Updates on GEM foil development in India & related issues at BARC

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on behalf of
India-CMS-GEM Collaboration
& BARC-Micropack-CERN

ToT from CERN for Single Mask GEM Foil development in India with M/s Micropack Bangalore is complete

The Cu clad polymide (5:50:5) from Korea via CERN (need to have an independent supply)

July 2014

Status

mp

- ToT signed and agreed between CERN and Micropack Ltd., India : Jan 2014
- 5 micron Cu clad polymide foils received from CERN via BARC
- 15 microns photoresist sourced from Korea
- Augmentation of resources for trial runs for the first 5 cm x 5 cm GEM foil (initial trials) with 200 microns / 400 micron pitch – In progress;
- SS 306 tanks for Polyimide etching is under fabrication. Expected to be ready for installation by Sep 1st week. Includes heaters / circulation pump / exhaust lips

Status

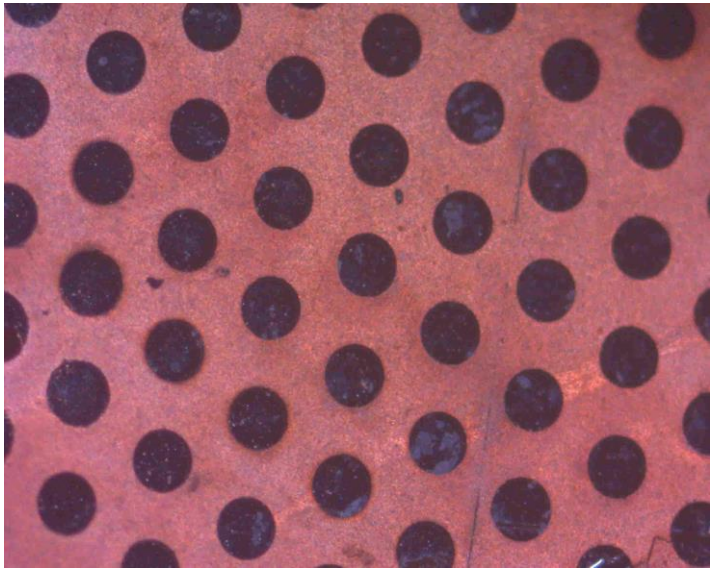
mp

- Foils with 70 μm diameter holes at 140 μm pitch of 10cm x 10cm will be initiated after process stabilisation of 5cm x 5cm
- Image transfer of 70microns / 140 microns well within the capability
- Process concerns in Polyimide etching and reverse copper etching
- Meeting with BARC personnel planned next month to freeze the Action Plan
- Mr. Rui from CERN visiting Micropack and BARC in October 2014

