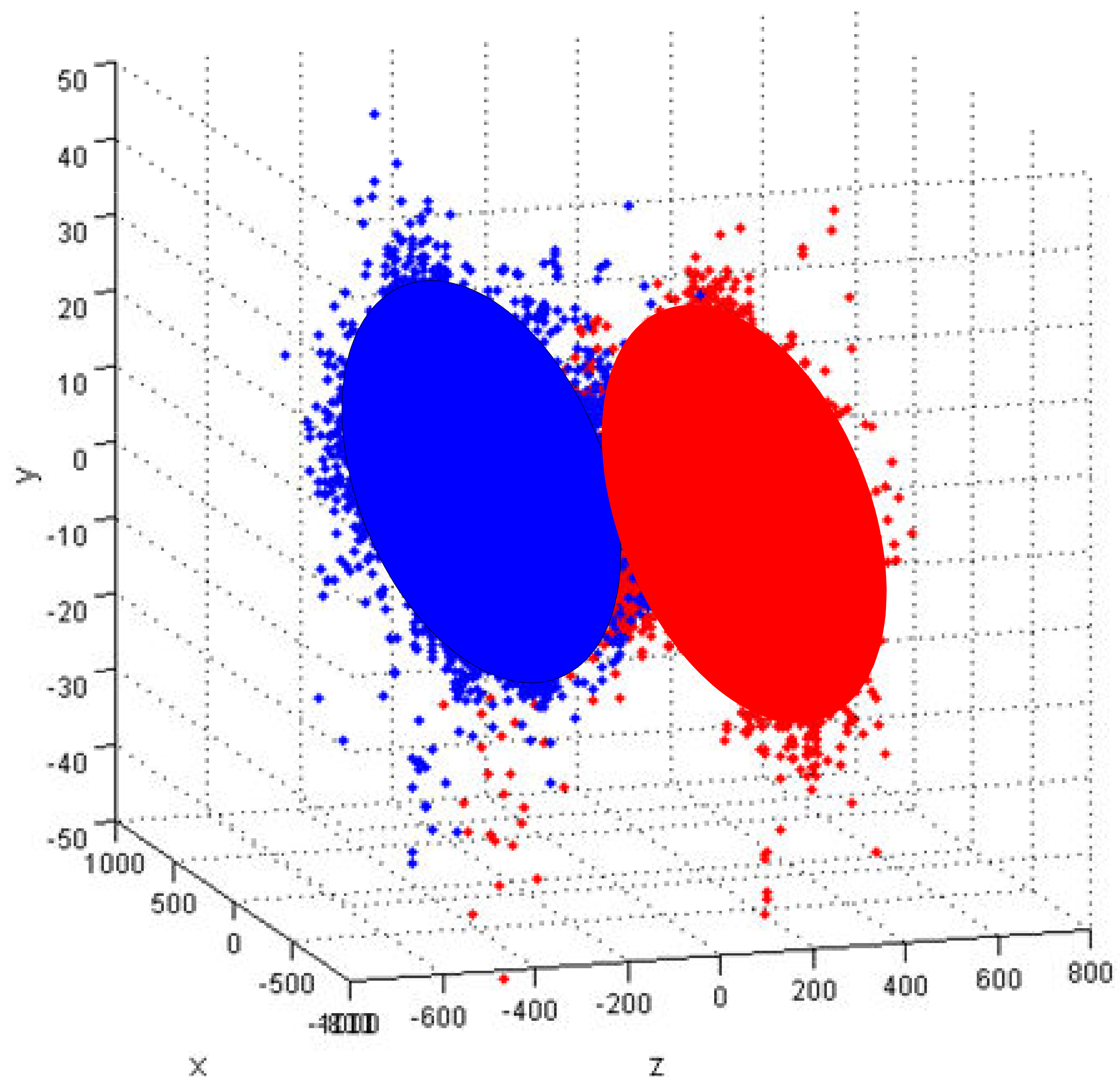
- The structure and characteristics of beam halo particles are different depending on its formation mechanism.
- Beam losses are typically associated with low density halo surrounding the beam core.

The ideal beam

development of halo particles



- Halo particles make strong and weak parts



Motivation: Beam Halo Monitor

- Prompt beam diagnostics are necessary to ensure automatic control for optimization and stabilization of the beam.

