CERN AXION SOLAR TELESCOPE

Statusreport to SPSC

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Outline

-Solar Axions

-CAST :

- Status

Magnet, sun tracking

-Detectors:

TPC

Micromegas

X-ray Telescope and CCD

-Outlook

Axions

α

pseudoscalar

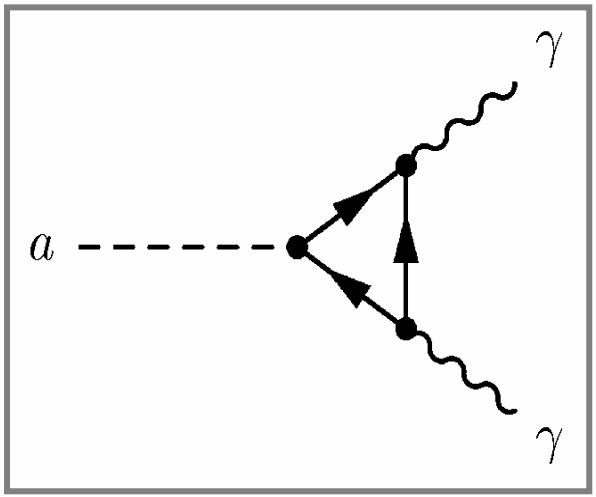
neutral

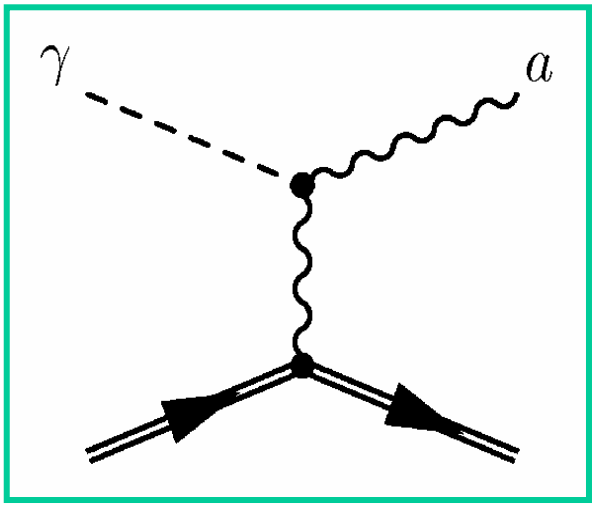
practically stable

phenomenology driven by the breaking scale f_a and the specific axion model

Couples to photon

$$L_{a\gamma} = g_{a\gamma}(\boldsymbol{E}\cdot\boldsymbol{B})\, a$$





Primakoff (1951) [$\pi^\circ \to \gamma\gamma$]

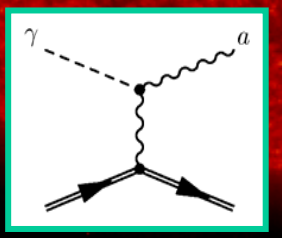
PRIMAKOFF EFFECT

Any scalar or pseudoscalar particles:

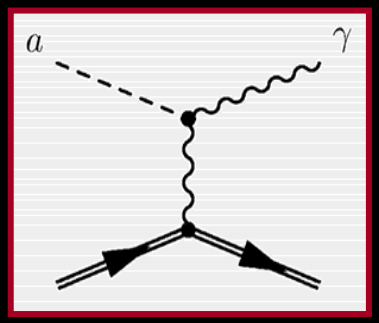
axion-like particles

Principle of detection

Solar axions



AXION PHOTON CONVERSION



axions

Transverse magnetic field (B)

L

X ray

X ray detector

$$P_{a\gamma} = 1.8 \times 10^{-17} (\frac{B}{8.4T})^2 (\frac{L}{10m})^2 (g_{a\gamma\gamma} \times 10^{10} GeV^{-1})^2 |\mathcal{M}|^2,$$

