In-Kind

FAIR

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Overview

Existing Facility

FAIR Costs:
1.027 billion in 2005 CB Euros

Later Modules

Overview

APPA
Atomic Physics, Plasma Physics Application

NuSTAR
Nuclear Structure Astrophysics and Reactions

PANDA
anti-Proton Annihilation at DArmstadt

CBM/HADES
Condensed Baryonic Matter Experiment

SIS100
heavy (Schwer) Ion Syncrotron

HEBT
High Energy Beam Transport

HESR
High Energy Storage Ring

SFRS
Super Fragment Separator

CRYRING

p-LINAC

p-bar target

HEBT

CR
Collector Ring

RESR

NESR

Later Modules
International Collaboration

Slovenia
Sweden
Finland
Germany
France
Poland
Romania
India
Russia
UK
FAIR-Convention

• Contributions to FAIR:
  – Total cost: 1027 M€ (2005)

• Contribution to accelerator:
  – Total cost: 386M€ (FAIR Council)
  – Oversubscribed
  – Costbook: first com first served

• Contribution to experiments:
  – Total cost: ~200 M€
  – Limited to 78 M€ by FAIR Council
    Decision
  – Undersubscribed
  – Rest responsibility of Collaborations

• Civil Construction
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• Civil Construction

Further rules established by Council:
• Every country must contribute 25% to Civil Construction unless
  • >75% contribution to accelerator
• Accelerator Elements that are not picked up by any country:
  • FAIR Tender
  • Reduces total acc. in-kind contributions
    • Currently ~20 M€
• Money that cannot be contributed by in-kind needs to be paid in cash, inflation corrected
  (e.g. civil construction)
FAIR Structure

- **FAIR GmbH:**
  - Steering Company
    - Project Management
    - Management of sub-project Construction
    - Management of sub-project Experiment

- **GSI:**
  - Existing Facility (operation, maintenance, preparation for FAIR)
  - Overall technical Responsibility for accelerator
  - Management of sub-project Accelerator
  - Technical Responsibility (design, assembly, commissioning) of HEBT, SIS100, Targets, p-Linac
  - Follow up of procurement and Quality Assurance
  - Acceptance tests
  - Coordination of assembly and Commissioning

- **FZ Jülich:**
  - Technical Responsibility for HESR

- **BINP (Budker Institute for Nuclear Physics):**
  - Technical Responsibility for CR
Challenges

• Project:
  – Very Complex
    • Many different small to medium size accelerators
    • large number of experiments with diverse user community
    • high activation areas, 2 production target areas

• Politics:
  – 2 Company model
    • Project Management at FAIR GmbH has no line of command for sub-project Accelerator (design and implementation)
    • Current Developments
      – Merger underway, but needs international treaty
      – Effective Merger by common Management and Project management
  – international collaboration
    • transition needed from national laboratory
Accelerator

• Costbook:
  – Should contain all elements needed for Accelerator
  – >2000 items
  – Each item (PSP number) has a value (2005) and number of pieces required.
  – Experience with valuation:
    • Fairly good for items similar to existing items at GSI
    • Insufficient funds planned for superconducting magnets
      – In particular underestimation of costs of testing
Shareholders

• Each country needs to name one or several shareholders, who are responsible to
  – Request items from Costbook
  – Find a Provider
  – Supply enough funds to the Provider to finish in-kind item
    • This usually requires to deal with funding agencies of the respective country.
  – Supply item to FAIR.
  – Install item in tunnel.
  – Finally get credit for item delivered in-kind
Assigning Item to a Shareholder

• Usually Shareholder makes Expression of Interest (EoI) to reserve item and sets out to find Provider
• Once situation is clarified Shareholder will request item via In-Kind Review Board (IKRB)
• IKRB will
  – Check suitability of proposed Provider
    • unless a tender is foreseen
  – Resolve conflicts between requests
  – Recommend assignments to Council
  – Follow up assignments
    • Current process is to transform IKRB to do mostly this task
• Council will assign item to Shareholder
  – About 87% in value of the Costbook is assigned
Special Situation Russia:

• Russia decided to contribute all in cash.
• With the understanding that
  – Russian institutions can request items in a similar procedure as used with the in-kind assignments.
  – The Russian institution will be payed by FAIR and will receive the inflation corrected Costbook value.
• Effect:
  – Safety for Russian partner in terms of Cost
  – Relatively few requests by Russian institutions
    • Danger that smaller than expected amount of money will be spend in Russia.
  – Once contract is closed, the fact that FAIR pays gives additional measure of control.
In-Kind Contracts

- 3 Party Contracts
  - Shareholder
  - Provider
  - FAIR

- Specifications from GSI
  - Not party in the contract!
  - GSI has limited number of designers
    - FAIR consists of many smaller accelerators > large design effort!