Beam

Light Source

Mask

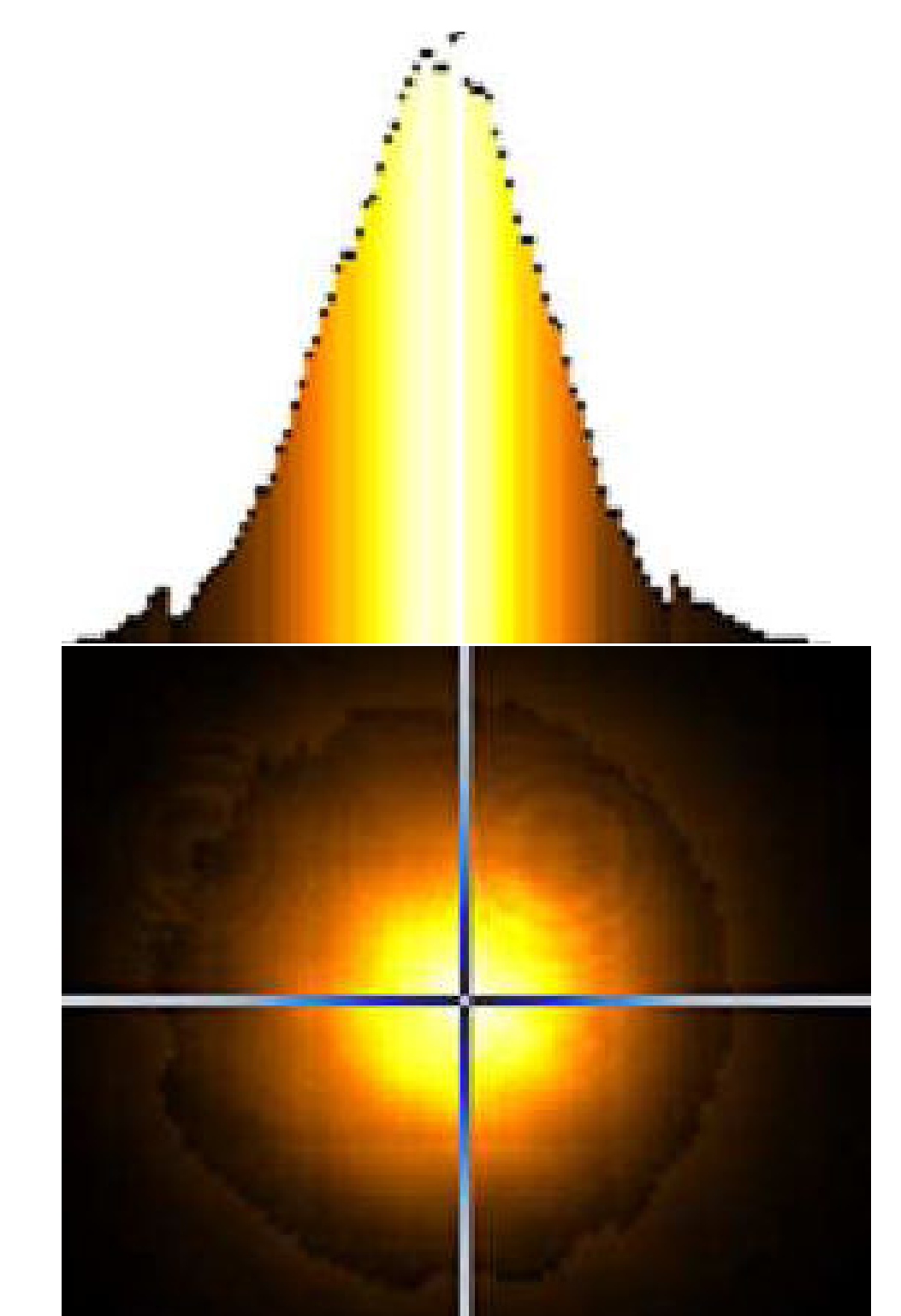