COHERENCE 1

Solar Axion Spectrum

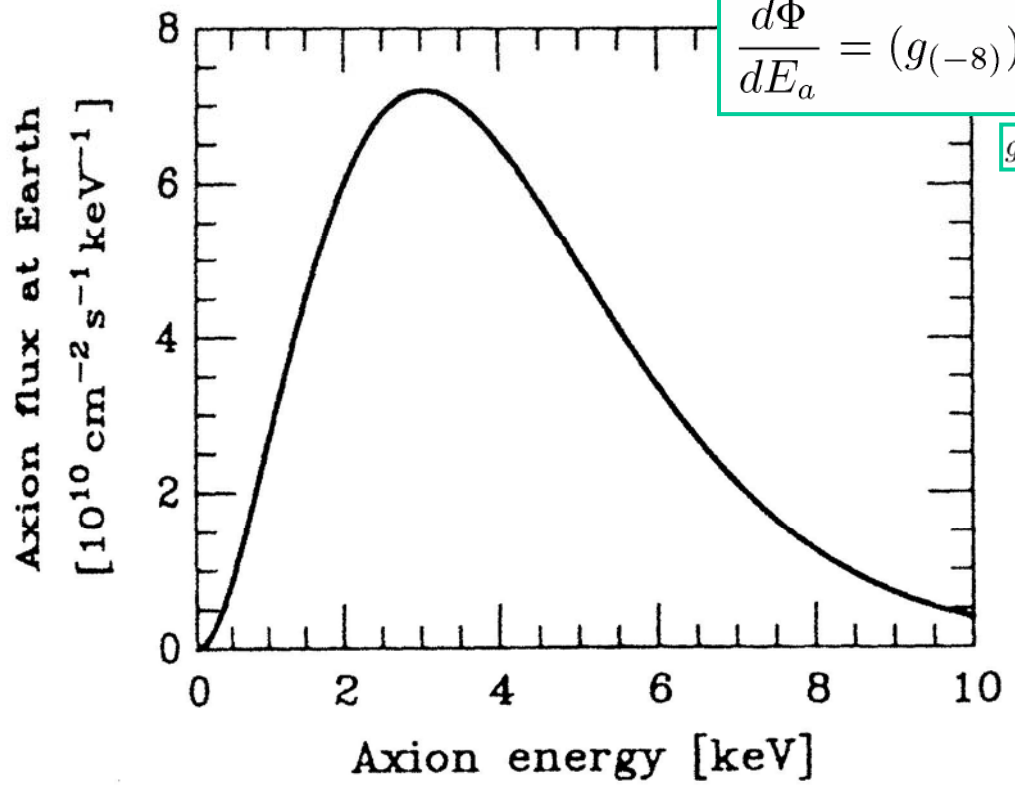
PRIMAKOFF EFFECT

Stellar interior → the Sun!! ⟶ *Solar Axions*

Flux at the Earth

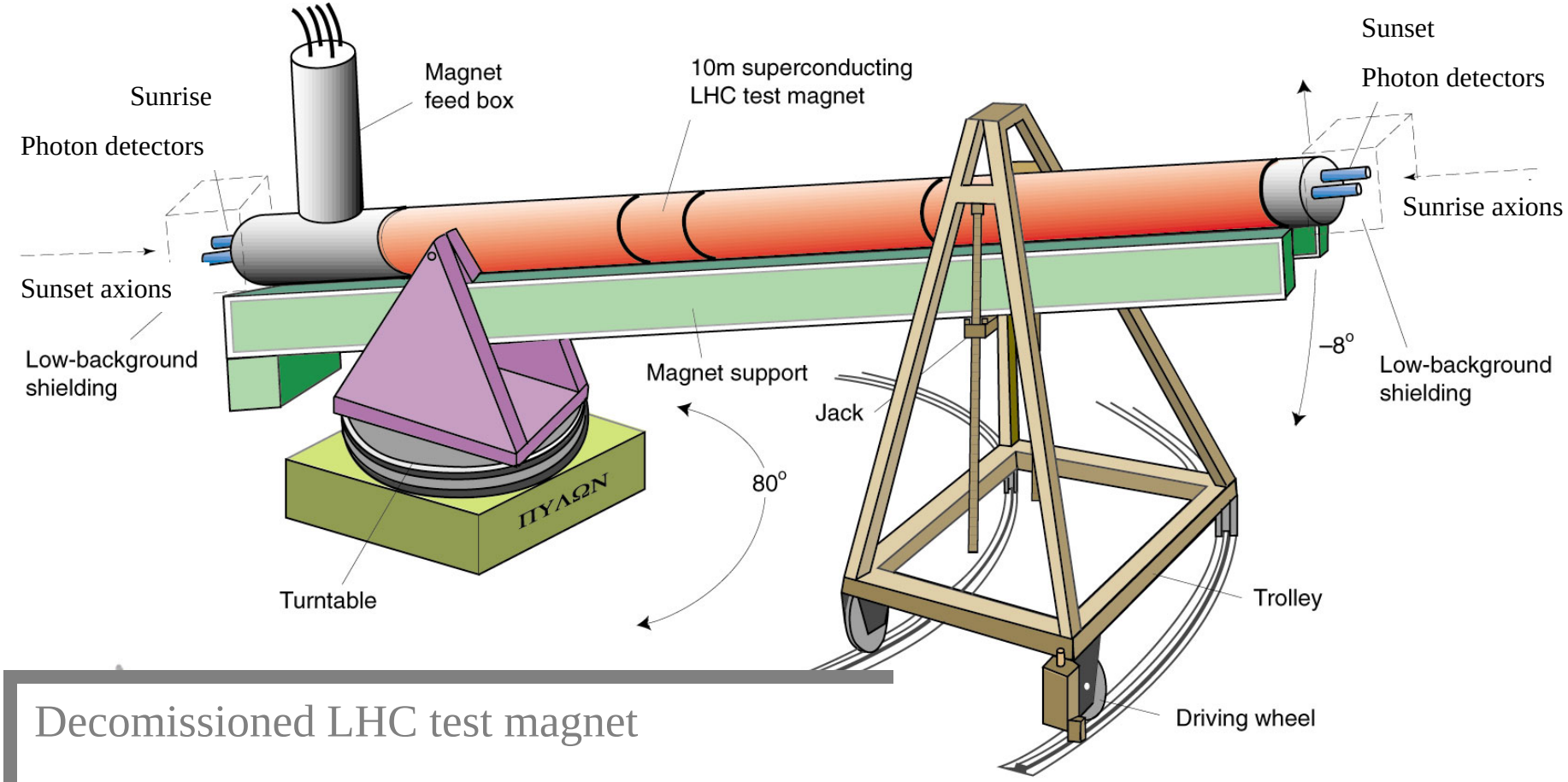
$$\frac{d\Phi}{dE_a} = (g_{(-8)})^2 \frac{\Phi_0}{E_0} \frac{(E_a/E_0)^3}{e^{E_a/E_0} - 1}$$

$$g_{(-8)} = g_{a\gamma\gamma} \times 10^8/\mathrm{GeV}^{-1}$$



[K.van Bibber et al.,1989]