- Shareholder often only now realises the fine print
  - Funds needed are often larger than CB + inflation
  - Only with specifications the real requirement of funds becomes clear

- In-kind Coordination task:
  - Negotiate with Shareholder to supply enough funds
  - Negotiate with Provider to supply at minimal cost
  - Negotiate with GSI to minimize requirements for item
  - Rule out technical and commercial issues

- Currently about 35% of CB value is contracted.
Experiments’ Costs (4th RRBs, 16th Council)

- Cost estimate Jan 2015, Collaborations’ input to 4th meetings of the Resources Review Boards (RRBs)
  - 245 M€ (2015 prices) = 196 M€ (2005 prices)

- Funds foreseen (2005 prices)
  - 78 M€ in FAIR budget
  - Remainder to be sought externally

- Breakdown (2005 prices)
  - FAIR’s part: 78 M€
  - Other approved funding: 35 M€
  - Expressions of Interest: 68 M€
  - To be assigned: 15 M€
In-Kind for Experiments

• Only 40% provided by FAIR.
  – Each Country decides which Collaboration will get how much and what it is used for.

• Experimental Costbook:
  – Only listed items can be assigned as FAIR contribution

• Each experimental component is assessed by the Expert Committee Experiment (ECE) and approved in form of a TDR.

• Upon request of the collaboration and Shareholder the Scientific director will submit a component to the Council for assignment as a FAIR contribution.

• The collaboration is responsible to supply the specification to FAIR

• FAIR will then conclude a contract between
  – FAIR, Shareholder, Provider
  – Collaborations are not party of contracts!
THANK YOU FOR YOUR ATTENTION
The 4 Scientific Pillars of FAIR

- APPA: Atomic, Plasma Physics and Applications
- CBM: Compressed Baryonic Matter
- NUSTAR: Nuclear Structure, Astrophysics and Reactions
- PANDA: Antiproton Annihilations at Darmstadt
CBM
Compressed Baryonic Matter Experiment

• The mission
  – Explore the properties of super-dense nuclear matter.

• The physics
  – Fundamental aspects of Quantum-Chromo-Dynamics (QCD) and astrophysics.

• The challenge
  – Measure rare and penetrating probes
    • Heavy-ion collisions at rates of up to 10 Million reactions per second.

• The technique
  – Tracking and vertex reconstruction
  – Electron identification
  – Muon identification
  – High speed signal processing and data acquisition.

• Beam
  – High energy heavy ions, high flux
APPA – Atomic Physics, Plasma Physics Application

**BIOMAT** (basic research to Biological MATerial and medical applications)
- e.g. Biological effects of heavy ions needed for space exploration

**SPARC** (Stored Particles Atomic Research Collaboration)
- The new instrumentation will permit to investigate the dynamics of multi-electron continua
  - in target and projectile
  - Strong collisions of highly charged heavy ions in ESR and HESR

**FLAIR** (Facility of Low energy Antiproton Research)
- Access to atomic structure and atomic collision dynamics
  - using CRYRING@ESR

**Plasma Physic**: 30 Proposed experiments
- Understanding interior of massive planets like Jupiter
- Warm and dense plasmas
- **WDM** (Warm Dense Matter)
  - Radiative Properties of Warm Dense Matter (WDM) produced by intense heavy ion beams
  - Warm and dense plasmas: Equation of State, transport properties, etc.,
  - Fusion: do we understand the basic physics?
- **HEDgeHOB** (High Energy Density Matter generated by Heavy Ion Beams)
  - Studying bulk properties of matter in high energy density states
NUSTAR
★NUclear STructure, Astrophysics and Reactions

• The mission
  – studying nuclear structures, astrophysics and reactions
  – employing radioactive ion beams for exploiting exotic states of matter and investigate:
    • ground state properties and decay properties of exotic isotopes
    • the structure of their excited states and their reaction mechanisms

• The physics
  – study the structure of exotic atomic nuclei, to investigate reactions of these nuclei and to apply the results for answering astrophysical questions

• The challenge
  – use of Radioactive Ion Beams (RIB’s) species separated and identified by the central “instrument” the large-acceptance Superconducting FRagment Separator (Super-FRS)
  – several experiments with different aspects

• Beam
  – use of RIB’s in three branches
    • high energy branch: RIBs at relativistic energies (300-1500 MeV/u)
    • low energy branch: beams in the range of 0-300 MeV/u
    • later: ring branch: cooled and stored beams
Panda - “anti-Proton ANnihilation at DArmstadt”

• The mission
  – Study precisely how mass is generated by strong interaction acting between the quarks
  – Basic research on weak and strong forces, exotic states of matter and the structure of hadrons

• The physics
  – Hadron spectroscopy

• The challenge
  – Production of high flux of antiprotons
  – Complexity of data analysis required
    • e.g. by producing glueballs and measure their masses and other properties
  – Large multi-purpose detector, large data rate

• The technique
  – full coverage of the solid angle together with good particle identification and high energy and angular resolutions for charged particles and photons:

• Beam
  – High energy antiprotons, high flux