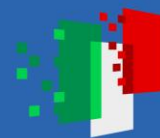




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Technology: from science to market

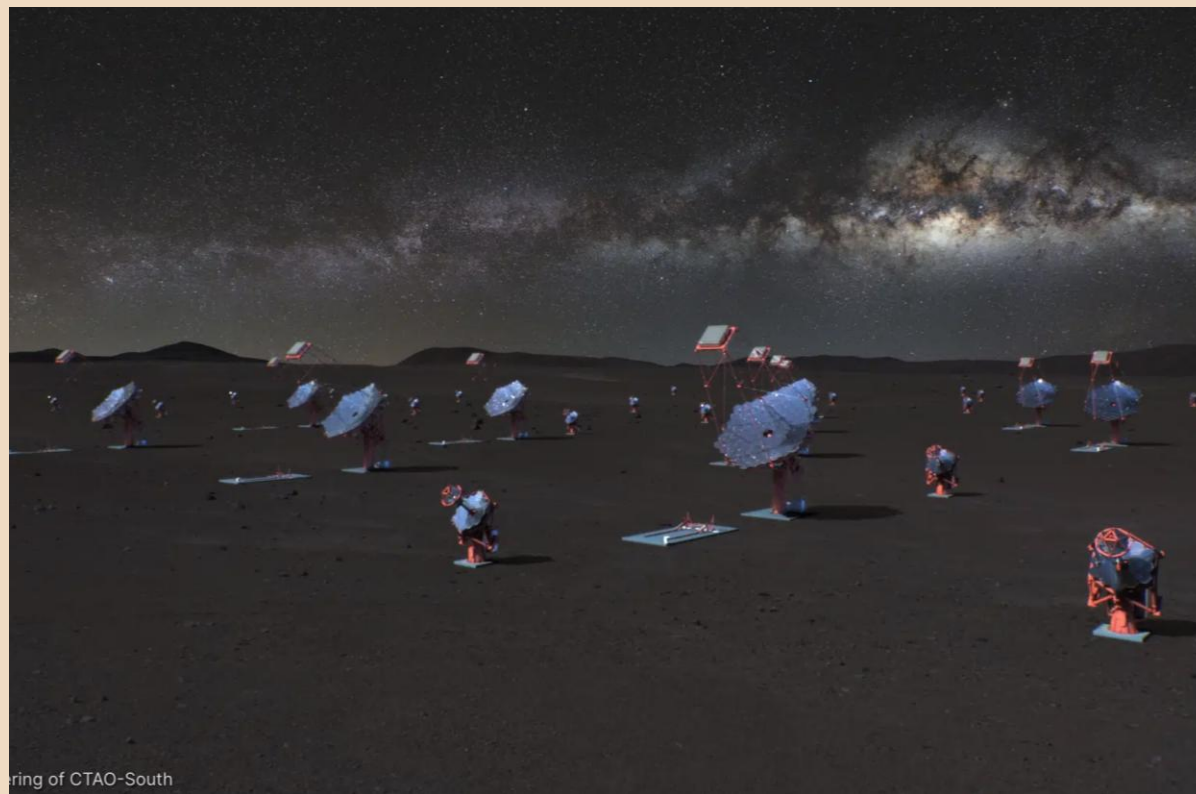
Pierluigi Bellutti

INAF

Osservatorio Astronomico di Brera

Gran Sasso National Laboratory

21 February, 2025

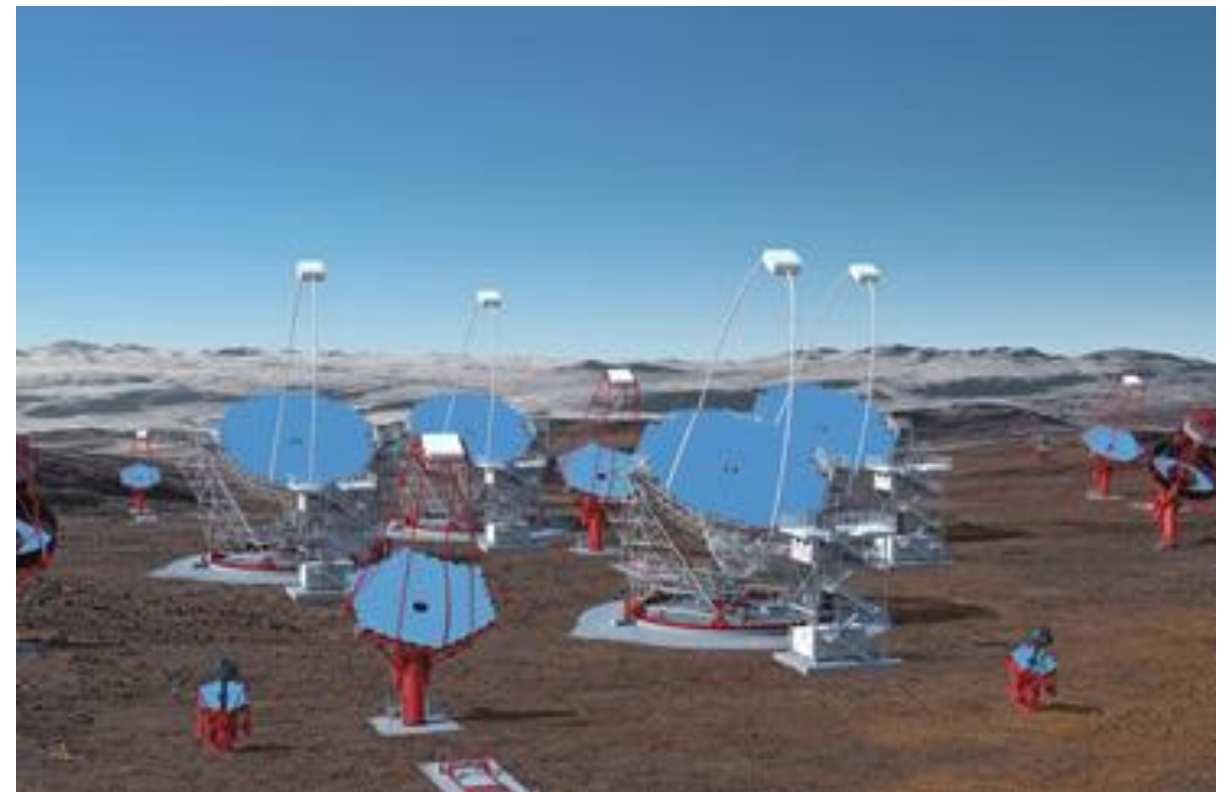




Premise 1/3

Actual position: Research
Infrastructure Manager @INAF for
Cherenkov Telescope Array Plus
(CTA+) program:

**Realization and installation of
large (23 m) and Small (4 m)
telescope in the Atacama Desert
of Chile**





Premise 2/3

CTA+ is a program funded within National Resilience Recovery Plan (PNRR). Among the task assigned to Research Infrastructure Manager:

To ensure the future sustainability of the infrastructure by means of promotion of the structure's capabilities, skills and services

Premise 3/3

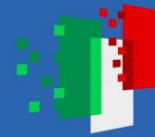
- Sustainability is a widespread topic of growing interest in the field of scientific and technological research. The **return on investment** in research for the benefit of society is a request characterising to most of the available funds.
- *Return is realised in several ways...*
- Talk based on personal (previous) experience and not on specific studies
- *Previous experience: 35 years in Micro and Nano Silicon Technologies @FBK-Fondazione Bruno Kessler (Trento, Italy)*



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Introduction

From Science (Technology) to Market: an Innovation Path

Relevant by-products of Innovation

- 1. Social-political objectives:*
 - nurture social growth (through: employment, taxes,...)*
 - social acknowledgement of Research*
- 2. Goals for Research: Contributing to its Sustainability*

* @ FBK- Fondazione Bruno Kessler (TN)



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Experiences (two ends of the spectrum of)

