

2014 Topical Workshop
Management of Instrumentation Projects
held at ESO Garching.

How Experiments Start

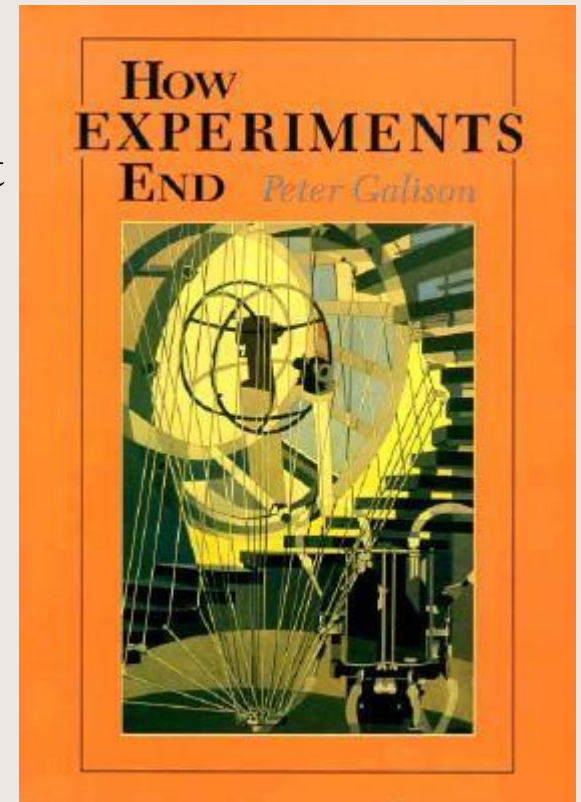
Ferdinand HAHN / CERN

NA62 Experiment

Prelude

“How Experiments End” from Peter Galison

- How much is the result of the experiment influenced by the assumptions?
- What are the assumption behind this anticipation ?



The Standard Model

extremely successful road

- Since > 40 years successful physics program
- Two methods:
 - Go to higher and higher energies -> discover new particles
 - Go to higher accuracy -> confirm/challenge predictions of the SM
- Has lead to: discovery of quark-states, charged and neutral currents, gluon, W, Z discoveries, precision measurements at LEP, Higgs discovery at the LHC



Sergio Bertolucci CERN's director of Research

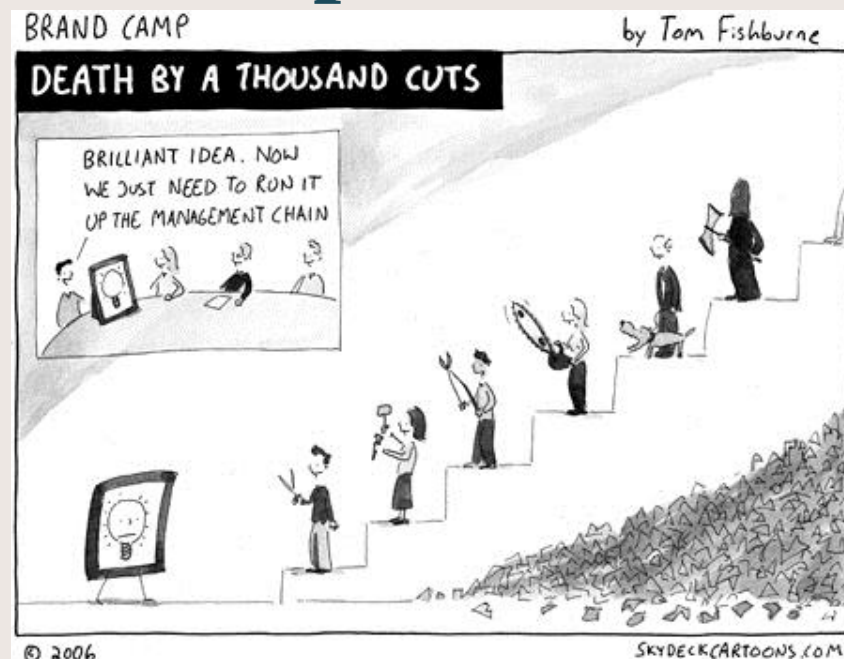
“The Higgs boson was the last of the known unknowns; Now, we have to challenge the unknown unknowns.”