Trial results

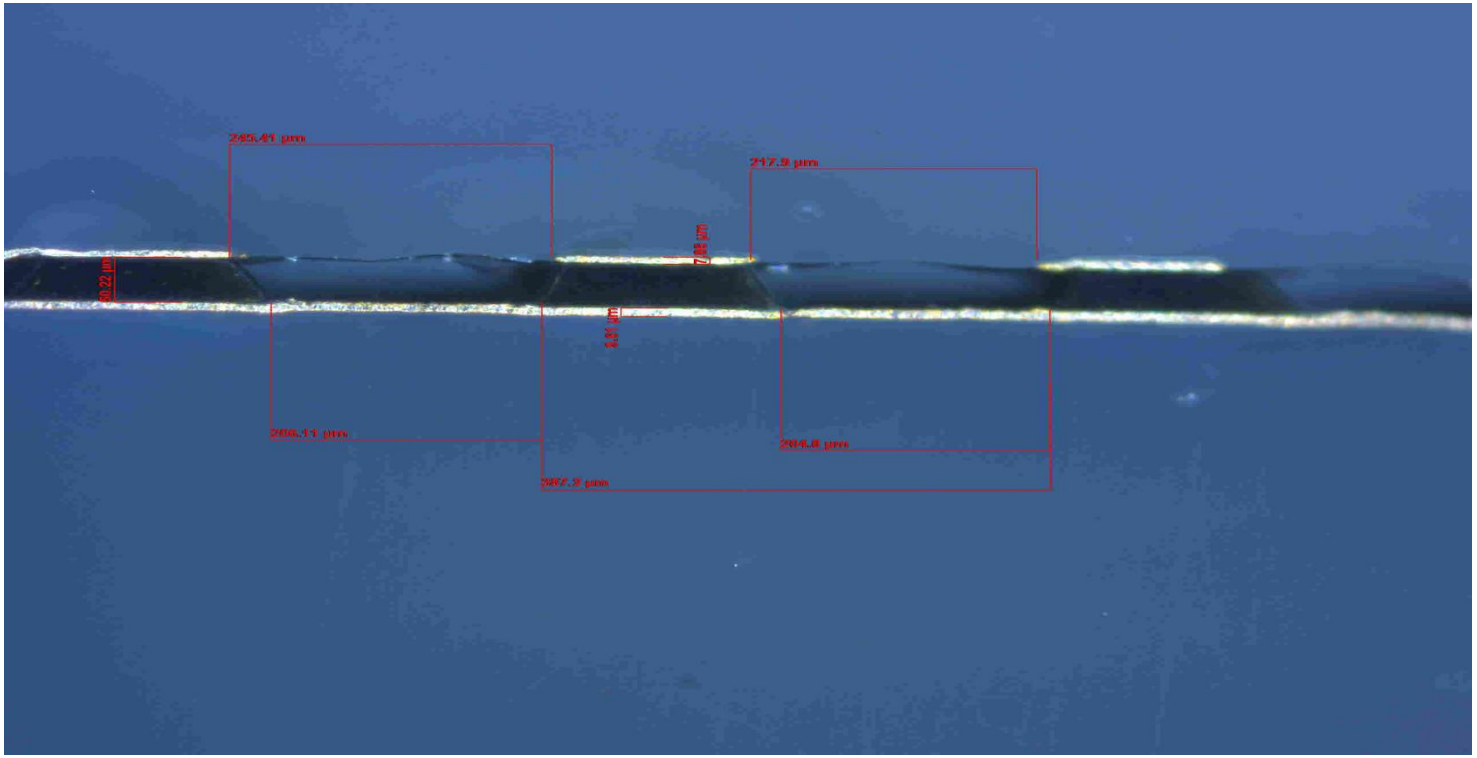
mp

5 cm x 5 cm foil, 200 μm holes, pitch : 400 μm



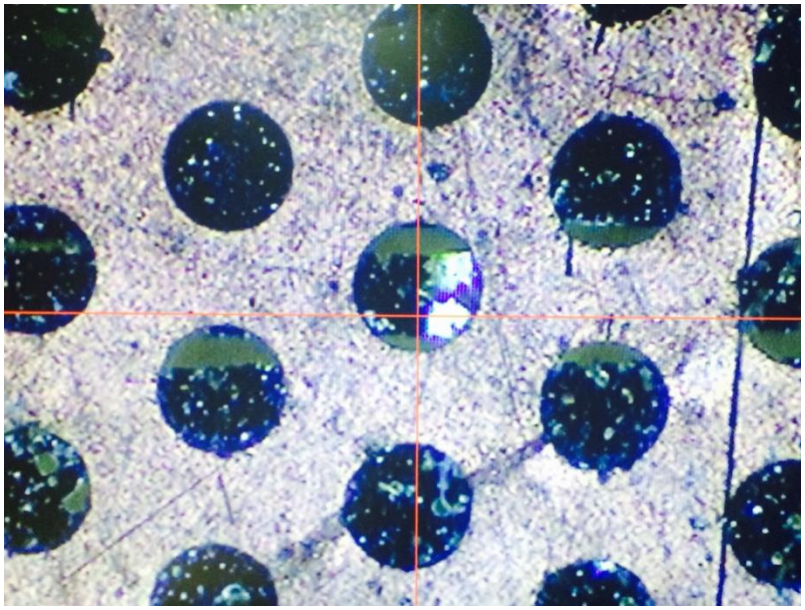
- **Polyimide etching carried out in a glass tray in our lab**
- **Hot plate with Magnetic stirrers used to achieve uniform temperature**
- **Polyimide etching observed. Uniformity and consistency not OK**