1. From Research to Market (Silicon PhotoMultiplier)

2. From Market to Research (Silicon Drift Detectors)



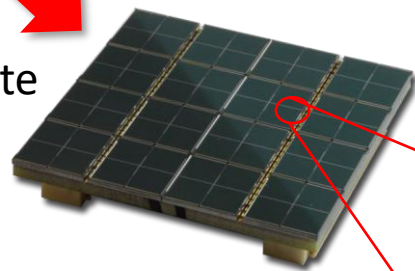
The Silicon PhotoMultiplier case (From Research to Market)



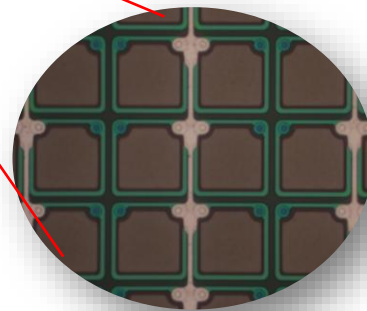
From vacuum...



...to solid-state



SiPM
array of tiny SPADs connected in parallel to give proportional information



AFBR-S4N Series

Product Brief

Broadcom High-Sensitivity NUV Silicon Photomultipliers

Broadcom® silicon photomultipliers (SiPMs) are ultra-sensitive optical sensors for the detection of near-ultraviolet to visible photons. Detectable light levels range from single photons up to 6.8×10^5 photons/ μ s. The compact design and various form factors of Broadcom SiPMs also make them the ideal sensor for many channel applications where high numbers of readout channels must fit in a limited design area.

Boost Your System Performance

The recently released NUV-MT SiPM series brings performance to unprecedented levels and allows customers to achieve best-in-class performance in their applications; for example:

- Flow cytometry/Fluorescence detection
- Radiation spectroscopy
- X-ray detection, X-ray photon counting
- Radon detection
- TOF-PET
- Line-of-sight data communication

Broadcom SiPM Leading-Edge Technology

The Broadcom NUV-MT brings sensitivity, low-light detection, and fast timing applications to unreached levels by combining:


- Best-in-class photo-detection efficiency (PDE)
- Excellent gain and breakdown uniformity
- Low noise characteristics

At the same time, high linearity and dynamic range is achieved by:


- 40- μ m SPAD pitch

Single SiPM


2x2 mm²
AFBR-S4N22P014M



4x4 mm²
AFBR-S4N44P014M




6x6 mm²
AFBR-S4N66P014M




SiPM Arrays

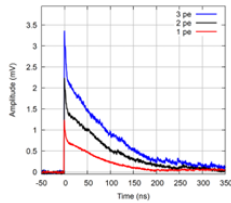
2x1 Channels (6x6 mm²)
AFBR-S4N66P024M



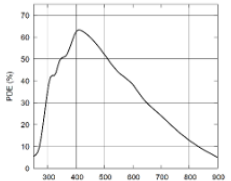
2x2 Channels (4x4 mm²)
AFBR-S4N44P024M

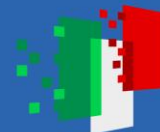


Waveforms (Over 25 Ohm)