What are the new Proposals ?

- Many on SPS Accelerator
- New Ideas:
 - steril neutrinos, WIMPS, AXION, Chameleons, etc.
- Thinking outside the box: use new methods, new procedures,...

Proposals are:

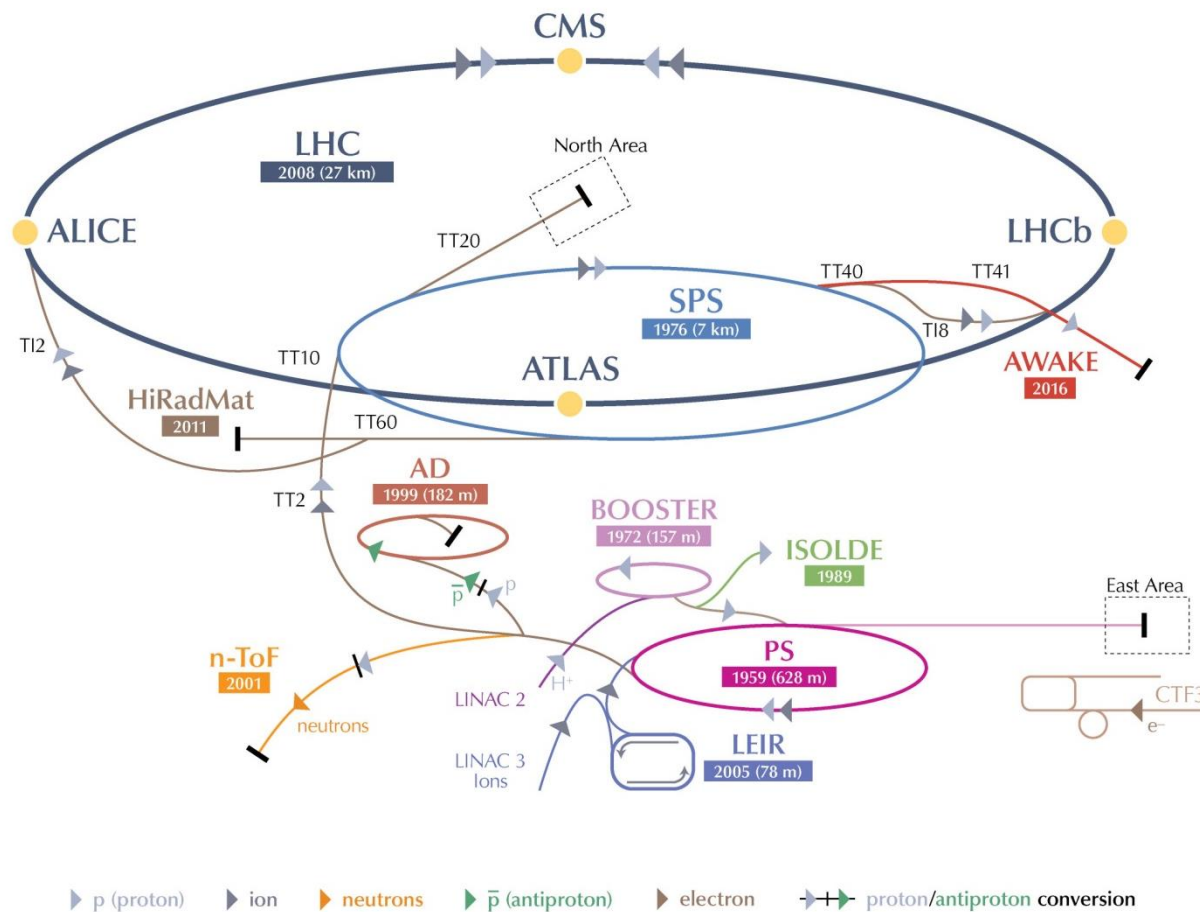
- More risky
- More controversial
- More difficult to get approved...