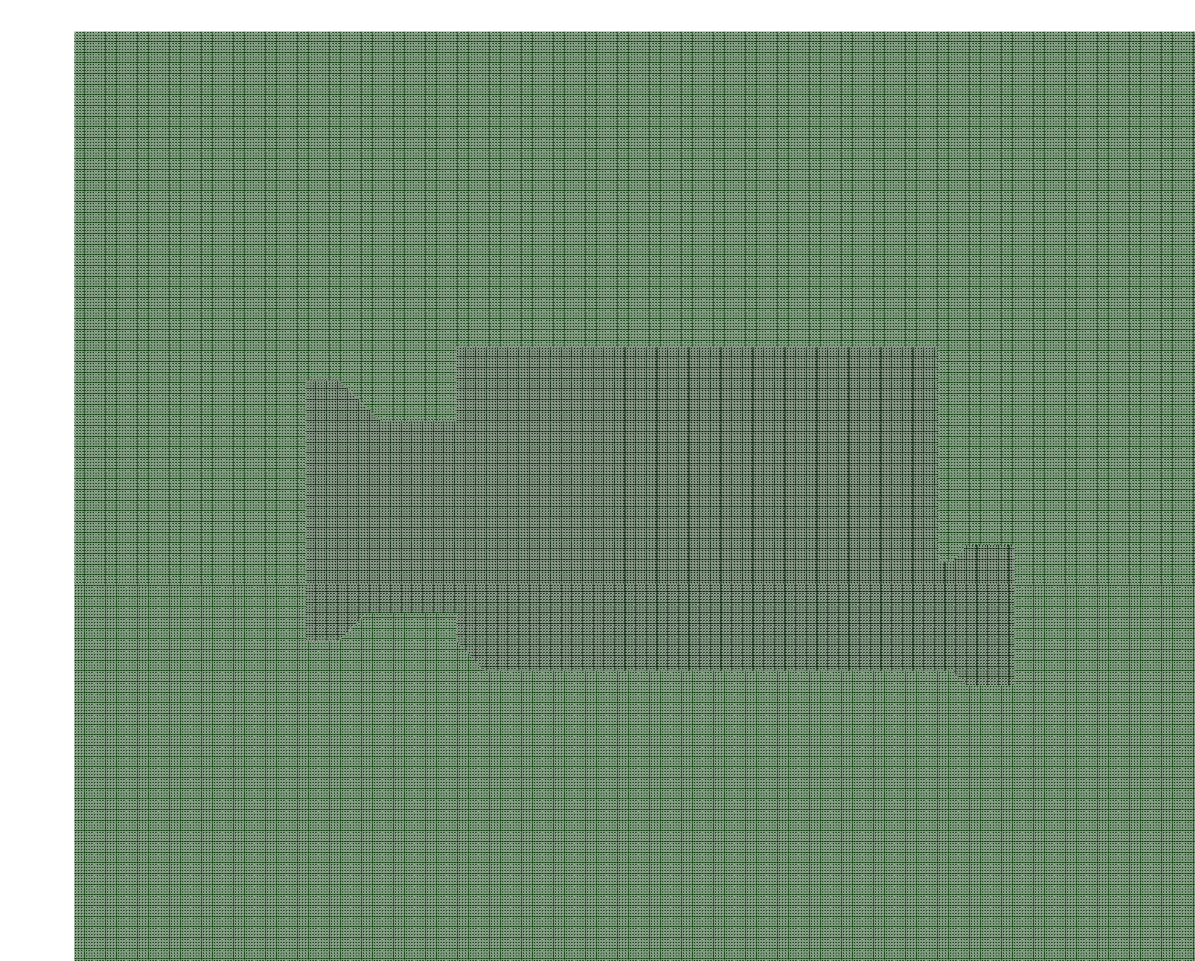
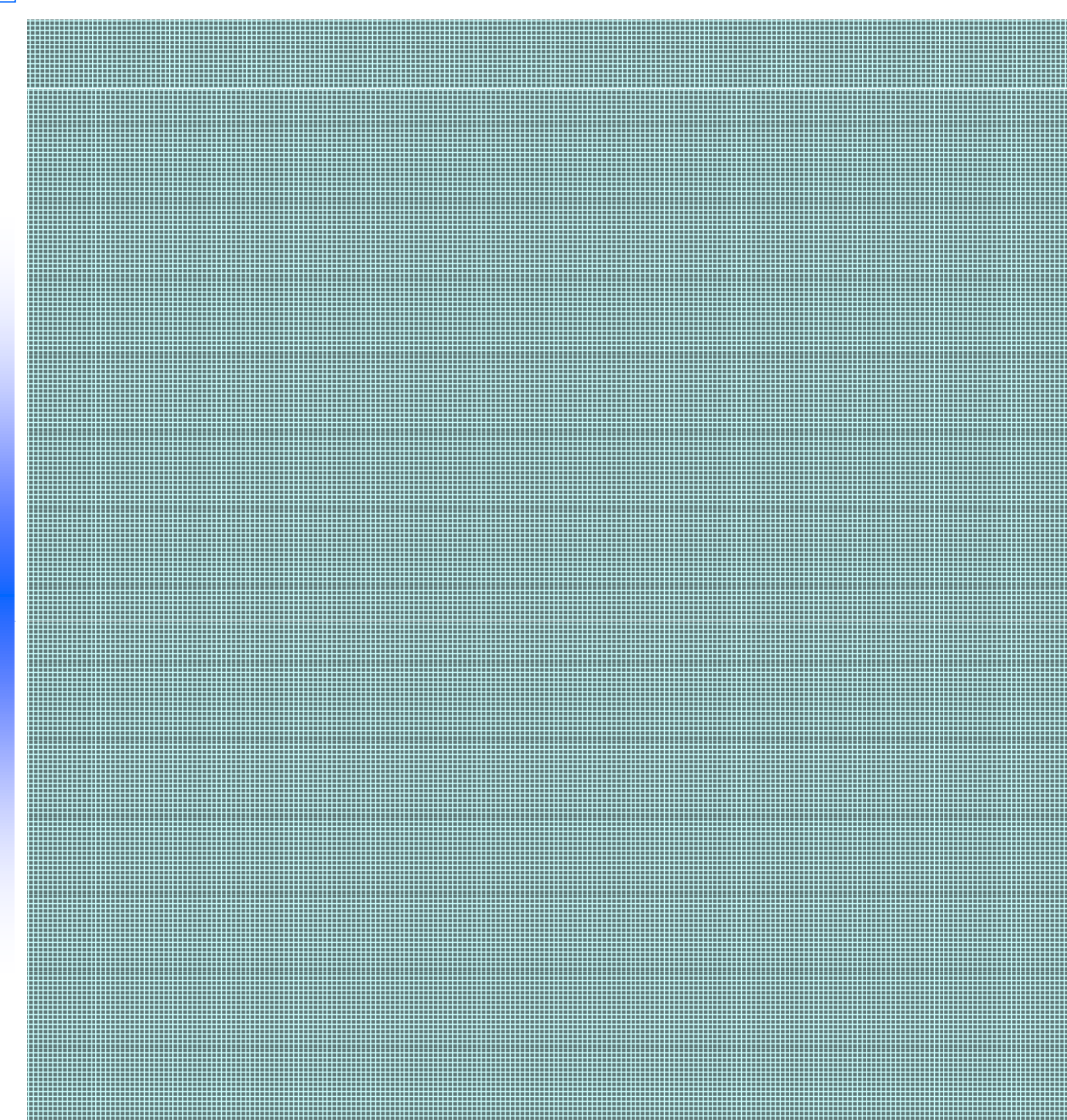