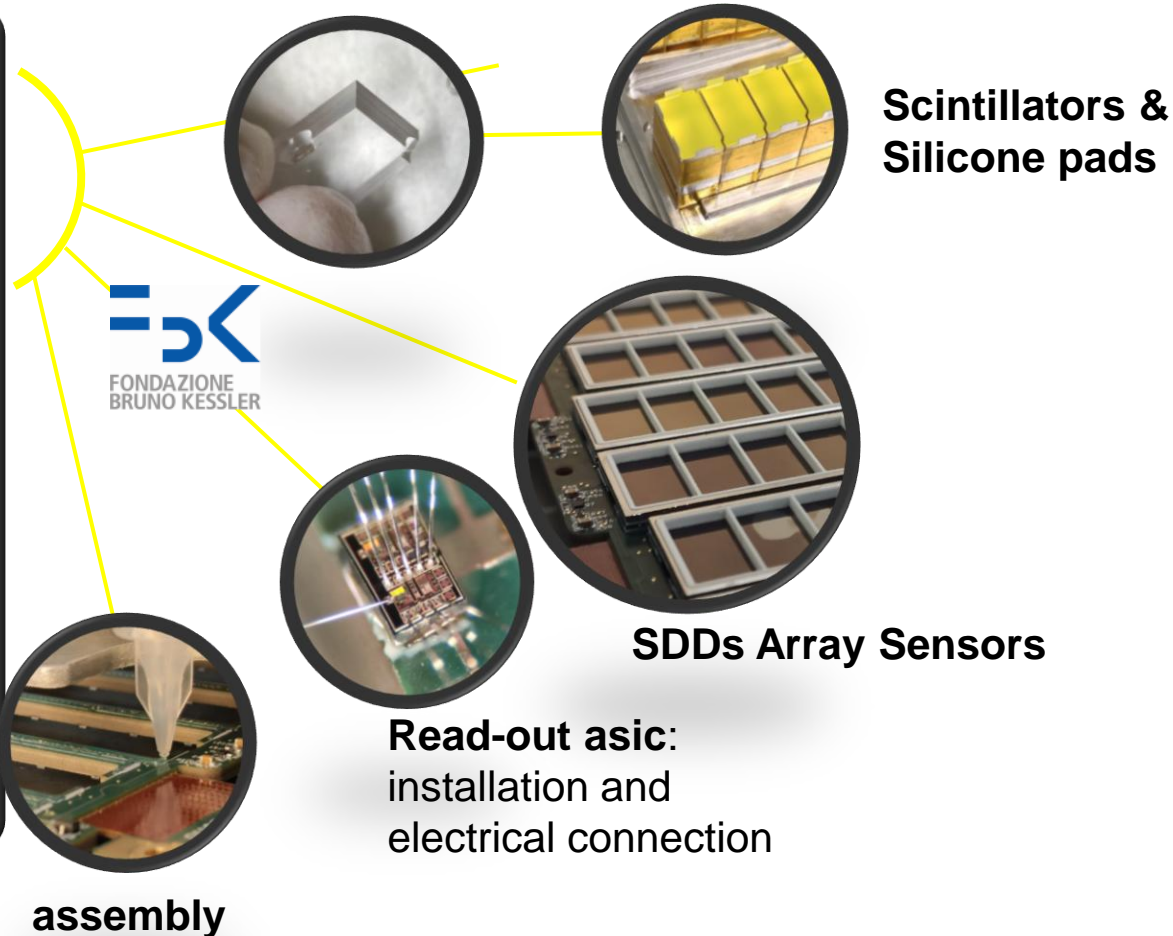
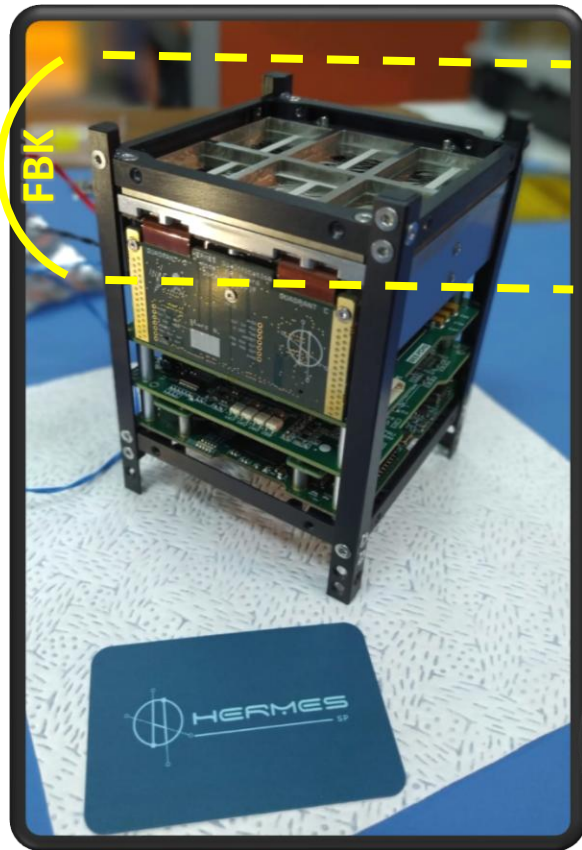