**...but,
there is an increased interest and a
significant number of proposals
to the SPSC**

SPSC = SPS Experiment Committee
the scientific committee that recommends
new experiments at the SPS accelerator

CERN's Accelerator Complex



LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron

AD Antiproton Decelerator CTF3 Clic Test Facility AWAKE Advanced WAKEfield Experiment ISOLDE Isotope Separator OnLine DEvice

LEIR Low Energy Ion Ring LINAC LINEar ACcelerator n-ToF Neutrons Time Of Flight HiRadMat High-Radiation to Materials

Capital Investment Size

Experiment investment scale at the SPSC:

- **< 2 MCHF** Small size Experiment
 - **3 - 15 MCHF** Medium size Experiment
 - **15 – 50 MCHF** Big size Experiment
 - **> 50 MCHF** LHC size
- typical for SPSC*

Infrastructure Investment:

CERN provides, among other things, in particular the experimental infrastructure (e.g. experiment building) and the beam line free of charge. That can be very costly in some cases...

Procedure to Start a new Experiment

1. Expression of Interest

⇒ Make a proposal known to the relevant Experiment Committee, i.e. SPSC, LHCC, INTC, or other.

2. Letter of Intend

⇒ Should allow to assess the scientific merit of the experiment in some greater detail.

⇒ The main experimental issues, infrastructure are outlined

3. Technical Proposal or Design Report

⇒ Full proposal including technical feasibility, cost, safety, infrastructure needs, ...

If recommended by the Experiment Committee, the new Experiment can be approved by the Research Board.

Two main Documents accompany a new Experiment

- **The Technical Proposal or Design Report**
- **The Memorandum of Understanding (MoU)**
Signed by the Host Lab. and all collaborating Institutes.

The MoU is an agreement between CERN and all collaborating institutions on the construction, installation, maintenance and operation of the experiment. It defines the responsibilities of each stakeholder and the cost sharing.

MoU: Framework for the Collaboration

- MoU Scope:
 - Define what is needed (list of sub-systems)
 - Understand the interest and competences of all partners
 - Defines sharing of responsibilities:
 - Who does what ?
 - Each partner is in charge of a deliverable
 - Core cost envelop and M&O cost
 - Procedural issues:
 - What is when a partner cannot deliver
 - Partners leaving or joining
 - Communication and decision making:
 - Regular face to face meetings (collaboration weeks)
 - Define specific bodies: Steering board, Resource Review Boards, etc.
- Focus the know-how of the partners to create a win-win situations.**

How Experiments Start

There are many proposals, but only certain experiments will ever be built.

Which proposal can be trusted ?





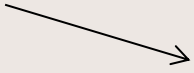

Your proposal is clear and irrefutable, Dr. Gardner.
Obviously, our committee cannot approve it.

How Experiments Start

There are many proposals, but only certain experiments will ever be built.

Which proposal can be trusted ?