Trial results



- Traces of polyimide observed at the bottom surface.
- Taper in Polyimide etching observed

Trial results



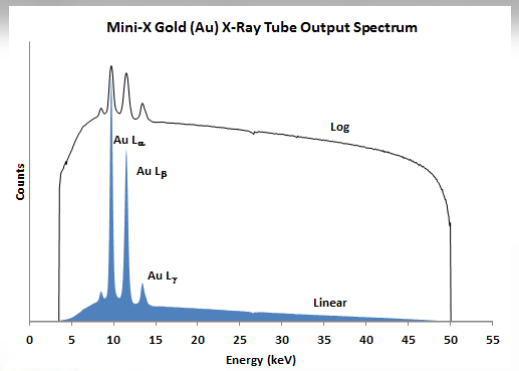
- Due to the presence of polyimide in the hole copper in the bottom layer not exposed
- Reverse copper etching observed only at few points where copper was exposed

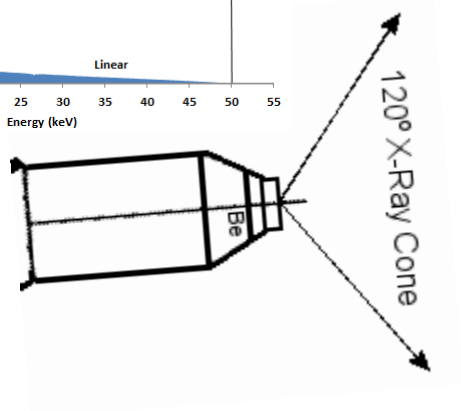
Updates from BARC

X-ray gun delivered at NPD-BARC

Installation to commence after the shielding is complete (first week of September)

Delivered





50 kV/80 µA
Gold (Au) Target
USB Controlled
Stable Output

Low Power	**: 9W at 50 kV & 80 µA**
Small	**: 400 grams**
App. Dose	**: 1.3 Sv/h @ 30 cm on axis**
App. Flux	**: 1.3×10^6 counts per second/mm^2 on the axis at a distance of 30 cm (50 keV/1 µA)**

Order placed for fabrication of Pb/Al cage for X-ray shielding and X, Y, Z movement of the source position, delivery expected by Sep 2014