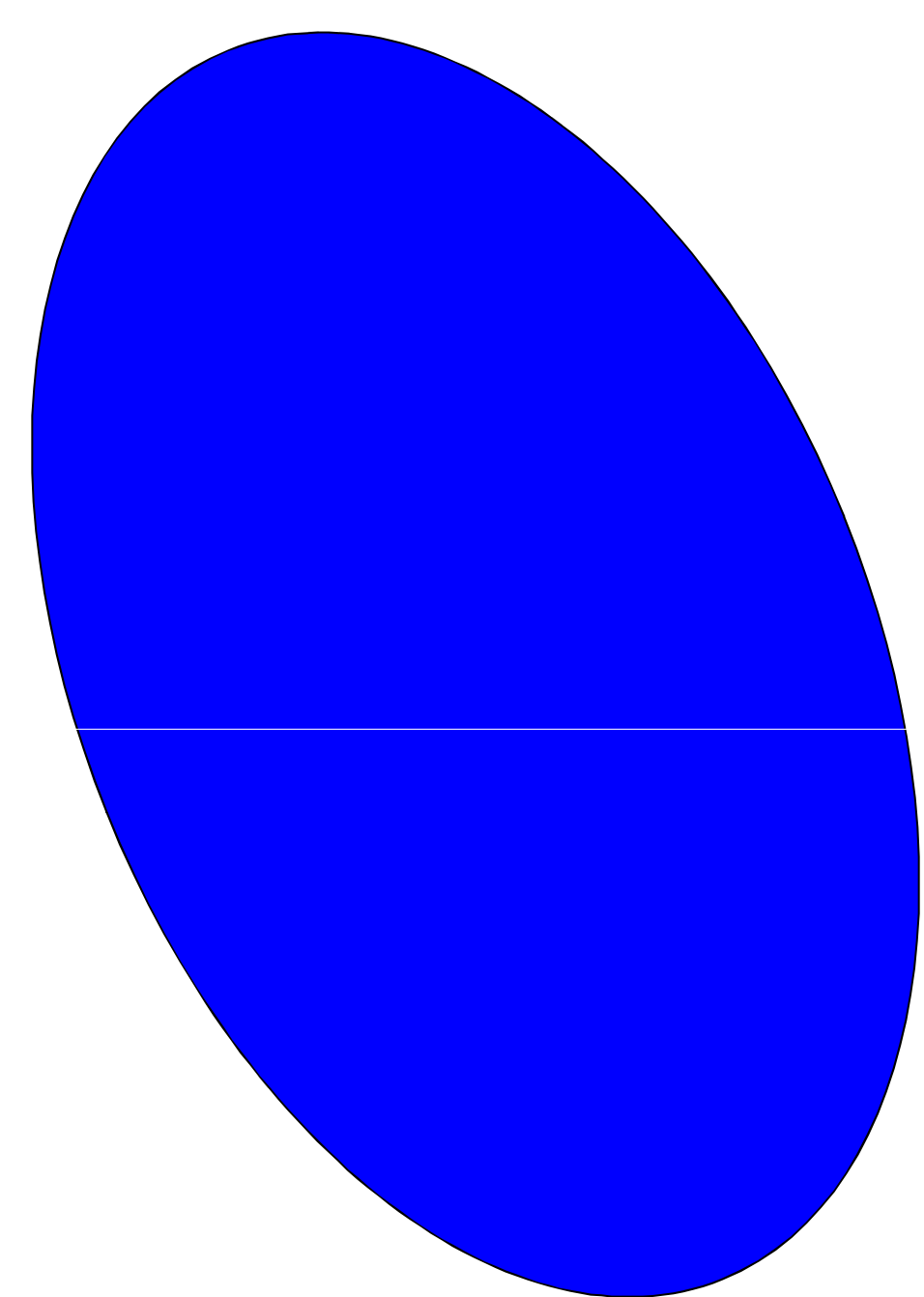
Readout