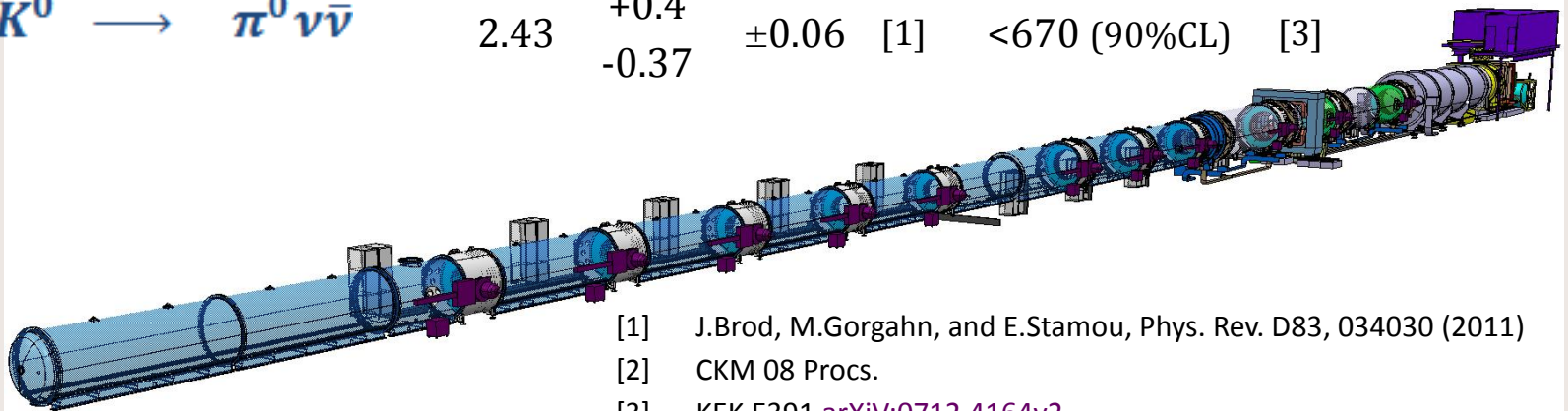
Key Ingredients:

1. An attractive physics target  Must convince the Scientific Committees
2. Strength of the collaboration  Capability to raise funds
3. (Re-)Use of existing facilities  How well fits a proposal in the CERN environment?
4. Versatility of the set-up  Bonus..

Example NA62

- Medium size experiment for CERN (big at SPS);
 - 207 Members / 30 Institutes from 12 countries
 - 26 MCHF Cap. Invest.
- Looking at Ultra rare Kaon Decays, i.e. $K^+ \rightarrow \pi^+ \nu \bar{\nu}$

Decay	Branching Ratio ($\times 10^{11}$)				
	Theory (SM)			Experiment	
$K^+ \longrightarrow \pi^+ \nu \bar{\nu}$	7.81	$+0.8$ -0.71	± 0.29 [1]	17.3	$+11.5$ -10.5 [2]
$K^0 \longrightarrow \pi^0 \nu \bar{\nu}$	2.43	$+0.4$ -0.37	± 0.06 [1]	<670 (90%CL) [3]	





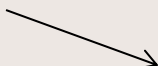
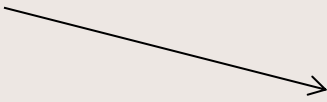
[1] J.Brod, M.Gorgahn, and E.Stamou, Phys. Rev. D83, 034030 (2011)

[2] CKM 08 Procs.