Cern Axion Solar Telescope



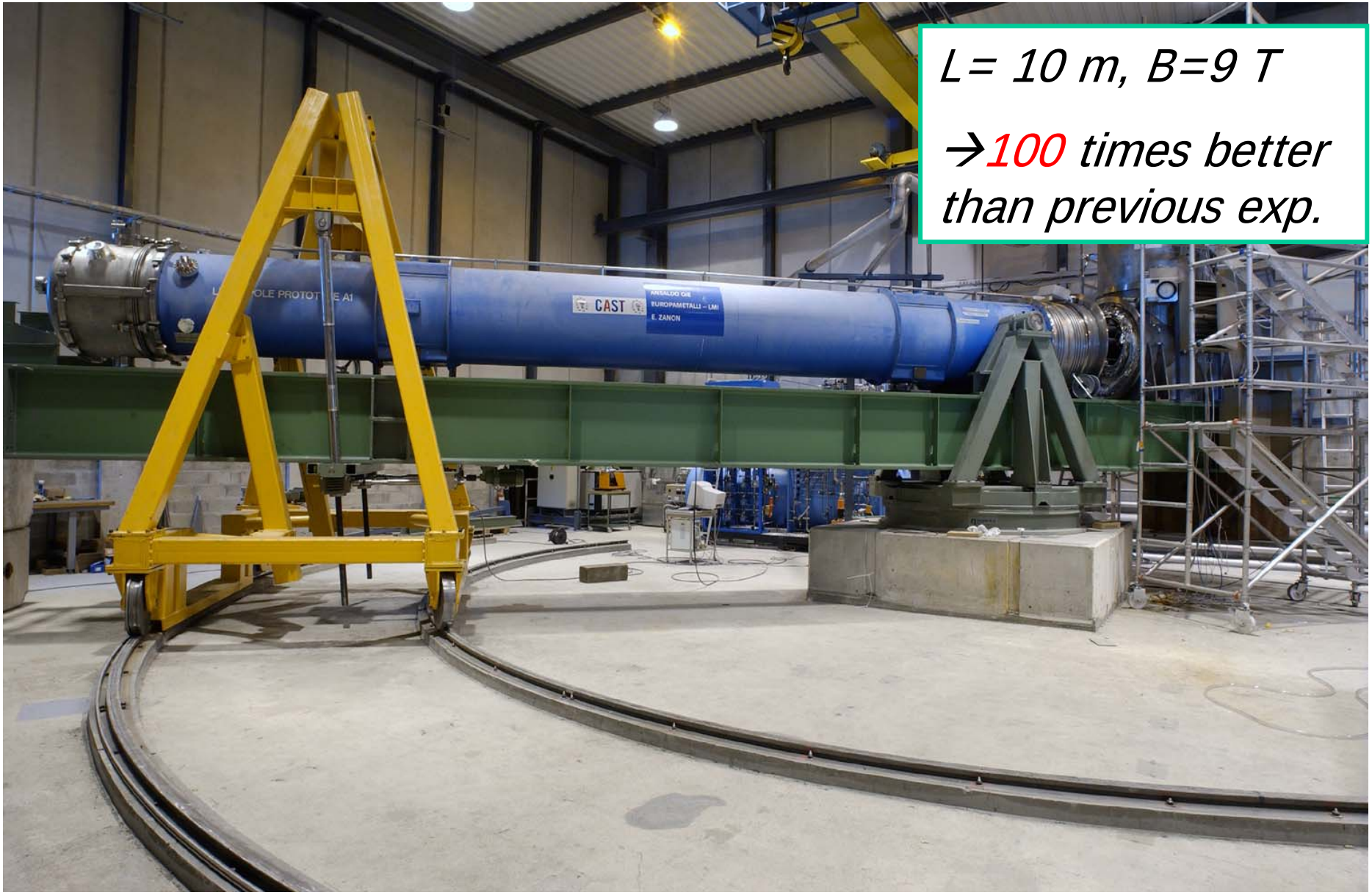
Decomissioned LHC test magnet

Rotating platform

3 X-ray detectors

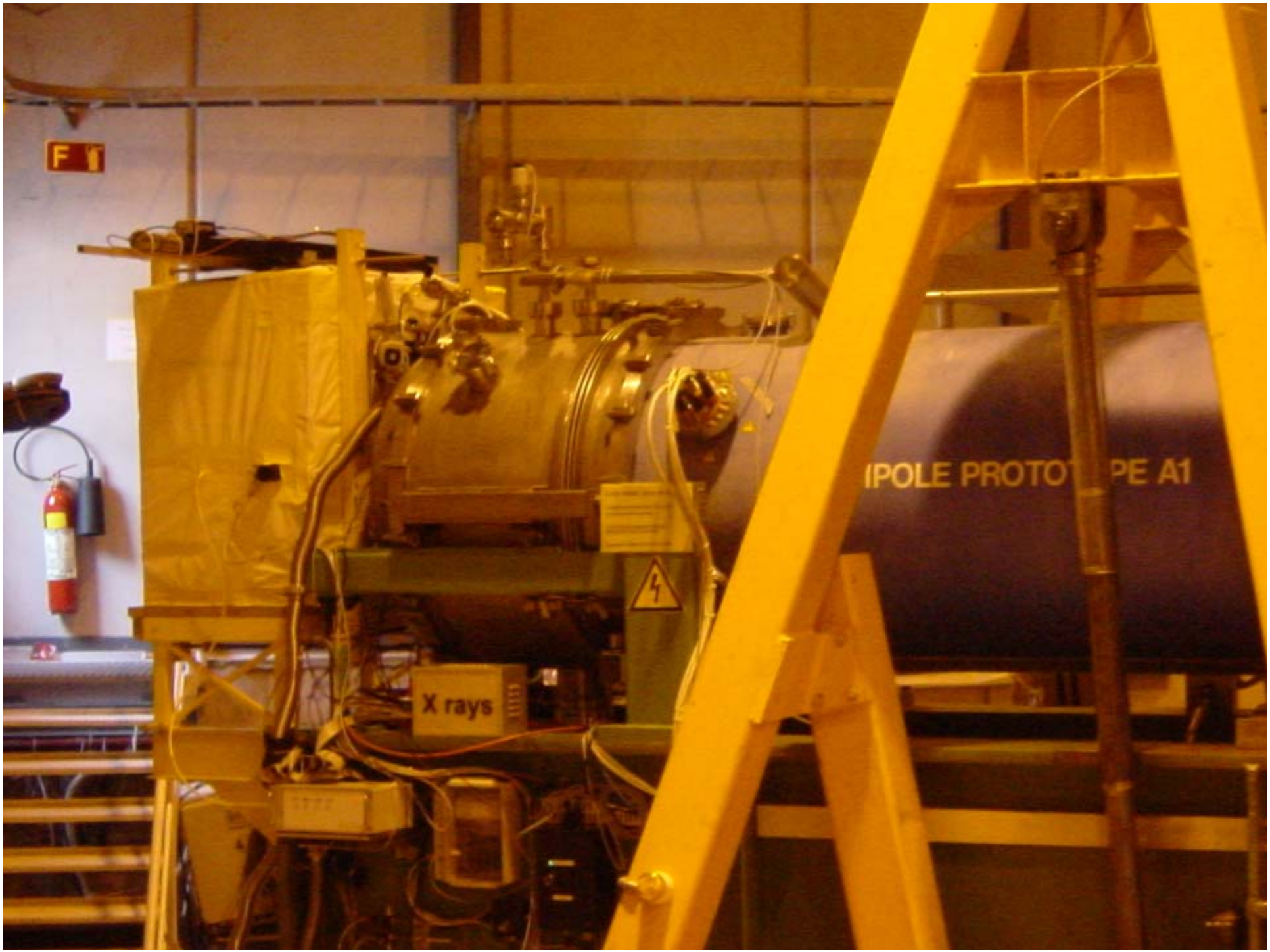