Software

optical transition radiation
optical diffraction radiation
synchrotron radiation
other

Digital
Micromirror
Device (DMD)

CID camera

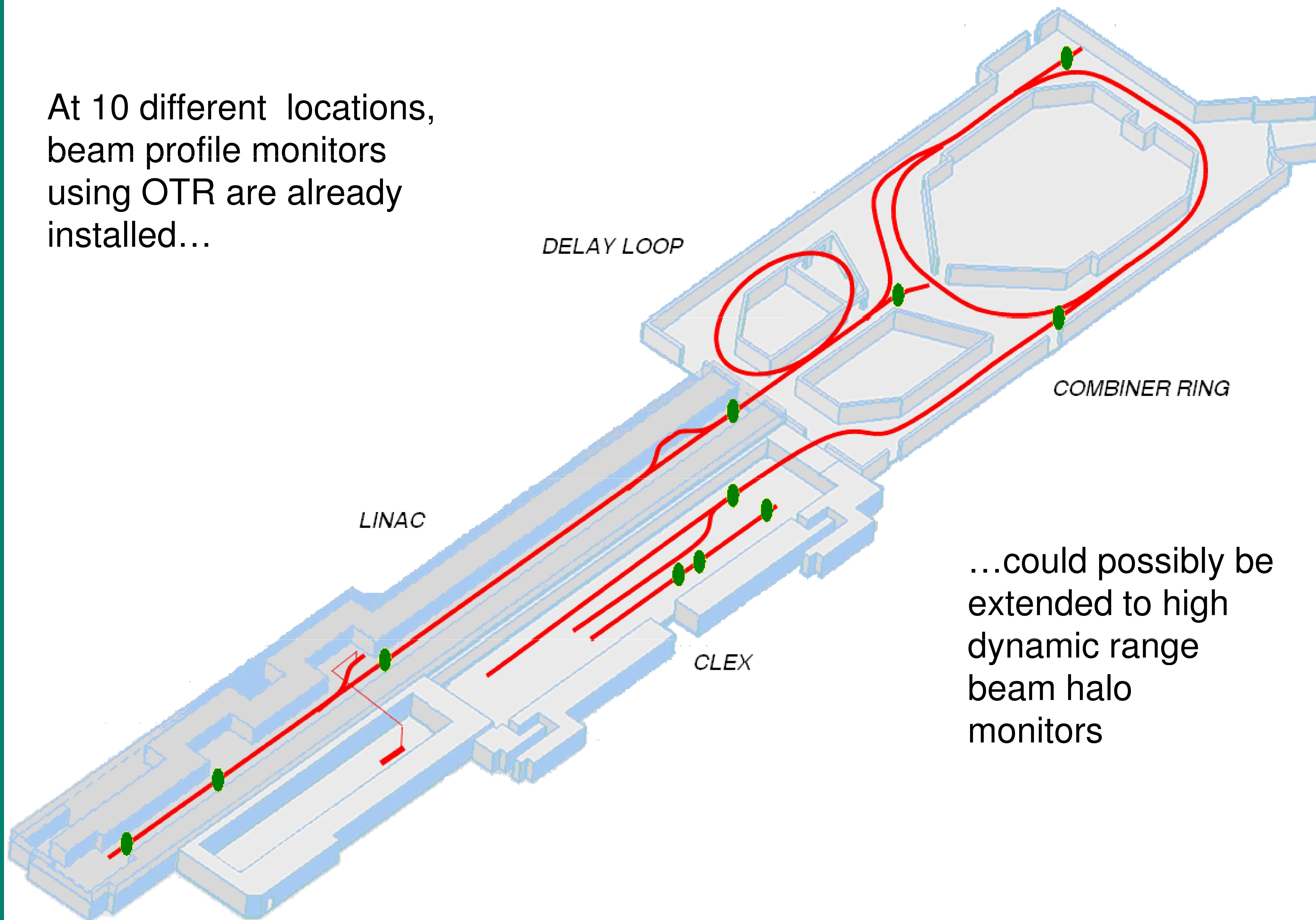


The scientific purpose & Applications of BHM

- *High dynamic range measurements*
- *Core masking technique*
- *Sophisticated method*
- *Test the theoretical models of halo formation mechanism*
- *Numerical, analytical studies of halo particles*
- *CLIC/CTF3 & the other possibilities*