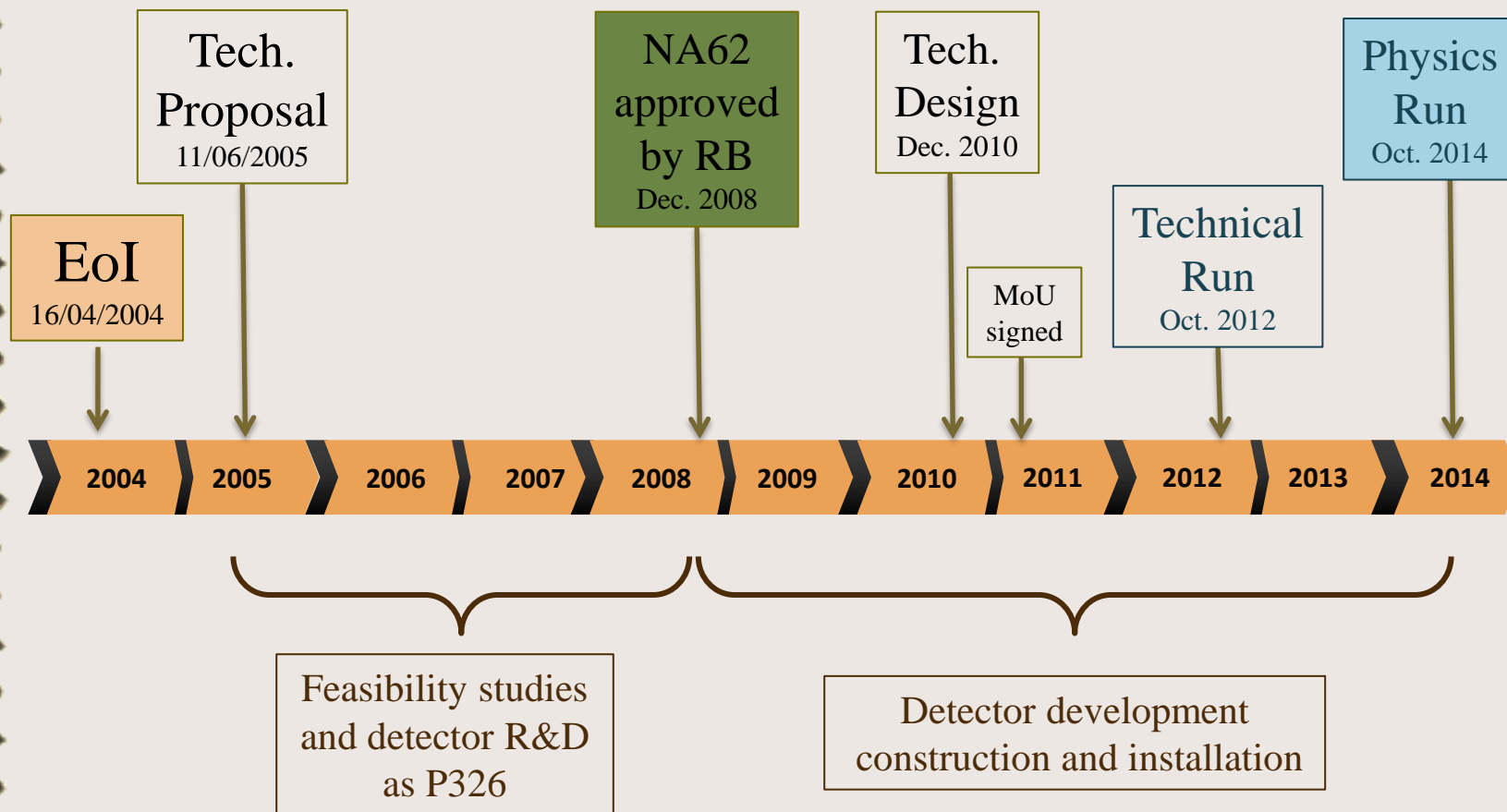
[3] KEK E391 [arXiv:0712.4164v2](https://arxiv.org/abs/0712.4164v2)

How did NA62 succeed?

Ingredients:

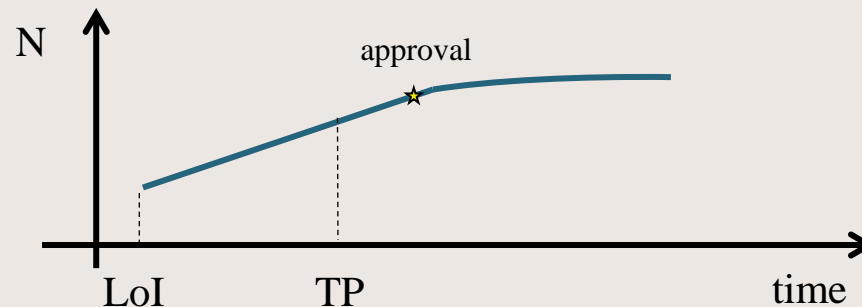
1. An attractive physics target  Considered very interesting questions on feasibility...
-> P326
2. Strength of the collaboration  Not bad, but could be stronger
3. (Re-)Use of existing facilities  Excellent, successor of NA48
Most of the infrastructure was existing
4. Versatility of the set-up  $K^0 \rightarrow \pi^0 \nu \bar{\nu}$

Timeline for NA62



Setup the Collaboration

- How big should the collaboration be?
 - As strong as possible: competence , funding, people,...
 - As small as possible: remain manageable, increased value of authorship, helps to stay focused...
- Who should join and under what conditions?
 - Each partner must be committed to achieve the scientific goal.
 - Each partner provides added value to the experiment
 - Higher contribution gives rise to more authorship
- Timeline:



Added value for the partners to join a collaboration

CERN has three missions, i.e.