X-ray Focusing Device

CAST : Magnet

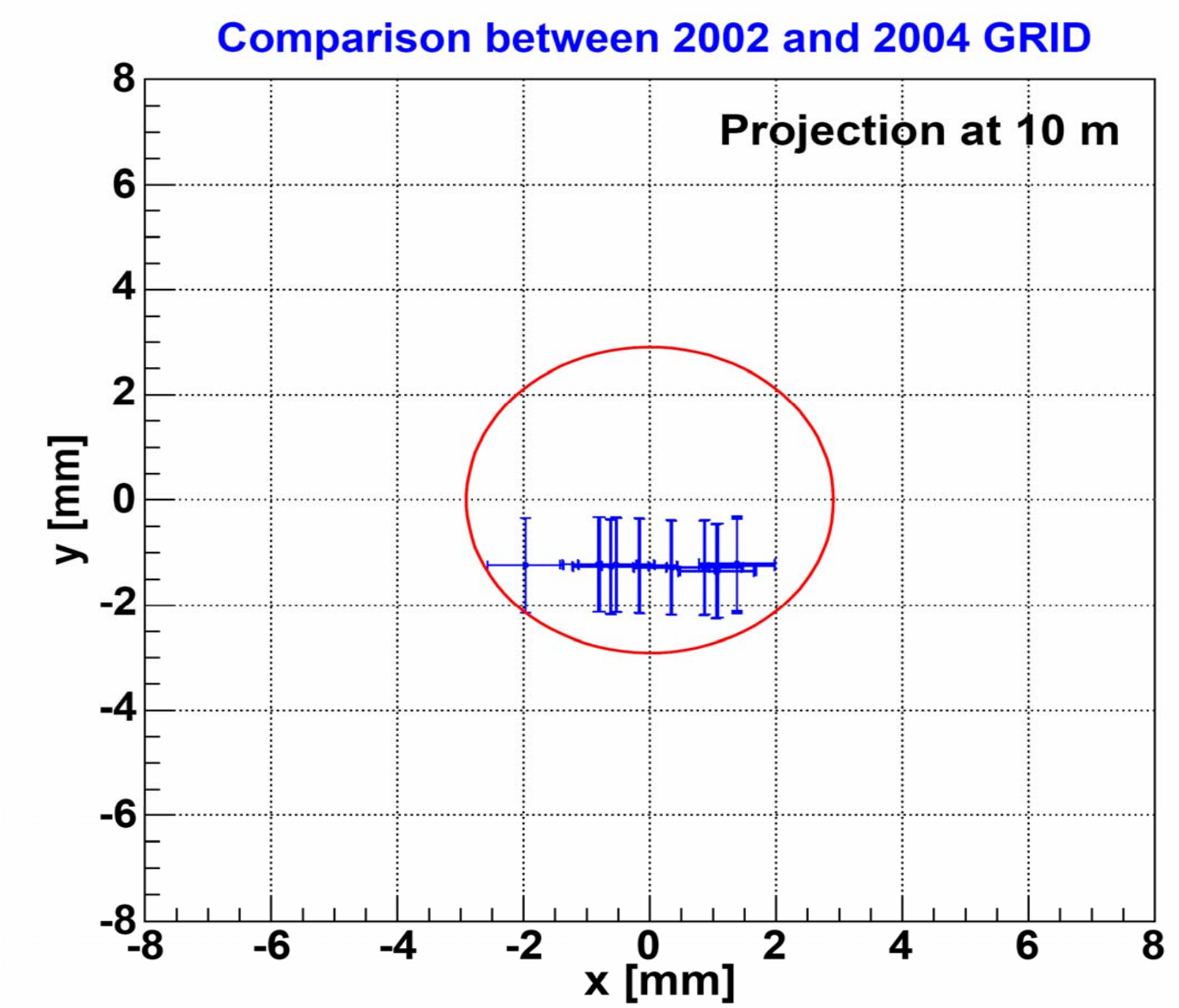


L = 10 m, B=9 T

→100 times better than previous exp.


X rays

Grid measurements after magnet loading



Angular encoders

Magnet, sun tracking

Looking at sunrise

Tracking System:

Calibrated and correlated with celestial coordinates

Twice a year (September&March) we can film the Sun through the window