Planning

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026+
PANDA Phase 0				Pre-Commissioning							
PANDA Start Setup			Design		Construction			Installation		Commissioning	Physics
PANDA Phase 1						**PANDA Hall assumed available Q4/2021**					
PANDA Full Setup			Design			Construction				Installation	Physics
PANDA Phase 2											
PANDA Phase 3: RESR											

Phase-C

PANDA physics: *light, strange, charm*

Key questions

Impact by *precision* (statistics, resolution) and *uniqueness* (terra incognita)

Nucleon properties

Exotic hadrons

In-medium hadron properties

Colour transparency

Neutron stars

Matter-antimatter asymmetry

$\bar{p}p$ and $\bar{p}A$ interactions

pp, pA?

PANDA Physics Pillars

Nucleon structure

Strangeness physics

Charm and exotics

Hadrons in Nuclei

Why physics@Phase-C?

- ✓ **Political**: risk scenario SIS100 delay, hence SIS18+HESR.
- ✓ **FAIR review**: this item likely will come up, requires preparation.
- ✓ **Commissioning:** plan to use protons to commission HESR, to calibrate detectors, fine-tune reconstruction software and online computing, etc..
- ✓ **Fast kick-off** of physics program once antiprotons become available! Besides detector commissioning, think of physics studies with p+A and p+p necessary to realise or complement the antiproton ambitions.
- ✓ Interest of **CBM** and **HADES** to use PANDA -> strengthens FAIR collaborations.

Prerequisites

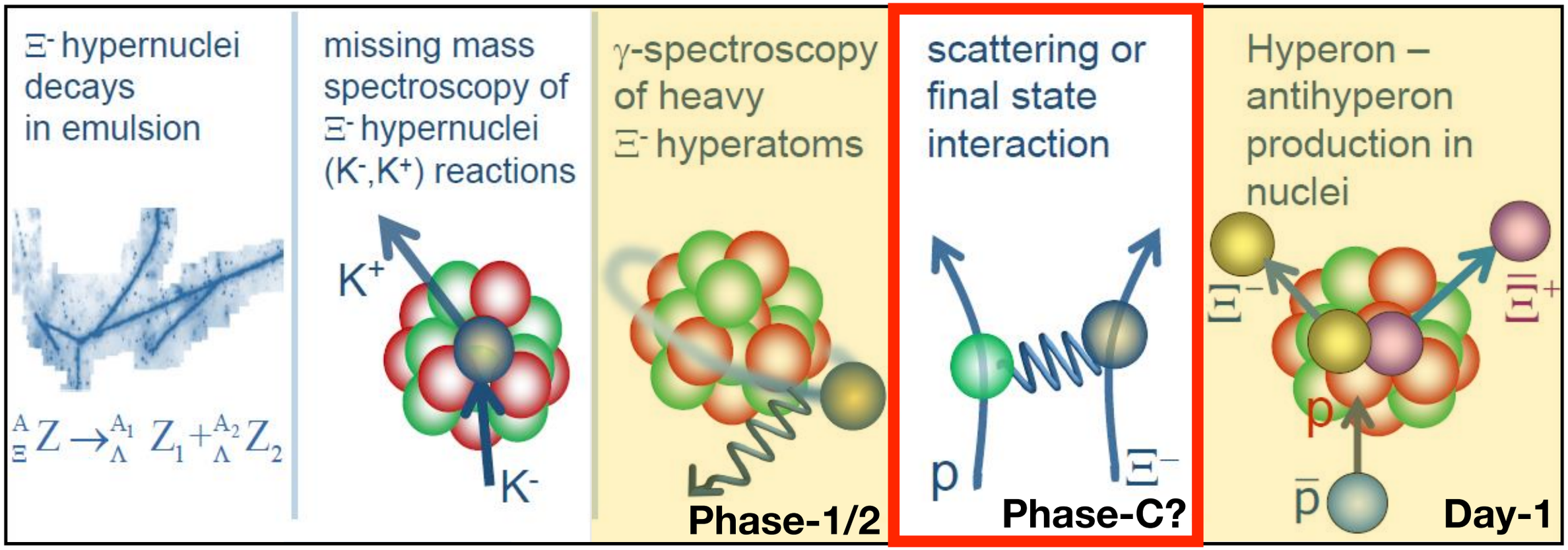
- ✓ **PANDA@HESR@SIS18**: p-momenta from 1.5-15 GeV/*c* with “day-one” setup.
- ✓ **Luminosity** not clear to me, limited since detectors are commissioned.
- ✓ Physics **parasitic** to commissioning!
- ✓ Connection with **antiproton program** of PANDA important!
- ✓ …

Questions to address

- ✓ What are the **potential physics items** with p+p and p+A?
- ✓ How do these items promote/connect to the **pbar+p/A program**?
- ✓ How is the competition, complementary, and **“added value”** with respect to other (FAIR) experiments?
- ✓ What are the **technical limitations** from the detector point of view?
- ✓ **Human resources** for MC studies: generators, occupancy studies, etc.?
- ✓ Further **organisation**, connection to CBM/HADES/APPA plans?
- ✓ …

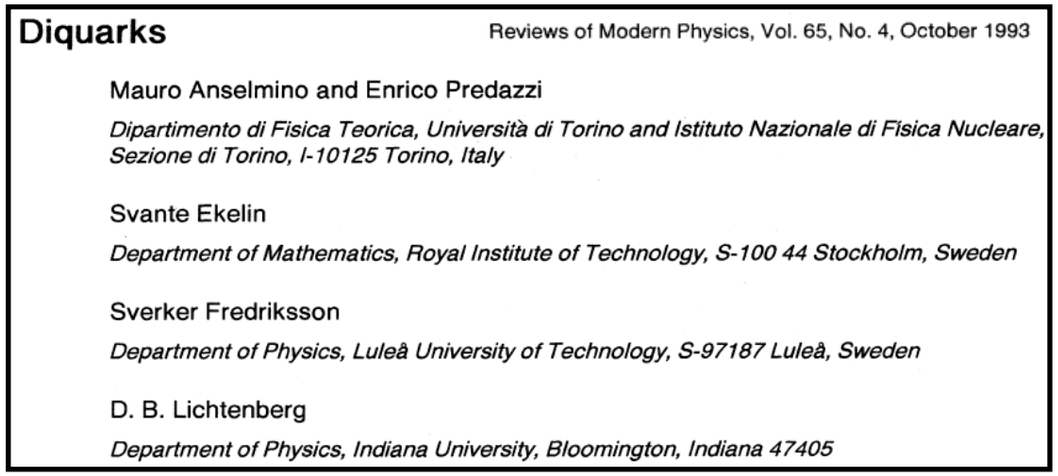
Example case….

- ✓ **(anti)Cascade (|S|=2) baryon-nucleon/nuclei interaction.**
  - p+p/A -> p+p/n+Xi+Xibar.
  - Input to hyperon dynamics and hypernuclei programs of PANDA.
  - Study Xi-N final-state interaction at small relative momenta?
  - Study the origin of hyperon polarisation?



Josef Pochodzalla, PANDA CM, November 2018

Example case….



- ✓ **“Diquarks” in baryons.**
  - p+p -> BB+MM versus pbar+p at large p_T.
  - Study “ds/dt” scaling laws.
  - Exclusive reactions require high acceptance detector, e.g. PANDA.
  - Connection to “XYZ” program of PANDA: exotic multiquark states.