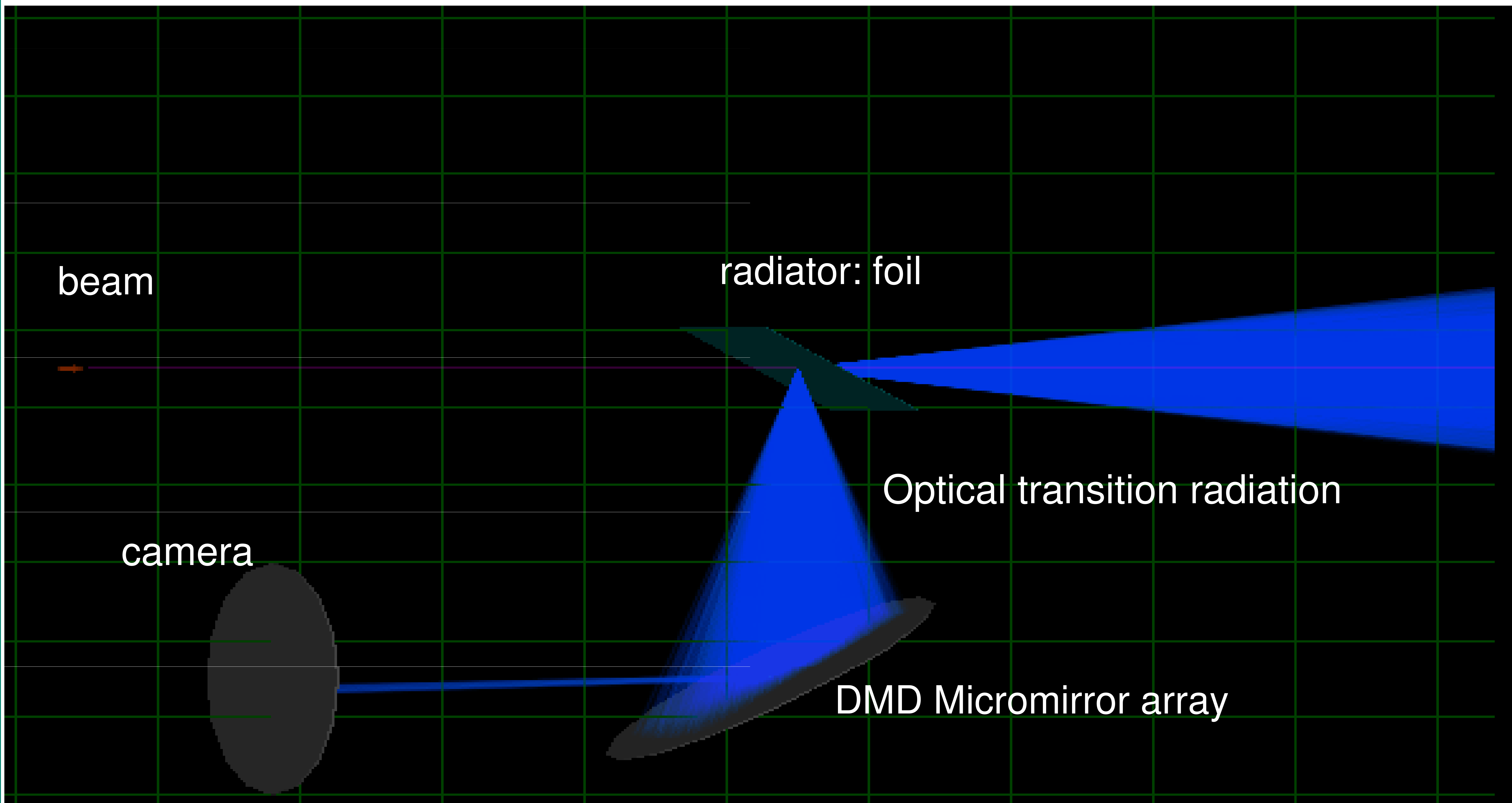
CLIC/CTF3

At 10 different locations,
beam profile monitors
using OTR are already
installed...