Spectral Sensitivity (PDE) at 12V OV





The Silicon Drift Detectors case (From Market to Research)

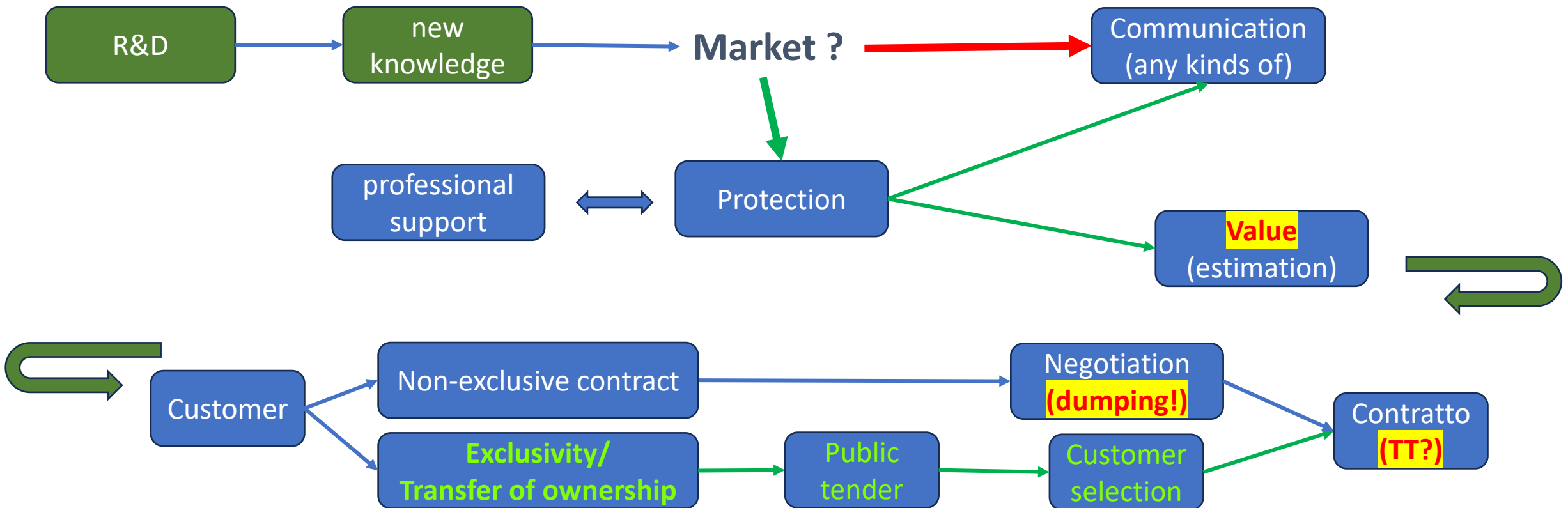


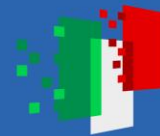
SDD is the main component of state-of-the-art EDX* instrument solutions that are widely integrated into SEM microscopes for chemical/elemental analysis.

* (Energy Dispersive X-ray Analysis)