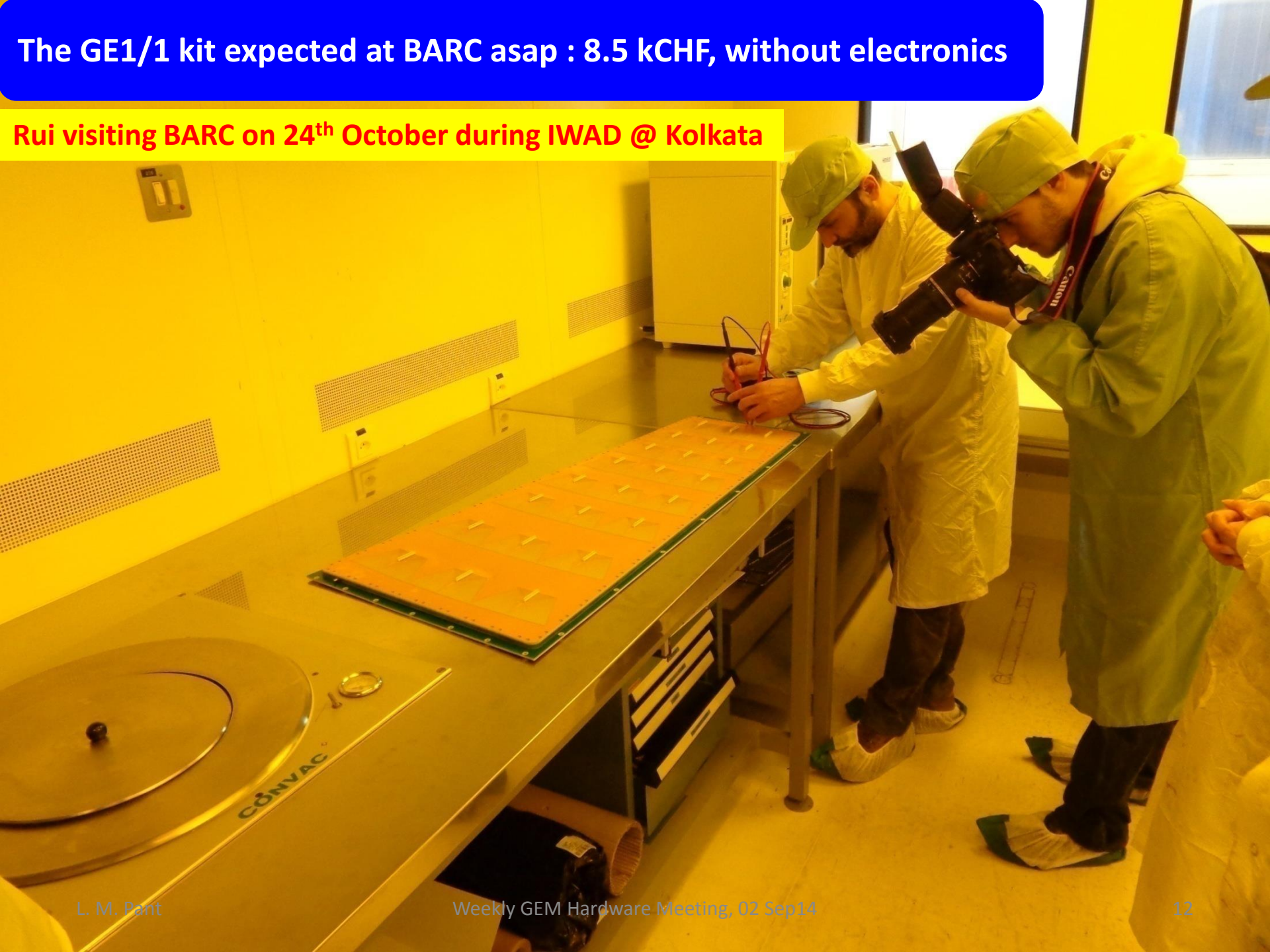
Schematic of the x-ray source and Pb shielding

1 mm of Pb housing, the inside of which is lined with 3 mm of aluminum in order to absorb the XRF from the shielding material.