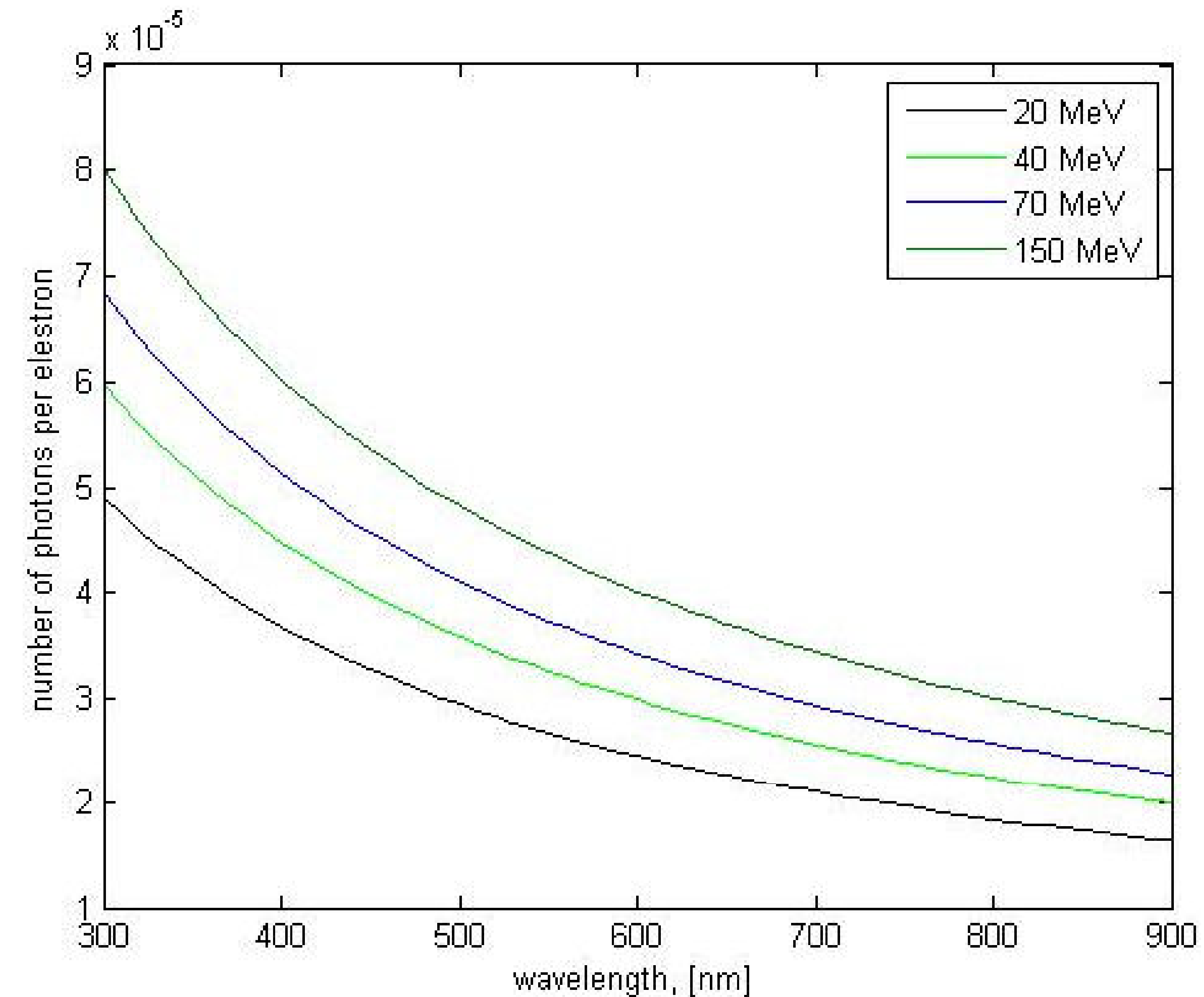
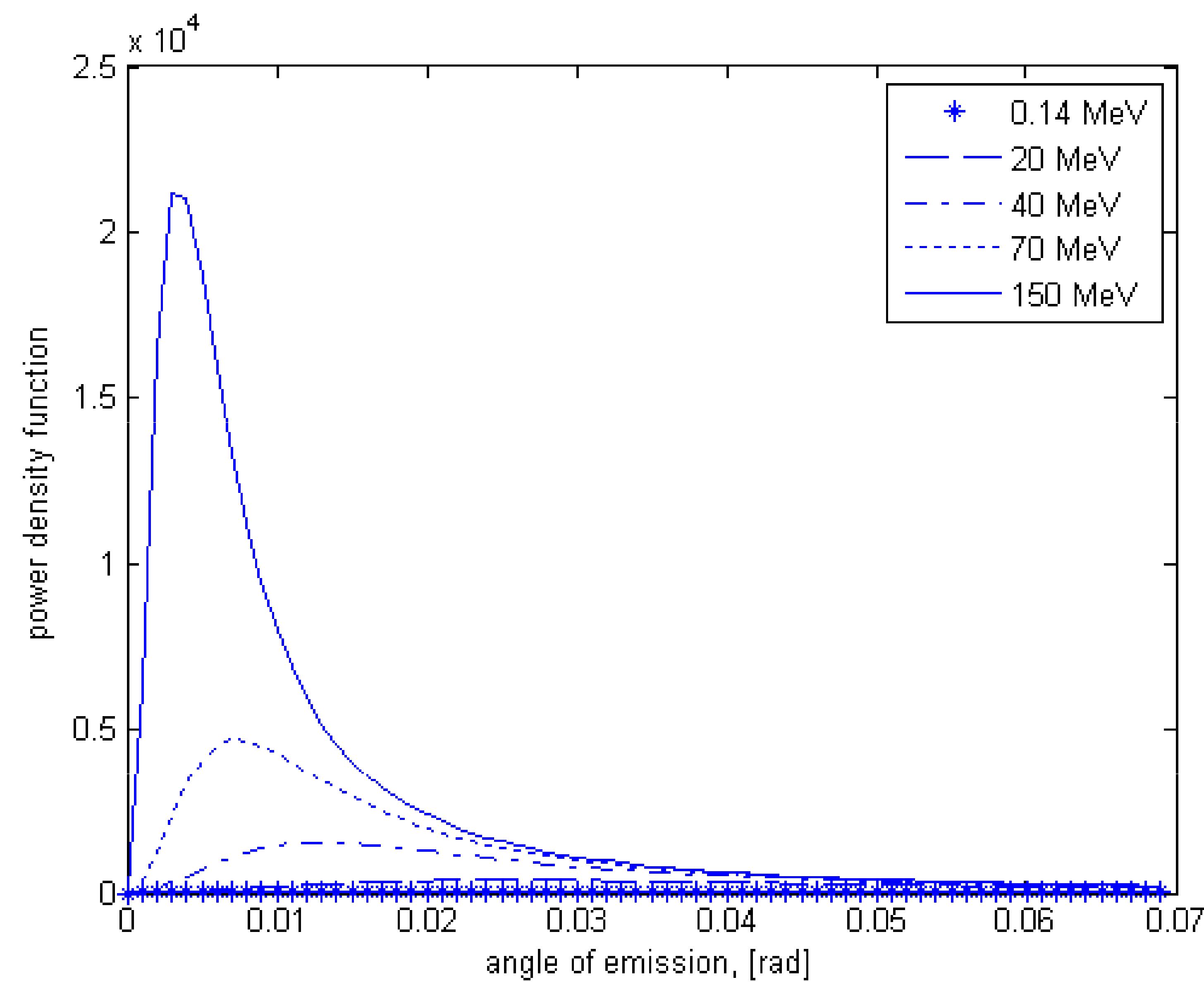
...could possibly be
extended to high
dynamic range
beam halo
monitors