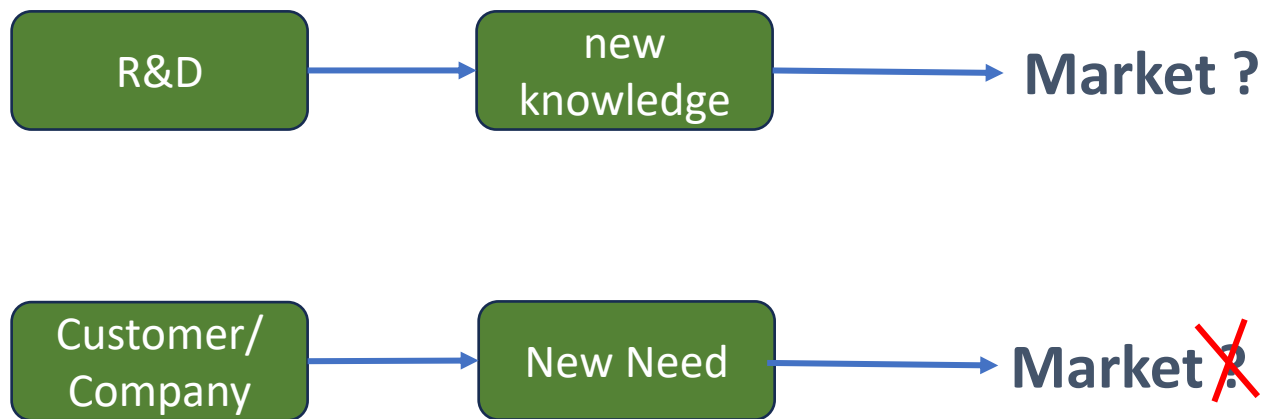


SiPM: from Research to Market

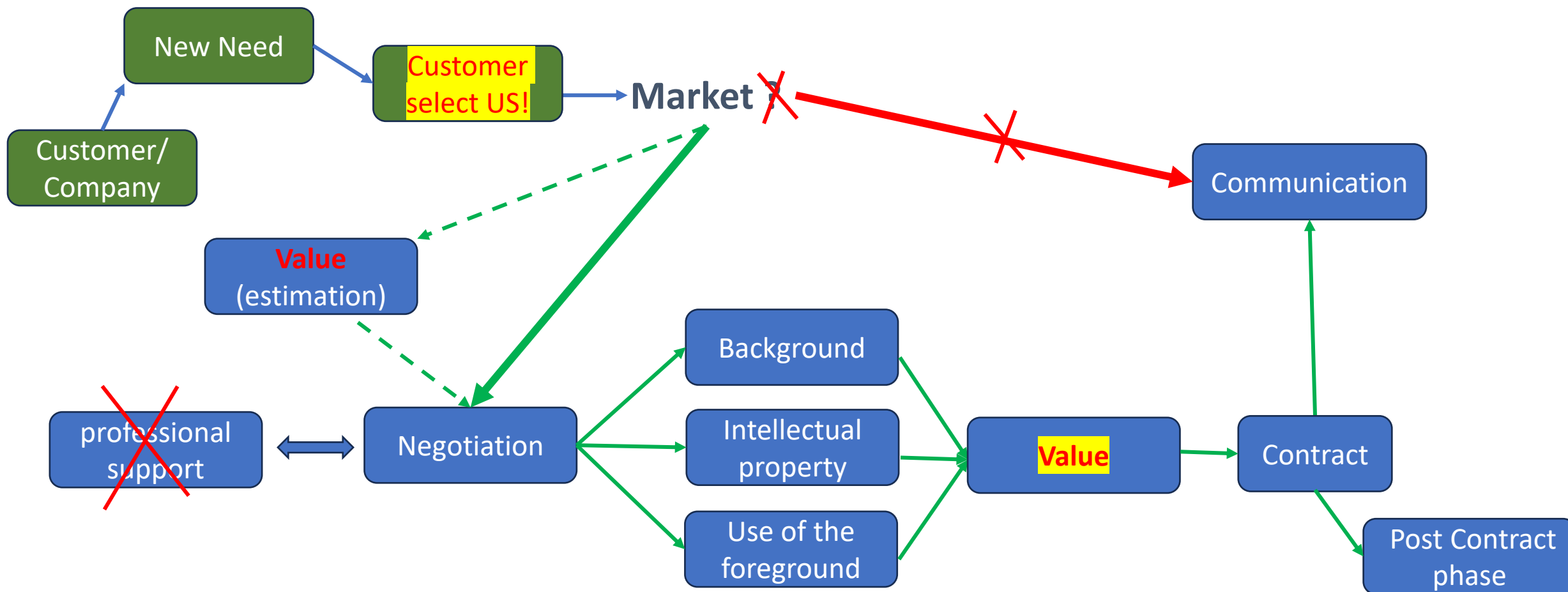




from Market to Research vs from Research to Market



SDD: from Market to Research





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Thank for your attention

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CTA+ Research Infrastructure Manager

pierluigi.bellutti@inaf.it