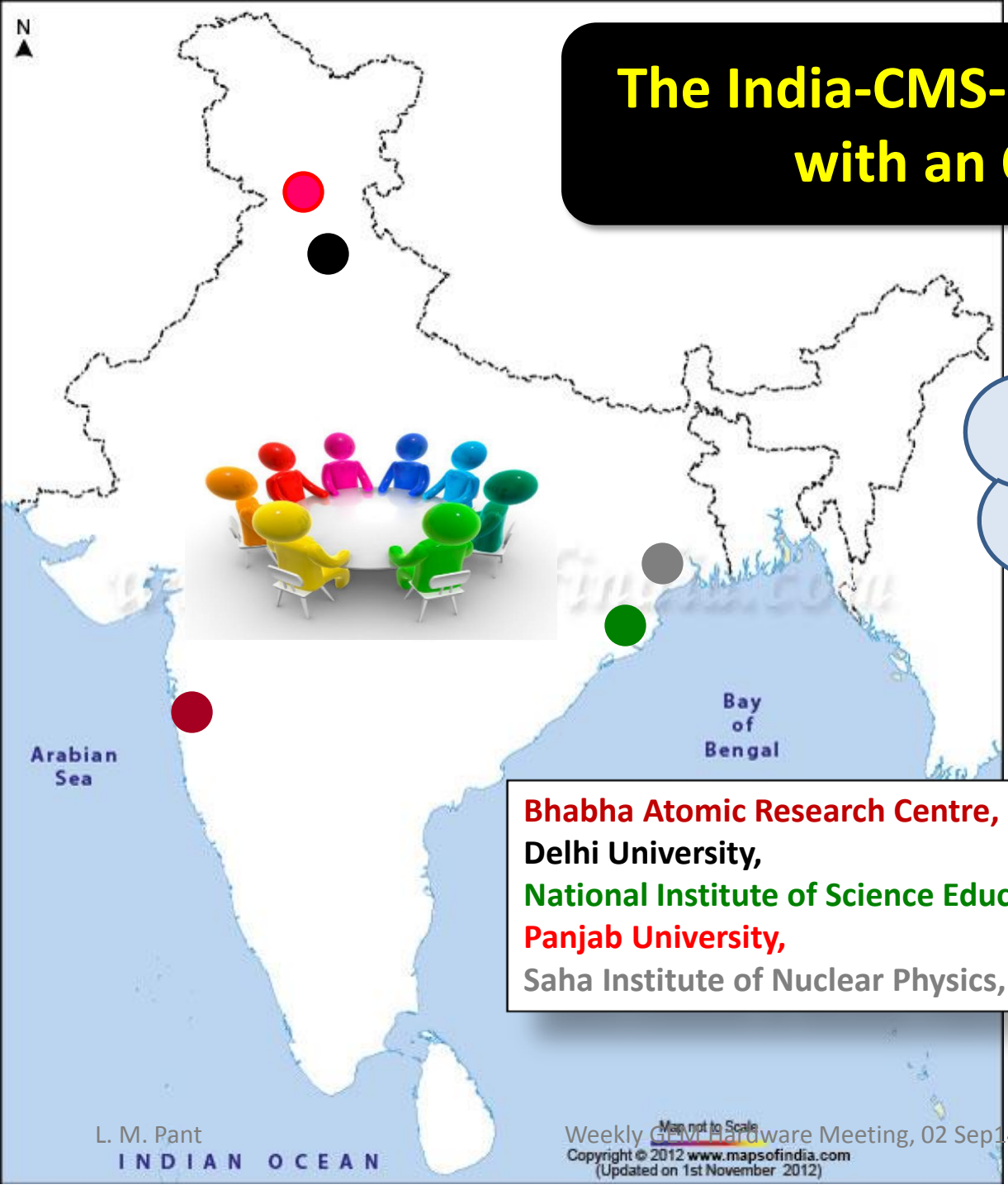
3Q : 2014

The GE1/1 kit expected at BARC asap : 8.5 kCHF, without electronics

Rui visiting BARC on 24th October during IWAD @ Kolkata



The India-CMS-GEM-Collaboration with an Organogram



Scientists,
Faculties,
Engineers,
Technitians &
Students

Bhabha Atomic Research Centre,	Mumbai
Delhi University,	Delhi
National Institute of Science Education & Research,	Bhubaneswar
Panjab University,	Chandigarh
Saha Institute of Nuclear Physics,	Kolkata

Projected budget (~ 1100 kCHF ~ 8 Crores)

Subject to approval	
COUNTRIES	**EOI - Amount (kCHF)**
CERN	729.7
Italy	1268
United States	513
India	**1151.01**
China	500.4
Belgium	482.1
Germany	250
France	0
S. Korea	800
Colombia	100
Qatar	400
Egypt	210.4
Total	**6404.61**

R&D		Core	Additional
Cash	In Kind		
43		**908.01**	**200**

~ 18%

~ 1100 kCHF ~ 8 Crores

~ 30 chambers

CERN and all the others (?) are actively participating in R&D and contributing to a common fund of ~ 3000 CHF per institution

India-CMS-GEM Collaboration

- **CERN Common Fund for GEM s** : **~ 3000 CHF per institute (??)**
- **Regular GEM meetings India** : **via Skype**
  : **Simulation, Hardware, technology & related issues**
  : **occasional presentation to CERN as a united activity**
- **To prepare a case** : **for funds in the next plan for contribution at CERN**

Summary and Outlook

- First Trial runs with 200 μm diameter holes & pitch of 400 μm on Cu clad polymide initiated at Micropack, Bangalore

  10 cm x 10 cm GEM foil with 70 μm holes with pitch of 140 μm to be initiated after process stabilization of 5 cm x 5 cm foil

- Following has arrived/expected to arrive (BARC specific) :
  1. X-ray source
  2. Shielding (Pb/Al) delivery expected in Sep., 2014

- Awaiting delivery of GE-1/1 kit from CERN at BARC