The technique



- CID camera
- Flexible masking technique

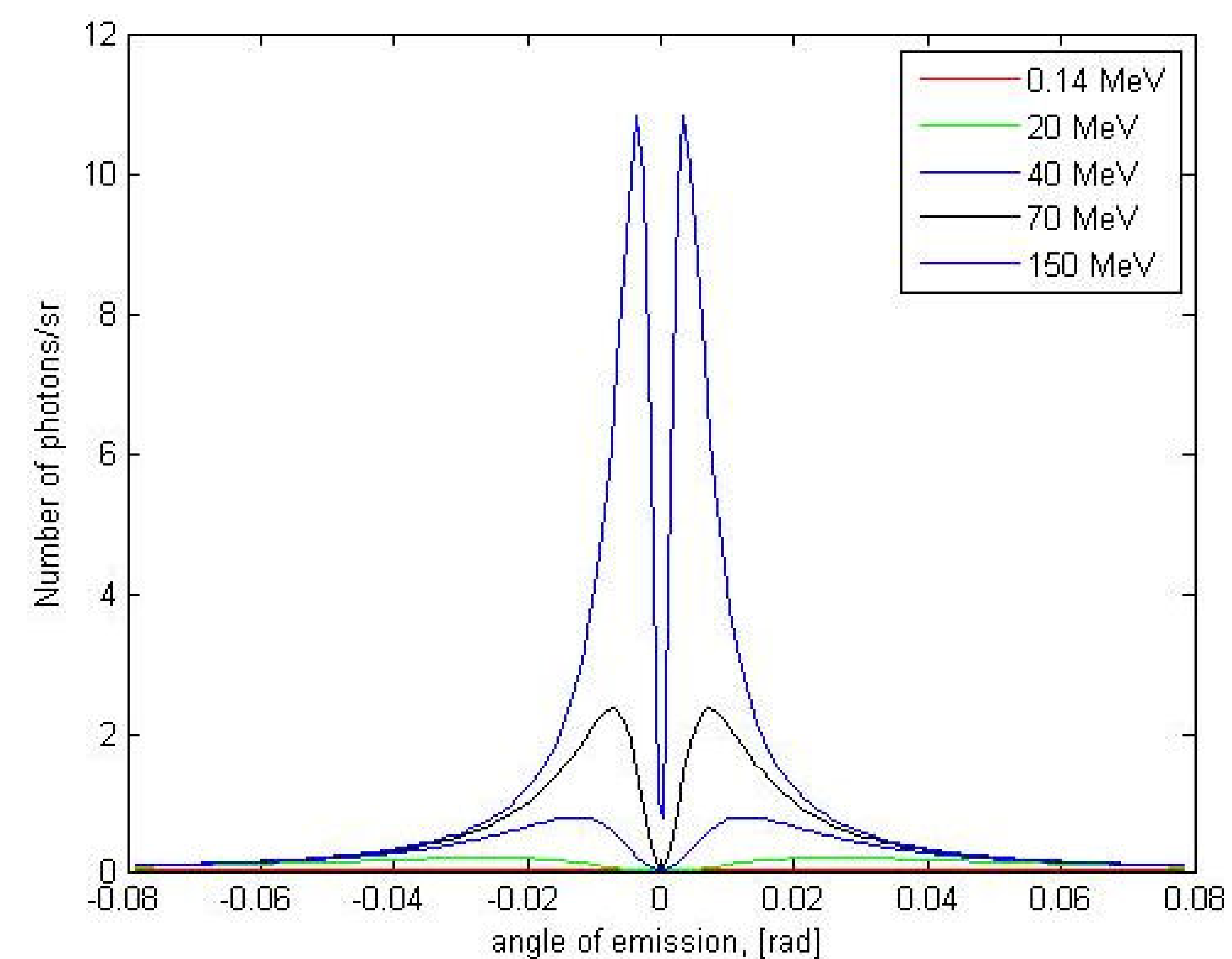
Numerical estimations



$$\frac{d^2W}{d\Omega d\omega} = \frac{e^2}{\pi^2 c} \left(\frac{\theta}{\frac{1}{\gamma^2} + \theta^2} \right)^2$$

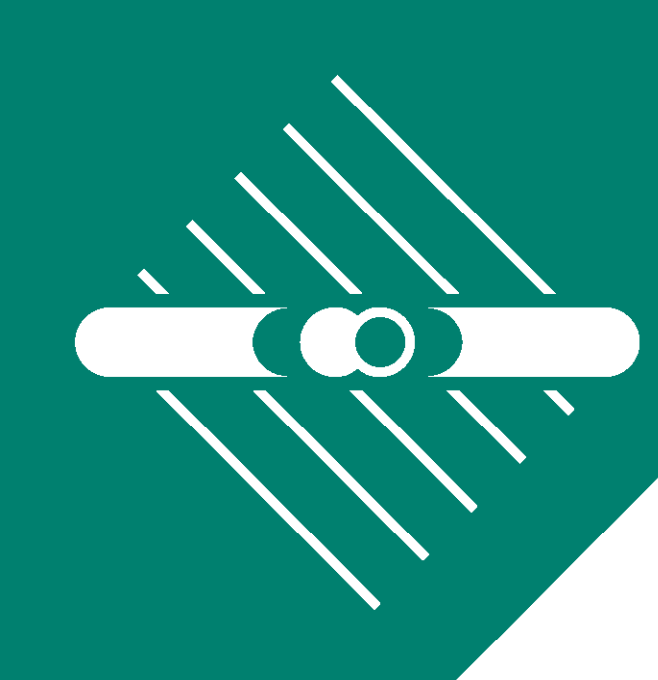
$$N_{\text{ORR}} = \frac{2\alpha}{\pi} \left[\ln \gamma - \frac{1}{2} \right] \ln \left(\frac{\lambda_\theta}{\lambda_z} \right)$$

$$\frac{dN}{d\Omega} = \frac{\alpha}{\pi^2} \left(\frac{\theta}{\frac{1}{\gamma^2} + \theta^2} \right)^2 \ln \left(\frac{\lambda_\theta}{\lambda_z} \right)$$



Current Status

- Numerical estimations of optical transition and diffraction radiations for CTF3 parameters are performed
- Research visit to CERN (discussion with beam dynamics experts)
- Monitors (tested in lab 2008, 2009) test with beam will be done at University of Maryland, 2009.



Thank you for your attention!