Science, Technology and Education.

Experiments exploit the three fields:

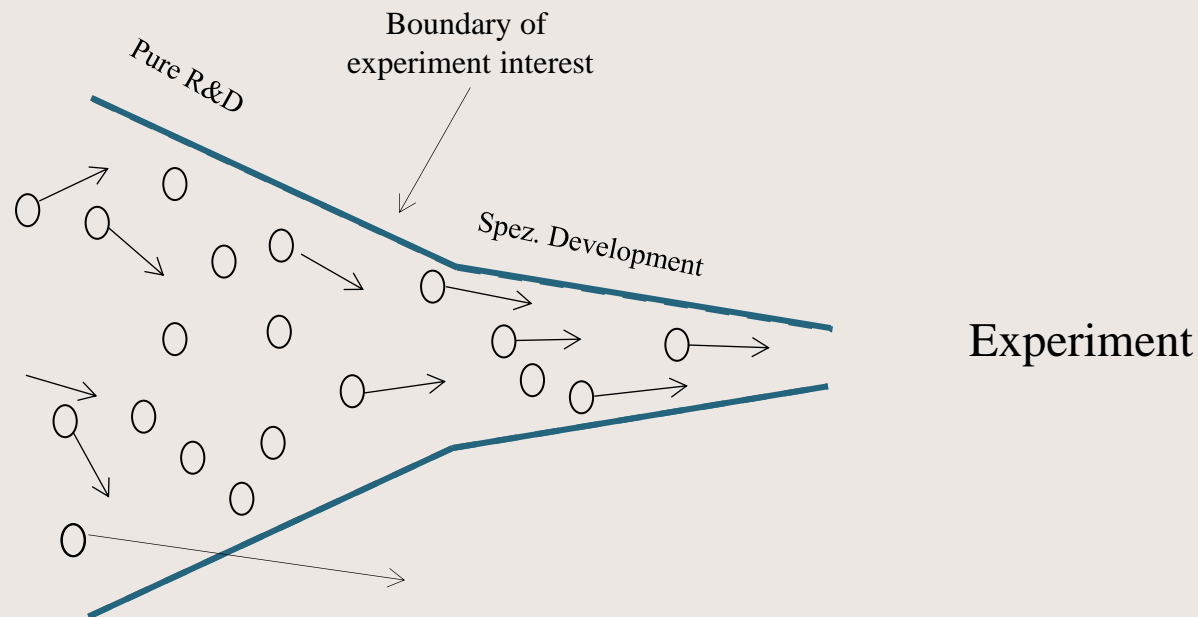
1. Science is the primary “output” that an experiment produces;
 - No individual team could do it alone.
2. Detector/system development is always a key ingredient...
 - Can bring in specific experience
3. PhD, Diploma students, trainees, etc.
 - Attractive to students, ...

Managerial aspects of the Collaboration

Managing a collaboration is distinct from managing monolithic organization.

Key Management Functions:

- Spokesman
- Technical Coordinator
- Glimos (in charge for Safety)



Conclusion

- There are a lot of new experiments proposals at the SPSC.
- To get an experiment approved is a long very competitive process.
 - Key factors to be successful are:
 - Distinct scientific case
 - Strong collaboration
 - Make good use of CERN tools
 - Be versatile

A silver metal spiral binding is visible along the left edge of the page, with the wire looping through a series of holes in the paper.

Thank you.